5.4.10 Severe Winter Storm

The following section provides the hazard profile and vulnerability assessment for the severe winter storm hazard of the Livingston County Hazard Mitigation Plan (HMP).

5.4.10.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the severe winter storm hazard.

Hazard Description

A winter storm is a weather event in which the main types of precipitation are snow, sleet or freezing rain. They can be a combination of heavy snow, blowing snow, and/or dangerous wind chills. There are three basic components needed to make a winter storm. Below freezing temperatures (cold air) in the clouds and near the ground are necessary to make snow and ice. Lift, something to raise the moist air to form clouds and cause precipitation, is needed. Examples of this is warm air colliding with cold air and being forced to rise over the cold dome or air flowing up a mountainside. The last thing needed to make a winter storm is moisture to form clouds and precipitation. Air blowing across a body of water, such as a large lake or the ocean (National Severe Storms Laboratory [NSSL] 2020).

Some winter storms are large enough to immobilize an entire region while others may only affect a single community. Winter storms are typically accompanied by low temperatures, high winds, freezing rain or sleet, and heavy snowfall. The aftermath of a winter storm can have an impact on a community or region for days, weeks, or even months; potentially causing cold temperatures, flooding, storm surge, closed and/or blocked roadways, downed utility lines, and power outages. For the purpose of this HMP update, and as deemed appropriate by Livingston County, the severe winter storm hazard includes heavy snow (snowstorms), blizzards, sleet, freezing rain, and ice storms. According to the 2019 New York State HMP (NYS DHSES 2019), winter storms are frequent events for the State of New York and occur from late October until mid-April. These types of winter events or conditions are further defined below.

Heavy Snow

According to the National Snow and Ice Data Center (NSIDC), snow is precipitation in the form of ice crystals. It originates in clouds when temperatures are below the freezing point (32 °F), when water vapor in the atmosphere condenses directly into ice without going through the liquid stage. Once an ice crystal has formed, it absorbs and freezes additional water vapor from the surrounding air, growing into a snow crystals or snow pallet, which then falls to the earth. Snow falls in different forms: snowflakes, snow pellets, or sleet. Snowflakes are clusters of ice crystals that form from a cloud. Snow pellets are opaque ice particles in the atmosphere. They form as ice crystals fall through super-cooled cloud droplets, which are below freezing but remain a liquid. The cloud droplets then freeze to the crystals. Sleet is made up of drops of rain that freeze into ice as they fall through colder air layers. They are usually smaller than 0.30 inch in diameter (NSIDC 2020).

Blizzards

A blizzard is a winter snowstorm with sustained or frequent wind gusts of 35 miles per hour (mph) or more, accompanied by falling or blowing snow reducing visibility to or below 0.25 mile. These conditions must be predominant over a 3-hour period to be considered a blizzard. Extremely cold temperatures are often associated with blizzard conditions, but are not a formal part of the definition. The hazard created by the combination of snow, wind, and low visibility significantly increases, however, with temperatures below 20 °F. A severe blizzard is categorized as having temperatures near or below 10 °F, winds exceeding 45 mph, and visibility

reduced by snow to near zero. Storm systems powerful enough to cause blizzards usually form when the jet stream dips far to the south, allowing cold air from the north to clash with warm air from the south. Blizzard conditions often develop on the northwest side of an intense storm system. The difference between the lower pressure in the storm and the higher pressure to the west creates a tight pressure gradient, resulting in strong winds and extreme conditions caused by the blowing snow (NSSL 2020).

Ice Storms

An ice storm is an event when damaging accumulations of ice are expected during freezing rain situations. Significant ice accumulations are typically 0.25 inch or greater (National Weather Service [NWS] n.d.). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (NSSL 2020).

Extent

The magnitude or severity of a severe winter storm depends on several factors including a region's climatological susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and time of occurrence during the day (e.g., weekday versus weekend), and time of season.

The extent of a severe winter storm can be classified by meteorological measurements and by evaluating its societal impacts. National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Information (NCEI) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the United States. The RSI ranks snowstorm impacts on a scale from 1 to 5. It is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population. The NCEI has analyzed and assigned RSI values since 1900. Table 5.4.10-1 presents the five RSI ranking categories (NOAA 2020).

Table 5.4.10-1. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1-3
2	Significant	3-6
3	Major	6-10
4	Crippling	10-18
5	Extreme	18.0+

Source: *NOAA-NCEI 2011*

Note: *RSI = Regional Snowfall Index*

The NWS operates a widespread network of observing systems such as geostationary satellites, Doppler radars, and automated surface observing systems that feed into the current state-of-the-art numerical computer models to provide a look into what will happen next, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts (NWS 2020).

The NWS uses winter weather watches, warnings and advisories to ensure that people know what to expect in the coming hours and days.

- A ***winter storm watch*** is issued when severe winter conditions (heavy snow, ice, etc.) may affect a certain area, but its occurrence, location, and timing are uncertain. A watch is issued to provide 24 to 72 hours of notice of the possibility of severe winter weather.

- A ***winter storm warning*** is issued when hazardous winter weather, in the form of heavy snow, heavy freezing rain, or heavy sleet, is imminent or occurring. A warning is usually issued 12 to 24 hours before the event is expected to begin.
- A ***winter weather advisory*** is issued when a hazardous winter weather event is occurring, is imminent, or has a greater than 80 percent chance of occurrence. Advisories are used to inform people that winter weather conditions are expected to cause significant inconveniences and that conditions may be hazardous. These conditions may refer to sleet, freezing rain, or ice storms, in addition to snow events.
- NWS may also issue a ***blizzard warning*** when snow and strong winds combine to produce the potential for blinding snow, deep drifts, and wind chill (NWS n.d.).

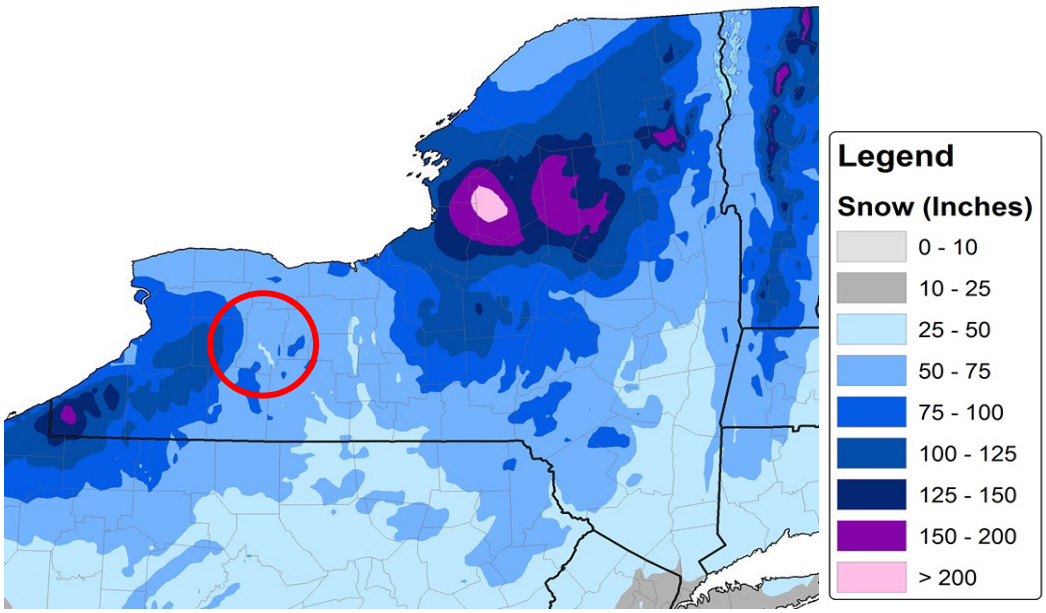
Location

The climate of New York State is marked by abundant ice storms and snowfall. Winter weather can reach New York State as early as October and is usually in full force by late November with average winter temperatures between 20 °F and 40 °F.

With the exception of coastal New York State, the state receives an average seasonal amount of 40 inches of snow or more. The average annual snowfall is greater than 70 inches over 60 percent of New York State's area, with Livingston County's average at less than 60-95 inches annually (NYS Division of Homeland Security and Emergency Services [DHSES]2014).

Figure 5.4.10-1, an annual average snowfall map, illustrates the annual average snowfall totals over a 50-year period for New York State. The general indication of the average annual snowfall map shows areas that are subject to a consistent risk for large quantities of snow (NYS DHSES 2014).

Figure 5.4.10-1. Annual Average Snowfall for New York State



Source: Cornell University, NYSkiBlog.com
Note: Livingston County is indicated by a red circle. Livingston County had an annual average snow accumulation of less than 60 to 95 inches.

New York State, including Livingston County is a prime area for freezing rain events. An average of 6 days of freezing rain occurs annually in Livingston County.

Previous Occurrences and Losses

Many sources provided winter storm information regarding previous occurrences and losses associated with winter storm events throughout Livingston County. With so many sources reviewed for this HMP update, loss and impact information for many events may vary. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP.

Between 1954 and 2019, Federal Emergency Management Agency (FEMA) included New York State in 276 winter-storm-related major disaster (DR) or emergency (EM) declarations. These events were classified as one or a combination of the following incidents: ice storm, severe storms, flooding, snowstorms, severe winter storm, severe blizzard, blizzard, snow, and winter storm. Generally, these disasters cover a wide region of the state; therefore, they may have impacted many counties. Livingston County was included in five of these declarations (Table 5.4.10-2).

Table 5.4.10-2. FEMA Declarations for Severe Winter Storm Events in Livingston County 1972 - 2021

Disaster Number	Event Date	Declaration Date	Incident Type	Title
DR-494	March 19, 1976	1976	Severe Ice Storm	Ice storm, Severe Storms & Flooding
DR-898	March 21, 1991	1991	Snow	Severe Winter Storm
EM-3107	March 17, 1993	1993	Snow	Severe Blizzard
EM-3138	March 10, 1999	1999	Snow	Snow
DR-1467	May 12, 2003	2003	Severe Ice Storm	Ice Storm

Source: FEMA 2021

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Livingston County was included in four USDA declarations involving winter weather between 2012 and 2019 (Table 5.4.10-3)

Table 5.4.10-3. USDA Disaster Declarations 2012 - 2019

Declaration	Event Date	Declaration Date	Event Description
S3249/50	3/1/2012 – 4/30/2012	6/1/2012	Frosts, freezes, unseasonably warm temperatures, and excessive heat
S3777	11/17/2014 – 11/24/2014	12/10/2014	Excessive Snow, Flooding, Freeze, and High Winds
S3886	1/1/2015 – 5/24/2015	9/9/2015	Frost, Freeze, and Excessive Snow
S3885	5/1/2015-7/14/2015	9/9/2015	Excessive Rain, high Winds, Hail, Lightning, and Tornado

Source: USDA 2020a

USDA crop loss data provide another indicator of the severity of previous events. Agriculture-related disasters are quite common. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. These impacts may have long-term consequences, particularly if crop yields are low the following years as well. Table 5.4.10-4 presents the crop losses from winter weather events in Livingston County, as reported by the USDA. This table includes information from 2014 to 2020.

Table 5.4.10-4. USDA Crop Losses from Severe Winter Storms in Livingston County 2014 - 2020

Year	Crop Type	Cause of Loss	Losses
2014	Corn	Cold Wet Weather	$35,000
2015	Wheat, corn, soybean, potatoes	Cold Wet Weather, Frost	$202,000
2016	Wheat, corn, soybeans	Cold Wet Weather	$1,300
2017	Corn, Soybeans, wheat	Cold Wet Weather	$1.8 million
2018	Wheat, corn	Cold Wet Weather	$111,000
2019	Wheat, corn, soybean	Cold Wet Weather, Cold Winter	$82,000

Source: USDA 2021

For this 2022 HMP update, severe winter storm events were summarized from 2014 to 2021 and are identified in Table 5.4.10-5. Events prior to 2014 are included in Appendix E. Not all events that have occurred in Livingston County are included because of the extent of documentation, and the fact that not all sources may have been identified or researched. Loss and impact information could vary depending on the source. Therefore, the accuracy of monetary figures discussed is based only on the available information identified during research for this HMP. Detailed information on damages and impacts to each municipality are included in Section 9, Jurisdictional Annexes.

Table 5.4.10-5. Winter Storm Events Impacting Livingston County between 2014 and 2021

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Losses / Impacts
2/1/2015	Winter Storm	N/A	N/A	Low pressure tracked across Ohio and Pennsylvania to the Maryland coast. The low brought a general eight to fourteen inches of snow to the entire region. Heaviest amounts were along the southern tier counties and over the counties along the south shore of Lake Ontario.
2/8/2015	Winter Storm	N/A	N/A	Low pressure moved across Ohio and Pennsylvania to the Virginia Coast. The system brought a light general snowfall to the area. The northerly flow crossing the warmer waters of Lake Ontario and higher elevations resulted in enhanced snowfall amounts across parts of the Genesee Valley and northern Finger Lakes.
2/15/2016	Winter Storm	N/A	N/A	Low pressure moved north across central Pennsylvania and central New York. This brought all snow to western New York. Across central New York what started initially as snow changed to rain Tuesday morning (16th) then back to snow for the evening hours. Across the north country minor snow accumulations accompanied up to a half inch of ice. The axis of heaviest snow (eighteen to twenty-two inches) fell across the Monroe county and the city of Rochester. The heavy snow began to fall during the early morning hours bringing the morning commute to a standstill.
11/20/2016	Lake-Effect Snow	N/A	N/A	A strong cold front crossed the Lower Great Lakes from west to east during the day of the 19th. The airmass was only marginally cold by late in the day on the 19th, with lake effect rain mixed with wet snow developing off Lake Erie near Buffalo, changing to all snow across the higher terrain south of the city during the evening.
3/13/2017	Winter Storm	N/A	N/A	Low pressure over the Great Lakes combined with low pressure lifting north along the Atlantic coast to bring significant snowfall to the entire region. Snow began across the region during the late evening into the early overnight hours of the 13th-14th. The snow continued through the day Tuesday (14th) before tapering off during the afternoon of the 15th.
1/12/2018	Winter Storm	N/A	N/A	A developing winter storm brought first a wintry mix of precipitation during the evening of the 12th and then heavy snow through the morning of the 13th. Rain changed to a mix of freezing rain and snow during the evening. Ice accumulations up to a tenth of an inch were reported along the lake shore counties. Once the precipitation changed to snow, the heavy snow fell at one to two inches an hour during the overnight hours.
3/1/2018	Winter Storm	N/A	N/A	A weak low pressure strengthened as it moved across Pennsylvania and merged with a low along the eastern coast. The storm brought a blanket of heavy, wet snow across the entire region during from late afternoon on the first through the late morning through early afternoon of the second. There were also several reports of downed trees and wires due to the combination of the weight of the snow and the brisk winds that accompanied the storm. |
4/14/2018	Ice Storm	N/A	N/A	Two rounds of mixed winter precipitation moved over the area with warm air aloft overriding a deep layer of cold air at the surface. This resulted in sleet initially that transitioned to freezing rain before temperatures eventually increased above freezing.
11/15/2018	Winter Storm	N/A	N/A	A complex system moved into the area with wildly varying thermal profiles. An initial mid-level trough and surface low moved across the southeast United States that gave way to secondary cyclogenesis near the southern tip of the Delmarva. The secondary low then moved northward along the east coast to the Gulf of Maine. The system had very marginal cold air to work with, particularly in western New York.

Date(s) of Event	Event Type	FEMA Declaration Number (if applicable)	County Designated?	Losses / Impacts
1/19/2019	Winter Storm	N/A	N/A	A system tracked along the New York/Pennsylvania line and spread heavy snow across our region over the weekend. The low pressure track fit perfectly with climatology for widespread heavy snow in our area. The heaviest amounts that model solutions generally had across the western Southern Tier ended up being across the entirety of the Thruway corridor, resulting in over a foot of snow for much of the area.

Source(s): *NYS DHSES 2019; FEMA 2021; NWS 2021; NOAA-NCEI 2021*
FEMA *Federal Emergency Management Agency*
NOAA-NCEI *National Oceanic Atmospheric Administration – National Centers for Environmental Information*
NWS *National Weather Service*
NYS DHSES *New York State Division of Homeland Security and Emergency Services*
N/A *Not applicable*
T *Town*
V *Village*

Probability of Future Events

Winter storm hazards in New York State are virtually guaranteed yearly since the state is located at relatively high latitudes resulting in winter temperatures that range between 0 °F and 32 °F for a good deal of the fall through early spring season (late October until mid-April). In addition, the state is exposed to large quantities of moisture from both the Great Lakes and the Atlantic Ocean. While it is almost certain that a number of significant winter storms will occur during the winter and fall season, what is not easily determined is how many such storms will occur during that time frame.

According to the 2019 New York State HMP Update, between 1996 and 2017, Livingston County had 66 severe winter storm event, which resulted in approximately $4.1 million in property damage, accounting for $196,578 in annualized damage (NOAA-NCEI 2021).

For the 2022 HMP update, the most up-to-date data was collected to calculate the probability of future occurrence of winter storm events, of all magnitudes, for Livingston County. Information from NOAA-NCEI storm events database and the NYS 2019 HMP were used to identify the number of winter storm events that occurred between 1960 and 2021. Using these sources ensures the most accurate probability estimates possible. Table 5.4.10-6 below shows these statistics, as well as the annual average number of events and the estimated percent chance of an incident occurring in any given year.

Table 5.4.10-6. Probability of Future Occurrence of Severe Winter Storm Events

Hazard Type	Number of Occurrences Between 1996 and 2021	% Chance of Occurring in Any Given Year*
Severe Winter Storms	66	100%

Source: NOAA-NCEI 2021; NYS DHSES 2019
Note: Severe winter storm events include blizzard, heavy snow, ice storm, lake-effect snow, winter storm, and winter weather
**Estimate of the likelihood of an event to occur*

In Section 5.3, the identified hazards of concern for Livingston County were ranked using a variety of parameters. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for severe winter storms in the county is considered "frequent" (event that will occur in 25 years) (Table 5.3-2).

Climate Change Impacts

New York State averages more than 40 inches of snow each year. Snowfall varies regionally, based on topography and the proximity to large lakes and the Atlantic Ocean. Maximum annual snowfall is more than 165 inches in parts of the Adirondacks and Tug Hill Plateau, as well as in the westernmost parts of the state. The warming influence of the Atlantic Ocean keeps snow in the New York City and Long Island areas generally below 36 inches each year.

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue to grow. Impacts related to increasing temperatures and sea level rise are already being felt in the state. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the state's vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA] 2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Livingston County is part of Region 1, which includes western New York and the Great Lakes Plain. Some areas in this region account for the highest agricultural revenue in the state and climate change could affect

rainfall and increase the risk of summer drought. High-value crops could also need irrigation and grapes may be affected (NYSERDA 2014).

In ClimAID Region 1, temperatures are estimated to increase by 4.3 to 6.3 ºF by the 2050s, and 5.7 to 9.6 ºF by the 2080s (baseline of 47.7 ºF, middle range projection). Precipitation totals will increase between 4 and 10 percent by the 2050s and 6 to 13 percent by the 2080s (baseline of 34.0 inches, middle-range projection) (NYSERDA 2011).

It is uncertain how climate change will impact winter storms. Based on historical data, it is expected that the following will occur at least once per 100 years:

- Up to 4 inches of freezing rain in the ice band near central New York State, consisting of between 1 and 2 inches of accumulated ice over a 24-hour period
- Up to 2 feet of accumulated snow in the snow band in northern and western New York State over a 48-hour period (NYSERDA 2011).

New York State is already experiencing the effects of climate change during the winter season. Annual ice cover has decreased 71 percent on the Great Lakes since 1973. According to the 2019 NYS HMP, the Intergovernmental Panel on Climate Change (IPCC) has found that global average surface temperature has increased and that there has been a reduction of the annual duration of lake ice cover in the Northern Hemisphere, the impacts of this change on snowfall projections for New York State are unclear. This decreased lake ice extent could increase the quantity of lake effect snow events. Research also indicates that there may be a decrease in the number of heavy Lake Effect snowstorms as a result of air temperature warming (IPCC 2018).

5.4.10.2 Vulnerability Assessment

To understand risk, a community must evaluate the assets exposed or vulnerable in the identified hazard area. For the severe winter storm hazard, all of Livingston County has been identified as the hazard area. Therefore, all assets in the county (population, structures, critical facilities and lifelines), as described in Section 4, County Profile, are vulnerable to a winter storm event.

Impact on Life, Health and Safety

The entire population of Livingston County (63,591 people) is exposed to severe winter storm events (Census 2019). The homeless and elderly are considered most susceptible to this hazard. The elderly are considered susceptible to this hazard due to their increased risk of injuries and death from falls and overexertion and/or hypothermia from attempts to clear snow and ice. According to the 2019 American Community Survey 5-year estimate, there are 10,929 persons over 65 years old that reside in the County that are considered vulnerable to severe winter weather. In addition, severe winter storm events and their associated impacts to roads and utilities can reduce the ability of these populations to access emergency services.

The homeless and residents below the poverty level may not have access to housing or their housing could be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Residents with low incomes might not have access to housing or their housing can be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). In Livingston County, the Village of Nunda has the highest concentration of population below the poverty level (i.e., 27.3 percent). Section 4, County Profile, displays the densities of low-income populations in Livingston County.

According to the NOAA National Severe Storms Laboratory (NSSL), every year, winter weather indirectly and deceptively kills hundreds of people in the United States every year, primarily from automobile accidents, overexertion and exposure. Winter storms are often accompanied by strong winds creating blizzard conditions

with blinding wind-driven snow, drifting snow and extreme cold temperatures and dangerous wind chill. They are considered deceptive killers because most deaths and other impacts or losses are indirectly related to the storm. People can die in traffic accidents on icy roads, heart attacks while shoveling snow, or of hypothermia from prolonged exposure to cold. Heavy accumulations of ice can bring down trees and power lines, disabling electric power and communications for days or weeks. Heavy snow can immobilize a region and paralyze a city, shutting down all air and rail transportation and disrupting medical and emergency services. Storms near the coast can cause coastal flooding and beach erosion as well as sink ships at sea. The economic impact of winter weather each year is huge, with costs for snow removal, damage and loss of business in the millions (NOAA NWS 2020).

Impact on General Building Stock

The entire general building stock inventory in Livingston County is vulnerable to the impacts of the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this plan considers percentage damages that could result from severe winter storm conditions. Table 5.4.10-7 below summarizes percent damages that could result from severe winter storm conditions for the Planning Area's total general building stock. Given professional knowledge and the currently available information, the potential loss for this hazard is many times considered to be overestimated because of varying factors (building structure type, age, load distribution, building codes in place, etc.). Therefore, the following information should be used as estimates only for planning purposes with the knowledge that the associated losses for severe winter storm events vary greatly.

Table 5.4.10-7. General Building Stock Exposure and Estimated Losses from Severe Winter Storm Events

Jurisdiction	Total Replacement Cost Value (RCV)	1-Percent Exposure/Loss	5-Percent Exposure/Loss	10-Percent Exposure/Loss
Avon (T)	$1,324,846,766	$13,248,468	$66,242,338	$132,484,677
Avon (V)	$1,365,771,007	$13,657,710	$68,288,550	$136,577,101
Caledonia (T)	$792,755,652	$7,927,557	$39,637,783	$79,275,565
Caledonia (V)	$735,609,120	$7,356,091	$36,780,456	$73,560,912
Conesus (T)	$625,005,723	$6,250,057	$31,250,286	$62,500,572
Dansville (V)	$1,341,807,175	$13,418,072	$67,090,359	$134,180,717
Geneseo (T)	$1,161,720,041	$11,617,200	$58,086,002	$116,172,004
Geneseo (V)	$1,570,704,963	$15,707,050	$78,535,248	$157,070,496
Groveland (T)	$1,203,662,583	$12,036,626	$60,183,129	$120,366,258
Leicester (T)	$715,987,145	$7,159,871	$35,799,357	$71,598,715
Leicester (V)	$142,879,953	$1,428,800	$7,143,998	$14,287,995
Lima (T)	$859,636,929	$8,596,369	$42,981,846	$85,963,693
Lima (V)	$452,768,112	$4,527,681	$22,638,406	$45,276,811
Livonia (T)	$1,866,897,181	$18,668,972	$93,344,859	$186,689,718
Livonia (V)	$371,319,429	$3,713,194	$18,565,971	$37,131,943
Mount Morris (T)	$646,574,328	$6,465,743	$32,328,716	$64,657,433
Mount Morris (V)	$785,505,655	$7,855,057	$39,275,283	$78,550,565
North Dansville (T)	$497,159,183	$4,971,592	$24,857,959	$49,715,918
Nunda (T)	$544,934,442	$5,449,344	$27,246,722	$54,493,444
Nunda (V)	$392,488,596	$3,924,886	$19,624,430	$39,248,860
Ossian (T)	$488,703,931	$4,887,039	$24,435,197	$48,870,393
Portage (T)	$338,465,763	$3,384,658	$16,923,288	$33,846,576
Sparta (T)	$449,674,840	$4,496,748	$22,483,742	$44,967,484
Springwater (T)	$702,256,303	$7,022,563	$35,112,815	$70,225,630
West Sparta (T)	$423,213,015	$4,232,130	$21,160,651	$42,321,302
York (T)	$1,677,949,006	$16,779,490	$83,897,450	$167,794,901
Livingston County (Total)	**$21,478,296,842**	**$214,782,968**	**$1,073,914,842**	**$2,147,829,684**

Source: Livingston County 2021; RS Means 2021
Notes: T - Town; V - Village

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. Severe winter storms can cause flooding through blockage of streams or through snow melt. At-risk residential infrastructure is presented in the section for the flood hazard (Section 5.4.3). Generally, losses resulting from flooding associated with severe winter storms should be less than that associated with a 100-year flood.

Impact on Critical Facilities and Lifelines

Full functionality of critical facilities such as police, fire and medical facilities is essential for response during and after a severe winter storm event. These critical facility structures are largely constructed of concrete and masonry; therefore, they should only suffer minimal structural damage from severe winter storm events. Because power interruption can occur, backup power is recommended. Infrastructure at risk for this hazard includes roadways that could be damaged due to the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires the clearing roadways and alerting citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required.

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. Heavy accumulations of ice can bring down trees, electrical wires, telephone poles and lines, and communication towers. Communications and power can be disrupted for days while utility companies work to repair the extensive damage. Even small accumulations of ice may cause extreme hazards to motorists and pedestrians. Bridges and overpasses are particularly dangerous because they can freeze before other surfaces if the temperature of their surfaces is already at or below freezing while it is freezing rain or sleeting (NSSL 2021).

Impact on Economy

The cost of snow removal, ice removal, and road repair due to the freeze/thaw process can drain local financial resources. The economy is also impacted by loss of commuters traveling into or out of the area for work or school. The loss of power and closure of roads prevents the commuter population from traveling to work within and outside of the County. Overall, the county includes snow removal costs in its annual budget, which can range between $30,000 up to $850,000 for the entire fiscal year (Livingston County 2021).

Impact on the Environment

Severe winter weather can have a major impact on the environment. Not only does winter weather create changes in natural processes, the residual impacts of a community's methods to maintain its infrastructure through winter weather maintenance may also have an impact on the environment. For example, an excess amount of snowfall and earlier warming periods may affect natural processes such as flow within water resources (U.S. Geological Survey [USGS] n.d.). Rain-on-snow events can also exacerbate runoff rates with warming winter weather. Consequentially, these flow rates and excess volumes of water can erode banks, tear apart habitat along the banks and coastline, and disrupt terrestrial plants and animals.

Furthermore, chemically based winter maintenance practices have its own effect on the natural environment. Melting snow and ice that carry deicing chemicals onto vegetation and into soils can contaminate the local waterways. Elevated salt levels may hinder vegetation from absorbing nutrients, slowing plant growth. Chloride concentrations are shown to be increasing with snow removal mechanisms such as salt, which is toxic to the aquatic species in the impacted water resources (EPA 2013; NHDES 2011).

Cascading Impacts on Other Hazards

Severe winter weather events may exacerbate flooding. As discussed, the freezing and thawing of snow and ice associated with winter weather events can create major flooding issues in the county. Maintaining winter weather hazards through snow and ice removal could minimize the potential risk of flooding during a warming period.

Future Changes That May Impact Vulnerability

Understanding future changes that affect vulnerability in the county can assist in planning for future development and ensure establishment of appropriate mitigation, planning, and preparedness measures. Changes in the natural environment and built environment and how they interact can also provide insight about ways to plan for the future.

Projected Development

As discussed and illustrated in Section 4 (County Profile), areas targeted for future growth and development have been identified across the County. Any areas of growth located could be potentially impacted by severe winter weather events; however, these structures will be built in accordance with the latest building codes.

Projected Changes in Population

According to the 2019 American Community Survey 5-year population estimates, the population of the county has decreased by approximately 3-percent since 2010. While less people will reside in the county, those that remain are still vulnerable to severe winter weather. Refer to Section 4, County Profile, which includes a discussion on population trends for the county.

Climate Change

As discussed above, most studies project that the State of New York will see an increase in average annual temperatures and precipitation. Annual precipitation amounts in the region are projected to increase, primarily in the form of heavy rainfalls, which have the potential to freeze into heavy snowfall and icing. This increase in snow and ice could result in an increased risk to life and health, an increase in structural losses, a diversion of additional resources to response and recovery efforts, and an increase in business closures affected by severe winter events due to loss of service or access.

Change of Vulnerability Since the 2014 HMP

Since the 2014 HMP, population statistics have been updated using the 5-Year 2015-2019 American Community Survey Population Estimates. The general building stock was also updated using 2021 building footprint and tax assessor data from Livingston County. Furthermore, the replacement cost values of the building inventory were updated using 2021 RS Means values. Additionally, 2021 critical facility inventory data was provided by the Livingston County Planning Partners and the Homeland Infrastructure Foundation-Level Data (HIFLD).

Overall, this vulnerability assessment uses a more precise and thorough approach, which provides increased accuracy for estimated exposure and potential losses for Livingston County.