5.4.2 SEVERE WINTER STORM / EXTREME COLD

This section provides a profile and vulnerability assessment for the severe winter storm and extreme cold hazards.

HAZARD PROFILE

This section provides profile information including description, extent, location, previous occurrences and losses and the probability of future occurrences.

Description

For the purpose of this HMP and as deemed appropriated by the County, most severe winter storm hazards include heavy snow, blizzards, sleet, freezing rain, ice storms and can be accompanied by extreme cold. Since most extra-tropical cyclones, particularly northeasters (or Nor'Easters), generally take place during the winter weather months (with some exceptions). Nor'Easters have also been grouped as a type of severe winter weather storm in this section. In addition, for the purpose of this plan and as consistent with the New York State Hazard Mitigation Plan (NYS HMP), extreme cold temperature events were grouped into this hazard profile. These types of winter events or conditions are further defined below.

Heavy Snow: According to the National Weather Service (NWS), heavy snow is generally snowfall accumulating to 4 inches or more in depth in 12 hours or less; or snowfall accumulating to 6 inches or more in depth in 24 hours or less. A snow squall is an intense, but limited duration, period of moderate to heavy snowfall, also known as a snowstorm, accompanied by strong, gusty surface winds and possibly lightning (generally moderate to heavy snow showers) (NWS, 2005). Snowstorms are complex phenomena involving heavy snow and winds, whose impact can be affected by a great many factors, including a region's climatologically susceptibility to snowstorms, snowfall amounts, snowfall rates, wind speeds, temperatures, visibility, storm duration, topography, and occurrence during the course of the day, weekday versus weekend, and time of season (Kocin and Uccellini, 2004).

Blizzard: Blizzards are characterized by low temperatures, wind gusts of 35 miles per hour (mph) or more and falling and/or blowing snow that reduces visibility to 0.25 miles or less for an extended period of time (three or more hours) (NWS, 2005).

Sleet or Freezing Rain Storm: Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Freezing rain is rain that falls as a liquid but freezes into glaze upon contact with the ground. Both types of precipitation, even in small accumulations, can cause significant hazards to a community (NWS, 2005).

Ice storm: An ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous, and can create extreme hazards to motorists and pedestrians (NWS, 2005).

Extra-Tropical Cyclone: Extra-tropical cyclones, sometimes called mid-latitude cyclones, are a group of cyclones defined as synoptic scale, low pressure, weather systems that occur in the middle latitudes

of the Earth. These storms have neither tropical nor polar characteristics and are connected with fronts and horizontal gradients in temperature and dew point otherwise known as "baroclinic zones". Extra-tropical cyclones are everyday weather phenomena which, along with anticyclones, drive the weather over much of the Earth. These cyclones produce impacts ranging from cloudiness and mild showers to heavy gales and thunderstorms. Tropical cyclones often transform into extra-tropical cyclones at the end of their tropical existence, usually between 30° and 40° latitude, where there is sufficient force from upper-level shortwave troughs riding the westerlies (weather systems moving west to east) for the process of extra-tropical transition to begin. A shortwave trough is a disturbance in the mid or upper part of the atmosphere which induces upward motion ahead of it. During an extra-tropical transition, a cyclone begins to tilt back into the colder air mass with height, and the cyclone's primary energy source converts from the release of latent heat from condensation (from thunderstorms near the center) to baroclinic processes (Canadian Hurricane Centre [CHC], 2003).

Nor'Easter (abbreviation for North Easter): Nor'Easters, named for the strong northeasterly winds blowing in ahead of the storm, are also referred to as a type of extra-tropical cyclones (mid-latitude storms, or Great Lake storms. A Nor'Easter is a macro-scale extra-tropical storm whose winds come from the northeast, especially in the coastal areas of the Northeastern U.S. and Atlantic Canada. More specifically, it describes a low pressure area whose center of rotation is just off the coast and whose leading winds in the left forward quadrant rotate onto land from the northeast. Wind gusts associated with these storms can exceed hurricane forces in intensity. Unlike tropical cyclones that form in the tropics and have warm cores (including tropical depressions, tropical storms and hurricanes); Nor'Easters contain a cold core of low barometric pressure that forms in the mid-latitudes. Their strongest winds are close to the earth's surface and they often measure several hundred miles across. Nor'Easters may occur at any time of the year but are most common during the fall and winter months (September through April) (New York State Emergency Management Office [NYSEMO], 2008).

Nor'Easters can cause heavy snow, rain, gale force winds, and oversized waves (storm surge) that can cause beach erosion, coastal flooding, structural damage, power outages and unsafe human conditions. If a Nor'Easter cyclone stays just offshore, the results are much more devastating than if the cyclone meanders up the coast on an inland track. Nor'Easters that stay inland are generally weaker and only cause strong wind and rain. Those that stay offshore can bring heavy snow, blizzards, ice, strong winds, high waves, and severe beach erosion. In these storms, the warmer air is aloft. Precipitation falling from this warm air moves into the colder air at the surface, causing crippling sleet or freezing rain.

If a significant pressure drop occurs within a Nor'Easter, this change can turn a simple extra-tropical storm into what is known as a "bomb". "Bombs" are characterized by a pressure drop of at least 24 millibars within 24 hours (similar to a rapidly-intensifying hurricane). Even though "bombs" occasionally share some characteristics with hurricanes, the two storms have several differences. "Bombs" (being a type of Nor'Easter) are extra-tropical, and therefore, are associated with fronts, higher latitudes, and cold cores. They require strong upper-level winds, which would destroy a hurricane (McNoldy, Date Unknown).

Extreme Cold: Extreme cold events are when temperatures drop well below normal in an area. Extremely cold temperatures often accompany a winter storm, which often brings snow and ice. What constitutes extreme cold and its effects can vary across different areas of the country. In regions relatively unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." Exposure to cold temperatures, whether indoors or outside, can lead to serious or life-threatening health problems such as hypothermia, cold stress, frostbite or freezing of the exposed extremities such as fingers, toes, nose and ear lobes. Extreme cold can cause emergencies in susceptible populations,

such as those without shelter or who are stranded, or those who live in a home that is poorly insulated or without heat. Infants and the elderly are particularly at risk, but anyone can be affected (Centers of Disease Control and Prevention [CDC], 2005).

According to the National Oceanic and Atmospheric Administration (NOAA) National Severe Storms Laboratory (NSSL); every year, winter weather indirectly and deceptively kills hundreds of people in the U.S., 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. Wind Chill is not the actual temperature but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down body temperature. Animals are also affected by wind chill; however, cars, plants and other objects are not. 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 (NSSL, 2006).

Heavy snow can immobilize a region and paralyze a city, stranding commuters, stopping the flow of supplies, and disrupting emergency and medical services. 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. The cost of snow removal, repairing damages, and loss of business can have large economic impacts on cities and towns (NSSL, 2006).

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).

Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Infants and elderly people are most susceptible. What constitutes extreme cold and its effect varies across different areas of the U.S. In areas unaccustomed to winter weather, near freezing temperatures are also considered "extreme cold." Freezing temperatures can cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. In the north, below zero temperatures may be considered as extreme cold. Long cold spells can cause rivers to freeze, disrupting shipping. Ice dams may form and lead to flooding (NSSL, 2006).

Also, winter storms can generate coastal flooding, ice jams and snow melt, resulting in significant damage and loss of life:

- Coastal Floods: Winds generated from intense winter storms can cause widespread tidal flooding and severe beach erosion along coastal areas.
- Ice Jams: Long cold spells can cause rivers and lakes to freeze. A rise in the water level or a thaw breaks the ice into large chunks that become jammed at man made and natural obstructions. Ice jams can act as a dam, resulting in severe flooding.

- Snowmelt: Sudden thaw of a heavy snow pack often leads to flooding (NSSL, 2006).

Extent

The magnitude or severity of a severe winter storm depends on several factors including a region's climatologically 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, such as those above, and by evaluating its societal impacts. The Northeast Snowfall Impact Scale (NESIS) categorizes snowstorms, including Nor'Easter events, in this manner. Unlike the Fujita and Saffir-Simpson Scales that characterize tornados and hurricanes, respectively, there is no widely used scale to classify snowstorms. NESIS was developed by Paul Kocin of The Weather Channel and Louis Uccellini of the NWS to characterize and rank high-impact, northeast snowstorms. These storms have large areas of 10 inch snowfall accumulations and greater. NESIS has five ranking categories: Notable (1), Significant (2), Major (3), Crippling (4), and Extreme (5) (Table 5.4.2-1). The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus, NESIS gives an indication of a storm's societal impacts. This scale was developed because of the impact northeast snowstorms can have on the rest of the country in terms of transportation and economic impact (Kocin and Uccellini, 2004).

Table 5.4.2-1. NESIS Ranking Categories 1 - 5

Category	Description	NESIS Range	Definition
1	Notable	1.0 – 2.49	These storms are notable for their large areas of 4-in. (10-cm) accumulations and small areas of 10-in. (25-cm) snowfall.
2	Significant	2.5 – 3.99	Includes storms that produce significant areas of greater than 10-in. (25-cm) snows while some include small areas of 20-in. (50-cm) snowfalls. A few cases may even include relatively small areas of very heavy snowfall accumulations [greater than 30 in. (75 cm)].
3	Major	4.0 – 5.99	This category encompasses the typical major Northeast snowstorm, with large areas of 10-in. snows (generally between 50 and 150 × 103 mi^2—roughly 1–3 times the size of New York State with significant areas of 20-in. (50-cm) accumulations.
4	Crippling	6.0 – 9.99	These storms consist of some of the most widespread, heavy snows of the sample and can be best described as crippling to the northeast U.S, with the impact to transportation and the economy felt throughout the United States. These storms encompass huge areas of 10-in. (25-cm) snowfalls, and each case is marked by large areas of 20-in. (50-cm) and greater snowfall accumulations.
5	Extreme	10 +	The storms represent those with the most extreme snowfall distributions, blanketing large areas and populations with snowfalls greater than 10, 20, and 30 in. (25, 50, and 75 cm). These are the only storms in which the 10-in. (25-cm) accumulations exceed 200 × 103 mi^2 and affect more than 60 million people.

Source: Kocin and Uccellini, 2004

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. These numbers are calculated into a raw data number ranking from "1" for an insignificant fall to over "10" for a massive snowstorm. Based on these raw numbers, the storm is placed into its decided category. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers (Enloe, 2007). Storms that have occurred in the northeastern U.S. using this impact scale are listed in Table 5.4.2-4 in the "Previous Occurrences" section of this HMP.

Nor'Easters

Though the occurrence of a Nor'Easter can be forecasted with some accuracy, predicting their impact can be a little more complex. The extent of a Nor'Easter can be categorized by the Dolan-Davis Nor'Easter Intensity Scale. In 1993, researchers Robert Davis and Robert Dolan created this Nor'Easter intensity scale, but it deals primarily with beach and coastal deterioration. This scale, presented as Table 5.4.2-2, categorizes or rates the intensity of Nor'Easters from 1 (weak) to 5 (extreme) based on their storm class. This is used to give an estimate of the potential beach erosion, dune erosion, overwash and property damages expected from a Nor'Easter (Multi-County Environmental Storm Observatory [MESO], 2002).

Table 5.4.2-2. The Dolan-Davis Nor'Easter Intensity Scale

Storm Class	Beach Erosion	Dune Erosion	Overwash	Property Damage
1 (*Weak*)	Minor Changes	None	No	No
2 (*Moderate*)	Modest; mostly to lower beach	Minor	No	Modest
3 (*Significant*)	Erosion extends across the beach	Can be significant	No	Loss of many structures at local level
4 (*Severe*)	Severe beach erosion and recession	Severe dune erosion or destruction	On low beaches	Loss of structures at community level
5 (*Extreme*)	Extreme beach erosion	Dunes destroyed over extensive areas	Massive in sheets and channels	Extensive at regional-scale; millions of dollars

Source: MESO, 2002

Dr. Gregory Ziellinski, Maine state climatologist and an associate research professor at the University of Maine Institute for Quaternary and Climate Studies, developed a way to help weather forecasters and the public understand the likely impacts of winter storms. Dr. Zielinski applies his analysis mainly to two types of storms: Nor'Easters that often intensity in the mid-Atlantic region and move up the coast into New England; and storms that originate east of the Rocky Mountains and that move through the Great Lakes region or up the Ohio River valley. These storms are often called the Witches of November and have been responsible for shipwrecks on the Great Lakes (sinking of the Edmund Fitzgerald) (MESO, 2002).

In an article posted in the January 2002 issue of the Bulletin of the American Meteorological Society (BAMS), Dr. Zielinski explains: "My classification scheme allows forecasters and meteorologists to easily summarize the intensity of a winter storm by giving it an intensity index and placing it into its appropriate category on a 1-5 scale. The potential impact of the storm can then be passed on to public service officials so they may make plans for precipitation amounts, particularly snow, snowfall rates, wind speeds, drifting potential and overall impact on schools, businesses, travelers, and coastal communities" (MESO, 2002).

His approach to storms uses two features of a storm: air pressure and forward speed. Based on the calculations to determine the different characteristics of the storms (Dolan-Davis Nor'Easter Intensity Scale), which reflects the storm's strength, Dr. Zielinski places the storm into a category between one and five. Forward speed is important because even moderately intense storms can have a large impact if they move slowly.

In Dr. Zielinski's classification system, a second number reflecting forward speed is used together with the first number from the Dolan-Davis Nor'Easter Intensity Scale. Like the Intensity Scale, the second

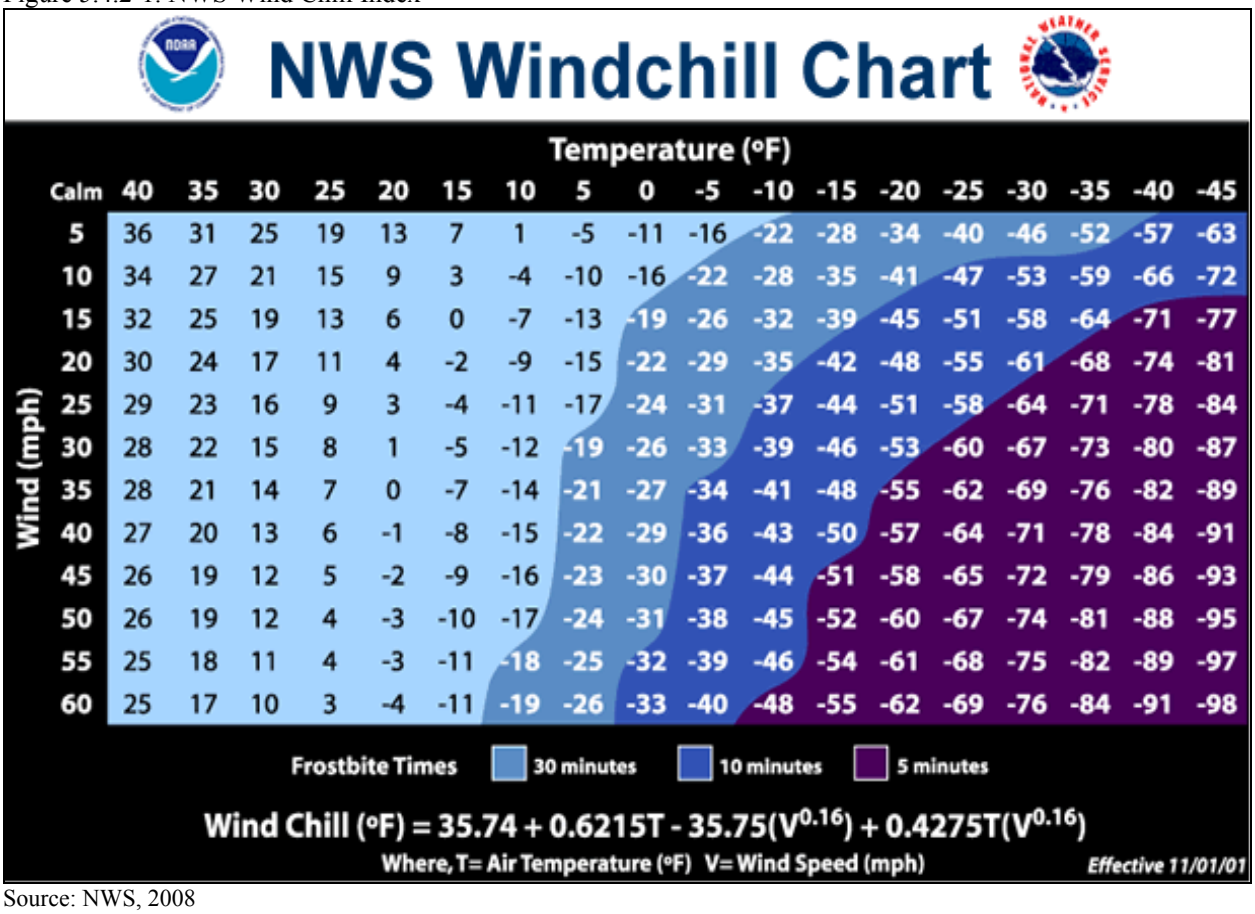
number of his scale ranges between one and five. A five would be the slowest moving and thus longest duration storm. A storm's category might be 2.4 or 4.3, reflecting intensity with the first digit and duration with the second (MESO, 2002).

Dr. Zielinski has used his system to classify more than 70 past storms. He has made over 550 individual classifications, looking at the March 1993 "Storm of the Century", the Great Arctic Outbreak of 1899, and Blizzard of 1888 and other storms that are a part of legendary U.S. weather (Zielinski, 2003).

Extreme Cold Temperatures

The extent (severity or magnitude) of extreme cold temperatures are generally measured through the Wind Chill Temperature (WCT) Index. Whenever temperatures drop well below normal and wind speed increases, heat can leave your body more rapidly (known by the National Weather Service (NWS) as the Wind Chill Temperature Index). The WCT Index is the temperature your body feels when the air temperature is combined with the wind speed. It is based on the rate of heat loss from exposed skin caused by the effects of wind and cold. As the speed of the wind increases, it can carry heat away from your body much more quickly, causing skin temperature to drop. When there are high winds, serious weather-related health problems are more likely, even when temperatures are only cool. The importance of the wind chill index is as an indicator of how to dress properly for winter weather to avoid extreme cold affects to human health. The Wind Chill Chart (Figure 5.4.2-1), which was improved in November 2001 from its original 1945 version, shows the difference between actual air temperature and perceived temperature, and amount of time until frostbite occurs (NWS, 2008).

Figure 5.4.2-1. NWS Wind Chill Index

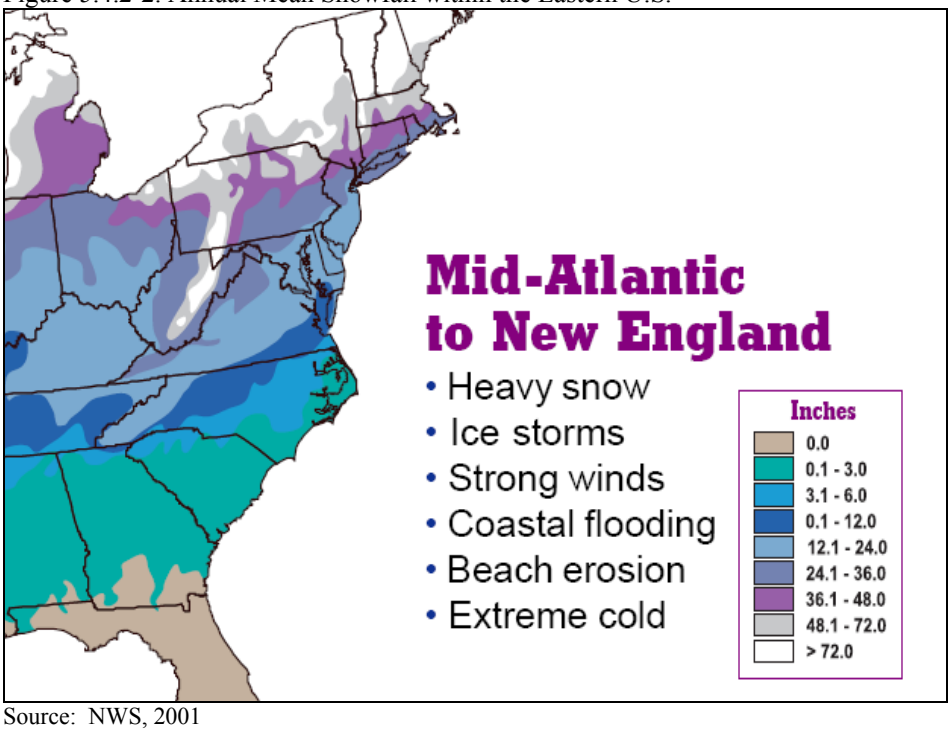


Source: NWS, 2008

Location

Winter weather, particularly snowstorm events, has historically affected many U.S. states, mainly in the Northeast and Midwest. 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° F. As indicated in the NYS HMP, communities in New York State receive more snow than most other communities in the Nation. Syracuse, Buffalo, Rochester, and Albany are typically in the top 10 cities in the Nation in annual snowfall. These municipalities are located in Onondaga, Erie, Monroe, and Albany Counties. Although the entire State is subject to winter storms, the easternmost and west-central portions of the State are more likely to suffer winter storm occurrences than are other locations (New York State Disaster Preparedness Commission [NYSDPC], 2008). 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, which includes all of Onondaga County (Figure 5.4.2-2).

Figure 5.4.2-2. Annual Mean Snowfall within the Eastern U.S.



Source: NWS, 2001

Topography, elevation and proximity to large bodies of water result in a great variation of snowfall in the State's interior, even within relatively short distances. Maximum seasonal snowfall, averaging more than 175 inches, occurs on the western and southwestern slopes of the Adirondacks and Tug Hill. A secondary maximum of 150 to 180 inches prevails in the southwestern highlands, some 10 to 30 miles inland from Lake Erie. Record heavy snow accumulations, averaging from 100 to 120 inches, also occur within (1) the uplands of southwestern Onondaga County and adjoining counties; the Cherry Valley section of northern Otsego and southern Herkimer counties; and (3) the Catskill highlands in Ulster, Delaware and Sullivan counties. Based on this information, all of Onondaga County is susceptible to winter storms (NCDC, Date Unknown).

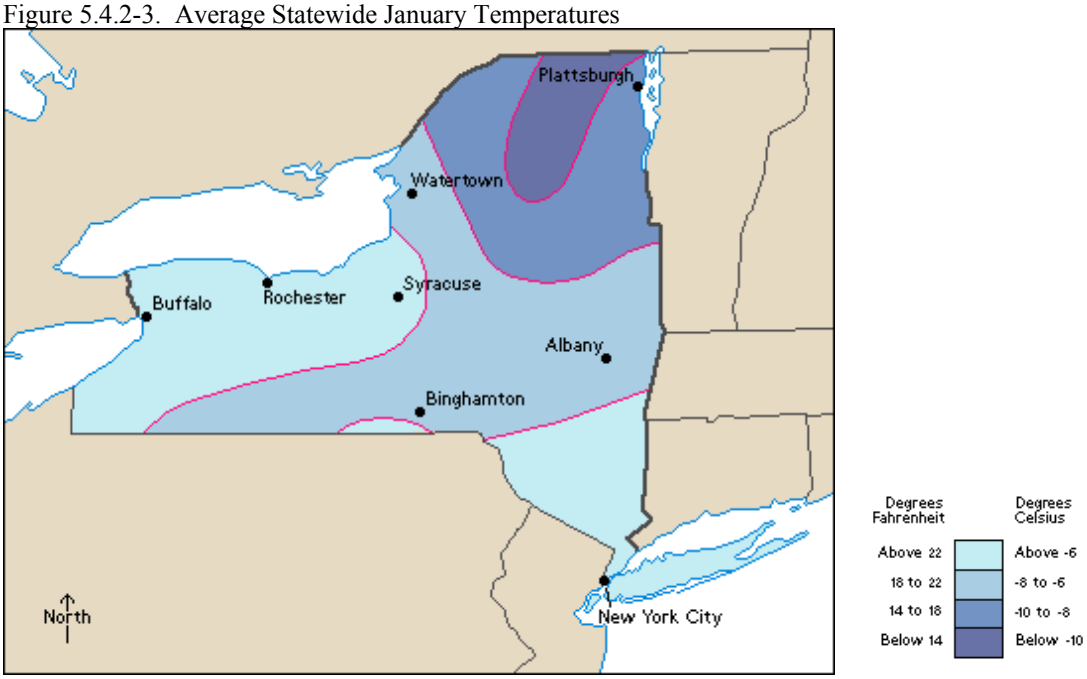
Overall, the NYSDPC and NYSEMO listed Onondaga County as the 7h county in the State most threatened by and vulnerable to snow and snow loss, with an annual average snowfall of between 107 and

114 inches (NYSDPC, 2008; Greater Syracuse Chamber of Commerce, 2008). Onondaga County is also listed as the 2nd county in New York State most threatened by and vulnerable to ice storms and ice storm loss. The County has been categorized as an "Extreme Snowfall Potential" area within the State. Counties are identified as having an extreme snowfall potential based on two general categories: (1) areas that are historically vulnerable to persistent heavy Lake Effect or enhanced snow from Lakes Erie and Ontario; and (2) those with elevation and latitude snow vulnerability. Counties that fall within these categories include Erie, Cattaraugus, and Chautauqua Counties (border of Lake Erie); and Oswego, Jefferson, Lewis, Onondaga, Madison, Oneida, and Herkimer (border of Lake Ontario) (NYSDPC, 2008).

Extreme Cold Temperatures

Extreme cold temperatures are existent throughout most of the winter season and generally accompany most winter storm events throughout the State. The New York State Climate (NYSC) Office of Cornell University indicates that cold temperatures prevail over the State whenever arctic air masses, under high barometric pressure, flow southward from central Canada or from Hudson Bay (NYSC, Date Unknown). Figure 5.4.2-3, identifies the average January temperatures of the State, with the northeast sections experiencing the coldest conditions and the west and southeast experiencing the mildest winters.

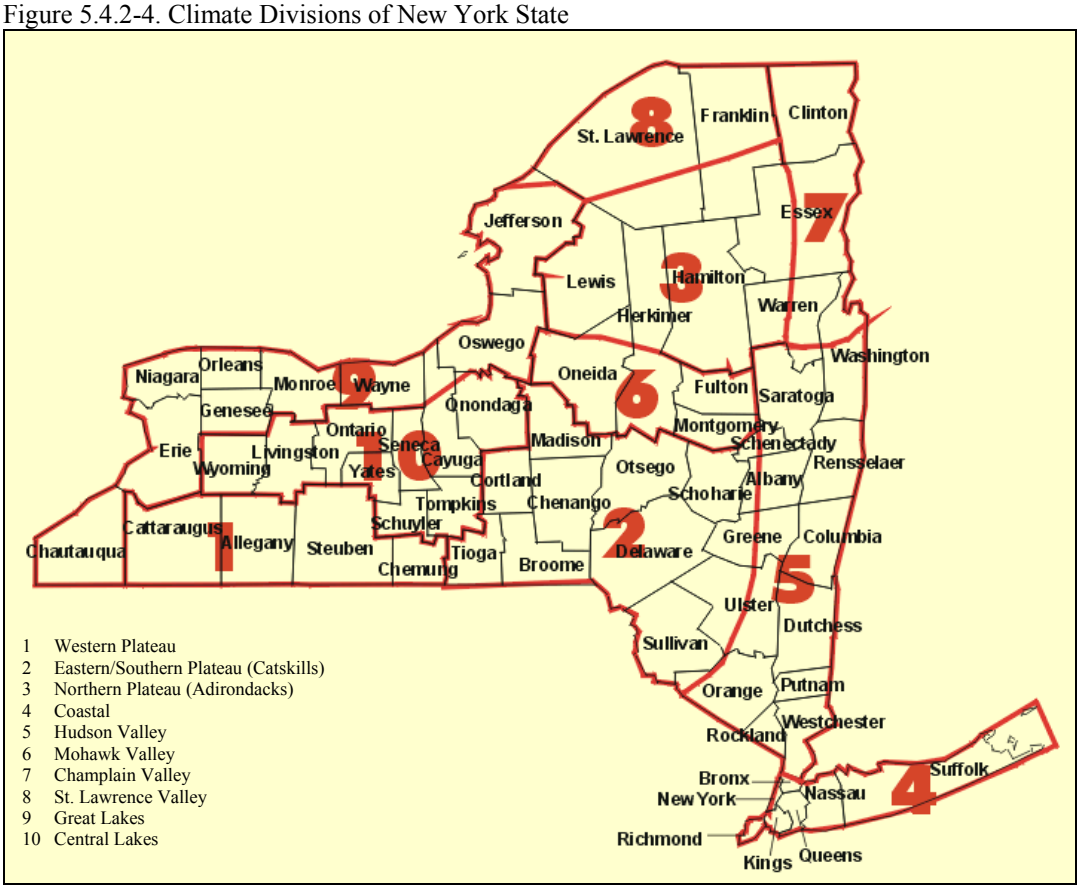
Figure 5.4.2-3. Average Statewide January Temperatures



Source: World Book Inc., 2007

The record coldest temperature in New York State is -52°F at Stillwater Reservoir (northern Herkimer County) on February 9, 1934 and also at Old Forge (also northern Herkimer County) on February 18, 1979. Some 30 communities have recorded temperatures of -40°F or colder, most of them occurring in the northern one-half of the State and the remainder in the Western Plateau Climate Division and in localities just south of the Mohawk Valley (Climate Division 6) (Earth System Research Laboratory [ESRL], Date Unknown; NYSC, Date Unknown). Figure 5.4.2-4 identifies the 10 climate divisions of the State: Western Plateau (1), Eastern Plateau (Catskill Mountains) (2), Northern Plateau (Adirondack Mountains) (3), Coastal (4), Hudson Valley (5), Mohawk Valley (6), Champlain Valley (7), St. Lawrence Valley (8), Great Lakes (9), and Central Lakes (10) (CPC, 2005). These regions have been divided because they are climatically homogenous or similar in comparison (Energy Information Administration, 2005).

Figure 5.4.2-4. Climate Divisions of New York State



Source: CPC, 2005; NYSC, Date Unknown

Onondaga County falls within the Central Lakes Climate Division (Division 10) (NCDC, Date Unknown; CPC, 2005; ERSL, Date Unknown). With the County located in such close proximity to the Great Lakes Climate Division (Division 9), much of the temperature conditions are similar in comparison. Winter temperatures are moderated considerably in the Great Lakes Plain. The moderating influence of Lake Erie and Lake Ontario is comparable to that produced by the Atlantic Ocean in the southern portion of the Hudson Valley. The coldest temperature in most winters will range between 0°F and -10°F (NYSC, Date Unknown).

As provided by The Weather Channel, a range of average high and low temperatures during the winter months in Onondaga County are identified in Table 5.4.2-3.

Table 5.4.2-3. Average High and Low Temperature Range for Winter Months in Onondaga County

Month	Average High	Average Low	Record Low Event(s)
January	26 to 31 ^{O}F	10 to 14^{O}F	-26^{O}F (1966)
February	29 to 34^{O}F	12 to 16^{O}F	-32^{O}F (1934)
March	37 to 43^{O}F	20 to 24^{O}F	-41^{O}F (1938)
November	42 to 47^{O}F	27 to 32^{O}F	1^{O}F (1933); 1^{O}F (1942)
December	31 to 36^{O}F	17 to 21^{O}F	-29^{O}F (1980)

Source: The Weather Channel, 1995-2007

Previous Occurrences and Losses

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

According to Paul Kocin of The Weather Channel, Louis Uccellini of the NWS, and Jesse Enloe of NOAA, over 74 snowstorm incidences were identified and ranked that affected the northeastern U.S between 1888 and 2007 (Table 5.4.2-4) (Kocin and Uccellini, 2004; Enloe, 2007). These storms have large areas of 10 inch snowfall accumulations and greater. Although the severity of these events may vary throughout the State, many of these listed storms impacted Onondaga County. This list does not represent all storms that may have impacted the northeastern U.S.

Table 5.4.2-4. Snowstorm Cases That Affected the Northeastern U.S (1888 – 2007)

Rank	Date	NESIS	Category	Description	Snowfall Range in Onondaga County (in inches)
1	March 12-14, 1993	12.52	5	Extreme	30-40
2	January 6-8, 1996	11.54	5	Extreme	0
3	February 15-18, 2003	8.91	4	Crippling	4-20
4	March 11-14, 1888	8.34	4	Crippling	4-10
5	February 11-14, 1899	8.11	4	Crippling	0
6	March 2-5, 1960	7.63	4	Crippling	4-20
7	January 21-24, 2005*	6.80	4	Crippling	NA
8	February 10-12, 1983	6.28	4	Crippling	0
9	February 5-7, 1978	6.25	4	Crippling	10-20
10	February 2-5, 1961	6.24	4	Crippling	20-40
11	February 14-17, 1958	5.98	3	Major	4-20
12	January 19-21, 1978	5.90	3	Major	10-20
13	January 11-14, 1964	5.74	3	Major	0-4
14	February 12-15, 2007*	5.63	3	Major	10-30
15	December 25-28, 1969	5.19	3	Major	10-30
16	January 29-31, 1966	5.05	3	Major	20-40
17	January 21-23, 1987	4.93	3	Major	4-10
18	January 7-8, 1988	4.85	3	Major	NA
19	February 8-12, 1994	4.81	3	Major	4-10
20	December 11-13, 1960	4.47	3	Major	0-4
21	January 22-23, 1966	4.45	3	Major	NA
22	February 17-19, 1979	4.42	3	Major	0
23	December 24-25, 2002	4.42	3	Major	4-10

Rank	Date	NESIS	Category	Description	Snowfall Range in Onondaga County (in inches)
24	February 18-20, 1972	4.19	3	Major	10-30
25	February 14-15, 1960	4.17	3	Major	NA
26	January 16-18, 1978	4.10	3	Major	NA
27	February 12-13, 2006*	4.10	3	Major	0
28	February 22-28, 1969	4.01	3	Major	0-4
29	March 18-21, 1958	3.92	2	Significant	0-4
30	February 5-7, 1967	3.82	2	Significant	0
31	December 23-25, 1966	3.79	2	Significant	4-20
32	April 6-7, 1982	3.75	2	Significant	4-10
33	March 3-5, 1971	3.73	2	Significant	NA
34	March 12-13, 1959	3.64	2	Significant	NA
35	January 27-29, 1922	3.63	2	Significant	0
36	March 3-5, 2001	3.53	2	Significant	10-20
37	February 2-4, 1995	3.51	2	Significant	4-20
38	December 26-27, 1947	3.50	2	Significant	0-4
39	January 18-21, 1961	3.47	2	Significant	0
40	March 2-4, 1994	3.46	2	Significant	NA
41	February 8-10, 1969	3.34	2	Significant	0
42	December 19-20, 1995	3.32	2	Significant	NA
43	December 22-23, 1963	3.17	2	Significant	NA
44	January 24-26, 2000	3.14	2	Significant	4-20
45	December 10-12, 1992	3.10	2	Significant	NA
46	January 13-15, 1982	3.08	2	Significant	NA
47	March 16-17, 1956	2.93	2	Significant	NA
48	January 3-5, 1994	2.87	2	Significant	NA
49	March 6-7, 1962	2.76	2	Significant	NA
50	January 3-4, 2003	2.65	2	Significant	10-20
51	March 15-18, 2007*	2.55	2	Significant	4-20
52	December 30-31, 2000	2.48	1	Notable	0
53	February 19-20, 1964	2.39	1	Notable	NA
54	March 31-April 1, 1997	2.37	1	Notable	0-4
55	November 25-27, 1971	2.33	1	Notable	NA
56	January 1-2, 1987	2.26	1	Notable	NA
57	March 18-19, 1956*	2.23	1	Notable	0
58	March 15-16, 1999	2.20	1	Notable	NA

Rank	Date	NESIS	Category	Description	Snowfall Range in Onondaga County (in inches)
59	February 16-17, 1952	2.17	1	Notable	NA
60	December 31 – January 1, 1971	2.10	1	Notable	NA
61	February 2-4, 1996	2.03	1	Notable	NA
62	December 4-5, 2002	1.99	1	Notable	0
63	January 16-17, 1965	1.95	1	Notable	NA
64	March 28-29, 1984	1.86	1	Notable	NA
65	January 25-26, 1987	1.70	1	Notable	0
66	February 16-17, 1996	1.65	1	Notable	NA
67	February 14-15, 1962	1.59	1	Notable	NA
68	December 26-27, 1990	1.56	1	Notable	0-4
69	February 22-23, 1987	1.46	1	Notable	0
70	December 23-25, 1961	1.37	1	Notable	NA
71	December 3-5, 1957	1.32	1	Notable	NA
72	March 8-9, 1984	1.29	1	Notable	NA
73	March 21-22, 1967	1.20	1	Notable	NA
74	February 6-7, 2003	1.18	1	Notable	0

Source: Kocin and Uccellini, 2004; Enloe, 2007
Note (1): The two sources used for this table identify different NESIS ratings for each event; therefore, the NESIS rating may vary upon reviewing the source.
Note (2): Storms are arranged by rank/category
* Additional events listed by Jesse Enloe (NOAA) between 2003 and 2007 that were not identified by Kocin and Uccellini.
NA Information regarding actual snowfall totals was not provided for these events.

Between 1953 and 2007, FEMA declared that New York State experienced over 18 winter storm-related disasters (DR) or emergencies (EM) classified as one or a combination of the following disaster types: winter storms, severe storms, coastal storms, ice storm, blizzard, snowstorm, severe Nor'Easter and flooding. Generally, these disasters covered a wide region of the State; therefore, they may have impacted many counties. However, not all counties were declared as disaster areas. Of those events, the NYS HMP and other sources indicate that Onondaga County has been declared as a disaster area as a result of 2 winter storm events (FEMA, 2008; NYSDPC, 2008). No extreme cold temperature events resulted in federal disaster declarations. Table 5.4.2-5 summarizes the FEMA Presidential Disaster (DR) or Emergency (EM) Declarations for winter storm events for the County.

Table 5.4.2-5. Presidential Disaster / Emergency Declarations for Severe Winter Storm Events in Onondaga County

Type of Event*	Date**	Declaration Number	Cost of Losses (approximate)***
Severe Blizzard ("The Storm of the Century") (also identified as a Nor'Easter);	March 1993	EM-3107	Listed as a top billion dollar weather disaster storm, impacting 26 states and resulted in approximately $3 B in damages. FEMA declared an EM in 17 states, including New York State. New York State experienced approximately $8.4 M in eligible damages (NYSDPC). Onondaga County received between 30 to 50 inches of snow from this event. Syracuse received 43.0 inches of snow. Snow totals in Skaneateles ranged between 26.0 and 34.9 inches. All Onondaga County schools were closed from this event, including Syracuse University. Onondaga County experienced approximately $455 K in property damages.
Ice Storm	April 2003	DR-1467	In central New York State this storm caused widespread damage, disrupted vital transportation routes and downed trees and power lines, cutting electric power to more than 300,000 customers. New York State experienced between $28.5 and $41.4 M in eligible damages (NYSDPC) In the Town of Clay, the Moyer's Corner Fire Department received 157 calls related to water problems, downed wires, pole fires, citizen assistance, fumes, outdoor fires, structure fires, car accidents, chimney fires, an explosion, and EMS-related incidences all caused by this ice storm event. Onondaga County experienced approximately $2.9 M in property damages. More than $25 M in disaster aid has been approved for the State. Disaster aid within Onondaga County is unknown.

Source: FEMA, 2008; NCDC, 2008; NYSEMO, 2006; Kocin and Uccellini, 2004

* The 'Type of Event' is the disaster classification that was assigned to the event by FEMA.

** Date of Incident

*** Flood impact or damage associated with any of these events are further discussed in Section 5.4.1

Notes: Dollars rounded to nearest thousand. Recorded losses indicate the dollar value of covered losses paid, as available through the public records reviewed. B = Billion, K = Thousand, M = Million

Based on all sources researched, many severe winter storm and extreme cold events have impacted Onondaga County, as summarized in Table 5.4.2-6. With flood documentation for New York State being so extensive, not all sources may have been identified or researched. Hence, Table 5.4.2-6 may not include all events that have occurred throughout the region.

Table 5.4.2-6 Severe Winter Events between 1888 and 2007

Event Date / Name	Location	Losses / Impacts	Source(s)
Blizzard March 11-14, 1888 (Blizzard of '88 or "Great White Hurricane")	Multi-State	$25 M nationwide in fire losses, 4 to 10 inches of snow fell in Onondaga County.	Brunner, Kocin and Uccellini, NWS
Snowstorm March 1, 1900	Village of Baldwinsville	Village of Baldwinsville received 20.0 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm January 17, 1904	Village of Baldwinsville	Village of Baldwinsville received 19.0 inches of snow.	NCDC Station Snow Climatology Database
Extreme Cold January 19, 1904	Village of Baldwinsville	Record cold event for this station between 1893 and 1908 recorded at -28^{O}F.	MRCC
Extreme Cold December 30, 1917	Countywide	Low temperatures throughout the Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, Village of East Syracuse, Village of Fayetteville, Village of Liverpool, Town of Manlius, Village of Minoa: -20^{O}F.	The Weather Channel
Extreme Cold November 16, 1933	Countywide	Record low temperatures for month of November throughout Town of Elbridge, Town of Marcellus, Town of Skaneateles: 1^{O}F.	The Weather Channel
Extreme Cold December 29-30, 1933	Countywide	Low temperatures throughout Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, Village of East Syracuse, Village of Fayetteville, Village of Liverpool, Town of Manlius, Village of Minoa: -24^{O}F. Record low temperatures for month of December throughout Town of Elbridge, Town of Marcellus, Town of Skaneateles: -21^{O}F.	The Weather Channel
Extreme Cold February 8-10, 1934	Countywide	Low temperatures throughout Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, Village of East Syracuse, Village of Fayetteville, Village of Liverpool, Town of Manlius, Village of Minoa: -22 to -24^{O}F. Record low temperatures for month of February throughout Town of Elbridge, Town of Marcellus, Town of Skaneateles: -32^{O}F.	The Weather Channel
Extreme Cold March 3, 1938	Countywide	Record low temperatures for month of March throughout Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, Village of East Syracuse, Village of Fayetteville, Village of Liverpool, Town of Manlius, Town of Minoa: -41^{O}F.	The Weather Channel
Extreme Cold	Countywide	Record low temperatures for month of November throughout	The Weather Channel

Event Date / Name	Location	Losses / Impacts	Source(s)
November 25, 1942		Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, Village of East Syracuse, Village of Fayetteville, Village of Liverpool, Town of Manlius, Village of Minoa: 1°F.	
Extreme Cold December 19-20, 1942	Countywide	Record low temperatures for month of December throughout Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, Village of East Syracuse, Village of Fayetteville, Village of Liverpool, Town of Manlius, Village of Minoa: -26°F. Low temperatures also throughout Town of Elbridge, Town of Marcellus, Town of Skaneateles: -20°F.	The Weather Channel
Snowstorm November 30 – December 3, 1944	Town of Skaneateles, City of Syracuse	Town of Skaneateles received 29.5 inches of snow; City of Syracuse received 30.4 inches of snow.	NCDC Station Snow Climatology Database
Extreme Cold January 18, 1945	Countywide	Record low temperatures for month of January throughout Town of Elbridge, Town of Marcellus, Town of Skaneateles: -23°F.	The Weather Channel
Snowstorm February 15-16, 1946	City of Syracuse	City of Syracuse received 34.2 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm March 3-5, 1947	Hamlet of Brewerton	Hamlet of Brewerton received between 17.0 and 46.8 inches of snow.	NCDC Station Snow Climatology Database
Extreme Cold February 1, 1948	Countywide	Low temperatures throughout Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, East Syracuse, Town of Fayetteville, Village of Liverpool, Town of Manlius, Village of Minoa: -20°F.	The Weather Channel
Extreme Cold March 12, 1948	Countywide	Low temperatures throughout Town of Elbridge, Town of Marcellus, Town of Skaneateles: -14°F.	The Weather Channel
Extreme Cold March 4, 1950	Countywide	Low temperatures throughout Village of Baldwinsville, Town of Camillus, Town of Cicero, Town of Clay, City of Syracuse, Village of East Syracuse, Village of Fayetteville, Village of Liverpool, Town of Manlius, Town of Minoa: -16°F.	The Weather Channel
Snowstorm December 16-19, 1951	Village of Baldwinsville	Village of Baldwinsville received between 19.5 and 27.3 inches of snow.	NCDC Station Snow Climatology Database
Extreme Cold December 21, 1955	Countywide	Low temperatures throughout Village of Baldwinsville, Towns of Camillus, Cicero, and Clay, City of Syracuse, Village of East Syracuse, and Towns of Fayetteville, Liverpool, Manlius, Minoa: -20°F.	The Weather Channel
Extreme Cold January 15, 1957	Countywide	Low temperatures throughout the Village of Baldwinsville, Towns of Camillus, Cicero, and Clay, City of Syracuse, Village of East Syracuse, and Towns of Fayetteville, Liverpool, Manlius, Minoa: -24°F.	The Weather Channel
Snowstorm	Hamlet of	Hamlet of Brewerton received 22.0 inches of snow.	NCDC Station Snow Climatology

Event Date / Name	Location	Losses / Impacts	Source(s)
February 10, 1958	Brewerton		Database
Snowstorm February 14-15, 1960	Village of Baldwinsville	Onondaga County experienced over $8 K in property damages. Village of Baldwinsville received 20.5 inches of snow.	Hazards and Vulnerability Research Institute (SHELDUS), NCDC Station Snow Climatology Database
Snowstorm February 18-20, 1960	Town of Skaneateles	Onondaga County experienced over $8 K in property damages. Town of Skaneateles received 22.0 inches of snow.	NCDC Station Snow Climatology Database, Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm March 2-5, 1960	Multi-County	Onondaga County experienced over $8 K in property damages. 4 to 20 inches of snow fell in Onondaga County.	Hazards and Vulnerability Research Institute (SHELDUS), Kocin and Uccellini
Extreme Cold March 11, 1960	Countywide	Low temperatures throughout the Towns of Elbridge, Marcellus, Skaneateles: -14^{O}F.	The Weather Channel
Snowstorm / Extreme Cold February 2-5, 1961	Statewide	Onondaga County experienced approximately $80 K in property damages. 20 to 40 inches of snow fell in Onondaga County.	Hazards and Vulnerability Research Institute (SHELDUS), Kocin and Uccellini, Evans, The Weather Channel
Snowstorm October 23-27, 1962	City of Syracuse	City of Syracuse received 26.0 inches of snow.	NCDC Station Snow Climatology Database
Extreme Cold January 26, 1966	City of Syracuse	Record cold event for this station between 1922 and 2003 recorded at -26^{O}F. Also a record cold event for the month of January in the Village of Baldwinsville, Towns of Camillus, Cicero, Clay, Village of East Syracuse, and the Towns of Fayetteville, Liverpool, Manlius, Minoa	MRCC, The Weather Channel
Snowstorm January 29-31, 1966	Multi-County	20 to 40 inches of snow fell in Onondaga County. Town of Skaneateles received 21.0 inches of snow.	Kocin and Uccellini, NCDC Station Snow Climatology Database
Snowstorm January 30 through February 5, 1966	Town of Skaneateles, City of Syracuse	Town of Skaneateles received 31.5 inches of snow; City of Syracuse received 44.0 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm December 23-29, 1966	Multi-County	4 to 20 inches of snow fell in Onondaga County. Hamlet of Brewerton received 16.5 inches of snow.	Kocin and Uccellini, NCDC Station Snow Climatology Database
Extreme Cold November 16, 1967	Countywide	Record low temperatures for month of November throughout the Towns of Fabius, Pompey, Tully: 0^{O}F.	The Weather Channel
Extreme Cold January 8-9, 1968	Countywide	Low temperatures throughout the Village of Baldwinsville, Towns of Camillus, Cicero, Clay, City of Syracuse, Village of East Syracuse, Towns of Fabius, Fayetteville, Liverpool, Manlius, Minoa, Pompey, Tully: -17 to -22^{O}F.	The Weather Channel
Snowstorm November 13-14, 1968	Town of Skaneateles	Town of Skaneateles received 15.0 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm December 25-28, 1969	Multi-County	Onondaga County experienced approximately $8 K in property damages. 10 to 30 inches of snow fell in Onondaga County.	Kocin and Uccellini, NCDC Station Snow Climatology Database, NWS, Hazards and Vulnerability Research Institute (SHELDUS)

Event Date / Name	Location	Losses / Impacts	Source(s)
Extreme Cold February 26, 1970	Countywide	Low temperatures throughout Fabius, Pompey, Tully: -21^{O}F.	The Weather Channel
Snowstorm March 4-5, 1971	Village of Baldwinsville, Town of Skaneateles	Onondaga County experienced approximately $806 in property damages. Village of Baldwinsville received 31.0 inches of snow; Town of Skaneateles received 30.8 inches of snow.	NCDC Station Snow Climatology Database, Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm / Extreme Cold February 18-23, 1972	Multi-County	Onondaga County experienced approximately $803 in property damages. 10 to 20 inches of snow fell in Onondaga County. Town of Skaneateles received 17.0 inches of snow.	Kocin and Uccellini, NCDC Station Snow Climatology Database, The Weather Channel, Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm November 6-9, 1973	Village of Baldwinsville	Village of Baldwinsville received 14.8 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm December 20, 1973	Countywide	Onondaga County experienced approximately $83 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm April 5-8, 1975	Town of Skaneateles	Town of Skaneateles received 19.0 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm May 18, 1976	Countywide	Onondaga County experienced approximately $31 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Extreme Cold January 18, 1976	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: -20^{O}F.	The Weather Channel
Snowstorm November 9-14, 1976	Village of Baldwinsville, Hamlet of Brewerton	Village of Baldwinsville received 17.7 inches of snow; Hamlet of Brewerton received 26.5 inches of snow	NCDC Station Snow Climatology Database
Extreme Cold November 30, 1976	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: 1^{O}F.	The Weather Channel
Blizzard January 27-28, 1977	Countywide	Resulted in an Emergency Declaration in New York State counties (EM-3027), however, it did not include Onondaga County. Onondaga County experienced approximately $2.1 M in property damages.	FEMA, Hazards and Vulnerability Research Institute (SHELDUS)
Blizzard January 7, 1978	Countywide	Onondaga County experienced approximately $31 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm January 17-25, 1978	Countywide	10 to 20 inches of snow fell in Onondaga County. Onondaga County experienced approximately $63 K in property damages. Town of Skaneateles received 25.0 inches of snow.	Kocin and Uccellini, Hazards and Vulnerability Research Institute (SHELDUS), NCDC Station Snow Climatology Database
Blizzard February 5-8, 1978	Multi-County	10 to 20 inches of snow fell in Onondaga County. Onondaga County experienced approximately $31 K in property damages.	Kocin and Uccellini, NCDC Station Snow Climatology Database
Snowstorm December 25-29, 1978	Town of Skaneateles	Town of Skaneateles received 26.0 inches of snow.	NCDC Station Snow Climatology Database
Extreme Cold February 17-18, 1979	Countywide	Record low temperatures for month of February throughout the Village of Baldwinsville, Towns of Camillus, Cicero, Clay, City of	The Weather Channel

Event Date / Name	Location	Losses / Impacts	Source(s)
		Syracuse, Village of East Syracuse, and Towns of Fabius, Fayetteville, Liverpool, Manlius, Minoa, Pompey, Tully: -22 to 26^{O}F.	
Extreme Cold March 1, 1980	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: -9 to -10^{O}F.	The Weather Channel
Extreme Cold December 25, 1980	Countywide	Low temperatures throughout the Village of Baldwinsville, Towns of Camillus, Cicero, and Clay, City of Syracuse, Village of East Syracuse, and Towns of Fayetteville, Liverpool, Manlius, Minoa: -22^{O}F. Record low temperatures for month of December throughout the Towns of Fabius, Pompey, Tully: -29^{O}F.	The Weather Channel
Extreme Cold January 3-4, 1981	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: -10 to -20^{O}F.	The Weather Channel
Snowstorm / Extreme Cold January 10-12, 1982	City of Syracuse	Onondaga County experienced approximately $5 K in property damages. City of Syracuse received 22.9 inches of snow. Low temperatures throughout Village of Baldwinsville, Towns of Camillus, Cicero, and Clay, City of Syracuse, Village of East Syracuse, and Towns of Fayetteville, Liverpool, Manlius, Minoa: -25^{O}F.	Hazards and Vulnerability Research Institute (SHELDUS), NCDC Station Snow Climatology Database, The Weather Channel
Snowstorm April 6-7, 1982	Multi-County	Onondaga County experienced approximately $20 K in property damages. 4 to 10 inches of snow fell in Onondaga County.	Hazards and Vulnerability Research Institute (SHELDUS), Kocin and Uccellini
Snowstorm April 20-22, 1983	Town of Skaneateles	Town of Skaneateles received 19.0 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm February 27, 1984	Multi-County	Onondaga County experienced approximately $156 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm March 1-4, 1984	Village of Baldwinsville, Hamlet of Brewerton	Village of Baldwinsville received 35.5 inches of snow; Hamlet of Brewerton received 39.7 inches of snow.	NCDC Station Snow Climatology Database
Extreme Cold March 12, 1984	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: -11^{O}F.	The Weather Channel
Snowstorm March 29, 1984	Multi-County	Onondaga County experienced approximately $42 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm December 6-8, 1984	Village of Baldwinsville, Hamlet of Brewerton	Village of Baldwinsville received 20.0 inches of snow; Hamlet of Brewerton received 25.3 inches of snow.	NCDC Station Snow Climatology Database
Snowstorm January 21-24, 1987	Multi-County	4 to 10 inches of snow fell in Onondaga County.	Kocin and Uccellini, NCDC Station Snow Climatology Database
Extreme Cold February 15-16, 1987	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: -19^{O}F.	The Weather Channel
Extreme Cold December 12, 1988	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: -10 ^{O}F.	The Weather Channel

Event Date / Name	Location	Losses / Impacts	Source(s)
Snowstorm January 29, 1989	Countywide	Onondaga County experienced approximately $24 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm February 15, 1990	Countywide	Onondaga County experienced approximately $20 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm December 3, 1990	Countywide	Onondaga County experienced approximately $27 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm December 15, 1990	Countywide	Onondaga County experienced approximately $25 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm December 28, 1990	Countywide	Onondaga County experienced approximately $25 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm November 11, 1991	Countywide	Onondaga County experienced approximately $27 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm December 4-7, 1991	Village of Baldwinsville	Onondaga County experienced approximately $2 K in property damages. Village of Baldwinsville received 21.5 inches of snow.	Hazards and Vulnerability Research Institute (SHELDUS), NCDC Station Snow Climatology Database
Snowstorm January 3, 1993	Countywide	Onondaga County experienced approximately $31 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm February 6, 1993	Countywide	Onondaga County experienced approximately $31 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Severe Blizzard "The Storm of the Century" March 12-15, 1993 FEMA EM-3107	Statewide	See FEMA Disaster Declarations (Table 5.4.2-5)	FEMA, Kocin and Uccelliini, NYSDPC, NCDC Station Snow Climatology Database, NWS, Arnold (The Post Standard), Carr (Syracuse-Herald Journal)
Extreme Cold March 19, 1993	Countywide	Record low temperatures for month of March throughout the Towns of Elbridge, Marcellus, Skaneateles: -14^{O}F.	The Weather Channel
Snowstorm April 21-22, 1993	Countywide	Onondaga County experienced approximately $100 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm December 21, 1993	Countywide	Onondaga County experienced approximately $50 K in property damages.	NOAA-NCDC
Snowstorm January 4-7, 1994	Village of Brewerton	Onondaga County experienced approximately $21 K in property damages. Village of Brewerton received 28.4 inches of snow.	Hazards and Vulnerability Research Institute (SHELDUS), NCDC Station Snow Climatology Database
Extreme Cold / Snow January 17, 1994	Countywide	Low temperatures throughout the Towns of Fabius, Pompey, Tully: -20^{O}F. Onondaga County experienced approximately $2 K in property damages from heavy snow.	The Weather Channel, Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm March 1-3, 1994	Town of Skaneateles	Onondaga County experienced approximately $35 K in property damages.	NOAA-NCDC, Hazards and Vulnerability Research Institute (SHELDUS)
Snowstorm February 2-4, 1995	Multi-State	4 to 20 inches of snow fell in Onondaga County.	Kocin and Uccellini
Snowstorm February 7-10, 1995	Village of Baldwinsville	Village of Baldwinsville received between 26.0 and 36.5 inches of snow.	NCDC Station Snow Climatology Database

Event Date / Name	Location	Losses / Impacts	Source(s)
Snowstorm November 14-16, 1995	Town of Skaneateles, City of Syracuse	Onondaga County experienced approximately $2.5 K in property damages. Town of Skaneateles received 17.5 inches of snow; City of Syracuse received 25.8 inches of snow.	Hazards and Vulnerability Research Institute (SHELDUS), NCDC Station Snow Climatology Database
Extreme Cold January 5-7, 1996	Countywide	Low temperatures throughout the Village of Baldwinsville, Towns of Camillus, Cicero, and Clay, City of Syracuse, Village of East Syracuse, and Towns of Fayetteville, Liverpool, Manlius, Minoa: -11 to -24^{O}F.	The Weather Channel
Extreme Cold February 5-7, 1996	Multi-County	Low temperatures in the City of Syracuse ranging between -15 and -24^{O}F	NOAA-NCDC
Snowstorm December 30-31, 1997	Syracuse	Syracuse received 18.6 inches of snow. City officials declared a state of emergency, and for the first time in more than four years, postal service was canceled in the City of Syracuse.	NCDC Station Snow Climatology Database, Sengupta (New York Times)
Snowstorm March 5, 1999	Multi-County	Resulted in an Emergency Declaration for 6 New York State counties (EM-3138), however, it did not include Onondaga County. However, Governor George E. Pataki did declare a disaster emergency for 17 counties in western New York State after this huge snowfall immobilized the region. The 17 counties included Monroe, Seneca, Schuyler, St. Lawrence, Madison, Onondaga, Oswego, Broome, Chenango, Wyoming, Livingston, Wayne, Cayuga, Cortland, Oneida, Lewis and Jefferson.	FEMA, New York Times
Snowstorm November 29, 1999	Multi-County	Baldwinsville received nearly a foot of snow. Elsewhere the City of Syracuse metro area demonstrated just how variable lake effect snow can be. The downtown observation recorded 7 inches of new snowfall, while just a few miles north of the city, the Syracuse International airport received only 3.2 inches.	NOAA-NCDC
Lake Effect Snowstorm December 26-27, 1999	Multi-County	Village of Baldwinsville received 12 inches of snow.	NOAA-NCDC
Snowstorm January 24-26, 2000	Multi-County	New York State experienced approximately $577 K in property damages. 4 to 20 inches of snow fell in Onondaga County.	NOAA-NCDC, Kocin and Uccellini
Extreme Cold March 2000	Multi-County	Governor George E. Pataki today announced that he requested emergency disaster aid to farm families in 30 New York State counties who've suffered devastating fruit crop losses from hail storms, freezing temperatures and other crop losses from continual heavy rains.	Chittenden (New York State Department of Agriculture and Markets)
Snowstorm November 21-22, 2000	Countywide	In Onondaga County, 7 to 12 inches of snow fell in the extreme northeast portion of the county, including the Hamlet of Kirkville and the Hancock International Airport in the Village of North Syracuse.	NOAA-NCDC
Lake Effect Snowstorm December 5-6, 2000	Countywide	A band of snow was stationary across northern Onondaga County north of the City of Syracuse. Maximum estimated	NOAA-NCDC

Event Date / Name	Location	Losses / Impacts	Source(s)
		hourly snowfall rates were 1.5 inches per hour. 6 to 9 inches fell in the Towns of Camillus and Clay, and at the Syracuse International Airport in the Village of North Syracuse.	
Snowstorm December 20, 2000	Countywide	The largest snow totals were 6 to 11 inches from the Town of Lysander through the Village of North Syracuse and the Town of Clay, all in northern Onondaga county	NOAA-NCDC
Snowstorm December 28-31, 2000	Hamlet of Brewerton	Hamlet of Brewerton received 27.1 inches of snow.	Kocin and Uccellini, NCDC Station Snow Climatology Database
Lake Effect Snowstorm December 31 - January 1, 2001	Countywide	6 to 16 inches of snow fell in extreme northern Onondaga County over the entire event. The areas affected included the Towns of Lysander and Clay, and the Village of North Syracuse.	NOAA-NCDC
Snowstorm February 28 - March 1, 2001	Countywide	Snowfall amounts ranged from almost two feet in the Town of Lysander in extreme northwest Onondaga County to 6 inches at the Syracuse International Airport in the Village of North Syracuse.	NOAA-NCDC
Snowstorm March 4-7, 2001	Multi-State	10 to 20 inches of snow fell in Onondaga County.	Kocin and Uccellini
Lake Effect Snowstorm November 30 - December 1, 2002	Countywide	Lake effect snow moved into northern Onondaga County. Snow accumulations were between 6 to 10 inches across northern Onondaga County. Locations which had this snowfall included the City of Syracuse, Village of North Syracuse, and Towns of Clay, Camillus, and Lysander.	NOAA-NCDC
Snowstorm December 24-25, 2002 and January 3-4, 2003	Multi-County	Resulted in an Emergency Declaration for 18 New York State counties (EM-3173), however, it did not include Onondaga County. In December, 4 to 10 inches of snow fell in Onondaga County. In January, 10 to 20 inches of snow fell in Onondaga County and the County experienced approximately $353 K in property damages.	FEMA, Kocin and Uccellini, NOAA-NCDC, Hazards and Vulnerability Research Institute (SHELDUS), NWS
Snowstorm February 12-15, 2003	Countywide	Snowfall amounts were highest north of the New York State Thruway in western Oneida, northern Madison, and extreme northern Onondaga counties. Onondaga County experienced approximately $83 K in property damages. Hamlet of Brewerton received 31.5 inches of snow.	Hazards and Vulnerability Research Institute (SHELDUS), NOAA-NCDC
Snowstorm "President's Day Storm" February 17-18, 2003	Multi-County	Resulted in an Emergency Declaration for 17 New York State counties (EM-3184), however, it did not include Onondaga County. Onondaga County experienced approximately $153 K in property damages. Between four and 20 inches of snow fell in Onondaga County.	FEMA, NWS, NOAA-NCDC, NYSDPC, Hazards and Vulnerability Research Institute (SHELDUS), Kocin and Uccellini
Extreme Cold March 3-4, 2003	Countywide	Record low temperatures for month of March throughout the Towns of Fabius, Pompey, Tully: -11^{O}F.	The Weather Channel
Ice Storm April 3-5, 2003	Multi-County	See FEMA Disaster Declarations (Table 5.4.2-5)	FEMA, NYSDPC, NYSEMO, NWS, Hazards and Vulnerability Research

Event Date / Name	Location	Losses / Impacts	Source(s)
(FEMA DR-1467)			Institute (SHELDUS), NYSDOT
Snowstorm December 14-15, 2003	Multi-County	Snowfall amounts were mostly 10 to 18 inches across Onondaga County. All counties affected experienced approximately $510 K in property damages.	NOAA-NCDC
Snowstorm December 18, 2003	Multi-County	Snowfall amounts were mostly 6 to 12 inches across Onondaga County.	NOAA-NCDC
Extreme Cold / Snow January 10, 2004	Countywide	Low temperatures throughout the Tows of Fabius, Pompey, Tully: -20^{O}F. Onondaga County experienced approximately $11 K in property damages from snow.	The Weather Channel, Hazards and Vulnerability Research Institute (SHELDUS), NOAA-NCDC
Extreme Cold / Snow January 14-15, 2004	Countywide	Record low temperatures for month of January throughout the Towns of Fabius, Pompey, Tully: -21^{O}F. Onondaga County experienced approximately $13 K in property damages from snow.	The Weather Channel, Hazards and Vulnerability Research Institute (SHELDUS), NOAA-NCDC
Snowstorm January 22-23, 2004	Multi-County	Snowfall amounts were mostly 6 to 12 inches across northern Onondaga County.	NOAA-NCDC
Snowstorm January 30-31, 2004	Countywide	Onondaga County experienced approximately $50 K in property damages. Snowfall rates were as high as 5 inches an hour throughout the County. Snowfall amounts were 10 to 20 inches across this area, which included the City of Syracuse and the Village of Baldwinsville.	Hazards and Vulnerability Research Institute (SHELDUS), Syracuse.com, NOAA-NCDC
Snowstorm March 16-17, 2004	Multi-County	5.5 to 12.2 inches of snow fell in Onondaga County.	NWS
Snowstorm / Extreme Cold January 22-23, 2005	Countywide	Onondaga County experienced approximately $28 K in property damages. 12.3 to 18.7 inches of snow fell in Onondaga County. Low temperatures were reported in the City of Syracuse: -14^{O}F	Hazards and Vulnerability Research Institute (SHELDUS), McFadden (New York Times), NOAA-NCDC, NWS
Snowstorm February 18-19, 2005	Countywide	Snowfall amounts were 8 to 14 inches in and north of the City of Syracuse. The highest amounts were right along the Onondaga/Oswego County line. Temperatures during the event fell through the 20s into the teens.	NOAA-NCDC
Snowstorm February 28 – March 1, 2005	Multi-County	8.6 to 12.3 inches of snow fell in Onondaga County.	NWS
Snowstorm October 25, 2005	Multi-County	Snow fell mainly over the higher elevations of central New York State and the Catskills. The hardest hits areas were in Broome, Chenango, Delaware, Cortland, Madison, Otsego and Onondaga counties. Between 6 and 12 inches of heavy wet snow fell above 1,400 feet elevation in these areas.	NOAA-NCDC, NWS
Lake-Effect Snowstorm December 2, 2005	Countywide	Onondaga County experienced approximately $18 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)
Extreme Cold December 14, 2005	Multi-County	Low temperatures were reported in the City of Syracuse, Village of North Syracuse and Town of Tully: -1 to -8^{O}F	NWS
Snowstorm December 16, 2005	Countywide	Onondaga County experienced approximately $27 K in property damages.	Hazards and Vulnerability Research Institute (SHELDUS)

Event Date / Name	Location	Losses / Impacts	Source(s)
Lake Effect Snowstorm / Extreme Cold February 2-12, 2007	Multi-County	Resulted in an Emergency Declaration for 3 New York State counties (EM-3273), however, it did not include Onondaga County. Northern Onondaga County experienced between 10 and 40 inches of snow from this lake effect snow event. Governor Eliot Spitzer asked President Bush to declare a federal emergency for the counties of Oswego, Jefferson, Lewis, Madison, Oneida and Onondaga to support the extraordinary actions taken by State and local governments to clear roads and battle the record amount of lake-effect snows that have fallen since February 2. County officials indicated that Onondaga County expended over $3 M responding to this event.	FEMA, Weather Underground, The State of New York, NYSEMO, Gibb
Snowstorm "Valentines Day Storm" February 12-15, 2007	Multi-County	10 to 30 inches of snow fell in Onondaga County. The Town of Cicero received the highest amount of snowfall totaling 21.5 inches.	FEMA, Evans, Enloe, Kocin and Uccellini, NOAA-NCDC, Syracuse.com, NWS
Snowstorm / Wind March 5, 2007	Countywide	A fatal three car crash occurred on Route 11 in Town of Cicero as a result of snowy roads. A 26-car pile up occurred on Onondaga Lake Parkway in City of Syracuse.	Syracuse.com
Snowstorm "St. Patrick's Day Storm" March 15-18, 2007	Multi-County	4 to 20 inches of snow fell in Onondaga County.	Kocin and Uccellini, Enloe
Severe Storms and Inland and Coastal Flooding (also identified as a Nor'Easter) April 16, 2007	Multi-County	Resulted in a Disaster Declaration for 13 New York State counties (EM-1692), however, it did not include Onondaga County. Between 3.5 and 16 inches of snow fell in Onondaga County. City of Syracuse and Town of Dewitt experienced many fallen trees and power lines. Many flights were delayed or canceled at the Syracuse Hancock International Airport. Over 5,600 residences of Onondaga County experienced power outages.	NOAA, FEMA, NWS, Syracuse.com, National Grid
Lake Effect Snowstorm December 4, 2007	Multi-County	This snow storm delivered a first blast of winter to a large part of upstate New York State, forcing schools to close in an area stretching from Syracuse to western New York State. Over 12 inches of snow fell throughout Onondaga and Lewis Counties. More than three dozen school districts in central New York State, including the cities of Syracuse, Binghamton, Cortland, Rome and Ithaca, shut down as blowing snow caused traffic problems. Many weather related accidents occurred throughout Syracuse.	The Associated Press (USA Today), Syracuse.com
Snowstorm December 13-14, 2007	Multi-County	3.8 to 9.0 inches of snow fell in Onondaga County, particularly in the Town of Camillus.	NWS
Snowstorm December 15-17, 2007	Multi-County	9.0 to 14.5 inches of snow fell in Onondaga County, particularly in the Town of Camillus. Many flights were canceled at the	Syracuse.com, NOAA-NCDC, NWS

Event Date / Name	Location	Losses / Impacts	Source(s)
		Syracuse Hancock International Airport.	
Snowstorm February 26-27, 2008	Multi-County	The storm brought heavy snow accumulations to much of central New York State. Snowfall amounts ranged generally between 5 and 10 inches throughout Onondaga County.	NOAA-NCDC, NWS

Note (1): This table does not represent all events that may have occurred throughout the County due to a lack of detail and/or their minor impact upon the County. The NOAA NCDC storm query indicated that Onondaga County has experienced 93 snow and ice storm events and 14 extreme cold temperature events between January 1, 1950 and February 28, 2008. However, most events are regional events not specific to Onondaga County alone. Therefore, not all of these events were identified in this table due to minimal information made available or their minor impact on the County.

Note (2): Monetary figures within this table were U.S. Dollar (USD) figures calculated during or within the approximate time of the event. If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

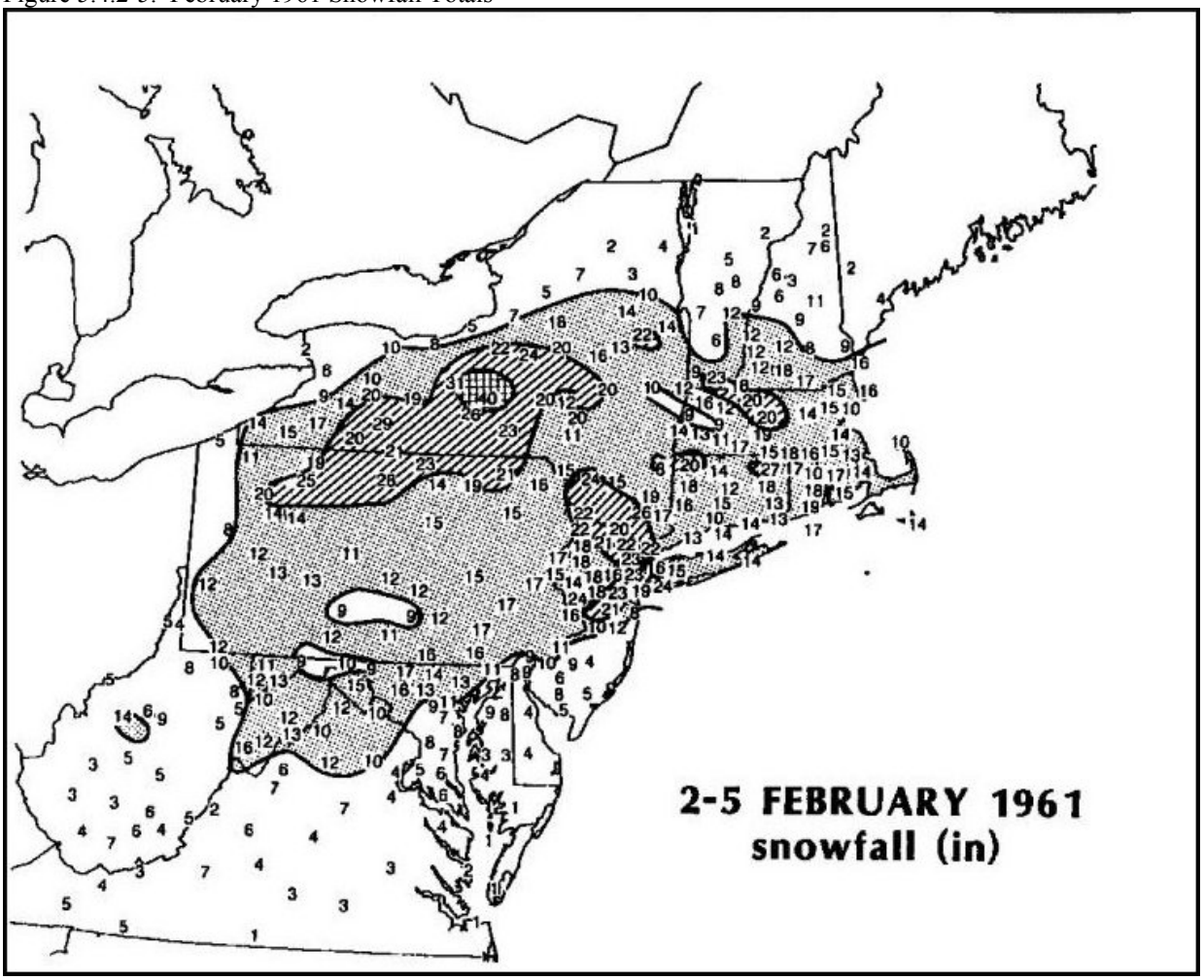
B	Billion ($)
DR	Federal Disaster Declaration
EM	Federal Emergency Declaration
FEMA	Federal Emergency Management Agency
HMP	Hazard Mitigation Plan
K	Thousand ($)
M	Million ($)
MRCC	Midwest Regional Climate Center
NCDC	National Climate Data Center
NOAA	National Oceanic Atmospheric Administration
NRCC	Northeast Regional Climate Center
NSIDC	National Snow and Ice Data Center
NWS	National Weather Service
NYS	New York State
NYS DPC	New York State Disaster Preparedness Center
NYSEMO	New York State Emergency Management Office
SHELDUS	Spatial Hazard Events and Losses Database for the United States

Further descriptions of particular severe winter storm and extreme cold events that have impacted Onondaga County are provided below for selected events where details regarding their impact were available. These descriptions are provided to give the reader a context of the winter storm and extreme cold events that have affected the County and to assist local officials in locating event-specific data for their municipalities based on the time and proximity of these events.

Monetary figures within the event descriptions were U.S. Dollar (USD) figures calculated during or within the approximate time of the event (unless present day recalculations were made by the sources reviewed). If such an event would occur in the present day, monetary losses would be considerably higher in USDs as a result of inflation.

February 2-5, 1961: This 1961 storm produced a maximum of 40 inches of snow in central New York State. A large area of one to two feet of snow accumulated across central New York State and northeast Pennsylvania (Evans, 2007) (Figure 5.4.2-5). In Onondaga County, 20 to 40 inches of snow fell during this event, resulting in over $80,000 in property damages (Kocin and Uccellini, 2004; Hazards and Vulnerability Research Institute, 2008).

Figure 5.4.2-5. February 1961 Snowfall Totals

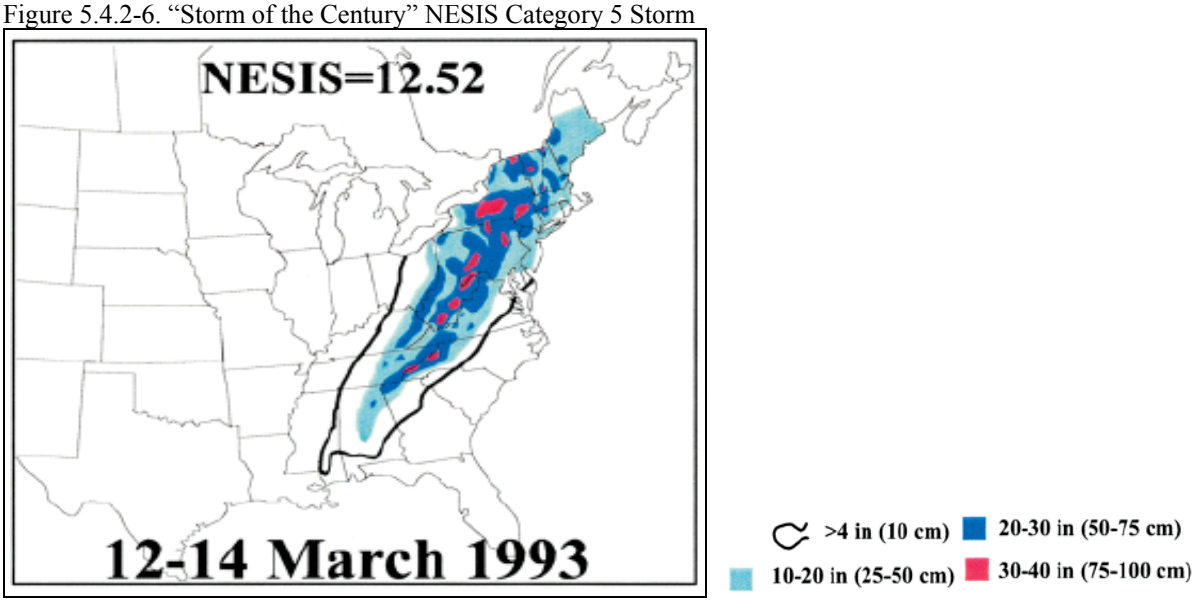


Source: Evans, 2007

March 12-15, 1993 ("Superstorm of 1993," "Storm of the Century" or "Great Storm of 1993") (FEMA EM-3107): This storm was identified as both a Nor'Easter and a blizzard by many sources. It was a massive storm complex, affecting at least 26 states and much of eastern Canada. The March 1993 storm is listed among the NOAA Top Billion Dollar Weather Disasters, reportedly causing a total of $6.6 billion in damages along the eastern coast of the U.S. and resulting in over 270 fatalities (23 fatalities in New York State) (Miller, 1995-2007; Lott, 1993). According to NYS HMP and NYSEMO, this blizzard resulted in total eligible damages of approximately $8.5 million through New York State (NYSDPC, 2008; NYSEMO, 2006).

Achieving a NESIS rating of 12.52, the "Storm of the Century" ranks as an 'Extreme' snow event. With a total area impacting, at peak, from Maine to Florida, a final snowfall total between 5 and 50 inches, and hurricane force winds, this storm brought most of the eastern seaboard to a halt for days (Figure 5.4.2-6). Total snowfall accumulations for Onondaga County were between 30 and 50 inches (Kocin and Uccellini, 2004). The City of Syracuse received 43.0 inches of snow and the Town of Skaneateles received between 26.0 and 34.9 inches. All Onondaga County schools were closed from this event, including Syracuse University (Arnold, 1993; Carr, 1993). Onondaga County experienced approximately $455,000 in property damages during this event (Hazards and Vulnerability Research Institute, 2007).

Figure 5.4.2-6. "Storm of the Century" NESIS Category 5 Storm

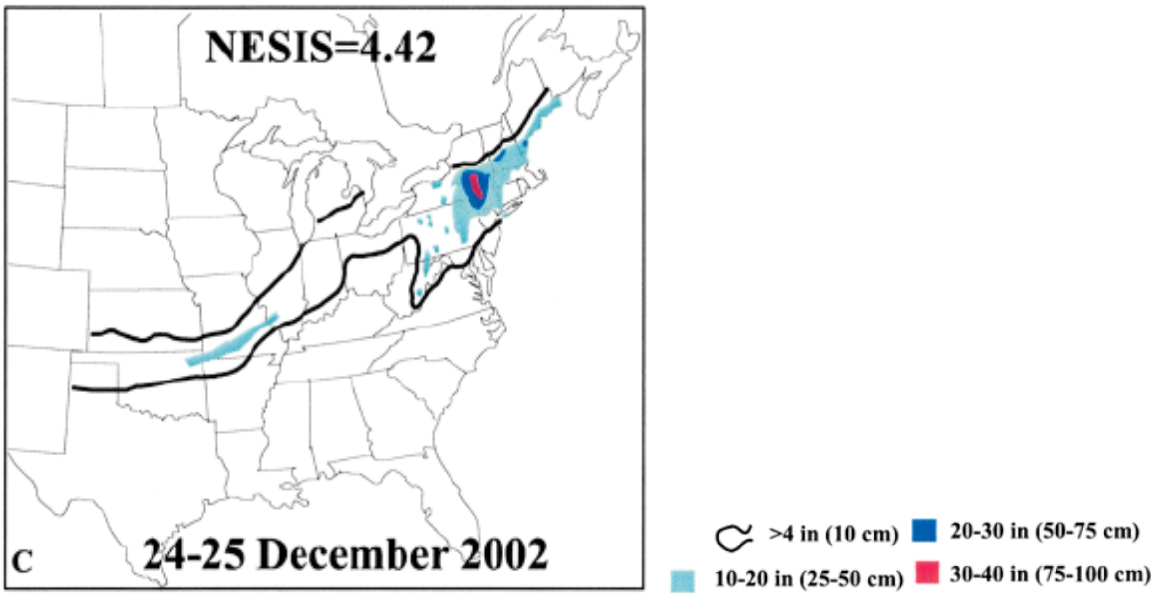


Source: Kocin and Uccellini, 2004

This storm resulted in a statewide FEMA Emergency Declaration (FEMA EM-3107) on March 17, 1993. Through this declaration, all counties were declared eligible for federal and State disaster public assistance funds (NYSEMO, 2006; FEMA, 2008). Disaster aid for Onondaga County was not available in the materials reviewed to develop this plan.

December 24-26, 2002 and January 2-4, 2003 (FEMA EM-3173): Two major storm systems extended through the northeast U.S. and struck on December 25-26, 2002 and January 3-4, 2003. Achieving a NESIS rating of 4.42, the December event placed itself in the 'Major' category (Figure 5.4.2-7) (Kocin and Uccellini, 2004).

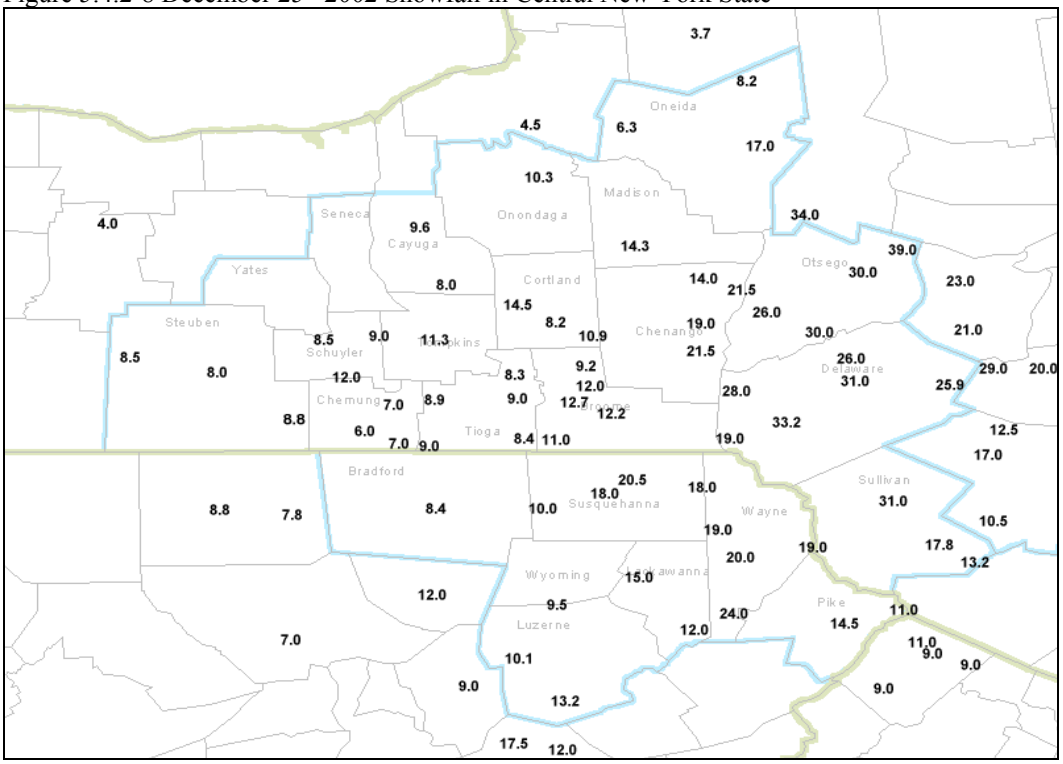
Figure 5.4.2-7. December 24-25, 2002 NESIS Category 3 Storm



Source: Kocin and Uccellini, 2004

In central New York State, snowfall rates were several inches an hour, resulting in snow amounts ranging from 8 inches to 3 feet (NCDC, 2008). Snowfall totals for the December storm in Onondaga County ranged between 10 and 20 inches. At the Syracuse Airport in North Syracuse, approximately 10.3 inches of snow fell (Figure 5.4.2-8) (NWS, 2002).

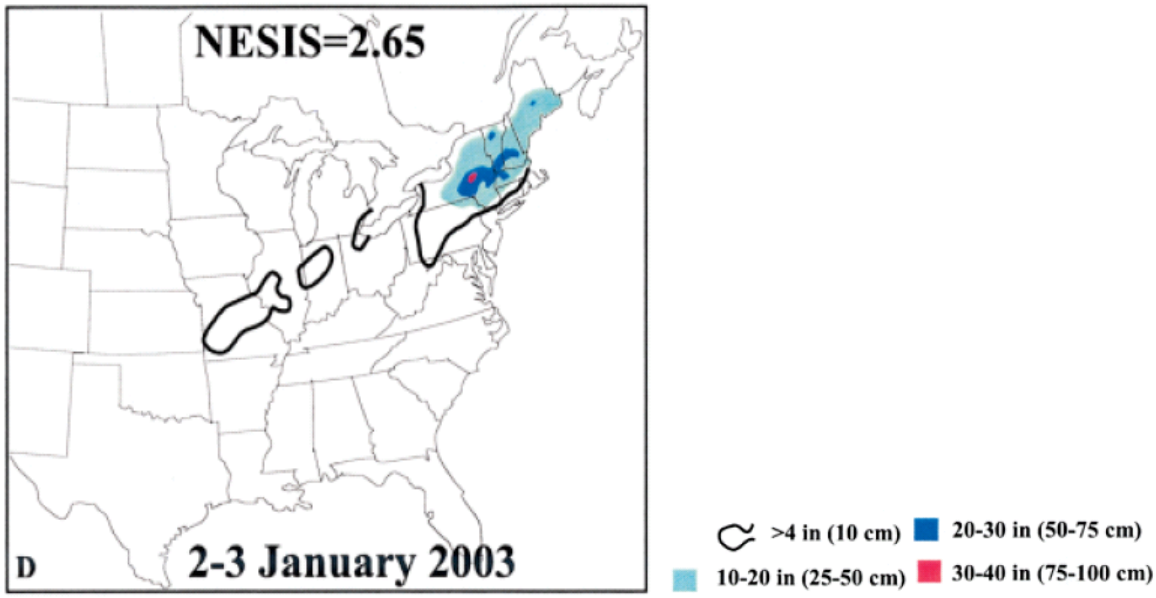
Figure 5.4.2-8 December 25th 2002 Snowfall in Central New York State



Source: NWS, 2002

The second storm on January 3-4, 2003 also brought heavy snow to New York State, resulting in approximately $434,000 in property damages in the counties affected. Achieving a NESIS rating of 2.65, this event placed itself in the 'Significant' category (Figure 5.4.2-9) (Kocin and Uccellini, 2004).

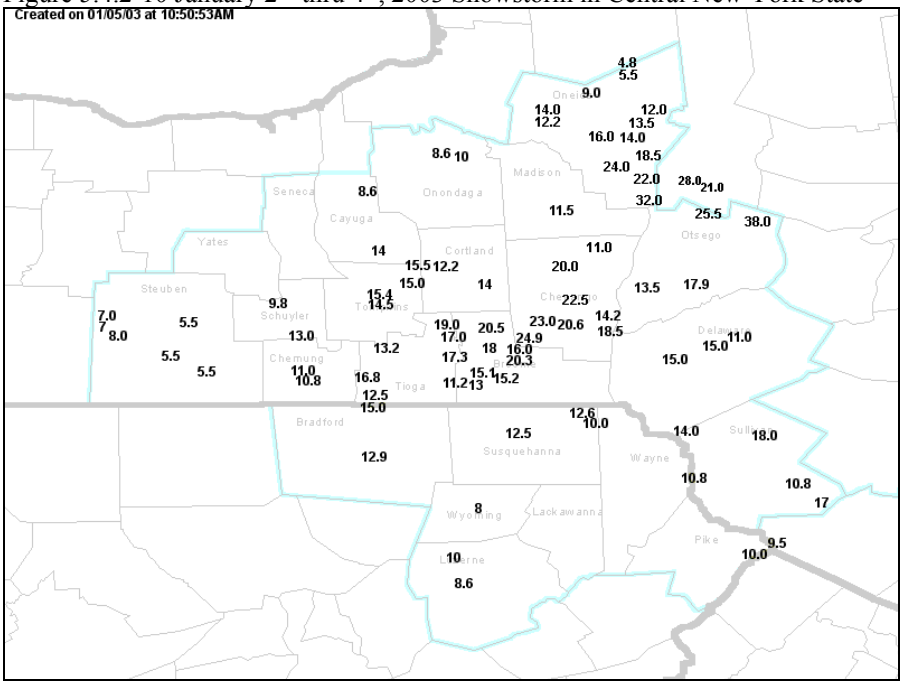
Figure 5.4.2-9. January 2-3, 2003 NESIS Category 2 Storm



Source: Kocin and Uccellini, 2004

Snowfall totals in Onondaga County ranged between 10 and 20 inches during this January event. Snowfall totals for certain locations in Onondaga County included: Syracuse University, 8.6 inches; and Syracuse Airport in North Syracuse, 10 inches (Figure 5.4.2-10) (NWS, 2003). Total damages throughout Onondaga County were not disclosed in the materials reviewed to develop this plan.

Figure 5.4.2-10 January 2nd thru 4th, 2003 Snowstorm in Central New York State



Source: NWS, 2003

These storms resulted in a FEMA Emergency Declaration (FEMA EM-3173) on February 25, 2003. Through this declaration, the following Counties were declared eligible for federal and State disaster funds: Albany, Broome, Chenango, Columbia, Delaware, Fulton, Greene, Herkimer, Madison, Montgomery, Oneida, Orange, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Sullivan, Tioga and Ulster (NYSEMO, 2006; FEMA, 2008). Onondaga County was not declared as an official disaster area under this declaration. Therefore, disaster aid for Onondaga County was not available through FEMA for these storms.

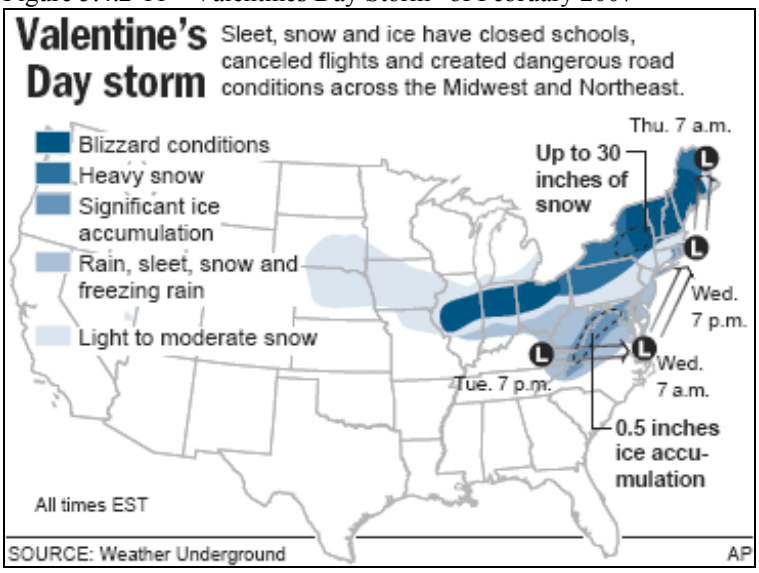
April 3-5, 2003 (FEMA DR-1467): A major ice storm disrupted vital transportation routes and downed trees and power lines, cutting electric power to more than 300,000 customers throughout western and central New York State (New York State Department of Transportation [NYSDOT], 2003). New York State experienced between $28.5 and $41.4 million in property damages from this event (NYSDPC, 2008; NCDC, 2008).

In Onondaga County, the Moyer's Corner Fire Department of the Town of Clay received 157 calls related to water problems, downed wires, pole fires, citizen assistance, fumes, outdoor fires, structure fires, car accidents, chimney fires, an explosion, and EMS-related incidences all caused by this ice storm event (Zaferakis, 2003). In the Village of Baldwinsville, the cost of cleaning up the Village after the ice storm surpassed $100,000, according to the Village's public works superintendent (The Post Standard, 2003). In the City of Syracuse, many tree limbs and power lines snapped and a transformer gave way on Howlett Hill Road causing a powerful, yet localized, fire. The loss of the transformer left hundreds of households within the area without electricity (Howlett Hill Fire Department, 2003). Onondaga County experienced approximately $2.9 million in property damages during this event (Hazards and Vulnerability Research Institute, 2007).

This storm resulted in a FEMA Emergency Declaration (FEMA DR-1467) on May 12, 2003. Through this declaration, the following Counties were declared eligible for federal and State disaster funds: Cayuga, Chenango, Livingston, Madison, Monroe, Oneida, Onondaga, Ontario, Orleans, Oswego, Otsego, Seneca, Schenectady, Wayne and Yates. Disaster assistance for all counties affected in the State totaled approximately $25 million (FEMA, 2008). Disaster aid for Onondaga County was not available in the materials reviewed to develop this plan.

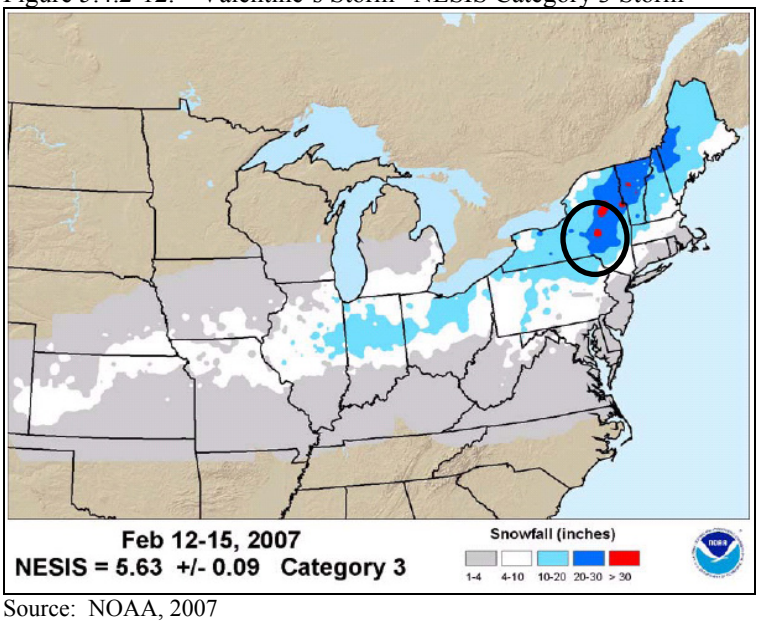
February 12-15, 2007 ("Valentine's Day Storm"): The "Valentine's Day Storm" was the largest storm to affect central New York State and north-northeast Pennsylvania during the 2006-2007 winter season. In much of the area, the storm was the biggest blizzard in several years, with snow accumulations of up to 30 inches in some areas (Evans, 2007; MSNBC, 2007) (Figure 5.4.2-11). This storm achieved a NESIS rating of 5.63, placing the storm in the 'Major' category (Figure 5.4.2-12) (Kocin and Uccellini, 2004).

Figure 5.4.2-11 "Valentines Day Storm" of February 2007



Source: MSNBC, 2007 (provided via Weather Underground)

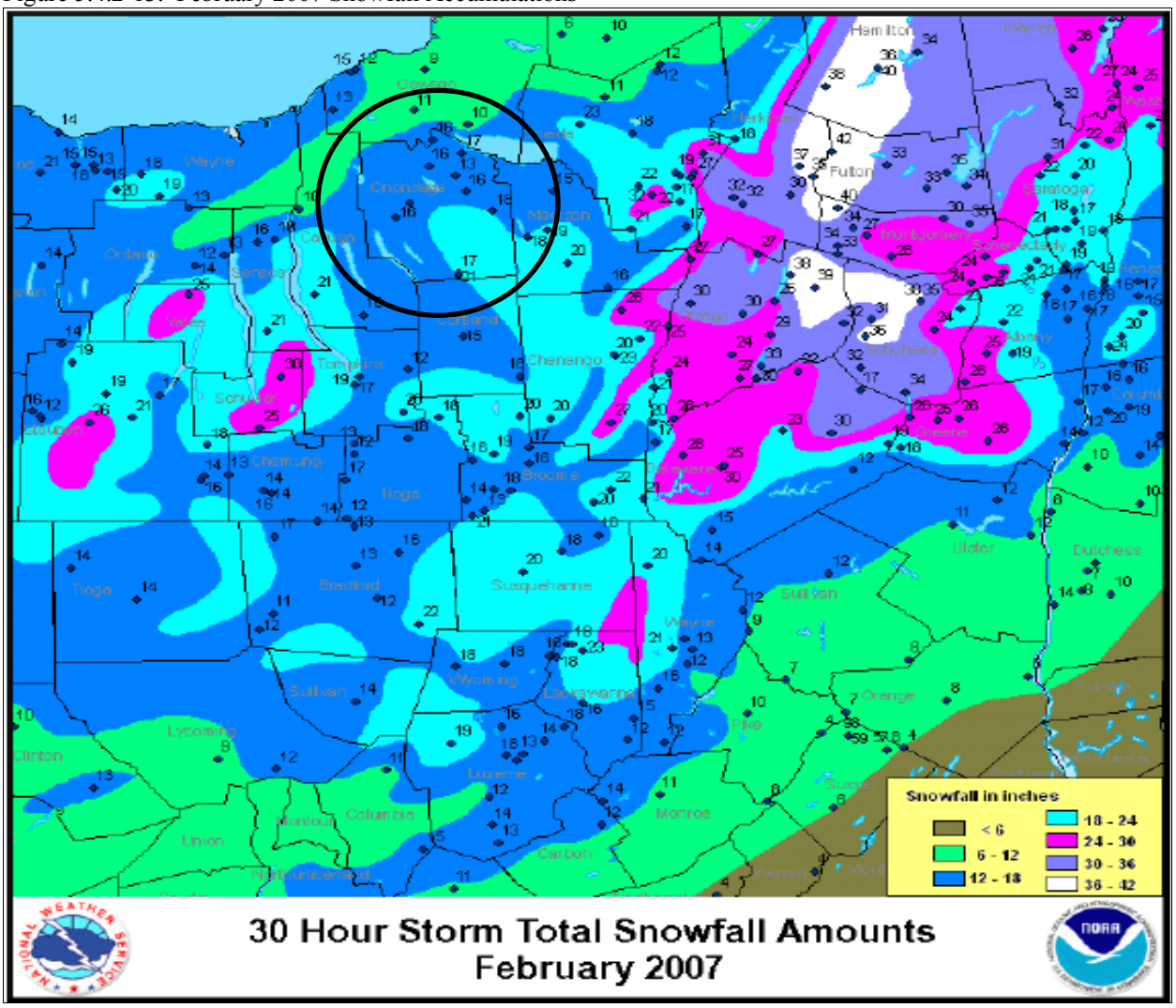
Figure 5.4.2-12. "Valentine's Storm" NESIS Category 3 Storm



Source: NOAA, 2007

In New York State, Schenectady, Schoharie, Montgomery, Washington, Essex, Warren and Clinton Counties, which were affected by extensive snowfall from the storm, had declared a state of emergency. The NWS indicated that accumulations within Onondaga County from this storm ranged between 12.0 and 24.0 inches, with the greatest accumulation in the southeastern portion of the county (Evans, 2007; NOAA, 2007) (Figure 5.4.2-13).

Figure 5.4.2-13. February 2007 Snowfall Accumulations



Source: Evans, 2007
Note: Snowfall totals for Onondaga County range from 12 inches to 24 inches.

Specific snowfall totals within the County include:

- Town of Camillus (21.5 inches)
- Town of Tully (11.7 to 20.5 inches)
- Town of Manlius (17.5 inches)
- Town of Cicero (15.5 to 17.2 inches)
- Town of Clay (16.3 inches)
- Town of Marcellus (16.0 inches)
- Village of East Syracuse (15.5 inches)
- Village of North Syracuse (13.2 inches)
- City of Syracuse (10.5 inches) (NWS, 2007).

Overall cost estimates of property damage or losses throughout the State, including Onondaga County, were not available in the materials reviewed to develop this plan. Figure 5.4.2-14 and Figure 5.4.2-15 present the snow conditions within Onondaga County during and after this event.

Figure 5.4.2-14 Snowfall in Tully

Source: Syracuse.com, 2002-2008

Figure 5.4.2-15 Downtown Syracuse

Source: Syracuse.com, 2002-2008

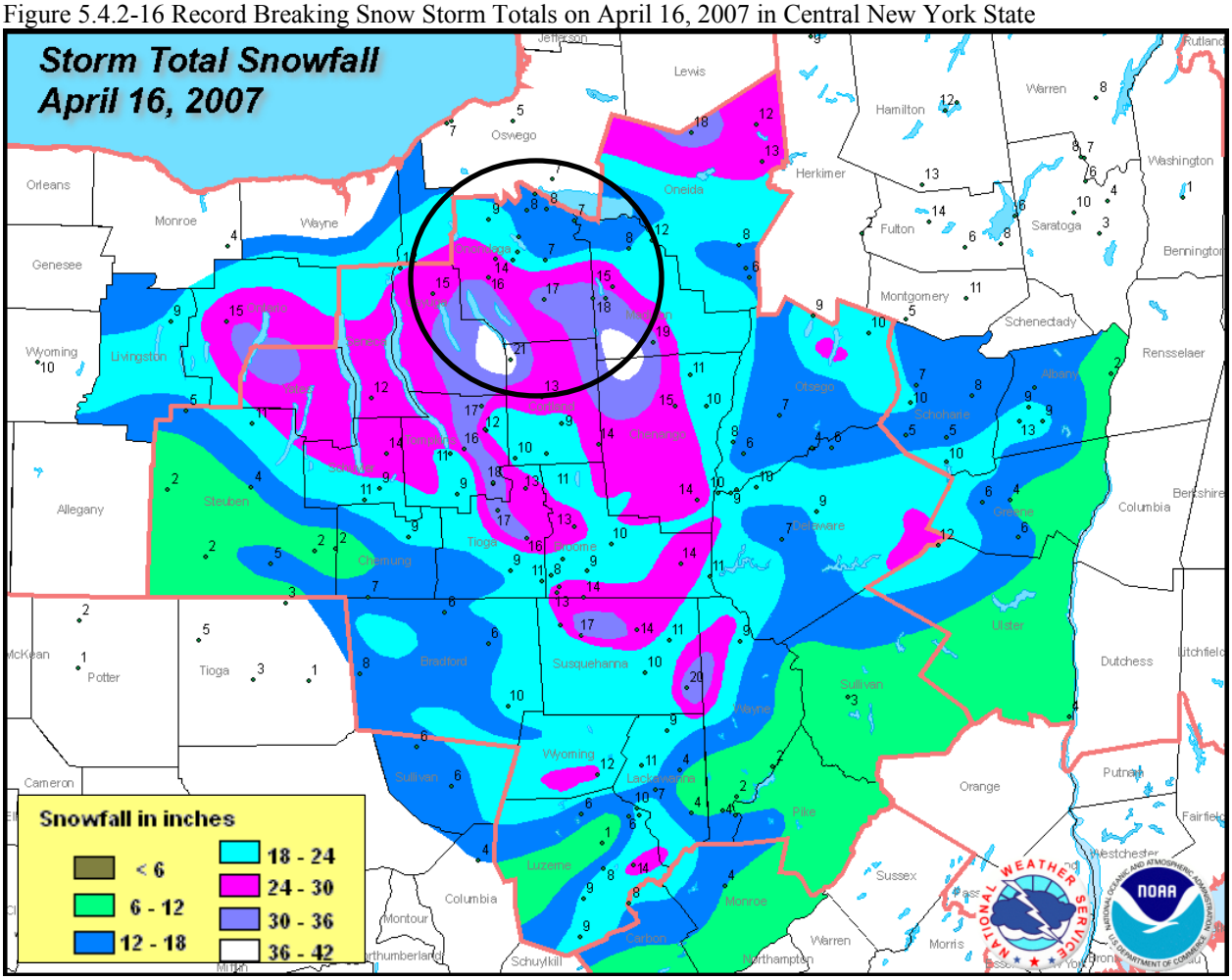
April 14-18, 2007: This Nor'Easter impacted New York State, New Jersey and Connecticut, bringing flooding rains and a heavy wet snowfall to the region. This event began as a spring storm, with high winds and heavy rainfall; which led to flooding, power outages, evacuations, and disruption of traffic and commerce in many locations throughout the affected states (NWS, 2007).

In New York State, various counties in the eastern Catskills and Mid-Hudson Region were impacted by several inches of rain. However, the heavy rains turned to snow on April 16th, resulting in extensive snowfall throughout the higher altitudes of central New York State. As a snowstorm event, it is one of the greatest April snowstorms on record for central New York State, as well as northeast Pennsylvania. One to two feet of snow was reported. The snow was heavy and wet and brought down many trees and power lines, along with wind gusts of over 40 mph (NWS, 2007)

In Onondaga County, snowfall totals ranged from 3.5 to 16.0 inches, with the greatest accumulations located within the southern portion of the County (Figure 5.4.2-16). Specific snowfall totals within the County include:

- Town of Marcellus (16.0 inches)
- Town of Camillus (14.0 inches)
- Town of Cicero (8.1 inches)
- Village of North Syracuse (6.5 inches)
- Hamlet of Little Utica (3.5 inches) (NWS, 2007).

Figure 5.4.2-16 Record Breaking Snow Storm Totals on April 16, 2007 in Central New York State



Source: NWS, 2007

As identified in Figures 5.4.2-17 through 5.4.2-20, the heavy snowfall within Onondaga County disrupted transportation, downed tree limbs and power lines, caused extensive power outages, created car accidents, closed schools and businesses, and canceled or delayed flights. Total damages throughout Onondaga County were not available in the materials reviewed to develop this plan.

Figure 5.4.2-17 Snowfall in Syracuse

Source: Sutherland, 2007 (Taken by H. Renee Ford)

Figure 5.4.2-18 Snow caused Trees to Snap in Dewitt

Source: Syracuse.com, 2002-2008

Figure 5.4.2-19 Sliding Vehicles in Syracuse

Source: Syracuse.com, 2002-2008

Figure 5.4.2-20 Trailer disabled from the Storm in Tully

Source: Syracuse.com, 2002-2008

This storm was classified by FEMA as a severe storm that caused inland and coastal flooding, resulting in a FEMA Disaster Declaration (FEMA DR-1692) on April 24, 2007. Through this declaration, the following Counties were declared eligible for federal and State disaster funds: Albany, Columbia, Dutchess, Essex, Greene, Montgomery, Orange, Putnam, Rockland, Schoharie, Suffolk, Ulster and Westchester Counties. Disaster assistance for all counties affected in the State totaled approximately $61 million (FEMA, 2008). This declaration was not issued as a result of the snow accumulation during the event; therefore, Onondaga County was not declared as a disaster area under this declaration.

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 winter temperatures 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 – Fall season, what is not easily determined is how many such storms will occur during that time frame (NYSDPC, 2008). As with winter storms, the frequency of occurrence for ice storms cannot be predicted.

Earlier in this section, the identified hazards of concern for the County were ranked. The New York State HMP includes a similar ranking process for hazards that affect the State. The probability of occurrence, or likelihood of the event, is one parameter used in this ranking process. Based on historical records and input from the Planning Committee, the probability of at least one winter snow storm of emergency declaration proportions, occurring during any given calendar year is virtually certain in the State. Based on historical snow related disaster declaration occurrences, New York State can expect a snow storm of disaster declaration proportions, on average, once every 3-5 years. Similarly, for ice storms, based on historical disaster declarations, it is expected that on average, ice storms of disaster proportions will occur once every 7-10 years within the State (NYSDPC, 2008).

As indicated previously in this hazard profile, Onondaga County is currently listed as the 7th County in the state most threatened by and vulnerable to snow and snow loss, with an annual average snowfalls ranging between 30 and 75 inches. Onondaga County is also listed as the 2nd County in New York State most threatened by and vulnerable to ice storms and ice storm loss (NYSDPC, 2008). Therefore, the probability of future events in Onondaga County is considered "frequent" (likely to occur within 25 years). It is estimated that Onondaga County and all of its jurisdictions, will continue to experience direct and indirect impacts of severe winter storms annually that may induce secondary hazards such as snow melt, flooding,

and water quality and supply concerns and cause utility failures, power outages, transportation delays/accidents/inconveniences and public health concerns.

Although extreme cold temperatures are not separately discussed in detail in the NYS HMP, it is anticipated that the State will continue to experience cold temperature events during the winter weather months. However, the severity of extreme cold events is expected to vary from county to county within the State, due to topography, geographical conditions, the potential impact of future climate change and other factors. Many sources indicate that future climate change could become a large factor in influencing the frequency of not only extreme cold temperatures but also, the overall frequency and severity of winter storm events throughout the U.S. In the event of climate change, research has indicated that temperatures will become warmer, even during winter weather months, which could influence the quantity of winter storm events through the U.S. According to the Fourth Assessment Report of the Intergovernmental Panel of Climate Change (IPCC), all of North America is very likely to warm during this century, and the annual mean warming is likely to exceed the global mean warming in most areas. In northern regions which would include New York State, warming is likely to be largest in winter, and in the southwest U.S., largest in summer. The lowest winter temperatures are likely to increase more than the average winter temperature in northern North America, and the highest summer temperatures are likely to increase more than the average summer temperature in the southwest U.S (IPCC, 2007). If temperatures become warmer, as predicted, the occurrence of winter storms and extreme cold temperatures is anticipated to decrease or have less of an impact; therefore, making an overall prediction regarding future probability of winter-related events difficult to determine. Although many uncertainties exist regarding magnitude, severity or impact of climate change, the U.S. Environmental Protection Agency (USEPA) indicated that future temperature changes, including a greater number of heat waves, are anticipated as a result, along with atmospheric, precipitation, storm and sea level changes (USEPA, 2007)

According to the 1997 USEPA publication *EPA 230-F-97-008ff: Climate Change and New York*, over the last century, temperatures in Albany, New York, have warmed by more than 1°F, and precipitation throughout the state has increased by up to 20-percent. Over the next century, New York State's climate may change even more. Based on projections given by the IPCC and results from the United Kingdom Hadley Centre's climate model (HadCM2), a model that has accounted for both greenhouse gases and aerosols, by 2100 temperatures in New York State could increase about 4°F in winter and spring, and slightly more in summer and fall (with a range of 2-8°F) (USEPA, 1997).

Local studies regarding climate change and its affects to Onondaga County have not been found. However, if scientific predictions are accurate and based on the regional studies that have been done for New York State and its surrounding states, it is anticipated that Onondaga County will be no exception and will also experience a change in temperatures in the future, which will determine the overall severity of winter conditions within the County.

VULNERABILITY ASSESSMENT

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For severe winter storms and extreme cold temperatures, the entire County has been identified as the hazard area. Therefore, all assets in Onondaga County (population, structures, critical facilities and lifelines), as described in the County Profile (Section 4), are vulnerable. The following text evaluates and estimates the potential impact of severe winter storms and extreme cold temperatures on the County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact, including: (1) impact on life, safety and health of County residents, (2) general building stock, (3) critical facilities, (4) economy and (5) future growth and development
- Further data collections that will assist understanding of this hazard over time
- Overall vulnerability conclusion

Overview of Vulnerability

Severe winter storms and extreme cold temperature events are of significant concern to Onondaga County because of their frequency and magnitude in the region. Additionally, they are of significant concern due to the direct and indirect costs associated with these events; delays caused by the storms; and impacts on the people and facilities of the region related to snow and ice removal, health problems, cascade effects such as utility failure (power outages) and traffic accidents, and stress on community resources.

Data and Methodology

National weather databases and local resources were used to collect and analyze severe winter storm and extreme cold temperature impacts on the County. Default HAZUS-MH MR3 data was used to support an evaluation of assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health and Safety

For the purposes of this HMP, the entire population in Onondaga County (200,635 people) is exposed to severe winter storm and extreme cold temperature events (U.S. Census, 2000). Snow accumulation and frozen/slippery road surfaces increase the frequency and impact of traffic accidents for the general population, resulting in personal injuries. Refer to Table 4-2 in the County Profile for population statistics for Onondaga County. The elderly are considered most 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. In addition, severe winter storm events can reduce the ability of these populations to access emergency services.

Extreme cold temperatures are often associated with severe winter storms. The high cost of fuel to heat residential homes can create a financial strain on populations with low or fixed incomes (a portion of which includes the elderly population). Residents with low incomes may not have access to housing or their housing may be less able to withstand cold temperatures (e.g., homes with poor insulation and heating supply). Table 5.4.2-7 summarizes the population over the age of 65 and individuals living below the Census poverty threshold.

Table 5.4.2-7. Vulnerable Population Exposed to Severe Winter Storm/Extreme Cold Events in Onondaga County

Population Category	Number of Persons Exposed	Percent of Total U.S. 2000 County Population
Elderly (Over 65 years of age)	63,294	13.8
Persons living below Census poverty threshold*	54,208	11.8
Elderly (Over 65 years of age) living below Census poverty threshold	4,299	<1

Source: U.S. Census, 2000.
* The Census poverty threshold for a three person family unit is approximately $15,000.

Impact on General Building Stock

The entire general building stock inventory in Onondaga County is exposed and vulnerable to the severe winter storm/extreme cold hazard. In general, structural impacts include damage to roofs and building frames. Historic information indicates Onondaga County has experienced losses up to $833,000 in damages due to a single severe winter storm event. In this case, the losses were experienced due to a freezing rain event in December 1991; however, specific losses to structures are unknown. Additionally, Onondaga County has greater than $500,000 in disaster aid for one severe winter storm event.

Historic data and 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/extreme cold conditions. Table 5.4.2-8 summarizes the exposed building values in the County and losses that would result from 1, 5, and 10 percent damage to this inventory as a result of a severe winter storm/extreme cold event. Table 5.4.2-9 summarizes percent damages that could result from severe winter storm/extreme cold conditions for each jurisdiction's total general building stock. Given professional knowledge and information available, the potential losses for this hazard are considered to be overestimated; hence, conservative estimates for losses associated with severe winter storms/extreme cold events.

Table 5.4.2-8. General Building Stock Exposure (Structure Only) and Estimated Losses from Severe Winter Storm/Extreme Cold Events in Onondaga County

Building Occupancy Class	Total Value	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Residential	$40,143,018,000	$401,430,180	$2,007,150,900	$4,014,301,800
Commercial	$27,890,609,000	$278,906,090	$1,394,530,450	$2,789,060,900
Industrial	$7,579,130,000	$75,791,300	$378,956,500	$757,913,000
Agricultural	$1,650,747,000	$16,507,470	$82,537,350	$165,074,700
Religious	$187,771,000	$1,877,710	$9,388,550	$18,777,100
Government	$733,400,000	$7,334,000	$36,670,000	$73,340,000
Educational	$361,033,000	$3,610,330	$18,051,650	$36,103,300
Total	**$1,740,328,000**	**$17,403,280**	**$87,016,400**	**$174,032,800**

Source: HAZUS-MH MR3, 2007
Notes: The building values shown are building structure only because damage for the severe winter storm/extreme cold hazard will generally impact structures such as the roof and building frame (rather than building content). The valuation of general building stock and the loss estimates determined in Onondaga County were based on the default general building stock database provided in HAZUS-MH MR3. The general building stock valuations provided in HAZUS-MH MR3 are Replacement Cost Value from RSMeans as of 2006.

Table 5.4.2-9. General Building Stock Estimated Losses from Severe Winter Storm/Extreme Cold Events in Onondaga County

Jurisdiction	Total (All Occupancy Classes)			Residential		
	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Village of Baldwinsville	$5,479,010	$27,395,050	$54,790,100	$4,207,430	$21,037,150	$42,074,300
Town of Camillus	$16,991,970	$84,959,850	$169,919,700	$13,908,600	$69,543,000	$139,086,000
Village of Camillus	$1,059,600	$5,298,000	$10,596,000	$767,650	$3,838,250	$7,676,500
Town of Cicero	$21,282,390	$106,411,950	$212,823,900	$16,027,980	$80,139,900	$160,279,800
Town of Clay	$40,021,260	$200,106,300	$400,212,600	$31,815,450	$159,077,250	$318,154,500
Town of Dewitt	$31,127,910	$155,639,550	$311,279,100	$15,082,170	$75,410,850	$150,821,700
Village of East Syracuse	$2,569,480	$12,847,400	$25,694,800	$1,498,720	$7,493,600	$14,987,200
Town of Elbridge	$2,345,980	$11,729,900	$23,459,800	$1,778,920	$8,894,600	$17,789,200
Village of Elbridge	$766,160	$3,830,800	$7,661,600	$525,470	$2,627,350	$5,254,700
Town of Fabius	$1,178,420	$5,892,100	$11,784,200	$1,013,300	$5,066,500	$10,133,000
Village of Fabius	$264,710	$1,323,550	$2,647,100	$215,030	$1,075,150	$2,150,300
Village of Fayetteville	$3,654,800	$18,274,000	$36,548,000	$2,783,010	$13,915,050	$27,830,100
Town of Geddes	$9,394,350	$46,971,750	$93,943,500	$7,223,170	$36,115,850	$72,231,700
Village of Jordan	$1,028,760	$5,143,800	$10,287,600	$666,150	$3,330,750	$6,661,500
Town of Lafayette	$3,328,160	$16,640,800	$33,281,600	$2,631,120	$13,155,600	$26,311,200
Village of Liverpool	$2,231,590	$11,157,950	$22,315,900	$1,504,120	$7,520,600	$15,041,200
Town of Lysander	$12,645,820	$63,229,100	$126,458,200	$10,001,490	$50,007,450	$100,014,900
Town of Manlius	$16,402,350	$82,011,750	$164,023,500	$13,888,560	$69,442,800	$138,885,600
Village of Manlius	$4,660,200	$23,301,000	$46,602,000	$3,198,160	$15,990,800	$31,981,600
Town of Marcellus	$3,372,900	$16,864,500	$33,729,000	$2,879,280	$14,396,400	$28,792,800
Village of Marcellus	$1,545,600	$7,728,000	$15,456,000	$1,180,670	$5,903,350	$11,806,700
Village of Minoa	$2,243,080	$11,215,400	$22,430,800	$1,909,890	$9,549,450	$19,098,900
Village of North Syracuse	$5,332,730	$26,663,650	$53,327,300	$4,152,690	$20,763,450	$41,526,900
Town of Onondaga	$17,236,240	$86,181,200	$172,362,400	$13,764,350	$68,821,750	$137,643,500
Town of Otisco	$1,773,350	$8,866,750	$17,733,500	$1,483,980	$7,419,900	$14,839,800
Town of Pompey	$4,741,220	$23,706,100	$47,412,200	$4,119,500	$20,597,500	$41,195,000
Town of Salina	$27,249,450	$136,247,250	$272,494,500	$18,376,290	$91,881,450	$183,762,900
Town of Skaneateles	$5,019,510	$25,097,550	$50,195,100	$3,579,510	$17,897,550	$35,795,100
Village of Skaneateles	$2,828,100	$14,140,500	$28,281,000	$1,749,700	$8,748,500	$17,497,000
Village of Solvay	$5,306,080	$26,530,400	$53,060,800	$3,756,940	$18,784,700	$37,569,400

Jurisdiction	Total (All Occupancy Classes)			Residential		
	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate	1% Damage Loss Estimate	5% Damage Loss Estimate	10% Damage Loss Estimate
Town of Spafford	$1,746,670	$8,733,350	$17,466,700	$1,621,360	$8,106,800	$16,213,600
City of Syracuse	$136,183,880	$680,919,400	$1,361,838,800	$83,556,550	$417,782,750	$835,565,500
Town of Tully	$1,559,200	$7,796,000	$15,592,000	$1,237,150	$6,185,750	$12,371,500
Village of Tully	$909,660	$4,548,300	$9,096,600	$593,370	$2,966,850	$5,933,700
Town of Van Buren	$7,949,590	$39,747,950	$79,495,900	$6,208,360	$31,041,800	$62,083,600
Onondaga County	$401,430,180	$2,007,150,900	$4,014,301,800	$278,906,090	$1,394,530,450	$2,789,060,900

Source: HAZUS-MH MR3, 2007

Notes: The building values shown are building structure only because damage for the severe winter storm/extreme cold hazard will generally impact structures such as the roof and building frame (rather than building content). The valuation of general building stock and the loss estimates determined in Onondaga County were based on the default general building stock database provided in HAZUS-MH MR3. The general building stock valuations provided in HAZUS-MH MR3 are Replacement Cost Value from RSMeans as of 2006.

A specific area that is vulnerable to the severe winter storm hazard is the floodplain. At risk general building stock and infrastructure in floodplains are presented in the flood hazard profile (Section 5.4.X). Generally, losses from flooding associated with severe winter storms should be less than that associated with a 100-year or 500-year flood. In summary, snow and ice melt can cause both riverine and urban flooding. Additionally, cold winter temperatures cause rivers to freeze. A rise in the water level due to snow/ice melt or a thaw breaking the river ice/compacted snow into large pieces can become jammed at man-made and natural obstructions (a.k.a., ice jams). Ice jams can act as a dam, resulting in severe flash riverine flooding. Specific losses due to ice jam events in Onondaga County were not identified.

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/extreme cold event. HAZUS-MH MR3 estimates the replacement value for each police station is $1,652,000 and each fire station is $708,000. 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 for critical facilities and infrastructure. 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 infrastructure to clear roadways, alert citizens to dangerous conditions, and following the winter requires resources for road maintenance and repair. Additionally, freezing rain and ice storms impact utilities (i.e., power lines and overhead utility wires) causing power outages for hundreds to thousands of residents.

Impact on Economy

The cost of snow and ice removal and repair of roads from the freeze/thaw process can drain local financial resources. Another impact on the economy includes impacts on commuting into, or out of, the area for work or school. The loss of power and closure of roads prevents the commuter population traveling to work within and outside of the County.

Future Growth and Development

As discussed in Section 4, 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/extreme cold hazard because the entire planning area is exposed and vulnerable.

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/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.

Overall Vulnerability Assessment

Severe winter storms and extreme cold temperatures are common in the study area, often causing impacts and losses to the County and Town roads, structures, facilities, utilities, and population. The overall hazard ranking determined for this HMP for the severe winter storm/extreme cold hazard is high (Table 5.3-6).

Existing and future mitigation efforts should continue to be developed and employed that will enable the study area to be prepared for these events when they occur. The cascade effects of severe winter storm/extreme cold temperature events include utility losses and transportation accidents and flooding. Losses associated with the flood hazard are discussed in Section 5.4.3. Particular areas of vulnerability include low-income and elderly populations, mobile homes, and infrastructure such as roadways and utilities that can be damaged by such storms and the low-lying areas that can be impacted by flooding related to rapid snow melt.