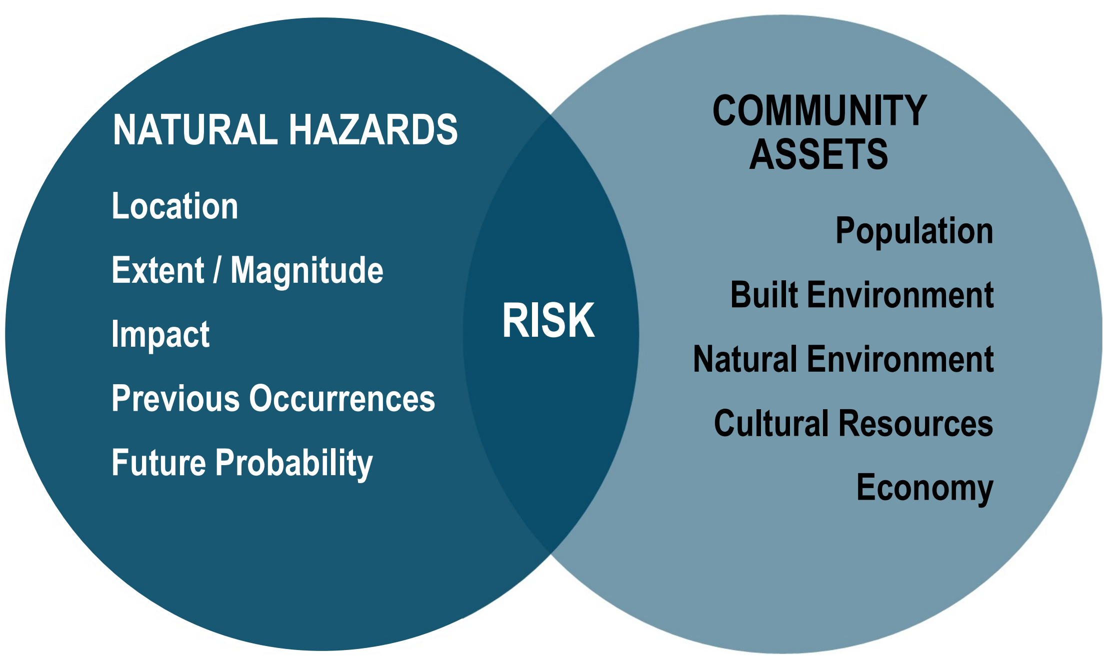
2.0 RISK ASSESSMENT

Disasters can cause loss of life, damage buildings, and infrastructure, and have devastating consequences on the regional economic, social, and environmental well-being. A risk assessment analyzes, "the potential for damage, loss, or other impacts created by the interaction of hazards with community assets" (FEMA, 2013). "A risk assessment is a robust, data-driven analysis. It explains what might happen. It also finds where the local jurisdiction is vulnerable to hazards" (FEMA, 2023c, p. 48). This risk assessment section contains information on identified hazards that threaten Ashtabula County, and the vulnerability of the area as it relates to the county's assets. This assessment includes a new subsection that ranks the hazards based on a "risk ranking" score. This ranking enables a comparison with data from sources such as the National Risk Index (FEMA, n.d.B).

This risk assessment provides the foundation for the rest of the mitigation planning process, which is focused on identifying and prioritizing actions to reduce risk to hazards. This risk assessment can also be used to establish emergency preparedness and response priorities, inform land use and comprehensive planning efforts, and facilitate decision making by elected officials, county departments, businesses, and organizations in Ashtabula County. The figure below illustrates the concept of risk as the relationship, or overlap, between hazards and community assets. The smaller the overlap, the lower the risk.



2.0 RISK ASSESSMENT

2.1 Identify Hazards

§201.6(c)(2)(i)	[The risk assessment shall include a] description of the…location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

The committee spent much of the first meeting discussing the hazards to include in the plan update. The discussion started with a list of the hazards from the previous version of the plan. A comprehensive list of hazards (i.e., natural, technological, and human-caused) was then evaluated by the committee along with the number of occurrences of each hazard since 2019. The consultant specifically asked several questions per hazard inclusions (i.e., changes in the locations, frequency, and magnitude of occurrences of each hazard; losses and damages suffered from each hazard over the past five years, and changes in vulnerability to each hazard).

During this meeting the committee decided to keep all the hazards included in the 2018 plan, and three new hazards were included (i.e., cyber incident, invasive species, and dry day utility failure) bringing the total number of hazards included in this plan to 15. The following table lists the hazards considered by the remainder of this risk assessment.

Table 2.1.1

HAZARDS IDENTIFICATION	
Hazard	*Description*
Natural Hazards	
Coastal Erosion	Existing. Briefly includes lake surge and seiche waves.
Drought	Existing. This profile includes meteorological, agricultural, hydrological, and socioeconomic droughts.
Earthquake	Existing.
Flooding	Existing. This profile includes both riverine and flash flooding.
Health Related Emergencies	Existing.
Invasive Species	New.
Severe Thunderstorm Winds & Hail	Revised.
Severe Winter Weather	Existing. This profile includes blizzards, heavy snow, lake-effect snow, and ice storms
Tornado	Existing.
Wildfire	Existing.
Human-Caused Hazards	
Terrorism / Civil Disturbance	Existing. Will focus more on domestic terrorism.
Technological Hazards	
Cyber Incident	New.

Dam & Levee Failure	Existing.
Hazardous Materials Release	Existing.
Utility Failure (Dry Day)	New. This profile focuses on non-storm related utility failures.

Planners utilized additional sources as lists to ensure the steering committee's consideration of a full range of hazard types. FEMA's National Risk Index (NRI) (2021b) summarizes risks to communities from a range of hazards, including the following.

- Avalanche
- Coastal Flooding
- Cold Wave
- Drought
- Earthquake
- Hail
- Heat Wave
- Hurricane
- Ice Storm
- Landslide
- Lightning
- Riverine Flooding
- Strong Wind
- Tornado
- Tsunami
- Volcanic Activity
- Wildfire
- Winter Weather

In addition to the 15 hazards outlined in Table 2.1.1 above, there exist other potential natural hazards this plan does not address. The following list presents those natural hazards with an explanation as to why those hazards were not included in this plan update.

- **Avalanche:** Avalanches happen mainly in the western United States and Canada. The terrain and geography of Ashtabula County is not rugged or severe enough to have avalanches. FEMA's NRI notes that this hazard does not apply to any county in Ohio.
- **Hurricanes:** The Atlantic east coast, where hurricane paths are nearest, is approximately 375 miles away, and the Pacific west coast is approximately 2,200 miles away. Neither would affect Ashtabula County. The county may experience wet weather as the remnants of Atlantic hurricanes pass through the area; however, winds would not likely be near hurricane or tropical storm levels.
- **Tsunami:** Tsunamis occur in oceans; the Atlantic east coast is approximately 375 miles away, and the Pacific west coast in approximately 2,200 miles away. The occurrence of a tsunami in either of those waterbodies would have no impact in Ashtabula County. The closest relatable hazards to tsunamis that may impact Ashtabula County include lake surge and seiche waves, both of which appear briefly in the coastal erosion discussion.

- **Volcano:** The closest active volcano is the Dotsero Volcano in western Eagle County in the state of Colorado, approximately 1,470 miles west. It would not affect Ashtabula County. The volcano last erupted 4,200 years ago, but a 2018 report from the United States Geological Survey lists it as a moderate threat to human activity. FEMA's NRI notes that this hazard does not apply to any county in Ohio.

Another source was the Ohio state hazard mitigation plan. In that document, the Ohio Emergency Management Agency (OEMA) identified 14 hazards (OEMA, 2024). Table 2.1.2 compares the hazards from the state plan with the list generated by the steering committee above.

Table 2.1.2

Included Hazard Types – Comparison of Ashtabula County & Ohio Plans		
Hazard	*In AC Plan (Y/N)*	*Notes*
Coastal Erosion	Y	Ashtabula County Hazard Profile Titled: Coastal Erosion. See note regarding "Seiche/Coastal Flooding."
Dam/Levee Failure	Y	Ashtabula County Hazard Profile Titled: Dam & Levee Failure
Drought	Y	Ashtabula County Hazard Profile Titled: Drought
Earthquake	Y	Ashtabula County Hazard Profile Titled: Earthquake
Extreme Heat	N	Extreme temperatures is not a concern in Ashtabula County.
Flooding	Y	Ashtabula County Hazard Profile Titled: Flooding
Invasive Species	Y	Ashtabula County Hazard Profile Titled: Invasive Species
Landslide	N	Landslides are not a concern in Ashtabula County.
Land Subsidence	N	Land subsidence is not a concern in Ashtabula County.
Seiche/Coastal Flooding	Y	Ashtabula County Hazard Profile Titled: Coastal Erosion. See note regarding "Seiche/Coastal Flooding."
Severe Summer Storms	Y	Ashtabula County Hazard Profile Titled: Severe Thunderstorm Winds & Hail
Tornado	Y	Ashtabula County Hazard Profile Titled: Tornado
Wildfire	Y	Ashtabula County Hazard Profile Titled: Wildfire
Winter Storm	Y	Ashtabula County Hazard Profile Titled: Severe Winter Storm

Though Ashtabula County's hazard list varies slightly from FEMA and OEMA, a comparison of the lists suggests that the county's committee assembled a viable and understandable list. A final step in validating the committee's thoughts comes by reviewing disaster declarations for Ashtabula County (FEMA, 2023b). For declarations referenced by the U.S. Small Business Administration (SBA) and the U.S. Department of Agriculture's Farm Service Agency (FSA), "P" refers to counties designated as "primary," while "C" refers to those designated as "contiguous." References to these declarations appear, as appropriate, in the profiles in Section 2.2 below.

Table 2.1.3

Disaster Declarations Impacting Ashtabula County				
Year	*Number*	*Incident Category*	*Declaration Title*	*In Plan? (Y/N)*
1969	DR-266-OH	Tornado	Tornadoes	Y
1972	DR-345-OH	Flood	Severe storms and flooding	Y
1973	DR-377-OH	Flood	Severe storms and Flooding	Y
1977	EM-3029-OH	Snowstorm	Snowstorms	Y
1978	EM-3055-OH	Snowstorm	Blizzards and snowstorms	Y
1985	DR-738-OH	Tornado	Severe storms and tornadoes	Y
2003	EM-3187-OH	Other	Infrastructure	Y
2004	DR-1556-OH	Severe Storm	Severe storms and flooding	Y
2005	EM-3250-OH	Tropical Storm	Hurricane Katrina evacuation	N
2006	DR-1656-OH	Severe Storm	Severe storms	Y
2008	EM-3286-OH	Snowstorm	Snowstorms	Y
2012	EM-3346-OH	Severe Storm	Severe storms	Y
2012	S3253 (FSA)	Frost, Freeze	(Ashtabula Co. = C) Freezing temperatures	Y
2012	S3384 (FSA)	Drought	(Ashtabula Co. = P) Drought, excessive heat	Y
2012	S3385 (FSA)	Frost, Freeze	(Ashtabula Co. = P) Freezing temperatures	Y
2013	DR-4098-OH	Tropical Storm	Hurricane Ike remnants	Y
2013	S3563 (FSA)	Excessive Rain	(Ashtabula Co. = C) Excessive rain, and tornadoes	Y
2014	S3744 (FSA)	Frost, Freeze	(Ashtabula Co. = P) Freeze and excessively cold winter	Y
2015	S3934 (FSA)	Flash Flood	(Ashtabula Co. = P) Excessive rain, flooding, hail, high winds, landslides, mudslides, lightning	Y
2016	S4038 (FSA)	Drought	(Ashtabula Co. = C) High winds, fire danger, high temperatures, low humidity, Drought-FAST TRACK	Y
2017	S4220 (FSA)	Frost, Freeze	(Ashtabula Co. = P) Freezing temperatures	Y
2017	S4275 (FSA)	Flash Flood	(Ashtabula Co. = P) Excessive rain, flooding, high winds, tornadoes, lightning	Y
2018	S4465 (FSA)	Flooding	(Ashtabula Co. = C) Excessive rain, flash flooding and flooding	Y
2019	S4539 (FSA)	Flooding	(Ashtabula Co. = P) Excessive rain and flooding	Y
2019	S4541 (FSA)	Flooding	(Ashtabula Co. = C) Excessive rain and flooding	Y
2020	EM-3457-OH	Other/Biological	COVID-19	Y
2020	DR-4507-OH	Other/Biological	COVID-19 pandemic	Y

The list of declarations also suggests that the hazards identified by the steering committee are appropriate; all incident types resulting in declarations (except for the Hurricane Katrina evacuation, a special consideration) appear in the hazard list.

2.0 RISK ASSESSMENT

2.2 Describe Hazards

The following profiles detail each hazard considered by this plan, which includes a discussion on how the hazard impacts Ashtabula County. Within each profile, research and historical data inform the following elements.

- **Hazard Introduction and Overview:** Defines the hazard and presents a summary table of the hazard.
- **Location and Extent:** Identifies the physical places in the county that are vulnerable to the hazard and the severity of a hazard in a given location.

§201.6(c)(2)(i)	A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

- **Impacts and Vulnerability:** Describes impacts on different topics such as the environment, economic development, housing and health, infrastructure, and natural and/or cultural resources that may result from the hazard as well as specific populations that may be vulnerable.

§201.6(c)(2)(ii)	A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008, must also address NFIP-insured structures that have been repetitively damaged by floods.

- **Historical Occurrences:** Summarizes significant past events related to the hazard.

§201.6(c)(2)(i)	A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

- **Loss and Damages:** Outlines the methods used for loss and units (of deaths, injuries, and property/crop damage depending on available information) and estimates based on historical information and projections. Many of the loss estimates in the profiles that follow utilize the National Risk Index (NRI) (FEMA, 2023) as a data source. The NRI presents data at the Census tract level. Figure 2.2.1 shows the Census tracts of the county.

§201.6 (c)(2)(ii)(B)	An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.

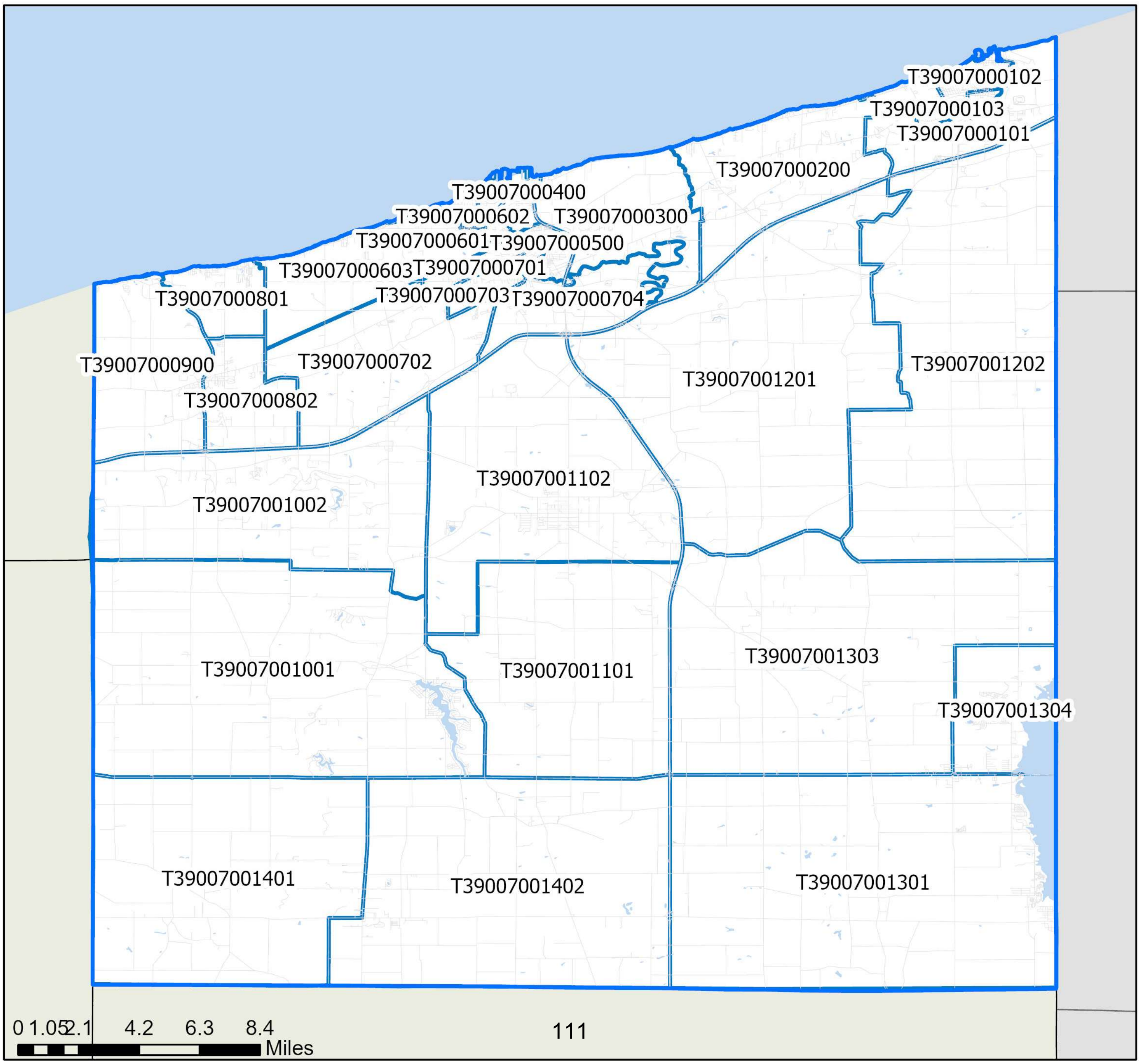
ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.1: Census Tracts

Data Source(s): USDHS National Risk Index

Census Tracts

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



- **Future Occurrences:** Describes the probability of future occurrences of the hazard under consideration. By taking future changes in land development into account and proactively reducing risk, communities increase their resilience and chances of withstanding future events.

§201.6(c)(2)(ii)(A)	The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

- **Risk Assessment:** Details methods for calculating the probability and severity of each hazard. Includes a summary of public sentiment about the hazard as well as risk categories (see below), and multi-jurisdictional considerations.

§201.6(c)(2)(ii)(A)	The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.
§201.6(c)(2)(iii)	For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

- **Maps and Assets:** Graphically shows the geographic locations or populations in the county that are vulnerable to each hazard. This subsection also identifies the assets that fall under the hazard risk area. Although there is not a defined title for this subsection in the profiles, assets and maps appear where they are most fitting within the narrative.

One of the components of the risk assessment is to quantify, to the extent possible, the risk of hazards as determined by the probability of occurrence and the potential severity of those occurrences. This process helps to identify which hazards pose the most significant concerns to Ashtabula County's communities. It is essential to recognize the value of implementing several categories to determine the overall risk. The following narrative and tables describe the categories utilized by this plan and how they relate to the available data. Historical occurrences inform all calculations, not worst-case scenarios. In cases with zero events, other available data (which varies across the hazards and is outlined in each profile) supports determinations.

"Frequency" refers to the number of times a hazard occurs in a specific period (based on available historical data). In most instances, the total occurrences (e.g., three occurrences) are divided by the length of time (in years) that data is available (e.g., 10 years). Thus, in the example, three occurrences divided by 10 years equals 0.3. The table above translates the resultant numeric values into a narrative frequency description.

Table 2.2.1

Frequency Categories			
Value	*Score*	*Description*	*Definition*
0.76 - >1.0	5	Frequent	Will occur during a year
0.51 – 0.75	4	Probable	Likely to occur in a year
0.26 – 0.50	3	Occasional	May (or may not) occur in a year
0 – 0.25	2	Remote	Unlikely to occur in a year
0	1	Improbable	So unlikely that it can be assumed it will not occur in a year

The hazard would have a "low" frequency in the example described here. At times, no historical data is available; in those cases, the hazard receives the lowest possible points for the category (i.e., one).

Other qualitative categories enable a clearer understanding of a hazard's potential impacts. Table 2.2.2 below depicts the variables used in this plan. Planners assigned values to these categories based on available research (cited, as appropriate, in the profiles), and each profile includes a brief description to contextualize the selection of the proper variable. Notably, the qualitative nature of these variables enables planners to consider potential future impacts, which is helpful when considering the nexus of risk and future development. These variables should be considered as a set. For instance, in the following profiles, a hazard like severe thunderstorm winds and hail would receive a *Magnitude* score of "catastrophic" simply because the entire county (i.e., well over 50% of the land area) is at risk. A catastrophic score, though, could mislead a reader without the context provided by the other variables that would receive a much lower score (such as *Onset* and *Human*, which would both receive the lowest scores available).

Table 2.2.2

Qualitative Risk Variables						
	Response	*Onset*	*Magnitude*	*Business*	*Human*	*Property*
1	< half a day	> 24 hours	Localized (< 10% land area affected)	< 24 hours	Minimum (minor injuries)	< 10% property affected
2	One day	12-24 hours	Limited (10-25% land area affected)	One week	Low (some injuries)	10-25% property affected
3	One week	6-12 hours	Critical (25-50% land area affected)	At least two weeks	Medium (multiple severe injuries)	25-50% property affected
4	One month	< 6 hours	Catastrophic (> 50% land area affected)	More than 30 days	High (multiple deaths)	> 50% property affected
5	> one month	N/A	N/A	N/A	N/A	N/A

All hazards receive a score for each category corresponding to the number in the far-left column. Hazards receive scores of between 7 (i.e., all seven categories receive a value of one) and 30 points (i.e., all seven categories receive a value of four or five). The list below represents a broad range by which planners ranked all the hazards in this plan.

Range of Points (Score)	*Hazard Ranking*
7 – 10	Lowest
11 – 15	Low
16 – 20	Medium
21 – 25	High
26 – 30	Highest

Socioeconomic Variables (Poverty and Educational Attainment)

The SVI includes a variable that measures the estimated number of persons who live below the poverty level. Researchers at the CDC, who authored *A Social Vulnerability Index for Disaster Management*, explain that "economically disadvantaged populations are disproportionately affected by disasters" (Flanagan, Gregory, Hallisey, Heitgard, & Lewis, 2011).

The poor are less likely to have the income or assets needed to properly prepare for a possible disaster, or to recover after a disaster occurs (Cutter, Boruff & Shirley, 2003). These areas will need significant support during recovery activities and could greatly benefit from targeted mitigation. Closely associated with the poverty level is the unemployment rate. The Median Household Income (MHI) for the county is $55,507, and the poverty rate is 18%. This exceeds the state poverty rate of 13%.

Scholars consider education as a socioeconomic variable, though the relationship between education and vulnerability is not absolutely understood (Flanagan et al, 2011). Education is, however, associated with both income and poverty. Many people without a high school diploma will struggle to find steady, well-paying jobs. This is especially true within the boom-and-bust cycles associated with natural resource industries. During boom times, these residents can earn decent wages, but when the industry enters a bust cycle there is little to fall back on. Applying for federal aid and other recovery activities requires the proper completion of complex paperwork. For people with less education, the practical and bureaucratic hurdles to cope with and recover from disaster prove increasingly difficult to surmount (Morrow & Gladwin, 1999). While most residents throughout Ashtabula County have a high school diploma, 13.4% of the population do not.

Access to Internet

During the COVID-19 Pandemic, the internet was keeping many connected to work, school, family, and friends. However, a Gallup analysis shows "more than half a billion of the world's most-vulnerable people, who were struggling to meet even their basic food and shelter needs and didn't have anyone to help them, didn't have internet access" (Ray, Pugliese, & Espova, 2020). Inequality in income and of opportunity worsens due to disadvantaged groups of people who live in rural areas having limited, or no internet access (Garcia-Escribano, 2020). Households that subscribe to broadband Internet average 85.8% in Ashtabula County. This is slightly below the national average of 87%.

Housing/Transportation

The SVI includes a number of variables that describe housing and transportation, three of which appear here: mobile homes, vehicle ownership/access, and institutionalized housing. Housing quality is an important factor in evaluating vulnerability and is closely tied with socioeconomic status and personal wealth (Flanagan et al, 2011). Mobile homes, which typically are inhabited by those of lower socioeconomic groups, are not designed to withstand severe weather events or flooding. Mobile homes are frequently found outside of metropolitan areas, making access difficult in regular conditions, even more so during and immediately after a disaster (Flanagan et al, 2011). Mobile homes are often clustered in communities, which increases the overall vulnerability of these communities (Flanagan et al, 2011).

Vehicle ownership or access is crucial to being prepared as well as evacuating, when needed. Those who do not possess or have access to a vehicle will have difficulty going to stores in order to obtain preparedness supplies and will have less capacity to bring those supplies back to their home. This is even more pronounced in rural areas, which typically lack robust public transportation networks.

The final housing vulnerability variable to discuss is those who live in institutional settings. These include college dorms, farm worker's dormitories, health institutions, and prisons, which present special concerns for evacuations (Flanagan, 2011). Nursing homes and other residential medical facilities are particularly vulnerable. The increased vulnerability is due to the special and timely needs of the residents, and because of understaffing in these institutions in emergencies (Flanagan, 2011). Evacuating these facilities is a time and resource consuming operation, requiring numerous specialty vehicles and staff such as advanced life support ambulances. While these facilities will have backup generators for vital machines, in an extended power outage, these generators will need additional fuel deliveries.

Language

A specific variable among minorities that can greatly increase their vulnerability during a disaster is an inability to speak or read English well, or at all. While small in comparison to the overall population of the county, this population is exceedingly vulnerable. Without accurate translations, these populations may not understand impending disasters, preparedness warnings, or evacuation notices. Research has shown that immigrant populations are more likely to rely on relatives, friends, and neighbors for information, rather than official sources (Flanagan et al., 2011). Ashtabula City and Rock Creek Village where slightly above the state percentage with regards to non-English speaking populations. Approximately 7.8% of the population of Ashtabula City, and 10.9% of the population of Rock Creek Village are non-English speaking, that state percentage is 7.7%.

Section 2.0: Risk Assessment concludes with a “risk ranking” table that summarizes the scores for all hazards included in the plan. Profiles appear in the following order.

- 2.2.1 Coastal Erosion
- 2.2.2 Cyber Incident
- 2.2.3 Dam & Levee Failure
- 2.2.4 Drought
- 2.2.5 Earthquake
- 2.2.6 Flooding
- 2.2.7 Hazardous Materials Release
- 2.2.8 Health Related Emergencies
- 2.2.9 Invasive Species
- 2.2.10 Severe Thunderstorm Winds & Hail
- 2.2.11 Severe Winter Weather
- 2.2.12 Terrorism/Civil Disturbance
- 2.2.13 Tornado
- 2.2.14 Utility Failure (Non-Storm Related)
- 2.2.15 Wildfire

2.2.1 Coastal Erosion

Coastal erosion is the gradual wearing and carrying away of land or beach materials by wave action, water, wind, general weather conditions, and tidal currents.				
RISK HIGHEST HIGH MEDIUM LOW LOWEST	**Period of Occurrence:**	Largely gradual, though impacts from seiche wave can be immediate.	**Risk Ranking:**	Low
	Warning Time:	Over 24 hours	**Type of Hazard:**	Natural
	Probability:	Probable (Likely to occur in a year)	**Impact:**	Localized (Less than 10% of land area affected)
	Disaster Declarations:	Resolution No. 2022-525; local State of Emergency (2022)		

<u>Hazard Introduction and Overview</u>

Coastal hazards are a constant threat to the 95,000 miles of U.S. coastline. Ohio contains 312 miles of Lake Erie's coastline, 28 miles of which make up Ashtabula County's northern border.

Coastal erosion results from beach-lake interaction and human activity. The beach system is one that is considered to be in dynamic equilibrium, which means that sand is moved from one location to another, but does not leave the system. For example, winter storms and other storm surges may remove significant amounts of sand, creating steep, narrow beaches. In the summer, gentle waves return the sand, widening beaches and creating gentle slopes. The sand movement will not be consistent year after year in the same location because there are so many factors involved in coastal erosion.

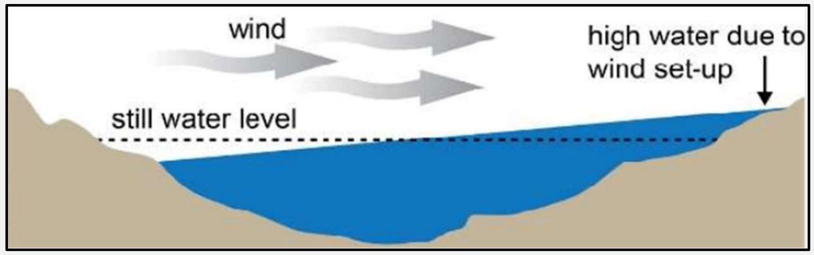
Ashtabula's bluffs are rich in clay and are prone to erosion from groundwater and runoff. Excess surface water and groundwater seepage can weaken bluff stability, causing slumping and block falls. The bluffs along Lake Erie are composed of glacial till, known as Ashtabula till, with portions covered with laminated clay and sand. Ashtabula till is silty and clayey and contains siltstone and shale fragments. Bluff height generally increases west to east, ranging from 15 feet to 60 feet. Lower relief also occurs at the Ashtabula River and Conneaut Creek mouths.

Wind, waves, and longshore currents are the driving forces behind coastal erosion. This removal and deposition of sand permanently changes beach shape and structure. Sand may be transported to landside dunes, underwater trenches, other beaches, and water bottoms.

Longshore currents can transport sediment parallel to the shore; this disruption of the natural process can exacerbate erosion in some areas and lead to deposition in others.

RELATED HAZARDS: LAKE SURGE AND SEICHE WAVES

When a storm first moves over one of the Great Lakes, typically the temperature drops and the wind changes direction; this disturbs the water in the lake and causes it to move in the same direction the storm is moving. For example, when a storm moves from west to east, water is moved from the western side to the eastern end of the lake. The water level in the eastern end of the lake is raised; this is called a storm surge. A surge can cause a difference in water level of several feet between both ends of the lake. Storm surges may cause seiches. The word seiche is French for "to sway back and forth." After a storm moves past the lake, and the wind and pressure are no longer pushing the water, the piled-up water moves toward the opposite end of the lake. The water sloshes from one end of the lake to the other a few times until the water level is returned to normal. The water sloshing back and forth is called a seiche. Often a seiche can be spotted because the water level will be high along the shore and within a relatively short period, the water level will then drop, sometimes leaving bottomlands exposed. Seiches may "slosh" back and forth like this several times before reaching equilibrium (University of Michigan, n.d.).



Lake Erie produces the largest seiches of the Great Lakes. This is due to its orientation and shallowness. Seiches are usually minor and are mistaken for tidal activity; however, the NWS begins to issue advisories when they are expected to be over two feet (Sousounis, 2014). Severe and deadly seiche events are rare on the Great Lakes. Minor seiches could cause damage to the property right on the lakefront, including cottages and boats. The water level of Lake Erie is subject to seasonal and yearly fluctuation. Generally, water levels are higher in the spring and lower in the fall. The seasonal change is typically 1 to 2 feet. Year-to-year change may be greater depending on regional climate conditions.

Possible Causes

Several factors influence storm surges and seiches in the Great Lakes; these can include the following.

- **Wind**: Sustained high winds from one direction
- **Atmospheric Pressure** (also known as barometric pressure): The pressure at any point in an atmosphere due solely to the weight of the atmospheric gases. Changes in atmospheric pressure add to the effect of wind
- **Basin Size, Shape and Depth**: Basin characteristics can affect the frequency and severity of storm surges and seiches. For example, storm surges and seiches are common on Lake Erie due to its east-west orientation, prevailing westerly winds and shallow depth at its western end

Location and Extent

The Lake Erie shoreline of Ohio is undergoing widespread recession. According to the Ohio Coastal Management Program (OCMP), approximately 95% of Ohio's Lake Erie shore is eroding with 43% of the shore now beachless. Nearly 2,500 structures are within 50 feet of the destruction.

The *Lake Erie Shore Erosion Management Plan* (LESEMP) notes the geologic features of Ashtabula County's shore as high bluffs ranging from 15 feet to over 60 feet in height. The bluffs are largely continuous and uninterrupted by river mouths. The county's shoreline contains two harbors, Ashtabula and Conneaut, and several marinas contain coastal infrastructure and alterations to the natural shore. Beaches have not been a prominent feature of the Ashtabula County area. Those that are in place, such as the areas west of the western harbor jetties in Ashtabula and Conneaut were formed by trapping sediment (ODNR Office of Coastal Management, 2011).

The LESEMP goes on to identify the major causes of lake-based erosion in Ashtabula County as those related to wave action and water in and on bluffs. These causes of erosion result in specific issues: (a) "surface water runoff causing surface erosion and rill and gully formation," (b) "perched groundwater causing slumping and block failure," and (c) "wave attack at the toe of a bluff causing lakebed downcutting and bluff instability" (i.e., undercutting) (ODNR, 2011, p. 6).

"Coastal Erosion Areas (CEAs)" are a component of the Ohio Coastal Management Law passed in 1988 (i.e., ORC Section 1506 and OAC Section 1501-6). A CEA is land adjacent to Lake Erie that officials anticipate losing to coastal erosion within 30 years absent preventive measures. The original designations were issued in 1998 (ODNR Office of Coastal Management, 2019). The land included in a CEA must be disclosed when ownership of the land changes hand. Further, property owners may have to have a "CEA permit" if considering new construction, installation of a septic system, or an addition of 500 sq. ft. or more to the ground level of an existing building. Municipalities located along the shoreline of Lake Eire include; the cities of Ashtabula and Conneaut, the villages of Geneva-on-the-Lake, and North Kingsville, as well as the townships of Ashtabula, Geneva, and Saybrook. Coastal Erosion Areas in Ashtabula County are as follows (2018, https://gis.ohiodnr.gov/MapViewer/?config=cea).

Table 2.2.1.1

Ashtabula County Coastal Erosion Areas (CEAs)						
Frame	*Average Recess Rate (ft.)*		*Average Anticipated Distance (ft.)*		*Coastal Erosion Areas*	
	1998	*2018*	*1998*	*2018*	*1998*	*2018*
268	2.85	1.23	83.56	35.87	25	26
269	2.29	0.74	39.38	23.84	34	25
270	2.90	0.63	60.83	18.83	15	13
271	0.02	0.02	0.62	0.45	0	0
272	0.21	0.02	6.49	0.81	3	0
273	0.91	0.15	26.46	4.42	22	4
274	0.50	0.03	14.75	0.67	19	0
275	0.69	0.11	19.65	3.14	15	2
276	1.44	0.18	43.44	7.70	31	8
277	1.13	0.34	33.87	9.91	26	9
278	1.07	0.17	31.33	4.17	24	2
279	1.63	0.76	48.23	22.17	28	20
280	3.76	0.67	113.15	19.89	36	15
281	2.92	1.65	87.85	31.76	26	22
282	2.35	0.59	69.54	17.48	29	14
283	4.01	0.21	119.48	5.91	38	7
284	3.57	0.49	106.78	14.74	35	13
285	1.78	0.13	53.79	3.32	32	0
286	2.45	0.28	73.96	8.71	24	5
287	3.27	0.67	98.95	19.57	35	21
288	2.84	1.23	85.15	32.38	33	33
289	2.89	0.72	85.57	21.11	34	30
290	1.45	0.56	44.01	17.01	22	16
292	0.36	0.18	10.86	5.35	8	6
293	0.20	0.05	6.48	1.63	6	3
295	0	0	0	0	0	0
296	0.003	0	0.18	0	0	0
297	0.21	0.06	4.45	1.37	6	0
298	1.23	0.05	30.67	1.76	24	0
299	0.88	0.24	24.32	6.60	25	3
300	0.73	0.15	22.01	4.49	26	0
301	0.74	0.08	21.72	2.24	22	0
302	0.57	0.06	17.15	2.23	12	0
303	0.93	0	27.79	0.35	25	0
304	1.44	0.12	41.45	3.33	33	2
305	0.93	0	28.16	0	24	0
306	1.41	0	42.69	0	33	0
307	0.93	0.084	28.19	2.53	9	0
308	0.71	0.016	21.47	0.46	9	0
309	5.12	0.17	151.9	6.19	14	3
310	0.84	0.11	25.39	3.52	12	5
311	0.30	0	7.65	0.12	3	0

Ashtabula County Coastal Erosion Areas (CEAs)						
Frame	*Average Recess Rate (ft.)*		*Average Anticipated Distance (ft.)*		*Coastal Erosion Areas*	
	1998	*2018*	*1998*	*2018*	*1998*	*2018*
312	0.24	0.02	6.41	0.40	6	0
313	1.67	0.003	49.54	0.19	26	0
314	1.40	0.07	10.83	2.04	39	0
315	0.73	0.23	20.94	6.97	14	5
AVERAGES	**1.23**	**0.29**	**34.25**	**8.17**	**20.91**	**6.78**

Upon analyzing the data contained in Table 2.2.1.1 above, the highest average recess rates and average anticipated distance of erosion between 1998 and 2018 have occurred in the northeastern most corner of the county in Conneaut, portions of North Kingsville and Ashtabula Township. The bluffs comprising interbedded silts, clays and shale west of Ashtabula are of particular concern, as well as a nearly three-mile stretch east of Ashtabula towards North Kingsville is threatening segments of State Route 531 in multiple locations. The area from Russell Drive to Labounty Road specifically shows exposed shale at lake level. Table 2.2.1.2 below contains a list of assets located in coastal erosion risk areas, the map that follows (Figure 2.2.1.1) graphically illustrates potential coastal erosion risk areas in Ashtabula County.

Table 2.2.1.2

Assets in Coastal Erosion Risk Areas			
Name or Description	*Address*	*City*	*Asset Type*
Ashtabula Harbor Light	Lat: 41.91855 Lon: -80.79586	Ashtabula	Built Environ: Cultural Resource
Kilpi Hall	1025 Buffalo Street	Conneaut	Built Environ: Cultural Resource
Conneaut Light Station Keeper's Dwelling	1059 Harbor Street	Conneaut	Built Environ: Cultural Resource
Community Care Ambulance Network	115 East 24th Street	Ashtabula	Built Environ: Critical Facility
Ashtabula Harbor Commercial District	1200 5th Street	Ashtabula	Built Environ: Cultural Resource
Conneaut City Sewage Treatment	1206 Broad Street Extension	Conneaut	Built Environ: Infrastructure
Mother of Sorrows Church	1500 West 6th Street	Ashtabula	Built Environ: Cultural Resource
Harbor-Topky Memorial Library	1633 Walnut Boulevard	Ashtabula	Built Environ: Existing Structure
Ashtabula WWTP	303 Woodland Avenue	Ashtabula	Built Environ: Infrastructure
Harpersfield Twp. FD Stn. #1	5430 State Route 534	Harpersfield	Built Environ: Critical Facility
Ashtabula PO	718 Lake Avenue	Ashtabula	Built Environ: Existing Structure
West Fifth Street Bridge	SR 531 over Ashtabula River	Ashtabula	Built Environ: Cultural Resource

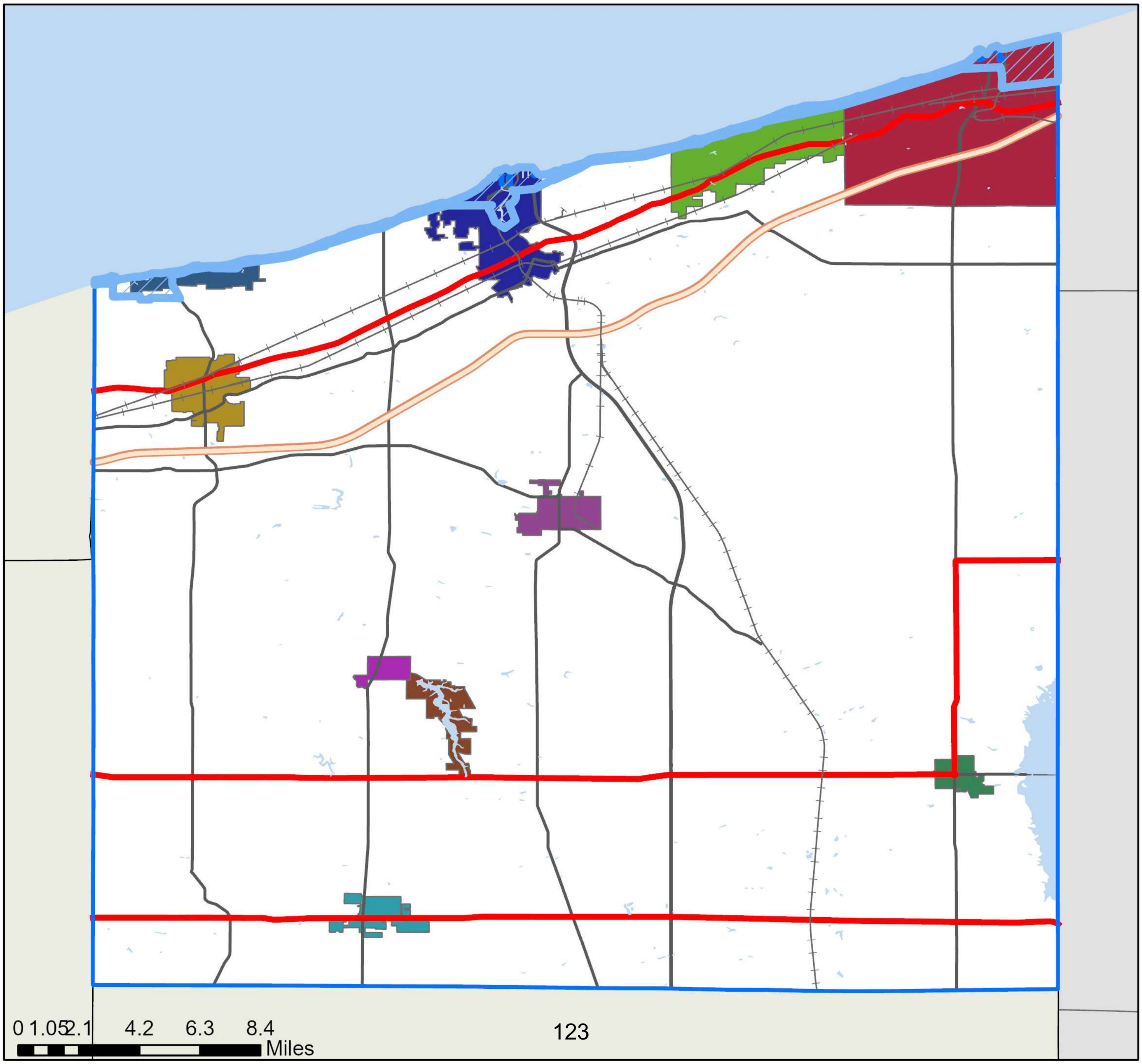
ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.1.1: Risk Areas

Data Source(s): ODOT

Coastal Erosion Risk Areas

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



Impacts and Vulnerability

Coastal erosion poses many problems to coastal communities in that valuable property is frequently lost to this dynamic beach-lake system. Additionally, human activity may accelerate the process of coastal erosion through poor land use methods. Thus, issues of beach restoration and erosion control are at the forefront in coastal communities. Factors that can cause shoreline erosion include the following.

- **Bluff Recession**: An eroded beach leaves the base of the bluff vulnerable to wave attack. As waves break farther inshore, they weaken and erode the base of the bluff, which is known as undercutting. Once the base area is eroded, upper bluff soils and vegetation lose their support and slide to the base of the bluff.
- **High Lake Levels**: High levels cause waves to break farther inshore, eroding the beach and lower bluff areas. High lake levels are primarily the result of increased precipitation in the upper Great Lakes Watershed.
- **High Winds**: High winds during storms also cause water levels to reach above-normal levels. During storms, high winds force the water surface higher at the downwind end of the lake. As the storm passes, this pent-up water is released and moves toward the opposite end of the lake. The wind-driven wave buildup, known as a seiche, can cause severe flooding along the shoreline.
- **Human Activities**: Activities such as the construction of marinas and groins block the natural movement of beach sediment by wave action. While some human activities can lessen coastal erosion, larger structures may cause currents to carry sediment offshore to deeper water, rather than transport it farther down the beach.

Though there are environmental and economic impacts associated with coastal erosion, local officials expect minimal structural damage resulting from the hazard. When compiling the data in Table 2.2.1.1 above that details average recession rates for all the identified Coastal Erosion Areas (CEAs) in Ashtabula County, planners counted the number of structures located within 2018 Coastal Erosion Areas (CEAs). In 2018, Ashtabula County had a total of 312 CEAs, and there were 53 structures located between the base recession line and the lake shore.

Historical Occurrences

The National Oceanic and Atmospheric Administration's (NOAAs) National Centers for Environmental Information (NCEI), Storm Events Database reports no seiche or storm surge/tide events between 1950 and 2024. However, the *Star Beacon* reported that high lake levels were keeping the sand bar in Conneaut, a popular recreation area, closed for the start of the 2019 summer season. The area at the southwest corner of Conneaut Harbor was underwater, making the access road linking the entrance gate to the largest part of the sandbar submerged (Todd, 2019).

The Ohio Department of Natural Resources (ODNR) Office of Coastal Management maintains the Lake Erie Shore Erosion Management Plan (LESEMP). According to ODNR's website, erosion rates for Ashtabula County have been as follows. "Long-term recession rates cover the years 1877 to 1973 with the short-term rates representing data from 1973 to 1990" (http://coastal.ohiodnr.gov/erosion).

Table 2.2.1.3

County	Long-Term Distance (ft.)	Long-Term Rate (ft/yr)	Short-Term Distance (ft.)	Short-Term Rate (ft/yr)
Ashtabula County	82	0.9	28	1.6

The Village of North Kingsville declared a state of emergency on December 5, 2022, due to Lake Erie levels creating accelerated erosion along the entire shoreline of the village. This erosion created an imminent threat to critical public infrastructure, unexpected loss of shoreline, and the inability for emergency vehicles and the public to use a critical roadway (SR 531).

The Village of Geneva-on-the-Lake also declared a state of emergency on December 8, 2022, due to continued Lake Erie water levels being higher than long term averages, the loss of natural vegetation, high wind and wave action creating accelerated erosion along the village's entire shoreline. This created an imminent threat to critical public infrastructure, and accelerated loss of shoreline along State Route 531 and adjacent areas causing an imminent hazard to public health, welfare, and the environment. Ashtabula County also declared a state of emergency for both Geneva and North Kingsville on December 13, 2022 (Resolution No. 2002-525)

Local officials have taken steps to address the hazard, most notably through participation in the statewide shore erosion management plan. According to the LESEMP (ODNR, 2011), the top priorities of local officials related to coastal erosion included protection of

State Route 531/Lake Road, dredging and sediment issues (countywide), and educating property owners and those working along the lake.

The *Star Beacon* reported that Lake Erie's high water levels contributed to "dramatic" erosion problems in eastern Lake County and western Ashtabula County (Deluca, 2017). The erosion caused a portion of the hiking/biking trail near Breakwater Beach in Geneva State Park to close, necessitating the establishment of a detour. The area in question was the "path connecting the Breakwater beach house parking lot to the state park's rental cabins."

Additionally, residents have contacted the Ashtabula County Emergency Management Agency (ACEMA) to report coastal erosion concerns. A homeowner in Geneva-on-the-Lake reported losing his entire beach and that his retaining wall was in jeopardy. The problems included a breach to erosion control efforts to his east.

Loss and Damages

There are numerous impacts that can result from coastal erosion, public parks, utilities, and infrastructure can, and often do, experience erosion-related damages. One of the greatest risks involves eroded shorelines that collapse without warning.

Within the Great Lakes Region, coastal erosion causes serious property damage, endangers public safety, and degrades overall environmental quality. Economic losses exceed tens of millions of dollars per year.

Ashtabula County has 3.9 miles of publicly accessible coastline with 12 access sites, and coastal erosion could impact all these community resources.

To complete the Mitigation Information Portal (MIP) vulnerability assessment, planners counted an approximate number of structures on the CEA maps cited above. The resultant calculation totaled 53 structures potentially at-risk. The majority of those structures (i.e., 50) appeared to be residential (and planners figured a loss estimate by multiplying the median value of the county's owner-occupied housing units [U.S. Census Bureau, 2024 estimates]). Planners estimated three non-residential structures in the CEAs and utilized HAZUS data to estimate non-residential losses.

Table 2.2.1.4

Coastal Erosion, Loss Estimates		
Structure Type	*Number*	*Loss Estimate*
Residential	50	$5,315,000
Non-Residential	3	$808,600
Critical Facilities	0	$0
TOTALS	**53**	**$6,123,600**

Future Occurrences

Predicting the exact timing and severity of future coastal erosion events in challenging because of the complex interaction of factors like lake levels, storm intensity, and human interventions. However, based on current trends several factors will likely contribute to future coastal erosion in Ashtabula County. The Great Lakes, including Lake Erie, are experiencing a decline in winter ice cover. Less ice leaves the shoreline vulnerable to the full force of winter storms and waves, which can worsen erosion.

Future efforts can be made to protect Lake Erie's shoreline. Structures, when properly placed, can protect the shoreline in two ways. In the water, they help trap and retain sediment. On land, they protect the shoreline against constant wave attack. Breakwaters are usually composed of stone or rocks and are placed a short distance offshore. By breaking the full force of incoming waves, they promote the accumulation of sediment between the structure and the eroding beach. The area behind the breakwater should be partially filled with sand after construction to avoid erosion to down-drift beaches.

Groins are structures that extend perpendicularly from the shore. Groins interrupt the natural movement of beach sediment by trapping and retaining sand on the up-drift side of the groin. The area on the up-drift side should be filled after construction to avoid erosion to down-drift beaches. Revetments are structures placed in the beach profile or along the base of bluffs to absorb the energy of incoming waves. These structures protect only the land immediately behind them and not adjacent areas. If placed in the water, revetments do not encourage sediment buildup and little, if any, beach will develop.

While intended to protect shoreline, hard structures (i.e., bulkheads and groins) can sometimes have unintended consequences, such as increased erosion in adjacent areas. The Ohio Department of Natural Resources emphasizes that these types of structures must be carefully designed to avoid exacerbating erosion and notes that many existing structures are aging and require monitoring and maintenance.

Risk Assessment

This section summarizes the vulnerability of Ashtabula County to coastal erosion. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. Table 2.2.1.5 presents the results of that survey, specifically regarding coastal erosion.

Table 2.2.1.5

Public Sentiment, Coastal Erosion					
	Level of Concern				
Hazard	*Not at All*	*Somewhat*	*Concerned*	*Very*	*Total Responses*
COASTAL EROSION	71 (47.97%)	41 (27.70%)	27 (18.24%)	9 (6.08%)	148
In the past five years, do you remember this hazard occurring in your community?				50 (33.78%)	148
Have you noticed an increase in the occurrences or intensity of this hazard?				52 (35.14%)	148
Have you noticed a decrease in the occurrences or intensity of this hazard?				0 (0.00%)	148

Source: Online Public Survey Results

The following table (Table 2.2.1.6) assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA's Mitigation Information Portal (MIP) tool.

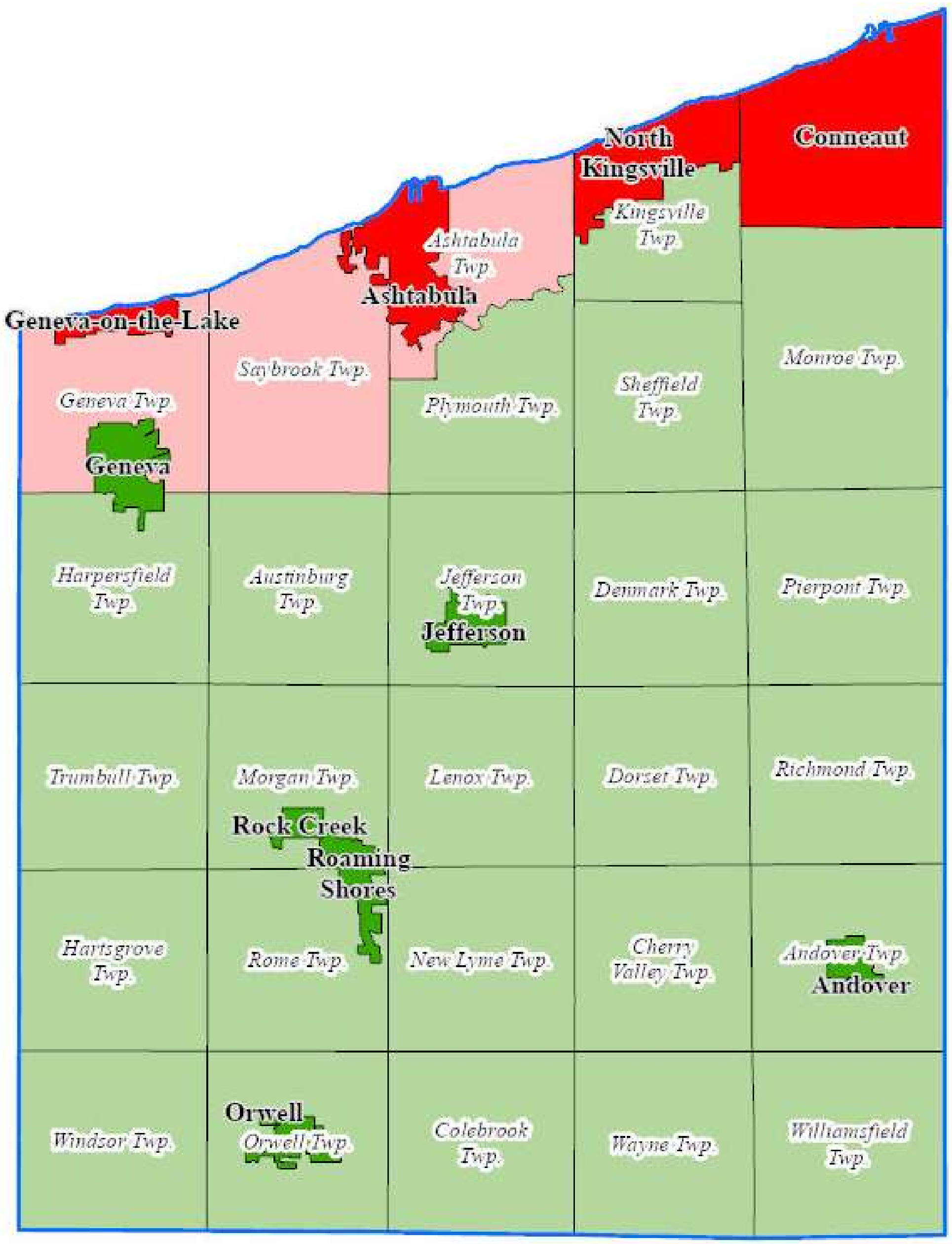
Table 2.2.1.6

Risk Ranking, Coastal Erosion			
Category	*Points*	*Description*	*Notes*
Frequency	4	Probable (Likely to occur in a year)	Listed as "probable" as coastal erosion is a continually occurring phenomenon.
Response	5	More than a month	Response considerations are on-going, and response actions are not acute in nature.
Onset	1	Over 24 hours	Coastal erosion is a gradual process, individuals and assets impacted are aware of the activity for much longer than 24 hours. However, if a bluff were to give way, it may do so with no warning.
Magnitude	1	Localized (Less than 10% of land area affected)	Coastal erosion only impacts the shoreline areas of Ashtabula County.
Business	1	Less than 24 hours	Because construction is largely regulated, there are few businesses located within risk areas.
Human	1	Minimum (minor injuries)	The gradual nature of the hazard should give individuals plenty of time to avoid injuries.
Property	1	Less than 10% of property affected	Impacts are confined to properties located in coastal erosion hazard areas.
Totals	**14**	**LOW**	

FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The following map identifies those multi-jurisdictional risks concerning coastal erosion. Jurisdictions underlaid by a red shaded drop shadow are more at risk, those underlaid with a green drop shadow are less at risk of coastal erosion.

Figure 2.2.1.2

Coastal Erosion Multi-Jurisdictional Risk Map



2.2.2 Cyber Incidents

A "cyber incident" is an assault launched, by cyber criminals using one or more computers, against a single (or multiple) computers or networks.				
Risk HIGHEST HIGH MEDIUM LOW LOWEST	**Period of Occurrence:**	At any time	**Risk Ranking:**	High
	Warning Time:	Less than 6 hours	**Type of Hazard:**	Technological
	Probability:	Frequent (Will occur during a year)	**Impact:**	Limited (10-25% of land area affected)
	Disaster Declarations:	None		

<u>Hazard Introduction and Overview</u>

Cyber incidents are generally defined as an event that actually or imminently jeopardizes, without lawful authority, the confidentiality, integrity, or availability of information or an information system; or constitutes a violation or imminent threat of violation of law, security policies, security procedures, or acceptable use policies. According to the Department of Homeland Security – Industrial Control Systems Cyber Emergency Response Team, cyber threats to a control system refer to persons who attempt unauthorized access to a control system device and/or network using a data communications pathway. This access can be directed from within an organization by trusted users or from remote locations by unknown persons using the Internet. Threats to control system can come from numerous sources, including hostile governments, terrorist groups, disgruntled employees, and malicious intruders.

A cyberattack targets an organization's use of cyberspace for the purpose of disrupting, disabling, destroying, or maliciously controlling a computing environment/infrastructure, or destroying the integrity of the data or stealing controlled information. Cyberattacks are unpredictable and typically occur without warning. To protect against these threats, it is necessary to create a secure cyber-barrier around the Industrial Control System (ICS). Though other threats exist, including environmental, mechanical failure, and inadvertent actions of an authorized user, this discussion will focus on deliberate threats as categorized in the Statement for the Record to the Joint Economic Committee by Lawrence K. Gershwin, the Central Intelligence Agency's National Intelligence Officer for Science and Technology (June 21, 2001). These include national governments, terrorist, industrial spies, organized crime groups, hacktivists, and hackers. Activities could include espionage, hacking, identity theft, crime, and terrorism.

Location and Extent

According to the FireEye Cyber Threat Map, approximately 725,000 major cyberattacks occur throughout the world per day. Because cyberattacks can cause severe disruptions to computers and electronics associated with critical infrastructure, statewide transportation, data centers, public safety, and utility services, all of which use Supervisory Control and Data Acquisition (SCADA) systems, all are vulnerable to attack. Because of this, the county and municipal agencies of Ashtabula County, as well as individuals, businesses and other institutions are potential targets for cyberattacks. The actual cause of cyberattacks can be difficult to identify because the internet provides cover for those responsible for attack initiation.

Although the most numerous and publicized cyber intrusions and other incidents are ascribed to lone computer-hacking hobbyists, such hackers pose a negligible threat of widespread long-duration damage to national-level infrastructure. Nevertheless, the large worldwide population of hackers poses a relatively high threat of an isolated or brief disruption causing serious damage, including extensive property damage or loss of life. As the hacker population grows, so does the likelihood of an exceptionally skilled and malicious hacker attempting and succeeding in such an attack. Hackers are subdivided as follows:

- Sub-communities of hackers.
- Script kiddies are unskilled attackers who do NOT have the ability to discover new vulnerabilities or write exploit code and are dependent on the research and tools from others. Their goal is achievement and to gain access and deface web pages.
- Worm and virus writers are attackers who write the propagation code used in the worms and viruses but not typically the exploit code used to penetrate the systems infected. Their goals is notoriety and to cause disruption of networks and attacked computers systems.
- Security researcher – white hats have two sub-categories; bug hunters and exploit coders. Their goal is profit, to improve security, earn money, and achieve recognition with an exploit.
- Professional hacker – black hats who gets paid to write exploits or actually penetrate networks, also falls into the two sub-categories; bug hunters and exploit coders. Their goal is profit.

Hackers and researchers interact with each other to discuss common interest, regardless of color of hat. Hackers and researchers specialize in one or two areas of expertise and depend on the exchange of ideas and tools to boost their capabilities in other area. Information regarding computer security research flows slowly from the inner circle of the best researchers and hackers to the general Information Technology (IT) security world, in a ripple-like pattern.

The table below was excerpted from NIST 800-82, "Guide to Supervisory Control and Data Acquisition (SCADA) and Industrial Control System Security" and provides a description of the extent of various threats to computer system networks.

Table 2.2.2.1

United States Government Accountability Office Threat Table	
Cyber-Threat	*Description*
Bot-network operations	Bot-network operators are hackers; however, instead of breaking into systems for the challenge of bragging rights, they take over multiple systems to coordinate attacks and to distribute phishing schemes, spam, and malware attacks.
Criminal groups	Groups that seek to attack systems for monetary gain. Organized crime groups are using spam, phishing, and spyware/malware to commit identify theft and online fraud.
Foreign intelligence services	Use cyber tools as part of their information-gathering and espionage activities. In addition, several nations are aggressively working to develop information warfare doctrine, programs, and capabilities. Such capabilities enable them to have a significant impact by disrupting the supply, communications, and economic infrastructures that support military power.
Hackers	Hackers break into networks for the thrill of the challenge or for bragging rights in the hacker community. While remote cracking once required a fair amount of skill or computer knowledge, hackers can now download attack scripts and protocols from the Internet and launch them against victim sites. While attack tools have become more sophisticated, they have also become easier to use.
Insiders	The disgruntled organization insider is a principal source of computer crime. Insiders may not need a great deal of knowledge about computer intrusions because their knowledge of a target system often allows them to gain unrestricted access to cause damage to the system or to steal system data. The insider threat also includes outsourcing vendors as well as employees who accidentally introduce malware into systems.
Phishers	Individuals, or small groups, who execute phishing schemes to steal identities or information for monetary gain. Phishers may also use spam and spyware/malware to accomplish their objectives.
Spammers	Individuals or organizations who distribute unsolicited e-mail with hidden or false information to sell products, conduct phishing schemes, distribute spyware/malware, or attack organizations (i.e., denial of service).
Spyware/malware authors	Individuals or organizations carry out attacks by producing and distributing spyware and malware. Several destructive computer viruses and worms have harmed files and hard drives, including the Melissa Macro Virus, Explore.Zip worm, CIH (Chernobyl) Virus, Nimda, Code Red, Slammer, and Blaster.
Terrorist	Terrorist seek to destroy, incapacitate, or exploit critical infrastructures to threaten national security, cause mass casualties, weaken the U.S. economy, and damage public morale and confidence. Terrorists may use phishing schemes or spyware/malware to generate funds or gather sensitive information.

<u>Impacts and Vulnerability</u>

Impacts from a large-scale cyberattack could disrupt the county's economy and potentially threaten its economic stability. The magnitude of a cyberattack will vary greatly based on the extent of systems affected, the attacks durations, and the type of attack. The magnitude will vary based upon which specific system is affected by an attack and the ability to preempt and address emerging issues.

While physical structures are generally not at risk, all networked electronic devices are vulnerable to cyberattacks. Because computer networks contain sensitive information that is integral to the county's security, they will likely continue to be the focus of coordinated cyberattacks. Computer networks are also entrusted with many forms of personal and financial information, including tax filings, birth and death records, social security numbers, medical information, and more. Additionally, many critical facilities that are essential to county operations rely upon computer networks to monitor and control critical functions. For example, an attack on the power grid could have detrimental impacts on county services and functions. A large-scale computer breach would likely lead to significant economic costs in lost productivity to the impacted county agencies and potentially related businesses and industries.

Cyberattack impacts can range from insignificant to catastrophic. The overwhelming majority of cyberattacks involve targeted attacks on a single computer. These happen every day and have little impact on the county as a whole. However, a coordinated attack could render county and municipal operated networks useless.

In recent years, cyberattacks have become a significant threat and can impact people, businesses, institutions, local governments, and state agencies to varying degrees. The table below describes the types of cyberattacks and the associated impacts likely to be encountered.

Table 2.2.2.2

Types of Cyberattacks	
Threat	*Description*
Malware	Malware is a term used to describe malicious software, including spyware, ransomware, viruses, and worms. Malware breaches a network through a vulnerability, typically when a user clicks a dangerous link or email attachment that then installs risky software. Once inside the system, malware can do the following: • Block access to key components of the network (ransomware) • Install malware or additional harmful software • Covertly obtain information by transmitting data from the hard drive (spyware) • Disrupt certain components and render the system inoperable
Botnet	A collection of computers subject to control by an outside party, usually without the knowledge of the owners, using secretly installed software robots. The robots are spread by Trojan horses and viruses. The botnets can be used to launch denial-of-service attacks and transmit spam.
Denial-of-Service Attack	Flooding the networks or servers of individuals or organizations with false data requests so they are unable to respond to requests from legitimate users.
Phishing	Phishing is the practice of sending fraudulent communications that appear to come from a reputable source, usually through email. The goal is to steal sensitive data such as credit care and login information or to install malware on the victim's machine. Phishing is an increasingly common cyberthreat.
SQL Injection	A Structured Query Language (SQL) injection occurs when an attacker inserts malicious code into a server that uses SQL and forces the server to reveal information it normally would not. An attacker could carry out an SQL injection simply by submitting malicious code into a vulnerable website search box.
Spoofing	Making a message or transaction appear to come from a source other than the originator. Spyware software that collects information without a user's knowledge and transfers it to a third party.
Trojan Horse	A destructive program that masquerades as a benign application. Unlike viruses, Trojan horses do not replicate themselves, but they can be just as destructive. One of the most insidious types of Trojan horse is a program that claims to rid your computer of viruses but instead introduces viruses onto your computer.
Virus	A program designed to degrade service, cause inexplicable symptoms, or damage networks.
Worm	Program or algorithm that replicates itself over a computer network and usually performs malicious actions, such as using up the computer's resources and possibly shutting the system down. A worm, unlike a virus, has the capability to travel without human action and does not need to be attached to another file or program.

Pursuant to the requirements of Ohio Revised Code (ORC), Section §111.09, the Secretary of State appoints a Chief Information Security Officer (CISO) to advise on information security matters. Ohio law assigns responsibility for information security policies to the Office of Information Technology (OIT). Local governments in Ohio must report any cybersecurity incidents that result in the following in accordance with ORC §1349.19:

- Entities that conduct business in Ohio and that own, or license computerized personal information must notify Ohio residents of any data breach that does result, or could result, in the unauthorized access and acquisition of their unencrypted or unredacted personal information that is likely to cause a risk to identify theft or fraud.

- Notice must be made in the most expedient time possible, no later than 45 days after discovery or notification of the breach. Breached third parties must notify the relevant data owners or licensees as well.
- If more than 1,000 individuals must be notified of a breach, breached entities must also notify all consumer reporting agencies that compile and maintain files on consumers on a nationwide basis, unless they are covered by Health Insurance Portability and Accountability Act (HIPAA).
- Substitute notice is permitted in specific circumstances, and notification may be delayed for law enforcement purposes.
- Financial institutions compliant with the Federal Interagency Guidance Response Programs for Unauthorized Access to Consumer Information and Customer Notice are deemed to comply with this law.

Ashtabula County has established an Information Technology (IT) Department that focuses on protecting data and systems from unauthorized access, disclosure, modification, and disruption, encompassing network, application, endpoint, and data security measures.

The latest Cybercrime Report from LexisNexis Risk Solutions reveals that the people most vulnerable to cybercrime tend to be adults over the age of 75 and younger adults. “It is believed that the particular vulnerability of young and older adults is largely due to the surge of new customers going online or working from home during the COVID-19 pandemic” (Cybernews, 2024). The report suggests that it is easy to assume that young adults are tech-savvy and therefore relatively immune from cyberattacks, but they often have a false sense of their capabilities and therefore tend to be more relaxed, especially in terms of their willingness to share personal information. “While younger adults are most susceptible to online fraud attacks, the average fraud loss per customer increases progressively with age, likely influenced by larger disposable incomes later in life” (Cybernews, 2024).

The older demographic, by contrast, are much less familiar with the latest technologies, and their lack of familiarity raises their susceptibility to the various scams and phishing attacks. “Protection of the older, and potentially more vulnerable population, is critical for organizations that are prioritizing a digital-first strategy” (Cybernews, 2024).

Historical Occurrences

In addition to large-scale cyberattacks, smaller incidents occur on a daily basis. Billions of emails are sent each day, and spam and phishing emails account for a significant share of all email traffic. Brute force attacks, which are trail-and-error attempts to obtain user passwords and pins, are frequently used by criminals to attempt to crack encrypted data or gain access to private accounts.

The majority of cyberattacks go either unnoticed or unreported and, therefore, there is no definitive list of attacks. In recent years, several significant cyberattacks have disrupted or even halted the provision of municipal services. These attacks have increased the urgency and attention to the need for cyber-security protection policies and measures. SecuLore has compiled an archive of all known cyberattacks against critical infrastructure throughout Ohio since 2021. Ashtabula County has experienced three reported cyberattacks since 2020.

Ashtabula County Medical Center Ransomware Cyberattack, September 2020

According to an article in the Star Beacon, the Ashtabula County Medical Center (ACMC) spent two weeks offline after being hit by an apparent cyberattack. The hospital began experiencing a technical disruption to computer systems the week of September 21 and immediately implemented downtime procedures. ACMC worked with independent technology experts to bring systems back online as quickly as possible. The outage affected the hospital's five family health centers, where doctors and nurses could not access patient's lab work, prescriptions, or health history. A cybersecurity expert stated that the attack appeared to stem from a ransomware attack which encrypted files and shut down computers.

City of Geneva – Online Data System Breach Ransomware, July 2021

The City of Geneva's government system was hit with a cyberattack, the attack was first reported on July 20, 2021. During the early morning hours city officials discovered an online breach into the city's website and online data systems. The Executive Management and Information Technology (IT) Department immediately began accessing the city departments that could have exposure. On July 18, threat actors calling themselves AVOSLocker listed Geneva on their dedicated leak site with a message, "The City of Geneva, in Ohio, was recently locked by one of our partners. We are waiting for them to contact us. In the meantime, we are releasing a small sample of files that were exfiltrated from their network. Sensitive citizen information such as social security numbers and credit cards were redacted." As proof of claims, they uploaded a few screencaps of files that involved criminal charges against one person, a directory of files from a drive, and some tax-related files which, unfortunately, were not fully redacted.

Recorder's Office Cott System Security Breach, 2022/2023

A more recent attack occurring in late 2022 through early 2023, involving a cyberattack on the Cott Systems, a Columbus-based computer data processing business used by the Ashtabula County Recorder's Office to process documents. This attack caused a system outage and disrupted property transfers (i.e., the recorder's office was unable to access any already recorded documents, could not process new documents, no cash or credit card payments could be taken). "The Ashtabula County Recorder's Office was forced to return to old methods."

During Cott's routine maintenance of the system, unusual activity was noticed, so Cott shut down all servers and connections to their clients, including the recorder's office. The breach reportedly occurred at an off-site data center containing the recorder's office data.

<u>Loss and Damages</u>

Cyberattacks can lead to loss of money, theft of personal information, and damage to an individual's or company's reputation and safety. Cyberattacks can be carried out using computers, mobile phones, gaming systems, and other electronic devices. The attacks may include identity theft, fraud, or block access to, or deleting documents and pictures.

According to a February 2018 report from The Council of Economic Advisers, malicious cyber activity cost the U.S. economy between $57 billion and $109 billion in 2016. The IBM Cost of Data Breach Report 2023 indicated that the average cost of a data breach reached an all-time high in 2023 of USD 4.45 million. This represents a 2.3% increase from the 2022 cost of USD 4.35 million. This report revealed that an alarming 83% of organizations experienced more than one data breach during 2022. If a major cyberattack was to strike the State of Ohio and cripple power plants and other critical lifeline utilities for an extended time, the economic impact would be in the billions.

As cybercriminals become more ruthless, the risks and damages that they can unleash become more serious to include physical losses and personal injury. Such events are now known as "cyber-physical attacks," according to the International Risk Management Institute's online glossary, this is a security breach in cyberspace that impacts on the physical environment. A malicious user can take control of the computing or communication component of water pumps, transportation system, pipeline valves, etc. and cause damage to property and put lives a risk.

Future Occurrences

Based on past historical data and trends, the future probability of cyberattacks occurring within Ashtabula County are moderate to high. Cyberterrorism is an emerging hazard that has the potential to impact the county's computer infrastructure and the systems and services that are provided to the public. Concerns about cyberattacks throughout the United States are growing as its impacts could have potentially crippling effects. Security experts describe the threat of cyber-terrorism as imminent and highly likely to occur in any given year.

In today's threat landscape, defenders have a huge disadvantage, attackers have to get it right once to accomplish their goal. Whereas the defender must patch, keep up on every possible vulnerability in all the systems, as you are only as strong as the weakest link. With more and more data accessible from anywhere in the world, passwords are not enough protection alone.

Risk Assessment

This section summarizes the vulnerability of the county to cyber incidents. The steering committee conducted an online survey for the public to share its thoughts on the hazards listed in this plan. The following table presents the results of that survey, specifically regarding cyber incidents.

Table 2.2.2.3

Public Sentiment, Cyber Incidents					
	Level of Concern				
Hazard	*Not at All*	*Somewhat*	*Concerned*	*Very*	*Total Responses*
CYBER INCIDENTS	29 (19.59%)	41 (27.70%)	53 (35.81%)	25 (16.89%)	148
In the past five years, do you remember this hazard occurring in your community?				51 (34.46%)	148
Have you noticed an increase in the occurrences or intensity of this hazard?				74 (50.0%)	148
Have you noticed a decrease in the occurrences or intensity of this hazard?				0 (0.00%)	148

Source: Online Public Survey Results

The following table assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA's Mitigation Information Portal (MIP) tool.

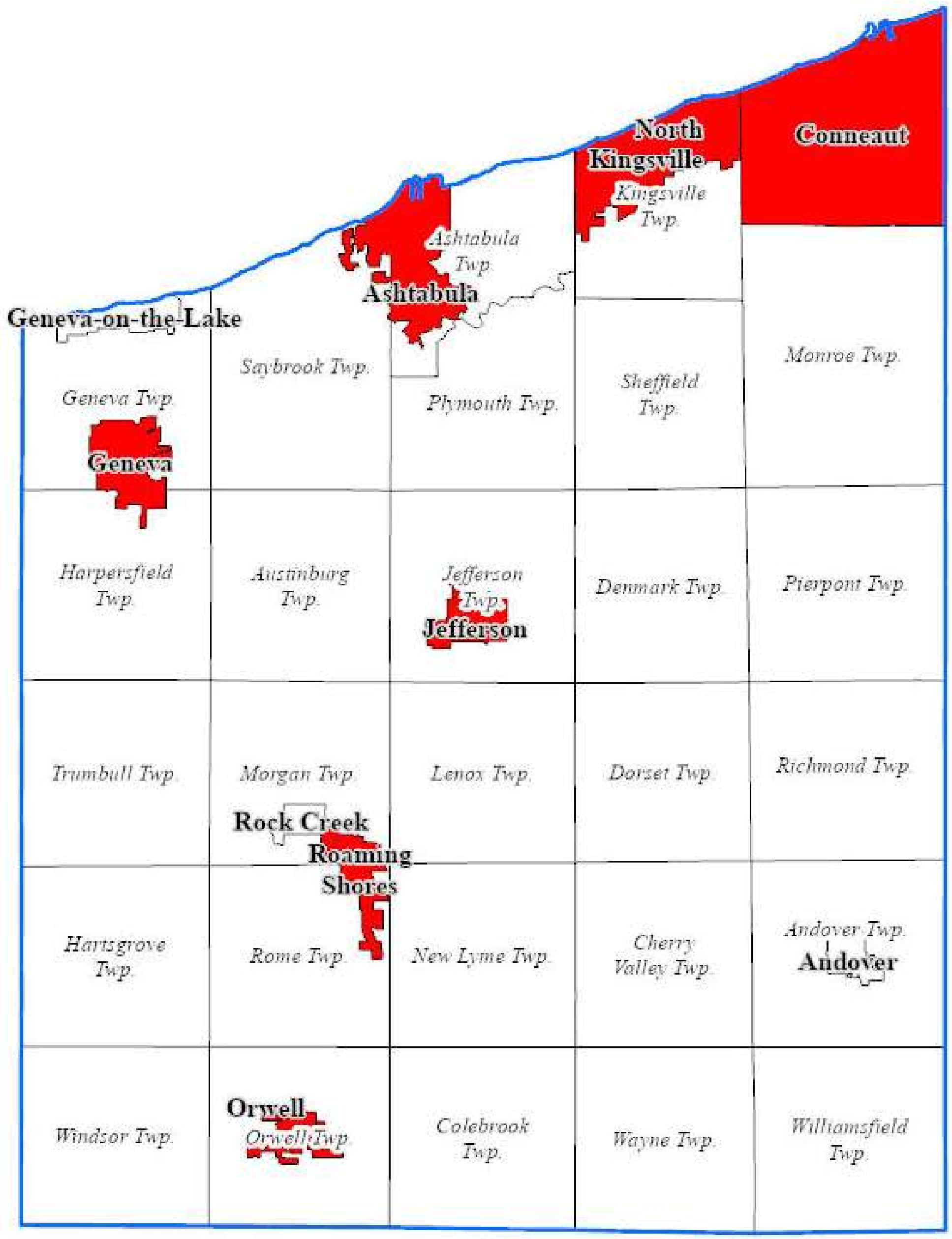
Table 2.2.2.4

Risk Ranking, Cyber Incidents			
Category	*Points*	*Description*	*Notes*
Frequency	5	Frequent (Will occur during a year)	Though no aggregated data summarizing the total number of cyber incidents that have occurred in a given period are available, local officials indicate that incidents are frequent (i.e., weekly, or even daily).
Response	5	More than one month	IBM's 2022 data security report indicates an average of 73 days to contain a cyber breach (on top of 206 days to identify a breach).
Onset	4	Less than 6 hours	A cyber incident is typically underway when local officials receive notification about it.
Magnitude	2	Limited (10-25% of land area affected)	Cyber incidents can severely disrupt critical infrastructure, transportation systems, and utility services. Magnitude will vary greatly based on the extent of systems affected, the attack durations, and type of attack; however, the incidents target individual systems or facilities, not large segments of the county (land area-wise).
Business	4	More than 30 days	Cyber incidents can impact residences, businesses, institutions, local governments, etc. A large-scale incident could yield operational impacts for the entirety of the response (see "Onset" above).
Human	1	Minimum (Minor injuries)	Cyber incidents would not likely cause widespread injury.
Property	2	10-25% of property affected	Despite significant disruption, cyber incidents would not likely "damage" private property (beyond computers or digital systems themselves).
Totals	**23**	**HIGH**	

FEMA's *Local Mitigation Planning Handbook* (2025b) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The following map identifies those multi-jurisdictional risks for cyber incidents. The jurisdictions labeled in white are not more or less at risk of cyber incidents. Those in red are more at risk.

Figure 2.2.2.1

Cyber Incident Multi-Jurisdictional Risk Map



2.2.3 Dam & Levee Failure

A dam is a barrier built across a waterway to control the flow or raise the water level. A dam failure occurs when the barrier constructed does not obstruct or restrain water as designed, which can rapidly result in a large area of completely inundated land. Levees, though similar, are embankments built to prevent the overflow of a body of water.				
RISK	**Period of Occurrence:**	At any time, typically following a period of prolonged precipitation	**Risk Ranking:**	Medium
HIGHEST HIGH	**Warning Time:**	6-12 hours	**Type of Hazard:**	Technological
MEDIUM LOW	**Probability:**	Remote (Unlikely to occur in a year)	**Impact:**	Localized (Less than 10% of land are affected)
LOWEST	**Disaster Declarations:**	None		

Hazard Introduction and Overview

Dams are man-made structures generally made with concrete or earthen materials, built across a stream or river to hold back water (National Geographic, N.d.). Dams are an integral component of infrastructure in the United States, the benefits of dams and levees are numerous: they provide water for drinking, navigation, agricultural irrigation, recreational opportunities, renewable energy through hydropower, and save lives by preventing or reducing floods.

There are approximately 92,527 dams in the United States, the majority of which are privately-owned; state and local authorities, public utilities, and federal agencies own others. Most of the dams in Ohio were constructed by farmers and other individuals and are small dams. The State of Ohio operates more than 100 dams in the state, while the federal government operates over 30. There are 366 Class I dams, 999 Class II and III dams, and 1,034 Class IV dams in Ohio. Upground reservoirs and lagoons are considered dams per Ohio Administrative Code (OAC) 1501:21-3-01. These dams are commonly used for drinking water supply and water treatment.

Currently, the average age of the dams in the country is 64 years, while seven of 10 dams nationwide are expected to reach 50 years of age by 2025 (NID, 2025). The American Society of Civil Engineers (ASCE) calculates the status of these dams and generates a grade; the grade of the U.S. dams is 'D+,' and 18% of all dams are classified as High-Hazard Potential Dams (HHPDs), meaning there is likelihood of deadly harm to residents and property in the event of a dam failure. (ASCE, 2025).

The Ohio Department of Natural Resources, Division of Water Resources – Dam Safety Program (ODNR-DSP) classifies dam failures as either *sunny day failures* or *rainy-day failures*.

Sunny day failures occur during a non-flooding situation with the reservoir near the normal pool level. *Rainy day failures* usually involve periods of rainfall and flooding and can exacerbate inadequate spillway capacity. Improper design of a spillway or operation of gates during high flows can lead to excessive water pressure and subsequent failure as well. Even though both types of failures can be disastrous, a *sunny day failure* could be more catastrophic due to its unanticipated occurrence and the lack of time to warn residents downstream (Ohio EMA, 2024).

There are three types of failures of earthen dams: overtopping, seepage or piping, and structural failure (ODNR, n.d.).

- **Overtopping** failures result from the erosive action of water on the embankment. Erosion is due to the uncontrolled flow of water over, around, and adjacent to the dam. Earthen embankments are not designed to be overtopped and therefore are particularly susceptible to erosion. Once erosion has begun during overtopping, it is almost impossible to stop. Overtopping causes 34% of dam failures.
- **Structural** failures can occur in either the embankment or the appurtenances. Structural failure of a spillway, lake drain, or other appurtenance may lead to failure of the embankment. Cracking, settlement, and slides are the more common signs of structural failure of embankments. Large cracks in an appurtenance or the embankment, major settlement, and major slides will require emergency measures to ensure safety, especially if the problems occur suddenly. Foundation defects and slope instability are the cause of 30% of dam failures.
- All earthen dams have **seepage** resulting from water percolating slowly through the dam and its foundation. Seepage must, however, be controlled in both velocity and quantity. If uncontrolled, it can progressively erode soil from the embankment or its foundation, resulting in the rapid failure of the dam. Erosion of the soil begins at the downstream side of the embankment, either in the dam proper or the foundation, progressively works toward the reservoir, and eventually develops a “pipe” or direct conduit into the reservoir. Seepage can cause slope failure by creating high pressures in the soil pores or by saturating the slope. Seepage or piping causes 20% of dam failures.

The three types of failures often interact in a complex manner. For example, uncontrolled seepage may weaken the soil and lead to a structural failure. Structural failure may shorten the seepage path and lead to a piping failure. Surface erosion may result in structural failure, and so on. Minor defects such as cracks in the embankment may be the first visual sign of a major problem, which could lead to failure of the structure. Someone experienced in dam design and construction should evaluate the seriousness of all deficiencies as soon as they are detected.

Dams are not the only structures that can fail. Levees, barriers, and other structures that retain water can fail and cause flood damage and loss of life. The ODNR is the agency responsible for the regulation of levees in Ohio. According to the ODNR, "a levee is any artificial barrier together with appurtenant works that will divert or restrain the flow of a stream of other body of water for the purpose of protection an area from inundation by flood water" (ODNR, 2016). While dams constantly control the flow of water, most levees are built purely for flood control and protection and are subjected to water loading during a few days or weeks in a given year.

Though levees are designed to a certain level of potential flood, the U.S. Army Corps of Engineers (USACE) notes that levees are not subject to consistent design, construction, operations, and maintenance standards. Those under the auspices of the USACE receive regular inspections, but this represents an estimated 15% of the levees in the country (USACE, n.d.). Levees function as part of a system. In other words, a levee in one area may overtop by design to protect larger populations downstream (USACE, n.d.). "'Levee failure' implies that something about the levee failed to prevent flooding on the land side of the levee" (USACE, n.d.). Levee failures can result from overtopping, water flow through or under a levee, erosion, by an object hitting the levee, or by an object on the levee (e.g., tree or building) falling and taking a portion of the structure with it (USACE, n.d.). The USACE also maintains the National Levee Database (NLD).

Location and Extent

The U.S. Army Corps of Engineers' National Inventory of Dams (NID) reports 29 dams in Ashtabula County with an average age of 67 years (see Table 2.2.3.2 below). Of the 29 dams, six are Class I, 12 are Class II, nine are Class III, and two are undetermined. All of the dams in the county are regulated by a state agency. The NID notes the presence of an Emergency Action Plan (EAP) for 50% of the high-hazard potential dams. Publication of Emergency Actions Plans (EAPs) are limited by regulations set by the Ohio Department of Natural Resources (ODNR). Completed EAPs are held by the Ashtabula County Emergency Management Agency (ACEMA) and the ODNR, Division of Water Resources – Dam Safety Program (DSP). The identification of an EAP for the dams listed in Table 2.2.3.2 below came from the U.S. ACE's National Inventory of Dams (NID). The site indicates that EAPs have been developed for 10 of the 29 total dams (i.e., 34%). The county has added a project to this plan update focusing on the collection of updated EAPs for all Class I and II dams.

The Ohio Department of Natural Resources, Division of Water Resources – Dam Safety Program (ODNR-DSP) provides a map of all dams in Ashtabula County. According to the ODNR, there are Class I-III dams located in 52% (i.e., 14 of the 27) township of Ashtabula County, Austinburg Township contains the most Class I-III dams with four. The maps below (Figures 2.2.3.1 & 2.2.3.4) depicts the locations of dams throughout the county by hazard classification and EAP Status.

Table 2.2.3.1

Ashtabula County Dams Summary

Hazard Classifications			
High Hazard	Significant Hazard	Low Hazard	Total Dams
6	12	9	29[1]

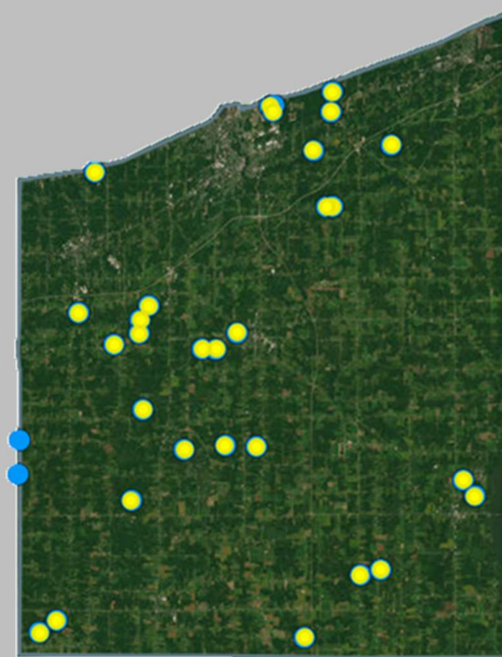
Age of Dams		
Oldest Dam (1900)	Newest Dam (1988)	Average Age
North Kingsville Rt 20 Lake Dam	Elkem Sludge Holding Pond 5C	67

Size of Dams		
Height Range	Length Range	Normal Storage Range
45 ft Roaming Rock Shores Dam	3,350 ft Elkem Fluid Waste Pond 3a	6,091 acre-ft Roaming Rock Shores Dam
9 ft Harpersfield Low Head Dam	180 ft Fischer Lower Lake Dam	14.4 acre-ft Palmetto Lake Dam

Dam Types			
Concrete	Earth	Rockfill	Other
1	28	0	0

Purpose of Dam			
Debris Control	Recreation	Tailings	Water Supply
1	25	2	1

Most Listed Nearest Community	
Eagleville	4
Mechanicsville	5



Approximately 83% of the dams in Ashtabula County are privately owned, local governments own approximately 14%

River or Stream with Most Dams	
Tributary Grand River	4 Dams
Tributary Ashtabula River	3 Dams
Tributary Lake Erie	3 Dams
Tributary Mill Creek	3 Dams

1 – Two dams are classified as undetermined

Table 2.2.3.2

Ashtabula County – Class I-III Dams											
National ID	*Dam Name*	*Hazard Class*	*River/ Stream*	*Dam Type*	*Nearest City (Miles)*	*Purpose*	*Year Completed*	*EAP (Rev. Date)*	*Dam Height (ft)*	*Dam Length (ft)*	*Normal Storage (ac-ft)*
OH00407	Ashtabula County Outdoor Club	High	Trib. Ashtabula River	Earth	Ashtabula (1.5)	Recreation	1928	3/15/2019	22	295	64
OH00396	Camp Whitewood Lake Dam	High	Trib. Phelps Creek	Earth	Circle Resort (18)	Recreation	1967	None	20	420	34
OH00938	Holiday Camplands Lake Dam	High	Gravel Run	Earth	Pymatuning (5)	Recreation	1975	2/25/2008	10	1,350	84
OH00392	Lower Jeffco Lake Dam	High	Trib. Pymatuning Creek	Earth	Kinsman (9.8)	Recreation	1963	None	17	365	84
OH01191	Naji Lake Dam	High	Mill Creek	Earth	Mechanicsville (17.8)	Recreation	1963	None	19	385	20.7
OH00397	Roaming Rock Shores Lake Dam	High	Rock Creek	Earth	Rock Creek (0.4)	Recreation	1967	2/6/2009	45	730	6,091
OH01179	Elkem Fluid Waste Pond 3a	Significant	Trib. Lake Erie	Earth	Ashtabula (1.5)	Tailings	1967	None	40	3,350	236
OH01180	Elkem Sludge Holding Pond 5C Dam	Significant	Trib. Lake Erie	Earth	Ashtabula (0.4)	Tailings	1988	None	20	2,475	160
OH02719	Fischer Lake Dam	Significant	Trib. Ashtabula River	Earth	Ashtabula (9.1)	Recreation	N/A	None	14	313	27
OH00405	Lake Asegra Dam	Significant	Trib. Grand River	Earth	Mechanicsville (0.6)	Recreation	1944	9/3/2015	29	350	374
OH00395	Lake Cardinal Dam	Significant	Plum Creek	Earth	Circle Resort (1.9)	Recreation	1927	9/28/2005	31	300	370
OH00402	Lake George Dam	Significant	Trib. Grand River	Earth	Mechanicsville (1.5)	Debris Control	1964	11/13/2015	17	300	146
OH01186	Lake Kenisee Dam	Significant	Trib. Mill Creek	Earth	Eagleville (1.7)	Recreation	1974	None	13	1,334	60
OH00399	Lenox Lake Dam	Significant	Trib. Three Brothers Creek	Earth	Mechanicsville (17)	Recreation	1969	None	28	350	58
OH01192	North Kingsville Lake Dam	Significant	Trib. Lake Erie	Earth	Kingsville (0.4)	Recreation	1968	None	13	250	17

Ashtabula County – Class I-III Dams											
National ID	*Dam Name*	*Hazard Class*	*River/ Stream*	*Dam Type*	*Nearest City (Miles)*	*Purpose*	*Year Completed*	*EAP (Rev. Date)*	*Dam Height (ft)*	*Dam Length (ft)*	*Normal Storage (ac-ft)*
OH01193	North Kingsville Route 20 Lake Dam	Significant	Trib. Lake Erie	Earth	Kingsville (0.4)	Recreation	1900	None	22	260	15.9
OH02781	Palmetto Lake Dam	Significant	Trib. Lake Erie	Earth	GOTL (0.1)	Recreation	N/A	None	12	235	14.4
OH00406	Pierce-Ruhland Pond Dam	Significant	Trib. Conneaut Creek	Earth	Kingsville (3.4)	Recreation	1969	3/6/2020	34	600	51
OH03055	Crystal Lake Dam	Low	Gravel Run	Earth	Espyville (2.8)	Recreation	1930	10/5/2022	11	280	21
OH03206	Fischer Lower Lake Dam	Low	Trib. Ashtabula River	Earth	N/A	Recreation	N/A	None	14	180	46
OH00394	Galicki Lake Dam	Low	Trib. Pymatuning Creek	Earth	Kinsman (11)	Recreation	1973	None	22	1,440	40
OH02777	Grenke Lake Dam	Low	Trib. Mill Creek	Earth	Eagleville (2.3)	Recreation	N/A	None	16	400	50.5
OH00393	Limpert Lower Lake Dam	Low	Trib. Mosquito Creek	Earth	Rices Mills (1.9)	Recreation	1963	3/9/2017	20	355	28
OH00404	Lindon Lake Dam	Low	Trib. Grand River	Earth	Eagleville (0.4)	Recreation	1961	3/14/2016	27	275	88
OH00398	O'Brien Lake Dam	Low	Trib. Three Brothers Creek	Earth	Turkeyfoot Corner (2.5)	Recreation	1968	None	24	525	104
OH00400	Private Lake Dam	Low	Trib. Mill Creek	Earth	Eagleville (4.2)	Recreation	1964	None	19	750	37.6
OH01195	Sili Lake Dam	Low	Trib. Grand River	Earth	Mechanicsville (3)	Recreation	1972	None	15	550	53
OH00810	Harpersfield Low Head Dam	Undetermined	Grand River	Concrete	Harpersfield (0.1)	Water Supply	1913	Not Req.	9	325	250
OH00401	Lake Klein Dam	Undetermined	Trib. Grand River	Earth	Mechanicsville (8.7)	Recreation	1965	Not Req.	26	300	64

Source: ONDR-Division of Water Resources-Dam Safety Program / USACE-National Inventory of Dams

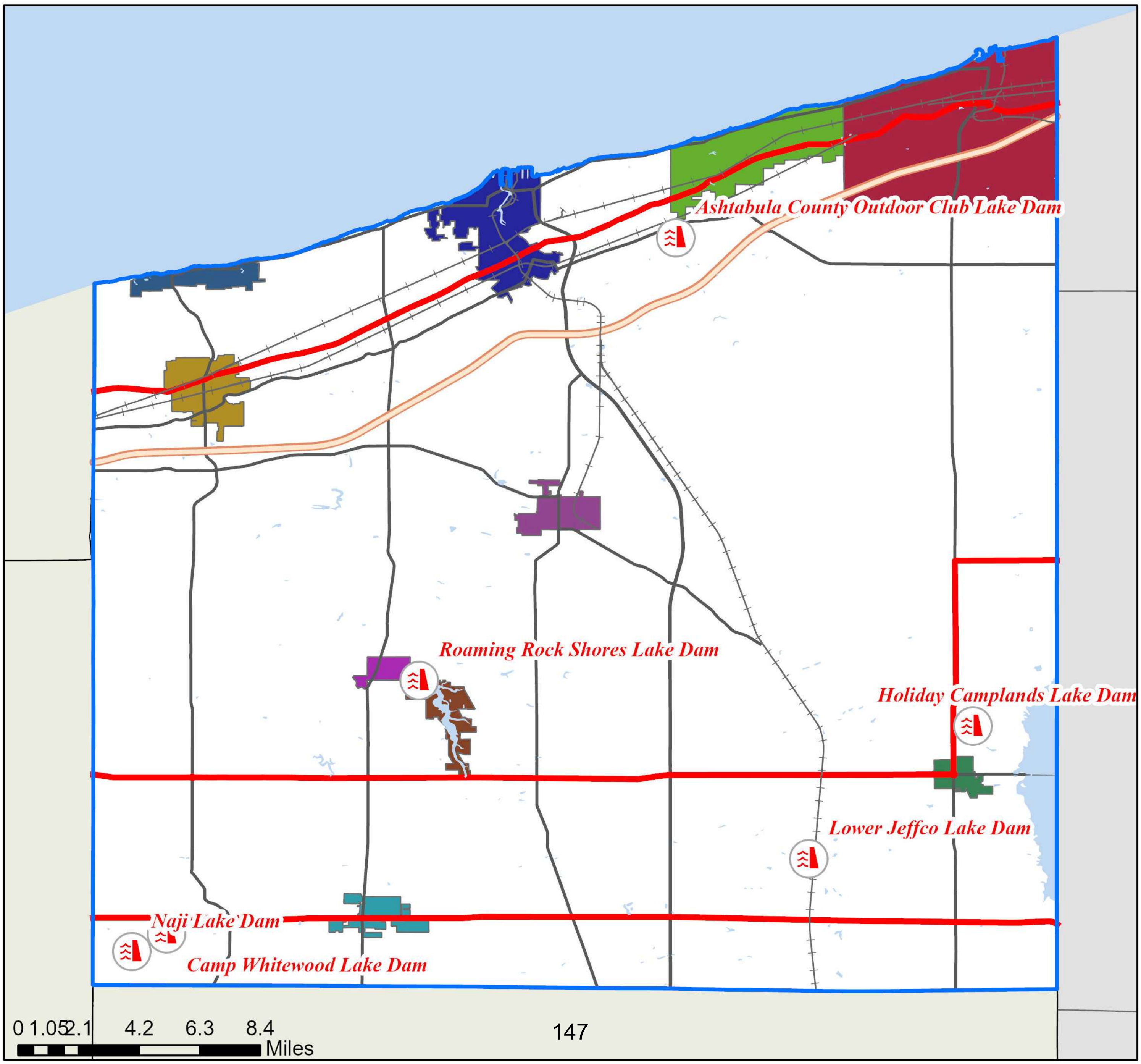
Class I: High Hazard Dams

ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.3.1: Class I Dams

Data Source(s):
ODNR

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



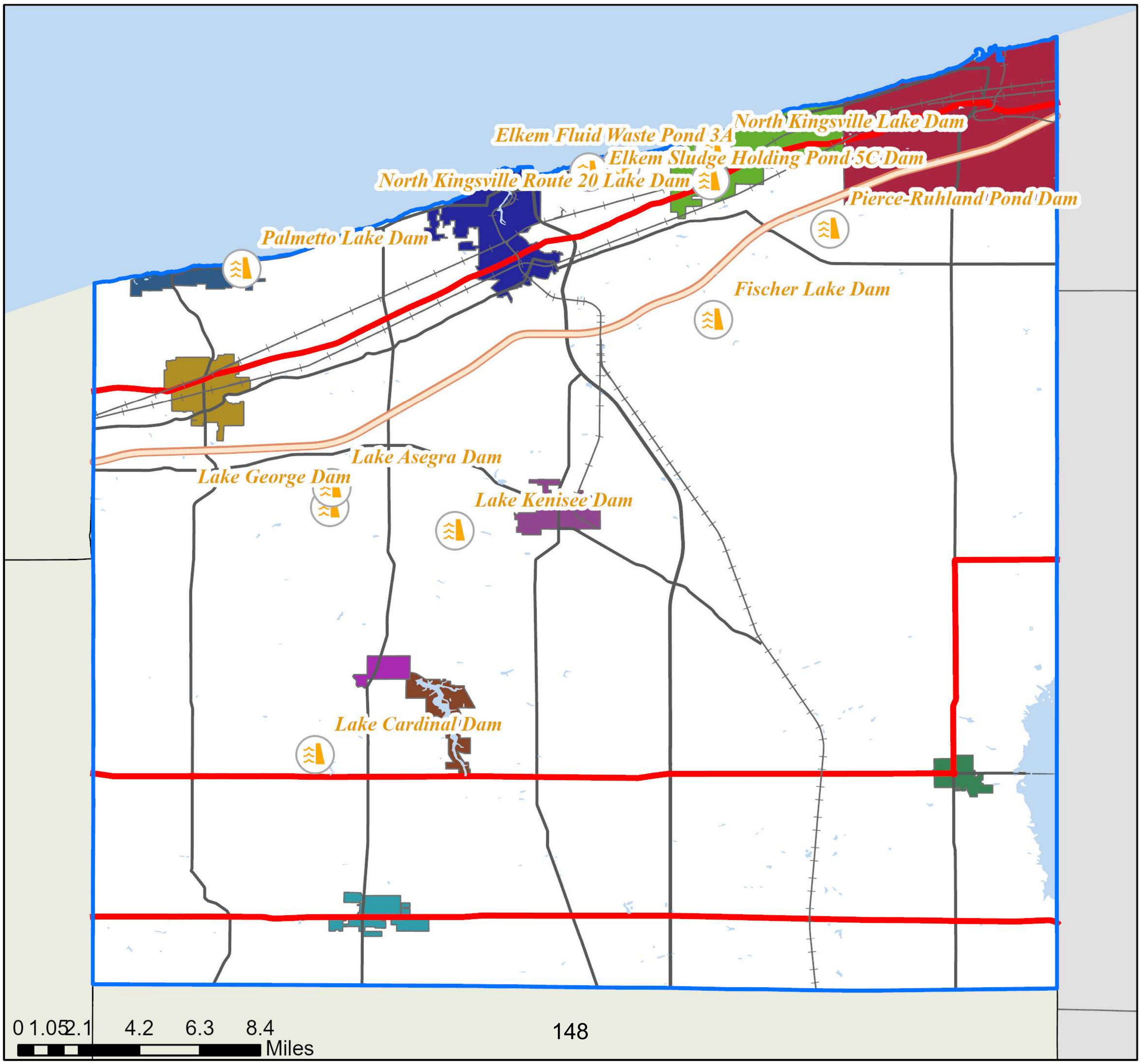
Class II: Significant Hazard Dams

ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.3.2: Class II Dams

Data Source(s): ODNR

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



ASHTABULA COUNTY HAZARD MITIGATION PLAN

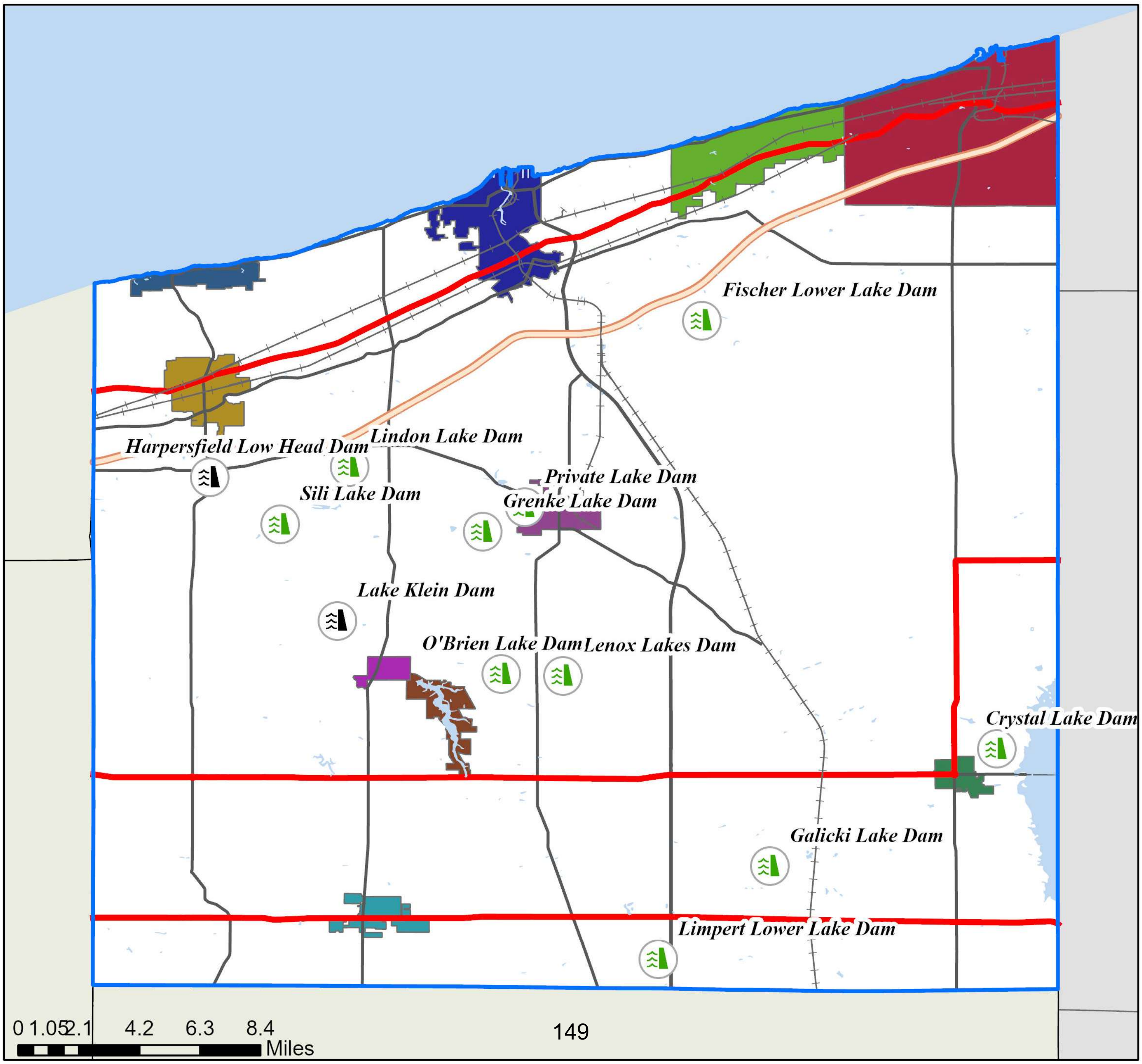
Figure 2.2.3.3: Class III Dams

Data Source(s): ODNR

Class III: Low Hazard

Structures Listed as "Other"

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.3.4: Dams by EAP Status

Data Source(s): ODNR

EAP Since 2020

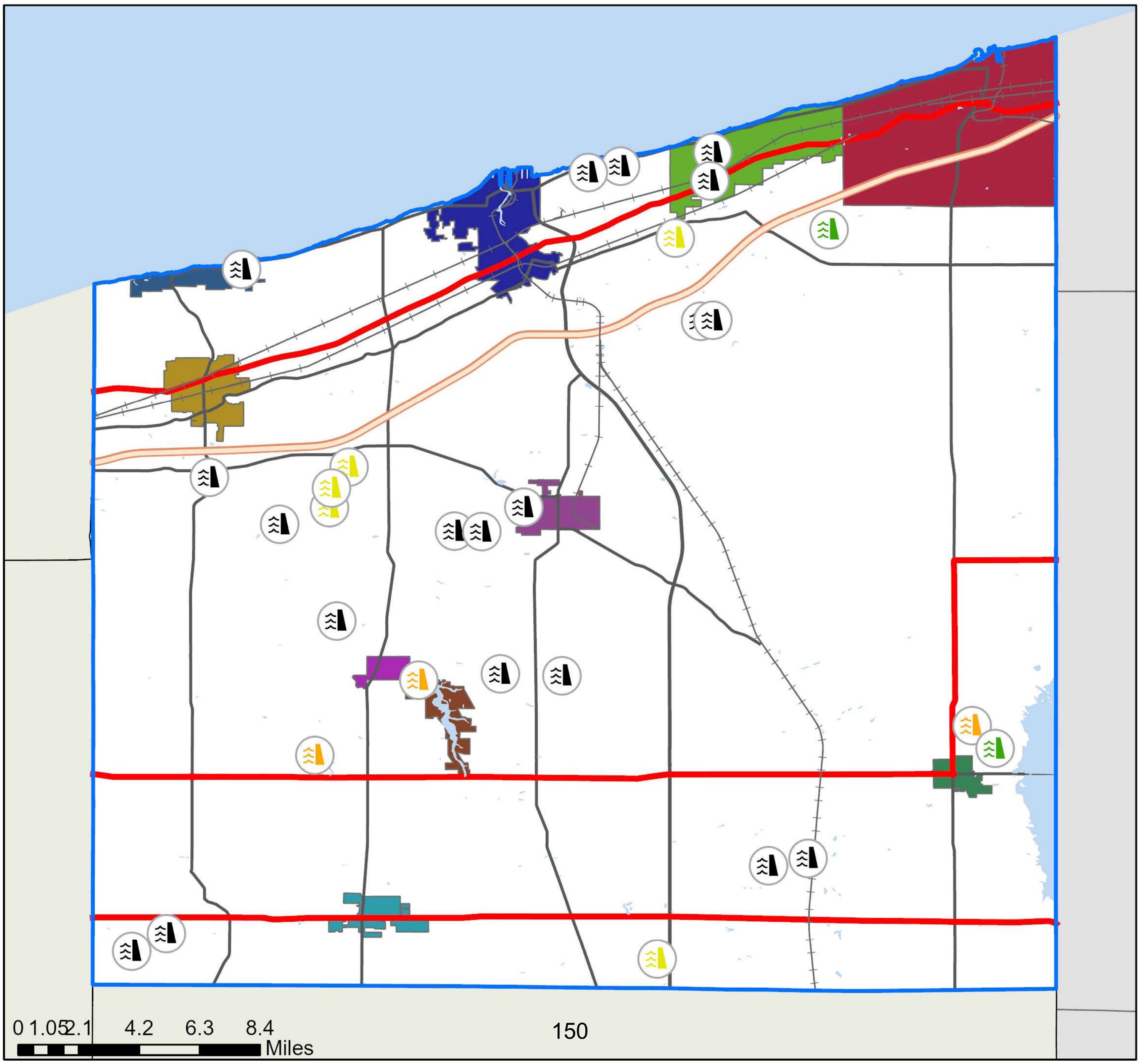
EAP 2015-2019

EAP 2005-2014

No EAP on File

EAP Not Required

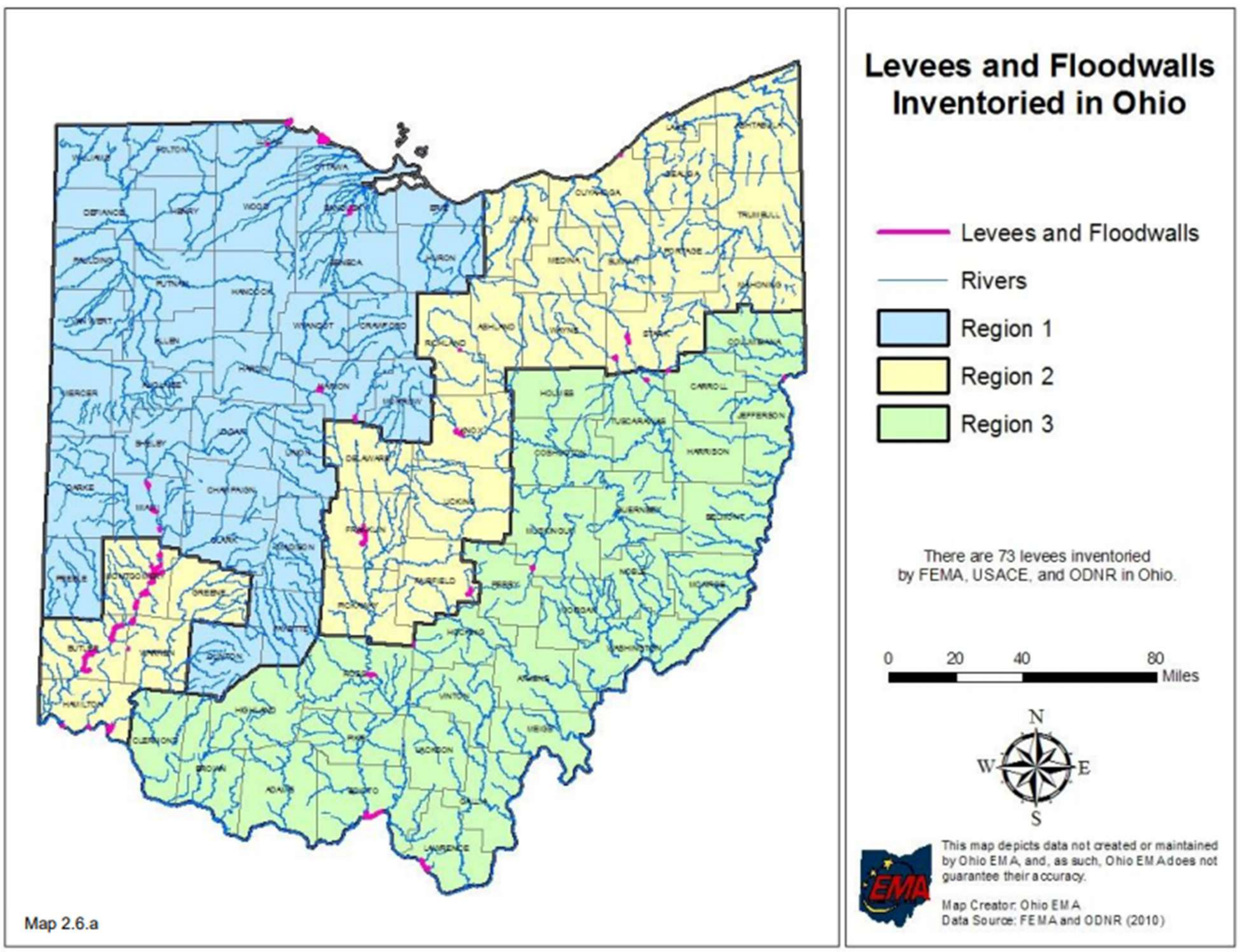
DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



The ODNR, Division of Water Resources oversees the state's Dam Safety Program (ODNR-DSP). As overseer, ODNR collaborates with dam owners and engineers to ensure design, construction, operation, and maintenance to prevent failures and the resulting consequences to the extent possible. The ODNR-Division of Water Resources is also responsible for inspecting dams for safety based on the "hazard classification, downstream hazard condition, issuing permits for new construction and repairs to existing structures."

According to the U.S. Army Corps of Engineer's National Levee Database (https://levees.sec.usace.army.mil/#/) as well as reviews of information from the ODNR-DSP, there are no levees located in Ashtabula County (see map below), thus levees will not be discussed further in this hazard profile.

Figure 2.2.3.5



Source: State of Ohio Enhanced Hazard Mitigation Plan, 2024

Impacts and Vulnerability

Uncontrolled floodwaters are one of the most powerful and destructive forces in nature. Dams not designed to withstand major storms or those in a state of disrepair may fail catastrophically, increasing flood damage downstream. The potential for damage due to dam failure is increasing along with the increased amount of residential and commercial development within the hydraulic shadow of dams. In many cases, existing dams will need to be modified to keep downstream areas safe from catastrophic flooding.

Dam failures can pose significant challenges to impacted communities. In addition to causing billions of dollars in economic losses and the potential loss of life, dam failures can result in damage to interconnected infrastructure systems. Flooding from dam failures can impact bridges and roadways, threaten drinking water supplies, place excessive strain on stormwater infrastructure, and damage levee systems that protect floodplains. Emergency Action Plans (EAPs) are critical to minimizing damage caused by a dam failure. EAPs identify potential emergency conditions at a dam, specify preplanned actions to reduce property damage and loss of life should those conditions occur, and are initiated in the event of an impending dam failure or other uncontrolled release of water.

The ODNR-DSP classifies dams in accordance with Ohio Administrative Code 1501:21-13.01, as Class I, Class II, Class III, and Class IV dams, with generally Class I being the highest risk and Class IV the lowest risk (see Table 2.2.3.3). The classification of a dam is based on three factors: the dam's height, storage capacity, and potential downstream hazard. The height of the dam is the vertical distance from the crest to the downstream toe. The storage capacity is the volume of water that the dam can impound at the top of dam (crest) elevation. The downstream hazard consists of roads, buildings, homes, and other structures that would be damaged in the event of a dam failure. Potential for loss of life is also evaluated.

The USACE's National Inventory of Dams (NID) compiles information about dams from a variety of agencies with an inventory of dams. Some of the partners that contribute data to the NID include ODNR DSP, Department of the Interior (National Park Service and Mine Safety and Health), USDA (Forest Service and Natural Resources Conservation Service), USACE, and Federal Energy Regulatory Commission. For a dam to be included in the NID it must meet at least one of the following criteria. 1) High hazard potential classification - loss of human life is likely if the dam fails; 2) Significant hazard potential classification - no probable loss of human life but can cause economic loss; environmental damage, disruption of lifeline facilities, or impact other concerns; 3) Equal or exceed 25 feet in height and exceed 15 acre-feet in storage; 4) Equal or exceed 50 acre-feet storage and exceed 6 feet in height. In addition to specifying the ODNR

Classification System, Table 2.2.3.3 summarizes how the ODNR-DSP classification corresponds with the hazard class in the NID.

Table 2.2.3.3

Ohio and Federal Dam Classification Systems				
Ohio Dam Classifications	*Hazard Description*	*Height (ft)*	*Storage (ac-ft)*	*Corresponding NID Classification*
Class I	Probable loss of life, serious hazard to health, structural damage to high value property (i.e., homes, industries, major public utilities)	>60	>5,000	High
Class II	Flood water damage to homes, businesses, industrial structures (no loss of life envisioned), damage to state and interstate highways, railroads, only access to residential areas	>40	>500	Significant
Class III	Damage to low value non- residential structures, local roads, agricultural crops, and livestock	>25	>50	Low
Class IV	Losses restricted mainly to the dam	≤25	≤50	Other
Exempt	N/A	<6	15 ac-ft OR <10ft & ≤50 ac-ft	N/A

<u>*Historical Occurrences*</u>

No one knows exactly how many dam failures have occurred in the U.S., but they have been documented in every state. There has been little property damage that has resulted from a dam failure alone, as dam failures are few in Ohio. However, there has been property damage due to a combination of downstream flooding from excessive precipitation and dam failure.

According to information obtained from the National Performance of Dams Program (NPDP) database developed by Stanford University, Ohio experienced 273 dam incidents from 1882 to 2025. Table 2.2.3.4 contains information regarding dam incidents and failures that have occurred in Ashtabula County since 1959. This information was obtained from a database developed by the ODNR-DSP as well as the NPDP.

Table 2.2.3.4

Ashtabula County High Hazard Dam Incidents/Failures – 1959 to 2023		
Dam Name	*Incident Year*	*Incident Description*
Elkem Fluid Waste Pond 3A	1980	A slide was noted in the downstream slope and was fixed.
Gerlat Lake Dam	2011	Spillway failed. ODNR issued an order for the dam to be repaired or breached. The dam was breached.
Lake Cardinal Dam	1959	The dam overtopped during a flood event.
Crystal Lake Dam	1995	During a periodic safety inspection, deterioration and corrosion was discovered on both principal spillways. A large seepage area was also present at the downstream toe.
Wagon Wheel Lake Dam	1998	Erosion of the outlet channel cutting into the toe of the embankment (three to four foot scarp) and deficient in storage-discharge capacity.

Loss and Damages

Dams are classified by their hazard potential, or the risk posed to downstream communities in the event of a dam failure. In the U.S., more than 16,700 dams are classified as high hazard potential as of August 2024, which means that if one of these dams should fail, the likely result would be loss of life and significant destruction to property.

The cost of maintaining, upgrading, and repairing these structures has increased significantly since the beginning of the 21st century because of an increase in extreme weather events, growing populations downstream, and the outdated design challenges of aging structures.

The owners of ten dams in Ashtabula County submitted Emergency Actions Plans (EAPs) to the Ashtabula County Emergency Management Agency (ACEMA). Those plans identified downstream hazards in various ways. For example, the plans for the Roaming Rock Shores Lake Dam and Holiday Camplands Lake Dam listed downstream hazards of “limited number of residences” and “some homes.” Other plans estimated specific structures.

Table 2.2.3.5 includes loss estimates for the Roaming Rock Shores Lame Dam. Losses were estimated using the number of people and structures that could be at risk from a dam failure as specified in the EAP, and utilizing inundation mapping. Where the estimated persons exposed was not specified in the EAP, the average persons per household in Ashtabula County (2.08 per the 2025 U.S. Census estimates) was multiplied by the number of exposed structures. Where the number of exposed structures was not specified in the EAP, inundation mapping was utilized in concert with GIS to determine the number of structures within the inundation area.

Table 2.2.3.5

Dam Failure Loss Estimates
Roaming Rock Shores Lake Dam • *Estimate of Exposed Persons:* 84 • *Residential Structures:* 32 • *Non-Residential Structures:* 8 • *Critical Facilities:* 0 • *Loss Estimate:* $8,400,000

HAZUS replacement valves by percentage of expected damage were applied to the total number of exposed structures by type (i.e., residential, non-residential, and critical facility) to determine the estimated losses below.

Future Occurrences

The condition of dam infrastructure throughout the state of Ohio is a concern. As dams age, they become susceptible to issues related to that age (concerning the life span of materials used in construction). Given the fact that the average age of the 29 dams in Ashtabula County is 67 years it is possible a dam could fail at any time given the right circumstances. The probability of future occurrence is reduced due to proactive preventative actions on the part of ODNR, DSP and individual dam owners.

According to a July 31, 2025, article obtained from the Gazette Newspapers, funding regarding a rehabilitation project on the Roaming Rock Shores Lake Dam through the Rehabilitation of High Hazard Potential Dams (HHPD) program was placed on hold. As stated in the article "as of March 14, 2025, the ODNR was not sure if the Village of Roaming Shores would receive the funds yet due to government halts." During an update provided at a July 15th meeting, the Village of Roaming Shores Administrator indicated that they were moving forward with an engineering analysis for the project.

The Harpersfield Dam Sea Lamprey Barrier Project on the Grant River in Geneva was also completed in April of 2020. This project was a collaborative effort by the U.S. Army Corps of Engineers, Buffalo District, the Great Lakes Fishery Commission, Ashtabula County Metro Parks, and the Ohio Department of Natural Resources. It involved replacing the previous hollow-core dam with a 326-foot solid concrete structure within the Harpersfield Covered Bridge Park.

Approximately 15%, or more than 2,500, of the nation's High Hazard–Potential Dams (HHPDs) are assessed to be in poor or unsatisfactory condition. Table 2.2.3.6 contains information obtained from the USACE NIDs regarding inspections and evaluations conducted as well as the overall assessment condition of the dams in Ashtabula County. Approximate 55% of the dams received an assessment condition of "poor", while only 7% received a "satisfactory".

Table 2.2.3.6

Ashtabula County Dams – Assessment Conditions			
Dam Name	*Hazard Class*	*Assessment Date*	*Assessment Condition*
Ashtabula County Outdoor Club	High	1/23/2024	Poor
Camp Whitewood Lake Dam	High	10/28/2021	Fair
Holiday Camplands Lake Dam	High	9/22/2022	Fair
Lower Jeffco Lake Dam	High	11/24/2021	Poor

Ashtabula County Dams – Assessment Conditions			
Dam Name	*Hazard Class*	*Assessment Date*	*Assessment Condition*
Naji Lake Dam	High	10/28/2021	Poor
Roaming Rock Shores Lake Dam	High	10/26/2021	Poor
Elkem Fluid Waste Pond 3a	Significant	8/25/2023	Fair
Elkem Sludge Holding Pond 5C Dam	Significant	8/25/2023	Fair
Fischer Lake Dam	Significant	10/11/2023	Poor
Lake Asegra Dam	Significant	10/6/2021	Poor
Lake Cardinal Dam	Significant	10/26/2021	Satisfactory
Lake George Dam	Significant	10/6/2021	Poor
Lake Kenisee Dam	Significant	10/6/2021	Fair
Lenox Lake Dam	Significant	10/26/2021	Fair
North Kingsville Lake Dam	Significant	8/20/2023	Fair
North Kingsville Route 20 Lake Dam	Significant	8/25/2023	Poor
Palmetto Lake Dam	Significant	10/11/2023	Poor
Pierce-Ruhland Pond Dam	Significant	8/20/2023	Satisfactory
Crystal Lake Dam	Low	11/24/2021	Poor
Fischer Lower Lake Dam	Low	10/11/2023	Poor
Galicki Lake Dam	Low	11/24/2021	Fair
Grenke Lake Dam	Low	10/6/2021	Poor
Limpert Lower Lake Dam	Low	10/28/2021	Poor
Lindon Lake Dam	Low	11/10/2021	Fair
O'Brien Lake Dam	Low	10/26/2021	Poor
Private Lake Dam	Low	10/6/2021	Poor
Sili Lake Dam	Low	11/10/2021	Poor
Harpersfield Low Head Dam	Undetermined	5/4/2016	N/A
Lake Klein Dam	Undetermined	2/7/2023	N/A

From 1959 to 2023, there were five documented dam incidents/failures in Ashtabula County. These events were generally minor and resulted in little property damage. Based on these past events, there is seemingly a 0.08% (5 incidents/64 years observed) annual chance of a dam incident/failure in any given year. However, from a dam safety perspective, past occurrences of incidents/failure are not a predictor of future failures.

As dam infrastructure continues to age, populations grow and development continues, the overall number of HHPDs is increasing, these dams nationwide have increased by 20% since 2012, driven mostly by increased development in downstream areas.

Risk Assessment

This section summarizes the vulnerability of Ashtabula County to dam and levee failure. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. The following table presents the results of that survey, specifically regarding dam and levee failure.

Table 2.2.3.7

Public Sentiment, Dam and Levee Failure					
	Level of Concern				
Hazard	*Not at All*	*Somewhat*	*Concerned*	*Very*	*Total Responses*
DAM / LEVEE FAILURE	106 (71.62%)	29 (19.59%)	7 (4.73%)	6 (4.05%)	148
In the past five years, do you remember this hazard occurring in your community?				7 (4.73%)	148
Have you noticed an increase in the occurrences or intensity of this hazard?				4 (2.70%)	148
Have you noticed a decrease in the occurrences or intensity of this hazard?				2 (1.35%)	148

Source: Online Public Survey Results

The following table assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA's Mitigation Information Portal (MIP) tool.

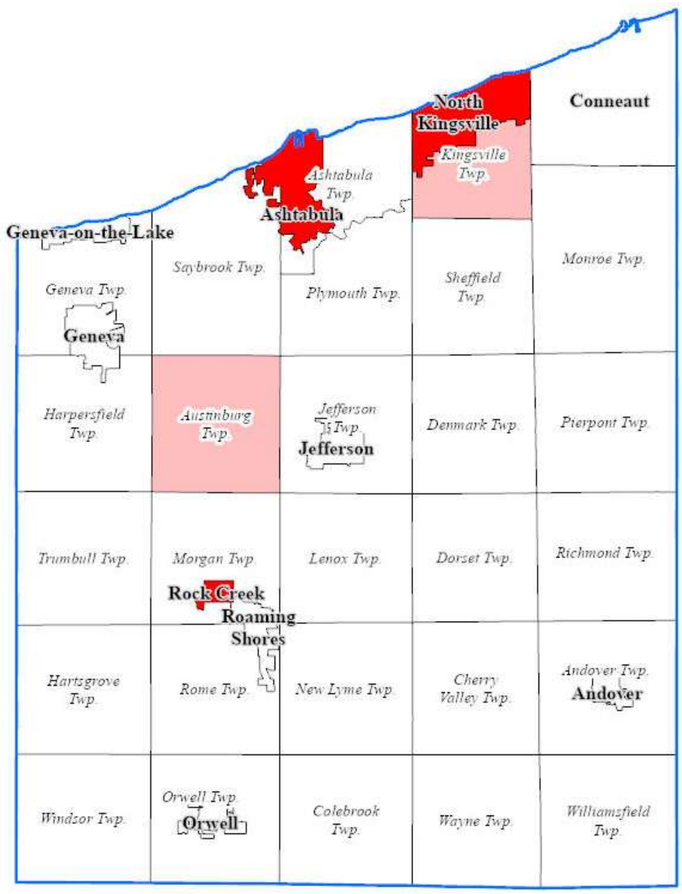
Table 2.2.3.8

Risk Ranking, Dam and Levee Failure			
Category	*Points*	*Description*	*Notes*
Frequency	2	Remote (Unlikely to occur in a year)	There have been five documented dam incidents/failures in Ashtabula County over 64 years, there is seemingly a 0.08% annual chance of a dam incident/failure in any given year.
Response	4	One month	The response to an event involving any of the six Class I dams could extended into months.
Onset	1	Over 24 hours	Because officials frequently inspect dams and their inundation can be predicted based on weather, warning of a critical failure is expected.
Magnitude	1	Localized (Less than 10% of land area affected)	Most dams are located in rural areas of the county.
Business	3	At least 2 weeks	Most dams are in rural areas; businesses should not be disrupted for more than two weeks.
Human	3	Medium (Multiple severe injuries)	There are six Class I dams located within the county, failure of these dams are likely to cause multiple severe injuries.
Property	3	25-50% of property affected	Approximately 25-50% of the properties located within the hydrological shadows of dams would be affected during a failure.
Totals	**17**	**MEDIUM**	

FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The following map (Figure 2.2.3.6) identifies those multi-jurisdictional risks concerning dam and levee failure. Those labels not underlaid by a shaded drop shadow are not more or less at risk. Those with red drop shadows are more at risk.

Figure 2.2.3.6

Dam & Levee Failure Multi-Jurisdictional Risk Map



2.2.4 Drought

A drought is a period of abnormally dry weather which persists long enough to produce a serious hydrological imbalance.				
RISK HIGHEST HIGH MEDIUM LOW LOWEST	**Period of Occurrence:**	At any time, typically after a period of prolonged absence of precipitation	**Risk Ranking:**	Low
	Warning Time:	Over 24 hours	**Type of Hazard:**	Natural
	Probability:	Remote (Unlikely to occur in a year)	**Impact:**	Catastrophic (Over 50% of land area affected
	Disaster Declarations:	USDA FSA S3253 (2012) USDA FSA S3384 (2012) USDA FSA S4038 (2016)		

<u>*Hazard Introduction and Overview*</u>

Drought is defined as a period of abnormally dry weather, which persists long enough to produce a serious hydrological imbalance. Drought is a term used in relation to who or what is being affected by the lack of moisture. Drought can be a result of multiple causes including global weather patterns that produce persistent, upper-level high-pressure systems with warm dry air resulting in less precipitation. Droughts develop slowly and are not identified until they are already under way. There are several types of droughts (Sears, 2017, p. 138).

- **Meteorological Drought:** Differences from the normal precipitation amounts. Because not every area receives the same amount of rainfall, a drought in one place might not be considered a drought in another.
- **Agricultural Drought:** Moisture deficiency seriously injurious to crops, livestock, or other agricultural commodities. Parched crops may wither and die. Pastures may become insufficient to support livestock. Effects of agricultural droughts are difficult to measure because there are many other variables that may impact production during the same growing season.
- **Hydrological Drought**: Reduction in stream flow, lake and reservoir levels, depletion of soil moisture, and a lowering of the ground water table. Consequently, there is a decrease in groundwater discharge to streams and lakes. A prolonged hydrological drought will affect the water supply.
- **Socioeconomic Drought:** A lack of water that begins to affect people's daily lives.

Precipitation falls in uneven patterns across the country; the amount of precipitation at a particular location varies from year to year, but over a period of years, the average amount is fairly constant. The amount of rain and snow also varies with the seasons. Even if the total amount of rainfall for a year is about average, rainfall shortages can occur during a period when moisture is critically needed for plant growth, such as in the early summer. When little or no rain falls, soils can dry out and plants can die. When rainfall is less than normal for several weeks, months, or years the flow of streams and rivers declines, water levels in lakes and reservoirs fall, and the depth to water in wells increases. If dry weather persists and water-supply problems develop, the dry period can become a drought (USGS, n.d.).

<u>*Location and Extent*</u>

Droughts occur throughout North America, and in any given year at least one region will experience drought conditions. Droughts are a region-wide hazard that can affect all areas and jurisdictions within the region. Droughts are widespread events that may extend to several states in varying degrees of severity. Based on historical drought monitoring data, the southern third of Ashtabula County has generally been impacted most severely by drought, often experiencing higher levels of drought intensity compared to the northern parts of the county. A drought can vary in severity throughout the year; what starts out as a mild drought can reach severe or extreme drought status and then return to a mild drought. This process could take weeks or even months and the effects could be felt even months after the drought conditions are over.

Table 2.2.4.1

USDM and PDSI Comparison			
U.S. Drought Monitor		*Palmer Drought Severity Index*	
N/A		> 4.0	Extreme moist spell
		3.0 to 3.99	Very moist spell
		2.0 to 2.99	Unusual moist spell
		1.0 to 1.99	Moist spell
		0.50 to 0.99	Incipient moist spell
		-0.49 to 0.49	Near normal
		-0.5 to -0.99	Incipient dry spell
D0	Abnormally dry	-1.0 to -1.99	Mild drought
D1	Moderate drought	-2.0 to -2.99	Moderate drought
D2	Severe drought	-3.0 to -3.99	Severe drought
D3	Extreme drought	< -4.0	Extreme drought
D4	Exceptional drought	N/A	

The Palmer Drought Severity Index (PDSI) is a widely used measure of drought to track moisture conditions. The PDSI is defined as “an interval of time, generally in months or years in duration, during which the actual moisture supply at a given place rather consistently falls short of the climatically expected or climatically appropriate moisture supply.” The range of PDSI is from

–4.0 (extremely dry) to +4.0 (excessively wet), with the central half (-0.5 to +0.5) representing the normal or near normal conditions. In the United States, the USDA, National Drought Mitigation Center at University of Nebraska-Lincoln, U.S. Department of Commerce, and NOAA developed another measurement of droughts named the U.S. Drought Monitor (USDM). Table 2.2.4.1 above shows the two scales and how they compare.

In addition to the PDSI, the Crop Moisture Index (CMI) calculates the change in moisture available from week to week, which gives a short-term status of agricultural moisture (National Weather Service, 2005). Table 2.2.4.2 describes the Crop Moisture Index.

Table 2.2.4.2

Crop Moisture Index	
Crop Moisture Index Value	*Drought Condition*
3.0 and up	Excessively Wet
2.0 to 2.9	Wet
1.0 to 1.9	Moist
-0.9 to 0.9	Slightly Dry/ Favorable Moist
-1.0 to -1.9	Abnormally Dry
-2.0 to -2.9	Excessively Dry
-3.0 or less	Severely Dry

Source: National Weather Service

A growing population, with individual and commercial demands upon water supplies, coupled with industrial and agricultural uses, will combine to affect water use during both normal and drought conditions. Water supplies in Ashtabula County are a mix of public and private systems. The primary public water system is operated by the Ashtabula County Water System which serves multiple townships and the City of Geneva and Village of Rock Creek. Additionally, the City of Ashtabula has its own water system serving the city and surrounding townships. Aqua Ohio also provides water in the Ashtabula area. These systems support industrial operations in portions of the County. A small percentage of Ashtabula County is supported by private water wells. Many of these private wells have the possibility of becoming dry during a drought prior to the public systems showing significant loss depending on use, size, and depth of well.

Private wells are subject to regulations and require permits for new installations or alterations. Ohio's Private Water Systems program, overseen by the local health department, mandates permits for wells, springs, cisterns, and ponds used as portable water sources. The map below (Figure 2.2.4.1) illustrates the drought risk areas in Ashtabula County.

ASHTABULA COUNTY HAZARD MITIGATION PLAN

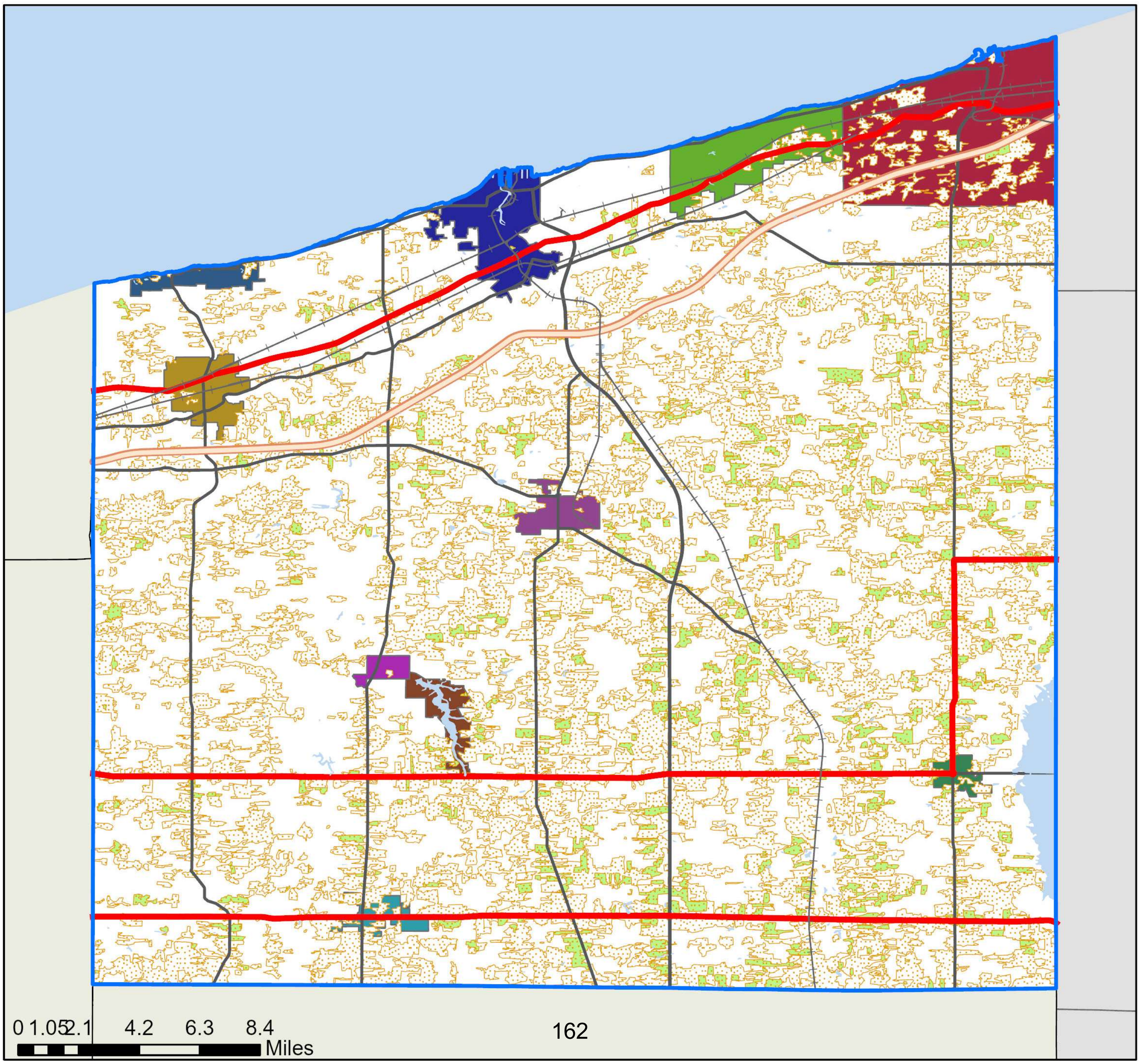
Figure 2.2.4.1: Risk Areas

Data Source(s): USGS NLCD (2021)

Crop

Pasture

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



Impacts and Vulnerability

Drought risk is based on a combination of the frequency, severity, and spatial extent of drought and the degree to which a population or activity is vulnerable to the effects of drought. Droughts can impact drinking water both in terms of availability and demand. According to the U.S. Environmental Protection Agency (EPA), as temperatures rise, people and animals need more water to maintain health. Additionally, a large number of economic activities require abundant water sources such as energy production (hydroelectric and nuclear power generation, for example) and growing food crops. As droughts reduce available water sources, local officials will need to closely monitor water usage to maintain enough for critical uses.

An extreme drought would have a negative effect on the large agricultural or open urban area sector of Ashtabula County which makes up approximately 34 percent (34%) of the land cover, or approximately 152,908 acres. In 2024 Ashtabula County had 1,034 farms in operation, with an average size of 130 acres per farm. These farms produced nearly $81.2 million of crops and livestock (OEDA, 2021).

Prolonged droughts can affect municipality's ability to provide adequate water supplies, as water storage supplies would begin to become critically low throughout the region. Mandatory water conservation measures and water use priorities may be enacted and enforced. The Ohio Department of Health (ODH) may have to conduct water quality sampling of numerous private water wells throughout the region as a buildup of contaminants in these wells is common during extreme drought conditions. Local clinics and hospitals may begin to see a significant increase in respiratory infections (i.e., asthma, bronchitis, and pneumonia) resulting from the extremely dry and windy conditions affecting air quality.

The significant lowering of the ground-water table and a decrease in ground-water discharge to streams and lakes may have an effect on tourism and recreational attractions at parks and lakes. The Ohio Environmental Protection Agency (OEPA) in coordination with the Ohio Department of Natural Resources (ODNR), Division of Water Resources may be required to post no boating and no swimming signs at various lakes and streams where water quality standards are not being met due to stagnant and contaminated water. Stagnant water from reduced levels can provide a breeding ground for disease-carrying mosquitoes.

The effects of drought would negatively impact the following business types throughout Ashtabula County; farmers, local water utilities, restaurants, tourism industry (recreation at parks and lakes, golfing, boating, fishing, etc.), laundry mats, community swimming pools, and car washes. A drought would also negatively impact the areas wine industry. The county is often referred to as Ohio Wine Country. Over 30 wineries throughout the region feature fine wines and produce over 65% of Ohio's grapes.

The National Drought Mitigation Center has developed the U.S. Drought Monitor. The Drought Monitor is a map that is updated weekly using data from the previous week to show areas of the U.S. that are in a drought. The following table lists the U.S. Drought Monitor classifications of drought, along with potential impacts.

Table 2.2.4.3

U.S. Drought Monitor Classification			
Category	*Description*	*Possible Impacts*	*Palmer Drought Severity Index*
D0	Abnormally Dry	Going into drought: • Short-term dryness slowing planting, growth of crops or pastures Coming out of drought • Some lingering water deficits • Pastures or crops not fully recovered	-1.0 to -1.9
D1	Moderate Drought	• Some damage to crops, pastures • Streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested	-2.0 to -2.9
D2	Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed	-3.0 to -3.9
D3	Extreme Drought	• Major crop/pasture losses • Widespread shortages or restrictions	-4.0 to -4.9
D4	Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less

Source: National Drought Mitigation Center

No two states experience drought the same way. In an effort to communicate the effects of drought on a smaller scale, the U.S. Drought Monitor developed a table presenting drought impacts that have reported in each state. The following table presents impacts listed for the state of Ohio.

Table 2.2.4.4

Drought Impacts by State – Ohio	
Category	*Impact*
D0	Crop growth is stunted; stock pond levels decline
	Prayer session is held for rain
D1	Hay yield is low; hay is expensive; corn is curling; farmers feed hay early; fruit (cherries and plums) yield is low
	Small brush fires occur; burn bans begin
	Voluntary water restrictions are requested
	Fewer mosquitoes are observed than normal
	Drought is hard on landscaping businesses
D2	Crops are suffering
	The number of wildfires is high
	Trees lose leaves early
	Soil is dry, cracked, and pulling away from foundations
	Creeks are dried up
D3	Soybeans are severely dry, crop yields are minimal, supplemental hay for livestock increases, livestock are stressed
	Lawns go dormant
D4	Ohio has had little or no experience in D4 so no impacts have been recorded at that level in the Drought Impact Reporter

Source: National Drought Mitigation Center

Severe drought conditions can negatively affect human health (CDC, 2019). Some effects are experienced short-term and can be directly observed and measured, while others are indirect and are not easy to anticipate or monitor. The possible health implications of drought include:

- Compromised quantity and quality of drinking water;
- Increased recreational risks;

- Effects on air quality;
- Diminished living conditions related to energy, air quality, and sanitation and hygiene;
- Compromised food and nutrition; and
- Increased incidence of illness and disease.

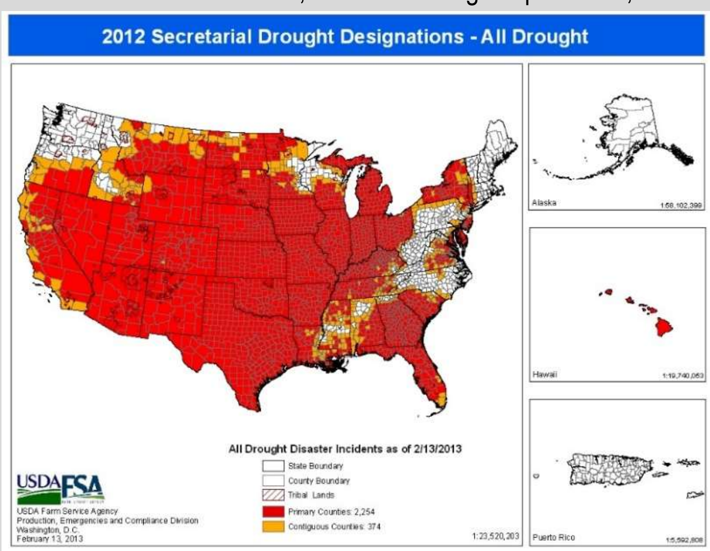
Historical Occurrences

Data sources suggest five significant droughts have impacted Ashtabula County. Occurring in 1996, 1997, 1999, 2012 and 2016. Ashtabula County received drought-related disaster declarations from the Secretary of the U.S. Department of Agriculture in 2012 and 2016 (USDA Farm Services Agency, 2025).

2012 DROUGHT

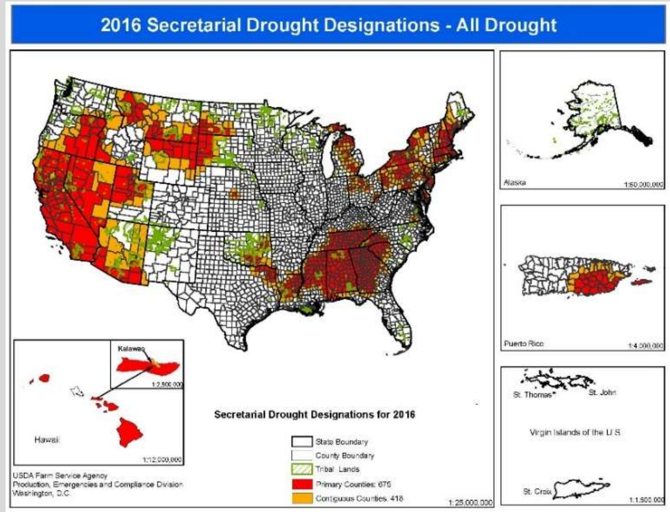
USDA FSA Designation: S3384 (Contiguous)

Most locations ended the winter season of 2011-2012 with near normal precipitation and below-normal snowfall, which led to below-normal snowmelt. March experienced much-above-normal, record-breaking temperatures, which led to above-normal evapotranspiration and an early start to the growing season. This, combined with lack of snowmelt in the winter, led to abnormally dry conditions across the region by the middle of April. Given much-below-normal rainfall in April and May, topsoil preconditioned for drought, and already low streamflow across area streams, rivers, and lakes, drought conditions developed across the Midwest region by May. With high pressure remaining in control outside of some fast-moving low pressure systems, dry weather ruled the summer months. Record-breaking heat combined and a lack of substantial precipitation brought on devastating drought conditions. By the middle of July, all of the local area was in at least D2 or severe drought conditions with a large portion of the area in D3 or extreme drought conditions (on a scale from D0 to D4 drought severity). These conditions lasted until the middle of August.



2016 DROUGHT

USDA FSA Designation: S4038 (Contiguous)
Farmers and ranchers in the following counties in New York and Ohio qualified for natural disaster assistance in 2016 because their counties are contiguous.



New York
Allegany, Chautauqua, Chemung, and Steuben

Ohio
Ashtabula

All counties listed above were designated natural disaster areas on Sep. 15, 2016, making all qualified farm operators in the designated areas eligible for low interest emergency (EM) loans from USDA's Farm Service Agency (FSA), provided eligibility requirements are met. Farmers had eight months from the date of the declaration to apply for loans to help cover part of their actual losses.

The National Centers for Environmental Information (NCEI) Storm Events Database records instances of drought form 1950 to present. The following table presents the NCEI droughts that have affected Ashtabula County.

Table 2.2.4.5

Historical Drought Occurrences – Ashtabula County				
Begin Date	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
8/1/1996	0	0	$0	$0
7/1/1997	0	0	$0	$0
9/1/1999	0	0	$0	$5,000,000
7/1/2012	0	0	$0	$0
9/1/2016	0	0	$0	$0

Source: NOAA – NCEI, Storm Events Database

Countywide Drought – May through September 1999

Dry conditions that began in May of 1999 continued through the month of September. Total rainfall during the month of May was only 1.25 to 2.5 inches, as drought conditions worsened a deterioration in stream flow and soil moisture was noted.

On August 10, the U.S. Department of Agriculture declared all Eastern Ohio an agricultural disaster area. Precipitation deficits for the period of May through August showed the area to be anywhere between two and eight inches below normal. Preliminary estimates predict a $600 million agricultural loss statewide from the drought. September rainfall for Eastern Ohio again averaged below normal, with the Palmer Drought Severity Index (PDSI) keeping the entire area under a moderate to severe drought. The Crop Moisture Index also showed abnormally dry conditions continuing across all Eastern Ohio. According to NOAA's National Climatic Data Center, this drought impacted twenty-eight Ohio counties resulting in $200 million in crop damages.

Loss and Damages

The USDA maintains data regarding agricultural activities through five-year censuses. Table 2.2.4.6 provides an overview of the 2012, 2017, and 2022 censuses.

Table 2.2.4.6

USDA Census of Agriculture Data – Ashtabula County					
Year	*Farms*	*Land in Farms (acres)*	*Harvested Cropland (acres)*	*Average Harvested Cropland per Farm (acres)*	*Market Value of Agricultural Products Sold*
2012	1,099	165,967	100,299	119	$82,256,000
2017	1,212	153,654	88,835	94	$57,887,000
2022	1,034	134,274	71,272	91	$81,259,000

Source: USDA, Census of Agriculture

Though there can be no correlation drawn between the presence of farms and drought risk, the market value of agricultural products sold provides evidence of total agricultural economic activity exposed to losses from droughts. On average, $73.8 million in agricultural products in Ashtabula County are vulnerable to drought conditions in any given year.

For planning purposes, utilizing research on average crop yield losses provides the basis for a mathematical loss calculation. Kuwayama (2019) focused on corn and soybeans and found that a week of drought in non-irrigating counties results in average crop yield reductions ranging from 0.1% to 1.2%. The average market value of agricultural products sold annually (i.e., across 52 weeks) in Ashtabula County suggests an average weekly value of approximately $1,419,244 (for a potential exposure ranging from $1,419 to $17,031).

The declared incident cited above indicate the length of the 1999 drought as from May through September (five months). The average length of historical droughts (receiving a secretarial designation) in Ashtabula County is thus five months (or 20 weeks). Combining these calculations suggests a range of exposure of $28,385 to $340,619 per drought.

Future Occurrences

Changes in precipitation can intensify droughts in certain areas. The quality and quantity of water available for use by people and ecosystems across the country can fluctuate, increasing risks and costs to agriculture, energy production, industry, recreation, and the environment. Droughts are projected to increase in frequency due to shifts in seasonal precipitation patterns and are projected to have a longer duration.

Though it is difficult to anticipate precisely where drought conditions will occur in the future, Ashtabula County can estimate the chances of experiencing drought conditions generally. NOAA's Earth System Research Laboratory (ESRL) has divided the U.S. into "climate divisions." ESRL further maintains data for each of these areas, including the historical Palmer Drought Severity Index (PDSI) values for all months between 1895 and 2022. Ashtabula County's climate division, Northeast Ohio, experienced severe or extreme drought conditions during 103 of the 1,560 (6.59%) months comprising the 1895-2025 period. The map below (Figure 2.2.4.2) displays ESRL Climate Divisions' months spent in severe or extreme drought in Ashtabula County (NOAA NCEI, 2023a).

ASHTABULA COUNTY HAZARD MITIGATION PLAN

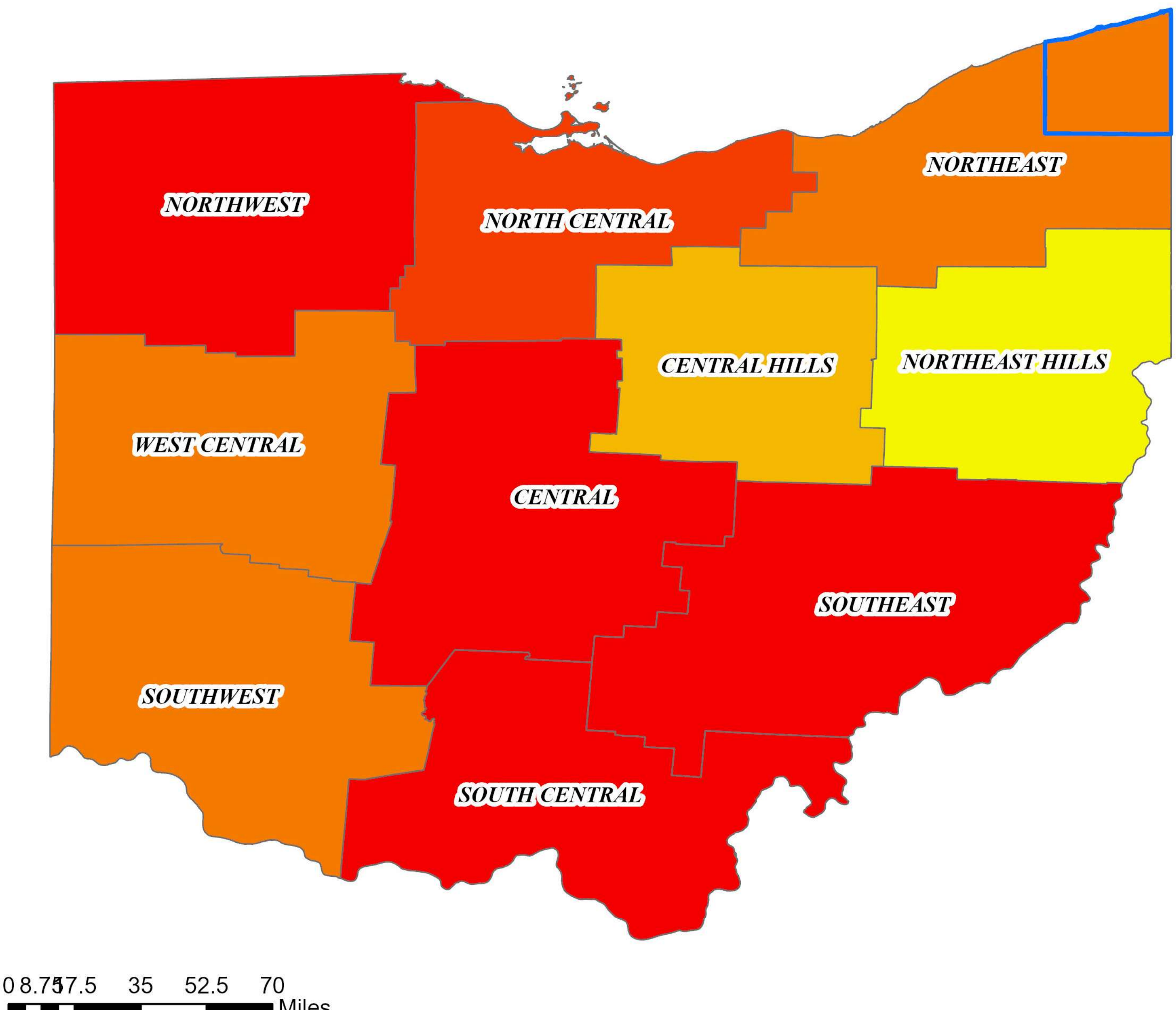
Figure 2.2.4.2: Months in Severe/ Extreme Drought

Data Source(s): NOAA Earth Systems Research Laboratory

% of Months, 1895-2025

- < 5.66%
- 5.67 - 6.30%
- 6.31 - 6.87%
- 6.88 - 7.19%
- 7.20 - 7.82%

DISCLAIMER: Data is meant for use as reference only. Some sources may be intended to be used at national or regional scales and are thus used beyond their original intent for demonstrative purposes.



Risk Assessment

This section summarizes the vulnerability of Ashtabula County to drought. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. The following table presents the results of that survey, specifically regarding drought.

Table 2.2.4.7

Public Sentiment, Drought					
	Level of Concern				
Hazard	Not at All	Somewhat	Concerned	Very	Total Responses
DROUGHT	49 (33.11%)	52 (35.14%)	35 (23.65%)	12 (8.11%)	148
In the past five years, do you remember this hazard occurring in your community?				42 (28.38%)	148
Have you noticed an increase in the occurrences or intensity of this hazard?				40 (27.03%)	148
Have you noticed a decrease in the occurrences or intensity of this hazard?				4 (2.70%)	148

Source: Online Public Survey Results

Table 2.2.4.8 assigns point totals based on the methodology identified in Section 2.2: Describe Hazards above. The categories in the table appear in Ohio EMA's Mitigation Information Portal (MIP) tool.

Table 2.2.4.8

Drought Risk Ranking			
Category	*Points*	*Description*	*Notes*
Frequency	2	Remote (Unlikely to occur in a year)	Five events in 28 years (i.e., 1996-2024) yields an estimate of 0.18 incidents per annum.
Response	2	One day	Though the agricultural response may be extensive and much longer, it is a response that is not as acute as many other emergency responses.
Onset	1	Over 24 hours	Drought conditions occur following an extended period of specific hydrological conditions.
Magnitude	4	Catastrophic (Over 50% of land area affected)	Land area totals cited in Section 1.2.4 identify approximately 75% of the land area as being dedicated to natural resources and agricultural use.
Business	1	Less than 24 hours	Drought is not likely to necessitate prolonged business closure.
Human	1	Minimum (Minor illnesses)	Drought is not likely to result in injuries; however, it can result in slight increases in respiratory infections such as bronchitis and pneumonia.
Property	2	10-25% of property affected	Though a significant amount of the land area could be impacted, drought conditions do not affect private property as severely.
Totals	**13**	**LOW**	

FEMA's *Local Mitigation Planning Handbook* (2023c) directs entities compiling multi-jurisdictional plans to identify any jurisdictions within the planning area for which the identified risks are more or less prevalent as compared to the rest of the planning area. The following map identifies those multi-jurisdictional risks concerning drought. Those labels not underlaid by a shaded drop shadow are not more or less at risk of drought. Those with red drop shadows are more at risk.

Figure 2.2.4.3

Drought Multi-Jurisdictional Risk Map