2.12 SEVERE SUMMER STORMS

For the purpose of this plan, Severe Summer Storms is an assessment of multiple hazards: thunderstorm- and high- winds, hail, and lightning events.

Severe summer storms traditionally precede an approaching cold air mass. In the northern hemisphere, the spin of the earth naturally produces weather patterns affecting North America, which travel from west to east across the continent. Key components to the formation of storms are a low-pressure zone, high-pressure zone and the jet stream.

The troposphere is the lowest portion of Earth's atmosphere containing approximately 75% of the atmosphere's mass and almost all of its water vapor. Air at this level is acted upon by the earth surface (land and water) and the heating cycle associated with sunlight. Unlike other portions of the atmosphere which are largely homogenous, at the surface discrete areas or bubbles exist of differing temperature, water vapor content and pressure. Warm areas (low pressure) tend to rise, pressing on the borders of surrounding cool areas (high pressure). It is where the pressure zones interface that temperature changes cause water vapor in the air to condense creating precipitation. The warmer the overall temperature of the atmosphere and the greater the volume of water vapor present, the larger the associated perception event.

Jet streams are fast flowing, relatively narrow air currents found in the atmosphere around 11 kilometers (36,000 ft.) above the surface of the Earth. They form at the boundaries of adjacent air masses with significant differences in temperature, such as of the polar region and the warmer air toward the equator. These air currents migrate north and south in a snakelike pattern changing their relative location as the planet's axis tilts with each passing year. These winds act on the high- and low-pressure zone moving them across the continent and shifting them north and south.

Summer storms are considered *high wind* events by the National Climactic Data Center when surface winds meet or exceed 50 knots or 57.6 miles per hour. It is possible for winds in strong storms to exceed 100 miles per hour, with gusts even stronger. On the occasion that a *high wind* event occurs on a convective line without lightning and embedded within an area with a tight surface pressure gradient, it is then classified as a *thunderstorm wind* event.

Figure 2.12a

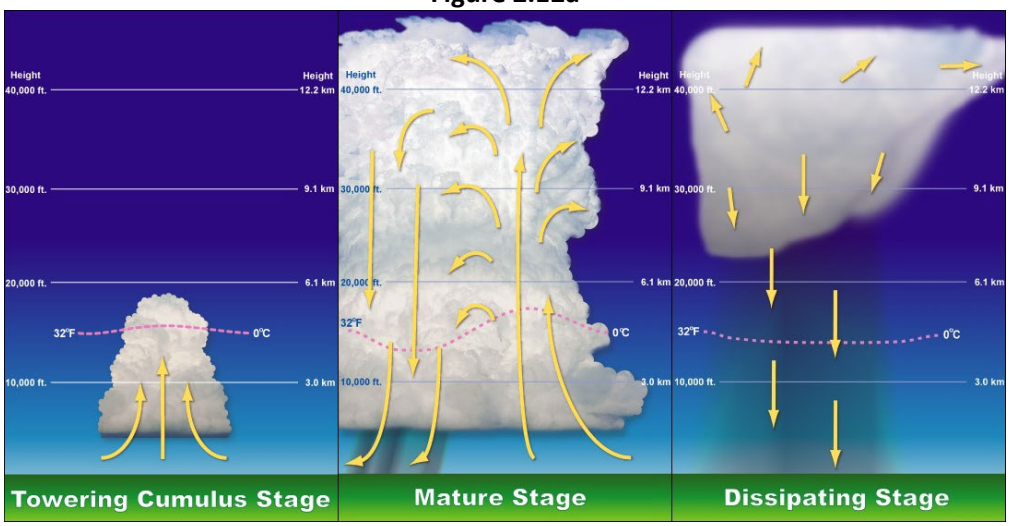

Figure 2.12.a: Stages of a Thunderstorm's Life
Source: Wikipedia

Figure 2.12.b: Tennis ball sized hail from June 8, 2007, Summit County

Source: National Weather Service, Cleveland. Photo courtesy of Dale Dailey

Thunderstorms develop when large differences exist between adjacent zones combined with significant water vapor. As warm air begins to lift, it eventually starts to cool and condensation takes place. When the moisture condenses, heat is released which further aids in the lifting process. If enough instability is present in the atmosphere, this process will continue long enough for cumulonimbus clouds to form, which supports lightning and thunder (see Diagram 2.12a). As water droplets rise into the colder air, they can freeze. When the velocity of wind becomes great enough, the ice pellets are repeatedly lifted and dropped in the storm adding layers of ice with each cycle. Once the wind cannot support the weight of the ice pellet it falls the ground in the form of *hail*.

Figure 2.12.c: Lightning event at Temescal Valley, CA

Source: National Weather Service, Photo courtesy of Willi Wilkens

One key component to a thunderstorm is lightning, an atmospheric discharge of electricity. High speed videos (examined frame-by frame) show that most lightning strikes are made up of multiple individual strokes. A typical strike is made of 3 to 4 strokes. The sudden increase in pressure and temperature from lightning produces rapid expansion of the air surrounding and within a bolt of lightning. In turn, this expansion of air produces a sonic shock wave which produces the sound of thunder. Lightning, other storm components, often seeks a path though the tallest object available. Trees, utility line/poles, tall buildings and even humans can be sought as a pathway for the discharging electricity.

According to the National Weather Service, lightning is a major cause of storm related deaths in the U.S. A lightning strike can result in a cardiac arrest (heart stopping) at the time of the injury, although some victims may appear to have a delayed death a few days later if they are resuscitated but have suffered irreversible brain damage. Over the last 30 years (1989-2018) the U.S. has averaged 43 reported lightning fatalities per year. Only about 10% of people who are struck by lightning are killed, leaving 90% with various degrees of disability. More recently, in the last 10 years (2009-2018), the U.S. has averaged 27 lightning fatalities.

RISK ASSESSMENT

LOCATION

Severe summer storms and associated thunderstorm/high winds, lightning, and hail events are common throughout Ohio and reported hundreds of times each year. Each of these hazards are not spatially-limited and are state-wide hazards. For thunderstorm wind and hail events, past occurrences will be reported based on days with events. For lightning, each reported event will be counted as a single event.

PAST OCCURRENCES AND PROBABILITY OF FUTURE EVENTS (TABLE 2.12.a/b/c)

HIGH- AND THUNDERSTORM- WINDS

According to the NCDC Storm Database, there has been *972 High- and Thunderstorm- Wind* events from January 1, 2003 to January 1, 2023. From these events, about *$1,550,716,970* (*Inflation-adjusted value 2023*) in property and crop damages have been reported and have resulted in *26* deaths and *153* injuries. Based on these figures, *High- and Thunderstorm- Winds* are the most prevalent natural hazard events in Ohio with having a *100%* chance events of occurring in any given year. The costliest high wind event happened on September 14, 2008 as a result of Hurricane Ike. High winds affected most parts of the state. The NCDC Storm Database reports that $771,955,000 had been caused in property and crop damage.

Table 2.12.a

High- and Thunderstorm- Winds Past Occurrences and Probability Assessment by County														
Region 1					Region 2					Region 3				
County	Total Deaths	Total Injuries	Days with Event [1, 2]	Est. Annual Probability [3]	County	Total Deaths	Total Injuries	Days with Event [1, 2]	Est. Annual Probability [3]	County	Total Deaths	Total Injuries	Days with Event [1, 2]	Est. Annual Probability [3]
Allen	0	3	76	3.8	Ashland	0	1	110	5.4	Adams	0	0	76	3.8
Auglaize	0	2	82	4.1	Butler	0	0	107	5.3	Ashtabula	0	0	120	5.9
Champaign	0	1	73	3.6	Clinton	0	0	102	5.0	Athens	0	6	76	3.8
Clark	0	0	106	5.2	Cuyahoga	0	6	182	8.9	Belmont	0	0	83	4.1
Crawford	0	0	97	4.8	Delaware	1	5	88	4.4	Brown	0	0	103	5.1
Darke	0	0	104	5.1	Fairfield	1	1	104	5.1	Carroll	0	0	100	5.0
Defiance	0	0	64	3.2	Fayette	0	1	74	3.7	Clermont	0	1	139	7.0
Erie	0	1	96	4.7	Franklin	0	10	144	7.2	Columbiana	0	3	127	6.2
Fulton	0	0	63	3.2	Geauga	1	0	115	5.6	Coshocton	0	0	98	4.9
Hancock	0	0	120	5.9	Greene	1	0	121	6.0	Gallia	0	0	55	2.9
Hardin	0	0	49	2.4	Hamilton	3	4	144	7.2	Guernsey	0	0	88	4.3
Henry	0	1	80	4.0	Knox	0	1	117	5.8	Harrison	2	0	83	4.1
Huron	0	0	113	5.6	Lake	0	2	108	5.3	Highland	0	1	90	4.5
Logan	0	0	84	4.2	Licking	2	4	115	5.7	Hocking	0	0	71	3.5
Lucas	2	0	123	6.1	Lorain	1	3	154	7.6	Holmes	0	0	101	5.0
Marion	1	4	103	5.1	Madison	1	3	67	3.3	Jackson	0	1	61	3.2
Mercer	0	3	78	3.9	Medina	1	3	112	5.5	Jefferson	1	2	102	5.1
Miami	0	3	98	4.8	Montgomery	1	2	141	7.0	Lawrence	0	1	71	3.5
Ottawa	0	5	101	5.0	Morrow	0	0	82	4.1	Mahoning	1	0	111	5.5
Paulding	0	0	56	2.8	Pickaway	0	2	68	3.4	Meigs	0	0	43	2.3
Preble	2	0	75	3.7	Portage	0	2	126	6.3	Monroe	0	0	54	2.7
Putnam	0	2	60	3.0	Richland	0	2	135	6.7	Morgan	0	0	55	2.8
Sandusky	0	2	100	4.9	Stark	1	1	122	6.1	Muskingum	1	1	98	4.9
Seneca	0	1	109	5.4	Summit	0	1	134	6.6	Noble	0	0	54	2.7
Shelby	0	1	86	4.3	Union	0	0	69	3.4	Perry	1	0	78	3.9
Van Wert	1	0	83	4.2	Warren	0	4	127	6.3	Pike	0	5	69	3.5
Williams	1	2	59	2.9	Wayne	0	2	122	6.0	Ross	0	0	87	4.3
Wood	0	1	118	5.8						Scioto	1	2	123	6.1
Wyandot	0	0	69	3.4						Trumbull	0	40	152	7.5
										Tuscarawas	0	0	127	6.3
										Vinton	0	0	57	3.0
										Washington	0	0	65	3.2

1- Count includes both high winds, and thunderstorm wind events as reported by the National Weather Service.

2- Events are counted as days with events, where multiple events per day is counted as one event.

3- Due to the reason above, estimated annual probability is the probability of an event day occurring in a given year.

HAIL

For *hail* during the same timeframe, there were *673* days with events that resulted in *$1,264,550,867* in property and crop damage and have resulted in *0* deaths and *3* injuries. Based on these figures, Hail events also have a *100%* chance of occurring in any given year. The costliest hail event from happened on May 25, 2012, affecting Hancock County and had reported *$85 million (approximately $116.5 million Inflation-adjusted value 2023*) in damages. The event had produced hail as large as baseballs. The western half of the city of Findlay was especially hard hit. As many as 4,000 homes and business in this area may have been damaged by the hail. Thousands of automobiles also sustained damage from the hail. This event could end up being one of costliest hail storms in Ohio history.

Table 2.12.b

Hail Past Occurrences and Probability Assessment by County														
Region 1					Region 2					Region 3				
County	Total Deaths	Total Injuries	Days with Event [1, 2]	Est. Events Per Year	County	Total Deaths	Total Injuries	Days with Event [1, 2]	Est. Events Per Year	County	Total Deaths	Total Injuries	Days with Event [1, 2]	Est. Events Per Year
Allen	0	0	24	1.2	Ashland	0	0	48	2.4	Adams	0	0	29	1.4
Auglaize	0	0	40	2.0	Butler	0	0	49	2.4	Ashtabula	0	0	35	1.7
Champaign	0	0	21	1.1	Clinton	0	0	36	1.8	Athens	0	0	31	1.5
Clark	0	0	35	1.7	Cuyahoga	0	0	68	3.4	Belmont	0	0	30	1.5
Crawford	0	0	35	1.7	Delaware	0	0	28	1.4	Brown	0	0	33	1.6
Darke	0	0	34	1.7	Fairfield	0	0	41	2.0	Carroll	0	0	18	0.9
Defiance	0	0	22	1.1	Fayette	0	0	30	1.5	Clermont	0	0	49	2.4
Erie	0	0	40	2.0	Franklin	0	0	70	3.5	Columbiana	0	0	46	2.3
Fulton	0	0	14	0.7	Geauga	0	0	36	1.8	Coshocton	0	0	25	1.3
Hancock	0	0	39	1.9	Greene	0	0	45	2.2	Gallia	0	0	28	1.4
Hardin	0	0	20	1.0	Hamilton	0	0	58	2.9	Guernsey	0	0	30	1.5
Henry	0	0	13	0.7	Knox	0	0	30	1.5	Harrison	0	0	15	0.7
Huron	0	0	48	2.4	Lake	0	0	37	1.9	Highland	0	0	23	1.1
Logan	0	0	25	1.3	Licking	0	1	45	2.2	Hocking	0	0	19	0.9
Lucas	0	0	48	2.4	Lorain	0	0	64	3.2	Holmes	0	0	32	1.6
Marion	0	0	40	2.0	Madison	0	0	20	1.0	Jackson	0	0	23	1.2
Mercer	0	0	31	1.5	Medina	0	0	57	2.8	Jefferson	0	0	29	1.5
Miami	0	0	30	1.5	Montgomery	0	2	63	3.1	Lawrence	0	0	36	1.8
Ottawa	0	0	43	2.2	Morrow	0	0	26	1.4	Mahoning	0	0	43	2.1
Paulding	0	0	25	1.3	Pickaway	0	0	21	1.0	Meigs	0	0	24	1.2
Preble	0	0	23	1.1	Portage	0	0	61	3.0	Monroe	0	0	19	1.0
Putnam	0	0	31	1.5	Richland	0	0	65	3.2	Morgan	0	0	15	0.8
Sandusky	0	0	40	2.0	Stark	0	0	67	3.3	Muskingum	0	0	33	1.7
Seneca	0	0	51	2.5	Summit	0	0	88	4.4	Noble	0	0	12	0.6
Shelby	0	0	36	1.8	Union	0	0	27	1.3	Perry	0	0	31	1.6
Van Wert	0	0	14	0.7	Warren	0	0	49	2.4	Pike	0	0	16	1.0
Williams	0	0	13	0.6	Wayne	0	0	49	2.4	Ross	0	0	33	1.7
Wood	0	0	53	2.6						Scioto	0	0	44	2.2
Wyandot	0	0	23	1.1						Trumbull	0	0	57	2.8
										Tuscarawas	0	0	34	1.7
										Vinton	0	0	8	0.5
										Washington	0	0	33	1.6

1- Count includes both high winds, and thunderstorm wind events as reported by the National Weather Service.

2- Events are counted as days with events, where multiple events per day is counted as one event.

3- Due to the reason above, estimated annual probability is the probability of an event day occurring in a given year.

LIGHTNING

Within the same period, there were 39 counties that reported 65 lightning events and resulted in $2,547,080 dollars in reported property and crop damages, *15* deaths, and *62* injuries. These figures are the reported events on the NCDC Storm Events Database within the observed period. However, it does not mean that these were the only events nor that there weren't any lightning events other counties. It could also be assumed from these figures that events were not recorded unless resulting in death, injuries, or damages to crops and/or property.

According to the National Weather Service, lightning detecting systems in the United States monitor an average of 25 million strokes of lightning per year, and the odds of being a lightning victim in the U.S. in any given year is about one in 1,222,000. The odds of being struck within a lifetime of 80 years, is one in 15,300.

Table 2.12.c

Lightning Past Occurrences by County					
County	**Region**	**Total Deaths**	**Total Injuries**	**Reported Events [1]**	**Reported Damages [2] 1/1/2003 to 1/1/2023**
Allen	1	0	0	3	$ 304,000
Clark	1	0	1	1	*None Reported*
Darke	1	0	0	1	$ 27,800
Fulton	1	0	0	1	$ 65,500
Hardin	1	1	0	1	*None Reported*
Huron	1	1	1	1	*None Reported*
Logan	1	0	1	1	*None Reported*
Miami	1	0	3	2	$ 4,800
Van Wert	1	0	0	1	$ 96,850
Wood	1	0	1	2	$ 60,000
Butler	2	1	2	3	$ 6,100
Cuyahoga	2	0	1	2	$ 126,400
Fairfield	2	0	1	1	*None Reported*
Franklin	2	2	4	4	$ 1,170
Hamilton	2	2	1	3	$ 36,200
Lorain	2	0	0	2	$ 181,700
Medina	2	0	1	2	$ 118,500
Montgomery	2	0	1	1	*None Reported*
Morrow	2	0	0	1	$ 23,700
Stark	2	1	1	5	$ 252,800
Summit	2	0	9	1	*None Reported*
Warren	2	1	2	4	$ 695,000
Wayne	2	0	0	1	$ 76,000
Ashtabula	3	0	1	2	$ 158,000
Athens	3	0	0	3	$ 17,050
Belmont	3	1	5	1	*None Reported*
Carroll	3	0	6	1	*None Reported*
Coshocton	3	1	0	1	*None Reported*
Gallia	3	0	1	1	*None Reported*
Hocking	3	0	10	1	*None Reported*
Lawrence	3	0	3	2	$ 34,250
Mahoning	3	1	0	1	*None Reported*
Meigs	3	0	0	1	$ 26,600
Monroe	3	1	0	1	*None Reported*
Muskingum	3	1	0	1	*None Reported*
Ross	3	1	5	1	*None Reported*
Trumbull	3	0	0	2	$ 229,700
Vinton	3	0	1	1	*None Reported*
Washington	3	0	0	1	$ 4,960
Total		**15**	**62**	**65**	**$ 2,547,080**

1- NCDC Storm Events Database only produces lightning events resulting in death, injuries, or damages to crops and/or property.

HURRICANES AND TROPICAL STORMS

In more recent years, a number of disaster declarations for Ohio was declared in result of remnants from hurricanes and tropical storms. Notably, wind events caused by remnants of Hurricane IKE in September 2008 had resulted in large damages across Ohio. High winds, rain, and flooding events from Hurricane SANDY, 2012, followed through to portions of Ohio.

STATEWIDE HIGH WINDS – SEPTEMBER 2008 (FEMA DR-1805-OH)
Usually, tropical storms and hurricanes directly affecting other states result in extended rainfall in Ohio. NOAA Operational Significant Event Imagery shows that the windstorms of 2008 were a legacy from Hurricane IKE, which arced clockwise from the Gulf of Mexico to the western basin of Lake Erie and the Saint Lawrence Seaway. Ohio was affected from Hamilton County in southwest Ohio to the northeastern counties of Ashland, Carroll and Summit. Unlike other secondary effects of a diminishing hurricane, high winds in excess of 65 miles per hour were primarily the cause of damage for many counties, causing power outages across these portions of the state. It was reported that winds equal to a Category 1 hurricane (winds up to 74 miles per hour) caused at least $1.255 billion in insured losses.

SEVERE STORMS, FLOODING AND LANDSLIDES – APRIL & MAY 2011 (FEMA DR- 4002-OH)
The impact of this event was widespread and costly due to the prolonged and record-setting spring rainfall during the months of March, April and May. According to the National Weather Service (NWS), a persistent upper valley weather channel over the eastern U.S. led to an active storm track over the Ohio Valley. During the month of April and into mid-May, the local NWS offices serving Ohio issued flood watches, flood warnings, flash flood watches and advisories and/or special weather statements for the Ohio River Watershed and Drainage Basin for 31 of the 44 days. Eighty-one percent of the watches, warnings and advisories were issued directly for the impacted counties, however, all of the counties had high stream levels on their watersheds. Also, during this time period, there were road closures almost every day due to flooding and/or high water. A notable incident was a small plane crashed near Ravenna, Ohio with three injuries due to saturated soil absorbing much of the impact. According to the Highway Patrol, had it not been for soft, soaked earth and mud, all three on board would have perished upon impact. Other incidents included 7,630 customers in power outages, trees uprooted, parts of buildings sustaining moderate damage and the loss of a countywide 911 system. As a result, the 21 affected Ohio counties received $44,506,071 in public assistance funds.

SEVERE STORMS AND STRAIGHT-LINE WINDS – JUNE 2012 (FEMA DR-4077-OH)
An anomalously strong storm ridge centered across the Southeast and brought record heat to the Upper Ohio Valley with the area in a flow on the northern edge of the ridge. A weak frontal boundary extended from northern Indiana into western Pennsylvania. Abundant moisture, strong instability, moderate shear, and a short wave just south of the boundary provided the ingredients for a long-tracked mesoscale convective system, classified by the Storm Prediction Center as a derecho, to track all the way from northern Indiana across eastern Ohio, southwestern Pennsylvania, northern WV, and western Maryland. As the system crossed the area, widespread wind damage was reported across areas primarily south and west of Pittsburgh. There were several reports of structural damage and damage led to a fatality when a barn collapsed in Muskingum County. Power outages were widespread with up to 130,000 outages reported immediately after the storms passage, most of which, were in Ohio. Muskingum and Guernsey counties sustained $712,000 and $500,000 in damages respectively. This also became one of the costliest disasters to hit Ohio, right behind Hurricane Ike in 2008. Two fatalities and eight injuries occurred during this event with $40,440,000 in property damage and $105,000 in damage to crops. As a result, of this event, 37 affected Ohio counties received $22,538,519 in public assistance funds.

HURRICANE SANDY – OCTOBER 2012 (FEMA DR-4098-OH)

On October 29, 2012, Hurricane Sandy made landfall near Atlantic City, New Jersey, however, the storm continued to produce significant wind, storm surge, rainfall and inland-flooding hazards across the Northeastern United States. High wind warnings as well as flood and flash flood watches and warnings for portions of Ohio and Indiana. The National Weather Service reported winds up to 80 miles per hour during the height of the storm system. First Energy Nuclear Operating Company reported sirens without AC power near Perry Nuclear Power Plant (Lake County-15 sirens, Geauga County-1 siren, Ashtabula-1siren) and Beaver Valley Power Station (Beaver County, PA-1siren). In Cuyahoga County, 80 people with functional needs were evacuated to a high school in Cleveland Heights, while another 11 shelters were being opened. The storm delivered a blow to Ashtabula County, but it wasn't the big uppercut some people had feared. As expected, strong wind toppled trees and dropped power lines, causing power outages across the county. Incessant rain toppled trees and flooded some thoroughfares in the area. Some of the hardest-hit areas were along the lakeshore, including Conneaut, North Kingsville, and Saybrook Township. Outages were reported in every city, village and township in the county, according to Illuminating Company information. Trees and limbs that collapsed on power lines were a big culprit, officials said. Lake County had residents from 142 homes near the mouth of the Chagrin River evacuated to the Mentor Community Center with another 70 evacuated to a shelter in Painesville. First Energy reported 55,516 customers without power in northeast Ohio. No fatalities were reported, however there was one injury that occurred. Property damage was estimated at $55,234,000 with no damage to crops. As a result, of this event, 37 affected Ohio counties received $17,810,815 in public assistance funds.

SEVERE STORMS, LANDSLIDES, AND MUDSLIDES – FEBRUARY 2018 (FEMA DR-4360-OH)

Beginning on February 14, 2018, and continuing through February 25, 2018, a persistent band of moderate to severe storms moved across Region V impacting Illinois, Indiana, Michigan, Ohio, and Wisconsin. While precipitation levels and storm-related damages varied, Ohio experienced a significant amount of flooding and subsequent damage along the southern portion of the state. The snowmelt and continued rain throughout the incident period, combined with the frozen soils, led to flooding along area streams, rivers, and low-lying areas. Numerous flood gauges in this area rose to moderate flood stage, and rainfall totals in the impacted areas during the incident period ranged from a total of five to nine inches. Following these storms, there were several road closures as well as reports of inaccessible areas throughout southern Ohio due to standing water.

On March 26, the Governor requested a Presidential Disaster Declaration. On April 17, 2018, a disaster was declared for the State of Ohio, due to severe storms, flooding, and landslides that occurred during the incident period of February 14, 2018, through February 25, 2018. As a result of that declaration, Public Assistance has been made available for Adams, Athens, Belmont, Brown, Columbiana, Gallia, Hamilton, Jackson, Lawrence, Meigs, Monroe, Muskingum, Noble, Perry, Pike, Scioto, Vinton, and Washington Counties. The Disaster impact data is fluid as only half of the Public Assistance projects have been awarded as of January 2019.

SEVERE STORMS, FLOODING, AND LANDSLIDES – APRIL 2019 (FEMA DR-4424-OH)

Beginning February 5 and lasting through February 13, created dangerous and damaging conditions affecting the health, safety and welfare of the citizens of Ohio. Ohio Governor Mike DeWine declared a state of emergency on March 11, 2019 for 20 Ohio counties including: Adams, Athens, Brown, Gallia, Guernsey, Hocking, Jackson, Jefferson, Lawrence, Meigs, Monroe, Morgan, Muskingum, Noble, Perry, Pike, Ross, Scioto, Vinton and Washington. The counties suffered from significant infrastructure damage as heavy rains poured down on already-saturated soils, damaging public infrastructure like roads and

culverts. On April 8, 2019, A Presidential Disaster Declaration was made that ordered Federal assistance to supplement State and local recovery efforts in the areas affected by severe storms, flooding, and landslides. Joint preliminary damage assessments conducted by local, state, and federal emergency management officials during the second week of March documented damages to critical infrastructure, such as county roads, bridges, culverts, and public buildings totaling $41.4 million.

SEVERE STORMS, STRAIGHT-LINE WINDS, TORNADOES, FLOODING, AND MORE– APRIL 2019 (FEMA DR-4447-OH)

Following the Memorial Day tornadoes that touched down in parts of western Ohio and brought rain and flooding impact across the state, the federal government declared a federal major disaster on June 18, 2019. Officially, this is the Ohio Severe Storms, Straight-line Winds, Tornadoes, Flooding, Landslides, and Mudslide (DR-4447). The federal disaster area includes households and business owners in Auglaize, Darke, Greene, Hocking, Mercer, Miami, Montgomery, Muskingum, Perry, and Pickaway counties. This list later included Mahoning and Columbiana counties in the eastern part of the state. In the June 27 request to the FEMA, Ohio Emergency Management Agency Executive Director Sima Merick included a preliminary damage assessment of about $18.1 million in eligible costs, of which two-thirds, or about $12 million, was debris removal.

LHMP DATA

HENRY COUNTY: The County's Hazard Mitigation Plan of 2018 states that from January of 1950 to June of 2017 in Henry County. These events have caused two injuries, over $800,000 in property damage, $600,000 in crop damage, and no deaths. Based on historical information, Henry County can expect to endure at least three severe storms in any given year.

DARKE COUNTY: The 2011 Updated Hazard Mitigation Plan cites that there has been a total of 2 lightning events, 64 hail events, and 148 thunderstorm/wind events in Darke County from June 9, 1958 through December 31, 2010. Based on NCDC data, Darke County can expect at least four severe summer storm events each year along with smaller events. Some of the significant events are described in the following paragraphs.

FAIRFIELD COUNTY: The 2016 Fairfield County Natural Hazards Mitigation Plan references 219 severe thunderstorm events from 1968 to 2016. From the period of 1961 to 2016, the County experienced 58 Hail events creating $52,000.00 in property damages. No deaths or injuries as a result of Hail storms.

MIP LHMP HIRA ASSESSMENT

Overall, Severe summer storms ranked fourth in cumulative scoring amongst the other hazards, falling from third in the 2019 SOHMP.

Table 2.12.d

FLOOD MIP LHMP HIRA ASSESSMENT								
Ranking	**3**	**7**	**5**	**2**	**10**	**6**	**2**	**4**
Criteria Score	**4.41**	**3.54**	**3.34**	**2.73**	**1.33**	**1.56**	**1.88**	**3.54**
[redacted]	Hazard Frequency	Response Time	Onset Time	Magnitude	Impact on Business	Impact on Humans	Impact on Property	Cumulative Score

VULNERABILITY ANALYSIS AND LOSS ESTIMATION

METHDOLOGY

In the National Risk Index, a hail, lightning, and strong winds hazard risk index score/rating represent a community's relative risk for those hazards when compared to the rest of the United States. The Expected Annual Loss (EAL) represents the relative level of agriculture, building, and population loss each year. For more information on current methodology and data, refer to Sections 11 (Hail), 16 (Lightning), and 18 (Strong Winds) of the National Risk Index Technical Manual

RESULTS

HAIL

The FEMA NRI estimates expected annual losses (EAL) will more heavily impact buildings than people. For county-specific estimates for lightning in Ohio, refer to table 2.12.e.

- Region 1 is estimated to have an expected annual loss of $7,851,253: $7,156,835 in building loss, $116,768 in population equivalence, and $577,650 in agriculture loss.
- Region 2 is estimated to have an expected annual loss of $39,640,581: $7,156,835 in building loss, $667,635 in population equivalence, and $263,035 in agriculture loss.
- Region 3 is estimated to have an expected annual loss of $7,244,652: $6,805,557 in building loss, $245,583 in population equivalence, and $193,512 in agriculture loss.

LIGHTNING

The FEMA NRI estimates expected annual losses (EAL) will more heavily impact people than buildings, and does not estimate EAL for agriculture. For county-specific estimates for lightning in Ohio, refer to table 2.12.f.

- Region 1 is estimated to have an expected annual loss of $3,013,923: $2,557,163 in population equivalence and $456,760 in building loss.
- Region 2 is estimated to have an expected annual loss of $12,112,966: $11,334,731 in population equivalence and $778,235 in building loss.
- Region 3 is estimated to have an expected annual loss of $3,013,923- $2,557,163 in population equivalence and $456,760 in building loss.

STRONG (HIGH AND THUNDERSTORM) WINDS

The FEMA NRI estimates expected annual losses (EAL) will more heavily impact buildings than people. For county-specific estimates for lightning in Ohio, refer to table 2.12.g.

- Region 1 is estimated to have an expected annual loss of $22,229,867: $14,419,400 in building loss, $7,406,297 in population equivalence, and $404,170 in agriculture loss.
- Region 2 is estimated to have an expected annual loss of $30,517,458: $23,665,793 in building loss, $6,753,214 in population equivalence, and $98,450 in agriculture loss.
- Region 3 is estimated to have an expected annual loss of $9,933,268: $7,014,647 in building loss, $2,877,856 in population equivalence, and $40,764 in agriculture loss.

Table 2.12.e

FEMA National Risk Index Hail Analysis by Region												
Region 1				Region 2				Region 3				
County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)	County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)	County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)	
Allen	$ 1,118,144	$ 1,471	$ 8,477	Ashland	$ 68,418	$ 2,860	$ 4,078	Adams	$ 260,713	$ 1,174	$ 4,903	
Auglaize	$ 5,358	$ 696	$ 628	Butler	$ 8,856	$ 6,022	$ 7,700	Ashtabula	$ 56,064	$ 10,191	$ 14,314	
Champaign	$ 17,592	$ 1,792	$ 15,604	Clinton	$ 80,650	$ 1,926	$ 15,322	Athens	$ 79,461	$ 2,379	$ 1,254	
Clark	$ 8,153	$ 6,337	$ 16,829	Cuyahoga	$ 75,575	$ 97,304	$ 400	Belmont	$ 800,338	$ 42,528	$ 3,891	
Crawford	$ 67,531	$ 6,409	$ 4,446	Delaware	$ 4,129,357	$ 9,328	$ 11,037	Brown	$ 9,246	$ 1,907	$ 2,602	
Darke	$ 12,575	$ 851	$ 74,524	Fairfield	$ 10,572	$ 6,106	$ 10,881	Carroll	$ 38	$ 4,204	$ 10,313	
Defiance	$ 505,188	$ 1,760	$ 30,411	Fayette	$ 61,818	$ 1,325	$ 16,565	Clermont	$ 221,852	$ 2,953	$ 5,854	
Erie	$ 224,048	$ 10,762	$ 5,921	Franklin	$ 6,808,896	$ 87,668	$ 6,173	Columbiana	$ 1,097,925	$ 16,562	$ 39,594	
Fulton	$ 416,638	$ 1,932	$ 64,456	Geauga	$ 111,669	$ 22,624	$ 4,124	Coshocton	$ 368,992	$ 1,702	$ 13,970	
Hancock	$ 1,542,012	$ 10,280	$ 2,762	Greene	$ 16,819	$ 7,934	$ 12,866	Gallia	$ 290,312	$ 1,108	$ 2,080	
Hardin	$ 3,013	$ 1,434	$ 14,038	Hamilton	$ 450,330	$ 60,033	$ 3,145	Guernsey	$ 514,574	$ 1,623	$ 3,224	
Henry	$ 410,301	$ 1,253	$ 2,843	Knox	$ 72,260	$ 3,307	$ 13,423	Harrison	$ 131,065	$ 2,104	$ 3,615	
Huron	$ 29,630	$ 8,961	$ 4,753	Lake	$ 102,218	$ 25,351	$ 821	Highland	$ 27,699	$ 1,959	$ 849	
Logan	$ 18,239	$ 2,053	$ 15,775	Licking	$ 2,407,612	$ 13,115	$ 23,112	Hocking	$ 14,093	$ 1,042	$ 549	
Lucas	$ 173,837	$ 19,128	$ 1,293	Lorain	$ 93,433	$ 44,531	$ 4,803	Holmes	$ 117,978	$ 2,437	$ 4,221	
Marion	$ 197,528	$ 3,185	$ 14,359	Madison	$ 13,257	$ 2,010	$ 20,962	Jackson	$ 99,904	$ 1,282	$ 1,240	
Mercer	$ 7,913	$ 661	$ 85,624	Medina	$ 78,572	$ 29,416	$ 1,963	Jefferson	$ 687,625	$ 8,996	$ 1,774	
Miami	$ 5,955	$ 1,622	$ 14,270	Montgomery	$ 7,919,778	$ 15,390	$ 10,910	Lawrence	$ 133,567	$ 38,014	$ 1,915	
Ottawa	$ 212,916	$ 5,532	$ 4,933	Morrow	$ 69,515	$ 1,717	$ 1,331	Mahoning	$ 70,607	$ 36,005	$ 25,366	
Paulding	$ 325,122	$ 864	$ 49,110	Pickaway	$ 23,938	$ 2,371	$ 19,004	Meigs	$ 31,735	$ 849	$ 1,810	
Preble	$ 395	$ 678	$ 21,209	Portage	$ 1,080,173	$ 26,648	$ 3,522	Monroe	$ 209,646	$ 7,322	$ 1,875	
Putnam	$ 411,068	$ 1,564	$ 13,029	Richland	$ 40,038	$ 11,876	$ 12,781	Morgan	$ 381	$ 488	$ 1,820	
Sandusky	$ 258,946	$ 8,119	$ 1,923	Stark	$ 6,815,319	$ 70,489	$ 5,869	Muskingum	$ 1,081,180	$ 3,635	$ 8,417	
Seneca	$ 81,581	$ 7,612	$ 6,188	Summit	$ 7,331,417	$ 91,855	$ 1,010	Noble	$ 212,888	$ 7,809	$ 979	
Shelby	$ 9,296	$ 683	$ 22,593	Union	$ 9,121	$ 2,915	$ 28,237	Perry	$ 10,615	$ 1,291	$ 3,562	
Van Wert	$ 271,963	$ 409	$ 23,754	Warren	$ 628,844	$ 3,571	$ 6,264	Pike	$ 10,567	$ 1,115	$ 6,461	
Williams	$ 355	$ 1,704	$ 34,416	Wayne	$ 201,456	$ 19,942	$ 16,733	Ross	$ 18,461	$ 3,328	$ 9,613	
Wood	$ 501,960	$ 5,893	$ 13,489	Total	$ 38,709,911	$ 667,635	$ 263,035	Scioto	$ 7,500	$ 2,936	$ 2,028	
Wyandot	$ 319,576	$ 3,124	$ 9,992					Trumbull	$ 139,379	$ 31,024	$ 1,413	
Total	$ 7,156,835	$ 116,768	$ 577,650					Tuscarawas	$ 1,541	$ 5,080	$ 9,166	
								Vinton	$ 91,115	$ 500	$ 636	
								Washington	$ 8,494	$ 2,042	$ 4,202	
								Total	$ 6,805,557	$ 245,583	$ 193,512	

Statewide			
County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)
All 88	$ 52,672,303	$ 1,029,986	$ 1,034,197

Table 2.12.f

FEMA National Risk Index Lightning Analysis by Region								
Region 1			Region 2			Region 3		
County	EAL (Buildings)	EAL (Pop Equiv.)	County	EAL (Buildings)	EAL (Pop Equiv.)	County	EAL (Buildings)	EAL (Pop Equiv.)
Allen	$ 17,466	$ 100,491	Ashland	$ 9,722	$ 106,375	Adams	$ 6,300	$ 85,807
Auglaize	$ 10,379	$ 47,860	Butler	$ 108,998	$ 947,889	Ashtabula	$ 13,557	$ 205,257
Champaign	$ 5,927	$ 127,924	Clinton	$ 12,423	$ 129,360	Athens	$ 6,275	$ 169,821
Clark	$ 21,601	$ 150,521	Cuyahoga	$ 22,413	$ 1,479,777	Belmont	$ 41,861	$ 575,670
Crawford	$ 5,099	$ 93,756	Delaware	$ 52,574	$ 568,191	Brown	$ 7,831	$ 141,346
Darke	$ 2,458	$ 47,860	Fairfield	$ 25,041	$ 55,287	Carroll	$ 2,386	$ 168,325
Defiance	$ 15,855	$ 88,798	Fayette	$ 5,847	$ 85,197	Clermont	$ 7,397	$ 263,896
Erie	$ 53,017	$ 52,028	Franklin	$ 2,063	$ 1,825,352	Columbiana	$ 1,263	$ 795,781
Fulton	$ 4,400	$ 83,660	Geauga	$ 16,699	$ 104,458	Coshocton	$ 276	$ 126,536
Hancock	$ 52,378	$ 165,845	Greene	$ 26,920	$ 498,296	Gallia	$ 4,783	$ 48,691
Hardin	$ 3,791	$ 94,170	Hamilton	$ 58,101	$ 1,454,180	Guernsey	$ 5,698	$ 91,972
Henry	$ 12,025	$ 58,725	Knox	$ 13,348	$ 147,689	Harrison	$ 1,420	$ 66,052
Huron	$ 12,857	$ 196,723	Lake	$ 5,597	$ 252,216	Highland	$ 5,141	$ 129,801
Logan	$ 8,121	$ 50,588	Licking	$ 5,535	$ 461,502	Hocking	$ 5,471	$ 116,584
Lucas	$ 15,202	$ 48,721	Lorain	$ 111,991	$ 162,834	Holmes	$ 1,690	$ 87,465
Marion	$ 9,226	$ 159,989	Madison	$ 7,960	$ 115,872	Jackson	$ 5,888	$ 100,033
Mercer	$ 25,952	$ 48,875	Medina	$ 10,836	$ 102,770	Jefferson	$ 7,287	$ 276,680
Miami	$ 3,064	$ 263,715	Montgomery	$ 9,496	$ 504,060	Lawrence	$ 3,369	$ 138,464
Ottawa	$ 12,828	$ 81,640	Morrow	$ 4,389	$ 50,849	Mahoning	$ 3,414	$ 1,078,258
Paulding	$ 10,144	$ 43,263	Pickaway	$ 7,650	$ 161,715	Meigs	$ 2,477	$ 60,687
Preble	$ 15,457	$ 43,777	Portage	$ 19,179	$ 101,998	Monroe	$ 14,154	$ 94,166
Putnam	$ 13,549	$ 82,047	Richland	$ 2,942	$ 50,975	Morgan	$ 1,841	$ 33,914
Sandusky	$ 379	$ 121,949	Stark	$ 81,039	$ 606,774	Muskingum	$ 12,228	$ 316,256
Seneca	$ 8,258	$ 50,745	Summit	$ 21,282	$ 462,132	Noble	$ 13,170	$ 70,396
Shelby	$ 18,132	$ 50,973	Union	$ 9,762	$ 155,873	Perry	$ 4,147	$ 94,009
Van Wert	$ 6,553	$ 31,081	Warren	$ 58,353	$ 528,913	Pike	$ 3,934	$ 83,078
Williams	$ 16,618	$ 76,713	Wayne	$ 68,077	$ 214,197	Ross	$ 9,839	$ 400,620
Wood	$ 57,786	$ 51,844	Total	$ 778,235	$ 11,334,731	Scioto	$ 10,255	$ 230,625
Wyandot	$ 18,239	$ 42,881				Trumbull	$ 13,977	$ 1,392,884
Total	$ 456,760	$ 2,557,163				Tuscarawas	$ 9,560	$ 52,399
						Vinton	$ 1,813	$ 37,352
						Washington	$ 13,682	$ 100,235
						Total	$ 242,384	$ 7,633,061

Statewide		
County	EAL (Buildings)	EAL (Pop Equiv.)
All 88	$ 1,477,379	$ 21,524,955

Table 2.12.g

FEMA National Risk Index Strong Winds Analysis by Region

Region 1				Region 2				Region 3			
County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)	County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)	County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)
Allen	$ 585,424	$ 218,858	$ 108	Ashland	$ 372,528	$ 33,799	$ 6,321	Adams	$ 382,754	$ 64,140	$ 1,810
Auglaize	$ 438,656	$ 95,324	$ 337	Butler	$ 2,192,159	$ 307,424	$ 35	Ashtabula	$ 155,380	$ 136,568	$ 1,368
Champaign	$ 314,418	$ 37,021	$ 5,160	Clinton	$ 395,720	$ 79,170	$ 4,430	Athens	$ 215,912	$ 101,781	$ 148
Clark	$ 835,540	$ 23,169	$ 1,133	Cuyahoga	$ 1,446,471	$ 1,056,654	$ 1,017	Belmont	$ 66,666	$ 206,222	$ 383
Crawford	$ 229,227	$ 58,979	$ 22,520	Delaware	$ 1,236,008	$ 121,616	$ 2,845	Brown	$ 435,294	$ 109,026	$ 3,398
Darke	$ 614,541	$ 518,020	$ 752	Fairfield	$ 625,716	$ 199,157	$ 380	Carroll	$ 68,161	$ 44,507	$ 1,150
Defiance	$ 184,188	$ 484,770	$ 2,321	Fayette	$ 272,930	$ 76,959	$ 190	Clermont	$ 1,109,820	$ 300,740	$ 24
Erie	$ 528,674	$ 21,687	$ 19,667	Franklin	$ 2,685,017	$ 527,699	$ 1,650	Columbiana	$ 185,369	$ 36,955	$ 2,763
Fulton	$ 391,771	$ 599,116	$ 29,900	Geauga	$ 203,479	$ 157,517	$ 1,279	Coshocton	$ 93,984	$ 49,706	$ 4,848
Hancock	$ 736,591	$ 29,974	$ 37,108	Greene	$ 1,014,288	$ 284,475	$ 3,864	Gallia	$ 110,924	$ 25,516	$ 360
Hardin	$ 231,413	$ 92,804	$ 10,494	Hamilton	$ 2,785,708	$ 1,106,455	$ 8	Guernsey	$ 123,614	$ 52,955	$ 416
Henry	$ 138,447	$ 119,168	$ 17,062	Knox	$ 350,437	$ 129,368	$ 7,066	Harrison	$ 34,838	$ 21,912	$ 397
Huron	$ 337,152	$ 110,491	$ 22,799	Lake	$ 296,778	$ 273,775	$ 496	Highland	$ 431,363	$ 29,013	$ 150
Logan	$ 544,270	$ 58,697	$ 5,372	Licking	$ 818,036	$ 316,893	$ 5,314	Hocking	$ 158,126	$ 33,313	$ 122
Lucas	$ 942,435	$ 1,087,806	$ 9,512	Lorain	$ 690,103	$ 263,061	$ 10,313	Holmes	$ 338,004	$ 18,393	$ 9,141
Marion	$ 458,726	$ 176,564	$ 8,512	Madison	$ 329,165	$ 110,795	$ 1,138	Jackson	$ 167,937	$ 25,801	$ 252
Mercer	$ 652,885	$ 540,474	$ 552	Medina	$ 616,737	$ 344,250	$ 8,701	Jefferson	$ 129,377	$ 132,450	$ 200
Miami	$ 740,658	$ 313,076	$ 71	Montgomery	$ 2,589,340	$ 361,156	$ 2	Lawrence	$ 265,076	$ 40,533	$ 227
Ottawa	$ 643,186	$ 143,544	$ 22,032	Morrow	$ 226,127	$ 61,103	$ 4,575	Mahoning	$ 373,049	$ 294,261	$ 2,512
Paulding	$ 344,887	$ 198,901	$ 21,468	Pickaway	$ 392,494	$ 62,203	$ 101	Meigs	$ 94,205	$ 20,485	$ 446
Preble	$ 407,549	$ 543,588	$ 119	Portage	$ 329,910	$ 60,549	$ 1,391	Monroe	$ 64,109	$ 32,204	$ 107
Putnam	$ 353,928	$ 248,238	$ 22,719	Richland	$ 503,358	$ 37,742	$ 7,502	Morgan	$ 47,221	$ 13,344	$ 226
Sandusky	$ 686,954	$ 111,456	$ 34,496	Stark	$ 367,726	$ 186,631	$ 4,211	Muskingum	$ 111,216	$ 132,862	$ 1,136
Seneca	$ 445,590	$ 25,023	$ 28,467	Summit	$ 902,078	$ 327,479	$ 456	Noble	$ 83,799	$ 35,573	$ 91
Shelby	$ 533,696	$ 114,653	$ 125	Union	$ 515,980	$ 23,979	$ 8,649	Perry	$ 113,785	$ 40,865	$ 807
Van Wert	$ 209,851	$ 411,033	$ 174	Warren	$ 1,181,475	$ 81,779	$ 26	Pike	$ 232,223	$ 57,550	$ 1,728
Williams	$ 272,618	$ 903,686	$ 18,472	Wayne	$ 326,026	$ 161,527	$ 16,491	Ross	$ 388,210	$ 121,405	$ 607
Wood	$ 1,401,314	$ 69,569	$ 24,782	Total	$ 23,665,793	$ 6,753,214	$ 98,450	Scioto	$ 322,250	$ 132,271	$ 549
Wyandot	$ 214,811	$ 50,605	$ 37,936					Trumbull	$ 363,942	$ 405,928	$ 1,989
Total	$ 14,419,400	$ 7,406,297	$ 404,170					Tuscarawas	$ 131,785	$ 73,093	$ 2,789
								Vinton	$ 46,880	$ 14,719	$ 132
								Washington	$ 169,377	$ 73,766	$ 489
								Total	$ 7,014,647	$ 2,877,856	$ 40,764

Statewide			
County	EAL (Buildings)	EAL (Pop Equiv.)	EAL (Agriculture)
All 88	$ 45,099,841	$ 17,037,367	$ 543,385

STATE-OWNED AND STATE-LEASED CRITICAL FACILITIES VULNERABILITY ANALYSIS & LOSS ESTIMATION

METHDOLOGY

The Vulnerability Analysis and Loss Estimation methodology above utilized FEMA's National Risk Index to estimate values including exposures and expected annual losses. To estimate the Expected Annual Losses (EAL) for state-owned and state-leased critical facilities, an *NRI Building EAL to Exposure* ratio was determined by taking each county's expected annual losses (for buildings) and dividing it by that county's total building exposure value. This ratio was then multiplied by the total replacement costs for critical facilities in each county to estimate the expected annual loss for state-owned and State-leased critical facilities.

RESULTS

The 3,678 state-owned and state-leased critical facilities are estimated to experience about the same amount of damage annually from hail and strong winds. They're expected to experience $180,210 from hail, $178,266 from strong winds, and $5,339 annually from lightning.

In Region 1, the 852 state-owned and state-leased critical facilities are estimated to experience:

- $20,146 in damages from hail
- $1,254 in damages from lightning
- $35,750 in damages from strong (high and thunderstorm) winds

In Region 2, the 1,684 state-owned and state-leased critical facilities are estimated to experience:

- $134,270 in damages from hail
- $2,245 in damages from lightning
- $100,951 in damages from strong (high and thunderstorm) winds

In Region 3, the 1,232 state-owned and state-leased critical facilities are estimated to experience:

- $25,795 in damages from hail
- $1,840 in damages from lightning
- $41,564 in damages from strong (high and thunderstorm) winds

Table 2.12.h — Hail

Expected Annual Loss of State-owned and State-leased Critical Facilities by Region
Hail

Region 1

County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL of CF
Allen	99	0.0049%	$ 148,535,104	$ 7,311
Auglaize	18	0.0001%	$ 6,542,813	$ 4
Champaign	21	0.0002%	$ 9,246,093	$ 21
Clark	27	0.0000%	$ 9,650,921	$ 3
Crawford	12	0.0009%	$ 11,520,704	$ 106
Darke	27	0.0001%	$ 17,992,950	$ 16
Defiance	15	0.0062%	$ 12,622,416	$ 788
Erie	55	0.0013%	$ 150,149,608	$ 1,887
Fulton	12	0.0044%	$ 9,821,964	$ 433
Hancock	20	0.0097%	$ 12,221,847	$ 1,181
Hardin	18	0.0001%	$ 6,825,758	$ 4
Henry	16	0.0062%	$ 4,250,244	$ 261
Huron	22	0.0002%	$ 10,837,347	$ 26
Logan	21	0.0001%	$ 9,389,923	$ 13
Lucas	52	0.0002%	$ 274,497,738	$ 568
Marion	59	0.0016%	$ 237,054,145	$ 3,711
Mercer	27	0.0001%	$ 9,141,077	$ 5
Miami	30	0.0000%	$ 20,994,660	$ 5
Ottawa	52	0.0015%	$ 42,237,937	$ 648
Paulding	11	0.0062%	$ 8,375,637	$ 522
Preble	28	0.0000%	$ 7,555,862	$ 0
Putnam	19	0.0062%	$ 4,857,269	$ 299
Sandusky	14	0.0019%	$ 8,633,501	$ 161
Seneca	47	0.0007%	$ 47,263,740	$ 340
Shelby	35	0.0001%	$ 32,329,713	$ 21
Van Wert	16	0.0048%	$ 7,772,807	$ 376
Williams	17	0.0000%	$ 7,837,080	$ 0
Wood	40	0.0015%	$ 68,292,566	$ 997
Wyandot	22	0.0065%	$ 6,729,705	$ 436
Total	**852**	**0.0016%**	**$ 1,203,181,127**	**$ 20,146**

Region 2

County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL CF
Ashland	145	0.0005%	$ 103,491,091	$ 513
Butler	29	0.0000%	$ 17,200,278	$ 2
Clinton	31	0.0008%	$ 13,450,515	$ 104
Cuyahoga	106	0.0000%	$ 389,621,908	$ 121
Delaware	33	0.0076%	$ 61,002,573	$ 4,607
Fairfield	67	0.0000%	$ 94,557,543	$ 34
Fayette	23	0.0009%	$ 11,052,410	$ 95
Franklin	190	0.0029%	$ 2,336,963,045	$ 67,304
Geauga	27	0.0005%	$ 12,064,728	$ 61
Greene	21	0.0001%	$ 17,560,307	$ 9
Hamilton	41	0.0003%	$ 113,316,790	$ 332
Knox	41	0.0005%	$ 76,691,482	$ 389
Lake	21	0.0002%	$ 12,988,101	$ 29
Licking	67	0.0064%	$ 186,741,453	$ 11,951
Lorain	83	0.0001%	$ 212,390,581	$ 313
Madison	104	0.0002%	$ 398,511,572	$ 616
Medina	17	0.0002%	$ 16,239,797	$ 33
Montgomery	72	0.0080%	$ 187,896,794	$ 14,963
Morrow	19	0.0010%	$ 12,996,574	$ 134
Pickaway	137	0.0002%	$ 346,622,641	$ 669
Portage	25	0.0033%	$ 17,793,583	$ 588
Richland	77	0.0002%	$ 236,998,425	$ 392
Stark	57	0.0090%	$ 148,641,582	$ 13,313
Summit	65	0.0068%	$ 197,956,468	$ 13,380
Union	55	0.0001%	$ 169,438,472	$ 111
Warren	109	0.0013%	$ 323,719,448	$ 4,106
Wayne	22	0.0008%	$ 12,202,802	$ 102
Total	**1,684**	**0.0012%**	**$ 5,728,110,964**	**$ 134,270**

Region 3

County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL CF
Adams	30	0.0036%	$ 12,672,306	$ 456
Ashtabula	72	0.0003%	$ 25,195,275	$ 69
Athens	35	0.0007%	$ 53,251,615	$ 362
Belmont	70	0.0059%	$ 153,564,291	$ 9,112
Brown	31	0.0001%	$ 35,387,446	$ 37
Carroll	18	0.0000%	$ 5,220,360	$ 0
Clermont	51	0.0006%	$ 32,967,768	$ 203
Columbiana	36	0.0052%	$ 14,981,756	$ 776
Coshocton	21	0.0048%	$ 16,813,037	$ 801
Gallia	61	0.0049%	$ 49,786,218	$ 2,415
Guernsey	50	0.0060%	$ 58,733,741	$ 3,526
Harrison	24	0.0046%	$ 9,202,403	$ 425
Highland	11	0.0003%	$ 6,701,555	$ 18
Hocking	27	0.0002%	$ 7,590,231	$ 16
Holmes	29	0.0010%	$ 9,188,433	$ 91
Jackson	21	0.0014%	$ 10,211,085	$ 146
Jefferson	34	0.0044%	$ 14,685,898	$ 643
Lawrence	26	0.0014%	$ 9,167,439	$ 125
Mahoning	58	0.0001%	$ 109,678,167	$ 160
Meigs	24	0.0007%	$ 9,369,001	$ 63
Monroe	12	0.0049%	$ 3,933,796	$ 193
Morgan	15	0.0000%	$ 7,945,305	$ 1
Muskingum	36	0.0060%	$ 14,169,870	$ 846
Noble	32	0.0052%	$ 65,273,141	$ 3,373
Perry	9	0.0002%	$ 7,167,121	$ 14
Pike	12	0.0002%	$ 8,643,712	$ 14
Ross	129	0.0001%	$ 510,798,521	$ 688
Scioto	66	0.0001%	$ 478,434,987	$ 303
Trumbull	69	0.0003%	$ 97,032,569	$ 322
Tuscarawas	54	0.0000%	$ 50,576,265	$ 4
Vinton	19	0.0040%	$ 14,102,427	$ 569
Washington	50	0.0001%	$ 36,699,000	$ 27
Total	**1,232**	**0.0017%**	**$ 1,939,144,738**	**$ 25,795**

Table 2.12.i — Lightning

Expected Annual Loss of State-owned and State-leased Critical Facilities by Region
Lightning

Region 1					Region 2					Region 3				
County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL of Critical Facilities	County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL of Critical Facilities	County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL of Critical Facilities
Allen	99	0.0001%	$ 148,535,104	$ 114	Ashland	145	0.0001%	$ 103,491,091	$ 73	Adams	30	0.0001%	$ 12,672,306	$ 11
Auglaize	18	0.0001%	$ 6,542,813	$ 7	Butler	29	0.0001%	$ 17,200,278	$ 25	Ashtabula	72	0.0001%	$ 25,195,275	$ 17
Champaign	21	0.0001%	$ 9,246,093	$ 7	Clinton	31	0.0001%	$ 13,450,515	$ 16	Athens	35	0.0001%	$ 53,251,615	$ 29
Clark	27	0.0001%	$ 9,650,921	$ 8	Cuyahoga	106	0.0000%	$ 389,621,908	$ 36	Belmont	70	0.0003%	$ 153,564,291	$ 477
Crawford	12	0.0001%	$ 11,520,704	$ 8	Delaware	33	0.0001%	$ 61,002,573	$ 59	Brown	31	0.0001%	$ 35,387,446	$ 32
Darke	27	0.0000%	$ 17,992,950	$ 3	Fairfield	67	0.0001%	$ 94,557,543	$ 80	Carroll	18	0.0000%	$ 5,220,360	$ 2
Defiance	15	0.0002%	$ 12,622,416	$ 25	Fayette	23	0.0001%	$ 11,052,410	$ 9	Clermont	51	0.0000%	$ 32,967,768	$ 7
Erie	55	0.0003%	$ 150,149,608	$ 447	Franklin	190	0.0000%	$ 2,336,963,045	$ 20	Columbiana	36	0.0000%	$ 14,981,756	$ 1
Fulton	12	0.0000%	$ 9,821,964	$ 5	Geauga	27	0.0001%	$ 12,064,728	$ 9	Coshocton	21	0.0000%	$ 16,813,037	$ 1
Hancock	20	0.0003%	$ 12,221,847	$ 40	Greene	21	0.0001%	$ 17,560,307	$ 14	Gallia	61	0.0001%	$ 49,786,218	$ 40
Hardin	18	0.0001%	$ 6,825,758	$ 4	Hamilton	41	0.0000%	$ 113,316,790	$ 43	Guernsey	50	0.0001%	$ 58,733,741	$ 39
Henry	16	0.0002%	$ 4,250,244	$ 8	Knox	41	0.0001%	$ 76,691,482	$ 72	Harrison	24	0.0001%	$ 9,202,403	$ 5
Huron	22	0.0001%	$ 10,837,347	$ 11	Lake	21	0.0000%	$ 12,988,101	$ 2	Highland	11	0.0000%	$ 6,701,555	$ 3
Logan	21	0.0001%	$ 9,389,923	$ 6	Licking	67	0.0000%	$ 186,741,453	$ 27	Hocking	27	0.0001%	$ 7,590,231	$ 6
Lucas	52	0.0000%	$ 274,497,738	$ 50	Lorain	83	0.0002%	$ 212,390,581	$ 375	Holmes	29	0.0000%	$ 9,188,433	$ 1
Marion	59	0.0001%	$ 237,054,145	$ 173	Madison	104	0.0001%	$ 398,511,572	$ 370	Jackson	21	0.0001%	$ 10,211,085	$ 9
Mercer	27	0.0002%	$ 9,141,077	$ 18	Medina	17	0.0000%	$ 16,239,797	$ 5	Jefferson	34	0.0000%	$ 14,685,898	$ 7
Miami	30	0.0000%	$ 20,994,660	$ 3	Montgomery	72	0.0000%	$ 187,896,794	$ 18	Lawrence	26	0.0000%	$ 9,167,439	$ 3
Ottawa	52	0.0001%	$ 42,237,937	$ 39	Morrow	19	0.0001%	$ 12,996,574	$ 8	Mahoning	58	0.0000%	$ 109,678,167	$ 8
Paulding	11	0.0002%	$ 8,375,637	$ 16	Pickaway	137	0.0001%	$ 346,622,641	$ 214	Meigs	24	0.0001%	$ 9,369,001	$ 5
Preble	28	0.0002%	$ 7,555,862	$ 14	Portage	25	0.0001%	$ 17,793,583	$ 10	Monroe	12	0.0003%	$ 3,933,796	$ 13
Putnam	19	0.0002%	$ 4,857,269	$ 10	Richland	77	0.0000%	$ 236,998,425	$ 29	Morgan	15	0.0001%	$ 7,945,305	$ 5
Sandusky	14	0.0000%	$ 8,633,501	$ 0	Stark	57	0.0001%	$ 148,641,582	$ 158	Muskingum	36	0.0001%	$ 14,169,870	$ 10
Seneca	47	0.0001%	$ 47,263,740	$ 34	Summit	65	0.0000%	$ 197,956,468	$ 39	Noble	32	0.0003%	$ 65,273,141	$ 209
Shelby	35	0.0001%	$ 32,329,713	$ 42	Union	55	0.0001%	$ 169,438,472	$ 118	Perry	9	0.0001%	$ 7,167,121	$ 5
Van Wert	16	0.0001%	$ 7,772,807	$ 9	Warren	109	0.0001%	$ 323,719,448	$ 381	Pike	12	0.0001%	$ 8,643,712	$ 5
Williams	17	0.0002%	$ 7,837,080	$ 14	Wayne	22	0.0003%	$ 12,202,802	$ 35	Ross	129	0.0001%	$ 510,798,521	$ 367
Wood	40	0.0002%	$ 68,292,566	$ 115	**Total**	**1,684**	**0.0001%**	**$ 5,728,110,964**	**$ 2,245**	Scioto	66	0.0001%	$ 478,434,987	$ 414
Wyandot	22	0.0004%	$ 6,729,705	$ 25						Trumbull	69	0.0000%	$ 97,032,569	$ 32
Total	**852**	**0.0001%**	**$ 1,203,181,127**	**$ 1,254**						Tuscarawas	54	0.0000%	$ 50,576,265	$ 25
										Vinton	19	0.0001%	$ 14,102,427	$ 11
										Washington	50	0.0001%	$ 36,699,000	$ 43
										Total	**1,232**	**0.0001%**	**$ 1,939,144,738**	**$ 1,840**

Table 2.12.j — Strong (High and Thunderstorm) Winds

Expected Annual Loss of State-owned and State-leased Critical Facilities by Region
Strong Winds

Region 1					Region 2					Region 3				
County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL of Critical Facilities	County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL of Critical Facilities	County	# of CF	NRI Building EAL:EXP Ratio	Replacement Cost of Critical Facilities	EAL of Critical Facilities
Allen	99	0.0026%	$ 148,535,104	$ 3,828	Ashland	145	0.0027%	$ 103,491,091	$ 2,793	Adams	30	0.0053%	$ 12,672,306	$ 669
Auglaize	18	0.0044%	$ 6,542,813	$ 291	Butler	29	0.0029%	$ 17,200,278	$ 503	Ashtabula	72	0.0008%	$ 25,195,275	$ 190
Champaign	21	0.0041%	$ 9,246,093	$ 379	Clinton	31	0.0038%	$ 13,450,515	$ 512	Athens	35	0.0018%	$ 53,251,615	$ 983
Clark	27	0.0032%	$ 9,650,921	$ 308	Cuyahoga	106	0.0006%	$ 389,621,908	$ 2,307	Belmont	70	0.0005%	$ 153,564,291	$ 759
Crawford	12	0.0031%	$ 11,520,704	$ 361	Delaware	33	0.0023%	$ 61,002,573	$ 1,379	Brown	31	0.0050%	$ 35,387,446	$ 1,752
Darke	27	0.0044%	$ 17,992,950	$ 789	Fairfield	67	0.0021%	$ 94,557,543	$ 1,993	Carroll	18	0.0013%	$ 5,220,360	$ 67
Defiance	15	0.0023%	$ 12,622,416	$ 287	Fayette	23	0.0038%	$ 11,052,410	$ 419	Clermont	51	0.0031%	$ 32,967,768	$ 1,014
Erie	55	0.0030%	$ 150,149,608	$ 4,453	Franklin	190	0.0011%	$ 2,336,963,045	$ 26,541	Columbiana	36	0.0009%	$ 14,981,756	$ 131
Fulton	12	0.0041%	$ 9,821,964	$ 407	Geauga	27	0.0009%	$ 12,064,728	$ 112	Coshocton	21	0.0012%	$ 16,813,037	$ 204
Hancock	20	0.0046%	$ 12,221,847	$ 564	Greene	21	0.0031%	$ 17,560,307	$ 541	Gallia	61	0.0019%	$ 49,786,218	$ 923
Hardin	18	0.0040%	$ 6,825,758	$ 274	Hamilton	41	0.0018%	$ 113,316,790	$ 2,051	Guernsey	50	0.0014%	$ 58,733,741	$ 847
Henry	16	0.0021%	$ 4,250,244	$ 88	Knox	41	0.0025%	$ 76,691,482	$ 1,884	Harrison	24	0.0012%	$ 9,202,403	$ 113
Huron	22	0.0027%	$ 10,837,347	$ 298	Lake	21	0.0006%	$ 12,988,101	$ 84	Highland	11	0.0041%	$ 6,701,555	$ 275
Logan	21	0.0042%	$ 9,389,923	$ 391	Licking	67	0.0022%	$ 186,741,453	$ 4,061	Hocking	27	0.0023%	$ 7,590,231	$ 178
Lucas	52	0.0011%	$ 274,497,738	$ 3,077	Lorain	83	0.0011%	$ 212,390,581	$ 2,311	Holmes	29	0.0028%	$ 9,188,433	$ 260
Marion	59	0.0036%	$ 237,054,145	$ 8,618	Madison	104	0.0038%	$ 398,511,572	$ 15,296	Jackson	21	0.0024%	$ 10,211,085	$ 246
Mercer	27	0.0048%	$ 9,141,077	$ 443	Medina	17	0.0016%	$ 16,239,797	$ 257	Jefferson	34	0.0008%	$ 14,685,898	$ 121
Miami	30	0.0031%	$ 20,994,660	$ 647	Montgomery	72	0.0026%	$ 187,896,794	$ 4,892	Lawrence	26	0.0027%	$ 9,167,439	$ 247
Ottawa	52	0.0046%	$ 42,237,937	$ 1,958	Morrow	19	0.0034%	$ 12,996,574	$ 436	Mahoning	58	0.0008%	$ 109,678,167	$ 847
Paulding	11	0.0066%	$ 8,375,637	$ 554	Pickaway	137	0.0032%	$ 346,622,641	$ 10,972	Meigs	24	0.0020%	$ 9,369,001	$ 187
Preble	28	0.0049%	$ 7,555,862	$ 368	Portage	25	0.0010%	$ 17,793,583	$ 180	Monroe	12	0.0015%	$ 3,933,796	$ 59
Putnam	19	0.0053%	$ 4,857,269	$ 258	Richland	77	0.0021%	$ 236,998,425	$ 4,930	Morgan	15	0.0017%	$ 7,945,305	$ 137
Sandusky	14	0.0050%	$ 8,633,501	$ 428	Stark	57	0.0005%	$ 148,641,582	$ 718	Muskingum	36	0.0006%	$ 14,169,870	$ 87
Seneca	47	0.0039%	$ 47,263,740	$ 1,859	Summit	65	0.0008%	$ 197,956,468	$ 1,646	Noble	32	0.0020%	$ 65,273,141	$ 1,328
Shelby	35	0.0038%	$ 32,329,713	$ 1,223	Union	55	0.0037%	$ 169,438,472	$ 6,253	Perry	9	0.0020%	$ 7,167,121	$ 145
Van Wert	16	0.0037%	$ 7,772,807	$ 290	Warren	109	0.0024%	$ 323,719,448	$ 7,714	Pike	12	0.0035%	$ 8,643,712	$ 305
Williams	17	0.0030%	$ 7,837,080	$ 233	Wayne	22	0.0014%	$ 12,202,802	$ 165	Ross	129	0.0028%	$ 510,798,521	$ 14,478
Wood	40	0.0041%	$ 68,292,566	$ 2,784	**Total**	**1,684**	**0.0032%**	**$ 5,728,110,964**	**$ 100,951**	Scioto	66	0.0027%	$ 478,434,987	$ 12,998
Wyandot	22	0.0044%	$ 6,729,705	$ 293						Trumbull	69	0.0009%	$ 97,032,569	$ 840
Total	**852**	**0.0033%**	**$ 1,203,181,127**	**$ 35,750**						Tuscarawas	54	0.0007%	$ 50,576,265	$ 345
										Vinton	19	0.0021%	$ 14,102,427	$ 293
										Washington	50	0.0015%	$ 36,699,000	$ 536
										Total	**1,232**	**0.0017%**	**$ 1,939,144,738**	**$ 41,564**