4.10 Severe Summer Weather

Description

Severe summer weather events may include severe thunderstorms and thunderstorm winds, hail, and lightning. High winds, tornadoes, and flooding may also be related to severe summer storms, and due to the potential threat of these events, they are each discussed in separate risk assessments. While tropical storms and hurricanes are also forms of severe storms, Clinton County does not have any record of such events affecting the County; therefore, the County has not deemed tropical storms and hurricanes to be a threat, and these specific types of weather will not be addressed further.

According to the National Weather Service (NWS), a severe thunderstorm is a thunderstorm that produces a tornado, has winds of at least 58 mph, and/or hail at least one inch in diameter. A Severe Thunderstorm Watch is issued by the NWS if conditions are favorable for the development of severe thunderstorms. A watch is usually in place for four to eight hours, during which time people should be prepared to move to a safe place if threatening weather approaches.

A Severe Thunderstorm Warning is issued if either the WSR-88D radar indicates a severe thunderstorm or if a spotter reports a storm producing hail or winds meeting the criteria outlined in the description above. The WSR-88D radar is an advanced Weather Surveillance Doppler Radar utilized by the NWS to generate a radar image. The NWS recommends that people in the affected area seek safe shelter immediately, as severe thunderstorms have the potential to produce tornadoes with little-to-no advance warning. Lightning frequency is not a criterion for issuing a severe thunderstorm warning. The warnings are usually issued for one hour and can be issued without a Severe Thunderstorm Watch already in effect. The National Weather Service Forecast Office in Cleveland, Ohio, is responsible for issuing Severe Thunderstorm Watches and Warnings for Clinton County.

Lightning is caused by a rapid discharge of electrical energy that has built up in the atmosphere between clouds, the air, or the ground. Lightning strikes can be either direct or indirect. A direct strike is when lightning strikes a building or a specific zone, which can result in fusion points melting holes of varying sizes at the point of impact of materials with high resistivity. An indirect lightning strike is when lightning causes power surges that disrupt electrical equipment.

Severe summer weather can also create strong winds – often called “straight-line” winds – to differentiate thunderstorm winds from tornadic winds. These winds, which have the potential to cause damage, are caused by an outflow generated by a thunderstorm downdraft.

Hail is a type of frozen precipitation that occurs when thunderstorm updrafts carry raindrops upward into extremely cold atmospheric zones where they freeze before falling to the ground. The resulting hailstones can fall at speeds greater than 100 mph and range in size from smaller than 0.50 inches (the size of a pea) to 4.5 inches (the size of a softball) (Source: National Weather Service).

The NWS can issue various types of wind advisories and warnings. A **Wind Advisory** is issued when sustained winds of 31 to 39 mph are reached for an hour or more and/or if there are wind gusts of 46 to 57 mph for any duration. A **High Wind Watch** indicates that sustained, strong winds are possible, and outdoor items should be secured. People should modify plans, so they are not caught outside. Additionally, a **High Wind Warning** indicates that sustained, strong winds (40 mph or greater) with even stronger gusts (greater than 58 mph) are happening. People should seek shelter, and those driving should keep both hands on the wheel and slow down. An **Extreme Wind Warning** is issued for surface winds of 115 mph or greater associated with non-convective, downslope, derecho (not associated with a tornado), or sustained hurricane winds that are expected to occur within one hour.

Location

Severe summer weather is a countywide hazard, and all of Clinton County is susceptible to severe summer weather.

Extent

Severe summer weather events have the potential to create large-scale damage in Clinton County. Specifically, lightning is responsible for approximately 20 deaths annually across the United States, as well as hundreds of injuries (Source: NOAA). Winds associated with severe summer storms have the potential to cause damage by bringing down tree limbs and generating widespread power outages. Additionally, hail can result in property damage. Severe summer storms can lead to flooding, downed trees and power lines, and other dangerous conditions.

History

According to the National Centers for Environmental Information (NCEI), there have been 269 high-, strong-, or thunderstorm-wind events, 100 hail events, three heavy rain events, and two lightning events recorded in Clinton County between January 1995 and December 2023. These events resulted in $8,255,100 in property damage and $20,000 in crop damage. No deaths or injuries caused by summer storm events were reported in Clinton County since 1995. All severe storm events from 1995 to 2023 are summarized in **Table 4.10.1**, below:

Table 4.10.1: Thunderstorm-Related Events in Clinton County since 1995

Severe Storm Event Type	Number of Events	Injuries	Deaths	Property Damage	Crop Damages
Hail	100	0	0	$271,000	$0
Heat	0	0	0	$0	$0
Heavy Rain	3	0	0	$0	$0
High Wind	17	0	0	$5,144,000	$0
Lightning	2	0	0	$150,000	$0
Strong Wind	1	0	0	$8,000	$0
Thunderstorm Wind	251	0	0	$2,682,100	$20,000
Grand Total	**374**	**0**	**0**	**$8,255,100**	**$20,000**

Source: NOAA Storm Events Database

Clinton County has not had a disaster declaration for severe storms since the previous hazard mitigation plan in 2020. However, since January 1995, the County has been subject to two Major Disaster Declarations for severe storms and flooding and damage from the remnants of Hurricane Ike and one emergency declaration (EM) for severe storms. Several of the most damaging events, events with emergency or disaster declarations, and events that resulted in deaths and/or injuries are described in more detail below.

Thunderstorm Wind Event, March 14, 2019:

Thunderstorms, strong winds, and hail in March 2019 caused numerous downed powerlines and trees across Clinton County, damage to barns across the County, and downed trees on State Routh 730 between Blanchester and Wilmington. Wind gusts over 50 mph damaged the National Weather Service Building in Wilmington. Hail from 1 to 1.5 inches damaged the siding and roofs of several houses, broke a few windows, and caused damage to vehicles. Property damages reported for Clinton County totaled $215,000. No deaths or injuries were reported.

Thunderstorm Wind Event, June 26, 2015:

On June 26, 2015, a low-pressure system moved through the area from the west developing severe thunderstorms that downed trees and tree limbs on State Route 350 near Farmers Road, Bernard

Road in New Vienna, and on Leslie Drive in Burtonville. Several trailers sustained structural damage, and a wall was ripped from a home in New Vienna. Reported property damage reached $65,000 in Clinton County. No deaths were reported.

Emergency Declaration for Severe Storms, June 29, 2012 - July 2, 2012:

At the end of June 2012, a heatwave gripped much of the Mid-Atlantic, helping to fuel severe weather. A line of powerful thunderstorms brought derecho winds with gusts estimated to reach 80 mph causing extensive damage to the Ohio Valley and Mid-Atlantic states on the afternoon of June 29. Around four million residents lost power for almost a week and were at risk of heat-related illness or death across several states as the winds knocked down and uprooted trees, snapped power lines, and produced large hail in some areas. Ohio was one of the hardest hit states. In Clinton County property damage totaled $11,000, mostly from downed trees and powerlines due to thunderstorm wind gusts. New Vienna lost power due to multiple downed lines. The Wilmington Weather Forecast Office clocked winds over 50 mph. No injuries or deaths were reported.

Major Disaster Declaration for Severe Storms and Flooding, April 4, 2011 - May 15, 2011:

In the spring of 2011, widespread severe weather including heavy rainfall and thunderstorms resulted from an unstable airmass and warm front colliding over the region. Severe thunderstorm winds damaged two hangars at the Wilmington Air Park by ripping their roofs off and several area barns were damaged near New Antioch. Other parts of the County saw structural damage to barns and buildings. Property damage reported for Clinton County was $71,000. No injuries or deaths were reported from this event.

Thunderstorm Wind Event, October 26, 2010:

Severe storms, wind gusts, and tornadoes developed along a very cold front on October 26, 2010, that resulted in severe thunderstorm winds causing multiple downed trees and damage to several barns in Pansy, Sabina, and Wilmington. The roof of a house was torn off near Pansy and a chicken coop ended up 35 yards away due to winds around 65 miles per hour (MPH). Property damages totaled $105,000 for this event in Clinton County. No injuries were reported.

Major Disaster Declaration for Severe Storm Associated with Tropical Depression Ike, September 14, 2008:

The remnants of Hurricane Ike swept across the Midwest on September 14, 2008, causing widespread damage across Ohio from strong winds upwards of 40-50 mph, and wind gusts of 77 mph recorded north of Wilmington. Widespread power outages, downed trees and powerlines, roof and structural damage to homes and buildings, as well as crop losses were reported. The total property damage reported for Clinton County reached $5,100,000. No injuries or deaths were reported for this event.

Major Disaster Declaration for Severe Storms and Flooding, August 27, 2004 - September 27, 2004:

In late summer 2004, severe thunderstorms collided with the remnants of Hurricanes Frances and Ivan causing severe storms, high winds, and flooding across Ohio. No property or crop damage was reported in Clinton County. Likewise, no deaths or injuries were reported related to this event.

Thunderstorm Wind Event, April 9, 2002:

On April 9, 2002, several homes sustained wind and/or hail (0.75 – 1 inch) damage near the intersection of Farmers Road. and State Route 350, and a house had its roof taken off in New Vienna. In total, the event resulted in $137,000 of property damage, and no injuries or deaths were reported in Clinton County.

Thunderstorm Wind Event, April 9, 1999:

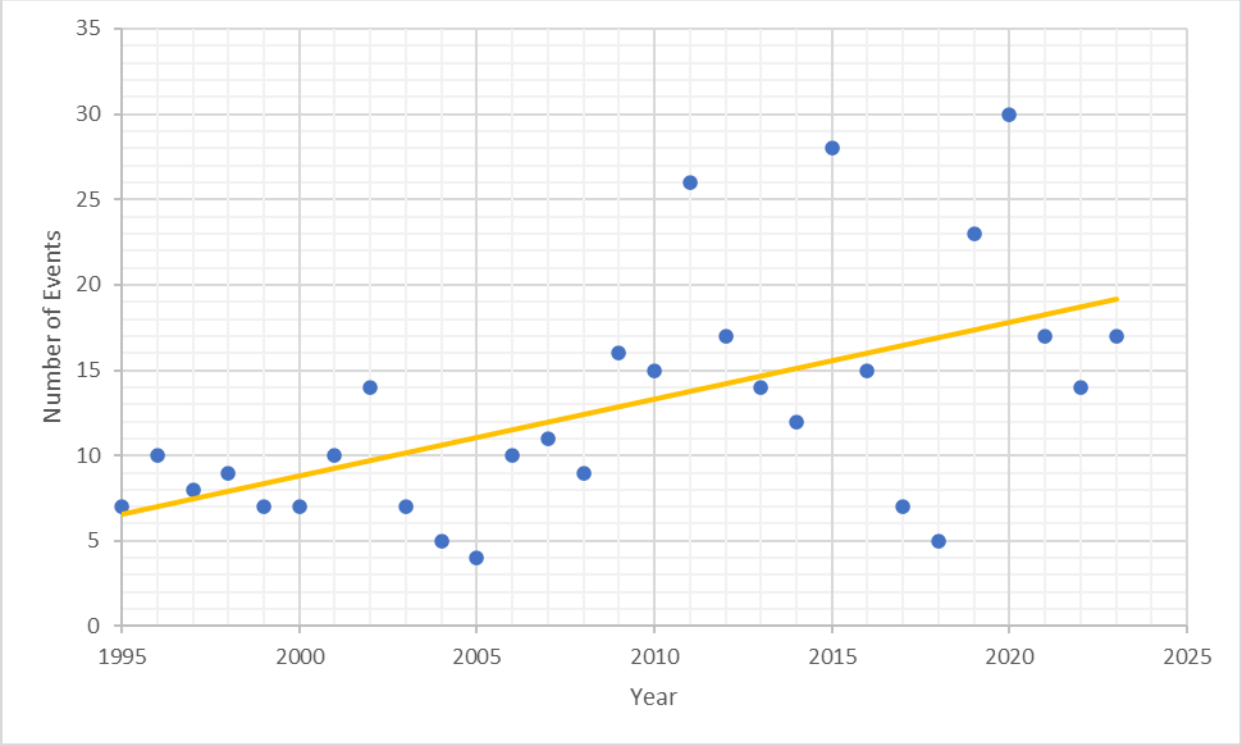
A line of severe thunderstorms moved through southern Ohio on April 9, 1999, producing tornadoes in southwest Clinton County and thunderstorm winds throughout. Multiple trees and powerlines were

damaged or downed by thunderstorm winds. Near Clarksville more than 20 structures were damaged, and three homes and a business were destroyed. There was a total of $1,000,000 in property damage reported for Clinton County. No injuries or deaths were reported.

Probability

According to the NCEI, there have been 374 severe summer storm events reported in Clinton County from January 1995 to December 2023 with total losses reaching $8,255,100 in property damage and $20,000 in crop damage. This amounts to around 12.9 severe summer storm events annually with an average annual total damage of approximately $285,356. **Figure 4.10.2** below shows the trend in number of severe summer weather events per year since 1995. The trendline (shown in yellow) indicates an increase in the number of summer storm events; however, the trendline may be skewed due to the spike in events in 2001 (26), 2015 (28), and 2020 (30).

Figure 4.10.2: Severe Summer Storm Probability



Source: NOAA

Vulnerability Assessment

Infrastructure Impact

Above-ground infrastructure is at risk for storm damage by wind and falling debris. For infrastructure, high winds and hail are the most damaging part of a severe storm. Thunderstorm winds can strip bark from trees and detach limbs. If large branches fall, they can damage buildings and above-ground infrastructure. In the most severe storms with high winds, large trees can be uprooted and have the potential to fall on buildings including houses, which can cause harm or death.

Utilities are at risk of damage by severe summer storms as well. Electrical lines are spread throughout the County connecting homes, businesses, and other facilities. Severe storms are likely to down tree limbs and generate other debris that can affect above-ground electrical lines causing power outages. Downed power lines that are still live are extremely hazardous and can cause death by electrocution.

Population Impact

Summer storms are random in nature and affect the entire area of the County. Everyone within the County should be prepared during a storm event. Populations residing in mobile home parks are particularly vulnerable and should seek shelter.

According to FEMA's National Risk Index, Clinton County was scored a 38.24 ("very low") risk from the negative impacts of natural hazards, based on a relatively moderate social vulnerability, very low expected annual loss, and very high community resilience, compared to all other counties in the U.S. The risk for individual hazard events associated with severe summer weather are as follows: 49.7 ("relatively low") for hail, 63.5 ("relatively low") for lightning, and 61.2 ("relatively moderate") for strong wind. The index also calculates an expected annual loss of $97,897 due to hail events, $141,783 due to lightning events, and $479,320 due to strong wind events, with 3.7, 76.5, and 2.2 events occurring per year, respectively.

Property Damage

As described above, severe summer weather events have caused an average of $8,255,100 in average annual property damage from 1995 to 2023. Due to the non-site-specific nature of this hazard, **Tables 4.10.3 - 4.10.5** list all structures within Clinton County as having potential impacts from severe storms.

Loss of Life

There were no deaths or injuries in Clinton County between January 1995 to December 2023 as a result of severe summer weather. All of Ohio has the potential for injuries and fatalities during severe summer weather.

Economic Losses

Severe summer weather has the potential to damage infrastructure, resulting in the economic burden of clean up and repairs, as well as the economic loss from deaths and injuries. Expected annual loss (EAL) rates, calculated by FEMA, identify the total value of loss expected each year for a particular community, in this case Clinton County census tracts. Expected losses for buildings, population ($11.6 million for each fatality or 10 injuries), and agriculture per census tract from hail, lightning, and strong wind events are recorded in **Tables 4.10.3 - 4.10.5** below. The tables list the 10 census tracts in Clinton County in order of the highest total EAL (expected annual loss) from severe summer events to the lowest. The EAL Total column combines the buildings, population, and agricultural losses for each census tract.

Table 4.10.3: Structure and Population Vulnerability from Hail

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027964400	$14,426	$238	$3,821	$18,485
39027964700	$14,945	$264	$470	$15,679
39027965100	$9,564	$196	$4,077	$13,837
39027965000	$6,837	$180	$2,679	$9,696
39027964800	$7,339	$224	$1,366	$8,929
39027964900	$7,269	$231	$489	$7,989
39027964300	$5,755	$169	$2,017	$7,941
39027964502	$5,528	$137	$225	$5,890

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027964501	$4,673	$154	$178	$5,005
39027964600	$4,312	$133	$0	$4,445
Grand Total	**$80,650**	**$1,926**	**$15,322**	**$97,896**

Source: FEMA National Risk Index

Table 4.10.4: Structure and Population Vulnerability from Lightning

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027964700	$2,294	$17,858	$0	$20,152
39027964900	$1,191	$16,374	$0	$17,565
39027964400	$2,133	$15,339	$0	$17,472
39027964800	$1,176	$15,557	$0	$16,733
39027965100	$1,487	$13,228	$0	$14,715
39027965000	$1,084	$12,328	$0	$13,412
39027964300	$811	$10,252	$0	$11,063
39027964501	$706	$10,084	$0	$10,790
39027964502	$859	$9,274	$0	$10,133
39027964600	$682	$9,066	$0	$9,748
Grand Total	**$12,423**	**$129,360**	**$0**	**$141,783**

Source: FEMA National Risk Index

Table 4.10.5: Structure and Population Vulnerability from Strong Winds

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027964700	$73,524	$10,897	$136	$84,557
39027964400	$70,606	$9,751	$1,103	$81,460
39027965100	$47,055	$8,072	$1,181	$56,308
39027964800	$35,834	$9,152	$393	$45,379
39027964900	$35,359	$9,429	$140	$44,928
39027965000	$33,623	$7,429	$776	$41,828
39027964300	$28,316	$6,979	$584	$35,879
39027964502	$27,198	$5,642	$65	$32,905
39027964501	$22,992	$6,351	$52	$29,395
39027964600	$21,213	$5,468	$0	$26,681

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
Grand Total	**$395,720**	**$79,170**	**$4,430**	**$479,320**

Source: FEMA National Risk Index

Future Trends

Land Use and Development Trends

Severe summer storms can occur anywhere, bringing an entire community or region to a standstill, including commuter and emergency transportation and medical services. Any development that has occurred since the adoption of the previous plan, and any future development, has the potential to be impacted by severe summer storms. All land uses are equally impacted by severe summer weather.

In 2023, Clinton County authorized 101 new residential units at a total value of $25,454,000. Though there are more buildings slated for construction. Clinton County's population has decreased 80 individuals from 2020 to 2023. The decline is set to continue such that by 2030 the population will lose an additional 1,343 people (3.2 percent). More buildings but less people may potentially mean more property loss but less population vulnerability.

Building design and construction are also impacted by the intensity of summer storms. Areas prone to severe storms should have buildings designed to withstand high winds, heavy rainfall, and potential flooding to avoid structural damage. On the other hand, proper ventilation and cooling systems are essential to manage the heat and humidity that often accompany summer storms.

It is important to maintain consistency between emergency planning, financial plans and budgets, and development planning. Zoning codes should ensure that there is adequate greenspace in existing and new developments to foster drainage and provide space for water runoff. Locating emergency facilities, and partnering with emergency organizations during the planning process, will help develop improved contingency responses in cases where emergency transportation and services are cut off during an extreme weather event.

Shifting Weather Patterns and Environmental Trends

Shifting weather patterns and environmental trends may also increase the number of days with conditions conducive to a severe thunderstorm. Future modeling techniques could reveal additional information about the correlation between atmospheric changes and severe thunderstorm formation and intensity.