4.11 Severe Winter Weather

Description

Severe winter weather includes winter storms, heavy snow, and extreme cold. Winter storms including blizzards are events that have heavy snow, sleet, ice, freezing rain, or high winds as their primary type of precipitation. While the precipitation itself is typically not dangerous, frozen roads and exposure to cold can cause death and injury.

A winter storm forms under the correct combination of three conditions:

1. Below freezing temperatures in the clouds and near the ground, which are necessary to make snow and ice.
2. Lift, which raises the moist air from the clouds and causes precipitation. Warm air colliding with cold air and being forced to rise over the cold is an example of lift.
3. Moisture is needed to form clouds and precipitation. Air blowing across a body of water is a common source of moisture.

Winter storms are categorized by their type: blizzards, ice storms, lake effect storms, and snow squalls. Extreme cold events often accompany winter storms, bringing low temperatures and higher risks of frostbite and hypothermia.

- **Blizzards** are winter storms that are a combination of blowing snow and wind which lead to very low visibility. Heavy snowfalls and severe cold often accompany blizzards, but this is not required. Ground blizzards occur when strong winds pick up snow that has already fallen.
- **Ice Storms** occur when at least a quarter inch of ice accumulates on exposed surfaces. Roads and sidewalks can become dangerously slick, and trees and powerlines can easily break under the weight of accumulated ice.
- **Lake Effect Storms** are cold, dry air masses that move over the Great Lakes regions and drop the moisture as snow in the northeastern portion of Ohio near the Great Lakes area.
- **Snow Squalls** are brief, intense snow showers accompanied by strong winds. Impacts may be significant.
- **Extreme Cold Events** occur when temperatures drop below normal for the given area, and they generally coincide with winter storms or are the lasting effect of a winter storm.

Location

Winter storms are typically large events that impact large areas at once. Winter storms will impact the entire County and have the potential to impact multiple counties.

Extent

The State of Ohio Hazard Mitigation Plan 2024 lists winter storms as one of the three highest threat hazards in Ohio. The average annual snowfall in Clinton County is 12-24 inches according to NOAA, which is less than the state average of about 27 inches. Snowfall typically occurs between November and April with January being the coldest month on average.

History

There have been at least 112 winter storm events, including cold/wind chill, extreme cold/wind chill, frost/freeze, heavy snow, ice storm, winter storm, and winter weather in Clinton County since January 1995. These events caused $525,000 in property damage and $540,000 in crop damage. No deaths or injuries were reported according to The National Centers for Environmental Information (NCEI). All

severe winter weather and extreme cold events from January 1995 to December 2023 are summarized in **Table 4.11.1,** below:

Table 4.11.1: Severe Winter Related Events in Clinton County since 1995

Severe Storm Event Type	Number of Events	Deaths	Injuries	Property Damage	Crop Damage
Cold/Wind Chill	1	0	0	$20,000	$0
Extreme Cold/Wind Chill	2	0	0	$0	$0
Frost/Freeze	1	0	0	$0	$540,000
Heavy Snow	11	0	0	$5,000	$0
Ice Storm	6	0	0	$0	$0
Winter Storm	43	0	0	$500,000	$0
Winter Weather	78	0	0	$0	$0
Total:	**142**	**0**	**0**	**$525,000**	**$540,000**

Source: NOAA Storm Events Database

Clinton County has had no disaster declarations or emergency declarations for severe winter storms since the last hazard mitigation plan was completed in 2020. Before 2020, there was one emergency declaration for winter storm events in 2008 for record/near record snow. There were no injuries or deaths reported between 1995-2023 due to severe winter storm events in Clinton County. Several of the most damaging events and/or events with emergency or disaster declarations are described in more detail below.

Winter Weather Event, November 22, 2014:

Due to a very cold ground, freezing rain developed along the line of rain showers in the wake of a warm front moving through the Ohio Valley on November 22, 2014. While temperature instruments recorded above freezing in most locations, the rain still froze on area roadways generating a slushy layer of ice on road surfaces. Numerous accidents and road closures occurred throughout the County as a result. No reports of property damage, injuries, or deaths were recorded for Clinton County.

Emergency Declaration for Record Snow and Near Record Snow, March 7, 2008 – March 9, 2008:

A low-pressure system along the Gulf Coast blanketed northeast and north-central Ohio with 5 to 20 inches of snow in March 2008, and Wilmington recorded 14 inches of snowfall. Wind gusts of 20-30 MPH led to intermittent blizzard conditions and snow drifts of three feet or more causing numerous accidents. There were no reports from Clinton County of property damage, injuries, or deaths because of this event.

Frost/Freeze Event, April 6, 2007:

Farmers across the Ohio Valley suffered crop losses from an unseasonably sudden drop in temperatures to the low 20s, in April 2007 after an abnormally warm March encouraged them to plant early. The state initially estimated almost 17 million in crop damage across 31 Ohio counties, with Clinton County reporting $540,000 in crop damage from this event. No injuries or deaths were reported.

Ice Storm Event, February 13, 2007:

Snowfall across southern Ohio reached one to five inches before warm temperatures moving in from the south turned snow to freezing rain and sleet. Ice accumulated between 0.5 to 1.0 inches on

structures, trees, and powerlines leading to significant damage from numerous downed trees and powerlines, power outages, and the collapse of a gas station canopy in Wilmington. However, no property damage was reported in Clinton County. Additionally, no injuries or deaths were reported for this event.

Winter Storm Event, March 19, 1996:

The interaction of a warm low pressure and unseasonably cold air from Canada combined with other weather conditions to create an intense winter storm with heavy, wet snow, sleet, and freezing rain across the Ohio Valley on March 19, 1996. Wind gusts of up to 40 MPH created snow drifts and low visibility, mimicking blizzard conditions. The heavy snow and sleet accumulated on highways causing numerous accidents, and on trees and powerlines knocking them down and causing power outages for over 10,000 customers in the Cincinnati area. There were no reports from Clinton County of property damage, injuries or deaths due to this event.

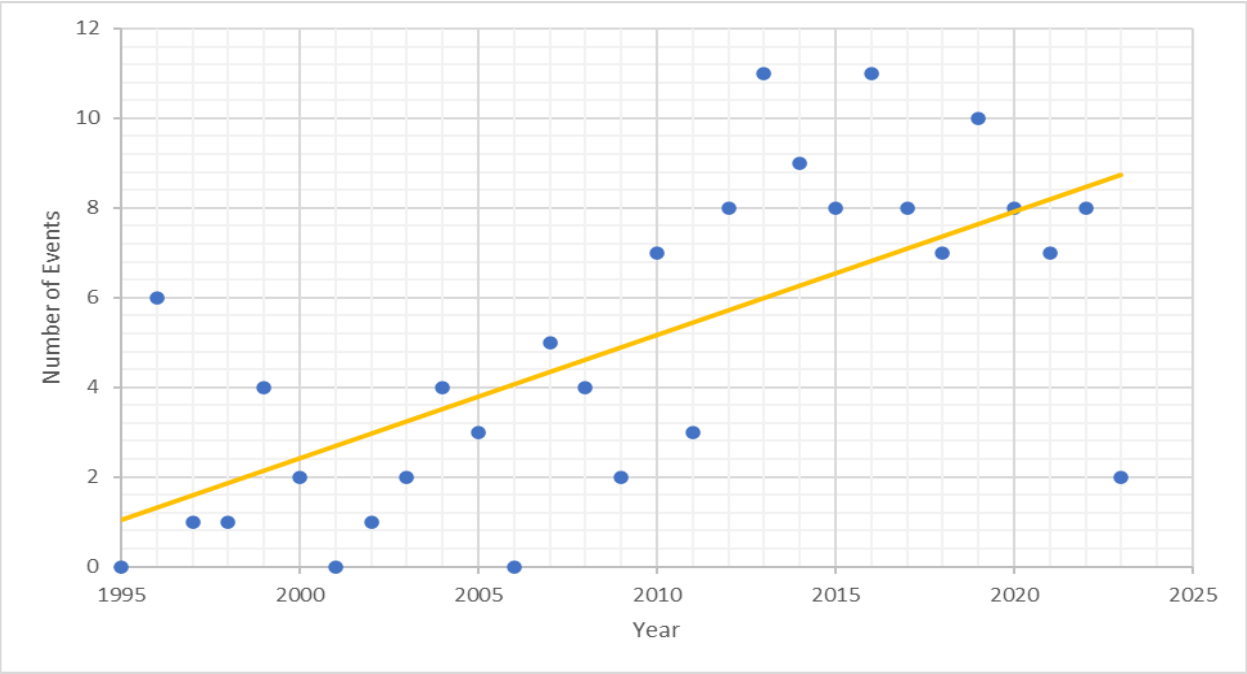
Winter Storm Event, January 6-8, 1996:

The January 1996 blizzard developed from a low-pressure system in the Gulf of Mexico and moved north up the East Coast dropping snow, sleet, and freezing rain over the region causing auto, air, and train traffic delays and power outages. The worst effects in Ohio were along the Ohio River and the I-70 corridor as wind gusts whipped up the dry, powdery snow into whiteout conditions. The weight of snow from this event, mixed with another snowstorm earlier in the week, caused the collapse and partial collapse of roofs of homes and businesses. The event caused a reported $500,000 in property damage in Clinton County, and $500,000,000 across the eastern U.S. No reports of injuries or deaths were reported in Clinton County from this event.

Probability

According to the NCEI, there have been a total of 142 severe winter storm events reported in Clinton County from January of 1995 to December 2023, with total losses amounting to $525,000 in property damage and $540,000 in crop damage. Averaged over that time period, there were approximately 4.9 winter storm events annually with average annual damage total of $36,724. **Figure 4.11.2** shows the number of severe winter events since 1995 has been increasing in Clinton County. According to the Fifth National Climate Assessment, due to the warming climate, extreme winter weather is expected to be less severe and less frequent in Ohio, and heavy snowfall will manifest as heavy rainfall in future years.

Figure 4.11.2: Severe Winter Weather Probability



Source: NOAA NCEI

Vulnerability Assessment

Infrastructure Impact

Winter storms can cause damage to overhead utilities. Wires can collapse under the weight of accumulated snow and ice leading to disruption in communication and power supply for days. Debris can block roadways or damage property as tree limbs can also collapse under the weight of accumulated snow and ice. Water pipes can freeze under extremely low temperatures that may accompany severe winter storms. Roads and sidewalks can be blocked by the accumulation of snow and can ice over. Bridges and overpasses are particularly dangerous because they freeze before other surfaces. Heavy snow fall and accumulation can cause business and private homes to have partial or full roof collapses. The State of Ohio Hazard Mitigation Plan 2024 estimates the annual probability of 5.8 severe winter storms annually for Clinton County.

Population Impact

All residents of Clinton County are expected to be affected by severe winter storms. Infants, older adults, sick people, and pets are more vulnerable to injuries and health conditions related to exposure to heavy snow, ice, and lasting extreme cold temperatures. It is advisable to equip vulnerable populations with indoor easy-to-read thermometers and heating devices in locations where they are highly visible.

According to FEMA's National Risk Index, Clinton County was scored a 38.2 or "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 residents of Clinton County for individual hazard events associated with severe winter weather are as follows: 44.1 ("relatively low") for cold wave, 91.2 ("relatively high") for ice storm, and 69.4 ("relatively moderate") for winter weather events. The index also calculates an expected annual loss of $ 40,187 due to cold wave, $649,195 due to ice storm, and $112,706 due to winter weather events, with 0.4, 1.2, and 3.4 events occurring per year, respectively.

Property Damage

Property can be damaged by accumulated snow and ice, debris, and falling trees and utility poles. Extreme low temperatures can also freeze the water in pipes which could cause them to explode. All buildings in the County are exposed and vulnerable to winter storms. The State of Ohio Hazard Mitigation Plan 2024 estimates potential annual losses caused by winter storms in Clinton County to be $124,564.

Property owners should weatherproof their homes and buildings and conduct regular inspections to eliminate impacts from extreme weather conditions. The Federal Emergency Management Agency (FEMA) suggests that individuals with damaged property should contact their insurance company and take photos of any damage. If individuals are uninsured or underinsured, they should seek assistance by visiting www.DisasterAssistance.gov.

Loss of Life

There were no reported deaths in Clinton County from severe winter events between January 1995 and December 2023. Most common causes of death from winter events are vehicular accidents from iced-over and dangerous roads, frostbite or hypothermia from prolonged exposure to cold, heart attacks from heavy snow shoveling, and carbon monoxide poisoning due to toxic fumes from heating sources.

A few ways to prepare and protect from extreme winter weather conditions include, but are not limited to, staying indoors during dangerous cold events, dressing warmly when outside, staying off icy and dangerous roads, equipping vehicles with an emergency supply kit, preparing for power outages and using heating devices intended for indoor use only, staying updated about emergency information and alerts, seeking medical assistance on signs of hypothermia or frostbite, and checking on neighbors.

Economic Losses

Economic losses can occur from businesses shutting down for potentially long periods of time, structural damage, and death and injury. Economic activity can be completely halted during winter storms including transportation of goods and people. Electricity outages may lead to spoiled goods. Since winter storms occur during the winter season, damage to crops is unlikely but possible. Damaged buildings and pipes, fallen trees and power lines, and costs to repair damages and remove snow further impact the economy of cities and towns. Additionally, deaths and injuries can lead to economic losses for a community. **Tables 4.11.3 - 4.11.5** show the total value of economic impacts expected in Clinton County from winter weather events.

Expected annual loss (EAL) rates, calculated by FEMA, identify the total value of loss expected each year for a particular community, in this case the census tracts for Clinton County. Expected losses are assessed for buildings, population ($11.6 million for each fatality or 10 injuries), and agriculture per census tract. The tables below show the 10 census tracts in Clinton County by order of the highest total EAL from severe winter events to the lowest, for cold wave, ice storm, and winter weather events. The EAL Total column combines the buildings, population, and agricultural losses for each census tract.

Table 4.11.3: Structure and Population Vulnerability from Cold Wave

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027965100	$274	$281	$9,349	$9,904
39027964400	$413	$341	$8,754	$9,508
39027965000	$196	$259	$6,143	$6,598

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027964300	$165	$243	$4,625	$5,033
39027964800	$210	$320	$3,125	$3,655
39027964700	$428	$379	$1,077	$1,884
39027964900	$208	$331	$1,119	$1,658
39027964502	$158	$196	$515	$869
39027964501	$134	$221	$408	$763
39027964600	$124	$190	$0	$314
Grand Total	**$2,310**	**$2,761**	**$35,115**	**$40,186**

Source: FEMA National Risk Index

Table 4.11.4: Structure and Population Vulnerability from Ice Storm

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027964700	$115,574	$3,565	$0	$119,1398
39027964400	$111,403	$3,205	$0	$114,608
39027965100	$73,962	$2,641	$0	$76,603
39027964800	$56,642	$3,013	$0	$59,655
39027964900	$56,046	$3,111	$0	$59,157
39027965000	$52,865	$2,431	$0	$55,296
39027964300	$44,507	$2,283	$0	$46,790
39027964502	$42,750	$1,846	$0	$44,596
39027964501	$36,139	$2,078	$0	$38,217
39027964600	$33,344	$1,789	$0	$35,133
Grand Total	**$623,232**	**$25,962**	**$0**	**$649,194**

Source: FEMA National Risk Index

Table 4.11.5: Structure and Population Vulnerability from Winter Weather

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027964700	$13,165	$5,656	$16	$18,837
39027964400	$12,690	$5,084	$132	$17,906
39027965100	$8,425	$4,189	$141	$12,755
39027964900	$6,384	$4,934	$17	$11,335
39027964800	$6,452	$4,779	$47	$11,278

Census Tract	Expected Annual Loss (Building)	Expected Annual Loss (Population Equivalence)	Expected Annual Loss (Agriculture)	Expected Annual Loss (Total)
39027965000	$6,022	$3,857	$92	$9,971
39027964300	$5,070	$3,622	$70	$8,762
39027964502	$4,870	$2,928	$8	$7,806
39027964501	$4,117	$3,296	$6	$7,419
39027964600	$3,798	$2,838	$0	$6,636
Grand Total	**$70,993**	**$41,183**	**$529**	**$112,705**

Source: FEMA National Risk Index

Future Trends

Land Use and Development Trends

Winter 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 winter storms. All land uses are equally impacted by severe winter 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 is also impacted by the amount of snowfall. Areas that receive high snowfall should have buildings designed to withstand the weight of the snow to avoid sagging, cracking, and collapsing roofs. On the other hand, snow is a natural insulator, and snow accumulated on rooftops helps hold heat in buildings and, consequently, reduces heating costs.

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 offers space to pile cleared snow. 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

Due to shifting weather patterns, the average Midwest air temperature increased by more than 1.5 degrees Fahrenheit between 1900 and 2010. In recent years, however, warming has increased three times as quickly between 1980 and 2010. By the end of 2030, Ohio's climate may trend towards the climate of Southern Illinois.