Section 3.0: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The following requirement(s) are met throughout this section:

Requirement §201.4(c)(2): *[The State plan **must** include a risk assessment] that provides the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy, and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments.*

Requirement §201.4(c)(2)(i): *[The State risk assessment **shall** include an overview of the] location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate … .*

Requirement §201.4(c)(2)(ii): *[The State risk assessment **shall** include an] overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State **shall** describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. State owned critical or operated facilities located in the identified hazard areas shall also be addressed ….*

Requirement §201.4(c) (2) (iii): *[The State risk assessment **shall** include an] overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State **shall** estimate the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.*

INTENT OF SECTION 3:

This Hazard Analysis assesses various risks facing New York State and its communities in order to evaluate and rank them. This process is then used to characterize hazards and their risks for planning purposes. It estimates the probability of occurrence and the severity of consequences for each hazard and provides a method of comparison. The assessment involves many inter-related variables (topography, demographics, development trends, etc.) and should be used by state and local officials in developing a mitigation strategy, goals, objectives and activities that address the natural hazards that

provide the greatest opportunity for loss reduction. In addition, the hazard risk assessment serves as guidance for general preparedness and response planning, including identifying, prioritizing and allocating resources. The information provided in this section identifies and focuses on those hazards with the highest potential for loss.

This section provides significant background information and guidance on natural hazards in New York State, which will assist in the development of Local Hazard Mitigation Plans (LHMPs) including:

- List of hazards to be considered by all jurisdictions for mitigation planning
- Methodology for assessing risk and estimating potential losses

"Roadmap" Activity[1]

In addition to the long-term and ongoing multi-hazard and hazard-specific strategies identified in **Section 4**, DHSES will continue to develop this section in key areas, such as integration of over the life cycle of the plan:

- Vulnerability and estimation of losses from local hazard mitigation plans
- Trends in development that potentially impact vulnerability to hazards
- Vulnerability and estimation of losses related to State facilities and critical infrastructure

2014 SHMP Update

This section of the plan uses information from the 2011 State Hazard Mitigation Plan (SHMP) as a foundation for the 2014 update, but is revised and restructured to be consistent with the Standard State Mitigation Plan crosswalk defined by 44 CFR §201.4(c)(2). **All hazards identified within the crosswalk were reviewed based on the following considerations:**

- Applicability to New York State and local jurisdictions
- Opportunity to identify new hazards data and information related to probability, frequency, vulnerability, and loss
- Methodology for a uniform risk assessment process for all-hazards planning

Based on this review, the hazards list was modified as described in **Table 3.1b**. Each hazard was thoroughly researched and updated with the most readily available information, including historical and scientific data. Hazard profiles show expanded information and offer enhanced examples of GIS data to characterize vulnerability. The format for the individual hazard sections was realigned to be consistent with 44CFR, §201.4 crosswalk. In addition, attempts were made throughout the hazard sections to

[1] Roadmap Activities are action items to be developed further during the life-cycle of the plan, through the monitoring, evaluation and update process. The comprehensive list of action items can be found in **Sections 2** and **4**.

streamline information and clarify data to enhance usability of the plan. Data was updated where available, and data limitations and key references are described at the end of Section 3.0 as well as each individual hazard section.

The 2011 plan featured updates of the hazards identified in the 2008 plan. As a result of the 2014 analysis, several hazards included in the 2011 plan as sub-types of other hazards were extracted and placed as stand-alone sections in the 2014 update. In addition, other hazard categories were restructured based on recommendations from FEMA's 2011 plan review, and input from the SHMP Planning Team and other stakeholders. The Flood profile was expanded to include all types of flooding events, including ice jams, and dam- and levee-break flooding. Coastal Erosion was extracted from the 2011 Flood section and developed as a stand-alone hazard section. In addition, Climate Change was identified as a significant hazard and discussion in Section 3.3.1 of the 2011 SHMP is now addressed in Section 3.4 of the 2014 update. This section includes the most recent validated data from multiple sources including scientific climate reports and studies, and provides guidance for the local planning and decision-making processes.

Summary of changes to the hazards sections includes:

- The list of 13 hazards identified and assessed in the 2011 Plan is restructured into 15 separate hazards, and one hazard omitted, in order to align more closely with the 44 CFR 201.4 criteria and recommendations from FEMA, State mitigation staff and stakeholder review of the 2011 Plan.
- Climate Change discussion was removed from Section 3.3.1 (2011 Plan) and developed as a new hazard profile and risk assessment.
- Coastal Erosion was removed from the Flood Hazard section and developed as a new hazard profile and risk assessment.
- Avalanche and Tsunami were profiled as new hazards and assessed for probability, vulnerability and potential losses.
- Power Failure was removed as a natural hazard, as it is primarily an impact or consequence of various types of natural and human-caused hazards, and has been integrated into the appropriate hazard sections.
- Updated listing of past Federal Disaster Declarations in New York State
- Updated state vulnerability and loss data
- Referenced *New York State Local Hazard Mitigation Planning Standards* (2012) as a planning tool and resource for developing local Plans
- Review of 56 LHMPs and integration of vulnerability and loss data in the SHMP.

3.1 OVERVIEW AND METHODOLOGY

This section describes the general approach used to identify and profile hazards, assess their impacts and vulnerabilities to the state and local communities, and rank the hazards by greatest opportunity for loss reduction.

3.1.1 Identifying Hazards

New York State's large size, varying climate, and substantial population make hazard mitigation essential for sustained quality of life for the citizens of the State. Hazard mitigation begins with *hazard identification*.

A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing. Natural hazards can exist with or without the presence of people and land development. However, hazards can be exacerbated by societal behavior and practice, such as building in a floodplain, along a shoreline, or on an earthquake fault. Natural disasters are inevitable, but many impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely.

The 2014 hazard review and identification process began with a list of **sixteen** potential hazards to be considered.

Table 3.1a: Hazards Initially Considered for the 2014 New York State Hazard Mitigation Plan

Hazard Type	Definitions and Key Terms
Avalanche	A downhill fall of snow: a rapid downhill flow of a large mass of something dislodged from a mountainside or the top of a precipice, especially snow or ice.
Climate Change	An emerging scientific consensus recognizing that the increasing concentration of carbon dioxide in the atmosphere, along with other heat-trapping greenhouse gasses, resulting from the combustion of fossil fuels and other human sources, is warming the planet and changing the climate. Increased impacts and consequences of climate change may include increased severe storms (including flooding and coastal erosion), excessive heat, sea level rise, and heavy demand on energy resources. These and other impacts may be addressed through initiatives related to adaptation and mitigation.
Coastal Erosion (including seiche)	A process whereby large storms, flooding, strong wave action, sea level rise, and human activities, such as inappropriate land use, alterations, and shore protection structures wear away the beaches and bluffs along the U.S. ocean and Great Lakes coastlines. Erosion

Hazard Type	Definitions and Key Terms
	undermines and often destroys homes, businesses, and public infrastructure, and can have long-term economic and social consequences. Similar in motion to a seesaw, a ***seiche*** is a standing wave in which the largest vertical oscillations are at each end of a body of water with very small oscillations at the "node," or center point, of the wave. Seiches can form in any enclosed or semi-enclosed body of water, from a massive lake to a small pond and can cause flooding and erosion along the adjacent shorelines.
Drought	A prolonged period with no rain, particularly during the planting and growing season in agricultural areas. Limited winter precipitation accompanied by moderately long periods during the Spring and Summer months can also lead to drought conditions.
Earthquake	The sudden motion or trembling of the ground produced by abrupt displacement of rock material, usually within the upper 10-20 miles of the earth's surface.
Extreme Temperatures **(Heat and Cold)**	Extreme Heat-temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat. Extreme Cold-Although no specific definition exists for extreme cold, the following are characteristics of an extreme cold event in New York State: temperatures at or below zero degrees for an extended period of time. Note that extreme cold events are usually part of Winter Storm events, but can occur during anytime of the year and have devastating effects on New York State agricultural production.
Flood	A general and temporary condition of partial or complete inundation on normally dry land from the following: • Riverine flooding, including overflow from a river channel, flash floods, alluvial fan floods, mud flows or debris floods; • Ice-jam floods • Dam- and levee break floods • Local drainage or high groundwater levels • Fluctuating lake levels • Coastal flooding
Hail Storm	Showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud.
High Wind Events (Tornado and Straight Line Winds)	Tornado- is a local atmospheric storm, generally of short duration, formed by winds rotating at very high speeds, usually in a counterclockwise direction in the Northern hemisphere. The vortex, up to several hundred yards wide, is visible to the observer as a

Hazard Type	Definitions and Key Terms
	whirlpool-like column of winds rotating about a hollow cavity or funnel. Top winds have been estimated to be in excess of 300 miles per hour. Straight-line wind- is wind that comes out of a thunderstorm. If these winds meet or exceed 58 miles per hours then the storm is classified as severe by the National Weather Service. These winds are produced by the downward momentum in the downdraft region of a thunderstorm. An environment conducive to strong straight-line wind is one in which the updrafts (and downdrafts) are strong, the air is dry in the middle troposphere and the storm has a fast forward motion. Straight-line wind intensity can be as powerful as a tornado. The National Weather Service distinguishes between straight-line wind and wind produced from a tornado when conducting surveys of wind damage.
Hurricane (Tropical Cyclones, Coastal Storms, and Nor'easters)	Tropical Cyclones- form in the atmosphere over warm ocean areas, in which wind speeds reach 74 miles per hour or more and blow in a large spiral around a relatively calm center or "eye". Circulation is counterclockwise in the Northern Hemisphere. Coastal Storms- are a disturbance of the stable conditions of the atmosphere with wind (sustained and high gusts) and heavy rain as the dominant meteorological element. Thunder and lightning may also be present. Types of storms include extra-tropical cyclones, in which there is a low central pressure relative to the surrounding pressure that may occur along with the high winds and heavy rains. Impacts can include wind damage, coastal flooding, high tides, coastal and inland erosion, impact to ecosystems, and power failure. Consequences from coastal storms are similar to those experienced in tropical cyclones and may include immediate threats to life, property, environment, and the coastal economy. Nor'easters- are coastal storms that occur along the east coast, and are most frequent and strongest between September and April. They typically account for more cumulative damage than hurricanes because they occur more frequently and may last for several days. Although Nor'easters are typically winter storms, they are addressed in this section due to the wind and wave actions similar to other coastal storms. (*See also Severe Winter Storms*)
Land Subsidence and Expansive Soils	Land Subsidence- is depressions, cracks, and sinkholes in the earth's surface which can threaten people and property. Subsidence depressions, which normally occur over many days to a few years,

Hazard Type	Definitions and Key Terms
	may damage structures with low strain tolerances such as dams, factories, nuclear reactors, and utility lines. The sudden collapse of the ground surface to form sinkholes, many yards wide and deep, within the span of a few minutes to a few hours poses immediate threat to life and property. Expansive Soils- is any soil that expands when wet and shrinks when dry. Soils are tested using an accepted standard of measurement to determine swell potential. Expansive soils can exert pressures up to 15,000 lbs. per foot causing the breakdown of building foundations and structural integrity. Roadbeds may also be affected, and could lead to avalanche and collapse when cutting into mountains and hillsides.
Landslide	The downward and outward movement of slope-forming materials reacting to the force of gravity. Slide materials may be composed of natural rock, soil, artificial fill, or combinations of these materials. The term landslide is generalized and includes rockfalls, rockslides, block glide, debris slide, earth flow, mud flow, slump, and other such terms that describe mass wasting.
Severe Winter Storm (Snow and Ice)	Includes ice storms and blizzards and can be accompanied by extreme cold. The National Weather Service characterizes blizzards as being combinations of winds in excess of 35 miles per hour with considerable falling or blowing snow, which frequently reduces visibility.
Tsunami	A series of ocean waves generated by a rapid large-scale disturbance of the sea water, tsunamis do not have a season and do not occur regularly or frequently on the east coast. Most tsunamis are generated by earthquakes, but may also be caused by volcanic eruptions, landslides, undersea slumps, or meteor impacts. Tsunami waves radiate outward in all directions from the disturbance and can move across entire ocean basins. A tsunami typically causes the most severe damage and casualties close to its source, where local populations may have little time to react before the waves arrive.
Wildfire	A wildfire is an uncontrolled fire in an area of combustible vegetation that occurs in the countryside or a wilderness area, sometimes in close proximity to development. A wildfire differs from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to change direction unexpectedly, and its ability to jump gaps such as roads, rivers and fire breaks. Wildfires are characterized in terms of the cause of ignition, their physical properties such as speed of propagation, the combustible material present, and the effect of weather on the fire.

Hazard Type	Definitions and Key Terms
Volcano	A volcano is an opening, or rupture, in the surface or crust of the Earth which allows hot lava, volcanic ash and gases to escape from the magma chamber below the surface. *(Volcano was eliminated from any further consideration in the SHMP because there are no historical records of occurrence in the State and the probability is extremely low.)*

3.1.2 Profiling Hazards

In its role as the coordinating agency for the State's Disaster Preparedness Commission (DPC) and for Federal Emergency Management Agency (FEMA) Programs in the State, New York State Department of Homeland Security and Emergency Services (DHSES) has identified multiple natural, technological, and human-caused hazards which have impacted, or have the potential to impact, New York State. However, given the scope of this plan, only natural hazards are addressed in the 2014 SHMP update.

The process to identify hazards that are relevant to New York State's mitigation planning involved the 2014 SHMP Planning Team and key stakeholders, and included consideration of the following elements:

- Recent disaster events and incidents for all natural hazards
- Profiles and assessments of the identified hazards by stakeholders
- Other New York State plans and programs that address hazards identified and/or managed by state agencies and authorities
- Hazards identified in current FEMA-approved county mitigation plans
- New data and information that determines hazard probabilities and risk

As new hazards are identified in future updates, they can be added to the hazard list, profiled, assessed for risk, and considered for mitigation potential.

As a result of the extensive research and analysis for the 2014 SHMP update, **fifteen** hazards were identified as relevant for State and Local mitigation planning. Volcano was eliminated for any further consideration because there are no historical records of occurrence in New York State and the probability of volcanic eruption or impact in the state from volcanic eruption in another jurisdiction is extremely low. **Table 3.1b** shows the **fifteen** natural hazards that were addressed in the 2014 SHMP and how and why they were identified. The level of detail provided in each hazard section correlates to the relative level of risk of the hazard and is limited by the type and level of data available.

Table 3.1b: Natural Hazards Considered for the 2014 SHMP

Hazard Profile	How Identified	Why Identified
Avalanche	▪ NYS Department of Homeland Security and Emergency Services (DHSES) ▪ New York State Department of Environmental Conservation (DEC), Division of Forest Protection ▪ National Avalanche Center	▪ History of previous localized occurrences ▪ Related loss of life from previous occurrences ▪ Potential damage to property and/or infrastructure
Climate Change	▪ New York State Department of Environmental Conservation (DEC) ▪ New York Energy Research and Development Authority (NYSERDA) ▪ New York State Department of State (DOS) ▪ DHSES ▪ State ad hoc adaptation interagency working group ▪ National Oceanic and Atmospheric Administration (NOAA)	▪ Potential link to occurrences of coastal flooding, erosion, and temperature change ▪ Potential impact to health and safety ▪ Potential impact to critical energy resources ▪ Identified research and planning priority for State agencies (and LHMPs)
Coastal Erosion	▪ DEC Coastal Management Program ▪ DOS Coastal Management Program ▪ DHSES ▪ United States Army Corps of Engineers (USACE) ▪ LHMPs	▪ History of previous occurrences ▪ Related loss of life ▪ Documented damage to natural and built infrastructure ▪ High potential loss of critical infrastructure ▪ High potential impact to State and local economies ▪ Link to climate change indicators
Drought	▪ Drought studies ▪ Farm Service Agency ▪ National Climatic Data Center (NCDC) ▪ National Drought Monitoring Center (NDMC) ▪ NYSDEC ▪ US Department of Agriculture (USDA)	▪ History of previous occurrences ▪ Importance of large water users and agriculture to the state's economy ▪ Numerous USDA disaster declarations and state declared disasters and emergencies

Hazard Profile	How Identified	Why Identified
Earthquake	▪ DHSES ▪ National Earthquake Hazards Reduction Program (NEHRP) ▪ New York State Geological Survey (NYSGS) ▪ US Geological Survey (USGS)	▪ History of previous occurrences ▪ Potential for significant earthquake losses
Extreme Temperatures	▪ NCDC ▪ National Severe Storms Laboratory ▪ National Weather Service (NWS), National Oceanic and Atmospheric Administration (NOAA) ▪ DHSES ▪ Storm Prediction Center, NOAA	▪ History of previous occurrences ▪ Potential health and safety issues ▪ Link to climate change indicators ▪ Potential impact to critical energy infrastructure
Flood	▪ FEMA ▪ NCDC ▪ DHSES ▪ DEC ▪ New York State (NYS) Thruway Authority and NYS Canal Corporation ▪ USACE ▪ USGS	▪ Extensive history of severe riverine flooding ▪ High losses from previous floods ▪ History of damaging ice jam and flash floods ▪ Ongoing, persistent closed basin flooding ▪ Numerous dams throughout the state, including 384 high hazard dams ▪ Dam maintenance problems and extreme weather events could cause failures ▪ History of coastal flooding ▪ Numerous Presidential disaster declarations for flooding
Hailstorm	▪ NWS, NOAA ▪ NCDC	▪ History of previous localized occurrences ▪ Potential health and safety issue ▪ Potential for significant damage to property
High Wind Events	▪ NWS, NOAA ▪ NCDC	▪ Extensive history of damaging tornadoes, hail, downbursts, lightning, and strong winds throughout the state ▪ Numerous Presidential Disaster Declarations for severe storms

Hazard Profile	How Identified	Why Identified
Hurricane	▪ National Hurricane Center, NOAA ▪ NWS, NOAA ▪ FEMA Disaster Declarations ▪ DHSES	▪ Significant history of previous occurrences ▪ High potential for loss of life ▪ High potential for property damage and loss ▪ High potential for infrastructure damage and loss ▪ High potential for environmental impacts ▪ High potential for economic damage and loss
Land Subsidence/ Expansive Soils	▪ NEHRP ▪ NYSGS ▪ USGS	▪ History of previous localized occurrences ▪ Potential for property damage
Landslides	▪ NYSGS ▪ USGS ▪ NYSDHSES	▪ History of previous localized occurrences ▪ Potential for property damage
Severe Winter Storms	▪ NCDC ▪ National Severe Storms Laboratory ▪ NWS, NOAA ▪ DHSES ▪ Storm Prediction Center, NOAA	▪ Significant history of previous occurrences ▪ Potential for loss of life ▪ Significant impacts to critical infrastructure
Tsunami	▪ 44 Code of Federal Regulations (CFR) §201.4, Standard State Hazard Mitigation Planning Criteria ▪ DHSES	▪ Low potential for occurrence based on lack of previous events ▪ Potential for loss of life ▪ Potential for significant environmental and economic losses
Wildfire	▪ DHSES ▪ DEC, Division of Forest Protection	▪ History of previous occurrences ▪ Potential for loss of life ▪ Potential for environmental impacts

Although the hazards described in **Table 3.1b** (above) were determined to be relevant to the state as a whole, some may not necessarily pose a significant threat to all areas, regions, counties or local jurisdictions within the state. DHSES recommends that all 15 hazards identified in **Table 3.1b** be initially considered during the local hazard mitigation planning process, but accepts that some hazards relevant at the state level may not need to be fully profiled and assessed for risk in local plans, if it is determined that they present a low probability or risk to the local jurisdiction. Conversely, some hazards considered to be significant by local jurisdictions may be more relevant for preparedness and response actions, and may not present cost effective opportunities for mitigation at the state level.

Table 3.1c illustrates the relationship of the **fifteen** hazards identified and addressed in the 2011 SHMP to the realigned hazards in the 2014 update (changes are noted in **Red** font).

2011 HMP (12 hazards)	2014 HMP (15 hazards)
Flood	Flood (sub-types - riverine overbank flooding, flash floods, alluvial fan floods, mudflows or debris floods, ice-jam floods, dam- and levee-break floods, local drainage or high groundwater levels, fluctuating lake levels, and coastal flooding)
Hurricane, Tropical Storm, and Coastal Storm	Hurricane (including Tropical Storm, Coastal Storm, and Nor'easter)
Tornado	High Wind Events (Tornado and Straight-line Winds)
Winter Storm (Severe)	Severe Winter Storm (including Snow and Ice)
Hailstorm	Hailstorm
Wildfire	Wildfire
Drought	Drought
Extreme Temperatures	Extreme Temperatures
Earthquake	Earthquake
Landslide	Landslide
Land Subsidence	Land Subsidence and Expansive Soils
Power Failure (removed with justification)	Coastal Erosion
*Climate Change	Climate Change
	Avalanche
**The 2011 SHMP included a discussion of issues and activities related to this hazard.*	Tsunami

3.1.3 Previous Occurrences and Probability of Future Events

This section provides a discussion of previous hazard events. This data serves to define historic hazard trends and provides a reference point for understanding the potential impacts from future predicted events**. Reviewing historic data assists in evaluating hazard event profiles, which focus on answering the following questions:**

- How often might a particular disaster occur?
- Where is New York State most likely to be affected?
- What is the potential loss/damage?

The 2014 update provides a percentage for probability/frequency calculated from the Spatial Hazard Events and Losses Database United States (SHELDUS™) for each hazard, where available. This information is included as a means to identify those jurisdictions that have the highest number of previous occurrences as a basis for calculating future probability. In some cases, other accepted methodology has been used to quantify probability for select hazards.

Past Major Disaster and Emergency Events

From February 2011 through September 2013, New York State had ten major disasters or emergency declarations related to weather events - hurricanes, tropical storms, severe storms, flooding, tornadoes, and straight-line winds. Between 1956 through 2013, all but five of the disasters or events that were declared major disasters or emergencies have been the result of damages from severe floods, hurricanes, coastal storms, and severe winter storms. The five disaster declarations that do not fall into those categories are: the Love Canal, the World Trade Center Bombing in 1993, the Long Island Wildfires in 1995, the September 11, 2001 Terrorist Attacks, and the April 2002 Earthquake.

Hurricane Sandy struck New York State on October 29, 2012, causing major impacts to the population, property, infrastructure and environment of the state. Specific information related to the impacts, consequences and outcomes from the storm, where available, is included throughout the hazard sections of this plan; however, quantitative information related to total costs and detailed losses have not yet been fully compiled into national databases. Additional information describing impacts from Hurricane Sandy are described in the featured box below.

Hurricane Sandy Summary[2]

On October 29, 2012, Hurricane Sandy made landfall in the New York City metropolitan area producing record storm surge, flooding, and wind damage. Tragically, 60 New Yorkers lost their lives as a result of the storm. Millions in the region were also impacted by flooded streets, water systems, and subways; loss of power to more than 2 million homes; and thousands of housing units were damaged and hundreds of homes destroyed.

On coastal Long Island, flood waters downed trees and inundated entire neighborhoods, creating 6 million cubic yards of debris. In Breezy Point, Queens, several explosions and fires erupted, destroying more than 80 homes in a small neighborhood.

In advance of the storm, the State, New York City, and numerous local Emergency Operations Centers (EOCs) were activated to prepare for this event and to pre-position critical supplies and assets. Over 400,000 New Yorkers were also evacuated pre-storm, before the mass transit system was shut down and several key bridges were closed.

Thousands of emergency personnel were deployed to the impacted area, including National Guard Troops, State Police, DHSES personnel, and over 1,200 citizen volunteers. In response to Sandy, more than 147 shelters were operating at the peak of the response and over 2 million meals were served or delivered. 63 Disaster Assistance Centers were opened, registering over 260,000 claims totaling over $800 million in damages. Disaster unemployment claims totaled over $1.7 million.

Hurricane Sandy damage critical infrastructure such as hospitals, wastewater treatment facilities, mass transit (subways/tunnels), and roads and bridges in its path across New York City, Long Island, and multiple other counties. Overall, 14 counties were included in New York's Presidential Disaster Declaration for Public Assistance totaling over 1,600 applicants and costs of over $3 billion dollars. *[NOTE: The number of applicants and total costs are not yet fully documented.]*

The effects of Hurricane Sandy will affect New York State for years to come; in particular, long-term housing and other recovery efforts will be a particularly challenging issue. In order to prepare for future catastrophic events, Governor Cuomo convened three task forces: The NYS Ready Commission, NYS Respond Commission, and the Moreland Commission (to review and make recommendations on utilities' preparations for and response to Sandy). The initial reports of these Commissions have been released and the State is beginning to take actions to address the recommendations put forth by the Commissions.

[2] New York State Threat/Hazard Identification and Risk Assessment (THIRA)

A bench sits in front of the wreckage of homes devastated by fire and the effects of Hurricane Sandy in Breezy Point, Queens, NY. October 31, 2012 (Reuters/Shannon Stapleton)

A bench sits in front of homes under construction in Breezy Point, Queens, NY a year after Hurricane Sandy devastated the area. October 10, 2013 (Gordon Donovan /Yahoo News)

Table 3.1d and **Figure 3.1a** provide a listing and map of New York's major disaster and emergency declarations. The disaster history demonstrates the wide variety of disaster types and locations where disasters have occurred in the State. Following many of these disasters, especially since 1996, post-disaster strategy reports were prepared. These reports, among other things, identify the hazards which caused the disasters or emergencies, assess the severity of the events and the factors contributing to the severity, and make recommendations for the implementation of mitigation and other emergency management actions. As appropriate, elements of these reports were used in the development of the State's Hazard Mitigation Plan. The losses attributed to the listed events range from minor property damage such as stream bank erosion and basement flooding, to catastrophic and devastating losses, such as loss of human life and destruction of many homes and businesses, resulting in severe regional and statewide economic impact.

Table 3.1d: Previous Occurrences – Federally Declared Disasters (1954-2013)

Disaster Number	Date Declared	Year	Incident Description	Declaration Type
4129	7/12/2013	2013	Severe Storms and Flooding	Major Disaster Declaration
4111	4/23/2013	2013	Severe Winter Storm and Snowstorm	Major Disaster Declaration
4085	10/30/2012	2012	Hurricane Sandy	Major Disaster Declaration
3351	10/28/2012	2012	Hurricane Sandy	Emergency Declaration
4031	9/13/2011	2011	Remnants of Tropical Storm Lee	Major Disaster Declaration
3341	9/8/2011	2011	Remnants of Tropical Storm Lee	Emergency Declaration
4020	8/31/2011	2011	Hurricane Irene	Major Disaster Declaration
3328	8/26/2011	2011	Hurricane Irene	Emergency Declaration
1993	6/10/2011	2011	Severe Storms, Flooding, Tornadoes, and Straight-line Winds	Major Disaster Declaration
1957	2/18/2011	2011	Severe Winter Storm and Snowstorm	Major Disaster Declaration
1943	10/14/2010	2010	Severe Storms, Tornadoes, and Straight-line Winds	Major Disaster Declaration

Disaster Number	Date Declared	Year	Incident Description	Declaration Type
1899	4/16/2010	2010	Severe Storms and Flooding	Major Disaster Declaration
1869	12/31/2009	2009	Severe Storms and Flooding Associated with Tropical Depression Ida and a Nor'easter	Major Disaster Declaration
1857	9/1/2009	2009	Severe Storms and Flooding	Major Disaster Declaration
1827	3/4/2009	2009	Severe Winter Storm	Major Disaster Declaration
3299	12/18/2008	2008	Severe Winter Storm	Emergency Declaration
1724	8/31/2007	2007	Severe Storms, Flooding, and Tornado	Major Disaster Declaration
1710	7/2/2007	2007	Severe Storms and Flooding	Major Disaster Declaration
1692	4/24/2007	2007	Severe Storms and Inland and Coastal Flooding	Major Disaster Declaration
3273	2/23/2007	2007	Snow	Emergency Declaration
1670	12/12/2006	2006	Severe Storms and Flooding	Major Disaster Declaration
1665	10/24/2006	2006	Severe Storms and Flooding	Major Disaster Declaration
3268	10/15/2006	2006	Snowstorm	Emergency Declaration
1650	7/1/2006	2006	Severe Storms and Flooding	Major Disaster Declaration
3262	9/30/2005	2005	Hurricane Katrina Evacuation	Emergency Declaration
1589	4/19/2005	2005	Severe Storms and Flooding	Major Disaster Declaration
1564	10/1/2004	2004	Severe Storms and Flooding	Major Disaster Declaration
1565	10/1/2004	2004	Tropical Depression Ivan	Major Disaster Declaration
1534	8/3/2004	2004	Severe Storms and Flooding	Major Disaster Declaration
3195	3/3/2004	2004	Snow	Emergency Declaration

Disaster Number	Date Declared	Year	Incident Description	Declaration Type
1486	8/29/2003	2003	Severe Storms, Tornadoes and Flooding	Major Disaster Declaration
3186	8/23/2003	2003	Power Outage	Emergency Declaration
1467	5/12/2003	2003	Ice Storm	Major Disaster Declaration
3184	3/27/2003	2003	Snowstorm	Emergency Declaration
3173	2/25/2003	2003	Snowstorm	Emergency Declaration
1415	5/16/2002	2002	Earthquake	Major Disaster Declaration
1404	3/1/2002	2002	Snowstorm	Major Disaster Declaration
3170	12/31/2001	2001	Snowstorm	Emergency Declaration
1391	9/11/2001	2001	Terrorist Attack	Major Disaster Declaration
3157	12/4/2000	2000	Snow Storm	Emergency Declaration
3155	10/11/2000	2000	Virus Threat	Emergency Declaration
1335	7/21/2000	2000	Severe Storms	Major Disaster Declaration
1296	9/19/1999	1999	Hurricane Floyd	Major Disaster Declaration
3149	9/18/1999	1999	Hurricane Floyd	Emergency Declaration
2269	8/9/1999	1999	West Point Fire Complex	Fire Management Assistance Declaration
3138	3/10/1999	1999	Winter Storm	Emergency Declaration
3136	1/15/1999	1999	Winter Storm	Emergency Declaration
1244	9/11/1998	1998	Severe Storms	Major Disaster Declaration
1233	7/7/1998	1998	Severe Storms and Flooding	Major Disaster Declaration
1222	6/16/1998	1998	New York Severe Thunderstorms and Tornadoes	Major Disaster Declaration

Disaster Number	Date Declared	Year	Incident Description	Declaration Type
1196	1/6/1998	1998	Severe Winter Storms	Major Disaster Declaration
1148	12/9/1996	1996	Severe Storms/Flooding	Major Disaster Declaration
1146	11/19/1996	1996	Severe Storms/Flooding	Major Disaster Declaration
1095	1/24/1996	1996	Severe Storms/Flooding	Major Disaster Declaration
1083	1/12/1996	1996	Blizzard	Major Disaster Declaration
2115	8/25/1995	1995	Sunrise Complex	Fire Management Assistance Declaration
984	4/2/1993	1993	World Trade Center Explosion	Major Disaster Declaration
3107	3/17/1993	1993	Severe Blizzard	Emergency Declaration
974	12/21/1992	1992	Coastal Storm, High Tides, Heavy Rain, Flooding	Major Disaster Declaration
918	9/16/1991	1991	Hurricane Bob	Major Disaster Declaration
898	3/21/1991	1991	Severe Storm, Winter Storm	Major Disaster Declaration
801	11/10/1987	1987	Severe Winter Storm	Major Disaster Declaration
792	5/15/1987	1987	Flooding	Major Disaster Declaration
750	10/18/1985	1985	Hurricane Gloria	Major Disaster Declaration
734	3/22/1985	1985	Snow Melt, Ice Jams	Major Disaster Declaration
733	3/20/1985	1985	Flooding	Major Disaster Declaration
725	9/25/1984	1984	Severe Storms, Flooding	Major Disaster Declaration
702	4/17/1984	1984	Coastal Storm, Flooding	Major Disaster Declaration
3080	5/21/1980	1980	Chemical Waste, Love Canal	Emergency Declaration

Disaster Number	Date Declared	Year	Incident Description	Declaration Type
3066	8/7/1978	1978	Chemical Waste, Love Canal	Emergency Declaration
527	2/5/1977	1977	Snowstorms	Major Disaster Declaration
3027	1/29/1977	1977	Snowstorms	Emergency Declaration
520	9/3/1976	1976	Hurricane Belle	Major Disaster Declaration
515	7/21/1976	1976	Severe Storms, Flooding	Major Disaster Declaration
512	6/29/1976	1976	Flash Flooding	Major Disaster Declaration
494	3/19/1976	1976	Ice Storm, Severe Storms, Flooding	Major Disaster Declaration
487	10/2/1975	1975	Severe Storms, Heavy Rain, Landslides, Flooding	Major Disaster Declaration
3004	11/2/1974	1974	Flooding (NYS Barge Canal)	Emergency Declaration
447	7/23/1974	1974	Severe Storms, Flooding	Major Disaster Declaration
401	7/20/1973	1973	Severe Storms, Flooding	Major Disaster Declaration
367	3/21/1973	1973	High Winds, Wave Action, Flooding	Major Disaster Declaration
338	6/23/1972	1972	Tropical Storm Agnes	Major Disaster Declaration
311	9/13/1971	1971	Severe Storms, Flooding	Major Disaster Declaration
290	7/22/1970	1970	Heavy Rains, Flooding	Major Disaster Declaration
275	8/26/1969	1969	Heavy Rains, Flooding	Major Disaster Declaration
233	10/30/1967	1967	Severe Storms, Flooding	Major Disaster Declaration
204	8/18/1965	1965	Water Shortage	Major Disaster Declaration
158	8/23/1963	1963	Heavy Rains, Flooding	Major Disaster Declaration

Disaster Number	Date Declared	Year	Incident Description	Declaration Type
129	3/16/1962	1962	Severe Storm, High Tides, Flooding	Major Disaster Declaration
52	3/29/1956	1956	Flood	Major Disaster Declaration
45	8/22/1955	1955	Hurricane, Floods	Major Disaster Declaration
26	10/7/1954	1954	Hurricane	Major Disaster Declaration

Source: FEMA

Figure 3.1a shows the number of PDDs by county for the period of 1954 through August 2013. Counties in the southern part of New York show the highest totals, with Delaware, Ulster, and Suffolk Counties having the greatest number of PDDs for the State.

Figure 3.1a: Number of Presidential Disaster Declarations, By County (1954-2013)

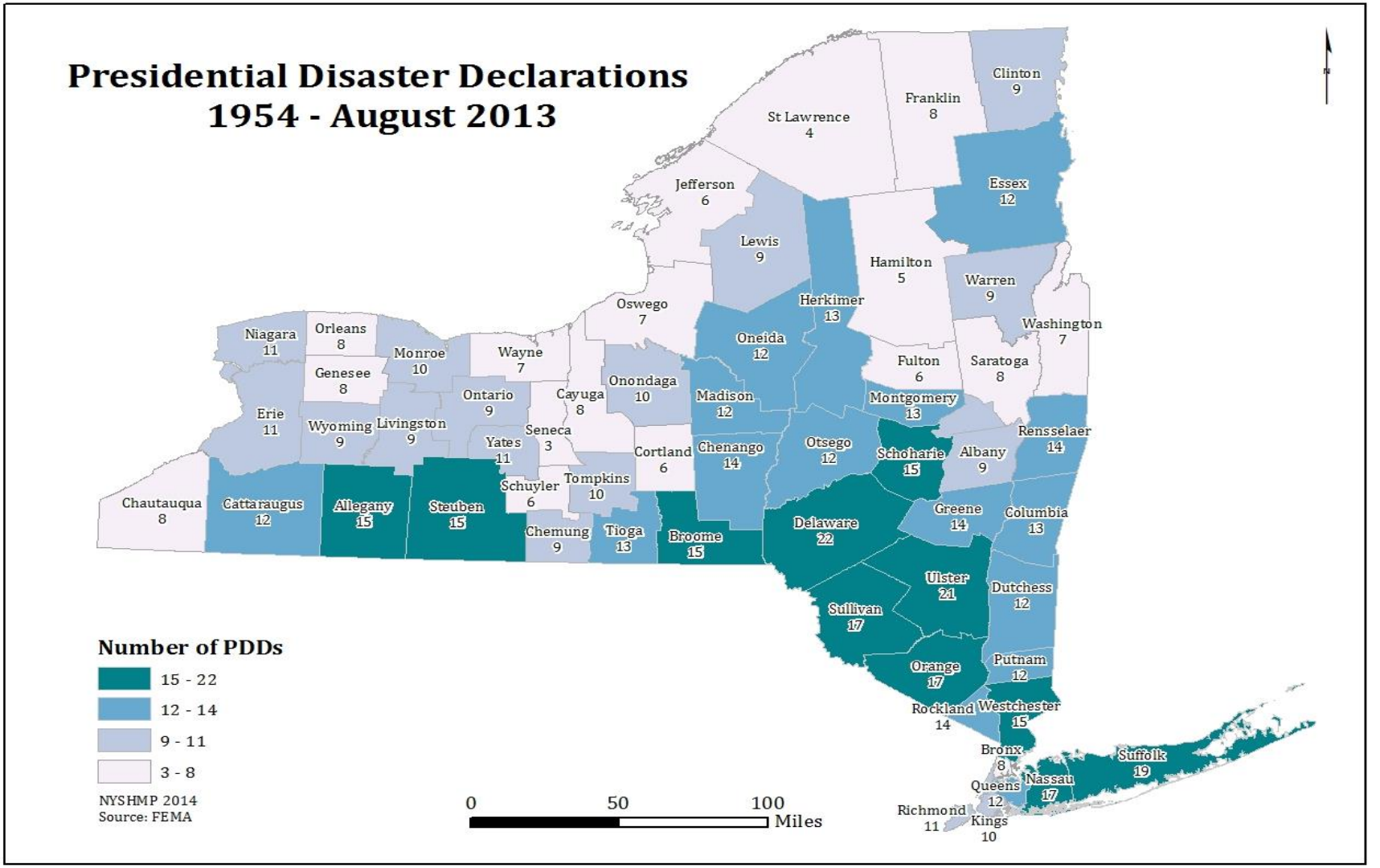


Table 3.1e provides a summary of the number of all hazard events, by county, for the period 1960 to 2012. [3] This information can be used in development of local plans to help prioritize hazards.

Table 3.1e: Summary of Hazard Events, By County (1960 – 2012)

County	Total Events	Coastal	Drought	Earth-quake	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Albany	516	0	3	41	8	64	42	159	4	195
Allegany	425	0	0	0	1	57	32	183	1	151
Bronx	225	3	0	0	13	37	26	72	9	65
Broome	601	0	3	0	7	126	37	252	2	174
Cattaraugus	684	0	0	0	17	77	54	255	1	280
Cayuga	567	0	2	0	3	36	40	207	2	277
Chautauqua	765	4	0	0	1	75	58	324	1	302
Chemung	363	0	2	0	3	52	34	140	2	130
Chenango	592	0	2	0	6	91	36	235	2	220
Clinton	702	0	1	15	22	87	42	217	1	317
Columbia	430	0	3	0	3	54	45	168	4	153
Cortland	522	0	3	0	6	62	29	185	2	235
Delaware	536	0	4	0	6	90	36	216	2	182
Dutchess	480	0	3	6	6	56	46	201	5	157
Erie	823	7	0	6	1	104	78	328	1	298
Essex	707	0	1	19	21	116	29	194	1	326
Franklin	645	0	1	13	24	45	34	203	1	324
Fulton	464	0	3	4	8	42	33	150	2	222

[3] *Source: SHELDUS. Hurricane Sandy data is not yet included in SHELDUS data.*

County	Total Events	Coastal	Drought	Earth-quake	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Genesee	424	0	0	0	2	43	37	158	1	183
Greene	423	0	3	0	4	69	40	125	4	178
Hamilton	421	0	3	7	7	29	28	106	2	239
Herkimer	583	0	3	1	15	85	34	167	3	275
Jefferson	560	0	2	1	2	34	34	211	2	274
Kings	235	4	0	0	15	34	26	83	9	64
Lewis	615	0	2	4	2	49	37	188	2	331
Livingston	392	0	0	6	1	41	33	156	1	154
Madison	497	0	3	0	4	36	31	160	2	261
Monroe	515	0	0	0	1	63	57	204	1	189
Montgomery	496	0	3	0	9	65	38	156	3	222
Nassau	296	13	0	0	6	42	26	134	10	65
New York	251	5	0	2	20	36	26	94	7	61
Niagara	541	1	0	4	1	42	66	246	1	180
Oneida	745	0	4	0	4	70	46	302	2	317
Onondaga	499	0	2	0	7	37	36	202	2	213
Ontario	396	0	0	0	1	44	40	155	2	154
Orange	408	1	2	12	6	43	32	171	6	135
Orleans	379	0	0	0	2	32	39	139	1	166
Oswego	704	0	2	0	4	36	49	239	2	372
Otsego	616	0	4	2	7	62	31	255	2	253
Putnam	293	1	2	4	6	34	27	87	8	124
Queens	284	13	0	0	18	40	28	112	8	65
Rensselaer	467	0	3	0	7	62	55	190	4	146

County	Total Events	Coastal	Drought	Earth-quake	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Richmond	193	2	0	0	7	30	24	63	7	60
Rockland	231	1	1	2	5	32	25	74	8	83
Saratoga	558	0	2	1	10	58	53	227	4	203
Schenectady	421	0	2	2	7	49	42	121	3	195
Schoharie	474	0	3	2	8	60	38	134	2	227
Schuyler	305	0	2	0	4	32	29	103	2	133
Seneca	321	0	2	0	3	26	27	112	2	149
St Lawrence	717	0	3	6	22	41	32	237	2	374
Steuben	408	0	1	2	3	65	33	185	2	117
Suffolk	317	14	0	1	5	39	26	151	11	70
Sullivan	434	0	4	0	6	69	31	179	3	142
Tioga	451	0	3	0	6	74	31	151	2	184
Tompkins	364	0	2	0	4	34	33	146	2	143
Ulster	505	0	3	0	5	87	41	189	5	175
Warren	437	0	2	4	10	55	38	135	3	190
Washington	423	0	2	2	7	52	41	164	2	153
Wayne	508	0	1	0	2	40	56	179	2	228
Westchester	336	2	1	13	7	41	26	150	7	89
Wyoming	464	0	0	7	1	43	37	156	1	219
Yates	275	0	1	0	1	25	30	103	2	113
Total	**29,229**	**71**	**104**	**189**	**430**	**3,351**	**2,320**	**10,688**	**200**	**11,876**

Source: SHELUS

Probability of Future Hazard Events

The hazards covered in the analysis are listed in **Table 3.1f,** along with the probability/frequency ratings, which have been validated by DHSES. The hazards listed are those that have been experienced by, or pose a potential threat to, New York State. However, local or isolated incidents that constitute potential disasters should not be overlooked. The ratings are situationally dependent.

The following criteria describe the probability/frequency ratings for each hazard:

- Rare Event (less than once every 50 years)
- Infrequent (once every 8-50 years)
- Regular (once every 1-7 years)
- Frequent (more than once a year)

For the 2014 SHMP update, probabilities are based on the typical period of record (52 years, or 1960 - 2012) for hazard occurrences. It is acknowledged that a much longer period of record is required for more accurate statistical reporting; however, this time frame is the most consistent currently available for the majority of hazards. Pre-1960 data is also often considered to be less reliable o accurate due to quality of record-keeping.

Table 3.1f: Natural Hazards Profiled in the All-Hazards Mitigation Plan

Natural Hazards	Probability/Frequency
Avalanche	Infrequent
Climate Change	Regular
Coastal Erosion	Regular
Drought	Infrequent
Earthquake	Infrequent
Extreme Temperatures	Regular
Flood	Regular
Hailstorm	Regular
High Winds	Regular
Hurricane	Regular
Land Subsidence/Expansive Soils	Rare event
Landslide	Rare event
Severe Winter Weather	Regular
Tsunami	Rare Event
Wildfire	Infrequent

3.1.4 Assessing Vulnerability – Overview

Vulnerability is discussed within each hazard section that is fully assessed for risk and potential losses, and will provide an overview and analysis of the State's vulnerability to the hazards. This will serve to describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. The overview of the vulnerability analysis was completed using a variety of methods, including, Hazus-MH, other GIS-based risk modeling, and statistical analysis of exposure, census data, and past historic losses of state facilities and information from local FEMA-approved hazard mitigation plans.

The 2014 update provided the opportunity for additional research related to the locations of jurisdictions most threatened and vulnerable to hazard occurrences. A significant omission of data available during the 2014 update planning period was that related to Hurricane Sandy. Because New York State is still in the recovery phase from this significant event, a full summary of the impacts, losses and mitigation opportunities from Hurricane Sandy will be added with the next update.

Methodology

Individual hazard profiles within this section include information related to general characteristics, location, previous occurrences, probability for future events, and severity based on impact and consequences to people, property, critical infrastructure, environment, and economy.

Each hazard profile section is followed by an analysis of probability/frequency in order to quantify the potential impact and consequences of the hazard. Based on the outcome of the hazard ranking process, "HAZNY-Mitigation", some hazards were determined to be of low probability and severity and further assessment of vulnerability and losses was not conducted. (See **Section 3.1.11** for a complete description of the HAZNY-Mitigation ranking process.)

For this update, three primary methodologies were chosen to ensure that a comprehensive compilation of probability, vulnerability and loss data was achieved. In addition, other information sources were reviewed and incorporated, as appropriate. The New York State Threat/Hazard Identification and Risk Assessment (THIRA), June 2013, was analyzed for additional information that could inform the hazards analysis process; however, the THIRA document focuses primarily on human-caused hazards. One capability target identified in the THIRA related to natural hazard mitigation. This was the "Threat and Hazard Identification" capability that noted that a threat/hazard identification should be conducted annually at the state level and every three to five years at the local level, which is consistent with the hazard mitigation planning and maintenance cycle.

Extensive GIS data derived from national state, regional, and local sources were utilized. Updated data sets from all FEMA-approved county-level and multi-jurisdictional mitigation plans were incorporated with existing statewide data sets, where available. Hazus-MH was used for specific hazards such as hurricane and earthquake to quantify potential loss estimates. In addition to geographic data, information for this update was compiled by the SHMP Planning Team from stakeholder agencies, including federal, state, regional and local entities, to ensure the most current and accurate information was obtained. In some instances, comprehensive data sets that were included in the 2011 plan were moved to **Appendix 3: Data Supplement** and were updated and summarized in tables or maps in the 2014 SHMP to enhance clarity related to hazard risk, vulnerability and estimated losses. Additional information is available in the appendices of this plan.

Methodology 1 – GIS Baseline Datasets

Geographic Information Systems (GIS) has become an accepted method of conducting spatial analysis of relationships between data. New York State agencies and key stakeholder groups have widely adopted GIS as the primary system to manage, analyze, and visualize spatial information. GIS enables the ability to see or visualize data in the form of a map, providing an effective way to comprehend information in a way that tabular or text based information alone cannot provide.

The New York State GIS Coordination Program provides access to an extensive repository of useful GIS data as well as a host of technical resources, references, and training opportunities that can facilitate the hazard mitigation planning. Counties and local governments can access the NYS GIS Clearinghouse by enrolling in the New York State GIS Data Sharing Cooperative. Many of the datasets used in this plan are accessible through this site. These include, among other datasets, the NYS Office of Real Property property parcels and the FEMA Q3 digital floodplain data used in the 100-year floodplain property exposure analysis.

Like many activities of government, successful hazard mitigation requires an understanding of geography, including knowledge of the spatial relationships between hazards and the population and property at risk. GIS can be used to help define the location and extent of hazardous areas, which is a requirement of the hazard mitigation plan (§201.4(c)(2)(i)). An example of using GIS for hazard identification is demonstrated by the "Landslide Susceptibility Pilot Study of Schenectady County, NY" found in Section 3.13 of this document. The technology can be used to identify and estimate potential damages to the property and populations exposed in these hazardous areas. An example of the use of GIS for natural hazard vulnerability analysis is demonstrated in this plan's "100-Year Floodplain Property Exposure Analysis" in the risk analysis of the Section 3.9 – Flood.

The role of GIS in the hazard mitigation plan is primarily for risk assessment in each hazard section. In addition to the landslide hazard identification and 100-year floodplain property

vulnerability analysis examples, GIS is used extensively in the risk assessment sections for earthquakes, hurricanes, winter storms, coastal erosion, and extreme heat.

DHSES GIS office has assisted in compiling data from multiple levels of government. Identification of GIS resources in local mitigation plans will assist in continuing to identify, validate, and map hazard data at the State level.

Three critical GIS resources that assisted in developing and updating the SHMP include:

1) New York State GIS Coordination Program and the associated New York State GIS Clearinghouse: http://www.nysgis.state.ny.us/
2) Hazus-MH, FEMA's GIS based software program for estimating potential losses to earthquakes, wind and floods:
   http://www.fema.gov/plan/prevent/hazus/index.shtm
   http://www.hazus.org/
3) Data obtained from the Spatial Hazard Events and Losses Database for the United States (SHELDUS™). SHELDUS is a county-level hazard data set for the U.S. for 18 different natural hazard event types such thunderstorms, hurricanes, floods, and tornados. For each event the database includes the beginning date, location (county and state), property losses, crop losses, injuries, and fatalities that affected each county. The data derives from the national data source, National Climatic Data Center's monthly Storm Data publications. Using the latest release of SHELDUS™ 12.0, the database includes every loss causing and/or deadly event between 1960 through 1992 and from 1995 onward. Between 1993 and 1995, SHELDUS™ reflects only events that caused at least one fatality or more than $50,000 in property or crop damages.

Methodology 2 – Hazus-MH2

FEMA has developed Hazus-MH as its primary, nationally standardized tool for hazard mitigation risk assessment. At this time Hazus-MH can be used for earthquake, hurricane winds, or flooding scenarios. Hazus-MH is a loss-estimation software program built upon an integrated GIS platform. The software enables both deterministic (e.g. user determines location for various scenarios) and probabilistic modeling (e.g. calculates annualized potential losses for earthquake (seismic), hurricane wind, or flooding hazards within a community).

Hazards such as dam and levee failure, landslides and expansive soils, geographic locations of areas at risk to the hazard are known. However, these hazards are outside the scope of Hazus-MH. For these hazards, the known locations of areas at risk are mapped utilizing GIS to show areas of the State at greatest risk.

Methodology 3 – Local Plan Integration

The process to update the SHMP for 2014 included a full review and assessment of FEMA-approved county mitigation plans, including the multi-jurisdictional plan for New York City. This assessment included identifying hazards consistent with the SHMP, significant vulnerabilities to specific hazards, and potential loss estimates, if available, by county. In addition, county plans were reviewed to determine specific threats related to changes in development.

Review of 56 FEMA-approved plans noted that no single method of analysis was used throughout all LHMPs to identify hazards by priority based on previous occurrences, probability, and severity. While some plans used the state's HAZNY methodology to rank hazards in a quantifiable manner, and categorize them as high, moderate, or low, some jurisdictions did not perform an analysis for the purpose of ranking each hazard. **Consequently, vulnerability of jurisdictions was determined for the 2014 update by the considering the following points:**

1. Which hazards did the jurisdiction address?
2. Was the county included in previous Federal Disaster Declarations (for Public Assistance) for this hazard? If so, how many, and for which hazards?
3. Did the jurisdiction identify specific vulnerabilities that were quantified, such as total number of population at risk, total value of property at risk, total value of potential economic loss, and/or critical infrastructure at risk?

The method used to incorporate this information in the 2014 SHMP update began with identifying the hazards identified and/or ranked in each county plan. Then the total number of disaster declarations by county was identified. Based on the hazards ranked as "high" or "moderately high" in each county plan, and the counties with the highest number of declarations for that hazard, specific county plans were reviewed to identify vulnerabilities or losses presented in the plans. It should be noted that the information provided in the individual county plans has not been verified beyond review of the most current and available FEMA-approved plans. As hazard mitigation planning matures as a practice and the local plans are updated and enhanced over time, the risk assessment methodologies and results are expected to continually improve.

Local jurisdictions should, at a minimum, include a full profile for all state-identified hazards in the local plan to the extent of their vulnerability to such hazards. If a hazard is omitted from a local plan, a justification should be written into the local plan explaining the reason why it was omitted. **For local mitigation plans, it is recommended that when determining the overall vulnerability related to a hazard, the jurisdiction should conduct a risk assessment evaluating the:**

1. Likelihood and frequency of an event occurring

2. Impact on the population
3. Impact on property within the jurisdiction
4. Impact on the environment
5. Potential economic losses

This methodology is consistent with the state's HAZNY ranking assessment and the modified HAZNY-Mitigation ranking process used for the 2014 SHMP update.

Consideration of Exposure of Cultural and Historic Sites

Historical and cultural sites are significant to the history and identity of the state and its residents. Many of these sites are in areas vulnerable to impact from specific hazards such as flooding, hurricanes, and earthquakes. Although these sites are not addressed from a site-specific perspective within each hazard profile or vulnerability assessment in the 2014 SHMP update, they should be considered in state and local mitigation planning, especially in the context of pre- and post-disaster plans, actions, and activities. Plans should focus on protecting these unique sites and objects from destruction by hazards and from subsequent cascading effects of the hazards after the events. Although the New York State Department of Parks, Recreation and Historic Preservation (DPRHP) is the lead state agency responsible for designation and protection of these sites, regulatory policies that address appropriate protection and mitigation measures are generally the responsibility of local governments working in coordination with the state. Numerous resources are available to guide integration of cultural and historic sites and issues into mitigation planning.

Impacts and Consequences Summary

Many natural hazards create conditions and consequences that result in cascading or secondary effects from additional hazards. The matrix illustrated in Table 3.1g shows the relationship between identified hazards and possible cascading or secondary effects from the primary hazards.

Table 3.1g: Primary Hazards and Consequences/Cascading Effects*

Primary Hazards	Structural Damage	Utility Outage	Chemical Release/Spill	Commodity Shortage	Emergency Comm. Failure	Erosion	Structural Fire	Environmental Impact	Economic -Direct or Indirect	Disease/Public Health	Impact to Responders and/or Program Operation	Flooding	Landslide	Dam/Levee Failure	Storm Surge	Tornado	Wildfire	Hail	Tsunami
Hurricane/TS/Nor'Easter	X	X	X	X	X	X	X	X	X	X	X	X			X	X			
Climate Change	X	X		X	X	X		X	X	X	X	X	X	X	X	X	X	X	
Flooding - Coastal	X	X	X			X	X	X	X	X	X	X	X						
Flooding - Inland	X	X	X			X		X		X	X		X	X					
Flooding - Ice Jam	X							X				X		X					
High Winds/Tornado	X	X	X																
Earthquake	X	X	X	X	X		X		X	X	X		X	X					X
Coastal Erosion	X					X		X	X			X	X						
Extreme Temperatures								X	X	X									
Drought				X				X	X	X									
Severe Winter Storm	X	X		X	X		X												
Wildfire	X						X	X					X						
Tsunami	X	X	X	X		X				X		X							
Hailstorm								X											
Avalanche	X																		
Landslide	X					X													
Land Subsidence/Expansive Soils	X																		

*Hazard Ranking colors: red = high; orange = moderate; yellow = low

3.1.5 Assessing Vulnerability by Jurisdiction

This section discusses the impacts and consequent vulnerabilities from each hazard and how it may affect the State's population, property and infrastructure, environment, and economy.

Information addressed in each section includes:

- State's vulnerability based on estimates provided in local and state risk assessments
- State's vulnerability in terms of jurisdictions most threatened and most vulnerable to damage and loss associated with the hazard
- Information from relevant local risk assessments
- Changes in development for jurisdictions in hazard prone areas

An example of data sources for county-level information related to vulnerability is displayed in **Table 3.1h**, which provides a comprehensive listing of Disaster Declaration between 2010-2013, all counties included in the declaration, and the total Public Assistance costs, by county.

Table 3.1h: Counties Included in Major Disaster Declarations and Total Public Assistance Costs (2010 – 2013)

Disaster Number	Date Declared	Year	Incident Description	Declaration Type	Counties Designated for Public Assistance	Total Public Assistance
4129	7/12/2013	2013	Severe Storms and Flooding	Major Disaster Declaration	Allegany, Broome , Chautauqua, Chenango, Clinton, Cortland, Delaware, Essex, Franklin, Herkimer, Madison, Montgomery, Niagara, Oneida, Otsego and Warren	$3,842
4111	4/23/2013	2013	Severe Winter Storm and Snowstorm	Major Disaster Declaration	Suffolk	$7,866,804
4085	10/30/2012	2012	Hurricane Sandy	Major Disaster Declaration	Bronx , Green , Kings, Nassau, New York, Orange , Putnam, Queens, Richmond, Rockland, Suffolk, Sullivan, Ulster and Westchester	$1,815,377,514
3351	10/28/2012	2012	Hurricane Sandy	Emergency Declaration	Albany , Allegany, Bronx, Broome, Cattaraugus, Cayuga, Chautauqua, Chemung, Chenango, Clinton, Columbia, Cortland, Delaware, Dutchess, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Herkimer, Jefferson, Kings, Lewis, Livingston, Madison, Monroe, Montgomery, Nassau, New York, Niagara, Oneida, Onondaga, Ontario, Orange, Orleans, Oswego, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saint Lawrence, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, Steuben, Suffolk, Sullivan, Tioga, Tompkins, Ulster, Warren, Washington, Wayne, Westchester, Wyoming, and Yates	N/A

Disaster Number	Date Declared	Year	Incident Description	Declaration Type	Counties Designated for Public Assistance	Total Public Assistance
4031	9/13/2011	2011	Remnants of Tropical Storm Lee	Major Disaster Declaration	Broome, Chemung, Chenango, Delaware, Herkimer, Montgomery, Oneida, Orange, Otsego, Schenectady, Schoharie, Tioga, Tompkins and Ulster	$213,234,221
3341	9/8/2011	2011	Remnants of Tropical Storm Lee	Emergency Declaration	Albany, Broome, Chemung, Chenango, Delaware, Greene, Herkimer, Montgomery, Oneida, Otsego, Rensselaer, Schenectady, Schoharie, Sullivan and Tioga	$3,194
4020	8/31/2011	2011	Hurricane Irene	Major Disaster Declaration	Albany, Bronx , Clinton, Columbia, Delaware, Dutchess, Essex, Franklin, Fulton, Greene, Hamilton, Herkimer, Kings, Montgomery, Nassau, New York, Orange, Otsego, Putnam, Queens, Rensselaer, Richmond, Rockland, Saratoga, Schenectady, Schoharie, Suffolk , Sullivan, Ulster, Warren, Washington and Westchester	$486,310,293
3328	8/26/2011	2011	Hurricane Irene	Emergency Declaration	Bronx, Columbia, Delaware, Greene, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Schoharie, Suffolk Sullivan, Ulster, and Westchester Counties.	$1,312,446
1993	6/10/2011	2011	Severe Storms, Flooding, Tornadoes, and Straight-line Winds	Major Disaster Declaration	Allegany, Broome, Chemung, Chenango, Clinton, Delaware, Essex, Franklin, Hamilton, Herkimer, Lewis, Livingston, Madison, Niagara, Oneida, Onondaga, Ontario, Steuben, Tioga, Ulster, Warren, Wyoming and Yates	$29,691,847
1957	2/18/2011	2011	Severe Winter Storm and Snowstorm	Major Disaster Declaration	Nassau and Suffolk	$37,732,272

Disaster Number	Date Declared	Year	Incident Description	Declaration Type	Counties Designated for Public Assistance	Total Public Assistance
1943	10/14/2010	2010	Severe Storms, Tornadoes, and Straight-line Winds	Major Disaster Declaration	Kings, Queens and Richmond	$17,923,129
1899	4/16/2010	2010	Severe Storms and Flooding	Major Disaster Declaration	Nassau, Orange, Otsego, Richmond, Rockland, Schoharie, Suffolk, Warren and Westchester	$81,486,959

****NOTE: Data related to Hurricane Sandy is limited to that which was available during the plan update. Disaster costs from Sandy were still being calculated at the time this plan was published (December 2013).***

Summaries of local risk assessment findings included in the 2014 Plan are extracted from FEMA-approved county multi-jurisdictional mitigation plans. Data presented in this state-level plan is summarized from LHMP examples to demonstrate consistency with data or information related to the hazard.

One limitation is that the information obtained from the individual county plans is summarized from plans available during the preparation of this update and may not represent plans approved after October 2013. In addition, local mitigation plans are revised and updated on a five-year schedule which precludes data from more recent events being included in the plans, in some cases.

The **New York State Local Hazard Mitigation Planning Standards (October 2012)** provides additional guidance to local jurisdictions to assist in accurately identifying, profiling and assessing the risks for these hazards.

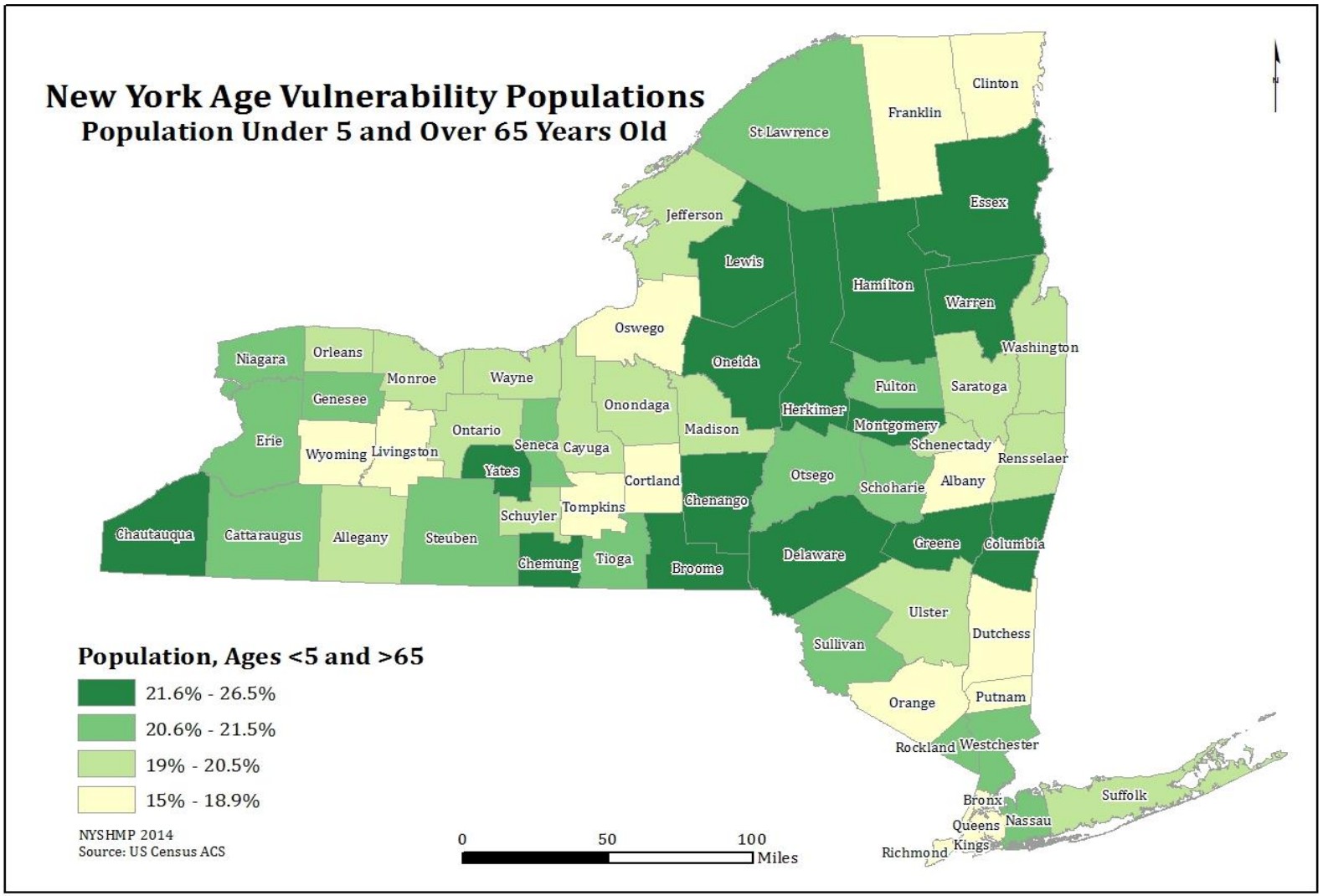
Vulnerability Categories

Population

Each hazard section identifies and quantifies, where data is available, the potential population that may be vulnerable to the hazard. As an example, counties along the Atlantic coastline are the most densely populated, and therefore, have the highest number of people who might be impacted from a hurricane or coastal storm.

Figure 3.1b shows an example of vulnerable population data using the spatial distribution of age-vulnerable populations. Populations under 5 years old and over 65 are considered more vulnerable in disasters because of dependency, mobility, physicality, and other characteristics that require support and assistance for such services as sheltering, evacuation, health and medical care, transportation and community social services. Hamilton, Delaware, and Yates Counties are the top three counties with the highest percentage of age-vulnerable populations in the state, and the over-65 population is the fastest growing population demographic. Other vulnerable populations are defined and addressed in local plans.

Figure 3.1b: Vulnerable Populations, by Age



Property

Vulnerability of property is considered for each hazard, specific to the characteristics of that hazard. As an example, impacts from hurricanes, coastal erosion, and high winds could have significant or even catastrophic impacts on property and critical infrastructure. Extreme temperatures and drought have low to little impact on property.

Environment

The environment has some level of vulnerability to almost every natural hazard. The extent of vulnerability is dependent on the conditions related to the hazard, magnitude of impact, location of impact, and potential cascading effects that compound the impacts. Each hazard section describes specific environmental impacts related to that hazard, as applicable.

Economy

Natural hazards have both direct and indirect impacts on a jurisdiction's economy. Events such as hurricanes and floods can cause immediate significant monetary loss due to damaged and destroyed structures and infrastructure. The magnitude of the event can also result in a more long-term indirect impact on state and local economies due to failure of businesses, redevelopment costs, and supply chain impacts. Some level of economic return may occur after a significant disaster; however, depending on other conditions and issues related to the impacted community, the economy may experience a slow, long-term recovery, or, in a catastrophic disaster, local economic loss may be permanent.

Data from one disaster assistance program (Small Business Administration (SBA) loans) for businesses related to the economic impacts of the repetitive storms in 2011 and 2012 illustrates the challenges for businesses as a result of natural disasters. **The *State of New York Action Plan for Community Development Block Grant Program (CDBG) Disaster Recovery*[4] (New York State Homes and Community Renewal Office of Community Renewal April, 2013) provides a summary of the number of affected New York businesses after Hurricane Sandy in 2012, and justification for the low response when assistance was available through low interest loans:**

- 17,468 New York businesses (outside of New York City) requested applications from the SBA after Sandy. While this number was believed to be indicative of the extent of damage to businesses across the State, and their different levels of underlying need, it was noted that many would ultimately not be eligible for NYS programs.

[4] *State of New York Action Plan for Community Development Block Grant Program (CDBG) Disaster Recovery*, Supplemental funding under the Department of Housing and Urban Development Appropriations Act, 2013 (Public Law 113-2); New York State Homes and Community Renewal Office of Community Renewal April, 2013, p. 30.

- Of the 17,468 requests for applications, only 1,141 businesses ultimately submitted applications.
- Of the 1,141 applications received, only 205 were ultimately approved for assistance by the SBA. Many of these applicants had true unmet needs, but lacked necessary collateral or credit needed to qualify for loans.
- New York State believes there are many other businesses in need of assistance. In addition to the 17,468 SBA application requests, estimates suggest as many as 37,282 businesses were in the Sandy surge areas.

Business development interests determined that the low application rate was attributable to four primary factors:

(1) Businesses perceive SBA interest rates to be high
(2) SBA loans require a large amount of documentation, often not readily available, for processing
(3) Many businesses are reluctant to accept SBA loan terms, for example requirements that business owners post personal residential property as collateral to qualify for loans
(4) Many impacted firms acquired incremental debt during the recession and are reluctant to take on additional debt for recovery.

The analysis in the CDBG plan provides significant insight into the challenges to restoring local economies following a major disaster.

3.1.6 Assessing Vulnerability of State Facilities

New York State has a specific interest in protecting facilities, property and infrastructure owned and managed by the state. Disasters can damage not only private property, but government property as well, placing a financial and operational burden on the state. Losses can extend from structures and contents to the interruption of services and the general economy.

The State owns and operates more than 19,000 building facilities statewide representing more than 210 million gross square feet of space. State-owned buildings are located in every county of the state and all of New York's major cities. Albany, New York's State Capital, is located on the Hudson River, approximately 150 miles north of New York City. The largest, single concentration of State-owned and operated facilities is located in the City of Albany and its environs.

A major data deficiency for the 2014 update is the limited information New York State maintains on its fixed assets necessary to conduct a comprehensive risk assessment. Currently, the primary database of state buildings is the New York State Office of General Service's (OGS) "Fixed Assets Inventory", which contains more than 16,000 building records. While this database contains some useful information such as building value and

square footage, it does not contain basic structural information needed to make general assessments of vulnerability to earthquakes, wind, flooding and other hazards. Additional information about the State's Fixed Assets Inventory Project is described below.

State Facilities and Fixed Assets Inventory Project

The State of New York is taking steps to inventory its facilities and built assets to evaluate its risk from natural hazards. Initial efforts to inventory facilities under a FEMA Earthquake grant, employing State Fire Inspectors utilizing FEMA-developed software, were unsuccessful. After regrouping, and evaluating what we know about our risk from discussions with State agencies during Irene, Lee and Sandy response (and during the 2014 update of the State Hazard Mitigation Plan), DHSES coordinated with FEMA and decided on a two-prong approach:

- We would begin our survey at facilities that house children and adults with mental and/or physical challenges because:
  - A March 2009 fire in Wells, Herkimer County killed four residents of a group home who could not evacuate themselves, and injured a fifth resident and two staffers (see www.nytimes.com/2009/03/22/nyregion/22fire.html?_r=0);
  - Such facilities are overseen by a small universe of State agencies, easing coordination on our first survey effort;
  - These facilities occur both as stand-alone buildings (residences) or campuses with several buildings; the latter will help inform subsequent survey efforts at various other campuses and complexes across the State.

- Having experienced Irene, Lee and Sandy, and traditionally citing water in its various forms as our most prevalent natural disaster, DHSES will poll State agencies in February 2014 to see if lives were lost, injuries occurred, or structures were damaged or destroyed in any of these three events;
  - From that we will ascertain whether there are inordinately high positive responses:
    - In specific counties or regions of the State;
    - Correlating to certain facility types or uses;
    - From certain agencies who may not have capacity to address mitigation deficits.
  - This will allow us to target assistance such as site visits (with other agencies if needed), webinars, etc., to provide technical assistance and develop short- and long-term strategies and flesh out activities in anticipation of future funding opportunities.

- The State will analyze risk from wind, flood and earthquake at all buildings surveyed, using hand-held software applications and FEMA's "Integrated Rapid Visual Screening of Buildings" to guide the process. Before teams conduct site visits, they will research available DFIRMs, State agency records (Office of General Services, the responsible agency's Main office and Regional Office capital facilities archives, etc.) and various online resources to gather relevant information regarding floodplain locations and

relationships, construction type, etc., then fill the gaps with onsite visits and interviews. Data will be collated and analyzed in an initial screening, which will then determine which structures and facilities get a more in-depth analysis and possible assistance in developing mitigation strategies.

These activities will run on parallel but independent tracks, and in close coordination with FEMA. (In fact, the survey effort was initiated with FEMA-sponsored training of the first architects and engineers occurring in Albany the week of December 9, 2013.) Once the initial group home survey has been completed we will analyze the results with FEMA to determine our ongoing survey strategy (e.g., by agency, region, facility type, year of construction, recent damage in declared disasters), and decide what tweaking, if any, is necessary moving forward to streamline the process and capture and collate all needed data.

DHSES will also decide with FEMA whether the results of the initial group home survey warrant revisions to the State Plan's description of hazards, analysis of risk, or the strategies and activities for key agencies. As noted above, subsequent survey strategies will be developed with FEMA's concurrence, and after each survey round we will revisit the Plan as noted above to see if changes are warranted, or if State agencies need targeted assistance.

The current Fixed Assets Inventory dataset was used for a partial assessment of all state-owned and operated in the 2008 and 2011 SHMPs; however, in addition to gathering information on more facilities, there is a need to gather missing structural information and refine the accuracy of the geographic coordinates to better enable GIS screening of these buildings as to their proximity to floodplains, the presence of soils that amplify earthquake shaking and other hazardous areas.

Table 3.1i provides a list of various State agencies that utilize State- owned and leased space throughout the State of New York, based on information currently available in the Fixed Asset Inventory. Agencies in **bold** directly manage State owned and leased properties.

Table 3.1i: NY State Entities that Utilize State-Owned and Leased Space

New York State Entities
Adirondack Park Agency
Aging, Office for the
Agriculture and Markets, Department of
Alcoholism and Substance Abuse Services, Office of
Attorney General, Office of the

New York State Entities
Banking, Department of
Budget, Division of the
Children and Family Services, Office of
City University of New York
Civil Service, Department of
Community Renewal, Office of
Correctional Services, Department of
Correctional Services, Division of Industries (Corcraft), Department of
Court Administration Office of
Criminal Justice Services, Division of
Dormitory Authority
Education, Department of
Empire State Development
Energy Research and Development Authority
Environmental Conservation, Department of
Family Assistance, Department of
General Services, Office of
Health, Department of
Homeland Security and Emergency Services, Division of (formerly New York State Office of Emergency Management)
Housing and Community Renewal, Division of
Human Rights, Division of
Insurance, Department of
Labor, Department of
Mental Health, Department of
Metropolitan Transportation Authority
Military and Naval Affairs, Division of
Motor Vehicles, Department of
New York Power Authority

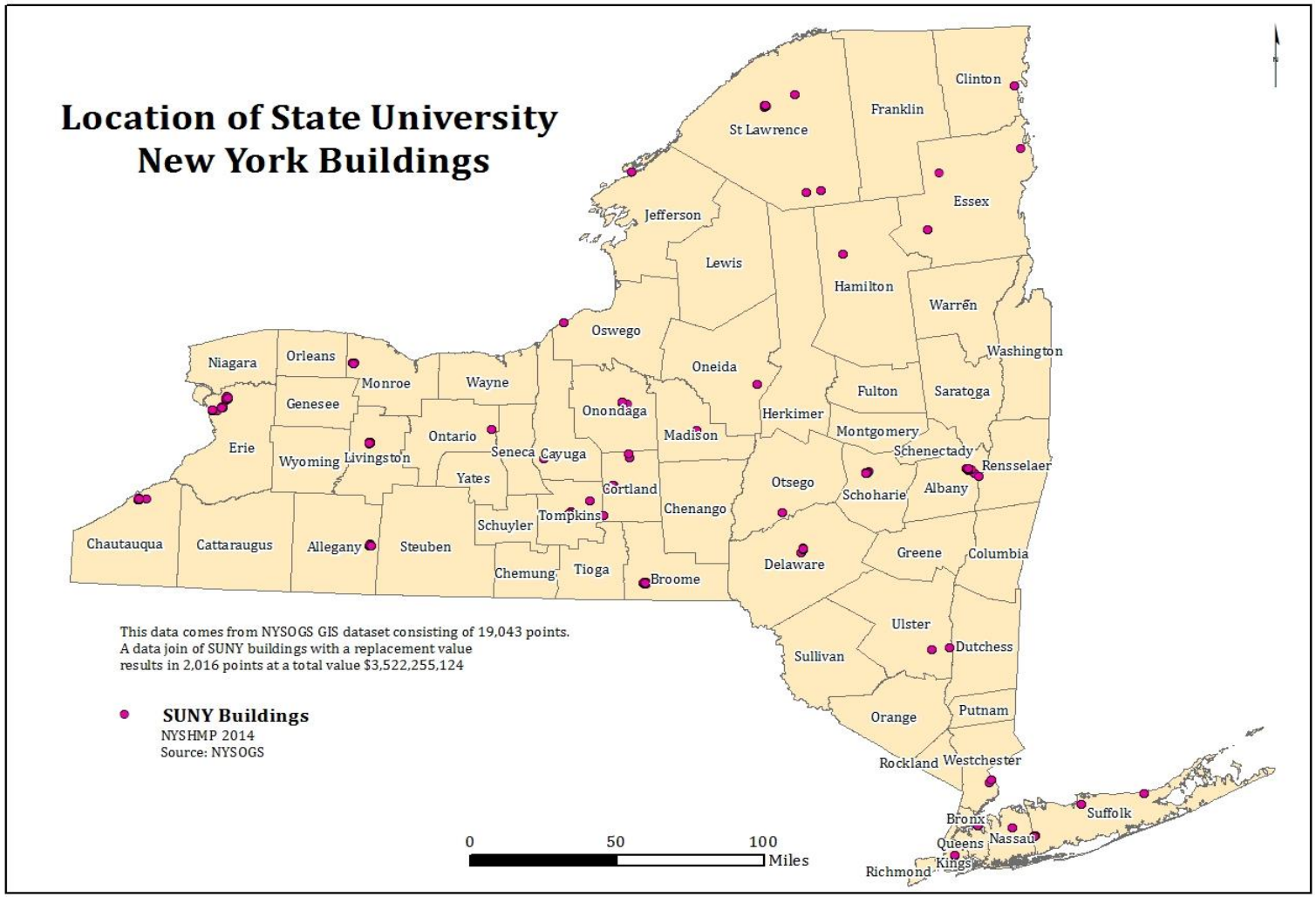
New York State Entities
New York State Bridge Authority
New York State Division of Parole
New York State Division of Probation and Correctional Alternatives
New York State Office for the Prevention of Domestic Violence
New York State Environmental Facilities Corporation
New York State Housing Finance Agency
New York State Racing and Wagering Board
Office of Mental Health
Office for People with Developmental Disabilities
Olympic Regional Development Authority
Parks, Recreation and Historic Preservation, Office of
Port Authority of New York and New Jersey
Power Authority
Public Service Commission
Real Property Services, Office of
State, Department of
State Comptroller, Office of
State Police, Division of
State University Construction Fund
State University of New York
Tax Appeals, Division of
Taxation and Finance, Department of
Technology, Office for
Temporary and Disability Assistance, Office of
Thruway Authority New York State (including Canal Corporation)
Transportation, Department of

For the 2014 SHMP update, the planning team utilized the OGS dataset and solicited information from other state departments and agencies related to the types of facilities New York State owns and operates; however, other priorities have prevented adding additional information, as suggested in the 2011 SHMP, to this database. Coincidentally, a

project to enhance the statewide inventory of facilities was initiated in August 2013, with a projected completion date for the initial phase in mid-2014

Figure 3.1c illustrates new data that was provided by the State University of New York (SUNY) during the 2014 plan update process. While the information provided for the update was not comprehensive, it provided addresses and building value information that allowed GIS mapping of 2,016 points that have a total building value of $3,522,255,124. Future assessment of these points in relation to flood zones, storm surge zones, seismic zones and other geographic hazards will assist in expanding the State's awareness of vulnerable state-owned and operated facilities.

Figure 3.1c: Sample GIS Mapping Update - Locations of State University of New York (SUNY) Buildings and Total Building Values



As additional data developed during the first phase of the statewide facilities inventory project becomes available, it will be incorporated into the future updates. For the purpose of the 2014 update, consideration of vulnerable state facilities in relation to most hazards was based on the theory that they have the potential for more localized impact which could damage a state-owned or –operated facility, and cause loss of individual sites or structures. More widespread hazards, such as hurricanes and coastal storms, were considered separately with available data. For example, **Table 3.1i** (**Section 3.1.8**) provides the number of buildings and total replacement costs, by agency, of state-owned and operated facilities based on the current state database.

3.1.7 Estimating Potential Losses by Jurisdiction

All jurisdictions in the state have hazard-prone areas related to a particular natural hazard; the most common is flooding. Those jurisdictions that are experiencing growth and development may also have an increase in their vulnerability to and impact from associated hazards. This is addressed in Local Hazard Mitigation Plans as well as in the County descriptions in this update of the State Plan in specific hazard sections.

When developing the potential loss estimates by jurisdiction, the SHMP planning team examined population, and critical facilities and infrastructure at risk as identified by jurisdictions. Generally, the local plans contain more specific data related to facilities; therefore, critical facilities listed in LHMPs were considered and included, where available. A significant issue was identified in reviewing local plans in that the methodology used to assess and estimate losses related to population, property, and critical facilities was not uniform. By generalizing the data to the county level using publically available sources, this allowed for a more consistent statewide approach and also provided some measure of protection for those with security concerns.

Table 3.1j provides a summary of the total losses resulting from all hazard events, by county. This information will assist all counties in estimating potential losses by hazard when developing local hazard mitigation plans and identifying the highest opportunity for loss reduction. As an example, Broome County has the highest dollar loss from flood in the state. This information can guide both state and local planning, technical assistance and project funding priorities, based on previous occurrences and losses.

Table 3.1j: Summary of Total Losses for All Hazard Events, By County (1960-2012)

County	Total Losses	Coastal	Drought	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Albany	$116,153,322	$0	$2,701,852	$2,890	$56,205,507	$1,187,866	$7,326,638	$197,749	$48,530,821
Allegany	$36,725,567	$0	$0	$806	$17,229,794	$157,499	$4,694,811	$8,065	$14,634,591
Bronx	$35,406,271	$714,286	$0	$36,521	$20,321,483	$66,851	$1,551,555	$9,528,242	$3,187,333
Broome	$847,823,740	$0	$4,863,640	$2,890	$813,832,702	$917,102	$4,834,071	$137,552	$23,235,784
Cattaraugus	$125,952,945	$0	$0	$1,289	$62,895,262	$427,181	$43,650,878	$8,065	$18,970,271
Cayuga	$59,392,985	$0	$3,180,307	$2,890	$4,632,700	$1,366,317	$31,908,989	$137,552	$18,164,230
Chautauqua	$74,371,528	$40,000	$0	$806	$35,130,262	$541,181	$18,503,241	$8,065	$20,147,974
Chemung	$53,471,047	$0	$3,180,307	$806	$33,580,154	$433,094	$12,521,816	$137,552	$3,617,318
Chenango	$168,335,379	$0	$4,624,510	$2,890	$133,039,252	$430,578	$4,925,276	$137,552	$25,175,322
Clinton	$102,474,663	$0	$1,683,333	$500,806	$67,465,101	$599,158	$6,826,050	$8,065	$25,392,150
Columbia	$137,274,159	$0	$2,701,852	$806	$57,343,337	$6,706,536	$19,607,467	$197,749	$50,716,411
Cortland	$66,727,624	$0	$4,863,640	$2,890	$33,069,835	$397,407	$3,685,485	$137,552	$24,570,815
Delaware	$402,136,680	$0	$5,048,825	$2,890	$341,181,541	$430,116	$4,380,768	$137,552	$50,954,988
Dutchess	$127,311,580	$0	$2,701,852	$37,021	$59,716,164	$1,288,358	$13,222,158	$197,749	$50,148,278
Erie	$121,498,228	$65,000	$0	$806	$25,706,818	$3,161,481	$35,274,978	$8,065	$57,281,080
Essex	$113,292,743	$0	$1,683,333	$500,806	$79,377,212	$90,974	$6,261,962	$8,065	$25,370,390
Franklin	$45,365,599	$0	$1,683,333	$450,806	$13,944,187	$410,446	$3,319,633	$8,065	$25,549,129
Fulton	$43,066,704	$0	$2,107,649	$2,890	$11,538,457	$166,237	$5,457,662	$137,552	$23,656,258
Genesee	$80,755,875	$0	$0	$806	$6,327,679	$10,877,814	$7,441,332	$8,065	$56,100,179
Greene	$132,727,771	$0	$2,701,852	$806	$63,829,382	$830,336	$16,267,243	$197,749	$48,900,403
Hamilton	$116,144,557	$0	$2,107,649	$2,890	$9,636,854	$416,775	$78,302,474	$137,552	$25,540,364

County	Total Losses	Coastal	Drought	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Herkimer	$96,766,819	$0	$2,107,649	$2,890	$25,767,786	$568,678	$13,866,897	$168,802	$54,284,118
Jefferson	$73,724,264	$0	$424,316	$2,890	$3,548,036	$437,995	$45,194,971	$137,552	$23,978,504
Kings	$38,571,913	$714,286	$0	$36,521	$14,877,252	$42,688	$10,225,424	$9,496,992	$3,178,749
Lewis	$44,716,971	$0	$424,316	$2,890	$3,886,786	$392,049	$19,502,907	$137,552	$20,370,472
Livingston	$46,185,532	$0	$0	$806	$13,948,529	$165,249	$4,543,112	$8,065	$27,519,770
Madison	$76,569,725	$0	$4,863,640	$2,890	$36,249,293	$416,031	$7,264,349	$137,552	$27,635,971
Monroe	$97,404,613	$0	$0	$806	$5,107,307	$1,447,915	$30,792,879	$8,065	$60,047,641
Montgomery	$81,208,191	$0	$2,107,649	$2,890	$20,336,013	$180,978	$6,392,107	$168,802	$52,019,752
Nassau	$61,118,806	$721,786	$0	$36,521	$35,349,175	$184,173	$7,151,409	$14,496,992	$3,178,749
New York	$26,595,276	$714,286	$0	$36,521	$19,780,169	$45,624	$2,716,132	$124,295	$3,178,250
Niagara	$74,482,150	$0	$0	$806	$6,104,929	$4,193,481	$10,789,494	$8,065	$53,385,375
Oneida	$193,413,630	$0	$5,048,825	$2,890	$68,748,230	$6,534,883	$84,965,518	$137,552	$27,975,732
Onondaga	$133,649,387	$0	$3,180,307	$2,890	$23,615,034	$969,178	$96,450,985	$137,552	$9,293,442
Ontario	$41,640,445	$0	$0	$806	$14,255,613	$1,607,325	$6,486,765	$137,552	$19,152,384
Orange	$131,397,063	$0	$1,868,519	$36,521	$56,646,212	$5,889,633	$14,480,775	$204,158	$52,271,246
Orleans	$80,590,392	$0	$0	$806	$4,945,512	$9,782,014	$16,022,965	$8,065	$49,831,030
Oswego	$32,567,248	$0	$424,316	$2,890	$2,177,989	$440,781	$7,788,678	$137,552	$21,595,043
Otsego	$169,723,377	$0	$5,048,825	$2,890	$131,694,754	$351,508	$4,799,199	$137,552	$27,688,649
Putnam	$119,579,050	$0	$1,868,519	$36,521	$52,118,664	$66,966	$5,802,987	$9,829,158	$49,856,235
Queens	$53,751,855	$714,286	$0	$36,521	$19,828,483	$48,688	$20,448,136	$9,496,992	$3,178,749
Rensselaer	$128,557,226	$0	$2,701,852	$806	$60,273,076	$2,836,466	$14,452,154	$197,749	$48,095,123
Richmond	$12,772,028	$714,286	$0	$36,521	$4,643,979	$35,423	$4,046,573	$121,992	$3,173,254
Rockland	$70,855,121	$0	$185,185	$36,521	$28,532,367	$44,866	$1,090,610	$9,699,671	$31,265,901

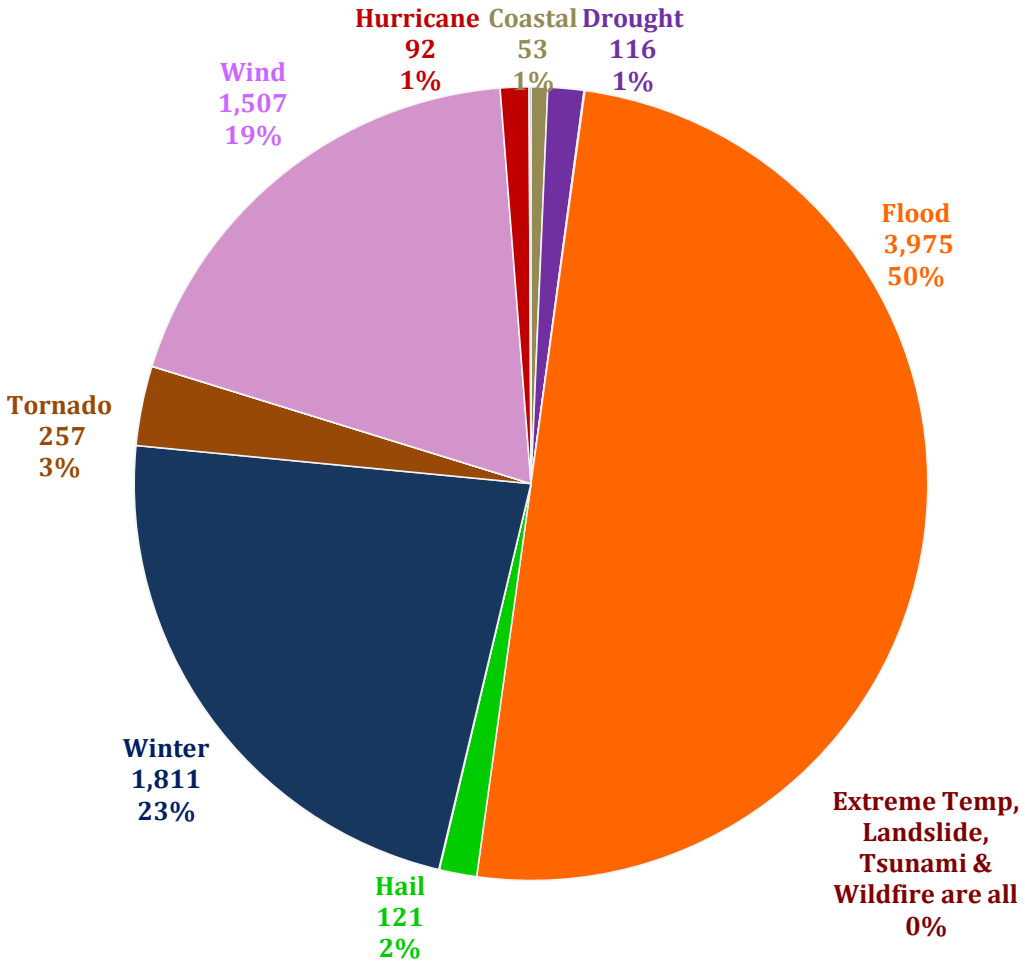
County	Total Losses	Coastal	Drought	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Saratoga	$180,832,727	$0	$1,868,519	$806	$58,720,426	$1,099,484	$69,597,518	$197,749	$49,348,226
Schenectady	$88,851,621	$0	$1,868,519	$806	$27,624,989	$2,774,622	$7,840,637	$168,802	$48,573,247
Schoharie	$56,785,643	$0	$2,107,649	$2,890	$24,745,121	$727,664	$4,339,348	$137,552	$24,725,419
Schuyler	$21,036,068	$0	$3,180,307	$2,890	$7,547,975	$366,829	$1,378,513	$137,552	$8,422,003
Seneca	$16,503,475	$0	$3,180,307	$2,890	$2,712,071	$71,408	$2,067,724	$137,552	$8,331,524
St Lawrence	$75,801,868	$0	$2,107,649	$702,890	$5,386,004	$413,177	$39,216,734	$137,552	$27,837,862
Steuben	$61,925,061	$0	$2,941,176	$806	$43,916,683	$491,593	$3,245,207	$137,552	$11,192,043
Suffolk	$109,843,299	$49,322,786	$0	$36,521	$35,094,104	$71,188	$7,586,176	$14,496,992	$3,235,532
Sullivan	$287,529,761	$0	$5,009,695	$36,521	$223,177,217	$212,933	$10,171,744	$137,552	$48,784,100
Tioga	$634,850,510	$0	$4,863,640	$2,890	$600,080,588	$448,125	$3,908,688	$137,552	$25,409,027
Tompkins	$36,128,893	$0	$3,180,307	$2,890	$23,457,315	$1,409,425	$2,223,898	$137,552	$5,717,507
Ulster	$645,404,114	$0	$2,701,852	$36,521	$70,127,560	$17,239,874	$505,713,981	$197,749	$49,386,576
Warren	$134,555,426	$0	$1,868,519	$806	$70,718,314	$176,472	$13,731,825	$166,499	$47,892,991
Washington	$113,703,197	$0	$1,868,519	$806	$53,633,792	$1,829,205	$8,820,904	$37,012	$47,512,959
Wayne	$74,374,100	$0	$239,130	$2,890	$6,930,182	$25,493,992	$15,235,765	$137,552	$26,334,590
Westchester	$156,249,932	$0	$185,185	$36,521	$100,347,596	$45,366	$14,822,656	$9,449,671	$31,362,937
Wyoming	$62,689,846	$0	$0	$806	$11,514,282	$235,181	$31,243,174	$8,065	$19,688,339
Yates	$32,132,801	$0	$2,941,176	$806	$10,856,613	$405,713	$1,595,880	$137,552	$16,195,061
Total	**$7,681,397,909**	**$53,721,000**	**$116,200,000**	**$2,700,500**	**$3,975,029,707**	**$121,098,150**	**$1,507,979,884**	**$92,720,500**	**$1,811,948,167**

Source: SHELDUS

Figure 3.1d represents the distribution of economic losses by hazard type for the period of 1960 through 2012. Dollar values are in millions and come from the Spatial Hazard Events and Losses Database for the United States (SHELDUS™). It is important to note that fire data may not be as accurate or detailed as records kept at the local or state level, because SHELDUS™ is a national database. The New York State Department of Environmental Conservation (DEC) has a more comprehensive count of wildfire events and losses, but for the purposes of data source consistency, the DEC dataset was not used in the following chart.

While this serves as a method to compare distribution of events, it does not necessarily reflect the hazards prioritized in the 2014 plan update or those that provide the highest opportunity for mitigation, as it does not take severity and other conditions, vulnerabilities and consequences of hazard events into account. However, this information may assist all-hazards preparedness, response, and recovery planning, as well as resource allocation.

Figure 3.1d: Distribution of Economic Losses by Hazard Type (1960 – 2012)



Source: SHELDUS

Table 3.1k describes the annualized losses tab takes the total economic losses divided by the number of years of record, so that it becomes losses per year. Information from SHELDUS provided the data for most hazards, except hurricane and earthquake which was calculated in Hazus. Annualized losses for hurricane and earthquake are provided within those hazard sections. *(Please note: Hurricane Sandy data has not yet been incorporated into SHELDUS.)*

Table 3.1k: Summary of Annualized Losses from Hazards, by County (1960 – 2012[5])

County	Total Losses	Coastal	Drought	Earthquake	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Albany	$2,231,766	$0	$51,959	$1,186	$56	$1,080,875	$22,844	$140,897	$666	$933,285
Allegany	$706,171	$0	$0	$58	$16	$331,342	$3,029	$90,285	$7	$281,434
Bronx	$532,824	$13,736	$0	$4,718	$702	$390,798	$1,286	$29,838	$30,451	$61,295
Broome	$16,302,018	$0	$93,532	$285	$56	$15,650,629	$17,637	$92,963	$76	$446,842
Cattaraugus	$2,422,138	$0	$0	$114	$25	$1,209,524	$8,215	$839,440	$8	$364,813
Cayuga	$1,139,653	$0	$61,160	$116	$56	$89,090	$26,275	$613,634	$10	$349,312
Chautauqua	$1,430,273	$769	$0	$200	$16	$675,582	$10,407	$355,832	$6	$387,461
Chemung	$1,025,765	$0	$61,160	$103	$16	$645,772	$8,329	$240,804	$18	$69,564
Chenango	$3,234,673	$0	$88,933	$79	$56	$2,558,447	$8,280	$94,717	$21	$484,141
Clinton	$1,971,740	$0	$32,372	$1,205	$9,631	$1,297,406	$11,522	$131,270	$24	$488,311
Columbia	$2,636,634	$0	$51,959	$173	$16	$1,102,756	$128,972	$377,067	$376	$975,316
Cortland	$1,280,655	$0	$93,532	$70	$56	$635,958	$7,642	$70,875	$7	$472,516
Delaware	$7,730,885	$0	$97,093	$96	$56	$6,561,183	$8,271	$84,246	$36	$979,904
Dutchess	$2,447,395	$0	$51,959	$806	$712	$1,148,388	$24,776	$254,272	$2,092	$964,390
Erie	$2,339,130	$1,250	$0	$2,734	$16	$494,362	$60,798	$678,365	$47	$1,101,559

[5] Hurricane Sandy data has not yet been incorporated into SHELDUS.

County	Total Losses	Coastal	Drought	Earthquake	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Essex	$2,179,059	$0	$32,372	$470	$9,631	$1,526,485	$1,750	$120,422	$38	$487,892
Franklin	$873,065	$0	$32,372	$795	$8,669	$268,157	$7,893	$63,839	$9	$491,329
Fulton	$825,819	$0	$40,532	$197	$56	$221,893	$3,197	$104,955	$61	$454,928
Genesee	$1,553,012	$0	$0	$165	$16	$121,686	$209,189	$143,103	$5	$1,078,850
Greene	$2,548,929	$0	$51,959	$123	$16	$1,227,488	$15,968	$312,832	$151	$940,392
Hamilton	$2,230,988	$0	$40,532	$76	$56	$185,324	$8,015	$1,505,817	$8	$491,161
Herkimer	$1,857,870	$0	$40,532	$196	$56	$495,534	$10,936	$266,671	$20	$1,043,925
Jefferson	$1,415,594	$0	$8,160	$460	$56	$68,231	$8,423	$869,134	$4	$461,125
Kings	$635,014	$13,736	$0	$9,143	$702	$286,101	$821	$196,643	$66,738	$61,130
Lewis	$857,407	$0	$8,160	$108	$56	$74,746	$7,539	$375,056	$3	$391,740
Livingston	$888,153	$0	$0	$117	$16	$268,241	$3,178	$87,368	$7	$529,226
Madison	$1,469,992	$0	$93,532	$131	$56	$697,102	$8,001	$139,699	$11	$531,461
Monroe	$1,874,615	$0	$0	$1,551	$16	$98,217	$27,845	$592,171	$54	$1,154,762
Montgomery	$1,558,656	$0	$40,532	$160	$56	$391,077	$3,480	$122,925	$46	$1,000,380
Nassau	$976,594	$13,880	$0	$6,276	$702	$679,792	$3,542	$137,527	$73,745	$61,130
New York	$563,092	$13,736	$0	$12,958	$702	$380,388	$877	$52,233	$41,076	$61,120
Niagara	$1,432,778	$0	$0	$577	$16	$117,402	$80,644	$207,490	$8	$1,026,642
Oneida	$3,717,522	$0	$97,093	$634	$56	$1,322,081	$125,671	$1,633,952	$40	$537,995
Onondaga	$2,568,567	$0	$61,160	$985	$56	$454,135	$18,638	$1,854,827	$46	$178,720
Ontario	$798,331	$0	$0	$187	$16	$274,146	$30,910	$124,745	$11	$368,315
Orange	$2,526,528	$0	$35,933	$1,165	$702	$1,089,350	$113,262	$278,476	$2,422	$1,005,216
Orleans	$1,549,749	$0	$0	$87	$16	$95,106	$188,116	$308,134	$2	$958,289
Oswego	$623,880	$0	$8,160	$221	$56	$41,884	$8,477	$149,782	$11	$415,289
Otsego	$3,261,433	$0	$97,093	$127	$56	$2,532,591	$6,760	$92,292	$40	$532,474
Putnam	$2,112,252	$0	$35,933	$329	$702	$1,002,282	$1,288	$111,596	$1,348	$958,774

County	Total Losses	Coastal	Drought	Earthquake	Extreme Temps	Flood	Hail	High Wind	Hurricane	Winter Storm
Queens	$925,813	$13,736	$0	$7,910	$702	$381,317	$936	$393,233	$66,848	$61,130
Rensselaer	$2,469,351	$0	$51,959	$446	$16	$1,159,098	$54,547	$277,926	$454	$924,906
Richmond	$255,816	$13,736	$0	$1,847	$702	$89,307	$681	$77,819	$10,699	$61,024
Rockland	$1,181,771	$0	$3,561	$1,400	$702	$548,699	$863	$20,973	$4,305	$601,267
Saratoga	$3,474,476	$0	$35,933	$722	$16	$1,129,239	$21,144	$1,338,414	$4	$949,004
Schenectady	$1,706,538	$0	$35,933	$651	$16	$531,250	$53,358	$150,781	$448	$934,101
Schoharie	$1,089,761	$0	$40,532	$76	$56	$475,868	$13,994	$83,449	$298	$475,489
Schuyler	$401,968	$0	$61,160	$23	$56	$145,153	$7,054	$26,510	$50	$161,962
Seneca	$314,779	$0	$61,160	$46	$56	$52,155	$1,373	$39,764	$4	$160,222
St Lawrence	$1,456,363	$0	$40,532	$1,276	$13,517	$103,577	$7,946	$754,168	$5	$535,344
Steuben	$1,188,362	$0	$56,561	$123	$16	$844,552	$9,454	$62,408	$18	$215,232
Suffolk	$1,991,633	$948,515	$0	$4,512	$702	$674,887	$1,369	$145,888	$153,539	$62,222
Sullivan	$5,527,237	$0	$96,340	$203	$702	$4,291,870	$4,095	$195,610	$260	$938,156
Tioga	$12,206,085	$0	$93,532	$51	$56	$11,540,011	$8,618	$75,167	$16	$488,635
Tompkins	$692,288	$0	$61,160	$131	$56	$451,102	$27,104	$42,767	$16	$109,952
Ulster	$12,409,154	$0	$51,959	$489	$702	$1,348,607	$331,536	$9,725,269	$850	$949,742
Warren	$2,584,972	$0	$35,933	$452	$16	$1,359,968	$3,394	$264,074	$117	$921,019
Washington	$2,186,241	$0	$35,933	$216	$16	$1,031,419	$35,177	$169,633	$137	$913,711
Wayne	$1,427,795	$0	$4,599	$161	$56	$133,273	$490,269	$292,995	$8	$506,434
Westchester	$2,850,238	$0	$3,561	$4,807	$702	$1,929,761	$872	$285,051	$22,350	$603,133
Wyoming	$1,205,514	$0	$0	$91	$16	$221,428	$4,523	$600,830	$4	$378,622
Yates	$615,335	$0	$56,561	$38	$16	$208,781	$7,802	$30,690	$4	$311,443
Total	**$146,491,137**	**$1,033,096**	**$2,234,615**	**$74,854**	**$51,933**	**$76,442,879**	**$2,328,811**	**$28,999,613**	**$480,180**	**$34,845,157**

Source: SHELDUS

3.1.8 Estimating Potential Losses of State Facilities

New York State government entities are responsible to provide affordable building insurance coverage for the facilities under their responsibility. Through this coverage, each department maintains a separate list of state-owned facilities and their replacement values. State-operated facilities are typically not included in this list, as building insurance is a responsibility of the property owner.

The current database contains the addresses and/or latitudes and longitudes of some state-owned and -operated properties, and, where available, this information has been integrated in the DHSES Geographic Information System (GIS) data for state-owned facilities; however, because a comprehensive inventory has not yet been conducted, the value of the state-owned buildings and property were assessed for this update with available information only.

Table 3.1l shows the values of state-owned buildings and property, based on currently available data. (Departments, agencies, transportation infrastructure)

Table3.1l: State- Owned Building Replacement Value

State Agency	No. of Buildings & Properties	Replacement Cost
Office of General Services (OGS)	2,046	$7,269,621,781
Department of Health (DOH)	468	$494,168,461
Department of Corrections and Community Services (DOCCS)	19,972	$9,111,425,045
Office of Parks, Recreation and Historic Preservation (OPRHP)	10,325	$2,073,612,475
Department of Environmental Conservation (DEC)	3,144	$270,643,840
Office of Mental Health (OMH)	4,497	$6,287,808,931
Office of Persons with Developmental Disabilities (OPWDD)	7,438	$2,755,709,522
Division of State Police (DSP)	267	$164,142,582
Department of Military and Naval Affairs (DMNA)	1,186	$735,644,622
Department of Transportation (DOT)	4,242	$691,748,381
Office of Children and Family Services (OCFS)	1,800	$424,633,865
Other Agencies	22	$9,809,970
Dormitory Authority (DASAS)	46	$33,880,238
NYS Unified Court System (COURTS)	42	$31,856,013
Department of Labor (DOL)	81	$146,468,249

State Agency	No. of Buildings & Properties	Replacement Cost
New York State Education Department (NYSED)	408	$530,134,651
Adirondack Park Agency (APA)	20	$4,026,713
Department of Agriculture and Markets (AG&MKTS)	634	$179,474,412
Department of State (DOS)	69	$22,851,819
Total	**56,707**	***$31,237,661,570**

Source: OGS; *This value accounts for 50,110 buildings, which are part of the 56,707 properties

3.1.9 Estimating Potential Losses – Critical Infrastructure

Facilities that support key emergency and disaster functions are important in protecting the safety of the population, the continuity of government, and the continued delivery of essential community services. These "critical" or "essential" functions are defined by the types of services they provide or support and include, but are not limited to, public safety, communications, transportation, healthcare, electric power, water, and sewer. Continuity of these functions relies on established infrastructure that, if lost, could directly threaten lives and increase the need for resources and services to vulnerable populations. The providers of these services use a variety of systems to ensure consistent service throughout the state. Each of these services is important to daily life in New York, and in some cases, is critical to the protection of life and property.

The definition of critical facilities and infrastructure used in this plan is based on the U.S. Department of Homeland Security definition of "critical infrastructure" as "systems and assets, whether physical or virtual, so vital that the incapacity or destruction of such may have a debilitating impact on the security, economy, public health or safety, environment, or any combination of these matters, across any Federal, State, regional, territorial, or local jurisdiction." (U.S. Department of Homeland Security, 2009) **Similarly, the state has its own set of criteria that is more specific to the State's resources, as identified in the *New York State Local Hazard Mitigation Planning Standards:***

- Any government facility that has sustained flooding in past events, regardless if it is located in the 100-year floodplain, as identified by FEMA
- Essential community services (Police, fire protection/emergency services, health and medical care/hospitals, education, libraries, utilities and administrative and support facilities essential to their operation (as defined by FEMA))
- Major communication centers
- Facilities designed for bulk storage of chemicals, petrochemicals, hazardous or toxic substances or floatable materials (as defined by DEC)
- Critical private non-profit facilities (fire protection/emergency services, health and medical care/hospitals, education, utilities, child care facilities, alcohol and drug

rehabilitation facilities, custodial care, homeless shelters, libraries and other facilities that provide health and safety services of a governmental nature

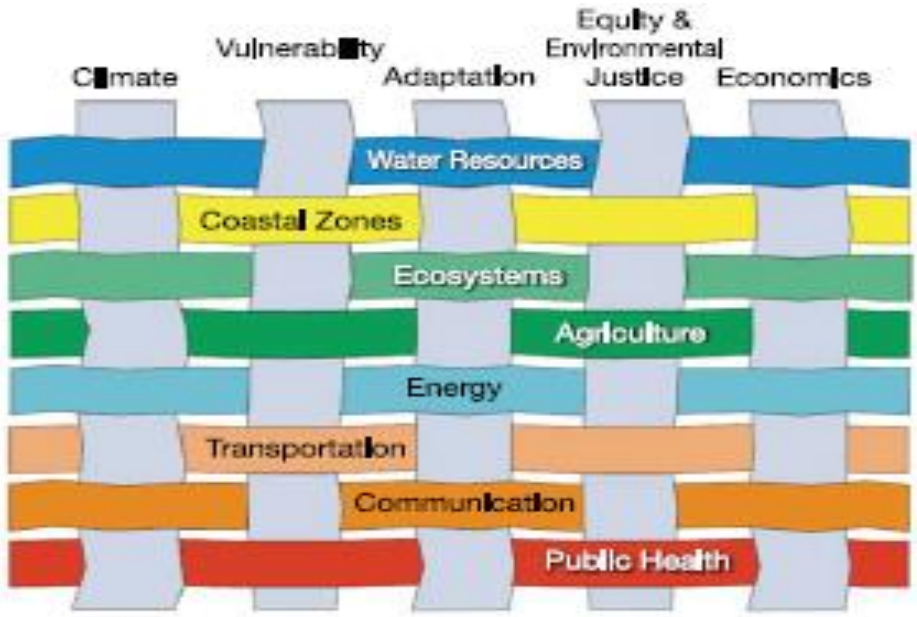
- Recommend consideration of major employers and other entities that could have an economic impact with prolonged down-time due to disasters

As a public document, this plan limits the amount of detail it provides related to critical facilities and infrastructure. For the most part, publicly available data sources have been used to describe and quantify the critical facilities and infrastructure in the state. Since much of the States critical infrastructure is owned and managed by private entities, information related to this infrastructure is typically propriety and is not readily available for inclusion in this plan.

One source of information related to critical infrastructure vulnerability and losses that was researched for the 2014 SHMP update is *Responding to Climate Change in New York State* (ClimAID). The ClimAID report was funded by the New York State Energy Research and Development Authority (NYSERDA), and focused on eight critical sectors of the state (agriculture, coastal zones, ecosystems, energy, public health, telecommunications, transportation, water resources). The report looks at vulnerability, and potential challenges to these critical sectors caused by multiple conditions related to climate change, as well as potential adaptation strategies. Although the focus was on adaptive strategies to address potential impacts of climate change, the scope of this report provides the best picture of the State's vulnerable infrastructure and the comprehensive approach to identifying potential measures to protect it from multiple hazards.

Figure 3.1e illustrates the integrating sectors and themes linked to climate change, which describe eight categories of critical infrastructure vulnerable to multiple natural hazards. Additional detail related to vulnerabilities and losses to the climate change hazard are included in **Section 3.4.**

Figure 3.1e: Integrated Sectors and Themes Linked to Climate Change



Several data sources were used to analyze potential impacts to critical facilities, including previous versions of the New York State Hazard Mitigation Plan, the ClimAID report, and internet research. Using these sources, the critical facilities and infrastructure can be assessed by sector in a general sense with several limitations. Losses estimated in the ClimAID report focus on impacts to the eight sectors related to climate change. First, although the general sectors defined in ClimAID relate to the State's services and support to population, environment and economy, the definitions of these sectors are not directly aligned with FEMA's definition of critical facilities, or the categories of critical facilities described in DHSES' *Hazard Mitigation Planning Standards*. In addition, the projected costs of impacts are based on various scenarios of probability. Costs of impacts are described in the ClimAID tables.

Losses related to sector impacts from climate change described in the ClimAID report are illustrated in the following example for water resources. Losses related to the various elements of climate change were identified as annual incremental costs at mid-century without adaptation, compared to annual incremental adaptation costs and benefits at mid-century.

Table 3.1m: Example of Vulnerability of Critical Infrastructure - Climate and Economic Sensitivity Matrix: Water Resources Sector (Values in $2010 US.)

Element	Main climate variables				Economic risks and opportunities: – is Risk + is Opportunity	Annual incremental impact costs of climate change at mid-century, without adaptation	Annual incremental adaptation costs and benefits of climate change at mid-century
	Temperature	Precipitation	Extreme events: heat	Sea level rise & storm surge			
Coastal flooding		•		•	– Damage to wastewater treatment plants – Blockage from SLR of system outfalls – Salt water intrusion into aquifers	Coastal flooding of WWTPs $116-203M	Costs: $47M Benefits: $186M
Inland flooding	•	•			– Increased runoff leading to water quality problems – Damage in inland infrastructure	High direct costs Statewide estimated $237M in 2010.	Restore natural flood area; decrease permeable surfaces; possible use of levees; control turbidity
Urban flooding		•			– Drainage system capacity exceeded; CSOs – Damage to infrastructure	Violation of standards	Very high costs of restructuring drainage systems
Droughts	•	•			– Reduction in available supplies to consumers – Loss of hydroelectric generation – Impacts on agricultural productivity	1960s drought in NYC system reduced surface safe yield from 1800 mgd to 1290 mgd	Increased redundancy and interconnected-ness costs for irrigation equipment
Power outages	•	•	•		– Loss of functionality of wastewater treatment plants and other facilities	Violation of standards	Flood walls
Total estimated costs of key elements						$353-440M	Costs: $47M Benefits: $186M

See **Section 3.4 Climate Change** for additional ClimAID vulnerability tables.

3.1.10 Changes in Development Trends

As part of the plan update process for 2014, the State looked at changes in growth and development. Also reviewed were notable and important trends identified in the review of the local hazard mitigation plans. Development trends are also addressed in each hazard section.

Development indicators such as population change and building permits demonstrate that there was relatively little change in both areas between 2000 and 2010, based on the most current available U.S. Census data.

Census information indicates that Orange (9.2%), Rockland (8.7%), and Saratoga (9.5%) Counties had the greatest increase in population, based on U.S. Census data, 2000-2010. Hamilton County had the greatest loss of population (10.1%) during the same period. The coastal area in and around New York City is the most densely populated area of the state, which could potentially be under significant pressure for development in sensitive coastal areas; however, population increase in New York City between 2000 to 2010 was only 3.9%. Information from the Orange, Rockland and Saratoga hazard mitigation plans provide this information related to changes in development trends:

- The Orange County plan[6] includes a history of land development patterns in the county, which provides a historical reference for assessment of changing trends. Also, a questionnaire was used to gather information related to current land uses and development trends occurring within the county, such as the predominant types of development occurring, location, expected intensity, and pace by land use; and regulations/ordinances/codes to protect new development from the effects of natural hazards. The plan includes tables that describe the acreages and percentages of all land uses in the County and its municipalities, including vacant land which could potentially be developed. In addition, the tables indicate the percentage of vacant land that lies within geographically delineated hazard zones. Municipalities could offer some level of protection from hazard events by minimizing future development in hazard prone areas, or by imposing certain development restrictions which would offer some protection from hazard events.

- The Rockland County plan[7] provides a summary of land cover uses by acreage and percentage, which illustrates that more than one third of the county (35.3%) is protected undeveloped land in the form of public parkland under various jurisdictions (state, county, town, etc.) and private recreational land.

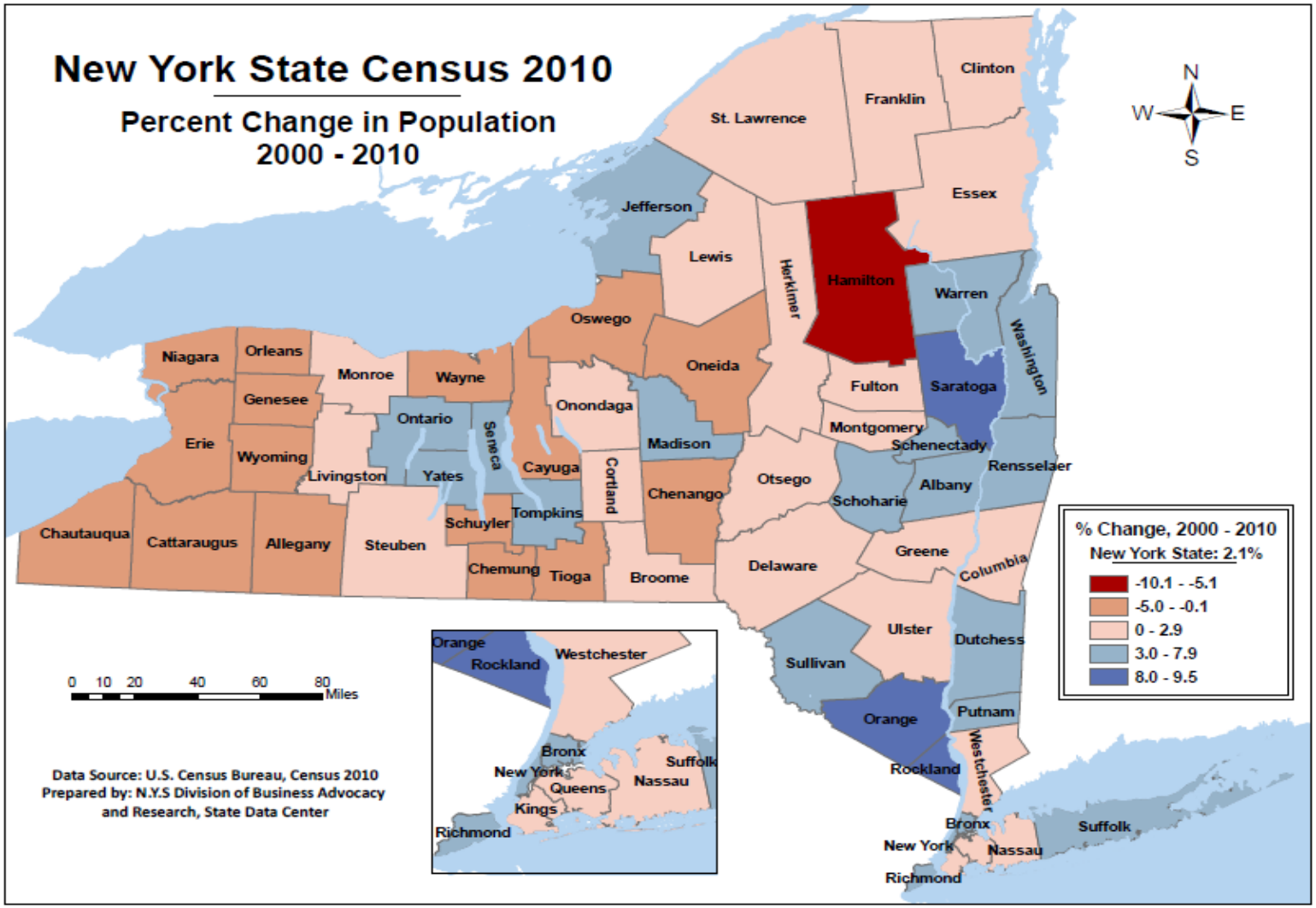
- The Saratoga County plan[8] includes statements within Section 4 and each community's annex related to areas targeted for future growth and development that have been identified across the county. As an example, the section of the plan that addresses earthquakes notes that the entire county is identified as the hazard area, and, "It is anticipated that the human exposure and vulnerability to earthquake impacts in newly developed areas will be similar to those that currently exist within the County. Current building codes require seismic provisions that should render new construction less vulnerable to seismic impacts than older, existing construction that may have been built to lower construction standards." In addition, the plan includes hazard maps that illustrate where potential new development is located in relation to the county's hazard areas.

[6] Orange County Single Jurisdiction Hazard Mitigation Plan, DRAFT 2010
[7] Rockland County Multi-Jurisdictional Hazard Mitigation Plan, FINAL, October 2010
[8] Saratoga County Multi-Jurisdictional Hazard Mitigation Plan, 2009, p. 5.4.5-50

Another indicator of development that may impact hazard-prone areas is tracking authorized building permits. Based on the number of permits issued (by month), the percent change in permits issued December 2012 and January 2013 was an 8% increase. However, there was a 32% increase in permits issued between January 2012 and January 2013. The wide variation between these percentages undoubtedly takes into account the increased volume of property repairs and reconstruction due to damages from Hurricane Sandy in October 2012, and does not reflect a significant amount of growth in new development.

Although New York State has various land use planning and building construction measures, such as the New York State Building Code, and Coastal Erosion Hazard Area regulations, that regulate or limit development in hazard-prone areas, it is primarily the local jurisdictions (counties and municipalities) that develop and enforce regulatory policies, codes, and/or practices that provide levels of protection for people and property from hazards related to development. The best source for detailed local-level development data and trends is the LHMPs.

Figure 3.1f: Illustrates the Percent Change in Population, 2000-2010



3.2 SUMMARY OF HAZARDS ASSESSED FOR RISK AND POTENTIAL LOSSES

In order to determine the hazards that present the greatest opportunity for mitigation of exposure and loss, a ranking process was developed based on probability of future events and severity/ extent of impact.

3.2.1 Ranking Methodology

The hazard mitigation ranking system was developed based on the state's HAZNY risk analysis methodology, described in **Section 1**. **The ranking process consisted of analysis in eight areas related to natural hazards:**

- Scope
- Cascade effects
- Frequency (relative probability of occurrence based on rating noted in Table 3.1e, Section 3.1.3, above.)
- Impact-People
- Impact – Private Property
- Impact-Community Infrastructure
- Onset
- Duration (time hazard is active)

Each category listed above included a series of questions that were used as the basis for the point system developed for ranking. Although HAZNY has a pre-defined numerical ranking system, it is predominantly focused on factors that impact preparedness and response capabilities. For the purpose of mitigation, an additional category, "Mitigation Potential" was added as a weighting factor to ensure that all hazards were considered for appropriate mitigation measures, based on cost benefit potential and technical feasibility. For the purpose of mitigation planning and activities, a point scale ranging from 9 (minimum) to 34 (maximum) was developed and applied to identify the hazards with the highest potential for mitigation. A score of 20 was selected as the appropriate cut-off point to separate high/moderate hazards from low hazards that required no further consideration for risk assessment due to low probability, limited impact or severity, or mitigation potential.

The ranking process, approved by the 2014 SHMP Planning Team in September 2013, resulted in the identification of **six** of the fifteen hazards ranked as high, which required further analysis to conduct the comprehensive risk assessment.

The following criteria specifically applied to those hazards ranked as high hazards:

1. **History** – High rating indicates that the hazard has affected the state often in the past and that the hazard has occurred often and/or with widespread or severe consequences.
2. **Presence of susceptible areas** – High rating indicates that the state has numerous facilities, operations, or populations that may be subjected to impact or damage from the hazard.
3. **Data availability** – High rating indicates that sufficient quality data is available to permit an accurate and comprehensive risk assessment.
4. **Federal disaster declarations** – High rating indicates that the state has received numerous disaster declarations for the particular hazard.
5. **Potential for Mitigation** – High rating indicates that there are ways to address the hazard, and that the methods are technically feasible and have the potential to be cost-effective.

Two additional hazards (wildfire and landslide), although they were ranked as low hazards, were determined to have to some potential for mitigation. Because the overall scores of these two hazards were below the cut-off point of 20 for a high hazard, a full risk assessment was not required; however, the probability of identifying cost-effective and feasible mitigation activities was determined to be substantial enough to include mitigation activities for both hazards.

Table 3.2a: Ranking of Hazards Identified in the 2014 SHMP, based on HAZNY-Mitigation scale

	Points	Hurricane	Climate Change	Flood	High Winds	Earthquake	Coastal Erosion	Extreme Temp	Drought	Severe Winter Storm	Wildfire	Tsunami	Hailstorm	Avalanche	Landslide	Land Sub/Expan
Scope																
Single location	1										1			1	1	1
Several individual locations	2						2					2				
Small region	3			3									3			
Large region	4	4	4		4	4		4	4	4						
Cascade Effects																
None	1															
Highly unlikely	2										2		2		2	2
Some potential	3							3	3	3		3		3		
Highly likely	4	4	4	4	4	4	4									
Frequency																
Rare event (<once every 50 yr)	1											1			1	1
Infrequent (once every 8-50 yr)	2					2			2		2			2		
Regular (once every 1-7 yr)	3	3	3		3		3	3		3			3			
Frequent (>once a year)	4			4												
Impact - People																
Serious injury/death likely, not large numbers	1		1	1	1	1	1	1	1	1	1		1	1	1	1
Serious injury/death likely, large numbers	2											2				
Serious injury/death likely, extreme numbers	3	3														
Impact - Private Property																
Little or no damage	1							1	1	1	1		1	1	1	1
Moderate damage	2		2	2	2	2	2					2				
Severe damage	3	3														
Impact - Community Infrastructure																
Little or no structural damage	1							1	1	1	1		1	1	1	1
Moderal structural damage	2		2	2	2	2	2					2				
Severe structural damage	3	3														
Onset																
Up to one week warning	1	1	1					1	1	1						
One day warning	2			2	2		2									
Several hours warning	3											3	3			3
No warning	4					4					4			4	4	
Duration - Time Hazard is Active																
Less than one day	1					1						1	1	1	1	1
One day warning	2				2											
Two-three days	3	3					3			3	3					
Four days - week	4			4				4								
More than one week	5		5						5							
Mitigation Potential																
Largely preparedness & response based	1							1	1	1		1	1	1		1
Unlikely cost-benefit & technical feasibility	2															
Possible cost-benefit & technical feasibility	3					3	3				3				3	
Likely cost-benefit & technical feasibility	4	4	4	4	4											
SCORE		**28**	**26**	**26**	**24**	**23**	**22**	**19**	**19**	**18**	**18**	**17**	**16**	**15**	**15**	**12**
Minimum = 9																
Maximum = 34																

**Although hazard scores were in the "low" range, these hazards have the potential for cost-effective mitigation activities.

Six hazards were ranked as high in the 2014 ranking process, based on probability/frequency, severity/impact and mitigation potential, as described in **Table 3.2b.**

Table3.2b: Summary of Hazards Profiled and Assessed for Risk and Potential Loss*

Natural Hazards	Ranking (Score)	Final Disposition in Plan
Hurricane	High (28)	Profiled and full risk assessment conducted
Climate Change	High (26)	Profiled and full risk assessment conducted
Flood	High (26)	Profiled and full risk assessment conducted
High Winds	High (24)	Profiled and full risk assessment conducted
Earthquake	High (23)	Profiled and full risk assessment conducted
Coastal Erosion	High (22)	Profiled and full risk assessment conducted

*Minimum score is 9; maximum score is 34.

Nine of the fifteen hazards identified in **Table 3.2a** were addressed within hazard profiles; however, as a result of the information assessed in the profiles they were eventually excluded in the full risk assessment for the 2014 update. **Table 3.2c** lists the **nine** hazards that were excluded or minimally addressed in this plan along with justification for this determination.

Table 3.2c: Hazards Excluded or Minimally Addressed in the 2014 SHMP

Hazard Profile	Why Hazard was not Assessed for Risk and Loss	Final Disposition in Plan
Avalanche	▪ New York is not covered by a National Avalanche Center. ▪ New York does not have a history of any declared state or federal avalanche disasters.	▪ Profiled, but detailed risk assessment not required
Drought	▪ New York experiences some occurrences and has some potential for loss, but projected impacts to people, property and infrastructure are low.	▪ Profiled, but detailed risk assessment not required
Extreme Temperatures	▪ New York does experience high summertime and low winter temperatures, but the impacts generally do not exceed local capabilities. ▪ New York does not have a history of any	▪ Profiled, but detailed risk assessment not required

Hazard Profile	Why Hazard was not Assessed for Risk and Loss	Final Disposition in Plan
	declared state or federal extreme heat/cold disasters. ▪ Some elements of the extreme heat hazard are included in the drought hazard profile and mitigation strategy	
Hailstorm	▪ New York experiences some occurrences and has some potential for loss, but projected impacts to people, property and infrastructure are low.	▪ Profiled, but detailed risk assessment not required
Land Subsidence and Expansive Soils	▪ New York does have a land subsidence and expansive soils hazard, but the hazard areas, history, impacts, and mitigation strategies are addressed through levee safety programs in the DEC and the USACE.	▪ Profiled, but detailed risk assessment not required
Landslide	▪ New York has experienced some occurrences; however, most are localized and losses are typically low. There is some opportunity for mitigation related to transportation infrastructure.	▪ Profiled, but detailed risk assessment not required
Severe Winter Storm	▪ New York has occurrences and some potential for losses; however, losses are typically low and are related to preparedness and emergency protective measures (response), providing little opportunity for cost-effective mitigation at the state level.	▪ Profiled, but detailed risk assessment not required
Tsunami	▪ There have been no past occurrences and the projected impacts to people, property and infrastructure are localized.	▪ Profiled, but detailed risk assessment not required
Wildfire	▪ Most wildfires are small, localized events that have little potential for broad impact. ▪ New York has had a minimal number of declared wildfire disasters, but there is some opportunity for mitigation	▪ Profiled, but detailed risk assessment not required

3.2.2 Data Sources and Limitations

- Code of Federal Regulations (CFR) at Title 44, Chapter 1, Part 201.4 - Standard State Mitigation Planning
- Code of Federal Regulations (CFR) at Title 44, Chapter 1, Part 201.6 – Local Mitigation Planning
- FEMA Mitigation Planning "Tool Kit", Mitigation Planning Series
  - FEMA "How to Guide: Understanding Your Risks" (FEMA 386-2)
  - FEMA, "Integrating Historic Property and Cultural Resources Considerations in Hazard Mitigation Planning" (FEMA 386-6)
- New York State Local Hazard Mitigation Planning Standards, NYSDHSES (October 2012)
- *Disaster Planning for Historic Sites*, Florida Department of State and Florida Division of Emergency Management (2005)
- *Disaster Mitigation for Historic Properties*, Florida Department of State and Florida Division of Emergency Management (2008)
- Hurricane Sandy recovery is still in progress and final data related to impacts and costs are not yet available. Data will be collected and added during the next phase of annual maintenance of the plan.
- A project to produce a statewide inventory of facilities was initiated in August 2013, with a projected completion date of the initial pilot for mid-2014. The pilot will identify and assess one category of state critical infrastructure, residential facilities, and develop the methodology for what is anticipated to be a multi-year project. The methodology will include analysis of hazard vulnerability and estimated potential losses to state facilities from future hazard events which will be added to future SHMP updates for GIS analysis to capture a more detailed picture of state facility vulnerabilities and potential losses for natural hazards.