Hazard Identification and Risk Assessment

Lorain County has experienced many natural disasters in the past one hundred years. These disasters have ranged from tornadoes and blizzards to flooding and droughts. The purpose of the Hazard Identification and Risk Assessment (HIRA) is to identify the number and frequency of disasters in Lorain County. This process allows officials and residents to better prepare for these incidents when they do occur. The HIRA identifies potential hazards in Lorain County, defines each hazard and its likely risks, and examines hazard events that have occurred in Lorain County. In developing this document, the Lorain County Hazard Mitigation Core Committee (HMCC) analyzed the hazards and risks present throughout Lorain County. The natural hazards assessed include:

- Dam/levee failure
- Drought/heat
- Earthquake
- Erosion/landslide/mudslide
- Flood, including coastal, and sieche
- Thunderstorm
- Tornado
- Windstorm
- Winter Storm

Hazard Profiles

In order to understand the risk posed by natural hazards in Lorain County, it is important to define and discuss the characteristics of each hazard. Below, the hazards identified for review by the HMCC are defined.

Dam/Levee Failure

A dam is defined as an artificial barrier built across flowing water. This barrier directs or slows the flow of water and often creates a lake or reservoir. A dam is considered hydrologically significant if has a height of at least 25 feet from the natural streambed and has a storage capacity of at least fifteen acre-feet or has an impounding capacity of at least 50 acre-feet and is six feet or more above the natural streambed. Dams are typically constructed for flood control purposes or to store water for irrigation, water supply, or energy generation. They can be constructed out of earth, rock, concrete, masonry, timber, or a combination of materials.

Levees are embankments constructed to prevent the overflow of a river and prevent land from flooding. They can be constructed out of earth, rock, or other materials. Levees built from concrete or masonry materials are referred to as floodwalls.

A dam failure is an uncontrolled release of the water held back by the dam in a lake or reservoir. The majority of dams have a small enough storage volume that a breach or failure will have a limited impact on the surrounding community. But the failure of a large dam can cause substantial flooding downstream and cause significant loss of life and property. There are many causes of dam failure; some of the most common include:

- Sub-standard construction
- Geological instability

- Spillway design error
- Poor maintenance
- Internal erosion
- Extreme inflow
- Earthquake

In Ohio, the Ohio Department of Natural Resources is responsible for determining the hazard potential for dams through their Dam Safety Program. ODNR classifies dams based on this scale:

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

Drought and Extreme Heat

A drought is a deficiency of moisture that causes adverse impacts on people, animals, and vegetation over an area of significant size. Because drought is a creeping phenomenon characterized by the absence of water, there is no defined beginning or end, nor is there a standard amount of time required for an extended dry period to be considered a drought. It is considered a drought when the dry period lasts long enough to impact the environment and economy of a region, typically months or years.

There are four common types of drought:

Type	Description
Meteorological	Based on the degree of dryness (rainfall deficit) and length of dry period
Hydrological	Based on impact of rainfall deficits on water supply such as stream flow, reservoir and lake levels and water table decline
Agricultural	Based on impacts to agriculture by rainfall deficits, soil water deficits, reduced ground water, and reservoir levels needed for irrigation
Socioeconomic	Based on the impact of drought conditions on supply and demand of some economic goods

Drought severity is measured using the Palmer Drought Severity Index, abbreviated PDSI. The PDSI measures dryness based on recent precipitation and temperature statistics. Drought classifications are identified in the chart below:

Measurement	Description
-4 or less	Extreme Drought
-4 to -3	Severe Drought
-3 to -2	Moderate Drought

-2 to -1	Mild Drought
-1 to -0.5	Incipient Dry Spell
-0.5 to 0.5	Near Normal
0.5 to 1	Incipient Wet Spell
1 to 2	Slightly Wet
2 to 3	Moderately Wet
3 to 4	Very Wet
4 or more	Extremely Wet

A heat wave is a period of abnormally hot and unusually humid weather, typically lasting for two or more days. This can be an extended period of time with higher than normal temperatures or a shorter period of time with abnormally high temperatures. Regardless of the length of time or exact temperatures, heat waves are a safety hazard to anyone exposed to the high heat. People are at risk for heat exhaustion and heat stroke, which can be fatal in the most serious cases. When heat waves are accompanied by drought conditions, the potential for a serious natural disaster increases. Between injuries, fatalities, and crop/property damage, these disasters can have a significant impact on the economy of a region.

Earthquake

An earthquake occurs when two blocks of earth, called plates, move past one another beneath earth's surface. The location where the plates meet is called the fault. The shifting of the plates causes movement along the fault line. This movement can often be felt in areas surrounding the earthquake's epicenter and can cause damage ranging from relatively minor to devastating. Damage caused by an earthquake can include rattling foundations, falling debris, and, in the most severe cases, toppling buildings, bridges, and culverts. The severity of earthquake movement is measured on the Richter scale as defined below:

Magnitude	Description	Average Earthquake Effects
Less than 2.0	Micro	Micro-earthquakes, not felt, or felt rarely by sensitive people. Recorded by seismographs.
2.0-2.9	Minor	Felt slightly by some people; no damage to buildings
3.0-3.9		Often felt by people, but very rarely causes damage. Shaking of indoor objects can be noticeable.
4.0-4.9	Light	Noticeable shaking of indoor objects and rattling noises. Felt by most people in the affected area. Slightly felt outside. Generally causes none to minimal damage. Moderate to severe damage very unlikely. Some objects may fall off shelves or be knocked over.
5.0-5.9	Moderate	Can cause damage of varying severity to poorly constructed buildings. As most, none to slight damage to all other buildings. Felt by everyone. Casualties range from none to a few.
6.0-6.9	Strong	Damage to a moderate number of well-built structures in populated areas. Earthquake-resistant structures survive with slight to moderate damage. Poorly designed structures receive moderate to severe damage. Felt in wider areas, up to hundreds of miles/kilometers from the epicenter. Damage can be caused far from the epicenter. Strong to violent shaking near the epicenter. Deal toll ranges from 0 to 25,000.
7.0-7.9	Major	Causes damage to most buildings, some to partially or completely collapse or receive severe damage. Well-designed structures are likely to receive

		damage. Felt across great distances with major damage mostly limited to 250 km from epicenter. Death toll ranges from 0 to 25,000.
8.0-8.9	Great	Major damage to buildings, structures likely to be destroyed. Will cause moderate to heavy damage to sturdy or earthquake-resistant buildings. Damaging in large areas up to 500 km from epicenter, some structures totally destroyed. Felt in extremely large regions. Death toll ranges from 1,000 to 1 million.
Greater		Permanent changes in ground topography. Death toll usually over 50,000.

According to the Ohio Seismic Network, part of the Ohio Department of Natural Resources, seismic risk in Ohio is difficult to evaluate because earthquakes are infrequent. The recurrence interval is generally very long, sometimes spanning hundreds or thousands of years. In geologic terms, this classifies Ohio's historic record as an instant. Another factor in earthquake risk is the nature of the geologic materials upon which a structure is built. ODNR states "ground motion from seismic waves tends to be magnified by unconsolidated sediments such as thick deposits of clay or sand and gravel."

Erosion/Landslide/Mudflow

Erosion is a natural process in which the materials on earth's crust are loosened, dissolved, or worn away from the effects of wind and water resulting in the movement of sediment from one location to another. The natural agents that cause or contribute to erosion include glaciers, wind, water, earthquakes, volcanoes, tornadoes, hurricanes, mudflows, and avalanches.

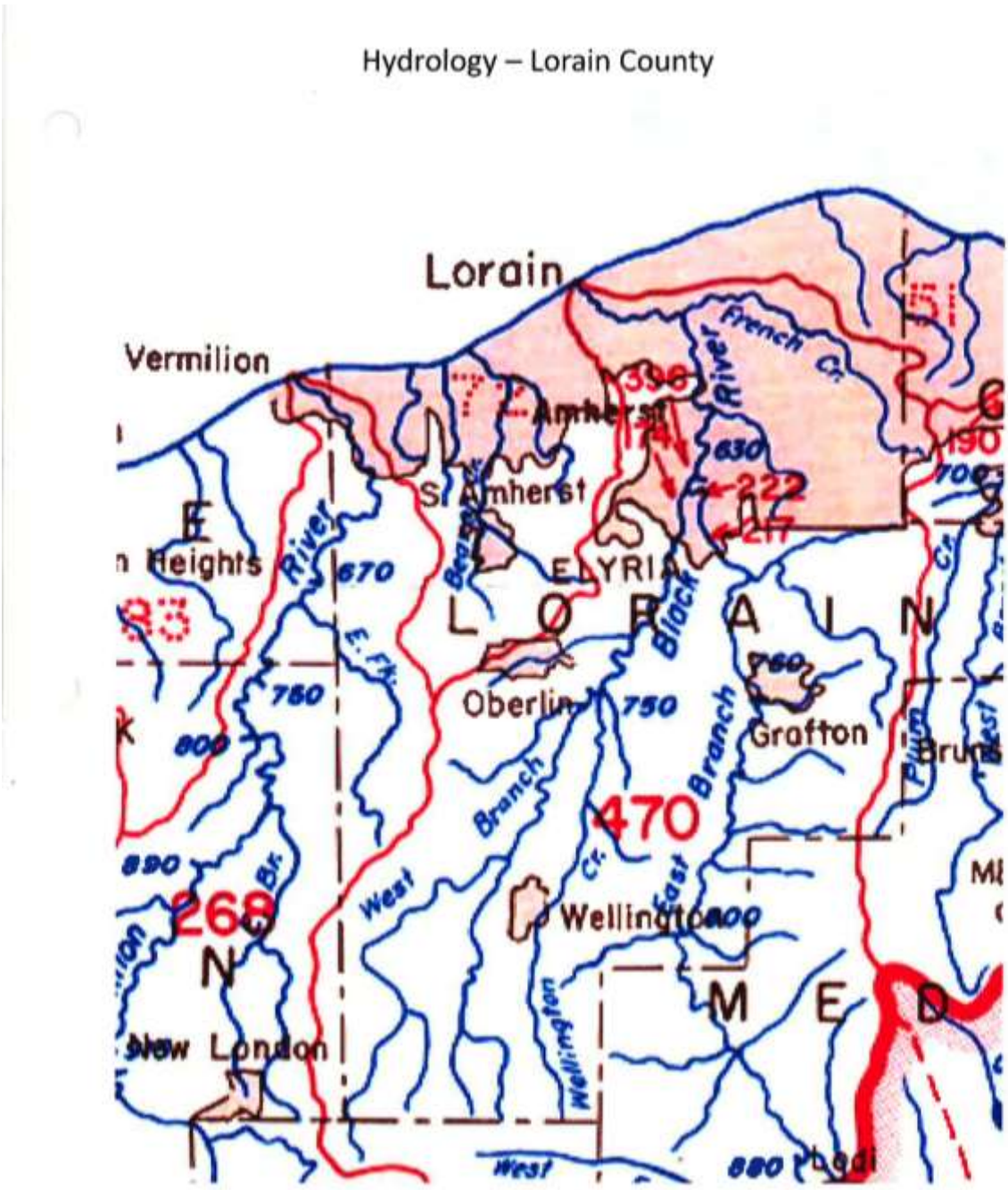
Stream bank erosion is the direct removal of banks and beds by flowing water; it typically occurs during periods of high stream flow. This erosion leads to excessive sediment deposits in the streambed, which can significantly reduce the velocity of the waterway. This can also lead to dramatic changes in the course of the waterway, reduction in water quality, loss of native aquatic habitats, and damage to public utilities.

A landslide is a wide area of ground movement that results in rock falls, deep failure of slopes, or shallow debris flows in which soil, rock, vegetation, and debris slide rapidly and forcefully down the slope. Gravity acting on over-steeped slopes is the most common cause of landslides. They can also result from erosion caused by rivers or glaciers and rock and soil slopes that have been weakened by snowfall or heavy rain. In areas with volcanic or seismic activity, landslides can occur after volcanic eruptions or earthquakes. If the slope material is saturated with water, the incident is referred to as a debris flow or mudflow.

Flood, including Sieche

A flood is defined as any high flow, overflow, or inundation of water over typically dry land that causes or threatens damage. Floods occur subsequent to meteorological events such as substantial precipitation, thunderstorms with heavy rainfall, rapid snowmelt, or extreme wind events along coastal waterways. In some areas, seismic activity can trigger floods. There are several primary types of flooding: riverine, flash, coastal, karst, and sieche.
Riverine flooding occurs when a river or stream rises to an elevation that causes the river to overflow its banks. The rising water causes or threatens damage to roadways, homes, buildings, and occupied spaces near the overflowing waterway. Lower levels of a watershed are more susceptible to this type of flooding because these waterways receive all the water from the upper levels and are responsible for carrying a much higher volume of water than the tributaries.

Flash floods are defined as the rapid and extreme flow of high water into a normally dry area; a flash flood can also occur when there is a rapid rise in the water level of a stream or creek and the water rises above a pre-determined flood level within six hours of a precipitation event. This type of flooding occurs then the ground is too saturated, impervious, or flat to drain rainfall into waterways through storm sewers, ditches, creeks, and streams at the same rate as the precipitation falls.



Coastal flooding is flooding of low-lying coastal land that is normally dry. This flooding is caused by severe weather events along the coast and occurs when water is driven onto land from the coastal body of water, its estuaries, and adjoining rivers. Storm surge occurs when there is an abnormal rise in water level that is greater than the regular astronomical tide. Forces generated from the wind, waves, and low atmospheric pressure of a severe storm cause this surge.

A sieche is a standing wave oscillating in a large body of water such as a bay or lake. This hazard is caused by a combination of strong winds and a large barometric temperature gradient. The effect of a sieche is similar to that of water sloshing back and forth in a bathtub or

swimming pool. Depending on conditions, the wave can oscillate back and forth for hours or days, causing flooding and damage along the coastline.

Worldwide, flooding is the most common and costly disaster, resulting in significant loss of life and property every year. Floods have a substantial impact on the infrastructure of a region. Common effects include roadway breeches, bridge washouts, roadway wash away, and water-covered roadways. As floodwater moves rapidly and forcefully, it washes away the surface and sub-surface of roads, causing holes, ruts, and other problems for vehicles. When floodwater reaches a depth of one foot, sometimes less depending on the forces present, it is strong enough to carry vehicles away with occupants inside. Rescuers are powerless against rapid, rising water because they are unable to exert enough strength to counteract the physics of moving water.

As floodwaters seek the path of least resistance as they travel to lower ground, water will seep into and occupy any structure in its path. Basements and lower levels of buildings can become inundated with floodwater. Installing sandbags along the exterior of a building can only serve as a temporary stopgap measure; if floodwaters do not recede quickly, the force of the water will move through the sandbags and enter the structure.

The aftermath of flooding can be just as damaging and dangerous as the initial incident. Cleanup is often a long, protracted activity with its own set of hazards. Prolonged power outages cause issues with refrigeration and sanitation. Sewer systems can become inundated with floodwater and cease to function properly. Standing water becomes contaminated with household and industrial chemicals, fuel, and other materials that have leaked into the water. All floodwater is considered contaminated, either from germs and disease or hazardous materials. This creates a hazard for responders and residents throughout the initial recovery phase of the disaster.

Thunderstorm

A thunderstorm is a local storm produced by a cumulonimbus cloud accompanied by thunder and lightning. Many thunderstorms include heavy precipitation. A thunderstorm that produces a tornado, winds of 58 mph or greater, and/or hail with a diameter of at least 1", is considered a severe thunderstorm. Severe thunderstorms typically develop as part of a larger storm front and are preceded and followed by regular thunderstorms.

These hazards can produce flash floods, tornadoes, and damaging winds that pose significant risk to people and property in the area. Lightning strikes can ignite fires that threaten the immediate area.

Tornado

A tornado is an intense, rotating column of air that protrudes from a cumulonimbus cloud in the shape of a funnel or a rope whose circulation is present on the ground. If the column of air does not touch the ground, it is referred to as a funnel cloud. This column of air circulates around an area of intense low pressure, almost always in a counterclockwise direction. Tornados usually range from 300 to 2,000 feet wide and form ahead of advancing cold fronts. They tend to move from southwest to northeast because they are most often driven by southwest winds. A tornado's life progresses through stages described as dust-whirl, organizing, mature, shrinking, and decay.

Once in the mature stage, the tornado generally stays in contact with the ground for the duration of its life cycle. When a single storm system produces more than one, and sometimes as many as six, distinct funnel clouds, this is referred to as a tornado family or outbreak.

Tornado magnitude is measured using the Enhanced Fujita scale, abbreviated as EF. The rankings range from EF-0 to EF-5 and are based on damages caused by the tornado. Prior to 2012, the Fujita scale was used to measure tornado damage and was abbreviated F-1, F-2, and so on depending on the level of impact.

EF Number	3 Second Gust
0	65-85 mph
1	86-110 mph
2	111-135 mph
3	136-165 mph
4	166-200 mph
5	+200 mph

Tornados are the most damaging of all atmospheric phenomena. While the frequency of tornados is low, the probability of significant damage is high. Because tornados occur as part of a storm system, they do not strike as independent incidents. Emerging out of a storm front or super cell, the tornado, especially when accompanied by heavy rain, straight-line wind, lightning, and hail can be extremely damaging. Effects of a tornado include uprooted trees, damaged or destroyed buildings, and smashed vehicles. Twisting and flying debris turns into projectile weapons, which can cause injuries and fatalities.

Windstorm

A windstorm is a weather event with very strong winds but little to no precipitation. Wind speed in this type of event typically reaches at least 34 mph but can be any speed that causes light or greater damage to trees and buildings. Damage can be caused by gusts, which are short bursts of high-speed wind, or longer periods of sustained wind.

A derecho is a specific type of windstorm that is widespread and fast moving. These storms that can produce damaging straight-line winds over extremely large areas, sometimes spanning hundreds of miles long and more than 100 miles wide. To be defined as a derecho, the storm must produce damage over at least 240 miles, have wind gusts of at least 58 mph across most of the storm's length, and multiple gusts of 75 mph or greater. The destruction produced by derechos can be very similar to that from tornados. However, the damage from this type of storm generally occurs in one direction along a straight path.

Winter Storm

A winter storm encompasses several types of winter weather events that develop between late fall and early spring. These events include weather systems that include snow, sleet, and other forms of precipitation that form at low temperatures or rainstorms with temperatures low enough to form ice. A blizzard is a winter storm characterized by sustained winds or frequent gusts of 35 mph or greater and falling or blowing snow that reduces visibility to less than ¼ mile; both of these conditions must be present for at least three hours to be considered a blizzard.

The greatest risk associated with winter storms is the loss of utilities. The elderly and small children are most at risk; when health equipment and food supplies cannot reach destinations, those populations endure excessive inconvenience. Although winter storms may make residents uncomfortable, it is extremely rare for casualties to occur as a result, with the exception of traffic accidents that transpire as a result of dangerous road conditions.

History

As a component of determining Lorain County's risk for specific natural hazards, historical occurrences of each identified natural hazard were reviewed. Information from the National Oceanic and Atmospheric Administration's National Climatic Data Center (NCDC) and the University of South Carolina's Spatial Hazard Events and Losses Database (SHELDUS).

Dam/Levee Failure

Across Lorain County, there are twenty-five dams of varying size, type, and purpose. The dams are owned by private entities, local governments, and the state of Ohio. The chart below provides a complete list of dam structures in the county.

Dam	Hazard Potential	Owner Type	Primary Purpose	Nearest City
Caley Woods Wildlife Lake Dam	Low	Local Government	Recreation	Oberlin
Charlemont Creek Lake Dam	Low	Private	Recreation	Wellington
Clare-Mar Camp Lake Dam	High	Private	Recreation	Wellington
East Branch Black River Dam No. 2	Significant	Not Listed	Recreation	Elyria
Echo Valley Lake Dam	Low	Private	Water Supply	Wellington
Elyria Country Club Low Head Dam	Low	Private	Recreation	Elyria
Eppley Lake Dam	Low	Private	Recreation	Grafton
Findley Lake Dam	High	State	Recreation	Wellington
Firelands Lake No.1 Dam	Low	Private	Recreation	Birmingham
Hickory Nut Golf Course Lake Dam	Significant	Private	Recreation	Lorain
Lake Haven Dam	Low	Private	Recreation	Lake Erie
Loretta Lake Dam	Low	Private	Recreation	Wellington
Oberlin Old Upground Reservoir	Low	Local Government	Recreation	Oberlin
Oberlin Upground Reservoir	High	Local Government	Water Supply	Oberlin
Oberlin Waterworks Unground No. 1 and 2	Significant	Local Government	Water Supply	Oberlin
Pheasant Run Lake Dam	Significant	Private	Recreation	Oberlin
Rustic Lake Dam	Low	Private	Recreation	Wellington
Sandy Ridge Wetland Dam	Low	Local Government	Other	Elyria
Shilo Lake Dam	Low	Private	Recreation	Grafton
Taylor Lake Dam	Low	Private	Recreation	Spencer

Dam	Hazard Potential	Owner Type	Primary Purpose	Nearest City
Ukrainian American Youth Lake Dam	Low	Private	Recreation	Wellington
USS/Kobe Lake Dam	Significant	Private	Water Supply	Sheffield
Wellington Reservoir No. 2 Dam	Significant	Local Government	Water Supply	Wellington
Wellington Upground Reservoir	High	Local Government	Water Supply	Wellington
Willoway Upground Reservoir No. 5 Dam	High	Private	Water Supply	Avon

While there have been no incidents of significant dam failure in Lorain County, there have been several incidents in which spillway capacity was inadequate. Because of the age of many of the dam structures and the increasing need for significant maintenance or repair, the county is susceptible to a dam failure at some point in the future. A list of documented dam incidents is included in the chart below.

Structure	Hazard Potential	Incident Date	Incident	Dam Failure
Loretta Lake Dam	Low	02/25/1999	Inadequate spillway capacity	No
Firelands Lake No. 1	Low	02/13/2001	Inadequate spillway capacity	No
Wellington Reservoir No. 2 Dam	Significant	01/31/2001	Inadequate spillway capacity	No

Drought and Extreme Heat

Drought and extreme heat are countywide hazards and can affect all areas and jurisdictions of the county. Heat waves can occur in Lorain County and all of Ohio, but the incidence is relatively rare and the duration is typically short. Extreme temperatures are considered anything above 90 degrees Fahrenheit. In the humid climate of northern Ohio, these temperatures are often accompanied by high humidity. Temperatures rarely exceed the mid-90s, although the region does sometimes experience temperatures of 100 degrees or slightly higher. These brief heat waves are not uncommon, but rarely last more than a few days or a week. A heat wave lasting longer than that is extremely rare.

Average temperatures and rainfall for Elyria, Ohio:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg. High	36°	40°	49°	62°	72°	81°	85°	83°	76°	65°	52°	39°
Avg. Low	21°	23°	30°	40°	72°	59°	64°	62°	56°	45°	36°	26°
Mean	29°	32°	40°	51°	61°	70°	75°	73°	66°	55°	44°	33°
Avg. Precip.	2.58”	2.36”	2.75”	3.37”	3.77”	3.74”	3.74”	3.92”	3.72”	3.10”	3.38”	3.16”

Drought is not common in Lorain County. Dry spells can last for several weeks, but most months come with sufficient rainfall to support crop growth and human sustenance. It is rare for the region to experience dry spells long enough to seriously impact the environment or economy of the county.

The drought of late 1989 followed a milder drought in the Southeastern United States and California the year before. This drought spread across the Mid-Atlantic, Southeast, Midwest, Northern Great Plains, and Western United States. It was widespread, unusually intense, and accompanied by heat waves. The heat waves killed 4,800 to 17,000 people and significant numbers of livestock across the country. The Drought of 1989 is believed to have been so damaging because farmers might have farmed land what was marginally arable. Another contributing factor was pumping groundwater near the depletion mark. This drought destroyed crops nationwide. In many cities, lawns went brown as water restrictions were put in place. This drought was catastrophic and continued across the Midwest and Northern Plains during 1989. The drought was not officially declared over until 1990.

The 2012-2013 North American Drought was an expansion of the 201-2012 United States Drought. The drought began in the spring of 2012 when lack of snow in the United States led to very little melt water to absorb into the soil. The drought included most of the United States, including Ohio. Among many other counties, Lorain County was designated with moderate drought conditions by mid-June. The effects of this drought have been compared to droughts of the 1930s and 1950s, but were not in place as long. However, the drought has caused catastrophic economic ramifications. In most measures, the drought exceeded the 1988-1989 North American Drought, which is the most recent comparable incident.

On July 30, 2012, the Governor of Ohio sent a memorandum to the USDA Ohio State Executive Director requesting primary county natural disaster designations for eligible counties due to agricultural losses caused by drought and additional disasters during the 2012 crop year. The USDA reviewed the Loss Assessment Reports and determined that there were sufficient production losses in 85 counties to warrant a Secretarial disaster designation. On September 5, 2012, Lorain County was one of those designated counties.

Other instances of extreme heat and drought impacting Lorain County per NCDC records are listed below.

Type	Location	Date	Injuries	Deaths	Property Damage	Crop Damage
Drought	Lorain (Zone)	08/01/1996	0	0	0	0
Drought	Lorain (Zone)	07/01/1997	0	0	0	0
Drought	Lorain (Zone)	06/01/1999	0	0	0	0
Drought	Lorain (Zone)	07/01/1999	0	0	0	0
Drought	Lorain (Zone)	08/01/1999	0	0	0	0
Drought	Lorain County	09/01/1999	0	0	0	7M

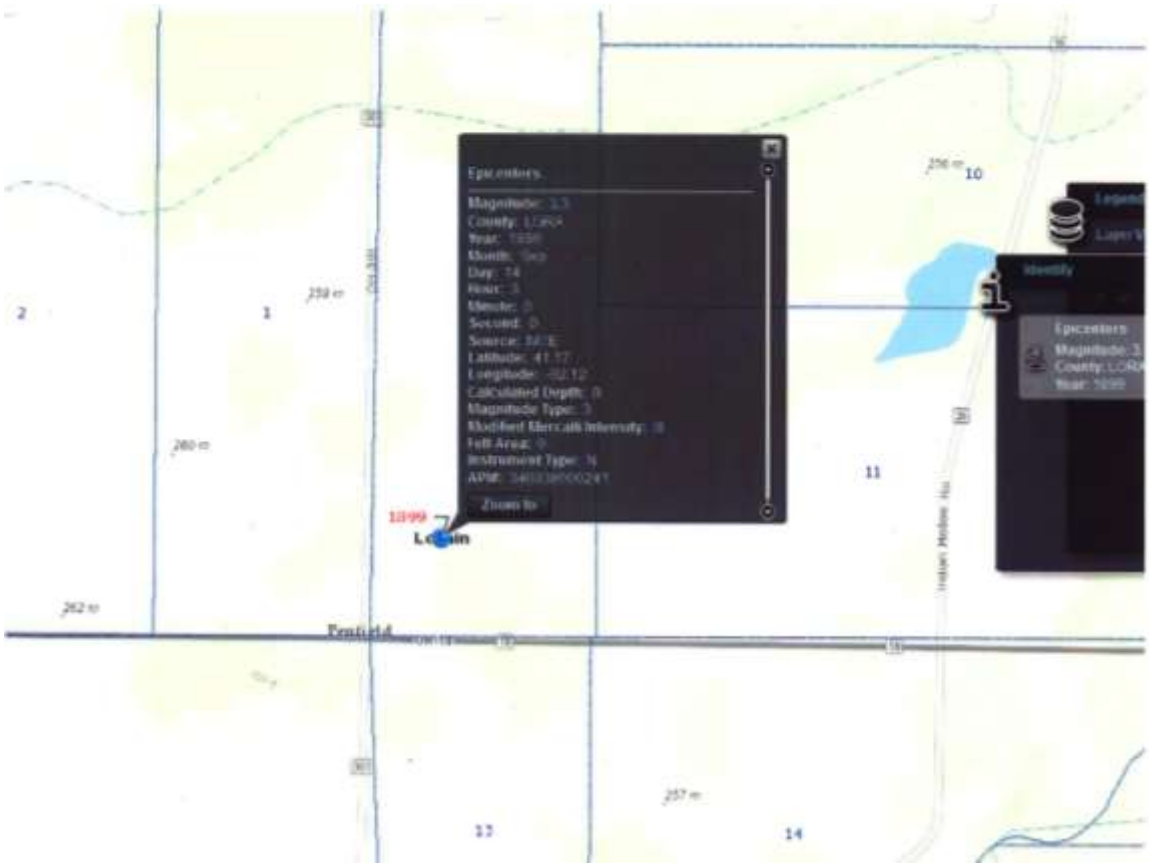
Earthquake

Ohio has experienced more than 120 earthquakes since 1776. While only fourteen of these events have caused damage classified as minor to moderate, there is a greater risk for earthquakes in Ohio than most people realize. Northeastern Ohio is the second most active

earthquake risk area in Ohio. Minor earthquakes have occurred in the northeast region and other areas of Ohio, including two documented occurrences in Lorain County. This hazard is countywide and can affect all areas and jurisdictions of the county.

Lorain County has experienced two earthquake incidents with epicenters in the county. The first of these incidents occurred on January 5, 1883. A 3.0 magnitude wave earthquake occurred with an epicenter at the intersection of Elyria South Park and East Avenue in Carlisle Township. The quake occurred and 10:30am and was detected by residents who felt the quake at that time. Estimated depth of the quake was zero kilometers.

A second earthquake occurred in Penfield Township on September 14, 1899. The epicenter of the 3.3 magnitude quake was approximately ¼ mile northwest of the intersection of State Routes 18 and 301. The incident occurred at 3:00 am and was detected by local residents. The event was determined to have a Modified Mercalli Index of III.



The strongest earthquake recorded in Ohio occurred in Shelby County in 1937 and was estimated to have a magnitude of 5.5 on the Richter Scale. This incident did cause some damage in Anna and surrounding west central Ohio communities. The same area in Ohio reported earthquake activity in 1875 and 1884. The Pomeroy area, southeast of Columbus, experienced an earthquake in 1926, and residents in Anna, near Lima in west central Ohio, felt minor quakes in 1930, 1931, and 1937. None of these earthquakes caused widespread damage or devastation. The minor quakes caused shaking buildings, crumbling mortar, and some limited property damage. Impacts were only felt locally; no statewide damages were reported.

Erosion/Landslide/Mudslide

Landslides occur in every state in the United States, but the highest concentration occurs in the mountainous regions in California, Oregon, and Washington. In Ohio, the region most susceptible to landslides and mudslides is the steep, hilly terrain in the southeast region of the state. In Lorain County, the hazard is countywide and can affect all areas and jurisdictions of the county. Because of the relatively flat terrain in Lorain County, there is limited local risk for these disasters. The difference in elevation between the highest point in the county and the lowest point is 600 feet. The slope of the declining elevation is not sufficient to allow for significant landslides or mudslides. There is minor risk for small, isolated landslides that could occur along isolated areas of steep riverbank. Any debris movement along these slopes would slide into the adjacent river and have a limited impact on the community.

Flood

Flooding has historically been a serious risk for Lorain County. Data from NCDC indicates that the county has been impacted by more than 50 flood events since 1950. The majority of these incidents are classified as flash flooding. In total, Lorain County has suffered more than $54,000,000 in property damage and $5,000,000 in crop damage due to flood incidents.

One of the most significant and costly flood incidents to impact Lorain County happened on May 21, 2004. This incident, which was the worst flooding the county had experienced since 1969, impacted the southern portion of the county, especially Wellington, Oberlin, and LaGrange. Torrential rainfall fell in the early morning hours and caused tributaries and the west branch of the Black River to overflow their banks. At the storm's peak, rain fell at approximately two inches per hour; some areas received total rainfall of six inches. Because the ground was already saturated from rainfall earlier in the month, significant flooding occurred. Dozens of water-covered roads, including State Route 18, were closed. Homes along the Black River were evacuated as floodwaters rose rapidly. Across the county, more than 500 homes sustained damage; 27 of these were classified as major damage and six were destroyed. Hundreds more homes suffered minor basement flooding. Property damage figures from the incident topped $13,000,000.

On June 22, 2006, heavy overnight rainfall caused a rapid rise in the rivers and streams across Lorain County. By mid-morning, evacuations were underway in Carlisle and LaGrange Townships along the east branch of the Black River and Elyria along the Black River. The Black River crested at 16.9 feet, significantly above the flood stage of 9.5 feet. One rescuer was killed while attempting to rescue two teenagers who had driven into a flooded area northwest of Wellington. The rescue diver was tethered, but was swept off his feet waging through swift water and died before he could be pulled from the water. At total of 25 homes sustained heavy damage, with dozens more sustaining minor damage. One home in Carlisle Township was destroyed. Dozens of roads, including State Routes 18, 511, 58, and 303, were closed because of flooding. Property damage for the event was $4,500,000. Due to substantial amounts of standing water, the county also sustained crop losses of at least $5,000,000.

The most recent major flood incident to impact Lorain County occurred on May 12, 2014 when a warm front tracked north over Lake Erie then reversed course and moved inland. This super cell storm spawned two tornados and caused significant flooding across the region. In Lorain County, North Ridgeville was heavily impacted with at least 300 homes and 1,000 businesses sustaining flood damage. Intense rainfall fell over a two-hour period causing storm drains to be overwhelmed. In Avon, local runoff and water flowing from North Ridgeville caused French Creek to flood. This led to basement flooding in at least 75 Avon residences. In nearby Sheffield Village, French Creek rapidly rose ten to fifteen feet above flood stage, flooding an additional eight homes. In total, the storm caused more than $26,000,000 in property damage. A complete list of Lorain County flooding incidents, per NCDC records, is provided below.

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Flash Flood	Lorain County	04/23/1996	0	0	4K	0
Flash Flood	Avon	06/04/1996	0	0	0	0
Flash Flood	Lorain County	06/12/1996	0	0	30K	0
Flash Flood	Avon	06/14/1996	0	0	0	0
Flash Flood	Vermilion	06/18/1996	0	0	10K	0
Flash Flood	Wellington	06/18/1996	0	0	20K	0
Flash Flood	Elyria	06/25/1996	0	0	2K	0
Flash Flood	Columbia Station	09/07/1996	0	0	10K	20K
Flash Flood	Northern Half	09/07/1996	0	0	200K	75K
Flash Flood	Northern Half	09/09/1996	0	0	0	0
Flash Flood	Northern Half	09/09/1996	0	0	75K	0
Flash Flood	Northern Half	09/13/1996	0	0	0	0
Flash Flood	Northern Half	09/13/1996	0	0	75K	0
Flash Flood	Northern Half	09/13/1996	0	0	50K	0
Flash Flood	Lorain County	10/18/1996	0	0	0	0
Flash Flood	Lorain County	02/27/1997	0	0	50K	0
Flash Flood	Lorain County	06/01/1997	0	0	80K	40K
Storm Surge/Tide	Lakeshore	06/01/1997	0	0	75K	0
Flash Flood	Lorain County	06/01/1997	0	0	30K	20K
Flash Flood	Lorain City	08/16/1997	0	0	0	0
Flash Flood	Lorain County	09/20/1997	0	0	50K	0
Flash Flood	Lorain County	01/07/1998	0	0	80K	0
Flash Flood	Lorain City	01/09/1998	0	0	0	0
Storm Surge/Tide	Lorain City	03/20/1998	0	0	50K	0
Flash Flood	Lorain County	04/16/1998	0	0	50K	0
Flash Flood	Lorain County	06/30/1998	0	0	15K	0
Flash Flood	Lorain County	06/30/1998	0	0	0	0
Flash Flood	Lorain City	07/21/1998	0	0	10K	0
Flash Flood	Lorain City	10/13/1999	0	0	0	0
Flash Flood	Elyria	07/27/2000	0	0	0	0
Flash Flood	Oberlin	04/19/2002	0	0	0	0
Flood	Lorain (Zone)	05/18/2004	0	0	50K	0
Flash Flood	Lorain County	05/21/2004	0	0	12.4M	0
Flood	Lorain (Zone)	05/21/2004	0	0	500K	0
Flash Flood	Lorain County	05/21/2004	0	0	250K	0
Flash Flood	Lorain County	05/22/2004	0	0	750K	0
Flood	Lorain (Zone)	01/01/2005	0	0	1.1M	0
Flood	Lorain (Zone)	02/08/2005	0	0	75K	0
Flood	Lorain (Zone)	04/03/2005	0	0	100K	0
Flash Flood	Lorain County	07/16/2005	0	2	1.2M	0
Flash Flood	Northern Half	08/08/2005	0	0	25K	0
Flash Flood	Northern Half	08/20/2005	0	0	2M	0
Flood	Lorain (Zone)	08/30/2005	0	0	125K	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Flash Flood	Lorain City	09/17/2005	0	0	1.1M	0
Flash Flood	Lorain County	06/21/2006	0	0	600K	0
Flood	Lorain County	06/22/2006	1	0	4.5M	5M
Flood	Elyria	01/05/2007	0	0	200K	0
Flash Flood	Vermilion on the Lake	03/02/2007	0	0	50K	0
Flash Flood	Lorain City	08/07/2007	0	0	1.5M	0
Flood	Elyria	08/21/2007	0	0	50K	0
Flash Flood	Semples	06/26/2008	0	0	100K	15K
Flood	Vermilion on the Lake	02/08/2009	0	0	50K	0
Flood	Vermilion on the Lake	02/28/2011	0	0	750K	0
Flood	Henrietta	04/04/2011	0	0	0	0
Flash Flood	Lorain Airport	04/25/2011	0	0	50K	0
Flash Flood	Lorain City	05/14/2011	0	0	0	0
Flash Flood	Oberlin	05/25/2011	0	0	0	0
Flash Flood	Pittsfield	05/25/2011	0	0	0	0
Flash Flood	Lorain City	05/26/2011	0	0	0	0
Flash Flood	Elyria	05/26/2011	0	0	0	0
Flood	Elyria	10/30/2012	0	0	1K	0
Flash Flood	Westview	06/25/2013	0	0	100K	0
Flash Flood	LaGrange	07/10/2013	0	0	100K	0
Flash Flood	Sheffield	05/12/2014	0	0	150K	0
Flash Flood	Shawville	05/12/2014	0	0	25M	0
Flash Flood	Sheffield	05/12/2014	0	0	1M	0
Flash Flood	Lorain County	06/24/2014	0	0	120K	0

Thunderstorm

Lorain County experiences many thunderstorm events each year. The hazard is countywide and can affect all areas and jurisdictions of the county. These storms range from mild to severe, with the majority falling in the mild category. Since 1950, Lorain County has experienced 452 thunderstorm events. Collectively, these events have caused $6,300,000 in property damage and $70,000 in crop damage.

One thunderstorm event that did cause significant property damage occurred on October 30, 1996. Wind gusts from this storm were measured as high as 58mph in Lorain. That particular gust caused a large tree limb to fall on a police car, causing significant damage. Tree limbs and power lines were downed across Lorain and Elyria; falling branches and limbs damaged several vehicles. In Elyria, an apartment building was damaged when a third floor wall collapsed during the storm. Property damages for the event totaled $200,000.

Another significant thunderstorm event occurred on July 21, 1998. In Camden, a church was destroyed by fire after it was struck by lightning. Damage from the fire topped $600,000. In Lorain, wind gusts of 60mph downed trees and power lines, causing an additional $50,000 in damage. Residents in North Ridgeville also reported ¾ inch hail.

On May 23, 2011, a low-pressure system moved across the Great Lakes region, causing widespread severe weather. Many counties in northern Ohio were impacted, including Lorain County. The storm system produced hail that ranged from nickel to golf ball size and caused significant damage in Vermilion, Elyria, and North Ridgeville. Amherst reported wind gusts of 60mph and thunderstorm winds caused damage in North Ridgeville and Elyria. Total property damage from the event was more than $330,000. Significant damage was also reported in neighboring Cuyahoga County.

Most recently, a thunderstorm downed trees and limbs across Lorain County and caused scattered power outages on June 18, 2014. Heavy rainfall led to minor, localized flooding in some areas. Total damages for the event were $150,000.

The list below includes all events since 1950, per NCDC records, that included hail, lightning, and/or thunderstorm wind.

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Thunderstorm Wind	Lorain County	07/09/1955	0	0	0	0
Thunderstorm Wind	Lorain County	06/23/1956	0	0	0	0
Thunderstorm Wind	Lorain County	04/24/1958	0	0	0	0
Thunderstorm Wind	Lorain County	09/06/1961	0	0	0	0
Hail	Lorain County	05/23/1962	0	0	0	0
Hail	Lorain County	05/23/1962	0	0	0	0
Thunderstorm Wind	Lorain County	09/13/1962	0	0	0	0
Hail	Lorain County	08/11/1964	0	0	0	0
Thunderstorm Wind	Lorain County	05/16/1965	0	0	0	0
Thunderstorm Wind	Lorain County	11/27/1965	0	0	0	0
Thunderstorm Wind	Lorain County	03/23/1966	0	0	0	0
Thunderstorm Wind	Lorain County	06/08/1967	0	0	0	0
Thunderstorm Wind	Lorain County	05/15/1968	0	0	0	0
Thunderstorm Wind	Lorain County	07/18/1968	0	0	0	0
Thunderstorm Wind	Lorain County	07/04/1969	0	0	0	0
Thunderstorm Wind	Lorain County	05/25/1970	0	0	0	0
Thunderstorm Wind	Lorain County	05/25/1970	0	0	0	0
Hail	Lorain County	05/25/1970	0	0	0	0
Hail	Lorain County	06/14/1970	0	0	0	0
Hail	Lorain County	06/05/1973	0	0	0	0
Hail	Lorain County	04/14/1974	0	0	0	0
Thunderstorm Wind	Lorain County	04/14/1974	0	0	0	0
Hail	Lorain County	04/14/1974	0	0	0	0
Thunderstorm Wind	Lorain County	04/14/1974	0	0	0	0
Thunderstorm Wind	Lorain County	05/11/1974	0	0	0	0
Thunderstorm Wind	Lorain County	07/09/1974	0	0	0	0
Hail	Lorain County	07/29/1974	0	0	0	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Hail	Lorain County	08/13/1974	0	0	0	0
Thunderstorm Wind	Lorain County	03/20/1976	0	0	0	0
Thunderstorm Wind	Lorain County	07/10/1976	0	0	0	0
Thunderstorm Wind	Lorain County	07/14/1976	0	0	0	0
Thunderstorm Wind	Lorain County	07/15/1976	0	0	0	0
Thunderstorm Wind	Lorain County	06/28/1977	0	0	0	0
Thunderstorm Wind	Lorain County	06/30/1977	0	0	0	0
Thunderstorm Wind	Lorain County	07/16/1977	0	0	0	0
Thunderstorm Wind	Lorain County	05/20/1978	0	0	0	0
Thunderstorm Wind	Lorain County	06/12/1978	0	0	0	0
Hail	Lorain County	06/20/1979	0	0	0	0
Thunderstorm Wind	Lorain County	06/20/1979	0	0	0	0
Thunderstorm Wind	Lorain County	08/05/1979	0	0	0	0
Thunderstorm Wind	Lorain County	09/07/1979	0	0	0	0
Hail	Lorain County	04/08/1980	0	0	0	0
Thunderstorm Wind	Lorain County	04/08/1980	0	0	0	0
Thunderstorm Wind	Lorain County	06/07/1980	0	0	0	0
Thunderstorm Wind	Lorain County	06/29/1980	0	0	0	0
Thunderstorm Wind	Lorain County	09/04/1980	0	0	0	0
Thunderstorm Wind	Lorain County	09/13/1980	0	0	0	0
Thunderstorm Wind	Lorain County	09/25/1980	0	0	0	0
Thunderstorm Wind	Lorain County	04/17/1981	0	0	0	0
Hail	Lorain County	04/28/1981	0	0	0	0
Thunderstorm Wind	Lorain County	04/28/1981	0	0	0	0
Thunderstorm Wind	Lorain County	06/22/1981	0	0	0	0
Thunderstorm Wind	Lorain County	08/07/1981	0	0	0	0
Thunderstorm Wind	Lorain County	01/04/1982	0	0	0	0
Thunderstorm Wind	Lorain County	01/04/1982	0	0	0	0
Hail	Lorain County	05/22/1982	0	0	0	0
Thunderstorm Wind	Lorain County	06/15/1982	0	0	0	0
Hail	Lorain County	06/22/1982	0	0	0	0
Thunderstorm Wind	Lorain County	09/02/1982	0	0	0	0
Thunderstorm Wind	Lorain County	05/02/1983	0	0	0	0
Hail	Lorain County	05/02/1983	0	0	0	0
Thunderstorm Wind	Lorain County	05/02/1983	0	0	0	0
Hail	Lorain County	05/02/1983	0	0	0	0
Hail	Lorain County	05/02/1983	0	0	0	0
Hail	Lorain County	05/02/1983	0	0	0	0
Hail	Lorain County	05/02/1983	0	0	0	0
Thunderstorm Wind	Lorain County	07/04/1983	0	0	0	0
Thunderstorm Wind	Lorain County	07/31/1983	0	0	0	0
Thunderstorm Wind	Lorain County	09/06/1983	0	0	0	0
Thunderstorm Wind	Lorain County	06/13/1984	0	0	0	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Thunderstorm Wind	Lorain County	07/06/1984	0	0	0	0
Hail	Lorain County	03/28/1985	0	0	0	0
Hail	Lorain County	03/28/1985	0	0	0	0
Thunderstorm Wind	Lorain County	03/28/1985	0	0	0	0
Thunderstorm Wind	Lorain County	04/05/1985	0	0	0	0
Thunderstorm Wind	Lorain County	04/05/1985	0	0	0	0
Thunderstorm Wind	Lorain County	04/05/1985	0	0	0	0
Thunderstorm Wind	Lorain County	07/10/1985	0	0	0	0
Thunderstorm Wind	Lorain County	03/10/1986	0	0	0	0
Thunderstorm Wind	Lorain County	06/16/1986	0	0	0	0
Thunderstorm Wind	Lorain County	07/25/1986	0	0	0	0
Thunderstorm Wind	Lorain County	08/26/1986	0	0	0	0
Thunderstorm Wind	Lorain County	09/26/1986	0	0	0	0
Thunderstorm Wind	Lorain County	09/26/1986	0	0	0	0
Thunderstorm Wind	Lorain County	09/27/1986	0	0	0	0
Thunderstorm Wind	Lorain County	05/30/1987	0	0	0	0
Thunderstorm Wind	Lorain County	06/08/1987	0	0	0	0
Thunderstorm Wind	Lorain County	06/29/1987	0	0	0	0
Thunderstorm Wind	Lorain County	06/29/1987	0	0	0	0
Thunderstorm Wind	Lorain County	06/29/1987	0	0	0	0
Thunderstorm Wind	Lorain County	08/02/1987	0	0	0	0
Thunderstorm Wind	Lorain County	08/02/1987	0	0	0	0
Thunderstorm Wind	Lorain County	08/02/1987	0	0	0	0
Thunderstorm Wind	Lorain County	05/09/1988	0	0	0	0
Thunderstorm Wind	Lorain County	05/09/1988	0	2	0	0
Hail	Lorain County	05/15/1988	0	0	0	0
Hail	Lorain County	05/15/1988	0	0	0	0
Thunderstorm Wind	Lorain County	05/15/1988	0	0	0	0
Thunderstorm Wind	Lorain County	05/15/1988	0	0	0	0
Thunderstorm Wind	Lorain County	08/14/1988	0	0	0	0
Thunderstorm Wind	Lorain County	08/15/1988	0	0	0	0
Thunderstorm Wind	Lorain County	05/25/1989	0	0	0	0
Thunderstorm Wind	Lorain County	05/31/1989	0	0	0	0
Thunderstorm Wind	Lorain County	06/27/1989	0	0	0	0
Thunderstorm Wind	Lorain County	09/07/1989	0	0	0	0
Thunderstorm Wind	Lorain County	11/27/1989	0	0	0	0
Thunderstorm Wind	Lorain County	06/03/1990	0	0	0	0
Thunderstorm Wind	Lorain County	06/30/1990	0	0	0	0
Thunderstorm Wind	Lorain County	09/06/1990	0	0	0	0
Thunderstorm Wind	Lorain County	09/14/1990	0	0	0	0
Thunderstorm Wind	Lorain County	03/27/1991	0	0	0	0
Thunderstorm Wind	Lorain County	03/27/1991	0	0	0	0
Thunderstorm Wind	Lorain County	05/24/1991	0	0	0	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Thunderstorm Wind	Lorain County	05/30/1991	0	0	0	0
Thunderstorm Wind	Lorain County	05/31/1991	0	0	0	0
Thunderstorm Wind	Lorain County	06/15/1991	0	0	0	0
Thunderstorm Wind	Lorain County	07/07/1991	0	0	0	0
Hail	Lorain County	08/19/1991	0	0	0	0
Thunderstorm Wind	Lorain County	04/11/1992	0	0	0	0
Thunderstorm Wind	Lorain County	04/16/1992	0	0	0	0
Thunderstorm Wind	Lorain County	05/17/1992	0	0	0	0
Thunderstorm Wind	Lorain County	06/17/1992	0	0	0	0
Thunderstorm Wind	Lorain County	07/14/1992	0	0	0	0
Thunderstorm Wind	Lorain County	07/14/1992	0	1	0	0
Thunderstorm Wind	Lorain County	07/14/1992	0	0	0	0
Thunderstorm Wind	Lorain County	08/10/1992	0	0	0	0
Hail	Lorain County	08/27/1992	0	0	0	0
Thunderstorm Wind	Lorain County	09/09/1992	0	0	0	0
Thunderstorm Wind	Lorain County	09/02/1993	0	0	50K	0
Thunderstorm Wind	Wellington	04/12/1994	0	0	5K	0
Thunderstorm Wind	Huntington	04/27/1994	0	0	5K	0
Thunderstorm Wind	Lorain County	06/20/1994	0	1	50K	0
Hail	Grafton	06/28/1994	0	0	0	0
Thunderstorm Wind	Avon Lake	08/04/1994	0	0	5K	0
Thunderstorm Wind	Wellington	08/04/1994	0	0	5K	0
Thunderstorm Wind	Western Portion	08/13/1994	0	0	5K	0
Thunderstorm Wind	Lorain	09/25/1994	0	0	50K	0
Thunderstorm Wind	Eastern Half	03/20/1995	0	0	15K	0
Thunderstorm Wind	Lorain County	05/28/1995	0	0	5K	0
Thunderstorm Wind	Elyria	07/05/1995	0	0	3K	0
Thunderstorm Wind	Lorain County	07/13/1995	0	0	400K	20K
Hail	Elyria and Oberlin	07/15/1995	0	0	0	0
Thunderstorm Wind	Elyria and Oberlin	07/15/1995	0	0	3K	0
Thunderstorm Wind	Avon Lake	07/16/1995	0	0	0	0
Thunderstorm Wind	Avon and Avon Point	08/13/1995	0	0	110K	0
Thunderstorm Wind	North Ridgeville	09/13/1995	0	0	0	0
Thunderstorm Wind	Lorain County	04/12/1996	0	0	300K	0
Hail	Amherst	04/20/1996	0	0	0	0
Hail	Vermilion	06/03/1996	0	0	0	0
Hail	Avon	06/04/1996	0	0	0	0
Lightning	Sheffield Township	06/12/1996	0	1	0	0
Hail	County Airport	06/12/1996	0	0	0	0
Hail	South of Airport	06/12/1996	0	0	0	0
Thunderstorm Wind	Avon	06/13/1996	0	0	0	0
Lightning	Grafton	06/18/1996	0	1	0	0
Thunderstorm Wind	New Russia Township	06/24/1996	0	0	0	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Lightning	Lorain County	06/24/1996	0	0	30K	0
Thunderstorm Wind	Lorain County	10/30/1996	0	0	200K	0
Thunderstorm Wind	Lorain City	11/07/1996	0	0	0	0
Thunderstorm Wind	Northern Portion	12/01/1996	0	0	2K	0
Hail	Wellington	05/18/1997	0	0	0	0
Hail	Amherst	08/04/1997	0	0	0	0
Hail	Oberlin	08/16/1997	0	0	0	0
Hail	Sheffield Lake	05/31/1998	0	0	0	0
Hail	Amherst	05/31/1998	0	0	0	0
Hail	Elyria	05/31/1998	0	0	0	0
Hail	Avon	05/31/1998	0	0	0	0
Lightning	Eaton Estates	05/31/1998	0	0	15K	0
Hail	Vermilion on the Lake	05/31/1998	0	0	0	0
Hail	Lorain City	05/31/1998	0	0	0	0
Hail	Lorain County	05/31/1998	0	0	0	0
Hail	Sheffield Lake	05/31/1998	0	0	0	0
Hail	Oberlin	06/30/1998	0	0	0	0
Thunderstorm Wind	Amherst	06/30/1998	0	0	0	0
Thunderstorm Wind	Lorain City	07/21/1998	0	0	50K	0
Hail	North Ridgeville	07/21/1998	0	0	0	0
Lightning	Camden	07/21/1998	0	0	600K	0
Thunderstorm Wind	Lorain County	11/10/1998	0	0	30K	0
Thunderstorm Wind	Oberlin	07/06/1999	0	0	15K	0
Lightning	Elyria	07/06/1999	0	1	0	0
Thunderstorm Wind	Lorain City	07/06/1999	0	0	15K	0
Thunderstorm Wind	Avon	07/09/1999	0	0	15K	0
Thunderstorm Wind	Elyria	07/28/1999	0	0	0	0
Lightning	Elyria	07/28/1999	0	0	225K	0
Hail	Lorain City	07/31/1999	0	0	0	0
Thunderstorm Wind	Lorain City	07/31/1999	0	0	0	0
Hail	Amherst	10/13/1999	0	0	0	0
Hail	Lorain Airport	10/13/1999	0	0	0	0
Thunderstorm Wind	Lorain Airport	04/20/2000	0	0	25K	0
Lightning	Lorain County	05/18/2000	0	0	20K	0
Hail	Avon Lake	05/31/2000	0	0	0	0
Hail	Grafton	06/29/2000	0	0	0	0
Hail	Penfield	07/28/2000	0	0	0	0
Hail	LaGrange	07/28/2000	0	0	0	0
Hail	Penfield	07/28/2000	0	0	0	0
Thunderstorm Wind	Oberlin	08/06/2000	0	0	0	0
Thunderstorm Wind	Lorain City	10/04/2000	0	0	300K	0
Hail	Eaton Estates	06/02/2001	0	0	0	0
Thunderstorm Wind	Elyria	08/09/2001	0	0	0	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Hail	Vermilion on the Lake	04/19/2002	0	0	5K	0
Hail	Henrietta	04/19/2002	0	0	5K	0
Hail	Penfield	04/19/2002	0	0	5K	0
Hail	Lorain City	05/30/2002	0	0	5K	0
Hail	Kipton	06/04/2002	0	0	5K	0
Hail	Vermilion on the Lake	06/14/2002	0	0	2K	0
Thunderstorm Wind	Elyria	07/28/2002	0	0	40K	0
Hail	LaGrange	09/14/2002	0	0	5K	0
Hail	LaGrange	09/14/2002	0	0	25K	0
Hail	Amherst	11/10/2002	0	0	5K	0
Thunderstorm Wind	Vermilion on the Lake	11/10/2002	0	0	25K	0
Thunderstorm Wind	LaGrange	04/04/2003	0	0	2K	0
Thunderstorm Wind	Avon Lake	04/20/2003	0	0	3K	0
Hail	Elyria	05/10/2003	0	0	0	0
Thunderstorm Wind	Avon Lake	06/26/2003	0	0	5K	0
Thunderstorm Wind	Oberlin	07/04/2003	0	0	25K	0
Thunderstorm Wind	Elyria	07/04/2003	0	0	15K	0
Hail	Elyria	07/04/2003	0	0	2K	0
Thunderstorm Wind	Amherst	07/04/2003	0	0	10K	0
Thunderstorm Wind	Eaton Estates	07/04/2003	0	0	50K	0
Thunderstorm Wind	Lorain City	07/07/2003	0	0	10K	0
Hail	LaGrange	07/07/2003	0	0	0	0
Thunderstorm Wind	Amherst	07/07/2003	0	0	30K	0
Thunderstorm Wind	Lorain County	07/08/2003	0	0	250K	0
Thunderstorm Wind	Lorain County	07/08/2003	0	0	50K	0
Thunderstorm Wind	Lorain City	07/10/2003	0	0	2K	0
Thunderstorm Wind	Sheffield Lake	07/10/2003	0	0	2K	0
Thunderstorm Wind	Lorain County	07/27/2003	0	0	15K	0
Hail	Penfield	08/16/2003	0	0	0	0
Thunderstorm Wind	Oberlin	08/22/2003	0	0	25K	0
Hail	Avon Lake	08/26/2003	0	0	0	0
Thunderstorm Wind	Amherst	09/27/2003	0	0	2K	0
Hail	Wellington	05/07/2004	0	0	0	0
Hail	Brighton	05/17/2004	0	0	5K	0
Thunderstorm Wind	Oberlin	05/17/2004	0	0	35K	0
Thunderstorm Wind	Kipton	05/17/2004	0	0	2K	0
Thunderstorm Wind	Elyria	05/17/2004	0	0	35K	0
Hail	Elyria	05/17/2004	0	0	0	0
Thunderstorm Wind	North Ridgeville	05/17/2004	0	0	0	0
Hail	Grafton	05/17/2004	0	0	0	0
Hail	Eaton Estates	05/17/2004	0	0	0	0
Thunderstorm Wind	Oberlin	05/17/2003	0	0	15K	0
Hail	Avon Lake	05/17/2004	0	0	0	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Hail	Eaton Estates	05/18/2004	0	0	0	0
Thunderstorm Wind	Penfield	05/18/2004	0	0	2K	0
Thunderstorm Wind	Oberlin	05/21/2004	0	0	2K	0
Thunderstorm Wind	LaGrange	05/21/2004	0	0	2K	0
Thunderstorm Wind	Lorain County	05/21/2004	0	0	150K	0
Hail	Elyria	05/21/2004	0	0	0	0
Hail	Avon Lake	05/22/2004	0	0	0	0
Thunderstorm Wind	Vermilion on the Lake	06/01/2004	0	0	10K	0
Thunderstorm Wind	Elyria	06/13/2004	0	0	10K	0
Thunderstorm Wind	Lorain County	06/14/2004	0	0	90K	0
Thunderstorm Wind	LaGrange	06/17/2004	0	0	3K	0
Thunderstorm Wind	North Ridgeville	06/17/2004	0	0	2K	0
Hail	Wellington	08/18/2004	0	0	0	0
Thunderstorm Wind	Wellington	08/28/2004	0	0	5K	0
Thunderstorm Wind	LaGrange	08/28/2004	0	0	3K	0
Hail	Grafton	04/20/2005	0	0	0	0
Thunderstorm Wind	Lorain County	05/13/2005	0	0	15K	0
Hail	Huntington	05/28/2005	0	0	0	0
Hail	Oberlin	06/09/2005	0	0	20K	0
Hail	Elyria	06/10/2005	0	0	30K	0
Hail	Oberlin	06/14/2005	0	0	5K	0
Thunderstorm Wind	Avon	06/30/2005	0	0	10K	0
Thunderstorm Wind	Elyria	07/13/2005	0	0	35K	0
Thunderstorm Wind	Grafton	07/18/2005	0	0	2K	0
Thunderstorm Wind	Avon Lake	07/26/2005	0	0	5K	0
Thunderstorm Wind	Lorain City	07/26/2005	0	0	10K	0
Thunderstorm Wind	Grafton	07/26/2005	0	0	2K	0
Thunderstorm Wind	LaGrange	07/26/2005	0	0	2K	0
Thunderstorm Wind	Amherst	07/26/2005	0	0	2K	0
Thunderstorm Wind	Amherst	07/26/2005	0	0	2K	0
Thunderstorm Wind	Avon	07/26/2005	0	0	15K	0
Lightning	Wellington	07/26/2005	0	0	5K	0
Hail	Lorain City	08/20/2005	0	0	2K	0
Thunderstorm Wind	Sheffield	08/20/2005	0	0	2K	0
Lightning	Elyria	09/22/2005	0	0	110K	0
Thunderstorm Wind	Lorain Airport	11/06/2005	0	0	0	0
Thunderstorm Wind	Elyria Airport	11/06/2005	0	0	1K	0
Hail	Elyria	04/07/2006	0	0	0	0
Hail	Oberlin	04/12/2006	0	0	0	0
Hail	Oberlin	04/12/2006	0	0	0	0
Hail	Grafton	05/18/2006	0	0	0	0
Thunderstorm Wind	Amherst	05/25/2006	0	0	30K	0
Thunderstorm Wind	Lorain City	06/19/2006	0	0	3K	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Hail	Elyria	06/19/2006	0	0	0	0
Hail	North Ridgeville	06/19/2006	0	0	0	0
Severe Storm	Vermilion on the Lake	06/21/2006	0	0	0	0
Hail	Grafton	06/22/2006	0	0	0	0
Thunderstorm Wind	Wellington	06/22/2006	0	0	1K	0
Thunderstorm Wind	Avon Lake	06/28/2006	0	1	8K	0
Thunderstorm Wind	Wellington	07/02/2006	0	0	10K	0
Thunderstorm Wind	Vermilion on the Lake	07/04/2006	0	0	25K	0
Thunderstorm Wind	Oberlin	07/10/2006	0	0	3K	0
Hail	Wellington	07/10/2006	0	0	0	0
Thunderstorm Wind	Grafton	10/28/2006	0	0	3K	0
Hail	Rochester	05/01/2007	0	0	0	0
Hail	Grafton	05/25/2007	0	0	0	0
Thunderstorm Wind	Oberlin	06/01/2007	0	0	5K	0
Thunderstorm Wind	Wellington	06/01/2007	0	0	35K	0
Thunderstorm Wind	Wellington	06/08/2007	0	0	15K	0
Hail	Wellington	06/08/2007	0	0	0	0
Thunderstorm Wind	LaGrange	07/27/2007	0	0	0	0
Hail	LaGrange	07/27/2007	0	0	0	0
Thunderstorm Wind	Lorain City	01/09/2008	0	0	5K	0
Thunderstorm Wind	Elyria	01/09/2008	0	0	0	0
Thunderstorm Wind	Lorain City	01/09/2008	0	0	25K	0
Thunderstorm Wind	Elyria	01/09/2008	0	0	0	0
Thunderstorm Wind	Grafton	01/30/2008	0	0	15K	0
Thunderstorm Wind	Amherst	04/11/2008	0	0	250K	0
Hail	North Ridgeville	05/02/2008	0	0	0	0
Thunderstorm Wind	Lorain City	06/09/2008	0	0	10K	0
Thunderstorm Wind	Oberlin	06/10/2008	0	0	1K	0
Thunderstorm Wind	LaGrange Airport	06/13/2008	0	0	0	0
Thunderstorm Wind	Wellington	06/21/2008	0	0	3K	0
Hail	Wellington	06/21/2008	0	0	0	0
Hail	North Ridgeville	06/21/2008	0	0	0	0
Hail	North Ridgeville	06/21/2008	0	0	0	0
Hail	North Ridgeville	06/21/2008	0	0	0	0
Thunderstorm Wind	LaGrange Airport	06/21/2008	0	0	0	0
Thunderstorm Wind	Wellington	06/21/2008	0	0	3K	0
Thunderstorm Wind	Wellington	06/21/2008	0	0	0	0
Hail	Vermilion on the Lake	06/22/2008	0	0	0	0
Thunderstorm Wind	Wellington	06/26/2008	0	0	3K	0
Thunderstorm Wind	Amherst	06/26/2008	0	0	30K	0
Thunderstorm Wind	Elyria	06/26/2008	0	0	20K	0
Thunderstorm Wind	Elyria	06/26/2008	0	0	5K	0
Thunderstorm Wind	Amherst	06/26/2008	0	0	25K	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Thunderstorm Wind	Elyria	07/08/2008	0	0	0	0
Thunderstorm Wind	Elyria	07/08/2008	0	0	0	0
Thunderstorm Wind	Sheffield Lake	07/08/2008	0	0	8K	0
Thunderstorm Wind	Wellington	07/22/2008	0	0	8K	0
Hail	LaGrange	07/22/2008	0	0	0	0
Thunderstorm Wind	Penfield	07/22/2008	0	0	5K	0
Thunderstorm Wind	LaGrange Airport	07/22/2008	0	0	10K	0
Thunderstorm Wind	Sheffield	08/09/2008	0	0	4K	0
Thunderstorm Wind	Avon	08/09/2008	0	0	4K	0
Thunderstorm Wind	Elyria Airport	12/28/2008	0	0	0	0
Hail	Elyria	05/28/2009	0	0	0	0
Thunderstorm Wind	Elyria	05/28/2009	0	0	60K	0
Hail	Elyria	05/28/2009	0	0	0	0
Thunderstorm Wind	North Eaton	06/25/2009	0	0	2K	0
Thunderstorm Wind	Lorain City	08/20/2009	0	0	3K	0
Hail	Avon	08/20/2009	0	0	0	0
Thunderstorm Wind	Wellington	08/20/2009	0	0	8K	0
Hail	Vermilion on the Lake	08/28/2009	0	0	0	0
Hail	Amherst	08/28/2009	0	0	0	0
Hail	Amherst	08/28/2009	0	0	0	0
Hail	Amherst	08/28/2009	0	0	25K	0
Hail	Elyria Airport	08/28/2009	0	0	0	0
Hail	Clearview	08/28/2009	0	0	0	0
Hail	Eaton Estates	08/28/2009	0	0	0	0
Hail	Avon Lake	05/07/2010	0	0	0	0
Hail	Amherst	05/07/2010	0	0	0	0
Hail	Lorain City	05/07/2010	0	0	0	0
Hail	Avon Lake	05/07/2010	0	0	5K	0
Hail	Avon Lake	05/07/2010	0	0	0	0
Thunderstorm Wind	Pittsfield	05/14/2010	0	0	15K	0
Hail	Amherst	05/14/2010	0	0	0	0
Hail	North Ridgeville	05/14/2010	0	0	0	0
Thunderstorm Wind	Elyria	06/06/2010	0	0	1K	0
Thunderstorm Wind	Kipton	06/23/2010	0	0	3K	0
Thunderstorm Wind	LaGrange	06/23/2010	0	0	15K	0
Thunderstorm Wind	Lorain Airport	06/23/2010	0	0	0	0
Thunderstorm Wind	LaGrange Airport	06/27/2010	0	0	0	0
Thunderstorm Wind	North Ridgeville	06/27/2010	0	0	5K	0
Thunderstorm Wind	Penfield	07/21/2010	0	0	25K	0
Thunderstorm Wind	Penfield	07/21/2010	0	0	2K	0
Thunderstorm Wind	Penfield	07/21/2010	0	0	10K	0
Thunderstorm Wind	Penfield	07/21/2010	0	0	0	0
Thunderstorm Wind	Avon Lake	09/16/2010	0	0	2K	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Thunderstorm Wind	Oberlin Airport	10/26/2010	0	0	30K	0
Thunderstorm Wind	Lorain	10/26/2010	0	0	5K	0
Hail	Avon	04/04/2011	0	0	1K	0
Hail	Vermilion on the Lake	04/16/2011	0	0	10K	0
Hail	Oberlin	04/16/2011	0	0	5K	0
Hail	LaGrange Airport	04/19/2011	0	0	0	0
Hail	Grafton	04/20/2011	0	0	0	0
Hail	Sheffield Lake	05/10/2011	0	0	10K	0
Thunderstorm Wind	Amherst	05/23/2011	0	0	0	0
Hail	Vermilion on the Lake	05/23/2011	0	0	300K	0
Thunderstorm Wind	North Ridgeville	05/23/2011	0	0	30K	0
Thunderstorm Wind	Elyria	05/23/2011	0	0	1K	0
Thunderstorm Wind	North Ridgeville	05/23/2011	0	0	1K	0
Hail	Vermilion on the Lake	05/25/2011	0	0	0	0
Hail	Elyria	05/25/2011	0	0	0	0
Hail	Elyria	05/25/2011	0	0	0	0
Hail	Sheffield	05/25/2011	0	0	0	0
Hail	Elyria	05/25/2011	0	0	0	0
Hail	North Ridgeville	05/25/2011	0	0	0	0
Hail	North Ridgeville	05/25/2011	0	0	0	0
Thunderstorm Wind	Sheffield	05/29/2011	0	0	10K	0
Thunderstorm Wind	North Ridgeville	05/29/2011	0	0	125K	0
Hail	Lorain City	06/07/2011	0	0	100K	0
Hail	Elyria	06/07/2011	0	0	0	0
Hail	Elyria	06/07/2011	0	0	100K	0
Hail	Amherst	06/07/2011	0	0	5K	0
Thunderstorm Wind	Amherst	06/07/2011	0	0	40K	0
Hail	Wellington	06/07/2011	0	0	0	0
Thunderstorm Wind	Lorain City	07/02/2011	0	0	2K	0
Thunderstorm Wind	Lorain City	07/22/2011	0	0	10K	0
Hail	Lorain City	07/23/2011	0	0	0	0
Thunderstorm Wind	Lorain City	07/23/2011	0	0	2K	0
Hail	Vermilion on the Lake	08/01/2011	0	0	0	0
Hail	Lorain City	08/24/2011	0	0	0	0
Thunderstorm Wind	Oberlin	08/24/2011	0	0	15K	0
Thunderstorm Wind	East Carlisle	08/24/2011	0	0	150K	0
Thunderstorm Wind	Fields	08/24/2011	0	0	0	0
Hail	Huntington	03/15/2012	0	0	0	0
Thunderstorm Wind	North Ridgeville	05/25/2012	0	0	50K	0
Hail	North Ridgeville	05/25/2012	0	0	0	0
Thunderstorm Wind	Vermilion on the Lake	06/18/2012	0	0	100K	0
Thunderstorm Wind	Wellington	06/18/2012	0	0	1K	0
Thunderstorm Wind	Amherst	06/18/2012	0	0	10K	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Thunderstorm Wind	Oberlin	07/01/2012	0	0	15K	0
Thunderstorm Wind	Sheffield Lake	07/03/2012	0	0	0	0
Thunderstorm Wind	Oberlin	07/03/2012	0	0	5K	0
Hail	Litchfield	07/03/2012	0	0	0	0
Hail	Sheffield Lake	07/05/2012	0	0	0	0
Thunderstorm Wind	Elyria	07/05/2012	0	0	15K	0
Thunderstorm Wind	Sheffield	07/26/2012	0	0	0	0
Hail	Henrietta	04/08/2013	0	0	1K	0
Hail	East Carlisle	04/08/2013	0	0	2K	0
Thunderstorm Wind	Wellington	05/31/2013	0	0	3K	0
Hail	Rochester	06/12/2013	0	0	50K	50K
Thunderstorm Wind	Elyria	06/13/2013	0	0	100K	0
Thunderstorm Wind	South Amherst	06/13/2013	0	0	1K	0
Thunderstorm Wind	Vermilion on the Lake	06/25/2013	0	0	18K	0
Thunderstorm Wind	Sheffield Lake	06/25/2013	0	0	110K	0
Thunderstorm Wind	North Ridgeville	06/25/2013	0	0	15K	0
Thunderstorm Wind	Elyria	06/25/2013	0	0	6K	0
Thunderstorm Wind	Elyria	07/10/2013	0	0	25K	0
Hail	Grafton	07/23/2013	0	0	10K	0
Thunderstorm Wind	Amherst	11/01/2013	0	0	8K	0
Thunderstorm Wind	South Amherst	11/17/2013	0	0	40K	0
Thunderstorm Wind	Avon	11/17/2013	0	0	3K	0
Thunderstorm Wind	South Amherst	11/17/2013	0	0	10K	0
Hail	Vermilion on the Lake	05/12/2004	0	0	0	0
Hail	Lorain City	05/12/2014	0	0	0	0
Thunderstorm Wind	Eaton Estates	05/12/2014	0	0	40K	0
Hail	Penfield	05/12/2014	0	0	0	0
Hail	LaGrange	05/12/2014	0	0	0	0
Hail	Clearview	05/12/2014	0	0	0	0
Thunderstorm Wind	North Eaton	05/27/2014	0	0	5K	0
Thunderstorm Wind	Lorain County	06/18/2014	0	0	0	0
Thunderstorm Wind	Lorain County	06/18/2014	0	0	0	0
Thunderstorm Wind	Lorain County	06/18/2014	0	0	15K	0
Thunderstorm Wind	Lorain County	06/18/2014	0	0	150K	0
Thunderstorm Wind	Lorain County	06/18/2014	0	0	2K	0
Thunderstorm Wind	Lorain County	06/18/2014	0	0	3K	0
Thunderstorm Wind	Lorain County	06/18/2014	0	0	12K	0
Thunderstorm Wind	Grafton Airport	07/08/2014	0	0	2K	0

Tornado

Ohio ranks among the top twenty states for injuries, fatalities, and property damage from tornado events. The hazard is countywide and can affect all areas and jurisdictions of the county. Since 1950, Lorain County has experienced 27 tornados. The twisters have ranged in magnitude from F/EF0 to F4. Twenty-two incidents have been measured as F/EF0 or F/EF1 storms and have

caused minimal damage. However, there have been three F2 and two F4 tornados that have causes substantial to major damage. In total, the county has suffered more than $36,000,000 in property damage from tornado incidents.

One of the most destructive tornados to impact Lorain County occurred on April 11, 1965. This tornado was part of the Palm Sunday tornado outbreak that spawned 47 tornados across the Midwest, including incidents in Iowa, Illinois, Indiana, Michigan, Ohio, and Wisconsin. At the time, the Palm Sunday outbreak was the second largest tornado outbreak. In Lorain County, the destructive tornado struck south of Oberlin as an F4 storm, causing extensive damage in Pittsfield. The storm weakened into an F2 before striking Grafton and moving into Cuyahoga County. Although the tornado is officially categorized as an F4, at least one meteorologist believed it was actually an F5. Seventeen individuals were killed and 100 injured as a result of the tornado. Property damages topped $25,000,000.

Another serious tornado outbreak impacted Ohio on July 12, 1992. Lorain County was struck by three tornados in the early evening hours. The first tornado, classified as F1, struck near North Ridgeville, causing serious damage to one home and minor damage to several others. The second tornado was classified as an F2 storm and touched down near LaGrange. It destroyed eight homes and damaged several others. The third tornado of the outbreak to strike Lorain County was an F1 storm that touched down in Amherst, causing damage to a school and several homes. In total, property damage from this tornado outbreak was more than $7,500,000.

The most recent tornado incident in Lorain County occurred on July 8, 2014. The tornado was first categorized as an EF0 when it developed in the extreme east central portion of the county. As the twister moved east toward Medina County, it quickly grew into an EF1 storm. Most of the damage from the storm was limited to downed trees and minor property damage, such as loose or missing shingles. Total damages in Lorain County were $8,000.

The list below identifies tornado events that have occurred in Lorain County since 1950 per NCDC records.

Type	Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Tornado	Lorain County	06/08/1953	F4	1	47	0	0
Tornado	Lorain County	07/20/1956	F1	0	0	2.5K	0
Tornado	Lorain County	06/20/1958	F1	0	3	25K	0
Tornado	Lorain County	04/19/1963	F0	0	0	25K	0
Tornado	Lorain County	04/11/1965	F4	17	100	25M	0
Tornado	Lorain County	10/13/1971	F1	0	1	25K	0
Tornado	Lorain County	07/23/1972	F1	0	0	25K	0
Tornado	Lorain County	07/23/1972	F1	0	0	25K	0
Tornado	Lorain County	08/01/1972	F1	0	0	250K	0
Tornado	Lorain County	08/20/1973	F0	0	0	0.25K	0
Tornado	Lorain County	07/13/1975	F2	0	0	250K	0

Type	Location	Date	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
Tornado	Lorain County	08/26/1975	F0	0	0	2.5K	0
Tornado	Lorain County	08/26/1986	F2	0	2	2.5M	0
Tornado	Lorain County	06/18/1992	F0	0	0	0	0
Tornado	Lorain County	06/18/1992	F0	0	0	0	0
Tornado	Lorain County	07/12/1992	F1	0	0	2.5M	0
Tornado	Lorain County	07/12/1992	F0	0	2	2.5M	0
Tornado	Lorain County	07/12/1992	F2	0	3	2.5M	0
Tornado	Wellington	06/28/1994	F1	0	0	500K	0
Tornado	Lorain	08/04/1997	F0	0	0	0	0
Tornado	Eaton Estates	04/09/1998	F0	0	0	0	0
Tornado	Rochester	07/09/1999	F0	0	0	30K	0
Funnel Cloud	Eaton Estates	08/26/1999		0	0	0	0
Funnel Cloud	Grafton	05/21/2001		0	0	0	0
Funnel Cloud	LaGrange	05/21/2001		0	0	0	0
Funnel Cloud	Amherst	07/10/2003		0	0	0	0
Tornado	Kipton	08/03/2003	F0	0	0	15K	50K
Tornado	Amherst	08/03/2003	F0	0	0	10K	0
Tornado	Elyria	03/14/2007	EF0	0	0	400K	0
Tornado	Shawville	05/12/2014	EF0	0	0	75K	0
Tornado	Belden	07/08/2014	EF1	0	0	8K	0

Windstorm

The topography of northern Ohio can be vulnerable to damages from high winds unaccompanied by any kind of precipitation. There is little change in elevation or extensive wooded cover area to break up the effects of strong windstorms. Although winds in excess of 50 miles per hour can occur independently, it is uncommon. Most of the time, severe winds are part of a larger storm system. The wind occurs as precipitation and unstable air moves into the area. High winds are frequently accompanied by heavy rain, hail, ice, snow, or thunderstorms. This hazard is countywide and can affect all areas and jurisdictions in the county.

Since 1950, Lorain County has experienced 39 wind events and suffered property damage in excess of $22,000,000. Crop damages from these events is almost $600,000. One of the most significant wind events to ever impact the county occurred on September 14, 2008. On that day, the remnants of Hurricane Ike moved northeast from Missouri across the Midwest and Ohio. In the afternoon hours, wind gusts as high as 70mph occurred in many areas of Ohio. The highest recorded wind speed in Lorain County was 71mph, which was recorded at the Lorain County Airport. The county reported one fatality, a 12-year-old boy who was struck by a falling tree and suffered fatal head injuries. Another woman was injured after her moving vehicle was hit by falling tree limbs. Lorain County suffered extensive property damage as thousands of trees and utility poles were downed by the extreme wind. Property damage to hundreds of homes ranges from a few missing shingles to major structural damage. Falling tree limbs and debris also damaged a significant number of vehicles. Across the county, roads and streets were closed

because of downed trees and utility poles, making travel difficult for several days. Widespread power outages impacted much of the county, forcing schools and businesses to close until power was restored. Because the storm occurred in the early fall before fields had been harvested, farmers suffered significant damage to their crops. Corn yields were reduced by three to five percent in many areas; soybean crop yields also suffered, but not as significantly as corn crops. In all, Lorain County suffered $15,000,000 in property damage and $500,000 in crop damage. Across all of northern Ohio, damages exceeded $300,000,000 from this event. Lorain and many other counties across the state received a federal disaster declaration to assist in recovery from this storm.

The most recent major windstorm to impact Lorain County occurred on October 29, 2012 when the remains of Hurricane Sandy tracked west across Pennsylvania and northern Ohio. Lorain County experienced significant rainfall and heavy winds, with gusts measured as high as 61mph. Extensive tree damage and power outages resulted across the county. In some cases, power was not restored for days. Some buildings suffered structural damage and, along the lakeshore, wind and storm surge caused extensive damage to many boats. In total, property damage in the county exceeded $4,500,000.

The list below identifies wind events that have occurred in Lorain County since 1950 per NCDC records.

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
High Wind	Lorain County	01/27/1996	0	0	0	0
High Wind	Lorain County	02/10/1996	0	0	3K	0
High Wind	Lorain County	03/25/1996	0	0	10K	0
High Wind	Lorain County	04/25/1996	0	0	0	0
High Wind	Lorain County	09/07/1996	0	0	5K	20K
High Wind	Lorain County	10/30/1996	0	0	75K	75K
High Wind	Lorain County	02/21/1997	0	0	0	0
High Wind	Lorain County	02/27/1997	0	0	5K	0
High Wind	Lorain County	05/01/1997	0	0	5K	0
High Wind	Lorain County	03/14/1998	0	0	20K	0
High Wind	Lorain County	03/09/2002	1	0	250K	0
High Wind	Lorain County	02/12/2003	0	0	75K	0
Strong Wind	Lorain County	05/11/2003	0	0	25K	0
Strong Wind	Lorain County	10/14/2003	0	0	10K	0
High Wind	Lorain County	11/12/2003	0	0	75K	0
High Wind	Lorain County	03/05/2004	0	1	250K	0
Strong Wind	Lorain County	11/27/2004	0	0	10K	0
High Wind	Lorain County	12/01/2004	0	0	25K	0
High Wind	Lorain County	12/07/2004	0	0	25K	0
High Wind	Lorain County	11/06/2005	0	0	30K	0
High Wind	Lorain County	02/17/2006	0	0	85K	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Strong Wind	Lorain County	03/10/2006	0	0	25K	0
High Wind	Lorain County	10/28/2006	0	0	100K	0
High Wind	Lorain County	12/01/2006	0	0	0	0
High Wind	Lorain County	12/23/2007	0	0	8K	0
High Wind	Lorain County	01/09/2008	0	0	0	0
High Wind	Lorain County	01/30/2008	0	0	0	0
High Wind	Lorain County	01/30/2008	0	0	0	0
High Wind	Lorain County	01/30/2008	0	0	0	0
High Wind	Lorain County	09/14/2008	1	1	15M	500K
High Wind	Lorain County	12/24/2008	0	0	75K	0
High Wind	Lorain County	02/11/2009	0	0	750K	0
High Wind	Lorain County	12/09/2009	0	0	450K	0
High Wind	Lorain County	05/08/2010	0	0	15K	0
High Wind	Lorain County	04/28/2011	0	0	60K	0
High Wind	Lorain County	04/28/2011	0	0	0	0
High Wind	Lorain County	04/28/2011	0	0	0	0
High Wind	Lorain County	04/28/2011	0	0	0	0
High Wind	Lorain County	04/28/2011	0	0	200K	0
High Wind	Lorain County	01/17/2012	0	0	0	0
High Wind	Lorain County	01/17/2012	0	0	50K	0
High Wind	Lorain County	02/24/2012	0	0	25K	0
High Wind	Lorain County	03/02/2012	0	0	0	0
High Wind	Lorain County	10/29/2012	0	0	15K	0
High Wind	Lorain County	10/29/2012	0	0	10K	0
High Wind	Lorain County	10/29/2012	0	0	50K	0
High Wind	Lorain County	10/29/2012	0	0	2.5M	0
High Wind	Lorain County	11/17/2013	0	0	0	0
High Wind	Lorain County	11/17/2013	0	0	75K	0
High Wind	Lorain County	04/14/2014	0	0	10K	0

Winter Storm

Severe winter weather is a risk across Ohio. All areas of the state are susceptible to winter storms that bring heavy snow, high winds, and ice. These storms can range from mild and short-lived to prolonged cold snaps with significant snowfall. In Lorain County, the hazard is countywide, affecting all areas and jurisdictions.

These winter weather events create hazardous conditions for residents of Lorain County. Sleet and ice make roadways slick and dangerous, increasing the potential for vehicular accidents. When ice accumulates on trees and power lines, they can break causing damage to anything in their path. This can lead to power outages that can last from a few hours to several days. In heavy snowfall, road crews are challenged to clear roadways and maintain safe transportation routes for residents.

Lorain County typically experiences several severe winter storm events each year. These events can occur anywhere from late November through early April. Most events are short lived enough to only cause a minor disruption of services to residents. But if an event is more extreme or prolonged, residents can experience more significant disruptions lasting several days.

Two of the most costly winter storm incidents in Lorain County occurred within a two week time period. On December 22, 2004, a strong winter storm dropped snowfall on northern Ohio at rates of up to one inch per hour. Lorain County received twelve to fifteen inches of snow. Northerly winds contributed to blowing and drifting, making travel nearly impossible at times. Property damage from this storm totaled $4,700,000. Just two weeks later, on January 5, 2015, northern Ohio was struck by a serious ice storm. As the storm moved into the region, a mixture of rain and snow transitioned into an extended period of freezing rain before turning back to rain. The ice accumulation caused major damage to trees and utility lines, leaving thousands of residents without power for days. Basement flooding was also a serious problem as power outages caused sump pumps to fail. Across the state, damages from this storm were among the highest ever in Ohio. Many counties suffered damages of more than $1,000,000. Lorain was one such county, suffering $4,800,000 in property damage.

On March 7, 2008, Lorain County experienced another significant winter weather event. Several inches of snow fell throughout the day on March 7; overnight, the snowfall intensified and wind speeds increased. Throughout the day on March 8, wind gusts of 20 to 30mph caused significant blowing and drifting, making roads impassable at times. Snowfall totals for the event reached 16 inches in Wellington and 13.5 inches in North Ridgeville and Oberlin. Property damages for the event totaled $1,500,000.

The winter of 2014 was long, cold, and intense for much of the county, Lorain County included. Residents suffered through many winter storm and extreme cold incidents throughout the winter season, but the winter storm on March 12, 1014 was more damaging than most other events that year. On that date, Lorain County received snowfall and freezing rain. Wind gusts of up to 40mph caused blowing and drifting, which contributed to deteriorating driving conditions. Much of the county received six inches of snowfall topped by a glaze of ice. This led to treacherous driving conditions and power outages, causing schools and business to close. Damages from the event totaled $250,000.

The chart below provides data on winter storm events that have impacted Lorain County since 1950 according to NCDC records.

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Winter Storm	Lorain County	01/02/1999	0	0	70K	0
Winter Storm	Lorain County	01/08/1999	0	0	2K	0
Winter Storm	Lorain County	01/13/1999	0	0	2K	0
Winter Storm	Lorain County	03/11/2000	0	0	25K	0

Type	Location	Date	Deaths	Injuries	Property Damage	Crop Damage
Winter Storm	Lorain County	12/13/2000	0	0	75K	0
Winter Storm	Lorain County	03/24/2002	0	0	50K	0
Winter Storm	Lorain County	03/26/2002	0	0	100K	0
Winter Storm	Lorain County	12/22/2004	0	0	4.7M	0
Ice Storm	Lorain County	01/05/2005	0	0	4.8M	0
Winter Storm	Lorain County	01/22/2005	0	0	250K	0
Winter Storm	Lorain County	04/23/2005	0	0	300K	0
Winter Storm	Lorain County	02/08/2006	0	0	100K	0
Winter Storm	Lorain County	02/13/2007	0	0	60K	0
Winter Storm	Lorain County	12/15/2007	0	0	350K	0
Winter Storm	Lorain County	02/25/2008	0	0	200K	0
Winter Storm	Lorain County	03/04/2008	0	0	500K	0
Winter Storm	Lorain County	03/07/2008	0	0	1.5M	0
Winter Storm	Lorain County	12/19/2008	0	0	40K	0
Winter Storm	Lorain County	01/09/2009	0	0	175K	0
Extreme Cold/Wind Chill	Lorain County	01/15/2009	0	0	0	0
Winter Storm	Lorain County	01/27/2009	0	0	350K	0
Lake Effect Snow	Lorain County	02/03/2009	0	0	200K	0
Winter Storm	Lorain County	02/05/2010	0	0	350K	0
Winter Storm	Lorain County	02/01/2011	0	0	350K	0
Winter Storm	Lorain County	02/20/2011	0	0	400K	0
Winter Storm	Lorain County	03/10/2011	0	0	200K	0
Extreme Cold/Wind Chill	Lorain County	04/29/2012	0	0	150K	0
Winter Storm	Lorain County	02/16/2013	0	0	75K	0
Extreme Cold/Wind Chill	Lorain County	01/06/2014	0	0	0	0
Extreme Cold/Wind Chill	Lorain County	01/28/2014	0	0	0	0
Winter Storm	Lorain County	02/04/2014	0	0	200K	0
Winter Storm	Lorain County	02/17/2014	0	0	300K	0
Winter Storm	Lorain County	03/12/2014	0	0	250K	0

Jurisdiction Characteristics and Risks

In the process of updating their mitigation plan, the Lorain County Hazard Mitigation Core Committee assessed all disaster types for possibility, probability, magnitude, and severity. While they developed a countywide prioritization for planning purposes, each jurisdiction is somewhat unique in its vulnerability to disasters. The countywide mitigation strategies were based upon the vulnerabilities of the entire county as well as those associated with the unincorporated areas like townships and rural neighborhoods.

Hazard Type	No. of Events	No. of Years	Probability
Dam Failure	(There is a less than 1% chance of a dam failure.)		
Drought	5	27	18.52%
Earthquake	2	132	1.52%
Flooding	67	19	3-4 Events/Year

Hazard Type	No. of Events	No. of Years	Probability
Thunderstorm	231	65	3-4 Events/Year
Hail	98	65	1-2 Events/Year
Tornado	31	62	50.00%
Winter Storm	33	16	2 Events/Year
Windstorm	50	19	2-3 Events/Year

Lorain County

In general, Lorain County's primary concern is severe thunderstorms. These storms come up suddenly sometimes, and bring along heavy precipitation, strong winds, occasional rotational winds, and once in a while, hail. These storms can crop up quickly and sometimes with little warning. In the rural areas, notification can be problematic due to low population concentration and lack of outdoor sirens or other public warning systems. Damages can include buildings blown down, roofs damaged, and trees uprooted. Crop damages and livestock injuries are not uncommon when hail and high winds are involved.

Winter storms ranked as the second highest risk to the county. In the rural areas and small communities, this translates to blowing and drifting snow that makes roadways difficult to keep open and power lines vulnerable to damage. When roads are closed, delivery of fuels to farms and rural homes is interrupted. Winter storms in Ohio often come with ice as temperatures drop from beginning to end, and when close to Lake Erie, lake effect snow makes that situation worse. Ice causes damage to power lines and further impedes highway/roadway travel. Winter storms do not last more than a few days in Ohio, but for the short duration, systems and services can be interrupted and ineffective.

Tornadoes, in Ohio, are most frequent in Lorain County. The county ranks #1 in the state for frequency of tornadoes that cause property damage and loss of life. However, while Ohio is in the top twenty states affected by tornadoes, they tend to be lower intensities on the EF Scale. Tornado damage, however, even at an EF-0 and EF- 1 magnitude, causes severe structural damage, uprooted trees, and utility interruption.

While Lorain County does not have a history of wildfire like the western states, Lorain County's concern in this area is for large field fires. Oftentimes the summers have significant dry spells. In rural areas, crops like wheat and oats that cover the ground for hundreds of acres can catch fire with the toss of a lit cigarette or a spark from lightening. When a field begins to burn, the houses built on single-acre rural lots are jeopardized as are the businesses, farms, and industries based in these areas. The sections of forested area are at risk for this kind of fire as they pepper the countryside across the county.

Lorain County is prone to various kinds of flooding. First, riverine flooding occurs during heavy precipitation. In rural areas, farmers have tiled their fields, causing the water to drain quicker and move faster. That often overwhelms the municipal water systems where the runoff ends up, and the small villages and towns experience heavier flooding of streets, homes, and basements. There are no storm sewers to handle this water in the outlying areas, and countywide storm water management systems do not exist. Therefore, the rural areas can experience flooding in areas not particularly identified through maps and topographical analysis.

There is no evidence of Karst flooding in Lorain County, although the adjacent Erie County does have areas of Karst formations.

The 23-mile coastline in Lorain County is mostly developed and incorporated into municipalities, but small lengths of unincorporated coastline exist in the western part of the county. This area is prone to coastal flooding when winds come from the north or northeast, blowing lake water back into the shoreline.

The county is not especially vulnerable to drought and extreme heat. Lake effects on temperatures keep the hottest of days slightly cooler. Electrical supply is dependable in all areas of the county, and outages are not extremely prevalent. Therefore air conditioning is usually available. Because Lorain County has coastal, and the Black River Watershed drains to the lake, Lorain County is the last area to experience drought within natural drainage patterns. There is little history of true drought, although dry spells that make fire risks higher than normal are common.

Lorain County does not have history of, nor is there much expressed concern, over earthquake risk. While the digital projections of earthquake damage are horrendous assuming a worst-case scenario, the likelihood of a severe earthquake is low enough that not a lot of concern is expressed, especially in rural areas where buildings are single and two-story, and infrastructure is simple.

Windstorms, without precipitation, are not common in Ohio and rural Lorain County expressed little concern over this phenomenon. Erosion is a slight concern, enough that Lorain County Agricultural Services has written an Erosion Control Plan for the county that relates to farming practices and conservation advocacy. However, with the slightly rolling topography and the relatively small fields that are commonly no-till farmed, great amounts of erosion is not common. Sediment in waterways and erosion of the higher riverbanks is common, so ditch maintenance and debris management is a concern.

Amherst

Vulnerabilities in Amherst that come to the top of the list include severe thunderstorms, heavy precipitation, and utility outages caused by severe winter storms and severe thunderstorms.

As an area of transition from rural areas to urban sprawl, Amherst is mostly vulnerable to runoff flooding from areas upstream. The city is rapidly growing, consuming the last of the rural coastline in the county. The city is supportive of comprehensive land use planning so it does not end up the recipient of excessive runoff and sedimentation in the waterways. Because their population is growing, their concern is to keep warning and notification systems upgraded and adequate to warn the residents of impending dangers. Because coastal storms can develop quickly and change course over the water, it is important that they be able to quickly and efficiently send warnings, communicate with first responders, and get cooperation from property owners in protecting their buildings and assets.

Much of Amherst's infrastructure is relatively new in the newly developed areas, but keeping up with development trends is difficult. They struggle to maintain services in a rapidly expanding

environment. The utility lines and services, along with some of the older water and sewer lines, are aging just as most of America's, so they are concerned about keeping all of this older infrastructure up to date.

Flash floods are of particular concern as strip malls, commercial developments, and highways cover the area. The Ohio Turnpike Commission works with Amherst to support construction of retention ponds for runoff from the interstate highway that cuts through Amherst Township and dumps storm water on Amherst. In times of heavy downfall, this can create challenges for Amherst.

Avon

Situated between developing North Ridgeville and Avon Lake on the coastline, the City of Avon is concerned about storm water management during severe thunderstorms. Avon is on the receiving end of runoff from the Black River Watershed area, and at times it is difficult to manage the very rapid drainage into the city. The agricultural tiling to the far south, the heavy development to the immediate south, and the extensive development within the city all contribute to great amounts of rapid runoff reaching the city's streets, homes, and businesses. Keeping ditches open, storm sewers operational, and water flowing as fast as it arrives is Avon's biggest challenge. Officials feel that their solutions to flood issues rests in multiple tactics, including acquisition and demolition, vegetative buffers and habitat restoration, retention ponds, and flood insurance programs.

Avon officials are also concerned about utilities in heavy-use times. The natural gas supply is sometimes, during extreme winter cold spells, insufficient and supplies are interrupted. The winter of 2014 brought challenges in gas supply during an extended cold snap early in the year. Concerns about propane supply, electrical grid stability and sufficiency, and water sources are of concern as water inlets froze and clogged during winter thaws. The officials want to make sure residents and others who might be displaced during these kinds of incidents have a safe and well-managed shelter to utilize.

Avon is supportive of development standards and building codes, and enforces their own at this point. They are proponents of staying current in this area of management to keep development appropriate and sustainable. They are well aware that economic development has a benefit side and a cost of business one, and that they need to keep in pace with the problems caused when even good development happens.

Avon Lake

This city sits on the coastline of Lake Erie just north of Avon. It receives the runoff from Avon and the areas south of Avon, and serves as the location where storm water finally makes it to its Lake Erie destination. Flooding happens in Avon as the water arrives faster than it can be pushed into Lake Erie, flooding homes, filling basements, and rendering streets unusable until the water drains.

As lakefront property, Avon Lake is a fast-developing community of many kinds of housing. Development standards are necessary to guide the management of storm and sewer water, installation of retention ponds, and restoration of vegetative buffers as runoff is kept from

properties during storms. Avon Lake suffers from flooded homes, washed out streets, and compromised bridges during severe storms. They struggle to maintain the capacity to notify and warn, and then shelter and support, thousands of residents in an evacuation or utility outage that was extensive.

Avon Lake shares Avon's concerns about utilities, natural gas supply, and distribution systems. They experienced the same problems last winter (2014) as their residents were out of natural gas and propane. At the end of distribution lines, the natural gas supply ran out before product arrived in Avon Lake residences, and propane suppliers had insufficient supplies of their product. Whether Avon Lake is supplying utilities or sheltering residents when utilities are out, they experiences some breaks in capability when circumstances become unusually demanding.

Avon Lake experiences communications problems with first responders. In a county where departments use various frequencies on two-way radios, Avon Lake is sometimes out of the loop. As they move toward current radio standards for first responders, they are concerned about "plugging in" with countywide departments, and being able to maintain wireless services that are sometimes not resilient.

Carlisle Township

This township is one of the fastest growing areas in the county. It lies just south of Elyria, the county seat. It is midway into the watershed, and receives runoff from agricultural and small communities.

Carlisle Township experiences flooding as waters rush into the township from well tiled farmland and neighborhoods further up the watershed. Roads and homes flood, bridges are covered with water, and what sewer lines they have are inundated with storm water. Flooding, power outages, and debris damage homes. They experience the same storm damage as all of Lorain County, but the victims are entrepreneurs, new franchises, new homeowners, and new developments.

Severe thunderstorms are a problem. They leave damage to roofs, shingles, and trees as they blow into and out of the township with a fury. Roadways flood and render residents idle. Maintaining transportation in and out of the township is difficult as roads flood and debris falls.

As an area filled with new and rapid development, the population and number of businesses operating in the county frequently changes. Having the ability to shelter enough, protect enough, and notify enough is their challenge. As they develop these pieces of infrastructure, Carlisle Township struggles to be able to provide the services needed in areas of public information and warning, communications, and recovery.

Elyria

Severe storms, tornadoes, and other natural disasters can cripple Elyria in ways that only a large city is crippled. With socioeconomic groups from homeless and extremely poor to the very wealthy, and everything in between, Elyria must be able to serve multiple clients during disasters. Providing the support services to help with broken transportation systems, utility

interruptions, injuries and damages, and flooded neighborhoods and streets all at the same time is a challenge.

Elyria has neighborhoods that flood extensively as the Black River winds its way through the city. As water finds its way to the river from the height of the riverbank, the floodwaters sweep homes and properties away. Roads can be washed out and rapid precipitation takes on a new personality, destroying everything in its way.

As the waters reach Elyria from upstream, the force and quantity of water is often too much for the storm sewers. The city is an older city in some parts, and infrastructure is unable to support the quantity of runoff, or the rapid and forceful waters. Infrastructure failure is an outcome of deterioration and demand. It can't keep up, so basements flood, streets are covered, homes are damaged, and property is destroyed. Elyria is prone to this kind of damage in heavy, rapid rainfall.

Utility protection is a concern for Elyria as they attempt to keep electric lines, water lines, and distribution systems functioning. There have been some problems in the past with these structures. Elyria intends to work diligently to harden supplies and to replace, replenish, and refurbish physical components as needed to prevent failures during storms.

Elyria is charged with caring for many people without homes, without adequate income, and with special disabilities when disaster strikes. In order to assure these special populations that their needs will be met, Elyria has placed special emphasis upon developing and insuring the availability of the assistance they need.

During disasters, Elyria faces transportation problems. When streets are closed or compromised in snowstorms or by debris from severe thunderstorms, people cannot get to work, hospitals, or homes. The city faces the challenge of being able to meet this need. Elevation of streets, protection of bridges and culverts, and installation/repair of storm sewers is critical to their capability to achieve this.

Elyria is the county seat. By that virtue, management of infrastructure and functionality is critical to all of Lorain County. Without Elyria up and running, the county comes to a service-provider halt, and resources are compromised to the entire population.

Grafton

This village is significantly upstream in the Black River Watershed, and so does not experience quite the same kind of widespread flooding as other communities. They do have some flooding in rapid and heavy precipitation, but not with runoff like the communities closer to the lake experience. Grafton is in the midst of agricultural land, and maintains a much more rural atmosphere than much of Lorain County, so they don't have the population concentration either.

Grafton faces utility outages due to their distance from suppliers and their small population. They face shortages in propane and gas supply like many communities have during heavy use periods. They are most challenged by water supply issues, and need to develop a redundant

supply source. They are further from cities, and thus face challenges in having comparable public safety services that include inspectors to help with new development and prevention.

Grafton could face a serious problem if a tornado or other severe incident damaged the prison just outside of the village. While corrections facilities must have and maintain their own disaster response capability, a large incident would likely require Grafton officials to assist. Therefore, Grafton is very concerned about communications in a disaster, warning and notification systems, and coordination of various levels of responders.

Kipton

Kipton is a small community of a few hundred people. It sits on relatively high ground on the west side of Lorain County, and is not especially prone to heavy flooding due to runoff, but it is prone to flash floods. The dangers in Kipton relate to being remote from other communities, with Oberlin being the closest city. Kipton is intersected by State Route 511 and is close to Interstate 20 where many hazardous materials are transported across Ohio.

Kipton is vulnerable to storm damages from wind, heavy precipitation, and hail. It is also prone to power outages during winter storms and other severe storms. Because it has so few houses, the village may not be a priority for service restoration when compared to the large cities and population centers.

LaGrange

This rural village sits on relatively high ground, and it at the initial portion of the Black River. It is not especially prone to riverine flooding, but flash floods and storm back up is a threat. LaGrange has an industrial park area that floods extensively during rapid or heavy rainfall due, in part, to the installation of drainage tile on farmland that causes drainage to flow into a creek that goes through the area of industries. When this occurs, these businesses close, usually for several days, because the road that serves them floods extensively and is impassable. LaGrange also has some flooding concerns and incidents where a ditch was changed by construction, now dumping runoff into a housing development and damaging houses. This village is adding residences and businesses regularly, and without continued enforcement of building standards and land use plans, inconsistencies could make the effects of flooding worse.

Lorain

As the most populated city in Lorain County, the City of Lorain faces many challenges in disasters. City management is concerned about providing shelters and necessities for its residents in times of need, and is concerned about having enough shelters, adequate protections, and effective warning systems.

Parts of Lorain are aged and deteriorating. Some buildings are multi-story and under-occupied. Building conditions can be deficient and not able to withstand the winds, hail, heavy rain, and abuse thrust on them by severe storms and lake effect weather. Because the city sits on the lakeshore, there is little natural protection for its properties.

The sanitary and sewer water lines are deteriorating in Lorain. The lines are undersized for today's population. This causes flooding and flash flooding when storm clouds dump extensive amounts of precipitation on the city. As some large creeks and the Black River flow directly

through the city, the banks overflow and homes, factories, and institutions are damaged. Streets flood and become impassable. Basements fill with water. Utilities fail due to the water. Residents need to leave their homes.

Lorain takes a beating from coastal storms. Sitting right on the lake, its downtown bears the brunt of winds and sleet, waves crashing against city properties, parks, and businesses. The streets flood and the businesses are damaged.

The concentrated population of Lorain includes all socioeconomic groups. Some of the poor community live in sub-standard housing and are not privy to warnings other than outdoor warning sirens. Special needs populations are concentrated within the city, but are difficult if not impossible to identify quickly. Some of them can do little to take cover when necessary. Therefore, the city is concerned about warnings and notifications, shelters, mass care, and making sure its entire population is afforded safety in a storm.

As the city develops and improves, they are prone to substandard construction practices for lakefront communities. Therefore they are concerned about maintaining building code enforcement and construction standards, vendor registration, and land use regulation. They are trying to keep pace with communication needs with responders to be able to enhance protection of their residents.

North Ridgeville

Voted the fourth best place to own a home in Ohio in 2014 by Nerdfacts and published by Yahoo, North Ridgeville is an up and coming city full of development activities and new residences, businesses, and industries.

North Ridgeville, on French Creek, one of the main tributaries of the Black River, is vulnerable to flooding, water intake problems when extreme cold hits, and utility supply issues under heavy use. Even though the city has been aggressive about development standards, flood prevention and retention pond installation, and residential building codes, they still experience the negative effects of heavy rainfall and severe storms.

North Ridgeville is prone to flooding, and because of that has taken on an aggressive program of ditch cleaning and erosion control. The city maintains all ditches within the incorporation as a means to move runoff rapidly and effectively through the city and on to Lake Erie. However, the runoff from developed townships upstream make keeping up with the amount of water difficult, and North Ridgeville experiences flooding amid the best of efforts.

North Ridgeville is prone to utility outages, and because distribution lines are at the end of the grid, they look for redundant supplies and alternatives. When water intake valves freeze or jam with ice, they search for alternatives to the water supply with the City of Cleveland to their nearby east.

The city is vulnerable to communications gaps as they work to make communication systems meet their ever-growing needs. They work with wireless providers, two-way radio suppliers, and

first response departments to decrease response times and always improve the city's ability to respond to disasters.

Oberlin

Plum Creek flows through Oberlin and could potentially cause flooding of some residential neighborhoods. Although Oberlin sits on high ground and isn't particularly prone to flooding, when rapid and heavy rainfall happens, flash floods do occur. As development is completed and water flow sometimes changes, the city is vulnerable to residential flooding and flash flooding. There are some homes that flood, and the city would like to decrease that vulnerability.

Oberlin is home to a residential college, and slightly less than 3,000 college students live in the city in various forms of temporary housing. This population is difficult to track and serve because until a disaster happens, there is no way for the city to be able to segregate college students from city residents. Dependent upon the time of a severe storm or extensive power outage, the students could constitute a significant increase in storm victims, or not. The city wants to be able to provide the same, high quality service to all residents but is vulnerable to inaccurate guesstimates of needs under some conditions (such as holiday weekends or late summer moving-in times).

Oberlin is vulnerable to tornadoes and high velocity wind events. Most homes are older, frame homes built of wood and masonry. They are exactly the type home that loses a roof or has a flooded basement in severe storms. The city is concerned about providing safe rooms for multi-family structures built on slabs, as well as homes without basements and shelter.

Because Oberlin is out in the country, and lies at the western end of the county, they feel prone to inadequate warning and notification. They work to keep outdoor warning sirens and other notification systems working well, and diminish their vulnerability by establishing redundant warning systems when possible. They work hard to keep their first responders in communication with all others, upgrading and maintaining a good communication system.

Rochester

Known as Lorain County's "quiet little corner", Rochester sits in the far southwest corner of the county. With less than 150 residents, the small village is prone to flooding in extremely heavy rainfall, and is prone to damage from severe storms and power outages. The village works to stay in the communication loop so its residents are abreast of storm warnings and emergency notifications.

Sheffield

This village is on the eastern, densely populated side of Lorain County, and sits just south of Sheffield Lake and to the east of Lorain. It is rapidly developing in residential, commercial, and industrial ways. It sits just one jurisdiction away from Lake Erie, and thus takes on storm water runoff from a large part of Lorain County as waterways traverse the village. It is prone to flooding, flash flooding, and coastal flooding. The storms can be severe as they rip off the lake onto shore, easily sustaining velocity through the village.

Sheffield Village is prone to home and business damage from flooding, tornadoes, wind, and hail. The streets can flood under rapid rainfall as storm sewers are unable to keep up with the drainage. They are prone to utility shortages, and experienced natural gas and water problems in the winter of 2014. Their water supply is from Lake Erie, and when intakes freeze or jam with ice, their water supply is compromised.

The village is vulnerable to shelter needs for a growing population. They work to maintain warning and notification systems when coastal storms develop quickly, striking their population without much time to prepare. They are prone to lack of awareness and knowledge of local disaster procedures due to the rapidly growing population so they work hard to maintain public information campaigns about disaster preparedness and response actions. They work to establish fire prevention and building inspection services to maintain high quality construction in new developments and renovations.

Sheffield Lake

Sitting on the shores of Lake Erie, Sheffield Lake is vulnerable to the beating of severe storms and coastal flooding, riverine flooding, flash flooding, hail, and ice. Their streets flood, storm sewers back up, and homes flood when Mother Nature dishes out her worst. When water intakes freeze or jam with ice, Sheffield Lake experiences loss of adequate water supply. They can experience utility outages as lines are damaged, or as distribution in other areas consumes excessive amounts of natural gas. Due to rapid development, some difficulty in mapping and location identification makes first response difficult at times.

Sheffield Lake is vulnerable to storm water back up, water supply shortages or interruptions, and flooded streets and roadways. They have homes that flood. Development projects threaten drainage and retention ponds are needed to hold excessive runoff and prevent flooding.

Sheffield Lake works to maintain warning and notification systems and first responder communications to facilitate rapid response to disasters. They work to keep wireless services dependable. They strive to maintain and improve utilities and infrastructure systems to serve their population.

South Amherst

This small village lies immediately to the south of Amherst, thus the name South Amherst. It is an older residential community on the verge of city vs. country in Lorain County. The village is not especially prone to flooding, although in one corner there are a few residents with repeated flooding issues during heavy rains. As a rural community, they are prone to the negative effects of inefficient storm water management and have interest in countywide efforts to improve flooding and flash flooding situations.

As an outlying community, South Amherst is prone to utility outages, especially electricity. Wireless communications are problematic at times when towers are a distance away. Communication between first responders is challenging as they lie adjacent to the cities in the county, but have all volunteer forces.

Vermilion
This city lies on the border of Erie and Lorain Counties on the far northwest edge of Lorain County. Vermilion's worst vulnerability is flooding due to ice jams in the Vermilion River as it meanders through town to Lake Erie. Vermilion sits on the shore of Lake Erie, and is part of the Vermilion River Watershed. There are many low-lying properties that flood when the river jams with ice, and snowmelt cannot get away.

Vermilion is vulnerable to lake storms, heavy winds, and Nor'easters. Homes are damaged when roofs are destroyed by wind or hail, and basements fill with water. The city works to communicate property protection, insurance coverage, and quality building standards to its residents. Sitting on a county line, the city is prone to communication glitches, and strives to override those problems through redundancy and strong efforts to communicate with both counties.

Wellington
This village is on the far southern border of Lorain County. They are prone to utility outages and severe storms, and due to their position in the warning progression, feel vulnerable to rapid onset storms without notice. The village is not exceptionally prone to flooding and sits at the upstream end of the Black River Watershed.

Loss Estimates
Lorain County could experience significant losses as a result of severe thunderstorms, tornadoes, straight-line winds, and wind. These storms come in both summer and winter, and can be associated with power outages, heavy precipitation, and temperature extremes. In almost all documented disasters, the damages have been a result of multiple hazards combined, and sometimes multiple incidents of the same combination happen in succession.

Lorain County's population concentration falls inside and adjacent to the cities along the lakeshore. Sixty-five percent of the county's development occupies only twenty-five percent of the land area according to the Lorain County Storm Water Management Study. The remaining seventy-five percent of the land is less densely populated, consisting of farms and houses on large plots of land in rural areas, or in small villages.

Lakefront properties are relatively expensive, and household incomes are relatively high according to demographic information obtained in community profiles. Most of the properties in the cities appear to be privately insured, and the financial ability for landowners to pay insurance premiums is likely higher than the typical statewide statistic. Therefore, it is possible that many disaster losses have occurred and repairs have been made privately, but the costs are not documented publically.

National Flood Program – Floodplain Mapping and FIRM
Lorain County began their floodplain modernization with ODNR in Fiscal Year 2002. This process began with a scoping meeting held on June 21, 2002 and culminated with revised maps becoming effective on August 19, 2008 when the County formally adopted them. Under the county Soil and Water District, Floodplain Regulations are currently in effect. Section 3.0 designates a Floodplain Administrator and duties of that Office, to include updating regulations

and enforcement of such regulations under Section 6.0. Additionally, the Floodplain Administrator routinely monitors flood hazard areas to enforce regulations and provide community assistance such as encouraging owners to maintain flood insurance policies. The updated maps placed new structures within the flood plain, and this required some homeowners to purchase flood insurance to maintain their mortgages whom had not be required to flood-insure previously. One landowner has placed a question on Ohio EMA's Mitigation website questioning the need for flood insurance due to the cost of those premiums.

The tables below provide information on participation in the National Flood Program for communities in Lorain County from the FEMA Community Status Book Report for Ohio.

Communities in the National Flood Program

Community	Init FHBM Identified	Init FIRM Identified	Curr EFF Map Date	Reg-Emer Date
Lorain County	06/03/1977	02/04/1981	08/19/2008	10/04/1991
Amherst	03/15/1974	08/01/1980	08/19/2008	05/17/1989
Avon	04/12/1974	06/18/1980	08/19/2008	07/12/1983
Avon Lake	04/12/1974	11/02/1977	08/19/2008	11/02/1977
Elyria	05/03/1974	07/02/1980	08/19/2008	07/02/1980
Grafton	12/20/1974	07/02/1980	08/19/2008	07/02/1980
Kipton	04/18/1975	09/22/1978	08/19/2008 (M)	10/05/1989
LaGrange	12/23/1988	08/19/2008	08/19/2008	08/19/2008
Lorain	05/17/1974	08/15/1978	08/19/2008	08/15/1978
North Ridgeville	06/07/1974	06/04/1980	08/19/2008	06/04/1980
Oberlin	01/09/1974	06/18/1980	08/19/2008	06/18/1980
Sheffield Lake	05/31/1974	03/01/1978	08/19/2008	03/01/1978
Sheffield Village	06/21/1974	06/18/1980	08/19/2008	06/18/1980
South Amherst	07/11/1975	05/01/1980	08/19/2008	05/01/1980
Vermilion	05/05/1970	12/31/1970	08/19/2008	12/31/1970
Wellington	01/09/1974	06/04/1980	08/19/2008	06/04/1980

Communities Not in the National Flood Program

Community	Init FHBM Identified	Init FIRM Identified	Curr EFF Map Date	Sanction Date
Rochester	08/08/1975	08/19/2008	08/19/2008	08/08/1976

Expenditures in Assistance per Declarations in Lorain County Ohio

Incidents in Ohio that resulted in an emergency declaration in Ohio for Lorain County are summarized in the following table. These are statewide only and not federal declarations.

DR or EM Number	Incident Date	Incident Type
EM-3346	June 29 – July 2, 2012	Severe storms
EM-3286	March 7 – 9, 2008	Severe snowstorm
EM-3250	August 29 – October 1, 2005	Hurricane Katrina Evacuation
EM-3198	December 22 – 24, 2004	Severe snowstorm
EM-3187	August 14-17, 2003	Statewide power outage
EM-3029	February 2, 1977	Severe snowstorm

Lorain County does not have a strong history of disaster declarations and federal assistance programs. While the State of Ohio has a longer comprehensive list of incidents than displayed, Lorain County escaped damages in many of the incidents that have stricken western, central, and southern Ohio over the years. However, 2014 has brought a severe late spring and early summer to Lorain County. Heavy precipitation, strong straight-line winds, and even an occasional tornado has hit between late May and late July. When these storms have caused extensive damages, declarations have made funding available for individual assistance. Due to the amount of damages, the SBA has made loans available to businesses for storm repair.

The following table includes data on declared disasters and public assistance provided to Lorain County.

COUNTY: Lorain			
Disaster Number	**Disaster Type**	**Declared**	**Public Assistance**
EM-3187	Power Outage	09/23/2003	$77,477.80
DR-1850	Flood, Mud/Landslide, Winter Storm	02/15/2005	$2,348,606.25

Repetitive and Severe Repetitive Loss Structures

Some structures in Lorain County experience repetitive losses and numerous claims have been submitted for flood damages. Only one acquisition and demolition project shows as having been completed in the past through the mitigation grant program. That property was located in the City of Elyria at 136 Woodside Drive, and was parcel number 10-00-008-109-015. There were seven (7) claims for the property prior to acquisition and demolition. The project expenditure in 2007 was allocated at $76,848.00 but the project was completed for $72,932.00. The property was to its natural state. Expected annual savings in claims was estimated to be $1,933.11 per year.

Repetitive loss and severe repetitive loss structures still exist in Lorain County. The charts below provide information on the number, location, type, and payments for repetitive and severe repetitive loss properties in the county.

REPETITIVE LOSS PROPERTIES						
Community	**Number**	**Type**	**Number of Losses**	**Building Payments**	**Contents Payments**	**Total Payments**
Lorain County	11	Residential	46	$311,295.47	$74,878.03	$386,173.50
	1	Non-Residential	2	$4,622,89	$2,460.00	$7,082.89
City of Avon	1	Residential	2	$26,425.85	-	$26,425.85
	0	Non-Residential	0	-	-	-
City of Avon Lake	2	Residential	4	$29,908.98	-	$29,908.98
	0	Non-Residential	0	-	-	-
Brownhelm Township	4	Residential	8	$29,545,37	$7,667.63	$37,213.00
	0	Non-Residential	0	-	-	-
City of Lorain	2	Residential	5	$312,399.01	$8,628.58	$321,027.59

	0	Non-Residential	0	-	-	-
City of North Ridgeville	3	Residential	6	$46,666.16	-	$46,666.16
	0	Non-Residential	0	-	-	-
Village of Sheffield	0	Residential	0	-	-	-
	1	Non-Residential	2	-	$10,972.80	$10,972.80
Village of South Amherst	2	Residential	6	$155,450.88	$178,491.91	$333,942.79
	0	Non-Residential	0	-	-	-
County/Jurisdictional Totals	**25**	**Residential**	**77**	**$911,691.72**	**$269,666.15**	**$1,181,357.87**
	2	**Non-Residential**	**4**	**$4,622.89**	**$13,432.80**	**$18,055.69**

SEVERE REPETITIVE LOSS (SRL) PROPERTIES						
Community	**Number**	**Type**	**Number of Losses**	**Building Payments**	**Contents Payments**	**Total Payments**
Village of South Amherst	1	Residential	4	$127,625.41	$20,000.00	$147,625.41
	0	Non-Residential	0	-	-	-
County/Jurisdictional Totals	**1**	**Residential**	**4**	$127,625.41	$20,000.00	$147,625.41
	0	**Non-Residential**	**0**	**-**	**-**	**-**

Property Vulnerabilities

Key factors in estimating damages involve an assessment of numbers of structures currently in place in Lorain County. Following is a summary of the structures that exist in Lorain County in 2014. It is estimated that 111,297 buildings exist in Lorain County.

Valuations of property were obtained from the Lorain County Auditor's office. Numbers expressed in the table obtained from the Auditor are 35% of the value of the property, which establishes the taxable value of the property. To obtain a real value of the property, those numbers were prorated to 100% through a calculation of dividing the auditor's numbers by 35, and then multiplying by 100 to obtain a real property value. The table below is a summary of county totals; a complete jurisdiction-by-jurisdiction table is included in Appendix D.

Occupancy/Type	Exposure	Percent of Total
Agricultural	$2,157,812,371	4%
Industrial and Special Abatements	$2,425,302,371	4%
Commercial; Public Utilities; Mineral Lands	$7,841,512,884	14%
Residential	$38,476,217,668	66%
Exempt (Religious, government, and educational facilities)	$6,899,104,317	12%
Total	*$57,799,949,611*	*100%*

Following are the types and numbers of critical facilities present in Lorain County in 2014:

- Hospitals – 5

- Hospital Beds – 750
- EMS/Fire Stations – 36
- Police Stations – 19
- Wastewater and Water Treatment Plants – 4
- Central Dispatch Centers – 1
- Post-Secondart Educational Institutions – 4
- Public Primary/Secondary Schools – 105
- Private Primary/Secondary Schools – 7

Loss Estimates Statistical Anomaly

The HAZUS prediction models operate using 2000 census data. The 2000 Census for Lorain County established population at 284,664. Throughout the loss estimations for flood and earthquake, those population numbers were used. The same 2000 Census was used for property values.

In 2014, Lorain County's 2012 census data shows population at 301356. For the purpose of utilizing the estimations established by HAZUS, the predictions were not modified to accommodate changes in population.

Likewise, property valuations assumed by the HAZUS program were utilized as-is. Data obtained from the Lorain County Auditor indicates that property values have increased as development has added homes, businesses, and factories. On the other hand, economic downturns have closed some school buildings, business, and industries. Because the underlying data was not available to make mathematically sound changes in the loss projections, the HAZUS data was accepted as is. The HMCC felt that the true application of mitigation strategies would not be changed in any way by modifying the data to accommodate changes in numbers. The cost of spending weeks to insert new numbers and run new calculations would not change the fact that floods are the first disaster priority in Lorain County, and earthquakes, while possible and devastating if one occurred, were not highly likely to happen. Therefore, the data set seen in the HAZUS projections is based in 2000 US Census information.

Flood Incidents and Losses

Lorain County is vulnerable to modest to significant damage from floods. Typical recurring damage is in areas close or adjacent to waterways, some low-lying roadways, and areas that are close to storm sewers that are undersized and inadequate. Much of the area that floods is occupied by residential structures, and includes areas around homes, in roadways and some farmland. The sloping topography facilitates natural runoff to the north whereby water eventually reaches Lake Erie through the Black River and its many tributaries, or for a few square miles in the northwest corner of the county, through the Vermilion River and its tributaries. In cases of very rapid and heavy rainfall, many areas not included in floodplains and areas adjacent to waterways could experience significant temporary flooding because the water cannot drain fast enough.

Lorain County is the lowest area of the watershed, and from here the runoff waters flow into Lake Erie. Ditch cleaning, stream channelization, and agricultural tiling of production areas has made the land upstream in the watershed drain much faster than in the past. As the water moves

faster and builds in quantity through the watershed, Lorain County can become inundated with runoff. This causes flooding, as water is unable to move into Lake Erie at the same rate at which it flows into Lorain County.

Lorain County flooding can be directly caused by one of two situations: First, significantly heavy, rapid, or extended duration rainfall causes riverine flooding and low elevation collection of water. The water flows into Lorain County fast and furious, draining upstream communities quickly. When waterways and tributaries are overwhelmed and unable to carry the water away as fast as it comes, flooding occurs. Residential, agricultural, and business properties are vulnerable to this kind of flooding at the onset, but only those properties close to the flood plains are vulnerable to extended flooding because the Black River and its tributaries do take the water into Lake Erie eventually. The longest and worst affected properties fall within the floodplains and immediate adjacent areas in Lorain County.

The second flooding situation is caused when rainfall is accompanied by snowmelt and heavy runoff while the ground is still frozen or is extremely saturated, mostly an incident that takes place in late winter and early spring. Flooding is exacerbated when development has resulted in conversion of porous absorbent soil to concrete and asphalt, causing flooding of parking areas and streets as well as residential and commercial properties. Due to the inability of the ground to absorb the water in a given time frame, flooding occurs in parking lots, streets, driveways and yards, as well as in low lying areas and floodplains too. The duration of this kind of flooding is dependent upon whether or not the Black River develops ice jams that impede drainage along the way, or if the water is able to readily flow into Lake Erie.

The Vermilion River is well known for its ice jams. The river winds and turns as it reaches Lake Erie inside the City of Vermilion. Although this part of the river is actually in Erie County, not Lorain County, the backup generated by the ice jams affects drainage in properties in the Vermilion River watershed in Lorain County. This causes flooding and more ice jams in the Vermilion River in Lorain County, and the jams cannot clear until the ice near the mouth of the river melts and the blockage is alleviated.

Flood Damage Profile

Flood damage in Lorain County would potentially include structural damage, infrastructure damage and destruction, and crop damage. Estimates were developed through use of HAZUS projections for 100-year and 25-year flood events. Valuations were estimated based on 2006 valuations, and may in fact be slightly lower due to decreases in property valuations over the past twelve months.

Residential structural damages would include damage to single and multiple family homes, congregate living facilities, and multi-family housing complexes. Commercial and industrial structural damages would include buildings used for manufacturing, product handling, transportation, warehousing, retail, business, and industrial, and the capital equipment associated with those uses. Agricultural structures would include barns used for livestock, equipment storage, and commodity storage, as well as the contents of those buildings that constitute business assets such as production animals, equipment, and machinery. Government, nonprofit, and educational institutions would include critical structures like fire stations, police stations,

hospitals, offices, schools, and special facilities like garages and maintenance buildings, and the capital contents of those structures.

Actual structural damage could include flooding of basements and ground level floors, destroying the contents of those properties. In the aftermath, the combination of substances could result in hazardous chemical exposure for rescuers, responders, and victims. Many roads can flood for short periods of time in Lorain County, closing businesses and institutions and crippling commerce for a short period of time. This period of business shutdown generally is confined to the floodplain areas, and lasts for only a day or two once the rain stops.

This damage would result in large amounts of debris to manage, including finish, structural, and foundation materials in the debris.

100-Year Flood Scenario

For a severe flood that has 1% likelihood of happening, or a 1 in 100 year likelihood of taking place, the damages to Lorain County would be severe. Using HAZUS software, the number of buildings damaged is estimated at 679.

The estimate for buildings totally destroyed is at 259. Following is a summary of the estimated structure damage:

Occupancy Type	1-10% damaged	11-20% damaged	21-30% damaged	31-40% damaged	41- 50 % damaged	> 50% damaged
Agriculture	0	0	0	0	0	0
Commercial	0	35	0	0	0	0
Education	0	0	0	0	0	0
Government	0	0	0	0	0	0
Industrial	0	1	0	0	0	0
Religious	0	0	0	0	0	0
Residential	0	24	65	121	174	259
TOTAL	*0*	*60*	*65*	*121*	*174*	*259*

Based upon the type construction of structures, the damage estimates cause a prediction of the following additional property casualty information:

Building Construction	1-10%	11-20%	21- 30 %	31- 40%	41- 50%	>50%
Concrete	0	3	0	0	0	0
Manufactured Housing	0	0	0	0	0	23
Masonry	0	11	8	17	29	32
Steel	0	11	0	0	0	0
Wood	0	35	57	104	145	204
TOTAL	*0*	*60*	*65*	*121*	*174*	*259*

HAZUS software does not predict that critical facilities will be damaged significantly, and therefore it is anticipated that the hospital beds, emergency services, and institutional services normally present in the county would continue to be functional in a 100-year flood scenario.

Given the locations of the hospitals, the HMCC thought that was a reasonable expectation because the hospitals are not typically damaged or incapacitated by floods.

Note: Adjustments were made to the HAZUS data based upon an increase in actual population compared to what was in the software. HAZUS databases calculated based upon a population of 284,664; actual population in 2012 was 301,356. Proportionate changes were made to estimates to bring them more in line with what actual numbers would be.

Debris generation by a 100-year flood would be significant. Estimates indicate that 2,217 truckloads of debris would need to be hauled and disposed of, under the assumption that each truckload would amount to 25 tons/load.

Sheltering needs could be significant as well. Adjusting the population base differences between the HAZUS assumptions and actual population, it is anticipated that a 100-year flood would displace 2,013 households and require sheltering in a public shelter, causing 4,129 persons to seek shelter in a Red Cross dormitory-type shelter.

Business losses were broken into two anticipated categories of loss: direct building loss and business interruption loss. Direct building losses include structural damage and damage to contents. Business interruption losses include the costs associated with not being able to conduct normal business, displaced workers, and lost opportunities. Following is a summary of those anticipated losses.

Area	Residential	Commercial	Industrial	Others	Total
Building Loss (in millions of dollars)					
Building	105.82	62.37	9.75	5.07	183.02
Contents	60.65	113.82	19.32	17.61	211.21
Inventory	0.00	1.00	3.68	0.39	5.07
Sub-Total	166.47	176.99	32.76	23.07	399.29
Business Interruption					
Income	0.02	1.87	0.01	0.09	1.98
Relocation	0.19	0.50	0.00	0.01	0.70
Rental Income	0.06	0.38	0.00	0.00	0.44
Wages	0.05	0.87	0.00	1.12	2.04
Sub-Total	0.32	3.62	0.01	1.21	5.16
TOTAL	*166.79*	*180.61*	*32.77*	*24.28*	*404.46*

25-Year Flood Scenario

For a severe flood that has 4% likelihood of happening, or a 1 in 25 year likelihood of taking place, the damages to Lorain County would be severe. Using HAZUS software, the number of buildings damaged is estimated at 593. The estimate for buildings totally destroyed is at 210. Following is a summary of the estimated structural damage:

Occupancy Type	1-10% damaged	11-20% damaged	21-30% damaged	31-40% damaged	41- 50 % damaged	> 50% damaged
Agriculture	0	0	0	0	0	0
Commercial	0	32	0	0	0	0

Education	0	0	0	0	0	0
Government	0	0	0	0	0	0
Industrial	0	1	0	0	0	0
Religious	0	0	0	0	0	0
Residential	0	22	61	104	164	210
TOTAL	*0*	*54*	*61*	*104*	*164*	*210*

Based upon the type construction of structures, the damage estimates cause a prediction of the following additional property casualty information:

Building Construction	**1-10%**	**11-20%**	**21- 30 %**	**31- 40%**	**41- 50%**	**>50%**
Concrete	0	3	0	0	0	0
Manufactured Housing	0	0	0	0	0	17
Masonry	0	10	7	13	27	25
Steel	0	9	0	0	0	0
Wood	0	32	54	91	137	168
TOTAL	*0*	*54*	*61*	*104*	*174*	*210*

HAZUS software does not predict that critical facilities will be damaged significantly, and therefore it is anticipated that the hospital beds, emergency services, and institutional services normally present in the county would continue to be functional in a 25-year flood scenario. Given the locations of the hospitals, the HMCC thought that was a reasonable expectation because the hospitals are not typically damaged or incapacitated by floods.

Note: Adjustments were made to the HAZUS data based upon an increase in actual population compared to what was in the software. HAZUS databases calculated based upon a population of 284,664; actual population in 2012 was 301,356. Proportionate changes were made to estimates to bring them more in line with what actual numbers would be.

Debris generation by a 25-year flood would be significant. Estimates indicate that 1,836 truckloads of debris would need to be hauled and disposed of, under the assumption that each truckload would amount to 25 tons/load.

Sheltering needs could be significant as well. Adjusting the population base differences between the HAZUS assumptions and actual population, it is anticipated that a 25-year flood would displace 1,844 households and require sheltering in a public shelter, causing 3,675 persons to seek shelter in a Red Cross dormitory-type shelter.

Business losses were broken into two anticipated categories of loss: direct building loss and business interruption loss. Direct building losses include structural damage and damage to contents. Business interruption losses include the costs associated with not being able to conduct normal business, displaced workers, and lost opportunities. Following is a summary of those anticipated losses.

Area	Residential	Commercial	Industrial	Others	Total
Building Loss (Expressed in millions of dollars)					
Building	93.19	59.53	8.73	4.21	152.66
Contents	54.15	103.98	17.42	15.93	191.46
Inventory	0.00	0.92	3.28	0.35	4.55
Sub-Total	147.34	161.43	29.42	20.48	358.67
Business Interruption (Expressed in millions of dollars)					
Income	0.02	1.75	0.01	0.08	1.85
Relocation	0.17	0.47	0.00	0.01	0.65
Rental Income	0.06	0.36	0.00	0.00	0.41
Wages	0.05	0.61	0.00	1.02	1.88
Sub-Total	0.29	3.39	0.01	1.10	4.79
TOTAL	*147.63*	*164.82*	*29.43*	*21.59*	*363.46*

Earthquake Incidents and Losses

Earthquakes are not common to Lorain County, and there is little historical data to support commitment of extensive resources to earthquake-proofing buildings and other structures. It is geographically possible to experience an event. The HMCC decided to not include earthquake in primary mitigation efforts due to low risk and high cost of implementing strategies, but loss profiles were obtained through use of the HAZUS software to give the committee the greatest amount of information possible in making their final determinations. Loss estimates, assumptions, and situational conditions follow.

Earthquake Scenario

While earthquakes are not common to Lorain County, and there is little historical data to support commitment of extensive resources to earthquake-proofing buildings and other structures, it is geographically possible to experience an event. The HMCC decided to not include earthquake in its primary mitigation efforts due to low risk, but loss profiles were obtained through use of the HAZUS software to give the committee the greatest amount of information possible in making their final determinations. Loss estimates, assumptions, and situational conditions follow. The simulated earthquake epicenter was assumed to be inside the City of Lorain, the county's most populous city, for a worst-case scenario.

Critical Facility Inventory

HAZUS separates critical facilities into essential facilities and high potential loss structures. Essential facilities are healthcare facilities like hospitals and clinics, fire and EMS stations, police stations, and operations and dispatch centers. Schools are included in essential facilities.

High potential loss structures include dams, levees, nuclear power plants, and military installations as well as hazardous material sites.

Lorain County has five hospitals with 750 beds; 3 airports; 3 additional heliports at hospitals; 36 fire and EMS stations; 19 police stations; 4 water treatment plants; 4 key government facilities; 4 post-secondary educational institutions; 105 public elementary or secondary school campuses; and 7 private elementary/secondary school campuses. There are transportation systems that include highways, railways, bus, ports, and airports. Utility systems include water treatment and potable water plants, wastewater treatment plants, natural gas suppliers, crude and refined oil

refineries, electrical power plants, and communications hubs. There are 354 bridges and 6,242 kilometers of pipelines. A table with this data follows.

System Type	Components	Quantity	Replacement Value
Highways	Bridges	354	341.4M
	Segments	127	$2,210.7M
Railways	Bridges	7	$0.6M
	Facilities	4	$10.7M
	Segments	183	$220.7M
Bus	Facilities	3	$3.4M
Port	Facilities	9	$18M
Airport	Facilities	5	$53.3M
	Runways	7	$265.7M

Utility System Inventory

System	Component	Quantity	Replacement Value
Potable Water	Distribution Lines	N/A	$62.4M
	Facilities	2	$79.9M
Waste Water	Distribution Lines	N/A	$37.5M
	Facilities	28	$1,958M
Natural Gas	Distribution Lines	N/A	$25M
Oil Systems	Facilities	1	$0.1M
Electrical Power	Facilities	3	$346.5M
Communication	Facilities	7	$0.7M

HAZUS estimates of building damages are extensive. The estimated number of buildings damaged to some degree, at least moderately, is 15,534. This amounts to over 14% of all buildings in the county. An estimated 613 buildings would be destroyed. A table of anticipated building damage follows.

Category/Damage Amount	None	Slight	Moderate	Extensive	Complete
Agriculture	304	75	61	20	3
Commercial	3,283	1,011	750	243	42
Education	117	37	30	10	2
Government	88	22	17	5	1
Industrial	1,223	355	291	96	13
Other Residential	9,283	3,490	2,059	453	78
Religious	290	100	73	25	5
Single Family Residential	56,831	19,256	8,718	2,067	469
TOTAL	*71,417*	*24,346*	*12,001*	*2,920*	*614*

Dependent upon the type construction of a building, the damages from an earthquake can be less or more. Based upon typical types of construction, the same scenario is extrapolated into damage according to construction type in the chart below.

Type/Damage Amount	None	Slight	Moderate	Extensive	Complete
Wood Construction	53,726	17,200	5,689	649	37

Type/Damage Amount	None	Slight	Moderate	Extensive	Complete
Steel Construction	1,715	432	432	140	11
Concrete	443	113	85	20	1
Precast	404	97	121	56	4
Reinforced Masonry	262	53	66	27	1
Unreinforced Masonry	13,178	5,672	4,832	1,889	551
Manufactured Housing	1.691	779	777	135	9
TOTAL	*71,417*	*24,346*	*12,001*	*2,920*	*614*

Of the essential facilities (schools, hospitals, dispatch centers, and public safety stations), it is estimated that 51% of the 750 (383 beds) hospital beds would be available and functional on the day of the earthquake. These would be needed by patients already hospitalized at the time of the quake and individuals injured and requiring hospitalization after the quake. By one week later, it is estimated that 67% of the beds (503 beds) would be functional. By 30 days post-event, an estimated 88%, or 660 beds, would be functional.

It is estimated that on Day #1 of the event, 8 of 19 police stations would experience some sort of functional impairment. Of 36 fire and EMS stations, 11 would be impaired. Of the 116 educational facilities, approximately 38 of the facilities would experience some degree of damage and loss of function.

HAZUS predicts a less grim picture for infrastructure resiliency. It predicts that all roadways, bridges, railways, rail bridges, rail facilities, bus stations, ports, and airports will experience greater than 50% functionality in the first 7 days after an earthquake, and will continue at greater than 50% function after Day #7. Estimates for more than 50% function for potable water plants amounts to 1 of 2 plants and 17 of 28 wastewater treatment plants are anticipated to function beyond 50% levels. Although electrical generation and distribution is expected to stumble at first, after one week it is estimated that all plants will be functional at more than 50% capacity. While 3 communication centers are expected to have at least moderate damage, after one week, it is anticipated that all 7 will be running at greater than 50% capacity.

In this scenario, it is anticipated that utility services would be interrupted following an incident. For water, wastewater, and natural gas, the following leaks and line breaks are predicted:

Utility	Anticipated Leaks	Anticipated Line Breaks
Water	83	21
Wastewater	66	16
Natural Gas	70	18
Oil Wells	0	0

Electrical service is more challenging to restore. The following chart outlines the number of customers anticipated to be without electric service following the incident:

Days Post-Event	Customers Without Electric Service
Initial Impact	66,180
3 Days	39,356
7 Days	14.066

30 Days	2,215
90 Days	85

HAZUS estimates the number of fires that would occur based upon the prospect of water not being available to fight fires and an abundance of spontaneous ignition. The program estimates 21 ignitions that would burn 0.75 squares miles of the area. It is estimated that as many as 1,114 people could be displaced by these fires and ruin close to $97M in property because of the fires.

Debris generation could top 20,360 truckloads of brick, wood, steel, and concrete.

HAZUS estimates that 1,130 households would be displaced, resulting in 782 persons in shelters.

Casualty estimates follow, with assigned times of the incident and modified projections. The lowest serious and least injuries overall would occur at 5 PM, and the highest and most serious at 2AM.

Time	Location	Level 1: Injured but not hospitalized	Level II: Hospitalized with non-life threatening	Level III: Hospitalized with Critical	Level IV: Dead
2 AM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	2	0	0	0
	Industrial	3	1	0	0
	Other Residential	85	17	2	4
	Single Family	337	68	9	17
	TOTAL	***429***	***87***	***11***	***21***
2 PM	Commercial	140	29	4	7
	Commuting	0	0	0	0
	Educational	75	17	2	4
	Hotels	0	0	0	0
	Industrial	25	5	1	1
	Other-Residential	20	4	1	1
	Single Family	75	16	2	4
	TOTAL	***335***	***70***	***9***	***17***
5 PM	Commercial	121	25	3	6
	Commuting	0	0	0	0
	Educational	6	1	0	0
	Hotels	1	0	0	0
	Industrial	16	3	0	1
	Other-Residential	34	7	1	2
	Single Family	135	28	4	7
	TOTAL	***312***	***65***	***9***	***16***

Building-Related Losses

Business losses were divided into two anticipated categories of loss: direct building loss and business interruption loss. Direct building losses include structural damage and damage to

contents. Business interruption losses include the costs associated with not being able to conduct normal business, displaced workers, and lost opportunities. Following is a summary of those anticipated losses.

Total estimated building losses were $1,787.98M. 15% of the losses were related to business interruption in the region; the largest loss projection was sustained by residential, which is 58% of the total. The table below summarizes the estimations.

Area	Single-Family	Other Residential	Commercial	Industrial	Other	Total
Building Loss (Expressed in millions of dollars)						
Structural	98.88	16.97	39.95	15.36	15.62	186.77
Non-Structural	443.42	128.08	149.99	78.21	54.35	854.05
Content	205.27	46.24	108.96	65.17	41.62	467.27
Inventory	0.00	0.00	2.93	16.96	0.65	20.55
Sub-total	747.56	191.30	301.83	175.70	112.24	1,528.64
Business Interruption (Expressed in millions of dollars)						
Wage	0.00	2.82	36.57	4.05	3.47	46.91
Capital-Related	0.00	1.19	32.43	2.55	1.18	37.35
Rental	15.82	12.14	22.14	1.41	1.44	52.94
Relocation	58.53	9.13	33.33	5.49	15.66	112.13
Sub-Total	74.35	25.27	124.47	13.50	21.75	259.34
TOTAL	*821.91*	*216.58*	*426.30*	*189.20*	*133.99*	*1,787.98*

Transportation and Utility Lifeline Losses

Earthquakes damage infrastructure extensively. The following chart depicts the potential damage Lorain County could expect in an earthquake scenario to its highways, airports, ports, and other transportation systems. Numbers are expressed in millions of dollars.

System	Component	Inventory Value	Economic Loss	Loss Ratio %
Highway	Segments	2,210.72	0.00	0.00
	Bridges	341.37	0.67	0.20
	Sub-total	***2552.10***	***0.70***	
Railways	Segments	220.71	0.00	0.00
	Bridges	0.61	0.00	0.07
	Facilities	10.65	3.66	34.32
	Sub-total	***232.00***	***3.70***	
Bus	Facilities	3.43	1.43	41.76
	Sub-Total	3.43	1.43	
Port	Facilities	17.97	7.87	43.80
	Sub-total	***17.97***	***7.87***	
Airport	Facilities	53.26	10.97	20.59
	Runways	265.75	0.00	0.00
	Sub-Total	***319.00***	***11.00***	
TOTAL		***3124.50***	***24.60***	

Following are the anticipated damages to utility systems.

System	Component	Inventory Value	Economic Loss	Loss Ratio %
Potable Water	Pipelines	0.00	0.00	0.00
	Facilities	69.90	15.79	22.58
	Distribution Lines	62.40	0.37	0.60
	Sub-total	***132.35***	***16.16***	
Waste Water	Pipelines	0.00	0.00	0.00
	Facilities	1,958.00	385.72	19.70
	Distribution Lines	37.50	0.30	0.79
	Sub-total	***1,995.49***	***386.02***	
Natural Gas	Pipelines	0.00	0.00	0.00
	Facilities	0.00	0.00	0.00
	Distribution Lines	25.00	0.32	1.26
	Sub-total	***24.97***	***0.32***	
Oil Systems	Pipelines	0.00	0.00	0.00
	Facilities	0.10	0.01	9.81
	Sub-total	***0.11***	***0.01***	
Communication	Facilities	0.70	0.12	15.77
	Sub-total	***0.74***	***0.12***	
	TOTAL	***2,500.15***	***506.31***	

Indirect Economic Impact

A disaster is felt long after the appearance of recovery is present. Employment tends to fluctuate, and the economy moves up and down as it reaches long-term recovery. Incomes follow employment, and company profits, government budgetary stability, and nonprofit operations take years to return to a stable sense of normal. Some community preparedness statistics indicate that one in four businesses never re-opens after a significant disaster. The following information attempts to project the intermediate and long-term employment and income numbers. Numbers expressed in the employment impact row are expressed in numbers of people; the income impact row is expressed in millions of dollars.

	Loss	Total	%
First Year	Employment Impact	397	0.64
	Income Impact	(10)	- 0.22
Second Year	Employment Impact	132	0.21
	Income Impact	(37)	- 0.78
Third Year	Employment Impact	0	0.00
	Income Impact	(49)	- 1.03
Fourth Year	Employment Impact	0	0.00
	Income Impact	(49)	- 1.04
Fifth Year	Employment Impact	0	0.00
	Income Impact	(49)	- 1.04
Years 6 – 15	Employment Impact	0	0.00
	Income Impact	(49)	- 1.04

Other Incidents and Losses

Incidents and losses from disasters other than earthquake and flood exist in Lorain County. In this section, loss estimates from winter storms, tornados, thunderstorms, windstorms, drought, and erosion are examined. While the losses from these incidents are often more casualties of convenience and disruption to business, some property and life casualty is possible.

Winter Storm Damage Profile

Winter storm damages can potentially affect virtually every home, business, or property in Lorain County indirectly. There is no area that is more or less vulnerable to snowfall because there are no hills and valleys that interrupt or redirect precipitation. The flat terrain and consistent elevations allow drifting and blowing snow to cause low visibility at any location in the county.

"Lake effect" snow can occur in Lorain County, and generally begins in the eastern half of the jurisdiction. As the weather fronts cross the lake and pick up moisture, that causes the amount of snow that blankets Sheffield, Sheffield Lake, Lorain, Elyria, Avon, Avon Lake, and North Ridgeville to sometimes be greater than the rest of the county. Lake effect snow generally only occurs in the northern half of the county, and does not reach as far south as Grafton, Wellington, and Rochester.

Power outages occur across the entire county during blizzards or snow storms that include significant ice, wind, or heavy amounts of snow. Residential electric lines are mostly above ground and vulnerable to wind and ice. Only some of the more recent housing developments have buried electric lines, and most of these are in the new subdivisions. Major supply lines are above ground as they enter Lorain County from the generation plants, and therefore power to the substations is vulnerable to wind and heavy snow and ice even if the residential lines are not. Therefore power outages are likely, frequent, and widespread.

In 2014, Lorain County experienced an extreme, prolonged cold spell. Eventually the natural gas and propane supply to the county was threatened, and some customers at the end of grids in the North Ridgeville, Amherst, South Amherst, and Avon areas experienced a loss of heat because their was not enough raw product to supply their home. At the same time, the extreme cold froze water intakes on Lake Erie, and other areas including Avon Lake, Avon, North Ridgeville, Lorain, and Elyria were without adequate raw water. This was a highly unusual incident that happens very infrequently. Most residents could remember this only in 2014, and other incidents were not documented.

The loss estimates for winter storms is relatively low in spite of this very recent and memorable incident. There is no identifiable history of property loss due to snow pack, avalanche, or other winter storm related cause. The reasonably anticipated loss from a winter storm would be content loss due to power interruptions, such as food and perishables. The losses in anything but an unusual, unpredictable incident would not include structures or infrastructure.

Winter Storm Scenario Vulnerability Analysis

Building Type	*Number of Buildings*	*Exposure*
Residential	38	$6,208,377.00
Non-Residential	8	$1,898,641.00
Critical Facilities	1	$293,981.00
Totals	***47***	***$8,400,999.00***

Tornado Damage Profile

Lorain County is universally vulnerable to tornado damage. In recent data, Lorain County is rated as the county most likely to experience loss of life or property from tornado in Ohio although the actual history of deaths and losses is fairly low. Relatively speaking, many tornadoes travel toward and through Lorain County and dissipate out over Lake Erie after passing through the county.

Mobile homes comprise 3%, or approximately 3,490, of Lorain County's residential structures. These homes are more vulnerable to wind damage because they are less secured to the ground than a building with a foundation, have no sub-terrain level such as a basement, and are lighter weight and made of less wind resistant material than a constructed home. These homes are scattered throughout the county, and are individually located or within a mobile home park. The vulnerability does not change dependent on the location.

Other homes are generally constructed using wood, concrete, brick, and stone. Many homes are older, very solid construction using limestone and other masonry materials native to the area. These homes are built on traditional foundations with basements or crawl spaces; some new homes are concrete slab construction without basements or crawl spaces. These homes are most prone to superficial damage, roof damage, and trees falling on them during tornadoes and severe windstorms.

Commercial buildings are made of concrete, brick, concrete block, stone, and wood. Again, many older buildings are made of stone and brick manufactured or mined locally. They are generally built on concrete slabs with structural support trusses and pitched roof construction to facilitate snow and ice melt and runoff. Flat roof buildings like the shopping malls are susceptible to heavy snow in blizzard conditions; there is no identifiable history of roof collapse incidents due to snow or ice.

The incidence of tornadoes in Lorain County is frequent; tornado warnings are issued several times each year as cold and warm fronts clash, creating turbulent weather. Most tornadoes occur in the spring and early summer, but there have been incidents of tornadoes in fall such as November 2002. Tornadoes that strike Lorain County have been measured as EF-0, EF-1, and EF-2 tornadoes; therefore damage has been moderate and frequently limited to a single or a few buildings in proximity to one another.

Property damage from tornadoes in Lorain County generally includes damaged roofs, gutters and downspouts, trees, and the occasional destruction of a whole building. Mobile homes are damaged or destroyed in the most serious outbreaks. Outbuildings, barns, and storage buildings

are frequently damaged because these structures are less resistant to wind damage and are frequently built on concrete slabs and dirt foundations. The following table was taken from FEMA's website, and indicates the type of damages per Enhanced Fujita Scale tornado classification. The tornados in Lorain County have historically been limited to EF-0, EF-1, and EF-2.

EF-Scale	Wind Speed	Typical Damage
0	65 – 85 mph	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over,
1	86 – 110 mph	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
2	111 – 135 mph	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
3	136 – 165 mph	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
4	166 – 200 mph	Devastating damage. Whole frame and well-constructed houses completely leveled; cars thrown and small missiles generated.
5	>200 mph	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters; high-rise buildings have significant structural damage; incredible phenomena will occur
No rating		Inconceivable damage. Should a tornado with the maximum wind speed in excess of EF-5 occur, the extent and types of damage may not be conceived. A number of missiles such as iceboxes, water heaters, storage tanks, automobiles, etc. Will create serious secondary damage on structures.

Tornado Scenario Vulnerability Analysis

Building Type	*Number of Buildings*	*Exposure*
Residential	3,587	$583,850,570.00
Non-Residential	1,097	$236,271,455.00
Critical Facilities	170	$41,550,784.00
Totals	***4,854***	***$861,672,809.00***

Thunderstorm Damage Profile

Thunderstorms are frequent in Lorain County, and can be enhanced by proximity to Lake Erie and temperature fluctuations due to the water's heat or cold. The storms are typically more of an inconvenience than a severely damaging storm. A rare lightning bolt may destroy an electrical transformer, strike a building and cause a fire, or hit a tree and cause damage to something it touches. More severe damage, including loss of property, and life is certainly possible, but statistics indicate the frequency with which that happens is extremely low.

When thunderstorms are accompanied by tornadoes, the damages due to tornadoes can be more significant, as described previously. Straight-line winds can be the result of downbursts and

microbursts, and can be just as destructive as a tornado. The damages are similar to that of the tornado EF scale listed above.

Thunderstorm Scenario Vulnerability Analysis

Building Type	*Number of Buildings*	*Exposure*
Residential	11	$1,790,651.00
Non-Residential	4	$861,462.00
Critical Facilities	2	$489,842.00
Totals	***17***	***$3,141,955.00***

Wind Storm Damage Profile

In recent years, Lorain County has experienced two windstorms that were, at the time, considered anomalies. In September 2008, Hurricane Ike reached Ohio sans the precipitation as a windstorm. Power lines were felled, and utility outages occurred although in far lower numbers than further south in central Ohio. Again in October 2012, Hurricane Sandy brought high winds to Lorain County at the hurricane finally fizzled out. In general, a wind incident could occur, and Lorain County could be in the impact zone. Damages would be similar to that of a tornado incident, as quantified previously.

Wind Storm Scenario Vulnerability Analysis

Building Type	*Number of Buildings*	*Exposure*
Residential	5	$777,768.00
Non-Residential	2	$237,857.00
Critical Facilities	1	$36,829.00
Totals	***8***	***$1,052,454.00***

Drought Damage Profile

Lorain County can experience slight drought, and regularly experiences periods of decreased precipitation during the growing season for area farms. There is no history of an extended drought that would cause casualty or property damage longer than a reduction in crop yields for a single year. The climate is moderate, and does not turn arid at any time. There is no history of extended drought conditions that would affect crops for any longer than a single growing season. There is no history of extensive crop losses in excess of a single crop year, although precipitation patterns can cause a series of years to have higher or lower average yields due to slight dryness, late planting due to excessive rainfall, or late harvest due to rainfall.

For the purpose of loss estimates, only the major cash grain crops were considered because those crops constitute the majority of production in Lorain County, and are consistently produced in the expressed acreages from year to year. Production livestock could be sold in spite of drought; other cash crops such as cucumbers, tomatoes, and vegetables are heavily insured. While most farmers purchase crop insurance for all crops, including grain, data does not exist to indicate whether or not all crops are insured in Lorain County.

Based on acreage reports from the Ohio State University Extension Service, U.S. Census data, and current grain prices on NASDAQ, Lorain County could expect the following loss amounts under total crop loss conditions for the most prevalent crops produced in the county:

Commodity	Average Yield/Acre (OSU Extension)	Average Acres in Lorain County (Census Data)	Current Price (NASDAQ)	Total Value
Corn	110 bu/acre	12,767	3.85	$5,406,824
Soybeans	40 bu/acre	72,316	9.70	$28,058,608
Wheat	52 bu/acre	12,019	6.24	$3,899.925
Vegetables	Unavailable	1,301	Varied	Undetermined
Fruit	Unavailable	786	Varied	Undetermined

Erosion/Landslide/Mudslide Damage Profile

Due to the lack of sloping topography, Lorain County is not vulnerable to landslides and mudslides except a few properties along the Black River. The properties along the river are generally high-value residential properties that are privately insured; there is no history of claims paid for damages due to natural hazards. Most of the landslide risk for these properties is from the erosion of topsoil near the embankment; as a result of this erosion, the usable portion of property is decreased as the soil erodes away.

There is less than 550 feet of variation in elevation across the entire county, which limits the amount of riverbank where a landslide could occur. Therefore, it was assessed that Lorain County is not vulnerable to landslide or mudslide, and no damage estimations were developed because no loss data or incident data exists to support that prediction.

Land Subsidence Scenario Vulnerability Analysis

Building Type	*Number of Buildings*	*Exposure*
Residential	5	$347,410.00
Non-Residential	5	$915,644.00
Critical Facilities	2	$1,159,614.00
Totals	***12***	***$2,422,668.00***

Estimated Non-Flood Losses

In consideration of all previously stated data and projections, Lorain County is at risk for damages from a variety of disasters. The following list of weather events was evaluated as a part of this update to the Hazard Mitigation Plan: dam failure, drought, earthquake, erosion/landslide, flood, tornado, thunderstorm, windstorm, and winter storm. Potential disasters were evaluated in terms of risk and damages; the following table summarizes that analysis and ranking of potential loss. The legend explaining values follows the table with full descriptions.

Frequency

Weather events that occur regularly are rated as a higher risk than those that occur on a sporadic basis.

One or more annually	5
At least one per three year period	4
At least one per ten year period	3
At least one per twenty-five year period	2

At least one per fifty year period	1
Less than one per 50 year period	0

Magnitude

Magnitude is rated using standard damage scales such as the Enhanced Fujita Scale, or through development of a local comparative scale that is comparable in damages at like levels using the established damage scales. Some scales from other geographic regions, such as the North East Snow Index Scale, were used as models to develop a comparative tool in Lorain County.

The Enhanced Fujita Scale was used for tornado ratings. The Windstorm scale was derived from a combination of tornado, hurricane, and derecho damage data, and extrapolated into a locally developed comparative rating. The Saffir-Simpson Scale was used for hurricane, and the National Weather Service descriptions of flooding were used, tempered with localized detail. The Richter Scale was used for earthquake, and the U.S. National Drought Mitigation Center scale was used for drought. The winter storm scale is an adaptation of the North East Snow Index System, or NECIS, based upon comparative local impact criteria. All scales are based upon damage to structures and disruption of normal services.

Plan Rate	Tornado	Windstorm	Hurricane	Flood	Earthquake	Drought	Winter Storm
5	EF-5	>100 mph	>157 mph	Catastrophic	> 9.0	Famine	> 24 " snow
4	EF-4	86-99mph	130-156 mph	Major	8.0 – 8.9	D-4 Exceptional	16-24" snow
3	EF-3	76-85 mph	111-129 mph	Significant	7.0 – 7.9	D-3 Extreme	12-16" snow
2	EF-2	68–75 mph	96-110 mph	Moderate	6.0 – 6.9	D-2 Severe	8-12" snow
1	EF-1	58-65 mph	74-95 mph	Minor	5.0 – 5.9	D- 1 Moderate	4-8" snow
0	EF-0	< 58 mph	<74 mph	Temporary	< 5.0	D-0 Very Dry	< 4 "snow

Feasibility

Feasibility indicates the geographic or meteorological possibility for the hazard to occur in Lorain County. If there is no presence of the geographical or meteorological characteristics of the hazard or no recorded incidence of the event in experiential data, the hazard is rated as a "1". For example, there are no volcanoes in the county. There are few possibilities for a landslide due to the relatively flat topography, with an elevation difference from the highest point to the lowest point in the county measuring only 545 feet over twenty-five miles, or a slope of only 0.002 feet per foot. Those hazards that would occur only in a specific location within the county are rated a "2". Hazards that occur seasonally only are rated a "3", and those that only occur during specific conditions that can occur year-round are rated a "4". Those events that can occur on any day during any season in any part of the county are rated a "5".

5	All conditions are present for this threat to occur at any time during the year
4	Conditions for this to occur are present all year, but not on all days of the year
3	All conditions are present for this threat to occur seasonally only
2	Only under special conditions is this threat viable, or only in specific

	geographic areas of the county
1	This threat is generally not a viable threat
0	The conditions for this hazard do not exist in Lorain County

Final Value

The frequency was multiplied by the magnitude because those two factors are significantly important when damages are calculated. The feasibility factor was added to either enhance or diminish the affect based upon possibility. The total number was a combination of frequency times magnitude, plus feasibility to result in one method of determining priority of risks. The results were then compared to an anecdotal ranking by HMCC members based on their recollections, historical data, and loss incidents.

Disaster Type	Frequency	Magnitude	Feasibility	Final Value	Rank
Flood	5	1	5	10	4
Winter Storm	5	2	3	13	3
Tornado	5	1	3	8	5
Thunderstorms	5	1	4	20	1
Windstorm	5	2	4	14	2
Drought	3	1	1	4	6
Earthquake	1	0	1	1	7
Erosion/Landslide	1	0	1	1	7
Dam Failure	0	0	1	1	7

Each of the above hazards was rated in comparison with the others to arrive at a determination of greatest risk to the population and property in Lorain County. The focus was placed on loss of life, property casualty, and disruption of normal daily activities such as going to work, school, or church and being able to enjoy one's home and activities. School and business closure, lack of passable roadways, disruption of transportation, and presence of utilities in normal functioning capacity were part of the determination for each rating. The least damaging events were those that did not cause the closure of business and schools and during which roads and bridges remained open.

Risk Assessment Summary

Lorain County is vulnerable to a variety of natural hazards. These hazards often present as combinations of multiple hazards, making the county's vulnerability higher and more severe. The Hazard Mitigation Core Committee provided input on the possibility, probability, magnitude, and frequency of potential natural hazards in Lorain County. Representatives from each jurisdiction assigned a rank of one through eleven to each hazard. This information was compiled to determine the overall raw and adjusted rank of each hazard as described below.

Jurisdiction	Erosion	Dam Failure	Drought	Earthquake	Flood	Hailstorm	Severe Thunderstorm	Tornado or Wind	Severe Winter Storm	Extreme Temperature
Lorain County	9	8	11	7	1	5	4	2	3	6
Amherst	10	8	9	11	4	3	1	2	5	6
Avon	7	8	11	9	1	5	4	2	6	3
Avon Lake	7	10	11	9	1	4	2	3	5	6
Elyria	11	8	9	7	1	6	2	5	3	4
Grafton	11	9	6	10	1	7	2	3	4	8
Kipton	11	10	9	8	7	4	2	1	3	5
LaGrange	11	7	9	10	1	4	3	2	5	6
Lorain	11	8	10	7	1	5	2	3	4	6
North Ridgeville	11	7	8	10	1	5	4	2	6	3
Oberlin	11	7	9	8	5	3	2	1	4	6
Rochester	11	10	7	8	6	3	1	2	4	5
Sheffield Lake	5	9	11	8	1	7	3	2	4	6
Sheffield Village	8	11	10	9	1	4	2	3	5	7
South Amherst	11	10	7	8	5	4	1	2	3	6
Vermilion	7	8	10	9	1	6	2	3	4	5
Wellington	11	7	8	19	6	4	1	2	3	5
Raw Score	*317*	*145*	*155*	*150*	*44*	*79*	*38*	*40*	*71*	*93*
Raw Rank	*11*	*7*	*10*	*8*	*3*	*5*	*1*	*2*	*4*	*6*
Adjusted Rank	**11**	**10**	**6**	**8**	**4**	**5**	**1**	**2**	**3**	**7**

Adjusted Rank

Adjusted rank figures were determined by modifying the raw scores to more accurately address actual damages to Lorain County and eliminate the halo effect of respondent's recent experiences with flooding and cold temperatures in recent months. While the raw scores indicated strong accuracies in some areas, other important vulnerabilities were not represented consistently with how the incidents would impact the community or the recovery challenges that would be present.

Considerations in adjusting the rank included impact on critical infrastructure and populations, amount of destruction inflicted on residents and property, and the degree of disruption to the community's infrastructure and business in general. These factors were combined with the "popular vote" results that relied heavily on recent memories more than actual impact.

In 2014, Lorain County experienced an abnormally cold and wet winter. Residents in North Ridgeville, Avon, Avon Lake, Lorain, and Elyria experienced shortages in natural gas and propane that caused a hardship for the community. This type of winter is extremely rare but

when participating in the survey, this most recent experience is what respondents recalled and considered when ranking the threat of severe winter weather.

Respondents also recalled the continual heavy rain and tornado sightings that occurred this year. While Lorain County ranks highest in Ohio for risk of a deadly tornado, the actual occurrence of a tornado is low. Many funnel cloud sightings do not result in a tornado touching the ground as the funnel clouds dissipate as they reach the altered lakeshore atmosphere.

Natural hazards in Lorain County are ranked according to the list below:

1. Severe Thunderstorm
2. Tornado or Wind
3. Severe Winter Storm
4. Flood
5. Hailstorm
6. Drought
7. Extreme Temperature
8. Earthquake
9. Dam Failure
10. Erosion