2.0 RISK ASSESSMENT

A risk assessment analyzes "the potential for damage, loss, or other impacts created by the interaction of hazards with community assets" (FEMA, 2013). This risk assessment section contains information on identified hazards that threaten Ashtabula County and the surrounding region and the vulnerability of the area as it relates to the county's assets.

2.0 RISK ASSESSMENT

2.1 Hazards Identification

§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 its second meeting discussing the hazards it wished to include in the plan. The majority of this discussion focused on the hazard list from previous versions of the mitigation plan. Committee members felt that some hazard considerations needed broadened, such as dam failure and wildfire (changed to “dam and levee failure” and “fires” respectively). Previous versions of the plan presented a single list of hazards. The committee decided to categorize hazards under three headings for this update: natural, technological, and intentional human-caused.

Additionally, during the committee’s third meeting, members reviewed results of an online public survey disseminated as part of this project. That survey asked the general public numerous questions, one of which dealt with hazards with which the public was concerned or had recently experienced. Many survey respondents reported health-related emergencies such as epidemic and pandemic. Committee members noted news reports documenting spikes in reportable diseases across the country. As a result of this discussion, the committee added “health-related emergencies” as a natural hazard in this update.

The following table lists the hazards considered by the remainder of this risk assessment.

HAZARDS IDENTIFICATION	
Hazard	*Description*
Natural Hazards	
Coastal Erosion	Existing. To briefly include lake surge and seiche waves.
Drought	Existing. To include meteorological, agricultural, hydrological, and socioeconomic droughts.
Earthquake	Existing.
Flood	Existing. To include flash flooding.
Health-Related Emergencies	New. Added based on public survey results and news reports of spikes in reportable diseases nationwide.
Severe Thunderstorms	Existing. To include hail events.
Severe Wind and Tornado	Existing.
Severe Winter Storms	Existing. To include blizzards, ice storms, and heavy snow.

2.0 RISK ASSESSMENT

2.2 Complicating Variables

Direct, calculable consequences of disasters can include fatalities, injuries, and damages to humans, animals, or property. However, disasters do not end there; there are several indirect effects, tangible and intangible, associated with disasters. Some examples of these include loss of livelihood and income, loss of community and population, mental and psychosocial impacts, costs of rebuilding, repair or replacement, loss of inventory, wages and tax revenue, etc. (Coppola, 2015). All of these also have a cost associated with them, but it is much more difficult to assign a specific dollar value and quantify them accurately. For this plan, the primary focus of loss estimates will be direct consequences of the given hazard.

Countless situations could occur that could result in a disruption to critical systems throughout Ashtabula County. Loosely-related variables often considered *cascading hazards*, can complicate some hazards. For example, high winds may cause sporadic damage, but often do not become a significant countywide concern until a large number of residents are without power. In addition to weather-related power outages, cascading hazards in Ashtabula County could include (but not be limited to) the following.

- Damage to infrastructure (i.e., roads, bridges, pipes, utility poles, etc.) and residences following flooding
- Flooding of downstream areas in the event of a dam or levee failure
- Drinking water supply shortages and contamination following severe and prolonged drought conditions or floods
- Power outages, ruptured gas lines, etc. following earthquakes or severe weather
- Public health concerns following flooding conditions
- Population displacement before, during, or after an event that may be temporary or permanent

The complicating variables related to each hazard appear in the hazard profiles. The information presented is based on worst-case scenario events; a single event may not always reach all impacts described. However, it is important to understand that the impacts of hazards go beyond what is seen immediately after the event. The effects of one event can last months or even years, especially where public health, social, economic, environmental, and infrastructure

2.0 RISK ASSESSMENT

2.3 Hazard Profiles

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

- **Hazard 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.

- **Impact and Vulnerability:** Describes impacts on different topics such as health, the environment, or infrastructure 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 amounts (of deaths, injury, and property damage depending on available information) and estimates based on historical information and vulnerable populations, structures, and infrastructure.

§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.

- **Risk Assessment:** Details methods for calculating the probability and severity of each hazard.
- **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 are located where they are most fitting within the narrative.

§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.

Hazard profiles appear categorized by their status as natural, technological, or intentional human-caused.

- **Section 2.4:** Natural Hazards
  - 2.4.1 Coastal Erosion
  - 2.4.2 Drought
  - 2.4.3 Earthquake
  - 2.4.4 Flood
  - 2.4.5 Health-Related Emergencies
  - 2.4.6 Severe Thunderstorms
  - 2.4.7 Severe Wind and Tornado
  - 2.4.8 Severe Winter Storms

- **Section 2.5:** Technological Hazards
  - 2.5.1 Dam and Levee Failures
  - 2.5.2 Fires
  - 2.5.3 Hazardous Materials Incident

- **Section 2.6:** Intentional Human-Caused Hazards
  - 2.6.1 Terrorism and Civil Disturbance

2.0 RISK ASSESSMENT

2.4 Natural Hazards

Natural hazards are naturally-occurring physical phenomena, and they can be rapid or slow-onset events. Natural hazards can be geophysical (e.g., earthquakes, mass movements/landslides, tsunamis, or volcanic activity), hydrological (e.g., avalanches or floods), climatological (e.g., temperature extremes, drought, or wildfires), meteorological (e.g., cyclones or storm/wave surges), or other natural processes (such as biological processes) that pose a threat to human populations (Haddow, Bullock & Coppola, 2017; IFRC, 2016). This subsection includes the following natural hazards.

- Coastal Erosion
- Drought
- Earthquake
- Flood
- Health-Related Emergencies
- Severe Thunderstorm
- Severe Wind/Tornado
- Severe Winter Storm

impacts are concerned.

Hazards and Climate Change

Many natural hazards are related to the climate or weather such as droughts, severe weather, and floods. There is an important distinction between weather and climate. Weather refers to the atmospheric conditions of a geographical region over a short period, such as days or weeks. Climate, in contrast, refers to the atmospheric conditions of a geographical area over long periods, such as years, or even decades (Keller & Devecchio, 2015, pp. 406-407). According to the U.S. Global Change Research Program, there are weather and climate changes already observed in the United States.

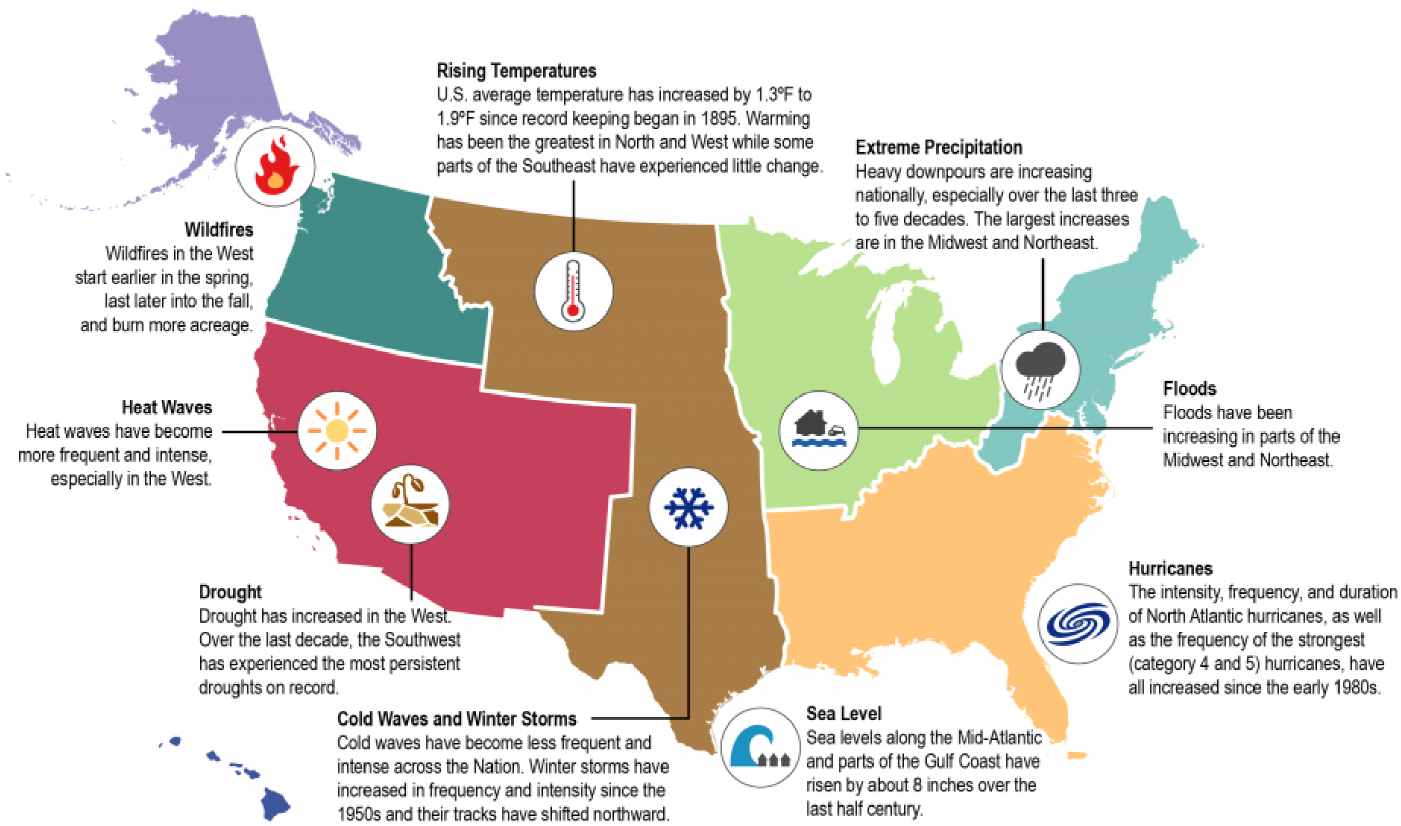
- Since recordkeeping began in 1895, the average U.S. temperature has increased by 1.3°F to 1.9°F with most of the increase happening since 1970. Also, the first decade of the 2000s was the warmest on record.
- The average precipitation across the U.S. has increased since 1900, with some areas experiencing higher than the national average and some lower. Heavy downpours are increasing, especially over the last 30-50 years.
- Drought events have increased in the west. Changes in precipitation and runoff, combined with changes in consumption and withdrawal, have reduced surface and groundwater supplies in many areas.
- Some types of severe weather events have experienced changes. Heat waves are more frequent and intense, and cold waves have become less frequent and intense overall.
- The intensity, frequency, and duration of North Atlantic hurricanes have increased since the early 1980s.

Climate change can have a significant impact on human health and the environment. The changes mentioned above can affect the environment by leading to changes in land use, ecosystems, infrastructure conditions, geography, and agricultural production. Extreme heat, poor air quality, reduced food and water supply and quality, changes in infectious agents, and population displacement can lead to public health concerns such as heat-related illnesses, cardiopulmonary illnesses, food, water and vector-borne diseases and have consequences on mental health and stress (USGCRP, 2016).

The National Climate Assessment (NCA) defined climate trends for national U.S. regions in 2014. The major trends are:

- wildfires and heat waves on the west coast,
- rising temperatures and increased severity and frequency of winter storms in the middle of the country,
- more rain and flooding in the Midwest and northeastern parts of the country, and
- an increase in sea levels in the mid-Atlantic with an increase of hurricane activity in the southeastern states.

The Intergovernmental Panel on Climate Change (IPCC) largely concurs with the above list (IPCC, n.d.). In Ohio, the trend will likely be an increase in flooding, as noted in the graphic below.



__Public Health, Social Vulnerability, and Other General Vulnerability Indicators__

Vulnerability is the "measure of the propensity of an object, area, individual, group, community, country, or other entity to incur the consequences of a hazard" (Coppola, 2015, p. 33). Many aspects contribute to the vulnerability of a people; these can include income disparity, class, race or ethnicity, gender, age, disability, health, and literacy (Thomas & Phillips, 2013, pp. 2-3). See Section 1.4 above for a discussion of potential social vulnerability indicators in Ashtabula County. Understanding the overall health status of the community is important in determining the vulnerability of the population to any given hazard; emergencies and disaster situations can exacerbate existing medical conditions. Vulnerable populations, populations of concern, or populations at risk are those individuals or groups of people who are more exposed to the risks of the impacts of a hazard because of their age, gender, income, occupation, disability, physical or mental health, literacy, income, religion, education, or ethnicity.

Some groups face several stressors related to both climate and non-climate factors. For example, people living in impoverished urban or isolated rural areas, floodplains, coastlines, and other at-risk locations are more vulnerable not only to extreme weather and persistent climate change but also to social and economic stressors. Many of these stressors can occur simultaneously or consecutively. Over time, this accumulation of multiple, complex stressors is expected to become more evident as climate impacts interact with stressors associated with existing mental and physical health conditions and with other socioeconomic and demographic factors. Where appropriate (and where information is available), hazard profiles provide further vulnerability details.

Technological Hazards	
Dam and Levee Failure	Existing (dam failure). Levee failure added to this update.
Fires	Existing (wildfires). Scope of hazard changed to include urban/structures fires and brush fires for this update.
Hazardous Materials Incidents	Existing. To include chemical, biological, radiological, nuclear, and explosive incidents.
Intentional Human-Caused Hazards	
Terrorism and Civil Disturbance	Existing. To include cyberterrorism, CBRNE attacks, riots, and active shooter incidents.

In addition to these 12 hazards, there exist other potential hazards this plan does not address. The following list presents those hazards.

- **Avalanche:** Avalanches happen mainly in the western United States and Canada. The terrain and geography of Ashtabula County are not rugged or severe enough to have avalanches.
- **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 a hurricane or tropical storm levels.
- **Sea Level Rise:** Sea level risk occurs in oceans; the Atlantic east coast is approximately 375 miles away, and the Pacific west coast is approximately 2,200 miles away. Neither would affect Ashtabula County.
- **Tsunami:** Tsunamis occur in oceans; the Atlantic east coast is approximately 375 miles away, and the Pacific west coast is approximately 2,200 miles away. Neither would affect Ashtabula County. The closest relatable hazards to tsunamis in Ashtabula County would be lake surge and seiche waves, both of which appear briefly in the coastal erosion discussion.
- **Volcano:** The closest monitored volcano is in Yellowstone National Park in Wyoming and is approximately 1,500 miles away. It would not affect Ashtabula County.

2.0 RISK ASSESSMENT

2.4.1 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.				
Vulnerability HIGHEST HIGH MEDIUM ➡ LOW LOWEST	Period of Occurrence:	Largely gradual, though some occurrences can be immediately following a seiche wave, etc.	Hazard Index Ranking:	Low
	Warning Time:	Over 24 hours	State Risk Ranking:	3 - Medium
	Probability:	Highly likely	Severity:	Limited
	Type of Hazard:	Natural	Disaster Declarations:	None

Hazard Overview

Coastal hazards are a constant threat to the 95,000 miles of U.S. coastline. Ohio contains 262 miles of Lake Erie's coastline, and 27 miles (ODNR, 2011) of it is in Ashtabula County. In the Great Lakes region, flooding and rising lake levels cause serious property damage, endanger public safety, and degrade environmental quality. Economic losses exceed tens of millions of dollars per year. 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.

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, including human activity, sea or lake level rise, seasonal fluctuations, and climate change.

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. 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.

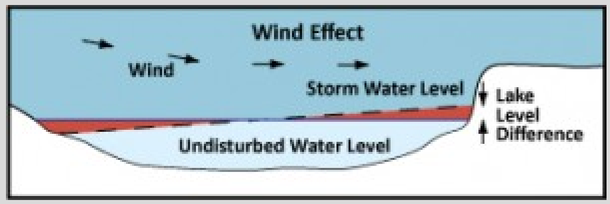
- **Bluff Recession**: An eroded beach leaves the base of the bluff vulnerable to wave attack. As waves break farther inshore, they weaken and erode the base of the bluff, which is known as undercutting. Once the base area is eroded, upper bluff soils and vegetation lose their support and slide to the 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.

Lake Erie's shoreline can be protected in several ways. 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 perpendicular 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.

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

According to the University of Michigan, some 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

Historical Occurrences

The NOAA National Centers for Environmental Information Storm Events Database reports no seiche or storm surge/tide events between 1950 and 2018. 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).

Location and Extent

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 fluff instability" (i.e., undercutting) (ODNR, 2011, p. 6).

"Coastal erosion areas" are a component of the Ohio Coastal Management Law passed in 1988 (i.e., ORC Section 1506 and OAC Section 1501-6). A coastal erosion area 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 coastal erosion area 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. Coastal erosion areas in Ashtabula County are as follows (2018, https://gis.ohiodnr.gov/MapViewer/?config=cea).

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

ASHTABULA COUNTY COASTAL EROSION AREAS (CEAs)						
Frame	*Average Recess Rate (ft.)*		*Average Anticipated Distance (ft.)*		*Coastal Erosion Areas*	
	1998	*2018*	*1998*	*2018*	*1998*	*2018*
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
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

<u>Impacts and Vulnerability</u>

Though there are environmental and economic impacts to erosion (discussed above), local officials expect minimal structural damage as a result of the hazard. When compiling the table above that detailed average recession rates for all Ashtabula County panels, 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 Ohio Department of Natural Resources (ODNR) Office of Coastal Management maintains the Lake Erie Shore Erosion Management Plan. 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).

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

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 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

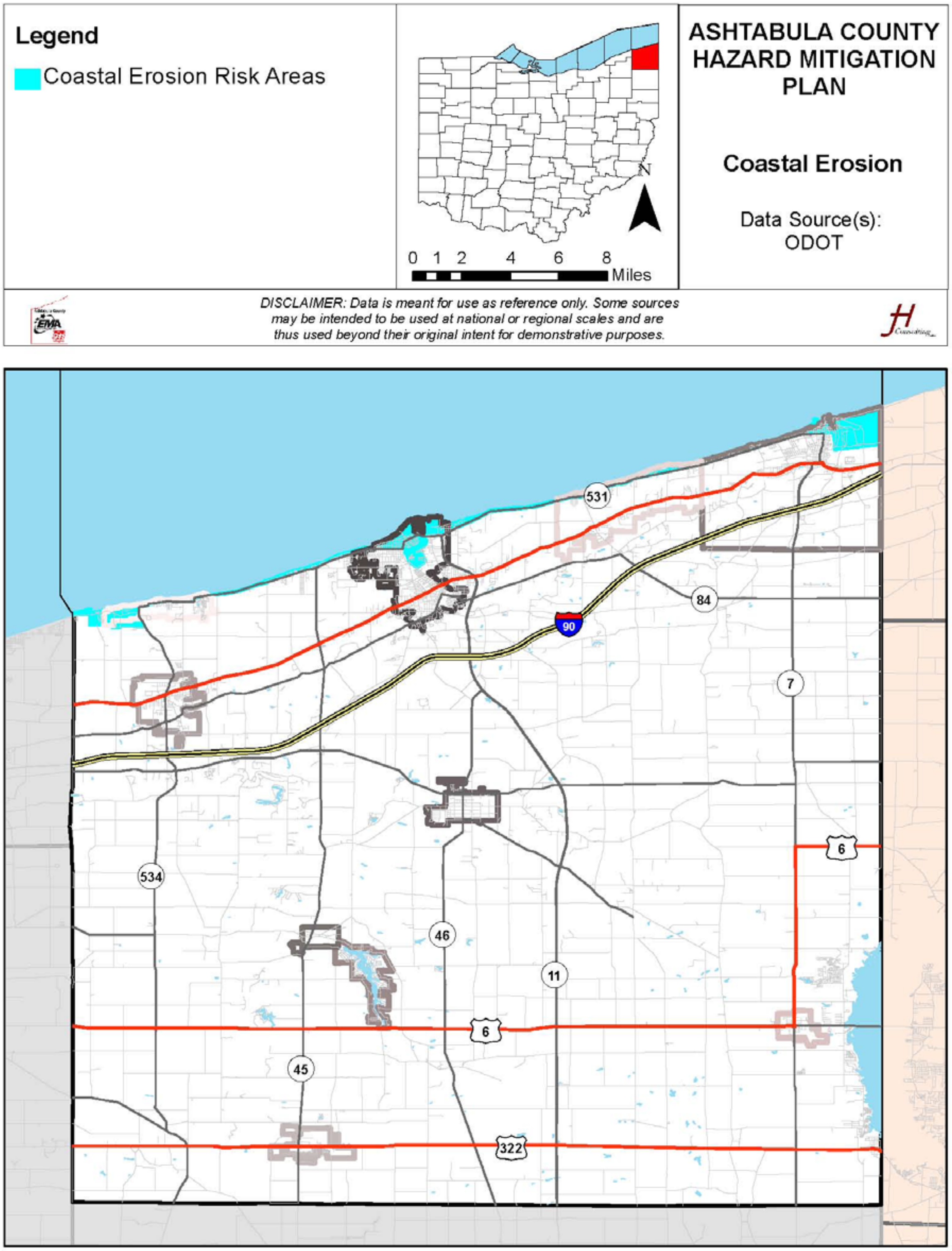
There are numerous impacts of coastal erosion. The ODNR reports three fatalities from when eroded shorelines collapsed without warning. Public parks, utilities, and infrastructure can also experience erosion-related damage (2011, http://geosurvey.ohiodnr.gov/lake-erie-geology/erosion-and-research/erosion-problems). Ashtabula County has 3.9 miles of publiclyaccessible coastline and 12 access sites, and coastal erosion could impact all of these community resources.

To complete the SHARPP 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, 2019]). Planners estimated three non-residential structures in the CEAs and utilized HAZUS data to estimate non-residential losses.

COASTAL EROSION LOSS ESTIMATE – SHARPP DATA ENTRY		
Structure Type	*Number*	*Loss Estimate*
Residential	50	$5,315,000
Non-Residential	3	$808,600
Critical Facilities	0	$0
TOTALS	53	$6,123,600

Risk Assessment

This section summarizes the risk to Ashtabula County from coastal erosion. The following map image graphically depicts potential risk areas in Ashtabula County.


Legend
Coastal Erosion Risk Areas
ASHTABULA COUNTY
HAZARD MITIGATION
PLAN
Coastal Erosion
Data Source(s):
ODOT
N
0 1 2 4 6 8
Miles
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.
531
84
90
7
6
534
46
11
6
45
322

The following table identifies the assets located in coastal erosion risk areas.

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

The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

COASTAL EROSION RISK SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	5	Excessive	Listed as "excessive" because coastal erosion is a continual process
Response	5	More than one month	Response considerations are on-going, even though the response actions may not be acute in nature.
Onset	1	Over 24 hours	Erosion is a gradual phenomenon, meaning that those impacted are aware of the activity for much longer than 24 hours prior; 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 in the areas.

COASTAL EROSION RISK SUMMARY			
Category	*Points*	*Description*	*Notes*
Human	1	Minimum (minor injuries)	The gradual nature of the hazard should give potential impactees plenty of time to avoid injuries.
Property	1	Less than 10% of property affected	The hazard could only impact properties in coastal erosion hazard areas.
Total	15	Low	

2.0 RISK ASSESSMENT

2.4.2 Drought

A drought is a period of abnormally dry weather which persists long enough to produce a serious hydrological imbalance.				
Vulnerability HIGHEST HIGH MEDIUM ▶ LOW LOWEST	Period of Occurrence:	At any time, typically after a period of prolonged absence of precipitation	Hazard Index Ranking:	Low
	Warning Time:	Over 24 hours	State Risk Ranking:	2 – Low
	Probability:	Possible	Severity:	Limited
	Type of Hazard:	Natural	Disaster Declarations:	USDA FSA S3253 (2) USDA FSA S4038 (2)

<u>Hazard 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.

2.0 RISK ASSESSMENT

2.4.3 Earthquake

An earthquake is the moving or shaking of the Earth's tectonic plates due to built-up pressure.				
Vulnerability HIGHEST HIGH MEDIUM LOW ◀ LOWEST	Period of Occurrence:	At any time	Hazard Index Ranking:	Low
	Warning Time:	Little to none	State Risk Ranking:	2 - Low
	Probability:	Highly likely	Severity:	Limited
	Type of Hazard:	Natural	Disaster Declarations:	None

<u>Hazard Overview</u>

Earthquakes are one of nature's most damaging hazards and 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.

<u>Location and Extent</u>

Earthquakes move or shake the earth in three different directions depending on the plate movements: convergent, divergent, and transform generating primary and secondary waves. There are three common ways to measure an earthquake.

- **Richter Scale**: Developed in 1935, the Richter scale measures the scale and severity of an earthquake, the magnitude of an earthquake can range between 0 and 10. The effects of an earthquake can extend far beyond the site of its occurrence.
- **Modified Mercalli Scale**: The modified Mercalli scale measures earthquakes based on their intensity on the surface. This scale uses Roman numerals I through XII to denote detection and damage levels associated with an earthquake.
- **Peak Ground Acceleration (PGA):** PGA is "the maximum ground acceleration that occurred during earthquake shaking at a location. PGA is equal to the amplitude of the

largest absolute acceleration recorded on an accelerogram at a site during a particular earthquake" (Douglas, 2003). The table to the right shows the relation between the Richter scale (magnitude) and the Modified Mercalli Scale.

The Earth is made up of tectonic plates; the boundary lines where these tectonic plates meet are called faults. Friction along the boundaries or faults causes the rocks to stress and strain. "When the stress of the rocks exceed their strength, that is, their ability to withstand the force, the rock rupture and are permanently displaced along the fault plane" (Keller & Devecchio, 2015) causing earthquakes that reach and affect the infrastructure on the surface.

A common misconception is that hydraulic fracturing, or "fracking" is causing all of the induced earthquakes. In reality, 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).

<u>Impacts and Vulnerability</u>

The severity of an earthquake is 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 causalities. Common effects of earthquakes are ground motion and shaking, surface ruptures, and ground failure. The risk of fire immediately following an earthquake is often high because of broken electrical lines and gas mains. In recent years, officials in most of the world's major cities have installed devices that shut these services down automatically if an earthquake strikes. Other hazards that may result from an earthquake are utility and communications failures.

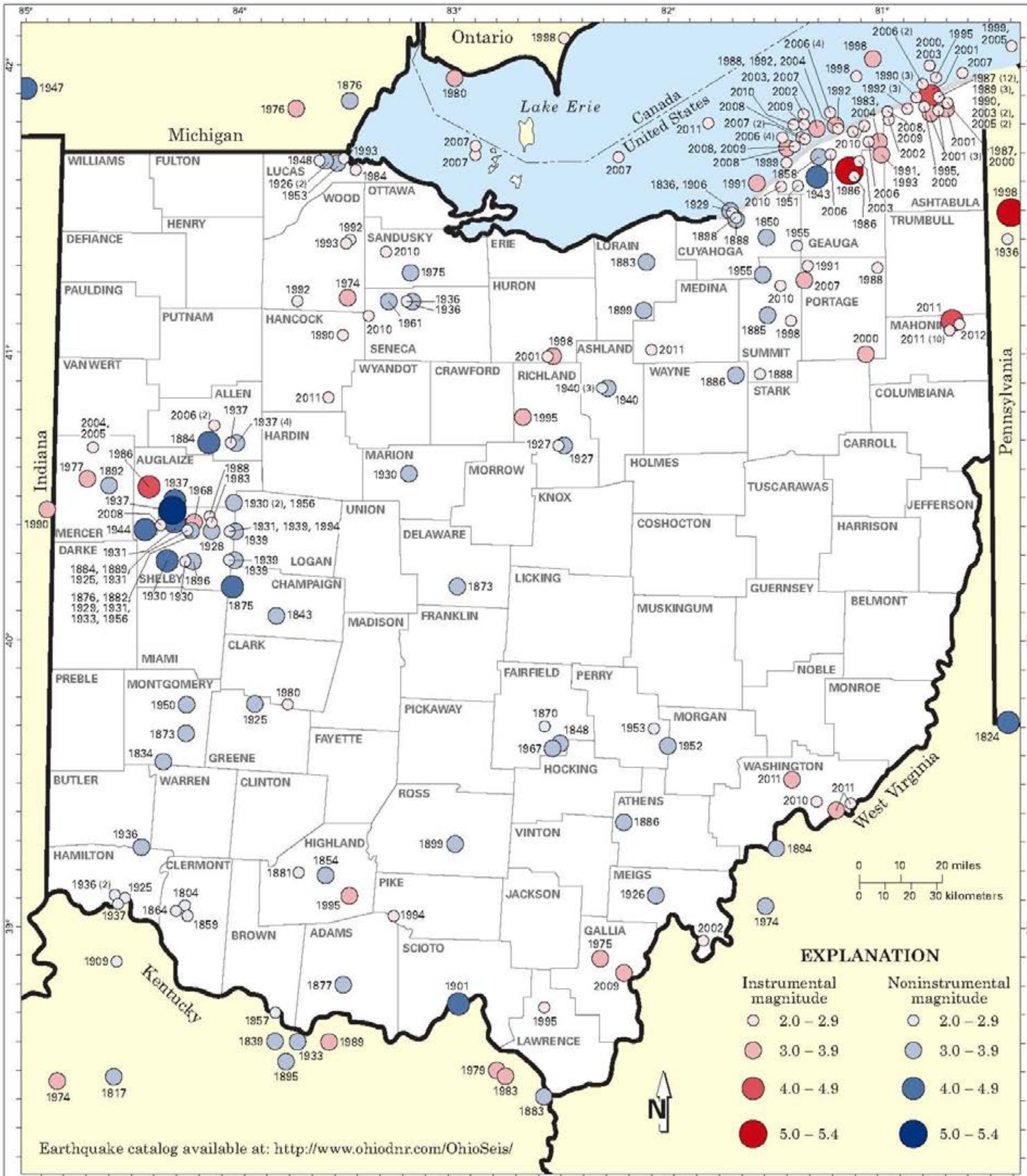
The impacts to a community from earthquake events include injuries to citizens and public safety officials, damage to property, lost revenue and economic damages, increased demand on public safety and infrastructure related services. Ground shaking from earthquakes can collapse buildings and bridges, disrupt gas, electric, and phone service, and sometimes trigger landslides, flash floods, fires, and tsunamis.

Historical Occurrences

The following graphic is from the ODNR Division of Geological Survey, Ohio Seismic Network. It shows the earthquake epicenters in Ohio, and the northeast Ohio area appears to be a hotspot for earthquake activity.

STATE OF OHIO • DEPARTMENT OF NATURAL RESOURCES • DIVISION OF GEOLOGICAL SURVEY

EARTHQUAKE EPICENTERS IN OHIO AND ADJACENT AREAS



OhioSeis
The Ohio Seismic Network

Recommended citation: Ohio Division of Geological Survey, 2012, Earthquake epicenters in Ohio and adjacent areas—color version: Ohio Department of Natural Resources, Division of Geological Survey Map EG-2, generalized page-size version, 1 p., scale 1:2,000,000.

The ODNR maintains a catalog of past earthquakes with magnitude 2.0 or greater in Ohio. The following table presents those in Ashtabula County.

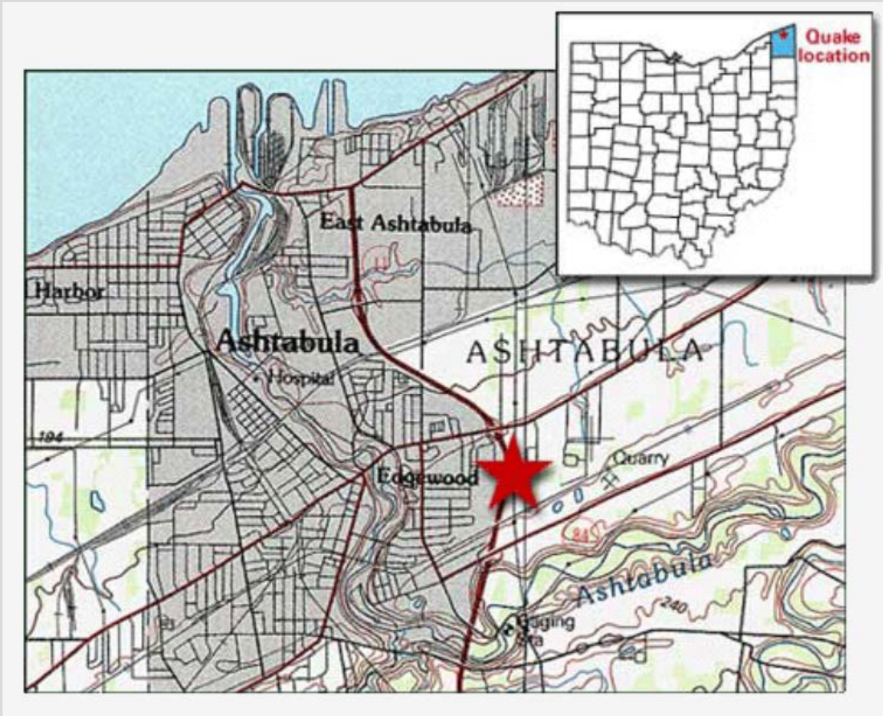
2.0+ EARTHQUAKES IN ASHTABULA COUNTY			
Year	*Date*	*Magnitude*	*MMI Rating*
1987	July 13 (5:49 a.m.)	3.8	N/A
1987	July 13 (5:58 a.m.)	2.2	N/A
1987	July 13 (7:52 a.m.)	3.0	N/A
1987	July 13 (1:13 p.m.)	2.9	N/A
1987	July 13 (6:25 p.m.)	2.8	N/A
1987	July 13 (7:00 p.m.)	2.3	N/A
1987	July 13 (7:39 p.m.)	2.1	N/A
1987	July 13 (8:53 p.m.)	2.2	N/A
1987	July 13 (11:49 p.m.)	2.4	N/A
1987	July 14 (7:47 a.m.)	2.5	N/A
1987	July 14 (2:51 p.m.)	5.8	N/A
1987	July 16 (4:49 a.m.)	2.7	N/A
1987	July 16 (6:02 a.m.)	2.4	N/A
1987	August 13	3.3	N/A
1989	August 1 (4:12 p.m.)	2.8	N/A
1989	August 1 (4:50 p.m.)	2.9	N/A
1989	August 3	2.2	N/A
1990	January 1	2.2	N/A
1990	July 24	2.3	N/A
1990	September 26	2.3	N/A
1990	November 18	2.3	N/A
1992	March 26	2.5	N/A
1992	March 28	2.9	N/A
1992	March 31	2.5	N/A
1992	April 7	2.0	N/A
1995	February 23	2.9	N/A
1995	April 9	2.4	N/A
2000	June 7 (6:19 a.m.)	2.0	N/A
2000	June 7 (6:55 a.m.)	2.4	N/A
2000	October 20	2.5	N/A
2001	January 20	2.6	III
2001	January 26 (3:03 a.m.)	4.5	VI
2001	January 26 (3:11 a.m.)	2.0	N/A
2001	January 26 (3:45 a.m.)	2.2	N/A
2001	January 26 (5:11 a.m.)	2.0	N/A
2001	January 26 (5:36 a.m.	3.2	III
2001	June 3	3.2	III
2001	June 5	2.2	II
2002	August 17	2.0	N/A
2003	February 10	2.4	N/A
2003	July 17	2.5	III
2005	February 23	2.0	N/A
2005	March 2	2.2	N/A
2005	December 11	2.0	N/A
2006	February 27	2.0	N/A
2007	September 28	2.7	N/A

2.0+ EARTHQUAKES IN ASHTABULA COUNTY			
Year	*Date*	*Magnitude*	*MMI Rating*
2009	February 14	2.6	N/A
2013	March 17	2.2	N/A
2015	April 12	2.3	N/A

February 23, 1995 Earthquake

A 2.9-magnitude event occurred at 4:32 a.m. local time and woke many residents according to the ACEMA Director at the time. The lack of seismographs in the area made it difficult to confirm that it was an earthquake and to obtain an official magnitude. It appeared as though the felt reports centered in Ashtabula City, suggesting that the event occurred beneath the city. The cause of this event is unknown (ODNR, 2003).

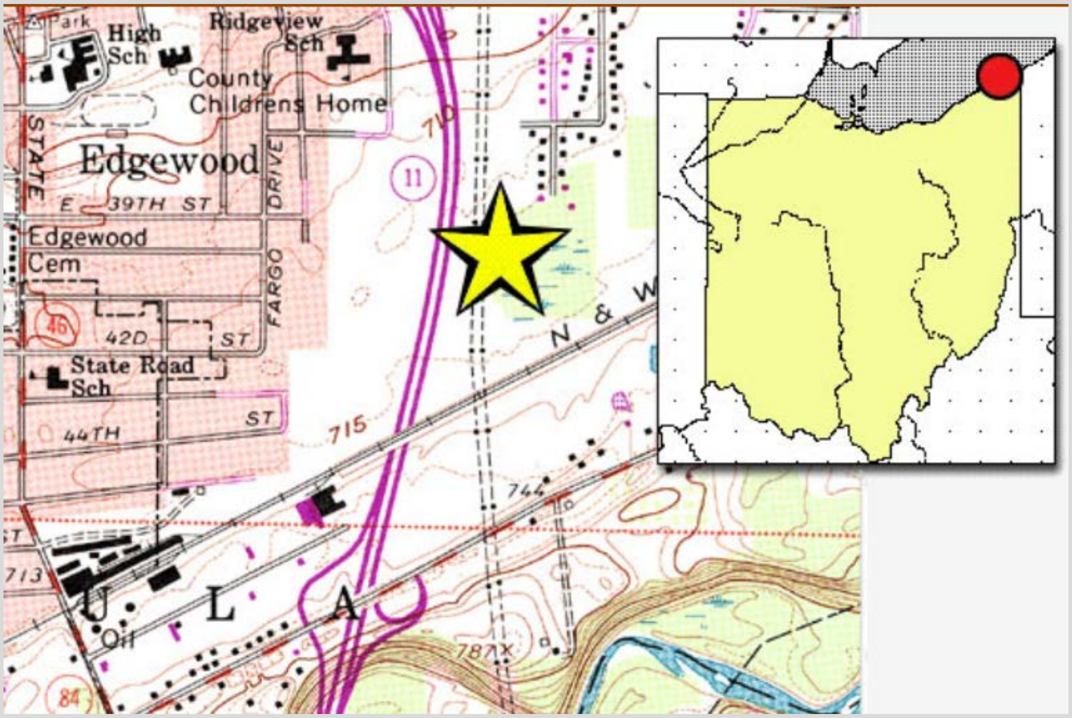
January 25, 2001 Earthquake (Source: ODNR, 2001, http://geosurvey.ohiodnr.gov/quakes-2000-to-2009-pgs/ashtabula-january-25-2001#topofcontent)



"Ashtabula, Ohio, and surrounding communities were shaken by a 4.5-magnitude earthquake at 10:03 p.m. eastern time on Thursday, January 25, 2001. This event followed a 2.6-magnitude earthquake on January 19, at 9:05 p.m. eastern time. The larger event was felt throughout an extensive area of northern Ohio, western Pennsylvania, Michigan, and Ontario, Canada. Preliminary damage reports from Ashtabula indicate cracked plaster and masonry, walls bowed or moved, items knocked off shelves, and a ruptured natural gas line that resulted in evacuation of some residents. Damage and felt reports are being gathered by the Division of Geological Survey, the U.S. Geological Survey, and the Ashtabula County Emergency Management Agency.

At least two aftershocks in the 3 magnitude range occurred in the hours after the main shock. The 4.5-magnitude mainshock is the largest earthquake in historic times in the Ashtabula area. Small earthquakes have previously been recorded in the area in 1987, 1989, 1992, and 1995. None of these events caused damage. The mainshock was widely recorded by the Ohio Seismic Network (OhioSeis) and at seismic stations operated outside of Ohio by the U.S. Geological Survey, the Geological Survey of Canada, the University of Western Ontario, and a variety of other networks and independent seismic stations. This wealth of data permitted the Ohio Seismic Network to locate the mainshock on the east side of Ashtabula."

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. The effects of a potential earthquake striking Ashtabula County were analyzed using the HAZUS-MH program from the Federal Emergency Management Agency. The scenario depicts a 5.0 earthquake (the lowest possible magnitude to use in the program) located at the county seat. The following tables describe the expected building damages by occupancy type and the building-related economic loss estimates.

ASHTABULA COUNTY EXPECTED BUILDING DAMAGE BY OCCUPANCY (HAZUS)										
	None		*Slight*		*Moderate*		*Extensive*		*Complete*	
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
Agriculture	148.14	0.47	47.26	0.60	47.81	1.17	21.27	1.92	4.52	1.95
Commercial	1,401.65	4.44	446.11	5.65	372.38	9.09	139.69	12.64	29.17	12.59
Education	49.16	0.16	14.90	0.19	12.77	0.31	4.15	0.38	1.01	0.44
Government	44.31	0.14	14.49	0.18	14.14	0.35	4.77	0.43	1.30	0.56
Industrial	489.15	1.55	154.23	1.95	145.43	3.55	59.92	5.42	12.27	5.30
Other Residential	3,016.73	9.56	1,005.53	12.74	912.24	22.27	255.98	23.16	39.53	17.07
Religion	175.70	0.56	47.84	0.61	35.84	0.88	13.62	1.23	3.00	1.30
Single Family	26,229.02	83.12	6,160.22	78.07	2,555.00	62.38	605.94	54.82	140.83	60.80
TOTAL	31,554		7,891		4,096		1,105		232	

ASHTABULA COUNTY HAZUS BUILDING-RELATED ECONOMIC LOSS ESTIMATES (MILLIONS OF DOLLARS)							
Category	*Area*	*Single Family*	*Other Residential*	*Commercial*	*Industrial*	*Others*	*Total*
Income Losses	Wage	0.00	1.5689	19.2544	1.5913	1.7975	24.2124
	Capital Related	0.00	0.6671	16.8509	0.9856	0.4476	18.9512
	Rental	6.9559	4.0236	9.8602	0.5932	0.8126	22.2455
	Relocation	24.5035	4.0182	15.4678	2.9384	6.9721	53.9000
	Subtotal	31.4594	10.2778	61.4333	6.1085	10.0301	119.3091
Capital Stock Losses	Structural	40.6527	8.1911	20.6620	9.1667	9.1376	87.8101
	Non-Structural	153.4927	38.8712	54.3774	28.4830	22.6288	297.8531
	Content	90.6884	11.3938	31.0549	20.4864	13.2066	136.8304
	Inventory	0.00	0.00	0.8237	3.6850	0.2122	4.7209
	Subtotal	254.8338	58.4561	106.9180	61.8214	45.1852	527.2145
TOTAL		286.29	68.73	168.35	67.93	55.22	646.52

To complete the SHARPP vulnerability assessment, the Ohio EMA's "loss estimate workbook for HAZUS results" provided the figures included in the following table.

EARTHQUAKE LOSS ESTIMATE – SHARPP DATA ENTRY		
Structure Type	*Number*	*Loss Estimate*
Residential	3,302	$820,839,900
Non-Residential	832	$676,623,800
Critical Facilities	91	$73,639,700
TOTALS	4,225	$1,571,103,400

Risk Assessment

This section summarizes the risk to Ashtabula County from an earthquake. The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

EARTHQUAKE RISK SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	4	High	49 occurrences in 32 years, for an average of 1.53 events per year
Response	2	1 day	The historical earthquakes in Ashtabula County have been of a low magnitude and caused little damage necessitating a minimal response.
Onset	5	N/A	Earthquakes can occur with no warning.
Magnitude	1	Localized (Less than 10% of land area affected)	This historical earthquakes in Ashtabula County have been of a low magnitude.
Business	1	Less than 24 hours	The historical earthquakes in Ashtabula County have been of a low magnitude and caused little damage, which would likely not cause a business closure.
Human	1	Minimum (minor injuries)	The historical earthquakes in Ashtabula County have been of a low magnitude and caused little damage, including minimal human injury.
Property	1	Less than 10% of property affected	The historical earthquakes in Ashtabula County have been of a low magnitude and caused little damage.
Total	15	Low	

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.).

Location and Extent

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. Within Ashtabula County, the extent of a drought would be equal or very similar given the region's geography and environmental qualities. 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.

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.

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	

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). The table to the right shows the two scales and how they compare.

Impacts and Vulnerability

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. According to the U.S. Drought Monitor, there are possible impacts from each level of drought, which appear in the graphic below.

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
D1 Moderate Drought	• Some damage to crops, pastures streams, reservoirs, or wells low, some water shortages developing or imminent • Voluntary water-use restrictions requested
D2 Severe Drought	• Crop or pasture losses likely • Water shortages common • Water restrictions imposed
D3 Extreme Drought	• Major crop/pasture losses Widespread water shortages or restrictions
D4 Exceptional Drought	• Exceptional and widespread crop/pasture losses • Shortages of water in reservoirs, streams, and wells creating water emergencies

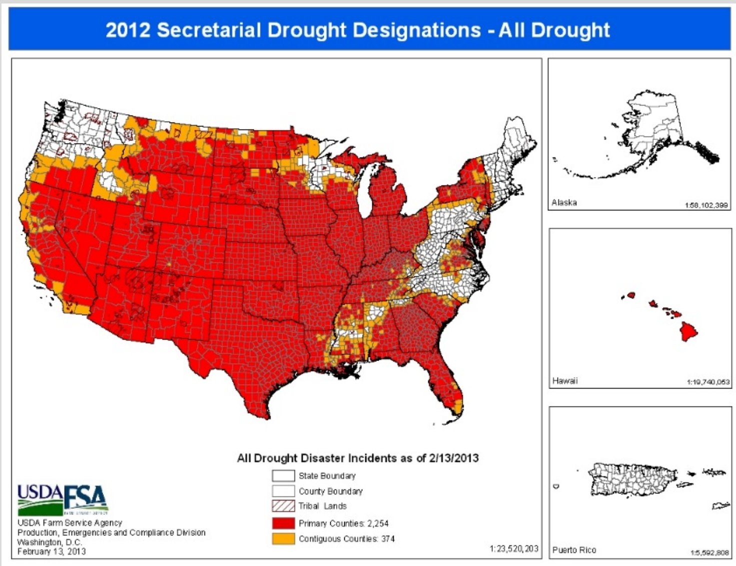
Ashtabula County is home to the wine making industry, with approximately 20 of the states 305 wineries located within its borders (Wysochanski, 2019). A 2008 report by the OSU Extension, Ashtabula estimated Northeast Ohio wine sales at $10.2 million with additional area impacts reaching another $2+ million (Marrison, 2008). Temperature fluctuations as well as drought conditions can have a substantial impact.

Historical Occurrences

Data sources suggest eight droughts have impacted Ashtabula County, though the drought of 1999 appears as four of these occurrences. 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, 2019).

2012 DROUGHT

USDA FSA Designation: S3253 (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, top soil 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.

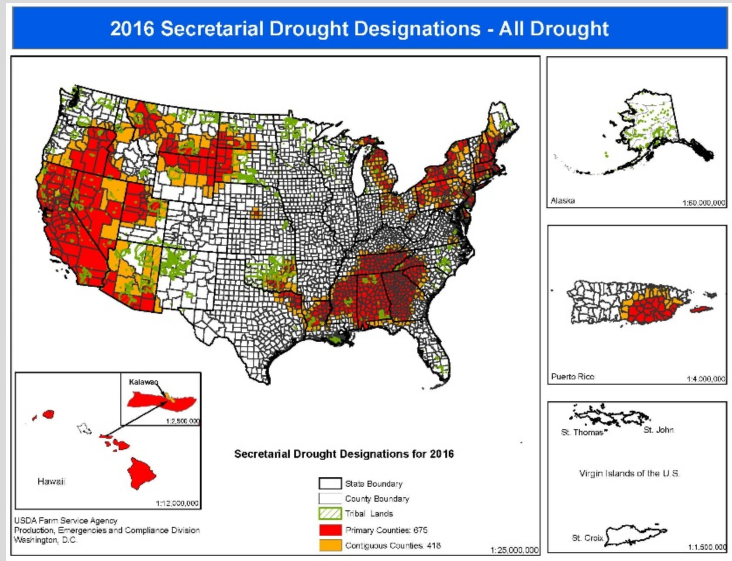
2016 DROUGHT

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

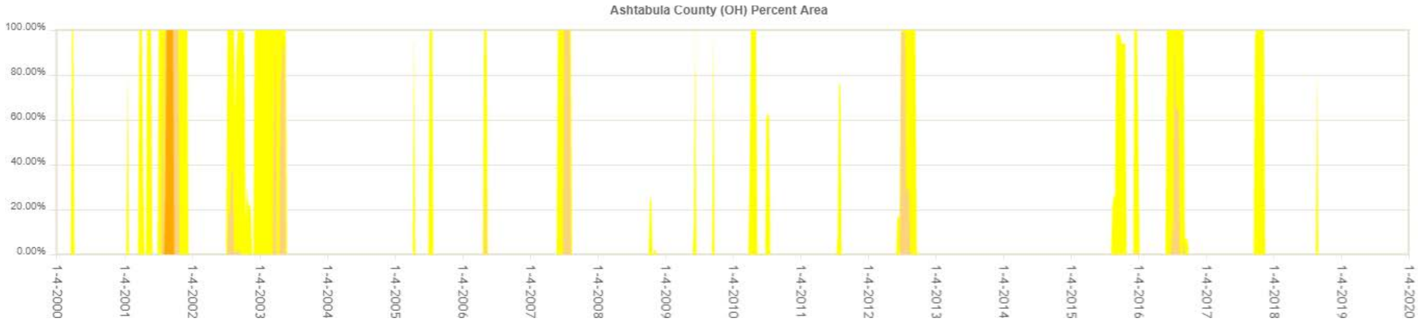
All counties listed above were designated natural disaster areas on Sep. 15, 2016, making all qualified farm operators in the designated areas eligible for low interest emergency (EM) loans from USDA's Farm Service Agency (FSA), provided eligibility requirements are met. Farmers had eight months from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



The Storm Events Database from the NOAA National Centers for Environmental Information lists the remaining historical occurrences.

DROUGHT HISTORICAL OCCURRENCES				
Begin Date	*Deaths*	*Injuries*	*Property Damage*	*Crop Damage*
8/1/1996	0	0	$0	$0
7/1/1997	0	0	$0	$0
6/4/1999	0	0	$0	$0
7/1/1999	0	0	$0	$0
8/1/1999	0	0	$0	$0
9/1/1999	0	0	$0	$5,000,000

The U.S. Drought Monitor, kept by the University of Nebraska-Lincoln, provides more detailed information about drought since 2000. The illustration below is a graphical representation of the time and severity of droughts presented in Ashtabula County between 2000 and 2019. Interestingly, 2012 does not present in this illustration.



Loss and Damages

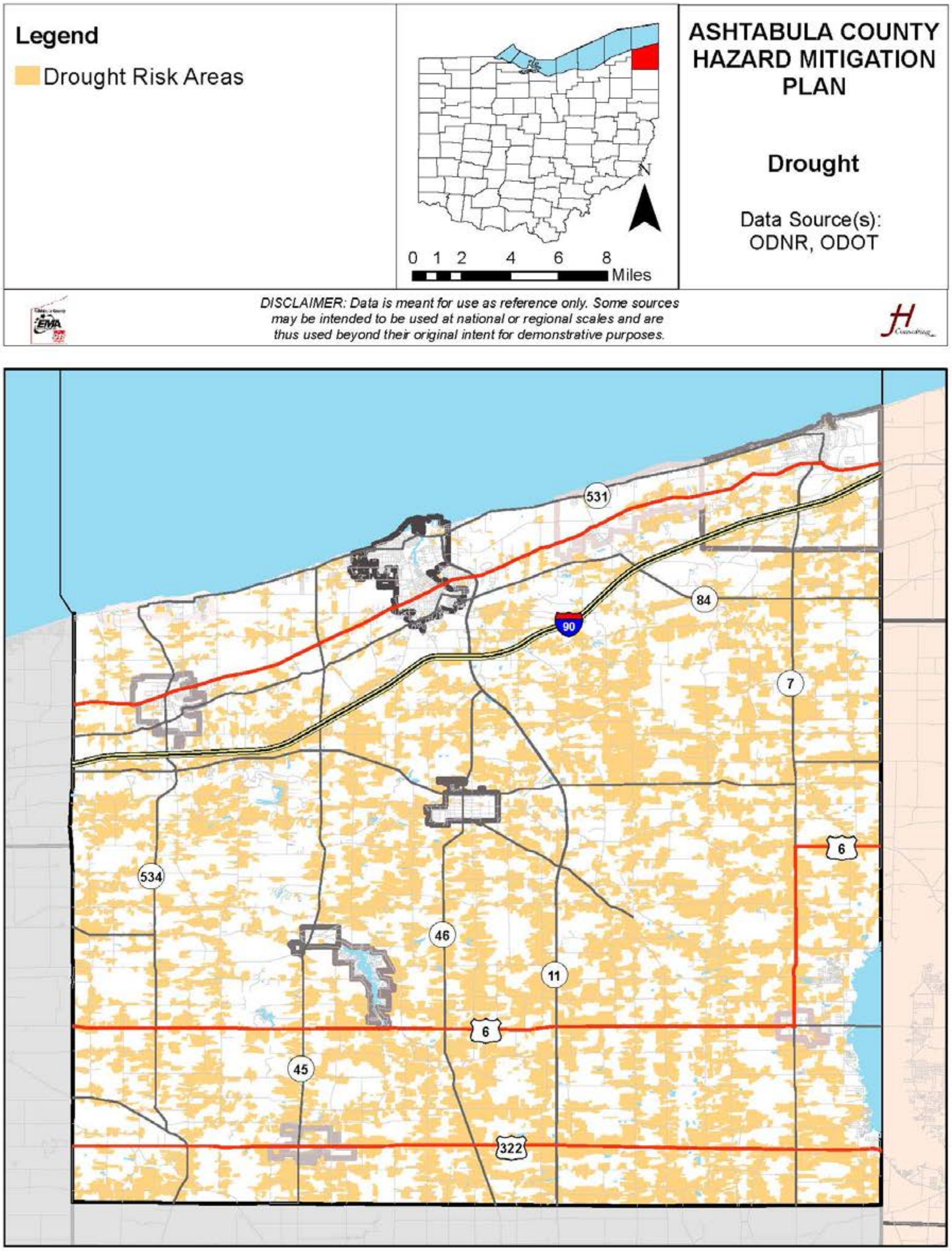
The USDA maintains data about agricultural activities through five-year censuses. The following table is taken from the 2007, 2012, and 2017 efforts.

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*
2007	1,127	161,698,000	93,639	107.63	$55,233,000
2012	1,099	165,967,000	100,299	118.98	$82,256,000
2017	1,212	153,654	88,835	94.00	$57,887,000

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 (an average of $65,125,333). Further, data for the eight historical occurrences cited above is inconsistent; only one event includes a crop loss estimate, and it is the final of four events in 1999. However, for planning purposes, aggregating the losses from available data yields $5,000,000 in losses over eight events, or an average of $625,000 in agricultural losses per event.

Risk Assessment

This section summarizes the risk to Ashtabula County from drought. The following map image graphically depicts potential risk areas in Ashtabula County.


Legend
Drought Risk Areas
0 1 2 4 6 8
Miles
N
ASHTABULA COUNTY
HAZARD MITIGATION
PLAN
Drought
Data Source(s):
ODNR, ODOT
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.
531
84
90
7
6
534
46
11
6
45
322

The following table assigns point totals based on the research presented in this profile for each category that appears in Ohio EMA's SHARPP tool.

DROUGHT RISK SUMMARY			
Category	*Points*	*Description*	*Notes*
Frequency	3	Medium	Nine events in 22 years (i.e., 1996-2018) yields an estimate of 0.41 incidents per annum.
Response	1	Less than half a 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	3	Critical (25-50% of land area affected)	Land area totals cited in Section 1.2 identify approximately 30% of the land area as cropland.
Business	1	Less than 24 hours	Drought is not likely to necessitate business closure.
Human	1	Minimum (minor injuries)	Drought is not likely to result in injuries.
Property	1	Less than 10% of property affected	Though a significant amount of the land area could be impacted, drought conditions do not affect personal property as severely.
Total	11	Low	