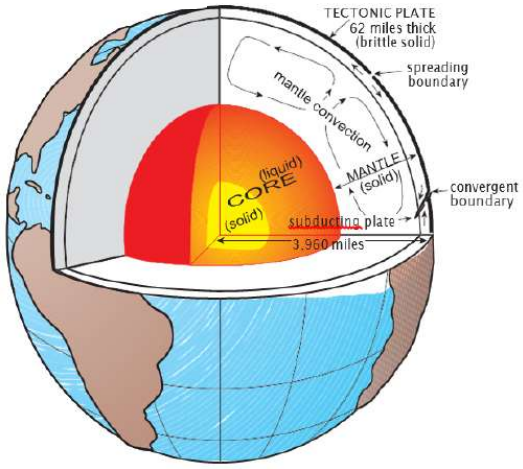
2.2.5 Earthquake

An earthquake is a sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the Earth's tectonic plates.				
RISK HIGHEST HIGH MEDIUM LOW LOWEST	**Period of Occurrence:**	Earthquakes can occur at any time	**Risk Ranking:**	Medium
	Warning Time:	None	**Type of Hazard:**	Natural
	Probability:	Frequent (Will occur during a year)	**Impact:**	Localized (Less than 10% of land are affected)
	Disaster Declarations:	None		

Hazard Introduction and Overview

Earth consists of four layers: the inner core (innermost layer), outer core, mantle, and crust (outermost layer). Figure 2.2.5.1 provides a three dimensional representation of the earth's layers. Further, the crust consists of many tectonic plates that are slowly moving, sliding past, and bumping into one another. Most earthquakes originate along the edges of these tectonic plates, called fault lines. The rough edges of the tectonic plates become lodged against each other. When a plate moves enough, the edges become dislodged, causing an earthquake. The epicenter of the earthquake is the location directly above the ruptured fault. (USGS, n.d.).

Figure 2.2.5.1



Interior zones of Earth. Earth's crust consists of great plates that slowly move across the surface of Earth in response to convection cells in the mantle. Most earthquakes occur where plates meet, such as at spreading or convergent boundaries. Modified from Washington Division of Geology and Earth Resources, Information Circular No. 85, 1988.

Source: Educational Leaflet No. 9 Revised Edition 2015 Division of Geological Survey

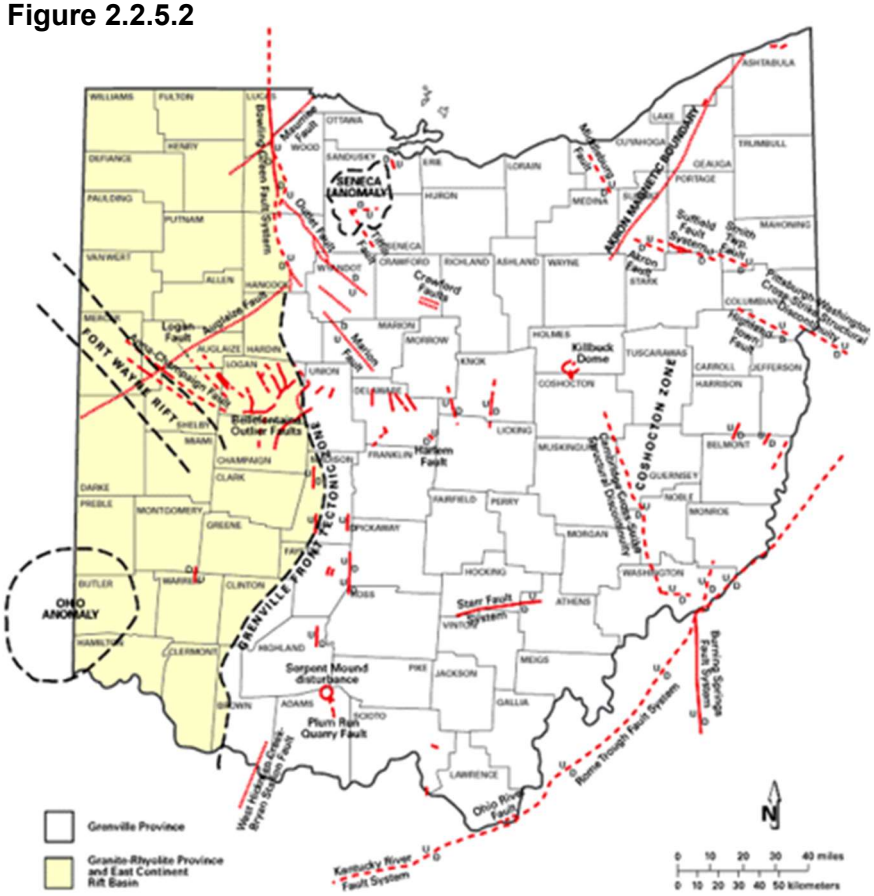
Some earthquakes have foreshocks, which are smaller earthquakes that happen at the same location as the larger earthquake that follows. The largest, main earthquake is called the main shock, which always has aftershock that follow. Current technology does not allow scientists to determine that an earthquake is a foreshock until the larger earthquake follows. Regulators and researchers have documented earthquakes induced by human activity in the United States, Japan, and Canada. The cause of these human-caused earthquakes was the injection of fluids into deep wells for waste disposal and secondary recovery

of oil and filling large reservoirs for water supplies. Deep mining and nuclear testing can also cause small to moderate quakes. A common misconception is that hydraulic fracturing, or "fracking," is causing *all* of the induced earthquakes. Fracking "is directly causing a small percentage of the felt-induced earthquakes observed in the United States. Most induced earthquakes in the United States are a result of the deep disposal of fluids (wastewater) related to oil and gas production" (Rubinstein and Mahani, 2015).

Location and Extent

Earthquakes are more widespread than is often realized. The area of greatest seismic activity in the United States is along the Pacific Coast, in the states of California and Alaska; however, as many as 40 states have moderate earthquake risk. Although most people do not think of Ohio as an earthquake-prone state, at least 170 earthquakes with epicenters in Ohio have been felt since 1776, and 14 of these have caused "minor to moderate" damage in Ohio. Ohio is on the periphery of the New Madrid Seismic Zone, an area in Missouri and adjacent states that was the site of the largest earthquake sequence to occur in historical times in the continental United States.

Figure 2.2.5.2



Earthquake epicenters occur on fault lines; however, their effects can be felt miles away. Although Ohio is not considered to be at high risk for earthquakes, there are several fault lines, some well-known and some speculative, traversing the state.

Figure 2.2.5.2 illustrates fault lines in Ohio and was modified by the USGS from a Division of Geological Survey Map PG-23. This map portrays a number of deep faults and other structures

that have been identified by a variety of geologic studies. Very few of the faults are visible at the surface. As shown, the Akron Magnetic Boundary fault is located directly beneath Ashtabula County. Ashtabula County is also located within the Southern Great Lakes Seismic Zone, which is an area of low to moderate earthquake activity around Lakes Erie and Ontario.

The northeast Ohio counties of Ashtabula, Geauga and Lake are the most earthquake-prone areas of the state. Of the 858 earthquakes documented by the Ohio Department of Natural Resources, Lake, Ashtabula, and Shelby had the most occurrences of all counties in the state. According to the Ohio Earthquake Epicenters interactive map provided by the Ohio Department of Natural Resources – Division of Geological Survey there have been 48 earthquakes epi-centered in Ashtabula County since 1987. The majority of these earthquakes were centered in or near Ashtabula City as well as Harpersfield and Trumbull Townships along the Ashtabula and Lake County boarder. The Division of Geological Survey also monitors a seismograph station as part of the OhioSeis Network located just west of Ashtabula City.

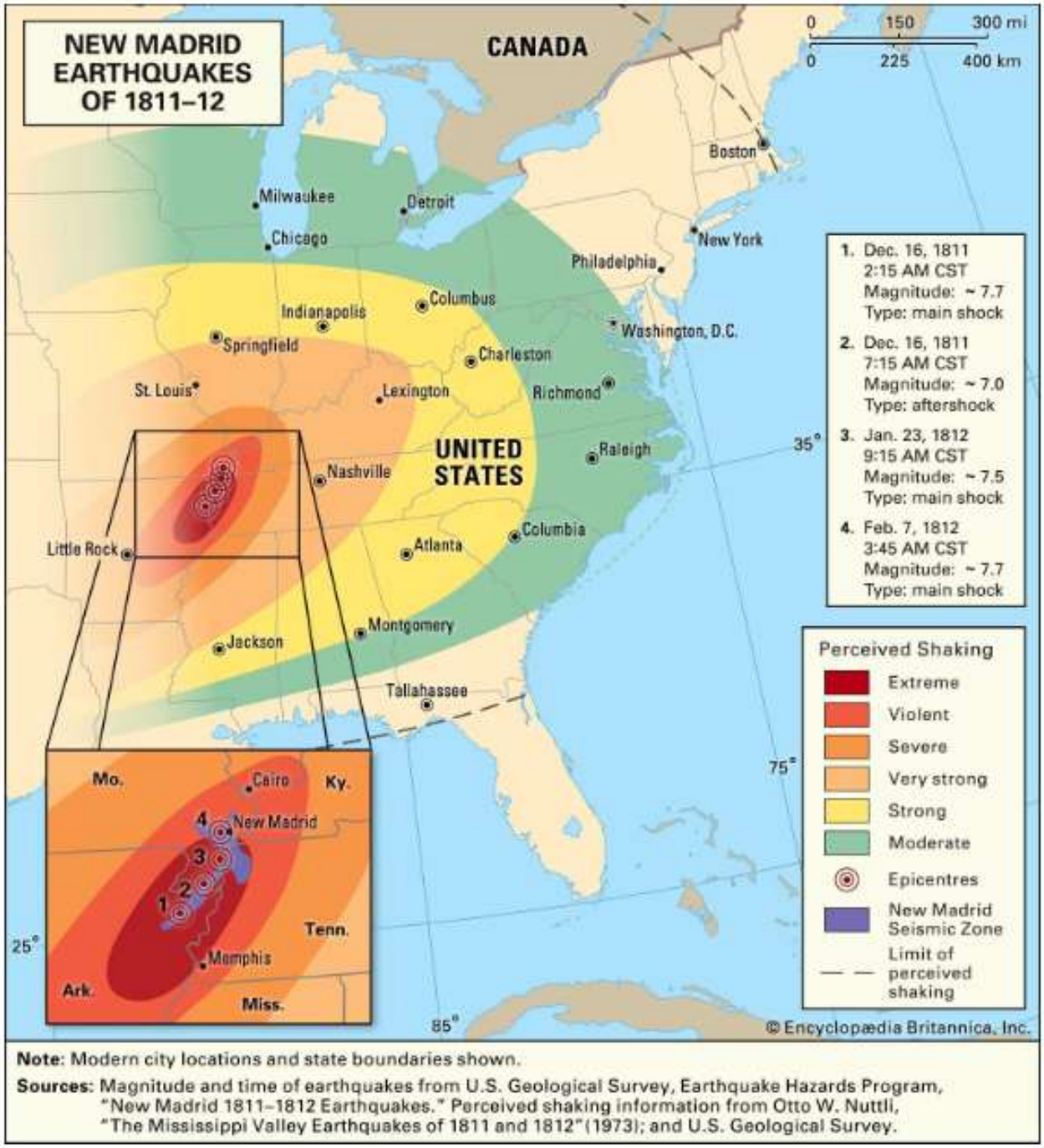
Although there are numerous intensity scales to evaluate the effect of earthquakes, the Modified Mercalli Intensity Scale (MMI) is the scale currently used in the U.S. The MMI was developed in 1931 by seismologists Harry Wood and Frank Neumann. The MMI scale assigns value to a site after an earthquake based on observed effects, ranging from acceptable to catastrophic. The MMI scale is shown in Figure 2.2.5.3 below.

Figure 2.2.5.3

MODIFIED MERCALLI AND MAGNITUDE SCALE COMPARISON		
Modified Mercalli Scale		*Magnitude Scale*
I	Felt by few people under especially favorable conditions.	1.5
II	Felt by few persons at rest, especially on upper floors of buildings.	2.0 2.5
III	Felt quite noticeably indoors, especially on upper floors of buildings. Many do not recognize it as an earthquake. Standing vehicles may rock slightly. Vibration feels like passing truck.	3.0
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation of a heavy truck striking building; standing vehicles rock noticeably.	3.5
V	Felt by nearly everyone; many awakened. Some dishes and windows broken. Unstable objects overturned.	4.0 4.5
VI	Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.	5.0
VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by vehicle drivers.	5.5
VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse; damage great in poorly built structures; fall of chimneys, factory stacks, columns, monuments, and walls. Heavy furniture overturned. Disturbs	6.0
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. Underground pipes broken.	6.5 7.0
X	Some well-built wooden structures are destroyed; most masonry and frame structures with foundations destroyed; train rails bent.	7.5
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Underground pipelines taken out of service. Train rails bent greatly.	8.0
XII	Damage total. Waves seen on ground surfaces. Lines of sight and level are distorted. Objects thrown into the air.	8.5

Scientific studies regarding earthquakes have identified the potential for a major incident occurring within the New Madrid Seismic Zone. Based on data from the New Madrid earthquake of 1811 and 1812, all of Ashtabula County could perceive moderate shaking in the event of an earthquake with the same magnitude occurring. (Britannica.com, n.d.).

Figure 2.2.5.4



Impacts and Vulnerability

The severity of the effects of earthquakes are dependent on the amount of energy released from the fault or epicenter. The effects of an earthquake can be felt far beyond the site of its occurrence. They usually occur without warning and after just a few seconds can cause massive damage and extensive casualties. Common effects of earthquakes are ground motion and shaking, surface ruptures, and ground failure. The most significant human risk during an earthquake is structure movement and collapse. Contents within structures may fall or fail and injure or kill occupants inside of the structures.

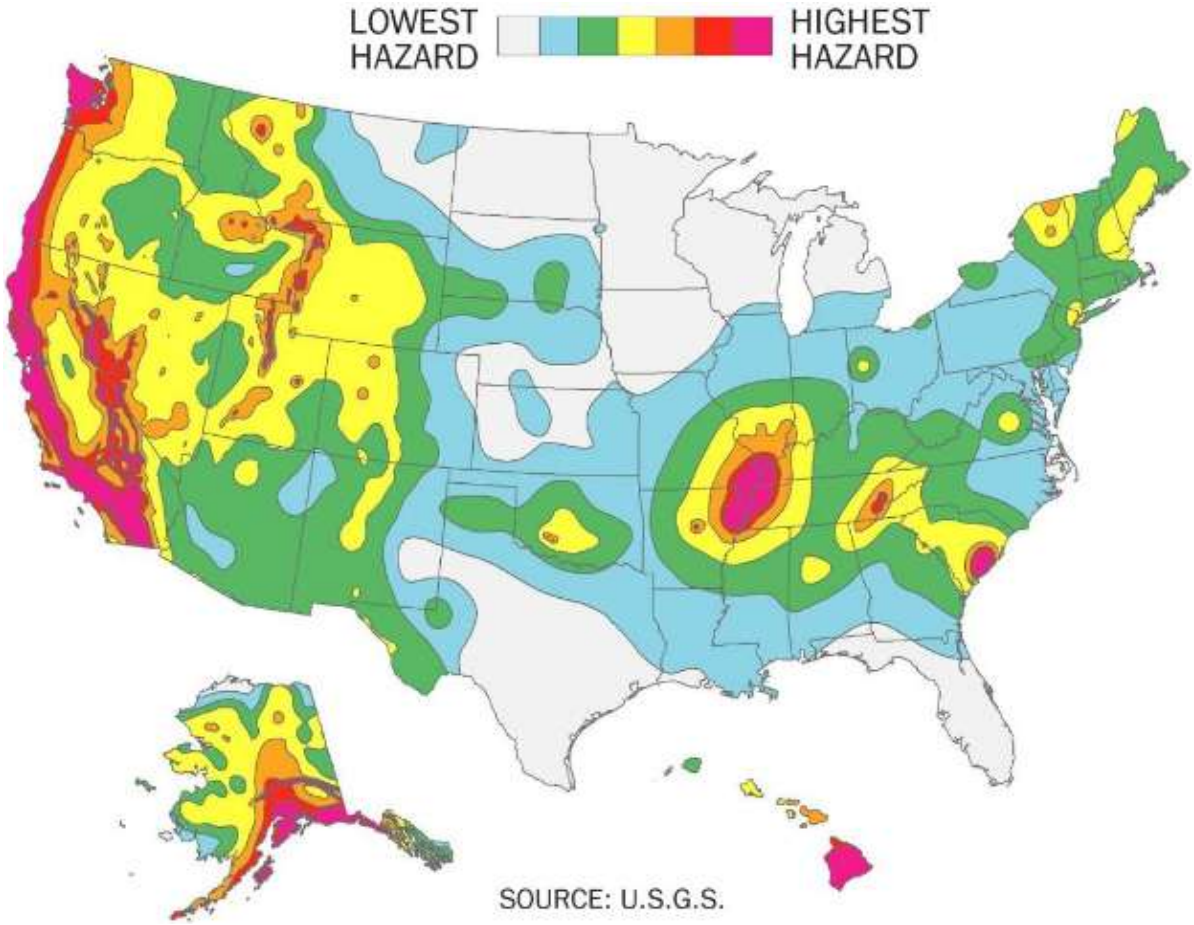
Earthquakes can affect people and structures alike, although older structures may be more susceptible to cracks and damage. “With most earthquakes, trauma caused by the collapse of buildings is the cause of most deaths and injuries. However, a surprisingly large number of patients require acute care for non-surgical problems such as acute myocardial infraction, exacerbation of chronic diseases such as diabetes or hypertension, anxiety and other mental health problems, respiratory disease from exposure to dust and asbestos fibers from rubble, and near-drowning resulting from significant, rapid flooding as a result of dam or levee failures.

Earthquakes can cause a variety of cascading effects, including fires due to broken electrical lines and gas mains, structural damage and utility and communication system outages, they can trigger landslides, and, less commonly, tsunamis. Ground shaking refers to the vibration of the ground during an earthquake. Generally, the severity of ground shaking increases as magnitude increases, and decreases as distance from the causative fault increases.

The largest magnitude earthquakes epi-centered in Ashtabula County were both magnitude 4.5, the first occurring on September 25th, 1998, and the second on January 26th, 2001, in the City of Ashtabula. These earthquakes measured VI on the Modified Mercalli Intensity Scale. This magnitude earthquake would likely result in negligible damage to buildings of good design and construction, possible broken chimneys, and would most likely be noticed by vehicle drivers.

As discussed above, there is one fault located beneath the northwestern corner of Ashtabula County. This fault has prompted the USGS to designate northwestern Ashtabula County above the second lowest hazard area it identifies for potential earthquakes in the nation, see the map below (Figure 2.2.5.5) . Further, historical data indicates that when earthquakes occur, there are typically of a low magnitude with minimal damage.

Figure 2.2.5.5



Historical Occurrences

The Ohio Department of Natural Resources-Division of Geological Survey maintains the Ohio Earthquake Epicenters Database, which lists all earthquakes detected in Ohio. The northeast corner of Ohio appears to be a hotspot for earthquake activity. According to the database, there has been 48 earthquake epi-centered in Ashtabula County since 1987, as illustrated in Table 2.2.5.1 and Figure 2.2.5.6 below. The most earthquakes to occur in a single year was five in both 1987 and 2024. The highest magnitude earthquakes to occur in the county were both 4.5 magnitude, one occurred on September 25, 1998, and the other on January 26, 2001.

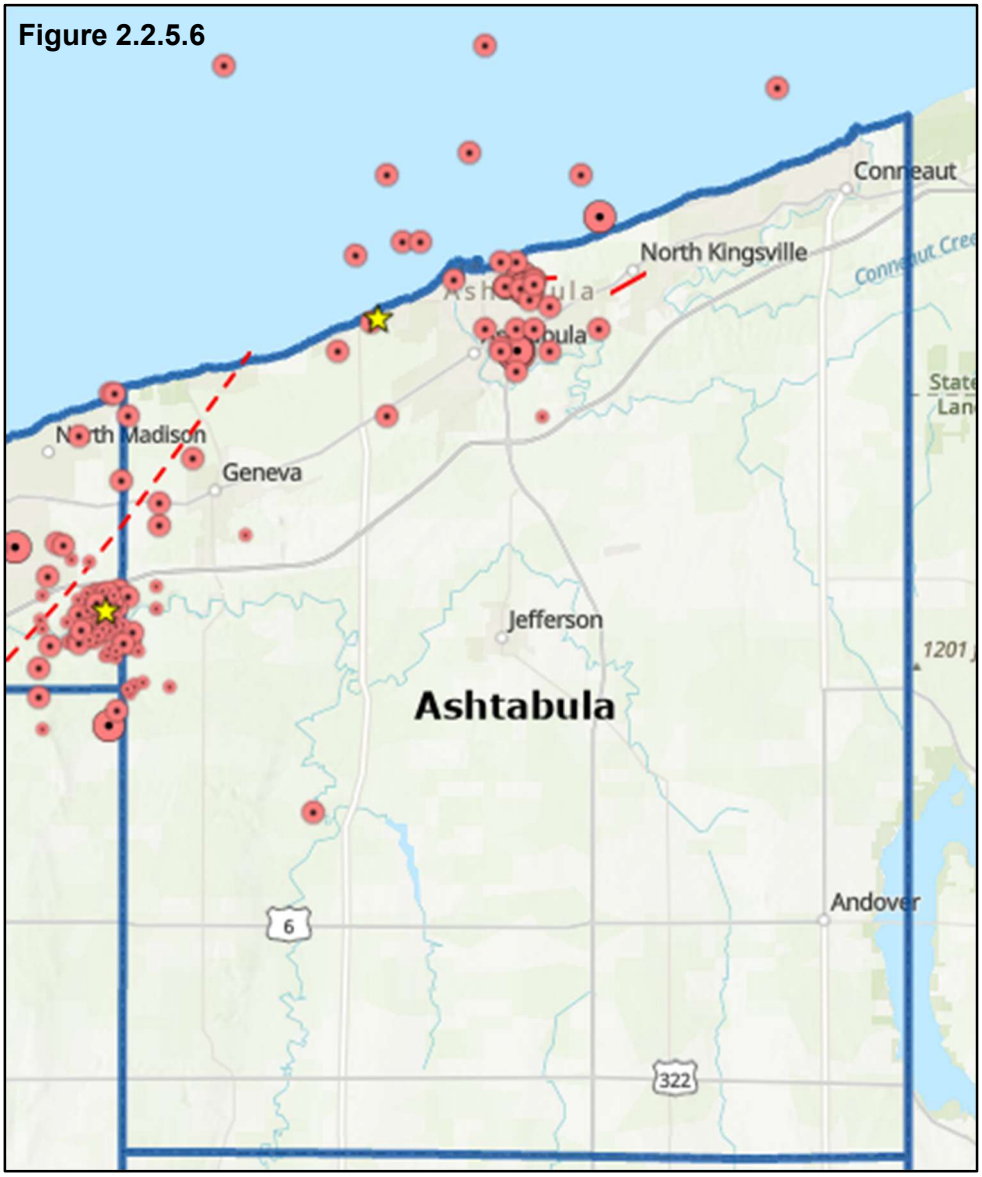
Table 2.2.5.1

Ashtabula County Earthquake Epicenters			
Date	*Location*	*Magnitude*	*MMI Rating*
February 28, 1857	Approximately 29.5 miles offshore of Ashtabula City in Lake Erie	4.1	IV
July 13, 1987	Ashtabula City, approximately 0.7 miles south of SR 531	3.8	IV
July 13, 1987	South of Edgewood along SR 84	2.8	II
July 14, 1987	Ashtabula City, current location of Cleveland Industrial Recycling	2.8	II
July 16, 1987	Ashtabula City, current location of Cleveland Industrial Recycling	2.7	II
August 13, 1987	Approximately ½ mile offshore of North Kingsville in Lake Erie	3.3	III
August 1, 1989	Ashtabula City, approximately 0.8 miles south of SR 531	2.9	II
August 3, 1989	North of Edgewood	2.2	NF[1]
January 1, 1990	Ashtabula City, 518ft west of Ashtabula River, 210ft north of West 5th Street	2.2	NF
July 24, 1990	Approximately 1.5 miles offshore of Saybrook-on-the-Lake in Lake Erie	2.3	NF
September 26, 1990	Northeast of Ashtabula City along SR 531	2.3	NF
November 18, 1990	East Ashtabula along SR 531	2.3	NF
March 26, 1992	Saybrook-on-the-Lake, Conneaut Park	2.5	II
March 28, 1992	Ashtabula City, current location of Cleveland Industrial Recycling	2.9	III
March 31, 1992	Approximately 1.8 miles offshore of Ashtabula City in Lake Erie	2.5	II
April 7, 1992	East of Saybrook-on-the-Lake, approximately 0.34 miles east of SR 45	2	NF
February 23, 1995	Ashtabula City north of US Route 20	2.9	IV
April 9, 1995	Ashtabula City south of US Route 20	2.4	NF
September 25, 1998	Approximately ½ mile west of Pymatuning Lake south of US 322	4.5	IV
June 7, 2000	Approximately 6.5 miles offshore of North Kingsville in Lake Erie	2.4	NF
October 20, 2000	North of Edgewood on Lake Erie shoreline	2.5	NF
January 20, 2001	Ashtabula City near Cederquist Park	2.6	III
January 26, 2001	Ashtabula City, just west of SR 11	4.5	VI
June 3, 2001	Ashtabula City, just west of SR 11	3.2	III
June 5, 2001	Ashtabula City, north of US Route 20	2.2	II
August 17, 2002	North of Harpersfield	2	NF
February 10, 2003	Approximately 2 miles offshore of North Kingsville in Lake Erie	2.4	II
July 17, 2003	Ashtabula City, just west of SR 11	2.5	III
July 22, 2003	Ashtabula City	2.1	NF
February 23, 2005	Approximately 1.3 miles north of Geneva	2.5	NF
March 2, 2005	Approximately 1.7 miles west of Geneva along US Route 20	2.2	NF
December 11, 2005	Approximately 3.4 miles offshore of Ashtabula Harbor in Lake Erie	2	NF
February 27, 2006	Approximately 1.5 miles offshore of Ashtabula Harbor in Lake Erie	2	NF
April 10, 2006	Approximately 1.1 miles offshore of Ashtabula Harbor in Lake Erie	2	NF
September 28, 2007	Approximately 2.5 miles offshore of Conneaut Harbor in Lake Erie	2.7	III
February 14, 2009	Northwest corner along Lake and Ashtabula county line	2.2	NF
March 17, 2013	Approximately 1.5 miles west of Rock Creek Village	2.2	NF
April 12, 2015	Approximately 2.7 miles southwest of Harpersfield	2.3	NF
October 7, 2019	Approximately 2.8 miles south of Harpersfield	1.5	NF
January 5, 2022	South of Ashtabula City near I-90 / US 11 interchange	1.5	NF
October 12, 2022	Approximately 2.25 miles south of Unionville along Grand River	1.7	NF

Ashtabula County Earthquake Epicenters			
Date	*Location*	*Magnitude*	*MMI Rating*
January 2, 2024	Approximately 2.6 miles south of Unionville	2.2	NF
January 5, 2024	South of Geneva and east of SR 534	1.0	NF
February 13, 2024	Approximately 4.5 miles south of Unionville	1.3	NF
February 24, 2024	Approximately 3.7 miles north of the Great Lakes Medieval Faire	1.5	NF
March 30, 2024	Approximately 2.0 miles south of Unionville	1.3	NF
May 21, 2025	Approximately 1.6 miles west of Harpersfield	1.6	NF
May 29, 2025	South of Unionville near intersection of County Routes 14 & 73	1.1	NF

Source: Ohio Earthquake Epicenters, ODNR-Division of Geological Survey, Ohio Seismic Network
1 – NF = Not Felt

Figure 2.2.5.6

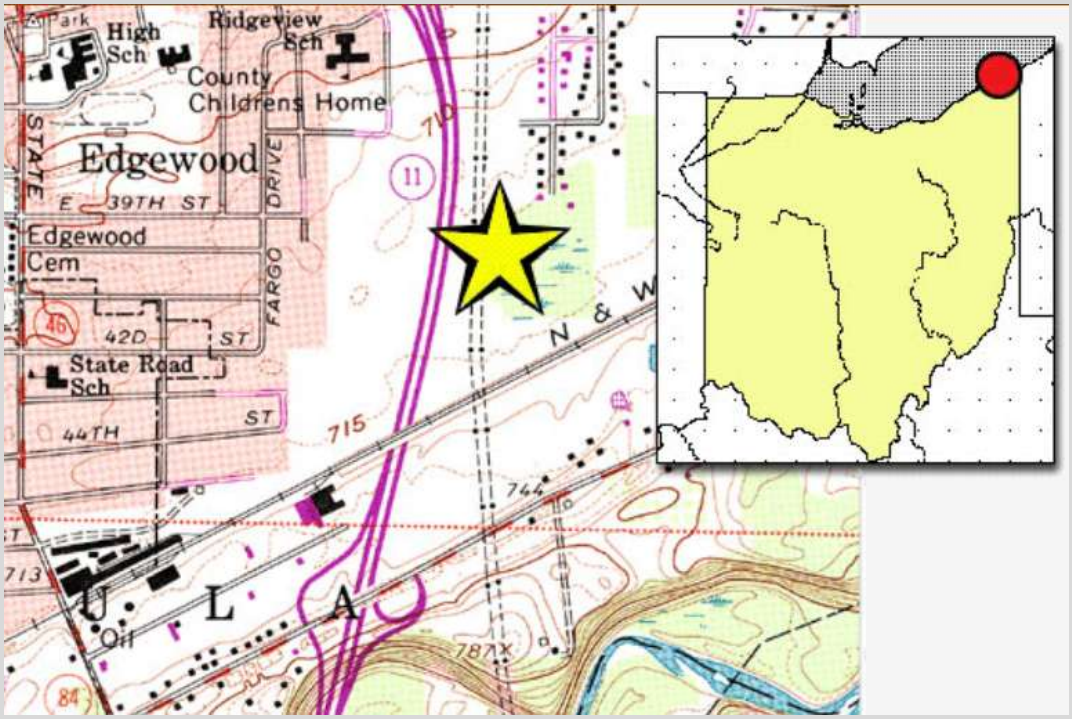


Source: ODNR-Division of Geological Survey

Earthquake – September 25, 1998

On Friday, September 25, 1998, a magnitude 4.5 earthquake, known as the Pymatuning earthquake occurred near the Ohio-Pennsylvania border approximately ½ mile west of Pymatuning Lake south of U.S. Route 322. This earthquake was widely felt throughout Ashtabula County. This event caused minor damage and seriously impacted many water wells in the area. The shaking was felt across a wide region including norther Ohio, western Pennsylvania, and New York, as well as a large portion of southern Ontario, Canada. Several small aftershocks followed the main earthquake.

June 3, 2001 Earthquake (Source: ODNR, 2001, http://geosurvey.ohiodnr.gov/quakes-2000-to-2009-pgs/ashtabula-june-03-2001#topofcontent)



"Residents of Ashtabula and nearby areas were shaken by another earthquake on June 3, 2001, at 6:36 p.m. This event had a magnitude of 3.2, as determined by the Ohio Seismic Network. No damage was reported, although more than 90 felt reports were received by the Ashtabula County Emergency Management Agency. A 2.3-magnitude aftershock was recorded at 4:27 a.m. on June 5. One person reported feeling it. The epicenter location is east of Ashtabula.

These earthquakes follow a 2.6-magnitude event on January 20 and a 4.5-magnitude event on January 25. The latter event resulted in at least 50 reports of damage. The cause of this earthquake sequence is unknown at this time but is being investigated by the Ohio Seismic Network and seismologists from Lamont-Doherty Geological Observatory of Columbia University and the University of Michigan."

Loss and Damages

All USGS and OhioSeis descriptions of earthquakes indicate that there have been no major losses or damages to structures or people, only minor damage such as cracked plaster or glass. Information obtained from FEMA's National Risk Index (NRI) was utilized to assess earthquake impacts for each participating jurisdiction.

Table 2.2.5.2

Ashtabula County Earthquake NRI Exposure / Expected Annual Loss Estimates					
Census Tract	*Exposure (Buildings)*	*Exposure Populations*	*Expected Annual Loss (Buildings)*	*Expected Annual Loss (Population Equivalence)*	*Expected Annual Loss (Total)*
39007000101	$965,537,000	4,653	$3,909	$763	$4,672
39007000102	$587,009,000	3,130	$2,047	$552	$2,599
39007000103	$781,761,000	3,527	$2,979	$557	$3,536
39007000200	$821,540,000	4,344	$3,015	$798	$3,812
39007000300	$1,170,989,000	2,093	$8,037	$952	$8,989
39007000400	$355,030,000	1,681	$1,874	$377	$2,251
39007000500	$785,402,000	4,108	$2,832	$670	$3,502
39007000601	$766,728,000	2,582	$5,578	$801	$6,378
39007000602	$430,643,000	3,294	$1,453	$509	$1,962
39007000603	$936,964,000	4,058	$5,603	$1,518	$7,121
39007000701	$655,449,000	3,036	$2,758	$494	$3,252
39007000702	$727,938,000	2,836	$3,882	$714	$4,596
39007000703	$574,928,000	3,631	$1,678	$547	$2,225
39007000704	$800,437,000	3,793	$2,893	$629	$3,522
39007000801	$602,765,000	1,346	$4,989	$568	$5,557
39007000802	$981,150,000	4,912	$6,784	$1,349	$8,133
39007000900	$978,552,000	4,477	$5,819	$1,210	$7,029
39007001001	$1,087,854,000	5,611	$6,007	$1,347	$7,354
39007001002	$944,284,000	3,397	$5,934	$1,020	$6,954
39007001101	$297,750,000	1,852	$1,611	$435	$2,046
39007001102	$1,309,501,000	6,139	$9,271	$2,091	$11,362
39007001201	$517,053,000	3,497	$2,814	$967	$3,782
39007001202	$522,999,000	3,327	$2,351	$773	$3,124
39007001301	$716,249,000	3,628	$2,925	$694	$3,619
39007001303	$461,654,000	2,835	$2,817	$1,160	$3,977
39007001304	$361,737,000	979	$1,612	$226	$1,838
39007001401	$532,466,000	4,119	$2,618	$874	$3,492
39007001402	$885,872,000	4,689	$6,235	$1,668	$7,903
Grant Total	**$20,560,241,000**	**97,574**	**$110,324**	**$24,264**	**$134,588**

Source: USDHS/FEMA – The National Risk Index, Version 1.19

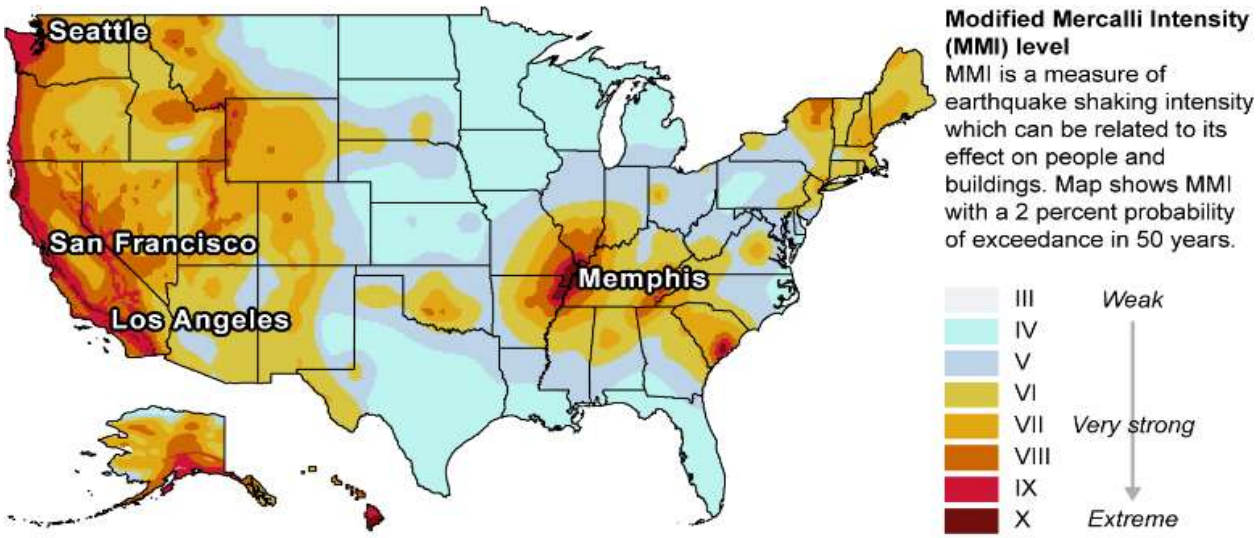
Future Occurrences

While not commonly considered an earthquake-prone area, the Great Lakes region of Ohio does experience seismic activity, primarily around Lake Erie. According to the USGS database, Ashtabula County has a low seismic hazard level. The USGS database indicates that there is a two percent (2%) chance of a potentially damaging earthquake occurring within the next 50 years in Ashtabula County.

Future occurrences of earthquakes in the Great-Lakes region are relatively low and remain a moderate-priority concern. Of the 48 historical earthquakes to be epi-centered in Ashtabula County approximately 40% were felt by humans. The highest rated earthquake was a MMI VI, these earthquakes are felt by everyone and often cause minor damage, such as falling plaster and damaged chimneys. Many people become frightened and heavy furniture may be moved.

In a study examining risks to federal buildings, the Government Accountability Office (GAO) included a map illustrating MMI level earthquakes with a 2% probability of exceedance in 50 years. For reference "A 2% in 50 year probability equates to an earthquake recurring and exceeding a given MMI level about every 2,475 years." As can be seen in the map below (Figure 2.2.5.7) a portion of Ashtabula County's Lake Erie shoreline is within a maximum MMI VI level.

Figure 2.2.5.7



Source: GAO presentation of U.S. Geological Survey mapping; MapInfo (map). | GAO-16-680

Risk Assessment

This section summarizes the vulnerability of Ashtabula County to earthquake. 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 earthquake.

Table 2.2.5.3

Public Sentiment, Earthquake					
Hazard	*Level of Concern*				*Total Responses*
	Not at All	*Somewhat*	*Concerned*	*Very*	
EARTHQUAKE	66 (44.59%)	57 (38.51%)	19 (12.84%)	6 (4.05%)	148
In the past five years, do you remember this hazard occurring in your community?				34 (22.97%)	148
Have you noticed an increase in the occurrences or intensity of this hazard?				25 (16.89%)	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.

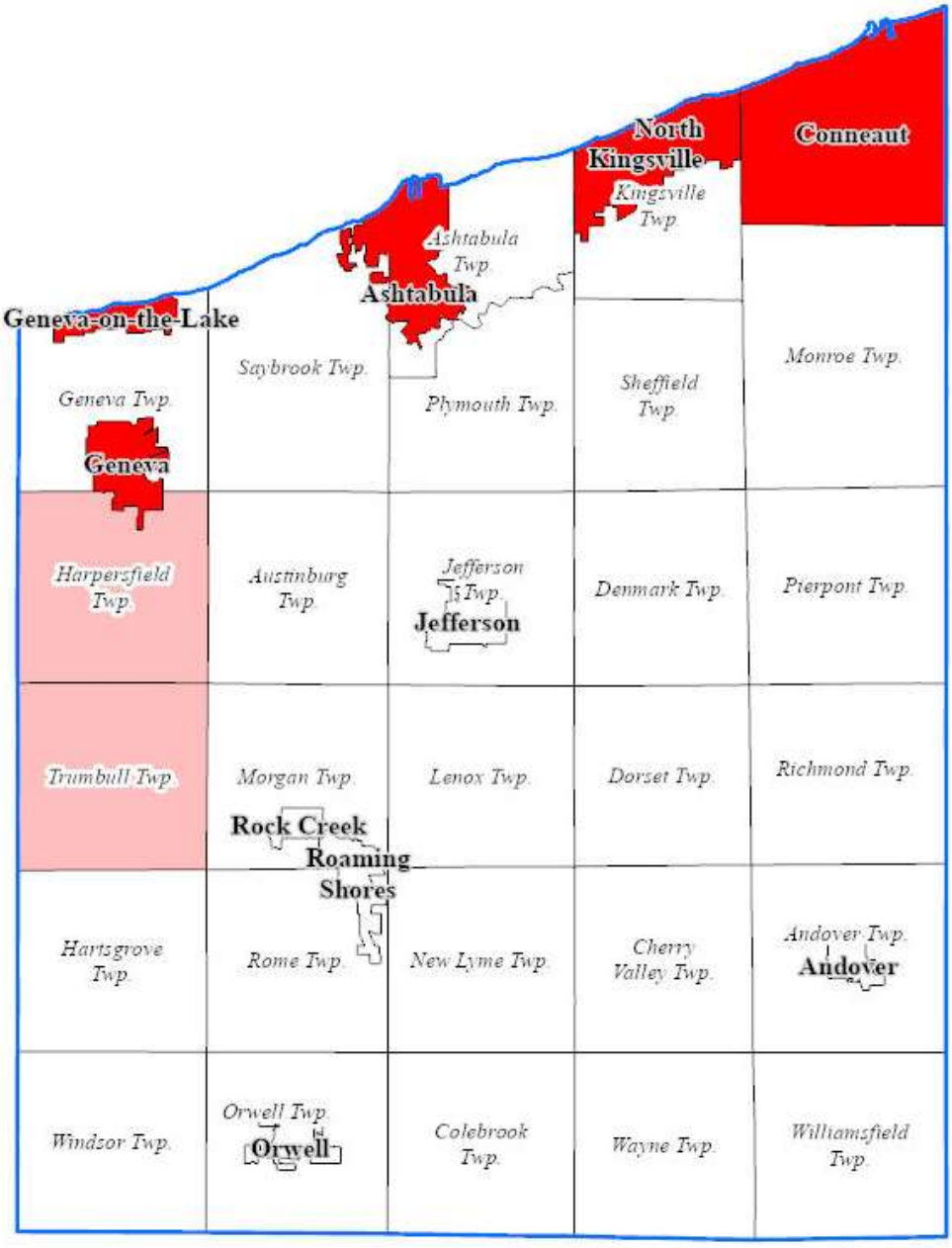
Table 2.2.5.4

Earthquake Risk Ranking			
Category	*Points*	*Description*	*Notes*
Frequency	5	Frequent (Will occur during a year)	48 occurrences in 37 years, creates an average of 1.30 events per year.
Response	2	One day	Data suggests that earthquakes in Ashtabula County have been of a low magnitude and caused little damage necessitating a minimal response.
Onset	5	No warning	Earthquakes occur with no warning.
Magnitude	1	Localized (<10% land area affected)	The largest earthquake event was a 4.5 magnitude with a MMI rating of VI. This event resulted in minimal recorded damage.
Business	1	Less than 24 hours	No historical earthquakes have disrupted the county's economy.
Human	1	Minimum (Minor injuries)	Past earthquakes in Ashtabula County have been low magnitude and have not caused any human injuries or deaths.
Property	1	Less than 10% property affected	Earthquakes in Ashtabula County have been low magnitude and have caused little to no property damage.
Totals	**16**	**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 identifies those multi-jurisdictional risks concerning earthquake. Those labels not underlaid by a shaded drop shadow are not more or less at risk of earthquake. Those with red drop shadows are more at risk.

Figure 2.2.5.8

Earthquake Multi-Jurisdictional Risk Map



2.2.6 Flooding

A general or temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland or tidal water or the rapid accumulation of runoff surface waters from any source. A flash flood is a sudden localized flood, typically due to intense rainfall.				
RISK HIGHEST HIGH MEDIUM LOW LOWEST	**Period of Occurrence:**	At any time, typically following a period of prolonged precipitation	**Risk Ranking:**	High
	Warning Time:	6-12 hours	**Type of Hazard:**	Natural
	Probability:	Frequent (Will occur during a year)	**Impact:**	Catastrophic (50% land areas affected)
	Disaster Declarations:	DR-266-OH (1969) DR-345-OH (1972) DR-377-OH (1973) DR-1556-OH (2004) DR-1656-OH (2006) DR-4098-OH (2013)		USDA FSA S3563 (2013) USDA FSA S3934 (2015) USDA FSA S4275 (2017) USDA FSA S4465 (2018) USDA FSA S4539 (2019) USDA FSA S4541 (2019)

Hazard Introduction and Overview

Floods are one of the most prevalent hazards in the United States (FEMA, 2017), and flooding is the most frequently occurring natural disaster in Ohio. Each year, floods cause more property damage in the United States than any other type of natural disaster, killing an average of 150 people a year. The history of flooding within Ashtabula County indicates that it can occur at any time of the year. However, nearly all major floods are produced by winter and spring rains falling on saturated, snow covered, or frozen soil. According to FEMA, flooding is a temporary condition of partial or complete inundation of normally dry land areas from:

1. The overflow of inland tidal waters (i.e., coastal flooding).
2. The unusual and rapid accumulation of runoff of surface waters from any source.
3. Mudslides which are proximately caused by flooding and are akin to a river of liquid and slowing mud on the surfaces of normally dry areas, as when earth is carried by a current of water and deposited along the path of the current.

Other types of flooding include flash flooding or river flooding from excessive rainfall, snowmelt, ice/debris jams, and dam or levee failure. Flooding is among the highest priority hazard in Ashtabula County as the county is vulnerable to all the above.

- **Excessive Rainfall:** This is the most common cause of flooding. Water accumulates quicker than the soil can absorb, resulting in flooding or flash flooding.
- **Snowmelt:** Occurs when the major source of water involved is melting snow. The water runs off the already saturated ground into nearby streams or rivers, causing them to rapidly rise or overflow. Unlike rainfall that can reach the soil almost immediately, the snowpack can store the water for an extended amount of time until temperatures rise above freezing and the snow melts.
- **Ice or Debris Jams:** Common during the winter and spring months along rivers, streams, and creeks. As ice or debris moves downstream, it may get caught on obstructions to the water flow. When this occurs, water can be held back, causing upstream flooding. When the jam finally breaks, flash flooding can occur downstream.
- **Dam or levee failures:** Dams and levees can overtop, have excessive seepage, or have a structural failure, which result in flooding, and are covered in section 2.2.3.

According to the National Flood Insurance Program (NFIP), flash floods are the most common severe weather emergency in the United States (2016.) The NFIP also states that a flash flood is defined as “a rapid flooding of low-lying areas in less than six hours, which is caused by intense rainfall from a thunderstorm or several thunderstorms” (2016.) These storms are capable of dropping large amounts of rain within a brief period. Flash floods occur with little or no warning and can reach full peak in only a few minutes. Flash floods develop more quickly than river flooding and are harder to predict. Unlike river flooding, flash floods can occur in many places that river flooding does not. These areas are less prepared for flooding, leading to greater danger and potential for property damage. Flash flooding is usually a widespread event, as small creeks and streams overfill their banks and flood large areas of agricultural fields and rural roads.

Flooding that occurs in or near the urban areas is often attributed to failing storm sewers and poor drainage systems. Excessive amounts of paved areas or other impermeable surfaces upstream can increase the amount and rate of water runoff. Development affects the runoff of storm water and snowmelt. When rain falls in an undeveloped area, as much as 90 percent (90%) of it will infiltrate the ground; in a highly developed area, as much as 90% will run off.

The State of Ohio Rain/Snow Monitoring System (STORMS) is an automated rain gauge system that monitors an area's snow and rainfall to identify potential flooding. The system transmits real-time precipitation data to the State Emergency Operations Center (SEOC), the National Weather Service (NWS), and county emergency management agencies. Rain gauges are positioned near watersheds and report data 24 hours a day electronically to Columbus and are used by the NWS as a tool to issue flood and flash flood watches and warnings. Local governments are able to access the data through computer systems connected to the gauges. There is a rain gauge located at the Northeast Ohio Regional Airport (HZY) which is monitored by the Ashtabula County Emergency Management Agency (ACEMA).

In the fall of 2017, the Buffalo District of the U.S. Army Corps of Engineers (USACE), Silver Jackets program conducted three workshops on ice jam education and risk reduction measures in communities along Lake Erie. Ashtabula County was one of those communities. The workshop was an educational effort designed to provide participants information on characteristics and knowledge on ice jam flooding as well as training on the use of the ice jam database.

Location and Extent

Floods occur in every state in the U.S., and, according to NOAA's National Severe Storms Laboratory, kill more people each year than tornados, hurricanes, or lightning (NSSL, n.d.). Ashtabula County has a history of being vulnerable to flooding, largely due to the physical geography of the county, which includes 28 miles of Lake Erie shoreline on the north, two rivers (i.e., Ashtabula and Grand Rivers), and several creeks (i.e., Conneaut, East & West Branches of Ashtabula River, Gravel Run, Mill, Phelps, Plum, Pymatuning, Rock, Three Brothers) as well as varied topography. Additional flash flooding can occur due to inadequate storm drain capacity in municipalities not located near a river or stream.

Ashtabula County has four major drainage basins. The Ashtabula River, Conneaut River, Grand Creek Watershed, and Pymatuning River. The major streams that drain into the Ashtabula River are the East and West Branches. Larger streams that drain into the Grand River watershed include Mill, Rock, and Three Brothers Creeks. Shenango and Mosquito Creeks are the larger streams that drain into the Pymatuning River.

- The **Ashtabula River** lies in extreme northeast Ohio, flowing into Lake Erie's central basin at the City of Ashtabula. Its drainage basin covers an area of 137 square miles, with 8.9 square miles located in western Pennsylvania. Major tributaries include Fields Brook, Hubbard Run, and Ashtabula Creek. The City of Ashtabula is the only significant urban area in the watershed. The remaining portions of the drainage basin are predominantly rural and agricultural.


Ashtabula River

- The **Conneaut Watershed** is in northeast Ashtabula County; it begins as a creek in Conneaut from Lake Erie and turns into a river as it flows eastward into Pennsylvania. It consists of 195 square miles.


Conneaut Creek

- The **Grand River Watershed** starts in southeastern Geauga County and flows through Trumbull and Ashtabula Counties before circling back around into Lake County to drain into Lake Erie near Fairport Harbor. The watershed occupies the western half of Ashtabula County. It is 98 miles long and drains 712 square miles.


Grand River

- The **Pymatuning / Shenango Watershed** consists of 1,065 square miles in Trumbull and Ashtabula Counties in Ohio and in Mercer, Lawrence, and Crawford Counties in Pennsylvania. In Ashtabula County, Pymatuning Creek begins west of Andover and flows south to Pymatuning Reservoir, where it joins the Shenango River.


Pymatuning Creek

The following table (Table 2.2.6.1) illustrates the major watersheds that have the potential to cause flooding in particular jurisdictions of Ashtabula County. The map that follows illustrates the flood risk areas of the county (for municipal flood risk maps see Appendix 5).

Table 2.2.6.1

Municipalities	Municipalities within Proximity of Major Watersheds					
	Ashtabula River	*Conneaut Creek*	*Grand River*	*Lake Erie*	*Pymatuning Creek*	*Rock Creek*
Ashtabula City	✓			✓		
Conneaut City		✓		✓		
Andover Village					✓	
GOTL Village				✓		
Harpersfield Twp			✓			
North Kingsville Village				✓		
Roaming Shores Village						✓
Rock Creek Village						✓

Floodway

Coastal Floodplain

1% Annual Chance

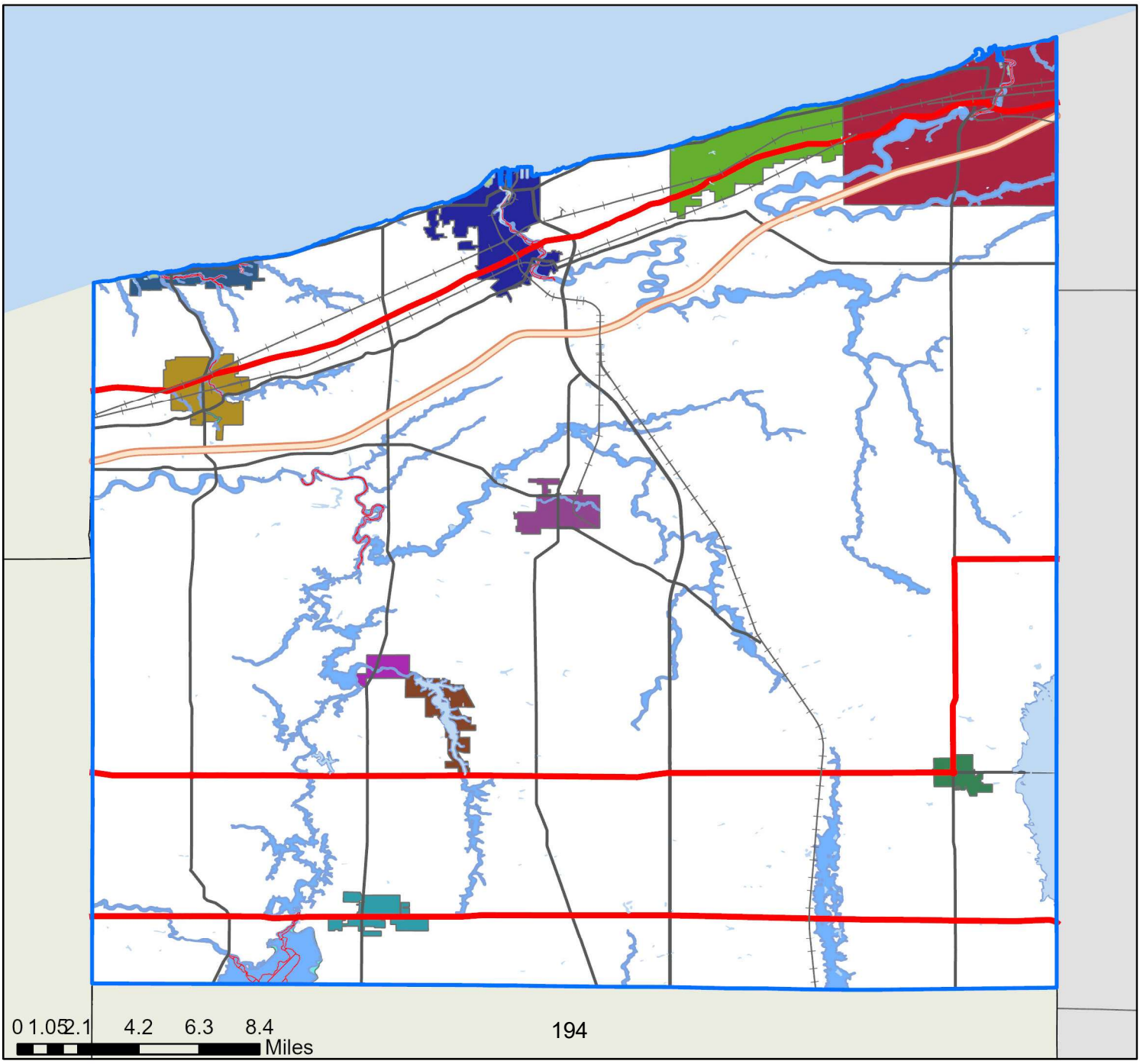
0.2% Annual Chance (incl. Coastal Areas)

ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.6.1: Risk Areas (SFHAs)

Data Source(s):
FEMA NFIP

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.



Floods are described by their horizontal extents, the depth of the floodwaters and the probability of occurrence. According to FEMA and the Ohio Committee for Severe Weather Awareness, floods are among the most frequent and costly disasters. Historically, floods were referred to as a function of time (i.e., a "100-year" flood). A more accurate description would be that a "100-year" flood is one that has a 1% chance of occurring in a year, a 50-year flood is one that has a 2% chance of occurrence in a year, a 500-year flood has a 0.2% chance of occurrence in any year.

Flooding can be exacerbated by the presence of impermeable surfaces due to buildings and pavement or lack of appropriately sized flood water detention basins. Any development within floodplains can impact the direction, flow, and level of the watercourse during periods of high water. If fill material is placed, or a house is constructed in a floodplain, it will alter the boundaries of the floodplain downstream of that area. Not only does development in the floodplain increase dangers downstream, developments within the floodplain are at higher risk of damage due to flooding. This damage includes fill material and debris from destroyed structures upstream colliding with structures in the floodplain downstream of an affected area. Many bridges are washed out in floods because river borne debris obstruct their free-flow area.

The National Flood Insurance Program (NFIP) has identified a subset of structures covered by flood insurance policies that are referred to as "repetitive loss" and "severe repetitive loss" properties.

Table 2.2.6.2 lists the criteria for classification as a repetitive loss or severe repetitive loss property as defined by both the Flood Mitigation Assistance (FMA) Grant and the NFIP.

Table 2.2.6.2

Repetitive Loss and Severe Repetitive Loss Definitions		
Program	*Repetitive Loss*	*Severe Repetitive Loss*
Flood Mitigation Assistance (FMA) Grant	*A Repetitive Loss (RL) property is a structure covered by a contract for flood insurance made available under the NFIP that:* Has incurred flood-related damage on 2 occasions, in which the cost of the repair, on the average, equaled or exceeded 25% of the market value of the time of each such flood event; At the time of the second incidence of flood-related damage, the contract for flood insurance contains increased cost of compliance coverage.	(a) Is covered under a contract for flood insurance made available under the NFIP; and (b) Has incurred flood-related damage i. For which 4 or more separate claims payments (includes building and contents) have been made under flood insurance coverage with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claim's payments exceeding $20,000, or ii. For which at least 2 separate claims payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure.

Repetitive Loss and Severe Repetitive Loss Definitions		
Program	*Repetitive Loss*	*Severe Repetitive Loss*
National Flood Insurance Program (NFIP)	A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978.	A single family property (consisting of 1 to 4 residences) that is covered under flood insurance by the NFIP and has incurred flood-related damage for which 4 or more separate claims payments have been paid under flood insurance coverage, with the amount of each claim payment exceeding $5,000 and with cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made with the cumulative amount of such claims exceeding the reported value of the property.

Source: FEMA, National Flood Insurance Program (NFIP)

Repetitive Loss Properties

Within Ashtabula County and its municipalities there are 13 unmitigated Repetitive Loss (RL) structures, and two Severe Repetitive Loss (SRL) structures, these structures combined have experienced 50 total losses. The majority of these structures are located outside of municipal boundaries, and all are classified as single family residential units. The cities of Conneaut and Geneva, as well as the Village of Jefferson each have one repetitive loss single family residential structure that is unmitigated. These structures combined have experienced eight total losses. Total payouts regarding losses incurred by these 15 RL/SRL structures to date is $885,098, see Table 2.2.6.3 below.

Table 2.2.6.3

Ashtabula County Unmitigated Repetitive Loss & Severe Repetitive Structures					
Community Name (Jurisdiction)	*Occupancy Type*	*Total RL/SRL Structures*	*RL Structures*	*SRL Structures*	*Total Losses*
Ashtabula County	Single Family	12	10	2	42
Conneaut City	Single Family	1	1	0	2
Geneva City	Single Family	1	1	0	2
Jefferson Village	Single Family	1	1	0	4
	Countywide Total	15	13	2	50

Source: Ohio Emergency Management Agency

Table 2.2.6.4 indicates the incorporated jurisdictions that are in compliance with state floodplain management standards and participate in the National Floodplain Insurance Program (NFIP), and the date in which they entered the program. Ashtabula County has been participating in the NFIP since March 3, 1978. The Villages of Andover and Orwell are not listed in FEMA's NFIP Community Status Book. Ashtabula County and participating jurisdictions have adopted and implemented floodplain management requirements, including regulating all and substantially improved construction in Special Flood Hazard Areas (SFHAs), and will continue to enforce regulations in the future.

Table 2.2.6.4

NFIP Enrollment			
Jurisdiction	*CID*	*Enrollment Date*	*Current Effective Map Date*
Ashtabula County	390010B	3/3/78	8/28/19
Ashtabula City	390011B	12/28/73	8/28/19
Conneaut City	390012B	5/3/74	8/28/19
Geneva City	390013#	11/23/73	12/18/07
GOTL Village	390658B	4/5/74	8/28/19
Jefferson Village	390014#	8/8/75	12/18/07
North Kingsville Village	390889B	--	8/28/19
Roaming Shores Village	390885#	--	12/18/07(M)
Rock Creek Village	390665#	4/5/74	12/18/07(M)

Source: FEMA NFIP Community Status Book Report
(M) – No Elevation Determined – All Zone A, C and X

Each jurisdiction has designated a floodplain administrator to serve as NFIP Coordinator. The floodplain administrators routinely monitors and maintains the jurisdiction's floodplain area and ordinance to ensure that development is compliant with that ordinance (and, consequently, the NFIP). Table 2.2.6.5 below identifies the designated floodplain administrators or local contacts for each jurisdiction of Ashtabula County.

Table 2.2.6.5

Designated Floodplain Administrators / Local Contacts – Ashtabula County				
Jurisdiction	*Point of Contact*	*Agency*	*Address*	*Phone*
Ashtabula County	Dave Strichko, Chief Building Official	County Building Department	25 W. Jefferson Street Jefferson, OH 44047	440.576.3742
Ashtabula City	Shawn Gruber, Fire Chief	Ashtabula City	4325 Main Avenue Ashtabula, OH 44004	440.992.7190
Conneaut City	Jennifer Hoover Planning & Zoning Manager	Conneaut Planning & Zoning	294 Main Street Conneaut, OH 44030	440.593.7406
Geneva City	Noell Siversten, Zoning Administrator	Geneva Zoning Department	44 North Forest Street Geneva, OH 44041	440.466.4675
Andover Village	Rich Mead, Village Administrator	Andover Village	134 Maple Street Andover, OH 44003	440.293.4747
GOTL Village	Jeremy Shaffer, Village Administrator	GOTL Village	4929 S. Warner Drive GOTL, OH 44041	440.466.8197
Jefferson Village	Terry Finger, Village Administrator	Jefferson Village	27 E. Jefferson Street Jefferson, OH 44047	440.576.3941
North Kingsville Village	Timothy Zee, Mayor	North Kingsville Village	P.O. Box 253 N. Kingsville, OH 44068	440.224.0091
Orwell Village	Tami Pentek, Village Manager	Orwell Village	179 West Main Street Orwell, OH 44076	440.437.6450
Roaming Shores Village	Mark Reed II, Village Administrator	Roaming Shores Village	2500 Hayford Road Roaming Shores, OH 44084	440.983.8095
Rock Creek Village	David Caskey, Zoning Inspector	Zoning Department	P.O. Box 92 Rock Creek, OH 44084	440.862.5415

Impacts and Vulnerability

Floods are one of the costliest disasters in the United States. Just one inch of water in a home can cause up to $25,000 in damages. Hazards associated with flooding can be divided into primary hazards that occur due to contact with water; cascading or secondary effects that occur because of the flooding, such as disruption of services and health impacts; and long-term or tertiary effects, such as changes in the position of river channels. Table 2.2.6.6 describes the types of effects of flooding.

Table 2.2.6.6

Effects of Flooding	
Type	*Description*
Primary Effects	• With higher velocities, streams are able to transport larger particles as suspended load. Such large particles include not only rocks and sediment, but, during a flood, such large objects as automobiles, houses, and bridges. • Massive amounts of erosion can be accomplished by floodwaters. Such erosion can undermine bridge structures, levees, and buildings, causing their collapse. • Water entering human-built structures causes damage. Even with minor flooding of homes, furniture is ruined, floors and walls are damaged, and anything that comes in contact with the water is likely to be damaged or lost. Flooding of automobiles usually results in damage that cannot easily be repaired. • The higher velocity of floodwaters allows the water to carry more sediment as suspended load. When the floodwaters retreat, velocity is generally much lower and sediment is deposited. After retreat of the floodwaters, everything is usually covered with a thick layer of stream-deposited mud, including the interior of buildings. • Flooding of farmland usually results in crop loss. Livestock, pets, and other animals are often carried away and drowned. • Humans that get caught in high velocity floodwaters are often drowned. • Floodwaters can concentrate garbage, debris, and toxic pollutants into small areas that can cause the secondary effects of health hazards.
Cascading or Secondary Effects	• Disruption of Services o Drinking water supplies may become polluted, especially if sewerage treatment plants are flooded. o Gas and electrical service may be disrupted. o Transportation systems may be disrupted, resulting in shortages of food and cleanup supplies.
Long-Term or Tertiary Effects	• Location of river channels may change as the result of flooding; new channels develop, leaving the old channels dry. • Sediment deposited by flooding may destroy farmland (although silt deposited by floodwaters could also help to increase agricultural productivity). • Jobs may be lost due to the disruption of services, destruction of business, etc. (although jobs may be gained in the construction industry to help rebuild or repair flood damage). • Destruction of wildlife habitat.

In addition to property and structure damage, flood waters pose a risk to human health. Floodwaters can contain downed power lines, human and livestock waste, household, medical, and industrial waste and debris, wild or stray animals, and other contaminants that can cause illnesses (CDC, 2018).

Flash floods are considered the most dangerous type of floods. Flash flood waters are fast-moving and can destroy buildings and bridges and scour new channels. Occasionally debris floating in flash-floodwater accumulates at natural or man-made obstructions and restricts the flow of water. This obstruction causes upstream flooding, and subsequent downstream flooding if the obstruction is suddenly released.

Some areas are at a higher risk for flooding than others. For example, densely populated areas are at a high risk for flash floods. Construction in these areas increases runoff by reducing

the amount of rain absorbed by the ground. In these areas, heavy rain can overwhelm storm drain systems, or drains can become plugged by debris, both of which contribute to flooding. Flood hazards are dynamic and change over time because of development, land use changes, and other variables.

Flooding impacts to a community include injuries and potentially fatalities to citizens and public safety officials, damage to property, loss revenue and economic damages, and increased demand on public safety and infrastructure related services. Response activities include unanticipated overtime for Emergency Operations Center (EOC) activations, evacuations and sheltering of displaced individuals, rerouting traffic destined for impassible roads, bridge and road damage repairs, and rescue or medical missions related to motorists and isolated individuals. Private property damages to homes and vehicles as well as land erosion, river channel changes, agricultural damages, and livestock losses resulting in significant rural economic impacts to local residents.

Areas near rivers are also at an increased risk for flooding. Excessive rain, ice jams, snowmelt, and runoff can all increase the water levels of a river or stream. The Conneaut Creek, Ashtabula and Grand Rivers as well as their tributaries have the potential to cause flooding in Ashtabula County. The following map depicts the location of creeks and streams throughout the county.

Rivers & Streams

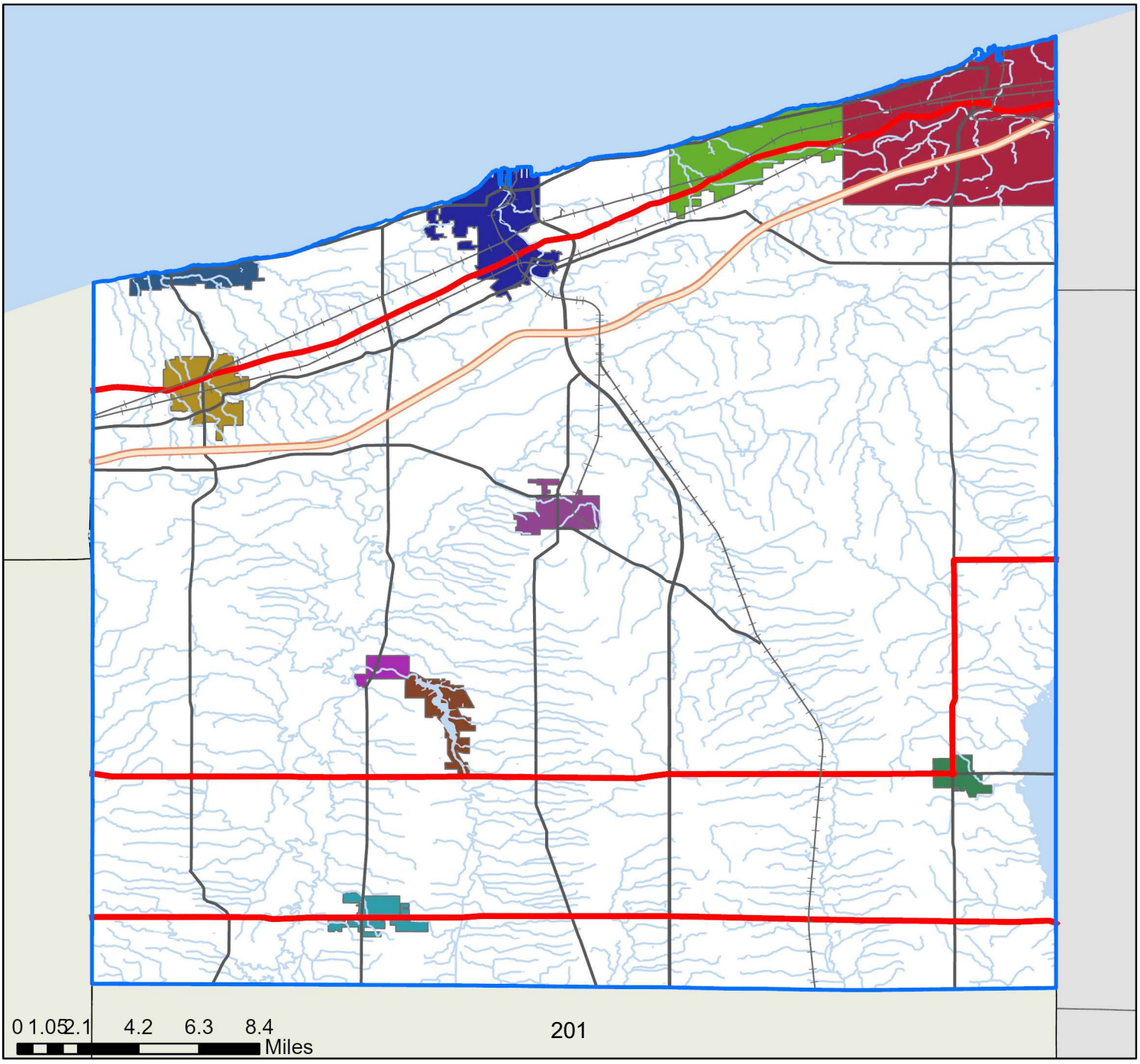
Area Water (Lakes)

ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.6.2: Rivers & Streams

Data Source(s):
U.S. Census (Tiger Data)

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.



Historical Occurrences

Ashtabula County has a long history of flooding and has suffered damage from numerous major flooding events. The county has received 12 flood / flash flood disaster declarations resulting in over $42.3 million in property damages in the past 55 years.

Flooding events are listed in the National Oceanic and Atmospheric Administration's (NOAAs) National Centers for Environmental Information's (NCEIs) Storm Events Database, which maintains records of flooding events in Ashtabula County since 1996. The following table (Table 2.2.6.7) presents the 11 reported floods in Ashtabula County since 1996 creating an average of 0.39 floods per year. These floods have resulted in approximately $16.8 million in reported property damage. As can be seen, the months with the most reported floods are January, February, June, and July with two flooding events each. Two of the flooding events were the result of coastal flooding along the Lake Erie shoreline.

Table 2.2.6.7

Historical Flooding Ashtabula County					
Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
Countywide	1/18/1996	0	0	$30,000	$0
Countywide	6/1/1997	0	0	$300,000	$0
Countywide	6/12/2003	0	0	$600,000	$0
Countywide	7/23/2003	0	0	$75,000	$0
Countywide	1/1/2005	0	0	$250,000	$0
Countywide	8/30/2005	0	0	$75,000	$0
Conneaut	2/28/2011	0	0	$300,000	$0
Lakeshore Zone	4/14/2019	0	0	$85,000	$0
Lakeshore Zone	7/7/2019	0	0	$100,000	$0
Sullivan	2/1/2020	0	0	$10,000,000	$0
Conneaut Harbor	3/1/2020	0	0	$5,000,000	$0
	TOTALS	**0**	**0**	**$16,815,000**	**$0**

Source: NCEI Storm Event Database

The NCEI Storm Events Database also maintains records of flash flood events that have occurred in Ashtabula County. Since 1996, there have been 33 flash flood events, for an average of 1.18 flash floods per year. These flash floods have resulted in approximately $25.4 million in property damage, and $1 million in crop damage. The months of May, June, and July had the most flash floods reported. Table 2.2.6.8 below describes these events.

Table 2.2.6.8

Historical Flash Flooding Ashtabula County					
Location	*Date*	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
Countywide	4/23/1996	0	0	$5,000	$0
Jefferson Village	5/10/1996	0	0	$0	$0
Andover Village	6/7/1996	0	0	$10,000	$0
Austinburg	6/12/1996	0	0	$0	$0
Northwest Portion	6/19/1996	0	0	$10,000	$0
Countywide	5/18/1997	0	0	$50,000	$0
Andover Village	6/25/1997	0	0	$50,000	$0
Countywide	1/7/1998	0	0	$0	$0
Countywide	1/9/1998	0	0	$0	$0
Conneaut	8/10/1998	0	0	$50,000	$0
Kingsville Village	1/23/1999	0	0	$75,000	$0
Countywide	8/2/2000	0	0	$0	$0
Countywide	9/15/2002	0	0	$50,000	$0
South Portion	7/21/2003	0	0	$500,000	$0
Countywide	5/21/2004	0	0	$750,000	$0
Countywide	5/23/2004	0	0	$100,000	$0
South Portion	6/9/2004	0	0	$150,000	$0
Countywide	8/28/2004	0	0	$200,000	$0
Countywide	9/8/2004	0	0	$800,000	$0
South Portion	6/28/2005	0	0	$50,000	$0
North Portion	7/22/2006	0	0	$7,500,000	$0
Countywide	7/27/2006	0	0	$400,000	$0
Countywide	7/28/2006	0	0	$12,800,000	$1,000,000
Southwest Portion	7/31/2006	0	0	$150,000	$0
Austinburg	7/8/2008	0	0	$150,000	$0
Conneaut	7/22/2008	0	0	$500,000	$0
Clark Corners	5/31/2010	0	0	$100,000	$0
New Lyme	5/13/2011	0	0	$30,000	$0
Geneva City	5/14/2011	0	0	$0	$0
Conneaut Harbor	6/27/2013	0	0	$400,000	$0
Geneva City	5/21/2014	0	0	$150,000	$0
Ashtabula City	7/29/2021	0	0	$100,000	$0
Ashtabula City & N. Kingsville	6/26/2024	0	0	$300,000	$0
TOTALS		**0**	**0**	**$25,430,000**	**$1,000,000**

Source: NCEI Storm Event Database

Countywide Flash Flood – July 28, 2006

A second round of thunderstorms moved across Ashtabula County during the early morning hours of July 28 with rainfall rates exceeding two inches per hour at times. Rainfall totals from late afternoon on July 27 through the early morning of July 28 included 5.88 inches in Trumbull Township, 4.30 inches in Geneva, 3.45 inches at New Lyme, and 3.33 inches at Jefferson.

Widespread flooding occurred as runoff from this rain entered area streams and rivers. Coffee Creek flooded in Austinburg and caused extensive damage, destroying at least five homes in the township and causing severe damage to another 20. Three homes in Jefferson had water on ground floors after a small creek left its banks. Floodwaters on Hillyer Drive were reportedly over three feet deep. At least nine homes in the Geneva area sustained major damage after Cowles Creek left its banks. Several families in the area had to be evacuated.

Many roads including State Routes 45, 307 and 46 as well as U.S. Route 20 had to be closed. In Harpersfield Township, Bronson Creek washed out Cold Springs Road. At least four roads were washed out elsewhere in the county, and there were multiple road closures reported in Trumbull, Geneva, Saybrook, Morgan, Austinburg, and Monroe Townships. Around 40 homes in the county suffered major damage with dozens more sustaining lesser damages. Most of these were in Jefferson, Austinburg, and Geneva Townships. Damage to roads, bridges, culverts, and other public infrastructure from the flash flooding events of July 22 and 28 totaled nearly $2 million. This event resulted in approximately $12.8 million in reported property damage and another $1 million in crop damage.

Countywide Flooding – August 1, 2006 (DR-1656-OH)

Two separate weather systems produced storms resulting in more than 11 inches of rain in parts of northeastern Ohio on July 27th and 28th, 2006. As a result of the storms and ensuing flooding, the counties of Lake, Geauga, and Ashtabula were declared Federal Disaster Areas. The flooding caused one fatality and 600 evacuations. The USGS streamflow-gaging station at the Grand River near Painesville, Ohio had record peak stream flow and peak stage. The recurrence interval for this event was estimated to be 500 years (Ebner, A.D.; Sherwood, J.M.; Astifan, Brian; and Lombardy, Kirk, 2007, Flood of July 27-31, 2006, on the Grand River near Painesville, Ohio: U.S. Geological Survey Open-File Report 2007-1164).

Hurricane Sandy Remnants – January 3, 2013 (DR-4098-OH)

Hurricane Sandy brought heavy rainfall and significant flooding to northern portions of Ohio on October 29th and 30th, 2012. The flooding was the result of three consecutive weather events; a cold front, hurricane Sandy remnants, and lake enhanced showers. Rain started on October 26th as a slow-moving cold front moved into the Ohio Valley. This front brought widespread 0.75 to 2.0 inches of rainfall to northern Ohio, highest near the lake. Moisture from Sandy moved into the region producing an additional rainfall of 2 to 3 inches by Tuesday the 30th.

In Ashtabula County, docks were damaged at the Port of Ashtabula due to severe wind and violent wave actions on Lake Erie, and marinas had to be dredged at the Conneaut Port Authority. A flood watch was in effect for the lakefront counties and flood advisories were issued during the event. A few dozen homes and businesses were impacted as water inundated basements or first floors. A number of homes affected were located in the floodplain of the rivers or along the shoreline where the raised lake level combined with the increased stream flows to produce flooding in areas not typically affected. Many basements flooded further inland as sump pumps failed due to power outages. As the result of Hurricane Sandy, an estimated $17.8 Million in public assistance funds had been awarded.

Lakeshore Coastal Flooding – April 14, 2019

A meteotsunami edge wave affected Lake Erie on the evening of April 14, 2019, causing damage along the shoreline and flooding of homes from Madison Township to Conneaut. Eyewitnesses reported a series of three waves that moved onshore and were approximately 10 to 12 feet high. Debris lines on the shore confirmed the estimated wave heights.

Geneva-on-the-Lake State Park marina sustained considerable damage to their docks inside of the well protected marina, reported damage to a marina in Conneaut was similar. Water levels rose four feet causing damage to the docks. The entire event lasted about 10 minutes and resulted in approximately $85,000 in property damage.

Lakeshore Flooding – February 1, 2020

Record Lake Erie water levels for February resulted in continued and exasperated lakeshore flooding and erosion. Lake Erie continued its seasonal rise in February, rising four inches from January to February to a level of 574 feet. This level was a new record high monthly mean water level for February, surpassing its previous record set in 1987 by five inches. In addition to these wind driven events, weakened shorelines showed signs of collapse and erosion throughout the month.

Erosion was made worse by the lack of ice over the winter. Lake Erie reported only 0.4 percent of ice coverage compared to the average of 67 percent in mid-February. The lack of ice

supported increased wave runup, eroding away cliffs, washing out beaches, and damaging shoreline infrastructure. Of note, in Geneva-on- the- Lake, the Geneva Township Park lost 45 feet of land between the 3rd and 13th of the month. About 600 feet of the park's 916 feet of lakefront was affected. This event resulted in approximately $10,000,000 in reported property damage.

Loss and Damages

Information obtained from FEMA's National Risk Index (NRI) was utilized to assess flooding impacts for each participating jurisdiction.

Table 2.2.6.9

Ashtabula County Flooding NRI Exposure / Expected Annual Loss Estimates							
Census Tract	*Exposure (Buildings)*	*Exposure (Pop)*	*Exposure (Ag)*	*EAL (Buildings)*	*EAL (Pop Equivalence)*	*EAL (Ag)*	*EAL (Total)*
39007000101	$9,494,534	21	$5,171	$43,842	$3,611	$101	$47,554
39007000102	$1,113,720	0	$0	$5,143	$42	$0	$5,185
39007000103	$1,921,255	12	$0	$8,872	$2,147	$0	$11,019
39007000200	$3,401,967	24	$7,886	$15,709	$4,087	$154	$19,950
39007000300	$2,969,211	7	$1,380	$13,711	$1,256	$27	$14,993
39007000400	$6,752,790	2	$0	$31,182	$388	$0	$31,570
39007000500	$2,218,350	11	$0	$10,244	$1,882	$0	$12,126
39007000601	$3,897,118	1	$0	$17,995	$96	$0	$18,091
39007000602	$735,240	2	$0	$3,395	$328	$0	$3,723
39007000603	$1,137,180	7	$1,500	$5,251	$1,196	$29	$6,477
39007000701	$973,729	2	$0	$4,496	$285	$0	$4,781
39007000702	$1,582,321	9	$15,794	$7,307	$1,572	$308	$9,186
39007000703	$0	0	$0	$0	$0	$0	$0
39007000704	$2,099,296	12	$316	$9,694	$2,091	$6	$11,791
39007000801	$12,692,001	44	$1,218	$58,607	$7,504	$24	$66,135
39007000802	$14,429,309	74	$474	$66,629	$12,726	$9	$79,365
39007000900	$19,433,222	116	$2,112	$89,735	$19,927	$41	$109,704
39007001001	$16,331,873	47	$36,773	$75,414	$8,144	$716	$84,274
39007001002	$15,050,649	68	$35,302	$69,498	$11,718	$688	$81,903
39007001101	$1,184,004	9	$25,077	$5,467	$1,602	$488	$7,558
39007001102	$8,874,243	53	$82,516	$40,978	$9,127	$1,607	$51,713
39007001201	$6,113,963	46	$42,441	$28,232	$7,883	$827	$36,942
39007001202	$8,847,538	58	$98,771	$40,855	$9,964	$1,924	$52,742
39007001301	$1,433,569	3	$202,809	$6,620	$542	$3,951	$11,112
39007001303	$3,516,484	26	$110,348	$16,238	$4,481	$2,149	$22,868
39007001304	$10,784	0	$67	$50	$10	$1	$61
39007001401	$8,693,168	76	$113,891	$40,142	$13,122	$2,218	$55,483
39007001402	$1,939,525	23	$33,226	$8,956	$4,026	$647	$13,629
Grant Total	**$156,847,041**	**753**	**$817,071**	**$724,260**	**$129,758**	**$15,916**	**$869,934**

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Table 2.2.6.10

Ashtabula County Coastal Flooding NRI Exposure / Expected Annual Loss Estimates				
Census Tract	*Exposure (Population)*	*EAL (Buildings)*	*EAL (Pop Equivalence)*	*EAL (Total)*
39007000101	24	$2,081	$7	$2,088
39007000102	1	$308	$0	$308
39007000103	12	$388	$3	$392
39007000200	24	$688	$7	$694
39007000300	7	$600	$2	$602
39007000400	3	$1,590	$1	$1,591
39007000500	0	$0	$0	$0
39007000601	1	$792	$0	$792
39007000602	3	$217	$1	$217
39007000603	8	$303	$2	$306
39007000701	0	$0	$0	$0
39007000702	0	$0	$0	$0
39007000703	0	$0	$0	$0
39007000704	0	$0	$0	$0
39007000801	52	$3,428	$13	$3,441
39007000802	0	$0	$0	$0
39007000900	145	$4,224	$34	$4,258
39007001001	0	$0	$0	$0
39007001002	0	$0	$0	$0
39007001101	0	$0	$0	$0
39007001102	0	$0	$0	$0
39007001201	0	$0	$0	$0
39007001202	0	$0	$0	$0
39007001301	0	$0	$0	$0
39007001303	0	$0	$0	$0
39007001304	0	$0	$0	$0
39007001401	0	$0	$0	$0
39007001402	0	$0	$0	$0
Grand Total	**280**	**$14,620**	**$69**	**$14,690**

Source: USDHS/FEMA – The National Risk Index, Version 1.19

Future Occurrences

Based on the frequency of previous occurrences, the probability of future flooding in Ashtabula County is highly likely. New urban development upslope of inadequate existing storm water facilities in older urban areas also exacerbates storm water runoff issues as these communities expand.

Floods can occur at any time but are most likely to occur between January and February as well as May through July. While this trend is expected to continue, intense severe storms at

various times in the year may result in floods at uncommon times. See Section 2.2.10: Severe Thunderstorm for a discussion of runoff flooding as a result of heavy downpours.

A recent project aimed at decreasing the future flooding risk in the Ashtabula Harbor involved the dredging and wetland habitat creation facilitated by the U.S. Army Corps of Engineers (USACE), Buffalo District. In May 2025, the USACE awarded a $1.5 million contract to conduct dredging of the federal navigation channel in Ashtabula Harbor. The dredged material will be used for a beneficial use project in Ashtabula's outer harbor, aiming to create up to 16.5 acres of new wetland habitat. This project not only improves navigation but also contributes to habitat creation and potentially enhances the area's natural flood resilience, according to the Great Lakes and Ohio River Division.

Risk Assessment

This section summarizes the vulnerability of Ashtabula County to flooding. 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 flooding.

Table 2.2.6.11

Public Sentiment, Flooding					
	Level of Concern				*Total Responses*
Hazard	*Not at All*	*Somewhat*	*Concerned*	*Very*	
FLOODING	24 (16.22%)	57 (38.51%)	54 (36.49%)	13 (8.78%)	148
In the past five years, do you remember this hazard occurring in your community?				64 (43.24%)	148
Have you noticed an increase in the occurrences or intensity of this hazard?				60 (40.54%)	148
Have you noticed a decrease in the occurrences or intensity of this hazard?				1 (0.68%)	148

Source: Online Public Survey Results

Table 2.2.6.12 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.

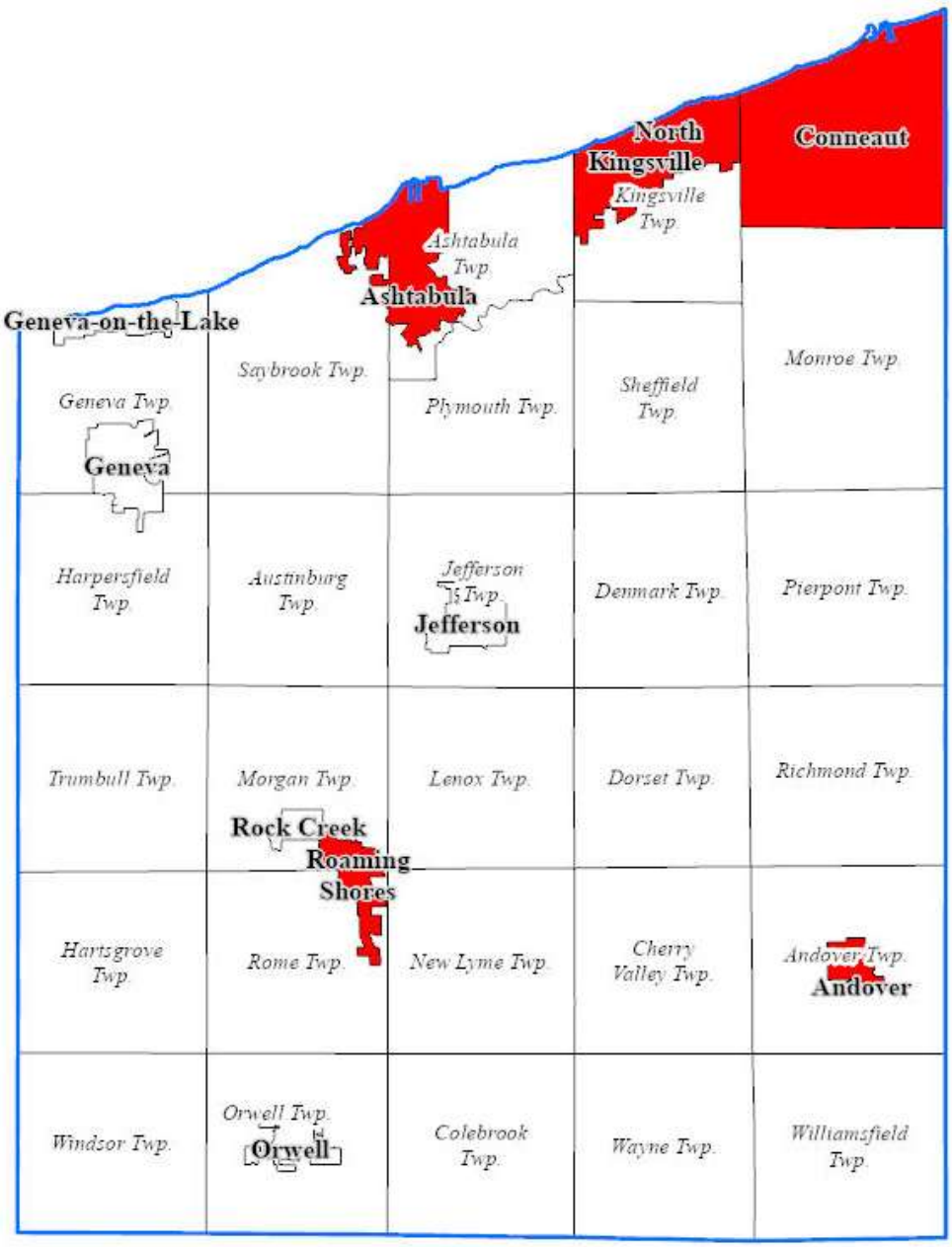
Table 2.2.6.12

Risk Ranking, Flooding			
Category	*Points*	*Description*	*Notes*
Frequency	5	Frequent (Will occur during a year)	Based on historical data, there have been 44 flood-related incidents in 28 years, for an average of 1.57 incidents per year.
Response	4	One month	The recovery following large-scale floods can take several weeks.
Onset	3	6-12 hours	The NWS typically issues flood watches and warnings within 12-24 hours; however, flash floods often have less lead time.
Magnitude	4	Catastrophic (50% land area affected)	Flooding is a site-specific hazard; though it may not impact a large area of land, it can devastate the areas it does impact.
Business	1	Less than 24 hours	The general economy of the county would likely resume operations within one day.
Human	3	Medium (Multiple severe injuries)	There have been no reported injuries or deaths related to flooding since 1996 (per the NCEI). However, flooding can cause injuries and fatalities.
Property	1	Less than 10% of property affected	Historical data depicts an average of $960,000 in property damage per incident since 1996 which is less than 10% of the property in Ashtabula County.
Totals	**21**	**HIGH**	

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 flooding. Those labels not underlaid by a shaded drop shadow are not more or less at risk of flooding. Those with red drop shadows are more at risk.

Figure 2.2.6.3

Flooding Multi-Jurisdictional Risk Map



2.2.7 Hazardous Materials Release

A chemical or biological material that may pose a threat to life, health, property, or the environment. For this profile, the hazardous materials incidents include only those that are not intentional.				
RISK HIGHEST HIGH MEDIUM LOW LOWEST	**Period of Occurrence:**	At any time	**Risk Ranking:**	Medium
	Warning Time:	None	**Type of Hazard:**	Technological
	Probability:	Frequent (Will occur during a year)	**Impact:**	Localized (less than 10% of land area affected)
	Disaster Declarations:	None		

Hazard Introduction and Overview

A hazardous material is a substance or material which, because of its chemical, physical, or biological nature, poses a threat to life, health, or property if released from a confined setting. A release may occur by spilling, leaking, emitting toxic vapors, or any other process that enables the material to escape its container, enter the environment, and create a potential hazard. Several common hazardous materials include those that are explosive, flammable, or combustible, poisonous or radioactive. Related combustible hazardous materials include oxidizers and reactive materials, while toxins produced by etiological (biological) agents are types of poison that can cause disease.

Through the possibility of a release is present at any time, a release while in transit is of great concern to the U. S. Department of Transportation (USDOT). While fixed sites store and use hazardous materials, the materials are usually produced elsewhere and shipped to a fixed facility by rail car, truck, or onboard ships or barges. Placards or other signage denoting the hazard material being shipped are placed on or in vehicles as required. Hazardous materials constantly move through Ohio on interstate highways, the rail system and on shipping lanes in rivers and Lake Erie.

The hauling, storage, and use of hazardous materials play a vital role in the economy of our nation. Over four billion tons of hazardous materials are transported annually, and 100,000 trucks haul hazardous materials on the country's highways each day. Almost half of all freight trains carry hazardous materials. Hazardous materials can release as a secondary result of a natural disaster like an earthquake or flood. In either case, buildings or vehicles can release their hazardous materials inventories when structurally compromised or involved in traffic accidents.

Location and Extent

Ohio is a crossroads state into which, through which, or out of which, virtually every one of the 50,000 chemicals known to be manufactured in the US are transported. There are approximately 2,500 hazardous materials shipments per day on the highways across Ohio.

Hazardous materials spills, leaks, or accidents can occur anywhere in Ashtabula County; however, they are more likely to happen on transportation pathways such as roads and railways, most often during the unloading phase of transport. Due to Ashtabula County's proximity to Lake Erie which is part of the Great Lakes-St. Lawrence Seaway, a major commercial shipping route, and the county's two deepwater ports, where commercial water transportation of commodities takes place, the lake and lakeshore are locations where hazardous materials incidents could occur, as well as at facilities that routinely handle hazardous materials such as gas stations, chemical companies, and other Tier II reporting or Toxic Release Inventory (TRI) facilities. The majority of the transportation infrastructure utilized to move hazardous materials through Ashtabula County is in the northern portion of the county, which is also the most populated area of the county. The Hazmat Risk Areas Map on the following page (Figure 2.2.7.1) graphically depicts buffers around the TRI facilities (1/2 mile), and along highways, railways and the deepwater ports (800 feet) where hazmat releases are most likely to occur in the county.

Ashtabula county hosts chemical manufacturing facilities that produce a range of chemicals for various industries. This includes specialty chemicals used in adhesives, coatings, and pharmaceuticals. These manufacturing processes may involve chemical synthesis, blending, and refining. The region also engages in plastics production, encompassing the manufacture of polymer materials used in diverse products. This includes plastic resins, compounds, and other raw materials produced through processes like extrusion, injection molding, or blow molding.

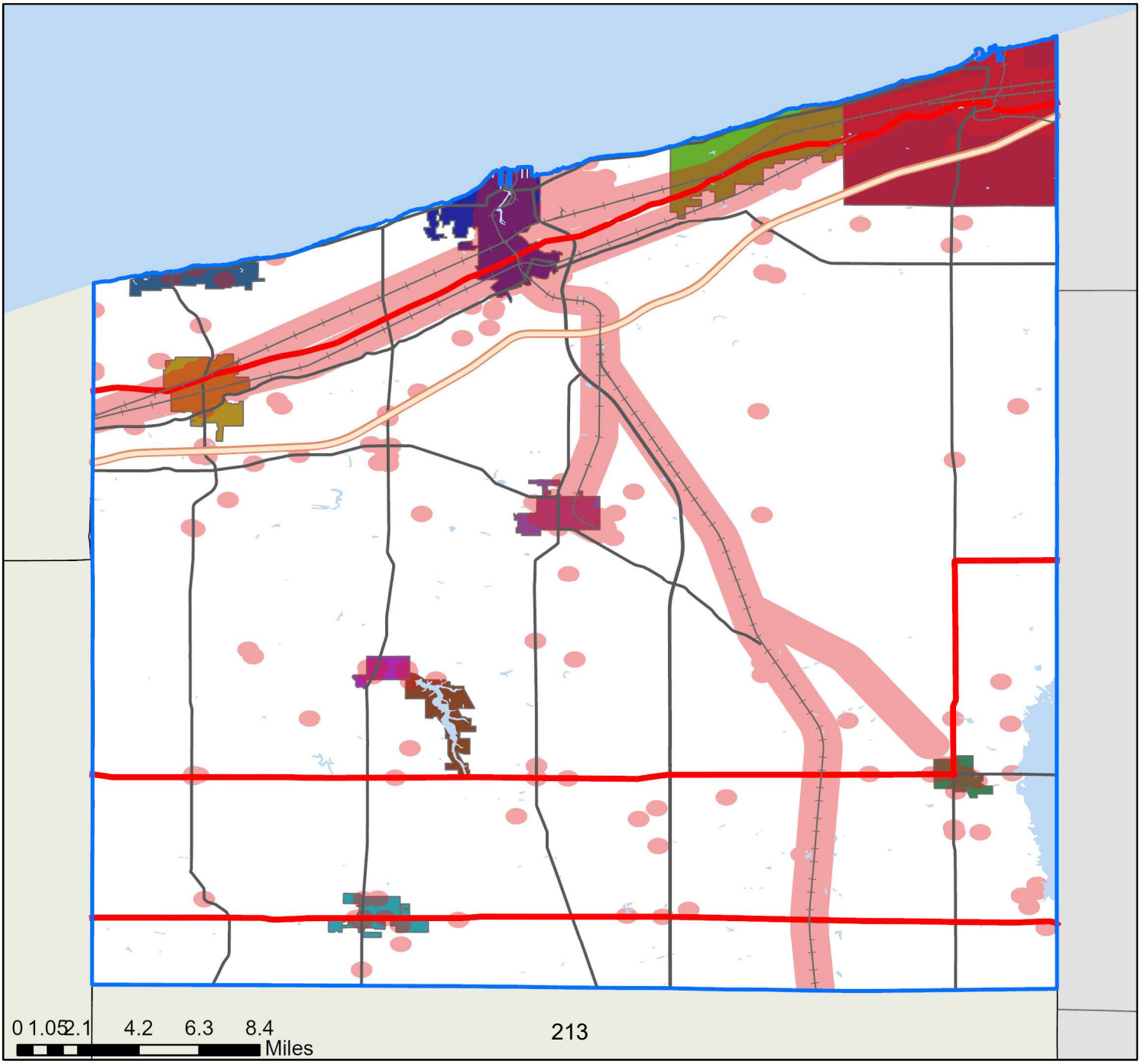
Hazmat Risk Areas

ASHTABULA COUNTY HAZARD MITIGATION PLAN

Figure 2.2.7.1: Risk Areas

Data Source(s):
USEPA ECHO,
U.S. Census (Tiger Data)

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.



Two major agencies collect data as they relate to hazardous materials incidents, the Pipeline and Hazardous Materials Safety Administration (PHMSA) governed by the U.S. Department of Transportation (DOT), and the National Response Center (NRC), governed by the U.S. Coast Guard (USCG). The types of materials that can cause a hazmat release are wide-ranging and may include chlorine, sodium hydroxide, sulfuric acid, radioactive isotopes, anhydrous ammonia, gasoline, and other hydrocarbons, as well as medical/biological waste from hospitals or clinics. Hazardous materials subject to reporting under the Emergency Planning and Community Right-to-Know Act (EPCRA) or Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) include these four groups:

- **Extremely Hazardous Substances (EHS)**: These are materials with acutely toxic properties that may do irreversible damage or cause death to people or harm the environment when released or used outside their intended use. Examples include ammonia, chlorine, and sulfuric acid.
- **Hazardous Substances:** These are any materials posing a threat to human health and the environment or any substance designated by the Environmental Protection Agency (EPA) to be reported if a designated quantity of the substance is spilled into the waters of the United States or otherwise released into the environment.
- **Hazardous Chemicals**: If present at a chemical facility in certain amounts, these substances require a Material Safety Data Sheet (MSDS) under the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard. Such substances are capable of producing fires and explosions or adverse health effects such as cancer, burns, or dermatitis.
- **Toxic Chemicals**: Chemicals or chemical categories that appear on the list because of their chronic or long-term toxicity.

During the 2025 update, planning committee members reported an increase in rail shipping activities. The railways serving Ashtabula County run north-south through the central portions of the county and east-west in the northern areas. There are gas transmission pipelines in the north-central and northeast portions of Ashtabula County (NPMS, 2019).

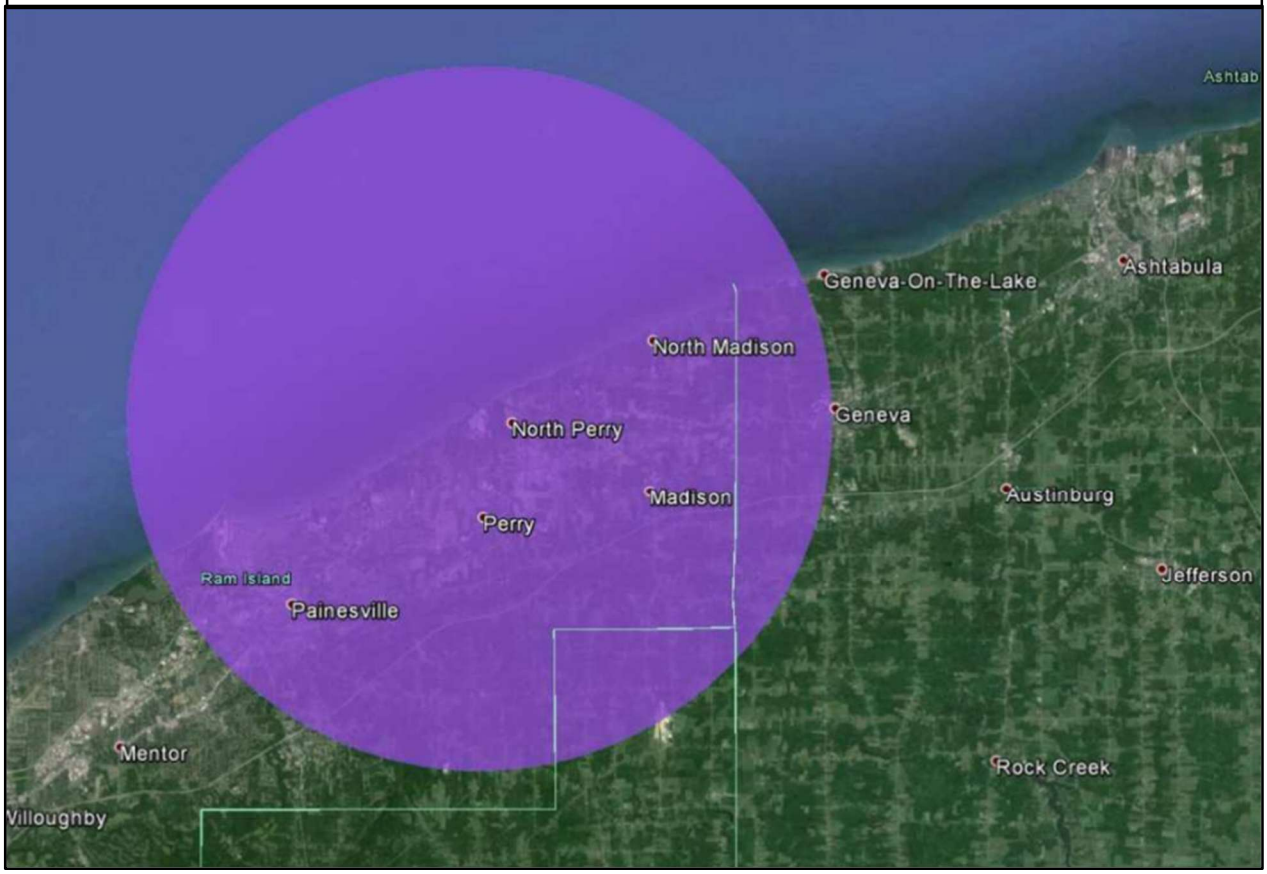
There are currently five brownfield sites (former industrial or commercial sites where future use is affected by real or perceived environmental contamination) in Ashtabula County, according to the Ohio Environmental Protection Agency's brownfield inventory database (n.d.). Two of the sites, the former New York Central Railroad on North Bend Road and "Plant C" on Lake Road East, are in Ashtabula. The other two are in Geneva: Advance Technology Corporation and

Tackle Hill, LLC at 193 North Cedar and Benson Gas Station on East Main Street; and in Conneaut, the former Astatic Corporation complex currently under remediation at the southeast quadrant of Broad Street (SR-7) and Jackson Street.

Portions of northwestern Ashtabula County including Harpersfield and Trumbull Townships are located within the 10-mile radius Emergency Planning Zone of the Perry Nuclear Power Plant located in the Village of Perry, in neighboring Lake County, OH. According to the Nuclear Regulaory Commission (NRC) areas within this 10-mile radius zone could be at risk of the inhalation of airborne radioactive contamination in the event of a release. The entirety of Ashtabula County is located within the 50-mile Potntial Contamiantion Zone that is concerned with the ingestion of food and liquid that could be contaminated by radioactivity.

Figure 2.2.7.2

Perry Nuclear Power Plant, 10-Mile Emergency Planning Zone



Impacts and Vulnerability

Due to the wide variety of substances used, transported, and stored in the area, it is difficult to assign an overall impact of these substances to public health, the environment, the economy, and infrastructure. An incident causing the accidental release of a hazardous material is spontaneous, with little time for warning, and they can occur rapidly. The chemical, physical, and biological properties of hazardous materials pose a potential risk to life, health, the environment, and property when not properly contained. Further, the recovery and clean-up activities involved in a hazmat incident may require several hours, days, or even weeks to complete and can cost thousands, if not millions of dollars to clean up.

The extent of the damage from a hazmat release can become widespread, to include hazardous materials reaching source water via storm drains, and the rivers and streams. Spills into waterways and those that reach the groundwater are of particular concern due to the threat they impose to drinking water and subsequently public health, the environment, and fauna in the area.

Additionally, transportation-based hazard incidents have the potential to result in cascading impacts. For example, a rail-based incident could isolate a community in Ashtabula County as well as several other communities in the region. Officials from such operators as CSX Transportation concur. In a recent interview, the company's hazmat manager out of Pittsburgh noted that a significant problem associated with rail incidents, particularly those involving hazardous materials, is that a stopped train can block several roadway intersections, essentially cutting some areas off. These blocks not only hinder evacuation from those areas but also emergency services access to those areas.

Many factors influence the impact of a potential incident, including quick and solid decision-making by emergency officials, location and type of release, evacuation and shelter-in-place needs, public health concerns, and relevant economic considerations. If evacuation is necessary, road closures and traffic jams may result. If a large-scale evacuation is deemed necessary, it can pose serious long-term economic consequences to the impacted area. A delay in the resumption of industry commerce may cause economic losses for both business owners and employees. Also, an evacuation ordered on short notice could cause serious problems for businesses requiring time to shut down specialized equipment. Public or private emergency response organizations may be challenged by the expenses dictated by a hazardous material release and may need to wait an uncomfortable length of time for the responsible party to reimburse any outstanding costs, further straining the economic resources of the impacted area.

A major incident involving significant injuries may severely tax regional medical services, as medical facilities are not generally designed to manage mass amounts of victims on short notice. Consequently, in the event of a major incident, hospitals and other medical facilities must still be able to provide their customary level of service to all patients, regardless of whether they were incident victims or not.

Historical Occurrences

The total approximate number of hazmat incidents occurring in Ashtabula County that were reported to the National Response Center (NRC) between 2020 and 2024 was 63. Of the 63 reported incidents, 18 occurred at fixed facilities, two were highway or mobile incidents, 23 were waterway incidents, 13 were rail incidents, and four involved pipelines. The source of information for these incidents is the National Response Center (NRC) (USGS, 2025). The following list outlines the findings.

- **Fixed Facilities**: The majority of the hazmat incidents at fixed facilities were due to equipment failure.
- **Highway:** According to PHMSA, there were four highway incidents involving the release of a hazardous material reported in Ashtabula County between 2019 and July of 2025.

Table 2.2.7.1

Highway Hazmat Incidents in Ashtabula County (2019-2025)						
Date	*City*	*Incident Route*	*Material Released*	*Cause of Failure*	*Quantity Released*	*Serious Indicator*
7/24/2019	Ashtabula	SR 11	Corrosive Liquid	Vehicular crash	5 gal	Yes
3/5/2021	Geneva	S. Broadway	Diesel Fuel	--	40 gal	No
9/14/2023	Ashtabula	I-90	Organic Peroxide	Improper preparation	2 gal	No
3/21/2025	Ashtabula	I-90	Elevated Temp. Liquid	Rollover accident	300 gal	Yes

Source: PHMSA, 2025

- **Waterway:** The most commonly reported cause of waterway hazmat incidents involved the vessel sinking, and equipment failure.
- **Rail:** According to PHMSA, there were three rail incidents involving the release of hazardous materials reported in Ashtabula County between 2019 and July of 2025.

Table 2.2.7.2

Railway Hazmat Incidents in Ashtabula County (2019-2025)						
Date	*City*	*Carrier*	*Material Released*	*Cause of Failure*	*Quantity Released*	*Serious Indicator*
5/26/2023	Ashtabula	CSXT	Methanol	Leaking tank car	5 gal	No
6/26/2024	Ashtabula	CSXT	Hydrochloric Acid	Improper preparation	2 gal	No
2/28/2025	Conneaut	NS	Pentanes	Loose closure	<1 gal	No

Source: PHMSA, 2025

Loss and Damages

The Pipeline and Hazardous Materials Safety Administration (PHMSA) provides loss data for some of the reported incidents. The Ashtabula County PHMSA data included 11 incidents with "damages" reported from 2016 to 2025. Those reported damages were $275,060, or an average of $25,005 per incident. Another perspective on these estimated losses would be an average of approximately $27,500 per year.

Data is also available nationally regarding loading/unloading incidents at fixed facilities. According to a report prepared for the Federal Motor Carrier Safety Administration, the average non-explosion loading/unloading incident results in losses of $5,000 (Battelle, 2001). Though it is difficult to extrapolate that figure to an annualized loss estimate, it provides a site-specific point of reference for future planning.

Future Occurrences

Predicting the exact probability of future hazardous materials incidents in Ashtabula County is complex and depends on several factors. Due to effective regulations, the number of hazardous materials incidents has decreased in recent decades nationwide according to FEMA. Despite the decrease in incidents, hazardous materials are integral to everyday life, and are involved in production, storage, transportation, and disposal of many products, thus, the risk of incidents, while potentially reduced, does remain.

Ashtabula County has a history of industrial activity, including chemical manufacturing and related industries which involves the handling and transportation of hazardous materials.

Risk Assessment

This section summarizes the vulnerability of Ashtabula County to hazardous materials releases. The county conducted an online survey for the public to share its thoughts on the hazards listed in this plan. Table 2.2.7.4 presents the results of that survey, specifically regarding hazardous materials releases.

Table 2.2.7.3

Public Sentiment, Hazardous Materials Release					
	Level of Concern				
Hazard	*Not at All*	*Somewhat*	*Concerned*	*Very*	*Total Responses*
HAZMAT RELEASE	24 (16.22%)	51 (34.46%)	45 (30.41%)	28 (18.92%)	148
In the past five years, do you remember this hazard occurring in your community?				22 (14.86%)	148
Have you noticed an increase in the occurrences or intensity of this hazard?				26 (17.57%)	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 2.2.7.4

Risk Ranking, Hazardous Materials Release			
Category	*Points*	*Description*	*Notes*
Frequency	5	Frequent (Will occur in a year)	A total of 63 hazmat incidents were reported to the National Response Center (NRC) between 2020 and 2024. This creates an average of 15.75 incidents per year.
Response	3	One week	The recovery and clean-up activities involved in a hazmat incident may require several hours, days, or even weeks to complete
Onset	5	None	Hazmat releases typically occur with no warning.
Magnitude	1	Localized (Less than 10% of land area affected)	Hazmat release are site-specific events and are highly localized.
Business	1	Less than 24 hours	Historical hazmat releases in Ashtabula County have rarely disrupted businesses for longer than 24 hours.
Human	3	Medium (Multiple severe injuries)	There is a potential for multiple severe injuries and illness to result from a hazmat release.
Property	1	Less than 10% of property affected	Hazmat releases are site-specific events and are likely to impact substantially less than 10% of the county.
Totals	**19**	**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 identifies those multi-jurisdictional risks concerning hazardous materials releases. 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 2.2.7.3

Hazardous Materials Release Multi-Jurisdictional Risk Map