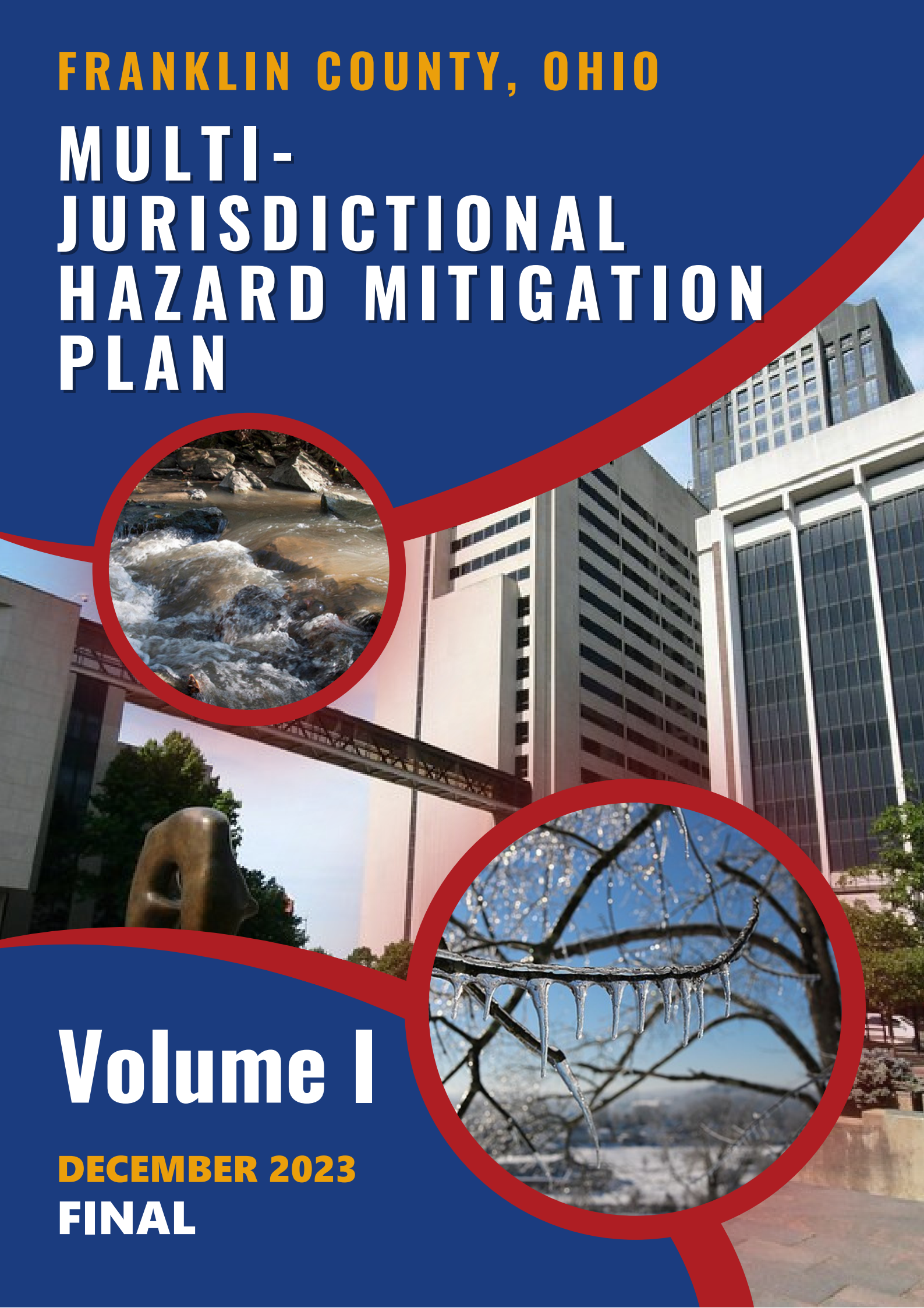
FRANKLIN COUNTY, OHIO

MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN



Volume I

DECEMBER 2023

FINAL

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SECTION 1. INTRODUCTION

1.1 PURPOSE

Franklin County and its participating jurisdictions (the Planning Team) have prepared this hazard mitigation plan (HMP) to better protect the residents and property throughout the Franklin County from the effects of hazard events. This plan demonstrates the Planning Team's commitment to reducing risk from hazards, increasing resilience overall, and providing a tool to help decision makers integrate mitigation in their day-to-day processes. This plan was also developed to position the Planning Team for eligibility of pre- and post-disaster Federal Emergency Management Agency (FEMA) grants, including Hazard Mitigation Assistance (HMA) grant programs, which include the Hazard Mitigation Grant Program (HMGP), Building Resilient Infrastructure and Communities (BRIC), and Flood Mitigation Assistance (FMA). This plan also aligns with the planning elements of the National Flood Insurance Program's (NFIP) Community Rating System (CRS), which provides for lower flood insurance premiums in CRS communities.

1.2 BACKGROUND

An HMP is a living document that communities use to reduce their vulnerability to hazards. It forms the foundation for a community's long-term strategy to reduce disaster losses and creates a framework for decision making to reduce damage to lives, property, and the economy from future disasters. Examples of mitigation projects include property acquisitions to remove structures from high-risk areas, structural elevations to protect from future flood events, upgrades to critical public facilities, and infrastructure improvements. Ultimately, these actions reduce vulnerability, and communities are able to recover more quickly from disasters. The Planning Team has demonstrated its commitment to reducing disaster losses by developing its initial HMP in 2007 and subsequent updates in 2012 and 2018 and updating information upon which to base a successful mitigation strategy to reduce the impacts of natural disasters and to increase the resiliency of the Planning Team.

Hazard Mitigation is any sustained action taken to reduce or eliminate the long-term risk and effects that can result from specific hazards.

FEMA defines a **Hazard Mitigation Plan** as the documentation of a state or local government evaluation of natural hazards and the strategies to mitigate such hazards.

NOTE: For hazard mitigation planning, FEMA defines **local governments** to include most governmental agencies below the state level.

For the Franklin County HMP, references to local governments generally refer to government agencies below the county level—specifically, townships and municipalities (municipalities include cities and villages).

In response to the requirements of the Disaster Mitigation Act of 2000 (DMA 2000), which requires local governmental agencies to develop and update their HMP every five years, this plan serves as the 2023 update to the 2018 Franklin County Hazard Mitigation Plan. During the course of the planning process, the entire plan was updated with a focus on examining changes in vulnerability due

to hazard events, reviewing capabilities and how they are used to implement hazard mitigation, reviewing the mitigation strategy, and identifying new initiatives to increase overall resiliency throughout Franklin County.

1.3 PLAN ORGANIZATION

The Franklin County HMP 2023 update is organized as a three-volume plan and is in alignment with the 2013 FEMA Local Mitigation Planning Handbook, the FEMA Local Mitigation Plan Review Tool, the 2023 FEMA Local Mitigation Planning Policy Guide, and the Ohio Emergency Management Agency (Ohio EMA) planning requirements.

Volume I provides information on the overall planning process and hazard profiling and vulnerability assessments, which serve as a basis for understanding risk and identifying mitigation actions. As such, Volume I is intended for use as a resource for ongoing mitigation analysis.

Volume II provides an annex dedicated to each participating jurisdiction. Each annex summarizes the jurisdiction's legal, regulatory, and fiscal capabilities; identifies vulnerabilities to hazards; documents mitigation plan integration with other planning efforts; records status of past mitigation actions; and presents an individualized mitigation strategy. The annexes provide a useful resource for each jurisdiction for implementation of mitigation projects and future grant opportunities, as well as a place for each jurisdiction to record and maintain its local aspect of the multi-jurisdictional plan.

Volume III provides appendices containing supplementary information from Volumes I and II. This information will serve as a resource for Franklin County and participating jurisdictions with reviewing, maintaining, and updating the 2023 HMP.

Table 1-1 describes the HMP's content by volume, section, and appendix.

Table 1-1. Franklin County 2023 HMP Update Contents

Section Number	Section Name	Contents
Volume I		
Section 1	Introduction	Overview of the planning process and organization of the plan.
Section 2	Planning Process	Description of the HMP methodology and development process; Core Planning Team, Planning Team, and stakeholder involvement efforts; and a description of how this HMP will be incorporated into existing programs.
Section 3	County Profile	Overview of the Planning Area, including: (1) physical setting, (2) land use, (3) land use trends, (4) population and demographics, (5) general building stock and (6) critical facilities and lifelines.
Section 4	Risk Assessment	Documentation of the hazard identification and hazard risk ranking process, hazard profiles, and findings of the vulnerability assessment (estimates of the impact of hazard events on life, safety, health, general building stock, critical facilities, and the economy); description of the status of local data; and planned steps to improve local data to support mitigation planning.
Section 5	Capability Assessment	A summary of existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, county, local) that support hazard mitigation within the Planning Area.
Section 6	Mitigation Strategy	Information regarding the mitigation goals and objectives in response to priority hazards of concern and the process by which Planning Area mitigation strategies have been developed or updated.

Section Number	Section Name	Contents
Section 7	Plan Maintenance	System established to continue to monitor, evaluate, maintain, and update the HMP.
Volume II		
Section 8	Planning Team	Description of the Planning Team, their responsibilities, and jurisdictional annexes.
Section 9	Jurisdictional Annexes	Jurisdiction-specific annexes for Franklin County and municipalities containing their hazards of concern, hazard ranking, capability assessment, mitigation actions, action prioritization progress on prior mitigation activities, and a discussion of prior local hazard mitigation plan integration into local planning processes.
Volume III		
Appendix A	Plan Adoption	Resolutions from Franklin County and all participating jurisdictions, included as each formally adopts the HMP update.
Appendix B	Participation Documentation	Matrix to listing who attended meetings and input provided to the HMP update; additional worksheets submitted during workshops conducted throughout the planning process.
Appendix C	Meeting Documentation	Agendas, attendance sheets, minutes, and other documentation of planning meetings convened during the development of the plan.
Appendix D	Public and Stakeholder Outreach Documentation	Documentation of the public and stakeholder outreach effort, including webpages, informational materials, public and stakeholder meetings and presentations, surveys, and other methods used to receive and incorporate public and stakeholder comment and input to the plan process.
Appendix E	Mitigation Strategy Supplementary Data	Documentation of the broad range of actions identified during the mitigation process; types of mitigation actions; the mitigation catalog developed using jurisdiction input and potential mitigation funding sources.
Appendix F	Plan Maintenance Tools	Examples of plan review tools and templates available to support annual plan review.
Appendix G	Critical Facilities	A full list of critical facilities identified for the update of the HMP. Due to the sensitive nature of the information, details have been redacted.
Appendix H	Linkage Procedures	Steps that non-participating local governments and other local jurisdictions such as Fire Districts, Utility Districts, School Districts, and any other eligible local government as defined in 44 CFR 201.2 within the planning area can take to join this plan as a participating jurisdiction and to achieve approved status.

1.4 THE PLAN UPDATE—WHAT IS DIFFERENT?

Both the planning process and the 2018 HMP have been enhanced and updated for this 2023 HMP update. An increased effort to actively engage stakeholders and the public was a focus of the update, as well as the continued education of the Planning Team about mitigation and available grant funding opportunities. The mitigation strategy was updated to include one mitigation action for every hazard of concern. Further, the sections in the 2023 HMP have been realigned to increase the readability of the plan. The following summarizes process and plan changes that differ from the 2018 process and HMP:

- Section 3 (County Profile) has been streamlined and updated.
    - Provides specific and detailed information about Franklin County.
    - Contains updated information regarding the County's physical setting, population and demographics and trends, including socially vulnerable populations, general building stock, land use and trends, potential new development, and critical facilities/community lifelines.
    - Critical facilities identified as community lifelines using FEMA's lifeline definition and seven categories were added to this inventory.

- Section 4 (Risk Assessment) includes identification of hazards of concern that impact Franklin County, methodology and tools used to conduct the risk assessment, hazard profiles and vulnerability assessment for the identified hazards of concern, and the overall hazard ranking.
    - Hazard profiles developed for each hazard of concern include the following: hazard description, location, extent, previous occurrences and losses, probability of future occurrences, climate change impacts, and vulnerability assessment.
    - The updated assessment is based on new inventory data and hazard data.
    - The topic of FEMA lifelines is included. All jurisdictions identified critical facilities considered lifelines in accordance with FEMA's community lifeline definition.
    - The hazard ranking methodology was expanded to include socially vulnerable populations, adaptive capacity, and climate change.
- Section 5 (Capability Assessment) is now a standalone section that has been expanded to include federal, state, and County capabilities. Jurisdiction-specific capabilities are expanded in each jurisdictional annex (Section 9).
- Section 6 (Mitigation Strategy) describes how the mitigation strategy was reviewed and updated for the 2023 HMP process. Goals and objectives were updated to align with County and local priorities and the 2019 State of Ohio HMP. Jurisdiction-specific mitigation strategies are now included in each jurisdictional annex (Section 9).
- Jurisdictional annexes (Section 9) have been enhanced to include the following:
    - Expanded capability assessment to include additional planning mechanisms in Ohio as well as information regarding plan integration in the table of planning, legal and regulatory capabilities
    - Identification of the NFIP floodplain administrator as part of the hazard mitigation planning team
    - Individuals that contributed to the annex listed at the beginning of each annex
    - Expansion of the critical facility and lifeline flood hazard exposure table to include a mitigation action, if appropriate
    - A user-friendly presentation of the hazard ranking results
    - A revised 2018 previous mitigation strategy status table to more clearly identify if the action is to be included in the 2023 HMP update
    - A more detailed proposed mitigation action table that specifies the problem statement and the proposed solution (mitigation action). The more detailed mitigation strategy is also reflected in the mitigation action worksheets , which also include additional details
    - A table that summarizes the actions across the ranked hazards and their mitigation action types
- To increase public and stakeholder engagement, the following efforts were made:

  - All Planning Team meetings were made open to the public.
  - Social media was used to inform the public meetings and to take the public survey.
  - A website was developed for the HMP to provide project updates, resources, links to the draft plan, and information on upcoming and previous meetings.
  - A StoryMap was developed to provide information regarding the HMP planning process and provide an opportunity for virtual public and stakeholder participation.
  - Stakeholder-specific surveys were deployed to collect input from stakeholders that provide services to Franklin County.
- An enhanced mitigation strategy process was utilized to develop a robust action plan.
  - A mitigation toolbox was built to assist with mitigation action identification.
  - Utilizing the risk assessment and capability assessment results, problem statements were drafted by each municipality and used to inform the mitigation action development.
  - Actions are identified, rather than strategies. Strategies provide direction, but actions are fundable under grant programs. The identified actions are designed to meet multiple measurable objectives, so that each planning partner can measure the effectiveness of their mitigation actions.
- The plan maintenance strategy is more clearly defined to provide a roadmap for the annual monitoring of the HMP.

Due to limitations on participation posed by the pandemic and the strains on time and resources for many local governments and other community organizations from 2018 to present, participation of stakeholders at the municipal level was limited. In accordance with FEMA guiding principles for inclusive participation at various levels, the planning team will place a high priority on an expanded effort on stakeholder participation with local planning committees in future plan updates.

Table 1-2 indicates the major changes incorporated into the 2023 HMP update compared to the 2018 HMP update as they relate to 44 CFR planning requirements.

Table 1-2. Franklin County HMP Changes Crosswalk

44 CFR Requirement	2018 HMP	2023 Updated Plan
Requirement §201.6(b): In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include: *(1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;* *(2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and non-profit interests to be involved in the planning process; and* *(3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.*	The 2018 plan followed an outreach strategy utilizing multiple media developed and approved by the Franklin County Planning Team. This strategy involved the following: • The public received invitations to multiple planning meetings. • Public participation surveys were deployed. • Stakeholders were identified and coordinated with throughout the process. • A variety of existing studies, plans, reports, and technical information were reviewed as part of the planning process. • Social media was utilized to engage the public. • A website was created on Franklin County's domain to keep the public informed of the planning process and how to get involved. • Adjacent communities, along with the County, were invited to participate in the planning meetings.	Building upon the success of the 2018 plan, the 2023 planning effort deployed the same public engagement methodology. The plan included the following enhancements: • Key department personnel formed a Core Planning Team for the plan. • A standalone project-specific website was developed to keep the public informed of the planning process, how to get involved, and review/comment on the draft plan. • A StoryMap was implemented as another form of public outreach, which provides an interactive way to learn about the planning process and review the HMP. • The 2018 HMP stakeholder list was expanded and included the six counties adjacent to Franklin County. Several of the stakeholders invited to participate provide services to socially vulnerable populations throughout the County. • Draft plan deliverables were made available on the County and multiple municipal websites. • All Planning Team meetings were open to the public. As with the 2018 plan, the 2023 planning process identified key stakeholders and coordinated with them throughout the process. A comprehensive review of relevant plans and programs was performed by the planning team.
§201.6(c)(2): The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.	The 2018 plan included a risk assessment of hazards of concern. The risk assessment included frequency of return, approximate annualized losses, historical occurrences, a description of general vulnerability, climate change impacts, secondary hazards, critical facilities and infrastructure, discussion on vulnerabilities, and future development trends.	The 2023 plan update includes a comprehensive update to the risk assessment. New and updated hazards of concern were included. Jurisdiction-specific risk assessment results are summarized in Section 4 (Risk Assessment) and in each jurisdictional annex (Section 9).

44 CFR Requirement	2018 HMP	2023 Updated Plan
§201.6(c)(2)(i): [The risk assessment] shall include a description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan must include information on previous occurrences of hazard events and on the probability of future hazard events.	The 2018 plan presented a risk assessment of each hazard of concern. Each section included the following: • General description • Hazard Location • Previous occurrences • Hazard Extent and probability • impact • Community drought vulnerability summaries • Climate change impacts on future probability.	A similar, but adjusted format, using new and updated data, was used for the 2023 plan update. Each section of the risk assessment includes the following: • Hazard profile, including hazard description and types, maps of extent and location, previous occurrences, and probability of future events. • Climate change impacts on future probability. • Vulnerability assessment including impact on life, safety, and health, general building stock, critical facilities, and the economy, as well as future changes that could impact vulnerability. The vulnerability assessment also includes changes in vulnerability since the 2018 plan.
§201.6(c)(2)(ii): [The risk assessment] shall include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description must include an overall summary of each hazard and its impact on the community.	Vulnerability was assessed for all hazards of concern. Each hazard of concern included a qualitative summary of assets exposed to the hazard.	A robust, quantitative vulnerability assessment was conducted for the 2023 plan update, using new and updated asset and hazard data. Volume 1, Section 4.3 summarizes the planning area's vulnerability for each hazard of concern. The jurisdictional annexes (Section 9) include a summary table of impacts on both planning partners.
§201.6(c)(2)(ii): [The risk assessment] must also address National Flood Insurance Program insured structures that have been repetitively damaged by floods.	A summary of NFIP-insured properties identified as repetitive loss and severe repetitive loss locations was included in each jurisdictional annex.	A summary of NFIP-insured properties identified as repetitive loss and severe repetitive loss locations was included in the plan and each annex.
Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure and critical facilities located in the identified hazard area.	An inventory of the numbers and types of buildings exposed was generated for each hazard of concern.	Quantitative and qualitative analyses were conducted using the updated hazard and inventory data as presented in Section 4 (Risk Assessment). In addition, critical facilities considered to be lifelines in accordance with FEMA's definition were identified.
Requirement §201.6©(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) and a description of the methodology used to prepare the estimate.	Loss estimates were generated for all hazards of concern by using readily available information.	Quantitative and qualitative analyses were conducted using the updated hazard and inventory data as presented in Section 4 (Risk Assessment). Estimated potential losses are reported in both Volume 1 Section 4.3 and Volume II Section 9 for each jurisdiction.

44 CFR Requirement	2018 HMP	2023 Updated Plan
Requirement §201.6(c)(2)(©(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.	Future trends in development were not discussed in each jurisdiction's annex.	A spatial analysis using identified growth areas, and potential new development identified by jurisdictions was conducted to determine if the development is located in hazard areas. These results were reported to all participants and summarized in their annexes to discuss mitigation measures. In Volume I, Section 4.3, discusses projected changes in population and development for each hazard and how these changes may lead to increased vulnerability. The section also discusses plans, regulations, and ordinances in place to implement mitigation to protect the development.
§201.6(c)(3):[The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.]	The 2018 plan contained goals, objectives, and actions. The identified actions covered multiple hazards and goals.	The Planning Team reviewed and updated the goals and created objectives. A mitigation strategy workshop with associated tools and guidance on problem statement development was deployed to inform the identification of mitigation actions. Actions that were completed or no longer considered to be feasible were removed. The balance of the actions were carried over to the 2023 plan, and in some cases, new actions were added to the plan.
Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	The Planning Team identified goals targeted specifically for this hazard mitigation plan. The planning component supported the actions identified in the plan.	The Planning Team reviewed and updated the goals and created objectives. New objectives were identified to align with updated Planning Area priorities.
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.	For each identified hazard, mitigation strategies were developed and prioritized using mitigation action worksheets. The mitigation actions were displayed in a table in each jurisdictional annex.	For the 2023 update, a mitigation catalog was developed to provide a comprehensive range of specific mitigation actions to be considered. A table with the analysis of mitigation actions by type and hazard was used in jurisdictional annexes to the plan. Mitigation action worksheets with an alternative project evaluation were prepared for FEMA-eligible projects.
Requirement: §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program, and continued compliance with the program's requirements, as appropriate.	Many jurisdictions included mitigations action to promote NFIP flood insurance.	For the 2023 update, each jurisdictional annex includes a description of how each jurisdiction participates in and implements the NFIP.

44 CFR Requirement	2018 HMP	2023 Updated Plan
Requirement: §201.6(c)(3)(iii): [The mitigation strategy shall describe] how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	Each action was prioritized based on FEMA's STAPLEE criteria, which includes consideration of the social, technical, administrative, political, legal, economic, and environmental factors necessary for the implementation of each action.	A revised methodology based on FEMA's STAPLEE (social, technical, administrative, political, legal, economic, and environmental) criteria and using new and updated data was used for the 2023 plan update. The 14 criteria were used to evaluate each potential mitigation action. The evaluation included a qualitative benefits and cost review. The results of the evaluation were used to identify the actions to include in the plan and assist with the prioritization.
Requirement §201.6I(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.	The 2018 plan details a plan maintenance strategy, giving a suggested schedule on when to review, revise, and maintain the plan.	The 2023 plan details a plan maintenance strategy similar to that of the initial plan. However, the 2023 plan maintenance strategy includes the use of the BATool[SM], which will enable township, municipal and County representatives to directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, and add or delete projects to maintain mitigation project implementation.
Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.	The 2018 plan details recommendations for incorporating the plan into other planning mechanisms.	The 2023 plan details recommendations for incorporating the plan into other planning mechanisms including, but not limited to, the following: • Comprehensive/Master Plan • Emergency Response Plan/ Emergency Operations Plan • Capital Improvement Programs • Municipal Code
Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.	The 2018 plan details a strategy for continuing public involvement.	The 2018 plan maintenance strategy was reviewed, and enhancements were added for the 2023 HMP. This includes a project-specific website (https://www.franklincountyohhmp.com/) and using a web-based program (BATool[SM]) to help the County and participating jurisdictions maintain the 2023 HMP over the next five years.
Requirement §201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).	Franklin County and all the planning partners have adopted the plan.	The 2023 plan achieves DMA compliance for Franklin County. Resolutions for each partner adopting the plan can be found in Appendix A.

SECTION 2. PLANNING PROCESS

2.1 INTRODUCTION

This section describes the planning process used to update the 2018 Franklin County HMP—how it was prepared, who was involved in the process, and how the public was involved. To ensure that the plan meets the requirements of the DMA 2000 and that the planning process had the broad and effective support of the participating jurisdictions, regional and local stakeholders, and the public, the approach to the planning process and plan documentation included the following:

1) The 2023 Franklin County HMP is multi-jurisdictional and considers natural hazards facing the Planning Area, thereby satisfying the natural hazards mitigation planning requirements specified in the DMA 2000.
2) Franklin County invited all townships and municipalities in the County to join in the update to the HMP. The County and 37 other jurisdictions, including The Ohio State University, are participating in the HMP as indicated in Table 2-1. Seven municipalities, including the Villages of Brice, Harrisburg, Lithopolis, Riverlea, Urbancrest, and Valleyview, as well as the City of Pickerington, have chosen not to participate. However, if any of these municipalities decide to join at a later time, they can collaborate with Franklin County EM&HS and follow the procedures detailed in Appendix H (Linkage Procedures) to become part of the plan.
3) The HMP was developed following the process outlined by the DMA 2000, FEMA regulations, and prevailing FEMA and Ohio EMA guidance. Following this process ensures that all the requirements are met and supports HMP review.

The hazard mitigation strategies identified in this HMP have been developed through an extensive planning process involving local, County, and regional agencies, Planning Area residents, and stakeholders. The HMP update was written using the best available information obtained from a wide variety of sources. Throughout the HMP update process, a concerted effort was made to gather information from local and regional agencies and staff, as well as stakeholders, federal and state agencies, and the residents of the Planning Area. The HMP Planning Team solicited information from local agencies and individuals with specific knowledge of certain hazards and past historical events, as well as reviewing planning and zoning codes, ordinances, and other recent planning decisions.

The mitigation planning process, as shown in Figure 2-1, consisted of six steps: (1) Organization of the Planning Process; (2) Stakeholder Outreach and Involvement; (3) Public Participation; (4) Incorporation of Existing Plans, Studies, Reports, and Technical Information; (5) Integration with Existing Planning Mechanisms and Programs; and (6) Continued Public Involvement.

Figure 2-1. Franklin County Hazard Mitigation Planning Process

Table 2-1. Franklin County Hazard Mitigation Planning Team and Core Planning Team

Organization	Name	Title	Core Planning Team Member	Planning Team Member
Franklin County Emergency Management and Homeland Security	Jeff Young	EM&HS Director	Yes	Yes
	Darrel Koerber	EM&HS Deputy Director	Yes	Yes
	Connor Robb	EM&HS Specialist	Yes	Yes
	Carter Smith	GIS Specialist	Yes	Yes
Franklin County Economic Development and Planning Department	Matt Brown	Planning Administrator	Yes	Yes
Mid-Ohio Regional Planning Commission	Brandi Whetstone	Sustainability Officer	Yes	Yes
NAACP	Carol Hector	Consultant	Yes	Yes
AEP Ohio	Brent M Gates	Distribution Design Manager	Yes	Yes
	Thomas A Kratt	VP Distribution Operations	Yes	Yes
The Ohio State University	Karina B. Peggau	Byrd Polar and Climate Research Center	Yes	Yes
	Bob Armstrong	Director of Emergency Management	Yes	Yes
	Josh Seymour	Planner, Emergency Management	Yes	Yes
Bexley (City)	Ben Kessler	Mayor	No	Yes
	Natalie Vawter	Executive Assistant	No	Yes
Blendon (Township)	Cathy Shinaberry	Trustee	No	Yes
	Jan Heichel	Trustee	No	Yes
	Jim Welch	Trustee	No	Yes
	John Giamarco	Administrator	No	Yes
Brown (Township)	Becky Kent	Fiscal Officer	No	Yes
	Joe Martin	Trustee	No	Yes
Canal Winchester (City)	Matt Peoples	Director of Public Services	No	Yes
	Michael Ebert	Mayor	No	Yes
Clinton (Township)	Matt Huffman	Township Administrator	No	Yes
Columbus (City)	Vikram Airi	Emergency Preparedness Planner	Yes	Yes
	James Howdyshell	Project Manager	Yes	Yes
	Tomeka Hopson	Deputy Director	Yes	Yes
	Rob Preistas	Administrator, Division of Sewerage & Drainage	Yes	Yes
	Sandy Ambris	-	Yes	Yes
	Andrew Ginther	Mayor/ExComm	No	Yes
	Steven Kranz	Emergency Preparedness Chief, Public Utilities	No	Yes
	Alana Shockey	Deputy Director, Sustainable Columbus	Yes	Yes
Dublin (City)	Tom Hirschy	Emergency Management Coordinator	Yes	Yes
	Megan O'Callaghan	City Manager/ExComm	No	Yes

Organization	Name	Title	Core Planning Team Member	Planning Team Member
Franklin (Township)	Steve Mazer	Township Administrator	No	Yes
Gahanna (City)	Laurie Jadwin	Mayor	No	Yes
	Tom Komlanc	Director of Engineering	No	Yes
Grandview Heights (City)	Aubrey Hale	Strategy and Engagement Officer	No	Yes
	Greta Kearns	Mayor	No	Yes
	James Beckett	Assistant Fire Chief	No	Yes
Grove City (City)	Richard "Ike" Stage	Mayor/ExComm	No	Yes
	William Vedra	Deputy City Administrator	No	Yes
	Kota Wharton	Building Permit Coordinator	Yes	Yes
Groveport (City)	Stephan Moore	Building Official	No	Yes
	Steve Farst	City Engineer	No	Yes
	B. J. King	City Administrator	No	Yes
Hamilton (Township)	Lisa Shirkey	Fiscal Officer	No	Yes
Hilliard (City)	Michelle Crandall	City Manager	No	Yes
Jackson (Township)	Shane Farnsworth	Township Administrator	No	Yes
Jefferson (Township)	Bradford Shull	Fire Chief	No	Yes
	Dion Grener	Township Administrator/Public Safety Director	No	Yes
	Joe Gerhart	Service Department Superintendent	No	Yes
	Kelly Kiener	Assistant Township Administrator	No	Yes
Lockbourne (Village)	Christie Ward	Mayor	No	Yes
	Kendall Collins	Deputy Administrator	No	Yes
	Lindsey McKnight	Safety Committee Chair	No	Yes
Madison (Township)	Susan Brobst	Township Administrator	No	Yes
Marble Cliff (Village)	Matthew Cincione	Mayor	No	Yes
Mifflin (Township)	Nancy White	Township Administrator	No	Yes
Minerva Park (Village)	Tiffany Hughes	Mayor	No	Yes
New Albany (City)	Sloan Spalding	Mayor	No	Yes
	Alicia McGovern	Administrative Assistant	No	Yes
	Anna van der Zwaag, AICP	Planner	No	Yes
	Joseph Stefanov	City Manager	No	Yes
Norwich (Township)	Jamie Fisher	Township Administrator	No	Yes
Obetz (City)	Stacey Boumis	Director of Community Services	No	Yes
	Jeff Griffith	Deputy Safety Director	No	Yes
Perry (Township)	Beth Beatty	Township Administrator	No	Yes
Plain (Township)	Ben Collins	Township Administrator	No	Yes
Pleasant (Township)	Paula Wilkins	Fiscal Officer	No	Yes
Prairie (Township)	Allen Scott	Chief	No	Yes
	James Jewell	Township Administrator	No	Yes
Reynoldsburg (City)	Joe Begeny	Mayor	No	Yes
Sharon (Township)	Michael Farley	Fiscal Officer	No	Yes
Truro (Township)	Jason Nicodemus	Township Administrator	No	Yes
Upper Arlington (City)	Chris Zimmer	Assistant Fire Chief	No	Yes
	Jackie Thiel	Assistant City Manager	No	Yes
	Steve Schoeny	City Manager/ExComm	No	Yes
Washington (Township)	Eric Richter	Township Administrator	No	Yes

Organization	Name	Title	Core Planning Team Member	Planning Team Member
Westerville (City)	Brian Miller	Fire Chief	No	Yes
	Monica Irelan	City Manager/ExComm	No	Yes
Whitehall (City)	Kim Maggard	Mayor/ExComm	No	Yes
Worthington (City)	John Moorehead	Director of Service & Engineering	No	Yes
	Mark Zambito	Fire Chief	No	Yes
	Matt Greeson	City Manager	No	Yes
	Robert Ware	Police Chief	No	Yes
	Robyn Stewart	Acting City Manager	No	Yes

2.2 ORGANIZATION OF THE PLANNING PROCESS

Many parties supported the preparation of this HMP update: County, township, and municipal officials, stakeholders, and a contract planning consultant. The planning process was part of ongoing hazard risk management in the Planning Area by state, County, and local agencies and individuals. A summary of past and ongoing mitigation efforts is provided in Section 6 (Mitigation Strategy) and Section 9 (Jurisdictional Annexes), to give a historical perspective of Planning Area activities implemented to reduce vulnerability to hazards.

This section of the HMP identifies how the planning process was organized with the many Planning Team members involved and outlines the major activities in the development of this HMP update.

2.2.1 Organization of the Planning Team

Contract Planning Consultant

Tetra Tech, Inc. (Tetra Tech) was selected as a contract planning consultant to guide Franklin County through the HMP update process. A contract between Tetra Tech and Franklin County was executed in June 2022. Specifically, Tetra Tech, as contract consultant, was tasked with the following:

- Assistance with the organization of the Core Planning Team and Planning Team
- Assistance with the development and implementation of a public and stakeholder outreach program
- Data collection
- Facilitation and attendance at meetings (Core Planning Team, Planning Team, stakeholder, public and others)
- Review and update of the hazards of concern, hazard profiling, and risk assessment
- Assistance with the review and update of mitigation planning goals and objectives
- Assistance with the review of past mitigation strategy progress
- Assistance with the screening of mitigation actions and the identification of appropriate actions

- Assistance with the prioritization of mitigation actions
- Authoring of the draft and final plan documents

Core Planning Team

Franklin County formed a Core Planning Team to provide guidance and direction to the HMP update effort and to ensure that the resulting document will be embraced politically and by the constituency within the County (Table 2-1). Specifically, the Core Planning Team was charged with the following:

The Core Planning Team led the update of the Franklin County HMP, working with the Planning Team and Stakeholders throughout the process. The Core Planning Team was made up of county departments and agencies, in addition to local municipalities and stakeholders. For the 2023 update, the Mid-Ohio Regional Planning Commission, NAACP, and AEP Ohio served on the Core Planning Team.

- Providing guidance and overseeing the planning process on behalf of the Planning Team
- Attending and participating in Core Planning Team meetings
- Establishing a timeline for completion of the plan
- Assisting with the following:
    - Reviewing and updating the hazards of concern
    - Developing a public and stakeholder outreach program
    - Ensuring that the data and information used in the plan update process is the best available
    - Reviewing and updating the hazard mitigation goals and objectives
    - Identifying and screening appropriate mitigation strategies and activities
    - Reviewing and commenting on plan documents prior to submission to Ohio EMA and FEMA
    - Ensuring that the plan meets the requirements of DMA 2000 and FEMA and Ohio EMA guidance.

Planning Team

In October 2022, Franklin County Emergency Management and Homeland Security (EM&HS) notified all jurisdictions within the County of the pending hazard mitigation plan update process and invited them to formally participate. Jurisdictions were provided with a letter explaining the process and expectations of Planning Team Members and were asked to notify the County of their intent to participate. Table 2-1 lists the names and titles of personnel representing each jurisdiction. Section 9 (Jurisdictional Annexes) lists names and titles of all personnel that provided input during the planning process.

Planning Team Members were charged to do the following:

- Represent their jurisdiction throughout the planning process and ensure participation expectations are met by their jurisdiction.

- Ensure participation of all departments and functions within their jurisdiction that have a stake in mitigation (e.g., planning, engineering, code enforcement, police, emergency services, public works).
- Assist in gathering information for inclusion in the HMP update, including the use of previously developed reports and data.
- Involve the local NFIP Floodplain Administrator in the planning process.
- Solicit and encourage the participation of regional agencies, a range of stakeholders, and residents in the plan development process.
- Support and promote the public involvement process.
- Assist with the development and completion of certain planning elements, including the following:
    - Reviewing and updating the hazards of concern
    - Developing a public and stakeholder outreach program
    - Ensuring that the data and information used in the plan update process are the best available
    - Reviewing and updating the hazard mitigation goals
    - Reporting on progress of mitigation actions identified in prior HMPs
    - Identifying and screening appropriate mitigation strategies and activities
    - Reviewing and commenting on plan documents prior to submission to Ohio EMA and FEMA
    - Adopting, implementing, and maintaining the plan update

The jurisdictions in Franklin County have differing levels of capabilities and resources available to apply to the plan update process. They also have differing exposure and vulnerability to the hazard risks being considered in this plan. Franklin County's intent was to encourage participation by all jurisdictions and to accommodate their specific needs and limitations while still meeting the intents and purpose of plan participation. Such accommodations included the establishment of the Core Planning Team and engaging a contract consultant to assume certain elements of the planning process on behalf of the jurisdictions, as well as providing alternative mechanisms to meet the purposes and intent of mitigation planning.

Ultimately, jurisdictional participation is evidenced by a completed annex of the HMP (Section 9) wherein the jurisdictions have identified their planning points of contact, evaluated their risk to the hazards of concern, identified their capabilities to effect mitigation in their community, and identified and prioritized an appropriate suite of mitigation initiatives, actions, and projects to mitigate their natural hazard risk; and eventually by the adoption of the updated plan via resolution.

Appendix B (Participation Documentation) identifies the individuals who represented their jurisdictions during this planning effort and indicates how they contributed to the planning process. This matrix gives a broad overview of who attended meetings and when input was provided. All participants were encouraged to attend the kickoff meeting and the risk assessment and mitigation action workshop. The planning consultant contacted each participant during the planning process to offer support, explain the

process, meet individually to collect updated information, and facilitate the submittal and review of critical documents.

All municipalities actively participate in the National Flood Insurance Program (NFIP) and have designated NFIP Floodplain Administrators (FPA). The FPAs were informed of the planning process, were provided the opportunity to review the plan, including the jurisdictional annex, and provide direct input to the plan update. Local FPAs are identified in the points of contact and administrative and technical portions of the jurisdictional annexes in Section 9 (Jurisdictional Annexes).

2.2.2 Planning Activities

Members of the Planning Team (individually and as a whole), as well as key stakeholders, convened and/or communicated regularly to share information and participate in workshops to identify hazards; assess risks; review existing inventories of critical facilities and identify new ones; assist in updating and developing new mitigation goals and strategies; and provide continuity through the process to ensure that natural hazard vulnerability information and appropriate mitigation strategies were incorporated. All members of the Core Planning Team and Planning Team had the opportunity to review the draft plan, supported interaction with other stakeholders, and assisted with public involvement efforts.

Table 2-2 summarizes planning process meetings (Core Planning Team and Planning Team) and key milestones during the development of the HMP update. It also identifies which DMA 2000 requirements each activity satisfies. Documentation of meetings (e.g., agendas, sign-in sheets, and meeting notes) are in Appendix C (Meeting Documentation). Table 2-2 identifies only the formal meetings held during plan development. It does not reflect all planning activities conducted by individuals and groups throughout the planning process. In addition to these meetings, there was a great deal of communication between Franklin County, committee members, and the contract consultant through individual local meetings, email, and phone.

After completion of the HMP update, implementation and ongoing maintenance will become a function of the Planning Partnership as described in Section 7 (Plan Maintenance). The Planning Team is responsible for reviewing the HMP and soliciting and considering public comment as part of the five-year mitigation plan update.

Table 2-2. Summary of Mitigation Planning Activities / Efforts

Date	DMA 2000 Requirement	Description of Activity	Participants
October 7, 2022	2	Pre-Kickoff Meeting with Franklin County: Plan timing and administration, data needs and sharing, hazards of concern, dates, and next steps	Franklin County EM&HS, Tetra Tech
November 7, 2022	2	Core Planning Team Meeting #1: Review of mitigation and the 2018 HMP; review of Core Planning Team guidelines; project schedule and data request; hazards of concern review; stakeholder and public outreach approach; review of goals and objectives.	Franklin County EM&HS, Franklin County Economic Development & Planning, City of Dublin, City of Columbus, City of Grove, NAACP, Mid-Ohio Regional Planning Commission, The Ohio State University, AEP Ohio, Sustainable Columbus, Tetra Tech
November 18, 2022	2, 3c, 4a	Planning Team Meeting #1: Importance of mitigation and HMP; participation requirements; hazards of concern identification and previous events exercise; distribution of outreach materials; review of worksheets to obtain jurisdiction-specific information.	Franklin County EM&HS, City of Canal Winchester, City of Columbus, City of Dublin, Township of Franklin, City of Gahanna, City of Grandview Heights, Township of Jefferson, Village of Lockbourne, City of New Albany, Village of Obetz, Township of Plain, Township of Prairie, Township of Truro, City of Upper Arlington, Township of Washington, City of Westerville, City of Worthington, Tetra Tech
January 5, 2023	2, 3a, 3b, 4a	Core Planning Team Meeting #2: Project status update; project schedule; review and finalize hazards of concern; review and finalize goals and objectives; update on public and stakeholder outreach; discussion of next steps.	Franklin County EM&HS, Franklin County Economic Development & Planning, Franklin County Engineering, City of Dublin, City of Columbus, City of Grove, NAACP, Mid-Ohio Regional Planning Commission, The Ohio State University, AEP Ohio, Sustainable Columbus, Tetra Tech
April 14, 2023	2, 3b, 3c, 3d, 3e, 4b	Core Planning Team Meeting #3: Project status update; project schedule; review risk assessment results; review and update preliminary hazard rankings; discussion of County mitigation actions.	Franklin County EM&HS, Franklin County Economic Development & Planning, Franklin County Engineering, City of Dublin, City of Columbus, City of Grove, NAACP, Mid-Ohio Regional Planning Commission, AEP Ohio, Tetra Tech
April 25, 2023	2, 3c, 3d, 3e, 4a, 4b, 5a, 5b	Core Planning Team Meeting #4: Project status update; project schedule; identify plan maintenance schedule for the 2023 HMP; discussion of County mitigation actions.	Franklin County EM&HS, Franklin County Economic Development & Planning, AEP Ohio, City of Dublin, City of Grove City, The Ohio State University, NAACP, Tetra Tech
April 27, 2023	2, 3c, 3d, 3e, 4a, 4b	Risk Assessment and Mitigation Strategy Meeting (Core Planning Team Meeting #5/Planning Team Meeting #2): Presentation of draft risk assessment results and hazard ranking; hazard ranking exercise; review of FEMA and state mitigation strategy requirements; mitigation resources distributed; review of mitigation action online form; next steps.	Franklin County EM&HS, City of Bexley, City of Dublin, Township of Franklin, City of Grandview Heights, City of Groveport, City of New Albany, City of Obetz, Township of Plan, Township of Prairie, City of Reynoldsburg, City of Upper Arlington, City of Westerville, City of Whitehall, Tetra Tech

Date	DMA 2000 Requirement	Description of Activity	Participants
June 14, 2023	2	Draft Plan Review Presentation (Core Planning Team Meeting #6/Planning Team Meeting #3): Overview of entire plan and sections; confirmed plan maintenance schedule	Franklin County EM&HS, County Engineer's Office, City of Canal Winchester, Township of Clinton, City of Columbus, City of Dublin, Township of Franklin, City of Gahanna, City of Grandview Heights, City of Grove City, City of Groveport, Township of Jackson, City of New Albany, City of Obetz, Township of Plain, Township of Prairie, City of Reynoldsburg, City of Upper Arlington, City of Westerville, City of Worthington, AEP Ohio, NAACP, and The Ohio State University
July 10, 2023	1b, 2	Draft HMP posted to public project website; all plan participants were notified and asked to assist with the public outreach including social media. Neighboring communities and stakeholders were notified of the posting as well.	Public and Stakeholders
August 10, 2023	4b, 4c, 5b	All jurisdictions consider public and stakeholder comments received; update the plan accordingly	All plan participants
September 29, 2023	2	HMP submitted to Ohio EMA and FEMA Region V	Ohio EMA, FEMA Region V
Upon plan approval by FEMA	1a	Plan adoption by resolution by the governing bodies of all participating jurisdictions	All Plan Participants

Each number in column 2 identifies specific DMA 2000 requirements, as follows:

1a, Prerequisite—Adoption by the Local Governing Body
1b, Public Participation
2, Planning Process—Documentation of the Planning Process
3a, Risk Assessment—Identifying Hazards
3b, Risk Assessment—Profiling Hazard Events
3c, Risk Assessment—Assessing Vulnerability: Identifying Assets
3d, Risk Assessment—Assessing Vulnerability: Estimating Potential Losses
3e, Risk Assessment—Assessing Vulnerability: Analyzing Development Trends
4a, Mitigation Strategy—Local Hazard Mitigation Goals
4b, Mitigation Strategy—Identification and Analysis of Mitigation Measures
4c, Mitigation Strategy—Implementation of Mitigation Measures
5a, Plan Maintenance Procedures—Monitoring, Evaluating, and Updating the Plan
5b, Plan Maintenance Procedures—Implementation through Existing Programs
5c, Plan Maintenance Procedures—Continued Public Involvement

2.3 STAKEHOLDER OUTREACH AND INVOLVEMENT

Stakeholders are the individuals, agencies, and jurisdictions that have a vested interest in the recommendations of the HMP, including all planning partners. Diligent efforts were made to assure broad regional, county, and local representation in this planning process. To that end, a comprehensive list of stakeholders was developed with the support of the Planning Team. Stakeholder outreach was performed early on, and continually throughout the planning process. This HMP update includes information and input provided by these stakeholders where appropriate, as identified in the references. This subsection identifies the stakeholders that were invited to participate in the development of this HMP update and discusses how they participated.

This is only a summary listing of stakeholders that were aware of and/or contributed to this HMP update. The planning partners made more formal and informal and outreach efforts throughout the process than can be documented here. The summary demonstrates the scope and breadth of the stakeholder outreach efforts. For details, refer to Appendix D (Public and Stakeholder Outreach).

Key elements of outreach to stakeholders were as follows:

- All Planning Team meetings were open to the public and advertised via the Franklin County HMP website.
- In November 2022, over 150 stakeholders and neighboring counties were emailed to notify them of the planning process and invite them to complete a mitigation survey regarding vulnerabilities, capabilities, and mitigation projects. Stakeholders included academia, state and local government, businesses, non-profits, emergency services, public works, transportation, and utility providers. Neighboring counties included Fairfield, Licking, Delaware, Union, Madison, and Pickaway Counties. The County received input from 20 stakeholders in the Planning Area and two neighboring counties. All responses to the stakeholder surveys may be found in Appendix D (Public and Stakeholder Outreach).

- In March 2023, the Core Planning Team and Planning Team were provided outreach materials to publicize the planning process. Materials included five social media posts, two informational graphics for municipal websites, and one flyer for printing and distribution in government offices. The outreach materials included information on the HMP process and a link to the public

survey. Between March 21 and April 10, the County and participating jurisdictions publicized the HMP on their websites and social media accounts. As a result, 180 members of the public completed the survey.

- In March 2023, the County deployed a StoryMap to provide information regarding the hazard mitigation planning process and an opportunity for virtual public participation. It also provides an interactive platform to learn about the hazards of concern and view hazard maps prepared for the HMP.
- In July 2023, the draft plan was posted on the Franklin County HMP website and advertised using jurisdictional websites and social media platforms. Additionally, regional stakeholders and neighboring counties were emailed to notify them that the draft HMP is available for review and input.

2.3.1 Federal, State, and County Agencies

The following sections list the departments and agencies that were involved during the planning process. Please see Appendix B (Participation Documentation) for further details.

Federal Agencies

FEMA Region 5 provided updated planning guidance and conducted plan review.

Information regarding hazard identification and the risk assessment for this plan update was requested and received or incorporated by reference from the following agencies and organizations:

- National Climatic Data Center (NCDC)
- National Hurricane Center (NHC)
- National Oceanic and Atmospheric Administration (NOAA)
- National Weather Service (NWS)
- Storm Prediction Center (SPC)
- U.S. Army Corps of Engineers (USACE)
- U.S. Census Bureau
- U.S. Department of Agriculture (USDA)
- U.S. Department of Health and Human Services
- U.S. Environmental Protection Agency (EPA)
- U.S. Geological Survey (USGS)

State Agencies

Ohio Emergency Management Agency (Ohio EMA) administered the planning grant, provided updated planning guidance, and provided review of the draft HMP update.

Information regarding hazard identification and the risk assessment for this plan update was requested and received or incorporated by reference from the following agencies and organizations:

- Ohio Department of Natural Resources (ODNR)
- ODNR Division of Parks and Recreation
- ODNR Division of Watercraft
- ODNR Division of Wildlife
- ODNR Office of Law Enforcement
- Ohio Department of Public Safety Investigative Unit Headquarters
- Ohio Health Police Department
- Ohio State Fire Marshal
- Ohio State Highway Patrol

County Agencies and Departments

County agencies and departments invited to participate in the HMP update process are listed below. Those that served on the Core Planning Team or Planning Team or those that provide services to the socially vulnerable in Franklin County are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

- Alcohol, Drug, and Mental Health Services Board
- Board of Trustees of the Columbus Metropolitan Library
- Community Shelter Board of Trustees
- Franklin County Board of Commissioners
- Franklin County Board of Developmental Disabilities—Completed the stakeholder survey and provided input during the planning process; provides services to all populations, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements.
- Franklin County Coroner
- Franklin County Economic Development and Planning
- Franklin County Engineer
- Franklin County Office on Aging—provides services to all populations, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements.
- Franklin County Public Facilities Management
- Franklin County Public Health

- Franklin County Sanitary Engineering
- Franklin County Soil and Water Commission
- Franklin County Transportation Improvement District
- Franklin County Veterans Service Commission

Refer to Section 5 (Capability Assessment) for details on each department, their roles during the HMP update, and their overall responsibilities in the planning area.

2.3.2 Regional and Local Stakeholders

Over 200 regional and local stakeholders invited to participate in the HMP update process are listed below. Of those invited to participate, 20 stakeholders from 15 different agencies provided input through the online survey. Those that served on the Core Planning Team or Planning Team, those that provide services to the socially vulnerable in Franklin County, or those that completed the survey are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

Academia

Schools, universities, and other academia institutions invited to attend planning process meetings and asked to complete the stakeholder survey are listed below. Those that served on the Core Planning Team or Planning Team or those that provide services to the socially vulnerable in Franklin County are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

- The Ohio State University—The Director of Emergency Management served on the Core Planning Team during the planning process and provided input throughout the HMP update.
- Bexley City School District—Completed the stakeholder survey and provided input during the planning process; provides services to all populations, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements.
- Canal Winchester Local School District—Completed the stakeholder survey and provided input during the planning process; provides services to all populations, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements.
- Dublin City School District
- Gahanna-Jefferson City School District
- Grandview Heights City School District
- Groveport Madison Local School District

- Hilliard City School District
- New Albany-Plain Local School District
- Otterbein University
- Reynoldsburg City School District—Completed the stakeholder survey and provided input during the planning process.
- South-Western City School District
- Upper Arlington City School District
- Westerville City School District—Completed the stakeholder survey and provided input during the planning process; provides services to all populations, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements.
- Whitehall City School District—Completed the stakeholder survey and provided input during the planning process.
- Worthington City School District

Business, Commercial, Non-Profit, and Sustainability Organizations

Business, commercial, non-profit, and sustainability organizations invited to participate in the HMP update process are listed below. Those that served on the Core Planning Team or Planning Team or those that provide services to the socially vulnerable in Franklin County are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

- American Red Cross—provides services to all populations, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements.
- Bexley Ohio Chamber of Commerce
- Canal Winchester Area Chamber of Commerce
- Central Ohio African American Chamber of Commerce
- Central Ohio Community Improvement Corporation
- Columbus Chamber of Commerce
- Columbus-Franklin County Finance Authority
- Columbus and Franklin County Metro Parks—Completed the stakeholder survey and provided input during the planning process; provides services to all populations, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements.

- Community Capital Development Corporation
- Dublin Chamber of Commerce
- Economic & Community Development Institute
- Franklin Park Conservatory Joint Recreation District Board of Trustees
- Gahanna Area Chamber of Commerce
- Grove City Area Chamber of Commerce
- Hilliard Area Chamber-Commerce
- Kiva
- Mid-Ohio Regional Planning Commission—The sustainability officer served on the Core Planning Team during the planning process and provided input throughout the HMP update.
- National Association for the Advancement of Colored People (NAACP) Columbus—Served on the Core Planning Team during the planning process and provided input throughout the HMP update.
- National Association of Women Business Owners
- New Albany Community Authority District
- New Albany Ohio Chamber of Commerce
- Ohio Chamber of Commerce
- One Columbus
- Reynoldsburg Chamber of Commerce
- Southeastern Franklin County Chamber of Commerce
- Sustainable Columbus—The deputy director served on the Core Planning Team during the planning process and provided input throughout the HMP update.
- Tri-Village Chamber Partnership
- Whitehall Area Chamber of Commerce
- Worthington Area Chamber of Commerce

Emergency Services

Local emergency service providers (police, fire, and EMS) invited to participate in the HMP update process are listed below. It should be noted that those listed below provide services to all populations in Franklin County, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements. Those that served on the Core Planning Team or Planning Team or those that provide services to the socially vulnerable in Franklin County are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder

agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

- Bexley Police Department
- Blendon Township Police Department
- Brice Police Department
- Capital University Police Department
- Clinton Township Police Department
- Clinton Township Fire Department
- Columbus Division of Fire
- Columbus Police Department
- Columbus Regional Airport Authority
- Columbus State Community College Police Department
- CSX Railroad Police Department
- Dublin Police Department—The City's Emergency Management Coordinator served on the Core Planning Team and Planning Team during the planning process and provided input throughout the HMP update. In addition, five officers completed the stakeholder survey and provided input during the planning process;
- Franklin County Sheriff's Office
- Franklin Township Police Department
- Franklin Township Fire Department
- Gahanna Police Department
- Grandview Heights Division of Fire—The Assistant Fire Chief served on the Planning Team during the planning process, attended meetings, and provided input throughout the HMP update.
- Grandview Heights Police Department—Completed the stakeholder survey and provided input during the planning process.
- Grove City Police Department
- Groveport Police Department—Completed the stakeholder survey and provided input during the planning process.
- Hamilton Township Fire Department
- Harrisburg Police Department
- Hilliard Police Department—Completed the stakeholder survey and provided input during the planning process.
- Jackson Township Fire Department

- Jefferson Township Fire Department
- Madison Township Fire Department
- Madison Township Police Department
- Mifflin Township Fire Department
- Mifflin Township Police Department
- Minerva Park Police Department
- New Albany Police Department
- Norwich Township Fire Department
- Obetz Police Department—Completed the stakeholder survey and provided input during the planning process.
- Otterbein Police Department
- Perry Township Police Department
- Plain Township Fire Department
- Pleasant Township Fire Department
- Port Columbus International Fire Department
- Prairie Township Fire Department—The Fire Chief served on the Planning Team during the planning process, attended meetings, and provided input throughout the HMP update.
- Reynoldsburg Police Department
- Sharon Township Police Department
- The Ohio State University Police Division
- Truro Township Fire Department
- Upper Arlington Fire Department—The Assistant Fire Chief served on the Planning Team during the planning process, attended meetings, and provided input throughout the HMP update.
- Upper Arlington Police Department
- Valleyview Police Department
- Washington Township Fire Department
- Westerville Fire Department—The Fire Chief served on the Planning Team during the planning process, attended meetings, and provided input throughout the HMP update.
- Westerville Police Department
- Whitehall Division of Fire
- Whitehall Police Department

- Worthington Fire Department—The Fire Chief served on the Planning Team during the planning process, attended meetings, and provided input throughout the HMP update.
- Worthington Police Department—The Police Chief served on the Planning Team during the planning process, attended meetings, and provided input throughout the HMP update.

Healthcare

Healthcare providers and facilities invited to participate in the HMP update process are listed below. It should be noted that those listed below provide services to all populations in Franklin County, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements. Those that served on the Core Planning Team or Planning Team or those that provide services to the socially vulnerable in Franklin County are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

- Central Ohio Agency on Aging
- Central Ohio Trauma Systems (COTS)
- Chalmers P. Wylie Veterans Outpatient Clinic
- City of Columbus Health Department—The emergency preparedness planner for public health served on the Core Planning Team and provided input throughout the HMP update.
- Grant Medical Center
- Mount Carmel Health System
- Nationwide Children's Hospital
- Ohio State University Hospitals
- OhioHealth
- Pomegranate Health Systems of Columbus
- Riverside Methodist Hospital
- Twin Valley Behavioral Healthcare
- Select Specialty Hospital-Columbus, Inc
- Sun Behavioral Columbus

Public Works and Transportation

County and local highway and public works departments invited to participate in the HMP update process are listed below. It should be noted that those listed below provide services to all populations in Franklin County, including socially vulnerable populations. Socially vulnerable populations often need additional

emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements. Those that served on the Core Planning Team or Planning Team or those that provide services to the socially vulnerable in Franklin County are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

- Bexley Service Department
- Blendon Township Service Department
- Canal Winchester Department of Public Service—The director of public services served on the Planning Team and represented the City, provided municipal-specific information about the City including the status of the 2018 mitigation actions, and identified new mitigation actions for the 2023 HMP.
- Central Ohio Transit Authority (COTA)
- Clinton Township Public Works Department
- Columbus & Ohio River Railroad
- Columbus Department of Public Service
- Conference of Minority Transportation Officials (COMTO)
- Dublin Department of Public Works
- Franklin County Highway Maintenance
- Franklin Township Roads Department
- Gahanna Public Service & Engineering
- Grandview Heights Service Department
- Grove City Public Service Department
- Groveport Public Works Department
- Hamilton Township Road Department
- Hilliard Transportation and Mobility Division
- Jackson Township Road and Service Department
- Jefferson Township Service Department
- Madison Township Department of Public Works
- Mifflin Township Service Department
- Minerva Park Public Works
- New Albany Public Service Department
- Norwich Township Road Department

- Obetz Service Department
- Ohio Public Works, District 3
- Perry Township Road Department
- Plain Township Maintenance Department
- Pleasant Township Road Department
- Prairie Township Roads, Cemeteries, and Parks Department
- Reynoldsburg Street Department
- Sharon Township Road Department
- Truro Township Roads Department
- Upper Arlington Public Works Division
- Urbancrest Street Commission Department
- Westerville Public Service Department
- Whitehall Public Service Department
- Worthington Department of Service and Engineering

Utilities

Utility providers that serve Franklin County and its municipalities invited to participate in the HMP update process are listed below. It should be noted that those listed below provide services to all populations in Franklin County, including socially vulnerable populations. Socially vulnerable populations often need additional emergency assistance in disaster events due to lack of ability to evacuate or housing that does not meet modern building requirements. Those that served on the Core Planning Team or Planning Team or those that provide services to the socially vulnerable in Franklin County are noted accordingly. Refer to Appendix B (Participation Documentation) for further details regarding regional and local stakeholder agency attendance at meetings. Refer to Appendix D for additional details on the public and stakeholder outreach, including responses received to the surveys.

- AEP Ohio Transmission Company—The distribution design manager and vice president of distribution operations both served on the Core Planning Team during the planning process and provided input throughout the HMP update.
- Columbus Department of Public Utilities—The deputy director served on the Core Planning Team during the planning process, provided input throughout the HMP update, and identified mitigation actions for the County and the City.
- Columbus Division of Water—Provided information regarding the high hazard dams located in Franklin County.
- Franklin County Utilities Department
- Interstate Gas Supply Inc.

- North Coast Gas Transmission LLC
- Ohio Public Utilities Commission
- Solid Waste Authority of Central Ohio Board of Trustees

Adjacent Counties

Franklin County made efforts to keep the surrounding counties apprised of the project. The following were invited to take the stakeholder survey and given opportunity to provide input to this planning process:

- Delaware County Homeland Security and Emergency Management
- Fairfield County Emergency Management Agency—Completed the online survey and provided input
- Licking County Emergency Management Agency
- Madison County Emergency Management Agency
- Pickaway County Office of Emergency Management and Homeland Security—Completed the online survey and provided input
- Union County Emergency Management Agency

2.3.3 Stakeholder Survey Summary

The following is a summary of the results and feedback received by stakeholders who completed the stakeholder survey. The survey was designed for stakeholders to help identify general needs for hazard mitigation and resiliency within Franklin County from their perspective, as well as to identify specific projects that may be included in the mitigation plan. It was distributed to identified stakeholders, including various County and municipal departments and agencies in Franklin County. Feedback was reviewed by the Planning Team and integrated into this plan where appropriate.

Responses from Stakeholders in the Planning Area

As of June 7, 2023, 20 stakeholders took the survey; however, not all stakeholders answered all the questions. Stakeholders from the following sectors completed the survey: academic/research, emergency services, health and human services, and public works. The following provides a summary of responses. For all survey results, refer to Appendix D (Public and Stakeholder Outreach).

What category does your facility operation/service fall under?

A majority of respondents (57.9 percent) indicated that they provide emergency services within the County, followed by academic services (21 percent), then human and health services (10.5 percent) and public works (10.5 percent).

Does your organization work with or help support socially vulnerable populations that may be at higher risk for hazard impacts?

A majority of respondents indicated that they work with or help support socially vulnerable populations. This includes interacting with all members of the community, including services to homeless populations; programs for persons with disabilities; work with social service organizations; free meals to economically disadvantaged students; and programs for senior citizens.

Have buildings/facilities/structures you have worked in and/or are responsible for been impacted by a hazard?

Half of respondents stated that their buildings/facilities/structures have not been impacted by a hazard and the other half stated that they have been. For those that experienced impacts, the following hazards were identified as causing the impacts: flooding, blizzards, extreme cold, power outages, wind, and disease outbreaks. Impacts included structural damage, closing of buildings, limited use of buildings, and loss of educational opportunities. Several respondents stated that they have facilities located in the floodplain as well as facilities vulnerable to stormwater flooding, tornadoes, and other hazards.

What areas in Franklin County are most vulnerable to hazards?

Fifteen respondents identified the following vulnerable areas in Franklin County:

- Dam at Glick Road could significantly impact the City of Dublin
- Hazardous material incidents along 270/33
- Cheryl's Cookies (high concentration of ammonia)
- Independent living apartment complexes for heat and cold emergencies (530 South State and 200 South State Street)
- Town Street in Franklinton is in a flood area
- Public Service facility is near Walnut Creek and vulnerable to flooding
- Elementary schools have had lightning strikes, and all buildings would be vulnerable to a tornado

What are your agency's primary concerns regarding hazards?

A majority of respondents (80 percent) stated that response capabilities are their primary concern regarding hazards, followed by vulnerability of specific facilities, and then likelihood of specific hazard events. Respondents also noted that that the water plant and electric substations are vulnerable to hazards, as well as residences, transportation, access to health services, and access to food and water.

What capabilities does your agency have to help address hazards?

Capabilities that respondents identified having to help Franklin County and its residents address hazards include the following:

- Senior center with natural gas generators, kitchen, and large space

- Response to hazards embedded in Emergency Operations Plan (EOP)
- Staff that will assist with emergencies as they arise
- An Emergency Operations Plan and individuals trained in Incident Command System (ICS) protocols
- Partnerships with area first responders, internal monitoring mechanisms
- Applying for grants and funding support
- Staffing, plans, and resources (vehicles, equipment, supplies, etc.)
- Availability to community members with developmental disabilities needing assistance in hazard conditions
- Fire/Police/Service/Water/Electric/Parks and Recreation/Planning and Development Departments, and an Emergency Operations Center (EOC)
- Ranger program, strong maintenance program, relatively newer facilities, construction crew, lots of equipment

Responses from Neighboring Jurisdictions

The stakeholder survey was sent to the counties surrounding Franklin County because, due to their proximity, effects of hazard events on the Planning Area would be similar to effects on these neighboring jurisdictions. As of June 7, 2023, two responses were received (Fairfield County and Pickaway County). The following is a summary of responses:

- Fairfield County has shared services/mutual aid agreements with Franklin County including assistance with resources/personnel when needed.
- At this time, neither county is involved in Franklin County's emergency operations planning; however, they do work together for sheltering in the region as needed.
- During disasters, the counties communicate response and coordination through mutual aid, first responder communications, and emergency management directors communicating with each other.
- Both counties identified hazard risks that impact both them and Franklin County:
    - Pickaway County —Flooding of the Scioto River is common; water runoff from Franklin results in flooding concerns; and any facilities dumping into the Scioto should be identified if failure would result in an increased hazard.
    - Fairfield County—Flooding at Waterloo Road that could affect transportation up and down Interstate 33 by potentially backing up traffic; storm drainage concerns in Pickerington that could affect traffic close to Franklin County; and a couple of dams in the northwest corner of Fairfield County.

For all survey results, refer to Appendix D (Public and Stakeholder Outreach).

2.4 PUBLIC PARTICIPATION—PUBLIC INVOLVEMENT

Community input on the HMP increases the likelihood of hazard mitigation becoming one of the standard considerations in the evolution and growth of the County. To facilitate better coordination and communication between the Planning Team and citizens and to involve the public in the planning process, it was determined that meeting dates and locations would be made available to the public via the Franklin County HMP website, StoryMap, and social media; and the draft HMP would be available on the Franklin County HMP website and StoryMap. The Planning Team made the following efforts toward public participation in the development and review of the HMP:

- A dedicated website was created for this project (https://www.franklincountyohhmp.com/). The website went live in January 2023 and was continuously updated throughout the planning process. The public website contains a project overview, meeting announcements, draft documents for review and comment, and a link to the public and stakeholder surveys.

Figure 2-2. Screenshot of the 2023 HMP Update Website

- An online StoryMap was developed to provide information regarding the hazard mitigation planning process and provide an opportunity for virtual public participation.
- All hazard mitigation Planning Team meetings that were open to the public were advertised on the Franklin HMP website and various social media accounts (Facebook, Instagram, and Twitter). Additional examples of municipal outreach are presented in Appendix D.
- An online hazard mitigation public survey was developed to gauge household preparedness that may impact the County and to assess the level of knowledge of tools and techniques to assist in reducing risk and loss from those hazards. The questionnaire asked quantifiable questions about public perception of risk, knowledge of mitigation, and support of community programs. The questionnaire also asked several demographic questions to help analyze trends. The questionnaire was available on the public website from January 2023 through May 2023, and further advertised on additional Planning Team websites, social media accounts, and printed materials. Reponses were collected and provided to plan participants for consideration in the mitigation action development (180 responses in total). Appendix D summarizes public input received through the website, the online survey, and other sources.

- Results from the natural hazards preparedness survey were used to inform the action plans of the planning partners. To address the most requested types of projects that residents wanted local and County agencies to be doing, many planning partners included actions to improve and strengthen infrastructure, improve the damage resistance of utilities, buy out flood prone properties, improve protective structures, and provide greater control over development in high hazard areas.

Figure 2-3. Example Social Media Post to Advertise the HMP and Public Survey

- All plan participants were encouraged to post links to the project webpage and public survey. In addition, all participants were requested to advertise the availability of the project website, public survey and stakeholder surveys via local homepage links and other available public announcement methods (e.g., Facebook, Twitter, email blasts). Appendix D highlights these local efforts.
- Residents within the Planning Area were provided with the opportunity to comment on the draft HMP before submittal to FEMA. The HMP was posted on the HMP public website on July 10, 2023, for review. All Planning Team participants were requested to assist with advertising that the plan was posted via their websites and social media. Public comments received through August 10, 2023, were distributed to Planning Team for their consideration.
- Additional examples of public outreach efforts and results of the public survey, are presented in Appendix D (Public and Stakeholder Outreach Documentation).

2.5 INCORPORATION OF EXISTING PLANS, STUDIES, REPORTS, AND TECHNICAL INFORMATION

The Franklin County HMP strives to use the best available technical information, plans, studies, and reports throughout the plan process to support hazard profiling; risk and vulnerability assessment; review and evaluation of mitigation capabilities; and the identification, development, and prioritization of County and local mitigation strategies.

The asset and inventory data used for the risk and vulnerability assessments is presented in the County Profile (Section 3). Details of the source of this data, along with technical information on how the data was used to develop the risk and vulnerability assessment, is presented in Section 4.2 (Methodology and Tools) and throughout the hazard profiles in Section 4.3 (Hazard Profiles). Sources of technical data and information used may be found in the References section.

Many plans, reports, and other technical information were identified and provided directly by the Planning Team and stakeholders involved in the planning effort, as well as through independent research by the planning consultant. Planning Team members were tasked with updating the inventory of their Planning and Regulatory capabilities in Section 9 (Annexes) and providing relevant planning and regulatory documents, as applicable. Relevant documents, including plans, reports, and ordinances were reviewed to identify the following:

- Existing local and regional capabilities
- Needs and opportunities to develop or enhance capabilities, which may be identified within the mitigation strategies
- Mitigation-related goals and objectives
- Proposed, in-progress, or potential mitigation actions to be incorporated into the updated County and local mitigation strategies.

The following local regulations, codes, ordinances, and plans were reviewed for the County and each participating jurisdiction, where applicable, to develop mitigation planning goals, objectives, and strategies that are consistent across local and regional planning and regulatory mechanisms:

- Comprehensive plans
- Building codes
- Zoning and subdivision ordinances
- NFIP Flood Damage Prevention Ordinances
- Site Plan Requirements
- Stormwater Management Plans
- Emergency Management and Response Plans
- Land Use and Open Space Plans
- Capital Plans
- State of Ohio Hazard Mitigation Plan (2019)
- Franklin County Hazard Mitigation Plan Update (2018)

Refer to Section 5 (Capability Assessment) and Section 9 (Jurisdictional Annexes) for details on the regulations, codes, ordinances, and plans reviewed for each participant.

2.6 INTEGRATION WITH EXISTING PLANNING MECHANISMS AND PROGRAMS

Effective mitigation is achieved when hazard awareness and risk management approaches and strategies become an integral part of public activities and decision-making. Within the Planning Area there are many existing plans and programs that support hazard risk management, so it is critical that this hazard mitigation plan integrate, coordinate with, and complement, those mechanisms.

Section 5 (Capability Assessment) provides a summary and description of the existing plans, programs, and regulatory mechanisms at all levels of government (federal, state, County, and local) that support hazard mitigation within the Planning Area. Within each annex in Section 9, the participating jurisdictions identified how they integrate hazard risk management into their existing planning, regulatory, and operational/administrative framework (integration capabilities) and how they intend to promote this integration (integration actions). In addition, Appendix E summarizes the plan reviews mentioned above, indicating relevant goals and mitigation actions. This information provided input to identify integration of mitigation concepts into the operations of the Planning Area.

A further summary of these continued efforts to develop and promote a comprehensive and holistic approach to hazard risk management and mitigation is presented in Section 7 (Plan Maintenance).

2.7 CONTINUED PUBLIC INVOLVEMENT

The public will continue to be apprised of the HMP's progress through the Franklin County HMP website (https://www.franklincountyohhmp.com/) and the EM&HS website (https://www.fcemhs.org/) and by providing copies of annual progress reports to participating jurisdictions. The annual progress reports will also be posted on the websites. Additionally, all planning partners will provide links to the HMP on their individual jurisdictional websites to increase avenues of public access to the HMP. Refer to Section 7 (Plan Maintenance) for details on how Franklin County will maintain the plan and include the public over the next five years.

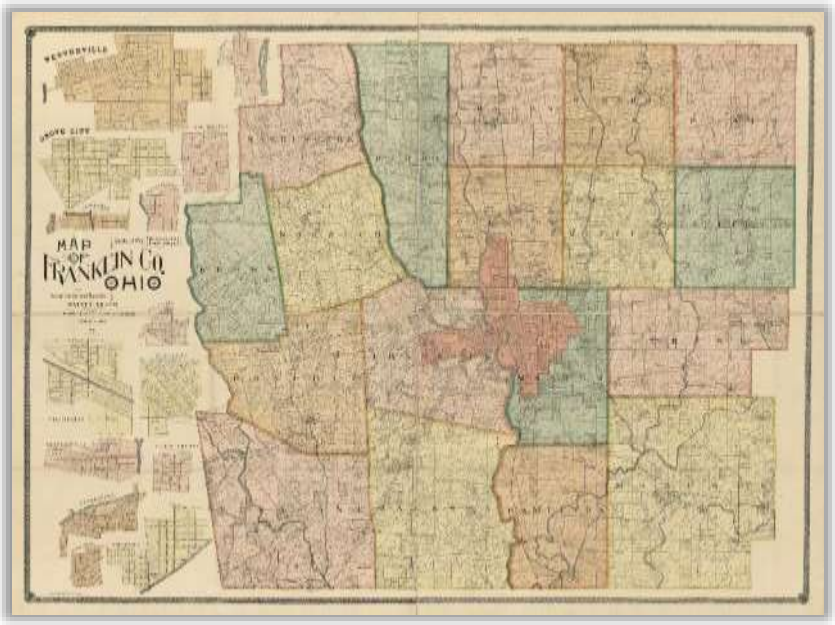
SECTION 3. COUNTY PROFILE

This section provides general information about Franklin County, including its physical setting, general building stock, land use, population, demographics, population trends, and critical facilities. Analyzing this information leads to an understanding of the study area, including economic, structural, and population assets at risk, and of concerns that could be related to hazards analyzed in this plan (e.g., low-lying areas prone to flooding, high percentage of vulnerable persons in an area).

3.1 HISTORICAL INFORMATION

The earliest history of the Franklin County region describes evidence of Native American mound-building societies near the confluence of the Scioto and Olentangy rivers. Mound Street in Columbus was named because of its proximity to a large burial mound. The ancient civilizations were later followed by the people of the Miami, Delaware, Wyandot, Shawnee, and Mingo nations—all familiar names today in Central Ohio. These nations resisted the expansion of the United States as explorers began moving into the region south of Lake Erie. After years of bitter conflict, the decisive battle at Fallen Timbers resulted in the Treaty of Greenville, which opened the way for new settlements (Franklin County 2018).

Figure 3-1. Historic Map of Franklin County, Ohio



Source: Library of Congress 1895

In 1797, a new settlement founded by a young surveyor from Virginia, Lucas Sullivant, flourished on the west bank of the forks of the Scioto River. Sullivant named his new settlement Franklinton, after Benjamin Franklin. In 1798, the first of many floods wiped out the new settlement. Sullivant rebuilt the village in the same place to stay near the navigable rivers. During the January 1959 flood, an existing levee along Dry Run failed, flooding about 225 commercial establishments and about 4,000 homes. In response to this devastating flood, the Franklinton Floodwall was built on the west banks of the Scioto River to protect Franklinton and the west side of Columbus from frequent flooding. Construction of the floodwall was finished in 2004 (Franklin County 2018); (U.S. Army Corps of Engineers 2023).

Franklin County was created shortly after Ohio achieved statehood in 1803. Originally part of Ross County, it extended north to Lake Erie until Ohio further subdivided into more counties. The state capital was

originally in Chillicothe, moved to Zanesville, then back to Chillicothe. Columbus was founded in February 1812 after the legislature decided a new capital would be located in the middle of the state. Lessons had been learned, however, and the new city was located on the high banks opposite Franklinton at the forks of the Scioto known as Wolf's Ridge (Franklin County 2018). Columbus was officially chartered as a city on March 3, 1834.

The National Road (known today as United States (U.S.) Route 40) reached Columbus from Baltimore in 1831, complementing the city's new link to the 308-mile Ohio and Erie Canal system. During the Ohio and Erie Canal Era (1832 – 1904), many factories, warehouses and homes were built along both banks of the Scioto. Rail service reached Columbus in 1850, further enhancing the city as a transportation center (Franklin County 2018).

From March 23 to March 27, 1913, a catastrophic flood reaching 22 feet inundated Franklinton, leaving 96 dead and thousands homeless. To stem future flooding, the U.S. Army Corps of Engineers (USACE) recommended widening the Scioto through downtown and building a retaining wall along its banks. The only bridge to survive the flood was the new earth-filled concrete arch bridge at King Avenue. The survival of this bridge changed the way bridges were built throughout Franklin County. The devastating flood also led to several urban renewal projects, including the building of the O'Shaughnessy Dam and Reservoir and many structures that are now downtown landmarks (Franklin County 2018).

As a result of President' Roosevelt's Federal-Aid Highway Act of 1944 authorizing the creation of a "National System of Interstate Highways", interstate highways were built through Franklin County starting in 1962 with Interstate 70, followed by Interstate 71 in 1966, Interstate 270 in 1976, and Interstate 670 in 2003. Other major federal and state routes in the County include Broad Street (State Route 16 and U.S. 40), Cleveland Avenue/Westerville Road (State Route 3), Dublin-Granville Road (State Route 161), Hamilton Road (State Route 317), Harrisburg Pike (State Route 3 and U.S. 62), High Street/Indianola Avenue/Portsmouth-Columbus Road (U.S. 23), Jackson Pike (State Route 104), Johnstown Road (U.S. 62), London-Groveport Road (State Route 665), Main Street (U.S. 40), Riverside Drive/Livingston Avenue/Columbus-Lancaster Road (U.S. 33), and State Route 315 (Franklin County Engineer's Office n.d.). With the development of these major roadways, Franklin County experienced rapid suburban growth and development. The County has continued to grow in both suburban and urban areas (Franklin County, Ohio 2018).

3.2 MAJOR PAST HAZARD EVENTS

Presidential disaster declarations (FEMA disaster declarations) are typically issued for hazard events that cause more damage than state and local governments can handle without assistance from the federal government, although no specific dollar loss threshold has been established for these declarations. A presidential disaster declaration puts federal recovery programs into motion to help disaster victims, businesses, and public entities. Some of the programs are matched by state programs. Review of presidential disaster declarations helps establish the probability of reoccurrence for each hazard and

identify targets for risk reduction. Table 3-1 shows FEMA disaster declarations that included Franklin County through 2022 since 1956, when records began for the State of Ohio.

Table 3-1. History of FEMA Disaster Declarations in Franklin County

Disaster Number	Event Date(s)	Declaration Date	Incident Type	Title
DR-57-OH	May 17, 1956	May 17, 1956	Other	Windstorm
DR-90-OH	January 23, 1959	January 23, 1959	Flood	Floods
DR-167-OH	March 24, 1964	March 24, 1964	Flood	Severe Storms & Flooding
DR-421-OH	April 4, 1974	April 4, 1974	Tornado	Tornadoes
EM-3055-OH	January 26, 1978	January 26, 1978	Snowstorm	Blizzards & Snowstorms
DR-831-OH	May 23 – June 26, 1989	June 10, 1989	Flood	Severe Storms & Flooding
DR-870-OH	May 28 – July 15, 1990	June 6, 1990	Severe Storm	Severe Storms, Tornadoes & Flooding
DR-951-OH	July 12 – August 1, 1992	August 4, 1992	Severe Storm	Severe Storms, Tornadoes & Flooding
DR-1227-OH	June 24 – July 5, 1998	June 30, 1998	Severe Storm	Severe Storms, Flooding, and Tornadoes
DR-1444-OH	November 10, 2002	November 18, 2002	Severe Storm	Severe Storms and Tornadoes
DR-1453-OH	February 14 – March 8, 2003	March 14, 2003	Severe Storm	Severe Winter Storm and Record/Near Record Snow
DR-1484-OH	July 21 – August 25, 2003	August 1, 2003	Tornado	Tornadoes, Flooding, Severe Storms, and High Winds
DR-1507-OH	January 3-30, 2004	January 26, 2004	Severe Storm	Severe Storms, Flooding, Mudslides, and Landslides
DR-1556-OH	August 27 – September 27, 2004	September 19, 2004	Severe Storm	Severe Storms and Flooding
EM-3198-OH	December 22-24, 2004	January 11, 2005	Snowstorm	Snow
DR-1580-OH	December 22 – February 1, 2004	February 15, 2005	Severe Storm	Severe Winter Storms, Flooding, and Mudslides
EM-3250-OH	August 29 – October 1, 2005	September 13, 2005	Hurricane	Hurricane Katrina Evacuation
EM-3286-OH	March 7-9, 2008	April 24, 2008	Snowstorm	Record Snow and Near Record Snow
DR-1805-OH	September 14, 2008	October 24, 2008	Severe Storm	Severe Windstorm Associated with Tropical Depression Ike
EM-3346-OH	June 29 – July 2, 2012	June 30, 2012	Severe Storm	Severe Storms
DR-4077-OH	June 29 – July 2, 2012	August 20, 2012	Severe Storm	Severe Storms and Straight-Line Winds
EM-3457-OH	January 20, 2020 – ongoing	March 13, 2020	Biological	Covid-19
DR-4507-OH	January 20, 2020 – ongoing	March 31, 2020	Biological	Covid-19 Pandemic

Source(s): *FEMA 2022*
DR *Major Disaster Declaration*
EM *Emergency Declaration*
FEMA *Federal Emergency Management Agency*
OH *Ohio*

3.3 PHYSICAL SETTING

This section presents the physical setting of the County, including location, topography and geology, hydrography and hydrology, climate, and land use/land cover.

3.3.1 Location

Franklin County covers 540 square miles near the geographic center of Ohio. It is bounded by Delaware County to the north, Licking and Fairfield Counties to the east, Pickaway County to the south, and Madison and Union Counties to the west (refer to Figure 3-2).

The County is a predominantly urban area, consisting of 17 cities, 9 villages and 17 townships. The City of Columbus is the County seat and covers a majority of the County. Franklin County was established on April 30, 1803, and was named after Benjamin Franklin (National Association of Counties 2023); (State of Ohio Office of Research 2021).

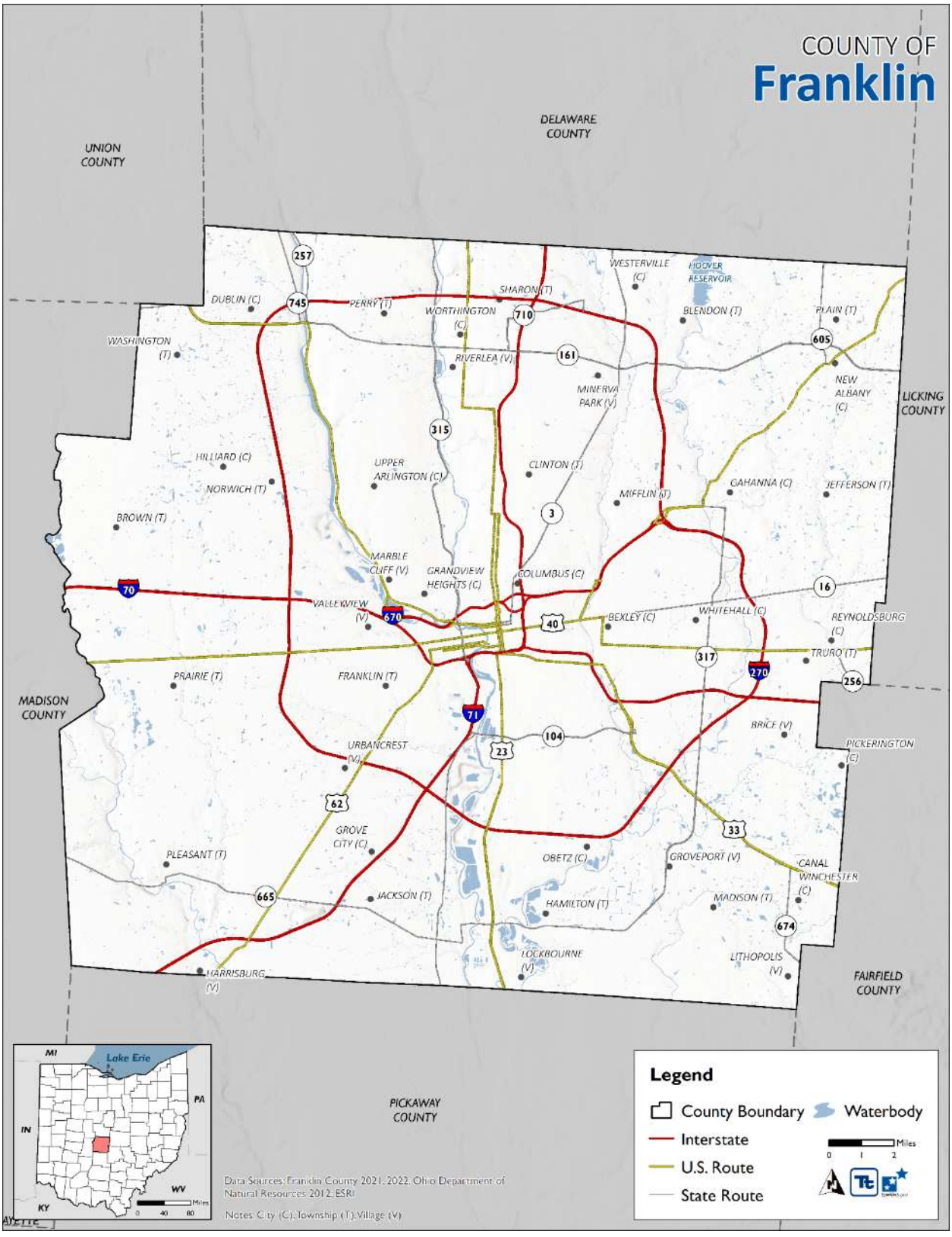
3.3.2 Topography and Geology

Franklin County lies within the Till Plains physiographic province, specifically the Columbus Lowland and Darby Plains, with a small portion of the northern edge of the County being in the Central Ohio Clayey Till Plain; the northwestern part of the County is also located in the Galion Glaciated Low Plateau. The Till Plains province is distinguished by both its clayey and loamy till, deposited in the Wisconsinan-age.

The County has relatively flat topography due to large glacial coverage during the Wisconsin Glacial Episode. The highest point in Franklin County is 1,132 feet above sea level, near New Albany, and the low point is 670 feet, where the Scioto River leaves the County near Lockbourne. The lowland areas typically vary by less than 25 feet in elevation. Higher elevations have up to a relief of 100 feet (U.S. EPA 2016).

The topography, soils, and drainage of the County have been significantly influenced by periods of glaciation during the Wisconsin Glacial Episode; glaciers covered nearly two-thirds of the state at the peak of the episode (about 24,000 years ago). As the climate once again warmed, the Wisconsinan glacier began to melt and retreated northward, finally leaving Ohio about 14,000 years ago. Much of the landscape in the glaciated portion of Ohio is the result of the Wisconsinan glacier. This includes thick deposits of till deposited as ground moraine; sand and gravel outwash from the melting glacier along larger stream courses; lobate ridges or hills of till are recessional moraines; and other features prominent in Ohio all record the presence of this massive ice sheet only a few thousand years ago (Ohio History Connection n.d.).

Figure 3-2. Franklin County, Ohio



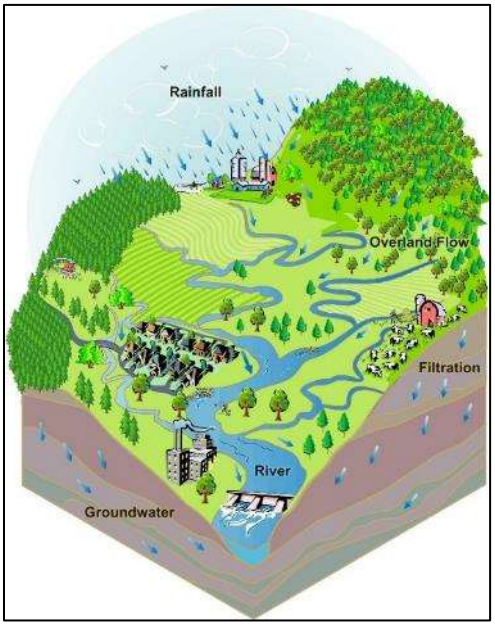
3.3.3 Hydrography and Hydrology

A watershed is an area or ridge of land that drains surface water to a common basin such as a stream, river, lake, or reservoir (City of Columbus 2023) (refer to Figure 3-3). A total of 10 watersheds are at least partly within Franklin County, with the Scioto River Watershed covering the largest portion of the County (Franklin Soil & Water Conservation District n.d.). The Scioto River is fed by four major tributaries: the Olentangy River, Alum Creek, Big Darby Creek, and Big Walnut Creek. Its watershed contains 339 linear miles of major streams and rivers. The confluence of the Scioto and Olentangy rivers is just west of downtown Columbus.

Figure 3-4 shows the watersheds located in Franklin County and Table 3-2 provides a description of each watershed.

The County has some variety in landscape due to numerous ravine areas near the creeks and rivers. Tributaries to Alum Creek and the Olentangy River cut through shale, while tributaries to the Scioto cut through limestone (Franklin County, Ohio 2018).

Figure 3-3. Watershed

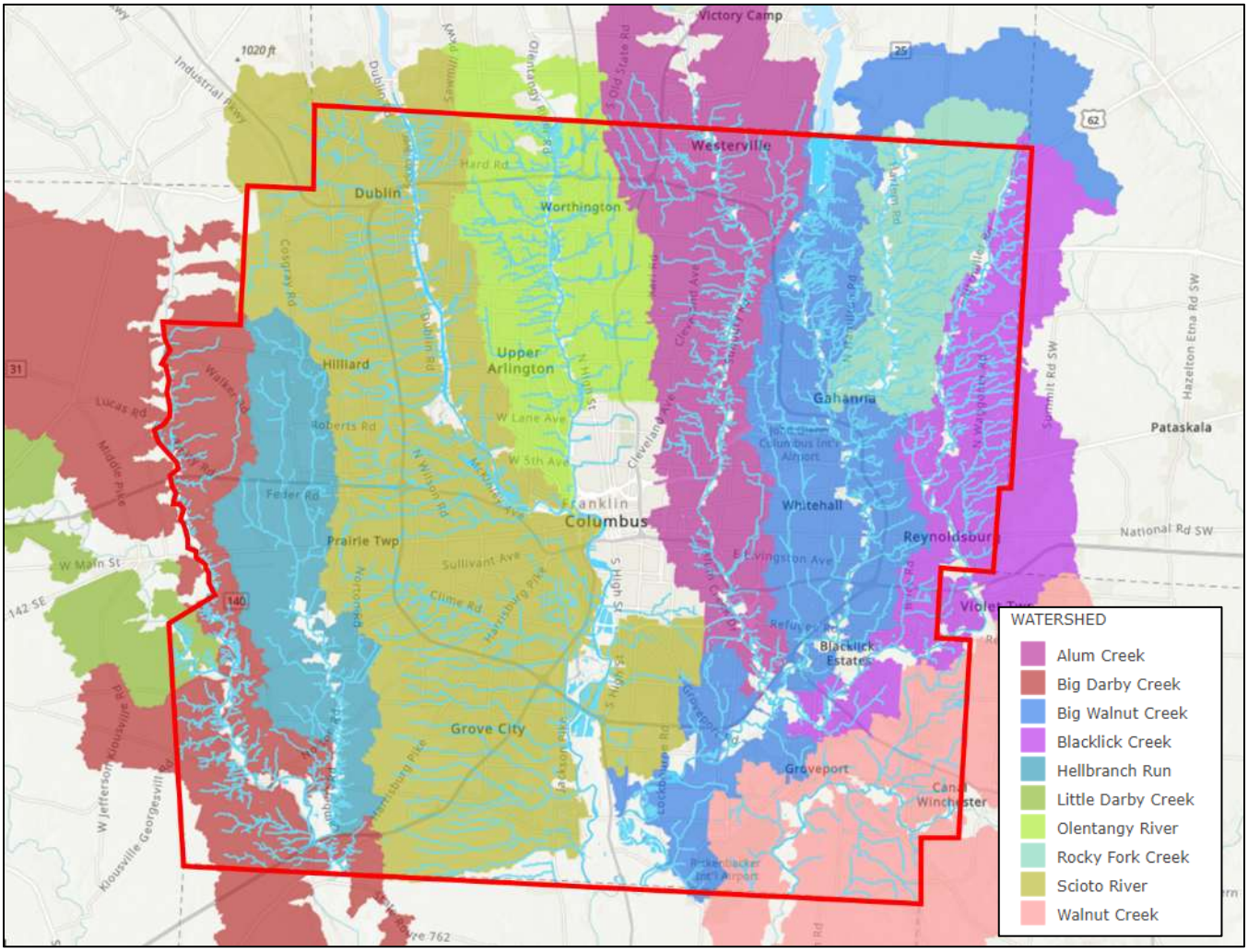


Source: City of Columbus 2023

3.3.4 Climate

Franklin County is located in an area of changeable weather with four distinct seasons. Cold air masses from central and northwestern Canada frequently affect the region. Tropical Gulf air masses reach central Ohio often during the summer and to a lesser extent in fall and winter. The hottest temperature ever recorded was 106°F, which occurred twice during the Dust Bowl drought of the 1930s. The coldest temperature ever recorded was -22°F on January 19, 1994. The County is subject to severe weather typical in the Midwest. Tornadoes are possible, as are floods, blizzards, and severe thunderstorms (Franklin County, Ohio 2018).

Figure 3-4. Watersheds of Franklin County



Source: Franklin County Soil & Water Conservation District n.d.

Table 3-2. Watershed Details

Watershed Name	Description
Alum Creek	The Alum Creek watershed is located in central Ohio, running through portions of Morrow, Delaware, and Franklin Counties. The watershed basin drains 199 square miles along Alum Creek's 55.8 miles. The lower Alum Creek watershed, which extends from the Alum Creek Lake Reservoir in southern Delaware County to the creek's mouth and confluence with Big Walnut and Blacklick Creeks in southeastern Franklin County.
Big Darby Creek	The Big Darby Creek watershed is located in central Ohio, draining agricultural areas and suburbs to the northwest and west of Columbus. The basin is primarily in Logan, Union, Champaign, Clark, Madison, Franklin, and Pickaway counties. Major streams in this watershed include Big Darby Creek, Little Darby Creek, Hellbranch Run, and Flat Branch.
Big Walnut Creek	The Big Walnut Creek watershed is located in central Ohio, draining the east side of Columbus. The basin is primarily in Delaware, Franklin and Morrow counties, and also includes small parts of Knox, Licking and Fairfield counties. Major streams included in the watershed are Big Walnut Creek, Alum Creek, Blacklick Creek, and Rocky Fork.

Watershed Name	Description
Blacklick Creek	Blacklick Creek is a tributary of Big Walnut Creek draining the eastern portion of Franklin County and the western edge of Licking County with a smaller portion of the northwest corner of Fairfield County and a fraction of the southeast corner of Delaware County also contributing to the creek. It is one of many streams flowing north to south across Central Ohio, crisscrossed by scores of roads, with hundreds of thousands of people driving by.
Hellbranch Run	The Hellbranch Run Watershed consists of two main tributary streams: Clover Groff Run and Hamilton Run. These tributary streams are near the expanding suburban areas of western Columbus; however, there is still a significant presence of agricultural land use within these watershed areas.
Little Darby Creek	The Little Darby Creek is a tributary to the Darby Creek System in central Ohio. The creeks are part of the Scioto River drainage basin. Little Darby Creek runs from an area near the Lafayette-Plain City Road Bridge downstream to the confluence with Big Darby Creek near the Darby Creek Metro Park.
Olentangy River	The Olentangy River is located in Central Ohio in Crawford, Richland, Delaware, Franklin, Marion and Morrow Counties. The Olentangy River is 93 miles long and flows from the east side of Galion west then south through agricultural land surrounding Caledonia. It passes the Villages of Claridon and Waldo before entering Delaware Lake. Downstream from Delaware Lake, the mainstem flows through the City of Delaware and areas of suburban development before reaching the City of Columbus. The mainstem joins the Scioto River in downtown Columbus.
Rocky Fork Creek	The Rocky Fork Watershed is a sub-watershed of Big Walnut Creek located in Franklin County, within the townships of Plain, Jefferson, and Harlem, the municipalities of New Albany and Gahanna, and the City of Columbus. The mainstem of Rocky Fork Creek meanders 13 miles from the headwaters in Delaware County, until it reaches the confluence with Big Walnut Creek in urban Gahanna. This sub-watershed drains approximately 30 square miles.
Scioto River	The Scioto River watershed is located in central and southern Ohio. It drains 6,513 square miles and flows through all or part of 31 counties. Major municipalities partially or fully in the watershed include Columbus and many of its suburbs, Delaware, Marysville, Chillicothe, Circleville, Jackson, and Portsmouth. The northern portion of the watershed predominantly consists of cultivated crops with some areas of substantial urban development. The southern portion of the watershed primarily consists of forest with pockets of agricultural lands.
Walnut Creek	The Walnut Creek watershed, located in central Ohio, drains 286 square miles. Land use in the watershed is predominantly cropland (58 percent) closely associated with pasture (13 percent) and forested (14 percent) areas. About 15 percent of the watershed is developed or urban land, mostly in the northern portion along the periphery of southeast Columbus. Current land development is most rapid in this part of the watershed, particularly in Violet Township in Fairfield County.

Source: Ohio Environmental Protection Agency 2023; Mid-Ohio Regional Planning Commission 2010; The Friends of Alum Creek & Tributaries 2005; EDAW, Inc. 2006; Friends of Big Walnut Creek & Tributaries 2010

3.3.5 Land Use and Land Cover

Land use refers to the way land is developed or left in an undeveloped state. Historical land use patterns show how a community has developed over time. Zoning and related ordinances are used to guide development and largely reflect the existing and desired development patterns. Traditional zoning divides a community into various districts and permits or disallows land uses by zoning district. Much of Franklin County's land area (63.9 percent) is set aside for urban (residential) uses, followed by agriculture at 23.9 percent. Table 3-3 identifies land use percentage and acreage for Franklin County; Figure 3-5 shows the land use and land cover for Franklin County.

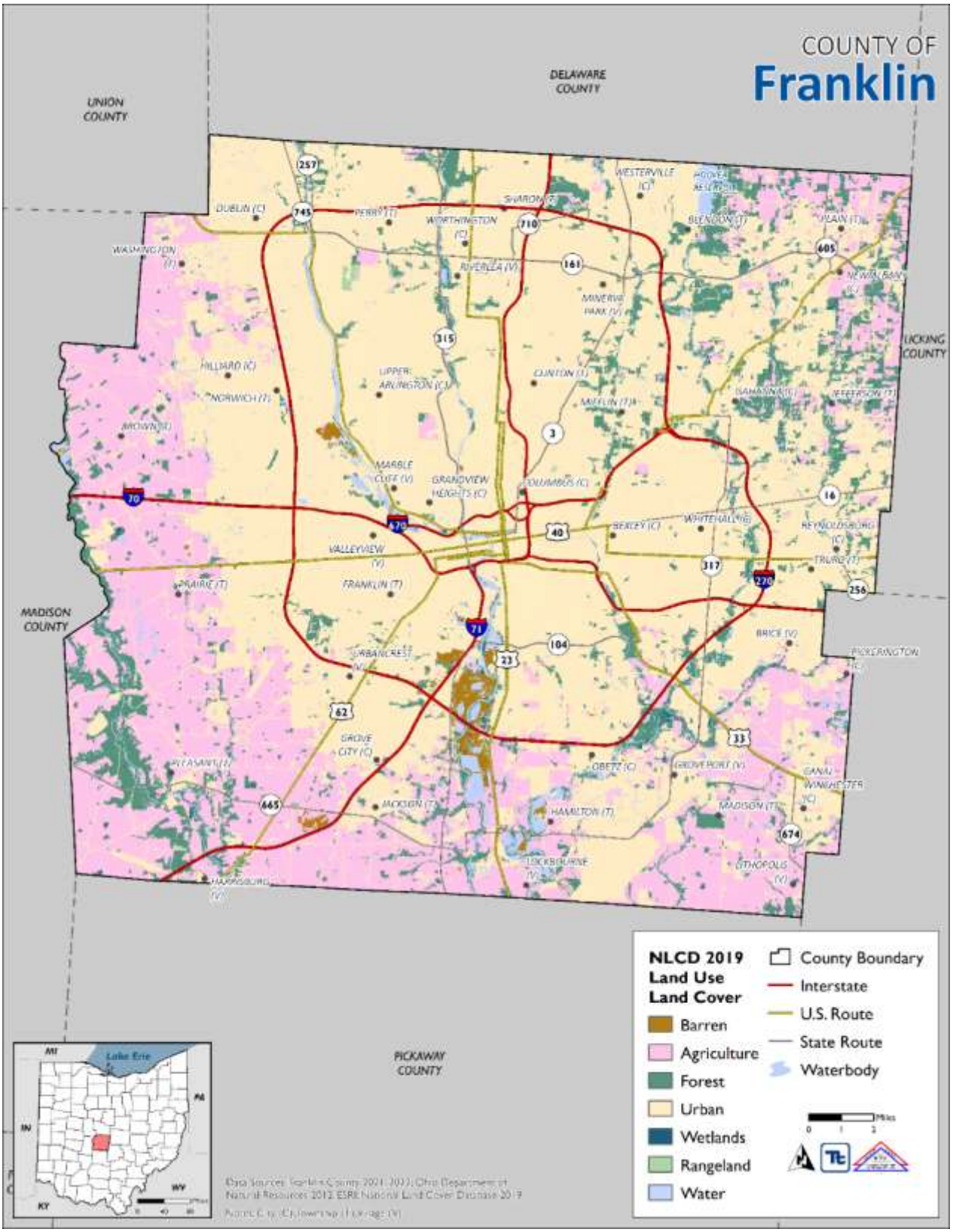
Table 3-3. Land Use Summary for Franklin County

Land Use Category*	2019 Data		2016 Data		2013 Data	
	Acreage	Percent of County	Acreage	Percent of County	Acreage	Percent of County
Agriculture	83,232	23.9%	84,411	24.3%	85,632	24.6%
Barren Land	2,294	0.7%	2,380	0.7%	2,322	0.7%
Forest	32,152	9.2%	32,512	9.3%	32,992	9.5%
Rangeland	1,762	0.5%	1,515	0.4%	1,270	0.4%
Urban Area	222,493	63.9%	221,117	63.5%	219,606	63.1%
Water	5,143	1.5%	5,210	1.5%	5,339	1.5%
Wetland	988	0.3%	920	0.3%	905	0.3%
Franklin County (Total)	**348,065**	**100.0%**	**348,065**	**100.0%**	**348,065**	**100.0%**

Source: Multi-Resolution Land Characteristics (MRLC) Consortium 2013, 2016

- *Agriculture—Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops; or areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation*
- *Barren Land—Areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material.*
- *Forest—Areas dominated by trees, typically greater than 15 feet tall, and greater than 20 percent total vegetation cover*
- *Rangeland—Areas dominated by shrubs, less than 15 feet tall with shrub canopy; includes shrubs, young trees in an early successional stage or trees stunted from environmental conditions; or areas dominated by herbaceous vegetation, generally greater than 80 percent of total vegetation*
- *Urban Area—Areas with a mixture of constructed materials and vegetation consisting of residential homes, parks, golf courses, and vegetation planted in developed settings*
- *Water—Areas of open water, generally with less than 25 percent cover of vegetation*
- *Wetland—Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water*

Figure 3-5. Land Use and Land Cover in Franklin County (2019)



3.4 POPULATION AND DEMOGRAPHICS

An understanding of the planning area population characteristics provides a foundation for assessing the impacts of natural hazards in the County. As noted in Section 4.2 (Methodology) of this plan, modeling of the impacts of natural hazards on the population was performed using FEMA's Hazus risk simulation model. Population information in the Hazus model used for this HMP (v5.1) includes the 2010 American Community Survey (ACS), which indicates a county population of 1,523,677. However, more current data, according to U.S. Census Bureau 2021 ACS 5-year estimate, estimates a county population of 1,313,598. Table 3-4 shows the 2021 ACS 5-year population estimates for Franklin County and its jurisdictions. The information in this table is the best population data available for this HMP update. Figure 3-6 shows the population density by census tract in Franklin County.

Various Census Bureau products were used as sources for the population trends section. The Decennial Census is the official population count taken every 10 years. American Community Survey 5-Year Estimates are used to show annual population changes, but it is not an official population county. 5-Year Estimates are used because they are the most accurate form of American Community Survey with the largest sample size, which allows for greater accuracy at smaller geographic areas. The American Community Survey 5-Year Estimate products were used to establish annual changes in population. The numbers provided are not official census counts, but are official estimates provided to communities so that they may have a greater understanding in population changes within their jurisdictions.

For this plan, the default population data available in Hazus (representing 2010 data) are used to support the analysis of displaced households and number of persons seeking shelter. Population exposure results are based upon the 2021 5-year ACS population estimates.

Table 3-4. Population Statistics From 2021 American Community Survey Population Estimates for Franklin County

Jurisdiction	ACS 2021		ACS 5-Year Population Estimates (2021)									
			Over 65		Under 5		Non-English Speaking		Disability		Poverty Level	
	Total Population	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Bexley (C)	13,820	1.1%	1,862	13.5%	870	6.3%	201	1.5%	1,008	7.3%	559	4.0%
Blendon (Twp)	10,073	0.8%	1,221	12.1%	760	7.5%	36	0.4%	886	8.8%	304	3.0%
Brice (V)	185	0.0%	36	19.5%	22	11.9%	0	0.0%	13	7.0%	25	13.5%
Brown (Twp)	3,679	0.3%	548	14.9%	138	3.8%	88	2.4%	296	8.0%	41	1.1%
Canal Winchester (C)	9,209	0.7%	1,620	17.6%	694	7.5%	0	0.0%	1,057	11.5%	301	3.3%
Clinton (Twp)	4,449	0.3%	431	9.7%	138	3.1%	153	3.4%	334	7.5%	565	12.7%
Columbus (C)	898,143	68.4%	89,445	10.0%	60,398	6.7%	28,333	3.2%	100,017	11.1%	155,265	17.3%
Dublin (C)*	48,613	3.7%	5,319	10.9%	2,300	4.7%	894	1.8%	2,325	4.8%	769	1.6%
Franklin (Twp)	11,312	0.9%	1,496	13.2%	920	8.1%	605	5.3%	1,953	17.3%	3,702	32.7%
Gahanna (C)	35,626	2.7%	5,834	16.4%	1,876	5.3%	258	0.7%	3,657	10.3%	1,838	5.2%
Grandview Heights (C)	8,099	0.6%	910	11.2%	461	5.7%	0	0.0%	483	6.0%	380	4.7%
Grove (C)	41,025	3.1%	6,912	16.8%	3,016	7.4%	189	0.5%	4,704	11.5%	2,013	4.9%
Groveport (C)	5,942	0.5%	870	14.6%	299	5.0%	0	0.0%	619	10.4%	176	3.0%
Hamilton (Twp)	8,743	0.7%	1,598	18.3%	412	4.7%	0	0.0%	1,540	17.6%	992	11.3%
Harrisburg (V)*	376	0.0%	99	26.3%	16	4.3%	0	0.0%	64	17.0%	45	12.0%
Hilliard (C)	35,530	2.7%	3,700	10.4%	2,076	5.8%	502	1.4%	2,775	7.8%	1,612	4.5%
Jackson (Twp)	46,340	3.5%	8,475	18.3%	3,301	7.1%	325	0.7%	5,577	12.0%	2,541	5.5%
Jefferson (Twp)	14,027	1.1%	2,411	17.2%	1,464	10.4%	378	2.7%	1,053	7.5%	93	0.7%
Lithopolis (V)	2,291	0.2%	276	12.0%	204	8.9%	0	0.0%	224	9.8%	57	2.5%
Lockbourne (V)	176	0.0%	20	11.4%	27	15.3%	0	0.0%	50	28.4%	42	23.9%
Madison (Twp)	25,896	2.0%	4,522	17.5%	1,326	5.1%	0	0.0%	3,487	13.5%	2,288	8.8%
Marble Cliff (V)	782	0.1%	187	23.9%	22	2.8%	0	0.0%	67	8.6%	27	3.5%
Mifflin (Twp)	38,121	2.9%	6,280	16.5%	2,136	5.6%	440	1.2%	4,201	11.0%	2,311	6.1%
Minerva Park (V)	1,611	0.1%	268	16.6%	144	8.9%	0	0.0%	156	9.7%	155	9.6%
New Albany (C)	10,962	0.8%	823	7.5%	674	6.1%	79	0.7%	470	4.3%	201	1.8%
Norwich (Twp)	37,356	2.8%	4,160	11.1%	2,247	6.0%	483	1.3%	2,974	8.0%	1,553	4.2%
Obetz (C)	5,351	0.4%	577	10.8%	264	4.9%	0	0.0%	831	15.5%	461	8.6%
Perry (Twp)	3,888	0.3%	591	15.2%	290	7.5%	0	0.0%	226	5.8%	20	0.5%
Pickerington (C)	22,682	1.7%	11	0.1%	7	0.0%	1	0.0%	10	0.0%	4	0.0%
Plain (Twp)	12,469	0.9%	1,267	10.2%	729	5.8%	79	0.6%	721	5.8%	295	2.4%
Pleasant (Twp)	6,768	0.5%	1,396	20.6%	226	3.3%	0	0.0%	1,089	16.1%	411	6.1%
Prairie (Twp)	17,433	1.3%	2,224	12.8%	1,091	6.3%	896	5.1%	2,217	12.7%	1,417	8.1%
Reynoldsburg (C)*	39,803	3.0%	4,230	10.6%	2,094	5.3%	993	2.5%	3,327	8.4%	2,863	7.2%
Riverlea (V)	566	0.0%	103	18.2%	24	4.2%	0	0.0%	33	5.8%	9	1.6%

Jurisdiction	ACS 2021		ACS 5-Year Population Estimates (2021)									
			Over 65		Under 5		Non-English Speaking		Disability		Poverty Level	
	Total Population	% of County Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total	Number	% of Jurisdiction Total
Sharon (Twp)	17,109	1.3%	3,592	21.0%	1,228	7.2%	45	0.3%	1,563	9.1%	391	2.3%
Truro (Twp)	30,165	2.3%	4,251	14.1%	2,156	7.1%	1,145	3.8%	3,896	12.9%	3,154	10.5%
Upper Arlington (C)	36,566	2.8%	5,991	16.4%	3,064	8.4%	552	1.5%	2,585	7.1%	843	2.3%
Urbancrest (V)	1,124	0.1%	91	8.1%	142	12.6%	136	12.1%	218	19.4%	452	40.2%
Valleyview (V)	722	0.1%	104	14.4%	42	5.8%	0	0.0%	108	15.0%	182	25.2%
Washington (Twp)	42,997	3.3%	5,208	12.1%	2,491	5.8%	987	2.3%	2,332	5.4%	1,602	3.7%
Westerville (C)*	38,960	3.0%	4,633	11.9%	1,638	4.2%	170	0.4%	2,123	5.4%	1,456	3.7%
Whitehall (C)	20,004	1.5%	2,177	10.9%	1,473	7.4%	1,147	5.7%	3,017	15.1%	4,230	21.1%
Worthington (C)	15,047	1.1%	3,130	20.8%	1,136	7.5%	45	0.3%	1,251	8.3%	342	2.3%
Franklin County (Total)	**1,313,598**	**100.0%**	**167,514**	**12.8%**	**87,571**	**6.7%**	**198,669**	**15.1%**	**149,479**	**11.4%**	**183,647**	**14.0%**

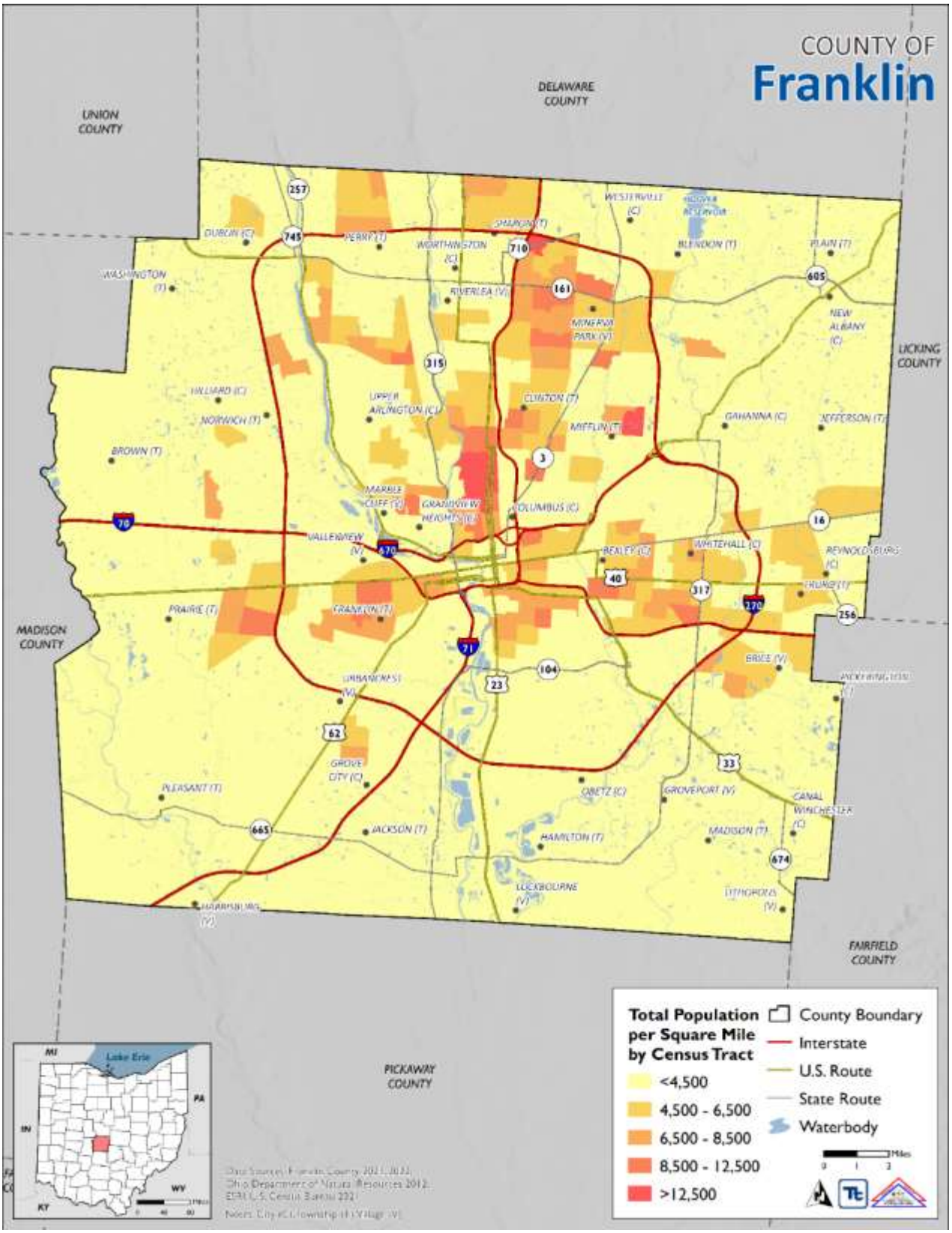
Source: U.S. Census Bureau 2020; Stats America 2022

Notes: Franklin County Persons Per Household = 2.39. Number used to calculate Non-English-Speaking population.

** Municipality partially located in Franklin County; the population shown is the entire population of the municipality.*

(C) = city; (Twp) = township; (V) = village

Figure 3-6. Total Population Density in Franklin County

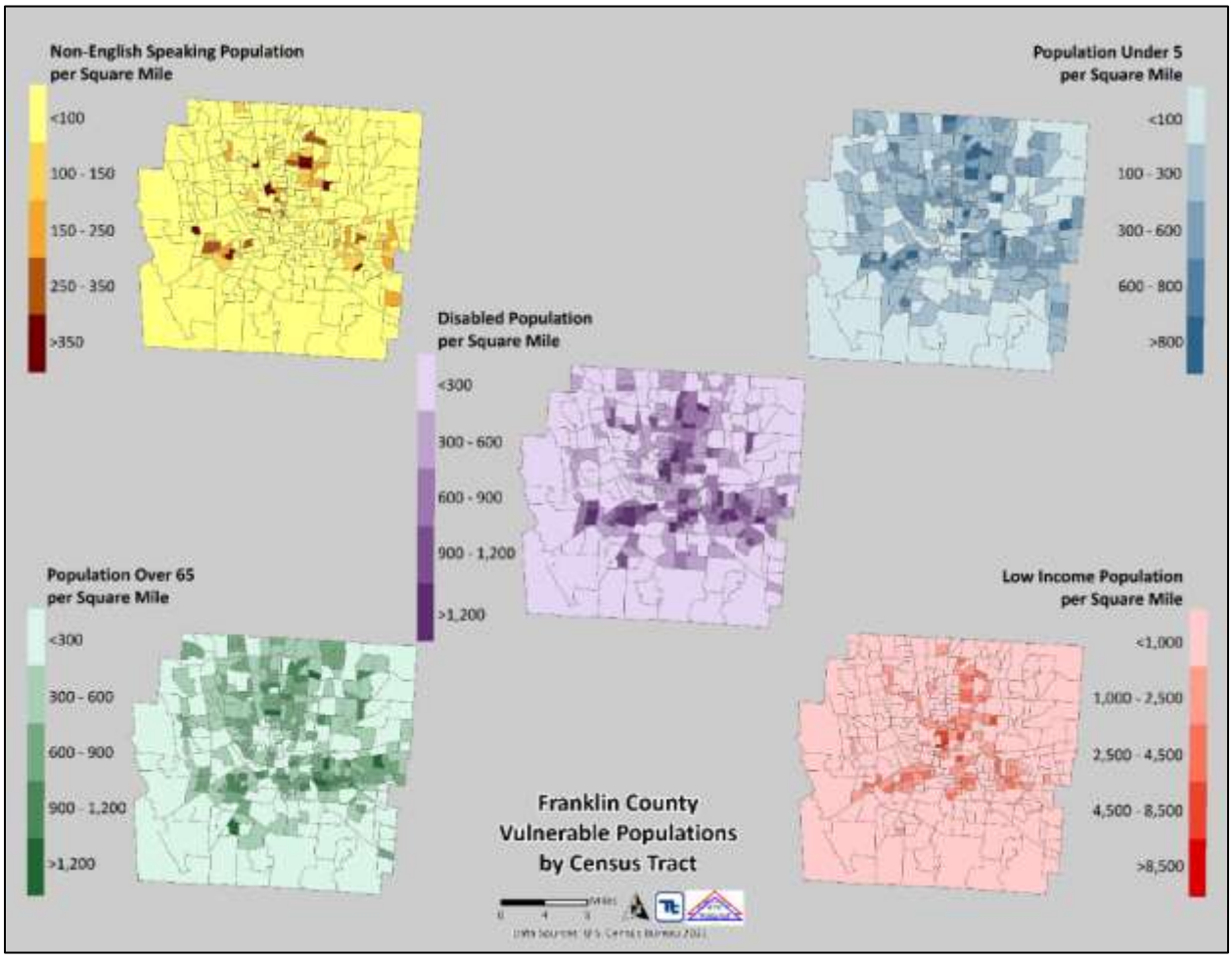


3.4.1 Vulnerable Populations

DMA 2000 requires that HMPs consider socially vulnerable populations. These populations can be more susceptible to hazard events based on several factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Populations with a higher level of vulnerability can be more seriously affected during an emergency or disaster. Vulnerable populations have unique needs that must be considered by public officials to ensure the safety of demographics with a higher level of risk.

The vulnerable populations in the 2023 HMP include (1) persons age 65 and over, (2) persons under 5 years of age, (3) households living below the poverty threshold (households with two adults and two children with an annual household income below $25,926 per year), (4) those with physical or mental disabilities, and (5) non-English speakers. Identifying concentrations of vulnerable populations can assist communities in targeting preparedness, response, and mitigation actions. Table 3-4 lists 2021 ACS vulnerable population statistics in Franklin County by jurisdiction. Figure 3-7 displays population densities by census tract for various vulnerable populations in Franklin County.

Figure 3-7. Vulnerable Population Densities in Franklin County

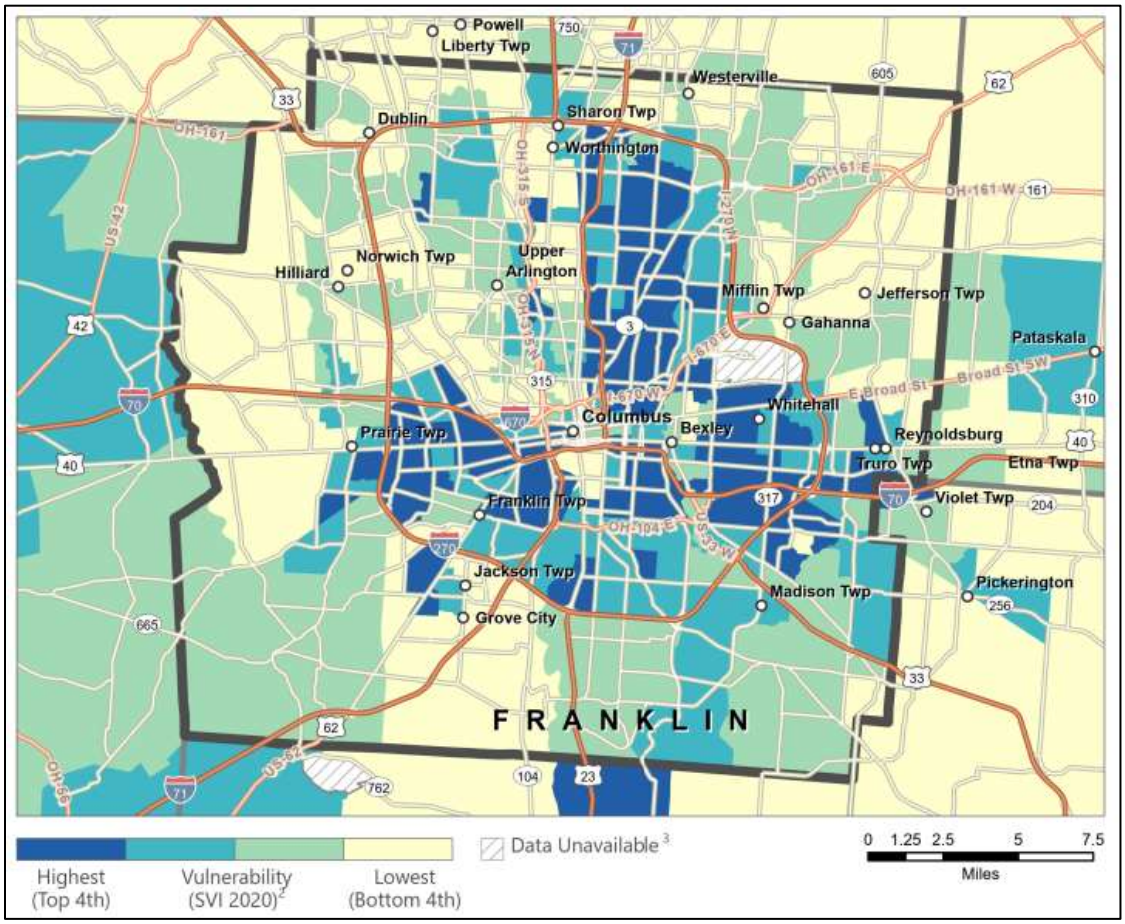


Social Vulnerability Index

> Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability 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 Social Vulnerability Index (SVI) is a recent tool developed by the U.S. Centers for Disease Control and Prevention (CDC) to identify socially vulnerable populations. The CDC defines socially vulnerable population using factors such as poverty, lack of access to transportation, and crowded housing. These factors may weaken a community's ability to prevent human suffering and financial loss in a disaster. The SVI uses U.S. Census data to determine the social vulnerability of every census tract. The SVI ranks each tract on 16 social factors and groups them into four related themes. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking (Agency for Toxic Substances and Disease Registry 2022). Figure 3-8 illustrates the overall social vulnerability distribution in Franklin County.

Figure 3-8. Overall Social Vulnerability in Franklin County



Source: Agency for Toxic Substances and Disease Registry 2022

Age

Children are considered vulnerable to hazard events because they are dependent on others to safely access resources during emergencies and may experience increased health risks from hazard exposure. Older adults are more vulnerable than other age groups before and after disasters and experience more causalities during and after disasters. Factors include a greater prevalence of chronic conditions, multi-morbidity, cognitive impairment, medication concerns, greater dependence on assistive devices (i.e., walkers, glasses), need for support from caregivers and others, and likelihood of social isolation (American Red Cross 2020).

The 2021 ACS reports 6.8 percent of the population of Franklin County is under the age 5 and 12.4 percent is age 65 and older.

Income

The U.S. Census Bureau identifies households with two adults and two children with an annual household income below $25,926 per year as low income (Census 2021). The 2021 ACS 5-year estimates indicate that 12.9 percent of the Franklin County population lives below the poverty level.

Physical or Mental Disability

According to the CDC, "Persons with a disability include those who have physical, sensory, or cognitive impairment that might limit a major life activity (U.S. Department of Justice 2023)." Cognitive impairments can increase the level of difficulty that individuals might face during an emergency and reduce an individual's capacity to receive, process, and respond to emergency information or warnings. Individuals with a physical or sensory disability can face issues of mobility, sight, hearing, or reliance on specialized medical equipment. According to the 2021 ACS, 10.9 percent of the County's total population is identified as having a disability.

Non-English Speakers

Individuals who are not fluent or not proficient in English are vulnerable because they can have difficulty with understanding information being conveyed to them. Cultural differences also can add complexity to how information is being conveyed to populations with limited proficiency of English (U.S. Department of Justice 2016). According to the 2021 ACS, 85.8 percent of the County's population over the age of 5 primarily speaks English at home; 5.3 percent of the County's total population speaks a language other than English at home, including Spanish (1.6 percent), Indo-European (3.4 percent), Asian and Pacific Islander (1.1 percent), and other languages (4.1 percent). The City of Whitehall (5.7 percent), Towns of Franklin (5.3 percent) and Prairie (5.1 percent), and the Village of Urbancrest (12.1 percent) have the largest percentages of non-English speaking populations.

3.4.2 General Building Stock

The U.S. Census Bureau defines household as all the persons who occupy a housing unit and a housing unit as a house, an apartment, a mobile home, a group of rooms, or a single room that is occupied (or if vacant, is intended for occupancy) as separate living quarters. The 2016-2021 ACS data identifies 576,698 household units in Franklin County. The median price of a single-family home in Franklin County was estimated at $203,200 in 2021 (ACS 5-year estimates).

For this update, a customized general building stock was created using building footprints and parcel data from the County, which was supplemented with County-provided data and 2022 RS Means replacement cost value for building and content replacement costs. Contents for residential structures are valued at 50 percent of the building's value. For non-residential facilities, contents are valued at 100 percent of the building's structural value.

The updated building inventory contains 350,503 buildings with a total building replacement value (structure and content) of approximately $283 billion. This inventory was incorporated into Hazus at the structure and aggregate level. Residential housing accounts for 95 percent of the buildings (333,050 buildings) and 45 percent of the building stock replacement value (approximately $128 billion). Commercial buildings make up the second building classification at 43.2 percent of the total building replacement value. Columbus has the greatest number of structures. at 210,344. The Village of Lithopolis has the smallest number of structures with 21. These numbers are based on information provided by the Franklin County Auditor. The replacement cost values of commercial, industrial, and residential properties in Franklin County are shown in Figure 3-9 through Figure 3-11, respectively.

Figure 3-9. Replacement Cost Value of Commercial Properties in Franklin County

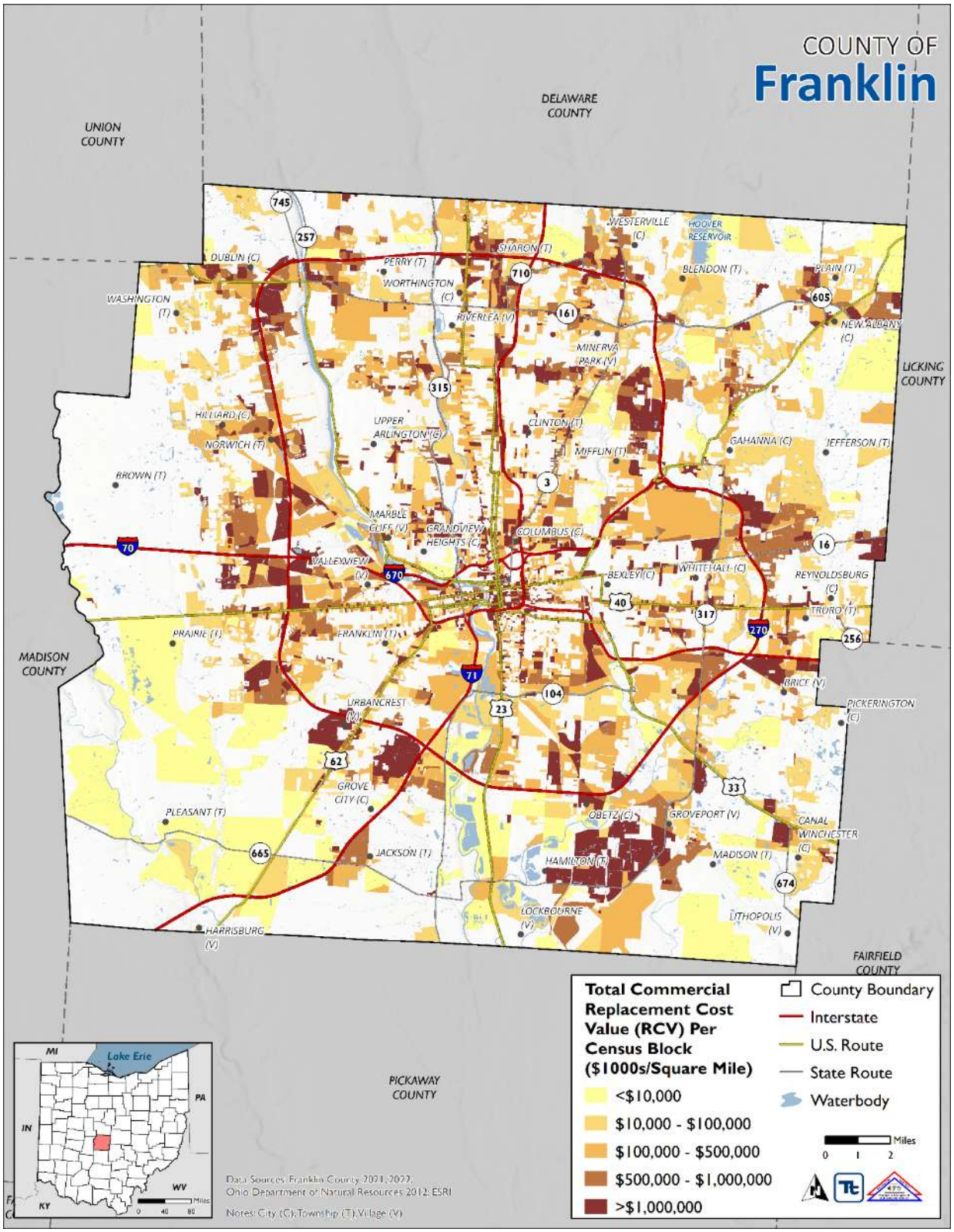


Figure 3-10. Replacement Cost Value of Industrial Properties in Franklin County

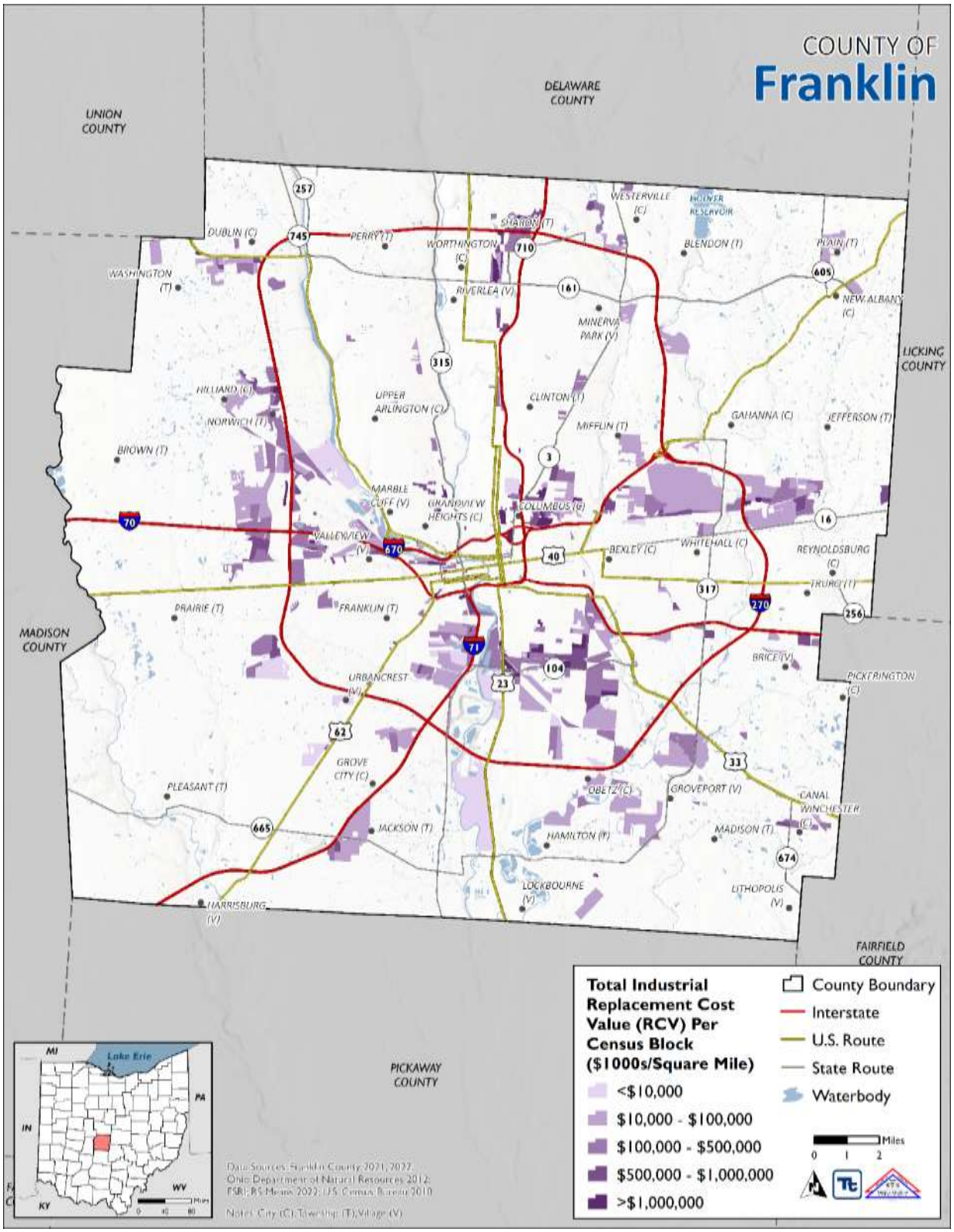
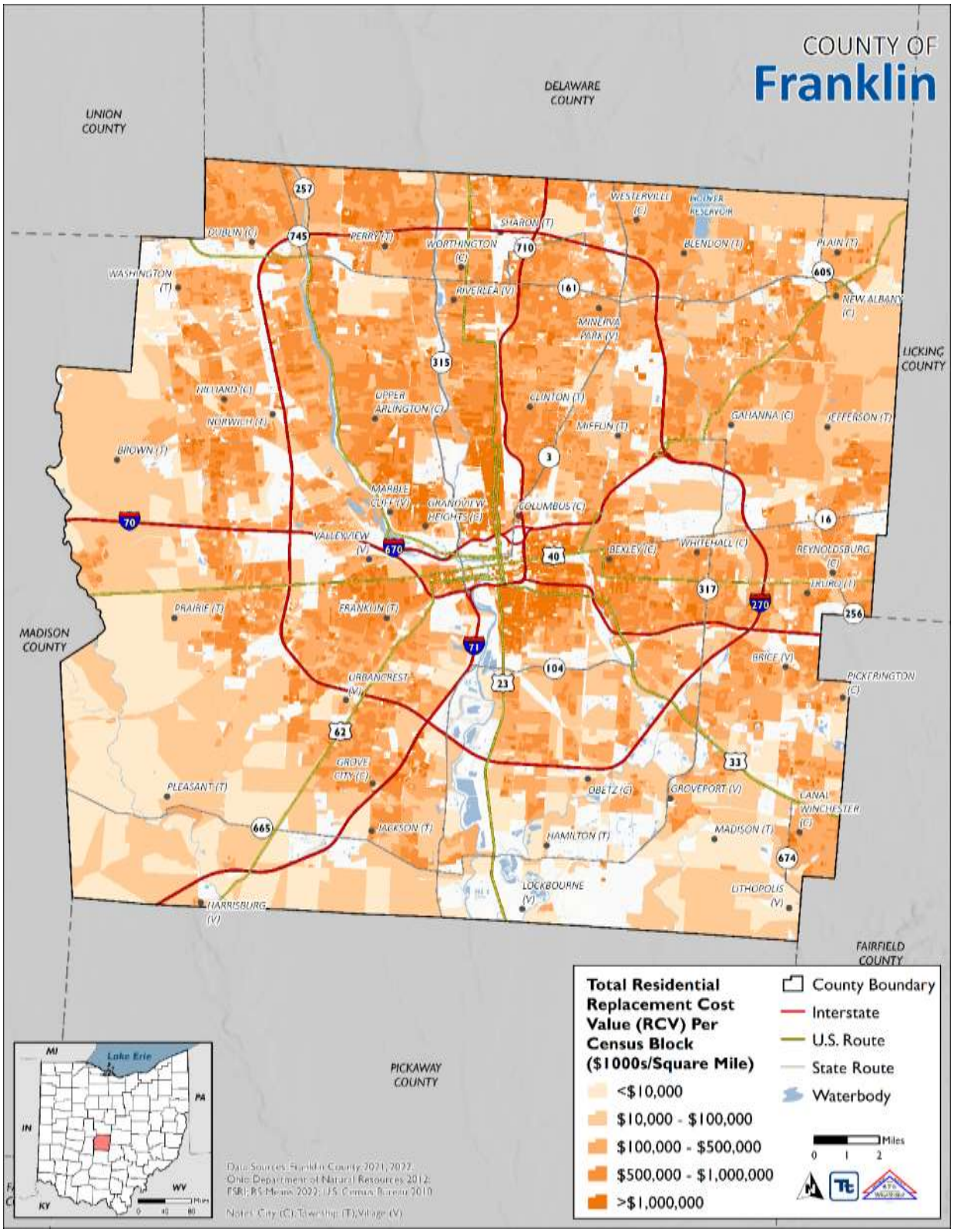


Figure 3-11. Replacement Cost Value of Residential Properties in Franklin County



3.5 LAND USE AND POPULATION TRENDS

DMA 2000 requires that communities consider land use trends, which can impact the need for and priority of mitigation options over time. Land use trends significantly impact exposure and vulnerability to various hazards. For example, significant development in a hazard area increases the building stock and population exposed to that hazard.

This plan provides a general overview of population and land use and types of development occurring within the study area. An understanding of these trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place to protect human health and community infrastructure.

3.5.1 Land Use Trends

Incorporated areas of Franklin County are subject to planning and zoning requirements set forth in local ordinance and are enforced at the local level. Unincorporated areas are subject to zoning regulations adopted by the Franklin County Board of Commissioners or local townships and are enforced by the Franklin County Economic Development and Planning Department or township zoning officials (Franklin County 2018).

Most of the new development in central Ohio is occurring near or outside of the I-270 outer-belt. Despite significant development in the downtown area, rapid suburban development has reduced the central city's "market share" of regional population and jobs. In addition, the "inner ring" suburbs (Upper Arlington, Bexley, Whitehall and Grandview Heights) are losing their share of the non-residential tax base to new development in the newer city and suburban county (Franklin County 2018).

As discussed below, the County's population has continued to grow over the last 60 years. The amount of land needed to accommodate the growing population has led to widespread new development and land use changes throughout the County. Since 2013, the County has seen an increase in urban area land use and a decrease in forest and agricultural land use.

3.5.2 Economy

Franklin County is the epicenter of the State of Ohio's political, economic, and social presence. Its central location is the crossroads of major transportation routes, making it an ideal location for both businesses and residents. Top employers in the County include Abercrombie & Fitch, Cardinal Health, Nationwide, and Worthington Industries (The Columbus Region 2023).

The U.S. Census Bureau's County Business Patterns program provides an annual series of sub-national economic data by industry covering the majority of the country's economic activity. The 2020 County Business Pattern reported 29,479 business establishments in Franklin County, providing more than $37 billion in annual payroll. Three industries dominate private employment in the County: health care and social assistance, professional, scientific, and technical services, and retail trade. Table 3-5 provides the 2020 industry and employment information in Franklin County exclusive of public administration.

Table 3-5. 2020 Economic Census for Franklin County

Industry	Number of Establishments	Annual Payroll ($1,000)	Number of Employees
Total for all sectors	29,479	37,097,059	672,835
Accommodation and food services	3,066	1,060,490	65,434
Administrative and support and waste management and remediation services	1,626	1,780,654	47,627
Agriculture, forestry, fishing and hunting, and mining	9	4,769	109
Construction	1,743	2,023,606	27,980
Educational services	470	469,737	13,592
Finance and insurance	1,976	5,261,073	55,091
Health care and social assistance	4,064	6,840,273	135,517
Industries not classified	24	1,269	37
Information	598	1,407,529	16,639
Management of companies and enterprises	335	2,769,955	29,269
Manufacturing	802	1,840,017	30,522
Mining, quarrying, and oil and gas extraction	12	11,554	160
Other services, except public administration	2,652	999,074	27,231
Professional, scientific, and technical services	3,767	3,579,081	45,950
Real estate and rental and leasing	1,751	738,472	13,719
Retail trade	3,570	2,231,637	66,747
Transportation and warehousing	1,057	2,753,523	47,838
Utilities	111	940,618	6,324
Wholesale trade	1,404	2,061,643	31,560

Source: United States Census Bureau 2022

3.5.3 Population Trends

This section discusses population trend information used to estimate future shifts that could significantly change the character of the area. Population trends can provide a basis for making decisions on the type of mitigation approaches to be considered and the locations in which these approaches should be applied. This information can also be used to support planning decisions regarding future development in vulnerable areas.

Since 1960, the County's population has grown, as shown in Table 3-6. Franklin County is one of the fastest-growing counties in its area, experiencing a 12.1 percent growth (106,418 people) in population between 2010 and 2020. Between 1960 and 1970, the County experienced its largest growth, increasing by 18 percent. The smallest increase in population was seen between 1970 and 1980, increasing by just 4.1 percent.

Table 3-6. Population Trends in Franklin County

County	1960	1970	1980	1990	2000	2010	2020
Franklin County	682,923	833,249	869,126	961,437	1,068,978	1,163,414	1,323,807

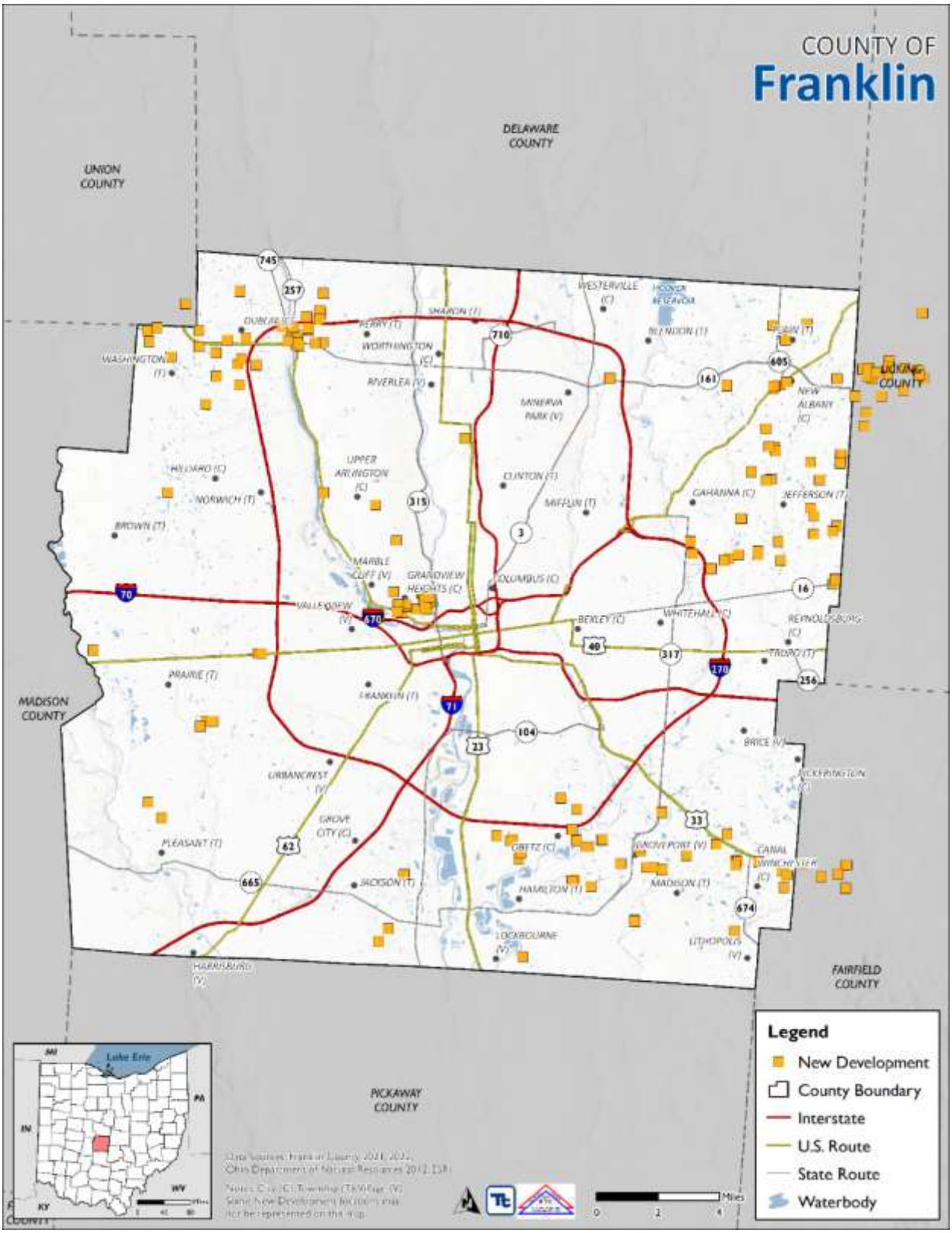
Source: U.S. Census Bureau 2000

The overall population for Franklin County is projected to increase through 2050, based on economic development partnerships, innovative corporations, affordable housing, central location for ease of commuting, and urban and suburban communities (Mid-Ohio Regional Planning Commission 2020).

3.6 FUTURE GROWTH AND DEVELOPMENT

The Mid-Ohio Regional Planning Commission (MORPC) has prepared development forecasts for the Columbus urbanized area. MORPC projects the Columbus region's population growth rate from 2000 to 2030 will outpace that of the State of Ohio and the nation. MORPC projects that the most business growth in the northern tier of the region will be in retail and office development, while new industrial warehouse and distribution centers will be located in the southern half of the County (MORPC 2021). Figure 3-12 displays new development in Franklin County between 2018 and 2022, as identified by Franklin County and participating jurisdictions. Refer to Section 9 (Jurisdictional Annexes) for details on new and proposed development at the jurisdictional level.

Figure 3-12. New Development in Franklin County (2018 to 2022)



3.7 COMMUNITY LIFELINES AND CRITICAL FACILITIES

Critical Facilities are those facilities that are considered critical to the health and welfare of the population and that are especially important following a hazard event. As defined for this HMP, critical facilities include transportation systems, lifeline utility systems, high-potential loss facilities, hazardous material facilities, and essential facilities.

Lifelines enable the continuous operation of critical business and government functions and are essential to human health and safety or economic security.

Critical infrastructure and facilities are those that are essential to the health and welfare of the population. These facilities are especially important after any hazard event. In 2017, FEMA created the concept of Community Lifelines. Lifelines allow for continuity of operations of critical facilities before, during, and after a disaster. Focusing on protecting lifelines, preventing and mitigating potential impacts, and building back stronger will increase the resilience of Franklin County and its jurisdictions.

Community lifelines represent the most fundamental services in the community that, when stabilized, enable all other aspects of society. Following a disaster event, intervention is required to stabilize community lifelines. Lifelines are divided into the following categories:

- Safety and Security
- Food, Hydration, Shelter
- Health and Medical
- Water Systems
- Energy (Power and Fuel)
- Communications
- Transportation
- Hazardous Materials

A comprehensive inventory of critical facilities and lifelines in Franklin County was developed from various sources, including input from the Planning Team. They include critical facilities and community lifelines provided and reviewed by Franklin County as well as facilities listed in Hazus v5.1. The list includes facilities owned and/or operated by County, local, or private entities. It does not include state-owned or -leased facilities. Table 3-7 summarizes the number of community lifelines identified, by jurisdiction and lifeline category.

Table 3-7. Community Lifelines in Franklin County

Jurisdiction	Communi-cations	Energy	Food, Hydration, Shelter	Water Systems	Hazardous Materials	Health and Medical	Safety and Security	Transpor-tation	Total
Bexley (city)	0	0	0	0	0	5	2	0	7
Blendon (township)	0	0	0	0	0	3	5	0	8
Brice (village)	0	0	0	0	0		1	1	2
Brown (township)	0	1	0	0	0	3	1	0	5
Canal Winchester (city)	1	3	0	2	3	18	7	0	34
Clinton (township)	1	0	0	0	0	4	1	0	6
Columbus (city)	21	54	0	6	171	944	718	909	2,823
Dublin (city)	22	6	0	0	0	127	53	0	208

Jurisdiction	Communi-cations	Energy	Food, Hydration, Shelter	Water Systems	Hazardous Materials	Health and Medical	Safety and Security	Transpor-tation	Total
Franklin (township)	3	3	0	0	35	11	6	6	64
Gahanna (city)	0	2	0	0	11	75	8	0	96
Grandview Heights (city)	0	0	0	0	2	8	3	0	13
Grove City (city)	0	0	0	0	3	88	8	0	99
Groveport (village)	0	4	0	7	3	11	12	0	37
Hamilton (township)	4	2	0	0	1	2	5	0	14
Harrisburg (village)	0	0	0	0	0	0	1	0	1
Hilliard (city)	0	2	0	0	3	65	3	0	73
Jackson (township)	1	5	0	1	0	2	2	0	11
Jefferson (township)	1	0	0	0	0	5	1	0	7
Lithopolis (village)	0	0	0	0	0	1	0	0	1
Madison (township)	0	3	0	0	0	1	2	2	8
Marble Cliff (village)	0	1	0	0	0	2	0	0	3
Mifflin (township)	0	0	0	0	0	2	3	1	6
Minerva Park (village)	0	0	0	0	0	1	2	0	3
New Albany (city)	4	1	0	0	2	33	8	0	48
Norwich (township)	0	0	0	0	0	0	0	2	2
Obetz (city)	0	1	0	0	1	5	2	0	9
Perry (township)	0	0	0	0	0	0	2	2	4
Plain (township)	1	1	0	0	0	1	0	0	3
Pleasant (township)	0	0	0	0	5	3	11	0	19
Prairie (township)	0	4	0	0	0	41	2	3	50
Reynoldsburg (city)	0	1	0	0	0	31	6	0	38
Sharon (township)	0	0	0	0	0	1	3	3	7
Truro (township)	0	0	0	0	0	1	0	0	1
Upper Arlington (city)	2	1	0	0	0	42	5	0	50
Urbancrest (village)	0	0	0	0	0	0	0	0	0
Valleyview (village)	0	0	0	0	0	0	1	0	1
Washington (township)	0	0	0	0	0	1	0	0	1
Westerville (city)	1	6	0	0	0	70	4	0	81
Whitehall (city)	0	2	0	0	5	40	3	1	51
Worthington (city)	0	3	0	0	3	44	6	0	56
Franklin County (Total)	**62**	**106**	**0**	**16**	**248**	**1,691**	**897**	**930**	**3,950**

Sources: Franklin County 2023; Hazus v5.1

Note: The critical facilities and community lifelines included in the 2023 HMP were provided and reviewed by Franklin County or listed in Hazus v5.1. The list includes facilities owned and/or operated by county, local, or private entities but not state-owned or -leased facilities.

3.7.1 Community Lifelines by Category

Communications

Communication lifelines include infrastructure, alerts/warnings/messages, 911 and dispatch, responder communications, and finance. Overall, 62 communication facilities were identified in Franklin County for this HMP update, consisting of cellular towers and FM transmission towers. Table 3-8 summarizes the number of each type of facility. Figure 3-13 shows their locations.

Table 3-8. Communication Lifelines in Franklin County

Cellular Tower	FM Transmission Tower	Total
32	30	62

Source: Franklin County 2023; Hazus v5.1

Energy (Power and Fuel)

Energy (power and fuel) lifelines include power grid and fuel facilities. For the purpose of this HMP update, 106 energy lifelines were identified in Franklin County, consisting of electric substations and power plant facilities. Table 3-9 summarizes the number of each type of facility. Figure 3-14 shows their locations.

Table 3-9. Energy Lifelines in Franklin County

Electric Substation	Power Plant Facility	Total
100	6	106

Source: Franklin County 2023; Hazus v5.1

Retail gas stations and fuel providers were not included in the critical facility/community lifeline total due to the number of facilities in the County: 380 recorded gas stations and 469 convenience stores (City of Columbus 2023).

Figure 3-13. Communication Lifelines in Franklin County

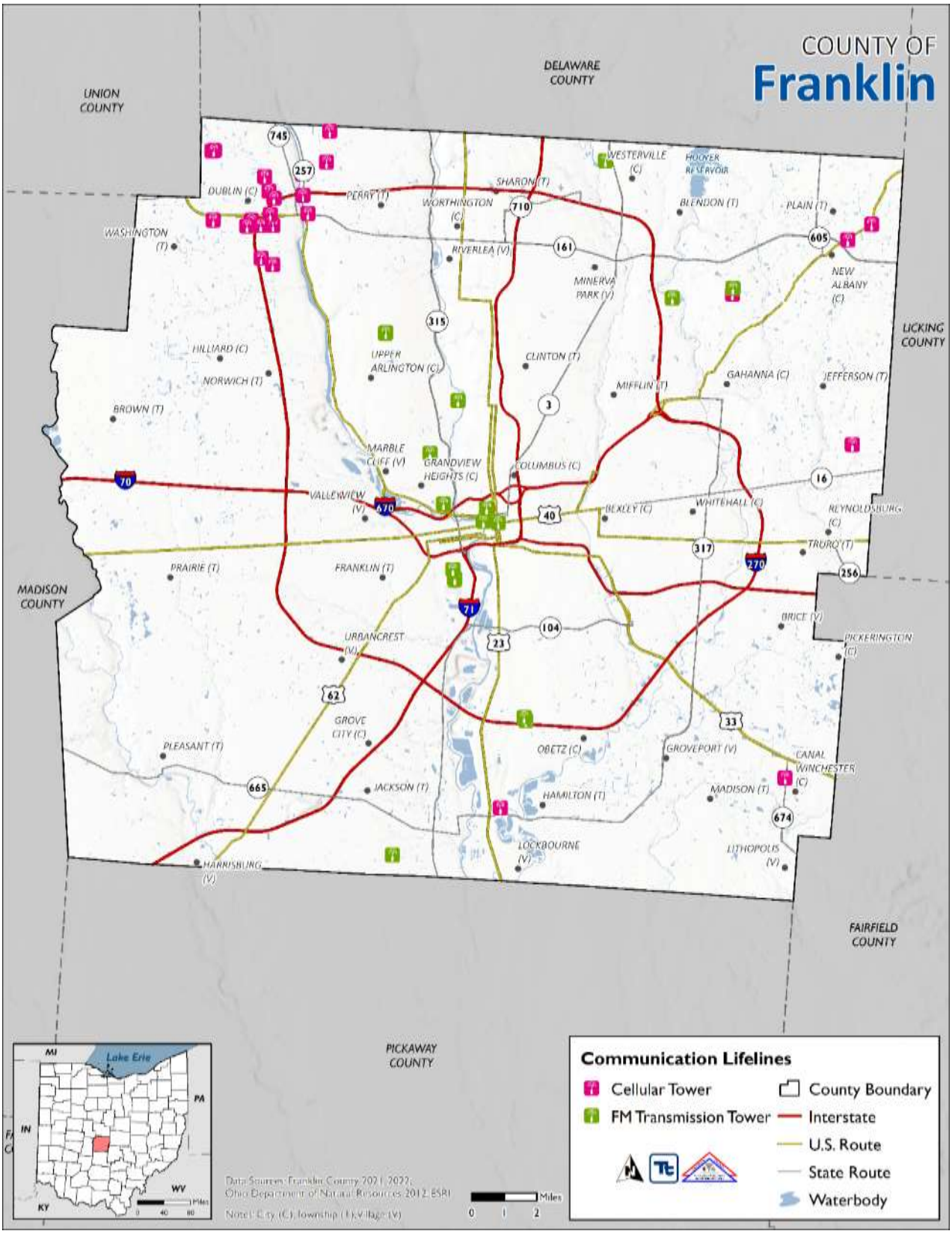
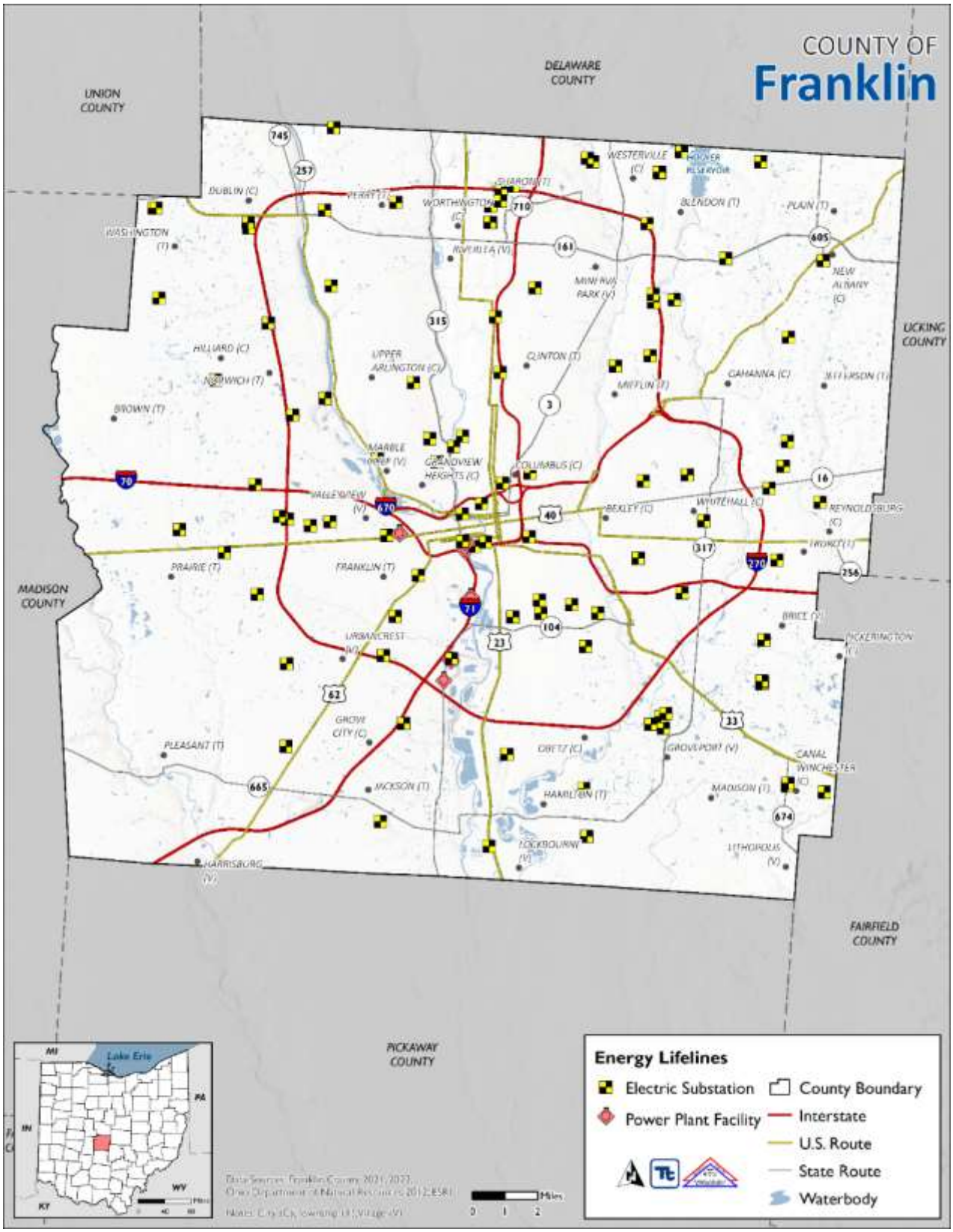


Figure 3-14. Energy (Power and Fuel) Lifelines in Franklin County



Food, Hydration, Shelter

Food, hydration, and shelter lifelines include facilities associated with commercial food distribution, commercial food supply chain, food distribution programs, temporary hydration missions, commercial water supply chain, housing, commercial facilities, animals, and agriculture. Table 3-10 summarizes the number of food, hydration, and shelter lifelines in the County identified during the development of the critical facility/community lifeline inventory.

Table 3-10. Food, Hydration, Shelter Lifelines in Franklin County

Hotels/Motels	Grocery/Convenience Stores	Total
161	786	947

Source: City of Columbus 2023

Due to the number of such lifelines across the County, they were not included in the critical facility/community lifeline total. However, these facilities provide essential services to the County before, during, and after a disaster.

Water Systems

Water system lifelines include potable water infrastructure (intake, treatment, storage, and distribution) and wastewater management (collection, storage, treatment, and discharge). For the purpose of this HMP update, 16 water system lifelines were identified, consisting of potable water, potable water wells, and wastewater systems. Table 3-11 summarizes the number of each type of facility. Figure 3-15 shows their locations.

Table 3-11. Water Systems Lifelines in Franklin County

Potable Water	Potable Water Well	Wastewater Systems	Total
1	1	14	16

Source: Franklin County 2023; Hazus v5.1

Three reservoirs in Franklin County provide 85 percent of the County's 130 million gallons of water used each day. The remaining 15 percent is drawn from wells located in southern Franklin County (City of Columbus 2023). According to the EPA, there are 29 active community water systems; 12 non-transient non-community water systems; and 58 transient non-community water systems in Franklin County. However, this does not represent all water systems in the County (U.S. EPA 2023, Ohio Environmental Protection Agency 2023).

Hazardous Materials

Hazardous materials lifelines include hazardous materials, pollutants, and contaminants, as well as the facilities that handle them. There are 248 hazardous material lifelines in Franklin County, including one Superfund site. Figure 3-16 shows the distribution of hazardous materials lifelines throughout the County; please note, locations are not available for all lifelines identified.

Figure 3-15. Water System Lifelines in Franklin County

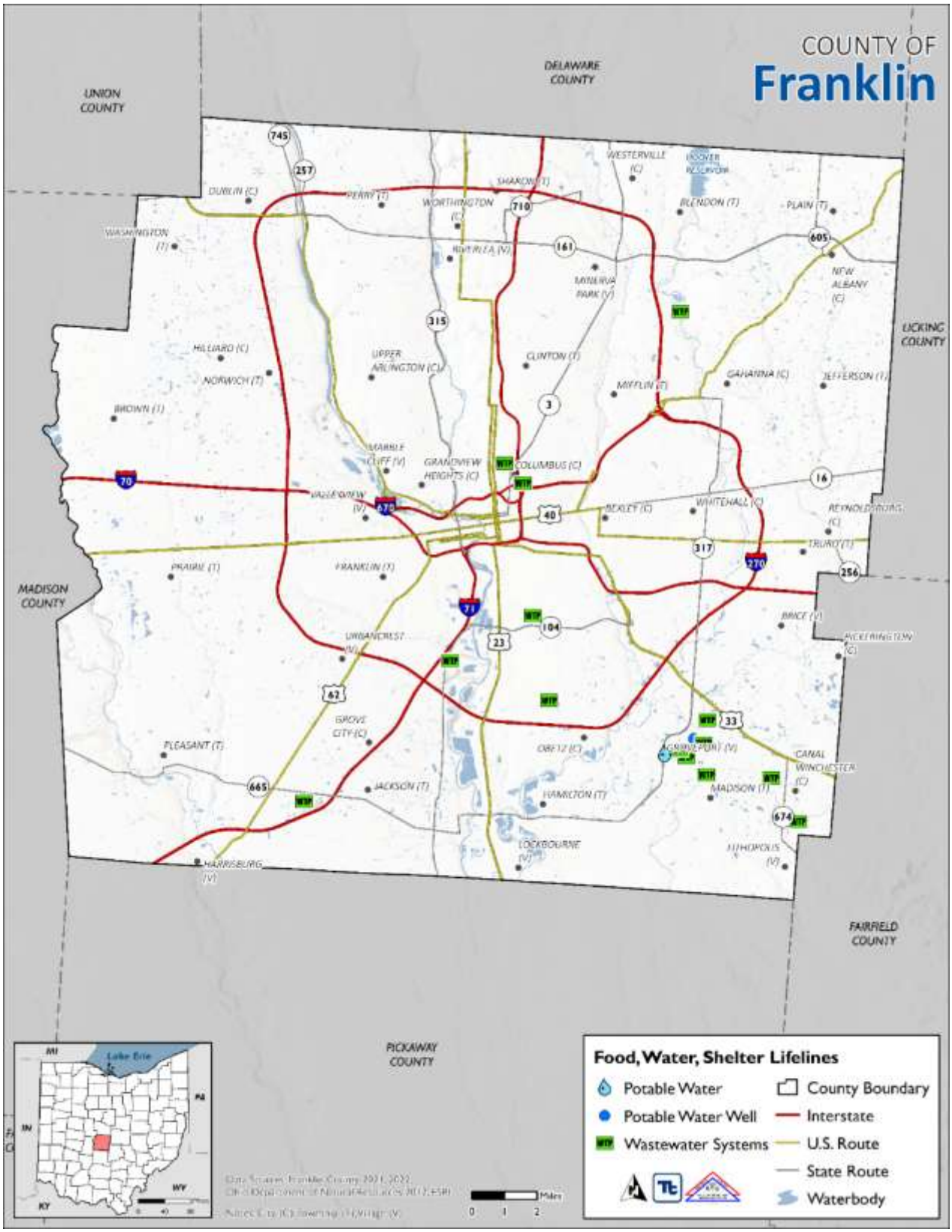
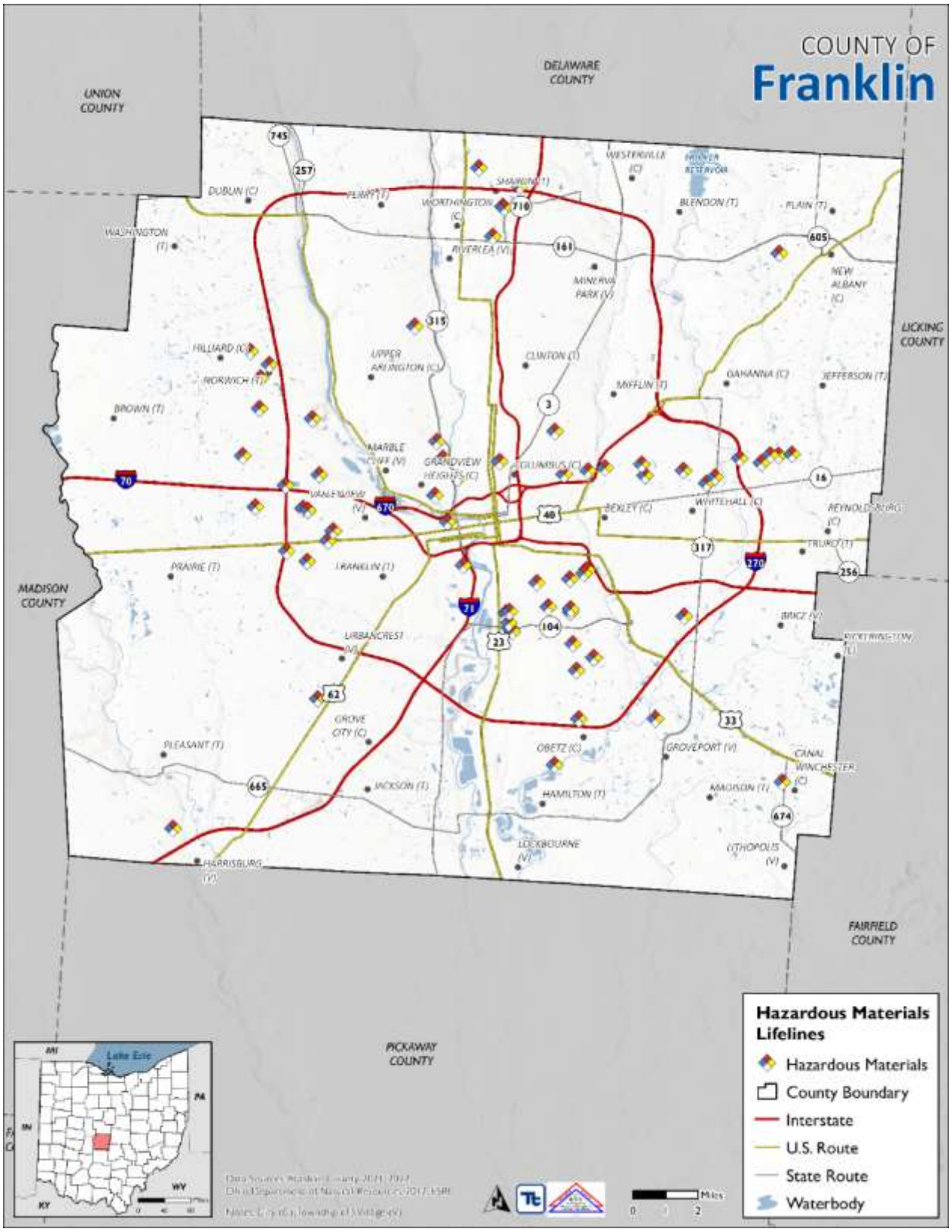


Figure 3-16. Hazardous Materials Lifelines in Franklin County



A Superfund site consists of land that has been contaminated by hazardous waste and identified by the EPA as a candidate for cleanup because it poses a risk to human health or the environment. These sites are placed on the National Priorities List (NPL), the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants. The NPL guides the EPA in determining which sites warrant further investigation.

Abandoned hazardous waste sites on the NPL that the EPA has determined present *a significant risk to human health or the environment* are eligible for remediation under the Superfund Trust Fund Program. As of March 2023, the one Franklin County hazardous site in the Superfund Program is listed as "proposed" on the NPL (U.S. EPA 2023).

Health and Medical

Health and medical lifelines include medical care (e.g., hospitals, pharmacies, long-term care facilities), patient movement (e.g., EMS), fatality management, public health, and medical supply chain. For the purpose of this HMP update, 1,691 health and medical lifelines were identified, consisting of drug and alcohol treatment facilities, emergency medical services, hospitals, medical clinic facilities, medical laboratory facilities, medical supply chain facilities, research/development facilities, and veterinary services. Table 3-12 summarizes the number of each type of facility. Figure 3-17 shows their locations.

Table 3-12. Health and Medical Lifelines in Franklin County

Drug and Alcohol Treatment Facility	Emergency Medical Service	Hospital	Medical Clinic Facility	Medical Laboratory Facility	Medical Supply Chain Facility	Research/ Development Facility	Veterinary Services	Total
34	96	28	1,360	5	27	1	140	**1,691**

Source: Franklin County 2023; Hazus v5.1

Safety and Security

Safety and Security lifelines include law enforcement/security, fire services, search and rescue services, government services, and community safety (e.g., dams). For the purpose of this HMP update, 897 safety and security lifelines were identified, consisting of alternative education facilities, correctional institutions, dams, emergency operation centers, fire stations, county-owned buildings, local government buildings, intermediate education facilities, police stations, post-secondary education facilities, primary education facilities, secondary education facilities, and tornado sirens. Table 3-13 summarizes the number of each type of facility. Figure 3-18 shows their location. Figure 3-19 shows the locations of just the dams. for use in the discussion of dam and levee failure (Section 4.3.1).

Table 3-13. Safety and Security Lifelines in Franklin County

Alternative Education Facility	Correctional Institution	Dam	EOC	Fire Station	Franklin County Building	Government Building	Intermediate Education Facility	Police Station	Post-Secondary Education Facility	Primary Education Facility	Secondary Education Facility	Tornado Siren	Total
147	6	70	4	70	70	7	29	63	211	138	58	24	**897**

Source: Franklin County 2023; Hazus v5.1

Figure 3-17. Health and Medical Lifelines in Franklin County

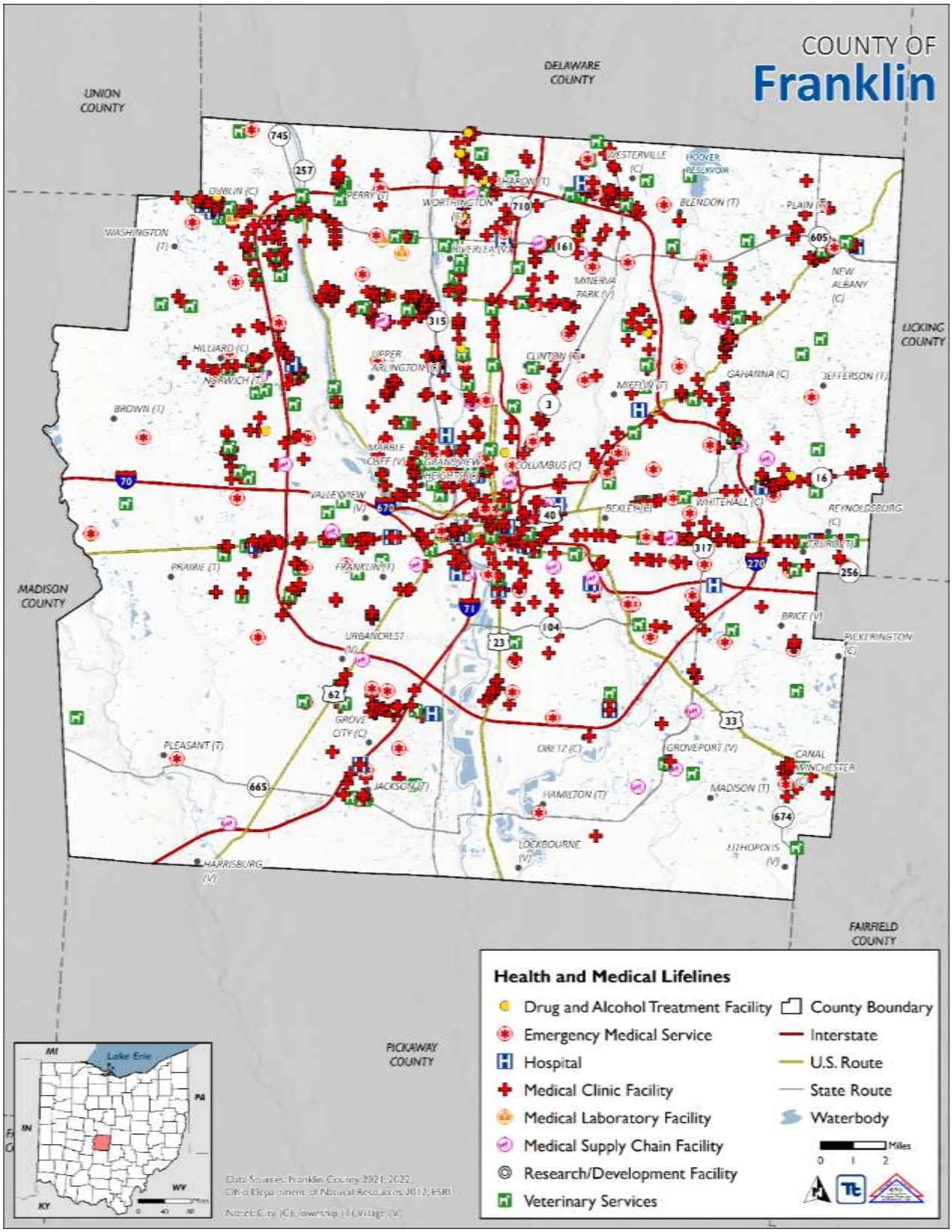


Figure 3-18. Safety and Security Lifelines in Franklin County

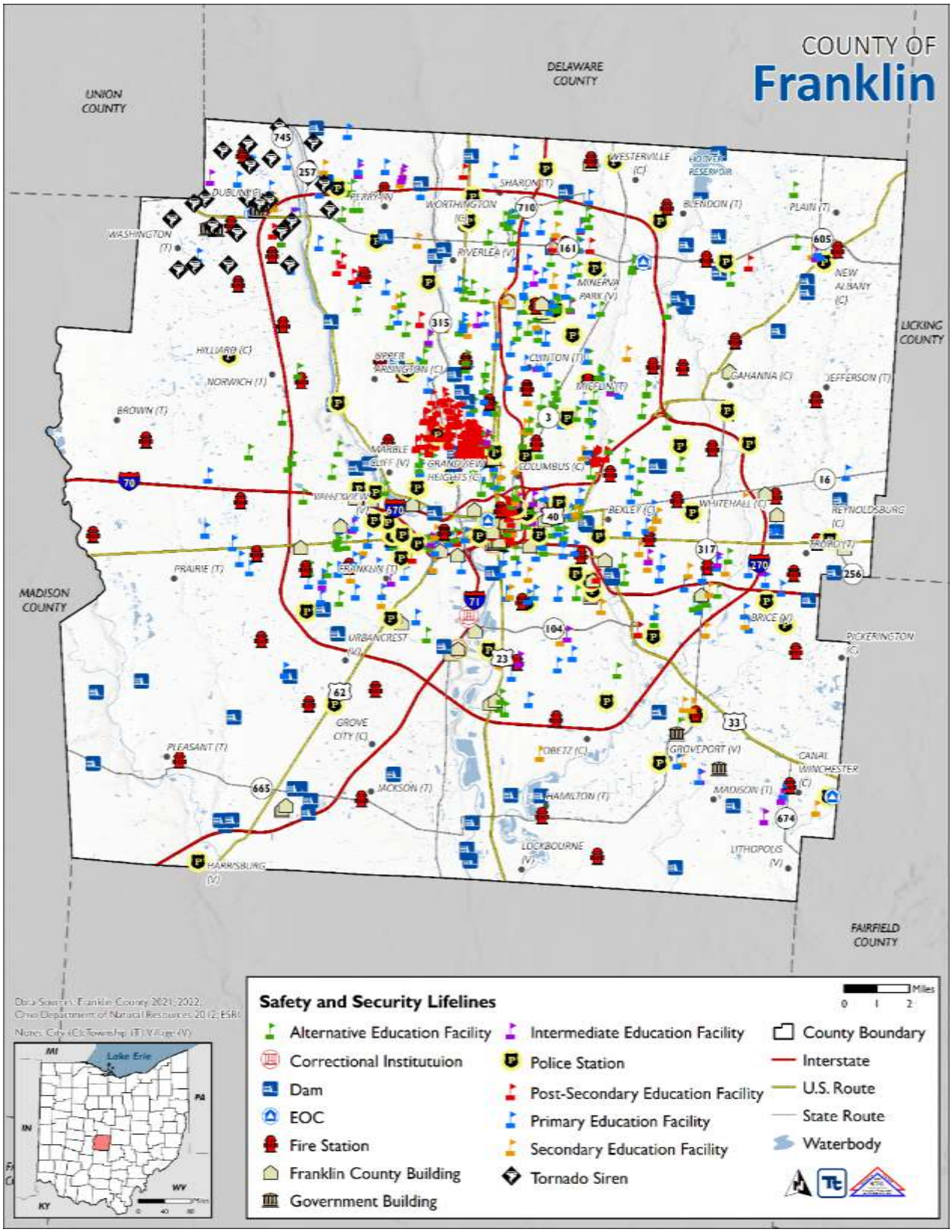
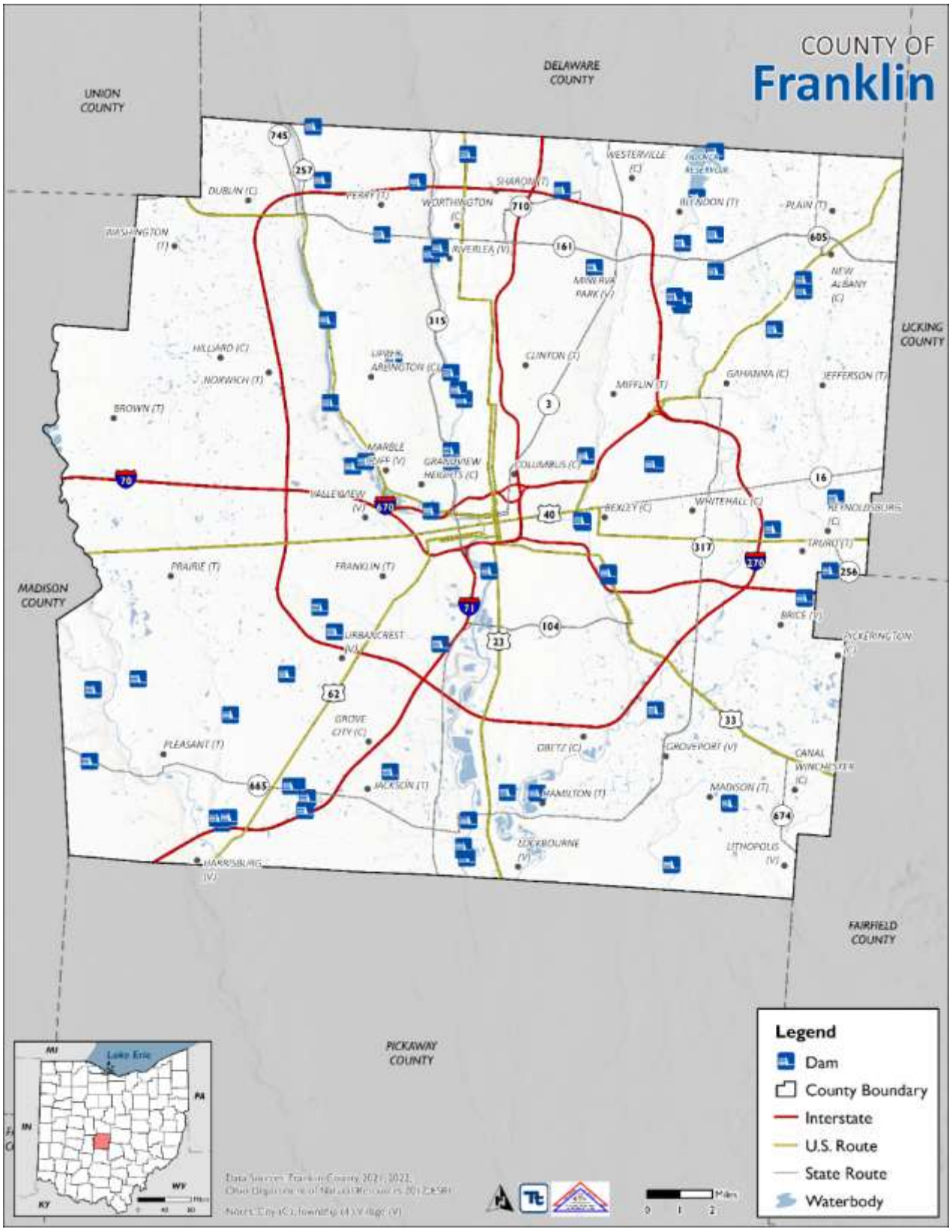


Figure 3-19. Dam Locations in Franklin County



Transportation

Transportation lifelines include highways and other roadways, mass transit, railways, aviation facilities, and maritime facilities. Major highways passing through Franklin County include I-71, a major north-south interstate, and I-70, a major east-west interstate. Combined, these highways and a regional network of state highways give Franklin County easy access to the five other major interstates in Ohio: I-75, I-76, I-77, I-80, and I-90. The regional major roadway network also includes I-270 and I-670, both exclusive to Franklin County. Commuters in the County have an average commute time of just over 20 minutes, one of the best in the nation.

Franklin County is served by the Central Ohio Transit Authority, or COTA, which offers bus services primarily in the City of Columbus and bordering towns, villages, and townships. There are currently no passenger rail transit options in Franklin County; however, in 2022 there were discussions of a potential Amtrak station in the City of Columbus.

Franklin County has six airports, one of which is an international airport. Major airports in Franklin County include the John Glenn Columbus International Port (CMH) and the Rickenbacker Inland Port (LCK). John Glenn International offers over 150 direct flights, ensuring the Columbus Region has access to markets around the country. Rickenbacker International is one of the world's only cargo-dedicated airports and offers two parallel 12,000-foot runways and a Category II Instrument Landing System for all-weather landing capabilities (Franklin County 2022).

The Rickenbacker Inland Port is also serviced by two of the largest rail providers in the U.S.—Norfolk Southern and CSX. The Rickenbacker Intermodal Terminal, just south of Franklin County, is capable of handling more than 400,000 containers annually and has access to roughly 21,000 route miles linking Franklin County to major East and West Coast ocean ports (Franklin County 2022).

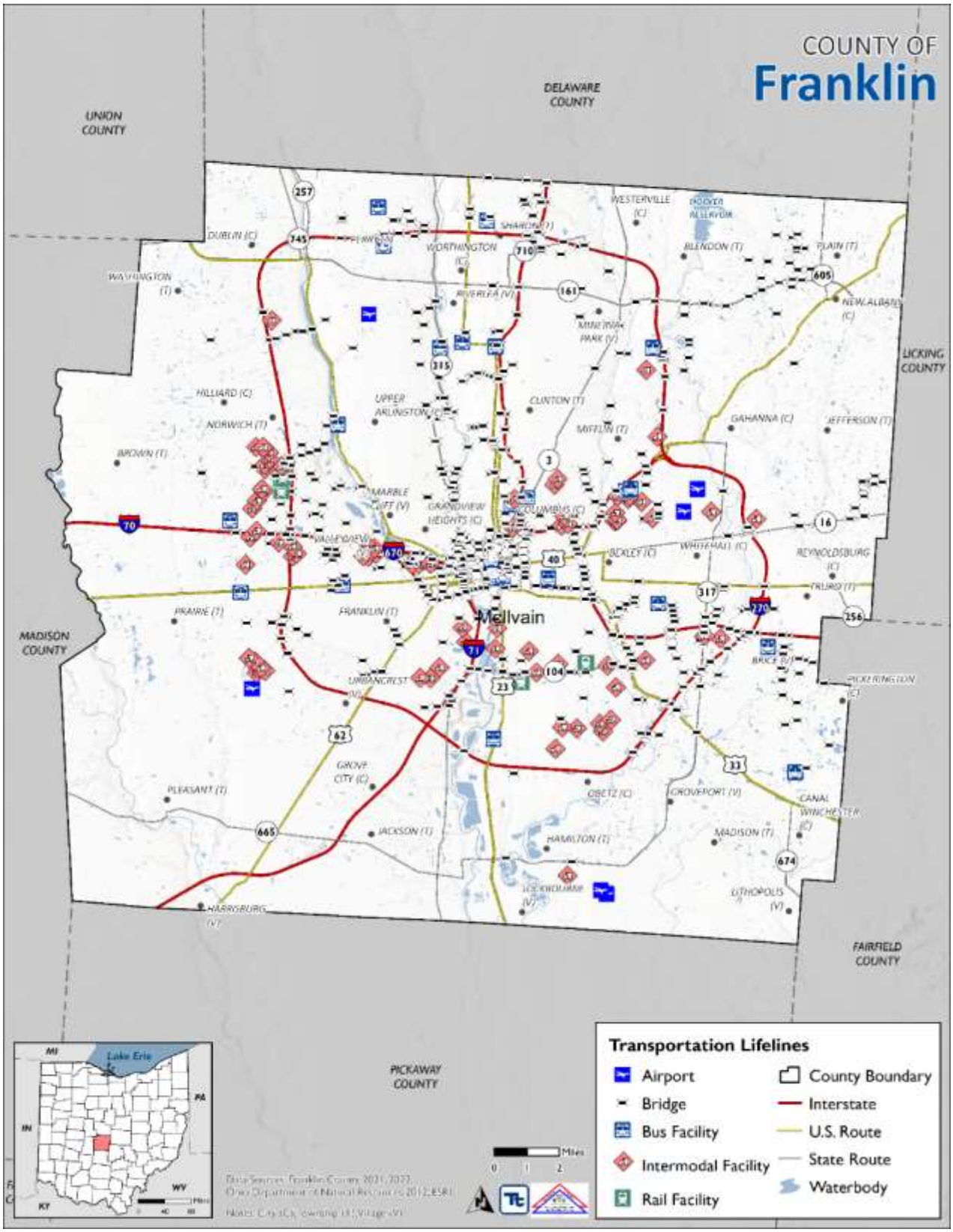
For the purpose of this HMP update, 930 transportation lifelines were identified, consisting of airports, bridges, bus facilities, intermodal facilities, and rail facilities. Table 3-14 summarizes the number of each type of facility. Figure 3-20 shows their locations.

Table 3-14. Transportation Lifelines in Franklin County

Airport	Bridge	Bus Facility	Intermodal Facility	Rail Facility	Total
6	813	23	78	10	**930**

Source: Franklin County 2023; Hazus v5.1

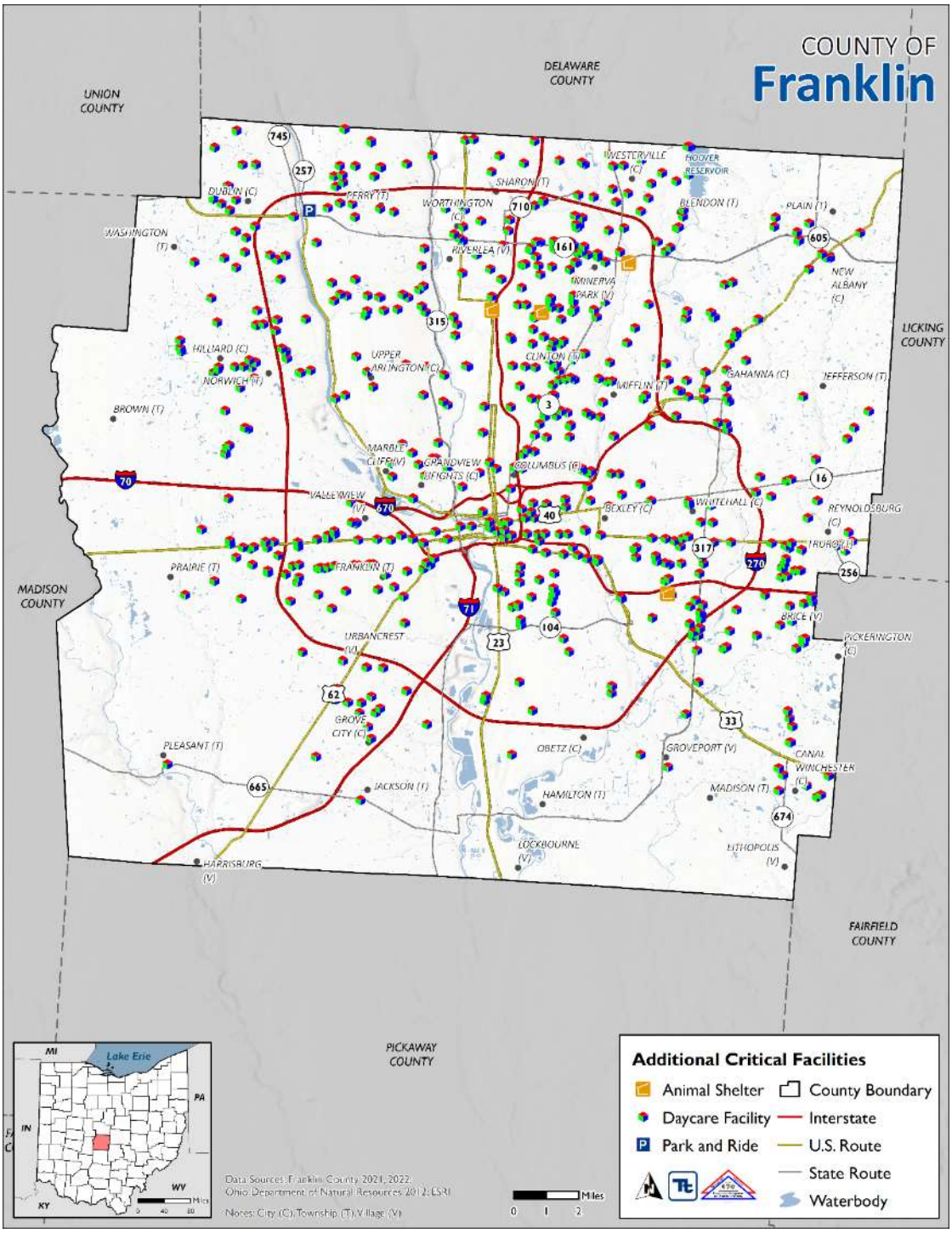
Figure 3-20. Transportation Lifelines in Franklin County



3.7.2 Other Critical Facilities

Figure 3-21 shows the location of identified critical facilities that do not fall into a lifeline category, including daycare facilities, animal shelters, and park and ride locations.

Figure 3-21. Additional Critical Facilities in Franklin County



SECTION 4. RISK ASSESSMENT

4.1 IDENTIFICATION OF HAZARDS OF CONCERN

Hazards of Concern are defined as the hazards that are most likely to impact a community. These are identified using available data and local knowledge.

To provide a strong foundation for mitigation strategies considered in Section 6 (Mitigation Strategy), Franklin County considered a full range of natural hazards that could impact the area, and then identified and ranked the hazards that present the greatest concern. The process of identifying natural hazards of concern incorporated input from the County and participating jurisdictions; review of the 2019 Ohio State HMP and previous hazard identification efforts; local, state, and federal information on the frequency, magnitude, and costs associated with hazards that have or could impact the region; and qualitative information about natural hazards and the vulnerability of the study area's assets to them.

4.1.1 Changes from the 2018 Hazard Mitigation Plan

Many of the hazards of concern for the Franklin County 2023 HMP update are the same as Franklin County's 2018 plan. The 2023 update includes best available data throughout the plan to present an updated understanding the Planning Area's risk. A few hazards were renamed to be more encompassing:

- The prior plan did not address disease outbreak as a natural hazard of concern, but it was expressed in the non-natural hazard of concern. Beginning in March 2020, the Planning Area was hit with the COVID-19 pandemic along with the rest of the world.
- The prior plan addressed extreme heat. The update addresses extreme temperatures, which include extreme cold as well.
- The geologic hazard is a newly identified hazard for Franklin County, replacing the 2018 karst/sinkhole hazard.

Since the development of Franklin County's 2018 HMP, hazards and disasters not assessed in that plan have occurred in the Planning Area. These hazards were identified by stakeholders as areas to address in the plan. The 2018 HMP identified the following non-natural disasters that are not included in the 2023 update: cyber threat; lone wolf terrorism; utility/energy interruption failure; chemical, biological, radiological, nuclear and explosive terrorism; hazardous materials; civil disturbance; transportation accidents; space weather; and air/water pollution and contamination.

4.1.2 Hazard Groupings

For this HMP, the Planning Team grouped some natural hazards together, based on the similarity of hazard events, their typical concurrence, their impacts, hazard groupings in the 2019 Ohio State HMP, and consideration of how hazards are grouped in FEMA guidance documents ("Understanding Your Risks,

Identifying Hazards and Estimating Losses" (FEMA 386-2); "Multi-Hazard Identification and Risk Assessment – The Cornerstone of the National Mitigation Strategy").

4.1.3 Hazards of Concern for the 2023 Hazard Mitigation Plan

Based on input from the County and review of all available resources, 11 hazards were identified as hazards of concern affecting the entire planning area, to be addressed at the county level in this plan:

The *Dam/Levee Failure* profile addresses dam or levee failures that may impact the Planning Area.

The *Disease Outbreak* hazard profile addresses diseases with the potential to impact the Planning Area, including the novel coronavirus (COVID-19), West Nile Virus, and influenza.

The *Drought* hazard profile addresses drought events that occurred in the Planning Area.

The *Earthquake* hazard profile addresses earthquake events that occurred in the Planning Area.

The *Extreme Temperature* hazard profile addresses periods of extreme heat and cold that occurred in the Planning Area.

The *Flood* hazard includes riverine flooding, flash flooding, coastal flooding, and stormwater flooding. Inclusion of the various forms of flooding is consistent with FEMA's *Multi-Hazard Identification and Risk Assessment* guidance.

The *Geologic Hazards* profile addresses the settling of the Earth's surface due to removal or displacement of earth materials.

The *Invasive Species* hazard profile addresses species that are nonnative and harmful to the Planning Area.

The *Severe Summer Weather Events* hazard profile extreme wind events, lightning, and severe storms that occurred in the Planning Area.

The *Severe Winter Weather* profile addresses heavy snow, blizzards, and ice storms. This grouping is consistent with the 2019 Ohio State HMP.

The *Tornado* hazard profile addresses tornado events that occurred in the Planning Area.

Other natural and human-caused hazards have not occurred in Franklin County, have a low potential to occur or to result in significant impacts within the County, or are covered in other plans that specifically

address technological and intentional hazards. Therefore, these hazards are not further addressed in this update. If deemed necessary by the County, these hazards may be considered in future versions of the HMP. Table 4.1-1 documents the process of identifying these hazards of concern for further profiling and evaluation.

Table 4.1-1. Identification of Hazards of Concern for Franklin County

Hazard	Is this a hazard that may occur in Franklin County?	Why was this determination made?	Sources
Coastal Erosion	No	• The 2019 Ohio State HMP does identify coastal erosion as a hazard of concern for Ohio; however, the Planning Team did not identify this as a hazard of concern for Franklin County. • Franklin County is located in central Ohio and is not greatly impacted by problems that occur with Lake Erie. Therefore, the Core Planning and Planning Teams elected to not include this hazard.	• 2019 Ohio State HMP • Core Planning and Planning Team input • Ohio DNR
Dam/Levee Failure	Yes	• The 2019 Ohio State HMP identifies dam/levee failure as a hazard of concern for Ohio. • Franklin County has three high hazard classified dams as well as 12 dams with a significant hazard potential classification. • The Core Planning and Planning Teams identified dam/levee failure as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • National Inventory of Dams
Disease Outbreak	Yes	• Franklin County has been identified in two FEMA declarations for COVID-19. • The County also is experiencing a measles outbreak and has had 32 cases according to the Franklin County Public Health Office. • Franklin County has been impacted by mosquito and tick-borne diseases, food-borne illness and recently, the COVID-19 pandemic. • The Core Planning and Planning Teams identified disease outbreak as a hazard of concern for Franklin County.	• FEMA • Franklin County Public Health • Core Planning and Planning Team input
Drought	Yes	• The 2019 Ohio State HMP identifies drought as a hazard of concern for Ohio. • Ohio has entered periods of drought and Franklin County has experienced droughts classified in the moderate and severe categories. • The Core Planning and Planning Teams identified drought as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • NOAA
Earthquake	Yes	• The 2019 Ohio State HMP identifies earthquakes as a hazard of concern for Ohio. • Although the county has not been recorded in any earthquake events documented by NOAA, the likelihood of Franklin experiencing an earthquake is high. • The Core Planning and Planning Teams identified earthquake as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • NOAA
Extreme Temperature	Yes – heat and cold	• Franklin County was included in three documented NOAA extreme temperature events in 2019. • The Core Planning and Planning Teams identified extreme temperature as a hazard of concern for Franklin County.	• Core Planning and Planning Team input • NOAA

Hazard	Is this a hazard that may occur in Franklin County?	Why was this determination made?	Sources
Flood	Yes – riverine/inland, flash, stormwater/urban, and ice jam	• The 2019 Ohio State HMP identifies flooding as a hazard of concern for Ohio. • Franklin County was part of a statewide emergency declaration for flooding in 1989 (DR-831). • Franklin County has been included in numerous flood and flashflood events from the NOAA database since 2018. • The Core Planning and Planning Teams identified flooding as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • FEMA • NOAA
Geologic Hazards	Yes – sinkholes, inland erosion	• The 2019 Ohio State HMP identifies landslides and land subsidence as hazards of concern for Ohio. • Even though there are no documented geological hazards from the NOAA database for the county, Ohio is home to a number of potential such hazards, including karst, mine subsidence, earthquakes, landslides, and shore erosion. • The Core Planning and Planning Teams identified geologic hazards as a hazard of concern for Franklin County.	• Core Planning and Planning Team input • 2019 Ohio State HMP • Ohio DNR
Invasive Species	Yes – Asian long horned beetle, emerald ash borer, harmful algal bloom, hemlock wooly adelgid, spotted lantern fly, and zebra mussels	• The 2019 Ohio State HMP identifies invasive species as a hazard of concern for Ohio. • Nearly 25 percent of the plant species that exist in Ohio are non-native and nearly 100 of those are classified as invasive. These species are affecting the natural ecosystems that cover the county and state of Ohio. • The Core Planning and Planning Teams identified invasive species as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • The Nature Conservancy
Land Subsidence (includes abandoned mines)	No	Please see geological hazards	
Landslide (includes mudslides)	No	Please see geological hazards	
Sea Level Rise	No	• The 2019 Ohio State HMP does not identify sea level rise as a hazard of concern for Ohio. • Franklin County is located in the center of the state and does not have to be concerned with sea level rise. • While climate change and sea level rise act as exacerbating conditions for the primary hazards of concern (flood, severe weather, wildfire, etc.), the Core Planning Team has elected to include climate change information in each individual hazard of concern.	• 2019 Ohio State HMP • Core Planning and Planning Team input • Ohio DNR
Seiche / Coastal Flooding	No	• The 2019 Ohio State HMP identifies seiche/coastal flooding as a hazard of concern for Ohio; however, the Planning Team did not identify this as a hazard of concern for Franklin County. • Franklin County is located in the center of the state and does not have to be as concerned with coastal flooding as the coastal counties, therefore, the Core Planning and Planning Teams elected to not include this hazard.	• 2019 Ohio State HMP • Core Planning and Planning Team input • Ohio DNR

Hazard	Is this a hazard that may occur in Franklin County?	Why was this determination made?	Sources
Severe Summer Weather	Yes – damaging winds, hail, hurricanes/ tropical storms, lightning, and thunderstorms	• The 2019 Ohio State HMP identifies severe summer storms as a hazard of concern for Ohio. • Franklin County was included in 8 FEMA declarations between 1990 and 2022 in relation to severe storms. • The Core Planning and Planning Teams identified severe summer weather as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • FEMA
Severe Winter Weather	Yes – blizzards, ice storms, lake-effect storms, and nor'easter	• The 2019 Ohio State HMP identifies winter storms as a hazard of concern for Ohio. • Franklin County was included in 5 FEMA disaster declarations for winter weather between 2003 and 2022. • The Core Planning and Planning Teams identified severe winter weather as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • FEMA
Space Weather	No	• The 2019 Ohio State HMP does not identify space weather as a hazard of concern for Ohio. • The County discussed this hazard in its 2018 plan but elected to remove it to discuss hazards that can be mitigated more easily.	• 2019 Ohio State HMP • Core Planning and Planning Team input • 2018 Franklin County HMP
Storm Surge	No	• The 2019 Ohio State HMP does not identify storm surge as a hazard of concern for Ohio. • Franklin County is not located near the Great Lakes and is therefore not as impacted as other counties, therefore, the Core Planning and Planning Teams elected to not include this hazard.	• 2019 Ohio State HMP • Core Planning and Planning Team input
Tornado	Yes	• The 2019 Ohio State HMP identifies tornado storms as a hazard of concern for Ohio. • Franklin County was included in 2 FEMA disaster declarations for tornados between 1974 and 2022. • Franklin County had two tornadoes identified in 2018 that totaled to almost $200,000 in damage. • The Core Planning and Planning Teams identified tornado as a hazard of concern for Franklin County.	• 2019 Ohio State HMP • Core Planning and Planning Team input • FEMA • NOAA
Tsunami	No	• The 2019 Ohio State HMP does not identify tsunami as a hazard of concern for Ohio. • Franklin County is not located on the coast, and is therefore not heavily impacted by tsunamis, Therefore, the Core Planning and Planning Teams elected to not include this hazard.	• 2019 Ohio State HMP • Core Planning and Planning Team input
Wildfire	No	• The 2019 Ohio State HMP does identify wildfire as a hazard of concern for Ohio. • No wildfire events in Franklin County have been reported by the NCEI database, which has been reporting events since 1950. Therefore the Core Planning and Planning Teams elected to not include this hazard.	• 2019 Ohio State HMP • Core Planning and Planning Team input • NOAA

SECTION 4. RISK ASSESSMENT

4.2 METHODOLOGY AND TOOLS

Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from identified hazards. It allows emergency management personnel to establish early response priorities by identifying potential hazards and vulnerable assets. The process focuses on the following elements:

- **Hazard identification**—Use all available information to determine what types of hazards may affect a jurisdiction, how often they can occur, and their potential severity.
- **Exposure identification**—Estimate the total number of people and properties in the jurisdiction that are likely to experience a hazard event if it occurs.
- **Vulnerability identification and loss estimation**—Assess the impact of hazard events on the people, property, environment, economy, and lands of the region, including estimates of the cost of potential damage or cost that can be avoided by mitigation.

The risk assessment for this HMP update evaluates the risk of natural hazards prevalent in the planning area and meets requirements of the DMA 2000 (44 CFR, Section 201.6(c)(2)).

The following describes the methodology and tools used to conduct the risk assessment for the Franklin County HMP 2023 update.

4.2.1 Risk Assessment Tools

Mapping

National, state, and county databases were reviewed to locate available spatially based data relevant to this planning effort. Maps were produced using geographic information system (GIS) software to show the spatial extent and location of hazards when such datasets were available. These maps are included in the hazard profile chapters of this document.

Hazus

FEMA's Hazus risk simulation model estimates losses caused by earthquakes, hurricanes, and floods and identifies areas that face the highest risk and potential for loss. Hazus is a GIS-based software program used to support risk assessments, mitigation planning, and emergency planning and response. It provides a wide range of inventory data—such as demographics, building stock, critical facilities, transportation and utility lifelines—and uses multiple models to estimate potential losses from natural disasters. The program maps and displays hazard data and the results of damage and economic loss estimates for buildings and infrastructure. Its advantages include the following:

- Provides a consistent methodology for assessing risk across geographic and political entities.

- Provides a way to save data so that it can readily be updated as population, inventory, and other factors change and as mitigation planning efforts evolve.
- Facilitates review of mitigation plans because it helps to ensure that FEMA methodologies are incorporated.
- Supports grant applications by calculating benefits using FEMA definitions and terminology.
- Produces hazard data and loss estimates that can be used in communication with local stakeholders.
- Is administered by the local government and can be used to manage and update a hazard mitigation plan throughout its implementation.

Level of Detail for Evaluation

Hazus provides default data for inventory, vulnerability, and hazards; the default data can be supplemented with local data to provide a more refined analysis. The model can carry out three levels of analysis, depending on the format and level of detail of information about the planning area:

- **Level 1**—All of the information needed to produce an estimate of losses is included in the software's default data. The data is derived from national databases and describes in general terms the characteristic parameters of the planning area.
- **Level 2**—More accurate estimates of losses require more detailed information about the planning area. To produce Level 2 estimates of losses, detailed information is required about local geology, hydrology, hydraulics, and building inventory, as well as data about utilities and critical facilities. This information is needed in a GIS format.
- **Level 3**—This level of analysis generates the most accurate estimate of losses. It requires detailed engineering and geotechnical information to customize it for the planning area.

4.2.2 Risk Assessment Approach

The risk assessments in this plan describe the risks associated with each hazard of concern identified. The following steps were used to define the risk of each hazard:

- **Identify and profile each hazard**—The following information is given for each hazard:
  - Geographic areas most affected by the hazard
  - Event frequency estimates
  - Severity estimates
- **Determine exposure to each hazard**—Exposure was assessed by overlaying hazard maps with an inventory of structures, facilities, and systems to decide which of them would be exposed to each hazard.
- **Assess the vulnerability of exposed facilities**—Vulnerability of exposed structures and infrastructure was evaluated by interpreting the probability of occurrence of each event and assessing structures, facilities, and systems that are exposed to each hazard. Hazus was used for

this assessment for the earthquake and flood. Outputs similar to those from Hazus were generated for other hazards, using data generated through GIS.

Dam/Levee Failure

Dam failure scenarios are designated as either non-breach or breach. In non-breach scenarios, the dam is operating as designed for the given pool level, releasing from outlets and controlled or uncontrolled spillways. In breach scenarios, the continuity of the structure has been compromised, resulting in uncontrolled water releases that exceed the magnitude of releases in the equivalent non-breach scenario. The maximum high (MH) scenario (breach) is based on the inflow design flood per FEMA guidelines and indicates the maximum reservoir pool level and likely maximum extent of inundation.

A quantitative assessment of the County's vulnerability to dam/levee failure and associated impacts was conducted using the 2023 MH (breach) dam inundation scenarios spatial layer from U.S. Army Corps of Engineers for the Alum Creek Dam and Delaware Dam. Assets (population, building stock, critical facilities and lifelines, new development) with their centroid in the hazard area were totaled to estimate the numbers and values exposed to the dam inundation hazard.

Disease Outbreak

All of Franklin County is exposed to disease outbreak events. A qualitative assessment was conducted. Research from the Centers for Disease Control and Prevention was utilized to qualitatively assess the most recent COVID-19 outbreak.

Drought

To assess the vulnerability of Franklin County to drought and its associated impacts, a qualitative assessment was conducted. The U.S. Department of Agriculture (USDA) Census of Agriculture 2017 was used to estimate economic impacts. Information from the census report regarding the number of farms and farmland area was summarized in the vulnerability assessment. Additional resources from 2019 Ohio State HMP and FEMA's National Risk Index were used to assess the potential impacts on the population from a drought event.

Earthquake

To provide a range of loss estimates for the earthquake hazard in Franklin County, a probabilistic assessment was conducted for the 250-year and 1,000-year mean return periods (MRPs) through a Level 2 analysis in Hazus v5.1. The probabilistic method uses information from historic earthquakes and inferred faults, locations, and magnitudes to compute the probable ground shaking levels that may be experienced during a recurrence period by census tract.

Hazus' potential loss estimates are acceptable for the purposes of this HMP. However, as noted in the Hazus Earthquake User Manual (FEMA 2022) "Although the software offers users the opportunity to prepare comprehensive loss estimates, it should be recognized that uncertainties are inherent in any

estimation methodology, even with state-of-the-art techniques. Any region or city studied will have an enormous variety of buildings and facilities of different sizes, shapes, and structural systems that have been constructed over a range of years under diverse seismic design codes. There are a variety of components that contribute to transportation and utility system damage estimations. These components can have differing seismic resistance."

Ground shaking is the primary cause of earthquake damage to man-made structures, and soft soils amplify ground shaking. One contributor to a site's amplification is the velocity at which the rock or soil transmits shear waves (S-waves). The National Earthquake Hazard Reductions Program (NEHRP) has developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from A to E, where A represents hard rock that reduces ground motions from an earthquake and E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class D and E NEHRP soils are the two classes most susceptible to amplified ground motion during an earthquake.

The default assumption is a magnitude 7.0 earthquake for all return periods. Although damage is estimated at the census tract level, results were presented at the municipal level.

Damage estimates are calculated for losses to buildings (structural and non-structural) and contents; structural losses include load carrying components of the structure, and non-structural losses include those to architectural, mechanical, and electrical components of the structure, such as nonbearing walls, veneer and finishes, HVAC systems, boilers, etc.

Extreme Temperature

All of Franklin County is exposed to extreme temperature events. A qualitative assessment was conducted for the extreme temperature hazard. Information from the National Weather Service (NWS), Centers for Disease Control and Prevention, stakeholder plans/reports, the 2019 Ohio State HMP, and the Planning Team was used to assess potential impacts on assets.

Flood

The 1-percent and 0.2-percent annual chance flood events were examined to evaluate the County's risk from the flood hazard. These are the flood events that are generally evaluated under federal programs such as the NFIP.

Flood hazard area boundaries were taken from the Franklin County effective FEMA Digital Flood Insurance Rate Map (DFIRM) dated June 16, 2011. The depth grid was developed using data from USGS's 1-meter resolution Digital Elevation Model from 2020.

To estimate exposure to the 1-percent and 0.2-percent annual chance flood events, the effective DFIRM flood boundaries were overlaid on the centroids of updated assets (population, building stock, and critical facilities). Centroids that intersected the flood boundaries were totaled to estimate the building replacement cost value and population vulnerable to the flood inundation areas.

A Level 2 Hazus riverine flood analysis was performed in Hazus v5.1. Both the critical facility and building inventories were formatted to be compatible with Hazus and its Comprehensive Data Management System (CDMS). Once updated with the inventories, the Hazus riverine flood model was run to estimate potential losses in Franklin County for the 1-percent annual chance flood event. A user-defined analysis was also performed for the building stock. Buildings located within the floodplain were imported as user-defined facilities to estimate potential losses to the building stock at the structural level. Hazus calculated the estimated potential losses to the population (default 2010 U.S. Census data across dasymetric blocks), potential damage to the general building stock, and potential damage to critical facility inventories based on the depth grid generated and the default Hazus damage functions in the flood model.

Geologic Hazards

This updated HMP referenced inland erosion and subsidence hazard areas to assess the County's risk to the geologic hazards.

To help understand the geographic distribution of inland erosion, 2022 soil data for Franklin County from the USDA Natural Resources Conservation Service was referenced. Soils with k-factor greater than or equal to 0.49 were selected as susceptible soil. K-factor is soil erodibility factor that represents both susceptibility of soil to erosion and the rate of runoff. Assets (population, building stock, critical facilities and lifelines, new development) with their centroid in the hazard area were totaled to estimate the numbers and values exposed to the subsidence hazard.

To assess the vulnerability of the County to subsidence, a quantitative assessment was conducted using a karst carbonate rock spatial layer from the Ohio Department of Natural Resources (DNR) Division of Geological Survey. Karst describes a distinctive topography that indicates dissolution of underlying carbonate rocks (limestone and dolomite) by surface water or groundwater over time. The dissolution process causes surface depressions and the development of sinkholes, sinking streams, enlarged bedrock fractures, caves, and underground streams. Assets (population, building stock, critical facilities and lifelines, new development) with their centroid in the hazard area were totaled to estimate the numbers and values exposed to the subsidence hazard.

Invasive Species

A qualitative analysis was conducted for the infestation and invasive species hazard. All of Franklin County is considered exposed due to the historical existence and evidence of invasive species in Ohio and the County. Data from the USDA, Ohio DNR, and Ohio Environmental Protection Agency (Ohio EPA) was used to develop the hazard profile and to determine risk and exposure.

Severe Summer Weather

All of Franklin County is exposed to severe summer weather. A qualitative analysis was conducted for this hazard. Information from the 2019 Ohio State HMP, the NWS, and the FEMA National Risk Index was used to develop the hazard profile and to determine risk and exposure.

Severe Winter Weather

All of Franklin County is exposed and vulnerable to the winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. Information and data from the 2019 Ohio State HMP, the NWS, and the FEMA National Risk Index was used to develop the hazard profile and to determine risk and exposure.

Tornado

All of Franklin County is exposed to tornadoes. A qualitative analysis was conducted for this hazard and information from the 2019 Ohio State HMP, the NWS, and the FEMA National Risk Index was used to develop the hazard profile and to determine risk and exposure.

4.2.3 Sources of Data Used in Hazus Modeling and Exposure Analyses

Franklin County assets were identified to assess potential exposure and loss associated with the hazards of concern. For the HMP update, Franklin County assessed exposure and vulnerability of the following types of assets: population, buildings, and critical facilities/community lifelines. Some assets may be more vulnerable because of their physical characteristics or socioeconomic uses. To protect individual privacy and the security of critical facilities, information on properties assessed is presented in aggregate, without details about specific individual personal or public properties.

Building and Cost Data

The data for general building stock was provided by the Franklin County Auditor, last updated in 2021. The general building stock is analyzed at the aggregate census block and census tract levels and incorporates 2010 Census data with the 2022 RS Means replacement cost values. Structural and content replacement cost values were calculated for each building utilizing available auditor data and RS Means 2022 values; a regional location factor of 0.93 for Franklin County was applied. The occupancy classes were condensed into the categories of residential, commercial, industrial, agricultural, religious, governmental, and educational to facilitate analysis and presentation of results. Residential loss estimates addressed both multi-family and single-family dwellings.

Critical Facilities and Lifelines

The 2023 HMP critical facility inventory, which includes essential facilities, utilities, government offices, transportation features, and user-defined facilities, was updated by Franklin County. The update involved a review for accuracy, additions or deletions of new or moved critical assets, identification of backup power for each asset (if known), and whether the critical facility is considered a community lifeline in accordance with FEMA's definition.

Population

Franklin County used total population statistics from the 2016-2021 American Community Survey (ACS) 5-year estimate to estimate exposure and potential impacts on the County's population. City, township, and village populations were extracted directly from the Census Bureau and ACS. Limitations of these analyses are recognized, so the results are used only to provide a general estimate for planning purposes.

As discussed in Section 3 (County Profile), research has shown that some populations are at greater risk from hazard events because of decreased resources or physical abilities. Vulnerable populations in Franklin County included in the risk assessment are children, elderly, and people living in low-income households.

Hazus Data Inputs

The following hazard datasets were used for the Hazus Level 2 analysis conducted for the risk assessment:

- **Earthquake**—Hazus earthquake probabilistic data were used for the analysis of this hazard.
- **Flood**— The effective 2021 DFIRM for the County was used to delineate flood hazard areas and estimate potential losses from the FEMA 1-percent annual chance flood event. Using the DFIRM floodplain boundaries and base flood (1-percent annual chance flood) elevation information, and the USGS 1-meter digital elevation model data, flood depth grids were generated and integrated into the Hazus model.

Other Local Hazard Data

Locally relevant information on hazards was gathered from a variety of sources. Frequency and severity indicators include past events and the expert opinions of geologists, emergency management specialists, and others. Data sources for specific hazards were as follows:

- **Inland Erosion**—USDA Natural Resources Conservation Service 2022 geologic data for areas with a K-Factor >= 0.49.
- **Land Subsidence**—Ohio DNR Division of Geological Survey 2022 geologic data for areas of karst carbonate rock
- **Dam Inundation**—U.S. Army Corps of Engineers 2023 for an MH-Breach scenario for the Alum Creek Dam & Delaware Dam.

No GIS format datasets appropriate for an exposure analysis were identified for the following hazards: disease outbreak, drought, extreme temperatures, invasive species, severe summer weather, severe winter weather, and tornadoes.

Data Source Summary

Table 4.2-1 summarizes the data sources used for the risk assessment for this plan.

Table 4.2-1. Data Source Summary

Data	Source	Date	Format
Population Data	U.S. Census Bureau ACS 5-Year Estimates; Stats America	2010/2020; 2017-2021;	Digital (GIS) Format; CSV
New Development	Franklin County Assessor; Blendon Township; City of Canal Winchester; City of Dublin, Planning Division; City of Gahanna; City of Groveport; City of New Albany, Administrative Services Department; City of Obetz; City of Upper Arlington Fire Department; Jefferson Township; Prairie Township; Truro Township; Village of Lockbourne	2023	Digital (GIS) Format; CSV
Building Inventory	Franklin County Assessor	2021	Digital (GIS) Format
Critical Facilities	Franklin County; Hazus v5.1	2023	Digital (GIS) Format
Digitized Effective FIRM Data	FEMA	2011	Digital (GIS) Format
Digital Elevation Model	USGS	2020	Digital (GIS) Format
Flood Depth Grids	FEMA; USGS	2021; 2020	Digital (GIS) Format
Inland Erosion	USDA, Natural Resources and Conservation Service	2022	Digital (GIS) Format
Land Subsidence	Ohio DNR, Division of Geological Survey	2022	Digital (GIS) Format
Dam Inundation	U.S. Army Corps of Engineers	2023	Digital (GIS) Format

Notes: FEMA – Federal Emergency Management Agency; DNR –Department of Natural Resources; USGS – United States Geological Survey; USDA – United States Department of Agriculture

4.2.4 Limitations

Loss estimates, exposure assessments, and hazard-specific vulnerability evaluations rely on the best available data and methodologies. Uncertainties are inherent in any loss estimation methodology and arise in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from the following:

- Approximations and simplifications necessary to conduct a study
- Incomplete or outdated inventory, demographic, or economic parameter data
- The unique nature, geographic extent, and severity of each hazard
- Mitigation measures already employed
- The amount of advance notice residents have to prepare for a specific hazard event

These factors can affect loss estimates by a factor of two or more. Therefore, potential exposure and loss estimates are approximate and should be used only to understand relative risk. Over the long term, Franklin County will collect additional data to assist in estimating potential losses associated with other hazards.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.1 Dam and Levee Failure

This section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the dam and levee failure hazard in Franklin County. As per Ohio Revised Code (ORC) 149.433, the State does not provide data on state-owned/operated dams. Therefore, a more qualitative assessment was completed for dams and levees in Franklin County.

Hazard Profile

Hazard Description

Dam Failure

A dam failure is defined as an uncontrolled release of impounded water. The causes of dam failures can be divided into three groups: dam overtopping, excessive seepage, and structural failure of a component. Despite efforts to provide sufficient structural integrity and to perform inspection and maintenance, problems can develop that can lead to failure. While most dams have storage volumes small enough that failures would have little or no consequences, dams with large storage amounts could cause significant flooding downstream (State of Ohio HMP 2019).

Levee Failure

A levee is any artificial barrier together with appurtenant works that will divert or restrain the flow of a stream or other body of water for the purpose of protecting an area from inundation by flood waters. Generally, a levee is subjected to water loading during a few days or weeks each year; unlike a dam that is retaining water most days of the year (Ohio DNR 2019).

A levee breach results when a portion of the levee breaks away, providing an opening for water to flood the landward side of the structure. Such breaches can be caused by surface erosion due to water velocities, or they can be the result of subsurface actions. Subsurface actions usually involve sand boils, in which the upward pressure of water flowing through porous soil under the levee exceeds the static pressure of the soil weight above it (i.e., under-seepage). These boils can indicate instability of the levee foundation given the liquefied substrate below it, leading to breaching.

Levee overtopping is similar to dam overtopping in that the flood waters simply exceed the design capacity of the structure, thus flowing over the lowest crest of the system. Such overtopping can lead to erosion on the landward side which, subsequently, can lead to breaching. In order to prevent this type of

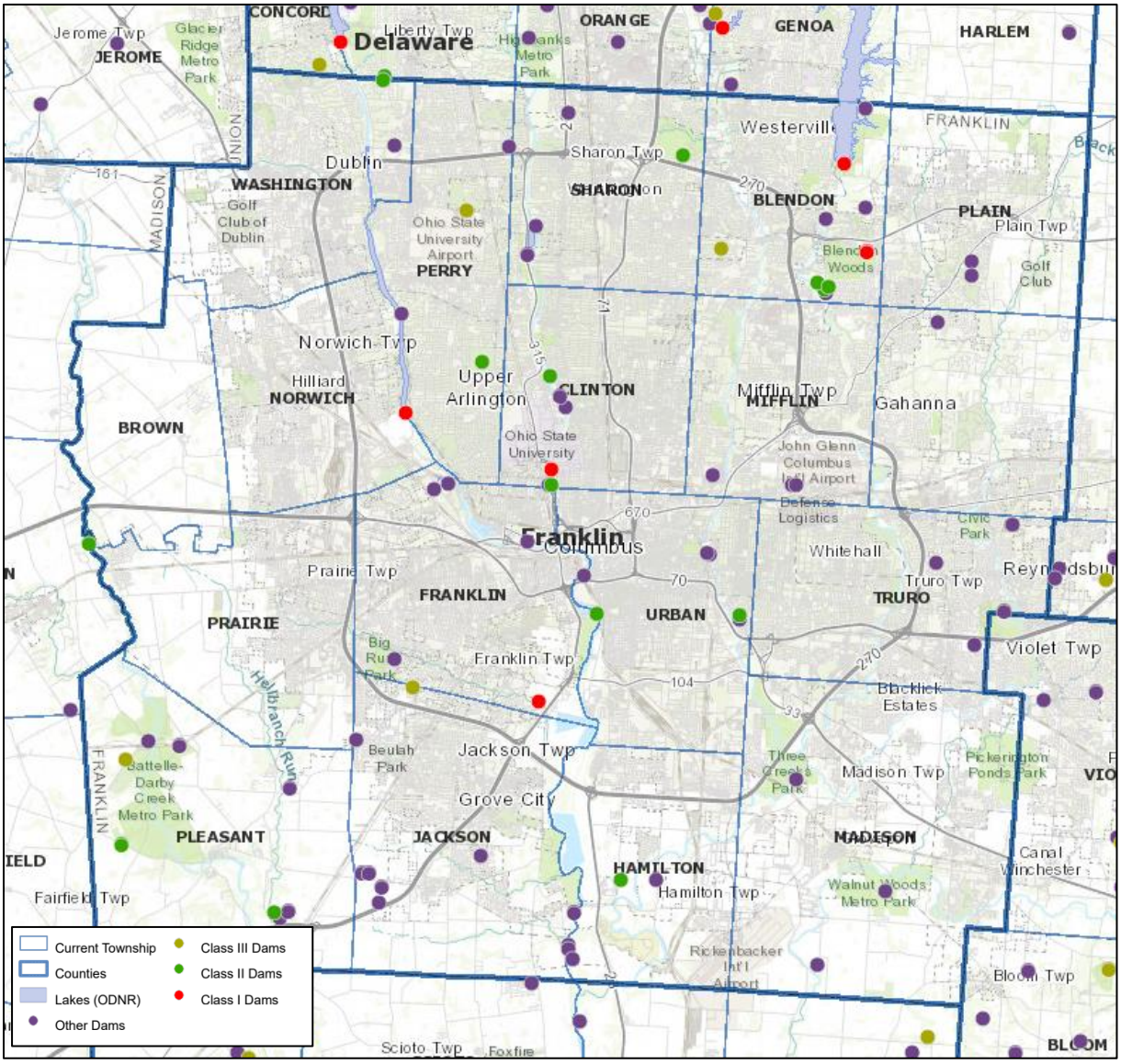
landward erosion, many levees are reinforced or armored with rocks or concrete (State of Ohio HMP 2019).

Location

Dam Failure

Franklin County has a total of 70 dams within the county limits. Of the 70 dams, three are Class I, 12 are Class II, and four are Class III. All other dams are classified as other. The Hoover Dam and the O'Shaughnessy Dam in Delaware County would impact Franklin County if they were to fail. These two dams are found on the Ohio EMA's list of top 10 most potentially hazardous dams in the state, based on the possible catastrophic consequences if the dam should fail (Franklin County HMP 2018). Figure 4.3.1-1 shows the locations of all Class I, Class II, and Class III dams within Franklin County.

Figure 4.3.1-1. Dam Location in Franklin County

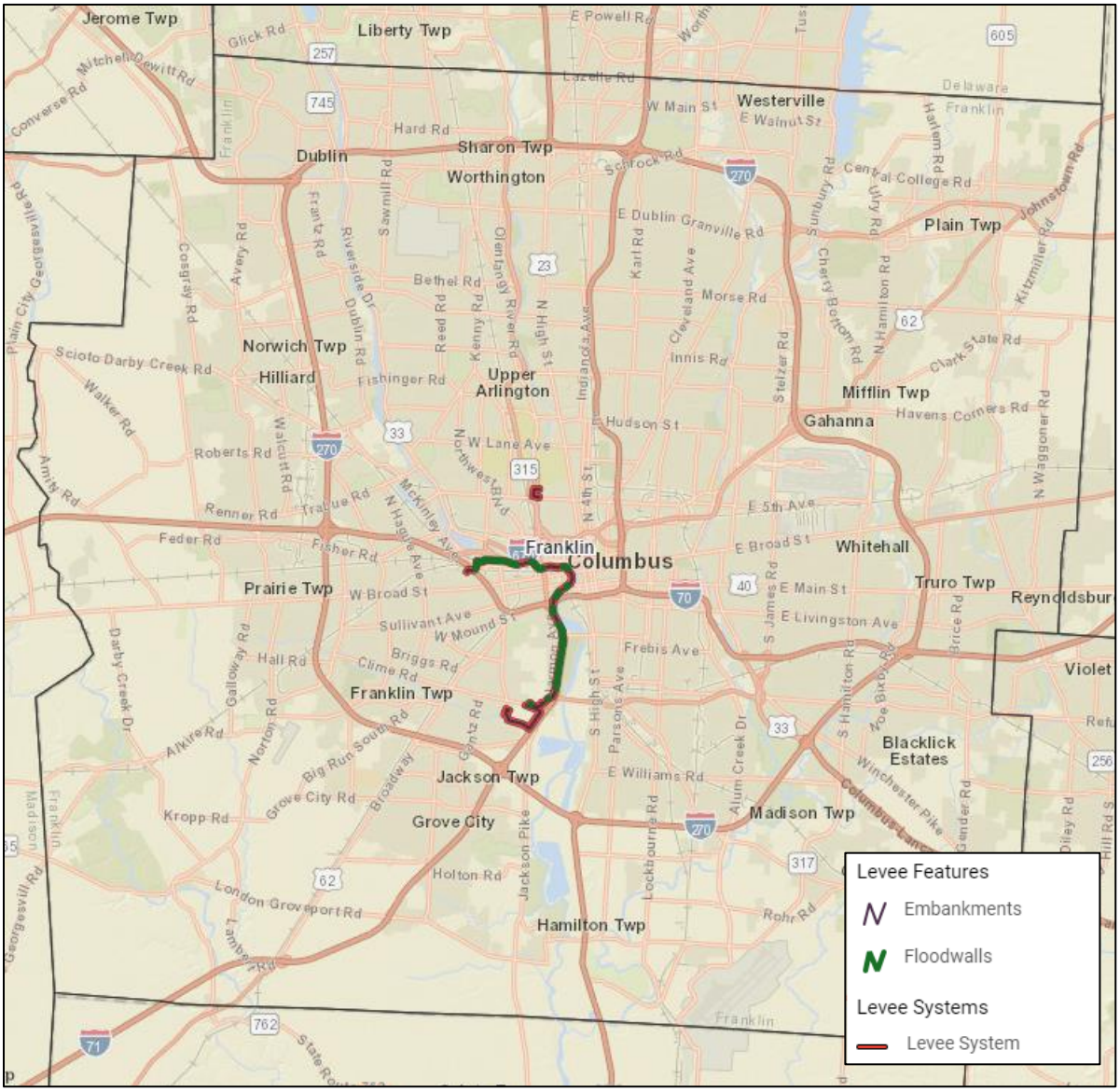


Source: Ohio Dam Safety Program – GIS Locator

Levee Failure

There are two primary sources of levee data for the State of Ohio: the U.S. Army Corps of Engineers (USACE) National Levee Database and the Ohio Department of Natural Resources (ODNR) Dam Safety Program. The National Levee Database provides static information regarding levee location and attributes, which can aid in decision making and better flood risk management (State of Ohio HMP 2019). The National Levee Database lists Agg Rock, Battelle King Avenue Campus Levee, and West Columbus, OH, LPP as the three levee systems within Franklin County (U.S. Army Corps of Engineers 2022). Figure 4.3.1-2 shows these levee systems.

Figure 4.3.1-2. Levee Locations in Franklin County



Source: National Levee Database, 2022

Extent

Dam Failure

There are 5,874 known existing structures that retain or detain water statewide included in the ODNR's inventory of dams. The volume of water impounded, and the density, type, and value of development downstream determine the potential severity and potential Classification of dam. The Ohio Administrative Code (OAC) categorizes dams into four Classes as follows (State of Ohio 2010):

- Dams with a total storage volume greater than 5,000 acre-feet or a height of greater than 60 feet are Class I. A dam is placed in Class I when sudden failure of the dam would result in one of the following conditions:
  - Probable loss of human life
  - Structural collapse of at least one residence or one commercial or industrial business
- Dams with a total storage volume greater than 500 acre-feet or a height of greater than 40 feet are Class II. A dam is placed in Class II when sudden failure of the dam would result in at least one of the following conditions, but loss of human life is not probable:
  - 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. At the request of the dam owner, the chief of the ODNR Division of Water Resources (the chief) may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property
  - Flooding of high-value property. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property
  - Damage or disruption to major roads, including but not limited to interstate and state highways, and the only access to residential or other critical areas such as hospitals, nursing homes, or correctional facilities, as determined by the chief
  - Damage or disruption to railroads or public utilities
  - Damage to downstream Class I, II or III dams or levees, or other dams or levees of high value. 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 potentially affected property
- Dams having a total storage volume greater than 50 acre-feet or a height of greater than 25 feet are Class III. A dam is placed in Class III when sudden failure of the dam would result in at least one of the following conditions, but loss of human life is not probable:
  - Property losses including but not limited to rural buildings not otherwise described in OAC Rule 1501:21-13-01 (A), and Class IV dams and levees not otherwise listed as high-value property in the same rule. At the request of the dam owner, the chief may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property.
  - Damage or disruption to local roads including but not limited to roads not otherwise listed as major roads in OAC Rule 1501:21-13-01 (A)
- Dams which are 25 feet or less in height and have a total storage volume of 50 acre-feet or less may be placed in Class IV. When sudden failure of the dam would result in property losses restricted mainly to the dam and rural lands, and loss of human life is not probable, the dam may be placed in Class IV.

There are 18 Class, I, Class II, or Class III dams in Franklin County, as listed in Table 4.3.1-1; the remaining 51 dams are Classified as Class IV.

Table 4.3.1-1. Franklin County Dams Classification (Class I to III)

Dam Name	Class I, II, III	Hazard Potential Classification	Emergency Action Plan (EAP)
Hoover Dam	Class I	High	Yes
Julian Griggs Dam	Class I	High	Yes
Thoreau Pond Dam	Class I	High	Yes
Anderson Lake Dam	Class II	Significant	No
Campden Lakes South Dam	Class II	Significant	Yes
Greenlaw Avenue Low Head Dam	Class II	Significant	Yes
Hap Cremean Lagoon #1	Class II	Significant	Yes
Hap Cremean Lagoon #2	Class II	Significant	Yes
Hap Cremean Lowhead Dam	Class II	Significant	No
North Broadway Low Head Dam	Class II	Significant	Yes
OSU Golf Course Lake Dam	Class II	Significant	Yes
Parsons Avenue Sludge Lagoons	Class II	Significant	Yes
Schrock Lake Dam	Class II	Significant	Yes
Timberlake No. 1 Dam	Class II	Significant	No
Twin Lakes Upper Dam	Class II	Significant	Yes
Alkire Lake Dam	Class III	-	-
Brookside Country Club Lake Dam	Class III	Low	Yes
Kagey Lake Dam	Class III	-	-
Minerva Park Lake Dam	Class III	Low	Yes

Source: NID USACE 2022; Ohio Dam Safety Program 2021

Levee Failure

The ODNR Classifies levees as Class I, Class II, or Class III, based on the following criteria (State of Ohio 2018):

- A levee shall be placed in Class I when sudden failure of the levee would result in one of the following conditions:
  - Probable loss of human life
  - Structural collapse of at least one residence or one commercial or industrial business
- A levee shall be placed in Class II when sudden failure of the levee would result in at least one of the following conditions, but loss of human life is not probable:
  - Disruption of a public water supply or wastewater treatment facility, or other health hazards
  - Flooding of residential, commercial, industrial, or publicly owned structures
  - Flooding of high-value property
  - Damage or disruption to major roads including but not limited to interstate and state highways, and the only access to critical areas such as hospitals, nursing homes, or correctional facilities as determined by the chief
  - Damage or disruption to railroads or public utilities
- A levee having a height of not more than 3 feet shall be placed in Class III. A levee having a height of more than Three feet shall be placed in Class III when sudden failure of the levee would result in at least one of the following conditions, but loss of human life is not probable:

- Property losses including but not limited to rural buildings not otherwise described in OAC Rule 1501:21-13-09 (A)
- Damage or disruption to local roads including but not limited to roads not otherwise listed as major roads in OAC Rule 1501:21-13-09 (A)
- Property losses restricted mainly to the levee and to the owner's property or to rural lands

There are three levee systems found in Franklin County, as listed in Table 4.3.1-2.

Table 4.3.1-2. Levee Systems in Franklin County

Levee System Name	Total Miles	Accredited?	Flood Source	Primary Purpose
Agg Rok	1.91	Yes	Scioto River	Flood Risk Reduction
Battelle King Avenue Campus Levee	0.46	Yes	Olentangy River	Flood Risk Reduction
West Columbus, OH, LPP	7.14	Yes	Dry Run, Scioto River	Flood Risk Reduction

Source: USACE 2023

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was not included in any federal major disaster (DR) or emergency (EM) declarations for dam/levee failure-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the USDA is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Franklin County was not included in any dam/levee failure-related agricultural disaster declarations.

Previous Occurrences

No known dam or levee failure events impacted Franklin County between 2018 and 2022. For events prior to 2018, refer to the 2018 Franklin County HMP.

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of dam and levee failure events for the County. Information from NOAA-NCEI storm events database, the 2019 State of Ohio HMP, and the 2018 Franklin County HMP was used to identify the number of dam and levee failure events that occurred between 1954 and 2022. Table 4.3.1-3 presents the probability of future events for the dam/levee failure in Franklin County. Based on historical records and input from the Planning Team, the probability of occurrence for dam and levee failures in the County is considered "rare."

Table 4.3.1-3. Probability of Future Dam and Levee Failure Events

Hazard Type	Number of Occurrences Between 1954 and 2022	% Chance of Occurring in Any Given Year
Dam Failure	1	1.45%
Levee Failure	0	0

Sources: NOAA NCEI 2022, State of Ohio 2019, Franklin County HMP 2018

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and events since 1968. Due to limitations in data, not all dam and levee failures events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. The identified hazards of concern for the County are ranked In Section 4.4.

Climate Change Impacts

Most dam failure events are due to overtopping. Overtopping failures result from the erosive action of water on the dam embankment. Erosion is due to uncontrolled flow of water over, around, and adjacent to the dam. Once erosion has begun during overtopping, it is almost impossible to stop. Overtopping is caused by inadequate spillway design, debris blockage of spillway or settlement of dam crest (Franklin County HMP 2018). With the increase of heavy storm events due to a warming climate, heavy flooding and rainfall will increase flood damage risks to infrastructure and public health for dams and levees in Franklin County.

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the dam and levee failure hazard, the areas of Franklin County located in dam failure inundation zones or protected by levees are considered exposed. Figure 4.3.1-3 illustrates the dam inundation areas and Figure 4.3.1-4 shows the leveed areas in Franklin County. It should be noted that the dam inundation zones included in this profile are for USACE-owned dams and does not include dams owned/operated by ODNR. As stated previously, per ORC149.433, the State does not provide data on state-owned/operated dams. Therefore, a more qualitative assessment was completed for dams and levees in Franklin County.

Figure 4.3.1-3. Franklin County Dam Inundation Areas

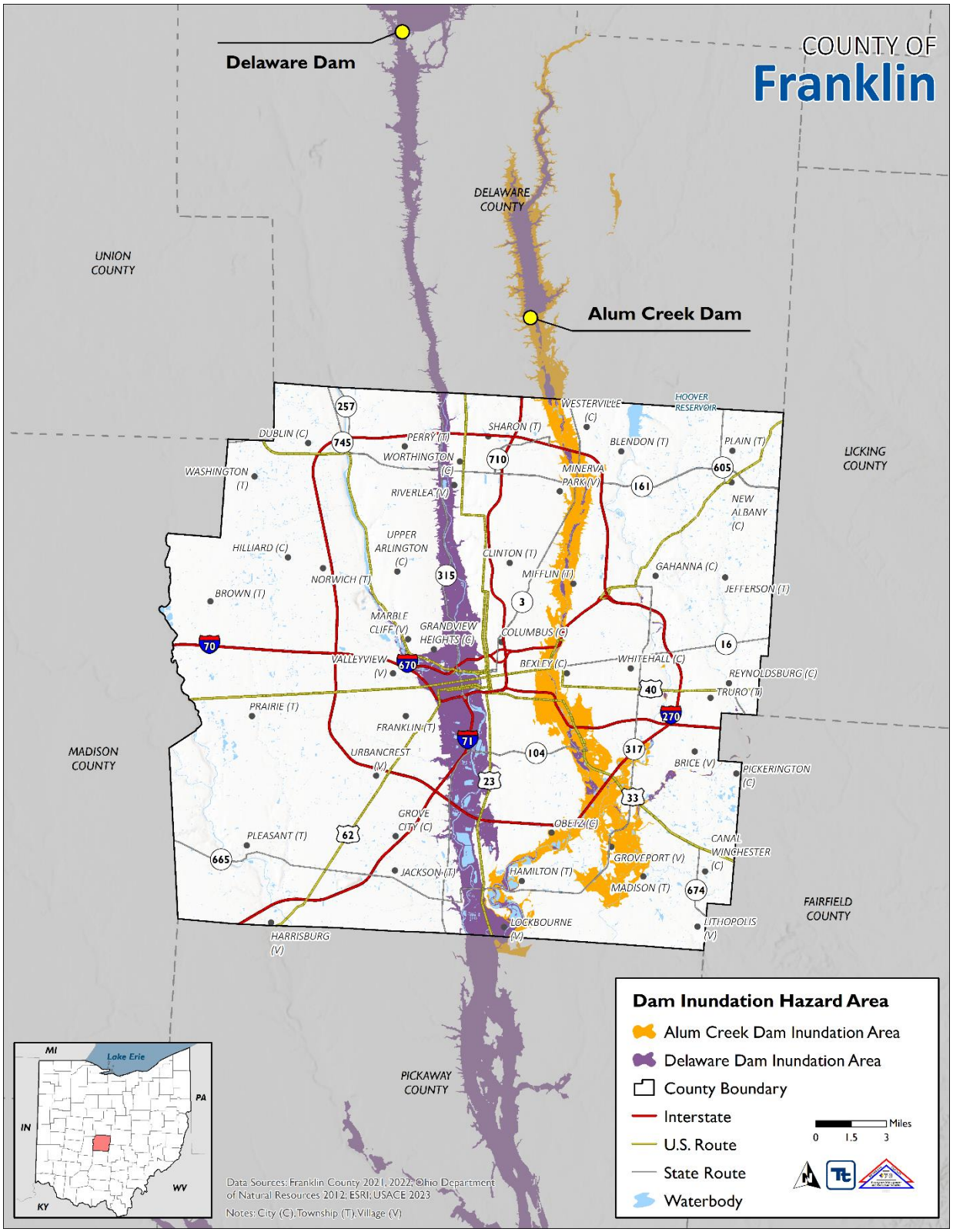
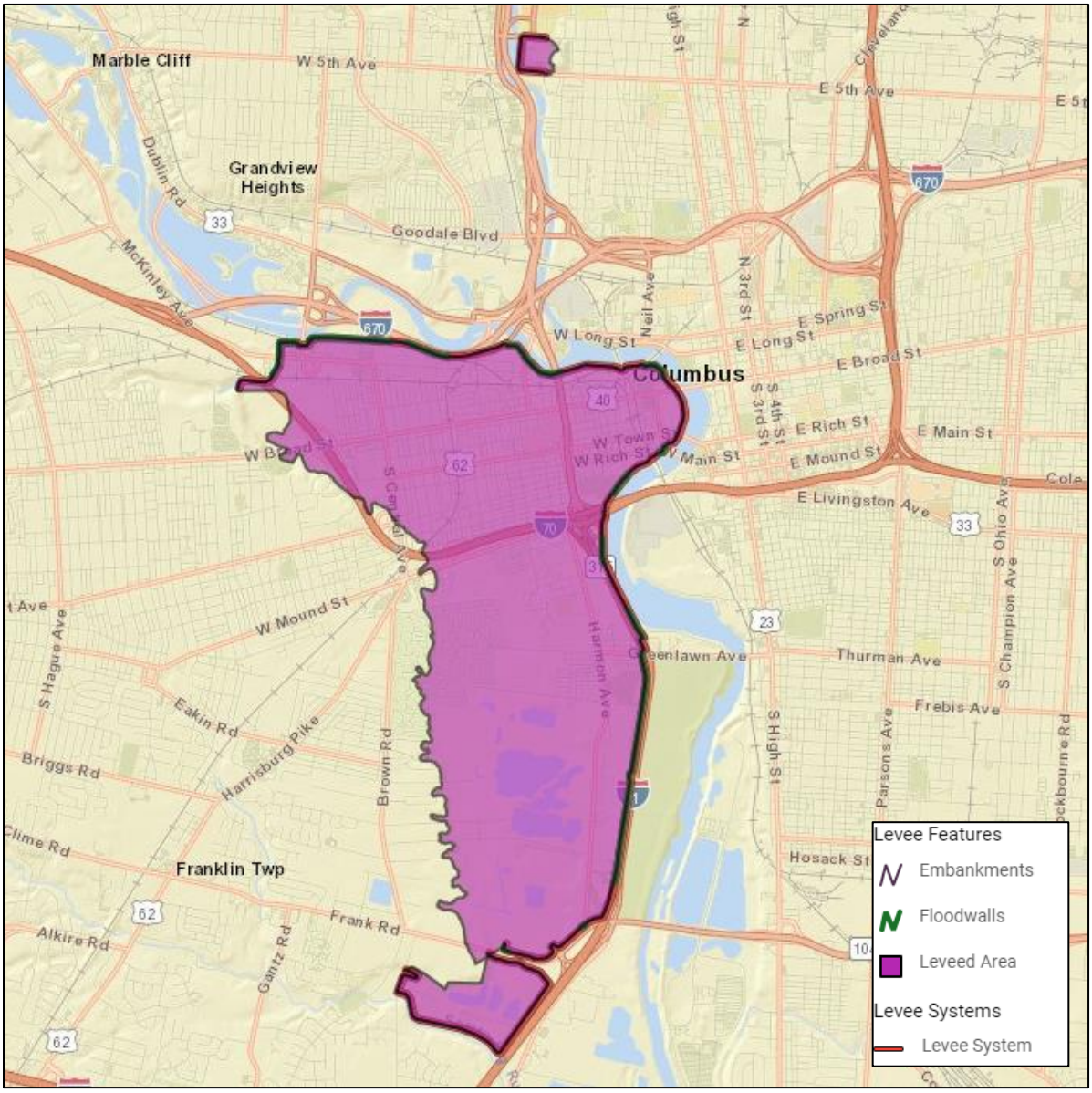


Figure 4.3.1-4. Levee Systems and Levee Protected Areas in Franklin County



Impact on Life, Health, and Safety

The impact of dam and levee failure on life, health, and safety is dependent on factors such as the Class of dam or levee, the area that the dam or levee is protecting, the location of the dam or levee, and the proximity of structures, infrastructure, and critical facilities to the dam or levee structure.

Dam Failure

The level of impact that a failure would have can be predicted based upon the hazard potential classification as rated by the USACE and ODNR (USACE n.d.) (State of Ohio HMP 2019). The classification of a dam is based on three factors: the dam's height, storage capacity, and potential downstream hazard. Each of the three factors is evaluated, and the final classification of the dam is based on the highest

individual factor. The classification of a dam can change based on future development along the downstream channel. In Ohio, all classes of dams are required to have Emergency Action Plans (EAPs) and Class I dams are required to include dam failure inundation mapping in their EAPs (State of Ohio HMP 2019). Table 4.3.1-4 outlines the hazard classifications.

Table 4.3.1-4. Ohio and Federal Dam Classification Systems

Ohio Dam Classification	Description	Corresponding Federal Classification
Class 1	Probable loss of life, serious hazard to health, structural damage to high value property (i.e., homes, industries, major public utilities)	High
Class 2	Flood water damage to homes, businesses, industrial structures (no loss of life envisioned), damage to state and interstate highways, railroads, only access to residential areas	Significant
Class 3	Damage to low value non- residential structures, local roads, agricultural crops and livestock	Significant
Class IV	Losses restricted mainly to the dam	Low

Source: State of Ohio HMP 2019

USACE information was used to estimate population exposure to the dam failure hazard. Based on the analysis, there are an estimated 60,198 residents living in the Alum Creek Dam Inundation (MH Breach) Area, or 4 percent of the County's total population. There are an estimated 40,535 residents living in the Delaware Dam Inundation (MH Breach) Area, or 2.7 percent of the County's total population. The City of Columbus has the greatest number of residents living in the Alum Creek Dam Inundation (MH Breach) Area, with an estimated 47,236 residents, and the greatest number of residents living in the Delaware Dam Inundation (MH Breach) Area, with an estimated 29,872 residents. Table 4.3.1-5 summarizes the population exposed to the dam failure hazard by jurisdiction.

Table 4.3.1-5. Estimated Number of Persons in Franklin County Living in the Alum Creek and Delaware Dam Inundation Areas

Jurisdiction	Total Population (ACS 2021)	Estimated Population in Alum Creek Dam Inundation (MH Breach) Area		Estimated Population in Delaware Dam Inundation (MH Breach) Area	
		Number of People	Percent of Total	Number of People	Percent of Total
Bexley (C)	13,820	1,881	13.6%	0	0.0%
Blendon (T)	10,073	2,777	27.6%	0	0.0%
Brice (V)	185	0	0.0%	0	0.0%
Brown (T)	3,679	0	0.0%	0	0.0%
Canal Winchester (C)	8,150	0	0.0%	0	0.0%
Clinton (T)	4,449	0	0.0%	702	15.8%
Columbus (C)	855,224	47,236	5.5%	29,872	3.5%
Dublin (C)	41,175	0	0.0%	0	0.0%
Franklin (T)	11,312	0	0.0%	494	4.4%
Gahanna (C)	35,626	70	0.2%	67	0.2%
Grandview Heights (C)	8,099	0	0.0%	1,258	15.5%
Grove City (C)	41,025	0	0.0%	105	0.3%
Groveport (V)	5,942	2,693	45.3%	0	0.0%
Hamilton (T)	8,743	144	1.6%	352	4.0%
Harrisburg	376	0	0.0%	0	0.0%

Jurisdiction	Total Population (ACS 2021)	Estimated Population in Alum Creek Dam Inundation (MH Breach) Area		Estimated Population in Delaware Dam Inundation (MH Breach) Area	
		Number of People	Percent of Total	Number of People	Percent of Total
Hilliard (C)	35,530	0	0.0%	0	0.0%
Jackson (T)	46,340	0	0.0%	1,101	2.4%
Jefferson (T)	14,027	0	0.0%	0	0.0%
Lithopolis (V)	2,225	0	0.0%	0	0.0%
Lockbourne (V)	176	176	100.0%	15	8.7%
Madison (T)	25,896	1,575	6.1%	51	0.2%
Marble Cliff (V)	782	0	0.0%	0	0.0%
Mifflin (T)	38,121	1,852	4.9%	0	0.0%
Minerva Park (V)	1,611	53	3.3%	0	0.0%
New Albany (C)	10,929	0	0.0%	0	0.0%
Norwich (T)	37,356	0	0.0%	0	0.0%
Obetz (C)	5,351	190	3.5%	0	0.0%
Perry (T)	3,888	0	0.0%	0	0.0%
Pickerington (C)	113	0	0.0%	0	0.0%
Plain (T)	12,469	0	0.0%	0	0.0%
Pleasant (T)	6,768	0	0.0%	0	0.0%
Prairie (T)	17,433	0	0.0%	0	0.0%
Reynoldsburg (C)	29,016	0	0.0%	0	0.0%
Riverlea (V)	566	0	0.0%	155	27.4%
Sharon (T)	17,109	63	0.4%	5,169	30.2%
Truro (T)	30,165	0	0.0%	0	0.0%
Upper Arlington (C)	36,566	0	0.0%	0	0.0%
Urbancrest (V)	1,124	0	0.0%	0	0.0%
Valleyview (V)	722	0	0.0%	0	0.0%
Washington (T)	42,997	0	0.0%	0	0.0%
Westerville (C)	23,467	1,488	6.3%	0	0.0%
Whitehall (C)	20,004	0	0.0%	0	0.0%
Worthington (C)	15,047	0	0.0%	1,196	7.9%
Franklin County (Total)	**1,523,677**	**60,198**	**4.0%**	**40,535**	**2.7%**

Source: U.S. Census Bureau 2021; Stats America 2022; USACE 2023

As per ORC 149.433, the State does not provide data on state-owned/operated dams. Therefore, a qualitative assessment was performed for the state-owned/operated dams. As per the 2019 State of Ohio HMP, Franklin County there are 69 dams, of which 3 are Class I, 15 are Class II or III, 11 are Class IV, and 40 are classified as other. The assessment looks at sunny day and rainy-day failures to categorize if infrastructure (roads, structures, water treatment facilities, etc.) would be damaged. Infrastructure damage categorization is as follows: "low" 1-3 impacted, "medium" 10-50 impacted, "high" 51-150 impacted, and "very high" over 150 impacted. This assessment also estimates a Population at Risk (PAR) that ranges from 0 – 10,000. PAR is categorized in the following way: "low" is less than 100 people, "medium" is 101-200 people, and "high" is more than 200 people (State of Ohio HMP 2019). Table 4.3.1-6 summarizes estimated damage for the Class I dams in Franklin County.

Table 4.3.1-6. Class I Dams in Franklin County – Estimated Downstream Damage Level and Estimated Population At-Risk (PAR)

County	Dam	Sunny Day Infrastructure Damage Level	Sunny Day PAR Level	Rainy Day Infrastructure Damage Level	Rainy Day PAR Level
Franklin	Hoover Dam	Very High	High	Very High	High
Franklin	Julian Griggs Dam	High	Low	High	Low

Source: State of Ohio HMP 2019

Notes: Sunny day failures occur during a non-flooding situation with the reservoir near normal pool level. Rainy day failures usually involve periods of rainfall and flooding.

Levee Failure

ODNR classifies the hazard potential for levees as Class I, III, and III, depending on what is identified as the landward risk.

Table 4.3.1-7. Ohio and Federal Levee Classification Systems

Ohio Levee Classification	Description	Corresponding Federal Classification
Class I	Probably loss of human life, structural collapse of at least one residence or one commercial or industrial business	Class I (Very High) and Class II (High)
Class II	Disruption of a public water supply or wastewater treatment facility, or other health hazards; flooding of residential, commercial, industrial, or publicly owned structures; flooding of high-value property; damage or disruption to major roads including but not limited to interstate and state highways, and the only access to residential or other critical areas such as hospitals, nursing homes, or correctional facilities as determined by the chief; damage or disruption to railroads or public utilities	Class III (Moderate) and Class IV (Low)
Class III	Property losses including but not limited to rural buildings not otherwise described in this rule; damage or disruption to local roads including but not limited to roads not otherwise listed as major roads in this rule	Class V (Very Low)

Sources: USACE 2013; State of Ohio HMP 2019

There are three levee systems in Franklin County. Table 4.3.1-8 provides details on the three systems including their classifications and what is at risk (population, buildings, and property value). The overall risk in Franklin County is as follows:

- 15,250 is the estimated population in Franklin County located within the leveed area. This is not life loss projection.
- 4,688 is the estimated number of buildings in Franklin County located within the leveed area.
- $2.4 billion is the estimated total of structure value, structure contents, and vehicles located in the leveed area. This total does not include land value, economic productivity loss, or transportation infrastructure values (e.g., bridges, roads, etc.).

Table 4.3.1-8. Franklin County Levee Systems

System Name	Total Levee Miles	Total Leveed Area (mi^2)	Population at Risk	Buildings at Risk	Property Value	Levee Classification
Agg Rock	1.91	0.25	0	2	$2.53 million	Class I

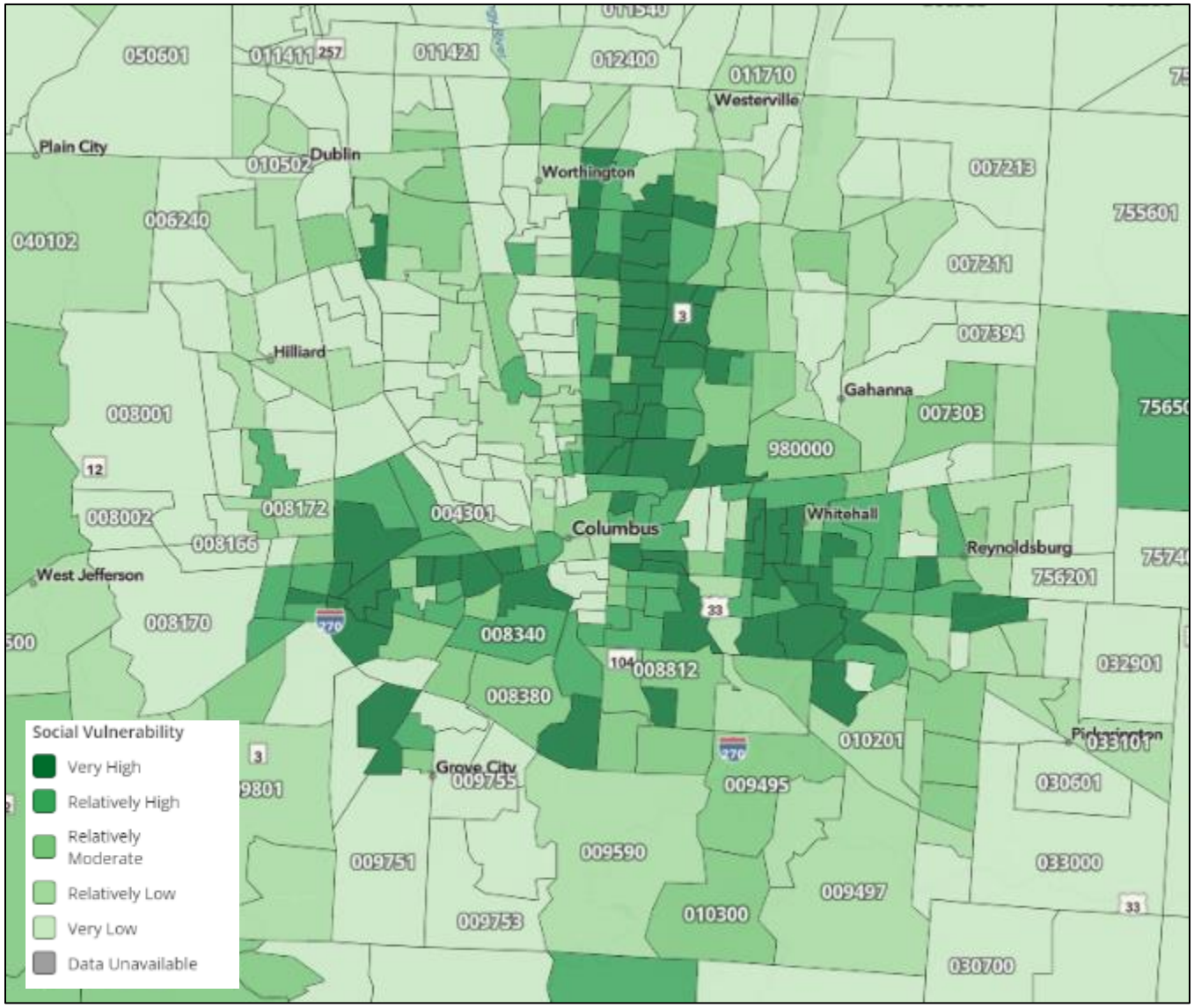
System Name	Total Levee Miles	Total Leveed Area (mi²)	Population at Risk	Buildings at Risk	Property Value	Levee Classification
Battelle King Avenue Campus Levee	0.46	0.038	1,566	6	$375 million	Class II
West Columbus, OH, LPP	7.14	4.55	13,684	4,680	$2.03 billion	Class III

Source: USACE 2023; State of Ohio HMP 2019

Social Vulnerability

The entire population residing within a dam failure inundation zone or in areas protected by levees is considered exposed and vulnerable to a dam or levee failure event. The potential for loss of life is affected by the capacity and number of evacuation routes available to populations living within these areas. Those most at risk include the economically disadvantaged and the population over the age of 65. According to the 5-Year 2021 ACS population estimates for Franklin County, there are 188,900 persons over 65 (12.4 percent of the County's total population) and 195,988 persons living in poverty (12.9 percent of the County's total population). These populations are more at risk during a dam or levee failure event. Economically disadvantaged populations are likely to evaluate their risk and make the decision to evacuate based upon the net economic impact on their family. Elderly populations are likely to seek or need medical attention. The availability of medical attention may be limited due to isolation during a dam or levee failure event and other difficulties in evacuating. There is often limited warning time for a dam failure event. Populations without adequate warning of the event are highly vulnerable. Refer to Figure 4.3.1-5 for Franklin County's Social Vulnerability Index for Natural Hazards.

Figure 4.3.1-5. FEMA Social Vulnerability Index for Natural Hazards



Source: FEMA NRI

Impact on General Building Stock

Buildings located downstream of a dam or in areas protected by levees are at risk to damage should there be a failure. The overall impact of flooding damage caused by dam or levee failure will vary depending on the depth of flooding and velocity of the surge. Properties located closest to the inundation area have the greatest potential to experience the largest, most destructive surge of water.

Dam and levee failure can cause severe downstream flooding and may transport large volumes of sediment and debris, depending on the magnitude of the event. Widespread damage to buildings and infrastructure affected by an event would result in large costs to repair these assets. In addition to physical

damage costs, businesses can be closed while flood waters retreat and utilities are returned to a functioning state.

Dam Failure

Table 4.3.1-9 summarizes the number of structures in the Alum Creek and Delaware Dam Inundation Areas by jurisdiction. Countywide, there are 15,261 buildings in the Alum Creek Dam Inundation (MH Breach) Area with an estimated $14.4 billion of replacement cost value (building and content replacement costs). This represents approximately 1 percent of the County's total general building stock inventory. There are 9,435 buildings in the Delaware Dam Inundation (MH Breach) Area with an estimated $12.7 billion of building stock and contents exposed. This represents approximately 1.5 percent of the County's total general building stock inventory.

Levee Failure

Structures located in leveed areas are more at risk to damages as a result of a levee breach or failure. In Franklin County, there are three levee systems that contain 4,688 buildings in the leveed areas with a property value of over $2.4 billion. Refer to Table 4.3.1-8 for the number of buildings located within each levee system.

Table 4.3.1-9. Estimated General Building Stock Located in the Alum Creek and Delaware Dam Inundation Areas

Jurisdiction	All Structures in Jurisdiction		Structures in the Alum Creek Dam Inundation (MH Breach) Area				Structures in the Delaware Dam Inundation (MH Breach) Area			
			Buildings		Total Replacement Cost Value		Buildings		Total Replacement Cost Value	
	Number of Buildings	Replacement Cost Value	Number	% of Total	Value	% of Total	Number	% of Total	Value	% of Total
Bexley (C)	4,185	$2,908,655,863	580	13.9%	$580,941,370	20.0%	0	0.0%	$0	0.0%
Blendon (T)	2,804	$1,413,412,606	805	28.7%	$431,609,529	30.5%	0	0.0%	$0	0.0%
Brice (V)	68	$101,696,013	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Brown (T)	894	$615,217,276	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Canal Winchester (C)	2,970	$2,664,295,038	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Clinton (T)	1,615	$1,407,647,207	0	0.0%	$0	0.0%	250	15.5%	$315,963,833	22.4%
Columbus (C)	210,344	$169,488,966,898	11,508	5.5%	$7,838,476,859	4.6%	7,823	3.7%	$11,611,651,620	6.9%
Dublin (C)	10,788	$12,346,217,589	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Franklin (T)	3,243	$2,786,144,235	0	0.0%	$0	0.0%	182	5.6%	$307,246,344	11.0%
Gahanna (C)	10,525	$7,777,120,383	20	0.2%	$6,954,445	0.1%	19	0.2%	$6,686,901	0.1%
Grandview Heights (C)	1,781	$864,354,956	0	0.0%	$0	0.0%	283	15.9%	$151,559,432	17.5%
Grove City (C)	14,736	$11,872,349,008	0	0.0%	$0	0.0%	38	0.3%	$18,237,492	0.2%
Groveport (V)	2,294	$8,015,019,558	1,060	46.2%	$3,427,877,251	42.8%	0	0.0%	$0	0.0%
Hamilton (T)	1,601	$954,562,909	34	2.1%	$43,931,294	4.6%	74	4.6%	$60,144,921	6.3%
Harrisburg	148	$59,706,145	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Hilliard (C)	9,926	$7,685,805,074	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Jackson (T)	1,780	$998,460,101	0	0.0%	$0	0.0%	44	2.5%	$25,257,174	2.5%
Jefferson (T)	4,841	$2,934,483,497	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Lithopolis (V)	21	$22,524,552	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Lockbourne (V)	118	$115,362,791	116	98.3%	$54,944,411	47.6%	10	8.5%	$2,360,158	2.0%
Madison (T)	4,223	$1,551,960,041	271	6.4%	$112,329,111	7.2%	9	0.2%	$1,646,606	0.1%
Marble Cliff (V)	201	$310,170,408	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Mifflin (T)	1,185	$757,041,007	59	5.0%	$52,241,923	6.9%	0	0.0%	$0	0.0%
Minerva Park (V)	845	$347,638,675	30	3.6%	$11,836,729	3.4%	0	0.0%	$0	0.0%
New Albany (C)	3,452	$4,624,598,720	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Norwich (T)	1,411	$592,173,496	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Obetz (C)	2,205	$5,853,753,986	91	4.1%	$537,545,925	9.2%	0	0.0%	$0	0.0%
Perry (T)	1,465	$806,651,425	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Pickerington (C)	23	$28,053,589	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Plain (T)	792	$421,165,756	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Pleasant (T)	2,393	$1,324,873,614	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Prairie (T)	5,877	$2,583,782,102	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Reynoldsburg (C)	8,007	$4,602,554,953	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Riverlea (V)	215	$88,150,926	0	0.0%	$0	0.0%	59	27.4%	$25,143,761	28.5%
Sharon (T)	839	$428,816,971	3	0.4%	$947,576	0.2%	250	29.8%	$79,403,191	18.5%
Truro (T)	448	$198,610,440	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%

Jurisdiction	All Structures in Jurisdiction		Structures in the Alum Creek Dam Inundation (MH Breach) Area				Structures in the Delaware Dam Inundation (MH Breach) Area			
	Number of Buildings	Replacement Cost Value	Buildings Number	Buildings % of Total	Total Replacement Cost Value Value	Total Replacement Cost Value % of Total	Buildings Number	Buildings % of Total	Total Replacement Cost Value Value	Total Replacement Cost Value % of Total
Upper Arlington (C)	11,995	$7,401,370,183	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Urbancrest (V)	312	$904,463,260	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Valleyview (V)	260	$102,695,732	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Washington (T)	272	$197,989,788	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Westerville (C)	9,502	$6,492,226,049	684	7.2%	$1,375,207,768	21.2%	0	0.0%	$0	0.0%
Whitehall (C)	4,661	$3,811,335,352	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Worthington (C)	5,238	$4,772,399,121	0	0.0%	$0	0.0%	394	7.5%	$171,266,336	3.6%
Franklin County (Total)	**350,503**	**$283,234,477,288**	**15,261**	**4.4%**	**$14,474,844,190**	**5.1%**	**9,435**	**2.7%**	**$12,776,567,770**	**4.5%**

Source: Franklin County 2021; RS Means 2022; USACE 2023

Impact on Critical Facilities and Community Lifelines

Dam and levee failures may impact critical facilities and infrastructure located in the downstream dam failure inundation zone or areas protected by levees. Dam failure can cut evacuation routes, limit emergency access, and create isolation issues. It can cause severe downstream flooding and transport large volumes of sediment and debris, depending on the magnitude of the event. Utilities such as overhead power lines, cable, and phone lines can also be vulnerable. Loss of these utilities could create additional isolation issues for the inundation areas.

Table 4.3.1-10 lists the number of community lifelines within the Alum Creek and Delaware Dam Inundation Areas. Of the 252 critical facilities located in the Alum Creek Dam Inundation (MH Breach) Area, the greatest number are transportation facilities. Additionally, there are 601 critical facilities located in the Delaware Dam Inundation (MH Breach) Area, 201 of which are transportation facilities. Table 4.3.1-11 summarizes the number of critical facilities and lifelines, by jurisdiction, located in the dam inundation areas.

For all other dams and all levees in Franklin County, it is assumed all critical facilities and lifelines located within the dam inundation areas or within the leveed areas are exposed and at risk to the impacts of dam and levee failures.

Table 4.3.1-10. Lifelines Located in the Alum Creek and Delaware Dam Inundation Areas

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in Alum Creek Dam Inundation (MH Breach) Area	Number of Lifelines Located in Delaware Dam Inundation (MH Breach) Area
Communications	62	2	15
Energy	106	6	14
Food, Water, Shelter	16	6	1
Hazardous Materials	248	8	16
Health and Medical	1,691	77	169
Safety and Security	897	62	185
Transportation	930	91	201
Franklin County (Total)	**3,950**	**252**	**601**

Source: Franklin County 2022; USACE 2023

Table 4.3.1-11. Critical Facilities and Lifelines, by Jurisdiction, Located in the Alum Creek and Delaware Dam Inundation Areas

Jurisdiction	Alum Creek Dam Inundation (MH Breach) Hazard Area		Delaware Dam Inundation (MH Breach) Hazard Area	
	Critical Facilities	Lifelines	Critical Facilities	Lifelines
Bexley (C)	2	2	1	1
Blendon (T)	2	1	0	0
Brice (V)	0	0	0	0
Brown (T)	0	0	0	0
Canal Winchester (C)	0	0	0	0
Clinton (T)	0	0	2	2
Columbus (C)	205	174	598	577
Dublin (C)	0	0	0	0

Jurisdiction	Alum Creek Dam Inundation (MH Breach) Hazard Area		Delaware Dam Inundation (MH Breach) Hazard Area	
	Critical Facilities	Lifelines	Critical Facilities	Lifelines
Franklin (T)	0	0	6	6
Gahanna (C)	0	0	0	0
Grandview Heights (C)	0	0	9	8
Grove City (C)	0	0	0	0
Groveport (V)	19	18	0	0
Hamilton (T)	3	3	1	1
Harrisburg (V)	0	0	0	0
Hilliard (C)	0	0	0	0
Jackson (T)	0	0	1	1
Jefferson (T)	0	0	0	0
Lithopolis (V)	0	0	0	0
Lockbourne (V)	0	0	0	0
Madison (T)	2	2	1	1
Marble Cliff (V)	0	0	0	0
Mifflin (T)	1	1	0	0
Minerva Park (V)	0	0	0	0
New Albany (C)	0	0	0	0
Norwich (T)	0	0	0	0
Obetz (C)	1	1	0	0
Perry (T)	0	0	0	0
Pickerington (C)	0	0	0	0
Plain (T)	0	0	0	0
Pleasant (T)	0	0	0	0
Prairie (T)	0	0	0	0
Reynoldsburg (C)	0	0	0	0
Riverlea (V)	0	0	0	0
Sharon (T)	0	0	2	2
Truro (T)	0	0	0	0
Upper Arlington (C)	0	0	0	0
Urbancrest (V)	0	0	0	0
Valleyview (V)	0	0	0	0
Washington (T)	0	0	0	0
Westerville (C)	55	50	0	0
Whitehall (C)	0	0	0	0
Worthington (C)	0	0	2	2
Franklin County (Total)	**290**	**252**	**623**	**601**

Source: Franklin County 2022; USACE 2023

Impact on the Economy

Severe flooding that follows an event like a dam or levee failure can cause extensive structural damage and withhold essential services. The cost to recover from damage after a failure will vary depending on the hazard risk of the failed dam or levee.

Severe flooding that follows an event like a dam or levee failure can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur and drinking water and wastewater treatment facilities can become temporarily out of operation. Debris from

surrounding buildings can accumulate should the dam or levee failure mimic major flood events, such as the 1-percent annual chance flood event that is discussed in Section 4.3.6 (Flood).

Impact on the Environment

The environmental impacts of a dam or levee failure can include significant water-quality and debris-disposal issues or severe erosion that can impact local ecosystems. Flood waters can back up sanitary sewer systems and inundate wastewater treatment plants, causing raw sewage to contaminate residential and commercial buildings and the flooded waterway. The contents of unsecured containers of oil, fertilizers, pesticides, and other chemicals may get added to flood waters. Hazardous materials may be released and distributed widely across the inundation area. Water supply and wastewater treatment facilities could be offline for weeks. After the flood waters subside, contaminated and flood-damaged building materials and contents must be properly disposed of. Contaminated sediment must be removed from buildings, yards, and properties.

Table 4.3.1-12 lists the number of acres exposed to the Alum Creek and Delaware Dam Inundation Areas. Based on the analysis, there are an estimated 21,728 acres of land in the Alum Creek Dam Inundation (MH Breach) Area, or 6.4 percent of the County's total acreage. There are an estimated 19,238 acres of land in the Delaware Dam Inundation (MH Breach) Area, or 5.7 percent of the County's total acreage. The City of Columbus has the greatest total acreage in the Alum Creek Dam Inundation (MH Breach) Area, with 11,983 acres and in the Delaware Dam Inundation (MH Breach) Area, with 13,747 acres.

For all other dams and all levees in Franklin County, it is assumed all land located within the dam inundation areas or within the leveed areas are exposed and at risk to the impacts of dam and levee failures.

Table 4.3.1-12. Land Area in Franklin County Located in the Alum Creek and Delaware Dam Inundation Areas

Jurisdiction	Total Land Area (acres)	Land Area (Excluding Water Bodies) in the Alum Creek Dam Inundation (MH Breach) Area		Land Area (Excluding Water Bodies) in the Delaware Dam Inundation (MH Breach) Area	
		Area (acres)	Percent of Total	Area (acres)	Percent of Total
Bexley (C)	1,548	326	21.0%	10	0.7%
Blendon (T)	3,092	569	18.4%	14	0.5%
Brice (V)	57	0	0.0%	0	0.0%
Brown (T)	12,173	0	0.0%	0	0.0%
Canal Winchester (C)	3,764	0	0.0%	0	0.0%
Clinton (T)	874	0	0.0%	126	14.4%
Columbus (C)	136,976	11,983	8.7%	13,747	10.0%
Dublin (C)	13,086	0	0.0%	1	<0.1%
Franklin (T)	4,194	6	0.1%	1,192	28.4%
Gahanna (C)	7,903	33	0.4%	25	0.3%
Grandview Heights (C)	843	0	0.0%	402	47.7%
Grove City (C)	11,767	310	2.6%	482	4.1%
Groveport (V)	5,454	3,168	58.1%	171	3.1%
Hamilton (T)	4,777	1,360	28.5%	984	20.6%
Harrisburg	83	0	0.0%	0	0.0%
Hilliard (C)	8,941	0	0.0%	0	0.0%
Jackson (T)	10,683	168	1.6%	516	4.8%

Jurisdiction	Total Land Area (acres)	Land Area (Excluding Water Bodies) in the Alum Creek Dam Inundation (MH Breach) Area		Land Area (Excluding Water Bodies) in the Delaware Dam Inundation (MH Breach) Area	
		Area (acres)	Percent of Total	Area (acres)	Percent of Total
Jefferson (T)	8,904	0	0.0%	0	0.0%
Lithopolis (V)	449	0	0.0%	0	0.0%
Lockbourne (V)	461	458	99.3%	404	87.7%
Madison (T)	14,469	1,441	10.0%	65	0.5%
Marble Cliff (V)	178	0	0.0%	4	2.4%
Mifflin (T)	1,212	196	16.2%	11	0.9%
Minerva Park (V)	405	53	13.2%	0	0.0%
New Albany (C)	6,855	0	0.0%	0	0.0%
Norwich (T)	1,607	0	0.0%	0	0.0%
Obetz (C)	3,725	501	13.4%	16	0.4%
Perry (T)	1,412	0	0.0%	4	0.3%
Pickerington (C)	204	0	0.0%	0	0.0%
Plain (T)	5,813	0	0.0%	0	0.0%
Pleasant (T)	27,162	0	0.0%	0	0.0%
Prairie (T)	11,672	0	0.0%	0	0.0%
Reynoldsburg (C)	4,740	1	<0.1%	9	0.2%
Riverlea (V)	96	0	0.0%	39	40.3%
Sharon (T)	1,844	34	1.9%	376	20.4%
Truro (T)	342	0	0.0%	0	0.0%
Upper Arlington (C)	6,224	0	0.0%	0	0.0%
Urbancrest (V)	366	0	0.0%	0	0.0%
Valleyview (V)	93	0	0.0%	0	0.0%
Washington (T)	1,682	0	0.0%	0	0.0%
Westerville (C)	5,477	1,118	20.4%	72	1.3%
Whitehall (C)	3,377	1	<0.1%	1	<0.1%
Worthington (C)	3,492	2	0.1%	568	16.3%
Franklin County (Total)	**338,479**	**21,728**	6.4%	**19,238**	**5.7%**

Source: Franklin County 2022; USACE 2023

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following as factors that may affect hazard vulnerability:

- Potential or projected development;
- Projected changes in population; and
- Other conditions identified as relevant and appropriate, including the impacts of climate change.

Projected Development

As discussed in Section 3, areas targeted for future growth and development have been identified across the County. Any areas of growth located in dam failure inundation zones or in areas protected by levees could increase the County's vulnerability to dam and levee failure events.

Project Changes in Population

According to the 2020 Census, the population of the County has increased by 13.7 percent since 2010. The County's population is anticipated to increase over the next two decades (12 percent increase by 2040). Any increase in population in dam failure inundation zones or areas protected by levees can create

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.2 Disease Outbreak

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the disease outbreak hazard in Franklin County.

Hazard Profile

Hazard Description

Infectious diseases are illnesses caused by germs (such as bacteria, viruses, and fungi) that enter the body, multiply, and can cause an infection. The Centers for Disease Control and Prevention (CDC) state that some infectious diseases are contagious (or communicable) and are spread from one person to another. Other infectious diseases are spread by germs carried in air, water, food, or soil. They can also be spread by vectors (like biting insects) or by animals (CDC 2022). Franklin County is susceptible to many common infectious diseases, such as seasonal flu, as well as diseases that are newly emerged or re-emerging, such as COVID-19.

Lyme Disease

Lyme disease is the most common vector-borne disease in the United States. Lyme disease is caused by the bacterium *Borrelia burgdorferi* and rarely, *Borrelia mayonii*. It is transmitted to humans through the bite of infected blacklegged ticks. Typical symptoms include fever, headache, fatigue, and a characteristic skin rash called erythema migrans. If left untreated, infection can spread to joints, the heart, and the nervous system. Lyme disease is diagnosed based on symptoms, physical findings (e.g., rash), and the possibility of exposure to infected ticks. Laboratory testing is helpful if used correctly and performed with validated methods. Most cases of Lyme disease can be treated successfully with a few weeks of antibiotics. Steps to prevent Lyme disease include using insect repellent, removing ticks promptly, applying pesticides, and reducing tick habitat. The ticks that transmit Lyme disease can occasionally transmit other tickborne diseases as well, including Anaplasmosis, Babesiosis, Ehrlichiosis, and Rocky Mountain spotted fever (CDC 2022).

West Nile Virus

West Nile virus (WNV) is the leading cause of mosquito-borne disease in the continental United States. It is most commonly spread to people by the bite of an infected mosquito. Cases of WNV occur during mosquito season, which starts in the summer and continues through fall. There are no vaccines to prevent or medications to treat WNV in people. Fortunately, most people infected with WNV do not feel sick. About one in five people who are infected develop a fever and other symptoms. About 1 out of 150

infected people develop a serious, sometimes fatal, illness. Risk of WNV can be reduced by using insect repellent and wearing long-sleeved shirts and long pants to prevent mosquito bites (CDC 2022).

According to Ohio Department of Health (ODH), most infections of WNV originate by "the northern house mosquito, *Culex pipiens*. Mosquitoes become infected when they feed on infected birds. Infected mosquitoes can then spread the virus to humans and other animals when they bite" (ODH n.d.). Other mosquito-borne diseases that may occur locally in Ohio include Eastern equine encephalitis virus, La Crosse virus, and St. Louis encephalitis virus.

Influenza

The CDC describes influenza (flu) as "a contagious respiratory illness caused by influenza viruses that infect the nose, throat, and lungs." Populations at higher risk of serious flu complications include people 65 years and older, young children, and people with certain health conditions. The following are health and age factors known to increase a person's risk of serious flu complications:

- Adults 65 years and older
- Asthma
- Blood disorders (such as sickle cell disease)
- Children younger than two years old
- Chronic lung disease (such as chronic obstructive pulmonary disease [COPD] and cystic fibrosis)
- Endocrine disorders (such as diabetes mellitus)
- Heart disease (such as congenital heart disease, congestive heart failure and coronary artery disease)
- Kidney diseases
- Liver disorders
- Metabolic disorders (such as inherited metabolic disorders and mitochondrial disorders)
- Neurologic and neurodevelopment conditions
- People who are obese with a body mass index [BMI] of 40 or higher
- People who have had a stroke
- People with a weakened immune system due to disease (such as people with HIV or AIDS, or some cancers such as leukemia) or medications (such as those receiving chemotherapy or radiation treatment for cancer, or persons with chronic conditions requiring chronic corticosteroids or other drugs that suppress the immune system)
- People younger than 19 years old on long-term aspirin- or salicylate-containing medications. (CDC 2022)

While the flu typically causes mild illness, it can result in serious illness and even death in some cases. The flu virus is spread when an infected individual coughs, sneezes, or talks, and tiny virus-carrying droplets land in the mouth or nose of a nearby individual. A 2018 CDC study found that children younger than 18 are more than twice as likely to develop a symptomatic flu virus infection than adults 65 and older (CDC 2022).

Ebola

The Ebola virus disease (Ebola) occurs mostly on the African continent. It is transmissible through body fluids or contaminated objects, making international travel of individuals infected with Ebola particularly dangerous.

According to the CDC, Ebola "gets into the body through broken skin or mucous membranes in the eyes, nose, or mouth. People can get the virus through sexual contact with someone who is sick with or has recovered from [Ebola]. The virus can persist in certain body fluids, like semen, after recovery from the illness" (CDC 2021).

The 2014 Ebola epidemic was the largest in history, affecting multiple countries in West Africa. Because Ebola is not spread through casual contact, the risk of an outbreak in Franklin County is very low.

Measles

Measles is a highly contagious virus that lives in the nose and throat mucus of an infected person. It can spread to others through coughing and sneezing. Also, measles virus can live for up to two hours in an airspace where the infected person coughed or sneezed. If other people breathe the contaminated air or touch the infected surface, then touch their eyes, noses, or mouths, they can become infected. Measles is so contagious that if one person has it, 90 percent of the people close to that person who are not immune will also become infected (CDC 2017).

Measles symptoms include high fever, cough, runny nose, and red, watery eyes. Measles can be dangerous and lead to hospitalization, pneumonia, or even death. Children are most likely to suffer the worst complications from measles (CDC 2020).

Monkey Pox

Monkey Pox, or Mpox, is a rare disease caused by infection with the Mpox virus. Mpox virus is part of the same family of viruses as variola virus, the virus that causes smallpox. Mpox symptoms are similar to smallpox symptoms, but milder, and Mpox is rarely fatal. Mpox was discovered in 1958 when two outbreaks of a pox-like disease occurred in colonies of monkeys kept for research. Despite being named "monkeypox," the source of the disease remains unknown. However, African rodents and non-human primates (like monkeys) might harbor the virus and infect people (CDC 2022).

There are two types of Mpox virus: Clade I and Clade II. Infections with Clade IIb are rarely fatal. Over 99% of people who get this form of the disease are likely to survive. However, people with severely weakened immune systems, children under 1 year of age, people with a history of eczema, and people who are pregnant or breastfeeding may be more likely to get seriously ill or die. The Clade I type of Mpox virus has a fatality rate around 10% (CDC 2022).

Mpox can spread to anyone through close, personal, often skin-to-skin contact. The risk is considered low for getting Mpox by touching objects, fabrics, and surfaces that have been used by someone with Mpox and not disinfected (CDC 2023).

COVID-19

The most significant disease outbreak in recent history has been SARS-CoV-2, the virus that causes COVID-19. COVID-19 was discovered in December 2019 in Wuhan, China. It is very contagious and has quickly spread around the world. Like many other respiratory viruses, COVID-19 spreads quickly through droplets that are projected out of an individual's mouth or nose when they breathe, cough, sneeze, or speak.

Numerous variants of the virus that causes COVID-19 are being tracked in the United States and globally during this pandemic. Public health officials from the CDC and state and local health departments work together to monitor the spread of all variants and provide an estimate of how common they are in the nation and at the regional level. This data can change over time as more information is available. As noted by the CDC, new variants are expected. "Viruses constantly change through mutation and sometimes these mutations result in a new variant of the virus. Some variations allow the virus to spread more easily or make it resistant to treatments or vaccines. As the virus spreads, it may change and may become harder to stop" (CDC 2021).

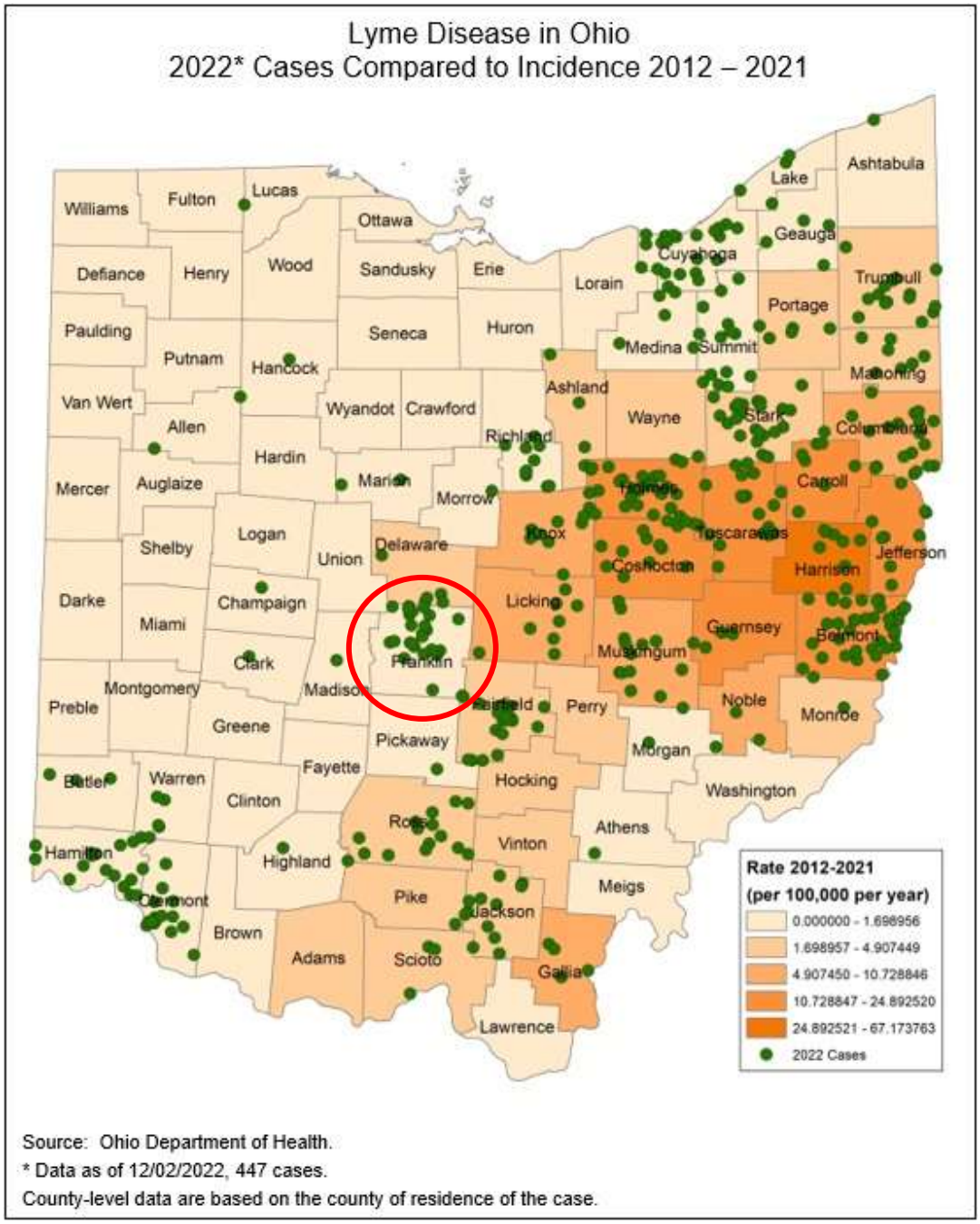
Location

Disease outbreaks can occur without regard for location. However, factors such as density, visitation, and the length of time in which the public spends in a location all contribute to the spread of infectious diseases. For example, COVID-19 is more likely spread by persons in close contact. Indoor areas in which people are in close contact with each other appear to be significant vectors for the disease, which is spread through respiratory droplets. Infectious diseases spread by insects may be subject to other types of location hazards. For example, the prevalence of standing water can provide breeding grounds for diseases such as West Nile Virus. Diseases that can infect humans are variable in nature and methods of transmission. Ultimately, residents need to be vigilant about diseases altogether in order to better understand and respond to disease outbreak hazards.

Lyme Disease

According to ODH, cases of Lyme disease across the state are increasing as "the range of blacklegged tick populations continues to expand in the state and encounters with this tick occur more frequently, particularly in the forest habitats preferred by this tick" (ODH n.d.). Figure 4.3.2-1 below shows cases of Lyme Disease across the state of Ohio in 2022 compared to Lyme disease incidence from 2012 to 2021. Franklin County ranks among the lowest incidence of Lyme disease in Ohio, between 0.0 and 0.7 cases per 100,000 individuals per year.

Figure 4.3.2-1. Lyme Disease in Ohio

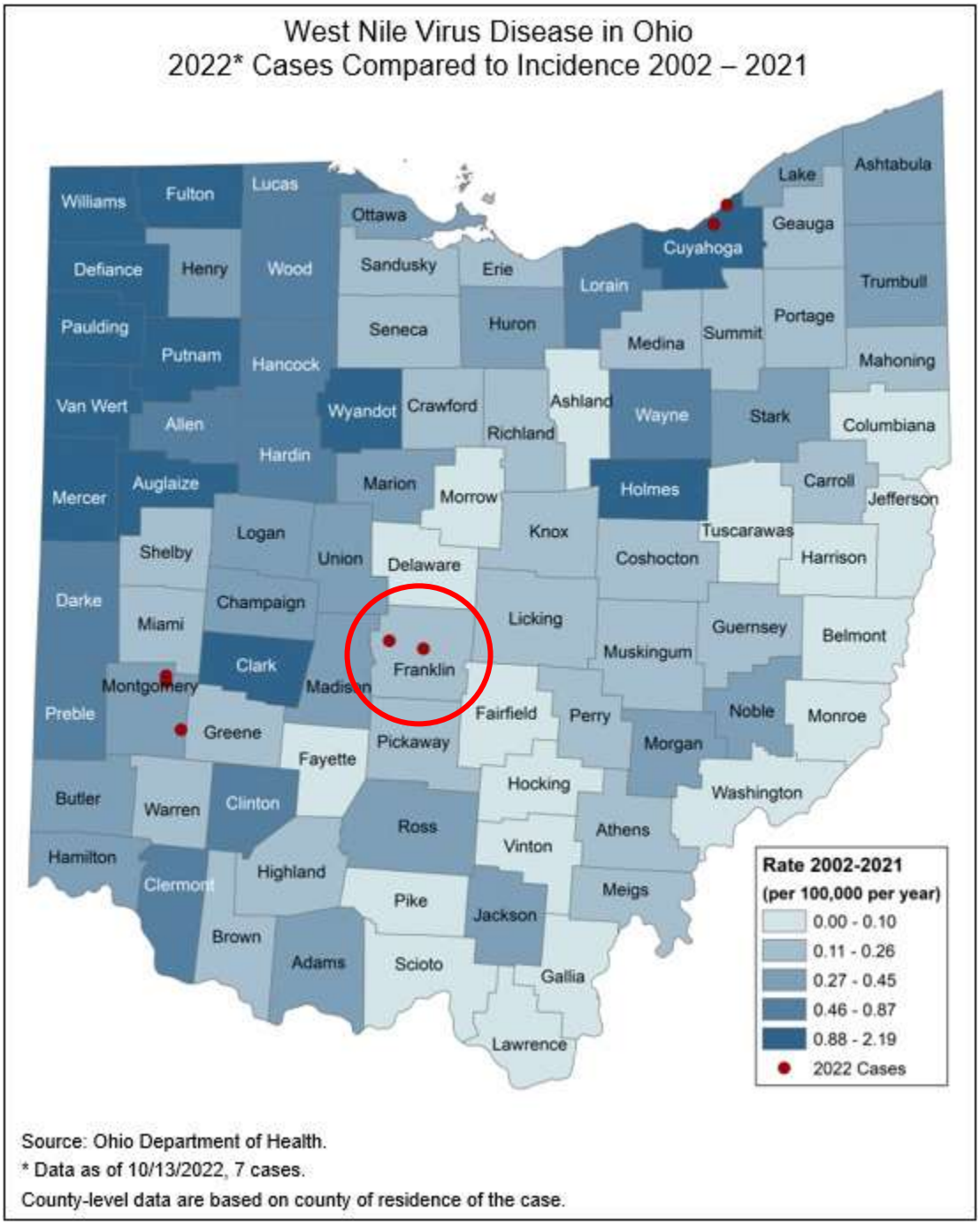


Source: ODH 2022
Note: Red circle represents the approximate location of Franklin County

West Nile Virus

Figure 4.3.2-2 below shows cases of West Nile Virus Disease across the state of Ohio in 2022 compared to West Nile Virus Disease incidence from 2002 to 2021. Franklin County was the site of 2 incidents of Wet Nile in 2022, compared to 0.11 – 0.26 cases per 100,000 individuals per year.

Figure 4.3.2-2. West Nile Virus Disease in Ohio



Source: ODH 2022
Note: Red circle represents the approximate location of Franklin County

Measles

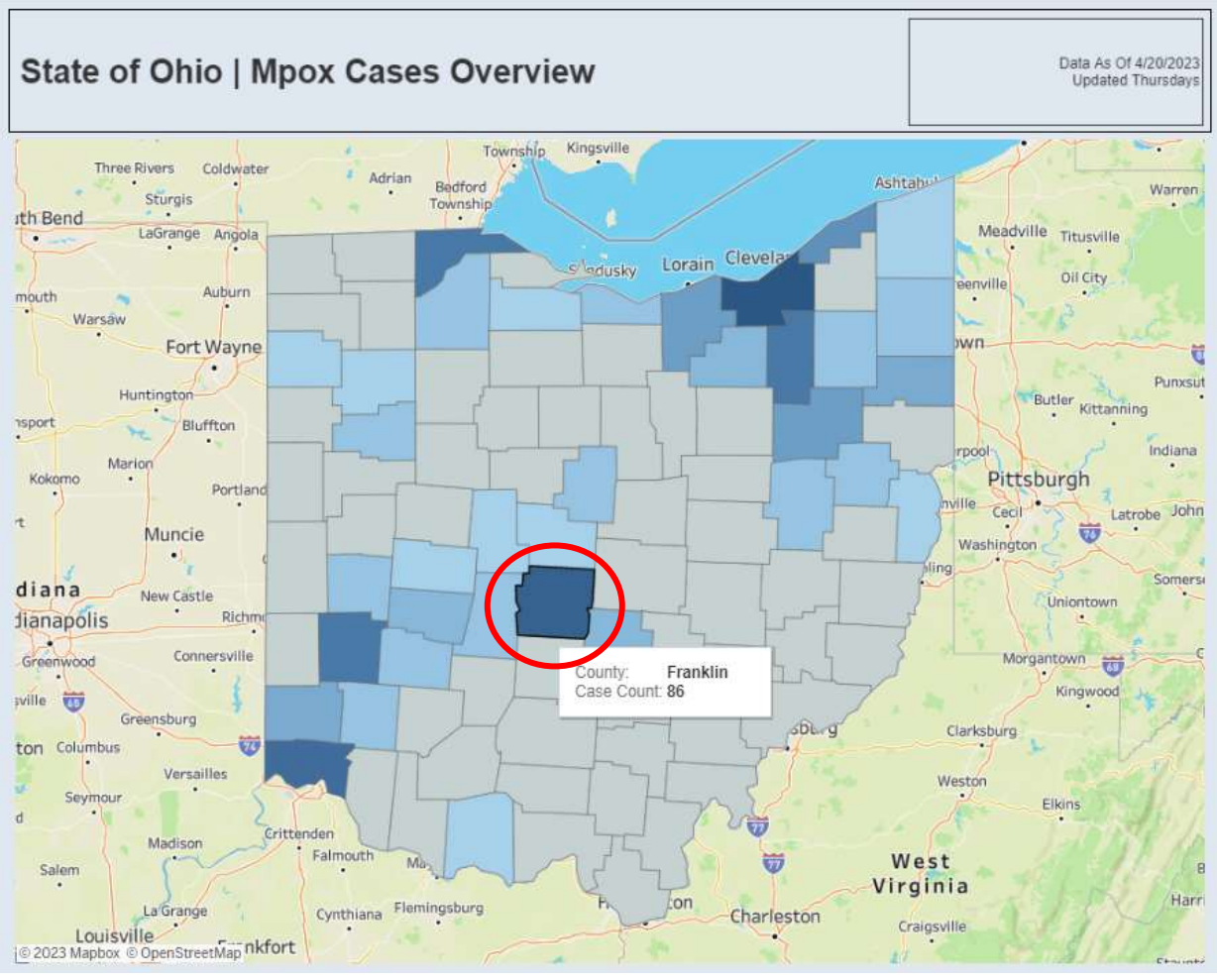
During the winter of 2022-2023, Franklin County experienced a Measles outbreak, as of February 23, 2023, the outbreak has been declared over. In total, there were 85 confirmed cases of Measles in Franklin

County, 35 hospitalizations, and zero deaths. Of the 85 confirmed cases, 65% of the cases were in individuals between the ages of 1 to 5 years old. Franklin County has distributed 1,039 MMR vaccinations since November 2022; of those who contracted the disease, 80 had not received a vaccination, and just 4 had received their first round of vaccination. Franklin County has continued its education and outreach to at risk groups and is encouraging vaccination to those who do not yet have the vaccine.

Monkey Pox

Figure 4.3.2-3 below shows cases of Mpox across the state of Ohio through April 20, 2023. Franklin County was the site of 86 cases of Mpox, with the last case having been reported in December 2022. Franklin County has distributed 6,275 Mpox vaccines, created a public dashboard dedicated to updating the public about the risk of Mpox in the County. Additionally, education and outreach initiatives have taken place to at risk groups, including partnering with community leaders to distribute information on the Mpox vaccine.

Figure 4.3.2-3. Mpox in Ohio



Source: *ODH 2023*

Note: *Red circle represents the approximate location of Franklin County*

COVID-19

According to the City of Columbus Department of Health, Franklin County experienced 391,089 cases of COVID-19 between January 2020 and April 2023; in the City of Columbus alone there were 262,234 cases. Hospitalizations during the same time period amounted to 6,411 in Franklin County and 4,624 in the City of Columbus; there were 3,035 deaths in Franklin County, 2,001 of which occurred in the City of Columbus. The large case numbers, hospitalizations, and deaths within the City of Columbus compared to the remaining areas of Franklin County can be attributed to the high population density of the City.

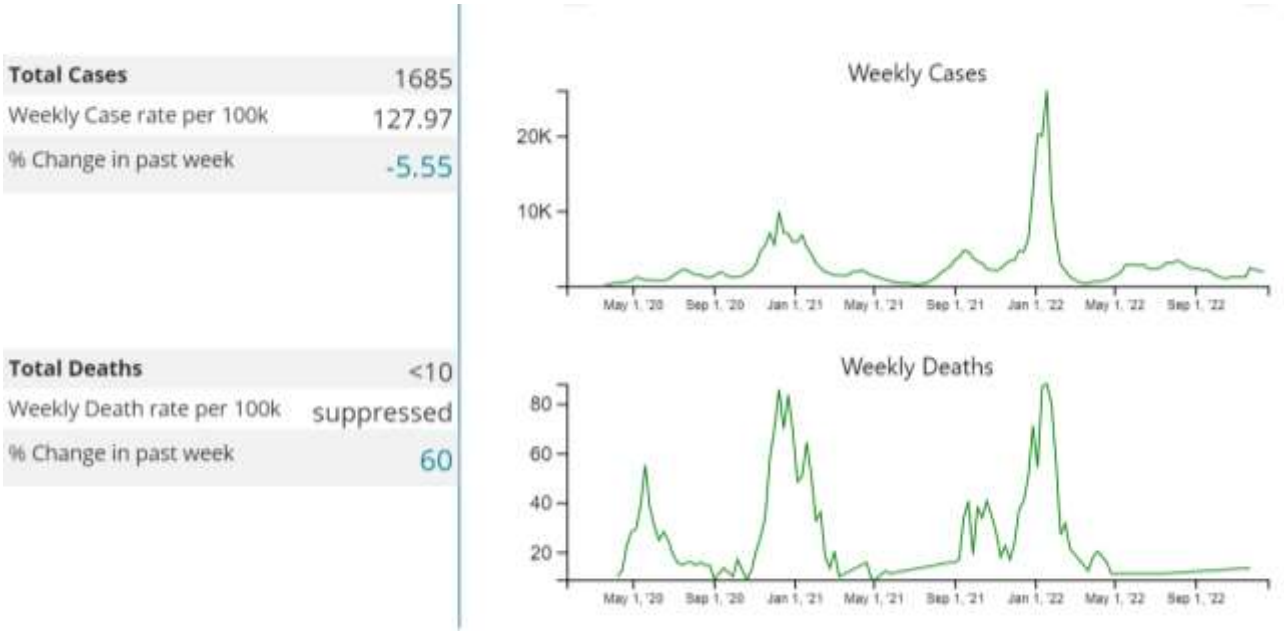
Extent

The magnitude of disease outbreaks species ranges from nuisance to widespread. The exact size and extent of an infected population depend on how easily the illness is spread, the mode of transmission, and the amount of contact between infected and uninfected individuals. The transmission rates of pandemic illnesses are often higher in more densely populated areas. The transmission rate of infectious diseases will depend on the mode of transmission of a given illness.

Previous Occurrences and Losses

CDC data, displayed below in Figure 4.3.2-4 show that since the beginning of the COVID-19 pandemic, the largest spike in reported cases in Franklin County occurred in January 2022. Several spikes in reported deaths have occurred, most notably at the beginning of the pandemic in April 2020; again in the winter of 2020-2021; and most recently in the early months of 2022.

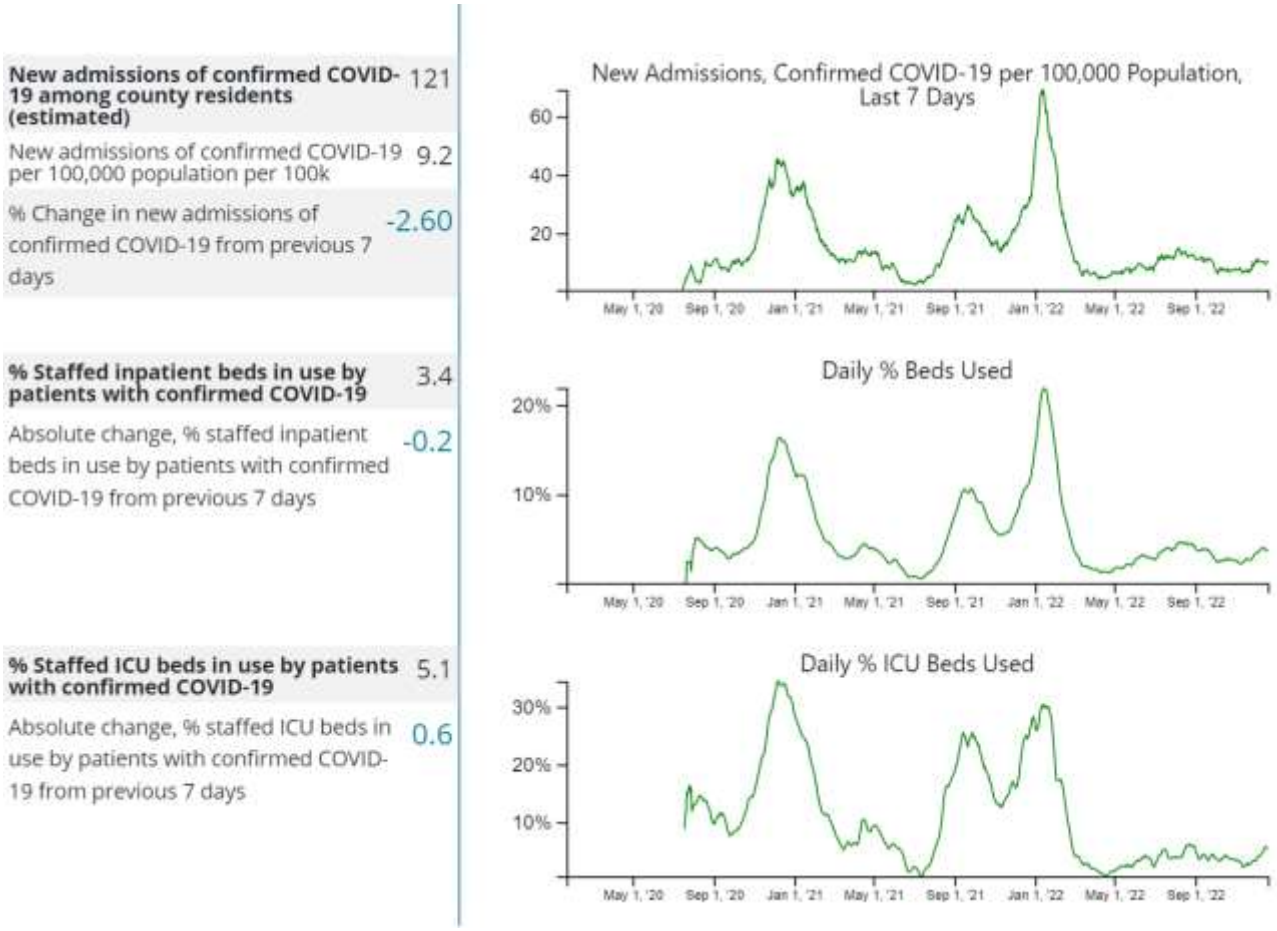
Figure 4.3.2-4. COVID-19 Cases & Deaths in Franklin County, Ohio, From January 21, 2020, through December 20, 2022



Source: CDC 2022

The weekly hospitalization rate has been an important data set for public health officials to track COVID-19 impacts throughout the community. Similar to case rates and death rates, Franklin County has seen spikes in new admissions, bed usage, and Intensive Care Unit (ICU) bed usage during the winter months of 2020, 2021, and 2022. Figure 4.3.2-5 shows hospitalizations in Franklin County throughout the COVID-19 pandemic.

Figure 4.3.2-5. Hospitalizations in Franklin County, Ohio, From January 21, 2020, Through December 20, 2022



Source: CDC 2022

Franklin County is currently experiencing a measles outbreak. Between November 2022 and February 10, 2023, the County has recorded 85 cases of measles. 36 of the cases have required hospitalization (Ohio Disease Reporting System 2023).

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was included in one disaster (DR) declaration and one emergency (EM) declaration for disease outbreak-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in

the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

USDA keeps records of agricultural disasters. Between 2012 and 2022, Franklin County was not included in any disease outbreak-related agricultural disaster declarations.

Previous Occurrences

For the 2023 HMP update, known disease outbreak events that impacted Franklin County between 2018 and 2022 are discussed below. For events prior to 2018, refer to the 2018 Franklin County HMP

Table 4.3.2-1. Disease Outbreak Events in Franklin County (2018 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
2018	Influenza	N/A	N/A	Franklin County	967 residents were hospitalized with influenza in Franklin County.
2018	Lyme disease	N/A	N/A	Franklin County	16 cases of Lyme disease were reported in Franklin County.
2018	West Nile Virus	N/A	N/A	Franklin County	2 cases of West Nile Virus were reported in Franklin County.
2019	Influenza	N/A	N/A	Franklin County	840 residents were hospitalized with influenza in Franklin County.
2019	Lyme disease	N/A	N/A	Franklin County	16 cases of Lyme disease were reported in Franklin County.
Jan 20, 2020 and continuing	COVID-19	EM-3457, DR-4507	Yes	Franklin County	As of January 24, 2023, Franklin County had 360,807 confirmed cases and 2,803 deaths from COVID-19.

Sources: FEMA 2022; Ohio Department of Health 2018, 2019; New York Times 2023

Note: The COVID-19 pandemic is ongoing in Franklin County and across the United States at the time of publication of this plan. County statistics for most infectious disease were only available up to 2019 from the Ohio Department of Health.

Probability of Future Occurrence

Though occurrences of disease outbreaks overall are often difficult to predict at the local level, it is anticipated that Franklin County will continue to be impacted by disease outbreaks for the foreseeable future. Additionally, seasonality for cold and flu is well established and anticipated in Ohio on an annual basis.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for disease outbreak in the County is considered 'frequent'.

Climate Change Impacts

Climate change will likely have significant indirect impacts on disease outbreaks. In Ohio higher temperatures, decreased water availability, and more severe storm events are anticipated due to climate change. According to the World Health Organization (WHO), changing climatic conditions are being studied for impacts upon disease transmission. Seasonal infectious diseases that are influenced by meteorological conditions may see significant variability in recurrence and duration. The WHO concludes that variations in infectious disease transmission patterns are likely major consequences of climate change (WHO 2021).

Warmer temperatures and changing rainfall patterns provide an environment where mosquitos can remain active longer, greatly increasing the risk for animals and humans. Lyme disease could also expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The climate changes can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resource Defense Council 2015).

An increase in temperature and humidity may also lead to a larger number of influenza outbreaks. Studies have shown that warmer winters led to an increase in influenza cases. During warm winters, fewer people contract influenza which causes a large number in population to remain vulnerable into the next season. This causes an early and strong occurrence of the virus (Towers, et al. 2013).

Vulnerability Assessment

To understand risk, a community must evaluate assets exposed to and vulnerable to the identified hazard. The following discusses Franklin County's vulnerability, in a qualitative nature, to disease outbreak.

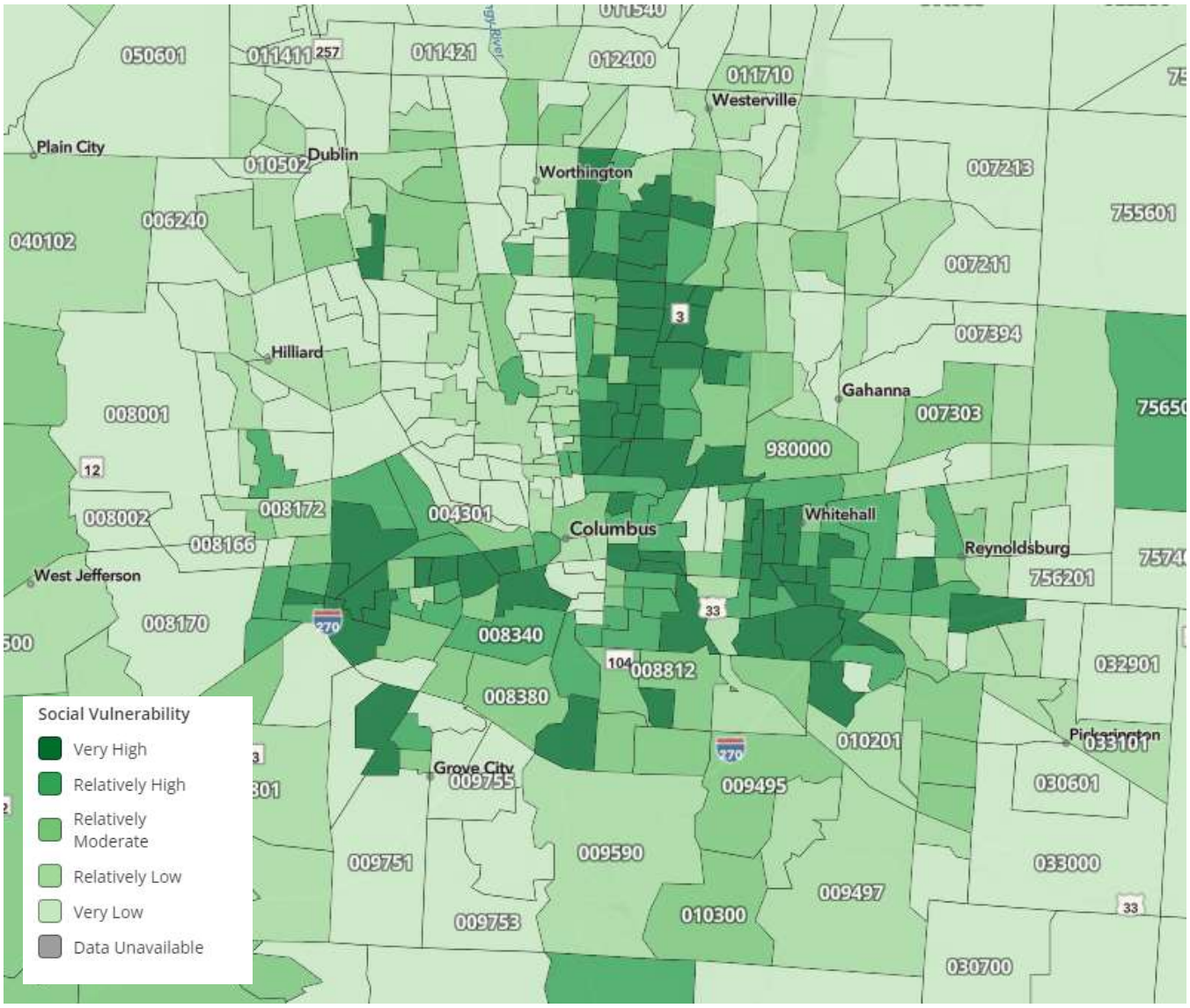
Impact on Life, Health, and Safety

The entire population of Franklin County is vulnerable to disease outbreak. Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard. Healthcare providers and first responders have an increased risk of exposure due to their frequent contact with infected populations. Areas with a higher population density also have an increased risk of exposure or transmission of disease to do the closer proximity of population to potentially infected people.

Social Vulnerability

Most recently with COVID-19, the Centers for Disease Control and Prevention have indicated that persons over 65 years and older, persons living in a nursing home or long-term care facility, and persons with underlying medical conditions such as diabetes, severe obesity, serious heart conditions, etc. are at a higher risk of getting severely ill (CDC 2021). According to the 5-Year 2021 American Community Survey Population Estimates, there are 188,900 (12.4% of the County's total population) persons over 65 and 195,988 (12.9% of the County's total population) persons living in poverty in Franklin County. Refer to Figure 4.3.2-6 for Franklin County's Social Vulnerability Index for Natural Hazards.

Figure 4.3.2-6. FEMA Social Vulnerability Index for Natural Hazards



Source: FEMA NRI

Impact on General Building Stock

No structures are anticipated to be directly affected by disease outbreak.

Impact on Critical Facilities and Community Lifelines

No critical facilities are anticipated to be affected by disease outbreaks. Hospitals and medical facilities will likely see an increase in patients, but it is unlikely that there will be damages or interruption of services. However, large rates of infection may result in an increase in the rate of hospitalization which may overwhelm hospitals and medical facilities and lead to decreased services for those seeking medical attention. The 2020 coronavirus pandemic has led to overwhelmed hospitals in numerous hotspots throughout Franklin County.

Impact on the Economy

Disease outbreaks impacts on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address disease outbreaks have not been quantified in available documentation. As evidenced in the COVID-19 outbreak, quarantines, shutdowns, and social distancing measures can have outsized economic impacts, particularly on the leisure, tourism, and food/accommodations sectors.

Impact on the Environment

Disease outbreaks may have an impact on the environment if the outbreaks are caused by invasive species. Invasive species tend to be competitive with native species and their habitat and can be the major transmitters of disease like Zika, dengue, and yellow fever (Placer Mosquito and Vector Control District 2019). Secondary impacts from mitigating disease outbreaks, such as pesticide use, could also have an impact on the environment.

Future Changes That May Impact Vulnerability

Understanding future changes that effect vulnerability in Franklin County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Franklin County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development;
- Projected changes in population; and
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Any areas of growth could be potentially impacted by the disease outbreak hazard because Franklin County is exposed and vulnerable. Additional development of structures in close proximity to waterbodies or areas with high population density are at an increased risk.

Project Changes in Population

Franklin County has experienced an increase in population between the 2010 Census (1,163,414) and the 2020 Census population of 1,323,807. The population of the County is expected to increase over the next few years. The Mid-Ohio Regional Planning Commission (MORPC) projects the region's total population to reach 3 million people by 2050, with a total of 1.2 million households and 1.5 million jobs.

MORPC states that their model accounts for long-term, stable trends over time – such as declining birth rates – while accounting for unpredictable short-term factors that impact growth – such as changing immigration policies or a pandemic. It is guided by the concept that long-term population growth generally follows cyclical patterns that can be informed by past trends. The region's natural increase – births minus deaths – slowly and steadily declined, making growth increasingly reliant on attracting

people to Central Ohio from around the country and internationally. The 2010s was the first decade when as much growth came from migration as from births (MORPC 2020).

An increase in population will expose more people to the pandemic hazard as residents move into area and the population exposed increases. Population density changes when households move throughout the Planning Area could influence the number of persons exposed to disease outbreaks. Higher density jurisdictions are not only at risk of greater exposure to disease outbreak, but density may also reduce available basic services provided by critical facilities such as hospitals and emergency facilities for persons that are not affected by a disease.

Climate Change

The relationship between infectious diseases occurrence and climate change is difficult to predict with certainty. However, there may be linkages between the two. Changes in the environment may create a more livable habitat for vectors carrying disease as suggested by the Centers for Disease Control and Prevention (CDC n.d.). Localized changes in climate and human interaction may also be a factor in the spread of disease. For example, in the wake of significant flooding events, prolonged and intense precipitation often provides breeding grounds for mosquitos that necessitate mosquito control measures.

The relationship between climate change and infectious diseases is not universally agreed upon. Climate change may affect the spread of disease, while others are not convinced. However, research indicates that the only force at work in increasing the spread of infectious diseases into the future. Other factors, such as expanded rapid travel and evolution of resistance to medical treatments, are already changing the ways pathogens infect people, plants, and animals. As climate change accelerates it is likely to work synergistically with many of these factors, especially in populations increasingly subject to massive migration and malnutrition (Harmon 2010).

Change of Vulnerability Since 2018 HMP

Disease outbreak was not included as a hazard of concern in the 2018 HMP. However, with an increase in population it can be assumed that the vulnerability to disease outbreak events has slightly increased since 2018.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.3 Drought

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the drought hazard in Franklin County.

Hazard Profile

Hazard Description

Drought is a normal, recurrent feature of climate that originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. Within the State of Ohio, drought is equally as possible to occur in one section of the state as it is in another. The effects of drought within the state vary though, based on land use (agricultural production as opposed to urban areas), economy (dependence on drought-impacted business such as farming), geology (presence of an aquifer or ground structure that limits well production), and water source (public water supply, private well, or cistern) (Ohio Emergency Management Agency 2019).

There are five primary types of drought: *meteorological, hydrological, agricultural, ecological, and socioeconomic*. The State of Ohio is most often affected by agricultural and hydrological types of drought and is often affected by both simultaneously (Ohio Emergency Management Agency 2019). Below, these two types of drought are described in more detail.

- **Agricultural Droughts**— Agricultural drought links characteristics of hydrological drought to agricultural impacts, focusing on precipitation shortages, differences between actual and potential evapotranspiration, soil water deficits, and reduced groundwater or reservoir levels. The amount of water available for agricultural use demand depends on prevailing weather conditions, biological characteristics of the specific plant, its stage of growth, and the physical and biological properties of the soil. A good definition of agricultural drought accounts for the variable susceptibility of crops during different stages of crop development, from emergence to maturity. Deficient topsoil moisture at planting may hinder germination, leading to low plant populations per acre and a reduction of final yield (Ohio Emergency Management Agency 2019).
- **Hydrological Drought**— Hydrological drought is associated with the effects of periods of precipitation (including snowfall) shortfalls on the surface or subsurface water supply – stream flow, reservoir, and lake levels and groundwater. The frequency and severity of hydrological drought are often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency plays out through the hydrologic system (Ohio Emergency Management Agency 2019)

Water in hydrologic storage systems (e.g., reservoirs, rivers) is often used for multiple and competing purposes (e.g., flood control, irrigation, recreation, navigation, hydropower, or wildlife habitat), further complicating the sequence and quantification of impacts. Competition for water in these storage systems escalates during drought and conflicts between water users increase significantly (National Drought Mitigation Center 2022).

Location

A drought occurs on a regional scale; therefore, all of Franklin County is vulnerable and at risk. Droughts can occur at any time and have the potential to impact every person directly or indirectly in the County, as well as the local economy.

Central Ohio normally receives about 39.31 inches of annual precipitation. Recorded annual extremes for Columbus are 21.6 inches during 1930 and 54.96 inches during 2011. The longest period of record having only a trace of, or no precipitation is 48 consecutive days, from September 13 through October 30, 1963. The driest year was 1930 when only 26.59 inches of precipitation was recorded, closely followed by 1934 and 1963 (Franklin County 2018).

Franklin County is primarily impacted by drought relating to water supply shortages and a decrease in overall water quality. Drought also greatly impacts land throughout the County that is utilized as cropland or pasture. As most of Franklin County is urbanized, the maximum impact of severe prolonged drought would be shortages in the water supply. Water quality could suffer and progressive restrictions on water use could be mandated as conditions require. These restrictions could include watering of lawns, parks, and golf courses; swimming pool use; washing of motor vehicles; and ornamental purposes such as fountains and reflecting pools (Franklin County 2018).

Extent

The severity of a drought depends on the degree of moisture deficiency, the event's duration, and the affected area's size and location. The longer the duration of the drought and the larger the area impacted, the more severe the potential impacts (University of Nevada, Reno Extension College of Agriculture, Biotechnology & Natural Resources n.d.). Franklin County has the potential to experience an entire range of effects, from extreme drought to extremely moist conditions, as described in the Palmer Drought Severity Index (PDSI).

Palmer Drought Severity Index

The PDSI is primarily based on soil conditions. Soil with decreased moisture content is the first indicator of an overall moisture deficit. Table 4.3.3-1 lists the PDSI classifications. At the one end of the spectrum, 0 is used as normal and drought is indicated by negative numbers. For example, -2 is moderate drought, -3 is severe drought, and -4 is extreme drought. The PDSI can reflect excess precipitation using positive numbers; however, this is not shown in Figure 4.3.3-1. The PDSI is commonly converted to the Palmer Drought Category (U.S. Drought Monitor n.d.).

Table 4.3.3-1. Palmer Drought Category and Palmer Drought Index Descriptions

Category	Description	Possible Impacts	Palmer Drought Index
D0	Abnormally Dry	• Producers begin supplemental feeding for livestock • Planting is postponed; forage germination is stunted; hay cutting is reduced • Grass fires increase • Surface water levels decline	-1.0 to -1.9
D1	Moderate Drought	• Dryland crops are stunted • Early cattle sales begin • Wildfire frequency increases • Stock tanks, creeks, streams are low; voluntary water restrictions are requested	-2.0 to -2.9
D2	Severe Drought	• Pasture conditions are very poor • Soil is hard, hindering planting; crop yields decrease • Wildfire danger is severe; burn bans are implemented • Wildlife moves into populated areas • Hydroelectric power is compromised; well water use increases; mandatory water restrictions are implemented	-3.0 to -3.9
D3	Extreme Drought	• Soil has large cracks; soil moisture is very low; dust and sandstorms occur • Row and forage crops fail to germinate; decreased yields for irrigated crops and very large yield reduction for dryland crops are reported • Need for supplemental feed, nutrients, protein, and water for livestock increases; herds are sold • Increased risk of large wildfires is noted • Many sectors experience financial burden • Severe fish, plant, and wildlife loss reported • Water sanitation is a concern; reservoir levels drop significantly; surface water is nearly dry; river flow is very low; salinity increases in bays and estuaries	-4.0 to -4.9
D4	Exceptional Drought	• Exceptional and widespread crop loss is reported; rangeland is dead; producers are not planting fields • Culling continues; producers wean calves early and liquidate herds due to importation of hay and water expenses • Seafood, forestry, tourism, and agriculture sectors report significant financial loss • Extreme sensitivity to fire danger; firework restrictions are implemented • Widespread tree mortality is reported; most wildlife species' health and population are suffering • Devastating algae blooms occur; water quality is very poor • Exceptional water shortages are noted across surface water sources; water table is declining • Boat ramps are closed; obstacles are exposed in water bodies; water levels are at or near historic lows	-5.0 or less

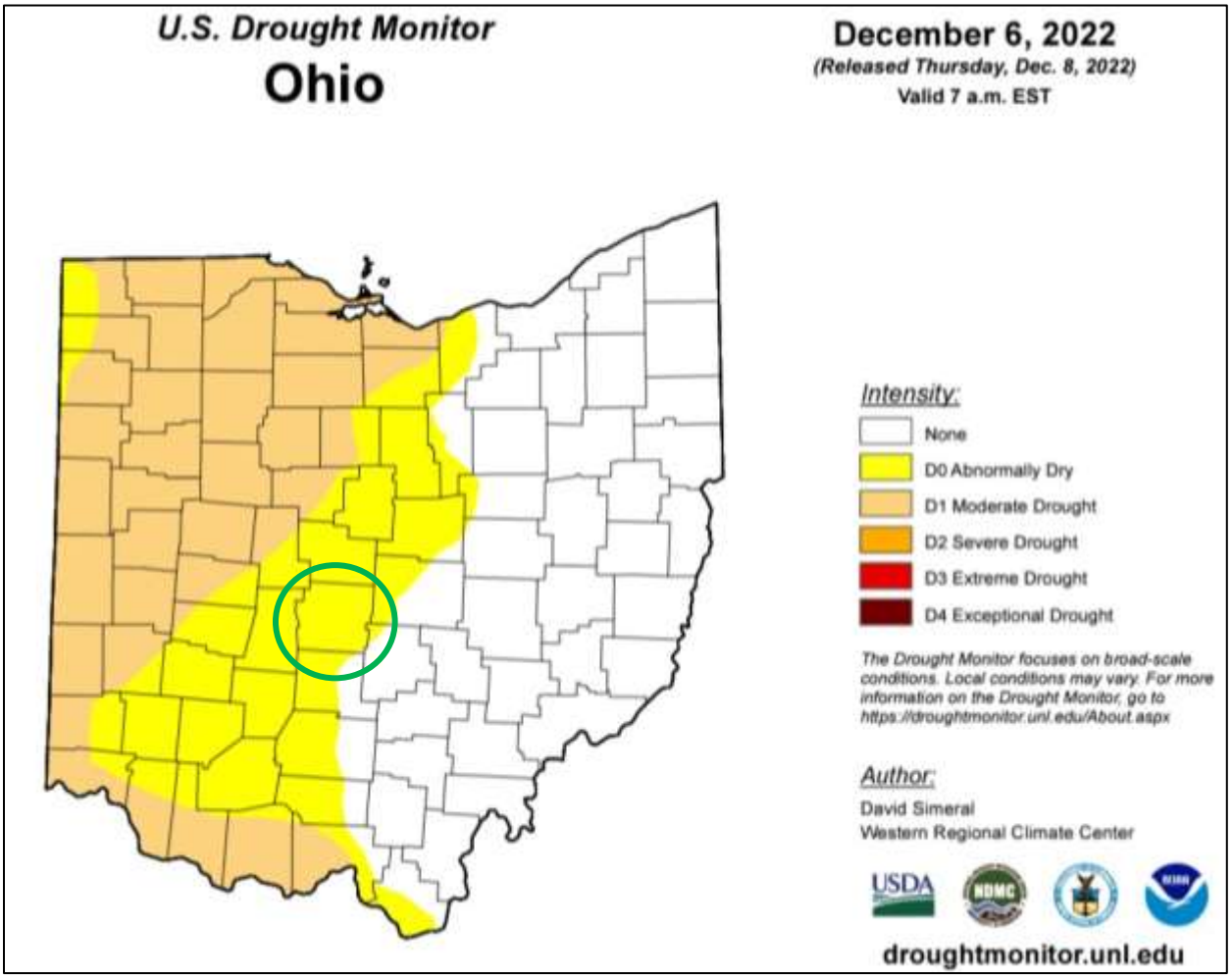
Source: U.S. Drought Monitor 2021

U.S. Drought Monitor

The U.S. Drought Monitor (USDM) is a map that shows the location and intensity of drought across the United States. The USDM uses a five-category system, labeled Abnormally Dry or D0, (a precursor to

drought, not actually drought), and Moderate (D1), Severe (D2), Extreme (D3) and Exceptional (D4) Drought. Drought categories show experts' assessments of conditions related to dryness and drought including observations of how much water is available in streams, lakes, and soils compared to usual for the same time of year. Figure 4.3.3-1 shows the USDM for December 6, 2022. The figure shows that Franklin County was experiencing Abnormally Dry (D0) conditions on December 6, 2022.

Figure 4.3.3-1. U.S. Drought Monitor for Ohio, December 6, 2022



Note: The green circle represents the location of Franklin County
Source: U.S. Drought Monitor 2022

Keetch-Byram Drought Index (KBDI)

The Keetch-Byram Drought Index (KBDI) is an index used to determining forest fire potential. The drought index is based on a daily water balance, where a drought factor is balanced with precipitation and soil moisture (assumed to have a maximum storage capacity of eight inches) and is expressed in hundredths of an inch of soil moisture depletion. The index ranges from 0 to 800, where a drought index of 0 represents no moisture depletion, while an index of 800 represents absolutely dry conditions (USFS - Wildland Fire Assessment System n.d.).

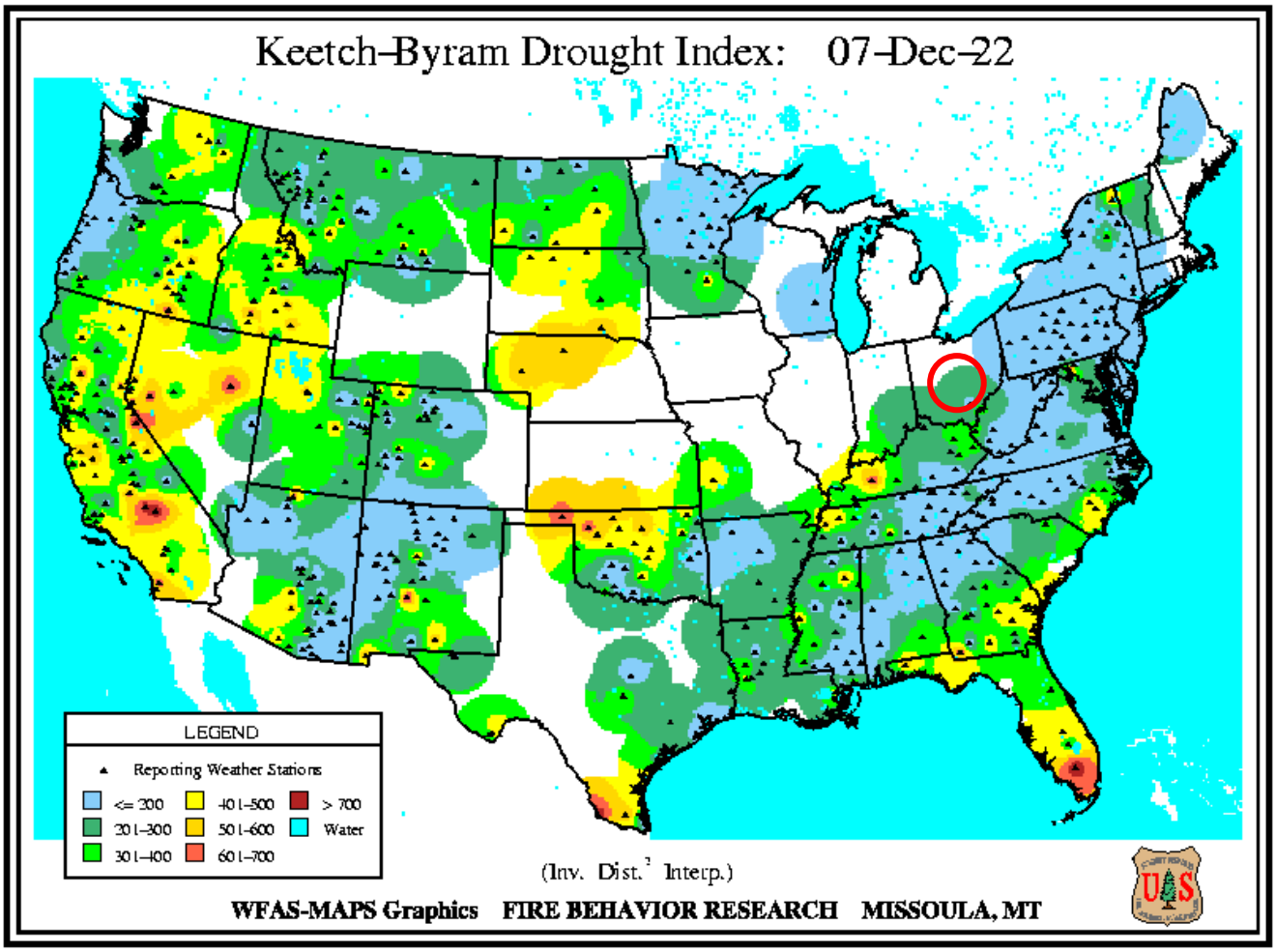
Table 4.3.3-2. KBDI Index

KBDI Value	Description
0 to 200	Soil moisture and large class fuel moistures are high and do not contribute much to fire intensity. Typical of spring dormant season following winter precipitation
200 to 400	Typical of late spring, early growing season. Lower litter and duff layers are drying and beginning to contribute to fire intensity
400 to 600	Typical of late summer, early fall. Lower litter and duff layers actively contribute to fire intensity and will burn actively.
600 to 800	Often associated with more severe drought with increased wildfire occurrence. Intense, deep burning fires with significant downwind spotting can be expected. Live fuels can also be expected to burn actively at these levels.

Source: TWC 2022

This index is currently derived from ground based estimates of temperature and precipitation resulting from weather stations and interpolated manually by experts. Figure 4.3.3-2 shows the KBDI for the State of Ohio for December 7, 2022. The figure shows KBDI value of 0-500 for the County.

Figure 4.3.3-2. KBDI for the United States, December 7, 2022



Note: The red circle represents the approximate location of Franklin County, Ohio

Source: USFS-WFAS 2022

Worst-Case Scenario

A multi-year drought with a Palmer Drought Category of D4 that impacts the central portion of Ohio is the worst-case scenario for Franklin County. If severe drought occurs, it could exacerbate the stress already placed on existing planning area water resources. Severe droughts can also lead to crop and livestock losses, impacting the food supply and economy.

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, neither Franklin County or the State of Ohio has experienced a drought-related major disaster (DR) or emergency (EM) declaration (FEMA 2022).

U.S. Department of Agriculture Disaster Declarations

USDA keeps records of agricultural disasters. Between 2012 and 2022, Franklin County was included in one declaration related to drought.

Table 4.3.3-3. USDA Drought Disaster Declarations for Franklin County, OH between 2012 and 2021

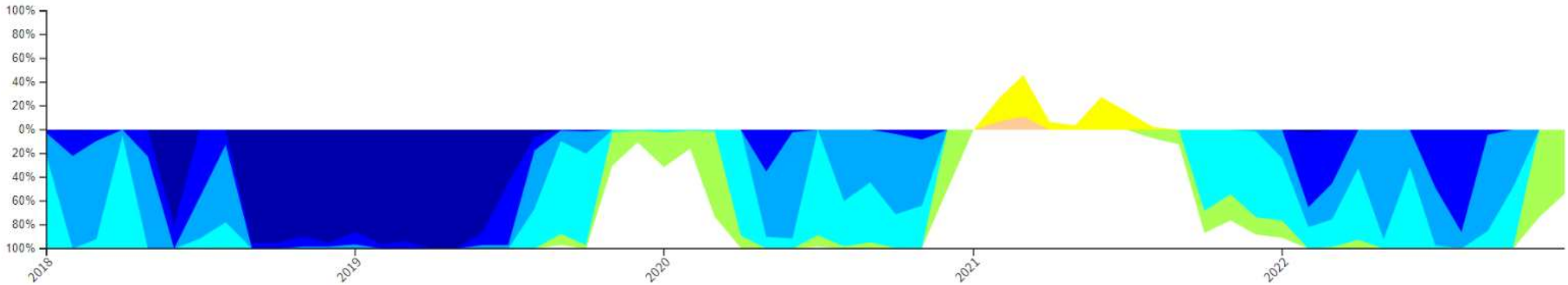
Designation Number	Incident Date(s)	Approval Date	Description of Disaster	Crop Disaster Year
S3384	February 1, 2012	September 5, 2012	USDA Secretarial disaster designation due to drought and excessive heat.	2012

Source: USDA Farm Service Agency 2022

Previous Occurrences

According to NOAA, USDA, and FEMA, there were no reported drought events in Franklin County between 2018 and 2022. In fact, according to the National Integrated Drought Information System, 2018 to 2022 has been mostly moderately wet to abnormally wet, with just an 8-month span (January 2021-August 2021) where there has been a moderate drought to abnormally dry conditions.

Figure 4.3.3-3. Historical Drought Conditions in Franklin County, Ohio (2018-2022)



In 1999, Franklin County experienced two drought events according to the NOAA Storm Events Database, U.S. Drought Monitor, and the Drought Impact Reporter. The drought spanned two months; however, the months of July and August were each classified as one occurrence. Dry conditions that began in the spring and early summer continued into July. Excessive heat contributed to substantial crop loss across much of the Buckeye state. Rainfall was widely scattered and did little to help farmers. Crop damage amounts were not available at the time of this writing.

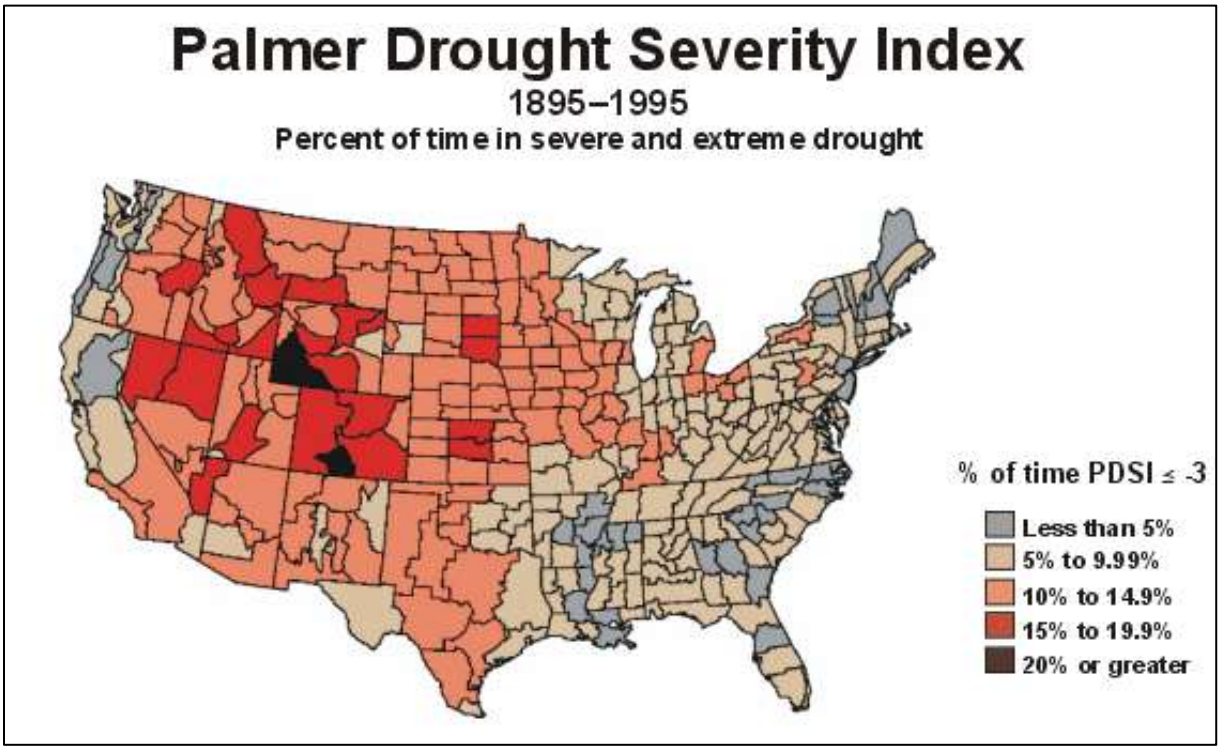
Drought conditions continued across the Ohio Valley through August with most areas receiving well below normal rainfall for the month. In some areas around 50 percent of crops were considered total losses. Most counties in southwest Ohio were declared Federal Disaster Areas by the US Department of Agriculture. At the time of this writing, no monetary estimates were available concerning the crop loss.

According to the U.S. Drought Monitor, Franklin County experience D2 drought conditions from September – October 2002 and from September – November 2012.

Probability of Future Occurrence

The frequency of droughts is difficult to forecast as drought occurrences are cyclical in nature and will occur in the future. Based on national annual data from 1895 to 1995, Franklin County underwent severe or extreme conditions approximately 5 to 9.9 percent of the time (illustrated in Figure 4.3.3-4).

Figure 4.3.3-4. Palmer Drought Severity Index (1895 to 1995)



Source: National Drought Mitigation Center 2020

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of drought events, of all magnitudes, for Franklin County. Information from NOAA-NCEI Storm Events Database, the 2019 State of Ohio HMP, the 2018 Franklin County HMP, and the Drought Impact Reporter were used to identify the number of drought events that occurred between 1950 and 2022. Using these sources ensures the most accurate probability estimates possible. There were five instances of drought in Franklin County between 1950 and 2022.

Based on the five recorded drought events over 72 years, Franklin County averages less than one drought a year. A drought event has a 6.94 percent chance of occurring in any given year in the County; the severity of drought events range extensively, therefore the percent chance of a drought of any severity is not discussed. Based on the history of events and input from the Core Planning Team, the probability for drought occurring in the County is considered 'rare'. Refer to Section 4.4 for additional information on the hazard ranking methodology and probability criteria.

Climate Change Impacts

Climate is defined not simply as average temperature and precipitation but also by the type, frequency, and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as droughts. While predicting changes of drought events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society, and the environment (EPA 2016).

With a warmer climate, droughts can become more frequent, more severe, and longer lasting. According to the National Climate Assessment, variable precipitation and rising temperatures are intensifying droughts, increasing heavy downpours, reducing snowpack, and causing declines in water survey quality. Future warming will add to the stress on water supplies and impact the availability of water supply (USGCRP 2018).

Vulnerability Assessment

Drought is a significant concern to Franklin County, mainly due to its impact on public health, natural resources, and agriculture. Estimated losses are difficult to quantify; however, drought events can impact Franklin County's population and economy. Assets at particular risk would include areas used for agricultural purposes (farms and cropland).

Impact on Life, Health, and Safety

The entire population of Franklin County is vulnerable to drought events. According to the 2020 U.S. Census, the County had a population of 1,323,807 (US Census 2022). Drought conditions can affect people's health and safety, including health problems related to low water flows and poor water quality, and health problems related to dust. Droughts also can lead to loss of human life (NDMC 2013). Other possible impacts on health from drought include increased recreational risks; effects on air quality; diminished living conditions related to energy, air quality, and sanitation and hygiene; compromised food and nutrition; and increased incidence of illness and disease. Health implications of drought are numerous. Some drought-related health effects are short-term while others can be long-term (CDC 2012).

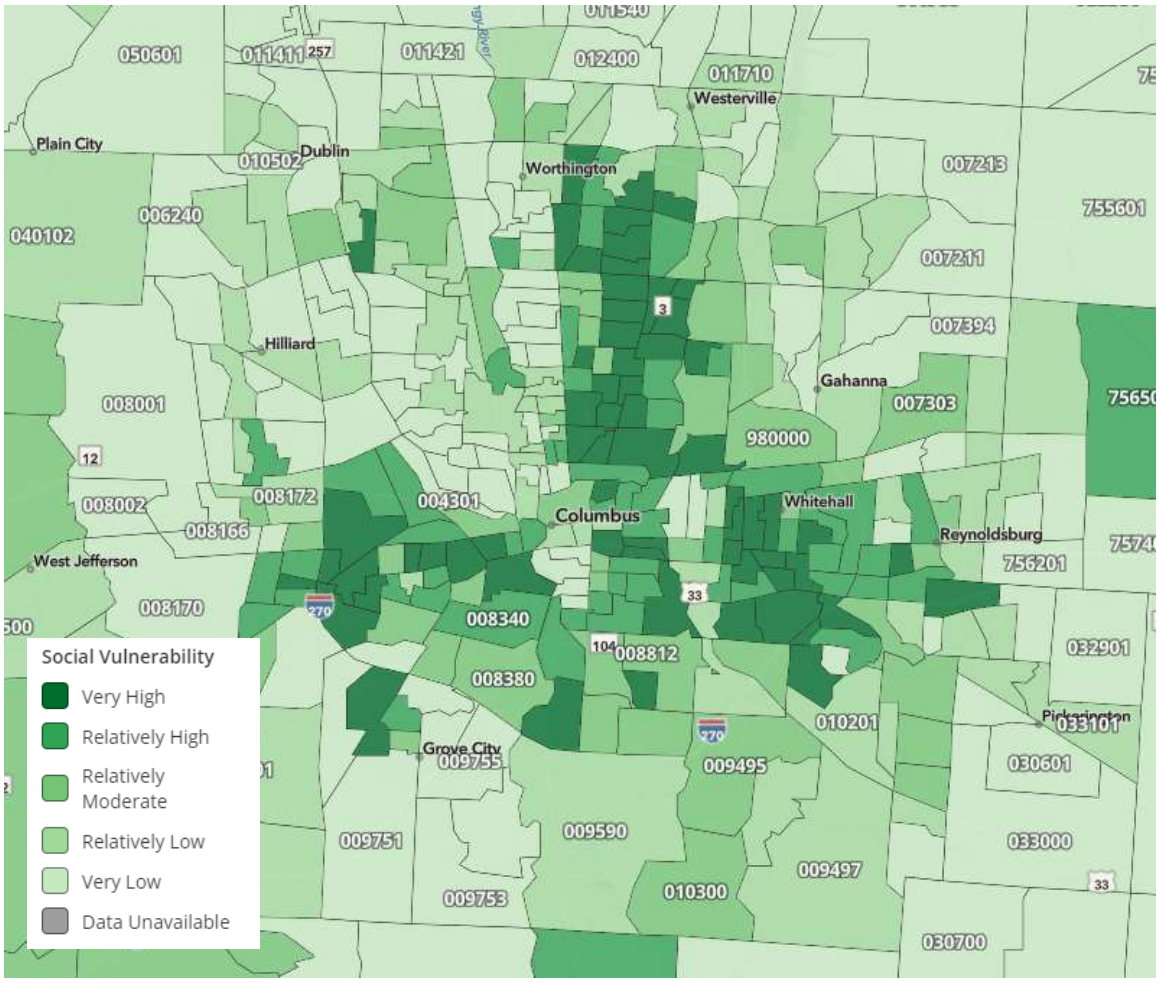
As previously stated, drought conditions can cause shortages of water for human consumption. Droughts can also lead to reduced local firefighting capabilities. The drought hazard is a concern for Monroe County because rural populations within the County rely upon private water supply from local groundwater resources.

Social Vulnerability

Socially vulnerable populations are most susceptible to drought events based on several factors, including their physical and financial ability to react or respond during a drought. Vulnerable populations include homeless persons, elderly (over 65 years old), low income or linguistically isolated populations, people with life-threatening illnesses, and residents that may have limited access to water as is. The population over the age of 65 is also more vulnerable. They may require extra water supplies or need assistance to obtain water and are more likely to seek or need medical attention. According to the 5-Year 2021 American Community Survey Population Estimates, there are 188,900 (12.4-percent of the County's total population) persons over 65 and 195,988 (12.9-percent of the County's total population) persons living in poverty in Franklin County. Refer to Figure 4.3.3-5 for a map indicating the social vulnerability index for drought in Franklin County.

> According to FEMA's National Risk Index, socially vulnerable populations in Franklin County have a relatively high susceptibility to the adverse impacts of droughts, when compared to the rest of the United States (FEMA n.d.).

Figure 4.3.3-5. FEMA Social Vulnerability Index for Drought



Source: FEMA NRI

Impact on General Building Stock

A drought event is not expected to directly affect any structures. However, droughts contribute to conditions conducive to wildfires and reduce fire-fighting capabilities. Risk to life and property is greatest within those areas where forested areas adjoin urbanized areas (high-density residential, commercial, and industrial) or wildland urban interface (WUI).

Impact on Critical Facilities and Community Lifelines

Water supply facilities may be affected by short supplies of water. As mentioned, drought events generally do not impact buildings; however, droughts can impact agriculture-related facilities and critical facilities associated with potable water supplies. Also, those critical facilities in and adjacent to the WUI zone could face heightened vulnerability to wildfire during drought conditions.

Impact on the Economy

Drought causes the most significant economic impacts on industries that use water or depend on water for their business, most notably agriculture and related sectors, power plants, and oil refineries. In addition to losses in yields in crop and livestock production, drought is associated with increased insect infestations, plant diseases, and wind erosion. Drought can lead to other losses because so many sectors are affected - losses that include reduced income for farmers and reduced business for retailers and others who provide goods and services to farmers. This leads to unemployment, increased credit risk for financial institutions, capital shortfalls, and loss of tax revenue. Prices for food, energy, and other products may also increase as supplies decrease.

When a drought occurs, the agricultural industry is most at risk for economic impact and damage. During droughts, crops do not mature, which results in smaller crop yield, undernourishment of wildlife and livestock, decreases in land values, and ultimately financial loss to the farmer (FEMA 1997).

Based on the 2017 Census of Agriculture, 408 farms were present in Franklin County, encompassing 52,356 acres of total farmland. The average farm size was 128 acres. Franklin County farms had a total market value of products sold of $52.2 million, averaging $127,839 per farm (USDA 2017). Table 4.3.3-4 lists the acreage of agricultural land exposed to the drought hazard.

Table 4.3.3-4. Agricultural Land in Franklin County

Number of Farms	Land in Farms (acres)	Total Cropland (acres)	Total Pastureland (acres)	Acres Irrigated
408	52,356	45,026	2,618	362

Sources: USDA 2017

In 2017, the top two agricultural products sold in Franklin County were nursey, greenhouse, floriculture, and sod at $23.6 million and grains, oilseeds, dry beans, and dry peas at $19.1 million. Franklin County was the fourth highest-ranked county in the State for its sales of cultivated Christmas trees and short

rotation woody crops, and fifth highest ranked for its sales of nursey, greenhouse, floriculture, and sod crops (USDA 2017).

If the average production (dollar value) per crop type could be identified on a per acre basis, loss estimates could be developed based on assumed percent damage that could result from a drought. If a drought impacted 40 percent of the agricultural products sold from Franklin County farms, based on 2017 market values, this would be a loss of $20.8 million. This figure does not include how the tourism industry and local jobs are impacted.

Impact on the Environment

Drought can impact the environment because it can trigger wildfires, increase insect infestations, and exacerbate the spread of disease (NOAA 2000). Droughts will also impact water resources that are relied upon by aquatic and terrestrial species. Ecologically sensitive areas, such as wetlands, can be particularly vulnerable to drought periods because they are dependent on steady water levels and soil moisture availability to sustain growth. As a result, these types of habitats can be negatively impacted after long periods of dryness.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the county can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development;
- Projected changes in the population; and
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

Section 3 identifies areas targeted for future growth and development across the County. Any areas of growth located in the County could be susceptible to drought. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Annexes) of this plan.

Project Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 13.78 percent since 2010 (US Census 2022). The County's population is anticipated to slightly increase over the next decade (5.37 percent increase by 2030 and 11.72 percent increase by 2050) (Ohio Development Services Agency 2018). Changes in the density of the population can impact the number of persons exposed to drought and the draw upon water resources.

Climate Change

Climate change as the potential to impact the number of and the severity of droughts. As discussed above, most studies project that the State of Ohio and Franklin County will see an increase in average annual temperatures. Additionally, the State is projected to experience more frequent droughts. An increased incidence of drought might impact availability of water supplies, primarily placing an increased stress on the population. It is unlikely that structure exposure and vulnerability would increase as a direct result of drought, although secondary impacts of drought, such as wildfire, could increase and threaten structures. If a wildfire were to occur during a drought, emergency services might face complications from a water shortage depending on their water source, and critical water-related service sectors might need to adjust management practices and actively manage resources. Increased incidence of drought increases the potential for impacts on the local economy, including the production of agricultural products.

Change of Vulnerability Since 2018 HMP

Franklin County continues to be vulnerable to the drought hazard. Updated population and building stock statistics were used in the current risk assessment. Further, exposure for both the population and critical facilities was analyzed. These updated datasets provide a more accurate exposure analysis to the drought hazard.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.4 Earthquake

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the earthquake hazard in Franklin County.

Hazard Profile

Hazard Description

An earthquake is the sudden movement of the Earth's surface caused by the release of stress accumulated within or along the edge of the Earth's tectonic plates, a volcanic eruption, or by a manmade explosion (FEMA 2013). Most earthquakes occur at the boundaries where the Earth's tectonic plates meet (faults); however, less than 10 percent of earthquakes occur within plate interiors. As plates continue to move and plate boundaries change over geologic time, weakened boundary regions become part of the interiors of the plates. These zones of weakness within the continents can cause earthquakes in response to stresses that originate at the edges of the plate or in the deeper crust (Shedlock and Pakiser 1997).

The location of an earthquake is commonly described by its focal depth and the geographic position of its epicenter. The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus or hypocenter). The epicenter of an earthquake is the point on the Earth's surface directly above the hypocenter (Shedlock and Pakiser 1997). Earthquakes usually occur without warning and their effects can impact areas of great distance from the epicenter.

According to the U.S. Geological Society (USGS) Earthquake Hazards Program, an earthquake hazard is anything associated with an earthquake that may affect resident's normal activities (FEMA 2001). This includes surface faulting, ground shaking, landslides, liquefaction, tectonic deformation, , and seiches. A description of each of these is provided below.

- **Surface faulting**: Displacement that reaches the earth's surface during slip along a fault. Commonly occurs with shallow earthquakes, those with an epicenter less than 20 kilometers.
- **Ground motion (shaking)**: The movement of the earth's surface from earthquakes or explosions. Ground motion or shaking is produced by waves that are generated by sudden slip on a fault or sudden pressure at the explosive source and travel through the earth and along its surface.
- **Landslide**: A movement of surface material down a slope.

- **Liquefaction**: A process by which water-saturated sediment temporarily loses strength and acts as a fluid, like when you wiggle your toes in the wet sand near the water at the beach. This effect can be caused by earthquake shaking.
- **Tectonic Deformation**: A change in the original shape of a material due to stress and strain.
- **Seiche**: The sloshing of a closed body of water from earthquake shaking (USGS 2022).

Location

Earthquake locations are recorded based on the latitude and longitude of the occurrence, called the epicenter, and the associated depth underneath the earth's surface. Earthquakes in Ohio are primarily located in the northeast and far west-central portions of the state and historically have not exceeded 5.4 magnitude (State of Ohio 2019).

According to information published by the Ohio Department of Natural Resources (ODNR) Division of Geological Survey, the origins of Ohio earthquakes, as with earthquakes throughout the eastern United States, are poorly understood at this time. Those in Ohio appear to be associated with ancient zones of weakness in the Earth's crust that formed during continental collision and mountain-building events about one billion years ago. These zones are characterized by deeply buried and poorly known faults, some of which serve as the sites for periodic release of strain that is constantly building up in the North American continental plate due to continuous movement of the tectonic plates that make up the Earth's crust (State of Ohio 2019).

Three areas of Ohio appear to be particularly susceptible to seismic activity. The most active area is Shelby County and surrounding counties in western Ohio. Figure 4.3.4-1 shows the fault lines in the state of Ohio. Franklin County is not located on a fault line, nor have any epicenters been located in Franklin County. Earthquakes occurring in other areas have been felt in Franklin County; however, no damage has been reported.

Extent

An earthquake's magnitude and intensity are used to describe the severity and size of the event. Intensity describes the overall felt severity of shaking during the event and magnitude describes the size at the focus of an earthquake. The earthquake's magnitude is a measure of the energy released at the source of the earthquake. Magnitude was formerly expressed by ratings on the Richter scale. Currently, it is now most commonly expressed using the moment magnitude (Mw) scale. This scale is based on the total moment release of the earthquake (the product of the distance a fault moved, and the force required to move it). The scale is as follows:

- Great Mw > 8
- Major Mw = 7.0 – 7.9
- Strong Mw = 6.0 – 6.9
- Moderate Mw = 5.0 – 5.9
- Light Mw = 4.0 – 4.9
- Minor Mw = 3.0 – 3.9

- Micro Mw = 3.0 – 3.9 (USGS n.d.)

Figure 4.3.4-1. Fault Lines in the State of Ohio

Source: State of Ohio 2019
Note: Red circle shows the approximate location of Franklin County, OH

The most commonly used intensity scale is the modified Mercalli intensity scale. Ratings of the scale, as well as the perceived shaking and damage potential for structures, are shown in Table 4.3.4-1. The modified Mercalli intensity scale is generally represented visually using shake maps, which show the expected ground shaking at any given location produced by an earthquake with a specified magnitude and epicenter. An earthquake has only one magnitude and one epicenter, but it produces a range of ground shaking at sites throughout the region. This shaking depends on the distance from the earthquake, the rock and soil conditions at sites, and variations in the propagation of seismic waves from the earthquake due to complexities in the structure of the earth's crust. A USGS shake map shows the variation of ground shaking in a region immediately following significant earthquakes. Table 4.3.4-2 displays the MMI scale and its relationship to the area's peak ground acceleration.

Table 4.3.4-1. Modified Mercalli Intensity Scale

Mercalli Intensity	Shaking	Description
I	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.

Mercalli Intensity	Shaking	Description
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X	Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

Source: USGS n.d

Table 4.3.4-2. Modified Mercalli Intensity and PGA Equivalents

Modified Mercalli Intensity	Acceleration (%g) (PGA)	Perceived Shaking	Potential Damage
I	< .17	Not Felt	None
II	.17 – 1.4	Weak	None
III	.17 – 1.4	Weak	None
IV	1.4 – 3.9	Light	None
V	3.9 – 9.2	Moderate	Very Light
VI	9.2 – 18	Strong	Light
VII	18 – 34	Very Strong	Moderate
VIII	34 – 65	Severe	Moderate to Heavy
IX	65-124	Violent	Heavy
X	>124	Extreme	Very Heavy

Source: Freeman et al. (Purdue University) 2004

Note: PGA Peak Ground Acceleration

The ground experiences acceleration as it shakes during an earthquake. The peak ground acceleration (PGA) is a measure of how hard the earth shakes in a given geographic area. It is expressed as a percentage of the acceleration due to gravity (percent g). Horizontal and vertical PGA varies with soil or rock type. Earthquake hazard assessment involves estimating the annual probability that certain ground accelerations will be exceeded, and then summing the annual probabilities over a period of interest. Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures.

PGA expresses the severity of an earthquake and is a measure of how hard the earth shakes, or accelerates, in a given geographic area. PGA is expressed as a percent acceleration force of gravity (%g). For example, 1.0%g PGA in an earthquake (an extremely strong ground motion) means that objects accelerate sideways at the same rate as if they had been dropped from the ceiling. 10%g PGA means that the ground acceleration is 10% that of gravity (USGS 2019). Damage levels experienced in an earthquake vary with the intensity of ground shaking and with the seismic capacity of structures, as noted in Table 4.3.4-3

Table 4.3.4-3. Damage Levels Experienced in Earthquakes

Ground Motion Percentage	Explanation of Damages
1-2%g	Motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels, if any, are usually very low.
Below 10%g	Usually causes only slight damage, except in unusually vulnerable facilities.
10 - 20%g	May cause minor-to-moderate damage in well-designed buildings, with higher levels of damage in poorly designed buildings. At this level of ground shaking, only unusually poor buildings would be subject to potential collapse.
20 - 50%g	May cause significant damage in some modern buildings and very high levels of damage (including collapse) in poorly designed buildings.
≥50%g	May causes higher levels of damage in many buildings, even those designed to resist seismic forces.

Source: USGS 2019

Note: %g Peak Ground Acceleration

As seen on the following Figure 4.3.4-2, the 250-year earthquake event for Franklin County has a ground motion percentage between 1.4 and 3.9, meaning the ground motions are widely felt by people; hanging plants and lamps swing strongly, but damage levels would be low or slight. Similarly, Figure 4.3.4-3 displays the 1,000-year earthquake even for Franklin County, which has a ground motion percentage between 3.9 and 9.2, meaning the ground motions are widely felt by people; hanging plants and lamps swing strongly; and damage levels would be slight, except in unusually vulnerable facilities.

Figure 4.3.4-2. 250-year Earthquake in Franklin County

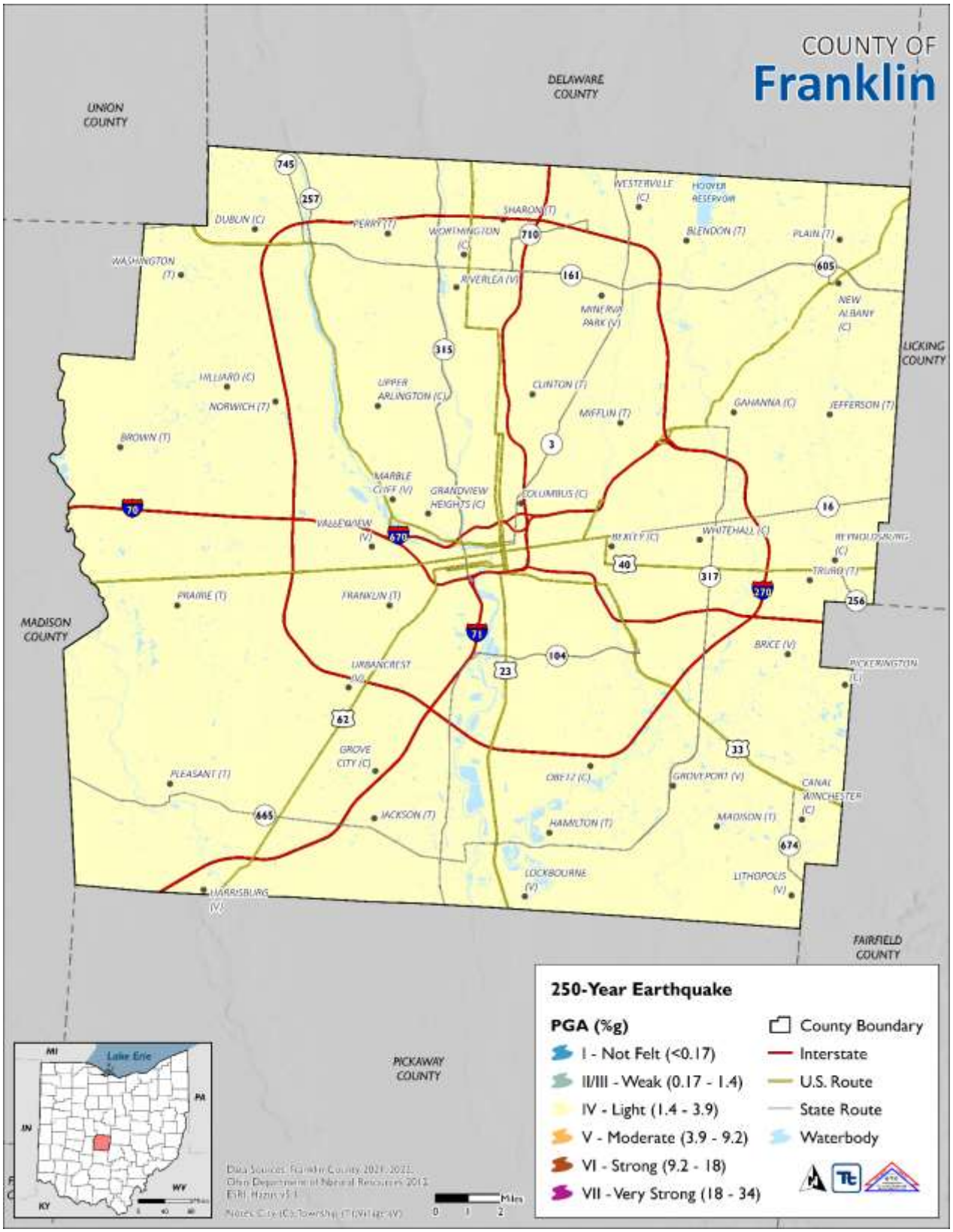
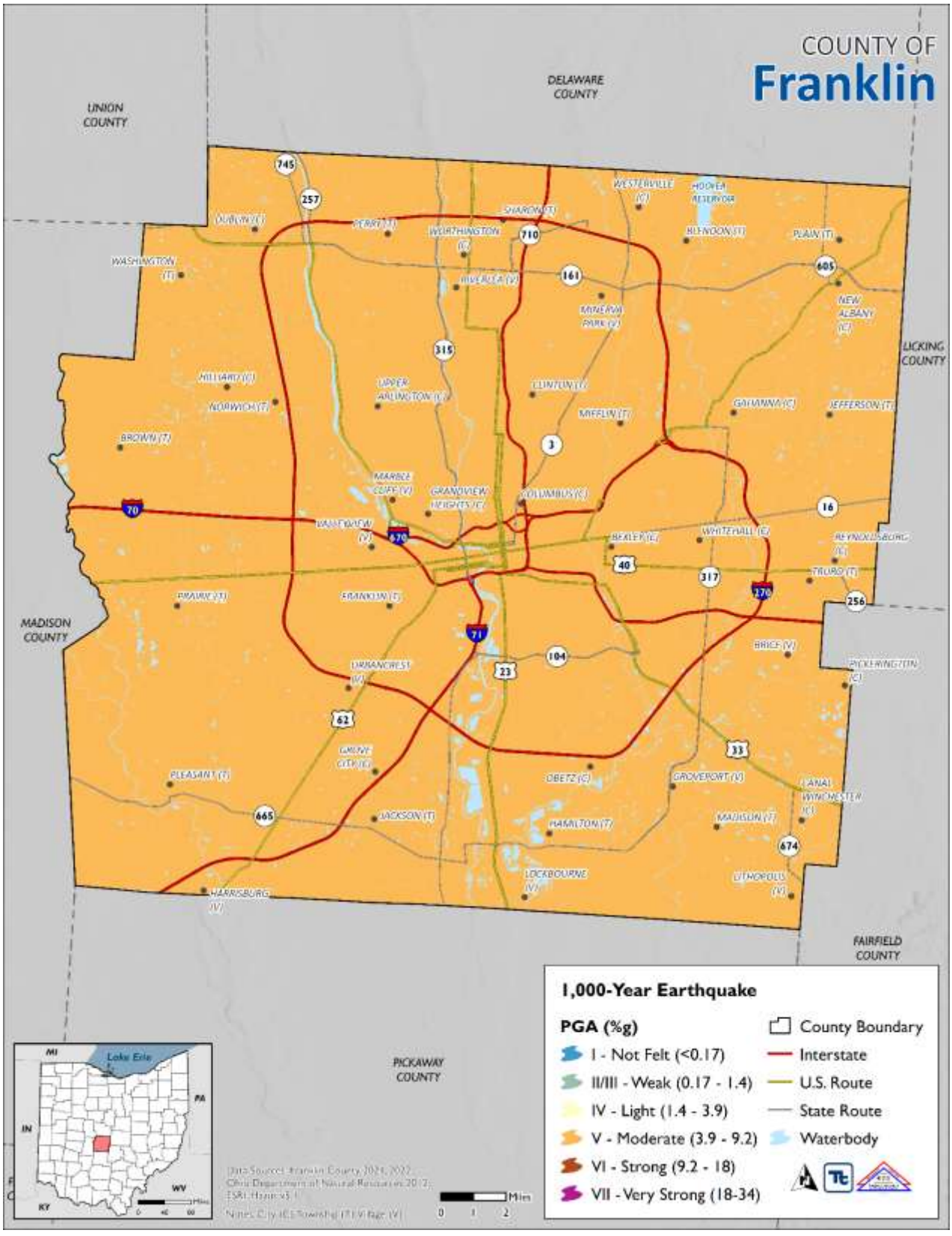
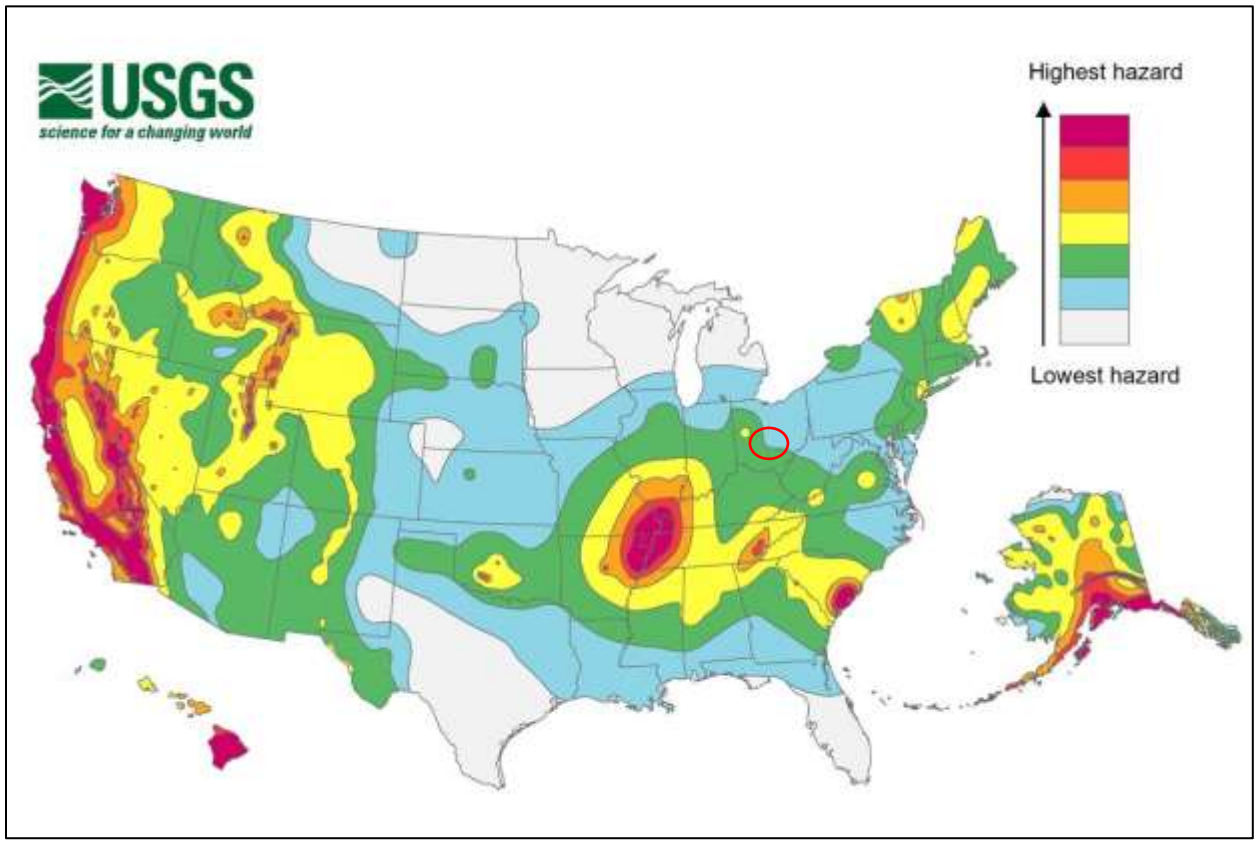


Figure 4.3.4-3. 1,000-year Earthquake in Franklin County



National maps of earthquake-shaking hazards provide information for creating and updating seismic design requirements for building codes, insurance rate structures, earthquake loss studies, retrofit priorities, and land use planning. After thorough review of the studies, professional organizations of engineers update the seismic-risk maps and seismic design requirements contained in building codes (Brown 2001). The USGS updated the National Seismic Hazard Maps in 2018. New seismic, geologic, and geodetic information on earthquake rates and associated ground shaking were incorporated into these revised maps. The 2018 map represents the best available data, as determined by the USGS.

Figure 4.3.4-4. 2018 Long-Term National Seismic Hazard Maps



Note: Red circle shows the approximate location of Franklin County, OH
Source: USGS 2018

The NEHRP developed five soil classifications defined by their shear-wave velocity that impact the severity of an earthquake. The soil classification system ranges from Class A to Class E, as noted in Table 4.3.4-4, where Class A represents hard rock that reduces ground motions from an earthquake and Class E represents soft soils that amplify and magnify ground shaking and increase building damage and losses. Class E soils include water-saturated mud and artificial fill. The strongest amplification of shaking due is expected for this soil type. Seismic waves travel faster through hard rock than through softer rock and sediments. As the waves pass from harder to softer rocks, the waves slow down, and their amplitude increases. Shaking tends to be stronger at locations with softer surface layers where seismic waves move

more slowly. Ground motion above an unconsolidated landfill or soft soils can be more than 10 times stronger than at neighboring locations on rock for small ground motions (FEMA 2013).

Table 4.3.4-4. NEHRP Soil Classifications

Soil Classification	Description
A	Hard rock
B	Rock
C	Very dense soil and soft rock
D	Stiff soils
E	Soft soils

Source: FEMA 2013

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was not included in any disaster (DR) or emergency (EM) declarations for earthquake-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

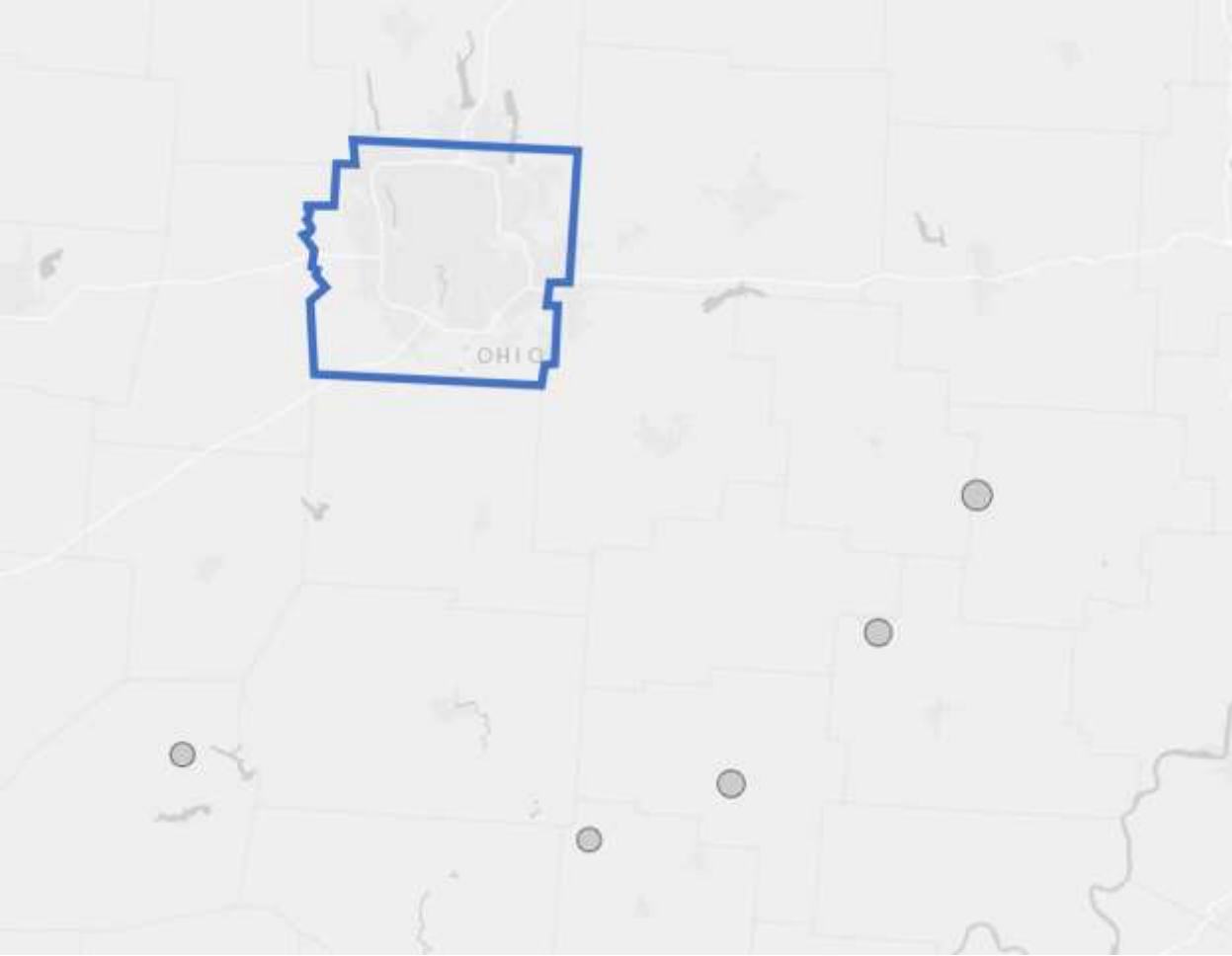
The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2018 and 2022, Franklin County was not included in any earthquake-related agricultural disaster declarations.

Previous Events

There have been no recorded earthquake epicenters in Franklin County. Earthquake movement has been felt in the county from epicenters in other parts of Ohio; however, no damage has been reported. The brief historic record of Ohio earthquakes suggests an approximately magnitude 5 earthquake is the maximum event for the state. Earthquakes would most likely happen in the western seismic zone, or in northeastern Ohio, with a lesser possibility in southeastern Ohio. Such earthquakes would be expected to cause little or no damage in Franklin County. It has been estimated that even a large earthquake in the New Madrid Seismic Zone would only cause slight damage in Franklin County.

For the 2023 HMP update, there were no known earthquake events that impacted Franklin County between 2018 and 2022. Figure 4.3.4-5 describes earthquake epicenters in Ohio between 1950 and 2022. None of the events were reported to be felt in Franklin County.

Figure 4.3.4-5. Earthquake Epicenters in Ohio, 1950 to 2022



Source: USGS 2022
Note: Franklin County is outlined in blue.

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of earthquake events for the County. Information from USGS Earthquake Hazards Program, the 2019 State of Ohio HMP, and the 2018 Franklin County HMP were used to identify the number of earthquake events that occurred between 1954 and 2022. Table 4.3.4-5 presents the probability of future events for earthquakes in Franklin County.

Table 4.3.4-5. Probability of Future Earthquake Events

Hazard Type	Number of Occurrences Between 1954 and 2022	% Chance of Occurring in Any Given Year
Earthquake	0	0%

Sources: USGS 2022; State of Ohio 2019; Franklin County 2018

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical

records and input from the Planning Team, the probability of occurrence for earthquakes in the County is considered 'rare'.

Climate Change Impacts

The impacts of global climate change on earthquake probability are unknown. Some scientists say that melting glaciers could induce tectonic activity. As ice melts and water runs off, tremendous amounts of weight are shifted on the earth's crust. As newly freed crust returns to its original, pre-glacier shape, it could cause seismic plates to slip and stimulate volcanic activity according to research into prehistoric earthquakes and volcanic activity. NASA and USGS scientists found that retreating glaciers in southern Alaska may be opening the way for future earthquakes (NASA 2004).

The secondary impacts of earthquakes could be magnified by climate change. Soils saturated by repetitive storms could experience liquefaction during seismic activity due to the increased saturation. Dams storing increased volumes of water due to changes in the hydrograph could fail during seismic events. There are currently no models available to estimate these impacts.

Vulnerability Assessment

A probabilistic assessment was conducted for the 100-year, 250-year, and 1,000-year Mean Return Period (MRP) events through a Level 2 analysis in Hazus v5.1 to analyze the earthquake hazard and provide a range of loss estimates. Refer to Section 4.2 (Methodology and Tools) for additional details on the methodology used to assess earthquake risk.

Impact on Life, Health, and Safety

The entire County may experience an earthquake. However, the degree of impact is dependent on many factors including the age and type of construction people live in, the soil types their homes are located on, and the intensity of the earthquake. Whether directly or indirectly impacted, residents could be faced with business closures, road closures that could isolate populations, and loss of function of critical facilities and utilities.

According to the 2020 decennial population estimates, Franklin County had a population of 1,323,807 people. Overall, risk to public safety and loss of life from an earthquake in the County is minimal for low magnitude events. However, there is a higher risk to public safety for those inside buildings due to structural damage or people walking below building ornamentations and chimneys that may be shaken loose and fall because of an earthquake.

As a result of a significant earthquake event, residents may be displaced or require temporary to long-term sheltering. The number of people requiring shelter is generally less than the number displaced as some displaced persons use hotels or stay with family or friends following a disaster event. Hazus estimates that there will be zero displaced households and zero persons seeking short-term sheltering caused by the 100-year MRP event. Table 4.3.4-6 summarizes the estimated number of displaced households and persons seeking short-term sheltering caused by the 250-year and 1,000-year MRP events. The results indicate no household will be displaced and no persons will seek short-term sheltering.

Table 4.3.4-6. Estimated Displaced Households and Number of Persons Requiring Sheltering

Jurisdiction	250-Year Mean Return Period Earthquake Event		1,000-Year Mean Return Period Earthquake Event	
	Displaced Households	Persons Seeking Short-Term Sheltering	Displaced Households	Persons Seeking Short-Term Sheltering
Bexley (C)	0	0	0	0
Blendon (T)	0	0	0	0
Brice (V)	0	0	0	0
Brown (T)	0	0	0	0
Canal Winchester (C)	0	0	0	0
Clinton (T)	0	0	0	0
Columbus (C)	0	0	0	0
Dublin (C)	0	0	0	0
Franklin (T)	0	0	0	0
Gahanna (C)	0	0	0	0
Grandview Heights (C)	0	0	0	0
Grove City (C)	0	0	0	0
Groveport (V)	0	0	0	0
Hamilton (T)	0	0	0	0
Harrisburg (V)	0	0	0	0
Hilliard (C)	0	0	0	0
Jackson (T)	0	0	0	0
Jefferson (T)	0	0	0	0
Lithopolis (V)	0	0	0	0
Lockbourne (V)	0	0	0	0
Madison (T)	0	0	0	0
Marble Cliff (V)	0	0	0	0
Mifflin (T)	0	0	0	0
Minerva Park (V)	0	0	0	0
New Albany (C)	0	0	0	0
Norwich (T)	0	0	0	0
Obetz (C)	0	0	0	0
Perry (T)	0	0	0	0
Pickerington (C)	0	0	0	0
Plain (T)	0	0	0	0
Pleasant (T)	0	0	0	0
Prairie (T)	0	0	0	0
Reynoldsburg (C)	0	0	0	0
Riverlea (V)	0	0	0	0
Sharon (T)	0	0	0	0
Truro (T)	0	0	0	0
Upper Arlington (C)	0	0	0	0
Urbancrest (V)	0	0	0	0
Valleyview (V)	0	0	0	0
Washington (T)	0	0	0	0
Westerville (C)	0	0	0	0
Whitehall (C)	0	0	0	0
Worthington (C)	0	0	0	0
Franklin County (Total)	**0**	**0**	**0**	**0**

Sources: Hazus v5.1

A strong correlation exists between structural building damage and number of injuries and casualties from an earthquake event. Further, the time of day also exposes different sectors of the community to the hazard. For example, Hazus considers the residential occupancy at its maximum at 2:00 a.m., where the educational, commercial, and industrial sectors are at their maximum at 2:00 p.m., with peak commute time at 5:00 p.m. Whether directly impacted or indirectly impact, the entire population will have to deal with the consequences of earthquakes to some degree. Business interruption could prevent people from working, road closures could isolate populations, and loss of functions of utilities could impact populations that suffered no direct damage from an event itself. Overall, Hazus estimates that there are no injuries or casualties caused by the 100-year MRP event. Table 4.3.4-7 and Table 4.3.4-8 summarize the estimated number of injuries or casualties caused by the 250-year and 1,000-year MRP events.

Table 4.3.4-7. Estimated Number of Injuries and Casualties Caused by the 250-Year MRP Earthquake Event

Level of Severity	Time of Day - 250-year		
	2:00 AM	2:00 PM	5:00 PM
Injuries	3	84	56
Hospitalization	0	9	6
Casualties	0	1	1

Sources: Hazus v5.1

Table 4.3.4-8. Estimated Number of Injuries and Casualties Caused by the 1,000-Year MRP Earthquake Event

Level of Severity	Time of Day – 1,000 year		
	2:00 AM	2:00 PM	5:00 PM
Injuries	21	465	310
Hospitalization	2	68	46
Casualties	0	10	7

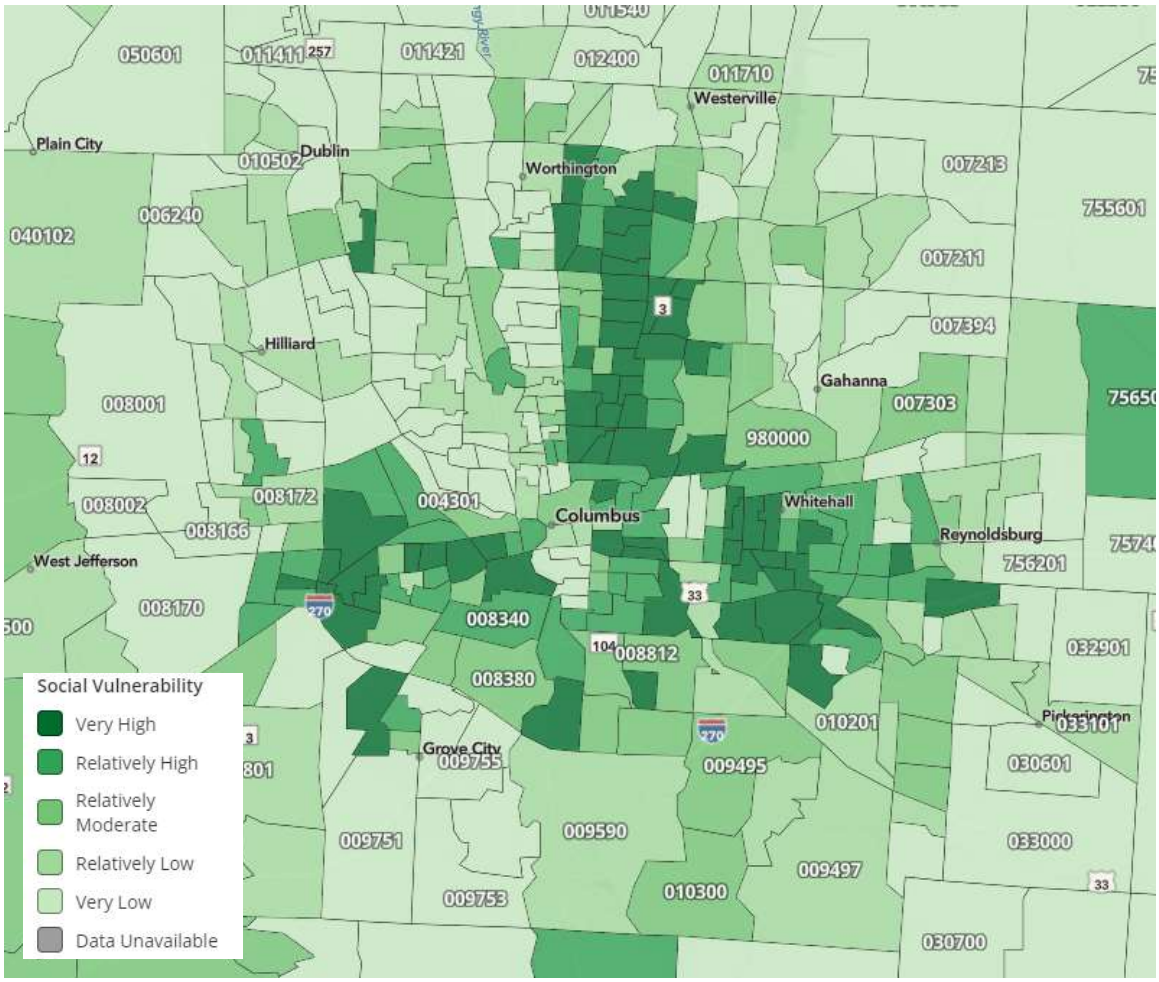
Sources: Hazus v5.1

Social Vulnerability

According to FEMA's National Risk Index, socially vulnerable populations in Franklin County have a relatively high susceptibility to the adverse impacts of earthquakes, when compared to the rest of the United States (FEMA n.d.).

Populations considered most vulnerable are those located in/near the built environment, particularly those near unreinforced masonry construction. Factors leadings to this higher susceptibility include decreased mobility and financial ability to react or respond during a hazard, and the location and construction quality of their housing. According to the 5-Year 2021 American Community Survey Population Estimates, there are 188,900 (12.4% of the County's total population) persons over 65 and 195,988 (12.9% of the County's total population) persons living in poverty in Franklin County. Refer to Figure 4.3.4-6 for the social vulnerability index for the earthquake hazard.

Figure 4.3.4-6. FEMA Social Vulnerability Index for Earthquake



Source: FEMA NRI

Impact on General Building Stock

The entire County's general building stock is considered at risk and exposed to this hazard. A building's construction determines how well it can withstand the force of an earthquake. Unreinforced masonry buildings are most at risk during an earthquake because the walls are prone to collapse outward, whereas steel and wood buildings absorb more of the earthquake's energy. Additional attributes that affect a building's capability to withstand an earthquake's force include its age, number of stories, and quality of construction. Hazus considers building construction and age of building as part of the analysis. Because a custom general building stock was used for this Hazus analysis, the building ages and building types from the inventory were incorporated into the Hazus model.

Potential building damage was evaluated by Hazus across the following damage categories: none, slight, moderate, extensive, and complete. Table 4.3.4-9 provides definitions of these five categories of damage for a light wood-framed building. Definitions for other building types are included in the Hazus technical manual documentation.

Table 4.3.4-9. Example of Structural Damage State Definitions for a Light Wood-Framed Building

Damage Category	Description
Slight	Small plaster or gypsum-board cracks at corners of door and window openings and wall-ceiling intersections; small cracks in masonry chimneys and masonry veneer.
Moderate	Large plaster or gypsum-board cracks at corners of door and window openings; small diagonal cracks across shear wall panels exhibited by small cracks in stucco and gypsum wall panels; large cracks in brick chimneys; toppling of tall masonry chimneys.
Extensive	Large diagonal cracks across shear wall panels or large cracks at plywood joints; permanent lateral movement of floors and roof; toppling of most brick chimneys; cracks in foundations; splitting of wood sill plates and/or slippage of structure over foundations; partial collapse of room-over-garage or other soft-story configurations.
Complete	Structure may have large permanent lateral displacement, may collapse, or be in imminent danger of collapse due to cripple wall failure or the failure of the lateral load resisting system; some structures may slip and fall off the foundations; large foundation cracks.

Sources: FEMA 2020

Building damage as a result of the 100-year, 500-year, and 2,500-year MRP earthquakes were estimated for each municipality using Hazus. Hazus estimates that zero damages will occur to buildings or contents during the 100-year MRP event. Table 4.3.4-10 and Table 4.3.4-11 summarize estimated total building and content losses caused by the 250-year and 1,000-year MRP events by jurisdiction, respectively. These tables also summarize losses for structures categorized as residential, commercial, and all other occupancy classes. Less than one percent of the County's structures are impacted by the 250-year MRP event (i.e., approximately $29 million in replacement cost value) and less than one percent of the County's structures are impacted by the 1,000-year MRP event (i.e., $257 million in replacement cost value). Majority of the losses are estimated to occur in the Town of Hamilton.

Table 4.3.4-10. Estimated Building Damages (Structure and Contents) from the 250-year MRP Earthquake Event

		Franklin County 250-Year Mean Return Period				
Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Total Damage	Percent of Total Replacement Cost	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damaged for All Other Occupancies
Bexley (C)	$2,908,655,863	$495,159	<0.1%	$118,058	$131,026	$246,075
Blendon (T)	$1,413,412,606	$81,127	<0.1%	$32,913	$23,369	$24,845
Brice (V)	$101,696,013	$7,055	<0.1%	$1,082	$5,327	$646
Brown (T)	$615,217,276	$97,138	<0.1%	$33,917	$949	$62,272
Canal Winchester (C)	$2,664,295,038	$232,102	<0.1%	$83,135	$59,965	$89,002
Clinton (T)	$1,407,647,207	$151,047	<0.1%	$19,851	$83,515	$47,681
Columbus (C)	$169,488,966,898	$16,379,831	<0.1%	$3,460,223	$8,361,025	$4,558,583
Dublin (C)	$12,346,217,589	$669,526	<0.1%	$237,243	$311,248	$121,035
Franklin (T)	$2,786,144,235	$253,499	<0.1%	$32,290	$144,955	$76,253
Gahanna (C)	$7,777,120,382	$410,996	<0.1%	$152,364	$143,982	$114,650
Grandview Heights (C)	$864,354,956	$75,579	<0.1%	$20,949	$18,866	$35,764
Grove City (C)	$11,872,349,008	$1,240,896	<0.1%	$249,040	$703,024	$288,833

Jurisdiction	Total Replacement Cost Value (RCV)	Franklin County 250-Year Mean Return Period				
		Estimated Total Damage	Percent of Total Replacement Cost	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damaged for All Other Occupancies
Groveport (V)	$8,015,019,558	$1,087,748	<0.1%	$61,157	$943,368	$83,222
Hamilton (T)	$954,562,909	$1,260,036	0.1%	$24,540	$1,138,239	$97,258
Harrisburg (V)	$59,706,145	$15,774	<0.1%	$2,835	$735	$12,205
Hilliard (C)	$7,685,805,074	$777,617	<0.1%	$284,909	$213,644	$279,063
Jackson (T)	$998,460,101	$126,180	<0.1%	$31,589	$60,152	$34,439
Jefferson (T)	$2,934,483,497	$186,817	<0.1%	$71,053	$50,513	$65,251
Lithopolis (V)	$22,524,552	$3,934	<0.1%	$498	$1,574	$1,862
Lockbourne (V)	$115,362,791	$75,395	0.1%	$1,886	$66,001	$7,508
Madison (T)	$1,551,960,041	$706,384	<0.1%	$76,571	$474,812	$155,002
Marble Cliff (V)	$310,170,408	$10,597	<0.1%	$2,598	$3,441	$4,558
Mifflin (T)	$757,041,007	$99,819	<0.1%	$15,768	$39,477	$44,574
Minerva Park (V)	$347,638,675	$16,611	<0.1%	$8,166	$3,716	$4,729
New Albany (C)	$4,624,598,721	$194,884	<0.1%	$79,609	$74,943	$40,332
Norwich (T)	$592,173,496	$141,993	<0.1%	$45,496	$79,610	$16,887
Obetz (C)	$5,853,753,986	$823,904	<0.1%	$39,690	$715,825	$68,389
Perry (T)	$806,651,425	$39,214	<0.1%	$18,059	$3,505	$17,650
Pickerington (C)	$28,053,589	$1,113	<0.1%	$542	$348	$223
Plain (T)	$421,165,756	$53,659	<0.1%	$17,421	$22,163	$14,076
Pleasant (T)	$1,324,873,614	$254,052	<0.1%	$45,967	$12,673	$195,411
Prairie (T)	$2,583,782,101	$437,452	<0.1%	$133,038	$140,362	$164,052
Reynoldsburg (C)	$4,602,554,954	$399,443	<0.1%	$96,468	$180,741	$122,235
Riverlea (V)	$88,150,926	$18,629	<0.1%	$3,067	$172	$15,389
Sharon (T)	$428,816,971	$32,458	<0.1%	$12,554	$11,752	$8,152
Truro (T)	$198,610,440	$19,940	<0.1%	$9,377	$2,110	$8,453
Upper Arlington (C)	$7,401,370,183	$536,496	<0.1%	$255,553	$69,136	$211,807
Urbancrest (V)	$904,463,260	$82,578	<0.1%	$5,343	$65,705	$11,530
Valleyview (V)	$102,695,732	$48,496	<0.1%	$3,342	$29,065	$16,090
Washington (T)	$197,989,788	$23,202	<0.1%	$8,522	$8,635	$6,046
Westerville (C)	$6,492,226,049	$447,264	<0.1%	$135,527	$81,615	$230,121
Whitehall (C)	$3,811,335,352	$415,111	<0.1%	$96,710	$172,763	$145,639
Worthington (C)	$4,772,399,121	$782,451	<0.1%	$121,487	$393,802	$267,162
Franklin County (Total)	**$283,234,477,288**	**$29,213,206**	**0.01%**	**$6,150,408**	**$15,047,844**	**$8,014,953**

Source: Hazus v5.1; Franklin County 2021; RS Means 2022

Table 4.3.4-11. Estimated Building Damages (Structure and Contents) from the 1,000-year MRP Earthquake Event

Jurisdiction	Total Replacement Cost Value (RCV)	Franklin County 1,000-Year Mean Return Period				
		Estimated Total Damage	Percent of Total Cost Replacement	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damaged for All Other Occupancies
Bexley (C)	$2,908,655,863	$3,608,245	0.1%	$1,332,701	$755,677	$1,519,868

Jurisdiction	Total Replacement Cost Value (RCV)	Franklin County 1,000-Year Mean Return Period				
		Estimated Total Damage	Percent of Total Cost Replacement	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damaged for All Other Occupancies
Blendon (T)	$1,413,412,606	$893,930	0.1%	$438,092	$287,766	$168,072
Brice (V)	$101,696,013	$65,423	0.1%	$12,298	$46,882	$6,244
Brown (T)	$615,217,276	$772,487	0.1%	$348,863	$9,362	$414,261
Canal Winchester (C)	$2,664,295,038	$2,000,167	0.1%	$891,264	$526,426	$582,477
Clinton (T)	$1,407,647,207	$1,223,344	0.1%	$291,432	$591,027	$340,886
Columbus (C)	$169,488,966,898	$146,239,638	0.1%	$43,170,683	$71,087,580	$31,981,374
Dublin (C)	$12,346,217,589	$7,403,093	0.1%	$3,154,486	$3,278,952	$969,655
Franklin (T)	$2,786,144,235	$2,284,096	0.1%	$431,198	$1,274,486	$578,412
Gahanna (C)	$7,777,120,382	$4,793,569	0.1%	$2,079,331	$1,833,431	$880,806
Grandview Heights (C)	$864,354,956	$715,791	0.1%	$296,392	$181,754	$237,645
Grove City (C)	$11,872,349,008	$10,871,538	0.1%	$3,087,784	$5,860,561	$1,923,193
Groveport (V)	$8,015,019,558	$7,817,514	0.1%	$635,475	$6,625,667	$556,373
Hamilton (T)	$954,562,909	$9,367,028	1.0%	$273,380	$8,400,842	$692,806
Harrisburg (V)	$59,706,145	$111,685	0.2%	$32,053	$6,112	$73,520
Hilliard (C)	$7,685,805,074	$7,404,128	0.1%	$3,202,877	$2,147,842	$2,053,410
Jackson (T)	$998,460,101	$1,108,780	0.1%	$384,970	$498,458	$225,352
Jefferson (T)	$2,934,483,497	$1,921,047	0.1%	$972,350	$484,322	$464,375
Lithopolis (V)	$22,524,552	$29,375	0.1%	$5,442	$12,201	$11,733
Lockbourne (V)	$115,362,791	$562,018	0.5%	$20,748	$488,527	$52,743
Madison (T)	$1,551,960,041	$5,340,179	0.3%	$820,139	$3,561,697	$958,343
Marble Cliff (V)	$310,170,408	$99,021	<0.1%	$36,606	$33,277	$29,139
Mifflin (T)	$757,041,007	$885,802	0.1%	$199,758	$373,752	$312,292
Minerva Park (V)	$347,638,675	$194,865	0.1%	$116,008	$47,952	$30,905
New Albany (C)	$4,624,598,721	$2,311,442	0.0%	$1,093,051	$915,330	$303,061
Norwich (T)	$592,173,496	$1,264,359	0.2%	$498,589	$644,734	$121,036
Obetz (C)	$5,853,753,986	$6,282,396	0.1%	$421,946	$5,345,932	$514,518
Perry (T)	$806,651,425	$455,931	0.1%	$278,482	$50,492	$126,958
Pickerington (C)	$28,053,589	$10,620	0.0%	$5,881	$3,267	$1,471
Plain (T)	$421,165,756	$558,705	0.1%	$219,081	$241,810	$97,813
Pleasant (T)	$1,324,873,614	$1,801,425	0.1%	$519,123	$104,712	$1,177,590
Prairie (T)	$2,583,782,101	$3,766,922	0.1%	$1,448,224	$1,210,999	$1,107,699
Reynoldsburg (C)	$4,602,554,954	$3,441,952	0.1%	$1,315,505	$1,369,299	$757,148
Riverlea (V)	$88,150,926	$138,531	0.2%	$43,549	$890	$94,093
Sharon (T)	$428,816,971	$373,075	0.1%	$184,292	$130,453	$58,329
Truro (T)	$198,610,440	$166,197	0.1%	$100,585	$18,545	$47,067
Upper Arlington (C)	$7,401,370,183	$5,231,789	0.1%	$3,118,985	$767,621	$1,345,183
Urbancrest (V)	$904,463,260	$609,661	0.1%	$61,524	$472,858	$75,279
Valleyview (V)	$102,695,732	$424,762	0.4%	$48,022	$243,405	$133,335
Washington (T)	$197,989,788	$247,719	0.1%	$100,823	$102,844	$44,052
Westerville (C)	$6,492,226,049	$4,383,859	0.1%	$1,879,669	$967,011	$1,537,179
Whitehall (C)	$3,811,335,352	$3,791,677	0.1%	$1,061,261	$1,829,870	$900,546
Worthington (C)	$4,772,399,121	$6,040,113	0.1%	$1,402,398	$2,903,405	$1,734,311

Jurisdiction	Total Replacement Cost Value (RCV)	Franklin County 1,000-Year Mean Return Period				
		Estimated Total Damage	Percent of Total Cost Replacement	Estimated Residential Damage	Estimated Commercial Damage	Estimated Damaged for All Other Occupancies
Franklin County (Total)	**$283,234,477,288**	**$257,013,898**	**0.1%**	**$76,035,319**	**$125,738,029**	**$55,240,551**

Source: Hazus v5.1; Franklin County 2021; RS Means 2022

Historically, Building Officials Code Administration (BOCA) regulations in the Midwest states were developed to address local concerns, including heavy snow loads and wind. Seismic requirements for design criteria are not as stringent as those of the west coast of the United States, which rely on the more seismically focused Uniform Building Code. As such, a smaller earthquake in the Midwest can cause more structural damage than if it would occur in the west.

Impact on Critical Facilities and Community Lifelines

Earthquakes have the potential to interrupt utilities which may impact water and power utilities which may impact public and private use, as well as cause disruption to critical infrastructure. Water and wastewater utilities are vulnerable to earthquakes as there are extensive networks of above and below ground pipelines, pump stations, tanks, administrative and laboratory buildings, reservoirs, chemical storage, and treatment facilities. For a drinking water system, an earthquake can cause breaks in water pipelines, ruptures in storage and process tanks and the collapse of buildings. This can cause a loss of water system pressure, contamination, and drinking water service disruptions for consumers. A wastewater system can expect infrastructure damage from an earthquake, including breaks in the collection system. Sewers and wastewater treatment plants tend to be built on ground which is subject to liquefaction. Damage can lead to sewage backups in homes and potential releases of untreated sewage into the environment (US EPA 2018).

Earthquakes can cause severe damage to critical electrical facilities such as substations, hydroelectric infrastructures as well as transmission, distribution, and communication systems. Without proper mitigation measures to reduce the impact of an earthquake, the effects could create large-scale power outages that could take weeks to restore. Lack of power can affect pipelines supplying fuels and natural gas, as well as other products, interrupting the delivery of goods needed for short- and long-term recovery.

All critical facilities and lifelines in Franklin County are considered exposed to the earthquake hazard. Refer to subsection "Critical Facilities and Lifelines" in Section 3 (County Profile) of this HMP for a complete inventory of critical facilities in Franklin County.

The Hazus earthquake model was used to assign the range or average probability of each damage state category to the critical facilities in Franklin County for the 250-year and 1,000-year MRP events. In addition, Hazus estimates the time to restore critical facilities to fully functional use. Results are presented as a probability of being functional at specified time increments (days after the event). For example,

Hazus might estimate that a facility has 5% chance of being fully functional at Day 3, and a 95% chance of being fully functional at Day 90. For percent probability of sustaining damage, the minimum and maximum damage estimated value for that facility type is presented.

As a result of a 250-year MRP event, Hazus estimates that 4 critical facilities will incur severe damages. However, for the 1,000-year MRP event, 29 critical facilities are estimated to incur severe damages, with 2 critical facilities facing destruction. Table 4.3.4-12 and Table 4.3.4-13 summarize the damage state probabilities for critical facilities during the 250-year and 1,000-year MRP events, respectively.

Table 4.3.4-12. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Franklin County for the 250-Year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 250-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	333,050	None	332,406	99.8%
		Minor	626	0.2%
		Moderate	19	<0.1%
		Severe	0	<0.1%
		Destruction	0	0.0%
Commercial Buildings	13,515	None	13,407	99.2%
		Minor	92	0.7%
		Moderate	14	0.1%
		Severe	1	<0.1%
		Destruction	0	<0.1%
Industrial Buildings	737	None	718	97.4%
		Minor	14	1.9%
		Moderate	5	0.6%
		Severe	0	<0.1%
		Destruction	0	0.0%
Government, Religion, Agricultural, and Education Buildings	3,201	None	3,106	97.0%
		Minor	70	2.2%
		Moderate	23	0.7%
		Severe	3	0.1%
		Destruction	0	<0.1%

Sources: Hazus v5.1

Table 4.3.4-13. Estimated Damage and Loss of Functionality for Critical Facilities and Utilities in Franklin County for the 1,000-Year MRP Earthquake Event

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 1,000-Year	
			Building Count	Percent Buildings in Occupancy Class
Residential Exposure (Single and Multi-Family Dwellings)	333,050	None	327,354	98.3%
		Minor	5,212	1.6%
		Moderate	483	0.1%
		Severe	1	<0.1%
		Destruction	0	<0.1%
Commercial Buildings	13,515	None	13,001	96.2%
		Minor	429	3.2%

Occupancy Class	Total Number of Buildings in Occupancy	Severity of Expected Damage	Earthquake 1,000-Year	
			Building Count	Percent Buildings in Occupancy Class
		Moderate	75	0.6%
		Severe	10	0.1%
		Destruction	1	<0.1%
Industrial Buildings	737	None	668	90.7%
		Minor	46	6.2%
		Moderate	20	2.7%
		Severe	3	0.4%
		Destruction	0	<0.1%
Government, Religion, Agricultural, and Education Buildings	3,201	None	2,875	89.8%
		Minor	216	6.8%
		Moderate	93	2.9%
		Severe	15	0.5%
		Destruction	1	<0.1%

Sources: Hazus v5.1

Impact on the Economy

Earthquakes also have impacts on the economy, including loss of business function, damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings. Hazus estimates building-related economic losses, including income losses (wage, rental, relocation, and capital-related losses) and capital stock losses (structural, non-structural, content, and inventory losses). Economic losses estimated by Hazus are summarized in Table 4.3.4-14.

Table 4.3.4-14. Economic Losses for Earthquake Mean Return Period Events

Mean Return Period (MRP)	Inventory Loss	Relocation Loss	Wages Losses	Rental Losses	Capital-Related Loss
250-year	$74,100	$4,821,200	$15,971,200	$2,002,100	$1,940,200
1,000-year	$1,555,500	$27,257,000	$124,672,500	$10,549,300	$11,622,800

Sources: Hazus v5.1
Notes: Values are in the millions

Although the Hazus analysis did not compute damage estimates for individual roadway segments and railroad tracks, assumedly these features would undergo damage due to ground failure, resulting in interruptions of regional transportation and of distribution of materials. Losses to the community that would result from damage to lifelines could exceed costs of repair.

Earthquake events can also significantly affect road bridges, many of which provide the only access to certain neighborhoods. Because softer soils generally follow floodplain boundaries, bridges that cross watercourses should be considered vulnerable. Another key factor in degree of vulnerability is age of facilities and infrastructure, which correlates with standards in place at times of construction.

Hazus also estimates the volume of debris that may be generated as a result of an earthquake event to enable the study region to prepare and rapidly and efficiently manage debris removal and disposal.

Debris estimates are divided into two categories: (1) reinforced concrete and steel that require special equipment to break it up before it can be transported, and (2) brick, wood, and other debris that can be loaded directly onto trucks with bulldozers (FEMA 2020).

For the 250-year and 1,000-year MRP events, Hazus estimates a total of 24,661 tons and 122,981 tons of debris will be generated county-wide, respectively. Table 4.3.4-15 summarizes the estimated debris generated as a result of these events by municipality.

Table 4.3.4-15. Estimated Debris Generated by the 250-Year and 1,000-Year MRP Earthquake Events

Jurisdiction	Estimated Debris Created During the 250-Year Mean Return Period Earthquake Event		Estimated Debris Created During the 1,000-Year Mean Return Period Earthquake Event	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Bexley (C)	299	111	1,225	550
Blendon (T)	38	5	188	37
Brice (V)	5	1	27	5
Brown (T)	63	8	291	54
Canal Winchester (C)	143	18	643	115
Clinton (T)	99	43	434	230
Columbus (C)	11,216	2,541	51,837	16,172
Dublin (C)	221	110	1,204	634
Franklin (T)	228	31	1,056	211
Gahanna (C)	180	57	1,304	417
Grandview Heights (C)	59	7	270	49
Grove City (C)	936	152	4,651	1,063
Groveport (V)	1,063	138	4,899	888
Hamilton (T)	1,290	153	6,407	1,087
Harrisburg (V)	14	2	60	12
Hilliard (C)	428	85	2,137	577
Jackson (T)	81	18	397	121
Jefferson (T)	113	20	595	144
Lithopolis (V)	4	0	17	3
Lockbourne (V)	78	9	386	66
Madison (T)	643	79	3,069	534
Marble Cliff (V)	7	1	34	6
Mifflin (T)	85	12	379	78
Minerva Park (V)	7	1	36	5
New Albany (C)	85	10	469	81
Norwich (T)	31	39	170	237
Obetz (C)	823	102	4,030	720
Perry (T)	19	2	107	18
Pickerington (C)	1	0	3	1
Plain (T)	27	6	134	38
Pleasant (T)	229	29	964	187
Prairie (T)	260	56	1,220	354
Reynoldsburg (C)	246	69	1,156	374
Riverlea (V)	17	2	70	14
Sharon (T)	12	3	66	17

Jurisdiction	Estimated Debris Created During the 250-Year Mean Return Period Earthquake Event		Estimated Debris Created During the 1,000-Year Mean Return Period Earthquake Event	
	Brick/Wood (tons)	Concrete/Steel (tons)	Brick/Wood (tons)	Concrete/Steel (tons)
Truro (T)	11	1	46	8
Upper Arlington (C)	256	41	1,216	259
Urbancrest (V)	82	11	375	71
Valleyview (V)	54	6	262	44
Washington (T)	12	2	56	10
Westerville (C)	327	43	1,471	293
Whitehall (C)	202	51	912	328
Worthington (C)	391	202	1,629	971
Franklin County (Total)	20,384	4,277	95,900	27,081

Source: Hazus v5.1

Impact on the Environment

According to USGS, earthquakes can cause damage to the surface of the Earth in various forms depending on the magnitude and distribution of the event (USGS n.d.). Surface faulting is one of the major seismic components to earthquakes that can create wide ruptures in the ground. Ruptures can have a direct impact on the landscape and natural environment because it can disconnect habitats for miles isolating animal species or tear apart plant roots.

Furthermore, ground failure as a result of soil liquefaction can have an impact on soil pores and retention of water resources (USGS n.d.). The greater the seismic activity and liquefaction properties of the soil, the more likely drainage of groundwater can occur which depletes groundwater resources. In areas where there is higher pressure of groundwater retention, the pores can build up more pressure and make soil behave more like a fluid rather than a solid increasing risk of localized flooding and deposition or accumulation of silt.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development;
- Projected changes in the population; and
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

As discussed and illustrated in Section 3 (County Profile), areas targeted for future growth and development have been identified across the County. Development built in areas with softer NEHRP soil classes, liquefaction, and landslide-susceptible areas may experience shifting or cracking in the

foundation during earthquakes because of the loose soil characteristics of these soil classes. However, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built to lower construction standards. Refer to Section 3, and Volume II Section 9 for more information about the potential new development in Franklin County.

Project Changes in Population

According to the 2021 American Community Survey 5-year population estimates, the population of the County has increased by approximately 13.7-percent since 2010. Persons that move into older buildings may increase their overall vulnerability to earthquakes. As noted earlier, if moving into new construction, current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts.

Climate Change

Because the impacts of climate change on earthquakes are not well understood, a change in the County's vulnerability as the climate continues to change is difficult to determine. However, climate change has the potential to magnify secondary impacts of earthquakes. As a result of the climate change projections discussed above, County's assets located on areas of saturated soils and on or at the base of steep slopes, are at a higher risk of landslides/mudslides because of seismic activity.

Change of Vulnerability Since 2018 HMP

Since the 2018 HMP, updated inventory data has become available to assess the earthquake in Franklin County. This data includes the 5-Year 2021 American Community Survey population estimates, updated 2021 tax assessor parcel data, 2021 general building stock data provided by the County, 2022 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Team members. Hazus v5.1 was also used to assess the losses in the County to the earthquake 100-year, 250-year and 1,000-year mean return period events. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the earthquake hazard.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.5 Extreme Temperature

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the extreme temperature hazard in Franklin County.

Hazard Profile

This section provides a profile and vulnerability assessment of the extreme temperatures hazard for Franklin County.

Hazard Description

Extreme temperature includes both heat and cold events, which can have a significant impact to human health, commercial/agricultural businesses, and primary and secondary effects on infrastructure (such as burst pipes and power failure). What constitutes "extreme cold" or "extreme heat" can vary across different areas of the country, based on the population's experience.

Extreme Cold

Extreme cold events occur when temperatures drop well below normal in an area. For example, near-freezing temperatures are considered "extreme cold" in regions relatively unaccustomed to winter weather. Conversely, "extreme cold" might be used to describe temperatures below 0° F in regions that are subjected to temperatures below freezing on more of a regular basis. For the purposes of this HMP, extreme cold temperatures are characterized when the ambient air temperature drops to approximately 0 degrees Fahrenheit (ºF) or below (National Weather Service n.d.). Extensive exposure to extreme cold temperatures can cause frostbite or hypothermia and can become life-threatening. Extreme cold also can cause emergencies in susceptible populations, such as those without shelter, those who are stranded, or those who live in a home that is poorly insulated or without heat (such as mobile homes). Infants and the elderly are most susceptible to the effects of extreme changes in temperatures and are particularly at risk, but anyone can be affected (CDC 2012).

Several health hazards are related to extreme cold temperatures and include wind chill, frostbite, and hypothermia:

- **Wind chill** is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.

- **Frostbite** is damage to body tissue caused by extreme cold. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite can cause a loss of feeling and a white or pale appearance in extremities.
- **Hypothermia** is a condition brought on when the body temperature drops to less than 95°F, and it can be deadly. Warning signs of hypothermia include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion (Mayo Clinic 2022).

Extreme Heat

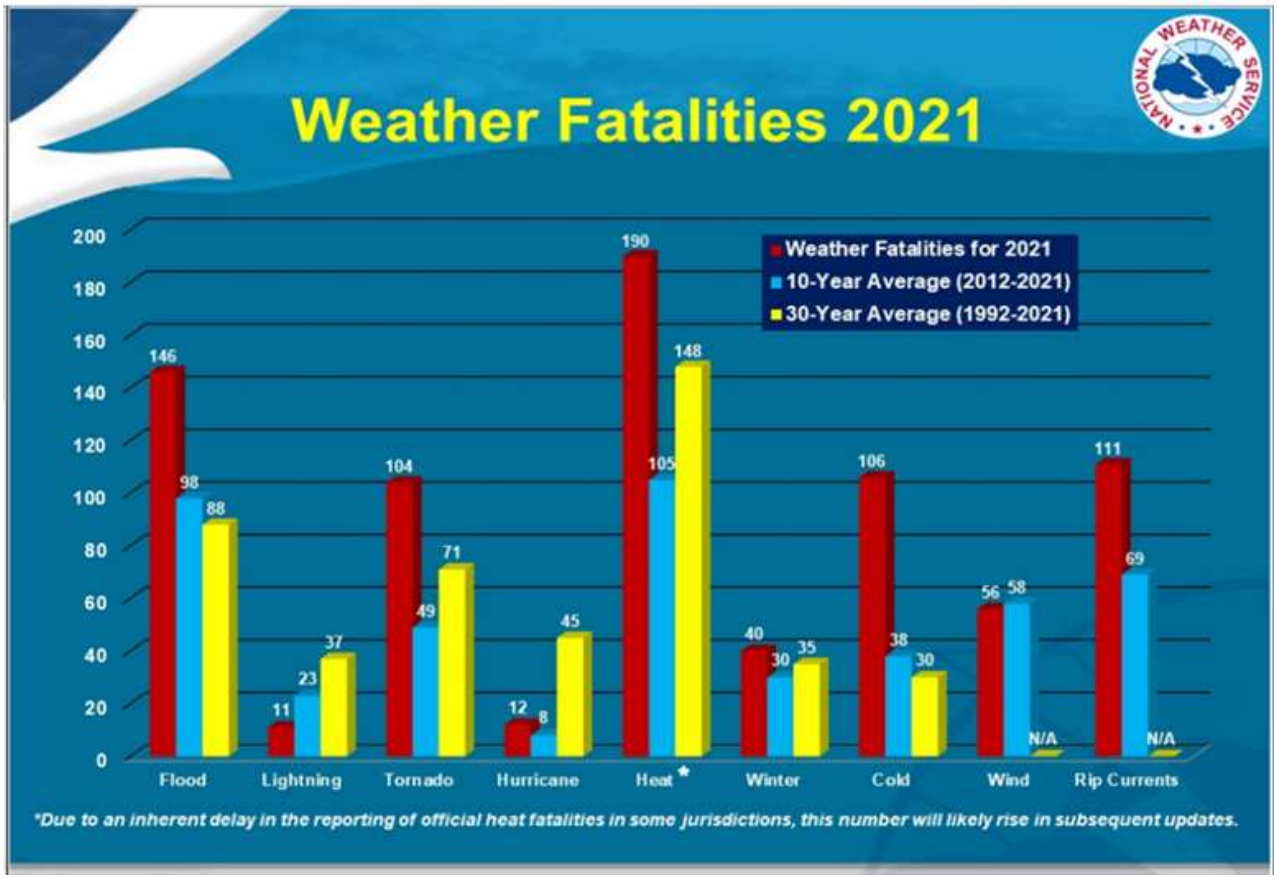
Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for a region and that last for several weeks (CDC 2012). Humid or muggy conditions occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground. A heat wave is a period of abnormally and uncomfortably hot and unusually humid weather. A heat wave will typically last two or more days (NOAA 2009).

Depending on the severity, duration, and location, extreme heat events can create secondary hazards including, dust storms, droughts, wildfires, water shortages, and power outages. These secondary hazards could result in a broad and far-reaching set of impacts throughout a local area or an entire region.

Extreme heat is the number one weather-related cause of death in the U.S. On average, nearly 150 people die each year in the United States from excessive heat (NWS 2021). Figure 4.3.5-1 shows the number of weather fatalities based on a 10-year average and a 30-year average. Heat caused the highest average of weather-related fatalities between 2012 and 2021.

Urban heat island is a phenomenon that explains why cities/towns tend to be warmer than their surrounding areas. Infrastructure such as roads and buildings absorb and re-emit the sun's heat, and because of the highly concentrated infrastructure and lack of greenery in some cities and towns, higher temperatures are documented as an "island" in relation to its surrounding areas (U.S. EPA 2022).

Figure 4.3.5-1. Average Number of Weather-Related Fatalities in the U.S.



Source: NWS 2022

Location

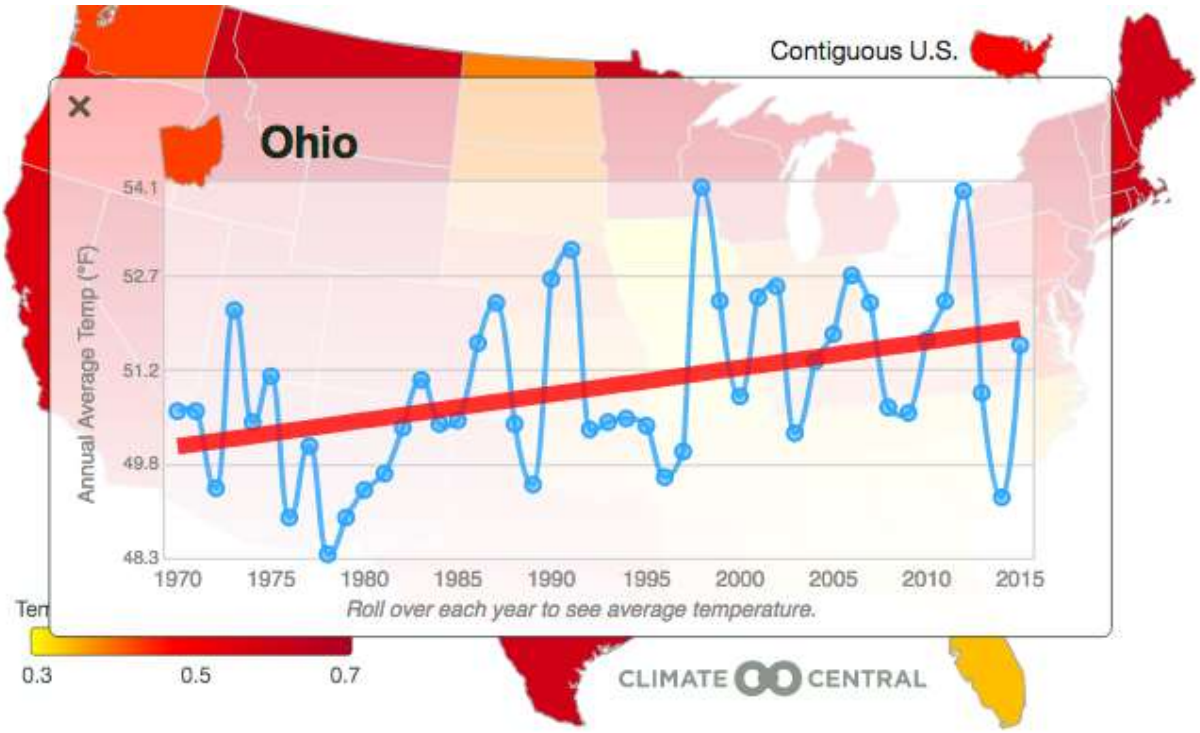
Extreme Cold

Extreme cold temperatures affect all of Franklin County, however, since the county is in the middle of the state, it does not experience as intense cold spells as the counties near Lake Erie.

Extreme Heat

Extreme heat affects all of Franklin County. Ohio averages nearly 5 dangerous heat days per year, and by 2050, climate change is projected to see an increase to nearly 30 dangerous heat days a year. Cities are also expected to experience an increase of the urban island heat effect. (Climate Central n.d.).

Figure 4.3.5-2. Average Temperature in Ohio



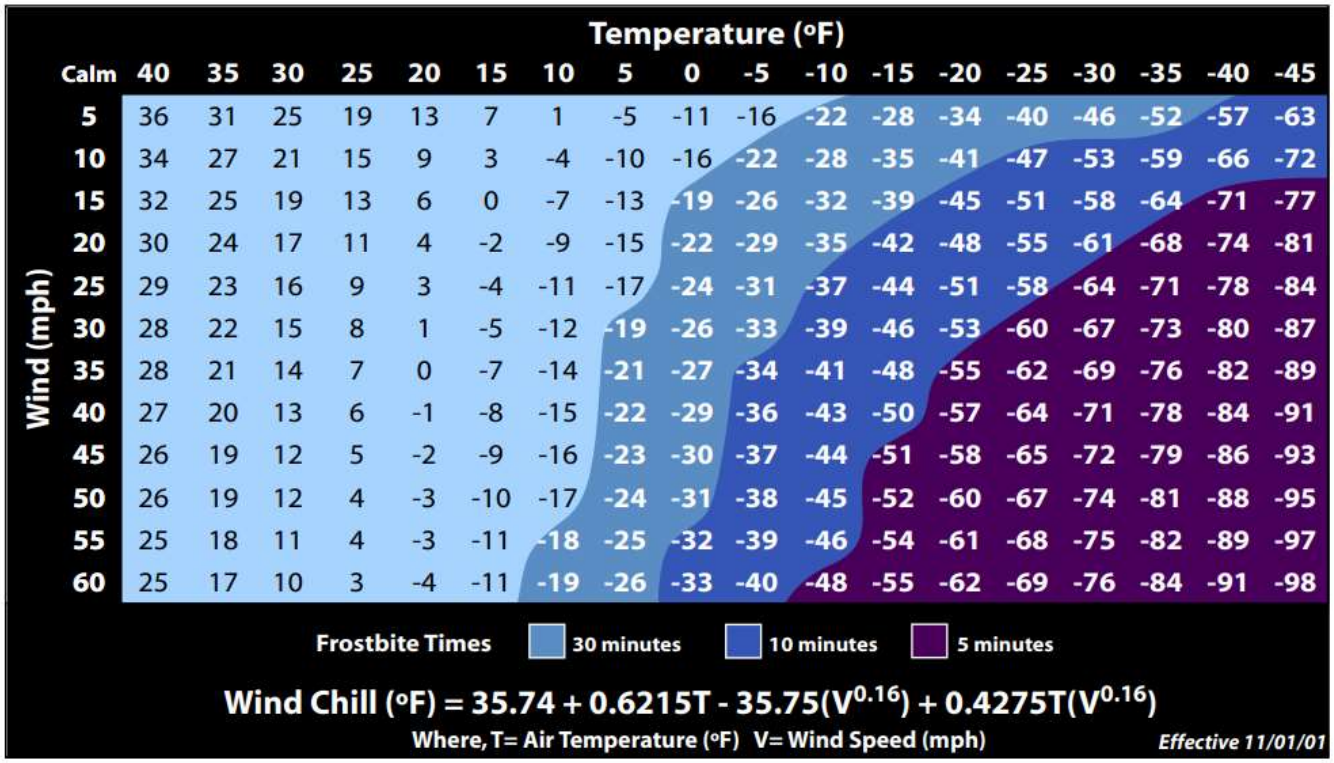
Source: Climate Central n.d.

Extent

Extreme Cold

The extent (severity or magnitude) of extreme cold temperatures is generally measured through the Wind Chill Temperature (WCT) Index. The index uses advances in science, technology, and computer modeling to provide an accurate, understandable, and useful formula for calculating the dangers from wind chill. WCT Index is presented in Figure 4.3.5-3.

Figure 4.3.5-3. Wind Chill Index

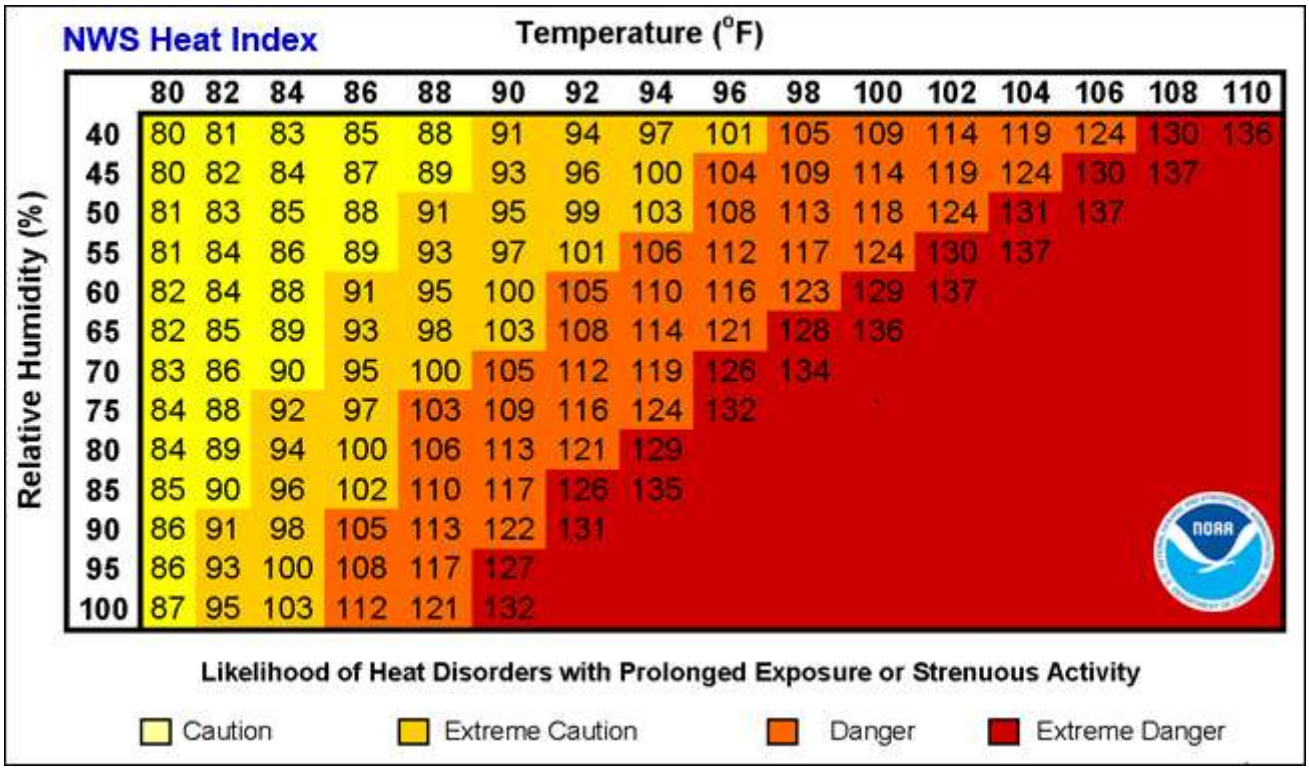


Source: NWS 2001

Extreme Heat

The extent of extreme heat temperatures is generally measured through the Heat Index, identified in Figure 4.3.5-4. Created by the NWS, the Heat Index is a chart that accurately measures apparent temperature of the air as it increases with the relative humidity. The temperature and relative humidity are needed to determine the Heat Index. Once both values have been identified, the Heat Index is the corresponding number of both values. This index provides a measure of how temperatures feel; however, the values are devised for shady, light wind conditions.

Figure 4.3.5-4. NWS Heat Index Chart – Shaded Areas



Source: NWS 2022

Table 4.3.5-1. Adverse Effects of Prolonged Exposure to Direct Sunlight

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

Source: NWS 2022

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was not included in any FEMA disaster (DR) or emergency (EM) declarations for extreme temperature-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

USDA keeps records of agricultural disasters. Between 2015 and 2022, Franklin County was included in three extreme temperature-related agricultural disaster declarations.

- S3934-2015 Heat
- S4498-2019 Cold
- S4795-2020 Cold

Previous Occurrences

For the 2023 HMP update, known extreme temperature events that impacted Franklin County between 2018 and 2022 are discussed below. For events prior to 2018, refer to the 2018 Franklin County HMP.

Table 4.3.5-2. Extreme Temperature Events in Franklin County (2018 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
January 30, 2019	Extreme Cold/Wind Chill	N/A	N/A	Entire County	Sub-zero temperatures reached the lower teens in some areas and combined with wind gusts of nearly 45 mph, creating wind chills from 20 to 40 below zero.
July 19 - 20, 2019	Excessive Heat	N/A	N/A	Entire County	The County experienced temperatures in the 90s with added humidity. Heat index values reached into the triple digits.

Sources: NOAA 2022, FEMA 2022

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of extreme temperature events for the County. Information from NOAA-NCEI storm events database, the 2019 State of Ohio HMP, the 2018 Franklin County HMP, and FEMA Disaster Declarations were used to identify the number of extreme temperature events that occurred between 1954 and 2022. Table 4.3.5-3 presents the probability of future events for extreme temperatures in Franklin County.

Table 4.3.5-3. Probability of Future Extreme Temperature Events

Hazard Type	Number of Occurrences Between 1954 and 2022	% Chance of Occurring in Any Given Year
Cold/Wind Chill	1	1.37%
Extreme Cold/Wind Chill	1	1.37%
Heat	3	4.11%
Excessive Heat	2	2.74%
Total	**7**	**9.59%**

Sources: NOAA NCEI 2022, 2019 State of Ohio HMP, 2018 Franklin County HMP, FEMA 2022

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and events since 1968. Due to limitations in data, not all extreme temperature events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for extreme temperature in the County is considered 'occasional'.

Climate Change Impacts

Records from the Intergovernmental Panel on Climate Change (IPCC) indicate that average global temperatures have increased by 0.72 degrees Fahrenheit above preindustrial temperatures and by 2100 it could increase to 7.2 degrees Fahrenheit above preindustrial temperatures (National Geographic 2022). These higher temperatures can lead to more frequent and prolonged heat waves and droughts. Longer and more severe heat can harm food production and human health.

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed for the extreme temperatures hazard. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 3), are exposed and potentially vulnerable.

Impact on Life, Health, and Safety

Extreme temperature events have potential health impacts including injury and death. More mild winters resulting from a warming climate can reduce illness and injuries associated with extreme cold temperatures and reallocate them to extreme heat events.

Social Vulnerability

According to the CDC, populations most at risk to extreme cold and heat events include the elderly, who are less able to withstand temperatures extremes because of their age, health conditions, and limited mobility to access shelters; infants and children up to 4 years of age; individuals who are physically ill (such as with heart disease or high blood pressure); low-income persons who cannot afford proper heating and cooling; and members of the general public who may overexert during work or exercise during extreme heat events or experience hypothermia during extreme cold events (CDC 2020). People who live in an urban setting are especially vulnerable due to the urban island heat effect. According to the 5-Year 2021 American Community Survey Population Estimates, there are 188,900 (12.4% of the County's total population) persons over 65 and 195,988 (12.9% of the County's total population) persons living in poverty in Franklin County. Refer to Figure 4.3.5-5 for the social vulnerability index for the natural hazard.

Impact on General Building Stock

Extreme heat generally does not affect buildings; however, losses may be associated with overheating of heating, ventilation, and air conditioning (HVAC) systems. Extreme cold temperature events can damage buildings through the freezing and bursting of pipes. Additionally, manufactured homes (mobile homes)

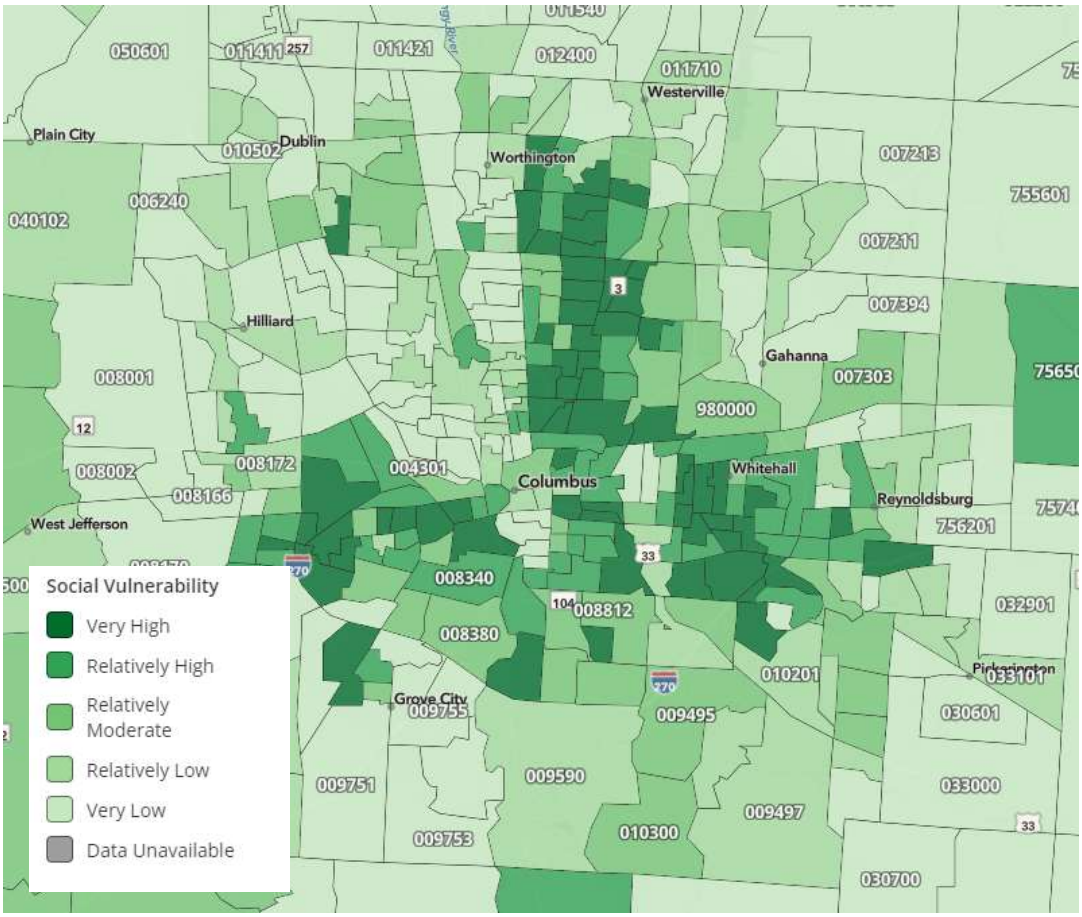
and antiquated or poorly constructed facilities may have inadequate capabilities to withstand extreme temperatures leading to a negative impact on human health and safety.

All building stock in the County is exposed to the extreme temperature hazard; however, direct impacts are expected to be minimal. Refer to the County Profile, which summarizes the building inventory in Franklin County.

Impact on Critical Facilities and Community Lifelines

All critical facilities in the County are exposed to extreme temperatures; however, direct impacts are expected to be minimal. Impacts to critical facilities are the same as previously described for general building stock. Additionally, it is essential that all critical facilities remain open and operational during all natural hazard events. Extreme heat events can sometimes cause short periods of utility failures, commonly referred to as "brown-outs," created by increased usage from air conditioners, appliances, and similar equipment. Similarly, heavy snowfall and ice storms, associated with extreme cold temperature events, can interrupt power, and freeze pipes as well as well. Backup power is essential for critical facilities and infrastructure that could be impacted by power outages.

Figure 4.3.5-5. FEMA Social Vulnerability Index for Natural Hazards



Source: FEMA NRI

Impact on the Economy

Extreme temperature events have impacts on the economy, including loss of business function and damage and loss of inventory. Business owners may be faced with increased financial burdens due to unexpected repairs caused to the building (previously discussed in Impact on General Building Stock), or a loss/delay of inventory.

The agricultural industry is most at risk in terms of economic impact and damage caused by extreme temperature events. Extreme heat events can result in drought and dry conditions and directly affect livestock and crop production. Extreme cold events can result in a freeze that kills many crops and drastically effects crop production.

Impact on the Environment

Extreme temperature events can have a major impact on the environment. Freezing and warming weather patterns can create changes in natural processes. An excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020). Extreme heat events can have particularly negative impacts on aquatic systems, contributing to fish kills, aquatic plant die offs, and increased likelihood of harmful algal blooms. These extreme temperature events can also affect the surrounding ecosystems which can destroy food webs and deplete resources in the environment.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The county considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development;
- Projected changes in the population; and
- Other identified conditions as relevant and appropriate, including the impacts of climate change.

Projected Development

The ability of new development to withstand extreme temperature impacts can be enhanced through land use practices and consistent enforcement of codes and regulations for new construction. New development will change the landscape where buildings, roads, and other infrastructure potentially replace open land and vegetation. Transformation of pervious surfaces (including vegetation) to impervious surfaces causes an island of higher temperatures.

Project Changes in Population

The population in Franklin County has grown from 1,163,414 (Census 2010) to 1,323,807 (Census 2020), a 13.7 percent increase. A growing population means more people and development that will be impacted by extreme temperature events. Franklin County will experience an increase in vulnerability to

extreme temperature events as the population continues to grow. Refer to the County Profile Section for more information about population trends.

Climate Change

As discussed above, most studies project that the Franklin County will see an increase in average annual temperatures and precipitation. As the climate warms, extreme cold events might decrease in frequency, while extreme heat events might increase in frequency; the shift in temperatures could also result in hotter extreme heat events. With increased temperatures, vulnerable populations could face more increased vulnerability to extreme heat and its associated health issues, such as heatstroke and cardiovascular and kidney disease. Additionally, as temperatures rise, more buildings, facilities, and infrastructure systems may exceed their ability to cope with the heat, taking a toll on the economically disadvantaged population.

Change of Vulnerability Since 2018 HMP

Franklin County's vulnerability to severe storm events has increased due to a population that has also grown. Since the 2018 HMP analysis, population statistics have been updated using the 2020 Census. The general building stock and the 2018 critical facility dataset was updated by the County and participating jurisdictions. Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2018 HMP.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.6 Flood

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the flood hazard in Franklin County.

Hazard Profile

Hazard Description

Flooding occurs when water overflows onto land that is normally dry. They can happen during heavy rains, rapid snow melt, or when dams or levees break (NOAA National Severe Storms Laboratory 2023). Floods are one of the most frequent and costly natural disasters in the United States and the State of Ohio.

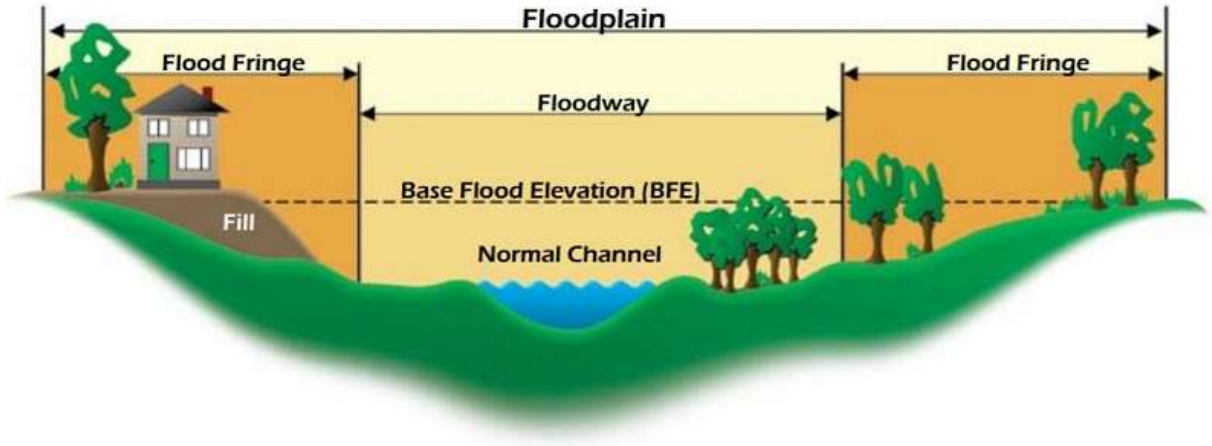
The flood-related hazards most likely to impact Franklin County are riverine (inland) flooding, flash flooding, ice jam flooding, stormwater/urban flooding due to insufficient drainage during heavy rain events, and flooding as a result of a dam or levee break. Dam and levee failure are discussed in Section 4.3.1 (Dam and Levee Failure).

Riverine/Inland Flooding

Riverine flooding, or fluvial flooding, is when streams and rivers exceed the capacity of their natural or constructed channels to accommodate water flow and water overflows the banks, spilling out into adjacent low-lying, dry land. This occurs when the flow of a river exceeds the bank sides and causes damage or obstruction to a nearby floodplain. Riverine flooding can turn into a flash flood if the river is at or above its flood stage and if the soil is saturated (FEMA 2019).

A floodplain is defined as the land adjoining the channel of a river, stream, ocean, lake, or other watercourse or water body that becomes inundated with water during a flood. In Franklin County, floodplains line the rivers, streams, and lakes of the County. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques. Figure 4.3.6-1 depicts the flood hazard area, the flood fringe, and the floodway areas of a floodplain.

Figure 4.3.6-1. Characteristics of a Floodplain



Source: FEMA 2022

Flash Flooding

A flash flood is a rapid inundation of low-lying areas caused by heavy rain associated with severe thunderstorms, tropical systems, or melting water from ice or snow. Flash flooding also occurs far away from water bodies when a large volume of water cannot be absorbed by the soil or storm water systems and travels overland unimpeded (NWS 2019).

Urban/Stormwater Flooding

Local (urban) drainage systems collect groundwater from heavy rainfall in developed areas. Water that does not evaporate or become absorbed by the ground is carried by conduits to waterways such as creeks, rivers, or the ocean. These systems have two purposes: 1) to control storm water runoff during periods of heavy rainfall; and 2) to minimize disruption of activity from more frequently occurring, less significant storms. Flooding occurs when runoff exceeds system capacity, or because systems are blocked from lack of maintenance. Flooding which results from poorly designed or blocked drainage systems is categorized as urban/stormwater flooding (NOAA 2022).

Ice Jam Flooding

An ice jam occurs when pieces of floating ice are carried with a stream's current and accumulate behind any obstruction to the stream flow. Obstructions may include river bends, mouths of tributaries, points where the river slope decreases, as well as dams and bridges. The water held back by this obstruction can cause flooding upstream, and if the obstruction suddenly breaks, flash flooding can occur as well (NOAA 2023).

The formation of ice jams depends on the weather and physical condition of the river and stream channels. Ice jams are common in locations where the channel slope changes from relatively steep to mild and where a tributary stream enters a large river. Ice jams and resulting floods can occur during different times of the year: fall freeze-up from the formation of frazil ice; mid-winter periods when stream channels freeze solid, forming anchor ice; and spring breakup when rising water levels from snowmelt or

rainfall break existing ice cover into pieces that accumulate at bridges or other types of obstructions (FEMA 2018).

There are two main types of ice jams: freeze-up and breakup. Freeze-up jams occur when floating ice may slow or stop due to a change in water slope as it reaches an obstruction to movement. Breakup jams occur during periods of thaw, generally in late winter and early spring. The ice cover breakup is usually associated with a rapid increase in runoff and corresponding river discharge due to a heavy rainfall, snowmelt, or warmer temperatures (FEMA 2018).

Dam and Levee Failure

The Alum Creek Dam and Delaware Dam have the potential to impact over 100,000 Franklin County residents, damage roughly 20,000 buildings, and cover over 40,000 acres of land. Roughly 853 lifelines are located within the inundation areas of both the Alum Creek Dam and Delaware Dam. For more information on the risk to dam failure in Franklin County, refer to Section 4.3.1 (Dam and Levee Failure).

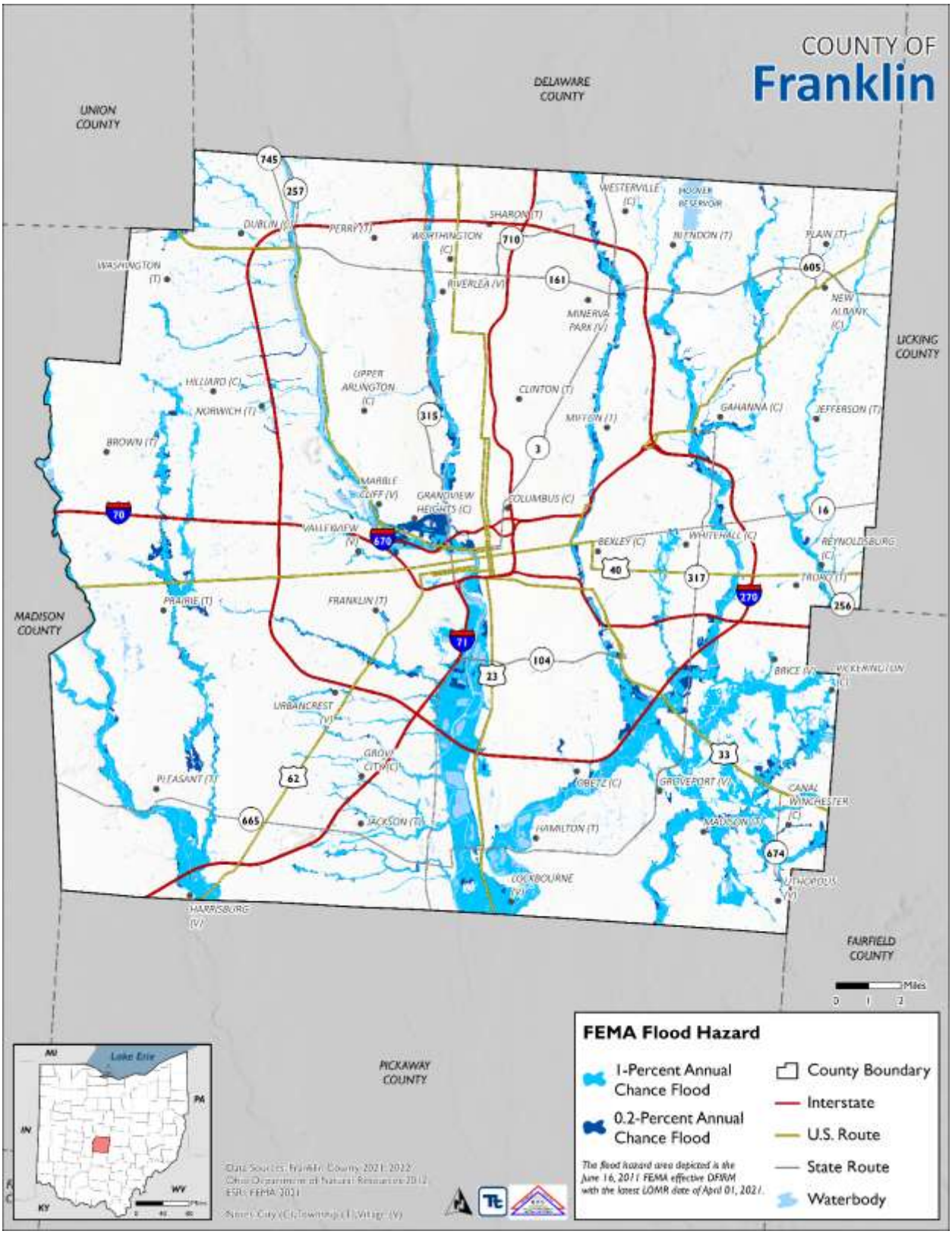
Location

Franklin County's topographic, climatological, and meteorological features create an environment conducive to year-round flooding. Warm weather flooding is caused by severe thunderstorms bringing heavy rainfall that leads to flash floods and riverine or overbank flooding. In cold weather, ice jams and fast-melting snow overwhelm waterways. Bank erosion and sediment deposits exacerbate flooding by blocking and re-directing the natural flow of waterways. Franklin County is not affected by storm surge from hurricanes or tropical storms, but severe storms associated with these systems can result in flooding.

In Franklin County, floodplains line the rivers and streams of the County. The boundaries of the floodplains are altered as a result of changes in land use, the amount of impervious surface, placement of obstructing structures in floodways, changes in precipitation and runoff patterns, improvements in technology for measuring topographic features, and utilization of different hydrologic modeling techniques.

See Figure 4.3.6-2 below which visualizes the FEMA designated flood hazard area for Franklin County.

Figure 4.3.6-2. Flood Hazard Area in Franklin County



Riverine/Inland Flooding

Flooding in Franklin County occurs throughout County, but primarily along the bodies of water that flow through it, which includes Big Darby Creek, Big Walnut Creek, Alum Creek, Olentangy River, and the Scioto River. The Scioto River Basin drains into the Ohio River, which in turn drains into the Mississippi, which makes its way south to the Gulf of Mexico. A distinguishing feature of these waterways is the sub-parallel, nearly straight, north-south direction of flow through the county. Another significant stream, the Big Darby, flows diagonally, northwest- southeast through the southwest corner of the county. Numerous factors can cause flooding along the bodies of water, including heavy and/or prolonged periods of rainfall, snowmelt, soil saturation, ground freeze, severe wind events and inadequate drainage systems (Franklin County 2018).

Flash Flooding

Flash flooding, like riverine/inland flooding, occurs throughout County, primarily along the bodies of water that flow through it, which includes Big Darby Creek, Big Walnut Creek, Alum Creek, Olentangy River, and the Scioto River. Severe thunderstorms and periods of heavy rainfall can lead to flash floods if local bodies of water reach and/or surpass its capacity. A flash flood, unlike a riverine/inland flood, occurs within 6 hours of the rain event and spills excess water into an area in a short span of time (NWS 2014).

Figure 4.3.6-3. Ohio Lakes, Rivers, and Water Resources

Source: Geoscience News and Information n.d.
Note: Red boxed area is Franklin County

Urban/Stormwater Flooding

Urbanization increases runoff two to six times over what would occur on natural terrain. During periods of urban flooding, streets can become swift moving rivers. This type of flooding occurs throughout Franklin County, particularly in areas where land has been converted from fields or woodlands to roads and parking lots; this causes the ground to lose its ability to absorb rainfall (NWS 2014).

Ice Jam Flooding

Ice jam flooding occurs on a body of water, which for Franklin County includes the Big Darby Creek, Big Walnut Creek, Alum Creek, Olentangy River, and Scioto River. Ice jam flooding can be unpredictable; it can take several hours from the time an ice jam forms to the start of flooding – or as little as one hour (The Hartford 2016). The ice is typically carried within the flow of a stream or river. However, the ice can begin to pile up and accumulate if it encounters an obstruction to the flow, including sharp bends on a river or objects such as a bridge that lies close to the river's elevation. Ice jams can also occur at the mouth of a tributary, or even an area where the river's slope decreases enough to slow the current and allow for the buildup of ice. All of that ice can very quickly back up the flow of water and cause a flood (Niziol 2020).

Extent

The strength or magnitude of a flood varies based meteorological, environmental, and geological factors, including latitude, altitude, topography, and atmospheric conditions. Flood is also affected by seasonal variation, storm characteristics, warning time, speed of onset, and duration. Most floods are preceded by a warning period that allows emergency managers to communicate the need to prepare for the event. A flood may last from minutes to days (O'Connor, Grant and Costa 2002).

Warnings issued through official sources, such as the National Weather Service (NWS) and the Storm Prediction Center, provide the most reliable and timely preparedness information, but the exact flood location and depth depends on the amount, duration, and location of rainfall. Many floods, especially flash floods, occur outside of FEMA-designated flood zones.

In the case of riverine flood hazard, once a river reaches flood stage, the flood extent or severity

Figure 4.3.6-4. Flood Advisory Definitions

Flood Advisory Definitions

Flash Flood Watch: Issued generally when there is the possibility of flash flooding or urban flooding over an area within the next 36 hours.

Flash Flood Warning: Issued when flash flooding is imminent, generally within the next 1 to 3 hours. Usually issued based on observed heavy rainfall (measured or radar estimated), but may also be issued for significant dam breaks that have occurred or are imminent.

Flood Watch: Issued when there is the possibility of widespread general flooding over an area within the next 36 hours.

Flood Warning for River Forecast Point: Issued when a river gauge has exceeded, or is forecast to exceed, a predetermined flood stage.

Flood Advisory: Issued when flooding is imminent or occurring, generally within the next 1 to 3 hours, but is not expected to substantially threaten life and property.

Source: NWS 2018

categories used by the NWS include minor flooding, moderate flooding, and major flooding. Each category has a definition based on property damage and public threat:

- Minor Flooding - minimal or no property damage, but possibly some public threat or inconvenience.
- Moderate Flooding - some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations are necessary.
- Major Flooding - extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations (NOAA 2021).

The severity of a flood depends not only on the amount of water that accumulates in a period of time, but also on the land's ability to manage this water. The size of rivers and streams in an area and infiltration rates are significant factors. When it rains, soil acts as a sponge. When the land is saturated or frozen, infiltration rates decrease and any more water that accumulates must flow as runoff (Harris 2001).

The frequency and severity of flooding are measured using a discharge probability, which is the probability that a certain river discharge (flow) level will be equaled or exceeded in a given year. Flood studies use historical records to determine the probability of occurrence for the different discharge levels. The flood frequency equals 100 divided by the discharge probability. For example, the 100-year discharge has a 1-percent chance of being equaled or exceeded in any given year. The "annual flood" is the greatest flood event expected to occur in a typical year. These measurements reflect statistical averages only; it is possible for two or more floods with a 100-year or higher recurrence interval to occur in a short time period. The same flood can have different recurrence intervals at different points on a river.

The extent of flooding associated with a 1-percent annual probability of occurrence (the base flood or 100-year flood) is used by the NFIP as the standard for floodplain management and to determine the need for flood insurance, as well as the regulatory flood boundary by many agencies. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. Many communities have maps that show the extent and likely depth of flooding for the base flood. Corresponding water-surface elevations describe the water elevation resulting from a given discharge level, which is one of the most important factors used in estimating flood damage. A structure located within a SFHA shown on an NFIP map has a 26-percent chance of suffering flood damage during the term of a 30-year mortgage.

The term "500-year flood" is the flood that has a 0.2-percent chance of being equaled or exceeded each year. The 500-year flood could occur more than once in a relatively short period of time. Statistically, the 0.2-percent (500-year) flood has a 6-percent chance of occurring during a 30-year period of time, the length of many mortgages. The 500-year floodplain is referred to as Zone X500 for insurance purposes on FIRMs. Base flood elevations or depths are not shown within this zone and insurance purchase is not required in this zone (FEMA 2022).

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 2018 and 2022, Franklin County was not included in any disaster (DR) or emergency (EM) declarations for flood-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2018 and 2022, Franklin County was included in four flood-related agricultural disaster declarations.

Table 4.3.6-1. Flood Events in Franklin County (2018 to 2022)

Date(s) of Event	Event Type	USDA Declaration Number	Franklin County included in Declaration?	Description
July 25, 2019	Flood, Excessive Rain	USDA S4498	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.
August 13, 2019	Flood, Excessive Rain	USDA S4539	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.
August 20, 2019	Flood, Excessive Rain	USDA S4539	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.
September 04, 2019	Flood, Excessive Rain	USDA S4541	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.

Source: USDA FSA 2022

Previous Events

For the 2023 HMP update, known flood events that impacted Franklin County between 2018 and 2022 are discussed below. For events prior to 2018, refer to the 2018 Franklin County HMP.

Table 4.3.6-2. Flood Events in Franklin County (2018 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
May 21, 2018	Flood	N/A	N/A	Valley View	Thunderstorms developed during the late afternoon and evening hours in a warm and unstable air mass that was in place across the region. Two feet of standing water was reported at the intersection of west Broad Street and Richardson Avenue.
June 09, 2018	Flood	N/A	N/A	Grove City	Scattered thunderstorms developed ahead of an upper-level disturbance in a moist and unstable air mass. Ponding of water approximately one foot deep was reported near the intersection of Franklin St. and Grove City Road.
June 21, 2018	Flood	N/A	N/A	Columbus, Mt. Air	Showers developed in a very moist tropical air mass, which was located ahead of a slow moving upper low. Between 1 and 3 inches of rain fell in general, with locally higher amounts. In Columbus, standing water, one to two inches deep, was reported on State Route 104 between Dyer Road and Stringtown Road. In Mt. Air, the ramp of southbound State Route 315 to eastbound I-270 was flooded.
July 23, 2018	Flood	N/A	N/A	Gahanna, Columbus	Isolated showers and thunderstorms developed in an unstable air mass during the late afternoon hours. The storms were slow moving and produced locally heavy rainfall. Widespread street flooding was reported in Gahanna. In Columbus, the intersection of Livingston Avenue and Kenwick Road was submerged in water. High water was also reported near the intersection of Broadview Road and North Hamilton Road.
August 11, 2018	Flood	N/A	N/A	Columbus, Lincoln Village	Scattered thunderstorms developed in the vicinity of a cold front. The thunderstorms produced heavy rain, which produced some flooding. High water was reported on the east bound lanes of I-70 at Wilson Road in Lincoln Village. In Columbus, water was reported up to the axle of vehicles at Frank Road and Westbrook Drive, underpasses were flooded on the south side of Columbus, with some cars stuck in the water, and State Route 104 had six to eight inches of water over the road. The flooding caused $2,000 worth of property damage in Columbus.
September 01, 2018	Flood, Flash Flood	N/A	N/A	Grove City, Westerville	Scattered thunderstorms developed during the afternoon hours as an upper-level disturbance moved through the Ohio Valley. A few of the

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
					storms produced locally heavy rainfall. Dorothy Lane in Grove City was impassable due to high water. High water was reported on numerous roads through the city of Westerville. Several cars became stranded in the high water. The flooding caused $2,000 worth of property damage in Westerville.
June 19, 2019	Flood, Flash Flood	N/A	N/A	Gahanna, Grandview Heights, Grove City, Pleasant Corners	Thunderstorms producing heavy rains developed on an oscillating frontal boundary draped across the region. High water was reported on Hamilton Road in Gahanna. In Grandview Heights, high water was reported on North High Street and East 13th Avenue and Interstate 71 was closed in both directions between I-670 and 11th Avenue due to high water. Grove City saw one foot of water was flowing on U.S. Route 62. In Pleasant Corners, Interstate 71 at London-Groverport Road was flooded and closed in both directions.
July 25, 2019	Flood, Excessive Rain	USDA S4498	Yes	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.
August 13, 2019	Flood, Excessive Rain	USDA S4539	Yes	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.
August 20, 2019	Flood, Excessive Rain	USDA S4539	Yes	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.
September 04, 2019	Flood, Excessive Rain	USDA S4541	Yes	Franklin County	USDA Secretarial disaster designation due to rain, flooding, or other weather conditions.
March 20, 2020	Flash Flood	N/A	N/A	Grove City, Whitehall	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. In Grove City, a few cars were stranded in high water on south State Route 104 near Stringtown Road. In Whitehall, several roads were closed throughout the county due to high flowing water and earlier heavy rainfall. The flooding caused $5,000 worth of property damage in Grove City.
May 18, 2020 – May 19, 2020	Flood, Flash Food	N/A	N/A	Mudsock, Grandview Heights, Price Aprt, Huber Ridge,	A slow-moving upper-level low pressure system produced showers and thunderstorms across the Ohio Valley. High water was reported on Hilliard Rome Road in Mudsock. A few people were stranded in vehicles in the city of Columbus due to rising water on roadways. In

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
				Riverlea, Worthington, Columbus	Price Aprt, a stranded vehicle along Hamilton Road was swept away in rising flood waters, leading to a fatality. At least 20 people had to be rescued from homes due to rising water in Huber Ridge. Underpass flooding was reported in Worthington along State Route 161 between Huntley and Proprietors Roads. Athletic fields and a pavilion were flooded at Thomas Worthington High School in Riverlea. In Columbus, Northbound U.S. 23 at I-270 was closed due to high water, he right lane of I-71 at Greenlawn Avenue was closed due to high water, flooding was reported on U.S. 23 at the I-270 interchange, and high water was reported on I-71 near Frank Road. The flooding caused $20,000 worth of property damage in Price Aprt., $50,000 of property damage in Huber Ridge, and $1,000 in Riverlea.
July 07, 2020	Flood	N/A	N/A	Columbus	Scattered thunderstorms developed during the afternoon in a warm and unstable air mass. Flooding was reported on West Lane Avenue in Columbus.
July 27, 2020	Flood	N/A	N/A	Grove City	A line of thunderstorms moved through the Ohio Valley ahead of an advancing cold front. High water was reported on I-71 and on Hoover Road in Grove City.
April 29, 2021	Flood	N/A	N/A	Hanford	Showers and thunderstorms ahead of a cold front produced locally heavy rain across central Ohio during the afternoon hours. Standing water was reported on the Miller-Kenton Avenue exit from West I-70 in Hanford.
August 07, 2021	Flood	N/A	N/A	Riverlea	Scattered thunderstorms developed in the late afternoon and evening hours in a warm and unstable airmass. High water was reported on State Route 161 in spots between New Albany and Worthington.
August 17, 2021	Flash Flood	N/A	N/A	Brice	Isolated thunderstorms produced locally heavy rainfall. Water was flowing across several roads in the Reynoldsburg area. Several basements were flooded, and one house suffered a partial collapse of a basement wall. The flooding caused $75,000 worth of property damage in Brice.
August 25, 2021	Flood	N/A	N/A	Grandview Heights	Scattered thunderstorms moved through the region during the afternoon hours in association with an upper-level disturbance moving through the Ohio Valley. The area around 13th and High Street was

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
					impassable due to high water. The intersection of Herrick Drive and Cannon Drive was closed due to high water.
May 14, 2022	Flood	N/A	N/A	Columbus	Scattered thunderstorms developed during the afternoon and evening in a warm and humid airmass that was in place across the Ohio Valley. High water was reported on Harley Drive.
July 06, 2022	Flood, Flash Flood	N/A	N/A	Gould Park, Columbus, Grandview Heights	An upper-level disturbance produced widespread showers and thunderstorms across central Ohio during the overnight hours. High water was reported at the intersection of Morse and Hamilton Roads in Gould Park. In Columbus, The westbound lanes of Interstate 70 were closed near the intersection with Interstate 71 due to high water. A few cars were stuck on southbound I-71 near the intersection with I-670 due to flooding in Grandview Heights. The flooding caused $5,000 worth of property damage in Grandview Heights.
August 21, 2022	Flood	N/A	N/A	Galloway, Grandview Heights, Worthington, Westerville	Showers and thunderstorms developed ahead of a low-pressure system moving through the Ohio Valley. High water was reported on Sundrops Avenue in Galloway. Three to five inches of high water was reported near Northwest Boulevard and Chesapeake Avenue in Grandview Heights. High water was reported on Karl Road in Worthington. High water was encroaching on a building at Columbus State Community College in Westerville.

Source: NOAA 2022; USDA FSA 2022; FEMA 2022; State of Ohio 2019; Franklin County 2018; USACE CRREL n.d.

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of flood events for the County. Information from NOAA-NCEI storm events database, the 2019 State of Ohio HMP, the 2018 Franklin County HMP, and the United States Army Corps of Engineers Cold Regions Research and Engineering Laboratory (USACE CRREL) were used to identify the number of flood events that occurred between 1954 and 2022. Table 4.3.6-3 presents the probability of future events for flood in Franklin County.

Table 4.3.6-3. Probability of Future Flood Events

Hazard Type	Number of Occurrences Between 1954 and 2022	% Chance of Occurring in Any Given Year
Riverine	65	95.59
Flash	47	69.12
Stormwater/Urban	-	-
Ice Jam	4	5.88
Total	**116**	**56.86**

Sources: NOAA 2022; State of Ohio 2019; Franklin County 2018; USACE CRREL n.d.

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all flood events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for flooding in the County is considered 'frequent'.

Climate Change Impacts

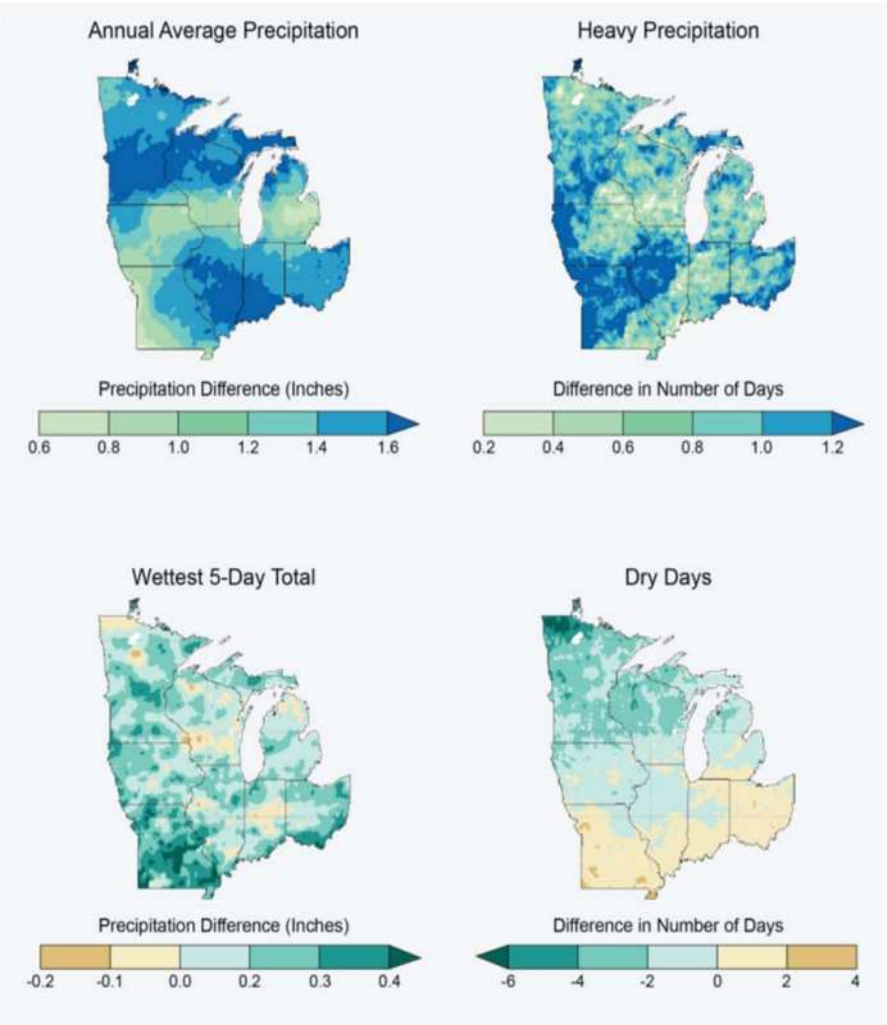
It is anticipated that Ohio will warm another two to four degrees F over next few decades. The largest impact of warming is anticipated to be to the agricultural sector, though it is assumed to be relatively resilient to gradual warming. Greater disruptions will occur to all sectors due to extreme heat, drought, and heavy downpours.

Relative to the general agreement regarding warming trends globally and in Ohio, there is generally less consensus on how precipitation will change in the future. There is agreement that the frequency and intensity of storm events will increase in the future (Bergeron and Clark 2010). What is projected to occur in Ohio is consistent with the atmosphere increasing in humidity. There are notable seasonal patterns to precipitation changes:

- Autumn is experiencing the greatest increase in precipitation.
- Winter precipitation is not increasing as much as in other seasons. Lake effect snowstorms are becoming less frequent and are more likely to turn into rain as the atmosphere heats up.
- There is significant consensus that extreme rainfall events and resulting flooding will increase in frequency and intensity. Recent weather patterns in Ohio are consistent with these characteristics:

- "Heavy" rainfall events (>1" over a 24-hour period) have gone up while "non-heavy" rainfall events (<1" over a 24-hour period) have decreased.
- Minimum and median stream flows are up in 3 of 4 season (Ohio DOT 2016).

Figure 4.3.6-5. Projected Changes in Precipitation Patterns, 2041-2070 Relative to 1971-2000



Source: Ohio DOT 2016

Increased frequency of heavy rain events can flood assets, including roads and bridges, and have other related impacts as well:

- Slope erosion, slumping of ditches, backfilled areas,
- Increased soil moisture causing increased hydrostatic pressure behind retaining walls and abutments, and reduced pavement subgrades stability,
- Overcapacity stormwater systems, including combined sewer systems leading to declining surface water quality,

- Increased runoff from heavy storms leads to heavier sediment loading with potential adverse impacts on bridge foundations,
- Increased scour action at bridge piers and abutments,
- Watercourse migration at bridge crossings and adjacent to highways
- Destabilization of stream/wetland mitigation areas which could compromise project permitting; and,
- Potential compromising of pavement integrity on roads constructed on expandable clay soils (Ohio DOT 2016).

A challenging case in the area of precipitation is the fact that some precipitation events are projected to occur along with great frequency of sustained drought – longer dry spells, punctuated with extreme rains. Further, sustained drought conditions can exacerbate flooding through greater soil compaction, reduced soil permeability, and higher runoff volume.

According to Jeffry Rogers, Ohio State Climatologist, Ohio is on a storm track that draws weather toward the Great Lakes. As a result, Ohio has access to weather systems that ultimately cause changes to weather in the state (Ohio DOT 2016).

Climate change is expected to make rain events more frequent and more intense across the United States. In the Mid-West, increased rainfall from April to June has been the most impactful climate trend for agriculture over the past 30 years (U.S. Global Change Research Program 2018). These extreme precipitation events will likely increase rates of erosion on waterways across Franklin County, particularly in areas without natural or built shoreline protection.

Vulnerability Assessment

To assess Franklin County's risk to the flood hazard, a spatial analysis was conducted using the FEMA Risk Map products dated 2021. The 1-percent annual chance flood event was further examined to estimate potential loss using the FEMA Hazus model. These results are summarized below. Refer to Section 4.2 (Methodology and Tools) for additional details on the methodology used to assess flood risk.

Impact on Life, Health, and Safety

The impact of flooding on life, health, and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time is provided to residents. Exposure represents the population living in or near floodplain areas that could be impacted should a flood event occur. Additionally, exposure should not be limited to only those who reside in a defined hazard zone, but everyone who may be affected by the effects of a hazard event (e.g., people are at risk while traveling in flooded areas, or their access to emergency services is compromised during an event). The degree of that impact will vary and is not strictly measurable. The impacts from each flood hazard of concern is described below.

To estimate population exposure to the 1-percent- and 0.2-percent annual chance flood events, the DFIRM flood boundaries were used. Based on the spatial analysis, there are an estimated 16,466 residents

living in the 1-percent annual chance floodplain, or 1.1-percent of the County's total population. There are an estimated 24,490 residents living in the 0.2-percent annual chance floodplain, or 1.6-percent of the County's total population. The Town of Madison has the greatest number of residents living in the 1-percent annual chance flood event hazard area with approximately 6,706 residents and the City of Columbus has the greatest number of residents living in the 0.2-percent annual chance flood event with approximately 10,868 residents. Table 4.3.6-4 summarizes the population exposed to the flood hazard by jurisdiction.

Table 4.3.6-4. Estimated Number of Persons in Franklin County Living in the 1-percent and 0.2-percent Annual Chance Flood Event Hazard Areas

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Population Located in the Flood Hazard Areas			
		Number of Persons Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Number of Persons Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
Bexley (C)	13,820	3	0.0%	3	0.0%
Blendon (T)	10,073	0	0.0%	0	0.0%
Brice (V)	185	0	0.0%	0	0.0%
Brown (T)	3,679	0	0.0%	22	0.6%
Canal Winchester (C)	8,150	225	2.8%	877	10.8%
Clinton (T)	4,449	0	0.0%	0	0.0%
Columbus (C)	855,224	6,569	0.8%	10,868	1.3%
Dublin (C)	41,175	20	0.0%	36	0.1%
Franklin (T)	11,312	153	1.4%	207	1.8%
Gahanna (C)	35,626	4	0.0%	32	0.1%
Grandview Heights (C)	8,099	0	0.0%	42	0.5%
Grove City (C)	41,025	489	1.2%	794	1.9%
Groveport (V)	5,942	131	2.2%	172	2.9%
Hamilton (T)	8,743	156	1.8%	190	2.2%
Harrisburg (V)	376	3	0.8%	3	0.8%
Hilliard (C)	35,530	4	0.0%	19	0.1%
Jackson (T)	46,340	826	1.8%	1,431	3.1%
Jefferson (T)	14,027	3	0.0%	3	0.0%
Lithopolis (V)	2,225	0	0.0%	148	6.7%
Lockbourne (V)	176	15	8.7%	15	8.7%
Madison (T)	25,896	6,706	25.9%	7,639	29.5%
Marble Cliff (V)	782	0	0.0%	0	0.0%
Mifflin (T)	38,121	0	0.0%	35	0.1%
Minerva Park (V)	1,611	0	0.0%	0	0.0%
New Albany (C)	10,929	3	0.0%	7	0.1%
Norwich (T)	37,356	160	0.4%	347	0.9%
Obetz (C)	5,351	5	0.1%	171	3.2%
Perry (T)	3,888	0	0.0%	0	0.0%
Pickerington (C)	113	27	23.7%	27	23.7%
Plain (T)	12,469	17	0.1%	67	0.5%
Pleasant (T)	6,768	133	2.0%	232	3.4%
Prairie (T)	17,433	130	0.7%	201	1.2%
Reynoldsburg (C)	29,016	0	0.0%	8	0.0%
Riverlea (V)	566	0	0.0%	0	0.0%
Sharon (T)	17,109	42	0.2%	42	0.2%
Truro (T)	30,165	0	0.0%	0	0.0%
Upper Arlington (C)	36,566	16	0.0%	16	0.0%

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Population Located in the Flood Hazard Areas			
		Number of Persons Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Number of Persons Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
Urbancrest (V)	1,124	0	0.0%	0	0.0%
Valleyview (V)	722	0	0.0%	9	1.2%
Washington (T)	42,997	551	1.3%	735	1.7%
Westerville (C)	23,467	3	0.0%	5	0.0%
Whitehall (C)	20,004	74	0.4%	88	0.4%
Worthington (C)	15,047	0	0.0%	0	0.0%
Franklin County (Total)	**1,523,677**	**16,466**	**1.1%**	**24,490**	**1.6%**

Source: U.S. Census Bureau 2021; Stats America 2022; FEMA 2021

In addition, displaced populations were estimated for the 1-percent annual chance flood event. It is important to note that the impacts to the households in the FEMA flood hazard area are assessed using the riverine flood model in Hazus. Using 2021 American Community Survey data, Hazus estimates 4,685 people may seek short-term sheltering. These statistics, by jurisdiction, are presented in Table 4.3.6-5.

Table 4.3.6-5. Estimated Population Seeking Short-Term Shelter from the 1-percent Annual Chance Flood Event

Jurisdiction	Total Population (American Community Survey 2021)	1-Percent Annual Chance Flood Event	
		Displaced Population	Persons Seeking Short-Term Sheltering
Bexley (C)	13,820	71	38
Blendon (T)	10,073	43	15
Brice (V)	185	0	0
Brown (T)	3,679	87	16
Canal Winchester (C)	9,209	431	86
Clinton (T)	4,449	0	0
Columbus (C)	873,569	11,553	2,116
Dublin (C)	48,613	716	251
Franklin (T)	11,312	404	88
Gahanna (C)	35,626	614	176
Grandview Heights (C)	8,099	15	4
Grove City (C)	41,025	1,565	382
Groveport (V)	5,942	472	58
Hamilton (T)	8,743	190	13
Harrisburg	376	10	0
Hilliard (C)	35,530	298	143
Jackson (T)	46,340	166	52
Jefferson (T)	14,027	193	59
Lithopolis (V)	2,291	0	0
Lockbourne (V)	176	43	3
Madison (T)	25,896	3,413	260
Marble Cliff (V)	782	0	0
Mifflin (T)	38,121	20	2
Minerva Park (V)	1,611	0	0
New Albany (C)	10,962	84	29
Norwich (T)	37,356	170	35
Obetz (C)	5,351	54	23

Jurisdiction	Total Population (American Community Survey 2021)	1-Percent Annual Chance Flood Event	
		Displaced Population	Persons Seeking Short-Term Sheltering
Perry (T)	3,888	0	0
Pickerington (C)	22,682	17	1
Plain (T)	12,469	21	14
Pleasant (T)	6,768	374	85
Prairie (T)	17,433	280	53
Reynoldsburg (C)	39,803	832	167
Riverlea (V)	566	0	0
Sharon (T)	17,109	76	9
Truro (T)	30,165	3	1
Upper Arlington (C)	36,566	125	78
Urbancrest (V)	1,124	99	13
Valleyview (V)	722	60	9
Washington (T)	42,997	48	3
Westerville (C)	29,933	442	182
Whitehall (C)	20,004	1,746	181
Worthington (C)	15,047	167	38
Franklin County (Total)	**1,590,439**	**24,903**	**4,685**

Sources: Hazus v5.1

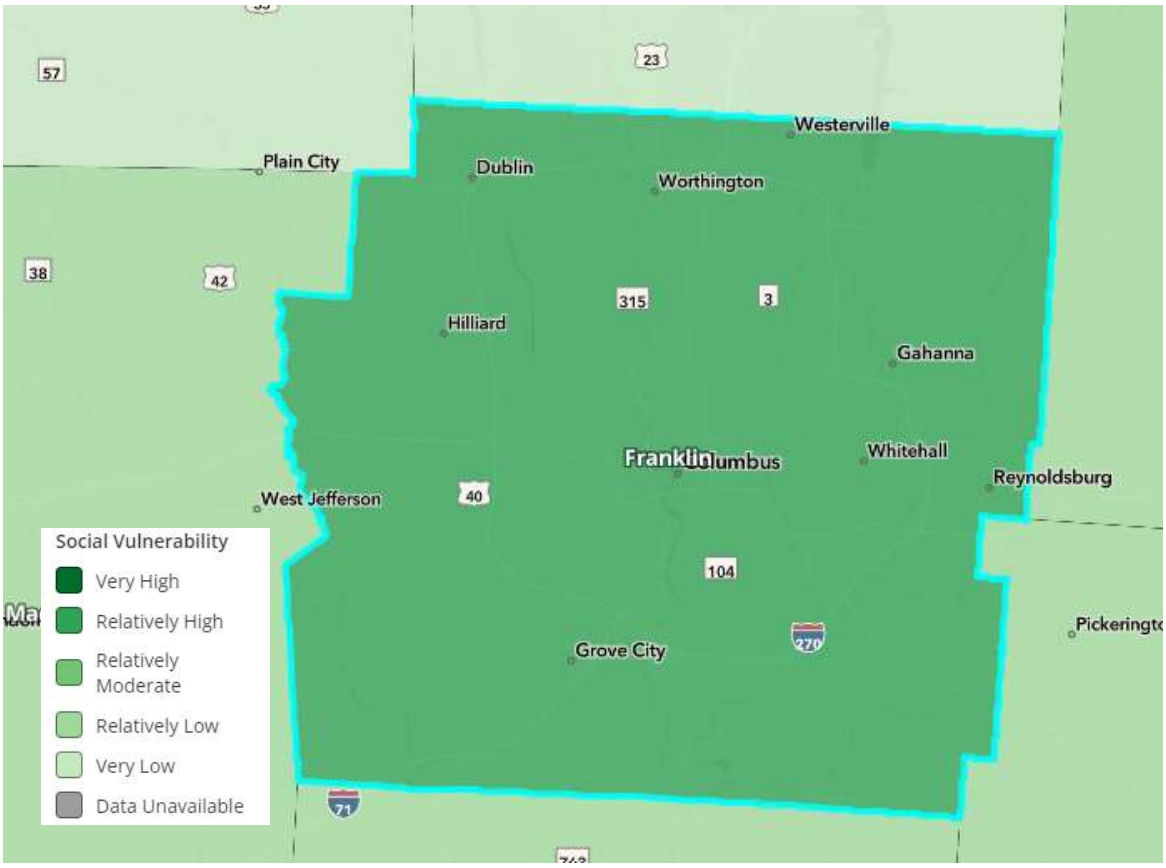
Social Vulnerability

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability 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.

According to FEMA's National Risk Index, socially vulnerable populations in Franklin County have a relatively high susceptibility to the adverse impacts of riverine flooding, when compared to the rest of the United States (FEMA n.d.).

Socially vulnerable populations are most susceptible to flood events based on several factors, including their physical and financial ability to react or respond during a flood. Vulnerable populations include homeless persons, elderly (over 65 years old), low income or linguistically isolated populations, people with life-threatening illnesses, and residents that may struggle to evacuate. The population over the age of 65 is also more vulnerable. They may require extra time to evacuate or need assistance to evacuate and are more likely to seek or need medical attention. According to the 5-Year 2021 American Community Survey Population Estimates, there are 188,900 (12.4% of the County's total population) persons over 65 and 195,988 (12.9% of the County's total population) persons living in poverty in Franklin County. Refer to Figure 4.3.6-6 for a map indicating the social vulnerability index for riverine flooding in Franklin County.

Figure 4.3.6-6. FEMA Social Vulnerability Index for Riverine Flooding



Source: FEMA NRI

Impact on General Building Stock

After considering the population exposed and potentially vulnerable to the flood hazard, the built environment was evaluated. Exposure includes those buildings located in the flood hazard areas. Potential damage is the modeled loss that could occur to the exposed inventory, including structural and content replacement cost values.

The Hazus flood model estimated potential damages to the buildings in Franklin County at the structure level using the custom structure inventory developed for this HMP and the depth grid generated using the effective DFIRM data.

Table 4.3.6-6 summarizes the number of structures located in the 1-percent and 0.2-percent annual chance flood events by jurisdiction. In summary, there are 3,330 buildings located in the 1-percent annual chance flood boundary with an estimated $3 billion of replacement cost value (i.e., building and content replacement costs). In total, this represents approximately 1-percent of the County's total general building stock inventory. In addition, there are 5,168 buildings located in the 0.2-percent annual chance flood boundary with an estimated $5.1 billion of building stock and contents exposed. This represents approximately 1.5-percent of the County's total general building stock inventory.

Table 4.3.6-7 provides the estimated building stock potential loss, by occupancy class, to the 1-percent annual chance flood event. Estimated losses for all occupancies is $939 million, of which $13 million is residential properties, $288 million is commercial properties, and $636 million is other occupancies. Out of the $939 million in estimated losses for all occupancy classes, the City of Columbus has the greatest percentage in estimated losses (58.3-percent) for all occupancy classes.

Table 4.3.6-6. Estimated General Building Stock Located in the 1- and 0.2-Percent Annual Chance Flood Event

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Located in the Flood Hazard Area							
			Number of Buildings Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Replacement Cost of Buildings in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Number of Buildings Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Replacement Cost of Buildings in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
Bexley (C)	4,185	$2,908,655,863	1	<0.1%	$12,260,899	0.4%	1	<0.1%	$12,260,899	0.4%
Blendon (T)	2,804	$1,413,412,606	0	0.0%	$0	0.0%	5	0.2%	$13,968,801	1.0%
Brice (V)	68	$101,696,013	5	7.4%	$6,107,953	6.0%	5	7.4%	$6,107,953	6.0%
Brown (T)	894	$615,217,276	0	0.0%	$0	0.0%	5	0.6%	$2,098,752	0.3%
Canal Winchester (C)	2,970	$2,664,295,038	110	3.7%	$675,474,380	25.4%	347	11.7%	$883,244,126	33.2%
Clinton (T)	1,615	$1,407,647,207	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Columbus (C)	210,344	$169,488,966,898	1,614	0.8%	$1,152,741,072	0.7%	2,673	1.3%	$2,299,162,646	1.4%
Dublin (C)	10,788	$12,346,217,589	8	0.1%	$145,801,545	1.2%	12	0.1%	$152,233,103	1.2%
Franklin (T)	3,243	$2,786,144,235	42	1.3%	$12,787,356	0.5%	58	1.8%	$18,311,275	0.7%
Gahanna (C)	10,525	$7,777,120,383	2	<0.1%	$1,621,727	<0.1%	11	0.1%	$27,549,526	0.4%
Grandview Heights (C)	1,781	$864,354,956	0	0.0%	$0	0.0%	10	0.6%	$4,821,173	0.6%
Grove City (C)	14,736	$11,872,349,008	184	1.2%	$333,405,502	2.8%	301	2.0%	$464,477,658	3.9%
Groveport (V)	2,294	$8,015,019,558	58	2.5%	$98,564,979	1.2%	76	3.3%	$122,227,365	1.5%
Hamilton (T)	1,601	$954,562,909	30	1.9%	$39,331,370	4.1%	39	2.4%	$42,422,691	4.4%
Harrisburg (V)	148	$59,706,145	1	0.7%	$470,463	0.8%	1	0.7%	$470,463	0.8%
Hilliard (C)	9,926	$7,685,805,074	2	<0.1%	$74,551,416	1.0%	8	0.1%	$159,729,478	2.1%
Jackson (T)	1,780	$998,460,101	35	2.0%	$14,759,343	1.5%	60	3.4%	$23,669,560	2.4%
Jefferson (T)	4,841	$2,934,483,497	2	<0.1%	$9,191,040	0.3%	2	<0.1%	$9,191,040	0.3%
Lithopolis (V)	21	$22,524,552	0	0.0%	$0	0.0%	1	4.8%	$292,938	1.3%
Lockbourne (V)	118	$115,362,791	10	8.5%	$2,338,697	2.0%	10	8.5%	$2,338,697	2.0%
Madison (T)	4,223	$1,551,960,041	1,076	25.5%	$277,099,989	17.9%	1,242	29.4%	$342,958,157	22.1%
Marble Cliff (V)	201	$310,170,408	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Mifflin (T)	1,185	$757,041,007	0	0.0%	$0	0.0%	1	0.1%	$258,244	<0.1%
Minerva Park (V)	845	$347,638,675	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
New Albany (C)	3,452	$4,624,598,720	1	<0.1%	$223,549	<0.1%	2	0.1%	$1,610,469	<0.1%
Norwich (T)	1,411	$592,173,496	6	0.4%	$1,981,376	0.3%	13	0.9%	$9,386,225	1.6%
Obetz (C)	2,205	$5,853,753,986	2	0.1%	$338,067	<0.1%	71	3.2%	$126,225,943	2.2%
Perry (T)	1,465	$806,651,425	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Pickerington (C)	23	$28,053,589	5	21.7%	$2,073,707	7.4%	5	21.7%	$2,073,707	7.4%
Plain (T)	792	$421,165,756	1	0.1%	$211,030	0.1%	4	0.5%	$1,467,008	0.3%
Pleasant (T)	2,393	$1,324,873,614	47	2.0%	$16,088,586	1.2%	79	3.3%	$26,875,988	2.0%

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Building Stock Located in the Flood Hazard Area							
			Number of Buildings Located in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Replacement Cost of Buildings in the 1-percent Annual Chance Flood Event Hazard Area	Percent of Total	Number of Buildings Located in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total	Total Replacement Cost of Buildings in the 0.2-percent Annual Chance Flood Event Hazard Area	Percent of Total
Prairie (T)	5,877	$2,583,782,102	51	0.9%	$19,390,120	0.8%	74	1.3%	$26,008,765	1.0%
Reynoldsburg (C)	8,007	$4,602,554,953	2	0.0%	$5,455,205	0.1%	5	0.1%	$24,847,307	0.5%
Riverlea (V)	215	$88,150,926	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Sharon (T)	839	$428,816,971	3	0.4%	$1,259,888	0.3%	4	0.5%	$1,462,564	0.3%
Truro (T)	448	$198,610,440	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Upper Arlington (C)	11,995	$7,401,370,183	5	0.0%	$2,091,887	<0.1%	5	<0.1%	$2,091,887	<0.1%
Urbancrest (V)	312	$904,463,260	4	1.3%	$149,036,254	16.5%	5	1.6%	$202,079,768	22.3%
Valleyview (V)	260	$102,695,732	0	0.0%	$0	0.0%	3	1.2%	$516,487	0.5%
Washington (T)	272	$197,989,788	3	1.1%	$2,750,822	1.4%	4	1.5%	$3,072,732	1.6%
Westerville (C)	9,502	$6,492,226,049	1	<1.0%	$467,868	<0.1%	4	<0.1%	$65,998,737	1.0%
Whitehall (C)	4,661	$3,811,335,352	19	0.4%	$10,879,164	0.3%	22	0.5%	$48,825,268	1.3%
Worthington (C)	5,238	$4,772,399,121	0	0.0%	$0	0.0%	0	0.0%	$0	0.0%
Franklin County (Total)	**350,503**	**$283,234,477,288**	**3,330**	**1.0%**	**$3,068,755,255**	**1.1%**	**5,168**	**1.5%**	**$5,130,337,400**	**1.8%**

Table 4.3.6-7. Estimated General Building Stock Potential Loss to the 1-Percent Annual Chance Flood Event

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Loss for All Occupancies	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Bexley (C)	$2,908,655,863	$0	$0	$0	$0
Blendon (T)	$1,413,412,606	$0	$0	$0	$0
Brice (V)	$101,696,013	$4,276,021	$0	$4,276,021	$0
Brown (T)	$615,217,276	$0	$0	$0	$0
Canal Winchester (C)	$2,664,295,038	$74,412,930	$13,286,992	$40,385,347	$20,740,592
Clinton (T)	$1,407,647,207	$0	$0	$0	$0
Columbus (C)	$169,488,966,898	$547,399,194	$277,370,418	$175,639,280	$94,389,496
Dublin (C)	$12,346,217,589	$3,835,510	$306,621	$0	$3,528,890
Franklin (T)	$2,786,144,235	$9,178,194	$7,409,439	$1,768,754	$0
Gahanna (C)	$7,777,120,382	$0	$0	$0	$0
Grandview Heights (C)	$864,354,956	$0	$0	$0	$0
Grove City (C)	$11,872,349,008	$25,590,140	$22,047,630	$3,321,238	$221,272
Groveport (V)	$8,015,019,558	$50,124,507	$9,935,960	$39,929,240	$259,307

Jurisdiction	Total Replacement Cost Value (RCV)	Estimated Loss for All Occupancies	Estimated Loss for Residential Properties	Estimated Loss for Commercial Properties	Estimated Loss for All Other Occupancies
Hamilton (T)	$954,562,909	$4,345,607	$3,607,748	$0	$737,859
Harrisburg	$59,706,145	$385,780	$385,780	$0	$0
Hilliard (C)	$7,685,805,074	$1,065,093	$1,065,093	$0	$0
Jackson (T)	$998,460,101	$8,259,763	$3,410,275	$4,533,813	$315,675
Jefferson (T)	$2,934,483,497	$7,899,012	$467,847	$0	$7,431,165
Lithopolis (V)	$22,524,552	$0	$0	$0	$0
Lockbourne (V)	$115,362,791	$1,624,179	$865,130	$0	$759,049
Madison (T)	$1,551,960,041	$170,207,605	$142,064,566	$11,924,636	$16,218,404
Marble Cliff (V)	$310,170,408	$0	$0	$0	$0
Mifflin (T)	$757,041,007	$0	$0	$0	$0
Minerva Park (V)	$347,638,675	$0	$0	$0	$0
New Albany (C)	$4,624,598,721	$0	$0	$0	$0
Norwich (T)	$592,173,496	$368,670	$368,670	$0	$0
Obetz (C)	$5,853,753,986	$167,991	$167,991	$0	$0
Perry (T)	$806,651,425	$0		$0	$0
Pickerington (C)	$28,053,589	$1,640,270	$1,640,270	$0	$0
Plain (T)	$421,165,756	$0		$0	$0
Pleasant (T)	$1,324,873,614	$11,703,374	$6,047,034	$1,288,216	$4,368,124
Prairie (T)	$2,583,782,101	$9,054,912	$5,227,010	$543,537	$3,284,365
Reynoldsburg (C)	$4,602,554,954	$457,246	$0	$457,246	$0
Riverlea (V)	$88,150,926	$0	$0	$0	$0
Sharon (T)	$428,816,971	$435,718	$0	$435,718	$0
Truro (T)	$198,610,440	$0	$0	$0	$0
Upper Arlington (C)	$7,401,370,183	$264,911	$264,911	$0	$0
Urbancrest (V)	$904,463,260	$1,384,991	$0	$1,384,991	$0
Valleyview (V)	$102,695,732	$0	$0	$0	$0
Washington (T)	$197,989,788	$1,447,424	$1,447,424	$0	$0
Westerville (C)	$6,492,226,049	$0	$0	$0	$0
Whitehall (C)	$3,811,335,352	$3,484,493	$880,613	$2,603,880	$0
Worthington (C)	$4,772,399,121	$0	$0	$0	$0
Franklin County (Total)	**$283,234,477,288**	**$939,013,534**	**$13,866,991**	**$288,491,917**	**$636,654,625**

NFIP Statistics

Participating in the NFIP is voluntary and to join, a community must complete an application; adopt a resolution of intent to participate and cooperate with FEMA; and adopt and submit a floodplain management ordinance that meets or exceeds the minimum NFIP criteria, and the ordinance must also adopt any FIRM or FHBM for the community. By participating, communities agree to adopt and implement local floodplain management regulations that protect lives and reduce risk from future flooding. In return, the federal government makes flood insurance available to property owners throughout the community (FEMA 2020) (FEMA 2022). Table 4.3.6-8 summarizes the NFIP community statistics for Franklin County. Out of the 43 communities in Franklin County, 23 participate in the NFIP, 3 do not participate, and 17 fall under Franklin County's participation in the NFIP.

Table 4.3.6-8. NFIP Community Statistics for Franklin County

Community Name*	Community Identification Number	Participates in the NFIP?
Bexley (C)	390168	Yes
Brice (V)	390898	No
Canal Winchester (C)	390169	Yes
Columbus (C)	390170	Yes
Dublin (C)	390673	Yes
Gahanna (C)	390171	Yes
Grandview Heights (C)	390172	Yes
Grove City (C)	390173	Yes
Groveport (C)	390174	Yes
Harrisburg (V)	390897	No
Hilliard (C)	390175	Yes
Lockbourne (V)	390691	Yes
Marble Cliff (V)	390896	Yes
Minerva Park (V)	390791	Yes
New Albany (C)	390895	Yes
Obetz (C)	390176	Yes
Pickerington (C)	390162	Yes
Reynoldsburg (C)	390177	Yes
Riverlea (V)	390692	Yes
Upper Arlington (C)	390178	Yes
Urbancrest (V)	390893	No
Valleyview (V)	390669	Yes
Westerville (C)	390179	Yes
Whitehall (C)	390180	Yes
Worthington (C)	390181	Yes
Franklin County	**390167**	**Yes**

Source: FEMA 2022

Note: Franklin County administers floodplain regulations for unincorporated areas of all townships in the County. Therefore, the Townships of Blendon, Brown, Clinton, Franklin, Hamilton, Jackson, Jefferson, Madison, Mifflin, Norwich, Plain, Pleasant, Prairie, Sharon, Truro, and Washington fall under Franklin County for NFIP participation.

Ohio EMA provided a redacted list of NFIP policies and past claims. Additional data was collected from claims and policy data available on the NFIP website (https://nfipservices.floodsmart.gov/reports-flood-insurance-data). Table 4.3.6-9 summarizes the NFIP policies, claims, and repetitive loss statistics for Franklin County. As of September 2022, there are 1,421 NFIP policies in Franklin County, with the City of Columbus having the highest percentage of policies (42.5-percent), followed up the unincorporated areas of the County (29.3-percent). In total, there have been 1,277 paid claims with over $7.5 million. Table 4.3.6-10 and Table 4.3.6-11 summarize the occupancy classes of repetitive and severe repetitive loss properties in the County. Of the occupancy classes represented, single family properties account for 81-percent of all RL properties and 100-percent of all SRL properties.

There are 100 RL and SRL properties in Franklin County (96 RL and 4 SRL). The City of Columbus has the largest number of RLs, with 41 properties. The City of Reynoldsburg has the largest number of SRLs, with 2 properties.

According to FEMA, a repetitive loss (RL) property is a NFIP-insured structure that has had at least two paid flood losses of more than $1,000 in any 10-year period since 1978. A severe repetitive loss (SRL) property is a NFIP-insured structure that has had four or more separate claim payments made under a standard flood insurance policy, with the amount of each claim exceeding $5,000 and with the cumulative amount of such claims payments exceeding $20,000; or at least two separate claims payments made under a standard flood insurance policy with the cumulative amount of such claim payments exceed the fair market value of the insured building on the day before each loss (FEMA 2022).

Table 4.3.6-9. NFIP Policies, Claims, and Repetitive Loss Statistics

Municipality*	Policies in Force[a]	Number of Paid Claims[a]	Amount of Paid Claims[a]	Number of NFIP RL Properties[b]	Number of NFIP SRL Properties[b]
Bexley (C)	14	23	$48,583.61	2	0
Blendon (Twp)	-	-	-	-	-
Brice (V)**	NP	NP	NP	NP	NP
Brown (Twp)	-	-	-	-	-
Canal Winchester (C)	7	7	$8,694.95	0	0
Clinton (Twp)	-	-	-	-	-
Columbus (C)	604	576	$3,821,431.58	41	0
Dublin (C)	52	8	$40,054.99	1	0
Franklin (Twp)	-	-	-	-	-
Gahanna (C)	48	29	$88,329.77	2	0
Grandview Heights (C)	9	3	$29,877.05	0	0
Grove City (C)	33	43	$163,350.86	4	0
Groveport (C)	11	7	$5,166.57	0	0
Hamilton (Twp)	-	-	-	-	-
Harrisburg (V)**	NP	NP	NP	NP	NP
Hilliard (C)	14	4	$2,387.83	0	0
Jackson (Twp)	-	-	-	-	-
Jefferson (Twp)	-	-	-	-	-
Lockbourne (V)	1	1	$9,250.18	0	0
Madison (Twp)	-	-	-	-	-
Marble Cliff (V)	NR	NR	NR	0	0
Mifflin (Twp)	-	-	-	-	-
Minerva Park (V)	1	3	$9,248.83	0	0
New Albany (C)	6	0	$0.00	0	0

Municipality*	Policies in Force[a]	Number of Paid Claims[a]	Amount of Paid Claims[a]	Number of NFIP RL Properties[b]	Number of NFIP SRL Properties[b]
Norwich (Twp)	-	-	-	-	-
Obetz (C)	1	0	$0.00	0	0
Perry (Twp)	-	-	-	-	-
Pickerington (C)	2	0	$0.00	0	0
Plain (Twp)	0	2	$685.20	0	0
Pleasant (Twp)	-	-	-	-	-
Prairie (Twp)	-	-	-	-	-
Reynoldsburg (C)	52	124	$885,582.78	14	2
Riverlea (V)	2	0	$0.00	0	0
Sharon (Twp)	-	-	-	-	-
Truro (Twp)	-	-	-	-	-
Upper Arlington (C)	39	49	$204,904.19	3	0
Urbancrest (V)**	NP	NP	NP	NP	NP
Valleyview (V)	3	4	$8,719.88	0	0
Washington (Twp)	-	-	-	-	-
Westerville (C)	30	17	$292,464.51	2	0
Whitehall (C)	51	66	$235,185.19	0	0
Worthington (C)	24	55	$271,451.85	4	1
Unincorporated Franklin County	417	258	$1,466,297.95	20	1
TOTAL	**1,421**	**1,277**	**$7,590,982.57**	**96**	**4**

Sources: a BureauNet 2023 (https://nfipservices.floodsmart.gov/reports-flood-insurance-data)
b State of Ohio 2023

* *Note: Franklin County administers floodplain regulations for unincorporated areas of all townships in the County. Therefore, the Townships of Blendon, Brown, Clinton, Franklin, Hamilton, Jackson, Jefferson, Madison, Mifflin, Norwich, Plain, Pleasant, Prairie, Sharon, Truro, and Washington fall under Franklin County for NFIP participation and NFIP policies and claims details is not available for these townships.*

** *Municipality does not participate in the NFIP*

Notes: Due to a contractual agreement with FEMA, detailed information at the municipal level was not available to incorporate into the 2023 HMP Update. The information presented here was collected from data provided by the State of Ohio and from FEMA's HUDEX Report.

\- *Township falls under the jurisdiction of Franklin County for NFIP purposes*

NP Not participating in the NFIP

NR Not reported

RL Repetitive Loss

SRL Severe Repetitive Loss

Table 4.3.6-10. Occupancy Class of Repetitive Loss Structures in Franklin County

Occupancy Class	Total Number of Repetitive Loss Properties (excludes SRL)	Total Number of Severe Repetitive Loss Properties	Total
Single Family	78	4	82
2-4 Family	6	0	6
Other Residential	5	0	5
Business/Non-Residential	1	0	1
Other Non-Residential	5	0	5
Unknown	1	0	1
Franklin County (Total)	**96**	**4**	**100**

Source: Ohio Emergency Management Agency 2022

Table 4.3.6-11. Occupancy Class of Repetitive Loss Structures in Franklin County, by Municipality

Municipality*	Repetitive Loss Properties (excludes SRL)						Severe Repetitive Loss Properties					
	Single Family	2-4 Family	Other Residential	Business/Non-Residential	Other Non-Residential	Unknown	Single Family	2-4 Family	Other Residential	Business/Non-Residential	Other Non-Residential	Unknown
Bexley (C)	2	0	0	0	0	0	0	0	0	0	0	0
Blendon (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Brice (V)**	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Brown (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Canal Winchester (C)	0	0	0	0	0	0	0	0	0	0	0	0
Clinton (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Columbus (C)	25	0	5	5	1	4	1	0	0	0	0	0
Dublin (C)	1	0	0	0	0	0	0	0	0	0	0	0
Franklin (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Gahanna (C)	2	0	0	0	0	0	0	0	0	0	0	0
Grandview Heights (C)	0	0	0	0	0	0	0	0	0	0	0	0
Grove City (C)	4	0	0	0	0	0	0	0	0	0	0	0
Groveport (C)	0	0	0	0	0	0	0	0	0	0	0	0
Hamilton (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Harrisburg (V)**	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Hilliard (C)	0	0	0	0	0	0	0	0	0	0	0	0
Jackson (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Jefferson (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Lockbourne (V)	0	0	0	0	0	0	0	0	0	0	0	0
Madison (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Marble Cliff (V)	0	0	0	0	0	0	0	0	0	0	0	0
Mifflin (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Minerva Park (V)	0	0	0	0	0	0	0	0	0	0	0	0
New Albany (C)	0	0	0	0	0	0	0	0	0	0	0	0
Norwich (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Obetz (C)	0	0	0	0	0	0	0	0	0	0	0	0
Perry (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Pickerington (C)	0	0	0	0	0	0	0	0	0	0	0	0
Plain (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Pleasant (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Prairie (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Reynoldsburg (C)	14	0	0	0	0	0	0	2	0	0	0	0
Riverlea (V)	0	0	0	0	0	0	0	0	0	0	0	0
Sharon (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Truro (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Upper Arlington (C)	3	0	0	0	0	0	0	0	0	0	0	0

Municipality*	Repetitive Loss Properties (excludes SRL)						Severe Repetitive Loss Properties					
	Single Family	2-4 Family	Other Residential	Business/Non-Residential	Other Non-Residential	Unknown	Single Family	2-4 Family	Other Residential	Business/Non-Residential	Other Non-Residential	Unknown
Urbancrest (V)**	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Valleyview (V)	0	0	0	0	0	0	0	0	0	0	0	0
Washington (Twp)	-	-	-	-	-	-	-	-	-	-	-	-
Westerville (C)	2	0	0	0	0	0	0	0	0	0	0	0
Whitehall (C)	3	0	0	0	0	0	0	0	0	0	0	0
Worthington (C)	4	0	0	0	0	0	0	1	0	0	0	0
Franklin County (Uninc)	18	0	1	0	0	1	0	1	0	0	0	0
TOTAL	78	0	6	5	1	5	1	4	0	0	0	0

Source: Ohio Emergency Management Agency 2022

* *Franklin County administers floodplain regulations for unincorporated areas of all townships in the County. Therefore, the Townships of Blendon, Brown, Clinton, Franklin, Hamilton, Jackson, Jefferson, Madison, Mifflin, Norwich, Plain, Pleasant, Prairie, Sharon, Truro, and Washington fall under Franklin County for NFIP participation and NFIP policies and claims details is not available for these townships.*

** *Municipality does not participate in the NFIP*

Impact on Critical Facilities and Community Lifelines

It is important to determine the critical facilities and infrastructure that may be at risk to flooding, and who may be impacted should damage occur. Critical services during and after a flood event may not be available if critical facilities are directly damaged or transportation routes to access these critical facilities are impacted. Roads that are blocked or damaged can isolate residents and can prevent access throughout the planning area to many service providers needing to reach vulnerable populations or to make repairs.

Critical facility exposure to the flood hazard was examined. Table 4.3.6-12 lists the lifelines and number of critical facilities within the 1-percent and 0.2-percent annual chance flood boundaries. Of the 259 critical facilities located in the 1-percent annual chance flood event boundary, the greatest number are transportation facilities. Additionally, there are 383 critical facilities located in the 0.2-percent annual chance flood event boundary, 204 of which are transportation facilities. A majority of the critical facilities located in the 1-percent and 0.2-percent annual chance flood event boundaries are in Larchmont and Rye, shown in Table 4.3.6-13 and Table 4.3.6-14.

In cases where short-term functionality is impacted by flooding, other facilities of neighboring municipalities may need to increase support response functions during a disaster event. Mitigation planning should consider means to reduce flood impacts to critical facilities and ensure sufficient emergency and school services remain when a significant event occurs.

Table 4.3.6-12. Lifelines and Critical Facilities Located in the 1-Percent and 0.2-Percent Annual Chance Event Floodplain

FEMA Lifeline Category	Number of Critical Facilities	Number of Critical Facilities Located in the 1-percent Annual Chance Flood Event Hazard Area	Number of Critical Facilities Located in the 0.2-percent Annual Chance Flood Event Hazard Area
Communications	62	13	16
Energy	106	5	9
Food, Water, Shelter	16	7	7
Hazardous Materials	248	1	6
Health and Medical	1,691	20	79
Safety and Security	897	39	62
Transportation	930	174	204
Franklin County (Total)	**3,950**	**259**	**383**

Sources: Franklin County 2022; FEMA 2021

Table 4.3.6-13. Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area by Jurisdiction

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Bexley (C)	12	7	1	8.3%	1	14.3%
Blendon (T)	12	8	1	8.3%	1	12.5%
Brice (V)	3	2	1	33.3%	1	50.0%
Brown (T)	5	5	0	0.0%	0	0.0%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Canal Winchester (C)	41	34	4	9.8%	3	8.8%
Clinton (T)	12	6	0	0.0%	0	0.0%
Columbus (C)	3,225	2,823	226	7.0%	219	7.8%
Dublin (C)	236	208	3	1.3%	3	1.4%
Franklin (T)	70	64	5	7.1%	5	7.8%
Gahanna (C)	123	96	0	0.0%	0	0.0%
Grandview Heights (C)	17	13	0	0.0%	0	0.0%
Grove City (C)	116	99	4	3.4%	3	3.0%
Groveport (V)	40	37	5	12.5%	5	13.5%
Hamilton (T)	14	14	3	21.4%	3	21.4%
Harrisburg (V)	1	1	0	0.0%	0	0.0%
Hilliard (C)	101	73	3	3.0%	3	4.1%
Jackson (T)	12	11	0	0.0%	0	0.0%
Jefferson (T)	10	7	0	0.0%	0	0.0%
Lithopolis (V)	1	1	0	0.0%	0	0.0%
Lockbourne (V)	0	0	0	0.0%	0	0.0%
Madison (T)	11	8	4	36.4%	2	25.0%
Marble Cliff (V)	5	3	2	40.0%	2	66.7%
Mifflin (T)	10	6	0	0.0%	0	0.0%
Minerva Park (V)	5	3	0	0.0%	0	0.0%
New Albany (C)	53	48	0	0.0%	0	0.0%
Norwich (T)	2	2	1	50.0%	1	50.0%
Obetz (C)	10	9	0	0.0%	0	0.0%
Perry (T)	6	4	1	16.7%	1	25.0%
Pickerington (C)	0	0	0	0.0%	0	0.0%
Plain (T)	3	3	0	0.0%	0	0.0%
Pleasant (T)	20	19	0	0.0%	0	0.0%
Prairie (T)	58	50	0	0.0%	0	0.0%
Reynoldsburg (C)	57	38	1	1.8%	1	2.6%
Riverlea (V)	0	0	0	0.0%	0	0.0%
Sharon (T)	10	7	0	0.0%	0	0.0%
Truro (T)	2	1	0	0.0%	0	0.0%
Upper Arlington (C)	58	50	1	1.7%	1	2.0%
Urbancrest (V)	1	0	0	0.0%	0	0.0%
Valleyview (V)	1	1	1	100.0%	1	100.0%
Washington (T)	1	1	0	0.0%	0	0.0%
Westerville (C)	105	81	0	0.0%	0	0.0%
Whitehall (C)	61	51	3	4.9%	2	3.9%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 1-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Worthington (C)	68	56	1	1.5%	1	1.8%
Franklin County (Total)	**4,598**	**3,950**	**271**	**5.9%**	**259**	**6.6%**

Source: Franklin County 2022; FEMA 2021

Table 4.3.6-14. Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area by Jurisdiction

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Bexley (C)	12	7	1	8.3%	1	14.3%
Blendon (T)	12	8	1	8.3%	1	12.5%
Brice (V)	3	2	1	33.3%	1	50.0%
Brown (T)	5	5	0	0.0%	0	0.0%
Canal Winchester (C)	41	34	6	14.6%	5	14.7%
Clinton (T)	12	6	0	0.0%	0	0.0%
Columbus (C)	3,225	2,823	325	10.1%	310	11.0%
Dublin (C)	236	208	6	2.5%	5	2.4%
Franklin (T)	70	64	6	8.6%	6	9.4%
Gahanna (C)	123	96	3	2.4%	3	3.1%
Grandview Heights (C)	17	13	9	52.9%	8	61.5%
Grove City (C)	116	99	5	4.3%	4	4.0%
Groveport (V)	40	37	5	12.5%	5	13.5%
Hamilton (T)	14	14	3	21.4%	3	21.4%
Harrisburg (V)	1	1	0	0.0%	0	0.0%
Hilliard (C)	101	73	5	5.0%	5	6.8%
Jackson (T)	12	11	0	0.0%	0	0.0%
Jefferson (T)	10	7	0	0.0%	0	0.0%
Lithopolis (V)	1	1	0	0.0%	0	0.0%
Lockbourne (V)	0	0	0	0.0%	0	0.0%
Madison (T)	11	8	5	45.5%	2	25.0%
Marble Cliff (V)	5	3	2	40.0%	2	66.7%
Mifflin (T)	10	6	0	0.0%	0	0.0%
Minerva Park (V)	5	3	0	0.0%	0	0.0%
New Albany (C)	53	48	2	3.8%	2	4.2%
Norwich (T)	2	2	1	50.0%	1	50.0%
Obetz (C)	10	9	0	0.0%	0	0.0%
Perry (T)	6	4	1	16.7%	1	25.0%
Pickerington (C)	0	0	0	0.0%	0	0.0%
Plain (T)	3	3	0	0.0%	0	0.0%
Pleasant (T)	20	19	0	0.0%	0	0.0%
Prairie (T)	58	50	0	0.0%	0	0.0%
Reynoldsburg (C)	57	38	1	1.8%	1	2.6%
Riverlea (V)	0	0	0	0.0%	0	0.0%
Sharon (T)	10	7	1	10.0%	1	14.3%
Truro (T)	2	1	0	0.0%	0	0.0%
Upper Arlington (C)	58	50	1	1.7%	1	2.0%
Urbancrest (V)	1	0	0	0.0%	0	0.0%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the 0.2-Percent Annual Chance Flood Event Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Valleyview (V)	1	1	1	100.0%	1	100.0%
Washington (T)	1	1	0	0.0%	0	0.0%
Westerville (C)	105	81	11	10.5%	11	13.6%
Whitehall (C)	61	51	3	4.9%	2	3.9%
Worthington (C)	68	56	1	1.5%	1	1.8%
Franklin County (Total)	**4,598**	**3,950**	**406**	**8.8%**	**383**	**9.7%**

Source: Franklin County 2022; FEMA 2021

Impact on the Economy

Flood events can significantly impact the local and regional economy. This includes but is not limited to general building stock damages and associated tax loss, impacts to utilities and infrastructure, business interruption, impacts on tourism, and impacts on the tax base to Franklin County. In areas that are directly flooded, renovations of commercial and industrial buildings may be necessary, disrupting associated services. Refer to the 'Impact on General Building Stock' subsection earlier which discusses direct impacts to buildings in Franklin County. Other economic components such as loss of facility use, functional downtime and socio-economic factors are less measurable with a high degree of certainty.

Flooding can cause extensive damage to public utilities and disruptions to delivery of services. Loss of power and communications may occur, and drinking water and wastewater treatment facilities may be temporarily out of operation.

Debris management may also be a large expense after a flood event. Hazus estimates the amount of debris generated from the 1-percent annual chance event. The model breaks down debris into three categories: (1) finishes (dry wall, insulation, etc.); (2) structural (wood, brick, etc.) and (3) foundations (concrete slab and block, rebar, etc.). The distinction is made because of the different types of equipment needed to handle the debris. Table 4.3.6-15 summarizes the debris Hazus estimates for these events. As a result of the 1-percent annual chance event, Hazus estimates approximately 85,461 tons of debris will be generated in total.

Table 4.3.6-15. Estimated Debris Generated from the 1-percent Annual Chance Flood Event

Jurisdiction	1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Bexley (C)	45	19	8	18
Blendon (T)	0	0	0	0
Brice (V)	0	0	0	0
Brown (T)	0	0	0	0
Canal Winchester (C)	5,122	524	2,626	1,971
Clinton (T)	0	0	0	0
Columbus (C)	33,804	4,429	17,637	11,738
Dublin (C)	82	12	39	31
Franklin (T)	573	106	262	205
Gahanna (C)	61	7	34	20
Grandview Heights (C)	0	0	0	0

Jurisdiction	1-Percent Annual Chance Flood Event			
	Total (tons)	Finish (tons)	Structure (tons)	Foundation (tons)
Grove City (C)	3,679	572	1,831	1,276
Groveport (V)	1,447	229	655	562
Hamilton (T)	3,404	287	1,994	1,123
Harrisburg	68	14	31	23
Hilliard (C)	123	11	62	50
Jackson (T)	79	15	36	27
Jefferson (T)	14	3	6	5
Lithopolis (V)	0	0	0	0
Lockbourne (V)	162	32	73	56
Madison (T)	29,796	5,568	13,725	10,504
Marble Cliff (V)	0	0	0	0
Mifflin (T)	14	1	8	6
Minerva Park (V)	0	0	0	0
New Albany (C)	0	0	0	0
Norwich (T)	58	12	26	20
Obetz (C)	5	1	2	2
Perry (T)	0	0	0	0
Pickerington (C)	7	1	3	2
Plain (T)	1	0	0	0
Pleasant (T)	828	132	396	300
Prairie (T)	674	114	316	244
Reynoldsburg (C)	26	1	15	10
Riverlea (V)	0	0	0	0
Sharon (T)	33	6	15	12
Truro (T)	0	0	0	0
Upper Arlington (C)	22	4	10	8
Urbancrest (V)	4,448	151	2,447	1,850
Valleyview (V)	0	0	0	0
Washington (T)	42	9	19	15
Westerville (C)	5	1	2	2
Whitehall (C)	838	124	439	275
Worthington (C)	0	0	0	0
Franklin County (Total)	**85,461**	**12,386**	**42,718**	**30,357**

Sources: Hazus v5.1; Franklin County 2022

Impact on the Environment

Flood extents for the 1- and 0.2-percent annual flood events will continue to evolve alongside natural occurrences such as sea level rise, climate change, and/or severity of storms. Further, residents living in and around areas of wildfire may be at increased risk of flooding in the future due to changes in the natural landscape.

Flood events will inevitably impact Franklin County's natural and local environment. Severe flooding not only influences the habitat of these natural land areas, but it can also be disruptive to species that reside in these natural habitats. Table 4.3.6-16 lists the number of acres exposed to the 1- and 0.2-percent annual chance flood extents.

Table 4.3.6-16. Land Acreage in Franklin County Located in 1% and 0.2% Flood Extents

Jurisdiction	Total Acres of Land Area	Total Acres of Land Area (Excluding Waterbodies) Located in the Flood Hazard Areas			
		Total Acres Located in the 1-Percent Annual Chance Flood Event	Percent of Total	Total Acres Located in the 0.2-Percent Annual Chance Flood Event	Percent of Total
Bexley (C)	1,548	26	1.7%	40	2.6%
Blendon (T)	3,092	126	4.1%	165	5.3%
Brice (V)	57	5	7.9%	5	7.9%
Brown (T)	12,173	485	4.0%	679	5.6%
Canal Winchester (C)	3,764	810	21.5%	1,029	27.3%
Clinton (T)	874	0	0.0%	0	0.0%
Columbus (C)	136,976	11,475	8.4%	14,135	10.3%
Dublin (C)	13,086	455	3.5%	594	4.5%
Franklin (T)	4,194	322	7.7%	376	9.0%
Gahanna (C)	7,903	635	8.0%	817	10.3%
Grandview Heights (C)	843	18	2.1%	350	41.5%
Grove City (C)	11,767	965	8.2%	1,107	9.4%
Groveport (V)	5,454	1,536	28.2%	1,600	29.3%
Hamilton (T)	4,777	1,169	24.5%	1,234	25.8%
Harrisburg (V)	83	21	25.4%	22	26.7%
Hilliard (C)	8,941	401	4.5%	567	6.3%
Jackson (T)	10,683	733	6.9%	843	7.9%
Jefferson (T)	8,904	426	4.8%	479	5.4%
Lithopolis (V)	449	18	4.0%	30	6.7%
Lockbourne (V)	461	398	86.4%	402	87.2%
Madison (T)	14,469	2,889	20.0%	3,258	22.5%
Marble Cliff (V)	178	7	4.1%	14	7.9%
Mifflin (T)	1,212	50	4.1%	63	5.2%
Minerva Park (V)	405	0	0.0%	0	0.0%
New Albany (C)	6,855	227	3.3%	266	3.9%
Norwich (T)	1,607	70	4.4%	95	5.9%
Obetz (C)	3,725	235	6.3%	300	8.0%
Perry (T)	1,412	14	1.0%	21	1.5%
Pickerington (C)	204	43	21.1%	43	21.1%
Plain (T)	5,813	216	3.7%	280	4.8%
Pleasant (T)	27,162	2,805	10.3%	3,222	11.9%
Prairie (T)	11,672	957	8.2%	1,229	10.5%
Reynoldsburg (C)	4,740	364	7.7%	443	9.3%
Riverlea (V)	96	7	6.8%	7	7.1%
Sharon (T)	1,844	125	6.8%	140	7.6%
Truro (T)	342	14	4.1%	16	4.8%
Upper Arlington (C)	6,224	26	0.4%	35	0.6%
Urbancrest (V)	366	25	6.7%	31	8.3%
Valleyview (V)	93	16	17.5%	20	21.9%
Washington (T)	1,682	82	4.9%	98	5.8%
Westerville (C)	5,477	291	5.3%	428	7.8%
Whitehall (C)	3,377	335	9.9%	349	10.3%
Worthington (C)	3,492	176	5.0%	207	5.9%
Franklin County (Total)	**338,479**	**28,997**	**8.6%**	**35,039**	**10.4%**

Sources: Franklin County 2022; FEMA 2021

Cascading Impacts on Other Hazards

Cascading impacts may also include exposure to pathogens such as mold. After flood events, excess moisture and standing water contribute to the growth of mold in buildings. Mold may present a health

risk to building occupants, especially those with already compromised immune systems such as infants, children, the elderly and pregnant women. The degree of impact will vary and is not strictly measurable. Mold spores can grow in as short a period as 24-48 hours in wet and damaged areas of buildings that have not been properly cleaned. Very small mold spores can easily be inhaled, creating the potential for allergic reactions, asthma episodes, and other respiratory problems. Buildings should be properly cleaned and dried out to safely prevent mold growth (CDC 2020).

Molds and mildews are not the only public health risk associated with flooding. Floodwaters can be contaminated by pollutants such as sewage, human and animal feces, pesticides, fertilizers, oil, asbestos, and rusting building materials. Common public health risks associated with flood events also include:

- Unsafe food
- Contaminated drinking and washing water and poor sanitation
- Mosquitos and animals
- Carbon monoxide poisoning
- Secondary hazards associated with re-entering/cleaning flooded structures
- Mental stress and fatigue

Current loss estimation models such as Hazus are not equipped to measure public health impacts. The best level of mitigation for these impacts is to be aware that they can occur, educate the public on prevention, and be prepared to deal with these vulnerabilities in responding to flood events.

Floods of any type have the potential to impact water and power utilities which may impact public and private use, as well as cause disruption to critical infrastructure. Refer to the list below to view flooding's harmful effects on the water supply:

- **Water Supply Contamination:** Excess floodwater can contaminate private drinking water sources, such as wells and springs. Floodwater picks up debris, increasing the number of bacteria, sewage, and other industrial waste and chemicals into the water source or leaky pipes. Excess water also makes it more difficult for water treatment plants to treat the water efficiently and effectively. If there is a contamination at any step of the water flow process, this puts consumers at risk of exposure to dangerous toxins that could result in serious harm, such as wound infections, skin rashes, gastrointestinal illnesses, and tetanus; in extreme cases, death may occur.
- **Disruption to Clean Drinking and Cooking Water:** In the event of only having access to contaminated water, consumers are unable to cook or clean in their home the water is certified as safe. Depending on the severity of the flood and the storm, this could take days, weeks, months and in some cases even years. Without access to clean drinking and cooking water, consumers ultimately become reliant on bottled water. In impoverished communities, this reality is even more detrimental because those affected may not have the economic means to "stock up" on bottled water. Moreover, in a flood, retail locations are often inaccessible and/or low on water supply (Andrew 2021).

Floodwaters can also cause damage to power utilities. In particular, flooded buildings may have the utilities disrupted if the service panel, generator, meter, etc. are not elevated above the flood protection level. Oversaturated soils from periods of heavy rain and flooding may cause utility poles to tip over or fall completely, interrupting the power grid for a potentially large area, especially if the transformer is impacted.

Future Changes That May Impact Vulnerability

Understanding future changes that affect vulnerability can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed and illustrated in Section 3 (County Profile), areas targeted for future growth and development have been identified across the County. New development that has occurred in the last five years within the County, and potential future development in the next five years as identified by the county and each municipality, is included in the jurisdictional annexes in Section 9, along with an indication of proximity to known hazard zones. Refer to Section 3, and Volume II Section 9 for more information about the potential new development in Franklin County.

Projected Changes in Population

According to the 2021 American Community Survey 5-year population estimates, the population of the County has increased by approximately 13.7-percent since 2010. The County's population is anticipated to slightly increase over the next decade (5.37 percent increase by 2030 and 11.72 percent increase by 2050) (Ohio Development Services Agency 2018). Increased population trends will change the County's overall risk to flood events. Refer to Section 3 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed above, most studies project that the State of Ohio will see an increase in average annual temperatures and precipitation. It is anticipated that Franklin County will continue to experience direct and indirect impacts of flooding events annually that may induce secondary hazards such as infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences.

Change of Vulnerability Since 2018 HMP

Since the 2018 HMP was drafted, updated inventory data has become available to assess additional flood hazard areas in Franklin County. This data includes the 5-Year 2021 American Community Survey

population estimates, updated 2022 tax assessor parcel data, 2022 general building stock data provided by the County, 2022 RS Means for building stock replacement cost valuation, and updated critical facility data provided by the County's Planning Partners. Hazus v5.1 was also used to assess the losses in the County to the overall risk from 100-year and 500-year flood risk. Overall, this vulnerability assessment uses a more accurate and updated asset inventory which provides more accurate estimated exposure to the flood hazard.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.7 Geologic Hazards

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for geologic hazards in Franklin County.

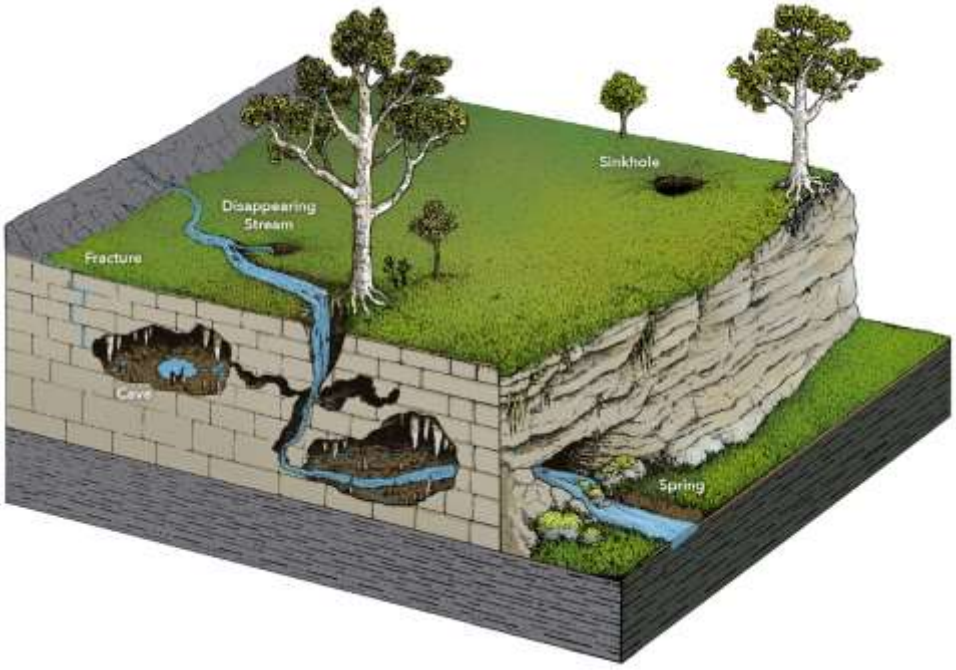
Hazard Profile

Hazard Description

Sinkholes and Land Subsidence

Sinkholes form as bedrock dissolves and surface materials erode or collapse into the resulting voids. In Ohio, karst forms largely in the Devonian-, Silurian-, and Ordovician-aged bedrock in the central and western portions of the State. Sinkholes are the main hazard associated with karst landforms in Ohio (Ohio Department of Natural Resources 2023).

Figure 4.3.7-1. Sinkhole Formations in Karst Terrains



Source: Ohio Department of Natural Resources 2023

Subsidence is the motion of the Earth's surface as it shifts downward relative to a benchmark (often sea level) of the surrounding terrain. There are a number of causes for this effect. In Ohio, the two primary causes are abandoned underground mines (AUMs) and karst (Ohio Emergency Management Agency 2019).

Erosion

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 (The Ohio State University 2023). 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 structure.

Location

Sinkholes and Land Subsidence

Karst is a little-known but unique and important landform that can be found throughout the State of Ohio. Sinkholes are the main hazard associated with karst landforms in Ohio and there are thousands of them in the state. Regions that contain sinkholes and other solutional features, such as caves, springs, disappearing streams, and enlarged fractures, are known as karst terrains. According to the Ohio Department of Natural Resources (ODNR), karst geology is most predominant in western portions of the state (Ohio Department of Natural Resources n.d.).

> The US Geological Survey (USGS) notes that "subsidence is a global problem and, in the United States, more than 17,000 square miles in 45 States, an area roughly the size of New Hampshire and Vermont combined, have been directly affected by subsidence" (USGS 2018).

Figure 4.3.7-2. Sinkhole in Washington Township, Ohio

Source: Ohio DNR 2021

Karst points including sinkholes have been documented in the northeastern portion of Franklin County, in Perry and Washington Townships. These sinkholes occur near the Scioto River and are potentially hazardous to the community, particularly given the residential nature of the area and the prevalence of parks along the river. Figure 4.3.7-2 shows a sinkhole (Karst ID number 340499008242) located near the intersection of Dublin Road and River Forest Road in Washington Township.

Ohio DNR's interactive karst map, available at https://gis.ohiodnr.gov/website/dgs/karst_interactivemap/, displays record of karst geology

and the status of known sinkholes. This map can serve as a valuable database for communities in Franklin County in their community planning and capital investment planning efforts.

To identify areas where subsidence may occur, locations with Karst Geology were mapped. Figure 4.3.7-3 shows the sinkhole/subsidence (karst geology) hazard area, areas of karst geology, in Franklin County; the land subsidence risk in Franklin County is primarily in the western portion of the County. Figure 4.3.7-4 shows the location of karst points in Franklin County. These points show the deepest point in a sinkhole or the location of a sinkhole.

Figure 4.3.7-3. Sinkhole/subsidence (karst geology) hazard area (Areas of Karst Geology)

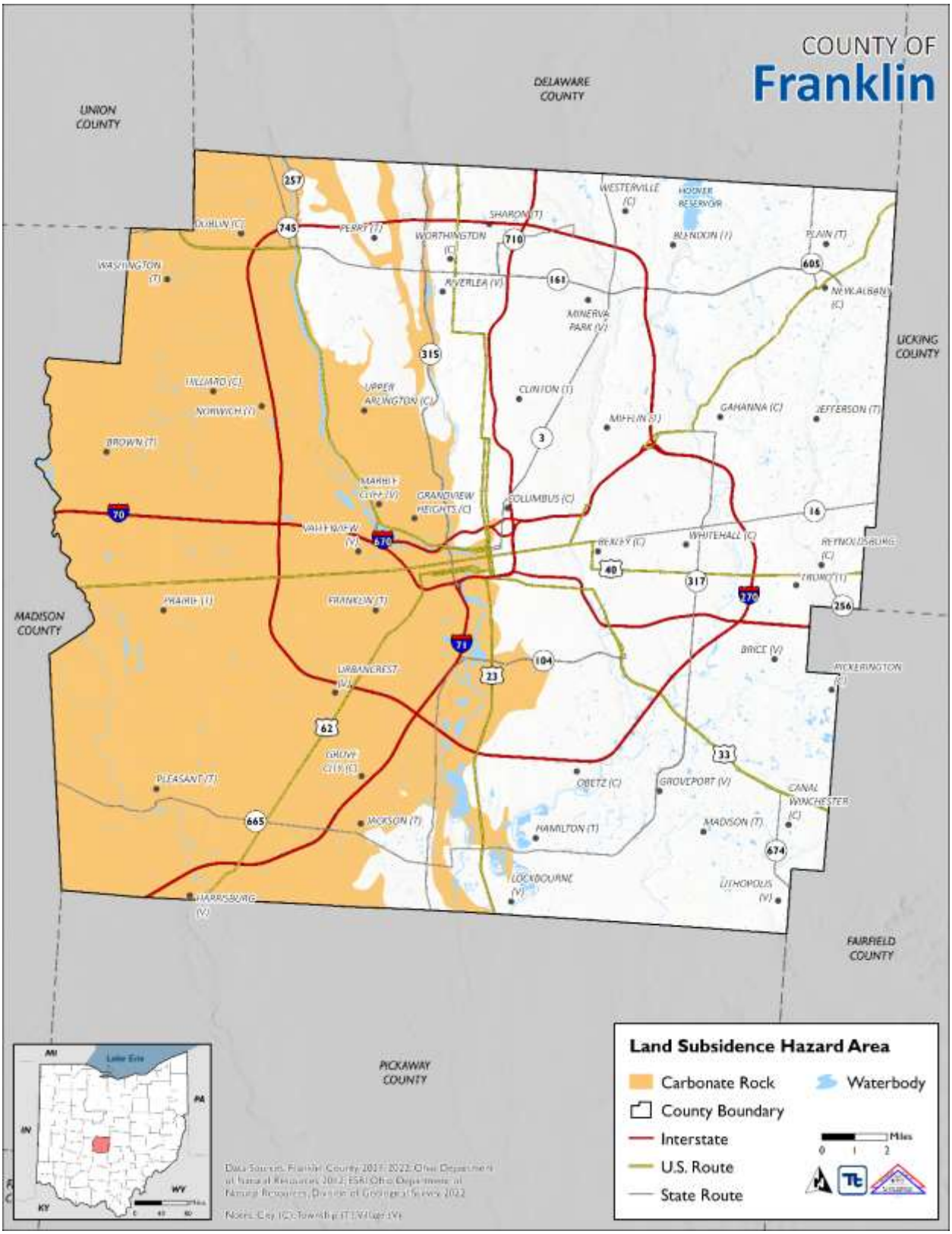
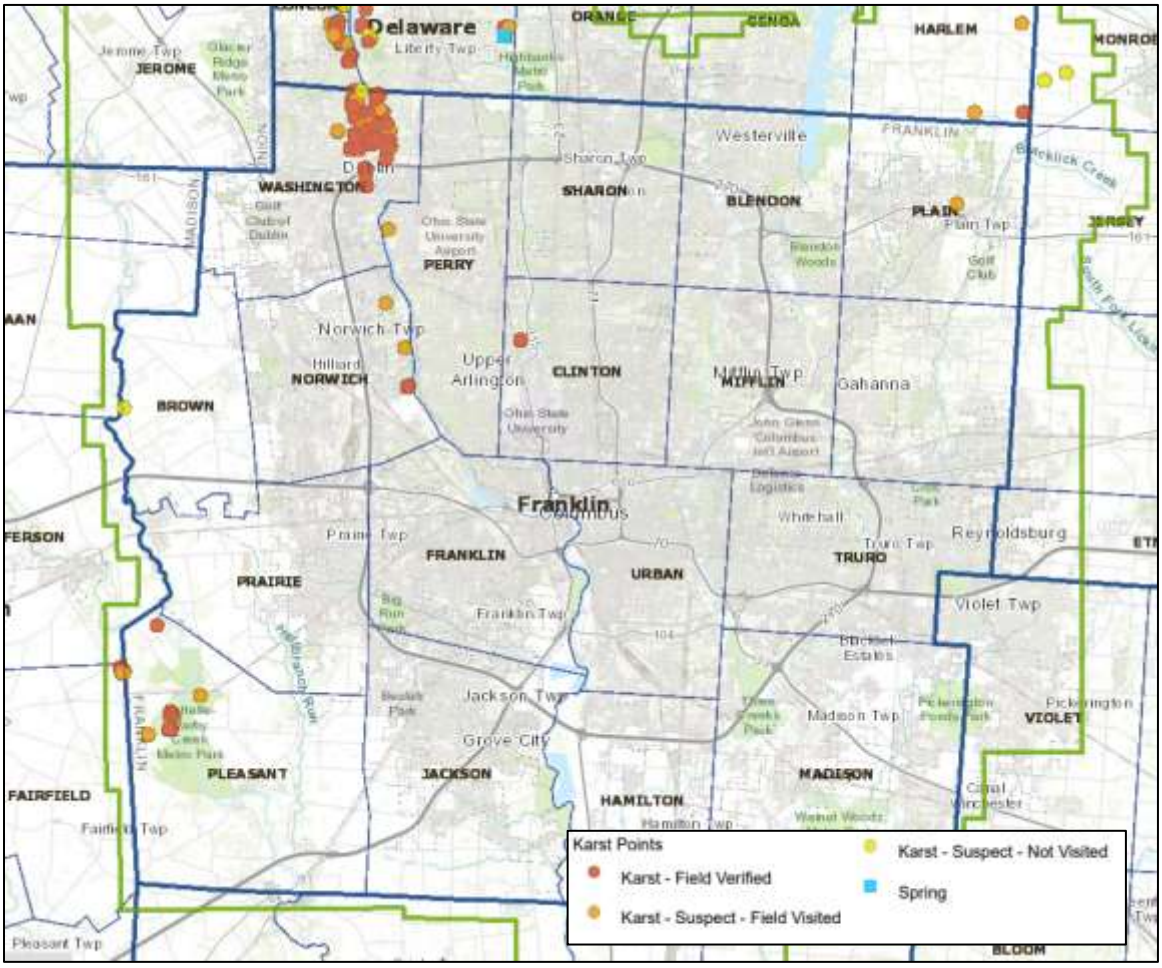


Figure 4.3.7-4. Sinkhole Locations in Franklin County



Source: ODNR Division of Geological Survey 2023
Notes: Karst – Field Verified – generally a sinkhole, confirmed by field work
Karst – Suspect – Field Visisted – likely a sinkhole, but could not be verified by a field visit
Karst – Suspect – Not Visited – possibly a sinkhole, but the point has not been field checked
Spring – where water re-emerges at the land surface from a karst system

Erosion

Erosion can occur throughout Franklin County, particularly along major bodies of water such as the Scioto and Olentangy Rivers. Additional tributaries subject to erosion include:

- Alum Creek
- Big Darby Creek
- Big Walnut Creek
- Backlick Creek
- Duncan Run
- Little Darby Creek
- Schleppi Run

The Friends of the Lower Olentangy Watershed (FLOW), a nonprofit organization dedicated to the health and safety of the Olentangy River and its tributaries, cites erosion as a concern for the waterways of Franklin County. FLOW points to development in the region as a driver of habitat loss, which exacerbates the wearing away of stream and riverbanks (FLOW n.d.).

Soil erodibility (K) factors of ≥0.49 were looked at to identify areas more susceptible to erosion. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water (U.S. Geological Survey 2002). Figure 4.3.7-3 shows the erosion hazard area in Franklin County.

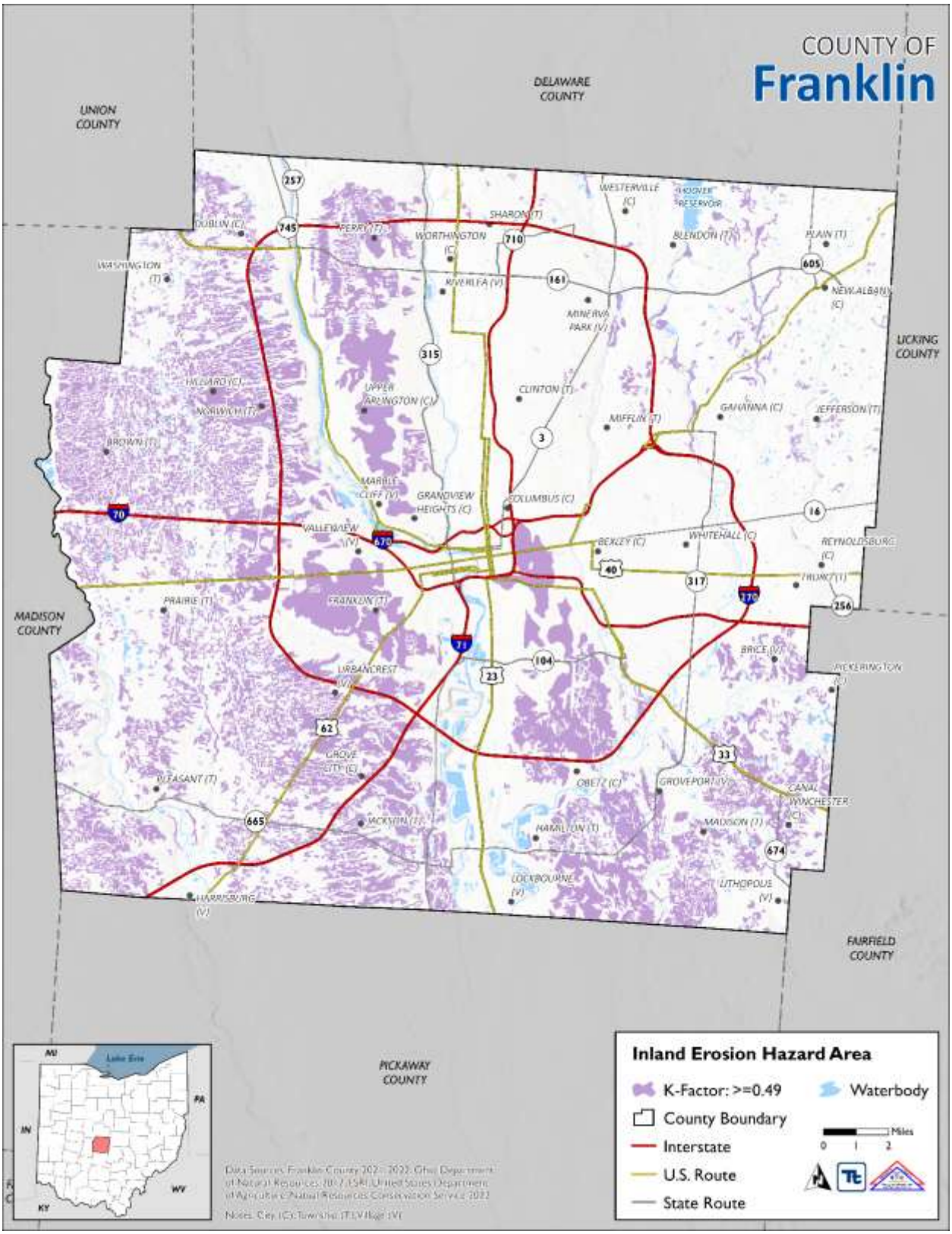
Extent

Sinkholes and Land Subsidence

The extent of risk from sinkholes in Franklin County is difficult to calculate. In general, Ohio sinkholes are relatively slow growing and, except in the densest and most active areas, only deepen or widen a few inches per year. Most sinkholes have been present in their current locations for as long as anyone can remember and likely thousands of years. In rural settings, farmers often allow areas of fields with sinkholes to remain wooded and unfarmed; this prevents erosion and limits growth of sinkholes. On the other hand, many sinkholes have storm runoff or field drainage directed into sinkholes; this is a sure way to encourage karst development and sinkhole growth as moving water carries away loose material and exposes rock to continued dissolution (Ohio DNR 2015).

Human activity can often be the cause of a subsidence area. Leaking water pipes or structures that convey stormwater runoff may also result in areas of subsidence as the water dissolves substantial amounts of rock over time. In some cases, construction, land grading, or earth-moving activities that cause changes in stormwater flow can trigger subsidence events. Subsidence events may occur during mining activities, especially in areas where the cover of a mine is thin, or in areas where bedrock is not necessarily conducive to their formation. Subsurface (i.e., underground) extraction of materials such as oil, gas, coal, metal ores (i.e., copper, iron, and zinc), clay, shale, limestone, or water may result in slow-moving or abrupt shifts in the ground surface (Whittaker and Reddish 1989).

Figure 4.3.7-5. Inland Erosion Hazard Area



Erosion

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 soil surface stability, sedimentation, and soil loss (USDA 2001).

Every five years the Natural Resources Conservation Service (NRCS) conducts a statistical survey of natural resource conditions and trends on non-federal land in the United States called the National Resources Inventory (NRI). The NRI provides nationally consistent statistical data on erosion resulting from water and wind processes on cropland. It uses a variety of tables and maps to document the ongoing state of erosion across the country (USDA n.d.).

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was not included in any disaster (DR) or emergency (EM) declarations for geologic hazard-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Franklin County was not included in any geologic hazard-related agricultural disaster declarations.

Previous Events

For the 2023 HMP update, known geologic hazard events that impacted Franklin County between 2018 and 2022 were researched. While numerous sources were researched during this plan update, information regarding occurrences and losses associated with geologic hazard events in Franklin County was limited. For events prior to 2018, refer to the 2018 Franklin County HMP.

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of geologic events for the County. The Ohio State University HMP notes that a significant karst related event occurs approximately once a decade in Ohio (Ohio Emergency Management Agency 2019). The frequency of such an event would be significantly lower for Franklin County alone.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical

records and input from the Planning Team, the probability of occurrence for geologic hazards in the County is considered 'unlikely'.

Climate Change Impacts

Climate change acts as an amplifier of existing natural hazards. The best available scientific data and modeling suggest that climate change has and will continue to impact natural hazards in the state. While the impacts of climate change may vary by regions and jurisdictions throughout the state, it is clear that the potential consequences of climate change will have significant impacts on all the citizens of the state (Ohio Emergency Management Agency 2019).

Since the beginning of the 20th century, temperatures in Ohio have risen more than 1.5°F, and temperatures in the 2000s and 2010s were warmer than in any other historical period. The State of Ohio has also experienced significant increase in heavy rain events, increasing the risk of springtime flooding. These storms can also cause major impacts to life, safety, property, and disruption to economic activity (NOAA National Centers for Environmental Information 2022).

Sinkholes and subsidence due to karst geology will continue to erode over time by water. Changes in precipitation or the hydrologic systems can create an abundance of moisture which has the potential to permeate the bedrock and cause sinkholes or subsidence incidents. 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).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. To complete the vulnerability assessment for the geological hazard, areas underlain by karst geology and areas with a K-factor of ≥0.49 were used as the hazard areas. Population, structures, critical facilities, and lifelines located in these hazard areas may be more susceptible to the geology hazard in Franklin County.

Impact on Life, Health, and Safety

A geologic event would be an isolated incidence and impact the populations within the immediate area of the incident. In addition to causing damages to residential buildings and displacing residents, geologic events can block off or damage major roadways and inhibit travel for emergency responders or populations trying to evacuate the area.

In Franklin County, those living in areas identified as having karst geology or those in areas with soil erodibility (K) factors of ≥0.49 have a greater risk to geologic events. Information from from the ODNR Division of Geological Survey and the NRCS were used to determine the number of people exposed to this hazard.

Based on the analysis, there are an estimated 563,703 residents living in the hazard area, or 37-percent of the County's total population. The City of Columbus has the greatest number of residents living in the

hazard area with approximately 247,258 residents. Table 4.3.7-1 summarizes the population exposed to the land subsidence hazard by jurisdiction.

Table 4.3.7-1. Estimated Number of Persons in Franklin County Living in the Sinkhole/Subsidence (Karst Geology) Hazard Area

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Population Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area	
		Number of Persons	Percent of Total
Bexley (C)	13,820	0	0.0%
Blendon (T)	10,073	0	0.0%
Brice (V)	185	0	0.0%
Brown (T)	3,679	3,679	100.0%
Canal Winchester (C)	8,150	0	0.0%
Clinton (T)	4,449	853	19.2%
Columbus (C)	855,224	247,258	28.9%
Dublin (C)	41,175	39,397	95.7%
Franklin (T)	11,312	11,312	100.0%
Gahanna (C)	35,626	0	0.0%
Grandview Heights (C)	8,099	8,099	100.0%
Grove City (C)	41,025	36,931	90.0%
Groveport (V)	5,942	0	0.0%
Hamilton (T)	8,743	29	0.3%
Harrisburg (V)	376	376	100.0%
Hilliard (C)	35,530	35,530	100.0%
Jackson (T)	46,340	38,002	82.0%
Jefferson (T)	14,027	0	0.0%
Lithopolis (V)	2,225	0	0.0%
Lockbourne (V)	176	0	0.0%
Madison (T)	25,896	0	0.0%
Marble Cliff (V)	782	782	100.0%
Mifflin (T)	38,121	0	0.0%
Minerva Park (V)	1,611	0	0.0%
New Albany (C)	10,929	0	0.0%
Norwich (T)	37,356	37,356	100.0%
Obetz (C)	5,351	0	0.0%
Perry (T)	3,888	1,434	36.9%
Pickerington (C)	113	0	0.0%
Plain (T)	12,469	0	0.0%
Pleasant (T)	6,768	6,768	100.0%
Prairie (T)	17,433	17,433	100.0%
Reynoldsburg (C)	29,016	0	0.0%
Riverlea (V)	566	0	0.0%
Sharon (T)	17,109	1,920	11.2%
Truro (T)	30,165	0	0.0%
Upper Arlington (C)	36,566	30,992	84.8%
Urbancrest (V)	1,124	1,124	100.0%

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Population Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area	
		Number of Persons	Percent of Total
Valleyview (V)	722	722	100.0%
Washington (T)	42,997	42,997	100.0%
Westerville (C)	23,467	0	0.0%
Whitehall (C)	20,004	0	0.0%
Worthington (C)	15,047	709	4.7%
Franklin County (Total)	**1,523,677**	**563,703**	**37.0%**

Source: U.S. Census Bureau 2021; Stats America 2022; ODNR, Division of Geological Survey 2022

To estimate population exposure to the inland erosion hazard area, information from the ODNR Division of Geological Survey 2022 was used. Based on the analysis, there are an estimated 345,809 residents living in the hazard area, or 23-percent of the County's total population. The City of Columbus has the greatest number of residents living in the hazard area with approximately 177,995 residents. Table 4.3.7-2 summarizes the population exposed to the inland erosion hazard by jurisdiction.

Table 4.3.7-2. Estimated Number of Persons in Franklin County Living in the Inland Erosion Hazard Area

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Population Located in the Inland Erosion (K-Factor >= 0.49) Hazard Area	
		Number of Persons	Percent of Total
Bexley (C)	13,820	0	0.0%
Blendon (T)	10,073	30	0.3%
Brice (V)	185	50	27.3%
Brown (T)	3,679	1,917	52.1%
Canal Winchester (C)	8,150	2,844	34.9%
Clinton (T)	4,449	15	0.3%
Columbus (C)	855,224	177,995	20.8%
Dublin (C)	41,175	7,960	19.3%
Franklin (T)	11,312	4,922	43.5%
Gahanna (C)	35,626	799	2.2%
Grandview Heights (C)	8,099	3,138	38.7%
Grove City (C)	41,025	23,144	56.4%
Groveport (V)	5,942	1,573	26.5%
Hamilton (T)	8,743	2,046	23.4%
Harrisburg (V)	376	0	0.0%
Hilliard (C)	35,530	19,203	54.0%
Jackson (T)	46,340	21,519	46.4%
Jefferson (T)	14,027	678	4.8%
Lithopolis (V)	2,225	148	6.7%
Lockbourne (V)	176	0	0.0%
Madison (T)	25,896	4,610	17.8%
Marble Cliff (V)	782	0	0.0%
Mifflin (T)	38,121	0	0.0%
Minerva Park (V)	1,611	0	0.0%

Jurisdiction	Total Population (American Community Survey 2021)	Estimated Population Located in the Inland Erosion (K-Factor >= 0.49) Hazard Area	
		Number of Persons	Percent of Total
New Albany (C)	10,929	107	1.0%
Norwich (T)	37,356	15,758	42.2%
Obetz (C)	5,351	3,305	61.8%
Perry (T)	3,888	607	15.6%
Pickerington (C)	113	11	9.5%
Plain (T)	12,469	217	1.7%
Pleasant (T)	6,768	1,964	29.0%
Prairie (T)	17,433	9,480	54.4%
Reynoldsburg (C)	29,016	0	0.0%
Riverlea (V)	566	0	0.0%
Sharon (T)	17,109	0	0.0%
Truro (T)	30,165	17,166	56.9%
Upper Arlington (C)	36,566	16,610	45.4%
Urbancrest (V)	1,124	684	60.9%
Valleyview (V)	722	0	0.0%
Washington (T)	42,997	6,431	15.0%
Westerville (C)	23,467	392	1.7%
Whitehall (C)	20,004	0	0.0%
Worthington (C)	15,047	483	3.2%
Franklin County (Total)	**1,523,677**	**345,809**	**22.7%**

Source: U.S. Census Bureau 2021; Stats America 2022; United States Department of Agriculture, NRCS 2022

Socially Vulnerable Populations

Social vulnerability is defined as the susceptibility of social groups to the adverse impacts of natural hazards, including disproportionate death, injury, loss, or disruption of livelihood. Social vulnerability 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. According to FEMA's National Risk Index, socially vulnerable populations in Franklin County have a relatively high susceptibility to the adverse impacts of natural hazards, including geological hazards, when compared to the rest of the United States.

Impact on General Building Stock

Geologic hazards have the potential to destabilize the foundation of structures, which may result in monetary losses to businesses and residents. These events can expose the underlying bedrock adjacent to structures, which can erode and threaten the structural integrity and safety of the structure above.

Table 4.3.7-3 summarizes the number of structures located in the sinkhole/subsidence (karst geology) hazard area by jurisdiction. In summary, there are 124,387 buildings located in the hazard area, with an estimated $102 billion of replacement cost value (i.e., building and content replacement costs). In total, this represents approximately 35-percent of the County's total general building stock inventory.

Table 4.3.7-3. Estimated General Building Stock Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Number and Total Replacement Cost Value of Structures Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area			
			Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total
Bexley (C)	4,185	$2,908,655,863	0	0.0%	$0	0.0%
Blendon (T)	2,804	$1,413,412,606	0	0.0%	$0	0.0%
Brice (V)	68	$101,696,013	0	0.0%	$0	0.0%
Brown (T)	894	$615,217,276	894	100.0%	$615,217,276	100.0%
Canal Winchester (C)	2,970	$2,664,295,038	0	0.0%	$0	0.0%
Clinton (T)	1,615	$1,407,647,207	335	20.7%	$586,938,262	41.7%
Columbus (C)	210,344	$169,488,966,898	61,250	29.1%	$53,902,468,163	31.8%
Dublin (C)	10,788	$12,346,217,589	10,273	95.2%	$11,166,344,610	90.4%
Franklin (T)	3,243	$2,786,144,235	3,243	100.0%	$2,786,144,235	100.0%
Gahanna (C)	10,525	$7,777,120,383	0	0.0%	$0	0.0%
Grandview Heights (C)	1,781	$864,354,956	1,781	100.0%	$864,354,956	100.0%
Grove City (C)	14,736	$11,872,349,008	13,325	90.4%	$11,288,145,236	95.1%
Groveport (V)	2,294	$8,015,019,558	0	0.0%	$0	0.0%
Hamilton (T)	1,601	$954,562,909	6	0.4%	$3,780,607	0.4%
Harrisburg (V)	148	$59,706,145	148	100.0%	$59,706,145	100.0%
Hilliard (C)	9,926	$7,685,805,074	9,926	100.0%	$7,685,805,074	100.0%
Jackson (T)	1,780	$998,460,101	1,459	82.0%	$766,713,773	76.8%
Jefferson (T)	4,841	$2,934,483,497	0	0.0%	$0	0.0%
Lithopolis (V)	21	$22,524,552	0	0.0%	$0	0.0%
Lockbourne (V)	118	$115,362,791	0	0.0%	$0	0.0%
Madison (T)	4,223	$1,551,960,041	0	0.0%	$0	0.0%
Marble Cliff (V)	201	$310,170,408	201	100.0%	$310,170,408	100.0%
Mifflin (T)	1,185	$757,041,007	0	0.0%	$0	0.0%
Minerva Park (V)	845	$347,638,675	0	0.0%	$0	0.0%
New Albany (C)	3,452	$4,624,598,720	0	0.0%	$0	0.0%
Norwich (T)	1,411	$592,173,496	1,411	100.0%	$592,173,496	100.0%
Obetz (C)	2,205	$5,853,753,986	0	0.0%	$0	0.0%
Perry (T)	1,465	$806,651,425	542	37.0%	$277,795,772	34.4%
Pickerington (C)	23	$28,053,589	0	0.0%	$0	0.0%
Plain (T)	792	$421,165,756	0	0.0%	$0	0.0%
Pleasant (T)	2,393	$1,324,873,614	2,393	100.0%	$1,324,873,614	100.0%
Prairie (T)	5,877	$2,583,782,102	5,877	100.0%	$2,583,782,101	100.0%
Reynoldsburg (C)	8,007	$4,602,554,953	0	0.0%	$0	0.0%
Riverlea (V)	215	$88,150,926	0	0.0%	$0	0.0%
Sharon (T)	839	$428,816,971	96	11.4%	$48,891,710	11.4%
Truro (T)	448	$198,610,440	0	0.0%	$0	0.0%
Upper Arlington (C)	11,995	$7,401,370,183	10,142	84.6%	$5,998,493,387	81.0%
Urbancrest (V)	312	$904,463,260	312	100.0%	$904,463,260	100.0%

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Number and Total Replacement Cost Value of Structures Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area			
			Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total
Valleyview (V)	260	$102,695,732	260	100.0%	$102,695,732	100.0%
Washington (T)	272	$197,989,788	272	100.0%	$197,989,788	100.0%
Westerville (C)	9,502	$6,492,226,049	0	0.0%	$0	0.0%
Whitehall (C)	4,661	$3,811,335,352	0	0.0%	$0	0.0%
Worthington (C)	5,238	$4,772,399,121	241	4.6%	$160,932,973	3.4%
Franklin County (Total)	**350,503**	**$283,234,477,288**	**124,387**	**35.5%**	**$102,227,880,577**	**36.1%**

Source: Source: Franklin County 2021; ODNR, Division of Geological Survey 2022; RS Means 2022

Table 4.3.7-4 summarizes the number of structures located in the sinkhole/subsidence (karst geology) hazard area by jurisdiction. In summary, there are 78,395 buildings located in the hazard area, with an estimated $65 billion of replacement cost value (i.e., building and content replacement costs). In total, this represents approximately 22-percent of the County's total general building stock inventory.

Table 4.3.7-4. Estimated General Building Stock Located in the Inland Erosion Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Number and Total Replacement Cost Value of Structures Located in the Inland Erosion (K-Factor >= 0.49) Hazard Area			
			Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total
Bexley (C)	4,185	$2,908,655,863	0	0.0%	$0	0.0%
Blendon (T)	2,804	$1,413,412,606	9	0.3%	$8,916,068	0.6%
Brice (V)	68	$101,696,013	29	42.6%	$80,713,814	79.4%
Brown (T)	894	$615,217,276	460	51.5%	$287,439,653	46.7%
Canal Winchester (C)	2,970	$2,664,295,038	1,019	34.3%	$1,115,498,362	41.9%
Clinton (T)	1,615	$1,407,647,207	13	0.8%	$52,005,196	3.7%
Columbus (C)	210,344	$169,488,966,898	43,444	20.7%	$33,043,906,474	19.5%
Dublin (C)	10,788	$12,346,217,589	2,140	19.8%	$2,832,536,930	22.9%
Franklin (T)	3,243	$2,786,144,235	1,380	42.6%	$994,590,699	35.7%
Gahanna (C)	10,525	$7,777,120,383	230	2.2%	$139,323,206	1.8%
Grandview Heights (C)	1,781	$864,354,956	700	39.3%	$384,821,604	44.5%
Grove City (C)	14,736	$11,872,349,008	8,329	56.5%	$6,924,444,048	58.3%
Groveport (V)	2,294	$8,015,019,558	602	26.2%	$4,404,614,335	55.0%
Hamilton (T)	1,601	$954,562,909	392	24.5%	$281,538,945	29.5%
Harrisburg (V)	148	$59,706,145	0	0.0%	$0	0.0%
Hilliard (C)	9,926	$7,685,805,074	5,441	54.8%	$4,309,803,809	56.1%
Jackson (T)	1,780	$998,460,101	820	46.1%	$441,152,273	44.2%
Jefferson (T)	4,841	$2,934,483,497	232	4.8%	$137,626,284	4.7%
Lithopolis (V)	21	$22,524,552	1	4.8%	$357,678	1.6%
Lockbourne (V)	118	$115,362,791	0	0.0%	$0	0.0%
Madison (T)	4,223	$1,551,960,041	755	17.9%	$422,151,513	27.2%
Marble Cliff (V)	201	$310,170,408	0	0.0%	$0	0.0%
Mifflin (T)	1,185	$757,041,007	1	0.1%	$1,503,128	0.2%

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value (RCV)	Estimated Number and Total Replacement Cost Value of Structures Located in the Inland Erosion (K-Factor >= 0.49) Hazard Area			
			Number of Buildings	Percent of Total	Total Replacement Cost Value of Buildings	Percent of Total
Minerva Park (V)	845	$347,638,675	0	0.0%	$0	0.0%
New Albany (C)	3,452	$4,624,598,720	34	1.0%	$79,378,119	1.7%
Norwich (T)	1,411	$592,173,496	596	42.2%	$223,126,357	37.7%
Obetz (C)	2,205	$5,853,753,986	1,362	61.8%	$2,941,876,011	50.3%
Perry (T)	1,465	$806,651,425	230	15.7%	$140,600,745	17.4%
Pickerington (C)	23	$28,053,589	2	8.7%	$958,907	3.4%
Plain (T)	792	$421,165,756	14	1.8%	$6,517,487	1.5%
Pleasant (T)	2,393	$1,324,873,614	699	29.2%	$460,460,162	34.8%
Prairie (T)	5,877	$2,583,782,102	3,199	54.4%	$1,500,158,565	58.1%
Reynoldsburg (C)	8,007	$4,602,554,953	0	0.0%	$0	0.0%
Riverlea (V)	215	$88,150,926	0	0.0%	$0	0.0%
Sharon (T)	839	$428,816,971	0	0.0%	$0	0.0%
Truro (T)	448	$198,610,440	251	56.0%	$75,796,939	38.2%
Upper Arlington (C)	11,995	$7,401,370,183	5,456	45.5%	$3,483,675,296	47.1%
Urbancrest (V)	312	$904,463,260	196	62.8%	$653,261,662	72.2%
Valleyview (V)	260	$102,695,732	0	0.0%	$0	0.0%
Washington (T)	272	$197,989,788	40	14.7%	$36,141,376	18.3%
Westerville (C)	9,502	$6,492,226,049	158	1.7%	$182,523,956	2.8%
Whitehall (C)	4,661	$3,811,335,352	0	0.0%	$0	0.0%
Worthington (C)	5,238	$4,772,399,121	161	3.1%	$109,488,580	2.3%
Franklin County (Total)	**350,503**	**$283,234,477,288**	**78,395**	**22.4%**	**$65,756,908,179**	**23.2%**

Source: Franklin County 2021; United States Department of Agriculture, NRCS 2022; RS Means 2022

Impact on Critical Facilities and Community Lifelines

Critical facility exposure to the geologic hazard was examined. Table 4.3.7-5 lists the critical facilities and number of lifelines within the sinkhole/subsidence (karst geology) hazard area. Of the 511 critical facilities located in the hazard area, the greatest number are health and medical facilities. A majority of the critical facilities located in the sinkhole/subsidence (karst geology) hazard area are in the City of Columbus, shown in Table 4.3.7-6.

Table 4.3.7-5. Critical Facilities and Lifelines Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area
Communications	62	40
Energy	106	41
Food, Hydration, Shelter	0	0
Hazardous Material	248	104
Health and Medical	1,691	686

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area
Safety and Security	897	302
Transportation	930	374
Water Systems	16	3
Franklin County (Total)	**3,950**	**1,549**

Sources: Franklin County 2022; ODNR, Division of Geological Survey 2022

Table 4.3.7-6. Critical Facilities and Lifeline Facilities Located in the Land Subsidence (Karst Geology) Hazard Area by Jurisdiction

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Bexley (C)	12	7	0	0.0%	0	0.0%
Blendon (T)	12	8	0	0.0%	0	0.0%
Brice (V)	3	2	0	0.0%	0	0.0%
Brown (T)	5	5	5	100.0%	5	100.0%
Canal Winchester (C)	41	34	0	0.0%	0	0.0%
Clinton (T)	12	6	5	41.7%	4	66.7%
Columbus (C)	3,225	2,823	1,067	33.1%	978	34.6%
Dublin (C)	236	208	205	86.9%	181	87.0%
Franklin (T)	70	64	70	100.0%	64	100.0%
Gahanna (C)	123	96	0	0.0%	0	0.0%
Grandview Heights (C)	17	13	17	100.0%	13	100.0%
Grove City (C)	116	99	116	100.0%	99	100.0%
Groveport (V)	40	37	0	0.0%	0	0.0%
Hamilton (T)	14	14	0	0.0%	0	0.0%
Harrisburg (V)	1	1	1	100.0%	1	100.0%
Hilliard (C)	101	73	101	100.0%	73	100.0%
Jackson (T)	12	11	9	75.0%	8	72.7%
Jefferson (T)	10	7	0	0.0%	0	0.0%
Lithopolis (V)	1	1	0	0.0%	0	0.0%
Lockbourne (V)	0	0	0	0.0%	0	0.0%
Madison (T)	11	8	0	0.0%	0	0.0%
Marble Cliff (V)	5	3	5	100.0%	3	100.0%
Mifflin (T)	10	6	0	0.0%	0	0.0%
Minerva Park (V)	5	3	0	0.0%	0	0.0%
New Albany (C)	53	48	0	0.0%	0	0.0%
Norwich (T)	2	2	2	100.0%	2	100.0%
Obetz (C)	10	9	0	0.0%	0	0.0%
Perry (T)	6	4	3	50.0%	3	75.0%
Pickerington (C)	0	0	0	0.0%	0	0.0%
Plain (T)	3	3	0	0.0%	0	0.0%
Pleasant (T)	20	19	20	100.0%	19	100.0%
Prairie (T)	58	50	58	100.0%	50	100.0%
Reynoldsburg (C)	57	38	0	0.0%	0	0.0%
Riverlea (V)	0	0	0	0.0%	0	0.0%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Sharon (T)	10	7	3	30.0%	2	28.6%
Truro (T)	2	1	0	0.0%	0	0.0%
Upper Arlington (C)	58	50	45	77.6%	39	78.0%
Urbancrest (V)	1	0	1	100.0%	0	0.0%
Valleyview (V)	1	1	1	100.0%	1	100.0%
Washington (T)	1	1	1	100.0%	1	100.0%
Westerville (C)	105	81	0	0.0%	0	0.0%
Whitehall (C)	61	51	0	0.0%	0	0.0%
Worthington (C)	68	56	3	4.4%	3	5.4%
Franklin County (Total)	4,598	3,950	1,738	37.8%	1,549	39.2%

Source: Franklin County 2022; ODNR, Division of Geological Survey 2022

Table 4.3.7-7 lists the critical facilities and number of lifelines within the inland erosion hazard area. Of the 708 critical facilities located in the hazard area, the greatest number are health and medical facilities. A majority of the critical facilities located in the inland erosion hazard area are in the City of Columbus, shown in Table 4.3.7-8.

Table 4.3.7-7. Critical Facilities and Lifelines Located in the Inland Erosion Hazard Area

FEMA Lifeline Category	Number of Lifelines	Number of Lifelines Located in the Inland Erosion (K-Factor >= 0.49) Hazard Area
Communications	62	13
Energy	106	24
Food, Hydration, Shelter	0	0
Hazardous Material	248	56
Health and Medical	1,691	432
Safety and Security	897	119
Transportation	930	62
Water Systems	16	2
Franklin County (Total)	**3,950**	**708**

Source: Franklin County 2022; United States Department of Agriculture, NRCS 2022

Table 4.3.7-8. Critical Facilities and Lifeline Facilities Located in the Inland Erosion Hazard Area by Jurisdiction

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Inland Erosion (K-Factor: >= 0.49) Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Bexley (C)	12	7	0	0.0%	0	0.0%
Blendon (T)	12	8	0	0.0%	0	0.0%
Brice (V)	3	2	1	33.3%	0	0.0%
Brown (T)	5	5	2	40.0%	2	40.0%
Canal Winchester (C)	41	34	21	51.2%	19	55.9%

Jurisdiction	Total Critical Facilities Located in Jurisdiction	Total Lifelines Located in Jurisdiction	Number of Critical Facilities and Lifeline Facilities Located in the Inland Erosion (K-Factor: >= 0.49) Hazard Area			
			Critical Facilities	Percent of Total Critical Facilities	Lifelines	Percent of Total Lifelines
Clinton (T)	12	6	1	8.3%	0	0.0%
Columbus (C)	3,225	2,823	438	13.6%	375	13.3%
Dublin (C)	236	208	87	36.9%	79	38.0%
Franklin (T)	70	64	22	31.4%	19	29.7%
Gahanna (C)	123	96	0	0.0%	0	0.0%
Grandview Heights (C)	17	13	1	5.9%	1	7.7%
Grove City (C)	116	99	75	64.7%	67	67.7%
Groveport (V)	40	37	6	15.0%	5	13.5%
Hamilton (T)	14	14	4	28.6%	4	28.6%
Harrisburg (V)	1	1	0	0.0%	0	0.0%
Hilliard (C)	101	73	64	63.4%	50	68.5%
Jackson (T)	12	11	6	50.0%	5	45.5%
Jefferson (T)	10	7	0	0.0%	0	0.0%
Lithopolis (V)	1	1	0	0.0%	0	0.0%
Lockbourne (V)	0	0	0	0.0%	0	0.0%
Madison (T)	11	8	3	27.3%	3	37.5%
Marble Cliff (V)	5	3	0	0.0%	0	0.0%
Mifflin (T)	10	6	0	0.0%	0	0.0%
Minerva Park (V)	5	3	0	0.0%	0	0.0%
New Albany (C)	53	48	0	0.0%	0	0.0%
Norwich (T)	2	2	0	0.0%	0	0.0%
Obetz (C)	10	9	5	50.0%	4	44.4%
Perry (T)	6	4	0	0.0%	0	0.0%
Pickerington (C)	0	0	0	0.0%	0	0.0%
Plain (T)	3	3	0	0.0%	0	0.0%
Pleasant (T)	20	19	3	15.0%	2	10.5%
Prairie (T)	58	50	45	77.6%	41	82.0%
Reynoldsburg (C)	57	38	0	0.0%	0	0.0%
Riverlea (V)	0	0	0	0.0%	0	0.0%
Sharon (T)	10	7	0	0.0%	0	0.0%
Truro (T)	2	1	1	50.0%	0	0.0%
Upper Arlington (C)	58	50	35	60.3%	30	60.0%
Urbancrest (V)	1	0	0	0.0%	0	0.0%
Valleyview (V)	1	1	0	0.0%	0	0.0%
Washington (T)	1	1	0	0.0%	0	0.0%
Westerville (C)	105	81	2	1.9%	2	2.5%
Whitehall (C)	61	51	0	0.0%	0	0.0%
Worthington (C)	68	56	0	0.0%	0	0.0%
Franklin County (Total)	**4,598**	**3,950**	**822**	**17.9%**	**708**	**17.9%**

Source: Franklin County 2022; United States Department of Agriculture, NRCS 2022

In addition to critical facilities, a significant amount of infrastructure can be exposed to geologic hazards:

- **Roads** – Access to major roads is crucial to life-safety after a disaster event and to response and recovery operations. Egress and ingress can be blocked on roads, causing isolation for neighborhoods, traffic problems, and delays for public and private transportation. This can result in economic losses for businesses.
- **Bridges** – Geologic hazards can significantly impact road bridges. Mass movements can knock out bridge abutments or significantly weaken the soil supporting them, making them hazardous for use.
- **Power Lines** – While power lines are generally elevated, the towers supporting them can be subject to geologic hazards. Soil underneath a tower could become unstable, causing it to collapse and ripping down the lines. Power and communication failures due to geologic hazards can create problems for vulnerable populations and businesses.
- **Rail Lines** – Similar to roads, rail lines are important for response and recovery operations after a disaster. Geologic hazards can block travel along the rail lines, which would become especially troublesome, because it would not be as easy to detour a rail line as it is on a local road or highway.

Several other types of infrastructure may also be exposed to geologic hazards, including water and sewer infrastructure. In some cases, water infrastructure may even be the cause of a hazard's formation due to the lines leaking.

Impact on the Economy

The impact of geologic hazards on the economy and estimated dollar losses are difficult to measure. As stated earlier, these hazards can impose direct and indirect impacts on society. Direct costs include the actual damage sustained by buildings, property, and infrastructure. Indirect costs, such as clean-up costs, business interruption, loss of tax revenues, reduced property values, and loss of productivity are difficult to measure. Additionally, geologic hazards threaten transportation corridors, fuel and energy conduits, and communication lines (USGS 2000).

Direct building losses are the estimated costs to repair or replace the damage caused to the building. Geologic hazards can cause several types of secondary effects, such as blocking access to roads, which can isolate residents and businesses and delay commercial, public, and private transportation.

Impact on the Environment

Geologic hazards can potentially alter rivers or streams, potentially harming water quality, fisheries, and spawning habitat; they can also create new depressions that can fill with water, creating new aquatic habitat. Table 4.3.7-9 lists the number of acres exposed to the sinkhole/subsidence (karst geology) hazard area; Table 4.3.7-10 lists the number of acres exposed to the inland erosion hazard area.

Table 4.3.7-9. Land Acreage in Franklin County Located in the Land Subsidence (Karst Geology) Hazard Areas

Jurisdiction	Total Acres of Land Area	Total Acres of Land Area (Excluding Waterbodies) Located in the Sinkhole/Subsidence (Karst Geology) Hazard Areas	
		Total Acres Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area	Percent of Total
Bexley (C)	1,548	0	0.0%
Blendon (T)	3,092	0	0.0%
Brice (V)	57	0	0.0%
Brown (T)	12,173	12,172	100.0%
Canal Winchester (C)	3,764	0	0.0%
Clinton (T)	874	187	21.4%
Columbus (C)	136,976	44,632	32.6%
Dublin (C)	13,086	11,880	90.8%
Franklin (T)	4,194	4,194	100.0%
Gahanna (C)	7,903	0	0.0%
Grandview Heights (C)	843	843	100.0%
Grove City (C)	11,767	10,427	88.6%
Groveport (V)	5,454	0	0.0%
Hamilton (T)	4,777	267	5.6%
Harrisburg (V)	83	83	100.0%
Hilliard (C)	8,941	8,941	100.0%
Jackson (T)	10,683	8,118	76.0%
Jefferson (T)	8,904	0	0.0%
Lithopolis (V)	449	0	0.0%
Lockbourne (V)	461	0	0.0%
Madison (T)	14,469	0	0.0%
Marble Cliff (V)	178	178	100.0%
Mifflin (T)	1,212	0	0.0%
Minerva Park (V)	405	0	0.0%
New Albany (C)	6,855	0	0.0%
Norwich (T)	1,607	1,607	100.0%
Obetz (C)	3,725	0	0.0%
Perry (T)	1,412	599	42.4%
Pickerington (C)	204	0	0.0%
Plain (T)	5,813	0	0.0%
Pleasant (T)	27,162	27,162	100.0%
Prairie (T)	11,672	11,672	100.0%
Reynoldsburg (C)	4,740	0	0.0%
Riverlea (V)	96	1	1.0%
Sharon (T)	1,844	249	13.5%
Truro (T)	342	0	0.0%
Upper Arlington (C)	6,224	4,850	77.9%
Urbancrest (V)	366	366	100.0%
Valleyview (V)	93	93	100.0%
Washington (T)	1,682	1,682	100.0%

Jurisdiction	Total Acres of Land Area	Total Acres of Land Area (Excluding Waterbodies) Located in the Sinkhole/Subsidence (Karst Geology) Hazard Areas	
		Total Acres Located in the Sinkhole/Subsidence (Karst Geology) Hazard Area	Percent of Total
Westerville (C)	5,477	0	0.0%
Whitehall (C)	3,377	0	0.0%
Worthington (C)	3,492	399	11.4%
Franklin County (Total)	**338,479**	**150,601**	**44.5%**

Sources: Franklin County 2022; ODNR, Division of Geological Survey 2022

Table 4.3.7-10. Land Acreage in Franklin County Located in the Inland Erosion Hazard Areas

Jurisdiction	Total Acres of Land Area	Total Acres of Land Area (Excluding Waterbodies) Located in the Inland Erosion Areas	
		Total Acres Located in the Inland Erosion (K-Factor: >=0.49)	Percent of Total
Bexley (C)	1,548	0	0.0%
Blendon (T)	3,092	113	3.7%
Brice (V)	57	25	43.3%
Brown (T)	12,173	5,045	41.4%
Canal Winchester (C)	3,764	1,228	32.6%
Clinton (T)	874	12	1.4%
Columbus (C)	136,976	24,376	17.8%
Dublin (C)	13,086	2,682	20.5%
Franklin (T)	4,194	982	23.4%
Gahanna (C)	7,903	318	4.0%
Grandview Heights (C)	843	171	20.2%
Grove City (C)	11,767	5,512	46.8%
Groveport (V)	5,454	1,439	26.4%
Hamilton (T)	4,777	1,297	27.2%
Harrisburg (V)	83	0	0.0%
Hilliard (C)	8,941	4,300	48.1%
Jackson (T)	10,683	3,986	37.3%
Jefferson (T)	8,904	436	4.9%
Lithopolis (V)	449	12	2.7%
Lockbourne (V)	461	0	0.0%
Madison (T)	14,469	5,051	34.9%
Marble Cliff (V)	178	0	0.0%
Mifflin (T)	1,212	4	0.3%
Minerva Park (V)	405	0	0.0%
New Albany (C)	6,855	142	2.1%
Norwich (T)	1,607	463	28.8%
Obetz (C)	3,725	1,680	45.1%
Perry (T)	1,412	219	15.5%
Pickerington (C)	204	7	3.5%
Plain (T)	5,813	282	4.9%
Pleasant (T)	27,162	6,603	24.3%

Jurisdiction	Total Acres of Land Area	Total Acres of Land Area (Excluding Waterbodies) Located in the Inland Erosion Areas	
		Total Acres Located in the Inland Erosion (K-Factor: >=0.49)	Percent of Total
Prairie (T)	11,672	3,045	26.1%
Reynoldsburg (C)	4,740	10	0.2%
Riverlea (V)	96	0	0.0%
Sharon (T)	1,844	12	0.7%
Truro (T)	342	72	21.0%
Upper Arlington (C)	6,224	2,537	40.8%
Urbancrest (V)	366	202	55.1%
Valleyview (V)	93	<0.01	<.01%
Washington (T)	1,682	170	10.1%
Westerville (C)	5,477	161	2.9%
Whitehall (C)	3,377	0	0.0%
Worthington (C)	3,492	124	3.5%
Franklin County (Total)	**338,479**	**72,720**	**21.5%**

Source: Franklin County 2022; United States Department of Agriculture, NRCS 2022

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed and illustrated in Section 3 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth located in the geological hazard areas (sinkhole/subsidence or erosion) could be potentially impacted by sinkholes, land subsidence, or erosion. New development that has occurred in the last five years within the County, and potential future development in the next five years as identified by the county and each municipality, is included in the jurisdictional annexes in Section 9, along with an indication of proximity to known hazard zones. Refer to Section 3, and Volume II Section 9 for more information about the potential new development in Franklin County.

Project Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 13.7 percent since 2010. The County's population is anticipated to slightly increase over the next decade (5.37 percent increase by 2030 and 11.72 percent increase by 2050) (Ohio Development Services Agency 2018). Any

increase in growth can create changes in density throughout the County, which may impact the ability of persons in the County to mobilize or receive essential services. Population growth in municipalities more vulnerable to geological hazards may be more at risk to such events. Refer to Section 3 (County Profile), which includes a discussion about population trends for the County.

Climate Change

As discussed previously, the entire State of Ohio is projected to experience an increase in the frequency and severity of extreme storms and rainfall. This can lead to a higher vulnerability in geological hazards occurring because changes in precipitation and groundwater increases the likelihood of sinkholes, subsidence, and erosion incidents occurring in the County.

Change of Vulnerability Since 2018 HMP

Overall, Franklin County's vulnerability to geologic hazards remains unchanged from the 2018 HMP.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.8 Invasive Species

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the invasive species hazard in Franklin County.

Hazard Profile

Hazard Description

Invasive species are non-native to a specific location and can harm the environment, the economy, or human health. They may come from anywhere in the world, and as international trade increases, so does the rate of invasive species introductions. They can contribute to habitat degradation, loss of native species, crop damage, and diseases in humans and livestock. The following species discussed below were identified as the current and largest threats of invasive species in Franklin County at the time of this plan update.

Asian Longhorned Beetle (ALB)

The Asian Longhorned Beetle (ALB), also known as *Anoplophora glabripennis,* was first discovered in New York State in 1996 and arrived accidentally in wood packing material from Asia. The ALB has a shiny black back, with white spots and long black and white antennae. The ALB has an extremely wide host range, including maple trees (Ohio DNR n.d.). The ALB threatens recreation and forest resources due to its destructive wood boring of maple and other hardwoods (USDA 2014).

Emerald Ash Borer (EAB)

Emerald Ash Borer (EAB), also known as *Agrilus planipennis,* was discovered in the United States in 2002 and arrived accidentally in cargo from Asia. The EAB is native to Russia, China, Japan, and Korea. The EAB is a small and very destructive beetle. The adult beetles have metallic green wing covers and a coppery red or purple abdomen. Signs of infection include tree canopy dieback, yellowing, and browning of leaves. Infected Ash trees will lose most of their canopy within 2 years of infestation and will die within 3-4 years of infection (USDA 2014)

Harmful Algal Blooms (HABs)

Harmful algal blooms (HAB) are overgrowth of microscopic algae and become harmful when a bloom produces toxins that are dangerous to humans and other organisms. These HABs can be caused by excessive nutrient pollution, warm water, still water and climate change (Denchak 2019). Algal blooms have started to become more and more noticeable in water bodies present in Ohio. HABs are presented

and reported on in a similar fashion to hurricanes and tornadoes and have advisories and cautions that are posted in the event of a harmful HAB (Ohio EPA n.d.).

Hemlock Woolly Adelgid

Hemlock Woolly Adelgid (HWA), also known as *Adelges tsugae,* is a nonnative insect that kills hemlock trees. Since the 1920's the Hemlock Woolly Adelgid has colonized almost everywhere the eastern hemlock is located. The adelgid uses long mouth parts to extract sap and nutrients from hemlock foliage, preventing free growth and causing needles to discolor from deep green to grayish green and to drop prematurely. These insects develop asexually and are present year-round, one generation present from summer to spring and another present from spring to summer (Maine Forest Service n.d.). Loss of new shoots and needles seriously impairs tree health. Infestation is usually fatal to the tree after several years. Wind, birds, other wildlife, and movement of infested host material (wood) by humans are all factors in dispersion of the adelgid.

Spotted Lanternfly

The Spotted Lanternfly, also known as *Lycorma delicatula,* is a planthopper native to China, India, and Vietnam, and attacks fruit plants, such as grapes and apples, ornamental, and woody trees and is a significant economic and lifestyle pest for residents, businesses, tourism, forestry, and agriculture. Its presence has led to crop loss, exporting issues, and increased management costs (Ohio Department of Agriculture n.d.).

Zebra Mussels

Zebra Mussels, also known as *Dreissena polymorpha,* are fingernail sized freshwater shellfish that are native to Russia and Ukraine and were most likely accidentally brought to the United States via ship. They get their name because of the black zigzag pattern that covers their shell. They are known for their rootlike threads which give them the ability to attach to hard surfaces in the water and can become problematic for boat machinery and native freshwater aquatic organisms (NPS n.d.).

Location

Asian Longhorned Beetle (ALB)

ALB has been located in Massachusetts, New York, Ohio, and South Carolina, although all states are considered to be at risk. Specifically, forests with Ash, Birch, Elm, Maples, Willow, and Poplar trees tend to attract the ALB, which means state forests and parks are a prime location for the ALB (UDSA n.d.). The ALB was discovered in Tate Township, Clermont County in June 2011 and spread throughout the state's hardwood forests (Ohio Department of Agriculture n.d.).

Emerald Ash Borer (EAB)

EAB has been found throughout the entire state of Ohio and became particularly common in Ohio's urban forests (Ohio State University 2016). The EAB is found anywhere ash trees are located in Ohio and can be moved around in terms of distribution of firewood and logs (USDA 2014).

Harmful Algal Blooms (HABs)

HAB have been found in the Ohio River and are fueled by excessive nutrient deposits from farming. The same issue has been happening for local freshwater bodies of water. People are businesses that depend on this water to drink, use for agriculture and other economic activities can suffer a great economic loss as well as health issues for people and ecosystems that depend on that water to survive (Stone 2021).

Hemlock Woolly Adelgid

In 2012, the first infestation of HWA in Ohio was discovered in Meigs County. Since then, HWA has been found in hemlock stands throughout other eastern Ohio counties. Ohio regulated the spread of HWA by restricting the movement of hemlock materials from infested counties. The regulation also requires movement of hemlock material to be inspected before leaving another state and more information can be found in Chapter 901:5-48 of the Ohio Administrative Code.

Spotted Lanternfly

In 2020, the Spotted Lanternfly was discovered in Ohio, along the Ohio River before moving into Cuyahoga and Jefferson counties. The insect has quickly spread, and every year, when the insect eggs hatch, it seems its range continues to broaden and now includes extensive populations in Delaware, New Jersey, Pennsylvania, Virginia, and Ohio (Ohio Department of Agriculture n.d.).

Zebra Mussels

Zebra mussels were discovered in the United States in the 1980's and quickly spread across the Great Lakes and down into the Ohio River basin. They have disrupted the food chain and contributed to the extinction of native mussels (Ohio River Foundation 2023).

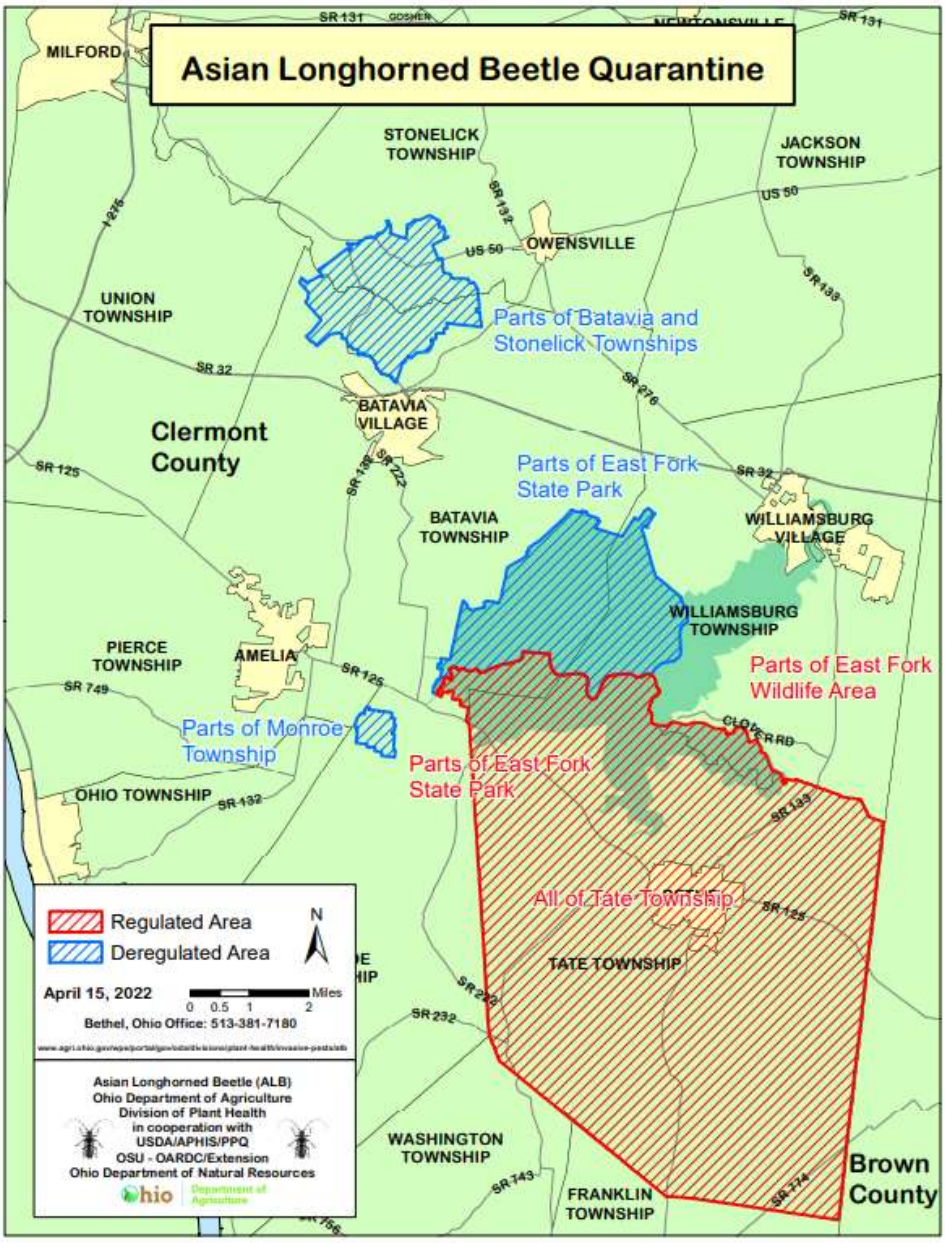
Extent

The extent and location of invasive species depends on the preferred habitat of the species, as well as the species' ease of movement and establishment. However, each of these threats can impact many areas of Franklin County. The magnitude of invasive species impacts ranges from nuisance to widespread. The threat is typically intensified when the ecosystem or host species is already stressed, such as periods of drought. The already weakened state of the ecosystem causes it to more easily be impacted by an invasive species.

Asian Longhorned Beetle (ALB)

ALB was first discovered in Ohio in June 2011 in Clermont County. The State has implemented quarantine areas to reduce the spread of ALB. Figure 4.3.8-1 is an example of the ALB quarantine map that Ohio DNR maintains. As of April 2022, Franklin County is not included in any ALB quarantine areas (Ohio DNR 2023).

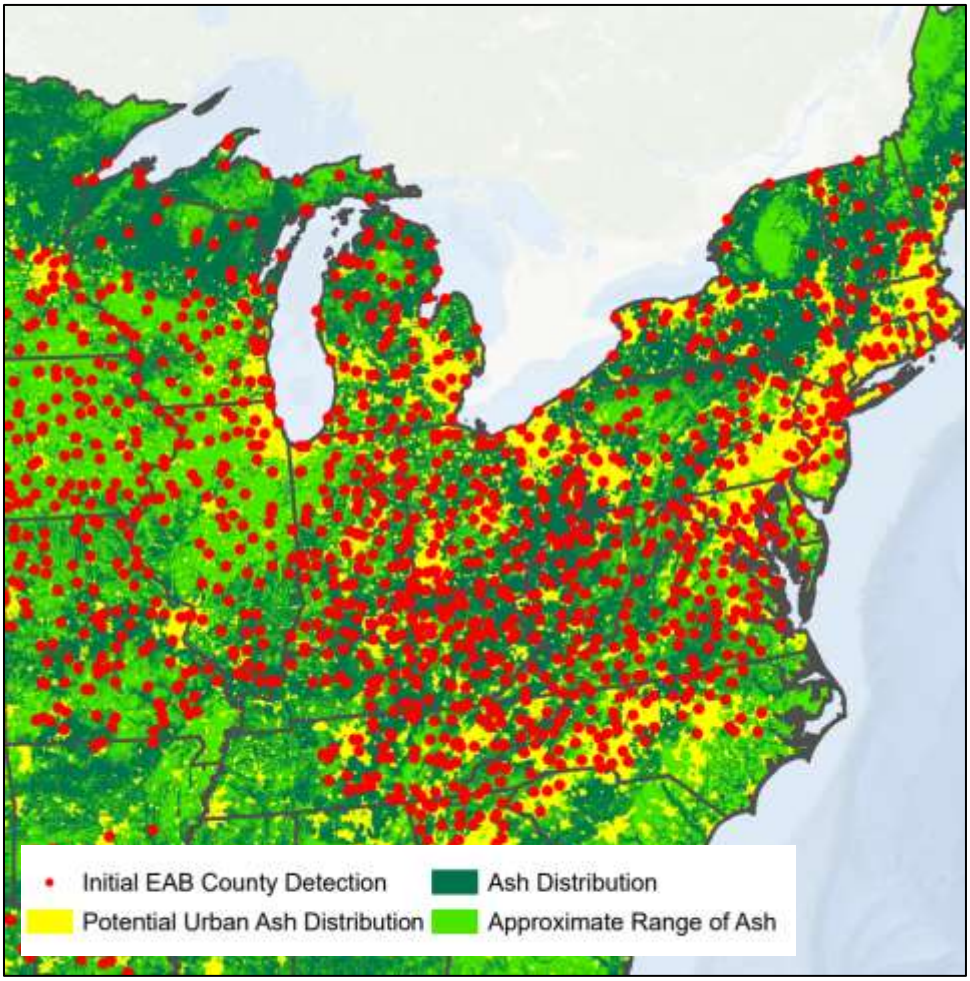
Figure 4.3.8-1. ALB Quarantine Areas in Ohio



Emerald Ash Borer (EAB)

In the State of Ohio, EAB has wiped out green ash trees, which used to be one of the most common woodland trees in Ohio. EAB has also wiped out mature white ash trees and continues to impact this species of trees across the State (Division of Wildlife 2019). Figure 4.3.8-2 shows the EAB distribution in the northeast United States. The figure indicates that EAB has been detected in Franklin County.

Figure 4.3.8-2. EAB Distribution in the United States

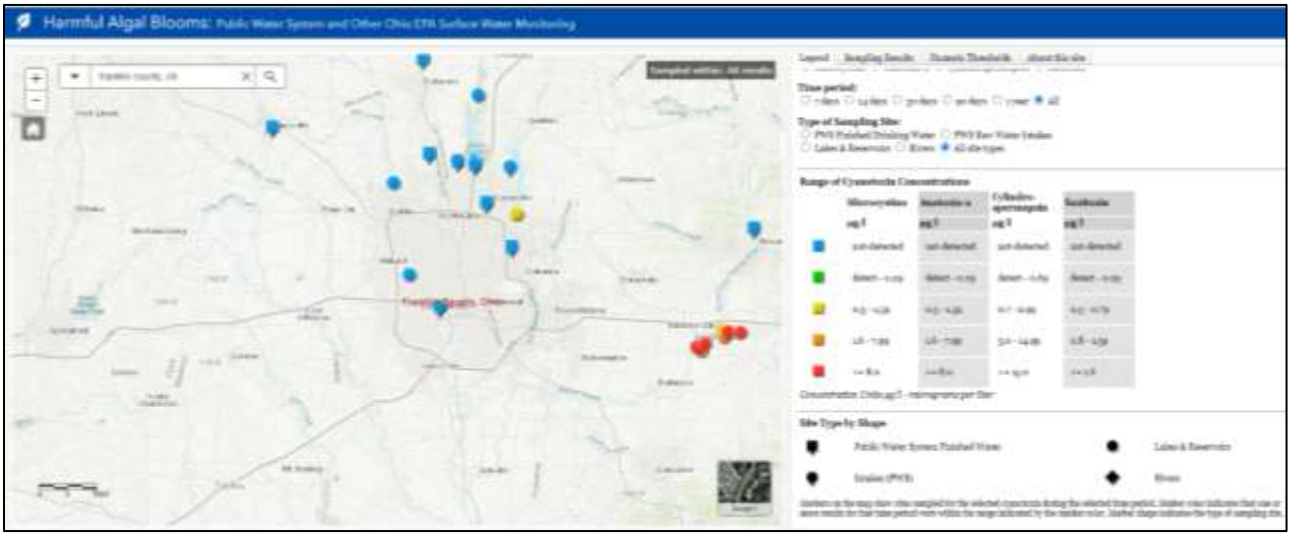


Source: U.S. Department of Agriculture 2023

Harmful Algal Blooms (HAB)

Ohio Environmental Protection Agency (Ohio EPA) monitors public water systems for cyanotoxins and HABs as required per the HAB Rules (finalized June 1, 2016). Ohio EPA also monitors inland lakes for cyanotoxins in watersheds being assessed for their Total Maximum Daily Load (TMDL). The samples collected by the State are analyzed at the Division of Environmental Services. Ohio EPA maintains an online map that shows where any cyanotoxins were identified in the public water sources (Ohio EPA 2023).

Figure 4.3.8-3. Ohio EPA Public Water System Monitoring for HABs



Source: Ohio EPA 2023

Hemlock Woolly Adelgid (HWA)

HWA was discovered in Ohio in February 2012 in Migs County. Since then HWA has been found in hemlock stands in other eastern Ohio counties as well. As a result, Ohio DNR implemented quarantine areas to restrict the movement of hemlock materials from counties known to be infested into non-infested Ohio counties. Ohio's quarantine law also requires hemlock materials grown in non-infested counties in quarantined states to be inspected before being shipped and have a phytosanitary certificate verifying that the plant material is free of HWA when entering Ohio. As of March 2022, Franklin County is not part of the HWA quarantine area (Ohio DNR 2022).

Spotted Lanternfly

Spotted Lanternfly has been confirmed in Cuyahoga and Jefferson Counties and as a result, the State has implemented quarantine areas. On October 28, 2021 the ODA announced a quarantine to combat the spread of the spotted lanternfly. Spotted Lanternfly is now designated a destructive plant pest under Ohio law, which increases inspections and restricts movement of certain items from infested counties in Ohio and other states into non-infested Ohio counties. Spotted Lanternfly can spread long distances quickly by people who move infested materials or those containing egg masses. Currently, Cuyahoga, Jefferson and Lorain Counties are the only known areas to have Spotted Lanternfly (Ohio DNR 2023).

Zebra Mussels

Zebra Mussels can prevent native mussels from moving and reproducing by attaching to them and outcompeting them in space and food. They can affect the composition of local food webs and ecosystems in which the zebra mussel thrives in. Zebra Mussels can also impact foul water intakes (NPS n.d.).

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was not included in FEMA disaster (DR) or emergency (EM) declarations for invasive species-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Franklin County was not included any invasive species-related agricultural disaster declarations.

Previous Events

Invasive species events that have impacted Franklin County between 2018 and 2022 are identified in the table below.

Table 4.3.8-1. Invasive Species Events in Franklin County, 2018 to 2022

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
2003	EAB	N/A	N/A	Countywide	Since 2003, the insect has been decimating the ash trees within the County and across the State (Buckeye Yard and Garden Line 2003). A second infestation of EAB occurred in 2009, resulting in Franklin County being placed under quarantine. The quarantine forbid the movement of ash wood out of the County (The Columbus Dispatch 2009). In 2010, the infestation worsened when the ODA quarantined the entire State (USDA 2011). The EAB is still an issue within Franklin County and will likely continue to be for years to come.
2013	HAB	N/A	N/A	Hoover Reservoir	On July 19, 2013 and September 16, 2013, HABs were detected at the Hoover Reservoir (Ohio EPA 2023).
2014	HAB	N/A	N/A	Hoover Reservoir	On August 14, 2014, HABs were detected at the Hoover Reservoir (Ohio EPA 2023).
2015	HAB	N/A	N/A	Columbus Dublin Road	On August 28th and August 31st, HABs were detected at the Columbus Dublin Road Water Treatment Plant (Ohio EPA 2023).

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of invasive species events for the County. Based on historical documentation, increased incidences of infestation throughout the State of Ohio and the overall impact of changing climate trends, it is estimated that Franklin County and its jurisdictions will continue to experience invasive species events that may induce secondary hazards and health threats to the County population if invasive species are not prevented, controlled, or eradicated effectively.

In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for invasive species in the County is considered 'occasional'.

Climate Change Impacts

Climate change acts as an amplifier of existing natural hazards. The best available scientific data and modeling suggest that climate change has and will continue to impact natural hazards in the state. While the impacts of climate change may vary by regions and jurisdictions throughout the state, it is clear that the potential consequences of climate change will have significant impacts on all the citizens of the state (Ohio Emergency Management Agency 2019).

Since the beginning of the 20th century, temperatures in Ohio have risen more than 1.5°F, and temperatures in the 2000s and 2010s were warmer than in any other historical period. The State of Ohio has also experienced significant increase in heavy rain events, increasing the risk of springtime flooding. These storms can also cause major impacts to life, safety, property, and disruption to economic activity (NOAA National Centers for Environmental Information 2022).

Climate Change conditions can foster the spread of invasive species due to the warming climate. New species may enter a region in a northern pattern to try and live in a habitat that matches their needs. This will affect food webs and hierarchies in ecosystems which will alter the composition of the typical ecosystem (USDA n.d.).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed to invasive species. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 3), are exposed and vulnerable to this hazard.

Impact on Life, Health, and Safety

The entire population of Franklin County (1,323,807) is exposed to invasive species (US Census 2020); however, those living in areas more impacted by invasive species may be more at risk. For example, homes

surrounded by ash trees may be more susceptible to falling trees due to the impacts EABs have on the trees.

The impacts of HAB on life, health, and safety depend on several factors, including the severity of the event and whether citizens and tourists have become exposed to waters suspected of containing toxins associated with cyanobacteria. Routes of exposure include consumption, inhalation, and dermal exposure. The population living near or visiting waterbodies is at risk for exposure as well as those that use those waterbodies for recreation, fishing, and water supply. Contact with water containing HAB can cause various health effects including diarrhea, nausea or vomiting; skin, eye, or throat irritation; and allergic reactions or breathing difficulties (CDC 2020).

Further, the population living near waterbodies is at risk for exposure to HABs as well as those that use those waterbodies for recreation, fishing, and water supply. Therefore, exposure should not be limited to only those who reside in a defined hazard zone, but visitors to Franklin County waterbodies as well.

Impact on General Building Stock

Structures are not anticipated to be directly affected by infestation or invasive species; however, EAB may cause an extreme loss of ash trees throughout the Franklin County, which could result in stream bank instability, erosion, increased sedimentation, impacting ground stabilization and possibly cause foundation issues for structures located close by. Additionally, with an increased number of dead trees, there is an increased risk of trees falling on roadways, power lines, and buildings.

Some invasive plants have been shown to destabilize soil due to high densities and shallow root systems, negatively impacting nearby buildings and septic systems. Other invasive plant species have been known to clog culverts and streams which increases flooding risk.

Impact on Critical Facilities and Community Lifelines

Water treatment plants could be impacted by infestation and invasive species because of similar issues that the general building stock may experience. Water that becomes polluted due to increased sedimentation and erosion will require additional treatment. If the system becomes clogged with these pollutants, the ability of water treatment plants to operate may become impaired. Similarly, Zebra Mussels can clog any water system that is connected to infected freshwater bodies of water. Additionally, soil that becomes unstable due to decaying vegetation can impact critical facilities that are built on or around these soils.

Impact on the Economy

Direct economic impacts resulting from invasive species include identification and management costs, research and monitoring programs, job losses and lesser incomes. Impacts of infestation and invasive species on the economy and estimated dollar losses are difficult to measure and quantify. Crops and agriculture tend to be the largest problem when discussing impacts of invasive species in terms of job loss and income.

Indirect economic impacts from invasive species can include reduced or complete loss of ecosystem services which then must be mimicked through human created mechanisms. Reduced biodiversity, resource production and property values can also be economic impacts resulting from invasive species. Management of an invasive species is an ongoing expense unless an affordable method of eradication with minimal effects on the ecosystem is more cost effective (Centre n.d.).

Impact on the Environment

As previously discussed, Franklin County's parks, forests, landscaping, and agricultural areas are vulnerable to spotted lanternfly, HWA, and EAB. Species that cause eventual destabilization of soil, such as invasive insects that destroy plants or invasive plants that outcompete native vegetation but have less effective root systems, can increase runoff into waterbodies. Soil destabilization can also increase the likelihood of mudslides in areas with a steep slope. Zebra Mussels and HAB negatively impact their aquatic environment by out competing native organisms and by exerting toxic chemicals into an aquatic ecosystem.

Future Changes That May Impact Vulnerability

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed for the extreme temperature events. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 3), are exposed and potentially vulnerable. The following text evaluates and estimates the potential impact of extreme temperatures on Franklin County, including:

Projected Development

Section 3 identifies areas targeted for future growth and development across the County. Any areas of growth located within Franklin County could be potentially impacted by invasive species and infestation. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Project Changes in Population

According to the 2021 American Community Survey 5-year population estimates, the population of the County has increased by approximately 13.7-percent since 2010. A growing population means more people and development that will be impacted by invasive species. Franklin County will experience an increase in vulnerability to invasive species as the population continues to grow. Refer to the County Profile Section for more information about population trends.

Climate Change

Climate change and invasive species are two of the top four drivers of global biodiversity loss, affecting production landscapes, reducing crop yields, and the provision of ecosystem services (Masters and Norgrove 2010). Land use changes because of climate change creates an empty niche for invasive species to occur so together these drivers have a greater impact. Climate change can facilities invasive species

and infestation such as new species that become invasive entering regions due to climate change, species hierarchy in ecosystems will begin to shift, leading to new dominants that may portrait invasive behaviors, and climate induced stress in the ecosystem will facilitate invasive ecosystems (Masters and Norgrove 2010). Alternatively, invasive species and infestations can facilitate climate stress by increasing the ecosystems susceptibility to climatic disturbance, through reducing the number of species and their functional types within an ecosystem.

Change of Vulnerability Since 2018 HMP

Franklin County's vulnerability to invasive species events has increased due to a population that has also grown. Since the 2018 HMP analysis, population statistics have been updated using the 2020 Census. The general building stock and the 2018 critical facility dataset was updated by the County and participating jurisdictions. Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2018 HMP.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.9 Severe Summer Weather

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the severe summer weather hazard in Franklin County.

Hazard Profile

Hazard Description

Thunderstorms

A thunderstorm is a local storm produced by a cumulonimbus cloud and accompanied by lightning and thunder (NWS 2021). A thunderstorm forms from a combination of moisture, rapidly rising warm air, and a force capable of lifting air, such as a warm and cold front, a sea breeze, or a mountain. Thunderstorms form from the equator to as far north as Alaska. Although thunderstorms generally affect a small area when they occur, they have the potential to become dangerous due to their ability in generating tornadoes, hailstorms, strong winds, flash flooding, and lightning. The NWS considers a thunderstorm *severe* only if it produces damaging wind gusts of 58 miles per hour (mph) or higher or large hail one inch (quarter size) in diameter or larger or tornadoes (NWS 2021).

Thunderstorms include heavy rainfall and occasional, gusty winds, but often include hail and lightning. Damage from severe thunderstorm winds account for half of all severe summer weather reports in the lower 48 states and is more common than damage from tornadoes. Heavy rainfall produced by thunderstorms may result in several types of flooding including riverine, flash floods, and local drainage floods. Thunderstorms can also range in magnitude and severity (NOAA n.d.).

Lightning

Lighting is a bright flash of electrical energy produced by a thunderstorm. The resulting clap of thunder is the result of a shock wave created by the rapid heating and cooling of the air in the lightning channel. All thunderstorms produce lightning and are very dangerous. Lightning ranks as one of the top weather killers in the United States, killing approximately 50 people and injuring hundreds each year. Lightning can occur anywhere there is a thunderstorm (NOAA n.d.). There are two main types of lighting: intra-cloud and cloud-to-ground.

- Intra-cloud lightning is an electrical discharge between oppositely charged areas within the thunderstorm cloud (National Weather Service 2023).

- Cloud-to-ground lightning is a discharge between opposite charges in the cloud and on the ground. Cloud-to-ground lightning can either occur between negative charges in the cloud and positive charges on the ground (a negative flash) or between positive charges in the cloud and negative charges on the ground (a positive flash) (National Weather Service 2023).

Hail

Hail forms inside a thunderstorm where there are strong updrafts of warm air and downdrafts of cold water. If a water droplet is picked up by the updrafts, it can be carried well above the freezing level. Water droplets freeze when temperatures reach 32°F or colder. As the frozen droplet begins to fall, it might thaw as it moves into warmer air toward the bottom of the thunderstorm, or the droplet might be picked up again by another updraft and carried back into the cold air to re-freeze. With each trip above and below the freezing level, the frozen droplet adds another layer of ice. The frozen droplet, with many layers of ice, falls to the ground as hail (NSSL 2021).

Damaging Winds

Wind begins with differences in air pressures. It is rough horizontal movement of air caused by uneven heating of the earth's surface. Wind occurs at all scales, from local breezes lasting a few minutes to global winds resulting from solar heating of the earth. High winds are often associated by other severe weather events such as thunderstorms, tornadoes, hurricanes, and tropical storms (NWS 2012). The following are descriptions of types of damaging winds:

- **Straight-line Wind**: Used to define thunderstorm wind which is not linked with rotation and is mainly used to differentiate from tornadic winds (NOAA n.d.)
- **Down Draft**: A small scale column of air that sinks towards the ground (NOAA n.d.)
- **Macroburst**: An outward burst of strong winds that are more than 2.5 miles in diameter (NOAA n.d.)
- **Microburst**: A small, concentrated downburst which produces an outward burst of relatively strong winds near the surface (NOAA n.d.)
- **Downburst:** General term to describe macro and microbursts (NOAA n.d.)
- **Gust Front:** Leading edge of rain-cooled air which clashes with a warm thunderstorm inflow (NOAA n.d.)
- **Derecho:** Long lived windstorm associated with rapidly moving precipitation or thunderstorms. If wind damage swatch is more than 240 miles and includes gusts of wind that reach 58 mph or greater, then the event can be classified as a derecho (NOAA n.d.)

Tropical cyclones are classified by their maximum wind speed.

- Tropical Depressions - winds less than 39 mph
- Tropical Storms - winds 39-73 mph
- Hurricanes - winds 74 mph or greater

Hurricanes and Tropical Storms

Hurricanes (tropical cyclones) are one of nature's most powerful storms. They produce strong winds, storm surge flooding, and heavy rainfall that can lead to inland flooding, tornadoes, and rip currents. Hurricanes form over tropical and subtropical waters, gaining energy from warm ocean

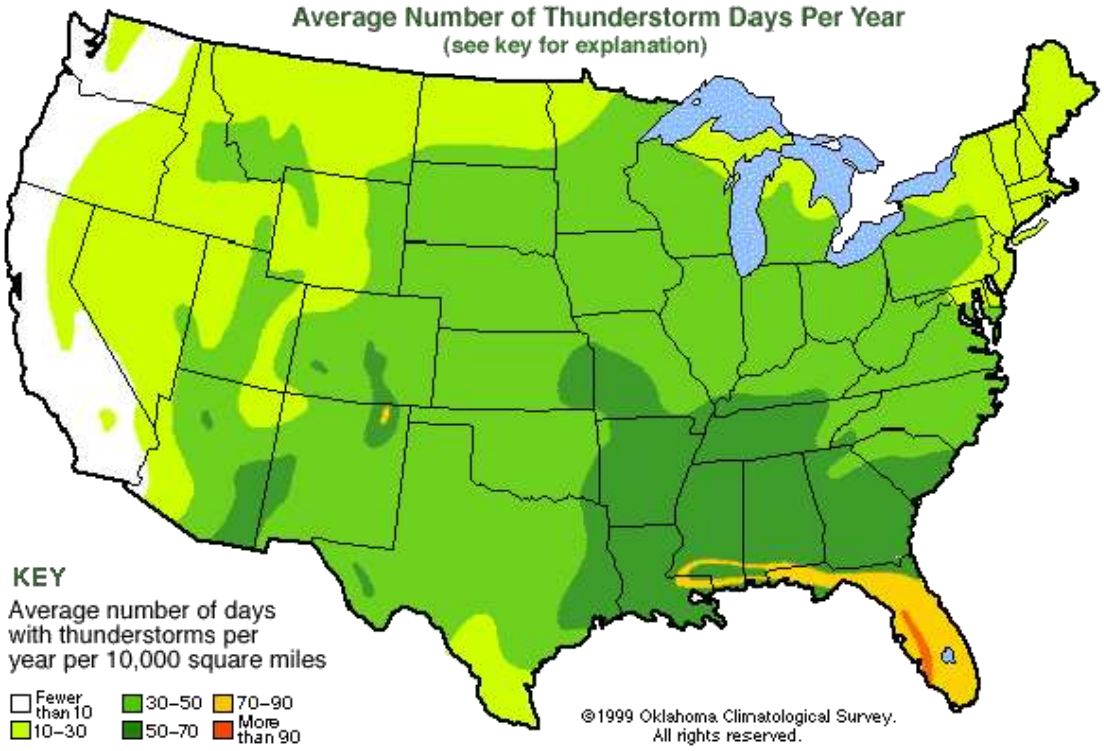
waters. As systems strengthen into hurricanes, the surface winds continuously in a circular motion. These rotating winds lead to the development of the characteristic "eye" of the hurricane, the calm, clear center of the storm (NOAA 2023).

Location

Thunderstorms and Lightning

Thunderstorms tend to take place during the spring and summer months, and during the warmest times of the day, which tend to be late afternoon and early evening (NOAA n.d.). Figure 4.3.9-1 displays thunderstorm days per year across the United States. The map shows that Franklin County is likely to have between 30 and 50 thunderstorms each year (University Corporation for Atmospheric Research 2023).

Figure 4.3.9-1. Average Number of Thunderstorms in the US



Source University Corporation for Atmospheric Research 2023

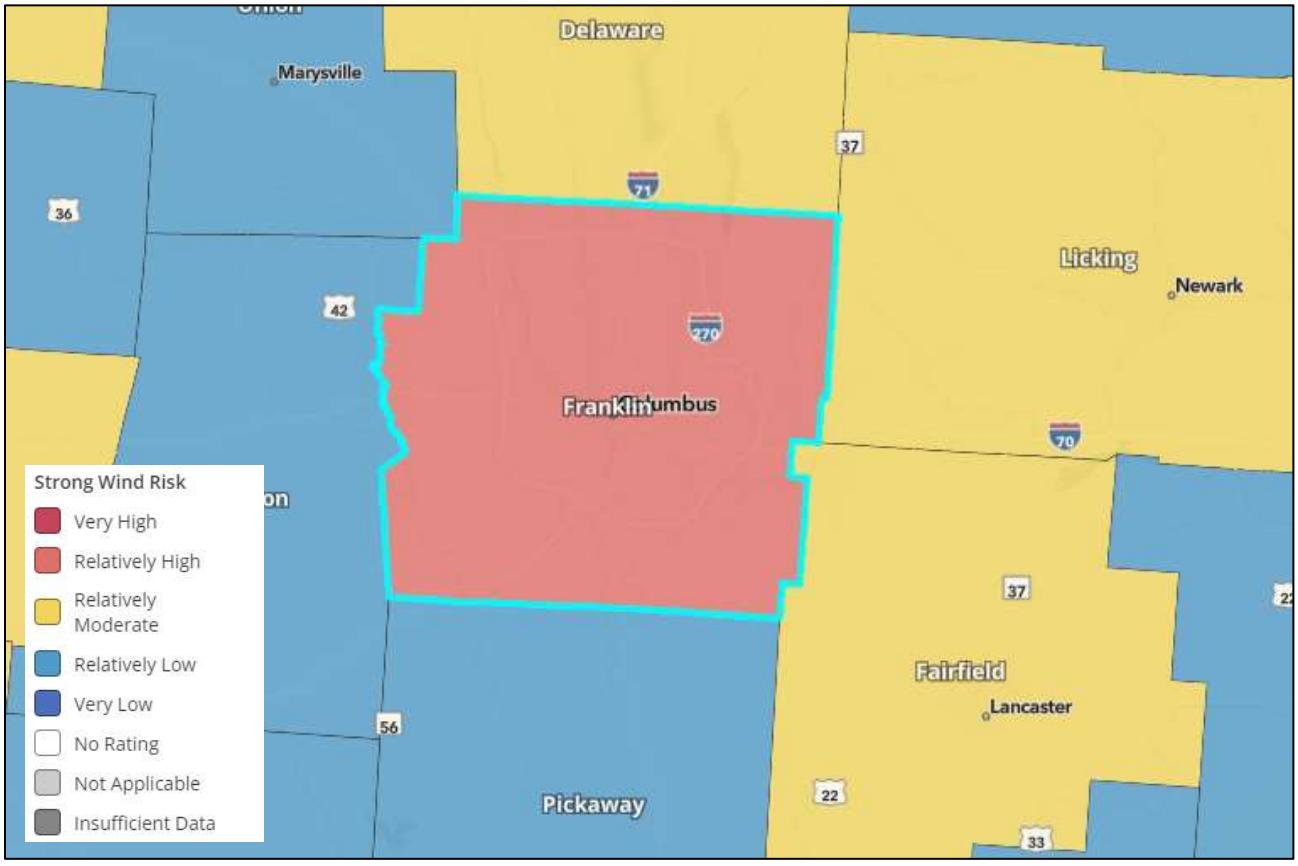
Hail

Hailstorms can form anywhere; however, they are more likely to fall in areas that have the most thunderstorms. The longer a hailstone spends in the clouds, the larger it becomes as more droplets continue to freeze. Hail falls when it becomes heavy enough to overcome the strength of the thunderstorm updraft and is pulled to the earth by gravity. Smaller hailstones may be blown away from the updraft by horizontal winds, so larger hail typically falls closer to the updraft than smaller hail (NOAA n.d.).

Damaging Winds

Severe summer weathers have the power to produce powerful winds; therefore, strong, and powerful winds have a higher chance of occurring in locations that are more likely to experience these storms (NOAA n.d.). In addition, high wind events may occur without a thunderstorm, tornado, or hurricane present and can be just as dangerous and destructive as those hazards. Figure 4.3.9-2 displays the Strong Wind Risk Index for Franklin County. According to the National Risk Index, Franklin County has "relatively high" risk to strong winds.

Figure 4.3.9-2. National Risk Index, Strong Wind Risk Index Score



Source: FEMA 2023

Hurricanes and Tropical Storms

Hurricanes are most likely to form during hurricane season, which is from June to November each year. Each Hurricane's path is predicted on a case-by-case basis which allows scientists to be able to consider information from the specific storm as well as what is known about the conditions of the atmosphere and the ocean (University Corporation for Atmospheric Research 2022). Figure 4.3.9-3 displays the Hurricane Risk Index for Franklin County. According to the National Risk Index, Franklin County has a "very low" risk to hurricanes and tropical storms.

Figure 4.3.9-3. National Risk Index, Hurricane Risk Index Score

Source: FEMA 2023

Extent

Thunderstorms

Severe thunderstorm statements, watches, and warnings are issued by the local NWS office and the Storm Prediction Center (SPC). The NWS and SPC will update the watches and warnings and notify the public when they are no longer in effect. NWS issues statements, watches, and warnings for thunderstorms:

- **Special Weather Statement:** Issued for strong storms that are below severe levels but may have impacts. Usually reserved for the threat of wind gust of 40–57 mph or hail of 0.5-inches to 0.99-inches in diameter (NWS 2023).
- **Severe Thunderstorm Watches:** A severe thunderstorm watch is issued when severe thunderstorms are possible in and near watch areas (NWS 2023).
- **Severe Thunderstorm Warning:** A severe thunderstorm is imminent or occurring; it is either detected by weather radar or reported by storm spotters. A severe thunderstorm is one that

produces winds 58 mph or stronger and/or hail 1 inch in diameter or larger. A warning means to take shelter (NWS 2023).

The NWS has five risk categories for severe weather: marginal, slight, enhanced, moderate, and high. The probabilistic forecast directly expresses the best estimate of a severe weather event occurring within 25 miles of a point (NWS 2022). Figure 4.3.9-4 details the thunderstorm risk categories.

Figure 4.3.9-4. Thunderstorm Risk

Source: NOAA

Lightning

Currently, cloud-to-ground (CG) and intra-cloud (IC) lightning flashes are detected and mapped in real-time by two different networks in the United States: the National Lightning Detection Network (NLDN) and the Earth Networks Total Lightning Network. These systems work by detecting radio waves (sferics) emitted by fast electric currents (strokes) in lightning channels. A "stroke" can be a fast current within the cloud, or a "return stroke" in a channel to ground (NOAA n.d.).

Hail

The severity of hail is measured by duration, hail size, and geographic extent. Hail can exhibit a variety of sizes, though only the very largest hail stones pose serious risk to people, if exposed. It is often estimated by comparing it to a known object (Figure 4.3.9-5). Most hailstorms are made up of a mix of different sizes, and only the very largest hail stones pose serious risk to people caught in the open (NSSL 2021).

Figure 4.3.9-5. Hail Size Chart

Source: NOAA

Damaging Winds

The NWS issues advisories and warnings for winds that are typically site-specific. The NWS issues high wind advisories, watches, and warnings when wind speeds can pose a hazard or are life threatening. The criterion for each of these varies from state to state. According to the NWS (2020), wind warnings and advisories for the State of Ohio are as follows:

- **High Wind Watch/Warnings:** Issued when sustained wind speeds of 40 mph or greater lasting for one hour or longer or for winds of 58 mph or greater for any duration or widespread damage are possible (NWS 2023).
- **Wind Advisories:** Issued when sustained winds of 30 to 39 mph are forecast for one hour or longer, or wind gusts of 46 to 57 mph for any duration (NWS 2023).

Hurricanes and Tropical Storms

Hurricanes are classified according to the Saffir-Simpson Hurricane Wind Scale from a Category 1 to Category 5 by sustained wind intensity. Figure 4.3.9-6 below shows the categories and the type of damage they produce.

Figure 4.3.9-6. Saffir-Simpson Hurricane Wind Scale

Source: NWS 2022

The NWS issues hurricane and tropical storm watches and warnings. These watches and warnings are issued or will remain in effect after a tropical cyclone becomes post-tropical, when such a storm poses a significant threat to life and property. The NWS allows the National Hurricane Center (NHC) to issue advisories during the post-tropical stage (NHC NOAA 2010).

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was included in 11 disaster (DR) or emergency (EM) declarations for events related to severe summer weathers (e.g., severe summer weathers, flooding, tornadoes, high winds, severe wind, and straight-line winds). Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2012 and 2022, Franklin County was

included in one severe summer weather-related agricultural disaster declaration: S3934 – 2015 – Excessive Rain, Hail, Wind, Lighting

Previous Events

Many sources provided severe summer weather information regarding previous occurrences and losses associated with severe summer weather events in Franklin County. The 2018 HMP discussed specific severe summer weather events that occurred in the County through 2018. For this 2023 HMP update, severe summer weather events were summarized between January 1, 2018, and December 31, 2022.

Table 4.3.9-1 includes details of major severe summer weather events that occurred in Franklin County between 2018 and 2022. Major events include those that resulted in losses (greater than $5,000 in property or crop damages) or fatalities, as reported by the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (NCEI), events that led to a FEMA disaster declaration, and/or event that led to a USDA declaration.

Table 4.3.9-1. Severe Summer Weather Events in Franklin County (2018 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
April 3, 2018	Hail and Thunderstorm Wind	N/A	N/A	Grove City, Hanford, Pleasant Corners, Canal Winchester	Severe thunderstorms and tornadoes across Franklin County, bringing up to three inches of rain. In the Hanford area of Columbus, a large portion of a building's roof was blown off, embedding slate tiles in the ground. Several homes had chimneys collapse. In Grove City, utility poles were knocked down, leading to power outages. Overall, the County had approximately $38,000 in property damage as a result of this event.
June 8-9, 2018	Thunderstorm Wind	N/A	N/A	Grove City, Briggsdale, Columbus	Scattered thunderstorms moved across Franklin County, producing torrential rainfall (as much as five inches). Strong winds from this event led to downed trees and power lines, causing widespread power outages. Overall, the County had approximately $15,000 in property damage as a result of this event.
September 1, 2018	Thunderstorm Wind	N/A	N/A	Grandview Heights	Scattered thunderstorms developed and a few of the storms produced locally heavy rainfall. In Franklin County, trees and power lines were knocked over, damaging multiple cars. Property damages totaled approximately $20,000.
February 24, 2018	High Wind	N/A	N/A	Countywide	Strong winds gusted between 40 and 60 mph in Franklin County, causing numerous power outages and damaged buildings. Overall, the County had approximately $60,000 in property damage as a result of this event.
April 14, 2019	Thunderstorm Wind	N/A	N/A	Countywide	Thunderstorms impacted portions of Franklin County, damaging buildings, and causing injuries. Three people were injured as a result of this event. Overall, the County had approximately $155,000 in property damage.
May 18, 2019	Thunderstorm Wind	N/A	N/A	Obetz, Groveport	Isolated thunderstorms developed, downing several trees and power poles in Franklin County. Overall, the County had approximately $15,000 in property damage.
July 2, 2019	Hail and Thunderstorm Wind	N/A	N/A	Hilliard, Riverlea, Worthington, Grandview Heights, Columbus, Goud Park, Reynoldsburg	Scattered thunderstorms in Franklin County downed trees and power lines, causing property damage. The County had approximately $11,750 in property damage from this event.

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
June 9-10, 2020	Thunderstorm Wind	N/A	N/A	Countywide	Widespread severe summer weathers brought damaging winds, with reports of up to 65 mph. Damages in Franklin County included uprooted trees, downed tree branches, and building damages. Overall, the County had approximately $20,000 in property damages.
July 10, 2020	Thunderstorm Wind	N/A	N/A	Bexley, Columbus	Strong winds from scattered thunderstorms downed trees and power lines in Franklin County. As a result of this event, Franklin County had approximately $5,000 in property damage.
July 27, 2020	Thunderstorm Wind	N/A	N/A	Briggsdale, Grove City, Columbus	A line of thunderstorms downed numerous trees and power line, leading to power outages and closed roadways. Overall, the County had approximately $7,500 in property damage from this event.
August 25, 2020	Thunderstorm Wind	N/A	N/A	Westerville, Blacklick	Strong to severe thunderstorms developed, knocking down trees and causing property damage. As a result of this event, Franklin County had approximately $7,000 in property damage.
November 15, 2020	Thunderstorm Wind	N/A	N/A	Ohio State University, Riverlea, Headley's Corner	A line of showers and thunderstorms impacted parts of Franklin County, with damaging winds knocking down trees and power lines. Wind gusts ranged from 59 mph to 62 mph. The County had approximately $75,000 in property damage from this event.
March 25-26, 2021	High Wind	N/A	N/A	Countywide	Scattered thunderstorms and widespread strong winds in Franklin County caused numerous trees to be blown down, power outages, and property damage. Wind gusts of 54 mph were measured at the Bolton Field Airport. The County had approximately $10,000 in property damage from this event.
July 29, 2021	Thunderstorm Wind	N/A	N/A	Grandview Heights	Showers and thunderstorms impacted parts of Franklin County. In Grandview Heights, strong winds downed large branches and power lines throughout. The County had approximately $6,000 in property damage from this event.
August 11, 2021	Thunderstorm Wind	N/A	N/A	Westerville	A series of thunderstorms moved east across along and north of I-70. In Westerville, numerous trees were downed, damaging homes and causing power outages. As a result of this event, the County had approximately $11,000 in property damage.
August 20, 2022	Thunderstorm Wind	N/A	N/A	South Columbus	Scattered thunderstorms developed, downing several trees and power lines in South Columbus. This led to approximately $5,000 in property damage.

Sources: NOAA NCEI 2023

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of severe summer weather events for the County. Information from FEMA, the National Hurricane Center, NOAA-NCEI storm events database, the 2019 State of Ohio HMP, and the 2018 Franklin County HMP were used to identify the number of severe summer weather events that occurred between 1954 and 2022. Table 4.3.9-2 presents the probability of future events for severe summer weather Franklin County.

Table 4.3.9-2. Probability of Future Severe Summer Weather Events

Hazard Type	Number of Occurrences Between 1954 and 2022	% Chance of Occurring in Any Given Year
Hail	236	100%
Heavy Rain	87	100%
High Wind	21	30.4%
Hurricane	0	0%
Lightning	6	8.7%
Strong Wind	6	8.7%
Thunderstorm Wind	>500	100%
Tropical Storm/Tropical Depression	0	0%
Total	**>850**	**100%**

Sources: NOAA NCEI 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all severe summer weather events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Based on the County's history of summer weather, Franklin County could experience at least 12 summer weather events (of any type) every year. In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for severe summer weather in the County is considered 'frequent'.

Climate Change Impacts

Climate change acts as an amplifier of existing natural hazards. The best available scientific data and modeling suggest that climate change has and will continue to impact natural hazards in the state. While the impacts of climate change may vary by regions and jurisdictions throughout the state, it is clear that the potential consequences of climate change will have significant impacts on all the citizens of the state (Ohio Emergency Management Agency 2019).

Since the beginning of the 20th century, temperatures in Ohio have risen more than 1.5°F, and temperatures in the 2000s and 2010s were warmer than in any other historical period. The State of Ohio has also experienced significant increase in heavy rain events, increasing the risk of springtime flooding. These storms can also cause major impacts to life, safety, property, and disruption to economic activity (NOAA National Centers for Environmental Information 2022).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed for severe summer weather. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 3), are exposed and vulnerable to severe summer weather events.

Impact on Life, Health, and Safety

The entire population of Franklin County (1,323,807) is exposed to severe summer storm events (US Census 2020); however, the impact of these events can have on life, health, and safety are dependent upon several factors, including the severity of the event and whether adequate warning time was provided to residents.

> The vulnerable population also includes those who would not have adequate warning from an emergency warning system (e.g., television or radio); this would include residents and visitors. The population adversely affected by severe summer weathers may also include those beyond the disaster area that rely on affected roads for transportation.

Socially vulnerable populations are most susceptible due to their physical and financial ability to react and respond during extreme severe summer weathers. This population includes the elderly, young, and individuals with disabilities or access or functional needs who may be unable to evacuate in the event of an emergency. The elderly are considered most vulnerable because they require extra time or outside assistance during evacuations and are more likely to seek or need medical attention that might not be readily available due to isolation during a storm event. Section 3 (County Profile) provides statistics of these populations.

Economically disadvantaged people are at high risk for bracing severe summer weathers because of the potential inability to afford up-to-code homes and buildings that are deemed safe from storms passing through. They also may pose health issues, such as exposure to mold and other health issues that water seepage may cause. These populations may also lack access to vehicles for any necessary evacuations.

Impact on General Building Stock

Damage to buildings is dependent upon several factors, including wind speed, storm duration, and path of the storm track. Building construction also plays a major role in the extent of damage resulting from a severe summer weather event. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. Furthermore, high-rise buildings are also very vulnerable structures.

Impact on Critical Facilities and Community Lifelines

Overall, all critical facilities and community lifelines are exposed to the severe summer weather hazard. Transportation routes are vulnerable to severe summer weathers and have the potential to be wiped out or blocked, creating isolation issues from responders. This includes all roads and bridges in the path of a severe summer weather event. Those that are most vulnerable are those that are already in poor condition

and would not be able to withstand high wind speeds and excessive precipitation. Utility infrastructure is also vulnerable; interruption of services may not only impact vulnerable populations but may also impact critical facilities that need to be in operation during a disaster. Because power interruption can occur, backup power is recommended for critical facilities and infrastructure. Full functionality of critical facilities such as police, fire, and medical services is essential for response during and after a severe summer weather event.

Impact on the Economy

Severe summer weather events can have short- and long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings.

According to FEMA's National Risk Index, Franklin County's expected annual losses from the following severe summer weather events include:

- Lightning - $1.8 million
- Hail - $6.9 million
- Wind - $3.2 million
- Hurricanes/Tropical Storms - $390,000

Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage and impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to the population. Direct building losses are the estimated costs to repair or replace the damage caused to the building. This is reported in the "Impact on General Building Stock" section discussed earlier. Business interruption losses are the losses associated with the inability to operate a business because of the wind damage sustained during the storm or the temporary living expenses for those displaced from their home because of the event.

Impact on the Environment

The impact of severe weather events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long-term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2020). For example, severe weather that creates longer periods of rainfall can erode natural banks along waterways and degrade soil stability for terrestrial species. Severe wind events can tear apart habitats, causing fragmentation across ecosystems. Researchers also believe that a greater number of diseases will spread across ecosystems because of impacts that severe weather and climate change will have on water supplies (NOAA 2019). Overall, as the physical environment becomes more altered, species will begin to contract or migrate in response, which may cause additional stressors to the entire ecosystem within Franklin County

Future Changes That May Impact Vulnerability

Understanding future changes that effect vulnerability in the county can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan.

Projected Development

As discussed in Section 3, areas targeted for future growth and development have been identified across the County. Any areas of growth located could be potentially impacted by severe summer weather. Some local municipalities in the Franklin County have implemented the following activities to eliminate loss of life and property and infrastructure damages during summer weather events:

- Removal of dead trees and trim trees/brush from roadways to lessen falling limbs and trees.
- Ensure proper road signs are visible and installed properly.
- Removal of debris/obstructions in waterways and develop routine inspections/maintenance plans to reduce potential flooding.
- Purchase and install backup generators in evacuation facilities and critical facilities to essential services to residents.

Project Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 13.7 percent since 2010. The County's population is anticipated to slightly increase over the next decade (5.37 percent increase by 2030 and 11.72 percent increase by 2050) (Ohio Development Services Agency 2018). Any increase in growth can create changes in density throughout the County, which may impact the ability of persons in the County to mobilize or receive essential services during summer weather events. Refer to Section 3 (County Profile), which includes a discussion about population trends for the County.

Climate Change

As discussed previously, the entire State of Ohio is projected to experience an increase in the frequency and severity of extreme storms and rainfall. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate, unleashing far more rain and posing a greater threat of flooding across wide areas (NASA 2013). An increase in storms will produce more wind events and may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (NASA 2013). With an increased likelihood of strong winds and tornado events, all the county's assets will experience additional risk for losses because of extreme wind events.

Change of Vulnerability Since 2018 HMP

Franklin County's vulnerability to severe summer weather events has increased due to a population that has also grown. Since the 2018 HMP analysis, population statistics have been updated using the 2020

Census. The general building stock and the 2018 critical facility dataset was updated by the County and participating jurisdictions. Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2018 HMP.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.10 Severe Winter Weather

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the severe winter weather hazard in Franklin County.

Hazard Profile

Hazard Description

Severe winter weather is classified as snow, ice, and extremely cold conditions. Winter storms are events in which the dominant forms of precipitation occur only at cold temperatures. The following are common severe winter weather descriptions from the National Weather Service (NWS).

Blizzards

A blizzard is a severe weather condition characterized by high winds and reduced visibilities due to falling or blowing snow. The NWS specifies a blizzard as sustained wind or frequent gusts of 16 miles per second (35 miles per hour) or greater, accompanied by falling and/or blowing snow, frequently reducing visibility to less than 0.25 miles for three hours or longer. Earlier definitions included a condition of low temperatures, on the order of -7°C (20°F) or lower, -12°C (10°F) or lower (severe blizzard) (American Meteorological Society 2014).

Ice Storms

An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually of ¼" or greater (National Weather Service 2009).

Lake-Effect Storms

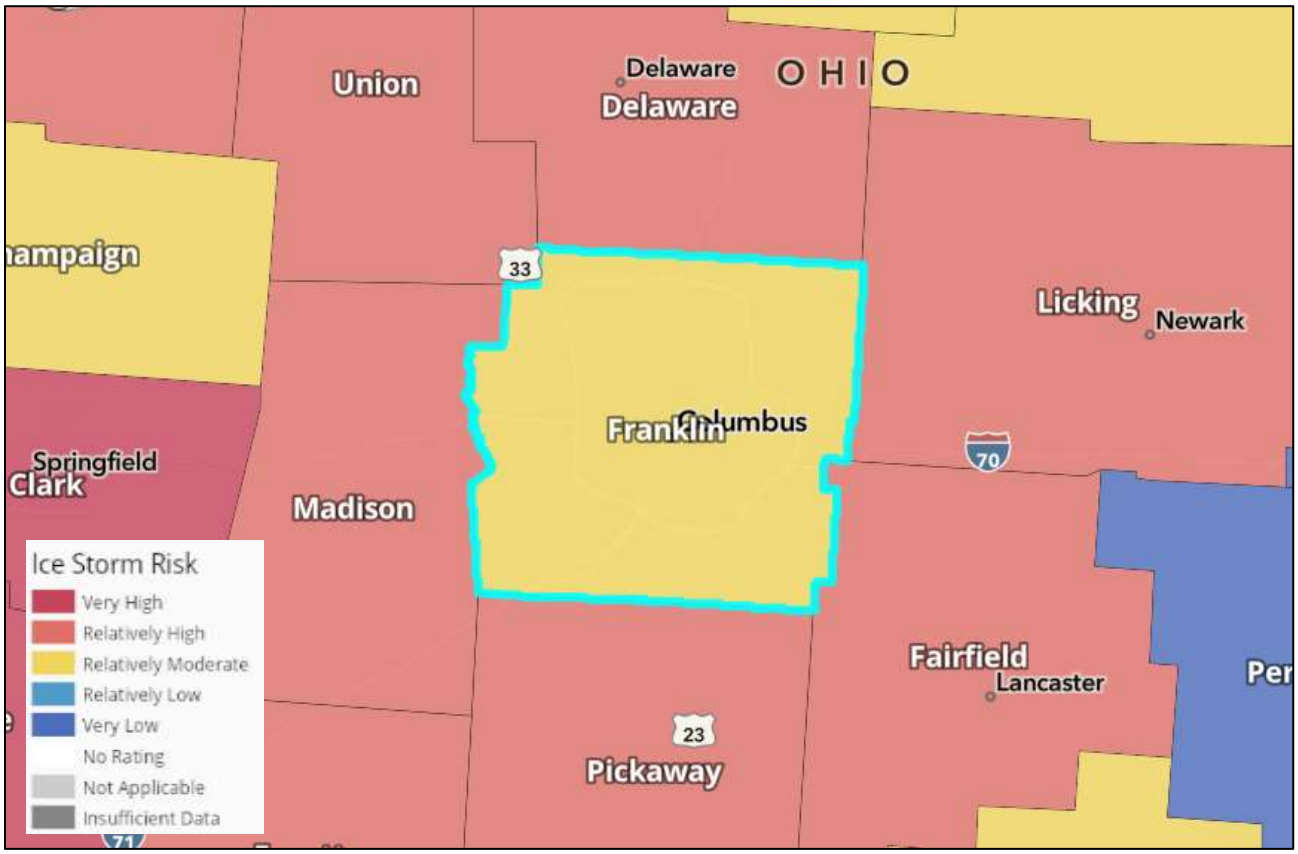
A lake-effect storm is a fall or winter storm that produces heavy but localized precipitation as a result of temperature differences between the air over snow-covered ground and the air over the open waters of a lake. Lake effect snowstorms occur when a mass of sufficiently cold air moves over a large body of warmer water. As warm, moist air rises it condenses to form liquid and cools to form ice particles. As a result, clouds build up over the lake and eventually develop into snow showers and squalls as they move downwind. The intensity of lake effect snow is increased when higher elevations downwind of the lake force the cold, snow-producing air to rise even further. The amount of snow resulting from lake effect

storms depends on the fetch, or the distance a cold, dry air mass travels over a warm, moist body of water (Franklin County HMP 2018).

Location

The Midwest and Plains states experience severe winter weather, including heavy snow, ice storms, and sometimes blizzards, as well as extremely low wind chill temperatures. Northeastern Ohio near the Great Lakes also experiences lake-effect snow. The worst of these storms are generally during late autumn/early winter. Lake-effect snowfall can vary greatly, with areas of deep snowfall adjacent to areas with relatively little snow. (Franklin County HMP 2018). Figure 4.3.10-1 displays the Ice Storm Risk Index for Franklin County. According to the National Risk Index, Franklin County has "relatively moderate" risk to ice storms.

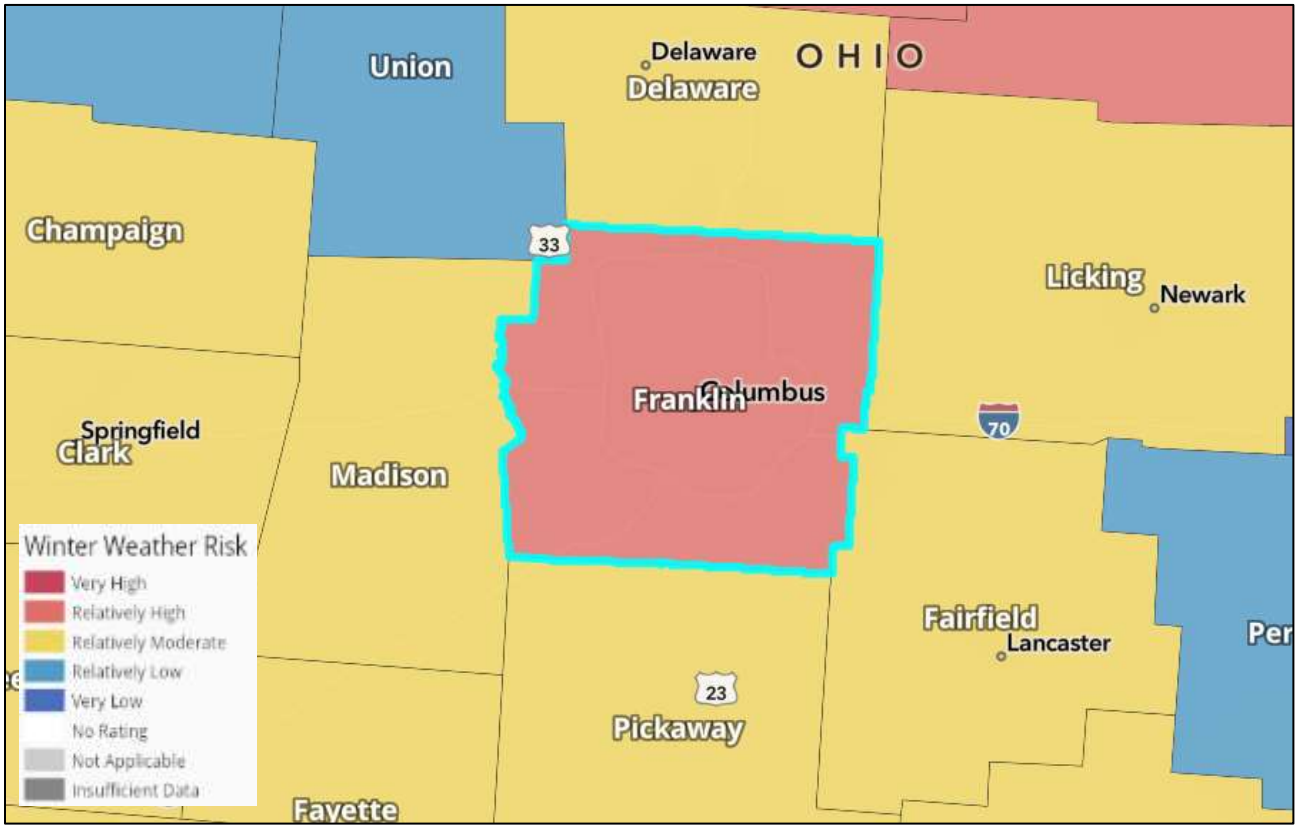
Figure 4.3.10-1. National Risk Index, Ice Storm Risk Index Score



Source: FEMA 2023

Figure 4.3.10-2 displays the Winter Weather Risk Index for Franklin County. According to the National Risk Index, Franklin County has "relatively high" risk to winter weather.

Figure 4.3.10-2. National Risk Index, Winter Weather Risk Index Score



Source: FEMA 2023

Extent

The magnitude or severity of a severe winter storm depends on several factors, including snowfall rates, regional climatological susceptibility to snowstorms, total snowfall and ice amounts, wind speeds, temperatures, visibility, storm duration, topography, time of occurrence during the day and week (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified both by meteorological measurements and by evaluating societal impacts. NOAA's National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5 and is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population. The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA n.d.). Table 4.3-1. presents the five RSI ranking categories.

Table 4.3-1. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1–3
2	Significant	3–6

Category	Description	RSI Value
3	Major	6–10
4	Crippling	10–18
5	Extreme	18.0+

Source: NOAA 2022

Note: RSI = Regional Snowfall Index

The NWS operates a widespread network of observing systems, such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into what will happen next, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts. According to NWS (NWS 2021), the magnitude of a severe winter storm can be qualified into five main categories by event type.

Table 4.3-2. Winter Storm Category Thresholds

Storm Type	Description
Heavy Snowstorm	Accumulations of 4 inches or more of snow in a 6-hour period, or 6 inches of snow in a 12-hour period.
Sleet Storm	Significant accumulations of solid pellets that form from the freezing of raindrops or partially melted snowflakes causing slippery surfaces, posing a hazard to pedestrians and motorists.
Ice Storm	Significant accumulation of rain or drizzle freezing on objects (trees, power lines, roadways) as it strikes them, causing slippery surfaces and damage from sheer weight of ice accumulations.
Blizzard	Wind velocity of 35 mph or more, temperatures below freezing, considerable blowing snow with visibility frequently below one-quarter mile prevailing over an extended period.
Severe Blizzard	Wind velocity of 45 mph, temperatures of 10 °F or lower, a high density of blowing snow with visibility frequently measured in feet prevailing over an extended period.

Source: NWS 2021

Additionally, the NWS uses winter weather watches, warnings, and advisories to help people anticipate what to expect in the days and hours prior to an approaching storm (NWS 2021). Refer to Figure 4.3.10-3 for the warning thresholds.

Figure 4.3.10-3. Winter Storm Warning Thresholds

Source: NOAA n.d.

The State of Ohio Committee for Severe Weather Awareness has snow emergency classifications that are issued in the event of winter weather. The classifications are as follows:

- **Level 1** - Roadways are hazardous with blowing and drifting snow. Roads may also be icy. Motorists are urged to drive very cautiously.
- **Level 2** - Roadways are hazardous with blowing and drifting snow. Roads may also be very icy. Only those who feel it is necessary to drive should be out on the roads. Contact your employer to see if you should report to work. Motorists should use extreme caution.
- **Level 3** - All roadways are closed to non-emergency personnel. No one should be driving during these conditions unless it is absolutely necessary to travel or a personal emergency exists. All employees should contact their employer to see if they should report to work. Those traveling on the roads may subject themselves to arrest (Ohio Committee for Severe Weather Awareness 2023).

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1954 and 2022, Franklin County was included in three disaster (DR) or emergency (EM) declarations for severe winter weather-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

Date(s) of Event	Event Type	FEMA Declaration Number	Franklin County included in Declaration?	Description
January 26, 1978	Snowstorm	EM-3055-OH	Franklin County	Ohio Blizzards and Snowstorms
December 22, 2004 – December 24, 2004	Snowstorm	EM-3198-OH	Franklin County	Ohio Snow
March 7, 2008 – March 9, 2008	Snowstorm	EM-3286-OH	Franklin County	Ohio Snow

Sources: FEMA 2022

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2018 and 2022, Franklin County was not included in any severe winter weather-related agricultural disaster declarations.

Previous Events

For the 2023 HMP update, known severe winter weather events that impacted Franklin County between 2018 and 2022 are discussed below. For events prior to 2018, refer to the 2018 Franklin County HMP.

Table 4.3.10-3. Severe Winter Weather Events in Franklin County (2018 to 2022)

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
February 6, 2018	Winter Weather	N/A	N/A	Dayton, Columbus	A system produced a wintery mix of freezing rain, sleet, and snowfall. The most accumulating snow fell between Dayton and Columbus, while areas to the southeast had more ice accumulations and areas to the northwest had lesser snow amounts.
March 7 – 8, 2018	Winter Weather	N/A	N/A	Franklin County	Significant travel issues occurred as some snow squalls created treacherous driving conditions across the region.
March 20, 2018	Winter Weather	N/A	N/A	Franklin County	A band of heavy snowfall set up northwest of this stacked system, producing 2 to 5 inches of snow along and west of the I-75 corridor.
February 1, 2019	Winter Weather	N/A	N/A	Franklin County	Four to six inches of snow fell along the I-70 corridor, with 4.5 inches reported in Prairie Township.
February 12, 2020	Winter Weather	N/A	N/A	Franklin County	During the afternoon and evening hours on February 12th, a period of heavy snow, mixed with sleet at times impacted areas along and north of the I-70 corridor during the evening commute. Accumulations were generally 2 to 4 inches.
January 30 – 31, 2021	Winter Weather	N/A	N/A	Franklin County	Heavy snow tracked north and continued along the I-70 corridor. South of the I-70 corridor, sleet and freezing rain mixed with the snow before eventually transitioning to all rain. Approximately four inches was recorded in Grove City.
February 8 - 9, 2021	Winter Weather	N/A	N/A	Franklin County	A system that moved over the Ohio Valley brought heavy snow along the I-71 corridor. Snowfall totals ranged from six to 10 inches, with four inches reported in Grove City.
April 20, 2021	Winter Weather	N/A	N/A	Franklin County	Rain changed over to snow during the evening of April 20th. Snowfall totals in Franklin County ranged from two to four inches with 2.5 inches reported in Grove City. Due to the time of year, trees that had leafed out were knocked down by the snow and did create some obstacles on roadways.
December 22-24, 2022	Winter Storm	N/A	N/A	Franklin County	A combination of snow and bitter wind chills created dangerous conditions for residents across Franklin County. Franklin County was under a Level 2 snow emergency due to the icy road conditions.

Sources: NOAA NCEI 2023, FEMA 2023, CoCoRaHS 2023

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of severe winter weather events for the County. Information from NOAA-NCEI storm events database, the 2019 State of Ohio HMP, the 2018 Franklin County HMP were used to identify the number of severe winter weather events that occurred between 1954 and 2022. Table 4.3.10-4 presents the probability of future events for severe winter weather Franklin County.

Table 4.3.10-4. Probability of Future Severe Winter Weather Events

Hazard Type	Number of Occurrences Between 1954 and 2022	% Chance of Occurring in Any Given Year
Blizzard	0	0%
Heavy Snow	10	14.5%
Ice Storm	6	8.7%
Lake Effect Snow	0	0%
Winter Storm	21	30.4%
Winter Weather	101	100%
Total	**138**	**100%**

Sources: NOAA NCEI 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all severe winter weather events occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

According to the National Risk Index, Franklin County has a relatively high risk for winter weather based on expected annual loss, social vulnerability, and community resilience. Based on the County's history of winter weather, Franklin County could experience at least two winter weather events (of any type) every year. In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for severe winter weather in the County is considered 'frequent'.

Climate Change Impacts

Climate change acts as an amplifier of existing natural hazards. The best available scientific data and modeling suggest that climate change has and will continue to impact natural hazards in the state. While the impacts of climate change may vary by regions and jurisdictions throughout the state, it is clear that the potential consequences of climate change will have significant impacts on all the citizens of the state (Ohio Emergency Management Agency 2019).

Since the beginning of the 20th century, temperatures in Ohio have risen more than 1.5°F, and temperatures in the 2000s and 2010s were warmer than in any other historical period. While annual precipitation projections are uncertain for the State of Ohio, winter and spring precipitation totals are projected to increase (NOAA National Centers for Environmental Information 2022).

Climate change is causing winter to be the fastest-warming season in much of the continental U.S., and seasonal snowfall is declining in many cities. In addition, cold snaps are becoming less severe and shorter

in duration due to the Arctic warming at three to four times the rate of the rest of the world. Seasonal snowfall is declining; however, heavy snowstorms can still happen when temperatures are cold enough (State Climate Office of Ohio 2023).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For the severe winter weather hazard, all of Franklin County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County Profile (Section 3), are vulnerable to a severe winter storm event.

Impact on Life, Health, and Safety

The entire population of Franklin County (1,323,807) is exposed to severe winter storm events (US Census 2020). According to the NOAA National Severe Storms Laboratory (NSSL); every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., primarily from automobile accidents, overexertion and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions with blinding wind-driven snow, drifting snow and extreme cold temperatures and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold (NSSL 2021).

The homeless and elderly are considered most susceptible to this hazard. The elderly are considered susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice. According to the 2021 American Community Survey 5-Year population estimate, there are 188,900 persons over 65 years old that reside in the County that are considered vulnerable to severe winter weather (14.6 percent of the County population). In addition, severe winter storm events can reduce the ability of these populations to access emergency services.

Impact on General Building Stock

The entire general building stock inventory is exposed and vulnerable to the severe winter weather hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard.

Impact on Critical Facilities and Community Lifelines

Similar to general building stock in Franklin County, all critical facilities and community lifelines are exposed and vulnerable to severe winter weather events. Critical facilities and community lifelines that are exposed to severe winter weather are likely to experience functional downtime associated with loss of power following these events, which could increase the net impact of these events. Additionally, the impacts of road closures during severe storm evets can cause functional downtime due to inaccessibility of locations and/or ability of employees to come to work.

Impact on the Economy

Depending on the severity and duration of the severe winter weather event, damage to the general building stock, critical facilities, and community lifelines can include roof damage from heavy snow loads, structural damage from downed trees, and power outages.

According to FEMA's National Risk Index, Franklin County's expected annual losses from the following severe winter weather events include:

- Ice Storm - $215,000
- Winter Weather - $283,000

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. In addition to snow removal costs, severe winter weather affects the ability of persons to commute into and out of the area for work or school. The loss of power and closure of roads prevents the commuter population traveling to work within and outside of the County and may cause a loss in economic productivity.

Impact on the Environment

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (USGS 2020). Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

As discussed in Section 3, areas targeted for future growth and development have been identified across the County. Any areas of growth located could be potentially impacted by severe winter storm events. Current Ohio State land use and building codes incorporate standards that address and mitigate snow accumulation. Some local municipalities in the Franklin County have implemented the following activities to eliminate loss of life and property and infrastructure damages during winter storm events:

- Removal of snow from roadways.
- Removal of dead trees and trim trees/brush from roadways to lessen falling limbs and trees.

- Ensure proper road signs are visible and installed properly.
- Removal of debris/obstructions in waterways and develop routine inspections/maintenance plans to reduce potential flooding.
- Purchase and install backup generators in evacuation facilities and critical facilities to essential services to residents.

Project Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 13.7 percent since 2010. The County's population is anticipated to slightly increase over the next decade (5.37 percent increase by 2030 and 11.72 percent increase by 2050) (Ohio Development Services Agency 2018). Any increase in growth can create changes in density throughout the County, which may impact the ability of persons in the County to mobilize or receive essential services during severe winter storm events. Historically, winter weather events with associated snowfall and ice accumulation have severely impacted transportation corridors as well as infrastructure. Refer to Section 3 (County Profile), which includes a more thorough discussion about population trends for the County.

Climate Change

As discussed above, most studies project that the State of Ohio will see an increase in average annual temperatures and precipitation. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to freeze into heavy snowfall and icing. This increase in snow and ice could result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by severe winter events due to loss of service or access.

Change of Vulnerability Since 2018 HMP

Franklin County remains vulnerable to severe winter weather events. Since the 2018 analysis, population statistics have been updated using the 2020 Census. Additionally, this updated analysis estimated exposure and losses at the structure level with updated building stock data. Overall, this vulnerability assessment uses a more accurate and updated building inventory which provides more accurate estimated exposure and potential losses for Franklin County.

SECTION 4. RISK ASSESSMENT

4.3 HAZARD PROFILES

4.3.11 Tornadoes

The following section provides the hazard profile (hazard description, location, extent, previous occurrences and losses, probability of future occurrences, and impact of climate change) and vulnerability assessment for the tornadoes hazard in Franklin County.

Hazard Profile

Hazard Description

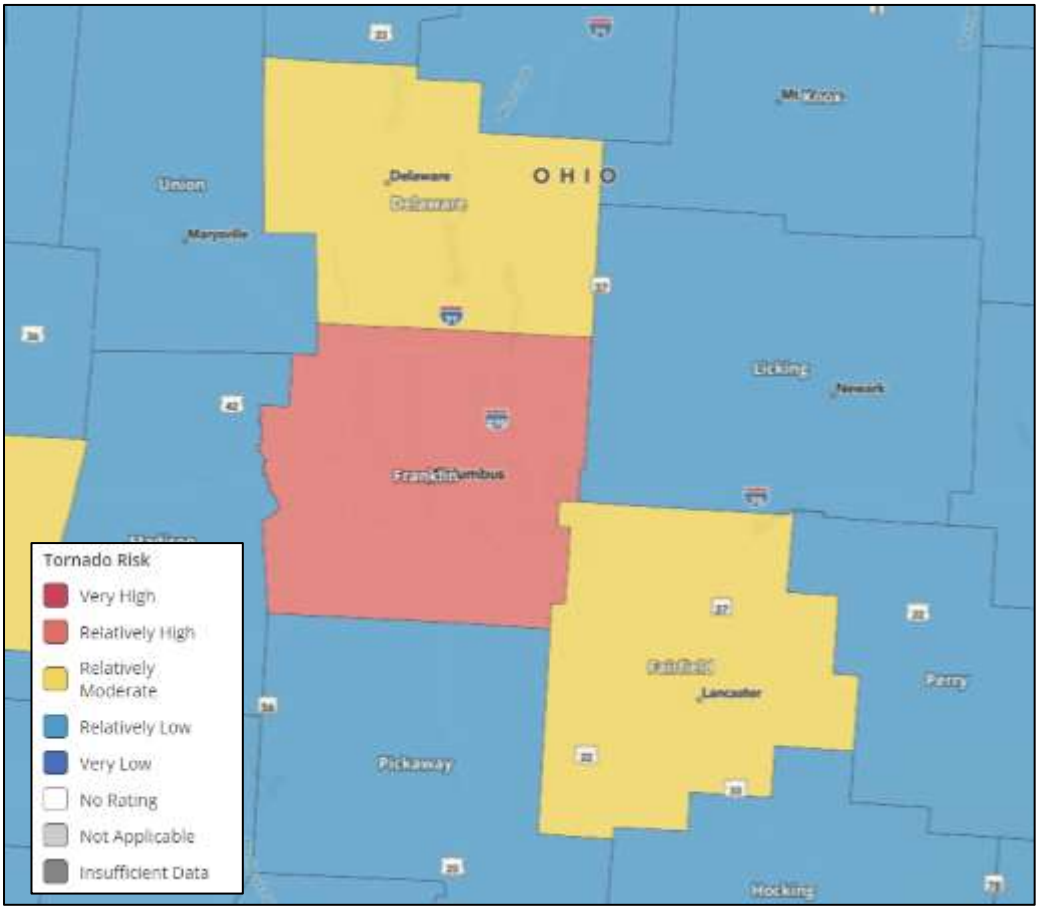
The National Oceanic Atmospheric Association (NOAA) defines a tornado as a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground (NOAA 2011). Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust, and debris. Tornadoes are the most violent of all atmospheric storms and the most hazardous when they occur in populated areas. Tornadoes can topple mobile homes, lift cars, snap trees, and turn objects into destructive missiles. Among the most unpredictable of weather phenomena, tornadoes can occur at any time of day, in any state in the union, and in any season. While the majority of tornadoes cause little or no damage, some are capable of tremendous destruction, reaching wind speeds of 200 mph or more (NOAA 2023).

Location

Similar to that of thunderstorms, tornadoes do not have any specific geographic boundary and can occur anywhere in Franklin County. Tornadoes are a fairly common occurrence in Ohio. Located on the eastern edge of Tornado Alley, Ohio averages 19 tornadoes a year (Ohio Emergency Management Agency 2019). The peak tornado season for Ohio is April through July. June has the most tornado occurrences, but many of the state's major tornado outbreaks have taken place in April and May (Ohio Emergency Management Agency 2019). Most tornadoes occurred between 2 and 10 p.m. However, history has proven that tornadoes can occur during any month of the year at any time of the day or night.

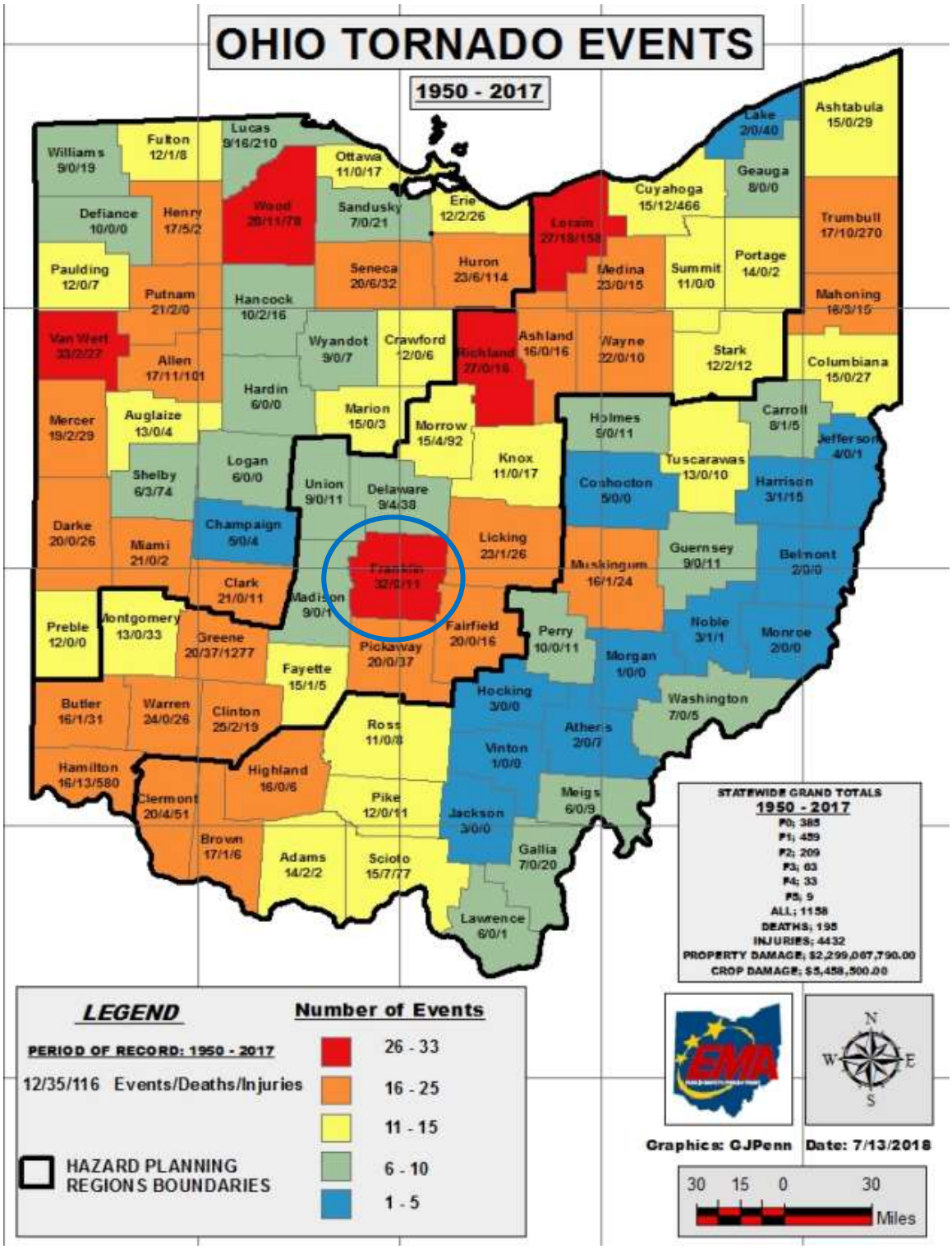
Franklin County is identified as one of the counties having the greatest number of tornado touchdowns in the State of Ohio. Figure 4.3.11-1 displays the Tornado Risk Index for Franklin County. According to the National Risk Index, Franklin County has a relatively high risk to tornadoes, based on expected building and population loss each year due to tornadoes. Figure 4.3.11-2 displays tornado events in Ohio from 1950 – 2017, as presented in the 2019 State of Ohio Hazard Mitigation Plan. Between 1950 and 2017, Franklin County had 32 reported tornadoes resulting in 11 injuries (Ohio Emergency Management Agency 2019).

Figure 4.3.11-1. National Risk Index, Tornado Risk Index Score



Source: FEMA 2023

Figure 4.3.11-2. Ohio Tornado Events, 1950 – 2017



Source: *Ohio Emergency Management Agency 2019*
Note: *The blue circle indicates the approximate location of Franklin County.*

Extent

Tornadoes are measured by damage scale based on their winds, with greater damage equating to greater wind speed. The original Fujita-scale (F-scale) was developed without considering a structure's integrity or condition as it relates to the wind speed necessary to damage it. The process of rating the damage was subjective with the original F-scale and arbitrary judgments were the norm. In order to reduce this subjectivity, the Enhanced F-scale (EF-scale) took effect on February 1, 2007 (Ohio Emergency Management Agency 2019).

Damage from tornadoes can vary from minor damage that breaks tree limbs to massive damage demolishing homes in its path. The type of damage depends on the intensity, size, and duration of the tornado. The magnitude or severity of a tornado is categorized using the Enhanced Fujita Tornado Intensity Scale (EF Scale). This is the scale now used exclusively for determining tornado ratings by comparing wind speed and actual damage. Figure 4.3.11-3 illustrates the relationship between EF ratings, wind speed, and expected tornado damage. Franklin County can experience tornadoes ranging from EF0 to EF4.

Figure 4.3.11-3. Explanation of EF-Scale Ratings

EF Rating	Wind Speeds	Expected Damage
EF-0	65-85 mph	'Minor' damage: shingles blown off or parts of a roof peeled off, damage to gutters/siding, branches broken off trees, shallow rooted trees toppled.
EF-1	86-110 mph	'Moderate' damage: more significant roof damage, windows broken, exterior doors damaged or lost, mobile homes overturned or badly damaged.
EF-2	111-135 mph	'Considerable' damage: roofs torn off well constructed homes, homes shifted off their foundation, mobile homes completely destroyed, large trees snapped or uprooted, cars can be tossed.
EF-3	136-165 mph	'Severe' damage: entire stories of well constructed homes destroyed, significant damage done to large buildings, homes with weak foundations can be blown away, trees begin to lose their bark.
EF-4	166-200 mph	'Extreme' damage: Well constructed homes are leveled, cars are thrown significant distances, top story exterior walls of masonry buildings would likely collapse.
EF-5	> 200 mph	'Massive/incredible' damage: Well constructed homes are swept away, steel-reinforced concrete structures are critically damaged, high-rise buildings sustain severe structural damage, trees are usually completely debarked, stripped of branches and snapped.

Source: NWS n.d.

The NWS issues tornado watches and warnings. They are issued when conditions are favorable for the development of tornadoes in and close to the watch area. Their size can vary depending on the weather situation. Watches are typically issued for a duration of four to eight hours. A tornado warning is issued by the local NWS office and will include where the tornado was located and what municipalities will be in its path. It is issued when a tornado is indicated by a radar or spotters. Warnings are issued for a duration of 30 minutes (NWS 2020). The current average lead time for tornado warnings is 13 minutes. Occasionally, tornadoes develop so rapidly, that little, if any, advance warning is possible (NOAA 2011).

Worst-Case Scenario

A worst-case scenario would be an EF5 tornado crossing through Franklin County with 3-second wind gusts ranging from 200 to 250 mph, causing severe damage. A tornado of this magnitude would tear off roofs and tear down walls, uproot trees, and lift vehicles off the ground. This could lead to downed utility poles, street signals, and debris on roadways, disrupting normal operations and impacting emergency response times. Critical and essential facilities could also be impacts, resulting in periods of service disruption to residents due to facility damages or lack of back-up power.

Previous Occurrences and Losses

FEMA Major Disasters and Emergency Declarations

Between 1953 and 2022, Franklin County was included in two disaster (DR) or emergency (EM) declarations for tornado-related events. Generally, these disasters cover a wide region of the State; therefore, they can impact many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2022). Detailed information about the declared disasters since 1954 is provided in Section 3 (County Profile).

U.S. Department of Agriculture Disaster Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2018 and 2022, Franklin County was not included in any tornado-related agricultural disaster declarations.

Previous Events

According to the National Climactic Data Center, 32 tornado events have been reported in Franklin County from January 1950 through December 2017, all of which were rated EF3 and under. For the 2023 HMP update, known tornado events that impacted Franklin County between 2018 and 2022 are discussed below. For events prior to 2018, refer to the 2018 Franklin County HMP.

Table 4.3.11-1. Tornado Events in Franklin County, 2018 to 2022

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
April 3, 2018	Tornado, EF1	N/A	N/A	Grove City	An EF1 tornado touched down in Franklin County, causing $120,000 in property damage. The tornado initially touched down just south of Orders Road and moved northeast, crossing Hoover Road and I-71, and eventually White Road before lifting just north of White Road and just south of Stringtown Road. The most significant damage along this path occurred on the west side of I-71, first near Orders Road where 4 large utility poles were snapped at the base and lying across Orders Road. Structural damage was found to multiple townhouses and other structures on the west side of Hoover Road, where a newly built detached garage was completely destroyed, and several townhouses had partial uplift and removal of roofing and damage to exterior walls. Many townhouses had garage doors pushed in, with portions of roofs removed. Four more large electrical transmission poles were snapped on the west side of Hoover Road. Eyewitness photos and videos confirm a tornado on the ground in this area. The most significant damage in this area was consistent with wind speeds around 105 mph and represents the strongest of the winds associated with this tornado. As the tornado crossed I-71, it began to weaken and lift as damage became lighter and more intermittent, consisting of tree and minor structural damage to roofing materials. Still, many homes immediately east of I-71 suffered at least minor damage and/or tree damage before the tornado lifted.
September 26, 2018	Tornado, EF1	N/A	N/A	Hanford, Bexley	An EF1 tornado touched down in Franklin County, causing $750,000 in property damage. Damage evident of a weak tornado began in the Olde Towne neighborhood of Columbus. There were numerous large tree branches down or tree trunks snapped, along with a pickup truck that was briefly

Date(s) of Event	Event Type	FEMA and/or USDA Declaration Number (if applicable)	Franklin County included in Declaration?	Location Impacted	Description
					partially lifted off the ground. The pickup truck suffered damage to both passenger side tires as it was forced back down to the pavement. In the same area of Olde Towne, there was damage to power poles. Damage in this area was consistent with an EF0 strength tornado. Further down the damage path, several areas of tree damage occurred in the Bexley area. The most significant tornado damage occurred in the Mayfair neighborhood near East Broad Street and South James Road, and where the wind speeds are estimated to be the highest. Several homes in this neighborhood sustained roof, siding and shingle damage. There were numerous large trees uprooted or snapped, causing significant damage to homes, garages and vehicles. Additionally, 2 cinder block garages had their roofs completely lifted off, with 1 or 2 block walls completely collapsed. It was this damage that was consistent with wind speeds of about 90 mph. Damage in this neighborhood was consistent with low end EF1 tornado winds.

Sources: NOAA-NCEI 2022; FEMA 2022

Probability of Future Occurrence

For the 2023 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of tornadoes for the County. Information from NOAA-NCEI storm events database, Storm Prediction Center, the 2019 State of Ohio HMP, and the 2018 Franklin County HMP were used to identify the number of tornadoes that occurred between 1954 and 2022. Table 4.3.11-2 presents the probability of future events for tornadoes in Franklin County.

Table 4.3.11-2. Probability of Future Tornado Events

Hazard Type	Number of Occurrences Between 1954 and 2022	% Chance of Occurring in Any Given Year
Tornado	34	49.3%

Sources: Ohio Emergency Management Agency 2019; Storm Prediction Center (SPC) 2023

Note: Disaster occurrences include federally declared disasters since the 1950 Federal Disaster Relief Act, and selected events since 1968. Due to limitations in data, not all tornadoes occurring between 1954 and 1996 are accounted for in the tally of occurrences. As a result, the number of hazard occurrences is underestimated.

Franklin County is identified as being one of the counties in Ohio with the greatest number of tornado touchdowns. Based on the number of tornadoes reported since 1954, Franklin County could experience one tornado, of any magnitude, every two years. In Section 4.4, the identified hazards of concern for the County were ranked (Table 4.4-2). The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Team, the probability of occurrence for tornadoes in the County is considered 'occasional'.

Climate Change Impacts

Climate change acts as an amplifier of existing natural hazards. The best available scientific data and modeling suggest that climate change has and will continue to impact natural hazards in the state. While the impacts of climate change may vary by regions and jurisdictions throughout the state, it is clear that the potential consequences of climate change will have significant impacts on all the citizens of the state (Ohio Emergency Management Agency 2019).

One of the primary impacts on the state from climate change will be the changes in precipitation rates and variability. Rainfall will increase variably across the Midwest over the next several decades, with the increased variability mostly occurring in the summer and fall months (Ohio Emergency Management Agency 2019).

After the year 2040, the increases occurring in the mean and maximum stream flows will be in the 10-percent to 40-percent range with the north and northeast parts of that state experiencing greater than 40-percent increases. These increases appear to occur primarily from later summer until early winter, with the autumn increases in maximum stream flows enhancing early cool season flood events in late autumn/early winter. These increases also indicated the possibility of worsening spring flooding beyond 2040 (Ohio Emergency Management Agency 2019). This will likely increase the frequency of tornadoes in the region.

An increase in severe storms will produce more wind events and may increase tornado activity. However, the link between tornadoes and climate change is unclear (Center for Climate and Energy Solutions n.d.).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the hazard area identified. The entire County has been identified as exposed for the tornado hazard. Therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 3), are exposed and potentially vulnerable.

Impact on Life, Health, and Safety

The impact of a tornado event on life, health, and safety is dependent upon several factors, including the severity of the event and whether adequate warning time was provided to residents. For the purposes of this HMP, all of Franklin County (1,323,807 persons) is considered vulnerable to a tornado event's impacts (US CENSUS 2022).

Secondary impacts caused by extreme wind from tornado events include downed trees, damaged buildings, and debris carried by high winds, which can lead to injury or loss of life.

Socially vulnerable populations are most susceptible to tornado events based on several factors, including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Vulnerable populations include homeless persons, elderly (over 65 years old), low income or linguistically isolated populations, people with life-threatening illnesses, and residents living in areas that are isolated from major roads. The population over the age of 65 is also more vulnerable and, physically, they may have more difficulty evacuating. They may require extra time or outside assistance during evacuations and are more likely to seek or need medical attention, which may not be available due to isolation during a storm event. According to the 5-Year 2021 American Community Survey Population Estimates, there are 188,900 persons over 65 and 195,988 persons living in poverty in Franklin County.

Additionally, people located outdoors (i.e., recreational activities and farming) are considered most vulnerable to tornadoes. This is because there is little to no warning, and shelter may not be available. Moving to a lower risk location will decrease a person's vulnerability. See Section 3, County Profile for population statistics for each participating jurisdiction.

Impact on General Building Stock

Damage to buildings is dependent upon several factors, including wind speed, tornado duration, and path of the tornado track. Building construction also plays a major role in the extent of damage resulting from a coastal storm. Due to differences in construction, residential structures are generally more susceptible to wind damage than commercial and industrial structures. Wood and masonry buildings, in general, regardless of their occupancy class, tend to experience more damage than concrete or steel buildings. Furthermore, high-rise buildings are also very vulnerable structures.

Impact on Critical Facilities and Community Lifelines

Critical facilities are at risk of being impacted by tornadic winds associated with structural damage or falling tree limbs/flying debris, which can result in the loss of power. Power loss can greatly impact households, business operations, public utilities, and emergency personnel. For example, vulnerable populations in Franklin County are at risk if power loss results in interruption of heating and cooling services, stagnated hospital operations, and potable water supplies. Emergency personnel such as police, fire, and emergency medical services (EMS) will not be able to effectively respond in a power loss event to maintain the safety of its citizens.

Impact on the Economy

Tornado events can have short- and long-lasting impacts on the economy. When a business is closed during storm recovery, there is lost economic activity in the form of day-to-day business and wages to employees. Overall, economic impacts include the loss of business function (e.g., tourism, recreation), damage to inventory, relocation costs, wage loss, and rental loss due to the repair/replacement of buildings.

According to FEMA's National Risk Index, Franklin County's expected annual losses from tornadoes is $25 million.

Impacts to transportation lifelines affect both short-term (e.g., evacuation activities) and long-term (e.g., day-to-day commuting and goods transport) transportation needs. Utility infrastructure (power lines, gas lines, electrical systems) could suffer damage and impacts can result in the loss of power, which can impact business operations and can impact heating or cooling provision to the population. Debris management can also be costly and may also impact the local economy.

Impact on the Environment

The impact of tornado events on the environment varies, but researchers are finding that the long-term impacts of more severe weather can be destructive to the natural and local environment. National organizations such as USGS and NOAA have been studying and monitoring the impacts of extreme weather phenomena as it impacts long-term climate change, streamflow, river levels, reservoir elevations, rainfall, floods, landslides, erosion, etc. (USGS 2020). Tornadoes can tear apart habitats, causing fragmentation across ecosystems. Overall, as the physical environment becomes more altered, species will begin to contract or migrate in response, which may cause additional stressors to the entire ecosystem within Franklin County.

Future Changes That May Impact Vulnerability

Understanding future changes that effect vulnerability in the County can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan.

Projected Development

Any areas of growth could be potentially impacted by the severe storm hazard because the entire county is exposed and vulnerable to the wind hazard associated with severe storms. However, due to increased standards and codes, new development may be less vulnerable to the severe storm hazard compared to the aging building stock in the County. Please refer to Section 4 and Section 9 for additional information regarding the areas targeted for future growth and development in the County.

Project Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 13.7 percent since 2010. The County's population is anticipated to slightly increase over the next decade (5.37 percent increase by 2030 and 11.72 percent increase by 2050) (Ohio Development Services Agency 2018). An increase in population will result in more of the population exposed to the tornado hazard as it impacts the entire planning area. Refer to Section 3 (County Profile), which includes a discussion on population trends for the County.

Climate Change

As discussed previously, the entire State of Ohio is projected to experience an increase in the frequency and severity of extreme storms and rainfall. Major clusters of summertime thunderstorms in North America will grow larger, more intense, and more frequent later this century in a changing climate (NASA 2013). An increase in storms may increase tornado activity. Additionally, an increase in temperature will provide more energy to produce storms that generate tornadoes (NASA 2013). With an increased likelihood of strong winds and tornado events, all the County's assets will experience additional risk for losses as a result of extreme wind events.

Change of Vulnerability Since 2018 HMP

Franklin County's vulnerability to tornado events has remained unchanged. Since the 2018 HMP analysis, population statistics have been updated using the 2020 Census. The general building stock and the 2018 critical facility dataset was updated by the County and participating jurisdictions. Overall, this vulnerability assessment uses a more accurate and updated building inventory than that used in the 2018 HMP.

SECTION 4. RISK ASSESSMENT

4.4 HAZARD RANKING

A comprehensive range of hazards that pose a significant risk to Franklin County were selected and considered during the development of this plan; see Section 4.1 (Identification of Hazards of Concern). However, each community has differing levels of exposure and vulnerability to each of these hazards. It is important for each community participating in this plan to recognize the hazards that pose the greatest risk to their community and direct their attention and resources accordingly to most effectively and efficiently manage risk and reduce losses. The hazard ranking for the Planning Area can be found in the jurisdictional annexes in Volume II, Section 9 of this plan.

To this end, a hazard risk ranking was conducted for the Planning Area using the method described below. This method includes four risk assessment categories—probability of occurrence, impact (population, property, and economy), adaptive capacity, and climate change. Each was assigned a weighting factor to calculate an overall ranking value for each hazard of concern. Depending on the calculation, each hazard was assigned a high, medium, or low ranking. Details regarding each of these categories is described below.

4.4.1 Hazard Ranking Methodology

Estimates of hazard risk for Franklin County were developed using methodologies promoted by FEMA's hazard mitigation planning guidance, based on results generated by FEMA's Hazus risk assessment tool and input from Franklin County and participating jurisdictions.

As described in Section 4.2 (Methodology and Tools), three levels of analysis were used to estimate potential impacts: 1) historic loss/qualitative analysis; 2) exposure analysis; and 3) loss estimation. All three levels of analysis are suitable for planning purposes; however, with any risk analysis, there is underlying uncertainty resulting from assumptions used to describe and assess vulnerability and the methodologies available to model impacts. Impacts from any hazard event within the County will vary from the analysis presented here based on the factors described for each hazard of concern—namely, location, extent, warning time, and mitigation measures in place at the time of an event.

The hazard ranking methodology for some hazards of concern is based on a scenario event, while others are based on their potential risk to the Planning Area as a whole. In order to account for these differences, the quantitative hazard ranking methodology was adjusted using professional judgement and subject-matter input; assumptions are included, as appropriate, in the following subsections. The limitations of this analysis are recognized given the scenarios do not have the same likelihood of occurrence; nonetheless, there is value in summarizing and comparing the hazards using a standardized approach to evaluate relative risk.

Categories

The following categories were considered when evaluating the relative risk of the hazards of concern.

- **Probability of Occurrence**—The probability of occurrence of the scenario evaluated was estimated by examining the historical record or calculating the likelihood of annual occurrence. When no scenario was assessed, an examination of the historical record and judgment was used to estimate the probability of occurrence of an event that will impact the County.
- **Impact**—The following three hazard impact subcategories were considered: impact on people; impact on buildings; and impact on the economy. The results of the updated risk assessment and/or professional judgment were used to assign numeric values for these three impact subcategories. A weighting factor was applied to each subcategory, giving impact on population the greatest weight:
  - Population—Numeric value x 3
  - Buildings—Numeric value x 2
  - Economy—Numeric value x 1
- **Adaptive Capacity**—Adaptive capacity describes a jurisdiction's current ability to protect from or withstand a hazard event. This includes capabilities and capacity in the following areas: administrative, technical, planning/regulatory, and financial. Mitigation measures already in place increase a jurisdiction's capacity to withstand and rebound from events (e.g., codes/ordinances with higher standards to withstand hazards due to design or location; deployable resources; or plans and procedures in place to respond to an event). Assigning "weak" for adaptive capacity means the jurisdiction does not have the capability to effectively respond, which increases vulnerability. "Strong" adaptive capacity means the jurisdiction does have the capability to effectively respond, which decreases vulnerability. These ratings were assigned using the results of the core capability assessment with input from each jurisdiction.
- **Climate Change**—Current climate change projections were considered as part of the hazard ranking to address any potential increase in the impact or probability of occurrence of the hazard. This is important because the hazard ranking helps guide and prioritize the mitigation strategy development, which should have a long-term future vision for hazard mitigation. The potential impacts of climate change on each hazard of concern are discussed in Section 4.3. The benchmark values in the methodology are similar to confidence levels outlined in the 2017 National Climate Assessment.

An additional weighting factor was applied to each of the above categories, assigning 30 percent of the total score to probability of occurrence, impact, and adaptive capacity (each) and 10 percent to climate change. The resulting calculation for calculating a hazard ranking score is as follows:

Hazard Ranking Equation

[Probability of Occurrence x 0.3] + [(Impact on Population x 3) + (Impact on Property x 2) + (Impact on Economy x 1) x 0.3] + [Adaptive Capacity x 0.3] + [Climate Change x 0.1]

Scoring

Table 4.4-1 summarizes the categories, benchmark values, and weights used to calculate the risk factor for each hazard.

Table 4.4-1. Summary of Hazard Ranking Approach

Category		Level / Category	Degree of Risk / Benchmark Value	Numeric Value	Weighted Value
Probability of Occurrence		Unlikely	A hazard event is not likely to occur at all or has less than a 1% annual probability of occurring.	0	30%
		Rare	Between 1% and 10% annual probability of a hazard event occurring.	1	
		Occasional	Between 10% and 100% annual probability of a hazard event occurring.	2	
		Frequent	100% annual probability; a hazard event may occur multiple times per year.	3	
Impact* (Sum of all 3)	Population (Numeric Value x 3)	Low	14% or less of the population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	1	30%
		Medium	15% to 29% of the population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	2	
		High	30% or more of the population is exposed to a hazard with potential for measurable life safety impact, due to its extent and location.	3	
	Property (Numeric Value x 2)	Low	Property exposure is 14% or less of the total number of structures for the community.	1	
		Medium	Property exposure is 15% to 29% of the total number of structures for the community.	2	
		High	Property exposure is 30% or more of the total number of structures for the community.	3	
	Economy (Numeric Value x 1)	Low	Loss estimate is 9% or less of the total replacement cost for the community.	1	
		Medium	Loss estimate is 10% to 19% of the total replacement cost for the community.	2	
		High	Loss estimate is 20% or more of the total replacement cost for the community.	3	
Adaptive Capacity		Weak	Weak, outdated, or inconsistent plans, policies, codes, and ordinances in place; no redundancies; limited to no deployable resources; limited capabilities to respond; long recovery.	1	30%
		Moderate	Plans, policies, codes, and ordinances are in place and meet minimum requirements; mitigation strategies are identified but not implemented on a widespread scale; the jurisdiction can recover but needs outside resources; moderate Jurisdiction capabilities.	0	
		Strong	Plans, policies, codes, and ordinances are in place and exceed minimum requirements; mitigation and protective measures are in place; the jurisdiction has ability to recover quickly because resources are readily available and capabilities are high.	-1	
Climate Change		Low	No local data is available; modeling projections are uncertain on whether there is increased future risk; confidence level is low (inconclusive evidence).	1	10%
		Medium	Studies and modeling projections indicate a potential for exacerbated conditions due to climate change; confidence level is medium to high (suggestive to moderate evidence).	2	
		High	Studies and modeling projections indicate exacerbated conditions and increased future risk due to climate change; very high confidence level (strong evidence, well documented and acceptable methods).	3	

Note: A numerical value of zero is assigned if there is no impact.

**For this exercise, "impact" for population and property means the percent of the total that are exposed; for economy impact refers to estimated loss as a percent of total value. For non-natural hazards, although they may occur anywhere in the Planning Area, an event will not likely cause countywide impacts; therefore, impact to population was scored using an event-specific scenario.*

Using the weighting applied, the highest possible risk factor value is 6.9. The higher the number, the greater the relative risk. Based on the total for each hazard, a priority ranking is assigned to each hazard of concern (high, medium, or low). The rankings were categorized as follows:

- Low = Values less than 3.9
- Medium = Values between 3.9 and 4.9
- High = Values greater than 4.9

Confidence Levels

To summarize the confidence level regarding the input utilized to populate the hazard ranking, a gradient of certainty was developed. A certainty factor of high, medium, or low was selected and assigned to each hazard to provide a level of transparency and increased understanding of the data utilized to support the resulting ranking:

- High—Defined scenario event to evaluate; probability calculated; evidenced-based quantitative assessment to estimate potential impacts through hazard modeling
- Moderate—Defined scenario event or only a hazard area to evaluate; estimated probability; combination of quantitative (exposure analysis) and qualitative data (no impact modeling) to estimate potential impacts
- Low—Scenario or hazard area is undefined; there is a degree of uncertainty regarding event probability; majority of potential impacts are qualitative

4.4.2 Hazard Ranking Results

Using the process described above, the ranking for the identified hazards of concern was determined for the Planning Area. Table 4.4-2 presents the category scoring for the ranking. Table 4.4-3 presents the total calculations for each hazard ranking value for the hazards of concern in Franklin County.

The ranking includes the entire planning area and may not reflect the highest risk indicated for any of the participating jurisdictions. The hazard ranks of each jurisdiction (provided in the annexes in Section 9) indicate the differing degrees of risk exposure and vulnerability.

The County and the participating jurisdictions all applied the same methodology to develop risk rankings to ensure consistency in the overall ranking of risk. Each jurisdictions had the ability to alter rankings based on local knowledge and experience in handling each hazard. The results support the appropriate selection and prioritization of initiatives to reduce the highest levels of risk for each participating jurisdiction.

Table 4.4-2. Category Ranking Scores for Hazards of Concern for Franklin County

Hazard of Concern	Probability		Impact	Population		Impact	Property		Impact	Economy		Total Impact Value	Adaptive Capacity	Climate Change
	Category	Numeric Value		Numeric Value	Weighted Value (x3)		Numeric Value	Weighted Value (x2)		Numeric Value	Weighted Value (x1)			
Dam/Levee Failure	Rare	1	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	11	Moderate	Medium
Disease Outbreak	Frequent	3	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	12	Moderate	Medium
Drought	Rare	1	Low	1	1 x 3 = 3	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	6	Moderate	High
Earthquake	Rare	1	Low	1	1 x 3 = 3	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	6	Moderate	Medium
Extreme Temperature	Occasional	2	High	3	3 x 3 = 9	Low	1	1 x 2 = 2	Low	1	1 x 1 = 1	12	Moderate	High
Flood	Frequent	3	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	12	Moderate	High
Geologic Hazards	Unlikely	0	Low	1	1 x 3 = 3	High	3	3 x 2 = 6	High	3	3 x 1 = 3	12	Moderate	Medium
Invasive Species	Occasional	2	Low	1	1 x 3 = 3	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	9	Moderate	High
Severe Weather	Frequent	3	High	3	3 x 3 = 9	Medium	2	2 x 2 = 4	Medium	2	2 x 1 = 2	15	Strong	High
Severe Winter Weather	Frequent	3	High	3	3 x 3 = 9	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	14	Moderate	High
Tornado	Occasional	2	Medium	2	2 x 3 = 6	Medium	2	2 x 2 = 4	Low	1	1 x 1 = 1	11	Moderate	High

Table 4.4-3. Total Hazard Ranking Values for the Hazards of Concern for Franklin County

Hazard of Concern	Probability x 30%	Total Impact x 30%	Adaptive Capacity x 30%	Climate Change x 10%	Total Hazard Ranking Value
Dam/Levee Failure	0.3	3.6	0	0.2	4.1
Disease Outbreak	0.9	3.6	0	0.2	4.7
Drought	0.3	1.8	0	0.3	2.4
Earthquake	0.3	1.8	0	0.2	2.3
Extreme Temperature	0.6	3.6	0	0.3	4.5
Flood	0.9	3.6	0	0.3	4.8
Geologic Hazards	0	3.6	0	0.2	3.8
Invasive Species	0.6	2.7	0	0.3	3.6
Severe Weather	0.9	4.5	-0.3	0.3	5.4
Severe Winter Weather	0.9	3.3	0	0.3	4.5
Tornado	0.6	3.3	0	0.3	4.2

SECTION 5. CAPABILITY ASSESSMENT

44 CFR § 201.6(c)(3) requires that a local mitigation plan describe existing authorities, policies, programs and resources available to each participant and their ability to expand on and improve existing policies and programs to support mitigation strategies. This assessment is an integral part of the planning process. The assessment process enables identification, review, and analysis of current federal, state, and local programs, policies, regulations, funding, and practices that could either facilitate or hinder mitigation.

Existing laws, ordinances, plans and programs at the federal, state, and local level can support or impact hazard mitigation actions identified in this plan. Hazard mitigation plans are required to include a review and incorporation, if appropriate, of existing plans, studies, reports, and technical information as part of the planning process (44 CFR, Section 201.6(b)(3)). Federal and state programs identified through this review are those that may interface with the actions identified in this plan. Each program enhances capabilities to implement mitigation actions or has a nexus with a mitigation action in this plan.

During the 2023 plan update process, all participating jurisdictions were tasked with developing or updating their capability assessment, paying particular attention to evaluating the effectiveness of these capabilities in supporting hazard mitigation and identifying opportunities to enhance local capabilities to integrate hazard mitigation into their plans, programs, and day-to-day operations.

The capability assessment section of each jurisdictional annex in Section 9 describes the planning, regulatory, administrative, technical, and fiscal capabilities of each participating jurisdiction.

5.1 UPDATE PROCESS SUMMARY

The purpose of the capability assessment is to understand the planning, regulatory, administrative, technical, and financial capabilities present in Franklin County. This assessment helps the County and other participating jurisdictions identify strengths and opportunities that can be used to reduce losses from hazard events and reduce risks throughout Franklin County.

To complete the capability assessment, the contracted consultant met virtually with each participating jurisdiction to review the capability assessment from the 2018 HMP and update accordingly. The consultant also reviewed plans, codes, and ordinances to enhance the information provided by the jurisdictions.

5.2 PLANNING AND REGULATORY CAPABILITY

Planning and regulatory capabilities are based on the implementation of ordinances, policies, local laws, state statutes, plans, and programs that relate to guiding and management growth and development. Planning and regulatory capabilities refer not only to current plans and regulations, but also to the jurisdiction's ability to change and improve those plans and regulations as needed. The City of Columbus, as the county seat, has many planning and regulatory capabilities that extent beyond the city limits, with

beneficial impacts on the region. The City of Columbus individual annex in Section 9.8 of this Plan identifies the capabilities that assist the County in addressing its vulnerabilities to certain hazards.

Table 5-1 summarizes the planning and regulatory capabilities available to Franklin County at the county and local level. Table 5-2. summarizes the planning and regulatory capabilities available to Franklin County, at the federal and state level.

Table 5-1. Planning and Regulatory Capabilities – County and Local

Capability	Details	
Building Code: 2019 RCO	**Description:**	The Building Department is responsible for issuing building permits for 1-, 2- and 3-family residential structures and associated development. The State of Ohio issues commercial building permits. For Franklin County Building Code, refer to the 2019 Residential Code of Ohio (RCO). Refer to Section 105.1 of the 2019 RCO for information of when approvals from the Building Department are required.
	Responsible Agency:	Franklin County Building Department
	Provides Funding for Mitigation:	No
	Hazard:	All hazards
Franklin County Subdivision Regulations – For unincorporated areas of Franklin County, Ohio Adopted March 27, 2012	**Description:**	These regulations apply to the subdivision of land in unincorporated Franklin County and may be applied to other development activities, including but not limited to major subdivision construction activities and the platting of land as required by applicable zoning authorities. Subdivisions by land contract, court partition, divorce decree, will, pending annexation, or other means shall not be exempt from these regulations. The County's Subdivision Regulations are adopted under provisions of Chapter 711 of the Ohio Revised Code (ORC). These regulations are adopted to: A. Secure and provide for the public health, safety and welfare B. Manage growth and development in accordance with plans, policies, and resolutions of the Franklin County Planning Commission (FCPC), county and townships and surrounding area plans C. Provide for adequate and convenient open spaces for traffic, utilities, fire and maintenance forces, recreation, light, and air D. Provide for the preservation of natural resources, sensitive natural areas, and natural features E. Provide safety from fire, flood, and other danger Proposals deemed unfavorable due to drainage, floodplain, topography, geometry, geology, water supply, soil, health, environmental, utility line, archaeological or historical site, or other characteristic shall not be approved unless measures adequate to deal with the issues are detailed by the subdivider.
	Responsible Agency:	Economic Development and Planning Department
	Provides Funding for Mitigation:	No
	Hazard:	All hazards
Franklin County Zoning Resolution – Amended and readopted, January 10, 2023	**Description:**	This Zoning Resolution shall regulate buildings and land use for the purpose of promoting public health, safety, and morals (general welfare) throughout Franklin County. Zoning accomplishes this purpose by encouraging appropriate use of lands, stabilizing and preserving the value of property, preventing congestion and hazards in the street, securing safety from fire, flood, water contamination, air pollution, and other dangers, providing adequate light, air, and open space, preventing the overcrowding of land, and avoiding undue concentrations of population. Zoning districts are delineated to reflect similar existing land uses, availability of public water and sewer or lack thereof, access, location, need for additional uses, and physical constraints such as soils, drainage and flooding. The zoning districts may be changed to encourage appropriate growth and development and are based on consistent land use plans or policies. The Resolution contains a Floodplain District. The Floodplain District is to regulate flood prone land along certain rivers, creeks, streams, and other natural water courses as identified by FEMA so as to make Franklin County landowners eligible for flood insurance under the NFIP. To avoid personal loss and expenditure of public funds for the control of such flooding, it is the purpose of these regulations to prevent obstruction of the

Table 5-1. Planning and Regulatory Capabilities – County and Local

Capability	Details	
		water channel and to protect structures and property from flood damage. Franklin County planners, along with a wide range of stakeholders, amended the Franklin County Zoning Resolution to improve development regulations in designated "Smart Growth" corridors. The improvements will facilitate economic growth and community improvement along commercial corridors. The proposed amendment seeks to modify development regulations along several main roads in Blendon, Clinton, Franklin, Mifflin, and Pleasant Townships.
	Responsible Agency:	Economic Development and Planning Department
	Provides Funding for Mitigation:	No
	Hazard:	All hazards
Franklin County Stormwater Partnership	**Description:**	The Franklin County Stormwater Partnership and program were initiated in 2003 to coordinate programs related to drainage management, water quality management and stormwater regulation compliance. The partnership was formed among the County Drainage Engineer, Economic Development and Planning, Sanitary Engineer, Public Health, Franklin Soil and Water Conservation District, and 17 townships. More recently, Franklin County Public Facilities Management and Fleet Management, and Mid-Ohio Regional Planning Commission have joined the partnership. For compliance with the Small MS4 general permit under the Ohio EPA Stormwater regulation program, the Franklin County Commissioners are the Permittee and the County Drainage Engineer and townships are Co-Permittees.
	Responsible Agency:	County Drainage Engineer, Economic Development and Planning, Sanitary Engineer, Public Health, Franklin Soil and Water Conservation District, Franklin County Public Facilities Management and Fleet Management, Mid-Ohio Regional Planning Commission, and 17 townships
	Provides Funding for Mitigation:	No
	Hazard:	Flood, Severe Summer Weather
Stormwater Management Program, 2022 to 2026 – Storm Water MS4 Pollution Control Order 2012	**Description:**	The purpose of the Stormwater Management Program (SWMP) is to protect and improve water quality, stream corridors and public health in accordance with federal and state stormwater regulations. Polluted stormwater runoff is often transported through municipal separate storm sewer systems (MS4s) and ultimately discharged into local rivers and streams without treatment. To address this reality, federal and state regulations require the establishment of MS4 stormwater management programs to improve the nation's waterways by reducing the quantity of pollutants that stormwater picks up and carries into storm sewer systems during storm events. Common pollutants include oil and grease from roadways, pesticides from lawns, sediment from construction sites, bacteria from failing septic systems and carelessly discarded trash. When deposited into nearby waterways through MS4 discharges, these pollutants can impair the waterways, thereby discouraging recreational use of the resource, contaminating drinking water supplies, and impairing the habitat of fish, other aquatic organisms, and wildlife.
	Responsible Agency:	Franklin County Public Health
	Provides Funding for Mitigation:	No
	Hazard:	Flood, Severe Summer Weather
Franklin County Stormwater Drainage Manual – For unincorporated areas of Franklin County, Ohio Approved March 13, 2012	**Description:**	The purpose of the Manual is to protect existing natural stormwater resources, convey and control stormwater in a safe and responsible manner, and meet water quality goals. The Manual is intended to provide information to the general public on the County's stormwater policies and design practices, as well as assist developers, engineers, and County staff in the preparation, review and approval of the Stormwater Management Report and Construction Drawings that must accompany private and public development proposals. Conservation of Natural Features and

Table 5-1. Planning and Regulatory Capabilities – County and Local

Capability	Details	
		Resources is a design technique incorporated in this manual that identifies and preserves the natural features and resources of the site and uses them to protect the water resources by reducing stormwater runoff, providing runoff storage, reducing flooding, preventing soil Geologic, promoting infiltration and removing pollutants (Franklin County Drainage Engineer 2012).
	Responsible Agency:	Franklin County Drainage Engineer
	Provides Funding for Mitigation:	No
	Hazard:	Flood, Severe Summer Weather
Franklin County Floodplain Administration	**Description:**	Franklin County flood damage reduction regulations protect life and property, encourage development outside of regulatory floodplains, promote mitigation and floodproofing techniques, encourage greenways and passive recreational opportunities, reduce public funds used in relief efforts, and maintain the County's eligibility in the NFIP. Participating in the NFIP allows Franklin County residents to purchase federally backed flood insurance that is not available, or that is extremely expensive, through a standard homeowner's insurance policy (Franklin County Economic Development & Planning 2023).
	Responsible Agency:	Franklin County Economic Development and Planning Department
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Special Resolution National Flood Insurance Program (NFIP) Regulation – Unincorporated Franklin County, Ohio, Last revised September 19, 2007 Community Number 390167 Last	**Description:**	Franklin County's flood damage reduction regulation was adopted on September 26, 1978, and is titled the Special Resolution National Flood Insurance Program Regulation. The regulation addresses the requirements for developing in regulatory floodplains and applies to all unincorporated areas of Franklin County. This regulation does not apply to properties located in a city or village within Franklin County. The Special Resolution NFIP Regulation requires, prior to any development in a regulatory floodplain, that an NFIP permit be issued. Development includes any man-made change to a property including but not limited to the construction of buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, or storage of equipment or materials (Franklin County Economic Development & Planning 2023).
	Responsible Agency:	Franklin County Economic Development and Planning Department
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Economic Development Strategic Plan – May 2019	**Description:**	The Franklin County Economic Development Strategic Plan (EDSP) provides a roadmap for the next generation of economic development work in Franklin County. It establishes a resident-centric framework for economic development while sustaining a commitment to business engagement and private sector job creation. The Strategic Plan is data-driven, has been informed by extensive stakeholder engagement, and complements other regional planning and economic development efforts. The EDSP leverages the full resources of the Economic Development and Planning Department and supports the broader mission of Franklin County government. One of the goals of the Strategic Plan states that the economic development activities and programs should promote and improve the environmental sustainability of the region.
	Responsible Agency:	Franklin County Economic Development and Planning Department/ Mid-Ohio Regional Planning Commission
	Provides Funding for Mitigation:	No
	Hazard:	None

Table 5-1. Planning and Regulatory Capabilities – County and Local

Capability	Details	
Strategic Action Plan, Central Ohio Greenways – February 1, 2016	**Description:**	Central Ohio is nationally known for its beautiful, ecologically diverse rivers and streams. Central Ohio Greenways was formed in 2005 with the mission to develop a world-class trail system focused on three main objectives: advocating for a connected network of trails among local jurisdictions; promoting and coordinating trail development in the region; and creating a cohesive branding system for the region. The Central Ohio Greenway consists of 126 miles of multi-use trails and continues to expand throughout greater Columbus. As the network grows and ridership increases, it is important for the Central Ohio Greenway Board to seek out national best practices as examples of how to plan for the growing demand. Many cities throughout the Midwest and across the country have been successful in the implementation and programming of greenway systems. These comparisons will provide insight into innovative ideas, possible partnerships, and organizing structures. The insight2050 study revealed that Central Ohio is estimated to grow by more than 500,000 people over the next 30+ years.
	Responsible Agency:	Mid-Ohio Regional Planning Commission
	Provides Funding for Mitigation:	No
	Hazard:	None
Franklin County Consolidated Plan 2015 – 2019	**Description:**	The Consolidated Plan is a collaborative process to identify housing and community development needs and to establish goals, priorities and strategies to address those needs, especially for low- and moderate-income households. The consolidated action plan is a multi-year plan which outlines the strategies and focus of the Community Development Block Grant Program. The plan highlights the targeted activities and programs for the Economic Planning and Development Department to accomplish and identifies how Franklin County will spend its federal HUD dollars over the next 5 years. One of the goals of the Consolidated Plan is improvement and maintenance of infrastructure. Public facilities and infrastructure play a vital role in making the County and its neighborhoods work for residents and business. The County will continue to support programs focused on public improvements and maintaining/creating infrastructure necessary to meet the everyday needs of people and businesses (Franklin County Economic Planning & PLanning Department 2023).
	Responsible Agency:	Franklin County Economic Planning and Development Department
	Provides Funding for Mitigation:	No
	Hazard:	None
Sustainable2050	**Description:**	Sustainable2050 is a program that supports communities in the Mid-Ohio Regional Planning Commission area with their sustainability efforts through direct technical assistance, collaboration, and recognition. The following communities in Franklin County are Sustainable2050 members (Mid-Ohio Regional Planning Commission 2022):

Table 5-1. Planning and Regulatory Capabilities – County and Local

Capability	Details		
		• Bexley – platinum • Blendon – silver • Columbus – platinum • Clinton – member • Dublin – platinum • Franklin County Commissioners – platinum • Franklin County Engineer's Office – platinum • Franklin Soil and Water Conservation District – platinum • Gahanna – silver • Grandview Heights – members • Grove City – gold	• Hillard – platinum • Lockbourne – silver • Mifflin – member • New Albany – silver • Plain – member • Prairie – member • Reynoldsburg – member • Upper Arlington – platinum • Washington – member • Westerville – platinum • Whitehall – silver • Worthington – platinum
	Responsible Agency:	Mid-Ohio Regional Planning Commission	
	Provides Funding for Mitigation:	Yes	
	Hazard:	All hazards	

Table 5-2. Planning and Regulatory Capabilities – Federal and State

Capability	Details	
Disaster Mitigation Act (DMA)	**Description:**	The DMA is the current federal legislation addressing hazard mitigation planning. It emphasizes planning for disasters before they occur. It specifically addresses planning at the local level, requiring plans to be in place before Hazard Mitigation Assistance grant funds are available to communities. This plan is designed to meet the requirements of DMA, improving eligibility for future hazard mitigation funds.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	HMPs that meet the requirements of DMA will remain eligible for future FEMA Hazard Mitigation Assistance funds
	Hazard:	All natural hazards
National Flood Insurance Program (NFIP)	**Description:**	The NFIP is a federal program enabling property owners in participating communities to purchase insurance as a protection against flood losses in exchange for state and community floodplain management regulations that reduce future flood damages. The Flood Hazard Profile in Section 4.3.6 (Flood) provides information on recent legislation related to reforms to the NFIP. All municipalities in Franklin County actively participate in the NFIP. As of September 2023, there were 1,659 NFIP policies in Franklin County. There have been 1,260 claims made, totaling over $7 million for damage to structures and contents.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Full compliance and good standing under the NFIP are application prerequisites for all FEMA grant programs for which participating jurisdictions are eligible under this plan.
	Hazard:	Flood

Table 5-2. Planning and Regulatory Capabilities – Federal and State

Capability	Details	
NFIP Community Rating System (CRS)	**Description:**	As an additional component of the NFIP, CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS: (1) reduce flood losses, (2) facilitate accurate insurance rating, and (3) promote the awareness of flood insurance. Municipalities, and the county as a whole, could expect significant cost savings on premiums if enrolled in the CRS program. As of April 2023, no communities in Franklin County participate in the CRS program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	CRS premium discounts on flood insurance range from 5 percent for Class 9 communities up to 45 percent for Class 1 communities.
	Hazard:	Flood
Ohio Environmental Protection Agency	**Description:**	The Ohio Environmental Protection Agency is a state agency whose goal is to protect the environment and public health by ensuring compliance with environmental laws. Those laws and related rules outline Ohio EPA's authority and what things the agency can consider when making decisions about regulated activities. Ohio EPA was created on Oct. 23, 1972. It combined environmental programs that previously had been scattered throughout several state departments. Ohio EPA's Central Office is located in Columbus, and five district offices manage the Agency's programs throughout the state. The director of Ohio EPA is appointed by the governor and serves as a cabinet member. Ohio EPA has several regulatory divisions that play different roles in environmental protection. Each division issues permits to regulate industries that pollute in a specific area, like air emissions or wastewater discharges to rivers and streams. The permits include requirements for operating, monitoring, and reporting compliance. There are a few core responsibilities that each regulatory division of Ohio EPA fulfills: • Review permit applications and issue permits to facilities. • Investigate citizen complaints. • Monitor to make sure all environmental standards are met (usually accomplished by collecting samples of air, water or soil and testing them for pollutants in a laboratory; and reviewing sampling and monitoring data submitted by a facility). • Provide technical assistance to help regulated facilities understand and follow environmental laws and permit requirements. • Take enforcement action against facilities that violate environmental laws and permit requirements. Non-regulatory divisions provide financial assistance to businesses and communities; site cleanup and spill response; environmental education programs for businesses and the public; pollution prevention assistance to help businesses minimize their waste at the source; laboratory analysis; and criminal environmental investigations.
	Responsible Agency:	State
	Provides Funding for Mitigation:	Yes
	Hazard:	All hazards

Table 5-2. Planning and Regulatory Capabilities – Federal and State

Capability	Details	
Ohio Transportation Department	**Description:**	The Ohio Department of Transportation supports the highway system and promotes transportation initiatives, such as road maintenance and construction, highway safety, snow and ice operations, biking and walking paths, public transit, roadway beautification, and more. With the mission to provide safe and easy movement of people and goods from place to place, the Ohio Department of Transportation supports the state highway system and promotes transportation initiatives statewide. As a more than $3 billion per year enterprise, the agency invests the bulk of its resources in system preservation through maintenance, construction, and snow and ice operations.
	Responsible Agency:	State
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Severe Winter Weather, Tornadoes, Earthquake & Geologic
Ohio Public Safety Department	**Description:**	The Ohio Department of Public Safety operates programs and services that create a safer Ohio. Divisions include the Ohio State Highway Patrol and the Bureau of Motor Vehicles. It also manages programs related to homeland security, human trafficking, school safety, traffic safety, EMS and fire services, emergency management, and more. With its forward-leaning emergency response continuum, the Ohio Department of Public Safety is able to support all its partners through its 24/7 year-round watch office at the Ohio Emergency Management Agency. Ohio is a safer and better place to live, work and travel because of the Department's collective efforts. However, the Department recognizes that its primary responsibility to protect Ohio's citizens can only be accomplished through a strong commitment and collaboration with public and private sector representatives throughout the state to coordinate programs that maintain the safety and security of Ohio's citizens and critical infrastructure.
	Responsible Agency:	State
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Ohio Homeland Security	**Description:**	Ohio Homeland Security (OHS) is a Division of the Ohio Department of Public Safety. The main function of OHS is to analyze and share information, awareness, and vulnerabilities, and to develop strategies to prevent, prepare for, and protect against terrorism and other threats to public safety. Analyze Threats • Cybersecurity analysts assist law enforcement with computer crime investigations and forensic support. • OHS catalogs Ohio's critical infrastructure and provides security and vulnerability assessments. • The Statewide Terrorism Analysis & Crime Center provides 24/7 resources, expertise, and information to public safety and homeland security partners. Share Information & Resources • The Communication and Information Management System is utilized to share alerts, bulletins, trainings, and notifications. • The Ohio Intelligence Liaison Officer program increases collaboration by building relationships with local representatives for the purpose of analysis, sharing, and dissemination of intelligence. • Through the Ohio Public Private Partnership, hundreds of member organizations share resources and services to help Ohioans quickly recover from disasters.

Table 5-2. Planning and Regulatory Capabilities – Federal and State

Capability	Details	
		• The Statewide Terrorism Analysis & Crime Center coordinates specialized assistance to local law enforcement such as special response teams, aviation support, forensic video analysis, and more. Reduce Vulnerabilities • By registering Ohio's scrap metal dealers and providing support to local law enforcement, Ohio's Scrap Metal Program helps thwart metal theft and protect Ohio's critical infrastructure. • OHS licenses and regulates security or investigative service providers and their employees as required by Ohio law to ensures providers are insured and meet state requirements. The Emergency Management Agency is a unit within Homeland Security.
	Responsible Agency:	State
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
The Central Ohio Community Improvement Corporation	**Description:**	The mission of Central Ohio Community Improvement Corporation is to acquire properties to improve the quality of neighborhoods, increase property values, return unproductive properties to contributing, tax-paying status, and create diverse housing and business opportunities by leveraging resources to promote and facilitate the reclamation, rehabilitation and reutilization of vacant, abandoned, tax-foreclosed, or other real property in the County.
	Responsible Agency:	Governor's Office
	Provides Funding for Mitigation:	Yes. But not the primary focus.
	Hazard:	Flood
Real Estate Disclosure – Ohio Revised Code – Chapter 5302 Statutory Forms for Land Conveyance	**Description:**	The Residential Property Disclosure Form is a statement of conditions and information concerning a property that are actually known by the owner. An owner may or may not have lived at the property, and unless the potential purchaser is informed in writing, the owner has no more information about the property than could be obtained by a careful inspection of the property by a potential purchaser. Unless the potential purchaser is otherwise informed, the owner has not conducted any inspection of generally inaccessible areas of the property. This form is required by Ohio Revised Code Section 5302.30 (Ohio.gov)
	Responsible Agency:	Ohio Department of Commerce
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Insight 2050 – Released in February 2015	**Description:**	Insight2050 is an effort to prepare Central Ohio for future growth. With the region slated to grow by more than 1 million people and an additional 300,000 jobs by 2050, insight2050 is designed to provide local and regional policy makers, business leaders, developers, and public stakeholders with a clear and objective understanding of the impacts of varying growth and public investment decisions. This initiative strives to arm decision makers and stakeholders with solid and defensible information about the fiscal, mobility, environmental, and public health impacts of development and investment choices
	Responsible Agency:	Regional
	Provides Funding for Mitigation:	No
	Hazard:	All hazards

Table 5-2. Planning and Regulatory Capabilities – Federal and State

Capability	Details	
U.S. Army Corps of Engineers Dam Safety Program	**Description:**	The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. USACE has inventoried dams and has surveyed each state and federal agency's capabilities, practices, and regulations regarding design, construction, operation, and maintenance of the dams. USACE has also developed guidelines for inspection and evaluation of dam safety (USACE 1997).
	Responsible Agency:	USACE
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood; Dam/Levee Failure

5.3 ADMINISTRATIVE AND TECHNICAL CAPABILITIES

Table 5-3 summarizes the administrative and technical capabilities in Franklin County. Detailed information regarding administrative and technical capabilities in the County and the municipalities can be found in each jurisdictional annex found in Section 9.

Table 5-3. Administrative and Technical Capability – County and Local

Capability	Details	
Emergency Management Franklin County Emergency Management & Homeland Security	**Description:**	Franklin County Emergency Management & Homeland Security coordinates and prepares for county-wide all-hazards disaster planning, community education, warning, training, grant funding, response, and recovery efforts in order to prepare and protect the citizens of Franklin County before, during, and after natural and man-made disasters. FCEM&HS serves as the emergency management agency for all 42 jurisdictions in Franklin County 24 hours a day 7 days a week and focuses on the following core competencies: warning systems, emergency operations center, resources, recovery, planning, training, exercises, citizen preparedness, and grants (FCEM&HS 2018).
	Responsible Agency:	FCEM&HS, in accordance with Chapter 5502 of the Ohio Revised Code, is organized as a regional agency under the 1988 Countywide Agreement
	Provides Funding for Mitigation:	No
	Hazard:	All hazards
Franklin County Public Facilities Management	**Description:**	The purpose of the Department of Public Facilities Management is to provide professional, technical and non-technical support and services to County staff and guests in order to create and maintain a safe, comfortable and functional environment for the conduct of public business. This is accomplished by managing the County's physical assets through efficient, cost-effective, eco-friendly and innovative utilization of available resources. Facilities Management provides building maintenance and upkeep at its county facilities to ensure a clean and functional environment, electronic voice communications, and sustainable and supplemental services to ensure a desirable business environment and construction administration and management, protective and safety enhancements, and workers compensation administration services, to ensure a safe and secure environment.
	Responsible Agency:	County

Table 5-3. Administrative and Technical Capability – County and Local

Capability	Details	
	Provides Funding for Mitigation:	No
	Hazard:	All Hazards
Franklin County Public Health – Emergency Preparedness Program	**Description:**	Public health emergencies, whether a bio-terrorist attack, foodborne disease outbreak or hazardous chemical spill, can quickly overwhelm a public health agency. The Emergency Preparedness Program works to develop plans to address these risks and maintain efficient public health services for the citizens of Franklin County. We also identify the training needs of our employees and strive to meet these needs. This program additionally provides the avenue for interaction of the Franklin County Public Health with other Franklin County agencies, ensuring a cooperative response to emergencies in the community that may threaten the safety and health of residents.
	Responsible Agency:	County
	Provides Funding for Mitigation:	Yes
	Hazard:	Disease Outbreak
Franklin County Sanitary Engineering	**Description:**	The Franklin County Department of Sanitary Engineering is committed to providing vital resources to Franklin County residents and to protecting the environment in a fiscally responsible manner. Sanitary Engineering is responsible for providing water and sewer service to approximately 40,000 residents of Franklin County. We operate one water treatment plant and four sewage treatment plants, which are located in various areas throughout the county. In addition, the department maintains nine sewer systems, whose discharge eventually is processed under contract by the City of Columbus. Two major areas of responsibility for the department are the Darbydale area in southwestern Franklin County and the New Rome/Lincoln Village areas in Prairie Township.
	Responsible Agency:	County
	Provides Funding for Mitigation:	No
	Hazard:	Flood
Franklin County Economic Development and Planning	**Description:**	The planning and zoning department is responsible for all zoning, code enforcement and land-use planning activities in the unincorporated area of Franklin County. The Economic Development and Planning Department administers county zoning for 10 of the 17 townships in Franklin County: Brown, Clinton, Franklin, Hamilton, Madison, Mifflin, Norwich, Pleasant, Sharon, and Truro Townships. The townships of Blendon, Jackson, Jefferson, Perry, Plain, Prairie, and Washington administer their own zoning. The Franklin County Community Development section of the Economic Development & Planning Department is responsible for providing funding and technical assistance to support community development activities and initiatives in Franklin County outside the auspices of the City of Columbus.
	Responsible Agency:	County
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Franklin Soil and Water Conservation District	**Description:**	Franklin Soil and Water Conservation District's mission is to promote responsible land use decisions for the conservation, protection and improvement of soil and water resources by providing information and assistance through effective partnering, technical guidance, and education. Soil and water conservation districts are subdivisions of the state, organized under ORC 940, and conterminous with county boundaries. In Ohio, there are 88 soil and water conservation districts. Districts are overseen by five-member, publicly elected Boards of

Table 5-3. Administrative and Technical Capability – County and Local

Capability	Details	
		Supervisors. Franklin Soil and Water receives non-mandated funding from the Franklin County Board of Commissioners, from local municipalities, and from the state as match funding. The District provides coordination services for state-approved watershed action plans and TMDLs in the Lower Big Walnut, Alum Creek and Lower Olentangy watersheds, including projects outside of Franklin County. This involves identifying local resources, needs, and interests for restoration projects and providing services to get projects implemented, including grant writing, meeting facilitation, public presentations, evaluation of new technologies, demonstration projects, overseeing project implementation, and water quality monitoring
	Responsible Agency:	County
	Provides Funding for Mitigation:	Yes
	Hazard:	Geologic, Flooding
Mid-Ohio Reginal Planning Commission	**Description:**	The Mid-Ohio Regional Planning Commission is Central Ohio's regional council with more than 80 local governments and community partners. The Commission brings together communities of all sizes and interests to collaborate on best practices and plan for the future growth and sustainability of the region. The Commission administers the application and selection process for the Clean Ohio Conservation Fund in Franklin County through the District 3 Natural Resources Assistance Council. This program funds projects that preserve open spaces, sensitive ecological areas, and stream corridors. The Commission provides planning services to the Ohio EPA to develop updated and comprehensive water quality management plans for the Central Ohio region. Water quality management plans describe the surface water quality of the watersheds based on data available from federal, state, and local sources. They show projected growth patterns and development trends and their implications for water quality and wastewater treatment needs to guide future infrastructure planning.
	Responsible Agency:	City and County Governments of Central Ohio
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards

5.4 FISCAL CAPABILITIES

Fiscal capabilities are the resources that a jurisdiction has access to or is eligible to use to fund mitigation actions. Table 5-4 provides a list of programs, descriptions, and links for jurisdictions seeking funding sources. This table is not intended to be a comprehensive list, but rather a tool to help begin identifying potential sources of funding.

Table 5-4. Fiscal Capabilities

Capability	Details
Federal	

Table 5-4. Fiscal Capabilities

Capability	Details	
Hazard Mitigation Grant Program	**Description:**	The Hazard Mitigation Grant Program (HMGP) is a post-disaster mitigation program. It is made available to states by FEMA after each federal disaster declaration. The HMGP can provide up to 75% funding for hazard mitigation measures. The HMGP can be used to fund cost-effective projects that will protect public or private property in an area covered by a federal disaster declaration or that will reduce the likely damage from future disasters. Examples of projects include acquisition and demolition of structures in hazard prone areas, flood-proofing or elevation to reduce future damage, minor structural improvements, and development of state or local standards. Projects must fit into an overall mitigation strategy for the area identified as part of a local planning effort. All applicants must have a FEMA-approved Hazard Mitigation Plan (this plan). Applicants who are eligible for the HMGP are state and local governments, certain nonprofit organizations or institutions that perform essential government services, and Indian tribes and authorized tribal organizations. Individuals or homeowners cannot apply directly for the HMGP; a local government must apply on their behalf. Applications are submitted to OHIO EMA, placed in rank order for available funding, and submitted to FEMA for final approval. Eligible projects not selected for funding are placed in an inactive status and may be considered as additional HMGP funding becomes available. For additional information: https://www.fema.gov/hazard-mitigation-grant-program
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Flood Mitigation Assistance Program	**Description:**	The Flood Mitigation Assistance (FMA) program combines the previous Repetitive Flood Claims and Severe Repetitive Loss Grants into one grant program. The FMA provides funding to assist states and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The FMA is funded annually; no federal disaster declaration is required. Only NFIP insured homes and businesses are eligible for mitigation in this program. Funding for FMA is very limited and, as with the HMGP, individuals cannot apply directly for the program. Applications must come from local governments or other eligible organizations. The federal cost share for an FMA project is at least 75 percent. At most 25 percent of the total eligible costs must be provided by a non-federal source; of this 25 percent, no more than half can be provided as in-kind contributions from third parties. At minimum, a FEMA-approved local flood mitigation plan is required before a project can be approved. The FMA funds are distributed from FEMA to the state. Ohio EMA serves as the grantee and program administrator for the FMA program. For additional information: https://www.fema.gov/flood-mitigation-assistance-grant-program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Severe Summer Weather

Table 5-4. Fiscal Capabilities

Capability	Details	
Building Resilient Infrastructure and Communities Program	**Description:**	Building Resilient Infrastructure and Communities (BRIC) supports states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards. BRIC is a new FEMA pre-disaster hazard mitigation program that replaces the Pre-Disaster Mitigation program. The BRIC program guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. For additional information: https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Extraordinary Circumstances	**Description:**	When an applicant for HMGP, PDM, and FMA funding does not have a current hazard mitigation plan, extraordinary circumstances exist when a determination is made by the Applicant and FEMA that the proposed project is consistent with the priorities and strategies identified in the state (standard or enhanced) mitigation plan and that the jurisdiction meets at least one of the criteria below: • The jurisdiction meets the small, impoverished community criteria. • The jurisdiction has been determined to have had insufficient capacity due to lack of available funding, staffing, or other necessary expertise to satisfy the mitigation planning requirement prior to the current disaster or application deadline. • The jurisdiction has been determined to have been at low risk from hazards because of low frequency of occurrence or minimal damage from previous occurrences as a result of sparse development. • The jurisdiction experienced significant disruption from a declared disaster or another event that impacts its ability to complete the mitigation planning process prior to award or final approval of a project award. • The jurisdiction does not have a mitigation plan for reasons beyond the control of the State, federally recognized tribe, or local community, such as Disaster Relief Fund restrictions that delay FEMA from granting a subaward prior to the expiration of the local or Tribal Mitigation Plan. If the jurisdiction does not meet at least one of these criteria, the FEMA Region must coordinate with FEMA Headquarters (Risk Reduction and Risk Analysis Divisions) for HMGP; For PDM and FMA, the Region must coordinate and seek concurrence prior to granting an exception. For PDM and FMA project subawards, the FEMA region may apply extraordinary circumstances when justification is provided and with concurrence from FEMA headquarters (Risk Reduction and Risk Analysis Divisions) prior to granting an exception. If this exception is granted, a local mitigation plan must be approved by FEMA within 12 months of the award of the project subaward to that community.

Table 5-4. Fiscal Capabilities

Capability	Details	
		For HMGP, PDM, and FMA, the Applicant must provide written justification that identifies the specific criteria or circumstance listed above, explains why there is no longer an impediment to satisfying the mitigation planning requirement, and identifies the specific actions or circumstances that eliminated the deficiency. When an HMGP project funding is awarded under extraordinary circumstances, the Recipient shall acknowledge in writing to the Regional Administrator that a plan will be completed within 12 months of the subaward. The Recipient must provide a work plan for completing the local or Tribal Mitigation Plan, including milestones and a timetable, to ensure that the jurisdiction will complete the plan in the required time. This requirement shall be incorporated into the award (both the planning and project subaward agreements, if a planning subaward is also awarded).
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Individual Assistance	**Description:**	Individual Assistance provides help for homeowners, renters, businesses, and some non-profit entities after disasters occur. This program is largely funded by the U.S. Small Business Administration. For homeowners and renters, those who suffered uninsured or underinsured losses could be eligible for a Home Disaster Loan to repair or replace damaged real estate or personal property. Renters are eligible for loans to cover personal property losses. Individuals are allowed to borrow up to $200,000 to repair or replace real estate, $40,000 to cover losses to personal property, and an additional 20 percent for mitigation. For businesses, loans could be made to repair or replace disaster damages to property owned by the business, including real estate, machinery and equipment, inventory, and supplies. Businesses of any size are eligible. Non-profit organizations, such as charities, churches, and private universities are eligible. An Economic Injury Disaster Loan provides necessary working capital until normal operations resume after a physical disaster but are restricted by law to small businesses only. For additional information: https://www.fema.gov/individual-disaster-assistance.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Public Assistance	**Description:**	Public Assistance provides cost reimbursement aid to local governments (state, county, local, municipal authorities, and school districts) and certain non-profit agencies that were involved in disaster response and recovery programs or that suffered loss or damage to facilities or property used to deliver government-like services. This program is largely funded by FEMA with both local and state matching contributions required. For additional information: https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit.
	Responsible Agency:	FEMA

Table 5-4. Fiscal Capabilities

Capability	Details	
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Department of Homeland Security Grant Program	**Description:**	The Homeland Security Grant Program (HSGP) plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. In FY 2019, the total amount of funds available under HSGP was $1.095 billion. HSGP consists of three interconnected grant programs: State Homeland Security Program, Urban Areas Security Initiative, and Operation Stonegarden. Together, these grant programs fund a range of preparedness activities, including planning, organization, equipment purchase, training, exercises, and management and administration. For additional information: https://www.fema.gov/homeland-security-grant-program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Fire Management Assistance Grant Program	**Description:**	Assistance for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands that threaten such destruction as would constitute a major disaster. Provides a 75% federal cost share and the state pays the remaining 25% for actual cost. For additional information: https://www.fema.gov/fire-management-assistance-grant-program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All hazards
Assistance to Firefighters Grant Program	**Description:**	The primary goal of the Assistance to Firefighters Grants is to enhance the safety of the public and firefighters with respect to fire-related hazards by providing direct financial assistance to eligible fire departments, nonaffiliated emergency medical services organizations, and state fire training academies. This funding is for critically needed resources to equip and train emergency personnel to recognized standards, enhance operations efficiencies, foster interoperability, and support community resilience. For additional information:: https://www.fema.gov/welcome-assistance-firefighters-grant-program.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	All hazards
High Hazard Potential Dams Grant Program	**Description:**	The Rehabilitation of High Hazard Potential Dams Grant Program provides technical, planning, design, and construction assistance in the form of grants to non-federal governmental organizations or nonprofit organizations for rehabilitation of

Table 5-4. Fiscal Capabilities

Capability	Details	
		eligible high hazard potential dams. For additional information: https://www.grants.gov/web/grants/view-opportunity.html?oppId=316238.
	Responsible Agency:	FEMA
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood
Small Business Administration Loan	**Description:**	The Small Business Administration (SBA) provides low-interest disaster loans to homeowners, renters, business of all sizes, and most private nonprofit organizations. SBA disaster loans can be used to repair or replace the following items damaged or destroyed in a declared disaster: real estate, personal property, machinery and equipment, and inventory and business assets. Homeowners could apply for up to $200,000 to replace or repair their primary residence. Renters and homeowners could borrow up to $40,000 to replace or repair personal property-such as clothing, furniture, cars, and appliances that were damaged or destroyed in a disaster. Physical disaster loans of up to $2 million are available to qualified businesses or most private nonprofit organizations. For additional information: https://www.sba.gov/managing-business/running-business/emergency-preparedness/disaster-assistance.
	Responsible Agency:	SBA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Community Development Block Grant Program	**Description:**	CDBG are federal funds intended to provide low and moderate-income households with viable communities, including decent housing, a suitable living environment, and expanded economic opportunities. Eligible activities include community facilities and improvements, roads and infrastructure, housing rehabilitation and preservation, development activities, public services, economic development, and planning and administration. Public improvements could include flood and drainage improvements. In limited instances and during the times of "urgent need" (e.g., post disaster) as defined by the CDBG National Objectives, CDBG funding could be used to acquire a property located in a floodplain that was severely damaged by a recent flood, demolish a structure severely damaged by an earthquake, or repair a public facility severely damaged by a hazard event. For additional information: https://www.hudexchange.info/programs/cdbg-entitlement/.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Federal Highway Administration-Emergency Relief	**Description:**	The Federal Highway Administration (FHWA) Emergency Relief is a grant program through the U.S. Department of Transportation that can be used for repair or reconstruction of federal-aid highways and roads on federal lands that have suffered serious damage as a result of a disaster. Ohio Department of Transportation serves as the liaison between local municipalities and FHWA. For additional information: https://www.fhwa.dot.gov/programadmin/erelief.cfm.

Table 5-4. Fiscal Capabilities

Capability	Details	
	Responsible Agency:	U.S. Department of Transportation
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Federal Transit Administration - Emergency Relief	**Description:**	The Federal Transit Authority Emergency Relief is a grant program that funds capital projects to protect, repair, reconstruct, or replace equipment and facilities of public transportation systems. Administered by the Federal Transit Authority at the U.S. Department of Transportation. For additional information: https://www.transit.dot.gov/funding/grant-programs/emergency-relief-program/emergency-relief-program.
	Responsible Agency:	U.S. Department of Transportation
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Disaster Housing Program	**Description:**	Emergency assistance for housing, including minor repair of homes to establish livable conditions, mortgage and rental assistance available through the U.S. Department of Housing and Urban Development (HUD). For additional information: https://www.hud.gov/program_offices/public_indian_housing/publications/dhap.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
HOME Investment Partnerships Program	**Description:**	Grants to local and state government and consortia for permanent and transitional housing, (including financial support for property acquisition and rehabilitation for low income persons). For additional information: https://www.hud.gov/program_offices/comm_planning/affordablehousing/programs/home/.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
HUD Disaster Recovery Assistance	**Description:**	Grants to fund gaps in available recovery assistance after disasters (including mitigation). For additional information: https://www.hud.gov/info/disasterresources.
	Responsible Agency:	HUD
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Section 108 Loan Guarantee	**Description:**	Enables states and local governments participating in the CDBG program to obtain federally guaranteed loans for disaster-distressed areas. For additional information: https://www.hudexchange.info/programs/section-108/.
	Responsible Agency:	HUD

Table 5-4. Fiscal Capabilities

Capability	Details	
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Smart Growth Implementation Assistance program	**Description:**	The Smart Growth Implementation Assistance program through the U.S. EPA focuses on complex or cutting-edge issues, such as stormwater management, code revision, transit-oriented development, affordable housing, infill development, corridor planning, green building, and climate change. Applicants can submit proposals under four categories: community resilience to disasters, job creation, the role of manufactured homes in sustainable neighborhood design, or medical and social service facilities siting. For additional information: https://www.epa.gov/smartgrowth.
	Responsible Agency:	EPA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Partners for Fish and Wildlife	**Description:**	Financial and technical assistance to private landowners interested in pursuing restoration projects affecting wetlands and riparian habitats. For additional information: https://www.fws.gov/partners/.
	Responsible Agency:	U.S. Fish and Wildlife Service
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
Transportation Investment Generating Economic Recovery (TIGER)	**Description:**	Investing in critical road, rail, transit, and port projects across the nation. For additional information: https://www.transportation.gov/tags/tiger-grants.
	Responsible Agency:	U.S. Department of Transportation
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Community Facilities Direct Loan & Grant Program	**Description:**	This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings. For additional information: https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program
	Responsible Agency:	USDA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Emergency Loan Program	**Description:**	USDA's Farm Service Agency provides emergency loans to help producers recover from production and physical losses due to drought, flooding, other natural disasters, or quarantine. For additional information: https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/emergency-farm-loans/index.

Table 5-4. Fiscal Capabilities

Capability	Details	
	Responsible Agency:	USDA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
Emergency Watershed Protection program	**Description:**	The Emergency Watershed Protection (EWP) program provides assistance to relieve imminent hazards to life and property caused by floods, fires, drought, windstorms, and other natural occurrences through the Natural Resources Conservation Service. For additional information: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/.
	Responsible Agency:	USDA
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
Financial Assistance	**Description:**	Financial assistance to help plan and implement conservation practices that address natural resource concerns or opportunities to help save energy, improve soil, water, plant, air, animal and related resources on agricultural lands, and non-industrial private forest land. For additional information: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/.
	Responsible Agency:	NRCS
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Emergency Management Performance Grants Program	**Description:**	Assists local, tribal, territorial, and state governments in enhancing and sustaining all-hazards emergency management capabilities. For additional information: https://www.fema.gov/emergency-management-performance-grant-program.
	Responsible Agency:	U.S. DHS
	Provides Funding for Mitigation:	Yes
	Hazard:	All Hazards
Reimbursement for Firefighting on Federal Property	**Description:**	Provides reimbursement only for direct costs and losses over and above normal operating costs. For additional information: https://www.usfa.fema.gov/grants/firefighting_federal_property.html.
	Responsible Agency:	U.S. DHS
	Provides Funding for Mitigation:	Yes
	Hazard:	All hazards
Land & Water Conservation Fund	**Description:**	Matching grants to states and local governments for the acquisition and development of public outdoor recreation areas and facilities (as well as funding for shared federal land acquisition and conservation strategies). For additional information: https://www.nps.gov/subjects/lwcf/index.htm.
	Responsible Agency:	National Park Service

Table 5-4. Fiscal Capabilities

Capability	Details	
	Provides Funding for Mitigation:	Yes
	Hazard:	All Natural Hazards
State		
Community Wildfire Risk Reduction	**Description:**	Community Wildfire Risk Reduction Grant projects support hazard mitigation, emergency readiness, public education, and firefighter training. The program is a 50/50 cost share reimbursement grant. It improves community safety, education, and readiness.
	Responsible Agency:	Ohio Department of Natural Resources
	Provides Funding for Mitigation:	Yes
	Hazard:	Wildfire
Prescribed Fire Supplies, Tools, Education, & Personal Protective Equipment (STEP) Grant	**Description:**	The Prescribed Fire Supplies, Tools, Education, & Personal Protective Equipment grant can help agencies build and expand their programs. It supports prescribed fire management projects in Ohio. Through this grant program, recipients may buy prescribed fire supplies, PPE, radios, tools, repair parts, weather data devices, pumps, signs and education materials, and more.
	Responsible Agency:	Ohio Department of Natural Resources
	Provides Funding for Mitigation:	Yes
	Hazard:	Wildfire
The Muskingum Watershed Conservancy District	**Description:**	The Muskingum Watershed Conservancy District is a political subdivision of the state. It was created in 1933. It makes and uses plans to reduce the effects of flooding and conserve water. It works for beneficial public uses under Ohio Revised Code Chapter 6101 (commonly called the Conservancy Act). The Muskingum Watershed Conservancy District is the largest conservancy district in the state. It led the effort to build 14 dams and reservoirs. Two others were built later. The federal government credits the system of dams and reservoirs with saving more than $7 billion worth of potential damage from flooding since its start. The District supports the work of agencies and groups involved in conservation programs, water quality issues, and flood reduction and mitigation projects. To do so, it developed the "Partners in Watershed Management" Project Assistance Program. This program helps groups that actively support the conservation and flood control aspects of the District.
	Responsible Agency:	Muskingum Watershed Conservancy District
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood, Severe Summer Weather
Ohio Department of Development	**Description:**	The Department of Development helps build strong communities in Ohio. With reliable infrastructure and strong, vibrant downtowns, Ohio communities provide an environment for entrepreneurship and job creation as well as a strong quality of life for residents. In addition, through specific Department programs, Ohioans can access assistance to improve their energy efficiency.
	Responsible Agency:	State

Table 5-4. Fiscal Capabilities

Capability	Details	
	Provides Funding for Mitigation:	Yes
	Hazard:	Geologic Hazards
State Recovery Strategies and Assistance Programs	**Description:**	The Ohio EMA State Recovery Strategies explain the roles and capabilities of local, state, federal and nongovernmental agencies in recovery work. These can include financial and technical assistance.
	Responsible Agency:	Ohio Emergency Management Agency
	Provides Funding for Mitigation:	Yes
	Hazard:	All natural hazards
Urban Canopy Restoration Grant	**Description:**	The USDA Forest Service Urban & Community Forestry Program provides funds to help restore and improve urban forests that had catastrophic losses from EAB. It also reduces the impact of climate change and increases resiliency by planting trees in urban communities where they are critical to human health.
	Responsible Agency:	Ohio Department of Natural Resources
	Provides Funding for Mitigation:	Yes
	Hazard:	Wildfire
Other		
Ecosystem Investment Partners	**Description:**	Ecosystem Investment Partners invests in major restoration. It spends private conservation money on local mitigation projects.
	Responsible Agency:	Ecosystem Investment Partners
	Provides Funding for Mitigation:	Yes
	Hazard:	Drought; Earthquake; Flood; Extreme Heat; Soil/Geologic Hazards; Wildfire; Tornado; Severe Summer Weather; Severe Winter Weathers
Partners for Places	**Description:**	Partners for Places helps cities and counties in the United States and Canada improve. It builds partnerships between local government sustainability offices and place-based foundations.
	Responsible Agency:	Funders' Network
	Provides Funding for Mitigation:	Yes
	Hazard:	All natural hazards
Environment Grantmaking: Climate Solutions and Great Lakes	**Description:**	The Joyce Foundation will address two of the Great Lakes Region's critical long-term environmental challenges: climate change and the health of the Great Lakes. The Joyce Foundation seeks to get people from impacted communities involved in environmental policy. Moreover, applicants looking to improve racial equity, social justice, inclusion and diversity in their organization are invited to describe their efforts and how Joyce can help reach those goals.
	Responsible Agency:	Joyce Foundation

Table 5-4. Fiscal Capabilities

Capability	Details	
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood; Geologic Hazards
Great Lakes & Drinking Water Initiative	**Description:**	The Environment Program grants support research, policy development, coalition building, and communications. They also support advocacy, policy implementation, policy enforcement and evaluation. They focus on local and state policy in Illinois, Ohio, Wisconsin, and Michigan.
	Responsible Agency:	Joyce Foundation
	Provides Funding for Mitigation:	Yes
	Hazard:	Drought; Flood; Severe Summer Weather; Severe Winter Weather
Lake Conservation Grant	**Description:**	The grant program supports projects that work toward the Midwest Glacial Lakes Partnership's goal of improving aquatic conservation efforts. It does so in Midwest communities.
	Responsible Agency:	Midwest Glacial Lakes Partnership
	Provides Funding for Mitigation:	Yes
	Hazard:	Flood; Geologic Hazards
Five Star and Urban Waters Restoration Grant Program	**Description:**	The Five Star and Urban Waters Restoration Program focuses on care of coastal, wetland and riparian ecosystems across the country. It seeks to meet the conservation needs of important species and habitats. The program provides measurable and meaningful conservation and educational outcomes. It also requires diverse partnerships and outreach.
	Responsible Agency:	National Fish & Wildlife Foundation
	Provides Funding for Mitigation:	Yes
	Hazard:	Drought; Flood; Geologic Hazards; Severe Summer Weather; Severe Winter Weather
Resilient Landscapes Funds	**Description:**	The Open Space Institute launched the Resilient Landscapes Initiative in 2013 to identify and protect the places where wildlife can thrive. The Doris Duke Charitable Foundation, Jane's Trust, the North Atlantic Landscape Cooperative and the New York state Conservation Partnership Program/Land Trust Alliance support the Resilient Landscapes Initiative.
	Responsible Agency:	Open Space Institute
	Provides Funding for Mitigation:	Yes
	Hazard:	Drought; Earthquake; Flood; Extreme Temperature; Geologic Hazards; Wildfire; Tornado; Severe Summer Weather; Severe Winter Weather

5.5 PLAN INTEGRATION

The information on hazard, risk, vulnerability, and mitigation contained in this plan is based on the best science and technology available at the time this plan was prepared. Planning Team members' comprehensive plans are considered to be integral parts of this plan. Planning Team members have planned for the impact of natural hazards through adoption of plans and ordinances. The HMP development process provided them with the opportunity to review and expand on policies contained within these planning mechanisms. Planning Team used their local plans and the HMP as complementary documents that work together to achieve the goal of reducing risk exposure to the residents of Franklin County.

The Franklin County Planning Team was tasked with identifying how hazard mitigation is integrated into existing planning mechanisms. Section 9 (Jurisdictional Annexes) details how this is done for each participating municipality and the County. During this process, many municipalities recognized the importance and benefits of incorporating hazard mitigation into future municipal planning and regulatory processes and have added new mitigation actions to support this effort.

The Planning Team members will continue to incorporate mitigation planning as an integral component of daily government operations. Planning Team representatives will continue to work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. The sample adoption resolution presented in Appendix A (Plan Adoption) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Planning Team anticipates that:

- Hazard mitigation planning will be formally recognized as an integral part of overall planning and emergency management efforts.
- The hazard mitigation plan, master plans, emergency management plans, and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of County residents.

Section 7 (Plan Maintenance) provides additional information on the implementation of the mitigation plan through existing programs.

SECTION 6. MITIGATION STRATEGY

6.1 INTRODUCTION

The Planning Team reviewed the risk assessment for this HMP to identify and develop mitigation actions for Franklin County that will reduce potential exposure and losses associated with identified hazards of concern. This section includes the following:

- Background and Past Mitigation Accomplishments
- General Mitigation Planning Approach
- Problems and Solutions
- Review and Update of Mitigation Goals and Objectives
- Mitigation Strategy Development and Update

Hazard mitigation reduces the potential impacts of, and costs associated with, emergency and disaster-related events. Mitigation actions address a range of impacts, including impacts on the population, property, the economy, and the environment.

Mitigation actions can include activities such as: revisions to land-use planning, training and education, and structural and nonstructural safety measures.

6.2 BACKGROUND AND PAST MITIGATION ACCOMPLISHMENTS

In accordance with DMA 2000 requirements, a discussion regarding past mitigation activities and an overview of past efforts is provided as a foundation for understanding the mitigation goals, objectives, and activities outlined in this HMP. Franklin County, through previous and ongoing hazard mitigation activities, has demonstrated that it is proactive in protecting its physical assets and citizens against losses from natural and human-caused hazards. Examples of previous and ongoing actions, projects and capabilities include the following:

- Franklin County participated in the development of the 2018 HMP and facilitated this 2023 update, with the participation of all municipal governments in Franklin County. The current planning process represents the regulatory five-year local plan update process.
- All municipalities in Franklin County participate in the NFIP, which requires the adoption of FEMA floodplain mapping and certain minimum construction standards for building within the floodplain.
- Municipalities have participated on a limited basis in available mitigation grant funding opportunities to implement mitigation projects, including the following:
    - Adopting stricter building codes
    - Implementing water conservation measures
    - Installing sirens for early warning for natural hazard events
- The County and its municipalities have implemented mitigation actions to protect critical facilities and community lifelines throughout Franklin County. These actions and others were identified in the 2018 HMP.

- Ohio EMA provides a comprehensive program to support local jurisdictions as they assess the risks they face, make plans to mitigate them, and fund those plans to implement mitigation projects that reduce risk across Franklin County.
- In 2020, the County and local municipalities responded to and worked to mitigate the impacts of the coronavirus pandemic through education of the public, enforcement of local and state social distancing and masking measures, and establishment of best practices to slow the spread of Covid-19.

These past and ongoing activities have contributed to Franklin County's understanding of its hazard preparedness and future mitigation activity needs, costs, and benefits. These efforts provide an ongoing foundation for the Planning Team to use in developing this HMP update.

6.3 GENERAL MITIGATION STRATEGY UPDATE APPROACH

The approach used to update the County and local hazard mitigation strategies was based on FEMA regulations and guidance regarding local mitigation plan development:

- DMA 2000 regulations (44 CFR 201.6, local mitigation planning)
- Local Mitigation Planning Policy Guide (FEMA, April 19, 2022)
- Local Mitigation Planning Handbook (FEMA, March 2013)
- Local Mitigation Plan Review Guide (FEMA, October 1, 2011)
- Integrating Hazard Mitigation into Local Planning (FEMA, March 1, 2013)
- Plan Integration: Linking Local Planning Efforts (FEMA, July 2015)
- Mitigation Planning How-To Guide #3, Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3, February 2013)
- Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards (FEMA, January 2013)

The mitigation strategy update approach includes the following steps that are further detailed in later subsections of this section:

- Section 6.4 – Problem and Solutions exercise
- Section 6.5 – Review and update mitigation goals and objectives.
- Section 6.6 - Develop and prepare a mitigation strategy, including:
  - Review of the 2018 HMP mitigation actions
  - Identification of progress on the previous county and local mitigation strategies
  - 2023 HMP Mitigation Action Plan
  - Mitigation best practices
  - Mitigation strategy evaluation and prioritization
  - Benefit/cost review

6.4 PROBLEM AND SOLUTION IDENTIFICATION

A problem and solutions identification exercise was completed via online survey of the participating jurisdictions. Participants were asked to fill out at least one problem and solution for each of the hazards of concern for the 2023 HMP update. The Planning Team was asked to begin the exercise by identifying a problem caused by one of the hazards. Next, potential solutions to that problem were identified. To conclude the discussion of each ranked hazard, participants were asked about anticipated costs, benefits, funding sources, and project feasibility. The results were compiled and presented to the Planning Team. The results were also used by the participants to help identify capabilities and potential mitigation actions.

6.5 REVIEW AND UPDATE OF MITIGATION GOALS AND OBJECTIVES

This section documents the efforts to update the guiding principles, goals, and objectives established to reduce or avoid long-term vulnerabilities to the identified hazards.

6.5.1 Goals and Objectives

FEMA defines ***Goals*** as general guidelines that explain what should be achieved. Goals are usually broad, long-term, policy statements, and represent a global vision.

FEMA defines ***Objectives*** as strategies or implementation steps to attain mitigation goals. Unlike goals, objectives are specific and measurable, where feasible.

FEMA defines ***Mitigation Actions*** as specific actions that help to achieve the mitigation goals and objectives.

According to CFR 201.6(c)(3)(i): "The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards." FEMA mitigation planning guidance recommends establishing objectives to better tie mitigation goals to specific mitigation strategies (e.g., projects, activities, and initiatives).

The goals established in the 2018 Franklin County HMP were presented to the Core Planning Team and Planning Team for review and amendment throughout the planning process. This review was made with consideration of the hazard events and losses since the 2018 plan, the updated risk assessment, and the goals and objectives established in the 2019 State of Ohio HMP.

The Core Planning Team met on January 5, 2023, to review the 2018 goals and objectives and provided input on updated goals and objectives. These updates were presented to the Planning Team during the April 2023 Mitigation Strategy Workshop. As a result of these efforts, Table 6-1 presents Franklin County's updated goals and objectives for the 2023 HMP update.

Table 6-1. Franklin County 2023 Hazard Mitigation Plan Goals and Objectives

2023 HMP Update Goals	
1	Integrate goals and action items from the Franklin County Hazard Mitigation Plan into existing and future land-use planning documents, existing regulatory programs, zoning code updates and floodplain management regulations.
2	Develop inventories of at-risk infrastructure and prioritize preventative measures equitably in areas vulnerable to natural hazards.

3	Involve watershed and natural resource management, and all other interested parties, in natural hazards mitigation planning to rehabilitate and maintain streams and waterways, particularly in vulnerable communities.
4	Strengthen partnerships between government agencies, private sector businesses, and non-profits to develop public outreach strategies and provide resources and involvement in natural hazards mitigation actions.
5	Develop and implement public education programs to provide necessary resources to increase public awareness and understanding of the risks, resilience strategies, and safety measures associated with natural hazards.
6	Protect buildings in repetitive loss areas through acquisition, elevation, or other mitigating activity.

	2023 HMP Update Objectives
1	Evaluate and improve safety and loss reduction codes and standards for hazards that affect Franklin County.
2	Develop and strengthen public/private partnerships between the County, non-profits, and the business community.
3	Identify funding sources and obtain funds from a variety of federal, state, regional, and local entities to implement mitigation activities.
4	Prioritize sustainable communities, green infrastructure, and hazard resilient development.
5	Continue to map hazard areas, refine existing hazard mapping data, and develop/refine loss estimation and vulnerability analysis data.
6	Promote the use of emergency notification systems and weather alert systems for all hazards.
7	Based on best practices from the State and FEMA, develop multi-lingual publications and guidance on how to be prepared for and respond to hazards which could impact Franklin County.
8	Identify the need for, and acquire, any special emergency services, training, and equipment to enhance response and recovery capabilities for the hazards that impact Franklin County.
9	Incorporate hazard mitigation into community planning mechanisms, codes and ordinances, day-to-day operations, and projects.
10	Identify and protect socially vulnerable populations and assist them in recovering from hazard impacts.
11	Encourage the use of sustainable nature-based solutions to address riverine, flash, and urban/stormwater flooding.

6.6 MITIGATION STRATEGY DEVELOPMENT AND UPDATE

As required by FEMA, the County and other participating jurisdictions completed a comprehensive evaluation of the mitigation strategies and actions from the 2018 HMP and reported on the status of each. Their updates may be found in each jurisdictional annex (Section 9). In addition, the County and other participating jurisdictions were provided the opportunity to include new strategies or actions in the 2023 HMP. New actions were prioritized to ensure they are cost-effective, environmentally sound, and technically feasible using the methodology outlined below.

6.6.1 Review of the 2018 HMP Mitigation Action Plans

To evaluate progress on local mitigation actions, the planning consultant met with each participant to discuss the status of the mitigation actions identified in the 2018 plan. For each action, jurisdictions were asked to provide the status of each action (*No Progress, In Progress, Ongoing Capability, Discontinue, or Completed*) and provide review comments on each. Jurisdictions were requested to quantify the extent of progress and provide reasons for the level of progress or why actions were being discontinued. Each jurisdictional annex in Section 9 provides a table identifying the jurisdiction's prior mitigation strategy, the status of those actions and initiatives, and their disposition within their updated strategy.

Local mitigation actions identified as *Complete*, and those actions identified as *Discontinued*, were removed from the updated strategies. Those actions identified as *No Progress* or *In Progress* that remain a priority for the jurisdiction have been carried forward into the updated mitigation strategy. Actions identified as *Ongoing Capabilities* which are fully integrated into the normal operational and administrative framework of the community have been identified within the capabilities section of each annex and removed from the updated mitigation strategy.

At the November 2022 Planning Team kickoff meeting and during subsequent local-level planning meetings by phone or email, all participating jurisdictions were requested to identify mitigation activities completed, ongoing, and proposed. As potential new mitigation actions became evident during the plan update process, including as part of the risk assessment update and as identified through the public and stakeholder outreach process detailed in Section 2 (Planning Process), jurisdictions were made aware of these either through direct communication (local meetings, email, phone), at Steering and Planning Committee meetings, or via their draft jurisdictional annexes.

Throughout the planning process, the planning consultant worked directly with each community by phone or email to assist with the development and update of their annex and include mitigation strategies, focusing on identifying well-defined, implementable projects with a careful consideration of benefits (risk reduction, losses avoided), costs, and possible funding sources (including mitigation grant programs).

6.6.2 Identification and Analysis of Mitigation Techniques

Concerted efforts were made to ensure that participating jurisdictions develop updated mitigation strategies that cover the range of mitigation action types described in recent FEMA planning guidance (FEMA "Local Mitigation Planning Handbook" March 2013), specifically:

- **Local Plans and Regulations**—These actions include government authorities, policies or codes that influence the way land and buildings are being developed and built.
- **Structure and Infrastructure Projects**—These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- **Natural Systems Protection**—These are actions that minimize damage and losses and preserve or restore the functions of natural systems.
- **Education and Awareness Programs**—These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. These actions may also include participation in national programs, such as the National Flood Insurance Program and Community Rating System, StormReady (NOAA), and Firewise (NFPA) Communities.

6.6.3 2023 HMP Mitigation Action Plan

To help support the selection of an appropriate, risk-based mitigation strategy, each participating jurisdiction's annex provides a summary of hazard vulnerabilities identified during the plan update

process, either directly by local representatives, through a review of county and local plans and reports, or through the updated risk assessment.

In April 2023, the Planning Team participated in a mitigation strategy development workshop, supplemented by emails and phone calls between jurisdictions and the contract consultant, for all participating jurisdictions to support the development of focused problem statements based on the impacts of natural hazards in the county and their communities. Each problem statement provides a detailed description of a problem area, problem impacts, past damage, loss of service, etc. Where possible, the problem statements list the street address of affected properties, adjacent streets, water bodies, well-known nearby structures, and existing conditions of the site (topography, terrain, hydrology). These problem statements form a bridge between the hazard risk assessment, which quantifies impacts on each community, and the development of actionable mitigation strategies.

As discussed in the hazard profiles in Section 4.3, the long-term effects of climate change are anticipated to exacerbate the impacts of weather-related hazards, including flood, severe summer weather, severe winter weather and tornado. Participating jurisdictions are working to evaluate the long-term implications of these climate change-sensitive hazards and to incorporate appropriate planning and capital improvement updates in their local mitigation strategies and integration actions.

To assist with the development of mitigation actions, municipalities were provided with the following:

- 2023 HMP goals and objectives
- 2018 HMP mitigation strategies
- Risk assessment results
- Outcome of the problem and solutions exercise
- Mitigation catalog
- Stakeholder and public input (e.g., citizen and stakeholder survey results)
- FEMA resources

The local mitigation strategies focus on clearly defined, readily implementable projects and initiatives that meet the definition or characteristics of mitigation. Broadly defined mitigation actions were eliminated unless accompanied by discrete actions, projects, or initiatives. Certain continuous or ongoing activities that represent programs that are fully integrated into the normal operational and administrative framework of the community have been removed from the updated mitigation strategy and included in the capabilities section of each annex.

A comprehensive range of mitigation actions was considered for each plan participant to pursue to reduce the effects of hazards. Some of these are previous actions carried forward for this plan update. These actions are dependent upon available funding (grants and local match availability) and may be modified or omitted based on the occurrence of new hazard events and changes in municipal priorities.

Throughout the course of the plan update process, additional regional and county-level mitigation actions were identified by the following processes:

- Review of the results and findings of the updated risk assessment
- Review of available regional and county plans reports and studies
- Direct input from county departments and other county and regional agencies
- Input received through the public and stakeholder outreach process

6.6.4 Mitigation Best Practices

Catalogs of hazard mitigation best practices were developed that present a broad range of alternatives to be considered for use in Franklin County, in compliance with 44 CFR Section 201.6(c)(3)(ii). One catalog was developed for each natural hazard of concern evaluated in this plan. The catalogs, included in Appendix F (Mitigation Strategy Supplementary Data), present alternatives that are categorized in two ways:

- By who would have responsibility for implementation:
  - Individuals – personal scale
  - Businesses – corporate scale
  - Government – government scale
- By what each of the alternatives would do:
  - Manipulate the hazard
  - Reduce exposure to the hazard
  - Reduce vulnerability to the hazard
  - Build local capacity to respond to or be prepared for the hazard

The alternatives presented include actions that will mitigate current risk from hazards and actions that will help reduce risk from changes in the impacts of these hazards resulting from climate change. Hazard mitigation actions recommended in this plan were selected from among the alternatives presented in the catalog, as well as other resources made available to all jurisdictions (i.e., FEMA's Mitigation Ideas). The catalog provides a baseline of mitigation alternatives that are backed by a planning process, are consistent with the established goals and objectives, and are within the capabilities of the planning partners to implement. Some of these actions may not be feasible based on the selection criteria identified for this plan. The purpose of the catalog was to provide a list of what could be considered to reduce risk from natural hazards within Franklin County. Actions in the catalog that are not included for the partnership's action plan were not selected for one or more of the following reasons:

- The action is not feasible;
- The action is already being implemented;
- There is an apparently more cost-effective alternative; and/or
- The action does not have public or political support.

6.6.5 Mitigation Action Evaluation and Prioritization

Section 201.c.3.iii of 44 CFR requires the action plan to describe how the identified actions will be prioritized. FEMA planning guidance (March 2013) identifies a hazard mitigation action evaluation methodology that uses 10 evaluation criteria for evaluating the opportunities and constraints of implementing a particular mitigation action.

Expanding on this guidance, the Core Planning Team adopted and applied an action evaluation and prioritization methodology which includes 14 criteria, in order to include the consideration of cost-effectiveness, availability of funding, anticipated timeline, and if the action addresses multiple hazards:

- **Life Safety**—How effective will the action be at protecting lives and preventing injuries?
- **Property Protection**—How significant will the action be at eliminating or reducing damage to structures and infrastructure?
- **Cost-Effectiveness**—Are the costs to implement the project or initiative commensurate with the benefits achieved?
- **Technical**—Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.
- **Political—**Is there overall public support for the mitigation action? Is there the political will to support it?
- **Legal**—Does the municipality have the authority to implement the action?
- **Fiscal**—Can the project be funded under existing program budgets (i.e., is this initiative currently budgeted for)? Or would it require a new budget authorization or funding from another source such as grants?
- **Environmental**—What are the potential environmental impacts of the action? Will it comply with environmental regulations?
- **Social**—Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?
- **Administrative**—Does the jurisdiction have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?
- **Multi-hazard**—Does the action reduce the risk from multiple hazards?
- **Timeline**—Can the action be completed in less than 5 years?
- **Local Champion**—Is there a strong advocate for the action or project among the jurisdiction's staff, governing body, or committees that will support the action's implementation?
- **Other Local Objectives**—Does the action advance other local objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of other plans and programs?

For each mitigation action, the jurisdictions were asked to assign a numeric rank (-1, 0, or 1) for each of the 14 evaluation criteria, defined as follows:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Jurisdictions were asked to provide a summary of the rationale behind the numeric rankings assigned, as applicable. The numerical results were totaled to assist each jurisdiction in selecting mitigation actions for the updated plan.

As the initial step in the prioritization process, actions that had a numerical value between 0 and 4 were prioritized as low; actions with numerical values between 5 and 9 were categorized as medium; and actions with numerical values between 10 and 14 were categorized as high. These attributes are included in the mitigation strategy table and for FEMA-eligible projects in the mitigation worksheets (Section 9).

For the plan update, there has been an effort to develop more clearly defined and action-oriented mitigation strategies. These local strategies include actions that are seen by the community as the most effective approaches to advance their local mitigation goals and objectives within their capabilities. In addition, each jurisdiction was asked to develop problem statements. With this process, participating jurisdictions were able to develop action-oriented and achievable mitigation strategies.

Benefit/Cost Review

Section 201.6.c.3iii of 44CFR requires the prioritization of the action plan to emphasize the extent to which benefits are maximized according to a benefit/cost review of the proposed actions. This is why cost-effectiveness is one of the criteria that must be applied during the evaluation and prioritization of all actions that make up the mitigation strategy.

The benefit/cost review used to evaluate and prioritize actions in this HMP update was qualitative. It did not include the level of detail required by FEMA for project grant eligibility under the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) and Building Resilient Infrastructure and Communities (BRIC) grant programs. For all actions identified in the local strategies, jurisdictions identified the associated costs and benefits:

- ***Costs*** are the total cost for the action or project, and may include administrative costs, construction costs (including engineering, design and permitting), and maintenance costs.
- ***Benefits*** are the savings from losses avoided attributed to the implementation of the project, which may include life-safety, structure and infrastructure damage, loss of service or function, and economic and environmental damage and losses.

When possible, jurisdictions were asked to identify the actual or estimated dollar value for project costs and associated benefits. Having defined costs and benefits allows a direct, quantitative evaluation of project cost-effectiveness. Often, however, numerical costs and/or benefits have not been identified or may be impossible to quantitatively assess.

For the purposes of this planning process, jurisdictions were tasked with evaluating project cost-effectiveness with both costs and benefits assigned ratings of high, medium, or low:

- Low = < $10,000
- Medium = $10,000 to $100,000

- High = > $100,000

Where quantitative estimates of costs and/or benefits were not available, qualitative ratings were assigned using the definitions shown in Table 6-2.

Table 6-2. Qualitative Cost and Benefit Ratings

Costs	
High	Existing funding levels are not adequate to cover the costs of the proposed project, and implementation would require an increase in revenue through an alternative source (e.g., bonds, grants, and fee increases).
Medium	The project could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the project would have to be spread over multiple years.
Low	The project could be funded under the existing budget. The project is part of or can be part of an existing, ongoing program.
Benefits	
High	Project will have an immediate impact on the reduction of risk exposure to life and property.
Medium	Project will have a long-term impact on the reduction of risk exposure to life and property or will provide an immediate reduction in the risk exposure to property.
Low	Long-term benefits of the project are difficult to quantify in the short term.

Using this approach, projects with positive benefit versus cost ratios (such as high over high, high over medium, medium over low, etc.) are considered cost-beneficial and are prioritized accordingly. For some of the Franklin County initiatives identified, the Planning Team may seek financial assistance under FEMA's HMGP or Hazard Mitigation Assistance (HMA) programs. These programs require detailed benefit/cost analysis as part of the application process. These analyses will be performed when funding applications are prepared, using the FEMA BCA model process. The Planning Team is committed to implementing mitigation strategies with benefits that exceed costs. For projects not seeking financial assistance from grant programs that require this sort of analysis, the Planning Team reserves the right to define "benefits" according to parameters that meet its needs and the goals and objectives of this HMP.

SECTION 7. PLAN MAINTENANCE

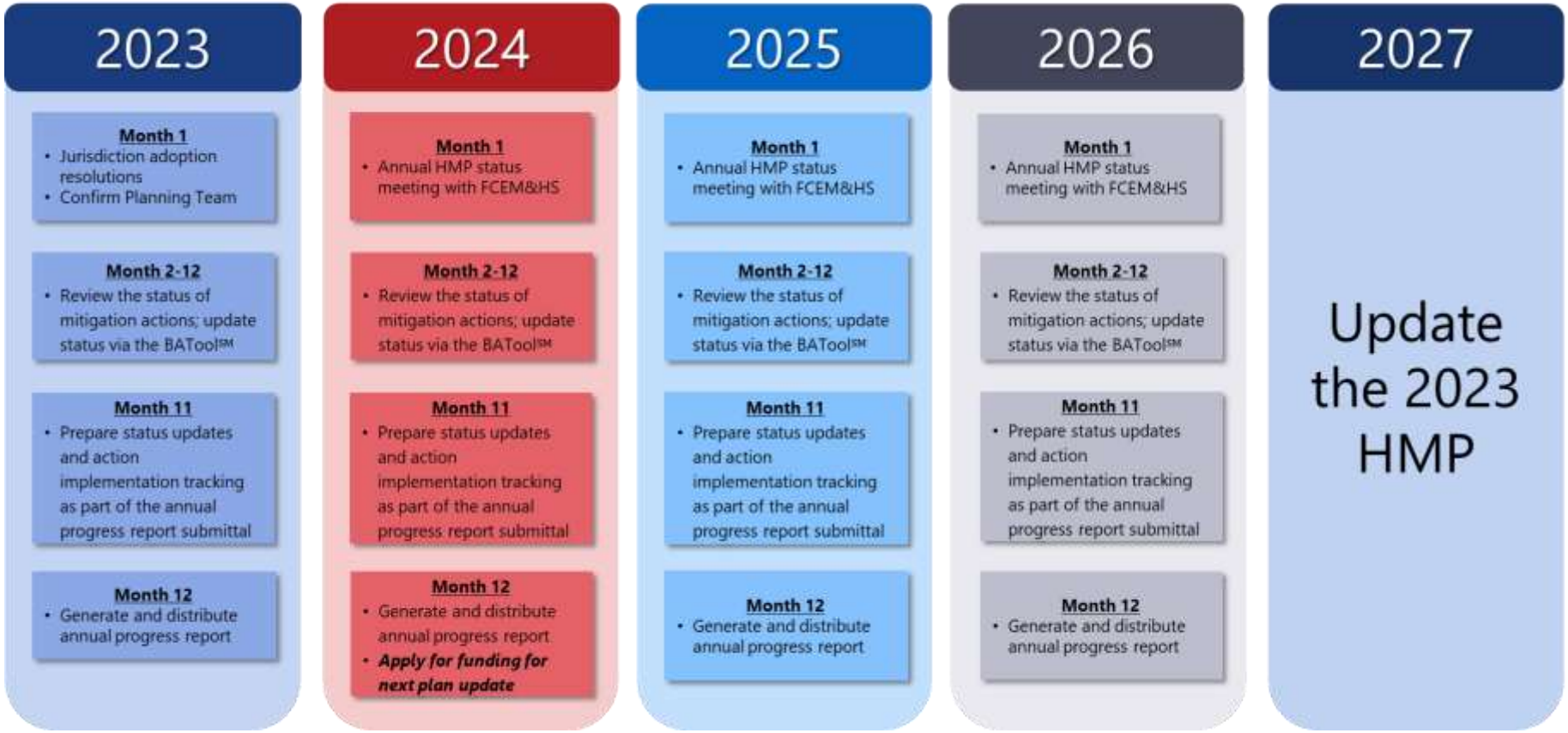
This section details the formal process that will ensure that the HMP remains an active and relevant document and that the Planning Team members maintain their eligibility for applicable funding sources. The plan maintenance process includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every five years. In addition, this section describes how public participation will be integrated throughout the plan maintenance and implementation process. It explains how the mitigation strategies outlined in this plan update will be incorporated into existing planning mechanisms and programs, such as comprehensive land use planning processes, capital improvement planning, and building code enforcement and implementation. The plan's format allows sections to be reviewed and updated when new data becomes available, resulting in a plan that will remain current and relevant.

The plan maintenance matrix shown in Table 7-1 provides a synopsis of responsibilities for plan monitoring, evaluation, and update, which are discussed in further detail in the sections below. A timeline is presented in Figure 7-1.

Table 7-1. Plan Maintenance Matrix

Task	Approach	Timeline	Lead Responsibility	Support Responsibility
Monitoring	Preparation of status updates and action implementation tracking as part of submission for Annual Progress Report.	October or upon major update to Comprehensive Plan or major disaster	Jurisdictional points of contact identified in Section 9 (Jurisdictional Annexes)	Jurisdictional implementation lead identified in Section 9 (Jurisdictional Annexes)
Integration	In order for mitigation principles to become a part of the ongoing county and local government activities, the County will distribute the safe growth worksheet for annual review and update by all participating jurisdictions.	October each year with interim email reminders to address integration in local government activities.	HMP Coordinator and jurisdictional points of contact identified in Section 8 (Planning Team) and Section 9 (Jurisdictional Annexes)	HMP Coordinator
Evaluation	Review the status of mitigation actions as submitted by the monitoring task lead and support to assess the effectiveness of the plan; compile and finalize the Annual Progress Report	Finalized progress report completed by January 31 each year	Core Planning Team; Plan Maintenance element	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)
Update	Reconvene the Planning Team, at a minimum, every 5 years to guide a comprehensive update to review and revise the plan.	Every 5 years or upon major update to Comprehensive Plan or major disaster	HMP Coordinator	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)
Grant Monitoring and Coordination	Franklin County HMP Coordinator will keep the Planning Team apprised of FEMA Hazard Mitigation Assistance grant openings and assist in developing letters of intent for grant opportunities when practicable	Annually when FEMA NOFO released for FMA and BRIC and/or when HMGP funding is available	HMP Coordinator	Jurisdictional points of contacts identified in Section 9 (Jurisdictional Annexes)

Figure 7-1. Plan Maintenance Timeline



7.1 MONITORING, EVALUATING, AND UPDATING THE PLAN

The procedures for monitoring, evaluating, and updating the plan are provided below.

The HMP Coordinator is assigned to manage the maintenance and update of the plan during its performance period. The HMP Coordinator will chair the Planning Team and be the prime point of contact for questions regarding the plan and its implementation as well as to coordinate incorporation of additional information into the plan. Currently, the designated Franklin County HMP Coordinator is:

Jeff Young, Director
Franklin County Office of Emergency Management and Homeland Security
(614) 794-0213 | jjyoung@franklincountyohio.gov

The Planning Team, consisting of a representative from each participating jurisdiction, will fulfill the monitoring, evaluation, and updating responsibilities identified in this section. Each jurisdiction is expected to maintain a representative on the Planning Team throughout the plan performance period (five years from the date of plan adoption). Primary and secondary mitigation planning representatives (points-of-contact) as of the date of this plan are identified in each jurisdictional annex in Section 9.

It is recognized that individual commitments change over time, and it will be the responsibility of each jurisdiction and its representatives to inform the HMP Coordinator of any changes in representation on the Core Planning Team. The HMP Coordinator will strive to keep the Core Planning Team makeup as a uniform representation of the Planning Team and stakeholders within Franklin County.

7.1.1 Monitoring

The Planning Team will be responsible for monitoring progress on, and evaluating the effectiveness of, the plan, and documenting annual progress. Each year, beginning one year after plan development, Franklin County and local Planning Team representatives will collect and process information from the departments, agencies and organizations involved in implementing mitigation projects or activities identified in their jurisdictional annexes (Section 9), by contacting persons responsible for initiating and/or overseeing the mitigation projects.

In the first year of the performance period, this will be accomplished by utilizing an online performance progress reporting system, the BATool[SM], which will enable jurisdictional and county representatives to directly access mitigation initiatives to easily update the status of each project, document successes or obstacles to implementation, and add or delete

projects to maintain mitigation project implementation. All participating partners will be prompted by the tool to update progress annually, providing an incentive for participants to refresh their mitigation strategies and to continue implementation of projects. This reporting system will support the submittal of an increased number of project grant fund applications due to the functionality of the system, which facilitates the sorting and prioritization of projects.

In addition to progress on the implementation of mitigation actions, including efforts to obtain outside funding, and obstacles or impediments to implementation of actions, the information that Planning Team representatives will be expected to document includes the following:

- Any grant applications filed on behalf of the participating jurisdictions
- Hazard events and losses occurring in their jurisdiction
- Additional mitigation actions believed to be appropriate and feasible
- Public and stakeholder input

Plan monitoring for years 2 through 4 of the plan performance period will be similarly addressed via the BATool[SM] or manually.

7.1.2 Integration of the HMP into Jurisdictional Planning Mechanisms

During the HMP annual review process, each participating jurisdiction will be asked to document how it is incorporating the Franklin County HMP 2023 update into its day-to-day operations and planning and regulatory processes. Additionally, the County will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report. The checklist presented in Table 7-2 was adapted from FEMA's 2023 Local Mitigation Handbook (Appendix B, Worksheet 6). This checklist will help a community analyze how hazard mitigation is integrated into local plans, ordinances, regulations, and policies. Completing the checklist will help the County identify areas that integrate hazard mitigation currently and where to make improvements to reduce vulnerability to future development. In this manner, the integration of mitigation into jurisdictional activities will evolve into an ongoing culture within the County.

Table 7-2. Jurisdictional Capabilities and Integrating the Hazard Mitigation Plan

Planning Mechanisms	Does the jurisdiction do this?		Describe how this is being done or how it can be done.
	Yes	No	
Comprehensive Plan			
Does the future land-use map clearly identify natural hazard areas?			
Do the land use policies discourage development or redevelopment within natural hazard areas?			
Does the plan leave enough space for expected future growth in areas outside natural hazard areas?			
Transportation Plan			
Does the transportation plan limit access to hazard areas?			

Planning Mechanisms	Does the jurisdiction do this?		Describe how this is being done or how it can be done.
	Yes	No	
Is transportation policy used to guide growth to safe locations?			
Are movement systems designed to function under disaster conditions (e.g., evacuation)?			
Does the transportation plan promote compact, mixed-use development near transit hubs and away from high hazard areas?			
Zoning Ordinances			
Does the zoning ordinance conform to the comprehensive plan in terms of discouraging development or redevelopment within natural hazard areas?			
Does the ordinance contain natural hazard overlay zones that set conditions for land use within such zones?			
Does the ordinance prohibit development within, or filling of, wetlands, floodways, and floodplains?			
Is a zoning code in place to encourage resilient development through density bonuses for projects outside of natural hazard areas?			
Do rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use?			
If applicable, is there a wildland-urban interface development code in place to prohibit or limit development in high wildfire risk areas?			
Overlay Districts			
Is a Conservation Overlay Zoning District in place to help protect environmentally sensitive areas?			
Is a Coastal Flood Resilience Overlay District in place to encourage development away from coastlines and floodplains?			
Are there Climate Hazard Overlay Zones in place to identify natural hazard risk areas and assign appropriate zoning ordinances to mitigate or adapt to those hazards?			
Subdivision Regulations			
Do the subdivision regulations restrict the subdivision of land within or next to natural hazard areas?			
Do the regulations provide for conservation subdivisions or cluster subdivisions to conserve environmental resources?			
Do the regulations allow density transfers where hazard areas exist?			
Stormwater Master Plan			
Does the stormwater master plan promote the use of porous building materials through incentive programs?			
Does the stormwater master plan include green stormwater infrastructure in impaired watersheds?			
Does the stormwater master plan include stormwater management best practices in areas that flooding affects the most?			
Does the placement of stormwater management projects prioritize socially vulnerable communities?			
Resilience Plan			
Does the plan identify sea level rise inundation zones, high wildfire risk areas, storm surge inundation zones, or other areas at high risk of natural disaster impacts?			

Planning Mechanisms	Does the jurisdiction do this?		Describe how this is being done or how it can be done.
	Yes	No	
Does the plan develop actions to recover from natural hazard events? Do those actions align with those the local hazard mitigation plan identifies?			
Does the plan identify areas in which socially vulnerable populations and underserved communities have a high risk of exposure to natural hazards? If so, do the actions identified to address that risk align with those in the local hazard mitigation plan?			
Local Environmental Plan			
Does the plan identify and map environmental systems that protect development from hazards?			
Do environmental policies maintain and restore protective ecosystems?			
Do environmental policies encourage development outside of protective ecosystems?			
Public Health and Safety Plan			
Do the goals and policies of the comprehensive plan relate to those of the local hazard mitigation plan?			
Do the plan's growth and development policies clearly address safety?			
Does the monitoring and implementation section of the plan cover safe growth objectives?			
Parks and Recreation Plan			
Does the plan prioritize open green spaces? Are such spaces planned in areas with high impervious surface coverage?			
Does the plan keep in mind the need for tree cover to mitigate the urban heat island effect? Are tree cover expansion projects planned in high-heat areas?			
Capital Improvements Plan			
Does the capital improvement program limit spending on projects that would encourage development in areas vulnerable to natural hazards?			
Do infrastructure policies limit extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards?			
Does the capital improvement program provide funding for hazard mitigation projects identified in the FEMA Mitigation Plan?			
Climate Action Plan			
Does the plan have specific and measurable targets for carbon emissions reduction?			
Does the plan include realistic and actionable strategies for reducing carbon emissions?			
Building Codes			
Does the building code have provisions to strengthen or elevate construction to withstand hazard forces?			
Are there building codes in place that meet or exceed those outlined in the National Flood Insurance Program's guidelines for safe building practices?			
Do existing building codes include development standards for withstanding storm surge, wind damage, earthquakes, or other relevant natural hazards?			
Economic Development Plan			
Do economic development or redevelopment strategies include provisions for mitigating natural hazards?			

Planning Mechanisms	Does the jurisdiction do this?		Describe how this is being done or how it can be done.
	Yes	No	
Emergency Action Plan			
Is there an adopted evacuation and shelter plan to deal with emergencies from natural hazards?			
Are evacuation routes located outside of floodplains, sea level rise inundation zones, or liquefaction zones?			
Are there emergency communication systems in place? Are those systems deployed in areas with the highest potential hazard exposure?			
Integrated Watershed Management Plan			
Does the plan include policies that restrict development that would increase downstream flooding?			
Does the plan include policies that restrict development that would increase sedimentation or erosion?			

7.1.3 Evaluating

The evaluation of the mitigation plan is an assessment of whether the planning process and actions have been effective, whether the HMP goals are being achieved, and whether changes are needed. The HMP will be evaluated on an annual basis to determine the effectiveness of the programs and to reflect changes that could affect mitigation priorities or available funding.

The status of the HMP will be discussed and documented at an annual plan review meeting of the Planning Team, to be held either in person or via teleconference approximately one year from the date of local adoption of this update, and successively thereafter. At least two weeks before the annual plan review meeting, the Franklin County HMP Coordinator will advise Planning Team members of the meeting date, agenda, and expectations of the members.

The Franklin County HMP Coordinator will be responsible for calling and coordinating the annual plan review meeting and soliciting input regarding progress toward meeting plan goals and objectives. These evaluations will assess whether:

- Goals and objectives address current and expected conditions.
- The nature or magnitude of the risks has changed.
- Current resources are appropriate for implementing the HMP or different or additional resources are now available.
- Actions were cost-effective.
- Schedules and budgets are feasible.
- Implementation problems are present, such as technical, political, legal, or coordination issues with other agencies.
- Outcomes have occurred as expected.
- Changes in County resources impacted plan implementation (e.g., funding, personnel, and equipment).
- New agencies, departments, or staff should be included, including other local governments as defined under 44 CFR 201.6.

Specifically, the Planning Team will review the mitigation goals, objectives, and activities using performance-based indicators, including the following:

- New agencies or departments
- Project completion
- Under- or over-spending
- Achievement of the goals and objectives
- Resource allocation
- Timeframes
- Budgets
- Lead and support agency commitment
- Resources
- Feasibility

Finally, the Planning Team will evaluate how other programs and policies have conflicted with or augmented planned or implemented measures, and will identify policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions (Section 7.2 discusses this process). Other programs and policies can include those that address the following:

- Economic development
- Environmental preservation
- Historic preservation
- Redevelopment
- Health and safety
- Recreation
- Land use and zoning
- Public education and outreach
- Transportation

The Planning Team should refer to the evaluation forms in the FEMA 386-4 guidance document (Worksheets #2 and #4) to assist in the evaluation process (see Appendix F – Plan Maintenance). The Planning Team also should refer to any process and deliverables developed by the County as a part of the review of prior or existing local HMPs within the County.

The Franklin County HMP Coordinator will be responsible for preparing an Annual HMP Progress Report for each year of the performance period, based on the information provided by the local Planning Team members, information presented at the annual Planning Team meeting, and other information as appropriate and relevant. These annual reports will provide data for the five-year update of this HMP and will assist in pinpointing any implementation challenges. By monitoring the implementation of the HMP on an annual basis, the Planning Team will be able to assess which projects are completed, which are no longer feasible, and what projects should require additional funding.

The Annual HMP Progress Report will be posted on Franklin County's website (https://www.fcemhs.org) to keep the public apprised of the plan's implementation. The website also provides details on the HMP update planning process. Communities in the CRS program can use this report to meet annual CRS recertification requirements. To meet this recertification timeline, the Planning Team will strive to complete the review process and prepare an Annual HMP Progress Report by January 31 each year.

The HMP will also be evaluated and revised following any major disasters, to determine if the recommended actions remain relevant and appropriate. The risk assessment will also be revisited to see if any changes are necessary based on the pattern of disaster damage or if data listed in Section 4.3 of this plan (Hazard Profiles) has been collected to facilitate the risk assessment. This is an opportunity to increase the community's disaster resistance and build a better and stronger community.

7.1.4 Updating

To facilitate the update process, the Franklin County HMP Coordinator, with support of the Planning Team, will use the second annual meeting to develop and commence the implementation of a detailed plan update program. The Franklin County HMP Coordinator will invite representatives from Ohio EMA to this meeting to provide guidance on plan update procedures. This program will, at a minimum, establish who will be responsible for managing and completing the plan update effort, what needs to be included in the updated plan, and a detailed timeline with milestones to ensure that the update is completed according to regulatory requirements.

At this meeting, the Planning Team will determine what resources will be needed to complete the update. The Franklin County HMP Coordinator will be responsible for assuring that needed resources are secured.

Following each five-year update of the mitigation plan, the updated plan will be distributed for public comment. After all comments are addressed, the HMP will be revised and distributed to the Planning Team and the State of Ohio State Hazard Mitigation Officer.

7.1.5 Grant Monitoring and Coordination

Franklin County recognizes the importance of having an annual coordination period that helps each planning partner become aware of upcoming mitigation grant opportunities and identifies multi-jurisdiction projects to pursue. Grant monitoring will be the responsibility of each jurisdictional partner as part of their annual progress reporting. The Franklin County HMP Coordinator will keep the Planning Team apprised of FEMA Hazard Mitigation Assistance grant openings and assist in developing letters of intent for grant opportunities when practicable.

Franklin County intends to be a resource to the Planning Team in the support of project grant writing and development. The degree of this support will depend on the level of assistance requested by the partnership during open windows for grant applications. As part of grant monitoring and coordination, Franklin County intends to provide the following:

- Notification to Planning Team about impending grant opportunities

- A current list of eligible, jurisdiction-specific projects for funding pursuit consideration
- Notification about mitigation priorities for the fiscal year to assist the Planning Team in the selection of appropriate projects

Grant monitoring and coordination will be integrated into the annual progress report or as needed based on the availability of non-HMA or post-disaster funding opportunities.

7.2 IMPLEMENTATION OF MITIGATION PLAN THROUGH EXISTING PROGRAMS

Effective mitigation is achieved when hazard mitigation approaches and strategies become an integral part of public activities and decision-making. Many existing County plans and programs support hazard risk mitigation, and thus it is critical that this hazard mitigation plan integrate, coordinate with, and complement, those existing plans and programs.

Section 5 (Capability Assessment) provides a summary and description of the existing plans, programs, and regulatory mechanisms at the federal, state, and county levels of government that support hazard mitigation within the County. Each jurisdictional annex in Section 9 identifies how each local capability reduces risk and how the jurisdictions are integrating hazard mitigation into their existing planning, regulatory, and operational/administrative framework. For jurisdictions not currently achieving this, the annexes indicate how they intend to promote this integration.

Planning Team representatives will work with local government officials to integrate the newly adopted hazard mitigation goals and actions into the general operations of government and partner organizations. The sample adoption resolution in Appendix A (Adoption Resolutions) includes a resolution item stating the intent of the local governing body to incorporate mitigation planning as an integral component of government and partner operations. By doing so, the Core Planning Team anticipates the following:

- Hazard mitigation planning will be formally recognized as an integral part of overall emergency management efforts.
- The HMP, comprehensive plans, emergency operations plans and other relevant planning mechanisms will become mutually supportive documents that work in concert to meet the goals and needs of county residents.

Other planning processes and programs to be coordinated with the recommendations of the hazard mitigation plan include the following:

- Emergency operations and response plans
- Training and exercise of emergency response plans
- Debris management plans
- Recovery plans
- Capital improvement programs
- Jurisdictional codes

- Community design guidelines
- Water-efficient landscape design guidelines
- Stormwater management programs
- Water system vulnerability assessments
- Community wildfire protection plans
- Comprehensive flood hazard management plans
- Resiliency plans
- Community Development Block Grant-Disaster Recovery action plans
- Public information/education plans

Some action items do not need to be implemented through regulation. Instead, they can be implemented through the creation of new educational programs, continued interagency coordination, or improved public participation.

During the annual plan evaluation process, the Planning Team representatives will identify additional policies, programs, practices, and procedures that could be modified to accommodate hazard mitigation actions and include these findings and recommendations in the Annual HMP Progress Report.

7.3 CONTINUED PUBLIC INVOLVEMENT

Franklin County and participating jurisdictions are committed to the continued involvement of the public in the hazard mitigation process. This HMP update will continue to be posted on-line (https://www.franklincountyohhmp.com). In addition, public outreach and dissemination of the HMP will include the following:

- Links to the plan on websites of each jurisdiction with capability
- Continued utilization of existing social media outlets (Facebook, Twitter) to inform the public of natural hazard events, such as floods and severe storms, and public education via the jurisdictional websites on how these applications can be used in an emergency situation
- Development of annual articles or workshops on flood hazards to educate the public and keep them aware of the dangers of flooding

The Franklin County HMP Coordinator will be responsible for receiving, tracking, and filing public comments regarding this HMP. The public will have an opportunity to comment on the plan via the hazard mitigation website at any time. The HMP Coordinator will maintain this website, posting new information and maintaining an active link to collect public comments.

The public can also provide input at the annual review meeting for the HMP and during the next five-year plan update. The Franklin County HMP Coordinator is responsible for coordinating the plan evaluation portion of the meeting, soliciting feedback, collecting and reviewing the comments, and ensuring their incorporation in the five-year plan update as appropriate. Additional meetings might be held as deemed necessary by the Planning Team to provide the public an opportunity to express concerns, opinions, and ideas about the mitigation plan.

The HMP Coordinator and Planning Team representatives will be responsible for ensuring the following:

- Public comment and input on the plan, and hazard mitigation in general, are recorded and addressed, as appropriate.
- Copies of the latest approved plan (or draft in the case that the five-year update effort is underway) are available for review, along with instructions to facilitate public input and comment on the HMP.
- Appropriate links to the Franklin County Hazard Mitigation Plan webpage are included on jurisdictional websites.
- Public notices are made as appropriate to inform the public of the availability of the plan, particularly during HMP update cycles.

ACRONYMS AND ABBREVIATIONS

A

ACS – American Community Survey

AEP – American Electric Power

AIA– American Institute of Architects

AICP – American Institute Certified Planner

AIDS – Acquired Immunodeficiency Syndrome

ALB – Asian Long horned Beetle

ARP– American Rescue Plan Program

ARPA– American Rescue Plan Act

B

BCA – Benefit Cost Analysis

BCEGS– Building Code Effectiveness Grading Schedule

BEAP– Building Emergency Action Plan

BFE– Base Flood Elevation

BMI – Body Mass Index

BOCA – Building Officials Code Administration

BRIC – Building Resilient Infrastructure and Communities

BZBA– Board of Zoning and Building Appeals

BZA– Board of Zoning Appeals

C

C – City

CAC– Community Assistance Contact

CAV– Community Assistance Visit

CDBG– Community Development Block Grant

CDC – Centers for Disease Control and Prevention

CRS – Community Rating System

CDMS – Comprehensive Data Management System

CEMP– Comprehensive Emergency Management Plan

CERT– Citizens Emergency Response Team

CFM– Certified Floodplain Manager

CFR – Code of Federal Regulations

CIP– Capital Improvements Program

CIMS– Communication and Information Management System

CMH– John Glenn Columbus International Port

COCIC– Central Ohio Community Improvement Corporation

COG– Central Ohio Greenway

COMTO – Conference of Minority Transportation Officials

COOP– Continuity of Operations Plan

COPD – Chronic Obstructive Pulmonary Disease

COTA – Central Ohio Transit Authority

COVID – Coronavirus

CPI– Communications and Public Information

CPT – Core Planning Team

CRREL – Cold Regions Research and Engineering Laboratory

CRS– Community Rating System

CSV– Comma Separated Values

CWRR– Community Wildfire Risk Reduction

D

DEM – Digital Elevation Model

DHS – Department of Homeland Security

DFIRM – Dynamic Flood Insurance Rate Map

DMA – Disaster Mitigation Act

DNR– Department of Natural Resources

DOSD– Division of Sewerage and Drainage

DOT – Department of Transportation

DPU– Department of Public Utilities

DR – Disaster Declaration

E

EAB – Emerald Ash Borer

EAP– Education and Awareness Program

EAP– Emergency Action Plans

EDP– Economic Development and Planning

EDSP– Economic Development Strategic Plan

EF-Scale – Enhanced Fujita Scale

EI – Erodibility Index

EM&HS – Emergency Management and Homeland Security

EM – Emergency Declaration

EMA– Emergency Management Agency

EMC – Emergency Management Coordinator

EMPG– Emergency Management Performance Grants

EMS – Emergency Medical Services

EOC– Emergency Operations Center

EOP– Emergency Operations Plan

ES– Emergency Services

ESG– Emergency Shelter Grant

ESRI – Environmental Systems Research Institute

EWP– Emergency Watershed Protection

F

FCPC– Franklin County Planning Commission

FCPH– Franklin County Public Health

FD– Fire Department

FEMA – Federal Emergency Management Agency

FIRM – Flood Insurance Rate Map

FITS– Facilities Information Technologies Services

FOD– Facilities and Operations Development

FPMS– Flood Plain Management Services

FLOW – Friends of the Lower Olentangy Watershed

FMA – Flood Mitigation Assistance

FSA – Farm Service Agency

FTA– Federal Transit Authority

G

GFA– General Flood Area

GIS – Geographic Information System

H

HAB – Hazardous Agal Bloom

HAZUS-MH – Hazards United States Multi-Hazard

HHPD– High Hazard Potential Dams

HIV – Human Immunodeficiency Virus

HMA – Hazard Mitigation Assistance

HMGP – Hazard Mitigation Grant Program

HMP – Hazard Mitigation Plan

HMA– Hazard Mitigation Assistance

HOPWA– Housing Opportunities for Persons with AIDS

HSGP– Homeland Security Grant Program

HUD– Department of Housing and Urban Development

HVAC – Heating, Ventilation, and Air Conditioning

HWA – Hemlock Woolly Adelgid

I

IA– Individual Assistance

ICU – Intensive Care Unit

ICS– Incident Command System

ID – Information Document

ID– Identification

IDDE– Illicit Discharge Detection and Elimination

ILO– Ohio Intelligence Liaison Office

IPAWS – Integrated Public Alert and Warning System

IPCC– International Panel on Climate Change

ISO– International Organization for Standardization

J

None

K

KBDI – Keetch Byram Drought Index

L

LCK– Rickenbacker Ilans Port

LEED– Leadership in Energy and Environmental Design

LLC – Limited Liability Company

LOMR– Letter of Map Revision

LPP – Local Protection Project

LPR– Local Plans and Regulations

M

MF– Multi Family

MH– Multi-Hazard

MMI – Modified Mercalli Intensity

MMR– Measles, Mumps, Rubella

MORPC – Mid-Ohio Regional Planning Commission

MPH – Miles per Hour

MRLC – Multi-Resolution Land Characteristics

MRP – Mean Return Period

MTA– Metropolitan Transit Authority

MWCD– Muskingum Watershed Conservancy District

N

NA– Not Applicable

NAACP – National Association for the Advancement of Colored People

NASA – National Aeronautics and Space Administration

NCDC – National Climatic Data Center

NCEI – National Centers for Environmental Information

NDMC – National Drought Mitigation Center

NEHRP – National Earthquake Hazard Reduction Program

NFIP – National Flood Insurance Program

NFPA – National Fire Protection Association

NFWF– National Fish & Wildlife Foundation

NGWSGP– Next Generation Warning System Grant Program

NHC – National Hurricane Center

NID – National Inventory of Dams

NIST – National Institute of Standards and Technology

NLD – National Levee Database

NOAA – National Oceanic and Atmospheric Administration

NPDES– National Pollution Discharge Elimination System

NPS – National Park Service

NPL– National Priorities List

NR– None Reported

NR– Natural Resources

NRPA– National Recreation and Park Association

NRS – Natural Resources Conservation Service

NRI – National Resources Inventory

NSP– Natural Systems Protection

NSSL – National Severe Storms Laboratory

NWS – National Weather Service

O

OHC– Ohio Administrative Code

OBC– Ohio Building Code

ODA– Ohio Department of Agriculture

ODH – Ohio Department of Health

ODNR – Ohio Department of Natural Resources

ODOT– Ohio Department of Transportation

ODPS – Ohio Department of Public Safety

OH - Ohio

Ohio EMA – Ohio Emergency Management Agency

Ohio EPA – Ohio Environmental Protection Agency

ORC– Ohio Revised Code

OSI– Open Space Institute

OSU – Ohio State University

OT– Overtime

P

PA– Public Assistance

PD– Police Department

PDM – Pre-Disaster Mitigation

PDSI – Palmer Drought Severity Index

PFM– Public Facilities Management

PGA – Peak Ground Acceleration

PI– Public Information

PO– Post Office

PP– Property Protection

PR– Preventative Measures

PROS– Parks, Recreation, and Open Space

PPE– Personal Protective Equipment

PTCC– Prairie Township Community Center

PZC– Planning and Zoning Commission

Q

None

R

RCO– Residential Code of Ohio

RCV – Replacement Cost Value

RL – Repetitive Loss

RLI– Resilient Landscapes Initiative

RSI – Regional /snowfall Index

S

SARS – Severe Acute Respiratory Syndrome

SBA– Small Business Administration

SF– Single Family

SFHA – Special Flood Hazard Area

SGIA– Smart Growth Implementation Assistance

SIP– Structure and Infrastructure Project

SP– Structural Flood Control Projects

SPC – Storm Prediction Center

SRL – Severe Repetitive Loss

STACC– Statewide Terrorism Analysis & Crime Center

STAPLEE – Social, Technical, Administrative, Political, Legal, Economic, and Environmental

STEP– Prescribed Fire Supplies, Tools, Education, & Personal Protective Equipment

SVI– Social Vulnerability Index

SW– South Western

SWAP – Source Water Assessment and Protection

SWACO– Solid Waste Authority of Central Ohio

SWCD – Soil and Water Conservation District

SWMP– Stormwater Management Program

SWOO – Strengths, Weaknesses, Obstacles, and Opportunities

T

TBD – To Be Determined

THIRA– Threat & Hazard Identification & Risk Assessment

TMDL– Total Maximum Daily Load

TORRO – Tornado and Storm Research Organization

TWP – Township

U

UDO– Unified Development Ordinance

US – United States

USA – United States of America

USACE – United Stated Army Corps of Engineers

USDA – United States Department of Agriculture

USDM – United States Drought Monitor

USEPA – United States Environmental Protection Agency

USFS – United States Forest Service

USGCRP – Unites States Global Change Research Program

USGS – United States Geographical Survey

V

V – Village

VE Zone – Coastal High Hazard Area

VFD – Volunteer Fire Department

VIPS– Volunteers in Police Service

VP– Vice President

W

WARN– Water/Wastewater Agency Response Networks

WCT – Wind Chill Temperature

WCLPP– West Columbus Local Protection Project

WFAS – Wildland Fire Assessment System

WHO – World Health Organizations

WNV – West Nile Virus

WTFD– Washington Township Fire Department

WUI – Wildland Urban Interface

WWTP– Wastewater Treatment Plant

X

None

Y

None

Z

None

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None

SECTION 2 – PLANNING PROCESS

None

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SECTION 4 – RISK ASSESSMENT

4.1 HAZARDS OF CONCERN IDENTIFICATION

None

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SECTION 9 –

9.1 FRANKLIN COUNTY JURISDICTIONAL ANNEX

None

9.2 BEXLEY (C) JURISDICTIONAL ANNEX

None

9.3 BLENDON (TWP) JURISDICTIONAL ANNEX

None

9.4 BRICE (V) JURISDICTIONAL ANNEX

None

9.5 BROWN (TWP) JURISDICTIONAL ANNEX

None

9.6 CANAL WINCHESTER (C) JURISDICTIONAL ANNEX

None

9.7 CLINTON (TWP) JURISDICTIONAL ANNEX

None

9.8 COLUMBUS (C) JURISDICTIONAL ANNEX

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9.9 DUBLIN (C) JURISDICTIONAL ANNEX

None

9.10 FRANKLIN (TWP) JURISDICTIONAL ANNEX

None

9.11 GAHANNA (C) JURISDICTIONAL ANNEX

None

9.12 GRANDVIEW HEIGHTS (C) JURISDICTIONAL ANNEX

None

9.13 GROVE CITY (C) JURISDICTIONAL ANNEX

None

9.14 GROVEPORT (C) JURISDICTIONAL ANNEX

None

9.15 HAMILTON (TWP) JURISDICTIONAL ANNEX

Warren County Regional Planning Commission. 2021. "Hamilton Township Comprehensive Plan 2020." January. https://drive.google.com/file/d/1-qoN1NL6Ltbb2znLuX3BL_TG9fKSIKLS/vie.

9.16 HARRISBURG (V) JURISDICTIONAL ANNEX

None

9.17 HILLIARD (C) JURISDICTIONAL ANNEX

None

9.18 JACKSON (TWP) JURISDICTIONAL ANNEX

None

9.19 JEFFERSON (TWP) JURISDICTIONAL ANNEX

None

9.20 LOCKBOURNE (V) JURISDICTIONAL ANNEX

Village of Lockbourne. n.d. Our Story. Accessed December 19, 2022. https://www.lockbourneohio.us/our-story.

9.21 MADISON (TWP) JURISDICTIONAL ANNEX

None

9.22 MARBLE CLIFF (V) JURISDICTIONAL ANNEX

Village of Marble Cliff. n.d. *Village of Marble Cliff.* https://marblecliff.org/.

9.23 MIFFLIN (TWP) JURISDICTIONAL ANNEX

None

9.24 MINERVA PARK (V) JURISDICTIONAL ANNEX

None

9.25 NEW ALBANY (C) JURISDICTIONAL ANNEX

None

9.26 NORWICH (TWP) JURISDICTIONAL ANNEX

None

9.27 OBETZ (C) JURISDICTIONAL ANNEX

None

9.28 PERRY (TWP) JURISDICTIONAL ANNEX

None

9.29 PLAIN (TWP) JURISDICTIONAL ANNEX

None

9.30 PLEASANT (TWP) JURISDICTIONAL ANNEX

None

9.31 PRAIRIE (TWP) JURISDICTIONAL ANNEX

None

9.32 REYNOLDSBURG (C) JURISDICTIONAL ANNEX

None

9.33 SHARON (TWP) JURISDICTIONAL ANNEX

None

9.34 TRURO (TWP) JURISDICTIONAL ANNEX

None

9.35 UPPER ARLINGTON (C) JURISDICTIONAL ANNEX

None

9.36 URBANCREST (V) JURISDICTIONAL ANNEX

None

9.37 VALLEYVIEW (V) JURISDICTIONAL ANNEX

None

9.38 WASHINGTON (TWP) JURISDICTIONAL ANNEX

Washington Township. 2022. About Us. December 15. https://wtwp.com/about-us/.

9.39 WESTERVILLE (C) JURISDICTIONAL ANNEX

None

9.40 WHITEHALL (C) JURISDICTIONAL ANNEX

None

9.41 WORTHINGTON (C) JURISDICTIONAL ANNEX

None

9.42 THE OHIO STATE UNIVERSITY JURISDICTIONAL ANNEX

None