

Highland County, OH

Countywide All-Natural Hazards Mitigation Plan

2024-2028

DRAFT 10/12/23

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Table of Contents:

EXECUTIVE SUMMARY 1

1.0 INTRODUCTION.....2

 1.1 Planning Approach4

 1.2 Participating Communities4

2.0 COMMUNITY INFORMATION6

 2.1 County Profile6

 2.2 County History7

 2.3 Jurisdictions **Error! Bookmark not defined.**

 2.4 Census Information 11

 2.5 County Land Use and Future Land Use 13

 2.6 Utilities 17

3.0 COUNTYWIDE ALL NATURAL HAZARDS MITIGATION PLANNING PROCESS20

 3.1 Mission Statement20

 3.2 Notification Process20

 3.3 Groups20

 3.4 Core Group Meetings21

 3.5 Public Update Meetings..... 26

 3.6 Finalization26

 3.7 Summary of Community Policies, Programs and Resources.....26

 3.8 Incorporation of Existing Plans, Studies, Reports and Technical Data.....28

4.0 HAZARD PROFILE29

 4.1 Initial Hazard Assessment29

 4.2 Risk Assessment Ranking30

 4.3 Summer Storms – Thunderstorms/High Winds/ Hail/Lightening30

 4.4 Winter Storms-Snow/Ice/Extreme Cold33

 4.5 Flooding36

 4.6 Extreme Heat40

 4.7 Tornadoes41

 4.8 Droughts /Wildfires45

 4.9 Earthquakes48

 4.10 Dam Failure51

5.0 VULNERABILITY ASSESSMENT54

 5.1 Critical Facilities556

 5.2 Potential Dollars Lost56

 5.3 Vulnerability Data Collection 58

 5.4 Vulnerability Assessment by Hazard59

6.0 GOALS AND ACTION ITEMS76

7.0 HAZARD MITIGATION PRACTICES84

 7.1 Property Protection84

 7.2 Preventive Measures85

 7.3 Natural Resource Protection91

7.4 Emergency Services.....97
7.5 Flood Control 100
7.6 Public Information 102
8.0 RESOLUTION OF ADOPTION 105

LIST OF APPENDICES

- Appendix A – Meeting Notices
- Appendix B – HIRA Documents
- Appendix C – Meeting Agendas, Sign in Sheets, Other Meeting Materials
- Appendix D – Community Survey
- Appendix E – Maps
- Appendix F – Critical Facilities List
- Appendix G – Historical Occurrence Data (NCEI), National Risk Assessment
- Appendix H – Resolutions of Adoption
- Appendix I -- Climate Change and other vulnerability data

EXECUTIVE SUMMARY



The Highland County Emergency Management Agency/Office of Homeland Security spearheaded this effort to complete a comprehensive countywide All Natural Hazard Mitigation Plan. Their dedication to this mitigation planning effort is seen in the results of having full participation from the County as well as the incorporated jurisdictions.

Highland County is subject to natural hazards that threaten life and health and have caused extensive property damage. To better understand these natural hazards and their impacts on people and property and to identify ways to reduce those impacts, the County's Emergency Management Agency (EMA) undertook this countywide Mitigation Plan.

Most mitigation activities need funding. Under the Disaster Mitigation Act of 2000 (DMA2K, 42 USC 5165), a mitigation plan is a requirement for Federal mitigation funds. Therefore, a mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from the Department of Homeland Security's Federal Emergency Management Agency (FEMA). This Mitigation Plan meets the criteria as set forth by FEMA in the DMA2K, as revised, and provides a community with a "comprehensive guide" for future mitigation efforts as they relate to the hazards that affect their community.

This Mitigation Plan was developed under the guidance of a Core Group of individuals from communities and agencies throughout Highland County. The Core Group met four separate times during the planning process to discuss the hazards that affect the County, the problems associated with these hazards, potential mitigation alternatives to minimize the effect of these hazards and goals that they would like to see achieved within the County.

Highland County has experienced many natural disasters in the past 100 years. The Core Group evaluated these hazards and chose to address the following hazards based on their impact on human health and property damage: summer storms (thunderstorms, high winds, hail and lightning), winter storms (snow, ice and extreme cold), flooding and 100-year flooding (associated with National Floodplain Insurance Program (NFIP) map), landslides, tornadoes, droughts/wildfires, extreme heat, earthquakes, and dam failure.

With the hazards identified, a vulnerability assessment was completed for Highland County. This assessment reviews how vulnerable the County is to property damage, threats to public health and safety, and adverse impact on the local economy. It also evaluates the location and likely damage to critical facilities and other structures from different scenarios of strikes by the nine (9) priority hazards.

The culmination of Highland County's Mitigation Plan was an Action Plan for the communities to identify project leadership and resources, and track progress on the implementation of their mitigation activities.

1.0 INTRODUCTION

A mitigation plan addresses natural disasters that could affect a local community, whether it is flooding, tornadoes, high winds, winter storms, landslides, or some other natural disaster. A mitigation plan is an administrative document that is issued to establish activities that should reduce or, when possible, eliminate long-term risk to human life and property. The plan will also provide a community with a “comprehensive guide” for future mitigation efforts as they relate to the hazards that affect their county. By developing a mitigation plan, a community can identify their areas of risk, assess the magnitude of the risk and develop strategies and priorities to identify projects for reducing risk. Regular updating of this Plan is paramount in maintaining a current view of County conditions and issues relating to natural disasters and how these specific conditions and issues may change over time.

The Highland County Commissioners supported developing both their initial All Natural Hazards Mitigation Plan (Mitigation Plan), as well as the Plan updates, with funds received from Ohio Emergency Management Agency (OEMA) and the Federal Emergency Management Agency (FEMA).

This planning effort was specifically designed to update the Highland Co Pre-Disaster Mitigation (PDM) plan for the five (5) year period of 2024 to 2028.

As part of the Disaster Mitigation Act of 2000 (DMA2K, 42 USC 5165), communities that desire to remain eligible for Federal and State mitigation funds must have an approved mitigation plan in place.

According to the DMA2K, incorporated jurisdictions within a county must participate as well as representatives from the unincorporated areas. Townships are not required to participate because the county commissioners can represent them on mitigation projects. However, if a township would like to take an active part by submitting a hazard mitigation project, then their participation in the planning effort is crucial. Local participation is “key” to the successful implementation of these mitigation plans.

If a community chooses not to participate in the mitigation planning effort, the community becomes ineligible for any future federal or state mitigation money. This mitigation money usually comes in the form of a grant such as the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA) or the PDM Grant Program, which is to be used to implement mitigation strategies and activities. Examples of eligible activities that could be supported by mitigation dollars include relocation, acquisitions, elevation, dry-flood proofing, wet-flood proofing, lightning prediction systems, interoperable siren systems, stream restorations or any other activity potentially funded with mitigation dollars.

To proceed with the revision of a locally initiated Natural Hazard Mitigation Plan, the County selected as a planning model the **Ohio Natural Hazard Mitigation Planning Guidebook**, which was developed cooperatively by the Ohio Emergency Management Agency (OEMA) and the Ohio Department of Natural Resources (ODNR). The planning model for this effort incorporates the following components:

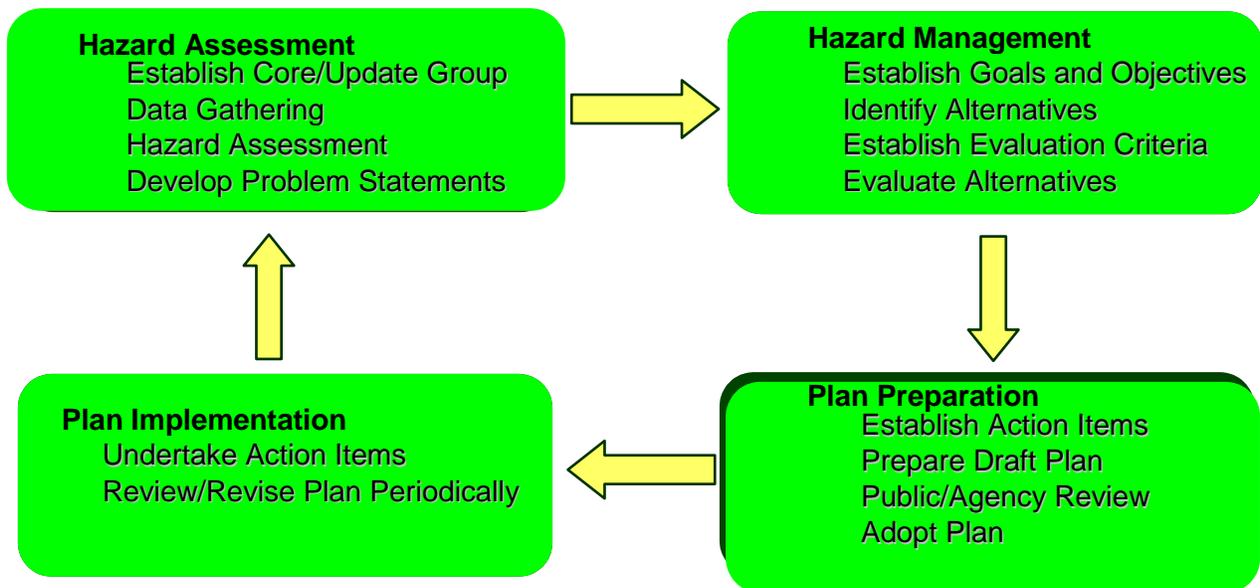
1. Introduction
2. County Profile
3. Mitigation Plan Process

4. Hazard Profile
5. Vulnerability Assessment
6. Goals and Actions
7. Mitigation Plan Maintenance and Schedule
8. Resolution to Adapt

New requirements for this plan revision include consideration of vulnerable populations and climate change impacts on the County.

Below is the typical Natural Hazard Mitigation Planning Process that was followed:

NATURAL HAZARD MITIGATION PLANNING PROCESS



In addition to this process, the Core Group and the designated leaders of the group made sure that every community that participated in this planning effort was aware of their responsibilities as well as how they could represent their community the best. Some suggestions that were incorporated into the initial invitation to participate in the natural hazard mitigation planning effort included:

- Participate in the Core/Update Group planning meetings representing the community's interests
- Supply any historic information (background) on natural disasters for the community to the Core Group
- Review and comment on the Draft Mitigation Plan
- Review and select mitigation activities developed by the Core Group for the community to implement
- Be an advocate for Final Adoption of the Mitigation Plan by the community

1.1 Planning Approach

To continue to meet the mission of protecting lives, property, economic viability and quality of life for the people of Highland County, the County Commissioners desired to create the Highland County Mitigation Plan for their community and its residents. Highland County authorized the engineering firm EMH&T, Inc. to help them fulfill this task in the development of the initial Plan. Regarding this five-year Plan updates, the County Commissioners contracted with a mitigation planning consultant, RFG Associates Inc., to assist in developing the 2019-2023 Mitigation Plan Update. RFG Associates Inc. was again selected to facilitate the 2024-2028 Mitigation Plan Update.

The approach undertaken in the creation of the Mitigation Plan for Highland County can be described as both comprehensive and collaborative. The comprehensive approach includes following the interim final rule guidelines enacted under the DMA2K and FEMA suggested guidelines for the creation of a mitigation plan. Any additional items that Highland County and the Core and Update Groups chose to address as part of the comprehensive analysis of their community were addressed as well.

The collaborative portion of creating the plan included working with the different agencies within Highland County and coordinating with all participating jurisdictions. The County could not have a comprehensive plan without the coordination of several other agencies. Information was collected from agencies such as the Highland County Emergency Management Agency (EMA), Highland County Floodplain Administration, the Highland County Planning Office and any other agencies that were involved in planning efforts for the County.

1.2 Participating Communities

Highland County has six incorporated areas within its borders. Six (6) of the seven (7) incorporated communities chose to participate in this planning effort. The Village of Sinking Springs chose not to participate in this planning effort and are not included in this report. The Highland County EMA, in coordination with their consultant, developed a comprehensive survey for each of these villages to complete and return with mitigation planning information specific to their community. Each of these communities was also contacted for involvement in the selection of problem statements and mitigation alternatives. See Appendix A for meeting notices, Appendix C for a list of meeting attendees and Appendix D for completed community surveys.

The process to create the Mitigation Plan started with the creation of a “Mitigation Core Group” of decision makers and implementers. To lead the planning efforts effectively and on a countywide basis, other representatives were added. The Core Group included:

The following chart identifies all participants on the Core Group:

Name	Affiliation
Shawn Adkin	City of Hillsboro
David Manning	PCJEFD Chief
Jared Warner	Health Commissioner
Christian Dunlap	Dep. Engineer, HCE
Gary Martin	GIS
Chris Fauber	Planning commission
David Daniels	Commissioner
Brad Rodes	Commissioner
Terry Britton	Commissioner
Chief Stevens	LEPC
Todd Wilkin	Greenfield City Manager
John Levo	Citizen/Ham Radio
David Troyer	Amish
Ammon Colblentz	Amish
Chuck Williams	Watershed District
Kathy Brunis	OSU Extension
Terry Burden	Lynchburg Mayor
Kerry McElwee	Sinking Springs Mayor
Jeremy Kibbey	Highland Mayor
James Allen	Mowrystown Mayor
Dave Bushelman	Highland Co EMA
Melissa Havens	Fayette Co EMA
Pam Bushelman	Manager, SWCD
Nathen Burns	Resource Specialist, SWCD
Eric Danik	Chief, HPD
Julie Bolender	HC Econ Development
Tom Royster	Adena Greene Med Center
Brianne Abbott	City of Hillsboro
Jamie Wheeler	Chamber of Commerce
Tim Parry	Highland Dist. Hospital
Donnie Barrera	Sheriff

2.0 COMMUNITY INFORMATION

As required by DMA2K, a community profile must be developed for the County and any jurisdiction participating in this effort. Because of the multiple jurisdictions involved in this plan, this section presents a demographic as well as historical description, if available, of each jurisdiction that will be adopting this plan. This brief profile of each jurisdiction gives some insight as to what types of communities exist in the county and provides a better understanding of the effect natural hazards, to be discussed in later sections, may have on this population. In numerous cases, the communities themselves provided the information that follows.

2.1 County Profile

Highland County is located in southwestern Ohio. The County is comprised of hilly topography, lying between the Little Miami and Scioto rivers. Located north of the Village of Sinking Spring is the highest point of elevation in the County: 1,343 feet above sea level. Highland County is bordered by Fayette and Clinton counties to the north, Ross and Pike counties to the east, Adams and Brown counties to the south and Brown and Clinton counties to the west. The County is comprised of 553 square miles of land. There are 17 townships located in Highland County and are as follows: Brushcreek, Clay, Concord, Dodson, Fairfield, Hamer, Jackson, Liberty, Madison, Marshall, New Market, Paint, Penn, Salem, Union, Washington and White Oak.



The incorporated areas of Highland County include the City of Hillsboro and Village of Greenfield and the Villages of Highland, Leesburg, Lynchburg, Mowrystown and Sinking Spring. According to the 2020 Census estimate, the largest areas of population are Hillsboro (6,481) and Greenfield (4,339). The County Seat of Highland County is located in the City of Hillsboro. The other incorporated jurisdictions in the order of descending population include Lynchburg, Leesburg, Mowrystown and Sinking Spring. Each City and Village has a mayor and council form of government. Hillsboro, Greenfield, Lynchburg and Leesburg have their own police and fire departments. The other Villages rely on the County sheriff's department and the township fire departments.

The Highland Chamber of Commerce is a volunteer organization of business and professional men and women. There are 16 men and women who serve on the Board of Directors and are involved with the policymaking for the County. Board members can serve for an unlimited term. The Highland County Board of Commissioners is composed of three commissioners elected at large to four-year terms. The board's primary responsibilities are setting policies and budgeting funds for all County offices. The voters in the County's 17 townships elect four-member boards of trustees who maintain the roads and cemeteries and perform other duties as provided by state law.

Highland County is primarily agricultural in setting and row crops dominate the landscape. The County also contains patches of wooded areas. U.S. Route 62 is the main north-south thoroughfare through the County and passes through the City of Hillsboro. U.S. Route 50 is the main east-west thoroughfare in the County, and also passes through the City of Hillsboro.

From 2019-2022 the leading industries in Highland County were service, manufacturing, shipping, and retail sales. Other industries employing significant percentages of County residents were transportation, communication, utilities, and trade. According to the Ohio Department of Development (ODOD), the County's major employers include Banta Corporation, the Greenfield and Hillsboro Boards of Education, the Highland District Hospital and Huhtamki Plastics.

2.2 County History

Highland County History

In 1805, Highland County was the twenty-first county to be organized in the southwest sector of Ohio. Its name originated because of the County's location on high land situated between the Little Miami and Scioto Rivers. The County was derived from Ross, Adams and Clermont counties. In 1810, Fayette and Clinton counties were formed and consequently reduced the size of Highland County. In 1813, Highland County's size was again reduced when more land was given to Clinton County. The County originally consisted of four townships, namely Brush Creek, Fairfield, Liberty, and New Market.

Highland County was originally part of the Virginia Military District. In 1781, in return for Virginia surrendering its land claims, Congress granted this section between the Scioto and Miami Rivers to Virginia as payment to its Revolutionary War veterans. The shapes and sizes of the townships were irregular because the Virginia Military District did not survey them into townships. Instead, the land was given to soldiers who could then create the township's natural borders by using the "grapevine method". This method implemented the use of natural springs and water supplies as township borders and eventually led to the saying: "Everything is crooked in Highland County but the people."

In 1795, John Wilcox migrated from Kentucky to become the first settler in the County. He crossed the Ohio River at Maysville, Kentucky and traveled the Zane Trace to Sinking Spring. More settlers came from Virginia and Pennsylvania through Kentucky to farm the land. Also, in 1795, Thomas Beals and Nathaniel Pope settled in the northern portion of Highland County. Other early settlers included Captain James Trimble and John and Asahel Edgington. On September 7, 1791, the first purchase of land was made by Simon Kenton. His property was located three (3) miles east of Hillsboro, near Rocky Fork.

In 1798, Henry Massie platted New Market, making it the first permanent settlement in Highland County. The state legislature made the town the seat of justice when Highland County was formed in 1805. In 1807, Hillsboro was made the County Seat after it was platted by Virginian David Hays. According to the 1807 Census, there were 776 families residing in Highland County at the time.

2.3 Jurisdictions

Greenfield

Greenfield is located in Madison Township. It is situated in northeastern Highland County along State Routes 28, 138 and 753. The City of Greenfield has a total land area of 1.9 mi². As of 2020, estimated populations include 4,339 people, 1,734 households. The population density is

approximately 2,085 people/mi². There are approximately 2,049 housing units in Greenfield. The medium per capita income in Greenfield is \$25,879 and the median household income for the city is \$41,425.

In 1799, Greenfield was founded by Duncan McArthur. In 1802, it was platted in checkerboard squares and a free lot was offered to the first girl and another to the first boy born in the new village. McArthur set aside land for a school, a meeting house and a cemetery. He reserved the lot on the southwest corner of Jefferson and Washington streets for a courthouse and a jail. Settlers began arriving to the area, as early as the spring of 1800, now known as Greenfield. The City of Greenfield was incorporated in 1841.

The early years of Greenfield supported principal industries such as milling, tanning and quarrying. Industrial expansion began when the Baltimore and Ohio Railroad was extended through Greenfield in the late 1850s. In the 1880s, industrial expansion continued when The American Pad and Textile Company was founded by Edward Lee McClain and The Waddell Company, Inc. was founded by John M. Waddell.

Today, the principal industrial products in the City of Greenfield include marine (life-save) equipment, outdoor apparel, shoes, road-building materials, hosiery, office equipment and showcases, machine tools, foundry castings, fire nets, ambulance cots, stretchers, mortuary tables and printing. Agriculture also plays a role in the economy of Greenfield.

Municipally, the City is administered by an elective mayor, a six-member council, clerk, treasurer and a three-member Board of Public Affairs which operates the municipal utilities system.

Highland

Highland is located in Fairfield Township. It is situated in northern Highland County along State Routes 28 and 72. The Village of Highland has a total land area of 0.2 mi². According to the 2020 census estimate, there are an estimated 232 people, with 113 households. The population density is 1,348 people/mi². There are 100 housing units and the median per capita income in Highland is \$25,694 and the median household income is \$40,547.

The Village of Highland was originally named New Lexington, after the City of Lexington, Kentucky. In 1816, the Village was platted by John Conner. By 1817, the Village grew to 10 families. The first store was kept by David Terrill, Sr., which was later known as Hardle's Blacksmith Shop. The mercantile business in Highland was run by John Savage, a man whose career in this type of business lasted well into the late 1800s. John Savage also ran the hotel that was attached to the mercantile store for several years. The first post office was kept at a store owned by David Terrill and he was considered to be the first postmaster in Highland. Solomon Adams was his successor. The first physician in the Village was Dr. Charles Conway. By 1880, a new school building had been erected as well as two churches and numerous stores.

History of Ross and Highland Counties, Ohio, 1880, William Brothers., W.W. Highland, Printer, Cleveland, Ohio

Hillsboro

Hillsboro is located in Liberty Township. It is situated in central Highland County along US Routes 50 and 62 and State Routes 73, 124 and 138. The City of Hillsboro has a total land area of 5.2 mi². As of 2020, there are approximately 6,481 people, 2,846 households. The population density is 1,184 people/mi². There are approximately 3,187 housing units with a median per capita income of \$18,179 and the median household income is \$36,798.

In 1807, the City of Hillsboro was platted on land belonging to Benjamin Ellicott of Baltimore, Maryland. It became the County Seat of Highland County in the same year. It was named for Lord Hillsborough, the Colonial Secretary of the British Government. The original plat was composed of approximately 200 acres, 100 of which was given to the County and the remainder sold by Ellicott at \$2 per acre.

The first act of the State Legislature, incorporating the Town of Hillsboro, originally known as Hillsborough, was passed on February 7, 1814. This act required a president, recorder, five trustees, an assessor, treasurer, collector and town marshal be appointed at that time and that the name of the corporation should be "The President, Recorder and Trustees of the Town of Hillsboro". No officers were elected and the act was disregarded. On February 26, 1842, the act was repealed. On February 18, 1848, a second act of incorporation was passed for Hillsboro, defining new boundaries.

By 1902, Hillsboro was showing signs of progression. A public library was erected containing approximately 7,000 volumes of books. A complete system of water works was built, obtaining its water supply from numerous wells sunken near Clear Creek. This creek was approximately three (3) miles from the center of town, and the water was pumped into a great standpipe that was 135 feet in height and 15 feet in diameter. By this time, the streets were lit with electricity.

Today, the primary industries for Hillsboro include printing and publishing, food, leather, dairy products, transportation equipment, bank equipment, farm machinery, wearing apparel, hogs, cattle and calves.

History of Ross and Highland Counties, Ohio, 1880, William Brothers., W.W. Highland, Printer, Cleveland, Ohio and *State Centennial History of Highland County, Ohio, Volume II*, 1902, by rev. J. W. Klise, Cook and McDowell Publications, Owensboro, KY

Leesburg

Leesburg is located in Fairfield Township. It is situated in northern Highland County along US Route 62 and State Route 28. The Village of Leesburg has a total land area of 0.8 mi². As of 2020, there are approximately 1,273 people. The population density is 1,087 people/mi². There are 552 housing units and the median per capita income in Leesburg is \$28,181, and the median household income is \$46,596.

In 1802, the Village of Leesburg was founded and incorporated by Nathaniel Pope, John Walters and John Howard.

History of Ross and Highland Counties, Ohio, 1880, William Brothers., W.W. Highland, Printer, Cleveland, Ohio

Lynchburg

Lynchburg is located in Highland and Clinton counties, with the majority of the Village located in Dodson Township, Highland County. It is situated in western Highland County along State Routes 134 and 135. The Village of Lynchburg has a total land area of 0.9 mi². As of 2020, there are approximately 1,510 people, 541 households and 80% residing as families in Lynchburg. The population density is 1,589 people/mi². There are 588 housing units and the median per capita income is \$25,339 and the medium household income is \$57,574.

In 1830, the Village of Lynchburg was platted by Andrew Smith and Coleman Botts, from Lynchburg, Virginia. In 1806, the first settlement made in the vicinity of Lynchburg was by William Spickard, David Hays and William Smith. In 1820, Lynchburg contained six (6) or seven (7) houses and became known as the settlement of Lynchburg because some of the settlers were from Lynchburg, Virginia. In 1854, the Village was incorporated, with Sinclair Liggett acting as the first mayor. As the forests were cleared and some of the land drained, corn and wheat crops were started in this area. The market for their surplus was the cities of Cincinnati and Manchester.

State Centennial History of Highland County, Ohio, Volume II, 1902, by rev. J. W. Klise, Cook and McDowell Publications, Owensboro, KY

Mowrystown

Mowrystown is located in White Oak Township. It is situated in southwestern Highland County along State Route 321. The Village of Mowrystown has a total land area of 0.5 mi². As of 2020, there are approximately 489 people, 150 households with 81% living as families. The population density is 1014/mi². There are 179 housing units, and the median per capita income is \$20,388 and the medium household income is \$65,278.

The first settler in Mowrystown was Captain Andrew Badgley. In 1806, the Village of Mowrystown was incorporated by Samuel Bell. On May 29, 1829, Samuel Bell platted the Village. In 1832, the post office was established, with Joseph Bell as postmaster. The first store was opened by John Smith in 1830. By 1812, a grist mill was built on White Oak by George Barngrover along with the help of George Fender, who built the dam. By 1865, a steam mill was built nearby by Weaver and Riley.

History of Ross and Highland Counties, Ohio, 1880, William Brothers., W.W. Highland, Printer, Cleveland, Ohio

Sinking Spring

Sinking Spring is located in Brushcreek Township. It is situated in southeast Highland County along State Routes 41 and 124. The Village of Sinking Spring has a total land area of 0.5 mi². As of 2020, there are approximately 303 people, 96 households and 91% living as families. The population density is 648/mi². There are 114 housing units, and the median per capita income is \$23,606 and the median household income is \$ 93,056.

The Village of Sinking Spring was platted in 1815. It was originally called Middletown but was later changed to Sinking Spring when it was discovered another Middletown already existed in Ohio. It was named Middletown by Jacob Hiestand because it is located about halfway between Maysville and Chillicothe, on the old Zane Trace. It was decided to change the name to Sinking

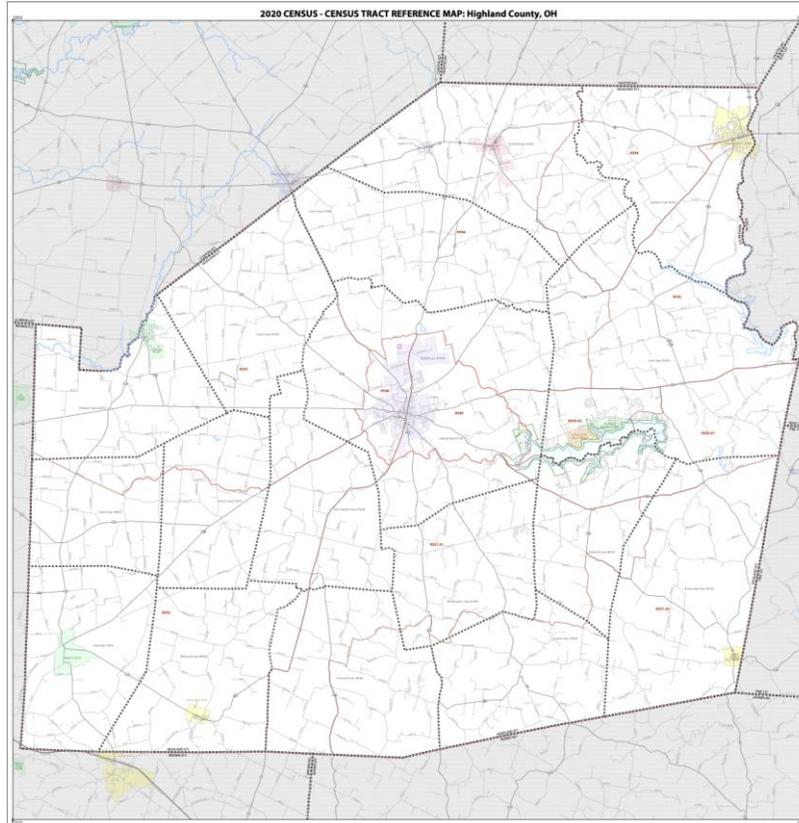
A Highland County demographic profile is also available on the ODOD's website and provides more specific information for Highland County and its political jurisdictions.

<https://development.ohio.gov/files/research/C1037.pdf>

2.4.3 Vulnerable Populations in Highland County

The Core Planning Committee evaluated all available data and local knowledge to help identify vulnerable populations in the county who may be adversely impacted by natural disasters.

Poverty: Based on Supplemental Nutrition Assistance Program (SNAP) data from 2017 to 2021, Census Tract 9550.02 has a poverty rate of 30.6%, with 33.3% of children under 18 living in poverty in this area. Further 20.3% of seniors in this tract were below poverty level income. No other Census Tract in Highland County exceeded a 25% poverty rate. This Tract also had 63.3% of households receiving SNAP assistance. 20.9 % of these households were single parents.



Limited Communications: The Committee also identified the growing Amish population in the county including the Petersburg area, Rainsboro area, Sinking Springs and a Mennonite community in Leesburg as being vulnerable to natural hazards, primarily as they have limited contact with communications systems, advanced weather information, and any early warning systems. They were invited to serve on the Core Planning Committee.

Census Data: In trying to identify minority concentration and low-income areas in the County, US Census data was reviewed. The only community with any US Census data collected was the City of Highland.

US Census Data (Quickfacts) identified the following:

Factor	City of Highland
% Black	4.5%
% White	90.0%
% Hispanic	1.9%
% 2 or more ethnicities	4.1%
Poverty Rate %	26.5%

Geographic Areas: The Core Planning Committee identified the area around Lake Area/Paint Township as a vulnerable population, in that most of the housing are grandfathered (non-compliant with the building code) trailers and other housing units. Some of these residents also have risk as they are located in the Rocky Fork Lake Dam inundation area.

Activities in the Action Plan address these unique and vulnerable populations.

2.5 County Land Use and Future Land Use

2.5.1 Topography

Highland County is composed of two different ecoregion types of eastern Corn Belt plains which occupy most of the County. The southern portion of the County is composed of interior plateau. The northern portion of the region is composed of eastern Corn Belt plains that are loamy, high lime till plains. This ecoregion contains soils that developed from loamy, limy, glacial deposits of the Wisconsinian age. The soil has relatively good drainage and supports corn, soybean, wheat, and livestock farming. Originally, the area was covered in beech forests and scattered elm-ash swamp forests.

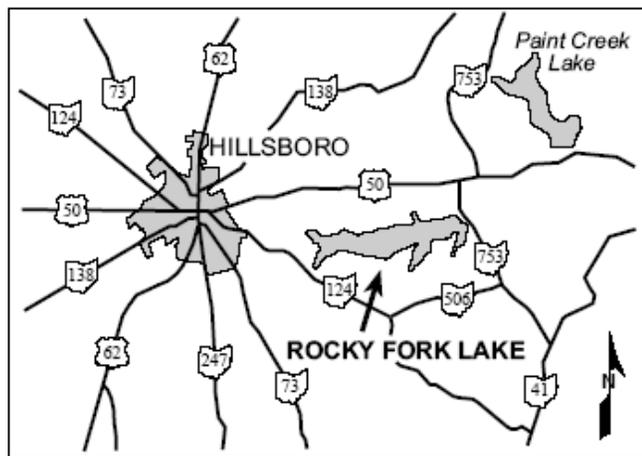
The central and western portion of Highland County is occupied with pre-Wisconsinian drift plains that are part of the eastern Corn Belt plain ecoregion. This ecoregion is differentiated from the surrounding ecoregions by its deeply-leached, acidic, pre-Wisconsinian till and thin loess. There are also widespread areas of nearly flat, very poorly-drained soils. In addition, some dissected areas occur. Streams in this region often have more sustained runoff and biotic diversity than other areas of Highland County. Originally, beech forests and elm-ash swamp forests were dominant in this area. Today, soybeans, corn, tobacco and livestock farming are dominant agricultural features found in this ecoregion.

The southeast portion of the County is composed of the northern bluegrass ecoregion of interior plateau. This ecoregion is deeply dissected and has some ephemeral streams in the east. The east is unglaciated whereas the plains and hills of the west are mantled by leached pre-Wisconsinian till and discontinuous loess. Ordovician limestone and shale underlay this region

and distinguishes it from other nearby ecoregions. Additional features include lower crestral elevation, alfisol soils and limestone bedrock. Originally, mixed mesophytic forests and oak-hickory forests grew in this area. Today, the ecoregion is a mosaic of forest and agriculture with urban-industrial activity occurring near Cincinnati and along the Ohio River. The steep areas in the County are wooded and general, while dairy and tobacco farming occurs on less rugged sites.

Highland County has four drainage basins: Ohio Brush Creek, Upper Paint Creek, White Oak Creek and the East Fork of the Little Miami River. The Ohio Brush Creek basin drains 435 mi² in Highland, Adams and Brown counties. The Upper Paint Creek Basin, which includes Rocky Fork and its tributaries, feeds into the Scioto River basin. White Oak Creek basin drains 235 mi² in Highland and Brown counties. The East Fork is located in northwestern Highland County and is part of the Little Miami River basin. The County contains approximately 434 linear miles of major streams and rivers.

The water acreage for Highland County consists of 3,380 acres of lakes. Rocky Fork Lake accounts for 2,080 acres and Paint Creek Lake for 1,190 acres. The map to the right shows the locations of both lakes.



Rocky Fork Lake is approximately five miles east of the City of Hillsboro and accessible from U. S. Route 50 and State Routes 124, 506 and 753. Rocky Fork Lake was impounded on Rocky Fork Creek in 1951. The Ohio Department of Natural Resources (ODNR) Division of Parks and Recreation constructed this lake for public recreation. Prior to impoundment, the present lake bottom was mainly agricultural fields. Many tree stumps were left standing in the upper end of the lake during construction.

Paint Creek Reservoir is located south of the City of Greenfield and is accessible from Rapid Forge Road and State Route 753. Construction of the dam on Paint Creek started in 1967 and the site was dedicated as a state park in 1972.

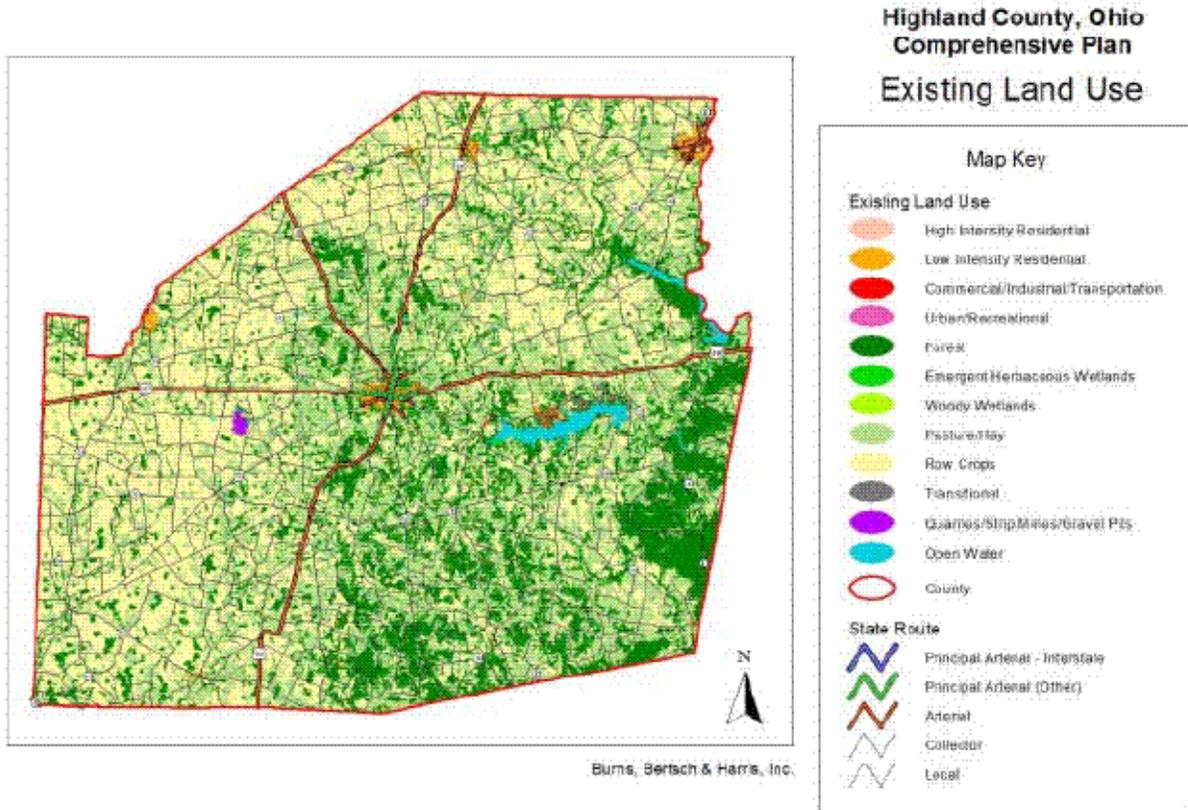
2.5.2 County Land Use

Two communities currently serve as major population and economic centers for Highland County. The City of Hillsboro and the Village of Greenfield along with the County's incorporated villages collectively comprise approximately 35% of the County's population and serve as the County's major commercial and industrial centers. Land uses in these communities make up much of the high intensity development in the County. However, there are also clusters of scattered residential development that create a land use pattern that, according to *The 2003 Highland County, Ohio Comprehensive Plan*, needs to be reevaluated. Table 2-2 details the existing land use in Highland County.

**Table 2-2
Existing Land Use**

Land Use/Land Cover	Acres	Percent of County
High Intensity Residential	177	0.05%
Low Intensity Residential	3,374	0.095%
Urban/Recreational	146	0.04%
Commercial/Industrial/Transportation	399	0.11%
Row Crops	138,149	38.70%
Pasture/Hay	132,906	37.23%
Deciduous/Evergreen/Mixed Forest	77,781	21.79%
Herbaceous/Woody Wetlands	360	0.10%
Quarries/Strip Mines/Gravel Pits	274	0.08%
Transitional	10	0.003%
Open Water	3,402	0.95%

The following map details Highland County's land use from the 2003 Comprehensive Plan.



2.5.3 Future Land Use

The 2003 Highland County, Ohio Comprehensive Plan, devotes an entire section of the plan to future land use. This section discusses three types of growth management concepts: Conservation Subdivision, Promotion of Infill/Redevelopment and Economic Development Agreements. Conservation subdivisions are developments where a certain percentage of the total land has been set aside as permanent, protected open space. Financial and other incentives can be used to promote redeveloping declining commercial/industrial areas. Economic development agreements include joint economic development districts and cooperative economic development agreements which help to facilitate economic development.

Some of the policies *The 2003 Highland County, Ohio Comprehensive Plan* discusses as it relates to future land use include policies for land use, economic development and residential development.

Land Use

- Minimize development within areas of the best agricultural lands to preserve critical masses of farmland.
- Direct new development toward areas planned for growth to prevent "leapfrog" or sprawl development patterns and allow for the cost-efficient provision of public services and facilities to County residents.
- Locate higher-density development near commercial and employment centers with access to major thoroughfares.

Economic Development

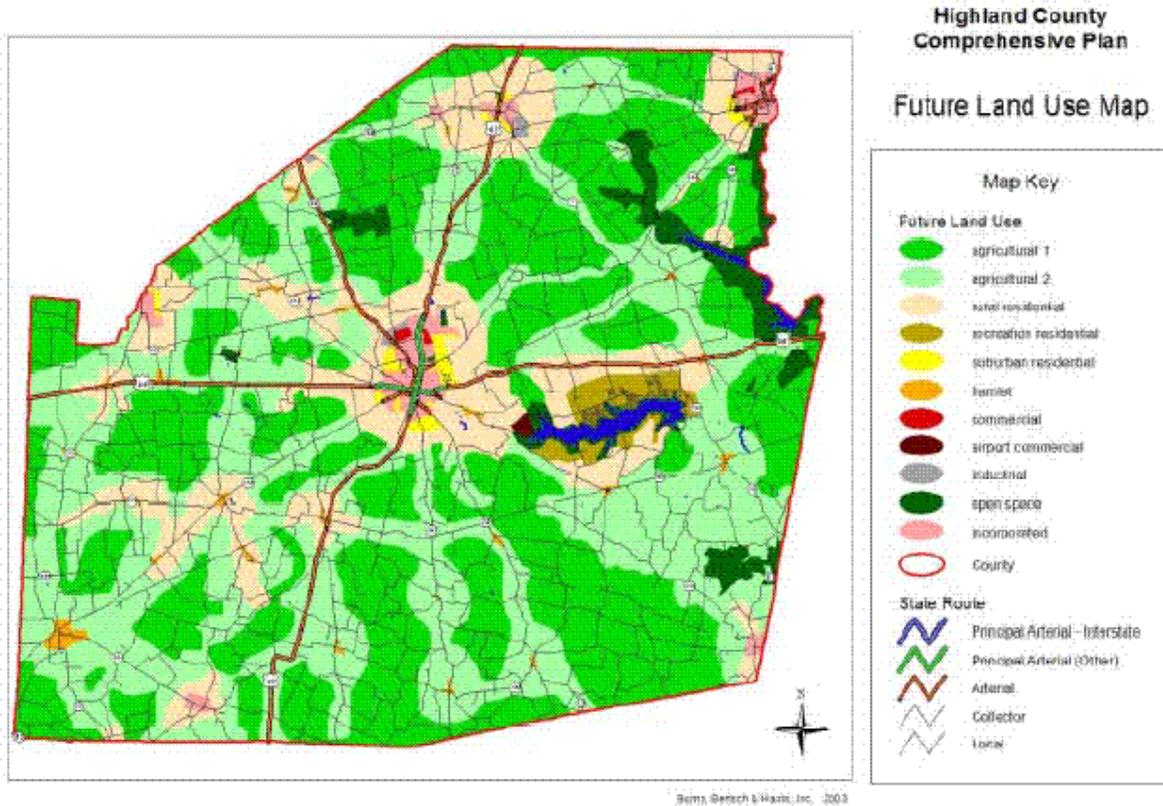
- Promote the infill and/or redevelopment of existing underutilized or vacant commercial, office and industrial spaces.
- Ensure sufficient commercial, office and industrial space to meet the needs of the existing and projected population.
- Promote industrial development within existing industrial parks.

Residential Development

- Promote the redevelopment and rehabilitation of existing housing and neighborhoods providing safe, decent and sanitary housing stock.
- Increase opportunities for citizens of Highland County who cannot purchase or rent a safe, sound, and sanitary home that meets their needs at a price or rent which they can afford.
- Promote the conservation concept as a preferred style of residential development.

Some of the recommendations *The 2003 Highland County, Ohio Comprehensive Plan* discusses as it relates to future land use include instituting a checklist to promote a systematic review of land use decisions, ensuring County subdivision regulations support managed growth and develop a protocol/application system through zoning that is aimed at promoting efficient and managed growth in the County's rural areas.

The following map illustrates the County's future land use as discussed in *The 2003 Highland County, Ohio Comprehensive Plan*:



The only other significant Community Plan in Highland County is the **Imagine Hillsboro 2019 Comprehensive Plan**. While this plan focuses on economic development, housing neighborhoods, transportation, and recreation, it also calls for enforcement of building codes and revisions to the zoning ordinance. The City is also proposing the development of new housing subdivisions. All new construction should be developed in accordance with natural hazards in mind.

2.6 County Utilities

2.6.1 Electric, Telephone and Gas

The electric power for Highland County is provided by five utilities: AEP, South Central Power, Duke, AES, and CGE. Phone companies that service Highland County include Frontier North and AT&T Ohio. Natural gas is provided by Pike Natural Gas Company.

2.6.2 Water and Wastewater

Water

Highland County's groundwater resources provide the majority of the area's water supply. The availability and quality of these resources are directly influenced by the properties of the geological formations underlying the County. Two primary aquifer formations are located in Highland County. One formation consists of sand, gravel and clayey till over limestone. The other formation consists of glacial till over shale and limestone.

There are no Public Utilities Commission of Ohio (PUCO) regulated water companies in the County. Approximately 12,000 County residents are served by water provided by the Highland County Water Company. The Highland County Water Company is the largest public water system in the State of Ohio. In addition to supplying water for the rural parts of Highland County, the water company's treatment plant also serves portions of Ross, Adams, Brown and Clinton counties are also serviced by this water treatment plant. The primary water source is groundwater, but less than 5% of total water resources are supplied by surface water from Paint Creek. Average daily demand is reported to be 1.7 million gallons per day (mgd). The total capacity of the county water plant is 2.0 mgd.

The incorporated jurisdictions of Greenfield, Hillsboro, Leesburg and Lynchburg all own and operate their own water treatment plants. The Villages of Highland, Mowrystown and Sinking Spring do not own a water treatment plant and rely on wells for their water needs.

Wastewater

Highland

The Village of Highland does not have a water or wastewater treatment plant (WWTP). The Village relies on septic tanks for their wastewater needs.

Hillsboro

The City of Hillsboro's WWTP was completed in 2003. It has a current capacity of 1.5 mgd, with the capacity for expansion to 3.0 mgd. The plant serves businesses and residents within the incorporated area of Hillsboro. Average daily demand is 1.1 mgd. The treatment system consists of an activated sludge process where the effluent is discharged into Clear Creek. The resulting sludge is land applied. The life expectancy of the plant is 50 years.

- *City of Hillsboro WWTP, 1520 N. High, Hillsboro, OH 45133*

Greenfield

- The WWTP serving the incorporated area of Greenfield has a capacity of 1.8 mgd and serves 2,100 homes and businesses. Average daily demand is about 0.8 mgd, with peak daily demand at approximately 1.0 mgd. The treatment system consists of an activated sludge process where the effluent is discharged into Paint Creek. The resulting sludge is deposited in a landfill. Greenfield has experienced some infiltration and inflow (I/I) problems, which can create capacity issues for both the collection and treatment systems.
- *City of Greenfield WWTP is located outside of the County limits on Rapids Ford Road.*

Leesburg

The Village of Leesburg's WWTP has a capacity of approximately 0.2 mgd and serves more than 600 customers. The plant serves the incorporated areas of Leesburg, Highland and portions of the unincorporated areas of the County. Average daily demand is reported to be approximately 0.1 mgd, with peak daily demand at 0.2 mgd. The Leesburg treatment system consists of an extended aeration process where the effluent is discharged into Lees Creek. The resulting sludge is deposited in a landfill.

- *Village of Leesburg WWTP, 7 East Street, Leesburg, OH 45135*

Lynchburg

The Village of Lynchburg's WWTP serves 500 customers within the incorporated areas of the Village. The average flow is approximately 0.1 mgd and was designed to accommodate an average flow capacity of 0.3 mgd. The treatment system consists of an extended aeration process where the effluent is discharged into the East Fork of the Little Miami River. The resulting sludge is deposited in a landfill.

- *Village of Lynchburg WWTP, 303 Wise Road, Lynchburg, OH 45142*

Mowrystown

The Village of Mowrystown does not have a WWTP. They rely on septic tanks for their wastewater needs. A public sewer facility is planned for Mowrystown and some unincorporated areas around the Village. The Southwest Wastewater Treatment Plant will be a County owned treatment facility. The scheduled date of completion is yet to be determined.

Sinking Spring

The Village of Sinking Spring does not have a WWTP. They rely on septic tanks for their wastewater needs.

Rocky Fork

The Rocky Fork WWTP serves approximately 1,433 customers in the County, primarily residents surrounding Rocky Fork Lake. The treatment plant was designed to accommodate an average flow capacity of 0.3 mgd and the estimated daily flow is 0.2 mgd. The treatment system consists of an extended aeration process where the effluent is discharged into Rocky Fork Creek. The resulting sludge is land applied.

Rocky Fork WWTP, 9353 SR 124, Hillsboro, OH 45133

Rural Sewage

While central water systems serve a significant portion of the County, there are portions of Highland County that continue to rely on household sewage disposal systems. This reliance is evidenced by the number of installation permits issued by the County Health Department. Overall, there are approximately 9,000 approved and permitted household sewage disposal systems in Highland County

3.0 COUNTYWIDE ALL NATURAL HAZARDS MITIGATION PLANNING PROCESS

3.1 Mission Statement

At the beginning of the planning process, a mission statement was drafted to establish a clear goal for the Core Group. The Core Group reviewed and approved the following as its Mission Statement:

“The mission of the Pre-Disaster Hazard Mitigation Core Committee for Highland County, Ohio is to develop a working document that fulfills the mandates of the Federal Disaster Mitigation Act of 2000, and satisfies the requirements of FEMA and the Ohio EMA, as well as meets the needs of all of Highland County. Further, by researching and planning for future natural hazards and implementing appropriate mitigation techniques, all of Highland County can save lives and protect property, reduce the cost of disasters, and provide for a rapid and efficient recovery by coordinating response efforts, and increasing the educational awareness of natural hazard events and their effects on the people, property, and resources of all Highland County.”

3.2 Notification Process

The incorporated jurisdictions of the County, as well as other agencies that work within the County, were notified of the mitigation planning process. The Highland County EMA Office created a master list of jurisdictions they felt necessary to participate in this planning effort. The comprehensive list was reviewed to ensure that all the appropriate agencies as well as jurisdictions would be invited to participate in this effort. Individuals representing a wide array of political subdivisions, as well as agency and private businesses, were notified of the mitigation planning update process. This comprehensive list of invited participants is listed in section 1.2.

Prior to commencing this planning process, in addition to contacting the Planning Group, Highland County notified the general public regarding this mitigation planning process. Highland County also posted all Hazard Mitigation Planning Meetings on their website (www.highlandcountyema.com) and issued a press release on 3/4/23 and 3/7/23 and to the Highland County Free Press (printed in *Events* and *Take Note* sections respectively). The Highland County EMA Director was the contact source, and his contact information was provided. See Appendix A for copies of this correspondence.

3.3 Groups

The Core Group is the original planning unit for this project. All Core Group members had the opportunity to be involved for the entire planning process. They are the decision makers and implementers. The purpose of the Core Group is to provide information to the various entities of Highland County that have a stake, either directly or indirectly, in the Mitigation Plan. They provide feedback, input, and review as the process of the Mitigation Plan development is completed, leading to a better quality and more inclusive scope of the Mitigation Plan that everyone can acknowledge and adopt, truly implementing a countywide plan.

Obtaining support from the whole community required a comprehensive approach to preparing the Mitigation Plan. Identifying those persons, community leaders and government agencies with the knowledge and authority to help the community organize a plan was key to the planning

effort. Establishing a group of leaders was necessary to give this task validity. The Core Group included individuals from multiple agencies, County departments and incorporated jurisdictions as previously listed in Section 1.2.

3.4 Core Group Meetings

There were three (3) Core Group meetings (all advertised and open to the public) and one (1) community meeting for public comment on the Draft Mitigation Plan. These meeting details are below.

3.4.1 Determination of Hazards - Meeting 1-Kick-Off Meeting Update Meeting 3/16/23 (Planning Group)

The kick-off meeting presented the Planning Group with the process to be followed in the update of the Mitigation Plan. Overall goals of the plan for Highland County were discussed and the Planning Group began a process to determine which hazards to focus on. This included a Hazard Identification and Risk Assessment (HIRA) based on historic disaster events data from the National Center for Environmental Information (NCEI), the new FEMA National Risk Index (NRI) for Highland County, OH, a summary of NCEI/NRI data prepared by the Consultant, and planning committee member insights about local hazard events. The initial list of critical hazards was established looking at the National Center for Environmental Information (NCEI) tables and the FEMA National Risk Index that illustrated which hazards in Highland County have produced the largest amount of damage based on human or monetary losses. The Planning Group also used the collective knowledge they had coupled with the vast amount of local experience and history to determine which hazards to address in their Mitigation Plan. This resulted in a listing of priority hazards to address including 1. Summer Storms, 2. Winter Storms, 3. Flooding, 4. Landslides, 5. Tornadoes, 6. Drought/Wildfires, 7. Extreme Heat, 8. Earthquakes, and 9. Dam Failure. The HIRA information is show in Appendix B.

The 2019 Highland Co Hazard Mitigation Plan includes the following Hazards:

1. Summer Storms (Thunderstorms/High Winds/Lightning, Hail)
2. Severe Winter Storms (Winter, Snow, Ice)
3. Flooding
4. Extreme Heat
5. Tornadoes
6. Earthquakes
7. Dam Failure
8. Drought/Wildfires

The committee then used all the noted data and summary information to select hazards for priority ranking. The Consultant collected the scores and would tabulate the results for Meeting #2.

Appendix G includes the historic National Center for Environmental Information (NCEI) event data, FEMA National Risk Index (NRI) for Highland County, OH and event data summary. Appendix B includes the HIRA data, summary and Hazard Priorities summary for Highland County.

During the initial meeting, other county and local planning efforts, such as the 2019-2023 Highland County HMP, The Highland County 2003 Comprehensive Plan, and the Hillsboro Ohio Code of Ordinances and 2019 Imagine Hillsboro Comprehensive Plan, were discussed, reviewed and implemented into the 2024-2028 Highland County HMP.

Additionally, by the end of the first meeting, Planning Group members had exchanged contact information, identified some additional data which needed to be collected for the plan, established a priority list of hazards and discussed the general process and timeline of the project.

Please see Appendix C for Meeting 1 Sign in sheet, Agenda, and other materials as presented.

3.4.2 Determination of Problem Statements and Overall Goals – Meeting 2 6/1/2023 Update Meeting (Planning Core)

The second meeting of the Planning Group focused on reviewing and approving the HIRA Hazard Priority list and reviewing prior plan progress and accomplishments.

The Committee also reviewed US Census Data regarding poverty areas in the county (by census tract) and new federal data regarding the impact of climate change on extreme heat, drought, wildfires, and flooding. This information was useful in finalizing hazard priorities and improving specific mitigation actions. Appendix I includes this data and research.

Based on the review of all data, the Planning Committee approved the following prioritization for Highland Co Natural Hazards for the 2024-2028 Plan:

1. Summer Storms (Thunderstorms/High Winds/Lightning, Hail)
2. Winter Storms (Winter, Snow, Ice)
3. Flooding
4. Landslides
5. Tornados
6. Drought/Wildfires
7. Extreme Heat
8. Earthquakes
9. Dam Failure

Please see Appendix C for Meeting 2 Sign in sheet, Agenda, and other materials as presented. Appendix D provides written input (survey format) from each participating jurisdiction.

3.4.3 Determination of Alternatives and Evaluation Criteria – Meeting 3 8/17/2023

The final meeting with the Planning Group focused on the goals and action items and establishing priorities.

Each individual community was also encouraged to identify an alternative or alternatives that they wanted to support and implement within their community.

The committee further discussed underserved populations at risk of hazards in the community. This focused on Census data and representation of minority and low-income residents on current census maps.

The remaining steps in the mitigation planning process were reviewed, which included setting a date for a public meeting.

Please see Appendix C for Meeting 3 Sign in sheet, Agenda, and other materials as presented.

3.5 Review of Current/Expiring Plan

During meetings 2 and 3, the Planning Group reviewed each Action Item in the current/expiring plan. The Consultant color coded each Action as green-completed, yellow-underway, red-not accomplished, and white-include in revised plan.

Highland Co Hazard Mitigation Plan Progress from 2019-2023 Plan

Status Key: Completed **(Green)**, Deferred **(Yellow)**, Ongoing/Combined (White), or Deleted **(Red)**. **Bold/Italic** is new language to add to the Plan (Completed with Committee input 3/16/23)

Goal and Obj.	Action	Comments
		Location in new plan (See...)
ALL Hazards	1.1.1 Develop a comprehensive annual public outreach/education plan which seasonally covers hazardous materials, seasonal cold/heat, Severe summer storms, flooding, tornadoes and high winds, severe winter storms, and droughts/wildfires	Completed
	Educate residents to prepare for 7 days of self-sufficiency.	Ongoing at 1.1.1
	1.1.2 Implement CODE RED notification system in County (HyperReach system implemented)	Completed
	1.1.3 Purchase/install emergency backup generators for high critical need locations including: Nursing Homes, public schools, senior centers, Southern States Patriot Center (Central Campus)	Ongoing at 1.1.3
	1.1.4 Two mobile generators to serve key gasoline distribution sites. Install hookups as needed at each identified site.	In progress at 1.1.4
	1.1.5 Continue to expand and strengthen early warning siren system by adding sirens at Lynchburg and in the Rocky Fork Lake area.	In progress at 1.1.5
	1.1.6 Complete and Implement Debris Management Plan for any natural disaster cleanup	In progress at 1.1.6
	1.1.7 Review and update regional mutual aid agreements (IMAC) between fire departments, law enforcement, and other counties to assist in emergency response needs	Completed/ Up-to-date
	1.1.8 Update emergency shelter locations and agreements (Red Cross, Hillsboro, and Greenfield)	In progress at 1.1.7
1.1.9 Investigate the installation of residential and community safe rooms	Ongoing at 1.1.9	

Summer Storms	2.1.1 Encourage developers to bury power and other utility lines to reduce power outages during storms	Ongoing at 2.1.1
	2.1.2 Develop a tree maintenance program for proactively trimming and pruning trees to reduce power outages	Ongoing at 2.1.2
	2.1.3 Complete Hillsboro storm water system upgrade, south-side of town	Project is underway at 2.1.3
Winter Storms	3.1.1 Secure and distribute NOAA radios to critical facilities (est. need for 50 radios)	Delete as ineffective given other early warning communication tools
	3.1.2 Seek funding for NOAA weather radios for residents at a discount rate	Delete (cell phones better option)
	3.1.3 Develop a warehouse for storing essential disaster supplies (food pantries, clothing, and medical) and distribution process to shelters during disaster events	COVID shelter supply In progress at 3.1.1
Flooding	4.1.1 Consider joining the National Flood Insurance Program (NFIP) (Highland Co)	In progress/ Ongoing at 4.1.1
	4.1.2 Encourage FEMA to update 30-year-old rate Flood Insurance Rate Maps (FIRM)	Ongoing at 4.1.2
	4.1.3 Address basement flooding in Mowrystown area for both residents and critical facilities	Remove, no longer a priority
	4.1.4 Acquisition, demolition, and /or retrofit of flood prone properties	Remove, few properties identified as eligible
Extreme Heat	5.1.1 Develop a list of special needs residents (and map locations) to serve during a Heat Emergency	In progress/ Ongoing at 8.1.1
	5.1.2 Identify cooling stations and their supply needs, including backup generators.	Ongoing at 8.1.2
Tornadoes	6.1.1 Seek funding and coordination to train weather spotters	Classes for 2023-2024 are scheduled/Ongoing at 6.1.1
	6.1.2 Investigate and implement best practice early warning protocols for public notification during tornado events	Ongoing at 6.1.2
Earthquakes	7.1.1 Educate public about what to do in the event of an earthquake using Facebook and other Social Media	Ongoing at 9.1.1

Dam Failure	8.1.1 Investigate and lobby for needed repairs at Rocky Fork Lake Dam	Repairs scheduled for 2023 with 2024 completion at 10.1.1
	8.1.2 Educate residents businesses in Rocky Fork Lake Dam inundation area about preparedness for a dam failure	Assessment in progress/ Ongoing at 10.1.2
Drought/Wildfires	9.1.1 Create a map of all dry hydrants throughout the County.	Completed
	9.1.2 Brush truck upgrades and replacements to combat brush and wildfires	Ongoing at 7.1.1

3.5 Public Update Meeting 11/1/23 (Planning Group and Public Meeting)

A public meeting was held on 11/1/23 to review the planning process and recommended plans with the public. This meeting was also used to address comments and questions concerning the Draft Mitigation Plan. The local media attended and covered this public meeting.

Public participation is extremely important and valuable during any phase of mitigation planning, including during the Plan update phase. To assure the opportunity for citizens to review and comment on the draft Plan Update, the Planning Group will include the draft Plan Update on the Highland County EMA website. A copy of the draft Plan will also be made available in the HCEMA office. A time frame of 14 days was provided for public comments and questions. Any comments or questions received during this period would be addressed and acted upon by the Planning Group prior to forwarding the final draft Plan Update version to the Ohio and Federal Emergency Management agencies for their review.

A few typographical corrections were recommended during the public hearing, which have been incorporated in this final document.

3.6 Finalization

Upon incorporation of all comments into the Hazard Mitigation Plan, the plan will be prepared and submitted to the State of Ohio Emergency Management Agency (OEMA) for initial review and comment. The plan will then be further revised and submitted to the State of Ohio Emergency Management Agency and Federal Emergency Management Agency for formal review and approval. Each incorporated jurisdiction, as well as any township choosing to adopt this Hazard Mitigation Plan as a separate entity from the County, will also receive a digital copy of the plan.

3.7 Summary of Community Policies, Programs and Resources

The following chart was compiled from the Community Survey distributed to each jurisdiction. The information was then verified by the County EMA Director. A copy of the Community Survey and the jurisdictional responses are included in Appendix D.

Table 3-1: Highland County and Jurisdictional Authorities, Policies, Programs and Resources

Community	Planning Commission	Comp. Plans	Floodplain Regulations	NFIP Compliant	Building Codes	Zoning Ord.	Capital Budget	Public Works Budget
Highland County	Yes	Yes	No	No	No	No	Yes	+/- \$5,000,000
City of Hillsboro	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes
City of Greenfield	Yes	Yes	Yes	No	Yes	Yes	None	None
Village of Highland	No	No	Yes	Yes	No	No	None	None
Village of Leesburg	No	No	Yes	Yes	No	No	None	Yes
Village of Lynchburg	No	Yes	No	No	No	No	No	Yes
Village of Mowrystown	No	No	No	No	No	No	None	None
Village of Sinking Springs	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A
Brushcreek Township	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A
Clay Township	No	No	No	No	No	No	None	None
Concord Township	No	No	No	No	No	No	None	None
Dodson Township	No	No	No	No	No	No	None	None
Fairfield Township	No	No	Yes	No	No	No	None	None
Hamer Township	No	No	No	No	No	No	None	None
Jackson Township	No	No	No	No	No	No	None	None
Liberty Township	No	No	Yes	No	No	No	None	None
Madison Township	Yes	No	No	No	No	Yes	None	None

Table 3-1: Highland County and Jurisdictional Authorities, Policies, Programs and Resources

Community	Planning Commission	Comp. Plans	Floodplain Regulations	NFIP Compliance	Building Codes	Zoning Ord.	Capital Budget	Public Works Budget
Marshall Township	No	No	No	No	No	No	None	None
New Market Township	No	No	No	No	No	No	None	None
Paint Township	No	No	No	No	No	No	None	None
Penn Township	No	No	No	No	No	No	None	None
Salem Township	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A
Union Township	No	No	No	No	No	No	None	None
Washington Township	N/A	N/A	N/A	No	N/A	N/A	N/A	N/A
White Oak Township	No	No	No	No	No	No	None	None

3.8 Incorporation of Existing Plans, Studies, Reports and Technical Data

The development of this plan update involved the collection and review of all local jurisdiction and County planning efforts since the prior plan’s adaption. This included a review of all local zoning and land use ordinances/plans, the County Comprehensive Plan, Imagine Hillsboro 2019 Comprehensive Plan, flood regulations, Emergency Action Plans (EAP) relating to natural hazards, The and local economic development plans and initiatives. This information is noted throughout this report and was integrated into this Highland County Hazard Mitigation Plan as appropriate.

Specific conversations were held with County Officials about including sustainability and other hazard mitigation efforts into the County Comprehensive Plan when they pursue its revision. There is currently no timeline for this process.

The County is also considering planning and paperwork to be the final Ohio county to join the National Flood Insurance Program (NFIP). This action is included in the Action Steps in Section 6. Goals and Action Items.

4.0 HAZARD PROFILE

Highland County has experienced many natural disasters in the past 100 years. These disasters have ranged from tornadoes and blizzards, to flooding and droughts. The purpose of this document is to identify the number and frequency of disasters in Highland County to better prepare and deal with them when they do occur. The following sections describe the process of determining upon which hazards to focus, general background information on each hazard as well as hazard events that have occurred in Highland County.

4.1 Initial Hazard Assessment

To properly evaluate the natural hazards to which Highland County may be susceptible, a four-step process was utilized. This four-step process was completed to “narrow-down” the hazards for which Highland County should prepare, and potentially mitigate, in the future. The five (5) steps are described in the following paragraphs.

Step 1 - FEMA’s new **National Risk Index (NRI)** for Highland County was generated on 2/2/23. This new tool provides a comprehensive review of overall hazard risk, expected annual loss resulting from a disaster, a Social Vulnerability score and a Community Resilience score. Hazards covered in this report include Cold Wave, Drought, Earthquake, Hail, Heat Wave, Hurricane, Ice Storm, Landslide, Lightning, Riverine Flooding, Strong Wind, Tornado Wildfire, and Winter Weather. Additional covered hazards, but not relevant to Highland County, include Avalanche, Coastal Flooding, Tsunami, and Active Volcano.

Step 2 - The **National Centers for Environmental Information (NCEI)** data was reviewed for historic hazard event information all the way down to the County level. The NCEI website presented each type of hazard and the historical information associated with it for each county, offering several hazard search parameters. These parameters included: droughts, dust storm, flooding, flash flooding, fog, hail, lightning, tornadoes, wild/forest fires, heavy rain, winter storms, blizzards, snow and ice storms, temperature extremes (hot and cold), thunderstorms and strong and high winds.

Because NCEI information did not address earthquakes or dams and dam safety, other sources were contacted for this data. The information pertaining to earthquake susceptibility was attained from **United States Geographical Survey (USGS)** data and the Ohio Earthquake Program Manager at OEMA. Dam and dam safety information was gathered from the **ODNR Division of Dam Safety**.

Step 3- Analyze the impact of climate change projections on local natural hazard impacts. Projected model information for Extreme Heat, Drought Wildfire and Flooding is provided by the **US Climate Resilience Toolkit**, which has been developed with input and data from the US Census Bureau, CEQ, Esri, FEMA, MMLC, NOAA and the UCSD. (<https://cmra-reports.s3.amazonaws.com/county/39071.html>).

Step 4 – Input from the Core Group was sought to address any known gaps not recorded in the data. Typically, this involves more recent events or damage estimates that have not yet found their way to the national database.

Step 5-- To address and create a more inclusive plan, census tract information, NRI data, and local committee knowledge was used to identify local physical locations and populations where underserved residents may live and be impacted by natural disasters. This information was particularly informative when developing Action Plan mitigations.

4.2 Risk Assessment Ranking

The research compiled during the initial hazard assessment was provided to the Core Group for their review and assessment. The Core Group evaluated all the hazards being considered and ranked them based on the number of historic events and cumulative damage that has occurred.

The following list shows the Core Group’s ranking of hazards with number one being the hazard of the most concern for the 2024-2028 Hazard Mitigation Plan:

1. Summer Storms – Thunderstorms/High Winds/Hail/Lightning
2. Winter Storms – Snow/Ice/Extreme Cold
3. Flooding – 100-year and Localized Flooding
4. Landslides
5. Tornadoes
6. Droughts/Wildfires
7. Extreme Heat
8. Earthquakes
9. Dam Failure

Natural hazards of coastal flooding, avalanche, tsunami, and volcanos are not applicable to the Highland County area.

4.2.1 Social Vulnerability and Community Resilience

Based on the National Risk Index for Highland County, the county scored as follows on Social Vulnerability and Community Resilience:

Assessment	Highland Co/100	Ohio/100	US/100
Social Vulnerability (Relatively Moderate)	35.63	34.28	38.35
Community Resilience (Relatively Moderate)	55.04	56.84	54.59

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

Community Resilience is the ability of a community to prepare for anticipated natural hazards, adapting to changing conditions, and withstand and recover rapidly from disruptions.

4.3 Summer Storms – Thunderstorms/High Winds/Hail/Lightning

4.3.1 Extent

Hazards that fit into the severe summer storm category include thunderstorms, high winds, hail, and lightning. One of the biggest problems associated with severe weather is the lack of public education and awareness. Severe storms can do damage but are often the precursor for much more severe weather to follow. One example is the direct association of tornadoes with thunderstorms.

A severe thunderstorm watch is issued by the NWS when the weather conditions are such that damaging winds of 58 mph or more, or hail 3/4 of an inch in diameter or greater, are likely to develop. Citizens should locate a safe place in the home and tell family members to watch the sky and listen to the radio or television for more information. A severe thunderstorm warning is issued when a severe thunderstorm has been sighted or indicated by weather radar. At this point, danger is imminent, and citizens should move to a safe place, turn on a battery-operated radio or television, and wait for the "all clear" by the authorities.

Severe storms are also associated with other hazards such as tornadoes and severe flooding. Since tornadoes and flash flooding are spawned by thunderstorms, people should review what action to take under a tornado warning or a flash flood warning when a "severe thunderstorm warning" is issued. When thunderstorms are forecasted to bring heavy rains (which can cause flash flooding), strong winds, hail, lightning and tornadoes, people should get inside a sturdy building and stay tuned to a battery-operated radio for weather information. People should also be aware that lightning and high winds are also major threats during thunderstorms.

According to the NCEI, a total of 153 thunderstorms, of which 18 caused damage, were recorded in Highland County between 1972 and 2022. The monetary damage totaled \$1.330 million in property damage and \$5,000 in crop damage, with no deaths and one (1) injury recorded. The data is included in *Appendix G*.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see an increase in the number of hot weather days and fewer days of rain, but with greater annual precipitation. The following charts show the projected trends.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Annual Days > 90°F	8	29	32
Annual Days > 95°F	1	7	9
Annual Days > 100°F	0	1	2
Annual days with temperature below 32 degrees	24	17	17
Avg. annual total precipitation	43"	44"	44"
Days with precipitation	200	197	197

The impact of this will be slightly more intense summer storms with more potential rain and flooding during some events. The increase in heat may also intensify storm conditions.

4.3.2 High/Strong Winds/Thunderstorms

Straight-line winds are often responsible for most of the wind damage associated with a thunderstorm. These winds are often confused with tornadoes because of similar damage and wind speeds. However, the strong and gusty winds associated with straight-line winds blow roughly in a straight line unlike the rotating winds of a tornado.



Property damage and loss of life from windstorms are increasing due to a variety of factors. According to the Ohio Manufactured Housing Association (OMHA), the use of manufactured housing is on an upward trend, and this type of structure provides less resistance to wind than conventional construction. Uniform building codes for wind resistant construction are not adopted by all states, and population trends show rapid growth in the highly exposed areas.

11 high/strong wind/ events were recorded in Highland County between 1972 and 2022. The data is included in *Appendix G* and include the five (5) events that resulted in damage:

- 09/14/2008, a high wind event of 52 kts. resulted in \$5.00M worth of property damage.
- 03/09/2002, a high wind event of 52kts. resulted in \$12,000 of property damage.
- 12/01/2006, a high wind event of 38kts. resulted in \$14,000 property damage.
- 03/25/2021, a high wind event of 50kts. resulted in \$5,000 of property damage.
- 12/11/2021, a strong wind event of 49 kts. resulted in \$1,000 worth of property damage.

153 thunderstorm events were recorded between 1972 and 2022 with 18 causing property damage of \$1.330 million and crop damages of \$5,000. Damage causing events ranges from 50-71kts. with 50kt.s being the average.

4.3.3 Hail

Hail is a type of precipitation composed of balls or irregular lumps of ice. It occurs when supercooled water droplets (remaining in a liquid state despite being below the freezing point, 0 °C/32 °F) in a storm cloud collide with some solid object, such as a dust particle or an already-forming hailstone.

Hail often forms in strong thunderstorms, often along a cold front, where the layer of air on top is much colder than that on the bottom. The smaller hailstones can bounce up and down between the warm and cold layers due to updrafts and gravity. The longer the stones bounce around, the larger they grow. These strong, severe, or even supercell thunderstorms can also produce hail in the summer months, even without a cold front.

Hailstones, while most commonly only a few millimeters in diameter, can sometimes grow to several inches or occasionally even bigger. Such large hailstones can do serious damage, notably to automobiles, skylights, and glass-roofed structures. Pea or golf ball-size hailstones are not uncommon in severe storms. Rarely, massive hailstones have been known to cause concussions or to kill people by causing head trauma.

43 hail events were recorded by the NCEI from 1972 to 2022 in Highland County. 10 of these 43 events were responsible for \$67,000 in property damage and \$505,000 in crop damage. The most significant recorded hail event was in Hillsboro on 7/29/94, when 1.00 inch hail caused \$500,000 in crop damage. No deaths or injuries have ever been hail related in Highland Co.

Over the past 10 years there were six (6) events resulting in property damage. The data is included in *Appendix G* and include:

- Greenfield on 05/15/2007 that resulted in \$1.00K worth of property damage.
- Lynchburg on 05/30/2009 that resulted in \$1.00K worth of property damage.
- Leesburg on 05/30/2009 that resulted in \$ 3.00K worth of property damage.'
- Hillsboro on 05/30/2009 that resulted in \$3.00K worth of property damage.
- New Market on 05/01/2012 that resulted in \$10.00K worth of property damage.
- Leesburg on 06/26/2015 that resulted in \$3.00K worth of property damage.

4.3.4 Lightning

Lightning kills 75 to 100 people a year in the USA. It is the second largest killer of natural hazard events, exceeded only by floods. Lightning strikes can happen anywhere and affect anyone. Only 10% of lightning strikes result in death, leaving the rest with various degrees of disability, most being central nervous system issues.

According to the NCEI, one lightning event is recorded from 1972 to 2023 for Highland County. A single event occurred on 06/14/1996 in Concord Township that caused \$25,000 in property damage. No deaths or injuries were recorded. The data is included in *Appendix G*.

4.3.5 Frequency/Probability of Future Occurrence

Severe storms for Highland County quantitatively have the highest likelihood of occurring on a yearly basis. According to the NCEI, 208 storm events including thunderstorms, high winds, strong winds, hail, and lightning were documented for Highland County since 1972. Severe storms in Highland County have caused cumulative property and crop damage with estimated total losses of property \$6.454 million and \$510,000 in agricultural losses over a 50-year period, based on the NCEI database. Based on historical information, Highland County can expect to endure approximately 4.16 severe storms in any given year (208 events / 50 years).

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index Rating/ Risk Index Score (0-100)	Record Period	Annualized Event Frequency	Expected Annual Loss Rating Score (0-100)	Expected Annual Property/Ag Loss \$	Expected Deaths/Injuries
Thunderstorms	N/A	N/A	N/A	N/A	N/A	N/A
Strong Wind	Relatively Low/10.84	1986-2017	2.3	Relatively Low/21.51	\$159,956/\$125	0
Hail	Very Low/4.59	1986-2017	3.6	Very Low/5.75	\$10,735/\$744	0
Lightning	Relatively Low/11.97	1991-2012	75.6	Relatively Low/20.61	\$1,973/\$0	0.01

There is a low annual frequency risk correlation between NCEI (4.16) data and the NRI data (27.17 average). This may be the result of the high number of lightening events reported in NRI vs NCEI and the shorter time span of the NRI data.

4.4 Winter Storms-Snow/Ice/Extreme Cold

A winter storm encompasses several types of storm systems that develop during the late fall to early spring. It deposits any of the following types of precipitation: snow, freezing rain, or ice. Blizzards and ice storms are subcategories of winter storms. A winter storm watch indicates that severe winter weather may affect an area. A winter storm warning indicates that severe winter weather conditions are on the way.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see an increase the average number of cooling degree days. The following charts show the projected trends.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Cooling degree days	931 degree days	1327 degree days	1379 degree days
Annual days with temperature below 32 degrees	24	17	17

The impact of this seems to indicate that the average temperature will be higher, with the reduction of cold weather days (sub-freezing) and the likely reduction of snow and hail events.

4.4.1 Winter Storms

NCEI data from 1972 to 2022 reported 36 winter storm events with two (2) causing any damage. These events occurred on 1/6/96 with \$725,0000 of property damage and again on 12/22/04 with \$225,0000 worth of property damage.

4.4.2 Heavy Snow/Blizzards

A blizzard warning signifies that large amount of falling or blowing snow, and sustained winds of at least 35 miles per hour (mph), are expected for several hours. To be classified as a blizzard, as opposed to merely a winter storm, the weather must meet several conditions. The storm must decrease visibility to a quarter of a mile for three consecutive hours, include snow or ice as precipitation, and have wind speeds of at least 35 mph. A blizzard is also characterized by low temperatures.

According to the NCEI and local estimates, there have been 11 heavy snow events in Highland County since 1972. Of these 11 events, two (2) events on 1/4/96 caused \$4,000 and on 1/11/96 caused \$1,000 worth of property damage. This data is included in *Appendix G*. Two additional (2) events in 1977 and 1978, based on local committee input, resulted in over \$100.00k of snow removal costs.

4.4.3 Ice Storms

An ice storm is defined as a weather event containing liquid rain that falls upon cold objects creating 1/4 inch thick or more accumulation of ice buildup. This ice accumulation creates serious damage such as downed trees and power lines, leaving people without power and communication. It also makes for extremely treacherous road conditions.

Occasionally, snow will fall after an ice storm has occurred. With the ice covered, it is nearly impossible to determine which travel areas to avoid. When traveling by car, this snow-covered ice causes accidents and when walking it causes people to fall, possibly sustaining injuries.

According to the NCEI, there have been four (4) recorded ice storm events since 1996 in Highland County. These events did not result in any property or crop damage. No deaths or injuries were recorded for these events. The data is included in *Appendix G*.

4.4.4 Extreme Cold

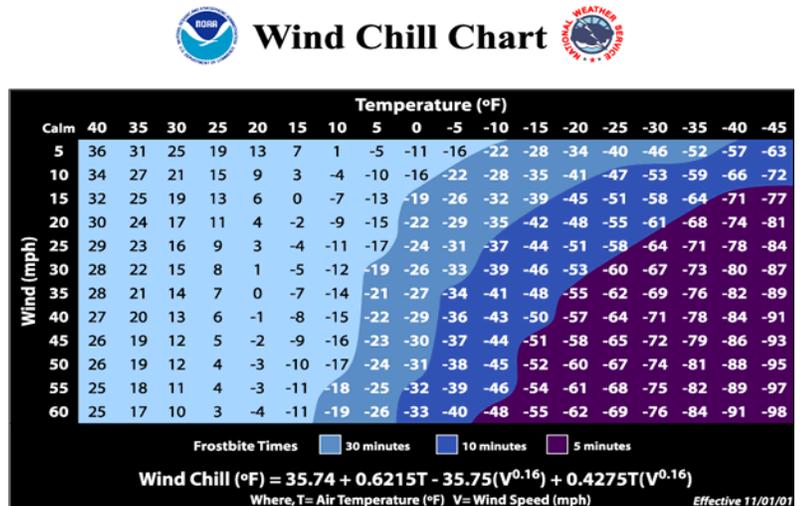
Extreme cold can immobilize an entire region. Even areas that normally experience mild winters can be hit with extreme cold with a wind chill. The impacts include frostbite and hypothermia.

The wind chill temperature is how cold people and animals feel when outside. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature. On November 1, 2001, the National Weather Service (NWS) implemented a replacement Wind Chill Temperature (WCT) index. The reason for the change was to improve upon the current WCT Index which was based on the 1945 Siple and Passel Index.

Therefore, the wind makes it feel much colder. If the temperature is 0 degrees Fahrenheit and the wind is blowing at 15 mph, the wind chill is -19 degrees Fahrenheit. At this wind chill temperature, exposed skin can freeze in 30 minutes. The following chart lists wind chill values associated with degrees in Fahrenheit and wind in mph.

Frostbite is a severe reaction to cold exposure that can permanently damage its victims. A loss of feeling and a white or pale appearance in fingers, toes, or nose and ear lobes are symptoms of frostbite.

Hypothermia is a condition brought on when the body temperature drops to less than 90 degrees Fahrenheit. Symptoms of hypothermia include uncontrollable shivering, slow speech, memory lapses, frequent stumbling, drowsiness, and exhaustion.



According to the NCEI, there have been no extreme cold events recorded from 1972 – 2023 in Highland County. There is one (1) reported cold/wind chill event on 2/1/96 that resulted in \$20,000 of property damage. The data is included in *Appendix G*.

4.4.5 Frequency/Probability of Future Occurrence

Winter storms for Highland County have the second highest quantitative likelihood of occurring on a yearly basis and are the first in causing the greatest amount of monetary damage. According to the NCEI, 52 winter storm events, including snow, ice and extreme cold, were documented for Highland County since 1972. These winter storms have caused estimated total losses of over \$955,000 over this 50-year period. Most of this damage was recorded in the two (2) 1996 winter storm events. Based on historical information, Highland County can expect to endure at least 1.04 winter storms in any given year. (52 events / 50 years). The impact of climate change, with anticipated fewer cold days per year, will likely reduce winter storm hazard impacts over the next few decades.

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index	Record	Annualized	Expected	Expected Annual	Expected
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	Rating/ Risk Index Score (0-100)	Period	Event Frequency	Annual Loss Rating Score (0- 100)	Property/Ag Loss \$	Deaths/ Injuries
Heavy Snow/Blizzards (Winter Weather)	Relatively Moderate/16.02	2005-2017	3.7	Very Low/22.95	\$47,342/\$527	0
Ice Storm	Relatively Low/13.18	1946-2014	1	Relatively Low/21.51	\$67,014/\$0	0
Extreme Cold (Cold Wave)	Relatively Low/13.18	2005-2017	0.3	Very Low/5.75	\$801/\$27,294	0

There is a reasonably good annual frequency risk correlation between NCEI data (1.04) and the NRI data (1.67 average).

4.5 Flooding

4.5.1 Extent

Floods are a naturally recurring event for a river or stream and are caused by weather phenomena and events that deliver more precipitation to a drainage basin that can be readily absorbed or stored within the basin. Flooding is a localized hazard that is a result of heavy or continuous rainfall exceeding the absorptive capacity of soil and the flow capacity of rivers and streams. Floods can be generally considered in two categories: flash floods, the product of heavy localized precipitation in a short time period over a given location; and riverine floods, caused by precipitation over a longer time period and over a given river basin.

Riverine flooding refers to periodic flooding of lands adjacent to non-tidal rivers and streams. It is a natural and inevitable occurrence. When stream flow exceeds the capacity of the normal watercourse, some of the above-normal stream flow spills over onto adjacent lands within the floodplain. Riverine flooding is a function of precipitation levels and water runoff volumes within the watershed of the stream or river. The recurrence interval of a flood is defined as the average time interval, in years, expected to take place between the occurrence of a flood of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see an increase in the number of hot weather days and fewer days of rain, but with greater annual precipitation. The following charts show the projected trends.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Avg. annual total precipitation	43"	44"	44"
Days with precipitation	200	197	197

Max period of consecutive wet days	13	13	13
Annual days with total precipitation >1 inch	4	5	5
Annual days that exceed 99 percentile precipitation	5	6	6

The impact of this will be slightly more intense rain and flooding during some events.

4.5.2 Special zone flood (100-year Floodplain)

Flood Insurance Rate Maps (FIRM) show areas delineated to be special flood hazards. The Base Flood Elevation (BFE) refers to the elevation associated with a special flood zone, or a flood with a 1% chance of occurring in any given year. Areas within a special flood zone area, also known as the 100-year floodplain, have an elevation lower than the BFE and are categorized into zones. Zone “A” is the flood insurance rate zone that corresponds to a special flood zone area that is determined in the Federal Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs or depths are shown within this zone. Zone “AE” is the flood insurance rate zone that corresponds to a special flood zone area that is determined in the Federal Flood Insurance Study by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Highland County has special zone floodplains identified within the County. The best way to combat a disaster happening within these special zone flood hazard areas is through public awareness. The following list gives the incorporated jurisdictions that are in compliance with state floodplain management standards and participate in the NFIP, and the date in which they entered the program.

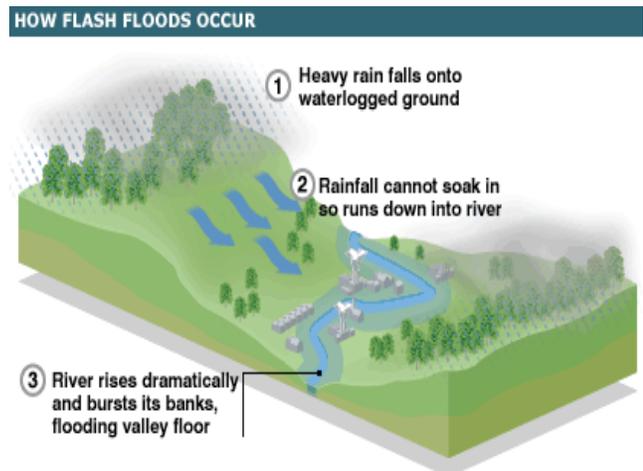
- Highland September 29, 1978 Currently in compliance
- Hillsboro September 4, 1986 Currently in compliance
- Leesburg December 6, 1993 Currently in compliance
- Lynchburg September 6, 1989 Currently in compliance

Highland County has actively chosen not to participate in the NFIP even though they have had hazard areas identified by FEMA located in their County. According to OEMA (Ohio Emergency Management Agency) they are the only county in Ohio (88 counties) not participating in the program. The villages of Mowrystown and Sinking Spring do not have hazard areas identified by FEMA, and also do not participate in the NFIP.

*Diagram illustrating how flash floods occur.
Photo courtesy of British Broadcasting Corporation (BBC) News.*

4.5.3 Flash or Localized Flooding

Flash floods occur within a few minutes or hours of heavy amounts of rainfall, from a dam or levee failure, or from a sudden release of water held by an ice jam. Flash floods can destroy buildings and bridges, uproot trees, and scour out new drainage channels.



Heavy rains that produce flash floods can also trigger mudslides. Most flash flooding is caused by slow-moving thunderstorms, repeated thunderstorms in a local area, or by heavy rains from hurricanes and tropical storms. Although flash flooding occurs often along mountain streams, it is also common in urban areas where much of the ground is covered by impervious surfaces. Roads and buildings generate greater amounts of runoff than typical forested land. Fixed drainage channels in urban areas may be unable to contain the runoff that is generated by relatively small, but intense, rainfall events.

Flash flooding can be intensified by:

- Changing land use such as the development in catchments (increasing the rate and volume of run-off; sediment movement that has changed river cross-sections and affected flood levels).
- Lacking proper maintenance of flood defense systems, watercourses, culverts (including the flood relief areas around them) and road gullies, particularly where this leads to channel blockage.
- Increasing the rate of flow and decreasing the time taken for water to travel within a catchment by means of canalization, modification and diversion of rivers and watercourses.
- Building of structures (such embankments) which restrict flows over historical flood plains and thereby create additional flood risks both upstream and downstream.

4.5.4 Repetitive Loss

In most counties there are areas that periodically suffer damage from floods. They are known as “Repetitive Loss” properties. Repetitive loss properties are defined as properties with structures that have had two or more insurance claims within a 10-year period. The following data was confirmed by the Highland Co EMA Office in September 2023.

Repetitive loss properties

State	Community	Comm Nbr	Mitigated?	Insured?	ZIP Code	Occupancy	Zone
Ohio	City of Hillsboro	390269	NO	NO	45133-0000	OTHR-NONRES	A

Firm	Tot Bldg. Payment	Tot Contents Payment	Losses	Total Paid	Avg. Paid	County
Y	0	11,992.37	2	11,992.37	5,996.37	Highland

4.5.5 Frequency/Probability of Future Occurrence/Flash Floods

Past floods are indications of what can happen in the future, but mitigation plans are based on the risk of future flooding. Flood studies interpret historical records to determine the statistical potential that storms and floods of certain magnitude will recur. Such events are measured by their recurrence interval.

According to the NCEI, Highland County has experienced 30 flash flood events over the past 50-year period with damage estimates totaling approximately \$493,000.

23 of the 30-flash flood events caused property damage, but no injuries or deaths.

Notable flash flood events include:

- 5/31/1997 resulting in \$10,000 worth of property damage.
- 2/18/2002 resulting in \$10,000 worth of property damage.
- 8/22/2003 resulting in \$15,000 worth of property damage.
- 10/4/2006 Greenfield, resulting in \$40,000 worth of property damage.
- 7/20/2013 Careytown, resulting in \$21,000 worth of property damage (2 events the same day).
- 8/17/2016 Belfast, resulting in \$300,000 worth of property damage.
- 6/16/2021 Hillsboro, resulting in \$50,000 worth of property damage.

According to the NCEI, Highland County has experienced 25 flood events over the past 50-year period with damage estimates totaling approximately \$47,000.

7 of the 25 flood events caused property damage, but no injuries or deaths. Notable flood events include:

- 1/23/1996 resulting in \$10,000 worth of property damage.
- 8/10/2018 East Danville, resulting in \$25,000 worth of property damage

4.5.6 Frequency/Probability of Future Occurrence/Flooding

Past floods are indications of what can happen in the future, but mitigation plans are based on the risk of future flooding. Flood studies interpret historical records to determine the statistical potential that storms and floods of certain magnitude will recur. Such events are measured by their recurrence interval.

Recurrence interval, or frequency of occurrence, is defined as the average number of years between storms of a given intensity. Recurrence intervals commonly used in technical studies and design are 2, 10, 25, 50 and 100 years. Recurrence interval addresses how often a flood of a specific depth will be expected to occur. Structures located within areas considered at higher risk should be prioritized higher as it relates to mitigation.

Based on the NCEI data, the future probability of a flash flood is 0.6 events in a given year (30 events/50 years) and 0.5 events per year for flooding (25 events/50 years). This data is included in *Appendix G*

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index Rating/ Risk Index Score (0-100)	Record Period	Annualized Event Frequency	Expected Annual Loss Rating Score (0-100)	Expected Annual Property/Ag Loss \$	Expected Deaths/Injuries
Flooding (Riverine)	Relatively Low/6.19	1996-2019	1.9	Relatively Low/7.12	\$63,625/\$53,778	0.01

There is a lower annual frequency risk correlation between NCEI (.60 flash flood/.50 flood) data and the NRI data (1.90). This may be caused by the NCEI data covering 50 years and the NRI data covering only 23 recent years. If this assumption is correct, flooding has become almost 3x more frequent over the past 25 years vs the past 50 years.

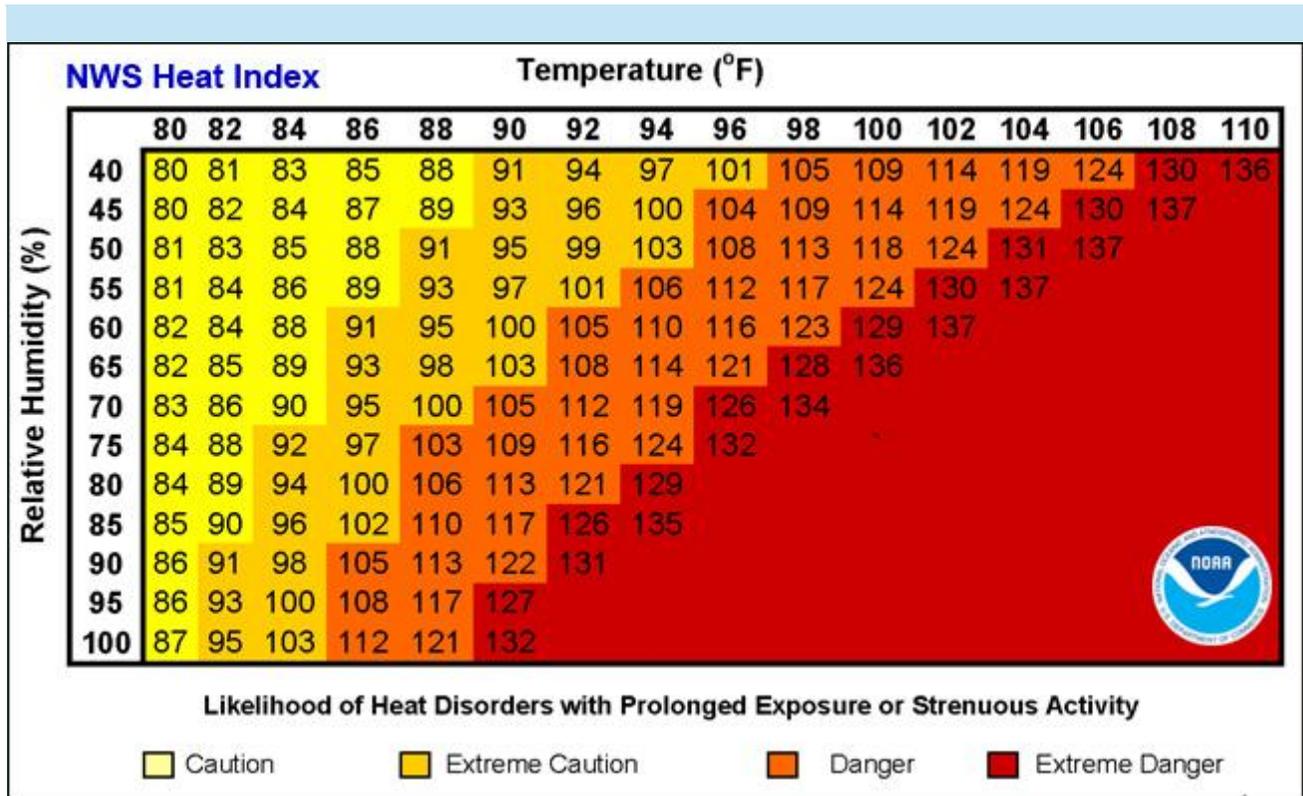
4.6 Extreme Heat

4.6.1 Extent

A heat wave or excessive heat event is defined as a prolonged period of excessive heat and humidity. Medical conditions that a population could suffer from during a heat wave are heat exhaustion and heat stroke.

Because heat-related deaths are preventable, people need to be aware of who is at greatest risk and what actions can be taken to prevent a heat-related illness or death. The elderly, the very young, and people with mental illness and chronic diseases are at highest risk.

However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Air-conditioning is the number one protective factor against heat-related illness and death. If a home is not air-conditioned, people can reduce their risk for heat-related illness by spending time in public facilities that are air-conditioned. The following National Weather Service (NWS) Heat Index chart shows the scale of magnitude and extent of heat and humidity including “Caution”, “Extreme Caution”, “Danger” and “Extreme Danger.”



The Heat Index is a measure of how hot it really feels when [relative humidity](#) is factored in with the actual air temperature. To find the Heat Index temperature, look at the Heat Index Chart above or check our [Heat Index Calculator](#). As an example, if the air temperature is 96°F and the relative humidity is 65%, the heat index--how hot it feels--is 121°F. The red area without

numbers indicates extreme danger. The National Weather Service will initiate alert procedures when the Heat Index is expected to exceed 105°-110°F (depending on local climate) for at least 2 consecutive days. NWS also offers a [Heat Index chart](#) for area with high heat but low relative humidity. Since heat index values were devised for shady, light wind conditions, **exposure to full sunshine can increase heat index values by up to 15°F**. Also, strong winds, particularly with very hot, dry air, can be extremely hazardous.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see an increase in the number of hot weather days.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Annual Days > 90°F	8	29	32
Annual Days > 95°F	1	7	9
Annual Days > 100°F	0	1	2

An increase of >90-degree days (from 8 baseline to 29-low estimate, a 363% increase; 95 degree days (from 1 baseline to 7-low estimate, a 700% increase; and 100 degree days from 0 to 1-low estimate, 100% increase, have implications for the health of vulnerable residents during these projected more frequent heat events.

4.6.2 Historical Occurrence

There have been three (3) heat events and one (1) excessive heat event in Highland Co since 1999, with no property or crop damage, injuries or deaths as per the NOAA-NCEI database and local assessments. The heat events occurred on 7/20/99, 6/28/12 and 7/1/12. The excessive heat event occurred on 8/7/07. The data is included in *Appendix G*.

4.6.3 Frequency/Probability of Future Occurrence

Based on four (4) documented heat/excessive heat events in the NOAA-NCEI database, over the past 20 years (1999), the probability of future occurrences of an annual event is 20% per any given year (4 events / 20 years).

Still, the Core Committee believes that climate change’s impact on weather patterns could alter these historic trends in short order. This plan identifies specific actions to prepare our community for future heat emergencies. The Planning Committee assumes one (1) heat emergency event per year. This is more consistent with the National Risk Index data below.

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index Rating/ Risk Index Score (0-100)	Record Period	Annualized Event Frequency	Expected Annual Loss Rating Score (0-100)	Expected Annual Property/Ag Loss \$	Expected Deaths/Injuries
Heat Wave	Relatively Low/8.86	2005-2017	1.1	Relatively Low/11.31	\$141/\$7,267	0.01

There is a high annual frequency risk correlation between Core Committee finding (1.0) and the NRI data (1.1).

4.7 Tornadoes

4.7.1 Extent

Tornadoes are produced from the energy released during a thunderstorm, but account for only a tiny fraction of the overall energy generated. What makes them particularly dangerous is that the energy is concentrated in a small area, perhaps only 100 yards across. Not all tornadoes are the same and science does not yet completely understand how a portion of a thunderstorm's energy becomes focused into something as small as a tornado.

Tornadoes occur mostly in the central plains of North America, east of the Rocky Mountains and west of the Appalachian Mountains. They occur primarily during the spring and summer – the tornado season comes early in the south and later in the north according to the seasonal changes in relation to latitude – usually during the late afternoon and early evening. They have been known to occur in every state in the United States and every continent on the earth, any day of the year, and at any hour.

The damaging strong winds generated from tornadoes can reach 300 mph in the most violent tornadoes, causing automobiles to become airborne, ripping ordinary homes to shreds, and turning broken glass and other debris into lethal missiles. The biggest threat to living creatures, including humans, during tornadoes is flying debris and being tossed about in the wind. Contrary to previous belief, it is not true that the pressure in a tornado contributes to damage by making buildings "explode."

According to the NWS, the development of Doppler radar has made it possible, under certain circumstances, to detect tornado winds with radar. However, spotters remain an important part of the system to detect tornadoes, because not all tornadoes occur in situations where the radar can "see" them. Citizen volunteers comprise what is called the SKYWARN (www.skywarn.org) network of storm spotters, who work with their local communities to watch out for approaching tornadoes to ensure that appropriate action is taken during tornado events. Spotter information is relayed to the NWS, who operates the Doppler radars and issues warnings, usually relayed to the public by radio and TV, for communities ahead of the storms. The NWS utilizes all the information they can obtain from weather maps, modern weather radars, storm spotters, monitoring power line breaks, as well as additional sources for issuing tornado warnings.

Although the process by which tornadoes form is not completely understood, scientific research has revealed that tornadoes usually form under certain types of atmospheric conditions. Those conditions can be predicted, but it is not yet possible to predict in advance exactly

Annual Average Number of Tornadoes, 1950-1995

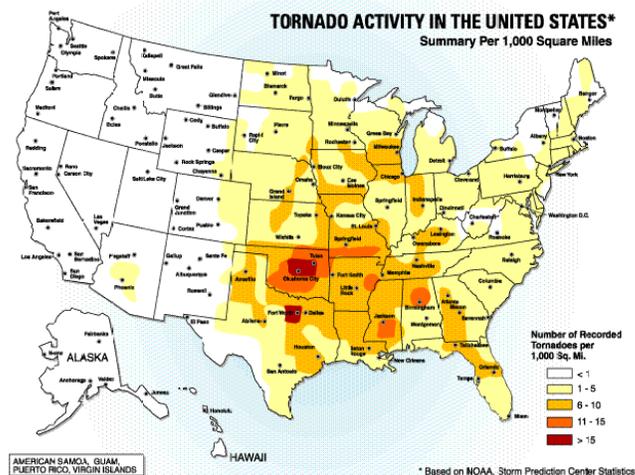
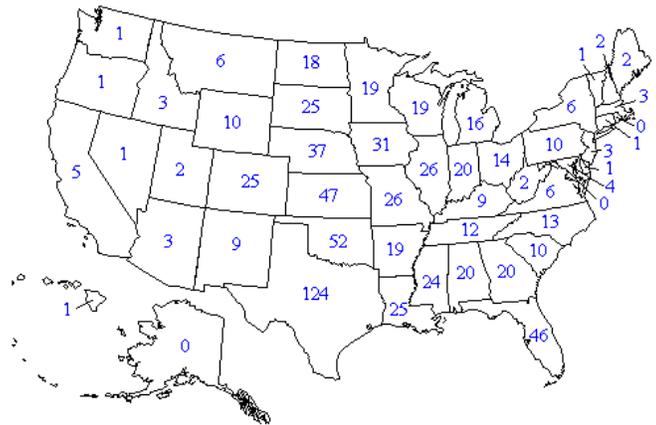


Figure 1.1 The number of tornadoes recorded per 1,000 square miles

Based on NOAA (National Oceanic Atmospheric Association) Storm Prediction Center Statistics

when and where they will develop, how strong they will be, or precisely what path they will follow. According to the NWS, there are some "surprises" every year, when tornadoes form in situations that do not look like the right conditions in advance, but these are becoming less frequent. Once a tornado is formed and has been detected, warnings can be issued based on the path of the storm producing the tornado, but even these cannot be perfectly precise regarding who will, or will not, be struck.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see an increase in the number of hot weather days and fewer days of rain, but with greater annual precipitation. The following charts show the projected trends.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Annual Days > 90°F	8	29	32
Annual Days > 95°F	1	7	9
Annual Days > 100°F	0	1	2
Avg. annual total precipitation	43"	44"	44"
Days with precipitation	200	197	197

The impact of this will be additional energy in the atmosphere which may result in slightly more frequent and intense tornadoes.

Table 4-2 shows that although the State of Ohio may not have the most tornadoes, those that do hit Ohio are significant in damage and have other indication factors of a large-scale tornado.

**Table 4-2
State Tornado Ranking**

Rank	Total Number of Tornadoes	Deaths per 10,000 sq. miles	Number of Killer Tornadoes	Total Tornado Path Length per 10,000 sq. miles	Killer Tornadoes as a % of all Tornadoes	Annual Tornadoes per 10,000 sq. miles
1	Texas	Massachusetts	Texas	Mississippi	Tennessee	Florida
2	Oklahoma	Mississippi	Oklahoma	Alabama	Kentucky	Oklahoma
3	Florida	Indiana	Arkansas	Oklahoma	Arkansas	Indiana
4	Kansas	Alabama	Alabama	Iowa	Ohio	Iowa
5	Nebraska	Ohio	Mississippi	Illinois	Alabama	Kansas
6	Iowa	Michigan	Illinois	Louisiana	Mississippi	Delaware
7	Missouri	Arkansas	Missouri	Kansas	North Carolina	Louisiana
8	Illinois	Illinois	Indiana	Indiana	Michigan	Mississippi
9	S Dakota	Oklahoma	Louisiana	Nebraska	New York	Nebraska
10	Louisiana	Kentucky	Tennessee	Wisconsin	Massachusetts	Texas

Although the number of tornadoes in Ohio does not rank high compared to other states in the United States, the State does average around 14 tornadoes a year. Ohio's peak tornado season runs from April through July, with most tornadoes occurring between 2 p.m. and 10 p.m. Even though June has been the month with the most tornado occurrences, many of the State's major tornado outbreaks have taken place in April and May. However, history has shown that tornadoes can occur during any month of the year and at any time of the day or night.

Tornadoes are considered the most violent atmospheric phenomenon on the face of the earth with their strength being measured by the Enhanced Fujita (EF) Scale as described in Table 4-3. This scale is the mechanism used to determine the potential type of tornado that may have affected a particular community. It is based on velocity of wind and the type of damage the tornado caused. Many EF0 and EF1 tornadoes have touched down in Ohio, but Ohio has also been struck by some of the most destructive (EF5) tornadoes ever, including the April 3, 1974 tornado which devastated Xenia, killing over 30 people and destroying 2,000 buildings.

**Table 4-3
Enhance Fujita (EF) Scale for Tornadoes**

Scale	Wind Speed	Typical Damage
EF-0 Light	65-85 mph	Light Damage: Some chimneys damaged, twigs and branches broken off trees, shallow-rooted trees pushed over, signboards damages, some windows broken.
EF-1 Moderate	86-110 mph	Moderate Damage: Surface of roofs peeled off, mobile homes pushed off foundations or overturned, outbuildings demolished, moving autos pushed off the roads, trees snapped or broken; beginning of hurricane speed winds.
EF-2 Strong	111-135 mph	Considerable Damage: Roofs torn off frame houses, mobile homes demolished, frame houses with weak foundations lifted and moved, large trees snapped or uprooted, light-object missiles generated.
EF-3 Severe	136-165 mph	Severe Damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted, heavy cars lifted off the ground and thrown, weak pavement blown off the roads.
EF-4 Violent	166-200 mph	Devastating Damage: Well-constructed houses leveled, structures with weak foundations blown off the distance, cars thrown and disintegrated, trees in forest uprooted and carried some distance away.
EF-5 Violent	+200 mph	Incredible Damage: Strong frame houses lifted off foundations and carried considerable distance to disintegrate, automobile-sized missiles fly through the air in excess of 300 feet, trees debarked, incredible phenomena will occur.

11 tornadoes were recorded in Highland County from 1972 to 2022, according to the NCEI. All 11 events caused property damage. These tornadoes caused \$2.14 million worth of property damage with no reported injury or deaths. National Weather Service data (Wilmington, OH) reports two (2) additional 2023 tornado events including an EF0 south of New Vienna (March 3, 2023) and an EF1 event west of Hillsboro (March 3,2023), for a total of 13 events. There is no reporting of damage, injury, or deaths from these events. The data is included in *Appendix G*.

4.7.2 Historic Occurrence

On average, tornadoes occur in the County every five (5) years (13 events over 50 years). Recent events include:

- 04/02/1977 with a magnitude of EF0 resulting in \$25.00K worth of property damage.
- 01/07/1978 with a magnitude of EF1 resulting in \$25.00K worth of property damage.
- 06/10/1986 with a magnitude of EF1 resulting in \$250.00K worth of property damage.
- 05/10/2006 in Hillsboro with a magnitude of EF0 resulting in \$30.00K worth of property damage.
- 05/21/2010 in Buford with a magnitude of EF1 resulting in \$100.00K worth of property damage.
- 06/04/2014 in Dodson with a magnitude of EF0 resulting in \$300.00K worth of property damage.
- 07/27/2014 in Hoagland with a magnitude of EF0 resulting in \$80.00K worth of property damage.
- 03/01/2017 in Samantha with a magnitude of EF0 resulting in \$30.00K worth of property damage.
- 03/01/2017 in New Market with a magnitude of EF1 resulting in \$50.00K worth of property damage.

4.7.3 Frequency/Probability of Future Occurrence

The probability of future occurrences is moderate, and the likelihood of severe damage based on past events is moderate. One reason that the County would not expect to suffer severe damage is because most of the County is sparsely populated. The County is more affected by straight-line winds, which are not categorized as a tornadic event but can do just as much damage. Please see Section 4.3.2 High Winds for more discussion on this topic. The likelihood of a future tornado is 26% (13 events / 50 years) in any one year, or one (1) event every five (5) years.

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index Rating/ Risk Index Score (0-100)	Record Period	Annualized Event Frequency	Expected Annual Loss Rating Score (0-100)	Expected Annual Property/Ag Loss \$	Expected Deaths/Injuries
Tornado	Relatively Low/13.61	1986-2019	0.3	Very Low/11.31	\$347,440/\$723	0.03

There is a good annual frequency risk correlation between NCEI data (.26) and the NRI data (.30).

4.8 Droughts /Wildfires

4.8.1 Extent

A drought is a period of abnormally dry weather that persists long enough to produce a serious hydrologic imbalance (i.e., crop damage, water supply shortage, etc.) The severity of the drought depends upon the degree of moisture deficiency, the duration and the size of the affected area.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see an increase in the number of hot weather days and fewer days of rain, but with greater annual precipitation. The following charts show the projected trends.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Annual Days > 90°F	8	29	32
Annual Days > 95°F	1	7	9
Annual Days > 100°F	0	1	2
Avg. annual total precipitation	43"	44"	44"
Days with precipitation	200	197	197
Days with no precipitation (dry days)	165	168	168
Max number of consecutive dry days	11	12	12

The data suggests that the risk of an increase in hotter days is real, the risk for a drought is relatively moderate and very low for future wildfires.

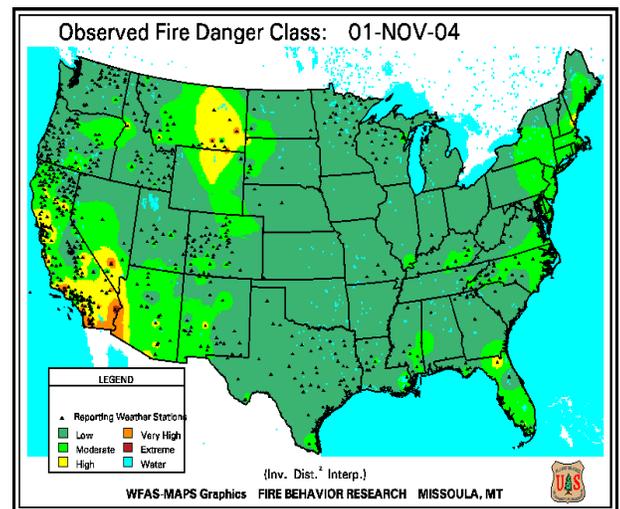
4.8.2 Historical Occurrence

According to the NCEI, drought conditions existed in Highland County in July and August of 1999. Dry conditions that began in the spring and early summer continued into July and August. Excessive heat contributed to substantial crop loss across much of the state. Rainfall was widely scattered and did little to help farmers. Most areas received well below normal rainfall for the month of August. In some areas, around 50% of crops were considered total losses. Most counties in southwest Ohio were declared Federal Disaster Areas by the United States Department of Agriculture (USDA). The total dollar loss amount is unknown.

The worst drought in 50 years affected 35 states during the long, hot summer of 1988, when some areas had been suffering from lack of rainfall since 1984. Rainfall totals in 1988 throughout the mid-west, Northern Plains and the Rockies were 50% to 85% below normal. Crops and livestock died, and some areas became desert. Forest fires began over the Northwest that left 4,100,000 acres destroyed by autumn.

4.8.3 Droughts-Precursor to Other Disasters

Rural counties are susceptible to wild land fires especially during drought conditions. When most people think of wildfires, the first



thing that comes to mind is the devastating and disastrous western fires that are quite prevalent during the summer months.

With more people than ever living, working, traveling and recreating in the urban/urban interface, the odds of wild land fires are increasing. Causes of wild land fires include the careless burning of debris, household trash and cigarettes, lightning, equipment and vehicles, railroad accidents, electrical fires, and arson.

Fire fighters talk of the fire triangle in terms of the heat of combustion, fuel and oxygen all being necessary for fire to occur. Wild land fire fighters are concerned with the wild land fire triangle of fuel (grass, brush, forests, crops, etc.), terrain (open flat lands, steep slopes and everything conducive to wild land fire spread) and weather (hot, dry, windy conditions are typical wild land fire weather).

During an average year in Ohio, an estimated 15,000 wildfires and natural fuel fires occur. Typically, a reported 1,000 wild land fires burn an average between 4,000 to 6,000 acres in Ohio each year.

4.8.4 Urban/Rural Fire Interface

The wildland-urban interface can be defined as the zone where structures and other human developments meet or intermingle with undeveloped lands.

Topography plays a major role in how fast wildfire spreads. Steep slopes are the greatest topographical influence on fire behavior. As the steepness of a slope increases, fires spread more quickly. A fire will spread twice as fast on a 30% slope than it will on level ground. This fast speed is the result of a fire starting at the bottom of a slope has a longer upslope run with more available fuel in its path. Unlike most hazards, the threat of a drought tends to be dismissed because of the relatively long time a drought takes to have damaging effects. The current US Forest Service forecasts a low fire danger potential for Highland County.

According to the NCEI, there have been no recorded wild or forest fires in Highland County’s history from 1972 to 2022. The data is included in *Appendix G*.

4.8.5 Frequency/Probability of Future Occurrence

According to the NCEI, Highland County has had no droughts since 1972, with NO property or crop damage. The odds of future occurrences based on this information are less than 1% (.01). However, Highland County is largely agricultural and suffers varying amounts of crop damage during severe heat and dry conditions that may not be categorized as a drought. The Core Group concluded that this damage is not always recorded but still has a detrimental effect on the County. The Core Group also realized that, unlike other hazards such as flooding or tornadoes, there is little mitigation that can be preplanned to reduce the amount of agricultural damage caused by a drought.

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index Rating/ Risk Index Score (0-100)	Record Period	Annualized Event Frequency	Expected Annual Loss Rating Score (0-100)	Expected Annual Property/Ag Loss \$	Expected Deaths/Injuries
Drought	Relatively Moderate/14.5	2005-2017	1.1	Relatively Moderate/15.94	N/A	N/A



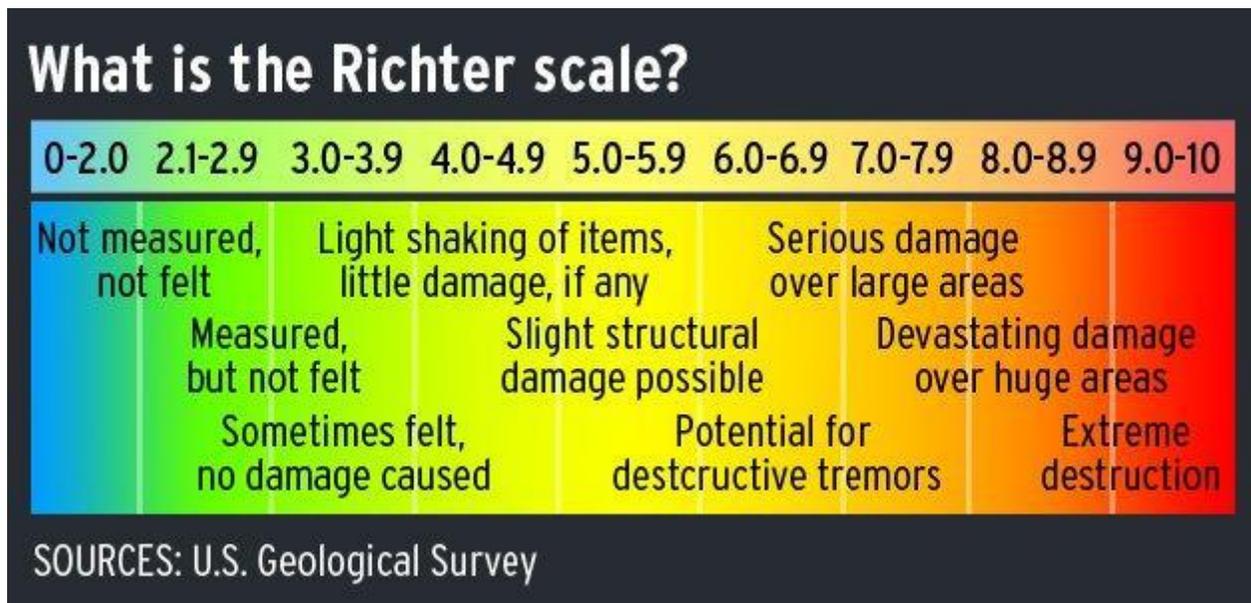
Wildfire	Very Low/2.32	2016	0.004% chance per year	Very Low/2.67	\$2,374/\$2	0
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There is a low annual frequency risk correlation between NCEI (.01) data and the NRI data (.552 average). This is likely the result of limited data in both reporting databases.

4.9 Earthquakes

4.9.1 Extent

The Richter scale is the recognized method for measuring the impact of earthquakes. The following chart shows Richter scale ratings from 0 to 10.

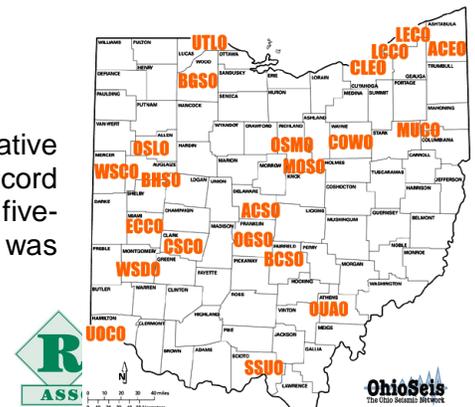


Climate Change Impact:

There is no available data, based on the US Geological Survey, suggesting that climate change will impact earthquakes anywhere in Ohio.

4.9.2 Monitoring of Earthquakes

The ODNR Division of Geological Survey has established a 23-station cooperative network of seismograph stations throughout the State to continuously record earthquake activity. The network, which went online in January 1999, ended a five-year gap during which there was only one operating station in Ohio. The State was



dependent on seismographs in Kentucky and Michigan to record Ohio earthquakes.

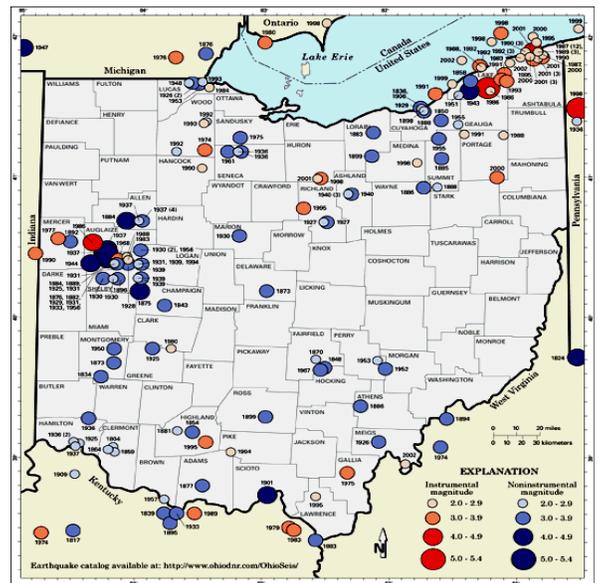
The 23 stations of the new seismograph network, which is called OhioSeis, are distributed across the State, but are concentrated in the most seismically active areas or in areas that provide optimal conditions for detecting and locating very small earthquakes that are below the threshold of human notice. These small micro earthquakes are important because they occur more frequently and help to identify the location of faults that may periodically produce larger, potentially damaging earthquakes.

The OhioSeis seismograph stations are located at colleges, universities, and other institutions, employing new technology that not only makes them very accurate, but also relatively inexpensive and easy to operate and maintain. In contrast to the old technology, in which a pen made a squiggly line on a paper drum, the new system is entirely digital and uses a desktop computer to continuously record and display data. Two other innovations have made the system unique.

An inexpensive Global Positioning System (GPS) receiver is used to keep very precise time on the continuously recorded seismogram, and each station's computer is connected to the Internet for rapid data transfer.

Each OhioSeis station is a cooperative effort. Seismometers, the instrument that detects Earth motions, and other seismic components were purchased by the Division of Geological Survey with funds provided by FEMA through the OEMA, as part of the National Earthquake Hazards Reduction Program. The computers and Internet connection were purchased and provided by the cooperating institutions.

The Division of Geological Survey is coordinating the seismic network and has established the Ohio Earthquake Information Center at the Horace R. Collins Laboratory at Alum Creek State Park, north of Columbus. This facility functions as a repository and laboratory for rock core and well cuttings but has a specially constructed room for earthquake recording. The seismograph system allows for very rapid location of the epicenter and calculation of the magnitude of any earthquake in the State. The earthquake records, or seismograms, from at least three seismograph stations are needed to determine earthquake locations (epicenters). These records can be downloaded from the internet at any station on the network, and location and magnitude can be determined. Small earthquakes were in many cases not even detected by distant, out-of-date seismograph stations.



Epicenters of past earthquakes in Ohio.

The OhioSeis network provides a whole new dimension of understanding about the pulse of the Earth beneath Ohio. Although the new seismograph network will not predict earthquakes or provide an alert prior to an event, it will provide insight into earthquake risk in the State so that intelligent decisions about building and facility design and construction, insurance coverage and other planning decisions can be made by individuals, business and industry, and governmental agencies.

4.9.3 Historic Occurrence

Earthquakes in Ohio

The problem with earthquakes is that major earthquakes are a low probability, high consequence event. It is because of the potential high consequences that geologists, emergency planners and other government officials have taken a greater interest in understanding the potential for earthquakes in some of the areas of the eastern United States and educating the population as to the risk in their areas. Although there have been great strides in increased earthquake awareness in the eastern United States, the low probability of such events makes it difficult to convince most people that they should be prepared.

It is surprising to many Ohioans that the State has experienced more than 120 earthquakes since 1776, and that 14 of these events have caused minor to moderate damage. The largest historic earthquake in Ohio was centered in Shelby County in 1937. This event, estimated to have had a magnitude of 5.5 on the Richter scale, caused considerable damage in Anna and several other western Ohio communities, where at least 40 earthquakes have been felt since 1875. Northeastern Ohio, east of Cleveland, is the second most active area of the state. At least 20 earthquakes have been recorded in the area since 1836, including a 5.0 magnitude event in 1986 that caused moderate damage. A broad area of southern Ohio has experienced more than 30 earthquakes.

Although the New Madrid Line is in close proximity to the State of Ohio, there has not been an earthquake of any significance since 1875 caused by this fault line. An earthquake on June 18, 1975 caused damage in western Ohio, and affected a total area estimated at over 40,000 square miles. Walls were cracked and chimneys thrown down in Sidney and Urbana. The shock was felt sharply at Jeffersonville, Indiana. The affected area included parts of Illinois, Indiana, Kentucky and Missouri.

Highland County Earthquake Events

Highland County experienced 7 (seven) recorded epicenters within its boundaries. The first occurred in 1854 and registered between 3.0 and 3.9 on the Richter scale. The second occurred in 1881 and registered between 2.0 and 2.9 on the Richter scale. Lastly, the third registered epicenter occurred in 1995 and registered between 3.0 and 3.9 on the Richter scale. Since 2015 there have been additional recorded events in or in close proximity to Highland County:

- 2.6 registered just NW of Jackson, OH in 2015.
- 2.5 ESE of Maysville, KY and in 2017.
- 2.8 in Ripley, OH in 2017.
- 2.4 Hillsboro, OH March 20, 2022
- 2.4 Peebles OH August 2, 2023 (nearby Adams County)

According to OEMA's Earthquake Program Manager, the risk in Highland County's zone is low. Though Highland County has had earthquake tremors in the past, the natural geology in the area lends itself to stable conditions if an earthquake were to occur. None of the 7 (seven) recorded events resulted in any loss of life, injury or property damage.

4.9.4 Frequency/Probability of Future Occurrence

Based on historical occurrences of earthquakes in the County, the odds of an earthquake striking Highland County would be a 4% (7 events / 169 years) chance in any one year or 1 earthquake every 25 years. Scientists speculate that the New Madrid Fault line, which runs in close proximity to the State of Ohio, has a high probably of activity within the next 50 years. However, these earthquakes will probably register low on the Richter scale and will be of insignificant detriment. The data is included in *Appendix G*.

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index Rating/ Risk Index Score (0-100)	Record Period	Annualized Event Frequency	Expected Annual Loss Rating Score (0-100)	Expected Annual Property/Ag Loss \$	Expected Deaths/ Injuries
Earthquake	Very Low/2.42	2017	0.044% chance per year	Very Low/3.23	\$54,098/ N/A	N/A

There is a high annual frequency risk correlation between NCEI data (.04) and the NRI data (.044).

4.10 Dam Failure

Dam failures are often referred to as disasters. By definition, a disaster is any event that causes great harm or damage, serious or sudden misfortune. Because of the rapid and unexpected manner in which dam failures can occur, they are classified in the same general magnitude as earthquakes and tornadoes.

Because of the many dams existing in Highland County, the Core Group chose to discuss dam safety in this Mitigation Plan. The Core Group is especially concerned with the development occurring downstream of these dams.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see a decrease in the number of days of rain, but with greater annual precipitation. The following charts show the projected trends.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Avg. annual total precipitation	43"	44"	44"
Days with precipitation	200	197	197

The impact of this will be slightly more intense summer storms with more potential rain and flooding during some events. The increase in heat may also intensify storm conditions. All of this could create flash flooding putting more stress on existing dams.

4.10.1 Extent

Dams in Ohio

A dam is an artificial barrier usually constructed across a stream channel to impound water. Timber, rock, concrete, earth, steel or a combination of these materials may be used to build the dam. In Ohio, most dams are constructed of earth. Dams must have spillway systems to safely convey normal stream and flood flows over, around, or through the dam. Spillways are commonly constructed of non-erosive materials such as concrete.

Dams also have a drain or other water-withdrawal facility to control the pool or lake level and to lower or drain the lake for normal maintenance and emergency purposes.

Most dams in Ohio are small and are constructed by farmers and other private individuals for water supply, recreation, swimming and fishing. Numerous other, usually larger, dams are built by cities and industry to form reservoirs for water supply or liquefied waste storage. Ownership of dams is diverse and maintained by both public and private interests. The federal government owns and operates over 30 dams for flood control, recreation and water supply. The state of Ohio has more than 100 dams, primarily located instate park and wildlife areas for recreational purposes. Flood control and some water supply are provided by dams owned by watershed conservancy districts.

The oldest dams in Ohio were constructed over 150 years ago to create water supply reservoirs for a network of navigational canals. Buckeye Lake Dam, built in about 1825 as part of the canal system and located in Licking and Fairfield counties, is the oldest dam in the state. The highest dam in Ohio is located in Jefferson County and is 240 feet high.

4.10.2 Classification of Dams in Ohio

According to Ohio Administrative Code Rule 1501:21-13-01, dams are classified as follows:

Class I: A dam shall be placed in Class I when failure of the dam would result in probable loss of human life. Dams having a storage volume greater than 5,000 acre-feet or a height of greater than 60 feet shall be placed in Class I.

Class II: Dams having a storage volume greater than 500 acre-feet or a height of greater than 40 feet shall be placed in Class II. A dam shall be placed in Class II when failure of the dam would result in at least one of the following conditions, but loss of human life is not envisioned:

(a) Possible health hazard, including but not limited to, loss of a public water supply or wastewater treatment facility.

(b) Probable loss of high-value property, including but not limited to, flooding of residential, commercial, industrial, publicly owned, and/or valuable agricultural structures, structural damage to downstream Class I, II, or III dams, dikes or levees, or other dams, dikes or levees of high value.

(c) Damage to major roads, including but not limited to, interstate and state highways and roads which provide the only access to residential or other critical areas such as hospitals, nursing homes or correctional facilities as determined by the Chief of ODNR's Division of Water.

(d) Damage to railroads, or public utilities.

Class III: Dams having a height of greater than 25 feet, or a storage volume of greater than 50 acre-feet, shall be placed in Class III. A dam shall be placed in Class III when failure of the dam would result in at least one of the following conditions, but loss of human life or hazard to health is not envisioned.

(a) Property losses, including but not limited to, rural buildings not otherwise listed as high-value property in paragraph (A) of this Rule and Class IV dams, dikes and levees not otherwise listed as high-value property in paragraph (A) of this Rule. At the request of the dam owner, the Chief of ODNR's Division of Water may exempt dams from the criterion of this paragraph if the dam owner owns the potentially affected property.

(b) Local roads including but not limited to roads not otherwise listed as major roads in paragraph (A) of this rule.

Class IV: When failure of the dam would result in property losses restricted mainly to the dam and rural lands, and not loss of human life or hazard to health is envisioned, the dam may be placed in Class IV. Dams which are twenty-five feet or less in height and have a storage volume of fifty acre-feet or less, may be placed in Class IV. No proposed dam shall be placed in Class IV unless the applicant has submitted the preliminary design report required by Rule 1501:21-5-02 of the Administrative Code. Class IV dams are exempt from the permit requirements of Section 1521.06 of the Revised Code pursuant to paragraph (A) of Rule 1501:21-19-01 of the Administrative Code. (water.ohiodnr.gov/safety/dam-safety)

There are more than 50,000 dams identified in Ohio. A great majority of these dams are small and do not fall under the jurisdiction of Ohio's Dam Safety Laws. The number of dams in Highland County, which fall under state law jurisdiction number as of September 2023 and their classifications are as follows:

- Class I Dams - 402
- Class II and III Dams – 1,089
- Class IV Dams – 1,049

According to the ODNR, Highland County has 43 dams within its boundaries. A map of their locations is included in Appendix F. The number of dams and their classifications, as of September 2023, are as follows:

- Class I - 3
- Class II - 5
- Class III - 3
- Other 38

Rocky Fork Lake Dam is the only dam in the county with an Emergency Action Plans (EAP). This plan is on file with the Highland Co EMA office.

In addition, Highland County has three (3) unclassified dams and 25 exempt dams, which have been determined by the ODNR's Chief of the Division of Water to not constitute a hazard to life, health, or property in the event of a failure.

According to the Highland County Engineer's Office, two areas of concern as it relates to dam safety are the areas downstream of the Rocky Fork Lake dam and the Ross County dam. The Rocky Fork dam would cause significant damage if it were to collapse. The dam in Ross County currently creates backwater problem areas in Highland County.

4.10.3 Historic Occurrence

History of Dam Safety in Ohio

Construction of dams in Ohio dates to the early 1800 when reservoirs such as Buckeye Lake and Grand Lake St. Mary's were built to supply water to the canal system, which provided a means of transportation for agricultural trade and commerce. Dam construction continued at a modest pace for about the next 100 years with relatively few dams built by private entities. In the early part of the nineteenth century, several large municipally owned dams and reservoirs were built for public water supply. Severe floods also prompted the formation of conservancy districts which constructed dams for flood control.

Although the true forerunner of current dam safety laws in Ohio was enacted in 1963, legislation pertaining to the construction of dams was enacted as early as 1937. This early set of laws aimed to encourage construction of dams for the storage of water in response to recent drought periods in Ohio and the "dust bowl" days on the Great Plains. The regulatory agency responsible for the enforcement of these early laws was the Division of Conservation and Natural Resources in the State Department of Agriculture.

Due to the availability of large earthmoving equipment after World War II, Ohio saw a significant increase in the number of dams built by individuals and private companies. Although the water storage and recreational capabilities provided by these dams were important benefits, concern about the adequacy of design and construction was prompted by the loss of life and property damage resulting from dam failures, which led to a greater interest in dam safety.

The ODNR's Division of Water has been involved in dam safety since 1963. During this year, the first Ohio law requiring construction permits for building new dams was enacted. In addition, following the failure of several dams in northeast Ohio during the severe flood of 1969, the General Assembly revised the law to include periodic inspections of existing structures. Inspections were required to help assure that the continued operation and use of a dam, dike or levee does not pose a hazard to life, health, or property. In 1972, the failure of Buffalo Creek Dam in West Virginia, which caused great loss of life and severe property damage, led to the enactment of the National Dam Safety Act. This law, administered by the Corp of Engineers, called for an inventory of dams in the United States and the inspection of those dams that could create the most hazards if they failed. The Corps contracted with the Division of Water to inventory roughly 4,500 non-federal dams in Ohio.

4.10.4 Highland County Dam History

Highland County does not have a significant history of dam failure. The State of Ohio Dam Safety Program is in place to monitor and provide dam owners in Highland County pertinent information to support their dam's maintenance requirements. The Dam Safety Program regulates the construction, operation and maintenance of Ohio's dams, dikes, and levees to protect life and property from damage due to failure. This regulation is accomplished through periodic inspection, new dam construction permits and regulation of improvements, maintenance and operation of existing dams.

4.10.5 Frequency/Probability of Events

The probability of future dam failure occurrences is quite low. The likelihood of severe damage of a Class I or a Class II Dam failure would not be very high because of the sparse population of the county. While there is limited data to support any frequency or probability of dam failure, for the purpose of this analysis the committee suggests one (1) possible class I or II dam failure every 50 years.

4.11 Landslides

4.11.1 Extent

The County Engineer has indicated that more landslides are occurring along county roads as a result of increased rain and flash flooding. As documented in 4.5 Flooding, the number of documented flash floods has increased 300% over the past 25 years as compared to data covering 50 years. This is likely to lead to increased landslides, potentially impacting property, but also impacting infrastructure.

Climate Change Impact:

Based on the US Climate Resilience Toolkit, Highland County is expected to see a decrease in the number of days of rain, but with greater annual precipitation. The following charts show the projected trends.

Indicator	Modeled History (1976-2005)	Low Estimate (2015 -2044)	High Estimate (2015-2044)
Avg. annual total precipitation	43"	44"	44"
Days with precipitation	200	197	197

The impact of this will be slightly more intense summer storms with more potential rain and flooding during some events. The increase in heat may also intensify storm conditions. All of this could create flash flooding putting more stress on creating the conditions for landslides.

4.11.2 Historical Occurrence

There is very little documentation of historic landslides, but the County Engineer has indicated they are increasing in frequency.

4.6.3 Frequency/Probability of Future Occurrence

The Highland County National Risk Index (2/2/23) indicates frequency and probability of future events as follow:

Hazard	Risk Index Rating/ Risk Index Score (0-100)	Record Period	Annualized Event Frequency	Expected Annual Loss Rating Score (0-100)	Expected Annual Property/Ag Loss \$	Expected Deaths/Injuries
Landslide	Relatively Low/6.19	2010-2019	0	Relatively Low/16.32	\$1,382/NA	0

Based on additional input from the County Engineer and other Core Committee members, it is estimated that there will be a landslide impacting property and/or infrastructure every five (5) years.

5.0 VULNERABILITY ASSESSMENT

Highland County is susceptible to many kinds of natural hazards as reviewed in the previous section of this plan. If a hazard event struck vacant land, there would not be much cause for concern. However, since Highland County has close to 44,000 residents and thousands of homes, businesses and critical facilities, the potential for damage and injury could be high, especially in higher populous areas such as Hillsboro and Greenfield.

This chapter reviews how vulnerable Highland County is to property damage and threats to public health and safety. This chapter also reviews how hazards may have an adverse impact on the economy. The potential for property damage is measured in dollars based on historical events of the past and damage incurred from those events.



A four-step process was followed to estimate the cost to Highland County of the hazards reviewed in the Hazard Profile section (Section 4.0) of this report. This process was documented on a per hazard basis. The steps that were used are as follows:

- Step 1: Inventory critical facilities and structures susceptible to property damage.
- Step 2: Determine potential dollars lost based on various levels of damage on different categories of structures.
- Step 3: Evaluate the impact on infrastructure and general population including any projected climate change impacts.
- Step 4: Evaluate property damage, loss of life and economic losses.

5.1 Critical Facilities

Members of the Core Group from each of the communities were asked to compile a list of critical facilities pertaining to their community. All the critical facilities within Highland County (schools, hospitals, water treatment plants, airports, police and fire stations, nursing homes, entertainment facilities, and any other facility deemed a critical facility for their county) are included in Appendix F. See the Table 5-1 for a summary of critical facilities by facility type. Please refer to Appendix G for a complete list of these critical facilities.

**Table 5-1
Critical Facilities in Planning Area**

Property	Count
Agencies	24
Airports	1
Cable	1
Childcare	3
Churches	45
Dialysis Centers	2
Electric Suppliers	2
Fire EMS	12
Highway	1
Hospitals	3
Nursing Homes	6
Police	6
Radio	2
Schools	18
Wastewater Plant	6
Water Plant	6
Total Critical Facilities	138

5.2 Potential Dollars Lost

The second step of the vulnerability assessment was to calculate the impact of the given hazards in terms of property damage and loss of property use. Average and typical situations were used for various categories of facilities. This approach did not predict which facilities would be hit by which hazard, but it instead provided a general estimate of the level of damage that would be expected based upon available data.

First, the value of the property being damaged was determined based on the average value of a facility within that category. Typical values of the structures were determined using data received from the County's Auditor's Office.

Contents value was calculated as a percentage of the structure's value. Table 5-2 shows the relative value of the typical contents to the typical structure type. These ratios were taken from FEMA guidance documents.

vulnerability assessment of the given hazards in and loss of property use. situations were used for facilities. This approach did not predict which facilities would be hit by which hazard, but it instead provided a general estimate of the level of damage that would be expected based upon available data.

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calculated as a percentage of the structure's value. Table 5-2 shows the relative value of the typical contents to the typical structure type.

Table 5-2

Contents Value as a Percentage of Structure Value

Occupancy Class	Value (%)
Residential	50%
Commercial	100%
Industrial	150%
Medical Facilities	150%
Emergency Services	150%
General Government	100%
Schools/Libraries	100%
Colleges/Universities	150%
Religion/Non-profit	100%
Shelters	100%

Second, three levels of physical damage were evaluated for each category of structure. These levels have a percentage of damage associated with each. The dollars lost for each level, however, may be underestimated since there may be downtime associated with closing a business for an extended period of time.

- **Minor damage:** Many structures exposed to a storm or other hazard will suffer only minor to moderate damage. For example, a hurricane may just damage the roof and windows of some structures. For this calculation, 5% of the structure’s value was used. Because the structure stays substantially intact, no contents losses were considered.
- **Moderate damage:** This category represents more serious damage, such as a collapsed wall or floodwater over the first floor of a building. Moderate damage is calculated as 40% of the structure’s value plus 40% of the content’s value.
- **Major damage:** This category is used when a building is demolished or heavily damaged. An example of the former is a house leveled by a tornado.

An example of the latter is floodwater more than 1.5 feet over the lowest floor (i.e., over the electrical outlets). The average dollar figure for this category is 75% of the structure’s value and 75% of the contents’ value.

Table 5-3 shows the calculated dollar losses for each level of damage per facility type. The type of facility listed was limited to that information available from the County Auditor’s Office.

**Table 5-3
Physical Potential Dollar Losses**

Property	Number of Units	Average Improved Value	Minor Damage	Moderate Damage	Major Damage
Residential	20,289	\$67,745	\$3,387.25	\$27,098	\$50,808.75
Commercial	1,340	\$151,926	\$7,596.30	\$60,770.40	\$113,944.50
Agricultural	6,349	\$177,370	\$8,868.50	\$70,948.00	\$133,027.50
Industrial	123	\$350,550	\$17,727.50	\$140,220.00	\$262,912.50

Critical Facilities					
Agencies	24	\$18,000,000	\$900,000	\$7,200,000	\$13,500,000
Airports	1	\$5,000,000	\$250,000	\$2,000,000	\$3,750,000
Child Care	3	\$450,000	\$22,500	\$180,000	\$337,500
Churches	45	\$22,500,000	\$1,125,000	\$9,000,000	\$16,875,000
Dialysis	2	\$600,000	\$30,000	\$240,000	\$450,000
Fire/ EMS	12	\$13,200,000	\$660,000	\$5,280,000	\$9,900,000
Hospitals	3	\$9,000,000	\$1,000,000	\$5,000,000	\$10,000,000
Nursing Homes	6	\$9,000,000	\$450,000	\$3,600,000	\$6,750,000
Police	6	\$1,800,000	\$90,000	\$720,000	\$1,350,000
Radio	2	N/A	N/A	N/A	N/A
Schools	18	19,800,000	\$990,000	\$7,920,000	\$14,850,000
WWTP	6	13,200,000	\$660,000	\$5,280,000	\$9,900,000
Water Plants	6	10,800,000	\$540,000	\$4,320,000	\$8,100,000
Total Critical Facilities	138	\$123,350,000	\$6,717,500	\$50,740,000	\$96,323,193

5.3 Vulnerability Data Collection

Prior to beginning an assessment of a community's vulnerability to hazards, local sources of information were researched including comprehensive plans, land use plans, land development regulations and flood regulations, to determine if the county previously addressed its vulnerability to any particular hazard. In most cases, local plans and regulations did not yet exist or were very minimal in addressing natural hazard situations and building parameters.

Therefore, other state and national sources were researched for detailed information. One of these resources was the NCEI. The NCEI is the world's largest active archive of weather data. The NCEI produces numerous climate publications and responds to data requests from all over the world. The NCEI supports a three-tier national climate services support program that includes partners such as the NCEI, Regional Climate Centers, and State Climatologists. The NCEI has long served as a national resource for climate information. The NCEI's data is used to address issues that span the breadth of this nation's interests. As climate knows no boundaries, the NCEI works closely with scientists and researchers world-wide to develop both national and global data sets that have been used by both government and the private sector to maximize the resources provided by our climate and minimize the risks of climate variability and weather extremes. The NCEI has a statutory mission to describe the climate of the United States and acts as the nation's scorekeeper regarding the trends and anomalies of weather and climate. The NCEI's climate data have been used in a variety of applications including

agriculture, air quality, construction, education, energy, engineering, forestry, health, insurance, landscape design, livestock management, manufacturing, recreation and tourism, retailing, transportation, and water resources management among other areas. The NCEI's data and products fulfill needs ranging from building codes to power plant and space shuttle design.

Another source of hazard information that was explored was the Ohio Seismic Network as described in previous sections of this report. The Division of Geological Survey of the ODNR coordinates a 23-station cooperative network of seismograph stations throughout the state to continuously record earthquake activity. OEMA's Ohio Earthquake Program Manager was also contacted to discuss the risks associated with each county to determine if the type of geology lends itself to increased damage.

Because the state and national agencies are not always privy to local knowledge, some information extracted from their libraries may not be comprehensive or complete. Therefore, the Core Group used their experience and knowledge with verification from the local EMA directors to prioritize the hazards determined to affect the county the most and assess them according to local concerns.

5.4 Vulnerability Assessment by Hazard

5.4.1 Summer Storms - Thunderstorms/High Winds/Hail/Lightning

Severe storms for Highland County quantitatively have the highest likelihood of occurring on a yearly basis. According to the NCEI, 208 storm events including thunderstorms, high winds, hail, and lightning were documented for Highland County since 1972. Severe storms in Highland County have caused cumulative property and crop damage with estimated total losses of \$5.123 million over a 50-year period. The county has rated Summer Storms as its top priority.

National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Thunderstorms	3.06*	\$ 26,700*	N/A	N/A	N/A	N/A
Strong Wind	2.3	\$178,584	\$159,956	\$125	\$18,502	0
Hail	3.6	\$ 12,719	\$ 10,735	\$744	\$ 1,241	0
Lightning	75.6	\$ 86,546	\$ 1,973	N/A	\$84,573	0.01

*Based on NCEI data

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Strong Wind	\$1.75 per \$100K	2.47 per 100M	\$4.38 per \$10M
Hail	\$7.28 per \$10M	1.03 per 1B	\$1.68 per \$1M
Lightening	\$6.44 per \$1B	3.38 per 1B	N/A

5.4.1.1 Infrastructure Impact

Since severe summer storms are random in nature, the impact on Highland County's infrastructure is not limited to a certain area as with river flooding. Homes and businesses all throughout the County are susceptible to thunderstorms, lightning, and hail. Shingles are blown from rooftops and hail may dent siding or break windows. Lightning strikes may be more damaging to structures that are not grounded with lightning rods. Trees may become uprooted, and limbs detached and blown into structures. Winds also cause severe damage to mobile home parks and campgrounds if units are not properly tied down.

Utilities and municipal plants may also be damaged during severe storms. Debris, such as tree limbs, blown into utility lines may cause downed power lines. Wastewater and water plants may also be adversely affected with blown limbs and debris clogging the tanks and filters.

Severe Summer Storms	# Units	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Infrastructure Impact	12	\$1,200,000	\$9,600,000	\$18,000,000

*Property and Contents

5.4.1.2 Population Impacts

Because severe storms are random in nature, the entire Highland County population is susceptible and should be prepared. The populations located in mobile home parks and campgrounds should take particular care to seek adequate shelter with approaching severe weather. Since 1972, there have been no deaths and one (1) injury resulting from Severe Summer Storms.

5.4.1.3 Property Damage

According to the NCEI, 208 storm events including thunderstorms, high winds, hail and lightning were documented for Highland County since 1972. Severe storms in Highland County have caused cumulative property and crop damage with estimated total losses of \$5.123 million over a 50-year period.

With the insured house value at \$100,000, damage costs from storms would accumulate quickly. Residents often cannot rely on federal assistance for the total damage incurred. If a Presidential Disaster Declaration is granted to the County, federal money may not cover the entire amount of damage. Therefore, the County and local governments must find the additional money needed to complete the cleanup process. It is assumed that no more than 25% of the total residential units may be damaged by any single summer storm event, which is used in the following calculations.

Severe Summer Storms	# Units	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Residential Property Impact	20,289x.25= 5,072	\$17,180,132	\$137,441,056	\$257,854,406

*Property and Contents

Based on historic damage for this natural hazardous event in Highland County, the following damage estimates are more probable. Historic data suggests thunderstorms, while numerous, caused little damage. High wind and Strong Wind have caused event damage ranging from \$5,000 to \$5,000,000 (9/14/08 event). Hail damage has impacted crops from \$1,000 to \$10,000 per event. Finally, lightning has resulted in one (1) reported \$25,000 damage event (6/14/96). Collectively, these damage estimates are shown below:

Severe Summer Storms	NO Damage	Minor Damage	Moderate Damage	Major Damage
Residential Property Impact	\$0	\$6,000	\$100,000	\$5,000,000

5.4.1.4 Loss of Life

Since 1972, there have been one (1) recorded injuries and NO deaths due to severe summer storms. Due to the severity of the storms affecting Highland County, the potential for death and injury is low. One of the biggest problems associated with severe summer storms is the lack of public education and awareness. Citizens are not aware of the warnings and dangers associated with severe weather.

5.4.1.5 Economic Losses

The economic losses a community suffers during a severe summer storm event can be high. In communities with hazard trees, these trees have the potential to destroy homes and businesses if uprooted. Fallen branches may also cause severe damage. Residents and business owners then turn their efforts from work and running a business to clean up efforts. It is assumed that no more than 25% of the total commercial/industrial units may be damaged by any single summer storm event, which is used in the following calculations.

As no data is available for local historic impact specifically for commercial and industrial damages, the following methodology is being used based on actual property units and property valuations in the county.

Severe Summer Storms	# Units	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Commercial Property Impact	1,340x.25= 335	\$2,544,760	\$20,357,950	\$38,171,240
Industrial Property Impact	123x.25= 31	\$543,337	\$4,346,820	\$8,150,272
Totals:	366	\$3,088,097	\$24,704,770	\$46,321,512

5.4.1.6 Prioritization Rankings

Severe Summer Storms within Highland County received Priority 1 of 9 identified natural hazard risks based on the NCEI data, National Risk Index and input from the Core Committee.

There is a low annual frequency risk correlation between NCEI (4.16 average/year) data and the NRI data

(27.17 average per year). This may be the result of the high number of lightning events reported in NRI vs NCEI and the shorter time span of the NRI data.

5.4.2 Winter Storms – Snow/Ice/Extreme Cold

Highland County is located in a portion of the State in the “snow belt” making it moderately to highly susceptible to winter storms, which encompass Blizzards, Ice Storms and extremely cold temperatures. See *Appendix G* for the tables extracted from the NCEI that show the number of reported events since 1995.

National Risk Index Data



Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Blizzards	N/A	N/A	N/A	N/A	N/A	N/A
Heavy Snow	Included with winter weather	--	--	--	--	--
Cold/Extreme Cold	0.3	\$29,716	\$801	\$27,294	\$1,622	0.00
Winter Storm	3.7	\$77,849	\$47,342	\$2	\$637	0.00
Ice Storm	1.0	\$83,260	\$67,014	N/A	\$16,246	0.00

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Cold/Extreme Weather	\$5.99 per \$10M	1.49 per 100M	\$6.74 per \$10K
Winter Storm	\$3.15 per \$1M	2.44 per 100M	\$1.16 per \$1M
Ice Storm	\$1.49 per \$100K	4.46 per 100M	N/A

5.4.2.1 Infrastructure Impact

Because the area receives a moderate to large amount of snowfall, all of the structures erected in Highland County are susceptible to damage if not designed to the proper snow loading parameters.

Severe Winter Storms	# Units	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Infrastructure Impact	12	\$1,200,000	\$9,600,000	\$18,000,000

*Property and Contents

5.4.2.2 Population Impact

Because winter storms occur countywide, the entire County population is susceptible and should be prepared. The sensitive populations will be the most susceptible to the deep snows and extreme temperatures and should prepare for such events prior to the winter months.

Motorists should be aware of declared snow emergencies and seek safety before becoming stranded. Residents may become trapped in their homes, without utilities or other services. One village within Highland County is especially susceptible to the effects of heavy snow. NRI data suggests no likely risk of death or injury due to these events.

5.4.2.3 Property Damage

According to the NCEI, there have been 36 winter storm events in Highland County reported since 1972, with total property losses of \$725,000. Most of this damage was caused by two (2) events: \$500,000 on 1/6/1996 and \$225,000 on 12/22/2014.

Residents often cannot rely on federal assistance for the total damage incurred. Since January 1, 1964, the President of the United States has declared Highland County a federal disaster area on only two (2) occasions due to damage suffered by winter storms. If a Presidential Disaster Declaration is granted to the County, federal money may not cover the entire amount of damage. Therefore, the County and local governments must find the additional money needed to complete the clean-up process. It is assumed that no more than 25% of the total residential units may be damaged by any single winter storm event, which is used in the following calculations.

Severe Winter Storms	# Units	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Residential Property Impact	20,289x.25= 5,072	\$17,180,132	\$137,441,056	\$257,854,406

*Property and Contents

Based on historic damage for this natural hazardous event in Highland County, the following damage estimates are more probable. Historic data suggests Winter Storms, while numerous in this category, in a few cases can cause serious damages (two (2) of 36 events caused damage- 1/6/96 \$500,000 and 12/22/04 \$225,000). Heavy Snow events have caused damages ranging from \$1,000 to \$4,000 in two (2) of 11 recorded events. Four (4) reported Ice Storms have caused no damage. The county has never had a reported Blizzard. Finally, only one (1) Cold or Extremely Cold event caused \$20,000 in damage on 2/1/96. Collectively, these damage estimates are shown below.

Severe Winter Storms	NO Damage	Minor Damage	Moderate Damage	Major Damage
Residential Property Impact	\$0	\$1,000	\$20,000	\$500,000

5.4.2.4 Loss of Life

Since 1996, there have been NO recorded deaths and NO recorded injuries due to severe winter storms and extremely cold temperatures. Due to the number of winter events affecting Highland County and being located along the “snow belt”, the potential for death and injury is moderate. Since the population of the County is forecasted to slightly increase, the potential for injury and/or loss of life will also slightly increase. One of the biggest problems associated with winter storms and extreme cold is the lack of public education and awareness. Citizens are not aware of the warnings and dangers associated with severe weather, such as driving on ice and snow and medical conditions relative to frost bite and hypothermia.

5.4.2.5 Economic Losses

The economic losses a community suffers during a Severe Winter Storm is high. Residents and business owners turn their efforts from work and running a business to digging themselves out of the snow. If power lines become burdened with snow and snap, prolonged power outages may cause some businesses to close for an extended

period of time leading to loss of revenue. In communities with hazard trees, these trees have the potential to damage homes and businesses if branches loaded with snow crack off and fall. It is assumed that no more than 25% of the total residential units may be damaged by any single winter storm event, which is used in the following calculations.

As no data is available for local historic impact specifically for commercial and industrial damages, the following methodology is being used based on actual property units and property valuations in the county.

Severe Summer Storms	# Units	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Commercial Property Impact	1,340x.25= 335	\$2,544,760	\$20,357,950	\$38,171,240
Industrial Property Impact	123x.25= 31	\$543,337	\$4,346,820	\$8,150,272
Totals:	366	\$3,088,097	\$24,704,770	\$46,321,512

*Property and Contents

Prioritization Rankings

Severe Winter Storms within Highland County received Priority 2 of 9 identified natural hazard risks based on the NCEI data, National Risk Index and input from the Core Committee.

5.4.3 Flooding - 100 Year and localized Flooding

Flooding is a site-specific hazard. Therefore, floodplains are an important planning consideration. A floodplain is any land area susceptible to inundation by floodwaters from any surface water source. Floodplains are measured in terms of the amount of storm water that it takes to cover a given area of land. These storm events are measured in frequency of occurrence, such as 5-year, 100-year and 500-year, with the standard measurement being the 100-year storm or floodplain.

The 100-year floodplain is the land area having a 1 in 100 chance of flooding in any given year, but the statistics can be misleading. In reality, the 100-year storm or flood could occur two, three, or several years in a row (unlikely but possible), because the 100-year flood is a statistical probability and not a predictable recurrence. Statistically, the 100-year flood has a 25% chance of occurring during the typical 30-year lifespan of a home mortgage.

Any development within floodplains can impact the direction, flow and level of the watercourse during periods of high water or flooding. In other words, if fill material is placed or a house constructed in a floodplain, it will alter the boundaries of the floodplain downstream of that area. This alteration happens because structures or fill utilize valuable space that would otherwise act as a natural retaining area for floodwaters to spread and slow. Not only does development in the floodplain increase dangers downstream, developments within the floodplain are at higher risk of damage due to flooding. This damage includes fill material and debris from destroyed structures upstream colliding with structures in the floodplain downstream of an affected area. Many bridges are washed out in floods because river borne debris clog their free-flow area.

National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Riverine Flooding	1.9	\$180,755	\$63,625	\$53,778	\$63,352	0.01

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Riverine Flooding	\$4.51 per \$10K	9.14 per 1M	\$1.00 per \$100

5.4.3.1 Infrastructure Impact

Based on historic Highland Co data, Essential Facilities Exposure to damage is shown on the following table.

Classification	Total	At Least/Moderate	At Least/Substantial	Loss of Use
Fire Stations	7	\$385,000	\$3,080,000	\$5,775,000
Hospitals	2	N/A	N/A	N/A
Police Stations	7	\$105,000	\$840,000	\$1,575,000
Schools	22	\$1,210,000	\$9,680,000	\$18,150,000

Local research data concluded there are 3 area hospitals valued at \$9 million with minimum loss at \$1 million, moderate loss at \$5 million, and major loss at \$10 million.

5.4.3.2 Population Impact

Based on the NCEI data published from 1972 through June 2022 time period, Highland County’s citizens have had to endure 55 flooding situations, including flash floods and river floods. Flash floods affect a specific area over a short period of time and a smaller population than river floods. There were NO deaths or injuries reported for flood events for Highland County. NRI data suggests a risk of death or injury to be 0.01.

For Flash Flooding, the quick change from calm to raging river is what catches people unaware, making flash floods very dangerous. On occasion, a life may be lost because of water rising very quickly in this short time.

Unlike flash flooding, the 100-year river flood has a less likelihood of occurring but will impact a larger population. The streams and rivers within the floodplain will flood their 100-year floodplains on average of once every 100 years. The populations occupying at-risk structures located in the floodplain shown on the Multi-hazard Map will be affected by this flood.

5.4.3.3 Property Damage

According to the NCEI, Highland County has experienced 30 flash flood events from 1972 to 2022 with damage estimates totaling approximately \$493,000 and 25 flood events causing an additional \$44,000 in damages.

National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Riverine Flooding	1.9	\$180,755	\$63,625	\$53,778	\$63,352	0.01

Based on past damages of events, a flood is likely to cause **minor property damage** in Highland County.

5.4.3.4 Loss of Life

The NCEI has NO death or injuries occurring due to flooding within the county. During flash floods, water rises very quickly and may catch citizens by surprise. Homeowner’s may not be prepared for the rising waters and the need to seek safety quickly. Motorists often think that they can drive through ponded water and risk getting stuck in the flooded area. Due to the frequency of flash flooding in Highland County, the risk to human life is high but can be reduced by educating the County’s residents.

5.4.3.5 Economic Loss

The economic losses a community suffers during a flood event can be high. Productivity decreases as residents miss work to tend to the damage incurred at their homes. Some inventory within a business itself may be lost if the owner was not prepared and the facility not flood proofed prior to a flood event. Small businesses may suffer so much damage that they are unable to reopen. Contractors and clean up companies may reap the benefits of the damage but not enough to offset the overall losses to the economy.

Based on past damages of events, a flood is likely to cause **minimal economic losses** in Highland County.

5.4.3.6 Prioritization Rankings

Flooding within Highland County received Priority 3 of 9 identified natural hazard risks based on the NCEI data, National Risk Index and input from the Core Committee.

5.4.4 Extreme Heat

There have been four (4) excessive heat events in Highland Co since 1972, with no property or crop damage, injuries or deaths as per the NOAA-NCEI database.

Heat-related deaths and illness are preventable yet annually many people succumb to extreme heat. Extreme heat caused 7,415 heat-related deaths in the United States from 1999 to 2010. From 1979-2014 extreme heat related deaths increased from .5 deaths per million in 1979 to about 2 deaths per million in 2014 (USEPA Data). This data suggests that US deaths caused by Extreme Heat will continue to rise. Extreme heat kills more people

than hurricanes, floods, tornadoes and lightning combined, according to the National Weather Service. In 2016, 94 deaths were caused by excessive heat exposure.

National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Heat Wave	1.1	\$101,521	\$141	\$7,267	\$94,113	0.01

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Heat Wave	\$3.23 per \$100M	2.65 per 10M	\$5.52 per \$100K

5.4.4.1 Infrastructure Impact

While excessive heat may cause some softening of asphalt roadways, the real infrastructure threat is overheating of critical facilities, including motors at water and sewer plants, and electrical generation/distribution facilities. Such system failures will cause broad impact across the population effected. Potential loss of water and electricity (AC) could result.

5.4.4.2 Population Impact

Heat emergencies will most dramatically impact vulnerable populations, including the elderly. Because heat-related deaths are preventable, people need to be aware of who is at greatest risk and what actions can be taken to prevent a heat-related illness or death. The elderly, the very young, and people with mental illness and chronic diseases are at highest risk. However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather. Air-conditioning is the number one protective factor against heat-related illness and death.

If a home is not air-conditioned, people can reduce their risk for heat-related illness by spending time in public facilities that are air-conditioned. The loss of electricity and limited potable water create the greatest threats to the population during a heat emergency.

5.4.4.3 Property Impact

The most likely impact on property will be on crop production. Extreme heat can ruin crops or deprive them of the water they need. There could also be spoilage of food and goods that require refrigeration if electrical service is interrupted. Residential, commercial, and industrial property will see minimal impact from heat emergencies. Based on past damages (\$0 damages in four (4) reported events) a heat emergency is likely to cause **minor property damage** in Highland County.

5.4.4.4 Loss of Life

Again, vulnerable populations, particularly the elderly, could be dramatically impacted by a heat emergency including death. This Hazard Mitigation plan addresses preparation planning to reduce the likelihood of such an outcome. The National Risk Index projects 0.01 deaths per year.

5.4.4.5 Economic Loss

Heat emergencies can cause work slowdowns, crop damage and spoilage of refrigerated goods. As such an event would likely be countywide, the following chart attempts to quantify these potential losses.

Based on past damages of events, a heat emergency is likely to cause **minor economic losses** in Highland County.

5.4.4.6 Prioritization Rankings

Excessive Heat within Highland County received Priority 7 of 9 identified natural hazard risks based on the NCEI data, National Risk Index and input from the Core Committee.

5.4.5 Tornadoes

13 tornadoes were recorded in Highland County from 1972 to 2023, according to the NCEI and current National Weather Service data. These tornadoes caused \$2.14 million worth of property damage, with NO deaths and NO injuries. Section 4.7.2 offers details about the most significant tornado events. Most recent events data from the National Weather Service, Wilmington OH, confirmed an EF1 Tornado west of Hillsboro on March 3, 2023 and a second EF0 tornado on March 3, 2023 south of New Vienna. NO injuries or damage has been reported.

National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Tornado		\$543,723	\$347,440	\$723	\$195,560	0.03

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Tornado	\$3.04 per \$10K	2.10 per 1M	\$2.09 per \$100K

5.4.5.1 Infrastructure Impact

Because tornadoes are random in nature, no one area of a county is more susceptible to infrastructure damage than another. In Highland County, the occurrence of tornadoes is moderate to high with 11 F-0 to F-3 events occurring since 1972. Since the occurrence of tornadoes is moderate, the effect on the infrastructure will also be

moderate with many houses or businesses needing some type of repair. On occasion, a structure may be destroyed completely but a high frequency of this extent of damage will not be expected.

Since tornadoes will not affect all of the county, the following chart assumes up to 10% of the county could be impacted by a single tornado event.

Tornadoes	# Units x .1	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Infrastructure Impact	12x.1= 1.2	\$120,000	\$960,000	\$1,800,000

*Property and Contents

5.4.5.2 Population Impact

Tornado occurrences are random in nature. Therefore, the entire Highland County population is susceptible and should be prepared. The populations located in mobile home parks and campgrounds should take particular care to seek adequate permanent shelter with approaching severe weather.

Since tornadoes typically present localized hazards, several homes may need repair, but typically homeowners will have insurance to cover these expenses and will not suffer long term financial hardship.

5.4.5.3 Property Damage

Since tornadoes will not affect all of the county, the following chart assumes up to 10% of the county could be impacted by a single tornado event.

Tornadoes	# Units x .1	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Residential Property Impact	20,289x.1= 2,029	\$6,870,194	\$54,961,552	\$103,052,910

*Property and Contents

Based on historic damage for this natural hazardous event in Highland County, the following damage estimates are more probable. Historic data indicated 11 of the 11 tornado events caused \$2.14 million in damages.

Tornadoes	NO Damage	Minor Damage	Moderate Damage	Major Damage
Residential Property Impact	\$0	\$25,000	\$100,000	\$300,000

5.4.5.4 Loss of Life

Since 1972, there have been NO injuries and NO recorded deaths due to tornadoes. One of the biggest problems associated with tornadoes is the lack of public education and awareness, especially since tornadoes do not happen that frequently. Citizens are not aware of the warnings and dangers associated with severe weather and tornadoes and thus may not be prepared. The National Risk Index suggests 0.03 deaths per year as a result of Tornadoes.

5.4.5.5 Economic Losses

Due to the frequency of tornado events in Highland County, the overall impact on the economy is moderate to high. However, Highland County sustained a total of \$2.14 million in damages in 11 recorded NCEI events. Thus, the overall economic impact may be considered moderate. If a tornado were to touch down, the majority of the economic losses would be localized versus countywide. It is very unlikely that a Presidential Disaster Declaration would occur, therefore the all clean-up costs would be funded locally. If a Presidential Disaster Declaration is granted to the County, federal money may not cover the entire amount of damage. Therefore, the County and local governments must find the additional money needed to complete the clean-up process. Highland County has only been included in a Presidential Disaster Declaration for two tornadoes that hit in 1965 and 1981.

Since tornadoes will not affect all of the county, the following chart assumes up to 10% of the county could be impacted by a single tornado event.

As no data is available for local historic impact specifically for commercial and industrial damages, the following methodology is being used based on actual property units and property valuations in the county.

Tornadoes	# Units x .1	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Commercial Property Impact	1,340x.1= 134	\$258,218	\$2,065,744	\$3,873,270
Industrial Property Impact	123x.1= 12	\$221,592	\$1,772,736	\$3,323,880
Totals:	146	\$479,810	\$3,838,480	\$7,197,150

*Property and Contents

5.4.5.5 Prioritization Rankings

Tornadoes within Highland County received Priority 5 of 9 identified natural hazard risks based on the NCEI data, National Risk Index, and input from the Core Committee.

5.4.6 Droughts/Extreme Heat/Wildfires

According to the NCEI, Highland County has experienced no drought events, and no reported wildfires in the past 50 years. According to records, neither drought event resulted in loss of life, injury, or any property or crop damage.



As seen in the hazard profile and as determined by the Planning Committee, Highland County has a low risk of incurring damage from droughts or wildfires.

5.4.1.1 National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Drought	3	\$988,499	N/A	988,499	N/A	0.00
Wildfires	0.004% chance per year	\$ 3,013	\$2,374	\$2	\$637	0.00
Heat Wave	1.1	\$101,521	\$ 141	\$7,267	\$94,113	0.01

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Drought	N/A	N/A	\$2.96 per \$1K
Wildfires	\$4.00 per \$100	1.21 per 1K	\$1.36 per \$100
Heat Wave	\$3.23 per \$100M	2.65 per 10M	\$5.52 per \$100K

5.4.6.1 Infrastructure Impact

Because droughts are non-site-specific hazards, the effects of a drought should be evaluated countywide. By themselves, droughts and temperature extremes do not damage developed property. However, over the long run, certain soils can expand and contract resulting in some structural damage to buildings. A small percentage of buildings in areas with such soils suffer minor damage during their “useful lives.” Therefore, the overall impact on Highland County’s infrastructure will be very low.

5.4.6.2 Population Impact

Since droughts are non-site specific, the entire Highland County population could be affected by the hot, dry conditions. The overall impact that droughts and extreme heat have on the County population is very low since only one (1) event has been recorded by the NCEI since 1972. However, many communities throughout the County depend on wells for their water supply. These communities need to be more aware of the potential for their water supply to be disrupted. In addition, the County residents, especially the sensitive populations, should still be aware of the dangers of extreme heat, such as heat exhaustion and heat stroke.

5.4.6.3 Property Damage

According to the NCEI, there have been one (1) drought in Highland County reported in 1999. The drought of 1999 was the most significant drought, lasting four months. However, no recorded property or crop damage, or death or injuries have ever been reported in Highland County, as a result of drought conditions.

With Highland County being a farming community, there is potential for crop damage due to droughts. However, this potential is low based on the number of drought occurrences in the County.

Other than agricultural losses calculated below under economic impact, no residential property damages are likely to be caused by drought.

5.4.6.4 Loss of Life

Since 1972, there have been NO recorded deaths and NO injuries due to drought, excessive heat, or wildfires in Highland County. Citizens still need to be educated on the dangers of drought, excessive heat, and wildfires. Because drought conditions are not prominent, citizens tend to not be aware of the warnings and dangers associated with conditions like heat exhaustion and heat stroke and thus may not be prepared.

5.4.6.5 Economic Losses

Due to the infrequency of drought and extreme temperature events in Highland County, the overall impact on the economy is very low. However, if a drought does occur, the economic losses would be countywide hitting the farming community the hardest. It is very unlikely that a Presidential Disaster Declaration would occur, therefore the all mitigation costs would be funded locally. It is assumed that no more than 25% of the total Agricultural property may be damaged by any single drought event, which is used in the following calculations.

Drought	# Units	5% of Units Minor Damage*	40% of Units Moderate Damage*	75% of Units Major Damage*
Agricultural Property Impact	6,349x.25= 1,587	\$14,073,516	\$112,594,476	\$211,113,849

Again, the above figures are based on the number of agricultural units in the county and their valuations as reported by the County Auditor. Historic drought and wildfire loss data report no drought or wildfire losses, and as such provide no information for any future loss assumptions (other than assuming no future damages).

5.4.6.5 Prioritization Rankings

Drought/Wildfires within Highland County received Priority 8 of 9 identified natural hazard risks based on the NCEI data, National Risk Index and input from the Core Committee.

5.4.7 Earthquakes

Highland County has experienced seven (7) recorded earthquake events since 1854, with NO deaths, NO injuries, and NO property damage.

As seen in the hazard profile and as determined by the Core Group, Highland County has a very low risk of incurring damage from earthquakes. The County has had four (4) recorded epicenters within its boundaries; one in 1854, the second in 1881 and the third in 1995, and a fourth in 2022. An additional event occurred in 2015 and two more occurred in 2017, all centered outside of the county (total of seven (7) local impact events).

National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Earthquake		\$58,070	\$54,098	N/A	\$3,973	1.4 per 10k population

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Earthquake	\$1.68 per \$100	1.40 per 10K	N/A

5.4.7.1 Infrastructure Impact

Due to the infrequency of earthquakes occurring in Highland County, the impact on the County’s infrastructure is quite low. Since 1972, five (5) quakes that were recorded registered between 2.0 and 3.9 on the Richter Scale. Earthquakes of these magnitudes are not expected to cause damage to infrastructure, as shown on the Richter Scale Chart in Section 4.9.

5.4.7.2 Population Impact

Since the threat of an earthquake is minimal, the overall impact on the County's population will be very low. Further, there are less than 8 (eight) non-agriculture buildings of more than 3 (three) stories in the county. However, all citizens within the County need to be aware of the threat of potential earthquakes. The NRI suggests 1.4 deaths or injuries per 10,000 people during an earthquake event of any serious magnitude.

5.4.7.3 Property Damage

The level of damage expected from an earthquake in Highland County is moderate. It would be expected to be on the order of a magnitude of 5.0 quake, or lower, as registered on the Richter scale. A quake of this magnitude would be felt by most people and include some breakage of dishes, windows and plasters.

Based on past damages of events, an earthquake is likely to cause **minor property damage** in Highland County.

5.4.7.4 Loss of Life

The level of an expected earthquake is not considered to be life threatening. Some minor injuries may result from falling objects. Because the likelihood of an earthquake occurring is very low, the potential for death or injury is minimal. The NRI suggests 1.4 deaths or injuries per 10,000 people during an earthquake event of any serious magnitude.

5.4.7.5 Economic Losses

Based on the very limited property damage expected from a 5.0 magnitude earthquake, the impact on the local economy and local government expenditures is considered to be moderate.

Based on past damages of events, an earthquake is likely to cause **moderate economic losses** in Highland County.

5.4.7.6 Prioritization Rankings

Earthquake within Highland County received Priority 8 of 9 identified natural hazard risks based on the NCEI data, National Risk Index and input from the Core Committee.

5.4.8 Dam Failure

Highland County has no history of Dam failure related deaths, injury, or property damage. There is no National Risk Index date for dam failure.

5.4.8.1 Infrastructure Impact

Inundation areas below the dams are most at risk for infrastructure damage. This plan identifies the need to address possible repairs inundation area and public areas around the Class I Rocky Fork Lake Dam.

5.4.8.2 Population Impact

As above, the inundation area around Rocky Fork Lake Dam present the highest risk for loss of life. Public awareness regarding the inundation zone will minimize any population impact. An Emergency Action Plan (EAP) is prepared for this area and is on file with the Co EMA office.

5.4.8.3 Property Damage

Property damage could be significant in the limited inundation zones in the event of a dam failure. The County will study and quantify these risks over the next few years.

Given the defined geographic nature of dam failure caused property damage, such an event is likely to cause **minor property damage** in Highland County.

5.4.8.4 Loss of Life

Given the anticipated lead time proceeding any potential dam failure, residents should be able to safely evacuate. Potential Loss of life is considered minimal given these conditions.

5.4.8.5 Economic Losses

Until the inundation zones are studied and quantified, there is no rational way to quantify the potential property damage or economic impact of a specific dam failure. Over the next few years, this data should be available for such calculations and risk assessments.

Again, given the defined geographic nature of dam failures, such an event would likely cause minor economic losses in Highland County.

5.4.8.6 Prioritization Rankings

Dam Failure within Highland County received Priority 9 of 9 identified natural hazard risks based on the NCEI data, National Risk Index and input from the Core Committee.

5.4.9 Landslides

There is no NCEI Landslides in Highland County. NRI landslide data follows:

National Risk Index Data

Hazard	Annualized Event Frequency	Expected Annual Loss Values Total	Building Annual Loss Value	Ag Annual Loss Value	Population Equivalency Annual Loss Value	Expected Annual Deaths/Injuries
Landslides	0	\$37,799	\$1,382	N/A	\$3,973	0

Further, NRI analysis suggests the following losses based on building value, population injury/death, and agriculture value.

Hazard	Building Value	Population	Agriculture Value
Landslides	\$7.39 per \$100K	2.29 per 100K	N/A

5.4.9.1 Infrastructure Impact

While Landslides may cause damage to asphalt roadways, and other infrastructure and critical facilities. The Action Plan documents two (2) existing landslides that have impacted county infrastructure. These include 10077 N. Union Rd (CR-21C) and 11825 Sinking Springs Rd (CR-4B).

5.4.9.2 Population Impacts

Landslides may impede travel corridors for weeks, months or even years.

5.4.9.3 Property Impact

In residential or commercial property situations, they may make repairs or reconstruction extremely costly or not viable.

5.4.9.4 Loss of Life

Normally, there should be some advanced warning of soil instability that will result in a landslide. Flash folding can drastically reduce this early warning time frame, but the committee does not expect any loss of life or injury resulting from landslides. NRI data supports this conclusion.

5.4.9.5 Economic Loss

Economic loss would be defined by extra travel time around closed routes, or lost productivity due to utility outages. We do not currently have any data to propose dollar estimates for such impacts.

Based on Core Committee input, a landslide is likely to cause **minor economic losses** in Highland County.

5.4.9.6 Prioritization Rankings

Landslides within Highland County received Priority 4 of 9 identified natural hazard risks based on input from the Core Committee. This score was high given the existing landslide impacted properties that need addressed.

6.0 GOALS AND ACTION ITEMS

Highland County, OH Mitigation Action Plan Matrix

The following chart shows 10 Goals and 31 Action Items which are intended to address and mitigate the loss of property and life because of Natural Hazards in Highland County over the next five (5) years (2024-2028). Priority Projects were determined by the Planning Committee and all Action Items are ranked (1 highest priority).

“ALL” under Target Jurisdiction and Comments includes ALL the following local jurisdictions: **City of Hillsboro, Villages of Greenfield, Highland, Leesburg, Lynchburg, Sinking Springs, and Mowrystown.** Townships include **Brush Creek, Clay, Concord, Dodson, Fairfield, Hamer, Jackson, Liberty, Madison, Marshall, New Market, Paint, Penn, Salem, Union, Washington, and White Oak.**

Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
1. ALL Hazards: 1.1 Reduce health and safety risks during future natural disasters	3	1.1.1 Deliver comprehensive annual public outreach/education plan which seasonally covers hazardous materials, seasonal cold/heat, Severe summer storms, flooding, tornadoes and high winds, severe winter storms, and droughts/wildfires. <ul style="list-style-type: none"> Educate residents to prepare for 7 days of self-sufficiency. 	1/1/24-ongoing	HCEMA Local media Co Public Info Officer Co Health Dept. Police/Sheriff Fire Depts. Co Engineer Red Cross Health Depart. Common message: “It could be up to 7 days until we can reach you in an emergency”.	Existing budget 1	County-wide, All Jurisdictions	Ongoing

Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
	17	1.1.2 Outreach to the Amish and Mennonite communities who have limited communication and access to emergency response systems (Elders and gatherings)	3/1/24-12/31/25	HCEMA	Existing Budget 1	Amish along SR 62 Mennonites in Leesburg	
	1	1.1.3 Purchase/install emergency backup generators for high critical need locations including: Red Cross shelters Greenfield FS 21 Leesburg Community Annx Southern States Patriot Center (Central Campus) Hillsboro Senior Center	2/1/24-12/31/25	HCEMA	FEMA, EMA, CDBG and other grants 2	Hillsboro Greenfield Leesburg Lynchburg Mowrystown	Ongoing At-Risk population
	4	1.1.4 Two mobile generators to serve key gasoline distribution sites. Install hookups as needed at each identified site.	2/1/24-12/31/25	HCEMA Co Engineer Lykins is fuel supplier	CDBG FEMA OEMA 2	Fairfield Township (north) White Oak Township (south)	In progress

Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
	2	1.1.5 Continue to expand and strengthen the early warning siren system by adding sirens at Lynchburg and in the Rocky Fork Lake area.	9/1/24-12/31/25	HCEMA County Engineer Fire Depts.	FEMA, EMA, and CDBG grants 1	Paint Township/Lake Area Lynchburg Rocky Fork Lake area Mowrystown Sinking Springs	In progress
	11	1.1.6 Complete and Implement Debris Management Plan for any natural disaster cleanup	6/1/24-7/1/25 Then ongoing	HCEMA County Engineer	Existing budget 1	Hillsboro Greenfield	In progress
	7	1.1.7 Update emergency shelter locations and agreements (Red Cross)	3/1/24-12/31/24	HCEMA Red Cross	Existing budget 1	Hillsboro Greenfield Lake Area	In progress
	27	1.1.8 Investigate ways to strengthen shelter management operations (in EOP)	3/1/23-12/31/24	HCEMA County Commissioners	Existing budget 1	Hillsboro and Greenfield	

Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
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Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
	8	1.1.9 Investigate the installation of residential and community safe rooms	9/1/24-12/31/25	HCEMA County and local officials Red Cross	OEMA Saferoom annual grants 3	Hillsboro Lynchburg Leesburg Rocky Fork Lake -Paint Township County Fairgrounds	Ongoing
	16	1.1.10 Public Health Emergency Preparedness via modernization of Public Health Education, data collection, surveillance, and data sharing	1/1/24-12/31/24	Health Dept. Local HC providers OEMA	Existing budget ODH grants as needed 1	County-wide	New
	5	1.1.11 Expand MARCS Radio towers to serve and provide interoperable communications between Police, Fire and EMS	2/1/25-12/31/26	HCEMA	OEMA 2	1. Marshall 2. SE Portion of County TBD	

<p>2. Summer Storms 2.1 Reduce health and safety risks during future summer storm events</p>	<p>30</p>	<p>2.1.1 Encourage developers to bury power and other utility lines to reduce power outages during storms</p>	<p>2/1/25-12/31/28 Then ongoing</p>	<p>County Engineer Planning Office</p>	<p>Existing budget 3</p>	<p>County-wide, All Jurisdictions</p>	<p>Ongoing</p>
	<p>15</p>	<p>2.1.2 Develop a tree maintenance program for proactively trimming and pruning trees to reduce power outages</p>	<p>6/1/24-9/30/25</p>	<p>HCEMA County Engineer Utility Companies Tree Commission Greenfield</p>	<p>Existing budget 1</p>	<p>Hillsboro Greenfield</p>	
	<p>29</p>	<p>2.1.3 Complete Hillsboro storm water system upgrade (Phases I, II and III), south-side of town</p>	<p>Completed by 5/1/24</p>	<p>Hillsboro Greenfield</p>	<p>EPA, CDBG 1</p>	<p>Hillsboro Greenfield</p>	<p>Underway</p>
<p>3. Winter Storms 3.1 Reduce health and safety risks during future Winter Storm events</p>	<p>23</p>	<p>3.1.1 Develop a warehouse for storing essential disaster supplies (food pantries, clothing, cots/bedding, and medical) and distribution process to shelters during disaster events</p>	<p>3/1/24-12/31/28 Then ongoing</p>	<p>HCEMA Community Action Senior Center (Meals on Wheels)</p>	<p>Local agencies Church food pantries 2</p>	<p>Leesburg Lynchburg Hillsboro Greenfield</p>	

	9	3.1.2 Emergency transportation services for delivery of critical medicine and essentials to vulnerable populations <ul style="list-style-type: none"> Investigate vehicle purchase. Identify priority roads for clearing 	1/1/24-6/30/25	HCEMA Family Recovery Service (FRS) County Engineer	ODOT Transit funding 2	County-wide, All Jurisdictions	New At-Risk population at Lake area
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Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
4. Flooding 4.1 Reduce health and safety risks during future localized and 100-year flooding events	21	4.1.1 Consider joining the National Flood Insurance Program (NFIP) (Highland Co)	1/1/24-12/31/25	HCEMA County Engineer County Commissioners	Existing budget 1	Highland Co	In progress
	10	4.1.2 Encourage FEMA to update 30-year-old rate Flood Insurance Rate Maps (FIRM)	1/1/24 until completed	HCEMA OEMA FEMA County Commissioners	FEMA 1	County-wide, All Jurisdictions	Little control on FEMA timeline
	26	4.1.3 Address bank erosion and floodings at Roadside Park		Village Ramboll Engineering HCEMA	OEMA ODNR 2	Village of Leesburg	Engineering underway
5. Landslides 5.1 Address existing	19	5.1.1 Repair slip near 10077 North Union Rd		County Engineer	Existing budget, OPWC		New

landslide locations to reduce the risk of failure		(CR-21C)			2		
	20	5.1.2 Repair slip near 11825 Sinking Springs Rd (CR-4B)		County Engineer	Existing budget, OPWC 2		New
6. Tornadoes 6.1 Reduce health and safety risks during future Tornado events	28	6.1.1 Seek funding and coordination to train weather spotters	1/1/24-12/31/28 Ongoing	HCEMA NWS Ham Radio Operators	NWS training grants 1	County-wide, All Jurisdictions	Classes are scheduled for 2023 and 2024
	6	6.1.2 Promote new Hyper-Reach early warning mass notification system (test, email, utility bills, and phone) to residents	1/1/23-12/31/24	HCEMA Fire Departments	Existing budget 1	County-wide, All Jurisdictions	
	22	6.1.3 Install a tornado alarm/siren in the Village		Village HCEMA	OEMA 1	Village of Lynchburg	
7. Drought/Wildfires 7.1 Reduce health and safety risks during future Drought or Wildfire events	12	7.1.1 Brush truck upgrades and replacements to combat brush and wildfires.	6/1/24-12/31/28	HCEMA Fire Departments 2	Fire Depts. FEMA AFG State Fire Marshall ODNR Forestry grants	Marshall Township Fire Depts	
	31	7.1.2 Educate the community about the risks of open burning		HCEMA Fire Depts 1		County-wide All Jurisdictions	New
	14	8.1.1 Develop a list of special needs residents	2/1/24-12/31/25	Fire Departments	Existing budget	County-wide, All	At -risk populations in

<p>8. Extreme Heat 8.1 Reduce health and safety risks during future Extreme Heat events</p>		<p>(and map locations) to serve during a Heat Emergency</p>		<p>Co Health Dept. Community Action Health Collaborative Meals on Wheels Regional Area on Aging 1</p>		<p>Jurisdictions</p>	<p>the Lake Area</p>
	<p>18</p>	<p>8.1.2 Identify cooling stations and their supply needs, including backup generators at Red Cross shelters Greenfield FS 21 Leesburg Community Annx Southern States Patriot Center (Central Campus) Hillsboro Senior Center</p>	<p>6/1/24-12/30/26</p>	<p>HCEMA Red Cross Senior Center 2</p>	<p>Existing budget</p>	<p>Hillsboro Greenfield Village fire stations</p>	<p>At -risk populations</p>

Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
<p>9. Earthquakes 9.1 Reduce health and safety risks during future Earthquake events</p>	<p>24</p>	<p>9.1.1 Educate public about what to do in the event of an earthquake using Facebook and other social media</p>	<p>9/1/24-12/31/28 Then ongoing</p>	<p>HCEMA Local media Co Public Info Officer Co Health Dept. Police/Sherriff Fire Depts. Co Engineer 1</p>	<p>Existing budget</p>	<p>County-wide, All Jurisdictions</p>	

Goal	Priority	Action Item	Start/End Dates	Responsible Party (key)	Resources Cost/Benefit 1 good/2 fair/3 poor	Target Jurisdiction and Comments	Status
10. Dam Failure 10.1 Reduce health and safety risks during a dam failure	13	10.1.1 Implement needed repairs at Rocky Fork Lake Dam	5/1/24-6/31/25	HCEMA County Commissioners ODNR Watershed Districts 2	ODNR FEMA Army Corp of Engineers	Paint Township	Repairs are scheduled Spring 2024 completion
	25	10.1.2 Educate residents businesses in Rocky Fork Lake Dam inundation area about preparedness for a dam failure	2/1/24-ongoing	HCEMA Watershed District(s) 1	Existing budget	Paint Township	Assessment in progress

7.0 HAZARD MITIGATION PRACTICES

As required by the DMA2K, this Mitigation Plan summarizes policies, plans, regulations, programs and projects that Highland County has implemented or is planning to implement in the future that affect growth and how the county can achieve and maintain sustainability and disaster resiliency. These administrative controls and activities are separated into six categories as determined by FEMA which are referred to as hazard mitigation activities. The following sections describe these general categories, as well as plans and activities that the communities are implementing now or plan to implement in the future.

7.1 Property Protection

Protection measures are usually undertaken by property owners on a building-by-building or parcel basis. They help reduce a building's susceptibility to flood damage.

7.1.1 Acquisition

Acquisition of a property and removing any structures eliminates the potential for harm to residents and businesses. After any structures are removed, the land is usually converted to public use, such as a park, or allowed to revert to natural conditions.

7.1.2 Relocation

Relocation is moving a building to higher ground, either within the same property boundary or to a separate property. The building should always be moved to an area not susceptible to flooding.



7.1.3 Retrofitting

Retrofitting a flood-prone structure entails installing flood protective measures on a specific structure or group of structures. Some of the more common examples of retrofitting and floodproofing are elevating a flood-prone building above the flood level, creating barriers around a flood-prone structure, dry floodproofing a structure to make it water-tight and wet floodproofing to intentionally allow flood waters to enter and yet reduce water pressure on the structure.

Retrofitting structures for other hazards is also possible. Structures affected by high winds can possibly be mitigated by securing a roof structure with adequate fasteners or tie downs to

mitigate damage that may occur. Other retrofits are to strengthen garage doors, windows and other large openings. For tornadoes, constructing underground shelters or safe rooms can save lives. Burying power lines is a retrofit measure that addresses the winds from tornadoes, thunderstorms and ice that accompany winter storms.

There have been no property protection measures enacted within Highland County.

7.2 Preventive Measures

7.2.1 Planning and Zoning

7.2.1.1 Comprehensive Planning

Comprehensive plans and land use plans specify how a community should be developed (and where development should not occur). Through these plans, uses of land can be tailored to match the land's hazards. Comprehensive planning reflects what a community wants to see happen to their land in the future. A comprehensive plan can look 5, 10, or even 20 years into the future to help a community plan and shape how they envision their community. However, planning is only one part of the puzzle and usually has limited authority. Tied with zoning comprehensive planning can be more effective.

The 2003 Highland County Comprehensive Plan serves as a guide for the Planning Commission and Highland County officials as they evaluate the location, character and extent of public and private development proposals within the County. It provides guidance on a variety of factors: land use, environmental issues, transportation, community investments, community character, open space and land preservation with special emphasis upon agricultural areas.

A Steering Committee was implemented for the planning process and contained individuals appointed by the Highland County Board of Commissioners and the Highland County Planning Commission. The community process included a visioning process, an assessment of existing conditions and historic trends and an examination of development issues facing the County. In developing the plan's goals and policies, a variety of strategies were developed including the preservation of the County's rich agricultural and environmental heritage, discouraging development patterns that are difficult or costly to provide public services and acknowledging private property rights.

Public participation was encouraged and made a fundamental goal of the planning process. Citizens' views were solicited and closely examined by the Steering Committee when deliberating policy and plan options. The Steering Committee make-up yielded a broad cross section of Highland County's citizens and elected officials. The Committee's views were supplemented through issue-oriented task forces reflecting individuals knowledgeable about specific issues and elected/appointed officials responsible for development decisions within the County.

The Plan is organized under the following categories: land use, farmland and rural character preservation and infrastructure. Included are policies and strategies that are to be used in guiding development decisions.

Many policies and recommendations important to the Plan's successful implementation are identified.

The following is a summary of the five highest priority actions that the County plans on undertaking in the near future.

- Create a development protocol including an application process requiring appropriate County departments and officials to sign and approve all development proposals. Such an instrument could contribute to broader understanding of the Plan's intent and assure compliance with the Plan's policies and recommendations.
- Modify Highland County's subdivision regulations to support managed growth. Modifications should include the broad array of recommendations contained within the various chapters of the Plan.
- Continue ongoing efforts to develop an access management plan and permitting process aimed at discouraging random driveway cuts and intersections along major thoroughfares.
- Pursue the development of a program supporting the agricultural economy through the implementation of policies aimed at preserving the County's valuable farmland.
- Prioritize the development of County zoning, reflecting the unique needs of Highland County. Also, include a public relations effort that provides citizens with information on how zoning can contribute to improved quality of life and the future health of the County.

The only other significant Community Plan in Highland County is the **Imagine Hillsboro 2019 Comprehensive Plan**. While this plan focuses on economic development, housing neighborhoods, transportation, and recreation, it also calls for enforcement of building codes and revisions to the zoning ordinance. The City is also proposing the development of new housing subdivisions. All new construction should be developed in accordance with natural hazards in mind.

7.2.1.2 Zoning Ordinance and Building Codes

A zoning ordinance regulates development by dividing the community into zones or districts and establishing the type of development allowed within each district. The floodplain can be designated as one or more separate zoning districts in which development is prohibited or allowed only if it is not susceptible to flood damage. Some districts that are appropriate for floodplains are those designated for public use, conservation or agriculture. Zoning works best in conjunction with a comprehensive plan or "road map" for future development and building codes.

Building codes provide some of the best methods of addressing all the hazards in this plan. They are the prime measure to protect new property from damage by high winds, tornadoes, earthquakes, hail, and winter storms. When properly designed and constructed according to code, the average building can withstand the impact of most of these forces.

Currently, Madison Township has zoning regulations in place as well as the incorporated jurisdictions in the County. The remaining unincorporated areas of Highland County do not have zoning regulations or building codes in place. The unincorporated areas typically comply with

the State of Ohio's codes. Discussion for the need of zoning regulations on a countywide level has started and plans for implementation have begun.

The City of Hillsboro, Ohio Code of Ordinances have been in effect since January 1, 1984. There have been several updates to the ordinances since its original adoption date. These ordinances contain comprehensive citywide regulations that ensure the safety of the residents of Hillsboro. The ordinances are divided into four titles, a table of special ordinances, parallel references and an index. The four titles are: Title IX: General Regulations, Title XI: Business Regulations, Title XIII: General Offenses and Title XV: Land Usage.

The ordinances contain certain preventative measures that are part of hazard mitigation planning. These measures include, but are not limited to, flood damage prevention, a shade tree commission and soil and erosion sediment controls.

7.2.1.3 Land Evaluation Site Assessment Model (LESA)

The USDA developed Land Evaluation Site Assessment Model (LESA) during the early 1970s using a concept of evaluating capability and suitability of landforms for the purpose of identifying land use opportunities and constraints on a parcel-by-parcel basis. In 1984, the LESA model was adopted by the USDA for use by local governments in the evaluation of agricultural land conversion.

Today, LESA models are being utilized in hundreds of jurisdictions throughout the country for the prioritization of land for purchase and/or transfer of development rights programs, the definition of minimum lot sizes for agricultural zoning and as an assessment tool for the purpose of evaluating local agricultural, forestry, range and other environmental riparian resources in the development of long range land use planning policies.

Highland County began using LESA models when they were developing the Farmland and Rural Character Preservation Plan that is part of *The 2003 Highland County Comprehensive Plan*. The LESA model gave the Steering Committee the ability to rate and prioritize agricultural areas worthy of preservation within Highland County. Also, by developing this GIS based model, established measurable and objective criteria for both land evaluation and site assessment considerations were developed. Highland County officials can utilize this tool to develop land use policies that support the preservation of the County's agricultural resources.

7.2.2 Open Space Preservation

Open space preservation is a technique that can be used to not only preserve floodplains but to preserve lands that may be crucial to controlling runoff that adds to flood problems. Existing undeveloped areas can be preserved as open space through zoning ordinances. Lands that ought to be set aside as open space but are already being put to other uses can be converted to public ownership (acquisition) or to public use (easement). Once the land is owned by the county, municipality, or state, buildings and other development that are subject to flood damage can be removed or prohibited. Open space lands and easements do not always have to be purchased outright. Developers can be required to dedicate land to the public for a park and/or to provide easements for flood flow, drainage, or maintenance.

Currently, Highland County has two open space preservation areas in the County. Fort Hill State Memorial is a nature preserve containing one of the best-preserved Indian hilltop enclosures in North America. The Hopewell Indians constructed the 1.5-mile-long earthwork hilltop enclosure as well as at least two ceremonial buildings and probably a village in the Brush Creek Valley.

Fort Hill is located off of State Route 41 on Township Road 256, five miles north of Sinking Springs and three miles south of Cynthiana in Highland County. Lying at the western edge of the Allegheny Plateau, immediately south of the glacial boundary, this hilly area contains an impressive diversity of bedrock, soils, flora and fauna. There are 11 miles of hiking trails at the 1,200 acre preserve as well as a picnic area.

The second open space preservation area is the Highlands Nature Sanctuary. In 1995, the Highlands Nature Sanctuary was founded along the Arc of Appalachia, a 90-mile crescent of land lying along the Appalachian Front where the foothills touch the western glaciated plains of southern Ohio. It is 1,900 acres in size and filled with springs, caves, rare plants and rock cliffs. The Sanctuary has designated four regions to date: the Rocky Fork Gorge in Highland County and the Bacon Flats on Scioto Brush Creek, the prairie lands and Sandy Springs on the Ohio River in Adams County.

In Highland County, many separate acquisitions occurred, bringing the Highlands Nature Sanctuary to its present state. The current 1,600 acres of holdings along the watershed required the purchase of 38 separate parcels ranging from 0.5 acres to 310 acres in size. Several of these 38 properties were donated to the Sanctuary and five were assisted with conservation easement purchases by the Ohio Division of Natural Areas and Preserves. A *Clean Ohio* grant from the State of Ohio paid 75% of the sale price of four of the properties, the largest of which was 200 acres along Sad Song Creek. Donations were also made by several citizens.

7.2.3 Subdivision Regulations

Subdivision Regulations govern how land will be broken up into individual lots. These regulations set construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers, storm water retention or detention basins, and drainage ways.

The Ohio Revised Code, Chapter 711, enables the Highland County Board of Commissioners and the planning commission of Highland County to adopt regulations governing plats and subdivisions of land within the incorporated area of the County. The adoption date for an update of these regulations is yet to be determined. The Highland County Board of Commissioners is in the final stages of review and completion for these regulations and should be adopted this year.

The regulations are divided into the following articles: Article 1: General Provisions, Article 2: Administration Standards, Article 3: Subdivision Application, Procedures and Approval Process, Article 4: Subdivision Design and Construction Standards, Article 5: Street Design and Construction Standards, Article 6: Utility Standards, Article 7: Environmental and Landscaping Design and Construction Standards, Article 8: Article 9: Article 10: Hillside Regulations, Article 11: Required Statements and Signatures to be Affixed on the Plat and Article 12: Definitions.

These regulations were adopted as minimum requirements for the regulation and control of land subdivision within the incorporated areas of the County. They will be used to:

- a. Establish standards for logical, sound and economical development.
- b. Provide for adequate light, air and privacy, to secure safety from fire, flood and other danger, to prevent population congestion and overcrowding of the land, to provide orderly expansion and extension of community services and facilities at minimum cost and maximum convenience.

- c. Provide for the proper arrangement of streets and highways in relation to those existing or planned and to provide for the most beneficial relationship between use of land, buildings, traffic and pedestrian movements.
- d. Improve the quality of life through protection of the total environment, including the prevention of air, water, light and noise pollution, the prevention of soil erosion and the preservation of natural beauty and topography.
- e. Ensure appropriate surveying of land, preparing and recording of plats and the equitable handling of all subdivision plats by providing uniform procedures and standards for observance of both Highland County and developers.
- f. Provide for the orderly expansion and extension of community services and facilities at minimum cost and maximum convenience.

7.2.4 Manufactured Homes

Previously, the location and installation of manufactured and mobile homes were regulated at the local level of government, with the construction and fabrication standards being set by the United States Department of Housing and Urban Development (HUD). All mobile type homes constructed after 1976 must comply with HUD's National Manufactured Home Construction and Safety Standards. These standards apply uniformly across the country and it is illegal for a local unit of government to require additional construction requirements.

The installation of manufactured homes in Highland County is currently regulated by Senate Bill 102, which became effective on August 6, 2004, and revised recently as 1/21/18 (ORC 4781). This bill created the Ohio Manufactured Homes Commission to regulate the installation of manufactured housing, which includes mobile and manufactured homes, and vests it with the exclusive authority to regulate manufactured housing installers, the installation of manufactured housing and manufactured housing foundations and support systems. The bill set forth that municipal corporations and other political subdivisions are preempted from regulating and licensing installers and regulating and inspecting the installation of manufactured housing and manufactured housing foundations and support systems. The Commission has exclusive power to adopt rules of uniform application throughout the state to govern the installation of manufactured housing, the inspection of manufactured housing, the inspection of manufactured housing foundations and support systems, the training and licensing of manufactured housing installers, and the investigation of complaints concerning manufactured housing installers. No political subdivision of the state or any other department or agency of the state may establish any other standards. The Law was promulgated as ORC 4781, and revised provisions have been added as recently as 1/21/2018.

The Commission must establish standards by rule that govern the installation of manufactured housing, with the minimum standards being the model standards the Secretary of the United States Department of HUD adopts. The standards established by the Commission must be consistent with, and not less stringent, than the standards adopted by the Department of HUD. The Commission has the exclusive authority to make rules regarding "blocking" and "tiedowns" of mobile and manufactured homes. The Commission must also approve permanent foundations to which a mobile or manufactured home may be affixed.

7.2.5 Floodplain Regulations

Communities that adopt and enforce a floodplain management ordinance, to regulate new development within the floodplains, can significantly reduce the effects of flood damage. Communities typically adopt minimum standards that are recommended by FEMA. The

objective of these regulations is to ensure that development will not aggravate existing flooding conditions and that new buildings will be protected from flood damage. Zoning and open space preservation work to keep damage-prone development out of hazardous or sensitive areas while floodplain development regulations impose construction standards on what is allowed to be built in the floodplain.

Currently, Highland County does not have flood damage prevention regulations in place.

The City of Hillsboro, Ohio Code of Ordinances has flood damage prevention measures within their city ordinances. The flood damage prevention measures were originally passed in 1981 and 1986 and are currently enforced today. In Chapter 158, flood prevention methods and provisions include:

- Restrict or prohibit uses which are dangerous to health, safety and property due to water hazards, or which result in damaging increases in flood heights or velocities.
- Require that uses vulnerable to floods, including facilities which serve those uses, be protected against flood damage at the time of initial construction.
- Control the alteration of natural flood plains, stream channels and natural protective barriers, which help accommodate or channel flood waters.
- Control filling, grading, dredging and other development which may increase flood damage.
- Prevent or regulating the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards in other areas.

7.2.6 Drainage Regulations

In order to protect a county's natural resources a community can implement regulations such as County Water Management and Sediment Control Regulations. The purposes of these regulations are to protect the county's water resources by ensuring that the proper storm water and erosion and sediment control measures are in place. Erosion and sediment control measures are called Best Management Practices (BMPs), and when installed and maintained correctly, they help prevent soil from leaving the site. Storm water control measures ensure that the volume of storm water runoff remains the same as before development occurs.

Some examples of what can go into a County Water Management and Sediment Control Ordinance are as follows:

- Submit a Water Management and Sediment Control (WMSC) Plan for proposed commercial, industrial, or residential development sites on parcels greater than one acre.
- Submit an abbreviated plan for sites on parcels less than five acres and part of a larger plan of development.
- Submit a plan for residential dwellings only if a village, township, or city zoning requires them to do so. They must check with the appropriate community for this information.

- Comply with the regulations whether or not a plan is required. All County residents are responsible for being familiar and complying with the regulations.

A designated agency should inspect sites to ensure that the regulations are being followed correctly. The designated agency should also work diligently to review plans and perform site inspections to ensure that these erosion and sediment control measures are in place.

Highland County currently does not have any drainage regulations in place.

The City of Hillsboro, Ohio Code of Ordinances contains Chapter 159: Erosion and Sediment Control Regulations. The erosion and sediment control regulations were originally passed in 1997 and are currently enforced. These regulations are intended to permit development while keeping erosion and sedimentation at existing levels and reduce damage to receiving streams and impairment of their capacity which may be caused by sedimentation. The City of Hillsboro requires the following BMP's to be enforced:

- Submit a sediment control plan for review when a proposed development area consists of five or more acres and earth-disturbing activities are proposed for the whole area or any part thereof.
- Comply with provisions in the regulations when a proposed development area involves less than five acres.
- Certify the sediment control plan by a professional engineer registered in the State of Ohio.
- Submit all plans to the City, accompanied with a filing fee.
- Notify the City 48 hours prior to commencement of earth-disturbing activities and again notify the City when the project is completed.
- Assure all improvements shall be constructed in conformity with approved plans and shall be completed within the time fixed or agreed upon by the City.

7.3 Natural Resource Protection

7.3.1 Riparian Buffer/Wetland Protection

Riparian area refers to the vegetated area next to a watercourse often thought of as the floodplain and its connected uplands. Riparian buffers can protect water resources from non-point source pollution and provide bank stabilization, flood storage and aquatic wildlife habitat. They can be a natural resource management tool used to limit disturbance within a certain distance of a water course to maintain streamside vegetation. Some communities in the State of Ohio have proceeded to adopt riparian buffer overlays and zoning ordinances to reap the benefits of such protection.

7.3.2 Urban Forestry

Eighty percent of Ohioans live and/or work within urban areas. The quality of life for them and their families is dependent upon the urban environment. Healthy trees enhance this environment by promoting clean air and water, increasing property values, reducing erosion and storm water runoff, providing wildlife habitat, moderating temperature, lessening energy demands, and offering year-round enjoyment.

Ohio's Urban Forestry Program was created in 1979 within the ODNR to promote trees and other vegetation as tools to enhance the quality of life within cities and villages. The purpose of the Urban Forestry Program is to provide community officials and allied agencies with the organizational and technical ability to effectively manage the trees along streets, within parks, and on public grounds. Through a statewide network of regional urban foresters, the program helps communities manage their urban forest resources to meet their local needs.

Trees are particularly subject to damage by tornadoes, wind, ice and snowstorms. Downed trees and branches break utility lines and damage buildings, parked vehicles, and anything else beneath them. An urban forestry program can reduce the damage potential of trees. A properly written and enforced urban forestry plan can reduce liability, alleviate the extent of fallen trees and limbs caused by wind and ice build-up, and provide guidance on repairs and pruning after a storm. Such a plan helps a community qualify to be a Tree City USA.

Ohio has been the Tree City USA national leader for the past 20 years. There are 248 Tree Cities USA in Ohio as of July 2023. Counties are not eligible for the program but can implement the credited activities.

The City of Hillsboro has been a Tree City USA for over 25 years. A shade tree commission has also been established since 1983 as defined in *The City of Hillsboro, Ohio Code of Ordinances*. The shade tree commission consists of the Safety and Service Director, the Chairman of the City Beautification Committee of Council, a Shade Tree Administrator appointed by the Mayor and three residents of Hillsboro or members of the Hillsboro Garden Club appointed by the Mayor with the approval of City Council. Their duties include studying, investigating, planning, advising, reporting and recommending any action, program, plan or legislation the Commission determines to be necessary for the care, preservation, trimming, planting, replanting, removal or disposition of trees and shrubs in public ways, streets and alleys. The Hillsboro Shade tree Commission is currently inactive (June 2023).

Currently, the unincorporated areas of Highland County do not have codes for issues concerning urban forestry. The Highland SWCD uses the State and Federal programs as they become available for issues associated with reforestation.

7.3.3 Flood Compensation Banking

A flood compensation bank is a detention basin that is used for floodplain encroachment compensation or for flood storage in which the basin's volume may be purchased to mitigate the effects of new development. A development may purchase storage volume from a bank to compensate for floodplain encroachment or to satisfy storm water detention requirements provided the basin is within the appropriate zone of influence.

Highland County currently has nothing enacted within the County dealing with flood compensation banking.

7.3.4 Watershed Planning Efforts

Cities and counties carry out many of the decisions that result from watershed planning efforts. Participation and cooperation with state agencies is also an important component to quality watershed planning.

Four different watersheds influence drainage in Highland County: The Ohio-Brush Creek is located in the southeast portion of the County, the White Oak Watershed is located in the southwest portion of the County, the Little Miami River is located in the northwest portion of the County and the Paint Watershed is located in the eastern and northeastern portions of the County.

The most recent watershed management plans of record include:

- East Fork Little Miami River Headwater Watershed Management Plan, May 2006
- East Fork-Glady Creek, Oct. 2021 (nine-element plan)
- East Fork- Solomon Run, May 2022 (nine-element plan)
- Paint Creek Watershed Management Plan, July 2002
- Rocky Fork Creek, 2004
- Rattlesnake Creek, 2004
- White Oak Creek Watershed Management Plan, April 2004
- Flat Run-North Whiteoak Creek, 2003 (nine-element plan)
- Miranda Run- Watershed Creek, 2023 (nine-element plan)
- Sterling Run, 2023 (nine-element plan)



7.3.4.1 H2Ohio

H2Ohio is a comprehensive water quality initiative launched by Gov. DeWine in 2019, to strategically address serious water issues that have been facing Ohio for decades. Such issues include harmful algal blooms, failing drinking water, wastewater, and home sewage systems due to aging infrastructure. H2Ohio was created through a collaboration between the Governor, ODA, ODNR, OEPA and many other partners. Although the initial focus is in the Lake Erie region, a statewide expansion is planned to roll out in 2024 with the focus on voluntary nutrient management plans.

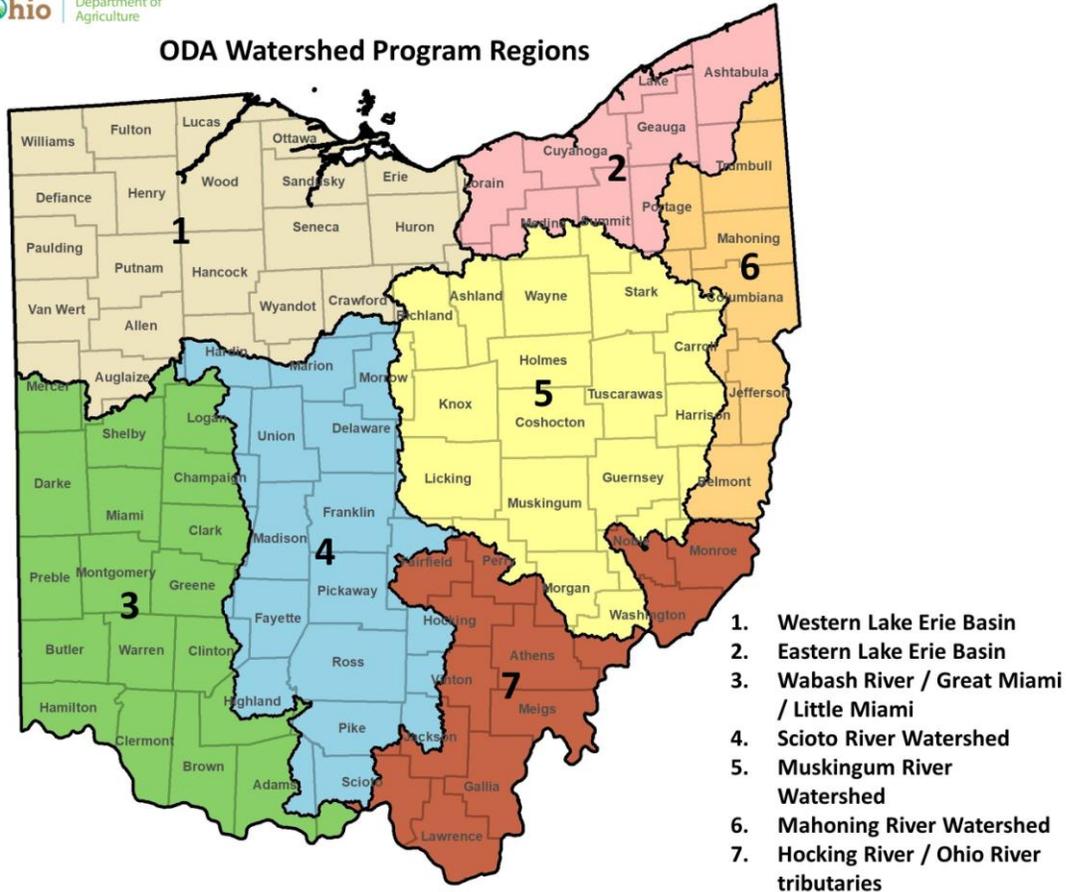
ODA and the Division of Soil and Water Conservation developed a statewide watershed program as part of H2Ohio authorized by HB 7 to improve and protect watersheds through conservation activities. The watershed program is divided into seven (7) regions with each region having a manager to lead the management and planning efforts. Highland County is part of the Little Miami River and the Scioto River watershed regions (Regions 3 and 4).

Regional Watershed Plans (in draft form as of 2023) include:

- East Fork Little Miami River
- Scioto River



ODA Watershed Program Regions



7.3.4.2 Habitat Restoration

In urbanized watersheds, some streams and/or rivers suffer the effects of increased erosion and water quality problems because of the amount of development that is occurring in a given area. Bioengineering techniques can help prevent further degradation and also provide water quality and habitat benefits.

Biotechnical practices use vegetative or other natural materials to achieve stream management objectives, usually erosion control. One of the chief advantages of biotechnical practices is that they help restore natural stream features, like in-stream habitat and streambank vegetation. The materials used for biotechnical practices are generally less expensive than for more traditional approaches, but installation is more labor intensive, and they may require more frequent maintenance.

The ODNR has published a *Stream Management Guide #10*. This Guide is one of a series of Ohio Stream Management Guides covering a variety of watershed and stream management issues and methods of addressing stream related problems. It maps and briefly describes some of the many projects that have been constructed in Ohio using biotechnical practices, including the installation date.

The Highland County SWCD currently promotes and provides technical support for several habitat restoration programs and projects.

Most voluntary programs are implemented through the USDA Farm Bill. Every five (5) years Congress drafts a new Farm Bill, which provides \$6 billion in conservation funding annually to improve habitat, soil health and water quality on private lands across the US. The last Farm Bill was enacted in 2018, which makes 2023 a critical time to recognize the value of enhancing habitat restoration and ensure proper conservation programs for future generations.

Some of the USDA programs include:

- Environmental Quality Incentives Program (EQIP) provides financial assistance to eligible landowners to address their natural resource concerns and deliver environmental benefits, such as improved water quality, reduced soil erosion, and to create wildfire habitat.
- Conservation Stewardship Program (CSP) helps producers maintain and improve their existing conservation practices by adapting additional conservation activities to address priority critical resource issues.
- Wetland Reserve Program (WRP) helps address wetland, wildlife habitat, soil, water, and other related concerns on private lands. The program provides an opportunity for eligible landowners to receive financial incentives to enhance wildlife habitat.
- Regional Conservation Partnership Program (RCPP) promotes coordination between USDA and partners to deliver conservation assistance to producers. The program targets specific areas of concern by the partners, which leverages concentrated assistance to a priority area providing a more effective response.
- Conservation Reserve Program (CRP) protects soil erosion, water quality, and habitat by removing highly erodible or environmentally sensitive land from agricultural production through long-term agreements.

Scioto River Watershed Conservation Reserve Enhancement Program (CREP)

The Scioto River Watershed Conservation Reserve Enhancement Program (CREP) is a farmer/landowner-implemented agricultural environmental stewardship program. The goal is to create 70,000 acres of filter strips, riparian buffers, wildlife habitat, wetlands and tree plantings to reduce sediment and nutrient runoff into the river and its tributaries. As a result, it will improve biodiversity in the entire watershed.



Highland County is rated second in the State of Ohio for largest number of acres enrolled in the CREP. The areas on which Highland County is focusing are Rocky Fork, Paint Creek and East Fork. The SWCD provides technical support by planting filter strips along the focus areas of the County.

- The H2Ohio Rivers Initiative has been developed as an expansion of the program to place an emphasis on the preservation of our rivers, which provide critical wildlife habitat, quality drinking water, and recreational space.
- The River Initiative is rolling out an extension to the CREP to include the Great Miami Watershed in western Ohio to encourage landowners to support ongoing water quality and habitat creation.

7.3.4.3 Watershed Groups

East Fork Watershed Collaborative

The East Fork Watershed Collaborative was formed in 2001 as a means of bringing together the diverse interests within the East Fork Watershed to protect and enhance the biological, chemical and physical integrity of the East Fork of the Little Miami River and its tributaries. The Collaborative completed and received state endorsement of a watershed plan for the Lower East Fork Watershed in 2003 and the headwaters of East Fork, which falls within Highland County, in 2006. A stakeholder's group was formed in 2018 to prioritize critical issues in the watershed and discuss various grant opportunities. Since OEPA now requires nine-element plans to be developed by 12-digit HUCs, a new plan was approved for East Fork Gladly Run in 2021 and East Fork Solomon Run in 2022. The East Fork Collaborative is continuing to move forward to complete five (5) more nine-element plans within the watershed.

White Oak Creek Watershed Group

The mission of the White Oak Creek Watershed Partners is to bring together local communities to enhance water quality and encourage natural resource protection. The White Oak Creek Watershed Advisory Board received the State of Ohio endorsement in 2004 for its comprehensive Watershed Action Plan and the inventory of the White Oak Creek.

The watershed group is actively working on several preventative measure projects. Eighty percent of the land surrounding the watershed is agricultural. Farmers work in conjunction with the watershed group to practice BMPs along the agricultural areas of the floodplains in order to keep non-point source pollution out of the creek. The Highland and Brown County Health Departments work in conjunction with the watershed group in receiving grants to reduce pollution from septic treatment plants, particularly in Mowrystown. The villages and cities of Highland and Brown counties are working with the group to install storm drain curb markers that discourage dumping to drains that flow to White Oak Creek.

Most recently, the watershed group identified the Highland SWCD as a stakeholder in the White Oak Creek Watershed in 2023 and is actively holding planning meetings to identify water quality improvement projects that will reduce nutrient and/or sediments from entering local waterway, as well as projects that will restore or create wetland and stream habitat. Once the process is complete, and critical resource issues are identified, nine-element watershed plans will be implemented for Flat Run, Miranda Run, and Sterling Run 12-digit HUCs in the White Oak Creek. These plans are set to be sent for approval in November 2023.

7.4 Emergency Services

Emergency services protect people before, during, and after a disaster. A good emergency management program addresses all hazards, natural and man-made. It involves the active participation and involvement of all County's departments and municipalities. Emergency services include:

- Threat Recognition
- Warning
- Response
- Evacuation and Sheltering
- Post-Disaster Recovery and Mitigation

7.4.1 Threat Recognition

The first step in responding to a hurricane, flood, tornado or other natural hazard is knowing when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

7.4.2 Warning

After there is a potential hazard recognized following steps must be taken to notify the public of its possible onset. Early and specific warnings allow more people the ability to set protection procedures in motion.

The NWS issues notices to the public using two levels of notification:

Watch: conditions are right for flooding, thunderstorms, tornadoes or winter storms.

Warning: a flood, tornado, etc. has started or has been observed.

A more specific warning may be disseminated by the community in a variety of ways. The following are the more common methods:

- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Telephone trees/mass telephone notification
- National Oceanic and Atmospheric Association (NOAA) Weather Radio
- Tone activated receivers in key facilities
- Outdoor warning sirens
- Sirens on public safety vehicles
- Door-to-door contact
- Mobile public address systems
- E-mail notifications

Highland County has 7 (seven) outdoor warning sirens located throughout the County. There are three (3) sirens in Hillsboro which can be activated by radio. The remaining fire sirens are in Leesburg, Highland, and (2) in Greenfield, and have to be manually activated.

Highland County EMA has four Emergency Alert System (EAS) radio stations located in the County. They are WVNU, operating out of Greenfield; WSRW, operating out of Hillsboro; WCHO operating out of Washington Courthouse, and WLW, operating out of Cincinnati. The County also has two NOAA Weather Radio Stations that broadcast continuous weather information direct from a nearby NWS Office. They broadcast NWS watches, warnings, forecasts and other hazard information 24 hours a day. The following is a list of these radio stations with their call numbers and location information:

- KIH42, Covington, KY
- WXM69, Otway, OH

7.4.3 Response

The protection of life and property is the most important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries.

Typical actions and responding parties include the following:

- Activate the emergency operations center (emergency preparedness)
- Close streets or bridges (sheriff or public works)
- Shut off power to threatened areas (utility company)
- Pass out sand and sandbags (public works)
- Hold children at school/releasing children from school (school superintendent)
- Open evacuation shelters (Red Cross)
- Monitor water levels (engineering)
- Establish security and other protection measures (police/sheriff)

An emergency operation plan (EOP) ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans are developed in coordination with the agencies or offices that are given various responsibilities.

In Ohio, an EOP is a requirement of the Ohio Revised Code, Section 5502.271. The purpose of an EOP is to predetermine, to the extent possible, actions to be taken by the governmental jurisdictions of Highland County to prevent avoidable disasters and respond quickly and adequately to emergencies in order to protect the lives and property of the residents of Highland County. It usually consists of a Basic Plan which defines and identifies areas of potential risk, lists people and organizations involved in response situations, and discusses plan development and maintenance. In addition to the Basic Plan are annexes that describe the details of various aspects of emergency response. Some examples of these annexes include Direction and Control, Notification and Warning, Law Enforcement, Medical, Anti-Terrorism and Resource Management. Lastly, the plan contains guidelines with respect to roles and responsibilities.

Currently, Highland County's EOP is current and includes Tornado Warning only. The Highland County EOP was jointly developed by the Highland County EMA Director, in cooperation with representatives from various departments and jurisdictions that have been tasked with emergency responsibilities.

The goal of the Highland County EOP is to save lives, property and the environment by developing programs and emergency operational capabilities that address mitigation

(preventative measures), preparedness (planning, training, and education), response (active post-event coordination of on-scene activities) and recovery (restoring affected areas to pre-disaster status) for natural, technological, hazardous materials, civil or attack-related emergencies.

According to Highland County EOP, the high-risk hazards most likely to affect the residents of Highland County are floods, winter storms, tornadoes, hazardous materials transported on highways and railways and hazardous materials housed at facilities within the County. The following is a list of each of these hazards and the number of at risk residents, determined by the planning group and by the Nuclear Attack Planning Base (NAPB).

- Tornadoes – 3,000 residents

This plan provides Highland County, and its political subdivisions, the basis for a systematic approach to the solution of problems created by the threat or occurrence of disasters that could potentially affect the County. It identifies the responsibilities, functions, operational procedures and working relationship among governmental entities and their various departments, private support groups and individual citizens. It assigns tasks and responsibilities to County officials and department heads, specifying their roles during an abnormal emergency or disaster situation.

The Highland County Commissioners, in coordination with personnel in the activated EOC, and Chief Executive Officers (CEOs) in other affected jurisdictions of the County, assume direction and control of emergency activities from the primary EOC, located at 1487 N. High Street, Hillsboro, Ohio. The alternate EOC, should the primary EOC be unusable, is the Highland County Administration Building, located at 114 Governor Foracker Place, Hillsboro, Ohio.

7.4.4 Evacuation and Sheltering

7.4.4.1 Evacuation

There are five key components to a successful evacuation:

1. Adequate warning
2. Adequate routes
3. Traffic control
4. Knowledgeable travelers
5. Care for special populations (i.e. handicapped, prisoners, school children)

According to the Highland County EOP, the Highland County Sheriff's Office, Municipal and Village Police Departments are responsible for evacuation procedures and traffic control in the event of an emergency. The Municipal, Village and Township Fire Departments are also responsible for conducting evacuations if necessary. In addition, they are responsible for assisting special populations during an evacuation.

7.4.4.2 Shelter

Shelter is required for those who cannot get out of harm's way. Typically, the Red Cross will staff a shelter and ensure that there is adequate food, bedding and washing facilities. Shelter management is a specialized skill. Managers must deal with problems like scared children, families that want to bring their pets and the potential for an overcrowded facility.

According to the Highland County EOP, the Chillicothe Red Cross is responsible for performing shelter operations, establishing reception and care centers and administering first aid at shelters and at scene if requested by Emergency Medical Services (EMS).

7.4.5 Post-Disaster Recovery and Mitigation

After a disaster, communities should undertake activities to protect public health and safety and facilitate recovery. Appropriate measures include:

- Patrol evacuated areas to prevent looting
- Provide safe drinking water
- Monitor for diseases
- Vaccinate residents for tetanus
- Clear streets
- Clean up debris and garbage

Throughout the recovery phase, everyone wants to return to their daily routines. The problem is when recovery efforts are being instituted, people may be performing a quick fix that returns them to their daily routines faster. However, it is imperative that during this recovery phase every effort should be made to think about how to prevent repeated damage from happening if another disaster were to strike. Some efforts include:

- Advise residents through public information activities to advise residents about mitigation measures they can incorporate into their reconstruction work
- Evaluate damaged public facilities to identify mitigation measures that can be included during repairs
- Acquire substantially or repeatedly damaged properties from willing sellers,
- Plan for long term mitigation activities, and
- Apply for post-disaster mitigation funds.

According to the Highland County EOP, damage assessment is conducted by the Ohio EMA. Private utility companies such as Pike Natural Gas, American Electric Power, Ohio Power, Dayton Power and Light, South Central Power, SBC and Verizon are responsible for restoring power to failed utilities after a natural hazard event.

7.5 Flood Control

Flood control projects have traditionally been used by communities to control or manage floodwater. They are also known as "structural" projects that keep flood waters away from an area as opposed to "non-structural" projects, like retrofitting, that do not rely on structures to control flows.

7.5.1 Flood Control Measures

The most common type of measures that keep flood waters away from an area are reservoirs and dams, diversion channels and levees and floodwalls.

7.5.1.1 Reservoirs and Dams

Reservoirs and dams impound water to reduce the amount of water that reaches an area at one time. A reservoir holds high flows behind a dam or in a storage basin. Water is released at a controlled rate. Reservoirs and dams are generally perpendicular to a stream or river.

There are four (4) reservoirs located in Highland County. The first, the Hillsboro Reservoir, is located two miles north of Hillsboro on US Route 62. It is comprised of 22 acres of water. The second, the Paint Creek Reservoir, is located south of the City of Greenfield on Rapid Forge Road. Construction of the dam on Paint Creek started in 1967 and the site was dedicated as a state park in 1972. It is comprised of 1,190 acres of water. Third, Rocky Fork Lake is located east of Hillsboro and south of US Route 50. The area became a state park in 1950 and in April 1953 the reservoir first held water. The park is comprised of 2,080 acres of water. Finally, the reservoir at Liberty Park holds 160 million gallons of water and sits on 20 acres.



Paint Creek State Park and Reservoir

7.5.1.2 Diversion Channels

A diversion is a new channel or overflow weir that sends floodwater to a different location, thereby reducing flooding along a watercourse. During normal flows, the water stays in the old channel. During flood flows, the stream spills over to the diversion channel.

Currently, there are no diversion channels constructed in Highland County.

7.5.1.3 Levees and Floodwalls

Levees and floodwalls restrain the flow of the stream or river. During a flood, the stream or river flow is not reduced; only confined. Levees and floodwalls are generally parallel to the flow of the stream.

Currently, there are no levees or floodwalls constructed in Highland County.

7.5.2 Drainage Maintenance

Man-made ditches and storm sewers help drain areas where the surface drainage system is inadequate, or where underground drainageways may be safer or more practical. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer improvements are designed to carry the runoff from smaller, more frequent storms. There are

three types of drainage improvements that are usually pursued to reduce storm water flooding: putting drainageways in underground pipes, channelization, and removing obstructions caused by stream crossings, such as culverts and bridges with small openings. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving stream or river has sufficient capacity to handle the additional volume and flow of water. To reduce the cumulative downstream flood impacts of numerous small drainage projects, additional detention or run-off reduction practices should be provided in conjunction with the drainage system improvements.

According to the Highland County Engineer's Office, the County maintains all culverts and bridges on county roads and all bridges and culverts over 36" on township roads. There is only one County drainage ditch the office maintains. There have been numerous petitions for ditch cleaning by the residents of the County. The maintenance of these ditches includes brush control, washout repair, debris and log jam removal, sandbar removal and slope stabilization. These are performed on an as needed basis.

7.6 Public Information

A successful hazard mitigation plan program involves both the public and private sectors. Public information activities advise property owners, renters and businesses about hazards and ways to protect people and property from these hazards. These activities can motivate people to take the steps necessary to protect themselves and others. Information can initiate voluntary mitigation activities at little or no cost to the government. Property owners mitigated their flooding problems long before there were government funding programs.

7.6.1 Outreach Projects

Outreach projects are the first step in the process of orienting property owners to the hazards they face and the concept of property protection. They are designed to encourage people to seek out more information in order to take steps to protect themselves and their properties. Research has proven that outreach projects work. However, awareness of the hazard is not enough; people need to be told what they can do about the hazard, so projects should include information on safety, health and property protection measures. Research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

Outreach efforts are described in section 6: Goals and Action Items in the updated plan.

7.6.2 Real Estate Disclosure

Many times, after a natural disaster, people say they would have taken steps to protect themselves if only they had known they had purchased a property that is exposed to a natural hazard. By reaching out to residents in a community to become informed as to what hazards are a potential in the community, the community has armed them with information that they did not have previously. This knowledge allows them to make an informed decision on purchasing insurance to cover their potential losses.

7.6.2.1 Federal law

Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building whether the property is in a floodplain as shown on the Flood Insurance Rate Map. If so, flood insurance is required for buildings located within the floodplain if the mortgage or loan is federally insured. However, because this requirement has to be met only 10 days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.

7.6.2.2 State law

The state of Ohio's Department of Commerce has a Residential Property Disclosure Form pursuant to section 5302.30 of the Revised Code and rule 1301:1-4-10 of the Administrative Code. It is to be completed by the owners who want to sell their property. Under a good faith stipulation, they are to note any areas of the house that may be dangerous which include being in a floodplain/Lake Erie Coastal Erosion Area, whether there are drainage/erosion problems, and if there are zoning/code violations.

7.6.3 Libraries and Websites

Highland County maintains a website of general County information such as departments and auditor's information (co.highland.oh.us) The County's Comprehensive Plan also can be found on the County's website.

The City of Hillsboro (<http://www.hillsboroohio.net/>), provides information such as departments and contacts. The City of Hillsboro enables residents to view their complete zoning ordinances in a readable file on the website.

Additional community websites include:

Village of Highland (<https://villageofhighland.weebly.com>)

Village of Leesburg (<https://www.leesburgohio.org>)

Village of Lynchburg (<https://lynchburgohio.org>)

Highland Co District Library (<https://www.highlandco.org>)

7.6.4 Mitigation Plan Maintenance and Schedule

The Core Group, in conjunction with the Highland County EMA/Office of Homeland Security, will establish methods for monitoring and evaluating the Countywide All Natural Hazards Mitigation Plan for the County and its participating incorporated jurisdictions on a five-year cycle. The Core Group will initially meet on a yearly basis, as determined by the Highland County EMA/Office of Homeland Security's Director, once the Mitigation Plan has been approved by the State of Ohio and FEMA. At these initial yearly meetings, it will be decided whether the Mitigation Plan needs to be updated immediately or to wait and collectively perform the updates on the five-year cycle. The Core Group will evaluate the Mitigation Plan and act as a forum for hazard mitigation issues. The Core Group's detailed Action Plan will act as a guide in evaluating the Mitigation Plan. The Action plan will also provide a method for monitoring the Mitigation Plan, as well as a schedule for the implementation of the mitigation alternatives. The success of the Mitigation Plan depends upon the efforts of the Core Group to become involved with other planning efforts in the community. Communities will be able to use the plan for a variety of activities, including

implementing specific mitigation projects, as well as implementing changes in the daily operation of the local government. To ensure the success of an ongoing program, it is critical that the plan remains relevant to the County's growth and development. Thus, it is important for the County to conduct periodic evaluations and make revisions as needed, as well as incorporate changes into other planning documents in the County.

The Core Group will review the goals and action items on a yearly basis, as needed, to determine their relevance to changing situations in Highland County and ensure that they are addressing current and expected conditions. They will also review the risk assessment portion of the mitigation plan to determine if this information should be updated or modified, given any new available data.

The public will be involved on a continuous basis. The Core Group is considering establishing a website to accomplish public involvement whereby the mitigation action items that are slated for development that current year will be highlighted, and the public will be encouraged to participate in the continued development of the Mitigation Plan. In addition, the Core Group is considering continued efforts of press releases to accomplish effective public participation. There will also be a formalized press release developed for their annual review process.

7.6.5 Local Planning Mechanisms

There are several local planning mechanisms in place within the County, which are described in detail, in **Section 7.2 Preventive Measures**. This section of the Mitigation Plan describes existing plans and efforts in the community, when they were adopted and what the document does for the community.

Within three (3) years of the formal adoption of the Mitigation Plan, the Core Group will strive to incorporate into the process of existing planning mechanisms any local policies recommended for revision by the Action Plan developed as part of this effort. The County utilizes comprehensive land use planning, development standards, and building codes, as well as various other regulatory mechanisms to guide and control development in the community. Since the County has autonomy over these various tools, the County can augment them as necessary to address applicable hazard mitigation requirements. However, as a community that exists in a rural area, many of these processes may also affect neighboring communities and development. To ensure that altering these standards does not negatively affect adjacent communities, Highland County will seek consistency and collaboration with its counterpart regulatory documents from surrounding jurisdictions. After adoption of the *Highland County All Natural Hazards Mitigation Plan*, the Core Group should encourage its incorporated jurisdictions to be aware of the hazards that are affected by the planning and development decisions they may make and implement. The Highland County All Naturals Hazard Mitigation Core Group will conduct periodic reviews of the planning documents described in Section 7.2. The Core Group will also analyze any plan amendments and provide technical assistance if needed to any incorporated jurisdiction participating in this effort.

8.0 Resolution of Adoption

The Highland County Commissioners as well as the incorporated areas of City of Hillsboro and the Villages of Greenfield, Highland, Leesburg, Lynchburg, **Sinking Springs** and Mowrystown will be passing a Resolution or Ordinance of Support for the Highland County countywide Mitigation Plan after contingent approval from the State of Ohio EMA as well as FEMA.

Examples of the Resolution of Adoption that will be presented to the Commissioners, as well as the Ordinance that the participating incorporated jurisdictions will pass, is provided in Appendix H.

RESOLUTION NO. _____

ADOPTION OF THE updated 2024-2028 HIGHLAND COUNTY COUNTYWIDE ALL NATURAL HAZARDS MITIGATION PLAN

WHEREAS, on _____, the Highland County Commissioners passed Resolution No. _____ adopting the HIGHLAND COUNTY COUNTYWIDE ALL NATURAL HAZARDS MITIGATION PLAN (the Mitigation Plan) pursuant to the Disaster Mitigation Act of 2000, which established goals to minimize and reduce storm water damages to existing structures and land use in order to maximize the protection of public health, safety, and welfare, and identify and develop revenue sources to complete the goals and objectives; and

WHEREAS, the mission of the Highland County Countywide All Natural Hazards Mitigation Plan Core Group is: “To develop a working document that fulfills the mandates of the Federal Disaster Mitigation Act of 2000, and satisfies the requirements of FEMA and the Ohio EMA, as well as meets the needs of all of Highland County. Further, by researching and planning for future natural hazards and implementing appropriate mitigation techniques, all of Highland County can save lives and protect property, reduce the cost of disasters and provide for a rapid and efficient recovery by coordinating response efforts, and increasing the educational awareness of natural hazard events and their effects on the people, property, and resources of all Highland County.”; and

WHEREAS, EVERY FIVE (5) YEARS, the Highland County Emergency Management Agency Director shall lead in the update of a Mitigation Plan on behalf of the Highland County Board of County Commissioners; and

WHEREAS, a Mitigation Plan for Highland County will be required beginning in _____, 2024 to receive any state or federal mitigation funding such as flood prone property improvement or buyout funds; and

WHEREAS, the County of Highland County is subject to flooding, tornadoes, winter storms, and other natural hazards that can damage property, close businesses, disrupt traffic, and present a public health and safety hazard; and

WHEREAS, Highland County contracted with RFG Associates, Inc. to facilitate and draft an updated Highland County Hazard Mitigation Plan; and

WHEREAS the Mitigation Planning Core Group, comprised of representatives from the County, municipalities and stakeholder organizations, has prepared a recommended updated Mitigation Plan that reviews the options to protect people and reduce damage from these natural hazards; and

WHEREAS, the recommended Mitigation Plan has been widely circulated for review by the County’s residents and federal, state and regional agencies and has been supported by those reviewers.

NOW, THEREFORE BE IT RESOLVED by the Highland County Commissioners that:

1. 2024-2028 HIGHLAND COUNTY COUNTYWIDE ALL NATURAL HAZARDS MITIGATION PLAN is hereby adopted as an official plan of Highland County.

2. The Mitigation Planning Core Group will continue as a permanent advisory body. It shall be composed of representatives from the existing Mitigation Planning Core Group, as recommended by the Highland County Emergency Management and Homeland Security Office. This includes those municipalities that pass a resolution to adopt the Mitigation Plan.
3. The Core Group shall meet as often as necessary to prepare or review mitigation activities and progress toward implementing the Mitigation Plan. It shall meet at least once each year to review the status of ongoing projects.
4. The schedule of Core Group meetings shall be posted in appropriate places. All meetings of the Core Group shall be open to the public.
5. By November 30 each year, the Core Group shall prepare an annual evaluation report on the Mitigation Plan for the County Board of Commissioners and the municipalities.

The report will cover the following points:

- a. A review of the updated plan.
 - b. A review of any natural disasters that occurred during the previous calendar year.
 - c. A review of the action items in the original plan, including how much was accomplished during the previous year.
 - d. A discussion of why any action items were not completed or why implementation is behind schedule.
 - e. Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by the County Board of Commissioners and the affected municipality's governing boards as amendments to the adopted plan.
6. The director of each County office identified as "responsible agency" for the Mitigation Plan's action items shall ensure that the action item is implemented by the listed deadline subject to fiscal and staff time constraints.

Passed by the Highland County Board of Commissioners on

Vote:

Yes _____

No _____

