



5.4.9 Nor’Easter

This section provides a profile and vulnerability assessment for the Nor’Easter hazard.

Hazard Profile

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

Description

A Nor’Easter is a cyclonic storm that moves along the East Coast of North America. It’s called a Nor’Easter because the damaging winds over coastal areas blow from a northeasterly direction. Nor’Easters can occur any time of the year, but are most frequent and strongest between September and April. These storms usually develop between Georgia and New Jersey within 100 miles of the coastline and typically move from southwest to northeast along the Atlantic Coast of the U.S. (National Oceanic and Atmospheric Administration [NOAA] 2013). In order to be called a Nor’Easter, a storm must have the following conditions:

- Must persist for at least a 12-hour period;
- Have a closed circulation;
- Be located within the quadrilateral bounded at 45°N by 65° and 70°W and at 30°N by 85°W and 75°W;
- Show general movement from the south-southwest to the north-northeast; and
- Contain wind speeds greater than 23 miles per hour (mph) (Northeast Regional Climate Center [NRCC], Date Unknown).

A Nor’Easter event can cause storm surges, waves, heavy rain, heavy snow, wind, and coastal flooding. Nor’Easters have diameters that can span 1,200 miles, impacting large areas of coastline. The forward speed of a Nor’Easter is usually much slower than a hurricane, so with the slower speed, a Nor’Easter can linger for days and cause tremendous damage to those areas impacted. Approximately 20 to 40 Nor’Easters occur every year, with at least two considered severe (Storm Solution, Date Unknown). The intensity of a Nor’Easter can rival that of a tropical cyclone in that, on occasion, it may flow or stall off the mid-Atlantic coast resulting in prolonged episodes of precipitation, coastal flooding, and high winds.

For the purpose of this HMP, only Nor’Easter events are being further discussed within this hazard profile, due to their significant historical impact on Suffolk County.

Extent

The extent of a Nor’Easter can be classified by meteorological measurements and by evaluating its societal impacts. NOAA’s National Climatic Data Center (NCDC) is currently producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two-thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5. It is based on the spatial extent of the storm, the amount of snowfall, and the interaction of the extent and snowfall totals with population (based on the 2000 Census). The NCDC has analyzed and assigned RSI values to over 500 storms since 1900 (NOAA-NCDC 2011). Table 5.4.9-1 explains the five categories:

Table 5.4.9-1. RSI Ranking Categories

Category	Description	RSI Value
1	Notable	1-3





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

Source: NOAA-NCDC, Date Unknown

Location

Eastern New York State, which includes New York City and Long Island, is vulnerable to Nor’Easters. Nor’Easters usually form off the east coast near the Carolina, and then follow a track northwards along the coast until they blow out to sea. Nor’Easters affect primarily eastern and southern New York State. They are most notable for snow accumulations greater than nine inches, accompanied by high, sometimes gale force, winds, and storm surges which cause severe flooding along the Long Island coastline (NYS DHSES, 2011).

Because Suffolk County is primarily surrounded by coastal waters, Nor’Easters affect the entire area, particularly communities along the north and south shores of the County. Multiple sources document that Suffolk County has been impacted by many Nor’Easters. The County has felt the direct and indirect landward effects, including high winds, heavy rains, flash and coastal flooding, and beach erosion associated with several Nor’Easters.

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with severe winter storms and extreme cold events throughout New York State and Suffolk 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.

The 2007 Plan discussed Nor’Easters events that occurred in Suffolk County from 1897 to 2007. For this 2014 plan update, Nor’Easters events that occurred in Suffolk County between January 1, 2008 and present will be included. Based on all sources researched, known Nor’Easter events, between 2008 and 2013, that have affected Suffolk County and its municipalities are identified in Table 5.4.9-2. Not all sources have been identified or researched; therefore, Table 5.4.9-2 may not include all events that have occurred throughout the County and region. Events included in the 2007 Plan are provided in Appendix H.



Table 5.4.9-2. Nor’Easter Events in Suffolk County, 2008 to 2013.

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Losses / Impacts	Source(s)
November 12-14, 2009	Severe Storms and Flooding (Remnants of Tropical Storm Ida and a Nor’Easter)	DR-1869	Yes	Severe storms and coastal flooding caused an estimated \$17 M in damages. Severe beach erosion and cuts into the dunes occurred along the Atlantic Ocean facing beaches.	FEMA
March 13-31, 2010	Severe Storms and Flooding (Nor’Easter)	DR-1899	Yes	<p>Between March 12th and 15th, rainfall totals in Suffolk County ranged between 2.26 inches and 4.93 inches. Wind gusts ranged between 47 mph and 69 mph.</p> <p>Between March 22nd and 23rd, rainfall totals in Suffolk County ranged between 0.85 inches and 1.82 inches.</p> <p>Between March 29th and 31st, rainfall totals for Suffolk County ranged between 4.33 inches and 8.83 inches. Peak wind gusts in the County ranged from 30 mph to 50 mph, with wind gusts of 38 mph in the Village of Westhampton Beach.</p> <p>FEMA issued a disaster declaration for this event and Suffolk County was included in this declaration. Suffolk County was approved for PA. FEMA approved \$86,529,838.16 in PA grant assistance.</p>	FEMA, NWS
November 7, 2012	Nor’Easter	N/A	N/A	Snowfall totals for Suffolk County ranged between 1.1 inches and 5.8 inches. Wind gusts ranged between 44 mph and 58 mph.	NOAA-NCDC
December 26-27, 2012	Nor’Easter	N/A	N/A	The storm brought strong winds and some coastal flooding. \$2,000 in property damages from the high winds (gusts up to 68 mph on Plum Island in the town of Southold) was recorded.	NWS; NOAA-NCDC

Sources: NOAA-NCDC, FEMA, NWS, SHELDUS

Note: 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.

DR	Disaster Declaration	N/A	Not Applicable
EM	Emergency Declaration	NCDC	National Climatic Data Center
FEMA	Federal Emergency Management Agency	NOAA	National Oceanic and Atmospheric Administration
K	Thousand (\$)	NWS	National Weather Service
M	Million (\$)	PA	Public Assistance





Probability of Future Events

Winter storm hazards in New York State are virtually guaranteed yearly since the State is located at relatively high latitudes resulting in winter temperatures that range between 0°F and 32°F for a good deal of the fall through early spring season (late October until mid-April). In addition, the State is exposed to large quantities of moisture from both the Great Lakes and the Atlantic Ocean. While it is almost certain that a number of significant winter storms will occur during the winter and fall season, what is not easily determined is how many such storms will occur during that time frame (NYS DHSES, 2011).

The New York State HMP includes a similar ranking process for hazards that affect the State. 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 three to five 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 seven to 10 years within the State (NYS DHSES, 2011).

In Section 5.3, the identified hazards of concern for Suffolk County were ranked. The probability of occurrence, or likelihood of the event, is one parameter used for hazard rankings. Based on historical records and input from the Planning Committee, the probability of occurrence for severe winter storms in the County is considered ‘frequent’ (hazard event that occurs more frequently than once in 10 years [Table 5.3-3]).

Climate Change Impacts

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

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to continue growing. Impacts related to increasing temperatures and sea level rise are already being felt in the State. ClimAID: the Integrated Assessment for Effective Climate Change in New York State (ClimAID) was undertaken to provide decision-makers with information on the State’s vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (New York State Energy Research and Development Authority [NYSERDA], 2011).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Suffolk County is part of Region 4, New York City and Long Island. Some of the issues in this region, affected by climate change, include: this region has the highest population density in the state; sea level rise and storm surge will increase coastal flooding, erosion and wetland loss; heat-related deaths will increase; illness related to air quality will increase; and higher summer energy demand will stress the energy system (NYSERDA, 2011).

Temperatures are expected to increase throughout the state, by 1.5 to 3°F by the 2020s, 3.5 to 5.5°F by the 2050s and 4.5 to 8.5°F by the 2080s. The lower ends of these ranges are for lower greenhouse gas emissions scenarios and the higher ends for higher emissions scenarios. Annual average precipitation is projected to increase by up to five-percent by the 2020s, up to 10-percent by the 2050s and up to 15-



percent by the 2080s. During the winter months is when this additional precipitation will most likely occur, in the form of rain, and with the possibility of slightly reduced precipitation projected for the late summer and early fall. Table 5.4.9-3 displays the projected seasonal precipitation change for the New York City and Long Island ClimAID Region (NYSERDA, 2011).

Table 5.4.9-3. Projected Seasonal Precipitation Change in Region 4, 2050s (% change)

Winter	Spring	Summer	Fall
0 to +15	0 to +10	-5 to +10	-5 to +10

Source: *NYSERDA, 2011*

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

- Up to eight inches of rain fall in the rain band near the coast over a 36-hour period
- Up to four inches of freezing rain in the ice band near central New York State, of which between one and two inches of accumulated ice, over a 24-hour period
- Up to two feet of accumulated snow in the snow band in northern and western New York State over a 48-hour period (NYSERDA, 2011)

New York State is already experiencing the effects of climate change during the winter season. Winter snow cover is decreasing and spring comes, on average, about a week earlier than it did a few years ago. Nighttime temperatures are measurably warmer, even during the colder months (NYSDEC, Date Unknown). Overall winter temperatures in New York State are almost five degrees warmer than in 1970 (NYSDEC, Date Unknown). The State has seen a decrease in the number of cold winter days (below 32°F) and can expect to see a decrease in snow cover, by as much as 25 to 50% by end of the next century. The lack of snow cover may jeopardize opportunities for skiing, snowmobiling and other types of winter recreation; and natural ecosystems will be affected by the changing snow cover (Cornell University College of Agriculture and Life Sciences, 2011).

Some climatologists believe that climate change may play a role in the frequency and intensity of Nor’Easters. Two ingredients are needed to produce strong Nor’Easters and intense snowfall: (1) temperatures which are just below freezing, and (2) massive moisture coming from the Gulf of Mexico. When temperatures are far below freezing, snow is less likely. As temperatures increase in the winter months they will be closer to freezing rather than frigidly cold. Climate change is expected to produce more moisture, thus increasing the likelihood that these two ingredients (temperatures just below freezing and intense moisture) will cause more intense snow events.



Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For Nor’Easter events, the entire County has been identified as the hazard area. Therefore, all assets in the County (population, structures, critical facilities and lifelines), as described in the County Profile (Section 4), are vulnerable. The following section includes an evaluation and estimation of the potential impact that Nor’Easters have on Suffolk County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, health and safety of residents, (2) general building stock, (3) critical facilities, (4) economy, and (5) future growth and development
- Effect of climate change on vulnerability
- Change of vulnerability as compared to that presented in the 2008 Suffolk County Hazard Mitigation Plan
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

There are many similarities between Nor’Easter and hurricane events. Both types of events can bring high winds and surge inundation resulting in similar impacts on the population, structures, and the economy. Refer to Section 5.4.7 (Hurricane) for a detailed and quantitative assessment on the wind and storm surge hazards. The section below discusses Nor’Easter events in a qualitative nature.

Data and Methodology

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. Step 4 in FEMA’s How To 386-2 describes the factors to consider when assessing the vulnerability of buildings in coastal storms; these include: (1) storm surge flooding; (2) erosion or scour; and (3) strong winds. Potential losses associated with high wind events were calculated for Suffolk County using HAZUS-MH for two probabilistic wind/hurricane events, the 100-year and 500-year MRP events (see the Hurricane hazard profile).

To assess Suffolk County’s vulnerability to coastal flooding and coastal erosion, potential losses were calculated for Suffolk County using HAZUS-MH for 100- and a 500-year MRP flood events and the CEHA data provided by NYSDEC to determine what assets are exposed to coastal erosion (see Section 5.4.1 - Coastal Erosion). To estimate losses due to heavy snow, historic data and current modeling tools are not considered adequate to estimate specific losses that are a potential for this hazard. As an alternate approach, this plan considers percentage damages that could result from severe winter storm conditions (see Section 5.4.13 - Severe Winter Storm).

Impact on Life, Health and Safety

The impact of a Nor’Easter on life, health and safety is dependent upon several factors including the severity of the event and whether or not adequate warning time was provided to residents. Typically, a Nor’Easter has a longer duration (potentially lasting days) than a hurricane or tropical storm event, which normally pass through an area in a matter of hours. For the purpose of this HMP update, the entire County is vulnerable to Nor’Easters.

According to the 2010 U.S. Census, Suffolk County had a population of 1,493,350 people. Vulnerable populations, including the elderly and low income populations, are considered most susceptible to the



Nor’Easter hazard. Socially vulnerable populations are most susceptible, based on a number of factors including their physical and financial ability to react or respond during a hazard and the location and construction quality of their housing. Low-income residents may not have adequate housing able to withstand high winds, rain, and snow associated with Nor’Easters. Refer to Section 4 (County Profile) for population statistics for each participating municipality.

Impact on General Building Stock

A Nor’Easter surge inundation zone does not exist to estimate assets exposed for this hazard. To estimate the population and area exposed to storm surge, the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model Category 1 through 4 zones were overlaid upon the custom County-wide inventory developed for this plan. The buildings with their centroid in the SLOSH zones were used to estimate the number of buildings and replacement cost value exposed to storm surge. Refer to Section 5.4.7 (Hurricane) which summarizes the buildings in the Category 1 through 4 SLOSH zones by jurisdiction.

Impact on Critical Facilities

All critical facilities are considered vulnerable to the Nor’Easter hazard. Section 4 of this Plan (County Profile) discusses the critical facilities in Suffolk County. Estimated potential impact on these facilities is outlined in the hurricane, flood and severe winter storm hazard profiles. Because power interruption can occur, backup power is recommended for all critical facilities.

Impact on Economy

As discussed above, Nor’Easter events can impact structures and the economy. Damages to buildings and infrastructure, utility outages, and roadways impassable due to snow or flood/surge can lead to closures of municipal or County buildings. These closures impact the services they provide and hinder response time for critical emergency services. Refer to Section 5.4.7 (Hurricane) for a detailed discussion on potential losses to County buildings, critical facilities, and infrastructure due to winds and storm-surge flooding.

Future Growth and Development

As discussed in Sections 4 and 9, areas targeted for future growth and development have been identified across the Planning Area. Any areas of growth could be potentially impacted by the Nor’Easter hazard because the entire planning area is exposed and vulnerable. Please refer to the specific areas of development indicated in tabular form and/or on the hazard maps included in the jurisdictional annexes in Volume II, Section 9 of this plan.

Effect of Climate Change on Vulnerability

Climate is defined not simply as average temperature and precipitation but also by the type, frequency and intensity of weather events. Both globally and at the local scale, climate change has the potential to alter the prevalence and severity of extremes such as winter storms (including Nor’Easters). While predicting changes of winter storm events under a changing climate is difficult, understanding vulnerabilities to potential changes is a critical part of estimating future climate change impacts on human health, society and the environment (U.S. Environmental Protection Agency [EPA], 2006).

The 2011 ‘Responding to Climate Change in New York State’ report was prepared for New York State Energy Research and Development Authority to study the potential impacts of global climate change on New York State. According to the synthesis report, it is uncertain how climate change will influence extreme winter storm events. Winter temperatures are projected to continue to increase. In general, warmer winters may lead to a decrease in snow cover and an earlier arrival in spring; all of which have numerous cascading effects on the environment and economy. Annual average precipitation is also projected to increase. The increase in precipitation is likely to occur during the winter months as rain,



with the possibility of slightly reduced precipitation projected for the late summer and early fall. Increased rain on snowpack may lead to increased flooding and related impacts on water quality, infrastructure, and agriculture in the State. Overall, it is anticipated that winter storms will continue to pass through New York State (NYSERDA, 2011). Future enhancements in climate modeling will provide an improved understanding of how the climate will change and impact the Northeast.

Change of Vulnerability

Overall, the County’s vulnerability has not changed and the entire County will continue to be exposed and vulnerable to Nor’Easter events.

Additional Data and Next Steps

The assessment above identifies vulnerable populations and economic losses associated with this hazard of concern. Historic data on structural losses to general building stock are not adequate to predict specific losses to this inventory; therefore, the percent of damage assumption methodology was applied. This methodology is based on FEMA’s How to Series (FEMA 386-2), Understanding Your Risks, Identifying and Estimating Losses (FEMA, 2001) and FEMA’s Using HAZUS-MH for Risk Assessment (FEMA 433) (FEMA, 2004). In summary, Nor’Easters can cause heavy precipitation, gale-force winds, and oversized waves (storm surge) that can cause beach erosion, coastal flooding, structural damage, power outages and unsafe human conditions. This level of devastation is similar to that of a hurricane. Over time, the County will obtain additional data to support the analysis of this hazard. The County will continue to work together with local, state, and federal entities to learn more about the hazards associated with a Nor’Easter, and support further mitigation efforts as discussed in Section 6 to reduce the losses when future Nor’Easter events occur. Data that will support future analysis would include additional detail on past hazard events and impacts, specific building information such as first floor elevation, type of construction, foundation type and details on protective features (e.g., hurricane straps). In addition, information on particular buildings or infrastructure age or year built would be helpful in future analysis of this hazard.

Overall Vulnerability Assessment

Historically, Nor’Easters have devastated the study area, causing impacts and losses to the County’s structures, facilities, utilities, and population. 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.