5.0 STATE RISK ASSESSMENT

SECTION 5.1 STATE RISK ASSESSMENT

5.1.1 STATE RISK ASSESSMENT OVERVIEW

44 CFR §201.4(c)(2): States are required to undertake 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.'

According to ***44 CFR 201.4 (c)(2)***, states are required to undertake a risk assessment that provides the factual basis for developing a mitigation strategy. The State of New Jersey 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.

All information on the risk assessment can be found in Section 5, as well as the referenced supporting appendices. For ease of review, the vulnerability assessment follows each hazard profile, so that all information about a specific hazard is continuous. This section describes the identification of hazards, Presidential disaster declarations, hazard profiles, and the vulnerability assessment.

5.1.2 IDENTIFICATION OF HAZARDS

Planning initiatives in the State of New Jersey are enhanced through the State's participation in the Emergency Management Accreditation Program (EMAP). EMAP is a voluntary assessment and accreditation process for the emergency management programs of states, territories, tribes, and local governments. The State passed the EMAP assessment and became accredited since October 28, 2011. EMAP is discussed further in Section 9 (Consequence Analysis) of this Plan.

According to the State's EMAP Program Manager, the State Hazard Mitigation Plan (HMP) has been identified as the one body of work that defines the hazards of concern to the State of New Jersey. Therefore, this Plan identifies the potential hazards (natural and human-caused), assesses their risks, and analyzes their consequences for all preparedness and planning efforts in the State. The hazard identification process took into account hazards that had been documented in local mitigation plans (including the 2011 State HMP); 2011 FEMA Crosswalk comments and interagency comments; State Hazard Mitigation Team (SHMT), New Jersey Office of Emergency Management (NJOEM) planners, Emergency Support Function leads, and Regional Operations Intelligence Center (ROIC) analysts.

Table 5.1-1 below lists the nature-based and human-based hazards listed in the 2014 State HMP, and those in the 2019 State HMP. The 2019 plan remains consistent with the 2014 plan based on input and review of NJOEM. During their meeting held on Sept. 13, 2017, the hazards list was distributed and approved by the SHMT. Additional input was sought on both the natural and human-caused hazards from NJOEM planners, ESF leads, ROIC analysts through additional telephone conversations, electronic mail correspondence, and meetings.

During the previous plan update, the planning consultant met with NJOEM and the State's EMAP Program Manager to discuss EMAP and the process to review and confirm the State's hazards of concern. Based on their review, two additional human-caused hazards were identified: cyber-attack and economic collapse. Additionally, they added disease outbreak within the pandemic hazard profile. Coincident to that plan update process, the State Office of Homeland Security and Preparedness had been preparing a Threat, Hazard Identification and Risk Assessment (THIRA) that further expanded the understanding of risk to the broad range of hazards that affect the State. The New Jersey Office of Homeland Security and Preparedness (NJOHSP) led the development of the State's THIRA process. The

NJOHSP coordinated with the ESF Coordinators and plan participants on this effort by providing critical facility data, attended meetings and reviewed and confirmed the Plan hazards of concern.

The State HMP planning process identified 24 hazards of concern: 11 natural and 13 human-caused. Table 5.1-1 lists the hazards of concern for the State, including the natural and human-caused hazards profiled in the 2019 State HMP update.

Table 5.1-1 State Hazards of Concern

2014 State HMP	2019 State HMP
Natural Hazards	
Coastal Erosion (including enhanced discussion of beach protection) and Sea-Level Rise	Coastal Erosion (including enhanced discussion of beach protection) and Sea-Level Rise
Dam/Levee Failure	Dam/Levee Failure
Drought	Drought
Earthquakes	Earthquakes
Flood (riverine, coastal, storm surge, tsunami, and stormwater flooding caused by local drainage and high groundwater levels)	Flood (riverine, coastal, storm surge, tsunami, and stormwater flooding caused by local drainage and high groundwater levels)
Geological Hazards (landslide and subsidence/sinkholes)	Geological Hazards (landslide and subsidence/sinkholes)
Hurricanes and Tropical Storms	Hurricanes and Tropical Storms
Nor'Easters	Nor' Easters
Severe Weather (high winds, tornadoes, thunderstorms, hail, and extreme temperature)	Severe Weather (high winds, tornadoes, thunderstorms, hail, and extreme temperature)
Wildfire	Severe Winter Weather (snow, blizzards, and ice storms)
Winter Storms (snow, blizzards, and ice storms)	Wildfire
Human-Caused Hazards	
Animal Disease Events	Animal Disease
Civil Unrest	Civil Unrest
Cyber Attack	Cyber Attack
Crop Failure	Crop Failure
Economic Collapse	Economic Collapse
Fishing Failure	Fishing Failure
Hazardous Substances – (Fixed Sites, In-Transit, Offshore)	Hazardous Substances (Fixed Sites, In-Transit, Offshore)
Nuclear Hazard	Nuclear Hazards
Pandemic (including disease outbreak)	Pandemic (including disease outbreak)
Power Outages	Power Failure
Terrorism	Terrorism

The following table (Table 5.1-2) includes the hazards of concern identified during each county's local mitigation planning efforts. The hazards named by each county for their distinct plan were then integrated and evaluated to assist the State in identifying the overall hazards of concern for the State of New Jersey.

Table 5.1-2 Identified Hazards of Concern by County

Hazard of Concern	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hunterdon	Hudson	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren
Natural																					
Avalanche																					
Climate Change					x										x						
Coastal Erosion and/or Sea Level Rise	x	x	x	x	x	x	x	x		x		x	x		x	x	x			x	
Dam/Levee Failure	x	x	x	x		x	x	x	x		x	x	x	x		x	x	x	x	x	x
Drought	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Earthquake	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Expansive Soils																					
Extreme Temperatures	x	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Extreme/High Wind	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	
Flood	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Geological Hazards	x	x		x		x	x	x	x	x		x	x	x	x	x	x		x		x
Hailstorm		x	x		x		x		x	x		x				x		x	x	x	x
Hurricane and Tropical Storm	x	x	x		x		x		x	x	x	x	x		x	x		x	x	x	x
Infestation			x											x							
Ice Jams									x										x		x
Ice Storm		x	x		x		x		x	x		x				x		x	x	x	x
Landslide		x	x						x		x	x	x			x			x	x	x
Land Subsidence		x							x		x	x				x			x		x
Lightning	x		x										x					x	x	x	
Nor'Easter	x	x	x		x		x		x	x		x	x		x	x		x	x	x	x
Severe Weather		x			x		x		x	x		x		x		x			x		x
Severe Summer Weather				x		x		x									x				
Severe Winter Weather			x	x	x	x	x	x	x	x				x		x	x	x	x	x	x
Storm Surge	x	x					x			x		x	x		x	x				x	
Thunderstorms		x	x		x		x		x	x						x		x	x		x
Tornado	x	x	x		x		x		x		x	x	x		x	x		x	x	x	x
Tsunami		x			x										x						
Volcano																					

Hazard of Concern	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hunterdon	Hudson	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren
Wave Action	x												x								
Wildfire	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x
Winter Storm	x	x									x	x	x		x						
Human-Caused																					
Animal Disease																					
Civil Disorder							x				x										
Civil Unrest																					
Crop Failure																					
Cyber Attack							x														
Disease Outbreak							x		x					x		x					
Energy Emergencies											x										
Economic Collapse																					
Fire Hazard											x										
Fishing Failure																					
Hazardous Substances - Fixed Sites							x		x		x	x		x	x	x			x	x	x
Hazardous Substances - Offshore															x						
Hazardous Substances - Transportation							x		x		x	x		x	x	x			x	x	x
Nuclear Attack											x										
Nuclear Hazard Issues											x				x						
Pandemic											x										
Power Outages							x					x			x						
Terrorism							x				x										
Transportation Accidents											x				x						
Transportation Failure (Bridge, Wailway, Roadway, Aviation)							x														
Urban Fire															x						

Tables 5.1-3 and 5.1-4 list all the natural and human-caused hazards in New Jersey identified in the Plan and provide details about the identification process.

Table 5.1-3 Process for Identifying Natural Hazards

Hazard of Concern	How the hazard was identified	Why the hazard was identified
Flood (riverine, coastal, storm surge, tsunami, and stormwater flooding caused by local drainage and high groundwater levels)	· Review of past disaster declarations · Review of the NCDC Storm Events Database · Review of SHELDUS · Review of FIRMs · Identification of NFIP RL and SRL in the State · Research including new media and Internet resources · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· New Jersey is affected by flooding nearly every year. · Floods can occur almost anywhere in the State. · Floods have been and continue to be the most frequent, destructive, and costly natural hazard in New Jersey. · A majority of the State's damage reported for major disasters is associated with floods. · Eighteen out of 49 federally declared disaster events in New Jersey were flooding events.
Hurricanes and Tropical Storms	· Review of past disaster declarations · Review of the NCDC Storm Events Database · Review of SHELDUS · Research including the NHC, new media and Internet resources · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· New Jersey has been impacted by hurricanes and tropical storms in the past. · Historic data have shown that a number of storms have impacted the State. · Eight out of 49 federally declared disasters in New Jersey were hurricane or tropical storm events. · The most recent federally declared disaster event in New Jersey (October 30, 2012) was Superstorm Sandy.
Nor'Easters	· Review of the NCDC Storm Events Database · Review of SHELDUS · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· New Jersey experiences between one and two Nor'Easters every year. · The coastal areas of New Jersey have been impacted by Nor'Easters and some events have been widespread in the State
Winter Storms (snow, blizzards, and ice storms)	· Review of past disaster declarations · Review of the NCDC Storm Events Database · Review of SHELDUS · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· New Jersey has been impacted by winter storm events in the past and historic data have shown a number of winter storms have impacted the State. · 8 out of 49 federally declared disasters in New Jersey were winter storm events. · The State's middle-latitude location results in snow falling in all areas of the state each winter. · Seasonal snowfall averages range between 10 and 20 inches in the southern third of the state, 20 to 30 inches in the central third, and 30 to 40 inches in the lower elevations of the northern third. The higher northern locations receive between 40 and 60 inches.
Severe Weather (high winds, tornadoes, thunderstorms, hail, and extreme temperature)	· Review of past disaster declarations · Review of the NCDC Storm Events Database · Research including the NWS, SPC, new media and Internet resources · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· Sixteen out of 49 federally declared disasters in New Jersey were severe storm events.

Hazard of Concern	How the hazard was identified	Why the hazard was identified
Earthquakes	· Researching including USGS, NJGS · Input from the SHMT, NJOEM planners, and ROIC analysts	· There are two factors that increase the earthquake risk in New Jersey: (1) eastern earthquakes affect areas 10 times larger than western ones of the same magnitude; and (2) New Jersey is the most densely populated state in the United States. · Numerous fault lines are located in New Jersey · Earthquakes have impacted New Jersey in the past. Between 1783 and 2013, there have been 181 earthquake events with epicenters in New Jersey
Drought	· Review of past disaster declarations · Review of the U.S. Drought Monitor and Drought Impact Reporter · Research including NRCC, NJDEP · Review of the NCDC Storm Events Database · Review of SHELDUS · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· The entire State is subject to the effects of drought. Nearly every county in the State has experienced at least one drought in the past 10 years. · The State has been included in two federally declared disasters (emergency declaration and major disaster declaration) for drought events.
Wildfire	· New Jersey Forest Fire Service statistics · Review of the NCDC Storm events Database · Review of the WUI · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· There have been over 950 wildfires in New Jersey, burning over 3,052 acres. · The State has been included in two FEMA fire management assistance declarations. · The New Jersey Pine Barrens has one of the most hazardous fuel types for wildfires in the United States · Each year, an average of 1,500 wildfires damage or destroy 7,000 acres in New Jersey.
Geological Hazards (landslides and subsidence/sinkholes)	· Research including NJGS · Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· Naturally occurring subsidence and sinkholes in New Jersey occur within bands of carbonate bedrock; in northern New Jersey, there are more than 225 square miles that are underlain by limestone, dolomite, and marble. In the southern part of New Jersey, there are 100 square miles that are underlain by a limesand, with thin limestone layers. · Between 1782 and 2018, there have been 285 landslide events in New Jersey.
Coastal Erosion (including enhanced discussion of beach erosion and climate change/sea level rise)	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· Coastal communities are most affected by coastal erosion. The Atlantic Ocean makes up the eastern border of New Jersey.

Table 5.1-4 Process for Identifying Human-Caused Hazards

Hazard of Concern	How the hazard was identified	Why the hazard was identified
Animal Disease Events	· Input from the SHMT, NJOEM planners, ESF leads, ROIC analysts, and Department of Agriculture	· There are over 10,000 farms in New Jersey totaling over $986 million in value. Of the $986 million, $135 million is livestock, poultry and their products. · Animal diseases in New Jersey include: avian influenza, canine influenza, equine herpes virus, eastern equine encephalitis, Johne's disease, West Nile Virus, and rabies. · Between 2010 and 2012, New Jersey had 884 reports of animal rabies cases.
Civil Unrest	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· There have been reported civil unrest incidents in New Jersey's history, including the Newark Riots in 1967 that left 26 people dead and injured hundreds. · With New Jersey's close proximity to New York City, areas of New Jersey may be targets of civil disturbance.
Crop Failure	· Input from the SHMT, NJOEM planners, ESF leads, ROIC analysts, and Department of Agriculture	· There are over 10,000 farms in New Jersey (733,450 acres). The market value of produce sold was over $900 million. 2016 Disaster Assistance for crop failure: $1.2 million
Fishing Failure	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· New Jersey's fishery and aquaculture resources contribute more than $1 billion annually to the State's economy. · New Jersey is home to six major fishing ports: Atlantic City, Barnegat Light, Bedford, Cape May, Point Pleasant, and Port Norris; four of these ranks in the top 50 ports in the U.S. (in terms of economic value). · In 2012, Superstorm Sandy caused severe flooding that mandated statewide closures of waters where shellfish are produced. Hatcheries were severely damaged or destroyed. New Jersey's fishing industry sustained nearly $120 million in losses. · The economic conditions of the State could be greatly affected by a fishing failure. In total, the New Jersey commercial fishing industry brings in an estimated $4.5 billion annually from fisheries, aquaculture, and recreational fishing. This is part of a $50 billion-a-year "Coastal Zone" sector of the State's economy, which employs one out of every six people working in New Jersey. The value of the seafood harvest extends well beyond the industry itself. The effects of a prosperous seafood industry are felt in other waterfront activities such as shipbuilding, maintenance and repair, support services (equipment, fuel, materials, and supplies), and ecotourism.
Hazardous Waste – Fixed Sites	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· There are 1,593 SARA Title III facilities in New Jersey. · Between 2007 and 2018, over 68 million pounds of chemicals have been released in New Jersey.

Hazard of Concern	How the hazard was identified	Why the hazard was identified
Hazardous Waste – Transportation	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· There are over 39,000 miles of public roads and approximately 1000 miles of rail freight lines in New Jersey and incidents involving hazardous materials in transit can occur anywhere in the State. · Between 2007 and 2018, over 15 million pounds of chemicals have been released off site in New Jersey. · Between 2008 and 2018, there have been over 1,800 accidents in New Jersey involving hazardous materials (air, highway, and rail).
Hazardous Waste – Offshore	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· New Jersey has 14 ports including the Port of New York and New Jersey, which is a critical link for shipping worldwide. The Port of New York and New Jersey ships a variety of goods, many of which consist of hazardous materials. · The ConocoPhillips' Bayway Refinery is located in the Cities of Linden and Elizabeth and processes 10 million gallons of crude oil each day. · There are six major petroleum refineries on the Delaware River shoreline that process nearly one million barrels of crude oil each day, as well as other chemicals associated with the refining process. · There have been several incidents involving hazardous material spills offshore of New Jersey that include the M/T ATHOS I releasing 265,000 gallons of crude oil in the Delaware River in 2004, and an Exxon underwater pipeline rupture in 1990 that released 567,000 gallons of No. 2 fuel oil into the Arthur Kill.
Nuclear Hazard Issues	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· Three active nuclear power plants are located within the State of New Jersey. There are also facilities in neighboring states that are within the 50-mile ingestion pathway zone that affects New Jersey. New Jersey; however, there have been a few minor incidents. · Due to the number of nuclear power plants in and around New Jersey, incidents will continue to occur.
Pandemic	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· All 21 counties in New Jersey have experienced the effects of a pandemic or disease outbreak (e.g., influenza). · Due to New Jersey's densely populated areas, a pandemic has the potential to spread more quickly. · There are numerous bodies of water located within the State that assist with the breeding of mosquitos, which can lead to the spread of the West Nile Virus. In 2012, there were 46 positive test results for West Nile Virus. · The H1N1 outbreak was widespread in New Jersey in July 2009, with 1,414 confirmed cases and 15 deaths. · As the population density increases in New Jersey, so will the probability of a pandemic event. · Extreme weather conditions in New Jersey can lead to an increase in West Nile Virus outbreaks.

Hazard of Concern	How the hazard was identified	Why the hazard was identified
Power Outages	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· There are four major electric service providers in the State of New Jersey responsible for maintaining power throughout their respective regions. · Power failures are problematic for homes heated with electricity. Approximately 10.7% of the homes in New Jersey are heated with electricity. · New Jersey has a history of widespread power outages, including Superstorm Sandy in 2012 when 2.7 million people were without power for an extended period of time. In August 2003, there was a widespread power outage that affected eight states in the northeast United States, including the State of New Jersey. · Based on past trends and historic power outages, New Jersey will continue to experience power outages.
Terrorism	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· Terrorist attacks can occur anywhere; however, New Jersey is an attractive target because of its dense population and location relative to major urban areas. · New Jersey is also home to the busiest commuter rail system in the United States, as well as the headquarters of major corporations for the financial and pharmaceutical industries. · Targets in New Jersey include critical infrastructure such as utilities, roadways, bridges, tunnels, hospitals, schools, civic centers, and reservoirs. · There have been several terrorist attacks in New Jersey's history and there is the potential for future occurrences.
Cyber Attack	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· New Jersey is located along a heavy transit corridor of people and goods, which makes the State a vulnerable target. · There have been reports of cyber-attacks in New Jersey, but on the smaller scale.
Economic Collapse	· Input from the SHMT, NJOEM planners, ESF leads, and ROIC analysts	· Economic collapse could impact the entire State. · There have been two reported economic collapses in New Jersey's history, and another economic collapse could occur in the future.

Figures 5.1-1 and 5.1-2 provide an overview of risk associated with selected nature- and human-based hazard profiles detailed later in this plan.

Figure 5.1-1 Selected Nature-based Hazard Profiles – Risk at a Glance

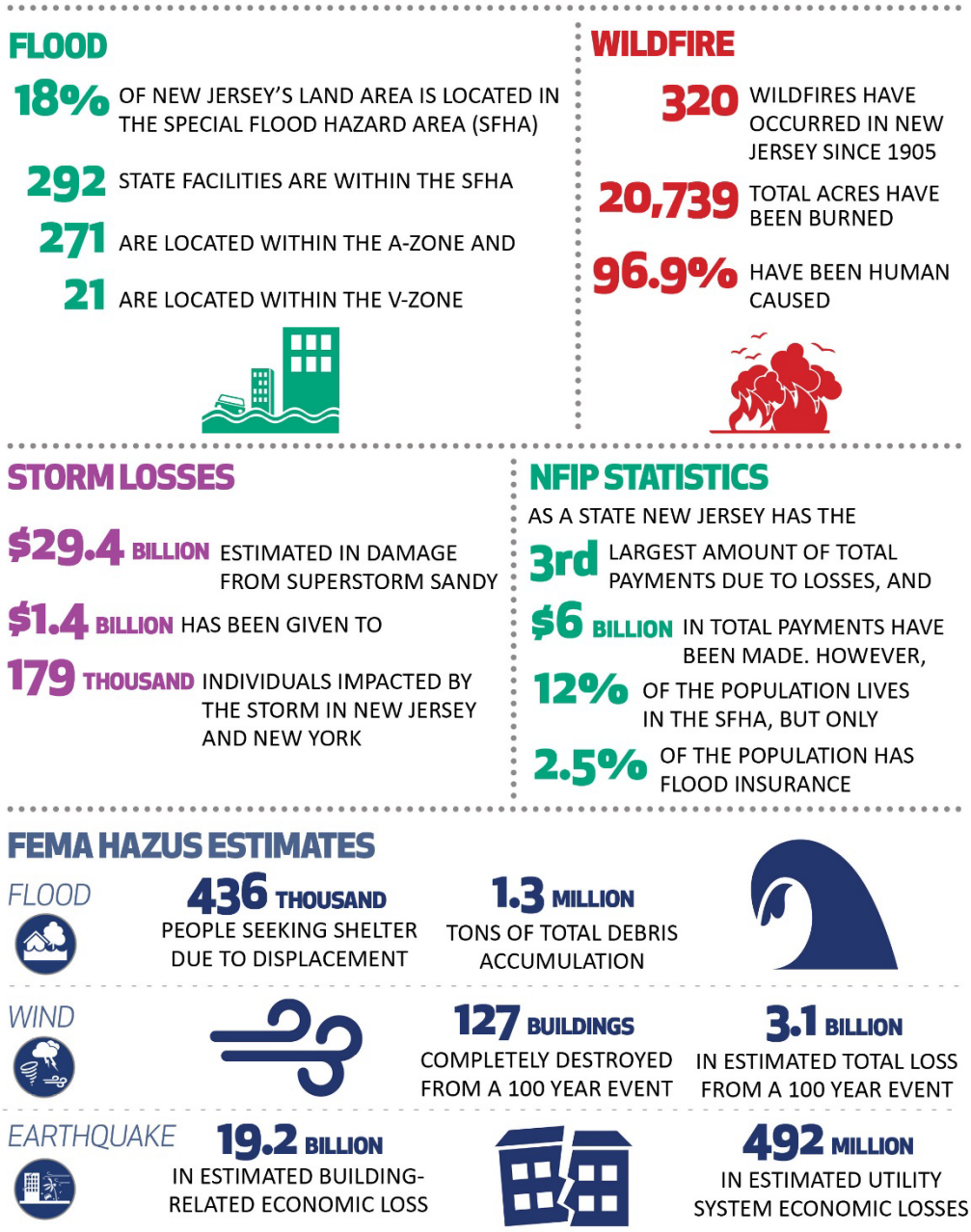


Figure 5.1-2 Selected Human-based Hazard Profiles – Risk at a Glance

ANIMAL DISEASE

11 CASES OF WEST NILE VIRUS WERE REPORTED IN LIVESTOCK IN NEW JERSEY IN 2016.

1 CASE OF EASTERN EQUINE ENCEPHALITIS WAS REPORTED IN PASSAIC COUNTY IN 2016 .

CROP FAILURE

THE "GARDEN STATE" HAS A MAJOR AGRICULTURAL INDUSTRY, WHICH INCLUDES OVER

1/2 MILLION ACRES OF AGRICULTURAL LAND.

14 USDA DISASTER DECLARATIONS RELATED TO CROP FAILURE HAVE IMPACTED NEW JERSEY SINCE 2011

PROTECTING AGAINST CYBER TERRORISM

IN 2015 NEW JERSEY CREATED THE NEW JERSEY CYBERSECURITY AND COMMUNICATIONS INTEGRATION CELL (NJCCIC) IN ORDER TO ADDRESS STATE VULNERABILITY TO A CYBER-ATTACK.

HAZARDOUS SUBSTANCE

MORE THAN **14 THOUSAND** SITES ARE LISTED ON NJDEP'S LIST OF KNOWN CONTAMINATED SITES IN NEW JERSEY.

NUCLEAR POWER

THE OYSTER CREEK NUCLEAR GENERATING STATION LOCATED IN OCEAN COUNTY WILL BE PERMANENTLY CLOSED BY OCTOBER 2018 TO HELP PROTECT BARNEGAT BAY.

TERRORISM

IN 2016 THERE WAS A TARGETED TERRORIST ATTACK IN NEW JERSEY. ON SEPTEMBER 17TH A PIPE BOMB WAS SET OFF IN SEASIDE PARK, AND ON SEPTEMBER 18TH MULTIPLE PIPE BOMBS WERE DISCOVERED AT THE TRAIN STATION IN ELIZABETH NEW JERSEY.

PANDEMIC

IN 2012 THE WORST OUTBREAK OF WEST NILE VIRUS (WNV) IN THE U.S. OCCURRED.

46 CASES WERE TESTED AND REPORTED AS POSITIVE FOR WNV IN NEW JERSEY.

THERE HAS BEEN AN OUTBREAK OF ZIKA INFLUENCING THE UNITED STATES OVER THE PAST FEW YEARS.

194 CASES OF ZIKA HAVE BEEN REPORTED IN NEW JERSEY SINCE 2015. ALL REPORTED CASES HAVE BEEN SYMPTOMATIC DISEASE CASES.

5.1.2.1 PRESIDENTIAL DISASTER DECLARATIONS

The State of New Jersey's disaster history provides direction on the identification of hazards and their significance to the State. Of the 49 federal disasters declared in New Jersey from 1955 to 2018, New Jersey received 37 major disaster declarations; 12 emergency declarations; and two fire emergency assistance declarations. These events included the following hazard events:

- Two coastal storm events
- Two drought events
- Three fire events
- Eight flood events
- Ten hurricane events
- Two other events (virus threat; power outage)
- Sixteen severe storm events
- Eight snow events

Table 5.1-5 outlines (in chronological order) each FEMA major disaster declaration that New Jersey has received since 1955. This establishes the vulnerability and historic occurrences of hazards that the State of New Jersey regularly experiences.

Table 5.1-5 FEMA Major Disaster Declarations: New Jersey, 1955-2018

Disaster Number	Disaster Type	Incident Period	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	Impacted Number of Counties
DR-41	Hurricane, Floods	8/20/1955	Not Available																					
DR-124	Severe Storm, High Tides, Flooding	3/9/1962	Data Not Available																					
DR-205	Water Shortage	8/18/1965	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
DR-245	Heavy Rains, Flooding	6/18/1968		X					X					X		X		X		X		X		7
DR-310	Heavy Rains, Flooding	9/4/1971	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
DR-402	Severe Storms, Flooding	8/7/1973							X					X						X		X		4
DR-477	Heavy Rains, High Winds, Hail, Tornadoes	7/23/1975		X	X			X	X	X			X	X		X		X	X	X	X	X		13
DR-519	Severe Storms,	8/21/1976	X				X								X		X							4

Disaster Number	Disaster Type	Incident Period	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	Impacted Number of Counties
	High Winds, Flooding																							
DR-701	Coastal Storms, Flooding	4/12/1984	X	X			X		X						X	X	X	X						8
DR-749	Hurricane Gloria	9/27/1985	X				X	X							X									4
DR-973	Coastal Storm, High Tides, Heavy, Rain, Flooding	12/10/1992 – 12/17/1992	X	X			X	X	X		X			X	X		X		X	X		X		12
DR-1145	Severe Storms/Flooding	11/19/1996									X			X		X				X		X		5
DR-1189	Flooding	9/23/1997	X																	1				
DR-1206	Coastal Storm	2/4/1998 – 2/8/1998	X				X										X							3
DR-1295	Hurricane Floyd	9/18/1999		X					X			X	X	X		X		X		X		X		9
DR-1337	Severe Storms, Flooding and Mudslides	8/17/2000														X					X			2
DR-1530	Severe Storms and Flooding	7/16/2004			X	X																		2
DR-1563	Tropical Depression Ivan	10/1/2004										X	X								X		X	4
DR-1588	Severe Storms and Flooding	4/19/2005		X					X	X		X	X			X		X			X		X	9
DR-1653	Severe Storms and Flooding	7/7/2006										X	X								X		X	4
DR-1694	Severe Storms, and Inland and Coastal Flooding	4/14/2007 – 4/20/2007	X	X	X	X			X		X		X	X		X		X		X	X	X	X	14

Disaster Number	Disaster Type	Incident Period	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	Impacted Number of Counties
DR-1867	Severe Storms, and Flooding Associated with Tropical Depression Ida and a Nor'Easter	11/11/2009 – 11/15/2009	X				X										X							3
DR-1867	Severe Storms and Flooding Associated with Tropical Depression Ida and a Nor'Easter	12/22/2009	X				X										X							3
DR-1873	Snowstorm	2/5/2010	X		X	X		X		X							X		X					7
DR-1889	Severe Winter Storm and Snowstorm	3/23/2010	X		X	X	X	X		X									X					7
DR-1897	Severe Storms and Flooding	4/2/2010	X	X	X		X	X	X	X		X	X	X	X	X	X	X		X		X		16
DR-1954	Severe Winter Storm and Snowstorm	2/4/2011	X	X	X		X	X	X		X		X	X	X	X	X	X		X		X		15
DR-4033	Severe Storms and Flooding	9/15/2011						X		X									X					3
DR-4039	Remnants of Tropical Storm Lee	10/14/2011										X	X					X			X		X	5
DR-4021	Hurricane Irene	8/27/2011 – 9/5/2011	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
DR-4048	Severe Storm	10/29/2011		X			X		X			X		X				X		X	X	X	X	10
DR-4070	Severe Storms and	7/19/2012	X					X											X					3

Disaster Number	Disaster Type	Incident Period	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hudson	Hunterdon	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren	Impacted Number of Counties
	Straight Line Winds																							
DR-4086	Hurricane Sandy	10/26/2012 – 11/8/2012	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	21
DR-4231	Severe Storm	6/23/2015	X		X	X			X															4
DR-4264	Severe Winter Storm and Snowstorm	1/22/2016	X	X	X	X	X	X	X		X	X	X	X	X	X	X			X		X	X	17
DR-4368	Severe Winter Storm and Snowstorm	3/6/2018 to 3/7/2018		X	X				X							X		X		X				6

Table 5.1-6 provides an itemized list of state and federal disaster declarations for the State of New Jersey. It includes a summary of assistance funding disbursed as a result of each past disaster declaration. This table was changed from the 2011 Plan to list disaster declarations in chronological order, and remove assistance type for disaster declarations prior to FEMA being founded in 1979. In addition, total funding was updated as provided by FEMA Region II. The funding is distributed in the following categories:

- Public Assistance (PA) project grants - Supplemental disaster assistance for states, local governments, and private non-profit organizations after declared disasters or emergencies
- Hazard Mitigation Grant Program (HMGP) project grants - To prevent future losses of lives and property caused disasters. Presidential declaration of a major disaster or emergency is designated for hazard mitigation assistance.
- Individual Assistance (IA) includes Individual Household Program (IHP; formerly named Individual and Family Grant Program [IFG]) - Grants to individuals to provide funds for the serious needs and necessary expenses of disaster victims. NOTE: Individual assistance funding includes loans and grants under the FEMA Disaster Housing, State IFG Program, and/or SBA Home and Business Loan Programs.

Table 5.1-6 Federal and State Disaster Declarations for the State of New Jersey, 1955 to 2018

Disaster Number	Disaster Name	Date(s) of Event	Declared Areas	Assistance Type	Federal	State	Total
DR-41	Hurricane and Floods	8/20/1955	Not available				Unavailable
DR-124	Severe Storm, High Tides, and Flooding	3/9/1962	Not available				Unavailable
DR-205	Water Shortage (Drought)	8/18/1965	All 21 Counties				Unavailable

Disaster Number	Disaster Name	Date(s) of Event	Declared Areas	Assistance Type	Federal	State	Total
DR-245	Heavy Rains and Flooding	6/18/1968	Bergen, Essex, Middlesex, Morris, Passaic, Somerset, Union				Unavailable
DR-310	Heavy Rains and Flooding	9/4/1971	All 21 Counties				Unavailable
DR-402	Severe Storms and Flooding	8/7/1973	Essex, Middlesex, Somerset, Union				Unavailable
EM-3005	Severe Storms, High Winds, and High Tides	12/24/1974	Cape May				Unavailable
DR-477	Heavy Rains, High Winds, Hail, and Tornadoes	7/23/1975	Bergen, Burlington, Cumberland, Essex, Gloucester, Mercer, Middlesex, Morris, Passaic, Somerset, Sussex, Union				Unavailable
DR-519	Severe Storms, High Winds, and Flooding	8/21/1976	Atlantic, Cape May, Monmouth, Ocean				Unavailable
DR-528	Ice Conditions	2/8/1977	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Ocean, Salem				Unavailable
EM-3083	Water Shortage (Drought)	10/19/1980	All 21 Counties	PA HMGP			Unavailable Unavailable
DR-701	Coastal Storms and Flooding	3/28/1984-4/8/84	Atlantic, Bergen, Cape May, Essex, Monmouth, Morris, Ocean, Passaic	IA PA HMGP			Unavailable Unavailable Unavailable
DR-749	Hurricane Gloria	9/27/1985	Atlantic, Cape May, Cumberland, Monmouth	PA HMGP			Unavailable Unavailable
DR-936	Severe Coastal Storm	1/4/1992	Atlantic, Cape May, Cumberland, Monmouth, Ocean	PA HMGP			Unavailable 250,736
DR-973	Coastal Storm, High Tides, Heavy Rain, and Flooding	12/10/1992-12/17/1992	Atlantic, Bergen, Cape May, Cumberland, Essex, Hudson, Middlesex, Monmouth, Ocean, Salem, Somerset, Union	IA PA HMGP			Unavailable Unavailable 2,061,868
EM-3005	Severe Storms, High Winds, and High Tides	12/24/1974	Cape May				Unavailable

Disaster Number	Disaster Name	Date(s) of Event	Declared Areas	Assistance Type	Federal	State	Total
DR-477	Heavy Rains, High Winds, Hail, and Tornadoes	7/23/1975	Bergen, Burlington, Cumberland, Essex, Gloucester, Mercer, Middlesex, Morris, Passaic, Somerset, Sussex, Union				Unavailable
DR-519	Severe Storms, High Winds, and Flooding	8/21/1976	Atlantic, Cape May Monmouth, Ocean				Unavailable
DR-528	Ice Conditions	2/8/1977	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Ocean, Salem				Unavailable
EM-3083	Water Shortage (Drought)	10/19/1980	All 21 Counties	PA HMGP			Unavailable Unavailable
DR-701	Coastal Storms and Flooding	3/28/1984-4/8/84	Atlantic, Bergen, Cape May, Essex, Monmouth, Morris, Ocean, Passaic	IA PA HMGP			Unavailable Unavailable Unavailable
DR-749	Hurricane Gloria	9/27/1985	Atlantic, Cape May, Cumberland, Monmouth	PA HMGP			Unavailable Unavailable
DR-936	Severe Coastal Storm	1/4/1992	Atlantic, Cape May, Cumberland, Monmouth, Ocean	PA HMGP			Unavailable 250,736
DR-973	Coastal Storm, High Tides, Heavy Rain, and Flooding	12/10/1992-12/17/1992	Atlantic, Bergen, Cape May, Cumberland, Essex, Hudson, Middlesex, Monmouth, Ocean, Salem, Somerset, Union	IA PA HMGP			Unavailable Unavailable 2,061,868
DR-3106	Severe Blizzard	3/13/1993-3/17/1993	All 21 Counties	PA			Unavailable
DR-1088	Severe Snow Storm (Blizzard of '96)	1/7/1996-1/12/1996	All 21 Counties	HMGP PA HMGP			Unavailable Unavailable Unavailable
DR-1145	Severe Storms and Flooding	10/18/1996 - 10/23/1996	Hudson, Middlesex, Morris, Somerset, Union	IA HMGP			Unavailable 298,688
DR-1189	Severe Storms and Flooding	8/20/97-8/21-97	Atlantic	IA PA HMGP			Unavailable Unavailable 358,416
DR-1206	Severe Winter Coastal Storm,	2/4/1998-2/8/1998	Atlantic, Cape May, Ocean	IA PA			Unavailable Unavailable

Disaster Number	Disaster Name	Date(s) of Event	Declared Areas	Assistance Type	Federal	State	Total
	High Winds, Flooding			HMGP			476,631
DR-1295	Hurricane Floyd	9/16/1999-9/18/1999	Bergen, Essex, Hunterdon, Mercer, Middlesex, Morris, Passaic, Somerset, Union	IA PA HMGP	38,703,383		Unavailable 38,703,383 10,345,765
EM-3148	Hurricane Floyd	9/16/1999-9/18/1999	All 21 Counties	PA			2,032,514
EM-3156	West Nile Virus	5/30/2000-11/1/2000	All 21 Counties	PA			2,440,547
DR-1337	Severe Storms, Flooding, and Mudslides	8/12/2000-8/21/2000	Morris, Sussex	IA PA HMGP	4,697,328		Unavailable 4,697,328 950,900
EM-3169	Terrorist Attack	9/11/2001	All 21 Counties	PA			88,203,232
FM-2411	Double Trouble Wildfire	6/2/2002	Ocean	PA			Unavailable
EM-3181	Snow	2/16/2003-2/17/2003	All 21 Counties	PA			36,139,478
EM-3188	Power Outage	8/14/2003-8/26/2003	Bergen, Essex, Hudson, Passaic, Union	PA			1,480,657
DR-1530	Severe Storms and Flooding	7/21/2004-7/23/2004	Burlington, Camden	IA PA HMGP	9,640,959 7,337,468		9,640,959 7,337,468 1,310,604
DR-1563	Severe Storms and Flooding	9/18/2004-10/1/2004	Hunterdon, Mercer, Sussex, Warren	IA PA HMGP	1,785,198 4,272,883		1,785,198 4,272,883 520,823
DR-1588	Severe Storms and Flooding	4/1/2005-4/3/2005	Bergen, Essex, Gloucester, Hunterdon, Mercer, Morris, Passaic, Sussex, Warren	IA PA HMGP	2,514,187 N/A		2,514,187 N/A 193,073
EM-3257	Hurricane Katrina Evacuation	8/29/2005-10/1/2005	All 21 Counties	PA			360,857
DR-1653	Severe Storms and Flooding	6/23/2006-7/10/2006	Hunterdon, Mercer, Sussex, Warren	IA PA HMGP	542,186 2,262,523		542,186 2,262,523 199,751
DR-1694	Severe Storms and Inland and Coastal Flooding	4/14/2007-4/20/2007	Atlantic, Bergen, Burlington, Camden, Essex, Gloucester, Hudson, Mercer, Middlesex, Morris, Passaic, Somerset,	IA PA HMGP	18,821,509 17,513,033		18,821,509 17,513,033 5,022,844

Disaster Number	Disaster Name	Date(s) of Event	Declared Areas	Assistance Type	Federal	State	Total
			Sussex, Union, Warren				
FM-2695	Warren Grove Fire	5/15/2007	Burlington, Ocean	PA			Unavailable
DR-1867	Severe Storms and Flooding Associated with Tropical Depression Ida and a Nor'Easter	11/11/09-11/15/09	Atlantic, Cape May, Ocean	PA HMGP	12,461,045 3,419,728	 1,709,909	12,461,045 5,129,637
DR-1873	Snowstorm	12/19/2009 - 12/20/2009	Atlantic, Burlington, Camden, Cumberland, Gloucester, Ocean, Salem	PA HMGP	11,898,567 1,862,860	 617,940	11,898,567 1,570,000
DR-1889	Severe Winter Storm and Snowstorm	2/5/2010-2/6/2010	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Salem	PA HMGP	13,770,410 1,913,345	13,432,189 637,782	27,202,600 2,551,127
DR-1897	Severe Storms and Flooding	3/12/2010-4/15/2010	Atlantic, Bergen, Burlington, Cape May, Cumberland, Essex, Gloucester, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Union	IA PA HMGP	16,920,234 30,742,406 5,153,860	 24,667,128 1,717,953	16,920,234 55,409,534 6,871,813
DR-1954	Severe Winter Storm and Snowstorm	12/26/2010 - 12/27/2010	Atlantic, Bergen, Burlington, Cape May, Cumberland, Essex, Hudson, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Union	PA HMGP	50,662,081 7,247,261	44,504,231 3,972,804	95,166,312 11,220,065
DR-4033	Severe Storms and Flooding	8/13/2011-8/15/2011	Cumberland, Gloucester, Salem	PA HMGP	4,151,240 1,438,007	1,064,56 453,973	5,215,795 1,891,980
EM-3332	Hurricane Irene	8/26/2011-9/5/2011	All 21 Counties	PA			See DR-4021
DR-4021	Hurricane Irene	8/27/2011-9/5/2011	All 21 Counties	IA PA HMGP	176,949,241 114,403,945 48,002,753	 71,140,287 17,031,101	176,949,241 185,544,232 65,033,854
DR-4033	Severe Storms and Flooding	8/13/2011-8/15/2011	Cumberland, Gloucester, Salem	PA HMGP	4,151,240 1,438,007	1,064,556 435,973	5,215,795 1,891,980
DR-4039	Remnants of Tropical Storm Lee	9/28/2011-10/6/2011	Hunterdon, Mercer, Passaic, Sussex, Warren	PA HMGP	4,152,279 1,200,000	1,760,636 400,000	5,912,915 1,600,000

Disaster Number	Disaster Name	Date(s) of Event	Declared Areas	Assistance Type	Federal	State	Total
DR-4048	Severe Storm	10/29/2011	Bergen, Cape May, Essex, Hunterdon, Middlesex, Morris, Passaic, Somerset, Sussex, Union, Warren	PA HMGP	24,843,186 3,533,500	16,033,991 3,717,250	40,877,177 7,317,417
DR-4070	Severe Storms and Straight-Line Winds	6/30/2012	Atlantic, Cumberland, Salem	PA HMGP	9,744,730 1,485,313	343,663	9,744,730 1,374,650
DR-4086	Hurricane Sandy	10/26/2012 -11/8/2012	All 21 Counties	IA PA HMGP	422,887,543 1,976,647,908 92,929,508		422,887,543 1,976,647,908 92,929,508
EM-3354	Hurricane Sandy	10/26/2012 -11/8/2012	All 21 Counties	PA			See DR-4086

5.1.3 HAZARD PROFILE

44 CFR §201.4(c)(2)(i): The risk assessment shall include the following: An overview of the type and 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 events, using maps where appropriate.

Table 5.1-7 Risk Assessment Overview

1. RISK ASSESSMENT	2. VULNERABILITY ASSESSMENT
a. Hazard Description Provides an understanding of the characteristics of the hazard addressed. Sub-sections include: • Regulations in Place to Manage the Hazard	a. Assessing Vulnerability by Jurisdiction Provides and overview of the vulnerability of jurisdictions to the identified hazards. This section identifies the jurisdictions most at risk to each hazard by drawing from the risk analysis as well as jurisdictional plans.
b. Extent Provides a narrative of the hazard location as well as the strength or magnitude of the hazard. Describes the characteristics of the hazard regardless of specific impacts to people and property from the hazard.	b. Estimating Potential Losses by Jurisdiction Estimates potential losses to vulnerable structures at the local level. Potential structural and population impacts are assessed to better prioritize mitigation in specific areas that are subject to hazards that cause the most estimated loss.
c. Previous Occurrences Summarizes a complete history of events. Discussion includes when and where past hazard events have occurred as well as the types of damage incurred and the duration and magnitude of each event. Sub-sections include: •FEMA related disasters	c. Assessing Vulnerability to State Facilities Provides and overview of the potential impacts of a hazard event to state assets by looking at the inventory of state facilities as a whole. This section comprehensively describes the vulnerability of state structures to the identified hazards.
d. Probability of Future Occurrences Describes the likelihood of a hazard event occurring in the future. Includes a summary of projected changes in occurrences in terms of location, extent, intensity and frequency. Sub-sections include: • Potential effects of climate change	d. Estimating Potential Losses to State Facilities Assesses which state assets are most vulnerable to the hazard by using quantitative methods to gather estimates for potential loss. Losses are considered estimates since an asset in a hazard area may experience a range of losses.
e. Impact Analysis Provides and overview of the impact the hazard could have on the State based on a variety of factors. Sub-sections include: • Severity of Impact and Warning Time • Secondary Hazards • Environmental Impacts	

During the profiling process for hazard events, planners considered historical records, information regarding the geographic area, and the probability of future occurrences. As part of the State HMP Update, each hazard was reconsidered, and new information was added for the period from 2012 to 2018. The hazard profiles section of the State HMP update contains the following subsections:

- General background information, including a description of all natural and human-caused hazards of concern. The hazard description provides a definition and description of each hazard, including any indices and/or classifications pertaining to the hazard of concern.
- Information regarding the geographic location and extent of the hazard, including detailed maps. A description of the geographic boundaries in the State that may be affected by each hazard is included. The anticipated magnitude and severity of the hazard, such as wind speeds, peak ground acceleration, and meteorological measurements are discussed in this section as well.
- Previous Occurrence section includes an overview of past significant events that occurred in the State before 2018. This section includes damages, level of severity, dates and duration of events, and sources of information used to obtain the information. Federal, state, and local sources were reviewed to obtain the historic information. Research was based on events that caused fatalities, injuries, property damages, and/or crop damages.
- Discussions and analyses of each hazard's probability for future occurrence, severity, warning time and secondary hazards are included. The probability of future occurrences are based on the number of past events divided by the number of years researched to determine the percentage.

5.1.4 VULNERABILITY ASSESSMENT

44 CFR §201.4(c)(2)(ii): 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 or operated critical facilities located in the identified hazard areas shall also be addressed;

44 CFR §201.4(c)(2)(iii): 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.

For the 2019 Plan update, the vulnerability assessment for each hazard follows its hazard profile, so that all information about a particular hazard is found in one section. A statewide risk assessment was conducted with results summarized at the county level. As discussed below, the 2019 Plan update contains an enhanced vulnerability assessment. New to this Plan update, the New Jersey Office of Management and Budget (OMB) within the Department of Treasury provided the Statewide Land and Building Asset Management (LBAM) database to use as the state building dataset for the risk assessment. The critical facility and infrastructure dataset was also expanded to include additional types. In addition, because increased numbers of local HMPs are available a more in-depth discussion of their results is incorporated throughout this section.

Furthermore, the New Jersey Department of Transportation (NJDOT) conducted two separate risk assessments of its assets. The first assessment was of NJDOT-owned and other state transportation agency- owned bridges and other public use infrastructure. During this same time period, it also conducted a risk assessment of NJDOT buildings, maintenance yards, and traffic operations centers. The risk

assessments are considered sensitive security information by the United States Department of Homeland Security and the NJOHSP, but are available on a need to know basis.

Post-Superstorm Sandy, the NJ Transit has made significant progress repairing the damage, restoring operations and working toward making the transit system more resilient against future storms. Close coordination will continue with state agencies and federal partners through the NJ Transit Commissioner's office. Emergency preparedness is coordinated through the NJ Transit Office of Emergency Management. NJ Transit conducted an agency wide counter-terrorism risk assessment. This risk assessment is used to identify vulnerabilities to terrorism and identify mitigation measures. The risk assessment is not public information.

The Port Authority of New York & New Jersey (PANYNJ) has embarked upon two new risk assessment efforts since experiencing severe damages from Superstorm Sandy. A consultant was hired to identify various realistic cyclonic events of concern (Hurricanes and Nor'Easters) and identify the risks, vulnerabilities, and mitigation options throughout the entire PANYNJ inventory of facilities. The PANYNJ then developed resiliency design guidelines and have made improvements to its vital infrastructure to make them more resilient.

This vulnerability assessment section outlines vulnerability assessments by jurisdiction and of state facilities, estimates the potential losses to each and discusses potential impacts on the environment. Further, new development in hazard-prone areas is discussed by hazard.

5.1.4.1 ASSESSING VULNERABILITY BY JURISDICTION

For the purpose of this Plan, the State of New Jersey has defined "jurisdiction" as its counties; whereas local HMPs defined jurisdictions as municipalities and special-purpose districts. Each local HMP was consulted, and the identification process for the hazards of concern, risk ranking (if any), and exposure and loss estimation methodology were reviewed for each hazard. Table 5.1-2 earlier in this section summarizes the hazards of concern identified in each local plan.

In terms of risk ranking, not every local plan ranked the risk of the hazards profiled. If the local HMP did not conduct a risk ranking, the jurisdictions prioritized mitigation actions and identified their most significant hazards using other methods. The local HMPs that ranked the hazards did not use a consistent methodology. In some cases, a risk quantitative ranking process was used; however, the results were not categorized as high, medium, or low. Table 5.1-8 below summarizes the risk rankings as presented in the local HMPs. If the local HMP identified the hazard as a concern but did not rank the hazard, then 'TBD' (risk ranking is to be determined) is noted in Table 5.1-8. If the local HMP determined the hazard does not impact the County and the hazard was not evaluated, or the local HMP did not consider human-caused hazards, then 'NA' (not applicable) is noted in Table 5.1-8.

When available, local HMP risk rankings were considered when assessing vulnerability by jurisdiction for the 2019 Plan update. These rankings are discussed in the specific hazard sections under 'Assessing Vulnerability by Jurisdiction' (Sections 5.2 through 5.23).

The evaluation and roll-up of local HMP risk assessments into the State Plan proved challenging due to inconsistent hazard data, population and building data and overall methodologies being used at the local level. The State recognizes these challenges and has proposed annual technical updates to the SHMP as outlined in the updated Section 7 Plan Maintenance. Currently all local HMPs are up to date. NJOEM has identified a new mitigation action to provide technical assistance regarding hazard mitigation plan updates to ensure consistency for reporting risk ranking and other elements to local HMPs.

Therefore, for the purposes of the 2019 Plan, a statewide vulnerability assessment was conducted to ensure consistent asset data (population and buildings) and hazard areas were used. The planning consultant collaborated with the subject-matter experts listed in Section 2 Planning Process to identify the

most appropriate risk assessment methodology and best available data for the State. The results of this analysis may be used for future local mitigation plan updates.

To determine exposure, a spatial analysis was conducted in GIS using the best available defined hazard boundaries, the 2015 Census tract population and default HAZUS-MH general building stock inventory. When the analysis determined that a hazard could impact the area in a jurisdiction, these locations were deemed potentially vulnerable to the hazard. The estimated population and general building stock located within defined hazard boundaries is reported by County. For hazards of concern with defined hazard boundaries, the area (square miles) of each County in the hazard boundary is calculated and reported.

The limitations of the analysis conducted at a Census-block level are recognized and the results presented should only be viewed as estimates. The population exposure analyses do not account for the increase in population (of both residents and tourists) during the summer months, or the changes in occupancy of homes seasonally or post-Superstorm Sandy. In terms of population and building exposure, a Census-block centroid analysis was conducted which can under or over- estimate exposure and potential loss. When statewide building footprint data becomes available, the risk assessment will be updated.

Additional details regarding the methodology and hazard data used are included in each hazard section (Sections 5.2 through 5.23) within the Vulnerability Assessment subsection.

Table 5.1-8 Risk Rankings

Hazard of Concern	Atlantic	Bergen	Burlington	Camden	Cape May	Cumberland	Essex	Gloucester	Hunterdon	Hudson	Mercer	Middlesex	Monmouth	Morris	Ocean	Passaic	Salem	Somerset	Sussex	Union	Warren
Natural																					
Coastal Erosion	3	NA	L	H	M	NA	M	M	NA	M	M	M	H	NA	2	H	M	NA	NA	NA	NA
Dam/Levee Failure	2	NA	NA	H	NA	2	NA	M	M	NA	M	H	L	M	NA	M	M	NA	M	M	M
Drought	2	NA	M	M	NA	3	M	L	M	H	L	M	L	H	2	M	L	M	H	M	H
Earthquake	2	NA	M	L	NA	1	M	M	M	M	M	L	L	M	2	M	M	L	M	L	M
Flood	3	NA	H	H	H	3	H	H	H	H	H	H	H	H	3	H	H	H	H	H	H
Geological Hazards	NA	NA	L	L	NA	3	M	L	L	M	L	L	M	H	NA	M	L	NA	H	L	H
Hurricane and Tropical Storm	3	NA	NA	NA	H	2	M	TBD	H	H	TBD	H	H	NA	3	NA	TBD	NA	H	NA	H
Nor'Easter	2	NA	NA	NA	H	NA	NA	NA	H	NA	NA	H	H	NA	3	NA	NA	NA	H	NA	H
Severe Weather	3	NA	H	M	H	3	H	H	H	H	H	M	M	H	2	H	H	H	H	H	H
Severe Winter Weather	3	NA	H	M	H	3	H	H	H	H	H	M	M	H	3	H	H	M	H	H	H
Wildfire	3	NA	H	L	M	2	H	H	M	H	H	M	M	H	3	M	H	M	H	L	H
Human-Caused																					
Animal Disease	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3	NA	NA	NA	NA	NA	NA	NA
Civil Unrest	NA	NA	NA	NA	NA	1	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Crop Failure	NA	NA	NA	NA	NA	NA	NA	TBD	NA	NA	NA	NA	NA	NA	NA	NA	TBD	NA	NA	NA	NA
Cyber Attack	NA	NA	NA	NA	NA	NA	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Economic Collapse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fishing Failure	NA	NA	NA	NA	NA	NA	NA	TBD	NA	NA	NA	NA	NA	NA	NA	NA	TBD	NA	NA	NA	NA
Hazardous Substances	NA	NA	NA	NA	NA	2	H	TBD	H	NA	H	TBD	NA	H	2	M	TBD	NA	H	H	H
Nuclear Hazard Issues	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	NA	NA	NA	2	NA	NA	NA	NA	NA	NA
Pandemic	NA	NA	NA	NA	NA	2	NA	NA	H	NA	NA	NA	NA	H	NA	M	NA	NA	NA	NA	NA
Power Outages	NA	NA	NA	NA	NA	2	H	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Terrorism	NA	NA	NA	NA	NA	2	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

5.1.4.2 ASSESSING VULNERABILITY OF STATE FACILITIES

To address the requirements of 44 CFR 201.4 and assess the vulnerability of state facilities, the best available data were gathered and used for the 2014 update. A detailed description of the state building and critical facility/infrastructure data used is described below, followed by a general description of the methodology used. More detailed information on the methodology used to assess vulnerability is included in the vulnerability assessment portion of each hazard section (Sections 5.2 through 5.23). This section discusses the vulnerability assessments of state buildings, and critical facilities and infrastructure within the State.

5.1.4.3 STATE BUILDINGS ASSESSING

The State of New Jersey maintains a comprehensive GIS mapping database of State-owned and leased facilities. The Department of Treasury, coordinating its efforts with the centralized statewide GIS office in the Department of Environmental Protection, is continually updating its GIS mapping capabilities for State-owned and leased facilities. The OMB within the Department of Treasury has developed a centralized statewide Land and Building Asset Management (LBAM) database that is currently being populated with an updated and expanded inventory of land, building improvements, infrastructure and inspections data. All State agencies maintaining facilities are included in the LBAM database.

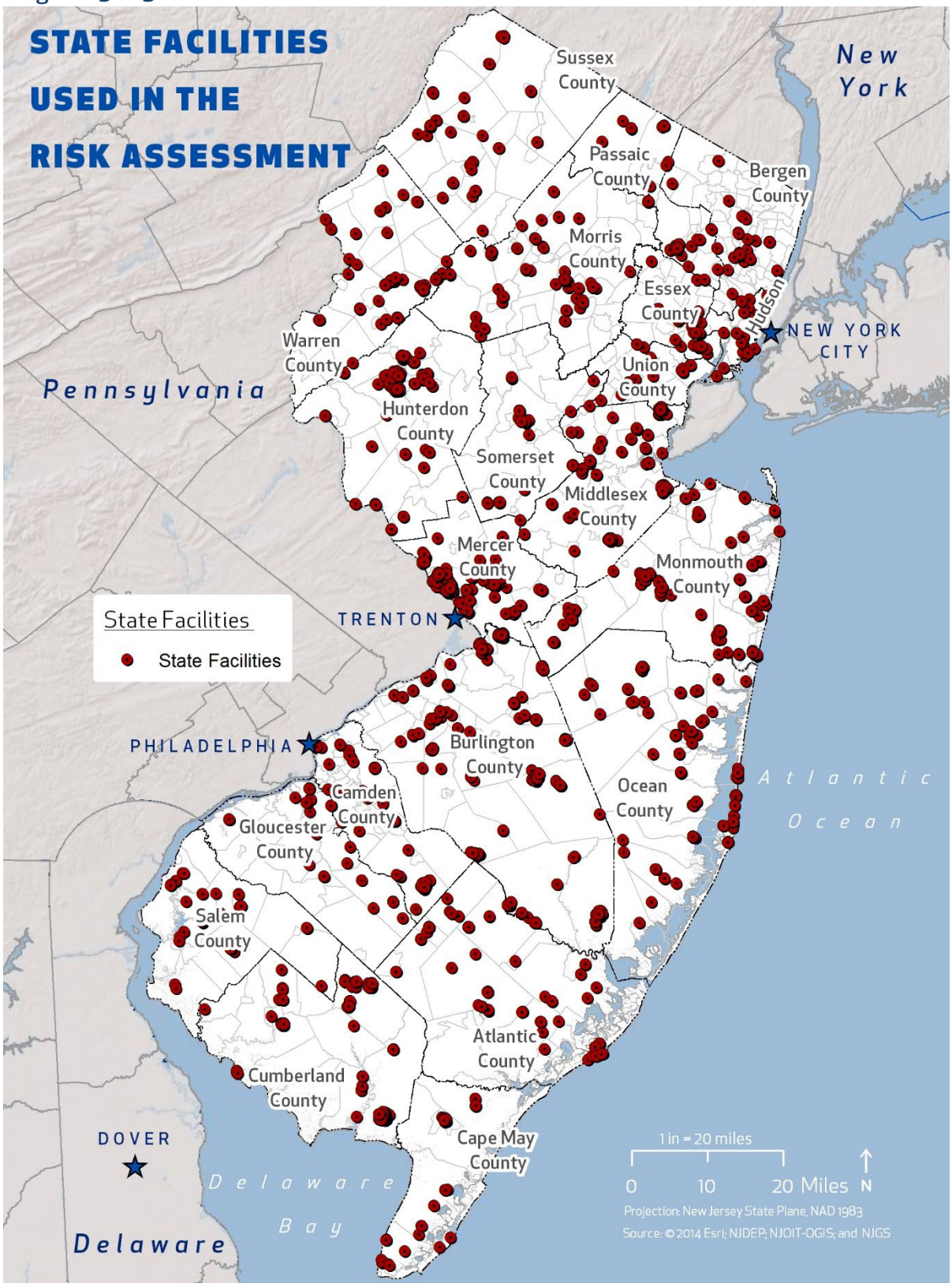
LBAM includes purchased, leased, and licensed buildings. The licensed buildings are those that the State does not own but is responsible for maintenance and repairs (such as federally-constructed buildings or buildings where ownership is unclear). For the purposes of this Plan, the OMB advised that the licensed buildings be classified as owned. Types of state-owned and -leased facilities contained in LBAM include, but are not limited to, administrative/office buildings, housing, armories, barns/garages/sheds, communication centers, dispensaries, correctional facilities, special-needs housing, hospitals, law enforcement buildings, schools, water and sewer facilities, fuel service stations, utility buildings, and warehouses.

Many state buildings and their attributes and locations are considered sensitive in nature. Therefore, all buildings reported in the 2019 Plan will be presented at the aggregate level (by agency or county). Individual facilities will not be specifically identified.

The 2011 HMP outlined a three-phase program regarding the LBAM database and its use in future mitigation planning efforts. Much progress has been made to the development and use of the database. Attributes have been added to the database to enable the capture of flood hazard areas, history of vulnerability, and mitigation actions. In addition, the critical state buildings have been identified in the database as an attribute. In May 2012, the Department of Treasury, the OMB, initiated the collection of GIS coordinates and photographs of all State-occupied buildings. There is an active effort in GIS and photography.

The LBAM database is always being updated, changed, and corrected as agencies change or modify. The August 2018 export of the database was used for the purposes of this Plan update. The LBAM database included 5,721 State-owned and leased buildings. 5,608 buildings were matched to a geographic location. All statistics reported in this Plan on state facilities are based on these 5,608 buildings. Figure 5.1-1 displays the location of these buildings. Tables 5.1-9 and 5.1-10 summarize the number of buildings and their replacement costs by agency and county, respectively

Figure 5.1-3 . State Facilities Used in the Risk Assessment



Source: NJOMB, 2018

Table 5.1-9 State Facilities by Agency

State Agency	Leased		Owned		Total (Leased and Owned)	
	Count	Total RCV	Count	Total RCV	Count	Total RCV
Agriculture	-	$ -	10	$ 8,096,184	10	$ 8,096,184
Banking and Insurance	-	$ -	1	$ 58,349,889	1	$ 58,349,889
Chief Executive	1	$ 6,803,870	1	$ 34,907,172	2	$ 41,711,042
Children and Families	52	$ 673,832,610	105	$ 36,957,672	157	$ 710,790,282
Community Affairs	9	$ 98,377,668	1	$ 35,478,921	10	$ 133,856,589
Corrections	10	$ 22,252,857	791	$ 1,137,551,159	801	$ 1,159,804,016
Education	5	$ 30,051,245	61	$ 147,420,986	66	$ 177,472,231
Environmental Protection	27	$ 115,079,503	1,977	$ 641,456,083	2,004	$ 756,535,586
Health	5	$ 51,567,407	4	$ 135,899,212	9	$ 187,466,620
Human Services	19	$ 117,568,320	710	$ 1,003,033,152	729	$ 1,120,601,472
Judiciary	33	$ 209,455,265	59	$ 886,969,303	92	$1,096,424,568
Juvenile Justice Commission	3	$ 17,045,648	196	$ 229,865,307	199	$ 246,910,955
Labor and Work Force Development	49	$ 242,731,648	1	$ 85,424,771	50	$ 328,156,420
Law and Public Safety	10	$ 154,628,422	17	$ 129,586,840	27	$ 284,215,262
Legislature	2	$ 6,072,832	4	$ 114,484,122	6	$ 120,556,954
Military And Veterans Affairs	4	$ 32,940,283	269	$ 705,006,382	273	$ 737,946,664
Miscellaneous Commissions	2	$ 18,027,989	-	$ -	2	$ 18,027,989
Motor Vehicles Commission	38	$ 400,978,259	103	$ 162,514,982	141	$ 563,493,240
Personnel	2	$ 9,656,017	-	$ -	2	$ 9,656,017
State	2	$ 9,296,870	17	$ 142,854,147	19	$ 152,151,016
State Police	41	$ 84,682,929	100	$ 348,089,156	141	$ 432,772,085
Transportation	-	$ -	617	$ 320,748,453	617	$ 320,748,453
Treasury	55	$ 773,282,633	195	$ 280,752,871	250	$ 1,054,035,504
Total	369	$3,074,332,275	5,239	$6,645,446,764	5,608	$ 9,719,779,039

Source: NJOMB 2018

Table 5.1-10 State Facilities by County

County	Leased		Owned		Total (Leased and Owned)	
	Count	Total RCV	Count	Total RCV	Count	Total RCV
Atlantic County	26	$ 186,608,614	139	$ 250,626,082	165	$ 437,234,696
Bergen County	12	$ 49,582,198	67	$ 117,835,865	79	$ 167,418,063
Burlington County	15	$ 71,960,039	668	$ 566,822,914	683	$ 638,782,952
Camden County	22	$ 220,611,250	132	$ 278,102,999	154	$ 498,714,249
Cape May County	9	$ 21,782,388	182	$ 93,189,419	191	$ 114,971,807
Cumberland County	15	$ 109,215,933	449	$ 534,665,767	464	$ 643,881,700
Essex County	22	$ 528,790,001	80	$ 293,884,559	102	$ 822,674,560
Gloucester County	8	$ 29,406,877	47	$ 76,459,626	55	$ 105,866,503
Hudson County	11	$ 121,714,894	42	$ 159,090,356	53	$ 280,805,250
Hunterdon County	8	$ 13,718,895	493	$ 246,936,665	501	$ 260,655,560
Mercer County	94	$ 873,056,824	579	$ 2,079,614,279	673	$ 2,952,671,103
Middlesex County	27	$ 220,496,783	307	$ 412,486,406	334	$ 632,983,190
Monmouth County	18	$ 112,074,600	432	$ 351,311,438	450	$ 463,386,037
Morris County	18	$ 141,204,791	209	$ 244,543,130	227	$ 385,747,921
Ocean County	12	$ 63,983,283	232	$ 246,643,553	244	$ 310,626,835
Passaic County	15	$ 127,455,955	235	$ 171,973,957	250	$ 299,429,912
Salem County	4	$ 17,639,439	117	$ 116,820,695	121	$ 134,460,134
Somerset County	5	$ 95,763,442	133	$ 130,922,009	138	$ 226,685,451
Sussex County	6	$ 9,893,813	440	$ 88,452,555	446	$ 98,346,368
Union County	18	$ 52,343,719	35	$ 112,222,819	53	$ 164,566,538
Warren County	4	$ 7,028,540	221	$ 72,841,669	225	$ 79,870,209
Total	369	$ 3,074,332,275	5,239	$6,645,446,764	5,608	$9,719,779,039

Source: NJOMB 2018

The OMB has implemented procedures (new RM/OMB Circular Loss Reporting) that require the agencies to immediately report losses via LBAM database.

To determine vulnerability, a spatial analysis was conducted in GIS using the best available hazard data and the LBAM database results. When the analysis determined the hazard area would impact the location of state buildings and critical facilities, these buildings and critical facilities/infrastructure were deemed vulnerable to the hazard. Additional details regarding the methodology used to assess vulnerability are presented in each hazard section (Sections 5.2 through 5.23).

5.1.4.4 CRITICAL FACILITIES AND INFRASTRUCTURE

For this 2019 Plan update, a critical facility is defined as the following for the purposes of the State Hazard Mitigation Plan.

A critical facility is a facility or system that has been identified by NJOEM and the State Hazard Mitigation Team as essential in providing vital State services, protects life and property, maintains continuity of government and operations, or supports emergency response, government, sheltering functions, and recovery.

The best available data sources were sought for each of these facility types. A total of 12,096 critical facilities and infrastructure were used for the 2018 Plan update; 21 facilities identified are located outside of the State boundaries and were not included in the risk assessment. The critical facility and infrastructure spatial inventory includes State-owned critical facilities and others that, although not owned by the State, have been defined as critical in accordance with the above definition. Due to the nature of the data available for the 2018 Plan update, the State-owned critical facilities could not be reported separately from the non-State-owned facilities. As specified in Section 6 as a new mitigation action, the State will continue to update this inventory with best-available data and identify which are State-owned critical facilities and which are non-State-owned critical facilities. Please note that duplicate facilities may be included in this analysis. For example, some schools may be considered shelters and therefore were included in the analysis for both critical facility types.

Table 5.1-11 summarizes the critical facilities and infrastructure types and data sources used for this planning effort. Table 5.1-12 summarizes the number of critical facilities by type per county.

Table 5.1-11 Critical Facilities and Infrastructure Types and Data Sources

Critical Facilities		Critical Infrastructure	
Type	Spatial Data Source	Type	Spatial Data Source
Medical Facilities	NJGIN	Airports	NJDOT
Fire and EMS	NJGIN	Hurricane Evacuation Routes	NJGIN
EOC (State and County)	NJOEM and OHSP	Rail and Light Stations	NJGIN
Police	NJGIN and OHSP	Ferry	OHSP
Jails/Juvenile Detention Centers	NJGIN	Wastewater	OHSP and NJDEP
Schools (primary, secondary, colleges)	NJGIN	Potable water	OHSP and NJDEP
Shelters	NJOEM	Dams	NJDEP
Nursing Homes	NJGIN	Bridges	OHSP
Storage of Critical Records	OHSP and LBAM	Tunnels (Rail and Highway)	OHSP
Communication Centers	OHSP	Ports	OHSP
-	-	Energy	OHSP

Notes: The Office of Homeland Security and Preparedness maintains a separate critical facility and infrastructure definition and list; therefore, the data received from this agency were maintained as critical for the facility types in which their data were used. NJ Transit Rail and Light Rail Stations, Port Authority Trans-Hudson (PATH) Stations, and Port Authority Transit Corporation (PATCO) stations are included in the critical facilities and infrastructure noted above.

Table 5.1-12 Number of Critical Facilities by County

County	Total Number	Airport	Special Needs	Communication	Correctional Institutions	Dams	Electric Power	EMS	EOC	Ferry	Fire	Highway Bridges	Highway Tunnels	Light Rail Facilities	Medical	Military	Natural Gas	Oil	Police	Ports	Potable Water	Rail Facilities	Rail Tunnels	School	Shelters	Storage of Critical Records	Wastewater
Atlantic	388	2	9	1	0	51	2	51	1	0	59	9	0	0	8	1	0	0	24	0	1	4	0	103	52	0	3
Bergen	1,148	1	46	0	1	79	4	101	1	1	142	1	0	0	9	0	0	0	74	0	3	30	0	419	228	0	6
Burlington	747	1	29	1	2	173	0	75	1	0	73	4	0	11	8	4	0	0	39	0	1	0	0	179	137	0	18
Camden	701	0	31	0	2	83	1	95	1	0	76	3	0	6	10	0	0	0	45	1	1	3	0	231	112	0	3
Cape May	229	2	0	0	0	15	0	32	1	1	36	2	0	0	1	1	0	0	14	1	1	0	0	42	63	0	6
Cumberland	251	1	9	1	6	38	0	28	1	0	25	0	0	0	6	0	0	0	15	0	0	0	0	70	49	0	3
Essex	784	2	43	0	2	34	1	57	2	0	63	2	0	17	15	0	0	0	42	3	4	22	0	360	109	1	6
Gloucester	346	0	17	0	0	70	0	43	1	0	55	1	0	0	3	0	0	0	26	0	0	0	0	120	9	0	3
Hudson	493	0	16	1	2	3	2	37	1	8	54	4	2	24	9	0	1	0	24	5	2	8	1	186	96	0	7
Hunterdon	328	0	6	0	3	107	0	38	1	0	38	0	0	0	2	0	0	0	19	0	1	4	0	69	45	0	3
Mercer	538	1	25	2	3	97	1	35	3	0	37	0	0	3	12	1	0	0	24	0	3	4	0	157	119	7	6
Middlesex	816	0	38	0	4	51	3	107	2	0	89	4	0	0	11	0	0	1	32	0	7	10	0	321	137	1	4
Monmouth	905	1	55	1	1	128	1	128	1	2	124	1	0	0	7	2	0	0	55	1	3	14	0	328	48	0	10
Morris	913	1	42	0	1	251	4	89	1	0	91	0	0	0	10	1	0	0	41	0	5	19	0	246	103	0	14
Ocean	621	0	50	1	0	105	1	93	1	0	80	5	0	0	9	0	0	0	34	0	2	2	0	208	32	1	3
Passaic	648	0	29	2	0	155	1	58	1	0	57	0	0	0	6	0	0	0	21	0	12	9	0	215	87	1	3
Salem	201	0	10	1	1	51	1	22	1	0	25	1	0	0	2	0	0	0	8	0	0	0	0	40	39	0	3
Somerset	539	0	29	1	1	102	1	52	1	0	51	0	0	0	5	0	0	0	22	0	2	11	0	159	105	0	3
Sussex	542	1	8	0	0	268	0	38	1	0	44	0	0	0	2	0	0	0	16	0	0	0	0	70	96	0	2
Union	607	0	26	0	1	32	1	53	1	0	45	2	0	0	9	0	0	0	26	5	3	16	0	244	141	0	5
Warren	351	0	10	1	1	105	1	29	1	0	32	4	0	0	3	0	0	0	15	0	0	1	0	55	94	0	2
Total	12,096	13	548	13	31	1,998	25	1,261	25	12	1,296	43	2	61	147	10	1	1	616	16	51	157	1	3,822	1,901	11	113

The State recognizes transit and infrastructure system vulnerability to hazard events. As previously noted, NJ Transit Rail and Light Rail Stations, Port Authority Trans-Hudson (PATH) Stations, and Port Authority Transit Corporation (PATCO) stations were included in the critical facilities and infrastructure data and were used to inform the 2018 Plan risk assessment analysis. For future plan updates, the SHMT will re-examine the critical facility and infrastructure types and consider including additional facilities/infrastructure in future plan updates (e.g., bus terminals and NJDOT- owned weight stations, maintenance yards, rest areas, and barges).

Information regarding critical facilities and infrastructure, specifically their attributes and locations, are considered sensitive in nature. Therefore, all critical facilities and infrastructure reported in the State HMP Update will be at the aggregate level (by type or county). Individual facilities will not be specifically identified.

To determine vulnerability, a spatial analysis was conducted in GIS using the best available hazard data for the critical facilities. When the exposure analysis determined the hazard area could potentially impact the location of critical facilities, they were deemed vulnerable to the hazard. The replacement cost value for the State- critical facilities was not available for the 2018 Plan update. The State will update the risk assessment with quantifiable loss estimates as replacement cost values for critical facilities become available.

Additional details regarding the methodology used to assess vulnerability are discussed in each hazard section (Sections 5.2 through 5.23).

5.1.4.5 ESTIMATING POTENTIAL LOSSES TO JURISDICTIONS AND STATE FACILITIES

To address the requirements of ***44 CFR 201.4*** and better understand potential losses associated with the hazards of concern, standardized tools combined with local, state, and federal data and expertise were used to conduct the risk assessment. The vulnerability assessment section in each hazard section (Sections 5.2 through 5.23) summarizes the detailed methodology used for each particular hazard of concern. A brief description of the methodology used to support estimating potential losses to jurisdictions and state facilities is described below.

5.1.4.6 HAZARDS U.S. – MULTI-HAZARD (HAZUS-MH)

In 1997, FEMA developed a standardized model for estimating losses caused by earthquakes, known as Hazards U.S. or HAZUS. HAZUS was developed in response to the need for more effective national-, state-, and community-level planning, and the need to identify areas that face the highest risk and potential for loss. HAZUS was expanded into a multi-hazard tool (HAZUS-MH) with new models for estimating potential losses from wind (hurricanes) and flood (riverine and coastal) hazards. HAZUS-MH is a GIS-based software tool that applies engineering and scientific risk calculations that have been developed by hazard and information technology experts, to provide defensible damage and loss estimates. These methodologies are accepted by FEMA and provide a consistent framework for assessing risk across a variety of hazards. The GIS framework also supports the evaluation of hazards and assessment of inventory and loss estimates for these hazards.

HAZUS-MH uses GIS technology to produce detailed maps and analytical reports that estimate a community's direct physical damage to building stock, critical facilities, transportation systems, and utility systems. To generate this information, HAZUS-MH uses default data provided by HAZUS-MH for inventory, vulnerability, and hazards; this default data can be supplemented with local data to provide a more refined analysis. Damage reports can include induced damage (inundation, fire, and threats posed by hazardous materials and debris) and direct economic and social losses (casualties, shelter requirements, and economic impact) depending on the hazard and available local data. HAZUS

MH's open data architecture can be used to manage community GIS data in a central location. The use of this of this software also promotes consistency of data output now and in the future and standardization of data collection and storage. The guidance "Using HAZUS- MH for Risk Assessment: How-to Guide (FEMA 433)" was used to support the application of HAZUS-MH for this risk assessment and Plan. More information on HAZUS-MH is available at https://www.fema.gov/hazus.

Probabilistic analyses were performed to estimate losses (mean return period losses) for the earthquake, flood, and wind hazards. The probabilistic hazard analysis generates estimates of damage and loss for specified return periods (such as a 100-year or one-percent annual chance event). For annualized losses, HAZUS-MH version 4.2 calculates the maximum potential annual dollar loss resulting from various return periods averaged on a per-year basis. It is the summation of all HAZUS-supplied return periods (such as 10-, 50-, 100-, 200-, and 500-year periods) multiplied by the return period probability (as a weighted calculation). In summary, the estimated cost of a hazard each year is calculated.

HAZUS-MH was updated with the state buildings provided in LBAM. The default building stock data in HAZUS-MH version 4.2 was not updated to estimate potential losses. The default aggregate building inventory is based on United States Census data for residential occupancies and Dun & Bradstreet for non-residential occupancies. As discussed earlier, the 2010 Census block population data was used to evaluate population exposure.

5.1.4.7 HAZARD-SPECIFIC METHODOLOGIES

The vulnerability assessment section in each hazard section (Sections 5.2 through 5.23) summarizes the detailed methodology used for that particular hazard of concern. For hazards in which HAZUS-MH could not be used, an exposure-based methodology was applied using the best available spatial data gathered from the State's subject-matter experts (SME), as well as the default general building stock in HAZUS-MH, state buildings as provided by LBAM and critical facilities and infrastructure.

5.1.5 CHANGES IN DEVELOPMENT FOR HAZARD-PRONE AREAS

44 CFR §201.4(c)(2)(ii): 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.

44 CFR §201.4(d): Plan must be reviewed and revised to reflect changes in development…

As described earlier in this section, the vulnerability assessment used the best available defined hazard areas, population, buildings, and facilities data. Each hazard section includes tables, maps, and narrative that illustrate and describe the most vulnerable areas. The use of these updated data sets (e.g., 2010 Census population, 2018 State buildings, updated critical facilities) and hazard areas (e.g., preliminary working flood maps and DFIRMs) provide an update in changes in vulnerability to population and development since the previous HMP update.

Section 4 State Profile of the Plan provides a detailed overview of the land use, development, transportation, economy, and population trends within the State of New Jersey. This section, as well as federal, state and local laws and regulations that impact development in hazard prone areas described in Section 6 Mitigation Strategy, served as the basis for the assessment of changes in jurisdictions and in development that may impact vulnerability by either increasing or decreasing risk. Additional discussion on changes in development for jurisdictions in hazard prone areas may be found in Sections 5.2 through 5.23 Vulnerability Assessment subsections.

Damages and losses as a result of hazard events are generally associated with older existing infrastructure and buildings rather than new development. This is because building codes and land use regulations limit

development in hazard areas or require construction to meet higher standards within hazard areas. This provides a reduction of risk in areas where new development or redevelopment is occurring.

The following discusses changes in development that may impact vulnerability for the coastal erosion, sea level rise, hurricanes and tropical storms, flood, earthquake and wildfire hazards. The State will continue to enhance this section through the review and incorporation of development trends provided in local HMPs as they are updated.

5.1.5.1 COASTAL EROSION AND SEA LEVEL RISE

New Jersey coastal counties are exposed to erosion and sea level rise. Open space within coastal areas prone to growth are either protected areas of open space or have regulatory controls [e.g., Coastal Area Facility Review Act (CAFRA)] which limit new development from taking place.

As discussed in Section 5.2 the counties most threatened by coastal erosion are Atlantic, Cape May, Monmouth and Ocean. Narrative in Section 4 indicates an increase in the number of housing units authorized by building permits from 2010 to 2015 for many of the coastal counties: Bergen, Essex, Hudson, Middlesex, Monmouth, Ocean, and Union. If the proposed new development is located within the coastal erosion-susceptible and hazard areas, there is a potential increase in risk to life, property and the environment. However, new construction will be required to meet current standards which are designed to provide increased protection compared to existing development in the area.

Coastal areas impacted by Superstorm Sandy have seen an increase in redevelopment. Similar to new construction, redevelopment will be required to meet current standards which may provide increased protection compared to their pre-event conditions. The U. S. Army Corps of Engineers dune replenishment projects as described in Section 5.2 will serve to help mitigate the impacts of coastal erosion.

5.1.5.2 DROUGHT

As development continues in New Jersey, the demand for water will increase as well. While New Jersey is not particularly prone to extreme instances of drought, increased demand has the potential to exacerbate moderate or severe droughts. New development in the southern portion of the State could increase the vulnerability to drought events, in terms of water supply. This is because the major source of water in southern New Jersey is the unconfined Kirkwood-Cohansey aquifer with a limited number of reservoirs for the collection and storage of back up supply. As indicated in Table 4-7 Population Growth Projections by County in Section 4 State Profile, several southern New Jersey counties are estimated to grow in excess of 4% through 2020, including Gloucester and Ocean Counties where greater than 7% growth is estimated. These growing populations will increase demand for water and may make the area increasingly vulnerable to the direct and indirect water supply impacts associated with drought.

5.1.5.3 EARTHQUAKE

In general, the northern half of New Jersey is more vulnerable to potential damage from an earthquake. The most vulnerable areas of the State are located near the Ramapo Fault. Bergen, Essex, Hudson, Hunterdon, Middlesex, Monmouth, Mercer, Passaic, Somerset, Sussex, and Union counties have the highest potential of sustaining damage during an event. As illustrated in Figure 4-16 in Section 4 many of these Counties are experiencing growth as seen by an increase in the number of housing building permits from 2010 to 2015. Increases in development and population growth may increase vulnerability to and impacts from earthquake events in these Counties. Seismic provisions in prevailing building code are intended to mitigate this risk in new construction.

5.1.5.4 FLOOD

As discussed throughout the State HMP Plan update and identified in the local HMPs, flood is the most significant natural hazard in New Jersey. In terms of life safety, the vulnerability assessment in Section 5.6 Flood indicates Cape May County has the highest percent of total population located within the SFHA (40%). The following counties have greater than 10% of their population in the Special Flood Hazard Area (SFHA or 1% annual chance flood boundary), in descending order: Cape May, Atlantic, Salem, Ocean, Hudson, and Monmouth. Monmouth, Ocean, Cape May and Atlantic Counties have the greatest percentage of population located in the V-zone (areas vulnerable to wave damage).

The jurisdictions most threatened by the flood hazard have also been experiencing an increase in permits for new construction and an overall increase in population. Hudson County experienced the greatest increase in permits for new construction closely followed by Ocean and Bergen Counties. The greatest increase occurred in 2012 which may be attributed to the post-Sandy environment.

An increase in impervious surfaces associated with development has the potential to impact urban and stormwater flooding. If the proposed new development is located within the flood hazard areas, there is a potential increase in risk to life and property. However, new construction will be required to meet current standards which may provide increased protection compared to existing development in the area. Further, the stricter construction codes are required for new and re-development in the V-zone.

5.1.5.5 GEOLOGIC HAZARDS

Section 5.7 Geologic Hazards presents the landslide and subsidence/sinkhole hazards. Bergen, Essex, Hudson, Hunterdon, Monmouth, Morris, Sussex, and Warren Counties have experienced the highest number of historic landslide events. As discussed in Section 5.7, naturally occurring subsidence and sinkholes in New Jersey occur within bands of carbonate bedrock. Primarily the northern region of New Jersey may be susceptible to natural subsidence and sinkholes. In addition, due to at least 588 abandoned mines, the northern part of the State may have a greater potential for significant surface collapse than does the southern part.

Abandoned mines in Bergen, Essex, Hunterdon, Morris, Passaic, Somerset, Sussex and Warren Counties could make these locations vulnerable to the subsidence/sinkhole hazard.

Over time, individual municipalities have implemented steep slope ordinances which prohibit development in the areas most susceptible to landslides. Therefore, potential to develop these vulnerable areas are decreasing. However, the existing populations in these areas remain potentially vulnerable. Similar to landslides, subsidence and sinkholes pose a danger to populations living in high risk areas, including loss of life. Compounding the vulnerability of populations to subsidence/sinkholes is the vast array of abandoned mines and the geological makeup of much of northern New Jersey, coupled with recent growth in the region. As illustrated by the population trends in Section 4, with the exception of Hunterdon, Sussex and Warren Counties, the counties most threatened by subsidence/sinkholes have experienced an increase in population. As populations move into high hazard areas, their vulnerability and potential for loss will increase.

5.1.5.6 HURRICANES AND TROPICAL STORMS

Historically, hurricanes and tropical storms have impacted all 21 New Jersey counties. The entire State is exposed to the wind and rains associated with these events. However, certain areas and types of building and infrastructure are at greater risk than others because of their proximity to the coast and/or their manner of construction. Storm surge from a hurricane/tropical storm poses one of the greatest risks to residents and property along the coast. The Counties with population and buildings exposed to storm surge are: Atlantic, Bergen, Burlington, Camden, Cape May, Cumberland, Essex, Gloucester, Hudson, Mercer, Middlesex, Monmouth, Ocean, Passaic, Salem and Union.

As New Jersey continues to develop, the State will remain vulnerable to the impacts of wind and storm surge. Improved mapping and higher regulatory standards will mitigate future impacts to new and redeveloped areas in defined hazard zones. FEMA's Advisory Base Flood Elevations (ABFE) maps were made available post Superstorm Sandy to certain impacted communities as best-available data for rebuilding and recovery efforts. Preliminary and updated work maps continue to be released showing coastal flood hazard data to replace the ABFE maps. These maps reflect the results of an ongoing coastal flood hazard study and are considered best available information. They are intended to help communities and property owners understand current flood risk and future flood insurance requirements based upon updated data.

Measures taken by the New Jersey Department of Environmental Protection (NJDEP) further increase New Jersey citizens' awareness of the impacts of tropical cyclone wind and storm surge hazards. People are increasingly aware that measures, like elevating their homes or installing hurricane straps on their roofs will help protect and mitigate against these hazards. Municipalities are increasingly aware that requiring measures such as flood proofing of the lower levels of buildings will help mitigate the impacts of these hazards. However, it is clear that much of the existing infrastructure and development along the immediate coast and adjacent bays will continue to be vulnerable.

5.1.5.7 SEVERE WEATHER

As discussed in Section 5.10, severe weather includes numerous weather types including high winds, tornadoes and extreme temperature events. The continued development of the State will increase the overall vulnerability to high winds and severe storm hazards. The entire population of the State is considered exposed to high wind. Wind speeds for the 50-year mean recurrence interval were determined based on three-second gusts in miles per hour at 33 feet above the ground. For the 50-year wind event, the portions of the following 12 coastal counties may experience wind speeds greater than 100 miles per hour: Atlantic, Bergen, Burlington, Cape May, Camden, Cumberland, Essex, Hudson, Gloucester, Middlesex, Monmouth, and Union Counties. Any future new or redevelopment in Atlantic, Bergen, Burlington, Cape May, Camden, Cumberland, Essex, Hudson, Gloucester, Middlesex, Monmouth, and Union Counties are vulnerable to winds over 100 mph. The development of new buildings in these areas must meet or exceed the standards in Section R301.2.1.1 of the International Building Code (IBC).

Tornado events are typically localized; whereas high wind and thunderstorm events can be more widespread. The impacts of tornadoes on the environment may include severe damage to complete devastation to buildings, vegetation and anything in its path. Based on previous occurrences of tornado touchdowns, generally the Interstate 95 corridor in New Jersey may be more vulnerable to tornado activity than other areas. New development proximate to this corridor has the potential to increase the number of people vulnerable to the hazards associated with tornadoes.

As summarized in Section 4 State Profile there is a growing trend in urbanization and redevelopment in Bergen, Hudson, Essex, Middlesex, Monmouth, Ocean and Union Counties as demonstrated by the increase in building permits and growth compared to the less developed areas of the State. Development that expands the densely developed urban centers has the potential to increase the vulnerability to extreme heat events due to the heat island effect.

5.1.5.8 WILDFIRE

The New Jersey Pinelands is one of the most hazardous wildland fuel types in the nation. A review of the historic record indicates a majority of the wildfire events in the State have occurred in the New Jersey Pinelands located in Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Ocean Counties. Wildfire specifically is a hazard that has and will continue to impact new development on or near the suburban and rural fringe, especially in areas in southern New Jersey. Although many areas of the Pinelands are publicly owned, permanently preserved land, much of the undeveloped privately-

owned land is located in the suburban rural fringe surrounding the Pinelands. As development in this area increases, the vulnerability to wildfire will increase.