2018 Multi-Jurisdictional All-Hazard Mitigation Plan

Ocean County, New Jersey

Prepared for:

Prepared by:

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List of Acronyms

AFS	Air Facility System
CAC	Community Assistance Contacts
CAV	Community Assistance Visit
CDBG	Community Development Block Grants
CFR	Code of Federal Regulations
CIS	FEMA Community Information System
CRS	Community Rating System
DFIRM	Digital Flood Insurance Rate Map
DHS	U.S. Department of Homeland Security
DMA 2000	Disaster Mitigation Act
EMA	Emergency Management Agency
EMC	Emergency Management Coordinator
EMPG	Emergency Management Performance Grants
EOP	Emergency Operations Plan
EPA	United States Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FBFM	Flood Boundary and Floodway Maps
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
GIS	Geographic Information Systems
HAZUS-MH	Hazards United States Multi-Hazard (FEMA Risk Assessment and Loss Estimation Software)
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HVA	Hazard Vulnerability Assessment
ICC	Increased Cost of Compliance
ICIS	Integrated Compliance Information System
LEPCs	Local Emergency Planning Committees
LQG	Large Quantity Generators
mph	Miles per hour
MRLC	Multi-Resolution Land Characteristics Consortium
NCDC	National Climatic Data Center
NDMC	National Drought Mitigation Center
NFIP	National Flood Insurance Program
NFPA	National Fire Protection Association
NIDIS	National Integrated Drought Information System
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System

NPL	Superfund National Priorities List
NRCS	Natural Resources Conservation Service
NTNC	Non-Transient Non-Community
NWS	National Weather Service
PCS	Permit Compliance System
PDM	Pre-Disaster Mitigation Program
PHGA	Peak horizontal ground acceleration
PSDI	Palmer Severity Drought Index
PUC	Public Utility Commission
RF	Risk Factor
RFC	Repetitive Flood Claims Program
RL	Repetitive Loss
SALDOs	Subdivision and land development ordinances
SARA	Superfund Amendments and Reauthorization Act
SFHA	Special Flood Hazard Area
SFIP	Standard Flood Insurance Policy
SRL	Severe Repetitive Loss
TMDLs	Total Maximum Daily Loads
TNC	Transient Non-Community
TRI	Toxic Release Inventory System
UCC	Uniform Code of Construction
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
WYO	Write Your Own Program

1 Introduction

1. Introduction Background

The *2018 Multi-jurisdictional All Hazard Mitigation Plan for Ocean County* (County HMP) is an update to the 2014 County HMP. The Plan is the result of work by citizens of the County to develop a pre-disaster, multi-hazard mitigation plan that will not only guide the County towards greater disaster resistance, but will also respect the character and needs of the community. A website at http://www.oceancohmp.com was used throughout the planning process to provide information, announce meetings, and post the draft plan for review.

Hazard mitigation planning has the potential to produce long-term and recurring benefits by breaking the cycle of loss. A core assumption of mitigation is that current dollars invested in mitigation practices will significantly reduce the demand for future dollars by lessening the amount needed for recovery, repair, and reconstruction. These mitigation practices will also enable local residents, businesses, and industries to re-establish themselves in the wake of a disaster, getting the economy back on track sooner and with less interruption.

Ocean County, New Jersey is an area with a wealth of natural resources which include 45-miles of Atlantic Ocean coast, Barnegat Bay, and pinelands. This beautiful landscape attracts residents, visitors, and businesses. Hazard mitigation and related planning are critical to managing the balance of the risks associated with flooding, coastal storms, wildfire, and other natural and human-made hazards in Ocean County. The *2018 Multi-jurisdictional All Hazard Mitigation Plan for Ocean County* will bring community officials and members together with stakeholders in order to further mitigation efforts. All municipalities participate in the National Flood Insurance Program (NFIP). Many municipalities participate in the Community Rating System (CRS), StormReady, and FireWise. The county and municipalities have invested in programs and projects that prevent, prepare mitigation respond and recover for natural and human made disasters. This plan furthers previous activities with a formal blueprint to make Ocean County more resilient.

Ocean County has declared 29 of the State of New Jersey's 50 Presidential Disaster, Emergency, and Fire Management Assistance Declarations. Ocean County's declarations have been primarily for flooding and coastal storms, followed by winter storms, and then wildfires. The emergency management community, citizens, planners, elected officials and other stakeholders in Ocean County recognize the impact of disasters on their community and support proactive efforts needed to reduce the impact of natural and human-caused hazards. Ocean County was in the process of recovering from Hurricane Sandy during the development of its first HMP. Hurricane Sandy is the storm of record for Ocean County and had catastrophic impacts on residential properties, business and infrastructure.

1.1. Purpose

This 2018 County HMP was developed for the purpose of:

- Providing a blueprint for reducing property damage and saving lives from the effects of future natural and man-made disasters in Ocean County;

- Qualifying the County for pre-disaster and post-disaster grant funding;
- Complying with state and federal legislative requirements related to local hazard mitigation planning;
- Demonstrating a firm local commitment to hazard mitigation principles; and
- Improving community resiliency following a disaster event.

The Disaster Mitigation Act of 2000 (DMA 2000), Section 322 requires that local governments (communities/counties), as a condition of receiving federal disaster mitigation funds, have a mitigation plan that describes the process for identifying hazards, creating a risk assessment and vulnerability analysis, identifying and prioritizing mitigation strategies, and developing an implementation schedule for the County and each of the municipalities. Congress authorized the establishment of a Federal grant program to provide financial assistance to States and communities for flood mitigation planning and activities. The Federal Emergency Management Agency (FEMA) has designated this Hazard Mitigation Assistance (HMA).

1.2. Scope

The 2018 County HMP has been prepared to meet requirements set forth by the FEMA and the New Jersey Office of Emergency Management (NJOEM) in order for the County to be eligible for funding and technical assistance from state and federal hazard mitigation programs. This multi-jurisdictional plan includes participation and will be adopted by Ocean County and all 33 municipalities. Ocean County and the municipalities participating in the plan have undergone hazard mitigation planning and related activities in the past. Previous and ongoing hazard mitigation activities are documented throughout the plan.

1.3. Authority and References

Authority for this plan originates from the following federal sources:

- Robert T. Stafford Disaster Relief and Emergency Assistance Act, 42 U.S.C., Section 322, as amended;
- Code of Federal Regulations (CFR), Title 44, Parts 201 and 206; and
- Disaster Mitigation Act of 2000, Public Law 106-390, as amended.
- National Flood Insurance Act of 1968, as amended, 42 U.S.C. 4001 *et seq.*

Authority for this plan originates from the following State of New Jersey sources:

- State of New Jersey 2014 State Hazard Mitigation Plan

FEMA's most recent guidance, the *Local Mitigation Planning Handbook* and *Integrating Hazard Mitigation Planning into Local Planning: Case Studies and Tools for Community Officials* were the primary FEMA guides used for the development of this plan. Additionally, guidance from the State Requirements to the Crosswalk from the *State of New Jersey 2014 State Hazard Mitigation Plan* was followed. Previous FEMA guides including the 386 series and information available from NJOEM on hazard mitigations was used to guide this plan's development.

2 Community Profile and Asset Inventory

2. Community Profile and Asset Inventory

2.1 Geography and Natural Environment

Ocean County is located in New Jersey's Atlantic Coastal Plain. At about 638 square miles of land area, Ocean County is the second-largest county in New Jersey. It is bounded by Monmouth County to the north; Burlington County to the west and south; Atlantic County to the southeast; and, the Atlantic Ocean to the east. Notably, the County boasts 45 miles of Atlantic coastline. The topography of Ocean County is largely flat and coastal. The topography is generally low and rolling from a maximum of 225 feet in elevation down to sea level. According to the County's Comprehensive Master Plan, over 75% of the land area of Ocean County is 150 feet in elevation or below.

The County lies nearly equidistant from Philadelphia and New York. This proximity has strongly influenced the growth and transportation patterns countywide. Major transportation routes include the Garden State Parkway, Interstate 195, US Route 9, and State Routes 13, 35, 37, 70, 72, 88, and 166 (see Figure 2.1-1). The Toms River Park and Ride is one of the busiest bus terminals in New Jersey and provides express bus service to New York City. Major east to west traffic to Philadelphia is accommodated by Route 70 and north and south circulation to New York and Atlantic City relies on the Garden State Parkway.

Ocean County falls into five Watershed Management Areas (WMAs). Most of the county falls into the Barnegat Bay Watershed. The western edges of Ocean County are defined by the Assiscunk, Crosswicks and Doctors; Rancocas; and Mullica WMAs. A small portion of the Arthur Kill WMA crosses into Ocean County in the northeastern portion of the county near Brick Township, and the Borough of Point Pleasant (NJDEP, 2017). Major streams include the Manasquan River, North Branch Metedeconk Creek, Toms River, Cedar Creek, and Westecunk Creek. Most of the county's waterways drain into the three major natural water bodies: Barnegat Bay, Little Egg Harbor, and Great Bay.

Figure 2.1-1 Ocean County Base Map

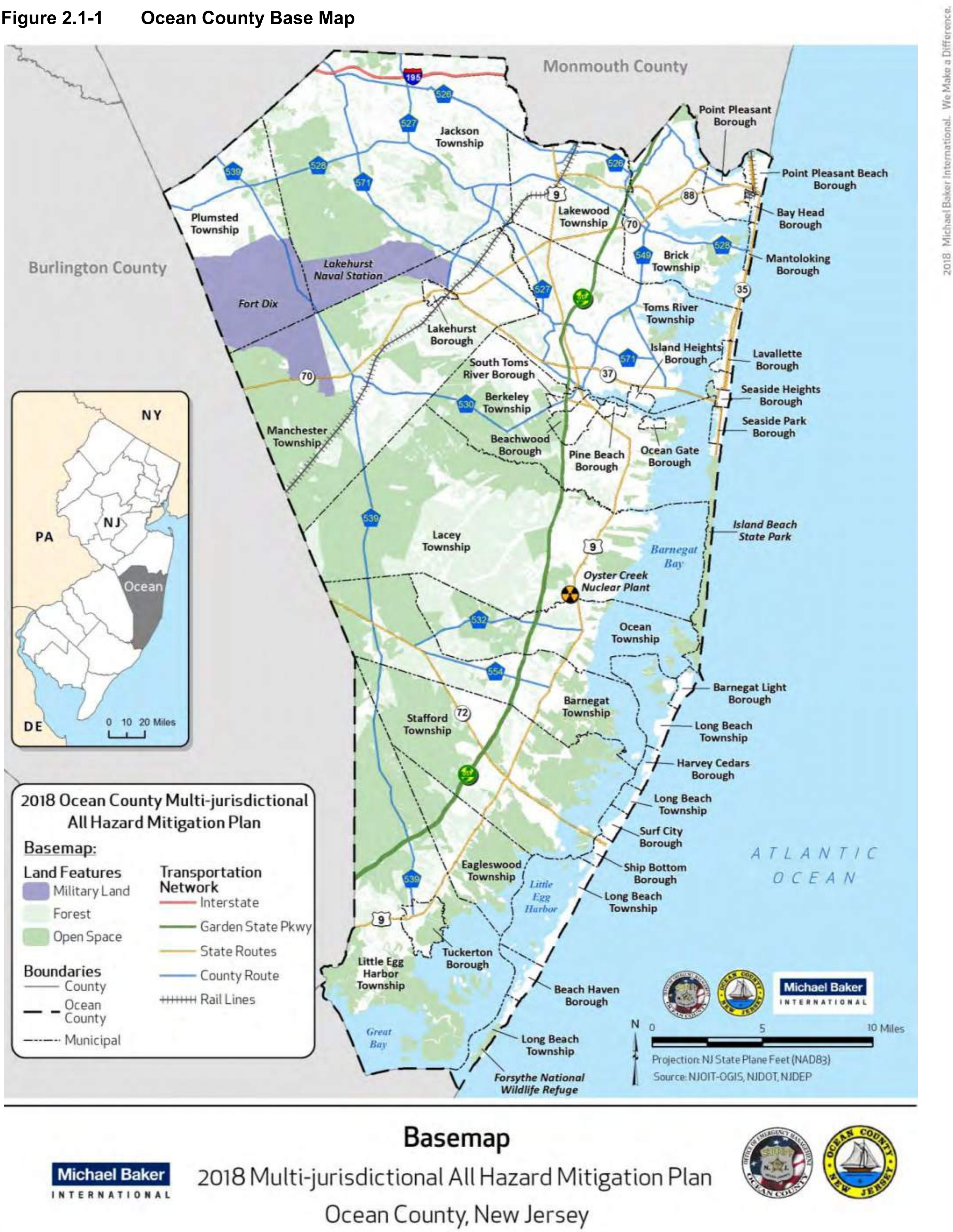
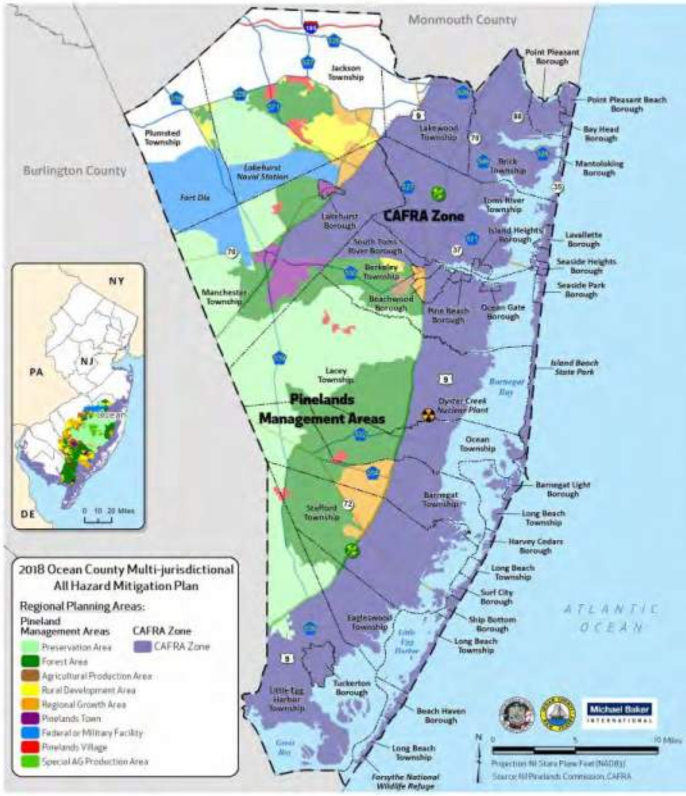


Figure 2.1-2 New Jersey Pinelands Area and the CAFRA Zone

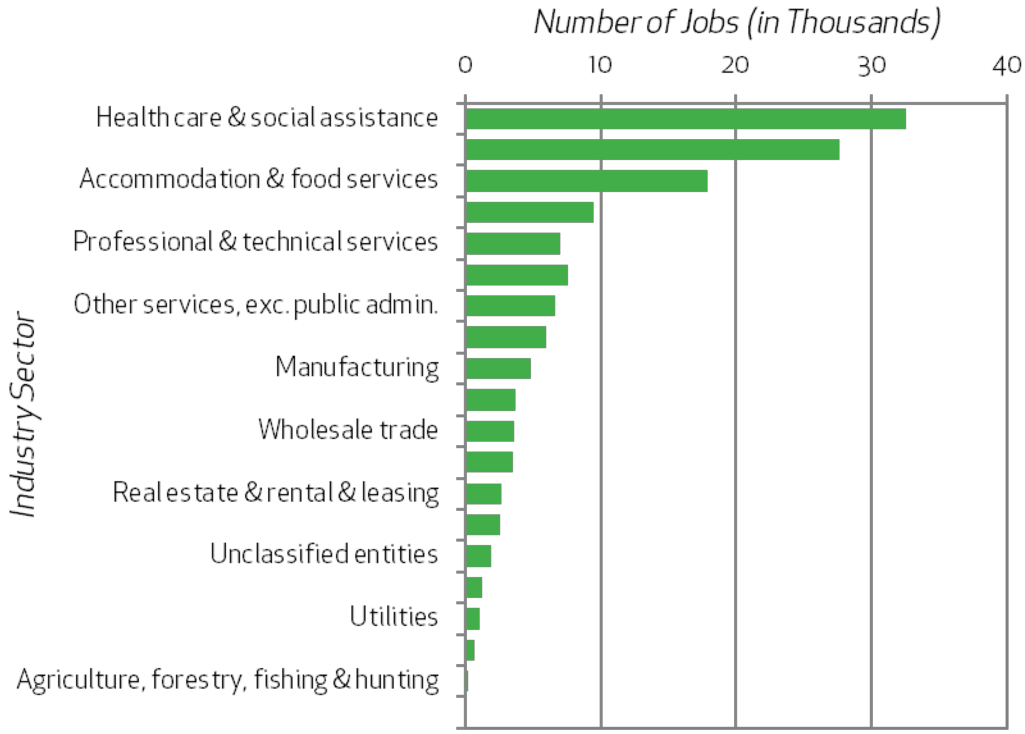


The County maintains a large amount of protected federal, state, and county open space, as well as preserved farmland. As shown in Figure 2.1-2, much of Ocean County falls into one of two state designated regional land use-planning areas focused on balancing economic development with environmental preservation: the Pinelands Area and the Coastal Area Facilities Review Act (CAFRA) Zone. The Pinelands Commission, an independent state agency, regulates development and preservation in the Pinelands Area through overlay zoning known as Pinelands Management Areas (PMAs). The CAFRA Zone is New Jersey's coastal zone; in this area, NJDEP has the authority to approve the location, design, and construction of major facilities with the intention of protecting coastal resources.

2.2 Economic Assets

Historically, Ocean County's main economic driver has been the tourism economy, especially in the coastal areas. However, with the advent of the Garden State Parkway and the interstate highway system, Ocean County grew to include a more year-round population with a more diverse economic base. The American Community Survey (ACS) estimates that in 2015, there were 133,871 private sector jobs in Ocean County. In 2015, the largest industry sector in Ocean County was Healthcare and Social Assistance consisting of 24.5% of all jobs in the County. Retail Trade was the second largest at 20.0%. Retail trade jobs are largely clustered around Toms River and Lakewood, spreading south around Route 9 and in the barrier island communities. The other industries rounding out Ocean County's top five are Construction, Professional and Technical Services, and Arts, Entertainment and Recreation (New Jersey Department of Labor, 2015). The number of jobs by industry in Ocean County are shown in Figure 2.2-1 below.

Figure 2.2-1 Jobs by employment sector in Ocean County (2015)



Source: Third Quarter Private Sector Report, New Jersey Department of Labor, 2010-2015

The high proportion of jobs in the health care and social assistance field correlates to Ocean County's high proportion of elderly residents (See Section 2.3). Retail trade, accommodation and food services, and arts, entertainment, and recreation all directly relate to Ocean County's tourism trade, which generated almost $4.6 billion for the local economy in 2015 (Tourism Economics, 2015). From 2010-2015, the number of jobs in the county grew by almost 9%, largely due to growth in the healthcare industry as well as in the green technology industry, which has grown significantly in an effort to promote resiliency post Hurricane Sandy. New Jersey is a leading State in advancing and implementing green technology, which has been reflected in Ocean County by the evident growth of green technology jobs.

Major employers include Saint Barnabas Health Care System, Six Flags Theme Park, Joint Base McGuire-Dix-Lakehurst, Toms River Regional School System, and the Ocean County Government. Each of these employers has greater than 2,000 total employees countywide. The inflow and outflow pattern of workers in Ocean County indicates a strong local economy. In 2014, 45,0086 workers came from outside the county to work in Ocean while 120,001 Ocean County workers commuted outside Ocean County for work. However, 92,908 workers were both living and employed in Ocean County (U.S. Census, On the Map, 2014).

2.3 Population and Demographics

The population of Ocean County was estimated at 583,450 in the year 2015 according to the American Community Survey 5-year estimates. From 2010-2015 the population grew by 1.2% as shown in Table 2.3-1. However, on the municipal level, there was a higher variety of population change. The most populous municipality in Ocean County is Lakewood Township, followed by Toms River Township as shown in Figure 3.2-1. Each of these jurisdictions has over 90,000 residents. The least populous communities are Mantoloking and Harvey Cedars, which together have fewer than 500 residents. Even after the horrific damages caused by Super Storm Sandy, Ocean County residents began to rebuild and continually grow as a community.

According to the 2015 American Community Survey 5-year estimates, the estimated median income of households in Ocean County in 2015 was $61, 994. This is about $10,000 greater than the national median household income but is less than the median household income of New Jersey ($72, 093). An estimated 11.3% of residents live below the federal poverty level. However, the poverty rate for children under 18 is 20%.

Figure 2.3-1 Total Population, Age Distribution, and Race and Hispanic Origin (ACS, 5-yr Estimates 2015)

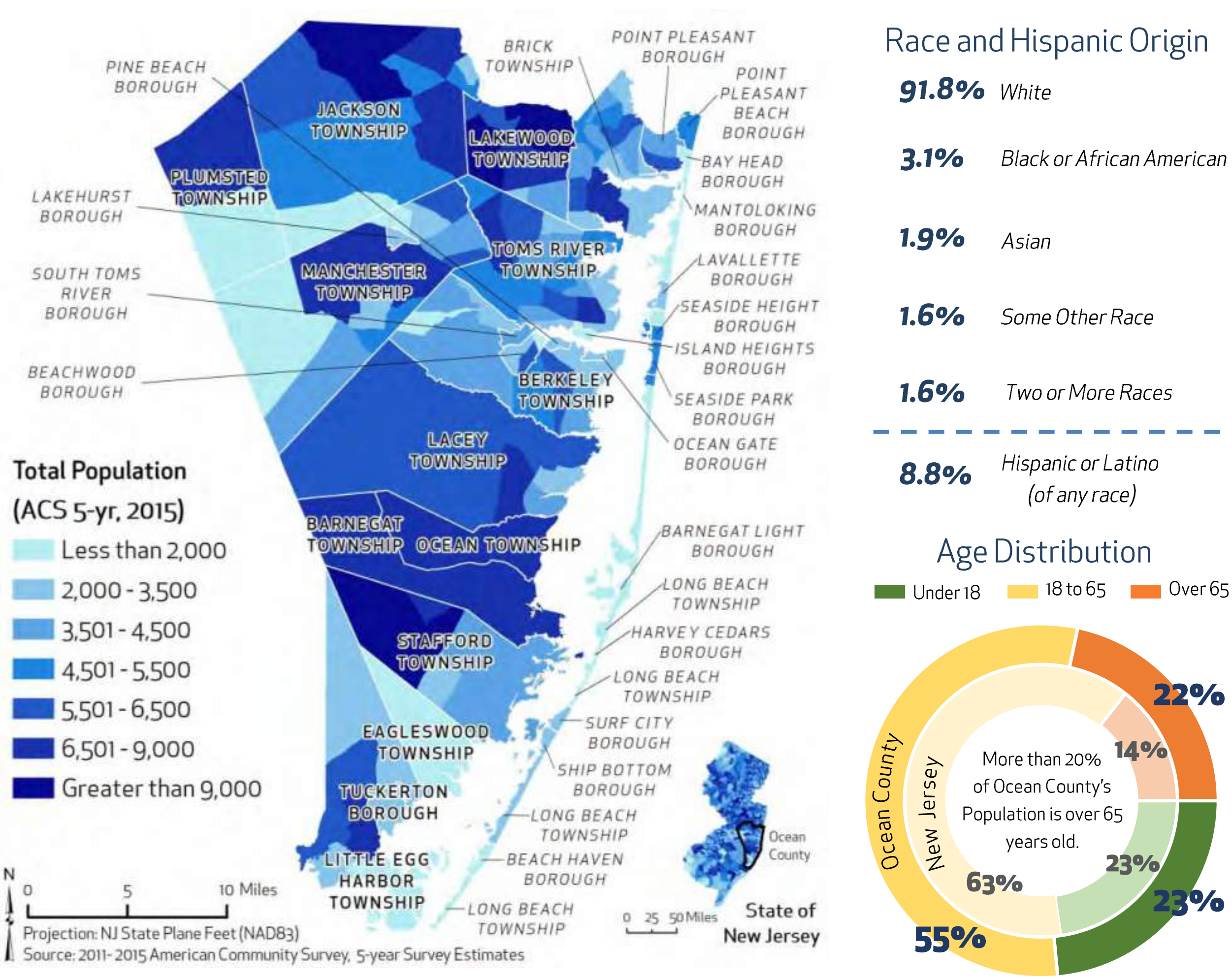


Table 2.3-1 Population Change in Ocean County 2010 to 2015

Municipality	2010 Population (Census)	2015 Population (Acs-5-Year)	Percent Change (%)	Change
Barnegat Light Borough	574	589	2.6%	15
Barnegat Township	20,936	21,617	3.3%	681
Bay Head Borough	968	992	2.5%	24
Beach Haven Borough	1,170	991	-15.3%	(179)
Beachwood Borough	11,045	11,128	0.8%	83
Berkeley Township	41,255	41,480	0.5%	225
Brick Township	75,072	74,991	-0.1%	(81)
Eagleswood Township	1,603	1,556	-2.9%	(47)
Harvey Cedars Borough	337	416	23.4%	79
Island Heights Borough	1,673	1,640	-2.0%	(33)
Jackson Township	54,856	55,851	1.8%	995
Lacey Township	27,644	28,105	1.7%	461
Lakehurst Borough	2,654	2,669	0.6%	15
Lakewood Township	92,843	96,575	4.0%	3,732
Lavallette Borough	1,875	2,108	12.4%	233
Little Egg Harbor Township	20,065	20,383	1.6%	318
Long Beach Township	3,051	3,028	-0.8%	(23)
Manchester Township	43,070	43,251	0.4%	181
Mantoloking Borough	296	340	14.9%	44
Ocean Gate Borough	2,011	2,105	4.7%	94
Ocean Township	8,332	8,628	3.6%	296
Pine Beach Borough	2,127	2,175	2.3%	48
Plumsted Township	8,421	8,465	0.5%	44
Point Pleasant Beach Borough	4,665	4,604	-1.3%	(61)
Point Pleasant Borough	18,392	18,426	0.2%	34
Seaside Heights Borough	2,887	2,885	-0.1%	(2)
Seaside Park Borough	1,579	1,543	-2.3%	(36)
Ship Bottom Borough	1,156	914	-20.9%	(242)
South Toms River Borough	3,684	3,706	0.6%	22
Stafford Township	26,535	26,766	0.9%	231
Surf City Borough	1,205	1,130	-6.2%	(75)
Toms River Township	91,239	91,029	-0.2%	(210)
Tuckerton Borough	3,347	3,364	0.5%	17
Total	576,567	583,450	1.2%	**6,883**

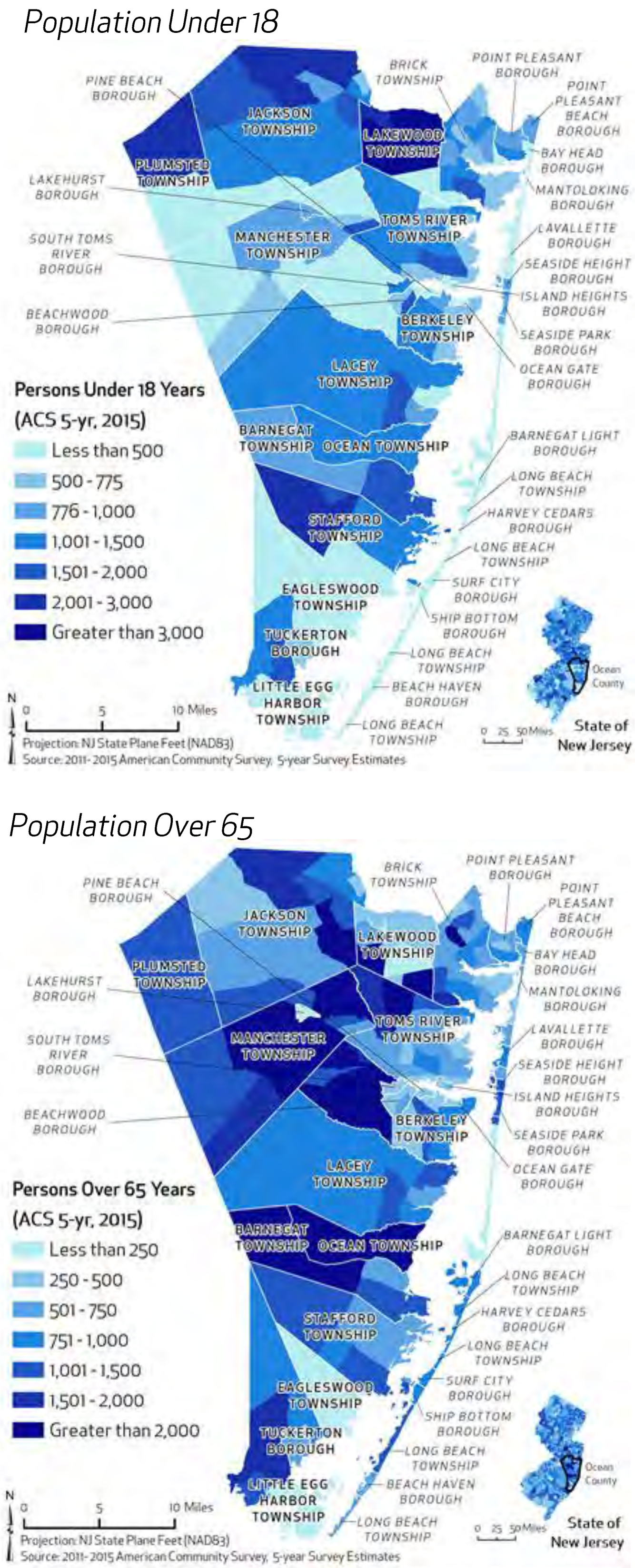
Source: U.S. Census, 2010 and American Community Survey 5-Year Estimates, 2015

Table 2.3-2 Age and Race for Ocean County Municipalities (ACS 5-Year Estimates, 2015)

Municipality	Under 18	Over 65	White	Black Or African American	American Indian & Alaska Native	Asian	Native Hawaiin & Other Pacific Islander	Some Other Race	Two Or More Races
Barnegat Light Borough	48	265	561	-	-	3	-	18	7
Barnegat Township	4,626	5,383	19,802	705	15	221	-	551	323
Bay Head Borough	185	343	922	-	-	18	-	17	35
Beach Haven Borough	92	396	966	16	-	8	-	-	1
Beachwood Borough	2,726	1,213	10,455	166	15	185	-	379	146
Berkeley Township	5,144	17,505	38,765	1,337	280	454	-	349	295
Brick Township	15,073	13,873	68,881	1,541	13	1,624	132	1,137	1,663
Eagleswood Township	352	227	1,466	-	-	12	-	63	15
Harvey Cedars Borough	38	238	412	1	2	-	-	1	-
Island Heights Borough	295	417	1,492	18	2	16	-	112	-
Jackson Township	13,069	9,606	48,948	3,483	8	1,660	-	1,345	407
Lacey Township	5,705	5,059	27,586	145	5	162	-	46	161
Lakehurst Borough	804	214	2,255	223	-	17	-	60	114
Lakewood Township	43,555	10,527	87,733	4,119	142	592	-	1,107	2,882
Lavallette Borough	259	961	2,099	-	-	-	-	9	-
Little Egg Harbor Township	4,036	5,137	19,263	152	7	323	-	603	35
Long Beach Township	209	1,596	2,991	-	3	14	-	20	-
Manchester Township	4,455	20,760	38,453	2,316	22	1,118	-	923	419
Mantoloking Borough	28	200	324	13	-	3	-	-	-
Ocean Gate Borough	396	320	2,066	34	-	5	-	-	-
Ocean Township	1,148	2,890	8,519	2	8	31	-	68	-
Pine Beach Borough	475	426	2,123	10	-	32	-	10	-
Plumsted Township	2,167	1,109	7,953	320	-	41	-	85	66
Point Pleasant Beach Borough	916	783	4,472	28	-	-	-	43	61
Point Pleasant Borough	3,796	2,635	17,938	89	11	44	-	158	186
Seaside Heights Borough	632	190	2,509	14	-	66	-	99	197
Seaside Park Borough	136	505	1,512	18	-	-	-	13	-
Ship Bottom Borough	66	394	872	15	-	3	-	5	19
South Toms River Borough	1,160	274	2,283	810	3	4	-	363	243
Stafford Township	5,567	5,005	25,407	447	42	242	-	442	186
Surf City Borough	66	480	1,121	-	-	5	-	4	-
Toms River Township	19,207	16,840	82,537	2,008	87	3,924	-	1,464	1,009
Tuckerton Borough	657	595	3,179	48	5	101	-	31	-

Total	137,085	126,366	535,865	18,073	670	10,928	132	12,791	8,710

Figure 2.3-2 Population Under 18 and Over 65 by Municipality (ACS 5-yr estimates 2015)



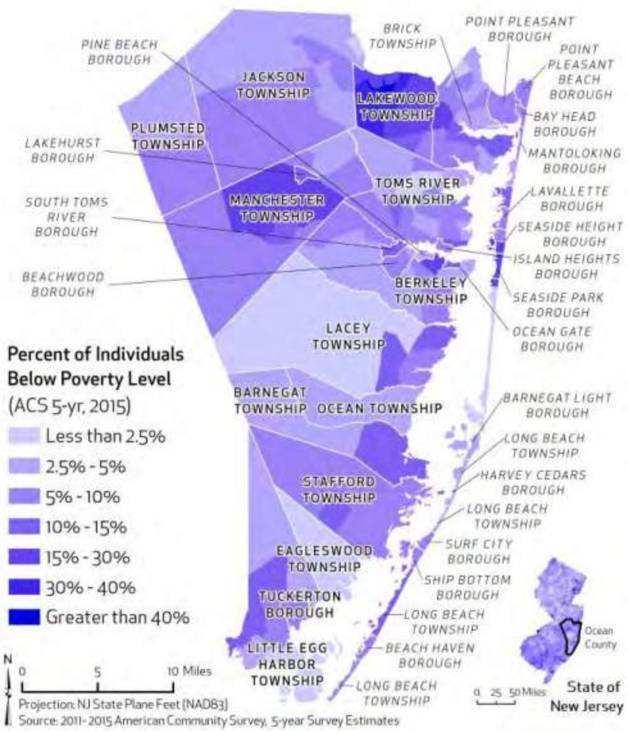
The median age of the population of Ocean County is 42.6 years old. Roughly 23% of the population is under 18 years of age and an estimated 22% of the population is over the age of 65. When compared to the age distribution of the State of New Jersey, the county has a distribution of 8% more of those over the age of 65. The population distribution of those under 18 is on par with the state at 23%. These populations are important when looking at hazard mitigation and recovery because they are frequently the populations that need the most assistance during a disaster event and are, therefore, more vulnerable to the impacts of hazard events. The spatial distribution of these age cohorts is shown in Figure 2.3-2.

The distribution of the minority population tells a different story. About 8.7% of Ocean County's population is part of a minority group, and 8% of residents are Hispanic or Latino. The county is 91.3% White, 3.0% black or African American, 1.7% Asian, and 0.1% is American Indian or Alaska Native. 2.2% identify as some other race (US Census ACS, 2015).

About 12% of the population speaks a language other than English at home. This segment of the population would likely need extra assistance during a disaster event. A municipal-level breakdown of these populations is in Table 2.3-2 and Figure 2.3-3.

Figure 2.3-3 **Populations living below the poverty line, with a disability, and speaks English less than very well" (ACS, 5-yr Estimates 2015)**

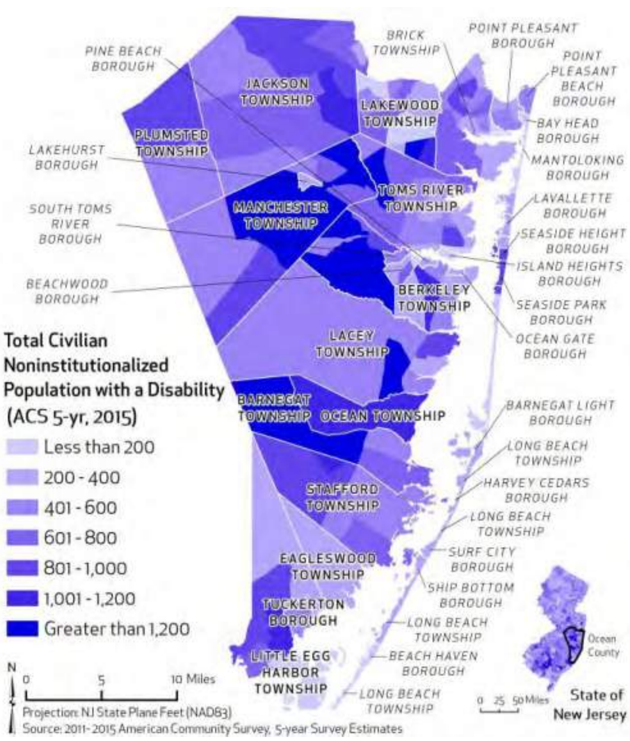
Population Living Below the Poverty Line



The spatial distribution of the population in Ocean County living below the poverty line, with a disability and that speak English less than "very well" are shown in Figure 2.3-3. These maps indicate clusters of vulnerable population in Ocean County. Approximately 11.25% of individuals and 7.7% of families in the County live below the poverty level with the greatest percent occurring in Lakewood Township. The map on the bottom right of the page shows that there is also a cluster of people who do not speak English well in the same area.

About 13% of the population over 5 years old has a disability (ACS 5 Year Estimates, 2015). The maps on the bottom left of the page illustrates the distribution of this population throughout the county.

Population with a Disability



Speaks English "Less Than Very Well"

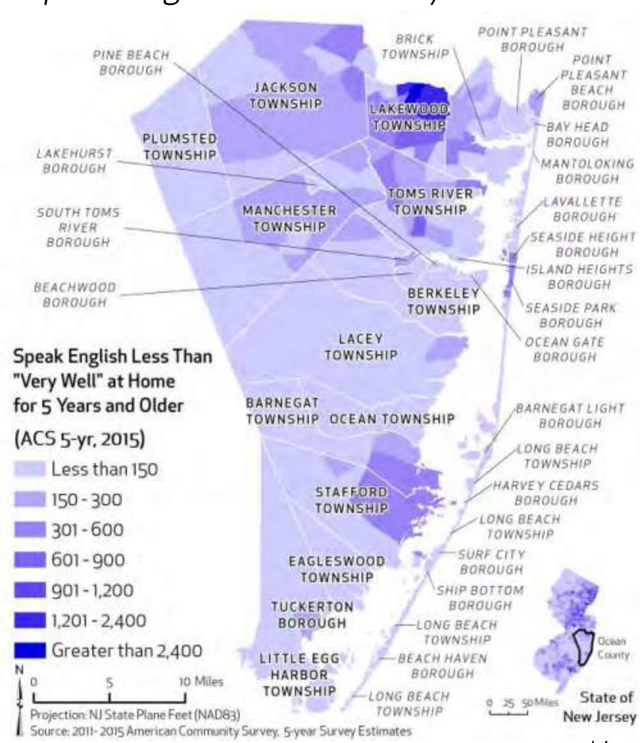


Table 2.3-3 Vulnerable Populations by Municipality (ACS, 5-Year Esitmates, 2015)

Municipality	Individuals Below Poverty	Individuals Over 5 With A Disability	Individuals Who Speak English "Less Than Very Well"
Barnegat Light Borough	23	29	18
Barnegat Township	2,253	2,562	711
Bay Head Borough	84	99	-
Beach Haven Borough	68	128	9
Beachwood Borough	974	1,146	258
Berkeley Township	3,100	9,277	1,312
Brick Township	4,864	9,700	2,338
Eagleswood Township	27	230	18
Harvey Cedars Borough	26	58	5
Island Heights Borough	135	197	34
Jackson Township	2,413	6,339	1,967
Lacey Township	2,473	3,566	347
Lakehurst Borough	311	272	103
Lakewood Township	30,345	6,894	9,651
Lavallette Borough	151	369	26
Little Egg Harbor Township	1,646	2,982	391
Long Beach Township	256	403	20
Manchester Township	3,525	10,599	1,608
Mantoloking Borough	8	37	4
Ocean Gate Borough	270	364	15
Ocean Township	365	1,161	145
Pine Beach Borough	80	259	32
Plumsted Township	404	864	76
Point Pleasant Beach Borough	390	545	166
Point Pleasant Borough	1,263	1,478	234
Seaside Heights Borough	729	519	478
Seaside Park Borough	105	260	9
Ship Bottom Borough	35	95	16
South Toms River Borough	505	453	167
Stafford Township	2,002	3,481	821
Surf City Borough	101	153	-
Toms River Township	5,604	10,930	3,606
Tuckerton Borough	260	428	151
Total	*64,795*	*75,877*	*24,736*

2.4 Land Use and Built Environment

Ocean County has been settled since the 1700s, as part of Monmouth County until 1850 when it was incorporated as Ocean County. For much of its settled history, Ocean County was an agricultural community with resort and commercial development in coastal areas. However, the construction of the Garden State Parkway in 1954 opened Ocean County to significant development since there was a plethora of undeveloped land within commuting distance of two major metropolitan areas.

Ocean County's most recent Land Use/Land Cover GIS data was collected in 2012 and incorporated into the County Comprehensive Plan. According to this plan, as of 2012, Ocean County's primary land use/land cover was forest, followed by urban land and wetlands. The total acreage by land use type is shown in Table 2.4-1. The Comprehensive Plan indicates that the proportion of urban land and water have been growing while other land use areas are shrinking. The strong land preservation work in Ocean County has contributed to the relatively small losses in agriculture and forested land.

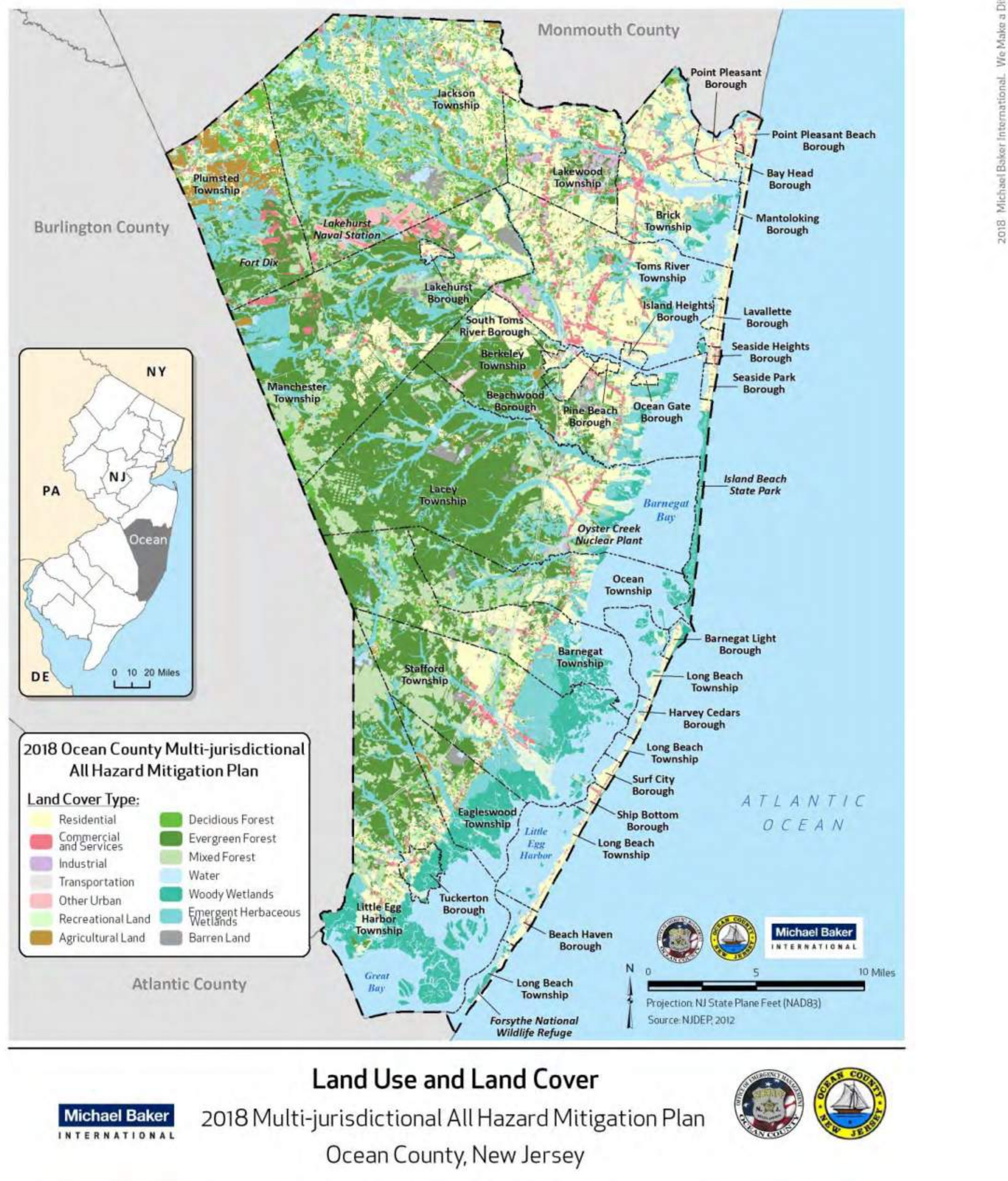
Table 2.4-1 Distribution of Land Use (NJDEP, 2007 and 2012)

Land Use Type	2007 Acres	2012 Acres	Percent Change (%)
Agriculture	5,835	5,473	-6.2%
Barren Land	7,818	7,048	-9.8%
Forest	176,305	174,991	-0.7%
Urban or Developed	109,146	111,882	2.5%
Water	85,844	86,213	0.4%
Wetlands	100,130	99,470	-0.7%
Total	485,078	485,078	

The majority of housing units in Ocean County's built-up areas are year-round, owner occupied household. Approximately 76% of housing units are single family detached dwellings (US Census ACS, 2015). Some of the smaller communities are considered built-out with few large development sites left. Some of the most intensely developed areas are in the boroughs, barrier island communities and townships in the northeast section of the county like Brick, Lakewood, Toms River, and Berkeley. The western and southern parts of the county are on the whole maintained as vegetated or forested land due in large part to the conservation efforts of the Pinelands National Preserve. According to the Comprehensive Master Plan, "strict zoning regulations and the lack of infrastructure, including sewer, utilities, and transportation networks limit opportunities for future development in these areas" (Ocean County, 2012). Ocean County also owns 25 park facilities, a combination of 3,594 acres, that contribute to the overall open space network in the county (Ocean County Parks and Recreation).

According to the 2015 American Community Survey 5-year estimates, in 2015 there were 279,898 housing units in Ocean County with a 20.5% vacancy rate. The estimated median value of an owner-occupied home was $262,700, which is more than a $20,000 decrease from 2011.

Figure 2.4-2 Land cover in Ocean County (NJDEP, 2012)



Development Trends

The Ocean County Planning Division maintains records of land development review data comprised of information about the number and type of proposed development projects that are submitted for review and approval to the County Planning Division annually. Although the County Planning Division's data is useful for providing insight into countywide development trends, it is important to note that it primarily represents projects that impact County roads and drainage facilities.

Over the last 20 years, Ocean County has annually averaged 2,780 new residential units authorized by building permits as indicated in Table 2.4-2. In 2017, 3,427 residential units were authorized. Ocean County has remained above the state average in the number of residential permits authorized. The towns with the highest number of permits were Toms River, Jackson, and Lakewood.

In addition, the Ocean County Planning Board subdivision and site plan application approvals indicate trends for housing stock and demand in the County. Since 2013, there has been a slight upward trend in the number of major and minor subdivisions approved with 189 approvals in 2018 as indicated in Table 2.4-3. What's more, total approvals are steady at over 300 total approvals every year since 2014. The number of multi-family residential unit approvals has also been steady with a range of 10 to 20 approvals each year. Multi-family development includes apartments, townhouses and condominiums, as well as certain retirement communities. Much of the recent multi-family approvals were approved in Lakewood Township.

In 2018, the top five municipalities in terms of total proposed residential lots and units were as follows:

- Lakewood Township – 1,290
- Toms River Township – 362
- Manchester Township– 309
- Barnegat Township– 275
- Stafford Township – 245

As indicated in Table 2.4-4, the top five municipalities in terms of total proposed non-residential square feet in 2018 were:

- Lakewood Township – 947,520
- Toms River Township – 546,517
- Jackson Township – 289,514
- Brick Township – 71,456
- Berkeley Township – 50,340

The construction of adult communities in Ocean County was rapid in the 1970's and 1980's. Currently, there are 90 adult communities in the County, which contain about 65,000 dwelling units. Manchester Township is home to the most adult communities in the County, followed by Brick and Berkeley Township, which is home to the largest adult community of Holiday City.

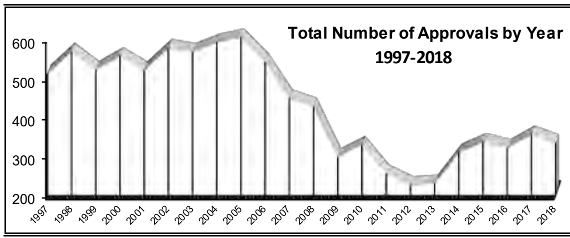
Table 2.4-2 Residential Units Authorized by Building Permit in Ocean County, 1997- 2017 (Ocean County Planning, 2019)

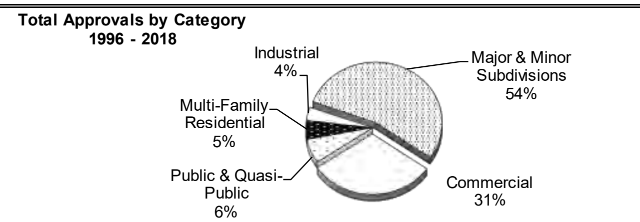
Municipality	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	1997 - 2017 Total	1997 - 2017 Avg. Annual
Barnegat Township	187	265	283	185	180	470	662	507	386	300	176	143	142	118	51	161	122	73	101	204	275	4,512	237
Barnegat Light Borough	16	17	23	17	11	12	29	17	22	5	7	9	5	8	5	7	10	8	7	9	14	235	12
Bay Head Borough	9	14	3	6	3	6	3	2	5	8	2	3	0	6	9	7	5	10	0	2	3	101	5
Beach Haven Borough	16	18	16	26	11	15	22	68	39	33	27	19	10	19	15	11	36	34	30	26	31	465	24
Beachwood Borough	35	34	21	25	34	19	18	18	15	23	21	6	11	5	9	4	15	7	5	5	6	325	17
Berkeley Township	111	128	254	633	254	124	188	128	111	102	78	57	41	71	56	71	57	116	107	72	92	2,687	141
Brick Township	381	334	338	320	236	170	140	76	142	111	111	71	51	53	69	58	101	166	142	209	95	3,070	162
Eagleswood Township	6	4	3	10	11	13	7	20	27	18	17	11	9	11	10	11	12	14	15	10	10	229	12
Harvey Cedars Borough	17	15	13	12	11	18	18	25	17	11	7	10	14	8	10	7	9	9	21	17	24	252	13
Island Heights Borough	8	12	12	10	9	11	10	11	11	10	9	6	3	3	1	2	3	1	11	4	4	143	8
Jackson Township	513	503	644	828	530	640	786	201	209	146	37	141	110	155	80	45	34	61	201	304	40	5,864	309
Lacey Township	122	164	180	157	117	8	11	71	63	35	39	47	37	27	45	50	82	81	63	85	90	1,399	74
Lakehurst Borough	1	1	2	1	4	2	2	3	1	16	2	0	0	2	0	7	0	12	0	5	0	56	3
Lakewood Township	410	882	664	897	613	173	371	957	364	185	426	100	45	83	8	170	424	469	761	660	1,290	8,002	421
Lavallette Borough	8	16	13	6	15	31	29	23	20	14	10	17	21	23	18	20	70	100	53	42	36	507	27
Little Egg Harbor Twp.	151	116	130	309	480	451	379	315	259	143	106	53	55	72	76	57	103	149	120	70	129	3,524	185
Long Beach Township	66	70	71	62	56	70	104	93	133	112	68	60	45	71	74	66	151	158	116	97	120	1,646	87
Manchester Township	281	428	431	823	328	395	109	17	24	1	2	4	1	3	1	1	2	5	5	2	309	2,861	151
Mantoloking Borough	4	6	4	8	10	3	10	2	4	1	2	2	2	4	5	4	5	28	20	9	9	124	7
Ocean Township	69	41	23	55	52	224	141	178	212	201	173	68	90	42	37	64	12	10	2	4	4	1,694	89
Ocean Gate Borough	2	0	0	0	7	5	7	2	17	3	6	4	3	5	2	3	20	19	13	7	3	118	6
Pine Beach Borough	4	3	6	3	10	4	10	7	7	16	9	4	3	2	2	3	1	1	0	4	5	95	5
Plumsted Township	54	61	89	116	72	31	25	20	38	30	21	15	13	15	14	16	17	16	13	7	1	676	36
Point Pleasant Borough	29	34	36	42	44	45	39	64	42	54	93	68	21	20	20	30	38	124	37	40	34	880	46
Point Pleasant Beach	24	15	13	4	27	11	11	14	17	19	13	8	13	22	6	6	65	61	21	18	16	370	19
Seaside Heights Borough	0	0	0	0	0	9	13	41	32	79	27	8	5	4	0	2	13	11	5	5	94	249	13
Seaside Park Borough	11	9	10	14	6	7	10	16	14	13	16	14	8	15	8	6	8	16	13	9	15	214	11
Ship Bottom Borough	4	15	12	10	9	11	11	12	24	26	20	16	7	10	12	11	25	59	32	24	23	326	17
S. Toms River Borough	0	0	2	0	5	4	5	6	9	5	2	0	0	1	1	0	9	9	0	0	0	58	3
Stafford Township	355	354	347	293	246	251	315	318	315	115	141	192	53	58	168	130	238	284	139	128	245	4,312	227
Surf City Borough	16	14	22	25	25	31	34	34	38	19	21	11	10	18	17	16	26	23	23	27	33	423	22
Toms River Township	518	355	519	733	405	262	481	440	252	244	450	347	69	368	103	83	371	803	545	518	362	7,348	387
Tuckerton Borough	5	6	8	3	9	8	9	112	35	16	21	13	5	3	1	0	0	0	0	5	15	254	13
Ocean County	3,433	3,934	4,192	5,633	3,830	3,534	4,009	3,818	2,904	2,114	2,160	1,527	902	1,325	933	933	2,084	2,937	2,621	2,628	3,427	52,823	2,780

Notes: Stafford township permit system also covers Eagleswood Township; In 2002, Dover township was renamed as Toms River Township.
Source: Annual Residential Building Permits Authorized, U.S. Bureau of the Census, Manufacturing and Construction Division; New Jersey Department of Labor and Workforce Development, July 2018
Prepared by: Ocean County Planning Department, November 2018.

Table 2.4-3 Summary of Site Plan and Subdivision Approval by Ocean County Planning Board, 1997-2018 (Ocean County Planning, 2019)

	SUBDIVISIONS			SITE PLANS														
	Major & Minor			Multi-Family Residential*			Commercial		Industrial		Public & Quasi-Pub.		Mixed Use (Residential/Commercial)				TOTAL APPROVALS
YEAR	No.	Lots	Acres	No.	Units	Acres	No.	Sq.Ft.	No.	Sq.Ft.	No.	Sq.Ft.	No.	Lots	Acres	Sq.Ft.	
1997	273	4,656	4,816	29	1,189	783	155	1,716,194	18	605,411	33	250,691	-	-	-	-	508
1998	271	4,034	6,434	25	1,335	1,711	229	2,833,217	14	247,760	26	271,094	-	-	-	-	565
1999	285	4,005	6,375	16	573	314	170	1,893,586	13	506,984	34	447,172	-	-	-	-	518
2000	301	5,160	5,590	25	1,405	361	186	1,930,046	7	164,111	34	209,007	-	-	-	-	553
2001	283	4,042	5,450	29	832	1,139	156	1,309,546	18	485,301	31	427,649	-	-	-	-	517
2002	277	4,396	5,482	34	838	1,125	214	1,672,189	13	372,674	36	616,576	-	-	-	-	574
2003	307	5,145	4,165	29	749	420	176	2,045,919	16	467,980	36	874,821	-	-	-	-	564
2004	348	3,927	3,147	28	984	335	164	2,589,791	8	258,526	40	489,373	-	-	-	-	588
2005	315	3,152	3,934	49	1,878	550	185	2,494,427	20	492,161	32	267,188	-	-	-	-	601
2006	293	3,029	5,015	34	1,251	140	175	2,905,822	11	184,505	25	632,312	-	-	-	-	538
2007	225	1,739	3,984	29	645	216	160	3,317,759	7	7,000	24	227,688	-	-	-	-	445
2008	198	1,557	1,686	18	521	123	153	1,783,875	19	194,344	36	296,923	-	-	-	-	424
2009	125	661	741	11	936	147	101	1,773,503	35	275,780	19	169,911	5	8	4	7,234	296
2010	173	1,237	881	18	1,264	191	76	1,072,747	29	394,059	21	570,174	10	9	221	121,162	327
2011	143	590	338	13	620	2,400	72	1,136,267	6	600	15	211,258	4	1	3	42,246	253
2012	106	470	2,349	7	836	128	71	1,020,970	11	19,961	17	211,625	12	0	46	48,558	224
2013	132	669	1,279	9	291	38	44	589,355	14	231,611	20	279,384	9	30	11	52,011	228
2014	165	1,114	2,282	15	1,283	319	77	890,047	19	222,354	21	193,096	11	18	152	77,970	308
2015	202	1,284	239	10	262	207	86	583,567	7	58,950	17	141,264	12	140	582	276,496	334
2016	178	1,059	1,681	21	1093	1,251	70	832,385	11	404,378	25	450,626	14	130	106	119,408	319
2017	240	1,653	1,840	11	1,281	319	56	1,199,447	10	95,779	25	323,805	11	8	66	82,299	353
2018	189	1,347	18,829	12	722	69	70	1,209,531	26	323,346	26	513,939	8	-	0	99,992	331
TOTAL	5,029	54,926	86,537	472	20,788	12,286	2,846	36,800,187	332	6,013,575	593	8,075,577	96	344	1,191	927,376	9,368





*NOTE: Residential Site Plans typically refer to apartment, townhouse or condominium developments. However, they may also include other developments where land is in community ownership, such as certain retirement communities and mobile home parks. Major subdivisions may include development types other than residential. Preliminary Major Subdivisions were not included. This list includes only those submissions approved or "approved with contingency;" incomplete and held plans, etc. are not included. For more information, download the development report at www.planning.co.ocean.nj.us/appsummary.htm.

Source: Ocean County Department of Planning, May 2019.

Table 2.4-4 2018 Site Plans and Subdivisions Approved by Ocean County Planning Board (Ocean County Planning, 2019)

Municipality	Subdivisions					Site Plans																Total Approvals
	Minor		Major			Residential			Commercial			Industrial			Public & Quasi-Public			Mixed use				
	No	Lots	No	Lots	Acres	No	Units	Acres	No	Bldg SF	Acres	No	Bldg SF	Acres	No	Bldg SF	Acres	No	Units	Bldg SF	Acres	
Barnegat Township	4	0	3	196	48.9	1	148	9.9	0	0	0.0	2	493	8.5	0	0	0.0	1	180.0	48,100	13.7	11
Barnegat Light Borough	1	2	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	1
Bay Head Borough	3	7	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	1	0.0	14,117	0.7	4
Beach Haven Borough	3	6	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	1	20.0	19,110	0.5	4
Beachwood Borough	0	0	0	0	0.0	0	0	0.0	0	0	0.0	1	9,000	1.4	0	0	0.0	0	0.0	0	0.0	1
Berkeley Township	3	8	1	51	109.1	0	0	0.0	3	45,000	21.2	1	2,400	3.5	1	2,940	0.6	0	0.0	0	0.0	9
Brick Township	8	18	2	8	6.2	2	10	0.5	16	45,736	54.1	2	1,730	17.2	1	23,990	1.9	3	0.0	12,552	18.9	34
Eagleswood Township	1	2	0	0	0.0	0	0	0.0	1	17,000	6.2	1	12,000	12.9	0	0	0.0	0	0.0	0	0.0	3
Harvey Cedars Borough	1	2	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	1
Island Heights Borough	3	6	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	3
Jackson Township	7	15	4	87	117.4	0	0	0.0	7	288,231	44.7	2	900	2,193.3	2	383	157.2	0	0.0	0	0.0	22
Lacey Township	1	2	0	0	0.0	0	0	0.0	4	40,971	9.5	0	0	0.0	0	0	0.0	0	0.0	0	0.0	5
Lakehurst Borough	0	0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	0
Lakewood Township	69	200	20	365	18,207.2	1	8	0.3	10	343,094	74.6	7	219,246	88.8	13	385,180	25.9	0	0.0	0	0.0	120
Lavallette Borough	0	0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	0
Little Egg Harbor Township	3	6	0	0	0.0	0	0	0.0	3	27,808	24.9	1	0	691.0	0	0	0.0	0	0.0	0	0.0	7
Long Beach Township	8	16	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	8
Manchester Township	2	4	2	98	128.2	1	519	51.9	1	0	4.1				1	0	1.9	0	0.0	0	0.0	7
Mantoloking Borough	1	2	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	1
Ocean Township	2	4	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	2
Ocean Gate Borough	0	0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	0
Pine Beach Borough	0	0	0	0	0.0	1	6	1.4	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	1
Plumsted Township	0	0	1	4	19.4	0	0	0.0	1	0	3.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	2
Point Pleasant Borough	4	8	0	0	0.0	1	3	0.3	3	5,351	3.9	0	0	0.0	0	0	0.0	0	0.0	0	0.0	8
Pt Pleasant Beach Boro.	1	2	0	0	0.0	1	0	0.2	1	0	1.2	0	0	0.0	0	0	0.0	0	0.0	0	0.0	3
Seaside Heights Borough	0	0	0	0	0.0	2	8	0.2	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	2
Seaside Park Borough	2	4	0	0	0.0	0	0	0.0	1	0	1.8	0	0	0.0	0	0	0.0	0	0.0	0	0.0	3
Ship Bottom Borough	1	2	0	0	0.0	0	0	0.0	1	5,790	0.5	0	0	0.0	0	0	0.0	0	0.0	0	0.0	2
So. Toms River Boro.	0	0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	0
Stafford Township	4	9	1	158	185.8	0	0	0.0	3	15,100	6.8	3	447	75.2	1	7,509	7.7	1	4.0	5,036	1.0	13
Surf City Borough	1	2	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	1
Toms River Township	19	46	1	2	5.9	2	20	3.9	15	375,450	75.5	6	77,130	42.8	7	93,937	349.9	1	0.0	1,077	1.6	51
Tuckerton Borough	1	2	1	3	1.4	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0	0	0.0	0	0.0	2
Ocean County Total	**153**	**375**	**36**	**972**	**18,829.2**	**12**	**722**	**68.7**	**70**	**1,209,531**	**331.7**	**26**	**323,346**	**3,134.3**	**26**	**513,939**	**545.1**	**8**	**204**	**99,992**	**36.4**	**331**

Note: Residential Site Plans typically refer to apartment, townhouse or condominium developments. However, they may also include other developments where land is in community ownership, such as certain retirement communities and mobile home parks. This list includes only those submissions approved or "approved with contingency;" incomplete and held plans, etc. are not included, nor are Preliminary Major Subdivisions. For more information, download the development report at www.planning.co.ocean.nj.us/appsummary.htm.

Prepared by: Ocean County Department of Planning, May 2019.

Major Factors Influencing Future Growth and Development Patterns

Projections for this housing type are mixed. In the near term, there is more supply than demand and new construction has dropped dramatically. In fact, a number of adult communities have dropped the over-55 age requirement. However, the demand is expected to pick up due to continued migration from the urban areas surrounding New York City and will be supplemented by the aging population in the baby boom generation. Ocean County is well positioned to attract future retirees for the same reasons it did in the past few decades. Its geographic location on the metropolitan fringe means that retirees can remain close to relatives and the amenities of New York, Philadelphia and Atlantic City, yet be far enough away to enjoy the beaches and natural amenities which are permanently protected in Ocean County.

As indicated in Figure 2.1-2, The Pinelands Comprehensive Management Plan establishes nine land use management areas with goals, objectives, development intensities and permitted uses for each. The boundaries of these management areas are displayed on the Pinelands Land Capability Map. They are implemented through local zoning that must conform with Pinelands land use standards.

In New Jersey, housing and land use have been significantly impacted by affordable housing litigation and subsequent legislation. The Mount Laurel IV Declaratory Judgment Process commenced in 2015 as a result of the responsibility for determining municipal affordable housing obligations and implementation of municipal housing elements and fair share plans pursuant to the Fair Housing Act being placed under the jurisdiction of the State Supreme Court, in response to a failure by the State Council on Affordable Housing to adopt updated Substantive and Procedural Rules and lack of a legislative solution. As the Declaratory Judgment Process continues, increasing numbers of municipalities in Ocean County and other areas of the state are reaching settlements with the Fair Share Housing Center and are adopting amended third round housing elements and fair share plans which describe municipal affordable housing obligations through 2025.

An email survey was distributed to all Municipal Officials and CRS Coordinators by the Ocean County Planning Department and specifically asked if they were aware of any potential major developments in their community in the next 5 years, *especially developments in Special Flood Hazard Areas.* Potential new development in Ocean County, as reported by participating jurisdictions as part of this plan update, is illustrated below in Table 2.4-5. When a community indicated they were unaware of any potential development, an estimate of the annual residential approved permits is given. This estimate is based on a 20-year average of development trends for each community.

Table 2.4-5 **Potential New Development in Ocean County**

Jurisdiction	Property Name	Type (Residential or Commercial)	Number of Structures / Units or Sq. Ft.	Address	Block and Lot	Known Hazard Zone	Description /Status
Barnegat Light Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 237 units per year.						
Barnegat Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 12 units per year.						
Bay Head Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 5 units per year.						
Beach Haven Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 24 units per year.						
Beachwood Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 17 units per year.						
Berkeley Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 141 units per year.						
Brick Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 162 units per year.						
Eagleswood Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 12 units per year.						
Harvey Cedars Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 13 units per year.						
Island Heights Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 8 units per year.						

Jurisdiction	Property Name	Type (Residential or Commercial)	Number of Structures / Units or Sq. Ft.	Address	Block and Lot	Known Hazard Zone	Description /Status
Jackson Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 309 units per year.						
Lacey Township	M&T Properties	Residential	258 townshouses	Laurel Blvd Ext 7 Rt 9	739.01 Lots 4, 2.06, 2.07, 7.03, 7.04	None	recently approved, but not constructed
Lakehurst Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 3 units per year.						
Lakewood Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 421 units per year.						
Lavallette Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 27 units per year.						
Little Egg Harbor Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 185 units per year.						
Long Beach Township	Holgate Residential Properties	Residential	41 single family	Holgate section	Not provided	Not provided	recently approved, under construction
Manchester Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 151 units per year.						
Mantolokin g Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 7 units per year.						

Jurisdiction	Property Name	Type (Residential or Commercial)	Number of Structures / Units or Sq. Ft.	Address	Block and Lot	Known Hazard Zone	Description /Status
Ocean Gate Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 89 units per year.						
Ocean Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 6 units per year.						
Pine Beach Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 5 units per year.						
Plumsted Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 36 units per year.						
Point Pleasant Beach Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 46 units per year.						
Point Pleasant Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 19 units per year.						
Seaside Heights Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 13 units per year.						
Seaside Park Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 11 units per year.						
Ship Bottom Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 17 units per year.						
South Toms River Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 3 units per year.						

Jurisdiction	Property Name	Type (Residential or Commercial)	Number of Structures / Units or Sq. Ft.	Address	Block and Lot	Known Hazard Zone	Description /Status
Stafford Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 227 units per year.						
Surf City Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 22 units per year.						
Toms River Township	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 387 units per year.						
Tuckerton Borough	Community is not aware of any major developments in the next five years, especially in SFHAs. However, the average annual (1997-2017) residential units authorized by building permit is 13 units per year.						

3 Planning Process

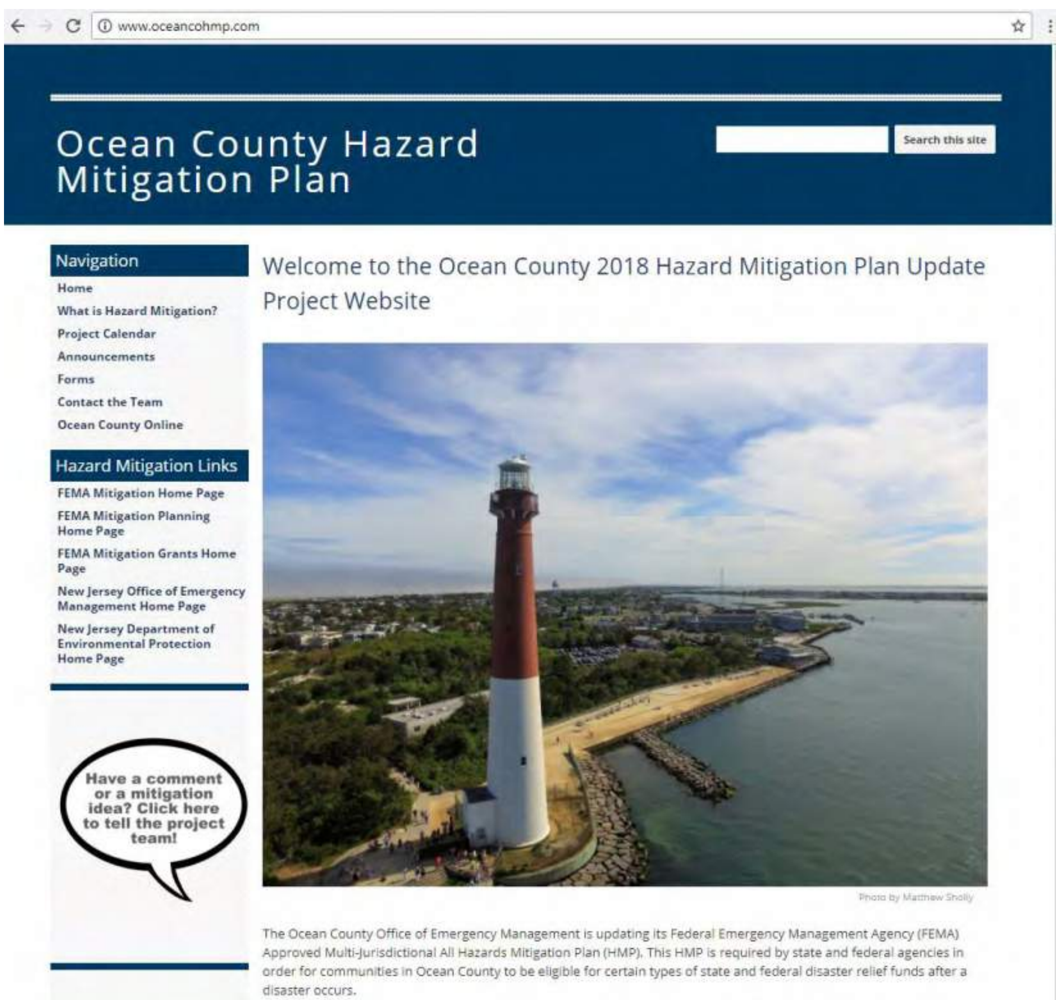
3. Planning Process

3.1 Process and Participation Summary

The Ocean County HMP included a robust planning process and participation strategy. The project was led by the county project managers, Robert Butkus and John Kirwin, who work for the Office of Emergency Management under the Ocean County Sheriff's Office. The Office of Emergency Management selected Michael Baker International (Baker) to support the development of the Ocean County HMP.

The 2018 update to the Ocean County HMP is built on a similar outreach strategy as the 2014 Ocean County HMP. One of the new strategies for the update included individual meetings with each of the local 33 municipalities in Ocean County. Overall, the outreach strategy was aimed at providing opportunities for municipal representatives, universities, adjacent counties, organizations, other stakeholders and the general public to participate in the planning process. A project website was developed at http://www.oceancohmp.com; this site was available from Spring of 2017 throughout the project to provide opportunities for input, meeting notices, and information on hazard mitigation. Municipal input and input from other stakeholders were targeted from group meetings and individual municipal meetings.

Figure 3.1-1 Project website found at http://www.oceancohmp.com/



A brief description of each meeting that was held is available in Section 3.3. In addition, meeting minutes, describing in detail, events of each meeting along are available for each community in Appendix B – Jurisdictions. Forms and surveys were distributed and collected throughout the planning process. Some forms were completed during planning meetings while others were sent via mail and email and completed and returned in between scheduled meetings. Appendix B includes all completed forms and surveys.

The draft plan was completed through a combination of input from all stakeholders and research. Research was completed using plans, reports and data from 78 sources found in Appendix A – Bibliography. Once complete it was posted to the project website for a 30-day review period. Comments received were incorporated into the plan prior to submission to NJOEM and FEMA for review. Stakeholders had opportunities to comment at the beginning, throughout the plan development and at the conclusion of the planning process.

3.2 The Planning Team

Ocean County formed a Hazard Mitigation Steering Committee prior to the start of the 2017-2018 planning process to guide the HMP development. The Steering Committee was active in releasing a request for proposals and then reviewing, interviewing and selecting a contractor for the project. Once the Steering Committee selected Michael Baker International, Inc., Project Manager Sarah Bowen and Deputy Project Manager Craig Wenger joined the committee. The following people form the Steering Committee:

- Robert Butkus, Ocean County Sheriff's Office, Project Manager
- John Kirwin, Ocean County Sheriff's Office, Project Manager
- Auther Abline, Manchester OEM
- Anthony Agliata, Ocean County Planning Department
- Lisa Auermuller, Jacques Cousteau National Estuarine Research Reserve
- Sarah Bowen, Michael Baker International, Inc.
- Scott Conklin, Ocean County Utility Authority
- Laura Connolly, New Jersey State Police
- Kevin Cooney, Ocean County Sheriff's Office
- William Demand, Ocean County Utility Authority
- John Ernst, Ocean County Engineering Department
- Tom Hartman, Ocean County Engineering Department
- Jenny Mance, Ocean County Planning Department
- Allen Mantz, Ocean County OEM
- Michael Mastronardy, Ocean County Sheriff's Office
- Martha Maxwell-Doyle, Barnegat Bay Partnership
- Karin Moser, Ocean County Sheriff's Office
- Rob Mulloy, Ocean County Engineering Department
- David Schenk, Ocean County Sheriff's Office
- Stephanie Specht, Ocean County Planning Department
- Chris Testa, New Jersey State Police
- Lori Van Lenten, Ocean County Sheriff's Office

- Mark Villinger, Ocean County Planning Department Charles Webster, Ocean County Sherriff's Office
- Charlie Webster, Ocean County Sheriff's Office
- Craig Wenger, Michael Baker International, Inc.

The Steering Committee developed a well-diversified list of potential HMP Stakeholders, which included municipal officials, Ocean County government representatives, state and federal partners, adjacent county representative, universities, and other stakeholder organizations. These individuals were invited to participate in the HMP process.

Emails were sent to the Mayor and Emergency Management Coordinator from each municipality to invite them to the first municipal focused meeting. The emails requested that Mayor and Emergency Management Coordinator consider extending the invitation, as appropriate for their municipality, to council members, engineers, zoning officers, planning commission members, building officials, GIS specialists, municipal managers, or other municipal representatives. This invitation method was used so that each municipality could determine which representatives they would like to participate in the HMP planning process. This process followed typical county and municipal protocol and respected the decision of the Mayor to determine which staff should represent their municipality. Many municipal positions are served by contractors and there are costs involved with selecting a contractor to attend a meeting. The result were 30 in-person meetings and 3 phone conference meetings, achieving participation from 100% of the municipalities.

The stakeholders listed in Table 3.2-1 actively participated in the planning process through attendance at meetings, completion of assessment surveys, and/or submission of comments. Participants representing multiple jurisdictions are listed more than once.

Table 3.1.1-1: Stakeholders who participated in the planning process

Municipality/ Organization	Participants(s)
Barnegat Light Borough	Jeffrey Washburn, Zoning Officer Allison Iannaccone, Municipal Engineer Diana Stott, CRS Coordinator Ed Wellington, Councilman Kathy Guerrero, Deputy Clerk Deputy OEM Coordinator Frank Mikuletzky, Barnegat Light Councilman Brenda Kuhn, Borough Clerk
Barnegat Township	Jeff Ryan, OEM Coordinator
Bay Head Borough	Silke Stutz, Bayhead OEM Coordinator Pamela Hilla, RVE Bob Hein, Councilman Kelley Jean Mickle, Director OEM Todd Morgano, Construction Official Bill Curtis, Mayor
Beach Haven Borough	Allison Iannaccone, Municipal Engineer Bill Tromm, EM Coordinator Beverly Tromm, Emergency Management Coordinator

	Sherry Mason, Borough Manager Nancy Davis, Mayor
Beachwood Borough	Robert Tapp, OEM Coordinator
Berkeley Township	Jamie Zimmerman, CFM, RVE Alan Dittenhofer, Township Engineer Nick Dickerson, Representative from the Office of the Township Planner John Camera, Administrator
Brick Township	Joseph Gilsenan, Risk Manager Elissa Commins, Township Engineer Mike Fowler, Township Planner Joe Pawlowicz, OEM Coordinator Tara Paxton, Assistant Planner James Riccio, Chief of Police Joanne Bergin, Administrator
Eagleswood Township	Cindi Maresca, Deputy OEM Coordinator
Harvey Cedars Borough	Allison Iannaccone, Municipal Engineer Jonathan Oldham, Mayor Diana Stutt, CRS Coordinator Robert Burnaford, Deputy OEM Coordinator Anna Grimste, Zoning/Code Enforcement Daina Dale, Clerk Michael Garofalo, Commissioner Judy Gerkens, Commissioner
Island Heights Borough	Douglas A. Platt, Emergency Management Coordinator Sean Asay, Council Member
Jackson Township	Daniel Burke, Municipal Engineer Barry G. Olejarz, Emergency Management Coordinator
Lacey Township	Christopher Reid, Director Community Development Veronica Laureigh, Clerk Christopher Kenny, Deputy OEM Michael C. Dibella, Lacey Township Police Chief and Emergency Management Coordinator Douglass Donahue, Construction Officer
Lakehurst Borough	Daniel Hourigan , Emergency Management Coordinator
Lakewood Township	Robert Lawson , Emergency Management Coordinator Meir Lichtenstein, Mayor
Lavallette Borough	Gary Royer, Zoning/Code Enforcement/Floodplain Manager Al DeBenedictis, OEM Deputy Coordinator David Finter, Lavallette Council John Bennett, Borough Administrator
Little Egg Harbor Township	Tom Bonfonti, LEHPD Jim Hawkins, LEHPD LT. Robin Schilling, Administrator Troy Bezak, LEHPD LT.
Long Beach Township	JoAnne Tallon, CRS Coordinator/Zoning Officer

	Brendan Kerlin, Long Beach Township OEM/Deputy Coordinator J. Dane Sprague, Construction Official CFM Butch Hartmann, LBTPD OEM Joe Mancini, Mayor Frank Little, Township Engineer
Manchester Township	Arthur Abline, Emergency Management Coordinator Mike Martin, Construction Official Nicole Askar, Zoning Officer Gary Sylvester, Director, Inspect. Donna Markulie, Business Admin. Sabrina Skibo, Municipal Clerk Al Yodakis, DDW Director
Mantoloking Borough	Stacy Ferris, Chief of Police Robert Mainberger, Engineer Frank Bruton, Engineer Scott Bland, DPW Scott Hulse, DPW Lance White, Council President Todd Morgano, Constriction Official Larry Plevier, Engineer
Ocean Gate Borough	Paul J. Kennedy, Mayor/Acting Administrator Paul Botow, Construction/Flood Official Pamela Hilla, Borough Engineer
Ocean Township	Diane B. Ambrosio, Clerk David Breeden, Administrator Scott Murphy, Deputy Coordinator
Pine Beach Borough	Kevin D. Simon, Emergency Management Coordinator
Plumsted Township	Linda Salcfas, Emergency Management Coordinator Glenn Ricardi, Construction Official Eric Sorchik, Deputy Mayor
Point Pleasant Beach Borough	Christine Riehl, Administrator- CFO Raymond Savacool, Borough Engineer Chris Demsey, PPB OEM Elaine P. Petrillo, Zoning Official
Point Pleasant Borough	Frank Pannucci, Borough Administrator Richard Larson, Chief of Police Bob Forsyth, PP DPW
Seaside Heights Borough	Erik Hershey, OEM Coordinator Ken Roberts, Fire Chief
Seaside Park Borough	Francis Larkin, Emergency Management Coordinator Joshua Fox, Water Superintendent Sandy Rice, Seaside Park CFO/Administrator Pamela Hilla, Borough Engineer Eric Wojciechowski, Public Works Supervisor Doug Rohmeyer, CME Associates Planning Board Engineer Ray Savacool, Consulting Engineer

	Matt DeMichele, Council Fritz McHugh, Council
Ship Bottom Borough	Frank Cooper, Chairman Land Use Board Frank Little, Borough Engineer Mark Pino, Borough Administrator, Susan Kiccheske, Ship Bottom Construction Official Joe Valyo, OEM Coordinator Councilman Bill Huelsenbeck, Mayor
South Toms River Borough	Kevin McCormack, OEM Coordinator
Stafford Township	Alan Smith, Councilman Jim Moran, Administrator John Spodofora, Mayor Thomas Dellane, OEM David Taylor
Surf City Borough	John Casella, Police Chief Grace Pitner, Zoning Thomas Hudson, Borough Superintendent Mary Madonna, Clerk/ Admin
Toms River Township	Paul Daley, Acting Coordinator OEM Tom Rodgers, Deputy OEM Coordinator Erika Stahl, Planner Christine Newman, OEM Operations Bob Chanitalian, Engineer Brendan Weiner, GIS Mike Brosman, Police Captain David Roberts, Township Planner
Tuckerton Borough	Jenny Gleghorn, Administrator/Deputy Coordinator Marilyn Kent, OEM Susan Marshall, OEM
Additional Ocean County Participants	John Ernst, Ocean County Engineer Rob Mulloy, Assistant Ocean County Engineer Tom Hartman, Ocean County Supervising Engineer Anthony Agliata, Ocean County Planning Director Mark Villinger, Ocean County Supervising Planner Jenny Mance, Ocean County Assistant Planner Stephanie Specht, Ocean County Assistant Planner Allen Mantz, Ocean County OEM John Kirwin, Ocean County Sherriff's Office Charles Webster, Ocean County Sherriff's Office Lt. Keven Cooney, Ocean County Sheriff's Office David Schenk, Ocean County OEM
Jacques Cousteau National Estuarine Research Reserve	Lisa M. Auermuller Chris Huch
Micromedia Publications	Sara Grillo
NJ DEP	Kevin Hassell, Coastal Management Program
NJOEM	Laura Connolly Michael Sangiovanni
Ocean County Utilities Authority	Scott Conhlin

	Participants(s)
The Nature Conservancy of NJ	John Truscinski
Toms River Downtown Business Improvement District	Alizar Zorojew, Director

3.3 Meetings and Documentation

Meetings were held to gather input into the Ocean County HMP, guide the planning process, and to leverage federal and state resources. Meetings were planned to maximize the time of participants. Municipal and public participation meetings were provided at the beginning of the process to provide input on hazard identification and mitigation selection and at the end of the process to review and provide comments on the draft plan. Invitations, agendas, presentations, sign-in sheets, and minutes for these meetings are included in Appendix B – Jurisdictions. The following list provides a summary of the 2017-2018 HMP planning process:

- **May 31, 2017, Northern Municipal and Stakeholder Kick-off and Risk Assessment Meeting –** This meeting was targeted for municipal officials. Though some additional stakeholders were invited from universities, organizations and adjacent counties. The meeting provided a brief overview of hazard mitigation planning and focused on reviewing and prioritizing hazards to be included and profiled in the HMP. The meeting also provided an overview of the project schedule and how to provide input into the planning process.
- **May 31, 2017, Southern Municipal and Stakeholder Kick-off and Risk Assessment Meeting –** This meeting was targeted for municipal officials. Though some additional stakeholders were invited from universities, organizations and adjacent counties. The meeting provided a brief overview of hazard mitigation planning and focused on reviewing and prioritizing hazards to be included and profiled in the HMP. The meeting also provided an overview of the project schedule and how to provide input into the planning process.

Figure 3.3-1 Well-attended May 31, 2017 Kick-off Meeting

Municipal Meetings

In-person meetings were conducted for the following municipalities below. Meetings were conducted in a round table discussion format with municipal leadership. Each municipality was encouraged to invite elected officials, emergency management coordinators, engineers, floodplain administrators, zoning officers, planning commission members, building officials, GIS specialists, municipal managers, or other municipal representatives to the meetings.

At each meeting the Goals and Objectives, Hazard Identification, Risk Assessment, Critical Facilities, Capability Assessment and Mitigation Actions of the plan were reviewed and discussed. Attendees were encouraged to discuss how municipal risk relates to the risk for each identified hazard and to select new and on-going mitigation actions. Mitigation actions were selected based on the municipality's current activities, their highest risks, their Letter of interests for HMGP funding, and strategies for the future. The Capability Assessment was reviewed and requested to be completed after each meeting. Meeting were held as follows:

- **October 4, 2017, Ship Bottom Borough**
- **October 11, 2017, Berkeley Township**
- **October 12, 2017, Bay Head Borough**
- **October 12, 2017, Island Heights Borough**
- **October 16, 2017, Surf City Borough**
- **October 17, 2017, Barnegat Light Borough**
- **October 17, 2017, Harvey Cedars**
- **October 18, 2017, Beach Haven Borough**
- **October 18, 2017, Brick Township**
- **October 18, 2017, Stafford Township**
- **October 19, 2017, Lavallette Township**
- **October 19, 2017, Ocean Gate Borough**
- **October 24, 2017, Long Beach Township**
- **October 24, 2017, Seaside Park Borough**
- **October 30, 2017, Lacey Township**
- **October 30, 2017, Ocean Township**
- **November 2, 2017, Point Pleasant Borough**
- **November 2, 2017, Tuckerton Borough**
- **November 6, 2017, Manchester Township**
- **November 15, 2017, Lakehurst Borough**
- **November 15, 2017, Little Egg Harbor Township**
- **November 16, 2017, Lakewood Township**
- **November 21, 2017, Plumsted Township**
- **November 29, 2017, Point Pleasant Beach Borough**
- **December 4, 2017, Jackson Township**
- **December 6, 2017, Mantoloking Township**
- **December 7, 2017, Pine Beach Borough**
- **December 12, 2017, Seaside Heights Borough**

- **December 12, 2017, Toms River Township**
- **December 14, 2017 South Toms River Borough**
- **January 5, 2018 Call Barnegat Township**
- **January 19, 2018 Call Beachwood Borough**
- **January 24, 2018 Call Eagleswood Township**

Draft Plan Review

- **April 6, 2018, Draft plan posted to website –** The Draft HMP was posted for public, municipal and other stakeholder review.
- **April 10, 2018, Southern and Northern Area Public, Municipal and Other Stakeholder Draft Plan Review Meetings –** Two day and one night meetings in northern and southern locations of the County were scheduled to provide a summary of the 2018 County HMP and an opportunity for attendees to provide comments on the plan prior to submission to NJOEM and FEMA.

3.4 Public & Stakeholder Participation

Participation opportunities were diversified to enable people to contribute to the planning process by spending a little to a lot of time providing input and making comments. Input was encouraged by in person and via the internet. The message throughout the project was to let people know all ideas were encouraged and that there were opportunities to learn more about mitigation.

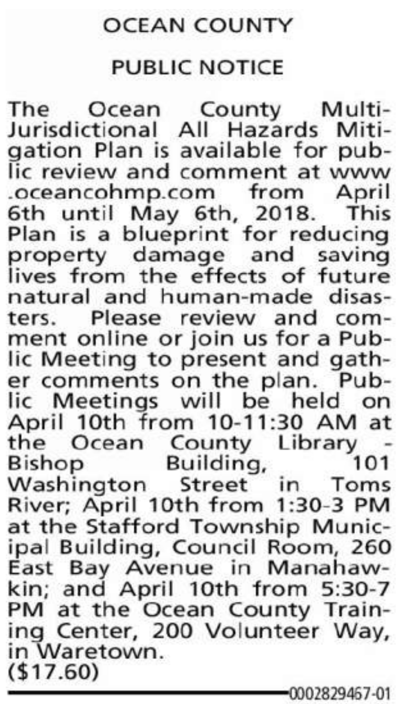
Municipal input was the most structured, since a multi-jurisdictional plan is directed by municipal and county involvement. The five tools listed below were distributed at meetings and via email to solicit data, information, and comments from local municipalities and other stakeholders in Ocean County. Responses to these worksheets informed the plan and are included in Appendix B:

- **Hazard Identification:** Collects information on frequency and impacts of all reviewed hazards for each municipality. The County and other stakeholders also used the form to note their concerns about hazards to be profiled in HMP.
- **Mitigation Strategy Identification and Developmen**t: Helps communities to start brainstorming mitigation strategies that they want to address in plan. It was not filled out by many communities, but all communities came to the individual municipal meetings with ideas for mitigation actions.
- **Municipal Hazard Worksheet:** Collects information on how municipal risk relates to overall county risk. Asks if municipal risk is greater than, less than, or equal to county.
- **Capability Assessment Survey:** Collects information on local planning, regulatory, administrative, technical, fiscal, political, and resiliency capabilities that can be included in the countywide mitigation strategy.

Figure 3.4-1 May 31, 2017 Northern Stakeholder and Public Meeting Provided Attendees Worksheets to Provide Input on HMP

Public notices of the Southern and Northern Area Public, Municipal and Other Stakeholder Draft Plan Review Meetings were published in the Asbury Park Press and the Press of Atlantic City on April 2, 2018 to publicize the public comment period. The affidavits of all the ads are included in Appendix B.

Figure 3.4-2 Asbury Park Press Public Notice on April 2. 2018



OCEAN COUNTY

PUBLIC NOTICE

The Ocean County Multi-Jurisdictional All Hazards Mitigation Plan is available for public review and comment at www.oceancohmp.com from April 6th until May 6th, 2018. This Plan is a blueprint for reducing property damage and saving lives from the effects of future natural and human-made disasters. Please review and comment online or join us for a Public Meeting to present and gather comments on the plan. Public Meetings will be held on April 10th from 10-11:30 AM at the Ocean County Library - Bishop Building, 101 Washington Street in Toms River; April 10th from 1:30-3 PM at the Stafford Township Municipal Building, Council Room, 260 East Bay Avenue in Manahawkin; and April 10th from 5:30-7 PM at the Ocean County Training Center, 200 Volunteer Way, in Waretown.
($17.60)

0002829467-01

The majority of public comments received were from municipal officials to add or edit mitigation actions in Section 6 and Appendix B – Jurisdictions. Additional comments received included updates to capabilities for county integration activities, hazardous material events and updates to participant titles to reflect changes in staffing.

3.5 Multi-Jurisdictional Planning

This HMP was developed using a multi-jurisdictional approach to include all municipalities within Ocean County. All jurisdictions needed to and did participate in the multi-jurisdictional planning process in order to have their own plan to be eligible for FEMA funding after a disaster. The plan was completed with the multi-jurisdictional approach to save resources and coordinate on a larger level. The planning process capitalized on both County level departments resources, such as technical expertise and data, and municipal level expertise and local knowledge of hazard events. Local municipalities also have the legal authority to enforce compliance with land use planning and development issues. The County undertook an intensive effort to involve and engage municipalities in the planning process. Table 3.5-1 lists jurisdictional participation in the HMP. All 33 municipalities in the County participated in the 2018 County HMP, thus achieving 100 percent participation.

Table 3.1.1-2: Municipal Participation in HMP Planning Process and Development

Municipality	Meetings			Worksheets					
	Kick-off Meeting	Local Meeting	Daft Review	Hazard ID 2014	Hazard ID Update	Mitigation Action Sheet 2014	Mitigation Action Sheet Update	Capability Assessment 2014	Capability Assessment Update
Barnegat Light Borough		X	X	X		X	X	X	
Barnegat Township	X	Phone Call	X		X	X	X		X
Bay Head Borough	X	X	X		X	X	X	X	X
Beach Haven Borough		X	X			X	X	X	
Beachwood Borough		Phone Call	X	X		X		X	
Berkeley Township	X	X	X		X	X	X	X	
Brick Township	X	X	X		X	X	X	X	
Eagleswood Township		Phone Call	X			X	X	X	

Municipality	Meetings			Worksheets					
	Kick-off Meeting	Local Meeting	Daft Review	Hazard ID 2014	Hazard ID Update	Mitigation Action Sheet 2014	Mitigation Action Sheet Update	Capability Assessment 2014	Capability Assessment Update
Harvey Cedars Borough	X	X	X	X	X	X		X	
Island Heights Borough		X	X	X		X	X	X	X
Jackson Township		X	X	X		X	X	X	
Lacey Township	X	X	X	X	X	X	X	X	
Lakehurst Borough	X	X	X	X	X	X	X	X	
Lakewood Township		X	X	X		X	X	X	
Lavallette Borough	X	X	X	X	X	X	X	X	X
Little Egg Harbor Township		X	X	X		X	X	X	
Long Beach Township	X	X	X	X	X	X	X	X	X
Manchester Township		X	X	X		X	X	X	X
Mantoloking Borough		X	X	X		X	X	X	X
Ocean Gate Borough	X	X	X	X	X	X	X		
Ocean Township		X	X			X	X	X	
Pine Beach Borough		X	X			X	X	X	
Plumsted Township		X	X			X	X	X	

Municipality	Meetings			Worksheets					
	Kick-off Meeting	Local Meeting	Daft Review	Hazard ID 2014	Hazard ID Update	Mitigation Action Sheet 2014	Mitigation Action Sheet Update	Capability Assessment 2014	Capability Assessment Update
Point Pleasant Beach Borough	X	X	X		X	X	X	X	
Point Pleasant Borough		X	X			X	X	X	
Seaside Heights Borough		X	X	X		X	X	X	
Seaside Park Borough	X	X	X		X	X	X		
Ship Bottom Borough		X	X			X	X	X	
South Toms River Borough	X	X	X		X	X	X	X	
Stafford Township	X	X	X		X	X	X	X	
Surf City Borough		X	X			X	X	X	
Toms River Township	X	X	X	X	X	X	X	X	X
Tuckerton Borough	X	X	X		X	X	X	X	

4 Risk Assessment

4. Risk Assessment

4.1 Process Summary

This risk assessment provides a factual basis for activities proposed by Ocean County in their mitigation strategy. Hazards that affect Ocean County are identified and defined in terms of location and geographic extent, magnitude of impact, previous events and likelihood of future occurrence.

The Ocean County HMP profiles 16 hazards. Table 4.1-1 provides a crosswalk table that highlights the hazard profile changes from the 2014 Ocean County HMP. Input from municipalities, Steering Committee member, other stakeholders and members of the general public was used to refine how the hazards were profiled emphasizing that time would be spent on hazards that were the highest risk for the County and required mitigation actions. The hazard profiles were also reviewed during the final public comment period.

Table 4.1-1 Previous Plan and New Plan Hazard Identification Crosswalk table

Hazard Profile	Plan Update Changes from 2014 Plan
Natural Hazards	
Coastal Erosion	
Drought	
Earthquake	
Extreme Temperature	
Flooding	Now incorporates information on Tsunami
Hurricanes, Tropical Storms and Nor'easters	
Subsidence	New Hazard Profile
Tornados and Windstorms	Now incorporates information on Waterspouts and Seiches
Wildfire	
Winter Storms	
Human-made Hazards	
Environmental Hazards	
Nuclear Incidents	
Terrorism	New Hazard Profile
Transportation Accidents	
Urban Fire and Explosion	
Utility Interruption	
Climate Change	*This hazard profile is incorporated into relevant natural hazard profiles and is not a stand-alone section in the plan update.

4.2 Hazard Identification

Hazard identification was completed by reviewing historic occurrences and impacts within Ocean County. The following describes the process of analyzing and identifying the hazards that impact Ocean County.

4.2.1 Presidential Disaster Declarations

Presidential Disaster Declarations represent the disasters which have had the greatest impact on the County since 1955. All the disaster types for which there have been Presidential Disaster Declarations are profiled in the plan. Presidential Major Disaster, Emergency, and Fire Management Assistance Declarations are issued when it has been determined that state and local governments need assistance in responding to a disaster event. Table 4.2-1 identifies Presidential Disaster and Emergency Declarations issued between 1955 through 2017 that have affected Ocean County.

Table 4.2-1 Presidential Major Disaster, Emergency and Fire Management Assistance Declarations affecting Ocean Count

Number	Date	Incident Description	Declaration Type
4264	1/22/2016	Winter Storm	Major Disaster Declaration
4086	10/29/2012	Hurricane Sandy	Major Disaster Declaration
4021	8/31/2011	Hurricane Irene	Major Disaster Declaration
3354	10/28/2012	Hurricane Sandy	Emergency Declaration
3332	8/27/2011	Hurricane Irene	Emergency Declaration
3257	9/19/2005	Hurricane Katrina Evacuation	Emergency Declaration
3181	3/20/2003	Snowstorm	Emergency Declaration
3169	9/19/2001	Terrorist Attack Emergency Declaration	Emergency Declaration
3156	11/1/2000	Virus Threat	Emergency Declaration
3148	9/16/1999	Hurricane Floyd	Emergency Declaration
3106	3/17/1993	Severe Blizzard	Emergency Declaration
3083	10/19/1980	Water Shortage	Emergency Declaration
2695	5/16/2007	Warren Grove Fire	Fire Management Assistance Declaration
2411	6/2/2002	Double Trouble Fire	Fire Management Assistance Declaration
1954	2/4/2011	Severe Winter Storm and Snowstorm	Major Disaster Declaration
1897	4/2/2010	Severe Storms and Flooding	Major Disaster Declaration
1873	2/5/2010	Snowstorm	Major Disaster Declaration

Number	Date	Incident Description	Declaration Type
1867	12/22/2009	Severe Storms and Flooding Associated with Tropical Depression Ida and a Nor'easter	Major Disaster Declaration
1206	3/3/1998	Coastal Storm	Major Disaster Declaration
1088	1/13/1996	Blizzard	Major Disaster Declaration
973	12/18/1992	Coastal Storm, High Tides, Heavy Rain, Flooding	Major Disaster Declaration
936	3/3/1992	Severe Coastal Storm	Major Disaster Declaration
701	4/12/1984	Coastal Storms, Flooding	Major Disaster Declaration
528	2/8/1977	Ice Conditions	Major Disaster Declaration
519	8/21/1976	Severe Storms, High Winds, Flooding	Major Disaster Declaration
310	9/4/1971	Heavy Rains, Flooding	Major Disaster Declaration
205	8/18/1965	Water Shortage	Major Disaster Declaration
124	3/9/1962	Severe Storm, High Tides, Flooding	Major Disaster Declaration
41	8/20/1955	Hurricane, Floods	Major Disaster Declaration

4.2.2 Hazards Review

While Presidential Disaster Declarations represent some of the largest disasters in the county, additional hazards impact the county. The hazards in this report were selected for review based on research into hazards present in Ocean County, reviewing the draft hazard mitigation planning documents and the New Jersey 2014 State Hazard Mitigation Plan. For purposes of this risk assessment, climate change is incorporated into individual natural hazards since it can alter the frequency and intensity of many natural hazards. Table 4.2-2 provides a definition of all the hazards reviewed for the Ocean County HMP.

This consensus was confirmed in the May Stakeholder and Public Meetings and in the Individual Municipal Meetings. The following hazards were considered and researched for their risk but not profiled for the following reasons:

- **Expansive Soils:** Hazard has minimal to no risk in Ocean County.
- **Hail:** Hazard is present with minimal risk and was not profiled because municipalities and County did not want mitigation actions specific to this hazard.
- **Invasive Species:** Hazard is present, yet the stakeholders' concern for hazard mitigation is only related to wildfire therefore it is noted as a contributing factor in the wildfire profile.
- **Landslide:** Hazard has minimal to no risk in Ocean County.

- **Lightning Strike:** Hazard is present, yet the stakeholders' concern for hazard mitigation was only related to other storms therefore it is noted as a contributing factor in the hurricane, tropical storm, nor'easter profile.
- **Pandemic:** Hazard is present with minimal risk and was not profiled because municipalities and County did not want mitigation actions specific to this hazard.
- **Radon Exposure:** Hazard has minimal to no risk in Ocean County.
- **Subsidence, Sinkhole:** Hazard has minimal to no risk in Ocean County without flooding; therefore it is noted as vulnerability in the flooding profile.
- **Animal Disease:** Hazard is present with minimal risk and was not profiled because municipalities and County did not want mitigation actions specific to this hazard.
- **Civil Unrest:** Hazard is present however it is suitably addressed in police operational planning and training and to some extent in the County's *Homeland Security Strategic Plan*. Consensus was to not profile civil unrest in HMP and leave it addressed by other, more suitable planning mechanisms.
- **Crop Failure:** Hazard is present with minimal risk and was not profiled because municipalities and County did not want mitigation actions specific to this hazard.
- **Dam Failure:** Hazard is present, yet the stakeholders' concern for hazard mitigation is only related to flooding therefore it is noted as vulnerability in the flooding profile.
- **Fishing Failure:** Hazard is present with minimal risk and was not profiled because municipalities and County did not want mitigation actions specific to this hazard.
- **Levee Failure:** There are no levees identified in the DFIRM database or USACE Levee Inventory.

Table 4.2-2 Definitions of Hazards Reviewed

Natural Hazards	Definition
Coastal Erosion	Coastal erosion is a natural coastal process in which sediment outflow exceeds sediment inflow at a particular location. These sediments are typically transported from one location to another by wind, waves, currents, tides, wind-driven water, waterborne ice, runoff of surface waters, or groundwater seepage. Depending on the location and processes in place, coastal erosion can take place very slowly, whereby the shoreline shifts only inches to a foot per year; or more rapidly, whereby changes can exceed ten feet per year. Intense storms and human interference can result in a sudden or rapid loss of land where large portions of a beach or dune are washed away by strong currents and large waves. (FEMA, 1997).
Drought	Drought is a natural climatic condition which occurs in virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought. This hazard is of particular concern in New Jersey due to the presence of farms as well as water-dependent industries and recreation areas across the State. A prolonged drought could severely impact these sectors of the local economy, as well as residents who depend on wells for drinking water and other personal uses. (National Drought Mitigation Center, 2006).

Natural Hazards	Definition
Earthquake	An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10-20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns. Earthquakes can affect hundreds of thousands of square miles, cause damage to property measured in the tens of billions of dollars, result in loss of life and injury to hundreds of thousands of persons, and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking which is dependent upon amplitude and duration of the earthquake. (FEMA, 1997).
Expansive Soils	Clay soils have the potential to shrink and swell when they become wetted or dried. Expansive soils do not change size quickly, but over time can result in significant movement that can damage supply lines (e.g. roads, power lines, railways, bridges, etc…) and structures that lack proper design. (Olive et al, 1989).
Extreme Temperature (including cold and heat)	Extreme cold temperatures drop well below what is considered normal for an area during the winter months and often accompany winter storm events. Combined with increases in wind speed, such temperatures in New Jersey can be life threatening to those exposed for extended periods of time. Extreme summer heat is the combination of very high temperatures and exceptionally humid conditions. If such conditions persist for an extended period of time, it is called a heat wave.
Flooding (riverine, coastal, storm surge, tsunami)	Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in New Jersey. Flooding events are generally the result of excessive precipitation. General flooding is typically experienced when precipitation occurs over a given river basin for an extended period of time. Riverine flooding is the accumulation of water within a water body (e.g., stream, river, lake, or reservoir) and the overflow of excess water onto adjacent floodplains. Riverine flooding occurs to some extent almost every year and is considered New Jersey's number one hazard. A storm surge is the rise of water levels during a storm measured by the difference between actual measured water levels and predicted astronomic tide levels. Though not as costly as other flood events, coastal flooding has caused beach erosion, damage to dunes and shore protection structures as well as tidal flooding impacts.There is an increased risk of flooding when the onset of coastal storms and storm surges occur at high tides. Slow moving storms can last through many high tides causing a great deal of damage. A tsunami is a series of ocean waves generated by sudden displacements in the sea floor, landslides, or volcanic activity. In the deep ocean, the tsunami wave may only be a few inches high. The tsunami wave may come gently ashore or may increase in height to become a fast moving wall of turbulent water several meters high. The probability of a large tsunami impacting the coast of New Jersey is very small due to the position of New Jersey on the trailing edge of the North Atlantic Plate. (NJ HMP 2011). All forms of flooding can damage infrastructure (USACE, 2007).

Natural Hazards	Definition
Hail	In addition to flooding and severe winds, hail is another potential damaging product of severe thunderstorms. Hailstorms occur when ice crystals form within a low pressure front due to the rapid rise of warm air into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight; they fall as precipitation in the form of balls or irregularly shaped masses of ice greater than 0.75 inches in diameter (FEMA, 1997). The size of hailstones is a direct function of the size and severity of the storm. High velocity updraft winds are required to keep hail in suspension in thunderclouds. The strength of the updraft is a function of the intensity of heating at the Earth's surface. Damage to crops and vehicles are typically the most significant impacts of hailstorms. (FEMA, 1997).
Hurricane, Tropical Storm, Nor'easter	Hurricanes, tropical storms, and nor'easters are classified as cyclones and are any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise (in the Northern Hemisphere) and whose diameter averages 10-30 miles across. Because of its northern location on the Atlantic coastline, direct hits by storms of hurricane strength have a relatively low probability of impacting New Jersey, compared to the Southern coastal and Gulf States. It is possible for the entire State to be impacted by hurricanes, although wind and surge effects tend to be concentrated in coastal areas, as well as specific riverine regions that may experience storm surge backwater effects (NJ HMP 2011). The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea, and Gulf of Mexico during the official Atlantic hurricane season of June through November (FEMA, 1997).
Invasive Species	Invasive species as species that are non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm, or harm to human health. Invasive species can be plants, animals, or pathogens. (NISC 2013)
Landslide	A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation reacting to the force of gravity. Landslides may be triggered by both natural and human-caused changes in the environment, including heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, and changes in groundwater levels. Mudflows, mudslides, rockfalls, rockslides, and rock topples are all forms of a landslide. Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, developed hillsides, and areas recently burned by forest and brush fires. (Delano & Wilshusen, 2001).
Lightning Strike	Lightning is a discharge of electrical energy resulting from the build-up of positive and negative charges within a thunderstorm. The flash or "bolt" of light usually occurs within clouds or between clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000°F. On average, 89 people are killed each year by lightning strikes in the United States. (FEMA, 1997).
Pandemic	A pandemic occurs when infection from of a new strain of a certain disease, to which most humans have no immunity, substantially exceeds the number of expected cases over a given period of time. Such a disease may or may not be transferable between humans and animals. (Martin & Martin-Granel, 2006).

Natural Hazards	Definition
Radon Exposure	Radon is a cancer-causing natural radioactive gas that you can't see, smell, or taste. It is a large component of the natural radiation that humans are exposed to and can pose a serious threat to public health when it accumulates in poorly ventilated residential and occupation settings. According to the USEPA, radon is estimated to cause about 21,000 lung cancer deaths per year, second only to smoking as the leading cause of lung cancer (EPA 402-R-03-003: EPA Assessment…, 2003).
Subsidence, Sinkhole	Subsidence is a natural geologic process that commonly occurs in areas with underlying limestone bedrock and other rock types that are soluble in water. Water passing through naturally occurring fractures dissolves these materials leaving underground voids. Eventually, overburden on top of the voids causes a collapse which can damage structures with low strain tolerances. This collapse can take place slowly over time or quickly in a single event, but in either case. Karst topography describes a landscape that contains characteristic structures such as sinkholes, linear depressions, and caves. In addition to natural processes, human activity such as water, natural gas, and oil extraction can cause subsidence and sinkhole formations. (FEMA, 1997).
Tornado, Wind Storm	A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud extending to the ground. Tornadoes are most often generated by thunderstorm activity (but sometimes result from hurricanes or tropical storms) when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The damage caused by a tornado is a result of high wind velocities and wind-blown debris. According to the National Weather Service, tornado wind speeds can range between 30 to more than 300 miles per hour. They are more likely to occur during the spring and early summer months of March through June and are most likely to form in the late afternoon and early evening. Most tornadoes are a few dozen yards wide and touch down briefly, but even small, short-lived tornadoes can inflict tremendous damage. Destruction ranges from minor to catastrophic depending on the intensity, size, and duration of the storm. Structures made of light materials such as mobile homes are most susceptible to damage. Each year, an average of over 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries (NOAA, 2002). A water spout is a tornado over a body of water (American Meteorological Society, 2009).
Wildfire	A wildfire is a raging, uncontrolled fire that spreads rapidly through vegetative fuels, exposing and possibly consuming structures. Wildfires often begin unnoticed and can spread quickly, creating dense smoke that can be seen for miles. Wildfires can occur at any time of the year, but mostly occur during long, dry hot spells. Any small fire in a wooded area, if not quickly detected and suppressed, can get out of control. Most wildfires are caused by human carelessness, negligence, and ignorance. However, some are precipitated by lightning strikes and in rare instances, spontaneous combustion.

Natural Hazards	Definition
Winter Storm	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. A winter storm can range from a moderate snowfall or ice event over a period of a few hours to blizzard conditions with wind-driven snow that lasts for several days. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility and disrupt transportation. (NOAA, 2009).
Animal Disease	Animal diseases may threaten public health, animal health, food production, agriculture, livestock production, wildlife, soils, and rangelands, as well as have cascading effects, including economic impact. The economic impact a large scale animal disease event could have would be catastrophic to the State. Agriculture and aquaculture are a large source or revenue for the State and could impact farmers and state commerce. (NJ HMP 2011).
Civil Unrest	Civil disturbance is a public crisis that occurs with or without warning and that may adversely impact significant portions of the population. These disturbances may be the actions of any number of persons causing disruption of the populace. Civil unrest can be defined to include those acts that involve criminal activity by a group that comprises a threat to the lives and property of others. These disturbances may be precipitated by a specific event, or result from longstanding grievances.
Crop Failure	Crop failure from a multitude of different sources, including but are not limited to, drought, flood, other severe weather events, agro-terrorism, chemical contamination, botanical diseases and wild fire. (NJ HMP 2011).
Dam Failure	A dam is a barrier across flowing water that obstructs, directs, or slows down water flow. Dams provide benefits such as flood protection, power generation, drinking water, irrigation, and recreation. Failure of these structures results in an uncontrolled release of impounded water. Failures are relatively rare, but immense damage and loss of life is possible in downstream communities when such events occur. Aging infrastructure, hydrologic, hydraulic and geologic characteristics, population growth, and design and maintenance practices should be considered when assessing dam failure hazards.
Environmental Hazards (Hazardous Materials Events- fixed, offshore, transportation)	The State of New Jersey is particularly vulnerable to the release of hazardous materials due to the high number of chemical manufacturers in the State, as well as other manufacturing concerns which utilize hazardous materials or create hazardous materials as a bi-product. The release of hazardous materials can serve as a threat to humans, animals and the environment · Hazardous Materials emergencies may occur as a result of accidents in facilities that manufacture, store or use toxic materials or during the transport of chemicals. Hazardous Materials emergencies may also occur as a result of an attack on a manufacturing or storage facility or by the deliberate release of toxic chemicals. · Hazardous Materials Transportation emergencies may occur as a result of traffic collisions, act of terrorism or train derailment. Transport can be over rail, highway, air, or maritime routes. Offshore hazardous materials incidents may result from transportation over the maritime routes, pipelines or facilities involved in offshore mineral exploration.

Natural Hazards	Definition
Fishing Failure	A fishing failure could occur for many different reasons, including over fishing, disease, changing migration patterns or climate change. (NJ HMP 2011).
Levee Failure	A levee is a human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding (Interagency Levee Policy Review Committee, 2006). Levee failures or breaches occur when a levee fails to contain the floodwaters for which it is designed to control or floodwaters exceed the height of the constructed levee.
Nuclear Hazard Events	Nuclear accidents generally refer to events involving the release of significant levels of radioactivity or exposure of workers or the general public to radiation (FEMA, 1997). Nuclear accidents/incidents can be placed into three categories: 1) Criticality accidents which involve loss of control of nuclear assemblies or power reactors, 2) Loss-of-coolant accidents which result whenever a reactor coolant system experiences a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating make-up system, and 3) Loss-of-containment accidents which involve the release of radioactivity. The primary concern following such an incident or accident is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g. death, burns, severe impairment), chronic health effects (e.g. cancer), and psychological effects. (FEMA, 1997).
Terrorism	Terrorism is use of force or violence against persons or property with the intent to intimidate or coerce. Acts of terrorism include threats of terrorism; assassinations; kidnappings; hijackings; bomb scares and bombings; cyber-attacks (computer-based); and the use of chemical, biological, nuclear and radiological weapons. (FEMA, 2009).
Transportation Accidents	Transportation accidents can result from any form of air, rail, water, or road travel. It is unlikely that small accidents would significantly impact the larger community. However, certain accidents could have secondary regional impacts such as a hazardous materials release or disruption in critical supply/access routes, especially if vital transportation corridors or junctions are present (Research and Innovative Technology Administration, 2009). Traffic congestion in certain circumstances can also be hazardous. Traffic congestion is a condition that occurs when traffic demand approaches or exceeds the available capacity of the road network. This hazard should be carefully evaluated during emergency planning since it is a key factor in timely disaster or hazard response, especially in areas with high population density. (Federal Highway Administration, 2009).
Urban Fire	An urban fire involves a structure or property within an urban or developed area. For hazard mitigation purposes, major urban fires involving large buildings and/or multiple properties are of primary concern. The effects of a major urban fire include minor to significant property damage, loss of life, and residential or business displacement. Explosions are extremely rapid releases of energy that usually generate high temperatures and often lead to fires. The risk of severe explosions can be reduced through careful management of flammable and explosive hazardous materials. (FEMA, 1997).

Natural Hazards	Definition
Utility Interruption (Power Outages)	Utility interruption hazards are hazards that impair the functioning of important utilities in the energy, telecommunications, public works, and information network sectors. Utility interruption hazards include the following: • Geomagnetic Storms; including temporary disturbances of the Earth's magnetic field resulting in disruptions of communication, navigation, and satellite systems (National Research Council et al., 1986). • Fuel or Resource Shortage; resulting from supply chain breaks or secondary to other hazard events, for example (Mercer County, PA, 2005). • Electromagnetic Pulse; originating from an explosion or fluctuating magnetic field and causing damaging current surges in electrical and electronic systems (Institute for Telecommunications Sciences, 1996). • Information Technology Failure; due to software bugs, viruses, or improper use (Rainer Jr., et al, 1991). • Ancillary Support Equipment; electrical generating, transmission, system-control, and distribution-system equipment for the energy industry (Hirst & Kirby, 1996). • Public Works Failure; damage to or failure of highways, flood control systems, deep-water ports and harbors, public buildings, bridges, dams, for example (United States Senate Committee on Environment and Public Works, 2009). • Telecommunications System Failure; Damage to data transfer, communications, and processing equipment, for example (FEMA, 1997) • Transmission Facility or Linear Utility Accident; liquefied natural gas leakages, explosions, facility problems, for example (United States Department of Energy, 2005) • Major Energy, Power, Utility Failure; interruptions of generation and distribution, power outages, for example (United States Department of Energy, 2000).
Climate Change	Climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties. These changes persist for an extended period, typically decades or longer (IPCC, 2007). Climate change can alter the frequency and intensity of hazards such as wildfire, extreme temperature, drought, or flooding, particularly impacting sea level rise and coastal flooding.

4.3 Hazard Profiles and Vulnerability Analysis

NATURAL HAZARDS

4.3.1 Coastal Erosion

Coastal erosion is a process of shoreline recession due to natural or man-made causes. Erosion naturally results from sea level rise, flooding, strong wave action or large storms but can also be caused by shore protection structures, inappropriate land use, and other alterations along the shoreline. Erosion can destroy personal, commercial, and public property along the coast. Over half of the US population lives in coastal counties, resulting in numerous vulnerable properties (NOAA, 2012).

4.3.1.1 Location and Extent

Ocean County's coastal and bayside communities from Point Pleasant Beach to Long Beach are subject to coastline changes due to coastal erosion. Coastal erosion can be classified as either chronic erosion or episodic erosion. Chronic erosion is characterized as the gradual recession of the shoreline over a period of decades. Episodic erosion occurs in response to flood events or coastal storms with a rapid recession of the shoreline (DNREC, 2013). Across the US, erosion rates can vary greatly; it is not uncommon to find erosion rates ranging from 25 feet per year on barrier islands in the Southeast to 50 feet per year along the Great Lakes (NOAA, 2012). However, coastal erosion rates can also be much lower and will depend on human activities, severe storms, flooding, and sea level rise in a given area.

Generally, coastal erosion rates will increase with increases in sea level rise rates. While actions such as construction of seawalls or beach nourishment may mitigate coastal erosion in an attempt to fix the location of the present day open coast shoreline, certain communities will become increasingly vulnerable to sea level rise in low-lying bayside locations. Barnegat Light Borough, Beach Haven Borough, and Surf City Borough serve as examples of this bayside inundation exposure.

Erosion can also impact the estuarine wetland shorelines along the bay in Ocean County. Wetland shoreline erosion is also an increasingly important element of erosion. Wetland plants serve as physical barriers to waves and anchor soils, making soils less likely to wash away. In 2012, NJDEP's Coastal Management Office modeled shoreline retreat along the western side of Barnegat Bay. This GIS exercise showed an average shoreline loss of 75 feet of retreat with an overall range of 21 to 107 feet from 1995 to 2007 (NJCMO, 2012). After Hurricane Sandy, there has been a great deal of attention placed on preventing shoreline loss and using living shorelines to reduce wetland losses and protect wetlands.

The coastal areas of Ocean County are located in the following municipalities: the Township of Barnegat, the Borough of Barnegat Light, the Borough of Bay Head, the Borough of Beach Haven, the Township of Berkeley, the Township of Brick, the Township of Eagleswood, the Borough of Harvey Cedars, the Township of Lacey, the Borough of Lavallette, the Township of Little Egg Harbor, the Township of Long Beach, the Borough of Mantoloking, the Township of Ocean, the Borough of Point Pleasant Beach, the Borough of Point Pleasant, the Borough of Seaside Heights, the Borough of Seaside Park, the Borough of Ship Bottom, the Township of

Stafford, the Borough of Surf City, the Township of Toms River and the Borough of Tuckerton. All of these jurisdictions are located either on the ocean or the bay front. The landward (i.e., bay) side of open-coast barrier island communities are particularly vulnerable to sea level rise due to coastal erosion.

Additionally, the Borough of Beachwood, the Borough of Island Heights, the Borough of Ocean Gate, the Borough of Pine Beach and the Borough of South Toms River are located on the Toms River and are occasionally impacted by coastal storms. Jackson and Plumsted Township have also experienced problems with coastal erosion.

4.3.1.2 Range of Magnitude

Ocean County has the potential for severe coastal storms that could and have caused devastation. Erosion during these storms is generally moderate, but can be severe. Coastal erosion will result in accumulated sediment in some areas and in depletion of sediment in others (CFOS, 2013). This could impact both housing and the population since the bulk of the residences in Ocean County are on or near waterfront property. The year-round population of almost six hundred thousand people can swell to nearly a million in the summer.

Figure 4.3.1-1 Heavy erosion displayed at beach in Holgate, NJ (CRC, 2007)

Figure 4.3.1-2 Estuarine wetlands shoreline loss due to erosion (NJ MACWA 2012)

Estuarine wetlands shoreline loss due to erosion is a result of a dynamic interaction between the physical processes (waves and tides) and the geologic composition of a specific location and sea level rise. Many of the changes observed over days to years are caused by storms or changes in the amount of sediment available to sustain the shore (NJ MACWA 2012).

The marsh surface must also maintain elevation through sediment or organic matter accretion to keep pace with sea level rise. Results of long term coastal wetlands monitoring being conducted by the Barnegat Bay Partnership is showing that under current conditions wetlands accretion is not keeping pace with the sea level rise (Barnegat Bay Partnership, 2017).

4.3.1.3 Past Occurrence

Coastal erosion has occurred during many past storms in Ocean County. The following list enumerates significant past events of erosion.

Table 4.3.1-1 Significant Past Erosion Events in Ocean County (NCDC, 2017)

Date	Type of Event	Origin of Event	Description
11/1/1755	Earthquake	Lisbon, Portugal	Caused a tidal wave on the east coast of the United States and likely impacted Ocean County.
6/18/1871	Earthquake	Long Island, New York	Caused a tidal wave that likely impacted Ocean County.
8/10/1884	Earthquake	Rockaway Beach, New York	Caused a tidal wave that likely impacted Ocean County. The earthquake measured 5.6 on the Richter scale.
6/17/1893	Hurricane	Within One Hundred and Eight Miles of the Coast	With winds of seventy-seven miles per hour.
8/24/1893	Hurricane	Within One Hundred Miles of the Coast	With winds of ninety-eight miles per hour.
8/29/1893	Hurricane	Within One Hundred Miles of the Coast	With winds of eighty-one miles per hour. It should be noted that this was the second hurricane to strike within five days.
9/30/1894	Hurricane	Within Seventy-Seven Miles of the Coast	With winds of seventy-nine miles per hour.
10/10/1894	Hurricane	Within Twenty-Three Miles of the Coast	With winds of seventy-four miles per hour.
9/1/1895	Earthquake	High Bridge, New Jersey	Caused a tidal wave that impacted Ocean County.
9/16/1903	Hurricane	Within Thirteen Miles of the Coast	With winds of eighty-four miles per hour.
9/15/1904	Hurricane	Within Twenty-Two Miles of the Coast	With seventy-five mile per hour winds.
6/9/1913	Earthquake	Longport, New Jersey	Is believed to have caused significant tidal surges in Ocean County.
8/6/1923	Earthquake	Rockaway Beach, New York	Is believed to have caused significant tidal surges in Ocean County.

Date	Type of Event	Origin of Event	Description
8/8/1924	Earthquake	Coney Island, New York	Is believed to have caused significant tidal surges in Ocean County.
6/1/1927	Earthquake	Asbury Park, New Jersey	The earthquake had three tremors that measured between 3.8 and 5.3 on the Richter scale. Damages were reported as far south as Toms River. It is likely that some of these damages were caused by tidal surges.
8/19/1931	Earthquake	Atlantic City, New Jersey	Is believed to have caused significant tidal surges in Ocean County.
9/17/1933	Hurricane	Within One Hundred and Nine Miles of the Coast	With eighty-five mile per hour winds.
9/8/1934	Hurricane	Within Fifty Miles of the Coast	With seventy-seven mile per hour winds.
9/18/1936	Hurricane	Within Fifty-One Miles of the Coast	With ninety-eight mile per hour winds.
9/21/1938	Hurricane	Within Eighty-Three Miles of the Coast	With one hundred and one mile per hour winds. A significant tidal surge was reported.
9/14/1944	Hurricane	Within Forty-Seven Miles of the Coast	With ninety-six mile per hour winds. A significant tidal surge was reported.
8/14/1953	Hurricane Barbara	Within Eighty-Five Miles of the Coast	With eighty-six mile per hour winds.
8/31/1954	Hurricane Carol	Within Sixty-Three Miles of the Coast	With ninety-eight mile per hour winds.
9/11/1954	Hurricane Edna	Within One Hundred and Fourteen Miles of the Coast	With one hundred and four mile per hour winds. It should be noted that this was the second hurricane to impact Ocean County in twelve days.
8/29/1958	Hurricane Daisy	Within One Hundred and Twenty-Four Miles of the Coast	With one hundred and twenty-six mile per hour winds.
9/12/1960	Hurricane Donna	Within Forty-Seven Miles of the Coast	With one hundred and eight miles per hour winds.

Date	Type of Event	Origin of Event	Description
3/6/1962 to 3/8/1962	Nor'easter	Ocean County	Caused the most significant and catastrophic damage in known history. It occurred over three days with five high tides and seventy-three mile per hour winds. Long Beach Island became five islands. The Borough of Harvey Cedars suffered the most damage on the east coast. One crevice, at 79th Street, where the ocean met the bay left a crevice sixty to seventy feet wide and more than twenty feet deep. More than fifty per cent of the structures in town were destroyed. A U.S. destroyer being towed from Bayonne, New Jersey to Newport, Rhode Island ended up on the south end of Long Beach Island when the cable broke. Three fishing trawlers from the Borough of Point Pleasant never came back. Southern Regional High School was the largest shelter opened and served eight thousand meals and another two thousand sandwiches "to go" for residents and responders. Ten deaths were reported in New Jersey – three of which were in Ocean County. Long Beach Police Chief Angelo Leonetti, Township Commissioner Kenneth Chipman and Robert Osborne who owned a news agency lost their lives attempting to rescue others.
9/16/1967	Hurricane Doria	Within One Hundred and Thirteen Miles of the Coast	With eighty-one mile per hour winds.
8/10/1976	Hurricane Belle	Within Forty-Three Miles of the Coast	With ninety-eight mile per hour winds.
March '84	Nor'easter	The Northern Barrier Island and Long Beach Island	Four homes suffered major damage.
9/27/1985	Hurricane Gloria	Within Twenty-Six Miles of the Coast	With ninety-nine mile per hour winds.
8/18/1991	Hurricane Bob	Within Seventy-Four Miles of the Coast	With one hundred and fifteen mile per hour winds.
10/31/1991	Nor'easter	Ocean County	
1/4/1992	Nor'easter	Ocean County	
12/11/1992	Nor'easter	Ocean County	Lasting through eleven high tides. Known as the "storm that stole Christmas"

Date	Type of Event	Origin of Event	Description
2/12/2006	Nor'easter	Ocean County	Beach erosion along the coast and widespread power outages, especially on Long Beach Island.
9/2/2006	Tropical Storm Ernesto	Ocean County	Induced coastal flooding and erosion. Vertical cuts averaged 3-6 feet with widths of up to 100 feet wide from Island Beach State park northward. Cuts averaged 2-4 feet from Barnegat Light south.
4/15/2007	Nor'easter	Ocean County	Caused severe erosion in Harvey Cedars and cuts of 2-4 feet elsewhere in the county.
11/3/2007	Hurricane Noel	Long Beach Township and Harvey Cedars Borough	Coastal erosion
12/16/2007	Coastal Storm	Harvey Cedars Borough, Surf City Borough, Long Beach Township	The worst erosion occurred in Harvey Cedars.
11/10/2009	"Nor-Ida" Nor'easter	Ocean County	Extensive beach erosion along the coast.
3/13/2010	Coastal Flooding	Ocean County	Caused coastal erosion events with 3-5 foot vertical cuts.
10/29/2012	Hurricane Sandy	Ocean County	Made landfall near Brigantine, New Jersey, causing beach erosion.
10/10/2013	High Wind	Southern New Jersey	Periods of heavy rain and strong winds caused some beach erosion.
1/3/2014	Winter Storm	Ocean County and Monmouth County	Strong winds during the storm caused tidal flooding with beach erosion.
12/9/2014	Nor'easter	South and Northwest New Jersey	The storm caused minor to moderate beach erosion. In Ocean County a nine foot drop-off was reported along the beach.
10/2/2015 to 10/3/2015	High Wind	Ocean, Cape May and Monmouth Counties	The beaches at Mantoloking and Brick were closed following the storm due to dangerous drop-offs between a protective steel flood wall and the beach. The severe beach erosion at these locations resulted in drop-offs ranging between 5 to 10 feet. In Toms River on the northern barrier island a breach reportedly occurred in the temporary dune line the township had constructed.
1/22/2016 to 1/24/2016	Winter Storm	South and Northwest New Jersey	Out of 66 municipalities surveyed for beach and/or dune erosion by NJDEP Bureau of Coastal Engineering, 28 had minor damage, 21 had moderate damage and 19 had major damage. A 100 foot flag pole

Date	Type of Event	Origin of Event	Description
			was knocked off its base in Ocean County due strong winds.
1/22/2017	Nor'easter	Southern New Jersey	Erosion was evident along the shore and caused certain beach access areas to be temporarily closed down.

Wetland erosion is more difficult to associate with a single storm or flooding event. However, as mentioned in Section 4.3.1, wetland retreat averaged 75 feet between 1995 and 2007.

According to Stockton University Coastal Research Center's 2017 report, *An Analysis of Thirty Years' Study of Sand Redistribution and Shoreline Changes in New Jersey's Four Coastal Counties Raritan Bay, The Atlantic Coast, and Delaware Bay*, the shoreline in the northern Ocean County segment has not been the recipient of significant amounts of beach nourishment sand over the past 30 years. Beach or dune restoration projects that occurred in these segments were completed by local efforts. In contrast, sections of the Long Beach Island shoreline and southern portions of the county have received large quantities of beach nourishment sand. As part of the on-going research conducted annually by the Coastal Research Center, twenty-eight beach profile sites are analyzed annually as part of the New Jersey Beach Profile Network (NJBPN). These sites in Ocean County are illustrated in Figure 4.3.1-3. Figure 4.3.1-4 shows the cumulative volume and shoreline position changes at each of the Ocean County profile locations from the earliest dataset to fall 2016. This chart clearly depicts the impact of federal involvement in shore protection in the southern portion of the County.

Figure 4.3.1-3 **New Jersey Beach Profile Network (NJBPN) location in Ocean County (Stockton University, Coastal Research Center 2017)**

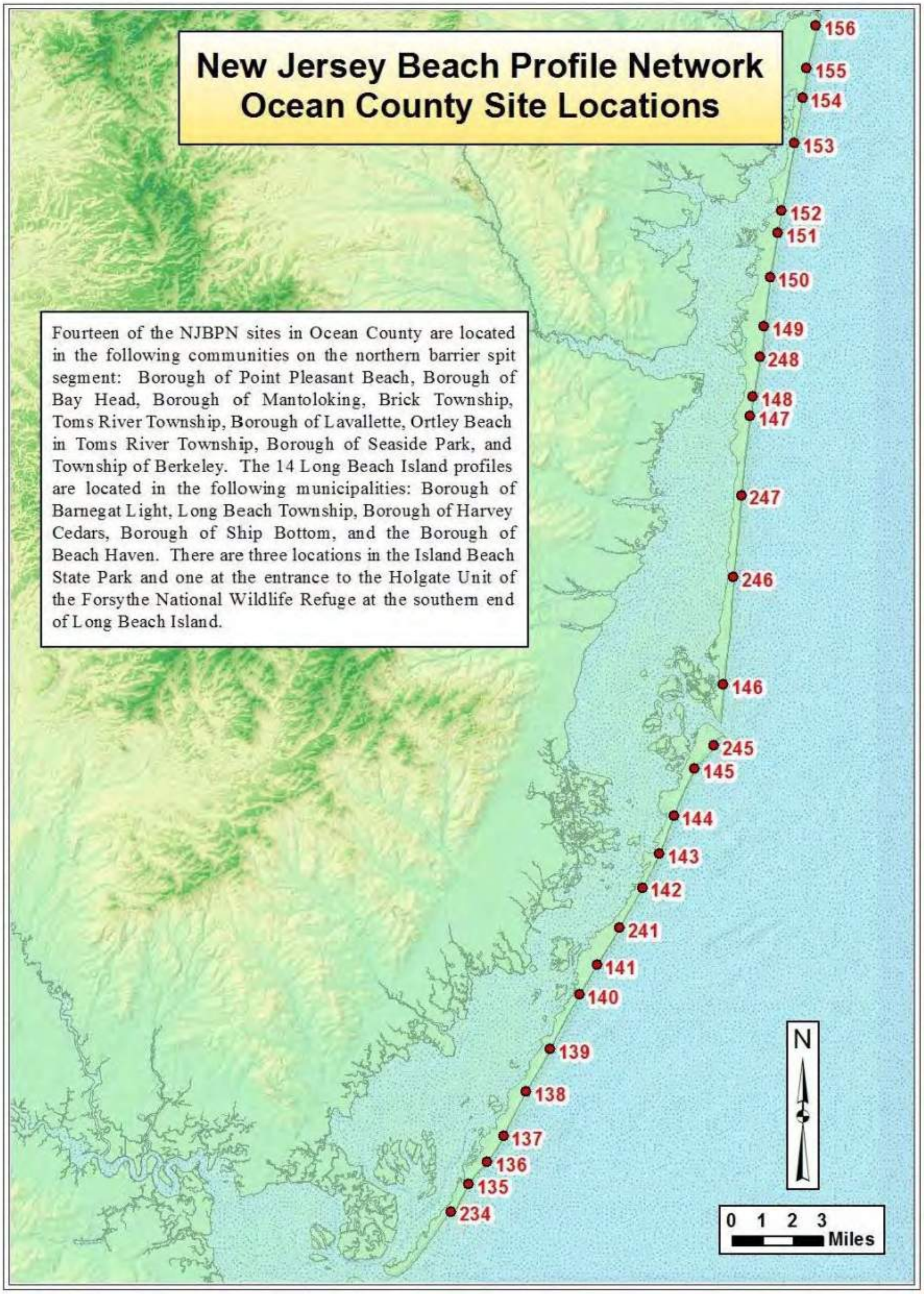
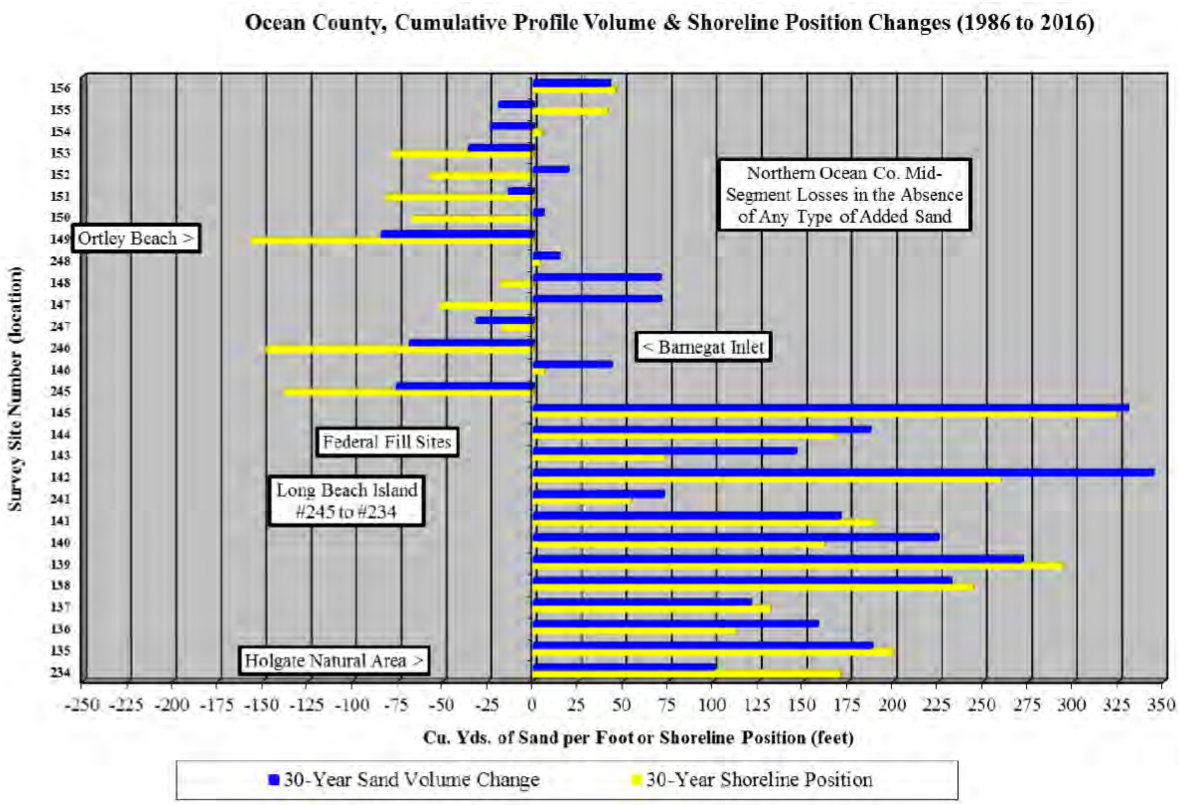


Figure 4.3.1-4 **Cumulative volume and shoreline changes over 30 years at each NJBPN location in Ocean County (Stockton University, Coastal Research Center 2017)**



4.3.1.4 Future Occurrence

The hydrological processes along Ocean County's Atlantic Ocean and Barnegat Bay shorelines are continuous but rates of erosion can vary because of natural and human-caused influences. Overall, the future occurrence of coastal erosion in Ocean County can be considered highly likely, as defined by the Risk Factor methodology probability criteria.

Furthermore, sea level rise will impact coastal erosion as well as other hazards. Projections of future accelerated level are uncertain and, in fact, a small deceleration has been reported in some studies (Douglas, 1992 & Houston & Dean, 2011). Nonetheless, broad agreement is found in existing climate science literature that sea level rise rates may increase with increases in greenhouse gas concentrations. The U.S. Global Change Research Program's Synthesis and Assessment Product 4.1 which states, "thoughtful precaution suggests that a global sea level rise of 1 meter to the year 2100 should be considered for future planning and policy decisions" (CCSP, 2009).

Local and regional sea level projections for New Jersey are summarized in a Rutgers University Science and Technical Advisory Panel (STAP) Report, entitled, *Assessing New Jersey's*

*Exposure to Sea-Level Rise and Coastal Storms: Report of the New Jersey Climate Adaptation Alliance Science and Technical Advisory Panel (*Kopp et al., 2016). This STAP Report was requested by the New Jersey Climate Adaptation Alliance, which is a network of policymakers, public and private sector practitioners, academics, nongovernmental organizations, and business leaders designed to build climate change preparedness capacity in New Jersey. Projected sea level rise estimates for New Jersey from the STAP Report are presented in Table 4.3.1-2.

Table 4.3.1-2 Projected Seal Level Rise for New Jersey (Kopp et al., 2016)

	Central Estimate	Likely Range	1-in-20 Chance	1-in-200 Chance	1-in-1000 Chance
Year	*50% probability SLR meets or exceeds…*	*67% probability SLR is between…*	*5% probability SLR meets or exceeds…*	*0.5% probability SLR meets or exceeds…*	*0.1% probability SLR meets or exceeds…*
2030	0.8 ft	0.6 – 1.0 ft	1.1 ft	1.3 ft	1.5 ft
2050	1.4 ft	1.0 – 1.8 ft	2.0 ft	2.4 ft	2.8 ft
2100 Low emissions	2.3 ft	1.7 – 3.1 ft	3.8 ft	5.9 ft	8.3 ft
2100 High emissions	3.4 ft	2.4 – 4.5 ft	5.3 ft	7.2 ft	10 ft
Estimates are based on Kopp et al. (2014). Columns correspond to different projection probabilities. For example, the 'Likely Range' column corresponds to the range between the 17th and 83rd percentile; consistent with the terms used by the Intergovernmental Panel on Climate Change (Mastrandrea et al., 2010). All values are with respect to a 1991-2009 baseline. Note that these results represent a single way of estimating the probability of different levels of SLR; alternative methods may yield higher or lower estimates of the probability of high-end outcomes.					

The STAP Report states, "it is likely that coastal areas of New Jersey will experience sea-level rise between 1.0 and 1.8 feet prior to 2050, regardless of future greenhouse gas emissions. Under a worst-case scenario, these communities could see as much as 2.8 feet of sea-level rise by 2050." Under a high-emissions scenario, it is likely that coastal areas of New Jersey will experience between 2.4 and 4.5 feet of sea-level rise by 2100; and, under a low-emissions scenario, it is likely that coastal areas of New Jersey will experience between 1.7 and 3.1 feet of sea-level rise by 2100.

The range of sea level rise estimates for 2050 are simulated for each coastal community in Figure 4.3.1-5 to Figure 4.3.1-32.

Figure 4.3.1-5 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Barnegat Light Borough**

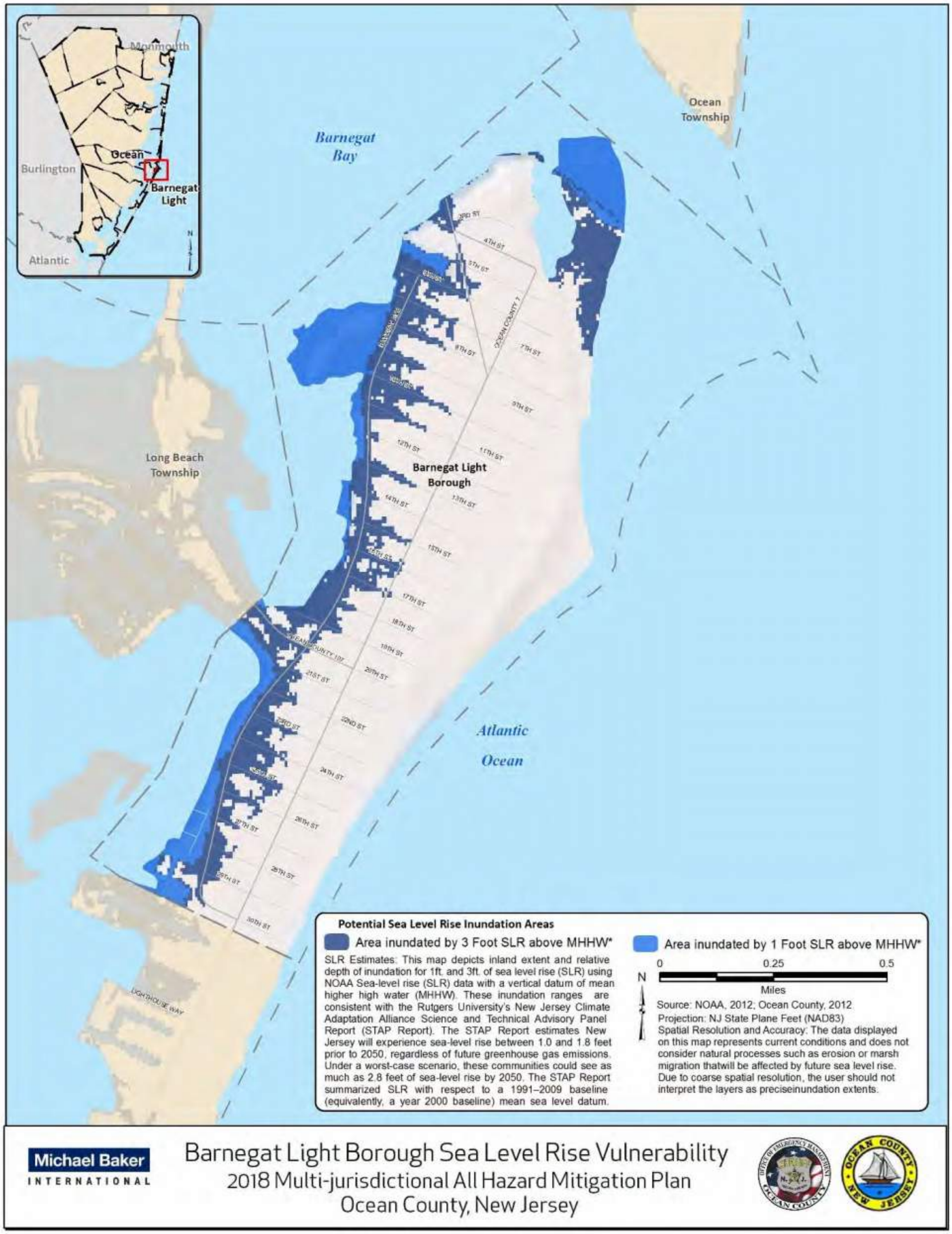


Figure 4.3.1-6 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Barnegat Township**

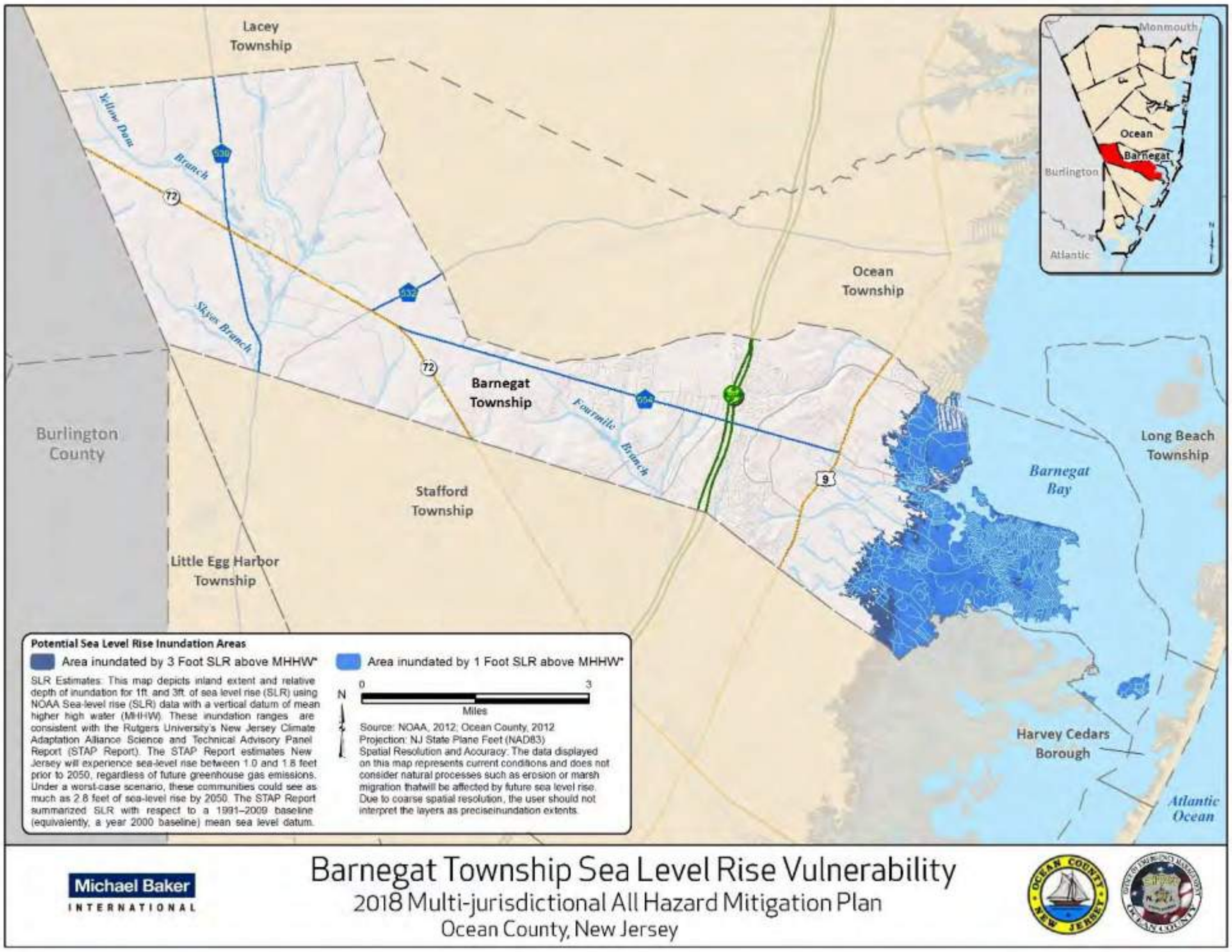


Figure 4.3.1-7 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Bay Head Borough.**

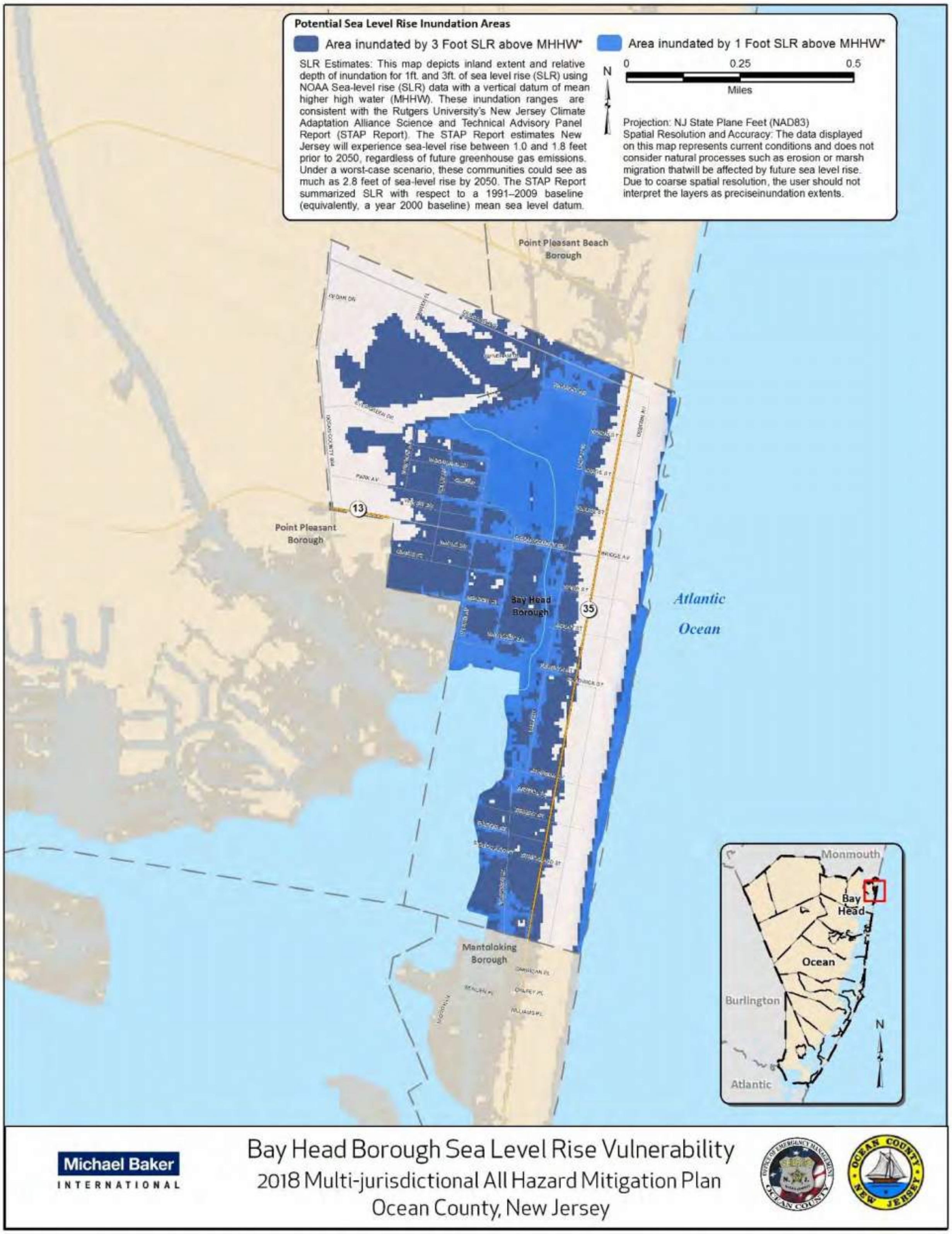


Figure 4.3.1-8 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Beach Haven Borough**

Figure 4.3.1-9 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Beachwood Borough.**

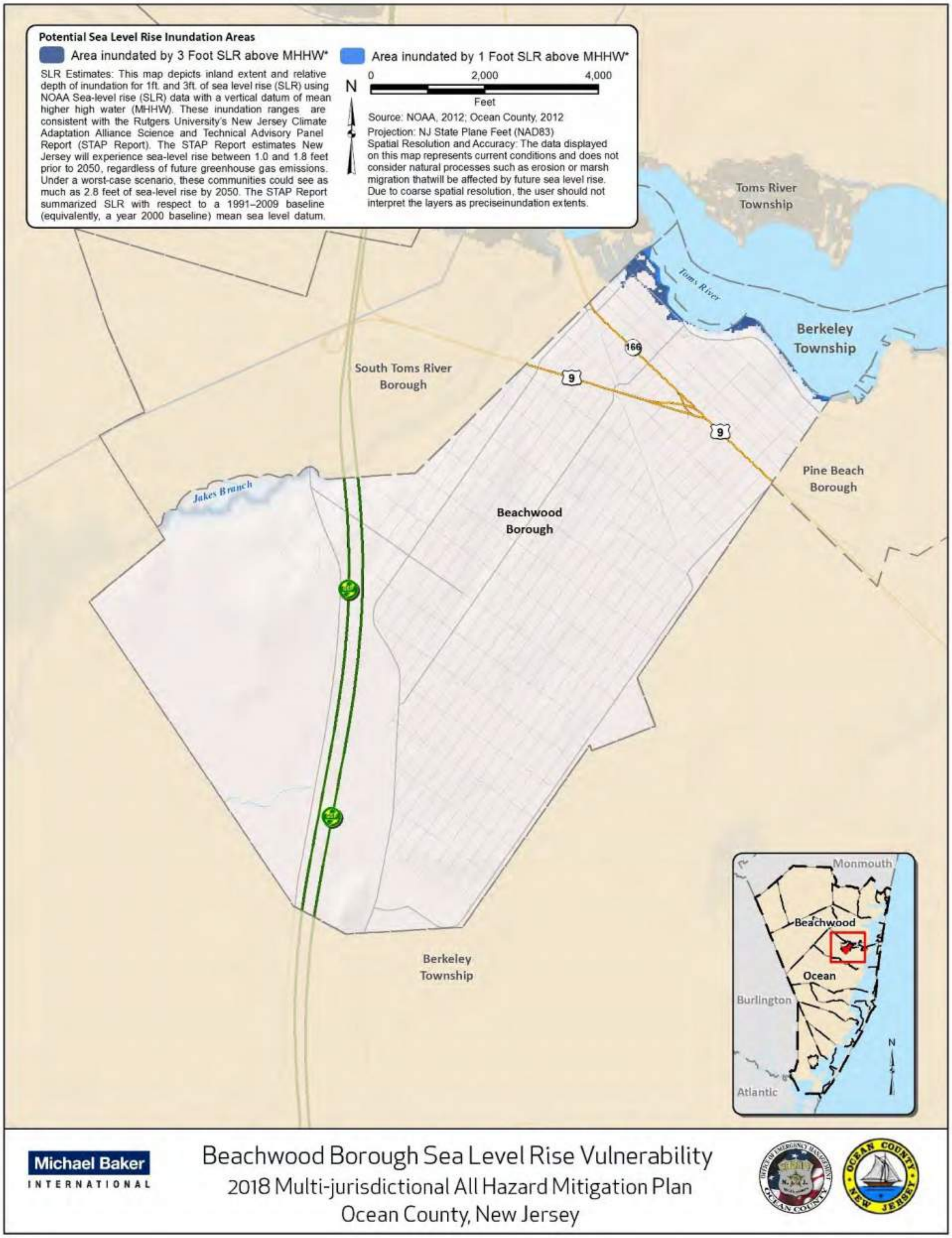


Figure 4.3.1-10 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Berkeley Township.**

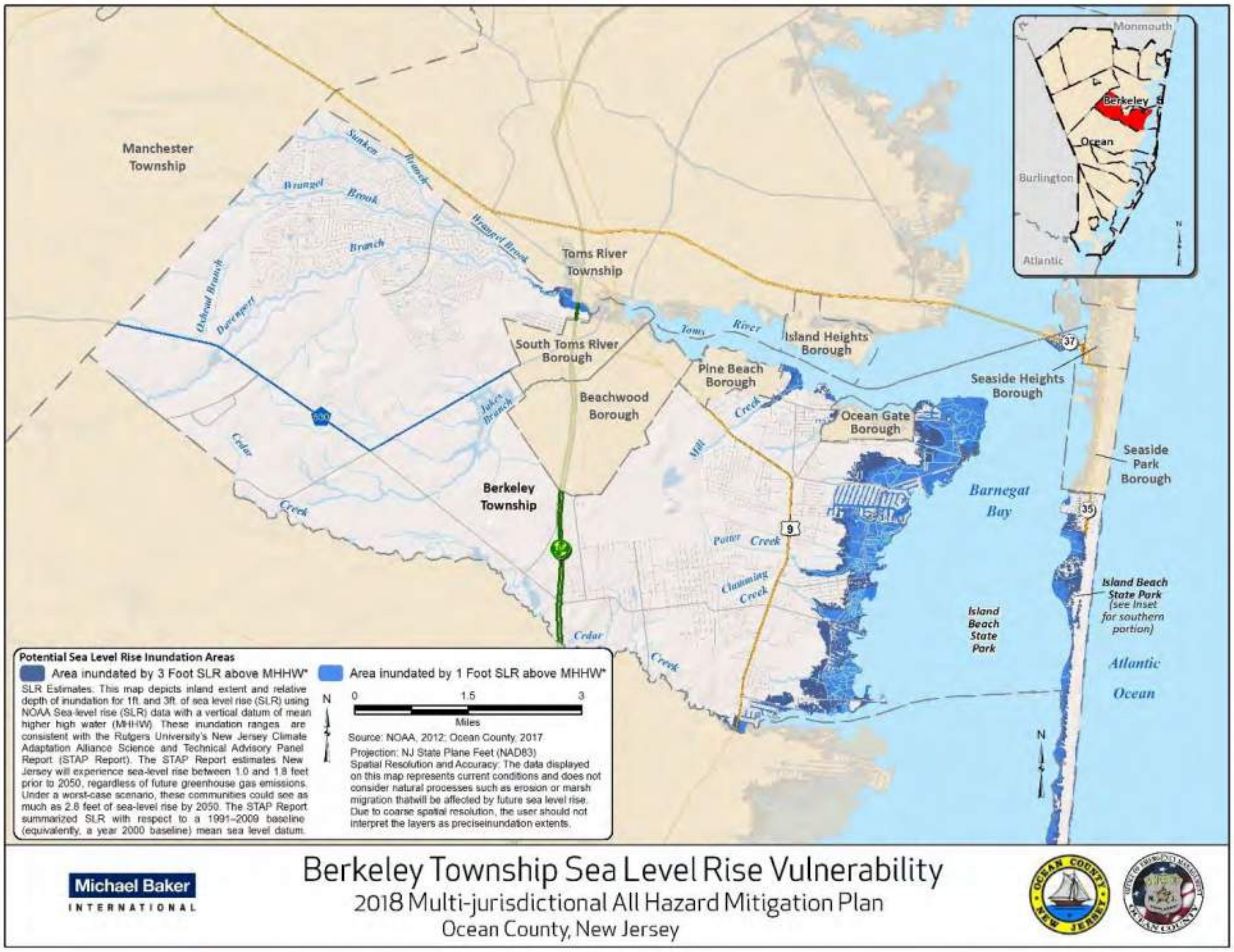


Figure 4.3.1-11 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Brick Township**

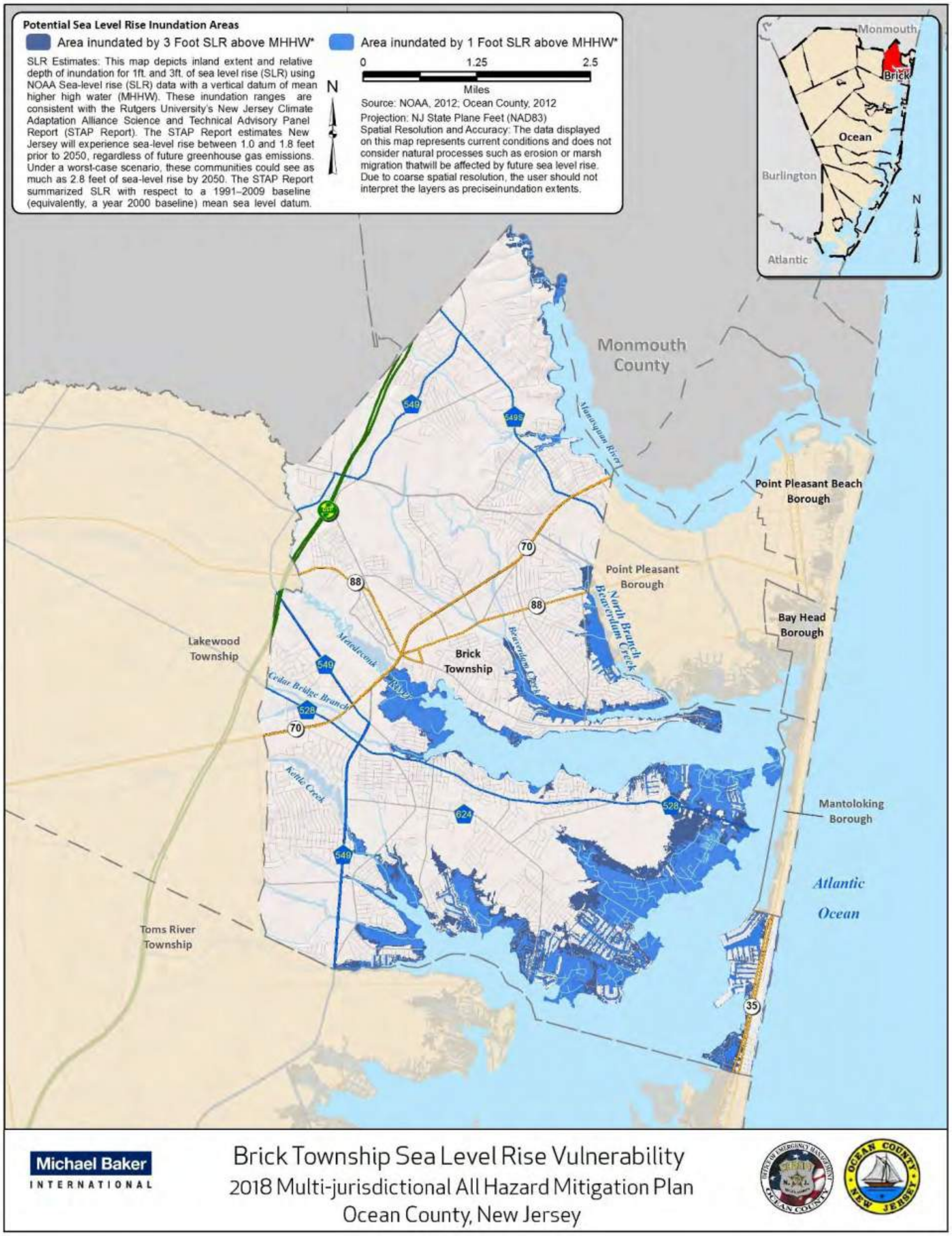


Figure 4.3.1-12 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Eagleswood Township.**

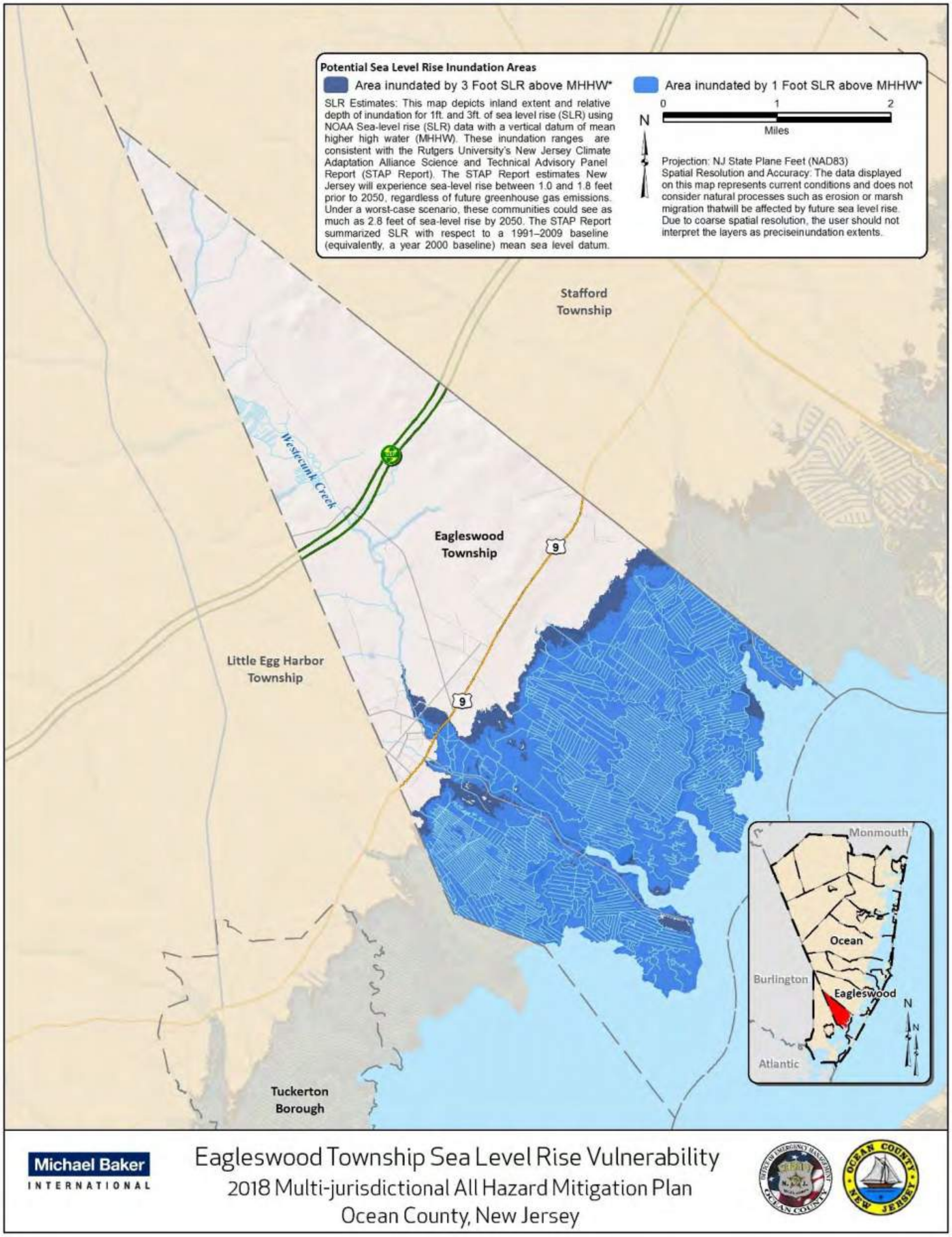


Figure 4.3.1-13 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Harvey Cedars Borough.**

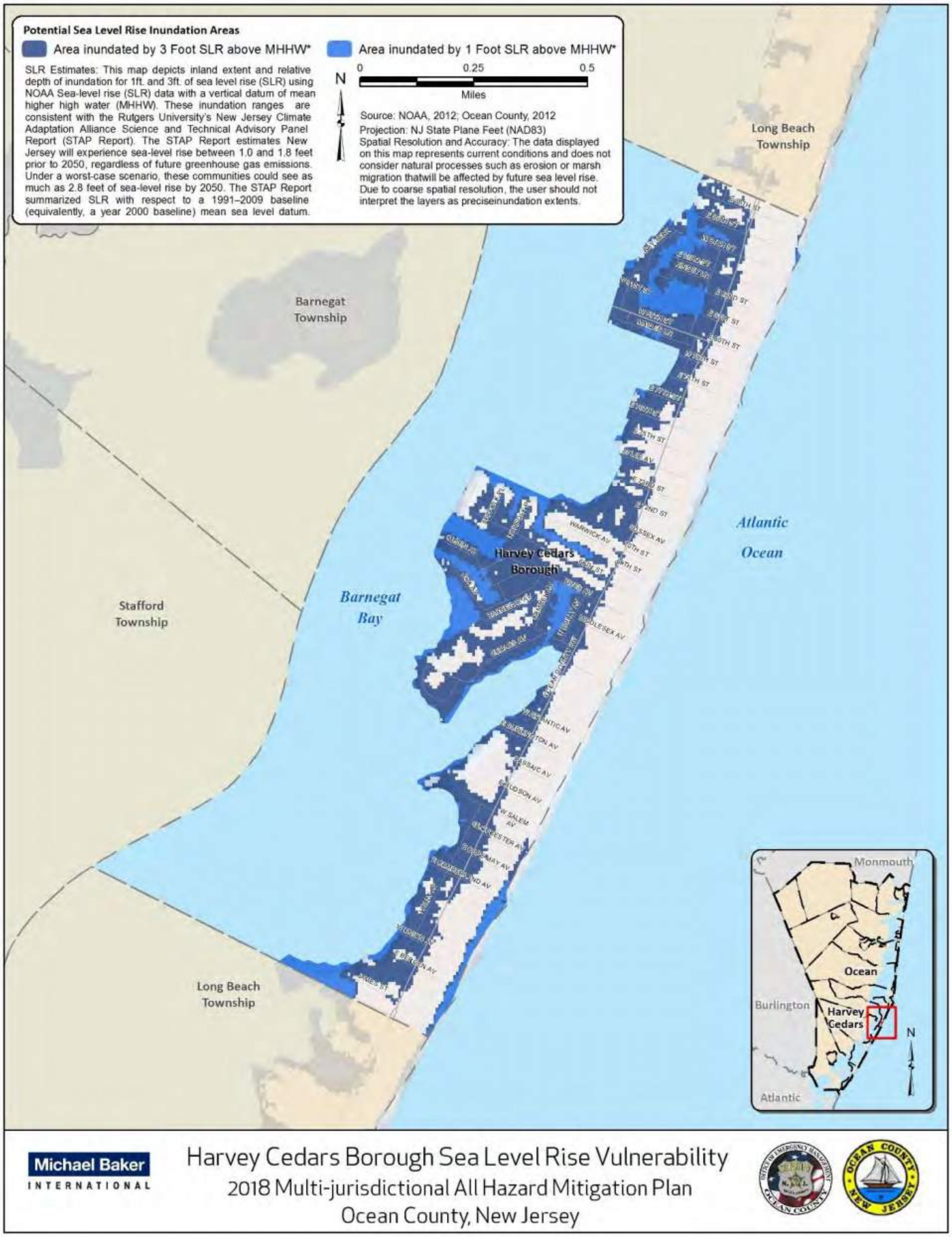


Figure 4.3.1-14 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Island Heights Borough.**

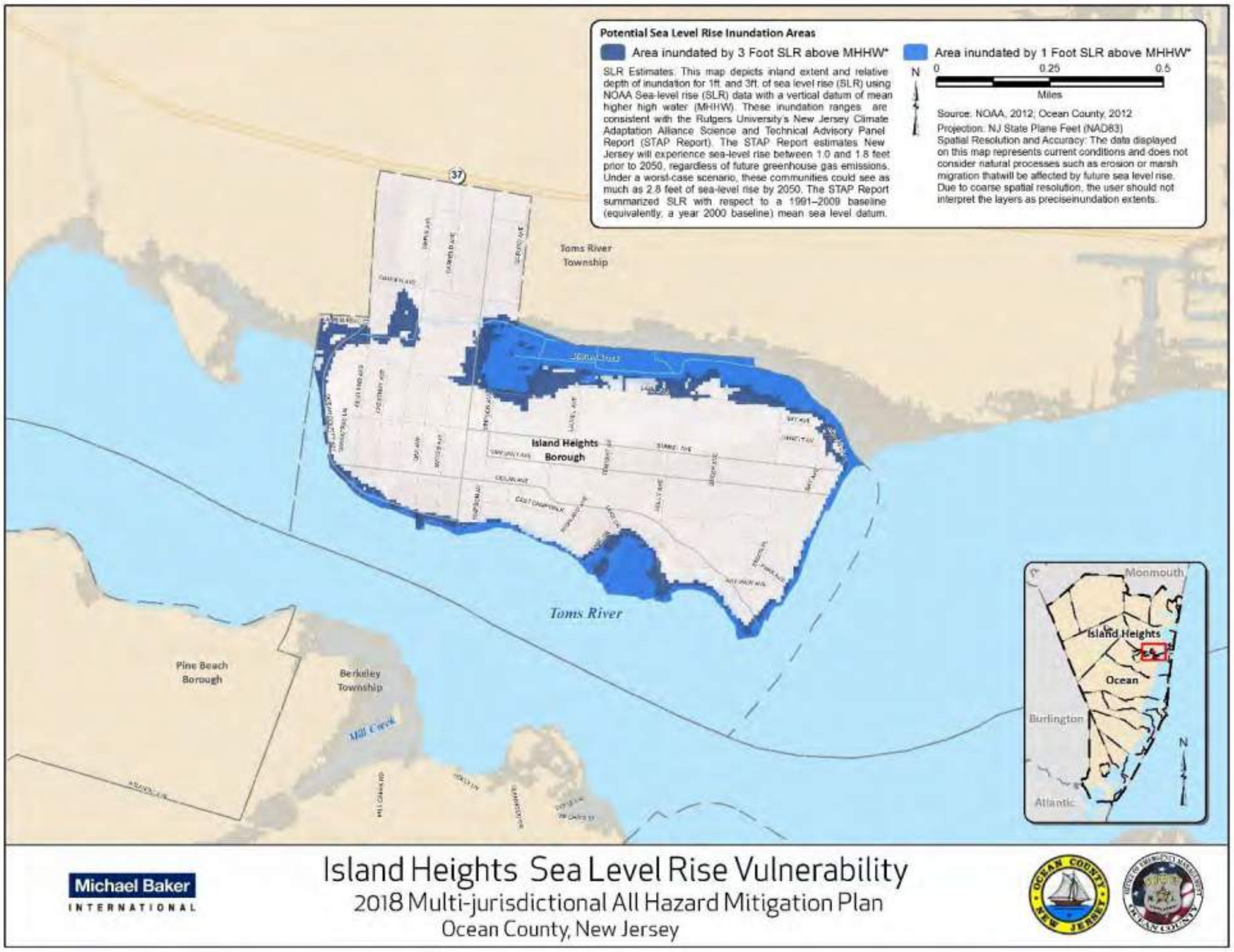


Figure 4.3.1-15 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Lacey Township.**

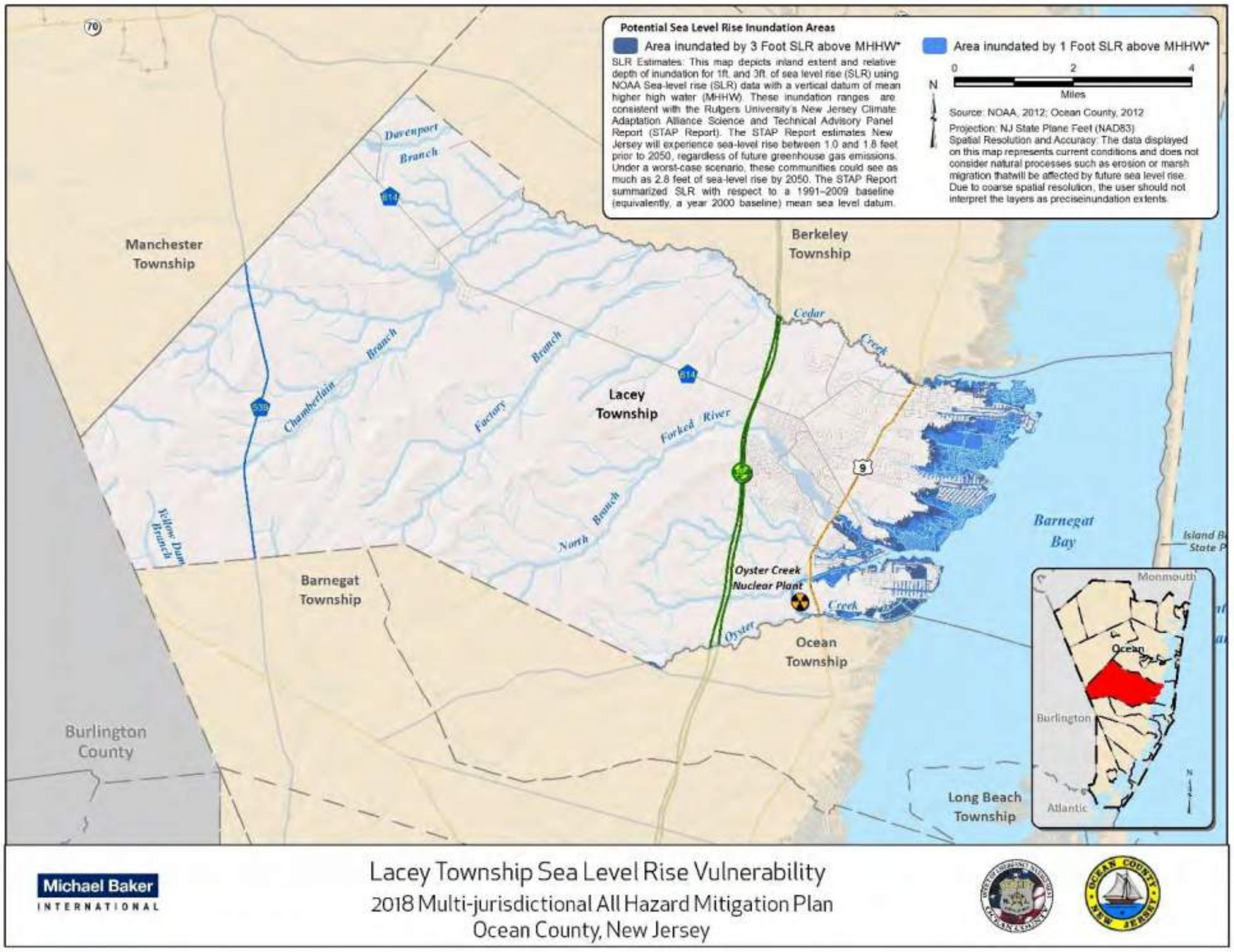


Figure 4.3.1-16 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Lavallette Borough.**

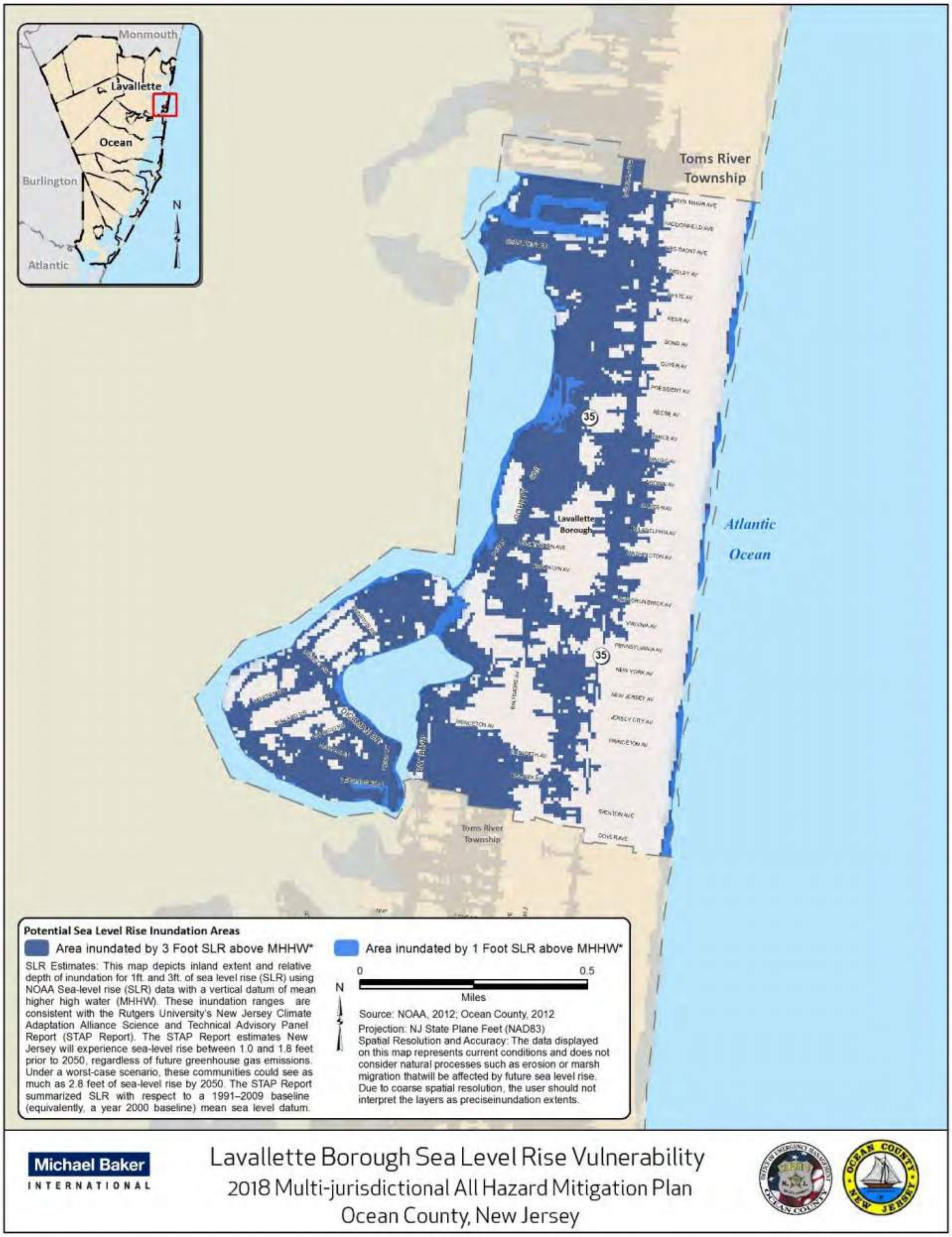


Figure 4.3.1-17 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Little Egg Harbor Township.**

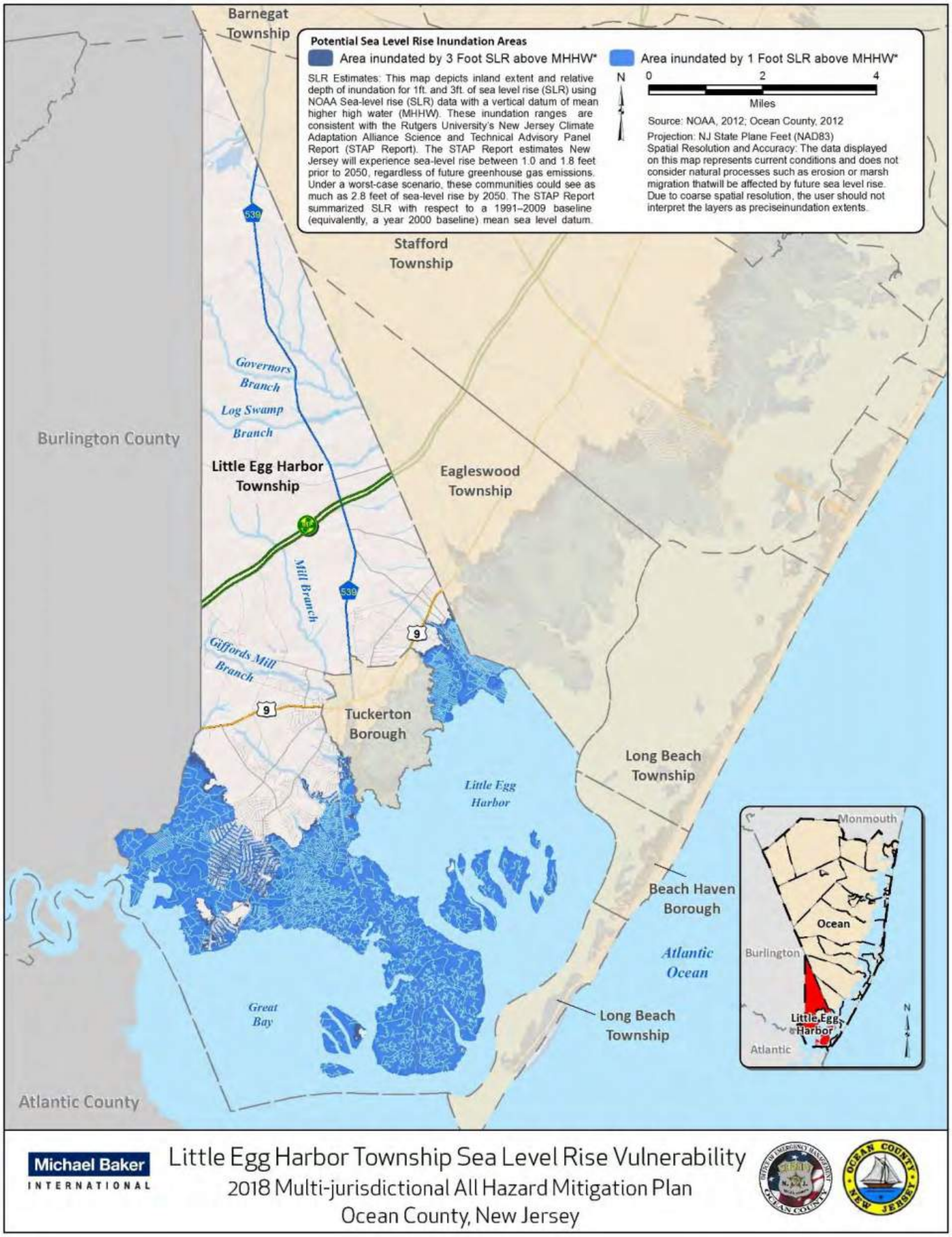


Figure 4.3.1-18 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Long Beach Township.**

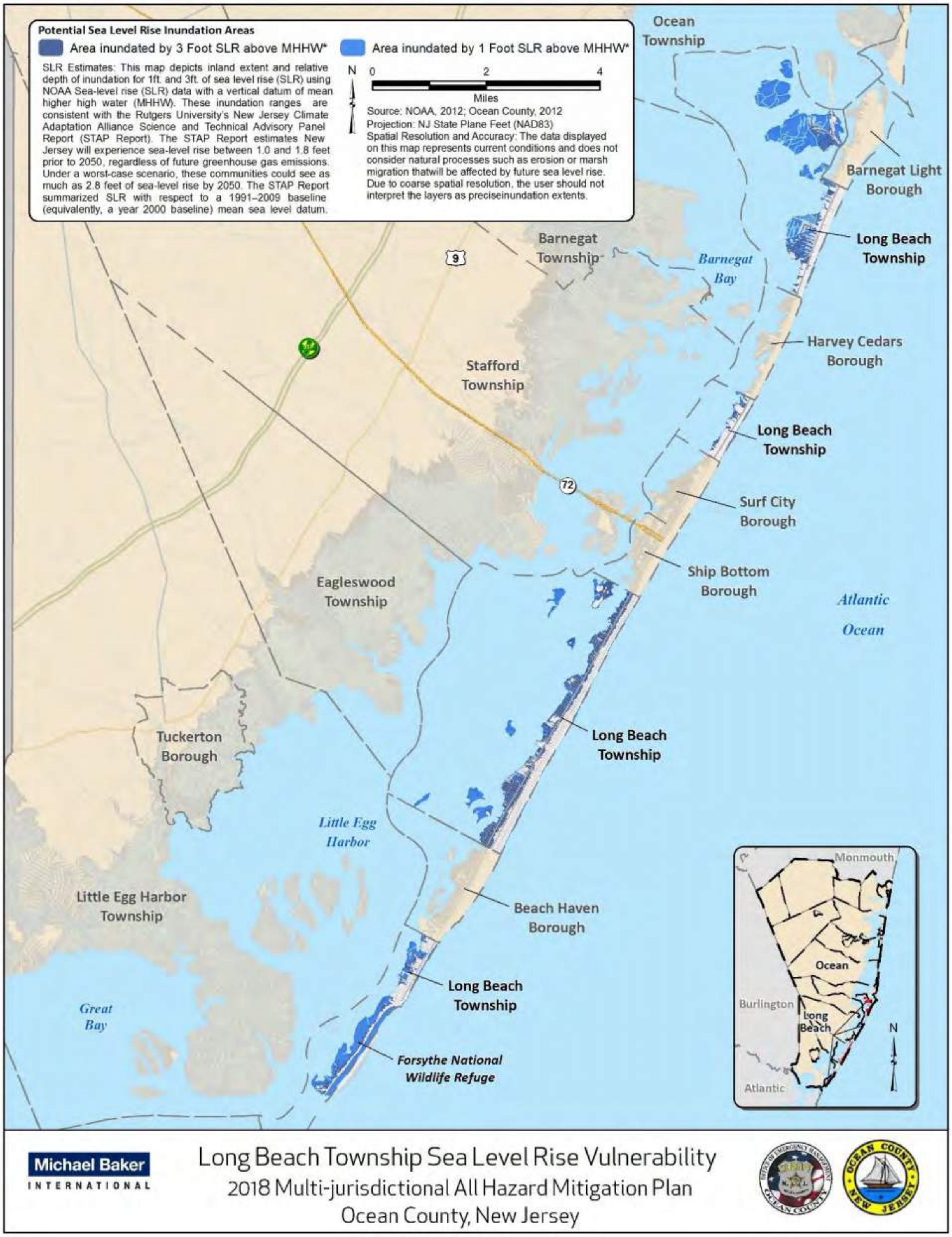


Figure 4.3.1-19 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Mantoloking Township.**

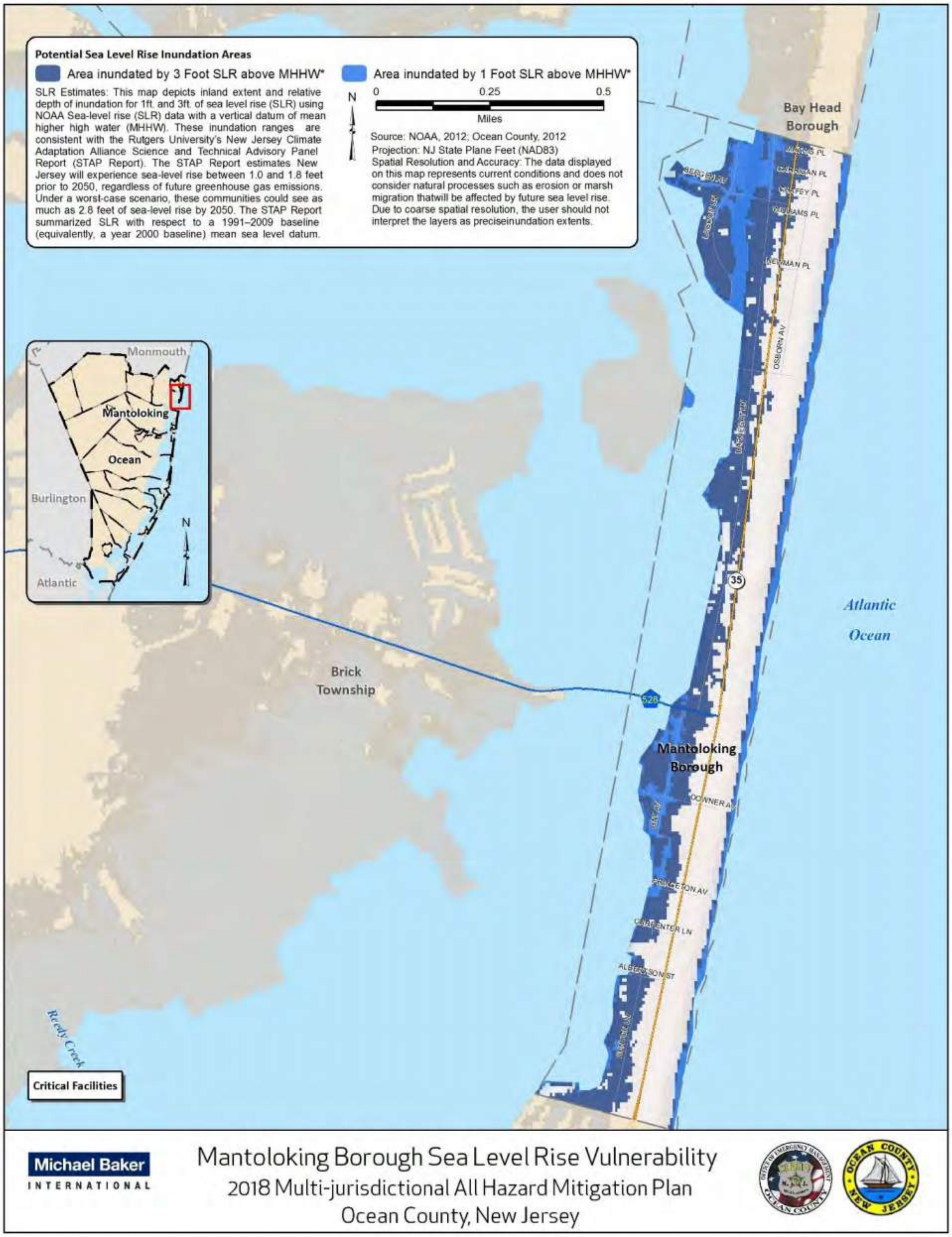


Figure 4.3.1-20 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Ocean Gate Borough.**

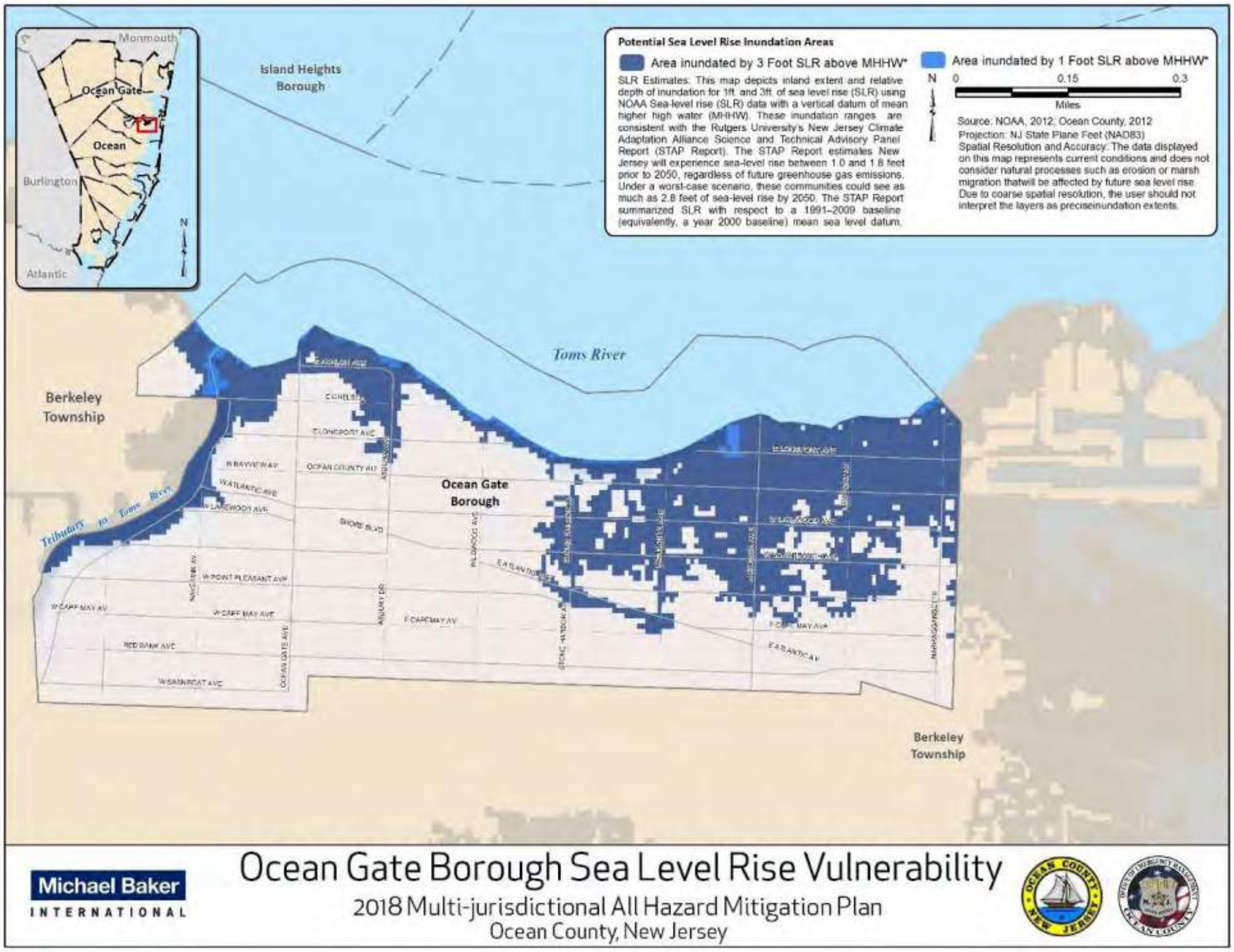


Figure 4.3.1-21 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Ocean Township**

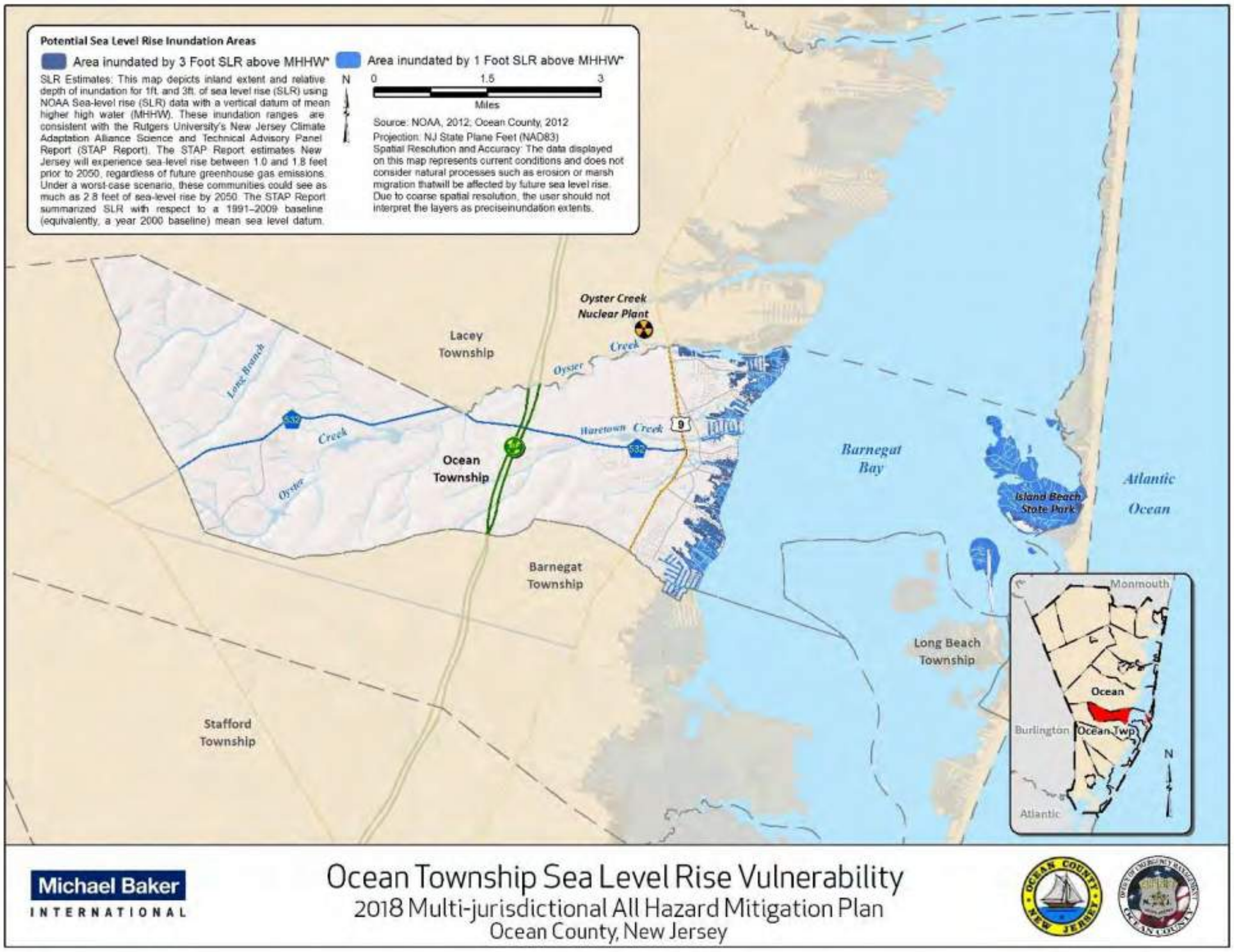


Figure 4.3.1-22 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Pine Beach Borough.**

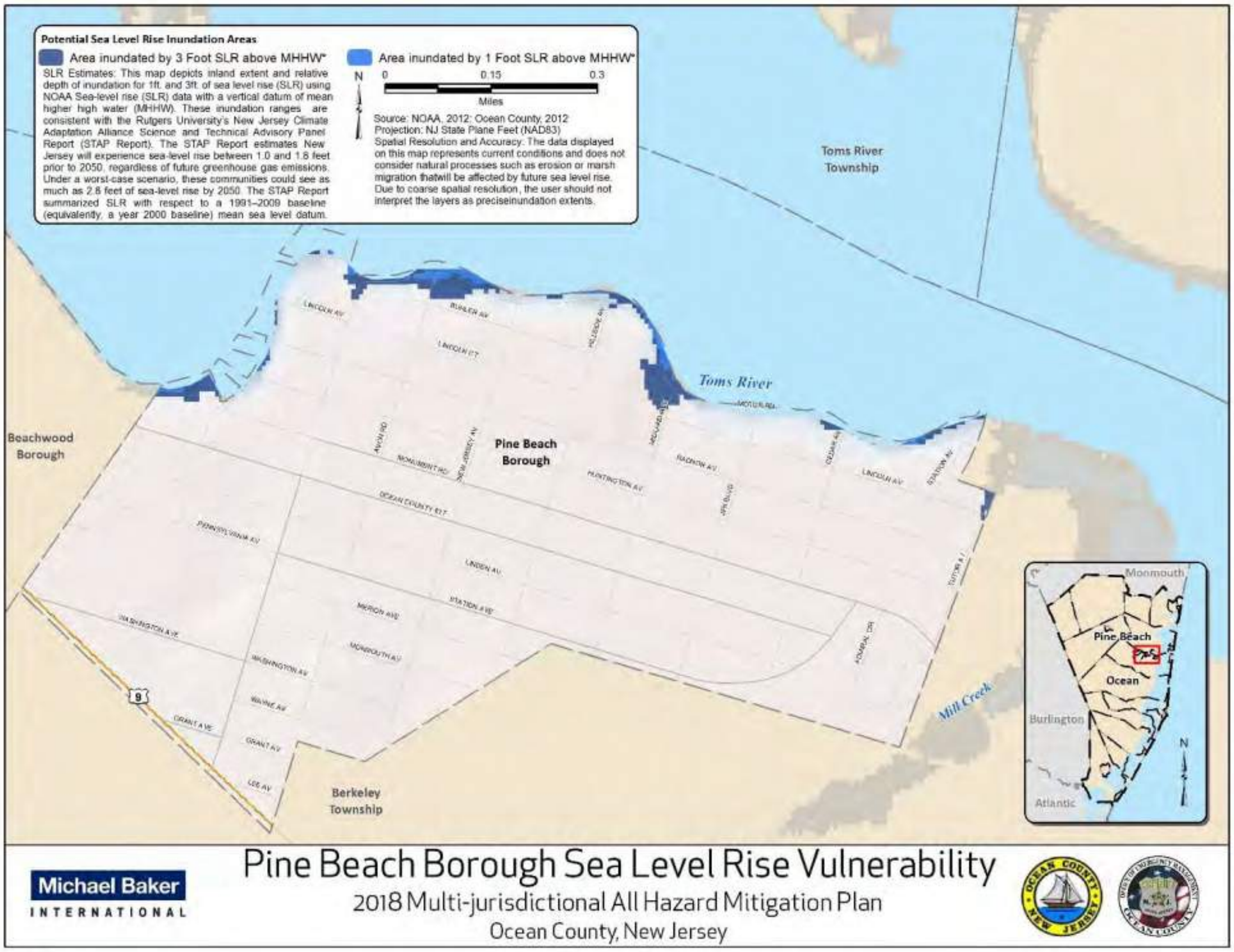


Figure 4.3.1-23 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Point Pleasant Beach Borough.**

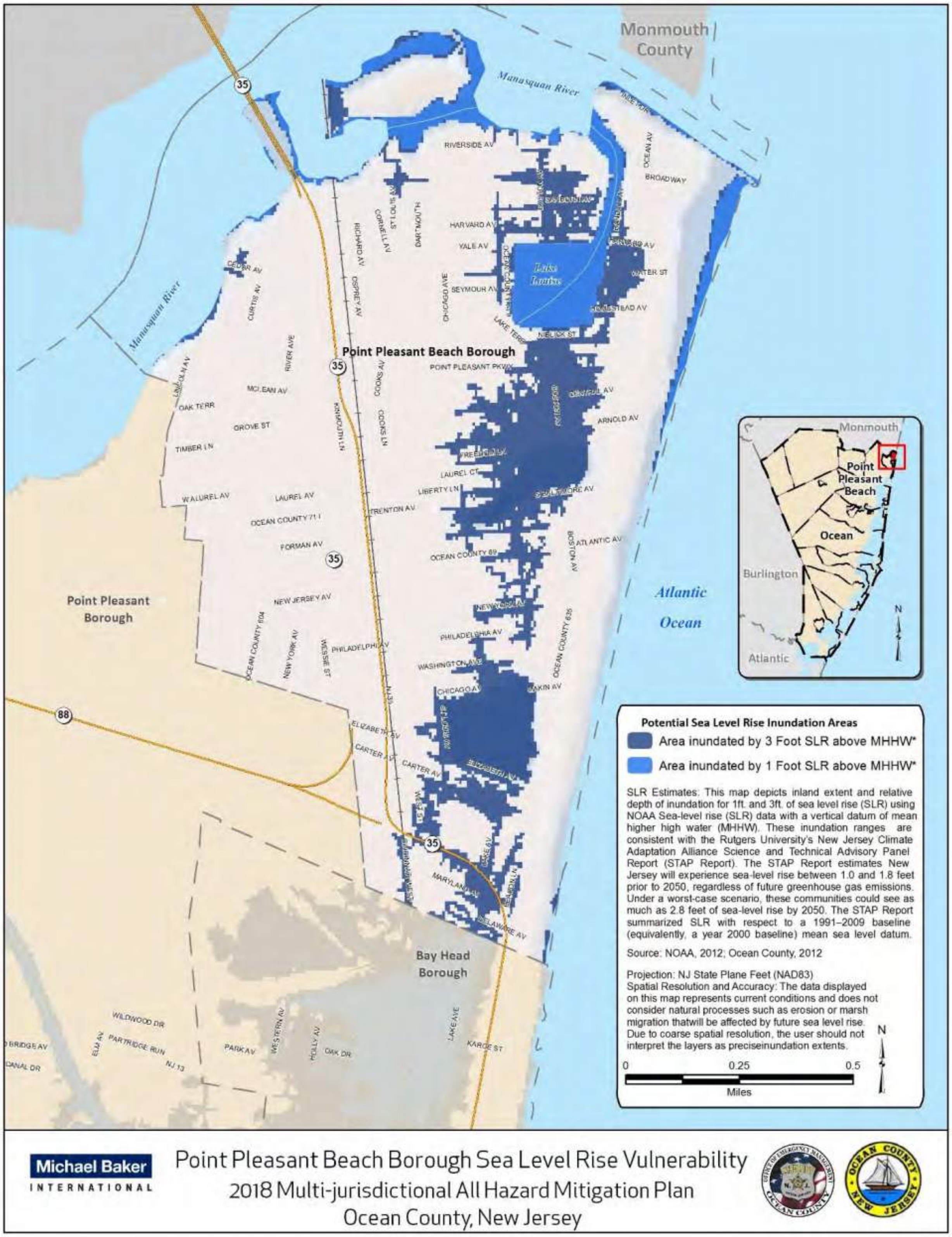


Figure 4.3.1-24 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Point Pleasant Borough.**

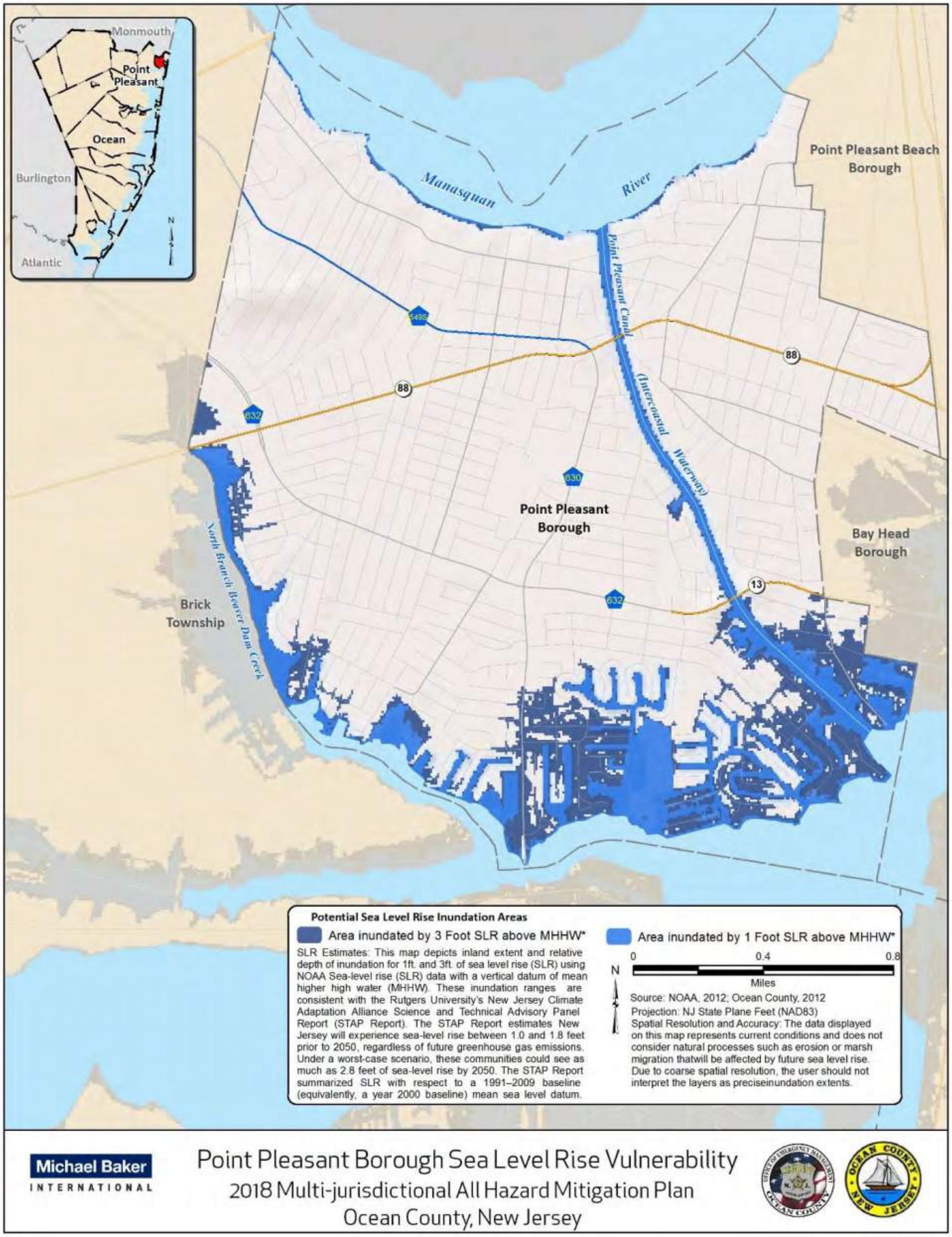


Figure 4.3.1-25 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Seaside Heights Borough.**

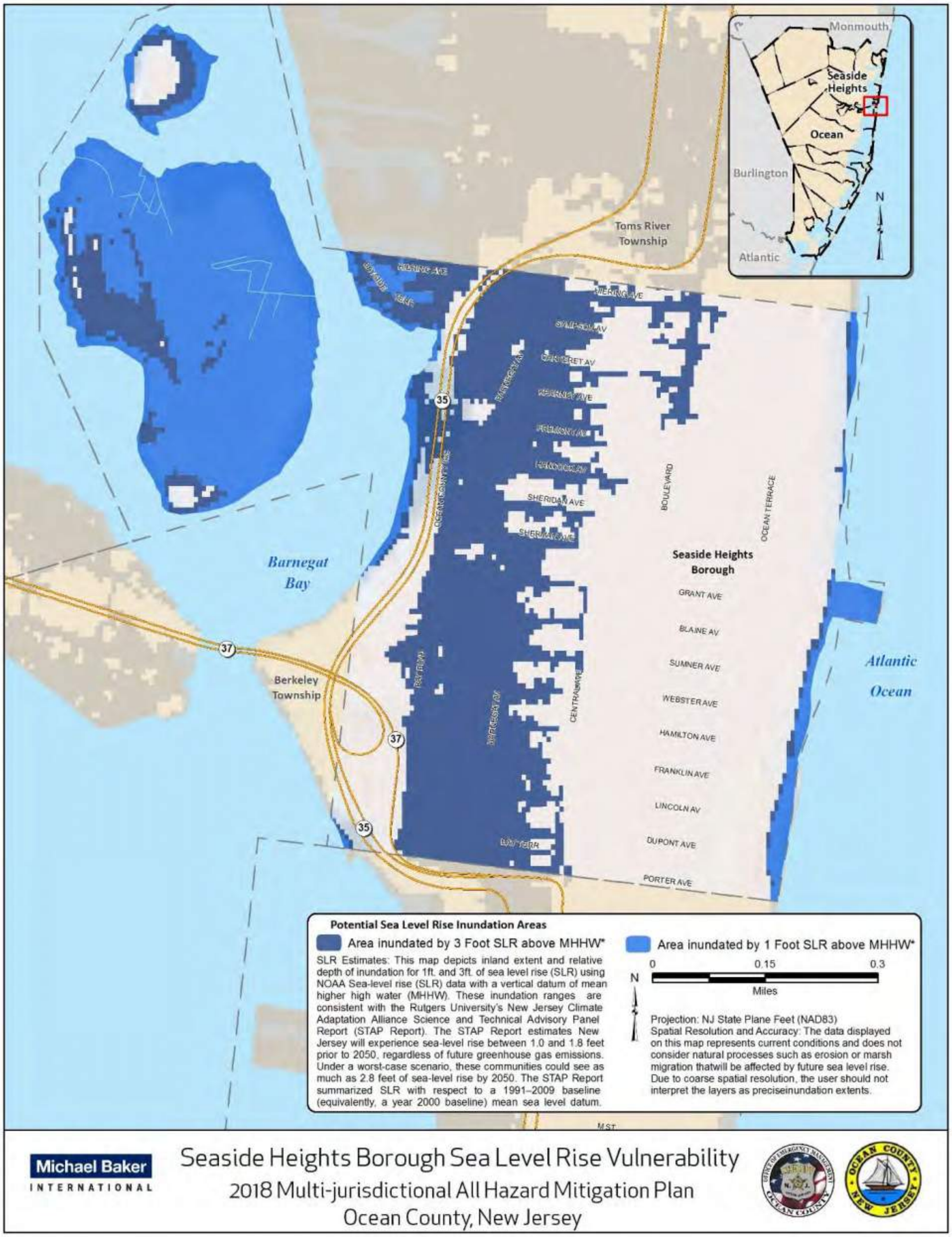


Figure 4.3.1-26 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Seaside Park Borough.**

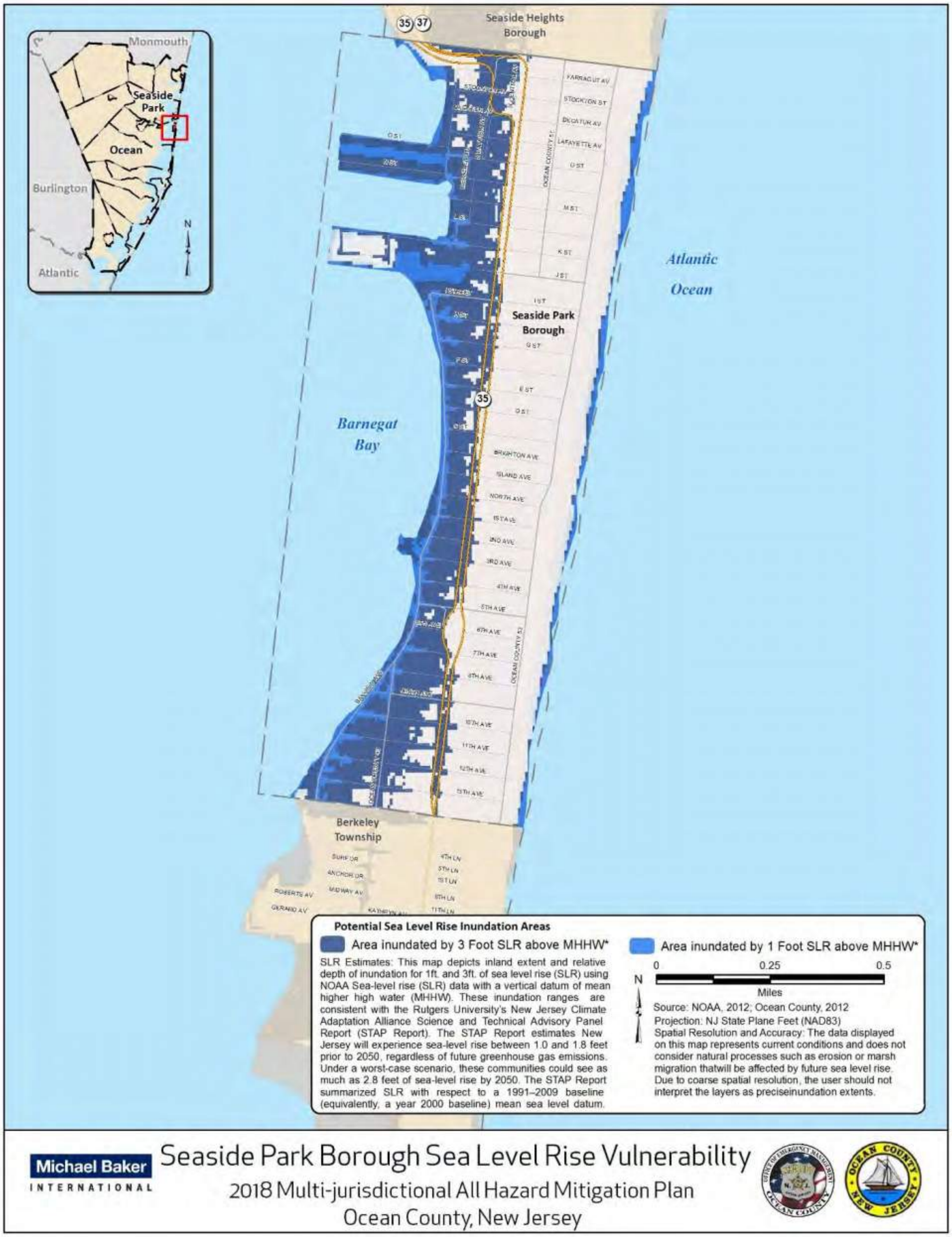


Figure 4.3.1-27 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Ship Bottom Borough.**

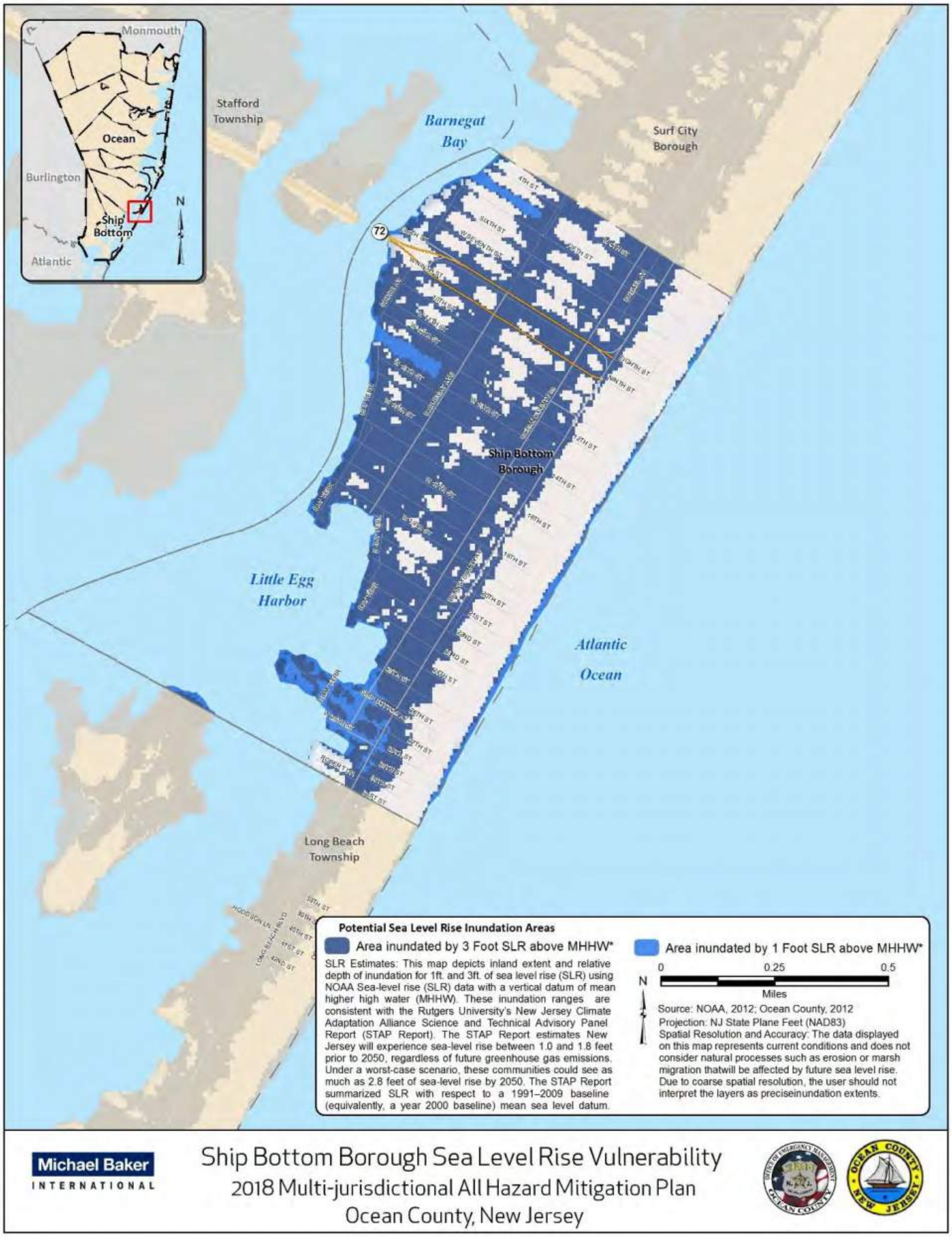


Figure 4.3.1-28 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in South Toms River Borough.**

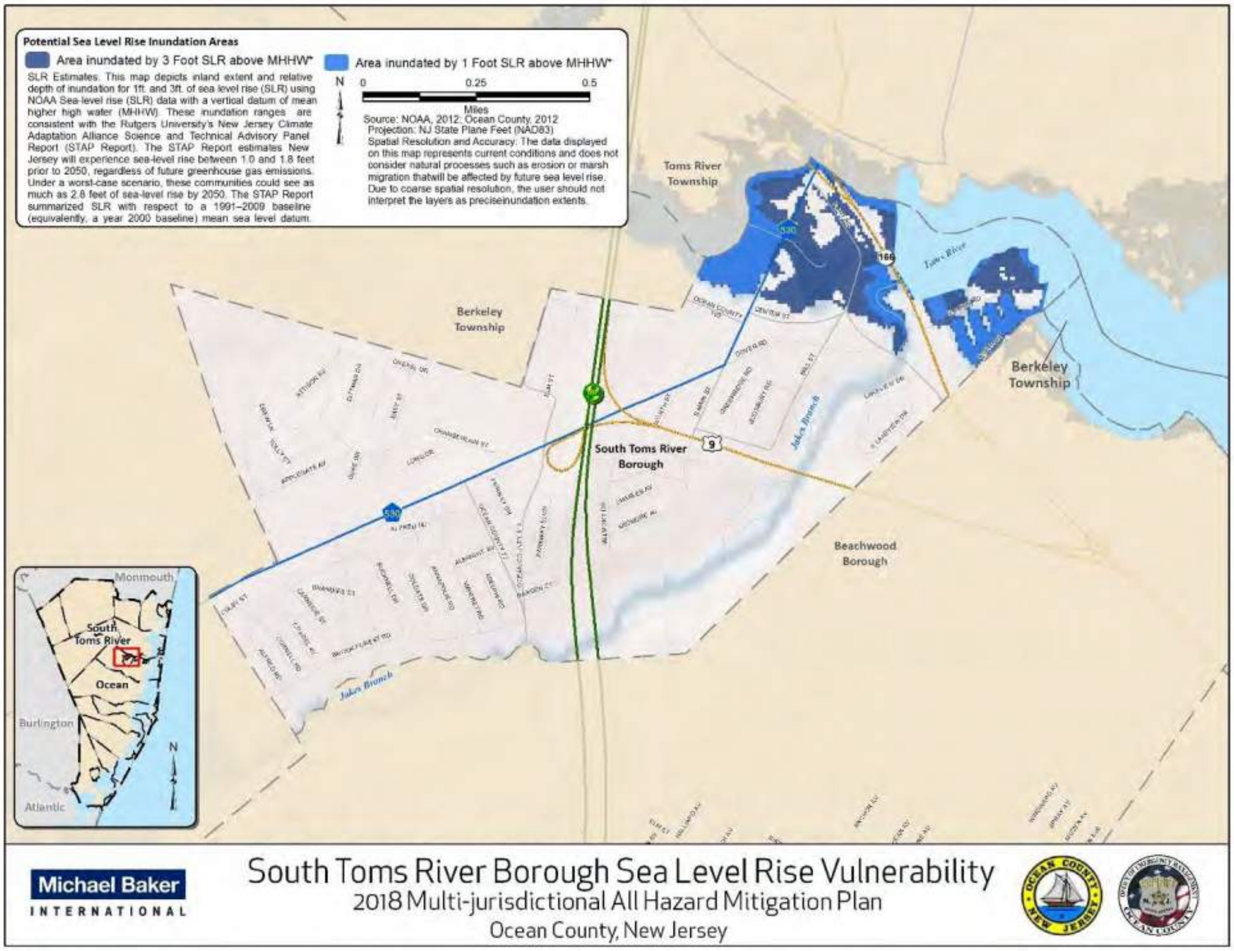


Figure 4.3.1-29 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Stafford Township.**

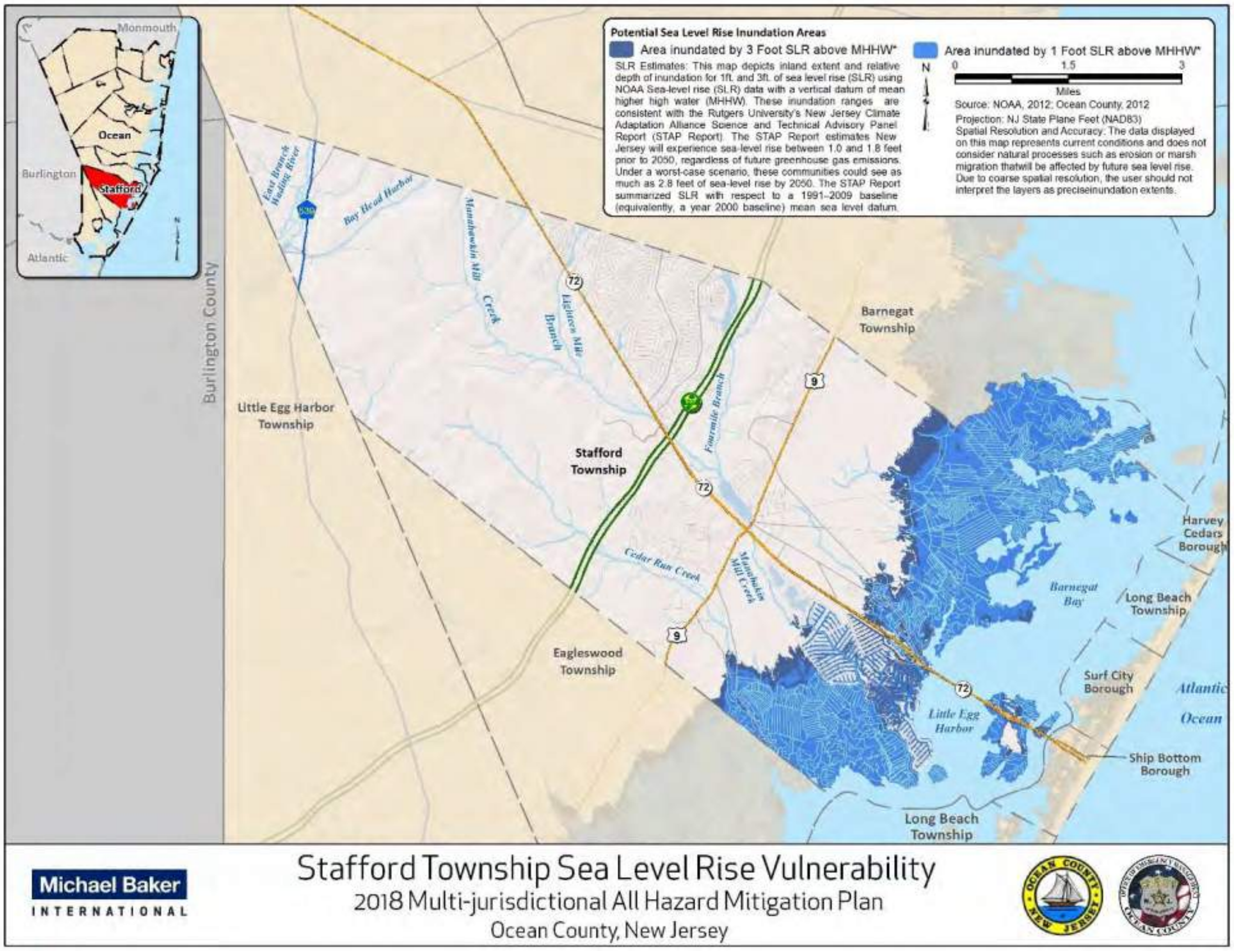


Figure 4.3.1-30 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Surf City Borough.**

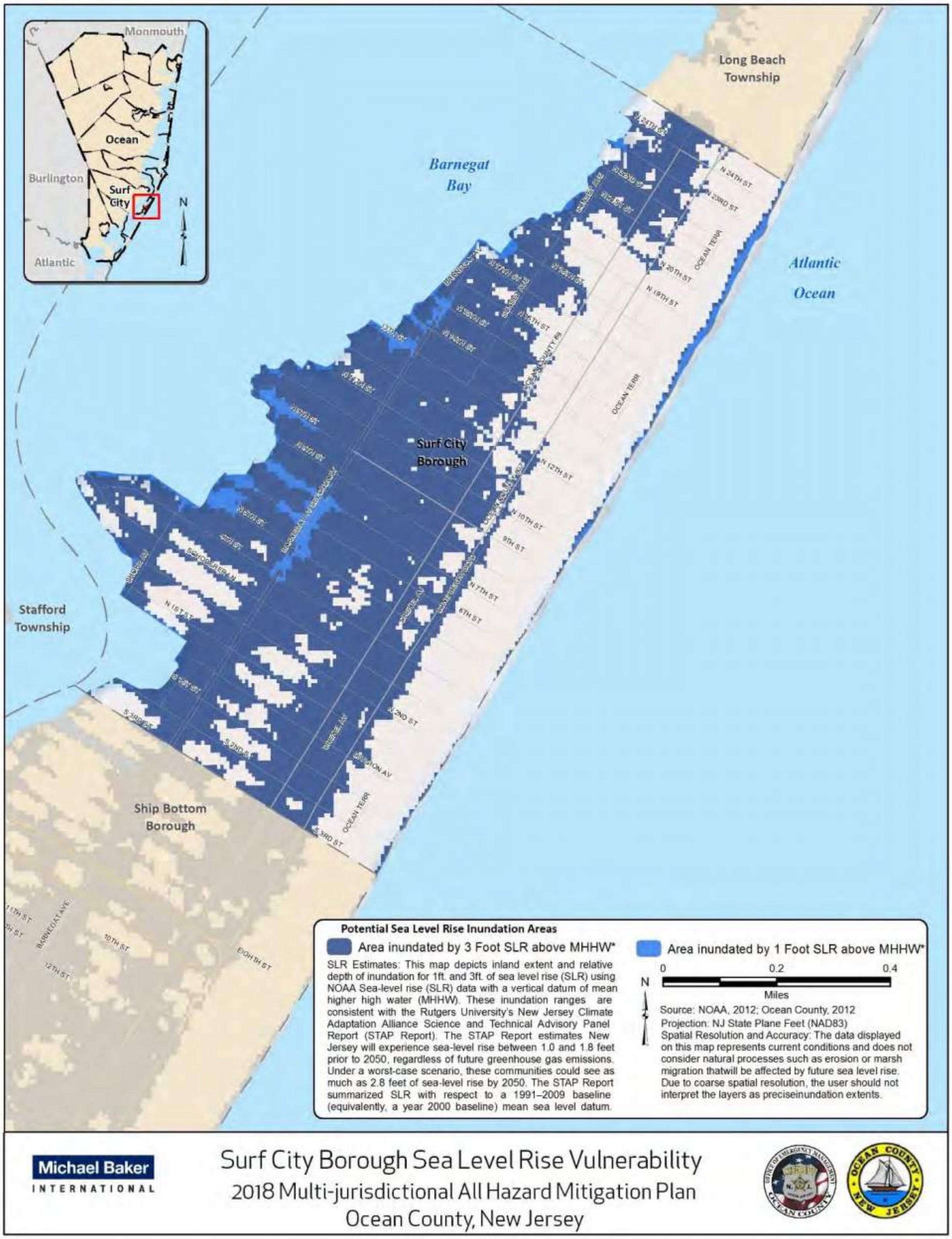


Figure 4.3.1-31 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Toms River Township.**

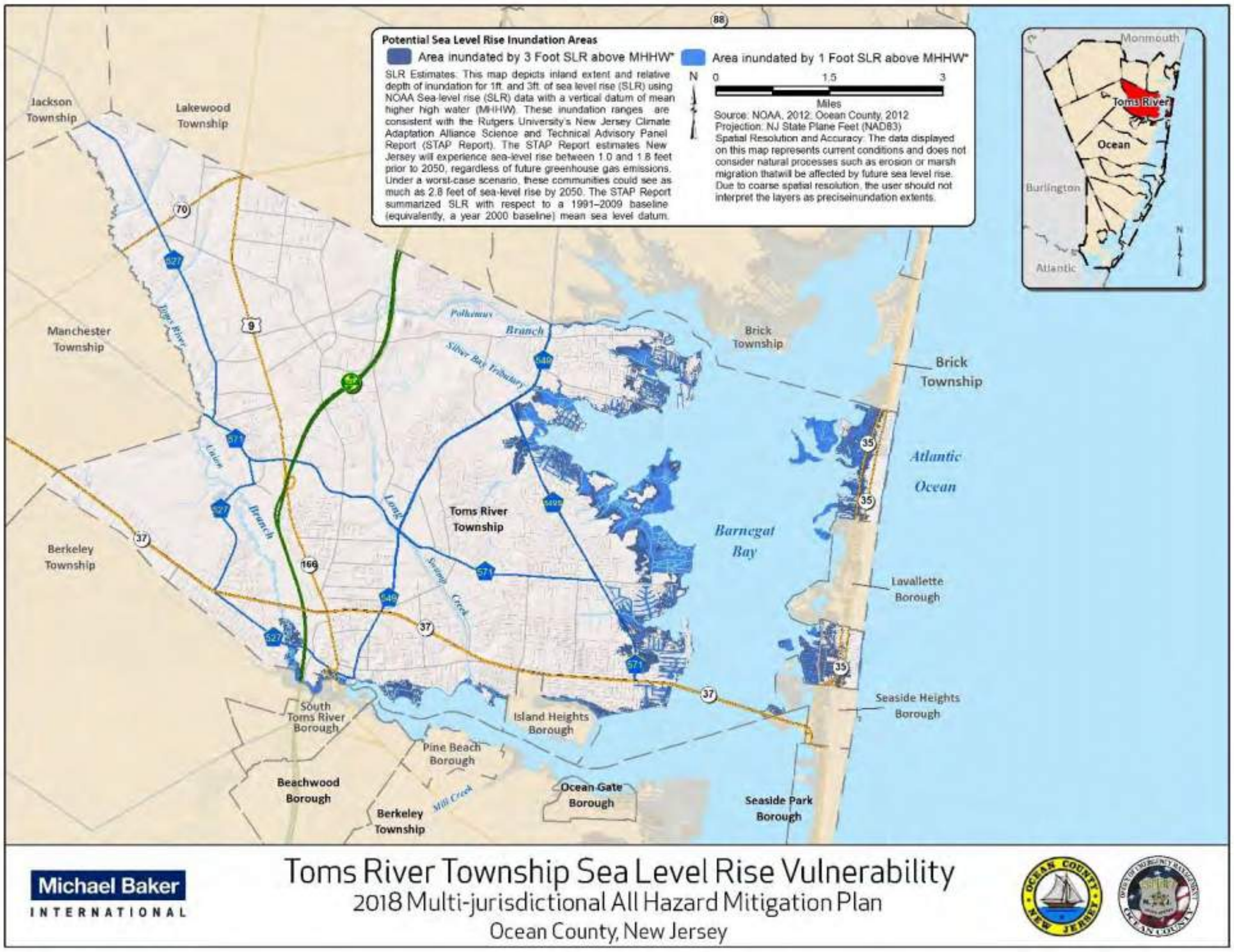
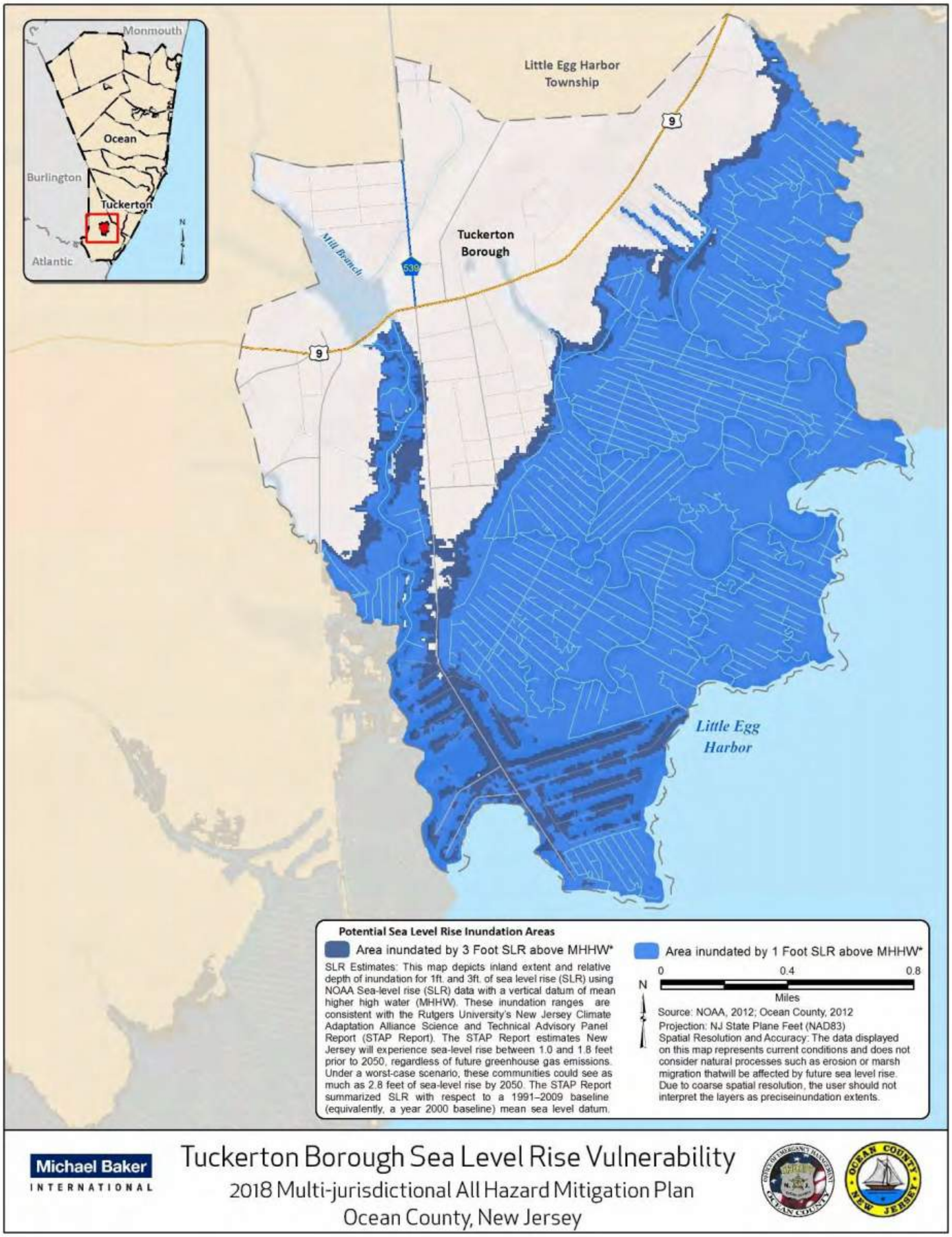


Figure 4.3.1-32 **Map showing areas of potential permanent inundation due to a 1 ft. and 3 ft. increase in sea level rise relative to mean higher high water (MHHW) in Tuckerton Borough.**



4.3.1.5 Vulnerability Assessment

Shoreline erosion increases the vulnerability of coastal structures to damage by exposing them to increased risk over the usable lifespan of the structure. Long-term erosion acts to shift the flood and wave hazard zone landward so that a building once protected from direct wave attack by a wide beach is increasingly susceptible to wave damage (Herrington 2008).

With the longest oceanfront shoreline of any county in New Jersey, Ocean County is significantly vulnerable to the effects of coastal erosion, and impacts of climate change make the coast even more vulnerable to coastal erosion and sea level rise. Only 13.4 miles out of 45.2 miles of coastline remains undeveloped. The undeveloped shoreline is contained in Island Beach State Park and in Holgate. Approximately 70% of the shoreline in Ocean County is developed (CRC, 2017). The severity of coastal erosion increases with development. Larger rates of coastal erosion are not considered hazardous in undeveloped areas, but the potential for destruction exists in developed areas of the coastline as homes, businesses, and infrastructure are vulnerable to erosion.

The Richard Stockton College of New Jersey began a GIS-based New Jersey beach-dune system susceptibility assessment in 2006. The beach-dune system provides protection to shore communities from storm damage. The nine figures below show the results of the assessment for notable regions along Long Beach Island. The assessment takes into account multiple factors including:

- bathymetry
- beach width
- dune crest height
- dune width
- foredune scarp slope
- vegetation coverage
- presence of structures
- proximity to groins

Each figure provides an estimate of the percent of foredune system removed during a 2, 5, 10, 20, and 50 year storm event. The data is displayed as 250 foot zonal analysis bins. Then each 250 foot bin is displayed with color that corresponds to its susceptibility during a during a 2, 5, 10, 20, and 50 year storm event. This provides a set of 5 indicator strips that shows less susceptibility in 2 year events in blues and more susceptibility in 50 year events in reds and oranges. There is a legend on each image and each indicator strip is labeled by year of the storm event analyzed in the following pages.

Figure 4.3.1-33 Harvey Cedars/North Beach beach-dune assessment (Stockton College 2013)

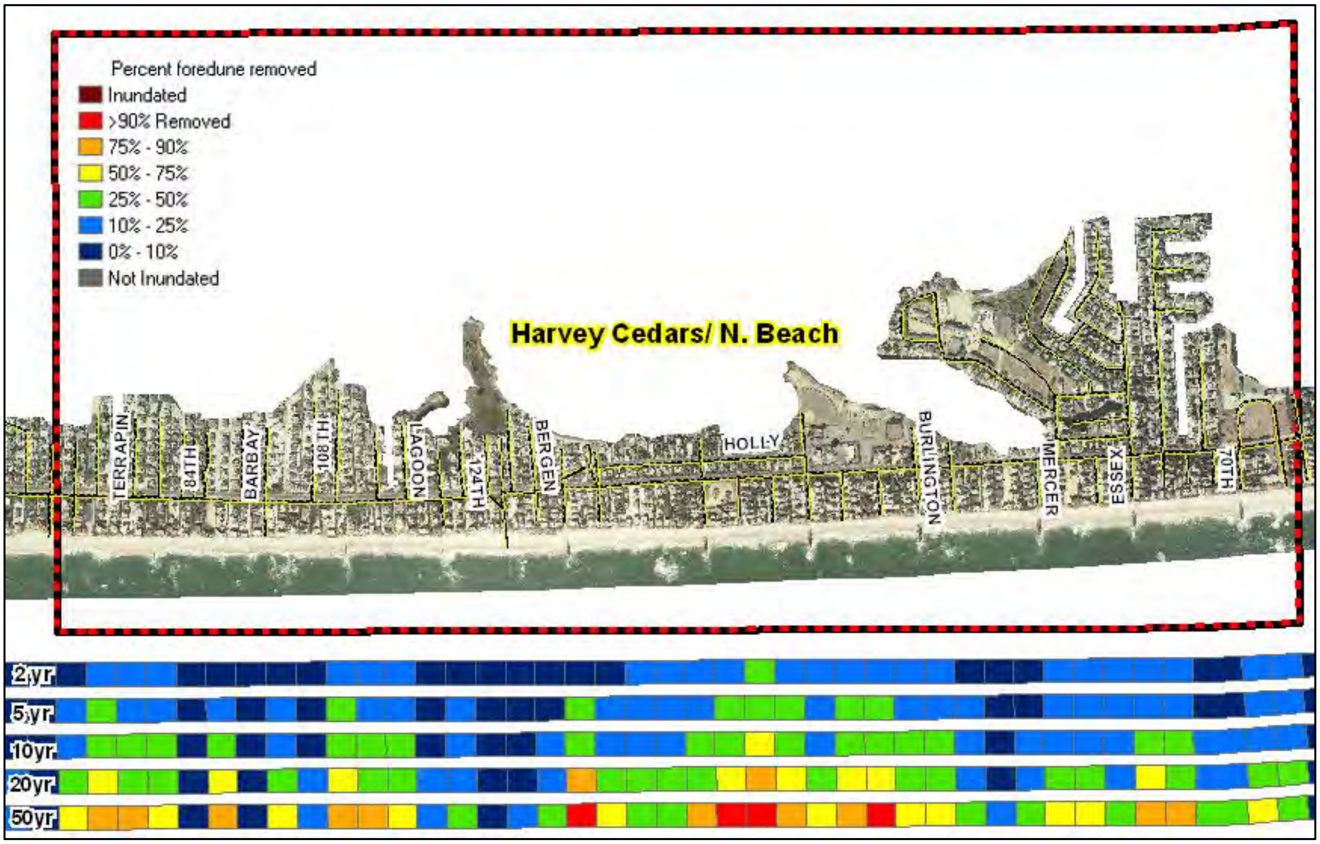


Figure 4.3.1-34 Surf City beach-dune assessment (Stockton College 2013)

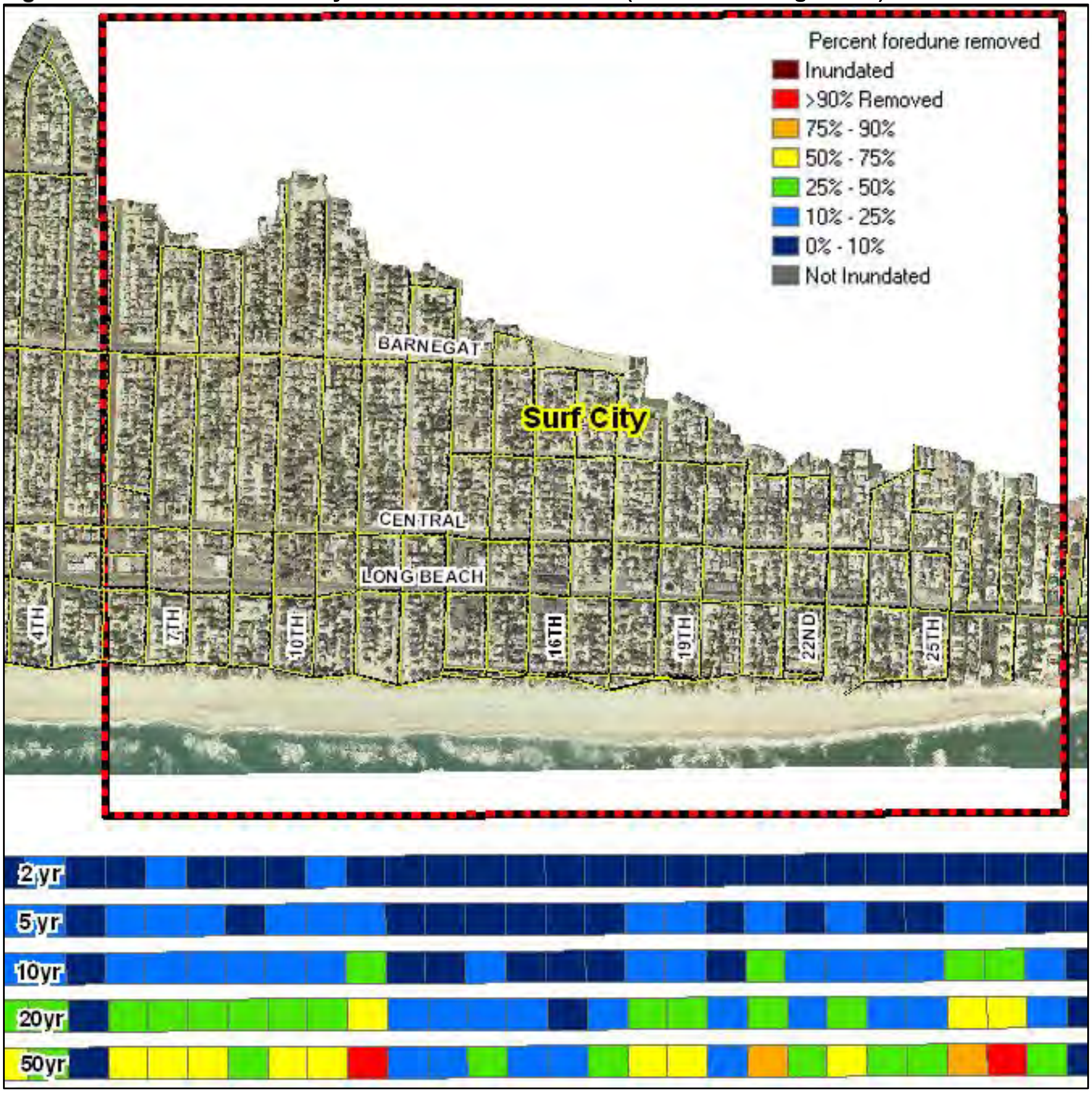


Figure 4.3.1-35 Ship Bottom beach-dune assessment (Stockton College 2013)

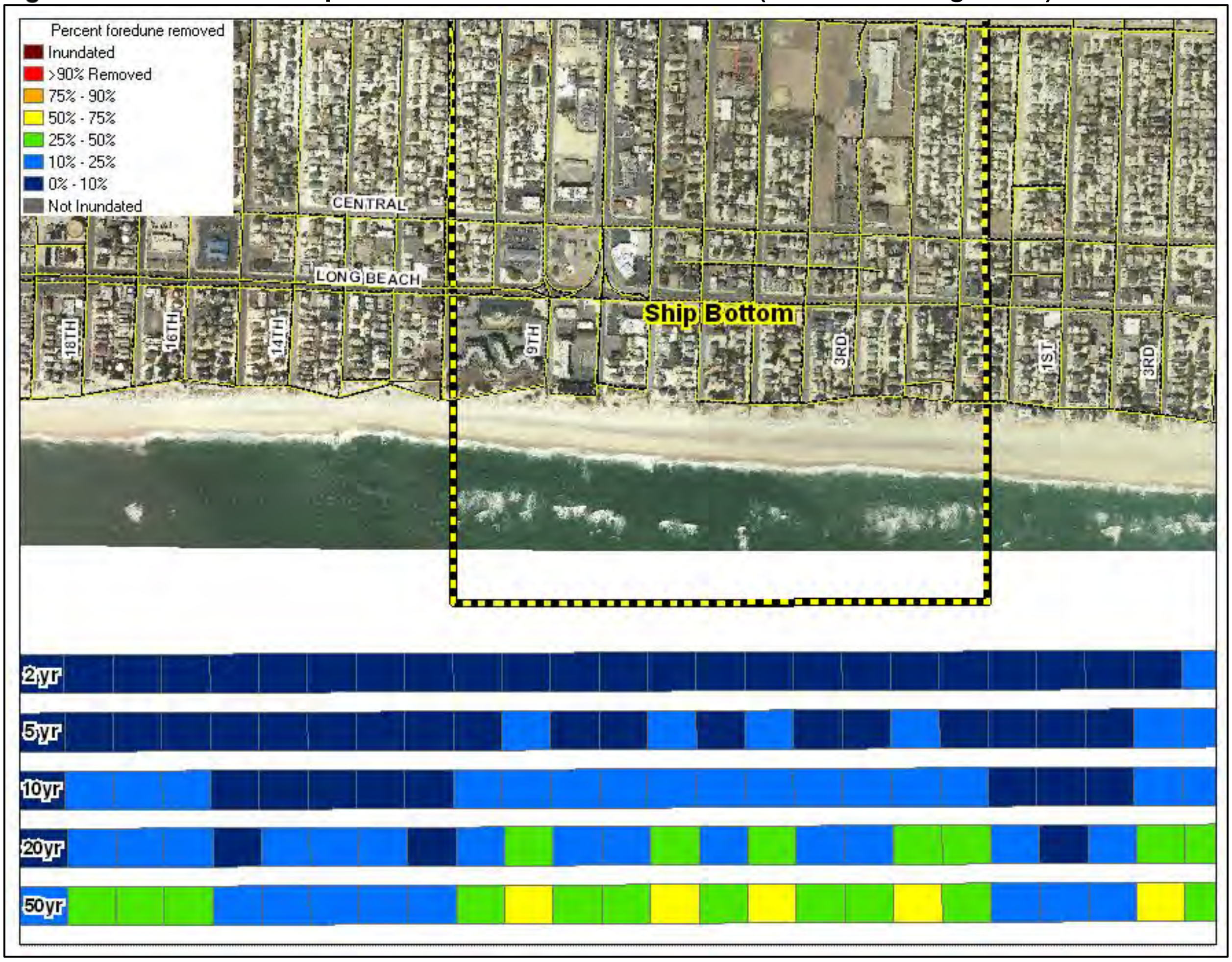


Figure 4.3.1-36 Brant Beach beach-dune assessment (Stockton College 2013)

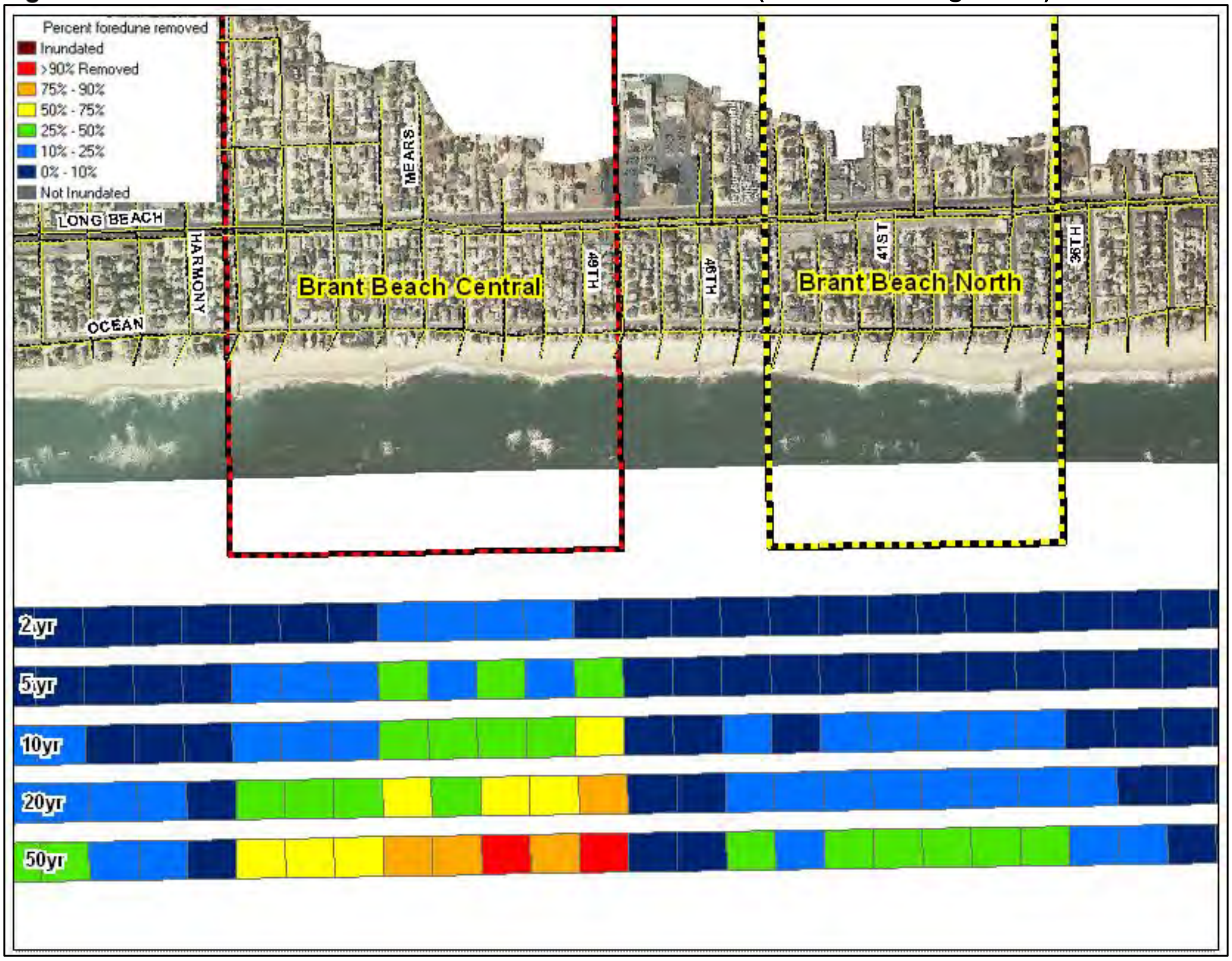


Figure 4.3.1-37 **Long Beach Township (north central) beach-dune assessment (Stockton College 2013)**

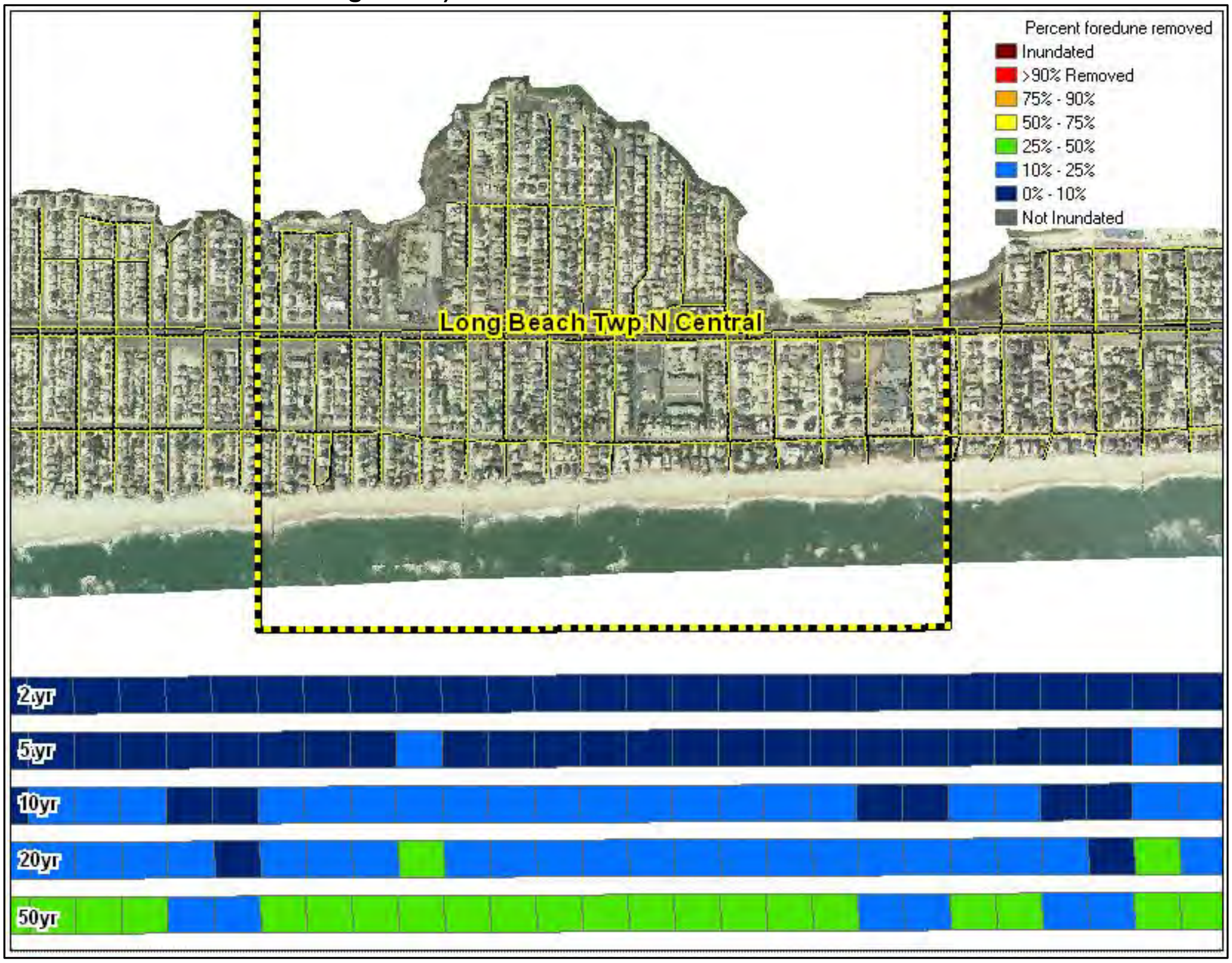


Figure 4.3.1-38 Long Beach Township (central) beach-dune assessment (Stockton College 2013)

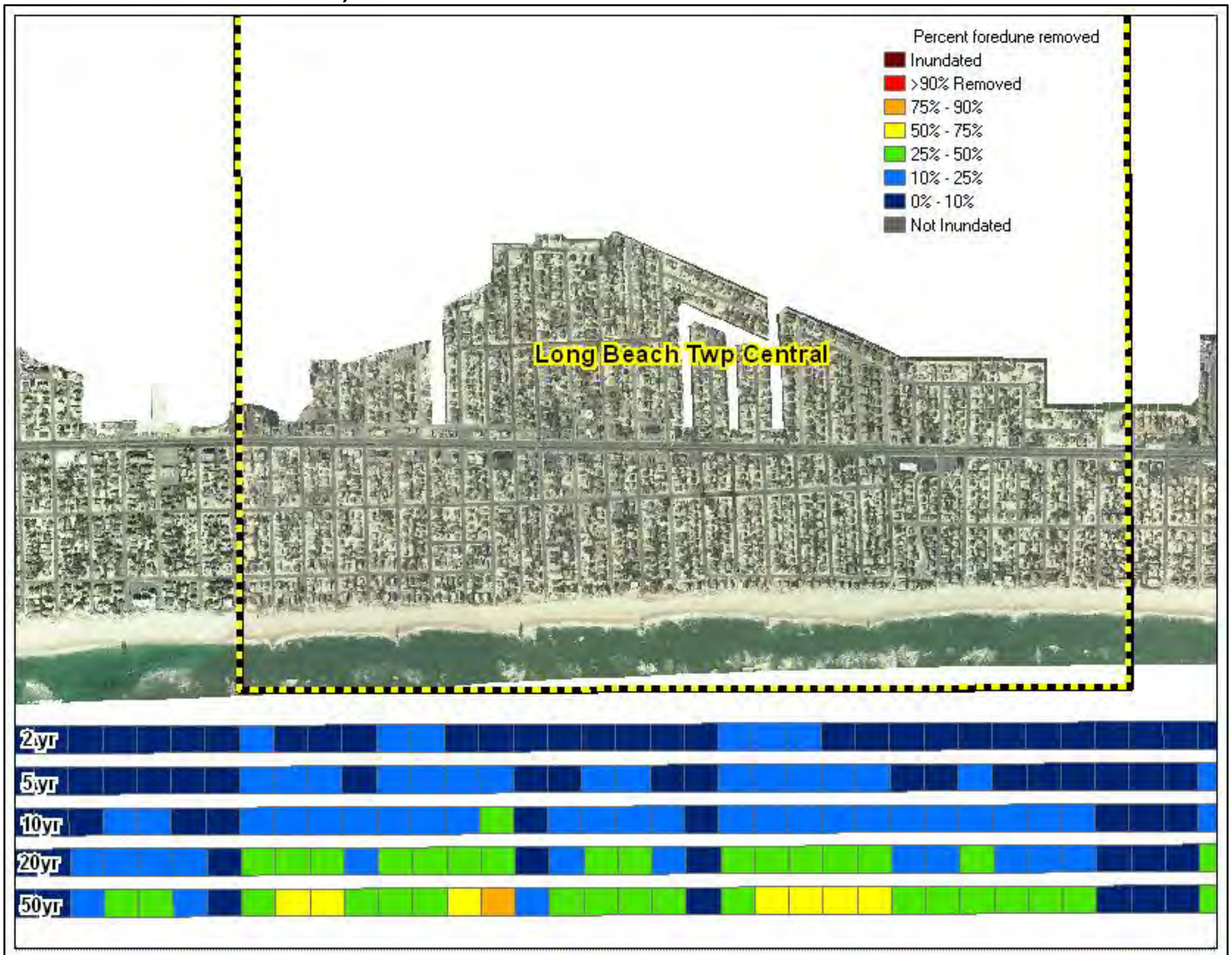


Figure 4.3.1-39 Beach Haven (north) beach-dune assessment (Stockton College 2013)

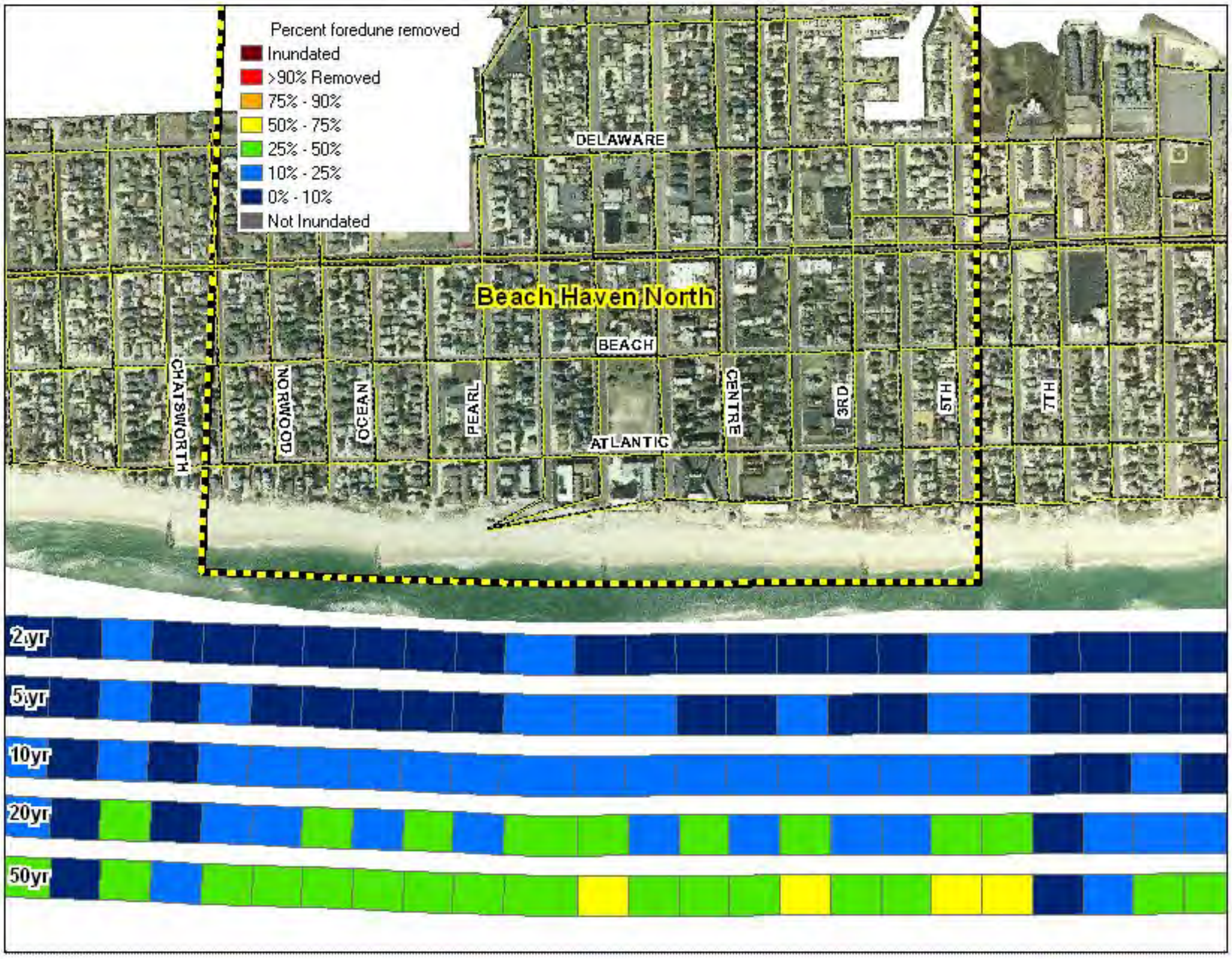


Figure 4.3.1-40 Beach Haven (south) beach-dune assessment (Stockton College 2013)

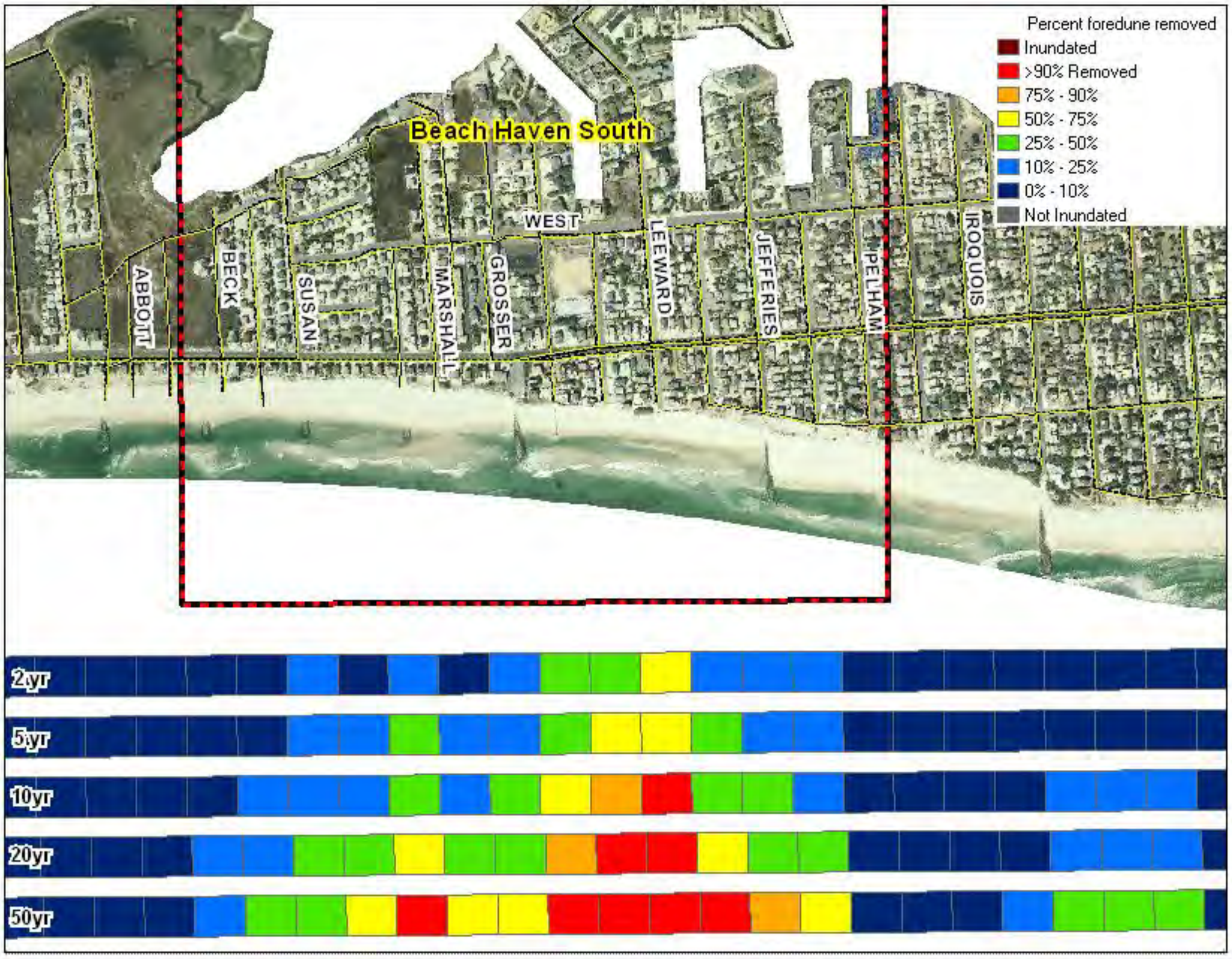
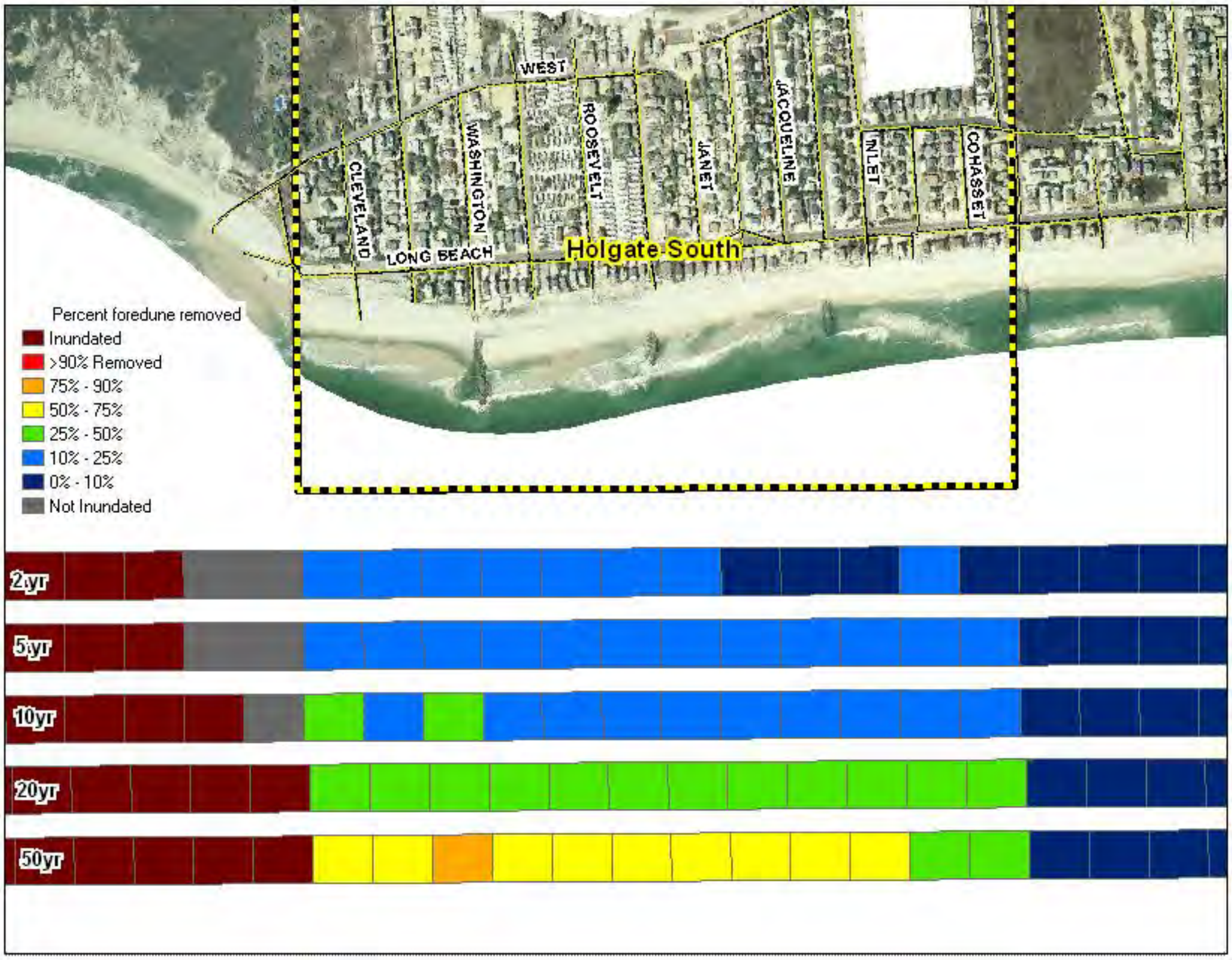


Figure 4.3.1-41 **Holgate (south) beach-dune assessment (Stockton College 2013)**



Similar data has also been collected for the northern portion of Ocean County between Point Pleasant and Island Beach State Park. Individual diagrams for this portion of the county are not yet available however Figure 4.3.1-42 below provides an overview of beach-dune system susceptibility for the 10-year storm event, while Figure 4.3.1-43 shows susceptibility for the 100-year storm event.

Figure 4.3.1-42 Northern Ocean County, 10-year storm event susceptibility (Stockton College 2013)

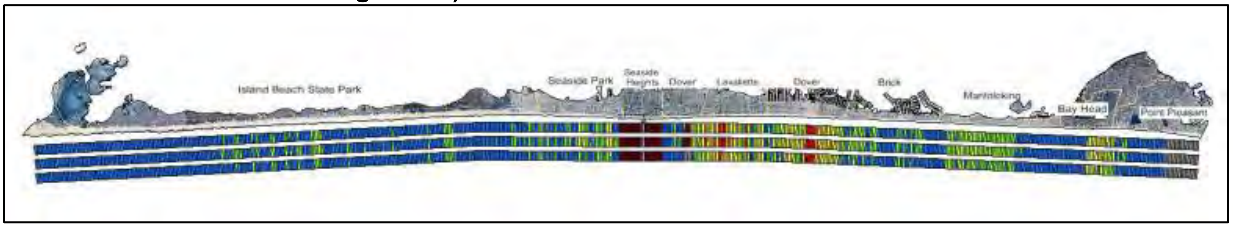


Figure 4.3.1-43 Northern Ocean County, 100-year storm event susceptibility (Stockton College 2013)

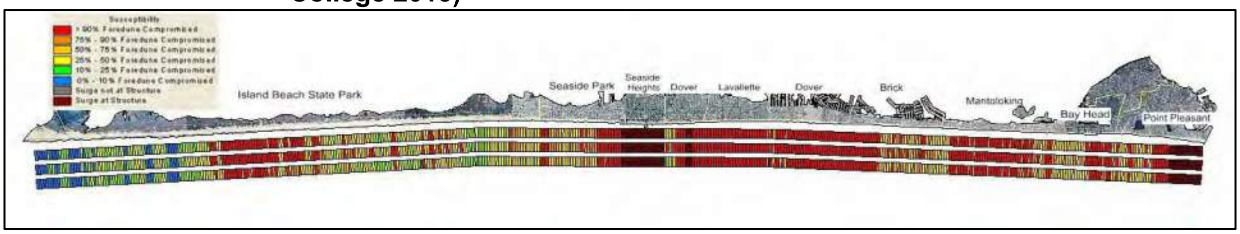


Table 4.3.1-3 shows assessed values of parcels located within 200 feet of erodible shoreline and beach as defined by the NJDEP.

Table 4.3.1-3 Parcels Numbers and Dollar Value on Improvements on Vulnerable Parcels by Municipality and at Risk of erodible shoreline and beaches (Ocean County, 2017, NJDEP Shoreline Type, 1993)

Municipality	Parcels Located within 200 Feet of Erodable Shoreline and Beaches	Total Parcels in Municipality	Percent Vulnerable Parcels	Dollar Value of Improvements on Vulnerable Parcels
Barnegat Light Borough	39	1,448	2.69%	$5,040,800
Barnegat Township	0	13,701	0.00%	$0
Bay Head Borough	124	1,223	10.14%	$96,717,400
Beach Haven Borough	166	3,098	5.36%	$15,418,500
Beachwood Borough	0	4,325	0.00%	$0
Berkeley Township	61	56,660	0.11%	$10,413,000
Brick Township	402	55,329	0.73%	$60,705,900
Eagleswood Township	0	4,524	0.00%	$0
Harvey Cedars Borough	125	1,487	8.41%	$27,428,700
Island Heights Borough	0	1,024	0.00%	$0
Jackson Township	0	22,210	0.00%	$0
Lacey Township	200	51,408	0.39%	$27,119,200
Lakehurst Borough	0	879	0.00%	$0
Lakewood Township	0	25,912	0.00%	$0
Lavallette Borough	45	2,991	1.50%	$6,443,500
Little Egg Harbor Township	0	13,046	0.00%	$0
Long Beach Township	918	10,458	8.78%	$271,689,100
Manchester Township	0	38,468	0.00%	$0
Mantoloking Borough	207	875	23.66%	$53,731,800
Ocean Gate Borough	4	1,202	0.33%	$488,100
Ocean Township	63	10,167	0.62%	$5,533,400
Pine Beach Borough	0	2,976	0.00%	$0
Plumsted Township	0	3,304	0.00%	$0
Point Pleasant Beach Borough	89	3,639	2.45%	$12,071,100
Point Pleasant Borough	0	8,574	0.00%	$0
Seaside Heights Borough	22	2,265	0.97%	$1,178,400
Seaside Park Borough	58	2,490	2.33%	$4,188,400
Ship Bottom Borough	23	2,257	1.02%	$4,667,900
South Toms River Borough	3	1,354	0.22%	742700
Stafford Township	67	15,715	0.43%	$13,754,700
Surf City Borough	26	2,557	1.02%	$7,978,200
Toms River Township	128	53,218	0.24%	$752,900
Tuckerton Borough	0	2,187	0.00%	$0
Total	**2,770**	**420,971**	**0.66%**	**$626,063,700**
Note: No improvements on land (no buildings)				

4.3.2 Drought

4.3.2.1 Location and Extent

A drought is described as a period of low or no precipitation in a given area. Events may be localized to small areas within the county or the state, or span the regional Mid-Atlantic or northeast area. Although it is not a frequent event, when it does occur the results can be devastating.

Regions with primarily agricultural land uses are most vulnerable to drought; these uses are largely found in the northwest portion of the County in Plumsted and Jackson townships. Businesses impacted include nurseries and florists, landscapers and farmers who are dependent on their crops are especially hurt by periods of drought. When a drought occurs, it can impact other businesses as well; car washes, swimming pools, recreational water parks, and even restaurants all suffer to some degree.

A drought can impact communities when restricted water use and regulations are implemented. Some municipalities restrict water use year round, regardless of drought conditions. Others only apply restrictions when governed by the State Department of Environmental Protection.

Ocean County is divided into two drought regions, the Coastal North Drought Region and the Coastal South Drought Region. The Coastal North Drought Region includes Bay Head, Beachwood, Island Heights, Lakehurst, Lavallette, Mantoloking, Ocean Gate, Pine Beach, Point Pleasant, Point Pleasant Beach, Seaside Heights, Seaside Park, and South Toms River Boroughs, and Berkeley, Brick, Jackson, Lakewood, Manchester, Plumsted, and Toms River townships.

The Coastal South Drought Region includes Barnegat Light, Beach Haven, Harvey Cedars, Ship Bottom, Surf City, and Tuckerton Boroughs, and Barnegat, Eagleswood, Lacey, Little Egg Harbor, Long Beach, Ocean, Stafford, and Toms River townships.

The County's low elevation and plentiful groundwater supply allow it to be less susceptible to drought than many other counties in New Jersey. The water restrictions however can impact the whole County and cause economic distress on garden centers, landscapers, farmers, and those businesses that depend on water for recreational purposes. In a pro-longed period of severe drought, Ocean County is vulnerable as well as the rest of New Jersey. During any period of drought, the risk of wildfires in Ocean County increases substantially.

4.3.2.2 Range of Magnitude

Drought events adversely affect stream flows, lake/reservoir storage, and groundwater levels. Other resources that may be impacted include public water supplies for human consumption, rural water supplies for livestock consumption and agricultural operations, water quality, natural soil water or irrigation water for agriculture, soil moisture, conditions conducive to wildfire events, and water for navigation and recreation.

In Ocean County, information from the National Weather Service and advisories and/or restrictions from the New Jersey Department of Environmental Protection are used to determine the severity of a drought event.

New Jersey State uses five parameters to assess drought conditions:

1. Stream flows (compared to benchmark records)
2. Precipitation (measured as the departure from normal, 30 year average precipitation)
3. Reservoir storage levels in a variety of locations (both in New Jersey and from the Delaware River reservoirs)
4. Groundwater elevations in a number of counties (comparing to past month, past year and historic record)
5. The Palmer Drought Severity Index – a soil moisture algorithm calibrated for relatively homogeneous regions which measures dryness based on recent precipitation and temperature (see Table 4.3.2-1).

Table 4.3.2-1 Palmer Drought Severity Index (PSDI) classifications (NDMC, 2013).

SEVERITY CATEGORY	PSDI VALUE
Extremely wet	4.0 or more
Very wet	3.0 to 3.99
Moderately wet	2.0 to 2.99
Slightly wet	1.0 to 1.99
Incipient wet spell	0.5 to 0.99
Near normal	0.49 to -0.49
Incipient dry spell	-0.5 to -0.99
Mild drought	-1.0 to -1.99
Moderate drought	-2.0 to -2.99
Severe drought	-3.0 to -3.99
Extreme drought	-4.0 or less

Condition levels of drought in New Jersey in order of increasing severity are:

- Drought Watch: Indicates the New Jersey Department of Environmental Protection is closely monitoring drought indicators, including precipitation, stream flows, and reservoir and ground water levels and water demands. Under a drought watch, the public should begin voluntarily cutting back on water usage. The Commissioner of DEP is responsible for exercising non-emergency powers during a Drought Watch. Such non-emergency powers are used to develop alternative water supplies where necessary, rehabilitate and activate interconnections between water systems, and transfers water between different water systems.

- Drought Warning: A drought warning condition may be designated by the Commissioner of DEP as a non-emergency response to managing available water supplies. Under a designated drought warning, the DEP may order water purveyors to develop alternative sources of water and to transfer water around the State from areas with relatively more water those with less. The aim of this stage of a response to drought conditions is to avert a more serious water shortage that would necessitate declaration of a water emergency and the imposition of mandatory water use restrictions.

- Water Emergency: There are three phases of water emergencies
    - Phase I: Restricts water use for non-commercial plants, cars, streets, hydrant flushing, etc.
    - Phase II-III: Water is allocated and rationed. These restrictions are enforced when there is substantial threat to public health.
    - Phase IV: Considered a disaster stage where public water service is interrupted. Public health and safety cannot be guaranteed and selective business and industrial closings are enforced.

- Drought Emergency: A drought emergency (also called a water supply emergency) can only be declared by the Governor. While drought warning actions focus on improving the supply of water, drought emergency actions focus on reducing water demands. During a water emergency that is imposed due to drought conditions, a phased approach to restricting water consumption may be initiated. Phase I of water use restrictions typically targets non-essential, outdoor residential water use. This includes water use for of non-commercial plants, cars, streets, hydrant flushing, etc. While some indirect economic impacts may occur, the first phases of water use restrictions seek to avoid curtailment of water use by the agriculture and business sectors. Those who are uniquely impacted by the restrictions can apply for a hardship exemption. Phases II through IV restrictions may be instituted as drought conditions worsen and the need for more drastic measures become essential to preserve public health and safety. Phase II, and Phase III restrictions are enforced when there is substantial threat to public health and welfare. Water usage is allocated and rationed. Phase IV is considered a disaster stage where public water service is interrupted. Public health and safety cannot be guaranteed and selective business and industrial closings are enforced.

Environmental impacts of drought include:

- Hydrologic effects – lower water levels in reservoirs, lakes, and ponds; reduced stream flow; loss of wetlands; estuarine impacts; groundwater depletion and land subsidence; effects on water quality such as increases in salt concentration and water temperature
- Damage to animal species – lack of feed and drinking water; disease; loss of biodiversity; migration or concentration; and reduction and degradation of fish and wildlife habitat
- Damage to plant communities – loss of biodiversity; loss of trees from urban landscapes and wooded conservation areas
- Increased number and severity of fires
- Reduced soil quality
- Air quality effects – dust and pollutants
- Loss of quality in landscape

The yearlong drought from October, 2001 until November, 2002 was the worst event with the largest impact on Ocean County. On October 30, 2001, a drought watch was issued for the entire state by New Jersey Department of Environmental Protection (NJDEP). On November 21, 2001, a drought warning was issued by the NJDEP for Northwest, Southwest and Coastal

South. NJDEP extends the drought warning to include the Northern Coast and Northeast areas on January 24, 2002. A statewide drought emergency was issued by New Jersey's Governor, James McGreevey on March 4, 2002. The State of New Jersey instated water-use restrictions in 2002. Though temporarily lifted in June, drought restrictions were re-issued in August. The actual precipitation that year was seven inches less than normal resulting in depletion of the underlying aquifers in Ocean County and neighboring Monmouth and Mercer counties. The statewide drought emergency was not lifted in New Jersey until January 8, 2003, when rainfall started to replenish ground water and surface water levels. The Coastal South and Southwest areas continued to operate under a drought warning until March 21, 2003 (DRBC, 2013)

4.3.2.3 Past Occurrence

The New Jersey Department of Environmental Protection, Drought Information Center documents periods of drought in New Jersey. The most significant events that have impacted Ocean County include:

- August 1965 – A FEMA Disaster Declaration was declared because a water shortage impacted the entire state
- October, 1980 – A FEMA Disaster Declaration was declared because a water shortage impacted the entire state
- August, 1999 – water restrictions enacted, crop loss registry activated, eighty million dollars in crop loss was reported.
- October, 2000 – water restrictions enacted, monthly precipitation recorded as lowest on record.
- April – May, 2001 – wildfires a grave concern, farmers impacted by delayed plantings, low or no crop yield.
- October, 2001 – November, 2002 – year long drought period, water restrictions enacted, drought emergency is declared, wildfires are a grave concern, river levels are at a record low.
- September, 2005 – water restrictions enacted, wildfires a grave concern
- May, 2006 – wildfires are a grave concern, water conservation is urged.
- June, 2012 – A USDA drought disaster declaration was declared, and remained in effect until November.
- April, 2015 – A USDA drought disaster declaration was declared and impacted many New Jersey counties through September
- April, 2016 – A USDA drought disaster declaration was declared and was in effect through September

Drought events reported by NOAA NCDC for Ocean County from 1995 to 2017 is shown in Table 4.3.2-2. Descriptions for drought status categories (i.e. *watch*, *warning*, and *emergency*) are included in Section 4.3.1.2. Data for Ocean County is available for the years 1950 through 2017.

Table 4.3.2-2 Past Drought Events in Ocean County (NCDC, 2017)

Date	Drought Status	Date	Drought Status
March 1995	None	January 2002	Warning
October 1997	Warning	February 2002	Water Emergency
December 1998	None	March 2002	Drought Warning
January 1999	Drought Emergency	March - November 2002	Drought Emergency
February 1999	Warning	September 2005	Watch
July 1999	Water Emergency	May – June 2006	Watch
August 1999	Drought Emergency	August - September 2008	None
September 1999	Drought Emergency	November 2010	Watch (Cancelled)
October 2001	Watch	June - November 2012	Watch
November 2001	Warning	April-December 2015	Watch
December 2001	Warning	April-December 2016	Watch

4.3.2.4 Future Occurrence

The probability that a drought event will occur in the future can be considered possible, as defined by the Risk Factor methodology probability criteria (see Table 4.4.1-1). This is a major concern because of the large Pinelands area with the risk of wildfire, as well as the farmers and business people who could be harmed if there should be a prolonged or significant drought impacting the County. Based on national data from 1895 to 1995, Ocean County is in severe or extreme drought approximately less than five percent of the time (see Figure 4.3.2-1). This is equivalent to a PDSI value greater than or equal to -3.

Figure 4.3.2-1 PDSI value for New Jersey (NIDIS, 2017).

As of August 1, 2017

Author: Deborah Bathke, National Drought Mitigation Center

Drought Conditions (Percent Area)

Week	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current 8/01/2017	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Last Week 7/25/2017	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Three Months Ago 5/02/2017	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Start of Calendar Year 1/03/2017	0.00%	100.00%	72.01%	37.85%	0.00%	0.00%
One Year Ago 8/02/2016	63.47%	36.53%	24.35%	0.00%	0.00%	0.00%

Drought events most directly impact the agriculture sector of the county's economy. By the end of the yearlong drought from 2001 to 2002, the estimated cost to farmers was $125 million from crop loss. Crops such as hay, wheat, soybeans, corn, and sorghum had no irrigation, and fared poorly during the drought. Crops were further damaged by deer and bears lacking food and water.

While these were statewide impacts, they illustrate the potential for droughts to severely impair the local economy in more agricultural communities. Drought can also have an impact on landscaping which had impact tourism and golf in Ocean County.

Water supplies for Ocean County are vulnerable to the effects of drought. Reservoirs in both New Jersey and New York help supply water for the State of New Jersey including Ocean County. Private wells are another main source of water for Ocean County residents. Droughts endanger both the level of water in reservoirs, but also the quality of well water as salt water intrusion can occur in coastal areas, where fresh water becomes brackish. Short-term, well water is a reliable source, however long-term, groundwater aquifers may falter without sufficient time for recharge. Ocean County residents that use private domestic wells are more vulnerable to droughts. NJDEP collects data on private well testing. While not a complete list of all wells in Ocean County the following table provides a sense of the number and location of private wells in Ocean County.

Table 4.3.2-3 Private Well Testing in Ocean County (NJDEP, 2017)

Municipality	Number of Wells Tested	Municipalities with less than 10 wells tested
Barnegat Township	303	Barengat Light Borough Bay Head Borough Beach Haven Borough Beachwood Borough Brick Township Harvey Cedars Borough Island Heights Borough Lavallette Borough Lakehurst Borough Long Beach Township Mantoloking Borough Ocean Gate Borough Pine Beach Boro Point Pleasant Beach Borough Point Pleasant Borough Seaside Heights Borough Seaside Park Borough Ship Bottom Borough South Toms River Borough Surf City Borough
Berkeley Township	421	
Eagleswood Township	194	
Jackson Township	1741	
Lacey Township	45	
Lakewood Township	419	
Little Egg Harbor	323	
Manchester Township	241	
Ocean Township	32	
Plumsted Township	481	
Stafford Township	928	
Toms River Township	441	
Tuckerton Boro	13	

4.3.3 Earthquake

The State of New Jersey Hazard Mitigation Plan offers the following definition for earthquake events: "An earthquake occurs when accumulated strain within the earth's crust is suddenly released along a fault. Energy from this movement travels along and below the ground surface and within the crust. The arrival of this released energy to an area is experienced as an earthquake" (NJOEM, 2014).

When an earthquake occurs, the initial source of damage to buildings and other structures is a product of ground movements that cause structures to vibrate. During moderate ground shaking the vibrations may be in the structure's elastic ring resulting in little or no damage to the building. The stronger the ground shaking episodes, the greater the strains on structural members that may then undergo sufficient strain to break these members. If severe enough, such cracking can result in the collapse of whole structures. Also, wood frame buildings that are not securely anchored to their foundations may be jolted off their mounts.

In most major earthquakes, structures most seriously damaged by ground movements are un-reinforced structures whose load-bearing walls are built from sand/lime/mortar brick. Multi-story steel frame buildings fare comparatively well, although extensive non-structural damage does occur. Highways, utility infrastructure, and industrial facilities are also at risk from earthquake damage.

Damage not caused directly by an earthquake often occurs after a shaking event. Known as secondary damage, it can be especially severe in heavily urbanized areas. Secondary damage after large earthquakes can include fires in collapsed buildings and severed utility lines, explosions from gas mains, and floods from dam breaches.

There are two common ways to measure earthquakes. Earthquake strength, or magnitude, is measured using networks of seismographs, instruments that precisely measure the shaking of the ground. The most well-known scale of magnitude is the Richter scale, designed by Charles F. Richter in 1935, in which an increase of one point represents a ten-fold increase in power of the earthquake and a thirty-two fold increase in energy released for an equal duration of shaking.

Although magnitude measures earthquake strength well, it is not an accurate measure of damage or intensity. An earthquake in a densely populated area, resulting in many casualties and building collapses, may have the same magnitude as an earthquake which occurs in a remote, rural locale that does nothing more than flush grouse from the underbrush.

The result of earthquake on the built environment is measured as intensity. Intensity measures the combined effects of magnitude, distance from the epicenter and local geology on earthquake effects. The most commonly used intensity scale is the Modified Mercalli Intensity Scale. Originally designed by Giuseppi Mercalli in 1902, the I to XII scale was modified in 1931 by American seismologists Harry O. Wood and Frank Neuman to better incorporate effects on modern infrastructure. The Modified Mercalli scale is based on firsthand reports of people awakening, sound descriptions, timing of the event, movement experienced, and visible effects on structures and landscapes. It is reported in the Roman Numeral format in order to differentiate it from measures of magnitude.

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock usually within the upper 10 to 20 miles of the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides, or the collapse of underground caverns (FEMA, 1997).

4.3.3.1 Location and Extent

In Ocean County, no specific area or jurisdiction is more susceptible to earthquakes than others; all municipalities all share in potential risk.

Earthquakes are located by the epicenter, or the surface location at the point of origin where the earthquake is strongest. The United States Geological Survey has identified hazard zones for the state of New Jersey. As seen in Figure 4.3.3-1, Ocean County falls within a low to moderate zone for seismic hazard (USGS, 2014). While the overall relative hazard is low, historically, earthquakes have occurred more often in the northern section of Ocean County than in the southern portion. Ocean County does not have a greater history of earthquakes than other counties in the state, and the earthquakes on record have been characterized by low severity.

4.3.3.2 Range of Magnitude

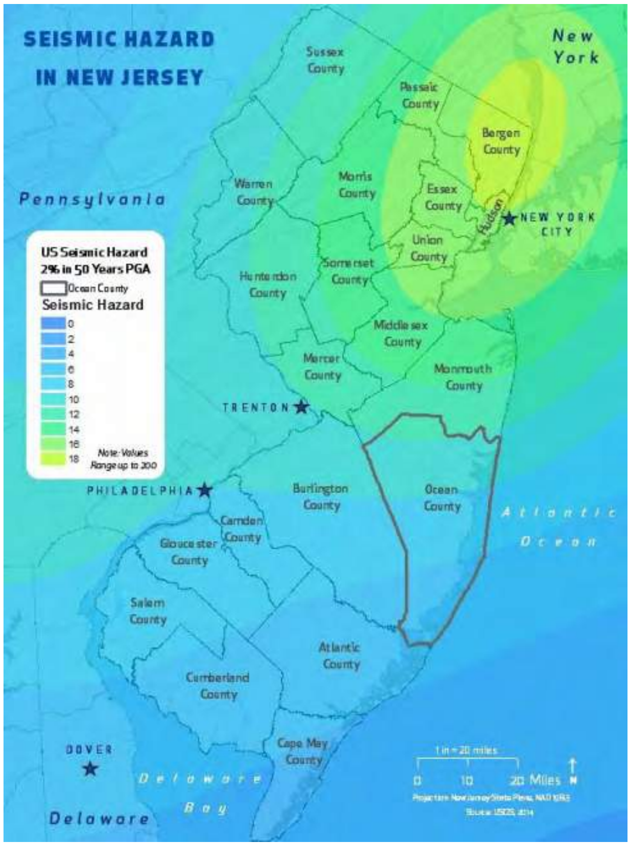
The following is an excerpt from the New Jersey Geological Survey, Information Circular:

"Predicting the location and extent of damage is an important part of preparing for earthquakes. Damage depends on the location, depth and magnitude of the earthquake, the thickness and composition of soil and bedrock beneath the area in question, and the types of building structures.

Soils influence damage in two ways. Soft soils amplify the motion of earthquake waves, producing greater ground shaking and increasing the stresses on structures. Loose, wet, sandy soils may lose strength and flow as a fluid when shaken (a process known as liquefaction), causing foundations and underground structures to shift and break. Mapping the ground-shaking and liquefaction potential of soils is an essential component in predicting earthquake damage. Ground-shaking behavior is mapped by summing physical measures of the density and compaction of soil and rock layers to a depth of one hundred feet. Liquefaction susceptibility is determined by the geologic history, depositional setting and topographic position of the soil."

Several factors influence the severity concerns of Ocean County officials. Sandy soils are certainly prone to the liquefaction described previously (figure 3.18). Another concern is in the wood frame residences that many residents live and in the mobile home parks that some residents live. None of these structures would fare well in a significant earthquake.

Figure 4.3.3-1 Seismic Hazard Map for State of New Jersey (USGS, 2014)



Compared to other states, especially California and Alaska, New Jersey is relatively free of earthquake activity. Even considering only the eastern half of North America, New Jersey has experienced fewer earthquakes than most other states. Nonetheless, earthquakes have occurred in New Jersey at a range of magnitudes.

Earthquake magnitude is often measured using the Richter scale, an open-ended logarithmic scale that describes the energy release of an earthquake. Table 4.3.3-3 summarizes Richter Scale Magnitudes as they relate to the spatial extent of impacted areas. There have been 11 historical earthquakes either in, or within the vicinity of Ocean County from 1919 to present day, ranging in magnitude from 2.0 to 4.0. Figure 4.3.3-illustrates New Jersey's Seismic Hazard map with the largest number of hazards occurring in the upper northeast portion of the State. Statewide, the largest earthquake in New Jersey's history reached a magnitude of 5.3 (NJDEP, 2017).

Table 4.3.3-1 Richter Scale Magnitudes and Associated Earthquake Size Effects

Richter Magnitudes	Earthquake Effects
Less than 3.5	Generally not felt, but recorded.
3.5-5.4	Often felt, but rarely causes damage.
Under 6.0	At most, slight damage to well-designed buildings.
6.1-6.9	Can be destructive in areas where people live up to about 100 kilometers across.
7.0-7.9	Major earthquake; can cause serious damage over large areas.
8.0 or greater	Great earthquake; can cause serious damage in areas several hundred kilometers across.

The Richter Scale does not give any indication of the impact or damage of an earthquake, although it can be inferred that higher magnitude events cause more damage. Instead, the impact of an earthquake event is measured in terms of earthquake intensity, usually measured using the Modified Mercalli Intensity Scale, shown in Table 4.3.1.2-2. Many earthquakes occurring in Ocean County in the past do not have recorded intensities. However, of the events with recorded intensities, the intensity has ranged from III to IV. However, since the worst earthquake recorded in New Jersey was a magnitude 5.3, a worst-case earthquake event would be of a similar magnitude in Ocean County. As described in Tables 4.3.1.2-1 and 4.3.1.2-2, this magnitude of event would be felt and non-stationary objects would shake or fall off shelves, walls would crack, trees would sway, and suspended objects would swing, but damage would overall be moderate and would likely be concentrated in populated areas of the County.

Table 4.3.3-2 Modified Mercalli Intensity Scale with Associated Impacts

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER SCALE MAGNITUDE
I	Instrumental	Detected only on seismographs	<4.2
II	Feeble	Some people feel it	<4.2
III	Slight	Felt by people resting; like a truck rumbling by	<4.2
IV	Moderate	Felt by people walking	<4.2
V	Slightly Strong	Sleepers awake; church bells ring	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	<5.4
VII	Very Strong	Mild alarm, walls crack, plaster falls	<6.1
VIII	Destructive	Moving cars uncontrollable, masonry fractures, poorly constructed buildings damaged	<6.9
IX	Ruinous	Some houses collapse, ground cracks, pipes break open	<6.9
X	Disastrous	Ground cracks profusely, many buildings destroyed, liquefaction and landslides widespread	<7.3
XI	Very Disastrous	Most buildings and bridges collapse, roads, railways, pipes and cables destroyed, general triggering of other hazards	<8.1
XII	Catastrophic	Total destruction, trees fall, ground rises and falls in waves	>8.1

Earthquakes can devastate a widespread area and often result in costly environmental impacts. Though these impacts will unlikely take place in Ocean County, here are some examples:

- Induced flooding or landslides and avalanches
- Poor water quality
- Damage to vegetation
- Breakage in sewage or toxic material containments

4.3.3.3 Past Occurrence

The following reflects a list of past occurrences in Ocean County. This list does not necessarily reflect all earthquakes that occurred outside the County, but only those that resulted in damage.

Table 4.3.3-3 Earthquakes that Have Impacted Ocean County and Resulted in Damage (NJDEP, 2017)

Date	Location of Earthquake	Details
11/1/1755	Lisbon, Portugal	Caused a tidal wave that impacted the east coast
6/18/1871	Long Island, New York	Caused a tidal wave that is believed to have caused a tidal surge that impacted Ocean County
9/1/1985	High Bridge, New Jersey	Is believed to have caused tidal surges that impacted Ocean County
11/6/1912	Borough of Beach Haven, New Jersey	Magnitude unknown
8/6/1923	Rockaway Beach, New York	Caused a tidal wave that impacted Ocean County
8/8/1924	Coney Island, New York	Caused a tidal wave that impacted Ocean County
6/1/1927	Asbury Park, New Jersey	Damages were reported as far south as Toms River. It is unknown whether these damages were caused by a tidal wave.
6/9/1930	Longport, New Jersey	Is believed to have caused a tidal surge that impacted Ocean County.
8/19/1931	Atlantic City, New Jersey	Caused a tidal wave in Ocean County
8/23/1938	Borough of Lakehurst, Ocean County	Two earthquakes with a magnitude of 3.8 and 4.0.
1/21/1971	Borough of Lakehurst, Ocean County	Earthquake with a magnitude of 2.7.
4/5/1980	Borough of Barnegat Light, Ocean County	Earthquake with a magnitude of 2.9.
7/29/1982	Borough of Seaside Park, Ocean County	Earthquake with a magnitude of 2.4.

According to records maintained by the New Jersey Geological Survey, there have been 8 historical earthquakes with epicenters within in Ocean County. In the neighboring counties of Burlington and Monmouth, there have been 3 earthquakes within close proximity to Ocean County. The range of earthquakes can extend to an area up to 100 kilometers; there have been 178 earthquake epicenters within New Jersey. These prior events are listed in Table 4.3.3-4 and shown in Figure 4.3.3-2 below.

Table 4.3.3-4 Past Earthquake Events Occurring in or near Ocean County (NJDEP, 2017)

Year	Location of Epicenter	Magnitude
1919	Off coast of Long Beach Township	Unknown
1938	Jackson Township	4
1938	Jackson Township	3.8
1968	Burlington County	1.9
1977	Manchester Township	2.7
1980	Off coast of Berkeley Township (barrier island section)	2.9
1982	Off coast and along the border of Toms River and Berkeley Townships	2.4
1986	Monmouth County	2.3
1996	Lacey Township	2
2011	24 km south-southwest of Lakehurst (Burlington County)	1.9
2014	Millstone Township, on the border of Monmouth and Ocean County	1.9

Figure 4.3.3-2 **Location and Magnitude of Past Earthquake Events in Ocean County (NJ DEP, NJ Geological Survey, 2012)**

4.3.3.4 Future Occurrence

It is impossible to predict earthquakes since they occur without warning. In Ocean County, the probability of an earthquake occurring is a real likelihood. Just as likely is the probability that an earthquake that has occurred outside of the borders of Ocean County will impact the County with either tidal surges or other damages at some time in the future.

Although the United States east of the Rocky Mountains has fewer and generally smaller earthquakes than the west, at least two factors increase the earthquake risk in New Jersey and the east. Due to geologic differences, eastern earthquakes affect areas ten times larger than western ones of the same magnitude. Also, the eastern United States is more densely populated, and New Jersey is the most densely populated state in the nation.

New Jersey's building code has some provisions for earthquake-resistant design. There are no requirements for retrofitting existing buildings or for un-reinforced masonry structures that are most vulnerable to earthquake damage. In Ocean County, the sandy soils only compound the problem.

The greatest probability for an earthquake in New Jersey exists in the northern portion of the State near the Ramapo Fault. This does not however, exempt Ocean County from this threat. History shows that past recorded earthquakes have been relatively small, with a magnitude of 2.4-4.0 on the Richter Scale. The impact on Ocean County during these events has been minimal.

In Ocean County the realization that past events have been minor does not guarantee that the county could not be severely impacted in the future either directly, or indirectly, by an earthquake.

One way to express an earthquake's severity is to compare its acceleration to the normal acceleration due to gravity. Peak horizontal ground acceleration (PHGA) measures the strength of ground movements in this manner. PHGA is the percent of g (acceleration due to gravity) experienced during the earthquake or the rate in change of motion of the earth's surface during an earthquake as a percent of the established rate of acceleration due to gravity. In general, an acceleration of 10 percent to 15 percent of gravity is associated with structural damage to ordinary buildings not designed to withstand earthquakes, although soil conditions at individual sites will impact the amount of damage.

Past events indicate that earthquakes will continue to occur in Ocean County even though their impacts may be small. Overall, the future occurrence of earthquakes in Ocean County is less than one percent annually, or unlikely, as defined by the Risk Factor methodology probability criteria (see Table 4.4.1-1).

4.3.3.5 Vulnerability Assessment

Earthquakes will continue to occur in Ocean County, but most events will have minor effects. In the event of an earthquake event of the size and magnitude experienced by Ocean County in the past, trees may sway, unanchored objects may be upset and, at worst, walls may crack and plaster may fall.

4.3.4 Extreme Temperature

Extreme Cold

Extreme cold often accompanies a winter storm or is left in its wake. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. In Ocean County, periods of twenty degrees or less for a period of three days or more are considered periods of extreme cold. Pipes may freeze and burst in homes that are poorly insulated or without heat. Long cold spells can cause rivers to freeze.

Extreme Heat

Extreme heat events are defined by summertime weather that is substantially hotter and/or more humid than average for a location at that time of year. Unlike other defined hazards, extreme heat events are more threatening to people and other living things, and less threatening to properties and structures. Extreme heat event conditions can increase the incidence of mortality and morbidity in affected populations.

4.3.4.1 Location and Extent

Extreme temperatures occur during winter and summer seasons in Ocean County. Extreme heat occurs when temperatures hover 10 degrees or more above the average high temperature for a region for several weeks. Urban environments tend to remain warmer as more heat is retained and less cooling takes place in the evenings. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric pressure traps hazy, damp air near the ground (CDC, 2007). Dust storms and low visibility can result from excessively dry and hot conditions. One of the most dangerous situations arising from extreme heat is the combination of a drought and a heat wave.

Ocean County is vulnerable to extreme events during the summer months. Prior to events, warnings and watches are issued by the National Weather Service to allow people time to prepare. If heat stress conditions are forecast to occur within the next 24 hours, an excessive heat warning will be issued. A heat advisory will be issued if, within the next 24 hours, heat stress is forecast to occur (if air mass is MT+, less than 5 deaths are forecast). If heat stress conditions are forecast to occur in the next 24 to 48 hours, an excessive heat watch is issued. If heat stress conditions are forecast to occur in the next 48 to 120 hours, an excessive heat outlook is issued. The coastal communities are often spared the brunt of extreme heat events, however, when the wind direction is west to southwest, the cooler ocean air no longer provides relief.

All of Ocean County is susceptible to extreme cold, snow storms and ice accumulations. Generally, the larger accumulation (approximately twenty-five inches) of snow falls in the northwest section of the County in the Townships of Plumsted and Jackson. The Municipalities along the coast usually receive the least amount of snow (approximately fifteen inches). These jurisdictions include Barnegat, Berkeley, Brick, Eagleswood, Lacey, Little Egg Harbor, Long Beach, Ocean, Stafford, and Toms River townships and Barnegat Light, Bay Head, Beach Haven, Harvey Cedars, Island Heights, Lavallette, Mantoloking, Point Pleasant Beach, Seaside Heights, Seaside Park, Ship Bottom, Surf City, and Tuckerton boroughs. However, it should be noted, snowfalls in a nor'easter frequently favor the southern end of the County and the coastline.

In the winter months, the county often experiences extreme cold temperatures. Winter storms and high winds can exacerbate cold temperatures and endanger people who are exposed for long periods of time. Extreme cold temperatures are well below the average level for an area during the winter and often coincide with winter storm events.

Table 4.3.4-1 describes the minimum, mean and maximum daily average temperatures for the period 1981 to 2010 for the Toms River Station. Years after 2010 are tracked; however, because of the variability of daily temperature, they are not included in long-term trend analysis of temperature until the end of the current decade. Figures 4.3.4-1 and Figure 4.3.4-2 illustrate the average minimum and maximum temperature based on temperature data collected between 1981 and 2010.

Table 4.3.4-1 Minimum, Mean and Maximum Temperature Normals (1981-2010), (USDA/NRCS)

Toms River Station - Based on Data from 1981-2010	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
Minimum Temperature Normals (Deg F)	22	24	30.1	39.3	48.9	59	64	62	55	43	34.6	27	42.3
Mean Temperature Normals (Deg F)	32	34	40.5	50.2	60	69	75	73	66	55	45.5	36	52.9
Maximum Temperature Normals (Deg F)	41	44	50.9	61	71.1	80	85	83	77	67	56.5	46	63.5

Figure 4.3.4-1 **Map showing average minimum temperature based on temperature data collected between 1981 and 2010 (USDA/NRCS, 2012)**

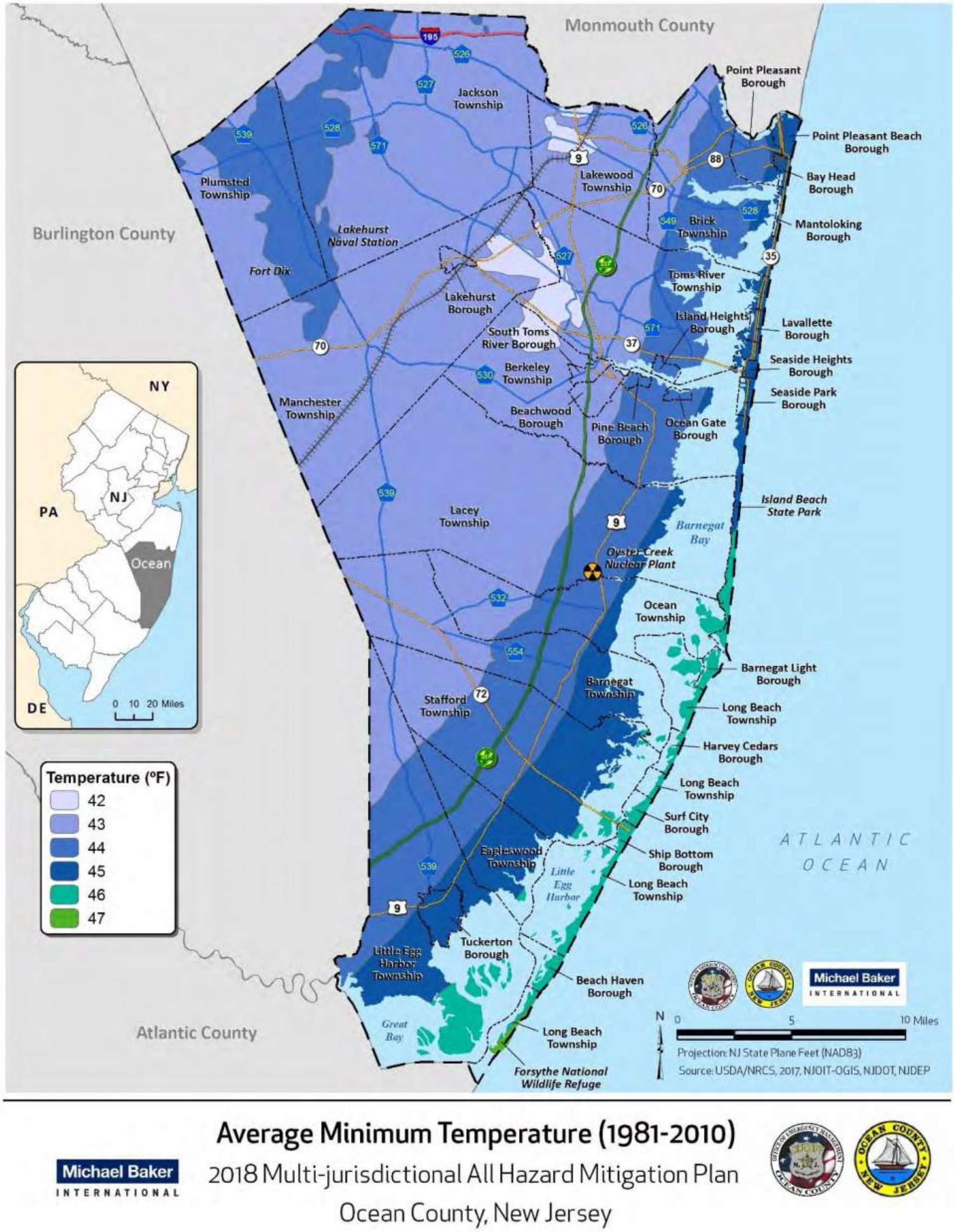
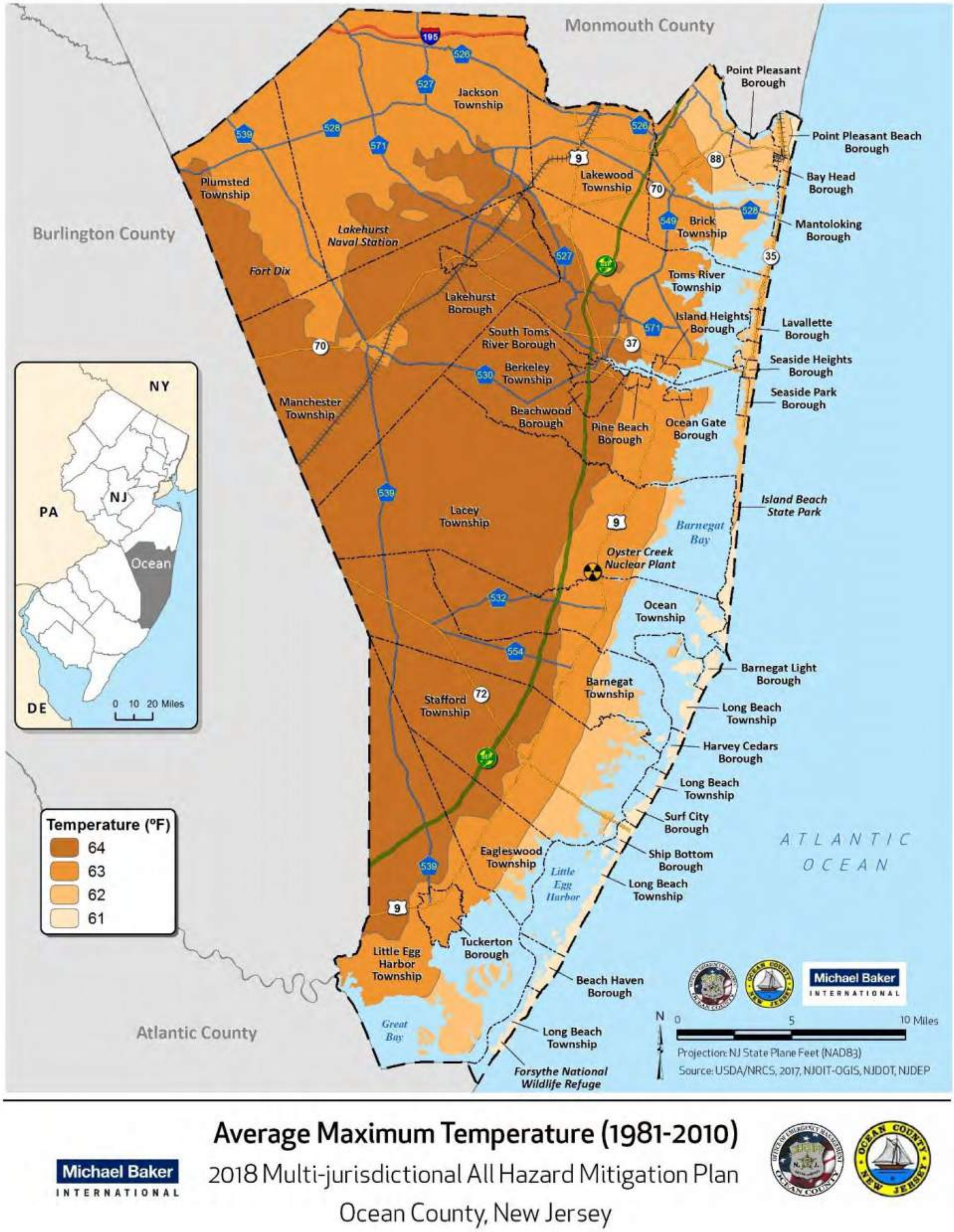


Figure 4.3.4-2 **Map showing average maximum temperature based on temperature data collected between 1981 and 2010 (USDA/NRCS, 2012)**



4.3.4.2 Range of Magnitude

Relative humidity and ambient air temperature are the main factors that determine the severity of extreme heat. Danger ensues when a prolonged heat wave occurs during drought conditions, limiting necessary water resources. If extreme temperatures remain for a prolonged period, Power supplies may be stressed if there are prolonged periods of extreme temperatures due to increased electricity demands from air conditioners that may overdraw the supply and lead to rolling brownouts. Exposure to extreme heat can indirectly cause health problems. This can be especially dangerous to individuals with preexisting medical conditions, typically the elderly, who make up a considerable portion of the population in Ocean County. Other groups at high risk of health impacts from extreme temperatures include infants, homeless individuals, economically disadvantaged people, socially isolated individuals, those with mental and physical disabilities, individuals exercising outdoors, and persons under the influence of drugs or alcohol.

The general population mortality rate varies by the season and more directly on weather conditions and temperature. On a winter's day the average mortality rate is about 15% higher than on a summer's day. Death and injury can result from cold weather through hypothermia, influenza, frostbite and pneumonia. Cold weather can often indirectly contribute to death and injury from falls, accidents, carbon monoxide poisoning, and house fires all of which are partially attributable to cold.

The following impacts can be observed following extreme temperature events:

Health Impacts - The health impacts of extreme cold are greater in terms of mortality in humans, but often after more prolonged exposure vs. a cold snap. Extreme heat waves, however, can prove more deadly over a shorter duration as heatstroke, heat exhaustion, seat syncope, sunburn, and heat cramps are all potential risks. Elderly residents living in urban settings with no access to an air-conditioned environment are at greatest risk of death during heat waves.

- Sunburn: redness and pain. In severe cases swelling of skin, blisters, fever, headaches.
- Heat cramps: painful spasms usually in muscles of legs and abdomen possible. Heavy sweating.
- Heat exhaustion: heavy sweating, weakness, skin cold, pale and clammy. Fast and weak pulse. Normal temperature possible. Fainting and vomiting.
- Heat stroke: sometimes called sunstroke, high body temperature, one hundred and six degrees or higher. Hot dry skin. Rapid and strong pulse, possible unconsciousness.

Heat disorders generally have to do with a reduction or collapse of the body’s ability to shed heat by circulatory changes and sweating, or a chemical (salt) imbalance caused by too much sweating. When heat gain exceeds the level the body can remove, or when the body cannot compensate for fluids and salt lost through perspiration, the temperature of the body’s inner core begins to rise and heat related illness may develop. Ranging in severity, heat disorders share one common feature: the individual has overexposed or over exercised for his age and physical condition in the existing thermal environment.

Sunburn, with its ultraviolet radiation burns, can significantly retard the skin's ability to shed excess heat. Studies indicate that, other things being equal, the severity of heat disorders tend to increase with age – heat cramps in a seventeen-year-old may be heat exhaustion in someone forty years old, and heat stroke in a person over sixty years old

Transportation Impacts – Cold weather can impact automotive engines, possibly stranding motorists, and stress metal bridge structures. Highway and railroad tracks can become distorted in high heat. Disruptions to the transportation network and accidents due to extreme temperatures represent an additional risk.

Agriculture Impacts – Absolute temperature and duration of extreme cold can have devastating effects on trees and winter crops. Livestock is especially vulnerable to heat and crop yields can be impacted by heat waves that occur during key development stages.

Energy Impacts - Energy consumption rise significantly during extreme cold weather, and any fuel shortages or utility failures that prevent the heating of a dwelling place residents in extreme danger. Extreme heat also can result in utility interruptions, and sagging transmission lines due to the heat can lead to shorting out.

Heat stress can result when people are exposed to extremely high temperatures. Heat stress can be divided into four categories of danger (see Table 4.3.4-2). Categories are defined by apparent temperature, which correlates to heat index, a value that takes into account relative humidity and the effects of dry air temperature. Major human risks for these temperatures include heat cramps, heat syncope, heat exhaustion, heatstroke, and death. The temperatures in Table 4.3.3-2 serve as a guide for various danger categories. The effect of extreme heat will differ for each person impacted. Factors such as health, age, and economic state will influence how a person reacts to heat stress.

Table 4.3.4-2 Four categories of heat stress (FEMA, 1997).

DANGER CATEGORY	HEAT DISORDERS	APPARENT TEMPERATURE (°F)
I (Caution)	Fatigue possible with prolonged exposure and physical activity.	80 to 90
II (Extreme Caution)	Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and physical activity.	90 to 105
III (Danger)	Sunstroke, heat cramps, or heat exhaustion likely; heat stroke possible with prolonged exposure and physical activity.	105 to 130
IV (Extreme Danger)	Heatstroke or sunstroke imminent.	>130

Both relative humidity and ambient air temperature contribute to the severity of extreme heat. Figure 4.3.4-3 displays the likely health effects suffered by people exposed to extreme heat and humidity.

Figure 4.3.4-3 The Heat Index (NOAA).

NWS Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution Extreme Caution Danger Extreme Danger

In addition, Ocean County is susceptible to long periods of below freezing temperatures that last for days or even for weeks at a time. Exposure to extreme cold can lead to frostbite and if exposed for too long, and death if exposure continues past a point. The risk of residential fires increases due to space heaters or other unsafe means of supplementing heat in homes. Pipes in homes have the potential to burst during long cold spells. Figure 4.3.4-4 shows wind chills and frostbite times.

Figure 4.3.4-4 National Weather Service Wind Chill Chart (NWS, 2001).

Temperature (°F)

Wind (mph) \ Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

One of the worst extreme heat events in Ocean County occurred on July 4, 1999. New Jersey experienced a heat wave throughout the entire Independence Day weekend. A strong wind blowing west to south west blocked the cooling effects of the ocean breeze. High temperatures combined with stifling humidity produced heat indices of around 110 degrees during the afternoon of each day of the weekend. Seventeen people in New Jersey including three in Ocean County died due to heat-related illness and approximately 160 people reported heat related injuries across the state. Most of the fatalities were elderly individuals in a poor state of health and lacking both air-conditioning and ventilation. Two of the three deaths attributed to Ocean County occurred on Long Beach Island. Many of the injuries reported happened in Ocean County, including eight critical cases of heat exhaustion. Due to the increase in demand for power, outages and blackouts in the county began on July 4th, especially on Long Beach Island. As a result, Red Cross opened shelters in Dover, Long Beach and Stafford Townships (NCDC, 2013).

Historically, Ocean County has experienced extreme cold, along with snow or freezing precipitation that typically accompanies cold temperatures. Since 1950, periods of extreme cold have resulted in 5 deaths and 7 injuries in New Jersey. One of the worst extreme cold events in Ocean County occurred from January 14 to 29, 2003. During this long cold spell, homeless shelters were filled and several water mains broke due to the cold. In Ocean County, fishing boats stayed at port due to freezing spray that threatens the stability of the vessels. Many homeowners in the county reported pipes bursting, especially for vacation homes that were not winterized properly. The minimum temperature in the county during this period was 3 degrees Fahrenheit.

4.3.4.3 *Past Occurrence*

Table 4.3.4-3 lists 87 extreme or record heat and cold events that have occurred in the County between 1996 and 2016. The number of fatalities and injuries are included in the table along with the length of the event and the maximum or minimum temperature in Ocean County.

Table 4.3.4-3 Previous Temperature extremes impacting Ocean County from 1996-2016 (NCDC, 2017)

Date	Event	Duration (in Days)	Max or Min Temperature	Deaths *	Injuries
2/4/1996	Cold/Wind Chill	3	-8	0	0
5/19/1996	Heat	3	96	0	0
1/3/1997	Record Heat	3	61	0	0
1/17/1997	Cold/Wind Chill	4	-1	0	0
4/9/1997	Record Cold	3	26	0	0
2/19/1997	Record Heat	4	73	0	0
2/26/1997	Record Heat	3	73	0	0
3/1/1997	Record Heat	2	73	0	0
6/25/1997	Heat	2	99	0	4
7/13/1997	Heat	8	99	0	25
8/16/1997	Heat	2	100	0	0
1/4/1998	Record Heat	6	67	0	0
3/27/1998	Record Heat	5	89	0	0
6/25/1998	Heat	2	95	0	20
7/20/1998	Heat	4	97	0	0
8/23/1998	Heat	4	95	0	0
9/27/1998	Record Heat	1	93	0	0
11/28/1998	Record Heat	3	70	0	0
12/1/1998	Record Heat	7	78	0	0
6/7/1999	Heat	3	98	0	0
7/4/1999	Heat	3	100	17	160
7/16/1999	Heat	4	96	1	0
7/23/1999	Heat	9	99	0	0
8/1/1999	Heat	1	99	0	0
1/2/2000	Record Heat	3	64	0	0
3/8/2000	Record heat	3	80	0	0
6/26/2001	Heat	5	94	0	0
7/24/2001	Heat	2	92	0	0
8/6/2001	Heat	5	103	2	0
12/1/2001	Record Heat	1	73	0	0
12/4/2001	Record Heat	3	73	0	0
1/27/2002	Record Heat	4	66	0	0

Date	Event	Duration (in Days)	Max or Min Temperature	Deaths *	Injuries
6/24/2002	Heat	4	96	0	0
7/1/2002	Heat	4	97	0	0
7/15/2002	Heat	5	94	0	0
7/28/2002	Heat	3	98	0	0
8/1/2002	Heat	5	96	1	0
8/11/2002	Heat	10	97	1	0
1/14/2003	Cold/Wind Chill	16	3	1	7
6/24/2003	Heat	4	94	0	0
7/4/2003	Heat	6	96	0	0
1/9/2004	Cold/Wind Chill	3	4	0	0
1/15/2004	Cold/Wind Chill	2	5	0	0
12/20/2004	Cold/Wind Chill	1	11	0	0
1/18/2005	Cold/Wind Chill	1	0	0	0
1/23/2005	Cold/Wind Chill	2	0	0	0
1/28/2005	Cold/Wind Chill	1	3	4	0
6/13/2005	Heat	2	93	0	0
7/18/2005	Heat	2	92	2	0
7/25/2005	Heat	3	97	0	0
8/2/2005	Heat	4	96	0	0
8/11/2005	Heat	4	98	0	0
8/1/2006	Heat	3	98	0	41
1/26/2007	Cold/Wind Chill	1	11	0	0
6/26/2007	Heat	3	94	0	0
7/8/2007	Heat	3	95	0	0
8/7/2007	Heat	2	93	0	0
8/25/2007	Heat	1	93	0	0
6/7/2008	Heat	4	100	0	10
7/16/2008	Heat	7	98	0	0
1/16/2009	Cold/Wind Chill	3	4	0	0
8/16/2009	Heat	6	95	0	4
6/23/2010	Heat	2	98	0	0
7/5/2010	Heat	3	100	0	0
8/10/2010	Heat	2	94	0	0
6/8/2011	Heat	2	102	0	0
6/20/2012	Heat	2	99	0	0
6/29/2012	Heat	1	96	0	0
7/1/2012	Heat	1	95	0	0
7/4/2012	Heat	4	100	0	0

Date	Event	Duration (in Days)	Max or Min Temperature	Deaths *	Injuries
7/26/2012	Heat	1	94	0	0
1/23/2013	Cold/Wind Chill	2	-3	0	1
7/6/2013	Heat	2	95	0	0
7/15/2013	Heat	6	99	0	0
9/11/2013	Heat	1	95	0	0
1/4/2014	Cold/Wind Chill	1	-8	0	0
1/7/2014	Cold/Wind Chill	1	6	0	0
1/22/2014	Cold/Wind Chill	1	4	0	0
6/17/2014	Heat	2	97	0	0
7/2/2014	Heat	1	94	0	0
1/7/2015	Cold/Wind Chill	2	7	0	0
2/13/2015	Cold/Wind Chill	1	9	1	0
2/15/2015	Cold/Wind Chill	1	-14	2	0
2/20/2015	Cold/Wind Chill	2	-22	0	0
2/24/2015	Cold/Wind Chill	1	1	1	0
7/19/2015	Heat	1	95	0	0
2/14/2016	Cold/Wind Chill	1	-12	0	0
*Death figures are for the entire area affected by the event. Where available, Ocean County specific death figures are included in parentheses.					

4.3.4.4 Future Occurrence

Based on geography, location, and past event history, the County is more likely to experience excessive heat than extreme cold. Temperature often differs due to topography and vegetation. As development continues in Ocean County, the effects of heat will increase as the new pavement and buildings retain more heat than vegetated areas. Winter events, including extreme cold, snow and ice will always be a threat to Ocean County residents. Nearly every winter such an event occurs at least once.

As climate changes, Ocean County is more likely to experience both extreme heat and extreme cold events. Figure 4.3.4-5 and Figure 4.3.4-6 graphs the historic and projected number of days with a maximum temperature above 95 degrees and Figure 4.3.3-6 graphs the historic and projected number of days with a minimum temperature below 32 degrees.

Figure 4.3.4-5 Days with a Maximum Temperature Above 95 Degrees in Ocean County

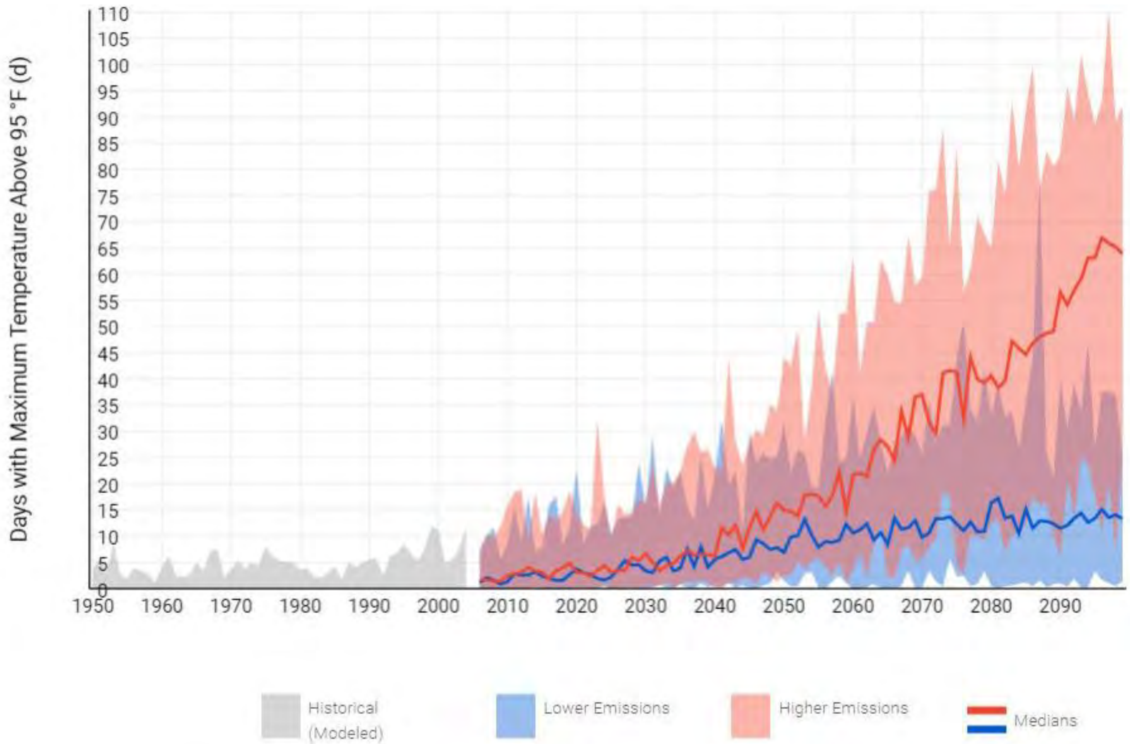
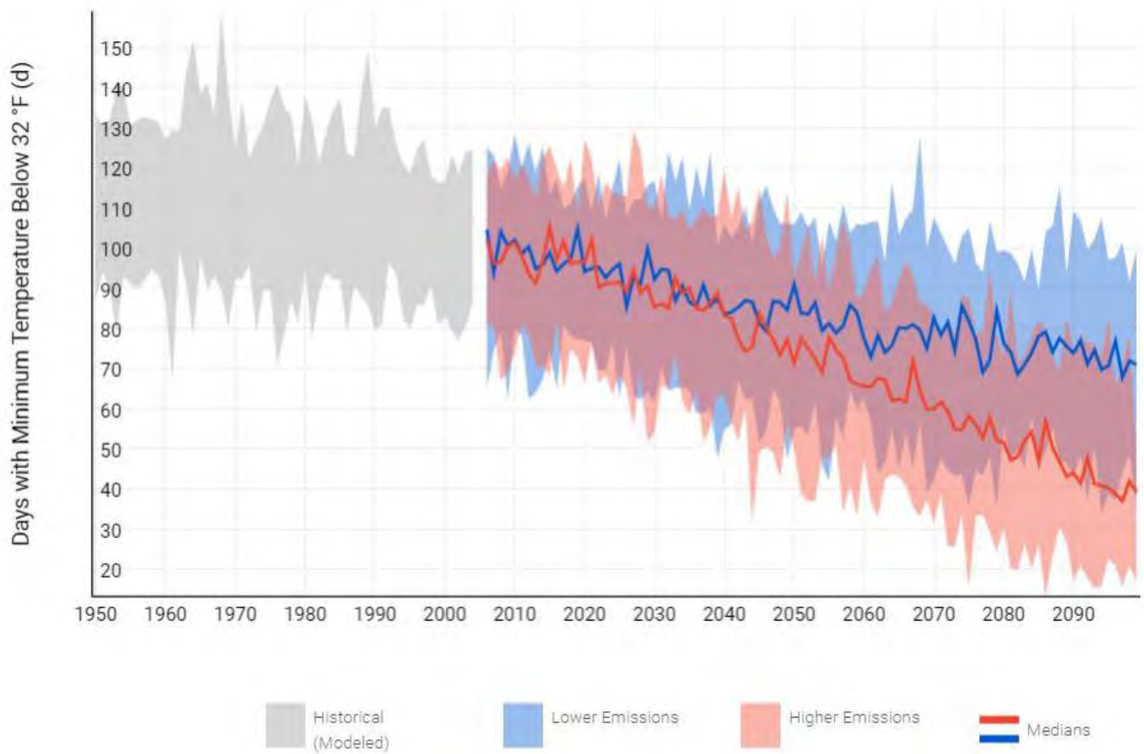


Figure 4.3.4-6 Days with a Minimum Temperature Below 32 Degrees in Ocean County



About Twenty-three percent of Ocean County's population is over the age of sixty five (ACS, 2015). With a large senior population, which is likely to climb in numbers in the future, the threats identified with extreme temperature events are likely to be more significant than in other jurisdictions in New Jersey. For more information on vulnerable populations in the county, see Section 2.3 Population and Demographics.

The probability that an extreme temperature event will occur in a given year can be considered possible, as defined by the Risk Factor methodology probability criteria (see Table 4.4.1-1).

4.3.4.5 Vulnerability Assessment

During summer and winter seasons, Ocean County residents will encounter extreme heat and cold weather conditions. Weather forecasts offer warning prior to most extreme temperature days. Risk of death and injury can be reduced by heeding warnings regarding dangerous high and low temperatures. This holds true especially for adults 75 years of age and older and for people with certain pre-existing medical conditions, who are most vulnerable to cold and heat spells. Long periods of extreme temperatures can overstress power supply systems, resulting in brown outs or blackouts, and leave large communities without means of cooling or heating their homes.

Contaminated air may result in urban areas during heat waves when stagnant atmospheric conditions trap pollutants. In more developed areas, this may occur, compounding the effects of extreme heat with an additional hazard.

Improved forecasts, warnings, community preparedness and appropriate community based response will help to reduce the risk of these impacts, especially health effects. Air conditioning offers immediate relief from heat for homes and buildings, but new green building techniques should also be considered to reduce the level of heat inside structures. Residents should be encouraged to plant trees to shade homes and help absorb heat in urban areas where roofs and asphalts radiate heat. Where possible in suburban and urban environments, green roofs are recommended to reduce the ambient air temperature.

During extreme heat or cold events, it is critical that communities plan ahead to help and protect vulnerable populations. This could include making local government buildings available to the public during the heat of the day or during the cold to provide refuge. Also, providing residents with information and guidance on extreme events as well as warning signs of health related problems that can develop will better prepare them.

4.3.5 Flooding

Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in Ocean County. Flooding concerns in Ocean County include riverine/inland flooding from excessive precipitation, stormwater flow issues, or dam failure, and coastal flooding from storm surge, storm tide, and shallow coastal flooding. Winter flooding with ice jams are unlikely in Ocean County, but are possible.

Riverine and inland flooding are typically experienced when precipitation occurs over a given river basin for an extended period of time. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious surfaces. The severity of a flood event is dependent upon a combination of stream and river basin topography and physiography, hydrology, precipitation and weather patterns, present soil moisture conditions, the degree of vegetative clearing as well as the presence of impervious surfaces in and around flood-prone areas (NOAA, 2009). Coastal flooding, on the other hand, occurs when a severe storm with heavy winds pushes water onto the shore above the predicted tide. Storm tide is also a concern for coastal flooding. According to the National Hurricane Center, storm tide "is defined as the water level rise due to the combination of storm surge and the astronomical tide" (NHC, 2013). The storm tide was a major factor during Hurricane Sandy. Shallow coastal flooding occurs when there is little to no wind influence when excessive precipitation occurs during high tides.

Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams. All forms of flooding can damage infrastructure such as bridges, flood control or channel stabilization structures (NOAA, 2006).

Flooding related to dam failures occurs most often during or after a massive rainfall, during a natural flood event, or during a spring thaw. Dam failure-related flooding may occur with little to no warning, and the severity of the flooding is dependent on the size of the water body or impoundment area of the dam.

The effect of sea level rise on coastal flooding due to climate change impacts is a major concern in the region. Generally speaking, sea level rise impacts all areas in Ocean County subject to coastal flood hazards. However, there are two specific mechanisms which influence the location and extent of sea level rise. First, sea level rise can result in the permanent submergence of low-lying coastal areas. In a simple sense, it can be assumed that a one foot rise in sea level will generally inundate areas that have an elevation of one foot or less. It is important to recognize that hazard areas identified in these figures do not consider natural processes such as coastal erosion or marsh migration that will occur due to sea level rise. Future geomorphological changes are expected.

A flood is a natural event for rivers, streams, and coastlines. Excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers, lakes, and oceans that are subject to recurring floods. Hundreds of floods occur each year, making it one of the most common hazards in all fifty states and the United States territories. Floods kill an average of one hundred and fifty people a year nationwide. They can occur at any time of the year, in any part of the country, and at any time of the day or night. Floodplains in the United States are home to over nine million households. Most injuries and deaths occur when people are swept away by flood currents, and most property damage results from inundation by sediment-filled water.

Several factors determine the severity of floods, including rainfall intensity and duration. A large amount of rainfall over a short time span may result in flash flood conditions. A small amount of rain may also result in floods in locations where the soil is saturated from a previous wet period, or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, or other impervious areas. Topography and ground cover are also contributing factors for floods. Water runoff is generally greater in areas with steep slopes and little or no vegetative ground cover.

Riverine and storm water flooding may include overflow from a river channel, flash floods, alluvial fan floods, mudflows and debris flows, ice-jam floods, flooding due to dam failure, overburdened drainage infrastructure, high groundwater levels, or fluctuating lake levels.

Coastal flooding often originates from tropical storms, hurricanes and mid-latitude low-pressure systems often referred to as extra tropical storms or nor'easters.

4.3.5.1 Location and Extent

Many communities in Ocean County are located along the Atlantic coast or by streams or creeks, all of which are flood prone as seen in Figure 4.3.5-3. Floodplains are lowlands adjacent to rivers, streams, and creeks that are subject to recurring floods. The size of the floodplain is described by the recurrence interval of a given flood. Flood recurrence intervals are explained in more detail in Section 4.3.5.4. Coastal flooding is often also associated with waves, high winds, coastal erosion, storm surge, and sea level rise.

In assessing the potential spatial extent of flooding, it is important to know that a floodplain associated with a flood that has a 10 percent chance of occurring in a given year is smaller than the floodplain associated with a flood that has a 0.2 percent annual chance of occurring. Community development of the floodplain has resulted in frequent flooding in these areas.

The NFIP, for which Flood Insurance Rate Maps (FIRMs) are published, identifies the 1 percent annual chance flood. This 1 percent annual chance flood event is used to delineate the Special Flood Hazard Area (SFHA) and identify Base Flood Elevations. Figure 4.3.5-1 illustrates these terms for riverine flood events. The SFHA serves as the primary regulatory boundary used by FEMA, the state of New Jersey, and Ocean County's local governments.

Figure 4.3.5-1 **Diagram Identifying Special Flood Hazard Area, 1 Percent Annual Change (100-Year) Floodplain, Floodway, and Flood**

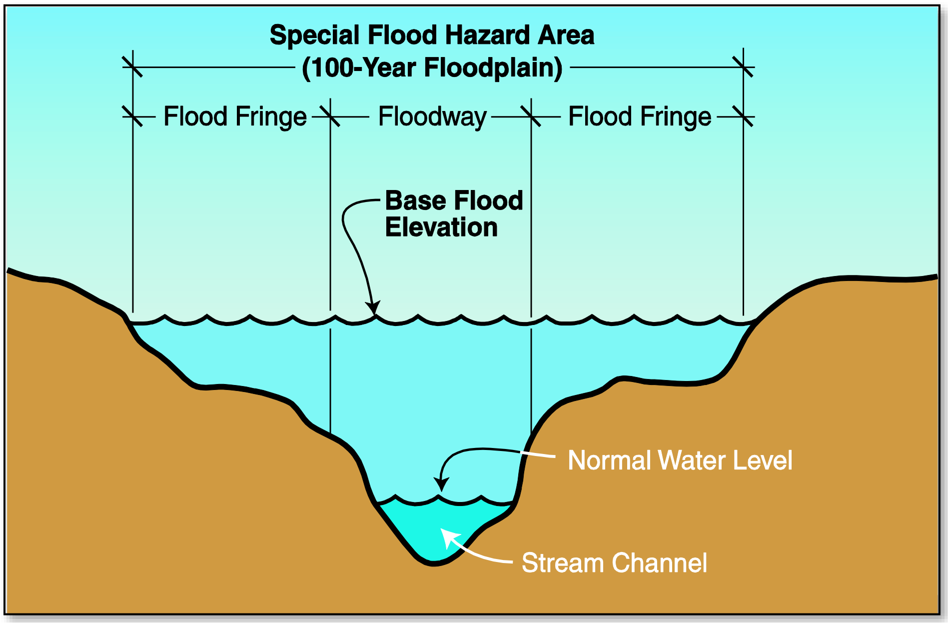
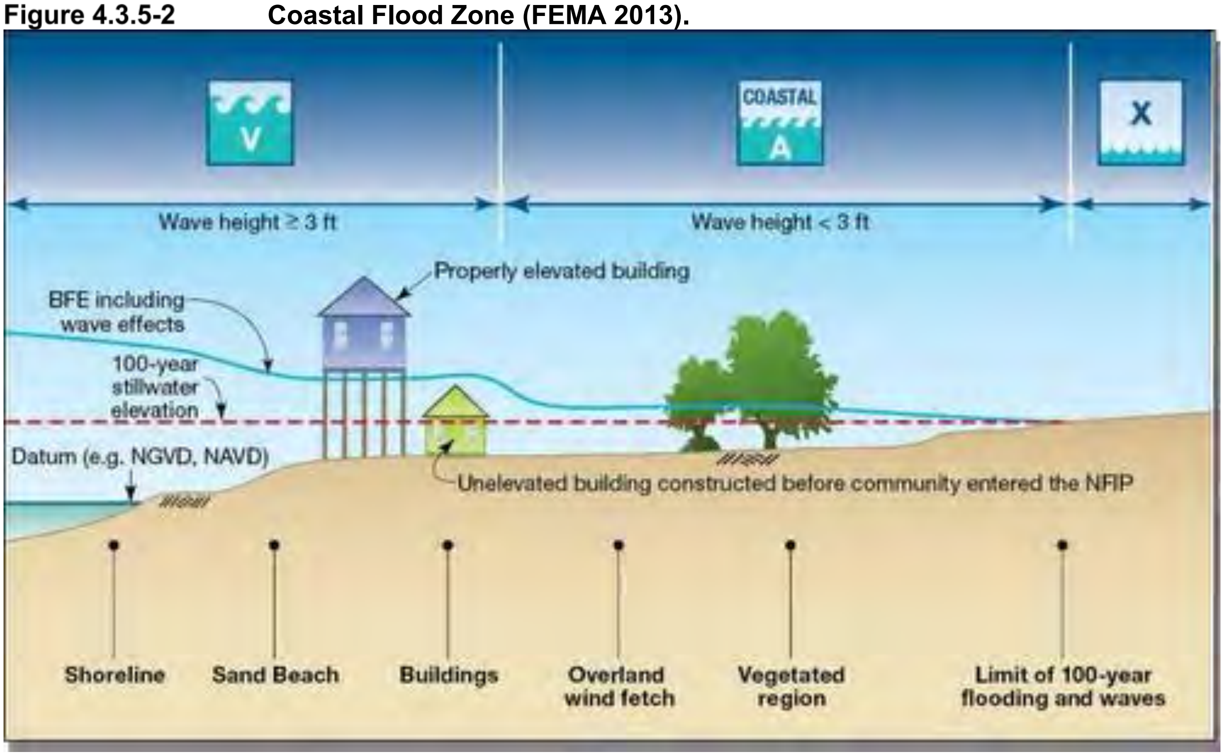


Figure 4.3.5-2 illustrates SFHA terminology for coastal flood zones. Coastal SFHAs are defined differently as they take into consideration wave height. V zones (coastal high hazard areas) are portions of the SFHA where wave heights are greater than 3 feet. Building requirements are more stringent in V Zones compared to A Zones

Figure 4.3.5-2 **Coastal Flood Zone (FEMA 2013).**

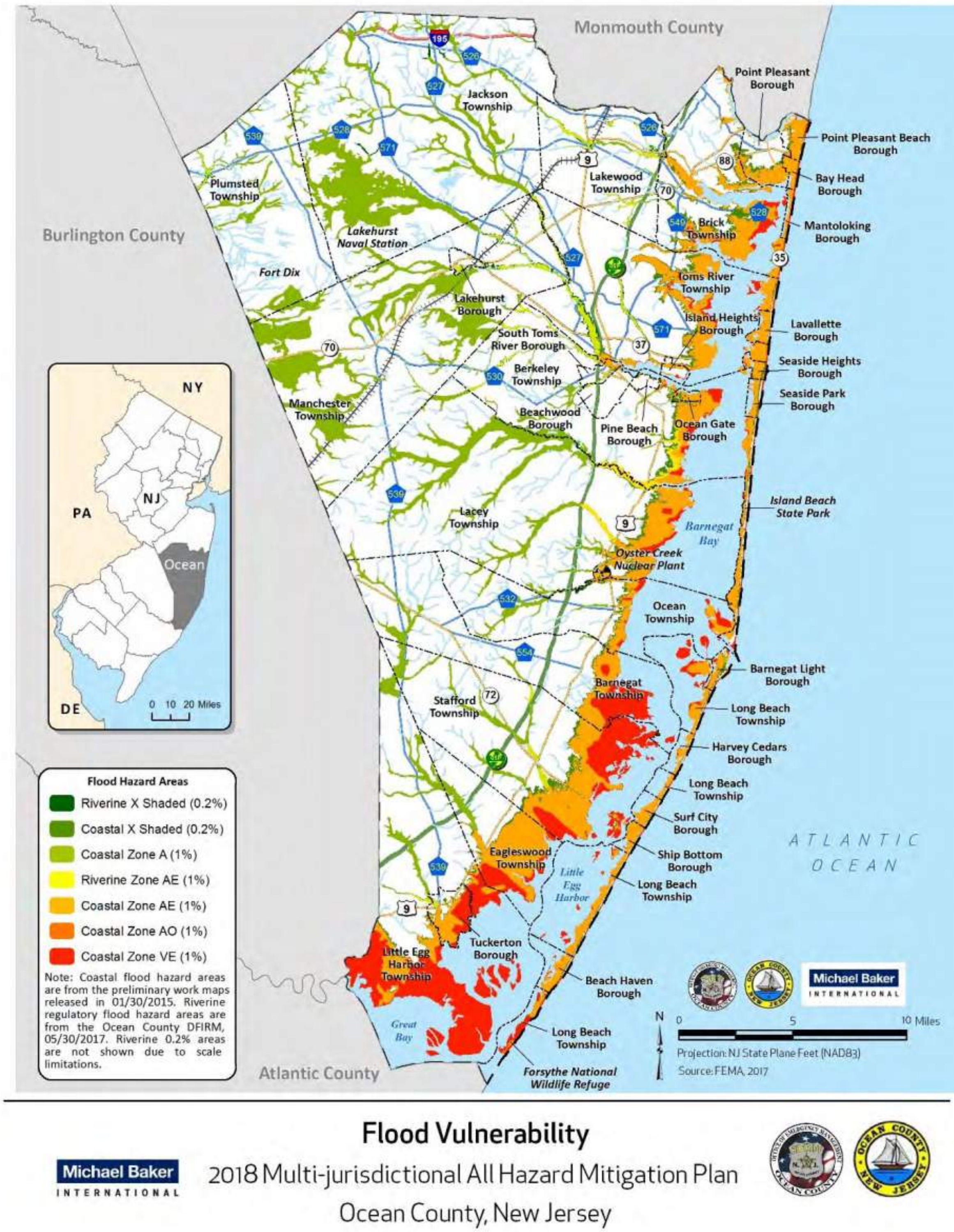


The Effective Countywide DFIRMs were released for Ocean County and all communities on September 29, 2006. All communities within the County are now shown on a single set of countywide FIRMs. Prior to the publication of this digital data, flood hazard information from FEMA was available through paper FIRMs and Q3 data. The final FIRMs and DFIRM data for Ocean County can be obtained from the FEMA Map Service Center (http://www.msc.fema.gov). These maps can be used to identify the expected spatial extent and elevation of flooding from a 1 percent and 0.2 percent annual chance event. All of the municipalities in the County have identified SFHAs.

The DFIRMs are currently in the process of being updated for Ocean County. The best available data is the Preliminary Work Maps of coastal flood hazard areas data released January 30, 2015 and riverine regulatory flood hazard areas data from Ocean County DFIRM released May 30, 2017. The Work Map data was used to prepare maps and analysis in this plan. The DFIRM is being updated for Ocean County through FEMA's Risk Map program. The Risk Map program is working to strengthen the link between hazard mitigation planning and floodplain map updates to improve mitigation strategies and more clearly explain risk to the general public, government officials, and other stakeholders. The Risk Map DFIRM update has created tools for Ocean County including an Areas of Mitigation Interest map, Changes Since the Last FIRM polygons, Flood Depth Grids, and Water Surface Elevation Change Grids.

Figure 4.3.5-3 shows the location of watercourses and flood zones in Ocean County as identified in the DFIRM database. The location of approximate and detailed (including Base Flood Elevations) Special Flood Hazard Areas (1 percent annual chance zones) are shown. Flooding occurs in the major watersheds and along the coast in Ocean County.

igure 4.3.5-3 Location of Watercourses and Flood Zones throughout Ocean County (NJDEP 2012; FEMA 2015, 2017)



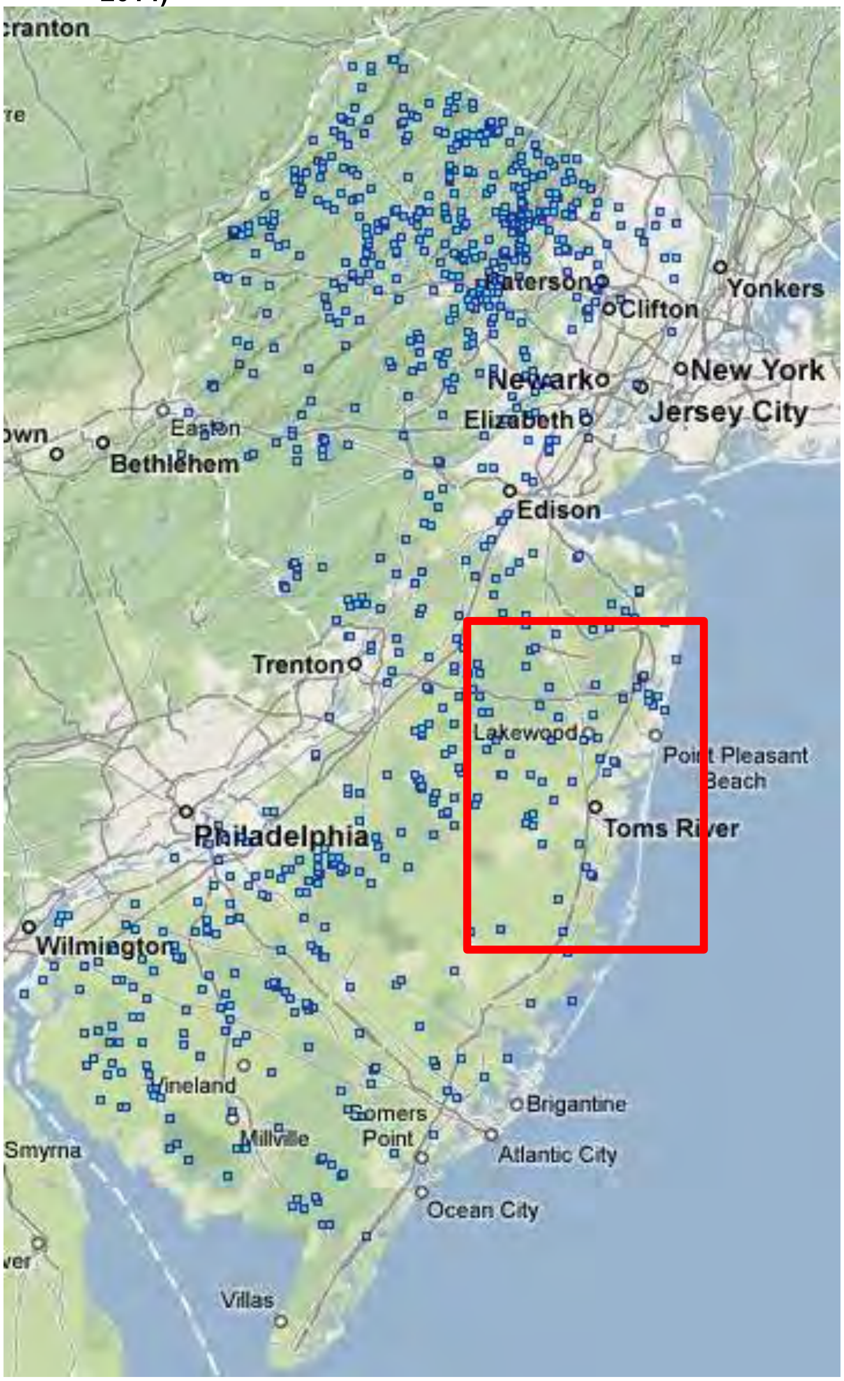
Flooding related to dam failures should be expected in areas downstream of Ocean County's 99 dams. While flooding related to dam failures can occur at any of these locations, the biggest concern is for communities downstream of one or the eight high-hazard dams in Jackson, Brick, Lakewood, and Lacey Townships and Tuckerton Borough. Table 4.3.5-1 lists all Class I High Hazard and Class II Significant Hazard dams. There are a further 70 low-hazard dams in Ocean County.

Table 4.3.5-1 List of Dams in Ocean County with Hazard Class (NJDEP, 2017)

Dam Name	Municipality	Hazard Class
Prospertown Dam	Jackson Township	I
BTMUA Reservoir Dam	Brick Township	I
Lake Carasaljo Dam	Lakewood Township	I
Rainbow Dam	Brick Township	I
Pohatcong Lake Dam	Tuckertown Borough	I
Deer Head Lake Dam	Lacey Township	I
Parker Street Dam	Lacey Township	I
Barnegat Lake Dam	Lacey Township	I
Jacksons Mills Dam	Jackson Township	II
Pine Lake Park Dam	Manchester Township	II
Lake Riviera Dam	Brick Township	II
Holiday Lake Dam	Stafford Township	II
Waddill Lake Dam	Lakewood Township	II
Lake Shenandoah Dam	Lakewood Township	II
New Jersey No Name #113 Dam	Toms River Township	II
Butterfly Bogs Dam	Jackson Township	II
Route 88 Dam	Brick Township	II
Upper Keswick Dam	Manchester Township	II
Manahawkin Lake Dam	Stafford Township	II
Stafford Forge Dam	Eagleswood Township	II

Figure 4.3.5-4 shows the location of all dams in New Jersey with Ocean County highlighted (USACE, 2014).

Figure 4.3.5-4 **Location New Jersey dams with Ocean County highlighted (USACE, 2014)**



4.3.5.2 Range of Magnitude

Floods are considered hazards when people and property are affected. Most injuries and deaths from flooding happen when people are swept away by flood currents, and most property damage results from inundation by sediment-filled water. A large amount of rainfall over a short time span can result in flash flood conditions. Small amounts of rain can result in floods in locations where the soil is frozen or saturated from a previous wet period or if the rain is concentrated in an area of impermeable surfaces such as large parking lots, paved roadways, or other impervious, developed areas. Flooding can occur as isolated incidents within individual municipalities of Ocean County or it can have a countywide effect, involving multiple sites and streams. Along this section of the east coast, flooding occurs most frequently in the fall and winter, when hurricanes and nor'easters are most likely to impact the area.

Several factors determine the severity of floods, including rainfall intensity and duration, topography, tide, wind strength, ground cover and rate of snowmelt. Water runoff is greater in areas with steep slopes and little to no vegetative ground cover. Also, urbanization typically results in the replacement of vegetative ground cover with impervious surfaces such as asphalt and concrete, increasing the volume of surface runoff and stormwater, particularly in areas with poorly planned stormwater drainage systems.

In the winter and early spring (February to April), major flooding has occurred as a result of heavy rainfall on dense snowpack throughout contributing watersheds. Summer floods have occurred from intense rainfall on previously saturated soils. Summer thunderstorms deposit large quantities of rainfall over a short period of time that can result in flash flood events, when the velocity of floodwaters has the potential to amplify the impacts of a flood event. Coastal flooding is a concern particularly during hurricane season in the Atlantic, which runs from June 1 to November 30, and in the winter when Nor'easters are likely to occur. For more information on hurricane, tropical storm, and Nor'easter hazards, please see Section 0.

Flooding related to dam failures can pose a serious threat to communities located downstream from high-hazard dams. The impact of the failure is dependent on the dam and reservoir characteristics and the amount and distance of populations to the dam. In general, concrete or masonry dams usually fail suddenly due to undermining or the loss of an entire section of the dam while earthen dams fail more gradually, usually due to erosion caused by piping or overtopping (NJDEP Dam Safety Section, 2004). Dam failures due to overtopping of a dam normally give sufficient lead time for evacuation while failures of concrete or masonry dams usually occur too suddenly to effectively evacuate. Dam failures may also be intentional, as their potential to cause serious destruction may make them a potential terrorism target. The range of magnitude for dam failure-related flooding depends on the hazard classification of the dam:

- Class I – High Hazard Potential Dams are expected to cause extensive property damage and cause probable loss of life;
- Class II – Significant Hazard Potential Dams are expected to cause extensive property damage but a loss of life is not expected;
- Class III – Low Hazard Potential Dams are expected to cause minimal property damage and are not expected to cause a loss of life.
- Class IV – Small Dam Low Hazard Potential Dams are not expected to cause loss of life or significant property damage

Hurricane Irene in August 2011 brought flood waters throughout Ocean County. Heavy rains, tropical storm force winds, and a tornado impacted the state of New Jersey. A three to five foot storm surge led to moderate to severe tidal flooding in Ocean County. Along the coast, communities saw nearly one million people evacuated; meanwhile low-lying lands flooded on the main land. Two people drowned in Ocean County. Flood waters also led to road closures and damaged corn crops. It was the costliest storm to date in the state of New Jersey. A major disaster declaration was declared on August 31, 2011.

The worst-case scenario for flooding in Ocean County was Super Storm Sandy on October 29th 2012. This powerful storm formed in the Caribbean Sea and brought high winds and heavy rain as it moved north along the Atlantic coastline. The coastal flooding from Hurricane Sandy caused $29.4 billion statewide and about $10 billion locally in Ocean County. Though the whole county was impacted, the coastal communities were hardest hit. Several homeowners saw their houses shifted from their foundations and many others had roofs or entire houses collapse. A new temporary inlet was formed in Mantoloking, creating a channel where houses once stood. The storm claimed the lives of at least 6 people in the county and 38 statewide (NCDC, 2013). The piers at Seaside Heights collapsed and two men drowned due to the storm. Tidal flooding caused Oyster Creek Nuclear power plant to suspend operations. Sandy replaced Irene as the most costly disaster for the state of New Jersey. On October 30, 2012, a major disaster declaration was declared.

Although floods can cause damage to property and loss of life, floods are naturally occurring events that benefit riparian systems that have not been disrupted by human actions. Such benefits include groundwater recharge and the introduction of nutrient-rich sediment that improves soil fertility. However, the destruction of riparian buffers, changes to land use and land cover throughout a watershed, and the introduction of chemical or biological contaminants that often accompany human presence cause environmental harm when floods occur. Hazardous material facilities are potential sources of contamination during flood events. Other negative environmental impacts of flooding include waterborne diseases, heavy siltation, damage or loss of crops, and drowning of both humans and animals.

4.3.5.3 Past Occurrence

Ocean County has a long history of flooding events. Thirteen of the twenty-nine Major Disaster Declarations affecting Ocean County have been in response to hazard events related to flooding (see Section 4.2.1: Presidential Disaster Declarations). Table 4.3.5-2 lists flood event information from 2010 to 2017 obtained from the NCDC database. The majority of the past events have been coastal flooding; almost two-thirds of the events being coastal or tidal flooding events. Additionally, some of the events titled flood, flash flood or urban flooding were linked to or exacerbated by the impact of coast flooding and tidal activity. There have been no major dam failure-related floods in Ocean County, though surrounding counties have experienced dam failures during, for example, the Atlantic County storm in 1997 and Tropical Storm Floyd.

Table 4.3.5-2 **Flood and Flash Flood Events Impacting Ocean County (NCDC, 2017)**

DATE	LOCATION AND DESCRIPTION
11/1/1755	Coastal Flooding - An earthquake in Lisbon, Portugal caused a tidal wave on the east coast of the United States and likely impacted Ocean County.
06/18/1871	Coastal Flooding - An earthquake on Long Island, New York caused a tidal wave that likely impacted Ocean County.
8/10/1884	Coastal Flooding - An earthquake measuring 5.6 on the Richter scale occurred near Rockaway Beach in New York and caused a tidal wave that likely impacted Ocean County.
6/17/1893	Coastal Flooding - A hurricane passed within one hundred eight miles of the coast, with winds of seventy-seven miles per hour.
8/24/1893	Coastal Flooding - A hurricane passed within one hundred miles of the coast, with winds of ninety-eight miles per hour.
8/29/1893	Coastal Flooding - A hurricane passed within one hundred miles of the coast, with winds of eighty-one miles per hour. It should be noted this was the second hurricane to strike within five days.
9/30/1894	Coastal Flooding - A hurricane passed within seventy-seven miles of the coast, with winds of seventy-nine miles per hour.
10/10/1894	Coastal Flooding - A hurricane passed within twenty-three miles of the coast, with winds of seventy-four miles per hour.
9/01/1895	Coastal Flooding - An earthquake occurred in High Bridge, New Jersey and a tidal wave impacted Ocean County.
9/16/1903	Coastal Flooding - A hurricane passed within thirteen miles of the coast, with winds of eighty-four miles per hour.
9/15/1904	Coastal Flooding - A hurricane passed within twenty-two miles of the coast, with seventy-five mile per hour winds.
6/9/1913	Coastal Flooding - An earthquake near Longport, New Jersey is believed to have caused significant tidal surges in Ocean County.
8/6/1923	Coastal Flooding - An earthquake near Rockaway Beach, New York is believed to have caused significant tidal surges in Ocean County.
8/8/1924	Coastal Flooding - An earthquake near Coney Island, New York is believed to have caused significant tidal surges in Ocean County.
6/1/1927	Coastal Flooding - An earthquake, with three tremors that measured between 3.8 and 5.3 on the Richter scale, occurred near Asbury Park, New Jersey and damages were reported as far south as Toms River. It is likely that some of these damages were caused by tidal surges.
8/19/1931	Coastal Flooding - An earthquake near Atlantic City is believed to have caused significant tidal surges in Ocean County.
9/17/1933	Coastal Flooding - A hurricane passed within one hundred nine miles of the coast, with eighty-five mile per hour winds.
9/8/1934	Coastal Flooding - A hurricane passed within fifty miles of the coast, with seventy-seven mile per hour winds.

DATE	LOCATION AND DESCRIPTION
9/18/1936	Coastal Flooding - A hurricane passed within fifty-one miles of the coast, with ninety-eight mile per hour winds.
9/21/1938	Coastal Flooding - A hurricane passed within eighty-three miles of the coast, with one hundred one mile per hour winds. A significant tidal surge was reported.
9/14/1944	Coastal Flooding - A hurricane passed within forty-seven miles of the coast, with ninety-six mile per hour winds. A significant tidal surge was reported.
8/14/1953	Coastal Flooding - Hurricane Barbara (the first named storm), passed within eighty-five miles of the coast, with eighty-six mile per hour winds.
8/31/1954	Coastal Flooding - Hurricane Carol passed within sixty-three miles of the coast, with ninety-eight mile per hour winds.
9/11/1954	Coastal Flooding - Hurricane Edna passed within one hundred fourteen miles of the coast, with one hundred four mile per hour winds. It should be noted that this was the second hurricane to impact Ocean County in twelve days.
8/29/1958	Coastal Flooding - Hurricane Daisy passed within one hundred twenty-four miles of the coast, with one hundred twenty-six mile per hour winds.
9/12/1960	Coastal Flooding - Hurricane Donna passed within forty-seven miles of the coast, with one hundred eight miles per hour winds.
3/6-8/1962	Coastal Flooding - A nor'easter that struck Ocean County caused the most significant and catastrophic damage in known history. It occurred over three days with five high tides and seventy-three mile per hour winds. Long Beach Island became five islands. The Borough of Harvey Cedars suffered the most damage on the east coast. One crevice, at 79th Street, where the ocean met the bay left a crevice sixty to seventy feet wide and more than twenty feet deep. More than fifty per cent of the structures in town were destroyed. A U.S. destroyer being towed from Bayonne, New Jersey to Newport, Rhode Island ended up on the south end of Long Beach Island when the cable broke. Three fishing trawlers from the Borough of Point Pleasant never came back. Southern Regional High School was the largest shelter opened and served eight thousand meals and another two thousand sandwiches "to go" for residents and responders. Ten deaths were reported in New Jersey – three of which were in Ocean County. Long Beach Police Chief Angelo Leonetti, Township Commissioner Kenneth Chipman and Robert Osborne who owned a news agency lost their lives attempting to rescue others.
9/16/1967	Coastal Flooding - Hurricane Doria passed within one hundred thirteen miles of the coast, with eighty-one mile per hour winds.
8/10/1976	Coastal Flooding - Hurricane Belle passed within forty-three miles of the coast with ninety-eight mile per hour winds.
Mar-84	Coastal Flooding - A significant nor'easter damaged both the northern barrier island and Long Beach Island. Four homes suffered major damage.
9/27/1985	Coastal Flooding - Hurricane Gloria passed within twenty-six miles of the coast, with ninety-nine mile per hour winds.
8/18/1991	Coastal Flooding - Hurricane Bob passed within seventy-four miles of the coast, with one hundred fifteen mile per hour winds.

DATE	LOCATION AND DESCRIPTION
10/31/1991	Coastal Flooding – Nor'easter
1/4/1992	Coastal Flooding – Nor'easter
12/11/1992	Coastal Flooding – Nor'easter, lasting through eleven high tides, known as the "storm that stole Christmas".
12/14/1993	Coastal/Tidal Flooding - Eastern Ocean County and southern New Jersey. Minor to moderate flooding, high winds, and beach erosion. Tidal flooding along the Delaware River.
7/25/1994	Urban flooding (Flood/Flash flood) - Stafford Township.
11/14/1995	Coastal Flooding.
12/20/1995	Coastal Flooding - Southeast New Jersey. Freezing rain and minor to moderate tidal flooding. Tidal flooding caused bayside road closures in Ship Bottom and Surf City.
1/3/1996	Coastal flooding - Eastern Ocean County. Moderate tidal flooding.
3/19/1996	Coastal/Tidal Flooding - Eastern Ocean County and southern coastal New Jersey. Moderate tidal flooding.
6/17/1996	Flash flood - Southern New Jersey. Heavy rains, with up to 4 inches in Tuckerton, NJ. Urban flooding reported.
9/17/1996	Flash flood - Southern New Jersey. 15 to 20 cars stranded by flood waters in Ship Bottom.
10/8/1996	Coastal flooding - Eastern Ocean County. Moderate tidal flooding. Roads flood in Little Egg Harbor Township and Point Pleasant Beach.
10/19/1996	Coastal flooding - Eastern Ocean County. Moderate tidal flooding. Flooding in Seaside Park, Point Pleasant Beach, and Ship Bottom. Back bay/river flooding in Toms River.
12/8/1996	Coastal flooding - Eastern Ocean County. Minor tidal flooding along the coast.
12/13/1996	Coastal Flooding - Southern New Jersey. Moderate tidal flooding. Central Ave flooded in Ship Bottom.
6/2/1997	Coastal flooding - Southern New Jersey, Eastern Ocean County. 49 mph wind gusts in Seaside Park. Heavy surf caused beach erosion.
7/16/1997	Flood - Southern New Jersey. In Barnegat, Stafford, and Ocean townships heavy rain during a thunderstorm causes urban flooding. Recorded 4 inches of rain in Barnegat Township. Several creeks and Lower Shore Road flooded.
7/24/1997	Urban/small stream flooding - Countywide. Heavy rains from Tropical Storm Danny led to urban flooding on back bay side of barrier islands. Roads flooded in Beach Haven, Brant Beach, & Ship Bottom. Three feet of water accumulated on some roadways. Toms River recorded 5.08 inches of rain.
8/20/1997	Coastal flooding - Southern New Jersey, Eastern Ocean County. Moderate tidal flooding along barrier islands. Five cars were stranded due to flood waters in Long Beach Township. Roads were closed in Surf City and Ship Bottom. 6.75 inches of rain recorded in Beach Haven.
8/20/1997	Flash flood - Southern New Jersey. Heavy rainfall in Ocean County. 8 to 10 inches of rain recorded in Little Egg Harbor Township. Worst flooding occurred at Mystic Island where cars floated through flood waters and 60 people were evacuated.

DATE	LOCATION AND DESCRIPTION
9/1/1997	Flood - Northern Ocean County, mainly in Dover Township; 3 inches of rain fell within one hour, accompanied by frequent lightning strikes.
10/19/1997	Coastal flooding - Along the New Jersey coast; caused high tides, rough surf, and beach erosion
11/7/1997	Coastal flooding - caused by a Nor'easter which brought high winds and resulted in beach erosion; two storms created severe tides, and the powerful surf scoured out a 6 foot cliff in Harvey Cedars.
11/14/1997	Coastal flooding - Along the New Jersey Coast. Minor to moderate tidal flooding; storm coincided with full moon and spring tides, causing high tides and flooding; onshore show caused beach erosion; Harvey Cedars reported severe erosion and also lost some dune fencing. Barnegat Bay tidal flooding also occurred on Cedar Bonnet Island, Little Egg Harbor Township and Tuckerton.
12/29/1997	Coastal flooding - Along the New Jersey Coast. Storm first hit the New Jersey coast at the Little Egg Harbor inlet, bringing heavy rains, high winds and minor tidal flooding; tides and heavy rain resulted in main road closures in Long Beach Township, Ship Bottom and Surf City; wind gusts reached around 60 mph and knocked down trees and power lines.
1/28/1998	Coastal flooding - Along the New Jersey Coast. A Nor'easter brought heavy rains, high winds, tidal flooding, and beach erosion; Max wind speed observed in Ocean County was 56 mph in Warestown; storms costs totaled about $15 million.
2/4/1998	Coastal flooding - Ocean County shore and coastal locations to the south. Nor'easter brought strong winds, moderate to severe coastal flooding, significant beach erosion, heavy rain, and dune breaches. Beach erosion was worst in Ocean & Monmouth counties; 100 people were evacuated from Ocean County and thousands lost power; Many access roads to the barrier islands were closed; $17 million cost statewide
2/17/1998	Coastal flooding - Along the New Jersey Coast; no serious damage.
2/24/1998	Coastal flooding - Along the New Jersey Coast. Nor'easter brings strong winds and minor to moderate flooding along the coast; the dune line in Bay Head was damaged by the powerful surf; much of the sand at 48th Street in Brant Beach was eroded; maximum wind gusts were 67 mph in Seaside Park and 64 mph in Harvey Cedars.
3/9/1998	Tidal flooding - Along the New Jersey Coast. Heavy winds cause power outages in Ocean and adjacent counties; max wind speeds were 55 mph in Seaside Park and 46 mph in Harvey Cedars; minor tidal flooding reported from Point Pleasant to Long Beach Island; most flooding occurred in Ocean Beach sections of Dover Township and Lavallette. Minor back bay flooding reported in Seaside Park and Seaside Heights.
3/21/1998	Coastal flooding - East Coast. 45 to 50 mph wind observed in coastal communities.
4/9/1998	Coastal flooding - Atlantic, Cape May, Monmouth and Ocean counties. Minor tidal flooding.

DATE	LOCATION AND DESCRIPTION
5/11/1998	Coastal flooding - Along the New Jersey Coast. Moderate tidal flooding and erosion; onshore winds inhibited drainage in back bay areas and caused flooding in Beach Haven, Harvey Cedars, and Toms River; isolated flooding reported at Point Pleasant Beach Tuckerton Beach, and on Mallard Island in Stafford Township; substantial erosion occurred at Seaside Park; Long Beach Boulevard flooded several times on Long Beach Island; Dunes were damaged in Brant Beach and Ship Bottom, and cliffs formed in Ship Bottom and Surf City.
1/3/1999	Coastal flooding - Along the New Jersey Coast; Minor tidal flooding reported along Long Beach Boulevard on Long Beach Island.
3/15/1999	Tidal flooding - Along the New Jersey Coast; Minor tidal flooding in Ocean County; erosion occurred in Long Beach Township
3/21/1999	Tidal flooding - Along the New Jersey Coast; Minor tidal flooding.
8/20/1999	Flash flood - Ocean County. Thunderstorms and heavy rains brought 2.0 to 3.5 inches of rain within two hours in Eastern Ocean County; urban and poor drainage flooding occurred on Long Beach Island and the urban/small stream flooding occurred on the mainland; roads flooded in Little Egg Township; the weather exacerbated traffic along major routes; base of the causeway flooded on Long Beach Island; Eighth Avenue was reduced to a single lane roadway; 20 vehicles damaged and several abandoned by attempting to drive through flooded waters; severe flooding reported in Stafford Township; total precipitation was 2.55 inches in Beach Haven and 1.37 inches in Harvey Cedars.
8/26/1999	Flash flood - Ocean and Burlington counties. heavy rains and thunderstorms; streams flooded in northeast Ocean County; 6 inches of precipitation fell in Manchester Township in Ocean County; part of New Jersey State Route 35 was washed away in Point Pleasant Beach; Bricks Estate First floor flooded in Brick Township; 2.19 inches were totaled at the McGuire AFB.
8/30/1999	Coastal flooding/erosion - Ocean, Atlantic, Monmouth, & Cape May Counties. Minor tidal flooding and beach erosion; strong northeast winds and back bay flooding of the barrier islands; the pounding surf also caused erosion at Brant Beach in Ocean County.
9/16/1999	Flash flood - Countywide. Hurricane Floyd brought heavy rains and damaging winds; largest disaster to impact New Jersey to date; estimated cost for the state is 1.1 billion dollars hitting Bergen and Somerset Counties the hardest; cost for Ocean County was about $5.5 million; statewide 3,900 homes, 1,208 apartments and 1,683 businesses majorly damaged along with 23,235 homes, 1,758 apartments and 1,043 businesses suffered minor damaged; about 616,400 homes and businesses lost power throughout the state for up to five days and some municipalities had limited water use; sewage treatment plants were overwhelmed with runoff; state of emergency was declared by Governor Christie Whitman and schools were closed;. Amtrak's Northeast Corridor and several New Jersey transit lines were temporarily suspended.

DATE	LOCATION AND DESCRIPTION
1/25/2000	Coastal flooding - Ocean, Monmouth, Cape May, and Atlantic counties. 6 to 15 inches of snow fell in New Jersey, along with sleet, freezing rain, moderate coastal flooding, and wind gusts up to 60 mph along the shore; drifts as high as four feet; county and government offices, businesses and schools were closed; Both the Millville Airport and the Atlantic City International Airport were shut down; scores of vehicles slid off roadways; at least one man died of a heart attack after shoveling the snow; power lines were downed due to wind and motorist crashing into poles and caused about 3,100 homes and businesses and 1,100 homes and businesses in northern New Jersey respectively to lose power; rough onshore winds generated moderate tidal flooding; severe wind damage occurred on the New Jersey State Route 72 Causeway between Long Beach Island and Stafford Township in Ocean County causing two utility poles to crack and their wires to fall onto the westbound lanes, closing the roadway temporarily; downed wires resulted in 2,500 homes in Surf City losing power; Mystic Islands also reported power outages.
3/21/2000	Coastal flooding - Monmouth, Cumberland, Cape May, Atlantic, and Eastern Ocean counties. Minor tidal flooding affecting areas that normally flood during spring tide events first; some erosion occurred at beaches due to the pounding surf; seas became very high.
4/18/2000	Coastal flooding - Monmouth, Cape May, Atlantic, and Eastern Ocean counties. Minor tidal flooding during high tide; the evening high tides reached 6.7 feet at Ship Bottom in Ocean County.
7/26/2000	Flash flood - Southern and Northwestern New Jersey, including Eastern Ocean County. Thunderstorms and heavy rains at high tide in Ocean County, causing widespread urban and poor drainage flooding along with flooding of some of the waterways that discharge into the Atlantic Ocean; roadways were closed and many cars were overcome by the flood waters; no serious injury reported; the causeway leading to the J. Stanley Tunney Bridge was closed in Ocean County due to the heavy rains; large parts of New Jersey State Route 35 were closed; the worst flooding occurred in Seaside Heights, Seaside Park, Lavallette, Bay Head, Point Pleasant and Point Pleasant Beach; most flooding occurred near Barnegat Bay; heavy rain caused flooding near the bay in Beach Haven and Beach Haven Crest; in Brick Township, flooding led to two roads closures and a voluntary evacuation of Laurelton Village; Toms River rose and flooded the beach; road closures also occurred in Long Branch and Ocean Township; total rainfall was 3.29 inches in Toms River (Ocean County)
8/13/2000	Coastal flooding - Monmouth, Cape May, Atlantic, and Eastern Ocean counties. Minor tidal flooding during high tide.
8/28/2000	Coastal flooding - Monmouth, Cape May, Atlantic, and Eastern Ocean counties. Minor tidal flooding during high tide.
9/25/2000	Coastal flooding - Monmouth, Cape May, Atlantic, and Eastern Ocean counties. Widespread minor tidal flooding during high tide; the onshore flow continued for several tide cycles.
11/10/2000	Coastal flooding - Monmouth, Cape May, Atlantic, and Eastern Ocean counties. Minor tidal flooding during high tide and strong winds.

DATE	LOCATION AND DESCRIPTION
3/5/2001	Coastal flooding/erosion - Eastern portions of Monmouth, Cape May, Atlantic, and Ocean counties.
6/17/2001	Flood - Countywide. Tropical Storm Allison brought thunderstorms and heavy rain causing small stream and poor drainage flooding in the county; the worst reported flooding occurred on the shore side; no serious injuries reported; in Point Pleasant Beach, six roadways were closed including New Jersey State Route 35. New Jersey State Route 35 was also closed in Ship Bottom due to severe flooding; an elderly woman was rescued from the water in Ortley Beach; trees were downed and caused isolated power outages; the North Branch of the Metedeconk River at Lakewood reached its 7 foot flood stage at 430 p.m. EDT on the 17th, crested at 8 feet at 10 p.m. EDT on the 17th and was back within bankfull at 340 a.m. EDT on the 18th; Storm totals included 8.10 inches in Tuckerton, 3.50 inches in Manahawkin and 2.65 inches in Bayville.
8/4/2001	Flash flood - Ocean and Monmouth Counties. Thunderstorms and heavy rains resulted in flash flooding of smaller streams in Plumsted Township in Ocean County and Upper Freehold Township in Monmouth County; in New Egypt (Plumsted Township), a SKYWARN Spotter reported 5.5 inches of rain fell in about 90 minutes; no serious injuries were reported.
8/13/2001	Flash flood - Northeast Ocean County. Thunderstorms with heavy downpours caused flooding of streams as well as urban and poor drainage flooding in Ocean County. Vehicles were stranded in Lacey Township with more than three feet of water on some roadways. People were rescued from their vehicles. Flooding was also reported along U.S. Route 9 in Lacey Township and on several roadways in Brick Township. A SKYWARN Spotter in Bayville reported 3.5 inches of rain fell in 90 minutes between 310 p.m. EDT and 440 p.m. EDT. Doppler Radar storm total estimates indicated that 3 to 4 inches of rain fell across much of eastern Berkeley and Lacey Townships.
8/27/2001	Flash flood - Northeast Ocean County. Thunderstorms produced heavy rainfall that resulted in urban, poor drainage, and area stream flooding; Doppler Radar storm total estimates ranged from 3 to 6 inches from Toms River northeast through Point Pleasant; worst flooding occurred from Point Pleasant to Bay Head and also in Toms River in Ocean County; New Jersey State Route 35 was closed in Point Pleasant and New Jersey State Route 37 in Toms River was flooded; flooding formed three foot deep "lakes" in neighborhoods of Dover and Brick Townships; basement flooding and overflowing sewers was also reported in the county; no serious injuries reported.
9/14/2001	Coastal flooding - Cape May County and Eastern portions of Monmouth, Atlantic, and Ocean counties. Minor tidal flooding during high tide.
9/29/2001	Coastal flooding - Cape May County and Eastern portions of Monmouth, Atlantic, and Ocean counties. A nor'easter produced an onshore flow bringing minor to locally moderate tidal flooding and some beach erosion along the New Jersey coast; the onshore flow persisted during several high tide cycles and coincided with a full moon.

DATE	LOCATION AND DESCRIPTION
10/1/2001	Coastal flooding - Cape May County and Eastern portions of Monmouth, Atlantic, and Ocean counties. A nor'easter produced an onshore flow bringing minor to locally moderate tidal flooding and some beach erosion along the New Jersey coast; the onshore flow persisted during several high tide cycles and coincided with a full moon.
10/14/2001	Coastal flooding - Cape May County and Eastern portions of Monmouth, Salem, Cumberland, Atlantic, and Ocean counties. Strong southeast onshore flow produced minor tidal flooding during high tide.
6/6/2002	Flash flood - Bayville, Ocean County. Heavy rain during thunderstorms produced poor drainage and stream flooding along Cedar Run and across southern Ocean County; Doppler Radar Storm total estimates reached between three and four inches; Berkeley and Stafford Townships observed the worst flooding; roads were closed in the Ocean Acres area of Stafford Township and in Berkeley Township; homes were flooded and many vehicles were left stranded on roadways; the emergency room in the Southern Ocean County Hospital was damaged when an internal drain pipe burst causing the ceiling to collapse above a nurse station; no injuries reported.
6/14/2002	Coastal flooding - Cape May County and Eastern portions of Monmouth, Atlantic, and Ocean counties. Isolated tidal flooding.
7/19/2002	Flash flood - Northern Ocean County. Heavy rain during thunderstorms resulted in Doppler Radar Storm Total estimate of 5 to 6 inches of rain in Lakewood and Jackson Townships; urban, small stream, and poor drainage flooding occurred in northern Ocean County; major roads closed in Lakewood Township including U.S. Route 9 and New Jersey State Route 70; the entrance to the Kimball Medical Center was flooded; street flooding also occurred in Dover Township in Toms River.
10/4/2002	Coastal flooding - Cape May County and Eastern portions of Monmouth, Atlantic, and Ocean counties. Minor tidal flooding during the evening high tide.
10/7/2002	Coastal flooding - Cape May County and Eastern portions of Monmouth, Atlantic, and Ocean counties. High spring tides produced isolated minor tidal flooding during the morning high tide.
10/16/2002	Coastal flooding - Ocean and Monmouth counties. Along the New Jersey coast and in back bays, a strong nor'easter caused minor to locally moderate tidal flooding and beach erosion, the worst of which occurred in Monmouth and Ocean counties; wind gusts reached 50 mph; power outages occurred due to downed trees in Ocean County, mostly in Berkeley, Dover and Lacey Townships; in Ortley Beach, siding was removed from a few homes; peak wind gusts in Ocean County reached 51 mph in Barnegat; significant beach erosion occurred in Beach Haven Borough of Ocean County where a 5 foot cliff was created at Liberty Avenue; the waves also tore away a set of stairs to the beach and freed the wreck of an unidentified ship; on the bay side wave action caused the partial collapse of the bulkhead behind some homes along the Hackensack Lagoon in Barnegat Light Borough; Damage estimates amounted to tens of thousands of dollars.

DATE	LOCATION AND DESCRIPTION
11/5/2002	Coastal flooding - Middlesex, Monmouth, and Cape May counties along with Eastern portions of Atlantic and Ocean counties. Widespread minor tidal flooding, isolated moderate flooding, and minor beach erosion occurred during a nor'easter; the worst coastal flooding occurred in northern New Jersey and in the back bays.
11/17/2002	Coastal flooding - Ocean and Cape May counties and Eastern portions of Monmouth and Atlantic counties. A nor'easter produced strong winds across Ocean and Monmouth Counties and some minor tidal flooding during high tide; max wind gust was 55 mph at Barnegat Light in Ocean County; minor flooding was reported during high tide on roads adjacent to Barnegat Bay and the Toms River in Ocean County; Doppler Radar Storm Total Estimates ranged between one and three inches; only minor beach erosion was reported, but sand covered the boardwalk in Lavallette in Ocean County.
2/23/2003	Flood - Western Ocean County. Heavy rain and snow melt run-off combined to cause minor flooding along the North Branch of the Metedeconk River; The North Branch of the Metedeconk River in Lakewood rose above its 7 foot flood stage and crested at 7.18 feet; storm totals were 2.20 inches in Point Pleasant.
8/1/2003	Flash flood - Lakewood Township, Ocean County and Monmouth County. Thunderstorms and heavy rains caused poor drainage and small stream flooding from Lakewood Township in Ocean County northeast through Howell and Wall Townships to Asbury Park in Monmouth County; Doppler Radar Storm total estimates indicated widespread 2 to 4 inches of rain fell across the region.
2/7/2004	Flood - Western Ocean County. Heavy rain and snow melt combined to cause poor drainage flooding and later flooding along the Metedeconk River in Ocean County; the North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 7.34 feet; storm totals were 1.36 inches in Beach Haven.
7/1/2004	Flash flood - Ocean and Monmouth Townships. Thunderstorms resulted in flash flooding in Howell Township of Monmouth County and in Lakewood and Brick Townships of Ocean County; several roads were closed in Brick Township; a few people were trapped in vehicles and were rescued; flooding caused traffic delays along the Garden State Parkway between mile markers 91 and 92.; Doppler Radar storm total estimates exceeded five inches along the county and township borders; a SKYWARN Spotter in Brick Township recorded 2.25 inches of rain.
7/12/2004	Flash flood - Countywide. Thunderstorms with torrential rain caused widespread poor drainage and small stream flooding in Ocean County; Near all municipalities within the county reported flooding; New Jersey State Route 37 near Toms River was flooded; Doppler Radar storm total estimates exceeded one inch throughout the county and reached between 6 to 8 inches in Berkeley and Lacey Townships, and 5.46 inches in Lakewood.
8/1/2004	Flash flood - Northern Ocean County. Thunderstorms with heavy rain caused poor drainage and small stream flooding in northern Ocean County in Jackson and Lakewood Townships; several water rescues from vehicles occurred in Lakewood Township; Doppler Radar storm total estimates reached around three inches, during approximately two hours.

DATE	LOCATION AND DESCRIPTION
9/29/2004	Flood - Western Ocean County. Hurricane Jeanne produced heavy downpours; Doppler Radar storm total estimates ranged from 1 to 5 inches, from the northern to the southern part of the county, resulting in poor drainage and eventually minor flooding along the North Branch of the Metedeconk Creek; the North Branch of the Metedeconk Creek at Lakewood was above its 7 foot flood stage and crested at 7.03 feet; storm totals included 5.16 inches in Point Pleasant, 2.47 inches in Lakehurst, 1.41 inches in Barnegat and 0.72 inches at Brant Beach.
7/18/2005	Flash flood - Bayville, Ocean County. Thunderstorms with heavy rain caused urban, poor drainage, and small stream flooding in southeastern Ocean County from Berkeley Township south through Eagleswood Township; Doppler Radar storm total estimates reached 5 inches, for a duration of about 90 minutes; Stafford Township reported the worst flooding with many roads flooding; the police advised motorists to stay off the road; New Jersey State Route 72 had four feet of standing water, causing significant backups; minor damage to the bulkheads along Manahawkin Bay was reported in the Beach Haven West section of Stafford Township; both Mill Creek in Stafford Township and Cedar Creek in Berkeley Township flooded; Property damage totaled about $30,000.
10/12/2005	Flood - Western Ocean County. Heavy rain fell across the Northern part of Ocean County causing poor drainage and small stream and river flooding; three day storm totals were about 1 inch in the southern part of the county and around 10 inches in the northern part of the county; the Metedeconk River flooded and New Jersey State Route 88 was closed in Brick and Lakewood Townships; the North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 8.58 feet; roads were closed in Dover and Brick Townships and a small stream flooded in Jackson Township; basements and yards were flooded along East Veterans Highway. flooding during damaged over 2,700 single family homes, over 640 apartment units and 220 businesses throughout the state of New Jersey; Specific three day storm totals included 11.41 inches in Point Pleasant, 3.10 inches in Barnegat Light and 1.14 inches in Brant Beach.
12/16/2005	Coastal flooding - Eastern Ocean and Monmouth counties. Minor tidal flooding during the morning high tide.
1/3/2006	Coastal flooding - Middlesex and Cape May counties and Eastern portions of Monmouth, Atlantic, and Ocean counties. Widespread minor tidal flooding during high tide along with some minor to moderate beach erosion; in Ocean County, many beaches were submerged at high tide and minor tidal flooding was reported on the Barnegat Bay side on Long Beach Island; in Ocean Township, flooding reached the foundation of one home and the Poplar Village parking lot.

DATE	LOCATION AND DESCRIPTION
1/31/2006	Coastal flooding - Ocean, Middlesex, Monmouth, Cumberland, Cape May, and Western Atlantic counties. Widespread minor and isolated moderate tidal flooding during high tide along the ocean as well as in Raritan and Delaware Bays; several streets were flooded and waters reached up to several homes; The high tide reached 6.84 feet above mean lower low water at Point Pleasant in Ocean County; minor tidal flooding begins at 6.7 feet above mean lower low water and moderate tidal flooding begins at 7.7 feet above mean lower low water.
2/12/2006	Coastal flooding - Middlesex, Monmouth, Ocean, Atlantic, and Cape May counties. Major winter storm that affected the state of New Jersey, especially the New Jersey Shore; coastal flooding and beach erosion resulted due to strong onshore winds and high tides; significant to severe damage to dunes occurred in Bay Head, Bricktown, Ortley Beach, Harvey Cedars and Long Beach Township; vertical cuts across most of the beaches ranged from 2 to 4 feet high by 50 to 75 feet wide; minor structural damage was reported in Holgate (Ocean County), with several towns conducting emergency sand replacement; significant erosion was reported in Brant Beach; on Long Beach Island, strong winds and high tides caused a house under construction to fall off its pilings damaging a neighbor's fence; storm costs totaled up to $900,000 in Ocean County.
9/1/2006	Coastal flooding - Middlesex, Cumberland, and Cape May counties and Eastern portions of Monmouth, Atlantic, and Ocean counties. Tropical Storm Ernesto brought heavy rain, tidal flooding, strong winds, and beach erosion in New Jersey; coastal counties were hit the hardest with both the tidal and inland flooding and high winds; Atlantic facing beaches reported severe erosion and damage to dune systems in Cape May, Ocean and Atlantic counties especially in Lavallette Borough; in Ocean County vertical cuts averaged 3 to 6 feet (with widths up to 100 feet wide) from Island Beach State Park northward and generally 2 to 4 feet from Barnegat Light southward; all coastal municipalities reported windblown sand.
9/3/2006	Flood -Lakewood Township in Ocean County. Tropical Storm Ernesto brought heavy rain, tidal flooding, strong winds, and beach erosion in New Jersey; coastal counties were hit the hardest with both the tidal and inland flooding and high winds; Atlantic facing beaches reported severe erosion and damage to dune systems in Cape May, Ocean and Atlantic counties especially in Lavallette Borough; in Ocean County vertical cuts averaged 3 to 6 feet (with widths up to 100 feet wide) from Island Beach State Park northward and generally 2 to 4 feet from Barnegat Light southward; all coastal municipalities reported windblown sand.
9/5/2006	Coastal flooding - Cape May County and Eastern portions of Monmouth, Atlantic, and Ocean counties. Minor tidal flooding during high tide.
9/11/2006	Coastal flooding - Monmouth, Cumberland, and Cape May counties and Eastern portions of Atlantic and Ocean counties. Minor tidal flooding at high tide.

DATE	LOCATION AND DESCRIPTION
9/15/2006	Flash flood - Eastern Ocean County. Thunderstorms produced torrential downpours across eastern sections of Ocean County and caused widespread flash flooding of smaller streams and roadways; Stafford and Berkeley Townships on the mainland and Lavallette, Seaside Heights, Seaside Park and the Ortley Beach section of Dover Township on the barrier islands were the hardest hit areas; Doppler Radar storm total estimates reached 8 to 10 inches in Berkeley Township and 6 to 8 inches in Stafford Township; major roadways were flooded including U.S. Route 9, New Jersey State Routes 37 and 72 and Ocean County Route 537; exit 77 off of the Garden State Parkway was also closed in Berkeley Township because of flooding along the exit roadways; two roads were closed pending inspection because the flooding undermined them; over 100 people were rescued from stranded vehicles including a one-month-old boy in Stafford Township; many home basements, schools, and hospitals were affected in Berkeley and Stafford townships; residents from six homes on Neptune Drive were evacuated by canoe; On the barrier islands, during the height of the heavy rain, it was impossible to get on and off of Long Beach Island; Long Beach and Ocean Boulevards were flooded; In Seaside Heights, Hiering Avenue was flooded and apartments below street level were flooded. Actual storm totals included 8.82 inches in Bayville of Berkeley Township and 6.30 inches in Lacey Township; storm costs totaled $750,000 in Ocean County.
10/6/2006	Coastal flooding - Middlesex, Monmouth, and Western Ocean counties. A nor'easter brought minor to moderate tidal flooding, heavy rain, strong winds and beach erosion to coastal New Jersey; in Harvey Cedars, a 6 by 7 foot vertical cut was reported in the dune system from Middlesex Avenue south to Bergen Avenue; in Brant Beach a 6 to 7 foot cut to the dune system from 54th Street north required Public Works to re-grade the beach; the dune systems were also cut in Holgate, Beach Haven and Surf City; max wind gust reached 47 mph in Barnegat in Ocean County.
10/28/2006	Coastal flooding - Middlesex, Monmouth, and Eastern Ocean counties. Minor tidal flooding during morning high tide.
3/16/2007	Coastal flooding - Eastern Ocean and Monmouth counties and Western Cape County. Strong winds, heavy rains, and minor tidal flooding during morning high tide; storm totals averaged 1.5 to 3.0 inches across southeast New Jersey; high winds caused a few scattered power outages; storm total precipitation was 3.10 inches in Point Pleasant in Ocean County; peak wind gusts reached 58 mph in Seaside Heights of Ocean County and 56 mph in Barnegat of Ocean County; the heavy rain, tidal flooding and strong winds were caused by a nor'easter.

DATE	LOCATION AND DESCRIPTION
4/15/2007	Coastal flooding - Eastern Ocean and Western Monmouth counties. A nor'easter caused widespread minor tidal flooding, isolated moderate tidal flooding and beach erosion along Delaware Bay, Raritan Bay and the Atlantic Ocean; in Ocean County, tidal flooding occurred along the westward facing side of Barnegat Bay in Ocean County; portions of State Route 35 as well as the ramps into and out of State Route 37 in Seaside Heights were flooded; bay flooding was reported in Lavallette, Mantoloking, Seaside Park and Surf City; tidal flooding reached into the yards of homes on Cedar Bonnet Island. Erosion was severe in Harvey Cedars in the Atlantic Avenue area where the vertical cut reached between 6 and 8 feet, but elsewhere, most of the vertical cuts were between 2 and 4 feet.
4/15/2007	Flood - Lakewood Township, Ocean County. A nor'easter brought heavy rains, flooding along the Metedeconk River, and flooding along the Toms River resulted in road closures in Brick Township and in Island Heights Borough; the North Branch of the Metedeconk at Lakewood was above its 7 foot flood stage and crested at 8.28 feet; precipitation totals included 3.76 inches in Beachwood, 3.04 inches in Point Pleasant, 2.65 inches in Brick, 1.90 inches in Berkeley, 1.76 inches in Seaside Heights, and 1.38 inches in Harvey Cedars; statewide damage was estimated at $180 million dollars, with approximately $1 million associated with Ocean County; it was the second worst rain storm (not related to a hurricane) in the state's history; acting Governor Richard J. Codey declared a state of emergency; about 5,000 people were evacuated in 11 of the state's 21 counties; at one time over 70 major roadways and interstates were closed including New Jersey State Routes 20, 23, 38, 46, 70 and 73 as well as U.S. Route 30 and Interstates 80 and 380; over 700 traffic accidents were indirectly caused by the flooding and heavy rain; three people in the state drowned; strong winds resulted in power outages for 120,000 homes and businesses across the state; the Internal Revenue Service extended the tax deadline for 48 hours in affected areas. spring planting on farms was expected to be delayed due to the flooding; heavy rain, snow, and winds downed trees and power lines; max wind gusts ranged between 40 and 60 mph.
12/16/2007	Coastal flooding - Eastern Ocean County. Beach erosion and minor coastal flooding occurred at the neap tides; in Ocean County, erosion was reported in Harvey Cedars, Surf City and Holgate; the worst erosion was reported in Harvey Cedars with vertical cuts reaching 3 to 4 feet.
12/22/2007	Coastal flooding - Eastern Ocean and Western Monmouth counties. Minor tidal flooding during high tide.
12/12/2008	Flood - Lakewood Township, Ocean County. The North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 7.86 feet; minor tidal flooding occurred during morning high tide along the ocean front; storm precipitation totals included 5.05 inches in Lavallette, 4.98 inches in Stafford Forge, 4.69 inches in Brick, and 4.34 inches in Little Egg Harbor.
7/31/2009	Flash flood - Point Pleasant Beach, Ocean County. Thunderstorms and heavy rain resulted in flash flooding to occur in and around the Point Pleasant Canal in Point Pleasant, Ocean County; both New Jersey State Routes 35 and 88 were flooded.

DATE	LOCATION AND DESCRIPTION
7/31/2009	Flash flood - South Toms River, Ocean County. Thunderstorms and heavy rain resulted in flash flooding to occur along Winding River in Toms River (Dover Township); some motorists were rescued from trapped vehicles on New Jersey State Route 37 near Hospital Drive.
9/11/2009	Flood - North Beach Haven, Ocean County. Thunderstorms and heavy rain caused flooding in and around Tuckerton and on Long Beach Island in Ocean County; in Tuckerton, two women were rescued uninjured from their home after about 18 inches of water invaded it; on Long Beach Island, flooding was reported along Long Beach Boulevard in North Beach Haven resulting in road closure; storm event precipitation totals included 3.37 inches in Stafford Township and 3.30 inches in Little Egg Harbor Township.
12/9/2009	Flood - Lakewood Township, Ocean County. Rain mixed with snow fell across central and southern New Jersey, with totals averaged 1.5 to 3.0 inches; heavy rain combined with snow melt runoff produced poor drainage and small stream flooding; in Ocean County, flooding occurred along sections of the North Branch of the Metedeconk River; the North Branch of the Metedeconk River near Lakewood was above its 7 foot flood stage and crested at 7.2 feet; storm event precipitation totals included 3.09 inches in Bayville, 2.75 inches in Stafford Township, 2.43 inches in Barnegat Township, 2.32 inches in Little Egg Harbor Township, 2.25 inches in Berkeley Township, 2.05 inches in Brick Township, 2.02 inches in Toms River and 1.95 inches in Point Pleasant.
12/26/2009	Flood - Parkway Pines, Ocean County. Melting snow runoff and between 1.5 and 3.0 inches of rain produced field, poor drainage and widespread river flooding in New Jersey; the North Branch of the Metedeconk at Lakewood was above its 7 foot flood stage and crested at 8.59 feet; storm event precipitation totals included 2.78 inches in South Toms River, 2.10 inches in Berkeley Township, 2.02 inches in Brick and 1.98 inches in Lavallette.
2/24/2010	Flood - Parkway Pines, Ocean County. Rain combined with snow melt runoff caused flooding of some of the more flood prone creeks and rivers in central and southern New Jersey; it was snowing when some of the waterways were above flood stage; storm event precipitation totals averaged 1 to 2.5 inches, and were highest in Ocean County with 2.57 in Stafford Township, 2.53 inches in Point Pleasant, 2.43 inches in Pine Beach, 2.29 inches in Berkeley Township, 2.28 inches in Brick Township and 1.95 inches in South Toms River; the North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 7.31 feet.

DATE	LOCATION AND DESCRIPTION
2/13/2010	Coastal flooding - Along the New Jersey coast. Moderate to locally severe coastal flooding coupled with pounding surf took battered the New Jersey coast; in Ocean County, 3 to 5 foot vertical cuts were common; in North Beach, four houses were undermined by the erosion on Long Beach Boulevard; in Surf City, a 15 foot high and a 40 foot wide cut in the dunes occurred between 18th and 23rd Streets; in Ortley Beach, 30 to 40 percent of the beach was gone; in Seaside Park, bay flooding occurred and residents used kayaks; in Toms River, both Barnegat Bay and Toms River flooded; in Beach Haven, 10 feet of roadway was lost at Merivale Avenue; in Holgate, a 10 foot high by 16 foot wide cut in the dunes occurred in a residential area; $2 million in total damages resulted.
2/13/2010	Riverine Flooding - Parkway Pines, Ocean County. Heavy rains led to major flooding in the Passaic and Raritan Basins and flooding throughout New Jersey; four day storm totals averaged around 2.5 to 6 inches with the highest amounts in the Raritan and Passaic Basins; it was the worst flooding in the Raritan Basin since April of 2007 and the worst flooding in the Passaic Basin since April of 1984; over 1000 people were evacuated in Morris and Somerset Counties; damage was estimated at 30 million dollars statewide as thousands of homes and businesses were damaged; New Jersey Governor Chris Christie declared a state of emergency on March 14th; the North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 8.49 feet; storm event precipitation totals included 5.32 inches in Staffordville, 4.80 inches in Cedar Beach, 4.59 inches in South Toms River and 4.40 inches in Point Pleasant.
3/29/2010	Flood - Lakewood Township, Ocean County. Heavy rain in combination with high caused renewed flooding in New Jersey, especially in the Raritan and Passaic Basins; the North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 8.27 feet; storm event precipitation totals included 4.61 inches in Lavallette, 4.60 inches in Oakwood, 4.50 inches in Brick and 3.96 inches in Toms River.
4/1/2010	Flood - Parkway Pines, Ocean County. River and stream flooding from the heavy rain that fell on March 28th and 30th continued through April 4th in parts of Morris, Somerset, Burlington, Ocean, Salem and Cumberland Counties. The North Branch of the Metedeconk River near Lakewood was above its 7 foot flood stage and crested at 8.27 feet.
7/3/2011	Flash flood - Pine Lake Park, Ocean County. Thunderstorms with very heavy rain caused flash flooding within Toms River Township; the worst flooding was reported at the intersection of New Jersey State Route 37 and Mule Road; about thirty motorists were stranded within their vehicles throughout the township and several had to be rescued; Many jug handles were also impassable; The Doppler Radar storm total estimate over the township was between 2 and 3 inches, most of which fell within one hour.

DATE	LOCATION AND DESCRIPTION
8/21/2011	Flash flood - Cassville, Ocean County. Thunderstorms with heavy rain caused poor drainage and stream flash flooding in southern Monmouth County and in the northwest part of Ocean County; the runoff also caused flooding along the North Branch of the Metedeconk River; the North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 7.42 feet; in Jackson Township, vehicles became trapped in flood waters on six roadways: Bennetts Mills Road, Cedar Swamp Road, Chandler Road, County Line Road, Fox Hollow Drive and Nottingham Way; the most concentrated flooding occurred in the Four Seasons Development; Six Flags, Great Adventure even closed early; No serious injuries were reported; Event precipitation totals included 3.85 inches in Jackson Township and 2.58 inches in Point Pleasant Beach.
8/22/2011	Flood - Lakewood Township, Ocean County. Thunderstorms with heavy rain caused poor drainage and stream flash flooding in southern Monmouth County and northern Ocean County; runoff from the heavy rain then caused some river flooding in central New Jersey; the runoff from the heavy rain on the 21st caused flooding along the North Branch of the Metedeconk River; flooding occurred as far upstream as Aldrich Road (which was closed) in Jackson Township; the North Branch of the Metedeconk River at Lakewood was above its 7 foot flood stage and crested at 7.42 feet.
8/27/2011	Flash flood - New Egypt, Ocean County. Irene produced torrential downpour rains that resulted in major flooding and a number of record breaking crests on area rivers, tropical storm force wind gusts with record breaking outages for New Jersey utilities, one confirmed tornado and a three to five foot storm surge that caused moderate to severe tidal flooding with extensive beach erosion; approximately one million people were evacuated from the coast and low lying areas prone to inland flooding throughout the state of New Jersey including all of Cape May County; Irene also caused record breaking outages to utility customers as around one and a half million people lost power throughout the state; power was not fully restored until September 5th; the widespread flooding resulted in the second highest crest (highest was with Hurricane Floyd in September 1999) on record for the Raritan Basin, but the highest crest on record for many other river basins including the Passaic; moderate tidal flooding occurred along the tidal Delaware River and Delaware Bay and minor to moderate flooding occurred farther north along the Delaware River; moderate to severe tidal flooding occurred along the Atlantic Coast and Raritan Bay; there were six direct deaths associated with Irene, all drowning; the deaths occurred in Salem County, Mercer County (two), Ocean County (two) and Morris County; preliminary damage estimates in the whole state of New Jersey were near one billion dollars to approximately 200,000 homes and businesses; the closure of the Atlantic City casinos (only the third time in history) for three days caused an estimated 45 million dollars in lost revenue; the combination of wind and flooding forced the closure of about 350 main roadways in the state including sections of Interstate 287, the Garden State Parkway and the New Jersey Turnpike; the flooding rains and winds also damaged the corn crop.

DATE	LOCATION AND DESCRIPTION
8/28/2011	Flood - New Egypt, Ocean County. flooding rains combined with tropical storm force wind gusts closed thirty-five roadways and about fifteen bridges in Ocean County including parts of New Jersey State Routes 33, 35, 36 and 79 and U.S. Route 9; Plumsted Township was hit hard as flooding divided the township in half as the Crosswicks Creek flooded; three families were stranded after a roadway was washed away; neighboring Jackson Township had eight bridges and culverts washed out; Toms River flooded and the North Branch of the Metedeconk River at Lakewood had major and record breaking flooding; It was above its 7 foot flood stage and crested at 11.40 feet; storm event rainfall totals included 9.10 inches in Jackson Township, 8.38 inches in Whitesville, 7.33 inches in Brick Township and 7.10 inches in Jackson Township; total costs of the storm for Ocean County sum up to $10 million.
6/4/2012	Coastal flooding - Along the New Jersey coast. Minor to moderate tidal flooding along Raritan Bay, coastal New Jersey and Delaware Bay; the highest tides occurred with the high tide cycle and reached moderate levels along the oceanfront and in Delaware Bay and nearly reached moderate levels on tidal sections of the Delaware River.
6/22/2012	Flash flood - Waretown, Ocean County. Thunderstorms and heavy rain fell across New Jersey; southern Ocean County was hardest hit as multiple thunderstorms moved over the same area; Doppler Radar storm total estimates exceeded 6 inches. the thunderstorms produced torrential downpours and flash flooding in eastern parts of Stafford, Barnegat and Ocean Townships; five inches of rain was reported within ninety minutes; Motorists were stranded within their vehicles with water rising to nearly window level in Manahawkin in Stafford Township; Multiple roadways were closed including New Jersey State Route 72 in Stafford Township; ten vehicles were so badly flooded that they had to be towed away from the Ocean Acres section of Stafford Township; weekend getaway traffic was blocked from reaching Long Beach Island; no serious injuries were reported; two CoCoRahs reports from Stafford Township had event totals of 7.60 inches and 5.77 inches respectively; total costs for Ocean County amounted to $100,000.
7/20/2012	Flash flood - Tuckerton, Ocean County. Several thunderstorms brought heavy rain across southeast New Jersey, which, in combination with the spring high tide produced poor drainage flooding as well as flash flooding in the Mystic Island section of Little Egg Harbor Township in Ocean County; Doppler Radar storm total estimates reached between 3 and 6 inches in parts of Cape May, Southeast Burlington and Southern Ocean Counties; several vehicles became stuck in flood waters and rescues were performed; actual rainfall amounts were 5.30 inches in Mystic Islands.
9/4/2012	Flash flood - Warren Grove, Ocean County. Heavy rain and thunderstorms resulted in poor drainage and small stream flooding in parts of Barnegat, Little Egg, and Stafford townships; the runoff caused flash flooding along the Wading and Oswego rivers; New Jersey State Route 72 was closed in western Barnegat Township.

DATE	LOCATION AND DESCRIPTION
9/5/2012	Flash flood - Cedar Run, Ocean County. Heavy rain and thunderstorms caused poor drainage flash flooding and small stream flooding along McKinley Ave. in Stafford Township and several basements flooded on Perry Lane; total precipitation during the 2 hour event was 3.49 inches in Berkeley Township and 3.01 inches in Stafford Township; total storm costs amounted to $5,000.
10/29/2012	Coastal flooding - Countywide. Hurricane Sandy made landfall in Brigantine City as a post tropical storm; the storm brought high, damaging winds that gusted up to 88 mph in Tuckerton, Ocean County; the maximum sustained winds speed for Ocean County was 60 mph in Bay Head; the highest estimated crest elevations in Ocean County were 8.70 feet above lower low water at Mantoloking, 6.99 feet at Barnegat Light, 6.54 feet at Ship Bottom, and 5.24 feet at Tuckerton; the eastern half of the county suffered widespread damage including roof collapse, ruptured gas lines, house fires, damage to public transit, and homes shifting off their foundations; the piers in Seaside Heights collapsed; Bay Head, Point Pleasant, and Mantoloking were ravaged by the storm; tidal flooding impacted homes on the west side of Barnegat Bay; in Mantoloking, a new temporary inlet was formed, sweeping away homes that once stood there; access to the barrier islands in Ocean County was limited until December; two men drowned in Ocean County, one in Brick Township and one in Little Egg Harbor Township; 3 people died of hypothermia and one man died when a tree stump fell on him in Ocean County; Oyster Creek nuclear power plant suspended operations due to tidal flooding; schools were closed as well as major roadways, such as the New Jersey Turnpike; power outages were worst in Ocean and Monmouth counties; total storm costs amounted to $7.5 billion for eastern Ocean County, and $2.5 billion for Western Ocean County; most costly natural disaster in history in the state of New Jersey (29.4 billion statewide).
12/21/2012	Flood - Ocean, Atlantic, and Cape May Counties - Strong onshore flow contributed to higher high tides with minor to moderate tidal flooding occurring along the southern New Jersey oceanfront and in Barnegat Bay. In Ocean County, tidal flooding was reported on the barrier island section of BrickTownship. In Toms River Township, tidal flooding was reported in the Green Island and Silverton sections of the township on Barnegat Bay. High tide at Atlantic City Reached 6.71 feet above mean lower low water. Minor tidal flooding starts at 6.0 feet above mean lower low water. High tide at Cape May reached 7.82 feet above mean lower low water. Moderate tidal flooding starts at 7.7 feet above mean lower low water.
12/27/2012	Coastal Flooding - In Ocean County, New Jersey State Route 35 was flooded in Mantoloking Borough. Brick Township closed off its part of the barrier islands to traffic and Toms River Township reported some ocean breaches on its barrier islands. In Barnegat Bay, tidal flooding caused the closure of Mandalay and Drum Point Roads. Tidal flooding was reported along Hovsons Boulevard and in the Silverton and Holiday City areas of the township.

DATE	LOCATION AND DESCRIPTION
3/7/2013	Coastal Flooding - Nor'easter - Central and Southern Ocean County - Brought strong to high winds on the 6th into the 7th as well as minor to moderate tidal flooding along Raritan Bay, lower Delaware Bay and on the ocean side. The coastal flooding was exacerbated by wave action as waves off of Barnegat (Ocean County) reached 15 feet and seas offshore 25 feet. The coastal flooding caused new breaches in Mantoloking, flooded roadways and prompted some voluntary evacuations in Monmouth and Ocean Counties. In Mantoloking, three dune breaches closed New Jersey State Route 35. Tidal flooding was reported in Long Beach Township in its Brant Beach and Holgate areas. In Berkeley Township tidal flooding in Barnegat Bay reached into Balsam Drive, Main Street and Bayview Avenue. Roadways on Pelican Island and Seaside Park also had some water on them. In Lacey Township, tidal flooding was reported in the Hawaii section as well as along the Bayside Beach Club.
3/9/2013	Coastal Flooding - Nor'easter - Ocean County - A subtle veering of the surface winds slowly drifted offshore brought areas of moderate tidal flooding. In Ocean County, the southbound lane of New Jersey State Route 35 was closed.
6/18/2013	Flash Flood -Thunderstorms and Heavy Rain - Toms River Township, Ocean County - The flooding affected the eastbound lanes of New Jersey State Route 37. Event precipitation totals included 3.48 inches in Berkeley Township and 2.57 inches in Toms River Township.
7/22/2013	Flash Flood -Thunderstorms and Heavy Rain - Jackson Township, Ocean County - Caused poor drainage and small stream flash flooding. Event precipitation totals included 6.07 inches in Jackson.
8/13/2013	Flash Flood -Thunderstorms and Torrential Downpours - Long Beach Island, Ocean County - Caused flash flooding on Long Beach Island from Surf City south through Beach Haven. Some poor drainage flooding also occurred in Point Pleasant and Little Egg Harbor Township. Doppler Radar storm total estimates reached 2 to 3 inches.
1/3/2014	Coastal Flooding -Winter Storm - Northern Ocean County - A winter storm dropped 10 inches of snow in northern Ocean County. The snow ended first in the far northwest and southwest parts of the state and last in Ocean and Monmouth Counties where the greatest snowfall occurred. Representative snowfall totals included 10.5 inches in Jackson Township and 9.5 inches in Whiting
5/1/2014	Flood - Ocean County - The North Branch of the Metedeconk River at Lakewood had minor flooding and was above its 8 foot flood stage. It crested at 8.37 feet. Event precipitation totals included 4.25 inches in Jackson Township, 3.28 inches in Brick Township, 3.19 inches in Stafford Township, 3.12 inches in Whiting and 3.04 inches in Toms River.
7/14/2014	Flash Flood -Thunderstroms with Torrential Downpours - Ocean and Monmouth Counties - Caused widespread street flooding with several impassable roadways within the township. Doppler Radar storm total estimates reached 6 inches in the township and in nearby Howell (Monmouth County), 5.91 inches of rain fell.

DATE	LOCATION AND DESCRIPTION
7/15/2014	Flood -Thunderstorms and Heavy Rain - Ocean County - The runoff from the thunderstorms with very heavy rain caused minor flooding along the North Branch of the Metedeconk River. The North Branch of the Metedeconk River near Lakewood was above its 8 foot flood stage. It crested at 8.08 feet. Event precipitation totals included 3.42 inches in Jackson Township and 2.95 inches in Brick Township. Runoff flooding occurred overnight in Ocean County. In Ocean County Doppler Radar storm total estimates reached as high as 6 inches.
8/13/2014	Flash Flood -Thunderstorms with Torrential Downpours - Eastern Ocean County - Doppler Radar storm total estimates reached 9 inches. In Seaside Park, New Jersey State Route 35 was closed north of 5th Avenue. In Point Pleasant, many roadways were flooded, up to two feet deep. Actual precipitation event totals included 8.35 inches in Lacey Township, 7.50 inches in Little Egg Harbor Township, 7.24 inches in Stafford Township, 6.55 inches in Lavallette, 6.02 inches in Point Pleasant, 5.87 inches in Brick Township, 5.43 inches in Berkeley Township, 4.59 inches in Seaside Heights, 4.39 inches in Toms River, 4.02 inches in Lakewood and 2.51 inches in Jackson Township.
10/21/2014	Flash Flood -Thunderstorms and Heavy Rain - Brick Township, Ocean County - Thunderstorms produced heavy downpours in parts of Ocean and Monmouth Counties and caused flash flooding in Brick Township. Event precipitation totals reached as high as around 2 inches, most of which fell within an hour.
12/9/2014	Coastal Flooding - Nor'easter - New Jersey Coast - Caused strong winds as well as minor to moderate tidal flooding in Upper Delaware Bay and around Raritan Bay and moderate tidal flooding in Lower Delaware Bay and Atlantic Coastal New Jersey. In Ocean County, a steel sea wall was exposed in Mantoloking and Brick. A nine foot drop-off was reported along the beach. In Lavallette, flooding forced the closure of one lane on Northbound New Jersey State Route 35 south of Washington Street. More extensive coastal and roadway flooding was reported on the southern half of Long Beach Island. Sections of Long Beach Boulevard were flooded and closed. Highest tides included 3.84 feet above mean lower low water at Ship Bottom (Ocean County) and 7.30 feet above mean lower lowwater at Tuckerton (Ocean County).
5/28/2015	Flash Flood -Thunderstorms - Toms River Township, Ocean County - New Jersey State Route 37 was flooded from Vaughn Avenue to the Thomas A. Mathis Bridge. No serious injuries were reported. Between 20 and 30 water rescues occurred. Flooding was also reported along Adams Avenue and Bash Road near New Jersey State Route 37 in Toms River. Event precipitation totals within Toms River included 5.24 inches and 4.60 inches.
6/27/2015	Flash Flood -Thunderstorms and Heavy Rain - Eastern Ocean County - Caused flash flooding of smaller streams as well as poor drainage flooding in eastern Ocean County from Toms River Township south through Little Egg Harbor Township. Event precipitation totals included 4.71 inches in Brick Township, 4.49 inches in Berkeley Township, 4.41 inches at Robert J. Miller Airport, 4.26 inches in Toms River, 3.73 inches in Little Egg Harbor Township, 3.70 inches in Pine Beach, 3.51 inches in Stafford Township, 2.90 inches in Tuckerton and 2.25 inches in Lacey Township.

DATE	LOCATION AND DESCRIPTION
7/15/2015	Flash Flood -Thunderstorms and Heavy Rain - Little Egg Harbor Township, Ocean County - Flash flooding in the Mystics Island section of Little Egg Harbor Township. Major street flooding was reported. No major injuries were reported. Event precipitation totals included 4.16 inches in Little Egg Harbor Township and 2.27 inches in Tuckerton.
1/23/2016	Coastal Flooding - Nor'easter - Southern New Jersey - Blizzard conditions along the eastern seaboard caused major to record flooding in parts of New Jersey and Delaware. The most severe flooding occurred along the southern New Jersey coast in Cape May County, where old tidal flood records were surpassed.
2/8/2016	Coastal Flooding - Onshore Flow Associated with Low Pressure along the Atlantic Coast - New Jersey Coast - A strong onshore flow associated with an intense low pressure system moving north just off the mid-Atlantic coast, in combination with a new moon, produced moderate coastal flooding during the morning high tide on February 9th.
2/9/2016	Coastal Flood - Onshore Flow Associated with Low Pressure along the Atlantic Coast - New Jersey Coast - Coastal flood - An onshore flow associated with low pressure along the mid-Atlantic coast, in combination with a new moon, produced moderate coastal flooding. Multiple roadways were flooded on Long Beach Island due to coastal flooding. Immediately in the wake of a much stronger storm system moving northeast away from the area, another weaker low pressure system developed along the mid-Atlantic coast.Generally between one-half inch and 2 inches of snow fell across the Garden State, with nothing at the shore. One of the highest snowfall amounts reported in the county included 1.1 inches in Berkeley Township.
5/6/2016	Coastal Flooding - Persistent Onshore Flow - Ocean County - A Low pressure system slowly moved onshore leading to a persistent period of onshore flow. Coupled with a New Moon cycle this led to abnormally high tidal levels and frequent minor to moderate coastal flooding corresponding to the high tides.
6/21/2016	Flood - Thunderstorms and Rain Showers - Ocean County - Flooding extended to Brick Blvd and Route 70. A cold frontal boundary moved south into New Jersey. This front served as a focal point for showers and thunderstorms to develop across the region. More than 30,000 people lost power for a time.
7/25/2016	Flood - A trough of low pressure led to the development of afternoon and evening showers and thunderstorms which became severe in spots and produced locally heavy rains. 40,000 were left without power across the state.
7/31/2016	Flood -Several clusters of thunderstorms associated with several shortwaves and a cold front became nearly stationary over Mercer County on the 29th and Hunderdon County on the morning of the 30th. Heavy rainfall over 5 inches occurred in these areas. The persistent heavy rain resulted in severe flash flooding including a state of emergency being issued in West Windsor Twp. Thousands were left without power as a result of the storms. The Monmouth county fair and New Jersey Balloon festival were cancelled due to weather on 7/31. Minor flooding occurred along route 530.

DATE	LOCATION AND DESCRIPTION
7/31/2016	Flood -Several clusters of thunderstorms associated with several shortwaves and a cold front became nearly stationary over Mercer County on the 29th and Hunderdon County on the morning of the 30th. Heavy rainfall over 5 inches occurred in these areas. The persistent heavy rain resulted in severe flash flooding including a state of emergency being issued in West Windsor Twp. Thousands were left without power as a result of the storms. The Monmouth county fair and New Jersey Balloon festival were cancelled due to weather on 7/31. The main road in Island Beach State park was flooded due to heavy rainfall.
9/19/2016	Flood -The remnants of tropical storm Julia and a frontal boundary interacted leading to several rounds of rainfall over the region. Several inches of water on streets.
9/29/2016	Coastal Flood -A stalled frontal boundary led to rounds of heavy rain across the southern portion of the state. Water was reported to be knee high at both high tides Thursday night and Friday in Tuckerton.
1/24/2017	Coastal Flood -Several inches of water came up with the morning high tide into Ocean City which flooded some roads. Numerous roads flooded throughout county including route 72 between GSP and Long Beach Island.
1/24/2017	Coastal Flood -Flooding reported in numerous locations on Long Beach Island.
3/14/2017	Coastal Flood -Widespread road flooding accompanied the morning high tide in the coastal communities of Ocean County. This led to numerous road closures. Communities such as Point Pleasant, Seaside heights and Long Beach Island were most affected. Tuckerton reached 5.89 ft, moderate begins at 5.6 feet.
7/24/2017	Flood -A stalled frontal boundary was the focus for several rounds of thunderstorms that produced damaging winds and flooding in spots. Several thousand people lost power throughout the state. Several reports of flooding.
8/18/2017	Flood -Severe thunderstorms formed in a hot and humid airmass ahead of a cold front. Flooding on route 37 from Collidge ave to Fischer blvd.
9/19/2017	Coastal Flood -Moderate coastal flooding affected western Ocean County with the evening high tide on Tuesday, September 19. Widespread roadway flooding was reported in the communities along tidal waters and many roads were closed. The following tidal gauge reached the moderate flooding threshold: Atlantic City Inside Thorofare.
9/19/2017	Coastal Flood - Moderate coastal flooding affected eastern Ocean County with the evening high tide on Tuesday, September 19. Widespread roadway flooding was reported in the communities along tidal waters and many roads were closed, including Long Beach Island. The following tidal gauge reached the moderate flooding threshold: Atlantic City Inside Thorofare.
10/30/2017	Flood - Roads were flooded with one to two feet of water.

In addition to the aforementioned past flood events, the NFIP identifies properties that frequently experience flooding. Repetitive loss properties are structures insured under the NFIP that have had at least two paid flood losses of more than $1,000 over any 10-year period since 1978. A property is considered a severe repetitive loss property either when there are at least four losses (each exceeding $5,000) or when there are two or more losses where the building payments exceed the property value.

Toms River Township, Stafford Township, Little Egg Harbor Township, Brick Township, and Long Beach Township have the most repetitive loss buildings, repetitive loss events, and amount of paid losses in the County respectively. The five communities listed above also have largest number of policies in force. Table 4.3.5-3 shows the number of NFIP policies in force, the number and amount of paid losses, the number of repetitive/severe repetitive loss events, and the amount of repetitive loss payments.

Table 4.3.5-3 Sum of NFIP Policies, losses and repetitive loss properties (FEMA (2017)

Municipality	Policies in Force	Total Number Losses	Number of Closed Paid Losses	Total Repetitive Loss Payments
Barnegat Township	436	318	250	$8,185,563
Barnegat Light Borough	936	239	151	$2,958,661
Bay Head Borough	728	832	743	$66,200,289
Beach Haven Borough	2,205	2646	2,202	$90,689,918
Beachwood Borough	41	32	28	$1,231,860
Berkeley Township	2,611	1915	1,624	$78,171,960
Brick Township	4,129	3940	3,386	$276,232,540
Eagleswood Township	92	197	174	$5,695,025
Harvey Cedars Borough	980	863	626	$11,099,225
Island Heights Borough	94	61	47	$2,375,713
Jackson Township	99	20	9	55790.69
Lacey Township	2,815	2052	1,746	$52,365,244
Lakehurst Borough	1	1	0	0
Lakewood Township	155	21	16	$280,071
Lavallette Borough	2,124	2070	1,833	$134,399,380
Little Egg Harbor Township	2,552	4140	3,709	$201,209,951
Long Beach Township	6,714	7566	6,240	$238,129,919
Manchester Township	96	29	16	$1,113,106
Mantoloking Borough	408	652	582	$95,636,806
Ocean Township	964	834	683	$27,697,357
Ocean Gate Borough	411	420	378	$18,150,842
Pine Beach Borough	30	12	8	378270.27
Plumsted Township	68	38	21	500014.39
Point Pleasant Borough	1,858	1276	1,111	$68,780,357

Municipality	Policies in Force	Total Number Losses	Number of Closed Paid Losses	Total Repetitive Loss Payments
Point Pleasant Beach Borough	1,812	1932	1,666	$101,530,783
Seaside Heights Borough	1,385	1017	842	$55,500,970
Seaside Park Borough	1,319	1092	845	$41,594,776
Ship Bottom Borough	1,536	1628	1,384	$68,152,451
South Toms River Borough	22	52	40	$2,414,160
Stafford Township	3,365	4581	4,054	$265,792,274
Surf City Borough	1,531	1395	1,101	$22,761,814
Toms River (Dover) Township	8,938	9317	8,130	$598,710,169
Tuckerton Borough	481	1282	1,087	$44,812,834
TOTALS	50,936	52,470	44,732	2,582,808,091

There are 1,829 repetitive loss (RL) properties and 229 severe repetitive loss (SRL) properties in the County. In keeping with Ocean County's overall land development patterns, most of these properties are single family homes. Toms River Township has the highest number of both RL and SRL properties, with 450 and 5 properties respectively. Table 4.3.5-4 lists the numbers of repetitive loss and severe repetitive loss structure.

Table 4.3.5-4 Summary of Repetitive Loss Properties (FEMA, 2017)

Municipality	Repetitive Loss by Property Type					Sum of Repetitive Loss Properties
	Non-Residential	2-4 Family	Single Family	Condo	Other Residential	
Barnegat Township	0	0	12	0	2	14
Barnegat Light Borough	0	1	0	1	0	2
Bay Head Borough	5	1	33	2	0	41
Beach Haven Borough	31	16	26	5	3	81
Beachwood Borough	0	1	0	0	0	1
Berkeley Township	0	3	50	1	1	55
Brick Township	2	1	133	0	0	136
Eagleswood Township	0	1	11	0	0	12
Harvey Cedars Borough	0	1	11	0	0	12
Island Heights Borough	1	0	2	0	0	3
Jackson Township	0	0	0	0	0	0
Lacey Township	1	0	80	0	0	81
Lakehurst Borough	0	0	0	0	0	0
Lakewood Township	0	0	2	0	0	2
Lavallette Borough	1	6	51	1	0	59
Little Egg Harbor Township	2	0	147	4	0	153
Long Beach Township	20	22	71	4	0	117

Municipality	Repetitive Loss by Property Type					Sum of Repetitive Loss Properties
	Non-Residential	2-4 Family	Single Family	Condo	Other Residential	
Manchester Township	0	0	1	1	0	2
Mantoloking Borough	0	0	22	0	1	23
Ocean Township	0	0	30	0	0	30
Ocean Gate Borough	0	0	10	0	0	10
Pine Beach Borough	0	0	0	0	0	0
Plumsted Township	0	0	0	0	0	0
Point Pleasant Borough	0	0	48	0	0	48
Point Pleasant Beach Borough	13	4	71	4	3	95
Seaside Heights Borough	1	23	17	1	2	44
Seaside Park Borough	0	9	35	1	0	45
Ship Bottom Borough	10	7	16	0	0	33
South Toms River Borough	2	0	1	0	0	3
Stafford Township	1	1	178	1	0	181
Surf City Borough	1	6	17	0	0	24
Toms River (Dover) Township	8	12	426	1	3	450
Tuckerton Borough	1	0	63	0	0	64
Total RL Properties	101	117	1,569	27	15	1,829

Floods are the most common and costly natural catastrophe in the United States. In terms of economic disruption, property damage, and loss of life, floods are “nature’s number-one disaster.” For that reason, flood insurance is almost never available under industry-standard homeowner’s and renter’s policies. The best way for citizens to protect their property against flood losses is to purchase flood insurance through the NFIP.

Congress established the NFIP in 1968 to help control the growing cost of federal disaster relief. The NFIP is administered by FEMA, part of the U.S. Department of Homeland Security. The NFIP offers federally backed flood insurance in communities that adopt and enforce effective floodplain management ordinances to reduce future flood losses.

Since 1983, the chief means of providing flood insurance coverage has been a cooperative venture of FEMA and the private insurance industry known as the Write Your Own (WYO) Program. This partnership allows qualified property and casualty insurance companies to “write” (i.e., issue) and service the NFIP’s Standard Flood Insurance Policy (SFIP) under their own names.

Today, nearly 90 WYO insurance companies issue and service the SFIP under their own names. More than 5 million federal flood insurance policies are in force. These policies represent about $1.2 trillion in flood insurance coverage for homeowners, renters, and business owners throughout the United States and its territories (FEMA, 2016).

The NFIP provides flood insurance to individuals in communities that are members of the program. Membership in the program is contingent on the community adopting and enforcing floodplain management and development regulations.

The NFIP is based on the voluntary participation of communities of all sizes. In the context of this program, a "community" is a political entity – whether an incorporated city, town, township, borough, village, or an unincorporated area of a county or parish – that has legal authority to adopt and enforce floodplain management ordinances for the area under its jurisdiction.

National Flood Insurance is available only in communities that apply for participation in the NFIP and agree to implement prescribed flood mitigation measures. Newly participating communities are admitted to the NFIP's Emergency Program. Most of these communities quickly earn "promotion" to the Regular Program. All the municipalities in Ocean County participating in the NFIP are in the Regular Program.

The minimum floodplain management requirements include the following:

- Review and permit all development in the SFHA
- Elevate new and substantially improved residential structures above the Base Flood Elevation
- Elevate or dry flood proof new and substantially improved nonresidential structures
- Limit development in floodways
- Locate or construct all public utilities and facilities so as to minimize or eliminate flood damage
- Anchor foundation or structure to resist floatation, collapse, or lateral movement

In addition, Regular Program communities are eligible to participate in the NFIP's Community Rating System (CRS). Under the CRS, policyholders can receive premium discounts of 5 to 45 percent as their cities and towns adopt more comprehensive flood mitigation measures. CRS rewards those communities that establish floodplain management programs that go beyond NFIP minimum requirements by providing discounts on flood insurance premiums. Under the CRS, communities receive credit for activities falling into four categories: public information, mapping and regulations, flood damage reduction, and flood preparedness.

The CRS was implemented in 1990 to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. Section 541 of the 1994 Act amends Section 1315 of the 1968 Act to codify the CRS in the NFIP, and expands the CRS goals to specifically include incentives to reduce the risk of flood-related erosion and to encourage measures that protect natural and beneficial floodplain functions. These goals have been incorporated into the CRS, and communities now receive credit toward premium reductions for activities that contribute to them.

There are 10 CRS classes that provide varied reductions in insurance premiums. Class 1 requires the most credit points and gives the largest premium reduction; Class 10 receives no premium reduction. CRS premium discounts on flood insurance range from 5 percent for Class 9 communities up to 45 percent for Class 1 communities.

Table 4.3.5-5 lists the municipalities in Ocean County participating in the NFIP along with the date of the initial FIRM and the current effective map date. All 33 jurisdictions in the County participate in the NFIP.

Table 4.3.5-5 Ocean County NFIP Participation (FEMA)

Community	Participation Status	CID	Initial FIRM Identified	Current Effective Map Date
Barnegat Township	Participating	340396	12/15/1982	9/29/2006
Barnegat Light Borough	Participating	345280	4/2/1971	9/29/2006
Bay Head Borough	Participating	345281	8/17/1971	9/29/2006
Beach Haven Borough	Participating	345282	4/2/1971	9/29/2006
Beachwood Borough	Participating	340368	5/1/1979	9/29/2006
Berkeley Township	Participating	340369	5/19/1981	9/29/2006
Brick Township	Participating	345285	8/4/1972	9/29/2006
Eagleswood Township	Participating	340372	2/16/1983	9/29/2006
Harvey Cedars Borough	Participating	345296	4/2/1971	9/29/2006
Island Heights Borough	Participating	340374	6/15/1979	9/29/2006
Jackson Township	Participating	340375	9/16/1982	9/29/2006
Lacey Township	Participating	340376	9/1/1977	9/29/2006
Lakehurst Borough	Participating	340377	12/15/1982	9/29/2006
Lakewood Township	Participating	340378	3/15/1977	9/29/2006
Lavallette Borough	Participating	340379	6/11/1971	9/29/2006
Little Egg Harbor Township	Participating	340380	9/1/1983	9/29/2006
Long Beach Township	Participating	345301	5/26/1970	9/29/2006
Manchester Township	Participating	340382	5/2/1983	9/29/2006
Mantoloking Borough	Participating	340383	9/30/1977	9/29/2006
Ocean Township	Participating	340518	1/6/1983	9/29/2006
Ocean Gate Borough	Participating	340384	5/19/1981	9/29/2006
Pine Beach Borough	Participating	340385	8/11/1978	9/29/2006
Plumsted Township	Participating	340386	9/30/1981	9/29/2006
Point Pleasant Borough	Participating	345313	7/7/1972	9/29/2006
Point Pleasant Beach Borough	Participating	340388	6/15/1979	9/29/2006
Seaside Heights Borough	Participating	340389	7/16/1979	9/29/2006
Seaside Park Borough	Participating	345319	8/13/1971	9/29/2006
Ship Bottom Borough	Participating	345320	4/2/1971	9/29/2006
South Toms River Borough	Participating	340392	1/6/1983	9/29/2006
Stafford Township	Participating	340393	9/14/1979	9/29/2006
Surf City Borough	Participating	345324	4/2/1971	9/29/2006
Toms River (Dover) Township	Participating	345293	3/22/1972	9/29/2006
Tuckerton Borough	Participating	340395	5/2/1983	9/29/2006

4.3.5.4 *Future Occurrence*

In Ocean County, flooding is a common occurrence and can occur during any season of the year. Therefore, the future occurrence of floods in Ocean County can be considered highly likely as defined by the Risk Factor Methodology probability criteria (see Table 4.4.1-1). Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. The NFIP uses historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence is expressed in percentages as the chance of a flood of a specific extent occurring in any given year.

The NFIP recognizes the 1 percent annual chance flood, also known as the base flood, as the standard for identifying properties subject to federal flood insurance purchase requirements. A 1 percent annual chance flood is a flood that has a 1 percent chance of occurring over a given year. The DFIRMs are used to identify areas subject to the 1 and 0.2 percent annual chance flooding. Areas subject to 2 percent and 10 percent annual chance events are not shown on maps; however, water surface elevations associated with these events are included in the flood source profiles contained in the Flood Insurance Study Report.

Table 4.3.5-6 shows a range of flood recurrence intervals and associated probabilities of occurrence. The probability that a flood event will occur in Ocean County each year should be considered highly likely, as defined by the Risk Factor methodology probability criteria (see Table 4.4.1-1).

Table 4.3.5-6 Recurrence Intervals and Associated Probabilities of Occurrence

Recurrence Intervals and Associated Probabilities of Occurrence	
Recurrence Interval	Chance of Occurrence in Any Given Year
10 year	10
50 year	2
100 year	1
500 year	0.2

With proper oversight and maintenance, it is unlikely that flooding related to dam will occur in the future. NJDEP's Division of Dam Safety and Flood Control inventories, regulated, and inspects dams in New Jersey; Class I and Class II dams are inspected every two years (or more for large high hazard dams) while Class III dams are inspected every four years. The Division of Dam Safety and Flood Control also coordinates with first responders and communities in preparing and approving Emergency Action Plans, which can save lives during a dam failure-related flood.

4.3.5.5 *Vulnerability Assessment*

Ocean County is vulnerable to severe flooding with the potential for catastrophic impact. The bulk of the residences in Ocean County are on or near waterfront property. The year-round population of almost six hundred thousand people can swell to nearly a million in the summer. Evacuation planning is critical in Ocean County to address both the year-round and summer population and to mitigate the challenges posed by a limited number of access roads for the barrier islands.

New Jersey state law has authorized the New Jersey Department of Environmental Protection to regulate and approve the location, design and construction of major facilities in certain coastal areas. Regulated development includes marine terminals, and public projects, such as new roads, wastewater treatment systems, parking lots and landfills. Amendments to the law have expanded jurisdiction to include all development on beaches and dunes, as well as first uses adjacent to and landward of beaches, dunes and tidal areas. This law is known as the Coastal Areas Facility Resources Act. Coastal areas regulated under this Act are from mean high water inland to an irregular line drawn along public roads, railroads and other features. The municipalities who have acres designated under this Act are as follows:

- Township of Barnegat (8,364 acres)
- Borough of Barnegat Light (448 acres)
- Borough of Bay Head (384 acres)
- Borough of Beach Haven (640 acres)
- Borough of Beachwood (1,342 acres)
- Township of Berkeley (16,512 acres)
- Township of Brick (16,896 acres)
- Township of Eagleswood (8,144 acres)
- Borough of Harvey Cedars (352 acres)
- Borough of Island Heights (384 acres)
- Township of Jackson (10 acres)
- Township of Lacey (12,160 acres)
- Borough of Lakehurst (68 acres)
- Township of Lakewood (12,240 acres)
- Borough of Lavallette (463 acres)
- Township of Little Egg Harbor (25,798 acres)
- Township of Long Beach (2,752 acres)
- Township of Manchester (14,273 acres)
- Borough of Mantoloking (282 acres)
- Township of Ocean (4,696 acres)
- Borough of Ocean Gate (320 acres)
- Borough of Pine Beach (384 acres)
- Township of Plumsted (no acres)
- Borough of Point Pleasant (2,368 acres)
- Borough of Point Pleasant Beach (960 acres)
- Borough of Seaside Heights (224 acres)
- Borough of Seaside Park (384 acres)
- Borough of Ship Bottom (454 acres)
- Borough of South Toms River (406 acres)
- Township of Stafford (16,832 acres)
- Borough of Surf City (416 acres)
- Township of Toms River (26,590 acres)
- Borough of Tuckerton (2,349 acres)

It should be noted that in the municipalities of Barnegat Light, Bay Head, Beach Haven, Brick, Harvey Cedars, Island Heights, Lavallette, Long Beach, Mantoloking, Ocean Gate, Pine Beach, Point Pleasant, Point Pleasant Beach, Seaside Heights, Seaside Park, Ship Bottom, Surf City, Toms River, and Tuckerton, the acres listed constitute the entire jurisdiction. Plumsted is the only municipality without designated Coastal Area Facility Review Act lands.

The Coastal Barrier Resources Act restricts federal expenditures and financial assistance, including flood insurance that encourages development in a defined set of undeveloped coastal areas. There are also lands that are designated Otherwise Protected Areas.

Ocean County is vulnerable to flooding that causes loss of lives, property damage, and road closures. Floodwater damages that occur to agricultural, urban, and other properties such as roads, bridges, and utilities are projected to increase when there is development in flood-prone lands. For purposes of assessing vulnerability, the County focused on community assets that are located in the 1 percent-annual-chance floodplain. While greater and smaller floods are possible, information about the extent and depths for this floodplain is available for all municipalities countywide, thus providing a consistent basis for analysis. The flood vulnerability analysis was completed by selecting critical facilities and parcels whose centers fall within the 1 percent-annual-chance flood hazard zones. The dollar value of improvements is used to represent the value of structures rather than land; the dollar value of improvements in the SFHA is a summation of the entire value of the parcel. While clearly an estimate, this analysis provides an understanding of the magnitude of property loss possible during a countywide 1 percent-annual-chance flood.

Critical facilities data is protected in the State of New Jersey under Executive Order 21. As a result, maps of critical infrastructure and key resources vis-à-vis the 1 percent-annual-chance floodplain in each municipality can be found in Appendix B – Jurisdictions.

This vulnerability analysis and the community flood vulnerability maps in Appendix B were prepared using FEMA's regulatory effective DFIRM data for inland communities and the preliminary work map data for coastal areas. The preliminary work maps are an interim product and are the best available flood hazard data at this time. They will eventually be replaced by the preliminary FIRMs. The preliminary work maps are intended to help local officials and property owners understand current flood risk and provide an opportunity to review and comment on revised flood zones. Please note that riverine tie-ins have not yet been done between the Effective DFIRM and the preliminary work map data.

Table 4.3.5-7 displays the total number of parcels and associated land improvement values for parcels intersecting the SFHA. Just over 25%, or 107,754, of all parcels in the County are located in the SFHA. The cumulative improvement value of all vulnerable parcels is over $14 billion. With the exception of Lakehurst Borough and Pine Beach Borough, each municipality has over $10 million dollars of improvement value within the SFHA with the highest seen in Long Beach, Toms River and Brick Township.

Table 4.3.5-7 also displays the number of critical facilities that are located in the SFHA by jurisdiction. Approximately 21% of all critical facilities within Ocean County are located in the SFHA; 25 of the 33 communities in Ocean County have at least one vulnerable critical facility. For more information on the flood vulnerability of each individual critical facility, please see Appendix B.

Table 4.3.5-7 Number of Parcels and Critical Facilities in the SFHA

Municipality	Parcels in SFHA	Total Parcels in Municipality	Percent Vulnerable Parcels	Dollar Value of Improvements in SFHA	Total Number of Critical Facilities in SFHA
Barnegat Township	1,149	1,448	79.35%	$73,531,075	0
Barnegat Light Borough	1,448	13,701	10.57%	$332,274,100	11
Bay Head Borough	945	1,223	77.27%	$376,331,400	10
Beach Haven Borough	3,095	3,098	99.90%	$363,305,000	23
Beachwood Borough	64	4,325	1.48%	$10,544,600	0
Berkeley Township	11,978	56,660	21.14%	$565,245,060	3
Brick Township	10,835	55,329	19.58%	$1,309,118,080	9
Eagleswood Township	565	4,524	12.49%	$24,139,800	0
Harvey Cedars Borough	1,487	1,487	100.00%	$365,896,500	8
Island Heights Borough	278	1,024	27.15%	$34,426,900	2
Jackson Township	1248	22,210	5.62%	$376,958,200	1
Lacey Township	9,233	51,408	17.96%	$774,702,300	12
Lakehurst Borough	47	879	5.35%	$2,410,800	0
Lakewood Township	430	25,912	1.66%	$231,679,800	0
Lavallette Borough	2,988	2,991	99.90%	$445,927,210	19
Little Egg Harbor Township	5,091	13,046	39.02%	$466,676,500	3
Long Beach Township	10,452	10,458	99.94%	$2,111,211,300	24
Manchester Township	1275	38,468	3.31%	$894,926,900	1
Mantoloking Borough	875	875	100.00%	$418,791,400	9
Ocean Township	2,149	1,202	178.79%	$193,417,200	1
Ocean Gate Borough	774	10,167	7.61%	$82,122,700	7
Pine Beach Borough	88	2,976	2.96%	$9,130,600	0
Plumsted Township	626	3,304	18.95%	$76,611,000	0
Point Pleasant Borough	2,716	3,639	74.64%	$514,236,400	5
Point Pleasant Beach Borough	2,893	8,574	33.74%	$456,808,000	6
Seaside Heights Borough	2,265	2,265	100.00%	$272,896,200	8
Seaside Park Borough	2,430	2,490	97.59%	$282,179,300	16
Ship Bottom Borough	2,257	2,257	100.00%	$397,071,200	9
South Toms River Borough	116	1,354	8.57%	$13,814,100	0
Stafford Township	5,954	15,715	37.89%	$693,812,000	1
Surf City Borough	2,557	2,557	100.00%	$521,857,100	15
Toms River Township	18,270	53,218	34.33%	$1,974,265,260	15
Tuckerton Borough	1,176	2,187	53.77%	$99,994,100	3
TOTAL	107,754	420,971	25.60%	$14,766,312,085	221

Communities located adjacent to and downstream of high and significant hazard dams should be considered vulnerable to a dam failure-related flood. Lacey Township is expected to be the most vulnerable to flooding related to dam failures, as this jurisdiction has three high-hazard dams within its borders. Jackson Township is also expected to have higher vulnerability to dam failures as it is home to one high hazard and three significant-hazard dams. In general, the coastal communities are less vulnerable to flooding from dam failures, as nearly all of Ocean County's dams are located inland.

The short warning time and significant velocity and volume of water typically means that communities with inadequate warning systems may be more vulnerable to the impacts of a dam failure-related hazard, and populations with low English literacy may be more at-risk due to the time sensitive nature of this kind of an event. Additionally, the elderly, the young, and populations without vehicles will face challenges during this kind of event since they typically do not have the ability to evacuate immediately.

High hazard dams in New Jersey are required to have maps of their inundation areas to assist first responders in emergency response. However, these maps are not always available in GIS format; because of this, coupled with the sensitive nature of dam inundation zones, calculated vulnerability and loss analysis was unable to be completed for this plan.

4.3.6 Hurricane, Tropical Storm, Nor'easter

4.3.6.1 Location and Extent

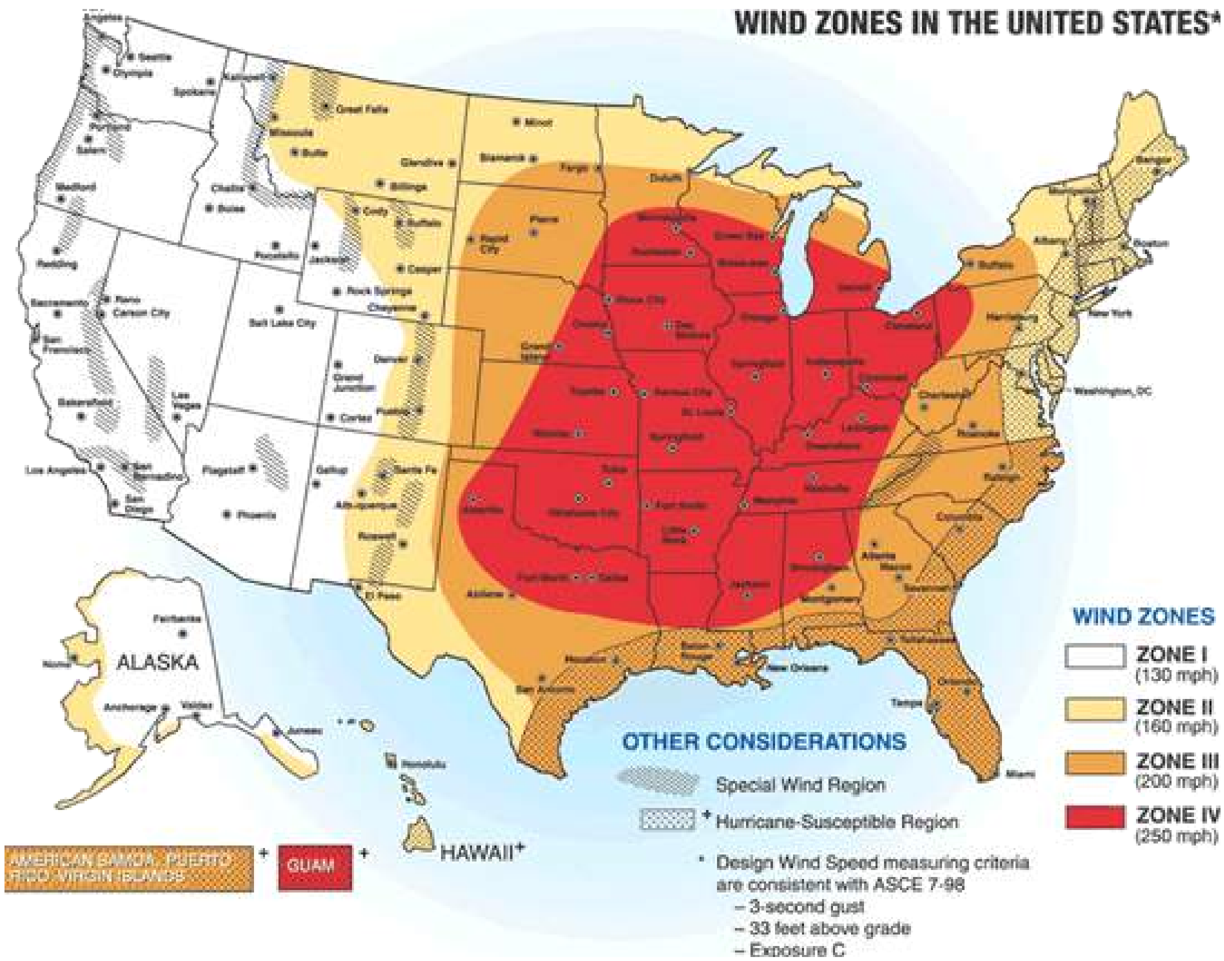
Hurricanes, tropical storms, and Nor'easters that impact Ocean County originate in tropical or sub-tropical waters found in the Atlantic Ocean between the African Coast and the Lesser Antilles, the Gulf of Mexico, or the Caribbean Sea. Tropical depressions are cyclones with maximum sustained winds of less than 39 miles per hour (mph). A tropical storm is a cyclone with maximum sustained winds between 39-74 mph. Tropical storms sometimes develop into hurricanes with wind speeds in excess of 74 mph.

Ocean County's coastal communities are vulnerable to wind and surge effects when storms hit. Tropical storms can also track inland causing heavy rainfall and strong winds, putting entirety of Ocean County at risk. Though cooler waters near the New Jersey coast tend to weaken storms as they travel up the coast, New Jersey and Ocean County specifically have been impacted by all three types of storms in the past. These storms move quickly and can impact very large areas hundreds to thousands of miles across. Communities of Ocean County which are subject to flooding, wind, and winter storm damage are especially vulnerable.

Figure 4.3.6-1 shows wind speed zones developed by the American Society of Civil Engineers based on information including 40 years of tornado history and over 100 years of hurricane history. It identifies wind speeds that could occur across the United States to be used as the basis for design and evaluation of the structural integrity of shelters and critical facilities.

Ocean County lies within Zone II, meaning design wind speeds for shelters and critical facilities should be able to withstand a 3-second gust of up to 160 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event. Ocean County also falls wholly within the identified Hurricane Susceptibility Region.

Figure 4.3.6-1 Wind zones in New Jersey and Ocean County (FEMA, 2009)



4.3.6.2 Range of Magnitude

Tropical depressions are defined as tropical cyclones with maximum sustained winds of less than 39 miles per hour (mph). They have low pressure systems but lack the spiral shape and eye of stronger storms. A cyclone with maximum sustained winds between 39-74 mph is called a *tropical storm* and is given a name by the National Oceanic and Atmospheric Administration (NOAA). Though these storms typically have no eye, they do start to form a cyclonic shape. Tropical storms sometimes develop into *hurricanes* if the wind speeds exceed 74 mph. Hurricanes have an eye present, which is a central area of calm that is surrounded by a wall of strong winds and thunderstorms. If the cyclone of a tropical storm or hurricane has lost its "tropical" characteristics and has cold air at its core, rather than warm air, the term *extra-tropical* is used to describe it. Extra-tropical storms are characterized by a change in weather pattern; its winds may still be as great as a tropical storm or hurricane force. Wind damage and flooding are the primary impacts associated with hurricanes and tropical storms. Tornadoes may develop during these events. In the past, tropical storm and hurricane events have brought intense rainfall, flooding, high winds, waterlogged soils, and subsequently fallen trees and downed utility poles.

Wind speed is used to measure the strength and potential impact of tropical storm or hurricane events have on an area. Expected damage from hurricane force winds can be anticipated using the Saffir-Simpson Scale. The Saffir-Simpson Scale categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential which are combined to estimate potential damage. Table 4.3.6-1 lists Saffir-Simpson Scale categories with associated wind speeds and expected damages. Categories 3, 4, and 5 are classified as “major” hurricanes. While major hurricanes comprise only 20 of all tropical cyclones making landfall, they account for over 70 percent of the damage in the United States. The likelihood of these damages occurring in Ocean County is assessed in Section 4.3.6.4, *Future Occurrence*.

Table 4.3.6-1 Saffir-Simpson Scale categories (NHC, 2009)

Saffir-Simpson Scale categories with associated wind speeds and damages (NHC, 2009).

Storm Category	Wind Speed (mph)	Description of Damages
1	74-95	MINIMAL: Damage is limited primarily to shrubbery and trees, unanchored mobile homes, and signs. No significant structural damage.
2	96-110	MODERATE: Some trees are toppled, some roof coverings are damaged, and major damage occurs to mobile homes. Some roofing material, door, and window damage.
3	111-130	EXTENSIVE: Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Large trees are toppled. Terrain may be flooded well inland.
4	131-155	EXTREME: Extensive damage to roofs, windows, and doors; roof systems on small buildings completely fail. More extensive curtain wall failures. Terrain may be flooded well inland.
5	>155	CATASTROPHIC: Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Massive evacuation of residential areas may be required.

The potential for flooding events during hurricanes and tropical storms is significant; the risk assessment and associated impact for these events is included in Section 4.3.5. In Ocean County, high winds typically lead to downed trees and utility poles, and often result in utility interruptions. Mobile homes and other manufactured housing are particularly vulnerable to high winds as these structures are not typically well-anchored and are highly susceptible to wind damage in a hurricane, tropical storm, or Nor’easter.

One of the worst case hurricane, tropical storm, or Nor’easter events in Ocean County was Tropical Storm Irene. Irene struck New Jersey in 2011 and resulted in an Emergency Declaration. Around one million people were evacuated from the coastal and low-lying areas. Heavy rainfall led to cresting of major streams and rivers while strong wind gusts took utilities out of service. A tornado formed during the storm in addition to a 3 to 5 foot storm surge, causing tidal flooding. Six people died of drowning due to Irene across the state of New Jersey, two within Ocean County. The total cost is estimated at one billion across the state. The storm also caused prolonged power outages, damage to crops, and road closures. Till 2011, it was the costliest natural disaster in the state of New Jersey.

The worst storm to hit the area was Hurricane Sandy in 2012. On October 29 2012, Hurricane Sandy made landfall at Atlantic City, New Jersey as it transitioned from a tropical to an extratropical cyclone. Sandy still had sustained winds of 80 miles per hour when it landed (NCDC, 2012). Coastal communities in Ocean County were hit hardest, devastating the waterfront areas of Lavallette, Toms River, Ortley Beach, and more. Homes were destroyed, beaches were re-shaped, streets were flooded, and active natural gas lines started leaking. Many communities experienced prolonged power outages, struggling to stay warm. Approximately 300 people were rescued from the area after staying in the area to wait out the storm (Queally, 2012) In Seaside Heights, the boardwalk was damaged beyond repair and the piers collapsed. Remnants of homes, cars, and flood water filled the streets days after the storm (Proebstle, 2012). In 2013 the State government released a total assessment of damage sustained from Hurricane Sandy to the State of New Jersey, which estimates the total cost to be $36.9 billion. (State of New Jersey, 2013). This event was declared as both an Emergency Declaration and as a Presidential Declaration of Major Disaster.

4.3.6.3 Past Occurrence

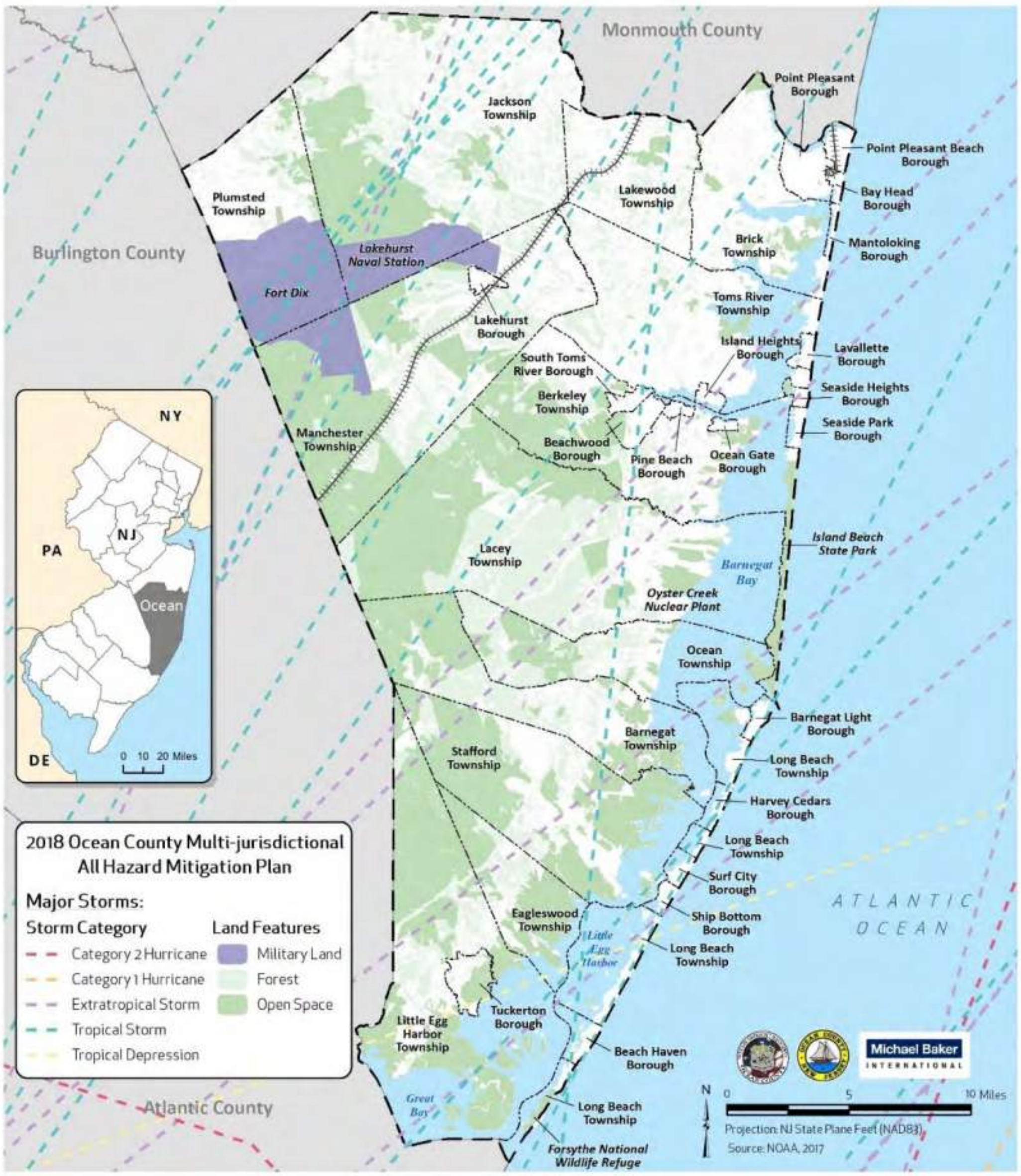
Records of all coastal storms occurring in the United States since the 1850s are maintained by the NOAA's Coastal Services Center. Table 4.3.6-2 lists all coastal storms with centers of circulation passing through or within 20 miles of the county.

Table 4.3.6-2 Coastal storms with centers of circulation passing through or within 20 miles of Ocean County.

Year	Event	Type of Storm
2013	Andrea	Tropical Storm
2012	Sandy	Category 2 Hurricane
2008	Hannah	Tropical Storm
2000	Gordon	Extratropical Storm
1999	Floyd	Tropical Storm
1996	Bertha	Tropical Storm
1985	Gloria	Category 2 Hurricane
1971	Doria	Tropical Storm
1961	Not Named	Tropical Storm
1960	Brenda	Tropical Storm
1934	Not Named	Extratropical Storm
1924	Not Named	Extratropical Storm
1916	Not Named	Extratropical Storm
1904	Not Named	Extratropical Storm
1902	Not Named	Extratropical Storm
1900	Not Named	Extratropical Storm
1894	Not Named	Category 1 Hurricane
1888	Not Named	Extratropical Storm
1886	Not Named	Tropical Depression
1882	Not Named	Tropical Storm
1877	Not Named	Extratropical Storm
1874	Not Named	Tropical Storm
1872	Not Named	Tropical Storm
1866	Not Named	Tropical Storm
1863	Not Named	Tropical Storm
1861	Not Named	Tropical Storm

Several storms have impacted the County without tracking near or through it; these storm events include two unnamed hurricanes in 1938 and 1944 along with Hurricane Katrina (2005), which was declared a Presidential Disaster. Please note that Sandy ranged from a post-tropical cyclone to Category 3 hurricane during its course through the Atlantic and up the North Atlantic coast. Sandy is often referred to as a Super Storm in press and research publications as well. For consistency, this plan refers to Sandy as a Hurricane except when referencing publications using the term Super Storm.

Figure 4.3.6-2 Major storms tracking through or near Ocean County



Major Storms in Ocean County

Michael Baker INTERNATIONAL

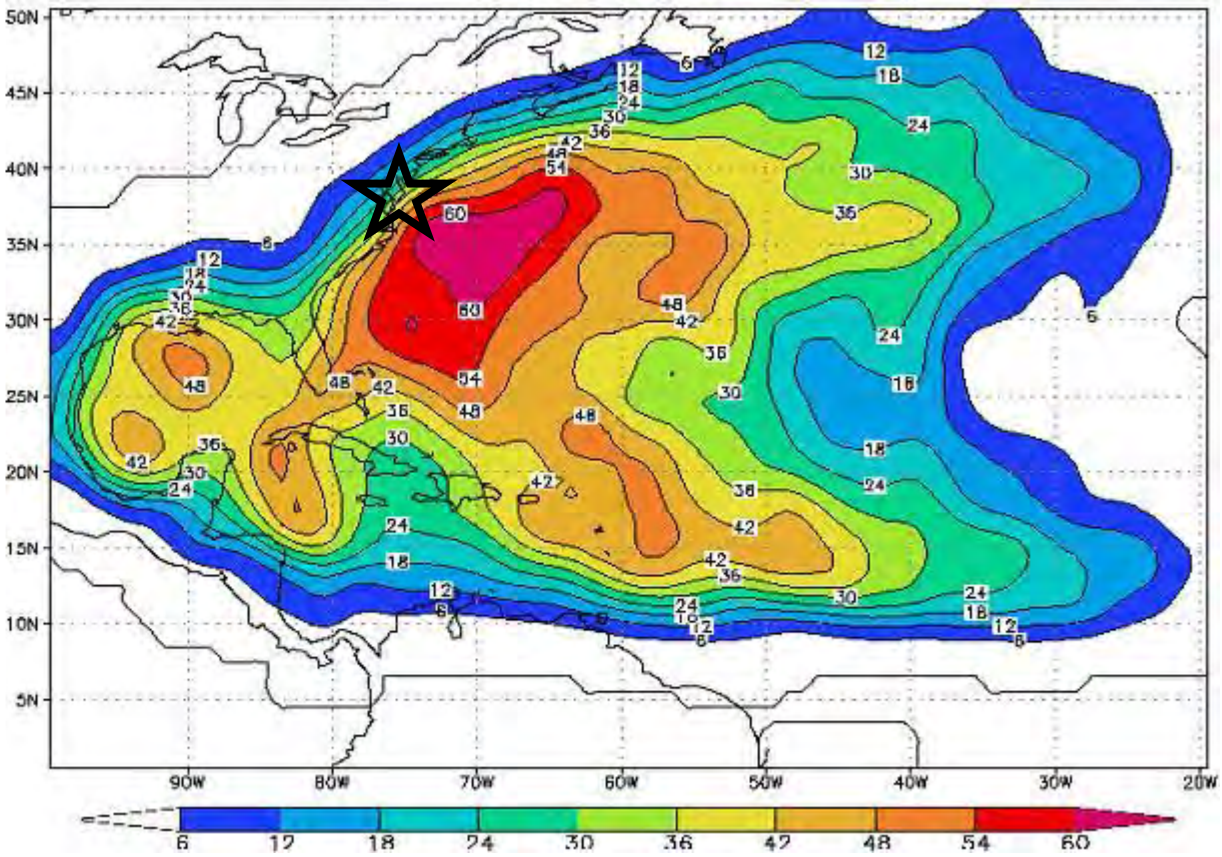
2018 Multi-jurisdictional All Hazard Mitigation Plan

Ocean County, New Jersey

4.3.6.4 *Future Occurrence*

The National Oceanic and Atmospheric Administration Hurricane Research Division published the map included as Figure 4.3.3-3 showing the chance that a tropical storm or hurricane will affect a given area during the entire Atlantic hurricane season spanning from June to November. However, the probability of a storm's intensity cannot be gleaned from the figure. Based on historical data between 1944 and 1999, this map reveals there is approximately 24 to 36 percent chance of experiencing a tropical storm or hurricane event between June and November of any given year in the County. This probability can be described as possible, as defined by the Risk Factor methodology probability criteria (see Table 4.4.1-1). In 2017, NOAA reported that the outlook for the 2017 hurricane season on the Atlantic Coast was a 60% chance of being an above-normal season, possibly extremely active.

Figure 4.3.6-3 Seasonal probability of a hurricane or tropical storm affecting Ocean County (NOAA HRD, 2009).



4.3.6.5 *Vulnerability Assessment*

Flooding, severe wind, and coastal erosion are the main hazards for which vulnerability for hurricanes and tropical storms should be assessed. Flood-related vulnerability is addressed in Section 4.3.5.5, vulnerability to wind damage is addressed in Section 4.3.8.5 and vulnerability to coastal erosion is summarized in Section 4.3.1.5. Vulnerability to winter weather impacts caused by Nor'easters is evaluated in 4.3.10.5.

4.3.7 Subsidence

Subsidence is the sinking of the ground because of underground material movement and is most often caused by the removal of water, oil, natural gas, or mineral resources out of the ground by pumping, fracking, or mining activities. Subsidence can also be caused by natural events such as earthquakes, soil compaction, glacial isostatic adjustment, erosion, sinkhole formation, and adding water to fine soils deposited by wind (a natural process known as loess deposits). Subsidence can happen over very large areas like whole states or provinces, or very small areas like the corner of your yard (NOAA).

Sinkholes, the type of subsidence most frequently seen in the New Jersey, are a natural and common geologic feature in areas with underlying limestone, carbonate rock, salt beds, or other rocks that are soluble in water. Over periods of time, measured in thousands of years, the carbonate bedrock can be dissolved through acidic rain water moving in fractures or cracks in the bedrock. This creates larger openings in the rock through which water and overlying soil materials will travel. Over time the voids will enlarge until the roof over the void is unable to support the land above will collapse forming a sinkhole. Manmade actions such as over-withdrawal of groundwater, diverting surface water from a large area and concentrating it in a single point, artificially creating ponds of surface water, and drilling new water wells can serve to accelerate the natural processes of creation of soil voids, which can have a direct impact on sinkhole creation.

While sinkholes are the most common form of subsidence in New Jersey, in many cases in New Jersey and in Ocean County land subsidence has been caused due to groundwater withdrawal and sea level rise. Subsidence due to groundwater withdrawal occurs because the water level drop creates a decline in upward pressure caused by the water. This creates a system where there is no counter to the downward pressure caused by the overlying rock. The imbalance of forces allows for subsidence to occur. Subsidence due to sea level rise occurs for a variety of reasons including the influences of fluctuations of ocean density and circulation, adjustment of land level, the extraction of underground fluids and more (Sun, Grandstaff and Shagam, 1999).

4.3.7.1 Location and Extent

Subsidence occurs slowly and continuously over time or abruptly for various reasons. Subsidence and sinkholes can occur due to either natural processes or as a result of human activities.

While northern New Jersey is more prone to subsidence than other areas of New Jersey due to the existence of many abandoned mines and the bands of carbonate rock located there, Ocean County is also prone to subsidence.

The very north-west corner of Ocean County consists of carbonate bedrock, which makes it prone to naturally occurring subsidence. Areas underlain by carbonate rock may contain surface depressions and open drainage passages making such areas unstable and susceptible to subsidence and surface collapse. As a result, the alteration of drainage patterns, placement of impervious coverage, grade changes or increased loads can result in land subsidence and sinkhole formation (Piefer, 2006).

The coastal areas of Ocean County are also prone to subsidence due to impacts of groundwater withdrawal and sea level rise. The relationship between water level decline and the rate of subsidence has been observed for many years. Observations of sea level rise along the east coastal areas have averaged 2 to 3 millimeters per year, and approximately 1.5 millimeters per year extra rise for the region is due to natural subsidence of the area (Sun, Grandstaff and Shagam, 1999). One of the triggers for subsidence is an abundance of moisture which has the potential to permeate the bedrock causing an event. Increased precipitation due to a change in climate could impact the extent of subsidence occurrences that influence Ocean County.

Manmade actions can also have an impact on subsidence events in Ocean County. The compaction of unconsolidated aquifer systems that can accompany excessive ground-water pumping can cause subsidence. The overdraft of aquifer systems has resulted in subsidence incidents (USGS, 2016). Figure 4.3.7-1 illustrates how all of Ocean County contains an unconsolidated aquifer system.

Figure 4.3.7-1 United States Unconsolidated Aquifer Systems

4.3.7.2 Range of Magnitude

Subsidence is often not obvious since it is typically gradual and widespread. Detection of subsidence events can be difficult. The inability to detect subsidence makes it a hazard. Subsidence can occur for a long period of time while going unnoticed, allowing it to do extensive damage (USGS, 2016).

The severity of subsidence can be based on how quickly it is detected. Once subsidence is identified, monitoring programs can be implemented and studies can be launched to better understand a specific case of subsidence. Along the coast in Ocean County, detection enables action to be taken to mitigate against the impacts of subsidence due to sea level rise and groundwater withdrawal.

4.3.7.3 Past Occurrence

There is limited record of past occurrences of subsidence in Ocean County. However, as subsidence often goes undetected, this does not mean it has not occurred. As previously discussed, Ocean County is at risk of various forms of subsidence. It can be assumed that with various factors of subsidence impacting Ocean County, such as evidence of sea level rise in many municipalities, that subsidence is occurring but has gone unreported.

4.3.7.4 Future Occurrence

While Ocean County is not identified as being a subsidence hazard area in the New Jersey State Hazard Mitigation Plan, Ocean County may be vulnerable to natural subsidence in the future. Sea level is rising faster along the New Jersey coast than the global average due to land subsidence (Rutgers Department of Earth and Planetary Sciences). Therefore, the probability of subsidence in Ocean County may be high. As coastal areas become increasingly developed, and as more people move out of the cities, the strain on underground aquifers could increase and influence of erosion could be impactful. If the current trend of water-level drop continues, the average subsidence of coastal New Jersey could be as much as up to 3 centimeters over the next twenty years (Sun, Grandstaff and Shagam, 1999). Based on evidence of coastal erosion, subsidence events are likely to occur in the future.

4.3.7.5 Vulnerability Assessment

The entire State of New Jersey is vulnerable to significant impacts due to geologic subsidence, topography of its coastline, current coastal erosion, and a high density of coastal development. The coastal regions of New Jersey, including many municipalities in Ocean County, may be particularly vulnerable to subsidence as sea level change and erosion occur. According to median projections of current sea level rise, it would threaten the majority of the Ocean County's coastal areas (Rutgers, 2013).

The combination of sea level rise and land subsidence could cause a serious increase in the flooding frequency. It could also result into encroachment onto a coastal community. The overall cost could be millions of dollars over time (Sun, Grandstaff and Shagam, 1999).

4.3.8 Tornado, Windstorm, Waterspouts, Seiches

Tornadoes produce winds in excess of two hundred fifty miles per hour. They can be a mile wide and stay on the ground for over fifty miles. A tornado is a violently rotating column of air in contact with the ground and extending from the base of a thunderstorm when a layer of warm air is quickly overlain with cool air. A condensation funnel does not need to reach to the ground for a tornado to form, as a debris cloud beneath a thunderstorm is all that is needed to confirm the presence of a tornado in the total absence of a condensation funnel.

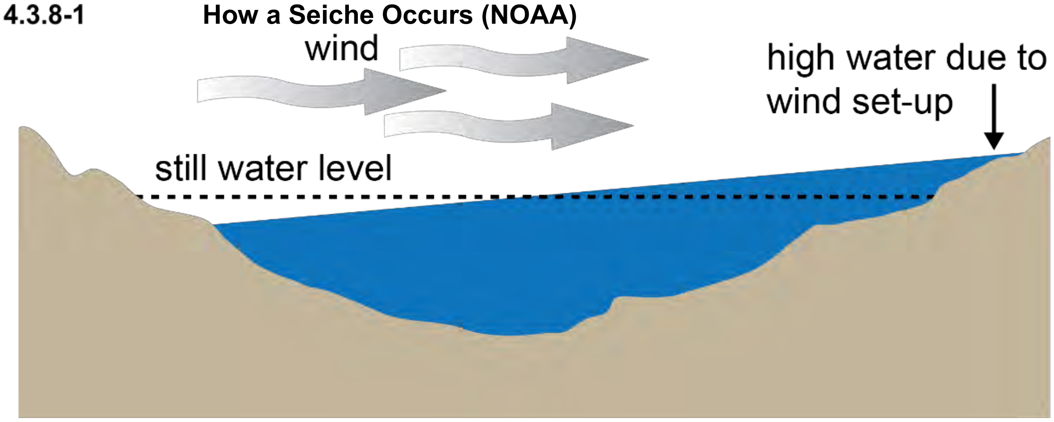
Waterspouts fall into two different categories of classification. Tornadic waterspouts are tornados that form over water or that move from land to water. Their characteristics are similar to those of a land tornado and their occurrence is associated with severe thunderstorms. Fair weather waterspouts typically form along the dark flat base of a line of a developing cumulous clouds. They are not usually associated with thunderstorms. Fair weather waterspouts form in light wind conditions. (NOAA, 2017).

Strong winds caused by a thunderstorm can exceed one hundred miles per hour and cause damage equal to a tornado. They can be extremely dangerous to aviation.

High winds are described as sustained winds of forty miles per hour or greater or winds gusting to fifty-eight miles per hour or greater.

A *Seiche* is a standing wave oscillating in a body of water caused by strong winds and rapid changes in atmospheric pressure from one end of a body of water to the other. When the wind stops, the water rebounds to the other side of a body of water, causing sloshing. It occurs in large bodies of water such as bays and lakes. It is like water sloshing back and forth in a swimming pool, bath tub or cup of water as illustrated in Figure 4.3.8-1 (NOAA).

Figure 4.3.8-1 **How a Seiche Occurs (NOAA)**



4.3.8.2 Location and Extent

Tornadoes and wind storms can occur throughout Ocean County. Though tornadoes are less likely to occur in the Northeast region of the country, Ocean County is more susceptible to tornadoes than the northern communities of New Jersey. Tornadoes can occur at any time of day, but often occur during late afternoon or early evening, when the temperature is the warmest. They are more likely to occur from March to August. Severe thunderstorms, hurricanes, or tropical storms can produce tornadoes, but most tornadoes form at the trailing edge of a thunderstorm. Tornado movement can be described in two ways: by forward movement or the storm track and by direction and speed of spinning winds. The storm track or tornado path ranges in length from few hundred yards or several hundred miles in length of forward motion. Tornado width tends to span from less than 100 feet to over a mile in width. Tornadoes can touch ground multiple times or not at all, depending on their duration and severity.

Tornadic waterspouts form downward from a thunderstorm, while fair weather waterspouts develop on the surface of the water working their way upward. Since fair weather waterspouts form in light wind conditions, they normally move very little. However, tornadic waterspouts can be large and often begin as true tornados, moving from land to water. Dr. Joseph Golden, a waterspout authority with NOAA describes five stages of water spout formation. They are:

1. Dark spot - A prominent circular, light-colored disk appears on the surface of the water, surrounded by a larger dark area of indeterminate shape and with diffused edges.

2. Spiral pattern - A pattern of light and dark-colored surface bands spiraling out from the dark spot which develops on the water surface.
3. Spray ring - A dense swirling annulus (ring) of sea spray, called a cascade, appears around the dark spot with what appears to be an eye similar to that seen in hurricanes.
4. Mature vortex - The waterspout, now visible from water surface to the overhead cloud mass, achieves maximum organization and intensity. Its funnel often appears hollow, with a surrounding shell of turbulent condensate. The spray vortex can rise to a height of several hundred feet or more and often creates a visible wake and an associated wave train as it moves.
5. Decay - The funnel and spray vortex begin to dissipate as the inflow of warm air into the vortex weakens.

Straight-line winds and windstorms impact widespread regions. Straight-lined winds are caused by the movement of air from higher pressure areas to lower pressure areas, and often accompany tornadoes. The difference in pressure produces stronger winds. Windstorms are characterized by sustained wind speeds of 40 mph or greater lasting for one hour or longer, or winds of 58 mph or greater for any duration.

Seiches can occur in different bodies of water such as lakes, sea and bays. A seiche can occur in a semi or fully enclosed body of water (NOAA, 2017). In Ocean County a seiche is most likely to occur in the bay or sea as the result of an earthquake, tsunami, severe storm or change in atmospheric pressure.

4.3.8.3 Range of Magnitude

Each year, tornadoes account for $1.1 billion in damages and cause over 80 deaths nationally (NCAR, 2001). The extreme winds that occur at the vortex of a tornado can cause significant damage to a localized area. Rotational wind speeds can range from 100 mph to more than 250 mph. Forward motion speed can vary from 0 to 50 mph. Maximum velocity, made up of a combination of ground speed, wind speed, and upper winds, is about 300 mph for tornadoes. Tornadoes cause damage by strong winds, lightning, hail, and wind-blown debris. The most violent tornadoes have Rotating winds of 250 miles per hour or more are characteristic of the most violent tornadoes. Winds at this speed can send large objects hurling through the air, and are hazards and they alone are capable of destroying buildings, trees, or anything in their path.

Damages and deaths can vary based on whether tornadoes move through densely or sparsely populated and developed areas. Depending on the size, intensity, and duration of the storm, damage from tornadoes ranges from minor to major. Mobile homes and other structures of light construction are most vulnerable to tornadoes. The Enhanced Fujita Scale, also known as the "EF-Scale," measures tornado strength and associated damages. The EF-Scale is an update to the earlier Fujita Scale, also known as the "F-Scale," that was published in 1971. It classifies United States tornadoes into six intensity categories, as shown in the table below, based upon the estimated maximum winds occurring within the wind vortex. Since its implementation by the National Weather Service in 2007, the EF-Scale has become the definitive metric for estimating wind speeds within tornadoes based upon damage to buildings and structures. F-Scale categories with corresponding EF-Scale wind speeds are provided in Table 4.3.7-1 since the magnitude of previous tornado occurrences is based on the F-Scale.

Table 4.3.8-1 Enhanced Fujita Scale

EF Scale Number	Wind Speed (MPH)	F-Scale Number	Type of Damage Possible
EF0	65–85	F0-F1	**Minor damage**: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over. Confirmed tornadoes with no reported damage (i.e., those that remain in open fields) are always rated EF0.
EF1	86-110	F1	**Moderate damage**: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111–135	F1-F2	**Considerable damage**: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136–165	F2-F3	**Severe damage**: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166–200	F3	**Devastating damage**: Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	F3-F6	**Extreme damage**: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (300 ft.); steel reinforced concrete structure badly damaged; high-rise buildings have significant structural deformation.

The worst case scenario of a tornado for Ocean County occurred in August 1999. Southeast of Beach Haven, a waterspout formed over the Atlantic Ocean and proceeded to move northwest and became a tornado while crossing over Long Beach Island. It eventually traveled back into Little Egg Harbor, becoming a waterspout again before it dissolved. At its peak it reached an F2 magnitude and the wind reached a maximum speed of 120 mph. The total property damage was estimated at $4.2 million. The tornado damaged, boats, homes, vehicles and caused enough damage to the Sea Spray Motel to condemn the building. The roof of the motel ripped off and the back wall was severely damaged. Flying debris injured a guest at the motel and 150 motel guests were displaced due to the event. Widespread power outages occurred on Long Beach Island after main transmission lines were downed. Off the coast of Atlantic City, the rough weather caused a well craft to sink and three of the men aboard drowned (NCDC, 2013).

On September 16, 2010, an F1 tornado with 90 mph winds occurred in Ocean County causing $25,000 in damages. A severe thunderstorm and the subsequent tornado let to power outages in Ocean and surrounding counties. Several houses and vehicles were damaged and a small barn was destroyed. About 300 trees were downed during the storm.

Figure 4.3.6-1 in the previous section shows wind speed zones developed by the American Society of Civil Engineers based on information including 40 years of tornado history and over 100 years of hurricane history. It identifies wind speeds that could occur across the United States to be used as the basis for design and evaluation of the structural integrity of shelters and critical facilities. Ocean County falls within Zone II, meaning design wind speeds for shelters and critical facilities should be able to withstand a 3-second gust of up to 160 mph, regardless of whether the gust is the result of a tornado, hurricane, tropical storm, or windstorm event. Therefore, these structures should be able to withstand speeds experienced in an EF3 tornado.

No fatalities that were directly caused by tornadoes have occurred in Ocean County. Most events have involved lower magnitude tornadoes. Six injuries, most being minor in nature, have been reported over the years. Tornadoes in Ocean County typically range from F-0 through F-2 levels. However, one F-3 level tornado was recorded on July 21, 1983. Property damages were estimated at $2.5 million. While this F-3 tornado was stronger than the August 1999 tornado, the F-2 storm caused significantly more damage and led to three deaths. Therefore the August 1999 tornado is considered the County's worst case scenario.

Environmental impacts are typically contained, as tornado events occur in localized areas. However, damage to vegetation and trees can be severe. Downed trees and an increased risk of wildfire are common following tornado events. Tornados and Windstorms are a hazard that may cause hazards. Tornados can damage facilities and transportation containing hazardous materials, cause utility interruptions and cause fires by breaking or rapturing utility connections, and cause transportation accidents. In order to prevent release of hazardous materials into the environment, hazardous materials facilities should be designed to withstand the conditions for their location's respective wind zone as shown in Figure 4.3.6-1.

In some cases, waterspouts can be just as dangerous as tornados. Tornadic waterspouts are often accompanied by high winds and seas, large hail and frequent lightening. These types of waterspouts can be large and are capable of considerable destruction. Fair weather waterspouts, however, form only over open water, are typically small, brief and therefore less dangerous (NOAA).

Seiches have the potential to be dangerous. One of the deadliest seiches in history occurred in 1929 in Grand Haven, Michigan. Thousands of people were gathered on the shore of Lake Michigan when high winds caused a 20 foot wave accompanied by a rise in lake level along the shoreline. The seiche occurred quickly that it was difficult for people to react and make it to high ground. Ten lives were lost (Tramley, 2017).

While that is an example of an extreme seiche occurrence, typically the range and magnitude of seiches are insignificant. Often times occurrences go unnoticed.

4.3.8.4 Past Occurrence

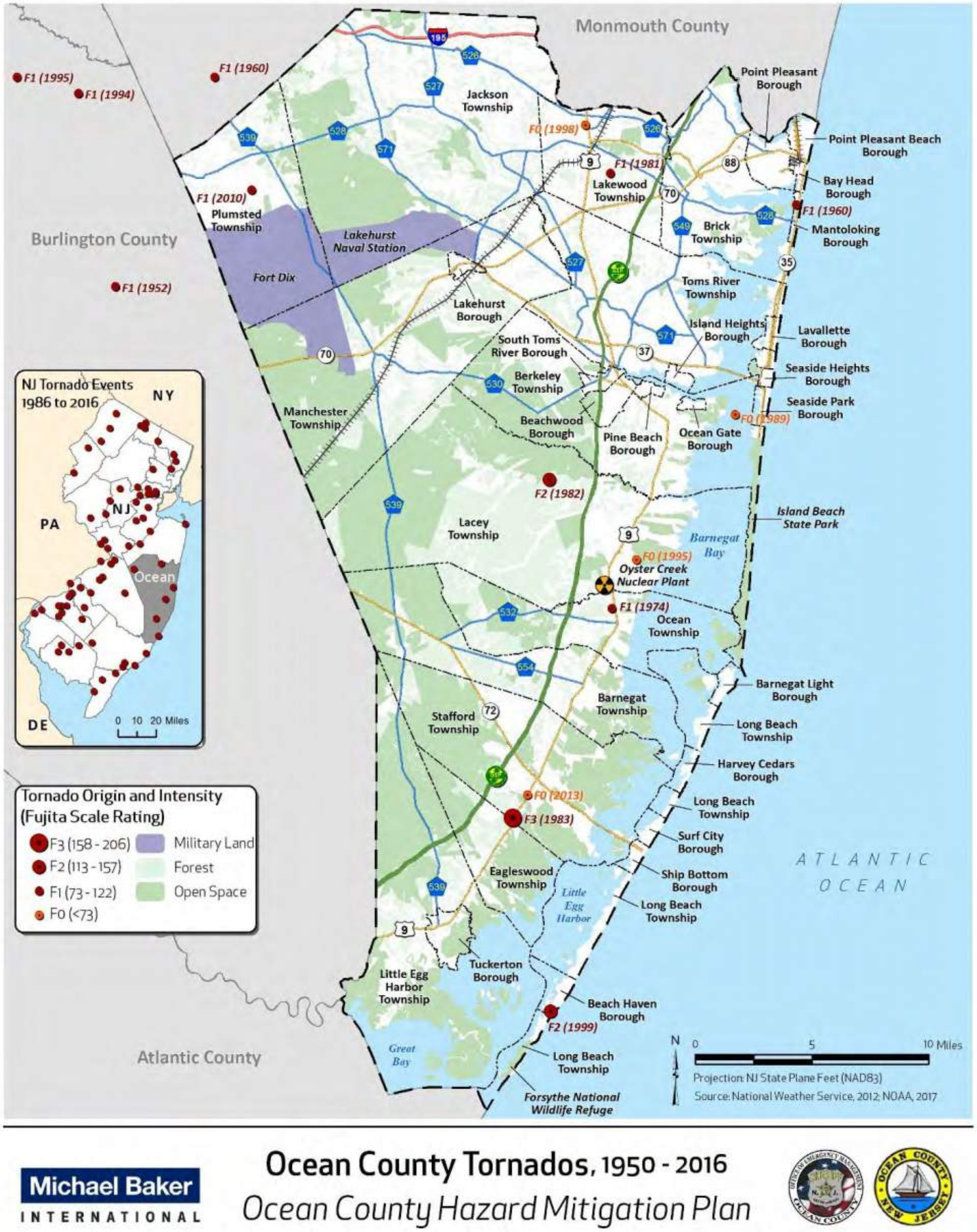
Tornadoes most often occur in the southern, more level portions of the state; however they have struck in all seasons and all regions of New Jersey. Below a list of tornado events that have occurred in Ocean County between 1950 and 2017 and is shown with an associated Fujita Tornado Scale magnitude. This list is followed by a list of waterspout events that have been recorded in the county. A map showing the approximate location of previous events is included in Figure 4.3.8-1.

Table 4.3.8-2 Tornado and Waterspout Events for Ocean County 1950-2017 (NCDC, 2017)

Tornado Events for Ocean County, New Jersey from 1950-2017 (NCDC, 2017)			
Location	**Date**	**Magnitude**	**Estimated Property Damage ($)**
Ocean County	6/13/1958	unknown	$ 2,500
Ocean County	7/1/1960	1	$ 2,500
Ocean County	3/10/1964	1	$ 250,000
Ocean County	7/24/1974	1	$ 0
Ocean County	6/29/1982	2	$ 2,500,000
Ocean County	7/21/1983	3	$ 2,500,000
Ocean County	8/17/1988	0	$ 2,500
Ocean County	11/20/1989	0	$ 2,500,000
Forked River, Ocean County	10/21/1995	0	$ 0
Beach Haven, Ocean County	8/20/1999	2	$ 4,200,000
New Egypt & Archer's Corner, Ocean County	9/16/2010	1	$ 25,000
Stafford Township, Ocean County	8/13/2013	0	$ 250,000

Recorded Waterspout Events for Ocean County, New Jersey from 1950-2017 (NCDC, 2017)		
Location	**Date**	**Wind Speed Indicators**
Beach Haven, Ocean County	8/20/1999	Turned into a F2 Tornado at the Shore
Seaside Park, Ocean County	8/10/2001	N/A
Seaside Park, Ocean County	10/21/2014	N/A
Long Beach Township, Ocean County	6/23/2015	34-63 knots

Figure 4.3.8-2 **Tornado History from 1950-2016, (National Weather Service, 2012; NOAA, 2017)**

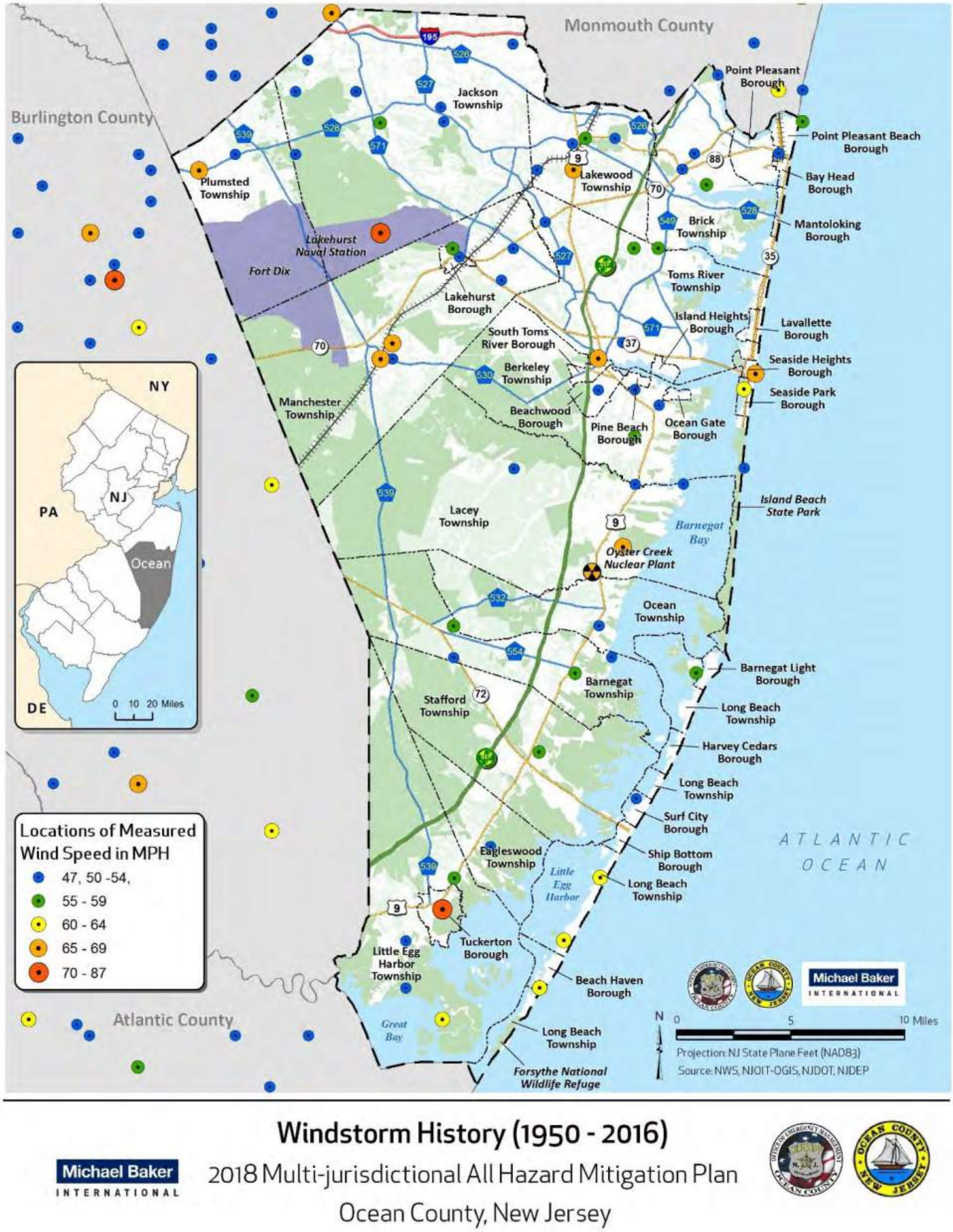


Since 1997, 268 strong wind events, with 140 of them resulting in property damage, have been recorded in Ocean County (NCDC, 2017). In the past the County has experienced severe windstorms, thunderstorms, and tornadoes. On average, Ocean County encounters fourteen windstorms each year (NCDC, 2017). Figure 4.3.8-3 shows the locations of windstorms in the County over a 56 year period.

An intense windstorm resulted in $5.7 million in property damages on March 13, 2010. The Governor declared a state of emergency on the following day. Telephones and trees were downed by the thousands and approximately one million people across the state lost power. Amtrak suspended service along the Northeast corridor and several major roadways were closed, including the New Jersey Turnpike in certain counties. Strong winds of up to 63 mph and fallen trees damaged many homes. Three injuries were reported, but no fatalities. The highest recorded wind speed is 76 mph, which occurred during a thunderstorm wind on March 9, 1998 (NCDC, 2013).

In Ocean County, there has been one recorded instance where a seiche may have occurred. On June 13, 2013 a rare type of tsunami hit Ocean County. It was caused by a strong weather system that moved across the eastern U.S. that day. The weather system caused a jump in air pressure, which created the wave. The impacts were greatest in Barnegat Light. An approximately 6 foot wave knocked three people off the inlet jetty, injuring at least two of them. No coastline damage was reported (NOAA, 2017). At over 30 gauges the indications were recorded for a tsunami in its strength and wave frequency. However, the nature of movement of the event could classify this event as a seiche. The strong downward rush of air that was caused by low-end derecho made the water slosh back and forth causing this wave event.

Figure 4.3.8-3 Windstorm History from 1950-2016, (National Weather Service, 2016)

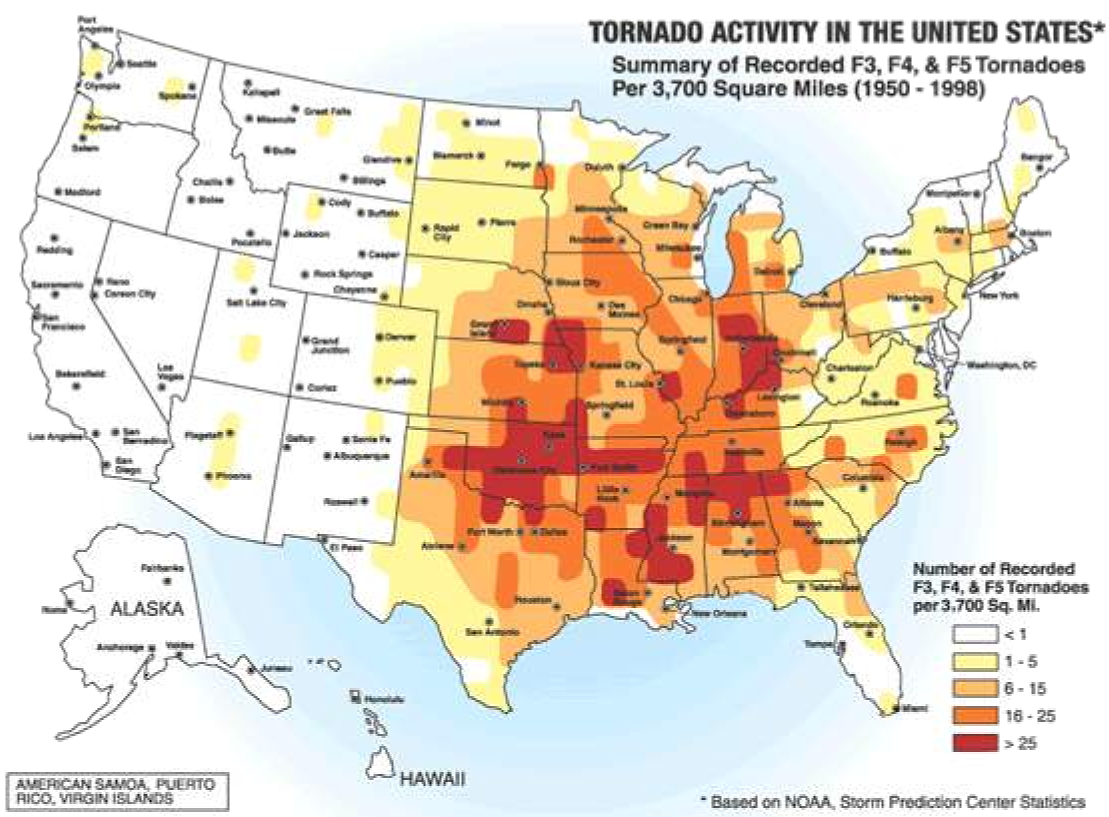


4.3.8.5 *Future Occurrence*

According to the National Weather Service, the state of New Jersey has an annual average of five tornadoes. Tornadoes are rare events in the northeast. When they do occur, the damage may be severe but is typically limited to a small area. Based on past occurrences, Ocean County is most likely to be impacted by F-0 to F-2 tornados. Only one F-3 tornado has occurred in the County on record. While an F4 tornado is unlikely, it has a 0.019 percent annual probability of occurring. F-4 tornados can carry wind velocities of 200 mph, resulting in a force of more than 100 pounds per square foot of surface area. This is a “wind load” that exceeds the design limits of most buildings.

The number of windstorms and tornadoes occurring in the County is expected to remain constant. Based on historical events between 1950 and 1998, there are two zones in New Jersey which experience <1 and 1 to 5 F3, F4, and F5 tornadoes per 3,700 square miles. As shown in the figure below, communities in Ocean County are expected to have less than one tornado annually.

Figure 4.3.8-4 **Tornado Activity in Ocean County**



Waterspouts and seiches are difficult to predict since there have been a limited number of occurrences recorded in New Jersey’s history. Since these events are often influenced by weather events, it can be anticipated that as the climate changes, the frequency and intensity of these events will change as well.

4.3.8.6 Vulnerability Assessment

Though it is difficult to predict the probability of occurrence of tornadoes, windstorms, waterspouts and seiches, vulnerability will increase as population and properties continue to rise. It is important to identify critical facilities and assets that are more vulnerable to hazard impacts.

Due to their light-weight and often unanchored design, mobile homes and commercial trailers are extremely vulnerable to high winds and will generally sustain the most damage. Jackson, Manchester, and Toms River townships are most vulnerable to tornadoes and wind storms because these communities have the largest populations and/or number of manufactured structures. Manchester Township has the largest number of mobile homes in the County with 1,892, followed by Jackson and Toms River townships, with over 1,000 manufactured homes each. Table 4.3.8-3 below shows the number of mobile homes for each municipality in Ocean County.

Coastal and waterside homes are most vulnerable to the impacts of seiches due to the nature and extent of these events. The waves, sloshing and water level rise caused by a seiche could damage or impact homes that are within the extent of an event.

Table 4.3.8-3 Mobile Homes in Ocean County (ACS, 2015)

Municipality	Total Number of Mobile Homes
Barnegat Light Borough	0
Barnegat Township	393
Bay Head Borough	9
Beach Haven Borough	37
Beachwood Borough	0
Berkeley Township	135
Brick Township	124
Eagleswood Township	36
Harvey Cedars Borough	9
Island Heights Borough	0
Jackson Township	1,076
Lacey Township	0
Lakehurst Borough	45
Lakewood Township	54
Lavallette Borough	14
Little Egg Harbor Township	0
Long Beach Township	222
Manchester Township	1,892
Mantoloking Borough	0
Ocean Gate Borough	0
Ocean Township	0
Pine Beach Borough	0
Plumsted Township	252

Municipality	Total Number of Mobile Homes
Point Pleasant Beach Borough	0
Point Pleasant Borough	0
Seaside Heights Borough	0
Seaside Park Borough	0
Ship Bottom Borough	0
South Toms River Borough	4
Stafford Township	361
Surf City Borough	0
Toms River Township	1,208
Tuckerton Borough	86
Total	5,957

4.3.9 Wildfire

4.3.9.1 Location and Extent

Wildfires typically occur in unoccupied, rural or forested areas. Most wildfires happen during hot and dry seasons, but they may occur at any time of year. Both human and natural causes start the fires, including carelessness, arson, children, and lightning strikes. Ninety-nine percent, or nearly all wildfires are caused by humans within the state of New Jersey. Wildfire often occurs in the Pinelands, which cover the majority of the western portion of Ocean County and about twenty-two percent of land in New Jersey State; however, wildfire may also occur in brush, grass, or fields.

Because a large portion – about one third - of Ocean County's land cover is forestland, the potential geographic extent of wildfires is significant. In New Jersey, annually there are approximately one thousand five hundred wildfires, which damage or destroy an average of seven thousand acres. Ocean County leads the State with an average of three hundred fifty-three wildfires that damage or destroy an average of 2,866 acres.

Fall and spring months characterized by dry spells and strong winds are when most wildfires occur. About 75% of all Ocean County wildfires occur in these two time periods. In the spring, bare trees allow sunlight to reach the forest floor, drying fallen leaves and other ground debris. In the fall, dried leaves are additional fuel for fires. Accordingly, wildfires most often occur in undeveloped areas where there are fewer fuel sources and lower surrounding populations. However, existing developed areas surrounding the Pinelands increases the risk of wildfires started by human causes.

The Pinelands National Reserve is the first National Reserve in the nation. It encompasses approximately 1.1 million acres covering portions of seven counties and fifty-six municipalities. This internationally important ecological region occupies twenty-two per cent of New Jersey's land area. It is the largest body of open space on the Mid-Atlantic seaboard between Richmond, Virginia and Boston, Massachusetts and is underlain by aquifers containing seventeen trillion gallons of some of the purest water in the land.

In 1979, New Jersey formed a partnership with the federal government to preserve, protect and enhance the natural and cultural resources of this special place. Today, with the Pinelands Comprehensive Management Plan, the region is protected in a manner that maintains its unique ecology while permitting compatible development.

Thirteen municipalities have the Pinelands within their jurisdiction. According to the Pinelands Commission's 2015 Long-Term Economic Monitoring Report they are as follows:

- Township of Barnegat – 56% - 14,357 acres
- Borough of Beachwood – 28% - 500 acres
- Township of Berkeley – 30% - 10,484 acres
- Township of Eagleswood – 22.9% - 2,435 acres
- Township of Jackson – 47% - 30,385 acres
- Township of Lacey – 67% - 42,688 acres
- Borough of Lakehurst – 87% - 551 acres
- Township of Little Egg Harbor – 25% - 11,582 acres
- Township of Manchester – 73% - 38,728 acres
- Township of Ocean – 41% - 8,233 acres
- Township of Plumsted – 53% - 13,423 acres
- Borough of South Toms River – 47% - 376 acres
- Township of Stafford – 39% - 13,709 acres
- Toms River Township - <1% - 13 acres

The Pinelands Comprehensive Management Plan protects more than forty-five per cent, or one hundred and eighty-five thousand acres in Ocean County.

4.3.9.2 Range of Magnitude

Wildfire events can range in size and intensity. Though some events are small enough to be managed by local firefighters, others impact large plots of land and require more force to subdue. Larger events may necessitate evacuation from communities and require regional or national firefighting support. Severe wildfires have the potential to devastate an area if not controlled. The worst wildfire event to occur in the region took place in 1963 from April 20-21. A series of wildfires burned over 183,000 acres of the Pinelands.

Pineland fires burn extremely hot and spread rapidly, often by crown fires (fire spreading from tree top to adjacent tree top) or long range spotting (fire spreads due to flying embers). The Pinelands are categorized as Fuel Model B of the National Fire Danger Rating System, or as a high hazard fuel similar to chaparral of California. Drought conditions increase the vulnerability of the Pinelands to fire from small sources such as improperly extinguished campfires, matches, or cigarette butts.

Wildfires threaten the lives of people, livestock, fish and wildlife. Property, timber, forage and recreational and scenic assets are also at risk of damage from wildfires. After a fire event, ground-cover loss may cause environmental impacts such as erosion, flooding, and the silting of streambeds and reservoirs.

Firefighter safety is also at risk due to wildfires. Though loss of life is a potential risk, more common firefighting injuries include falls, sprains, abrasions or heat-related injuries such as dehydration. Response to wildfires also exposes emergency responders to the risk of motor vehicle accidents and can place them in remote areas away from the communities that they are chartered to protect.

Wildfires are often a part of natural succession and can have positive impacts by allowing for new growth. They burn dead trees, leaves, and grasses allowing room for new vegetation and better access to sunlight. New growth on trees and shrubs often follows naturally after a wildfire has occurred.

4.3.9.3 Past Occurrence

Historically, some of the most severe wildfires in New Jersey occur in Ocean County. There have been 24 wildfire events for Ocean County reported to the National Climatic Data Center from 1950-2017. This number does not include wildfires that were not reported to NCDC or that were controlled solely by the volunteer fire departments in the County. For example, there was a forest fire in Berkeley Township in 1998 that destroyed and damaged homes that is not captured in the NCDC. Table 4.3.8-1 shows the list of wildfire events reported to the NCDC.

Of all of Ocean County's jurisdictions, Berkeley Township was impacted by 6 wildfires between 1950 and 2017 according to NCDC, making it the most affected municipality. Lacey Township followed closely with 5 wildfires during that time. Manchester, Lacey, and Ocean Townships had the most area burn during this time period, with 19,225 acres burned by wildfires during one event.

Table 4.3.9-1 Wildfire Events Reported in Ocean County (NCDC, 2017)

Year	Municipality	Area (acres)	Year	Municipality	Area (acres)
1995	Manchester, Lacey, & Ocean Townships	19,225	2008	Fort Dix Military Base	3200
1995	Eaglewood Township	200	2010	Barnegat Township	540
1997	Berkeley & Manchester Townships	702	2010	Stafford Township	890
1999	Lacey & Berkeley Townships	115	2010	McGuire-Fort Dix-Lakehurst Joint Military Base	4,000
1999	Lacey Township	70	2011	West Tuckerton	20
2001	Berkeley Township	4	2012	Lacey Township	6.5
2001	Stafford Township	1,600	2012	Lacey Township	3
2002	Berkeley Township	0	2012	Barnegat Township	20
2002	Berkeley Township & Beachwood Boroug	1,300	2014	Berkeley Township & Beachwood Borough	307
2002	Fort Dix Military Base	3,000	2015	Manchester Township	3
2007	Stafford and Barnegat Townships	15,550	2015	Jackson Township	25
2008	Barnegat Township	144	2015	Manchester Township	1012
				Total	50,590

4.3.9.4 Future Occurrence

History demonstrates that Ocean County wildfires have been extremely severe in the past. Compounding the threat of wildfires is the growth of residential areas near forest borders. Wildfires in the future may be equally, and possibly, even more severe.

As long as there are Pinelands in Ocean County, the probability of wildfires will remain extremely high. The average number of wildfires in the State of New Jersey in a ten-year period is 1456. The average number of wildfires per year in Ocean County over a ten-year period is 289. The average number of acres burned each year based on a ten-year period in the State of New Jersey is 3,818, and in Ocean County the average in the same ten year period is 783. These figures demonstrate why Ocean County has the unfortunate designation as a leader in wildfire events. This is likely to remain unchanged.

The New Jersey Forest Service works to limit the number of wildfires that occur and the acreage burned each year through their fire management program. The Ocean County Office of Emergency Management prescribes several recommendations for homeowners to protect their property from and to prevent the spread of wildfire (OCOEM, 2013).

Over the ten-year period between 2007 and 2017, 25,720 acres of land burned in Ocean County in the wildfire events. The likelihood of wildfires occurring can increase due to weather conditions such as drought.

Though the probability of a wildfire occurring in Ocean County is likely, the probability of one of those fires attaining significant size and intensity is difficult to predict and depends on both firefighting response and environmental conditions.

4.3.9.5 Vulnerability Assessment

The New Jersey Forest Fire Service has evaluated the entire state for the risk of wildfire. Results of that assessment are shown in Figure 4.3.8-1. The ranking of locations for wildfire hazard is based on conditions such as amount and type of fuel, topography and local weather. Based on the assessment, the majority of Ocean County is at an extreme level of risk for wildfires. Much of the remaining land area has a high or very high risk, while a small portion is shown as low or moderate risk. The urban areas are less susceptible to wildfire and are categorized separately (NJ FFS, 2010). Table 4.3.9-2 shows the critical facilities in the high wildfire hazard areas.

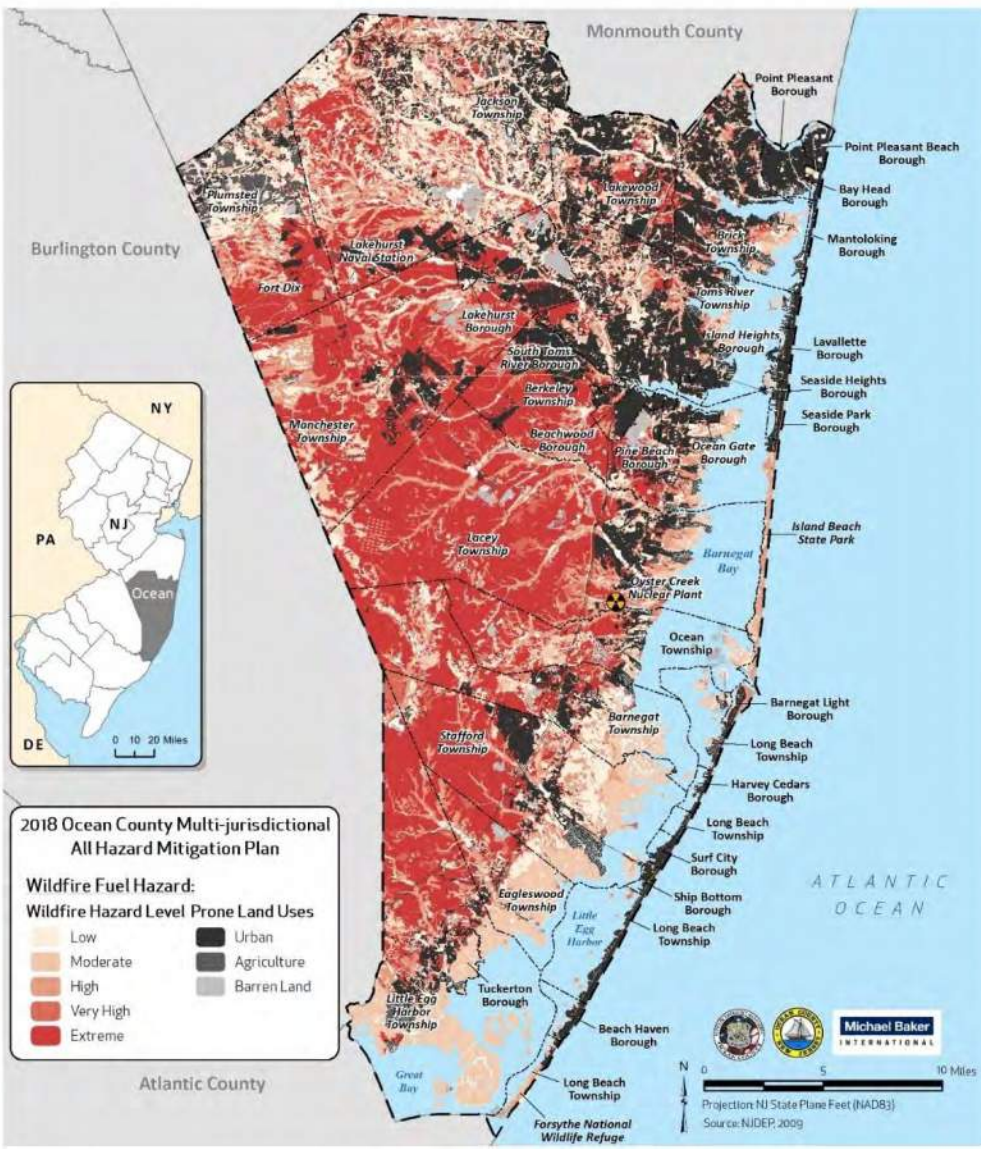
Manchester Township has the most critical facilities vulnerable to wildfire, while Beachwood, Jackson, Lakehurst, and South Toms River boroughs have only one critical facility vulnerable each. The municipalities not listed in the table do not have any critical facilities located within the high wildfire hazard area; however, they may have other structures that are vulnerable.

Table 4.3.9-2 Critical Facilities Located in High Wildfire Hazard Areas

Municipality	Total Number of Critical Facilities	Total Critical Facilities in High Wildfire Hazard Areas
Barnegat Township	28	3
Beachwood Borough	9	1
Berkeley Township	46	3

Municipality	Total Number of Critical Facilities	Total Critical Facilities in High Wildfire Hazard Areas
Jackson Township	44	1
Lacey Township	50	3
Lakehurst Borough	14	1
Little Egg Harbor Township	22	2
Manchester Township	143	28
Ocean Township	29	6
South Toms River Borough	14	1
Stafford Township	50	12
Toms River Township	163	6
Total	612	67

Figure 4.3.9-1 **Wildfire hazard potential in Ocean County (NJFFS, 2010).**



4.3.10 Winter Storms

Winter storms are characterized by snow, sleet, freezing rain, or any mix of precipitation. A winter storm may last for several hours or continue for several days and they can vary from a moderate snowfall or ice event to a stronger, wind-driven blizzard. Low temperatures and heavy and/or blowing snow often characterize winter storms, reducing visibility and disrupting transportation systems. Severe winter weather can disrupt everyday life for residents of Ocean County.

4.3.10.1 Location and Extent

Winter storms impact entire regions and often affect more than one county and more than one state. The entire state of New Jersey is subject to severe winter storms. However, the northwestern regions of the state tend to experience a higher quantity and severity of winter storms than the southeastern region where Ocean County is located. On average, the coastal portion of the County receives 15 inches of snow annually while the northwest section of the County receives approximately 21 inches annually (NCDC, 2013).

4.3.10.2 Range of Magnitude

The typical components of winter storms are cold temperatures, heavy snow or ice, and oftentimes strong winds. Most storms originate as low-pressure systems that move through New Jersey by following the jet stream. If winter storms develop as extra-tropical cyclonic weather systems over the Atlantic Ocean, they are called nor'easters. Winter storms are common occurrences in northeast America, but severe storms are hazardous due to the result in damage to specific structures or disruption to traffic, communications, electric power, or other utilities.

In addition to impacting buildings, utilities, and transportation systems, a winter storm can cause frostbite or loss of life. Older populations are more vulnerable mostly due to physical condition and their financial position. During the growing season, winter weather can also damage crops and reduce agricultural yields. The following weather events are typical of winter storms:

- **Heavy Snowstorm:** Accumulations of four inches or more in a six-hour period, or six inches or more in a 12-hour period.
- **Sleet Storm:** Sleet is formed by rain drops that freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. However, it can accumulate like snow and cause a hazard to motorists and pedestrians.
- **Ice Storm:** Significant accumulations of rain or drizzle freezing on objects (trees, power lines, roadways, etc.) as it strikes them, causing slippery surfaces and damage from the sheer weight of ice accumulation.
- **Blizzard:** Temperatures below freezing, winds over thirty-five miles per hour for an extended period of time with snow blowing and reducing visibility to near zero (less than ¼ mile)
- **Severe Blizzard:** Temperatures of degrees Fahrenheit or lower, wind velocity of 45 miles per hour, a high density of blowing snow with visibility frequently measured in feet lasting over an extended period of time.

Severe winter storms can result in transportation accidents, closing of roadways, stranded motorists, power outages, and depletion of oil heating supplies. Damage to vegetation and downed trees are common due to heavy snow loading, ice buildup, and/or high winds. Snow and ice can provide groundwater recharge when they melt gradually. However, if temperatures are too high following a heavy snowfall, rapid surface water runoff and severe flooding may occur.

Along the coastline, the mean annual snowfall is about 15 inches, and this portion of Ocean County has experienced seasonal snowfalls ranging from barely seeing traces of snow during the winter of 1973 to a high of 42.5 inches in the winter of 1899. The inland part of Ocean County sees a mean annual snowfall of approximately 21 inches, but snowfall has ranged from 51.3 during the winter of 1979 to just traces of snow in 1938. The winter months from November to April define the “season”.

Five of the 24 Major Disaster and Emergency Declarations impacting Ocean County have been in response to hazard events related to winter storms (see Table 4.2-1). The January 1996 blizzard caused a great deal of damage in New Jersey and in other northeastern states. A state of emergency and a major disaster declaration was declared for the entire state, and evacuations were carried out in Ocean County and in neighboring Cape May and Monmouth counties. Snowfall totals ranged from 14 to 30 inches from the interior portion of the state to the coastal regions. Coastal flooding accompanied the heavy snowfall, damaging beaches and creating big waves. Mass-transit was suspended during the storm and travel was discouraged across the state. Property damages in New Jersey totaled at least $18.8 million and three people lost their lives during the storm.

4.3.10.3 Past Occurrence

Severe weather has characterized many past winter seasons in Ocean County, New Jersey. From 1995 to 2017 a total of 10 people were injured and $46.5 million in property damage was reported due to winter storms in Ocean County. Some of the most recent winter storms that have affected the county are represented in Table 4.3.10-1 below. These events represent a comprehensive list of snow events from the NCDC storm events database.

Table 4.3.10-1 History of Winter Storms in Ocean County (NCDC, 2017)

DATE	TYPE	PROPERTY DAMAGE ($)*
2/3/1995	Heavy Snow	0
2/26/1995	Light Snow	0
12/14/1995	Wintry Mix	0
12/19/1995	Ice Storm	0
1/7/1996	Blizzard	18.8M
2/2/1996	Heavy Snow	0
2/16/1996	Heavy Snow	0
3/2/1996	Heavy Snow	0
3/8/1996	Heavy Snow	0
4/9/1996	Heavy Snow	0
1/9/1997	Wintry Mix	0

DATE	TYPE	PROPERTY DAMAGE ($)*
1/11/1997	Snow	0
2/8/1997	Snow	0
2/8/1997	Heavy Snow	0
2/14/1997	Wintry Mix	0
12/27/1997	Snow	0
12/23/1998	Snow	0
1/8/1999	Wintry Mix	0
1/13/1999	Wintry Mix	0
3/14/1999	Heavy Snow	0
1/20/2000	Heavy Snow	0
1/25/2000	Winter Storm	0
2/18/2000	Wintry Mix	0
4/9/2000	Snow	0
12/19/2000	Snow	0
12/22/2000	Snow	0
12/30/2000	Heavy Snow	0
1/5/2001	Snow	0
1/20/2001	Wintry Mix	0
2/22/2001	Heavy Snow	0
1/19/2002	Wintry Mix	0
12/5/2002	Winter Storm	0
1/5/2003	Winter Weather/Mix	0
1/29/2003	Winter Weather/Mix	0
2/6/2003	Heavy Snow	0
2/10/2003	Winter Weather/Mix	0
2/16/2003	Winter Storm	11.5M
2/23/2003	Winter Weather/Mix	0
2/26/2003	Winter Weather/Mix	0
2/27/2003	Winter Weather/Mix	0
4/7/2003	Winter Weather/Mix	0
12/5/2003	Winter Storm	0
12/6/2003	Winter Weather/Mix	0
1/14/2004	Heavy Snow	0
1/17/2004	Winter Weather/Mix	0
1/25/2004	Winter Weather/Mix	0
1/27/2004	Winter Weather/Mix	0
2/5/2004	Winter Weather/Mix	0
2/17/2004	Heavy Snow	0
12/19/2004	Winter Weather/Mix	0
12/26/2004	Winter Weather/Mix	0
1/19/2005	Winter Weather/Mix	0
1/22/2005	Winter Storm	16.2M
2/3/2005	Winter Weather/Mix	0

DATE	TYPE	PROPERTY DAMAGE ($)*
2/20/2005	Winter Weather/Mix	0
2/24/2005	Heavy Snow	0
2/28/2005	Heavy Snow	0
2/28/2005	Winter Weather/Mix	0
3/1/2005	Heavy Snow	0
3/1/2005	Winter Weather/Mix	0
3/8/2005	Winter Weather/Mix	0
12/4/2005	Winter Weather/Mix	0
12/6/2005	Heavy Snow	0
12/9/2005	Winter Weather	0
1/15/2006	Winter Storm	0
2/12/2006	Winter Storm	0
1/21/2007	Winter Weather	0
1/28/2007	Winter Weather	0
2/13/2007	Winter Storm	0
2/25/2007	Winter Storm	0
2/25/2007	Winter Weather	0
3/7/2007	Winter Weather	0
3/16/2007	Winter Weather	0
12/2/2007	Winter Weather	0
12/5/2007	Winter Weather	0
1/24/2008	Winter Weather	0
2/12/2008	Winter Weather	0
2/12/2008	Winter Weather	0
2/22/2008	Winter Weather	0
2/22/2008	Winter Storm	0
12/21/2008	Winter Weather	0
12/24/2008	Winter Weather	0
1/10/2009	Winter Weather	0
1/15/2009	Winter Weather	0
1/18/2009	Winter Weather	0
1/19/2009	Winter Weather	0
1/28/2009	Winter Weather	0
1/28/2009	Winter Storm	0
2/3/2009	Heavy Snow	0
2/3/2009	Winter Weather	0
3/1/2009	Winter Weather	0
3/1/2009	Winter Storm	0
3/1/2009	Winter Storm	0
12/19/2009	Heavy Snow	0
12/31/2009	Winter Weather	0
1/30/2010	Winter Weather	0
2/5/2010	Winter Storm	0

DATE	TYPE	PROPERTY DAMAGE ($)*
2/6/2010	Blizzard	0
2/9/2010	Winter Storm	0
2/16/2010	Winter Weather	0
2/25/2010	Winter Weather	0
2/25/2010	Winter Storm	0
12/16/2010	Winter Weather	0
12/26/2010	Blizzard	0
12/26/2010	Heavy Snow	0
1/7/2011	Winter Weather	0
1/8/2011	Heavy Snow	0
1/11/2011	Winter Storm	0
1/11/2011	Winter Weather	0
1/17/2011	Winter Weather	0
1/17/2011	Winter Storm	0
1/26/2011	Winter Storm	0
2/1/2011	Ice Storm	0
2/1/2011	Winter Weather	0
2/5/2011	Winter Weather	0
2/21/2011	Heavy Snow	0
2/21/2011	Winter Weather	0
1/21/2012	Winter Weather	0
2/8/2012	Winter Weather	0
2/11/2012	Winter Weather	0
11/7/2012	Winter Storm	0
11/8/2012	Winter Storm	0
1/6/2013	Winter Weather	0
1/21/2013	Winter Weather	0
1/25/2013	Winter Weather	0
2/8/2013	Winter Storm	0
2/13/2013	Winter Weather	0
3/7/2013	Winter Weather	0
3/21/2013	Winter Weather	0
3/25/2013	Winter Weather	0
12/8/2013	Winter Storm	0
12/10/2013	Winter Weather	0
1/2/2014	Heavy Snow	0
1/5/2014	Winter Weather	0
1/10/2014	Winter Weather	0
1/21/2014	Heavy Snow	0
1/25/2014	Winter Weather	0
1/28/2014	Heavy Snow	0
2/3/2014	Winter Weather	0
2/4/2014	Winter Weather	0

DATE	TYPE	PROPERTY DAMAGE ($)*
2/9/2014	Winter Weather	0
2/12/2014	Winther Storm/Mix	0
2/18/2014	Winter Weather	0
3/3/2014	Winter Storm	0
3/16/2014	Heavy Snow	0
3/25/2014	Winter Weather	0
1/21/2015	Winter Weather	0
1/23/2015	Winter Weather	0
1/26/2015	Heavy Snow	0
2/9/2015	Winter Weather	0
2/14/2015	Winter Weather	0
2/16/2015	Winter Weather/Mix	0
2/21/2015	Winter Storm	0
2/26/2015	Winter Weather	0
3/1/2015	Winter Storm	0
3/3/2015	Winter Weather	0
3/5/2015	Heavy Snow	0
3/20/2015	Winter Weather	0
1/17/2016	Winter Weather	0
1/22/2016	Winter Storm	0
2/5/2016	Winter Weather	0
2/15/2016	Winter Weather	0
3/4/2016	Winter Weather	0
12/17/2016	Winter Weather	0
1/5/2017	Winter Weather	0
1/7/2017	Winter Storm	0

*Property Damage is considered a best guess by the National Weather Service. Estimates are made using best available data from a variety of sources including the NWS, government agencies, private companies, individuals, and law enforcement. These estimates are a broad estimate; property damage of $0.00 does not necessarily mean there were no damages. Instead, it means that no damages were reported to the NCDC.

In February 2003, New Jersey was hit by the worst storm since the 1996 blizzard. Power outages lasted for several days in Ocean County. Beach erosion and tidal flooding impacted coastal areas. Inland areas received heavier snowfall and led to roof collapses for some homes. Total property damages in Ocean County and surrounding counties added up to $11.5 million.

January 2005 brought another powerful snowstorm to New Jersey. Snowfall amounts varied from 8 to 17 inches in north and southwestern parts of the state as well as for Ocean County. A state of emergency was declared by the governor and driving was banned on major roadways. A mix of snow and sleet fell over Ocean County and neighboring Atlantic and Cumberland counties. Strong northwest winds downed wires and tree limbs, caused major power outages, and caused snowdrift to cover roadways.

4.3.10.4 Future Occurrence

Winter storms are a regular occurrence in Ocean County and should be considered highly likely as defined by the Risk Factor Methodology (Section 4.4.1). Table 4.3.10-2 shows the probability of receiving measurable snowfall by month in Ocean County. These probabilities are based on data collected over a minimum of 18 years.

Table 4.3.10-2 History of Winter Storms in Ocean County (NCDC, 2017)

MONTH	PROBABILITY (%)	
	TOMS RIVER STATION	TUCKERTON STATION
January	93.60%	89.30%
February	84.90%	93.40%
March	61.20%	67.10%
April	11.10%	27.90%
May	0.00%	0.00%
June	0.00%	0.00%
July	0.00%	0.00%
August	0.00%	0.00%
September	0.00%	0.00%
October	2.00%	4.10%
November	10.70%	27.10%
December	60.80%	82.30%

4.3.10.5 Vulnerability Assessment

All communities in Ocean County are vulnerable to the direct impacts of winter storms, though residents in the northwestern portion of the county tend to receive higher annual snowfalls. Emergency vehicles may have greater difficulty in reaching the coastal communities as access points are limited. In the Pinelands region of the county, emergency response can be difficult when roadways are blocked by downed trees and wires.

Older populations along with people residing in structures without adequate means or heating equipment to protect against cold temperatures are considerably more vulnerable to winter storm events. Auxiliary heat and power supplies such as wood-burning stoves, kerosene heaters, and gasoline-power generators can help to reduce the vulnerability of humans to extreme cold temperatures commonly associated with winter storms.

Severe events involving snow accumulations that exceed six or more inches in a 12-hour period can interrupt power supply and communications, cause traffic accidents, and cause roofs to collapse due to the weight of accumulated snowfall. Accumulated snowfall on roofs is more concerning for the 9% of residential structures were built prior to 1950 countywide. Older homes were not built following today's construction codes and are more likely to have insufficient support for accumulated snowfall on roofs than newer homes.

HUMAN-MADE HAZARDS

4.3.11 Environmental Hazards – Hazardous Materials

4.3.11.1 Location and Extent

Hazardous material releases can occur at fixed sites on land and off shore, or during transport. Hazardous materials include but are not limited to toxic chemicals, flammable and combustible materials, compressed gases, explosive and blasting agents, radioactive materials, oxidizing materials, poisons, and corrosive liquids. Most incidents are unintentional and are often associated with transportation accidents or mishaps at fixed facilities. However, hazardous materials can also be released as a terrorist or criminal act. Possible consequences include injury or death for humans and contamination of water, air, or soil for the surrounding environment.

Facilities in New Jersey that use, manufacture, or store hazardous materials must comply with both Title III of the federal Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-to-Know Act (EPCRA). Due to the reporting requirements of EPCRA, communities are to be informed of the presence and/or release of chemicals at facilities. The purpose of the EPCRA is to ensure that state and local communities are prepared to respond to potential chemical accidents through Local Emergency Planning Committees (LEPCs). LEPCs are responsible for developing emergency response plans for SARA Title III facilities; included in the plans are the location and extent of hazardous materials, evacuation plans, response procedures, methods to reduce the magnitude of a materials release, as well as methods and schedules for training and exercises.

This HMP will focus on the Environmental Protection Agency-identified hazardous materials sites known collectively as Toxic Release Inventory (TRI) sites, because SARA Title III facilities are covered under their own unique planning process and are continually evaluated through the LEPC. This dataset, publicly available at http://www.epa.gov/enviro/geo_data.html, includes a number of materials facilities:

- Superfund National Priorities List (NPL) sites
- RCRAInfo (EPA and state treatment, storage, disposal) facilities
- TRI system sites
- Integrated Compliance Information System (ICIS) and Permit Compliance System (PCS) - National Pollutant Discharge Elimination System (NPDES) Majors
- RCRAInfo - Large Quantity Generators (LQGs)
- Air Facility System (AFS) - Major discharges of air pollutants
- RCRAInfo - Corrective Actions
- Risk Management Plan
- Section Seven Tracking System Sites (Pesticides)
- ACRES - Brownfields Properties

The location and extent of hazardous materials releases in the county will be better communicated by observing this dataset. There are currently 12 superfund sites on the National Priorities list in Ocean County. They are located in Beachwood and Lakehurst boroughs, Berkeley, Dover (Toms River), Jackson, and Plumsted townships (EPA, 2012).

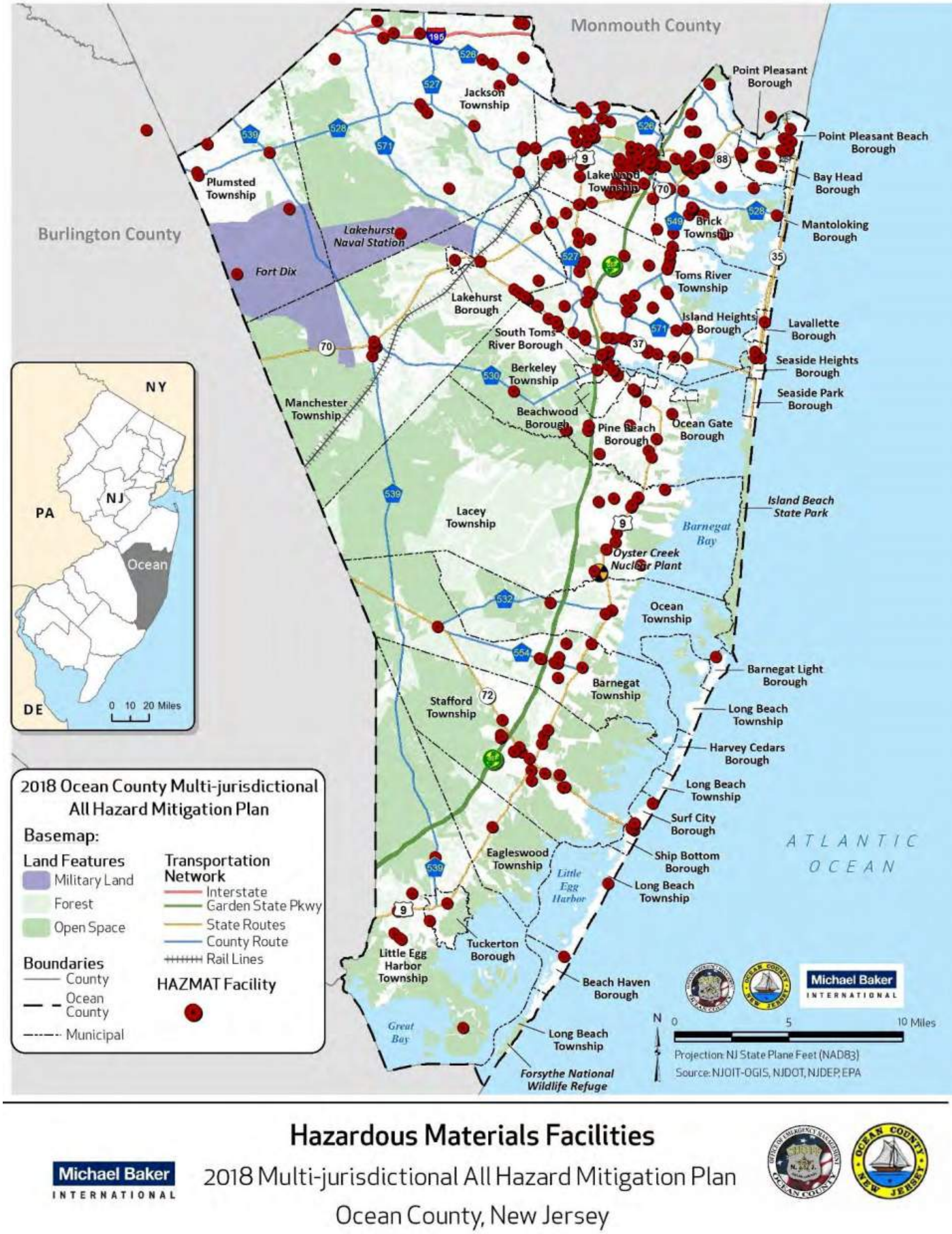
Ocean County has 22 TRI sites designated by the EPA within the County, as shown in Table 4.3.11-1. Several of these facilities are located in close proximity to population centers that could be affected should a major accident or spill occur. Lakewood Township has the most facilities with 14. Many municipalities do not have any TRI facilities located within their jurisdiction, reducing the risk of incidents occurring due to fixed sites.

Additionally, Ocean County has 313 Hazardous Material Facilities. Hazardous Waste Management Facilities data is maintained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system of hazardous waste handlers. These facilities are shown in Figure 4.3.11-1.

Table 4.3.11-1 EPA Number of Hazardous Material Facilities per jurisdiction in Ocean County (EPA, 2017)

Municipality	Number of TRI Facilities	Municipality	Number of TRI Facilities
Barnegat Light Borough	0	Manchester Township	1
Barnegat Township	0	Mantoloking Borough	0
Bay Head Borough	0	Ocean Gate Borough	0
Beach Haven Borough	0	Ocean Township	0
Beachwood Borough	0	Pine Beach Borough	0
Berkeley Township	0	Plumsted Township	1
Brick Township	1	Point Pleasant Beach Borough	0
Eagleswood Township	0	Point Pleasant Borough	0
Harvey Cedars Borough	0	Seaside Heights Borough	0
Island Heights Borough	0	Seaside Park Borough	0
Jackson Township	1	Ship Bottom Borough	0
Lacey Township	0	South Toms River Borough	0
Lakehurst Borough	1	Stafford Township	0
Lakewood Township	14	Surf City Borough	0
Lavallette Borough	0	Toms River Township	3
Little Egg Harbor Township	0	Tuckerton Borough	0
Long Beach Township	0	**Total**	22

Figure 4.3.11-1 Ocean County hazardous materials facilities and major transportation



4.3.11.2 Range of Magnitude

Hazardous material releases can contaminate air, water, and soils, possibly resulting in death and/or injuries. Dispersion can take place rapidly when transported by water and wind. While often accidental, releases can occur as a result of human carelessness, intentional acts, or natural hazards. When caused by natural hazards, these incidents are known as secondary events. Hazardous materials can include toxic chemicals, radioactive materials, infectious substances, and hazardous wastes. Such releases can affect nearby populations and contaminate critical or sensitive environmental areas.

With a hazardous material release, whether accidental or intentional, there are several potentially exacerbating or mitigating circumstances that will affect its severity or impact. Mitigating conditions are precautionary measures taken in advance to reduce the impact of a release on the surrounding environment. Primary and secondary containment or shielding by sheltering-in-place protects people and property from the harmful effects of a hazardous material release. Exacerbating conditions, or characteristics that can enhance or magnify the effects of a hazardous material release, include the following:

- Weather conditions: Affect how the hazard occurs and develops
- Micro-meteorological effects of buildings and terrain: Alters dispersion of hazardous materials
- Noncompliance with applicable codes (e.g., building or fire codes) and maintenance failures (e.g., fire protection and containment features): Can substantially increase the damage to the facility itself and to surrounding buildings

Whether or not a hazardous materials site is contained in the SFHA is also a concern, as there could be larger-scale water contamination during a flood event, should the flood compromise the production or storage of hazardous chemicals. Such a situation could swiftly move toxic chemicals throughout a water supply and across great distances. There is concern about the level of contaminants and the potential clean-up needs after Hurricane Sandy and studies into the impact are ongoing.

The severity of a given incident is dependent not only on the circumstances described above, but also with the type of material released and the distance and related response time for emergency response teams. The areas within closest proximity to the releases are generally at greatest risk, yet depending on the agent, a release can travel great distances or remain present in the environment for a long period of time (e.g., centuries to millennia for radioactive materials), resulting in extensive impacts on people and the environment.

One of the worst incidents on record in Ocean County was the 1984 pipeline leak of treated chemical waste from the Ciba-Geigy company at Vaughn and Bay Avenues. The company had been pumping the waste across Barnegat Bay and the barrier island and releasing the waste into the ocean at Ortley Beach, but was exposed when the pipeline leaked. The leak and ongoing releases resulted in a superfund site to be formed (Miller, 2013). A nearby example of a hazardous material accident happened in Paulsboro, NJ when a train derailed and released vinyl chloride. Nearby school needed to shelter in place and 20 people accessed the hospital for burning throat symptoms. The release and spill also necessitated extensive environmental clean-up (West Deptford Patch, 2012).

4.3.11.3 Past Occurrence

With some exceptions, the majority of incidents over the years have involved combustible liquid spills along the highway. Most of the 61 incidents reported by USDOT occurred in Lakewood Township and were determined to be caused by improper preparation for transportation.

Table 4.3.11-2 displays hazardous material events obtained from the U.S. Department of Transportation Hazmat Intelligence Portal.

Ocean County also has a County Hospital Management of Chemical, Biological, Radiological, Nuclear & Explosive Team (Station 85 -Berkeley Emergency Response Team) that on average responds to 55-65 calls per year, most of which are not reported to USDOT because they do not involve highway incidents. Many of these incidents have direct impacts on water bodies in the County. BERT receives County Environmental Health Act (CEHA) funding from the State (NJDEP) through the Ocean County Health Department. HM/CBRNE incident responses data is reported to OCHD which is included in the County's CEHA reporting to NJDEP.

Table 4.3.11-2 Hazardous Materials incidents in Ocean County from 1990 to present as reported to the Hazmat Intelligence Portal (USDOT, 2017)

Incident Route	Incident City	Date	Commodity Name	Hazardous Class	Mode	Cause
105 LEHIGH AVE	Lakewood	1/5/1990	Resin solution flammable	Flammable - combustible liquid	Highway	Loose Closure Component or Device
105 LEHIGH AVE	Lakewood	1/25/1990	Resin solution flammable	Flammable - combustible liquid	Highway	Not provided
ROUTE 9	Lakewood	6/26/1990	Ink printers flammable	Flammable - combustible liquid	Highway	Improper Preparation for Transportation
105 LEHIGH AVE	Lakewood	11/12/1990	Compounds cleaning liquid	Flammable - combustible liquid	Highway	Over-pressurized
105 LEHIGH AVE	Lakewood	2/13/1991	Corrosive liquids poisonous N.O.S.	Corrosive material	Highway	Improper Preparation for Transportation
105 LEHIGH AVE	Lakewood	3/4/1991	Petroleum distillates N.O.S. or petroleum products N.O.S.	Flammable - combustible liquid	Highway	Not provided

Incident Route	Incident City	Date	Commodity Name	Hazardous Class	Mode	Cause
BARNEGAT LONG BEACH ISLAND	Barnegat	8/7/1991	Fuel oil no. 1 2 4 5 or 6	Combustible liquid	Highway	Rollover Accident; Vehicular Crash or Accident Damage
105 LEHIGH	Lakewood	9/3/1991	Oxidizing liquid corrosive N.O.S.	Oxidizer	Highway	Loose Closure Component or Device; Improper Preparation for Transportation; Loose Closure Component or Device
105 LEHIGH AVENUE	Lakewood	7/21/1992	Oxidizing liquid corrosive N.O.S.	Oxidizer	Highway	Loose Closure Component or Device; Dropped
100 LEHIGH AVENUE	Lakewood	8/11/1992	Chloroform	Poisonous materials	Highway	Improper Preparation for Transportation; Improper Preparation for Transportation
200 ROUTE 37 W	Lakehurst	9/28/1993	Gasoline includes gasoline mixed with ethyl alcohol with not more than 10% alcohol	Flammable - combustible liquid	Highway	Loose Closure Component or Device;
VASSAR AVE	Lakewood	12/20/1993	Resin solution flammable	Flammable - combustible liquid	Highway	Dropped
710 VASSAR AVE	Lakewood	3/30/1994	Flammable solids poisonous N.O.S.	Flammable solid	Highway	Not provided
100 RIDGEWAY	Lakehurst	11/28/1994	Magnesium powder or magnesium alloys powder	Dangerous when wet material	Highway	Improper Preparation for Transportation; Inadequate Blocking and Bracing

Incident Route	Incident City	Date	Commodity Name	Hazardous Class	Mode	Cause
710 VASSAR AVE	Lakewood	1/10/1995	Sulfamic acid	Corrosive material	Highway	Not provided
710 VASSAR AVE	Lakewood	1/13/1995	Cyclohexanone	Flammable - combustible liquid	Highway	Not provided
710 VASSAR AVE	Lakewood	5/18/1995	Petroleum oil	Flammable - combustible liquid	Highway	Abrasion; Abrasion
1895 SWARTHMORE AVE	Lakewood	7/27/1995	Organophosphorus pesticides solid toxic	Poisonous materials	Highway	Improper Preparation for Transportation; Inadequate Blocking and Bracing; Impact with Sharp or Protruding Object (e.g. nails)
1895 SWARTHMORE AVE	Lakewood	8/15/1995	Resin solution flammable	Flammable - combustible liquid	Highway	Not provided
105 LEHIGH	Lakewood	7/22/1997	Corrosive liquids N.O.S.	Corrosive material	Highway	Improper Preparation for Transportation
NOT RECORDED	Lakewood	6/5/1998	Combustible liquid N.O.S.	Combustible liquid	Highway	Inadequate Blocking and Bracing
NOT RECORDED	Ocean	6/10/1998	Resin solution flammable	Flammable - combustible liquid	Highway	Overfilled
NOT RECORDED	Lakewood	7/12/1999	Combustible liquid N.O.S.	Combustible liquid	Highway	Overfilled
MM90 GARDEN STATE PARKWAY	Lakewood	1/20/2000	Gasoline includes gasoline mixed with ethyl alcohol with not more than 10% alcohol	Flammable - combustible liquid	Highway	Vehicular Crash or Accident Damage
200 ROUTE 37 WEST	Lakehurst	2/17/2000	Gasoline includes gasoline mixed with ethyl alcohol with	Flammable - combustible liquid	Highway	Not provided

Incident Route	Incident City	Date	Commodity Name	Hazardous Class	Mode	Cause
			not more than 10% alcohol			
100 Ridgeway *entry provided by Art Abline	Manchester	9/29/2000	Military explosive	Military explosion mixed in magnesium	Highway	Not provided
1895 SWARTHMORE AVE	Lakewood	1/23/2001	Flammable liquids N.O.S.	Flammable - combustible liquid	Highway	Not provided
SWARTHMORE DRIVE	Lakewood	6/13/2001	Corrosive solids N.O.S.	Corrosive material	Highway	Inadequate Blocking and Bracing
NOT RECORDED	Lakewood	8/20/2001	Ammonia solution relative density between 0.880 and 0.957 at 15 degrees c in water with more than 10 percent but not more than 35 percent ammonia	Corrosive material	Highway	Not provided
1895 SWARTHMORE AVE	Lakewood	9/9/2002	Petroleum distillates N.O.S. or petroleum products N.O.S.	Flammable - combustible liquid	Highway	Improper Preparation for Transportation
105 LEHIGH AVE	Lakewood	4/2/2003	Pesticides solid toxic N.O.S.	Poisonous materials	Highway	Improper Preparation for Transportation
1895 SWARTHMORE AVE	Lakewood	12/17/2003	Organic peroxide type e liquid	Organic peroxide	Highway	Improper Preparation for Transportation; Improper Preparation for Transportation;
1895 SWAITHMORE AVE	Lakewood	4/16/2004	Nitrogen refrigerated liquid (cryogenic liquid)	Nonflammab le compressed gas	Highway	Improper Preparation for Transportation; Inadequate Blocking and

Incident Route	Incident City	Date	Commodity Name	Hazardous Class	Mode	Cause
						Bracing; Freezing
1895 SWARTHMORE AVE	Lakewood	6/23/2004	Corrosive liquid acidic organic N.O.S.	Corrosive material	Highway	Improper Preparation for Transportation; Inadequate Blocking and Bracing
1895 SWARTHMORE AVE	Lakewood	6/25/2004	Hypochlorite solutions	Corrosive material	Highway	Impact with Sharp or Protruding Object (e.g. nails)
1895 SWARTHMORE AVE	Lakewood	7/16/2004	Nitrogen refrigerated liquid (cryogenic liquid)	Nonflammab le compressed gas	Highway	Inadequate Blocking and Bracing
710 VASSAR AVENUE	Lakewood	4/21/2005	Battery fluid acid	Corrosive material	Highway	Not provided
710 VASSAR RD	Lakewood	7/13/2005	Isopropanol or isopropyl alcohol	Flammable - combustible liquid	Highway	Human Error
1895 SWARTHMORE AVE	Lakewood	1/11/2006	Paint including paint lacquer enamel stain shellac solutions varnish polish liquid filler and liquid lacquer base	Flammable - combustible liquid	Highway	Inadequate Blocking and Bracing
1895 SWARTHMORE AVE	Lakewood	8/17/2006	Barium compounds N.O.S.	Poisonous materials	Highway	Improper Preparation for Transportation
712 VASSAR AVENUE	Lakewood	1/23/2007	Paint including paint lacquer enamel stain shellac solutions varnish polish liquid filler and liquid lacquer base	Flammable - combustible liquid	Highway	Human Error

Incident Route	Incident City	Date	Commodity Name	Hazardous Class	Mode	Cause
1895 SWARTHMORE AVENUE	Lakewood	7/5/2007	Barium compounds N.O.S.	Poisonous materials	Highway	Forklift Accident
NOT RECORDED	Lakewood	10/16/2007	Flammable liquids N.O.S.	Flammable - combustible liquid	Highway	Deterioration or Aging
710 VASSAR AVE	Lakewood	6/12/2008	Carbon dioxide solid or dry ice	Miscellaneous hazardous material	Air	Freezing
710 VASSAR RD	Lakewood	7/14/2008	Sodium hydroxide solution	Corrosive material	Highway	Human Error
710 VASSAR RD	Lakewood	9/23/2008	Aerosols flammable (each not exceeding 1 l capacity)	Flammable gas	Highway	Not provided
NOT RECORDED	Lakewood	11/11/2008	Gasoline includes gasoline mixed with ethyl alcohol with not more than 10% alcohol	Flammable - combustible liquid	Highway	Vandalism
NOT RECORDED	Lakewood	5/13/2009	Carbon dioxide solid or dry ice	Miscellaneous hazardous material	Air	Not provided
710 VASSAR RD.	Lakewood	8/7/2009	Consumer commodity	Other regulated material class d	Highway	Defective Component or Device
710 VASSAR RD	Lakewood	10/19/2009	Consumer commodity	Other regulated material class d	Highway	Not provided
105 Lehigh Ave.	Lakewood	8/20/2010	Resin solution flammable	Flammable - combustible liquid	Highway	Forklift Accident
Door 4	Lakewood	9/29/2011	Corrosive liquid acidic inorganic N.O.S.	Corrosive material	Highway	Dropped

Incident Route	Incident City	Date	Commodity Name	Hazardous Class	Mode	Cause
710 VASSAR RD	Lakewood	9/12/2012	Vanadium pentoxide nonfused form	Poisonous materials	Highway	Loose Closure Component or Device
800 Airport Rd	Lakewood	6/4/2015	Printing ink flammable or printing ink related material (including printing ink thinning or reducing compoun) flammable	Flammable - combustible liquid	Highway	Punctured; Abrasion
105 Lehigh Avenue	Lakewood	8/10/2015	Hypochlorite solutions	Corrosive material	Highway	Inadequate Blocking and Bracing
105 Lehigh Ave	Lakewood	9/23/2015	Tarpene hydrocarbons N.O.S.	Flammable - combustible liquid	Highway	Deterioration or Aging
105 Lehigh Ave	Lakewood	9/23/2015	Tarpene hydrocarbons N.O.S.	Flammable - combustible liquid	Highway	Forklift Accident
1 Benedict St	Point Pleasant	11/18/2015	Corrosive liquid acidic organic N.O.S.	Corrosive material	Highway	Dropped
1 Benedict St	Bay Head	2/5/2016	Corrosive liquid acidic organic N.O.S.	Corrosive material	Highway	Loose Closure Component or Device
604 Parker Ave	Brick	10/4/2016	Corrosive liquid basic inorganic N.O.S.	Corrosive material	Highway	Dropped
710 VASSAR RD	Lakewood	1/26/2017	Paint including paint lacquer enamel stain shellac solutions varnish polish liquid filler and liquid lacquer base	Flammable - combustible liquid	Highway	Defective Component or Device

4.3.11.4 Future Occurrence

While incidents involving hazardous materials releases have occurred in Ocean County in the past, they are generally difficult to predict. Any occurrence is largely dependent upon the accidental or intentional actions of a person or group. Population growth, especially in areas close to transportation routes, can expose more people to these hazards if a release incident occurs. The transport, storage, and handling of hazardous materials are increasing nationwide and with this is the potential for an increase in accidents.

The continuing trend of accidents involving hazardous materials in Ocean County is expected to remain constant. The probability of future occurrence is likely, according to the Risk Factor Methodology probability criteria. The following sections discuss any unique factors that may impact the future occurrence of each type of environmental hazard.

4.3.11.5 Vulnerability Assessment

There is an added concern of potential vulnerability to hazardous materials facilities in Ocean County because many of them are located in close proximity to the coastline, or nearby bays or rivers. A release into a body of water has the potential to impact not only the local municipality residents where the incident occurs but also those in neighboring municipalities and counties. Another major contributing factor is the high number of major roadways that run through Ocean County, including the Garden State Parkway, I-195, US Route 9, and New Jersey Routes 35, 37, 70, and 88.

Table 4.3.10-3 provides the number of Hazardous Materials Facilities by municipalities as well as an estimate of number and value of parcels located within 1.5 miles of a Hazardous Materials Facility.

Table 4.3.11-3 Parcels Located within 1.5 miles of Hazardous Materials

Municipality	Parcels Located Within 1.5 Miles of HAZMAT Facility	Total Parcels in Municipality	Percent Vulnerable Parcels	Dollar Value of Improvements on Vulnerable Parcels
Barnegat Light Borough	1,257	1,448	87%	$332,274,100
Barnegat Township	10,186	13,701	74%	$1,247,667,411
Bay Head Borough	1,078	1,223	88%	$448,770,500
Beach Haven Borough	1,763	3,098	57%	$309,041,500
Beachwood Borough	4,266	4,325	99%	$550,192,600
Berkeley Township	22,936	56,660	40%	$2,771,193,585
Brick Township	32,215	55,329	58%	$4,960,429,678
Eagleswood Township	837	4,524	19%	$93,079,600
Harvey Cedars Borough	11	1,487	1%	$2,804,000
Island Heights Borough	910	1,024	89%	$122,544,000
Jackson Township	17,501	22,210	79%	$3,993,732,220
Lacey Township	14,747	51,408	29%	$2,100,865,900
Lakehurst Borough	831	879	95%	$108,497,800
Lakewood Township	25,120	25,912	97%	$4,391,746,300
Lavallette Borough	2,604	2,991	87%	$446,533,310

Municipality	Parcels Located Within 1.5 Miles of HAZMAT Facility	Total Parcels in Municipality	Percent Vulnerable Parcels	Dollar Value of Improvements on Vulnerable Parcels
Little Egg Harbor Township	10,580	13,046	81%	$1,207,707,014
Long Beach Township	6,241	10,458	60%	$1,339,013,400
Manchester Township	16,498	38,468	43%	$2,579,990,935
Mantoloking Borough	569	875	65%	$418,791,400
Ocean Gate Borough	1,136	1,202	95%	$131,718,600
Ocean Township	5,543	10,167	55%	$760,187,200
Pine Beach Borough	975	2,976	33%	$138,238,900
Plumsted Township	2,356	3,304	71%	$390,497,000
Point Pleasant Beach Borough	8,307	3,639	228%	$1,396,024,810
Point Pleasant Borough	3,351	8,574	39%	$589,456,000
Seaside Heights Borough	2,083	2,265	92%	$272,896,200
Seaside Park Borough	1,050	2,490	42%	$122,853,100
Ship Bottom Borough	1,985	2,257	88%	$397,071,200
South Toms River Borough	1,276	1,354	94%	$140,407,100
Stafford Township	12,274	15,715	78%	$1,962,736,900
Surf City Borough	2,299	2,557	90%	$521,857,100
Toms River Township	38,633	53,218	73%	$7,030,563,460
Tuckerton Borough	1,989	2,187	91%	$207,983,700
Total	**253,407**	**420,971**	**60%**	**$41,487,366,523**

Ocean County also has several active railroad lines that operate within the county, on which numerous hazardous materials are transported daily. Because the transportation of these hazardous materials often passes through highly populated/traveled areas, serious HAZ-MAT incidents have the potential to have great and serious impact upon many people. Agriculture is prevalent in small regions of Ocean County, so the use of herbicides, insecticides and fertilizers that are classified as extremely hazardous substances is common in those sectors. Without proper control, those substances can contribute to health and/or environmental problems. There are also numerous major underground pipelines, pump stations and terminals that transport and distribute a number of different petroleum products and other underground systems for transporting natural gas. These pipelines and related facilities pose a certain level of risk, depending on the type of materials and their proximity to highly populated sections of the County.

4.3.12 Nuclear Incidents

Nuclear incidents involve the release radioactive materials and/or exposure to radiation. The main source of concern is a nuclear power plant; however laboratory accidents, industrial processes, terrorism attacks, and transportation accidents may also result in nuclear incidents occurring. After a nuclear incident, the main concern is the extent of radiation, inhalation, and ingestion of radioactive isotopes which can cause acute health effects (e.g. death, burns, severe impairments), chronic health effects (e.g. cancer), and psychological effects. Long-term impacts include damage to public and mental health of the overall population in addition to detrimental effects on the environment.

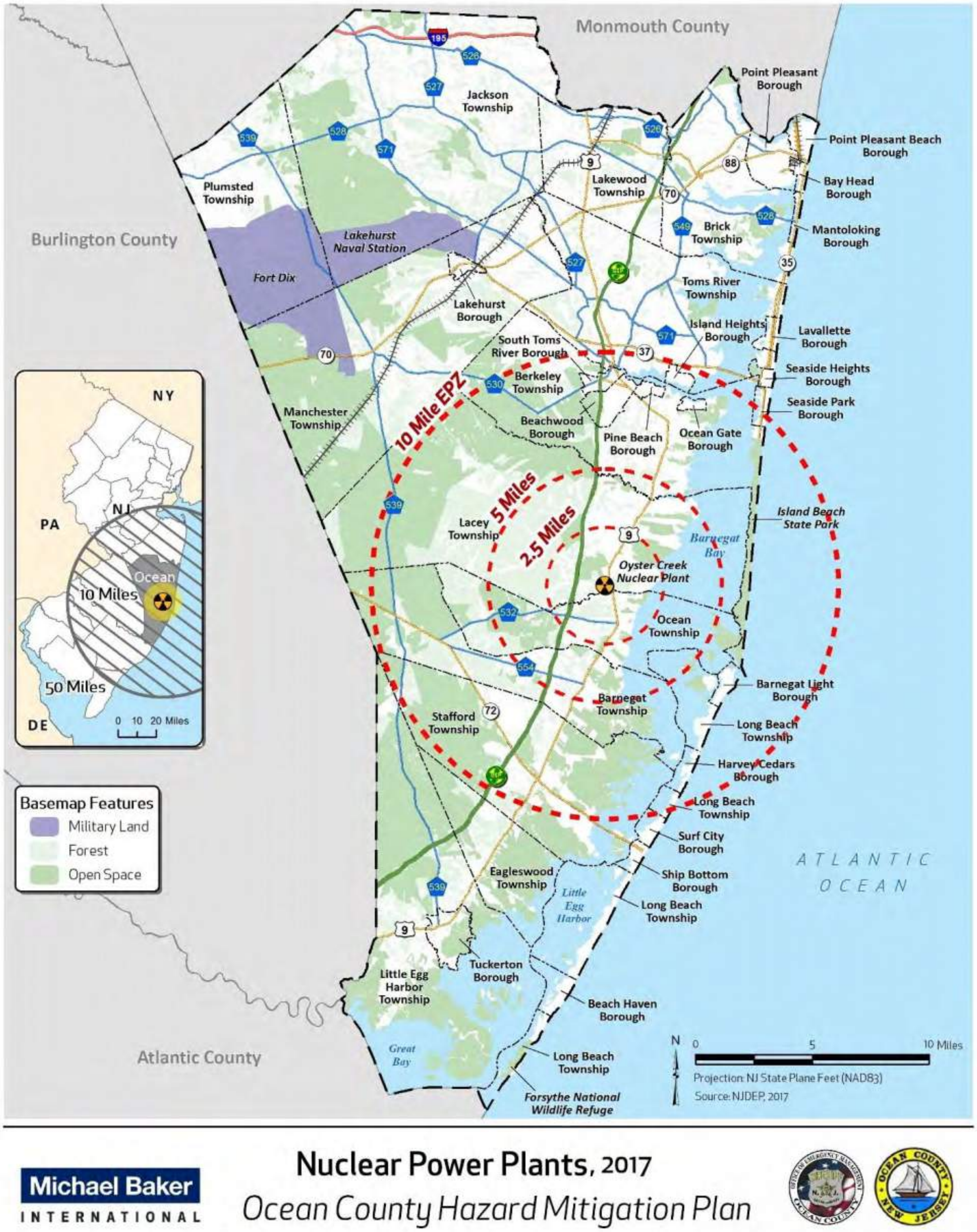
4.3.12.1 Location and Extent

Ocean County has one nuclear facility within its borders. Oyster Creek Nuclear Generating Station is located in Forked River, Lacey Township, New Jersey. The plant has one operating license and is run by Exelon Generation Company (US NRC, 2012). Two other nuclear facilities, Hope Creek Nuclear Generating Station and Salem Nuclear Power Plant are located west of Ocean County in Salem, New Jersey. However, the other stations are not close enough to impact Ocean County.

The use of Probabilistic Risk Assessments (PRA) is preferred by the Nuclear Regulatory Commission to estimate quantitatively the potential risk to public health and safety considering the design, operations and maintenance practices at nuclear power plants. PRAs typically focus on accidents that can severely damage the core and that may challenge containment. FEMA, PEMA and county governments have formulated Radiological Emergency Response Plans that include a Plume Exposure Pathway Emergency Planning Zone (EPZ) with a radius of about ten miles from each nuclear power facility and an Ingestion Exposure Pathway EPZ with a radius of about fifty miles from each facility. Specific configuration and size of an EPZ may vary in relation to local emergency response capabilities, topography, road networks, and political boundaries. Figure 4.3.12-1 shows the location of the Oyster Creek nuclear facility within Ocean County along with the 10-mile EPZ. The entire land area of the county is located within at least one 50-mile EPZ.

Evacuation in case of a disaster at the Oyster Creek Nuclear generating Station is covered in the New Jersey State Police, Office of Emergency Management's Radiological Emergency Response Plan which is exercised twice annually.

Figure 4.3.12-1 Location of EPZ Zones for Oyster Creek Nuclear Plant and At-Risk Populations in Ocean County (NJDEP, 2013)



4.3.12.2 Range of Magnitude

The extent of impact of a nuclear incident differs for those within the Plume Exposure Pathway EPZ and those within the Ingestion Exposure Pathway EPZ. The Plume Exposure Pathway refers to whole-body external exposure to gamma radiation from a radioactive plume and from deposited materials and inhalation exposure from the passing radioactive plume. The duration of primary exposures could range in length from hours to days. The Ingestion Exposure Pathway refers to exposure primarily from ingestion of water or foods such as milk and fresh vegetables that have been contaminated with radiation.

Nuclear accidents can be classified into the three following categories:

- **Criticality accidents:** Involves loss of control of nuclear assemblies or power reactors.
- **Loss-of-coolant accidents:** Occurs whenever a reactor coolant system experiences a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating make-up system.
- **Loss-of-containment accidents:** Involves the release of radioactivity from materials such as tritium, fission products, plutonium, and natural, depleted, or enriched uranium. Points of release have been containment vessels at fixed facilities or damaged packages during transportation accidents.

In the event of an accident, nuclear facilities must notify the appropriate authorities. The Nuclear Regulatory Commission uses the four following classification levels for nuclear incidents (Nuclear Regulatory Commission, 2008):

- **Unusual Event**: An unusual event is signified by the potential for degradation in the level of safety of the plant. No release of radioactive material requiring offsite response or monitoring is expected unless further degradation occurs.
- **Alert:** An alert is declared, if events have occurred or are occurring which involves an actual or potential substantial degradation in the level of safety of the plant. Any releases of radioactive material from the plant are expected to be limited to a small fraction of the EPA Protective Action Guides (PAGs).
- **Site Area Emergency:** Events in process or which have occurred that result in actual or likely major failures of plant functions needed for protection of the public. Any releases of radioactive material are not expected to exceed the EPA PAGs except near the site boundary.
- **General Emergency:** Imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity. Radioactive releases during a general emergency can reasonably be expected to exceed the EPA PAGs for more than the immediate site area.

Nuclear incidents are evaluated based on the impact on:

- The Public – Impact on human life is dependent on exposure time. Whether or not water or food supplies are exposed to radiation or radioactive material also greatly determines the effects on the general population.

- Responders – Without proper precautions, responders to nuclear incidents can be exposed to radiation.
- Continuity of Operations including Delivery of Services – Containment of the site of a nuclear incident may inhibit the movement of traffic and thus delivery of services and continuity of operations will be hindered as well.
- Property – Contamination from radiation exposure can affect industrial, business, and residential structures.
- Facilities – Radiation can also impact facilities, including their electrical systems if affected by an electromagnetic pulse.
- Infrastructure – Nuclear events can damage or even ruin infrastructure.
- The Environment – Radiological events can affect groundwater, soil, animals, plants, and other wildlife. Clean up can become costly and some environmental impacts may be difficult or impossible to reverse.
- The Economy – The aftermath of nuclear events can devastate communities and especially inhibit economic progress. If facilities, water supplies, and food supplies are impacted, the local economy will take a hit and recovery will be difficult.
- Public Confidence in government – A community's confidence in governing powers may falter after a devastating event such as a nuclear incident.

Though New Jersey has never experienced a catastrophic nuclear accident, the neighboring Commonwealth of Pennsylvania did in 1979. A General Emergency level incident occurred at Three Mile Island Generating Station in March 1979. This is the nation's worst nuclear incident on record. A partial meltdown of the TMI Unit 2 reactor core occurred due to a combination of "equipment malfunctions, design-related problems, and worker errors," (US NRC, 2011).

The nuclear industry has adopted pre-determined, site-specific Emergency Action Levels (EALs). The EALs provide the framework and guidance to observe, address, and classify the severity of site-specific events and conditions that are communicated to off-site emergency response organizations (Nuclear Regulatory Commission, 2008). Other EALs deal specifically with issues of security, such as threats of airborne attack, hostile action within the facility, or facility attack. The purpose of EALs is to ensure that appropriate notifications for the security threat are made in a timely manner. Public alerting systems are a part of each facility, and include a number of sirens to alert the public located in the Plume Ingestion Pathway EPZ. Counties of each specific EPZ can activate the alerting system when necessary. Emergency notifications and instructions are communicated to the public via the Emergency Alert System using warning sirens and local radio stations including AM, FM, and a boater's station. Oyster Creek has a publicly available emergency planning guide for local residents and businesses to reference in preparation of an event. Emergency bus evacuation routes and reception center locations are provided in the plan as well as emergency planning area descriptions for residents (Exelon Corporation, 2013). Additional guidance is available from the New Jersey Office of Emergency Management, in a manual entitled, Radiological Emergency Information for New Jersey farmers, food processors, and Distributors for those located within 50 miles of a Nuclear Power Station (NJOEM, 2012).

4.3.12.3 Past Occurrence

Though no critical nuclear incidents have occurred in Ocean County, a large series of wildfires threatened the Oyster Creek plant in 1992. The fire began in Lacey Township and caused the plant to shut down as it continued to spread. Fortunately, no damage to the plant was incurred (Batcha, 2003). When natural disasters have occurred, nuclear plants respond to avoid compounding the situation with a nuclear incident. Most recently, during Hurricane Sandy, an unusual event was declared at Oyster Creek Nuclear Generating Station and later upgraded to an alert due to rising water levels near the facility (AP, 2012).

In 2003, ground water contamination due to naturally occurring radioactive element, Radium was found in central and southern New Jersey. Not only were the levels of Radium found to exceed Federal standards, but residents exposed to the contaminated water were found to be significantly more susceptible to developing a rare type of bone cancer called Osteosarcoma (NJDOHSS, 2003).

Nuclear incidents rarely occur, but the incident at Three Mile Island is the worst fixed-nuclear facility accident in U.S. history. The resulting contamination and state of the reactor core led to the development of a fourteen-year cleanup and scientific effort. Additionally, the President's Commission on the Accident at Three Mile Island examined the costs of the accident, concluding, "The accident at Three Mile Island on March 28, 1979, generated considerable economic disturbance. Some of the impacts were short term, occurring during the first days of the accident. Many of the impacts were experienced by the local community; others will be felt at the regional and national levels." The report concluded: "It appears clear that the major costs of the TMI Unit 2 accident are associated with the emergency management replacement power and the plant refurbishment or replacement. The minimum cost estimate of nearly $1 billion supports the argument that considerable additional resources can be cost effective if spent to guard against future accidents."

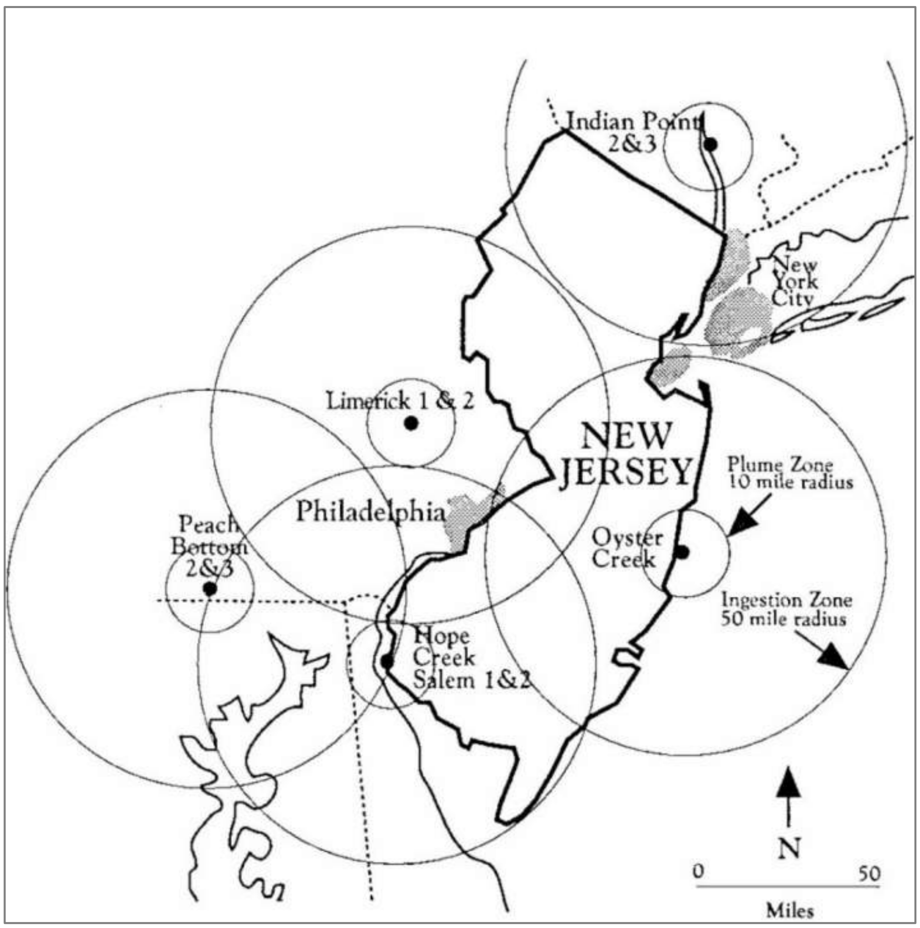
Despite the severity of the damage, no injuries due to radiation exposure occurred. However, numerous studies were conducted to determine the measurable health effects related to radiation and/or stress. More than a dozen epidemiological and stress related studies conducted to date have found no discernible direct health effects to the population in the vicinity of the plant. However, one study conducted by the DOH's Three Mile Island Health Research Program did find evidence of psychological stress, "lasting in some cases for five to six years." According to the program chief, "the people suffering from stress perceived their health as being poorer than it actually was when the Health Department checked the medical records."

The issue of radiation effects resulting from the accident at TMI will continue to be debated. Radiation science does accept thresholds of expected mortality and morbidity resulting from the exposure to radiation. Administrative standards have been incorporated into plans used by public health officials and emergency planners for the purpose of making protective actions decisions pertaining to sheltering and evacuation.

The accident at Three Mile Island had a profound effect on the residents, emergency management community, government officials and nuclear industry, not only in Pennsylvania, but nationwide. There were minimal requirements for off-site emergency planning for nuclear power stations prior to this accident. Afterwards, comprehensive, coordinated, and exercised plans were developed for the state, counties, school districts, special facilities (hospitals, nursing homes and detention facilities) and municipalities to assure the safety of the population. Costs associated with an event at one of Pennsylvania's nuclear facilities, be it real or perceived, are significant. The mitigation efforts put in place immediately following the 1979 continue until today.

In Figure 4.3.11-2 below, the ingestion pathway zones are shown for each nuclear power plant with the potential to impact New Jersey. As shown in the map, Oyster Creek is of main concern for Ocean County residents.

Figure 4.3.12-2 50 Mile Ingestion Pathway Zone Map for All Nuclear Power Plants Affecting New Jersey (NJOEM, 2012)



4.3.12.4 Future Occurrence

Ocean County is home to one nuclear power plant, so there is a risk of an incident occurring in the future. However, NJ Department of Environmental Protections (NJDEP) entered into an Administrative Consent Order with Exelon, the plant operator, on December 9, 2009 to close Oyster Creek by December 31. 2019. As of February 2018, Exelon Generation announced the Oyster Creek nuclear power plant will shut down in October 2018 and prepare for long-term decommissioning of the plant. While the plant remains open, there is still a chance that a fixed nuclear facility event could impact Ocean County. The Nuclear Energy Agency of the Organization for Economic Co-Operation and Development estimates that the chance of protective barriers failing in a modern nuclear facility is less than one in 100,000 per year (NEA, 2005). Intentional actions could cause a nuclear incident; these terrorist acts are possible but are. Nuclear Incidents should be considered unlikely as defined by the Risk Factor Methodology (Section 4.4.1) until the decommissioning of Oyster Creek; after that point, risk to this hazard will be eliminated.

4.3.12.5 Vulnerability Assessment

Fourteen jurisdictions are located within the 10-mile EPZ of Oyster Creek. Not all parts of these jurisdictions are located in the 10-mile EPZ; approximately 238,971 people live in the 10-Mile EPZ, and these individuals are considered vulnerable to direct radiation exposure if a significant nuclear event were to occur. However, evacuation and emergency planning for nuclear incidents is usually conducted for the municipality on the whole. Table 4.3.12-1 lists the vulnerable populations and critical facilities at risk in a nuclear incident.

Table 4.3.12-1 Population and Critical Facilities at Risk to Nuclear Incidents (ACS 5 yr Estimates, 2015)

Municipality	Total Population in at-Risk Municipalities in 10-Mile EPZ	Critical Facilities Located Within 10 Miles of Nuclear Plants
Barnegat Light Borough	589	11
Barnegat Township	21,617	27
Bay Head Borough	0	0
Beach Haven Borough	0	0
Beachwood Borough	11,128	9
Berkeley Township	41,480	42
Brick Township	0	0
Eagleswood Township	0	0
Harvey Cedars Borough	416	8
Island Heights Borough	1,640	8
Jackson Township	0	0
Lacey Township	28,105	50
Lakehurst Borough	0	0
Lakewood Township	0	0
Lavallette Borough	0	0
Little Egg Harbor Township	0	0
Long Beach Township	3028	0
Manchester Township	0	0
Mantoloking Borough	0	0
Ocean Gate Borough	2,105	11
Ocean Township	8,628	29
Pine Beach Borough	2,175	5

Municipality	Total Population in at-Risk Municipalities in 10-Mile EPZ	Critical Facilities Located Within 10 Miles of Nuclear Plants
Plumsted Township	0	0
Point Pleasant Beach Borough	0	0
Point Pleasant Borough	0	0
Seaside Heights Borough	0	0
Seaside Park Borough	1,543	10
Ship Bottom Borough	0	0
South Toms River Borough	3,706	14
Stafford Township	26,766	50
Surf City Borough	0	0
Toms River Township	91,029	46
Tuckerton Borough	0	0
Total	243,955	320

Table 4.3.12-2 provides an estimate of parcels and values by municipality within the 10-mile EPZ.

Table 4.3.12-2 **Number and Dollar Value of Improvements on Vulnerable Parcels at Risk to Nuclear Incidents by Municipality (NJDEP, MOD IV Tax Data, 2017)**

Municipality	Parcels located in 10-Mile EPZ	Total Parcels in Municipality	Percent Vulnerable Parcels	Dollar Value of Improvements on Vulnerable Parcels
Barnegat Light Borough	1,448	1,448	100%	$332,274,100
Barnegat Township	13,192	13,701	96%	$1,401,175,450
Bay Head Borough	0	1,223	0%	$0
Beach Haven Borough	0	3,098	0%	$0
Beachwood Borough	4,325	4,325	100%	$550,192,600
Berkeley Township	44,114	56,660	78%	$2,277,754,285
Brick Township	0	55,329	0%	$0
Eagleswood Township	0	4,524	0%	$0
Harvey Cedars Borough	1,487	1,487	100%	$365,896,500
Island Heights Borough	1,024	1,024	100%	$122,544,000
Jackson Township	0	22,210	0%	$0
Lacey Township	47,648	51,408	93%	$2,261,607,600
Lakehurst Borough	0	879	0%	$0
Lakewood Township	0	25,912	0%	$0
Lavallette Borough	0	2,991	0%	$0
Little Egg Harbor Township	0	13,046	0%	$0
Long Beach Township	2,332	10,458	22%	$672,276,900

Municipality	Parcels located in 10-Mile EPZ	Total Parcels in Municipality	Percent Vulnerabl e Parcels	Dollar Value of Improvements on Vulnerable Parcels
Manchester Township	0	38,468	0%	$0
Mantoloking Borough	0	875	0%	$0
Ocean Gate Borough	1,202	1,202	100%	$131,718,600
Ocean Township	10,167	10,167	100%	$765,966,600
Pine Beach Borough	2,976	2,976	100%	$138,238,900
Plumsted Township	0	3,304	0%	$0
Point Pleasant Beach Borough	0	3,639	0%	$0
Point Pleasant Borough	0	8,574	0%	$0
Seaside Heights Borough	0	2,265	0%	$0
Seaside Park Borough	623	2,490	25%	$94,188,400
Ship Bottom Borough	0	2,257	0%	$0
South Toms River Borough	1,354	1,354	100%	$140,407,100
Stafford Township	11,984	15,715	76%	$1,882,580,400
Surf City Borough	0	2,557	0%	$0
Toms River Township	4,327	53,218	8%	$801,799,700
Tuckerton Borough	0	2,187	0%	$0
Total	**148,203**	**420,971**	**35%**	**$11,938,621,135**

One concern within Ocean County is the potential for contamination of food, soil, and water. Ocean County's 7,969 acres of farmland made up of 178 farms are vulnerable to radiological contamination in the event of a nuclear incident. According to the 2012 USDA Census of Agriculture, the market value of all agricultural products of these farms was approximately $11.5 million (USDA NASS, 2012).

Water contamination is a major concern in the event of a nuclear incident. Public water supplies, domestic drinking water wells, and local aquatic life are all vulnerable to the impacts of a nuclear incident. Some portion of the agricultural products would likely be lost if a nuclear event occurred. Estimated agricultural loss for a nuclear incident is dependent on time of year; an incident that occurs during the prime growing and harvesting season will have a larger impact on the County than an event that happens in the off season.

Ocean County communities' vulnerability to nuclear incidents can be reduced by emergency planning at the county and municipal levels. Routine tests are conducted annually at the Oyster Creek plant to ensure that the warning systems function properly (Exelon Corporation, 2013). Oyster Creek has alert sirens located within 20 miles of the facility including those within the EPZ. With these systems in place and planning mechanisms on hand, Ocean County citizens will be better prepared for a nuclear emergency.

4.3.13 Terrorism

4.3.13.1 Location and Extent

Terrorist attacks can occur anywhere at any time. The State of New Jersey is a particularly attractive target for potential terrorist activity because of its dense population and location relative to major urban areas. Ocean County is an area of interest in terms of protection because of its central and coastal proximity in New Jersey.

The National Terrorism Advisory System (NTAS) communicates information about terrorist threats by providing detailed information to the public, government agencies, first responders, airports and other transportation hubs, and the private sector. When there is a threat, an NTAS Alert will be announced by the Secretary of Homeland Security and will be shared with the public. It may include specific information about the nature of the threat, including the geographic region, mode of transportation, or critical infrastructure potentially affected, as well as steps that individuals and communities can take to protect themselves and help prevent, mitigate or respond to the threat. The alert indicates whether the threat is elevated or imminent. Elevated threats are when there is no specific information about the timing or location. Imminent threats are when it is believed the threat is impending or very soon. The alerts will be posted online and released to the news media for distribution. The United States Department of Homeland Security (USDHS) will also distribute alerts through its social media channels (USDHS, 2015).

In recent years there has been an evident evolution of the tactics used in terrorist attacks, and actions should be taken to prepare for prevention of terrorism. Community engagement is important in making the population aware of how to recognize potential threats and/or types of recruitment tactics (USDHS, 2015). By addressing terrorism in this plan, the goal is to prepare Ocean County to respond to potential instances of terrorism.

4.3.13.2 Range of Magnitude

The effect of a terrorism event can vary depending on the type of attack and the magnitude of the event or events. A terrorism event can cause public fear regarding the use of mass transportation or leaving their homes in the event of a biological or nuclear attack. Communication systems, both public and private, can fail because of an overwhelming amount of usage, or damage to its infrastructure. Healthcare facilities can become quickly inundated and must be prepared to triage injured patients, handle mass casualties, and conduct decontamination operations. Various types of terrorism are discussed in the sections below:

- Armed Attacks and Assassinations: Armed attacks include raids and ambushes. Assassinations are the killing of a selected victim, usually by bombings or small arms. Drive-by shootings is a common technique employed by unsophisticated or loosely organized terrorist groups. Historically, terrorists have assassinated specific individuals for psychological effect.
- Arson and Firebombing: Incendiary devices are inexpensive and easy to hide. Arson and firebombings are easily conducted by terrorist groups that may not be as well organized, equipped, or trained as a major terrorist organization. An act of arson or firebombing

against a utility, hotel, government building, or industrial center portrays an image to the public that the ruling government is incapable of maintaining order.

- Bioterrorism: Bioterrorism refers to the intentional release of toxic biological agents to harm and terrorize civilians, in the name of a political or other cause. The United States Centers for Disease Control and Prevention (CDC) has classified the viruses, bacteria, and toxins that could be used in an attack. Category A Biological Diseases are those most likely to do the most damage. They include:
    - Anthrax (Bacillus anthracis)
    - Botulism (Clostridium botulinum toxin)
    - The Plague (Yersinia pestis)
    - Smallpox (Variola major)
    - Tularemia (Francisella tularensis)
    - Hemorrahagic fever, due to Ebola Virus or Marburg Virus
- Bombings: Bombings are the most common type of terrorist act. Explosive devices used in bombing can come in many forms ranging from a pipe bomb to a sophisticated device capable of causing massive damage and loss of life (The National Academies and Homeland Security). Typically, improvised explosive devices are inexpensive and easy to make. Modern devices are smaller and harder to detect, and contain very destructive capabilities. The accessibility, as well as the frequency of explosive attack, makes this a hazard of concern
- Cyber Terrorism: Cyber terrorists use information technology to attack civilians and draw attention to the terrorists' cause. This may mean that they use information technology, such as computer systems or telecommunications, as a tool to orchestrate a traditional attack. More often, cyber terrorism refers to an attack on information technology itself in a way that would radically disrupt networked services. For example, cyber terrorists could disable networked emergency systems or hack into networks housing critical financial information. There is wide disagreement over the extent of the existing threat by cyber terrorists.
- Ecoterrorism: Ecoterrorism is a recently coined term describing violence in the interests of environmentalism. In general, environmental extremists sabotage property to inflict economic damage on industries, businesses, or persons perceived as harming animals or the natural environment. Targets of ecoterrorist attacks have included fur companies, logging companies, and animal research laboratories.
- Hijackings and Skyjackings: Hijacking is the seizure by force of a surface vehicle, its passengers, and/or its cargo. Skyjacking is the taking of an aircraft, which creates a mobile, hostage barricade situation; provides terrorists with hostages from many nations; and draws heavy media attention. Skyjacking also provides mobility for the terrorists to relocate the aircraft to a country that supports their cause and provides them with a human shield, making retaliation difficult.
- Kidnappings and Hostage-Takings: Terrorists use kidnapping and hostage-taking to establish a bargaining position and to elicit publicity. Kidnapping is one of the most difficult acts for a terrorist group to accomplish, but, if a kidnapping is successful, it can

gain terrorists money, release of jailed comrades, and publicity for an extended period. Hostage-taking involves the seizure of a facility or location and the taking of hostages present in that facility. Unlike a kidnapping, hostage-taking provokes a confrontation with authorities. It forces authorities to either make dramatic decisions or to comply with the terrorist's demands. It is overt and designed to attract and hold media attention. The terrorists' intended target is the audience affected by the hostage's confinement, not the hostage.

- Nuclear Terrorism: Nuclear terrorism refers to a number of different ways nuclear materials might be exploited as a terrorist tactic. These include attacking nuclear facilities, purchasing nuclear weapons, or building nuclear weapons or otherwise finding ways to disperse radioactive materials. Since World War II, several nations have been able to develop nuclear weapon technology; and, some nations have or are in the process of establishing the capability of nuclear weaponry.

4.3.15.1 Past Occurrence

Terrorist attacks have impacted Ocean County in the past. Table 4.3.12-1 provides details on each attack within and within proximity to Ocean County.

Table 4.3.13-1 Previous terrorist attacks within and within proximity to Ocean County

Date	Type of Event	Loaction of Event	Event Description
4/1/1987	Terroristic Threat	Atlantic County	Apparent Islamic terrorist plan to bomb casinos in Atlantic City was called off due to alerted authorities.
9/11/2001	Terrorist Attack	Various Locations Along the East Coast	The September 11, 2001 terrorist attacks killed nearly 3,000 civilians in coordinated attacks in New York City and Washington D.C.
5/7/2007	Attempted Terrorist Attack	Burlington County	Six men planned to attack Fort Dix, but the plot was stopped by authorities who arrested the individuals prior to the planned event.
9/17/2016	Terrorist Attack	Ocean County	A pipe-bomb exploded near Seaside Park Racecourse during a Marine Corp charity 5k run.

4.3.15.2 Future Occurrence

While the potential for future terrorism events in Ocean County is difficult to predict, the combination of past event and potential terrorist targets make a terrorism event possible. Efforts from local, state, and federal officials must be coordinated to prevent future terrorist incidents from occurring. However, despite the best efforts of these entities, the reality is that a terrorist attack may occur in Ocean County or the surrounding areas, and the County should be prepared for that.

4.3.15.3 Vulnerability Assessment

The entire population of Ocean County is exposed to the effects of terrorism and terrorist incidents. Since terrorists typically prefer to impact the greatest number of individuals in a given location, it can be inferred that individuals living in highly populated areas will have greater exposure to terrorist incidents than those living in rural areas. Other indicators of vulnerable populations may be commuters using public transportation on a regular basis (as mass transit systems have been the targets of past terrorist attacks outside New Jersey), locations in and around military bases or government facilities (as was planned for Fort Dix in New Jersey in 2007), as well as high-profile gatherings of a large number of people (such as the attacks that occurred at the 5k Seaside Park Racecourse on Jersey Shore). However, because terrorist attacks are designed to take victims by surprise, predicting the location and nature of potential attacks is extremely difficult, as is assessing the population's vulnerability.

Critical facilities are exposed to terrorist attacks, particularly because of the impact that an attack has on these types of facilities. Dams, power stations, and tunnels are all examples of critical infrastructure and facilities that are vulnerable. Additionally, communications systems, first-responder stations, and emergency operations centers are all vulnerable to terrorist attacks. All State facilities are exposed to terrorist attacks. The vulnerability of these facilities is derived from importance of these buildings and the visual symbols that the buildings represent in New Jersey. Particularly vulnerable are military facilities that are located in Brick, Toms River, Manchester Township, and Lakehurst. Military facilities outside of Ocean County, but in surrounding areas, are at risk as well.

Measuring the economic impact of a terrorist attack on Ocean County is a difficult task. The initial impact can be measured in immediate costs such as costs related to responding to the event, and those associated with the immediate loss of productivity due to closed businesses. The fuller economic impact includes long-term costs such as terrorism mitigation activities.

If an attack would occur along the Coast of Ocean County, effecting the Jersey Shore, the impact of lost tourism dollars would be significant. Depending on the type and location of an act of terrorism, it can impact the environment and result in loss of life for humans and animals. A radiological device or an improvised nuclear device would have a long-term impact that could cost billions of dollars to remediate. Additionally, an attack on waste treatment, natural gas, petroleum, or chemical facilities could also have long term environmental impacts in Ocean County.

4.3.14 Transportation Accidents

4.3.14.1 Location and Extent

Transportation accidents encompass any incident involving air, rail and roadway travel resulting in death, serious injury, extensive property loss, or property damage. Accidents may involve hazardous materials that are harmful to the environment and to human beings; these are considered under the hazardous materials section of this document.

Ocean County is ranked 2nd in the state as having the most miles of local roads and streets maintained by local municipalities. About 80 percent of the County's road miles are considered local (BTDD, 2017). The highway system in Ocean County is shown in Figure 4.3.14-1.

Figure 4.3.14-1 2010 Functional Classification, revised 2017 (NJDOT 2017)

There are approximately 3,110 miles of roadway in the county as shown in Table 4.3.14-1.

Table 4.3.14-1 Miles of Roadway in Ocean County by Functional Class (NJDOT, 2015)

Functional Class	Miles of Roadway
Rural Interstate	0
Rural Arterial	12
Rural Minor Arterial	0
Rural Major Collector	45
Rural Minor Collector	2
Rural Local	232
Urban Interstate	9
Urban Freeway/Expressway	39
Urban Principal Arterial	141
Urban Minor Arterial	197
Urban Collector Major	188
Urban Collector Minor	11
Urban Local	2,234
Total	3,110

Ocean County has one airport with a Federal Aviation Administration (FAA) tower, called Lakewood Airport. The following airports accommodate small corporate and passenger planes are available to the public:

1. Ocean County Airport (Berkeley)
2. Eagles Nest Airport (Eagleswood Township)

4.3.14.2 Range of Magnitude

The outcome of transportation accidents can range from human injury to death and from minor property damage to extensive property loss. Road and railway accidents can increase due to poor weather conditions and the resulting wet or icy roads or rails. Hazardous materials releases may result due to road and railway incidents, potentially endangering the surrounding environment and population when a crash occurs. One of the worst transportation related incidents recently occurred on October 10, 2012, when two teenage sisters were killed in a head-on collision in Jackson Township (Muchanic, 2012).

4.3.14.3 Past Occurrence

Highway incidents involving motor vehicles are the most common transportation accidents in the County. Crash facts and statistics were obtained from NJDOT and the National Highway Traffic Safety Administration's (NTSA) Fatality Analysis Reporting System (FARS). Table 4.3.14-2 displays the total vehicle crashes, the number of injury crashes and the number of fatal crashes between 2007 and 2016. Table 4.3.14-3 displays crash related fatalities by year as reported by the NTSA. Although the population has increased in the County over the last 2 decades, crash fatality rates have fluctuated up and down, but generally remained about the same.

Table 4.3.14-2 Ocean County Crash Data from NJDOT Crash Records (NJDOT, 2015)

Category	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Total Crashes	17,676	17,180	17,683	18,241	16,750	16,640	17,658	16,540	14,233	152,601
Injury Crashes	4,367	4,190	4,054	4,258	3,755	3,855	3,883	3,748	3,386	35,496
Fatal Crashes	65	40	53	60	47	49	42	38	39	433

Table 4.3.14-3 Crash Related Fatalities by year in Ocean County, NJ as reported by National Highway Traffic Safety Administration (NHTSA, 2017)

YEAR	NUMBER OF FATALITIES
1994	74
1995	57
1996	50
1997	57
1998	68
1999	46
2000	43
2001	69
2002	51
2003	50
2004	66
2005	38
2006	62
2007	74
2008	38
2009	63
2010	54
2011	47
2012	50
2013	43
2014	44
2015	38
2016	39

On December 23, 2012, a small plane crashed on Bay Head Beach. The plane engine malfunctioned, forcing the pilot to perform an emergency landing on the beach. No injuries were sustained due to the crash (NBC, 2012).

In November 2017, a Beachwood pilot died after crashing his private plane after he lost control when he encountered severe wind shear (NJ Advance Media, 2017).

In May 2017, a small antique plane crashed near Laurel Hill Lane in Eagleswood Township resulting in no injuries (Townsquare Media, 2017).

4.3.14.4 Future Occurrence

Transportation related accidents will most likely increase with growing population and increased vehicle use. If mitigation strategies are not utilized, transportation incidents may increase. Therefore, based on this and past occurrences, the probability of transportation accidents is characterized as highly likely.

For 2016, the average rate of aviation accidents for general aviation is 3.46 accidents per 100,000 flight hours (FAA, 2017).

4.3.14.5 Vulnerability Assessment

Transportation accidents can occur anywhere in Ocean County. Accidents are most common and often more severe along major routes such as the I-195, the Garden State Parkway, US-9, or NJ 35 along the coast where traffic volumes are greater.

4.3.15 Urban Fire and Explosion

4.3.15.1 Location and Extent

Urban fire and explosions can cause localized or widespread damage depending on their size and intensity. Vehicles and/or structures are often the sites where fires ignite due to human mishaps and various fuel sources or flammable materials. Residential structure fires are the most common, especially in denser urban or suburban areas (US Fire Administration, 2009). The density of buildings allows fires to spread more easily.

Urban fires and explosions are often started by other hazards, namely severe storms, drought, transportation accidents, hazardous materials releases, or by criminal activity such as arson or terrorism.

4.3.15.2 Range of Magnitude

Fire damage can vary greatly by intensity and scale, from minor smoke and/or water damage to the destruction of buildings. Depending on the severity of the explosion or fire, people can be displaced from their homes for several months to years. Urban fires and explosions can also cause injuries and death. In 2014, the fire death rate in New Jersey was 2.4 per 1,000 fires, which is slightly higher than the 2.3 national rate (USFA, 2014). Though small fires cause limited damage, the overall impact of all small fires is often much greater than the impact of the few major fire and explosion hazards that occur.

Fires and explosions often result in significant economic consequences. If businesses or personal property are damaged due to urban fires and explosions, wages and investment in properties may be lost. Public, private, and non-profit agencies are relied upon to provide relief to victims in the wake of fire incidents. Urban fire and explosions can also affect human services agencies such as community support programs, health and medical services, public assistance programs and social services. Their facilities and equipment can be damaged, emergency communications may be disrupted, and critical medical supplies may be lost. These facilities may also see a wave of victims who are suffering from the effects of urban fire, including loss of their home, place of business, or other personal property.

One of the worst urban fire events in Ocean County occurred during Hurricane Sandy. In Brick Township, 14 homes were destroyed by fires fueled by natural gas. Firefighters could not reach the fire to extinguish it at first, as the roads were blocked by debris and high water (AP, 2012).

4.3.15.3 Past Occurrence

A number of urban fire and explosion events occur in Ocean County each year. Most events are small, contained events that only affect a limited number of structures.

In 2010 and again in 2012, fires have destroyed trailers at the Roberts trailer park in Toms River (Galioto, 2012). In Manahawkin in 2010, Sweet Jenny's Restaurant, a local favorite, was completely engulfed by flames. Firefighters were eventually able to control the flames, but not before the log cabin restaurant was destroyed (Brashear, 2010).

During Hurricane Sandy, as many as 20 fires broke out in Ocean County. Most occurred in areas where water levels were high, due to the storm, thus inhibiting firefighters to subdue the flames. One fire was sparked at the Beachwood Plaza shopping Center in Berkeley Township while several other fires occurred in the Mystic Island section of Little Egg Harbor Township (NJ.com, 2012). During Hurricane Sandy, 60 of the 118 bungalows in the Camp Osborne area of Brick were damaged during fires fueled by wind and natural gas leaks. The fires continued for approximately two days.

On September 12, 2013, a massive fire erupted in Seaside Park, eventually destroying at least 50 businesses. Heavy winds, gusting 23 to 30 mph over a sustained period of time, exacerbated the fire and pushed it into Seaside Heights. More than 400 firefighters were called to the scene. Damage estimates have been reported at approximately $4,000,000. Figure 4.3.14-2 shows the boardwalk after the fire was mostly extinguished.

Figure 4.3.15-1 Seaside Heights boardwalk fire. (CBS News 2013).

The Seaside Heights Boardwalk fire was a clear example of how hazards can build on and, in some cases, exacerbate each other. September 12th was a very windy day for Seaside Heights and the peak wind gusts were at 20 to 30 miles per hour.

4.3.15.4 Future Occurrence

Urban fire and explosion events will continue to occur in Ocean County. However, major fires or explosions will likely occur less frequently than minor fire incidents. Though residential fires are common, industrial fires involve greater risk because of the potential for large quantities of flammable materials or fuel sources. The probability that an urban fire or explosion will occur can be considered highly likely, as defined by the Risk Factor methodology probability criteria (see Table 4.4.1-1).

4.3.15.5 Vulnerability Assessment

Development areas, towns, or cities where buildings are closely spaced are more vulnerable to urban fire and explosion events; in Ocean County, the denser, more heavily populated jurisdictions include Lakewood, Toms River, Jackson, Brick, and Manchester Townships (US Census, 2010).

To determine vulnerability of buildings to urban fires and explosions, detailed information on the design specifications, specifically fire codes, used for the construction of those buildings is required. All communities in New Jersey are required to comply with the International Building, Mechanical, Fuel Gas, and Residential Codes. The state also adopted the National Electrical Code, which was provided by the National Fire Protection Association. The adoption and enforcement of these codes should help to decrease the overall vulnerability of structures in Ocean County. Unfortunately, these regulations only impact new construction, as well as changes to existing structures, under the Rehabilitation sub code. Older buildings will continue to remain significantly vulnerable to urban fire and explosion events (State of New Jersey, 2013).

4.3.16 Utility Interruption

4.3.16.1 Location and Extent

Ocean County has experienced utility interruption for each of the following services: fuel, water, electric, and telecommunications capabilities. Utility interruptions are caused by equipment failure, accidents, and most often by natural hazards. Windstorms and severe winter storms alike can cause major power outages due to snow and wind that result in downed trees and wires. Supplies of potable water, electricity, and fuel at utility facilities can be compromised if flooding occurs. Depending on the source of the interruption, the geographic extent of utility failure can spread countywide or further. Traffic accidents and wind damage tend to cause localized outages whereas tornados, thunderstorms, and winter storms often result in regional utility interruptions. Rolling blackouts may be caused by heat waves, resulting in loss of power for an extended period of time.

4.3.16.2 Range of Magnitude

Utility interruptions and power failures tend to impact widespread regions rather than localized areas. Utility interruption can lead to lack of water supply (either because of a damaged pipeline or well pump failure), food spoilage, loss of heating or air conditioning, basement flooding (sump pump failure), lack of indoor lighting, and loss of communication services. Interruption events range from a minor inconvenience to a serious hazard, however the degree of damage or harm depends on the population affected, the time of year, and the severity of the outage. Elderly populations and small children rely heavily on utilities to maintain safe ambient temperatures, so loss of heating and cooling capability is more dangerous for them in the winter and summer months. The length of time that a utility is out of service determines the level of impact on residents and businesses, and affects the total cost of an event. Significant power failures occur when utility interruptions last long enough to require that emergency management organizations or shelters provide basic necessities to residents.

Short term disruption in utilities can impact basic services of business, government, and private citizens such as traffic signals, elevators, and retail sales. One of the worst utility interruptions experienced in Ocean County occurred in September 2003 during Tropical Storm Isabel. The storm downed numbers of trees and lines, leading power loss for 220,000 Jersey Central Power and Light customers and 162,000 Connectiv Energy customers (NCDC, 2013).

4.3.16.3 Past Occurrence

Some of the worst statewide interruptions occurred in 1965, 1977, 2003, and most recently in 2012 during Hurricane Sandy. Statewide, the outages during Hurricane Sandy were widespread and long-lasting. Public Service Enterprise Group (PSE&G) had 1.4 million outages at the height of the disaster while Jersey Center Power & Light and Atlantic City Electric reported 958,000 and 121,000 customers without power respectively (Heyboer, 2012). Minor power outages occur annually in Ocean County.

In 2017, over 24,000 customers were affected in Lacey, Barnegat, Berkley and Waretown from a problem with the Oyster Creek Substation in Lacey Township as reported by JCP&L.

4.3.16.4 Future Occurrence

Utility interruptions can happen unexpectedly and are difficult to predict. Short-term interruptions are more likely to occur whereas long-term events are less common. Severe storms often cause outages, so communities should prepare for utility interruptions when severe weather arrives. Therefore, the future occurrence of utility interruptions should be considered *highly likely* as defined by the Risk Factor Methodology probability criteria (see Table 4.4-1).

4.3.16.5 Vulnerability Assessment

Risk of utility interruption is fairly uniform across the county. However, some locations are more vulnerable to the effects of losing power or another vital service. Hospitals and emergency medical facilities as well as retirement homes and senior centers are among the most vulnerable to power outages, due to the critical nature of these facilities. Back-up power generators are often used at these facilities, but the loss of electricity may still result in hot or cold temperatures for which elderly populations are particularly vulnerable. Retail stores, businesses, and government buildings may have security systems that are vulnerable to utility interruption.

Major power electric providers in Ocean County include Atlantic City Electric Company and Jersey Central Power & Light. Each company has taken steps to reduce the vulnerability their service area to utility interruptions. The most common cause of power outages are trees and overgrown vegetation. In response, Jersey Central Power & Light operates a Vegetation Management Program to clear overgrown trees, shrubs, and brush from power lines, equipment, and facilities (FirstEnergy Corp, 2012). Atlantic City Electric Company utilizes automatic sensing equipment, should a dangerous condition arise. Though this may result in a temporary power outage, it gives the company time to remedy the situation and then restore power. In order to reinforce their system, Atlantic City Electric has installed animal guards to protect against animals chewing through wire, insulated wire to better resist the impact of fallen tree limbs, and grounded shield wire to protect against lightning strikes (ACE, 2013).

4.4 Hazard Vulnerability Summary

4.4.1 Methodology

Ranking hazards helps communities set goals and priorities for mitigation based on their vulnerabilities. A Risk Factor (RF) is a tool used to measure the degree of risk for identified hazards in a particular planning area. The RF can also be used to assist local community officials in ranking and prioritizing those hazards that pose the most significant threat to their area based on a variety of factors deemed important by the planning team and other stakeholders involved in the hazard mitigation planning process. The RF system relies mainly on historical data, local knowledge, local knowledge from the municipalities and information collected through development of the hazard profiles included in Section 4.3. The RF approach produces numerical values that allow identified hazards to be ranked against one another; the higher the RF value, the greater the hazard risk.

RF values were obtained by assigning varying degrees of risk to five categories for each of the sixteen hazards profiled. Those categories include: *probability*, *impact*, *spatial extent*, *warning* *time* and *duration*. Each degree of risk was assigned a value ranging from 1 to 4. The weighting factor is shown in Table 4.4-1. To calculate the RF value for a given hazard, the assigned risk value for each category was multiplied by the weighting factor. The sum of all five categories equals the final RF value, as demonstrated in the example equation:

Risk Factor Value = [(Probability x .30) + (Impact x .30) +
(Spatial Extent x .20) + (Warning Time x .10) + (Duration x .10)]

Table 4.4-1 summarizes each of the five categories used for calculating a RF for each hazard. According to the weighting scheme applied, the highest possible RF value is 4.0.

Table 4.4.1-1 Summary of Risk Factor Approach

Summary of Risk Factor approach used to rank hazard risk.

Risk Assessment Category	Degree of Risk: Level	Degree of Risk: Criteria	Degree of Risk: Index	Weight Value
PROBABILITY *What is the likelihood of a hazard event occurring in a given year?*	UNLIKELY	LESS THAN 1% ANNUAL PROBABILITY	1	30%
	POSSIBLE	BETWEEN 1% & 49.9% ANNUAL PROBABILITY	2	
	LIKELY	BETWEEN 50% & 90% ANNUAL PROBABILITY	3	
	HIGHLY LIKELY	GREATER THAN 90% ANNUAL PROBABILTY	4	
IMPACT *In terms of injuries, damage, or death, would you anticipate impacts to be minor, limited, critical, or catastrophic when a significant hazard event occurs?*	MINOR	VERY FEW INJURIES, IF ANY. ONLY MINOR PROPERTY DAMAGE & MINIMAL DISRUPTION ON QUALITY OF LIFE. TEMPORARY SHUTDOWN OF CRITICAL FACILITIES.	1	30%
	LIMITED	MINOR INJURIES ONLY. MORE THAN 10% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE DAY.	2	
	CRITICAL	MULTIPLE DEATHS/INJURIES POSSIBLE. MORE THAN 25% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR MORE THAN ONE WEEK.	3	
	CATASTROPHIC	HIGH NUMBER OF DEATHS/INJURIES POSSIBLE. MORE THAN 50% OF PROPERTY IN AFFECTED AREA DAMAGED OR DESTROYED. COMPLETE SHUTDOWN OF CRITICAL FACILITIES FOR 30 DAYS OR MORE.	4	
SPATIAL EXTENT *How large of an area could be impacted by a hazard event? Are impacts localized or regional?*	NEGLIGIBLE	LESS THAN 1% OF AREA AFFECTED	1	20%
	SMALL	BETWEEN 1 & 10.9% OF AREA AFFECTED	2	
	MODERATE	BETWEEN 11 & 25% OF AREA AFFECTED	3	
	LARGE	GREATER THAN 25% OF AREA AFFECTED	4	
WARNING TIME *Is there usually some lead time associated with the hazard event? Have warning measures been implemented?*	MORE THAN 24 HRS	SELF-DEFINED *(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	12 TO 24 HRS	SELF-DEFINED	2	
	6 TO 12 HRS	SELF-DEFINED	3	
	LESS THAN 6 HRS	SELF-DEFINED	4	
DURATION *How long does the hazard event usually last?*	LESS THAN 6 HRS	SELF-DEFINED *(NOTE: Levels of warning time and criteria that define them may be adjusted based on hazard addressed.)*	1	10%
	LESS THAN 24 HRS	SELF-DEFINED	2	
	LESS THAN 1 WEEK	SELF-DEFINED	3	
	MORE THAN 1 WEEK	SELF-DEFINED	4	

4.4.2 Ranking Results

Using the methodology described in Section 4.4.1, Table 4.4.2-1 lists the Risk Factor calculated for each of the 16 potential hazards identified in the HMP. Hazards identified as high risk have risk factors greater than 2.5. Risk Factors ranging from 2.0 to 2.4 were deemed moderate risk hazards. Hazards with Risk Factors 1.9 and less are considered low risk.

Table 4.4.2-1 **Risk Factors for Hazard Profiles**

Risk	Hazard	Risk Assessment Category					Risk Factor
		Probability (1-4)	Impact (1-4)	Spatial Extent (1-4)	Warning Time (1-4)	Duration (1-4)	
High	Flood, Flash Flood, Ice Jam	4	3	3	1	4	3.2
	Hurricane, TS, Nor'easter	2	4	4	1	4	3.1
	Utility Interrupt.	4	2	3	3	4	3.1
	Winter Storm	4	2	4	1	3	3
	Wildfire	3	2	3	4	2	2.7
Moderate	Extreme Temp.	2	2	4	1	3	2.4
	Coastal Erosion	4	2	1	2	1	2.3
	Environmental Hazards	3	2	1	4	2	2.3
	Drought	2	1	4	1	4	2.2
	Terrorism	1	3	2	4	2	2.2
	Transport. Accidents	4	1	1	4	1	2.2
	Urban Fire and Explosion	4	1	1	4	1	2.2
	Nuclear Incidents	1	2	3	4	2	2.1
Low	Tornado, Wind Storm	2	2	1	3	1	1.8
	Subsidence	1	1	2	4	1	1.5
	Earthquake	1	1	2	4	1	1.5

Based on these results, there are five high risk hazards, eight moderate risk hazards and two low risk hazards in Ocean County. A risk assessment result for the entire county does not mean that each municipality is at the same amount of risk to each hazard. Table 4.4.2-2 shows the different municipalities in Ocean County and whether their risk is greater than (+), less than (-), or equal to (=) the risk factor assigned to the County as a whole. This table was developed through a combination of the findings in the hazard profiles of Section 4.3 and input from municipalities during individual municipal meetings. Municipal officials reviewed the selected hazards and considered how their community's risk related to the county level risk.

Table 4.4.2-2 Comparative Jurisdictional Risk Factor for High Hazards

Municipality	Flood	Hurricane, TS, Nor'easter	Utility Interrupt.	Winter Storm	Wildfire	Extreme Temp.	Coastal Erosion	Envir. Hazards	Drought	Terrorism	Transport. Accidents	Urban Fire and Explosion	Nuclear Incidents	Tornado, Wind Storm	Subsidence	Earthquake
	3.2	3.1	3.1	3.0	2.7	2.4	2.3	2.3	2.2	2.2	2.2	2.2	2.1	1.8	1.5	1.5
Barnegat Light Borough	=	=	=	=	-	=	+	-	=	+	-	=	+	=	+	=
Barnegat Township	+	+	+	=	+	=/+	+	=	=	+	=	+	+	=	+	=
Bay Head Borough	+	+	+	=	-	=	+	+	-	+	=	=	=	=	+	=
Beach Haven Borough	+	+	+	=	-	=	+	-	-	+	-	=	=	=	+	=
Beachwood Borough	+	=	+	+	=	=	-	=	=	=	=	+	=	+	-	-
Berkeley Township	+	+	+	=	+	=	+	=/+	=	+	=	+	+	=	+	=
Brick Township	+	+	+	=	+	=	+	+	=	=	+	+	=	=	+	=
Eagleswood Township	+	=/+	+	=	-	=	+	=/+	=	=	+	=	=	=	+	=
Harvey Cedars Borough	+	+	+	=	-	+	+	+	-	=	=	=	+	=	+	=
Island Heights Borough	+	+	+	=	-	=	=	-	=	+	=	+	+	=	=	=
Jackson Township	=	=	+	=	+	=	-	+	=	=	+	+	=	=	-	=
Lacey Township	+	+	+	=	+	=	=	=	=	=	+	+	+	+	=	+
Lakehurst Borough	-	-	=	=	+	=	-	+	=	=	+	+	=/+	=	-	=
Lakewood Township	-	-	=	=	+	=	-	+	=	+	+	+	=/+	=	-	=
Lavallette Borough	=	=	+	=	=	=	-	+	=	=	=	=	=	=/+	-	=

	Flood	Hurricane, TS, Nor'easter	Utility Interrupt.	Winter Storm	Wildfire	Extreme Temp.	Coastal Erosion	Envir. Hazards	Drought	Terrorism	Transport. Accidents	Urban Fire and Explosion	Nuclear Incidents	Tornado, Wind Storm	Subsidence	Earthquake
Municipality	3.2	3.1	3.1	3.0	2.7	2.4	2.3	2.3	2.2	2.2	2.2	2.2	2.1	1.8	1.5	1.5
Little Egg Harbor Township	+	+	+	+	+	=	=	-	+	=	-	+	=	=	=	=
Long Beach Township	+	+	+	=	-	=	+	-	-	+	-	=	+	=	+	=
Manchester Township	+	+	+	=	+	=	+	-	-	=	-	+	+	=	+	=
Mantoloking Borough	+	+	+	+	+	+	-	+	-	=	+	=	=	+	-	-
Ocean Gate Borough												+				
Ocean Township	+	+	+	+	+	+	+	=	=	+	=	=	+	+	+	=
Pine Beach Borough	+	+	+	=	+	=/+	+	=	=	=	=	=	+	=	+	=
Plumsted Township	+	+	=	=	-	=	+	-	-	+	=	=	+	+	+	=
Point Pleasant Beach Borough	+	+	=	=	+	=	-	+	+	+	+				-	
Point Pleasant Borough	+	+	+	+	-	=/+	+	=	=	+	=	+	-	=	+	=
Seaside Heights Borough	+	+	+	=	-	=	+	=	=	+	=	+	=	=	+	=
Seaside Park Borough	+	+	+	=	-	=	+	=	-	+	-	+	=	+	+	=
Ship Bottom Borough	+	+	+	+	-	+	+	=	=	+	=/+	=	+	+	+	=
South Toms River Borough	+	+	=/+	-	-	=	+	+	-	=	+	=	+	+	+	=

	Flood	Hurricane, TS, Nor'easter	Utility Interrupt.	Winter Storm	Wildfire	Extreme Temp.	Coastal Erosion	Envir. Hazards	Drought	Terrorism	Transport. Accidents	Urban Fire and Explosion	Nuclear Incidents	Tornado, Wind Storm	Subsidence	Earthquake
Municipality	3.2	3.1	3.1	3.0	2.7	2.4	2.3	2.3	2.2	2.2	2.2	2.2	2.1	1.8	1.5	1.5
Stafford Township	=	+	=	=	+	-	=	=	-	=	=	+	=	+	=	-
Surf City Borough	+	+	=	=	-	=	=	-	=	=	-	+	+	-	=	-
Toms River Township	+	+	=	+	-	=	+	=	=	+	=	=	=	=	+	=
Tuckerton Borough	+	+	-	=	=	=	=	-	-	=	-	+	=	=	=	=

4.4.3 Potential Loss Estimates

Based on various kinds of available data, potential loss estimates were established for flood, flash flood, and ice jam, hurricane wind, tornado and windstorms, drought, wildfires, and winter storms. Estimates provided in this section are based on Hazus-MH, version 3.2, geospatial analysis, and previous events. Estimates are considered potential in that they generally represent losses that could occur in a countywide hazard scenario. In events that are localized, losses may be lower, while regional events could yield higher losses.

Potential loss estimates have four basic components, including:

- **Replacement Value:** Current cost of returning an asset to its pre-damaged condition, using present-day cost of labor and materials.
- **Content Loss:** Value of building's contents, typically measured as a percentage of the building replacement value.
- **Functional Loss:** The value of a building's use or function that would be lost if it were damaged or closed.
- **Displacement Cost:** The dollar amount required for relocation of the function (business or service) to another structure following a hazard event.

Figure 4.4.1-1 displays total economic losses by census block expected in a 1% annual flood event. Loss estimates include both riverine and coastal flooding, but do not include losses due to storm surge. Total economic losses include both direct building and business interruption losses. Figure 4.4.1-2 displays this same data but aggregate losses to the Census tract level for Ocean County. There are an estimated 266,271 buildings in the region with a total building replacement value (excluding contents) of 72,109 million dollars (2010 dollars). Approximately 94.12% of the buildings (and 82.99% of the building value) are associated with residential housing. For the purposes of this analysis, only critical facilities defined as Emergency

Operation Centers (20 identified), Fire (92 identified), Police (37 identified), Medical (118 identified), Schools (175 identified) and Utilities (81 identified) had replacement costs as defined in Hazus. Other critical facilities identified through the planning process or User Defined Facilities (UDFs) had no identified or modeled replacement values, therefore no Hazus analysis was performed on these sites. The full results of the Hazus-MH analysis is available in Appendix E — Hazus Reports.

While the full suite of losses is available for flooding and hurricane wind via Hazus-MH, losses for the other hazards are generally an estimation of historical damage.

The parcel data used in this plan includes the assessed value of parcel improvements provided in municipal tax assessment databases. Parcel improvements are generally understood to be the value of any structure or structures on a parcel. These values are representative of replacement value alone; content loss, functional loss, and displacement cost are not included. Figure 4.4-1 illustrates the range of parcel improvement assessed values in Ocean County. In general, the highest structure assessed values are concentrated in the northeastern portion of the county and in many of the barrier island communities. In the Pinelands area, where development is more strictly controlled and there are larger naturalized spaces, parcel improvement values are lower.

Table 4.4.3-1 Total Economic Loss by Census Block (FEMA, HAZUS)

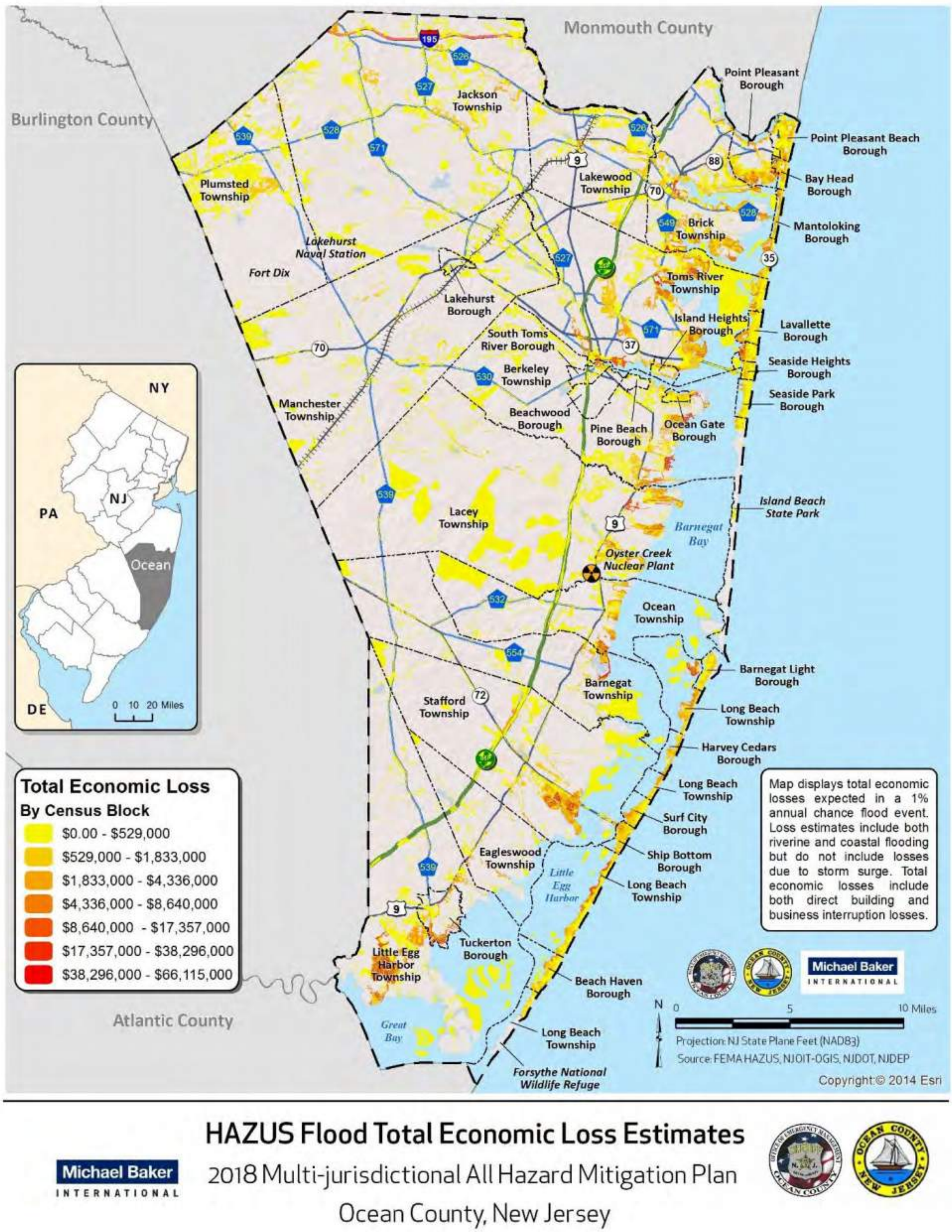


Figure 4.4.3-2 Total Economic Loss by Census Tract (FEMA, HAZUS)

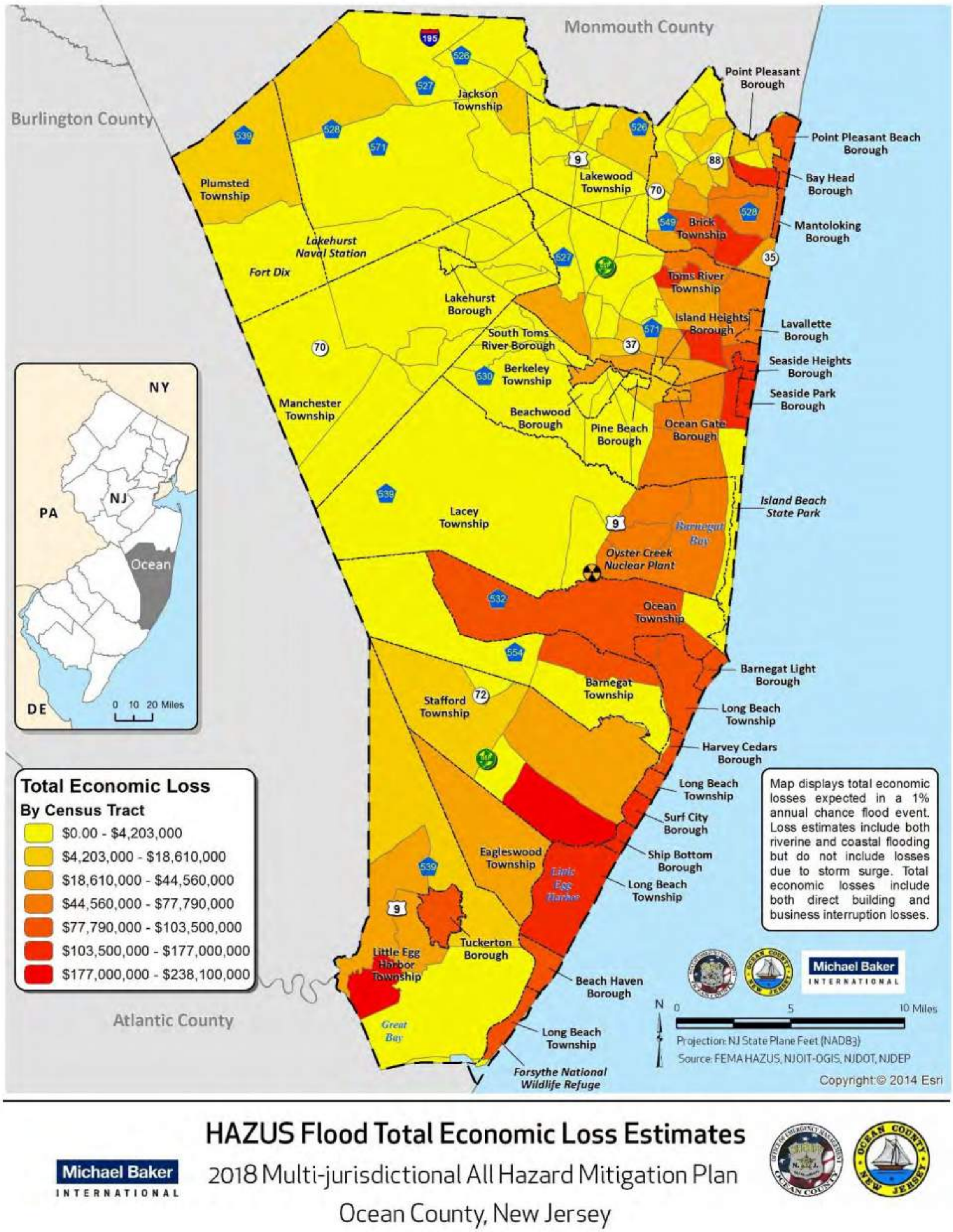
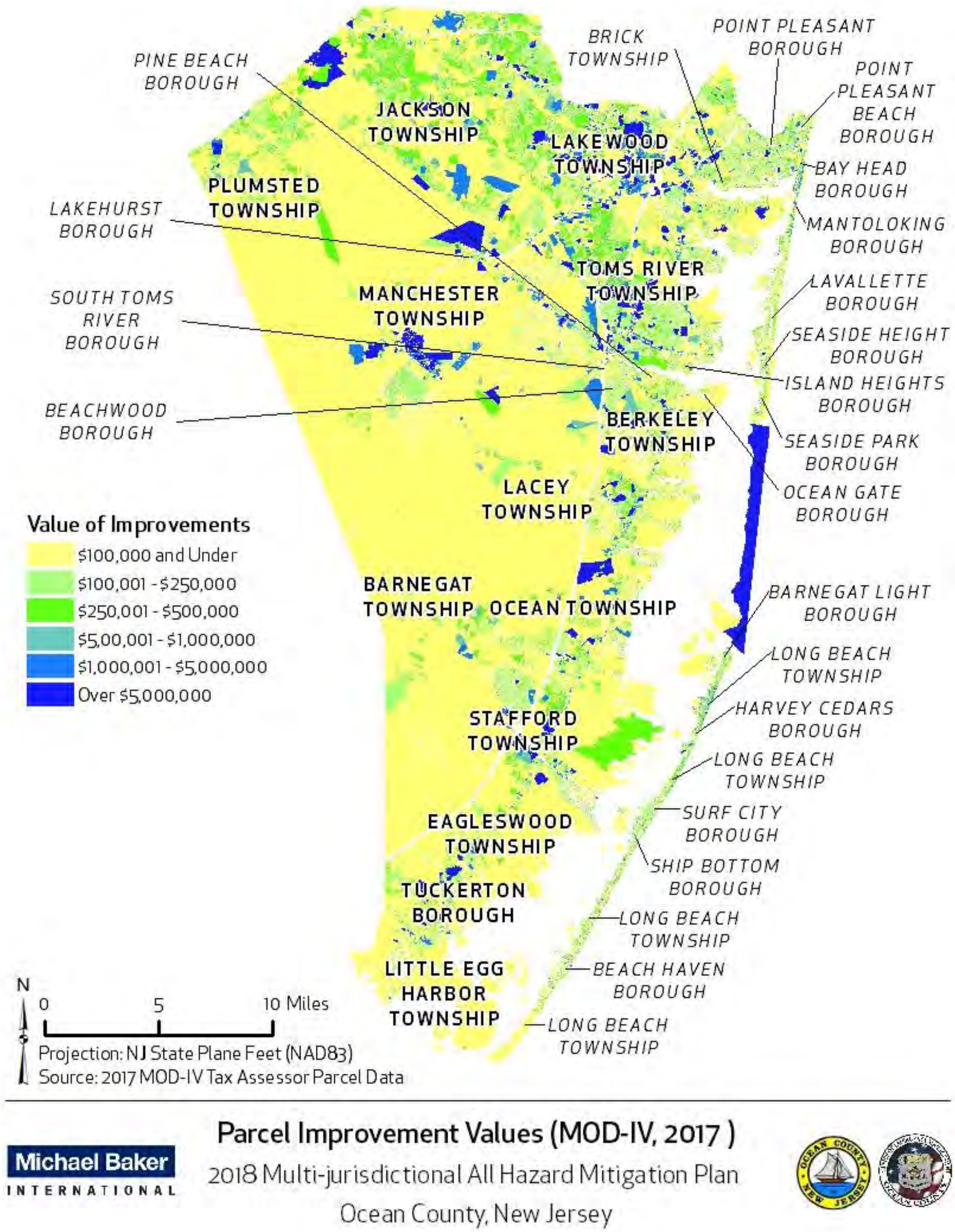


Figure 4.4.3-3 **Assessed value of parcel improvements in Ocean County. "Parcel improvements" generally equates to a building or structure value.**



4.4.4 Future Development and Vulnerability

The population in Ocean County grew 1.2% percent from the 2010 to 2015 census. The percent change in population of individual municipalities ranges from -20.9% in Ship Bottom Borough to 23.4% in Harvey Cedars Borough. This range of population percent change should be considered in comparison to the number of people living in each municipality. The range of total population for municipalities in Ocean County is 340 in Mantoloking Borough to 96,575 in Lakewood Township. The municipalities with the largest percent growth are Harvey Cedars Borough with 23.4% and Mantoloking Borough with 14.9%. The communities with the largest change in number of people will have a greater impact on vulnerability. The municipalities that added over five hundred residents between 2010 and 2015 are as follow:

- Lakewood Township, 54% increase with 3,732 new residents
- Jackson Township, 28% increase with 995 new residents
- Barnegat Township, 37% increase with 5,666 new residents

No municipalities that lost over 500 residents between 2010 and 2015. However, Ship Bottom Borough and Beach Haven Borough both had over a 15% reduction in population during that time period. The following municipalities reported a loss of over five percent population during 2010 and 2015:

- Ship Bottom Borough, -20.9% decrease with 242 fewer residents
- Beach Haven Borough, -15.3% decrease with 179 fewer residents
- Surf City Borough decrease with -6.2% decrease, with -75 fewer residents

Since Lakewood Township is by far the largest population change in Ocean County, it represents the largest change in vulnerability. Lakewood's location is partially protected from the County's highest risks. It is not located on the coast or bay so it has a slightly lower risk for hurricanes, tropical storms, nor'easters and flooding and the related risk of utility interruption. It does have some urban wild land interface which concerns the Emergency Management Coordinator for the township based on how it is maintained, so it was moved to a slightly higher risk for wildfire. The community is also at the nexus of many transportation arteries in the county and therefore at a high risk for transportation accidents. The population growth in Lakewood increase vulnerability to wildfire and transportation accidents.

Barnegat Township, Berkeley Township, Lacey Township, Little Egg Harbor Township, Ocean Township, Stafford Township, and Toms River Township are areas of population growth that have bay and/or coastal frontage. The population growth in these communities increases vulnerability to hurricanes, tropical storms, nor'easters and flooding and the related risk of utility interruption. With the exception of Toms River these communities also have urban/ wild land interface which increases the risk for wildfire.

The population increases in Barnegat Township and Ocean Township represent an increase in vulnerability to wildfire. Plumsted Township's interior location and population increase might suggest increased risk to wildfire. However, the urban/ wild land interface is well maintained in

Plumsted. Their risk of flooding is higher than the county as a whole and most of the interior municipalities based on flooding from New Egypt Lake.

The highest population decreases were all in coastal communities, thus slightly decreasing risk to hurricanes, tropical storms, nor'easters and flooding and the related risk of utility interruption. However, the overall population increase means more people are vulnerable to these hazards and balances out the slight decrease in vulnerability in these municipalities.

In total the population increases in Ocean County increase vulnerability to the County's highest ranked hazards.

5 Capability Assessment

5. Capability Assessment

5.1 Process Summary

The purpose of the Capability Assessment is to understand the unique planning, regulatory, administrative, technical, financial, and education and outreach capabilities present in Ocean County. This assessment helps Ocean County and its municipalities identify strengths that could be used to reduce losses and reduce risks in the community. It also identifies areas where mitigation actions might be used to supplement current capabilities and create a more resilient Ocean County before, during, and after a disaster event. Finally, the Capability Assessment examines the integration of existing planning mechanisms and the HMP, highlighting areas and initiatives in other planning efforts that seek to reduce risk and losses. While the capability assessment serves as a good instrument for identifying local capabilities, it also provides a means for recognizing gaps and weaknesses that can be resolved through future mitigation actions. The results of this assessment lend critical information for developing an effective mitigation strategy.

In order to complete the Capability Assessment, the project team met with each municipality and the county one-on-one to review the risk assessment, explain the Capability Assessment, and discuss the connection between the Capability Assessment and the development of the Mitigation Strategy. A *Capability Assessment Worksheet* was distributed to all municipalities and the county. Jurisdictions updated the worksheet to include changes to local capabilities that have occurred since the acceptance of the previous plan. Where there were gaps in local knowledge or where extra information was available through research, this information was added to complement community feedback via the worksheet. The HMP provides an inventory of the most critical local planning tools available within each municipality and a summary of the fiscal and technical capabilities available through programs and organizations outside of the County. It also identifies emergency management capabilities and the processes used for implementation of the NFIP.

5.2 Planning and Regulatory Capability

Planning and regulatory capabilities are focused on the implementation of laws, ordinances, policies, plans, and programs that relate to growth management and land development. In Ocean County, some of the most ubiquitous planning capabilities include comprehensive or master plans, capital improvement plans, local emergency operations plans (EOPs), and stormwater management plans (SWMPs). All municipalities use and enforce a building code and require site plan review for development projects. Ocean County also has strong participation of land use and planning ordinances; all communities have a floodplain ordinance and flood insurance rate maps and all communities have a zoning ordinance.

Tables 5.2-1 and 5.2-2 present the summary results of the planning and regulatory capability. The completed *Capability Assessment Worksheet*s are included in Appendix B – Jurisdictions. These forms contain additional information for each municipality including how the plans address hazards and may be used to implement mitigation actions. The year developed or updated is also provided for many plans on the *Capability Assessment Worksheet*s. The surveys were completed with varying levels of detail so, Tables 5.2-1 and 5.2-2 present summary information as yes and no responses.

Some communities also have unique planning and regulatory mechanisms that enhance hazard mitigation. Examples of hazard-specific land use and regulatory capabilities include:

- Wildfire protection plans or initiatives in Manchester Township
- Coastal erosion protection measures in Long Beach Township and Mantoloking
- Advanced flood protection measures in Beach Haven Borough and Manchester Township.
- Beach Development Plan in Lavallette
- Conservation and energy resource planning in Long Beach Township
- Beach and Dune Preservation Ordinance in Mantoloking
- Community Forestry Plan in Ocean Township

One of the most important land planning capabilities in Ocean County is the comprehensive master plan. Comprehensive master plans promote sound land use and provide a forum to address planning issues. These plans serve as the official policy guide for influencing the location, type and extent of future development by establishing the basis for decision-making and review processes on zoning matters, subdivision and land development, land uses, public facilities and housing needs over time. Ocean County completed its most recent comprehensive master plan in 2011. This plan includes information on population growth, economic development, transportation, housing, design, land use, agriculture, open space, environmental, and military land use compatibility concerns. With relation to hazards, the county comprehensive master plan establishes objectives that seek to preserve open space and other natural areas in a way that reduces flood losses and prevents development in hazard-prone areas. In addition, 100% of all local communities have their own comprehensive master plans which complement the county's plan. Municipal planning capabilities are detailed in full in Table 5.2-1.

5.2-1 Municipal Planning Capability (Capability Survey, 2013 and 2018 Capability Updates)

MUNICIPALITY	Comprehensive/ Master Plan	Capital Improvements Plan	Economic Development Plan	Local EOP	COOP Plan	Transportation Plan	SWMP	Wildfire Protection Plan
Barnegat Light Borough	Yes	Yes	No	Yes	No	No	Yes	No
Barnegat Township	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Bay Head Borough	Yes	Yes	No	Yes	No	No	Yes	No
Beach Haven Borough	Yes	Yes	No	Yes	No	No	Yes	No
Beachwood Borough	Yes	Yes	No	Yes	No	No	Yes	No
Berkeley Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Brick Township	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Eagleswood Township	Yes	No	No	Yes	No	No	Yes	No
Harvey Cedars Borough	Yes	No	No	Yes	No	Yes	Yes	No
Island Heights Borough	Yes	No	No	Yes	Yes	No	Yes	No
Jackson Township	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Lacey Township	Yes	Yes	Yes	Yes	No	No	Yes	No
Lakehurst Borough	Yes	Yes	No	Yes	No	No	Yes	YES
Lakewood Township	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Lavallette Borough	Yes	Yes	No	Yes	No	No	Yes	No
Little Egg Harbor Township	Yes	Yes annual budget	Yes	Yes	No	No	Yes	No
Long Beach Township	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Manchester Township	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Mantoloking Borough	Yes	Yes annual budget	No	Yes	Yes	Yes	Yes	No
Ocean Gate Borough	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Ocean Township	Yes	Yes	Yes	Yes	No	No	Yes	No
Pine Beach Borough	Yes	No	No	Yes	Yes	Yes	Yes	No
Plumsted Township	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Point Pleasant Beach Borough	Yes	Yes	No	Yes	Yes	No	Yes	No
Point Pleasant Borough	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Seaside Heights Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Seaside Park Borough	Yes	Yes	No	Yes	No	Yes	Yes	No
Ship Bottom Borough	Yes	Yes annual budget	No	Yes	No	No	Yes	No
South Toms River Borough	Yes	Yes	Yes	Yes	Yes	No	Yes	No

MUNICIPALITY	Comprehensive/ Master Plan	Capital Improvements Plan	Economic Development Plan	Local EOP	COOP Plan	Transportation Plan	SWMP	Wildfire Protection Plan
Stafford Township	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Surf City Borough	Yes	No	No	Yes	No	No	Yes	No
Toms River Township	Yes	Yes	Yes	Yes	In Progress	No	Yes	No
Tuckerton Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Percent with Planning Capability	**100%**	**73%**	**39%**	**100%**	**39%**	**39%**	**100%**	**21%**

Building codes regulate construction standards for new construction and substantially renovated buildings. New Jersey has adopted the International Building Code, New Jersey Edition. This code was first adopted in 2007 and was most recently revised in 2015. At the state level, building and construction codes are administered by the New Jersey Department of Community Affairs. Local standards can be adopted that require resistant or resilient building design practices to address hazard impacts common to a given community. All municipalities have an active building code.

Through administration of floodplain ordinances, municipalities can ensure that all new construction or substantial improvements to existing structures located in the floodplain are flood-proofed, dry-proofed, or built above anticipated flood elevations. Floodplain ordinances may also prohibit development in certain areas altogether. The NFIP establishes minimum ordinance requirements which must be met in order for that community to participate in the program. However, a community is permitted and in fact, encouraged, to adopt standards which exceed NFIP requirements. Additional information on NFIP requirements can be found in Section 5.2.3.

Subdivision ordinances are intended to regulate the development of housing, commercial, industrial or other uses, including associated public infrastructure, as land is subdivided into buildable lots for sale or future development. Within these ordinances, guidelines on how land will be divided, the placement and size of roads and the location of infrastructure can reduce exposure of development to hazard events. All jurisdictions have a subdivision ordinance.

Zoning ordinances allow for local communities to regulate the use of land in order to protect the interested and safety of the general public. Zoning ordinances can be designed to address unique conditions or concerns within a given community. They may be used to create buffers between structures and high-risk areas, limit the type or density of development and/or require land development to consider specific hazard vulnerabilities. All municipalities in Ocean County have zoning regulations.

5.2-2 Municipal Building Code, Land Use Planning, and Ordinances Capability (Capability Survey, 2013 and 2018 Capability Updates)

MUNICIPALITY	Building Code	Site plan review	Zoning ordinance	Subdivision ordinance	Floodplain ordinance	Natural hazard ordinance	Flood insurance rate maps	Acquisition for open space
Barnegat Light Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Barnegat Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bay Head Borough	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Beach Haven Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Beachwood Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Berkeley Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Brick Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Eagleswood Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Harvey Cedars Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Island Heights Borough	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Jackson Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lacey Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Lakehurst Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Lakewood Township	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Lavallette Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Little Egg Harbor Township	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Long Beach Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Manchester Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mantoloking Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ocean Gate Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ocean Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pine Beach Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Plumsted Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Point Pleasant Beach Borough	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Point Pleasant Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seaside Heights Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Seaside Park Borough	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Ship Bottom Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
South Toms River Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Stafford Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Surf City Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Toms River Township	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tuckerton Borough	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Percent with Planning Mechanism	**100%**	**100%**	**100%**	**100%**	**100%**	**82%**	**100%**	**76%**

5.2.2 Emergency Management

Emergency Management capabilities are a sub-set of planning and regulatory capabilities relating directly to emergency preparedness, response, and recovery. The Ocean County Office of Emergency Management, a subsidiary of the Ocean County Sheriff's Office, coordinates countywide emergency management efforts. Each municipality has a designated local emergency management coordinator who possesses a unique knowledge of the impact hazard events have on their community. Over half of all municipal participation in this HMP is due to the participation of a local emergency management coordinator (EMC), which is an indicator of the strong local emergency management capability present in Ocean County. Local emergency managers in Ocean County actively coordinate with each other for regionalized response and recovery options, as evidenced during Hurricane Sandy. Additionally, New Jersey OEM Directive No. 102 states that each local EMC must have two years or more of experience in emergency response and establishes basic training and ongoing responsibilities. This directive ensures that local EMCs are qualified professionals.

Every county and municipality in New Jersey is required by law to prepare and maintain a multi-hazard emergency operations plan which is updated and certified every four years by NJ OEM. All jurisdictions in the County have an EOP. A countywide EOP also exists. Additionally, 52% of jurisdictions have or are in the process of creating a continuity of operations (COOP) plan. This is an important emergency management capability in that it establishes procedures for maintaining the smooth operations of government during a disaster event.

Ocean County is supported in its emergency management capability by the greater Sheriff's Office staff and by the Jersey Coast Chapter of the American Red Cross. County departments and agencies sit at the Emergency Operations Center during an emergency event to allow greater coordination and enhance response capabilities.

5.2.3 Participation in the NFIP and CRS

All Ocean County jurisdictions participate in the NFIP. The program is managed by local municipalities participating in the program through ordinance adoption and floodplain regulations. New Jersey Department of Environmental Protection provides a coordinating role statewide while the Ocean County Planning Department provides an oversight and coordination role. Similarly, permitting processes needed for building construction and development in the floodplain are implemented at the municipal level through various ordinances (e.g. zoning, subdivision/land development and floodplain ordinances), but the county provides technical assistance and guidance upon request.

Currently, FEMA, DEP, and Ocean County are in the process of updating Ocean County's DFIRM data under the Risk MAP program. This new study will produce new countywide flood maps that include 88 miles of detailed coastal analysis, 11 miles of detailed riverine analysis, and 85 miles of approximate riverine analysis. All jurisdictions in Ocean County will update their floodplain ordinances in conjunction with the new mapping. Preliminary work maps have been released for Ocean County for coastal areas on January 30, 2015 and DFIRM maps for riverine regulatory flood hazard areas were release on May 30, 2017.

As new DFIRMs are published, NJDEP works with communities to ensure the timely and successful adoption of an updated floodplain management ordinance by reviewing and providing feedback on existing and draft ordinances. In addition, NJDEP provides guidance and technical support through Community Assistance Contacts (CAC) and Community Assistance Visits (CAV).

CRS recognizes communities that establish floodplain management programs that go beyond NFIP minimum requirements. Under the CRS, communities receive credit for more restrictive regulations, acquisition, relocation, or flood-proofing of flood-prone buildings, preservation of open space, and other measures that reduce flood damage or protect the natural resources and functions of floodplains. Seventeen communities in Ocean County currently participate in the Community Ratings System (CRS) and two communities have participated in CRS but have a current status of rescinded (FEMA CIS, 2017).

The CRS was implemented in 1990 to recognize and encourage community floodplain management activities that exceed the minimum NFIP standards. Section 541 of the 1994 Act amends Section 1315 of the 1968 Act to codify the CRS in the NFIP, and expands the CRS goals to specifically include incentives to reduce the risk of flood-related erosion and to encourage measures that protect natural and beneficial floodplain functions. These goals have been incorporated into the CRS, and communities now receive credit toward premium reductions for activities that contribute to them.

The CRS recognizes 18 creditable activities that are organized under four categories: Public Information, Mapping and Regulations, Flood Damage Reduction, and Flood Preparedness. Table 5.2-3 summarizes the number of credit points associated with each CRS class.

5.2-3 CRS classes and associated credit points.

CRS CLASS	CREDIT POINTS	PREMIUM REDUCTION SFHA	PREMIUM REDUCTION NON-SFHA
1	4500+	45%	10%
2	4,000-4,499	40%	10%
3	3,500-3,999	35%	10%
4	3,000-3,499	30%	10%
5	2,500-2,999	25%	10%
6	2,000-2,499	20%	10%
7	1,500-1,999	15%	5%
8	1,000-1,499	10%	5%
9	500-999	5%	5%
10	0-499	0	0

Table 5.2-4 lists the CRS status of Ocean County municipalities. The participation of Ocean County municipalities in CRS saves 47,014 policy holders $9,284,021 in premium savings. If the non-participating communities and two communities at class 10 joined or moved to class 9 there could be an additional $5.6 million in premium savings. Jackson and Little Egg Harbor Townships would account for the majority of the potential savings with $4.8 million of the

savings being realized at about $2.4 million for each. The remaining 11 municipalities that are not part of CRS would save 870K combined. CRS Participation (FEMA, 2018).

MUNICIPALITY	CRS ENTRY DATE	STATUS	CLASS	NUMBER OF POLICIES	COMMUNITY PREMIUM SAVINGS	AVERAGE PER POLICY SAVINGS
Barnegat Light Borough	10/1/1992	Current	8	921	$82,173	$89
Barnegat Township	5/1/2014	Current	7	434	$47,426	$109
Bay Head Borough	10/1/1993	Current	6	727	$211,286	$291
Beach Haven Borough	10/1/1991	Current	5	2,133	$825,471	$387
Beachwood Borough	N/A – Not Part of CRS					
Berkeley Township	10/1/1992	Current	6	2,622	$395,142	$151
Brick Township	5/1/2017	Current	6	4,157	$699,359	$168
Eagleswood Township	N/A – Not Part of CRS					
Harvey Cedars Borough	10/1/1991	Current	8	968	$111,143	$115
Island Heights Borough	N/A – Not Part of CRS					
Jackson Township	N/A – Not Part of CRS					
Lacey Township	10/1/1992	Rescinded	10	2,807	0	$0
Lakehurst Borough	N/A – Not Part of CRS					
Lakewood Township	N/A – Not Part of CRS					
Lavallette Borough	5/1/2004	Current	6	2,116	$414,491	$196
Little Egg Harbor Township	N/A – Not Part of CRS					
Long Beach Township	10/1/1992	Current	5	6,614	$2,342,275	$354
Manchester Township	N/A – Not Part of CRS					
Mantoloking Borough	10/1/1992	Current	5	407	$229,525	$564
Ocean Gate Borough	N/A – Not Part of CRS					
Ocean Township	5/1/2014	Current	6	934	$186,213	$199
Pine Beach Borough	N/A – Not Part of CRS					
Plumsted Township	N/A – Not Part of CRS					
Point Pleasant Beach Borough	10/1/1992	Current	6	1,825	$653,942	$358
Point Pleasant Borough	10/1/1993	Current	7	1,849	$192,875	$104
Seaside Heights Borough	5/1/2017	Current	8	1,366	$152,071	$111
Seaside Park Borough	10/1/1992	Current	7	1,319	$266,613	$202
Ship Bottom Borough	10/1/1992	Current	7	1,520	$308,636	$203
South Toms River Borough	N/A – Not Part of CRS					
Stafford Township	10/1/1991	Current	5	3,334	$805,432	$242
Surf City Borough	10/1/1992	Current	5	1,512	$533,340	$353
Toms River Township	10/1/1992	Current	8	8,970	$826,608	$92
Tuckerton Borough	10/1/1993	Rescinded	10	479	0	$0
Note: Rescinded means communities previously participated in CRS and may find it easier to re-establish participation in the program						

5.3 Administrative and Technical Capability

Administrative capability is described by an adequacy of departmental and personnel resources for the implementation of mitigation-related activities. Technical capability relates to an adequacy of knowledge and technical expertise of local government employees or the ability to contract outside resources for this expertise in order to effectively execute mitigation activities. Common examples of skill sets and technical personnel needed for hazard mitigation include: planners with knowledge of land development/management practices, engineers or professionals trained in construction practices related to buildings and/or infrastructure (e.g. building inspectors), planners or engineers with an understanding of natural and/or human caused hazards, emergency managers, floodplain managers, land surveyors, scientists familiar with hazards in the community, staff with the education or expertise to assess community vulnerability to hazards, personnel skilled in geographic information systems, resource development staff or grant writers, fiscal staff to handle complex grant application processes.

5.3-1 Municipal Administrative Capability (Capability Survey, 2013 and 2018 Capability Updates)

MUNICIPALITY	Planning Board	Mitigation Planning Committee	Maintenance programs to reduce risk	Mutual aid agreements
Barnegat Light Borough	Yes	No	No	Yes
Barnegat Township	Yes	No	Yes	Yes
Bay Head Borough	Yes	Yes	Yes	Yes
Beach Haven Borough	Yes	No	Yes	Yes
Beachwood Borough	Yes	Yes	Yes	Yes
Berkeley Township	Yes	No	Yes	Yes
Brick Township	Yes	Yes	Yes	Yes
Eagleswood Township	Yes	No	Yes	Yes
Harvey Cedars Borough	Yes	No	Yes	Yes
Island Heights Borough	Yes	No	No	Yes
Jackson Township	Yes	Yes	Yes	Yes
Lacey Township	Yes	No	No	Yes
Lakehurst Borough	Yes	No	Yes	Yes
Lakewood Township	Yes	No	Yes	Yes
Lavallette Borough	Yes	No	Yes	Yes
Little Egg Harbor Township	Yes	Yes	Yes	Yes
Long Beach Township	Yes	Yes	Yes	Yes
Manchester Township	Yes	Yes	Yes	Yes
Mantoloking Borough	Yes	Yes	Yes	Yes
Ocean Gate Borough	Yes	No	Yes	Yes
Ocean Township	Yes	No	Yes	Yes
Pine Beach Borough	Yes	No	Yes	Yes
Plumsted Township	Yes	No	Yes	Yes
Point Pleasant Beach Borough	Yes	Yes	Yes	Yes
Point Pleasant Borough	Yes	No	Yes	Yes
Seaside Heights Borough	Yes	Yes	Yes	Yes
Seaside Park Borough	Yes	Yes	Yes	Yes
Ship Bottom Borough	Yes	Yes	Yes	Yes
South Toms River Borough	Yes	No	Yes	Yes
Stafford Township	Yes	Yes	Yes	Yes
Surf City Borough	Yes	No	Yes	Yes
Toms River Township	Yes	Yes, through	Yes	Yes

MUNICIPALITY	Planning Board	Mitigation Planning Committee	Maintenance programs to reduce risk	Mutual aid agreements
		Planning Board		
Tuckerton Borough	Yes	Yes	Yes	Yes
Percent With Capability	**100%**	**42%**	**91%**	**100%**

Based on assessment result, Ocean County municipalities have a moderate-to-high administrative and technical capability needed to conduct hazard mitigation activities. All jurisdictions have a planning board and over 90% state they have maintenance programs in place intended to reduce risk. Additionally, mutual aid agreements appear to be common. In terms of staffing, nearly all jurisdictions have a chief building official, floodplain management administrator, and emergency manager. Municipal staff is frequently part time, contracted to a consulting firm, or is shared, as shown in Table 5.3-2.

5.3-2 Municipal Staffing Capability (Capability Survey, 2013 and 2018 Capability Updates)

MUNICIPALITY	Chief Building Official	Floodplain Admin.	Emergency Manager	Community Planner	Civil Engineer	GIS Coordinator
Barnegat Light Borough	Yes/ PT	Yes/ PT	Yes/ FT	No	Yes/ Consultant	No
Barnegat Township	Yes/ PT	Yes/ PT	Yes/ Shared Duties	Yes/ Consultant	Yes/ Consultant	Yes/ Consultant
Bay Head Borough	Yes/ FT	Yes/ PT	Yes/ Shared Duties	Yes/ Consultant	Yes/ Consultant	Yes/ Consultant
Beach Haven Borough	Yes/ PT	Yes/ PT	Yes/ PT	Yes/ Consultant	Yes/ Consultant	Yes/ Consultant
Beachwood Borough	Yes/ PT	Yes/ PT	Yes/ PT	Yes	Yes	No
Berkeley Township	Yes/ FT	Yes/ PT	Yes/ Shared Duties	Yes/ FT	Yes/ FT	No
Brick Township	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ FT
Eagleswood Township	No	Yes/ Shared Duties	Yes	Yes/ Shared Duties	Yes/ Shared Duties	No
Harvey Cedars Borough	Yes/ PT	Yes/ PT	Yes/ PT	Yes/ PT	Yes/ PT	Yes/ PT
Island Heights Borough	Yes/ PT	Yes/ PT	Yes/ PT	No	No	No
Jackson Township	Yes/ FT	Yes/ FT	Yes/ PT	Yes/ PT	Yes/ FT	Yes/ PT
Lacey Township	Yes/ FT	Yes/ FT	Yes/ PT	No	No	No
Lakehurst Borough	Yes/ PT	Yes/ PT	Yes/ PT	No	Yes/ Consultant	No
Lakewood Township	Yes	Yes/ Shared Duties	Yes/ Shared Duties	No	Yes/ Consultant	No
Lavallette Borough	Yes/ FT	Yes/ FT	Yes/ Shared Duties	No	Yes/ Consultant	No
Little Egg Harbor Township	Yes/ FT	Yes/ FT	Yes/ Shared Duties	Yes/ Shared Duties	Yes/ Shared Duties	No
Long Beach Township	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ Shared Duties	Yes/ Shared Duties	Yes/ Shared Duties
Manchester Township	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ PT	Yes/ PT	Yes/ FT
Mantoloking Borough	Yes/ FT	Yes/ PT	Yes/ PT	Yes/ Shared Duties	Yes/ Consultant	Yes/ PT

MUNICIPALITY	Chief Building Official	Floodplain Admin.	Emergency Manager	Community Planner	Civil Engineer	GIS Coordinator
Ocean Gate Borough	Yes/ PT	Yes/ PT	Yes/ PT	No	Yes/ Consultant	Yes/ Consultant
Ocean Township	Yes/ PT	Yes/ PT	Yes/ PT	Yes/ Consultant	Yes/ Consultant	No
Pine Beach Borough	Yes/ PT	Yes/ Shared Duties	Yes/ PT	Yes/ PT	Yes/ PT	No
Plumsted Township	Yes/ PT	Yes/ Shared Duties	Yes	Yes/ PT	No	No
Point Pleasant Beach Borough	Yes/ Shared Duties	Yes/ Shared Duties	Yes/ PT	No	Yes/ Consultant	Yes/ Shared Duties
Point Pleasant Borough	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ Consultant	Yes/ Consultant	No
Seaside Heights Borough	Yes	Yes	Yes	Yes	Yes	No
Seaside Park Borough	Yes/ PT	Yes/ Consultant	Yes/ PT	Yes/ Consultant	Yes/ Consultant	Yes/ Consultant
Ship Bottom Borough	Yes/ FT	Yes/ PT	Yes	Yes/ Shared Duties	Yes/ Shared Duties	Yes/ Shared Duties
South Toms River Borough	Yes/ PT	Yes/ Volunteer	Yes/ PT	Yes/ PT	Yes/ PT	No
Stafford Township	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ FT	Yes/ PT	Yes/ PT
Surf City Borough	Yes/ PT	Yes/ PT	Yes/ PT	Yes/ Consultant	Yes/ Consultant	Yes/ Consultant
Toms River Township	Yes/ FT	Yes/ FT	Yes	Yes/ FT	Yes/ FT	Yes/ FT
Tuckerton Borough	Yes/ FT	Yes/ Shared Duties	Yes/ Volunteer	No	Yes/ Consultant	Yes/ Consultant

It is noted whether position is Full-time (FT) or Part-time (PT) if that detail was provided in survey. It is noted 'Shared Duties' when the position is shared with other duties. For instance, many Emergency Managers are also police officers and many communities have building, planning and engineering duties shared within a position held by one person. This detail was provided when available to show more accurate capability; yes's do not often mean 5 full-time employees.

Municipal technical capability can overall be considered moderate-to-high. Nearly all Ocean County municipalities have some kind of warning system or warning service in place, 70% have grant writing expertise available, and 61% maintain hazard data and information. There is a technical skills gap with relation to knowledge of Hazus, FEMA's loss estimation software.

5.3-3 Municipal Technical Capability (Capability Survey, 2013 and 2018 Capability Updates)

MUNICIPALITY	Warning systems/ services	Hazard data/ information	Grant writing	Hazus analysis
Barnegat Light Borough	Yes	No	No	No
Barnegat Township	Yes	No	Yes	No
Bay Head Borough	Yes	Yes	No	No
Beach Haven Borough	Yes	Yes	Yes	No
Beachwood Borough	Yes	Yes	Yes	No
Berkeley Township	Yes	Yes	Yes	No
Brick Township	Yes	Yes	Yes	Yes
Eaglewood Township	Yes	Yes	Yes	Yes

MUNICIPALITY	Warning systems/ services	Hazard data/ information	Grant writing	Hazus analysis
Harvey Cedars Borough	Yes	Yes	No	Yes
Island Heights Borough	Yes	No	No	No
Jackson Township	Yes	Yes	Yes	No
Lacey Township	Yes	No	No	No
Lakehurst Borough	Yes	Yes	Yes	No
Lakewood Township	Yes	No	No	No
Lavallette Borough	Yes	No	Yes	No
Little Egg Harbor Township	Yes	Yes	Yes	No
Long Beach Township	Yes	Yes	Yes	No
Manchester Township	Yes	Yes	No	No
Mantoloking Borough	Yes	Yes	Yes	Yes
Ocean Gate Borough	Yes	No	Yes	No
Ocean Township	Yes	No	Yes	No
Pine Beach Borough	Yes	No	No	No
Plumsted Township	Yes	Yes	Yes	No
Point Pleasant Beach Borough	Yes	Yes	Yes	No
Point Pleasant Borough	Yes	No	Yes	No
Seaside Heights Borough	Yes	Yes	Yes	Yes
Seaside Park Borough	Yes	Yes	Yes	No
Ship Bottom Borough	Yes	No	Yes	No
South Toms River Borough	No	Yes	Yes	No
Stafford Township	Yes	Yes	Yes	No
Surf City Borough	Yes	No	No	No
Toms River Township	Yes	No	No	No
Tuckerton Borough	Yes	Yes	Yes	Yes
Percent with Technical Capability	**97%**	**61%**	**70%**	**18%**

Other local organizations that have acted as partners in hazard mitigation include the Barnegat Bay Partnership, New Jersey Association for Floodplain Management, NJ DEP, NJ Department of Community Affairs, the Jacques Cousteau Institute for Estuarine Research, and Stockton College.

Federal agencies which can provide technical assistance for mitigation activities include, but are not limited to:

- Pinelands Commission
- Army Corps of Engineers
- Department of Housing and Urban Development
- Department of Agriculture
- Economic Development Administration

- Emergency Management Institute
- Environmental Protection Agency
- FEMA
- Small Business Administration.

5.4 Fiscal Capability

The decision and capacity to implement mitigation-related activities is often strongly dependent on the presence of local financial resources. While some mitigation actions are less costly than others, it is important that money is available locally to implement policies and projects. Financial resources are particularly important if communities are trying to take advantage of state or federal mitigation grant funding opportunities that require local-match contributions. Based on survey results, most municipalities within the County perceive fiscal capability to be limited. The most common fiscal capabilities in Ocean County are capital improvements programs, Community Development Block Grants, and the authority to levy taxes. Seventy-six percent of communities also had access to other federal funding and other state funding for hazard mitigation. The complete results of the fiscal capability assessment are in Table 5.4-1.

5.4-1 Municipal Fiscal Capability (Capability Survey, 2013 and 2018 Capability Updates)

MUNICIPALITY	Capital improvements project	Authority to levy taxes	Fees for water, sewer, gas, or electric	Impact fees for new development	Storm water utility fee	Incur debt through private activities	Community Development Block Grant	Other federal funding programs	State funding programs
Barnegat Light Borough	No	No	Yes	No	No	No	Yes	No	No
Barnegat Township	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Bay Head Borough	Yes	No	Yes	No	No	No	Yes	Yes	Yes
Beach Haven Borough	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Beachwood Borough	Yes	No	No	No	No	No	Yes	No	No
Berkeley Township	Yes	No	No	No	No	No	Yes	Yes	Yes
Brick Township	Yes	Yes	No	No	No	No	Yes	Yes	Yes
Eagleswood Township	Yes	No	Yes	No	No	No	Yes	Yes	No
Harvey Cedars Borough	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Island Heights Borough	Yes	Yes	Yes	No	No	No	Yes	No	No
Jackson Township	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Lacey Township	No	No	No	No	No	No	Yes	No	No
Lakehurst Borough	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Lakewood Township	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes

MUNICIPALITY	Capital improvements project	Authority to levy taxes	Fees for water, sewer, gas, or electric	Impact fees for new development	Storm water utility fee	Incur debt through private activities	Community Development Block Grant	Other federal funding programs	State funding programs
Lavallette Borough	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Little Egg Harbor Township	Yes	Yes	No	No	No	No	Yes	Yes	Yes
Long Beach Township	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Manchester Township	Yes	No	No	No	No	No	Yes	Yes	Yes
Mantoloking Borough	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Ocean Gate Borough	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Ocean Township	Yes	No	Yes	No	No	No	Yes	Yes	Yes
Pine Beach Borough	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Plumsted Township	No	No	Yes	Yes	No	No	Yes	Yes	Yes
Point Pleasant Beach Borough	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Point Pleasant Borough	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes
Seaside Heights Borough	Yes	No	No	No	No	No	Yes	Yes	Yes
Seaside Park Borough	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Ship Bottom Borough	Yes	Yes	Yes	No	No	No	Yes	No	No
South Toms River Borough	Yes	No	No	No	No	No	Yes	No	No
Stafford Township	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Surf City Borough	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Toms River Township	No	No	No	No	No	No	Yes	No	No
Tuckerton Borough	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Percent with funding tool available for hazard mitigation	**82%**	**61%**	**70%**	**30%**	**9%**	**3%**	**100%**	**76%**	**76%**

Federal programs which may provide financial support for mitigation activities include, but are not limited to:

- Community Development Block Grants (CDBG)
- Disaster Housing Program
- Emergency Conservation Program
- Emergency Management Performance Grants (EMPG)

- Emergency Watershed Protection Program
- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance Program
- Non-insured Crop Disaster Assistance Program
- Pre-Disaster Mitigation Program (PDM)
- Repetitive Flood Claims Program (RFC)
- Severe Repetitive Loss Grant Program (SRL)
- Weatherization Assistance Program

5.5 Education and Outreach

Education and outreach capability refers to public outreach programs and methods in place that could be leveraged to implement hazard mitigation activities and to better communicate risk and vulnerability to citizens. Most Ocean County jurisdictions have ongoing public education programs related to risk and/or mitigation, and nearly 80% of communities have a local citizen group, non-governmental organization, or advocacy group with a mitigation-related focus. Slightly over half of municipalities conduct disaster or safety education programs in schools.

Other hazard-specific outreach capabilities include FireWise and StormReady. FireWise is a national program intended to reduce losses due to wildfire. FireWise Communities develop local solutions for safety in wildfire-prone areas by involving homeowners in taking responsibility for preparing their homes from risk of wildfire. This program is typically undertaken at the homeowner's association or neighborhood level, and includes significant outreach to the public. Similarly, the National Weather Service's StormReady program can enhance the emergency management capability of communities, commercial sites, and military installations. StormReady helps American communities with the communication and safety skills needed to save lives and prevent destruction of property before and during a severe weather incident. In Ocean County, Barnegat Light, Beach Haven, Harvey Cedars, and Long Beach are StormReady communities; Six Flags Great Adventure in Jackson Township is a StormReady commercial site, and Joint Base McGuire-Dix-Lakehurst is a StormReady military site. Table 5.5-1 summarizes education and outreach capability for Ocean County municipalities.

5.5-1 Municipal Education and Outreach Capability (Capability Survey, 2013 and 2018 Capability Updates)

MUNICIPALITY	Local citizen groups/ NGOs w/ mitigation related focus	Ongoing public education	Natural disaster or safety related school programs	Storm Ready	FireWise	Public-private partnership
Barnegat Light Borough	No	Yes	No	Yes	No	No
Barnegat Township	Yes	Yes	No	No	Yes	No
Bay Head Borough	Yes	Yes	Yes	No	No	No
Beach Haven Borough	No	Yes	Yes	Yes	No	No
Beachwood Borough	Yes	Yes	Yes	No	No	No
Berkeley Township	Yes	Yes	Yes	No	No	No
Brick Township	Yes	Yes	Yes	Yes	In progress	Yes
Eagleswood Township	Yes	Yes	No	No	No	No
Harvey Cedars Borough	No	Yes	No	Yes	No	No
Island Heights Borough	Yes	Yes	Yes	No	No	No
Jackson Township	Yes	Yes	Yes	Yes	In progress	Yes
Lacey Township	No	No	No	No	No	No
Lakehurst Borough	Yes	Yes	Yes	No	In progress	No
Lakewood Township	Yes	Yes	Yes	No	No	Yes
Lavallette Borough	Yes	Yes	No	No	No	No
Little Egg Harbor Township	Yes	Yes	No	No	No	No
Long Beach Township	Yes	Yes	Yes	Yes	No	Yes
Manchester Township	Yes	Yes	Yes	No	Yes	No
Mantoloking Borough	No	Yes	No	No	No	No
Ocean Gate Borough	No	Yes	Yes	No	No	No
Ocean Township	Yes	Yes	No	No	No	No
Pine Beach Borough	Yes	Yes	Yes	No	No	No
Plumsted Township	Yes	Yes	Yes	No	No	Yes
Point Pleasant Beach Borough	Yes	Yes	No	No	No	Yes
Point Pleasant Borough	No	Yes	Yes	No	No	No
Seaside Heights Borough	Yes	Yes	Yes	Yes	No	Yes
Seaside Park Borough	Yes	Yes	No	No	No	No
Ship Bottom Borough	Yes	Yes	Yes	No	No	No
South Toms River Borough	Yes	Yes	No	No	No	No
Stafford Township	Yes	Yes	No	Yes	Yes	Yes
Surf City Borough	Yes	Yes	No	No	No	No
Toms River Township	Yes	No	No	No	No	No
Tuckerton Borough	Yes	Yes	Yes	No	No	No
Percent with program	**79%**	**94%**	**55%**	**24%**	**9%**	**24%**

5.6 Plan Integration

5.6.1 County Integration Activities

As demonstrated in previous sections, Ocean County has a wealth of natural resources. Planning for the protection and management of the coast, Pinelands, and Barnegat Bay already integrates hazard mitigation into other planning mechanism and provides an excellent opportunity for continued and improved integration.

As shown in Figure 2.1-2 New Jersey Pinelands and the CAFRA Zone, the majority of Ocean County falls either within the Pinelands or the CAFRA zone. The Pinelands Commission regulates and promotes orderly development of the Pinelands so as to preserve and protect the significant and unique natural, ecological, agricultural, archaeological, historical, scenic, cultural and recreational resources of the Pinelands. Managing development both protects the pinelands and mitigates the potential negative impacts of the urban/wild land interface by preventing forest fires. In the CAFRA Zone, NJDEP has the authority to approve the location, design, and construction of major facilities with the intention of protecting coastal resources. Maintaining the health of coastal resources has multiple mitigation benefits including providing space for flooding and stormwater to be naturally absorbed without impacting structures and infrastructure and preventing development in vulnerable areas.

Barnegat Bay is another natural resource that borders the majority of municipalities in Ocean County. The health of the bay is promoted by the Barnegat Bay Partnership. Plans for the bay include the 2002 Comprehensive Conservation and Management Plan (CCMP) for the Barnegat Bay Estuary updated in 2008 and 2011 and the NJDEP's 10 Point Plan of Action to Restore Barnegat Bay. From 2016 through 2018, the Barnegat Bay Partnership will be reviewing and revising the original CCMP to reflect the changes in the Barnegat Bay's condition and emerging threats, such as climate change and sea level rise. Mitigation related actions from these plans echoed in the Ocean County HMP include:

- Finalize the development of a comprehensive database of stormwater facilities to assist in a coordinated approach to stormwater management
- Maximize opportunities for Education, Outreach and Training
- Fund Stormwater Mitigation Projects
- Acquire Land in the Watershed
- Continued coastal wetlands monitoring and vulnerability assessment
- Implementation of nature-based shoreline and wetlands enhancement projects

In addition to natural resource related planning, Ocean County participated in the Joint Land Use Study for the Joint Base McGuire-Dix-Lakehurst. The joint Base is an important component of the County's economy and as a major land holder. The following are mitigation related actions for the Joint Land Use Study:

- Continue to establish Joint Base Priority locations for farmland and open space preservation.
- County health departments should work with Joint Base and NJDEP project managers to perform locally known contaminant testing of local wells as a precautionary step.

- Continue environmental impact studies in communication with Joint Base as additional information on base missions becomes available and work with Steering Committee to address future issues for natural resources.
- Implement wildfire management practices, including dust and bird control, to offset possible effects to Joint Base and JLUS municipalities.
- Distribute Bird/Wildlife Aircraft Strike Hazard (BASH) educational materials to local farmers to promote awareness on reducing the potential for bird and wildlife attractions that may impede safe air operations Partner.

These mitigation actions will particularly help with addressing transportation accidents, and wildfires, hazardous materials incidents. The Joint Land Use Study strongly supports all types of natural resources protection surrounding the base.

The 2011 Ocean County Comprehensive Master Plan summarizes many of the links between hazard mitigation and other planning mechanisms. The new 2018 HMP is anticipated to further the integration of hazard mitigation and other planning mechanisms.

Ocean County is also the subject of tools that increase awareness and planning capability for hazards resent in the county. The following tools are mechanisms for municipalities and the County to examine hazards and support project implementation. These tools were available at the Public Meetings for the Plan in May to explain and inform attendees about risk at a station supported by Barnegat Bay Partnership.

Coastal Community Vulnerability Assessment and Mapping Protocol: Community resilience is highly dependent upon the location of development in relation to high hazard areas. In order for local governments to take proactive measures to adapt, mitigate, and plan for episodic events or long-term changes in the shoreline, they must first be aware of the hazards they face and the potential exposure of people, property, and resources. The Coastal Community Vulnerability Assessment and Mapping Protocol (CCVAMP) was developed to assist land use planners, hazard mitigation planners, emergency managers, and other local decision-makers in the identification of their community's vulnerability to coastal hazards.

The CCVAMP defines the necessary steps to geospatially identify vulnerable land areas under present and future inundation scenarios, whether it be shallow coastal flooding due to spring tides, storm surge, or sea level rise. Through the development of inundation scenarios, coastal decision-makers can then determine threats to infrastructure, sensitive natural resources, and special needs populations. The first step in the analysis is the development of a Coastal Vulnerability Index (CVI), which stratifies high hazard areas in coastal communities by compiling available hazard, elevation, and landscape geospatial data into an analysis that considers environmental hazards. Armed with the understanding of areas naturally predisposed to risk, coastal decision-makers may guide future development away from high hazard areas and mitigate future losses. The CCVAMP Report is available at http://www.state.nj.us/dep/cmp/docs/ccvamp-final.pdf.

Getting to Resilience: Getting to Resilience (GTR) is a non-regulatory tool intended to assist local decision-makers in the collaborative identification of planning, mitigation, and adaptation opportunities that will reduce vulnerability to coastal storms, flooding and sea level rise. GTR was envisioned to work in conjunction with the mapped information provided through the CVI and CCVAMP initiatives discussed above. GTR is not intended to grade the resiliency of a community. It is, however, intended to start a dialogue among decision-makers, by encouraging creative, synergistic and collaborative thinking regarding plans and practices that increase community resiliency for current and future generations.

GTR highlights the importance of local plan integration and consistency with municipal building codes, ordinances and zoning to seamlessly support flood protection efforts. GTR should be conducted as a collaborative discussion and commence with a review of available vulnerability assessments and/or the results of CCVAMP. Participants will then be fully aware of the hazards their community faces when assessing its resilience.

Since the development of the original GTR questionnaire, the Jacques Cousteau National Estuarine Research Reserve (JC NERR) and the Barnegat Bay Partnership has translated the GTR tool into an interactive online tool (http://www.prepareyourcommunitynj.org/) that provides information on recommended strategies where improved community resilience is warranted. The online tool was a joint effort supported by federal funds through the EPA Climate Ready Estuaries Program. The online GTR tool goes beyond the original questionnaire and also provides information on where these recommendations overlap with other community planning tools (e.g., National Flood Insurance Program Community Ratings System).

The CCVAMP (CVI and GTR) tools were applied in the communities of Cape May Point, Greenwich, Little Silver and Oceanport, New Jersey as demonstration projects. The findings from these projects were presented to the communities and are summarized and available on the web at: http://www.state.nj.us/dep/cmp/docs/ccvap-pilot-final.pdf and http://www.state.nj.us/dep/cmp/docs/ccvap-greenwich.pdf.

NJ FloodMapper: The NJ FloodMapper uses high resolution mapping of the land surface elevation to model areas vulnerable to sea level rise. Through collaborative efforts of partners on this proposal, New Jersey continues to improve the NJ FloodMapper tool as a community resource to advance coastal resilience. This is a collaborative project with the NOAA Coastal Services Center (CSC) through a partnership with the Jacques Cousteau National Estuarine Research Reserve (JCNERR) and the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA) at Rutgers University. The NJ FloodMapper is an interactive mapping website designed and created with the assistance of NOAA Coastal Services Center to provide a user-friendly visualization tool that will help get information into the hands of local communities which need to make decisions concerning flooding hazards and sea level rise. This hazard mapping tool is available on the web at www.NJFloodMapper.org.

CVI and NJ FloodMapper differ in that the NJ FloodMapper depicts sea level rise at a 25 foot grid scaled at 1:15,000. CVI shows both episodic and long term impacts from storm surge and sea level rise at a at 10 foot grid and can be viewed at 1:2000. CVI is a more comprehensive analysis and includes soil characteristics of flooding, erosion and drainage not included in NJ FloodMapper. CVI produces a comprehensive vulnerability assessment while NJ FloodMapper is an online, user-friendly mapping tool that acts as a valuable communication and informational tool the public.

Another New Jersey planning initiative that is a tool for Ocean County is the Hazard Mitigation Grant Program Energy Allocation Initiative. This initiative is sponsored by the NJ Board of Public Utilities, the NJ Department of Environmental Protection, the NJ Office of Emergency Management, Sustainable Jersey, the US Department of Energy, and the National Renewable Energy Laboratory. More information on this program is available at http://www.sustainablejersey.com/index.php?id=305.

5.6.2 Local Integration Activities

Section 5 outlines plans, tools, and other capabilities that the county and municipalities intend to use to promote mitigation efforts. The county and its corresponding municipalities have decided to incorporate mitigation requirements that would decrease their overall risk and vulnerability to hazard events by performing the following general tasks:

- All municipalities in Ocean County have local Comprehensive Master Plans, which are the legal roadmap to planning for appropriate and safe land development. Particular attention will be paid in future local comprehensive master planning efforts to integrating mitigation measures, particularly for the required land use planning element. Land use planning in the coastal and bay front communities will include examining where land uses may be improved and changed to accommodate flooding; for example, utilizing parks or other open space to accommodate drainage and stormwater. Interior municipalities plan to integrate mitigation into the land use element in ways that address the urban wild interface as well as planning buffers and breaks to mitigate the impact of wildfires. Additionally, portions of the risk assessment analysis completed for the HMP can contribute to the development of other plan elements like natural resources, infrastructure, and the environment.
- Mitigation is integrated into local floodplain management practices and will be increased through several initiatives in the mitigation strategy. Municipalities have adopted the Advisory BFE maps and intend to adopt the updated DFIRMs after they are released through the Letter of Final Determination. Mitigation is integrated into floodplain management through practices including regulating where and how building permits are issued, requiring building materials and methods that mitigate the impact of flooding on homes, and encouraging property owners to exceed requirements and build with freeboard above the BFE.
- Several municipalities will integrate mitigation into plans to increase participation in the CRS program.
- Municipalities will review dam action plans and coordinate with private dam owners to implement mitigation actions into the plans and into maintenance practices.
- Local budgets and capital improvement plans will incorporate budgets for maintenance that can mitigate the impact of storms and flooding. For instance, clean-up plans for debris in the bay will assist in mitigating flooding, trimming trees near power lines will reduce or prevent utility outages during storms, and brush clean-up will mitigate wildfire.

- Local Emergency Planning Committees will continue to mitigate the impact of Hazardous Materials through integrating mitigation into their plans, coordination and meetings.
- Local evacuation and shelter plans focus on response. However, mitigation is integrated into these plans by maintaining and improving infrastructure that provides a safe exit for evacuees, maintaining and improving critical facilities such as Emergency Operations Centers and shelters to provide safe guidance and respite during a disaster, and planning for locations for generator back-up power.

Many of the municipalities in Ocean County have local Hazard Mitigation Plans that address resiliency. Mitigation Actions identified in these plans have been incorporated into this HMP update.These plans include the following:

- **Long Beach Island Coastal Vulnerability Assessment, 2016:** This study includes the six municipalities of Barnegat Light Borough, Beach Haven Borough, Harvey Cedars Borough, Ship Bottom Borough, Surf City Borough and Long Beach Township. This multijurisdictional plan was created to help assess and address the vulnerabilities that Long Beach Island Faces as coastal storms and sea level rise become even more prominent threats. Through this plan, both regional and local vulnerabilities to the coast were assessed to help determine both regional and local actions that Long Beach Island can take to protect the Jersey Shore Coast.
- **Hazard Mitigation Plan for Borough of Bay Head, May 2017:** This plan was created by the borough engineer on behalf of Bay Head Borough as an extraction from the Ocean County Hazard Mitigation Plan for matters that relate to Bay Head Borough. The plan addresses topics including the community's needs, goals, new reports, supplemental information, hazard and vulnerability assessments and a review of the action plan to account for completed projects. The goal of this plan is to help produce long- term, recurring benefits that will reduce vulnerability and enable local residents, businesses and industries to re-establish themselves in the wake of a disaster.
- **Hazard Mitigation Plan for Berkeley Township, October 2015:** Berkeley Townships Hazard Mitigation Plan is an extraction form the Ocean County Hazard Mitigation Plan for matters that relate to Berkeley Township. Topics that are addressed in the plan include community's needs, goals, new reports, supplemental information, hazard and vulnerability assessments and review of the action plan to account for completed and new projects. The purpose of this plan is to evaluate the impacts of potential future storms and reduce vulnerabilities. Mitigation practices established in this plan enable local residents, businesses and industries to re-establish themselves post disaster.
- **Township of Brick Hazard Mitigation Plan Element, March 2016:** The Township of Brick created this plan as a method to mitigate against the risk associated with its coastal location and abundance of waterways. To address Brick's vulnerability to coastal storms, the Post Sandy Planning Grant Program presented the Township and opportunity to create a linkage between the Ocean County Hazard Mitigation Plan and the town's Floodplain Management Plan. Through this plan, Township specific analysis is conducted to better understand potential hazards and vulnerabilities.

- **Borough of Mantoloking Flood Mitigation Plan, Updated Annually:** The Borough of Mantoloking has developed, adopted and is implementing a Flood Mitigation Plan to serve as a guidance document to mitigate flood damage to properties and the environment within the Borough. The Plan not only establishes the goals and guidelines for future flood protection throughout the community, but provides a summary of past efforts made by the Borough throughout the years to control flood damage. The Plan defines the Borough's continued commitment towards the protection, health, safety and welfare of its residents and their property, as well as the Borough's commitment towards the improvement of their environment. The Committee meets annually continually updating said Plan based on activities conduct during the previous year and the proposed activities scheduled for the upcoming year.
- **Ocean Township Strategic Recovery Planning Report, 2014:** In response to the impacts of Superstorm Sandy, Ocean Township created this Recovery Planning Report that assesses the Townships capabilities, strategies for future hazard recovery, recovery efforts as well as future potential mitigation efforts.
- **Toms River Township Local Hazard Mitigation Plan, 2016:** Toms River Township is subject to natural, technological and human hazards, and this plan was created to help mitigate against those hazards on a local scale. The emergency management community, citizens, planners, elected officials and other stakeholders in Toms River recognize the impact of disasters on the community, especially flooding. This plan was created to specifically address the community's vulnerability to flooding, and looks at specific local mitigation strategies to improve community resiliency post-disaster overall.

Table 5.6-1 lists specific integration activities for each of Ocean County's municipalities based on the results of the municipal capability assessments and the mitigation activities selected during this planning process.

5.6-1 Ongoing Planned Municipal Integration Activities

MUNICIPALITY	ONGOING PLANNED INTEGRATION ACTIVITIES
Barnegat Light Borough	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas. Emergency Operations Plan: EOP will be updated to reflect the hazards discussed in the HMP, especially with regard to probability, impact, and extent.
Barnegat Township	Floodplain management: Community will use the HMP to support future floodplain management.
Bay Head Borough	Comprehensive/Master Plan: Document addresses flooding but will be reviewed with the up-to-date flood vulnerability and instances described in the HMP.

MUNICIPALITY	ONGOING PLANNED INTEGRATION ACTIVITIES
Beach Haven Borough	Stormwater Management Plan: As a part of the next Stormwater Management Plan Update, the HMP will act as a resource to identify areas of flooding, and flood mitigation activities will be incorporated as appropriate. School Emergency Operations Plan: Plan components will be supported by data in HMP.
Beachwood Borough	Emergency Operations Plan: EOP will be updated to reflect the hazards discussed in the HMP, especially with regard to probability, impact, and extent.
Berkeley Township	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas and to provide for future mitigation projects.
Brick Township	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas. Zoning ordinance in particular can be improved by zoning floodprone areas as Conservation and Open Space. Comprehensive/Master Plan: Document will be revisited to ensure it adequately discourages development in known hazard areas. Plan will also be revisited to explore CRS participation.
Eagleswood Township	Emergency Operations Plan: EOP will be updated to better reflect the mitigation actions selected in the HMP.
Harvey Cedars Borough	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas. Emergency Operations Plan: EOP will be updated to reflect the hazards discussed in the HMP, especially with regard to probability, impact, and extent.
Island Heights Borough	Comprehensive/Master Plan: Document does not currently address hazards. At next update, the HMP will be reviewed and discussion of hazard-prone areas will be added as appropriate.

MUNICIPALITY	ONGOING PLANNED INTEGRATION ACTIVITIES
Jackson Township	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas, especially the deficiencies identified related to the Township's steep slope ordinance. Coordination with private dam owners: Township will work with private dam owners to identify future risks and mitigation activities to reduce flooding risks related to dam failures.
Lacey Township	Comprehensive/Master Plan: Document does not currently address hazards. At next update, the HMP will be reviewed and discussion of hazard-prone areas will be added as appropriate.
Lakehurst Borough	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas.
Lakewood Township	Comprehensive/Master Plan: Document currently minimally addresses hazards (terrorism and severe weather). At next update, the HMP will be reviewed and discussion of hazard-prone areas will be added as appropriate.
Lavallette Borough	Comprehensive/Master Plan: Document does not currently address hazards. At next update, the HMP will be reviewed and discussion of hazard-prone areas will be added as appropriate.
Little Egg Harbor Township	Floodplain management: Community has adopted the ABFE maps and will use the HMP to support future floodplain management. Community education and outreach: Community has police and fire outreach programs in schools; HMP will be used as a resource for developing program in the future. GIS and mapping capability: Community will work with County OEM to obtain GIS data used in HMP to improve local mapping program.
Long Beach Township	Building code: At time of next update, code will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate.
Manchester Township	Hazard identification and documentation: A joint effort between Emergency Services and the Bureau of Inspections identifies and documents hazards. HMP data sources and findings will be used to supplement local identification efforts.

MUNICIPALITY	ONGOING PLANNED INTEGRATION ACTIVITIES
Mantoloking Borough	Comprehensive/Master Plan: HMP will be used to support Master Plan updates and flooding resiliency goals and objectives. Evacuation planning: Community will use HMP community flood vulnerability and sea level rise mapping to improve evacuation plans with alternative routes and/or alternative re-entry strategies.
Ocean Gate Borough	Acquisition of land for open space and public recreation: Community has a precedent of purchasing land for open space. HMP will be used to identify acquisition sites that may also help alleviate risks.
Ocean Township	Floodplain management: Community will use the HMP to support future floodplain management. Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas.
Pine Beach Borough	Floodplain management: Community has adopted the ABFE maps with one foot of freeboard and will use the HMP to support future floodplain management.
Plumsted Township	Hazard identification and documentation: Community will use information in the HMP to continue their evaluation of the risk and vulnerability of erosion and sinkholes. Commodity Flow Study: Community will use HMP as a basis for evaluating its vulnerability to hazardous materials incidents and determining if a Commodity Flow Study would assist in reducing risk.
Point Pleasant Beach Borough	Floodplain management: Community has adopted the ABFE maps with one foot of freeboard and will use the HMP to support future floodplain management. Local land use codes: Local OEM will look into creating a natural hazard ordinance to assist in reducing risk using the Risk Assessment section of the HMP to guide which hazards should be addressed.
Point Pleasant Borough	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas.
Seaside Heights Borough	Comprehensive/Master Plan, Capital Improvement Plan, Economic Development Plan, EOP, Continuity of Operations Plan: Community is reviewing these planning mechanisms post-Sandy. HMP will be used to assist in the review and any appropriate updates stemming from hazard events.

MUNICIPALITY	ONGOING PLANNED INTEGRATION ACTIVITIES
Seaside Park Borough	Emergency response protocols: Community has emergency response protocols for a number of hazards. Protocols will be reviewed with the HMP risk assessment to identify any appropriate changes.
Ship Bottom Borough	Floodplain management: Community has adopted the ABFE maps with one foot of freeboard and will use the HMP to support future floodplain management.
South Toms River Borough	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas.
Stafford Township	Floodplain management: Community has adopted the ABFE maps and will use the HMP to support future floodplain management. Comprehensive/Master Plan: Document currently minimally addresses hazards. At next update, the HMP will be reviewed and discussion of hazard-prone areas will be added as appropriate.
Surf City Borough	Floodplain management: Community has adopted the ABFE maps and will use the HMP to support future floodplain management. Evacuation planning: Community will use HMP community flood vulnerability and sea level rise mapping to improve evacuation plans with alternative routes and/or alternative re-entry strategies.
Toms River Township	Building code, floodplain ordinance, and/or local land use codes: Codes will be reviewed with the approved HMP to incorporate findings of the HMP risk assessment as appropriate to address hazard-prone areas. Comprehensive/Master Plan: Document addresses the conservation of open space to develop greenways. HMP will be used to identify other natural systems whose conservation would address both open space and hazard risk reduction.
Tuckerton Borough	Critical facilities/critical infrastructure protection: Community will use the HMP to support mitigation of community facilities and infrastructure. This process will be led by the community flood vulnerability analysis and mapping from the HMP.

6 Mitigation Strategy

6. Mitigation Strategy

6.1 Process Summary

The Ocean County HMP includes goals, objectives, and actions identified by municipal, county and other stakeholders. Mitigation goals are general guidelines that explain what the County wants to achieve. Goals are usually expressed as broad policy statements representing desired long-term results. Mitigation objectives describe strategies or implementation steps to attain the identified goals. Objectives are more specific statements than goals; the described steps are usually measurable and can have a defined completion date. Actions provide more detailed descriptions of specific work tasks to help the County and its municipalities achieve prescribed goals and objectives.

The steps involved in developing a mitigation strategy were introduced at the May 31st, 2017 Kickoff Meeting and discussed in depth at meetings conducted with each individual municipality. It was explained that many current activities are mitigation and should also be part of the mitigation strategy in the plan. The focus of the Individual Municipal Meetings was on developing the mitigation strategy. In each municipal meeting, the risks for the municipality were considered and a mitigation strategy was developed to address those risks. The contractor consolidated the notes from the meetings to draft detailed mitigation action lists for each municipality and in some cases municipal authorities. The detailed actions worksheets are included in Appendix B – Jurisdictions; the worksheets follow the outline of a sample form provided by FEMA Region II. The full mitigation strategy was reviewed by municipalities and the public in the Draft Plan Review Meetings on April 10, 2018.

6.2 Mitigation Goals and Objectives

The Strategy, Goals, and objectives from the 2014 County HMP are continued for the 2018 County HMP update. Table 6.2-1 details the mitigation goals and objectives.

Table 6.2-1 Strategy, Goals and Objectives

GOAL 1	**Encourage sustainable development to protect people, property, community resources and the environment from natural and human-made disasters**
Objective 1A	Meet and preferably exceed minimum standards for NFIP
Objective 1B	Manage building code, land use code, ordinance and other planning mechanisms to prevent and mitigate the impact of disasters on people and property
Objective 1C	Improve information available for mitigation planning
Objective 1D	Coordinate and increase applications for Federal and State grant programs
Objective 1E	Integrate and leverage other planning mechanism from neighboring jurisdictions; local, county and regional organizations; and State partnerships to implement Ocean County HMP
Objective 1F	Improve shelter management

GOAL 2	**Build and rebuild structures and infrastructure to protect people and to reduce impacts of future disasters**
Objective 2A	Increase the number of residential properties protected from hazards
Objective 2B	Increase the number of community resources/infrastructure protected from hazards
Objective 2C	Improve the ability of critical facilities and infrastructure to safely operate during storms and utility interruptions
Objective 2D	Improve evacuation capability
GOAL 3	**Protect and restore the natural environment to support disaster resiliency**
Objective 3A	Improve health of natural systems to safely and naturally accommodate flooding and wildfire
Objective 3B	Improve health of natural systems used to protect residential properties and other community resources
Objective 3C	Plan for increased open space in most vulnerable areas
Objective 3D	Promote appropriate urban-wild land interface for wildfire mitigation
GOAL 4	**Promote education, awareness and outreach before, during and after disaster**
Objective 4A	Improve and expand information and opportunities for input available by television, radio, websites, social media, newsletters, and meetings
Objective 4B	Increase participation in mitigation programs including CRS, StormReady, and FireWise
Objective 4C	Tailor timely messages for audiences including children, parents, community groups, universities, seniors and other groups
Objective 4D	Improve alert and warning systems

6.3 Identification and Analysis of Mitigation Techniques

The result of the municipal meetings was an added 141 new and 285 ongoing Mitigation Actions in the County HMP Update. Since 2014, a total of 92 Mitigation Actions have been completed and 106 have been withdrawn. Mitigation Actions were withdrawn as identified as by the municipality or were withdrawn as they were recognized as being an existing capability. The new actions were identified by each municipality based on their risk and capability. A variety of mitigation methods were used to address all hazards present in each municipality and the County.

The mitigation technique categories outlined in the *Local Mitigation Planning Handbook* (March 2013) were utilized to identify a range of actions for each municipality and the county. In the individual municipal meetings, each category was reviewed to determine current and future actions that each municipality wanted to be part of the mitigation strategy. The four categories include:

- **Plans and Regulations:** These actions include government authorities, policies, or codes that influence the way land and buildings are developed and built.

- **Structure and Infrastructure Projects:** These actions involve modifying existing structures and infrastructure to protect them from a hazard or remove them from a hazard area. This could apply to public or private structures as well as critical facilities and infrastructure. This type of action also involves projects to construct manmade structures to reduce the impact of hazards.
- **Natural Systems Protection:** These are actions that minimize damage and losses and also preserve or restore the functions of natural systems.
- **Education and Awareness Programs:** These are actions to inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them. Although this type of mitigation reduces risk less directly than structural projects or regulation, it is an important foundation. A greater understanding and awareness of hazards and risk among local officials, stakeholders, and the public is more likely to lead to direct actions.

The Ocean County HMP employs these four categories of techniques to address each of the hazards that affect the County, shown in Table 6.3-1.

Table 6.3-1 Mitigation Techniques Used for Each Hazard in Ocean County

HAZARD (ORDERED FROM HIGHEST TO LOWEST RISK FACTOR) NATURAL (N) OR MAN-MADE (M)	MITIGATION TECHNIQUE			
	PLANS AND REGULATIONS	STRUCTURE AND INFRASTRUCTURE PROJECTS	NATURAL SYSTEMS PROTECTION	EDUCATION AND AWARENESS PROGRAMS
Flood, Flash Flood, Ice Jam	✓	✓	✓	✓
Hurricane, Tropical Storm, Nor'easter	✓	✓	✓	✓
Utility Interruption	✓	✓		✓
Winter Storm	✓	✓		✓
Wildfire	✓	✓	✓	✓
Extreme Temperature	✓	✓		✓
Coastal Erosion	✓	✓	✓	✓
Environmental Hazards	✓	✓		✓
Terrorism		✓		
Drought	✓	✓		✓
Transportation Accidents	✓	✓		✓
Urban Fire and Explosion	✓	✓		✓
Nuclear Incidents	✓	✓		✓
Tornado, Wind Storm	✓	✓		✓
Subsidence			✓	
Earthquake	✓	✓		✓

Mitigation actions were evaluated on Detailed Mitigation Action Worksheets. A sample of this worksheet is shown in Figure 6.3-1. The worksheet uses the following criteria:

- **Benefit/Cost:** Is the benefit greater than the cost? If an exact cost is not quantifiable describe the benefit compared to cost/time investment.
- **Technical:** How effective will the action be in avoiding or reducing future losses?
- **Political:** Does the action have public and political support?
- **Legal:** Does the community have the authority to implement the proposed measure?
- **Environmental:** Will the action provide environmental benefits and will it comply with local, state and federal environmental regulations?
- **Social:** Will the action be acceptable by the community or will it cause any one segment of the population to be treated unfairly?
- **Administrative:** Is there adequate staffing and funding available to implement the action in a timely manner?
- **Economic:** What are the costs and benefits of the action and does it contribute to community economic goals?
- **Local Champion:** Is there a local champion that will work towards implementing action?
- **Other Community Objective**: Does the action meet another community criteria not identified above?

Figure 6.3-1 Detailed Mitigation Action Worksheet

Action Number and Title	
Assessing the Risk	
Hazard(s) addressed	
Risk finding	
Describing the Action	
Action category	
Action type	
Existing, future &/or NA	
Evaluating the Action	
Losses avoided (i.e., benefits)	
Cost estimate	
Cost effectiveness (i.e., benefit/cost)	
Technical	
Political	
Legal	
Environmental	
Social	
Administrative capability	
Local champion	
Other community objectives	

Implementing the Action	
Priority	
Local planning mechanism	
Responsible party	
Potential funding sources	
Time line	

6.4 Mitigation Action Plan

Each municipal and county action has a *Detailed Mitigation Action Worksheet* in Appendix B. These worksheets evaluate the effectiveness of each action and provide information to support implementation. In total there are 454 new and ongoing Mitigation Actions. The *Detailed Mitigation Action Worksheets* provide the opportunity for individualization between municipalities. Actions are tailored to municipal interest, risk, vulnerability and capability in Appendix B. The actions are summarized in Section 6.4 to group together similar types of actions. When grouped there are 11 municipal types of actions which include:

- Building Improvements - Includes actions related to structural improvements that will help mitigate against natural hazards.
- Coastal Resiliency Project - Includes actions that will help reduce coastal flood risk and support a healthy coastal environment.
- Elevation Project - Includes actions targeted at elevating structures or infrastructure to mitigate against natural hazards.
- Engineering/Planning Study - Includes actions focused on completing a study, a plan or analysis to help better understand what actions should be taken to mitigate against hazards.
- Generators - Includes any action involving the purchase or installation of a generator.
- Increasing CRS Participation - Includes actions that are focused on improving a community's involvement in CRS.
- Land Acquisition - Includes actions that target acquiring land to help mitigate against hazards.
- Natural Area Improvement - Includes actions that target improving natural areas, excluding coastal area improvements.
- Public Outreach - Includes all actions focused on public outreach and encouraging public involvement in understanding risk and vulnerability of hazards.
- Target Hardening - Includes all actions focused on mitigating against potential terrorist or security threats.
- Utility Infrastructure Improvements - Includes actions that focus on improving utilities to be more resistant to risks from hazards.

A hazard mitigation action is defined as follows:

- **Hazard Mitigation Action:** Any sustained action to reduce or eliminate long-term risk to human life and property from natural hazards.

As a Hazard Mitigation Plan, each municipality is required to have identified Hazard Mitigation Actions. A complete listing of new and ongoing Mitigation Actions and a detailed Mitigation Action Worksheet for each action are in Appendix B. Table 6.4-1 is summary of new and ongoing municipal actions and Table 6.4-2 highlights all completed mitigation actions since the previous plan, respectively.

Table 6.4-1 New and Ongoing Mitigation Actions Summary

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
<u>Building Improvements</u> Includes actions related to structural improvements that will help mitigate against natural hazards.	Structure and Infrastructure Project	Bay Head Borough	Action 6.4.3-23:	New	Flood, Flash Flood, Hurricane, Tropical Storm, Nor'easter
			Action 6.4.4-20:	New	All
		Beachwood Township	Action 6.4.5-11	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Berkeley Township	Action 6.4.6-24:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Brick Township	Action 6.4.8-4:	Ongoing	Tornado, Wind Storm
			Action 6.4.8-9:	Ongoing	All
			Action 6.4.8-21:	Ongoing	
			Action 6.4.8-30:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.8-35:	Ongoing	All
		Harvey Cedars Borough	Action 6.4.11-18:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Lanoka Harbor Emergency Medical Services	Action 6.4.18-1:	Ongoing	Tornado, Wind Storm
			Action 6.4.21-10:	New	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Building Improvements Includes actions related to structural improvements that will help mitigate against hazards including flooding and wind.		Lavallette Borough	Action 6.4.21-11:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm,
		Little Egg Harbor Township	Action 6.4.22-7:	Ongoing	Hurricane, Tropical Storm, Nor'easter; Utility Interruption
		Long Beach Township	Action 6.4.24-22:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Manchester Township	Action 6.4.25-20:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Mantoloking Borough	Action 6.4.26-3:	Ongoing	Flood, Flash Flood, Ice Jam; Hurricane Tropical Storm, Nor'easter; Tornado, Windstorm
			Action 6.4.26-7:	Ongoing	All
		Ocean Gate Borough	Action 6.4.27-3:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.27-17:	Ongoing	
		Point Pleasant Borough	Action 6.4.32-5:	Ongoing	
			Action 6.4.32-25:	Ongoing	
		Seaside Park Borough	Action 6.4.34-2:	Ongoing	
			Action 6.4.34-21:	Ongoing	
		South Toms River Borough	Action 6.4.36-10:	Ongoing	
			Action 6.4.36-11:	Ongoing	
		Stafford Township	Action 6.4.37-19:	New	
		Toms River Township	Action 6.4.39-2:	Ongoing	
		Tuckerton Borough	Action 6.4.40-13:	Ongoing	All

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Coastal Resiliency Project	Local Plans and Regulations	Barnegate Light Borough	Action 6.4.1-6:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Lavallette Borough	Action 6.4.21-5:	New	
Coastal Resiliency Project Includes actions that will help reduce coastal flood risk and support a healthy coastal environment.	Natural Systems Protection Natural Systems Protection	Barnegat Township	Action 6.4.2-8:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Barnegate Light	Action 6.4.1-8:	Ongoing	
			Action 6.4.1-9:	Ongoing	
		Bay Head Borough	Action 6.4.3-8:	Ongoing	
			Action 6.4.3-10:	Ongoing	
		Beach Haven Borough	Action 6.4.4-6:	Ongoing	
			Action 6.4.4-7:	Ongoing	
		Beachwood Township	Action 6.4.5-5:	New	
		Berkeley Township	Action 6.4.6-6:	Ongoing	
		Brick Township	Action 6.4.8-43:	New	
			Action 6.4.8-45:	New	
			Action 6.4.8-24:	Ongoing	
		Harvey Cedars Borough	Action 6.4.11-10:	Ongoing	
			Action 6.4.11-4:	Ongoing	
		Little Egg Harbor Township	Action 6.4.22-11:	Ongoing	
		Long Beach Township	Action 6.4.24-8:	Ongoing	
			Action 6.4.24-9:	Ongoing	
		Mantoloking Borough	Action 6.4.26-8:	Ongoing	
			Action 6.4.26-15:	Ongoing	
		Pine Beach Borough	Action 6.4.29-6:	Ongoing	
		Point Pleasant Beach Borough	Action 6.4.31-8:	Ongoing	
		Seaside Heights Borough	Action 6.4.33-10:	Ongoing	
			Action 6.4.34-26:	Ongoing	
			Action 6.4.34-7:	Ongoing	
			Action 6.4.34-12:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Coastal Resiliency Project Includes actions that will help reduce coastal flood risk and support a healthy coastal environment.		Ship Bottom Borough	Action 6.4.35-14	New	
		Toms River Township	Action 6.4.39-7:	Ongoing	
	Structure and Infrastructure Project	Barnegat Township	Action 6.4.2-3:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter;
		Barnegate Light Borough	Action 6.4.1-14:	New	
			Action 6.4.1-16:	New	
		Berkeley Township	Action 6.4.6-10:	Ongoing	
		Harvey Cedars Borough	Action 6.4.11-23:	New	
		Little Egg Harbor Township	Action 6.4.22-6:	Ongoing	
			Action 6.4.22-9:	Ongoing	
			Action 6.4.22-21:	Ongoing	
	Structure and Infrastructure Project	Ocean Gate Borough	Action 6.4.27-4:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter;
		Ocean Township	Action 6.4.28-3:	Ongoing	
		Point Pleasant Borough	Action 6.4.32-32:	Ongoing	
		Stafford Township	Action 6.4.37-26:	New	
			Action 6.4.37-22:	New	
			Action 6.4.37-2:	Ongoing	
			Action 6.4.37-22:	New	
		Tuckerton Borough	Action 6.4.40-4:	Ongoing	
Elevation Project Includes actions targeted at elevating structures or infrastructure	Local Plans and Regulations	Barnegate Light Borough	Action 6.4.1-15:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Harvey Cedars Borough	Action 6.4.11-22:	New	
		Pine Beach Borough	Action 6.4.29-5:	Ongoing	
		Barnegat Township	Action 6.4.2-1:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
to mitigate against natural hazards.	Structure and Infrastructure Project	Barnegate Light Borough	Action 6.4.1-1:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter;
		Bay Head Borough	Action 6.4.3-18:	New	
			Action 6.4.3-1:	Ongoing	
			Action 6.4.3-17:	New	
		Beach Haven Borough	Action 6.4.4-1:	Ongoing	
			Action 6.4.4-16:	New	
			Action 6.4.4-21:	New	
<u>Elevation Project</u> Includes actions targeted at elevating structures or infrastructure to mitigate against natural hazards.	Structure and Infrastructure Project	Berkeley Township	Action 6.4.6-38:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter;
			Action 6.4.6-1:	Ongoing	
		Brick Township	Action 6.4.8-1:	Ongoing	
			Action 6.4.8-6:	Ongoing	
			Action 6.4.8-42:	New	
		Harvey Cedars Borough	Action 6.4.11-1:	Ongoing	
			Action 6.4.11-3:	Ongoing	
			Action 6.4.11-19:	New	
		Island Heights Borough	Action 6.4.12-1:	Ongoing	
			Action 6.4.12-2:	Ongoing	
			Action 6.4.12-3:	Ongoing	
			Action 6.4.12-14:	New	
		Lacey Township	Action 6.4.15-4:	Ongoing	
		Lavallette Borough	Action 6.4.21-1:	Ongoing	
			Action 6.4.21-9:	New	
		Little Egg Harbor Township	Action 6.4.22-1:	Ongoing	
		Long Beach Township	Action 6.4.24-27:	New	
			Action 6.4.24-1:	Ongoing	
			Action 6.4.24-2:	Ongoing	
			Action 6.4.24-4:	Ongoing	
			Action 6.4.24-18:	New	
		Mantoloking Borough	Action 6.4.26-1:	Ongoing	
			Action 6.4.26-6:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Elevation Project Includes actions targeted at elevating structures or infrastructure to mitigate against natural hazards.	Structure and Infrastructure Project	Ocean Gate Borough	Action 6.4.27-1:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.27-26:	New	
			Action 6.4.27-27:	New	
		Ocean Township	Action 6.4.28-2:	Ongoing	
		Pine Beach Borough	Action 6.4.29-1:	Ongoing	
		Plumsted Township	Action 6.4.30-11:	New	
		Point Pleasant Beach Borough	Action 6.4.31-4:	Ongoing	
			Action 6.4.32-2:	Ongoing	
		Seaside Heights Borough	Action 6.4.33-9:	Ongoing	
			Action 6.4.33-2:	Ongoing	
			Action 6.4.33-7:	Ongoing	
			Action 6.4.33-8:	Ongoing	
		Seaside Park Borough	Action 6.4.34-4:	Ongoing	
			Action 6.4.34-30:	New	
			Action 6.4.34-35:	New	
			Action 6.4.34-36:	New	
		Ship Bottom Borough	Action 6.4.35-3:	Ongoing	
			Action 6.4.35-11	New	
			Action 6.4.35-13	New	
			Action 6.4.35-1:	Ongoing	
		South Toms River Borough	Action 6.4.36-9:	Ongoing	
		Stafford Township	Action 6.4.37-17:	New	
			Action 6.4.37-23:	New	
			Action 6.4.37-25:	New	
			Action 6.4.37-3:	Ongoing	
		Stafford Township	Action 6.4.37-4:	Ongoing	
		Surf City Borough	Action 6.4.38-1:	Ongoing	
			Action 6.4.38-3:	Ongoing	
		Toms River Township	Action 6.4.39-1:	Ongoing	
			Action 6.4.40-3:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
		Tuckerton Borough	Action 6.4.40-7:	Ongoing	
<u>Plans and Studies</u>	Local Plans and Regulations	Barnegate Light Borough	Action 6.4.1-7:	Ongoing	All
		Bay Head Borough	Action 6.4.3-24:	New	Flood, Flash Flood, Hurricane, Tropical Storm, Nor'easter
			Action 6.4.3-25:	New	
		Beach Haven Borough	Action 6.4.4-5:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
<u>Plans and Studies</u>		Berkeley Township	Action 6.4.6-34:	New	
			Action 6.4.6-35:	New	
Includes actions focused on completing a study, a plan or analysis to help better understand what actions should be taken to mitigate against hazards.	Local Plans and Regulations		Action 6.4.6-36:	New	All
			Action 6.4.6-39:	New	
			Action 6.4.6-25:	Ongoing	
		Brick Township	Action 6.4.8-12:	Ongoing	
		Island Heights Borough	Action 6.4.12-12:	New	
		Jackson Township	Action 6.4.13-14:	New	
	Local Plans and Regulations	Manchester Township	Action 6.4.25-19:	New	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Tornado, Wind Storm; Winter Storm
			Action 6.4.25-4:	Ongoing	Wildfire
		Mantoloking Borough	Action 6.4.26-12:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.26-13:	Ongoing	All

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Plans and Studies Includes actions focused on completing a study, a plan or analysis to help better understand what actions should be taken to mitigate against hazards.			Action 6.4.26-22:	New	
			Action 6.4.26-24:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Ocean County	Action 6.4.41-5:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.41-6:	Ongoing	
			Action 6.4.41-11:	Ongoing	
			Action 6.4.41-13:	Ongoing	
		Ocean County	Action 6.4.41-14:	Ongoing	
			Action 6.4.41-15:	Ongoing	
			Action 6.4.41-20:	Ongoing	
		Ocean Gate Borough	Action 6.4.27-18:	Ongoing	
	Local Plans and Regulations		Action 6.4.27-21:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.27-24:	Ongoing	All
		Plumsted Township	Action 6.4.30-2:	Ongoing	Wildfire
			Action 6.4.30-5:	Ongoing	Flood, Flash Flood, Ice Jam
			Action 6.4.30-6:	Ongoing	Hazardous Materials
			Action 6.4.30-9:	New	All
		Point Pleasant Borough	Action 6.4.32-33:	Ongoing	
		Seaside Park Borough	Action 6.4.34-29:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Stafford Township	Action 6.4.37-5:	Ongoing	
		Brick Township	Action 6.4.8-40:	New	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.8-39:	New	
		Lakehurst Borough	Action 6.4.19-13:	Ongoing	Transportation Accidents

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
		Long Beach Township	Action 6.4.24-25:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Mantoloking Borough	Action 6.4.26-23:	New	
Generators Includes any action involving the purchase or installation of a generator.	Structure and Infrastructure Project	Barnegat Light Borough	Action 6.4.1-2:	Ongoing	Hurricane, Topical Storm, Nor'easter; Tornado, Wind Storm; Winter Storm; Utility Interruption
		Berkeley Township	Action 6.4.6-2:	Ongoing	
		Berkeley Township Sewerage Authority	Action 6.4.7-1:	Ongoing	
			Action 6.4.7-2:	Ongoing	
			Action 6.4.7-3:	Ongoing	
			Action 6.4.7-1:	Ongoing	
			Action 6.4.7-2:	Ongoing	
			Action 6.4.7-3:	Ongoing	
		Brick Township	Action 6.4.8-2:	Ongoing	Hurricane, Topical Storm, Nor'easter; Tornado, Wind Storm; Winter Storm; Utility Interruption
		Eagleswood Township	Action 6.4.10-1:	Ongoing	
		Harvey Cedars Borough	Action 6.4.11-2:	Ongoing	
Generators Includes any action involving the purchase or installation of a generator.	Structure and Infrastructure Project	Island Heights Borough	Action 6.4.12-13:	New	All
		Jackson Township	Action 6.4.13-13:	New	Hurricane, Tropical Storm, Nor'easter; Tornado, Wind Storm; Winter Storm; Utility Interruption, Coastal Storm, Nor'easter, Lightning & Thunderstorm
		Jackson Township Municipal Utilities Authority	Action 6.4.14-1:	Ongoing	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Tornado, Wind
			Action 6.4.14-4:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Generators Includes any action involving the purchase or installation of a generator.	Structure and Infrastructure Project	Lacey Township	Action 6.4.15-14:	New	Storm; Winter Storm; Utility Interruption
		Lakehurst Borough	Action 6.4.19-5:	Ongoing	
			Action 6.4.19-2:	Ongoing	
			Action 6.4.19-4:	Ongoing	
		Lakewood Township	Action 6.4.20-3:	Ongoing	
			Action 6.4.20-4:	Ongoing	
			Action 6.4.20-9:	Ongoing	
		Little Egg Harbor Township	Action 6.4.22-37:	New	All
		Mantoloking Borough	Action 6.4.26-5:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm,
		Plumsted Township	Action 6.4.30-1:	Ongoing	Hurricane, Topical Storm, Nor'easter; Tornado, Wind Storm; Winter Storm; Utility Interruption
			Action 6.4.30-10:	New	All
		Point Pleasant Borough	Action 6.4.32-6:	Ongoing	Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter; Tornado, Wind Storm; Winter Storm; Utility Interruption
			Action 6.4.32-7:	Ongoing	Hurricane, Tropical Storm, Nor'easter; Tornado, Wind Storm; Winter Storm; Utility Interruption
		Seaside Heights Borough	Action 6.4.33-18:	New	
			Action 6.4.33-21:	New	
			Action 6.4.33-4:	Ongoing	
		Seaside Park Borough	Action 6.4.34-3:	Ongoing	
		South Toms River Borough	Action 6.4.36-12:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane,

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
					Tropical Storm, Nor'easter
		Stafford Township	Action 6.4.37-18:	New	All
			Action 6.4.37-24:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter;
		Toms River Township	Action 6.4.39-3:	Ongoing	Hurricane, Tropical Storm, Tornado, Wind Storm; Winter Storm; Utility Interruption
Increasing CRS Participation Includes actions that are focused on improving a community's involvement in CRS.	Education and Awareness Program	Barnegat Township	Action 6.4.2-11:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Barnegat Light Borough	Action 6.4.1-11:	Ongoing	
		Bay Head Borough	Action 6.4.3-11:	Ongoing	
		Beach Haven Borough	Action 6.4.4-8:	Ongoing	
		Beachwood Township	Action 6.4.5-6:	New	
		Berkeley Township	Action 6.4.6-14:	Ongoing	
		Brick Township	Action 6.4.8-26:	Ongoing	
		Eagleswood Township	Action 6.4.10-6:	Ongoing	
		Harvey Cedars Borough	Action 6.4.11-11:	Ongoing	
		Island Heights Borough	Action 6.4.12-9:	Ongoing	
		Lacey Township	Action 6.4.15-8:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Increasing CRS Participation Includes actions that are focused on improving a community's involvement in CRS.	Education and Awareness Program	Lavallette Borough	Action 6.4.21-7:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Little Egg Harbor Township	Action 6.4.22-19:	Ongoing	
		Long Beach Township	Action 6.4.24-10:	Ongoing	
		Manchester Township	Action 6.4.25-7:	Ongoing	
		Mantoloking Borough	Action 6.4.26-26:	New	
			Action 6.4.26-17:	Ongoing	
		Ocean Gate Borough	Action 6.4.27-11:	Ongoing	
		Ocean Township	Action 6.4.28-10:	Ongoing	
		Pine Beach Borough	Action 6.4.29-7:	Ongoing	
		Point Pleasant Beach Borough	Action 6.4.31-10:	Ongoing	
		Point Pleasant Borough	Action 6.4.32-11:	Ongoing	
		Seaside Park Borough	Action 6.4.34-13:	Ongoing	
		Ship Bottom Borough	Action 6.4.35-10:	Ongoing	
		South Toms River Borough	Action 6.4.36-7:	Ongoing	
		Stafford Township	Action 6.4.37-6:	Ongoing	
		Surf City Borough	Action 6.4.38-9:	Ongoing	
		Toms River Township	Action 6.4.39-8:	Ongoing	
		Tuckerton Borough	Action 6.4.40-14:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Land Acquisition Includes actions that target acquiring land to help mitigate against hazards	Natural Systems Protection	Barnegat Township	Action 6.4.2-7:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Berkeley Township	Action 6.4.6-5:	Ongoing	
			Action 6.4.6-30:	Ongoing	
		Brick Township	Action 6.4.8-3:	Ongoing	
		Ocean Gate Borough	Action 6.4.27-2:	Ongoing	
		Ocean Township	Action 6.4.28-1:	Ongoing	
Land Acquisition Includes actions that target acquiring land to help mitigate against hazards	Natural Systems Protection	Point Pleasant Beach Borough	Action 6.4.31-3:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Point Pleasant Borough	Action 6.4.32-3:	Ongoing	
		Seaside Park Borough	Action 6.4.34-1:	Ongoing	
		Ship Bottom Borough	Action 6.4.35-12	New	
		Tuckerton Borough	Action 6.4.40-5:	Ongoing	
Natural Area Improvement Includes actions that target improving natural areas, excluding coastal area improvements	Natural Systems Protection	Jackson Township	Action 6.4.13-4:	Ongoing	Wildfire
		Lakehurst Borough	Action 6.4.19-8:	Ongoing	
		Little Egg Harbor Township	Action 6.4.22-12:	Ongoing	
			Action 6.4.22-18:	Ongoing	
		Mantoloking Borough	Action 6.4.26-16:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Ocean County	Action 6.4.41-9:	Ongoing	
			Action 6.4.41-10:	Ongoing	
		Seaside Park Borough	Action 6.4.34-33:	New	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
		South Toms River Borough	Action 6.4.36-5:	Ongoing	
		Stafford Township	Action 6.4.37-14:	New	
		Brick Township	Action 6.4.8-16:	Ongoing	Coastal Erosion
		Brick Township	Action 6.4.8-23:	Ongoing	Coastal Erosion
		Harvey Cedars Borough	Action 6.4.11-21:	Ongoing	Coastal Erosion
		Tuckerton Borough	Action 6.4.40-2:	Ongoing	Coastal Erosion
Public Outreach	Education and Awareness Program	Barnegat Township	Action 6.4.2-16:	Ongoing	All
		Barnegat Township	Action 6.4.2-9:	Ongoing	Wildfire
		Barnegat Township	Action 6.4.2-12:	Ongoing	All
		Barnegat Township	Action 6.4.2-13:	Ongoing	All
		Barnegat Township	Action 6.4.2-14:	Ongoing	All
		Barnegat Township	Action 6.4.2-15:	Ongoing	All
		Barnegate Light Borough	Action 6.4.1-18:	New	All
		Barnegate Light Borough	Action 6.4.1-17:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
Public Outreach Includes all actions focused on public outreach and encouraging public involvement in understanding risk and vulnerability of hazards.	Education and Awareness Program	Beach Haven Borough	Action 6.4.4-22:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Beach Haven Borough	Action 6.4.4-23:	New	All
		Beach Haven Borough	Action 6.4.4-9:	Ongoing	All
		Beach Haven Borough	Action 6.4.4-10:	Ongoing	All
		Beach Haven Borough	Action 6.4.4-12:	Ongoing	All
		Beach Haven Borough	Action 6.4.4-13:	Ongoing	All
		Beach Haven Borough	Action 6.4.4-14:	Ongoing	All
		Beach Haven Borough	Action 6.4.4-15:	Ongoing	All
		Beachwood Township	Action 6.4.5-7:	New	All
		Beachwood Township	Action 6.4.5-8:	New	All
		Beachwood Township	Action 6.4.5-9:	New	All
		Beachwood Township	Action 6.4.5-10:	New	All
		Berkeley Township	Action 6.4.6-32:	Ongoing	All
		Berkeley Township	Action 6.4.6-13:	Ongoing	All
		Berkeley Township	Action 6.4.6-15:	Ongoing	All

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
			Action 6.4.6-16:	Ongoing	
			Action 6.4.6-26:	Ongoing	
			Action 6.4.6-31:	Ongoing	Wildfire
		Brick Township	Action 6.4.8-36:	Ongoing	All
			Action 6.4.8-37:	New	
			Action 6.4.8-44:	New	
			Action 6.4.8-15:	Ongoing	
			Action 6.4.8-20:	Ongoing	
			Action 6.4.8-29:	Ongoing	
		Eagleswood Township	Action 6.4.10-8:	Ongoing	Wildfire
		Harvey Cedars Borough	Action 6.4.11-24:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter;
			Action 6.4.11-25:	New	All
			Action 6.4.11-14:	Ongoing	
		Jackson Township	Action 6.4.13-9:	Ongoing	Wildfire
			Action 6.4.13-10:	Ongoing	All
			Action 6.4.13-11:	Ongoing	
			Action 6.4.14-6:	Ongoing	
		Lakehurst Borough	Action 6.4.19-9:	Ongoing	Wildfire
			Action 6.4.19-10:	Ongoing	Wildfire; Urban Fire and Explosion
Public Outreach Includes all actions focused on public outreach and encouraging public involvement in understanding risk and vulnerability of hazards.	Education and Awareness Program	Little Egg Harbor Township	Action 6.4.22-22:	Ongoing	All
			Action 6.4.22-27:	Ongoing	All
			Action 6.4.22-28:	Ongoing	All
		Long Beach Township	Action 6.4.24-20:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.24-26:	New	
			Action 6.4.24-28:	New	All
		Manchester Township	Action 6.4.25-12:	Ongoing	Wildfire
			Action 6.4.25-13:	Ongoing	All
			Action 6.4.25-16:	Ongoing	
			Action 6.4.25-10:	Ongoing	
			Action 6.4.25-11:	Ongoing	
			Action 6.4.26-9:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Public Outreach Includes all actions focused on public outreach and encouraging public involvement in understanding risk and	Education and Awareness Program	Mantoloking Borough	Action 6.4.26-18:	Ongoing	
			Action 6.4.26-19:	Ongoing	
		Ocean County	Action 6.4.41-16:	Ongoing	
			Action 6.4.41-17:	Ongoing	
			Action 6.4.41-18:	Ongoing	
			Action 6.4.41-19:	Ongoing	
			Action 6.4.41-20:	Ongoing	
		Ocean Gate Borough	Action 6.4.27-23:	Ongoing	
			Action 6.4.27-19:	Ongoing	
		Ocean Township	Action 6.4.28-16:	New	Wildfire
		Pine Beach Borough	Action 6.4.29-8:	Ongoing	All
			Action 6.4.29-9:	Ongoing	Wildfire; Urban Fire and Explosion
			Action 6.4.29-10:	Ongoing	Transportation Accidents
			Action 6.4.29-12:	Ongoing	All
		Plumsted Township	Action 6.4.30-7:	Ongoing	All
			Action 6.4.30-8:	Ongoing	Wildfire; Urban Fire and Explosion
		Point Pleasant Borough	Action 6.4.32-31:	Ongoing	All
		Seaside Park Borough	Action 6.4.34-28:	New	All
			Action 6.4.34-14:	Ongoing	
			Action 6.4.34-15:	Ongoing	
			Action 6.4.34-23:	Ongoing	
			Action 6.4.34-27:	Ongoing	
		Ship Bottom Borough	Action 6.4.35-5:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		South Toms River Borough	Action 6.4.36-6:	Ongoing	
			Action 6.4.36-8:	Ongoing	Wildfire
		Stafford Township	Action 6.4.37-7:	Ongoing	All
			Action 6.4.37-8:	Ongoing	
			Action 6.4.37-9:	Ongoing	
			Action 6.4.37-10:	Ongoing	
			Action 6.4.37-11:	Ongoing	Wildfire; Urban Fire and Explosion

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
vulnerability of hazards.			Action 6.4.37-12:	Ongoing	Transportation Accidents
		Surf City Borough	Action 6.4.38-12:	Ongoing	All
			Action 6.4.38-16:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter;
			Action 6.4.38-17:	New	All
			Action 6.4.38-10:	Ongoing	
			Action 6.4.38-11:	Ongoing	Wildfire; Urban Fire and Explosion
		Tuckerton Borough	Action 6.4.40-15:	Ongoing	Hurricane, Tropical Storm, Nor'easter
			Action 6.4.40-16:	Ongoing	All
			Action 6.4.40-17:	Ongoing	
		Bay Head Borough	Action 6.4.3-7:	Ongoing	All
		Brick Township	Action 6.4.8-27:	Ongoing	
		Jackson Township	Action 6.4.13-6:	Ongoing	Flood, Flash Flood, Ice Jam
	Education and Awareness Program	Little Egg Harbor Township	Action 6.4.22-3:	Ongoing	All
<u>Public Outreach</u> Includes all actions focused on public outreach and encouraging public involvement in understanding risk and vulnerability of hazards.		Point Pleasant Borough	Action 6.4.32-30:	Ongoing	All
		Beach Haven Borough	Action 6.4.4-24:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Eagleswood Township	Action 6.4.10-2:	Ongoing	All
<u>Target</u>		Lacey Township	Action 6.4.15-15:	New	Terrorism
			Action 6.4.15-16:	New	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Hardening Includes all actions focused on mitigating against potential terrorist or security threats.	Structure and Infrastructure Project	Lavallette Borough	Action 6.4.21-12:	New	
			Action 6.4.21-13:	New	
		Little Egg Harbor Township	Action 6.4.22-38:	New	
			Action 6.4.22-39:	New	
			Action 6.4.22-40:	New	
		Manchester Township	Action 6.4.25-17:	New	
			Action 6.4.25-18:	New	
		Mantoloking Borough	Action 6.4.26-21:	New	
		Ocean Township	Action 6.4.28-17:	New	
			Action 6.4.28-18:	New	
		Pine Beach Borough	Action 6.4.29-14:	New	
		Seaside Heights Borough	Action 6.4.33-20:	New	
Utility Infrastructure Improvements	Structure and Infrastructure Project	Barnegat Light Borough	Action 6.4.1-13:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
		Bay Head Borough	Action 6.4.3-19:	New	
			Action 6.4.3-20:	New	
			Action 6.4.3-21:	New	
			Action 6.4.3-22:	New	
		Beach Haven Borough	Action 6.4.4-19:	New	
			Action 6.4.4-17:	New	
			Action 6.4.4-18:	New	
		Berkeley Township	Action 6.4.6-37:	New	
			Action 6.4.6-4:	Ongoing	
Utility Infrastructure Improvements Includes actions that focus on improving utilities to be more resistant to risks from hazards.	Structure and Infrastructure Project	Brick Township	Action 6.4.8-38:	New	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.8-41:	New	
			Action 6.4.8-7:	Ongoing	
			Action 6.4.8-22:	Ongoing	
			Action 6.4.8-31:	Ongoing	
			Action 6.4.8-32:	Ongoing	
		Harvey Cedars Borough	Action 6.4.11-17:	New	
			Action 6.4.11-20:	New	
		Island Heights Borough	Action 6.4.12-15:	New	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
Utility Infrastructure Improvements Includes actions that focus on improving utilities to be more resistant to risks from hazards.	Structure and Infrastructure Project	Jackson Township Municipal Utilities Authority	Action 6.4.14-2:	Ongoing	Coastal Erosion; Flood, Flash Flood, Ice Jam; Hurricane, Tropical Storm, Nor'easter
			Action 6.4.14-3:	Ongoing	
			Action 6.4.14-5:	Ongoing	
		Lacey Township	Action 6.4.15-13:	Ongoing	
			Action 6.4.15-1:	Ongoing	
			Action 6.4.15-3:	Ongoing	
		Lakehurst Borough	Action 6.4.19-3:	Ongoing	
		Lakewood Townsip	Action 6.4.20-5:	Ongoing	
			Action 6.4.20-8:	Ongoing	
		Little Egg Harbor Township	Action 6.4.22-5:	Ongoing	
			Action 6.4.22-10:	Ongoing	
		Long Beach Township	Action 6.4.24-19:	New	
			Action 6.4.24-21:	New	
			Action 6.4.24-23:	New	
			Action 6.4.24-24:	New	
		Mantoloking Borough	Action 6.4.26-14:	Ongoing	
			Action 6.4.26-20:	New	
			Action 6.4.26-25:	New	
		Ocean County	Action 6.4.41-1:	Ongoing	
			Action 6.4.41-2:	Ongoing	
			Action 6.4.41-3:	Ongoing	
			Action 6.4.41-4:	Ongoing	
			Action 6.4.41-7:	Ongoing	
			Action 6.4.41-8:	Ongoing	
			Action 6.4.41-21:	New	
			Action 6.4.41-22:	New	
		Ocean County MUA	Action 6.4.42-1:	Ongoing	
			Action 6.4.42-2:	Ongoing	
			Action 6.4.42-3:	Ongoing	
			Action 6.4.42-4:	Ongoing	
			Action 6.4.42-5:	Ongoing	
			Action 6.4.42-6:	Ongoing	
			Action 6.4.42-7:	Ongoing	
		Ocean Gate Borough	Action 6.4.27-6:	Ongoing	
			Action 6.4.27-8:	Ongoing	

Action Group	Action Category	Municipality	Action	Action Status	Hazards Addressed
		Pine Beach Borough	Action 6.4.29-2:	Ongoing	
		Point Pleasant Beach Borough	Action 6.4.31-1:	Ongoing	
			Action 6.4.31-2:	Ongoing	
		Point Pleasant Borough	Action 6.4.32-4:	Ongoing	
		Seaside Heights Borough	Action 6.4.33-19:	New	
		Seaside Park Borough	Action 6.4.34-5:	Ongoing	
			Action 6.4.34-6:	Ongoing	
			Action 6.4.34-8:	Ongoing	
			Action 6.4.34-31:	New	
			Action 6.4.34-32:	New	
			Action 6.4.34-34:	New	
		Stafford Township	Action 6.4.37-27:	New	
			Action 6.4.37-20:	New	
			Action 6.4.37-21:	New	
			Action 6.4.37-15:	New	
			Action 6.4.37-16:	New	
			Action 6.4.37-1:	Ongoing	
		Surf City Borough	Action 6.4.38-13:	New	
			Action 6.4.38-14:	New	
			Action 6.4.38-15:	New	

Table 6.4-2 below summarizes completed actions since the previous 2014 County HMP. While these actions are not included in the Mitigation Action Worksheets in Appendix B, detailed Mitigation Action worksheets are available in the 2014 County HMP for each action.

Table 6.4-2 Completed Mitigation Action Summary

Action Status	Action Category	Municipality	Action	Action Name
Completed		Barnegat Light Borough	Action 6.4.1-10	Reverse 911 for whole island
		Bay Head Borough	Action 6.4.3-12	Considering new alert system, such as Reverse 911

Action Status	Action Category	Municipality	Action	Action Name
Completed	Education and Awareness Program		Action 6.4.3-15	Start quarterly emergency management town hall meetings
			Action 6.4.3-13	Maintain Police Department Facebook page
		Brick Township	Action 6.4.8-18	Consider creating social media site on Facebook, or a radio station for people to find information and provide feedback
			Action 6.4.8-19	Improve mapping and purchase additional AutoCAD license
		Eagleswood Township	Action 6.4.10-7	Maintain new website to continue to display emergency information
		Harvey Cedars Borough	Action 6.4.11-13	NFIP coordinator to continue attending events and distributing information to borough residents
		Island Heights Borough	Action 6.4.12-11	Route Alerting Plan - Fire truck/police car door to door communication
			Action 6.4.12-10	Reverse 911 for whole community
		Lacey Township	Action 6.4.15-9	FireWise
			Action 6.4.15-10	Reverse 911 system
		Little Egg Harbor Township	Action 6.4.22-25	Start quarterly emergency management town hall meetings
			Action 6.4.22-24	Participate in National Night Out
			Action 6.4.22-35	Continue to utilize Nixle notification service to reach residents
		Long Beach Township	Action 6.4.24-12	Reverse 911 system
		Ocean Gate Borough	Action 6.4.27-12	Reverse 911 System
	Education and Awareness Program	Pine Beach Borough	Action 6.4.29-13	Continue to provide Nixle system for residents; allows borough residents to sign up to receive alerts via text
			Action 6.4.29-11	Obtain Reverse 911 System
		Seaside Heights Borough	Action 6.4.33-15	Obtain Revers 911 System

Action Status	Action Category	Municipality	Action	Action Name
Completed		Tuckerton Borough	Action 6.4.40-18	Improve AM radio; provide better communication for sending out alerts during a storm
			Action 6.4.40-19	Maintain and improve information on website
	Local Plans and Regulations	Barnegat Township	Action 6.4.2-2	Accepted the FEMA advisory flood maps
		Berkeley Township	Action 6.4.6-19	Accepted the FEMA Best Available Flood Hazard Data Maps
			Action 6.4.6-20	Adopted ABFE ordinance
			Action 6.4.6-23	Develop and Implement Shelter Management Plans and Capability
			Action 6.4.6-29	Flood Mitigation Plans
			Action 6.4.6-33	Storage of Hazardous Materials Ordinance
		Brick Township	Action 6.4.8-28	Township Accepted the FEMA Best Available Flood Hazard Data Maps
		Harvey Cedars Borough	Action 6.4.11-9	Change in building code for raising homes
		Little Egg Harbor Township	Action 6.4.22-15	Adopted Advisory Base Flood Elevations (ABFEs)
		Seaside Park Borough	Action 6.4.34-11	Comprehensive clean-up system plan for inlets
		Ship Bottom Borough	Action 6.4.35-8	Incorporate ICS implementation into existing planning mechanisms
			Action 6.4.35-6	Maintain and improve building code enforcement
		Surf City Borough	Action 6.4.38-6	Accepted the FEMA advisory flood maps
		Toms River Township	Action 6.4.39-6	BFE ordinance/zoning change
		Tuckerton Borough	Action 6.4.40-1	FEMA planning group - Master Plan to move Borough Hall which includes Police, municipal services, and the EOC
			Action 6.4.40-10	Adopted ABFE ordinance

Action Status	Action Category	Municipality	Action	Action Name
Completed	Natural Systems Protection	Barnegat Light Borough	Action 6.4.1-3	Consider elevating walkways over dunes to eliminate gaps in dune protection
		Bay Head Borough	Action 6.4.3-9	Maintain higher walkways over dunes to eliminate gaps in dune protection or install hurricane straps to mitigate the entrances
		Brick Township	Action 6.4.8-5	Soil stabilization to stabilize foundations and restore a fire break
		Harvey Cedars Borough	Action 6.4.11-5	Bayside at Sunset Park replenishment project; adding sand and rock to the shore up to the shoreline
		Island Heights Borough	Action 6.4.12-5	Repair/replenish eroded beach
			Action 6.4.12-8	Continue planting program
	Natural Systems Protection	Little Egg Harbor Township	Action 6.4.22-8	Repair/replenish eroded beach (Dock road)
			Action 6.4.22-17	Prescribed burns
		South Toms River Borough	Action 6.4.36-4	CARFA & FEMA - No paving - Mathiason Plaza - CIP maintain park & improve
		Surf City Borough	Action 6.4.38-7	USACE replenishment project and dune restoration
			Action 6.4.38-8	Maintain and improve fall dune grass planting
	Structure and Infrastructure Project	Bay Head Borough	Action 6.4.3-2	Plan to elevate one building in Bay Head Borough
			Action 6.4.3-3	Rebuild Police Headquarter/municipal buildings to minimize flood risk by re-location or mitigation in its present location
			Action 6.4.3-4	Rock wall to be installed in front of 9 residential homes to reduce storm water flooding
		Beach Haven Borough	Action 6.4.4-2	Update and elevate the pump room at the water plant
		Beachwood Township	Action 6.4.5-1	Make repairs to Community Center in Beachwood Township; investigate

Action Status	Action Category	Municipality	Action	Action Name
				mitigation improvements such as elevation
			Action 6.4.5-4	Repair bulkheads, maintain new bulkhead, and repair and raise 2 T-docks
		Berkeley Township	Action 6.4.6-3	Purchase and install 10 tide flex valves to prevent backflow flood water from the bay and river
		Brick Township	Action 6.4.8-8	Soil stabilization project at Bay Harbor Beach; plan to install geotextiles at park next to Windward Beach
		Brick Township Municipal Utilities Authority	Action 6.4.9-3	Purchase and install permanent generators for critical facilities Mantoloking road, Morris Avenue and Ridge Road Water booster stations
			Action 6.4.9-5	Elevating Electrical equipment, controls, instrumentation and emergency generators above the base flood elevation stipulated on the FEMA advisory base flood elevation map. 8 wastewater pump stations were elevated
		Eagleswood Township	Action 6.4.10-3	Reconstruction of damaged bulkhead at Dock Road
		Harvey Cedars Borough	Action 6.4.11-8	Raise the minimum height of bulkheads
		Island Heights Borough	Action 6.4.12-4	Repair of bulkhead at Dillon's Creek
		Jackson Township	Action 6.4.13-1	Purchase and installation of permanent generator for the First Aid building and Town Hall
		Lacey Township	Action 6.4.15-2	Bayberry Flood Control Project - Fix drainage in Marshlands
			Action 6.4.15-7	Bay front Control Project - Bay front Park flood protection by addition of floodhead/walls and rip rap
	Structure and Infrastructure Project	Lacey Township Municipal	Action 6.4.16-1	Purchase and installation of permanent generators and elevation of equipment control panels

Action Status	Action Category	Municipality	Action	Action Name
Completed	Structure and Infrastructure Project	Utilities Authority		
		Lakehurst Borough	Action 6.4.19-1	Generator at water treatment plant
		Lakewood Township	Action 6.4.20-6	Install drainage basin adjacent to John Patrick Park
			Action 6.4.20-7	Flood control/drainage project at Hamed Health Facility
			Action 6.4.20-1	Install generator for municipal operations building (Main building with Police Department offices); the emergency operations center has a generator as does the police department
			Action 6.4.20-2	Install generator for Code and Enforcement building
		Lavellette Borough	Action 6.4.21-2	Elevation project for municipal buildings housing essential services
		Little Egg Harbor Township	Action 6.4.22-4	Restore Radio Road - Acts as a barrier
		Long Beach Township	Action 6.4.24-3	Grounding system to better protect the Police Department building from future lightning strikes
		Manchester Township	Action 6.4.25-1	Put 4 generators in municipal buildings and move smaller generator to repair garage (storage); EOC is located in the municipal building
		Mantoloking Borough	Action 6.4.26-2	Demolish and reconstruct 100 homes in Mantoloking
			Action 6.4.26-4	Elevation of newly reconstructed pump station
		Ocean Gate Borough	Action 6.4.27-5	Bulkhead at Ocean Gate Yacht Club
			Action 6.4.27-7	Emergency berm installation - Berm in front of boardwalk; to fill in gaps of structural installations (sand)
			Action 6.4.27-22	Purchase On-Site Generator at Borough Hall
Completed		Ocean Township	Action 6.4.28-7	Relocation of streetlight at Bryant Road; located near bay front on repetitive loss property

Action Status	Action Category	Municipality	Action	Action Name
Completed	Structure and Infrastructure Project	Seaside Heights Borough	Action 6.4.33-3	Elevation of transformer, electrical components and switch gear in department of Public Works (DPW) generator building
			Action 6.4.33-5	Purchase of a 0.5 megawatt natural gas & diesel generators at Police Department and Borough Hall
			Action 6.4.33-6	Elevation of water and sewer treatment plant controls above flood level and electrical upgrades
		Ship Bottom Borough	Action 6.4.35-2	Raising or relocating the 17th Street water plant generator
			Action 6.4.35-4	Requesting two portable LED signs to improve the evacuation route off of Long Beach Island
			Action 6.4.35-7	Passed ordinance for ABFE +1
			Action 6.4.35-9	USACE replenishment project and dune restoration; USACE seeking permission to construct continuous dune system
		South Toms River Borough	Action 6.4.36-1	Bulkhead Replacement - Between Flint Road and 166; Water rises above bulkhead at only 3 ft above water; Lakeview Lake to river that rises - at least repair the bulkhead; prefer to improve and build a continuous new bulkhead
		Surf City Borough	Action 6.4.38-2	Installation of a permanent generator at 14th Street
		Tuckerton Borough	Action 6.4.40-6	Generators for Department of Public Works and the Municipal Building
			Action 6.4.40-11	Mitigate Critical Facilities- EOC, Police, Municipal
			Action 6.4.40-12	Borough of Tuckerton Police Department Parcel flood mitigation

Appendix B provides additional details including linking mitigation actions to other planning and operational activities and funding that support implementation.

Community and County stakeholders participating in the HMP update elected to streamline the mitigation section by withdrawing a number of actions. This was done based on a few different recommendations. First, in the 2014 plan review FEMA noted that some actions were truly mitigation actions and some were recognition of existing capacity. Second, the Community and County stakeholders have done a good job at completing annual reviews and reviewing action progress. It made sense to capture existing capability to the Capability Section of the plan, rather than review items like "Continue to participate in the NFIP" or "Maintain Building Codes" annually. Third, less is more. Since the communities are reviewing annually and accomplishing mitigation it was not necessary to note capability in the Capability and Mitigation Strategy Sections of the plan. Everyone was confident that they would maintain NFIP participations and building codes and therefore it was find to note in one place in the HMP. The 'withdrawn' status captures this thought process and discussion during the 2018 plan update.

Table 6.4-3 Withdrawn Actions

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Barnegat Light Borough	Action 6.4.1-12:	Maintain borough website; keep website updated	Capability
		Barnegat Township	Action 6.4.2-10:	Continue participation in FireWise program; continue to implement program at senior centers to better protect the senior population	Capability
		Bay Head Borough	Action 6.4.3-14:	Continue Police outreach programs in schools	Capability
		Bay Head Borough	Action 6.4.3-16:	Maintain borough website; continue to update	Capability
		Berkeley Township	Action 6.4.6-11:	Continue Fire Prevention Bureau outreach program to schools; hold contest for fire escape plans and have students draw out fire plans	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Berkeley Township	Action 6.4.6-12:	Maintain Police Department Facebook page	Capability
		Berkeley Township	Action 6.4.6-17:	Continue Police outreach programs in schools	Capability
		Berkeley Township	Action 6.4.6-18:	Continue to maintain and update township website; allows for the township to share information with residents and for residents to provide feedback and comments	Capability
		Berkeley Township	Action 6.4.6-22:	Continue Outreach Through Local Radio Station	Capability
		Brick Township	Action 6.4.8-17:	Maintain township website; continue to provide importation information post-emergencies	Capability
		Brick Township	Action 6.4.8-25:	Continue hazard mitigation outreach	Capability
		Harvey Cedars Borough	Action 6.4.11-12:	Continue Storm Ready program	Capability
		Harvey Cedars Borough	Action 6.4.11-15:	Maintain local emergency AM radio station (based in Harvey Cedars)	Capability
		Harvey Cedars Borough	Action 6.4.11-16:	Maintain borough and police department websites and social media sites. Appoint a social media manager to update	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
				and maintain the websites	
Withdrawn	Education and Awareness Program	Jackson Township	Action 6.4.13-5:	Extra AM Radio with pre-recording	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Jackson Township	Action 6.4.13-12:	Conduct 6 Flags Great Adventure exercise - military involved	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Lacey Township	Action 6.4.15-11:	Create an emergency AM Radio Station	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Lacey Township	Action 6.4.15-12:	Maintain Township Facebook page; keep page updated	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Lakehurst Borough	Action 6.4.19-11:	Continue National Night Out program to connect to the community	Capability
		Lakehurst Borough	Action 6.4.19-12:	LEPC - Meet every month and perform drills	Capability
		Lavallette Borough	Action 6.4.21-8:	Continue distribution of newsletter to Lavallette Borough residents	Capability
		Little Egg Harbor Township	Action 6.4.22-26:	Considering new alert system, such as Reverse 911	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Little Egg Harbor Township	Action 6.4.22-29:	Continue Police outreach programs in schools	Capability
		Little Egg Harbor Township	Action 6.4.22-30:	Maintain website; keep website updated	Capability
		Little Egg Harbor Township	Action 6.4.22-32:	Continue Community Emergency Response Team (CERT)	Capability
		Little Egg Harbor Township	Action 6.4.22-33:	Support and share information on grant programs that support residential, business and natural resource mitigation projects with appropriate local stakeholders	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Little Egg Harbor Township	Action 6.4.22-34:	Continue distribution of newsletter to residents	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Little Egg Harbor Township	Action 6.4.22-36:	Continue Fire Prevention Bureau outreach program to schools; hold contest for fire escape plans and have students draw out fire plans	Capability
		Long Beach Township	Action 6.4.24-11:	Have information booths at LBI festivals with representatives from towns in CRS Program	Capability
		Long Beach Township	Action 6.4.24-13:	Continue to provide Nixle system for residents; allows township residents to sign up to receive alerts via text message	Capability
		Long Beach Township	Action 6.4.24-14:	Continue outreach through local radio station	Capability
		Long Beach Township	Action 6.4.24-15:	Maintain Storm Ready	Capability
		Long Beach Township	Action 6.4.24-16:	Continue police department outreach to schools	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Long Beach Township	Action 6.4.24-17:	Support and share information on grant programs that support residential, business and natural resource mitigation projects with appropriate local stakeholders	Capability
		Manchester Township	Action 6.4.25-9:	Educate the public to be more disaster ready and prevent disasters through local papers (Manchester Citizen) or newsletters	Capability
		Manchester Township	Action 6.4.25-14:	Maintain Storm Ready	Capability
		Manchester Township	Action 6.4.25-15:	Continue police department outreach to schools	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Ocean Gate Borough	Action 6.4.27-15:	Continue Outreach Through Local Radio Station	Capability
		Ocean Gate Borough	Action 6.4.27-25:	Maintain and Improve Information on Website and Facebook	Capability
		Ocean Township	Action 6.4.28-9:	Maintain Forest Fire website; continue to post updates and share information through site	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Ocean Township	Action 6.4.28-11:	Continue Community Emergency Response Team (CERT) program	Capability
		Ocean Township	Action 6.4.28-12:	Continue Police outreach programs in schools	Capability
		Ocean Township	Action 6.4.28-13:	Continue Junior Police Academy Program	Capability
		Ocean Township	Action 6.4.28-14:	Continue 'Register Ready State Program' to look out for residents with special needs during emergencies	Capability
		Ocean Township	Action 6.4.28-15:	Continue awareness level training for public	Capability
		Point Pleasant Beach Borough	Action 6.4.31-11:	Continue outreach through local radio station	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Point Pleasant Beach Borough	Action 6.4.31-12:	Maintain Reverse 911 System	Capability
		Point Pleasant Beach Borough	Action 6.4.31-13:	Continue Fire and Police Department outreach to the schools	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Point Pleasant Beach Borough	Action 6.4.31-14:	Continue Police outreach programs to the schools	Capability
		Borough of Point Pleasant	Action 6.4.32-12:	Obtain Reverse 911 System	Capability
		Borough of Point Pleasant	Action 6.4.32-13:	Maintain and make regular updates to borough website	Capability
		Borough of Point Pleasant	Action 6.4.32-14:	Continue to provide Nixle system for residents; allows borough residents to sign up to receive alerts via text message	Capability
		Borough of Point Pleasant	Action 6.4.32-15:	Continue Community Watch Program	Capability
		Borough of Point Pleasant	Action 6.4.32-16:	Continue National Night Out program to connect to the community	Capability
		Borough of Point Pleasant	Action 6.4.32-17:	Continue outreach through local radio station	Capability
		Borough of Point Pleasant	Action 6.4.32-18:	Borough will continue to maintain the Facebook Page	Capability
		Borough of Point Pleasant	Action 6.4.32-20:	Borough will continue to host Town Hall meetings to allow township officials and residents to gather and communicate with each other post-disaster or at other strategic times	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Education and Awareness Program	Borough of Point Pleasant	Action 6.4.32-23:	Continue outreach through local radio station	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Borough of Point Pleasant	Action 6.4.32-27:	Participate in Storm Ready Program	Capability
		Seaside Heights Borough	Action 6.4.33-14:	Fire and Police Departments will continue Outreach programs; conduct drills in the community; carry out water rescues when needed	Capability
		Seaside Heights Borough	Action 6.4.33-16:	Continue outreach through local radio station	Capability
		Seaside Park Borough	Action 6.4.34-16:	School outreach by Police and Fire Departments	Capability
		Seaside Park Borough	Action 6.4.34-17:	Continue outreach through local radio station	Capability
	Local Plans and Regulations	Barnegat Light Borough	Action 6.4.1-4:	Continue to participate in the NFIP	Capability
		Barnegat Light Borough	Action 6.4.1-5:	Continue to enforce building codes	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Barnegat Township	Action 6.4.2-4:	Continue to participate in the NFIP	Capability
		Barnegat Township	Action 6.4.2-5:	Continue to enforce building codes	Capability
		Barnegat Township	Action 6.4.2-6:	Develop and implement Shelter Management Plans	Capability
		Bay Head Borough	Action 6.4.3-5:	Continue to participate in the NFIP	Capability
		Bay Head Borough	Action 6.4.3-6:	Continue to enforce building codes	Capability
		Beach Haven Borough	Action 6.4.4-3:	Continue to participate in the NFIP	Capability
		Beach Haven Borough	Action 6.4.4-4:	Continue to enforce building codes	Capability
		Beachwood Township	Action 6.4.5-2:	Continue to participate in the NFIP	Capability
		Beachwood Township	Action 6.4.5-3:	Continue to enforce building codes	Capability
		Berkeley Township	Action 6.4.6-7:	Continue to participate in the NFIP	Capability
		Berkeley Township	Action 6.4.6-8:	Continue to enforce building codes and ordinances	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Berkeley Township	Action 6.4.6-28:	Maintain Emergency Operations Plan	Capability
		Brick Township	Action 6.4.8-10:	Continue to participate in the NFIP	Capability
		Brick Township	Action 6.4.8-11:	Continue to enforce building codes	Capability
		Brick Township	Action 6.4.8-14:	Maintain a Local Emergency Planning Committee	Capability
		Brick Township	Action 6.4.8-34:	Maintain Emergency Operations Plan	Capability
		Eagleswood Township	Action 6.4.10-4:	Continue to participate in the NFIP	Capability
		Eagleswood Township	Action 6.4.10-5:	Continue to enforce building codes	Capability
		Harvey Cedars Borough	Action 6.4.11-6:	Continue to participate in the NFIP	Capability
		Harvey Cedars Borough	Action 6.4.11-7:	Continue to enforce building codes	Capability
		Island Heights Borough	Action 6.4.12-6:	Continue to participate in the NFIP	Capability
		Island Heights Borough	Action 6.4.12-7:	Continue to enforce building codes	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Jackson Township	Action 6.4.13-7:	Continue to enforce building codes	Capability
		Jackson Township	Action 6.4.13-8:	State Uniform Construction Code	Capability
		Lacey Township	Action 6.4.15-5:	Continue to participate in the NFIP	Capability
		Lacey Township	Action 6.4.15-6:	Continue to enforce building codes	Capability
		Lakehurst Borough	Action 6.4.19-6:	Continue to participate in the NFIP	Capability
		Lakehurst Borough	Action 6.4.19-7:	Continue to enforce building codes	Capability
		Lakewood Township	Action 6.4.20-10:	Continue to participate in the NFIP	Capability
		Lakewood Township	Action 6.4.20-11:	Continue to enforce building codes	Capability
		Lavallette Borough	Action 6.4.21-3:	Continue to participate in the NFIP	Capability
		Lavallette Borough	Action 6.4.21-4:	Continue to enforce building codes	Capability
		Little Egg Harbor Township	Action 6.4.22-13:	Continue to participate in the NFIP	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Little Egg Harbor Township	Action 6.4.22-14:	Continue to enforce building codes	Capability
		Little Egg Harbor Township	Action 6.4.22-16:	Consider requirements for sheltering & fund - all four schools	Capability
		Little Egg Harbor Township	Action 6.4.22-23:	Maintain a Local Emergency Planning Committee	Capability
		Little Egg Harbor Township	Action 6.4.22-31:	Maintain Emergency Operations Plan	Capability
		Long Beach Township	Action 6.4.24-5:	Continue to participate in the NFIP	Capability
		Long Beach Township	Action 6.4.24-6:	Continue to enforce building codes	Capability
		Long Beach Township	Action 6.4.24-7:	Maintain Flood Mitigation Plans	Capability
		Manchester Township	Action 6.4.25-2:	Continue to participate in the NFIP	Capability
		Manchester Township	Action 6.4.25-3:	Continue to enforce building codes	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Manchester Township	Action 6.4.25-5:	Removing debris near Toms River - obtained permit from DEP - flooding with Hurricane Irene	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Mantoloking Borough	Action 6.4.26-10:	Continue to participate in the NFIP	Capability
		Mantoloking Borough	Action 6.4.26-11:	Continue to enforce building codes	Capability
		Ocean Gate Borough	Action 6.4.27-9:	Continue to participate in the NFIP	Capability
		Ocean Gate Borough	Action 6.4.27-10:	Continue to enforce building codes	Capability
		Ocean Gate Borough	Action 6.4.27-16:	Develop and Implement Shelter Management Plans and Capability	Capability
		Ocean Gate Borough	Action 6.4.27-20:	Maintain Emergency Operations Plan	Capability
		Ocean Township	Action 6.4.28-4:	Continue to participate in the NFIP	Capability
		Ocean Township	Action 6.4.28-5:	Continue to enforce building codes	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Ocean Township	Action 6.4.28-6:	Develop and implement Shelter Management Plans	Capability
		Ocean Township	Action 6.4.28-8:	Accepted the FEMA Advisory flood maps	Capability
		Pine Beach Borough	Action 6.4.29-3:	Continue to participate in the NFIP	Capability
		Pine Beach Borough	Action 6.4.29-4:	Continue to enforce building codes	Capability
		Plumsted Township	Action 6.4.30-3:	Continue to participate in the NFIP	Capability
		Plumsted Township	Action 6.4.30-4:	Continue to enforce building codes	Capability
		Point Pleasant Beach Borough	Action 6.4.31-5:	Continue to participate in the NFIP	Capability
		Point Pleasant Beach Borough	Action 6.4.31-6:	Continue to enforce local ordinances and building codes	Capability
		Point Pleasant Beach Borough	Action 6.4.31-7:	Passed ordinance for ABFE +1	Capability
		Borough of Point Pleasant	Action 6.4.32-8:	Continue to participate in the NFIP	Capability
		Borough of Point Pleasant	Action 6.4.32-9:	Continue to enforce building codes	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Borough of Point Pleasant	Action 6.4.32-10:	Continue to enforce land use codes	Capability
		Borough of Point Pleasant	Action 6.4.32-21:	Accepted the FEMA Best Available Flood Hazard Data Maps	Capability
		Borough of Point Pleasant	Action 6.4.32-22:	Adopted ABFE ordinance	Capability
		Borough of Point Pleasant	Action 6.4.32-24:	Develop and Implement Shelter Management Plans and Capability	Capability
		Borough of Point Pleasant	Action 6.4.32-26:	Improve and/or Develop Evacuation Plan	Capability
		Borough of Point Pleasant	Action 6.4.32-28:	Maintain Emergency Operations Plan	Capability
		Borough of Point Pleasant	Action 6.4.32-29:	Flood Mitigation Plans	Capability
		Seaside Heights Borough	Action 6.4.33-11:	Continue to participate in the NFIP	Capability
		Seaside Heights Borough	Action 6.4.33-12:	Continue to enforce building codes	Capability
		Seaside Park Borough	Action 6.4.34-9:	Continue to participate in the NFIP	Capability
		Seaside Park Borough	Action 6.4.34-10:	Continue to enforce building codes	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Seaside Park Borough	Action 6.4.34-18:	Accepted the FEMA Best Available Flood Hazard Data Maps	Capability
		Seaside Park Borough	Action 6.4.34-19:	Adopted ABFE ordinance	Capability
		Seaside Park Borough	Action 6.4.34-20:	Develop and Implement Shelter Management Plans and Capability	Capability
		Seaside Park Borough	Action 6.4.34-22:	Improve Evacuation Plan with Alternative Routes and Re-Entry Guidance	Capability
		Seaside Park Borough	Action 6.4.34-24:	Maintain Emergency Operations Plan	Capability
		Seaside Park Borough	Action 6.4.34-25:	Flood Mitigation Plans	Capability
		South Toms River Borough	Action 6.4.36-2:	Continue to participate in the NFIP	Capability
		South Toms River Borough	Action 6.4.36-3:	Continue to enforce building codes	Capability
		Surf City Borough	Action 6.4.21-3:	Continue to participate in the NFIP	Capability
		Surf City Borough	Action 6.4.21-4:	Continue to enforce building codes	Capability
		Toms River Township	Action 6.4.39-4:	Continue to participate in the NFIP	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Local Plans and Regulations	Toms River Township	Action 6.4.39-5:	Continue to enforce building codes	Capability
		Tuckerton Borough	Action 6.4.40-8:	Continue to participate in the NFIP	Capability
		Tuckerton Borough	Action 6.4.40-9:	Continue to enforce building codes	Capability
		Ocean County	Action 6.4.41-5:	Support municipalities in managing NFIP with information and technical assistance	Capability
		Ocean County	Action 6.4.41-6:	Support municipalities in managing building codes and land use codes with information, training and technical assistance	Capability
	Local Plans and Regulations/Natural Systems Protection	Point Pleasant Beach Borough	Action 6.4.31-9:	Maintain dune ordinance - must carry out dune inspection	Capability
	Natural Systems Protection	Berkeley Township	Action 6.4.6-21:	Maintain Dunes	Capability
		Berkeley Township	Action 6.4.6-27:	Improve Dunes	Capability
		Lavallette Borough	Action 6.4.21-6:	Adopted Army Corps plan for beach replenishment project	Capability

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Natural Systems Protection	Seaside Heights Borough	Action 6.4.33-13:	USACE replenishment project and dune restoration	Capability
	Structure/ Infrastructure Project	Seaside Heights Borough	Action 6.4.33-1:	Sand covered stone revetment to protect new boardwalk from coastal flooding, storm surge, and beach erosion	Capability
		Ocean County	Action 6.4.41-2:	Apply for County projects and support municipalities in grant process for flood and erosion control projects	Capability
		Ocean County	Action 6.4.41-7:	Support municipalities in grant process for acquiring, elevating, demolishing and reconstructing residential properties	Capability
		Seaside Heights Borough	Action 6.4.33-17:	Replacing and adding bulkheads; repairing existing bulkheads on bayside	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Jackson Township	Action 6.4.13-3:	Solar variable signs (3 in community); permanent in three locations throughout county	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward

Action Status	Action Category	Jurisdiction	Action	Name	Reason
Withdrawn	Structure/Infrastructure Project	Little Egg Harbor Township	Action 6.4.22-20:	Temporary debris management area - Permanent facility Equipment, Staff building	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Borough of Point Pleasant	Action 6.4.32-1:	Update infrastructure at Borough power plant to improve reliability of power	Capability
		Brick Township Municipal Utilities Authority	Action 6.4.9-2:	Alternate fuel supply for the emergency generators at the William miller Water Treatment Plant	Capability
		Jackson Township	Action 6.4.13-2:	Install solar-LED generators for traffic lights	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Lacey Township Board of Education	Action 6.417-1:	Purchase and installation of permanent generator	Current community leaders have prioritized other actions and do not plan on pursuing this action

Action Status	Action Category	Jurisdiction	Action	Name	Reason
					moving forward
Withdrawn	Structure/Infrastructure Project	Little Egg Harbor Township	Action 6.4.22-2:	E. Sail boat Dorey streets. There south 900 request rather lift 4 than buy 200K	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward
		Manchester Township	Action 6.4.25-6:	Implement movable Tiger Dam system to use along the river near Cedar Glen homes or residents east of the location	Current community leaders have prioritized other actions and do not plan on pursuing this action moving forward

7 Plan Maintenance

7. Plan Maintenance

7.1 Process Summary

Monitoring, evaluating and updating this plan, is critical to maintaining its value and success in Ocean County's hazard mitigation efforts. Ensuring effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. This section explains who will be responsible for maintenance activities and what those responsibilities entail. It also provides a methodology and schedule of maintenance activities including a description of how the public will be involved on a continued basis. This section was discussed in the Individual Municipal Meetings, and reviewed by municipalities and the public in the Draft Plan Review Meetings on April 10, 2018.

7.2 Monitoring Implementation and Evaluating Effectiveness

Monitoring implementation and evaluating effectiveness of the mitigation strategy are tasks effectively accomplished together. Monitoring implementation involves tracking progress and reasons for lack of progress. It is important to document successes on a regular basis. For instance, it is typically difficult to list all public outreach activities conducted over a five year period unless you have a log to monitor outreach. Recognizing lack of progress provides the opportunity to change the approach and evaluate the action. Evaluating effectiveness complements monitoring because it is a chance for evaluating both progress and lack of progress. When projects are accomplished, it is helpful to consider whether they were successful in accomplishing the intended goal and objective. For instance, did grant related outreach increase the number of residents gaining access to mitigation project funding. If so, the action might be continued and if not a new or revised action may be considered. Evaluating lack of progress provides the chance to consider whether new resources might be needed or if the action might be discontinued because it is not feasible or a current priority.

Ocean County intends to monitor implementation and evaluate effectiveness of the mitigation strategy through a combination of efforts by both the Steering Committee and municipal representatives. This process will be led by the Ocean County OEM and John Kirwin, Domestic Preparedness Planner. The Steering Committee will host an annual meeting to review the plan inviting municipal representatives and key stakeholders. Prior to the meeting, the Steering Committee will distribute forms to complete and submit prior to or at the meeting. The following forms, located in Appendix F – Monitoring, Evaluating and Updating Tools, will be used to monitor implementation and evaluate effectiveness:

- **Action Progress Worksheet:** This worksheet will capture the responsible party, progress, integration into existing planning mechanisms, accomplishments during reporting period, obstacles, continued relevance, and other comments.
- **Update and Annual Review Worksheet:** This worksheet asks questions that spur the county, municipalities and key stakeholders to consider changes in local planning process, risk, and capability and the implication of those changes on mitigation strategy implementation. For instance, the worksheet asks: 'Have any internal or external agencies been invaluable to the mitigation strategy?' and 'Are there additional funding sources to consider?'

Issues that arise during monitoring and evaluation which require changes to the risk assessment, mitigation strategy and other components of the plan will be used in two ways. First, they will be used to improve implementation between plan updates. Second, new information will be incorporated during future plan updates.

7.3 Updating the Plan

The Ocean County Multi-Jurisdictional HMP will be updated every five years, as required by the Disaster Mitigation Act of 2000. Ocean County may also select to update the plan following a disaster event that impacts how the county and municipalities want to implement the mitigation strategy. All plan updates will be led by John Kirwin, Ocean County OEM. Future plan updates will account for any new hazard vulnerabilities, special circumstances, or new information that becomes available. During the five-year review process, the following questions will be considered as criteria for assessing the effectiveness the Ocean County HMP.

- Has the nature or magnitude of hazards affecting the County changed?
- Are there new hazards that have the potential to impact the County?
- Do the identified goals and actions address current and expected conditions?
- Have mitigation actions been implemented or completed?
- Has the implementation of identified mitigation actions resulted in expected outcomes?
- Are current resources adequate to implement the Plan?
- Should additional local resources be committed to address identified hazards?
- Has the HMP mitigation strategy been integrated into other planning mechanisms to further progress?

7.4 Continued Public Involvement

The public will have access to an electronic copy of the current HMP through the www.OceanCoHMP.com website. Information on upcoming events related to the HMP or solicitation for comments will be announced via newsletters, newspapers, mailings, and on the website. A summary of the Annual Meeting to monitor and evaluate progress will be posted to the plan website. All municipalities selected to continue or begin actions for Education and Awareness Programs. The following is a summary of actions that provide the opportunity to both inform and engage the public for input and to provide outreach that furthers the implementation of the HMP:

- Continue Junior Police Academy Program
- Continue or develop CERT program
- Continue outreach through local radio station
- Continue outreach through local television station
- Continue Police and/or Fire outreach programs in schools
- Continue 'We Care' Program; Ocean County program to look out for residents with special needs during emergencies
- Develop, improve or maintain AM Radio station

- Have computers available at senior communities
- Maintain and improve information on website and/or Facebook
- Maintain, improve, and expand education and awareness programs
- Participate in National Night Out
- Support and share information on grant programs that support residential, business and natural resource mitigation projects with appropriate local stakeholders

Municipal representatives will gather and incorporate public comments to both improve mitigation strategy implementation and to inform updates to the HMP.

8 Plan Adoption

8. Plan Adoption

The Plan was submitted to the New Jersey State Hazard Mitigation Officer on September 21, 2018. It was forwarded to FEMA for final review and approval-pending-adoption on May 14, 2019. FEMA granted approval-pending-adoption on September 16, 2019.

Full approval from FEMA was received on July 16, 2020.

This section of the plan includes a copy of the resolution passed by Ocean County and a copy of FEMA's notice of plan approval. A completed Local Mitigation Plan Review Tool can be found in Appendix G.

U.S. Department of Homeland Security
Federal Emergency Management Agency
FEMA Region II
26 Federal Plaza, Suite [illegible]
New York, NY 10278

FEMA

July 16, 2020

Major Louis Bucchere
Commanding Officer
Emergency Management Section
New Jersey Office of Emergency Management
P.O. Box 7068
West Trenton, NJ 08628-0068

RE: Approval of the Ocean County, New Jersey Multi-Jurisdiction Hazard Mitigation Plan (Initial)

Dear Major Bucchere:

I am pleased to inform you that Federal Emergency Management Agency (FEMA) Region II has approved the Ocean County, NJ Multi-Jurisdiction Hazard Mitigation Plan. Having received one or more adoption resolutions on July 16, 2020, FEMA has approved this plan for a period of five years. This plan expires on July 15, 2025.

Our office conducted a review of the referenced plan in conformance with Title 44 Code of Federal Regulations (CFR) Part 201, Mitigation Planning and FEMA's Local Multi-Hazard Mitigation Plan Review Guide, the official guidance to develop and review updated and final mitigation plans. The Region's review is documented in the Local Hazard Mitigation Plan Review Tool dated September 15, 2019.

The jurisdictions for which the State has forwarded adoption resolutions to our office are identified in the enclosure along with the other jurisdictions that participated in this plan. Those jurisdictions with adopted plans are now eligible as sub-grantees for project grants under FEMA's Hazard Mitigation Assistance programs, including the Hazard Mitigation Grant Program, the Pre-Disaster Mitigation, and Flood Mitigation Assistance programs.

We commend Ocean County and the participating jurisdictions for taking this important step toward disaster resilience. Note jurisdictions that have approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Additional information regarding the CRS can be found through a local floodplain manager or by visiting http://www.fema.gov/national-flood-insurance-program-community-rating-system online.

Please inform Ocean County of this approval. If you have any questions, contact Jack Heide, Hazard Mitigation Community Planner, at (202) 709-0671.

Sincerely,

Michael Moriarty
Director, Mitigation Division

Enclosure

cc: SFC Bradley Waugh
State Hazard Mitigation Officer
New Jersey Office of Emergency Management

RESOLUTION
November 20, 2019

WHEREAS the County of Ocean, NJ, has experienced natural and man-made hazards that result in public safety issues and damage to private and public property;

WHEREAS the hazard mitigation planning process set forth by the State of New Jersey and the Federal Emergency Management Agency offers the opportunity to consider natural and man-made hazards and risks, and to identify mitigation actions to reduce future risk;

WHEREAS the New Jersey Office of Emergency Management provided federal mitigation funds to support development of the Ocean County Multi-jurisdictional All Hazards Mitigation Plan;

WHEREAS this Hazard Mitigation Plan has been developed by the Mitigation Steering Committee;

WHEREAS this Hazard Mitigation Plan includes a prioritized list of mitigation actions including activities that, over time, will help minimize and reduce safety threats and damage to private and public property, and

WHEREAS public meetings were held to introduce the planning concept and to solicit questions and comment; and to present the Plan and request comments, as required by law,

NOW THEREFORE BE IT RESOLVED by the Ocean County Board of Chosen Freeholders:

1. The ***Hazard Mitigation Plan*** is hereby adopted as an official plan of Ocean County.
2. The Ocean County Office of Emergency Management and the various Ocean County Departments identified in the Plan are hereby encouraged to pursue implementation of the recommended high priority activities that are applicable to their departments.
3. Any action proposed by the Plan shall be subject to and contingent upon budget approval, if required, which shall be at the discretion of the Board of Chosen Freeholders, and this resolution shall not be interpreted so as to mandate any such appropriations.
4. The Ocean County Office of Emergency Management is designated to coordinate with other offices/departments/agencies and shall periodically report on the activities, accomplishments, and progress, and shall prepare an annual progress report to be submitted to the New Jersey Office of Emergency Management. The status reports shall be submitted by May 1st of each year.