5.4.10 Severe Winter Storm

This section provides a hazard profile, and vulnerability assessment for the severe winter storm hazard for the Allegany County Hazard Mitigation Plan (HMP).

5.4.10.1 Hazard Profile

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

Description

For the purpose of this HMP and as deemed appropriate by Allegany County, the severe winter storm hazard includes heavy snow (snowstorms), blizzards, sleet, freezing rain, and ice storms. According to the 2014 New York State Hazard Mitigation Plan (NYS HMP), winter storms are frequent events for the State of New York and occur from late October until mid-April. Heavy snow, blizzards, and ice storm 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 degrees Fahrenheit [°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 snow crystals or snow pellets, which then fall to the earth. Snow falls in different forms, such as 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 that 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. They are usually smaller than 0.30 inch in diameter (NSIDC 2015).

Heavy snow accumulations can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting the distribution of emergency and medical services. Ice storms can be accompanied by high winds and have similar impacts, especially to trees, power lines, and residential utility services. Because of its unique location at a climactic crossroads and distinctive geography, New York State experiences the full effect of all four seasons, and winter is no exception. Snowstorms are the most obvious manifestation of intense winter weather.

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 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 0 mile. 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 (The Weather Channel 2014).

Ice Storms

An ice storm is an event caused by damaging accumulations of ice during freezing rain situations. Significant ice accumulations are typically 0.25 inch or greater (National Weather Service [NWS] 2013). Heavy accumulations of ice can bring down trees, power lines, utility poles, and communication towers. Ice can cause complications that disrupt communications and power for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians (NWS 2009).

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, time of occurrence during the day (for example, weekday versus weekend), and time of season. The National Oceanic and Atmospheric Administration's (NOAA) National Climatic Data Center (NCDC) 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 Category 1 to 5, which is similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. The RSI differs from the Northeast Snowfall Impact Scale (NESIS) because it includes population data. RSI is based on the spatial extent of the storm, the amount of snowfall, and the combination of the extent and snowfall totals with population (based on the 2000 Census). The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA-NCDC n.d.). Table 5.4.10-1 explains the five RSI ranking categories.

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-NCDC n.d.
Notes:
RSI Regional Snowfall Index

NWS operates a widespread network of observation 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 future weather, ranging from hours to days. The models are then analyzed by NWS meteorologists who then write and disseminate forecasts (NWS n.d.).

While sleet accumulation is measured and tracked in a method similar to snow events, the extent or severity of freezing rain or an ice storm requires a different and sometimes more challenging process. According to NWS, ice accumulation does not coat the surface of an object evenly, as gravity typically forces rainwater to the underside of an object before it freezes. Wind can also force rainwater downward prior to freezing, resulting in a thicker coating of ice on one side of the object than the other side. Ice mass is then determined by taking the average from the thickest and thinnest portions of ice on the sample used for measurement.

NWS uses winter weather watches, warnings, and advisories to help people anticipate what to expect in the days and hours prior to an approaching storm. A winter storm watch means that severe winter conditions (heavy

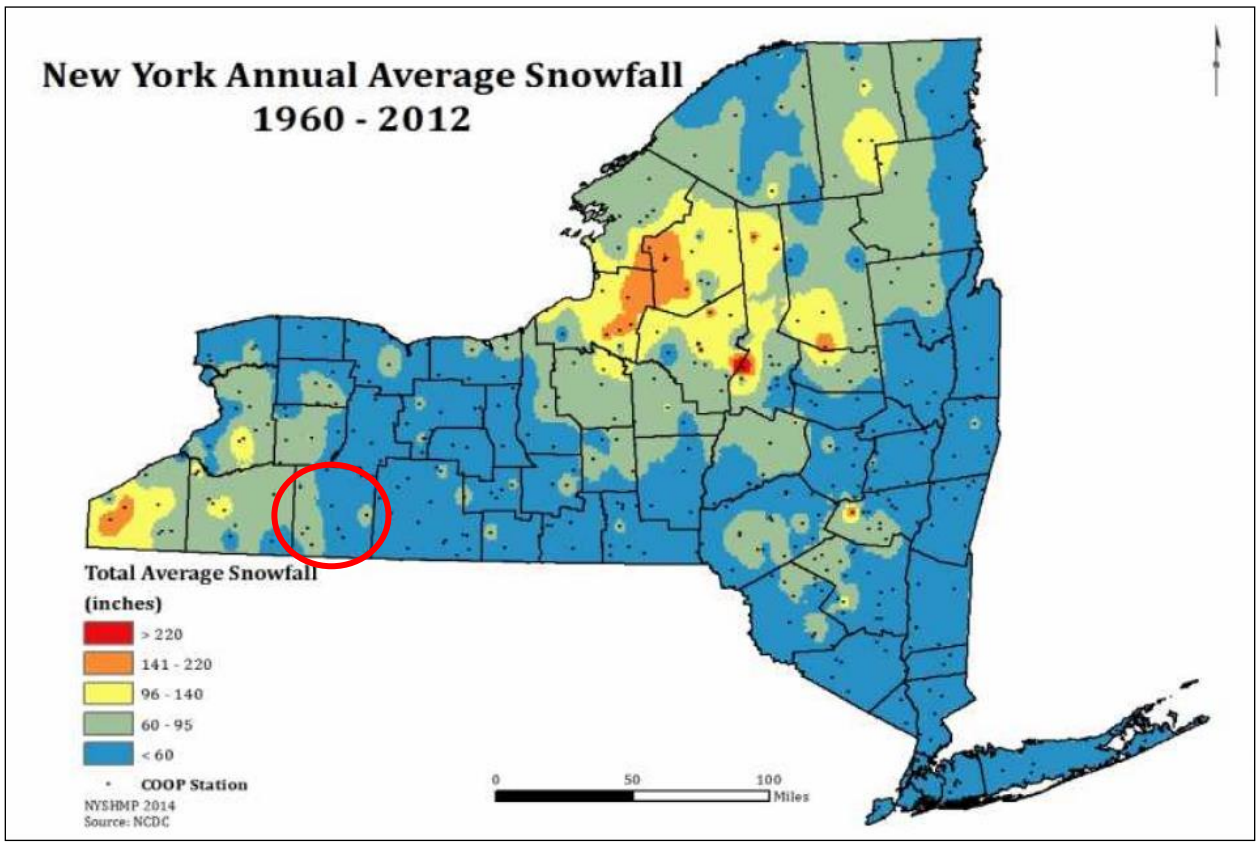
snow, ice, etc.) may affect a certain area, but its occurrence, location, and timing are uncertain. A watch is issued to provide 24 to 72 hours of notice of the possibility of severe winter weather. A watch is upgraded to a winter storm warning when hazardous winter weather, in the form of heavy snow, heavy freezing rain or heavy sleet, is imminent or occurring. A watch is usually issued 12 to 24 hours before the event is expected to begin. Winter weather advisories are issued when the 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 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 and 40 ^{o}F. As indicated in the 2014 NYS HMP, communities in New York State receive more snow than most other communities in the nation. Although the entire State is subject to winter storms, the easternmost and west-central portions of the State are more likely to suffer under winter storm occurrences than any other location (New York State Division of Homeland Security and Emergency Services [NYS DHSES] 2014). With the exception of its coastal communities, New York State receives an average seasonal amount of 40 inches of snow or more. The average annual snowfall is greater than 70 inches in over 60 percent of New York State's area, with Allegany County's average over 68 inches annually (NYS 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 average annual snowfall map shows areas that are consistently subject to a risk for large quantities of snow (NYS DHSES 2014).

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



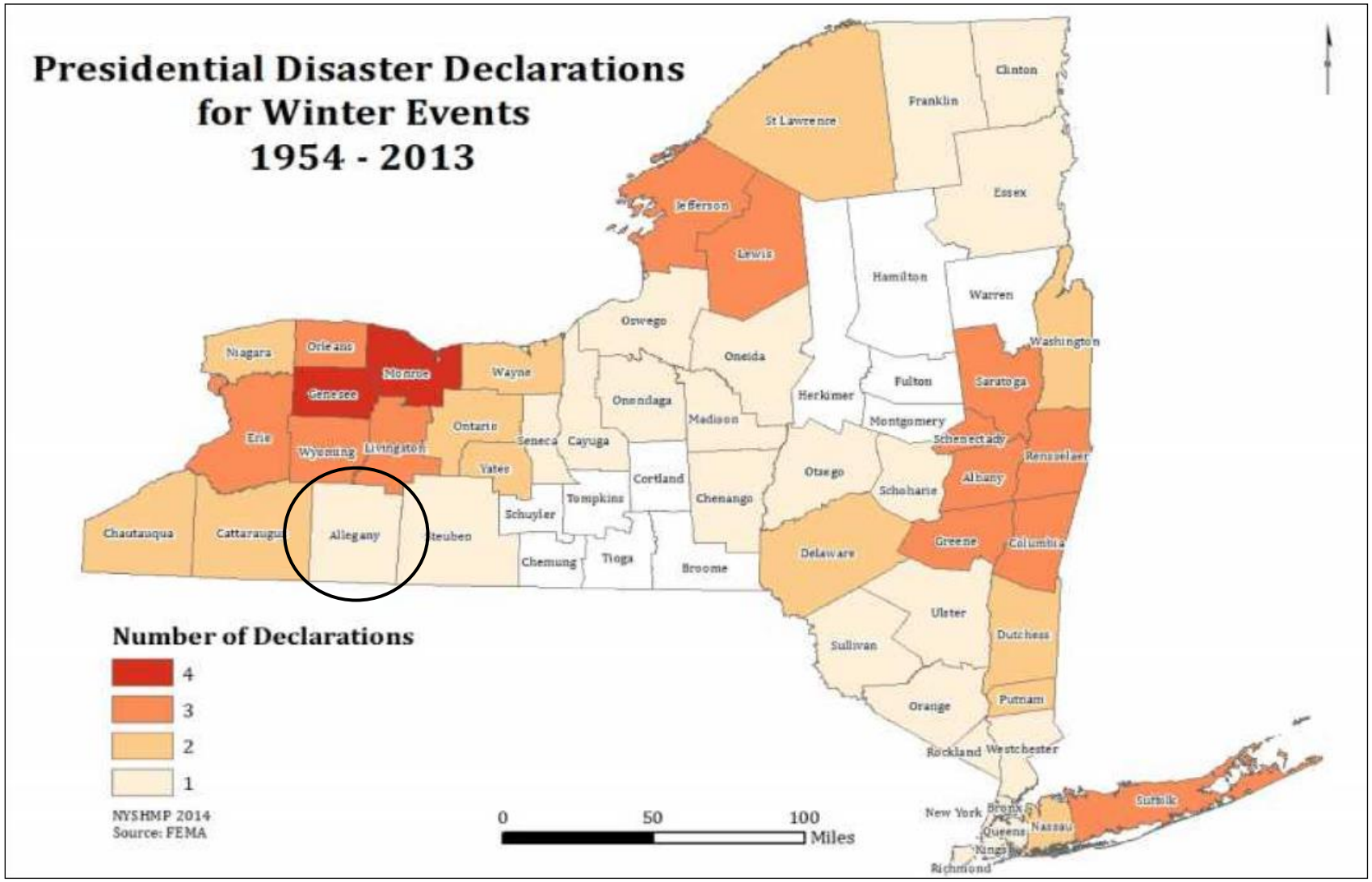
Source: NYS HMP 2014
Note: Allegany County is indicated on the map by a red oval. The annual average snow accumulation in Allegany County is either 60-95 inches, or less than 60 inches.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe winter storms and extreme cold events throughout New York State and Allegany County. With so many sources reviewed for the purpose of this HMP, loss and impact information for many events 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.

Between 1954 and 2015, the Federal Emergency Management Agency (FEMA) declared that New York State experienced 26 winter storm-related disasters (DR) or emergencies (EM), classified as one or a combination of the following disaster types: winter storm and snowstorms. Generally, these disasters cover a wide region of the State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations. Allegany County has been declared as a disaster area on one occasion resulting from winter storm-related events. This information is indicated on Figure 5.4.10-2, which shows Presidential (FEMA) disaster declarations for winter storms and blizzards in New York State from 1954 to 2013. However, the last time Allegany County was included in a severe winter storm disaster declaration was in 1990 (NYS DHSES 2014).

Figure 5.4.10-2. Presidential Disaster Declarations in New York State from Winter Snow Storms and Blizzards (1954 to 2013)



Source: *NYS DHSES 2014*
Note: *The black oval indicates the approximate location of Allegany County. Allegany County has been included in one winter storm/blizzard disaster declaration in New York State between 1954 and 2013.*

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 based within and contiguous to a designated county that are suffering losses. USDA records indicate that Allegany County has experienced crop losses from winter storm events. Between 1989 and 2015, USDA recorded 32 recorded crop loss events in Allegany County that involved severe winter storms (USDA 2015).

Table 5.4.10-2 presents USDA-declared winter events impacting Allegany County, along with other historical occurrences as reported by other sources. Details on these and other events are provided in Table 5.4.10-2 immediately below.

Table 5.4.10-2. USDA Crop Losses from Severe Winter Storms in Allegany County

Year	Crop Type	Cause of Loss	Losses
2015	Wheat	Cold Winter	$ 2,220.50
2014	Wheat	Cold Winter	$ 9,393.00
2014	Wheat	Cold Winter	$ 3,180.00
2014	Wheat	Cold Winter	$ 15,266.00
2014	Wheat	Cold Winter	$16, 708.00
2014	Wheat	Cold Wet Weather	$ 1,735.00
2014	Corn	Other (Snow, Lightning, etc.)	$ 20,598.00
2014	Corn	Other (Snow, Lightning, etc.)	$ 117,941.00
2014	Soybeans	Other (Snow, Lightning, etc.)	$ 17,464.00
2013	Oats	Other (Snow, Lightning, etc.)	$ 1,534
2013	Corn	Cold Wet Weather	$ 22,296
2012	All Other Crops	Freeze	$ 3,925
2009	All Other Crops	Cold Wet Weather	$ 32,651.00
2009	All Other Crops	Cold Wet Weather	$ 68,103.00
2009	All Other Crops	Cold Wet Weather	$ 460.00
2008	All Other Crops	Other (Snow, Lightning, etc.)	$ 2,567.00
2008	All Other Crops	Other (Snow, Lightning, etc.)	$ 4,083.00
2004	All Other Crops	Frost	$ 501.00
1997	All Other Crops	Cold Wet Weather	$ 7,189.00
1997	All Other Crops	Cold Wet Weather	$ 2,919.00
1996	All Other Crops	Cold Wet Weather	$ 318.00
1993	All Other Crops	Freeze	$ 821.00
1992	All Other Crops	Frost	$ 2,353.00
1992	All Other Crops	Freeze	$ 2,299.00
1992	All Other Crops	Cold Wet Weather	$ 11,798.00
1991	All Other Crops	Freeze	$ 245.00
1990	All Other Crops	Freeze	$ 4,058.00
1990	All Other Crops	Cold Wet Weather	$ 8,465.00
1990	All Other Crops	Cold Wet Weather	$ 1,132.00
1990	All Other Crops	Cold Wet Weather	$ 903.00
1989	All Other Crops	Cold Wet Weather	$8,445
1989	All Other Crops	Cold Wet Weather	$6,004
		Total	**$380,866.50**

Source: USDA 2015

According to NOAA NCDC, 68 severe winter storm events occurred in Allegany County between 1950 and 2015, classified as winter storm, cold wind/chill, extreme cold wind/chill, freezing fog, frost/freeze, heavy snow, ice storm, blizzard, lake-effect snow, and winter weather resulting in $2.7 million in property damage and $40,000 in crop damage (NOAA-NCDC 2015). For this 2018 HMP Update, known major winter storm events that have impacted Allegany County between 1950 and 2016 are identified in Table 5.4.10-3. Because documentation for New York State and Allegany County winter storms is so extensive, not all sources have been identified or researched. Therefore, Table 5.4.10-3 may not include all events that have occurred in the County.

Table 5.4.10-3. Winter Storm Events Impacting Allegany County between 1950 and 2016

Date(s) of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
January 3, 1996	Winter Storm	N/A	No	A major winter storm brought heavy snowfall to the area. Approximately 10-15 inches of snow fell across the area.
March 14, 1997	Winter Storm	N/A	No	Several inches of the icy slush coated trees and power lines, the weight of which downed the trees and lines. Various school districts throughout the area cancelled classes because of the treacherous conditions. Countless automobile accidents, some with injuries, were blamed on the storm. Power outages were scattered across the region.
November 14, 1997	Heavy Snow	N/A	No	Snowfall amounts ranged from six (6) to 12 inches across the region with the highest amounts over the Genesee Valley and western Finger Lakes. The snow was wet and heavy and snarled traffic badly. Countless accidents were reported, many with injuries. Several school districts were forced to close.
December 10, 1997	Heavy Snow	N/A	No	Moisture associated with low pressure approaching the area spread throughout the region. Most locations had a burst of snow that fell at the rate of one (1) to two (2) inches per hour for several hours. The heaviest snow fell at the worst possible time, creating havoc with the rush hour traffic. Numerous auto accidents were blamed on the storm and several school districts were forced to close early. Snowfall totals ranged from six (6) to 12 inches.
January 3, 1999	Winter Storm	N/A	No	An intensifying storm over the Southern Plains moved northeast spreading a mix of snow, sleet, and freezing rain across the area. Several inches of snow were followed by sleet and freezing rain. In some areas, especially east of Lake Ontario, an unprecedented four (4) to five (5) inches of sleet fell. The wintry precipitation stalled traffic and forced schools to extend the holiday break a few more days. Numerous automobile accidents, several with injuries, were blamed on the storm.
March 4, 1999	Heavy Snow	N/A	No	Deep low pressure moved from West Virginia north across New York to Quebec, Canada. Heavy rain changed to heavy snow as cold air circulated into the region. Snow fell at the rate of two (2) to three (3) inches per hour. The National Guard was called on to help remove cars, rescue stranded motorists, and deliver food and medical supplies. Schools and businesses were closed throughout the area. Nearly 10,000 customers lost power during the storm.
March 4, 2001	Heavy Snow	N/A	No	A complex low-pressure system that plagued the Northeast brought significant snowfall to western and central New York. The snow in western New York came in two phases from Sunday night to early Monday morning (March 4-5) and again Monday night to Tuesday morning (March 5-6). The heaviest snow fell during the first period and was associated with upper-level energy, while the second snow period resulted from the western fringe of a large coastal storm south of New England.
March 16, 2004	Heavy Snow	N/A	No	A low-pressure system strengthened over the mid-Mississippi Valley, moved to the Virginias, and then tracked northeast along the Atlantic coast. The late season storm produced 10 to 20 inches of heavy, wet snow across much of the region. Many schools and businesses heeded warnings, closed on the March 16 and remained closed on March 17. The storm was blamed for numerous automobile accidents, including several fatalities.
March 4, 2008	Winter Storm	N/A	No	Low pressure developed over the lower Mississippi Valley and lifted to the Ohio Valley. The storm brought a mix of snow, sleet, and freezing rain to the region. A general snow of four (4) to

Date(s) of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts
				six (6) inches blanketed the entire region and was followed by several inches of sleet and up to 0.5 inch of glaze from freezing rain. Schools were closed in many parts of the region. Some County officials declared States of Emergency, while others recommended no unnecessary travel. Utility companies reported that scattered power outages affected tens of thousands of customers across the region.
January 28, 2009	Heavy Snow	N/A	No	Low pressure moved out of the southern Plains northeast across the Tennessee Valley reaching the southern New England Coast on January 28. The low brought an eight (8) to 12-inch blanket of snow to the entire region by the evening of January 28. Innumerable automobile accidents were reported throughout the region as the roads became hard to navigate and the heavy snow caused reduced visibility. Many schools cancelled classes across the region.
February 25, 2010	Winter Storm	N/A	No	A deep storm system off Long Island strengthened and stalled off the New York/New Jersey coast. The system circulated Atlantic moisture back across western and north central New York. A general six (6) to 10 inches of snow fell across the region with higher amounts to the east (closer to the low center) and downwind of the Great Lakes (where lake enhancement occurred). Many schools throughout the region were closed due to the snow. Numerous automobile accidents were blamed on the treacherous driving conditions.
February 25, 2011	Winter Storm	N/A	No	An intensifying area of low pressure moved across Pennsylvania, then headed northeast across New England. The system brought a significant snowfall of six (6) to 12 inches of snow to the entire area. A brisk northerly flow also resulted in a significant amount of blowing and drifting snow. There were several reports of building collapses throughout the region from the weight of the snow that had built up throughout the snowy winter.
March 23, 2011	Heavy Snow	N/A	No	Low pressure moved east from Iowa across western Pennsylvania to the mid-Atlantic Coast. The low brought a blanket of seven (7) to nine (9) inches of heavy, wet snow to parts of western New York. The snow resulted in slick roads and numerous motor vehicle accidents. In some locations, the weight of the moisture-laden snow brought down power lines. About 5,000 customers were without power in southern Erie, Cattaraugus, and Allegany Counties.
March 12, 2014	Blizzard	N/A	No	Low pressure moved across the Ohio Valley to the Mid-Atlantic coast, then lifted northeast to the Canadian Maritimes. Snow began falling across the region during the pre-dawn hours of Wednesday, March 12. By morning, the combination of heavy snow and strong winds produced blizzard conditions across much of the region. Damages were mainly limited to economic loss of business and cost of cleanup as most businesses and schools announced closings early in the well-forecasted storm. Sustained winds of 25 to 35 mph were accompanied by frequent gusts of 45 to 50 mph.

Sources: NOAA-NCDC 2016; FEMA 2016
Notes:
FEMA Federal Emergency Management Agency
mph Miles per hour
N/A Not applicable

Probability of Future Occurrences

Based on historical records and input from the Planning Partnership, the probability of at least one winter snow storm of emergency declaration proportions, occurring during any given calendar year, is virtually certain in the New York State. Based on historical snow-related disaster declarations, New York State can expect a snow storm of disaster-declaration proportions, on average, once every three (3) to five (5) years. Similarly, ice storms of disaster proportions are expected to occur once every seven (7) to 10 years within the State based on historical disaster declarations (NYS DHSES 2014). Allegany County is estimated to continue experiencing direct and indirect impacts of severe winter storms annually.

Table 5.4.10-4 provides the probability of occurrences of severe winter storm events. Based on historic occurrences, heavy storm events are the most common in Allegany County, followed by winter storm events. However, the information used to calculate the probability of occurrences is only based on NOAA-NCDC storm events database results.

Table 5.4.10-4. Probability of Occurrence of Severe Storm Events

Hazard Type	Number of Occurrences Between 1950 and 2016	Recurrence Interval (years)	Percent Chance of Occurring in Any Given Year
Blizzard	1	65	1.54
Heavy snow	27	2.41	41.49
Frost/Freeze	19	3.42	29.24
Lake-Effect Snow	1	65	1.54
Winter storm	18	3.61	27.70
Ice Storm	2	32.50	3.08
Total	68	0.96	100.00

Source: *NOAA-NCDC 2015*
Note: *Probability was calculated using the available data provided in the NOAA-NCDC storm events database.*
* *Greater than 100 percent is shown as 100 percent.*

In Section 5.3, the identified hazards of concern for Allegany County are 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 Partnership, the probability of occurrence for severe winter storms in the County is considered "frequent" (likely to occur within 25 years, as presented in Table 5.3-3).

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 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. Allegany County is part of Region 3, which includes the Southern Tier of New York. Some of the issues in this region that are affected by climate change include the dairy dominating agricultural economy, milk production losses projected, increased Susquehanna River flooding, and first portion of the State to be impacted by invasive species moving north (NYSERDA 2014).

Temperatures are expected to increase throughout the State, by two (2) to 3.4 ºF by the 2020s, 4.1 to 6.8 °F by the 2050s, and 5.3 to 10.1 °F by the 2080s. The lower ends of these ranges are for lower greenhouse gas emission scenarios and the higher ends are for higher emission scenarios. Annual average precipitation is projected to increase by one (1) to up to eight (8) percent by the 2020s, from three (3) to up to 12 percent by the 2050s, and from four (4) to up to 15 percent by the 2080s. By the end of the century, the greatest increases in precipitation are projected to be in the northern parts of the State. Although seasonal projections are less certain than annual results, this additional precipitation will most likely occur during the winter months, with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.10-5 displays the projected precipitation change for the Southern Tier ClimAID Region (NYSERDA 2014).

Table 5.4.10-5. Projected Seasonal Precipitation Change in Region 3, 2050s (Percent Change)

Baseline (1971-2000) 34.0 inches	Low Estimate (10th Percentile)	Middle Range (25th to 75th Percentile)	High Estimate (90th Percentile)
2020s	-4 percent	+ 1 to + 7 percent	+ 9 percent
2050s	+ 2 percent	+ 4 to + 10 percent	+ 15 percent
2080s	+ 3 percent	+ 6 to + 14 percent	+ 16 percent
2100	- 2 percent	+ 5 to + 20 percent	+ 26 percent

Source: NYSERDA 2014

The impact of climate change on winter storms is uncertain. Based on historical data, the following scenarios are expected to occur at least once per 100 years:

- Up to four (4) inches of freezing rain in the ice band near central New York State, consisting of between one (1) and two (2) inches of accumulated ice over a 24-hour period
- Up to two (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. This decrease may lead to increased lake-effect snow in the next two of decades through greater moisture availability. By mid-century, however, lake-effect snow will generally decrease as temperatures below freezing become less frequent (NYSERDA 2014). Winter snow cover is decreasing and spring weather is seen, on average, about one week earlier than a few years ago. Night-time temperatures are measurably warmer, even during the colder months (NYSERDA 2014). Overall winter temperatures in New York State are almost five (5) °F warmer than in 1970 (NYSERDA 2014). The State has seen a decrease in the number of cold winter days (below 32 °F) and can expect to see a decrease in snow cover, by as much as 25 to 50 percent, by end of the next century. The lack of snow cover may jeopardize winter sport businesses offering skiing, snowmobiling, and other types of winter recreation; and natural ecosystems will be affected by the changing snow cover (Cornell University College of Agriculture and Life Sciences 2011).

5.4.10.2 Vulnerability Assessment

To understand risk, a community must evaluate its assets that are exposed and potentially vulnerable to the identified hazard. For the severe winter storm hazard, all of Allegany County is exposed; therefore, all assets in the County (population, structures, critical facilities, and lifelines), as described in the County Profile (Section 4), are potentially vulnerable to a winter storm event. This section addresses the following factors to evaluate and estimate the potential impact of severe winter storm events on the County:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impacts to (1) life, health, and safety of residents; (2) general building stock; (3) critical facilities; (4) economy; and (5) future growth and development
- Change of vulnerability compared to the 2011 Allegany County HMP
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

Severe winter storms are of significant concern to the County because of the frequency and magnitude of these events in the region. In addition, the impacts from these events can be great and can include direct and indirect costs associated preparation, response, and recovery stressing community resources; transportation delays; impacts on the people and facilities of the region related to snow and ice removal; health problems; and cascade effects such as utility failure (power outages) and traffic accidents.

Data and Methodology

Updated population and general building stock data were used to support an evaluation of the assets exposed to this hazard and the potential impacts associated with severe winter storm events. Additionally, available economic losses were provided by the Planning Committee to support this vulnerability assessment.

Impact on Life, Health and Safety

According to the NOAA National Severe Storms Laboratory (NSSL), every year winter weather indirectly and deceptively kills hundreds of people in the United States, 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, extreme cold temperatures, and dangerous wind chill. They are considered deceptive killers because most deaths, impacts, or losses are indirectly related to the storm. People may die in traffic accidents on icy roads, from 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. The economic impact of winter weather each year is huge, with costs for snow removal, damage repair, and loss of business in the millions (NSSL 2006).

Accumulations of snow can collapse buildings and knock down trees and power lines. In rural areas, homes and farms may be isolated for days, and unprotected livestock may be lost. In the mountains, heavy snow can lead to avalanches.

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 freeze before other surfaces (NSSL 2006).

For the purposes of this HMP, the entire population of Allegany County (48,946) is exposed to severe winter storm events (U.S. Census 2010). Snow accumulation and frozen or slippery road surfaces increase the frequency and impact of traffic accidents, which may result in personal injuries. The County Profile in Section 4 of this HMP includes population statistics for each participating municipality.

The elderly population is considered most susceptible to this hazard because of their increased risk of injuries and death from falls, and overexertion or hypothermia from attempts to clear snow and ice. In addition, severe winter storm events can reduce the ability of these populations to access emergency services. Residents with low incomes may not have access to housing or their housing may be less able to withstand cold temperatures (for example, homes with poor insulation and heating supply).

Impact on General Building Stock

The entire general building stock inventory in Allegany County is exposed and potentially vulnerable to the severe winter storm hazard. In general, structural impacts include damage to roofs and building frames, rather than building content. Table 5.4.10-6 presents the total exposure value for general building stock for each participating municipality (structure only).

Current modeling tools are not available to estimate specific losses for this hazard. As an alternate approach, this HMP update considers percentage damages that could result from severe winter storm conditions. Table 5.4.10-6 summarizes percent damages that could result from severe winter storm conditions for Allegany County'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 5.4.10-6. General Building Stock Exposure (Structure Only) and Estimated Potential Losses from Severe Winter Storm Events in Allegany County

Municipality	Total RCV (Structure only)	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Alfred (T)	$235,833,436	$2,358,334	$11,791,672	$23,583,344
Alfred (V)	$344,568,810	$3,445,688	$17,228,440	$34,456,881
Allen (T)	$105,698,559	$1,056,986	$5,284,928	$10,569,856
Alma (T)	$165,632,005	$1,656,320	$8,281,600	$16,563,200
Almond (T)	$202,093,532	$2,020,935	$10,104,677	$20,209,353
Almond (V)	$86,607,225	$866,072	$4,330,361	$8,660,723
Amity (T)	$214,848,732	$2,148,487	$10,742,437	$21,484,873
Andover (T)	$150,580,260	$1,505,803	$7,529,013	$15,058,026
Andover (V)	$211,214,385	$2,112,144	$10,560,719	$21,121,439
Angelica (T)	$124,958,517	$1,249,585	$6,247,926	$12,495,852
Angelica (V)	$178,634,415	$1,786,344	$8,931,721	$17,863,442
Belfast (T)	$341,221,848	$3,412,218	$17,061,092	$34,122,185
Belmont (V)	$242,397,843	$2,423,978	$12,119,892	$24,239,784
Birdsall (T)	$75,747,446	$757,474	$3,787,372	$7,574,745
Bolivar (T)	$171,980,462	$1,719,805	$8,599,023	$17,198,046
Bolivar (V)	$256,381,192	$2,563,812	$12,819,060	$25,638,119
Burns (T)	$113,642,307	$1,136,423	$5,682,115	$11,364,231
Canaseraga (V)	$121,248,846	$1,212,488	$6,062,442	$12,124,885
Caneadea (T)	$323,103,002	$3,231,030	$16,155,150	$32,310,300
Centerville (T)	$139,748,391	$1,397,484	$6,987,420	$13,974,839
Clarksville (T)	$191,915,647	$1,919,156	$9,595,782	$19,191,565
Cuba (T)	$296,679,765	$2,966,798	$14,833,988	$29,667,977
Cuba (V)	$369,424,521	$3,694,245	$18,471,226	$36,942,452

Municipality	Total RCV (Structure only)	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Friendship (T)	$410,747,777	$4,107,478	$20,537,389	$41,074,778
Genesee (T)	$239,176,109	$2,391,761	$11,958,805	$23,917,611
Granger (T)	$118,474,228	$1,184,742	$5,923,711	$11,847,423
Grove (T)	$131,721,806	$1,317,218	$6,586,090	$13,172,181
Hume (T)	$374,787,783	$3,747,878	$18,739,389	$37,478,778
Independence (T)	$200,727,981	$2,007,280	$10,036,399	$20,072,798
New Hudson (T)	$161,142,826	$1,611,428	$8,057,141	$16,114,283
Richburg (V)	$73,809,245	$738,092	$3,690,462	$7,380,925
Rushford (T)	$429,785,920	$4,297,859	$21,489,296	$42,978,592
Scio (T)	$277,826,609	$2,778,266	$13,891,330	$27,782,661
Ward (T)	$75,125,267	$751,253	$3,756,263	$7,512,527
Wellsville (T)	$471,554,227	$4,715,542	$23,577,711	$47,155,423
Wellsville (V)	$1,207,001,334	$12,070,013	$60,350,067	$120,700,133
West Almond (T)	$94,914,093	$949,141	$4,745,705	$9,491,409
Willing (T)	$204,894,983	$2,048,950	$10,244,749	$20,489,498
Wirt (T)	$143,336,938	$1,433,369	$7,166,847	$14,333,694
Allegany County (Total)	**$9,279,188,271**	**$92,791,883**	**$463,959,414**	**$927,918,827**

Source: Allegany County 2016
Notes:
RCV Replacement Cost Value

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 are presented in the flood hazard section of this HMP (Section 5.4.4). Generally, losses resulting from flooding associated with severe winter storms should be less than those associated with a 100-year flood. In addition, high winds may accompany winter storm events. The severe storm profile in Section 5.4.9 discusses losses resulting from wind.

Impact on Critical Facilities

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 from the application of salt and intermittent freezing and warming conditions that can damage roads over time. Severe snowfall requires clearing of roadways and alerting of citizens to dangerous conditions; following the winter season, resources for road maintenance and repair are required.

Impact on the Economy

The cost of snow and ice removal, and road repair due to the freezing and thawing 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.

Future Growth and Development

As discussed in Sections 4 and 9 (Volume II), areas targeted for future growth and development have been identified across the County. Any areas of growth could be potentially impacted by the severe winter storm hazard because the entire planning area is exposed and vulnerable. Areas targeted for potential future growth

and development in the next five (5) years have been identified across the County at the municipal level. The jurisdictional annexes in Volume II of this HMP contain additional information.

Current New York State land use and building codes incorporate standards that address and mitigate snow accumulation. Some local municipalities in the State have implemented the following measures to eliminate loss of life and property and infrastructure damages during winter storm events:

- Remove snow from roadways
- Remove dead trees and trim trees/brush from roadways to lessen falling limbs and trees
- Ensure proper road signs are visible and installed properly
- Bury electrical and telephone utility lines to minimize downed lines
- Remove debris and obstructions in waterways and develop routine inspections and maintenance plans to reduce potential flooding
- Replace substandard roofs of critical facilities to reduce exposure to airborne germs resulting from leakage
- Purchase and install backup generators in evacuation facilities and critical facilities offering essential services to residents
- Install cell towers in areas where limited telecommunication is available to increase emergency response and cell phone coverage (NYS DHSES 2014)

Change of Vulnerability

The previous HMP provided an estimated damage calculation for various critical facilities as a result of a severe winter event. For this HMP Update, the County's building inventory replacement cost value is being used to estimate potential losses as a result of severe winter storms. Overall, Allegany County's vulnerability has not changed, and the entire County will continue to be exposed and vulnerable to severe winter storm events.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and economic losses associated with this hazard of concern. Historic data on structural losses to general building stock are not adequate to predict specific losses to this inventory; therefore, the percent of damage assumption methodology was applied. This methodology is based on FEMA's How to Series (FEMA 386-2), "Understanding Your Risks, Identifying and Estimating Losses" (FEMA 2001) and FEMA's "Using HAZUS-MH for Risk Assessment (FEMA 433)" (FEMA 2004). The collection of additional and actual valuation data for general building stock and critical infrastructure losses would further support future estimates of potential exposure and damage for the general building stock inventory. Mitigation strategies addressing early warning, dissemination of hazard information, provisions for snow removal, and backup power are included in Volume II, Section 9 of this HMP.