Multi-Jurisdictional Natural Hazard Mitigation Plan Monmouth County, New Jersey

FINAL

Prepared for

COUNTY OF MONMOUTH NEW JERSEY

Monmouth County Office of Emergency Management
300 Halls Mill Road
Freehold, New Jersey 07728

March 2009

Prepared by

URS

201 Willowbrook Boulevard, 3rd Floor
Wayne, New Jersey 07470-7005

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PLAN ADOPTION RESOLUTIONS

In accordance with Part 201.6 of the Disaster Mitigation Act of 2000 (DMA 2000), Monmouth County, New Jersey, has developed this Multi-Jurisdictional Hazard Mitigation Plan to identify hazards that threaten the County and ways to reduce future damages associated with these hazards.

Following this page are the signed adoption resolutions of the County and all participating jurisdictions that have adopted this plan, authorizing municipal government staff to carry out the actions detailed herein.

Signed resolutions of adoption by all participating jurisdictions shall be inserted following this page after FEMA has reviewed and determined that the Draft plan is approvable.

EXECUTIVE SUMMARY

Across the United States and around the world, natural disasters occur each day, as they have for thousands of years. As the worldôs population and development have increased, so have the effects of these natural disasters. The time and money required to recover from these events often strain or exhaust local resources. The purpose of hazard mitigation planning is to identify policies, actions, and tools for implementation that will, over time, work to reduce risk and the potential for future losses. Hazard mitigation is best realized when community leaders, businesses, citizens, and other stakeholders join together an in effort to undertake a process of learning about hazards that can affect their area and use this knowledge to prioritize needs and develop a strategy for reducing damages.

Section 322, Mitigation Planning, of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (ñthe Stafford Actò), enacted by Section 104 of the Disaster Mitigation Act of 2000 (ñDMA 2000ò), provides new and revitalized approaches to mitigation planning. Section 322 continues the requirement for a State mitigation plan as a condition of disaster assistance, and establishes a new requirement for local mitigation plans. In order to apply for Federal aid for technical assistance and post-disaster funding, local jurisdictions must comply with DMA 2000 and its implementing regulations (44 CFR Part 201.6).

While Monmouth County has always sought ways to reduce their vulnerability to hazards, the passage of DMA 2000 helped County officials to recognize the benefits of pursuing a long-term, coordinated approach to hazard mitigation through hazard mitigation planning. The County has received grant funds from the Federal Emergency Management Agency (FEMA) for the purpose of developing this very hazard mitigation plan. Funding was received under the Pre-Disaster Mitigation Grant Program for development of a multi-jurisdictional hazard mitigation plan for the County and as many of its 53 municipalities that chose to participate. This **Monmouth County Multi-Jurisdictional Natural Hazard Mitigation Plan** represents the collective efforts of 52 participating jurisdictions, the general public, and other stakeholders. Natural disasters cannot be prevented from occurring. However, over the long-term, the continued implementations of this Plan will gradually, but steadily, lessen the impacts associated with hazard events.

The Monmouth County Multi-Jurisdictional Hazard Mitigation Plan has been developed by the Monmouth County Hazard Mitigation Planning Committee (the ñPlanning Committeeò), with support from outside consultants. The efforts of the Planning Committee were headed by the Monmouth County Office of Emergency Managementôs Hazard Mitigation Coordinator. The overall Planning Committee was divided into a Core Planning Group (CPG) and Jurisdictional Assessment Teams (JATs), with one JAT for each of the Countyôs participating jurisdictions. In addition there was a County Steering Committee which oversaw the process, headed by the Monmouth County Office of Emergency Management (MCOEM).

The plan development process was initiated in earnest in the Summer of 2007 with the Monmouth County Steering Committeeôs Meeting held on June 20, 2007. The Steering Committee met on a monthly basis throughout the plan development process to oversee the work of the consultant and to guide participating municipalities throughout the process requirements. A Kickoff Meeting of the full Core Planning Group was conducted on July 17, 2007. Thereafter, the Core Planning Group met on November 29, 2007; January 31, 2008; March 10, 2008; and April 4, 2008. Jurisdictional Assessment Teams met individually throughout the plan development process as they deemed necessary.

Community support is vital to the success of any hazard mitigation plan. The Planning Committee provided opportunities for participation and input of the public and other stakeholders throughout the plan development process, both prior to this Draft and before approval of the Final plan, providing citizens and

other stakeholders with opportunities to take part in the decisions that will affect their future. On a mitigation planning section of the Monmouth County web site, the MCOEM posted information on the plan development process and where to go for additional information or comments beginning in July of 2007; this web site has been and continues to be maintained and updated regularly. The County also conducted several other outreach actions including press releases issued in August 2007, October 2007, and February 2008. During the plan development process, the public and other stakeholders were invited to attend two of the five Core Planning Group Meetings (November 29, 2007 and March 10, 2008) and were also invited to respond to a survey that was posted on the MCOEM mitigation planning web site. They also spoke about the Mitigation Plan at a meeting of Local Emergency Planning Coordinators and CPG members on January 31, 2008. Jurisdictional Assessment Team members supplemented County efforts by reaching out to the public and other stakeholders within their respective jurisdictions to get the word out through various means and provide opportunities for feedback and participation.

The hazard mitigation planning process consisted of the following key steps:

- Researching a full range of natural hazards to identify which hazards could affect the County;
- Identifying the location and extent of hazard areas;
- Identifying assets located within these hazard areas;
- Characterizing existing and potential future assets at risk;
- Assessing vulnerabilities to the most prevalent hazards; and
- Formulation and prioritization of goals, objectives, and mitigation actions to reduce or avoid long-term vulnerabilities to the identified hazards.

Natural hazards that can affect Monmouth County that were studied in detail in the Plan are as follows:

- ***Atmospheric hazards***, including: extreme temperatures, extreme wind, hurricanes and tropical storms, lightning, norôeasters, tornadoes, and winter storms;
- ***Hydrologic hazards***, including: coastal erosion, dam failure, drought, flooding, storm surge, and wave action;
- ***Geologic hazards***, including: earthquakes and landslides; and
- ***Other hazards***, including: wildfires.

After evaluating these hazards and assets within the County to which they are vulnerable, the Planning Committee developed a mitigation strategy to increase the disaster resistance of the County, along with procedures for monitoring, evaluating and updating the Plan to ensure that it remains a ñliving document.ò

This Draft Plan is currently under review by the Planning Committee, NJOEM, FEMA, and the public and other stakeholders. Later, comments will be incorporated, and the County and all participating jurisdictions will each formally adopt the Final Plan. The Final Plan will include copies of adoption resolutions following Page i.

If you have any questions or comments on the Multi-Jurisdictional Natural Hazard Mitigation Plan for Monmouth County, New Jersey, additional information can be obtained by contacting:

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ACKNOWLEDGEMENTS

Throughout the plan development process, the Monmouth County Office of Emergency Management (MCOEM) worked tirelessly to involve all of its 53 municipalities. These local jurisdictions were not only invited to participate but were truly guided through the process by MCOEM at every stage.

The following municipal entities (Monmouth County and 52 of its municipalities) participated in the development of this plan:

County of Monmouth

Aberdeen, Township of
Allenhurst, Borough of
Allentown, Borough of
Asbury Park, City of
Atlantic Highlands, Borough of
Avon-by-the-Sea, Borough of
Belmar, Borough of
Bradley Beach, Borough of
Brielle, Borough of
Colts Neck, Township of
Deal, Borough of
Eatontown, Borough of
Englishtown, Borough of
Fair Haven, Borough of
Farmingdale, Borough of
Freehold, Borough of
Freehold, Township of
Hazlet, Township of
Highlands, Borough of
Holmdel, Township of
Howell, Township of
Interlaken, Borough of
Keansburg, Borough of
Keyport, Borough of
Lake Como, Borough of
Little Silver, Borough of
Loch Arbour, Village of
Long Branch, City of
Manalapan, Township of
Manasquan, Borough of
Marlboro, Township of
Matawan, Borough of
Middletown, Township of
Millstone, Township of
Monmouth Beach, Borough of
Neptune, Township of
Neptune City, Borough of
Ocean, Township of
Oceanport, Borough of
Red Bank, Borough of
Rumson, Borough of
Sea Bright, Borough of
Sea Girt, Borough of
Shrewsbury, Borough of
Shrewsbury, Township of
Spring Lake, Borough of
Spring Lake Heights, Borough of
Tinton Falls, Borough of
Union Beach, Borough of
Upper Freehold, Township of
Wall, Township of
West Long Branch, Borough of

In addition, the records show that the following four stakeholder entities participated through attending at least one meeting or responding to at least one questionnaire.

New Jersey State Police, Central Region
New Jersey Office of Emergency Management
Monmouth University
Brookdale Community College

URS Corporation (Wayne, NJ) acted as the plan development consultant providing hazard mitigation planning services, with PBS&J and T&M Associates as their subconsultants.

TABLE OF CONTENTS

<u>Appendices</u>:

List of Tables

List of Figures

SECTION 1 - INTRODUCTION

Purpose

Monmouth County is susceptible to a number of different natural hazards. These natural hazards have the potential to cause property loss, loss of life, economic hardship, and threats to public health and safety. While an important aspect of emergency management deals with disaster recovery ï those actions that a community must take to repair damages and make itself whole in the wake of a natural disaster ï an equally important aspect of emergency management involves hazard mitigation. Hazard mitigation measures are efforts taken *before* a disaster happens to lessen the impact that future disasters of that type will have on people and property in the community. They are things you do today to be more protected in the future.

Recognizing the risks that natural hazards pose to Monmouth County, the Office of Emergency Management submitted an application, and was approved for, grant monies from the Federal Emergency Management Agency (FEMA) under the Pre-Disaster Mitigation Program in 2006, to be used to develop a hazard mitigation plan for the County.

This **Monmouth County Multi-Jurisdictional Natural Hazard Mitigation Plan** (the ñPlanò) has been developed by the Monmouth County Hazard Mitigation Planning Committee (the ñPlanning Committeeò), with support from outside consultants at URS Corporation (ñURS,ò the contractor responsible for providing the Planning Committee with hazard mitigation planning support services). The Plan represents the collective efforts of citizens, elected and appointed government officials, business leaders, volunteers of non-profit organizations, and other stakeholders.

Through the development of this Plan, the Planning Committee has identified the natural hazards that could affect the County, and has evaluated the risks associated with these hazards. The successful implementation of this Plan will make Monmouth County more disaster-resistant because the County has taken the initiative to recognize the benefits that can be gained by planning ahead and taking measures to reduce damages before the next disaster strikes. The Plan will also allow Monmouth County and participating jurisdictions to comply with the Disaster Mitigation Act of 2000 (DMA 2000) and its implementing regulations (44 CFR Part 201.6), thus resulting in eligibility to apply for Federal aid for technical assistance and post-disaster hazard mitigation project funding.

Natural disasters cannot be prevented from occurring. However, over the long-term, the continued implementation of this Plan will gradually, but steadily, lessen the impacts associated with hazard events.

About Monmouth County

Overview

Monmouth County is located in eastern-central New Jersey. It is the northernmost of New Jerseyôs shore counties. Monmouth County is bounded by Middlesex, Mercer, Burlington, and Ocean Counties (from Middlesex County in the north and moving in a counter-clockwise direction to Ocean County in the South). Eastern sections of Monmouth Countyôs northern limits are bounded by Raritan Bay and Sandy Hook Bay. To the east of Monmouth County lies the Atlantic Ocean. Monmouth County has a land area of 472 square miles, making it New Jerseyôs sixth largest county in terms of area. As of the year 2000 Census, Monmouth County had a population of 615,301 making it the fourth largest in the state in terms

of population. In addition, Monmouth County, home to 53 municipalities each with its distinct character, is one of the most diverse counties in the state.

In Monmouth County, there are two cities, 35 boroughs, 15 townships and 1 village. They are the Cities of Asbury Park and Long Branch; Boroughs of Allenhurst, Allentown, Atlantic Highlands, Avon-by-the-Sea, Belmar, Bradley Beach, Brielle, Deal, Eatontown, Englishtown, Fair Haven, Farmingdale, Freehold, Highlands, Interlaken, Keansburg, Keyport, Lake Como, Little Silver, Manasquan, Matawan, Monmouth Beach, Neptune City, Oceanport, Red Bank, Roosevelt, Rumson, Sea Bright, Sea Girt, Shrewsbury, Spring Lake, Spring Lake Heights, Tinton Falls, Union Beach, and West Long Branch; Townships of Aberdeen, Colts Neck, Freehold, Hazlet, Holmdel, Howell, Manalapan, Marlboro, Middletown, Millstone, Neptune, Ocean, Shrewsbury, Upper Freehold, and Wall; and Village of Loch Arbour.

Figure 1.1 depicts the location of Monmouth County in relation to the rest of the State of New Jersey.

Figure 1.1 - Location of Monmouth County in New Jersey

Monmouth County has a wide variety of natural resources and landscapes including slopes, bay front and oceanfront beaches, rivers, lakes, streams, forests, and farmlands. High lands and cliffs dominate the Bayshore areas, while shorelines and rivers characterize eastern portions of the County and rolling hills and farmland characterizes the western portions of the County. Although the land use patterns are also diverse, residential development is the predominant use. County residents have access to major employment, entertainment, and transportation centers by public transportation and a superior highway network. This access will greatly improve with the construction of the proposed Monmouth Ocean Middlesex passenger rail line currently under study. In addition, the county features an abundance of top-rate parks, golf courses, open space, educational facilities as well as low crime rates. Over the past four decades, Monmouth County has become increasingly more suburbanized as growth increased dramatically, making this county one of the fastest growing regions in the State. Much of this growth is attributable to net in-migration. People are drawn to the exceptional quality of life in Monmouth County.

As noted in the Countyôs Open Space Plan (2006), pressure to develop and redevelop land in Monmouth County remains strong thus presenting challenges to maintaining quality of life for present and future generations. A growing population, competition for diminishing land resources, escalating property values, and increasing public demand for control of growth and provision of recreation services point toward the importance of preserving open space. Monmouth County currently has preserved 15.2 percent of its land area as protected public open space. The largest percentages of vacant land are found in the western portions of the County where agriculture is still the primary land use.

Much of Monmouth County is flat and low-lying; however, there are some hilly areas in Holmdel Township, Middletown Township, Atlantic Highlands Borough, and Highlands Borough. Crawford Hill, in Holmdel Township, is the tallest point in the County at approximately 380 feet above sea level.

Today, the County offers numerous cultural activities ranging from visual and performing arts groups to a multitude of festivals and special events attracting thousands of people from throughout the Philadelphia/South Jersey region. The Countyôs great environmental and cultural diversity continues to attract new residents.

Population. According to the US Census, the population of Monmouth County in 1990 was 553,124 whereas, in 2000 it increased to 615,301 ï an increase of approximately 11.2 percent over ten years. The County expects this general trend to continue between now and the year 2025. Table 1.1 shows key County population changes and projections (county-wide and for each municipality) as reported in the Monmouth County Cross Acceptance Report (2004).

Table 1.1
Key County Population Changes and Projections
(Source: Monmouth County Cross Acceptance Report)

Municipality	Population 1970 Census	Population 1980 Census	Population 1990 Census	Population 2000 Census	Population 2025 Estimate	Absolute Change 2000-2025	Percent Change 2000-2025
Monmouth County	461,849	503,173	553,124	615,301	703,784	88,483	14.4%
Aberdeen, Township of	17,680	17,235	17,038	17,454	20,634	3,180	18.2%
Allenhurst, Borough of	1,012	912	759	718	733	15	2.1%
Allentown, Borough of	1,603	1,962	1,828	1,882	1,980	98	5.2%
Asbury Park, City of	16,533	17,015	16,799	16,930	20,500	3,570	21.1%
Atlantic Highlands, Borough of	5,102	4,950	4,629	4,705	4,825	120	2.6%
Avon-by-the-Sea, Borough of	2,163	2,337	2,165	2,244	2,244	0	0.0%
Belmar, Borough of	5,782	6,771	5,877	6,045	6,048	3	0.0%
Bradley Beach, Borough of	4,163	4,772	4,475	4,793	4,793	0	0.0%
Brielle, Borough of	3,594	4,068	4,406	4,893	5,227	334	6.8%
Colts Neck, Township of	5,819	7,888	8,559	11,179	12,447	1,268	11.3%
Deal, Borough of	2,401	1,952	1,179	1,070	1,132	62	5.8%
Eatontown, Borough of	14,619	12,703	13,800	14,008	14,458	450	3.2%
Englishtown, Borough of	1,048	976	1,268	1,764	2,399	635	36.0%
Fair Haven, Borough of	6,142	5,679	5,270	5,937	6,095	158	2.7%
Farmingdale, Borough of	1,148	1,348	1,462	1,587	1,602	15	0.9%
Freehold, Borough of	10,545	10,020	10,742	10,976	11,339	363	3.3%
Freehold, Township of	13,185	19,202	24,710	31,537	36,377	4,840	15.3%
Hazlet, Township of	22,239	23,013	21,976	21,378	22,293	915	4.3%
Highlands, Borough of	3,916	5,187	4,849	5,097	5,274	177	3.5%
Holmdel, Township of	6,117	8,447	11,532	15,781	19,608	3,827	24.3%
Howell, Township of	21,756	25,065	38,987	48,903	64,078	15,175	31.0%
Interlaken, Borough of	1,182	1,037	910	900	908	8	0.9%
Keansburg, Borough of	9,720	10,613	11,069	10,732	10,810	78	0.7%
Keyport, Borough of	7,205	7,413	7,586	7,568	7,661	93	1.2%
Lake Como, Borough of	1,490	1,566	1,482	1,806	1,806	0	0.0%
Little Silver, Borough of	6,010	5,548	5,721	6,170	6,392	222	3.6%
Loch Arbour, Village of	395	369	380	280	280	0	0.0%

Table 1.1
Key County Population Changes and Projections
(Source: Monmouth County Cross Acceptance Report)

Municipality	Population 1970 Census	Population 1980 Census	Population 1990 Census	Population 2000 Census	Population 2025 Estimate	Absolute Change 2000-2025	Percent Change 2000-2025
Long Branch, City of	31,774	29,819	28,658	31,340	34,106	2,766	8.8%
Manalapan, Township of	14,049	18,914	26,716	33,423	47,190	13,767	41.2%
Manasquan, Borough of	4,971	5,354	5,369	6,310	6,772	462	7.3%
Marlboro, Township of	12,273	17,560	27,974	36,398	41,991	5,593	15.4%
Matawan, Borough of	9,136	8,837	9,270	8,910	9,420	510	5.7%
Middletown, Township of	54,623	62,574	68,183	67,479	71,597	4,118	6.1%
Millstone, Township of	2,535	3,926	5,069	8,970	13,152	4,182	46.6%
Monmouth Beach, Borough of	2,042	3,318	3,303	3,595	3,744	149	4.1%
Neptune, Township of	27,863	28,366	28,148	27,690	33,215	5,525	20.0%
Neptune City, Borough of	5,502	5,276	4,997	5,218	5,447	229	4.4%
Ocean, Township of	18,643	23,570	25,058	26,959	29,216	2,257	8.4%
Oceanport, Borough of	7,503	5,888	6,146	5,807	6,105	298	5.1%
Red Bank, Borough of	12,847	12,031	10,636	11,844	12,306	462	3.9%
Roosevelt, Borough of	814	835	884	933	1,072	139	14.9%
Rumson, Borough of	7,421	7,623	6,701	7,137	7,275	138	1.9%
Sea Bright, Borough of	1,339	1,812	1,693	1,818	2,085	267	14.7%
Sea Girt, Borough of	2,207	2,650	2,099	2,148	2,148	0	0.0%
Shrewsbury, Borough of	3,315	2,962	3,096	3,590	3,781	191	5.3%
Shrewsbury, Township of	1,164	995	1,098	1,098	1,144	46	4.2%
Spring Lake, Borough of	3,896	4,215	3,499	3,567	3,661	94	2.6%
Spring Lake Heights, Borough of	4,602	5,424	5,341	5,227	5,367	140	2.7%
Tinton Falls, Borough of	8,395	7,740	12,361	15,053	20,659	5,606	37.2%
Union Beach, Borough of	6,472	6,354	6,156	6,649	7,011	362	5.4%
Upper Freehold, Township of	2,551	2,750	3,277	4,282	6,837	2,555	59.7%
Wall, Township of	16,498	18,952	20,244	25,261	28,015	2,754	10.9%
West Long Branch, Borough of	6,845	7,380	7,690	8,258	8,525	267	3.2%

The average percent change between 2000 and 2025 for Monmouth County municipalities is a 10.3 percent increase in population. The three highest observed increases are Upper Freehold with a projected increase of 59.7 percent; Millstone at 46.6 percent; and Manalapan at 41.2 percent. The lowest observed are Interlaken with a projected decrease of 0.9 percent; Keansburg at 0.7 percent; and Avon-by-the-Sea, Bradley Beach, Lake Como, Loch Arbour, Sea Girt, and Belmar all at zero percent.

US Census data for the year 2000 shows that 35.3 percent of the population lives in Coastal communities. Another 26.7 percent lives in Western areas and 21.9 percent lives in Central areas. The remaining 16.0 percent of the Countyôs population resides in Bayshore and Panhandle communities (at 13.4 and 2.6 percent, respectively). The County Cross Acceptance Report estimates that between the year 2000 and 2025, percent increases in population will be the greatest in the Panhandle areas at 46.6 percent, followed by Western areas at 24.5 percent. Central regions are projected to realize percent population increases of 13.0 percent, while Coastal and Bayshore regions are projected to realize 8.3 and 6.6 percent increases, respectively.

According to the U.S. Census Bureau, the county has a total area of 665 square miles, of which 472 square miles is land and 193 square miles is water.

The 1990 U.S. Census population density per square mile of land in Monmouth County was 1,172 persons per square mile; whereas, in the 2000 U.S. Census, there were 1,304 persons per square mile ï an increase of 11.3 percent. By 2025, the population density is projected to be 1,491 persons per square mile ï an increase of 14.4 percent over the year 2000 values.

Monmouth Countyôs population is also aging. The overall median age rose from 35 in 1990 to 37.7 in 2000. However, the percentage of the population over 65 years of age has remained relatively constant (at 12.5 percent in 2000 and 12.7 percent in 1990).

Roads and Bridges. Monmouth County has excellent access to all major modes of transportation. A 27 mile segment of the Garden State Parkway runs through eastern Monmouth County. There are seven Parkway interchanges in the county along with Exit 116 for the PNC Arts Center, making Monmouth County a convenient destination for tourists and visitors from northern New Jersey and New York, particularly in the summer months. Interstate 195, with 17 miles in southern Monmouth County, connects the New Jersey Turnpike, Mercer County and Eastern Pennsylvania with the coast, making the county convenient for tourists from the Philadelphia area. In addition, there are 178 miles of state roads, and 381 miles of county roads. Major state and county capital improvements, underway or planned, are keeping pace with the increased traffic.

Rail. The NJ TRANSIT North Jersey Coast Line provides easy rail access to Newark and New York City. There are 13 year-round rail stations located in Monmouth County and one seasonal station located at Monmouth Park Racetrack, operational during the racing season. Parts of the county have easy access to Amtrak stations at Metro Park, New Brunswick and Princeton Junction. NJ TRANSIT provides AirTrain service from a station near Pennsylvania Station, Newark to Newark Airport. This five minute ride allows North Jersey Coast Line passengers to use rail service to and from the airport.

Bus. Virtually the entire county is served by a network of local and regional bus service. The county is presently working to expand and enhance these services to better serve the growing commercial and industrial areas of the region.

Ferry. Ferry service to New York City is available from Atlantic Highlands, Highlands and the Belford section of Middletown. Ridership from Atlantic Highlands is about 2700 persons per day to New York City and 1,200 per day from Highlands. The recently opened Belford ferry service began in October 2002. Service has risen to 2,000 weekday riders.

Airports. On a more regional scale, Newark International Airport is easy to access by car from all of Monmouth County. For most residents, the drive is between 45 minutes to an hour. Direct bus service to the airport is also available from central areas of the county and a new passenger rail transfer (AirTrain) provides direct access to trains originating in coastal communities of the county. Many county residents are less than an hour to the Philadelphia International Airport. Monmouth County residents can also take advantage of the Monmouth Executive Airport (formerly known as Allaire Airport) in Wall Township for charter flights all over the country.

Public Water and Sewer. The county's water supplies can accommodate the projected future growth. Our water supplies are plentiful according to the draft of the New Jersey Statewide Water Supply Plan, prepared by the New Jersey Department of Environmental Protection (September 1995). Projections of water use to the year 2010 indicate that the countyôs watershed areas will have substantial water surpluses in 2010. During the 2002 water shortage, Monmouth County had ample supplies. The Monmouth County Planning Board recently completed the draft of the county-wide wastewater management plan that combined all wastewater management plans into a single cohesive plan and map for the county. The study was a detailed analysis of the processing ability of existing wastewater facilities to meet future demand. This GIS-based analysis utilized individual parcels, municipal zoning maps, and past trends in growth patterns to project future wastewater generation. The study concluded that the county had sufficient wastewater capacity through 2022 and beyond.

Income. Throughout the 1990s, income growth in Monmouth County has continued to rise above the state and national average. According to the 2000 U.S. Census, median household income in Monmouth County from 1989 to 1999 rose 40%. Median household income in Monmouth County in 1999 was $64,271, 17% higher than $55,146 for New Jersey and 53% higher than $41,994 for the United States. Per capita income in Monmouth County is 15% above the state average and 44% above the national average. In terms of high-income households, 12.1% of Monmouth County households have incomes above $150,000 per year versus 8.6% for New Jersey and 4.6% for the United States. In terms of persons living below the poverty level, Monmouth County at 3.6% ranks fourth lowest among the 236 counties in the USA with populations greater than 250,000. For children under 18 years of age living in poverty, Monmouth County ranks second lowest among these 236 counties with 2.7%.

Employment. According to the US Census 2000, most of Monmouth Countyôs residents also are employed within the County (60.0 percent). An estimated 10.3 percent work in Middlesex County, while 7.7 percent commute to New York City and the remainder in other areas.

Tourism. The Monmouth County Planning Board indicates in their *Monmouth County Profile 2006* highlight the importance of summer tourism to the Countyôs overall economy. Tourism spending in Monmouth County was $1.9 billion in 2005, up 15.6 percent from 2004. Among New Jersey counties with at least a $350 million tourism industry, Monmouth County had the second largest percentage increase in 2005. Tourism resulted in about 39,000 jobs. Monmouth ranks third in the state in terms of tourism employment. The County also ranks fourth in the state in terms of the number of seasonal homes (7,726). In addition to its beaches, Monmouth County communities offer tourists several public golf courses including two courses which Golf Digest has ranked within the top 50 public courses in the country. Monmouth County also offer tourists two major horse racing tracks at Monmouth Park and Freehold Raceway.

Military Installations. Fort Monmouth is the Countyôs second largest employer with 500 military personnel and 4,800 private contractors. Fort Monmouth is the headquarters for the Army Communications-Electronics Command (CECOM). Fort Monmouth is likely to be closed in the future, and local municipal, county and state officials and other stakeholders are working together via a Fort Monmouth Redevelopment Authority to develop plans for the area. The Naval Weapons Station Earle (NWSE) is located in Colts Neck, providing 1,100 jobs (the Countyôs 11th largest employer).

FEMA Disaster Declarations. Disaster declarations, for the county or counties affected by a disaster, are declared by the President of the United States under the authority of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (the ñStafford Actò). FEMA then manages the entire process, including making federally-funded assistance available in declared areas; coordinates emergency rescue and response efforts; provides emergency resources; and provides other related activities/funding in the process of aiding citizens and local governments in a nationally-declared disaster. Tables 1.2, 1.3 and 1.4 provide a summary of disaster and emergency declarations for the State of New Jersey (based on review of the FEMA web site and the New Jersey State Hazard Mitigation Plan), with an indication as to whether Monmouth County was part of the declared area.

Table 1.2
New Jersey State Major Disaster Declarations: 1955 – 2007
(Source: FEMA, online at http://www.fema.gov/news/disasters_state.fema?id=34
And Appendix N of the New Jersey State Hazard Mitigation Plan)

Year	Date	Disaster Type	Disaster Number	Was Monmouth County Declared?
2007	26-Apr	Severe Storms and Inland and Coastal Flooding	1694	No
2006	7-Jul	Severe Storms and Flooding	1653	No
2005	19-Apr	Severe Storms and Flooding	1588	No
2004	1-Oct	Tropical Depression Ivan	1563	No
2004	16-Jul	Severe Storms and Flooding	1530	No
2000	17-Aug	Severe Storms, Flooding And Mudslides	1337	No
1999	18-Sep	Hurricane Floyd	1295	No
1998	3-Mar	Coastal Storm	1206	Unknown
1997	23-Sep	Flooding	1189	Unknown
1996	19-Nov	Severe Storms/Flooding	1145	Unknown
1996	13-Jan	Blizzard	1088	Unknown
1992	18-Dec	Coastal Storm, High Tides, Heavy Rain, Flooding	973	Unknown
1992	3-Mar	Severe Coastal Storm	936	Unknown
1985	15-Oct	Hurricane Gloria	749	Unknown
1984	12-Apr	Coastal Storms, Flooding	701	Unknown
1977	8-Feb	Ice Conditions	528	Unknown
				table continued on the following page →
1976	21-Aug	Severe Storms, High Winds, Flooding	519	Unknown
1975	23-Jul	Heavy Rains, High Winds, Hail, Tornadoes	477	Unknown
1973	7-Aug	Severe Storms, Flooding	402	Unknown
1971	4-Sep	Heavy Rains, Flooding	310	Unknown
1968	18-Jun	Heavy Rains, Flooding	245	Unknown
1965	18-Aug	Water Shortage	205	Unknown
1962	9-Mar	Severe Storm, High Tides, Flooding	124	Unknown
1955	20-Aug	Hurricane, Floods	41	Unknown

Table 1.3
New Jersey State Emergency Declarations: 1955 – 2007
(Source: FEMA, online at http://www.fema.gov/news/disasters_state.fema?id=34

Year	Date	Emergency Type	Declaration Number	Was Monmouth County Declared?
2005	**19-Sep**	**Hurricane Katrina Evacuation**	**3257**	**Yes**
2003	23-Sep	Power Outage	3188	No
2003	**20-Mar**	**Snowstorm**	**3181**	**Yes**
2001	**19-Sep**	**Terrorist Attack Emergency Declaration**	**3169**	**Yes**
2000	**1-Nov**	**Virus Threat**	**3156**	**Yes**
1999	**17-Sep**	**Hurricane Floyd**	**3147**	**Yes**
1993	17-Mar	Severe Blizzard	3106	Unknown
1980	19-Oct	Water Shortage	3083	Unknown
1974	24-Dec	Severe Storms, High Winds & High Tides	3005	Unknown

Table 1.4
New Jersey State Fire Management Assistance Declarations
(Source: FEMA, online at http://www.fema.gov/news/disasters_state.fema?id=34

Year	Date	Emergency Type	Declaration Number	Was Monmouth County Declared?
2007	16-May	Warren Grove Fire	2695	No
2002	2-Jun	Double Trouble Fire	2411	No

Plan Development Process

Multi-Jurisdictional Approach

Monmouth County took a multi-jurisdictional approach to preparing its hazard mitigation plan. The County had resources (i.e., funding, data, GIS, etc.) which local jurisdictions lacked. However, the County could not develop the plan on its own. To undertake such a regional planning effort, the County needed to involve its member municipalities since only they have the legal authority to enforce compliance with land use planning and development issues.

Throughout the plan development process, the Monmouth County Office of Emergency Management (MCOEM) worked tirelessly to involve all of its 53 municipalities. These local jurisdictions were not only invited to participate but were truly guided through the process by MCOEM at every stage. At the beginning of the process, MCOEM was notified by all 53 of its municipalities that they were interested in participating.

To track participation, MCOEM worked with its Steering Committee to develop participation criteria based on a points system for local efforts undertaken, whereby a minimum score of 80 points (out of a possible 100) had to be amassed by a jurisdiction to be deemed a successful participant. The scoring system entailed:

Table 1.5
Participation Criteria

Nature of Participation	Points	Mandatory Elements
1. Committee representative who is empowered to act on the jurisdiction's behalf and bear the responsibility to be a conduit between the plan author and the jurisdiction.	10	ã
2. Fill out and return the following worksheets completely and on time:		
Worksheet #1 - "Wish List"	5	
Worksheet #2 - Hazard ID Questionnaire	5	
Worksheet #3 - Land Uses and Development Trends Questionnaire	5	
Worksheet #4 - Capability Assessment Questionnaire	5	
Worksheet #5 - Guidance Memorandum 2 - Plan Maintenance Procedures	5	
Worksheet #6 - Guidance Memorandum 3 - Plan Integration	5	
Worksheet #7 – Mitigation Actions Prioritization Sheet	5	ã
Worksheet #8 –Mitigation Actions Implementation Strategy Sheet	5	ã
3. Be available to provide telephone/email feedback for the clarification of information on the surveys/questionnaires, if requested.	5	ã
4. Attendance at 2 meetings (10 points/meeting)	20	
5. Review and comment on the draft plan on time. <Monmouth County is responsible for providing coordinated comments to URS> At a minimum, written notice via mail or email should be provided stating that the document has been reviewed and there are no comments. For the draft plan, 2 weeks will be allowed for review and comment. If no feedback is received by the deadline, this participation criteria will be deemed "unmet."	10	
6. Use suggestions presented in Guidance Memo #1 to provide at least one opportunity for neighboring jurisdictions, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and non-profit interests to be involved in the planning process. Required to provide at least one method of outreach that will reach the full realm. Can be supplemented by targeted outreach to key entities. Fill out the Outreach Log to summarize activities conducted.	15	ã

The following municipal entities (Monmouth County and 52 of its municipalities) participated successfully in the development of this plan by meeting the above participation criteria through amassing a minimum of 80 points (as tallied, logged, and maintained by MCOEM):

County of Monmouth

Aberdeen, Township of
Allenhurst, Borough of
Allentown, Borough of
Asbury Park, City of
Atlantic Highlands, Borough of
Avon-by-the-Sea, Borough of
Belmar, Borough of
Bradley Beach, Borough of
Brielle, Borough of
Colts Neck, Township of
Deal, Borough of
Eatontown, Borough of
Englishtown, Borough of
Fair Haven, Borough of
Farmingdale, Borough of
Freehold, Borough of
Freehold, Township of
Hazlet, Township of
Highlands, Borough of
Holmdel, Township of
Howell, Township of
Interlaken, Borough of
Keansburg, Borough of
Keyport, Borough of
Lake Como, Borough of
Little Silver, Borough of
Loch Arbour, Village of
Long Branch, City of
Manalapan, Township of
Manasquan, Borough of
Marlboro, Township of
Matawan, Borough of
Middletown, Township of
Millstone, Township of
Monmouth Beach, Borough of
Neptune, Township of
Neptune City, Borough of
Ocean, Township of
Oceanport, Borough of
Red Bank, Borough of
Rumson, Borough of
Sea Bright, Borough of
Sea Girt, Borough of
Shrewsbury, Borough of
Shrewsbury, Township of
Spring Lake, Borough of
Spring Lake Heights, Borough of
Tinton Falls, Borough of
Union Beach, Borough of
Upper Freehold, Township of
Wall, Township of
West Long Branch, Borough of

In addition, the records show that the following four stakeholder entities participated through attending at least one meeting or responding to at least one questionnaire.

New Jersey State Police, Central Region
New Jersey Office of Emergency Management
Monmouth University
Brookdale Community College

The Borough of Roosevelt expressed an interest in participating and took part at some level, but did not meet the aforementioned participation criteria.

Readers are invited to review the contents of ***Appendix A – Planning Committee Membership Information*** for a list of Steering Committee and Core Planning Group members.

While the County did retain the services of a consultant (URS Corporation, with PBS&J and T&M Associates as their subconsultants) to guide participants through the process and author the plan, participating jurisdictions contributed throughout the overall planning process, as follows:

- Each participating jurisdiction provided staff to participate in the overall county-wide Core Planning Group (CPG). The jurisdictionôs CPG member(s) were lead members of their municipalityôs Jurisdictional Assessment Team (JAT). JATs were responsible for reviewing information, data and documents, submitting feedback to the Consultant, completing questionnaires/forms, reaching out to the public and other stakeholders in their respective jurisdictions, developing a unique mitigation strategy for their municipality, and reviewing and

commenting on draft documents. *More information on the planning team structure and roles/responsibilities is presented later in this section.*

- The Consultant provided **"*Guidance Memorandum 1- Assessing Community Support, Building the Planning Team, and Engaging the Public and Other Stakeholders*"** at the project outset (July 2007). This memorandum was prepared to provide Monmouth County and its participating jurisdictions with suggestions for: assessing community support, building the planning team and engaging the public and other stakeholders throughout the plan development process and prior to plan approval. The Jurisdictional Assessment Team for each municipality used this memorandum as a guide for outreach, documented their completed activities in the memorandumôs ñ**Outreach Log**ò. Fifty-two jurisdictions provided this log back to the Consultant for incorporation into the plan.
- Participating jurisdictions provided feedback during the Hazard Identification and Hazard Profile steps of the process (Sections 2 and 3.a of the plan, respectively) through their completion and submittal of a **Hazard Identification Questionnaire** to the Consultant. This questionnaire summarized the Consultantôs evaluation of a full range of natural hazards, including whether or not each hazard was recommended for inclusion in the plan and why. Municipalities were asked to provide information as to whether or not they concurred with the consultantôs findings, and information on impacts from past events in their respective communities. Local responses were used by the Consultant to supplement hazard information obtained through research of past disaster declarations in the County, review of the New Jersey State Hazard Mitigation Plan (2005), and review of readily available online information from reputable sources (such as federal and state agencies). Fifty-two jurisdictions returned this questionnaire.
- Participating jurisdictions provided feedback during the evaluation of Land Uses and Development Trends step of the process (Section 3.d of the plan) through their completion and submittal of a **Land Uses and Development Trends Questionnaire** to the Consultant. This questionnaire asked jurisdictions to: (1) describe development trends occurring within their jurisdiction, such as the predominant types of development occurring, location, expected intensity, and pace by land use; and (2) describe any regulations/ordinances/codes their jurisdiction enforces to protect new development from the effects of natural hazards. Local responses were used by the Consultant to supplement information presented in the County Cross-Acceptance Report. Fifty-four jurisdictions and two stakeholder entities returned this questionnaire.
- Participating jurisdictions provided feedback during the Capability Assessment step of the process (Section 4 of the plan) through their completion and submittal of a **Capability Assessment Questionnaire** to the Consultant. This questionnaire asked respondents to examine their jurisdictionôs abilities to implement and manage a comprehensive mitigation strategy, which includes a range of mitigation actions. The questionnaires requested information pertaining to existing plans, polices, and regulations that contribute to or hinder the ability to implement hazard mitigation actions. They also requested information pertaining to the legal and regulatory capability, technical and administrative capacity, and fiscal capability of each jurisdiction. Fifty jurisdictions and one stakeholder entity submitted completed questionnaires illustrating their capability to implement a mitigation strategy.
- Participating jurisdictions provided feedback regarding **problem areas in need of mitigation and possible mitigation alternatives**. Some municipalities provided this type of information to the consultant separately, either via phone call, email, or separate written correspondence. Their feedback is included in Section 6 of the plan. Finally, at a working session of the Core Planning Group on April 4, 2008, participating jurisdictions were asked to consider range of various types of hazard mitigation actions, and identify a mitigation strategy for their municipality. Monmouth County and 52 participating jurisdictions have submitted a unique mitigation strategy.

- The Consultant provided **"*Guidance Memorandum #2 – Plan Maintenance Procedures: Monitoring, Evaluating and Updating the Plan*** in August 2007. This memorandum provided participants with an overview of the requirements regarding plan maintenance, types of plan maintenance activities that can be selected to meet the requirements, and some examples of plan maintenance strategies from other FEMA-approved plans in FEMA Region 2. Participating jurisdictions were asked to review this information, coordinate with their Jurisdictional Assessment Team, and provide comments back to MCOEM regarding what types of plan maintenance activities their community was in favor of, versus any elements their community like to see excluded. Jurisdictions were asked to submit their feedback to MCOEM. They were advised that lack of feedback would be interpreted to indicate that their jurisdiction had no particular preferences regarding this plan element. In turn, MCOEM reviewed feedback received and developed a county-wide plan maintenance strategy that best reflected the expressed desires of the full team.
- The Consultant provided ñ***Guidance Memorandum #3 – Plan Integration***ò in August 2007. The memorandum summarized requirements in terms of how mitigation recommendations will be integrated into job descriptions, or existing planning mechanisms such as comprehensive plans, capital improvement plans, zoning and building codes, site reviews, permitting and other planning tools, where such tools are appropriate. Various ways that the hazard mitigation plan can be integrated into local planning mechanisms were presented, along with sample text from other plans approved by FEMA Region 2. Participating jurisdictions were asked to review this information, coordinate with their Jurisdictional Assessment Team, and provide comments back to MCOEM regarding what types of plan integration activities their community was in favor of, versus any elements their community like to see excluded. Jurisdictions were asked to submit their feedback to MCOEM. They were advised that lack of feedback would be interpreted to indicate that their jurisdiction had no particular preferences regarding this plan element. In turn, MCOEM reviewed feedback received and developed a county-wide plan maintenance strategy that best reflected the expressed desires of the full team.

Monmouth County Hazard Mitigation Planning Committee

This Plan has been developed by the **Monmouth County Hazard Mitigation Planning Committee (the "Planning Committee"**), with support from an outside consulting firm (URS Corporation, ñURSò). The efforts of the Planning Committee were headed by the Monmouth County Office of Emergency Managementôs Coordinator. The Plan represents the collective efforts of citizens, elected and appointed government officials, business leaders, volunteers of non-profit organizations, and other stakeholders.

The overall **Planning Committee** consisted of members of Monmouth County, each participating jurisdiction, and the public and other stakeholders. The overall Planning Committee did not meet together in one place during the planning process. Instead, a team concept was used to more evenly distribute responsibilities and to make best of use of every participantôs unique capabilities.

As shown in Figure 1.2, the overall Planning Committee was divided into a **Core Planning Group (CPG)** and a series of **Jurisdictional Assessment Teams (JATs),** with one JAT for each of the Countyôs participating jurisdictions.

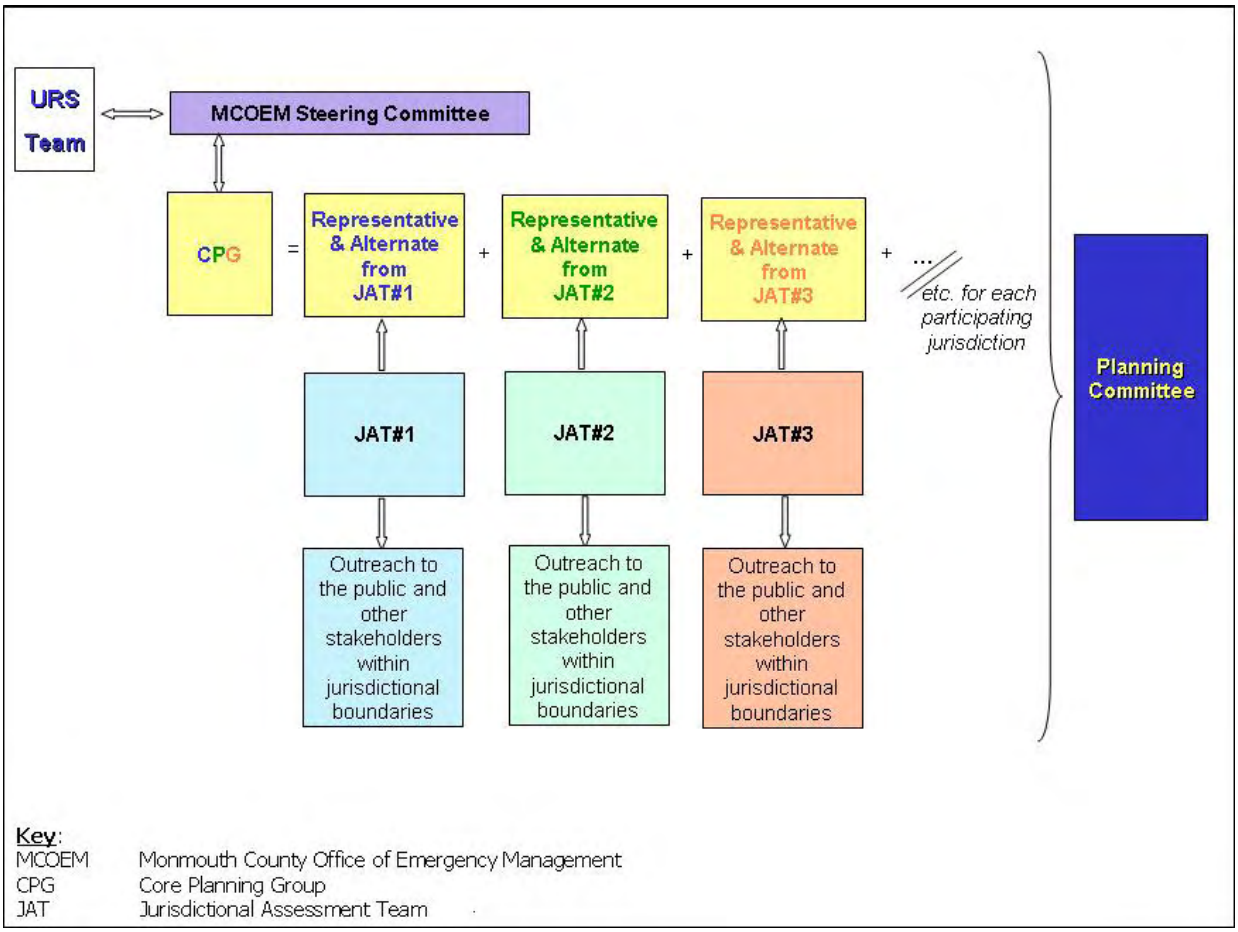


Figure 1.2 – Planning Committee Organizational Structure

This team concept was beneficial for two reasons: (1) the Consultant and the County's main point of contact was the Monmouth County Steering Committee and the CPG; and (2) JATs with intimate local knowledge were best suited for coordination and outreach within their respective jurisdictions.

All members of the CPG and the JATs were also members of the overall Planning Committee. The CPG included head members of each JAT (the County and each of the municipalities who elected to participate in the process). The Monmouth County Steering Committee was responsible for managing the overall plan formulation activities. The CPG was responsible for attending CPG meetings and providing information and feedback, and coordinating an outreach program within their municipality's JAT and beyond to the public and other stakeholders. Each JAT was responsible for coordinating and facilitating local efforts, sending CPG representatives to meetings, providing information and feedback, involving the public and local community stakeholders in the planning process, assessing mitigation alternatives, selecting a course of action to be followed for their community, adopting the plan, and participating in plan monitoring and implementation.

With regard to meetings, MCOEM was responsible for setting meeting dates and times, securing a meeting facility, and notifying all team members of upcoming meetings. They also played a very large role in reminding CPG members of certain project deadlines. The Consultant prepared meeting agendas, handouts, PowerPoint presentations, and meeting minutes. MCOEM distributed meeting minutes via email, and ensured that all meeting materials and report deliverables were posted on the County web site.

The plan development process was initiated in earnest in the Summer of 2007 with the Monmouth County **Steering Committee's Meeting held on June 20, 2007.** At this meeting, the consultant met with the Steering Committee to refine the project work plan, discuss schedule and the anticipated level of County labor support. The Consultant provided a ñWish Listò of information, data and documents they hope each participating jurisdiction can submit for their review and incorporation into the plan. The Consultant also provided Guidance Memorandum #1 regarding assessing community support, building the planning team, and engaging the public. At this meeting, expectations regarding the CPG Project Kickoff Meeting were discussed. Handouts included the project scope of work, targeted implementation schedule and Wish List.

The Steering Committee met on a monthly basis throughout the plan development process to oversee the work of the consultant and to guide participating municipalities throughout the process requirements.

Jurisdictional Assessment Teams met individually throughout the plan development process as they deemed necessary.

The following is an overview of CPG meetings held during the plan development process.

- July 17, 2007 ï Core Planning Group Kickoff Meeting. This was the first meeting of the Core Planning Group. Participants were provided with an overview of: the intent of the project; the organizational structure of the planning group; the plan development process overall; the role of participating jurisdictions, contractors, the public and other stakeholders; what it means to participate; key deliverables; data collection/supporting documents; the project timeline; and next steps. Handouts included the PowerPoint presentation, targeted implementation schedule, Wish List, sources of information on hazard mitigation planning, project Fact Sheet and Guidance Memo #1.
- November 29, 2007 ï Core Planning Group Meeting #2 (open to the public and other stakeholders). This meeting was conducted to provide an overview of plan development progress and continued work to be completed. The Consultant provided an overview of the Hazard Identification and Hazard Profile steps, and the ongoing Risk Assessment portion of the draft plan.
- January 31, 2008 ï Joint Meeting, Core Planning Group and LEPC (Local Emergency Planning Coordinators). The purpose of the Mitigation Planning meeting was to: review the project timeline and current status; remind CPG members of the need for continuing to reach out to the public and other stakeholders in their respective jurisdictions; and present final plan participation criteria.
- March 10, 2008 ï Core Planning Group Meeting #3 (open to the public and other stakeholders): Risk Assessment Question and Answer Session. The purpose of the meeting was to provide CPG members with an opportunity to ask questions and submit feedback on the recently distributed Risk Assessment Interim Deliverable. The Risk Assessment Interim Deliverable comprised the following working chapters of the draft report: Hazard Identification, Hazard Profiles, Asset Identification, Vulnerability Assessment, Range of Mitigation Actions to be Considered.
- April 4, 2008 ï Core Planning Group Meeting #4: Mitigation Strategy Working Session. At this working session, attendees conducted an evaluation and prioritization of hazard mitigation actions and developed an implementation strategy for selected mitigation actions. For jurisdictions not present, or those who were present but who needed more time to complete the Prioritization and Implementation Strategy sheets, an opportunity was provided for jurisdictions to do so remotely. Following this meeting, the County and 52 participating jurisdictions had evaluated, prioritized, and developed a strategy for at least one mitigation action.

Additional information, such as meeting agendas, presentations, handouts, and minutes were posted on the Monmouth County mitigation planning web site at:

http://www.co.monmouth.nj.us/page.asp?agency=29&Section=1944&ID=1944.

The Role of the Contractors in the Plan Development Process

This Hazard Mitigation Plan is the Countyôs plan; as such, its success rests on the decisions and directions set by the Planning Committee members throughout the plan development process. URS was contracted by Monmouth County to work with the County OEM and the Planning Committee to assist them in developing a plan that would meet the requirements of DMA 2000. **URS was the lead firm for this assignment**, doing so from their local office in Wayne, New Jersey. URS was the direct County point of contact, assisted in the hazard identification and risk assessment, lead the hazard mitigation planning efforts, authored the final document, and provided overall contract administration. While URS had in-house all the expertise required to complete this project, for this very important assignment **they retained the firms of PBS&J and T&M Associates as subconsultants** to provide added specialized strength and capabilities to the team and to achieve the project objectives in the most cost efficient manner. PBS&J was responsible for the hazard identification and risk assessment including the use of the HAZUS loss estimation software. T&M Associates is a local Monmouth County engineering firm that was brought on board because of their familiarity with the Countyôs local jurisdictions and the problems they face regarding natural hazards.

URS assisted the Planning Committee by conducting the analyses necessary to provide the team members with the information they needed to make sound decisions, and helped guide them through the necessary steps of the plan development process. The Planning Committee, in turn, took the lead by including the local community, assessing the alternatives, and ultimately selecting the course of action to be followed. At the end of the planning process, URS prepared this Plan text (with feedback from the Planning Committee) to document the groupôs efforts, along with hazard information and findings, in a manner consistent with applicable regulations (DMA 2000), criteria (44 CFR Part 201.6), and guidance (FEMAôs Mitigation Planning ñHow-Toò Guides; FEMAôs Multi-Hazard Mitigation Planning Guidance document of March 2004, revised November 2006).

A series of three Guidance Memorandums were distributed to MCOEM and the Core Planning Group by URS Corporation, at various meetings and also were posted on the Countyôs mitigation planning web site. These three memos provide a summary of key information presented in DMA 2000, its implementing regulations (IFR), and the FEMA How-To Guides for three key topic areas. The memos are intended to serve as a supplement ï and not as a replacement ï to the FEMA documents. Each memo provides suggestions to municipalities in a certain topic area, and requests feedback from each municipality at the end of the process regarding their decisions. A summary of the Guidance Memos is presented below.

Guidance Memorandum #1 – Assessing Community Support, Building the Planning Team, and Engaging the Public and Other Stakeholders , dated July 10, 2007, describes the project and its goal of identifying the risks associated with natural hazards in Monmouth County. It is centered on developing the structure of the Planning Committee and identifying the jurisdictions that are interested in participating in the plan; reaching out to various parties (general public, local residents, business owners, non-profit organizations, community leaders and other stakeholders) during the development and maintenance processes; identifying the role of contractors in the planning process; and ultimately, documenting the planning process.

Guidance Memorandum #2 - Plan Maintenance Procedures: Monitoring, Evaluating and Updating the Plan, dated August 8, 2007, highlights the essential steps necessary for monitoring, evaluating and

maintaining the plan, and its value as a vital tool for mitigating hazards and reducing risk. The memo stresses several key factors that need to be undertaken by the Planning Committee: organizing resources, i.e., identifying and organizing interested parties, including the public, during the planning process; assessing the risks, i.e., identifying the natural hazards that generally affect Monmouth County; how the communities will be impacted by the hazards; and developing a mitigation plan, i.e., once the risks have been identified, the Planning Committee determines the methods and strategies for avoiding or minimizing the risks. The memo also conveys the importance of following the regulations that require the plan to be monitored, evaluated and updated within a five-year cycle, and the importance of periodically measuring the effectiveness of the actions contributing to the overall success of the plan.

Guidance Memorandum #3 - Plan Integration, dated August 8, 2007, recapitulates the importance of using existing processes and resources by the Planning Committee during plan implementation; thus, saving time and effort in meeting the plan's goals and objectives. The memo states that by following the requirements and key steps previously discussed, the next essential goal is taking action by integrating the objectives into daily activities and by implementing the plan in a timely manner.

The memos are valuable tools that guide the team members through each step toward the establishment of the hazard mitigation plan. As such, these memos assist the Planning Committee through the planning process that leads to the formal adoption of the plan.

URS also: (1) Distributed questionnaires for CPG member completion, as described previously beginning on Page 1-9. They were the: Hazard Identification Questionnaire, Land Uses and Development Trends Questionnaire, Capability Assessment Questionnaire; (2) Assisted the CPG through preparation of a project Fact Sheet (discussed on Page 1-18) and development of a project web site (discussed beginning on Page 1-16); and (3) presented at each CPG meeting to guide participating jurisdictions through the process, and advise CPG members regarding each step of the process such as hazards identified and profiled, risks and vulnerabilities identified, possible types of mitigation solutions, etc.

Public Involvement in the Plan Development Process

The role of public involvement in the plan development process is to provide the general public with some variety of means to not only learn about the process that the Planning Committee is undertaking, but to voice concerns and to provide input throughout the planning process. CPG members undertook a range of activities to: (a) alert the public to the fact that the Planning Committee was working to develop this Hazard Mitigation Plan, and (b) provide the public an opportunity to participate with a forum to ask questions, and submit comments and/or suggestions on the process.

The Planning Committee pursued a variety of different ways to provide the public with an opportunity to become involved and engaged during the planning process, in addition to ensuring that the participating jurisdictions were also fully aware of the process and were able to contribute and voice their concerns as well as the general public. As such, the below list of key activities were employed:

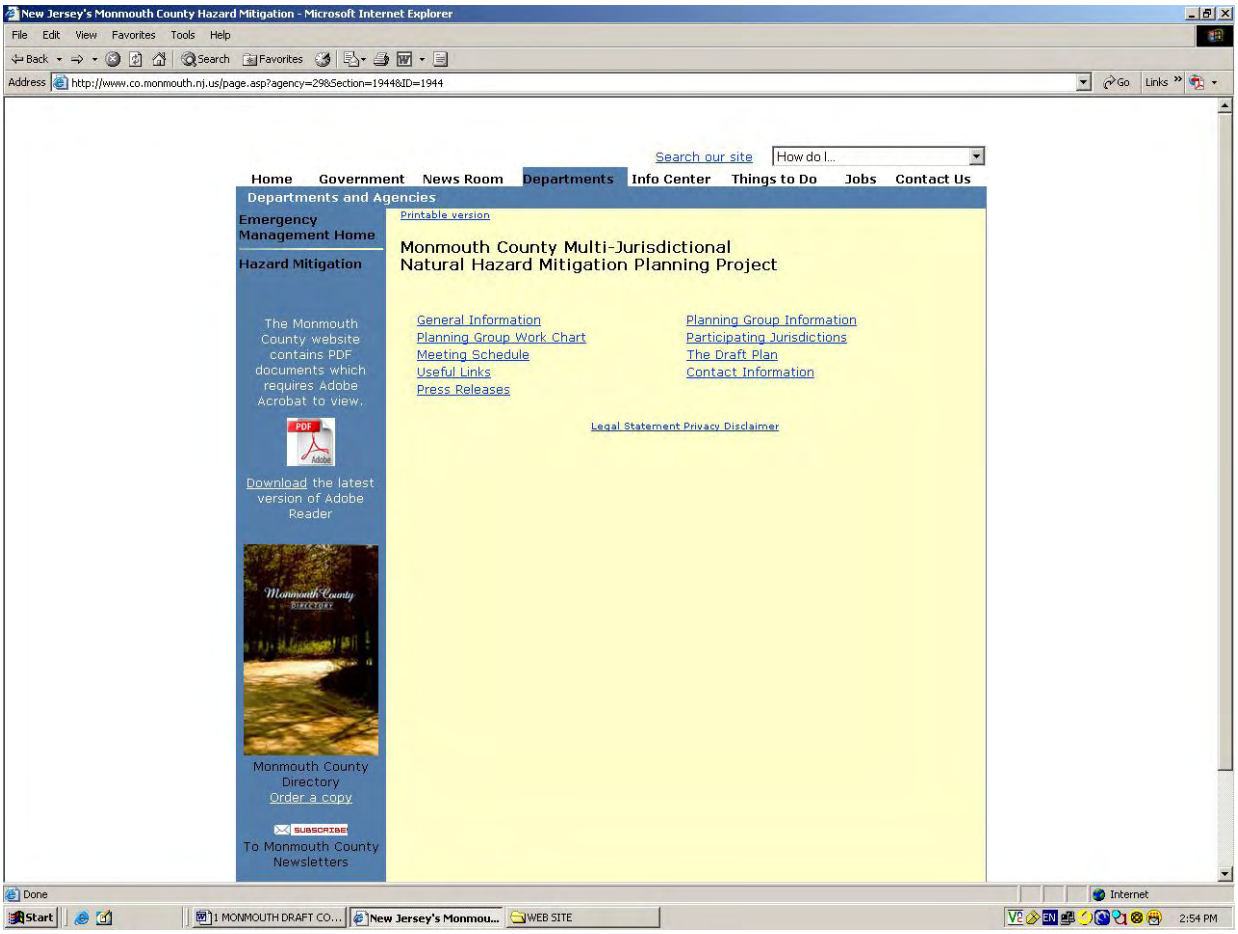
- Monmouth County Multi-jurisdictional Mitigation Planning web site
- Press releases
- *PlanFacts* fact sheet
- Public survey
- Open Public Meetings
- Other Outreach Activities by MCOEM and CPG Members

Monmouth County Multi-Jurisdictional Mitigation Planning Web Site

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through a mitigation planning web site. The Monmouth County Web site contains a new section on the county-wide multi-jurisdictional hazard mitigation planning process. It can be found online at:

http://www.co.monmouth.nj.us/page.asp?agency=29&Section=1944&ID=1944

The web site was initiated in July 2007 and will continue to be maintained and updated by MCOEM on a regular basis. The additional web pages were incorporated into the site for the purpose of informing the public (including businesses, local citizens and the residents that are part of the Monmouth County communities) about the importance of hazard mitigation planning and their opportunity to participate and provide feedback during the process. In this section, the MCOEM provides general information about the process, the organizational structure of the planning team, meeting information (agendas, presentations, handouts, and minutes), other reference materials, a link for the Risk Assessment Interim Deliverable and the Draft Plan, and more. Contact information for the MCOEM Coordinator is also provided and individuals are invited to reach out to this person for information on how to become involved or to provide comments. The image below is a screen-capture of the main mitigation planning web page on the County's site.



Other jurisdictions have supplemented this by creating similar links on their jurisdiction web sites to the overall county mitigation planning pages, including the communities of Aberdeen, Allenhurst, Asbury Park, Atlantic Highlands, Avon-by-the-Sea, Brielle, Colts Neck, Deal, Englishtown, Fair Haven,

Farmingdale, Freehold (Borough), Freehold (Township), Hazlet, Highlands, Holmdel, Interlaken, Keansburg, Keyport, Lake Como, Little Silver, Loch Arbour, Manalapan, Marlboro, Matawan, Millstone, Monmouth Beach, Neptune City, Neptune (Township), Ocean, Red Bank, Rumson, Sea Bright, Sea Girt, Shrewsbury (Borough), Spring Lake, Spring Lake Heights, Tinton Falls, Union Beach, and Wall.

On the All Natural Hazards Mitigation Planning page, topics are organized under the following main categories: General Information, Planning Group Work Chart, Meeting Schedule, Useful Links, Press Releases, Planning Group Information, Participating Jurisdictions, The Draft Plan, and Contact Information.

- The *General Information* section informs the reader about hazard mitigation and the hazard mitigation plan, the purpose and need for the plan, and a general overview of the process. It also points out the by implementing the hazard mitigation plan over the long-term, the damages and loss of life, as a result of a natural disaster, may be diminished.
- The *Planning Group Work Chart* section contains a flowchart representation of the participating entities in the plan development process.
- The *Meeting Schedule* section offers a listing of all the meetings held during 2007 and 2008 with the Core Planning Group. The meeting agenda, minutes and other documents pertinent to each meeting can be found in this section for viewing or downloading.
- Under *Useful Links*, the reader can find links to various FEMA and New Jersey State Police Office of Emergency Management (NJOEM) web pages with information on hazard mitigation, the guidelines, DMA 2000 and other related topics.
- Under *Press Releases*, the reader can find posted press releases regarding the mitigation plan that were issued throughout the plan development process (August 22, 2007; October 30, 2007; and February 29, 2008).
- The *Planning Group Information* section offers a text description of the Planning Group Work Chart regarding the overall Planning Committee, Core Planning Group, Jurisdictional Assessment Teams, and the role of the consultant in the plan development process.
- The *Participation Jurisdictions* section contains contact information for all municipalities participating in the process.
- The *Draft Plan* section contains the Draft Plan in Adobe PDF format, as well as the Risk Assessment Interim Deliverable. Interested parties without an internet connection were alternatively able to review the plan documents by contacting their local emergency management office, or by calling the MCOEM to make separate arrangements.
- The *Contact Information* section provides contact information for the MCOEM Coordinator regarding the County Multi-Jurisdictional Hazard Mitigation Plan.

Press Releases

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through press releases. Throughout the plan development process Monmouth County issued three press releases to advise the public and other stakeholders about the planning process and to solicit their feedback. The press releases were also posted on the Mitigation Planning web page of the county site. A brief summary of the press releases is presented below, and copies are included in Appendix F.

- August 22, 2007. ñ*Monmouth County Towns Preparing For Next Natural Hazard: FEMA Emergency Management Grant Jumpstarts Initiative.*ò This press release provided an overview of the process and where to go for more information.

- October 30, 2007. ñ*Input From Residents Sought To Create Hazards Plan*.ò This press release notified interested parties of a brief survey questionnaire posted on the Countyôs web site to collect information on respondentsô personal experiences with natural disasters,
- February 29, 2008. ñ*County Makes Progress On Hazard Mitigation Plan*.ò This press release invited interested parties to an open question and answer session regarding the risk assessment phase of the process, to be held on March 10, 2008.

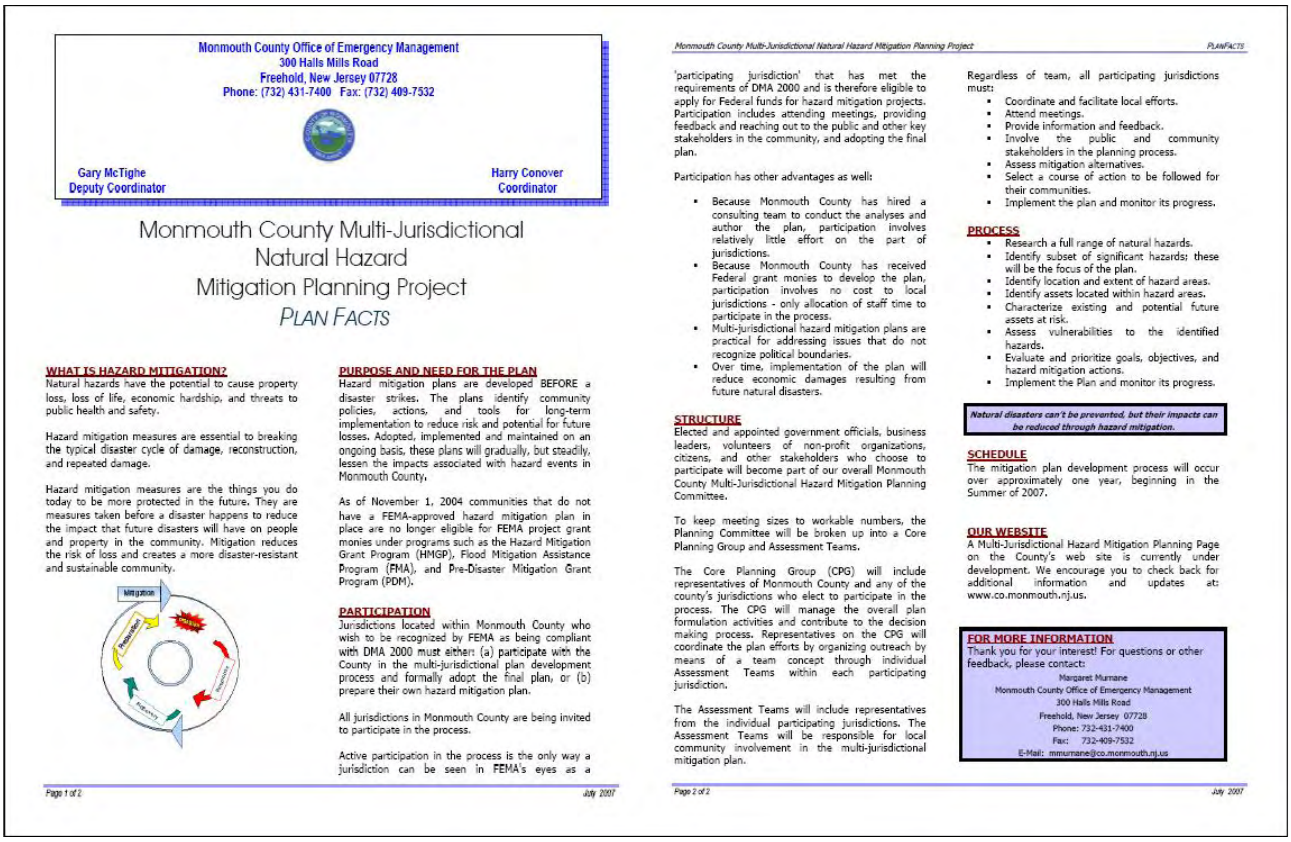
PlanFacts

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through a fact sheet. The Planning Committee increased public awareness of the hazard mitigation plan process by providing a two-page summation on hazard mitigation facts and the mitigation planning process to the public, community leaders, business owners, local residents and other stakeholders in the plan. The flyer, entitled *Monmouth County Multi-Jurisdictional Natural Hazard Mitigation Planning Project PlanFacts*, furnishes pertinent plan data that explains the purpose and need for the mitigation plan in Monmouth County.

The two-page flyer begins by providing a basic understanding to ñWhat is hazard mitigation?ò It then contains information on the plan development process and how jurisdictions can participate in the plan or prepare their own hazard mitigation plans in compliance with DMA 2000 requirements. It also provides an overview of the Hazard Mitigation Planning Committee members and their roles; the steps in the mitigation process (goals, objectives, natural hazards evaluation, etc.); the plan scheduled target completion date; and a point of contact at MCOEM for more information.

PlanFacts was distributed to the attendees at the Core Planning Group Kickoff Meeting on July 17, 2007. It was also posted by several Core Planning Group Members on local notice boards throughout the county. The Fact Sheet can be found electronically on the Monmouth County Office of Emergency Management web site.

PlanFacts was also distributed in hard copy format widely throughout the County by CPG members. Locations that it has been posted/distributed include: Farmingdale web site; Howell web site; Farmingdale town hall, library, and borough hall; Interlaken town hall, library, web site and borough hall; Holmdel town notice board and library; Atlantic Highlands web site; Brielle (various); Freehold (Township) municipal building, County Library; Union Beach borough hall; Little Silver borough hall bulletin board and library; Red Bank borough bulletin board and web site; Keansburg borough hall and library; Rumson municipal complex and library; Spring Lake Heights emergency management office board; Deal library and municipal building; Monmouth Beach municipal complex and library; Fair Haven borough hall, library, and police headquarters; Colts Neck municipal buildings notice boards and library; Sea Bright clerkôs office and municipal bulletin board; Englishtown bulletin board at municipal complex; Manalapan public access buildings notice boards; Millstone township bulletin boards at municipally-owned buildings; Sea Girt bulletin boards in municipal complex and library; . A screen-capture of the document follows.



Monmouth County Office of Emergency Management
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Gary McTighe
Deputy Coordinator

Harry Conover
Coordinator

Monmouth County Multi-Jurisdictional
Natural Hazard
Mitigation Planning Project
PLAN FACTS

WHAT IS HAZARD MITIGATION?
Natural hazards have the potential to cause property loss, loss of life, economic hardship, and threats to public health and safety.

Hazard mitigation measures are essential to breaking the typical disaster cycle of damage, reconstruction, and repeated damage.

Hazard mitigation measures are the things you do today to be more protected in the future. They are measures taken before a disaster happens to reduce the impact that future disasters will have on people and property in the community. Mitigation reduces the risk of loss and creates a more disaster-resistant and sustainable community.

PURPOSE AND NEED FOR THE PLAN
Hazard mitigation plans are developed BEFORE a disaster strikes. The plans identify community policies, actions, and tools for long-term implementation to reduce risk and potential for future losses. Adopted, implemented and maintained on an ongoing basis, these plans will gradually, but steadily, lessen the impacts associated with hazard events in Monmouth County.

As of November 1, 2004 communities that do not have a FEMA-approved hazard mitigation plan in place are no longer eligible for FEMA project grant monies under programs such as the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance Program (FMA), and Pre-Disaster Mitigation Grant Program (PDM).

PARTICIPATION
Jurisdictions located within Monmouth County who wish to be recognized by FEMA as being compliant with DMA 2000 must either (a) participate with the County in the multi-jurisdictional plan development process and formally adopt the final plan, or (b) prepare their own hazard mitigation plan.

All jurisdictions in Monmouth County are being invited to participate in the process.

Active participation in the process is the only way a jurisdiction can be seen in FEMA's eyes as a

Page 1 of 2 July 2007

Monmouth County Multi-Jurisdictional Natural Hazard Mitigation Planning Project PLANFACTS

'participating jurisdiction' that has met the requirements of DMA 2000 and is therefore eligible to apply for Federal funds for hazard mitigation projects. Participation includes attending meetings, providing feedback and reaching out to the public and other key stakeholders in the community, and adopting the final plan.

Participation has other advantages as well:

- Because Monmouth County has hired a consulting team to conduct the analyses and author the plan, participation involves relatively little effort on the part of jurisdictions.
- Because Monmouth County has received Federal grant monies to develop the plan, participation involves no cost to local jurisdictions - only allocation of staff time to participate in the process.
- Multi-jurisdictional hazard mitigation plans are practical for addressing issues that do not recognize political boundaries.
- Over time, implementation of the plan will reduce economic damages resulting from future natural disasters.

STRUCTURE
Elected and appointed government officials, business leaders, volunteers of non-profit organizations, citizens, and other stakeholders who choose to participate will become part of our overall Monmouth County Multi-Jurisdictional Hazard Mitigation Planning Committee.

To keep meeting sizes to workable numbers, the Planning Committee will be broken up into a Core Planning Group and Assessment Teams.

The Core Planning Group (CPG) will include representatives of Monmouth County and any of the county's jurisdictions who elect to participate in the process. The CPG will manage the overall plan formulation activities and contribute to the decision making process. Representatives on the CPG will coordinate the plan efforts by organizing outreach by means of a team concept through individual Assessment Teams within each participating jurisdiction.

The Assessment Teams will include representatives from the individual participating jurisdictions. The Assessment Teams will be responsible for local community involvement in the multi-jurisdictional mitigation plan.

Regardless of team, all participating jurisdictions must:

- Coordinate and facilitate local efforts.
- Attend meetings.
- Provide information and feedback.
- Involve the public and community stakeholders in the planning process.
- Assess mitigation alternatives.
- Select a course of action to be followed for their communities.
- Implement the plan and monitor its progress.

PROCESS
- Research a full range of natural hazards.
- Identify subset of significant hazards: these will be the focus of the plan.
- Identify location and extent of hazard areas.
- Identify assets located within hazard areas.
- Characterize existing and potential future assets at risk.
- Assess vulnerabilities to the identified hazards.
- Evaluate and prioritize goals, objectives, and hazard mitigation actions.
- Implement the Plan and monitor its progress.

Natural disasters can't be prevented, but their impacts can be reduced through hazard mitigation.

SCHEDULE
The mitigation plan development process will occur over approximately one year, beginning in the Summer of 2007.

OUR WEBSITE
A Multi-Jurisdictional Hazard Mitigation Planning Page on the County's web site is currently under development. We encourage you to check back for additional information and updates at: www.co.monmouth.nj.us.

FOR MORE INFORMATION
Thank you for your interest! For questions or other feedback, please contact:
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Page 2 of 2 July 2007

Public Survey

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through a public survey. The Monmouth County Steering Committee was interested in learning more about the level of knowledge local citizens have about natural disasters and vulnerable areas in their communities. They posted on the county web site a short, 15 question survey for interested parties to complete. A press release was issued on October 30, 2007, to notify interested parties that the survey was available. The survey was estimated to take approximately 5 minutes to complete. It was made to be interactive and responses were tallied automatically. The information provided was used by the County in their identification and prioritization of mitigation actions to reduce the risk of injury or property damage in the future.

More than 260 people chose to submit responses to the survey, and a summary of these responses is presented in Table 1.6. Some significant observations are as follows:

- Two-thirds of all respondents have lived in Monmouth County for 20 or more years.
- The results suggest that the hazard events of most concern to respondents were hurricanes, severe storms, and winter storms. For these events the majority of respondents were either ñvery concernedò or ñextremely concernedò, while for all other listed hazards the majority of respondents were ñsomewhat concernedò or ñnot concernedò.
- However, flooding of private property drew the largest number of ñextremely concernedò respondents for any single hazard event.
- Landslides appear to be the hazard event of least concern to respondents.

- 40% of respondents rated their hazard preparedness exactly in the middle of the ranking scale, while almost twice as many respondents considered themselves to be well-prepared as opposed to ill-prepared.
- More than half of all respondents attributed their level of preparedness wholly or partially to information from government sources, while approximately a quarter of all respondents claimed to have attended meetings dealing with disaster preparedness.
- In descending order of importance, responders ranked TV news, the internet, and radio news as the three most effective sources of information for protection against natural hazards.
- Almost three quarters of respondents would consider a buyout, relocation, or elevation of their property if it were repetitively damaged or located in a designated high hazard area, and if such measures were offered by a public agency.
- 17% of respondents knew for sure that they live in a designated flood plain, while 73% were sure they did not live in a floodplain.
- 22% of respondents have flood insurance.

Table 1.6
Summary of Responses to MCOEM Hazard Mitigation Survey

Age of Respondents		**Gender of Respondents**			
Age 18-30	12	Male			143
Age 31-40	48	Female			114
Age 41-50	93	**Highest level of Education of Respondents**			
Age 51-60	62	Grade School			1
Over 60	52	Some High School			1
How long have respondents lived in Monmouth County?		High School Graduate			43
Less than a year	4	Some College			86
One to five years	24	College Graduate			92
Six to Nine years	16	Post Graduate			43
Ten to Nineteen	42	**Respondents' Property Status**			
Twenty or more	178	Own	250	Rent	14
Natural Hazard Information					
Drought Have experienced	121	**Flooded Basement** Have experienced			85
Drought Have not experienced	148	Flooded Basement Have not experienced			184
Drought Not Concerned	56	Flooded Basement Not Concerned			72
Drought Somewhat Concerned	129	Flooded Basement Somewhat Concerned			69
Drought Very Concerned	40	Flooded Basement Very Concerned			35
Drought Extremely Concerned	8	Flooded Basement Extremely Concerned			38
Erosion Have experienced	85	**Flooded Property** Have experienced			68
Erosion Have not experienced	184	Flooded Property Have not experienced			201
Erosion Not Concerned	56	Flooded Property Not Concerned			57
Erosion Somewhat Concerned	74	Flooded Property Somewhat Concerned			81
Erosion Very Concerned	53	Flooded Property Very Concerned			32
Erosion Extremely Concerned	36	Flooded Property Extremely Concerned			52
Flooded First Floor Have experienced	6	**Flooded Street** Have experienced			137
Flooded First Floor Have not experienced	184	Flooded Street Have not experienced			132
Flooded First Floor Not Concerned	101	Flooded Street Not Concerned			70
Flooded First Floor Somewhat Concerned	43	Flooded Street Somewhat Concerned			87

Table 1.6 Summary of Responses to MCOEM Hazard Mitigation Survey			
Flooded First Floor Very Concerned	21	Flooded Street Very Concerned	35
Flooded First Floor Extremely Concerned	34	Flooded Street Extremely Concerned	34
Hurricane Have experienced	172	**Severe Storms** Have experienced	236
Hurricane Have not experienced	97	Severe Storms Have not experienced	33
Hurricane Not Concerned	22	Severe Storms Not Concerned	24
Hurricane Somewhat Concerned	97	Severe Storms Somewhat Concerned	88
Hurricane Very Concerned	83	Severe Storms Very Concerned	94
Hurricane Extremely Concerned	39	Severe Storms Extremely Concerned	40
Severe Winter Storm Have experienced	225	**Tornado** Have experienced	30
Severe Winter Storm Have not experienced	44	Tornado Have not experienced	239
Severe Winter Storm Not Concerned	24	Tornado Not Concerned	98
Severe Winter Storm Somewhat Concerned	100	Tornado Somewhat Concerned	87
Severe Winter Storm Very Concerned	83	Tornado Very Concerned	13
Severe Winter Storm Extremely Concerned	42	Tornado Extremely Concerned	13
Extreme Temperatures Have experienced	170	**Expansive Soils** Have experienced	25
Extreme Temperatures Have not experienced	99	Expansive Soils Have not experienced	244
Extreme Temperatures Not Concerned	72	Expansive Soils Not Concerned	103
Extreme Temperatures Somewhat Concerned	105	Expansive Soils Somewhat Concerned	78
Extreme Temperatures Very Concerned	45	Expansive Soils Very Concerned	16
Extreme Temperatures Extremely Concerned	12	Expansive Soils Extremely Concerned	9
Groundwater Contamination Have experienced	34	**Ice Storm** Have experienced	214
Groundwater Contamination Have not experienced	235	Ice Storm Have not experienced	55
Groundwater Contamination Not Concerned	51	Ice Storm Not Concerned	43
Groundwater Contamination Somewhat Concerned	70	Ice Storm Somewhat Concerned	112
Groundwater Contamination Very Concerned	50	Ice Storm Very Concerned	66
Groundwater Contamination Extremely Concerned	49	Ice Storm Extremely Concerned	26
Ice Jam Have experienced	34	**Landslide** Have experienced	4
Ice Jam Have not experienced	235	Landslide Have not experienced	265
Ice Jam Not Concerned	113	Landslide Not Concerned	158
Ice Jam Somewhat Concerned	67	Landslide Somewhat Concerned	37
Ice Jam Very Concerned	16	Landslide Very Concerned	8
Ice Jam Extremely Concerned	9	Landslide Extremely Concerned	6
Groundwater Seepage Have experienced	34	**Sink Holes** Have experienced	35
Groundwater Seepage Have not experienced)	235	Sink Holes Have not experienced	234
Groundwater Seepage Not Concerned	51	Sink Holes Not Concerned	97
Groundwater Seepage Somewhat Concerned	70	Sink Holes Somewhat Concerned	79
Groundwater Seepage Very Concerned	50	Sink Holes Very Concerned	23
Groundwater Seepage Extremely Concerned	49	Sink Holes Extremely Concerned	16
Respondents' Household Preparedness		**If repetitively damaged from a natural hazard event or located in a designated high hazard area, would respondents consider a buyout, structure elevation,**	
1 Not Prepared	24		
2	29		

Table 1.6 Summary of Responses to MCOEM Hazard Mitigation Survey					
3	105	**or relocation of their property if offered by a public agency?**			
4	85	Yes	181		
5 Most Prepared	18	No	65		
Why do respondents think they are prepared for the probable impacts of natural hazard events?					
Emergency preparedness information from a government source (e.g., federal, state, or local emergency management)	141				
Locally provided news or other media information	129				
Schools and other academic institutions	36				
Attended meetings that have dealt with disaster preparedness	71				
Which of the following do respondents consider the most effective sources of information to help respondents protect life and property from the impacts of natural hazards?					
Newspaper ï Courier News	21	Outdoor Advertisements	27		
Newspaper ï Star Ledger	13	Internet	139		
Newspaper ï Other	104	Chamber of Commerce	9		
Telephone Book	12	Fire Department/EMS Agency	95		
Informational Brochures	81	Academic Institutions	63		
Public Meetings	75	Workshops	57		
Schools	53	TV News	160		
TV Advertisements	58	Radio News	128		
Radio Advertisements	44	Other	0		
Do responders have problems getting homeowners insurance?		**Do respondents live in a Flood Plain?**			
		Yes	44		
Yes	22	No	190		
No	235	Not Sure	27		
Do respondents have flood insurance?		Yes	58	No	202

Open Public Meetings

The CPG made an effort to involve the public and other stakeholders in the process during the drafting stage of the plan in part through making two of its five CPG meetings open to interested parties.

- November 29, 2007 ï Core Planning Group Meeting #2 (open to the public and other stakeholders). This meeting was conducted to provide an overview of plan development progress and continued work to be completed. The Consultant provided an overview of the Hazard Identification and Hazard Profile steps, and the ongoing Risk Assessment portion of the draft plan. No members of the public or other stakeholders attended the meeting, despite being invited.
- March 10, 2008 ï Core Planning Group Meeting #3 (open to the public and other stakeholders): Risk Assessment Question and Answer Session. The purpose of the meeting was to provide CPG members with an opportunity to ask questions and submit feedback on the recently distributed Risk Assessment Interim Deliverable. The Risk Assessment Interim Deliverable comprised the following working chapters of the draft report: Hazard Identification, Hazard Profiles, Asset Identification, Vulnerability Assessment, Range of Mitigation Actions to be Considered. No members of the public or other stakeholders attended the meeting, despite being invited.

Other Outreach Activities by MCOEM and CPG Members

In addition to the web site, press releases, fact sheet, public survey, and open public meetings held, the Core Planning Group (through their respective JATs) undertook the actions summarized in chronological order in Table 1.7 to raise public awareness of the plan development process and provide the public and other stakeholders with a forum for participating in - and providing feedback throughout - the plan development process. While participating jurisdictions have provided comments, to date, no feedback from the public or other stakeholders has been received, apart from the responses to the mitigation survey posted on the MCOEM website, which have been summarized above. Comments received in time to be incorporated into the Final will be reviewed by the Consultant and MCOEM and integrated into the plan as applicable. As this is a living document, other comments will be considered for integration during future maintenance cycles and plan updates.

Table 1.7
Summary of Jurisdiction Outreach Activities

Date	Jurisdiction	Action
7/1/07	Englishtown	OEM held Public Meeting at regularly scheduled council meeting open to the public explaining Mitigation Plan.
8/1/07	Loch Arbour	Village Clerk/Dep. OEM - Public Notice- Board of Trustees meeting reported detailed information about purpose of plan and benefits to Village through its participation.
8/13/07	Oceanport	Capt., OEM held Area Meeting with local coordinators to present info on project.
8/13/07	West Long Branch	Capt and OEM held Area Meeting with local coordinators to present information
8/13/07	Holmdel	OEM Coordinator held Guidance and Info Meeting.
8/14/07	Spring Lake	Environmental Commission Chair held Discussions with Regional Stormwater Management Plan Committee including environmental and flooding issues. Meetings continued monthly.
8/15/07	Farmingdale	OEM held Public Meeting with information session.
8/15/07	Howell	OEM held Public Meeting with information session.
8/22/07	Monmouth County	OEM - Press Release announcement of FEMA grant award and brief description of planning process.
9/1/07	Loch Arbour	Village Clerk/Dep. OEM - Public Notice - Village's website linked to County Website.
9/3/07	Bradley Beach	OEM and Borough Engineer held meeting updates received on project phases and completion dates.
9/11/07	Bradley Beach	OEM and Borough Public Works Supervisor held meeting with Public Works Supervisor to ensure proper dune management and snow fencing is in place to prevent flooding and sand displacement.
9/12/07	Spring Lake	Councilor provided article for fall newsletter addressing activity of Borough in Emergency planning including actions in support of flood mitigation.
9/18/07	Oceanport	Capt; OEM held Meeting with Local Public Safety Committee to present info on project.
9/20/07	Oceanport	Capt; OEM held Public Meeting of Mayor and Council to present info on project.
9/20/07	Monmouth County	OEM Added Hazard Mitigation link under OEM which includes meeting information, agendas, handouts, mitigation survey, press releases, participating jurisdictions, plan fact sheet

Table 1.7 Summary of Jurisdiction Outreach Activities		
9/30/07	Farmingdale	OEM Community gathering - made fact sheet and questionnaire available at OEM Booth.
9/30/07	Howell	OEM Community gathering - made fact sheet and questionnaire available at OEM Booth.
10/6/07	Neptune (Township)	Deputy OEM Coordinator, Special Projects Coordinator posted information on township website www.neptunetownship.org with info concerning program with link to County website.
10/6/07	Neptune (Township)	Deputy OEM Coordinator, Special Projects Coordinator sent Blast e-mail to all residents who have registered their email addresses to Township with info concerning program and asking them to visit website to discuss.
10/15/07	Neptune (Township)	OEM Coordinator and Deputy OEM Coordinator issued Township Newsletter to every home and business including an article with specific information about Hazard Mitigation Plan.
10/17/07	Monmouth County	OEM ï targeted outreach via email to adjacent counties (Ocean, Mercer, Middlesex)
10/25/07	Monmouth County	OEM ï targeted outreach via email to local water authorities, Jersey Central Power and Light
10/30/07	Monmouth County	OEM - Press Release - online Mitigation Survey for residents.
11/1/07	Atlantic Highlands	OEM Coordinator Announced Strategy and Goals of Plan at Public Mayor and Council Meeting
11/1/07	Shrewsbury (Borough)	OEM Coordinator advertised the public meeting on Community Board.
11/2/07	Manasquan	OEM Meeting with mayor, OEM liaison, department heads and administrator to discuss status of draft plan.
11/19/07	Shrewsbury (Borough)	OEM Meeting held Public Meeting to describe plan, seek comments.
11/19/07	Spring Lake	OEM: Master Plan Meeting (public Open Session) to discuss mitigation issues that relate to land use and comments for updated Master Plan.
11/29/07	Farmingdale	OEM held Public Meeting with information session.
11/29/07	Holmdel	OEM Coordinator held County Meeting.
11/29/07	Interlaken	OEM held Public Meeting to hold Information Session.
11/29/07	Monmouth County	OEM Public Meeting - Plan Development Process.
11/30/07	Highlands	OEM posted link to County Website with information pertaining to the Mitigation.
12/6/07	Colts Neck	Municipal OEM Coordinator had local Meeting open to the public: Discussion on Mitigation Plan.
12/13/07	Neptune (Township)	OEM Coordinator and Deputy OEM Coordinator conducted Local Emergency Planning Committee Meeting to review program with all Municipal Depts, local businesses, non-profit agencies and member of public.
On-going	Farmingdale	IT Dept. made Fact Sheet available on-line, provided link to County OEM and Mitigation web pages.
On-going	Howell	IT Dept. made Fact Sheet available on-line, provided link to County OEM and Mitigation web pages.
On-going	Farmingdale	OEM made fact sheet available at Town Hall, library and Borough Hall.
On-Going	Interlaken	OEM - made Fact Sheet available at Town Hall, library, and Borough Hall.

Table 1.7 Summary of Jurisdiction Outreach Activities		
Monthly 2007 - 2008	Holmdel	OEM/LEPC had monthly meeting with update and discussion.
2007-2008	Holmdel	OEM - Public Outreach with fact sheets flyers on township notice board and in library.
2008	Holmdel	OEM - Public Outreach - Presentation to Half Century Club at community center.
2008	Holmdel	Township Clerk/OEM - Public Outreach - sent invitations to complete survey emailed to township email list and link placed on township web site.
Ongoing	Rumson	OEM Director, Borough Administrator, Web Designer added link to website from County Website
1/08	Matawan	Posting of Community Survey on Borough website www.matawanborough.com also posted additional resources regarding hazard mitigation specifically for this project
1/1/08	Atlantic Highlands	Municipal Clerk posted on website Announcement of public posting "Fact Sheet"
1/1/08	Shrewsbury (Borough)	OEM Coordinator - On-line Information created link to Borough Website to OEM Mitigation Site.
1/1/08	Loch Arbour	Village Clerk/Dep. OEM - Public Notice - information poster detailing the County's Hazard Mitigation Plan posted on bulletin board in Municipal Building and copies made available to the public.
1/3/08 - 4/20/08	Belmar	Coordinator engaged public through letters and notices posted at public gatherings and referred residents to County website.
1/7/08	Bradley Beach	OEM held Meeting with OEM Coordinator to discuss Borough Community Emergency Response Team. Program.
1/8/08	West Long Branch	OEM to present information on multiple agency drainage relief project for design, informational session with Local Public Engineers WLB-LB - MONB CTY - MONM University.
1/18/08	Manasquan	OEM Meeting with mayor, OEM liaison, department heads and administrator to discuss status of draft plan.
1/24/08	Colts Neck	Municipal OEM Coordinator had local Meeting open to the public: Discussion on Mitigation Plan.
1/31/08	Holmdel	OEM Coordinator held Meeting.
2/1/08	Brielle	OEM/Police Department/Chief of Police Patrolmen made Borough Web Page Announcement for Borough residents have access to Multi-Jurisdictional Hazard Mitigation Plan.
2/1/08	Spring Lake	OEM provided article on Mitigation Plan to Newsletter addressing Mitigation Planning and provided status to Borough Citizens and FEMA guidance.
2/1/08-4/30/08	Manasquan	OEM Radio Message - Advertise Hazard Mitigation Plan draft availability and meeting on 4/30.
2/3/08	Spring Lake Heights	Emergency Management coordinator posted Letter on Participation of Mitigation Plan on Borough Web Site explaining plan, view minute meetings and draft plan.
2/6/08	Aberdeen	OEM Coordinator placed notice on Website explaining program and providing links to County.
2/12/08	Aberdeen	OEM Coordinator prepared press releases.

Table 1.7 Summary of Jurisdiction Outreach Activities		
2/18/08	Marlboro	Deputy Emergency Management Coordinator held Public Posting notice along with copies of plan description with directions to find online questionnaire at Municipal Office and Library.
2/26/08	Rumson	OEM Director, Mayor, Council, Borough Administrator held Public Council Meeting on the Mitigation Plan.
2/28/08	Brielle	OEM and Chief of Police placed article in local newspaper explaining plan and where public can pick up copies of County Hazard Mitigation Planning Project Plan Facts.
2/28/08	Oceanport	Capt; OEM held Public Meeting of Local Emergency Planning Council to present info on project.
2/28/08	Spring Lake	OEM met with Lake Local Emergency Planning Committee to provide updates on County draft of mitigation report, identifying goals and discussed recommended mitigation actions.
2/28/08	Marlboro	Deputy Emergency Management Coordinator held Public Posting notice on Township website along with links to County Site and public questionnaire.
2/29/08	Monmouth County	OEM ï targeted outreach via email to Monmouth County Superintendent of Schools
2/29/08	Monmouth County	OEM Press Release - 3/10/2008 public meeting notification and brief description of planning process to date.
3/1/08	Monmouth County	OEM ï targeted outreach via email to Monmouth ï Ocean Development Council
3/1/08	Middletown	Township Administration and Office Of Emergency Management - Four Neighborhood Meetings in Township - surveys were distributed for areas of concern in particular neighborhoods.
3/1/08	Spring Lake	Borough Clerk posted County mitigation plan data sheet at public review at Borough Hall to obtain information on Mitigation Plan.
3/6/08	Brielle	OEM, Chief of Police, County OEM placed article in local newspaper (Coast Star) announcing Public Meeting held for public's participation in the Plan Meeting.
3/8/08	Upper Freehold	Emergency Management Staff had personal contact with residents who experienced problems due to storms.
3/10/08	Atlantic Highlands	County OEM held Public meeting work session.
3/10/08	Holmdel	OEM Coordinator held Meeting.
3/10/08	Monmouth County	OEM - Public Meeting Draft Risk Assessment Working session.
3/11/08	Colts Neck	Municipal OEM posted Web-Link of Mitigation Plan on Township Website.
3/12/08	Long Branch	OEM Coordinator held Staff Meeting discussing Mitigation Program with all City Department heads present. All were asked to review areas of responsibility and report any issues back to OEM.
3/14/08	Allenhurst	Chief Deputy OEM Coordinator contacted EMS/FIRE/PUBLIC Work heads and discussed mitigation issues.
3/15/08	Freehold (Township)	OEM added section to the OEM web page explaining All Hazards Mitigation Plan and provided link to County OEM site to view a draft copy of plan.
3/15/08	Ocean	OEM, Ocean TV Coordinator advertised on town cable channel with Public Education on our involvement with Plan.

Table 1.7 Summary of Jurisdiction Outreach Activities		
3/18/08	Oceanport	Capt; OEM held Public Meeting at local school did presentation on Project to Public based on Interim Report, Power Point Presentation with specific info.
3/21/08	Monmouth Beach	OEM local website linked to County Website advising residents of Hazard Mitigation Plan and information regarding OEM Mitigation Plan.
3/21/08	Bradley Beach	OEM and Borough Public Works held Meeting with Commission to discuss status of outfall pipes and current operation.
3/26/08	Atlantic Highlands	OEM Coordinator held Public meeting reporting present overview at Mayor and Council Meeting.
3/28/08	Lake Como	OEM Coordinator and Borough Administrator made copies of Guidance Memorandum #1 (URS) were made and placed in Borough Hall for distribution to public.
3/28/08	Manasquan	OEM Meeting with community reps and local business owners, recreation committee to discuss draft plan.
3/31/08	Ocean	OEM, Twp Manager and Mayor - Public Meeting - conducted open meeting for Flood area residents on process.
4/1/08	Freehold (Borough)	OEM Coordinator added link to County Hazard Mitigation page to Municipal Page on the borough website.
4/1/08	Freehold (Borough)	OEM Coordinator placed Public Notice in the Municipal Building informing residents of participation in the County Pre-Disaster Mitigation Plan with contact phone number.
4/1/08	Freehold (Township)	OEM placed news Release to local weekly newspapers detailing all Hazards Mitigation Plan and providing information on how to view a draft copy of the plan.
4/1/08	Freehold (Township)	OEM posted 2 page fact sheet at Municipal Building and County Library HQ with copies provided for public.
4/1/08	Middletown	Educational Meeting at Port Monmouth School in Township for Hazard Mitigation Public Information Session sponsored by BEMA provided residents with status report.
4/1/08	Ocean	OEM, Webmaster gave Public Information with internet Link from OEM Website to County webpage to assist residents with more info.
4/1/08	Shrewsbury (Borough)	OEM Coordinator - Newsletter with informative article on Mitigation Plan.
4/1/08	Union Beach	Councilman, OEM Coordinator, Borough Engineer hung fact sheets in Borough Hall to explain to public what the Mitigation Plan is about and its benefits
4/1/08	Union Beach	Councilman, OEM Coordinator, Borough Engineer hung fact sheets in Borough Hall to explain to public what the Mitigation Plan is about and its benefits
4/1/08	Wall	Deputy OEM Coordinator created link to Police/OEM Website directing citizens to County Site and Hazard Mitigation Plan.
4/1/08	Wall	Deputy OEM Coordinator posted copies in lobbies of wall Municipal Complex, Library and Police HQ.
4/2/08	Fair Haven	OEM put up flyers asking for feedback from residents for Mitigation Plan.
4/3/08	Fair Haven	OEM met with Mayor and Boro Administrator discussing suggestions on what was important to be included in Plan.

Table 1.7 Summary of Jurisdiction Outreach Activities		
4/3/08	Spring Lake	Borough Clerk added County Link to Borough Website.
4/4/08	Upper Freehold	Emergency Management Coordinator and School Bus Coordinator contacted UFRSD Transportation Dept to have bus drivers report conditions from their experiences driving during and after storms. School bus drivers reported two unpaved roads which was not included in "wish list". Section of one is not easily passable and second road floods out at one location.
4/5/08	Fair Haven	OEM met with Boro Engineer discussing suggestions on what was important to be included in Plan.
4/7/08	Lake Como	Borough Administrator and OEM Coordinator provided link on Borough's Website to County Website concerning the Flood Mitigation Plan.
4/7/08	Neptune City	OEM Coordinator addressed local volunteer Fire Company and explained plan
4/8/08	Allentown	Borough OEM, Deputy OEM created Mailer to all residents and businesses describing actions underway and proposed for Borough regarding Hazard Mitigation.
4/8/08	Spring Lake	OEM - Council Meeting providing update to Mayor, Council and attending public on participation in mitigation plan and strategies for implementing actions.
4/8/08	Spring Lake	OEM and DEP: Wreck Pond Brook Regional Stormwater Management Plan Committee Meeting to review Draft watershed Plan, provided comments, options to provide mutual coordination between mitigation plans and watershed implementation plans.
4/9/08	Atlantic Highlands	OEM Coordinator held Public Meeting with Report Status
4/10/08	Allenhurst	Chief Deputy OEM Coordinator conferred with Borough Engineer to discuss mitigation issues.
4/11/08	Hazlet	OEM placed Website Posting with information about the Mitigation Plan with link to Risk Assessment portion.
4/11/08	Bradley Beach	OEM held Meeting with OEM Coordinator to plan how evaluations will take place and who will conduct them.
4/14/08	Avon By the Sea	OEM Coordinator made presentation at Borough Meeting regarding scope and activities of planning process and current status.
4/14/08	Little Silver	OEM Coordinator posted Multi-Jurisdictional Natural Hazard Mitigation Planning Project Plan Facts Sheet on Borough Hall Bulletin Board and Library.
4/14/08	Little Silver	OEM Coordinator, webmaster had link to County OEM website regarding Hazard Mitigation Plan posted on www.littlesilver.org.
4/14/08	Long Branch	OEM Construction Zoning Public Works City Administration held selected department meeting to determine which activities would be requested.
4/14/08	Hazlet	OEM Held Township Meeting announcing Mitigation Plan and risk assessment portion at monthly township meeting.
4/15/08	Lake Como	OEM Coordinator, Borough Administrator and the Mayor and Council held Public Meeting in Borough Hall; meeting advertised in Asbury Park Press and the Coast Star.

Table 1.7 Summary of Jurisdiction Outreach Activities		
4/15/08	Red Bank	OEM Coordinator and Borough Website Manger issued Borough Notification posting fact sheet on Borough Bulletin Board and on Borough website.
4/15/08	Sea Bright	Municipal Clerk and Borough Engineer held Regular Council Meeting and noticed in Compliance of Open Public Meetings Act. Mitigation Plans and project ideas discussed, Mayor and Council passed Resolution No. 79-2008 accepting Implementation Strategy and Prioritization of Actions of All Hazard Mitigation Plan.
4/15/08	Hazlet	OEM placed newspaper posting of information regarding the Mitigation Plan in 2 local newspapers. Announcement of Public Meeting.
4/15/08	Ocean	OEM, and TWP Manager held Public Meeting for residents on Plan Process.
4/16/08	Aberdeen	OEM Coordinator prepared press release regarding Outreach Meetings and posted on Township website.
4/16/08	Allentown	Borough OEM, Deputy OEM placed Hazard Mitigation brochures at Borough, and Deputy contacts.
4/17/08	Holmdel	OEM - Public Outreach - Presentation to Township Committee and public at open township meeting.
4/18/08	Allenhurst	Chief Deputy OEM Coordinator posted Public Notice and directed IT person to place Mitigation link on Borough website.
4/21/08	Keyport	Asst Coordinator presented to Historical Society located in floodplain - purpose of plan and invited to attend noted meeting 4/28.
4/21/08	Keyport	Asst. Coordinator and Boro Admin. - Public Outreach Notice - inviting all to attend Public Meeting held by County OEM office at Elementary School and posted on Public Bulletin Board in Borough Hall.
4/22/08	Allenhurst	Chief Deputy OEM Coordinator conducted an Info and question and answer session and held public presentation on Mitigation at Borough Meeting.
4/22/08	Spring Lake	OEM provided copies of Spring Lake prioritized action plan to other municipalities for coordination.
4/23/08	Keansburg	Chief of Police, OEM Coordinator created Fact Sheet posted in Borough Halls and Library.
4/23/08	Keansburg	Chief of Police, OEM Coordinator created Web Link to Borough website
4/23/08	Keyport	Asst Coordinator posted invitation at First Aid Building bulletin Board to attend noted meeting.
4/23/08	Keyport	Asst Coordinator presented to Fire Museum - purpose of plan and invited to attend noted meeting 4/28.
4/23/08	Keyport	Coordinator posted notice and invitation to attend noted 4/28 meeting on local Cable Channel operated by Public School System.
4/23/08	Manalapan	Municipal Engineer - Township Committee Public Meeting recorded for Local Cable Channel - Municipal Engineer Report on the Holiday Lake Dredging Project.
4/23/08	Neptune City	OEM Coordinator discussed process of Mitigation Planning to PTA and briefed members on Plan.

Table 1.7 Summary of Jurisdiction Outreach Activities		
4/24/08	Neptune City	OEM Coordinator and Deputy Borough Clerk worked on getting County Website on Borough website so residents can link for more information.
4/25/08	Atlantic Highlands	Public Information Officer issued a Press Release in AHHerald.com Newspaper Release.
4/25/08	Avon By the Sea	OEM Coordinator submitted documentation for inclusion on Borough's New website detailing information developed for Borough.
4/25/08	Tinton Falls	OEM provided Fact Sheet printed to be handed out at Meetings and available at Borough Hall and Municipal Library.
4/25/08	Highlands	Borough Sign Board Manager posted sign of Public Meeting to be held on 4/28/08.
4/27/08	Highlands	OEM held Public Meeting Announcement of Meeting to be held 4/28/08 (Asbury Park Press).
4/28/08	Aberdeen	Emergency Management Alliance held Regional Outreach Meetings for residents.
4/28/08	Atlantic Highlands	BEMA held Public Meeting
4/28/08	Keansburg	Chief of Police, OEM Coordinator, BEMA Municipalities held Public BEMA Meetings posted on Borough Marquee, Hall, Library.
4/28/08	Rumson	OEM Director posted Plan Fact Sheet displayed at Municipal Complex and library, copies available for residents.
4/28/08	Tinton Falls	OEM, Clerk incorporating discussion of mitigation plan into other regularly attended meetings. Speaking at Borough Council Meeting - high priority public outreach.
4/28/08	Asbury Park	Captain posted Natural Hazard Mitigation Plan Project Information at City Hall and Library.
4/28/08	Hazlet	OEM held Public Meeting to review and discuss the risk assessment portion of plan.
4/28/08	Highlands	OEM held Open Public Meeting at Elementary School.
4/28/08	Holmdel	OEM - Public Outreach - Open public meeting for residents of Bayshore towns at school.
4/28/08	Keyport	Asst. Coordinators presented to Fire Dept at their meeting- purpose of plan and invited to attend meeting
4/28/08	Matawan	Public meeting advertised and held at Port Monmouth Elementary School in Middletown Twp. Meeting was held by the Bayshore Emergency Management Alliance (BEMA) of which Matawan is one of 10 member towns.
4/29/08	Atlantic Highlands	Municipal Clerk posted on website AHNJ.com
4/29/08	Tinton Falls	OEM IT added link to Borough's website to County Mitigation planning website - high priority public outreach.
4/29/08	Keyport	APP Reporter released general public news story front page of Park Press advising all residents in of its plan, its purpose and benefits to towns and residents.
4/29/08	Bradley Beach	OEM held Meeting with OEM Coordinator to discuss re-evaluation of Emergency Service Buildings, floodplain areas and creation of new maps.
4/30/08	Spring Lake Heights	Emergency Management coordinator , Borough IT linked Municipal Website to County website with Hazard Mitigation information.

Table 1.7 Summary of Jurisdiction Outreach Activities		
4/30/08	Spring Lake Heights	Emergency Management coordinator Posted Fact Sheet on Hazard Mitigation Plan with copies available to public.
4/30/08	Interlaken	Administration Dept. Borough Administrator - Public Notice - Posted Fact Sheet in Borough Hall. Copies available for public.
4/30/08	Interlaken	Administration Dept. Borough Administrator - Public Notice - posted Fact Sheet in Library, with copies available to public.
4/30/08	Keyport	Keyport Town Website, Boro Administrator, OEM Coordinator posted link to County website regarding all Natural Hazard Mitigation Plan and other related information, Public Outreach.
4/30/08	Manasquan	OEM Public Meeting with LEPC members, business owners, department heads, community representatives to discuss plan draft, mitigation strategies and prioritization.
4/30/08	Shrewsbury (Township)	Mayor implemented complete reorganization of EOC personnel.
4/30/08	Union Beach	Core Group added web link to County Municipal website to give public more information on the Mitigation Plan.
5/1/08	Deal	OEM posted Internet Link to County website with Hazard mitigation plan info.
5/1/08	Deal	OEM posted Public mitigation plan fact sheet in library and Municipal Building.
5/1/08	West Long Branch	OEM held Meeting of Local Emergency Planning Council to present information.
5/1/08	West Long Branch	OEM held Public Meeting of Mayor and Council to present information.
5/1/08	Sea Girt	OEM Coordinator added link to County Website regarding Plan.
5/1/08	Fair Haven	OEM link FH Website to MC OEM website
5/2/08	Monmouth Beach	OEM posted Mitigation Plan Fact Sheets for residents posted on Bulletin Boards at Municipal Complex and library. Copies made available to public.
5/2/08	Fair Haven	OEM distributed mitigation planning project plan facts at Boro Hall, library, Police Headquarters for residents
5/5/08	Avon By the Sea	OEM Coordinator had newspaper article written for inclusion in Spring Newsletter.
5/5/08	Asbury Park	Captain provided Natural Hazard Mitigation plan on City website with link to County OEM Plan.
5/5/08	Colts Neck	Municipal OEM posted Mitigation Plan Fact Sheet in Municipal Buildings and Library
5/6/08	Sea Bright	Municipal Clerk's Office provided Hazard Mitigation Project Plan Facts and posted on Municipal Bulletin Board with copies available to residents.
5/6/08	Sea Bright	Municipal Clerk's Office requested webmaster to add link to County website for residents to view Hazard Mitigation Planning Information.
5/6/08	Englishtown	OEM posted Plan fact Sheet to bulletin board at municipal complex.
5/6/08	Manalapan	OEM Staff - posting Project Plan Facts Sheet in Public Access Buildings regarding Monmouth County Mitigation Project.
5/6/08	Millstone	Township Administration and OEM Coordinator used Township Web Site link to County OEM Website, advising residents of Hazard Mitigation Program as well as information regarding OEM Mitigation Plan.

Table 1.7 Summary of Jurisdiction Outreach Activities		
5/6/08	Shrewsbury (Township)	Mayor and Clerk posted Hazard Mitigation Facts Sheet on Municipal Complex Bulletin Board and made copies available to public.
5/7/08	Englishtown	Deputy Clerk posted link to Municipal web site to County Web site for residents to view mitigation planning process.
5/7/08	Interlaken	Administration Dept. Borough Administrator -Discussion at open Public Meeting by Governing Body at their Council meeting of 5/7/08. Copies of Fact Sheet with meeting agenda provided to public.
5/7/08	Manalapan	Administration providing web-link to County OEM, providing access to Hazard Mitigation Plan.
5/7/08	Millstone	Township Administration and OEM Coordinator posted Mitigation Plan Fact Sheets for township residents posted on Township Bulletin Boards at Municipal Owned Buildings. Copies were made to residents.
5/7/08	Sea Girt	OEM Coordinator posted Plan Fact Sheet posted on Monmouth Mitigation Plan Fact sheet on Bulletin Boards in Municipal Complex and local library. Copies available for residents.
5/19/08	Long Branch	OEM Building, City Administration Public hosted public meeting to discuss any problems or ideas residents had.
5/20/08	Sea Bright	Municipal Clerk and Borough Engineer held Regular Council Meeting in Compliance of Open Public Meetings Act. Borough Engineer present and discuss Mitigation Plans.
5/21/08	Little Silver	OEM Coordinator held Public Meeting for information on Mitigation Plan. Notice on Website and Community Signboard.
5/21/08	Red Bank	OEM Coordinators held Joint Town Meeting to Notify Public.
5/21/08	Asbury Park	OEM Director, Mayor and Council held City Council Meeting to provide City Natural Hazard Mitigation Plan and allow for public input.
5/27/08	Shrewsbury (Township)	Mayor and Clerk scheduled Public Hearing to discuss Hazard Mitigation Plan. Will be published in local newspaper, posted in Municipal Complex.
6/1/08	Fair Haven	OEM conducted information session during Boro Council Meeting explaining the Mitigation Grant to the public and receive as much feedback as possible.
6/28/08	Union Beach	Councilman, OEM Coordinator and BEMA Group will conduct a group meeting to the public with a Mitigation Plan Presentation.
7/1/08	Interlaken	Administration Dept. Borough Administrator -posted Fact Sheet to Municipal Website which may be ready to launch by July 1, 2008 or sooner. Link to County OEM will be provided also.
7/1/08	Union Beach	Core Planning Group created an article in Municipal Newsletter explaining benefits of Plan.
7/17/08	Union Beach	Core Group conducted power point presentation to public and elected officials about Hazards and how vulnerable it could be to community.

Involvement of Other Stakeholders in the Plan Development Process

In order to meet Federal requirements, the plan development process must be open to stakeholders beyond planning group members and the general public. That is, opportunities must be available for other stakeholders (such as businesses, neighboring communities, academia, other relevant private and non-profit interests, and other interested parties) to become involved in the planning process.

As with the general public, other stakeholders must be provided with some variety of means to not only learn about the process that the Planning Committee is undertaking, but to voice concerns and to provide input throughout the planning process. With support and guidance from URS, each JAT took the lead in pursuing a range of activities to: (a) alert other stakeholders to the fact that the planning was working to develop this Hazard Mitigation Plan, and (b) provide other stakeholders with a forum to ask questions, and to submit comments and/or suggestions on the process or directly participate.

The Core Planning Group determined that outreach activities to the general public as summarized in the previous section would also reach and provide the same opportunities for other stakeholders such as businesses, neighboring communities, academia, other relevant private and non-profit interests, and other interested parties. In addition, targeted outreach to key stakeholder groups included:

- Ocean, Mercer, and Middlesex Counties (immediately adjacent to Monmouth County)
- Monmouth ï Ocean Development Council
- Monmouth County Superintendent of Schools
- Jersey Central Power and Light
- Local water and wastewater authorities

Review and Incorporation of Existing Plans, Studies, Reports, and Technical Information

In the process of preparing this hazard mitigation plan, many other existing plans, studies, reports, and technical information were evaluated. These sources are noted throughout this report as various topics are discussed. In summary, the development of this hazard mitigation plan included the review and incorporation as applicable of data from the following sources:

- Readily available on-line information from federal and state agency web sites including: FEMA, NJOEM, NJ Department of Environmental Protection, US Forest Service National Avalanche Center, US Geological Survey, National Oceanic and Atmospheric Administration (including National Weather Service and National Climatic Data Center, and the National Severe Storms Laboratory), University of Buffalo Multidisciplinary Center for Earthquake Engineering Research (MCEER), USGS National Geomagnetism Program, USGS National Earthquake Information Center, NASA Space Environment Center, and the US Department of Transportation Federal Highway Authority.
- Monmouth Countyôs Cross Acceptance Report (2004)
- New Jersey State Hazard Mitigation Plan (Apr. 2005)
- FEMA Q3 Flood Data and municipal Flood Insurance Studies
- Monmouth County GIS
- Monmouth County Quality of Life Survey (Apr. 1999)
- Monmouth County Open Space Plan (2006)
- USGS Earthquake History of New Jersey
- NJGS Earthquakes Epicentered in New Jersey

- USDA Understanding Soil Risks and Hazards (2004)
- USGS Hydrologic Atlas 730-L (1997)
- State of New Jersey Drought Emergency Plan (Feb. 1991)
- USDA Monmouth County Soil Survey (1989)
- New Jersey Geological Survey Landslide Event Database
- Tropical Storm Floyd Post Flood Report (July 2000)
- In the Wake of Doria (1971)
- NJDEP Floods of August and September 1971 in New Jersey, Special Report 37 (1972)
- USGS Open File Report 79-559, Flood of November 8-10, 1977 in Northeastern and Central New Jersey (April 1979)
- USDA National Agricultural Statistics Service, Census of Agriculture, Monmouth County
- National Weather Service, Eastern Region, Disaster Survey Report, The Great Norôeaster of December 1992 (June 1994)
- HAZUS-MH GIS shape files for emergency facilities, utilities, and population
- Stanford University National Performance of Dams Program web site
- New Jersey Historic Preservation Office GIS shape files for state and federally listed historic and cultural resources
- New Jersey Administrative Code 7:7E; Coastal Zone Management Rules
- FEMA NFIP Community Status Book
- FEMA data for NFIP Repetitive Loss Properties and Community Rating System communities
- FEMAôs ñNFIP Floodplain Management Requirements: a Study Guide and Desk Reference for Local Officials (FEMA-480)ò
- USGS Landslide Overview Map of the Conterminous United States, prepared in hard copy format in 1982 by Dorothy H. Radbruch-Hall, Roger B. Colton, William E. Davies, Ivo Lucchitta, Betty A. Skipp, and David J. Varnes (Geologic Survey Professional Paper 1183), compiled digitally by Jonathan W. Godt (USGS Open File Report 97-289), as viewed on NationalAtlas.gov
- American Society of Civil Engineers (ASCE) Standard 7-98: Minimum Design Loads for Buildings and Other Structures
- FEMAôs ñMulti-Hazard Identification and Risk Assessmentò (1997)
- American Society of Civil Engineers ñWind Zones in the United Statesò map
- NOAAôs Atlantic Oceanographic and Meteorological Laboratoryôs mapping ï ñEmpirical Probability of a Named Stormò
- American Meteorological Society ñGlossary of Meteorologyò
- In addition, to conduct their Capability Assessments, local jurisdictions considered relevant plans, codes, and ordinances currently in place such as building codes, zoning ordinances, subdivision ordinances, special purpose ordinances, site plan review requirements, growth management ordinances, comprehensive plans, capital improvements plans, economic development plans, emergency response plans, post-disaster recovery plans, post-disaster recovery ordinances, and real estate disclosure ordinances. For additional information, please see the ñCapabilities and Resourcesò section of this plan.

Regulatory Compliance

This Hazard Mitigation Plan was prepared in a manner consistent with applicable regulations, criteria, and guidance. The Planôs components address the local hazard mitigation planning requirements of the DMA 2000. The Planning Group used FEMAôs Multi-Hazard Mitigation Planning Guidance document of March 2004 (Revised November 2006) as a guide. This document contains what is known as a Crosswalk Reference Document for FEMA reviewers to track where in a document various criteria are addressed.

Each criterion must be addressed satisfactorily for a plan to be approved by FEMA. There are three exceptions, with regard to assessing vulnerability. They are:

- Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)
- Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)
- Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)

For these three criteria, highlighted in gray in Table 1.8, actions are strongly encouraged by FEMA, though not required by the DMA 2000 Interim Final Rule. While FEMA encourages communities to address such criteria, they are not required for Plan approval. For the Monmouth County Multi-Jurisdictional Hazard Mitigation Plan, these three criteria were addressed to the greatest extent practicable in the time available and using the best readily-available data.

The following table summarizes specific requirements in the Interim Final Rule, and whether the regulation implementing DMA 2000 is addressed in this plan. Information in this plan is presented in the order of the plan review criteria for NYSEMO/FEMA reviewerôs ease in evaluating compliance.

Table 1.8
FEMA Plan Review Criteria

FEMA Plan Review Criteria	Addressed in this Plan
Prerequisites	
Adoption by the Local Governing Body: §201.6(c)(5)	Placeholder following page i
Multi-Jurisdictional Plan Adoption: §201.6(c)(5)	Placeholder following page i
Multi-Jurisdictional Planning Participation: §201.6(a)(3)	Section 1
Planning Process	
Documentation of the Planning Process: §201.6(b) and §201.6(c)(1)	Section 1 and Apdx. A
Risk Assessment	
Identifying Hazards: §201.6(c)(2)(i)	Section 2
Profiling Hazards: §201.6(c)(2)(i)	Section 3
Assessing Vulnerability: Overview: §201.6(c)(2)(ii)	Section 3 and Apdx. B-C
Assessing Vulnerability: Identifying Structures: §201.6(c)(2)(ii)(A)	Section 3 and Apdx. C
Assessing Vulnerability: Estimating Potential Losses: §201.6(c)(2)(ii)(B)	Section 3
Assessing Vulnerability: Analyzing Development Trends: §201.6(c)(2)(ii)(C)	Section 3
Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)	Section 3
Mitigation Strategy	
Local Hazard Mitigation Goals: §201.6(c)(3)(i)	Section 5
Identification and Analysis of Mitigation Actions: §201.6(c)(3)(ii)	Sections 6 - 7 and Apdx. D
Implementation of Mitigation Actions: §201.6(c)(3)(iii)	Section 8 and Apdx. E
Multi-Jurisdictional Mitigation Actions: §201.6(c)(3)(iv)	Section 8 and Apdx. E
Plan Maintenance Process	
Monitoring, Evaluating, and Updating the Plan: §201.6(c)(4)(i)	Section 9
Incorporation into Existing Planning Mechanisms: §201.6(c)(4)(ii)	Section 9
Continued Public Involvement: §201.6(c)(4)(iii)	Section 9

Document Organization

This Multi-Jurisdictional Hazard Mitigation Plan for Monmouth County is organized into the following major sections.

Introduction. Plan purpose, overview of Monmouth County, summary of plan development process, document organization, and key terms.

Identification of Potential Hazards. Documentation of the Planning Committeeôs evaluation of a full range of natural hazards, and indication of which hazards were identified for inclusion in this plan (and why) versus those that were not identified (and why not).

Risk Assessment. Hazard profiles, identification and characterization of assets in hazard areas, damage estimates, and summary of land uses and development trends in hazard areas.

Capabilities and Resources. Overview of local, state, and federal resources for hazard mitigation.

Mitigation Goals. Summary of hazard mitigation goals for the State Hazard Mitigation Plan and also for this county-wide multi-jurisdictional hazard mitigation plan.

Range of Alternative Mitigation Actions Considered. Summary of mitigation actions considered by participating jurisdictions.

Action Item Evaluation and Prioritization. Information regarding the methodology and process followed by participating jurisdictions to evaluate and prioritize unique hazard mitigation actions for their communities.

Implementation Strategy. Summary of hazard mitigation actions selected by each participating jurisdiction.

Plan Maintenance. Procedures selected for monitoring, evaluating, and updating this mitigation plan; including participation of the public and other stakeholders in plan maintenance, and plan integration.

Key Terms

For the purpose of clarity throughout this document, the following definitions are briefly outlined:

- **Hazard mitigation** is the method by which measures are taken to reduce, eliminate, avoid or redirect natural hazards in order to diminish or eradicate the long-term risks to human life and property.

- A **natural hazard** is any hazard that occurs or results from acts of nature such as floods, earthquakes, hurricanes, tornadoes and coastal storms, to name a few.

- A **hazard mitigation plan** is a well-organized and well-documented evaluation of the natural hazards and the extent that the events will occur. In addition, the plan identifies the vulnerability to the effects of the natural hazards typically present in a certain area, as well as the goals, objectives and actions required for minimizing future loss of life and property damage as a result of natural hazards.

- **Hazard mitigation planning** is the process of managing actions taken by individual citizens and professional organizations involved in mitigation activities. The process involves carrying out plans to reduce loss of life, injuries and damage to property, as well as reducing the costs associated with losses from natural hazards. It is a long-term process with benefits best realized over time.

- A **disaster** is any catastrophic event that causes loss of life, injuries and widespread destruction to property. For the purpose of this document, a disaster is the result of a natural hazard, whether anticipated (such as flash flood warnings) or fortuitous (such as earthquakes).

- The term **human-caused hazards** refers to technological hazards + terrorism, where ñtechnological hazardsò are incidents that arise from human activities such as the manufacture, transportation, storage, and use of hazardous materials, where the incidents are accidental and their consequences unintended; and ñterrorismò is the intentional, criminal, and/or malicious acts resulting from the use of Weapons of Mass Destruction (WMD), including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive and armed attacks; industrial sabotage and intentional hazardous materials releases; and cyberterrorism.

SECTION 2 - IDENTIFICATION OF POTENTIAL HAZARDS

Monmouth County, New Jersey is vulnerable to a wide range of natural and human-caused hazards that threaten life and property. FEMAôs current regulations and interim guidance under the Disaster Mitigation Act of 2000 (DMA 2000) require, at a minimum, an evaluation of a full range of natural hazards. An evaluation of human-caused hazards (i.e., technological hazards, terrorism, etc.) is encouraged, though not required, for plan approval. Monmouth County has focused solely on natural hazards at this time. Incorporation of human-caused hazards may be evaluated in future versions of the plan, as it is a ñliving documentò which will be monitored, evaluated and updated regularly.

Upon a review of the full range of natural hazards suggested under FEMA planning guidance, Monmouth County has identified a number of hazards that are to be addressed in its Multi-Jurisdictional Hazard Mitigation Plan. These hazards were identified through an extensive process that utilized input from Planning Committee members, research of past disaster declarations in the County, and review of the New Jersey State Hazard Mitigation Plan (2005). Readily available online information from reputable sources (such as federal and state agencies) was also evaluated to supplement information from these key sources.

Table 2.1 lists the full range of natural hazards initially identified for inclusion in the plan and provides a brief description for each. This table includes 22 individual hazards. Some of these hazards are considered to be interrelated or cascading (i.e., hurricanes can cause flooding, storm surge and tornadoes), but for preliminary hazard identification purposes these individual hazards are broken out separately. It should also be noted that some hazards, such as earthquakes or winter storms may impact a large area yet cause little damage, while other hazards, such as a tornado, may impact a small area yet cause extensive damage.

Subsequently, **Table 2.2** documents the evaluation process used for determining which of the initially identified hazards are considered significant enough for further evaluation through Monmouth Countyôs multi-jurisdictional hazard risk assessment. For each hazard considered, the table indicates whether or not the hazard was identified as a significant hazard to be further assessed, how this determination was made, and why this determination was made. The table works to summarize not only those hazards that *were* identified (and why) but also those that *were not* identified (and why not). Hazard events not identified for inclusion at this time may be addressed during future evaluations and updates of the risk assessment if deemed necessary by the Planning Committee during the plan update process.

Lastly, **Table 2.3** provides a summary of the hazard identification and evaluation process noting which of the 22 initially identified hazards are considered significant enough for further evaluation through Monmouth Countyôs multi-jurisdictional hazard risk assessment (marked with a ñ☑ò).

Table 2.1
Descriptions of the Full Range of Initially Identified Hazards

Hazard	Description
ATMOSPHERIC	
Avalanche	A rapid fall or slide of a large mass of snow down a mountainside.
Extreme Temperatures	Extreme heat and extreme cold constitute different conditions in different parts of the country. Extreme cold can range from near freezing in the South to temperatures well below zero in the North. Similarly, extreme heat is typically recognized as the condition whereby temperatures hover ten degrees or more above the average high temperature for a region for an extended period.
Extreme Wind	Wind is air that is in constant motion relative to the surface of the earth. Extreme wind events can occur suddenly without warning. They can occur at any time of the day or night, in any part of the country. Extreme winds pose a threat to lives, property, and vital utilities primarily due to the effects of flying debris and can down trees and power lines. Extreme winds are most commonly the result of hurricanes, tropical storms, norôeasters, severe thunderstorms and tornadoes, but can also occur in their absence as mere ñwindstorms.ò One type of windstorm, the downburst, can cause damage equivalent to a strong tornado.
Hailstorm	Any storm that produces hailstones that fall to the ground; usually used when the amount or size of the hail is considered significant. Hail is formed when updrafts in thunderstorms carry raindrops in to parts of the atmosphere where the temperatures are below freezing.
Hurricane and Tropical Storm	Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and with a diameter averaging 10 to 30 miles across. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding which can be more destructive than cyclone wind. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which extends from June through November.
Lightning	Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a ñboltò when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes, but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes thunder. On average, 73 people are killed each year by lightning strikes in the United States.
Nor'easter	Similar to hurricanes, norôeasters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful. Norôeasters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding.
Tornado	A tornado is a violently rotating column of air that has contact with the ground and is often visible as a funnel cloud. Its vortex rotates cyclonically with wind speeds ranging from as low as 40 mph to as high as 300 mph. Tornadoes are most often generated by thunderstorm activity when cool, dry air intersects and overrides a layer of warm, moist air forcing the warm air to rise rapidly. The destruction caused by tornadoes ranges from light to catastrophic depending on the intensity, size and duration of the storm.
Winter Storm	Winter storms may include snow, sleet, freezing rain, or a mix of these wintry forms of precipitation. Blizzards, the most dangerous of all winter storms, combine low temperatures, heavy snowfall, and winds of at least 35 miles per hour, reducing visibility to only a few yards. Ice storms occur when moisture falls and freezes immediately upon impact on trees, powerlines, communication towers, structures, roads and other hard surfaces. Winter storms and ice storms can down trees, cause widespread power outages, damage property, and cause fatalities and injuries to human life.
HYDROLOGIC	
Coastal Erosion	Landward displacement of a shoreline caused by the forces of waves and currents. Coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. It is generally associated with episodic events such as hurricanes and tropical storms, norôeasters, storm surge and coastal flooding but may also be caused by human activities that alter sediment transport. Construction of shoreline protection structures can mitigate the hazard, but may also exacerbate it under some circumstances.
Dam Failure	Dam failure is the collapse, breach, or other failure of a dam structure resulting in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream of the dam. Dam failure can result from natural events, human-induced events, or a combination of the two. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning.

Drought	A prolonged period of less than normal precipitation such that the lack of water causes a serious hydrologic imbalance. Common effects of drought include crop failure, water supply shortages, and fish and wildlife mortality. High temperatures, high winds, and low humidity can worsen drought conditions and also make areas more susceptible to wildfire. Human demands and actions have the ability to hasten or mitigate drought-related impacts on local communities.
Flood	The accumulation of water within a water body which results in the overflow of excess water onto adjacent lands, usually floodplains. The floodplain is the land adjoining the channel of a river, stream ocean, lake or other watercourse or water body that is susceptible to flooding. Most floods fall into the following three categories: riverine flooding, coastal flooding, or shallow flooding (where shallow flooding refers to sheet flow, ponding and urban drainage).
Storm Surge	A storm surge is a large dome of water often 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to more than 30 feet in a Category 5 storm. Storm surge heights and associated waves are also dependent upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. Storm surge arrives ahead of a stormôs actual landfall and the more intense the hurricane is, the sooner the surge arrives. Storm surge can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate coast. Further, water rise caused by storm surge can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas.
Wave Action	The characteristics and effects of waves that move inland from an ocean, bay, or other large body of water. Large, fast moving waves can cause extreme erosion and scour and their impact on buildings can cause severe damage. During hurricanes and other high-wind events, storm surge and wind increase the destructiveness of waves and cause them to reach higher elevations and penetrate further inland.
GEOLOGIC	
Earthquake	A sudden, rapid shaking of the Earth caused by the breaking and shifting of rock beneath the surface. This movement forces the gradual building and accumulation of energy. Eventually, strain becomes so great that the energy is abruptly released, causing the shaking at the earthôs surface which we know as an earthquake. Roughly 90 percent of all earthquakes occur at the boundaries where plates meet, although it is possible for earthquakes to occur entirely within plates. 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.
Expansive Soils	Soils that will exhibit some degree of volume change with variations in moisture conditions. The most important properties affecting degree of volume change in a soil are clay mineralogy and the aqueous environment. Expansive soils will exhibit expansion caused by the intake of water and, conversely, will exhibit contraction when moisture is removed by drying. Generally speaking, they often appear sticky when wet, and are characterized by surface cracks when dry. Expansive soils become a problem when structures are built upon them without taking proper design precautions into account with regard to soil type. Cracking in walls and floors can be minor, or can be severe enough for the home to be structurally unsafe.
Landslide	The movement of a mass of rock, debris, or earth down a slope when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high.
Land Subsidence	The gradual settling or sudden sinking of the Earthôs surface due to the subsurface movement of earth materials. Causes of land subsidence include groundwater pumpage, aquifer system compaction, drainage of organic soils, underground mining, hydrocompaction, natural compaction, sinkholes, and thawing permafrost.
Tsunami	A series of waves generated by an undersea disturbance such as an earthquake. The speed of a tsunami traveling away from its source can range from up to 500 miles per hour in deep water to approximately 20 to 30 miles per hour in shallower areas near coastlines. Tsunamis differ from regular ocean waves in that their currents travel from the water surface all the way down to the sea floor. Wave amplitudes in deep water are typically less than one meter; they are often barely detectable to the human eye. However, as they approach shore, they slow in shallower water, basically causing the waves from behind to effectively ñpile upò, and wave heights to increase dramatically. As opposed to typical waves which crash at the shoreline, tsunamis bring with them a continuously flowing ówall of waterô with the potential to cause devastating damage in coastal areas located immediately along the shore.
Volcano	A mountain that opens downward to a reservoir of molten rock below the surface of the earth. While most mountains are created by forces pushing up the earth from below, volcanoes are different in that they are built up over time by an accumulation of their own eruptive products: lava, ash flows, and airborne ash and dust. Volcanoes erupt when pressure from gases and the molten rock beneath becomes strong enough to cause an explosion.
OTHER	
Wildfire	An uncontrolled fire burning in an area of vegetative fuels such as grasslands, brush, or woodlands. Heavier fuels with high continuity, steep slopes, high temperatures, low humidity, low rainfall, and high winds all work to increase risk for people and property located within wildfire hazard areas or along the urban/wildland interface. Wildfires are part of the natural management of forest ecosystems, but most are caused by human factors. Over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
ATMOSPHERIC HAZARDS			
Avalanche	NO	• Review of US Forest Service National Avalanche Center web site • Review of FEMAôs Multi-Hazard Identification and Risk Assessment	• There is no risk of avalanche events in New Jersey. The United States avalanche hazard is limited to mountainous western states including Alaska, as well as some areas of low risk in New England. • The topography and climate in Monmouth County would not support conditions needed for an avalanche to occur.
Extreme Temperatures	YES	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA National Climatic Data Center (NCDC) Storm Events Database	• Extreme temperature events are discussed in the state plan (in the context of the drought hazard for extreme heat, and in the context of winter storms for extreme cold). • NCDC reports 77 extreme temperature events for Monmouth County between November 1994 and March 2007 (including 63 extreme heat events and 14 extreme cold events. For these events there are no recorded property damages but there are a number of attributed fatalities and injuries. • Primary impacts of concern for extreme temperatures include the life-threatening effects of heat stress or hypothermia on people, particularly the elderly or people in poor physical health. Other significant impacts include strains on livestock and agriculture and excessive demands for electricity during extended heat waves that can lead to power outages and intentional rolling blackouts. • Local emergency managers noted significant concerns regarding extreme temperatures including life/safety threats and infrastructure-related losses, damages and expenses.
Extreme Wind	YES	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • Review of maximum 3 second wind gust per the American Society of Civil Engineers (ASCE) Standard 7-98.	• Extreme wind events are discussed in the state plan. • NCDC reports 193 high wind events for Monmouth County between October 1968 and March 2007. These events have resulted in recorded estimates of 7 deaths, 96 injuries and more than $33 million in property damage. • Monmouth County is located in a climate region that is highly susceptible to numerous types of extreme wind events including severe thunderstorms, hurricanes, tropical storms, norôeasters and severe winter storms. • The maximum 3 second wind gust for Monmouth County per ASCE 7-98 is 120 mph.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Hailstorm	NO	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database and National Severe Storms Laboratory (NSSL) web site	• Hailstorm events are discussed briefly in the state plan under the section on thunderstorms and tornadoes. • NCDC reports 23 severe hailstorm events (3/4 inch size hail or greater) for Monmouth County between October 1955 and March 2007. For these events there are no recorded property damages, no deaths and no injuries. • Hail probability data available on the NSSL web site indicate that Monmouth County is at minimal risk to severe weather threats from damaging hail (at least 2 inches in diameter). NCDC reports only one event in which hail of this magnitude fell in Monmouth County (Neptune Township ï July 23, 2003). • Monmouth County is located in a part of the country with the lowest annual number of days with hailstorms (less than 2). Damaging hailstorm events in Monmouth County arenôt very likely, nor are they likely to be very intense. • There are minimal hazard mitigation techniques available to reduce hailstorm impacts outside of the emergency preparedness procedures and severe weather warning systems already in place (i.e. mass public notifications that recommend immediate protective actions).
Hurricane and Tropical Storm	YES	• Review of NJ State Hazard Mitigation Plan • Analysis of NOAA historical tropical cyclone tracks • FEMA HAZUS-MH storm return periods • Review of NOAA NCDC Storm Events Database and National Hurricane Center web site	• Hurricane and tropical storm events are discussed in the state plan. • NOAA historical records indicate 34 storm tracks (11 hurricanes, 23 tropical storms) have come within 75 miles of Monmouth County between 1851 and 2007 (22 percent annual probability). • The 50-year return period peak gust for hurricane and tropical storm events in Monmouth County is between 80 and 92 mph. • Recent tropical storm events including Bertha (1996), Floyd (1999) and Isabel (2003) have caused significant wind, flood and coastal erosion related damages in Monmouth County.
Lightning	YES	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database, NOAA lightning statistics, and National Severe Storms Laboratory (NSSL) web site	• Lightning events are discussed briefly in the state plan as part of the thunderstorm hazard, and the installation of lightning rods is mentioned as a helpful mitigation action. • According to NOAA data, Monmouth County is located in an area of the country that experiences an average of 10-30 thunderstorm events and three lightning flashes per square kilometer per year. • NCDC reports 32 lightning events for Monmouth County between July 1994 and March 2007. These events have resulted in a recorded 2 deaths, 3 injuries and $665,000 in property damage. • Local emergency managers noted significant concerns regarding lightning including historical casualties, property damages and disruption to electrical power and emergency communications.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Norôeaster	YES	• Review of NJ State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database	• Norôeasters are discussed in the state plan as a significant hazard of concern for New Jersey communities, particularly located along the shore. • Monmouth County has a lengthy history of devastating impacts wrought by norôeasters. This includes major damages caused by the effects of high wind, rain, snow, heavy surf, coastal flooding and severe beach erosion. • Monmouth Countyôs shore is vital to the local economy but remains highly susceptible to the effects of major coastal storms, including norôeasters.
Tornado	YES	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database and National Severe Storms Laboratory (NSSL) web site	• Tornado events are discussed in the state plan, including historic events in Monmouth County. • NCDC reports 8 tornado events in Monmouth County between August 1952 and March 2007. These events have resulted in no recorded deaths or injuries but have caused $1.4 million in property damage with the most severe being an F2 that struck northern Manalapan and extreme southwest Marlboro Townships in May 2001. • NSSL tornado probability data indicate that Monmouth County is in an area that experiences less than 1 tornado event per year, but life-threatening and damaging events do remain very possible.
Winter Storm	YES	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of NOAA NCDC Storm Events Database • Office of New Jersey State Climatologist web site	• Winter storms including snow storms and ice storms are discussed in the state plan. The state plan notes that Monmouth County averages between 20 and 25 inches of snowfall per year. • NCDC reports that Monmouth County has been affected by 79 snow and ice events between February 1994 and March 2007. These events resulted in no reported deaths or injuries in Monmouth County, but did cause an estimated $2.6 million in property damages. • According to the Office of New Jersey State Climatologist, parts of Monmouth County experience an average of 2 days per year with daily snowfall of up to four inches (large snowstorms will bring much higher short-term accumulations). • During the winter of 1995-1996, a recorded 61-80 inches of snowfall fell across Monmouth County (highlighted by the Blizzard of 1996). • The 2003 Presidentôs Day Storm resulted in more than 20 inches of snow in Monmouth County and caused a high school roof to collapse in Wall Township among other damages.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
HYDROLOGIC HAZARDS			
Coastal Erosion	YES	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of New Jersey Department of Environmental Protection (NJDEP) Coastal Management Program web site	• Coastal erosion is discussed in the state plan as a hazard of concern for Monmouth County. • Historic shoreline data for Monmouth County indicate erratic long-term shifts between coastal erosion and accretion resulting in dynamic shoreline change. This change is linked to a variety of natural factors as well as human activity. • The most severe coastal erosion hazards for Monmouth County are related to rapid, episodic coastal storm events including hurricanes, tropical storms, and norôeasters. Following such an event, areas of Monmouth County will be even more vulnerable to the destructive effects of coastal erosion, wave action and coastal flooding. • Shore protection projects are routinely initiated and funded in Monmouth County through NJDEP and the U.S. Army Corps of Engineers. These projects in addition to many other elements of NJDEPôs Coastal Management Program serve to reduce damages to public and private property caused by coastal erosion.
Dam Failure	YES	• Review of NJ State Hazard Mitigation Plan • Review of New Jersey Department of Environmental Protection (NJDEP) Bureau of Dam Safety and Flood Control web site • Review of U.S. Army Corps of Engineers National Inventory of Dams database • Review of Stanford Universityôs National Performance of Dams Program web site	• Dam Failure is discussed in the state plan as a hazard of concern for Monmouth County (classified under ñman-made disastersò). • New Jersey has seen property damages as a result of small dam failures (including damage or loss of bridges, roads and buildings), but has not experienced a catastrophic dam failure to date. • According to the National Inventory of Dams, three major dams classified as high hazard (defined as ñwhere failure or misoperation will probably cause loss of human lifeò) are located in Monmouth County but are not associated with any recorded dam failure events. • Some local emergency managers noted concerns regarding the potential failure of earthen dams and other dam structures that are in need of repair or replacement.
Drought	YES	• Review of NJ State Hazard Mitigation Plan • Review of New Jersey Department of Environmental Protection (NJDEP) Drought Information web site • Review of National Drought Mitigation Center web site and Palmer Drought Severity Index	• Drought is discussed in the state plan, but indicates that Monmouth County is among the least affected areas by drought because of massive groundwater supplies, and low development densities. • According to the Palmer Drought Severity Index, New Jersey was experienced severe or extreme drought conditions less than five percent of the time between 1895 and 1995. However less severe, short-term droughts are a more frequent occurrence and can have serious implications for local water supply and the agricultural sector of some areas. • Some local emergency managers noted concerns over recent drought conditions that resulted in local water restrictions and drought emergency declarations.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Flood	YES	• Review of NJ State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of FEMAôs NFIP Community Status Book and Community Rating System (CRS) • Review of FEMA Q3 flood data for Monmouth County	• The flood hazard is thoroughly discussed in the state plan and indicates that it is the most common natural hazard in New Jersey. • More than half of all federal disaster declarations for Monmouth County have involved flooding. • NCDC reports that Monmouth County has been affected by 83 flood events between April 1993 and March 2007. These events in total caused no reported deaths or injuries but an estimated $18.2 million in property damages. • Nearly 10% of Monmouth County is located in the identified 100-year floodplain including riverine and coastal flood hazard areas. Nearly all municipalities participate in the NFIP and six participate in CRS.
Storm Surge	YES	• Review of NJ State Hazard Mitigation Plan • Review of U.S. Army Corps of Engineers SLOSH model data	• Storm surge is discussed in the state plan under the flood hazard and tropical storm and hurricane (and norôeaster) hazard, and highlights Monmouth County as being at risk to the forces of storm surge. • According to SLOSH model data the majority of Monmouth Countyôs municipalities are at risk to storm surge, and particularly those areas located within three to five miles of the shore.
Wave Action	YES	• Review of NJ State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of FEMA Q3 flood data for Monmouth County	• Wave action is identified as a hazard of concern for Monmouth County in the state plan. • NCDC reports that Monmouth County has been affected by 49 coastal flooding and heavy surf events (including rip currents) between December 1993 and March 2007. These incidents resulted in a reported total of eight deaths and 12 injuries in Monmouth County and caused an estimated $1 million in property damages. • According to Q3 flood data, 26 municipalities in Monmouth County include coastal flood hazard areas with storm-induced velocity wave action.
GEOLOGIC HAZARDS			
Earthquake	YES	• Review of NJ State Hazard Mitigation Plan • USGS Earthquake Hazards Program web site • Review of New Jersey Geological Survey web site	• Earthquake events are discussed in the state plan. • Earthquakes have occurred in and around the State of New Jersey in the past; according to the NJGS seven have been epicentered in Monmouth County. • According to USGS seismic hazard maps, the peak ground acceleration (PGA) with a 10% probability of exceedance in 50 years for Monmouth County is between 4%g and 5%g. FEMA recommends that earthquakes be further evaluated for mitigation purposes in areas with a PGA of 3%g or more. • Historical earthquake events have caused documented damages in Monmouth County (though all reported damages to date have been minor). • Data provided by NJGS suggest that New Jersey is overdue for a moderate, damaging earthquake.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Expansive Soils	NO	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of USDA Soil Conservation Serviceôs Soil Survey for Monmouth County (1989) • Review of USDA Natural Resources Conservation Service (NRCS) Soil Survey Geographic Database	• Expansive soils are not identified in the state plan. • According to FEMA and USDA sources, Monmouth County is located in an area that has a ñslight to moderateò clay swelling potential. • According to USDOT FHA Report No. FHWA-RD-76-82, Monmouth County lies in an area mapped as generally of low expansive character and/or low frequency of occurrence. • The NRCS Freehold Service Center confirms that the potential for expansive soils in Monmouth County is slight to moderate, with more moderate potential in the western, less developed portions of the County where more clay soils exist. • New Jersey has adopted the International Building Code of 2000, in which Chapter 18 includes provisions for building on expansive soils (through either design, removal or stabilization) so that new construction will be protected.
Landslide	YES	• Review of NJ State Hazard Mitigation Plan • Review of USGS Landslide Incidence and Susceptibility Hazard Map • Review of New Jersey Geological Survey GIS database of historic landslides in New Jersey	• Landslide events are discussed in the state plan, with particular attention focused on the coastal area landsliding (or slumping) in natural bluff areas of Monmouth County. • USGS landslide hazard maps indicate ñhigh landslide incidenceò (more than 15% of the area is involved in landsliding) for areas located in nine municipalities in northeast Monmouth County. • Data provided by NJGS indicate nine recorded landslide events in Monmouth County, including five that resulted in documented property damage.
Land Subsidence	NO	• Review of NJ State Hazard Mitigation Plan • Review of New Jersey Geological Survey digital GIS layers of Bedrock Geology and Abandoned Mines of New Jersey	• The state plan delineates certain areas that are susceptible to land subsidence hazards in New Jersey; however none of these areas are located in Monmouth County. The plan identifies no areas of mapped known sinkholes in the County. • Monmouth Countyôs lack of carbonate rock terrain does not favor naturally occurring land subsidence or sinkholes. Further, there are no abandoned mines located in the County that could be prone to collapse.
Tsunami	NO	• Review of NJ State Hazard Mitigation Plan • Review of FEMAôs Multi-Hazard Identification and Risk Assessment • Review of FEMA ñHow-toò mitigation planning guidance (Publication 386-2, ñUnderstanding Your Risks ï Identifying Hazards and Estimating Losses).	• Tsunamis are discussed in the state plan. The plan states that the return period for a mid-Atlantic tsunami is 1 in every 36 years; however this includes small scale events with waves of less then 0.5 meters. No record exists of a catastrophic Atlantic basin tsunami impacting the mid-Atlantic coast of the United States. The plan estimates that there is a probability of 0.3% in any given year for a tsunami to occur of great than one meter. • Tsunami inundation zone maps are not available for communities located along the U.S. East Coast. • FEMA mitigation planning guidance suggests that locations along the U.S. East Coast have a relatively low tsunami risk and need not conduct a tsunami risk assessment at this time.

Table 2.2
Documentation of the Hazard Evaluation Process

Natural Hazards Considered	Was this hazard identified as a significant hazard to be addressed in the plan at this time? (Yes or No)	How was this determination made?	Why was this determination made?
Volcano	NO	• Review of NJ State Hazard Mitigation Plan • Review of USGS Volcano Hazards Program web site	• Volcanoes are not located anywhere remotely near Monmouth County.
OTHER HAZARDS			
Wildfire	YES	• Review of NJ State Hazard Mitigation Plan • Review of NOAA NCDC Storm Events Database • Review of New Jersey Forest Fire Service web site	• Wildfires are discussed in the state plan as a significant hazard of concern, particularly with regard to the Pine Barrens in south and central portions of the state. • According to New Jersey Forest Fire Service records, Monmouth County experienced 512 wildfire incidents that burned 353 acres between 1993 and 2003. The statistics indicate an average of 51 wildfire events per year, but also that most are quickly suppressed. • NCDC historical records indicate some minor property damage associated with wildfire has occurred within Monmouth County. • According to the New Jersey Forest Fire Service Wildfire Hazard Assessment (Draft 2004), portions of Monmouth County have been mapped as high hazard and extreme hazard. • There is a high probability of future wildfire occurrences in Monmouth County. • Wildfire hazard risks will increase as low-density development along the urban/wildland interface increases.

Table 2.3
Summary Results of the Hazard Identification and Evaluation Process

ATMOSPHERIC

- ☐ Avalanche
- ☑ Extreme Temperatures
- ☑ Extreme Wind
- ☐ Hailstorm
- ☑ Hurricane and Tropical Storm
- ☑ Lightning
- ☑ Norôeaster
- ☑ Tornado
- ☑ Winter Storm

HYDROLOGIC

- ☑ Coastal Erosion
- ☑ Dam Failure
- ☑ Drought
- ☑ Flood
- ☑ Storm Surge
- ☑ Wave Action

GEOLOGIC

- ☑ Earthquake
- ☐ Expansive Soils
- ☑ Landslide
- ☐ Land Subsidence
- ☐ Tsunami
- ☐ Volcano

OTHER

- ☑ Wildfire

☑ = Hazard considered significant enough for further evaluation through Monmouth Countyôs multi-jurisdictional hazard risk assessment.

SECTION 3A - HAZARD PROFILES FOR MONMOUTH COUNTY, NJ

Overview

This section includes detailed hazard profiles for each of the hazards identified in the previous section (*Identification of Potential Hazards*) as significant enough for further evaluation through Monmouth Countyôs multi-jurisdictional hazard risk assessment. Each hazard profile includes a general description of the hazard, its location and extent, notable historical occurrences and the probability of future occurrences. Each profile also includes specific items noted by members of the Planning Committee as it relates to unique historical or anecdotal hazard information for Monmouth County or a particular municipal jurisdiction.

Table 3a.1 lists each significant hazard for Monmouth County and identifies whether or not it has been determined to be a specific hazard of concern for each of the Countyôs 53 municipal jurisdictions based on best available data and local information provided by the Planning Committee (ŏ = hazard of concern). Although numerous map figures are included in this section for particular hazards, **Figure 3a.1** provides a countywide base map for reference with Monmouth Countyôs multi-jurisdictional risk assessment.

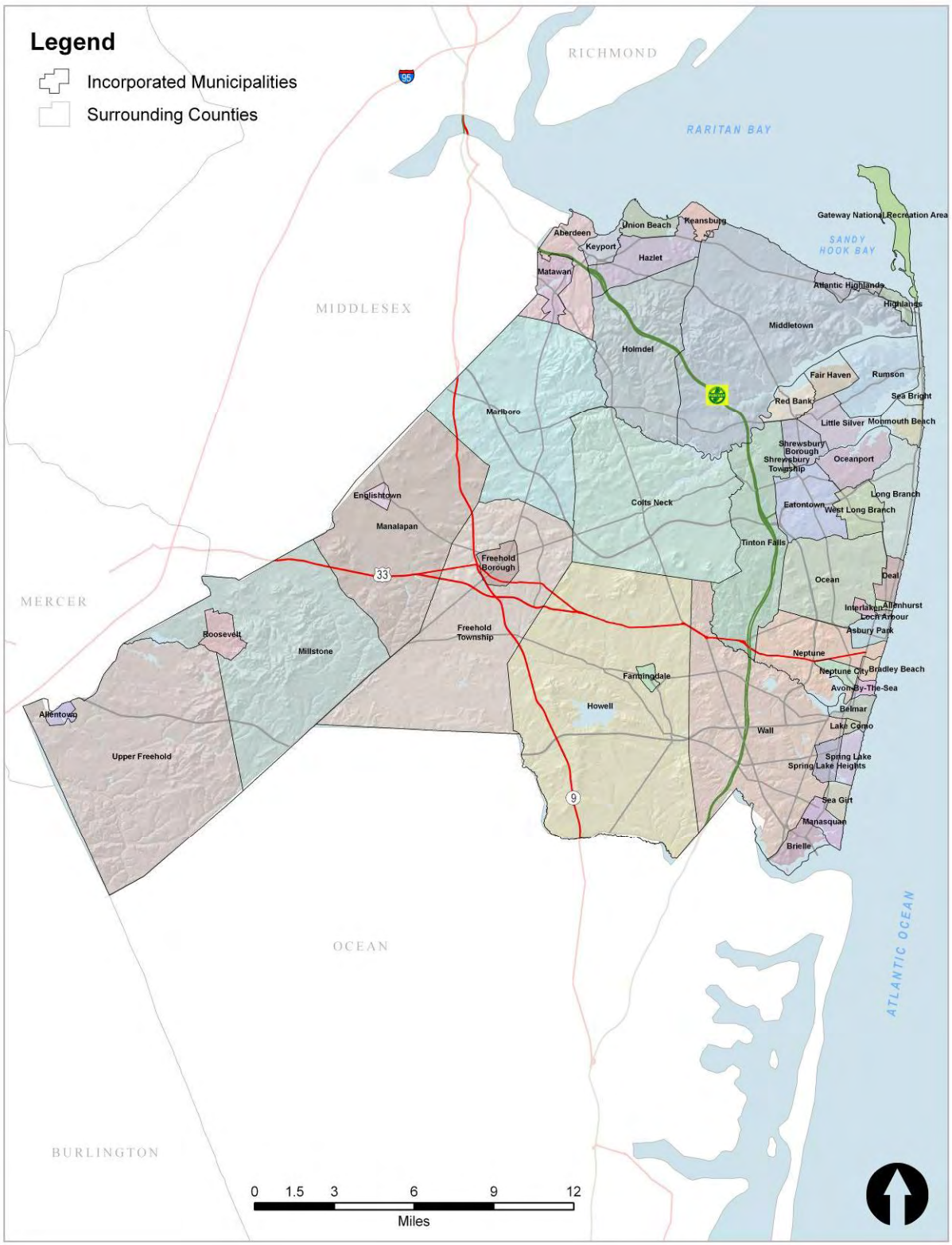
Table 3a.1
Summary of Identified Hazard Events in Monmouth County

Jurisdiction	Atmospheric							Hydrologic						Geologic		
	Extreme Temperatures	Extreme Wind	Hurricane and Tropical Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Aberdeen, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Allenhurst, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Allentown, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ			ŏ		ŏ
Asbury Park, City of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Atlantic Highlands, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Avon-By-The-Sea, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Belmar, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Bradley Beach, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Brielle, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Colts Neck, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ			ŏ		ŏ
Deal, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Eatontown, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Englishtown, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ			ŏ		ŏ
Fair Haven, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Farmingdale, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ			ŏ		ŏ
Freehold, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ			ŏ		ŏ
Freehold, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ			ŏ	ŏ	ŏ
Hazlet, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Highlands, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Holmdel, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Howell, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ
Interlaken, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Keansburg, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Keyport, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Lake Como, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Little Silver, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ

Table 3a.1
Summary of Identified Hazard Events in Monmouth County

Jurisdiction	Atmospheric							Hydrologic						Geologic		
	Extreme Temperatures	Extreme Wind	Hurricane and Tropical Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Loch Arbour, Village of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Long Branch, City of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Manalapan, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ			ŏ		ŏ
Manasquan, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Marlboro, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ			ŏ		ŏ
Matawan, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ		ŏ		ŏ
Middletown, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Millstone, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ			ŏ		ŏ
Monmouth Beach, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Neptune City, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ		ŏ		ŏ
Neptune, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Ocean, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Oceanport, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Red Bank, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Roosevelt, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ			ŏ		ŏ
Rumson, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Sea Bright, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Sea Girt, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Shrewsbury, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Shrewsbury, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ			ŏ		ŏ
Spring Lake, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Spring Lake Heights, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Tinton Falls, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ
Union Beach, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ	ŏ		ŏ
Upper Freehold, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ			ŏ		ŏ
Wall, Township of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ		ŏ
West Long Branch, Borough of	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ		ŏ		ŏ

Figure 3a.1
Monmouth County Base Map



Extreme Temperatures

Description – Extreme Temperatures

The hazard of extreme temperatures is primarily a threat to human life and health, though they are also hazardous to livestock and agricultural crops and occasionally might threaten property and infrastructure. They might also exacerbate the impact of other hazards such as severe weather events that cause widespread power outages.

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and that last for an extended period of time. Humid conditions might also add to the discomfort of high temperatures. Health risks from extreme heat include heat cramps, heat fainting, heat exhaustion and heat stroke. According to the National Weather Service, heat is the leading weather-related killer in the United States and during the 10-year period between 1993 and 2002 killed more people than lightning, tornadoes, floods and hurricanes combined. However, most deaths are attributed to prolonged heat waves in large cities that rarely experience hot weather. The elderly and the ill are most at-risk, along with those who work or exercise outdoors in hot, humid weather. Power outages are potential life-threatening consequences during periods of extreme heat, as excessive demands for electricity can overwhelm local utilities or force intentional rolling blackouts. Further, when heat waves are accompanied by drought conditions, agriculture losses can be high.

Extreme cold is a dangerous situation that can bring on health emergencies in susceptible people, such as those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Health risks to those exposed to extreme cold conditions include hypothermia and frostbite which require prompt medical care. Persons most at-risk include infants and the elderly with inadequate clothing or shelter, as well as those who remain outdoors in the cold for long periods such as the homeless, outdoor laborers, hikers and hunters. Extreme cold conditions often accompany severe winter storms that cause power outages, creating extremely dangerous situations for those relying on electricity for heat. When people must use space heaters, wood stoves and fireplaces to stay warm, the risk of household fires increases as does the risk of carbon monoxide poisoning. Other potential impacts of extreme cold include property damage caused by pipe freezes and ruptures, as well as agricultural losses when temperatures remain below the freezing point for long durations of time.

Location and Extent – Extreme Temperatures

Monmouth County is located in a region of the country that is susceptible to extreme heat and extreme cold. During periods of extreme temperature conditions the effects will be felt over widespread geographic areas, and it is generally assumed that Monmouth County and all of its municipalities are uniformly exposed to extreme heat and extreme cold. Areas along the immediate coast might experience minor differences in apparent temperatures due to the combined effects of air temperature, relative humidity and wind speed (i.e., extreme heat conditions are typically moderated along the coast). The effects of extreme temperatures will be primarily limited to the elderly and homeless populations, with occasionally minor, sporadic property damages.

Historical Occurrences – Extreme Temperatures

According to the National Climatic Data Center (NCDC), 63 recorded extreme heat events have affected Monmouth County since 1994. These incidents resulted in a reported total of four deaths and 110 injuries in Monmouth County. Notable events include the following:

June 25, 1998
A two day hot spell brought some of the highest temperatures of the summer to New Jersey. Injuries occurred when 15 people fainted at an outdoor ceremony in Fort Monmouth.

July 4-11, 1999
A very strong and oppressive high pressure system impacted New Jersey with a brutal heat wave that spanned the entire Independence Day weekend and ran through the 11th. The combination of the temperature and humidity produced heat indices of around 110 degrees during the afternoon of each day. Four heat-related deaths occurred in Monmouth County, mostly impacting elderly persons in poor health with no air-conditioning and inadequate ventilation. Utility companies issued power alerts and requested that customers reduce consumption, and some implemented rolling blackouts. The highest temperatures during this hot spell occurred mainly on the 5th, including 100 degrees in Freehold and 99 degrees in Belmar.

August 1-3, 2006
A strong area of high pressure anchored over the East Coast and the western Atlantic resulted in a stretch of excessive heat for the entire region. The combination of temperatures well into the 90s and moderate to high humidity pushed heat indices into the 105 to 110 degree range across the state. Local utility companies broke records for demand. Sporadic blackouts occurred throughout the county during August 1-2. Several people were treated on the boardwalk for heat exhaustion. A total of 35 people suffered from heat-related injuries in Belmar on August 2nd; however none were reported to be serious.

According to NCDC, 14 recorded extreme cold events have affected Monmouth County since 1994. These incidents resulted in a reported total of no deaths or injuries and no property damage. Notable events include the following:

January 13-28, 2003
A cold frontal passage initiated two weeks of unseasonably cold weather across New Jersey. The coldest mornings were on the 18th and 28th as low temperatures dipped into the single digits or below zero. The extreme cold caused homeless shelters to fill to capacity. Several water mains broke because of the extreme cold. The U.S. Coast Guard (USCG) had to break the ice in the Delaware River to make heavy shipping possible. In Monmouth County, ferry service between the county and New York City was suspended from January 23rd through the 26th because of ice in Raritan Bay and around the piers in New York City. About 70 percent of Raritan Bay was frozen. About 4,000 commuters who took the ferries in Highlands, Atlantic Highlands and the Belford section of Middletown Township had to scramble to find alternate ways to get to and from Manhattan. In Freehold, a 12-inch water main burst on U.S. Route 9 on the 30th that flooded and closed the southbound lanes of the roadway. A low temperature of 4 degrees was recorded in Freehold.

January 2004
An arctic air mass brought some of the coldest weather in years to New Jersey from the evening of the 9th through the morning of the 11th. The unseasonably cold weather presented a dangerous situation for the homeless as well as for the elderly who could not afford to heat their homes. Many pipes froze and burst both inside and outside of structures. Firefighters had difficulty battling blazes as the water quickly turned to ice. There was a higher incidence of chimney fires and a general shortage of firewood developed. Another arctic air mass invaded New Jersey on the 15th. While temperatures were slightly higher than the previous outbreak, winds were stronger and the wind chill factors were lower. Ferry service between Monmouth County and New York City had to be cancelled because of excessive ice in Raritan Bay and the Hudson River. The low temperature at Freehold was recorded at 1 degree, and the lowest hourly wind chill factor in Belmar was 23 degrees below zero.

Other notable reports of historical extreme temperature events include the following, as identified by the Planning Committee:

- The Borough of Farmingdale and the Township of Howell have experienced several heat emergencies coupled with power outages that have required evacuation and shelter of senior facilities.

- The Township of Holmdel indicated that many of the power distribution transformers are located ñin groundò and on days when temperatures reach or exceed 100 degrees it is not uncommon to have two or three concurrent power outages in developments. Coupled with the potential for a wind event at the same time, power outages could cause many heavily treed areas/developments to be without power for extended periods. More and more ñage restrictedò developments also mean the potential for high impact on the areaôs growing senior population.
- The Borough of Matawan has experienced rolling blackouts that have caused brief power outages during the extreme heat, specifically causing an issue with signalized traffic control at main intersections throughout the Borough.
- The Township of Ocean has a history of dealing with extreme temperatures. Within the town, there are multiple senior housing and low income housing units where local emergency management officials have to perform welfare (courtesy) checks to assure they are prepared to overcome extreme heat or freezing temperatures.
- The Borough of Oceanport has experienced recent power loss situations coupled with extreme heat events. Although no major damage or financial loss has occurred, power loss has impacted the local population, and particularly seniors.
- The Borough of Sea Girt indicated minor damages (pipe bursts) associated with past extreme cold events.
- The Borough of Shrewsbury indicated that extreme temperature related events have recently been on the rise. The Borough experiences power outages during extreme heat and drought conditions forcing water usage restrictions. Cold temperatures create similar power outages and property damage due to freezing water pipes in private homes and businesses alike.
- The Borough of Tinton Falls noted that a historical extreme cold and ice storm event occurred February 14, 2007, which resulted in an emergency declaration.
- The Township of Wall experienced extreme temperature conditions in the late 1990s and early 2000s including a couple of extreme heat and extreme cold events that caused damages. The extreme heat significantly strained the power infrastructure resulting in many outages. During extreme cold, water main breaks have often occurred.
- The Borough of West Long Branch indicated that past extreme heat events have led to various power outages.

Probability of Occurrence – Extreme Temperatures

Extreme temperature events will remain a very frequent occurrence in Monmouth County, and the probability of future occurrences in Monmouth County is certain (higher for extreme heat than extreme cold). While the impact of such occurrences on people and property is typically minimal, it is anticipated that the threat to human lives and safety is increasing due to growing elderly populations in many of Monmouth Countyôs municipal jurisdictions.

Extreme Wind

Description – Extreme Wind

Wind is defined as the motion of air relative to the earthôs surface, and the hazard of extreme wind is commonly associated with severe thunderstorm winds (exceeding 58 mph) as well as tornadoes, hurricanes, tropical storms and norôeasters.[1] Extreme winds can also occur in the absence of other definable hazard conditions, events often referred to as simply ñwindstorms.ò Extreme wind events might occur over large, widespread areas or in a very limited, localized area. They can occur suddenly without warning, at any time of the day or night.

Typically, extreme winds occur when large air masses of varying temperatures meet. Rapidly rising warm moist air serves as the ñengineò for severe thunderstorms, tornadoes and other windstorm events. These storms can occur singularly, in lines or in clusters. They can move through an area very quickly or linger for several hours.

Straight-line winds, which in extreme cases have the potential to cause wind gusts that exceed 100 mph, are responsible for the most frequent wind damages. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation. Extreme winds pose a significant threat to lives, property and infrastructure due to direct wind forces but also flying debris, such as rocks, lumber, fuel drums, sheet metal and loose gear of any type that can be picked up by the wind and hurled with great force. Extreme winds also down trees and power lines that often result in power outages across an affected area. **Table 3a.2** illustrates the severity and typical effects of various wind speeds for extreme wind events.

Table 3a.2
Severity and Typical Effects of Various Wind Speeds

Maximum Wind Speeds (mph)	Equivalent Saffir-Simpson Scale* (Hurricanes)	Equivalent Fujita Scale* (Tornadoes)	Severity	Typical Effects
40-72	Tropical Storm = 39-73 mph	F0	MINIMAL	Some damage to chimneys; breaks twigs and branches off trees; pushes over shallow-rooted trees; damages signboards; some windows broken.
73-112	Cat. 1 = 74-95 mph Cat. 2 = 96-110 mph Cat. 3 = 111-130 mph	F1	MODERATE	Peels surfaces off roofs; mobile homes pushed off foundations or overturned; outbuildings demolished; moving autos pushed off the roads; trees snapped or broken.
113-157	Cat. 3 = 111-130 mph Cat. 4 = 131-155 mph Cat. 5 = 155+ mph	F2	CONSIDERABLE	Roofs torn off frame houses; mobile homes demolished; frame houses with weak foundations lifted and moved; boxcars pushed over; large trees snapped or uprooted; light-object missiles generated.
158-206	Cat. 5 = 155+ mph	F3	SEVERE	Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forests uprooted; heavy cars lifted off the ground and thrown; weak pavement blown off roads.

[1] Tornadoes, hurricanes, tropical storms and norôeasters are addressed individually in this section.

Table 3a.2
Severity and Typical Effects of Various Wind Speeds

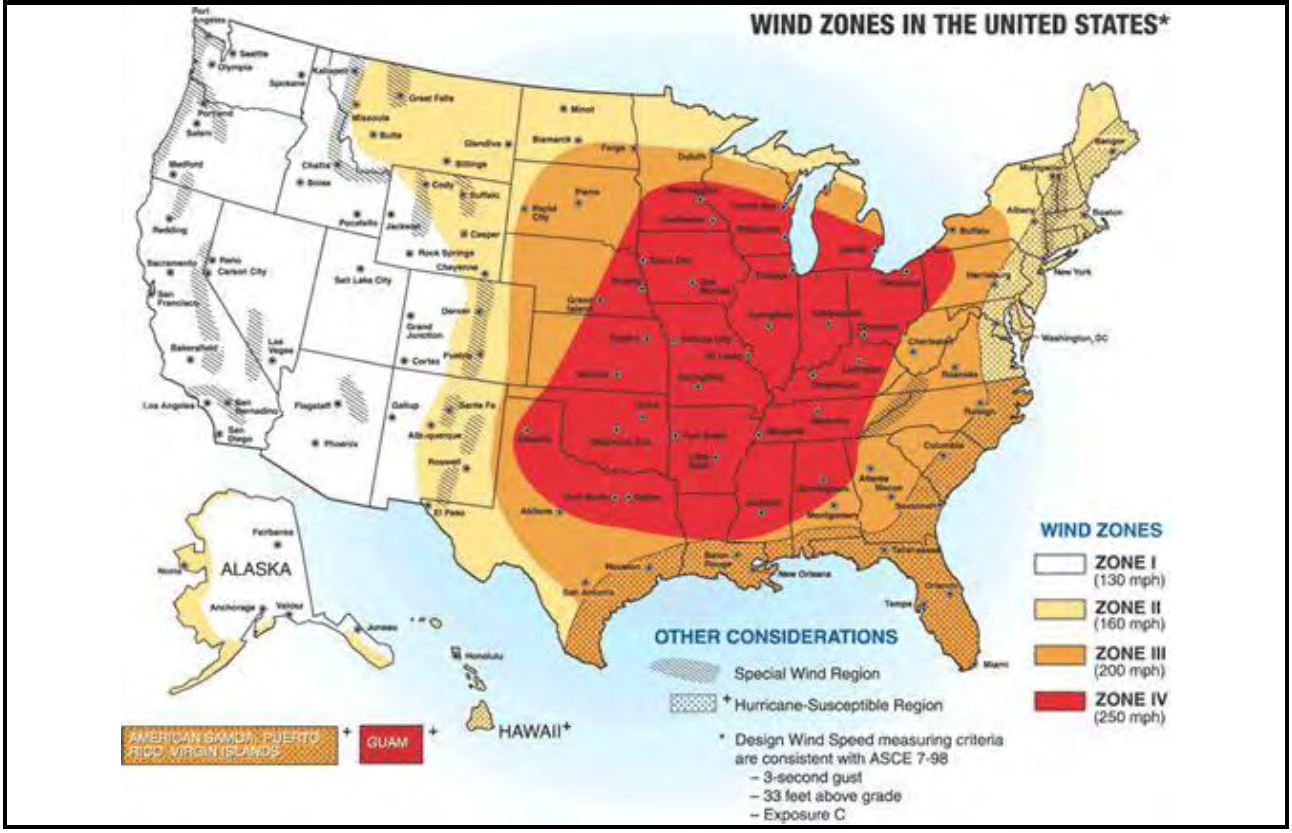
Maximum Wind Speeds (mph)	Equivalent Saffir-Simpson Scale* (Hurricanes)	Equivalent Fujita Scale* (Tornadoes)	Severity	Typical Effects
207-260	Cat. 5 = 155+ mph	F4	DEVASTATING	Well constructed homes destroyed; structures with weak foundations blown off some distance; cars thrown and disintegrated; large missiles generated; trees uprooted and carried some distance away. The maximum wind speeds of hurricanes are not likely to reach this level.
261-318	N/A	F5	INCREDIBLE	Strong frame houses lifted off foundations and carried considerable distance to disintegrate; automobile-sized missiles fly through the air in excess of 300 feet; trees debarked; incredible phenomena will occur.
319+	N/A	N/A	INCONCEIVABLE	The maximum wind speeds of tornadoes are not expected to reach this level.

Source: National Oceanic and Atmospheric Administration
** The Saffir-Simpson Scale and Fujita Scale are described further in this section under Hurricanes and Tornadoes, respectively.*

Location and Extent – Extreme Wind

Extreme wind events are experienced in every region of the United States. **Figure 3a.2** illustrates various wind zones throughout the country based on design wind speeds established by the American Society of Civil Engineers. It divides the country into four wind zones, geographically representing the frequency and magnitude of potential extreme wind events including severe thunderstorms, tornadoes and hurricanes. The figure shows that all areas of Monmouth County are located within Zone II and are susceptible to hurricanes, with a design wind speed for shelters of 160 mph.

Figure 3a.2
Wind Zones in the United States



Source: Federal Emergency Management Agency

Historical Occurrences – Extreme Wind

Monmouth County has experienced numerous types of damaging extreme wind events in the past including severe thunderstorms, tornadoes, hurricanes, tropical storms and norêasters.

According to NCDC, 193 recorded high wind events have affected Monmouth County since 1968 (data excludes tornado events which are addressed separately within this section). These incidents resulted in a reported total of three deaths and 75 injuries in Monmouth County and caused an estimated $14.5 million in property damages. Some recent notable events include the following:

September 9, 1998
A squall line of severe thunderstorms capsized boats and downed trees and power lines throughout Monmouth County. A man drowned in Sandy Hook Bay after his fishing boat rolled over. About 30 people were injured, predominantly from hypothermia after their sailing vessels capsized mainly in Sandy Hook Bay. The USCG rescued about 60 people from overturned boats. In Sea Bright, lifeguards rescued people hanging on to a capsized catamaran. A wind gust to 75 mph was reported in Freehold.

August 7, 2000
A very strong downburst produced by a severe thunderstorm caused significant tree damage in Marlboro and Colts Neck Townships. There were no serious injuries, and property damages were estimated at $1 million. Funnel clouds were sighted over Colts Neck Township, but all the damage was determined to be caused by straight line winds from the downburst. The estimated wind gusts were between 75 and 90 mph. The most significant damage occurred in an area bounded by New Jersey State Route 18 to the west,

County Route 537 to the south, Dutch Land Road to the north and Montrose Road to the east. The affected area was roughly two miles long and half a mile wide.

August 2, 2002
A complex line of severe thunderstorms brought hurricane-force wind gusts across the county and downed thousands of trees and power lines, damaging homes, vehicles and hundreds of poles. Most municipalities in the county reported damage from the storm, and a state of emergency was declared in the county. The preliminary damage estimate was $10.2 million. No deaths or serious injuries were reported during the storm; however, a few deaths and injuries occurred during the clean-up. Debris along roadways was stacked six feet high. A wind gust of 83 mph was measured at the North Shrewsbury Ice Boat Clubhouse before the instrument broke. In West Long Branch Borough, Monmouth University suffered extensive damage.

July 22, 2003
A severe thunderstorm moved northeast from Ocean County and intensified as it approached Belmar. In Wall Township, numerous tree limbs and one large tree was knocked down. In Belmar, about 25 homes and six cars were damaged, a home on 13th Avenue was shifted off its foundation, and the A-frame of a roof was ripped from a 12th Avenue home. Wind damage in Belmar started near the intersection of E Street and 16th Avenue and proceeded northeast to the oceanfront at 5th Avenue. About 4,000 homes and businesses lost power. No serious injuries were reported, and property damage was estimated at $500,000.

January 18, 2006
Strong southeast winds during the early morning and strong west winds during the late morning and afternoon impacted New Jersey. Peak wind gusts nearly reached 70 mph during the early morning and averaged around 45 mph during the westerly flow in the late morning and afternoon. In Middletown Township, a school bus struck a downed tree, but no injuries occurred. Vehicles were damaged by downed trees in Colts Neck Township and Englishtown Borough. Peak wind gusts included 68 mph in Keansburg.

As mentioned earlier, extreme wind events are often associated with other notable events such as hurricanes and tropical storms, norôeasters and winter storms ï each of which are more specifically addressed separately within this section. According to NCDC, several notable extreme wind events in Monmouth County were directly associated with these event types, as shown in **Table 3a.3**.

Table 3a.3
Other Notable Extreme Wind Events

Date	Associated Event Type
11/14/1995	Norôeaster
10/08/1996	Tropical Storm Josephine
03/31/1997	Winter Storm
11/07/1997	Norôeaster
02/04/1998	Norôeaster
02/23-25/1998	Norôeaster
09/16/1999	Hurricane Floyd
01/25/2000	Winter Storm
04/09/2000	Winter Storm
09/11/2002	Tropical Storm Gustav
10/16/2002	Norôeaster
11/16/2002	Norôeaster
02/17/2003	Winter Storm
09/18/2003	Tropical Storm Isabel
03/08/2005	Winter Storm
02/11/2006	Winter Storm
09/01/2006	Remnants of Tropical Storm Ernesto

Other notable reports of historical extreme wind events include the following, as identified by the Planning Committee:

- The Borough of Atlantic Highlands is located on Raritan and Sandy Hook Bays, and high winds routinely cause large problems with boats, docks and buildings.
- The Borough of Deal experienced extreme winds including microbursts during the reported August 2002 event that resulted in approximately $250,000 in damages to Borough facilities.
- The Borough of Fair Haven reports that wind damage has caused many problems to older large trees in town over the last few years.
- The Borough of Freehold reported that many wind events have caused damages to street trees.
- The Township of Marlboro had a straight line wind occurrence in the early 1990s that caused moderate damage to a wooded area on School Road East.
- The Borough of Matawan recently experienced an extreme wind event for one portion of town resulting in the loss of power for the Freneau section and the closing of State Highway 79 for several hours due to downed trees and power lines.
- The Borough of Neptune City had numerous trees blown down with power lines taken down during a storm event in 1993, causing many outages.
- The Township of Ocean has experienced several severe windstorms between 2002 and 2007 which caused damage to both residential and commercial structures.
- The Borough of Oceanport was devastated by the August 2002 storm event. For three days they had no power, and the cleanup was extensive and costly.
- The Borough of Rumson has seen damage in recent years due to wind, mainly on trees, telephone poles and power lines.
- The Borough of Shrewsbury has sustained heavy tree damage during periods of heavy winds. Damage to private property such as homes and automobiles have been documented on numerous occasions.
- The Township of Upper Freehold experienced damaging wind events in August 2002 and August 2003, which resulted in downed trees and utilities, and impassable roads.

Probability of Occurrence – Extreme Wind

Extreme wind events will remain a very frequent occurrence in Monmouth County, and the probability of future occurrences in Monmouth County is certain. The entire planning area is susceptible to a wide variety of recurring events that cause extreme wind conditions including severe thunderstorms (most frequent), tornadoes, hurricanes, tropical storms and norêasters.

Hurricane and Tropical Storm

Description – Hurricane and Tropical Storm

Hurricanes and tropical storms are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. A tropical cyclone refers to any such circulation that develops over tropical waters. Tropical cyclones act as a ñsafety-valve,ò limiting the continued build-up of heat and energy in tropical regions by maintaining the atmospheric heat and moisture balance between the tropics and the pole-ward latitudes. The primary damaging forces associated with these storms are high-level sustained winds, heavy precipitation that causes inland flooding and tornadoes. Coastal areas are also vulnerable to the additional forces of storm surge, wind-driven waves and tidal flooding, which can be more destructive than cyclone wind. While mentioned here, each of these individual forces are more thoroughly addressed as separate hazards within this section (i.e., Extreme Wind, Flood, Tornado, Storm Surge and Wave Action).

The key energy source for a tropical cyclone is the release of latent heat from the condensation of warm water. Their formation requires a low-pressure disturbance, warm sea surface temperature, rotational force from the spinning of the earth and the absence of wind shear in the lowest 50,000 feet of the atmosphere. The majority of hurricanes and tropical storms form in the Atlantic Ocean, Caribbean Sea and Gulf of Mexico during the official Atlantic hurricane season, which encompasses the months of June through November. The peak of the Atlantic hurricane season is in early to mid-September and the average number of storms that reach hurricane intensity per year in this basin is six.

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 mph, the system is designated a tropical storm, given a name and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 mph the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Scale (**Table 3a.4**), which rates hurricane intensity in categories on a scale of 1 to 5, with category 5 being the most intense.

Table 3a.4
Saffir-Simpson Scale for Hurricanes

Category	Maximum Sustained Wind Speed (mph)	Minimum Surface Pressure (Millibars)	Storm Surge (Feet)
1	74ï 95	Greater than 980	3ï 5
2	96ï 110	979ï 965	6ï 8
3	111ï 130	964ï 945	9ï 12
4	131ï 155	944ï 920	13ï 18
5	155 +	Less than 920	19+

Source: National Oceanic and Atmospheric Administration

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. Categories 3, 4 and 5 are classified as ñmajorò hurricanes, and while hurricanes within this range comprise only 20 percent of total tropical cyclone landfalls, they account for over 70 percent of the damage in the United States. **Table 3a.5** describes the damage that could be expected for each category of hurricane. Damage during hurricanes might also result from spawned tornadoes, storm surge and inland flooding associated with heavy rainfall that usually accompanies these storms.

Table 3a.5
Hurricane Damage Classifications

Storm Category	Damage Level	Description of Damages	Photo Example
1	MINIMAL	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery and trees. Also, some coastal flooding and minor pier damage.	
2	MODERATE	Some roofing material, door and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings might break their moorings.	
3	EXTENSIVE	Some structural damage to small residences and utility buildings, with a minor amount of curtainwall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain might be flooded well inland.	
4	EXTREME	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain might be flooded well inland.	
5	CATASTROPHIC	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas might be required.	

Source: National Oceanic and Atmospheric Administration; Federal Emergency Management Agency

Location and Extent – Hurricane and Tropical Storm

Hurricanes and tropical storms threaten the entire Atlantic and Gulf seaboard of the United States, and while coastal areas are most directly exposed to the brunt of landfalling storms their impact is often felt hundreds of miles inland. Monmouth County is located in a region of the country that is susceptible to all of the hazards wrought by hurricanes and tropical storms. All areas throughout the County are susceptible to the accompanying hazard effects of extreme wind, flooding and tornadoes associated with the hurricane categories presented in Tables 3a.4 and 3a.5, and the Countyôs coastal jurisdictions are also extremely susceptible to the added effects of storm surge, wave action, coastal erosion and tidal flooding.[2]

Historical Occurrences – Hurricane and Tropical Storm

Monmouth County has an active history of hurricanes and tropical storms. According to NOAA historical records, 34 hurricane or tropical storm tracks have passed within 75 miles of Monmouth County since 1850. This includes six Category 2 hurricanes; five Category 1 hurricanes; and 23 tropical storms. Of the 34 recorded storm events, nine tropical storm tracks traversed directly through Monmouth County. **Figure 3a.3** shows the track of each recorded historical storm track in relation to Monmouth County. As can be seen in the figure, almost all hurricane and tropical storm tracks traverse northward through the area. For each event, **Table 3a.6** provides the date of occurrence, storm name (if applicable), maximum wind speed (as recorded within 75 miles of Monmouth County) and category of the storm based on the Saffir-Simpson Scale.

[2] Distinct hazard area locations for flooding, storm surge, wave action and coastal erosion are discussed elsewhere in this section.

Figure 3a.3
Historical Hurricane and Tropical Storm Tracks, 1850-2007

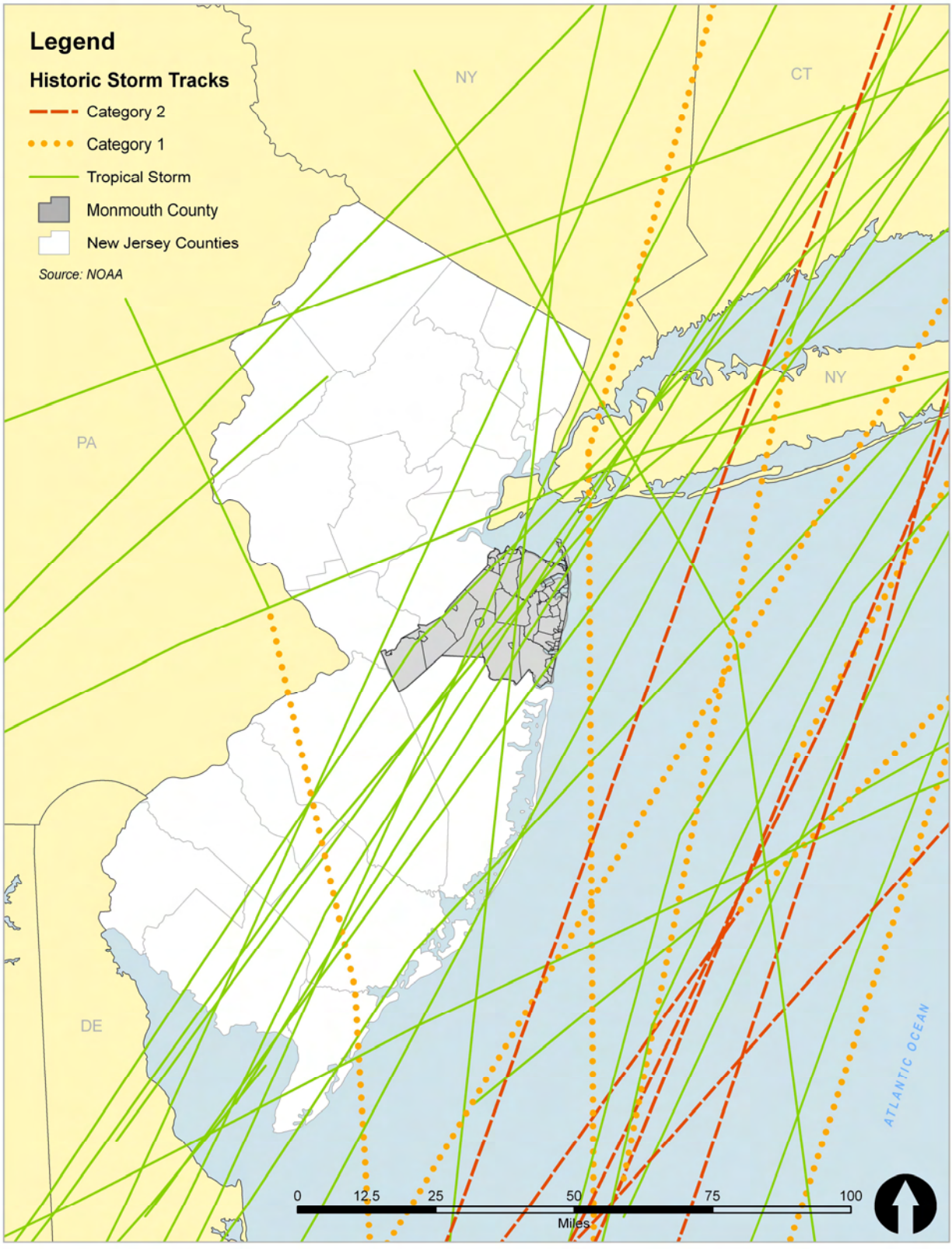


Table 3a.6
Historical Storm Tracks within 75 Miles of Monmouth County (Since 1850)

Date of Occurrence	Storm Name	Maximum Wind Speed (mph)	Storm Category
8/20/1856	Unnamed	60	Tropical Storm
9/16/1858	Unnamed	90	Category 1 Hurricane
9/28/1861	Unnamed	70	Tropical Storm
11/3/1861	Unnamed	70	Tropical Storm
9/19/1863	Unnamed	60	Tropical Storm
10/30/1866	Unnamed	70	Tropical Storm
10/26/1872	Unnamed	45	Tropical Storm
09/30/1874	Unnamed	70	Tropical Storm
8/18/1879	Unnamed	105	Category 2 Hurricane
9/24/1882	Unnamed	45	Tropical Storm
8/22/1888	Unnamed	45	Tropical Storm
8/24/1893	Unnamed	85	Category 1 Hurricane
8/29/1893	Unnamed	65	Tropical Storm
10/10/1894	Unnamed	85	Category 1 Hurricane
9/24/1897	Unnamed	70	Tropical Storm
9/16/1903	Unnamed	80	Category 1 Hurricane
9/15/1904	Unnamed	65	Tropical Storm
5/30/1908	Unnamed	60	Tropical Storm
9/19/1936	Unnamed	100	Category 2 Hurricane
8/3/1944	Unnamed	40	Tropical Storm
9/14/1944	Unnamed	100	Category 2 Hurricane
9/1/1952	Able	40	Tropical Storm
8/31/1954	Carol	100	Category 2 Hurricane
8/19/1955	Diane	45	Tropical Storm
7/30/1960	Brenda	50	Tropical Storm
9/12/1960	Donna	110	Category 2 Hurricane
9/15/1961	Unnamed	40	Tropical Storm
8/28/1971	Doria	60	Tropical Storm
6/22/1972	Agnes	70	Tropical Storm
8/10/1976	Belle	90	Category 1 Hurricane
9/27/1985	Gloria	100	Category 2 Hurricane
9/24/1985	Henri	40	Tropical Storm
7/13/1996	Bertha	70	Tropical Storm
9/16/1999	Floyd	70	Tropical Storm

Source: National Oceanic and Atmospheric Administration

Notable recent events include the following:

September 27, 1985 (Hurricane Gloria)
Hurricane Gloria came ashore in Long Island, New York as a Category 2 storm. The storm knocked out power and forced people to be evacuated from homes along the Jersey Shore, including Monmouth County. Floodwaters on Long Beach Island split the island in half for a period of time. Gloria downed thousands of trees and caused extensive power outages across the state. Storm surge tides averaged two meters above predicted tide levels; however, coastal flooding was minimized as the peak surge arrived during low tide.

July 13, 1996 (Tropical Storm Bertha)
A weakening Tropical Storm Bertha passed across eastern parts of the state on July 13th. One storm-related death occurred on the 12th. A 41-year-old man from New Egypt drowned while surfing at Ocean Beach in the Borough of Belmar. Most beaches were already closed due to the rough surf and the potential for rip tides. Otherwise, tidal departures were about two feet or less from normal. Only Monmouth Beach suffered severe beach erosion. Sixty feet of the 120-foot wide beach at the south of the borough was gone. This beach is one of dozens in New Jersey that was being replenished under a U.S. Army Corps of Engineers project. There was little beach erosion elsewhere. While there was urban and poor drainage flooding, no serious property or vehicular damage was reported and there were only a few water rescues of trapped motorists.

July 16, 1999 (Tropical Storm Floyd)
Hurricane Floyd will go down in history as the greatest natural disaster to impact New Jersey to date. Wind gusts rarely exceeded 50 mph, but all the flooding rains made it easier for trees to be knocked over. In Monmouth County, the worst flood-related problems occurred as the torrential rain coincided with the high tide. The worst flooding was reported in the Borough of Union Beach and bay areas of Middletown Township, requiring some evacuation. New Jersey State Routes 35 and 36 were closed due to flooding. Farther inland, Manalapan Township was hardest hit with overflowing brooks that forced the closure of six roads and sandbagging of homes on Birmingham Road. The strongest winds occurred during the evening and blew down transformers, wires, tree limbs and several trees throughout the county. Coastal areas escaped with minimal damage: just some minor beach erosion and minor back bay flooding at times of high tide. Precipitation storm totals in Monmouth County include 6.4 inches in Hazlet Township, 5.82 inches in Marlboro Township, 5.2 inches in Sandy Hook (Highlands Borough) and 4.57 inches in Keansburg Borough.

Other notable reports of historical hurricane and tropical storm events include the following, as identified by the Planning Committee:

- The Township of Aberdeen has been affected by numerous storms, and reports that Hurricane Gloria was the most formidable in recent memory. The Cliffwood Beach area has received most of the impact of these storms, an area that borders Raritan Bay and is home to two marinas, the Township's Department of Public Works and several pump stations. The area is partially protected by a seawall built in the 1970s. In 1960, Hurricane Donna destroyed the boardwalk and surrounding properties and significantly eroded areas along Cliffwood Beach.
- The Borough of Allenhurst has experienced numerous storm events and indicates that most damage has occurred along the beach area and inland two blocks.
- The Borough of Matawan has been fortunate with previous storms; however the remnants of some tropical storms such as Ernesto in September 2006 have caused minor flooding, downed trees and power outages.
- The Borough of Shrewsbury has experienced minimal flooding associated with past hurricanes and tropical storms, but heavy tree damage due to winds causing damage to private property.

Probability of Occurrence – Hurricane and Tropical Storm

The probability of future hurricane and tropical storm events for Monmouth County is high. According to NOAA statistical data, Monmouth County is located in an area with an annual probability of a named storm between 18 and 24 percent. This empirical probability is fairly consistent with other scientific studies and observed historical data made available through a variety of federal, state and local sources. According to the NOAA data on historical storm tracks, the annual probability of a hurricane or tropical storm coming within 75 miles of Monmouth County is 22 percent. Also, a recent study headed by Colorado State University's Dr. William Gray concluded that the probability of a named storm *making landfall* in the vicinity of Monmouth County is 13.2 percent.

The probability of storm occurrences will vary significantly based on the return interval for different categories of magnitude. The probability of less intense storms (lower return periods) is higher than more intense storms (higher return periods). **Table 3a.7** profiles the potential peak gust wind speeds that can

be expected in Monmouth County during a hurricane event for various return periods according to FEMAôs HAZUS-MH® loss estimation methodology.

Table 3a.7
Peak Gust Wind Speeds vs. Return Period for Monmouth County, NJ

10-Year	20-Year	50-Year	100-Year	200-Year	500-Year	1,000-Year
44 mph	63 mph	86 mph	102 mph	115 mph	132 mph	143 mph

Source: HAZUS-MH, MR2

Lightning

Description – Lightning

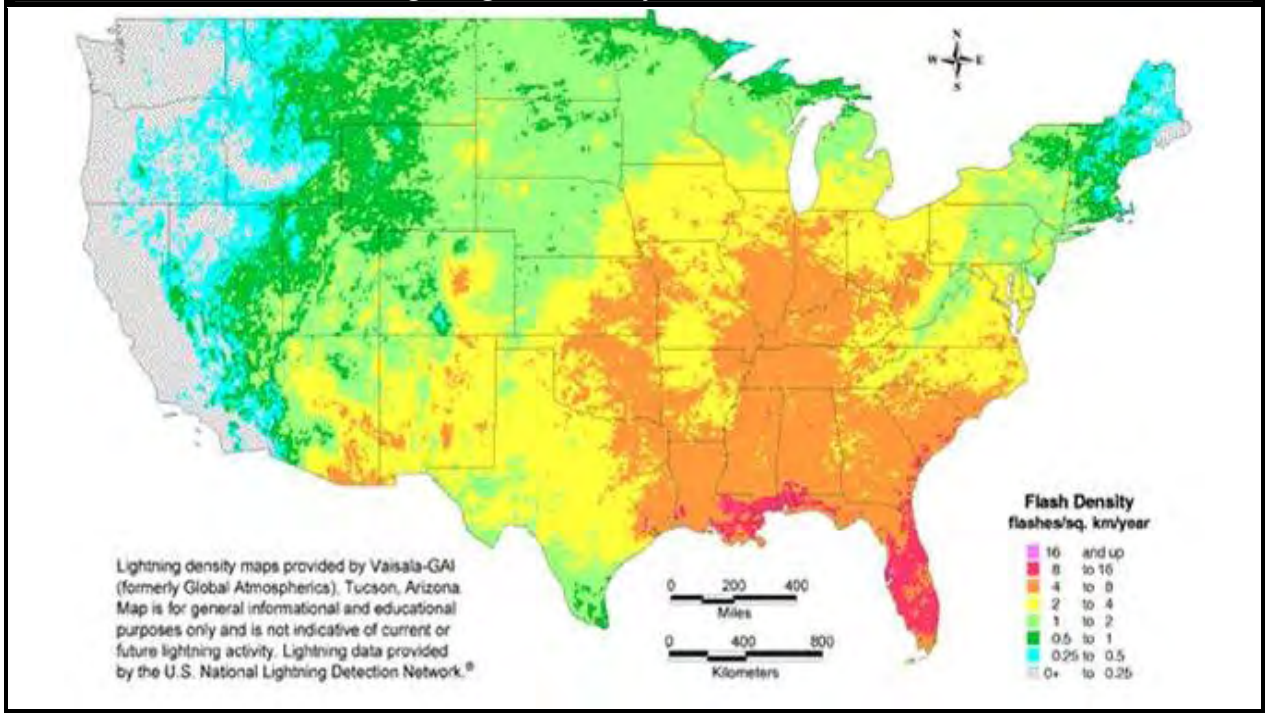
Lightning is a discharge of electrical energy resulting from the buildup of positive and negative charges within a thunderstorm, creating a ñboltò when the buildup of charges becomes strong enough. This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning can reach temperatures approaching 50,000 degrees Fahrenheit. Lightning rapidly heats the sky as it flashes but the surrounding air cools following the bolt. This rapid heating and cooling of the surrounding air causes the thunder which often accompanies lightning strikes. While most often affiliated with severe thunderstorms, lightning often strikes outside of heavy rain and might occur as far as 10 miles away from any rainfall.

According to FEMA an average of 300 people are injured and 80 people are killed in the United States each year by lightning. Direct lightning strikes also have the ability to cause significant damage to buildings, critical facilities and infrastructure. Lightning is also responsible for igniting wildfires that can result in widespread damages to property before firefighters have the ability to contain and suppress the resultant fire.

Location and Extent – Lightning

Monmouth County is located in a region of the country that is susceptible to lightning strike, though not as susceptible as southeastern states. **Figure 3a.4** shows a lightning flash density map for the years 1996-2000 based upon data provided by Vaisalaôs U.S. National Lightning Detection Network (NLDN®).

Figure 3a.4
Lightning Flash Density in the United States



Source: Vaisala U.S. National Lightning Detection Network

All areas of Monmouth County are equally susceptible to lightning strike. While lightning occurs randomly anywhere and anytime, the most common location for lightning fatalities and injuries to people is in open areas such as parks, beaches, golf courses and other recreational areas. Monmouth County remains susceptible to lightning deaths and injuries due to the large number of people who engage in outdoor activities, particularly more so along the shoreline of its coastal jurisdictions.

Historical Occurrences – Lightning

According to NCDC, 32 recorded lightning strike incidents have affected Monmouth County since 1994. These incidents resulted in a reported total of two deaths and three injuries, and caused an estimated $665,000 in property damages. Some recent notable events include the following:

May 1, 1997
A man was killed while driving southbound on Hockkockson Road in Tinton Falls when lightning struck a tree and sliced it in half, crushing the vehicle he was driving.

September 15, 2000
Lightning struck the communications tower of the Neptune Township Police Department. The lightning proceeded to damage the police radios, repeaters and dispatch consoles. All 911 calls were forwarded to the county center. The police operated from a backup communications center until normal operations resumed later in the evening. Damages were estimated at $40,000.

August 27, 2001
Lightning struck a three-story home in Upper Freehold Township. The ensuing fire reached four alarms and totally destroyed the home. Damages were estimated at $500,000.

July 11, 2002
A 28-year-old woman was fatally struck by lightning on the LaReine Avenue Beach in Bradley Beach Borough. She was found in distress on the beach with burn marks on the mid-section of her body before she died.

Other notable reports of historical lightning events include the following, as identified by the Planning Committee:

- The Borough of Bradley Beach has dealt with at least two significant lightning situations in recent years, one in which lightning struck the ocean in the vicinity of a swimmer who was killed, and the other was a lightning storm in which two houses were struck causing extensive damage.
- The Borough of Farmingdaleôs Police Department radio tower was once struck and lost power (a portable field communications unit was mobilized to handle dispatch duties).
- The Borough of Highlands has experienced lighting storms, which have resulted in buildings being struck and damaged, trees being struck and knocked down thus blocking roadways and critical facilities (Borough Hall and Police Department) being struck and having computer and electrical equipment damaged/destroyed.
- The Borough of Keansburgôs Police Department radio tower has been struck by lightning twice.
- The Borough of Matawan Police Department Headquarters suffered a direct lightning strike in 2005 which resulted in the loss of power and all communication, including radio, telephone and computer equipment.
- The Township of Ocean has experienced numerous lightning events which caused several large trees to come down onto private property and cause extensive damage.
- The Borough of Oceanport had a police officer on traffic post during the summer struck during a lightning event. The lightning knocked him to the ground, but he suffered no serious injury.
- The Borough of Sea Bright has experienced lightning strikes in the past knocking out power stations and pumping (sewer) stations.
- The Township of Upper Freehold reports that from February 2000 to August 2007 records from the fire company show that lightning struck 15 houses (one of which burnt to the ground), plus numerous power poles and transformers and trees that endangered structures.

Probability of Occurrence – Lightning

The probability of occurrence for future lightning events in Monmouth County is certain. According to NOAA, Monmouth County is located in an area of the country that experiences three lightning flashes per square kilometer per year (approximately 2,300 flashes countywide per year). Given this regular frequency of occurrence, it can be expected that future lightning events will continue to threaten life and cause minor property damages throughout Monmouth County.

Nor'easter

Description – Nor'easter

Similar to hurricanes, norôeasters are ocean storms capable of causing substantial damage to coastal areas in the Eastern United States due to their associated strong winds and heavy surf. Nor'easters are named for the winds that blow in from the northeast and drive the storm up the East Coast along the Gulf Stream, a band of warm water that lies off the Atlantic coast. They are caused by the interaction of the jet stream with horizontal temperature gradients and generally occur during the fall and winter months when moisture and cold air are plentiful.

Norôeasters are known for dumping heavy amounts of rain and snow, producing hurricane-force winds, and creating high surf that causes severe beach erosion and coastal flooding. There are two main components to a nor'easter: (1) a Gulf Stream low-pressure system (counter-clockwise winds) generated off the southeastern U.S. coast, gathering warm air and moisture from the Atlantic, and pulled up the East Coast by strong northeasterly winds at the leading edge of the storm; and (2) an Arctic high-pressure system (clockwise winds) which meets the low-pressure system with cold, arctic air blowing down from Canada. When the two systems collide, the moisture and cold air produce a mix of precipitation and have the potential for creating dangerously high winds and heavy seas. As the low-pressure system deepens, the intensity of the winds and waves will increase and cause serious damage to coastal areas as the storm moves northeast. Norôeasters can be extremely large (up to 1,000 miles in diameter) and their duration can last for days and multiple tidal cycles, often causing major coastal flooding, erosion and damages that might even exceed the impacts of shorter-term hurricane events.

While there are a variety of indicators for norôeaster intensity, **Table 3a.8** describes the Dolan-Davis Norôeaster Intensity Scale which is based on coastal storm erosion, degradation and property damage.

Table 3a.8
Dolan-Davis Nor'easter Intensity Scale

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

Source: Federal Emergency Management Agency

Location and Extent – Nor'easters

Norôeasters threaten the entire Atlantic Coast of the United States, and while coastal areas are most directly exposed to the damaging forces of such storm systems their impact is often felt far inland. Monmouth County is located in an area that is extremely susceptible to norôeasters. All areas throughout the County are susceptible to the hazard effects of extreme wind, flooding and heavy snowfall.

Monmouth Countyôs coastal jurisdictions are also extremely susceptible to the added effects of storm surge, wave action, coastal erosion and tidal flooding.[3]

Historical Occurrences – Nor'easters

Monmouth County has a lengthy history of devastating impacts wrought by norôeasters. This includes damages caused by the effects of extreme wind, heavy rain, snow, wave action, storm surge, coastal flooding and beach erosion (also addressed separately within this section).

According to the New Jersey Office of Emergency Management (NJOEM), the stateôs worst norôeaster event occurred in March 1962 when gale force winds kept storm surges on shore for five successive high tides during a three-day period. During these tides, waves reached heights of 20 to 30 feet doing tremendous damage to dunes and coastal properties. The erosive effect of the storm reportedly changed the face of the shoreline, eroding some beaches entirely away, while also carving new channels and inlets in Monmouth County. Many inland areas were inundated as well, with hundreds of homes damaged or destroyed.

Other notable norôeaster events cited by NJOEM include the following:

- The norôeasters of March 1984, October 1991 and January 1992 all caused severe beach and dune erosion, widespread damage to oceanfront roads, promenades and boardwalks, as well as extensive flooding to coastal and riverine areas. These storm events coincided with astronomically high tides, which worsened the flooding, erosion and associated damages.

- The norôeaster event of December 1992 was the harshest New Jersey storm since 1962, in terms of both damage and weather conditions. The storm caused extreme coastal flooding and extensive beach erosion. Tide heights ranged from a little over 9 feet above mean low water along the ocean front, to an estimated 10 feet above mean low water on some back bays, which is four to five feet above normal. The storm resulted in destruction of public property including debris-ridden roadways, beach erosion, collapsed public facilities, boardwalks and damage to storm drainage facilities. Private properties were also pummeled by the storm; some of these properties were rendered uninhabitable.

According to NCDC, 12 recorded norôeaster events have affected Monmouth County since 1993. Some recent notable events include the following:

March 12-13, 1993
According to the National Weather Service, this "Storm of the Century" was an extremely intense nor'easter which impacted New Jersey with a wide variety of hazardous weather. It was one of the most powerful storms (tropical or extratropical) on record to hit New Jersey, having a record low minimum central pressure of 961 millibars at almost the same time as it passed over New Jersey. Snow became very heavy during the event before changing to sleet. Accumulations ranged from three to six inches on the southeastern sections, six to 14 inches in east central and southwestern sections, 10 to 18 inches in west central and northeastern sections, and 15 to 26 inches in northwestern sections. Winds were sustained at 30 to 45 mph, with gusts to 75 mph (hurricane force) measured in Cape May. Moderate coastal flooding occurred the morning of the 13th as a result of the high winds, tides and pounding surf, with waves of six to eight feet above high tide levels. Tide levels reached seven to 7.5 feet above mean low water in the back bays.

February 4, 1998
The strongest norôeaster of the winter season battered coastal New Jersey. Monmouth County was spared by the eastward movement of the norôeaster off of Cape Hatteras, experiencing moderate to severe beach erosion due to the continuous onshore flow. Two to four feet of beach were lost in most areas. At Sandy

[3] Distinct hazard area locations for coastal flooding, wave action and coastal erosion are discussed elsewhere in this section.

Hook (Highlands Borough), tides measured 3.2 feet above normal and about 80 percent of the new sand placed in a replenishment project was lost as several hundred feet of beach disappeared. Both Bradley Beach Borough and Ocean Grove Borough were hard hit by erosion. The waves washed sand onto Ocean Avenue in Bradley Beach Borough. New Jersey State Route 36 was flooded in Sea Bright Borough. In Raritan Bay, tidal flooding caused road closures in Middletown Township.

February 24, 1998
Another strong norôeaster brought very strong winds and coastal flooding to the New Jersey Shore. But, unlike the previous norôeaster, the worst conditions affected Monmouth County. Tidal departures averaged around three feet above normal. A breach in the sea wall occurred in Allenhurst Borough. Flooding forced the closure of New Jersey State Routes 35 and 36 in Keyport Borough, Ocean Avenue in Sea Bright Borough and the entrance road to Sandy Hook (Highlands Borough), as well as several roads along the bay side of Sea Bright Borough. Wind gusts reached as strong as 61 mph in Ocean Grove.

October 16, 2002
A strong norôeaster caused tidal flooding along the New Jersey coast and in the back bays, gusty winds and beach erosion. Tides, winds and erosion were worse in Ocean and Monmouth counties than farther south. Two downed trees damaged a home in Wall Township. Peak wind gusts included 49 mph winds in Keansburg Borough and 47 mph winds at Sandy Hook (Highlands Borough). Streets were knee deep in water in Sea Bright Borough. Water spilled over the docks along the Shark River and also in Manasquan Borough. Several roads were flooded in Manasquan, and the Glimmer Glass Bridge was left in the open position. Tides reached seven feet above mean low water at Sandy Hook (Highlands Borough) and six feet above average tide levels in Sea Bright Borough.

December 5-6, 2003
A norôeaster dropped heavy snow across much of New Jersey. Many municipalities declared snow emergencies to help clear the roads for plowing. A 36-year-old man died in Millstone Township after his vehicle left the westbound lanes of Interstate 195 and struck a tree. Specific snow accumulations included 15 inches in Clarksburg, 12.8 inches in Cream Ridge, and 11.5 inches in Oakhurst.

Other notable reports of historical nor'easter events include the following, as identified by the Planning Committee:

- The Township of Aberdeen has experienced significant beach erosion caused by past norôeaster events.
- The Borough of Atlantic Highlands suffered more than $4 million in damages from the 1992 norôeaster, not including damages to private boats. FEMA paid more than $ million in damage claims, and repairs to local infrastructure took two years to complete.
- The Borough of Avon-By-The-Sea reportedly experienced the most severe damage in the past 40 years during the 1992 norôeaster event.
- The Borough of Bradley Beach has been victim to several nor'easters over the years, which have caused extensive destruction and beach erosion.
- The Borough of Deal cites that annual storm events cause flooding of Poplar Brook and beach erosion.
- The Borough of Fair Haven indicated that power outages lasted up to six days during the 1992 event.
- The Borough of Little Silver reported that the 1992 event was devastating, and resulted in an 11-foot storm surge for the area.
- The Borough of Manasquanôs local records indicate that the 1992 norôeaster brought the highest tide of recent memory, with an approximate tide height of 5 feet above average.
- The Township of Marlboro has had issues with power outages, localized flooding, and significant snow storms causing lengthy disruptions of service to the community as well as limiting the publicôs ability to travel and commute.
- The Borough of Matawan has experienced minor flooding and other effects from norôeasters, but no major damages to date.
- The Borough of Neptune City has had numerous norôeasters affect the area, with most of the damage attributed to downed power lines and trees as well as flooding from the Shark River.
- The Township of Ocean reports that norôeasters have caused extensive damage throughout the township between the years 2000 and 2005.

- The Borough of Sea Girt has experienced flooding, beach erosion and major property damage associated with norôeaster events. The 1992 event caused major infrastructure damage along Ocean Avenue and the boardwalk.
- The Borough of Union Beach indicated that severe storm impacts were felt in the area following the 1992 norôeaster event.
- The Township of Upper Freehold reports that approximately $10,000 was spent on debris removal and emergency response associated with the 1992 event. Damages and impacts included road obstructions, flash flooding, downed utilities, and the destruction of a communications tower. Another norôeaster event in April 2007 caused flooding to roads and private property.
- The Borough of West Long Branch indicated that some minor flood damage has occurred as a result of past norôeasters.

Probability of Occurrence – Nor'easters

Norôeasters will remain a very frequent occurrence for Monmouth County, and the probability of future occurrences affecting all of Monmouth Countyôs jurisdictions is certain.

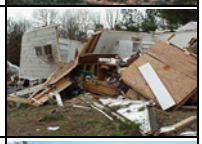
Tornado

Description – Tornado

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 and other 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 the high wind velocity and wind-blown debris, also accompanied by lightning or large hail. According to the National Weather Service, tornado wind speeds normally range from 40 to more than 300 mph. The most violent tornadoes have rotating winds of 250 mph or more, and are capable of causing extreme destruction and turning normally harmless objects into deadly missiles.

The damage caused by tornadoes ranges from light to inconceivable, depending on the intensity, size and duration of the storm. Typically, tornadoes cause the greatest damage to structures of light construction such as residential homes (particularly mobile homes). **Table 3a.9** shows the Enhanced Fujita Scale for Tornadoes which was developed to measure tornado strength and associated damages.

Table 3a.9
Enhanced Fujita Scale for Tornadoes

Storm Category	Damage Level	3 Second Gust (mph)	Description of Damages	Photo Example
F0	GALE	65ï 85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.	
F1	WEAK	86ï 110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages might be destroyed.	
F2	STRONG	111ï 135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.	
F3	SEVERE	136ï 165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.	
F4	DEVASTATING	166ï 200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.	
F5	INCREDIBLE	200+	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel re-enforced concrete structures badly damaged.	

Source: National Oceanic and Atmospheric Administration; Federal Emergency Management Agency

Each year, an average of more than 800 tornadoes is reported nationwide, resulting in an average of 80 deaths and 1,500 injuries. They are more likely to occur during the months of March through May and can occur at any time of day, but are likely to form in the late afternoon and early evening. Most tornadoes are

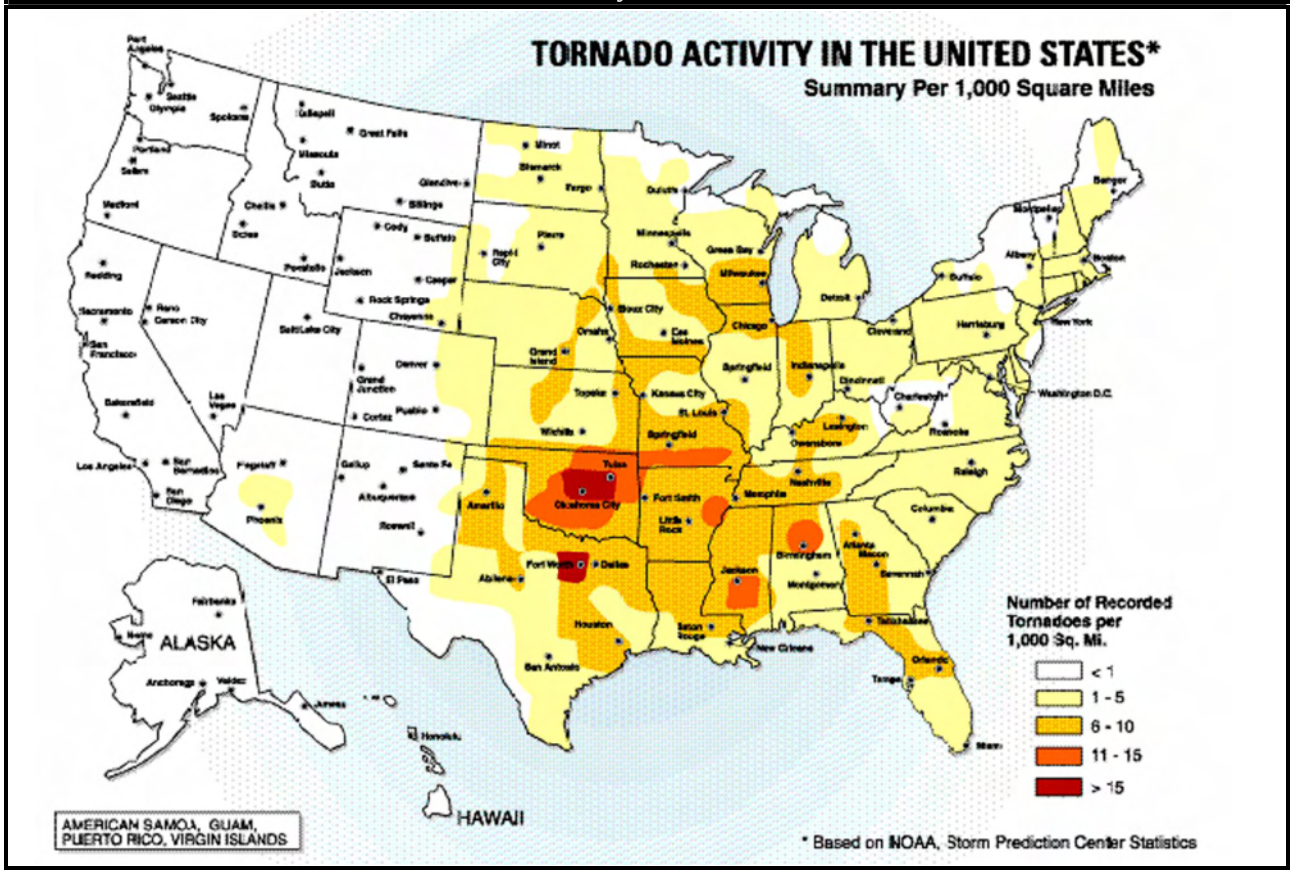
a few dozen yards wide and touch down briefly, but even small short-lived tornadoes can inflict tremendous damage. Highly destructive tornadoes might carve out a path over a mile wide and several miles long.

The tornadoes associated with tropical cyclones are most frequent in September and October when the incidence of tropical storm systems is greatest. This type of tornado usually occurs around the perimeter of the storm, and most often to the right and ahead of the storm path or the storm center as it comes ashore. These tornadoes commonly occur as part of large outbreaks and generally move in an easterly direction.

Location and Extent – Tornado

Monmouth County is located in an area that is susceptible to tornado events, though their occurrence is not nearly as frequent or intense as other regions of the country. Most New Jersey tornadoes that do occur range from F0 to F2 in magnitude and typically impact a relatively small area. **Figure 3a.5** shows tornado activity in the United States based on the number of recorded tornadoes per 1,000 square miles.

Figure 3a.5
Tornado Activity in the United States



Source: Federal Emergency Management Agency

Tornado events are completely random and it is not possible to predict specific areas that are more susceptible to tornado strikes over time. Therefore, it is assumed that all of Monmouth County is uniformly exposed to the tornado hazard. The specific location of reported touchdown occurrences for each of these events in Monmouth County (where known) is shown in **Figure 3a.6**.

Historical Occurrences – Tornado

According to NCDC, there have been eight recorded tornado events in Monmouth County since 1950. Most of these events were determined to be of minimal tornado intensity, as shown in **Table 3a.10**. These events resulted in no recorded deaths or injuries, but did cause an estimated $1.4 million in property damages, with the most severe event being an F2 tornado that struck northern Manalapan Township and extreme southwest Marlboro Township in May 2001.

Table 3a.10
Historical Tornadoes in Monmouth County (Since 1950)

Location	Date	Magnitude	Deaths	Injuries	Property Damage
Millstone, Township of	08/10/1952	F1	0	0	$25,000
Tinton Falls, Borough of	10/16/1955	F2	0	0	$0
Upper Freehold, Township of	04/18/1960	F1	0	0	$0
Howell, Township of	03/10/1964	F1	0	0	$250,000
Neptune, Township of	03/26/1964	F0	0	0	$25,000
Loch Arbour, Village of	11/01/1994	F0	0	0	$75,000
Middletown, Township of / Highlands, Borough of	08/13/1997	F0	0	0	$50,000
Gordons Corner (northern Manalapan/ southwest Marlboro)	05/27/2001	F2	0	0	$1,000,000
		Total	**0**	**0**	**$1,425,000**

Source: National Climatic Data Center

Notable events include the following:

November 1, 1994
A tornado briefly touched down in the Village of Loch Arbour around 6 p.m. at the intersection of Euclid and Edgemont Avenues. The tornado lifted between Spier and Corlies Avenue about 100 yards from the Atlantic Ocean. About five homes on Euclid Avenue suffered substantial roof damage. Most of the eight other homes which sustained minor damage were on Buena Vista Court. About two dozen trees were uprooted. Most of them were decaying within. Tops were sheared off a number of other trees. Damage was estimated at $75,000.

August 13, 1997
A F0 tornado touched down briefly in Middletown Township and Highlands Borough before it went into Sandy Hook Bay and dissipated. The path length was about 1.2 miles and the path width about 75 yards. The tornado damaged several cars and homes, and uprooted and/or snapped numerous trees, but no injuries were reported. The tornado touched down in northeastern Middletown Township near Pape Drive and Navesink Avenue, moving northeast where it uprooted a tree on Williams Street that crushed three parked cars. Another car was burned when it came in contact with downed wires on Buttermilk Valley Road. A tree also crushed an awning in the Shadow Lane Mobile Home Park. In Highlands Borough, a shed was blown off its foundation and carried by the tornado between two houses. Other structural damage was mainly confined to broken windows, torn shingles and gutters. Maximum wind speeds were estimated at the high end of the F0 scale at about 70 mph.

May 27, 2001
An F2 tornado struck extreme northern Manalapan and extreme southwest Marlboro Townships. The tornado's path length was estimated at 1.5 miles and its path width was around 200 feet. It was initially a relatively weak tornado (F0), but intensified into an F1 before it reached Kentucky Court in Manalapan Township. One property on Kentucky Court lost dozens of trees. The tornado also downed trees on Ivanhoe and Rowena Roads. The tornado reached its maximum strength (F2) as it passed through Debracy Court, where the worst damage occurred. Four houses were severely damaged, and about 12 others suffered minor damage. The tornado weakened to an F1 after it left Debracy Court. As the tornado crossed into Marlboro Township, it knocked down dozens of trees in Hawkins Road Park. As the tornado exited the park, it weakened to an F0. It still knocked a tree onto a house on MacLeisch Drive and ripped shingles

and gutters from homes on Guest and MacLeisch Drives. The tornado lifted as it approached Barclay Brook.

Table 3a.11 lists the number of tornado events in Monmouth County by municipal jurisdiction and by their estimated magnitude. As tornado events might impact multiple jurisdictions, the total number of events in this table is greater than the number of records provided by NCDC based on detailed information regarding impacted areas. The specific location of reported touchdown occurrences for each of these events in Monmouth County (where known) is shown in **Figure 3a.6**.

Table 3a.11
Historical Tornadoes in Monmouth County (1950-2007), By Jurisdiction

Jurisdiction	Number of Events	Magnitude (Fujita Scale)						Maximum F Scale
		F0	F1	F2	F3	F4	F5	
Aberdeen, Township of	0	0	0	0	0	0	0	*Not applicable*
Allenhurst, Borough of	0	0	0	0	0	0	0	*Not applicable*
Allentown, Borough of	0	0	0	0	0	0	0	*Not applicable*
Asbury Park, City of	0	0	0	0	0	0	0	*Not applicable*
Atlantic Highlands, Borough of	0	0	0	0	0	0	0	*Not applicable*
Avon-By-The-Sea, Borough of	0	0	0	0	0	0	0	*Not applicable*
Belmar, Borough of	0	0	0	0	0	0	0	*Not applicable*
Bradley Beach, Borough of	0	0	0	0	0	0	0	*Not applicable*
Brielle, Borough of	0	0	0	0	0	0	0	*Not applicable*
Colts Neck, Township of	0	0	0	0	0	0	0	*Not applicable*
Deal, Borough of	0	0	0	0	0	0	0	*Not applicable*
Eatontown, Borough of	0	0	0	0	0	0	0	*Not applicable*
Englishtown, Borough of	0	0	0	0	0	0	0	*Not applicable*
Fair Haven, Borough of	0	0	0	0	0	0	0	*Not applicable*
Farmingdale, Borough of	0	0	0	0	0	0	0	*Not applicable*
Freehold, Borough of	0	0	0	0	0	0	0	*Not applicable*
Freehold, Township of	0	0	0	0	0	0	0	*Not applicable*
Hazlet, Township of	0	0	0	0	0	0	0	*Not applicable*
Highlands, Borough of	1	1	0	0	0	0	0	F0
Holmdel, Township of	0	0	0	0	0	0	0	*Not applicable*
Howell, Township of	1	0	1	0	0	0	0	F1
Interlaken, Borough of	0	0	0	0	0	0	0	*Not applicable*
Keansburg, Borough of	0	0	0	0	0	0	0	*Not applicable*
Keyport, Borough of	0	0	0	0	0	0	0	*Not applicable*
Lake Como, Borough of	0	0	0	0	0	0	0	*Not applicable*
Little Silver, Borough of	0	0	0	0	0	0	0	*Not applicable*
Loch Arbour, Village of	1	1	0	0	0	0	0	F0
Long Branch, City of	0	0	0	0	0	0	0	*Not applicable*
Manalapan, Township of	1	0	0	1	0	0	0	F2
Manasquan, Borough of	0	0	0	0	0	0	0	*Not applicable*
Marlboro, Township of	1	0	0	1	0	0	0	F2
Matawan, Borough of	0	0	0	0	0	0	0	*Not applicable*
Middletown, Township of	1	1	0	0	0	0	0	F0
Millstone, Township of	1	0	1	0	0	0	0	F1
Monmouth Beach, Borough of	0	0	0	0	0	0	0	*Not applicable*
Neptune City, Borough of	0	1	0	0	0	0	0	*Not applicable*
Neptune, Township of	1	0	0	0	0	0	0	F0
Ocean, Township of	0	0	0	0	0	0	0	*Not applicable*
Oceanport, Borough of	0	0	0	0	0	0	0	*Not applicable*
Red Bank, Borough of	0	0	0	0	0	0	0	*Not applicable*
Roosevelt, Borough of	0	0	0	0	0	0	0	*Not applicable*
Rumson, Borough of	0	0	0	0	0	0	0	*Not applicable*

Table 3a.11
Historical Tornadoes in Monmouth County (1950-2007), By Jurisdiction

Jurisdiction	Number of Events	Magnitude (Fujita Scale)						Maximum F Scale
		F0	F1	F2	F3	F4	F5	
Sea Bright, Borough of	0	0	0	0	0	0	0	*Not applicable*
Sea Girt, Borough of	0	0	0	0	0	0	0	*Not applicable*
Shrewsbury, Borough of	0	0	0	0	0	0	0	*Not applicable*
Shrewsbury, Township of	0	0	0	0	0	0	0	*Not applicable*
Spring Lake, Borough of	0	0	0	0	0	0	0	*Not applicable*
Spring Lake Heights, Borough of	0	0	0	0	0	0	0	*Not applicable*
Tinton Falls, Borough of	1	0	0	1	0	0	0	F2
Union Beach, Borough of	0	0	0	0	0	0	0	*Not applicable*
Upper Freehold, Township of	1	0	1	0	0	0	0	F1
Wall, Township of	0	0	0	0	0	0	0	*Not applicable*
West Long Branch, Borough of	0	0	0	0	0	0	0	*Not applicable*
Total	**10**	**4**	**3**	**3**	**0**	**0**	**0**	**F2**

Source: National Climatic Data Center

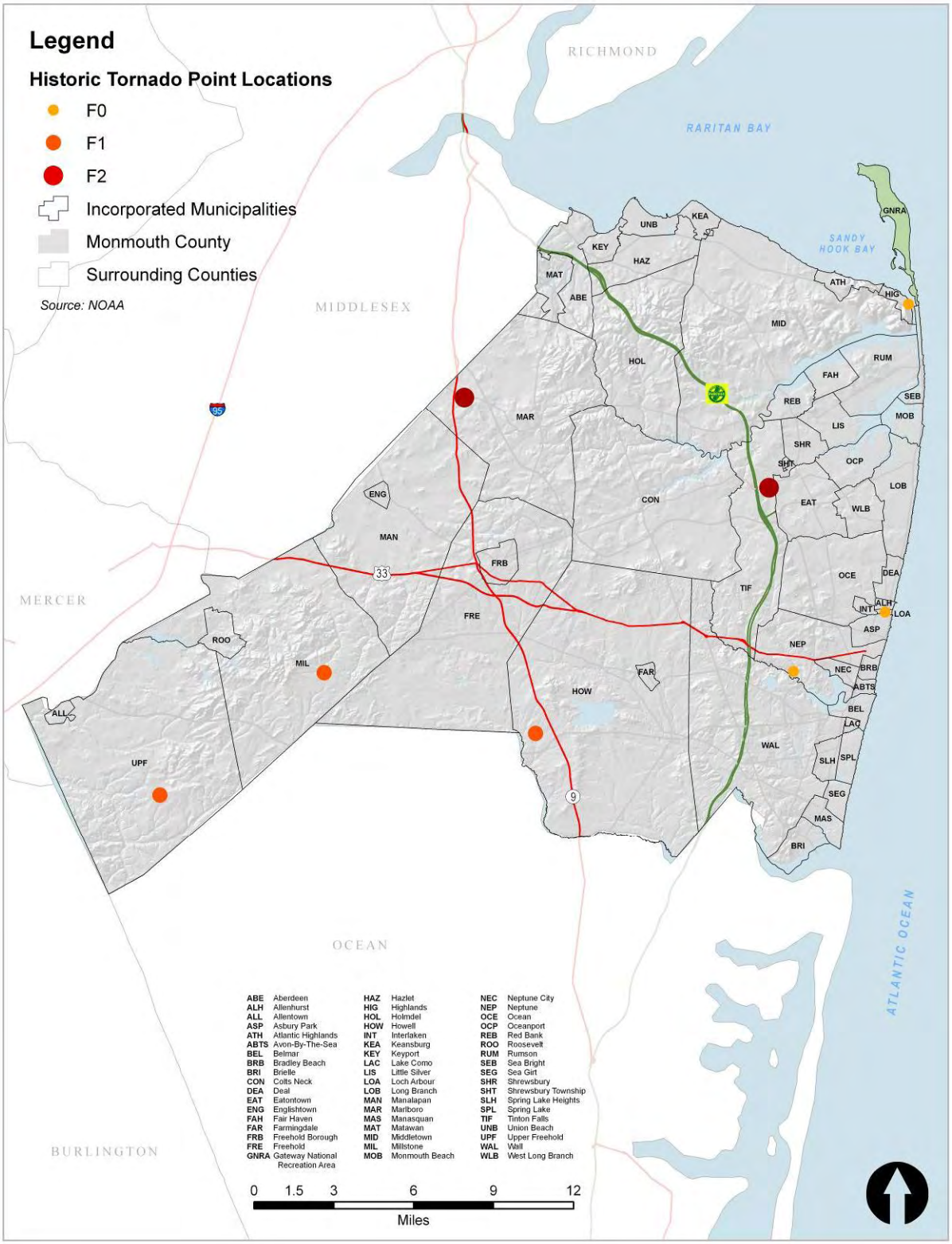
Other notable reports of historical tornado events include the following, as identified by the Planning Committee:

- The Village of Loch Arbour indicated that the F0 tornado reported in 1994 resulted in property damages totaling $200,000.
- The Township of Upper Freehold reported that property damages associated with its one historic event included damage to communications antennas, schools, and horse and agricultural farms.

Probability of Occurrence – Tornado

It is likely that Monmouth County will continue to experience weak to moderate tornado events, though their frequency of occurrence will be fairly low. Probability data made available through NOAAôs National Severe Storms Laboratory (NSSL) indicate that Monmouth County is in an area that experiences less than one tornado event per year. Historical storm data made available through NCDC confirm this data (eight confirmed events in 55 years, resulting in an estimated annual probability of a tornado event of 15 percent).

Figure 3a.6
Historical Tornado Touchdown Locations, 1950-2007



Winter Storm

Description – Winter Storm

A winter storm can range from a moderate snow over a period of a few hours to blizzard conditions with blinding wind-driven snow that lasts for several days. Some winter storms might be large enough to affect several states, while others might affect only limited, localized areas. Many winter storms are accompanied by low temperatures and heavy and/or blowing snow, which can severely impair visibility and disrupt commerce and transportation. Occasionally heavy snow might also cause significant property damages, such as roof collapses on older buildings.

Winter storms may include snow, sleet, freezing rain or a mix of these wintry forms of precipitation. Sleet ï raindrops that freeze into ice pellets before reaching the ground ï usually bounce when hitting a surface and do not stick to objects; however, sleet can accumulate like snow and cause a hazard to motorists. Freezing rain is rain that falls onto a surface with a temperature below freezing, forming a glaze of ice. Even small accumulations of ice can cause a significant hazard, especially on roadways, power lines and trees. An ice storm occurs when freezing rain falls and freezes immediately upon impact on trees, power lines, communication towers, structures, roadways and other hard surfaces. Communications and power can be disrupted for days, and even small accumulations of ice might cause extreme hazards to motorists and pedestrians.

Winter storms typically occur in New Jersey from late November through mid-April, with peak months being December through March. Norôeasters are one type of severe winter storm that typically bring high winds, coastal surge and tidal flooding along with heavy precipitation, which are addressed separately within this section.

Location and Extent – Winter Storm

Nearly the entire continental United States is susceptible to winter storms, but the degree of exposure typically depends on the normal expected severity of local winter weather. Monmouth County is accustomed to severe winter weather conditions and is prepared for the potential disruptions they might cause, though intense winter storms might still overwhelm local capabilities. While Monmouth County is located south of the typical boundary between freezing and non-freezing precipitation during wintertime, annual snowfall on a countywide basis averages 25 to 26 inches and the maximum recorded seasonal snowfall is 70 inches (1957-1958). All areas throughout the County are susceptible to the hazard effects of winter storms including snow and ice, and Monmouth Countyôs coastal jurisdictions are also extremely susceptible to the added effects of storm surge, wave action, coastal erosion and tidal flooding that might be wrought by norôeasters.[4]

Historical Occurrences – Winter Storm

According to NCDC, 79 recorded winter storm events have affected Monmouth County since 1994. These incidents resulted in a reported total of no deaths or injuries in Monmouth County, but did cause an estimated $2.6 million in property damages. Notable events include the following:

January 6-8, 1996
The Blizzard of 1996 brought record breaking snow to most of New Jersey and paralyzed the region for several days, caused most municipalities to exceed their annual snow budgets during this one storm.

[4] Norôeasters and their hazard effects are discussed separately within this section.

Blizzard conditions developed as strong northeast winds developed around the intensifying low. A state of emergency was declared by Governor Whitman, which lasted a week. The state was also declared a federal disaster area. Snowfall accumulations averaged 20 to 30 inches in Monmouth County, with 30 inches in Howell and 28 inches in Freehold. In addition to the heavy snow, wind gusts reached hurricane force along the coast. Eight housing additions in Manasquan collapsed. Navigation Tower aides at Manasquan were toppled. Many areas lost power. Evacuations of some coastal residents occurred in Belmar, Port Monmouth, Sea Bright and Manasquan in Monmouth County. Street flooding was reported in these areas and also in Avon. In Sea Bright, flooding from the Shrewsbury River exacerbated the flooding. New Jersey State Route 36 was closed from the Highlands/Sea Bright Bridge through Monmouth Beach. The worst damage done along the coast was the erosion.

February 16-17, 2003 (President's Day Storm)
The most powerful storm to affect New Jersey since the Blizzard of 1996 struck during the President's Day Weekend. Governor James McGreevey declared a state of emergency, and many municipalities declared their own snow emergencies. In Monmouth County, drifts reached six feet. In Wall Township, a high school roof collapsed on the 18th because of four foot drifts at one corner of the roof. A country store was badly damaged in Freehold. The National Guard was deployed to assist with evacuations. The strong winds caused about 11,000 homes and businesses to lose power. Monmouth Beach was hit the hardest by power outages, waiting two days for power to be restored. Peak wind gusts included 49 mph in Keansburg and snow accumulations included 22.8 inches in Cream Ridge, 22 inches in Hazlet, 21 inches in Manalapan, and 20.5 inches in Wall Township.

January 22, 2005
A very potent Alberta low pressure system dropped heavy snow across northern and southwestern New Jersey and a wintry mix across southeastern New Jersey. Governor Richard Codey declared a state of emergency, requiring vehicles to stay off of public roads and thoroughfares. Gusty northwest winds, which followed in the wake of the storm caused considerable drifting snow and hampered road crewsô efforts as drifts continued to form on roads. The unseasonably cold weather also rendered the salt less effective. Snow emergencies were declared by many municipalities. Specific snowfall accumulations included 17 inches in Howell and 16.5 inches in Cream Ridge.

February 14, 2007 (Valentine's Day Storm)
A severe winter storm impacted the Ohio Valley before moving northeast over New England. Monmouth County experienced a severe icing, with 0.5 inches of ice accumulation reported at Tinton Falls. Peak wind speeds ranged from 36 to 48 mph. Cream Ridge recorded 3.2 inches of total precipitation, which was all sleet. Numerous trees were downed and extensive power outages plagued the area.

Other notable reports of historical winter storm events include the following, as identified by the Planning Committee:

- The Township of Aberdeen was affected by the Blizzard of 1996, as well as severe snowstorms in 2003, 2005 and 2006. The Township incurred substantial costs related to emergency protective measures, snow removal, etc.
- The Borough of Avon-By-The-Sea reported that winter storms have been the most common occurrence resulting in disaster declarations for their jurisdiction in the past few years.
- The Borough of Brielle indicated that the most severe winter storms affecting Brielle are usually coastal/norôeaster events, during which the Borough experiences minor to moderate coastal flooding. The other major concern is power outages due to snow laden trees/branches falling on power lines.
- The Borough of Fair Haven reported that the Valentineôs Day Storm of 2007 caused power outages that lasted for several days.
- The Township of Ocean was heavily impacted by the Valentineôs Day Storm of 2007 which paralyzed a section of town by fallen trees across roadways and downed power/phone lines, which caused the evacuation of several hundred residents.
- The Borough of Oceanport indicated that the Valentineôs Day Storm of 2007 had a big impact on all areas. Major cleanup lasted over a month and some areas went without power for 12 to 18 hours.

- The Borough of Shrewsbury was heavily affected by the ice storm of February 2007, which caused three days of power outage for 90 percent of the areaôs homes and businesses, and up to seven days for several dozen homes. It also caused damage to three private homes.

Probability of Occurrence – Winter Storm

Winter storm events will remain a very frequent occurrence in Monmouth County, and the probability of future occurrences in Monmouth County is certain. While the impact of snow and ice storms will cause major disruptions to transportation, commerce and electrical power as well as significant overtime work for government employees, large scale property damages and/or threats to human life and safety are not expected. Norôeasters occur less frequently but represent a much greater hazard of concern as it relates to the impacts of winter storm events (addressed separately within this section).

Coastal Erosion

Description – Coastal Erosion

Coastal erosion is a hydrologic hazard defined as the wearing away of land and loss of beach, shoreline or dune material and is measured as the rate of change in the position or horizontal (landward) displacement of a shoreline over a period of time. Short-term erosion typically results from episodic natural events such as hurricanes and storm surge, windstorms and flooding hazards, but may be exacerbated by human activities such as boat wakes, removal of dune and vegetative buffers, shoreline hardening and dredging. Long-term erosion is a function of multi-year impacts such as wave action, sea level rise, sediment loss, subsidence and climate change. Climatic trends can change a beach from naturally accreting to eroding due to increased episodic erosion events caused by waves from an above-average number of storms and high tides, or the long-term effects of fluctuations in sea level.

Natural recovery from erosion can take years to decades. If a beach and dune system does not recover quickly enough naturally, coastal and upland property may be exposed to further damage in subsequent coastal erosion and flooding events. Human actions to supplement natural coastal recovery, such as beach nourishment, dune stabilization and shoreline protection structures (sea walls, groins, jetties, etc.) can mitigate the hazard of coastal erosion, but may exacerbate it under some circumstances.

Death and injury are not associated with coastal erosion; however, it can cause the destruction of buildings and infrastructure and represents a major threat to the local economies of coastal communities that rely on the financial benefits of recreational beaches.

Location and Extent – Coastal Erosion

All of Monmouth Countyôs coastal jurisdictions are susceptible to the coastal erosion hazard. Following a review of historic shoreline data dating back to 1836 provided by the New Jersey Department of Environmental Protection (NJDEP), it is clear that Monmouth County has experienced significantly changing shorelines (moving landward and seaward) due to the effects of erosion, accretion, beach nourishment and structural shoreline protection measures.

The severity of coastal erosion is typically measured through a quantitative assessment of annual shoreline change for a given beach cross-section of profile (feet or meters per year) over a long period of time.[5] Erosion rates vary as a function of shoreline type and are influenced primarily by episodic events, but can be used in land use and hazard management to define areas of critical concern. Unfortunately, there is no uniform erosion rate database or GIS data layer that defines erosion rates or such areas of critical concern for Monmouth Countyôs shoreline. However, NJOEM indicates that the New Jersey coast is characterized by episodic change resulting from severe but episodic storm events with a recurrence interval of 25 years or greater. Areas of natural erosion and accretion show erratic and almost cyclical patterns in response to storm events. The recovery process, although long, results in a stable beach with a slight recession of approximately one foot per year, half of which can be attributed to relative sea level rise. While erosion rates experienced along the New Jersey shore may vary significantly from location to location, and no global maximum rate is readily available for Monmouth County, according to a study prepared by the Heinz Center[6], much of the coastline of New Jersey, including Monmouth County, experiences an average of three feet of erosion per year.

[5] Seasonal fluctuations in beach width is common along the New Jersey shore, but is not considered erosion as the sand removed is typically re-deposited at other times of the year.

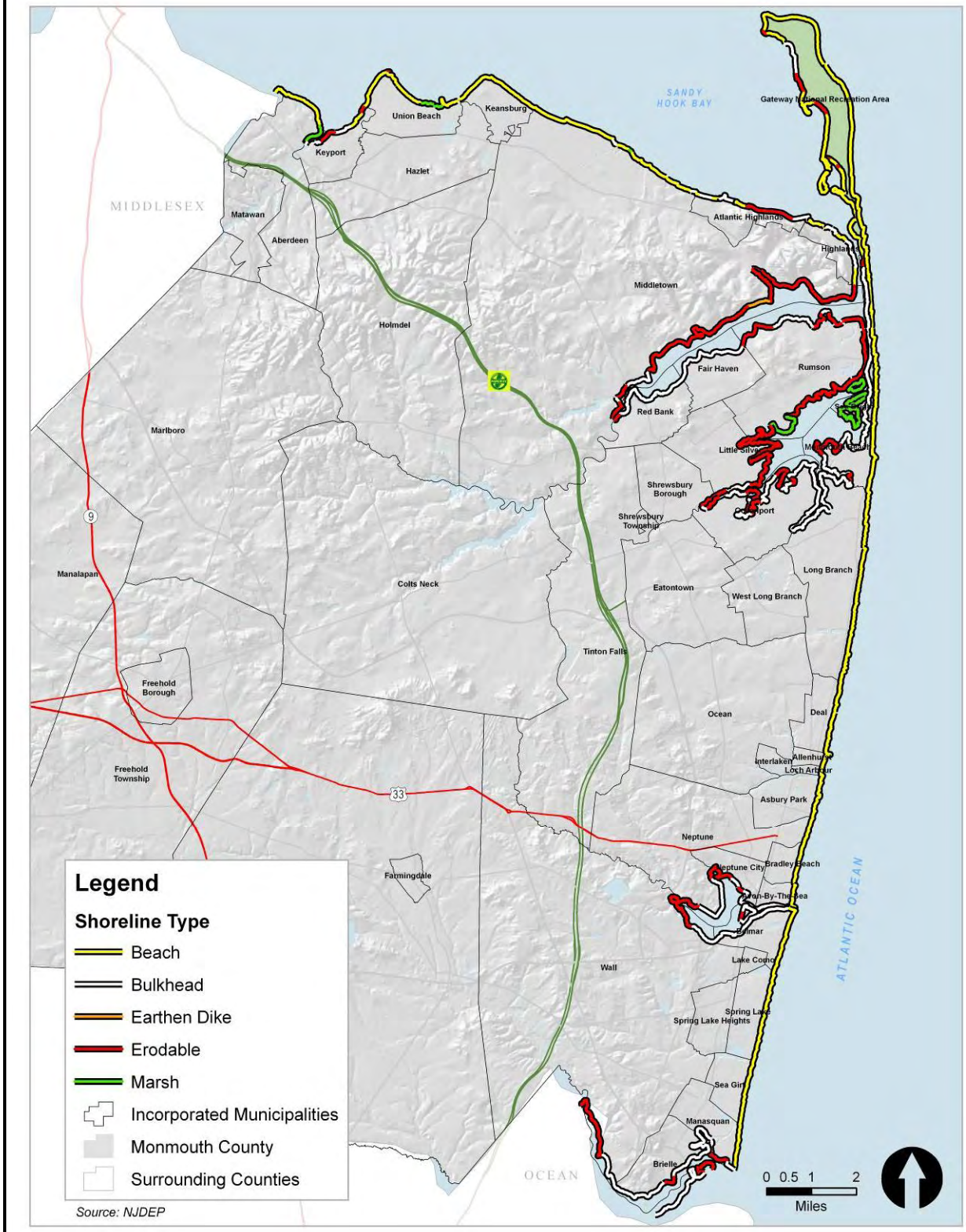
[6] ñ*Evaluation of Erosion Hazards*ò prepared by The H. John Heinz III Center for Science, Economics and the Environment, April 2000. www.heinzctr.org/NEW_WEB/PDF/erosnrpt.pdf#pagemode=bookmarks&view=Fit

Figure 3a.7 illustrates the type of shorelines in Monmouth County as classified by NJDEP. These include the following types: (1) beach, which includes waterfront areas comprised of 100 percent sand; (2) bulkhead, which includes manmade structures at the water's edge, after the rip-rap, which were designed to hold back water and protect the adjacent areas from erosion; (3) marsh, which is classified areas of natural marsh edge; (4) earthen dike, classified as structures which serve as natural barriers between the land and the water; and (5) erodable, which includes any soft shoreline other than beach, rock, marsh or earthen dike, which are vulnerable at the water's edge. As can be seen in the figure, most of Monmouth Countyôs shoreline is classified as susceptible to coastal erosion (including ñbeachò and ñerodableò classifications). Coastal erosion in these areas, where coupled with densely developed or significant recreational shorelines, are routinely addressed through beach nourishment programs.

Although not shown on the countywide map figure, there are also many shoreline protection features located along the Monmouth County shore that are designed to reduce coastal storm and erosion hazards. These include hard structures such as jetties, groins, revetments, sea walls and breakwaters. Jetties and groins are protective structures (usually built from rock, wood or concrete) which extend outward from the shoreline. They look alike and provide similar function, but the difference between the two is that jetties are located at inlets, while groins are located along beaches. Sea walls are similar to bulkheads in function, but unlike bulkheads, they are located along the high beach line adjacent to the ocean, protecting property from ocean forces. Revetments are sea walls, which are surrounded on either side by rock or earth fill. A breakwater structure is a protective barrier placed in the water, out in front of a harbor.

In addition to hard structures, some areas also feature coastal protection systems incorporating engineered dunes and beaches, which are maintained through regular scheduled maintenance and renourishment. Failure to continue these activities would result in an increased risk of damage in many areas during coastal storm events, as the levels of protection are degraded. However, local government entities within Monmouth County and the State of New Jersey have been very active in cooperating with Federal government agencies to ensure that these activities continue to be implemented and adequately maintained. These practices are encouraged and expected to continue.

Figure 3a.7
NJDEP Shoreline Classifications for Monmouth County



Historical Occurrences – Coastal Erosion

According to NCDC, 24 recorded instances of episodic coastal erosion have affected Monmouth County since 1995, which include those instances associated with other hazard event types such as hurricanes and tropical storms, norôeasters, coastal flooding, storm surge and wave action (listed in **Table 3a.12**, and addressed separately within this section).

Table 3a.12
Historical Incidents of Coastal Erosion

Date	Associated Hazard Event Type
08/14/1995	Wave Action
01/06/1996	Winter Storm
07/13/1996	Tropical Storm
06/02/1997	Coastal Flood
10/19/1997	Coastal Flood
11/14/1997	Coastal Flood
02/04/1998	Coastal Flood/ Erosion
05/11/1998	Coastal Flood
08/23/1998	Wave Action
01/15/1999	Coastal Flood
08/30/1999	Coastal Flood/ Erosion
03/21/2000	Coastal Flood
10/01/2001	Coastal Flood
10/16/2002	Coastal Flood
11/05/2002	Coastal Flood
11/17/2002	Coastal Flood
09/18/2003	Tropical Storm
12/05/2003	Wave Action
10/21/2004	Wave Action
03/01/2005	Wave Action
10/12/2005	Wave Action
10/24/2005	Wave Action
01/03/2006	Coastal Flood
02/12/2006	Coastal Flood
09/01/2006	Coastal Flood

Some of the more recent notable events include:

January 6-8, 1996
The Blizzard of 1996 created erosion damage along the coast as a result of high winds and waves. Sand was scoured away by the blizzard, leaving some locations vulnerable to future storms with the worst damage from Manasquan southward. In Manasquan, the storm scoured vertically about four feet of beach for a 500-foot stretch.

July 13, 1996
As a result of Tropical Storm Bertha, Monmouth Beach suffered severe beach erosion. Fifty percent of the beach at the south of the borough was gone. This beach is one of dozens in New Jersey that was being replenished under a U.S. Army Corps of Engineers project. There was little beach erosion elsewhere.

February 4, 1998
The strongest norôeaster of the winter caused continuous onshore flow resulting in moderate to severe beach erosion in Monmouth County. Two to four feet of beach were lost in most areas. At Sandy Hook, about 80 percent of the new sand placed in a replenishment project was lost as several hundred feet of beach disappeared. Both Bradley Beach and Ocean Grove were hard hit by erosion. The waves washed sand onto Ocean Avenue in Bradley Beach.

October 12, 2005
A persistent onshore flow for nearly a week caused moderate beach erosion along the shore. In Monmouth County, most vertical cuts averaged two to three feet, but reached up to four feet in Belmar and Spring Lake. Windblown sand was reported in Belmar, Spring Lake and Sea Girt.

Other notable reports of historical coastal erosion events include the following, as identified by the Planning Committee:

- The Township of Aberdeen reported that there has been significant beach erosion in the Cliffwood Beach section of town resulting from hurricanes, tropical storms and norôeasters.
- The Borough of Avon-By-The-Sea indicated that even moderate storms have eaten away at its beachfront leaving portions of the community at risk.
- The Borough of Deal cited that coastal erosion occurs annually for their jurisdiction, and particularly during winter norôeasters.
- The Borough of Keansburg indicated that it is currently experiencing severe coastal erosion.
- The Village of Loch Arbour stated that in 1994 persistent northeasterly winds through the winter to early spring resulted in severe coastal erosion and threatened beach facilities.
- The Township of Ocean has a severe coastal erosion issue along its waterways that lead to the ocean. As storm surge from the ocean pushes back up the waterways, it breaks down the embankments and causes more flooding issues for the ongoing storm and future storms.
- The Borough of Sea Bright has experienced coastal beach erosion since the turn of the 20th century and continues to do so. Also, the Shrewsbury River overtops the western bulkhead every moon tide and in most moderate storms, causing flooding in both the downtown residential and commercial areas of town. The back bay / Shrewsbury River shoreline is mostly bulkhead, but most of it is privately owned and in very poor condition. In some locations the bulkheads require fairly urgent replacement since erosion though the bulkhead line has been observed..
- The Borough of Union Beach, similar to other areas, relies on its coastline as a major line of defense against coastal flooding. Every other year the Borough participates in a sand replenishment program to maintain this line of defense but every coastal storm event increases the amount of sand required for replenishment.

Probability of Occurrence – Coastal Erosion

Coastal erosion remains a natural, dynamic and continuous process for Monmouth Countyôs coastal jurisdictions and its probability of occurrence is certain. The damaging impacts of coastal erosion are lessened through continuous (and costly) beach nourishment and structural shoreline protection measures; however, it is likely that the impacts of coastal erosion will increase in severity due to future episodic storm events as well as the anticipated slow onset, long-term effects of climate change and sea level rise.

Dam Failure

Description – Dam Failure

Dam failure is the breakdown, collapse or other failure of a dam structure characterized by the uncontrolled release of impounded water that results in downstream flooding. In the event of a dam failure, the energy of the water stored behind even a small dam is capable of causing loss of life and severe property damage if development exists downstream. There are varying degrees of failure, and an unexpected or unplanned dam breach is considered one type of failure. A breach is an opening through a dam which drains the water impounded behind it. A controlled breach is a planned, constructed opening and not considered a dam failure event, while an uncontrolled breach is the unintentional discharge from the impounded water body and considered a failure.

Dam failure can result from natural events, human-induced events or a combination of the two. Natural occurrences that may cause dam failure include hurricanes, floods, earthquakes and landslides; human-induced actions may include the deterioration of the foundation or the materials used in dam construction. In recent years, dams have also received considerably more attention in the emergency management community as potential targets for terrorist acts.

Dam failure presents a significant potential for disaster, in that significant loss of life and property would be expected in addition to the possible loss of power and water resources. The most common cause of dam failure is prolonged rainfall that produces flooding. Failures due to other natural events such as hurricanes, earthquakes or landslides are significant because there is generally little or no advance warning. The best way to mitigate dam failure is through the proper construction, inspection, maintenance and operation of dams, as well as maintaining and updating Emergency Action Plans for use in the event of a dam failure.

Location and Extent – Dam Failure

The New Jersey Department of Environmental Protection has identified and classified 106 state-regulated dams[7] located within Monmouth County. Of these, nine dams have been classified as having ñhigh hazard potential,ò meaning their failure may cause the probable loss of life or extensive property damage. Another 13 dams have been classified as having ñsignificant hazard potential,ò meaning their failure may cause significant damage to property and project operation, but loss of human life is not envisioned. This classification applies to predominantly rural, agricultural areas, where dam failure may damage isolated homes, major highways or railroads or cause interruption of service of relatively important public utilities. The remaining 84 dams are classified as ñlow hazard potentialò meaning their failure would cause loss of the dam itself but little or no additional damage to other property. It is important to note that dam hazard classification is based on the consequences of dam failureð not the condition, probability or risk of failure itself.

Specific locations for all state-regulated dams that have been geo-referenced for mapping purposes are illustrated in **Figure 3a.8**. **Table 3a.13** lists information for all state-regulated dams in Monmouth County reported as having high (H) hazard potential or significant (S) hazard potential.

[7] As defined in NJAC 7:20 (Dam Safety Standards),"Dam" means any artificial dike, levee or other barrier, together with appurtenant works, which is constructed for the purpose of impounding water on a permanent or temporary basis, that raises the water level five feet or more above the usual, mean, low water height when measured from the downstream toe-of-dam to the emergency spillway crest or, in the absence of an emergency spillway, the top-of dam.

Figure 3a.8
State-Regulated Dams in Monmouth County

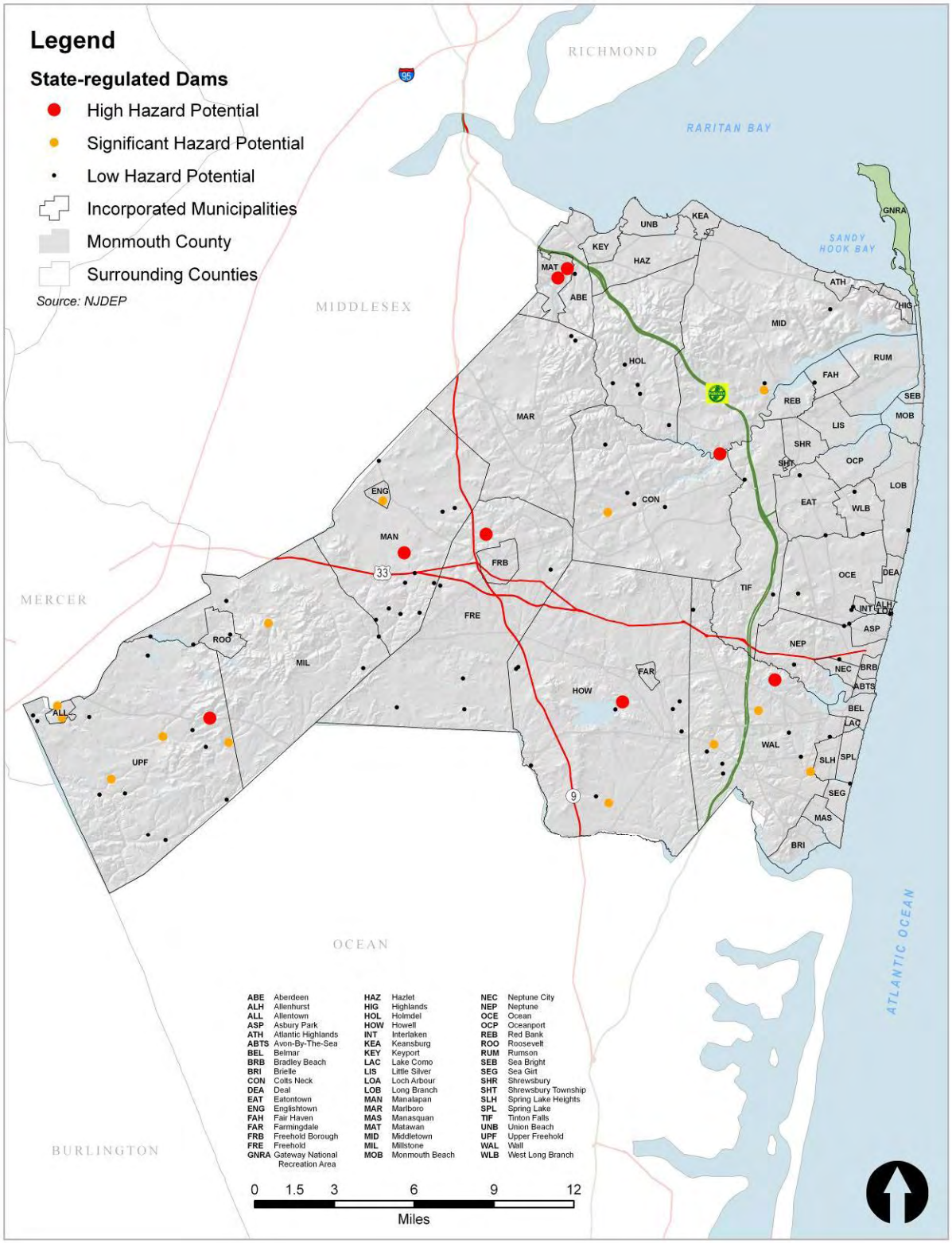


Table 3a.13
State-Regulated Dams with High or Significant Hazard Potential

Dam Name	Hazard Potential	Jurisdiction	River/Stream	Owner(s)
Allentown Dam	H	Allentown Borough	Doctors Creek	County of Monmouth; Borough of Allentown
Brisbane Lake Dam	S	Wall Township	Mill Run	Division of Parks and Forestry; County of Monmouth
Bucks Mill Dam	S	Colts Neck Township	Yellow Brook	County of Monmouth Freeholders
Dawns Dam	S	Upper Freehold Township	Doctors Creek	Private Individual (name withheld)
Echo Lake Dam	H	Howell Township	Haystack Brook-TR	Township of Howell; County of Monmouth Bridge Department
Englishtown Lake Dam	S	Emglishtown Borough	Weamaconk Creek	County of Monmouth
Glendola Reservoir Dam*	H	Wall Township	Robins Swamp Brook	New Jersey-American Water Company
Hurley Pond Dam	S	Wall Township	Wreck Pond Brook	County of Monmouth; Wall Township; Private Individual (name withheld)
Imlaystown Lake Dam	S	Upper Freehold Township	Doctors Creek	Division of Fish & Wildlife; Township of Freehold; County of Monmouth
Indian Dam	S	Allentown Borough	Indian Run	County of Monmouth; Borough of Allentown
Lake Lefferts Dam	H	Matawan Borough	Matawan Creek	Borough of Matawan; County of Monmouth
Lake Louise Dam	S	Howell Township	Haystack Brook	Howell Township; Private Individual (name withheld)
Lake Topanemus Dam	H	Freehold Township	McGellaird's Brook	County of Monmouth; Borough of Freehold; Township of Freehold
Manasquan Reservoir Dam*	H	Howell Township	Timber Swamp Brook	New Jersey Water Supply Authority
Matawan Lake Dam	H	Matawan Borough	Gravelly Brook	Borough of Matawan
Millhurst Lake Dam	H	Manalapan Township	Manalapan Brook	Township of Manalapan; County of Monmouth Engineer
New Jersey No Name # 57 Dam	S	Upper Freehold Township	Crosswicks Creek-TR	Fair Winds Farm, Inc.
Old Mill Pond Dam	S	Wall Township	Wreck Pond Brook	Township of Wall; Old Mill Inn
Perrineville Dam	S	Millstone Township	Rocky Brook	County of Monmouth
Red Valley Dam	S	Upper Freehold Township	Doctors Creek	County of Monmouth
Shadow Lake Dam	S	Middletown Township	Quioley Creek	County of Monmouth; Township of Middletown
Swimming River Reservoir Dam*	H	Colts Neck Township	Robins Swamp Brook	New Jersey-American Water Company

Source: New Jersey Department of Environmental Protection, Bureau of Dam Safety and Flood Control
* Dam also listed as a ñmajorò dam in the USGS National Inventory of Dams (NID). Major dams are described as 50 feet or more in height, or with a normal storage capacity of 5,000 acre-feet or more, or with a maximum storage capacity of 25,000 acre-feet or more.

In addition to the dams listed above, representatives of Wall Township have also expressed concern about the Brick Reservoir. While this dam is not currently considered a major dam by the Federal NID, or a high/significant hazard dam in the State's Inventory, local authorities have concerns regarding the impact any failure of this dam would have on the Herbertsville Road area of the Township.

Historical Occurrences – Dam Failure

According to NJDEPôs Bureau of Dam Safety and Flood Control, New Jersey has not experienced any historic major dam failures but there have been an increasing number of small dam failures. This is largely attributed to the lack of maintenance and inspection, as well as the fact that many of the dams in the state are nearing the end of their design life.

Although not catastrophic events, Monmouth County has experienced a number of small dam failure events that have caused reported property damages. Notable events include the following:

July 1989
According to the National Performance of Dams Program (NPDP) at Stanford University, the Holmdel Park Dam located in the Township of Holmdel reportedly failed following heavy rains at the spillway culvert but no associated property damages were reported. Records indicate that seepage piping (soil erosion) was involved in the failure, and the dam was subsequently reconstructed.

October 13-14, 2005
Monmouth County experienced a heavy rain event which brought several inches to the area in a short amount of time. According to NCDC, this led to flooding on area creeks and rivers, which also caused minor dam failures at several locations. Dams failed on both Spring Lake and Mill Pond, and Deal Lake overflowed, forcing the evacuation of nearly 1,200 residents and a declared state of emergency. The failure of a dam on Wreck Pond caused the flooding of Spring Lake Borough, Spring Lake Heights Borough, Sea Girt Borough and Wall Township. A mandatory evacuation of Spring Lake Borough was implemented during the morning of the 14th. In Wall Township, the cost of repairing the Wreck Pond Dam was estimated at $4.2 million. On the other side of the township, a dam breach on Mill Pond within Allaire State Park caused significant water damage and a roadway collapse in the Historic Village within the park, flooding the general purposes building within the Historic Village.

Probability of Occurrence – Dam Failure

The probability of a dam failure occurrence in Monmouth County is relatively low due to routine inspection, repair and maintenance programs, though the possibility of a future failure event is likely increasing due to aging dam structures that may be in need of repair or reconstruction. The NJDEPôs Dam Safety program serves to ensure the safety and integrity of dams in New Jersey and, thereby, protect people and property from the consequences of dam failures.

Drought

Description – Drought

Drought is a natural climatic condition caused by an extended period of limited rainfall beyond that which occurs naturally in a broad geographic area. High temperatures, high winds and low humidity can worsen drought conditions, and can make areas more susceptible to wildfire. Human demands and actions can also hasten drought-related impacts.

Droughts are frequently classified as one of the following four types: meteorological, agricultural, hydrological or socio-economic. Meteorological droughts are typically defined by the level of ñdrynessò when compared to an average, or normal amount of precipitation over a given period of time. Agricultural droughts relate common characteristics of drought to their specific agricultural-related impacts (when the amount of moisture in soil does not meet the needs of a particular crop). Hydrological drought is directly related to the effect of precipitation shortfalls on surface and groundwater supplies. Human factors, particularly changes in land use, can alter the hydrologic characteristics of a basin. Socio-economic drought is the result of water shortages that affect people and limit the ability to supply water-dependent products in the marketplace.

Drought conditions typically do not cause property damages or threaten lives, but rather drought effects are most directly felt by agricultural sectors. At times, drought may also cause community-wide impacts as a result of acute water shortages (regulatory use restrictions, drinking water supply and salt water intrusion). The magnitude of such impacts correlates directly with local groundwater supplies, reservoir storage and development densities.

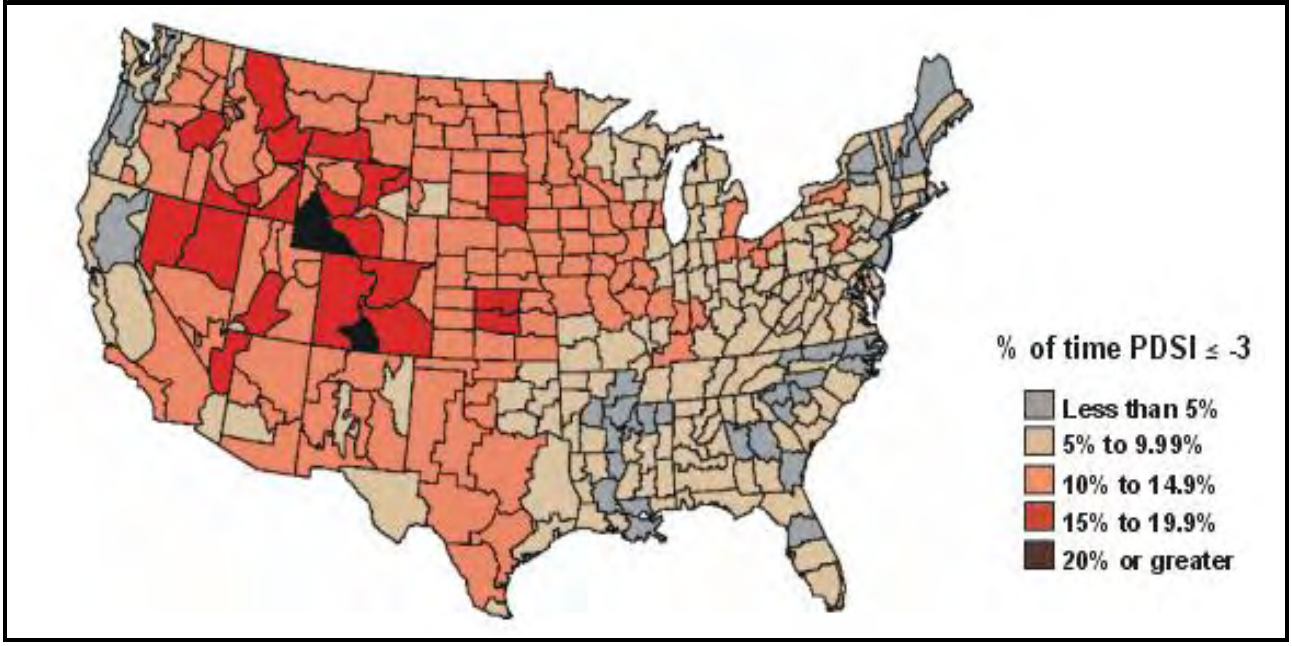
Location and Extent – Drought

Droughts occur in all parts of the country and at any time of year, depending on temperature and precipitation over time. Arid regions are more susceptible to long-term or extreme drought conditions, while other areas (including Monmouth County) tend to be more susceptible to short-term, less severe droughts.

Figure 3a.9 shows the Palmer Drought Severity Index (PDSI) Summary Map for the United States from 1895 to 1995. PDSI drought classifications are based on observed drought conditions and will range from -0.5 (incipient dry spell) to -4.0 (extreme drought). According to the PDSI map, Monmouth County is in a zone that experienced severe drought conditions less than 5 percent of the 100-year period during 1895 to 1995, meaning that severe drought conditions are a relatively low risk for Monmouth County. However, shorter term droughts of less severity are more common and may occur several times in a decade.

The extent of drought impacts for Monmouth County includes public water supply issues, as well as some limited agricultural impacts (crop damages) for rural areas in the central and western municipal jurisdictions. According to NJOEM, Monmouth County is usually not affected during drought conditions as severely as other areas of the state, because most of its water supply is obtained from wells or river flows, and development is not as intense as the northeastern counties. The most severe effects of drought in the area are likely to be experienced by farmers, who can suffer heavy financial losses due to crop loss.

Figure 3a.9
Palmer Drought Severity Index Summary Map for the United States



Source: National Drought Mitigation Center

Historical Occurrences – Drought

According to NCDC, seven recorded instances of drought conditions have affected Monmouth County since 1993, causing an estimated $5 million in losses to agricultural crops.

October 1997
Unseasonably dry weather with below normal rainfall, which became worse during the summer months, forced the Delaware River Basin Commission to declare a drought warning on October 27th. The commission urged the seven million residents within the basin's 13,539 square mile area to voluntarily conserve water. Water levels in the New York City Reservoirs, which are in the headwaters of the Delaware River, fell below 40 percent of capacity in late October. Precipitation deficits through October 31st averaged around five inches.

1998-1999
What began as unseasonably dry weather became a drought, which heavily impacted agriculture and water supplies. As reservoir levels continued to fall, the Delaware River Basin Commission declared a drought warning in December 1998. Also in December, NJDEP declared a drought warning for the entire state. In late December, the Delaware River Basin Commission declared Stage Two of its drought warning. In July 1999, Governor Christie Whitman declared a water shortage alert and called for residents to voluntarily conserve water by not watering lawns or washing cars. In Monmouth County, a drought emergency was declared and odd/even non-essential watering restrictions were implemented. The drought finally ended as Tropical Storm Floyd dumped significant rainfall amounts across the state. Agricultural losses throughout the state as a result of this long drought were estimated at $80 million.

October 2001 - October 2002
Unseasonably dry weather again turned to drought as precipitation levels fell short of normal levels. Continued dry weather, the drop in stream flow and groundwater levels and the reduced levels in the New York State reservoirs prompted NJDEP to upgrade the drought watch to a drought warning for counties in the Delaware River Basin and southern New Jersey in November 2001, including Monmouth County. By October 2002, a drought disaster was declared by the U.S. Department of Agriculture for several states

including New Jersey. Several rain events in October 2002 helped quench the drought and returned the areaôs reservoirs to normal levels.

Other notable reports of historical drought events include the following, as identified by the Planning Committee:

- The Borough of Union Beach indicated that it has been put on water restrictions on many occasions due to the lack of water in the local reservoir.
- The Township of Upper Freehold has reportedly experienced severe drought conditions, which lowered the head pressure of potable water in wells and caused numerous wells to go dry. Most of the area depends on wells for potable water, so it is vitally important to maintain head pressure from the aquifers.

Probability of Occurrence – Drought

Monmouth County faces a low to moderate probability of severe drought conditions, though short-term instances of drought will be a more frequent occurrence. According to the PDSI map, Monmouth County is in a zone that experienced severe drought conditions less than 5 percent of the time between 1895 and 1995, but recent instances of short-term, less severe drought conditions indicate that they are certainly possible.

Flood

Description – Flood

Flooding is the most frequent and costly natural hazard in the United States, a hazard that has caused more than 10,000 deaths since 1900. Nearly 90 percent of presidential disaster declarations result from natural events where flooding was a major component.

Floods are generally the result of excessive precipitation, and can be classified under two categories: general floods, precipitation over a given river basin for a long period of time along with storm-induced wave or tidal action; and flash floods, the product of heavy localized precipitation in a short time period over a given location. The severity of a flooding event is typically determined by a combination of several major factors, including: stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface.

General floods are usually long-term events that may last for several days. The primary types of general flooding include riverine, coastal and urban flooding. Riverine flooding is a function of excessive precipitation levels and water runoff volumes within the watershed of a stream or river. Coastal flooding is typically a result of storm surge, wind-driven waves and heavy rainfall produced by hurricanes, tropical storms and other large coastal storms. Urban flooding occurs where manmade development has obstructed the natural flow of water and decreased the ability of natural groundcover to absorb and retain surface water runoff.

Most flash flooding is caused by slow-moving thunderstorms in a local area or by heavy rains associated with hurricanes and tropical storms. However, flash flooding events may also occur from a dam or levee failure within minutes or hours of heavy amounts of rainfall, or from a sudden release of water held by a retention basin or other stormwater control facility. Although flash flooding occurs most often along mountain streams, it is also common in urbanized areas where much of the ground is covered by impervious surfaces.

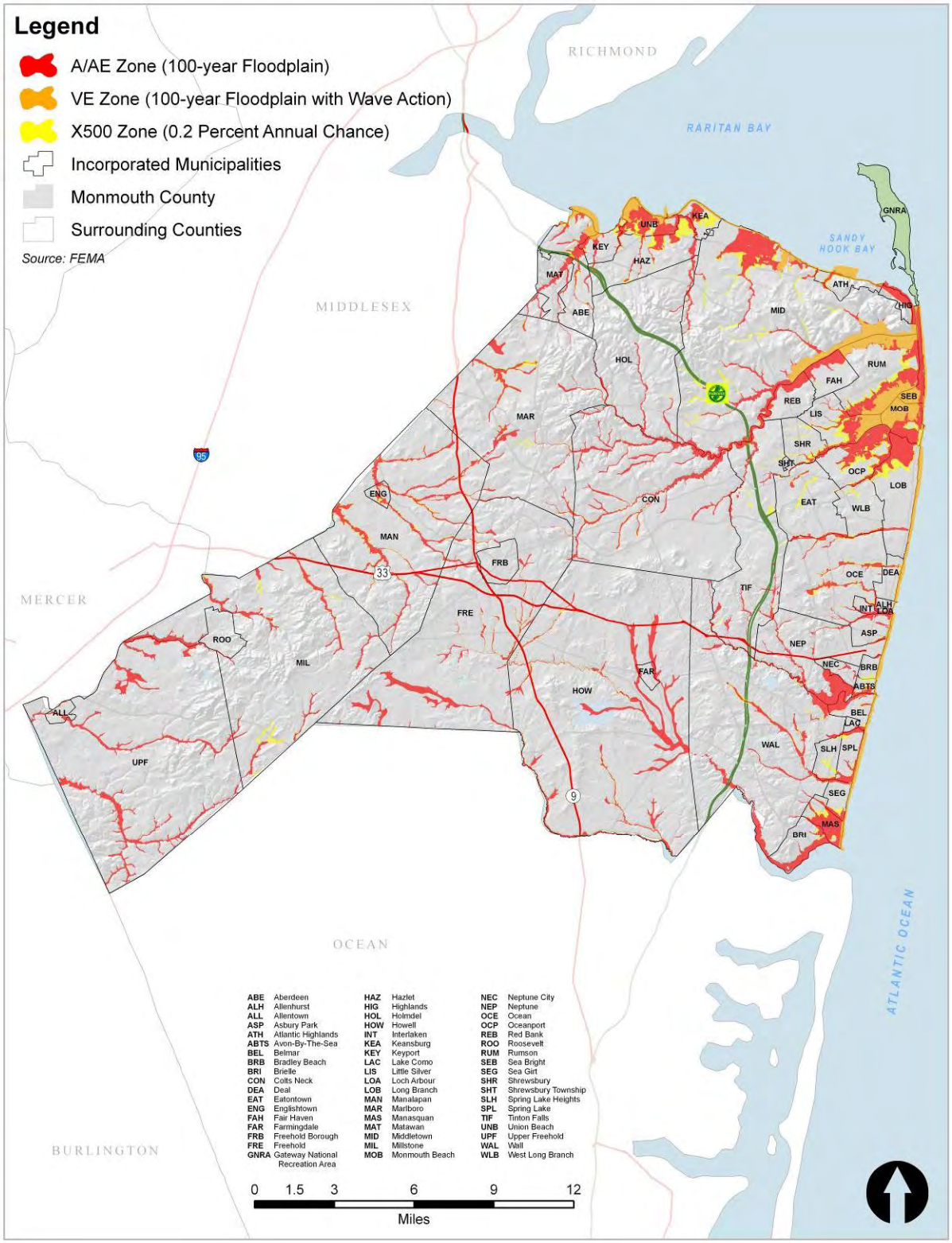
The periodic flooding of lands adjacent to rivers, streams and shorelines (land known as floodplain) is a natural and inevitable occurrence that can be expected to take place based upon established recurrence intervals. The recurrence interval of a flood is defined as the average time interval, in years, expected between a flood event of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence intervals, and floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be inundated by the 10-year flood and the 100-year floodplain by the 100-year flood. Another way of expressing the flood frequency is the chance of occurrence in a given year, which is the percentage of the probability of flooding each year. For example, the 100-year flood has a 1 percent chance of occurring in any given year. The 500-year flood has a 0.2 percent chance of occurring in any given year.

Location and Extent – Flood

Many areas of Monmouth County are susceptible to riverine and urban (stormwater) flooding, and its coastal jurisdictions are also very susceptible to tidal and coastal flooding due to coastal storm events including storm surge.[8] It is estimated that nearly 10 percent of lands within Monmouth County are located in the 100-year floodplain. **Figure 3a.10** illustrates the location and extent of currently mapped

[8] Storm surge is addressed separately within this section.

Figure 3a.10
Special Flood Hazard Areas in Monmouth County



special flood hazard areas for Monmouth County based on FEMA digital Q3 flood data. This includes Zones A/AE (100-year floodplain), Zone VE (100-year coastal flood zones, associated with wave action) and Zone X500 (500-year floodplain). It is important to note that while FEMA digital flood data is recognized as best available data for planning purposes, it does not always reflect the most accurate and up-to-date flood risk. Flooding and flood-related losses often do occur outside of delineated special flood hazard areas ï particularly in areas that were note included in detailed study areas.

Several municipalities in the County, mostly in coastal areas, already benefit from some existing flood protection structures such as levees, floodwalls, and beach/dune systems. In cases where these structures have been certified by FEMA as providing protection to the ñ100-yearò flood event, their effectiveness in reducing flood risk is implicit in the current flood mapping (Figure 3a.10), since the areas they protect to this level have been removed from the A/AE Zones. However, there is currently no readily available database which identifies these structures, their construction types, dimensions, level of protection, assets protected, and existing maintenance operations. For future updates of this plan, the County should consider as an action item a comprehensive effort to compile such a database, which will aid both the County and individual municipalities in future flood mitigation planning activities.

When this hazard mitigation planning process was initiated in June of 2007, the Q3 mapping represented best readily available digital data on the flood hazard in Monmouth County, and thus was selected for use in the risk assessment. Halfway through the planning process, in January of 2008, FEMA released Preliminary DFIRMs for Monmouth County. It was not deemed appropriate at this late date to revisit all aspects of the plan related to flooding, to incorporate what was only ñpreliminaryò data, of which several municipalities indicated that they planned to file appeals/protests. In addition, the appeal protest period was not scheduled to open until one month before the Draft Plan was scheduled for release, and the DFIRM effective date is still many months away at this time (not being targeted for release until June 2009). Because the new DFIRMs did not become available until half way through the planning process, were preliminary, are being appealed in some locations for which they were available, and do not represent the current adopted floodplain maps being enforced by local municipalities in the planning area, the decision was made to use the Q3 data for this initial version of the hazard mitigation plan. The flooding portion of this hazard mitigation plan will have to be revised during the next plan update to reflect changes between the Q3 mapping and the Final adopted DFIRMs, which are not targeted for release until the Summer of 2009.

Historical Occurrences – Flood

Flooding is the most common major natural hazard in New Jersey. According to NCDC, 83 recorded flood events have occurred in Monmouth County since 1993. These events have resulted in no deaths or injuries and an estimated $18.2 million in property damages. Some recent notable events include the following:

February 4, 1998
In Monmouth County, damage was estimated at $500,000 as the county was spared by the eastward movement of the norôeaster off of Cape Hatteras. The continuous onshore flow caused moderate to severe beach erosion (described under coastal erosion hazard). New Jersey State Route 36 was flooded in Sea Bright. In Raritan Bay, tidal flooding caused road closures in Middletown Township.

September 16, 1999
Hurricane Floyd brought torrential rains. In Monmouth County, the worst flooding related problems occurred when the torrential rain coincided with the high tide. The worst flooding was reported in Union Beach and bay areas of Middletown Township. Mandatory evacuations occurred in Union Beach (which became an island) and voluntary evacuations occurred in Middletown Township along the bay and near Compton's and Pew Creeks. New Jersey State Routes 35 and 36 were closed due to flooding. Farther inland, Manalapan Township was hardest hit with overflowing brooks that forced the closure of six roads

and sandbagging of homes on Birmingham Road. Coastal areas escaped with minimal damage: just some minor beach erosion and minor back bay flooding at times of high tide. Thousands of barrels and drums (some containing hazardous solvents and acids) were found bobbing in the waters of Raritan and Sandy Hook Bays and washed ashore on local beaches. Precipitation totals in Monmouth County included 6.4 inches in Hazlet, 5.82 inches in Marlboro, 5.2 inches in Sandy Hook and 4.57 inches in Keansburg.

October 13-14, 2005
Heavy rain associated with a low pressure system southeast of New Jersey moved into Monmouth County on the 13th. Three-day storm totals (from the 11th through the 14th) in the county averaged between four and 11 inches, with the highest amounts near the coast. In Asbury Park and Loch Arbour Village, Deal Lake overflowed and forced the evacuation of about 65 homes in Loch Arbour and 30 homes in Asbury Park. In Eatontown Borough, Eatoncrest Apartments flooded as water was three to four feet deep in areas. In Belmar Borough, flooding occurred along Lake Como and along the Shark River. In Monmouth Beach, flooding along the Shrewsbury River affected several blocks. In Ocean Township, flooding along the Poplar Brook caused the evacuation of the entire 104 unit Poplar Village Senior Citizens Center. After the brook receded, 22 units were deemed uninhabitable. In Rumson Borough, flooding along the Shrewsbury River closed roads near the Sea Bright-Rumson Bridge. In Howell Township, seven units of the Friendship Gardens (Senior Citizen) complex were evacuated. Metedeconk River flooding also affected Freehold Township, the Borough of Spring Lake and Wall Township. Dozens of homes were flooded, mainly along Ocean Road and Union Avenue. The borough sewage treatment plant flooded. Saint Catherine's Grammar School was hit hard with up to 2.5 feet of water on its first floor. In Spring Lake Heights, Borough Shore Road and Jersey Avenue flooded with cars under water. The Brighton Avenue Bridge was also damaged. About 11 homes were evacuated and three were classified as uninhabitable. Elsewhere in the township, flooding along Whalepond Brook inundated Branch Road. The Manasquan River at Squankum reached its 7.5 foot flood stage on the 13th, cresting at 9.62 feet on the 14th. Specific storm totals included 11.58 inches in Manasquan and 10.15 inches in Tinton Falls.

Other notable reports of historical flood events include the following, as identified by the Planning Committee:

- Major tidal and storm surge flooding occurred to jurisdictions located along the immediate shoreline and along the Shrewsbury River during the 1992 norôeaster, resulting in an estimated $270 million in insured damage to public and private property.
- The Township of Aberdeen indicated that the low-lying areas of Cliffwood Beach have been subject to repeated flooding during storms.
- The Borough of Allentown reported that during periods of heavy rainfall, Doctors Creek and Indian Creek have overflowed their banks and backed up the municipalityôs drainage system, which causes flooding of streets and adjacent properties.
- The Borough of Avon-By-The-Sea reported that coastal flooding occurs even during moderate storm events.
- The Borough of Bradley Beach has had flooding situations due to storms in the past, and currently a lake frequently crests due to outfall pipes being inoperable.
- The Borough of Brielle indicated that historically the damages caused by flood events have been confined to flooded basements on private property.
- The Borough of Farmingdale stated that Mariners Cove rests in the middle of an ox-bow in the Manasquan River and has flooded five residences on at least five different occasions and has inundated the road and threatened the residences on a regular basis.
- The Township of Hazlet indicated that there are multiple roadways that flood during extreme rain events, including state highways.
- The Borough of Keansburg has certain areas that currently flood during extreme high tides and severe rain storms.
- The Village of Loch Arbour reported that the flood event of October 2005 affected 80 percent of the village.
- The Township of Marlboro explained that its flooding issues have been worsening in the past seven to 10 years. Small streams overflow their banks regularly during prolonged rain events, and severe storms cause widespread flooding in these areas.

- The Borough of Matawan reported that Aberdeen Road, Ravine Drive and occasionally Main Street (near Lake Matawan) have been subject to historical flooding.
- The Borough of Neptune City indicated that it is vulnerable to both street flooding during heavy rains as well as tidal and storm flooding from the Shark River.
- The Township of Ocean experiences a severe flooding issue every time it rains hard for more than 30 minutes. During any storm, there is an 85 percent chance or better that the Township will have to evacuate residents (mostly senior citizens) from their homes. This has occurred every year since 1985.
- The Borough of Oceanport indicated that even frequent heavy rains will cause minor to moderate flooding (particularly street flooding) due to the low lying nature of the area. In addition, the storm drainage infrastructure reportedly needs improvements due to development over the years. Past flooding has caused major traffic issues with County and local roadways flooding.
- The Borough of Shrewsbury has reported that only minor localized flooding occurs in the town, mostly surrounding local streams and due to poor storm drainage along the roads.
- The Borough of Spring Lake reported significant riverine flooding occurrences in the Wreck Pond subwatershed. Damages of $9.8 million were reported in this area following the October 2005 flood event.
- The Township of Upper Freehold has indicated that all County and Township roads in its jurisdiction have no shoulders, and heavy rain from storm events erodes or washes out the roadways.

Historical Summary of Insured Flood Losses

According to FEMA flood insurance policy records, there have been more than 7,300 flood losses reported in Monmouth County through the National Flood Insurance Program (NFIP) since 1972, totaling more than $76 million in claims payments. Every municipal jurisdiction in Monmouth County with the exception of Freehold Borough and Shrewsbury Township is listed by FEMA as being an active participant in the NFIP. The name of the Floodplain Administrator (the person responsible for ensuring that development activities comply with floodplain management ordinances and NFIP regulations) for each jurisdiction, as of April 2008, is included in Appendix A.

In addition to NFIP participation, the Boroughs of Bradley Beach, Manasquan, Sea Bright, Spring Lake, and Union Beach are listed by FEMA as Community Rating System (CRS) eligible communities. Under the CRS, communities which implement floodplain management actions that go beyond the minimum requirements of the NFIP are eligible for discounts on flood insurance premiums for properties within that community.

Monmouth County OEM will continue to work with all jurisdictions in the County, encouraging them all to participate fully in the National Flood Insurance Program, and to take full advantage of additional FEMA programs such as the Community Rating System (CRS). Jurisdictions already eligible for the CRS will be encouraged to upgrade their CRS status, while non-eligible jurisdictions will be encouraged t work towards eligibility. The County will also support local jurisdiction participation in the Cooperating Technical Partners Program (CTP), of which the main objective is to increase local involvement in the floodplain mapping process.

Table 3a.14 lists the number of losses and total claims payments under the NFIP, by municipal jurisdiction. It should be emphasized that this listing includes only those losses to structures that were insured through the NFIP policies, and for losses in which claims were sought and received. It is likely that many additional instances of flood losses in Monmouth County were either uninsured, denied claims payment, or not reported.

Table 3a.14
National Flood Insurance Program Loss Statistics (as of June 30, 2008)
Source: FEMA / http://bsa.nfipstat.com/reports/1040.htm#34

Jurisdiction	Date Entered NFIP	Current Effective FIRM Date	CRS Class	Number of Losses	Total Claims Payments
Aberdeen, Township of	03/18/85	08/03/92		22	$146,428
Allenhurst, Borough of	03/15/79	09/15/83		15	$171,799
Allentown, Borough of	09/16/81	09/16/81		3	$5,143
Asbury Park, City of	02/15/79	09/15/83		27	$197,171
Atlantic Highlands, Borough of	08/03/81	07/05/84		31	$210,553
Avon-By-The-Sea, Borough of	03/15/79	07/05/83		98	$549,967
Belmar, Borough of	05/12/72	03/01/84		133	$941,070
Bradley Beach, Borough of	08/01/79	06/15/83	7	18	$44,103
Brielle, Borough of	04/02/79	04/02/79		77	$491,890
Colts Neck, Township of	04/15/82	04/15/82		23	$54,771
Deal, Borough of	03/05/76	03/05/76		54	$350,314
Eatontown, Borough of	09/16/81	09/16/81		11	$10,503
Englishtown, Borough of	03/15/81	03/15/81		10	$32,719
Fair Haven, Borough of	10/16/79	10/16/79		16	$82,518
Farmingdale, Borough of	11/26/82	11/26/82		4	$144,860
Freehold, Borough of	Not in NFIP				
Freehold, Township of	04/04/83	04/04/83		26	$86,344
Hazlet, Township of	12/01/82	12/01/82		43	$343,377
Highlands, Borough of	09/03/71	09/03/71		654	$5,904,615
Holmdel, Township of	03/01/82	03/01/82		7	$244,282
Howell, Township of	01/06/83	01/06/83		33	$148,975
Interlaken, Borough of	01/02/81	01/02/81		5	$98,988
Keansburg, Borough of	05/16/83	05/16/83		66	$200,032
Keyport, Borough of	07/02/79	07/02/79		75	$1,700,470
Lake Como, Borough of	11/28/80	11/28/80		8	$14,263
Little Silver, Borough of	02/01/78	12/15/82		158	$3,256,482
Loch Arbour, Village of	03/15/79	09/15/83		37	$377,636
Long Branch, City of	05/05/76	01/05/84		504	$4,463,572
Manalapan, Township of	09/15/77	09/15/77		27	$120,925
Manasquan, Borough of	05/12/72	12/15/83	8	774	$6,103,304
Marlboro, Township of	06/15/78	04/09/82		36	$48,034
Matawan, Borough of	09/30/81	09/30/81		21	$96,578
Middletown, Township of	02/15/84	07/15/92		391	$2,842,987
Millstone, Township of	01/20/82	01/20/82		4	$4,417
Monmouth Beach, Borough of	05/16/77	07/15/92		864	$11,060,063
Neptune City, Borough of	08/11/78	08/11/78		19	$225,891
Neptune, Township of	02/16/77	03/01/84		93	$815,829
Ocean, Township of	10/14/77	10/14/77		418	$4,094,475
Oceanport, Borough of	02/16/77	02/16/77		371	$6,684,169
Red Bank, Borough of	05/19/81	05/19/81		10	$368,110
Roosevelt, Borough of	12/21/73	07/15/92		0	$0
Rumson, Borough of	10/08/71	07/15/92		399	$5,012,777
Sea Bright, Borough of	03/05/76	01/05/84		1,134	$11,560,466
Sea Girt, Borough of	08/01/79	08/01/79	10	31	$164,371
Shrewsbury, Borough of	04/04/83	04/04/83		6	$5,628
Shrewsbury, Township of	Not in NFIP				
Spring Lake, Borough of	02/17/82	03/01/84	8	191	$4,551,528
Spring Lake Heights, Borough of	12/15/81	12/15/81		17	$191,495
Tinton Falls, Borough of	04/15/82	04/15/82		2	$1,577

Table 3a.14
National Flood Insurance Program Loss Statistics (as of June 30, 2008)
Source: FEMA / http://bsa.nfipstat.com/reports/1040.htm#34

Jurisdiction	Date Entered NFIP	Current Effective FIRM Date	CRS Class	Number of Losses	Total Claims Payments
Union Beach, Borough of	05/15/80	07/15/92	8	340	$2,276,597
Upper Freehold, Township of	10/02/79	12/11/81		2	$5,235
Wall, Township of	02/16/77	02/16/77		29	$361,373
West Long Branch, Borough of	01/16/81	01/16/81		10	$13,274
Total				**7,347**	**$76,881,948**

Repetitive Loss Properties

FEMA defines a repetitive loss property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period, since 1978. A repetitive loss property may or may not be currently insured by the NFIP. Currently there are over 122,000 repetitive loss properties nationwide.

According to FEMA repetitive loss property records there are 594 ñnon-mitigatedò repetitive loss properties located in Monmouth County as of August 27, 2008. These properties are associated with a total of 1,541 losses and slightly less than $30 million in claims payments under the NFIP since January 1978 (the earliest recorded date of loss), as shown in **Table 3a.15**, while **Table 3a.16** identifies the number and type of repetitive loss properties that are located in each identified flood hazard zone for each municipality. The approximate areas where RL properties are clustered are plotted in **Figures 3a.11 through 3a.13** in comparison with the extent of the mapped A/AE/V Zones (the Base/100-year floodplain). These figures do not show areas of the County where occasional isolated RL properties are located, and they show only the approximate areas covering clusters of RL properties, since the component data is subject to the 1974 Privacy Act. This legislation prohibits the public release of any information regarding individual NFIP claims or information which may lead to the identification of associated individual addresses and property owners. However, while this information is not available to the general public, the County may subsequently obtain comprehensive RL property data from FEMA for the purposes of targeted mitigation of RL areas or individual RL structures.

Thirty-seven (70 percent) of Monmouth Countyôs municipal jurisdictions are identified as having one or more Repetitive Loss (RL) properties, with the coastal Boroughs of Sea Bright and Monmouth Beach having the most RL properties (130 and 103 respectively, almost 40% of all the RL properties in the County). Slightly more than three quarters of all RL properties are single-family residential buildings, while only 9% are non-residential. Data to permit a further breakdown of the non-residential structures into commercial, institutional, and so on was not readily available at the time of writing.

The average repetitive loss property in Monmouth County has experienced 2.6 loss events: 66% have experienced two losses, 21% have experienced three, 11% have experienced four or five, and the remaining 2% have experienced more than five. At the extreme end, two properties in the Boroughs of Keyport and Sea Bright are recorded as having experienced 16 and 10 losses respectively.

Table 3a.15
NFIP Repetitive Loss Property Statistics (as of August 27, 2008)
(Source: FEMA Region 2)

Jurisdiction	Single Family			Other Residential			Non-Residential			Total		
	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments
Aberdeen, Township of				0	0	$0	3	12	$186,131	3	12	$186,131
Allenhurst, Borough of				0	0	$0	2	7	$152,088	2	7	$152,088
Allentown, Borough of				0	0	$0				0	0	$0
Asbury Park, City of				0	0	$0	1	2	$13,766	1	2	$13,766
Atlantic Highlands, Borough of	1	3	$9,294	0	0	$0				1	3	$9,294
Avon-By-The-Sea, Borough of	6	12	$67,468	1	2	$22,660				7	14	$90,128
Belmar, Borough of	5	12	$119,983	1	2	$5,512	1	4	$66,348	7	18	$191,843
Bradley Beach, Borough of	1	3	$22,726	0	0	$0				1	3	$22,726
Brielle, Borough of	3	7	$106,736	1	3	$38,242				4	10	$144,978
Colts Neck, Township of	2	5	$38,373	0	0	$0				2	5	$38,373
Deal, Borough of	3	11	$156,086	0	0	$0				3	11	$156,086
Eatontown, Borough of	1	2	$9,923	0	0	$0				1	2	$9,923
Englishtown, Borough of	2	4	$9,389	0	0	$0				2	4	$9,389
Fair Haven, Borough of				0	0	$0				0	0	$0
Farmingdale, Borough of				0	0	$0	1	2	$134,876	1	2	$134,876
Freehold, Borough of*				0	0	$0				0	0	$0
Freehold, Township of	2	5	$53,830	0	0	$0				2	5	$53,830
Hazlet, Township of	2	10	$171,060	1	2	$26,521				3	12	$197,581
Highlands, Borough of	29	61	$564,274	13	27	$302,522	6	13	$318,296	48	101	$1,185,092
Holmdel, Township of				0	0	$0				0	0	$0
Howell, Township of	3	6	$56,176	0	0	$0	1	3	$44,795	4	9	$100,971
Interlaken, Borough of				0	0	$0				0	0	$0
Keansburg, Borough of	1	2	$3,197	0	0	$0				1	2	$3,197
Keyport, Borough of				1	2	$12,841	4	32	$1,302,210	5	34	$1,315,051
Lake Como, Borough of				0	0	$0				0	0	$0
Little Silver, Borough of	13	29	$1,122,446	0	0	$0				13	29	$1,122,446
Loch Arbour, Village of				0	0	$0	1	2	$3,303	1	2	$3,303
Long Branch, City of	22	56	$795,535	8	23	$500,748	6	16	$884,451	36	95	$2,180,734

Table 3a.15
NFIP Repetitive Loss Property Statistics (as of August 27, 2008)
(Source: FEMA Region 2)

Jurisdiction	Single Family			Other Residential			Non-Residential			Total		
	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments	Properties	Losses	Payments
Manalapan, Township of	2	4	$37,656	0	0	$0				2	4	$37,656
Manasquan, Borough of	47	109	$997,881	10	31	$356,751				57	140	$1,354,632
Marlboro, Township of	2	5	$17,259	0	0	$0				2	5	$17,259
Matawan, Borough of				0	0	$0				0	0	$0
Middletown, Township of	21	54	$613,280	1	2	$19,972				22	56	$633,253
Millstone, Township of				0	0	$0				0	0	$0
Monmouth Beach, Borough of	86	236	$3,840,400	10	30	$1,411,582	7	27	$928,272	103	293	$6,180,254
Neptune City, Borough of	1	2	$129,585	0	0	$0				1	2	$129,585
Neptune, Township of	1	2	$31,732	0	0	$0	1	6	$183,461	2	8	$215,193
Ocean, Township of	8	21	$318,482	6	17	$427,610	1	5	$83,311	15	43	$829,403
Oceanport, Borough of	46	105	$3,093,308	0	0	$0				46	105	$3,093,308
Red Bank, Borough of				0	0	$0	1	2	$25,015	1	2	$25,015
Roosevelt, Borough of				0	0	$0				0	0	$0
Rumson, Borough of	44	100	$2,123,203	1	2	$56,046				45	102	$2,179,249
Sea Bright, Borough of	80	219	$3,447,841	33	84	$2,164,768	17	42	$1,669,803	130	345	$7,282,412
Sea Girt, Borough of				0	0	$0				0	0	$0
Shrewsbury, Borough of				0	0	$0	1	2	$5,628	1	2	$5,628
Shrewsbury, Township of*				0	0	$0				0	0	$0
Spring Lake, Borough of	2	5	$124,181	0	0	$0				2	5	$124,181
Spring Lake Heights, Borough of				0	0	$0				0	0	$0
Tinton Falls, Borough of				0	0	$0				0	0	$0
Union Beach, Borough of	15	41	$377,363	0	0	$0	1	2	$158,241	16	43	$535,604
Upper Freehold, Township of	1	4	$22,424	0	0	$0				1	4	$22,424
Wall, Township of				0	0	$0				0	0	$0
West Long Branch, Borough of				0	0	$0				0	0	$0
Total	**452**	**1135**	**$18,481,093**	**87**	**227**	**$5,345,774**	**55**	**179**	**$6,159,994**	**594**	**1,541**	**$29,986,861**

*Not currently participating in the NFIP

Table 3a.16
Repetitive Loss Properties by Municipality and Location in Mapped Flood Hazard Zones
(Source: FEMA Region 2)

Jurisdiction	V Zone (100-Year Floodplain)			A Zone (100-Year Floodplain)			X500 Zone (500-Year Floodplain)			Other Zone (>500-Year Floodplain)		
	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential
Aberdeen, Township of						3						
Allenhurst, Borough of		2										
Allentown, Borough of												
Asbury Park, City of												
Atlantic Highlands, Borough of				1								
Avon-By-The-Sea, Borough of				5				1		1		
Belmar, Borough of				4	1				1	1		
Bradley Beach, Borough of							1					
Brielle, Borough of				4								
Colts Neck, Township of							2					
Deal, Borough of				1			1			1		
Eatontown, Borough of							1					
Englishtown, Borough of							2					
Fair Haven, Borough of												
Farmingdale, Borough of									1			
Freehold, Borough of												
Freehold, Township of							2					
Hazlet, Township of					1		1			1		
Highlands, Borough of	13	5	1	16	8	5						
Holmdel, Township of												
Howell, Township of							3		1			
Interlaken, Borough of												
Keansburg, Borough of										1		
Keyport, Borough of					1	3						1
Lake Como, Borough of												
Little Silver, Borough of	3			9								
Loch Arbour, Village of									1			
Long Branch, City of		2	1	16	5	1	5	1	4	1		

Table 3a.16
Repetitive Loss Properties by Municipality and Location in Mapped Flood Hazard Zones
(Source: FEMA Region 2)

Jurisdiction	V Zone (100-Year Floodplain)			A Zone (100-Year Floodplain)			X500 Zone (500-Year Floodplain)			Other Zone (>500-Year Floodplain)		
	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential	Single-Family	Other Residential	Non-Residential
Manalapan, Township of	1						1					
Manasquan, Borough of	47	10										
Marlboro, Township of							2					
Matawan, Borough of												
Middletown, Township of				17	1		4					
Millstone, Township of												
Monmouth Beach, Borough of	23	3	1	47	2	3	3	1	1	13	4	1
Neptune City, Borough of				1								
Neptune, Township of						1			1			
Ocean, Township of				6	6				1	2		
Oceanport, Borough of				43						1		
Red Bank, Borough of						1						
Roosevelt, Borough of												
Rumson, Borough of				41	1		2			1		
Sea Bright, Borough of	41	15	8	33	13	8	6	3	1			
Sea Girt, Borough of												
Shrewsbury, Borough of									1			
Shrewsbury, Township of												
Spring Lake, Borough of				1			1					
Spring Lake Heights, Borough of												
Tinton Falls, Borough of												
Union Beach, Borough of				15			1					
Upper Freehold, Township of										1		
Wall, Township of												
West Long Branch, Borough of												
Totals	**128**	**37**	**11**	**260**	**39**	**25**	**38**	**6**	**13**	**24**	**4**	**2**

Note: Some jurisdiction totals may not exactly match those in Table 3a.15; for a small number of RL Properties address details were insufficient to allow plotting.

Figure 3a.11: Repetitive Loss Property Cluster Areas – Raritan Bay

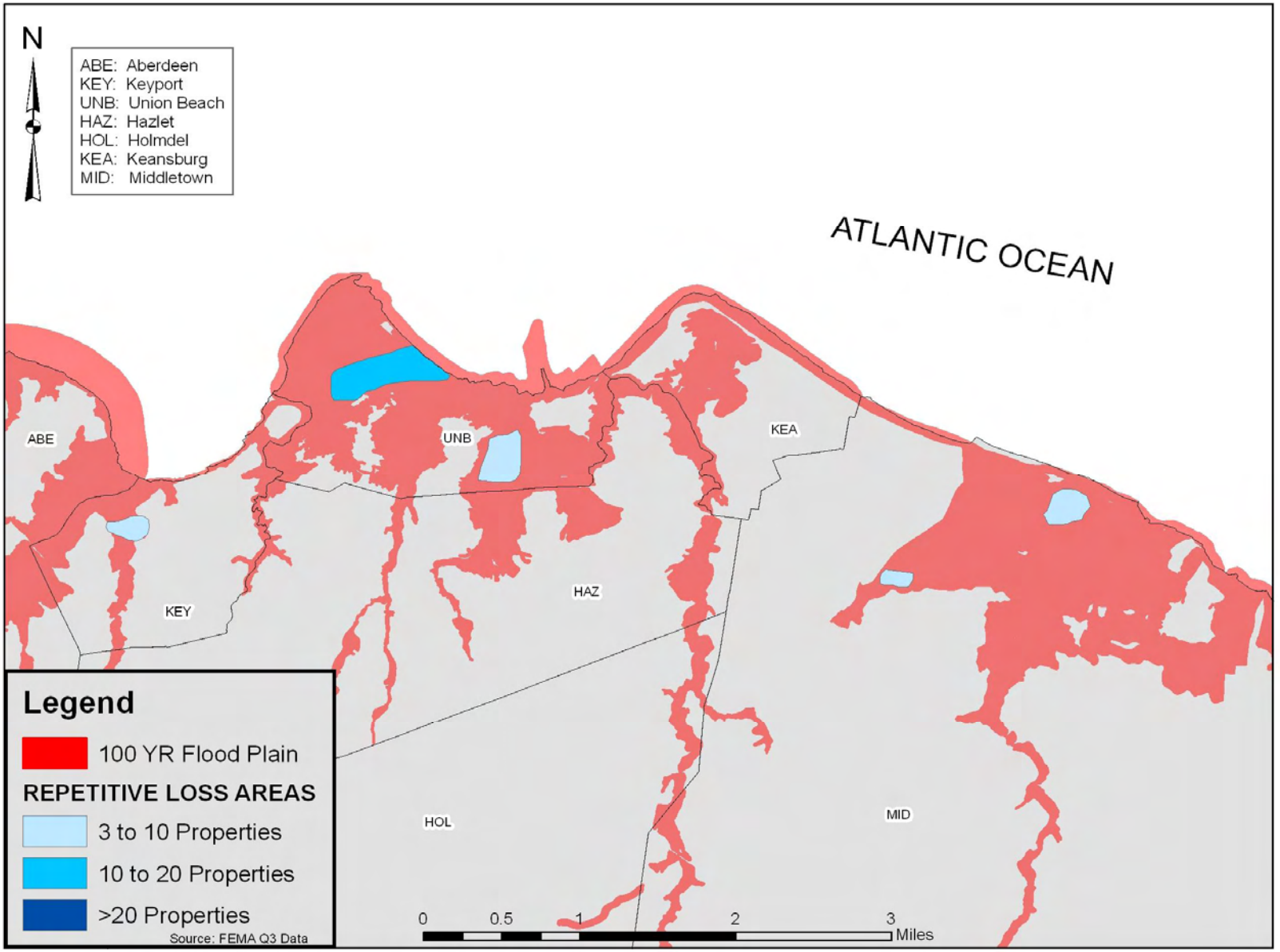


Figure 3a.12: Repetitive Loss Property Cluster Areas – Atlantic Ocean Shore (North)

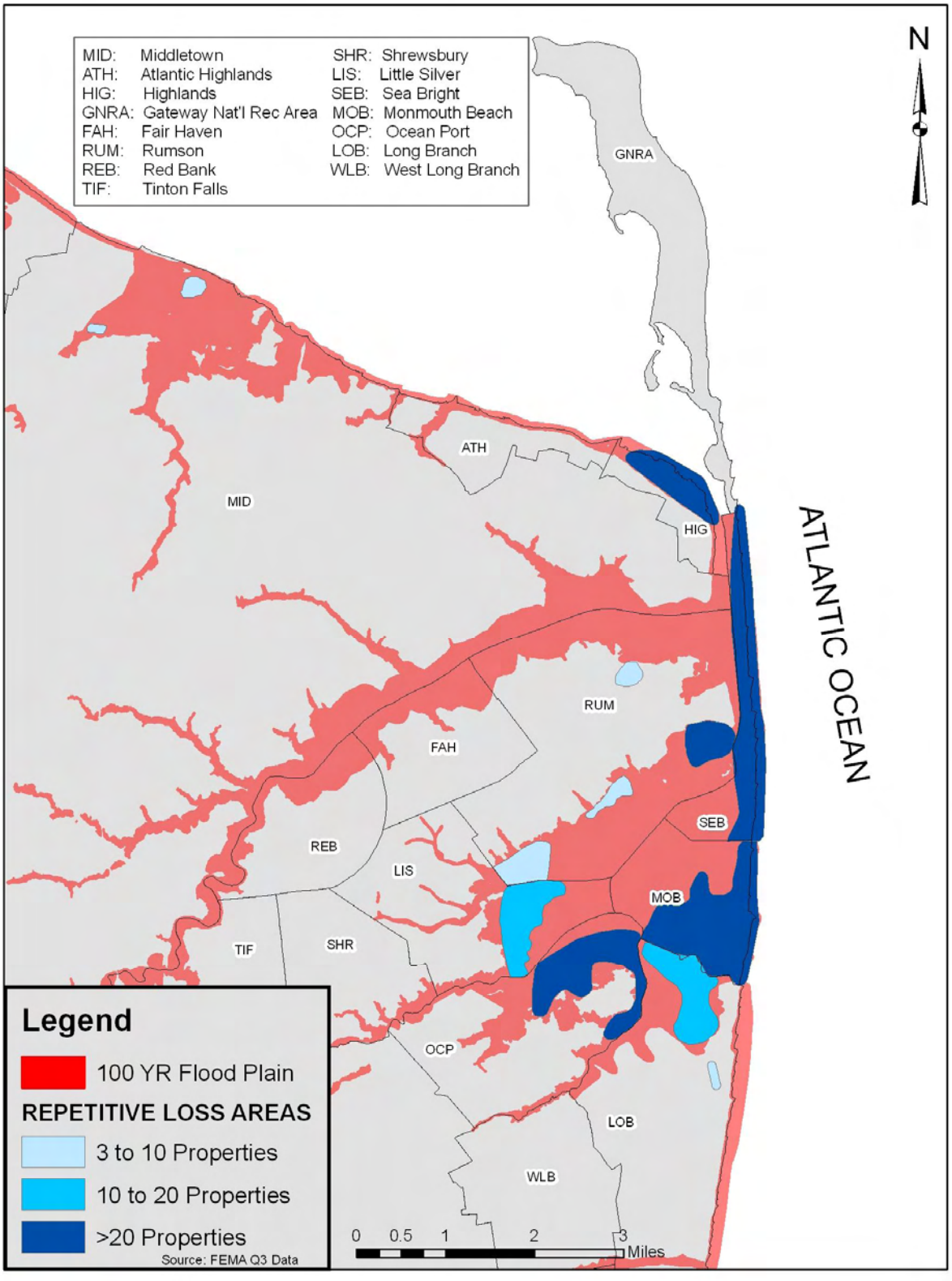


Figure 3a.13: Repetitive Loss Property Cluster Areas – Atlantic Ocean Shore (South)

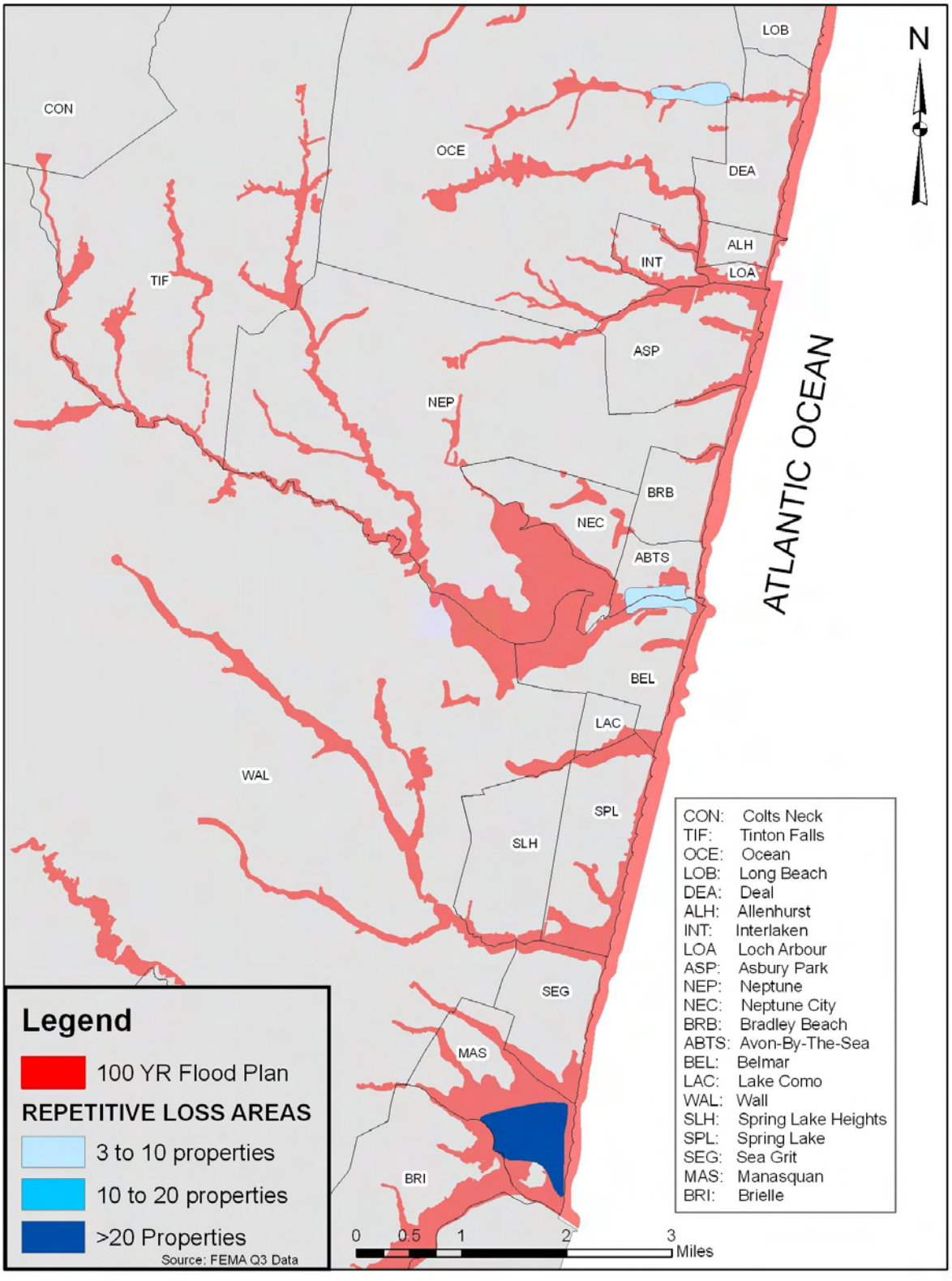


Table 3a.16 and **Figures 3a.11 – 13** show that the majority of all RL properties (85%) are located in the 100-year floodplain, and leaving aside scattered individual RL properties, the RL clusters are almost entirely within the 100-year floodplain. The only exceptions to this are two small clusters of less than 10 RL properties each that are found outside the 500-year floodplain in the Borough of Rumson and the City of Long Branch.

Probability of Occurrence – Flood

Flood events will remain a very frequent occurrence in Monmouth County, and the probability of future occurrences in Monmouth County is certain. The probability of future flood events based on magnitude and according to best available data is illustrated in Figure 3a.10, which indicates those areas susceptible to the 1 percent annual chance flood (100-year floodplain); the 1 percent annual chance flood with wave action (100-year coastal floodplain); and the 0.2 percent annual chance flood (500-year floodplain).

It should also be noted that anticipated sea level rise will increase the risk of damages/losses due to future coastal flooding events. Rising sea level over time will shorten the return period (increasing the frequency) of significant flood events. For example; sea level rise of 1 foot over a typical project analysis period (50 years) may cause a flood event currently of annual probability 2 percent (50-year flood) to become an event of 10 percent annual probability (10-year flood). This increased probability obviously has an effect on the estimation of annualized loss/damage, but one that is typically only analyzed during detailed feasibility studies for projects proposed by the US Army Corps of Engineers

Storm Surge

Description – Storm Surge

Storm surge occurs when the water level of a tidally influenced body of water increases above the normal astronomical high tide, and are most common in conjunction with coastal storms with massive low-pressure systems with cyclonic flows such as hurricanes, tropical storms and norôeasters. The low barometric pressure associated with these storms cause the water surface to rise, and storms landfalling during peak tides have surge heights and more extensive flood inundation limits. Storm surges will inundate coastal floodplains by dune overwash, tidal elevation rise in inland bays and harbors, and backwater flooding through coastal river mouths. The duration of a storm is the most influential factor affecting the severity and impact of storm surges. While hurricanes and tropical storms often move through areas relatively quickly, norôeasters can last for days and multiple tidal cycles ï often causing major coastal flooding, erosion and damage.

A storm surge is often described as a wave that has outrun its generating source and become a long period swell. It is often recognized as a large dome of water that may be 50 to 100 miles wide and rising anywhere from four to five feet in a Category 1 hurricane up to 20 feet in a Category 5 storm. The storm surge arrives ahead of the storm centerôs actual landfall and the more intense the storm is, the sooner the surge arrives. Water rise can be very rapid, posing a serious threat to those who have not yet evacuated flood-prone areas. The surge is always highest in the right-front quadrant of the direction in which the storm is moving. As the storm approaches shore, the greatest storm surge will be to the north of the low-pressure system or hurricane eye. Such a surge of high water topped by waves driven by hurricane force winds can be devastating to coastal regions, causing severe beach erosion and property damage along the immediate shoreline.

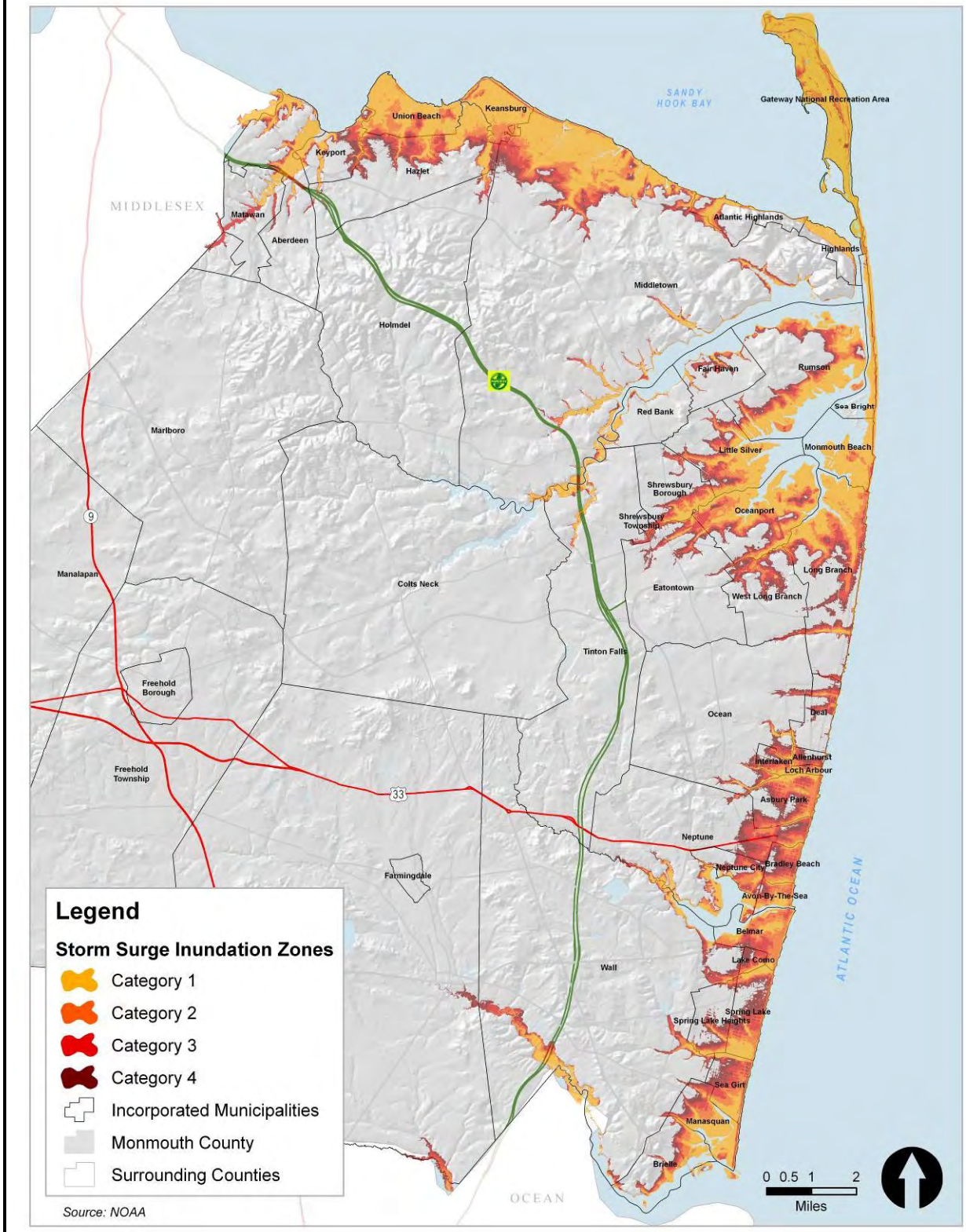
Storm surge heights and associated waves are dependent on not only the stormôs intensity but also upon the shape of the offshore continental shelf (narrow or wide) and the depth of the ocean bottom (bathymetry). A narrow shelf, or one that drops steeply from the shoreline and subsequently produces deep water close to the shoreline, tends to produce a lower surge but higher and more powerful storm waves. The storms that generate the largest coastal storm surges can develop year-round, but they are most frequent from late summer to early spring.

Location and Extent – Storm Surge

There are many areas in Monmouth County subject to potential storm surge inundation as modeled and mapped by the U.S. Army Corps of Engineers (USACE). **Figure 3a.14** illustrates inundation zones storm surges associated with hurricanes of category 1 to 4 for Monmouth County derived from georeferenced SLOSH (Sea, Lake and Overland Surge from Hurricanes) data produced by the USACE in coordination with NOAA. SLOSH is a modeling tool used to estimate storm surge for coastal areas resulting from historical, hypothetical or predicted hurricanes taking into account maximum expected levels for pressure, size, forward speed, track and winds. Therefore, the SLOSH data is best used for defining the potential maximum surge associated with various storm intensities for any particular location.

As shown in the figure, all of Monmouth Countyôs coastal jurisdictions are at high risk to storm surge inundation. While non-coastal areas may not be directly impacted by storm surge inundation, they might experience flooding caused by storm surge and extremely high tides that can affect the drainage of areas further inland. In total, 41 (77 percent) of municipal jurisdictions have been identified as being at risk to the storm surge hazard in Monmouth County.

Figure 3a.14
Hurricane Storm Surge Inundation Zones in Monmouth County



Historical Occurrences – Storm Surge

There is very limited data available for historical weather events that have caused storm surge inundation in Monmouth County. According to NCDC records, Monmouth County experienced a recent storm surge event that accounted for an estimated $900,000 in property damages, as described below. Storm surge has been a major factor associated with other weather events affecting Monmouth County, particularly norôeasters (as described separately within this section).

February 12, 2006
The major winter storm that affected New Jersey had a major impact on the New Jersey shore. Strong onshore winds along with high tides produced coastal flooding along with beach erosion. Across coastal Monmouth County, minor to locally moderate coastal flooding was reported across many areas. In the Monmouth Beach area, a storm surge flooded the Patten Avenue Bridge along with some other streets during the early morning, where some cars were overtaken by water.

Other notable reports of historical storm surge events include the following, as identified by the Planning Committee:

- The Borough of Allenhurst reportedly lost numerous beach buildings to storm surge during the 1992 norôeaster event.
- The Borough of Bradley Beach has experienced significant flooding issues due to storm surge in the past.
- Little Silver Borough indicated that the storm surge associated with the 1992 norôeaster was measured at a height of 11 feet and caused major coastal flooding along the waterfront.

Probability of Occurrence – Storm Surge

Monmouth County faces a relatively low probability of major storm surge inundation as derived from current SLOSH data for major hurricanes (Category 3-4). As described elsewhere in this section, the probability of a named storm making landfall in the vicinity of Monmouth County is 13 percent but is less for events that cause significant storm surge (dependent on storm speed, direction, tides, etc.). However, less severe to moderate storm surge events typically associated with norôeasters and less intense coastal storms are more likely to occur, and in the case of norôeasters will last longer and possibly cause more damage than fast-moving hurricanes. Additionally, the long-term rise in sea level can be expected to impact the occurrence of significant storm surges and hence future damages from coastal flooding in Monmouth County. Rising sea levels over time will shorten the return period (or exceedance interval) and hence increase the frequency of significant storm surge events. To take a hypothetical example, a one foot rise in sea level over 50 years could result in a storm surge event with a current annual occurrence probability of 2% (a ñ50-yearò event) becoming an event of 10% annual probability (a ñ10-yearò event).

Wave Action

Description – Wave Action

Wave action refers to the additional destructive force of floodwater that may cause severe property damage and coastal erosion along the immediate shoreline of an ocean, bay or other large body of water. Waves typically result from wind or geologic effects and may travel thousands of miles before striking land. They range in size from small ripples to huge tsunamis or seiches[9], with the most dominant factors being wind speed, fetch (distance of water the wind has blown over) and the length of time the wind has blown over a given area. The largest of wind-induced waves are associated with large coastal storms including hurricanes, tropical storms and norôeasters.

Waves generated by wind locally are steeper and shorter (crests close together); and the stronger and longer the wind blows the bigger and longer (crests far apart) the waves get. Long waves travel faster than short waves, and very long waves called ñswellsò come from storms far away, and are too long and round to be dangerous until they reach shallow water and closer to shore.

Wave action is a significant hazard to buildings and infrastructure located in coastal areas. Large, fast moving waves can cause extreme erosion and scour and their impact on buildings can cause severe damage. During hurricanes, norôeasters and other high-wind events, storm surge and wind increase the destructiveness of waves and cause them to reach higher elevations and penetrate further inland.

Location and Extent – Wave Action

The areas most susceptible to wave action in Monmouth County are predominantly located along the immediate coastal and shoreline areas of the Atlantic Ocean and Raritan Bay. Additional areas may occasionally experience wave action during extremely large storm events that cause storm surge (addressed separately within this section). **Figure 3a.15** illustrates the wave action hazard zones for Monmouth County based on FEMA digital Q3 flood data. This includes areas mapped as Zone VE according to the most recent Flood Insurance Study (FIS) completed by FEMA. Zone VE refers to coastal areas with a 1 percent or greater chance of flooding and an additional hazard associated with storm-driven velocity waves of three feet or more.[10]

Historical Occurrences – Wave Action

According to NCDC, 49 recorded wave action events have affected Monmouth County since 1993 (data excludes wave action associated with other major historical events addressed separately within this section, such as hurricanes and norôeasters). These incidents resulted in a reported total of eight deaths and 12 injuries in Monmouth County and caused an estimated $1 million in property damages. Some recent notable events include the following:

[9] Tsunamis and seiches are generally described as a series of high-energy waves triggered by earthquake and landslide events. While tsunamis are generated in the open ocean, seiches are generated in enclosed or partly enclosed bodies of water such as reservoirs, lakes, bays and rivers.

[10] Figure 3a3.12 illustrates best available data based on the most recent FEMA Flood Insurance Study (FIS). It should be noted that although wave action hazard areas are not delineated along the Navesink River for the municipalities of Red Bank and Fair Haven, it has been determined that these areas in general should be considered susceptible to wave action. It is anticipated that future, more detailed flood studies for the area will delineate VE Zones that will support this determination.

Figure 3a.15
Wave Action Hazard Zones in Monmouth County

August 14-20, 1995
Swells associated with Hurricane Felix generated rough surf and rip currents for about one week along the New Jersey shore. A 17-year-old surfer drowned off Deal. Two boys were swept off the beach by a large wave at Point Pleasant Beach. A 45-year-old male drowned in Avon-By-The-Sea. Numerous injuries were reported, five alone in Long Beach Township. The rough surf spread to Monmouth County and municipalities along the shore began restricting bathing. By the 16th, waves reached up to eight feet at Sandy Hook and most bathing was prohibited. As Felix weakened offshore, bathing restrictions began to be lifted on the 20th.

August 23-28, 1998
Rip currents and large waves associated with Hurricane Bonnie in the Atlantic Ocean caused hundreds of water rescues and resulted in swimming restrictions up and down the New Jersey shore. In Monmouth County, 10 swimmers were rescued at Bradley Beach and 25 were rescued at Manasquan and Spring Lake. On the 24th, swimming restrictions started as swells increased to six to eight feet. The most reported rescues on the 24th were in Monmouth County (about 25) in Manasquan and Spring Lake. One teenager in Spring Lake was injured. As Bonnie neared the North Carolina Coast on the 26th, beach restrictions became tighter. Numerous beaches were closed and surfing was banned in several communities.

August 30-31, 1999
The combination of swells from Hurricane Dennis and a stiff northeast flow caused by a strong high pressure system building over New England produced rough surf, some minor tidal flooding and beach erosion. A major contributing factor to the winds and rip currents was a very strong high pressure system that built into eastern Canada and New England. Bathing restrictions were in place. The highest recorded tide in Monmouth County was 6.7 feet above average tide heights at Sandy Hook.

August 25-26, 2001
The northeast to east flow around a high and a developing low pressure system produced rough surf and rip currents along the New Jersey shore. A person nearly drowned while fishing along the shore. A total bathing ban was in effect in Allenhurst, while yellow cautionary flags flew and partial bathing bans were in effect in other places such as Sea Girt. A 17-foot vessel capsized half a mile off of Shark River Inlet in five to six foot seas. In Belmar, a 42-foot sport fisher vessel carrying eight persons ran aground between the south jetty and a fishing pier.

Other notable reports of historical wave action events include the following, as identified by the Planning Committee:

- The Borough of Brielle has indicated that sustained wave action over the years has caused substantial deterioration to a bulkhead along the Manasquan River (at the end of Ocean Avenue). It is believed that during a future coastal storm, severe wave action could cause complete failure of the bulkhead causing great damage to not only the Borough-owned street but could also threaten a large commercial structure and a marine fuel facility located in the immediate proximity of this bulkhead. Salt water infiltration to the boroughôs potable water system may also occur.

Probability of Occurrence – Wave Action

Wave action will remain a very frequent occurrence for the coastal flood hazard zones of Monmouth County, and the probability of future occurrences is certain. Less severe wave action events will be more frequent but likely cause less impact (i.e., minor damages, coastal erosion, etc.), while more severe waves associated with less frequent coastal storm events such as hurricanes and norôeasters will cause higher impacts (including property damages) along Monmouth Countyôs shoreline.

Earthquake

Description – Earthquake

An earthquake is the motion or trembling of the ground produced by sudden displacement of rock in the Earth's crust. Earthquakes result from crustal strain, volcanism, landslides or the collapse of 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. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quick sand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture or collapse.

Most earthquakes are caused by the release of stresses accumulated as a result of the rupture of rocks along opposing fault planes in the Earthôs outer crust. These fault planes are typically found along borders of the Earth's 10 tectonic plates. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. Deformation along plate boundaries causes strain in the rock and the consequent buildup of stored energy. When the built-up stress exceeds the rocks' strength, a rupture occurs. The rock on both sides of the fracture is snapped, releasing the stored energy and producing seismic waves, generating an earthquake.

Earthquakes are measured in terms of their magnitude and intensity. Magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (**Table 3a.17**). Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, with a I corresponding to imperceptible (instrumental) events, IV corresponding to moderate (felt by people awake), to XII for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in **Table 3a.18**.

Table 3a.17
Richter Scale

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. Can cause major damage to poorly constructed buildings over small regions.
6.1-6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0-7.9	Major earthquake. Can cause serious damage over larger areas.
8 or greater	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: Federal Emergency Management Agency

Table 3a.18
Modified Mercalli Intensity Scale for Earthquakes

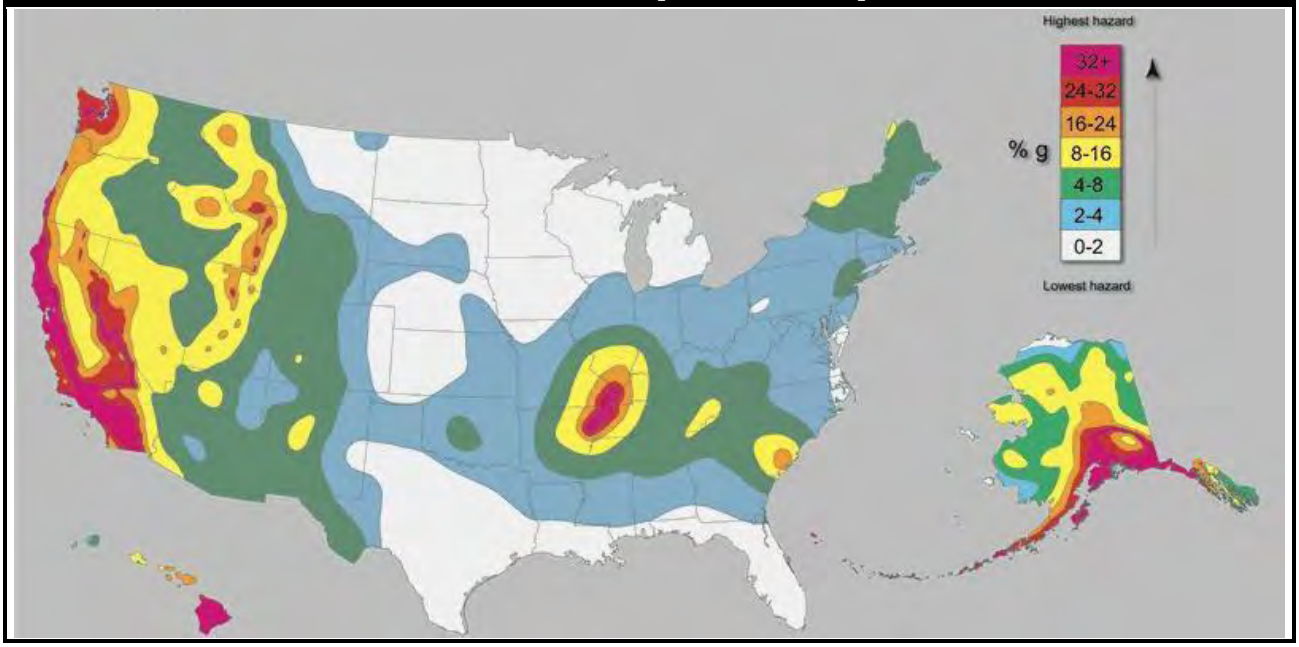
Scale	Intensity	Description of Effects	Corresponding Richter Scale Magnitude
I	INSTRUMENTAL	Detected only on seismographs.	
II	FEEBLE	Some people feel it.	<4.2
III	SLIGHT	Felt by people resting; like a truck rumbling by.	
IV	MODERATE	Felt by people walking.	
V	SLIGHTLY STRONG	Sleepers awake; church bells 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.	
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

Source: Federal Emergency Management Agency

Location and Extent – Earthquake

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, the East Coast does face moderate risk to less frequent, less intense earthquake events. **Figure 3a.16** shows relative seismic risk for the United States.

Figure 3a.16
United States Earthquake Hazard Map



Source: United States Geological Survey

Figure 3a.17 shows the probability that ground motion will reach a certain level during an earthquake in Monmouth County and the surrounding region. The data shows peak horizontal ground acceleration (the fastest measured change in speed for a particle at ground level that is moving horizontally due to an earthquake) with a 10 percent probability of exceedance in 50 years. Monmouth County is located in an area with peak ground acceleration (PGA) values between 4%g and 5%g, which is a relatively low seismic risk but still enough to suggest that Monmouth County is susceptible to moderate, damaging earthquakes over time.

Historical Occurrences – Earthquake

Earthquakes do occur on a fairly regular basis in New Jersey, though most are of very low magnitude (MMI intensity of less than II) and often not felt by people or capable of causing property damage. According to the New Jersey Geological Survey, there have been 150 recorded earthquakes in New Jersey since 1783, including seven with epicenters located in Monmouth County (as shown in Figure 3.14). However, New Jerseyôs susceptibility to earthquakes extends to events located beyond state borders, and some of the most damaging earthquakes were associated with larger, more significant events occurring elsewhere along the East Coast (also shown in Figure 3.14). Most past earthquake damage in New Jersey has been to building contents and architectural damage, such as fallen chimneys, cracked plaster and masonry, and items falling off shelves. Some of the more notable earthquake events for the New Jersey region are identified in **Table 3a.19**.

Table 3a.19
Damaging Earthquakes Felt in the New Jersey Region

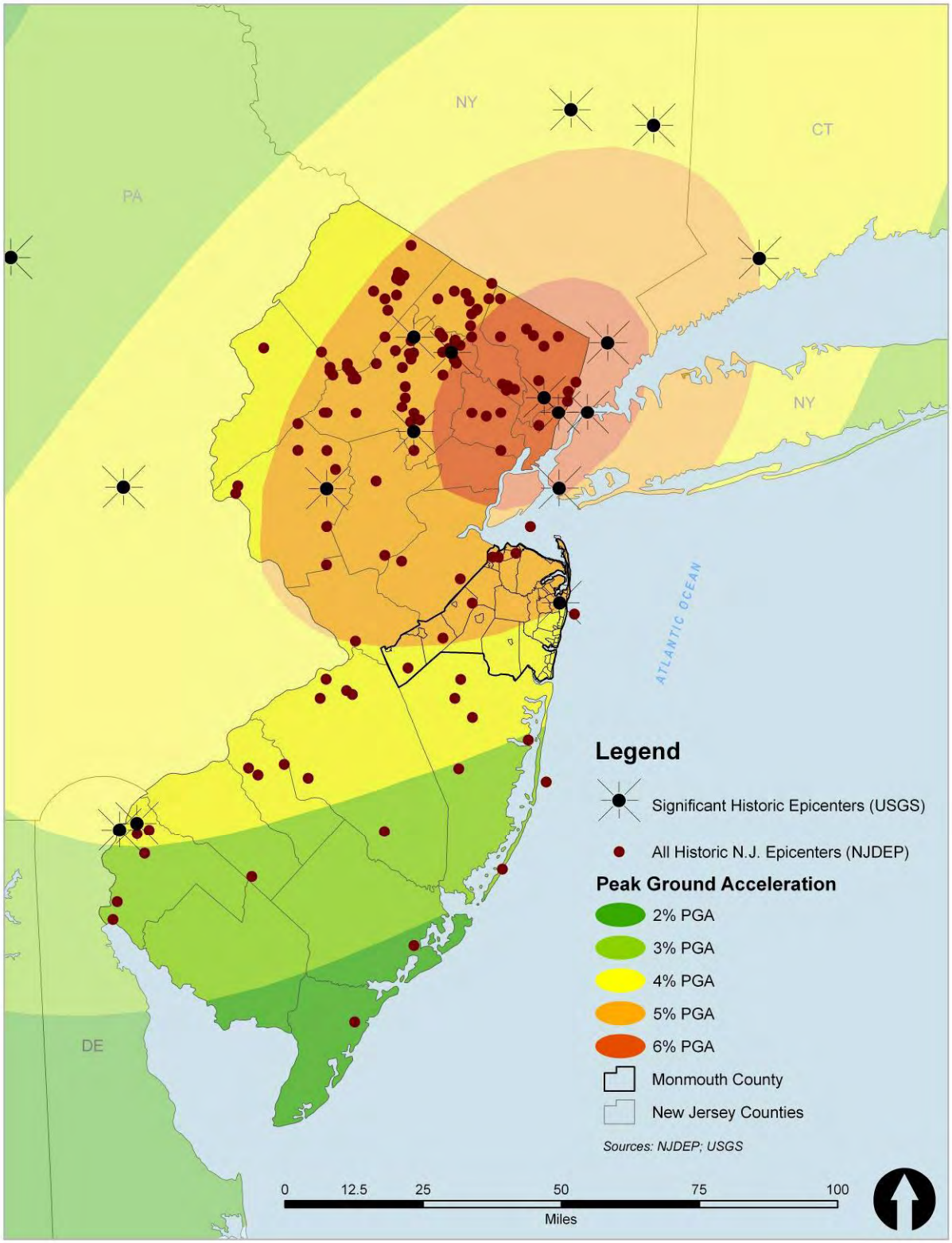
Year	Location	Richter Magnitude	MMI Scale (in NJ)	Description
1737	New York City, NY	N/A	VII	Chimneys down in New York City. Felt from Boston, MA to Philadelphia, PA.
1755	Cape Ann, MA	6	IV	Chimneys and brick buildings down in Boston, MA.
1783	West of New York City, NY	N/A	VII	Felt from New Hampshire to Pennsylvania.
1811-1812	New Madrid, MO	8.0-8.8	IV-V	Four great earthquakes. Changed course of Mississippi River. Town of New Madrid, MO destroyed. Loss of life low due to sparse settlement. Damage in Chicago.
1884	New York City, NY	5.5	VII	Toppled chimneys in New York City and New Jersey. Cracked masonry from Hartford, CT to West Chester, PA. Felt from Maine to Virginia, and eastern Ohio.
1886	Charleston, SC	7.7	IV	Sixty people killed. Over 10,000 chimneys down.
1927	Asbury Park, NJ	N/A	VII	The highest intensity earthquake ever observed in New Jersey occurred in the Asbury Park area. Three shocks were felt along the coast from Sandy Hook to Toms River. Several chimneys down from Asbury Park to Long Branch. Other reported damages include cracked plaster, and articles were thrown from their shelves.

Source: Earthquake Risk in New Jersey, New Jersey State Police, Office of Emergency Management

Probability of Occurrence – Earthquake

The probability of significant, damaging earthquake events affecting Monmouth County is low. According to the United States Geological Survey (USGS), an earthquake with a 10 percent probability of exceedance over 50 years would have PGA values between 4%g and 5%g, which would result in light to moderate perceived shaking and damages ranging from none to very light. More destructive earthquakes are very rare, low probability events for Monmouth County with highly infrequent recurrence periods.

Figure 3a.17
Peak Ground Acceleration with a 10% Probability of Exceedance over 50 years



Landslide

Description – Landslide

A landslide is the downward and outward movement of slope-forming soil, rock and vegetation, which is driven by 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, volcanic eruptions and changes in groundwater levels. Landslides occur when the force of gravity pulling down the slope exceeds the strength of the earth materials that comprise to hold it in place.

There are several types of landslides: rock falls, rock topple, slides, slumps and debris flows. Rock falls are rapid movements of bedrock, which result in bouncing or rolling. A topple is a section or block of rock that rotates or tilts before falling to the slope below. Slides are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material. Slumps are landslides that typically occur on smaller slopes when loosely consolidated materials or rock layers move a short distance down a slope, typically in a rotational fashion. Debris flows, sometimes referred to as mudslides, mudflows, lahars or debris avalanches, are fast-moving rivers of rock, earth and other debris saturated with water.

Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. Slopes are also more likely to fail if vegetative cover is low and/or soil water content is high. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Slopes greater than 10 degrees are more likely to slide, as are slopes where the height from the top of the slope to its toe is greater than 40 feet.

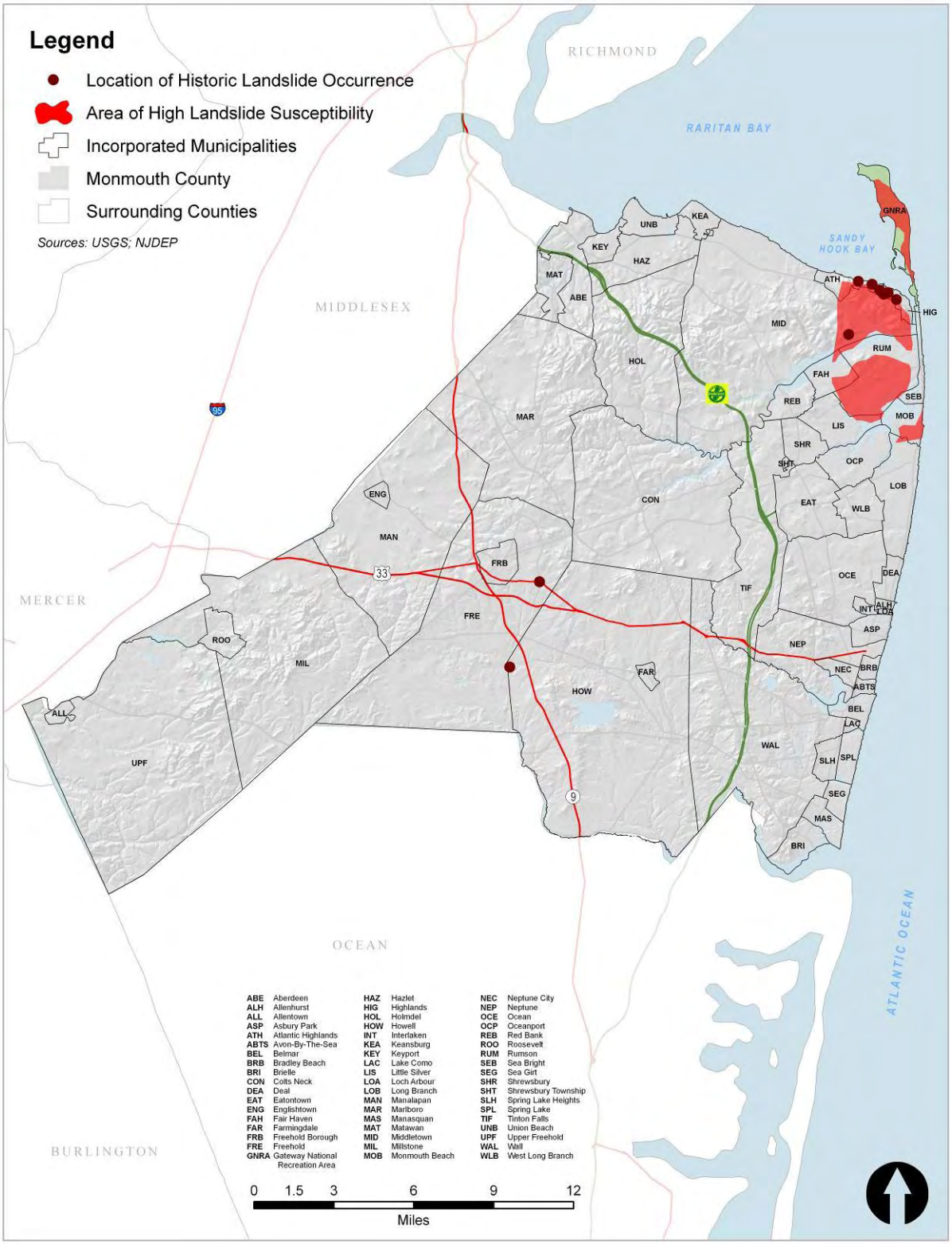
In the United States, it is estimated that landslides cause up to $2 billion in damages and from 25 to 50 deaths annually. Globally, landslides cause billions of dollars in damage and thousands of deaths and injuries each year.

Location and Extent – Landslide

Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels and developed hillsides where leach-field septic systems are used. Although in New Jersey landslides are not as common as in other areas of the United States, they are a geologic hazard in areas with steep to moderate slopes or geologic units prone to failure. According to the NJOEM, the largest landslide events in New Jersey occur in the form of slumping along the coastal bluffs of the Navesink Highlands area of Monmouth County (including the Boroughs of Atlantic Highlands and Highlands and Township of Middletown). While originally attributed to coastal erosion, slumping has reportedly begun anew in the last 30 years likely due to development at the bottom of slopes, an unusually high water table and changes in vegetative patterns.

The USGS has delineated areas throughout the country where large numbers of landslides have occurred and areas which are susceptible to land sliding, and this data confirms that the extreme northeast portion of Monmouth County is highly susceptible (including the municipalities of Atlantic Highlands, Fair Haven, Highlands, Little Silver, Long Branch, Middletown, Monmouth Beach, Rumson and Sea Bright). These areas of high susceptibility are illustrated in **Figure 3a.18** along with the locations of historic landslide occurrences as recorded by the New Jersey Geological Survey (NJGS) and described further under ñHistorical Occurrences.ò

Figure 3a.18
Landslide Susceptibility and Historical Incidents for Monmouth County



Historical Occurrences – Landslide

According to NJGS, nine historical landslide events have affected Monmouth County, as listed in **Table 3a.20**. Most of these events occurred in areas of high landslide susceptibility and reportedly caused minor property damages and a total of two injuries.

Table 3a.20
Historical Landslide Events in Monmouth County

Date of Occurrence	Location	Type	Damage	Deaths	Injuries	Description
Unknown	Atlantic Highlands, Borough of	Slump	No	0	0	Historic slump area, older landslide, probably hundreds of years old, estimated location.
April 1782	Highlands, Borough of	Slump	No	0	0	1782 landslide from newspaper account possibly triggered by undercutting wave action, small landslide in 1972.
October 1903	Highlands, Borough of	Debris flow	Yes	0	0	Report of a big landslide at WaterWitch, just below the long pier, shut down the Central Railroad of NJ, estimated location.
November 1977	Highlands, Borough of	Slump	No	0	0	Landslide after heavy rain.
January 1999	Highlands, Borough of	Debris flow	Yes	0	2	Landslide, possibly due to fill material failure after heavy rain, one condominium unit destroyed, three others damaged.
August 2002	Middletown, Township of	Slump	No	0	0	Recent small slump in slump block possibly hundreds of years old on Navesink River bluff.
2003	Howell, Township of	Slump	Yes	0	0	River bank slumping on 26-foot high bank due to undercutting from the Manasquan River along 200 feet of Bergerville Road, some damage to road.
October 2005	Freehold, Township of	Debris flow	Yes	0	0	Landslide partially blocked road after heavy rain during road construction.
October 2005	Atlantic Highlands, Borough of	Slump	Yes	0	0	Small backyard slump caused by water saturation after heavy rain, some property damage, estimated location.

Source: New Jersey Geological Survey

Other notable reports of historical landslide events include the following, as identified by the Planning Committee:

- The Borough of Atlantic Highlands and surrounding municipalities have been dealing with the fundamental problem of geologic instability, slope fragility and slumping for years. The problem in this high elevation area of Monmouth County has been so clearly established that it has a specific geological name: slump blocking. Slump blocking is characterized as an entire block of land slips downward, and there are numerous reports of large slump block occurrences in the areaôs recent geologic past, including those listed above. Specifically Mount Mitchill is an area of concern, but the extent of landslide risk has been described as the entire bluff along the south side of Sandy Hook Bay for a distance of four miles from Atlantic Highlands Yacht Harbor to the mouth of the Navesink River.
- The Borough of Highlands indicated that much of its hillside areas have suffered major erosion and smaller landslides are a common occurrence after most storms, occasionally causing property damage and frequently blocking roadways. Specifically, Bayside Drive (main road connecting Highlands to Atlantic

Highlands) has been closed more often than not during the past 10 years due to erosion of the hillside and regular landslide activity.

Probability of Occurrence – Landslide

There is a high probability of future landslide events (primarily slumps and slump blocking) in the northeast portion of Monmouth County, including the municipalities of Atlantic Highlands, Fair Haven, Highlands, Little Silver, Long Branch, Middletown, Monmouth Beach, Rumson and Sea Bright. Particularly, slump blocking is highly likely to continue occurring along the coastal bluffs of Sandy Hook Bay and along the shore of the Navesink River. The probability of landslide events elsewhere in Monmouth County is low.

Wildfire

Description – Wildfire

A wildfire is any fire occurring in a wildland area (e.g., grassland, forest, brush land) except for fire under prescription. Wildfires are part of the natural management of forest ecosystems, but may also be caused by human factors. Nationally, over 80 percent of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning.

There are three classes of wildland fires: surface fire, ground fire and crown fire. A surface fire is the most common of these three classes and burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. Wildland fires are usually signaled by dense smoke that fills the area for miles around.

Wildfire probability depends on local weather conditions, outdoor activities such as camping, debris burning and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural hazards (tornadoes, hurricanes, etc.) increase the probability of wildfires by producing fuel in both urban and rural settings. Forest damage from hurricanes and tornadoes may also block interior access roads and fire breaks, pull down overhead power lines or damage pavement and underground utilities.

Wildfires can cause significant damage to property and threatens the lives of people who are unable to evacuate wildfire-prone areas. Many individual homes and cabins, subdivisions, resorts, recreational areas, organizational camps, businesses and industries are located within high wildfire hazard areas. Further, the increasing demand for outdoor recreation places more people in wildlands during holidays, weekends and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for wildfire events that can sweep through the brush and timber and destroy property within minutes.

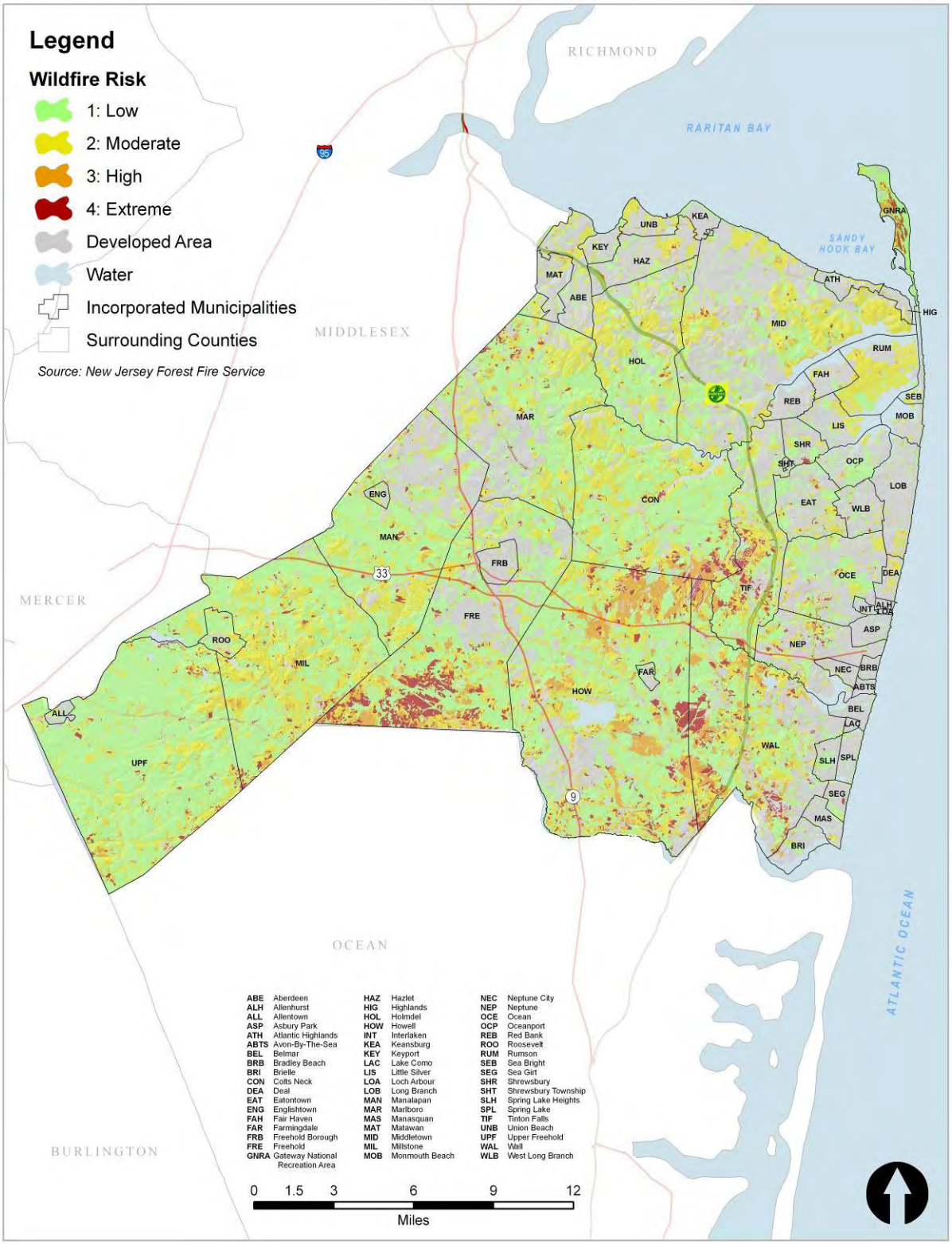
Wildfires can result in severe economic losses. Businesses that depend on timber, such as paper mills and lumber companies, experience losses that are often passed along to consumers through higher prices, and sometimes jobs are lost. The high cost of responding to and recovering from wildfires can deplete state resources and increase insurance rates. The economic impact of wildfires can also be felt in the tourism industry if roads and tourist attractions are closed due to health and safety concerns, such as reduced air quality by means of wildfire smoke and ash.

Location and Extent – Wildfire

Areas typically prone to wildfire occurrence include large tracts of undeveloped wildlands containing heavier fuels with high continuity, steep slopes and far away from firefighting apparatus that would suppress the spread of wildfires once reported. The New Jersey Forest Fire Service (NJFFS) recently conducted a wildfire hazard assessment[11] for much of the state and has published a map of wildfire hazard areas in Monmouth County. **Figure 3a.19** illustrates this information and shows that the most significant wildfire hazard areas are located predominantly in the southern portions of the county.

[11] The methodological basis for the NJFFS wildfire risk assessment in Monmouth County was based on a correlation of fire risk to vegetation type as recorded in 1996 data for Land Use / Land Cover data.

Figure 3a.19
Wildfire Hazard Areas for Monmouth County



Historical Occurrences – Wildfire

According to data made available through NJFFS, Monmouth County averages approximately 50 wildfire events per year though most of these are kept fairly small and are suppressed rather quickly (burning less than one acre). The 10-year average for number of wildfires in Monmouth County between 1993 and 2003 was 51 incidents per year, and the average number of acres burned was 35 per year (0.69 acres per fire). Some recent notable events as recorded by NCDC include the following:

April 30, 2001
The unseasonably dry weather during the second half of April continued to make it easy for brush and wildfires to begin and then spread quickly. Three such wildfires occurred during the afternoon and evening on the 30th across central New Jersey. In Port Monmouth, a four-acre fire consumed vegetation. No property damage was reported.

May 1, 2001
The extremely dry and unseasonably warm weather of early May made New Jersey primed for wild and forest fires. In the Belford section of Middletown Township, a wildfire consumed four grassy acres before it was under control. One home's siding was damaged when the fire crept close to it. Two smaller brush fires occurred that afternoon within the township off of County Route 520 and Harbor Way. No damage or injuries were reported.

March 10, 2002
A brush fire, largely exacerbated by strong gusty winds, scorched about 200 acres of brush in the Port Monmouth section of Middletown Township. The fire began near Main Street and Broadway. The strong winds fanned the fire and brought it close to several houses on Park Avenue, but none were damaged. About 100 firefighters fought the blaze, which was extinguished about two hours later.

Two of Monmouth Countyôs more significant wildfire occurrences are described below:

September 7-10, 1838
The *New York Herald* reported a fire south and east of Bordentown in Burlington and Monmouth counties 14 miles wide by 20 miles long (approximately 179,200 acres). A good deal of property damage was reported, along with possible loss of life.

April 15, 1977
A local newspaper reported that approximately 300 acres of woods were burned in Howell Township. The fire was fanned by winds of 15 mph which swept across Yellowbrook Road. Approximately 20 fire departments provided assistance for fighting the fire. Yellowbrook Road and a portion of Route 33 were closed for several hours.

Other notable reports of historical wildfire events include the following, as identified by the Planning Committee:

- The Township of Ocean has several large wooded areas that are a part of the Green Acres Preserve and has a history of wildfires. Due to lightning or human-caused incidents, local fire departments respond to these areas several times on an annual basis. Many of these areas are not accessible by traditional fire apparatus.
- The Borough of Roosevelt is located next to Assunpink Wildlife Preserve which has several brush fires per year.

Probability of Occurrence – Wildfire

Wildfire events will remain a very frequent occurrence in Monmouth County, and the probability of future occurrences in Monmouth County is certain. However, these events are typically contained and extinguished rather quickly and those events causing major property damage or life/safety threats are much less likely to occur.

Conclusions on Hazard Risk

The hazard profiles presented in this section were developed using best available data and result in what may be considered principally a qualitative assessment as recommended by FEMA in its ñHow-toò guidance document titled *Understanding Your Risks: Identifying Hazards and Estimating Losses* (FEMA Publication 386-2). It relies heavily on historical and anecdotal data, stakeholder input, and professional and experienced judgment regarding observed and/or anticipated hazard impacts. It also carefully considers the findings in other relevant plans, studies and technical reports.

Priority Risk Index

In order to draw some meaningful planning conclusions on hazard risk for Monmouth County as a whole, the results of the hazard profiling process were used to generate countywide hazard classifications according to a ñPriority Risk Indexò (PRI). The purpose of the PRI, described further below, is to categorize and prioritize all potential hazards for Monmouth County as high, moderate or low risk. Combined with the asset inventory and quantitative vulnerability assessment provided in the next section, the summary hazard classifications generated through the use of the PRI allows for the prioritization of those high hazard risks for mitigation planning purposes, and more specifically, the identification of hazard mitigation opportunities for Monmouth County jurisdictions to consider as part of their proposed mitigation strategy. Of course, each municipal jurisdiction will focus on the identification of mitigation actions that will reduce or eliminate their own unique hazard risks as well as those facing the entire county planning area.

The prioritization and categorization of identified hazards for Monmouth County is based principally on the PRI, a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI is used to assist the Monmouth County Planning Committee in gaining consensus on the determination of those hazards that pose the most significant threat to Monmouth County based on a variety of factors. The PRI is not scientifically based, but is rather meant to be utilized as an objective planning tool for classifying and prioritizing hazard risks in Monmouth County based on standardized criteria.

The application of the PRI results in numerical values that allow identified hazards to be ranked against one another (the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard (probability, impact, spatial extent, warning time and duration). Each degree of risk has been assigned a value (1 to 4) and an agreed upon weighting factor[12], as summarized in **Table 3a.21**. To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

According to the weighting scheme applied for Monmouth County, the highest possible PRI value is 4.0. Prior to being finalized, PRI values for each identified hazard were reviewed and accepted by the members of the Planning Committee.

[12] The Monmouth County Planning Committee, based upon any unique concerns or factors for the planning area, may adjust the PRI weighting scheme during future plan updates.

Table 3a.21
Priority Risk Index for Monmouth County

PRI Category	Degree of Risk			Assigned Weighting Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 100% annual probability	3	
	Highly Likely	100% annual probability	4	
Impact	Minor	Very few injuries, if any. Only minor property damage and 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	Negligible	Less than 1% of area affected	1	20%
	Small	Between 1 and 10% of area affected	2	
	Moderate	Between 10 and 50% of area affected	3	
	Large	Between 50 and 100% of area affected	4	
Warning Time	More than 24 hours	Self explanatory	1	10%
	12 to 24 hours	Self explanatory	2	
	6 to 12 hours	Self explanatory	3	
	Less than 6 hours	Self explanatory	4	
Duration	Less than 6 hours	Self explanatory	1	10%
	Less than 24 hours	Self explanatory	2	
	Less than one week	Self explanatory	3	
	More than one week	Self explanatory	4	

PRI Results

Table 3a.22 summarizes the degree of risk assigned to each category for all initially identified hazards based on the application of the PRI. Assigned risk levels were based on the detailed hazard profiles developed for this section, as well as input from the Planning Committee. The results were then used in calculating PRI values and making final determinations for the risk assessment.

Table 3a.22
Summary of PRI Results for Monmouth County

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Atmospheric Hazards						
Extreme Temperatures	Highly Likely	Minor	Small	More than 24 hours	Less than one week	**2.3**
Extreme Wind	Highly Likely	Critical	Large	More than 24 hours	Less than 24 hours	**3.2**
Hurricane & Tropical Storm	Likely	Catastrophic	Large	More than 24 hours	Less than 24 hours	**3.2**
Lightning	Highly Likely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Norêaster	Highly Likely	Catastrophic	Large	More than 24 hours	Less than one week	**3.6**
Tornado	Likely	Limited	Small	Less than 6 hours	Less than 6 hours	**2.4**
Winter Storm	Highly Likely	Limited	Large	More than 24 hours	Less than one week	**3.0**
Hydrologic Hazards						
Coastal Erosion	Highly Likely	Limited	Moderate	More than 24 hours	More than one week	**2.9**
Dam Failure	Unlikely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.1**
Drought	Possible	Limited	Moderate	More than 24 hours	More than one week	**2.3**
Flood	Highly Likely	Critical	Moderate	6 to 12 hours	More than one week	**3.4**
Storm Surge	Possible	Critical	Moderate	More than 24 hours	Less than 24 hours	**2.4**
Wave Action	Highly Likely	Limited	Moderate	More than 24 hours	More than one week	**2.9**
Geologic Hazards						
Earthquake	Unlikely	Minor	Small	Less than 6 hours	Less than 6 hours	**1.5**
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.7**
Other Natural Hazards						
Wildfire	Highly Likely	Minor	Moderate	Less than 6 hours	Less than one week	**2.8**

Final Determinations

The conclusions drawn from the hazard profiling process for Monmouth County, including the PRI results and input from the Planning Committee, resulted in the classification of risk for each identified hazard according to three categories: High Risk, Moderate Risk and Low Risk (**Table 3a.23**). For purposes of these classifications, risk is expressed in relative terms according to the estimated impact that a hazard will have on human life and property throughout all of Monmouth County. A more quantitative analysis to estimate potential dollar losses for each hazard has been performed separately at the local jurisdictional level, and is described in the *Vulnerability Assessment* section. It should be noted that although some hazards are classified below as posing low risk, their occurrence of varying or unprecedented magnitudes is still possible in some cases and their assigned classification will continue to be evaluated during future plan updates.

Table 3a.23
Conclusions on Hazard Risk for Monmouth County

HIGH RISK	Norôeaster Flood Extreme Wind Hurricane and Tropical Storm Winter Storm
MODERATE RISK	Coastal Erosion Wave Action Wildfire Landslide Storm Surge Tornado
LOW RISK	Drought Extreme Temperatures Lightning Dam Failure Earthquake

VULNERABILITY ASSESSMENT FOR MONMOUTH COUNTY, NJ

Overview

This section builds upon the information provided in the *Hazard Profiles* section by identifying and characterizing an inventory of assets in Monmouth County, and then assessing the potential impact and amount of damages that can be expected to be caused by each identified hazard event. The primary objective of the vulnerability assessment is to quantify exposure and the potential loss estimates for each hazard, by jurisdiction. In so doing, Monmouth County and each of its municipalities may better understand their own unique risks to identified hazards and be better prepared to evaluate and prioritize unique hazard mitigation actions for their communities.

This section begins with a summary description of the asset inventory as compiled for Monmouth County through coordination with the Monmouth County Office of GIS, as well as an explanation of the methodology applied to complete the multi-jurisdictional vulnerability assessment. The remainder of this section focuses on the results of the vulnerability assessment and is organized by hazard in similar format to the *Hazard Profiles* section, and as listed below.

- **Atmospheric**
  - Extreme Temperatures
  - Extreme Wind
  - Hurricane and Tropical Storm
  - Lightning
  - Norôeaster
  - Tornado
  - Winter Storm

- **Hydrologic**
  - Coastal Erosion
  - Dam Failure
  - Drought
  - Flood
  - Storm Surge
  - Wave Action

- **Geologic**
  - Earthquake
  - Landslide

- **Wildfire**

Section 3B - Identification and Characterization of Assets in Hazard Areas

An inventory of Monmouth Countyôs georeferenced assets[1] was created in order to identify and characterize property and persons potentially at risk to the identified hazards. By understanding the type and number of assets that exist and where they are located in relation to known hazard areas, the relative risk and vulnerability for such assets can be assessed. Under this assessment, six categories of assets were created and then further assessed through geographic information systems (GIS) analysis. The six categories of assets include:

1. Improved Property: Includes all developed properties according to local parcel data provided by Monmouth County. The information has been expressed in terms of the total assessed value of improvements[2] that may be exposed to the identified hazards.

2. Emergency Facilities: Includes emergency operations centers (EOCs), fire stations, police stations and hospitals. Schools that serve as Red Cross shelters are not included in this category but are addressed separately under ñother critical facilities.ò Data for fire stations, police stations and hospitals was provided by Monmouth County, and EOC data was obtained from HAZUS-MH®.

3. Critical Infrastructure and Utilities: Includes airports, ferry ports, potable water treatment facilities, wastewater treatment facilities and municipal public works buildings. Data for ferry ports and municipal public works buildings was provided by Monmouth County, and data for airports, potable water treatment facilities and wastewater treatment facilities was obtained from HAZUS-MH.

4. Other Critical Facilities: Includes schools, child care facilities and senior care facilities according to data provided by Monmouth County. These are non-emergency facilities but still provide critical services and functions for vulnerable sectors of the population.

5. Historic and Cultural Resources: Includes those historic properties and sites that are included in the New Jersey or National Registers of Historic Places, or that have been determined eligible for inclusion through Federal or state processes as administered by the New Jersey Historic Preservation Office.

6. Population: Includes the number of persons residing throughout Monmouth County as delineated by census block data from U.S. Census 2000.

The following summary tables are provided in order to show a more detailed breakdown, by municipal jurisdiction, of georeferenced assets that have been identified for inclusion in the multi-jurisdictional vulnerability assessment. More specific information (e.g., facility name, owner, address) is provided for those assets identified as potentially at-risk to identified hazards later in this section.

[1] While potentially not all-inclusive for Monmouth County, ñgeoreferencedò assets include those assets for which specific location data is readily available for connecting the asset to a specific geographic location for purposes of GIS analysis.
[2] Total assessed values for improvements is based on tax assessor records as provided by municipal jurisdictions to Monmouth County and joined to parcel data. It does not include dollar figures for tax-exempt improvements, such as publicly-owned facilities.

Improved Property

There is an estimated $36.7 billion in improved property value throughout Monmouth County. **Table 3b.1** lists the total number and percentage of improved parcels as well the total assessed value of their improvements by jurisdiction based on data provided through the Monmouth County Office of GIS.

Table 3b.1
Improved Property by Jurisdiction

Jurisdiction	Total Number of Parcels	Number of Improved Parcels	Percent of Improved Parcels	Total Assessed Value of Improvements
Aberdeen, Township of	6,871	5,936	86.39%	$515,957,370
Allenhurst, Borough of	347	329	94.81%	$100,652,200
Allentown, Borough of	698	632	90.54%	$77,448,700
Asbury Park, City of	3,933	2,773	70.51%	$320,791,800
Atlantic Highlands, Borough of	1,859	1,858	99.95%	$445,377,200
Avon-By-The-Sea, Borough of	967	865	89.45%	$127,812,100
Belmar, Borough of	2,356	2,256	95.76%	$432,498,600
Bradley Beach, Borough of	1,956	1,825	93.30%	$198,617,900
Brielle, Borough of	2,230	1,915	85.87%	$270,948,535
Colts Neck, Township of	3,656	2,859	78.20%	$620,440,600
Deal, Borough of	928	854	92.03%	$402,837,700
Eatontown, Borough of	4,064	3,408	83.86%	$1,176,943,200
Englishtown, Borough of	673	454	67.46%	$50,184,400
Fair Haven, Borough of	2,247	2,072	92.21%	$516,903,700
Farmingdale, Borough of	449	403	89.76%	$47,555,700
Freehold, Borough of	3,310	3,071	92.78%	$438,446,925
Freehold, Township of	12,840	10,440	81.31%	$2,033,417,200
Hazlet, Township of	6,823	6,378	93.48%	$693,335,000
Highlands, Borough of	2,611	2,256	86.40%	$318,826,200
Holmdel, Township of	5,013	4,135	82.49%	$1,995,955,600
Howell, Township of	23,883	16,448	68.87%	$1,914,832,390
Interlaken, Borough of	433	397	91.69%	$88,855,300
Keansburg, Borough of	3,301	3,027	91.70%	$199,892,700
Keyport, Borough of	2,356	2,091	88.75%	$219,673,450
Lake Como, Borough of	925	878	94.92%	$65,026,800
Little Silver, Borough of	2,601	2,598	99.88%	$622,615,400
Loch Arbour, Village of	148	142	95.95%	$28,719,700
Long Branch, City of	8,155	7,261	89.04%	$1,085,212,300
Manalapan, Township of	13,216	11,054	83.64%	$3,229,721,500
Manasquan, Borough of	3,874	3,434	88.64%	$394,840,400
Marlboro, Township of	12,232	10,948	89.50%	$2,270,927,800
Matawan, Borough of	2,766	2,454	88.72%	$280,292,084
Middletown, Township of	25,651	22,988	89.62%	$3,327,619,578
Millstone, Township of	3,776	3,137	83.08%	$263,436,400
Monmouth Beach, Borough of	1,695	1,478	87.20%	$169,824,000
Neptune City, Borough of	1,645	1,525	92.71%	$142,043,700
Neptune, Township of	19,068	13,783	72.28%	$1,576,460,100
Ocean, Township of	9,623	8,510	88.43%	$2,612,650,600
Oceanport, Borough of	2,222	2,009	90.41%	$322,084,700
Red Bank, Borough of	4,216	4,056	96.20%	$1,219,372,800

Table 3b.1 Improved Property by Jurisdiction				
Jurisdiction	**Total Number of Parcels**	**Number of Improved Parcels**	**Percent of Improved Parcels**	**Total Assessed Value of Improvements**
Roosevelt, Borough of	369	328	88.89%	$23,470,660
Rumson, Borough of	2,613	2,451	93.80%	$507,589,781
Sea Bright, Borough of	1,337	1,077	80.55%	$98,620,100
Sea Girt, Borough of	1,304	1,231	94.40%	$235,924,250
Shrewsbury, Borough of	1,453	1,371	94.36%	$451,418,300
Shrewsbury, Township of	11	9	81.82%	$3,900,100
Spring Lake, Borough of	1,871	1,747	93.37%	$489,616,500
Spring Lake Heights, Borough of	2,397	2,106	87.86%	$276,945,800
Tinton Falls, Borough of	8,653	6,072	70.17%	$920,707,700
Union Beach, Borough of	2,475	2,175	87.88%	$236,450,400
Upper Freehold, Township of	2,774	2,103	75.81%	$143,501,070
Wall, Township of	10,372	9,358	90.22%	$2,039,081,200
West Long Branch, Borough of	2,866	2,416	84.30%	$495,025,500
Total	**244,112**	**205,381**	**84.13%**	**$36,741,303,693**

Source: Monmouth County Office of GIS

NOTE: Municipal tax records were made available for all jurisdictions. To complete the GIS-based analysis for determining hazard vulnerability in this section, these tax records were ñjoinedò with Monmouth Countyôs GIS parcel layers for all jurisdictions with the exception of the Borough of Red Bank. For Red Bank, an average building value of $289,294 was applied to complete the analysis (in which the average building value was multiplied by the number of parcels with buildings determined to be located in each of the following hazard areas: flood, storm surge, wave action, coastal erosion, landslide, dam failure and wildfire). More information on the GIS-based analysis is provided under ñMethodologyò and under the vulnerability assessment section of each respective hazard.

Emergency Facilities

There are 248 identified emergency facilities in Monmouth County, including 16 EOCs, 170 fire stations, 57 police stations and five hospitals. **Table 3b.2** shows emergency facilities by jurisdiction. Geographic coordinates (i.e., latitude and longitude) were used to determine the location of each facility within each jurisdiction.

Table 3b.2 Emergency Facilities by Jurisdiction				
Jurisdiction	**EOCs**	**Fire Stations**	**Police Stations**	**Hospitals**
Aberdeen, Township of	0	2	1	0
Allenhurst, Borough of	0	1	1	0
Allentown, Borough of	0	2	1	0
Asbury Park, City of	0	1	1	0
Atlantic Highlands, Borough of	1	1	1	0
Avon-By-The-Sea, Borough of	0	2	1	0
Belmar, Borough of	1	4	1	0
Bradley Beach, Borough of	0	2	1	0
Brielle, Borough of	0	2	1	0
Colts Neck, Township of	0	5	2	0
Deal, Borough of	0	1	1	0
Eatontown, Borough of	1	1	1	0
Englishtown, Borough of	0	2	1	0
Fair Haven, Borough of	0	1	2	0
Farmingdale, Borough of	0	2	1	0
Freehold, Borough of	1	3	2	0

Table 3b.2
Emergency Facilities by Jurisdiction

Jurisdiction	EOCs	Fire Stations	Police Stations	Hospitals
Freehold, Township of	0	4	1	1
Hazlet, Township of	1	5	2	0
Highlands, Borough of	0	2	1	0
Holmdel, Township of	0	3	1	1
Howell, Township of	0	7	2	0
Interlaken, Borough of	0	0	1	0
Keansburg, Borough of	0	2	2	0
Keyport, Borough of	1	8	1	0
Lake Como, Borough of	0	0	0	0
Little Silver, Borough of	0	2	1	0
Loch Arbour, Village of	0	0	1	0
Long Branch, City of	1	10	1	1
Manalapan, Township of	0	2	1	0
Manasquan, Borough of	1	3	1	0
Marlboro, Township of	0	7	1	0
Matawan, Borough of	0	4	1	0
Middletown, Township of	1	16	1	0
Millstone, Township of	0	3	1	0
Monmouth Beach, Borough of	0	1	1	0
Neptune City, Borough of	0	1	1	0
Neptune, Township of	0	9	1	1
Ocean, Township of	1	4	1	0
Oceanport, Borough of	1	3	1	0
Red Bank, Borough of	0	9	1	1
Roosevelt, Borough of	0	1	1	0
Rumson, Borough of	0	3	1	0
Sea Bright, Borough of	0	2	0	0
Sea Girt, Borough of	2	1	1	0
Shrewsbury, Borough of	1	1	1	0
Shrewsbury, Township of	0	0	1	0
Spring Lake, Borough of	0	3	2	0
Spring Lake Heights, Borough of	0	1	1	0
Tinton Falls, Borough of	0	7	1	0
Union Beach, Borough of	1	4	1	0
Upper Freehold, Township of	1	1	0	0
Wall, Township of	0	7	1	0
West Long Branch, Borough of	0	2	1	0
Total	**16**	**170**	**57**	**5**

Sources: Monmouth County Office of GIS; HAZUS-MH

Critical Infrastructure and Utilities

There are 109 identified critical infrastructure and utility elements in Monmouth County, including 16 potable water treatment facilities, 24 wastewater treatment facilities, 58 municipal public works buildings, one significant airport and four ferry ports. **Table 3b.3** shows critical infrastructure and utilities by jurisdiction. Geographic coordinates (i.e., latitude and longitude) were used to determine the location of each facility within each jurisdiction.

Table 3b.3
Critical Infrastructure and Utilities by Jurisdiction

Jurisdiction	Potable Water Treatment Facilities	Wastewater Treatment Facilities	Public Works Buildings	Airports*	Ferry Ports
Aberdeen, Township of	1	0	1	0	0
Allenhurst, Borough of	0	0	0	0	0
Allentown, Borough of	0	1	1	0	0
Asbury Park, City of	0	1	1	0	0
Atlantic Highlands, Borough of	1	0	1	0	1
Avon-By-The-Sea, Borough of	0	0	1	0	0
Belmar, Borough of	1	1	1	0	0
Bradley Beach, Borough of	0	0	1	0	0
Brielle, Borough of	0	0	1	0	0
Colts Neck, Township of	0	1	1	0	0
Deal, Borough of	0	0	1	0	0
Eatontown, Borough of	0	0	1	0	0
Englishtown, Borough of	1	0	1	0	0
Fair Haven, Borough of	0	0	1	0	0
Farmingdale, Borough of	0	0	1	0	0
Freehold, Borough of	0	0	1	0	0
Freehold, Township of	1**	1	1	1	0
Hazlet, Township of	1	0	1	0	0
Highlands, Borough of	0	0	1	0	2
Holmdel, Township of	1	***5	1	1	0
Howell, Township of	0	0	1	1	0
Interlaken, Borough of	0	0	1	0	0
Keansburg, Borough of	0	0	1	0	0
Keyport, Borough of	0	0	1	0	0
Lake Como, Borough of	0	0	0	0	0
Little Silver, Borough of	0	0	1	0	0
Loch Arbour, Village of	0	0	0	0	0
Long Branch, City of	0	1	1	0	0
Manalapan, Township of	0	1	1	1	0
Manasquan, Borough of	0	0	1	0	0
Marlboro, Township of	0	2	1	1	0
Matawan, Borough of	1	0	1	0	0
Middletown, Township of	0	3	1	0	1
Millstone, Township of	0	0	1	1	0
Monmouth Beach, Borough of	0	1	1	0	0
Neptune City, Borough of	0	0	1	0	0
Neptune, Township of	0	1	1	0	0
Ocean, Township of	0	1	9	0	0
Oceanport, Borough of	0	0	1	0	0
Red Bank, Borough of	0	0	1	0	0
Roosevelt, Borough of	0	1	1	0	0
Rumson, Borough of	0	0	1	0	0
Sea Bright, Borough of	0	0	1	0	0
Sea Girt, Borough of	2	1	1	0	0

Table 3b.3 Critical Infrastructure and Utilities by Jurisdiction					
Jurisdiction	**Potable Water Treatment Facilities**	**Wastewater Treatment Facilities**	**Public Works Buildings**	**Airports***	**Ferry Ports**
Shrewsbury, Borough of	0	0	1	0	0
Shrewsbury, Township of	0	0	1	0	0
Spring Lake, Borough of	0	0	1	0	0
Spring Lake Heights, Borough of	0	0	1	0	0
Tinton Falls, Borough of	0	0	1	0	0
Union Beach, Borough of	0	1	1	0	0
Upper Freehold, Township of	0	0	1	0	0
Wall, Township of	6	1	1	1	0
West Long Branch, Borough of	0	0	1	0	0
Total	**16**	**24**	**58**	**7**	**4**

Sources: HAZUS-MH, Monmouth County Office of GIS
* Monmouth Executive Airport in Wall Township is the only significant working airport in the county ï others are small former airports or farm landing fields used for crop spraying.
** Water Treatment Facility located in Freehold Township is operated by and for Freehold Borough.
*** Five sewer pumping stations considered critical facilities by local authorities.

Other Critical Facilities

There are 804 facilities which are considered non-emergency but still critical in Monmouth County, including 665 schools and child care facilities (including camps) and 139 senior care facilities. **Table 3b.4** shows these facilities by jurisdiction. Geographic coordinates (i.e., latitude and longitude) were used to determine the location of each facility within each jurisdiction.

Table 3b.4 Other Critical Facilities by Jurisdiction		
Jurisdiction	**Schools/Child Care Facilities**	**Senior Care Facilities**
Aberdeen, Township of	16	3
Allenhurst, Borough of	0	0
Allentown, Borough of	3	0
Asbury Park, City of	22	10
Atlantic Highlands, Borough of	7	1
Avon-By-The-Sea, Borough of	2	0
Belmar, Borough of	6	1
Bradley Beach, Borough of	6	0
Brielle, Borough of	5	0
Colts Neck, Township of	9	1
Deal, Borough of	1	0
Eatontown, Borough of	12	1
Englishtown, Borough of	2	1
Fair Haven, Borough of	10	0
Farmingdale, Borough of	3	0
Freehold, Borough of	11	6
Freehold, Township of	34	8
Hazlet, Township of	22	5
Highlands, Borough of	6	1
Holmdel, Township of	16	6
Howell, Township of	56	6
Interlaken, Borough of	0	0

Table 3b.4
Other Critical Facilities by Jurisdiction

Jurisdiction	Schools/Child Care Facilities	Senior Care Facilities
Keansburg, Borough of	12	5
Keyport, Borough of	11	3
Lake Como, Borough of	2	12
Little Silver, Borough of	8	0
Loch Arbour, Village of	0	0
Long Branch, City of	32	0
Manalapan, Township of	36	4
Manasquan, Borough of	11	1
Marlboro, Township of	37	5
Matawan, Borough of	6	2
Middletown, Township of	73	12
Millstone, Township of	7	1
Monmouth Beach, Borough of	3	0
Neptune City, Borough of	5	2
Neptune, Township of	26	12
Ocean, Township of	29	3
Oceanport, Borough of	2	1
Red Bank, Borough of	16	6
Roosevelt, Borough of	2	0
Rumson, Borough of	11	0
Sea Bright, Borough of	0	0
Sea Girt, Borough of	1	0
Shrewsbury, Borough of	4	3
Shrewsbury, Township of	0	2
Spring Lake, Borough of	6	0
Spring Lake Heights, Borough of	6	0
Tinton Falls, Borough of	19	6
Union Beach, Borough of	4	0
Upper Freehold, Township of	5	0
Wall, Township of	26	8
West Long Branch, Borough of	15	1
Gateway National Recreation Area*	**1**	**0**
Total	**665**	**139**

Sources: HAZUS-MH, Monmouth County Office of GIS
*NOTE: One school is located in Gateway National Recreation Area, which is not associated with a jurisdiction but is located in Monmouth County.

Historic and Cultural Resources

There are 95 georeferenced historic properties and sites in Monmouth County which are included in the New Jersey or National Registers of Historic Places, or that have been determined eligible for inclusion through Federal or state processes as administered by the New Jersey Historic Preservation Office (HPO). These properties are listed in **Table 3b.5,** along with other properties considered to be of historic and/or cultural significance that have been identified by the individual jurisdictions. The data does not preclude the existence of other historic properties or sites not within this category or as yet unidentified. Further, this data represents only a portion of the total number of registered or eligible historic properties as HPO is still in the process of building the GIS database of historic and cultural resource properties.

Table 3b.5
Inventory of Historic Properties

Property Name	Location	Jurisdiction
Garden State Parkway Historic District	Traverses through Monmouth County	Aberdeen, Township of; Hazlet, Township of; Holmdel, Township of; Keyport, Borough of; Matawan, Borough of; Middletown, Township of; Tinton Falls, Borough of; and Wall, Township of
Asbury Park Casino and Carousel	Lake & Atlantic Avenues	Asbury Park, City of
Asbury Park Convention Hall	Ocean Avenue	Asbury Park, City of
Asbury Park Post Office	801 Bangs Avenue	Asbury Park, City of
Belmont Hotel	300 Asbury Avenue	Asbury Park, City of
Berkeley-Carteret Hotel	1401 Ocean Ave.	Asbury Park, City of
Britwoods Court	216-218 Second Avenue	Asbury Park, City of
George Wurt's Summer Home	306 Eighth Avenue	Asbury Park, City of
Howard Johnson's Pavilion	Ocean Ave at Fifth Ave	Asbury Park, City of
Jersey Apartments	212 Second Avenue	Asbury Park, City of
Library Square Historic District	Not provided	Asbury Park, City of
Palace Amusements Building	201-207 Lake Avenue	Asbury Park, City of
Savoy Theater/Kinmoth Bldg.	710 Mattison Ave.	Asbury Park, City of
Steinbach/Cookman Building	Cookman Avenue	Asbury Park, City of
Sunset Lake Historic District	Not provided	Asbury Park, City of
Turn of the Century Historic District	Not provided	Asbury Park, City of
Winsor Building	400-420 Main Street	Asbury Park, City of
Williamson-Sickles Barn	21 Driftwood Lane	Colts Neck, Township of
Naval Weapons Station Earle Historic District	Not provided	Colts Neck, Township of; Howell, Township of; Middletown, Township of; Tinton Falls, Borough of; and Wall, Township of
Fort Monmouth Historic District (1)	Not provided	Eatontown, Borough of
The Village Inn	2 Water Street	Englishtown, Borough of
Fort Hancock and Sandy Hook Proving Ground Historic District	Not provided	Gateway National Recreation Area
Fort Hancock U.S. Lifesaving Station	Not provided	Gateway National Recreation Area
Bahrs Landing Restaurant and Marina	2 Bay Avenue	Highlands, Borough of
Murray/Masciale House	Lighthouse Road	Highlands, Borough of
Holmdel Dutch Reformed Church	41 Main Street	Holmdel, Township of
Holmes-Hendrickson House	Longstreet Road	Holmdel, Township of
Horn Antenna Bell Labs	Crawford Hill	Holmdel, Township of
Longstreet Farm	Longstreet Road	Holmdel, Township of
Baptist Church Meeting House	40 Main Street	Holmdel, Township of
Ocean Avenue Bridge	Ocean Avenue over Lake Takanasee	Long Branch, City of
Patten Point Yacht Club	Patten Avenue	Long Branch, City of
Summer Cottage at 109 Park Avenue	109 Park Avenue	Long Branch, City of
Millhurst Mill / Black's Mills / Clifford Snyder Grist Mill Complex	County Route 527	Manalapan, Township of
Brielle Road Bridge (S.I. & A. #13000W9)	Brielle Road over Glimmer Glass	Manasquan, Borough of
Burrowes Mansion	94 Main Street	Matawan, Borough of
Marlboro Railroad Depot	SW Corner of Vanderburg Rd & Central Railroad of NJ	Marlboro, Township of
Old Scots Burying Ground	Gordon's Corner Road	Marlboro, Township of
Uriah Smock House	42 Vanderburg Road	Marlboro, Township of
Van Kirk Farm	107 Vanderburg Road	Marlboro, Township of

Table 3b.5
Inventory of Historic Properties

Property Name	Location	Jurisdiction
Bowne House	Leonard Avenue	Middletown, Township of
Dorsett's Creek Bridge	NJ Transit North Jersey Coast Line, Milepost 11.3	Middletown, Township of
Grover House	940 West Front Street	Middletown, Township of
Navesink Historic District	Not provided	Middletown, Township of
Water Witch Historic District	Not provided	Middletown, Township of
703 South Edgemere Avenue	703 South Edgemere Ave	Ocean, Township of
Eden Wooley House	715 Deal Road	Ocean, Township of
Deal Test Site	Joe Palaia Park, Whalepond Road	Ocean, Township of
Fort Monmouth Historic District (2)	Not provided	Oceanport, Borough of
Oceanport Creek Bridge	NJ Transit North Jersey Coast Line, Milepost 19.80 over Oceanport Creek	Oceanport, Borough of
First Presbyterian Church of Rumson	East River Rd at Park Ave	Rumson, Borough of
Lauriston	91 Rumson Rd.	Rumson, Borough of
Saint George's-by-the River Episcopal Church	7 Lincoln Avenue	Rumson, Borough of
Allen House	Broad St and Sycamore Ave	Shrewsbury, Borough of
Camp Charles Wood Radar Antenna Shelters (1)	Laboratory Road	Tinton Falls, Borough of
Camp Charles Wood Radar Antenna Shelters (2)	Laboratory Road	Tinton Falls, Borough of
Camp Charles Wood Radar Antenna Shelters (3)	Laboratory Road	Tinton Falls, Borough of
Tinton Falls Historic District	Not provided	Tinton Falls, Borough of
Joshua Cox House	Clarksburg-Robbinsville Rd	Upper Freehold, Township of
Walnford Historic District	Not provided	Upper Freehold, Township of
Waln's Mill Road Bridge over Crosswicks (SI & A #1300U47)	Waln's Mill Road	Upper Freehold, Township of
Waln's Mill Road Bridge over Crosswicks Creek (SI & A #1300U48)	Waln's Mill Road	Upper Freehold, Township of
2751 18th Avenue	2751 18th Avenue	Wall, Township of
Camp Evans Historic District (Marconi Belmar Station; U.S. Army Signal Corps Radar Laboratory)	Not provided	Wall, Township of
Diana Dish Support Facility (Building 9116)	Not provided	Wall, Township of
Dymaxion Deployment Units (Surviving)	Not provided	Wall, Township of
Dymaxion Deployment Units (Surviving)	Not provided	Wall, Township of
Electric Shop (Building 9034)	Not provided	Wall, Township of
Evans Radar Antenna Shelter (Building 9023)	Not provided	Wall, Township of
Fire Station (Building 9031)	Not provided	Wall, Township of
General Purpose Warehouse (Building 9084)	Not provided	Wall, Township of
General Purpose Warehouse (Building 9085)	Not provided	Wall, Township of
Guard Headquarters (Building 9093)	Not provided	Wall, Township of
Heating Oil Plant (Building 9012)	Not provided	Wall, Township of
Heating Oil Plant (Building 9030)	Not provided	Wall, Township of
Heating Oil Plant (Building 9033)	Not provided	Wall, Township of
Heating Oil Plant (Building 9035)	Not provided	Wall, Township of
Heating Oil Plant (Building 9038)	Not provided	Wall, Township of
Laboratory General Purpose (Building 9086)	Not provided	Wall, Township of
Laboratory General Purpose (Building 9092)	Not provided	Wall, Township of
Laboratory General Purpose (Building 9097)	Not provided	Wall, Township of

Table 3b.5 Inventory of Historic Properties		
Property Name	**Location**	**Jurisdiction**
Laboratory General Purpose (Building 9098)	Not provided	Wall, Township of
Laboratory General Purpose (Building 9400)	Not provided	Wall, Township of
Marconi Building (Building 9001)	Marconi Road	Wall, Township of
Marconi Engineer Cottage (Building 9003)	Not provided	Wall, Township of
Marconi Manager Cottage (Building 9002)	Not provided	Wall, Township of
Marconi Power Plant (Building 9006)	Not provided	Wall, Township of
Marconi Wireless Operations (Building 9004)	Not provided	Wall, Township of
Platform (Diana Site) (Building 9196)	Not provided	Wall, Township of
Platform/Tower (Building 9178)	Not provided	Wall, Township of
Project DIANA Site	Not provided	Wall, Township of
Radar Laboratory (Building 9010)	Not provided	Wall, Township of
Radar Laboratory (Building 9011)	Not provided	Wall, Township of
Radar Laboratory (Building 9036)	Not provided	Wall, Township of
Radar Laboratory (Building 9037)	Not provided	Wall, Township of
Radar Shelter (Building 9017)	Not provided	Wall, Township of
Signal Administration (Building 9029)	Not provided	Wall, Township of
Signal Administration Annex (Bldg 9032)	Not provided	Wall, Township of
Space Sentry (Diana Site) (Building 9195)	Not provided	Wall, Township of
Space Sentry Support Facility (Bldg 9162)	Not provided	Wall, Township of
Telephone Exchange (Building 9059)	Not provided	Wall, Township of
Wellhouse (Building 9081)	Not provided	Wall, Township of
Wireless Support (Building 9005)	Not provided	Wall, Township of

Source: New Jersey Historic Preservation Office

Population

According to the U.S. Census Bureau, the total population of Monmouth County in 2000 was 615,301 persons, comprising 224,236 households. **Table 3b.6** shows population and household counts by jurisdiction.

Table 3b.6 Population and Households by Jurisdiction (2000 Census)				
Jurisdiction	**Population**		**Households**	
	Count	**% of County Total**	**Count**	**% of County Total**
Aberdeen, Township of	17,454	2.84%	6,421	2.86%
Allenhurst, Borough of	599	0.10%	243	0.11%
Allentown, Borough of	1,882	0.31%	708	0.32%
Asbury Park, City of	16,930	2.75%	6,754	3.01%
Atlantic Highlands, Borough of	4,705	0.76%	1,969	0.88%
Avon-By-The-Sea, Borough of	2,244	0.36%	1,043	0.47%
Belmar, Borough of	6,045	0.98%	2,946	1.31%
Bradley Beach, Borough of	4,793	0.78%	2,297	1.02%
Brielle, Borough of	4,893	0.80%	1,938	0.86%
Colts Neck, Township of	12,331	2.00%	3,513	1.57%
Deal, Borough of	1,070	0.17%	434	0.19%
Eatontown, Borough of	13,964	2.27%	5,739	2.56%
Englishtown, Borough of	1,764	0.29%	643	0.29%
Fair Haven, Borough of	5,937	0.96%	1,998	0.89%
Farmingdale, Borough of	1,587	0.26%	625	0.28%

Table 3b.6
Population and Households by Jurisdiction (2000 Census)

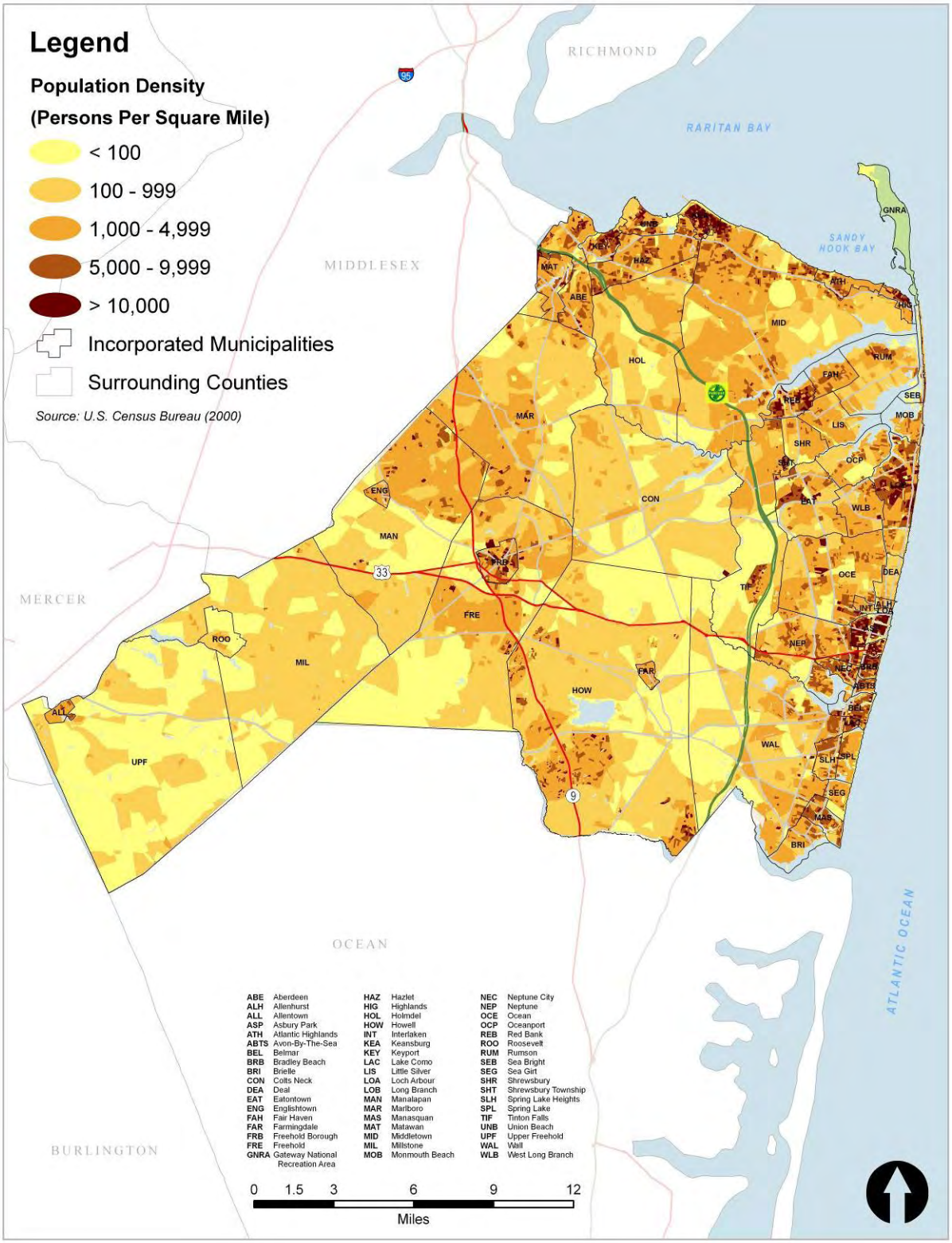
Jurisdiction	Population		Households	
	Count	% of County Total	Count	% of County Total
Freehold, Borough of	10,976	1.78%	3,695	1.65%
Freehold, Township of	31,537	5.13%	10,814	4.82%
Hazlet, Township of	21,378	3.47%	7,244	3.23%
Highlands, Borough of	5,097	0.83%	2,450	1.09%
Holmdel, Township of	15,781	2.56%	4,947	2.21%
Howell, Township of	48,903	7.95%	16,063	7.16%
Interlaken, Borough of	900	0.15%	386	0.17%
Keansburg, Borough of	10,426	1.69%	3,761	1.68%
Keyport, Borough of	7,568	1.23%	3,264	1.46%
Lake Como, Borough of	1,806	0.29%	824	0.37%
Little Silver, Borough of	6,170	1.00%	2,232	1.00%
Loch Arbour, Village of	399	0.06%	162	0.07%
Long Branch, City of	31,340	5.09%	12,594	5.62%
Manalapan, Township of	33,423	5.43%	10,781	4.81%
Manasquan, Borough of	6,310	1.03%	2,600	1.16%
Marlboro, Township of	36,398	5.92%	11,478	5.12%
Matawan, Borough of	8,910	1.45%	3,531	1.57%
Middletown, Township of	66,633	10.83%	23,347	10.41%
Millstone, Township of	8,970	1.46%	2,708	1.21%
Monmouth Beach, Borough of	3,595	0.58%	1,633	0.73%
Neptune City, Borough of	5,218	0.85%	2,221	0.99%
Neptune, Township of	27,690	4.50%	10,907	4.86%
Ocean, Township of	26,959	4.38%	10,254	4.57%
Oceanport, Borough of	5,834	0.95%	2,075	0.93%
Red Bank, Borough of	11,844	1.92%	5,201	2.32%
Roosevelt, Borough of	933	0.15%	337	0.15%
Rumson, Borough of	7,137	1.16%	2,452	1.09%
Sea Bright, Borough of	1,818	0.30%	1,003	0.45%
Sea Girt, Borough of	2,148	0.35%	942	0.42%
Shrewsbury, Borough of	3,590	0.58%	1,207	0.54%
Shrewsbury, Township of	1,098	0.18%	521	0.23%
Spring Lake, Borough of	3,567	0.58%	1,463	0.65%
Spring Lake Heights, Borough of	5,227	0.85%	2,511	1.12%
Tinton Falls, Borough of	15,070	2.45%	5,893	2.63%
Union Beach, Borough of	6,649	1.08%	2,143	0.96%
Upper Freehold, Township of	4,282	0.70%	1,437	0.64%
Wall, Township of	25,261	4.11%	9,437	4.21%
West Long Branch, Borough of	8,258	1.34%	2,448	1.09%
Total	**615,301**	**100.00%**	**224,236**	**100.00%**

Source: U.S. Census Bureau

According to the 2000 census, the median age in Monmouth County is 37.7 years and the average household size is 2.7 persons. In terms of population segments that may potentially be at higher risk in general, 6.9 percent of the total population is under the age of five (a total of 42,231 persons) and 12.5 percent is age 65 years and over (a total of 76,923 persons). Approximately 17.5 percent of households have incomes of $25,000 or less (39,170 households), and 14.9 percent (84,529 persons age five and up)

hold disability status. Census Bureau estimates from 2006 indicate that the population is growing and skewing older, with a rise in median age and number of older persons while numbers of young children and disabled individuals are decreasing. **Figure 3b.1** illustrates the residential population density across Monmouth County. Most of the countyôs population is located along or near coastal areas. There is also development along major thoroughfares including Route 33 and Route 9. Areas in the western portion of the county are less populated and include agricultural lands and undeveloped park lands.

Figure 3b.1
Monmouth County Population Density



SECTION 3C - Damage Estimates

Methodology

This multi-jurisdictional vulnerability assessment was conducted with two distinct methodologies, utilizing GIS-based analysis and a statistical risk assessment methodology. Each approach provides estimates for the potential impact of hazards by using a common, systematic framework for evaluation, including historical occurrence information provided in the *Hazard Profiles* section. The results of the multi-jurisdictional vulnerability assessment are provided for each hazard immediately following the summary of information provided through the hazard identification and analysis, as listed above.

A GIS-based analysis was conducted for 10 hazards:

- hurricane and tropical storm;
- norôeaster;
- coastal erosion;
- dam failure;
- flood;
- storm surge;
- wave action;
- earthquake;
- landslide; and
- wildfire.

A statistical risk assessment approach was used to analyze six hazards:

- extreme temperatures;
- extreme wind;
- lightning;
- tornado;
- winter storm; and
- drought.

Below is a brief description of these approaches.

GIS-Based Analysis

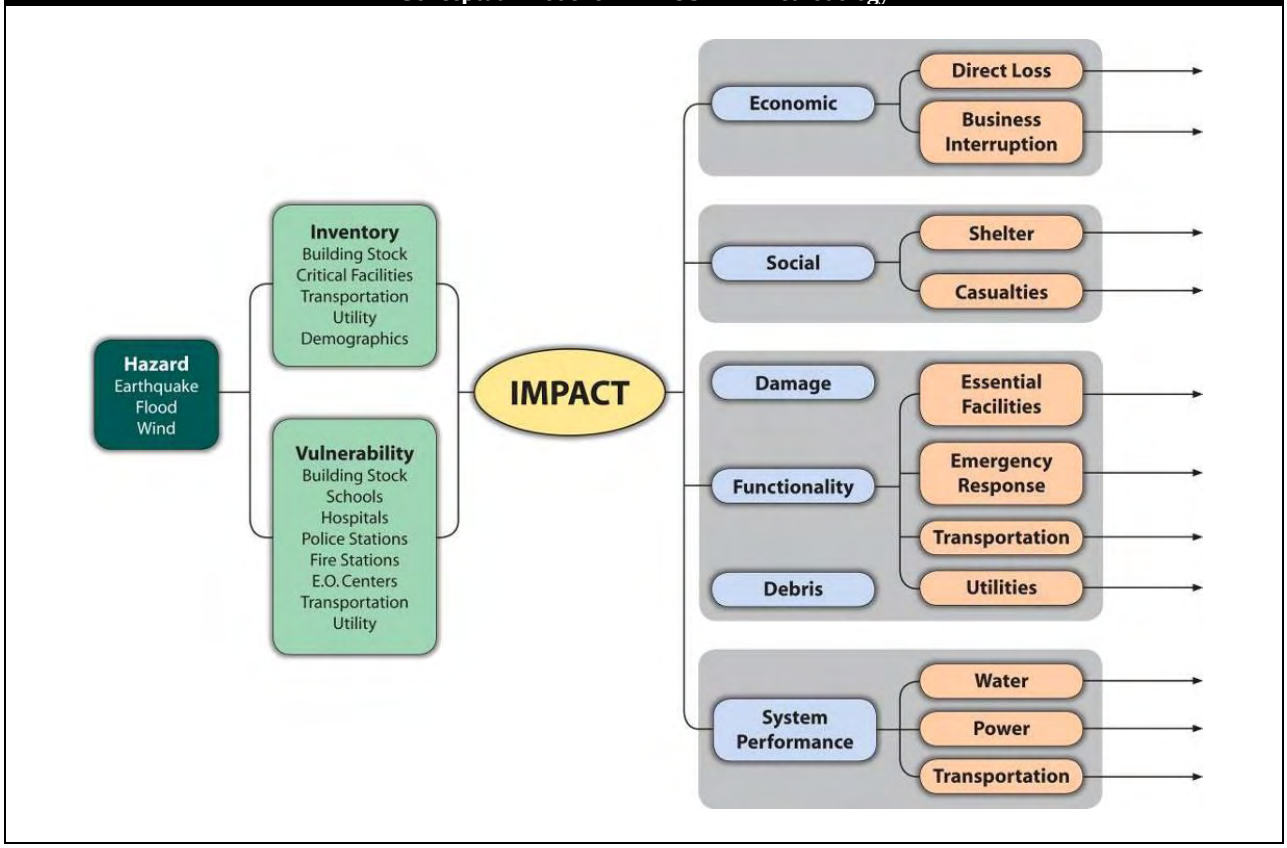
For GIS-based assessment, digital data was collected from local, state and national sources. ESRI® ArcGISÊ 9.2 was used to assess risk utilizing digital data including local tax records for individual parcels and georeferenced point locations for buildings and critical facilities. Using these data layers, risk was assessed by estimating the assessed building value for buildings determined to be located in identified hazard areas. HAZUS-MH was also used to model hurricane winds, riverine flood, storm surge, norôeaster winds and earthquakes and estimate potential losses for these hazards. To estimate population in hazard areas, Census 2000 population data by census block was obtained from HAZUS-MH and census blocks intersecting with hazard areas were used to determine exposed population counts.

The objective of the GIS-based analysis was to determine the estimated vulnerability of people, buildings and critical facilities to the identified hazards for Monmouth County using best available geospatial data. In so doing, local databases made available through Monmouth County such as local tax assessor records, parcel boundaries, building footprints and critical facilities data, were used in combination with digital hazard data as included and described in the *Hazard Profiles* section. The results of the analysis provided an estimated number of people, as well as the numbers and values of buildings and critical facilities determined to be potentially at risk to those hazards with delineable geographic hazard boundaries. These hazards included the flood, storm surge, wave action, coastal erosion, landslide, dam failure and wildfire

hazards. A more specific description of the GIS-based analysis for each particular hazard is provided under the vulnerability assessment section of each respective hazard.

HAZUS-MH is FEMAôs standardized loss estimation software program built upon an integrated GIS platform (**Figure 3c.1**) to conduct analysis at a regional level (i.e., not on a structure-by-structure basis). The HAZUS-MH risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) were modeled using the HAZUS-MH software to determine the impact (i.e., damages and losses) on the built environment. This risk assessment applied HAZUS-MH to produce countywide profiles and estimate losses for five hazards at the jurisdictional level. At the time this analysis was completed, HAZUS-MH MR-3 (September 2007) was used to estimate potential losses from hurricane winds, riverine flood, storm surge, norôeaster winds[3], and earthquake using HAZUS-MH default building stock inventory data. The results of the HAZUS-MH model analysis includes annualized loss estimates for each municipal jurisdiction in Monmouth County so that potential loss values may be compared to one another throughout Monmouth County. In generating loss estimates through HAZUS-MH, some data normalization was necessary to account for recognized differences between actual assessed building values as provided by Monmouth County and estimated replacement building value data as provided within HAZUS-MH. In order to account for the difference between modeled and actual values, the ratio of estimated losses produced by HAZUS-MH as compared to total HAZUS-MH building inventory was used to estimate percent damage. The percent damage ratio was then applied to the local assessed values of each jurisdiction to estimate potential losses and loss ratios in Monmouth County for this analysis.

Figure 3c.1
Conceptual Model of HAZUS-MH Methodology



[3] HAZUS-MH does not currently include a norôeaster scenario model. However, an alternative methodology using parameters from the hurricane model were used in conjunction with NOAA observations to model historic norôeasters to estimate potential losses. This methodology is described in the norôeaster section of this assessment.

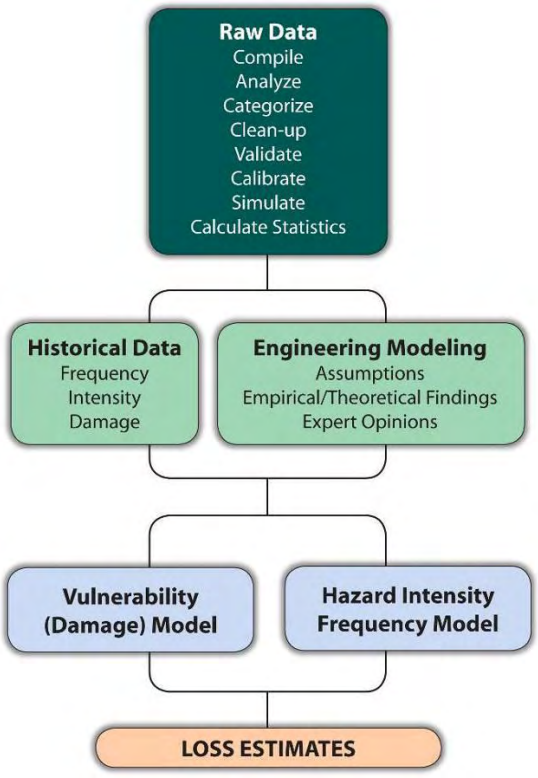
Statistical Risk Assessment Methodology

The statistical risk assessment methodology was applied to analyze hazards of concern that were outside the scope of HAZUS-MH and the GIS-based risk assessment. This methodology uses a statistical approach and mathematical modeling of risk to predict a hazardôs frequency of occurrence and estimated impacts based on recorded or historic damage information (presented in the *Hazard Profiles* section). This methodology was used to assess risk to the extreme temperatures, lightning, tornado and drought hazards. Historical data for each hazard as described in the *Hazard Profiles* section was used and statistical evaluations were performed using manual calculations. The general steps used in the statistical risk assessment methodology are summarized below:

1. Compile data from local, state and national sources, as well as literature;
2. Clean up data, including removal of duplicate records and update losses to account for inflation;
3. Identify patterns in frequency, intensity, vulnerability and loss
4. Statistically and probabilistically extrapolate the patterns[4]; and
5. Produce meaningful results, including the development of annualized loss estimates.

Figure 3c.2 illustrates a conceptual model of the statistical risk assessment methodology as applied to Monmouth County.

Figure 3c.2
Conceptual Model of the Statistical Risk Assessment Methodology



[4] In cases where historical events/losses were recorded for the county as a whole, losses were averaged across all jurisdictions in order to estimate losses by jurisdiction and calculate potential annualized losses by jurisdiction.

Risk (vulnerability) assessment is presented in terms of potential annualized losses, whenever possible. In general, presenting results in the annualized form is useful in three ways:

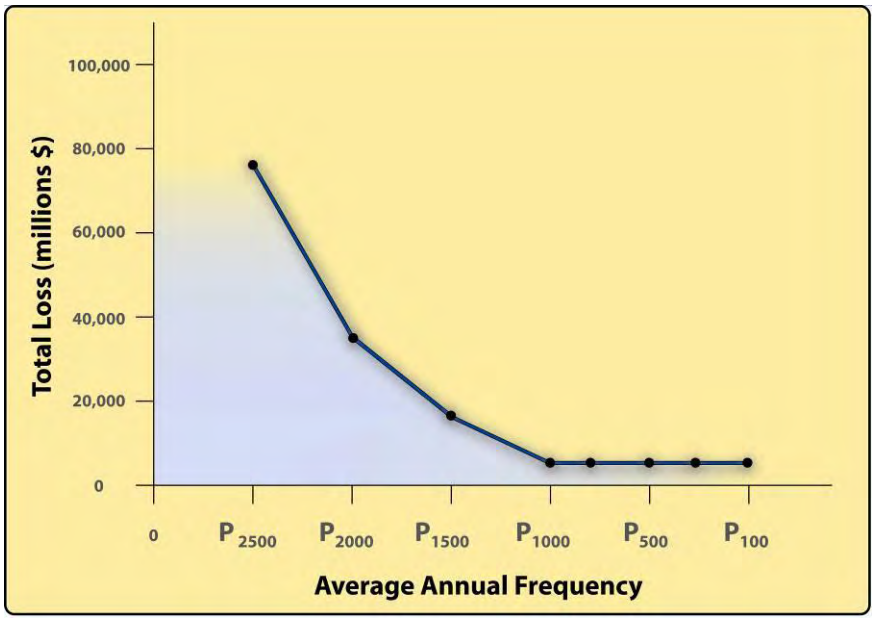
1. This approach accounts for the contribution of potential losses from all future disasters;
2. Annualized results for different hazards are readily comparable, thus easier to rank; and
3. The use of annualized losses is the most objective approach for evaluating mitigation alternatives.

Annualized losses for the hazards where the parametric approach was utilized were computed in a three-step process:

1. Compute/estimate losses for a number of scenario events with different return periods [e.g., 10-year, 100-year, 200-year, 500-year, etc.];
2. Approximate the Probability versus Loss Curve through curve fitting; and
3. Calculate the area under the fitted curve to obtain annualized losses.

This approach is illustrated graphically in **Figure 3c.3**. For other hazards where the statistical approach was used, the computations are based primarily on the observed historical losses.

Figure 3c.3
Graphical Representation of the Annualized Loss Methodology



The economic loss results are presented here using two interrelated risk indicators: Annualized Loss and Annualized Loss Ratio. The Annualized Loss is the estimated long-term weighted average value of losses to property in any single year in a specified geographic area (i.e., municipal jurisdiction). The Annualized Loss Ratio expresses estimated annualized loss normalized by assessed building value.

The estimated Annualized Loss (AL) addresses the key idea of risk: the probability of the loss occurring in the study area (largely a function of building construction type and quality). By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to

provide a balanced presentation of the risk. The Annualized Loss Ratio (ALR) represents the AL as a fraction of the assessed value of the local inventory. This ratio is calculated using the following formula:

ALR = Annualized Losses / Total Exposure

The ALR gauges the relationship between average annualized loss and assessed values. This ratio can be used as a measure of vulnerability in the areas and, since it is normalized by assessed value, it can be directly compared across different geographic units such as metropolitan areas, counties or municipalities.

Loss estimates provided in this vulnerability assessment are based on best available data, and the methodologies applied result in an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, demographics or economic parameters).

All conclusions are presented in ñConclusions on Hazard Riskò at the end of this section. Findings for each hazard are detailed in the hazard-by-hazard vulnerability assessment that follows.

Extreme Temperatures

While all of Monmouth County is exposed to extreme temperatures, existing buildings, infrastructure and critical facilities are not considered vulnerable to significant damage caused by extreme heat or cold events. Therefore any estimated property losses associated with these hazards are anticipated to be minimal across the area. Extreme temperatures do however present a significant life and safety threat to Monmouth Countyôs population.

Heat casualties are usually caused by lack of adequate air conditioning or heat exhaustion. The most vulnerable population to heat casualties are the elderly or infirmed, who frequently live on low fixed incomes and cannot afford to run air-conditioning on a regular basis. This population is sometimes isolated, with no immediate family or friends to look out for their well being.

Casualties resulting from extreme cold may result from a lack of adequate heat, carbon monoxide poisoning from unsafe heat sources and frostbite. The most vulnerable populations to cold casualties are the elderly or infirmed as well as low income households, as they may not be able to afford to operate a heat source on a regular basis and may not have immediate family or friends to look out for their well being.

Given the lack of historical data and limited likelihood for structural losses resulting from extreme heat or cold occurrences in Monmouth County, annualizing potential structural losses over a long period of time would most likely yield a negligible annualized loss estimate for the entire county.

Extreme Wind

Extreme winds may stem from other hazards, including hurricanes and tropical storms, norôeaster, and tornadoes; however, only reported extreme wind events not related to other hazards are considered in this analysis. Vulnerability to winds from hurricanes and tropical storms, norôeaster, and tornadoes are addressed individually in other sections.

Because it cannot be predicted where extreme winds (as defined in the *Hazard Profiles* section) may occur, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported extreme wind occurrences have been factored into this vulnerability assessment[5].

To estimate losses due to extreme wind, NCDC historical extreme wind loss data was used to develop an extreme wind stochastic model. In this model:

- Losses were obtained for each jurisdiction and scaled for inflation. For all events impacting the entire county (loss data not provided for specific jurisdictions), losses were averaged across all 53 jurisdictions;
- Average historic extreme wind damageability was used to generate losses for historical extreme wind events where losses were not reported;
- Expected annualized losses were calculated through a non-linear regression of historical data; and
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event.

Table 3c.1 shows potential annualized property losses and percent loss ratio resulting from extreme wind for each jurisdiction in Monmouth County.

Table 3c.1
Potential Annualized Losses from Extreme Wind by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Aberdeen, Township of	17,454	$515,957,370	$5,746	0.00%
Allenhurst, Borough of	599	$100,652,200	$5,746	0.01%
Allentown, Borough of	1,882	$77,448,700	$5,746	0.01%
Asbury Park, City of	16,930	$320,791,800	$5,746	0.00%
Atlantic Highlands, Borough of	4,705	$445,377,200	$5,746	0.00%
Avon-By-The-Sea, Borough of	2,244	$127,812,100	$5,746	0.00%
Belmar, Borough of	6,045	$432,498,600	$17,470	0.00%
Bradley Beach, Borough of	4,793	$198,617,900	$5,746	0.00%
Brielle, Borough of	4,893	$270,948,535	$5,746	0.00%
Colts Neck, Township of	12,331	$620,440,600	$18,557	0.00%
Deal, Borough of	1,070	$402,837,700	$5,746	0.00%
Eatontown, Borough of	13,964	$1,176,943,200	$5,746	0.00%
Englishtown, Borough of	1,764	$50,184,400	$5,746	0.01%
Fair Haven, Borough of	5,937	$516,903,700	$5,746	0.00%

[5] It is possible that additional extreme wind events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

Table 3c.1
Potential Annualized Losses from Extreme Wind by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)*	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Farmingdale, Borough of	1,587	$47,555,700	$5,746	0.01%
Freehold, Borough of	10,976	$438,446,925	$5,746	0.00%
Freehold, Township of	31,537	$2,033,417,200	$5,746	0.00%
Hazlet, Township of	21,378	$693,335,000	$5,746	0.00%
Highlands, Borough of	5,097	$318,826,200	$5,746	0.00%
Holmdel, Township of	15,781	$1,995,955,600	$5,746	0.00%
Howell, Township of	48,903	$1,914,832,390	$5,746	0.00%
Interlaken, Borough of	900	$88,855,300	$5,746	0.01%
Keansburg, Borough of	10,426	$199,892,700	$5,746	0.00%
Keyport, Borough of	7,568	$219,673,450	$5,746	0.00%
Lake Como, Borough of	1,806	$65,026,800	$5,746	0.01%
Little Silver, Borough of	6,170	$622,615,400	$5,746	0.00%
Loch Arbour, Village of	399	$28,719,700	$5,746	0.02%
Long Branch, City of	31,340	$1,085,212,300	$5,746	0.00%
Manalapan, Township of	33,423	$3,229,721,500	$5,746	0.00%
Manasquan, Borough of	6,310	$394,840,400	$5,746	0.00%
Marlboro, Township of	36,398	$2,270,927,800	$18,557	0.00%
Matawan, Borough of	8,910	$280,292,084	$5,746	0.00%
Middletown, Township of	66,633	$3,327,619,578	$5,746	0.00%
Millstone, Township of	8,970	$263,436,400	$5,746	0.00%
Monmouth Beach, Borough of	3,595	$169,824,000	$5,746	0.00%
Neptune City, Borough of	5,218	$142,043,700	$5,746	0.00%
Neptune, Township of	27,690	$1,576,460,100	$5,746	0.00%
Ocean, Township of	26,959	$2,612,650,600	$5,746	0.00%
Oceanport, Borough of	5,834	$322,084,700	$5,746	0.00%
Red Bank, Borough of	11,844	$1,219,372,800	$8,856	0.00%
Roosevelt, Borough of	933	$23,470,660	$5,746	0.02%
Rumson, Borough of	7,137	$507,589,781	$5,746	0.00%
Sea Bright, Borough of	1,818	$98,620,100	$5,746	0.01%
Sea Girt, Borough of	2,148	$235,924,250	$5,746	0.00%
Shrewsbury, Borough of	3,590	$451,418,300	$5,746	0.00%
Shrewsbury, Township of	1,098	$3,900,100	$5,746	0.15%
Spring Lake, Borough of	3,567	$489,616,500	$5,746	0.00%
Spring Lake Heights, Borough of	5,227	$276,945,800	$5,746	0.00%
Tinton Falls, Borough of	15,070	$920,707,700	$5,746	0.00%
Union Beach, Borough of	6,649	$236,450,400	$5,746	0.00%
Upper Freehold, Township of	4,282	$143,501,070	$5,746	0.00%
Wall, Township of	25,261	$2,039,081,200	$5,746	0.00%
West Long Branch, Borough of	8,258	$495,025,500	$5,746	0.00%
Total	**615,301**	**$36,741,303,693**	**$344,994**	**0.00%**

**Exposure calculated by GIS Analysis using local assessed values*

Hurricane and Tropical Storm

Because hurricanes and tropical storms often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. Hurricanes and tropical storms can cause damage through numerous additional hazards such as flooding, coastal erosion, high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. However, the current HAZUS-MH hurricane model only analyzes hurricane winds and is not capable of modeling and estimating cumulative losses from all hazards associated with hurricanes; therefore only hurricane winds are analyzed in this section. Vulnerability to storm surge resulting from hurricanes is addressed individually in a later section.

A probabilistic scenario was created using HAZUS-MH to assess the vulnerability of Monmouth County to hurricane winds. Default HAZUS-MH wind speed data and damage functions, and methodology were used to determine the potential estimated losses for 50-, 100-, 200-, 500-, and 1000-year frequency events and annual expected loss at the census tract level. **Table 3c.2** shows estimated potential losses for 50-, 100-, 200-, 500- and 1000-year hurricane wind event scenarios by jurisdiction.

Table 3c.2
Estimated Potential Losses from 50-, 100-, 200-, 500-, and 1000-year Hurricane Wind Events

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Potential Total Building Losses				
		50-Year Event	100-Year Event	200-Year Event	500-Year Event	1000-Year Event
Aberdeen, Township of	$515,957,370	$549,681	$1,074,276	$3,498,397	$3,772,147	$26,475,190
Allenhurst, Borough of	$100,652,200	$238,164	$934,812	$2,722,073	$11,721,526	$15,663,933
Allentown, Borough of	$77,448,700	$53,903	$96,188	$168,678	$60,408	$2,792,246
Asbury Park, City of	$320,791,800	$812,386	$3,451,924	$7,388,772	$21,885,076	$27,439,647
Atlantic Highlands, Borough of	$445,377,200	$669,637	$1,552,823	$5,319,411	$20,297,828	$25,789,237
Avon-By-The-Sea, Borough of	$127,812,100	$282,450	$1,045,066	$2,469,286	$10,171,082	$15,072,313
Belmar, Borough of	$432,498,600	$1,078,197	$4,396,315	$9,729,916	$38,073,557	$56,668,154
Bradley Beach, Borough of	$198,617,900	$447,779	$1,723,421	$3,811,834	$14,149,095	$19,179,477
Brielle, Borough of	$270,948,535	$620,971	$2,378,700	$4,973,390	$23,822,439	$42,481,934
Colts Neck, Township of	$620,440,600	$750,359	$1,816,150	$4,655,033	$9,792,405	$42,775,311
Deal, Borough of	$402,837,700	$963,033	$3,438,138	$9,402,299	$40,558,068	$54,706,901
Eatontown, Borough of	$1,176,943,200	$1,435,926	$4,764,142	$12,496,720	$50,384,468	$70,692,112
Englishtown, Borough of	$50,184,400	$33,150	$88,103	$205,174	$146,638	$2,394,298
Fair Haven, Borough of	$516,903,700	$836,769	$1,933,711	$5,263,209	$27,142,265	$37,422,574
Farmingdale, Borough of	$47,555,700	$48,329	$147,087	$370,119	$1,025,408	$3,203,199
Freehold, Borough of	$438,446,925	$388,467	$1,058,159	$2,450,013	$2,924,090	$26,042,032
Freehold, Township of	$2,033,417,200	$2,095,304	$5,329,649	$12,257,927	$15,071,753	$156,417,370
Hazlet, Township of	$693,335,000	$780,275	$1,419,294	$4,759,426	$7,315,500	$37,653,320
Highlands, Borough of	$318,826,200	$647,611	$1,662,423	$5,271,387	$19,816,291	$22,908,947
Holmdel, Township of	$1,995,955,600	$2,054,426	$4,112,073	$12,178,352	$21,235,867	$101,267,183
Howell, Township of	$1,914,832,390	$2,130,333	$5,806,003	$11,883,975	$27,901,085	$136,360,649
Interlaken, Borough of	$88,855,300	$177,847	$569,854	$1,290,551	$6,141,758	$8,213,531
Keansburg, Borough of	$199,892,700	$273,585	$537,590	$2,045,061	$3,698,524	$12,091,435
Keyport, Borough of	$219,673,450	$245,145	$454,353	$1,980,095	$2,440,224	$11,669,117
Lake Como, Borough of	$65,026,800	$137,560	$470,294	$1,001,438	$4,247,211	$6,747,569
Little Silver, Borough of	$622,615,400	$946,667	$2,276,245	$6,243,759	$32,068,579	$44,898,410
Loch Arbour, Village of	$28,719,700	$67,957	$266,736	$776,706	$3,344,574	$4,469,485

Table 3c.2
Estimated Potential Losses from 50-, 100-, 200-, 500-, and 1000-year Hurricane Wind Events

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Potential Total Building Losses				
		50-Year Event	100-Year Event	200-Year Event	500-Year Event	1000-Year Event
Long Branch, City of	$1,085,212,300	$2,528,541	$9,076,242	$22,134,754	$75,550,639	$92,702,546
Manalapan, Township of	$3,229,721,500	$2,704,047	$6,340,980	$14,645,639	$12,779,868	$182,074,347
Manasquan, Borough of	$394,840,400	$771,257	$2,717,932	$5,620,681	$25,494,637	$43,623,491
Marlboro, Township of	$2,270,927,800	$2,116,491	$4,512,037	$11,868,786	$12,809,166	$118,222,771
Matawan, Borough of	$280,292,084	$273,299	$574,791	$1,952,565	$2,005,965	$13,046,066
Middletown, Township of	$3,327,619,578	$4,619,849	$9,704,409	$29,972,614	$85,016,269	$206,653,649
Millstone, Township of	$263,436,400	$192,261	$454,568	$790,144	$495,892	$12,657,845
Monmouth Beach, Borough of	$169,824,000	$481,144	$1,409,092	$4,305,032	$16,631,627	$19,641,637
Neptune City, Borough of	$142,043,700	$283,382	$1,124,525	$2,216,642	$8,448,158	$12,537,927
Neptune, Township of	$1,576,460,100	$2,811,385	$10,513,186	$22,443,477	$94,907,573	$138,365,032
Ocean, Township of	$2,612,650,600	$4,123,900	$14,420,875	$31,319,155	$144,311,971	$192,481,372
Oceanport, Borough of	$322,084,700	$535,566	$1,481,512	$3,886,464	$19,571,110	$24,349,162
Red Bank, Borough of	$1,219,372,800	$1,496,667	$4,138,091	$12,594,007	$43,912,307	$66,686,504
Roosevelt, Borough of	$23,470,660	$15,918	$36,578	$66,383	$36,578	$1,040,107
Rumson, Borough of	$507,589,781	$992,474	$2,456,589	$7,755,320	$40,071,615	$48,814,491
Sea Bright, Borough of	$98,620,100	$449,630	$1,194,151	$4,812,177	$17,617,732	$20,420,448
Sea Girt, Borough of	$235,924,250	$552,505	$1,932,493	$4,504,258	$20,981,805	$33,337,254
Shrewsbury, Borough of	$451,418,300	$470,815	$1,157,679	$3,452,905	$16,577,659	$27,033,169
Shrewsbury, Township of	$3,900,100	$6,826	$20,585	$56,463	$182,355	$283,640
Spring Lake, Borough of	$489,616,500	$1,129,264	$4,232,697	$8,315,492	$37,606,411	$55,015,979
Spring Lake Heights, Borough of	$276,945,800	$644,934	$2,400,952	$5,604,409	$25,523,623	$39,860,648
Tinton Falls, Borough of	$920,707,700	$1,175,118	$3,284,461	$8,234,254	$30,573,704	$56,877,579
Union Beach, Borough of	$236,450,400	$280,666	$502,700	$1,829,138	$2,767,255	$15,165,118
Upper Freehold, Township of	$143,501,070	$97,126	$186,646	$357,787	$167,045	$9,753,872
Wall, Township of	$2,039,081,200	$2,811,827	$10,086,531	$18,785,643	$93,752,684	$165,751,872
West Long Branch, Borough of	$495,025,500	$768,285	$2,522,664	$6,001,307	$27,824,240	$37,622,148
Total	**$36,741,303,693**	**$52,110,352**	**$152,564,299**	**$378,211,450**	**$1,266,445,102**	**$2,661,325,680**

Source: HAZUS-MH

Table 3.9 shows potential annualized property losses and percent loss ratios resulting from hurricane wind by jurisdiction.

Table 3c.3
Potential Annualized Losses from Hurricane Wind by Jurisdiction

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Aberdeen, Township of	$515,957,370	$119,626	0.02%
Allenhurst, Borough of	$100,652,200	$75,376	0.07%
Allentown, Borough of	$77,448,700	$14,701	0.02%
Asbury Park, City of	$320,791,800	$167,036	0.05%
Atlantic Highlands, Borough of	$445,377,200	$135,478	0.03%
Avon-By-The-Sea, Borough of	$127,812,100	$73,881	0.06%
Belmar, Borough of	$432,498,600	$276,023	0.06%
Bradley Beach, Borough of	$198,617,900	$103,700	0.05%
Brielle, Borough of	$270,948,535	$177,937	0.07%

Table 3c.3
Potential Annualized Losses from Hurricane Wind by Jurisdiction

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Colts Neck, Township of	$620,440,600	$188,503	0.03%
Deal, Borough of	$402,837,700	$268,940	0.07%
Eatontown, Borough of	$1,176,943,200	$362,223	0.03%
Englishtown, Borough of	$50,184,400	$9,327	0.02%
Fair Haven, Borough of	$516,903,700	$186,548	0.04%
Farmingdale, Borough of	$47,555,700	$13,805	0.03%
Freehold, Borough of	$438,446,925	$105,579	0.02%
Freehold, Township of	$2,033,417,200	$582,220	0.03%
Hazlet, Township of	$693,335,000	$166,646	0.02%
Highlands, Borough of	$318,826,200	$122,462	0.04%
Holmdel, Township of	$1,995,955,600	$467,208	0.02%
Howell, Township of	$1,914,832,390	$530,692	0.03%
Interlaken, Borough of	$88,855,300	$44,805	0.05%
Keansburg, Borough of	$199,892,700	$54,213	0.03%
Keyport, Borough of	$219,673,450	$53,078	0.02%
Lake Como, Borough of	$65,026,800	$33,115	0.05%
Little Silver, Borough of	$622,615,400	$223,050	0.04%
Loch Arbour, Village of	$28,719,700	$21,507	0.07%
Long Branch, City of	$1,085,212,300	$523,567	0.05%
Manalapan, Township of	$3,229,721,500	$699,125	0.02%
Manasquan, Borough of	$394,840,400	$202,646	0.05%
Marlboro, Township of	$2,270,927,800	$507,522	0.02%
Matawan, Borough of	$280,292,084	$63,710	0.02%
Middletown, Township of	$3,327,619,578	$969,428	0.03%
Millstone, Township of	$263,436,400	$48,913	0.02%
Monmouth Beach, Borough of	$169,824,000	$101,381	0.06%
Neptune City, Borough of	$142,043,700	$63,780	0.04%
Neptune, Township of	$1,576,460,100	$695,856	0.04%
Ocean, Township of	$2,612,650,600	$1,035,587	0.04%
Oceanport, Borough of	$322,084,700	$124,989	0.04%
Red Bank, Borough of	$1,219,372,800	$344,235	0.03%
Roosevelt, Borough of	$23,470,660	*Negligible*	0.02%
Rumson, Borough of	$507,589,781	$234,581	0.05%
Sea Bright, Borough of	$98,620,100	$96,014	0.10%
Sea Girt, Borough of	$235,924,250	$155,325	0.07%
Shrewsbury, Borough of	$451,418,300	$126,147	0.03%
Shrewsbury, Township of	$3,900,100	*Negligible*	0.04%
Spring Lake, Borough of	$489,616,500	$336,867	0.07%
Spring Lake Heights, Borough of	$276,945,800	$157,303	0.06%
Tinton Falls, Borough of	$920,707,700	$275,457	0.03%
Union Beach, Borough of	$236,450,400	$61,057	0.03%
Upper Freehold, Township of	$143,501,070	$33,659	0.02%
Wall, Township of	$2,039,081,200	$750,080	0.04%
West Long Branch, Borough of	$495,025,500	$190,333	0.04%
Total	**$36,741,303,693**	**$12,437,276**	**0.03%**

Source: HAZUS-MH
NOTE: Negligible means less than $5,000 annual average damage

Lightning

Because it cannot be predicted where lightning may strike, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported lightning strikes have been factored into this vulnerability assessment[6].

To estimate losses due to lightning, NCDC historical lightning loss data was used to develop a lightning stochastic model. In this model:

- Losses were scaled for inflation;
- Average historic lightning damageability was used to generate losses for historical lightning events where losses were not reported;
- Expected annualized losses were calculated through a non-linear regression of historical data; and
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event.

Table 3c.4 shows potential annualized property losses and percent loss ratios resulting from the lightning hazard for each jurisdiction in Monmouth County.

Table 3c.4
Potential Annualized Losses from Lightning by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Aberdeen, Township of	17,454	$515,957,370	*Negligible*	0.00%
Allenhurst, Borough of	599	$100,652,200	*Negligible*	0.00%
Allentown, Borough of	1,882	$77,448,700	*Negligible*	0.00%
Asbury Park, City of	16,930	$320,791,800	*Negligible*	0.00%
Atlantic Highlands, Borough of	4,705	$445,377,200	*Negligible*	0.00%
Avon-By-The-Sea, Borough of	2,244	$127,812,100	*Negligible*	0.00%
Belmar, Borough of	6,045	$432,498,600	*Negligible*	0.00%
Bradley Beach, Borough of	4,793	$198,617,900	*Negligible*	0.00%
Brielle, Borough of	4,893	$270,948,535	*Negligible*	0.00%
Colts Neck, Township of	12,331	$620,440,600	*Negligible*	0.00%
Deal, Borough of	1,070	$402,837,700	*Negligible*	0.00%
Eatontown, Borough of	13,964	$1,176,943,200	*Negligible*	0.00%
Englishtown, Borough of	1,764	$50,184,400	*Negligible*	0.00%
Fair Haven, Borough of	5,937	$516,903,700	*Negligible*	0.00%
Farmingdale, Borough of	1,587	$47,555,700	*Negligible*	0.00%
Freehold, Borough of	10,976	$438,446,925	*Negligible*	0.00%
Freehold, Township of	31,537	$2,033,417,200	*Negligible*	0.00%
Hazlet, Township of	21,378	$693,335,000	*Negligible*	0.00%
Highlands, Borough of	5,097	$318,826,200	*Negligible*	0.00%
Holmdel, Township of	15,781	$1,995,955,600	*Negligible*	0.00%

[6] It is possible that additional lightning strikes may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

Table 3c.4
Potential Annualized Losses from Lightning by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Howell, Township of	48,903	$1,914,832,390	*Negligible*	0.00%
Interlaken, Borough of	900	$88,855,300	*Negligible*	0.00%
Keansburg, Borough of	10,426	$199,892,700	*Negligible*	0.00%
Keyport, Borough of	7,568	$219,673,450	*Negligible*	0.00%
Lake Como, Borough of	1,806	$65,026,800	*Negligible*	0.00%
Little Silver, Borough of	6,170	$622,615,400	*Negligible*	0.00%
Loch Arbour, Village of	399	$28,719,700	*Negligible*	0.00%
Long Branch, City of	31,340	$1,085,212,300	*Negligible*	0.00%
Manalapan, Township of	33,423	$3,229,721,500	*Negligible*	0.00%
Manasquan, Borough of	6,310	$394,840,400	*Negligible*	0.00%
Marlboro, Township of	36,398	$2,270,927,800	*Negligible*	0.00%
Matawan, Borough of	8,910	$280,292,084	*Negligible*	0.00%
Middletown, Township of	66,633	$3,327,619,578	*Negligible*	0.00%
Millstone, Township of	8,970	$263,436,400	*Negligible*	0.00%
Monmouth Beach, Borough of	3,595	$169,824,000	*Negligible*	0.00%
Neptune City, Borough of	5,218	$142,043,700	*Negligible*	0.00%
Neptune, Township of	27,690	$1,576,460,100	*Negligible*	0.00%
Ocean, Township of	26,959	$2,612,650,600	*Negligible*	0.00%
Oceanport, Borough of	5,834	$322,084,700	*Negligible*	0.00%
Red Bank, Borough of	11,844	$1,219,372,800	*Negligible*	0.00%
Roosevelt, Borough of	933	$23,470,660	*Negligible*	0.00%
Rumson, Borough of	7,137	$507,589,781	*Negligible*	0.00%
Sea Bright, Borough of	1,818	$98,620,100	*Negligible*	0.00%
Sea Girt, Borough of	2,148	$235,924,250	*Negligible*	0.00%
Shrewsbury, Borough of	3,590	$451,418,300	*Negligible*	0.00%
Shrewsbury, Township of	1,098	$3,900,100	*Negligible*	0.00%
Spring Lake, Borough of	3,567	$489,616,500	*Negligible*	0.00%
Spring Lake Heights, Borough of	5,227	$276,945,800	*Negligible*	0.00%
Tinton Falls, Borough of	15,070	$920,707,700	*Negligible*	0.00%
Union Beach, Borough of	6,649	$236,450,400	*Negligible*	0.00%
Upper Freehold, Township of	4,282	$143,501,070	$12,438	0.01%
Wall, Township of	25,261	$2,039,081,200	*Negligible*	0.00%
West Long Branch, Borough of	8,258	$495,025,500	*Negligible*	0.00%
Total	**615,301**	**$36,741,303,693**	**$16,528**	**0.00%**

NOTE: Negligible means less than $5,000 annual average damage

Nor'easter

Because norôeasters often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. Norôeasters can cause damage through numerous hazards such as flooding, coastal erosion, high winds and precipitation, thus it is difficult to estimate total potential losses from these cumulative effects. However, because norôeasters are low pressure systems, the impacts from winds found in a strong norôeaster can be modeled using methodology similar to that used for hurricanes.

For this assessment, the HAZUS-MH hurricane model was used to model two representative historic norôeasters which directly impacted Monmouth County in December 1992 and April 2007, respectively, and for which data was readily available. These two storms were chosen for analysis because wind speed data was available for georeferenced buoy points and varied in strength, with the 1992 storm identified by locals as one of the most memorable in several decades. Although this modeling does not account for increased duration or precipitation levels which may exceed those found in typical hurricanes, it can help quantify a conservative estimate of potential losses if these storms were to impact Monmouth County today. Due to these limitations and other uncertainties inherent in mathematical simulations such as this one, there remains the possibility that the modeled damage estimates may not closely reflect actual recorded damages in every case.

To use the HAZUS-MH hurricane model to analyze norôeaster data, historical wind speed data for each storm for georeferenced buoys within range of Monmouth County was obtained (where available) from the National Data Buoy Center[7]. To model peak intensity, peak wind gusts measured on December 11, 1992 at 4 p.m. EST were used for the December 1992 storm analysis, and peak wind gusts measured on April 16, 2007 at 2 a.m. EST were used for the April 2007 storm analysis. Using known wind gust data normalized to 10-meter height for at least three georeferenced points (buoy locations), wind gust speeds were interpolated[8] to estimate wind gust speed at the centroid of each census tract, which was imported into HAZUS-MH for analysis and potential loss estimates.

Modeling of the April 2007 norôeaster estimates negligible damage resulting from norôeaster winds. Wind gusts in the county ranged from 23 to 56 mph, which is less than tropical-storm force. Modeling of the December 1992 norôeaster estimates over $36 million in damages countywide as a result of wind gusts ranging from 63 to 79 mph, which is comparable to Category 1 hurricane wind speeds in some areas of the county. **Table 3c.5** shows estimated potential losses for a norôeaster similar in strength to the December 1992 storm if it were to occur in the current built environment, by jurisdiction.

Table 3c.5
Potential Losses from Nor'easter by Jurisdiction (December 11, 1992 storm model)

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Total Losses 12/11/1992 storm
Aberdeen, Township of	$515,957,370	$730,555
Allenhurst, Borough of	$100,652,200	$98,977
Allentown, Borough of	$77,448,700	$34,135
Asbury Park, City of	$320,791,800	$215,090
Atlantic Highlands, Borough of	$445,377,200	$717,631
Avon-By-The-Sea, Borough of	$127,812,100	$71,246
Belmar, Borough of	$432,498,600	$264,422
Bradley Beach, Borough of	$198,617,900	$112,293

[7] www.ndbc.noaa.gov
[8] This method assumes that the wind speeds are linear and can be interpolated with reasonable results.

Table 3c.5
Potential Losses from Nor'easter by Jurisdiction (December 11, 1992 storm model)

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Total Losses 12/11/1992 storm
Brielle, Borough of	$270,948,535	$92,462
Colts Neck, Township of	$620,440,600	$747,373
Deal, Borough of	$402,837,700	$477,559
Eatontown, Borough of	$1,176,943,200	$1,037,058
Englishtown, Borough of	$50,184,400	$32,080
Fair Haven, Borough of	$516,903,700	$836,817
Farmingdale, Borough of	$47,555,700	$23,722
Freehold, Borough of	$438,446,925	$328,684
Freehold, Township of	$2,033,417,200	$1,715,094
Hazlet, Township of	$693,335,000	$1,035,862
Highlands, Borough of	$318,826,200	$647,415
Holmdel, Township of	$1,995,955,600	$2,281,667
Howell, Township of	$1,914,832,390	$953,376
Interlaken, Borough of	$88,855,300	$72,573
Keansburg, Borough of	$199,892,700	$357,238
Keyport, Borough of	$219,673,450	$335,683
Lake Como, Borough of	$65,026,800	$28,619
Little Silver, Borough of	$622,615,400	$946,472
Loch Arbour, Village of	$28,719,700	$28,242
Long Branch, City of	$1,085,212,300	$1,371,851
Manalapan, Township of	$3,229,721,500	$2,694,056
Manasquan, Borough of	$394,840,400	$100,475
Marlboro, Township of	$2,270,927,800	$2,213,267
Matawan, Borough of	$280,292,084	$361,436
Middletown, Township of	$3,327,619,578	$5,121,491
Millstone, Township of	$263,436,400	$151,230
Monmouth Beach, Borough of	$169,824,000	$338,677
Neptune City, Borough of	$142,043,700	$86,102
Neptune, Township of	$1,576,460,100	$964,480
Ocean, Township of	$2,612,650,600	$2,006,644
Oceanport, Borough of	$322,084,700	$402,244
Red Bank, Borough of	$1,219,372,800	$1,514,142
Roosevelt, Borough of	$23,470,660	$12,090
Rumson, Borough of	$507,589,781	$929,150
Sea Bright, Borough of	$98,620,100	$313,402
Sea Girt, Borough of	$235,924,250	$82,201
Shrewsbury, Borough of	$451,418,300	$471,117
Shrewsbury, Township of	$3,900,100	$6,262
Spring Lake, Borough of	$489,616,500	$220,560
Spring Lake Heights, Borough of	$276,945,800	$136,331
Tinton Falls, Borough of	$920,707,700	$902,735
Union Beach, Borough of	$236,450,400	$379,818
Upper Freehold, Township of	$143,501,070	$48,362
Wall, Township of	$2,039,081,200	$629,878
West Long Branch, Borough of	$495,025,500	$523,807
Total	**$36,741,303,693**	**$36,663,622**

Source: HAZUS-MH

Norôeasters of the strength and magnitude of the December 1992 storm are not common and do not occur on a frequent basis. In the absence of a frequency level determination for this specific event, for the purposes of this analysis it is assumed using professional judgment that the probability of such a strong norôeaster causing this amount of damage could be 0.2 percent in any given year (i.e., a 500-year event frequency). This probability can be multiplied by the modeled losses from the 1992 storm to conservatively estimate potential annualized losses as shown in **Table 3c.6**.

Table 3c.6
Potential Annualized Losses from Nor'easter by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Aberdeen, Township of	17,454	$515,957,370	*Negligible*	0.00%
Allenhurst, Borough of	599	$100,652,200	*Negligible*	0.00%
Allentown, Borough of	1,882	$77,448,700	*Negligible*	0.00%
Asbury Park, City of	16,930	$320,791,800	*Negligible*	0.00%
Atlantic Highlands, Borough of	4,705	$445,377,200	*Negligible*	0.00%
Avon-By-The-Sea, Borough of	2,244	$127,812,100	*Negligible*	0.00%
Belmar, Borough of	6,045	$432,498,600	*Negligible*	0.00%
Bradley Beach, Borough of	4,793	$198,617,900	*Negligible*	0.00%
Brielle, Borough of	4,893	$270,948,535	*Negligible*	0.00%
Colts Neck, Township of	12,331	$620,440,600	*Negligible*	0.00%
Deal, Borough of	1,070	$402,837,700	*Negligible*	0.00%
Eatontown, Borough of	13,964	$1,176,943,200	*Negligible*	0.00%
Englishtown, Borough of	1,764	$50,184,400	*Negligible*	0.00%
Fair Haven, Borough of	5,937	$516,903,700	*Negligible*	0.00%
Farmingdale, Borough of	1,587	$47,555,700	*Negligible*	0.00%
Freehold, Borough of	10,976	$438,446,925	*Negligible*	0.00%
Freehold, Township of	31,537	$2,033,417,200	*Negligible*	0.00%
Hazlet, Township of	21,378	$693,335,000	*Negligible*	0.00%
Highlands, Borough of	5,097	$318,826,200	*Negligible*	0.00%
Holmdel, Township of	15,781	$1,995,955,600	*Negligible*	0.00%
Howell, Township of	48,903	$1,914,832,390	*Negligible*	0.00%
Interlaken, Borough of	900	$88,855,300	*Negligible*	0.00%
Keansburg, Borough of	10,426	$199,892,700	*Negligible*	0.00%
Keyport, Borough of	7,568	$219,673,450	*Negligible*	0.00%
Lake Como, Borough of	1,806	$65,026,800	*Negligible*	0.00%
Little Silver, Borough of	6,170	$622,615,400	*Negligible*	0.00%
Loch Arbour, Village of	399	$28,719,700	*Negligible*	0.00%
Long Branch, City of	31,340	$1,085,212,300	*Negligible*	0.00%
Manalapan, Township of	33,423	$3,229,721,500	$5,388	0.00%
Manasquan, Borough of	6,310	$394,840,400	*Negligible*	0.00%
Marlboro, Township of	36,398	$2,270,927,800	*Negligible*	0.00%
Matawan, Borough of	8,910	$280,292,084	*Negligible*	0.00%
Middletown, Township of	66,633	$3,327,619,578	$10,243	0.00%
Millstone, Township of	8,970	$263,436,400	*Negligible*	0.00%
Monmouth Beach, Borough of	3,595	$169,824,000	*Negligible*	0.00%
Neptune City, Borough of	5,218	$142,043,700	*Negligible*	0.00%
Neptune, Township of	27,690	$1,576,460,100	*Negligible*	0.00%
Ocean, Township of	26,959	$2,612,650,600	*Negligible*	0.00%
Oceanport, Borough of	5,834	$322,084,700	*Negligible*	0.00%

Table 3c.6
Potential Annualized Losses from Nor'easter by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Red Bank, Borough of	11,844	$1,219,372,800	*Negligible*	0.00%
Roosevelt, Borough of	933	$23,470,660	*Negligible*	0.00%
Rumson, Borough of	7,137	$507,589,781	*Negligible*	0.00%
Sea Bright, Borough of	1,818	$98,620,100	*Negligible*	0.00%
Sea Girt, Borough of	2,148	$235,924,250	*Negligible*	0.00%
Shrewsbury, Borough of	3,590	$451,418,300	*Negligible*	0.00%
Shrewsbury, Township of	1,098	$3,900,100	*Negligible*	0.00%
Spring Lake, Borough of	3,567	$489,616,500	*Negligible*	0.00%
Spring Lake Heights, Borough of	5,227	$276,945,800	*Negligible*	0.00%
Tinton Falls, Borough of	15,070	$920,707,700	*Negligible*	0.00%
Union Beach, Borough of	6,649	$236,450,400	*Negligible*	0.00%
Upper Freehold, Township of	4,282	$143,501,070	*Negligible*	0.00%
Wall, Township of	25,261	$2,039,081,200	*Negligible*	0.00%
West Long Branch, Borough of	8,258	$495,025,500	*Negligible*	0.00%
Total	**615,301**	**$36,741,303,693**	**$73,327**	**0.00%**

NOTE: Negligible means less than $5,000 annual average damage

Tornado

Historical evidence shows that the county is vulnerable to tornadic activity. This hazard can result from severe thunderstorm activity or may occur during a major tropical storm or hurricane. Because it cannot be predicted where a tornado may touch down, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported tornadoes have been factored into this vulnerability assessment[9].

To estimate losses due to tornadoes, NCDC historical tornado loss data was used to develop a tornado stochastic model. In this model:

- Losses were scaled for inflation;
- Average historic tornado damageability was used to generate losses for historical tornadic events where losses were not reported;
- Expected annualized losses were calculated through a non-linear regression of historical data; and
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event.

Table 3c.7 shows potential annualized property losses and percent loss ratios resulting from the tornado hazard for each jurisdiction in Monmouth County.

Table 3c.7
Potential Annualized Losses from Tornado by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Aberdeen, Township of	17,454	$515,957,370	*Negligible*	0.00%
Allenhurst, Borough of	599	$100,652,200	*Negligible*	0.00%
Allentown, Borough of	1,882	$77,448,700	*Negligible*	0.00%
Asbury Park, City of	16,930	$320,791,800	*Negligible*	0.00%
Atlantic Highlands, Borough of	4,705	$445,377,200	*Negligible*	0.00%
Avon-By-The-Sea, Borough of	2,244	$127,812,100	*Negligible*	0.00%
Belmar, Borough of	6,045	$432,498,600	*Negligible*	0.00%
Bradley Beach, Borough of	4,793	$198,617,900	*Negligible*	0.00%
Brielle, Borough of	4,893	$270,948,535	*Negligible*	0.00%
Colts Neck, Township of	12,331	$620,440,600	*Negligible*	0.00%
Deal, Borough of	1,070	$402,837,700	*Negligible*	0.00%
Eatontown, Borough of	13,964	$1,176,943,200	*Negligible*	0.00%
Englishtown, Borough of	1,764	$50,184,400	*Negligible*	0.00%
Fair Haven, Borough of	5,937	$516,903,700	*Negligible*	0.00%
Farmingdale, Borough of	1,587	$47,555,700	*Negligible*	0.00%
Freehold, Borough of	10,976	$438,446,925	*Negligible*	0.00%
Freehold, Township of	31,537	$2,033,417,200	*Negligible*	0.00%

[9] It is possible that additional tornado events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

Table 3c.7
Potential Annualized Losses from Tornado by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Annualized Expected Property Losses	Annualized Percent Loss Ratio
Hazlet, Township of	21,378	$693,335,000	*Negligible*	0.00%
Highlands, Borough of	5,097	$318,826,200	*Negligible*	0.00%
Holmdel, Township of	15,781	$1,995,955,600	*Negligible*	0.00%
Howell, Township of	48,903	$1,914,832,390	$28,503	0.00%
Interlaken, Borough of	900	$88,855,300	*Negligible*	0.00%
Keansburg, Borough of	10,426	$199,892,700	*Negligible*	0.00%
Keyport, Borough of	7,568	$219,673,450	*Negligible*	0.00%
Lake Como, Borough of	1,806	$65,026,800	*Negligible*	0.00%
Little Silver, Borough of	6,170	$622,615,400	*Negligible*	0.00%
Loch Arbour, Village of	399	$28,719,700	*Negligible*	0.00%
Long Branch, City of	31,340	$1,085,212,300	*Negligible*	0.00%
Manalapan, Township of	33,423	$3,229,721,500	$12,438	0.00%
Manasquan, Borough of	6,310	$394,840,400	*Negligible*	0.00%
Marlboro, Township of	36,398	$2,270,927,800	$12,438	0.00%
Matawan, Borough of	8,910	$280,292,084	*Negligible*	0.00%
Middletown, Township of	66,633	$3,327,619,578	*Negligible*	0.00%
Millstone, Township of	8,970	$263,436,400	*Negligible*	0.00%
Monmouth Beach, Borough of	3,595	$169,824,000	*Negligible*	0.00%
Neptune City, Borough of	5,218	$142,043,700	*Negligible*	0.00%
Neptune, Township of	27,690	$1,576,460,100	*Negligible*	0.00%
Ocean, Township of	26,959	$2,612,650,600	*Negligible*	0.00%
Oceanport, Borough of	5,834	$322,084,700	*Negligible*	0.00%
Red Bank, Borough of	11,844	$1,219,372,800	*Negligible*	0.00%
Roosevelt, Borough of	933	$23,470,660	*Negligible*	0.00%
Rumson, Borough of	7,137	$507,589,781	*Negligible*	0.00%
Sea Bright, Borough of	1,818	$98,620,100	*Negligible*	0.00%
Sea Girt, Borough of	2,148	$235,924,250	*Negligible*	0.00%
Shrewsbury, Borough of	3,590	$451,418,300	*Negligible*	0.00%
Shrewsbury, Township of	1,098	$3,900,100	*Negligible*	0.00%
Spring Lake, Borough of	3,567	$489,616,500	*Negligible*	0.00%
Spring Lake Heights, Borough of	5,227	$276,945,800	*Negligible*	0.00%
Tinton Falls, Borough of	15,070	$920,707,700	*Negligible*	0.00%
Union Beach, Borough of	6,649	$236,450,400	*Negligible*	0.00%
Upper Freehold, Township of	4,282	$143,501,070	*Negligible*	0.00%
Wall, Township of	25,261	$2,039,081,200	*Negligible*	0.00%
West Long Branch, Borough of	8,258	$495,025,500	*Negligible*	0.00%
Total	**615,301**	**$36,741,303,693**	**$62,434**	**0.00%**

NOTE: Negligible means less than $5,000 annual average damage

Winter Storm

Because winter storms often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. It is important to note that only reported winter storms have been factored into this vulnerability assessment[10].

To estimate losses due to winter storm, NCDC historical winter storm loss data was used to develop a winter storm stochastic model. In this model:

- Losses were obtained for each jurisdiction and scaled for inflation. For all events impacting the entire county (loss data not provided for specific jurisdictions), losses were averaged across all 53 jurisdictions;
- Average historic winter storm damageability was used to generate losses for historical winter storm events where losses were not reported;
- Expected annualized losses were calculated through a non-linear regression of historical data; and
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event.

The vulnerability assessment for winter storm as applied to Monmouth County using statistical methods resulted in ñnegligibleò annualized property losses and percent loss ratios for each jurisdiction in Monmouth County. It is likely that very few buildings in Monmouth County will be directly threatened or damaged by winter storm; therefore, any building damages directly attributable to the winter storm hazard would be considered negligible for the purposes of this risk assessment. It should be noted that the estimation of losses to winter storms was limited to documented structural damages and do not include other types of damages or economic impacts such as power outages, infrastructure repair and restoration, loss of business income and snow removal costs. In the absence of detailed historical data, it is difficult to model and quantify these other types of non-structural losses for winter storm at a jurisdictional level in Monmouth County. However, as described in the *Hazard Profiles* section, it should be recognized that such losses are indeed significant and their associated costs are most often borne by local government and the private sector.

[10] It is possible that additional winter storm events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

Coastal Erosion

Unlike other hazards, the coastal erosion hazard is best described as a relatively slow natural process occurring over the long term, with occasional major impacts wrought by episodic natural events such as hurricanes and norôeasters. Another complicating factor in accurately determining specific coastal erosion hazard areas is the continuous implementation of shoreline reinforcement or nourishment projects completed by federal, state and local government agencies. Typically, areas of high concern with regard to long term coastal erosion are addressed through shoreline hardening or stabilization projects, such as seawalls, breakwaters and beach nourishment. The ability to continue successfully mitigating the effects of coastal erosion hazards throughout Monmouth County will therefore depend on regular shoreline monitoring and the design and implementation of site-specific solutions, as has been done in the past.

According to the New Jersey Coastal Zone Management Rules (NJAC 7:7E), erosion hazard areas are defined as extending inland from the edge of a stabilized upland area to the limit of the area likely to be eroded in 30 years for one to four unit dwelling structures, and 60 years for all other structures, including developed and undeveloped areas[11]. The extent of an erosion hazard area is calculated by multiplying the projected annual erosion rate at a site by 30 for the development of one to four unit dwelling structures and by 60 for all other developments. According to a study prepared by the Heinz Center[12], much of the coastline of New Jersey, including Monmouth County, experiences an average of three feet of erosion per year.

To estimate exposure to coastal erosion for purposes of this assessment, data on shoreline type (as classified by the New Jersey Department of Environmental Protection) was used to delineate areas potentially susceptible to the erosion hazard. For purposes of this analysis, these shoreline types were limited to (1) ñbeach,ò which includes waterfront areas comprised of 100 percent sand; and (2) ñerodable,ò which includes any soft shoreline other than beach, rock, marsh, sea wall or earthen dike. The determination of value at-risk was calculated through GIS analysis by summing the total improved values for only those parcels that were confirmed to have at least one building located within 200 feet of the identified beach or erodable shoreline types. The figure of 200 feet was determined to be a reasonable yet slightly more conservative estimate for defining erosion hazard areas based on the calculations recommended under NJAC 7:7E as described above (annual erosion rate of three feet per year x 60 years = 180 feet).

According to the assessment, only 28 jurisdictions have beach or erodable areas susceptible to coastal erosion. **Table 3c.8** shows exposure to coastal erosion by jurisdiction.

Table 3c.8
Exposure in Coastal Erosion Areas by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located Within 200 Feet of Coastline*	Percent of Total Building Value Exposed to Coastal Erosion
Aberdeen, Township of	179	$515,957,370	$628,000	0.12%
Allenhurst, Borough of	82	$100,652,200	$4,619,700	4.59%
Allentown, Borough of	0	$77,448,700	$0	0.00%
Asbury Park, City of	368	$320,791,800	$4,000,000	1.25%

[11] This distance is measured from the crest of a bluff for coastal bluff areas, the most seaward established dune crest for unvegetated dune areas, the first vegetation line from the water for established vegetated dune areas, and the landward edge of a beach or the eight foot North American Datum (NAD), 1983, contour line, whichever is farther inland, for non-dune areas.

[12] ñ*Evaluation of Erosion Hazards*ò prepared by The H. John Heinz III Center for Science, Economics and the Environment, April 2000. www.heinzctr.org/NEW_WEB/PDF/erosnrpt.pdf#pagemode=bookmarks&view=Fit

Table 3c.8
Exposure in Coastal Erosion Areas by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located Within 200 Feet of Coastline*	Percent of Total Building Value Exposed to Coastal Erosion
Atlantic Highlands, Borough of	612	$445,377,200	$21,194,800	4.76%
Avon-By-The-Sea, Borough of	464	$127,812,100	$1,263,700	0.99%
Belmar, Borough of	1,557	$432,498,600	$6,769,900	1.57%
Bradley Beach, Borough of	854	$198,617,900	$265,400	0.13%
Brielle, Borough of	907	$270,948,535	$724,700	0.27%
Colts Neck, Township of	0	$620,440,600	$0	0.00%
Deal, Borough of	137	$402,837,700	$26,175,900	6.50%
Eatontown, Borough of	0	$1,176,943,200	$0	0.00%
Englishtown, Borough of	0	$50,184,400	$0	0.00%
Fair Haven, Borough of	810	$516,903,700	$2,160,500	0.42%
Farmingdale, Borough of	0	$47,555,700	$0	0.00%
Freehold, Borough of	0	$438,446,925	$0	0.00%
Freehold, Township of	0	$2,033,417,200	$0	0.00%
Hazlet, Township of	0	$693,335,000	$0	0.00%
Highlands, Borough of	1,685	$318,826,200	$28,506,900	8.94%
Holmdel, Township of	0	$1,995,955,600	$0	0.00%
Howell, Township of	0	$1,914,832,390	$0	0.00%
Interlaken, Borough of	0	$88,855,300	$0	0.00%
Keansburg, Borough of	0	$199,892,700	$0	0.00%
Keyport, Borough of	498	$219,673,450	$2,837,200	1.29%
Lake Como, Borough of	0	$65,026,800	$0	0.00%
Little Silver, Borough of	1,193	$622,615,400	$55,524,600	8.92%
Loch Arbour, Village of	47	$28,719,700	$339,800	1.18%
Long Branch, City of	5,875	$1,085,212,300	$83,703,900	7.71%
Manalapan, Township of	0	$3,229,721,500	$0	0.00%
Manasquan, Borough of	678	$394,840,400	$1,912,100	0.48%
Marlboro, Township of	0	$2,270,927,800	$0	0.00%
Matawan, Borough of	0	$280,292,084	$0	0.00%
Middletown, Township of	634	$3,327,619,578	$39,412,400	1.18%
Millstone, Township of	0	$263,436,400	$0	0.00%
Monmouth Beach, Borough of	1,291	$169,824,000	$22,142,200	13.04%
Neptune City, Borough of	469	$142,043,700	$1,719,500	1.21%
Neptune, Township of	1,290	$1,576,460,100	$8,551,700	0.54%
Ocean, Township of	0	$2,612,650,600	$0	0.00%
Oceanport, Borough of	1,550	$322,084,700	$17,792,900	5.52%
Red Bank, Borough of	1,512	$1,219,372,800	$578,587	0.05%
Roosevelt, Borough of	0	$23,470,660	$0	0.00%
Rumson, Borough of	1,803	$507,589,781	$42,344,300	8.34%
Sea Bright, Borough of	1,091	$98,620,100	$39,993,900	40.55%
Sea Girt, Borough of	172	$235,924,250	$25,202,100	10.68%
Shrewsbury, Borough of	0	$451,418,300	$0	0.00%
Shrewsbury, Township of	0	$3,900,100	$0	0.00%
Spring Lake, Borough of	247	$489,616,500	$1,485,300	0.30%
Spring Lake Heights, Borough of	0	$276,945,800	$0	0.00%

Table 3c.8
Exposure in Coastal Erosion Areas by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located Within 200 Feet of Coastline*	Percent of Total Building Value Exposed to Coastal Erosion
Tinton Falls, Borough of	0	$920,707,700	$0	0.00%
Union Beach, Borough of	420	$236,450,400	$7,021,100	2.97%
Upper Freehold, Township of	0	$143,501,070	$0	0.00%
Wall, Township of	847	$2,039,081,200	$14,211,300	0.70%
West Long Branch, Borough of	0	$495,025,500	$0	0.00%
Total	**27,272**	**$36,741,303,693**	**$461,082,387**	**1.25%**

**Exposure calculated by GIS Analysis using local assessed values for structures located within 200 feet of beach or other erodable shorelines as delineated by the New Jersey Department of Environmental Protection in 1986.*

As mentioned earlier, much of the coastline of New Jersey reportedly experiences an average of three feet of erosion per year. However, due to beach nourishment and other mitigating factors in Monmouth County, it is likely that no buildings will be threatened by erosion through 2038 (a 30-year period). This determination is based on the fact that Monmouth County has an active history of pursuing and implementing successful shoreline protection strategies, particularly through the nourishment of critically eroding beaches and for areas in which property is threatened by continued erosion. Due to these practices (which are expected and encouraged to continue), any building damages directly attributable to the erosion hazard would be considered negligible for the purposes of this risk assessment.

As mentioned in the *Hazard Profiles* section, sea level rise will increase the risk of damages/losses due to future coastal erosion and flood events. Rising sea level over time will shorten the return period (increasing the frequency) of episodic coastal erosion. This increased probability clearly will have an effect on the estimation of annualized loss/damage, but one that is typically only analyzed during detailed feasibility studies for projects proposed by the US Army Corps of Engineers.

Dam Failure

Of the nine ñhigh hazardò dams in Monmouth County, there are three that have been classified by USGS as ñmajorò dams and represent the most significant hazard risk based on the potential consequences of a dam failure. According to USGS, major dams are described as 50 feet or more in height, or with a normal storage capacity of 5,000 acre-feet or more, or with a maximum storage capacity of 25,000 acre-feet or more. In Monmouth County, these include the Glendola Reservoir Dam in Wall Township, the Manasquan Reservoir Dam in Howell Township and the Swimming River Reservoir Dam in Colts Neck Township.

The most accurate method to estimate exposure and potential losses to the dam failure hazard relies on data produced through detailed dam failure inundation studies. These studies are often prepared by the owners of dam facilities as part of their own emergency action plans. Inundation studies and/or associated maps for dams in Monmouth County dams requested from the New Jersey Department of Environmental Protection for this assessment, but were not made available because they either did not exist or were restricted from public release due to Department policy. Should NJDEP policy change, or dam failure inundation data become available to Monmouth County from alternative sources, such data will be utilized to perform further vulnerability assessments for dam failure during future plan updates.

To estimate exposure to dam failure for purposes of this current assessment, data on the three major dams in Monmouth County was used to delineate areas potentially susceptible in the event of a dam failure. In the event of a dam failure, the most immediate area of impact would likely be within one mile downstream of the location of a dam; therefore, this area was used to assess exposure to dam failure. The determination of value at-risk was calculated through GIS analysis by summing the total improved values for only those parcels that were confirmed to have at least one building located within one mile on the downstream side of the dam location. **Table 3c.9** shows population and assessed building value exposure to dam failure by jurisdiction.

Table 3c.9
Exposure Within One Mile Downstream of Major Dam Locations

Jurisdiction	Population At-Risk	Value of Buildings At-Risk*
Glendola Reservoir Dam (height = 65 feet / normal storage capacity = 3,155 acre feet)		
Neptune, Township of	1,509	$71,481,100
Wall, Township of	502	$26,374,300
Total	**2,011**	**$97,855,400**
Manasquan Reservoir Dam (height = 53 feet / normal storage capacity = 14,470 acre feet)		
Howell, Township of	249	$40,073,300
Total	**249**	**$40,073,300**
Swimming River Reservoir Dam (height = 45 feet / normal storage capacity = 8,000 acre feet)		
Colts Neck, Township of	0	$0
Middletown, Township of	1,564	$55,931,500
Tinton Falls, Borough of	503	$35,306,500
Total	**2,067**	**$91,238,000**

**Exposure calculated by GIS Analysis using local assessed values*

The Glendola Reservoir Dam is located in Wall Township and is southwest of Neptune Township. In Wall, the area downstream of this dam location includes residential buildings within close proximity (within 0.25 miles of the dam), as well as a large county-owned park comprised of approximately 100 acres of undeveloped land. North of the park, there is residential development in Neptune that is within a one-mile radius of the dam and could potentially be impacted should the dam fail.

The Manasquan Reservoir Dam is located in Howell Township. Within a one-mile radius from the dam on the downstream side, there is a county-owned golf course, two schools located north of the golf course, residential development east of the golf course, and new residential development south of the golf course. Most property in the immediate area surrounding the dam is owned by either the State of New Jersey or Monmouth County.

The Swimming River Reservoir Dam is located in Colts Neck Township, but is situated so that the outfall is in close proximity to Middletown Township and Tinton Falls Township. There are no buildings located on the downstream side of the dam in Colts Neck. Middletown has residential development within 0.3 miles of the dam (downstream), and Tinton Falls has residential development within 0.5 miles of the dam (downstream). Middletown would likely experience greater impacts from a failure of this dam than Tinton Falls, as Middletown has more area located within a one-mile radius of the dam on the downstream side. Along the stream that outfalls from the dam, there is undeveloped land along the stream, which would likely experience the most water inundation in the event of a dam failure.

The general at-risk population in the event of a dam failure would be located downstream of the dam within close proximity of the outfall (most likely within one mile). Protection of human life through administration of proper emergency notification and evacuation planning is crucial to minimizing social losses due to dam failure.

Given the lack of historical data on significant dam failure occurrences or the availability of inundation maps for Monmouth County, it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for jurisdictions exposed to this hazard.

Drought

Because drought impacts large areas and crosses jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted. However, drought impacts are mostly experienced in water shortages and crop losses on agricultural lands and have no impact on buildings. To estimate land exposure to drought, agricultural land acreage was acquired from 2006 land use classification data as provided by the Monmouth County Office of GIS. **Table 3c.10** shows agricultural land acreage in Monmouth County by jurisdiction. Nearly 12 percent of land in Monmouth County is used for agriculture.

Table 3c.10
Acreage of Agricultural Land by Jurisdiction

Jurisdiction	Total Acres	Agricultural Land (Acres)	Percentage of Total
Aberdeen, Township of	3,587.00	11.4657	0.32%
Allenhurst, Borough of	162.42	0	0.00%
Allentown, Borough of	398.55	6.8182	1.71%
Asbury Park, City of	955.41	0	0.00%
Atlantic Highlands, Borough of	782.04	0	0.00%
Avon-By-The-Sea, Borough of	291.95	0	0.00%
Belmar, Borough of	888.33	0	0.00%
Bradley Beach, Borough of	382.48	0	0.00%
Brielle, Borough of	1,521.20	0	0.00%
Colts Neck, Township of	20,713.34	3,311.43	15.99%
Deal, Borough of	759.33	0	0.00%
Eatontown, Borough of	3,765.16	15.8767	0.42%
Englishtown, Borough of	373.16	9.2398	2.48%
Fair Haven, Borough of	1,345.00	0	0.00%
Farmingdale, Borough of	337.71	10.4517	3.09%
Freehold, Borough of	1,249.06	1.7195	0.14%
Freehold, Township of	24,673.29	2,486.27	10.08%
Hazlet, Township of	3,681.59	14.6921	0.40%
Highlands, Borough of	463.46	0	0.00%
Holmdel, Township of	11,418.67	1,623.43	14.22%
Howell, Township of	39,424.92	4,083.57	10.36%
Interlaken, Borough of	247.26	0	0.00%
Keansburg, Borough of	748.42	0	0.00%
Keyport, Borough of	937.06	0.0017	0.00%
Lake Como, Borough of	158.20	0	0.00%
Little Silver, Borough of	2,132.68	9.3079	0.44%
Loch Arbour, Village of	76.65	0	0.00%
Long Branch, City of	3,407.85	0	0.00%
Manalapan, Township of	19,776.83	2,769.38	14.00%
Manasquan, Borough of	982.59	0	0.00%
Marlboro, Township of	19,675.62	1,669.19	8.48%
Matawan, Borough of	1,509.75	0	0.00%
Middletown, Township of	25,826.00	963.8969	3.73%
Millstone, Township of	23,909.54	5,204.85	21.77%
Monmouth Beach, Borough of	1,242.67	0	0.00%
Neptune City, Borough of	562.92	0	0.00%

Table 3c.10
Acreage of Agricultural Land by Jurisdiction

Jurisdiction	Total Acres	Agricultural Land (Acres)	Percentage of Total
Neptune, Township of	5,641.90	6.4917	0.12%
Ocean, Township of	7,023.33	24.4166	0.35%
Oceanport, Borough of	2,431.01	2.0966	0.09%
Red Bank, Borough of	1,373.95	0	0.00%
Roosevelt, Borough of	1,251.17	323.1916	25.83%
Rumson, Borough of	4,555.42	14.8252	0.33%
Sea Bright, Borough of	651.23	0	0.00%
Sea Girt, Borough of	675.37	0	0.00%
Shrewsbury, Borough of	1,403.58	12.0029	0.86%
Shrewsbury, Township of	62.40	0	0.00%
Spring Lake, Borough of	901.93	0	0.00%
Spring Lake Heights, Borough of	839.72	0	0.00%
Tinton Falls, Borough of	9,964.77	218.4585	2.19%
Union Beach, Borough of	1,209.76	0	0.00%
Upper Freehold, Township of	30,133.67	12,314.33	40.87%
Wall, Township of	19,828.89	1,217.80	6.14%
West Long Branch, Borough of	1,842.22	18.2386	0.99%
Total	**308,158.41**	**36,343.45**	**11.79%**

Source: Monmouth County Office of GIS

In order to analyze the exposure of Monmouth County crops to drought, 100 years of county-level statistical crop value data from the University of Nebraska was used (this data was developed by the University based on Palmer Drought and Crop Severity Indices) as well as 2002 USDA agriculture data for the county. County level data was scaled for inflation to estimate exposure of crops in Monmouth County at $84,280,384.

To estimate losses due to drought, NCDC historical drought loss data for Monmouth County[13] was used to develop a drought stochastic model[14]. In this model:

- Losses were obtained for each jurisdiction and scaled for inflation. For all events impacting the entire county (loss data not provided for specific jurisdictions), losses were averaged across all 53 jurisdictions;
- Average historic drought damageability was used to generate losses for historical drought events where losses were not reported;
- Expected annualized losses were calculated through a non-linear regression of historical data; and
- Probabilistic losses were scaled to account for would-be losses where no exposure/instrument was present at the time of the event.

Using this method based on historical losses and crop market value exposure for Monmouth County as a whole, annualized expected crop losses are approximately $108,098, with an annualized percent loss ratio of 0.13 percent for Monmouth County.

[13] Crop exposure data and NCDC historical losses to drought were recorded on a countywide level, and data for jurisdictions is not currently available. Therefore, potential losses to drought were calculated at the county level.

[14] It is important to note that only drought events that have been reported have been factored into this vulnerability assessment. It is possible that additional drought events may have occurred since 1950 that were not reported to NCDC and are not accounted for in this analysis.

Flood

In order to assess flood risk, a GIS-based analysis was used to estimate exposure to flood events using FEMAôs digital Q3 flood data in combination with local tax assessor records. The determination of assessed value at-risk (exposure) was calculated using GIS analysis by summing the total assessed building values for only those parcels that were confirmed to have at least one building located within the currently effective A, AE or VE flood zones, as presented in **Table 3c.11**.

Table 3c.11
Exposure in Flood Zones by Jurisdiction

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Buildings Located in A/AE Zones		Buildings Located in VE Zone		Buildings Located in All Flood Zones (A/AE and VE)	
		Value At-Risk	Percent	Value At-Risk	Percent	Value At-Risk	Percent
Aberdeen, Township of	$515,957,370	$15,750,900	3.05%	$1,868,400	0.36%	$17,619,300	3.41%
Allenhurst, Borough of	$100,652,200	$11,622,200	11.55%	$4,079,600	4.05%	$15,701,800	15.60%
Allentown, Borough of	$77,448,700	$2,056,000	2.65%	$0	0.00%	$2,056,000	2.65%
Asbury Park, City of	$320,791,800	$33,006,700	10.29%	$14,568,700	4.54%	$47,575,400	14.83%
Atlantic Highlands, Borough of	$445,377,200	$20,770,100	4.66%	$11,609,200	2.61%	$32,379,300	7.27%
Avon-By-The-Sea, Borough of	$127,812,100	$30,977,100	24.24%	$0	0.00%	$30,977,100	24.24%
Belmar, Borough of	$432,498,600	$45,092,200	10.43%	$3,943,200	0.91%	$49,035,400	11.34%
Bradley Beach, Borough of	$198,617,900	$5,199,100	2.62%	$0	0.00%	$5,199,100	2.62%
Brielle, Borough of	$270,948,535	$17,392,900	6.42%	$0	0.00%	$17,392,900	6.42%
Colts Neck, Township of	$620,440,600	$18,245,800	2.94%	$0	0.00%	$18,245,800	2.94%
Deal, Borough of	$402,837,700	$18,964,100	4.71%	$13,492,400	3.35%	$32,456,500	8.06%
Eatontown, Borough of	$1,176,943,200	$28,126,300	2.39%	$0	0.00%	$28,126,300	2.39%
Englishtown, Borough of	$50,184,400	$5,045,600	10.05%	$0	0.00%	$5,045,600	10.05%
Fair Haven, Borough of	$516,903,700	$16,849,400	3.26%	$0	0.00%	$16,849,400	3.26%
Farmingdale, Borough of	$47,555,700	$4,761,700	10.01%	$0	0.00%	$4,761,700	10.01%
Freehold, Borough of	$438,446,925	$166,400	0.04%	$0	0.00%	$166,400	0.04%
Freehold, Township of	$2,033,417,200	$14,937,000	0.73%	$0	0.00%	$14,937,000	0.73%
Hazlet, Township of	$693,335,000	$58,536,000	8.44%	$0	0.00%	$58,536,000	8.44%
Highlands, Borough of	$318,826,200	$158,474,300	49.71%	$552,100	0.17%	$159,026,400	49.88%
Holmdel, Township of	$1,995,955,600	$8,647,000	0.43%	$0	0.00%	$8,647,000	0.43%
Howell, Township of	$1,914,832,390	$18,657,100	0.97%	$0	0.00%	$18,657,100	0.97%
Interlaken, Borough of	$88,855,300	$12,364,400	13.92%	$0	0.00%	$12,364,400	13.92%
Keansburg, Borough of	$199,892,700	$55,784,600	27.91%	$0	0.00%	$55,784,600	27.91%
Keyport, Borough of	$219,673,450	$18,519,400	8.43%	$749,000	0.34%	$19,268,400	8.77%
Lake Como, Borough of	$65,026,800	$2,606,000	4.01%	$0	0.00%	$2,606,000	4.01%
Little Silver, Borough of	$622,615,400	$107,551,900	17.27%	$22,128,300	3.55%	$129,680,200	20.83%
Loch Arbour, Village of	$28,719,700	$15,476,200	53.89%	$199,600	0.69%	$15,675,800	54.58%
Long Branch, City of	$1,085,212,300	$169,229,600	15.59%	$5,615,500	0.52%	$174,845,100	16.11%
Manalapan, Township of	$3,229,721,500	$69,988,800	2.17%	$0	0.00%	$69,988,800	2.17%
Manasquan, Borough of	$394,840,400	$234,798,900	59.47%	$18,137,700	4.59%	$252,936,600	64.06%
Marlboro, Township of	$2,270,927,800	$25,648,300	1.13%	$0	0.00%	$25,648,300	1.13%
Matawan, Borough of	$280,292,084	$4,921,400	1.76%	$0	0.00%	$4,921,400	1.76%
Middletown, Township of	$3,327,619,578	$175,341,100	5.27%	$9,083,300	0.27%	$184,424,400	5.54%
Millstone, Township of	$263,436,400	$4,618,300	1.75%	$0	0.00%	$4,618,300	1.75%

Table 3c.11
Exposure in Flood Zones by Jurisdiction

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Buildings Located in A/AE Zones		Buildings Located in VE Zone		Buildings Located in All Flood Zones (A/AE and VE)	
		Value At-Risk	Percent	Value At-Risk	Percent	Value At-Risk	Percent
Monmouth Beach, Borough of	$169,824,000	$125,564,900	73.94%	$16,629,100	9.79%	$142,194,000	83.73%
Neptune City, Borough of	$142,043,700	$18,219,600	12.83%	$0	0.00%	$18,219,600	12.83%
Neptune, Township of	$1,576,460,100	$82,958,800	5.26%	$767,800	0.00%	$83,726,600	5.31%
Ocean, Township of	$2,612,650,600	$179,626,600	6.88%	$0	0.00%	$179,626,600	6.88%
Oceanport, Borough of	$322,084,700	$177,555,400	55.13%	$0	0.00%	$177,555,400	55.13%
Red Bank, Borough of	$1,219,372,800	$16,489,739	1.35%	$0	0.00%	$16,489,739	1.35%
Roosevelt, Borough of	$23,470,660	$0	0.00%	$0	0.00%	$0	0.00%
Rumson, Borough of	$507,589,781	$102,800,000	20.25%	$5,983,500	1.18%	$108,783,500	21.43%
Sea Bright, Borough of	$98,620,100	$88,498,600	89.74%	$10,121,500	10.26%	$98,620,100	100.00%
Sea Girt, Borough of	$235,924,250	$18,804,800	7.97%	$14,198,700	6.02%	$33,003,500	13.99%
Shrewsbury, Borough of	$451,418,300	$10,900,100	2.41%	$0	0.00%	$10,900,100	2.41%
Shrewsbury, Township of	$3,900,100	$0	0.00%	$0	0.00%	$0	0.00%
Spring Lake, Borough of	$489,616,500	$57,876,100	11.82%	$775,000	0.16%	$58,651,100	11.98%
Spring Lake Heights, Borough of	$276,945,800	$19,041,300	6.88%	$0	0.00%	$19,041,300	6.88%
Tinton Falls, Borough of	$920,707,700	$8,760,200	0.95%	$0	0.00%	$8,760,200	0.95%
Union Beach, Borough of	$236,450,400	$176,373,300	74.59%	$2,901,900	1.23%	$179,275,200	75.82%
Upper Freehold, Township of	$143,501,070	$1,601,100	1.12%	$0	0.00%	$1,601,100	1.12%
Wall, Township of	$2,039,081,200	$94,955,500	4.66%	$0	0.00%	$94,955,500	4.66%
West Long Branch, Borough of	$495,025,500	$41,151,100	8.31%	$0	0.00%	$41,151,100	8.31%
Total	**$36,741,303,693**	**$2,651,303,939**	**7.22%**	**$157,404,500**	**0.43%**	**$2,808,708,439**	**7.64%**

NOTES: Exposure calculated by GIS Analysis using local assessed values

To estimate potential losses resulting from the flood hazard, a basic HAZUS-MH analysis was conducted for both riverine and coastal flooding. After attempting to use the model to analyze coastal flooding, it was determined that the current model does not sufficiently address coastal flooding in Monmouth County. Coastal flooding potential is addressed in the storm surge section of this document, but it should be noted that an analysis for ordinary coastal flooding events not associated with hurricanes could not be modeled in this risk assessment. As better data and modeling tools become available to assess coastal flooding, future plan updates should expand the assessment of coastal flooding in Monmouth County. Thus, only riverine flood impacts are analyzed in this section.

HAZUS-MH was used to estimate potential losses in Monmouth County resulting from potential riverine flood events. A Digital Elevation Model (1 arc second) was obtained from USGS for the study area coordinates for input and flood depth was estimated at the pixel level for affected areas, along with the proportion of the area affected within the census block. HAZUS-MH was utilized to estimate floodplain boundaries, potential exposure for each event frequency, and loss estimates based on probabilistic scenarios for 10-, 50-, 100-, 200- and 500-year flood events using a Level 1 analysis[15]. **Table 3c.12** shows estimated potential losses for 10-, 50-, 100-, 200-, and 500-year flood event scenarios.

[15] According to FEMA's HAZUS Web site, "a Level 1 analysis yields a rough estimate based on the nationwide database and is a great way to begin the risk assessment process and prioritize high-risk communities."

Table 3c.12
Estimated Potential Losses From 10-, 50-, 100-, 200- and 500-year Riverine Flood Events

Jurisdiction	Potential Total Building Losses				
	10-Year Event	50-Year Event	100-Year Event	200-Year Event	500-Year Event
Aberdeen, Township of	$114,153	$175,956	$226,125	$321,374	$519,506
Allenhurst, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Allentown, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Asbury Park, City of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Atlantic Highlands, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Avon-By-The-Sea, Borough of	*Negligible*	*Negligible*	$35,905	$88,565	$140,746
Belmar, Borough of	$420,184	$728,787	$1,005,510	$1,111,990	$1,223,572
Bradley Beach, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Brielle, Borough of	$41,623	$58,497	$80,996	$91,683	$99,558
Colts Neck, Township of	$1,950,644	$2,895,487	$3,218,659	$3,667,133	$5,736,789
Deal, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Eatontown, Borough of	$1,102,172	$1,343,268	$1,583,632	$1,694,728	$2,799,829
Englishtown, Borough of	$994,812	$1,215,815	$1,436,519	$2,095,944	$2,661,294
Fair Haven, Borough of	$233,803	$352,463	$753,268	$793,700	$1,378,208
Farmingdale, Borough of	$284,569	$396,835	$460,773	$505,200	$578,443
Freehold, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Freehold, Township of	$2,468,141	$3,874,061	$4,338,286	$5,243,558	$6,592,526
Hazlet, Township of	$657,096	$862,675	$966,936	$1,125,009	$1,337,314
Highlands, Borough of	$807,844	$1,371,629	$2,225,466	$3,436,861	$4,981,335
Holmdel, Township of	$5,722,966	$7,736,583	$8,862,060	$10,460,066	$13,212,545
Howell, Township of	$7,575,001	$10,776,781	$12,419,215	$13,892,574	$17,831,034
Interlaken, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Keansburg, Borough of	$885,693	$1,341,180	$1,527,483	$1,712,462	$2,385,214
Keyport, Borough of	$211,775	$323,759	$425,475	$541,951	$632,758
Lake Como, Borough of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Little Silver, Borough of	$321,092	$371,839	$477,947	$536,076	$494,555
Loch Arbour, Village of	*Negligible*	*Negligible*	*Negligible*	*Negligible*	*Negligible*
Long Branch, City of	$320,166	$413,985	$517,367	$724,587	$1,696,017
Manalapan, Township of	$11,954,793	$16,213,282	$18,713,811	$14,831,556	$29,328,682
Manasquan, Borough of	$6,601	$11,678	$15,232	$16,755	$18,279
Marlboro, Township of	$818,054	$1,418,852	$1,629,099	$2,021,561	$2,389,175
Matawan, Borough of	$963,181	$1,453,727	$1,990,708	$2,500,822	$4,188,048
Middletown, Township of	$7,705,643	$11,078,618	$13,256,172	$15,109,920	$18,228,674
Millstone, Township of	$849,933	$1,182,579	$1,352,859	$1,533,982	$2,377,760
Monmouth Beach, Borough of	$6,315	$6,710	$7,105	$34,734	$76,967
Neptune City, Borough of	$6,924	$8,282	$8,642	$9,362	$11,162
Neptune, Township of	$2,369,233	$2,892,903	$3,687,865	$4,128,713	$5,637,770
Ocean, Township of	$1,400,184	$1,964,346	$2,286,286	$2,747,223	$3,813,202
Oceanport, Borough of	$1,049,666	$1,274,319	$1,707,352	$1,722,734	$3,082,819
Red Bank, Borough of	$11,232,560	$14,695,387	$16,352,471	$17,582,056	$19,916,924
Roosevelt, Borough of	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Rumson, Borough of	$578,636	$1,045,357	$1,192,937	$1,512,693	$2,988,492
Sea Bright, Borough of	*Negligible*	*Negligible*	*Negligible*	$369,593	$1,747,295
Sea Girt, Borough of	$96,976	$138,445	$162,689	$176,725	$209,263

Table 3c.12
Estimated Potential Losses From 10-, 50-, 100-, 200- and 500-year Riverine Flood Events

Jurisdiction	Potential Total Building Losses				
	10-Year Event	50-Year Event	100-Year Event	200-Year Event	500-Year Event
Shrewsbury, Borough of	$275,675	$304,326	$332,204	$653,566	$974,929
Shrewsbury, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Spring Lake, Borough of	$157,170	$281,635	$508,759	$559,635	$704,995
Spring Lake Heights, Borough of	$173,733	$419,182	$483,827	$549,987	$670,186
Tinton Falls, Borough of	$2,627,162	$3,876,088	$4,550,532	$5,054,403	$6,835,968
Union Beach, Borough of	$5,287	$13,937	$16,821	$18,743	$26,433
Upper Freehold, Township of	$723,181	$938,497	$1,085,064	$1,200,328	$1,471,228
Wall, Township of	$2,917,414	$4,663,961	$5,231,572	$6,152,259	$7,502,017
West Long Branch, Borough of	*Negligible*	$988,895	$1,292,848	$1,488,946	$1,866,435
Total	**$68,336,452**	**$97,202,202**	**$114,557,953**	**$129,496,366**	**$179,370,442**

Source: HAZUS-MH
NOTE: Negligible means less than $5,000 damage per event

Table 3b.13 shows potential annualized property losses calculated by HAZUS-MH as well as percent loss ratios resulting from flood for each jurisdiction in Monmouth County.

Table 3c.13
Potential Annualized Losses from Riverine Flood by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in Identified Flood Areas*	Annualized Total Building Loss	Annualized Percent Loss Ratio
Aberdeen, Township of	4,655	$515,957,370	$17,619,300	$33,446	0.01%
Allenhurst, Borough of	144	$100,652,200	$15,701,800	*Negligible*	0.00%
Allentown, Borough of	1,036	$77,448,700	$2,056,000	*Negligible*	0.00%
Asbury Park, City of	2,890	$320,791,800	$47,575,400	*Negligible*	0.00%
Atlantic Highlands, Borough of	841	$445,377,200	$32,379,300	*Negligible*	0.00%
Avon-By-The-Sea, Borough of	637	$127,812,100	$30,977,100	*Negligible*	0.00%
Belmar, Borough of	1,413	$432,498,600	$49,035,400	$105,843	0.02%
Bradley Beach, Borough of	276	$198,617,900	$5,199,100	*Negligible*	0.00%
Brielle, Borough of	1,719	$270,948,535	$17,392,900	$11,812	0.00%
Colts Neck, Township of	2,884	$620,440,600	$18,245,800	$442,185	0.07%
Deal, Borough of	314	$402,837,700	$32,456,500	*Negligible*	0.00%
Eatontown, Borough of	3,573	$1,176,943,200	$28,126,300	$197,230	0.02%
Englishtown, Borough of	1,145	$50,184,400	$5,045,600	$216,523	0.43%
Fair Haven, Borough of	866	$516,903,700	$16,849,400	$66,801	0.01%
Farmingdale, Borough of	706	$47,555,700	$4,761,700	$65,739	0.14%
Freehold, Borough of	0	$438,446,925	$166,400	*Negligible*	0.00%
Freehold, Township of	9,232	$2,033,417,200	$14,937,000	$552,302	0.03%
Hazlet, Township of	7,549	$693,335,000	$58,536,000	$127,383	0.02%
Highlands, Borough of	4,033	$318,826,200	$159,026,400	$255,187	0.08%
Holmdel, Township of	2,184	$1,995,955,600	$8,647,000	$1,152,326	0.06%
Howell, Township of	14,019	$1,914,832,390	$18,657,100	$1,569,973	0.08%
Interlaken, Borough of	328	$88,855,300	$12,364,400	*Negligible*	0.00%
Keansburg, Borough of	5,408	$199,892,700	$55,784,600	$230,683	0.12%
Keyport, Borough of	2,974	$219,673,450	$19,268,400	$49,735	0.02%

Table 3c.13
Potential Annualized Losses from Riverine Flood by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in Identified Flood Areas*	Annualized Total Building Loss	Annualized Percent Loss Ratio
Lake Como, Borough of	579	$65,026,800	$2,606,000	*Negligible*	0.00%
Little Silver, Borough of	3,052	$622,615,400	$129,680,200	$72,892	0.01%
Loch Arbour, Village of	242	$28,719,700	$15,675,800	*Negligible*	0.00%
Long Branch, City of	9,387	$1,085,212,300	$174,845,100	$89,719	0.01%
Manalapan, Township of	10,242	$3,229,721,500	$69,988,800	$2,481,827	0.08%
Manasquan, Borough of	4,707	$394,840,400	$252,936,600	*Negligible*	0.00%
Marlboro, Township of	7,762	$2,270,927,800	$25,648,300	$207,062	0.01%
Matawan, Borough of	2,552	$280,292,084	$4,921,400	$225,207	0.08%
Middletown, Township of	20,041	$3,327,619,578	$184,424,400	$1,559,377	0.05%
Millstone, Township of	3,986	$263,436,400	$4,618,300	$181,710	0.07%
Monmouth Beach, Borough of	3,072	$169,824,000	$142,194,000	*Negligible*	0.00%
Neptune City, Borough of	2,140	$142,043,700	$18,219,600	*Negligible*	0.00%
Neptune, Township of	5,498	$1,576,460,100	$83,726,600	$465,630	0.03%
Ocean, Township of	11,774	$2,612,650,600	$179,626,600	$302,522	0.01%
Oceanport, Borough of	4,623	$322,084,700	$177,555,400	$222,427	0.07%
Red Bank, Borough of	1,963	$1,219,372,800	$16,489,739	$2,050,988	0.17%
Roosevelt, Borough of	0	$23,470,660	$0	Not Applicable	0.00%
Rumson, Borough of	3,055	$507,589,781	$108,783,500	$154,344	0.03%
Sea Bright, Borough of	1,199	$98,620,100	$98,620,100	*Negligible*	0.00%
Sea Girt, Borough of	351	$235,924,250	$33,003,500	$23,606	0.01%
Shrewsbury, Borough of	1,194	$451,418,300	$10,900,100	$48,011	0.01%
Shrewsbury, Township of	0	$3,900,100	$0	Not Applicable	0.00%
Spring Lake, Borough of	880	$489,616,500	$58,651,100	$50,876	0.01%
Spring Lake Heights, Borough of	810	$276,945,800	$19,041,300	$47,474	0.02%
Tinton Falls, Borough of	2,638	$920,707,700	$8,760,200	$535,254	0.06%
Union Beach, Borough of	5,938	$236,450,400	$179,275,200	*Negligible*	0.00%
Upper Freehold, Township of	1,953	$143,501,070	$1,601,100	$148,907	0.10%
Wall, Township of	6,435	$2,039,081,200	$94,955,500	$663,110	0.03%
West Long Branch, Borough of	527	$495,025,500	$41,151,100	$142,171	0.03%
Total	**185,426**	**$36,741,303,693**	**$2,808,708,439**	**$14,572,654**	**0.04%**

Source: HAZUS-MH
**Exposure calculated by GIS Analysis using local assessed values*
NOTE: Negligible means less than $5,000 annual average damage

As noted above, this analysis principally estimates damages from riverine sources, therefore the risks and damages in this section for coastal communities may appear underestimated when read in isolation from the accompanying sections estimating damages from storm surge, wave action, and erosion.

For the subset of structures identified as Repetitive Loss Properties (see Section 3a, Pages 3a-51 to 60), a simple review of the history of paid claims on these structures suggests an annualized loss of approximately $1 million for these 600 or so properties. Without efforts to mitigate these and other individual properties at risk from frequent flooding, annual repetitive losses can be expected to remain at this order of magnitude, and even to increase, as structures that have up till now only been flooded once become flooded repeatedly and hence meet the definition of ñRepetitive Loss Propertyò. A more detailed assessment of potential future losses suffered by these properties would require a comprehensive survey of each individual repetitive loss property, which was outside the scope of this initial plan. However, the

compilation of a detailed inventory of repetitive loss properties for targeted mitigation is something that should be considered for future plan updates.

In accordance with FEMA guidance, all analyses in this plan have been conducted using the best readily available data. However, in the opinion of some members of the planning committee, in particular County Engineering staff, the extent of property damage or risk due to potential stream flooding may be underestimated by this level of analysis, for the following reasons: With a few exceptions, the countywide Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) are primarily based on hydrologic and hydraulic analyses and wave height analyses completed for each municipality during the late 1970s/early 1980s. For many municipalities, these analyses were conducted before the intense development of the 1980s and 1990s occurred. The analyses assume uniform conveyance throughout the stream corridor and do not necessarily account for changes in channel width or depth caused by siltation. Encroachments into the floodplain and or floodway could increase the flood elevation and therefore, widen the delineations of the 1%, 0.2% annual chance floodplains and 1% annual chance floodway depicted on the FIRMs.

Since the initial FEMA FIS, the Stateôs the Flood Hazard Area and Freshwater Wetlands rules have regulated development in floodplains and floodways. While these regulations have served to guide appropriate development trends within these sensitive areas, they have been considered by some to be an obstacle for many local government agencies in implementing systematic stream-cleaning and maintenance of stormwater facilities. As a result, many stream segments throughout Monmouth County are silted in and or blocked by debris and flood control basins are not functioning as designed

In addition to these concerns, at the time of writing, FEMA has issued preliminary updated FIRMs for many areas in Monmouth County which significantly revise the 1% flood event hazard area (the ñ100-yearò floodplain) to include some developed areas which were not previously identified as vulnerable to the same level of risk. This issue mainly concerns coastal areas in the north of the County where FEMA is no longer willing to certify certain dune structures as levees providing protection to the 100-year event. At the time of writing the revised FIRMs are still considered preliminary and subject to further review. It is recommended that the flood risk and vulnerability assessment be revisited in detail as part of the first formal update of this plan, by which time revised FIRMs will have been formally adopted.

Storm Surge

Storm surge is a flood hazard which is related to hurricanes, which differs from coastal flood events. Only storm surge related to hurricanes is analyzed in this section. Due to data limitations, analysis for ordinary coastal flooding events not associated with hurricanes could not be modeled in this risk assessment. In order to assess storm surge risk, two distinct vulnerability assessment approaches were applied for Monmouth County in order to assess exposure and potential losses to storm surge hazard events. This includes a GIS-based analysis to estimate exposure and HAZUS-MH to estimate potential losses for storm surge events.

Coastal flood inundation zone maps were derived from georeferenced data produced by the National Oceanic and Atmospheric Administration (NOAA). Storm surge data was provided from NOAA Sea, Lake and Overland Surges from Hurricanes (SLOSH) data (2006). SLOSH is a modeling tool used to estimate storm surge resulting from historical, hypothetical or predicted hurricanes. In this analysis, color-coded storm surge inundation areas were created and overlaid with parcel and census block data, defining the potential maximum surge for coastal locations in Monmouth County. For Monmouth County, the New York (NY2) SLOSH basin was used.

The determination of value at-risk (exposure) was calculated using GIS analysis by summing the total improved values for only those parcels that were confirmed to have at least one building located within an identified storm surge zone (Category 1-4 storm events), as presented in **Table 3c.14**. Five jurisdictions are 100 percent exposed to storm surge: Keansburg Borough, Loch Arbour Village, Monmouth Beach Borough, Sea Bright Borough, and Union Beach Borough. Twelve jurisdictions have no improved property exposed to storm surge.

Table 3c.14
Exposure in Storm Surge Areas by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in Category 1-4 Storm Surge Areas*	Percent of Total Building Value Exposed to Surge
Aberdeen, Township of	5,551	$515,957,370	$17,203,250	3.33%
Allenhurst, Borough of	599	$100,652,200	$68,906,300	68.46%
Allentown, Borough of	0	$77,448,700	$0	0.00%
Asbury Park, City of	16,705	$320,791,800	$240,662,300	75.02%
Atlantic Highlands, Borough of	2,207	$445,377,200	$109,635,800	24.62%
Avon-By-The-Sea, Borough of	2,244	$127,812,100	$125,480,200	98.18%
Belmar, Borough of	6,045	$432,498,600	$431,351,100	99.73%
Bradley Beach, Borough of	4,793	$198,617,900	$178,237,700	89.74%
Brielle, Borough of	3,671	$270,948,535	$131,058,900	48.37%
Colts Neck, Township of	1,332	$620,440,600	$0	0.00%
Deal, Borough of	967	$402,837,700	$100,081,900	24.84%
Eatontown, Borough of	6,992	$1,176,943,200	$171,591,700	14.58%
Englishtown, Borough of	0	$50,184,400	$0	0.00%
Fair Haven, Borough of	3,683	$516,903,700	$109,633,100	21.21%
Farmingdale, Borough of	0	$47,555,700	$0	0.00%
Freehold, Borough of	0	$438,446,925	$0	0.00%
Freehold, Township of	0	$2,033,417,200	$0	0.00%
Hazlet, Township of	13,171	$693,335,000	$198,831,700	28.68%
Highlands, Borough of	4,372	$318,826,200	$158,587,900	49.74%

Table 3c.14
Exposure in Storm Surge Areas by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in Category 1-4 Storm Surge Areas*	Percent of Total Building Value Exposed to Surge
Holmdel, Township of	2,250	$1,995,955,600	$6,055,000	0.30%
Howell, Township of	62	$1,914,832,390	$74,100	0.00%
Interlaken, Borough of	900	$88,855,300	$69,889,600	78.66%
Keansburg, Borough of	10,426	$199,892,700	$199,892,700	100.00%
Keyport, Borough of	7,059	$219,673,450	$109,451,100	49.82%
Lake Como, Borough of	1,806	$65,026,800	$62,840,100	96.64%
Little Silver, Borough of	4,972	$622,615,400	$336,027,100	53.97%
Loch Arbour, Village of	399	$28,719,700	$28,719,700	100.00%
Long Branch, City of	28,616	$1,085,212,300	$607,702,200	56.00%
Manalapan, Township of	0	$3,229,721,500	$0	0.00%
Manasquan, Borough of	6,063	$394,840,400	$335,512,700	84.97%
Marlboro, Township of	0	$2,270,927,800	$0	0.00%
Matawan, Borough of	3,013	$280,292,084	$2,705,450	0.97%
Middletown, Township of	34,020	$3,327,619,578	$535,335,800	16.09%
Millstone, Township of	0	$263,436,400	$0	0.00%
Monmouth Beach, Borough of	3,595	$169,824,000	$169,824,000	100.00%
Neptune City, Borough of	4,345	$142,043,700	$77,699,900	54.70%
Neptune, Township of	14,107	$1,576,460,100	$557,303,400	35.35%
Ocean, Township of	5,380	$2,612,650,600	$122,910,500	4.70%
Oceanport, Borough of	5,582	$322,084,700	$279,458,900	86.77%
Red Bank, Borough of	3,816	$1,219,372,800	$29,507,954	2.42%
Roosevelt, Borough of	0	$23,470,660	$0	0.00%
Rumson, Borough of	6,041	$507,589,781	$291,391,581	57.41%
Sea Bright, Borough of	1,818	$98,620,100	$98,620,100	100.00%
Sea Girt, Borough of	2,148	$235,924,250	$217,683,550	92.27%
Shrewsbury, Borough of	2,820	$451,418,300	$91,204,200	20.20%
Shrewsbury, Township of	547	$3,900,100	$0	0.00%
Spring Lake, Borough of	3,567	$489,616,500	$392,482,300	80.16%
Spring Lake Heights, Borough of	4,078	$276,945,800	$80,424,200	29.04%
Tinton Falls, Borough of	2,379	$920,707,700	$10,654,000	1.16%
Union Beach, Borough of	6,649	$236,450,400	$236,450,400	100.00%
Upper Freehold, Township of	0	$143,501,070	$0	0.00%
Wall, Township of	7,944	$2,039,081,200	$77,371,700	3.79%
West Long Branch, Borough of	3,564	$495,025,500	$160,450,600	32.41%
Total	**250,298**	**$36,741,303,693**	**$7,228,904,685**	**19.68%**

**Exposure calculated by GIS Analysis using local assessed values*

To analyze potential losses, color-coded storm surge inundation areas were created and overlaid with census block data, defining the potential maximum surge for coastal locations for each category of hurricane, as well as exposed structures located in those areas. Additionally, transects were used to group areas with still water heights within a range of 0.5 feet at the coastline. A GIS analysis was conducted to verify that the surge boundaries and depths estimated by HAZUS-MH reasonably correspond with the boundaries in the NOAA data, and HAZUS-MH inventory was used to estimate potential losses.

For developing the depth grid files, the SLOSH data was used in combination with ground elevation data from the USGS National Elevation Dataset (NED). The MOM value (Maximum of the Maximum Envelopes of Water; a composite measure that expresses the maximum flood elevation) for Categories 1, 2, 3 and 4[16] from the SLOSH data was used to determine the ñsurgeò or water elevation. A GRID digital map of flood elevation was produced from the SLOSH shapefile data. A simple GIS operation of subtraction was performed with the ground elevation data set to determine the water depth.

HAZUS-MH was used to estimate potential losses in Monmouth County resulting from potential storm surge events. SLOSH flood elevations and shoreline characteristics based on topography at transect locations were input into HAZUS-MH so that the programôs depth damage functions and coastal methodology could be applied to determine the potential estimated losses for storm surge resulting from Category 1, 2, 3 and 4 hurricane events and annual expected loss at the census block level. **Table 3c.15** shows estimated potential losses for Category 1, 2, 3 and 4 storm surge event scenarios for each jurisdiction.

It should be noted that HAZUS-MH is a regional modeling tool and does not include specific building or parcel information or assessment, and damages modeled do not directly correspond with the GIS-analysis of parcel exposure presented earlier in this section.

Table 3c.15
Estimated Potential Losses from Category 1, 2, 3 and 4 Storm Surge Events

Jurisdiction	Potential Total Building Losses			
	Category 1 Event	Category 2 Event	Category 3 Event	Category 4 Event
Aberdeen, Township of	$2,673,512	$6,778,303	$17,986,770	$27,313,525
Allenhurst, Borough of	$1,622,537	$16,201,347	$33,781,577	$43,713,781
Allentown, Borough of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Asbury Park, City of	$1,051,846	$31,313,040	$94,291,913	$123,558,972
Atlantic Highlands, Borough of	$4,013,957	$13,155,999	$49,313,498	$74,941,365
Avon-By-The-Sea, Borough of	$1,522,359	$31,347,193	$54,685,724	$64,041,530
Belmar, Borough of	$3,642,661	$104,895,000	$185,967,646	$217,047,906
Bradley Beach, Borough of	$1,391,460	$24,149,910	$67,731,326	$86,452,420
Brielle, Borough of	$6,208,582	$36,088,861	$60,053,043	$74,853,970
Colts Neck, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Deal, Borough of	$6,331,663	$12,404,304	$56,132,632	$91,406,197
Eatontown, Borough of	$115,223	$654,194	$24,436,363	$48,988,281
Englishtown, Borough of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Fair Haven, Borough of	$1,874,820	$2,733,564	$44,292,521	$88,741,496
Farmingdale, Borough of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Freehold, Borough of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Freehold, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Hazlet, Township of	$10,264,654	$27,058,647	$79,744,456	$111,476,345
Highlands, Borough of	$24,586,207	$54,273,924	$98,519,156	$116,713,825
Holmdel, Township of	*Negligible*	*Negligible*	$12,945,137	$26,346,693
Howell, Township of	*Negligible*	*Negligible*	*Negligible*	$22,704
Interlaken, Borough of	$1,048,457	$10,216,399	$22,765,289	$34,333,695
Keansburg, Borough of	$37,722,107	$83,572,877	$108,983,770	$121,551,572
Keyport, Borough of	$3,913,022	$10,839,666	$30,318,784	$55,098,371
Lake Como, Borough of	$111,990	$6,817,806	$22,138,126	$29,509,409

[16] The NY2 SLOSH basin data did not include MOM values for Category 5 storms; therefore this category was not included in this analysis.

Table 3c.15
Estimated Potential Losses from Category 1, 2, 3 and 4 Storm Surge Events

Jurisdiction	Potential Total Building Losses			
	Category 1 Event	Category 2 Event	Category 3 Event	Category 4 Event
Little Silver, Borough of	$4,619,846	$16,489,170	$118,714,456	$169,715,455
Loch Arbour, Village of	$462,968	$4,622,828	$9,639,101	$12,473,117
Long Branch, City of	$23,874,948	$33,812,861	$187,155,305	$333,964,622
Manalapan, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Manasquan, Borough of	$21,720,606	$101,652,580	$164,013,705	$192,908,169
Marlboro, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Matawan, Borough of	*Negligible*	$390,380	$6,562,834	$11,526,336
Middletown, Township of	$10,184,116	$168,211,441	$326,472,535	$422,190,063
Millstone, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Monmouth Beach, Borough of	$13,211,125	$17,492,870	$47,754,798	$75,370,237
Neptune City, Borough of	$167,076	$12,598,781	$32,012,044	$42,134,566
Neptune, Township of	$8,367,638	$80,778,258	$221,251,666	$294,274,648
Ocean, Township of	$3,927,670	$17,707,730	$68,586,538	$107,054,809
Oceanport, Borough of	$6,935,402	$12,774,941	$87,972,754	$119,012,139
Red Bank, Borough of	$18,851,116	$36,094,700	$82,383,029	$124,970,004
Roosevelt, Borough of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Rumson, Borough of	$15,407,335	$71,724,416	$126,262,544	$158,583,759
Sea Bright, Borough of	$19,844,182	$29,741,017	$40,155,069	$50,034,118
Sea Girt, Borough of	$1,732,162	$19,234,970	$77,777,569	$99,819,725
Shrewsbury, Borough of	$181,976	$1,544,863	$33,263,730	$54,554,189
Shrewsbury, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Spring Lake, Borough of	$10,342,354	$51,126,694	$108,505,679	$174,249,215
Spring Lake Heights, Borough of	$1,264,111	$10,967,915	$37,007,687	$65,030,239
Tinton Falls, Borough of	*Negligible*	$1,981,777	$8,293,242	$15,353,541
Union Beach, Borough of	$53,651,500	$97,838,197	$131,246,151	$144,514,368
Upper Freehold, Township of	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Wall, Township of	$4,914,141	$19,486,414	$49,668,666	$80,484,437
West Long Branch, Borough of	*Negligible*	*Negligible*	$24,648,849	$45,820,455
Total	**$416,316,922**	**$1,534,756,228**	**$3,524,208,384**	**$4,814,774,152**

Source: HAZUS-MH
NOTE: Negligible means less than $5,000

Table 3c.16 shows potential annualized property losses and percent loss ratios resulting from storm surge by jurisdiction.

Table 3c.16
Potential Annualized Losses from Storm Surge by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Buildings Exposed to Surge*	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Aberdeen, Township of	5,551	$17,203,250	$748,903	0.15%
Allenhurst, Borough of	599	$68,906,300	$811,955	0.81%
Allentown, Borough of	0	$0	Not Applicable	0.00%
Asbury Park, City of	16,705	$240,662,300	$872,447	0.27%
Atlantic Highlands, Borough of	2,207	$109,635,800	$900,580	0.20%
Avon-By-The-Sea, Borough of	2,244	$125,480,200	$1,752,149	1.37%

Table 3c.16
Potential Annualized Losses from Storm Surge by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Buildings Exposed to Surge*	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Belmar, Borough of	6,045	$431,351,100	$5,059,429	1.17%
Bradley Beach, Borough of	4,793	$178,237,700	$994,658	0.50%
Brielle, Borough of	3,671	$131,058,900	$2,973,235	1.10%
Colts Neck, Township of	1,332	$0	Not Applicable	0.00%
Deal, Borough of	967	$100,081,900	$1,474,436	0.37%
Eatontown, Borough of	6,992	$171,591,700	$111,828	0.01%
Englishtown, Borough of	0	$0	Not Applicable	0.00%
Fair Haven, Borough of	3,683	$109,633,100	$641,640	0.12%
Farmingdale, Borough of	0	$0	Not Applicable	0.00%
Freehold, Borough of	0	$0	Not Applicable	0.00%
Freehold, Township of	0	$0	Not Applicable	0.00%
Hazlet, Township of	13,171	$198,831,700	$2,407,670	0.35%
Highlands, Borough of	4,372	$158,587,900	$5,917,514	1.86%
Holmdel, Township of	2,250	$6,055,000	*Negligible*	0.00%
Howell, Township of	62	$74,100	*Negligible*	0.00%
Interlaken, Borough of	900	$69,889,600	$589,408	0.66%
Keansburg, Borough of	10,426	$199,892,700	$9,093,351	4.55%
Keyport, Borough of	7,059	$109,451,100	$1,193,640	0.54%
Lake Como, Borough of	1,806	$62,840,100	$381,608	0.59%
Little Silver, Borough of	4,972	$336,027,100	$1,932,087	0.31%
Loch Arbour, Village of	399	$28,719,700	$231,680	0.81%
Long Branch, City of	28,616	$607,702,200	$4,923,641	0.45%
Manalapan, Township of	0	$0	Not Applicable	0.00%
Manasquan, Borough of	6,063	$335,512,700	$8,821,981	2.23%
Marlboro, Township of	0	$0	Not Applicable	0.00%
Matawan, Borough of	3,013	$2,705,450	*Negligible*	0.00%
Middletown, Township of	34,020	$535,335,800	$11,676,258	0.35%
Millstone, Township of	0	$0	Not Applicable	0.00%
Monmouth Beach, Borough of	3,595	$169,824,000	$2,661,881	1.57%
Neptune City, Borough of	4,345	$77,699,900	$270,779	0.19%
Neptune, Township of	14,107	$557,303,400	$4,529,780	0.29%
Ocean, Township of	5,380	$122,910,500	$1,576,996	0.06%
Oceanport, Borough of	5,582	$279,458,900	$1,900,794	0.59%
Red Bank, Borough of	3,816	$29,507,954	$4,318,665	0.35%
Roosevelt, Borough of	0	$0	Not Applicable	0.00%
Rumson, Borough of	6,041	$291,391,581	$5,616,643	1.11%
Sea Bright, Borough of	1,818	$98,620,100	$3,839,639	3.89%
Sea Girt, Borough of	2,148	$217,683,550	$616,943	0.26%
Shrewsbury, Borough of	2,820	$91,204,200	$305,101	0.07%
Shrewsbury, Township of	547	$0	Not Applicable	0.00%
Spring Lake, Borough of	3,567	$392,482,300	$4,111,867	0.84%
Spring Lake Heights, Borough of	4,078	$80,424,200	$735,336	0.27%
Tinton Falls, Borough of	2,379	$10,654,000	*Negligible*	0.00%
Union Beach, Borough of	6,649	$236,450,400	$10,691,276	4.52%
Upper Freehold, Township of	0	$0	Not Applicable	0.00%

Table 3c.16
Potential Annualized Losses from Storm Surge by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Buildings Exposed to Surge*	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Wall, Township of	7,944	$77,371,700	$1,657,102	0.08%
West Long Branch, Borough of	3,564	$160,450,600	*Negligible*	0.00%
Total	**250,298**	**$7,228,904,685**	**$128,980,037**	**0.35%**

Source: HAZUS-MH
**Exposure calculated by GIS Analysis using local assessed values*
NOTE: Negligible means less than $5,000 annual average damage

As mentioned in the Hazard Profiles section, long-term sea level rise can be expected to increase the annual occurrence probability of significant storm surge events and hence the future expected annual losses in Monmouth County. Quantifying this increase in damages requires significant amounts of hydrologic data and detailed analyses which are typically only undertaken at the feasibility stage during the planning for specific coastal flood and erosion protection projects, and hence is outside the scope of this current plan.

Wave Action

To estimate exposure to wave action, it is assumed that vulnerable areas are located in the VE flood zone, which experiences coastal flood with velocity hazard (wave action). The determination of value at-risk was calculated through GIS analysis by summing the total improved values for only those parcels that were confirmed to have at least one building located within an identified VE flood zone. **Table 3c.17** shows exposure to wave action by jurisdiction. Only 16 jurisdictions have property exposed to wave action.

Table 3c.17
Exposure to Wave Action by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in VE Flood Zone*	Percent of Total Building Value Exposed to Wave Action
Aberdeen, Township of	1,160	$515,957,370	$1,868,400	0.36%
Allenhurst, Borough of	70	$100,652,200	$4,079,600	4.05%
Allentown, Borough of	0	$77,448,700	$0	0.00%
Asbury Park, City of	454	$320,791,800	$14,568,700	4.54%
Atlantic Highlands, Borough of	393	$445,377,200	$11,609,200	2.61%
Avon-By-The-Sea, Borough of	66	$127,812,100	$0	0.00%
Belmar, Borough of	55	$432,498,600	$3,943,200	0.91%
Bradley Beach, Borough of	82	$198,617,900	$0	0.00%
Brielle, Borough of	0	$270,948,535	$0	0.00%
Colts Neck, Township of	0	$620,440,600	$0	0.00%
Deal, Borough of	137	$402,837,700	$13,492,400	3.35%
Eatontown, Borough of	0	$1,176,943,200	$0	0.00%
Englishtown, Borough of	0	$50,184,400	$0	0.00%
Fair Haven, Borough of	0	$516,903,700	$0	0.00%
Farmingdale, Borough of	0	$47,555,700	$0	0.00%
Freehold, Borough of	0	$438,446,925	$0	0.00%
Freehold, Township of	0	$2,033,417,200	$0	0.00%
Hazlet, Township of	0	$693,335,000	$0	0.00%
Highlands**, Borough of	147	$318,826,200	$552,100	0.17%
Holmdel, Township of	0	$1,995,955,600	$0	0.00%
Howell, Township of	0	$1,914,832,390	$0	0.00%
Interlaken, Borough of	0	$88,855,300	$0	0.00%
Keansburg, Borough of	83	$199,892,700	$0	0.00%
Keyport, Borough of	289	$219,673,450	$749,000	0.34%
Lake Como, Borough of	0	$65,026,800	$0	0.00%
Little Silver, Borough of	283	$622,615,400	$22,128,300	3.55%
Loch Arbour, Village of	47	$28,719,700	$199,600	0.69%
Long Branch, City of	3,080	$1,085,212,300	$5,615,500	0.52%
Manalapan, Township of	0	$3,229,721,500	$0	0.00%
Manasquan, Borough of	345	$394,840,400	$18,137,700	4.59%
Marlboro, Township of	0	$2,270,927,800	$0	0.00%
Matawan, Borough of	0	$280,292,084	$0	0.00%
Middletown, Township of	1,591	$3,327,619,578	$9,083,300	0.27%
Millstone, Township of	0	$263,436,400	$0	0.00%

Table 3c.17
Exposure to Wave Action by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in VE Flood Zone*	Percent of Total Building Value Exposed to Wave Action
Monmouth Beach, Borough of	2,202	$169,824,000	$16,629,100	9.79%
Neptune City, Borough of	0	$142,043,700	$0	0.00%
Neptune, Township of	9	$1,576,460,100	$767,800	0.00%
Ocean, Township of	0	$2,612,650,600	$0	0.00%
Oceanport, Borough of	0	$322,084,700	$0	0.00%
Red Bank, Borough of	0	$1,219,372,800	$0	0.00%
Roosevelt, Borough of	0	$23,470,660	$0	0.00%
Rumson, Borough of	1,037	$507,589,781	$5,983,500	1.18%
Sea Bright, Borough of	1,392	$98,620,100	$10,121,500	10.26%
Sea Girt, Borough of	18	$235,924,250	$14,198,700	6.02%
Shrewsbury, Borough of	0	$451,418,300	$0	0.00%
Shrewsbury, Township of	0	$3,900,100	$0	0.00%
Spring Lake, Borough of	0	$489,616,500	$775,000	0.16%
Spring Lake Heights, Borough of	0	$276,945,800	$0	0.00%
Tinton Falls, Borough of	0	$920,707,700	$0	0.00%
Union Beach, Borough of	657	$236,450,400	$2,901,900	1.23%
Upper Freehold, Township of	0	$143,501,070	$0	0.00%
Wall, Township of	0	$2,039,081,200	$0	0.00%
West Long Branch, Borough of	0	$495,025,500	$0	0.00%
Total	**13,597**	**$36,741,303,693**	**$157,404,500**	**0.43%**

**Exposure calculated by GIS Analysis using local assessed values of buildings located in VE zones*
***Due to apparent discrepancies between County DFIRM data and the currently effective individual FIRM panel, the population and assets at risk from wave action may be significantly underestimated by current analyses. This aspect of the vulnerability analysis will need to be revisited in detail for the first formal update of this plan.*

Given the lack of readily available historical loss data on significant wave action occurrences in Monmouth County, it is assumed that while one major event (e.g., hurricane or norôeaster) may result in significant losses due to wave action, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate in each jurisdiction exposed to this hazard. However, it should also be noted that over the long term, anticipated sea level rise will increase the risk of damages/losses to future wave action events.

Earthquake

Because earthquakes often impact large areas and cross jurisdictional boundaries, all existing and future buildings, facilities and populations are considered to be exposed to this hazard and could potentially be impacted.

To assess the vulnerability of Monmouth County to earthquakes, probabilistic scenarios of various potential events were created using HAZUS-MH. HAZUS-MH default ground shaking data, inventory and damage functions, and methodology was used to determine the potential estimated losses for 100-, 500-, 1000-, and 2500-year frequency events and annual expected loss at the census tract level, as well as exceeding probability curves. **Table 3c.18** lists the expected peak ground acceleration (PGA) for 100- and 500-year earthquake events by jurisdiction.

Table 3c.18
Peak Ground Acceleration (Ground Motion) for 100- and 500-Year Earthquake Events

Jurisdiction	100-year PGA	500-year PGA
Aberdeen, Township of	0.015	0.079
Allenhurst, Borough of	0.013	0.067
Allentown, Borough of	0.014	0.073
Asbury Park, City of	0.013	0.067
Atlantic Highlands, Borough of	0.014	0.077
Avon-By-The-Sea, Borough of	0.013	0.067
Belmar, Borough of	0.013	0.067
Bradley Beach, Borough of	0.013	0.067
Brielle, Borough of	0.013	0.069
Colts Neck, Township of	0.014	0.075
Deal, Borough of	0.014	0.072
Eatontown, Borough of	0.014	0.074
Englishtown, Borough of	0.014	0.076
Fair Haven, Borough of	0.014	0.077
Farmingdale, Borough of	0.014	0.071
Freehold, Borough of	0.014	0.076
Freehold, Township of	0.014	0.072
Hazlet, Township of	0.015	0.079
Highlands, Borough of	0.014	0.077
Holmdel, Township of	0.015	0.079
Howell, Township of	0.014	0.071
Interlaken, Borough of	0.013	0.067
Keansburg, Borough of	0.014	0.078
Keyport, Borough of	0.015	0.079
Lake Como, Borough of	0.013	0.067
Little Silver, Borough of	0.014	0.072
Loch Arbour, Village of	0.013	0.067
Long Branch, City of	0.014	0.072
Manalapan, Township of	0.014	0.076

Table 3c.18
Peak Ground Acceleration (Ground Motion) for 100- and 500-Year Earthquake Events

Jurisdiction	100-year PGA	500-year PGA
Manasquan, Borough of	0.013	0.067
Marlboro, Township of	0.014	0.076
Matawan, Borough of	0.015	0.079
Middletown, Township of	0.014	0.078
Millstone, Township of	0.014	0.072
Monmouth Beach, Borough of	0.014	0.072
Neptune City, Borough of	0.013	0.067
Neptune, Township of	0.013	0.067
Ocean, Township of	0.014	0.072
Oceanport, Borough of	0.014	0.072
Red Bank, Borough of	0.014	0.074
Roosevelt, Borough of	0.014	0.073
Rumson, Borough of	0.014	0.077
Sea Bright, Borough of	0.014	0.077
Sea Girt, Borough of	0.013	0.067
Shrewsbury, Borough of	0.014	0.074
Shrewsbury, Township of	0.014	0.074
Spring Lake, Borough of	0.013	0.067
Spring Lake Heights, Borough of	0.013	0.067
Tinton Falls, Borough of	0.014	0.074
Union Beach, Borough of	0.015	0.079
Upper Freehold, Township of	0.014	0.073
Wall, Township of	0.013	0.069
West Long Branch, Borough of	0.014	0.072

Source: HAZUS-MH

Earthquakes with higher levels of PGA cause more damage, but have a low probability of occurrence. Conversely, earthquakes with low PGA levels such as those which could potentially impact Monmouth County, have a higher probability of occurrence but would only cause negligible to minor damage due to light shaking. In comparison to PGA levels above 0.25g which can cause strong to violent shaking and major damage, expected PGA levels for Monmouth County will likely only cause negligible to light shaking and negligible to minor damage.

Estimated losses for a 100-year earthquake event in Monmouth County are considered to be negligible. **Table 3c.19** shows estimated potential losses for 500-, 1000-, and 2500-year events as estimated using HAZUS-MH.

Table 3c.19
Estimated Potential Losses From 500-, 1000- and 2500-year Earthquake Events

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Potential Total Building Losses		
		500-Year Event	1000-Year Event	2500-Year Event
Aberdeen, Township of	$515,957,370	$350,327	$1,051,842	$3,663,617
Allenhurst, Borough of	$100,652,200	$52,513	$171,279	$555,980
Allentown, Borough of	$77,448,700	$29,558	$127,600	$386,138

Table 3c.19
Estimated Potential Losses From 500-, 1000- and 2500-year Earthquake Events

Jurisdiction	Total Assessed Value of Improvements (Buildings)	Potential Total Building Losses		
		500-Year Event	1000-Year Event	2500-Year Event
Asbury Park, City of	$320,791,800	$171,740	$554,585	$1,886,408
Atlantic Highlands, Borough of	$445,377,200	$296,756	$910,523	$3,045,969
Avon-By-The-Sea, Borough of	$127,812,100	$61,531	$199,175	$641,095
Belmar, Borough of	$432,498,600	$208,288	$672,633	$2,198,068
Bradley Beach, Borough of	$198,617,900	$90,229	$290,172	$939,382
Brielle, Borough of	$270,948,535	$137,125	$447,251	$1,406,229
Colts Neck, Township of	$620,440,600	$402,669	$1,270,482	$4,424,521
Deal, Borough of	$402,837,700	$218,929	$681,628	$2,086,062
Eatontown, Borough of	$1,176,943,200	$804,950	$2,741,832	$9,199,224
Englishtown, Borough of	$50,184,400	$36,567	$114,578	$399,409
Fair Haven, Borough of	$516,903,700	$322,596	$983,371	$3,254,690
Farmingdale, Borough of	$47,555,700	$33,857	$111,975	$369,294
Freehold, Borough of	$438,446,925	$330,400	$1,032,476	$3,576,766
Freehold, Township of	$2,033,417,200	$1,263,864	$4,010,057	$13,211,502
Hazlet, Township of	$693,335,000	$506,317	$1,534,599	$5,268,497
Highlands, Borough of	$318,826,200	$207,332	$628,998	$2,101,960
Holmdel, Township of	$1,995,955,600	$1,475,664	$4,482,321	$15,626,093
Howell, Township of	$1,914,832,390	$1,095,310	$3,548,903	$11,088,051
Interlaken, Borough of	$88,855,300	$38,633	$124,167	$381,206
Keansburg, Borough of	$199,892,700	$132,133	$400,269	$1,381,040
Keyport, Borough of	$219,673,450	$174,628	$531,215	$1,859,040
Lake Como, Borough of	$65,026,800	$29,622	$95,328	$301,571
Little Silver, Borough of	$622,615,400	$382,275	$1,214,714	$3,806,875
Loch Arbour, Village of	$28,719,700	$14,984	$48,872	$158,641
Long Branch, City of	$1,085,212,300	$636,321	$2,009,024	$6,424,480
Manalapan, Township of	$3,229,721,500	$2,071,137	$6,375,677	$22,312,658
Manasquan, Borough of	$394,840,400	$196,495	$639,910	$2,063,298
Marlboro, Township of	$2,270,927,800	$1,414,761	$4,350,816	$15,225,132
Matawan, Borough of	$280,292,084	$203,897	$617,139	$2,158,919
Middletown, Township of	$3,327,619,578	$2,135,891	$6,554,611	$22,272,100
Millstone, Township of	$263,436,400	$158,524	$500,300	$1,546,948
Monmouth Beach, Borough of	$169,824,000	$93,817	$295,136	$917,737
Neptune City, Borough of	$142,043,700	$75,656	$248,785	$821,533
Neptune, Township of	$1,576,460,100	$839,620	$2,742,415	$8,953,646
Ocean, Township of	$2,612,650,600	$1,461,639	$4,747,789	$15,450,194
Oceanport, Borough of	$322,084,700	$185,137	$588,469	$1,851,409
Red Bank, Borough of	$1,219,372,800	$944,672	$3,076,851	$10,546,135
Roosevelt, Borough of	$23,470,660	$8,870	$38,963	$119,143
Rumson, Borough of	$507,589,781	$318,822	$978,258	$3,236,284
Sea Bright, Borough of	$98,620,100	$62,959	$194,159	$657,818
Sea Girt, Borough of	$235,924,250	$109,072	$352,646	$1,104,743
Shrewsbury, Borough of	$451,418,300	$317,816	$1,137,337	$3,841,862
Shrewsbury, Township of	$3,900,100	*Negligible*	$6,631	$22,431
Spring Lake, Borough of	$489,616,500	$232,149	$747,667	$2,378,178
Spring Lake Heights, Borough of	$276,945,800	$128,406	$416,480	$1,324,624
Tinton Falls, Borough of	$920,707,700	$533,981	$1,771,773	$5,918,106
Union Beach, Borough of	$236,450,400	$158,846	$479,488	$1,668,139
Upper Freehold, Township of	$143,501,070	$100,491	$392,030	$1,232,824

Table 3c.19 Estimated Potential Losses From 500-, 1000- and 2500-year Earthquake Events				
Jurisdiction	Total Assessed Value of Improvements (Buildings)	Potential Total Building Losses		
		500-Year Event	1000-Year Event	2500-Year Event
Wall, Township of	$2,039,081,200	$1,214,311	$4,019,333	$13,127,514
West Long Branch, Borough of	$495,025,500	$329,256	$1,044,223	$3,326,204
Total	**$36,741,303,693**	**$22,744,213**	**$72,173,430**	**$240,847,632**

Source: HAZUS-MH
NOTE: Negligible means less than $5,000 damage per event

Table 3c.20 shows potential annualized property losses and percent loss ratios resulting from earthquake for each jurisdiction in Monmouth County.

Table 3c.20 Potential Annualized Losses from Earthquake by Jurisdiction				
Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)*	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Aberdeen, Township of	17,454	$515,957,370	*Negligible*	0.00%
Allenhurst, Borough of	599	$100,652,200	*Negligible*	0.00%
Allentown, Borough of	1,882	$77,448,700	*Negligible*	0.00%
Asbury Park, City of	16,930	$320,791,800	*Negligible*	0.00%
Atlantic Highlands, Borough of	4,705	$445,377,200	*Negligible*	0.00%
Avon-By-The-Sea, Borough of	2,244	$127,812,100	*Negligible*	0.00%
Belmar, Borough of	6,045	$432,498,600	*Negligible*	0.00%
Bradley Beach, Borough of	4,793	$198,617,900	*Negligible*	0.00%
Brielle, Borough of	4,893	$270,948,535	*Negligible*	0.00%
Colts Neck, Township of	12,331	$620,440,600	$5,477	0.00%
Deal, Borough of	1,070	$402,837,700	*Negligible*	0.00%
Eatontown, Borough of	13,964	$1,176,943,200	$12,440	0.00%
Englishtown, Borough of	1,764	$50,184,400	*Negligible*	0.00%
Fair Haven, Borough of	5,937	$516,903,700	*Negligible*	0.00%
Farmingdale, Borough of	1,587	$47,555,700	*Negligible*	0.00%
Freehold, Borough of	10,976	$438,446,925	*Negligible*	0.00%
Freehold, Township of	31,537	$2,033,417,200	$17,259	0.00%
Hazlet, Township of	21,378	$693,335,000	$6,880	0.00%
Highlands, Borough of	5,097	$318,826,200	*Negligible*	0.00%
Holmdel, Township of	15,781	$1,995,955,600	$20,367	0.00%
Howell, Township of	48,903	$1,914,832,390	$14,794	0.00%
Interlaken, Borough of	900	$88,855,300	*Negligible*	0.00%
Keansburg, Borough of	10,426	$199,892,700	*Negligible*	0.00%
Keyport, Borough of	7,568	$219,673,450	*Negligible*	0.00%
Lake Como, Borough of	1,806	$65,026,800	*Negligible*	0.00%
Little Silver, Borough of	6,170	$622,615,400	$5,101	0.00%
Loch Arbour, Village of	399	$28,719,700	*Negligible*	0.00%
Long Branch, City of	31,340	$1,085,212,300	$8,658	0.00%
Manalapan, Township of	33,423	$3,229,721,500	$27,839	0.00%
Manasquan, Borough of	6,310	$394,840,400	*Negligible*	0.00%
Marlboro, Township of	36,398	$2,270,927,800	$18,771	0.00%
Matawan, Borough of	8,910	$280,292,084	*Negligible*	0.00%
Middletown, Township of	66,633	$3,327,619,578	$28,601	0.00%
Millstone, Township of	8,970	$263,436,400	*Negligible*	0.00%

Table 3c.20
Potential Annualized Losses from Earthquake by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)*	Total Annualized Expected Property Losses	Annualized Percent Loss Ratio
Monmouth Beach, Borough of	3,595	$169,824,000	*Negligible*	0.00%
Neptune City, Borough of	5,218	$142,043,700	*Negligible*	0.00%
Neptune, Township of	27,690	$1,576,460,100	$11,772	0.00%
Ocean, Township of	26,959	$2,612,650,600	$20,312	0.00%
Oceanport, Borough of	5,834	$322,084,700	*Negligible*	0.00%
Red Bank, Borough of	11,844	$1,219,372,800	$14,275	0.00%
Roosevelt, Borough of	933	$23,470,660	*Negligible*	0.00%
Rumson, Borough of	7,137	$507,589,781	*Negligible*	0.00%
Sea Bright, Borough of	1,818	$98,620,100	*Negligible*	0.00%
Sea Girt, Borough of	2,148	$235,924,250	*Negligible*	0.00%
Shrewsbury, Borough of	3,590	$451,418,300	$5,124	0.00%
Shrewsbury, Township of	1,098	$3,900,100	*Negligible*	0.00%
Spring Lake, Borough of	3,567	$489,616,500	*Negligible*	0.00%
Spring Lake Heights, Borough of	5,227	$276,945,800	*Negligible*	0.00%
Tinton Falls, Borough of	15,070	$920,707,700	$7,642	0.00%
Union Beach, Borough of	6,649	$236,450,400	*Negligible*	0.00%
Upper Freehold, Township of	4,282	$143,501,070	*Negligible*	0.00%
Wall, Township of	25,261	$2,039,081,200	$17,513	0.00%
West Long Branch, Borough of	8,258	$495,025,500	*Negligible*	0.00%
Total	**615,301**	**$36,741,303,693**	**$312,837**	**0.00%**

Source: HAZUS-MH
NOTE: Negligible means less than $5,000 annual average damage

Landslide

To estimate exposure to landslide, the determination of value at-risk was calculated through GIS analysis by summing the total improved values for only those parcels that were confirmed to have at least one building located within a high landslide susceptibility area. Only eight jurisdictions in Monmouth County include areas of high landslide susceptibility, with less than 3 percent of total assessed improvements in the county located in these hazard areas. **Table 3c.21** shows exposure to landslide by jurisdiction.

Table 3c.21
Exposure to Landslide by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in High Susceptibility Areas*	Percent of Total Building Value Exposed to Landslide
Aberdeen, Township of	0	$515,957,370	$0	0.00%
Allenhurst, Borough of	0	$100,652,200	$0	0.00%
Allentown, Borough of	0	$77,448,700	$0	0.00%
Asbury Park, City of	0	$320,791,800	$0	0.00%
Atlantic Highlands, Borough of	1,924	$445,377,200	$143,022,400	32.11%
Avon-By-The-Sea, Borough of	0	$127,812,100	$0	0.00%
Belmar, Borough of	0	$432,498,600	$0	0.00%
Bradley Beach, Borough of	0	$198,617,900	$0	0.00%
Brielle, Borough of	0	$270,948,535	$0	0.00%
Colts Neck, Township of	0	$620,440,600	$0	0.00%
Deal, Borough of	0	$402,837,700	$0	0.00%
Eatontown, Borough of	0	$1,176,943,200	$0	0.00%
Englishtown, Borough of	0	$50,184,400	$0	0.00%
Fair Haven, Borough of	1,764	$516,903,700	$101,547,400	19.65%
Farmingdale, Borough of	0	$47,555,700	$0	0.00%
Freehold, Borough of	0	$438,446,925	$0	0.00%
Freehold, Township of	0	$2,033,417,200	$0	0.00%
Hazlet, Township of	0	$693,335,000	$0	0.00%
Highlands, Borough of	2,649	$318,826,200	$131,722,900	41.31%
Holmdel, Township of	0	$1,995,955,600	$0	0.00%
Howell, Township of	0	$1,914,832,390	$0	0.00%
Interlaken, Borough of	0	$88,855,300	$0	0.00%
Keansburg, Borough of	0	$199,892,700	$0	0.00%
Keyport, Borough of	0	$219,673,450	$0	0.00%
Lake Como, Borough of	0	$65,026,800	$0	0.00%
Little Silver, Borough of	206	$622,615,400	$27,410,000	4.40%
Loch Arbour, Village of	0	$28,719,700	$0	0.00%
Long Branch, City of	753	$1,085,212,300	$8,079,000	0.74%
Manalapan, Township of	0	$3,229,721,500	$0	0.00%
Manasquan, Borough of	0	$394,840,400	$0	0.00%
Marlboro, Township of	0	$2,270,927,800	$0	0.00%
Matawan, Borough of	0	$280,292,084	$0	0.00%
Middletown, Township of	2,761	$3,327,619,578	$152,132,800	4.57%
Millstone, Township of	0	$263,436,400	$0	0.00%
Monmouth Beach, Borough of	2,362	$169,824,000	$83,999,700	49.46%
Neptune City, Borough of	0	$142,043,700	$0	0.00%

Table 3c.21
Exposure to Landslide by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in High Susceptibility Areas*	Percent of Total Building Value Exposed to Landslide
Neptune, Township of	0	$1,576,460,100	$0	0.00%
Ocean, Township of	0	$2,612,650,600	$0	0.00%
Oceanport, Borough of	0	$322,084,700	$0	0.00%
Red Bank, Borough of	0	$1,219,372,800	$0	0.00%
Roosevelt, Borough of	0	$23,470,660	$0	0.00%
Rumson, Borough of	4,326	$507,589,781	$317,087,800	62.47%
Sea Bright, Borough of	0	$98,620,100	$0	0.00%
Sea Girt, Borough of	0	$235,924,250	$0	0.00%
Shrewsbury, Borough of	0	$451,418,300	$0	0.00%
Shrewsbury, Township of	0	$3,900,100	$0	0.00%
Spring Lake, Borough of	0	$489,616,500	$0	0.00%
Spring Lake Heights, Borough of	0	$276,945,800	$0	0.00%
Tinton Falls, Borough of	0	$920,707,700	$0	0.00%
Union Beach, Borough of	0	$236,450,400	$0	0.00%
Upper Freehold, Township of	0	$143,501,070	$0	0.00%
Wall, Township of	0	$2,039,081,200	$0	0.00%
West Long Branch, Borough of	0	$495,025,500	$0	0.00%
Total	**16,745**	**$36,741,303,693**	**$965,002,000**	**2.63%**

**Exposure calculated by GIS Analysis using local assessed values in High Landslide Susceptibility Areas*

Any damage resulting from a landslide would most likely be localized, and it is unlikely that all areas of high landslide susceptibility in the county would experience landslide impacts at the same time. Therefore, it is difficult to estimate potential losses in a landslide event. Given the lack of historical loss data on significant landslide occurrences in Monmouth County, it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate for all jurisdictions exposed to this hazard.

Wildfire

To estimate exposure to wildfire, the determination of value at-risk was calculated through GIS analysis by summing the total improved values for only those parcels that were confirmed to have at least one building located within areas of wildfire susceptibility (low/moderate and high/extreme). Only two jurisdictions in Monmouth County do not include areas of wildfire susceptibility (Village of Loch Arbour and the Township of Shrewsbury). Over 28 percent of total assessed improvements in the county are located in wildfire hazard areas, and over 2 percent are located in high or extreme susceptibility areas. **Table 3c.22** shows exposure to wildfire by jurisdiction.

Table 3c.22
Exposure to Wildfire by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in Low/Moderate Susceptibility Areas	Total Assessed Value of Buildings Located in High/Extreme Susceptibility Areas	Total Assessed Value of Buildings Located in All Wildfire Susceptibility Areas	Percent of Total Building Value Exposed to Wildfire
Aberdeen, Township of	12,612	$515,957,370	$46,531,220	$46,531,220	$48,650,020	9.43%
Allenhurst, Borough of	86	$100,652,200	$3,400,900	$3,400,900	$3,400,900	3.38%
Allentown, Borough of	1,424	$77,448,700	$12,183,900	$12,183,900	$12,517,900	16.16%
Asbury Park, City of	5,414	$320,791,800	$34,909,300	$34,909,300	$34,909,300	10.88%
Atlantic Highlands, Borough of	2,028	$445,377,200	$37,639,500	$37,639,500	$37,639,500	8.45%
Avon-By-The-Sea, Borough of	369	$127,812,100	$2,028,700	$2,028,700	$2,028,700	1.59%
Belmar, Borough of	2,159	$432,498,600	$9,506,100	$9,506,100	$9,506,100	2.20%
Bradley Beach, Borough of	1,042	$198,617,900	$3,109,200	$3,109,200	$3,109,200	1.57%
Brielle, Borough of	3,147	$270,948,535	$7,065,800	$7,065,800	$8,930,700	3.30%
Colts Neck, Township of	12,275	$620,440,600	$507,382,200	$507,382,200	$524,233,700	84.49%
Deal, Borough of	736	$402,837,700	$126,400,100	$126,400,100	$126,400,100	31.38%
Eatontown, Borough of	12,602	$1,176,943,200	$406,431,200	$406,431,200	$438,121,400	37.23%
Englishtown, Borough of	1,518	$50,184,400	$8,275,900	$8,275,900	$10,152,700	20.23%
Fair Haven, Borough of	3,540	$516,903,700	$66,651,700	$66,651,700	$66,651,700	12.89%
Farmingdale, Borough of	1,309	$47,555,700	$4,039,300	$4,039,300	$4,039,300	8.49%
Freehold, Borough of	5,092	$438,446,925	$32,903,825	$32,903,825	$33,020,025	7.53%
Freehold, Township of	25,067	$2,033,417,200	$871,456,800	$871,456,800	$999,298,700	49.14%
Hazlet, Township of	12,326	$693,335,000	$70,823,000	$70,823,000	$71,543,200	10.32%
Highlands, Borough of	3,408	$318,826,200	$39,069,800	$39,069,800	$40,069,800	12.57%
Holmdel, Township of	14,947	$1,995,955,600	$999,908,200	$999,908,200	$1,088,434,900	54.53%
Howell, Township of	42,035	$1,914,832,390	$603,096,750	$603,096,750	$687,612,050	35.91%
Interlaken, Borough of	249	$88,855,300	$5,456,600	$5,456,600	$5,639,400	6.35%
Keansburg, Borough of	2,337	$199,892,700	$7,628,600	$7,628,600	$7,628,600	3.82%
Keyport, Borough of	3,657	$219,673,450	$3,428,200	$3,428,200	$3,428,200	1.56%
Lake Como, Borough of	569	$65,026,800	$761,400	$761,400	$761,400	1.17%
Little Silver, Borough of	4,368	$622,615,400	$167,683,800	$167,683,800	$169,669,800	27.25%
Loch Arbour, Village of	0	$28,719,700	$0	$0	$0	0.00%
Long Branch, City of	16,897	$1,085,212,300	$117,806,200	$117,806,200	$119,202,400	10.98%
Manalapan, Township of	27,064	$3,229,721,500	$844,099,400	$844,099,400	$929,728,600	28.79%
Manasquan, Borough of	1,860	$394,840,400	$22,772,300	$22,772,300	$22,772,300	5.77%
Marlboro, Township of	31,757	$2,270,927,800	$872,246,800	$872,246,800	$913,104,100	40.21%

Table 3c.22
Exposure to Wildfire by Jurisdiction

Jurisdiction	Estimated Population At Risk	Total Assessed Value of Improvements (Buildings)	Total Assessed Value of Buildings Located in Low/Moderate Susceptibility Areas	Total Assessed Value of Buildings Located in High/Extreme Susceptibility Areas	Total Assessed Value of Buildings Located in All Wildfire Susceptibility Areas	Percent of Total Building Value Exposed to Wildfire
Matawan, Borough of	5,878	$280,292,084	$21,769,750	$21,769,750	$23,118,250	8.25%
Middletown, Township of	47,314	$3,327,619,578	$767,066,800	$767,066,800	$895,915,700	26.92%
Millstone, Township of	8,927	$263,436,400	$225,080,600	$225,080,600	$239,569,000	90.94%
Monmouth Beach, Borough of	2,886	$169,824,000	$12,107,100	$12,107,100	$12,107,100	7.13%
Neptune City, Borough of	1,996	$142,043,700	$11,940,400	$11,940,400	$13,181,100	9.28%
Neptune, Township of	11,980	$1,576,460,100	$190,473,500	$190,473,500	$215,012,500	13.64%
Ocean, Township of	19,929	$2,612,650,600	$628,832,300	$628,832,300	$710,374,800	27.19%
Oceanport, Borough of	4,019	$322,084,700	$74,334,700	$74,334,700	$79,013,000	24.53%
Red Bank, Borough of	4,877	$1,219,372,800	$56,122,971	$56,122,971	$57,569,439	4.72%
Roosevelt, Borough of	868	$23,470,660	$4,064,800	$4,064,800	$4,064,800	17.32%
Rumson, Borough of	4,691	$507,589,781	$334,429,900	$334,429,900	$340,533,500	67.09%
Sea Bright, Borough of	1,111	$98,620,100	$13,388,800	$13,388,800	$13,388,800	13.58%
Sea Girt, Borough of	856	$235,924,250	$15,375,900	$15,375,900	$15,375,900	6.52%
Shrewsbury, Borough of	2,842	$451,418,300	$69,480,000	$69,480,000	$69,480,000	15.39%
Shrewsbury, Township of	0	$3,900,100	$0	$0	$0	0.00%
Spring Lake, Borough of	1,038	$489,616,500	$8,785,400	$8,785,400	$8,785,400	1.79%
Spring Lake Heights, Borough of	3,098	$276,945,800	$11,004,200	$11,004,200	$11,114,600	4.01%
Tinton Falls, Borough of	13,609	$920,707,700	$307,944,900	$307,944,900	$332,477,700	36.11%
Union Beach, Borough of	3,259	$236,450,400	$35,492,100	$35,492,100	$35,701,700	15.10%
Upper Freehold, Township of	4,322	$143,501,070	$110,218,000	$110,218,000	$112,911,900	78.68%
Wall, Township of	18,637	$2,039,081,200	$684,236,400	$684,236,400	$811,160,400	39.78%
West Long Branch, Borough of	5,802	$495,025,500	$91,697,200	$91,697,200	$98,320,200	19.86%
Total	**419,833**	**$36,741,303,693**	**$9,608,542,416**	**$9,608,542,416**	**$10,521,380,484**	**28.64%**

NOTE: Exposure calculated by GIS Analysis using local assessed values

Given the lack of historical loss data on significant wildfire occurrences resulting in large-scale structural losses in Monmouth County, it is assumed that while one major event may result in significant losses, annualizing structural losses over a long period of time would most likely yield a negligible annualized loss estimate in each jurisdiction exposed to this hazard.

Vulnerability of Assets

The Asset Inventory presented earlier in this document presented six categories of assets, including improved property, emergency facilities, critical infrastructure and utilities, other critical facilities, historic and cultural resources, and population. The preceding sections of this vulnerability assessment have addressed improved property and population for each hazard. This section will specifically address the vulnerability of the other asset categories.

To analyze vulnerability of specific assets located in Monmouth County, facilities were grouped as follows:

- Critical Facilities:
  - Airports/Ferry Ports
  - Emergency Operations Centers/Fire Stations/Police Stations
  - Hospitals
  - Public Works Buildings/Wastewater Treatment Facilities
  - Schools/Child Care Facilities (including camps)
  - Senior Care Facilities
- Historical and Cultural Resources

All assets throughout Monmouth County are exposed to extreme temperatures, extreme winds, hurricanes and tropical storms, lightning, norôeasters, tornadoes, winter storms, drought and earthquakes.

Table 3c.23 shows exposure of Monmouth Countyôs critical facilities by jurisdiction for seven hazards (i.e., flood, wave action, storm surge, coastal erosion, dam failure, landslide and wildfire). Only those jurisdictions which have at least one facility exposed to at least one of the seven hazards are included in the table. Also, only those facility types which have at least one facility exposed to at least one of the seven hazards are included in the table. Exposure of these assets was determined through GIS analysis of hazard areas using georeferenced point locations for critical facilities provided by Monmouth County, which were aggregated by facility type. A full list of exposed critical facilities by hazard is provided in **Appendix C**.

Approximately 270 critical facilities are exposed to storm surgeð 110 are located in low to moderate wildfire susceptibility areas, 71 are exposed to flood, 19 are located in high landslide susceptibility areas, seven are located within a one-mile radius downstream of major dams, four are located in high to extreme wildfire susceptibility areas, two are exposed to wave action and two are exposed to coastal erosion. Eight jurisdictions do not have any critical facilities exposed to these hazards, including Borough of Deal, Borough of Farmingdale, Borough of Freehold, Village of Loch Arbour, Borough of Matawan, Borough of Roosevelt, Township of Shrewsbury and Township of Upper Freehold. The jurisdictions with the highest number of critical facilities determined to be exposed to these hazards include the City of Long Branch (32), City of Asbury Park (30), Township of Middletown (28), Township of Howell (21), Borough of Keansburg (19), and the Township of Neptune (18).

Table 3c.24 shows exposure of historic and cultural resources for seven hazards (i.e., flood, wave action, storm surge, coastal erosion, dam failure, landslide and wildfire). Only those historic property locations which intersect with at least one of the seven hazards are included in the table. Exposure of historic properties was determined through GIS analysis of hazard areas using georeferenced locations for historic properties provided by the New Jersey Historic Preservation Office.

Table 3c.23
Exposure of Georeferenced Critical Facility Types by Jurisdiction

Facility Type by Jurisdiction	Number of Exposed Critical Facilities by Hazard Area							
	Flood (A/AE/V)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Aberdeen, Township of								
Public Works Buildings/Wastewater Treatment Facilities	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	1	0	0	0	3	0
Senior Care Facilities	1	0	0	0	0	0	0	0
Total	**1**	**0**	**2**	**0**	**0**	**0**	**3**	**0**
Allenhurst, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	0	0
Total	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
Allentown, Borough of								
Public Works Buildings/Wastewater Treatment Facilities	1	0	0	0	0	0	1	0
Total	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Asbury Park, City of								
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	2	0	0	0	0	0
Schools/Child Care Facilities	0	0	18	0	0	0	1	0
Senior Care Facilities	1	0	8	0	0	0	0	0
Total	**2**	**0**	**30**	**0**	**0**	**0**	**1**	**0**
Atlantic Highlands, Borough of								
Airports/Ferry Ports	1	1	1	0	0	0	0	0
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	2	0	0	0	0	0
Schools/Child Care Facilities	0	0	5	0	0	0	0	0
Senior Care Facilities	0	0	1	0	0	0	1	0
Total	**1**	**1**	**11**	**0**	**0**	**0**	**1**	**0**
Avon-By-The-Sea, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	2	0	0	0	0	0
Total	**1**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
Belmar, Borough of								
Emergency Centers/Fire Stations/Police Stations	1	0	4	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	2	0	0	0	0	0
Schools/Child Care Facilities	0	0	6	0	0	0	0	0
Senior Care Facilities	0	0	1	0	0	0	0	0
Total	**1**	**0**	**13**	**0**	**0**	**0**	**0**	**0**

Table 3c.23
Exposure of Georeferenced Critical Facility Types by Jurisdiction

Facility Type by Jurisdiction	Number of Exposed Critical Facilities by Hazard Area							
	Flood (A/AE/V)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Bradley Beach, Borough of								
Public Works Buildings/Wastewater Treatment Facilities	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	6	0	0	0	0	0
Total	**0**	**0**	**7**	**0**	**0**	**0**	**0**	**0**
Brielle, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	0	0
Schools/Child Care Facilities	0	0	4	0	0	0	0	0
Total	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**0**
Colts Neck, Township of								
Public Works Buildings/Wastewater Treatment Facilities	1	0	0	0	0	0	0	0
Schools/Child Care Facilities	0	0	0	0	0	0	4	0
Senior Care Facilities	0	0	0	0	0	0	1	0
Total	**1**	**0**	**0**	**0**	**0**	**0**	**5**	**0**
Eatontown, Borough of								
Schools/Child Care Facilities	0	0	5	0	0	0	2	0
Senior Care Facilities	0	0	0	0	0	0	3	0
Total	**0**	**0**	**5**	**0**	**0**	**0**	**5**	**0**
Englishtown, Borough of								
Emergency Centers/Fire Stations/Police Stations	1	0	0	0	0	0	0	0
Total	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Fair Haven, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	1	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	0	0	0	1	0	0
Schools/Child Care Facilities	0	0	4	0	0	0	1	0
Total	**0**	**0**	**6**	**0**	**0**	**1**	**2**	**0**
Freehold, Township of								
Airports/Ferry Ports	0	0	0	0	0	0	1	0
Hospitals	0	0	0	0	0	0	1	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	0	0	0	0	1	0
Schools/Child Care Facilities	0	0	0	0	0	0	2	0
Senior Care Facilities	0	0	0	0	0	0	2	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**
Hazlet, Township of								
Emergency Centers/Fire Stations/Police Stations	1	0	1	0	0	0	1	0
Schools/Child Care Facilities	2	0	1	0	0	0	2	0
Total	**3**	**0**	**2**	**0**	**0**	**0**	**3**	**0**

Table 3c.23
Exposure of Georeferenced Critical Facility Types by Jurisdiction

Facility Type by Jurisdiction	Number of Exposed Critical Facilities by Hazard Area							
	Flood (A/AE/V)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Highlands, Borough of								
Airports/Ferry Ports	2	0	0	1	0	0	0	0
Emergency Centers/Fire Stations/Police Stations	1	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	1	0	0	0	0	0
Schools/Child Care Facilities	2	0	2	0	0	2	0	0
Senior Care Facilities	1	0	1	0	0	0	0	0
Total	**7**	**0**	**5**	**1**	**0**	**2**	**0**	**0**
Holmdel, Township of								
Airports/Ferry Ports	0	0	0	0	0	0	1	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	0	0	0	0	1	0
Schools/Child Care Facilities	0	0	0	0	0	0	2	0
Senior Care Facilities	0	0	0	0	0	0	2	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**
Howell, Township of								
Airports/Ferry Ports	0	0	0	0	0	0	1	0
Emergency Centers/Fire Stations/Police Stations	0	0	0	0	1	0	0	0
Schools/Child Care Facilities	0	0	0	0	3	0	13	0
Senior Care Facilities	1	0	0	0	0	0	2	1
Total	**1**	**0**	**0**	**0**	**4**	**0**	**16**	**1**
Interlaken, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	1	0	0	0	1	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	0	0	0	0	0	0
Total	**1**	**0**	**1**	**0**	**0**	**0**	**1**	**0**
Keansburg, Borough of								
Emergency Centers/Fire Stations/Police Stations	1	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	1	0	12	0	0	0	0	0
Senior Care Facilities	1	0	5	0	0	0	0	0
Total	**3**	**0**	**19**	**0**	**0**	**0**	**0**	**0**
Keyport, Borough of								
Emergency Centers/Fire Stations/Police Stations	1	0	2	0	0	0	0	0
Schools/Child Care Facilities	0	0	4	0	0	0	0	0
Senior Care Facilities	1	0	1	0	0	0	0	0
Total	**2**	**0**	**7**	**0**	**0**	**0**	**0**	**0**

Table 3c.23
Exposure of Georeferenced Critical Facility Types by Jurisdiction

Facility Type by Jurisdiction	Number of Exposed Critical Facilities by Hazard Area							
	Flood (A/AE/V)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Lake Como, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	2	0	0	0	0	0
Total	**0**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
Little Silver, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	2	0	5	0	0	0	0	0
Total	**2**	**0**	**7**	**0**	**0**	**0**	**0**	**0**
Long Branch, City of								
Emergency Centers/Fire Stations/Police Stations	0	0	4	0	0	0	0	0
Hospitals	0	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	1	0	0	0	0	0
Schools/Child Care Facilities	2	0	18	0	0	0	2	0
Senior Care Facilities	0	0	8	1	0	0	0	0
Total	**3**	**0**	**32**	**1**	**0**	**0**	**2**	**0**
Manalapan, Township of								
Airports/Ferry Ports	0	0	0	0	0	0	1	0
Schools/Child Care Facilities	0	0	0	0	0	0	10	0
Senior Care Facilities	1	0	0	0	0	0	1	0
Total	**1**	**0**	**0**	**0**	**0**	**0**	**12**	**0**
Manasquan, Borough of								
Emergency Centers/Fire Stations/Police Stations	1	0	4	0	0	0	1	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	1	0	0	0	0	0
Schools/Child Care Facilities	3	0	11	0	0	0	0	0
Total	**5**	**0**	**16**	**0**	**0**	**0**	**1**	**0**
Marlboro, Township of								
Schools/Child Care Facilities	0	0	0	0	0	0	4	0
Senior Care Facilities	0	0	0	0	0	0	2	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**
Matawan, Borough of								
Public Works Buildings/Wastewater Treatment Facilities	0	0	0	0	0	0	1	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Middletown, Township of								
Public Works Buildings/Wastewater Treatment Facilities	2	0	2	0	0	0	0	0
Schools/Child Care Facilities	1	0	14	0	0	2	5	0
Senior Care Facilities	1	0	1	0	0	2	3	0

Table 3c.23
Exposure of Georeferenced Critical Facility Types by Jurisdiction

Facility Type by Jurisdiction	Number of Exposed Critical Facilities by Hazard Area							
	Flood (A/AE/V)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Total	**4**	**0**	**17**	**0**	**0**	**4**	**8**	**0**
Millstone, Township of								
Airports/Ferry Ports	0	0	0	0	0	0	1	0
Schools/Child Care Facilities	0	0	0	0	0	0	1	0
Total	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**0**
Monmouth Beach, Borough of								
Emergency Centers/Fire Stations/Police Stations	2	0	2	0	0	2	0	0
Public Works Buildings/Wastewater Treatment Facilities	2	1	2	0	0	1	0	0
Schools/Child Care Facilities	2	0	3	0	0	2	0	0
Total	**6**	**1**	**7**	**0**	**0**	**5**	**0**	**0**
Neptune City, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	0	0	0	0	0	0
Schools/Child Care Facilities	0	0	2	0	0	0	0	0
Total	**1**	**0**	**4**	**0**	**0**	**0**	**0**	**0**
Neptune, Township of								
Emergency Centers/Fire Stations/Police Stations	0	0	3	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	0	0	1	0	0	0
Schools/Child Care Facilities	0	0	5	0	1	0	4	0
Senior Care Facilities	1	0	3	0	0	0	0	0
Total	**1**	**0**	**11**	**0**	**2**	**0**	**4**	**0**
Ocean, Township of								
Emergency Centers/Fire Stations/Police Stations	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	1	0	1	0	0	0	7	0
Senior Care Facilities	1	0	1	0	0	0	0	0
Total	**2**	**0**	**3**	**0**	**0**	**0**	**7**	**0**
Oceanport, Borough of								
Emergency Centers/Fire Stations/Police Stations	4	0	4	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	2	0	0	0	0	0
Senior Care Facilities	0	0	1	0	0	0	0	0
Total	**5**	**0**	**8**	**0**	**0**	**0**	**0**	**0**
Red Bank, Borough of								
Schools/Child Care Facilities	1	0	1	0	0	0	2	0
Senior Care Facilities	1	0	2	0	0	0	0	0
Total	**2**	**0**	**3**	**0**	**0**	**0**	**2**	**0**

Table 3c.23
Exposure of Georeferenced Critical Facility Types by Jurisdiction

Facility Type by Jurisdiction	Number of Exposed Critical Facilities by Hazard Area							
	Flood (A/AE/V)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Rumson, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	1	0	0	1	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	3	0	0	6	1	0
Total	**1**	**0**	**5**	**0**	**0**	**7**	**1**	**0**
Sea Bright, Borough of								
Emergency Centers/Fire Stations/Police Stations	1	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	1	0	1	0	0	0	0	0
Total	**2**	**0**	**2**	**0**	**0**	**0**	**0**	**0**
Sea Girt, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	0	0
Schools/Child Care Facilities	0	0	1	0	0	0	0	0
Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**0**
Shrewsbury, Borough of								
Schools/Child Care Facilities	0	0	1	0	0	0	0	0
Senior Care Facilities	0	0	0	0	0	0	1	0
Total	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**0**
Spring Lake, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	2	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	4	0	0	0	1	0
Total	**0**	**0**	**7**	**0**	**0**	**0**	**1**	**0**
Spring Lake Heights, Borough of								
Emergency Centers/Fire Stations/Police Stations	0	0	1	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	0	0	1	0	0	0	0	0
Schools/Child Care Facilities	0	0	1	0	0	0	0	1
Total	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**1**
Tinton Falls, Borough of								
Public Works Buildings/Wastewater Treatment Facilities	1	0	0	0	0	0	0	0
Schools/Child Care Facilities	0	0	0	0	0	0	4	0
Senior Care Facilities	0	0	0	0	0	0	3	1
Total	**1**	**0**	**0**	**0**	**0**	**0**	**7**	**1**
Union Beach, Borough of								
Emergency Centers/Fire Stations/Police Stations	2	0	5	0	0	0	0	0
Public Works Buildings/Wastewater Treatment Facilities	2	0	2	0	0	0	0	0

Table 3c.23
Exposure of Georeferenced Critical Facility Types by Jurisdiction

Facility Type by Jurisdiction	Number of Exposed Critical Facilities by Hazard Area							
	Flood (A/AE/V)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Schools/Child Care Facilities	3	0	4	0	0	0	0	0
Total	**7**	**0**	**11**	**0**	**0**	**0**	**0**	**0**
Wall, Township of								
Schools/Child Care Facilities	0	0	1	0	1	0	3	0
Senior Care Facilities	0	0	0	0	0	0	1	1
Total	**0**	**0**	**1**	**0**	**0**	**0**	**4**	**1**
West Long Branch, Borough of								
Schools/Child Care Facilities	0	0	4	0	0	0	1	0
Senior Care Facilities	0	0	1	0	0	0	0	0
Total	**0**	**0**	**5**	**0**	**0**	**0**	**1**	**0**
Monmouth County Total	**69**	**2**	**270**	**2**	**7**	**19**	**109**	**4**

NOTE: Exposure calculated by GIS Analysis using georeferenced locations

Table 3c.24
Exposure of Historic Properties by Hazard

Property Name	Location	Jurisdiction	Flood (A/AE/VE)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/Mod)	Wildfire (High/Ext)
Garden State Parkway Historic District	Not provided	Aberdeen, Township of; Hazlet, Township of; Holmdel, Township of; Keyport, Borough of; Matawan, Borough of; Middletown, Township of; Tinton Falls, Borough of; and Wall, Township of	•						•	•
Asbury Park Casino and Carousel	Lake & Atlantic Avenues	Asbury Park, City of	•		•					
Belmont Hotel	300 Asbury Ave	Asbury Park, City of			•					
Steinbach/Cookman Building	Cookman Ave	Asbury Park, City of			•					
Asbury Park Convention Hall	Ocean Ave	Asbury Park, City of	•	•						
George Wurt's Summer Home	306 Eighth Ave	Asbury Park, City of			•					
Palace Amusements Building	201-207 Lake Ave	Asbury Park, City of	•		•					
Berkeley-Carteret Hotel	1401 Ocean Ave	Asbury Park, City of			•					
Jersey Apartments	212 Second Ave	Asbury Park, City of			•					

Table 3c.24
Exposure of Historic Properties by Hazard

Property Name	Location	Jurisdiction	Flood (A/AE/ VE)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/ Mod)	Wildfire (High/ Ext)
Savoy Theater/Kinmoth Bldg.	710 Mattison Ave	Asbury Park, City of			●					
Britwoods Court	216-218 Second Ave	Asbury Park, City of			●					
Howard Johnson's Pavilion	Ocean Ave at Fifth Ave	Asbury Park, City of	●	●	●	●				
Turn of the Century Historic District	Not provided	Asbury Park, City of			●				●	●
Library Square Historic District	Not provided	Asbury Park, City of			●				●	
Sunset Lake Historic District	Not provided	Asbury Park, City of	●		●				●	
Williamson-Sickles Barn	21 Driftwood Ln	Colts Neck, Township of							●	
Naval Weapons Station Earle Historic District	Not provided	Colts Neck, Township of; Howell, Township of; Middletown, Township of; Tinton Falls, Borough of; and Wall, Township of	●	●	●	●			●	
Fort Monmouth Historic District (1)	Not provided	Eatontown, Borough of			●				●	
Fort Hancock U.S. Lifesaving Station	Not provided	Gateway National Recreation Area			●			●	●	
Fort Hancock and Sandy Hook Proving Ground Historic District	Not provided	Gateway National Recreation Area			●	●		●	●	●
Bahrs Landing Restaurant and Marina	2 Bay Ave	Highlands, Borough of	●		●					
Holmes-Hendrickson House	Longstreet Road	Holmdel, Township of							●	
Horn Antenna Bell Labs	Crawford Hill	Holmdel, Township of							●	
Longstreet Farm	Longstreet Road	Holmdel, Township of							●	
Patten Point Yacht Club	Patten Ave	Long Branch, City of	●		●				●	
Ocean Avenue Bridge	Ocean Ave over Lake Takanasee	Long Branch, City of	●		●				●	
Millhurst Mill / Black's Mills / Clifford Snyder Grist Mill Complex	County Route 527	Manalapan, Township of	●						●	
Brielle Road Bridge (S.I. & A. #13000W9)	Brielle Rd over Glimmer Glass	Manasquan, Borough of	●							
Van Kirk Farm	107 Vanderburg Rd	Marlboro, Township of							●	

Table 3c.24
Exposure of Historic Properties by Hazard

Property Name	Location	Jurisdiction	Flood (A/AE/ VE)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/ Mod)	Wildfire (High/ Ext)
Uriah Smock House	42 Vanderburg Rd	Marlboro, Township of							●	
Dorsett's Creek Bridge	NJ Transit North Jersey Coast Line, Milepost 11.3	Middletown, Township of	●							
Bowne House	Leonard Ave	Middletown, Township of			●				●	
Grover House	940 West Front St	Middletown, Township of							●	
Water Witch Historic District	Not provided	Middletown, Township of						●	●	
Navesink Historic District	Not provided	Middletown, Township of						●	●	
Eden Wooley House	715 Deal Rd	Ocean, Township of							●	
703 South Edgemere Avenue	703 South Edgemere Ave	Ocean, Township of			●					
Deal Test Site	Whalepond Road	Ocean Township	●							
Oceanport Creek Bridge	NJ Transit North Jersey Coast Line, Milepost 19.80 over Oceanport Creek	Oceanport, Borough of	●		●	●				
Fort Monmouth Historic District (2)	Not provided	Oceanport, Borough of	●		●	●			●	●
Lauriston	91 Rumson Rd.	Rumson, Borough of			●			●	●	
Saint George's-by-the River Episcopal Church	7 Lincoln Ave	Rumson, Borough of	●		●					
First Presbyterian Church of Rumson	East River Rd at Park Ave	Rumson, Borough of			●					
Tinton Falls Historic District	Not provided	Tinton Falls, Borough of	●		●				●	
Joshua Cox House	Clarksburg-Robbinsville Rd	Upper Freehold, Township of							●	
Waln's Mill Road Bridge over Crosswicks (SI&A #1300U47)	Waln's Mill Rd	Upper Freehold, Township of	●							●
Waln's Mill Road Bridge over Crosswicks Creek (SI & A #1300U48)	Waln's Mill Rd	Upper Freehold, Township of								●
Walnford Historic District	Not provided	Upper Freehold, Township of	●						●	●

Table 3c.24
Exposure of Historic Properties by Hazard

Property Name	Location	Jurisdiction	Flood (A/AE/ VE)	Wave Action (VE)	Storm Surge (Cat 1-4)	Coastal Erosion	Dam Failure	Landslide (High)	Wildfire (Low/ Mod)	Wildfire (High/ Ext)
Marconi Wireless Operations (Building 9004)	Not provided	Wall, Township of			•					
Wireless Support (Building 9005)	Not provided	Wall, Township of			•					
Project DIANA Site	Not provided	Wall, Township of								•
2751 18th Avenue	2751 18th Ave	Wall, Township of	•						•	•
Camp Evans Historic District (Marconi Belmar Station; U.S. Army Signal Corps Radar Laboratory)	Not provided	Wall, Township of			•	•			•	•

NOTE: Exposure calculated by GIS Analysis using georeferenced locations

Conclusions on Hazard Risk

The results of this vulnerability assessment are useful in at least three ways:

- Improving our understanding of the risk associated with the natural hazards in Monmouth County through better understanding of the complexities and dynamics of risk, how levels of risk can be measured and compared, and the myriad of factors that influence risk. An understanding of these relationships is critical in making balanced and informed decisions on managing the risk.
- Providing a baseline for policy development and comparison of mitigation alternatives. The data used for this analysis presents a current picture of risk in Monmouth County. Updating this risk ñsnapshotò with future data will enable comparison of the changes in risk with time. Baselines of this type can support the objective analysis of policy and program options for risk reduction in the region.
- Comparing the risk among the natural hazards addressed. The ability to quantify the risk to all these hazards relative to one another helps in a balanced, multi-hazard approach to risk management at each level of governing authority. This ranking provides a systematic framework to compare and prioritize the very disparate natural hazards that are present in Monmouth County. This final step in the risk assessment provides the necessary information for local officials to craft a mitigation strategy to focus resources on only those hazards that pose the most threat to the county.

Exposure to hazards can be an indicator of vulnerability. Economic exposure can be identified through locally assessed values for improvements (buildings), and social exposure can be identified by estimating the population exposed to each hazard. This information is especially important for decision-makers to use in planning for evacuation or other public safety related needs. A summary of the value of buildings at-risk (exposed) to each hazard is presented in **Table 3c.25,** and a summary of population exposure is presented in **Table 3c.26**.

Using the previously described methodology, economic results were estimated for the different hazards profiled earlier in this section. The economic loss results are summarized in **Table 3c.27** using Annualized Loss (AL), which is the estimated long-term value of losses to the general building stock in any single year in a specified geographic area (i.e., jurisdiction). The estimated AL addresses the two key components of risk: the probability of the hazard occurring in the jurisdiction and the consequences of the hazard, largely a function of building construction type and quality, and of the intensity of the hazard event. By annualizing estimated losses, the AL factors in historic patterns of frequent smaller events with infrequent but larger events to provide a balanced presentation of the risk.

A summary of the annualized loss ratio (ALR) results is presented in **Table 3c.28**. The ALR represents the AL as a fraction of the local assessed value of improvements (calculated as annualized losses divided by the total exposure at risk). The annualized loss ratio gauges the relationship between average annualized loss and assessed value. This ratio can be used as a measure of vulnerability in the areas and, since it is normalized by assessed value, it can be directly compared across different jurisdictions.

In order to illustrate composite vulnerability, four hazards (i.e., flood, storm surge, landslide and wildfire) were mapped for the county and each jurisdiction using overlays to show areas which are vulnerable (indicated by shading scaled so that darker tones indicate vulnerability to multiple hazards). It should be noted that some jurisdictions may not be exposed to all four hazards. **Figure 3c.4** shows Monmouth Countyôs composite vulnerability and **Figures 3c.5** ï **3c.57** show composite vulnerability by jurisdiction.

Table 3c.25
Assessed Building Value At-Risk by Hazard by Jurisdiction

Jurisdiction	Extreme Temps, Tornado, Hurricane, Extreme Wind, Lightning, Nor'easter, Earthquake, and Winter Storm*	Coastal Erosion	Dam Failure	Drought**	Flood	Storm Surge	Wave Action	Landslide	Wildfire
Aberdeen, Township of	$515,957,370	$628,000	$0	Not Available	$17,619,300	$17,203,250	$1,868,400	$0	$48,650,020
Allenhurst, Borough of	$100,652,200	$4,619,700	$0	Not Available	$15,701,800	$68,906,300	$4,079,600	$0	$3,400,900
Allentown, Borough of	$77,448,700	$0	$0	Not Available	$2,056,000	$0	$0	$0	$12,517,900
Asbury Park, City of	$320,791,800	$4,000,000	$0	Not Available	$47,575,400	$240,662,300	$14,568,700	$0	$34,909,300
Atlantic Highlands, Borough of	$445,377,200	$21,194,800	$0	Not Available	$32,379,300	$109,635,800	$11,609,200	$143,022,400	$37,639,500
Avon-By-The-Sea, Borough of	$127,812,100	$1,263,700	$0	Not Available	$30,977,100	$125,480,200	$0	$0	$2,028,700
Belmar, Borough of	$432,498,600	$6,769,900	$0	Not Available	$49,035,400	$431,351,100	$3,943,200	$0	$9,506,100
Bradley Beach, Borough of	$198,617,900	$265,400	$0	Not Available	$5,199,100	$178,237,700	$0	$0	$3,109,200
Brielle, Borough of	$270,948,535	$724,700	$0	Not Available	$17,392,900	$131,058,900	$0	$0	$8,930,700
Colts Neck, Township of	$620,440,600	$0	$0	Not Available	$18,245,800	$0	$0	$0	$524,233,700
Deal, Borough of	$402,837,700	$26,175,900	$0	Not Available	$32,456,500	$100,081,900	$13,492,400	$0	$126,400,100
Eatontown, Borough of	$1,176,943,200	$0	$0	Not Available	$28,126,300	$171,591,700	$0	$0	$438,121,400
Englishtown, Borough of	$50,184,400	$0	$0	Not Available	$5,045,600	$0	$0	$0	$10,152,700
Fair Haven, Borough of	$516,903,700	$2,160,500	$0	Not Available	$16,849,400	$109,633,100	$0	$101,547,400	$66,651,700
Farmingdale, Borough of	$47,555,700	$0	$0	Not Available	$4,761,700	$0	$0	$0	$4,039,300
Freehold, Borough of	$438,446,925	$0	$0	Not Available	$166,400	$0	$0	$0	$33,020,025
Freehold, Township of	$2,033,417,200	$0	$0	Not Available	$14,937,000	$0	$0	$0	$999,298,700
Hazlet, Township of	$693,335,000	$0	$0	Not Available	$58,536,000	$198,831,700	$0	$0	$71,543,200
Highlands, Borough of	$318,826,200	$28,506,900	$0	Not Available	$159,026,400	$158,587,900	$552,100	$131,722,900	$40,069,800
Holmdel, Township of	$1,995,955,600	$0	$0	Not Available	$8,647,000	$6,055,000	$0	$0	$1,088,434,900
Howell, Township of	$1,914,832,390	$0	$40,073,300	Not Available	$18,657,100	$74,100	$0	$0	$687,612,050
Interlaken, Borough of	$88,855,300	$0	$0	Not Available	$12,364,400	$69,889,600	$0	$0	$5,639,400
Keansburg, Borough of	$199,892,700	$0	$0	Not Available	$55,784,600	$199,892,700	$0	$0	$7,628,600
Keyport, Borough of	$219,673,450	$2,837,200	$0	Not Available	$19,268,400	$109,451,100	$749,000	$0	$3,428,200
Lake Como, Borough of	$65,026,800	$0	$0	Not Available	$2,606,000	$62,840,100	$0	$0	$761,400
Little Silver, Borough of	$622,615,400	$55,524,600	$0	Not Available	$129,680,200	$336,027,100	$22,128,300	$27,410,000	$169,669,800
Loch Arbour, Village of	$28,719,700	$339,800	$0	Not Available	$15,675,800	$28,719,700	$199,600	$0	$0
Long Branch, City of	$1,085,212,300	$83,703,900	$0	Not Available	$174,845,100	$607,702,200	$5,615,500	$8,079,000	$119,202,400
Manalapan, Township of	$3,229,721,500	$0	$0	Not Available	$69,988,800	$0	$0	$0	$929,728,600

Table 3c.25
Assessed Building Value At-Risk by Hazard by Jurisdiction

Jurisdiction	Extreme Temps, Tornado, Hurricane, Extreme Wind, Lightning, Nor'easter, Earthquake, and Winter Storm*	Coastal Erosion	Dam Failure	Drought**	Flood	Storm Surge	Wave Action	Landslide	Wildfire
Manasquan, Borough of	$394,840,400	$1,912,100	$0	Not Available	$252,936,600	$335,512,700	$18,137,700	$0	$22,772,300
Marlboro, Township of	$2,270,927,800	$0	$0	Not Available	$25,648,300	$0	$0	$0	$913,104,100
Matawan, Borough of	$280,292,084	$0	$0	Not Available	$4,921,400	$2,705,450	$0	$0	$23,118,250
Middletown, Township of	$3,327,619,578	$39,412,400	$55,931,500	Not Available	$184,424,400	$535,335,800	$9,083,300	$152,132,800	$895,915,700
Millstone, Township of	$263,436,400	$0	$0	Not Available	$4,618,300	$0	$0	$0	$239,569,000
Monmouth Beach, Borough of	$169,824,000	$22,142,200	$0	Not Available	$142,194,000	$169,824,000	$16,629,100	$83,999,700	$12,107,100
Neptune City, Borough of	$142,043,700	$1,719,500	$0	Not Available	$18,219,600	$77,699,900	$0	$0	$13,181,100
Neptune, Township of	$1,576,460,100	$8,551,700	$71,481,100	Not Available	$83,726,600	$557,303,400	$767,800	$0	$215,012,500
Ocean, Township of	$2,612,650,600	$0	$0	Not Available	$179,626,600	$122,910,500	$0	$0	$710,374,800
Oceanport, Borough of	$322,084,700	$17,792,900	$0	Not Available	$177,555,400	$279,458,900	$0	$0	$79,013,000
Red Bank, Borough of	$1,219,372,800	$578,587	$0	Not Available	$16,489,739	$29,507,954	$0	$0	$57,569,439
Roosevelt, Borough of	$23,470,660	$0	$0	Not Available	$0	$0	$0	$0	$4,064,800
Rumson, Borough of	$507,589,781	$42,344,300	$0	Not Available	$108,783,500	$291,391,581	$5,983,500	$317,087,800	$340,533,500
Sea Bright, Borough of	$98,620,100	$39,993,900	$0	Not Available	$98,620,100	$98,620,100	$10,121,500	$0	$13,388,800
Sea Girt, Borough of	$235,924,250	$25,202,100	$0	Not Available	$33,003,500	$217,683,550	$14,198,700	$0	$15,375,900
Shrewsbury, Borough of	$451,418,300	$0	$0	Not Available	$10,900,100	$91,204,200	$0	$0	$69,480,000
Shrewsbury, Township of	$3,900,100	$0	$0	Not Available	$0	$0	$0	$0	$0
Spring Lake, Borough of	$489,616,500	$1,485,300	$0	Not Available	$58,651,100	$392,482,300	$775,000	$0	$8,785,400
Spring Lake Heights, Borough of	$276,945,800	$0	$0	Not Available	$19,041,300	$80,424,200	$0	$0	$11,114,600
Tinton Falls, Borough of	$920,707,700	$0	$35,306,500	Not Available	$8,760,200	$10,654,000	$0	$0	$332,477,700
Union Beach, Borough of	$236,450,400	$7,021,100	$0	Not Available	$179,275,200	$236,450,400	$2,901,900	$0	$35,701,700
Upper Freehold, Township of	$143,501,070	$0	$0	Not Available	$1,601,100	$0	$0	$0	$112,911,900
Wall, Township of	$2,039,081,200	$14,211,300	$26,374,300	Not Available	$94,955,500	$77,371,700	$0	$0	$811,160,400
West Long Branch, Borough of	$495,025,500	$0	$0	Not Available	$41,151,100	$160,450,600	$0	$0	$98,320,200
Total	**$36,741,303,693**	**$461,082,387**	**$229,166,700**	**$84,280,384**	**$2,808,708,439**	**$7,228,904,685**	**$157,404,500**	**$965,002,000**	**$10,521,380,484**
Percent of Total Exposure	**100.0%**	**1.3%**	**0.6%**	**N/A**	**7.6%**	**19.7%**	**0.4%**	**2.6%**	**28.6%**

**Each of these hazards could potentially impact all areas of the county, so the total assessed value in each jurisdiction is considered exposed to each hazard.*
***Only Crop Value At-Risk shown. Crop data at the jurisdictional level is not currently available.*

Table 3c.26
Population Exposure by Hazard by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Aberdeen, Township of	17,454	17,454	17,454	17,454	17,454	17,454	17,454	179	0	17,454	4,655	5,551	1,160	17,454	0	12,612
Allenhurst, Borough of	599	599	599	599	599	599	599	82	0	599	144	599	70	599	0	86
Allentown, Borough of	1,882	1,882	1,882	1,882	1,882	1,882	1,882	0	0	1,882	1,036	0	0	1,882	0	1,424
Asbury Park, City of	16,930	16,930	16,930	16,930	16,930	16,930	16,930	368	0	16,930	2,890	16,705	454	16,930	0	5,414
Atlantic Highlands, Borough of	4,705	4,705	4,705	4,705	4,705	4,705	4,705	612	0	4,705	841	2,207	393	4,705	1,924	2,028
Avon-By-The-Sea, Borough of	2,244	2,244	2,244	2,244	2,244	2,244	2,244	464	0	2,244	637	2,244	66	2,244	0	369
Belmar, Borough of	6,045	6,045	6,045	6,045	6,045	6,045	6,045	1,557	0	6,045	1,413	6,045	55	6,045	0	2,159
Bradley Beach, Borough of	4,793	4,793	4,793	4,793	4,793	4,793	4,793	854	0	4,793	276	4,793	82	4,793	0	1,042
Brielle, Borough of	4,893	4,893	4,893	4,893	4,893	4,893	4,893	907	0	4,893	1,719	3,671	0	4,893	0	3,147
Colts Neck, Township of	12,331	12,331	12,331	12,331	12,331	12,331	12,331	0	0	12,331	2,884	1,332	0	12,331	0	12,275
Deal, Borough of	1,070	1,070	1,070	1,070	1,070	1,070	1,070	137	0	1,070	314	967	137	1,070	0	736
Eatontown, Borough of	13,964	13,964	13,964	13,964	13,964	13,964	13,964	0	0	13,964	3,573	6,992	0	13,964	0	12,602
Englishtown, Borough of	1,764	1,764	1,764	1,764	1,764	1,764	1,764	0	0	1,764	1,145	0	0	1,764	0	1,518
Fair Haven, Borough of	5,937	5,937	5,937	5,937	5,937	5,937	5,937	810	0	5,937	866	3,683	0	5,937	1,764	3,540
Farmingdale, Borough of	1,587	1,587	1,587	1,587	1,587	1,587	1,587	0	0	1,587	706	0	0	1,587	0	1,309
Freehold, Borough of	10,976	10,976	10,976	10,976	10,976	10,976	10,976	0	0	10,976	0	0	0	10,976	0	5,092
Freehold, Township of	31,537	31,537	31,537	31,537	31,537	31,537	31,537	0	0	31,537	9,232	0	0	31,537	0	25,067
Hazlet, Township of	21,378	21,378	21,378	21,378	21,378	21,378	21,378	0	0	21,378	7,549	13,171	0	21,378	0	12,326
Highlands, Borough of	5,097	5,097	5,097	5,097	5,097	5,097	5,097	1,685	0	5,097	4,033	4,372	147	5,097	2,649	3,408
Holmdel, Township of	15,781	15,781	15,781	15,781	15,781	15,781	15,781	0	0	15,781	2,184	2,250	0	15,781	0	14,947
Howell, Township of	48,903	48,903	48,903	48,903	48,903	48,903	48,903	0	249	48,903	14,019	62	0	48,903	0	42,035
Interlaken, Borough of	900	900	900	900	900	900	900	0	0	900	328	900	0	900	0	249
Keansburg, Borough of	10,426	10,426	10,426	10,426	10,426	10,426	10,426	7	0	10,426	5,408	10,426	83	10,426	0	2,337
Keyport, Borough of	7,568	7,568	7,568	7,568	7,568	7,568	7,568	498	0	7,568	2,974	7,059	289	7,568	0	3,657
Lake Como, Borough of	1,806	1,806	1,806	1,806	1,806	1,806	1,806	0	0	1,806	579	1,806	0	1,806	0	569
Little Silver, Borough of	6,170	6,170	6,170	6,170	6,170	6,170	6,170	1,193	0	6,170	3,052	4,972	283	6,170	206	4,368
Loch Arbour, Village of	399	399	399	399	399	399	399	47	0	399	242	399	47	399	0	25
Long Branch, City of	31,340	31,340	31,340	31,340	31,340	31,340	31,340	5,875	0	31,340	9,387	28,616	3,080	31,340	753	16,897

Table 3c.26
Population Exposure by Hazard by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Manalapan, Township of	33,423	33,423	33,423	33,423	33,423	33,423	33,423	0	0	33,423	10,242	0	0	33,423	0	27,064
Manasquan, Borough of	6,310	6,310	6,310	6,310	6,310	6,310	6,310	678	0	6,310	4,707	6,063	345	6,310	0	1,860
Marlboro, Township of	36,398	36,398	36,398	36,398	36,398	36,398	36,398	0	0	36,398	7,762	0	0	36,398	0	31,757
Matawan, Borough of	8,910	8,910	8,910	8,910	8,910	8,910	8,910	0	0	8,910	2,552	3,013	0	8,910	0	5,878
Middletown, Township of	66,633	66,633	66,633	66,633	66,633	66,633	66,633	634	1,564	66,633	20,041	34,020	1,591	66,633	2,761	47,314
Millstone, Township of	8,970	8,970	8,970	8,970	8,970	8,970	8,970	0	0	8,970	3,986	0	0	8,970	0	8,927
Monmouth Beach, Borough of	3,595	3,595	3,595	3,595	3,595	3,595	3,595	1,291	0	3,595	3,072	3,595	2,202	3,595	2,362	2,886
Neptune City, Borough of	5,218	5,218	5,218	5,218	5,218	5,218	5,218	469	0	5,218	2,140	4,345	0	5,218	0	1,996
Neptune, Township of	27,690	27,690	27,690	27,690	27,690	27,690	27,690	1,290	1,509	27,690	5,498	14,107	9	27,690	0	11,980
Ocean, Township of	26,959	26,959	26,959	26,959	26,959	26,959	26,959	0	0	26,959	11,774	5,380	0	26,959	0	19,929
Oceanport, Borough of	5,834	5,834	5,834	5,834	5,834	5,834	5,834	1,550	0	5,834	4,623	5,582	0	5,834	0	4,019
Red Bank, Borough of	11,844	11,844	11,844	11,844	11,844	11,844	11,844	1,512	0	11,844	1,963	3,816	0	11,844	0	4,877
Roosevelt, Borough of	933	933	933	933	933	933	933	0	0	933	0	0	0	933	0	868
Rumson, Borough of	7,137	7,137	7,137	7,137	7,137	7,137	7,137	1,803	0	7,137	3,055	6,041	1,037	7,137	4,326	4,691
Sea Bright, Borough of	1,818	1,818	1,818	1,818	1,818	1,818	1,818	1,091	0	1,818	1,199	1,818	1,392	1,818	0	1,111
Sea Girt, Borough of	2,148	2,148	2,148	2,148	2,148	2,148	2,148	172	0	2,148	351	2,148	18	2,148	0	856
Shrewsbury, Borough of	3,590	3,590	3,590	3,590	3,590	3,590	3,590	55	0	3,590	1,194	2,820	0	3,590	0	2,842
Shrewsbury, Township of	1,098	1,098	1,098	1,098	1,098	1,098	1,098	0	0	1,098	0	547	0	1,098	0	582
Spring Lake, Borough of	3,567	3,567	3,567	3,567	3,567	3,567	3,567	247	0	3,567	880	3,567	0	3,567	0	1,038
Spring Lake Heights, Borough of	5,227	5,227	5,227	5,227	5,227	5,227	5,227	0	0	5,227	810	4,078	0	5,227	0	3,098
Tinton Falls, Borough of	15,070	15,070	15,070	15,070	15,070	15,070	15,070	0	503	15,070	2,638	2,379	0	15,070	0	13,609
Union Beach, Borough of	6,649	6,649	6,649	6,649	6,649	6,649	6,649	420	0	6,649	5,938	6,649	657	6,649	0	3,259
Upper Freehold, Township of	4,282	4,282	4,282	4,282	4,282	4,282	4,282	0	0	4,282	1,953	0	0	4,282	0	4,322
Wall, Township of	25,261	25,261	25,261	25,261	25,261	25,261	25,261	847	502	25,261	6,435	7,944	0	25,261	0	18,637
West Long Branch, Borough of	8,258	8,258	8,258	8,258	8,258	8,258	8,258	0	0	8,258	527	3,564	0	8,258	0	5,802
Total	**615,301**	**615,301**	**615,301**	**615,301**	**615,301**	**615,301**	**615,301**	**27,334**	**4,327**	**615,301**	**185,426**	**250,298**	**13,597**	**615,301**	**16,745**	**420,440**
Percent of Total Population	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**4.4%**	**0.7%**	**100.0%**	**30.1%**	**40.7%**	**2.2%**	**100.0%**	**2.7%**	**68.3%**

Table 3c.27
Annualized Losses by Hazard by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought*	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Aberdeen, Township of	*Negl*	$5,746	$119,626	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$33,446	$748,903	*Negl*	*Negl*	N/A	*Negl*
Allenhurst, Borough of	*Negl*	$5,746	$75,376	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$811,955	*Negl*	*Negl*	N/A	*Negl*
Allentown, Borough of	*Negl*	$5,746	$14,701	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	*Negl*	N/A	N/A	*Negl*	N/A	*Negl*
Asbury Park, City of	*Negl*	$5,746	$167,036	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$872,447	N/A	*Negl*	N/A	*Negl*
Atlantic Highlands, Borough of	*Negl*	$5,746	$135,478	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$900,580	*Negl*	*Negl*	*Negl*	*Negl*
Avon-By-The-Sea, Borough of	*Negl*	$5,746	$73,881	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$1,752,149	N/A	*Negl*	N/A	*Negl*
Belmar, Borough of	*Negl*	$17,470	$276,023	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$105,843	$5,059,429	N/A	*Negl*	N/A	*Negl*
Bradley Beach, Borough of	*Negl*	$5,746	$103,700	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$994,658	N/A	*Negl*	N/A	*Negl*
Brielle, Borough of	*Negl*	$5,746	$177,937	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$11,812	$2,973,235	N/A	*Negl*	N/A	*Negl*
Colts Neck, Township of	*Negl*	$18,557	$188,503	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$442,185	N/A	N/A	$5,477	N/A	*Negl*
Deal, Borough of	*Negl*	$5,746	$268,940	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$1,474,436	*Negl*	*Negl*	N/A	*Negl*
Eatontown, Borough of	*Negl*	$5,746	$362,223	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$197,230	$111,828	N/A	$12,440	N/A	*Negl*
Englishtown, Borough of	*Negl*	$5,746	$9,327	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$216,523	N/A	*Negl*	*Negl*	N/A	*Negl*
Fair Haven, Borough of	*Negl*	$5,746	$186,548	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$66,801	$641,640	N/A	*Negl*	*Negl*	*Negl*
Farmingdale, Borough of	*Negl*	$5,746	$13,805	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$65,739	N/A	N/A	*Negl*	N/A	*Negl*
Freehold, Borough of	*Negl*	$5,746	$105,579	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	*Negl*	N/A	N/A	*Negl*	N/A	*Negl*
Freehold, Township of	*Negl*	$5,746	$582,220	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$552,302	N/A	N/A	$17,259	N/A	*Negl*
Hazlet, Township of	*Negl*	$5,746	$166,646	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$127,383	$2,407,670	N/A	$6,880	N/A	*Negl*
Highlands, Borough of	*Negl*	$5,746	$122,462	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$255,187	$5,917,514	N/A	*Negl*	*Negl*	*Negl*
Holmdel, Township of	*Negl*	$5,746	$467,208	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$1,152,326	*Negl*	N/A	$20,367	N/A	*Negl*
Howell, Township of	*Negl*	$5,746	$530,692	*Negl*	*Negl*	$28,503	*Negl*	N/A	*Negl*	Not Available	$1,569,973	*Negl*	N/A	$14,794	N/A	*Negl*
Interlaken, Borough of	*Negl*	$5,746	$44,805	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	*Negl*	$589,408	N/A	*Negl*	N/A	*Negl*
Keansburg, Borough of	*Negl*	$5,746	$54,213	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$230,683	$9,093,351	N/A	*Negl*	N/A	*Negl*
Keyport, Borough of	*Negl*	$5,746	$53,078	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$49,735	$1,193,640	*Negl*	*Negl*	N/A	*Negl*
Lake Como, Borough of	*Negl*	$5,746	$33,115	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	*Negl*	$381,608	N/A	*Negl*	N/A	*Negl*
Little Silver, Borough of	*Negl*	$5,746	$223,050	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$72,892	$1,932,087	*Negl*	$5,101	*Negl*	*Negl*
Loch Arbour, Village of	*Negl*	$5,746	$21,507	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$231,680	*Negl*	*Negl*	N/A	N/A
Long Branch, City of	*Negl*	$5,746	$523,567	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$89,719	$4,923,641	*Negl*	$8,658	*Negl*	*Negl*

Table 3c.27
Annualized Losses by Hazard by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought*	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Manalapan, Township of	*Negl*	$5,746	$699,125	*Negl*	$5,388	$12,438	*Negl*	N/A	*Negl*	Not Available	$2,481,827	N/A	N/A	$27,839	N/A	*Negl*
Manasquan, Borough of	*Negl*	$5,746	$202,646	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$8,821,981	*Negl*	*Negl*	N/A	*Negl*
Marlboro, Township of	*Negl*	$18,557	$507,522	*Negl*	*Negl*	$12,438	*Negl*	N/A	*Negl*	Not Available	$207,062	N/A	N/A	$18,771	N/A	*Negl*
Matawan, Borough of	*Negl*	$5,746	$63,710	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$225,207	*Negl*	N/A	*Negl*	N/A	*Negl*
Middletown, Township of	*Negl*	$5,746	$969,428	*Negl*	$10,243	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$1,559,377	$11,676,258	*Negl*	$28,601	Negl	*Negl*
Millstone, Township of	*Negl*	$5,746	$48,913	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$181,710	N/A	N/A	*Negl*	N/A	*Negl*
Monmouth Beach, Borough of	*Negl*	$5,746	$101,381	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$2,661,881	*Negl*	*Negl*	*Negl*	*Negl*
Neptune City, Borough of	*Negl*	$5,746	$63,780	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$270,779	N/A	*Negl*	N/A	*Negl*
Neptune, Township of	*Negl*	$5,746	$695,856	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$465,630	$4,529,780	N/A	$11,772	N/A	*Negl*
Ocean, Township of	*Negl*	$5,746	$1,035,587	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$302,522	$1,576,996	N/A	$20,312	N/A	*Negl*
Oceanport, Borough of	*Negl*	$5,746	$124,989	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$222,427	$1,900,794	N/A	*Negl*	N/A	*Negl*
Red Bank, Borough of	*Negl*	$8,856	$344,235	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$2,050,988	$4,318,665	N/A	$14,275	N/A	*Negl*
Roosevelt, Borough of	*Negl*	$5,746	$4,094	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	N/A	N/A	N/A	*Negl*	N/A	*Negl*
Rumson, Borough of	*Negl*	$5,746	$234,581	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$154,344	$5,616,643	*Negl*	*Negl*	*Negl*	*Negl*
Sea Bright, Borough of	*Negl*	$5,746	$96,014	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$3,839,639	*Negl*	*Negl*	N/A	*Negl*
Sea Girt, Borough of	*Negl*	$5,746	$155,325	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$23,606	$616,943	N/A	*Negl*	N/A	*Negl*
Shrewsbury, Borough of	*Negl*	$5,746	$126,147	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$48,011	$305,101	N/A	$5,124	N/A	*Negl*
Shrewsbury, Township of	*Negl*	$5,746	$1,470	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	N/A	N/A	N/A	*Negl*	N/A	*Negl*
Spring Lake, Borough of	*Negl*	$5,746	$336,867	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$50,876	$4,111,867	*Negl*	*Negl*	N/A	*Negl*
Spring Lake Heights, Borough of	*Negl*	$5,746	$157,303	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$47,474	$735,336	N/A	*Negl*	N/A	*Negl*
Tinton Falls, Borough of	*Negl*	$5,746	$275,457	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$535,254	*Negl*	N/A	$7,642	N/A	*Negl*
Union Beach, Borough of	*Negl*	$5,746	$61,057	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	*Negl*	$10,691,276	*Negl*	*Negl*	N/A	*Negl*
Upper Freehold, Township of	*Negl*	$5,746	$33,659	$12,438	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$148,907	N/A	N/A	*Negl*	N/A	*Negl*
Wall, Township of	*Negl*	$5,746	$750,080	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	*Negl*	Not Available	$663,110	$1,657,102	N/A	$17,513	N/A	*Negl*
West Long Branch, Borough of	*Negl*	$5,746	$190,333	*Negl*	*Negl*	*Negl*	*Negl*	N/A	*Negl*	Not Available	$142,171	*Negl*	N/A	*Negl*	N/A	*Negl*
Total	*Negl*	**$344,994**	**$12,437,276**	**$16,528**	**$73,327**	**$62,434**	**$58,194**	*Negl*	*Negl*	**$108,098**	**$14,572,654**	**$128,980,037**	**$80,000**	**$312,837**	*Negl*	**$245,000**

**Potential Crop Losses Only*
Negl= Negligible; less than $5,000 annual average damage
N/A= Not Applicable

Table 3c.28
Annualized Loss Ratios by Hazard by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Aberdeen, Township of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.15%	0.00%	0.00%	0.00%	0.00%
Allenhurst, Borough of	0.00%	0.01%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.81%	0.00%	0.00%	0.00%	0.00%
Allentown, Borough of	0.00%	0.01%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Asbury Park, City of	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.27%	0.00%	0.00%	0.00%	0.00%
Atlantic Highlands, Borough of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.20%	0.00%	0.00%	0.00%	0.00%
Avon-By-The-Sea, Borough of	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	1.37%	0.00%	0.00%	0.00%	0.00%
Belmar, Borough of	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.02%	1.17%	0.00%	0.00%	0.00%	0.00%
Bradley Beach, Borough of	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.50%	0.00%	0.00%	0.00%	0.00%
Brielle, Borough of	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	1.10%	0.00%	0.00%	0.00%	0.00%
Colts Neck, Township of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%
Deal, Borough of	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.37%	0.00%	0.00%	0.00%	0.00%
Eatontown, Borough of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%
Englishtown, Borough of	0.00%	0.01%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.43%	0.00%	0.00%	0.00%	0.00%	0.00%
Fair Haven, Borough of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.12%	0.00%	0.00%	0.00%	0.00%
Farmingdale, Borough of	0.00%	0.01%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.14%	0.00%	0.00%	0.00%	0.00%	0.00%
Freehold, Borough of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Freehold, Township of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
Hazlet, Township of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.02%	0.35%	0.00%	0.00%	0.00%	0.00%
Highlands, Borough of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.08%	1.86%	0.00%	0.00%	0.00%	0.00%
Holmdel, Township of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%
Howell, Township of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%
Interlaken, Borough of	0.00%	0.01%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.66%	0.00%	0.00%	0.00%	0.00%
Keansburg, Borough of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.12%	4.55%	0.00%	0.00%	0.00%	0.00%
Keyport, Borough of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.02%	0.54%	0.00%	0.00%	0.00%	0.00%
Lake Como, Borough of	0.00%	0.01%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.59%	0.00%	0.00%	0.00%	0.00%
Little Silver, Borough of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.31%	0.00%	0.00%	0.00%	0.00%
Loch Arbour, Village of	0.00%	0.02%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.81%	0.00%	0.00%	0.00%	0.00%
Long Branch, City of	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.45%	0.00%	0.00%	0.00%	0.00%

Table 3c.28
Annualized Loss Ratios by Hazard by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Manalapan, Township of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%
Manasquan, Borough of	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	2.23%	0.00%	0.00%	0.00%	0.00%
Marlboro, Township of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
Matawan, Borough of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.08%	0.00%	0.00%	0.00%	0.00%	0.00%
Middletown, Township of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.05%	0.35%	0.00%	0.00%	0.00%	0.00%
Millstone, Township of	0.00%	0.00%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%
Monmouth Beach, Borough of	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	1.57%	0.00%	0.00%	0.00%	0.00%
Neptune City, Borough of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.19%	0.00%	0.00%	0.00%	0.00%
Neptune, Township of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.03%	0.29%	0.00%	0.00%	0.00%	0.00%
Ocean, Township of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.06%	0.00%	0.00%	0.00%	0.00%
Oceanport, Borough of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.07%	0.59%	0.00%	0.00%	0.00%	0.00%
Red Bank, Borough of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.17%	0.35%	0.00%	0.00%	0.00%	0.00%
Roosevelt, Borough of	0.00%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Rumson, Borough of	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.03%	1.11%	0.00%	0.00%	0.00%	0.00%
Sea Bright, Borough of	0.00%	0.01%	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	3.89%	0.00%	0.00%	0.00%	0.00%
Sea Girt, Borough of	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.26%	0.00%	0.00%	0.00%	0.00%
Shrewsbury, Borough of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.07%	0.00%	0.00%	0.00%	0.00%
Shrewsbury, Township of	0.00%	0.15%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spring Lake, Borough of	0.00%	0.00%	0.07%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.01%	0.84%	0.00%	0.00%	0.00%	0.00%
Spring Lake Heights, Borough of	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.02%	0.27%	0.00%	0.00%	0.00%	0.00%
Tinton Falls, Borough of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.06%	0.00%	0.00%	0.00%	0.00%	0.00%
Union Beach, Borough of	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.00%	4.52%	0.00%	0.00%	0.00%	0.00%
Upper Freehold, Township of	0.00%	0.00%	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.10%	0.00%	0.00%	0.00%	0.00%	0.00%
Wall, Township of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.03%	0.08%	0.00%	0.00%	0.00%	0.00%
West Long Branch, Borough of	0.00%	0.00%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	Not Available	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%
Total	**0.00%**	**0.00%**	**0.03%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.13%**	**0.04%**	**0.35%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**

Note: All ALRs exceeding 0.00% are indicated in red.

Figure 3c.4
Monmouth County Composite Map of Vulnerability

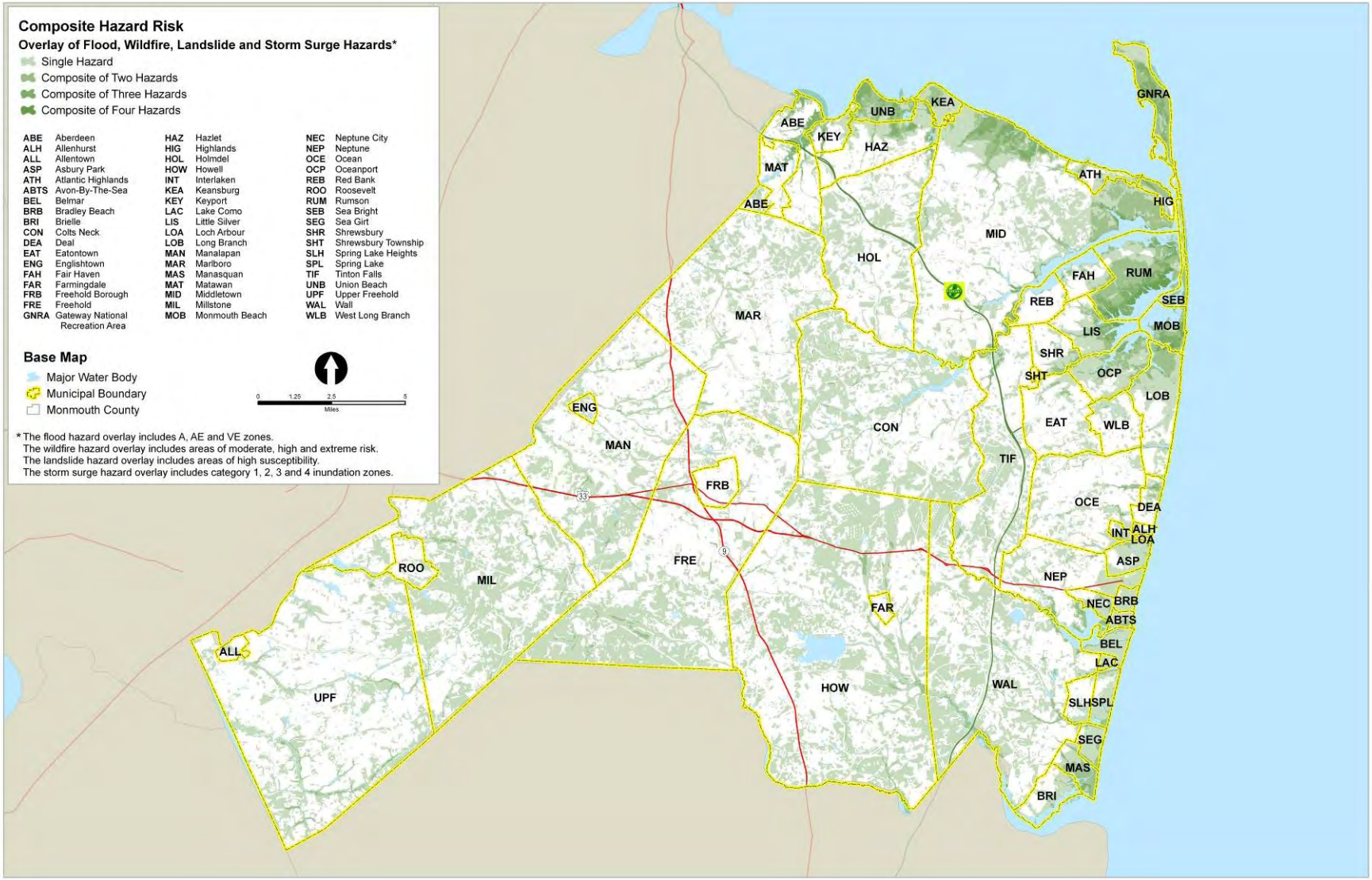


Figure 3c.5
Aberdeen Composite Map of Vulnerability

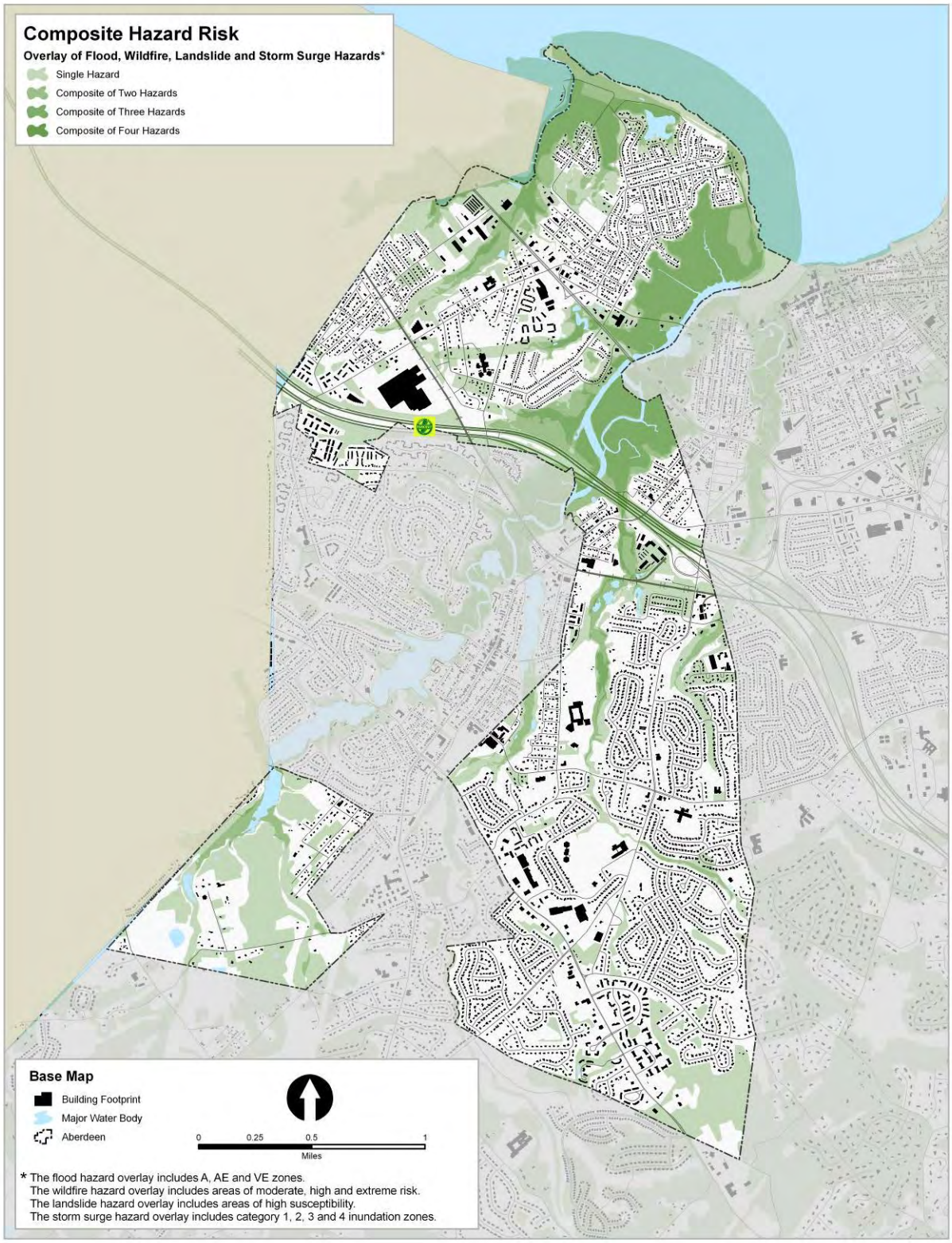


Figure 3c.6
Allenhurst Composite Map of Vulnerability

Figure 3c.7
Allentown Composite Map of Vulnerability

Figure 3c.8
Asbury Park Composite Map of Vulnerability

Figure 3c.9
Atlantic Highlands Composite Map of Vulnerability

Figure 3c.10
Avon-By-The-Sea Composite Map of Vulnerability

Figure 3c.11
Belmar Composite Map of Vulnerability

Figure 3c.12
Bradley Beach Composite Map of Vulnerability

Figure 3c.13
Brielle Composite Map of Vulnerability

Figure 3c.14
Colts Neck Composite Map of Vulnerability

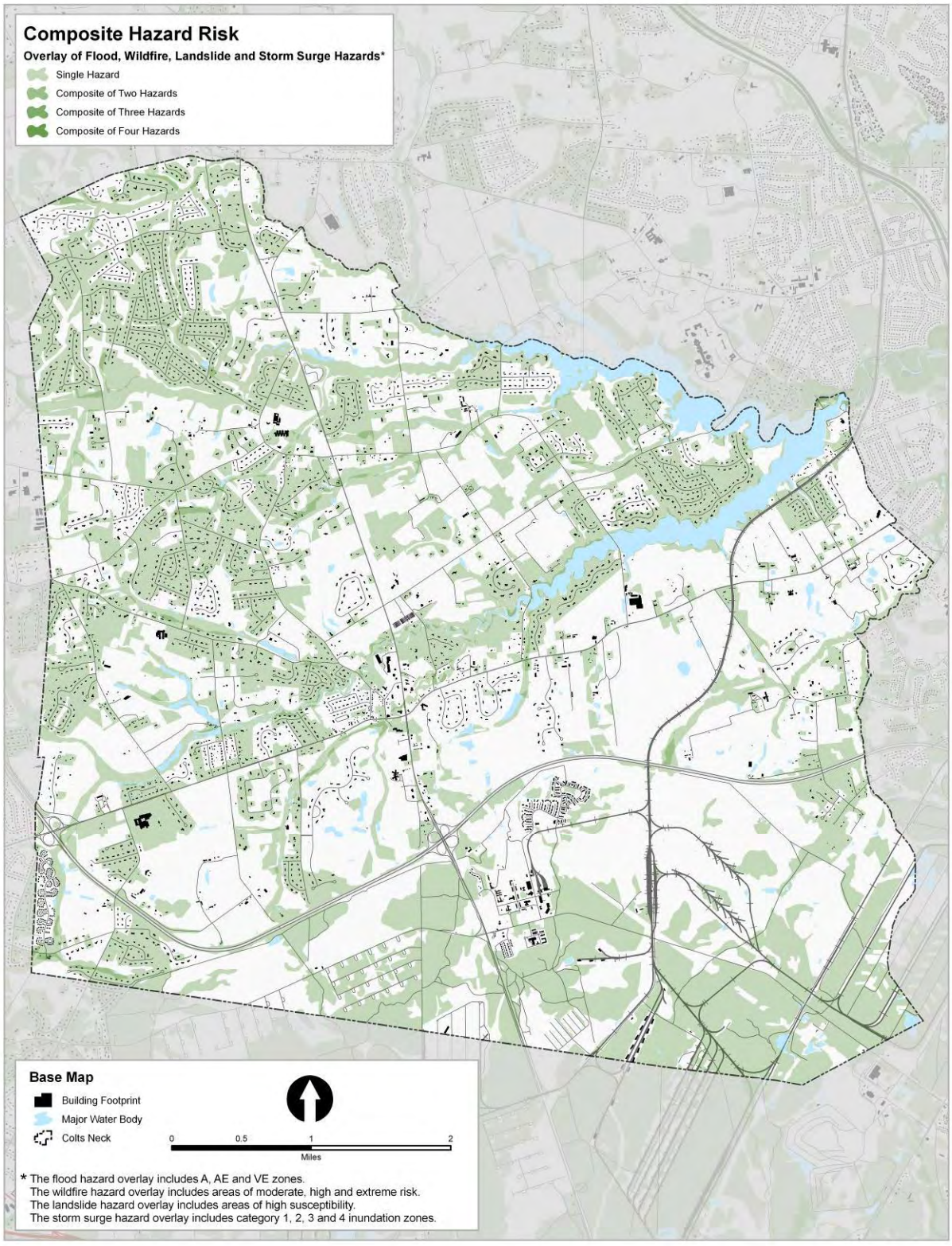


Figure 3c.15
Deal Composite Map of Vulnerability

Figure 3c.16
Eatontown Composite Map of Vulnerability

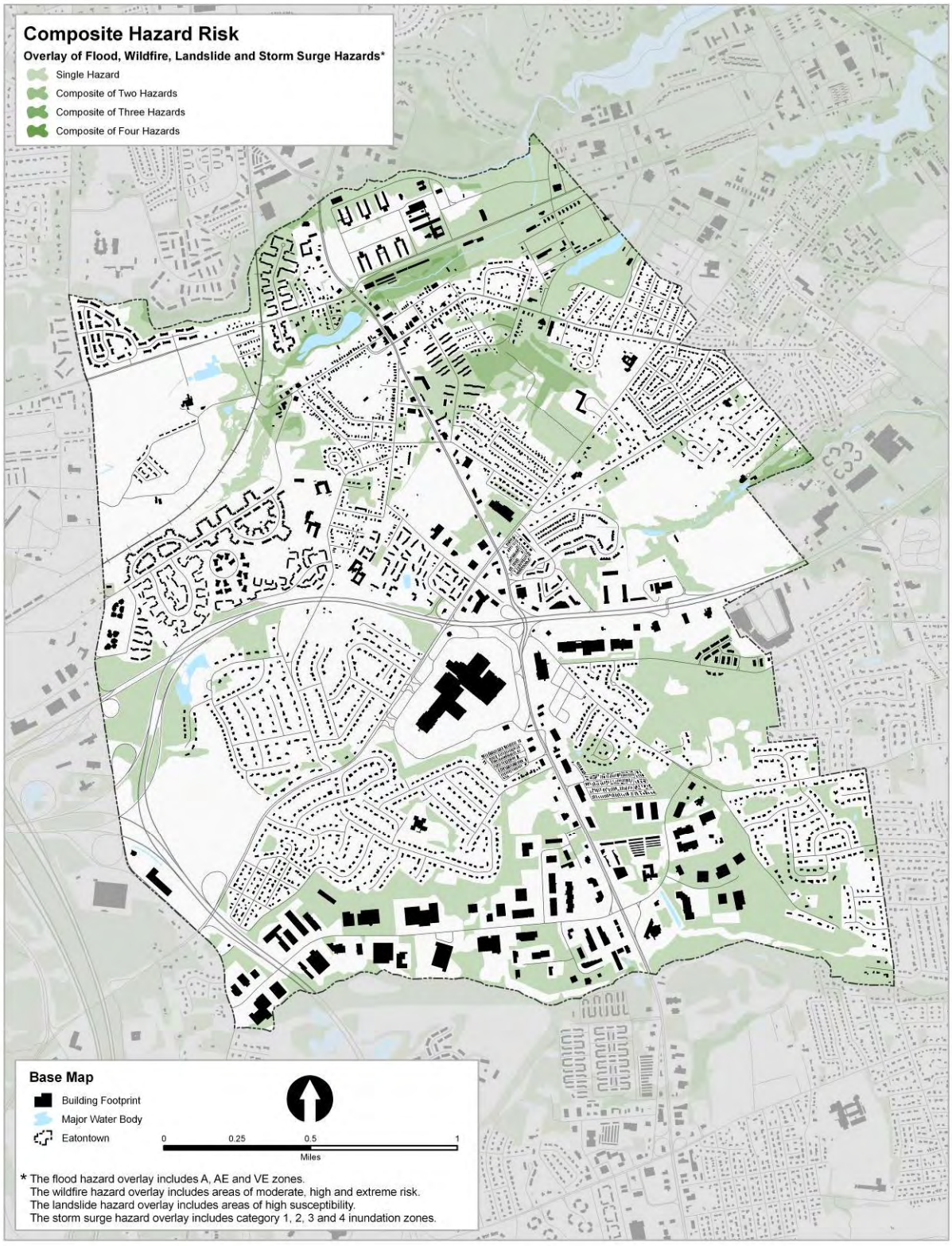


Figure 3c.17
Englishtown Composite Map of Vulnerability

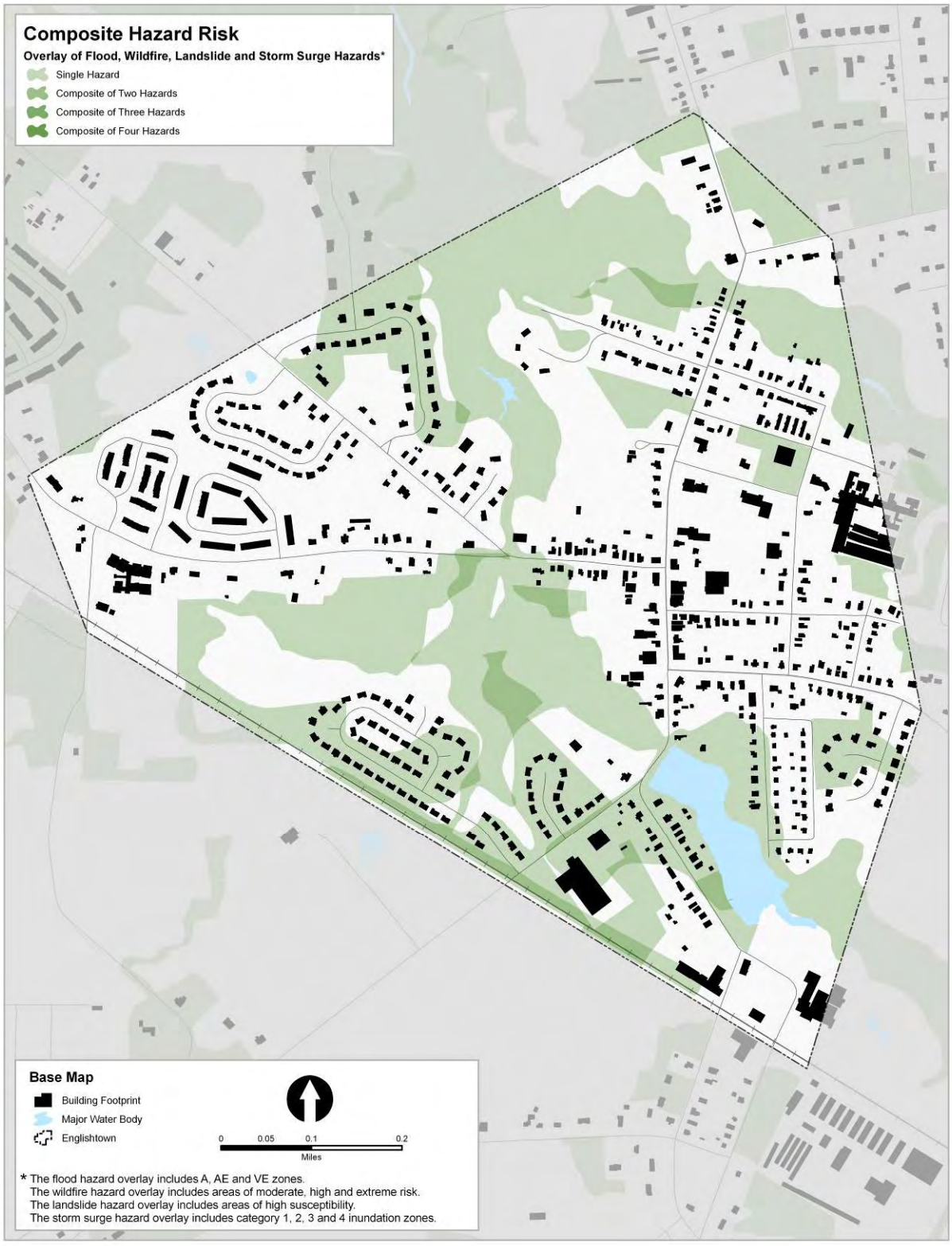


Figure 3c.18
Fair Haven Composite Map of Vulnerability

Figure 3c.19
Farmingdale Composite Map of Vulnerability

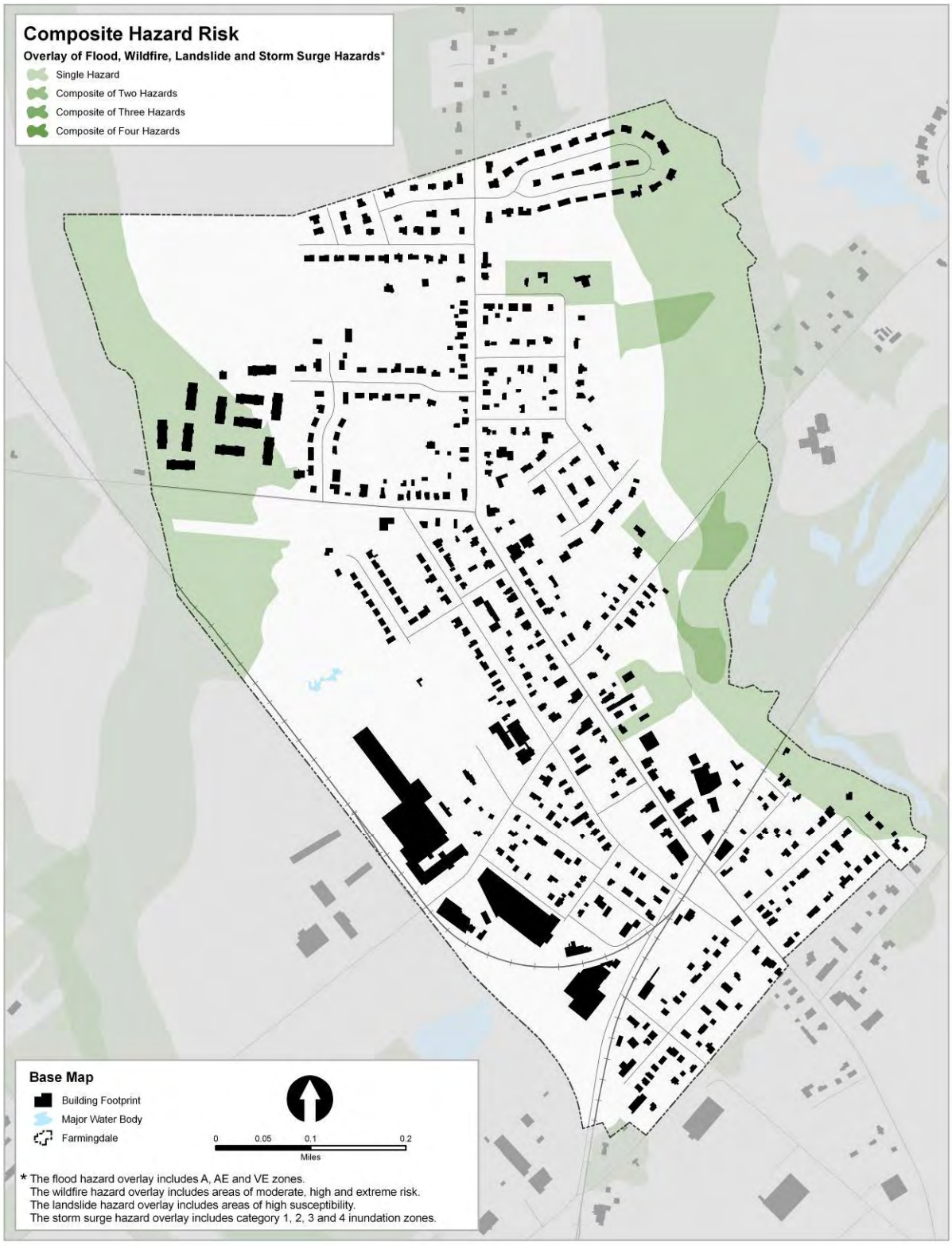


Figure 3c.20
Freehold Borough Composite Map of Vulnerability

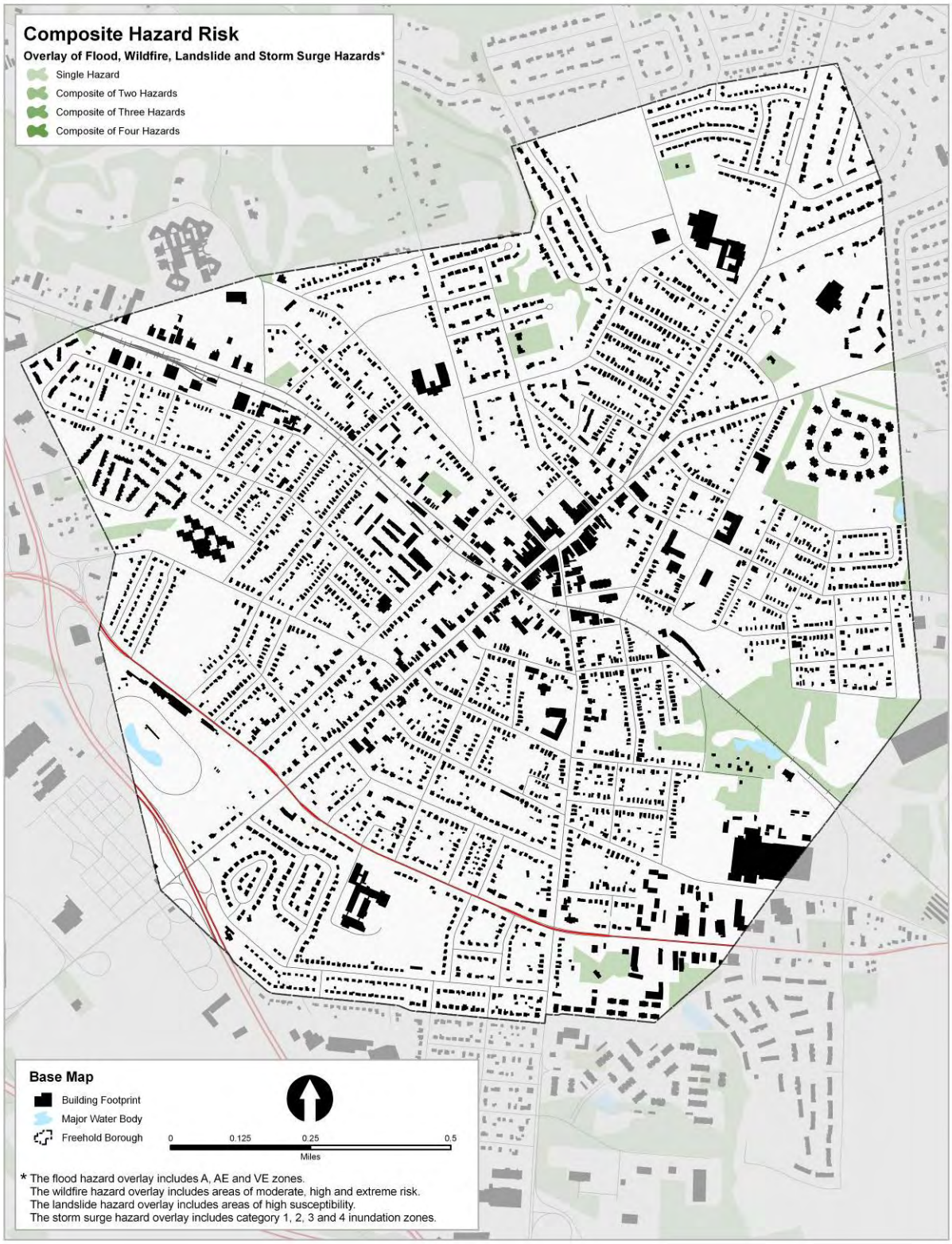


Figure 3c.21
Freehold Township Composite Map of Vulnerability

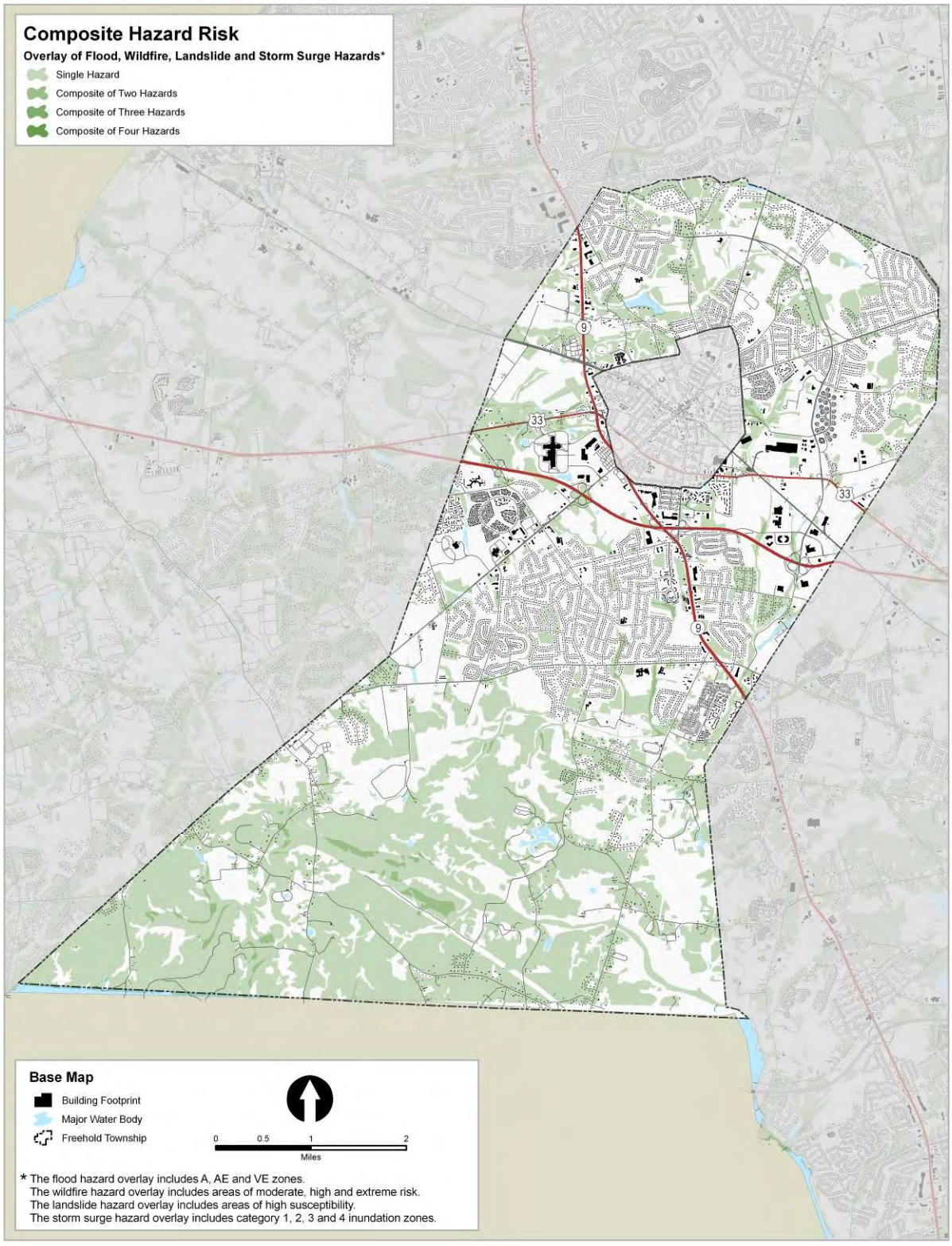


Figure 3c.22
Hazlet Composite Map of Vulnerability

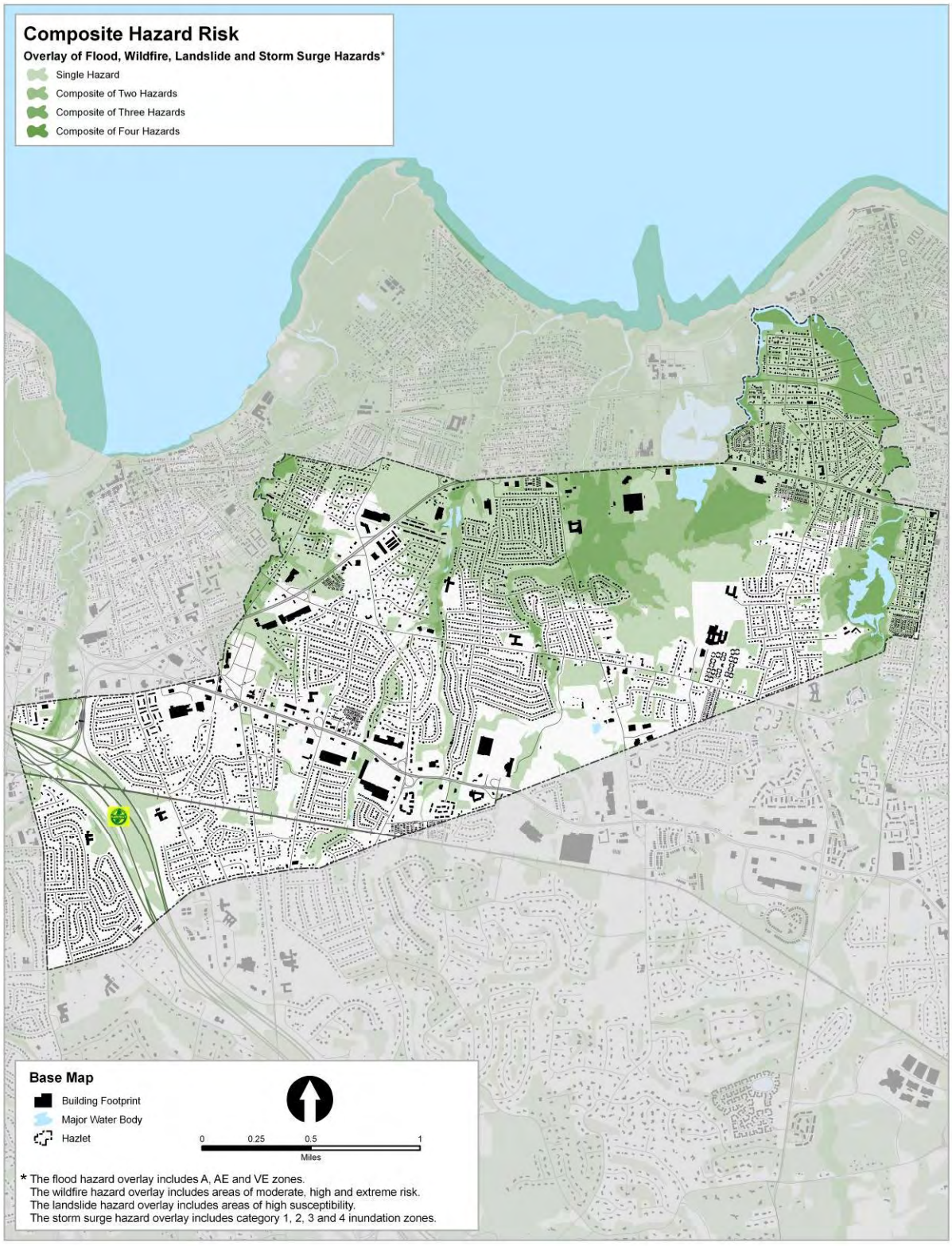


Figure 3c.23
Highlands Composite Map of Vulnerability

Figure 3c.24
Holmdel Composite Map of Vulnerability

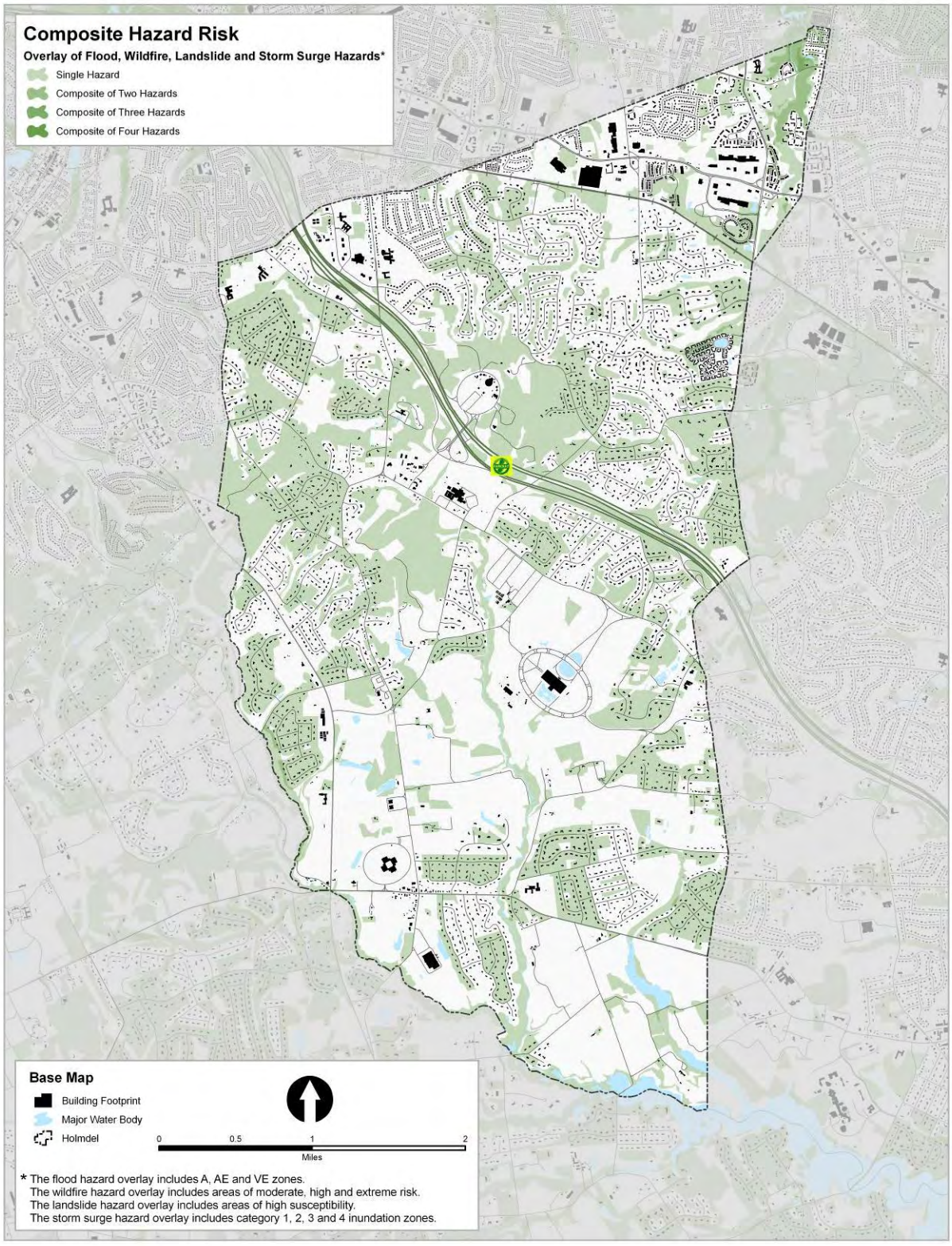


Figure 3c.25
Howell Composite Map of Vulnerability

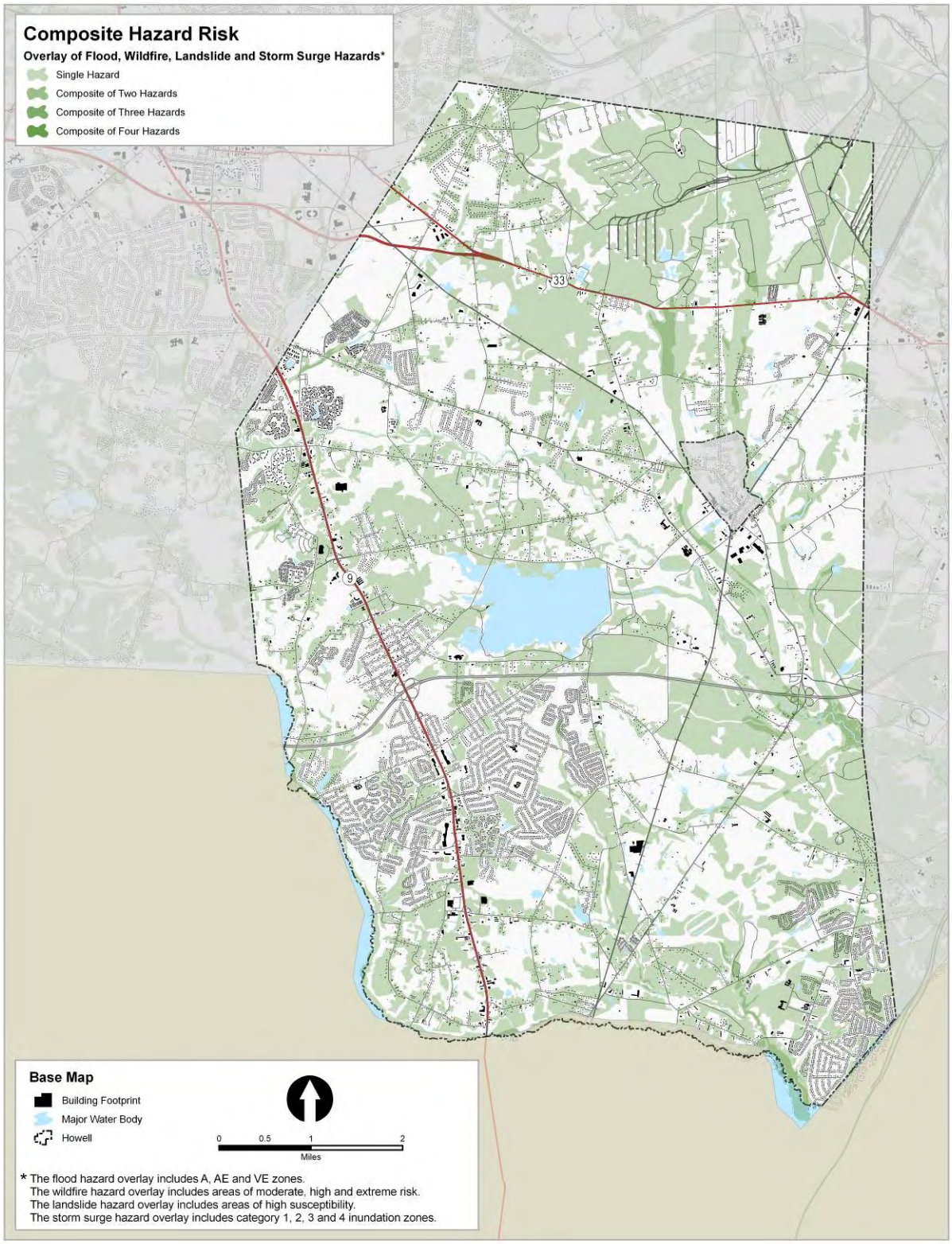


Figure 3c.26
Interlaken Composite Map of Vulnerability

Figure 3c.27
Keansburg Composite Map of Vulnerability

Figure 3c.28
Keyport Composite Map of Vulnerability

Figure 3c.29
Lake Como Composite Map of Vulnerability

Figure 3c.30
Little Silver Composite Map of Vulnerability

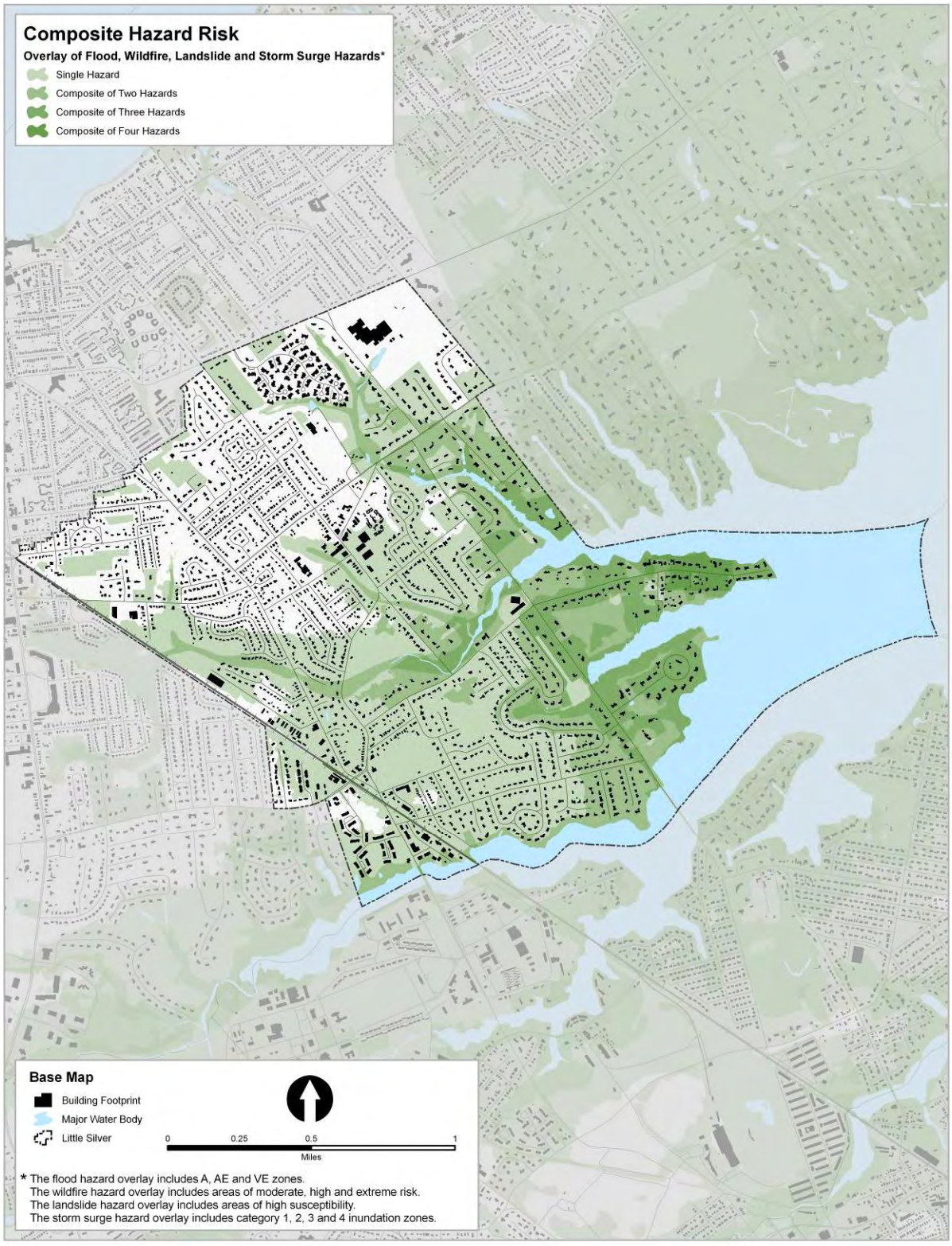


Figure 3c.31
Loch Arbour Composite Map of Vulnerability

Figure 3c.32
Long Branch Composite Map of Vulnerability

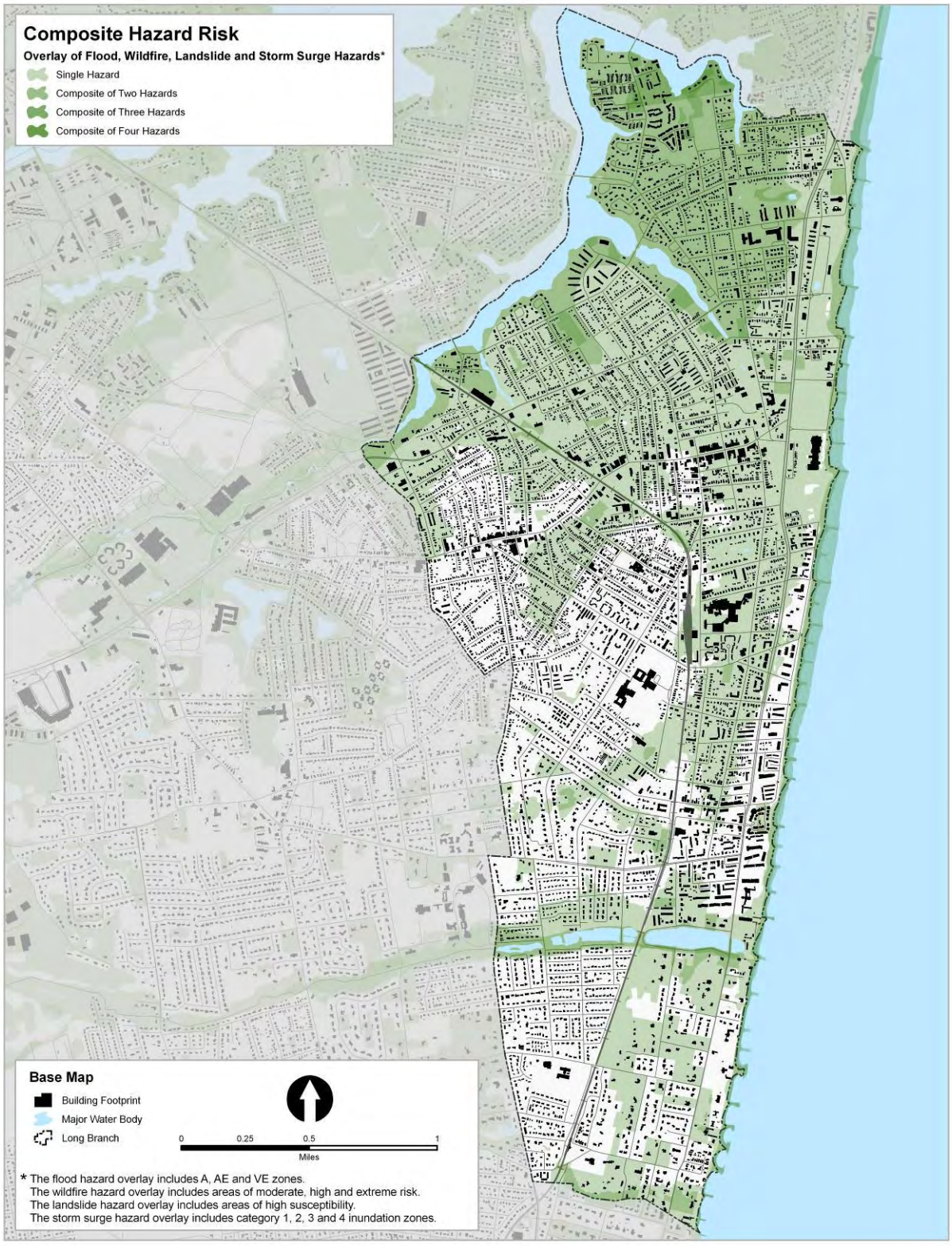


Figure 3c.33
Manalapan Composite Map of Vulnerability

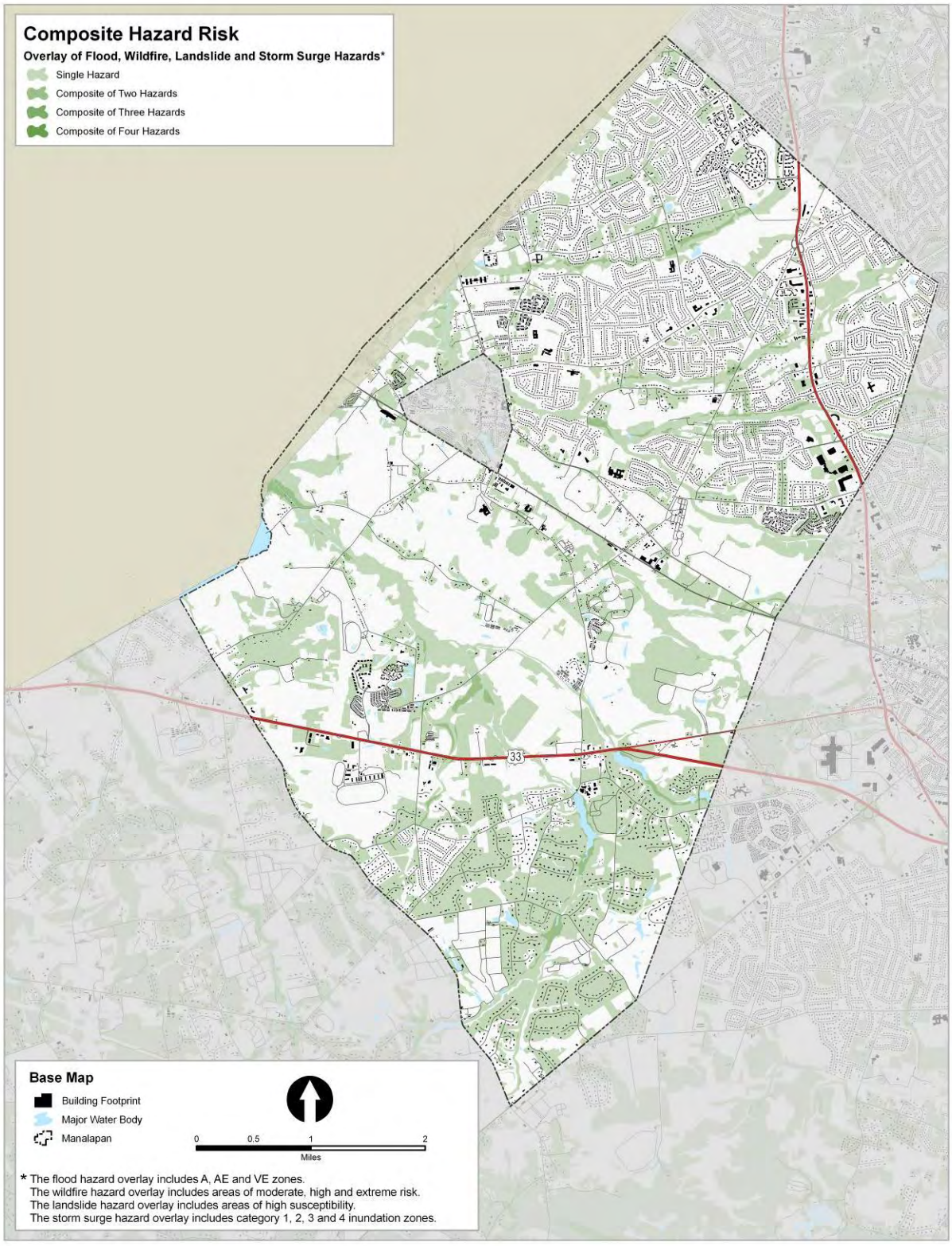


Figure 3c.34
Manasquan Composite Map of Vulnerability

Figure 3c.35
Marlboro Composite Map of Vulnerability

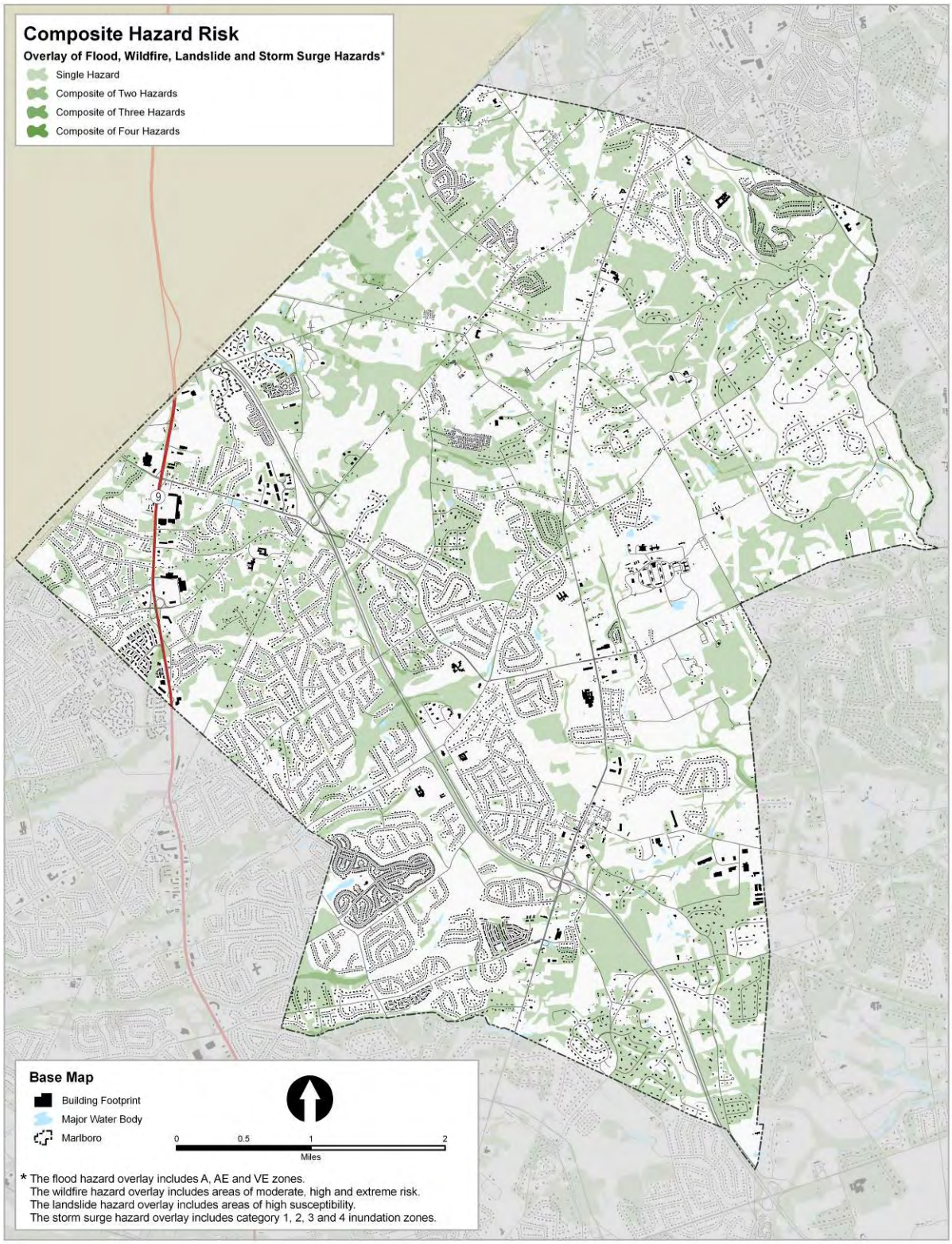


Figure 3c.36
Matawan Composite Map of Vulnerability

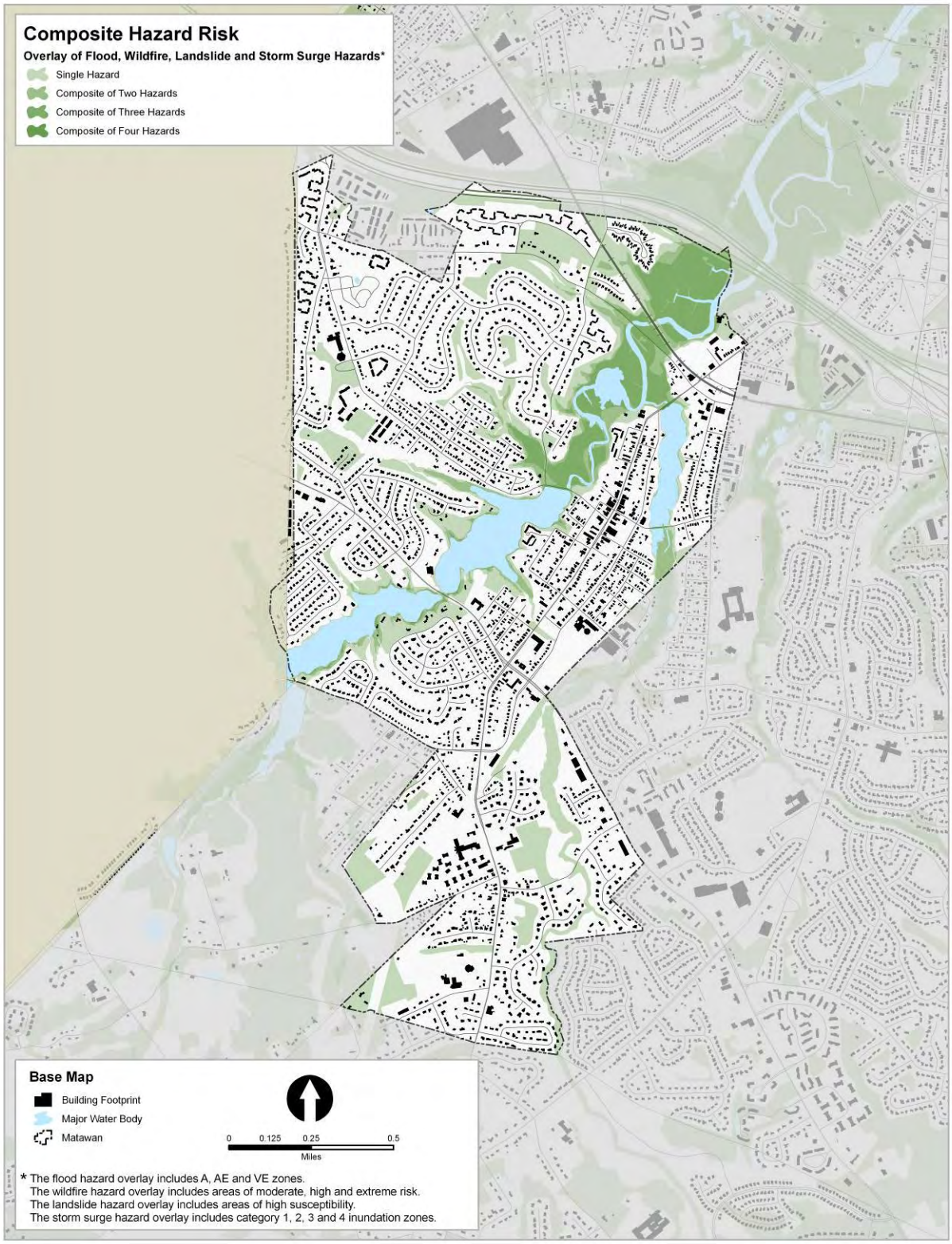


Figure 3c.37
Middletown Composite Map of Vulnerability

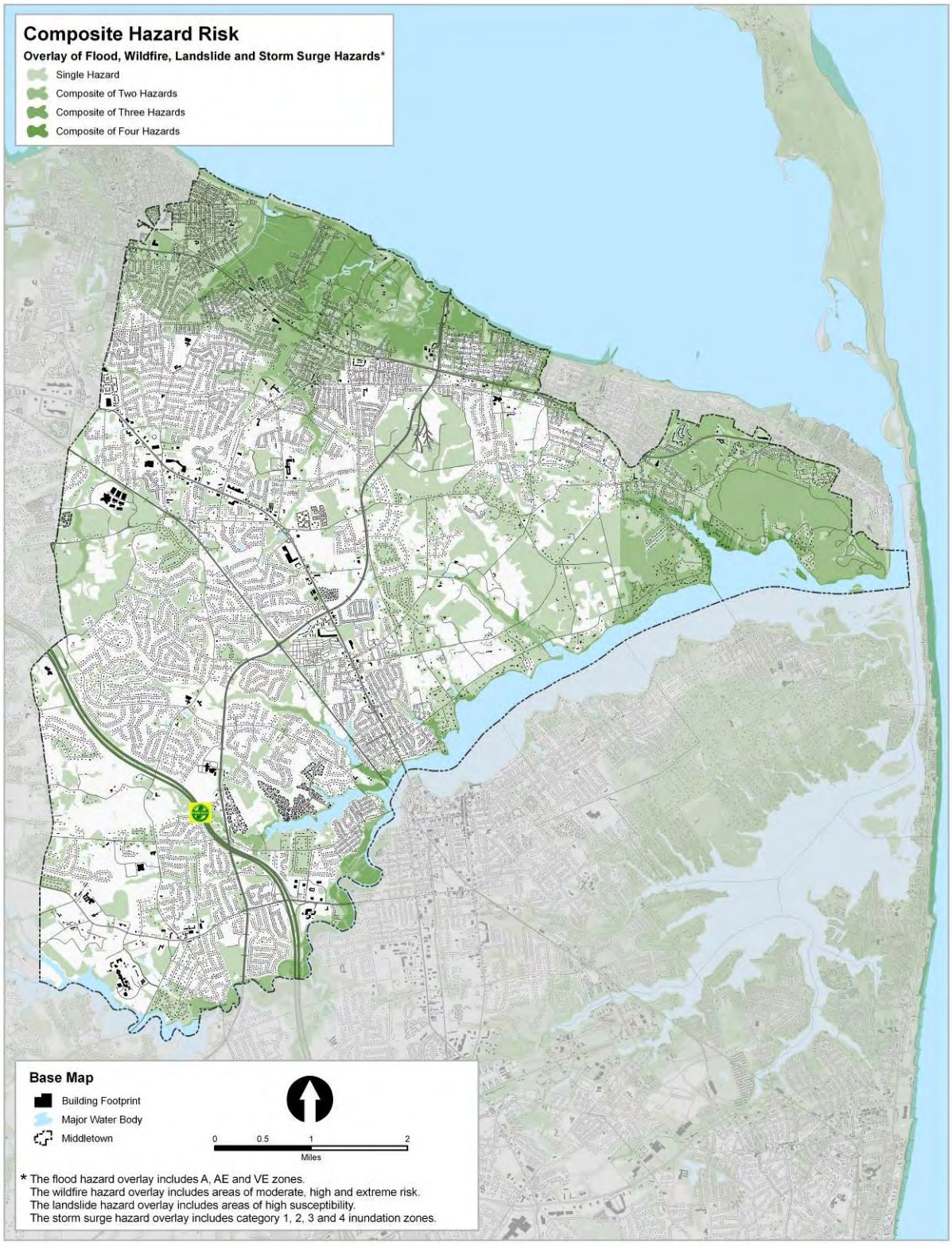


Figure 3c.38
Millstone Composite Map of Vulnerability

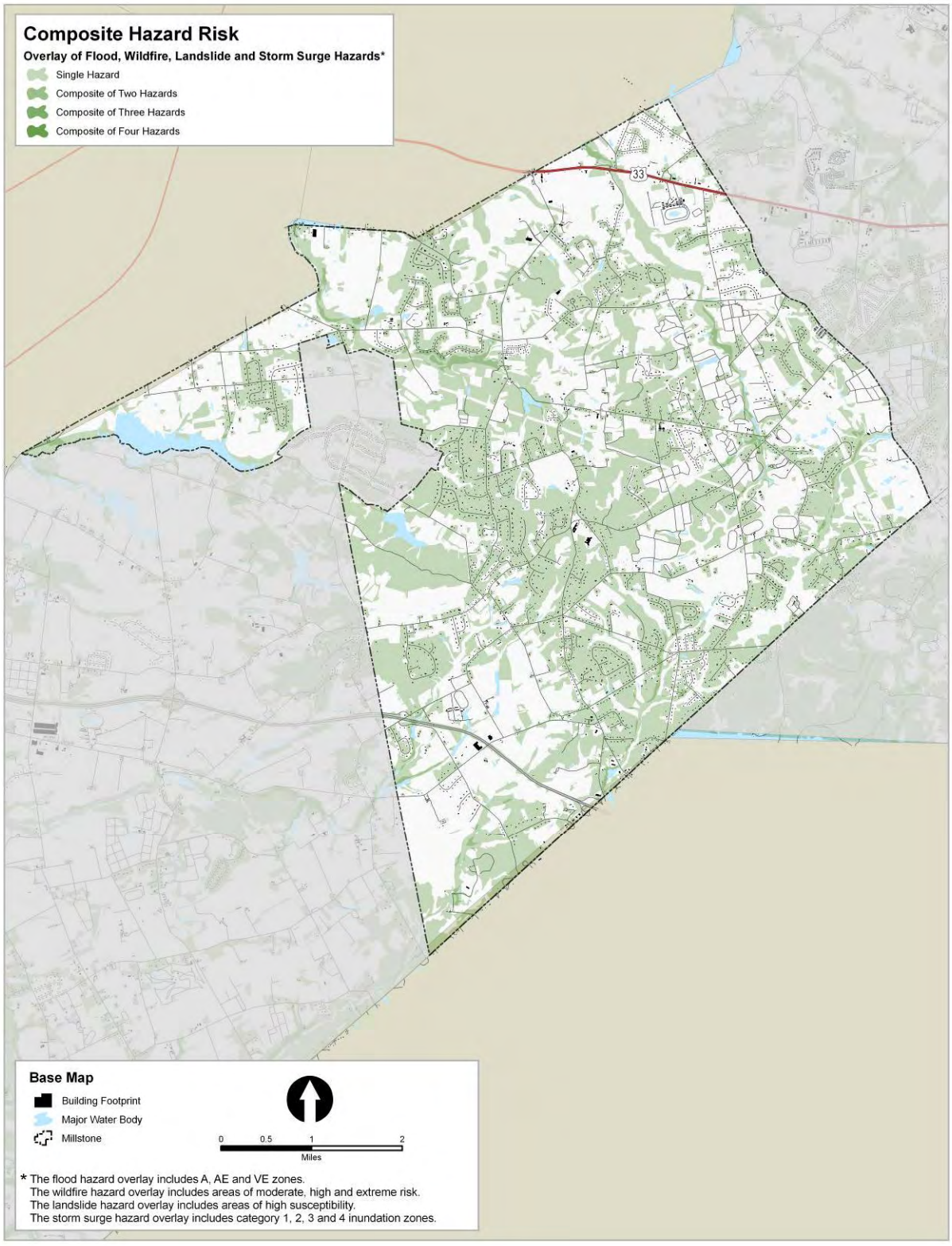


Figure 3c.39
Monmouth Beach Composite Map of Vulnerability

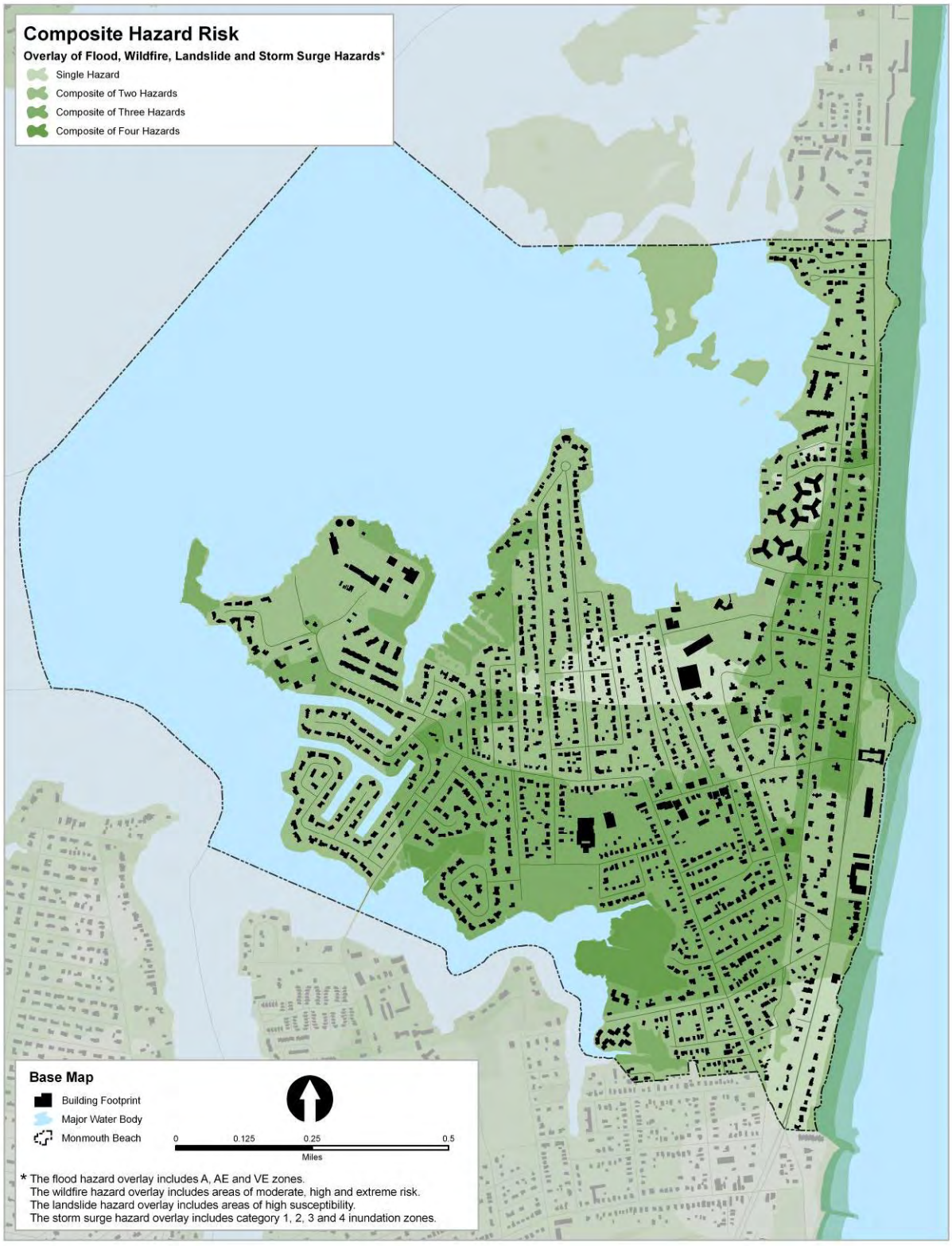


Figure 3c.40
Neptune City Composite Map of Vulnerability

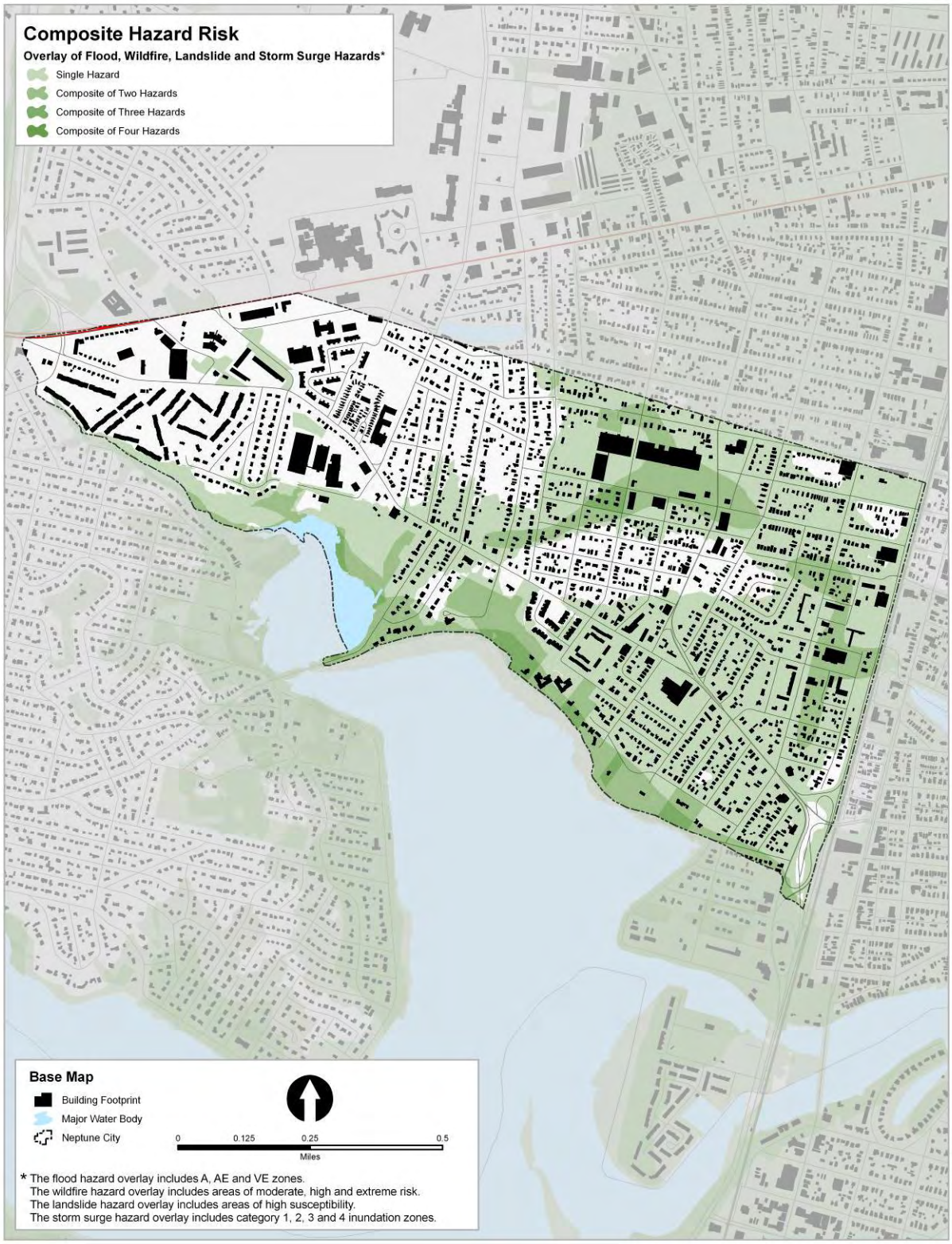


Figure 3c.41
Neptune Composite Map of Vulnerability

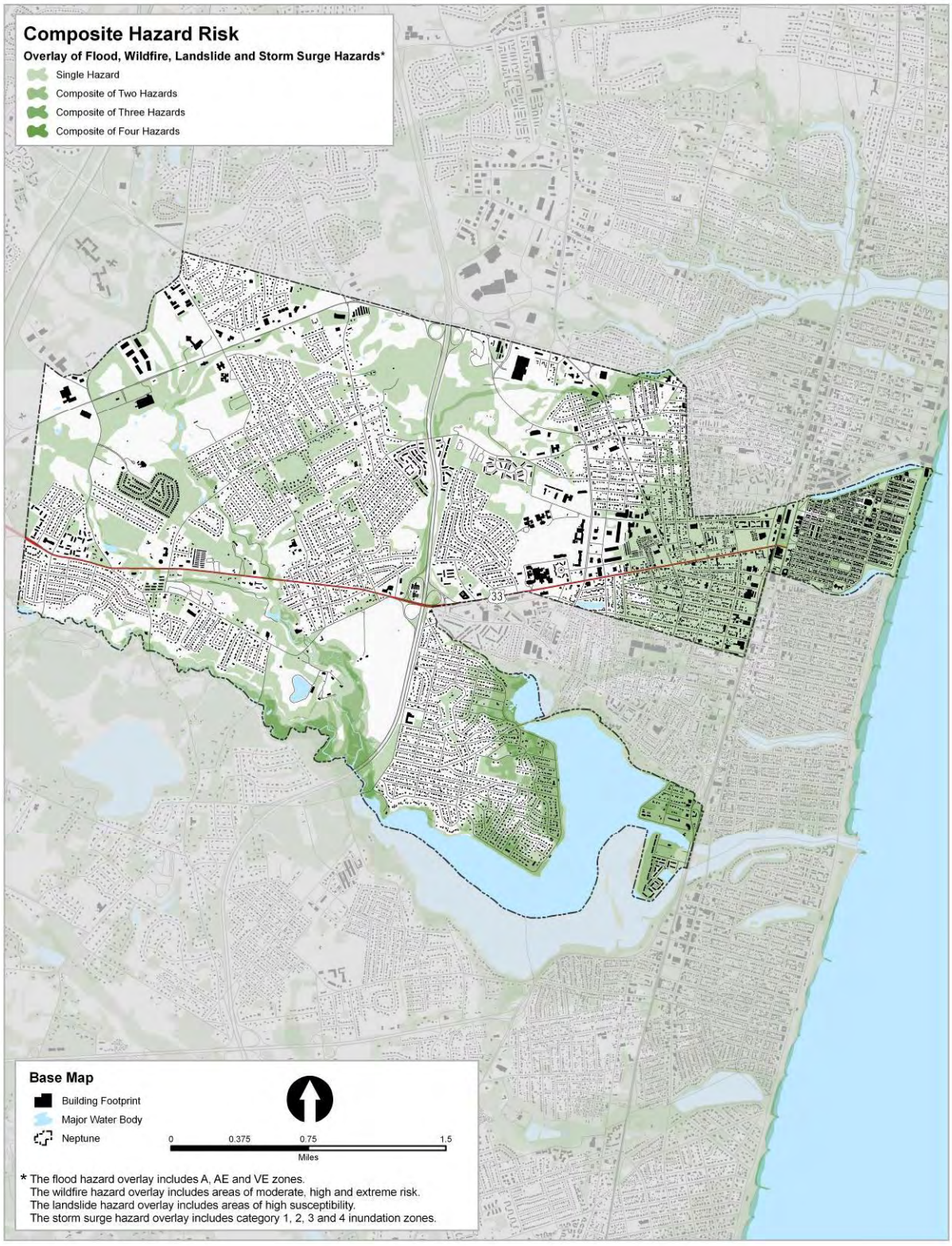


Figure 3c.42
Ocean Composite Map of Vulnerability

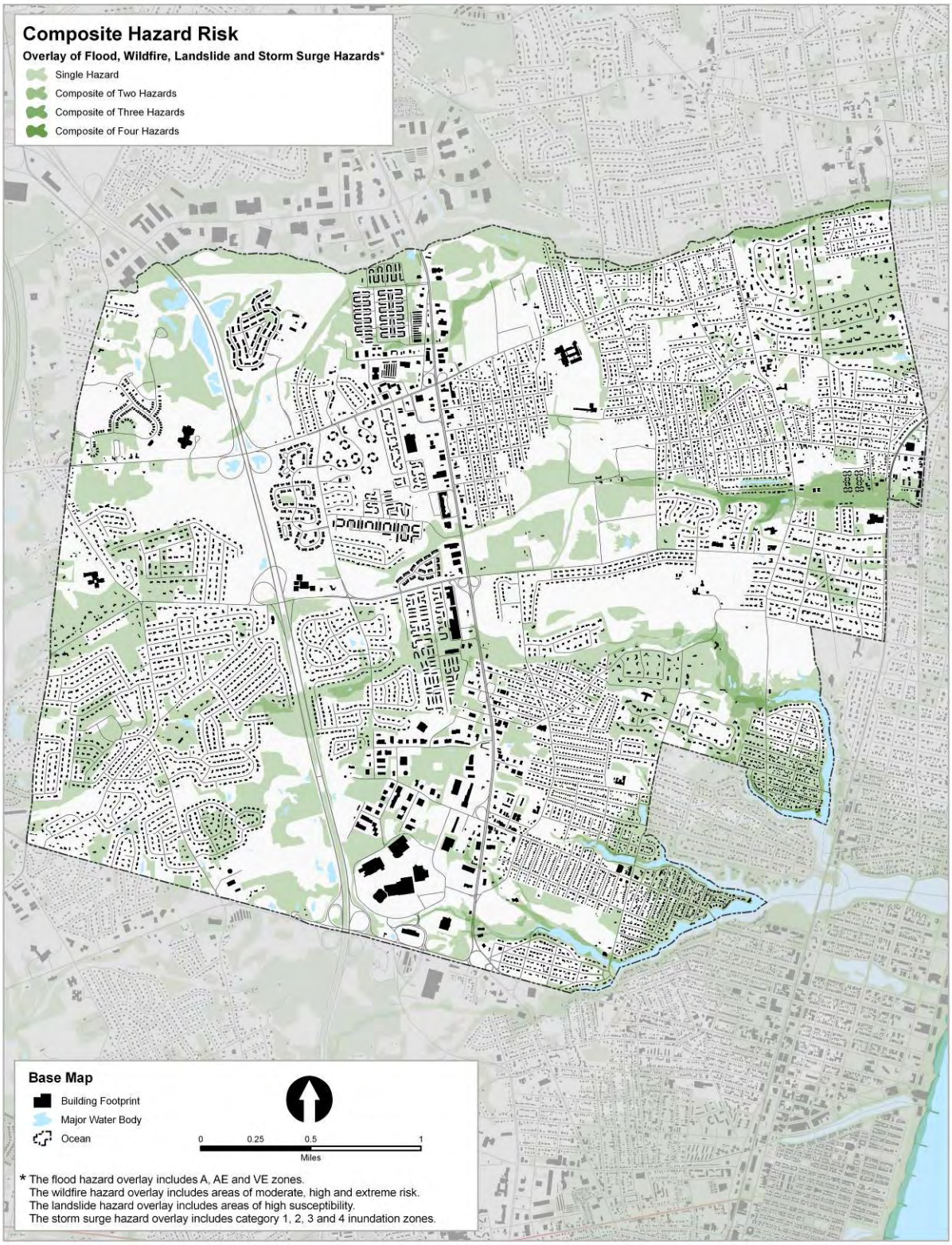


Figure 3c.43
Oceanport Composite Map of Vulnerability

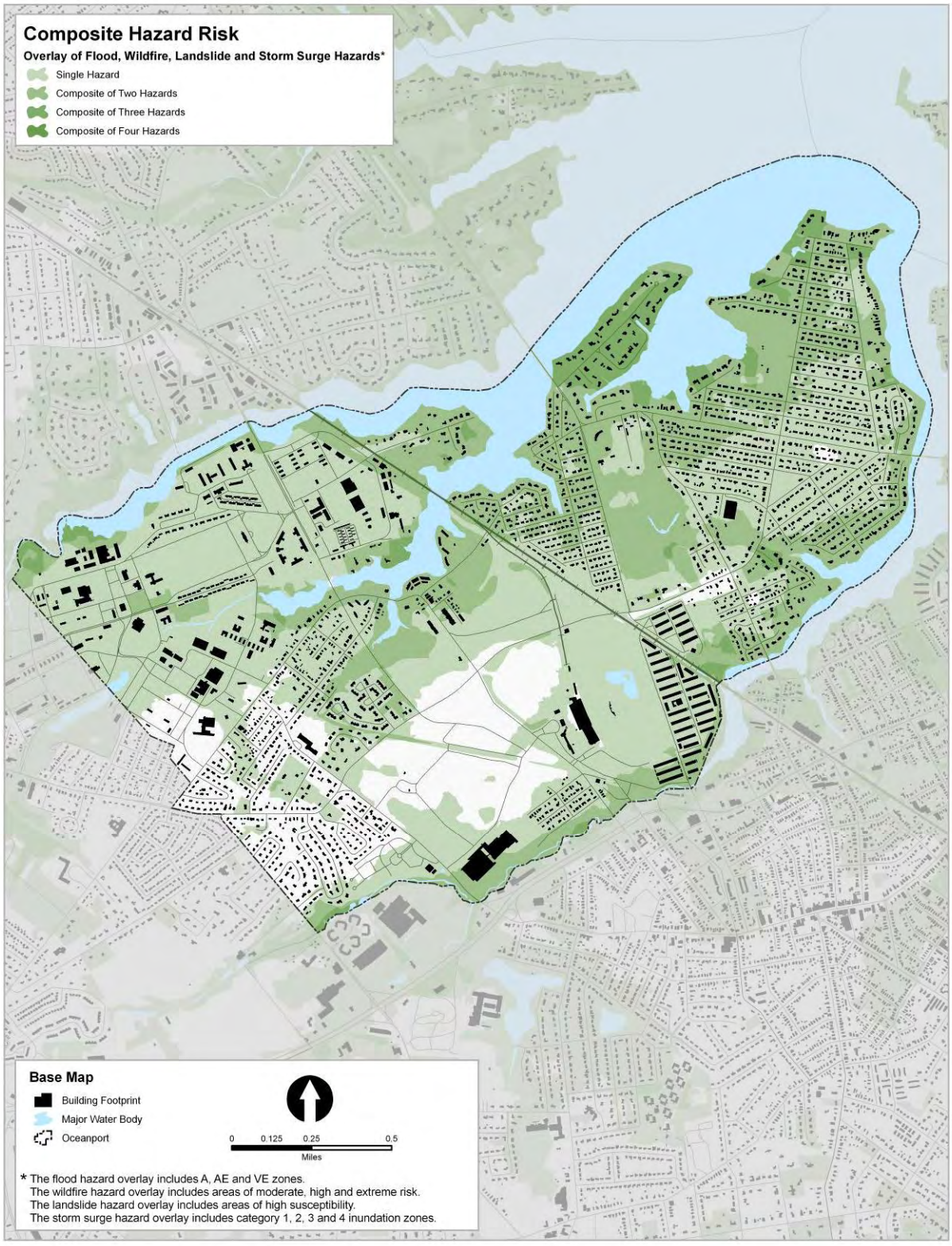


Figure 3c.44
Red Bank Composite Map of Vulnerability

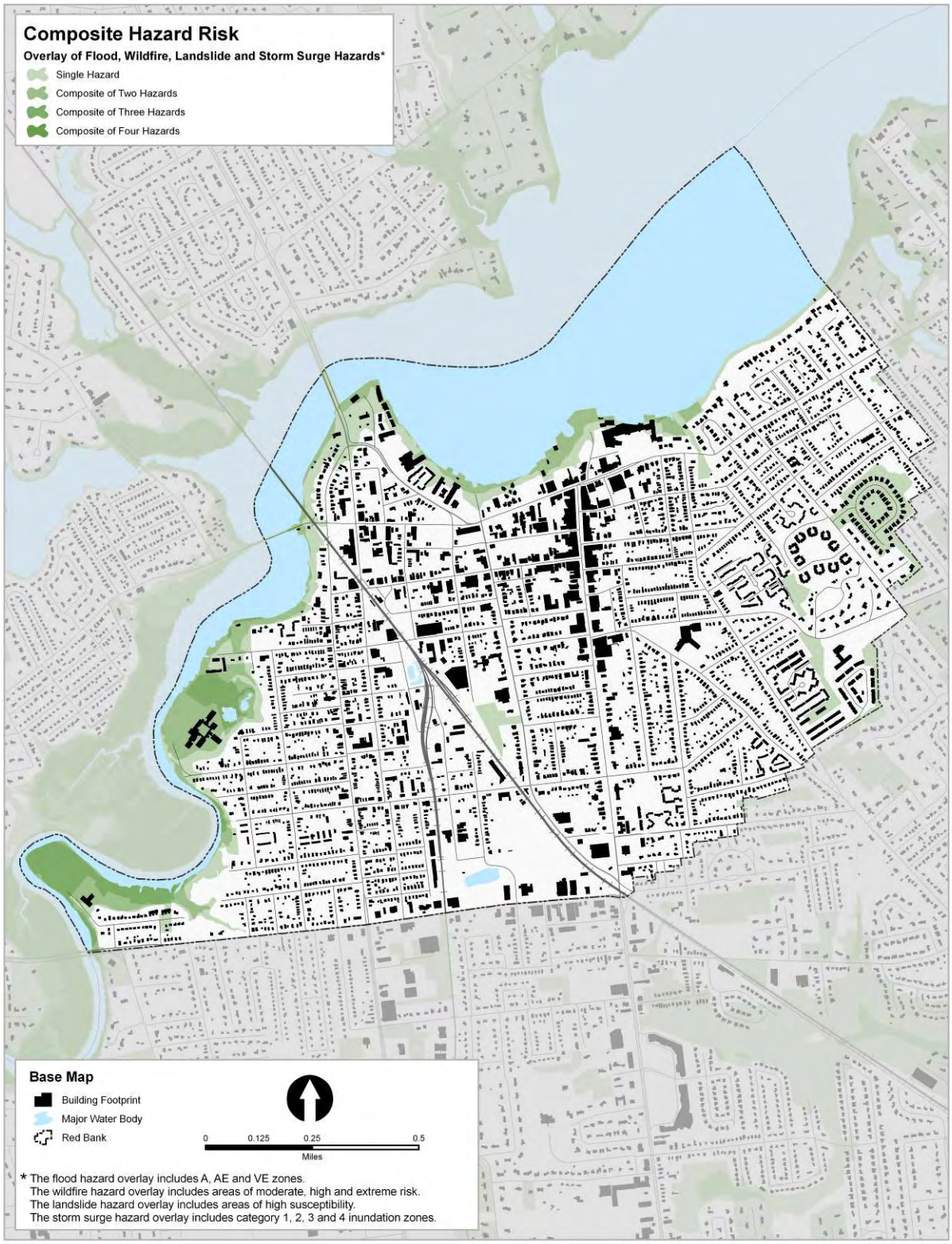


Figure 3c.45
Roosevelt Composite Map of Vulnerability

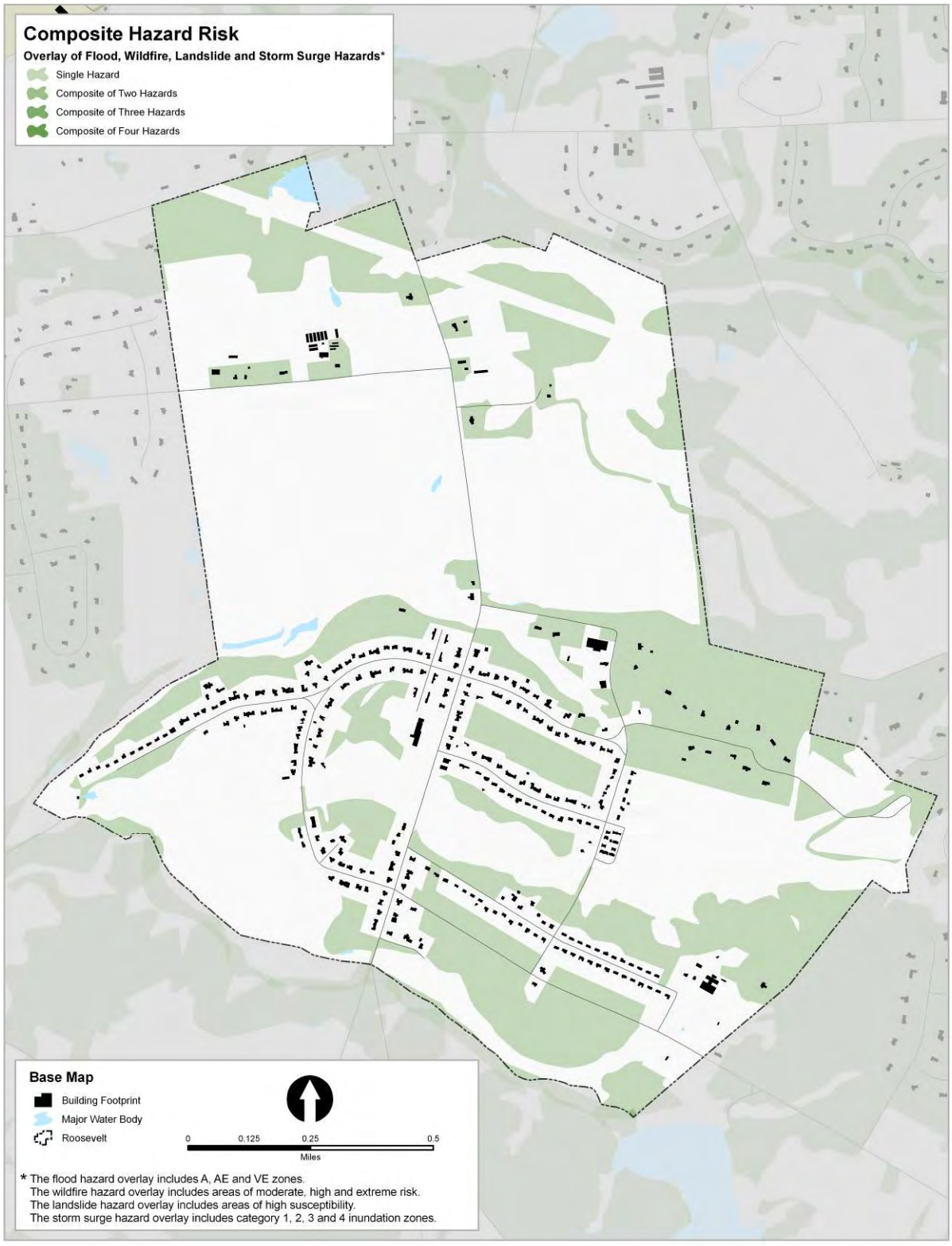


Figure 3c.46
Rumson Composite Map of Vulnerability

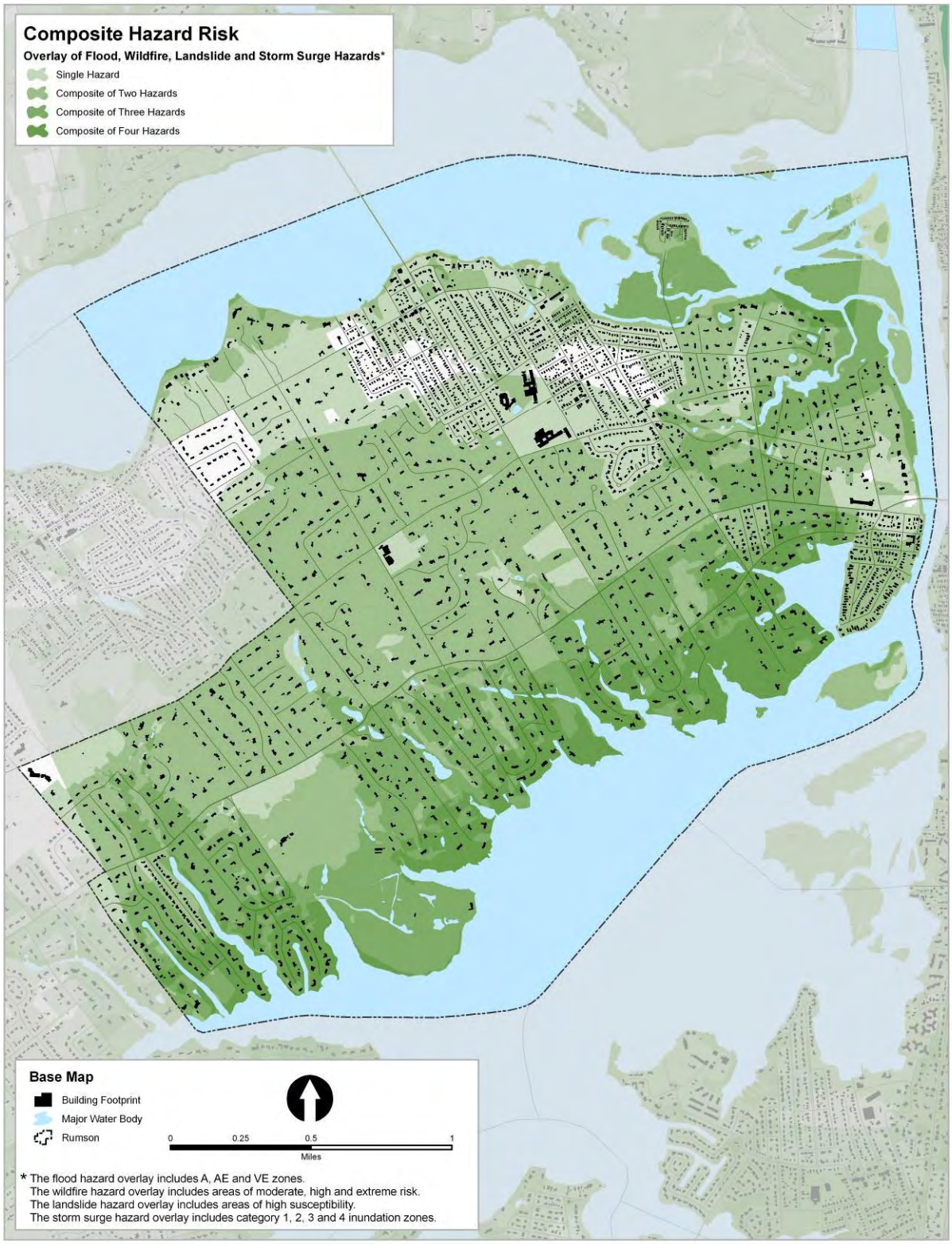


Figure 3c.47
Sea Bright Composite Map of Vulnerability

Figure 3c.48
Sea Girt Composite Map of Vulnerability

Figure 3c.49
Shrewsbury Borough Composite Map of Vulnerability

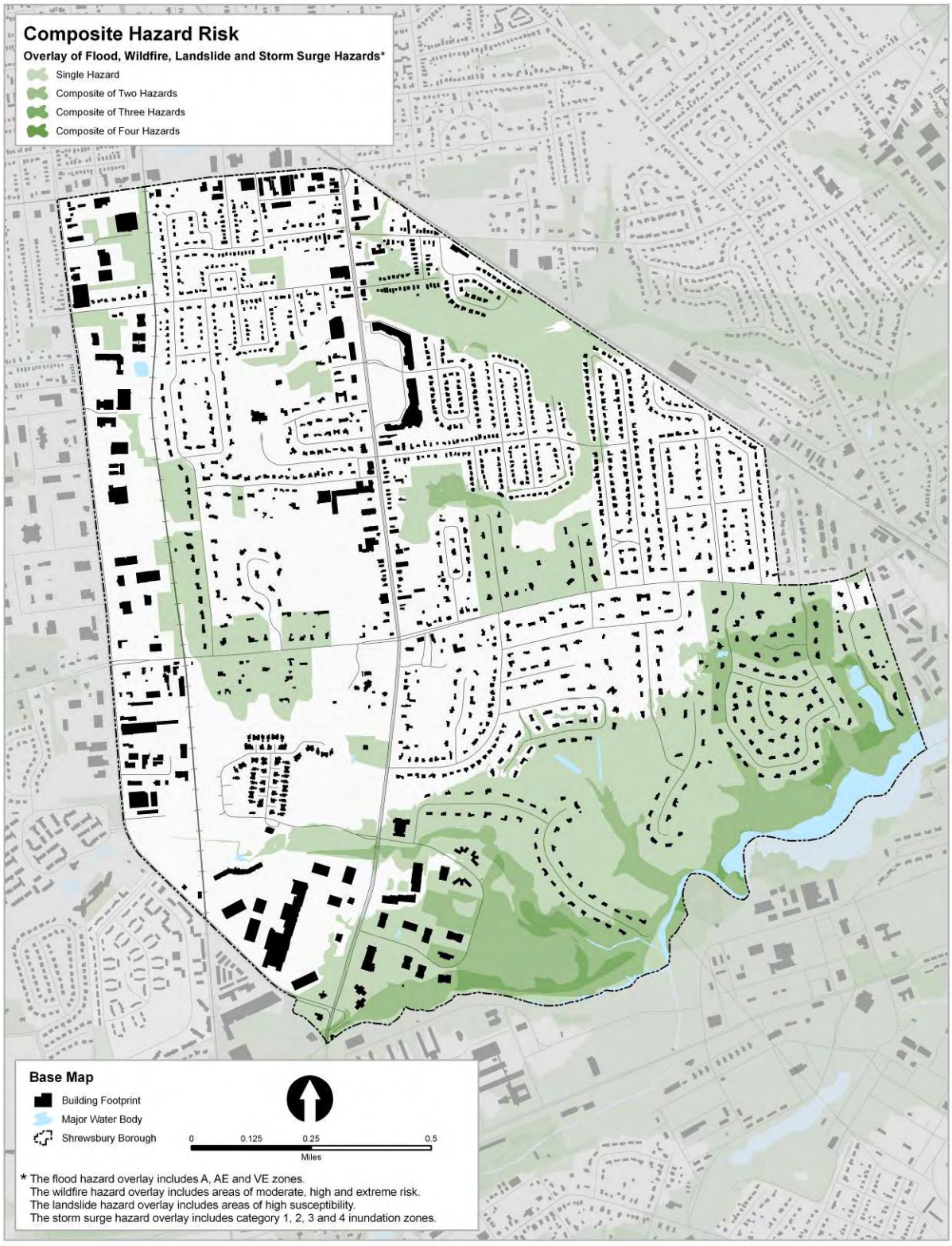


Figure 3c.50
Shrewsbury Township Composite Map of Vulnerability

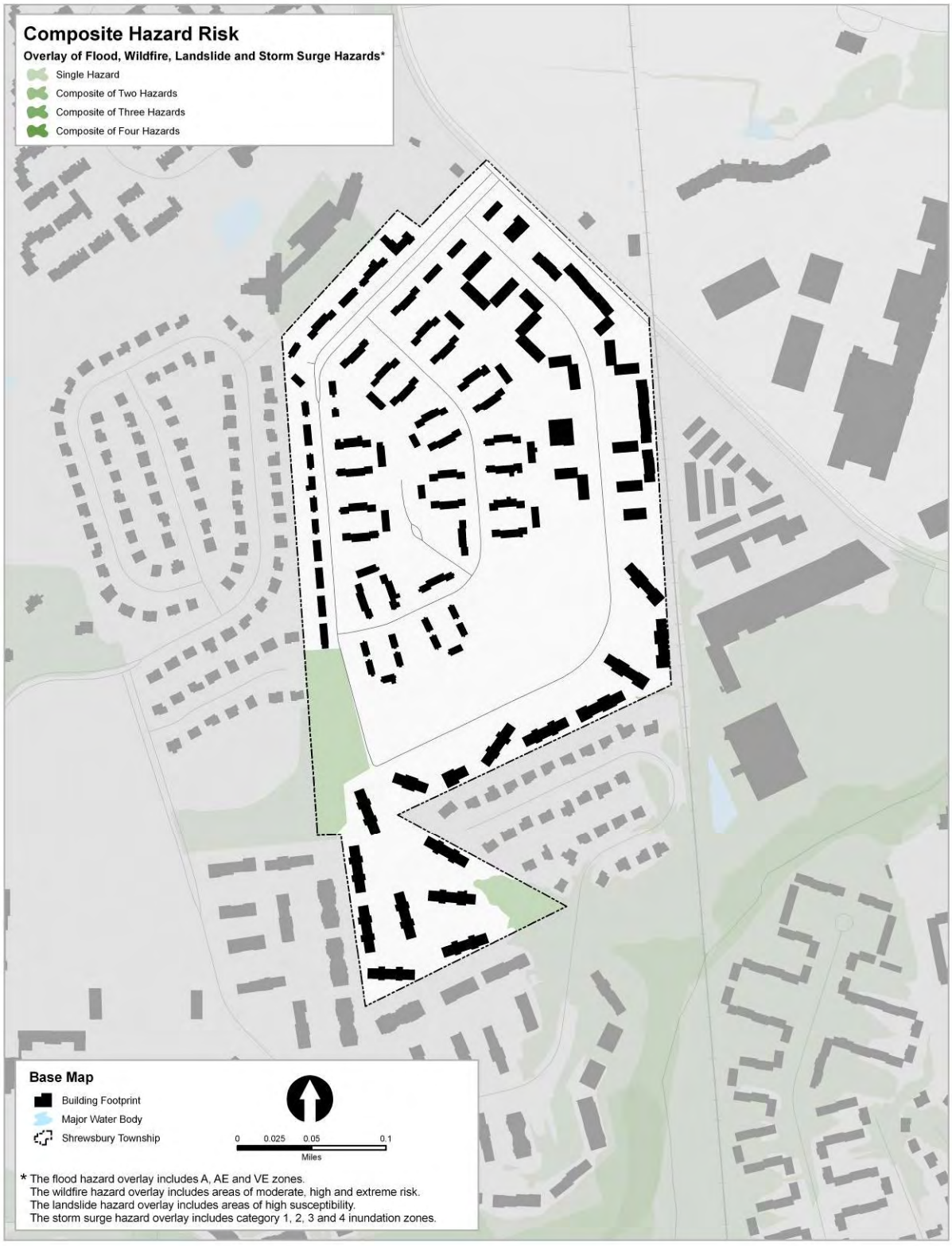


Figure 3c.51
Spring Lake Composite Map of Vulnerability

Figure 3c.52
Spring Lake Heights Composite Map of Vulnerability

Figure 3c.53
Tinton Falls Composite Map of Vulnerability

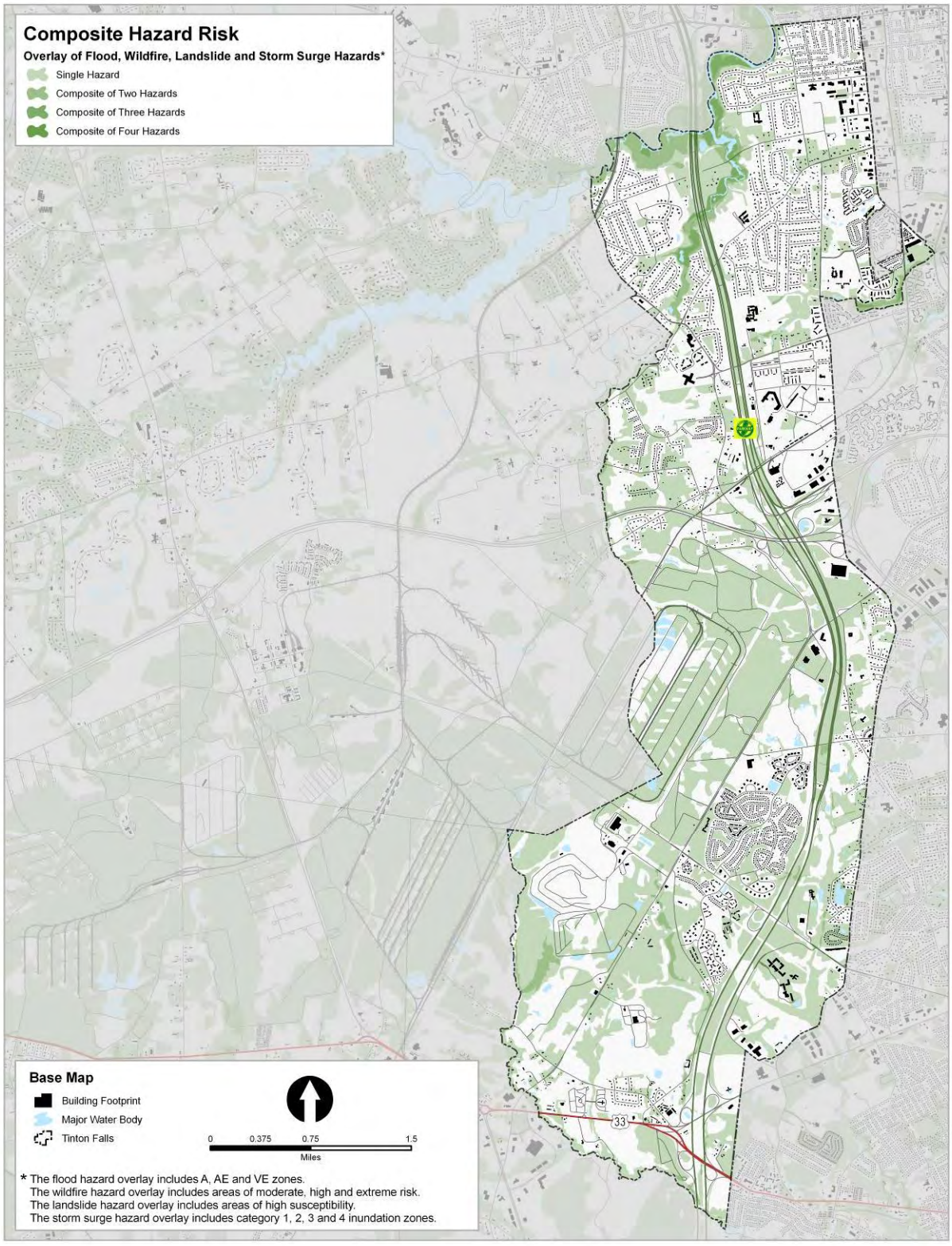


Figure 3c.54
Union Beach Composite Map of Vulnerability

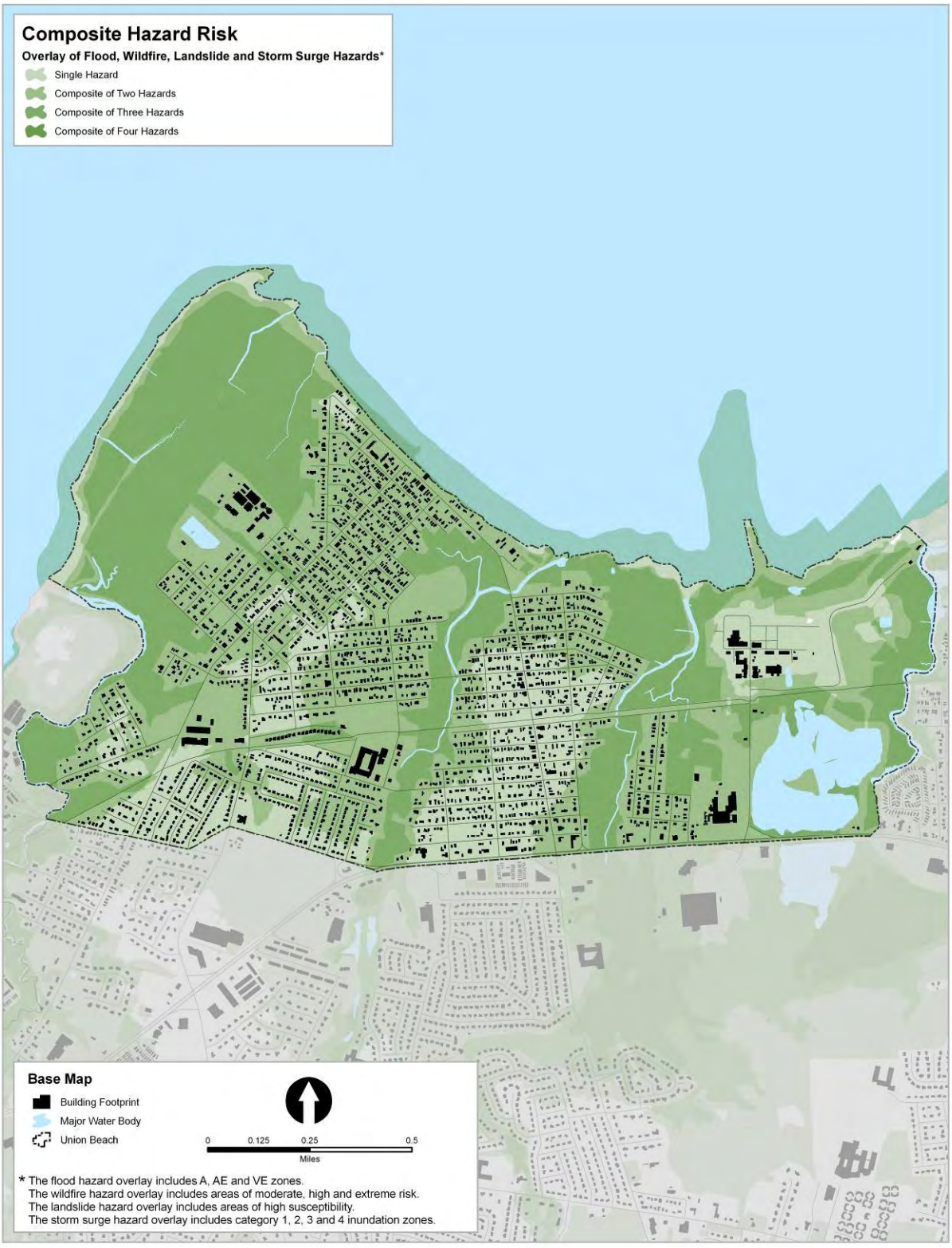


Figure 3c.55
Upper Freehold Composite Map of Vulnerability

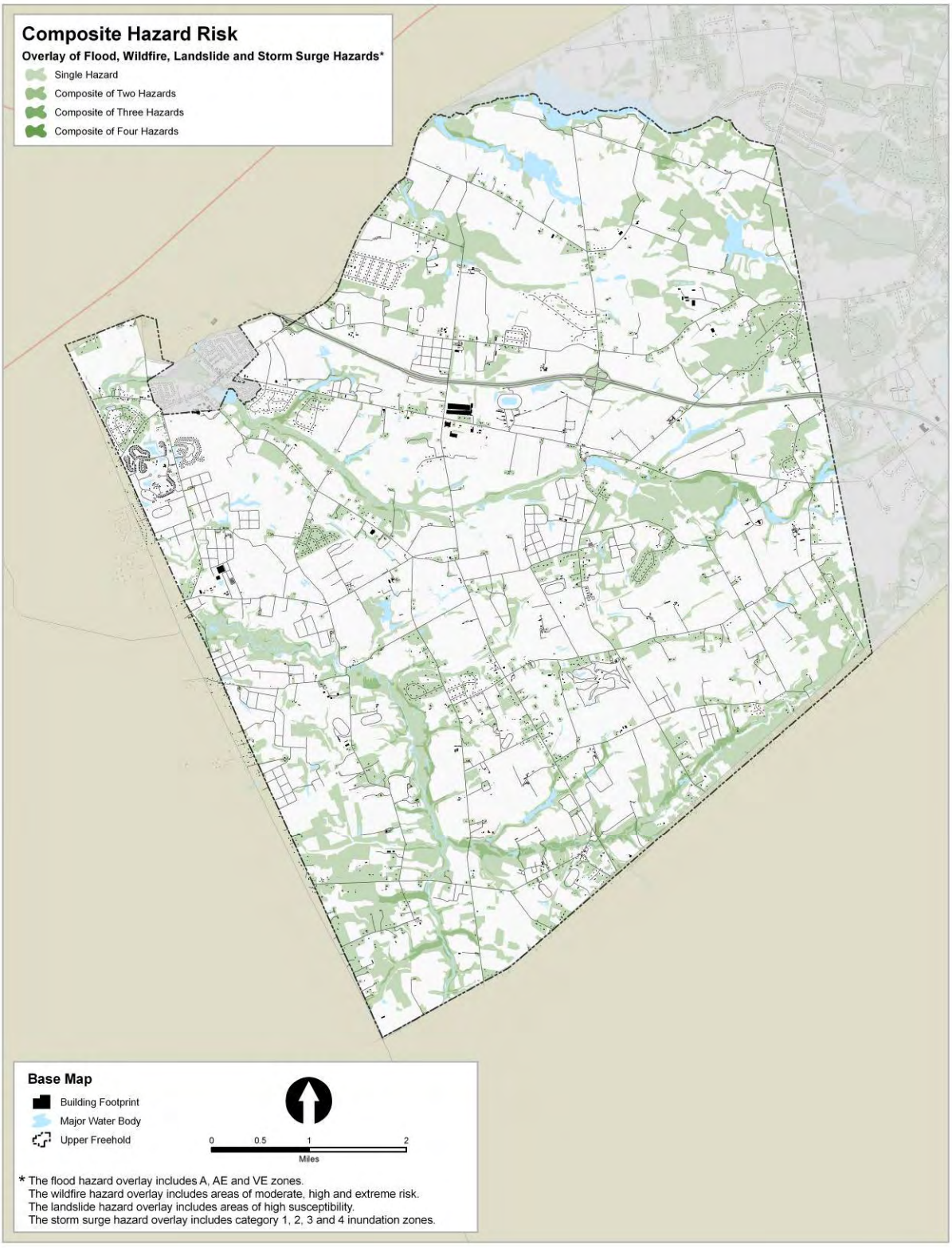


Figure 3c.56
Wall Composite Map of Vulnerability

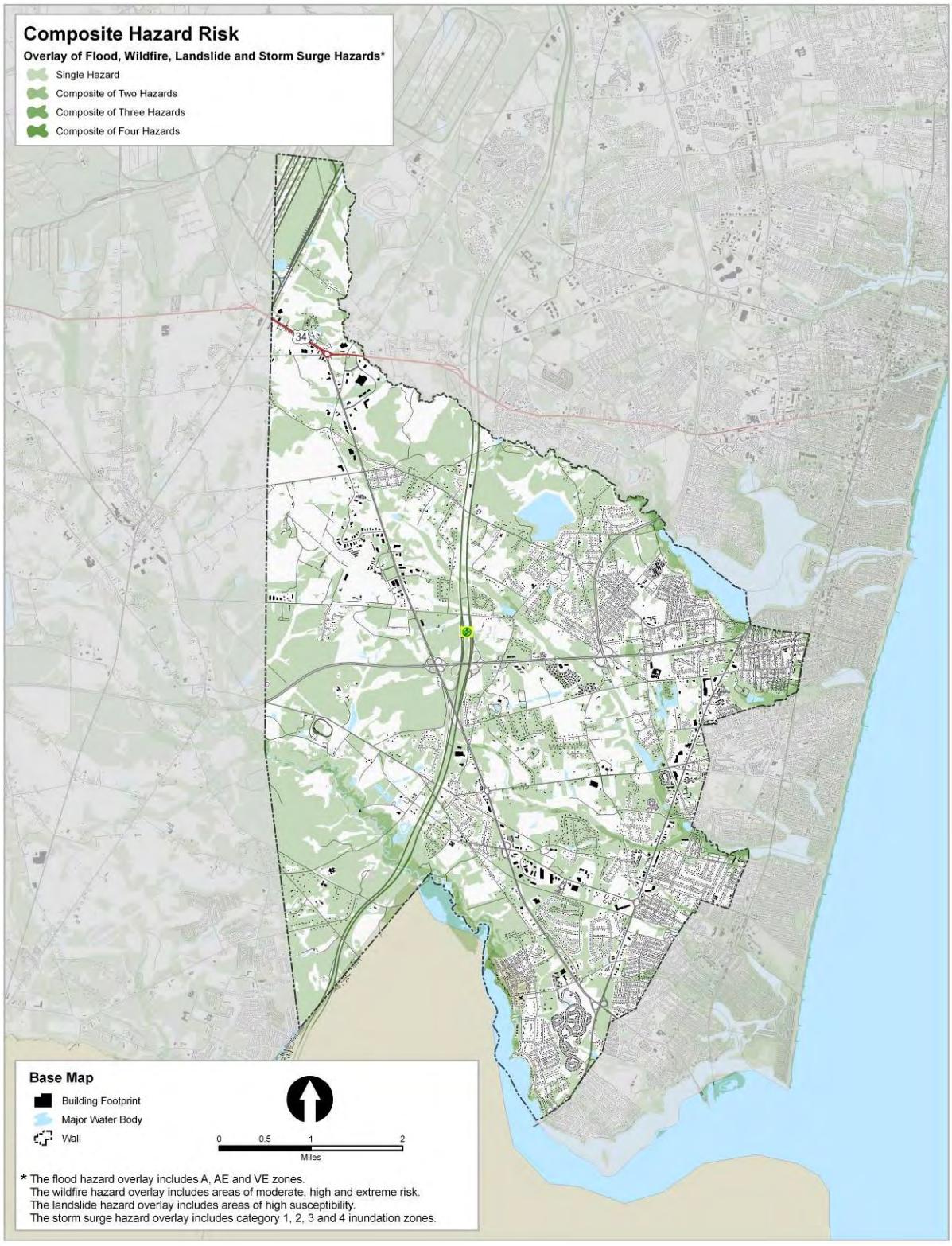
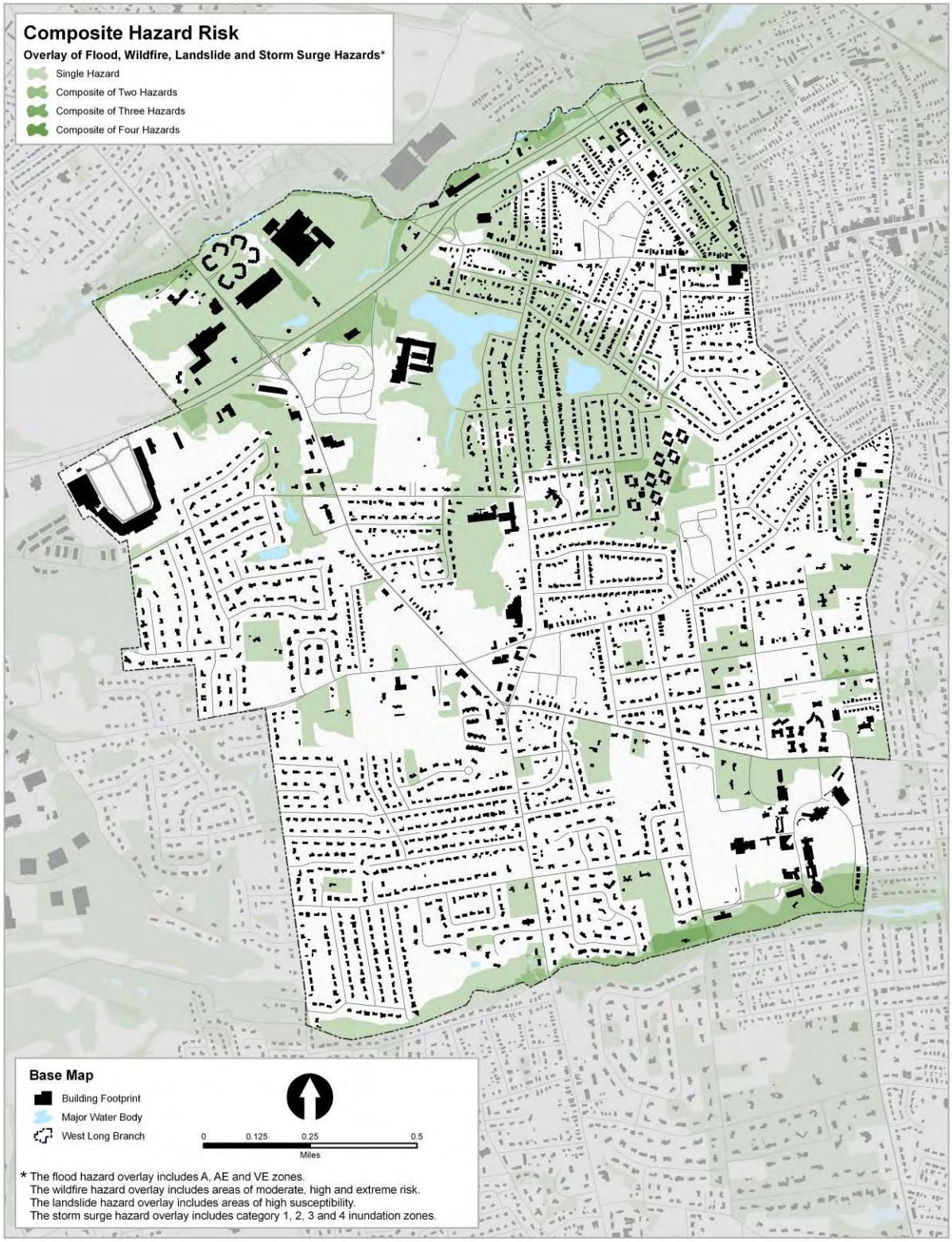


Figure 3c.57
West Long Branch Composite Map of Vulnerability



Hazard rating depends on the severity, area of impact, and probability of occurrence (return period). **Table 3c.29** provides the hazard rating by jurisdiction for each hazard. For each jurisdiction, each hazard was given a rating of high (H), moderate (M), low (L), or not applicable (N/A) based on how vulnerable they are to that hazard or how probable that hazard is to impact the jurisdiction. The rating is based on a combination of factors such as population and building exposure, or annualized loss (or ALRs) when available. The rating of N/A was used if the results for loss or potential impacts were zero.

Table 3c.29
Hazard Risk Rating by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Aberdeen, Township of	L	H	H	L	H	M	H	L	N/A	L	L	M	M	L	N/A	L
Allenhurst, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	H	M	L	N/A	L
Allentown, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	N/A	N/A	L	N/A	M
Asbury Park, City of	L	H	H	L	H	M	H	M	N/A	L	L	M	N/A	L	N/A	L
Atlantic Highlands, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	M	M	L	M	L
Avon-By-The-Sea, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	M	N/A	L	N/A	L
Belmar, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	M	N/A	L	N/A	L
Bradley Beach, Borough of	L	H	H	L	H	M	H	L	N/A	L	L	M	N/A	L	N/A	L
Brielle, Borough of	L	H	H	L	H	M	H	L	N/A	L	L	M	N/A	L	N/A	L
Colts Neck, Township of	L	H	H	L	H	M	H	N/A	L	L	H	N/A	N/A	L	N/A	H
Deal, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	L	M	L	N/A	H
Eatontown, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	M	N/A	L	N/A	H
Englishtown, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	H	N/A	M	L	N/A	M
Fair Haven, Borough of	L	H	H	L	H	M	H	L	N/A	L	L	L	N/A	L	M	M
Farmingdale, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	M	N/A	N/A	L	N/A	L
Freehold, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	N/A	N/A	L	N/A	L
Freehold, Township of	L	H	H	L	H	M	H	N/A	N/A	L	H	N/A	N/A	L	N/A	H
Hazlet, Township of	L	H	H	L	H	M	H	N/A	N/A	L	L	M	N/A	L	N/A	L
Highlands, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	H	N/A	L	M	L
Holmdel, Township of	L	H	H	L	H	M	H	N/A	N/A	L	H	L	N/A	L	N/A	H
Howell, Township of	L	H	H	L	H	M	H	N/A	L	L	H	L	N/A	L	N/A	H
Interlaken, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	L	N/A	L	N/A	L
Keansburg, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	M	H	N/A	L	N/A	L
Keyport, Borough of	L	H	H	L	H	M	H	M	N/A	L	M	H	M	L	N/A	L
Lake Como, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	M	N/A	L	N/A	L
Little Silver, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	L	M	L	L	M
Loch Arbour, Village of	L	H	H	L	H	M	H	M	N/A	L	L	M	M	L	N/A	N/A
Long Branch, City of	L	H	H	L	H	M	H	M	N/A	L	L	M	M	L	L	L
Manalapan, Township of	L	H	H	L	H	M	H	N/A	N/A	L	M	N/A	N/A	L	N/A	M
Manasquan, Borough of	L	H	H	L	H	M	H	L	N/A	L	L	H	M	L	N/A	L
Marlboro, Township of	L	H	H	L	H	M	H	N/A	N/A	L	M	N/A	N/A	L	N/A	H
Matawan, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	H	L	N/A	L	N/A	L
Middletown, Township of	L	H	H	L	H	M	H	M	L	L	M	M	M	L	L	M
Millstone, Township of	L	H	H	L	H	M	H	N/A	N/A	L	H	N/A	N/A	L	N/A	H
Monmouth Beach, Borough of	L	H	H	L	H	M	H	H	N/A	L	L	M	M	L	H	L
Neptune City, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	M	N/A	L	N/A	L
Neptune, Township of	L	H	H	L	H	M	H	L	L	L	M	M	M	L	N/A	L

Table 3c.29
Hazard Risk Rating by Jurisdiction

Jurisdiction	Extreme Temps	Extreme Wind	Hurricane & Trop. Storm	Lightning	Nor'easter	Tornado	Winter Storm	Coastal Erosion	Dam Failure	Drought	Flood	Storm Surge	Wave Action	Earthquake	Landslide	Wildfire
Ocean, Township of	L	H	H	L	H	M	H	N/A	N/A	L	L	M	N/A	L	N/A	M
Oceanport, Borough of	L	H	H	L	H	M	H	M	N/A	L	M	M	N/A	L	N/A	M
Red Bank, Borough of	L	H	H	L	H	M	H	L	N/A	L	M	M	N/A	L	N/A	L
Roosevelt, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	N/A	N/A	N/A	L	N/A	M
Rumson, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	M	M	L	H	H
Sea Bright, Borough of	L	H	H	L	H	M	H	H	N/A	L	L	H	M	L	N/A	M
Sea Girt, Borough of	L	H	H	L	H	M	H	H	N/A	L	L	L	N/A	L	N/A	L
Shrewsbury, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	L	N/A	L	N/A	M
Shrewsbury, Township of	L	H	H	L	H	M	H	N/A	N/A	L	N/A	N/A	N/A	L	N/A	N/A
Spring Lake, Borough of	L	H	H	L	H	M	H	L	N/A	L	L	M	M	L	N/A	L
Spring Lake Heights, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	M	N/A	L	N/A	L
Tinton Falls, Borough of	L	H	H	L	H	M	H	N/A	L	L	H	L	N/A	L	N/A	H
Union Beach, Borough of	L	H	H	L	H	M	H	M	N/A	L	L	H	M	L	N/A	M
Upper Freehold, Township of	L	H	H	L	H	M	H	N/A	N/A	L	L	N/A	N/A	L	N/A	H
Wall, Township of	L	H	H	L	H	M	H	L	L	L	M	M	N/A	L	N/A	H
West Long Branch, Borough of	L	H	H	L	H	M	H	N/A	N/A	L	L	L	N/A	L	N/A	M
Monmouth County Overall	**L**	**H**	**H**	**L**	**H**	**M**	**H**	**M**	**L**	**L**	**H**	**M**	**M**	**L**	**M**	**M**

Four hazards are rated as high hazards for all jurisdictions: extreme wind, hurricane and tropical storms, norôeasters and winter storms. Four hazards are rated as low hazards for all jurisdictions: extreme temperatures, lightning, drought and earthquake.

For the coastal erosion hazard, three of the jurisdictions exposed to coastal erosion have a high rating for this hazard: Borough of Monmouth Beach, Borough of Sea Bright and Borough of Sea Girt. For the landslide hazard, two of the jurisdictions with high landslide susceptibility areas have a high rating for this hazard: Borough of Monmouth Beach and Borough of Rumson.

For the flood hazard, eight jurisdictions which are exposed to riverine flooding have a high hazard rating: Township of Colts Neck, Borough of Englishtown, Township of Freehold, Township of Holmdel, Township of Howell, Borough of Matawan, Township of Millstone and Borough of Tinton Falls. For the storm surge hazard, seven jurisdictions exposed to storm surge have a high hazard rating: Borough of Allenhurst, Borough of Highlands, Borough of Keansburg, Borough of Keyport, Borough of Manasquan, Borough of Sea Bright and Borough of Union Beach.

Twelve jurisdictions have a high hazard rating for wildfire: Township of Colts Neck, Borough of Deal, Borough of Eatontown, Township of Freehold, Township of Holmdel, Township of Howell, Township of Marlboro, Township of Millstone, Borough of Rumson, Borough of Tinton Falls, Township of Upper Freehold and Township of Wall.

Overall, the highest rated hazards are norôeaster, flood, extreme wind, hurricane and tropical storm, and winter storm.

Land Use and Development Trends

Monmouth County has a total land area of 472 square miles. While much of this land has already been developed, particularly in the eastern coastal areas as well as along major thoroughfares including Route 9 and Route 33, there remains a large amount of land that currently remains free from development. In order to better understand how and where future land use and development trends might affect hazard vulnerability, it is useful to consider several factors including:

- Population Growth
- Vacant Land
- Protected Open Space
- Potential for Future Development in Identified Key Hazard Areas
- Current County Planning and Growth Management Efforts
- Municipal Land Use and Development Patterns

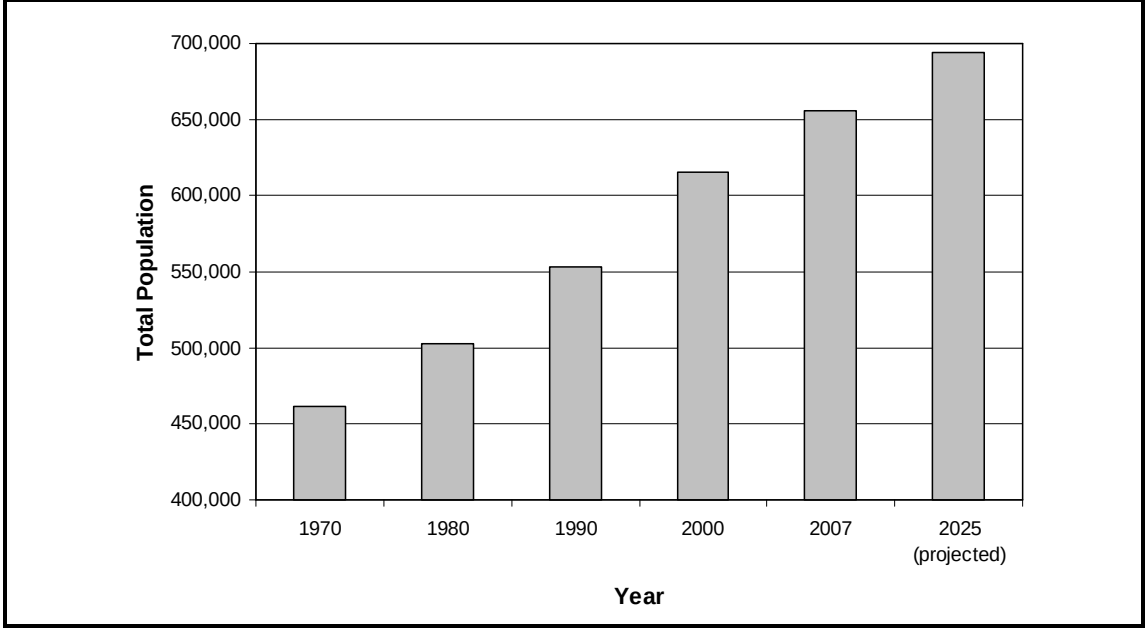
This section includes a brief description of these factors for Monmouth County and its participating municipal jurisdictions, along with some general analysis on potential implications of future growth and development with regard to hazard vulnerability. This information is provided so that hazard mitigation practices and principles will continue to be an element of consideration in the local decision making process for regulating land use and new development in Monmouth County.

Population Growth

Figure 3d.1 illustrates the historic and projected population growth in Monmouth County from 1970 to 2025.

Over the past four decades, Monmouth County has become increasingly more developed and suburbanized as population growth increased dramatically. According to the U.S. Census Bureau, the countyôs total population in 1970 was 461,849 and increased to 615,301 in 2000 (a 33.2 percent increase).

Figure 3d.1
Historic and Projected Population Growth for Monmouth County, 1970-2025



Source: U.S. Census Bureau; Monmouth County Planning Board

This number has since increased another 6.6 percent to an estimated 655,674 in 2007. According to current estimates, the county's population in 2025 is projected to be nearly 695,000 (a further 5.9 percent increase).

As population increases it can be safely assumed that more residential and commercial buildings, infrastructure, public facilities and other assets will be constructed to support such growth, likely increasing a jurisdiction's overall exposure to natural hazards. Therefore, population growth is considered a general indicator of potential future hazard vulnerability. **Table 3d.1** lists the current estimated population (2007) along with the projected 2025 population counts and densities for each of Monmouth County's municipal jurisdictions. According to the data, the following jurisdictions are projected to experience the highest growth rates during this period: Township of Millstone (26 percent), Borough of Englishtown (24.1 percent), Township of Howell (22.3 percent), City of Asbury Park (21.6 percent), Borough of Tinton Falls (17.1 percent), Borough of Roosevelt (15.2 percent), Township of Neptune (14.3 percent), Township of Holmdel (13.5 percent) and Borough of Sea Bright (12.7 percent). All of the remaining jurisdictions are anticipated to experience growth rates of less than 7 percent during this period.

Table 3d.1
Projected Population Count and Densities by Jurisdiction

Jurisdiction	Population 2000 (US Census)	Population 2007 (Estimate)	Population 2025 (Projected)	Number Change	Percent Change	Density 2025 (Projected per/sq. mi.)
Aberdeen, Township of	17,454	18,848	18,866	18	0.1%	3,462
Allenhurst, Borough of	599	716	733	17	2.4%	2,443
Allentown, Borough of	1,882	1,892	1,980	88	4.6%	3,300
Asbury Park, City of	16,930	16,862	20,500	3,638	21.6%	13,667
Atlantic Highlands, Borough of	4,705	4,717	4,719	2	0.0%	3,933
Avon-By-The-Sea, Borough of	2,244	2,219	2,244	25	1.1%	5,610
Belmar, Borough of	6,045	6,029	6,048	19	0.3%	6,048
Bradley Beach, Borough of	4,793	4,940	4,793	-147	-3.0%	6,847
Brielle, Borough of	4,893	4,972	5,227	255	5.1%	3,168
Colts Neck, Township of	12,331	11,956	12,447	491	4.1%	393
Deal, Borough of	1,070	1,060	1,132	72	6.8%	943
Eatontown, Borough of	13,964	14,381	14,458	77	0.5%	2,493
Englishtown, Borough of	1,764	1,933	2,399	466	24.1%	4,209
Fair Haven, Borough of	5,937	6,021	6,095	74	1.2%	3,932
Farmingdale, Borough of	1,587	1,604	1,602	-2	-0.2%	3,204
Freehold, Borough of	10,976	11,681	11,335	-346	-3.0%	5,966
Freehold, Township of	31,537	35,575	36,377	802	2.3%	983
Hazlet, Township of	21,378	21,470	21,590	120	0.6%	3,855
Highlands, Borough of	5,097	5,179	5,168	-11	-0.2%	8,075
Holmdel, Township of	15,781	17,271	19,608	2,337	13.5%	1,095
Howell, Township of	48,903	52,400	64,078	11,678	22.3%	1,032
Interlaken, Borough of	900	900	908	8	0.9%	2,389
Keansburg, Borough of	10,426	10,772	10,848	76	0.7%	11,419
Keyport, Borough of	7,568	7,638	7,637	-1	0.0%	5,455
Lake Como, Borough of	1,806	1,817	1,806	-11	-0.6%	9,030
Little Silver, Borough of	6,170	6,224	6,370	146	2.3%	2,275
Loch Arbour, Village of	399	280	280	0	0.0%	2,800

Table 3d.1
Projected Population Count and Densities by Jurisdiction

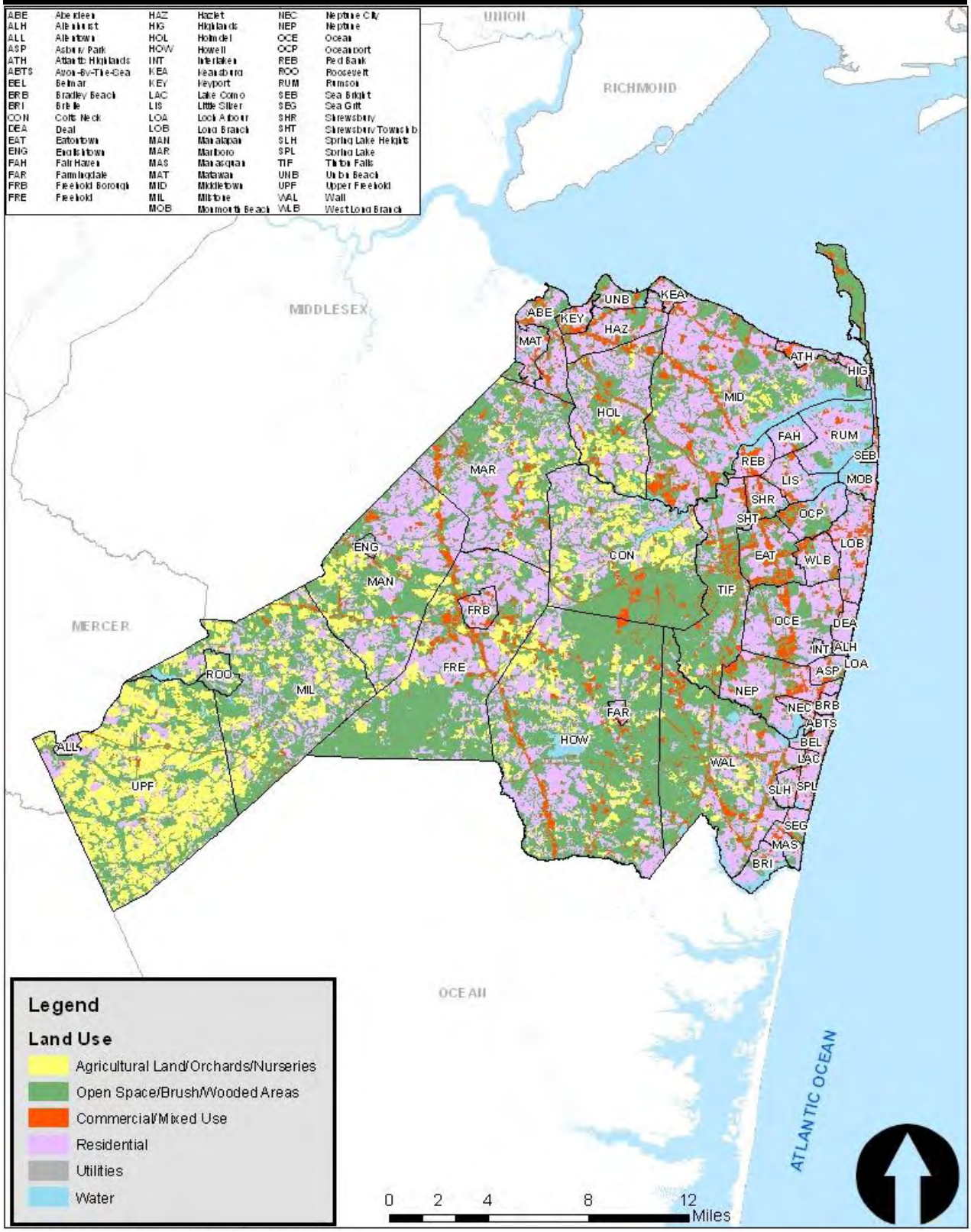
Jurisdiction	Population 2000 (US Census)	Population 2007 (Estimate)	Population 2025 (Projected)	Number Change	Percent Change	Density 2025 (Projected per/sq. mi.)
Long Branch, City of	31,340	33,066	34,106	1,040	3.1%	6,687
Manalapan, Township of	33,423	39,370	40,923	1,553	3.9%	1,327
Manasquan, Borough of	6,310	6,372	6,772	400	6.3%	4,837
Marlboro, Township of	36,398	41,535	41,991	456	1.1%	1,384
Matawan, Borough of	8,910	8,969	9,172	203	2.3%	4,058
Middletown, Township of	66,633	69,166	71,597	2,431	3.5%	1,743
Millstone, Township of	8,970	10,439	13,152	2,713	26.0%	352
Monmouth Beach, Borough of	3,595	3,655	3,744	89	2.4%	3,404
Neptune, Township of	5,218	29,055	33,215	4,160	14.3%	4,152
Neptune City, Borough of	27,690	5,258	5,447	189	3.6%	6,052
Ocean, Township of	26,959	28,884	29,216	332	1.2%	2,609
Oceanport, Borough of	5,834	5,868	6,108	240	4.1%	1,970
Red Bank, Borough of	11,844	12,124	12,306	182	1.5%	7,032
Roosevelt, Borough of	933	930	1,072	142	15.2%	555
Rumson, Borough of	7,137	7,365	7,275	-90	-1.2%	1,399
Sea Bright, Borough of	1,818	1,850	2,085	235	12.7%	3,475
Sea Girt, Borough of	2,148	2,068	2,148	80	3.9%	2,046
Shrewsbury, Borough of	3,590	3,825	3,781	-44	-1.1%	1,644
Shrewsbury, Township of	1,098	1,098	1,144	46	4.2%	12,711
Spring Lake, Borough of	3,567	3,574	3,661	87	2.4%	2,816
Spring Lake Heights, Borough of	5,227	5,227	5,367	140	2.7%	4,128
Tinton Falls, Borough of	15,070	17,641	20,659	3,018	17.1%	1,364
Union Beach, Borough of	6,649	6,788	7,046	258	3.8%	3,914
Upper Freehold, Township of	4,282	7,026	6,837	-189	-2.7%	144
Wall, Township of	25,261	26,891	27,575	684	2.5%	889
West Long Branch, Borough of	8,258	8,272	8,525	253	3.1%	3,012
Total	**615,301**	**655,674**	**694,189**	**38,515**	**5.9%**	**1,472**

Source: Monmouth County Planning Board

Existing Land Use

Generalized current Land Use as compiled from Monmouth County GIS records is presented graphically in Figure 3d.2 and tabulated by jurisdiction in Table 3d.2. The figure and table show that more than half the County is essentially undeveloped, since agricultural land, woodland, and open space combined account for 47% of the County land area. However, the majority of the municipalities in Monmouth County are considerably developed, with 35 out of 53 municipalities having 60% or more of their land areas covered by residential and commercial development. Of these, 16 have 75% or more covered by these land use categories, of which three (the Boroughs of Bradley Beach, Neptune City, and Lake Como) are more than 90% developed. At the opposite end of the spectrum, only four municipalities (the Townships of Howell, Millstone, and Upper Freehold, and the Borough of Roosevelt) are less than 25% developed. In all 53 municipalities, residential is the dominant developed land use category.

Figure 3d.2
Monmouth County Land Use



Source: Monmouth County GIS, Land Use, 2006

Table 3d.2
Monmouth County Land Use by Jurisdiction

Jurisdiction	Total Acreage	Commercial & Mixed Use		Agricultural, Orchards & Nurseries		Open Space, Woodland & Brush		Residential	
		Acres	%	Acres	%	Acres	%	Acres	%
Aberdeen, Township of	3,588	500	13.9%	14	0.4%	1314	36.6%	1653	46.1%
Allenhurst, Borough of	162	20	12.4%	0	0.0%	13	8.2%	123	75.5%
Allentown, Borough of	399	41	10.2%	11	2.8%	112	28.2%	217	54.6%
Asbury Park, City of	955	221	23.1%	0	0.0%	132	13.8%	545	57.1%
Atlantic Highlands, Borough of	782	135	17.2%	0	0.0%	141	18.0%	506	64.8%
Avon-By-The-Sea, Borough of	292	52	17.7%	0	0.0%	14	4.7%	196	67.0%
Belmar, Borough of	888	154	17.4%	0	0.0%	66	7.4%	448	50.4%
Bradley Beach, Borough of	382	74	19.2%	0	0.0%	19	4.9%	277	72.5%
Brielle, Borough of	1,521	91	5.9%	0	0.0%	259	17.1%	779	51.2%
Colts Neck, Township of	20,713	934	4.5%	3600	17.4%	10283	49.6%	5277	25.5%
Deal, Borough of	759	66	8.7%	0	0.0%	74	9.8%	614	80.9%
Eatontown, Borough of	3,765	968	25.7%	16	0.4%	1414	37.5%	1326	35.2%
Englishtown, Borough of	373	64	17.2%	9	2.5%	120	32.3%	165	44.1%
Fair Haven, Borough of	1,345	71	5.3%	0	0.0%	119	8.8%	839	62.4%
Farmingdale, Borough of	338	62	18.3%	10	3.1%	105	31.0%	161	47.6%
Freehold, Borough of	1,249	292	23.4%	2	0.1%	202	16.2%	753	60.3%
Freehold, Township of	24,673	1385	5.6%	2662	10.8%	13342	54.1%	7006	28.4%
Gateway National Recreation Area	1,763	172	9.8%	0	0.0%	1515	85.9%	12	0.7%
Hazlet, Township of	3,682	553	15.0%	16	0.4%	1133	30.8%	1926	52.3%
Highlands, Borough of	463	96	20.8%	0	0.0%	84	18.1%	281	60.7%
Holmdel, Township of	11,419	792	6.9%	1761	15.4%	4161	36.4%	4547	39.8%
Howell, Township of	39,425	2162	5.5%	4359	11.1%	22872	58.0%	8904	22.6%
Interlaken, Borough of	247	1	0.4%	0	0.0%	26	10.6%	186	75.2%
Keansburg, Borough of	748	99	13.2%	0	0.0%	133	17.8%	496	66.3%
Keyport, Borough of	937	234	24.9%	0	0.0%	234	24.9%	426	45.5%
Lake Como, Borough of	158	24	15.3%	0	0.0%	8	5.1%	119	75.1%
Little Silver, Borough of	2,133	206	9.7%	9	0.4%	289	13.6%	1239	58.1%
Loch Arbour, Village of	77	5	6.8%	0	0.0%	6	7.4%	44	57.3%
Long Branch, City of	3,408	566	16.6%	0	0.0%	361	10.6%	2299	67.5%
Manalapan, Township of	19,777	912	4.6%	3191	16.1%	8052	40.7%	7421	37.5%

Table 3d.2
Monmouth County Land Use by Jurisdiction

Jurisdiction	Total Acreage	Commercial & Mixed Use		Agricultural, Orchards & Nurseries		Open Space, Woodland & Brush		Residential	
		Acres	%	Acres	%	Acres	%	Acres	%
Manasquan, Borough of	983	135	13.7%	0	0.0%	184	18.7%	566	57.6%
Marlboro, Township of	19,676	1125	5.7%	1850	9.4%	8739	44.4%	7791	39.6%
Matawan, Borough of	1,510	173	11.5%	0	0.0%	372	24.6%	861	57.0%
Middletown, Township of	25,829	2409	9.3%	982	3.8%	9849	38.1%	11176	43.3%
Millstone, Township of	23,910	316	1.3%	6279	26.3%	11960	50.0%	4917	20.6%
Monmouth Beach, Borough of	1,243	90	7.2%	0	0.0%	71	5.7%	458	36.8%
Neptune City, Borough of	563	160	28.4%	0	0.0%	48	8.6%	355	63.1%
Neptune, Township of	5,642	860	15.2%	21	0.4%	1877	33.3%	2539	45.0%
Ocean, Township of	7,023	834	11.9%	24	0.3%	2443	34.8%	3614	51.5%
Oceanport, Borough of	2,431	306	12.6%	12	0.5%	857	35.2%	837	34.4%
Red Bank, Borough of	1,374	369	26.8%	0	0.0%	72	5.3%	658	47.9%
Roosevelt, Borough of	1,251	12	1.0%	323	25.8%	717	57.3%	196	15.6%
Rumson, Borough of	4,555	135	3.0%	15	0.3%	727	16.0%	2376	52.2%
Sea Bright, Borough of	651	100	15.4%	0	0.0%	120	18.5%	123	18.8%
Sea Girt, Borough of	675	95	14.1%	0	0.0%	169	25.0%	386	57.2%
Shrewsbury, Borough of	1,404	304	21.6%	12	0.9%	357	25.4%	703	50.1%
Shrewsbury, Township of	62	1	2.4%	0	0.0%	10	16.2%	51	81.4%
Spring Lake, Borough of	902	86	9.6%	0	0.0%	120	13.3%	616	68.3%
Spring Lake Heights, Borough of	840	68	8.1%	0	0.0%	252	30.1%	498	59.4%
Tinton Falls, Borough of	9,965	1240	12.4%	249	2.5%	5963	59.8%	2368	23.8%
Union Beach, Borough of	1,210	119	9.9%	0	0.0%	540	44.6%	477	39.4%
Upper Freehold, Township of	30,134	300	1.0%	16660	55.3%	9820	32.6%	2801	9.3%
Wall, Township of	19,829	1780	9.0%	1273	6.4%	10567	53.3%	5514	27.8%
West Long Branch, Borough of	1,842	322	17.5%	18	1.0%	371	20.1%	1109	60.2%
Total	*309,925*	*22289*	*7.2%*	*43379*	*14.0%*	*132807*	*42.9%*	*99775*	*32.2%*

Note: Identified Utility land use is considered comparatively negligible (0.0007% of total County acreage)

Vacant Land

According to the Countyôs 2006 Open Space Plan, a rough estimate of the remaining land supply of ñpotentially developableò land (i.e. vacant land not inside areas designated as protected open space) is somewhere between 94 and 110 square miles (approximately 20-23 percent of the countyôs total land area). This figure was based on available Geographic Information System data and Monmouth County Planning Board records of pending development.

The largest percentage of vacant land in Monmouth County is found in far western areas where agriculture is still the primary land use. According to the 2002 Census of Agriculture, there are 892 farms in Monmouth County with nearly 74 square miles of farmland (approximately 16 percent of the countyôs total land area). Of these, nearly 16 square miles have been protected from future development through a variety of agricultural preservation programs. The large amount of potentially developable vacant land in western Monmouth County is located mostly outside of the defined areas of the four main geographically limited hazards (flood, storm surge, landslide and wildfire), These hazard areas are mostly found along the eastern and coastal region of Monmouth County. All potentially developable land is of course still vulnerable to the identified hazards which may affect the entire County (e.g. hurricane and other extreme winds, extreme temperatures and winter storms, etc.).

Protected Open Space

While the majority of Monmouth County lands are already developed or zoned for residential and commercial uses, an estimated 84.5 square miles (nearly 18 percent of the countyôs total land area) are classified as protected open space. Many of these lands are located in identified natural hazard zones and will remain vacant and free from any future development. **Table 3d.3** lists the various types and amounts of protected open space as reported by the Monmouth County Planning Board in 2007. As indicated in the table, more than 14,000 acres (21.9 square miles) of open space have been preserved as part of the Monmouth County Park System. The Park System's ultimate goal is to preserve over 20,000 acres (31.3 square miles) to meet the county's park, recreation, conservation, and open space needs of the future.

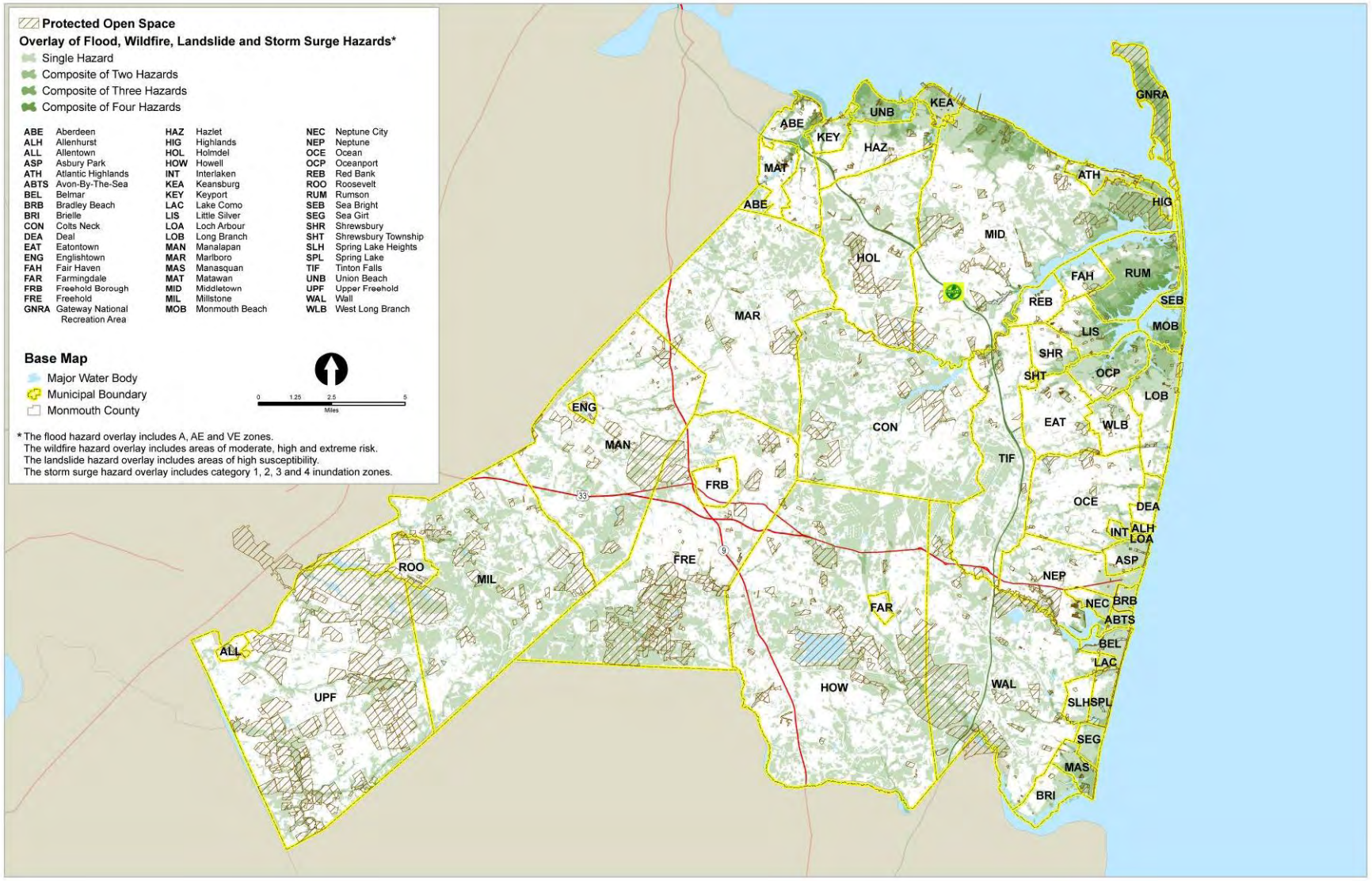
Table 3d.3
Protected Open Space in Monmouth County, 2007

Open Space Classification	Acres	Sq. Miles	Percent of Total Land Area
County-owned Parkland, Conservation Areas and Golf Courses	14,003	21.9	4.6%
State Parks, Natural Areas and Watershed Protection Areas	14,810	23.1	4.9%
Sandy Hook Unit of the Gateway National Recreation Area	1,733	2.7	0.6%
Municipal Land Reserved for Open Space	13,300	20.8	4.4%
Preserved Farmland	10,205	15.9	3.4%
Total Protected Open Space	**54,051**	**84.5**	**17.9%**

Source: Monmouth County Planning Board, 2007

Figure 3d.3 illustrates the locations of protected open space in Monmouth County as provided by the Monmouth County Office of GIS in relation to the overlay of the four key hazard zones developed for the composite hazard maps presented in the risk assessment section of this plan (flood, wildfire, landslide and storm surge). As can be see in the figure, there are a number of large areas of protected open space that intersect with these identified hazard zones.

Figure 3d.3
Protected Open Space



The identification and acquisition land to be maintained as protected open space presents a significant opportunity for jurisdictions to minimize future hazard exposures and vulnerability. As seen in the preceding table, municipal jurisdictions in Monmouth County have collectively protected more than 13,000 acres (20.8 square miles) of open space through their own local preservation measures. Though often done for conservation, recreation or other community purposes, protecting lands located in identified natural hazard zones can help jurisdictions meet complementary hazard mitigation objectives. It is often found that those natural areas deemed targets for open space protection are often also identified as potential hazard zones (e.g., environmentally-sensitive lands such as wetlands, floodplains, etc.).

Table 3d.4 lists the amount of existing municipal land reserved for open space in Monmouth County as compiled and reported by the Monmouth County Park System (using data provided by municipal officials) in the 2006 Open Space Plan. The table also includes each jurisdictionôs identified ñtargetò numbers for protected open space through future land use, development and preservation practices. According to the data, sixteen jurisdictions have existing deficits of open space while the rest are currently at or above their established targets. Of those below their targets, the following jurisdictions have the greatest deficits (representing possible hazard mitigation opportunities through future open space protection efforts): Township of Upper Freehold (3.3 percent of target / 881 acre deficit); Borough of Englishtown (7.3 percent of target / 10 acre deficit); Borough of Sea Bright (39.9 percent of target / 7 acre deficit); Borough of Keyport (41.4 percent of target / 15 acre deficit); Township of Freehold (53.6 percent of deficit / 329 acre deficit). It should also be noted that those jurisdictions listed with existing surpluses of open space can capitalize on similar hazard mitigation opportunities by targeting identified hazard zones for continued protection from future development.

Table 3d.4
Existing Municipal Open Space and Targets by Jurisdiction, 2005

Jurisdiction	Existing Open Space (Acres)	Percent of Land Area	Target for Open Space (Acres)	Surplus / Deficit	Percent of Target Owned
Aberdeen, Township of	420.49	12.1%	103.83	316.66	405.0%
Allenhurst, Borough of	10.50	5.5%	5.76	4.74	182.3%
Allentown, Borough of	50.50	13.2%	11.52	38.98	438.4%
Asbury Park, City of	138.50	14.4%	28.80	109.70	480.9%
Atlantic Highlands, Borough of	88.55	11.5%	23.04	65.51	384.3%
Avon-By-The-Sea, Borough of	15.28	6.0%	7.68	7.60	199.0%
Belmar, Borough of	69.71	10.9%	19.20	50.51	363.1%
Bradley Beach, Borough of	28.60	6.4%	13.44	15.16	212.8%
Brielle, Borough of	28.00	2.7%	31.68	**-3.68**	88.4%
Colts Neck, Township of	1,922.00	9.5%	608.64	1,313.36	315.8%
Deal, Borough of	19.40	2.5%	23.04	**-3.64**	84.2%
Eatontown, Borough of	183.91	5.0%	111.36	72.55	165.1%
Englishtown, Borough of	0.80	0.2%	10.95	**-10.15**	7.3%
Fair Haven, Borough of	89.60	9.0%	29.76	59.84	301.1%
Farmingdale, Borough of	10.60	3.3%	9.60	1.00	110.4%
Freehold, Borough of	20.80	1.7%	36.48	**-15.68**	57.0%
Freehold, Township of	381.03	1.6%	710.40	**-329.37**	53.6%
Hazlet, Township of	335.31	9.0%	111.48	223.83	300.8%
Highlands, Borough of	20.70	4.6%	13.41	7.29	154.4%
Holmdel, Township of	862.73	7.1%	365.70	497.03	235.9%

Table 3d.4
Existing Municipal Open Space and Targets by Jurisdiction, 2005

Jurisdiction	Existing Open Space (Acres)	Percent of Land Area	Target for Open Space (Acres)	Surplus / Deficit	Percent of Target Owned
Howell, Township of	1,600.00	4.0%	1,192.32	407.68	134.2%
Interlaken, Borough of	10.75	4.4%	7.29	3.46	147.5%
Keansburg, Borough of	38.29	6.1%	18.90	19.39	202.6%
Keyport, Borough of	10.88	1.2%	26.31	**-15.43**	41.4%
Lake Como, Borough of	7.36	5.8%	3.84	3.52	191.7%
Little Silver, Borough of	98.73	5.5%	53.76	44.97	183.6%
Loch Arbour, Village of	1.30	2.0%	1.92	**-0.62**	67.7%
Long Branch, City of	109.29	3.3%	97.92	11.37	111.6%
Manalapan, Township of	676.20	3.4%	592.32	83.88	114.2%
Manasquan, Borough of	94.00	10.5%	26.88	67.12	349.7%
Marlboro, Township of	1,134.50	5.8%	582.75	551.75	194.7%
Matawan, Borough of	31.22	2.1%	43.59	**-12.37**	71.6%
Middletown, Township of	990.15	4.3%	687.87	302.28	143.9%
Millstone, Township of	462.79	1.9%	717.69	**-254.90**	64.5%
Monmouth Beach, Borough of	21.60	3.1%	21.12	0.48	102.3%
Neptune, Township of	179.46	3.5%	153.60	25.86	116.8%
Neptune City, Borough of	13.99	2.4%	17.28	**-3.29**	81.0%
Ocean, Township of	308.03	4.3%	215.04	92.99	143.2%
Oceanport, Borough of	78.94	4.0%	59.52	19.42	132.6%
Red Bank, Borough of	25.90	2.3%	33.60	**-7.70**	77.1%
Roosevelt, Borough of	130.58	15.3%	25.59	104.99	510.3%
Rumson, Borough of	89.79	2.7%	99.84	**-10.05**	89.9%
Sea Bright, Borough of	4.60	1.2%	11.52	**-6.92**	39.9%
Sea Girt, Borough of	42.03	6.3%	20.16	21.87	208.5%
Shrewsbury, Borough of	44.30	3.0%	44.16	0.14	100.3%
Shrewsbury, Township of	1.48	2.6%	1.74	**-0.26**	85.1%
Spring Lake, Borough of	119.45	14.4%	24.96	94.49	478.6%
Spring Lake Heights, Borough of	25.42	3.1%	24.96	0.46	101.8%
Tinton Falls, Borough of	352.75	3.6%	290.97	61.78	121.2%
Union Beach, Borough of	29.60	2.9%	30.45	**-0.85**	97.2%
Upper Freehold, Township of	30.00	0.1%	911.04	**-881.04**	3.3%
Wall, Township of	1,461.23	7.5%	595.38	865.85	245.4%
West Long Branch, Borough of	110.30	6.1%	54.33	55.97	203.0%
Total	**13,031.92**	**4.4%**	**8,964.39**	**4,067.53**	**145.4%**

Source: Monmouth County Park System, 2005

Potential for Future Development in Identified Hazard Areas

While future development patterns are subject to many regulatory and market-driven factors, it is possible to prepare general estimates of the relative potential for future development in those four key hazard areas identified for Monmouth County through GIS analysis using data layers provided by the Monmouth County Office of GIS. These data layers include tax parcel records, building footprints and protected open space in combination with the geographically defined hazard areas identified for the risk assessment

purposes of this plan (flood, wildfire, landslide and storm surge[1]). **Table 3d.5** lists the estimated number of potentially developable vacant parcels throughout Monmouth County in relation to these four hazard zones.

According to the analysis, it is estimated that there are 32,835 vacant parcels in Monmouth County. Of these, 23,632 parcels (72 percent) are located in the identified hazard areas described above. Nearly 3,000 of these (approximately 12 percent) are located in areas identified as protected open space, with the remaining vacant parcels being classified as ñpotentially developable.ò In total, it is estimated that 63.1 percent of all vacant parcels in Monmouth County are potentially developable and are located in identified hazard areas. The following jurisdictions are listed as having the largest number of potentially developable vacant parcels located in identified hazard areas: Township of Howell (4,896), Township of Neptune (2,953), Borough of Tinton Falls (1,981) Township of Middletown (1,450), Township of Marlboro (953) and the Township of Manalapan (918).

Table 3d.5
Potentially Developable Vacant Land in Identified Hazard Areas, by Jurisdiction

Jurisdiction	Total Estimated Number of Vacant Parcels	Vacant Parcels in Identified Key Hazard Areas	Vacant Parcels in Identified Hazard Areas Protected as Open Space	Potentially Developable Vacant Parcels in Identified Key Hazard Areas	Percent of Vacant Parcels Potentially Developable in Key Hazard Areas
Aberdeen, Township of	739	407	45	362	49.0%
Allenhurst, Borough of	12	11	0	11	91.7%
Allentown, Borough of	43	16	7	9	20.9%
Asbury Park, City of	505	413	18	395	78.2%
Atlantic Highlands, Borough of	170	160	61	99	58.2%
Avon-By-The-Sea, Borough of	38	37	5	32	84.2%
Belmar, Borough of	47	47	12	35	74.5%
Bradley Beach, Borough of	72	68	12	56	77.8%
Brielle, Borough of	115	99	3	96	83.5%
Colts Neck, Township of	333	271	37	234	70.3%
Deal, Borough of	55	44	0	44	80.0%
Eatontown, Borough of	656	344	144	200	30.5%
Englishtown, Borough of	51	29	9	20	39.2%
Fair Haven, Borough of	112	92	12	80	71.4%
Farmingdale, Borough of	37	11	0	11	29.7%
Freehold, Borough of	217	46	3	43	19.8%
Freehold, Township of	1,373	973	323	650	47.3%
Hazlet, Township of	311	243	39	204	65.6%
Highlands, Borough of	318	300	29	271	85.2%
Holmdel, Township of	404	287	60	227	56.2%
Howell, Township of	7,104	5,381	485	4,896	68.9%
Interlaken, Borough of	27	27	0	27	100.0%
Keansburg, Borough of	176	176	25	151	85.8%

[1] For purposes of this analysis flood hazard areas include Zones A, AE and VE; wildfire areas includes zones of moderate, high or extreme risk; landslide areas include zones of high landslide susceptibility; and storm surge areas include category 1-4 inundation zones.

Table 3d.5
Potentially Developable Vacant Land in Identified Hazard Areas, by Jurisdiction

Jurisdiction	Total Estimated Number of Vacant Parcels	Vacant Parcels in Identified Key Hazard Areas	Vacant Parcels in Identified Hazard Areas Protected as Open Space	Potentially Developable Vacant Parcels in Identified Key Hazard Areas	Percent of Vacant Parcels Potentially Developable in Key Hazard Areas
Keyport, Borough of	155	95	10	85	54.8%
Lake Como, Borough of	25	22	3	19	76.0%
Little Silver, Borough of	196	169	54	115	58.7%
Loch Arbour, Village of	4	4	0	4	100.0%
Long Branch, City of	750	681	51	630	84.0%
Manalapan, Township of	1,729	1,006	88	918	53.1%
Manasquan, Borough of	418	394	44	350	83.7%
Marlboro, Township of	1,413	987	34	953	67.4%
Matawan, Borough of	260	166	44	122	46.9%
Middletown, Township of	2,022	1,654	204	1,450	71.7%
Millstone, Township of	639	551	137	414	64.8%
Monmouth Beach, Borough of	173	173	11	162	93.6%
Neptune, Township of	5,285	3,336	383	2,953	55.9%
Neptune City, Borough of	79	62	2	60	75.9%
Ocean, Township of	1,287	813	50	763	59.3%
Oceanport, Borough of	159	157	17	140	88.1%
Red Bank, Borough of	349	111	16	95	27.2%
Roosevelt, Borough of	35	28	19	9	25.7%
Rumson, Borough of	88	85	27	58	65.9%
Sea Bright, Borough of	244	244	0	244	100.0%
Sea Girt, Borough of	37	35	4	31	83.8%
Shrewsbury, Borough of	56	31	8	23	41.1%
Shrewsbury, Township of	1	0	0	0	0.0%
Spring Lake, Borough of	57	55	19	36	63.2%
Spring Lake Heights, Borough of	54	37	6	31	57.4%
Tinton Falls, Borough of	2,581	2,025	44	1,981	76.8%
Union Beach, Borough of	263	263	14	249	94.7%
Upper Freehold, Township of	671	380	175	205	30.6%
Wall, Township of	691	485	102	383	55.4%
West Long Branch, Borough of	199	101	16	85	42.7%
Total	**32,835**	**23,632**	**2,911**	**20,721**	**63.1%**

Source: Calculated by GIS Analysis using data provided by the Monmouth County Office of GIS in combination with hazard data made available by the Federal Emergency Management Agency (flood), New Jersey Forest Fire Service (wildfire), New Jersey Geological Survey (landslide) and the National Oceanic and Atmospheric Administration (storm surge). Figures should be considered general estimates only.

Current County Planning and Growth Management Efforts

Monmouth Countyôs land use planning goals, objectives and policies are outlined in the 1995 *Growth Management Guide*, which today still serves as the County Planning Boardôs official master plan. The Guide is a broad policy document that includes ten elements focused on air resources; centers (mixed-use); comprehensive planning; economic development; farmland preservation and agriculture

development; historic, cultural, natural and scenic resources; housing; solid waste; transportation; and water resources. Hazard mitigation is not addressed as its own element of the plan, though there are a number of policies that are consistent with the principles of hazard mitigation (e.g., encourage the preservation of floodplains, wetlands and stream corridors).

Since the adoption of the Growth Management Guide, there have been several more key planning and growth management efforts which help to identify Monmouth Countyôs land use and development issues of concern. This includes the 2004 *Western Monmouth Development Plan*, which focuses on seven municipalities in Western Monmouth County tied together by their common dependence on U.S. Route 9 as the major north-south arterial. The need for this separate plan stemmed from the rapid development of this particular region, as reflected in sprawling suburban development on farms and fields, the corresponding loss of open space, and an increase in traffic congestion. The document, adopted by the Monmouth County Planning Board in August 2004, is intended to serve as a ñsmart growthò plan for the study area; one that will encourage the formation of more livable communities and better preserve the natural resources currently being consumed by suburban sprawl.

The Monmouth County Planning Board and the Board of Recreation Commissioners have also each adopted the 2006 *Monmouth County Open Space Plan* which serves as the Monmouth County Park Systemôs strategic plan for land acquisition and preservation[2]. The Plan states that ñpressure to develop, and redevelop, land in Monmouth County remains strong and the challenges to maintaining quality of life for present and future generations that the Freeholders faced in 1961 ï a growing population, competition for diminishing land resources, escalating property values, and increasing public demand for control of growth and provision of recreation services ï are even greater in 2006.ò

To help further meet this challenge, the Planning Board has recently initiated the Coastal Monmouth Plan (CMP), an important two-year regional planning effort that will outline a vision for the future of the Monmouth County coastal region. Covering the region as a whole, as well as each of the 30 municipalities within the study area, the plan is aiming to help communities prepare, collectively and individually, for sustainable growth, while protecting environmental resources and maintaining their unique coastal character. Initiated in the fall of 2006, the plan will be completed in the fall of 2008.

Each of the above referenced plans identifies goals, key objectives, policies and strategies for managing its future growth and development throughout Monmouth County in coordination with municipal jurisdictions and the State of New Jersey. Such coordination is aided through the New Jersey Department of Community Affairs *Cross-Acceptance Process*. Cross-acceptance is a bottom-up approach to planning, designed to encourage consistency between municipal, county, regional, and state plans to create a meaningful, up-to-date and viable *State Development and Redevelopment Plan*. To accomplish this, municipal, county, and regional master plans must be coordinated regionally with each ñlocal visionò of growth and the community taken into consideration during the process. The last Cross Acceptance Report for Monmouth County was completed in 2004.

Municipal Land Use and Development Patterns

Monmouth County can be characterized by one word: growth. Its economy is strong and its tax base continues to grow at a strong rate for more than a decade. Monmouth County has outpaced both the State of New Jersey and the nation as a whole in terms of total employment growth. Similarly, incomes are

[2] The Plan was adopted by the Planning Board as added element to the 1995 Growth Management Guide.

rising faster than state and national averages. Monmouth Countyôs quality of life includes strong job prospects both within Monmouth County and in other parts of the tri-state region. These gains in population are fueling increases in local construction and retail trade employment. Transportation improvements are providing better access to and within the County for both commuters and tourists, and improved ferry service to Manhattan makes Monmouth County attractive to commuters. The Monmouth County Planning Board estimates that Monmouth County is currently growing and the major factors that generate growth are sustainable in the near term and are expected to simulate growth in the long-term.

Based on a review of the Monmouth County Profile and the Monmouth County Cross Acceptance Report, the following recent development trends are expected to continue in the future, with the focus on striking a balance between development and natural resource preservation efforts:

- New development is projected to be concentrated in the Western and Central Regions of Monmouth County (with the Western Region being strongest and the Central Region being second strongest).

- Most of the municipalities along the Coastal and Bayshore Regions of Monmouth County are undergoing redevelopment. Commercial facades are being upgraded, streetscapes are being improved and small vacation homes are being replaced with new larger structures.

- These coastal redevelopment projects mark a turning point for Monmouth County. Since 1970 development had been concentrated in the western half of the county while parts of the coastal area languished. Revitalization of the coastal areas boosts the Countyôs economy in places where there currently exists public transportation, existing infrastructure, and until recently high unemployment. This comes at a time that Monmouth Countyôs overall population growth is slowing and western Monmouth County is past its peak growth. The Monmouth County Planning Board estimates that in the future, the financial health of the county will come more from the eastern and northern areas.

- Monmouth County has received Smart Growth Grants to conduct regional studies aimed at managing growth and development in certain regions within Monmouth County. To-date, plans have been completed for Western Monmouth County, the Bayshore region, and Coastal regions.

- Western Monmouth County is one of the fastest growing regions in the state.

- Waterfront and downtown redevelopment is most prominent in Long Branch, Asbury Park, and Neptune. In Long Branch, the cityôs redevelopment efforts are focused primarily on converting underutilized beachfront into new homes, shops and restaurants. This includes plans for 104 townhomes, 529 condominiums, 543 rental apartments, 100,000 square feet of retail space, 500 other units, 500 new residences, 70 business, a 1500 car parking garage, and 2 performing arts center, and the renovation of the Paramount theater. In Asbury Park, development of a fifty-six acre area Is projected to include 3,165 housing units at a cost of $1.25 billion. The downtown redevelopment plan calls for retails stores on the first floor and residential uses above. Neptune, while not having coastal frontage, is working to redevelop land along the Shark River (which connects to the Atlantic through an inlet). Waterfront redevelopment plans along the northern section of the Shark River includes approximately 150 condominiums and stores.

Core Planning Group members were asked to supplement information presented in the Cross Acceptance Report with responses to a Land Uses and Development Trends Questionnaire for the individual jurisdictions. This brief questionnaire consisted of the following two questions:

1. Please describe development trends occurring within your jurisdiction, such as the predominant types of development occurring, location, expected intensity, and pace by land use. While details are preferred, it is ok if your feedback is qualitative and quite general, such as ñ*high-occupancy, high-density residential development is occurring near the waterfront*ò.

2. Does your jurisdiction enforce regulations/ordinances/codes to protect new development from the effects of natural hazards? (Some examples might be floodplain management ordinances enforcing FEMAôs NFIP for new development or substantial improvements in the floodplain; steep slope ordinances for communityôs which may have landslide hazards; earthquake resistant design criteria and/or high wind design criteria; or buffer zones in wildfire hazard areas.) If so, please describe.

Responses of individual jurisdictions are presented in Table 3d.6.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Aberdeen, Township of	The Township of Aberdeen has very little remaining vacant land available and suitable for development. Therefore, the predominant development occurring in the Township in the recent years is on single, small lots with in-fill development or the redevelopment of existing sites, both for residential and non-residential uses. The Township has identified a number of larger areas for redevelopment, some of which have been designated as Redevelopment Areas under the Local Redevelopment And Housing Law. The areas either identified or designated are as follows: Å A "Commerce & Transportation Center" Redevelopment Area has been designated on lands in the vicinity of the Aberdeen/Matawan Train Station. The subject land area is coupled with land area in Matawan Borough. At this time, the formulation of the Redevelopment Plan and the appointment of a redeveloper are still under discussion. Å A "Planned Adult Community Redevelopment Area" as a Redevelopment Area has been designated on lands (approx. 183 acres) in the Freneau portion of the Township where public sewer and water service are proposed to be extended to serve both the existing and proposed developments. Development approvals under the enabling ordinances have been granted for the redevelopment of this area for 521 age-restricted dwelling units plus 68 non-age restricted affordable housing units; however, the developments have yet to be built. Å A designated "Age-Restricted Affordable Housing" zoning district was created for a 13.8 acre brownfield site formerly owned by the South River Metal Products Company which permits the municipally sponsored development of up to 154 age-restricted apartments; and Å A Redevelopment Area has been designated on the Anchor Glass Manufacturing Facility of 50.55 acres for a Planned Unit Development with up to approximately 200,000 square feet of retail/office space, 750 dwelling units and a hotel; no specific provisions or plans have been developed at this time.	The Land Development Ordinance (LDO) of the Township of Aberdeen contains specific provisions to protect environmentally critical areas from the negative effects of development, as follows: 1. A "Conservation/Recreation" zoning district (Section 408) has been established in the Township for most of the marshland and wetlands of the Raritan Bay and associated stream corridors of Whale, Long Neck and Matawan creeks. This zoning district limits the types of permitted development to farms, boat yards and other similar marina uses, restaurants, and conservation areas, public parks and other similar public purpose uses. All permitted land uses must have a "definite relationship to the estuarial zone" and be approved by NJDEP, where required. 2. All residential development is required to be located a minimum of 100 feet from any existing or proposed detention or retention basin, pond, lake or other water body or course, as measured from the highest topographic grade of said water body or course (Section 401 G.). 3. Section 514 of the LDO regulates retaining walls, embankment slopes and bulkheads. Slope returns for embankments are limited to a 3 to 1 slope. Bulkheads or other appropriate permanent bank stabilization acceptable to the Board are required for all development on or along waterways, and the design must be approved by the Township Engineer. 4. Section 523 of the LDO regulates Surface Water Management and Section 524 regulates Stormwater Management consistent with the new NJDEP regulations. 5. Section 608 of the LDO regulates and protects "Critical Areas" which are defined by ordinance as 100-year flood plains, freshwater wetlands, wetlands transition areas or steep slopes 15% or greater. Stream corridors with buffer strips of 100 feet in width from the top of the channel banks or the flood plain area, if larger, also are regulated and protected from most types of development. All development in the Township is subject to the provisions of this section of the LDO. Design or performance standards are included within the regulations for those developments that are permitted when variances or waivers are granted. 6. In addition to the specific LDO regulations, the Township of Aberdeen has adopted Master Plan documents which recommend the protection of environmentally sensitive areas and the provision for open spaces and recreation areas. When variances from the LDO are sought, an applicant must show that there is no substantial detriment to the intent and purpose (negative criteria) of these Master Plan documents.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
Allenhurst, Borough of	Little development has taken place for near 70+ years. Borough can best be described as low-occupy and low density. JCP&L Co. has had a large facility within the Borough but has recently relocated and redevelopment is in the works. The new development will consist of mix residential and commercial and will conform with the Boroughôs current occupancy and density make up.	The Borough complies with all state and federal regulations.
Allentown, Borough of	The Borough of Allentown is almost totally developed. The land that is not used for commercial or residential buildings is protected land under "Green Acres".	Any development that is occurring within the Borough of Allenton is being done in existing residential areas. Most are rehabs or lots next to existing structures. To my knowledge none of the areas off development apply to the question asked.
Asbury Park, City of	Redevelopment of oceanfront consisting of 4 to 6 story combined commercial / residential, 1 t o2 story commercial and up to 25 story residential high-rise throughout oceanfront area. Redevelopment of south west portion of the city consisting of 2 to 4 story commercial / multi-family. Scattered throughout the city 2 to 6 story residential new construction and rehabilitations.	Our city complies with all applicable building codes concerning hurricane resistance and all requirements of the Uniform Fire Code.
Atlantic Highlands, Borough of	For the most part, Atlantic Highlands is "Built-Out" community. The Borough has 2 waterfront properties still undeveloped although they are currently used for commercial purposes. 1) McConnell Property - Former site a fuel farm. 2 huge Esso tanks were on property and dismantled in 1986. Property is contaminated. This is zoned for 19 single family homes. Although KHOV Developers has tried to get Planning Board approval for mix use (Condo/Homes) but they withdrew their application. Boro wants to purchase but its their application. Boro wants to purchase but it's big $s. Want to preserve for open space-extension of current back-beach. 2) Guiliani property-former home of a contracting company. Now a boat storage facility. KHOV wanted to build 80 condos. They withdrew this application also. Property is contaminated from 1920's Coal Manufacturing plant that is owned by NJ Natural Gas Co. Town wants to buy this piece to extend the Boro owned Municipal Harbor. The Boro can not purchase these 2 pieces of property due to EOAA restrictions. Other areas along the waterfront are not buildable. Some buyers are taking down smaller homes and building larger homes on the property. Biggest issue for the Boro is water runoff/erosion. New or old - this is the real challenge. Boro acre has 7 condo/high density apartment complexes. this is 1 - 5 vacant acre parcel but it's in the hills. Anything built there must meet steep slope ordinance requirements. 1 former restaurant parcel is about 3 acres. Not sure what owner is going to do. He too withdrew his application.	As provided in the first request: 1) Steep slope ordinance. Upheld by Supreme Court in challenges 3 times. 2) Land use regulations. 3) Stormwater Management Ordinance
Avon-by-the-Sea, Borough of	The Borough of Avon By The Sea is fully developed. At this time there are less than 10 lots to be built upon within the Borough and all but one have been created by demolishing existing structures on the sites. The predominant development is older structures are demolished to be replaced by new, modern	Floodplain management is addressed by the building department for all new construction. In addition, the current construction code requires wind-storm resistant windows and other structural elements to address the coastal high wind concerns associated with our municipality.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	single-family homes, with one multi-family (nine unit) building under construction on the site of a former commercial building.	
Belmar, Borough of	We are a one sq. mile municipal located on the east coast of central New Jersey. The community consists mostly of single family homes. We are currently updating our Business Zone by re-building and redesigning a 6 block area. We are a summer resort with a year round population of about 6,000.	Belmar participates in the NFIP and enforced codes and ordinances regarding same.
Bradley Beach, Borough of	Bradley Beach is primarily a residential community with mixed use retail / residential and office / residential along the Main Street Corridor at the west edge of the Borough. The majority of the Borough is zoned single family residential except for the aforementioned mixed use zone and townhouse and apartment used permitted along the beachfront block. The Borough is fully developed with no vacant property available for development. Development is limited to demolition and construction of wither single family homes throughout the Borough or small condominium projects or larger lots in the beachfront area.	The Borough of Bradley Beach enforces floodplain management regulations and all FEMA regulations regarding natural hazards. There are no steep slopes or potential earthquake or landslide areas in the Borough. Building regulations related to high winds and hurricanes design standards are enforced by the Borough's Building Department.
Brielle, Borough of	Brielle is 1.3 square miles and there is little room for development. The trend is toward minor subdivisions, in particular in the area east of Union Land, between Old Bridge Road and Green Avenue, where the required frontage is 75 feet and the trend is for the division of 100 foot lots into 50 foot lots. The trend is distressing, but hard to stop. The few remaining commercial areas, i.e. marinas, are in danger of going condominium. While the increase in density is manageable; it cannot but help to adversely impact the overall quality of life.	The Borough has enacted a Flood Plain Management Ordinance and has supplemented it with a Stormwater Management Ordinance and Soil Removal.
Brookdale Community College	Brookdale Community College operates academic, administrative and support facilities in excess of 1 million square feet on 200 acres of land in the Lincroft section of Middletown Township. The College also operates individual facilities in Hazlet, Wall, Long Branch and Freehold. The College leases space in Neptune and on Sandy Hook. Expansion of the Lincroft Campus is expected to include the renovation of the Collins Arena and development of a 32,000 sq. ft multi-purpose activity center as well as a 9,600 sq. ft. expansion of the Auto Technology center. Future plans include expansion of the College facilities in Freehold and in Wall.	Not Applicable ï The College complies with all relevant Federal, state and county land use regulations. The College does not have the statutory authority to adopt regulations of development. The College does not have the statutory authority to enforce development regulations.
Colts Neck, Township of	Historically development in the Township of Colts Neck consists of agriculture and detached single family dwellings. The A-1 Agriculture/ Residential Zone is a two acre zone with a density of 0.1 dwellings per acre. Over the past five years the Township has issued 110 certificates of occupancy and 37 demolition permits for a net gain of 73 dwellings. This averages 15 dwellings per year. This trend is anticipated to decline in the near future, due to a lack of vacant land and current market conditions. The only multifamily development plan is The Manor Homes at Colt Neck. A 48 unit inclusionary development proposed in Route 537. Commercial development is limited to the Route 34 corridor between Artisan Place and Route 18. Due to a reliance of on-site well and	The Township Code Enforcement Officer enforces the Township's local ordinances published in Chapter 102 - Development Regulations of the Township of Colts Neck. The Construction Official enforces building code though compliance with the Universal Construction Code (UCC). The State of New Jersey oversees State regulations including the Freshwater Wetlands, Stream Encroachment, Highway Access, Stormwater Management, Residential Site Improvement Standards and other State permits. While Federal regulations such as FEMA and Soil Erosion and Sediment Control Plans are administered by Federal Agencies. Compliance with these outside agencies requirements are addressed as part of the planning process within each individual Planning Board Application.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	septic systems, the density of the commercial zone is kept low with a 0.15 floor area ratio.	
Deal, Borough of	Development in the Borough of Deal is limited to single family residential dwellings. We have only one multiple family condo on the oceanfront and do not have the potential for additional multiple family residential units near the ocean front.	The Borough of Deal enforces the laws of New Jersey regarding the protection of wet lands, streams, lakes, ocean front, etc. through zoning regulations. Among the factors limiting development is a 40% impervious restriction on development.
Eatontown, Borough of	1) Multi-family Townhouse developments ï upward of 300 units with 1,000 new residents 2) Expansion of regional shopping mall 50,000 square ft. Type 1 construction. Population will vary on times of years. 3) New business in Industrial Park Area - 2 business complexes Type 1 100,000+ sq ft. 1 medical office/Operating Room 25,000 sq ft Type 1 4) approval on new Rt 35 - Rt 36 Construction to soon facilitate movement of traffic.	DEP Standards, NJ Building Code, NEPA Standards, OSHA, Boro of Eatontown Codes, Stormwater Management of NJ DEP, Electrical codes, State DOT.
Englishtown, Borough of	Englishtown is a half-square mile community that is for the most part completely built out except for two land tracks. One has plans for four to six single family homes and the other track is going to be 8 apartment buildings with a total of 134 apartments.	N/A
Fair Haven, Borough of	At this time the only land available is lots that 1 or 2 houses can be built on. No major building is expected.	Yes, if the building were to affect an area.
Farmingdale, Borough of	Farmingdale is a very small (1.5 sq. mile) Borough with limited development. Spot lot residential and limited commercial construction takes place sporadically.	Within our limited development, yes.
Freehold, Borough of	The Borough of Freehold is approximately 95% built out. At the present time there are two residential developments proposed both are located on Orchard Street in the southeast area of the municipality. One development has already been approved and is in the process of being built - Liberty Crossing 1 consists of 12 two story single family homes to be built on the west side of Orchard Street. Liberty Crossing II is presently before the Borough of Freehold Planning Board, it consists of a four story age restricted condominiums, level 1 will be a parking garage with levels 2,3&4 will be 30 condominiums. This is to be built on the east side of Orchard Street and is adjacent to a wetland area. Commercial development at this time consists of a three story office building being built at 83 South Street and a two story commercial building, first floor retail second floor office approved to be built at 63 East Main Street which is located at the corner of East Main Street and Spring Street.	The Borough of Freehold does not appear on any FEMA Flood Maps due to the fact that it is located 178 feet above sea level and there are no streams, rivers or lakes in the Borough. The only flooding problems are localized during times of extremely heavy rainfall because of an antiquated storm drainage system in some areas. The Borough of Freehold enforces the State Uniform Construction Code which adopts the 2006 International Building Code and has provisions for earthquake resistant design criteria and high wind design criteria. There are no wildfire hazard areas located in the Borough of Freehold.
Freehold, Township of	Although the Township has experienced significant growth over the last three decades, a recent Build-Out Analysis indicated that the Township is at approximately 94% build out, development is expected along Route 9 and Route 537 corridors.	The Land Use Ordinance discourages development in critical Areas: 100 Year Floodplain; Wetlands; Wetland Buffers; Slopes Greater than 15%; Lands that are Highly Erodable (USDA factor "K"); Land with a Seasonal High Water Table of 24" or Less; Lands within Conservation Easements. In the Southern portion of the Township some land is located within a NJ Forest Fire Service Area. The Freehold

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
		Township Fire Prevention Bureau follows the policies of the NJ State Forest Fire Services in that area.
Hazlet, Township of	Many various projects approved or pending and under construction currently; Details provided by Sharon A. Keegan, Zoning Official.	The Township utilizes a Development Review Ordinance that regulates all property within its boundaries. The intent of the ordinances is to guide the appropriate use of development of all lands in a manner that promotes the public health, safely, morals and general welfare. To secure safety from fire, panic and other natural or manmade disasters. The following ordinances are some of the ways the township regulates new development from the effects of a natural hazard. 1. Section 412 - Flood Hazard Regulations-designed to regulate development of lands within the defined flood hazard areas. 2. Section 500 - Performance $ Design Standards - designed to promote the creation of functional and attractive development that shall promote to the health, safety, general welfare, morals, efficiency, economy, maintenance of property values and the character of the Township. To minimize adverse impacts of flooding, drainage, erosion vehicular traffic, pedestrian movement, parking, vibration, lighting and glare, noise, odor, solid waste disposal and litter. 3. Section 508 Land Use Restrictions and Easements, such as drainage easements, sight triangle easements and utility easements. 4. Section 525 Storm Water Management Control. 5. Section 526 Stream Setback, No activity shall be permitted within 100 feet of the top of the bank of a stream or other body of water. No building shall be constructed within the 100 year flood plain.
Highlands, Borough	Near the waterfront: Single family residential units are being renovated, older single and multi family housing units are being demolished and replaced with single and multi family housing units. Some pre-existing high density areas have been rezoned into ñMXDò areas and are currently awaiting redevelopment. Pre-existing open areas are being developed and are becoming, single and multi-family housing units. Much of the waterfront business area zones has already been developed with restaurants or marinas. Older restaurants are being renovated and re-opened as restaurants as business thru-out the town continues to increase.	The borough has developed, adopted and enforces: Flood plain ordinances, Steep slope ordinances, storm water management plans. Additionally the borough follows the FEMA NFIP program and has adopted the current edition of the International Code Council (ICC) construction codes and the current edition of the New Jersey Residential Construction Code.
Holmdel, Township of	The analysis concluded that the 2003 population of the Township was approximately 17,487 and that with current zoning the population at total build-out would be about 19,608. Most of the undeveloped properties are in residential zones with the largest properties zoned for single-family homes in clustered developments with a maximum density of 0.2 units per acre. Some of the undeveloped properties have received development approvals from the Planning Board. Given the state of the real estate market the actual development of these properties is at present proceeding very slowly.	Holmdel Township includes in its Development Regulations Section 30-116, Resource Management Regulations. These regulations limit development within stream corridors including floodplains, on steep slopes, and around water bodies and limit tree and woodland removal on properties proposed for development. The regulations require that buffers be placed in conservation easements.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	There are two clusters of undeveloped properties along Route 35. Each of these has about 25 acres and they are currently zoned for commercial/retail use. There are no currently known development plans for either of these properties. The largest development uncertainty in the Township is the potential redevelopment of the 472-acre property owned by Alcatel-Lucent that formerly housed research and development facilities of Bell Laboratories. On this property is an approximately 2,000,000 sq. ft building that was designed by Aero Saarinen for Bell Laboratories and is now vacant. Six to eight years ago there were 6-7,000 employees working in the building. A redevelopment company has a contract to purchase the property. However, the sale has not closed. Some of the possibilities for the redevelopment include the partial or complete demolition of the existing building, the re-use of a portion of the building, the construction of new buildings for professional and office use, the construction of a 350,000 sq. ft. data center, the construction of age-restricted residences, some municipal facilities, and some combination of all of these and other possibilities. The Township Committee has appointed an Advisory Committee to advise it on the options. Because of the poor state of the commercial real estate market in Monmouth County and New Jersey, the lack of population and employment growth in New Jersey, and the lack of identified or contracted tenants, the ultimate plan for the development of this property is unknown at this time.	
Howell, Township of	Large McMansion development exists within areas of previously farmed land. A large area of the Township maintains a rural character. Most of the Township's development is scattered throughout rural locations and located at previously farmed areas and wetland areas. Agricultural Rural Estate zone districts are present within the Township and prevent the impacts of development in areas located outside of centers that are identified in the Township's Master Plan. Agricultural uses and low density development are encouraged within the ARE zone districts. High density residential development within the Township are located within the residential zone districts and located in the vicinity of well traveled roadways. Commercial development within the Township can be found along the Rt. 9 and Rt. 35 corridors.	Yes, the Township has a 300 foot Riparian Buffer Ordinance (188-34). A 300 foot buffer is required adjacent to all streams, lakes, ponds within the Township. The buffer is measured as a line extending perpendicularly from the 100-year flood plan delineation. If there is no 100 year flood line delineated, the distance shall be measured outward from the top of the bank. This ordinance protects communities from potential flood hazard occurrences.
Interlaken, Borough of	The Borough of Interlaken is unique in that the municipality is completely single-family residential. The only non-residential land use is borough-owned property such as Borough Hall, a park and an arboretum. The Borough's goal is to retain the current character of the community and this is reinforced in its Master Plan and Zoning Ordinance. The Borough is concerned about	The Borough of Interlaken does enforce a Flood Hazard Prevention Ordinance and a full circuit of Storm water management ordinances. The Borough of Interlaken also has an arboretum along Deal Lake and has steep slope easement and conservation easement in place to preserve stream corridors.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	preserving its Deal Lake frontage as well as environmental stabilization of the Deal Lake itself.	
Keansburg, Borough of	Town House/ Condo Development and retail development near our waterfront areas; feasibility study being conducted for a marina.	Floodplain management ordinances for new construction in floodplain zones.
Keyport, Borough of	Residential development 50 yards from waterfront; 10 new homes within last 5 years; Future Project: Multi Condo project along a creek bed.	The jurisdiction enforces or regulates development for floodplain along Raritan Bay and along our two creeks. Also for added / new or development along the Bay has high wind Criteria.
Lake Como, Borough of	There is a number of recently approved and soon-to-be proposed "high-density residential over commercial" projects on Main Street. The projects range from 4 to 25 residential units each and there is a maximum potential for about 8 to 10 such projects to ultimately be built pending on further economic growth. The remainder of the town is completely developed with most work being confined to additions and alterations and or replacement of existing single-family residences (usually small bungalows being replaced with new larger homes).	Yes, State and Federal flood plan, wind design and general building code requirements are enforced.
Little Silver, Borough of	Little Silver is largely residential, developing slowly in accordance with its current zoning. Development is mostly renovation of existing homes except for one age restricting housing development recently approved by the Planning Board.	Yes, the Borough has an Ordinance restricting all development below the six foot contour (along stream corridors) and has recently adopted ordinances prohibiting the use of steep slopes and environmentally sensitive areas for lit area calculations.
Loch Arbour, Village of	Village of Loch Arbour is fully developed, primarily single family residential development is usually in the form of knock-downs and rebuilds.	Yes, floodplain management, high wind design criteria apply in the Village. No other criteria are necessary.
Long Branch, City of	Over the last ten years the City of Long Branch has been developing and implementing an extremely progressive redevelopment program. The Oceanfront development has already begun with Beachfront North ï a high-density residential development and Pier Village ï a high-density residential/commercial mix. In the near future the city will begin the next four phases of their development plan, which includes Broadway Corridor, Broadway Gateway, Hotel Campus and Beachfront South. Broadway Corridor is a high-density residential/retail mix with an emphasis on the arts. Broadway Gateway is a mix of commercial and big box retail. Hotel Campus is another beachfront project, which includes a large expansion of an existing hotel and added high-density residential/dormitories. The final project is Beachfront South, which is expected to also include high density residential with improvements to the public boardwalk.	The City of Long Branch follows FEMAôs National Flood Insurance Program, the State of New Jersey Uniform Construction Code, the State of New Jersey Municipal Land Use Laws and Monmouth County Freehold Soil Conservation. The City has also adopted several ordinances on a local level to help protect new development and give local officials guidance. These ordinances include Land Use Procedures, Environmental Commission, Urban Enterprise Zone, Property Maintenance, Flood Damage Prevention, Public Property, Redevelopment, Soil Removal and Zoning. Although each of the above listed ordinances may not individually affect each project the combination of several will benefit a large majority of our development.
Manalapan, Township of	The township continues to grow and develop both residential and non-residential uses. The Town completed a Vacant Land Analysis and Employment and Population Projections report as part of the Master Plan Housing Element, which was adopted in 2005. The Town projects that its population will grow from 33,423 in 2000 to 40,923 in 2025. At that point, the Town expects that it will be at its residential buildout based on the current zone plan. Future residential development that has been approved for construction includes single family detached housing, attached housing, affordable housing, and age-restricted housing. Nonresidential growth and development would	All development and building within the Township is regulated pursuant to the development regulations of the Township of Manalapan, the State Residential Site Improvement Standards, the State Uniform Construction Code, and any other applicable State or County regulations. Township development regulations are enforced through the Township development review and approval process and by the Township agencies and officials responsible for the administration of the regulations and the issuance of development permits Township development regulations include a Flood Hazard Area Overlay zone

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	increase employment within the Town from 8,145 in 2000 to 13,430 in 2025. Development pressures within the Township have generally corresponded to economic cycles. Over the last decade, the Township has experienced a strong demand for residential development and increasing land values. The Township has also experienced a demand for non-residential development for retail office, and office-warehouse uses.	which prohibits most types of development in the 100-year floodplain, irrespaective of the underlying zone district. The objective is to conserve the natural floodplain, The regulations also include building setback requirements from the floodplain. Any permitted development in the floodplain must comply with the Flood Damage Prevention Regulations of the Township Code which incorporates FEMA standards. Township development regulations include provisions to regulate development activities along streams and within stream corridors. The regulation is also applicable to any pond, lake, or perennial or intermittent waterway as shown by USGS maps, the Monmouth County Soils Survey, or the Natural Resource Inventory for Manalapan Township. Township development regulations include standards for the development on steep slopes. The standards restrict development on slopes of 10% or greater. Disturbance of slopes 20% or greater is only permitted if the disturbance is essential to the reasonable use of the property. The Township has an active open space and farmland preservation program to retain significant areas of the Township in farm and open space use.
Manasquan, Borough of	Manasquan is a built-out year-round shore community consisting of approximately 6,400 residents. Most development consists of razing older, smaller homes and replacement with larger, 2 to 3 story homes, especially along the oceanfront.	The Borough of Manasquan enforced the following: Wind Design Criteria: Uniform Construction Code (UCC); Flood Plain Ordinance NJSA 58:16A.57 (required by the State); Borough Ordinance Chapter # 29 (Flood Prevention & Construction Design)
Marlboro, Township of	The Township is seeing a combination of high-density high-occupancy residential, commercial and low-density residential on lots of 1 acre or larger. Ten commercial properties include a big-box retail store, 2 banks, 2 office buildings, 2 combination office buildings/warehouses, one house of worship, a drive-thru pharmacy and an indoor tennis & training facility. Six pending residential developments include one with a combination of single family homes and 2 Multi-family dwellings, one multi-unit single family attached dwelling, and 4 single family dwelling Developments with lot sizes ranging from ¼ acre to 2+ acres.	The Zoning and/or Engineering Departments enforce the following sections of the Township Code: 1. General Provisions 84-30D(1)[a]: ñNo structure shall be built within 100ô of top-of-bank of a Stream or other body of water or within any drainage or conservation easementé .No building shall be constructed within the 100 year flood plain of any stream or watercourseé ò 2. Flood Damage Prevention 84-37 and NJSA 40:48-1 et seq. 3. Storm Water Management 84-104 4. Floodplain Regulations 84-1095. SoilRemoval84-1346. Grading & Clearing 84-30 D (24), 84-83 F
Matawan, Borough of	The Borough of Matawan is a 2.26 square mile community which has mostly been developed to capacity. Currently, there is one residential development in the initial stages of construction. The development (The Preserve at Matawan) encompasses an approximate sixteen acre tract of land formally used as both a residence and retail business. This tract of land included a warehouse type building and a residential home with the undeveloped acres remaining wooded and wetland areas. This development is located between State Highway #79 and Mill Rd. and borders Matawanôs Gravelly Brook and Gravelly Brook Park. The Preserve at Matawan will encompass one hundred twenty-six luxury	With the exception of prohibitions for developing on or near preserved wetland areas, I am not aware of any such regulations/ordinances or codes currently in place to protect new development from the effects of natural hazards.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	condominiums. The condominiums will be offered in one, two or three bedroom models. The development will be restricted to active adults 55 years old and older and reportedly will include a low-income component. A portion of the site will remain un-developed due to wetland restrictions. In addition to this development the Borough of Matawan is in the initial stages of a large scale re-development for the entire area of the Matawan-Aberdeen Train Station. The original plans called for a combination of retail, commercial and residential development in this area. The area has been approved as a Transit Village by New Jersey Transit. The entire re-development process was a joint venture with neighboring Aberdeen Twp. but has stalled due to on-going litigation.	
Middleton, Township of	Development trends in recent years have essentially been a continuation of the trends and patterns of the past. New development consists largely of single family homes and subdivisions. Typical subdivision applications currently range in size from 2-12 lots, whereas in years past they tended to be much larger, with 30 - 50 lot developments being common. [More multi-family developments, both rental and for sale, have been occurring in the past 10 years and will likely continue. This is primarily due to the Township's efforts in complying with State mandated affordable housing obligations. More than 1,100 new units have been approved and/or built in the past decade and another 200 - 300 hundred are likely in the next 10 years. Densities typically range from 3 - 10 units per acre, with project sizes ranging from 12 units to 150 units. Some multi-family developments has occurred near the waterfront. There is also an area of 10 -15 acres near the waterfront that is adjacent to the commercial fishing cooperative that is slated for redevelopment in the next few years. Other than that the Bayshore area is mostly built out, with some infill development possibilities. Newly enacted State regulations (11/5/07), applicable to floodplains, will have a significant impact on the magnitude of new development in those areas. Commercial development continues steadily, although the scale of commercial projects is somewhat smaller. Nearly all of our major shopping centers have been fully rehabilitated within the past 10-15 years. Scattered smaller commercial and retail developments (5,000 - 10,000 square feet) continue to take place. The only major land uses not occurring much are large office developments and industrial development.	The Township participates extensively in the FEMA National Flood Insurance Rate Map Program. Properties are regularly reviewed to determine if they are located in flood hazard areas. If they are, special design and development standards are imposed and a Floodplain Encroachment Permit process is implemented, via Township Ordinance. As indicated in #1 new State regulations applicable in flood hazard areas will severely limit new development and filling in Floodplains. Design and development standards relative to earthquakes and high winds are implemented via state regulated uniform construction standards. Landslide hazards and wildfire hazards are typically not applicable here. The Township does have steep slope conditions that limit and in some cases even prohibit developments that disturb sloped areas.
Millstone, Township of	Millstone Township is considered a Low Density rural residential. Development is permitted along stream corridors and limited areas of commercial development.	Millstone Township strictly enforces various township ordinances that protect new development from various natural hazards. We have in place Steep slopes, soil contamination, flood plain, conservation Easement and Storm water management ordinances.
Monmouth Beach, Borough of	Redevelopment of existing property to meet newer codes. US Coast Guard Life	Monmouth Beach complies with stormwater management rules; Drainage and road

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	Saving Station reconstructed into Monmouth Beach Cultural Center. Flood Plain Management enacted.	improvements for active flooding; Land disturbance ordinance enacted to prevent flooding encroachment; Seawall reconstruction to prevent encroaching ocean tides.
Neptune City, Borough of	Neptune City is 99% developed with majority of that as single family homes. It has some apartment complexes and commercial areas. There is a process of a possible 16 acres of redevelopment of high density housing.	At this time we do not. All new development is by the regular building codes.
Neptune, Township of	Development trends vary depending on the area of Neptune Township. Below is a listing based on location within the Township: Western Neptune: Medical office - 15,000 sf to 30,000 sf. Big Box Retail, including pad sites for restaurants, banks, pharmacies, and other retail, Major Subdivisions - not exceeding 20 lots. Eastern Neptune - In-fill residential, smaller lots. West Lake Ave. redevelopment area - dense mixed use including residential retail and office Former Ridge Ave. School Site redevelopment area - dense residential including single-family townhouses, and apartments. Other Areas: In-fill residential mainly including 2-lot minor subdivisions. Large expansion of regional hospital. Potential Redevelopment Areas: Transit Village - dense mixed use near railroad station. Shark River Waterfront- moderate dense residential with a portion of retail and hotel. Existing highway corridors - possible in-fill and new development.	All buildings are designed for 120 mph winds due to the proximity to the Atlantic Ocean and potential hurricanes. Other building requirements include flood vents and hurricane clips. These are ICC codes that are enforced by the Township's building department. The local zoning ordinance has a section for steep slopes. Although Neptune Township is a coastal community, there are sections of town with steep slopes. The ordinance requires individuals proposing excavation and construction in areas greater than 25% slope to obtain variances, which require review by the planning or zoning board and board engineer. The Township doesn't have a flood plain ordinance and relies on FEMA, Special Flood Hazard Areas.
Ocean, Township of	There is substantial redevelopment of commercial space along State Highway 35. Residential Development is basically of 2 kinds: 1- Infill ï Undeveloped parcels in the middle of an otherwise developed neighborhood. Usually large new homes on small lots. 2-Age Restricted Adult Communities ï Continuing construction on two large projects, while a third was recently completed.	We use the FEMA maps and also have a generally more restrictive local flood plain study. Any construction in a flood hazard area requires a variance from the Zoning Board of Adjustment. Variances are only granted after review by the Board Engineer. All applicable flood construction standards must be maintained.
Oceanport, Borough of	Currently a 44 home development is under construction off Port-au-Peck Ave between Oceanport Ave and East Main St. This is an over 50 complex and there is a retention pond on site. The next major development will be a commercial complex across from the above development, with rental units on the second level. Still awaiting a developer to take Project over. A 12 lot sub-division, on single family homes is planned off Port-au-Peck Ave between Branchport Ave and Myrtle Ave. There are concerns of storm water management for this site. A four unit townhouse complex is slated for Main St and Oceanport Ave. This borders water front area.	Yes, Floodplain. A 9 foot elevation or better. All new development and over 50% improvement based on the assessed value will require an elevation of 11.5 feet.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	6 affordable housing units are being considered for Main St. with a water front border, but over 125 feet set back. A 36 unit three story condo on East Main St. which borders water front. An possibly a 6 story, 60 unit complex on water front property along the Shrewsbury River of Morris Place and River St.. A major concern is Fort Monmouth will be closing and over 400 acres of property will become part of the Boro. Several redevelopment designs are presently being examined. Residential, commercial and recreational sites being looked at. Unable to give you an actual count of what each would be.	
Red Bank, Borough of	Five major projects under construction, including mixed-use structures, the largest of which includes more than 83,000 sf office space and a three-story parking garage. 10 significant projects approved for construction, several more pending board approval. (Full details were provided by the Planning and Zoning Dept.)	The planning and zoning process enforces stormwater regulations in accordance with the Borough Stormwater Ordinance. Where appropriate, we require applicants for development apply to the appropriate State agencies to gain approval for applicable floodplain requirements, CAFRA and waterfront development permits, including coastal bluff. Applicants are required, as a condition of Borough approvals, to obtain all required NJDEP permits. Refer to the building department for earthquake resistant design criteria and other building issues.
Roosevelt, Borough of	Due to the historical restrictions and open space preservation efforts, very little development is going on in Roosevelt at this time. The last large-scale residential development that was proposed was vehemently opposed and eventually turned down. The last spurt of residential development happened in the 1970s, with a house being built every few years since then. We have a very small industrial zone, which has little to no development happening or planned, as well as a very small commercial zone which also has little to no development happening or planned.	We have no such regulations at this time.
Rumson, Borough of	The Borough of Rumson is basically fully developed. New households (approximately four per year) are the result of the demolition of an existing house and the building of two homes to replace the former residence. The two new homes that are built are generally larger than the original home. Many smaller ranch homes are being demolished and replaced with larger, two-story homes.	The Borough of Rumson follows State conservation guidelines and codes for all new houses built in the Borough. The Borough of Rumson follows all FEMA guidelines for construction and development in flood areas. In addition, our construction official and zoning officers utilize our Borough Engineer for compliance testing for all applications submitted to the Borough.
Sea Bright, Borough of	Sea Bright is near fully developed. Any development proposed is typically rehabilitation or small scale redevelopment site. Downtown redevelopment is occurring on a small scale as well with some new businesses moving in and older, small bungalows being demolished, rebuilt, or raised out of flood zone. Waterfront development is minimal and regulated by CAFRA.	We have a flood damage prevention Ordinance as well as a new Stormwater Management Ordinance. We also have a Beach Preservation Ordinance and an established Coastal Protection Zone, running along the beachfront.
Sea Girt, Borough of	Sea Girt is a predominately a fully built up community. There is no or virtually	All homes built within the mile zone of the ocean are required to either have

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	no, open land for building. Residents that have double lots often break them up into two lots and sell them off. The impact of this type building is negligible on our infrastructure as well as our school system. Many homes being built in this manner, or new homes in general, belong to summer residents or part time residents in that make Sea Girt their home part of the year. The summer season, say from mid April to Mid October is when the community is at its peak with residents and visitors. The town is almost 1.1 square miles.	hurricane proof glass or regular windows with plywood storm panels for each individual window. Residents in the zero one hundred block are recommended to install hurricane shutters on their east facing windows and are also advised to utilize high wind building design. Recently The Borough rebuilt the Lifeguard Headquarters and Beachfront pavilion and during the process which I was intimately involved in ï for example ï the Borough took the lead in using some of the above mentioned items for storm and natural hazard protection both at the recommendation of the Borough Engineer and the residents.
Shrewsbury, Borough of	Development patterns in the Borough of Shrewsbury have trended towards infill development, as well as commercial re-development. A recent vacant land development analysis undertaken by the Borough revealed that there are no vacant parcels that are suited for development. The majority of future land development applications are expected to be largely made up of re-development initiatives of commercial properties along Broad Street (Hwy 35) and secondary arterials which are situated in commercial zones. It is also expected that mixed use residential & commercial development shall occur in non-residential zones as part of the Boroughôs Fair-Share Affordable Housing Plan, to create real opportunities for affordable housing in the Borough.	The Borough of Shrewsbury has enacted certain ordinances to protect against hazards due to natural disasters, including the following: §122 Flood Hazard Areas §94-5.13 Preservation of Natural Features §94-8.39 Stormwater Control.
Shrewsbury, Township of	Shrewsbury Township does not have growth capacity to develop any of our land. To put simply, we do not have any room to grow as a community.	We do not see these types of codes essential to our emergency management growth and development plan.
Spring Lake, Borough of	Spring Lake Borough land area is approximately 1.3 sq miles, with the Atlantic on the East and bordered by the communities of Lake Como, Spring Lake Heights and Sea Girt and Wall. It is a fully developed community with mature settlement patterns and little vacant land (identified by the state as part of the Metropolitan Planning Area). Spring Lake developed a 1974 Zoning and Land Use Plan in 1974 when it developed its current Master Plan. That Plan has been reviewed periodically. In 2007 the Borough is conducting a ñComprehensive Master Plan Updateò. This Master Plan Update will be consistent with the Monmouth County Growth Management Guide/Coastal Monmouth Plan (1995). The Borough has undergone a transformation from a resort community to a more year round bedroom community. Most construction today involves either renovation of older homes or the tear down of older homes and construction of new, significantly larger homes on existing lots. The Borough currently owns 119.45 acres of open space and 80.89 acres of land available to the public for active or passive recreational use. This land percentage compares favorably with National Recreation and Park Association standards. The Master Plan Update objectives for Land Use focus on maintaining the quality of residential neighborhoods, encouraging the development of the business district and maintaining the traditional elements of neighborhoods such as sidewalks, alleys, front porches, public spaces, green spaces and street trees.	The town does not have specific regulations or ordinances specific for the protection of new development from the effects of natural hazards. However the Borough has taken the steps to develop a Stormwater Management Plan; the Borough is a member of a County managed watershed working group for Wreck Pond that addresses a multitude of issues related to the watershed and water management. The Borough is considering steps to mitigate the risk of damage from floods in flood prone areas by allowing variances in zoning for persons desiring to elevate homes. It is also reviewing maximum lot coverage and maximum impervious coverage with consideration to storm runoff and management. The Borough will include a Land Use Element in the 2007 Master Plan Update.
Spring Lake Heights, Borough of	The Borough of Spring Lake Heights enforces Zoning Ordinance Section 22-	The Borough of Spring Lake Heights is essentially built out. There is

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	513 Flood Plain Regulations which restricts development in the flood plain. The Borough of Spring Lakes enforces Zoning Ordinance Section 22-513.2 Elevations which restricts development below the 100 year flood hazard elevation. The Borough of Spring Lake Heights currently enforces all applicable codes and regulations for building construction required by the State of New Jersey, namely the Uniform Construction Code which regulated high wind design criteria.	approximately 5% or less of vacant/undeveloped land available in the Borough. The majority of development is residential in nature and occurs as part of home additions and renovations. Records indicate the Borough of Spring Lake Heights has not issued a multi-family building permit from 2000 to 2006. The Borough issued a total of 23 single-family building permits in 2006 of which the majority were home additions and improvements. There were a total number of 133 single-family residential building permits issued in the Borough of Spring Lake Heights from 2000 thru 2006.
Tinton Falls, Borough of	Residential: Recent residential development trends in Tinton Falls have been in line with existing zoning, and include several approved higher density developments with an affordable component (i.e.. Traditions and Avalon Bay). These developments, combined with the smaller Parkview Town homes and Meadows at Tinton Falls' developments, will result in well over 500 new residential units. Greenbriar Falls, a new active adult community currently under construction, will contain 168 residential units. In addition, many of the larger residential developments in the Borough, such as Fox Chase, The Pines, and Seabrook, are beginning their final phases of development and will reach their full built-out potential. There is also a steady flow of smaller subdivisions that have been approved under the Borough's zoning standards. Non-Residential: By far the largest non-residential development planned in Tinton Falls is the Jersey Shore Premium Outlets (Chelsea Outlets), which will contain approximately 450,000 square feet of retail space. Infrastructure construction has already begun on the outlets, which will be located just off the Garden State Parkway at Exit 100 along Essex Road and Route 66. There are a number of other smaller-scale non-residential developments that have been approved, including a Wawa convenience store and gas station. The Tinton Falls Towne Centre, which will contain approximately 24,000 square feet of retail space, has recently been completed. In general, there is a steady stream of smaller-scale non-residential development (e.g. office, warehousing) being approved in Tinton Falls, particularly within the MFG and IOP zones.	The Borough currently takes several different approaches to protect new development from natural hazards in its Land Development Ordinance. One approach is to exclude critical areas from building areas, yard and buffer requirements. Extensive details provided by jurisdiction; too lengthy to attach here.
Union Beach, Borough of	The Borough of Union Beach is a predominantly developed suburban community with single-family housing located on lots ranging from 2,000 square feet to 75,620 square feet. The Borough is nearly fully developed with very little land that is not impacted by environmental constraints available for development. Most of the development in the Borough is redevelopment, rehabilitation of older housing or infill development in established neighborhoods with the exception of a portion of the shorefront area. The area along the shorefront north of Brook Avenue extending west to the intersection	The Borough Council adopted a Floodplain Mitigation Plan on July 18, 2003 as part of the National Flood Insurance Community Rating Program. In addition, the Borough's Floodplain Management Ordinance requires all new development to conform to the Regulations of State and Federal Flood Insurance Program.

Table 3d.6
Summary of Responses
Land Uses and Development Trends Questionnaire
(Source: Core Planning Group Members)

Community	Land Uses and Development Trends in Hazard Areas	Regulations/Codes/Ordinances To Protect New Development From Natural Hazards
	of Front Street and Union Avenue. This area has been re-zoned as the townhouse district with townhouses as a principal permitted use having a density not to exceed ten units per acre (medium-density residential).	
Upper Freehold, Township of	Upper Freehold Township's number one goal is preserving farmland and open space and we currently have in excess of 7,000 acres in the farmland preservation program. The type of residential development that we do have is generally subdivisions of 49 lots and under. They occur in all areas of the township with several of them located near neighboring Allentown Borough. Approximately 13 developments have been approved in the last 3-4 years resulting in approximately 475 single-family homes, when built out has been completed which may take many, many years. (Several of these sub-divisions only have preliminary approval; therefore, no building has begun.) We also have a small amount of commercial development within the Township such as small plazas with allowable retail uses (i.e. hair salons, convenience stores, doctor/professional offices, nursery schools, etc.)	Upper Freehold Township has adopted and enforces the following: 35-604 Flood plain areas (Flood Plain Management) 35-502 Storm Water Management 15% Steep Slope 2006 International Residential and Commercial Code 100 mph wind load 20 lb. live/10 lb dead snow land
Wall, Township of	Single Family development has slowed currently. Renovations and single family tear downs and rebuilds have moderately increased. Commercial development is steady, particularly along the Route 34 corridors. There are currently two higher density residential projects under construction. There are no new high density residential developments being considered. There are no major waterfront developments.	Building design criteria follows current regulations with regards to earthquake and high wind design criteria. All development is reviewed with respect to impacts of floodplains through the township's floodplain Management Ordinance. Natural features such as steep slopes, wetlands etc., are preserved per state and local regulations Ordinances.
West Long Branch, Borough of	Development in West Long Branch is minimal as the municipality is somewhat developed to the maximum. There are some minor sub-divisions planned for the last remaining open space parcels which will amount to a dozen or so home and a planned residential townhouse project.	Our Zoning and Planning Boards enforce the Land Use Code and Monitor any specific hazards. There are no obvious potentials such as landslides or wildfires. There are some minor flooding areas.

SECTION 4 - CAPABILITIES AND RESOURCES

This capability assessment examines the ability of Monmouth County and other participating jurisdictions to implement and manage a comprehensive mitigation strategy, which includes a range of mitigation actions. The strengths, weaknesses, and resources of participating jurisdictions are identified in this assessment as a means to develop an effective hazard mitigation program. Furthermore, the capabilities identified in this assessment are evaluated collectively to develop recommendations, which support the implementation of effective mitigation actions throughout the County.

URS Corporation distributed questionnaires to the Monmouth County Office of Emergency Management and the Core Planning Group in order to initiate this capability assessment. The questionnaires requested information pertaining to existing plans, polices, and regulations that contribute to or hinder the ability to implement hazard mitigation actions. They also requested information pertaining to the legal and regulatory capability, technical and administrative capacity, and fiscal capability of each jurisdiction. Completed questionnaires were received by January 2008 from Monmouth County, 49 municipalities, and Monmouth University, illustrating their capability to implement a mitigation strategy.

This section describes the activities currently underway which contribute to or can be utilized for hazard mitigation. This assessment of capabilities emphasizes the technical and financial resources available at the State and Federal levels, which the County can access to effectively implement a hazard mitigation program.

Capabilities and Resources – Monmouth County and Participating Jurisdictions

Legal and Regulatory Capability

As indicated in Table 4-1, Monmouth County and its incorporated jurisdictions have several policies, programs, and capabilities, which help to prevent and minimize future damages resulting from hazards. These tools are valuable instruments in pre- and post-disaster mitigation as they facilitate the implementation of mitigation activities through the current legal and regulatory framework. These policies, programs, and capabilities are described in greater detail for Monmouth County and the participating jurisdictions, as well as the State and Federal levels.

Table 4-1
Jurisdictional Legal and Regulatory Capabilities

Jurisdiction	Building Code	Zoning Ordinance	Subdivision Ordinance	Special Purposes Ordinance	Growth Management Ordinance	Site Plan Review Requirements	Comprehensive Plan	Capital Improvements Plan	Economic Development Plan	Emergency Response Plan	Post-Disaster Recovery Plan	Post-Disaster Recovery Ordinance	Real Estate Disclosure Ordinance
Monmouth County				ã		ã	ã	ã		ã			
Aberdeen Township		ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	
Allenhurst Borough	ã	ã	ã			ã	ã	ã	ã	ã			ã
Allentown Borough	ã	ã	ã	ã		ã		ã	ã	ã			
City of Asbury Park	ã	ã	ã	ã		ã	ã	ã	ã	ã	ã		ã
Atlantic Highlands Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã		
Avon-by-the-Sea Borough		ã	ã	ã	ã	ã	ã	ã		ã	ã		ã
Belmar Borough		ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	ã
Bradley Beach Borough	ã	ã	ã	ã		ã	ã	ã		ã	ã	ã	
Brielle Borough	ã	ã	ã	ã		ã	ã	ã		ã			ã
Colts Neck Township		ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	ã
Deal Borough	ã	ã	ã	ã		ã	ã	ã		ã	ã	ã	
Eatontown Borough	ã	ã	ã	ã		ã	ã	ã	ã	ã	ã		
Fair Haven Borough		ã	ã	ã		ã		ã		ã			
Farmingdale Borough	ã	ã	ã	ã	ã	ã	ã			ã	ã		ã
Freehold Borough	ã	ã	ã	ã		ã	ã	ã		ã	ã		ã
Freehold Township		ã	ã	ã		ã	ã	ã	ã	ã		ã	ã
Hazlet Township	ã	ã	ã	ã		ã	ã	ã	ã	ã			ã
Highlands Borough	ã	ã	ã	ã		ã	ã	ã	ã	ã			
Holmdel Township		ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	ã
Howell Township	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã		ã
Interlaken Borough	ã	ã	ã	ã	ã	ã	ã		ã	ã	ã		ã
Keansburg Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Keyport Borough		ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	ã
Lake Como Borough		ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	
Little Silver Borough		ã	ã	ã	ã	ã	ã		ã	ã		ã	ã
City of Long Branch		ã	ã	ã		ã	ã	ã	ã	ã			ã
Manalapan Township	ã	ã	ã	ã	ã	ã	ã	ã		ã	ã	ã	ã
Manasquan Borough	ã	ã	ã	ã		ã	ã	ã		ã	ã	ã	ã
Marlboro Township		ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Matawan Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã			

Table 4-1 (continued)
Jurisdictional Legal and Regulatory Capabilities

Jurisdiction	Building Code	Zoning Ordinance	Subdivision Ordinance	Special Purposes Ordinance	Growth Management Ordinance	Site Plan Review Requirements	Comprehensive Plan	Capital Improvements Plan	Economic Development Plan	Emergency Response Plan	Post-Disaster Recovery Plan	Post-Disaster Recovery Ordinance	Real Estate Disclosure Ordinance
Middletown Township		ã	ã	ã		ã		ã	ã	ã	ã	ã	ã
Millstone Township		ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	ã
Monmouth Beach Borough	ã	ã	ã	ã		ã		ã		ã	ã		
Neptune Township	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã			
City of Neptune		ã	ã	ã		ã	ã	ã		ã			
Ocean Township	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã		ã
Oceanport Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã		ã
Red Bank Borough	ã	ã	ã	ã	ã								
Rumson Borough	ã	ã	ã	ã		ã	ã	ã					
Sea Bright Borough		ã	ã	ã		ã	ã			ã	ã		
Sea Girt Borough		ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Shrewsbury Borough	ã	ã	ã	ã		ã	ã	ã	ã	ã	ã	ã	ã
Spring Lake Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã		
Spring Lake Heights Borough		ã	ã	ã		ã	ã	ã		ã			
Tinton Falls Borough	ã	ã	ã	ã	ã	ã	ã	ã		ã	ã	ã	
Union Beach Borough	ã	ã	ã	ã	ã	ã	ã	ã		ã			
Upper Freehold Township	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Wall Township		ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã	
West Long Branch Borough	ã	ã	ã	ã	ã	ã	ã	ã		ã	ã		ã
Monmouth University										ã			

Building Code

Building codes regulate construction standards and are developed for specific geographic areas of the country. They consider the type, frequency, and intensity of hazards present in the region. Structures built to applicable building codes are inherently resistant to many hazards such as strong winds, floods, and earthquakes, up to a certain level of severity. Due to the location specific nature of the building codes, these are very valuable tools for mitigation. In the State of New Jersey, the current building code in place is the International Building Code 2006 ï New Jersey Edition. This code is applicable state-wide and local municipalities may not adopt more stringent or additional provisions at their discretion.

The following jurisdictions reported that they adhere to a building code through local authority: The City of Asbury Park; the Boroughs of Allenhurst, Allentown, Atlantic Highlands, Belmar, Bradley Beach, Brielle, Deal, Eatontown, Farmingdale, Highlands, Manasquan, Matawan, Monmouth Beach, Oceanport, Red Bank, Rumson, Shrewsbury, Spring Lake, Tinton Falls, and Union Beach; the Townships of Freehold, Hazlet, Howell, Interlaken, Keansburg, Millstone, Neptune, Ocean, Upper Freehold and West Long Branch.

The following jurisdictions reported that they adhere to a code administered through the authority of a higher jurisdiction: the City of Long Branch; the Boroughs of Avon By The Sea, Freehold, Keansburg, Keyport, Lake Como, Little Silver, Manasquan, Neptune City, Sea Bright, Spring Lake, Tinton Falls and Union Beach; the Townships of Aberdeen, Colts Neck, Holmdel, Manalapan, Marlboro, Middletown, Monmouth Beach, Millstone, Neptune, Upper Freehold, Wall; and Monmouth University. Monmouth County adheres to a building code through local authority. The Boroughs of Fair Haven and Sea Girt have no local authority building code.

Zoning Ordinance

Zoning is a useful tool to consider when developing a mitigation strategy. It can be used to restrict new development, require low-density development, and designate specific uses (e.g. recreational) in the hazard prone areas. Private property rights must be considered, but enacting a zoning ordinance can reduce or potentially eliminate damages from future hazard events.

All of the jurisdictions that completed the Capability Assessment Questionnaire have adopted a zoning ordinance with the exception of Monmouth County and Monmouth University. Monmouth County adheres to local ordinances.

Subdivision Ordinance

Subdivision ordinances offer an opportunity to account for natural hazards prior to the development of land as they formulate regulations when the land is subdivided. Subdivision design that incorporates mitigation principles can reduce the exposure of future development to hazard events.

All of the jurisdictions that completed the Capability Assessment Questionnaire have adopted a subdivision ordinance with the exception of Monmouth County and Monmouth University. Monmouth County adheres to local ordinances.

Special Purpose Ordinance

A special purpose ordinance is a form of zoning in which specific standards dependent upon the special purpose or use must be met. For example, many special purpose ordinances include basic development requirements such as setbacks and elevations. The special purpose ordinance is a useful mitigation technique particularly when implemented to reduce damages associated with flooding and coastal erosion. Special purpose ordinances identified by jurisdictions include stormwater management, erosion, floodplain, steep slope, setback ordinances and standards for roads, bridges and drainage structures.

All of the jurisdictions that completed the Capability Assessment Questionnaire have adopted a special purpose ordinance with the exception of Allenhurst Borough and Monmouth University.

Growth Management Ordinance

Growth management ordinances are enacted as a means to control the location, amount, and type of development in accordance with the larger planning goals of the jurisdiction. These ordinances often designate the areas in which certain types of development is limited and encourage the protection of open space for reason such as environmental protection and limitation of sprawl.

The State Policies for Comprehensive Planning given in the New Jersey State Development and Redevelopment Plan (March 2001) encourages coordination of growth management plans and policies with hazard mitigation and emergency response planning.

The following jurisdictions have adopted growth management ordinances: The Boroughs of Atlantic Highlands, Farmingdale, Interlaken, Keansburg, Little Silver, Matawan, Oceanport, Red Bank, Sea Girt, Spring Lake, Tinton Falls, Union Beach And West Long Branch; and the townships, of Howell, Manalapan, Marlboro, Neptune, Ocean, Upper Freehold and Wall.

Site Plan Review Requirements

Site plan review requirements are used to evaluate proposed development prior to construction. An illustration of the proposed work, including its location, exact dimensions, existing and proposed buildings, and many other elements are often included in the site plan review requirements. The site plan reviews offer an opportunity to incorporate mitigation principles, such as ensuring that the proposed development is not in an identified hazard area and that appropriate setbacks are included.

All of the jurisdictions that completed the Capability Assessment Questionnaire, except Monmouth University, have adopted site plan review requirements.

Comprehensive Plan

A comprehensive plan is a document which illustrates the overall vision and goals of a community. It serves as a guide for the communityôs future and often includes anticipated demographics, land use, transportation, and actions to achieve desired goals. Integrating mitigation concepts and policies into a comprehensive plan provides a means for implementing initiatives through legal frameworks and enhances the opportunity to reduce the risk posed by hazard events.

All of the jurisdictions that completed the Capability Assessment Questionnaire have a Comprehensive Plan with the exception of the Boroughs of Allentown, Fairhaven, Monmouth Beach, and Red Bank, the Township of Middletown, and Monmouth University.

Capital Improvement Plan

Capital Improvement Plans schedule the capital spending and investments necessary for public improvements such as schools, roads, libraries, and fire services. These plans can serve as an important mechanism to manage development in identified hazard areas through limited public spending and can be used as a to develop a match for mitigation projects.

All of the jurisdictions that completed the Capability Assessment Questionnaire have a Capital Improvement Plan with the exception of the Boroughs of Farmingdale, Interlaken, Little Silver, Red Bank, and Sea Bright, and Monmouth University.

Economic Development Plan

Economic development plans offer a comprehensive overview of the local or regional economic state, establish policies to guide economic growth, and include strategies, projects, and initiatives to improve the economy in the future.

Furthermore, economic development plans, similar to capital improvement plans, offer an opportunity to reduce development in hazard prone areas by encouraging economic growth in areas less susceptible to hazard events.

Monmouth County does not have an economic development plan, according to the response to the Capability Assessment Questionnaire. All other jurisdictions have such a plan, except for the following: the City of Neptune, the Boroughs of Avon-by-the-Sea, Bradley Beach, Brielle, Deal, Fairhaven, Farmingdale, Freehold, Manasquan, Monmouth Beach, Red Bank, Rumson, Sea Bright, Spring Lake Heights, Tinton Falls, Union Beach and West Long Branch, the Township of Manalapan, and Monmouth University.

Emergency Response Plan

Emergency response plans provide an opportunity for local governments to anticipate an emergency and plan the response accordingly. In the event of an emergency, a previously established emergency response plan can reduce negative effects as the responsibilities and means by which resources are deployed has been previously determined.

All of the jurisdictions that completed the Capability Assessment Questionnaire have adopted an emergency response plan, except for the Boroughs of Red Bank and Rumson.

Post-Disaster Recovery Plan

A post-disaster recovery plan guides the physical, social, environmental, and economic recovery and reconstruction procedures after a disaster. Hazard mitigation principles are often incorporated into post-disaster recovery plans in order to reduce repetitive disaster losses.

The following jurisdictions have developed a post-disaster recovery plan: The City of Asbury Park, the Boroughs of Atlantic Highlands, Avon-by-the-Sea, Belmar, Bradley, Deal, Eatontown, Farmingdale, Freehold, Interlaken, Keansburg, Keyport, Lake Como, Manasquan, Monmouth Beach, Oceanport, Sea Bright, Sea Girt, Shrewsbury, Spring Lake, Tinton Falls ,and West Long Branch, the Townships of Aberdeen, Colts Neck, Holmdel, Howell, Manalapan, Marlboro, Middletown, Millstone, Ocean, Upper Freehold and Wall.

Post-Disaster Recovery Ordinance

Post-disaster recovery ordinances are often produced in conjunction with post-disaster recovery plans. The ordinances are enacted after a hazard event to guide redevelopment in order to reduce future damages and mitigate repetitive loss.

The following jurisdictions have adopted post-disaster recovery ordinances: The Boroughs of Belmar, Bradley Beach, Deal, Keansburg, Keyport, Lake Como, Little Silver, Manasquan, Sea Girt, Shrewsbury, and Tinton Falls; the Townships of Aberdeen, Colts Neck, Freehold, Holmdel, Manalapan, Marlboro, Middletown, Millstone, Upper Freehold, and Wall.

Real Estate Disclosure Ordinance

A real estate disclosure ordinance requires individuals selling real estate to inform potential buyers of the hazards to which the property and/or structure is vulnerable prior to the sale. Such a requirement ensures that the new property owner is aware of the hazards to which the property is at risk of damage.

The following jurisdictions have adopted real estate disclosure ordinances: The Boroughs of Allenhurst, Avon-by-the-Sea, Belmar, Brielle, Farmingdale, Freehold, Interlaken, Keansburg, Keyport, Little Silver, Manasquan, Oceanport, Sea Girt, Shrewsbury, and West Long Branch; the Townships of Colts Neck, Freehold, Hazlet, Howell, Manalapan, Marlboro, Middletown, Millstone, Ocean, and Upper Freehold, and the Cities of Asbury Park and Long Branch.

Administrative and Technical Capability

The ability of a local government to develop and implement mitigation projects, policies, and programs is contingent upon its staff and resources. Administrative capability is determined by evaluating whether there are an adequate number of personnel to complete mitigation activities. Similarly, technical capability can be evaluated by assessing the level of knowledge and technical expertise of local government employees, such as personnel skilled in surveying and Geographic Information Systems.

Table 4-2 provides a summary of the administrative and technical capabilities currently in place in each participating jurisdiction. The checkmark (ã) indicates that the local government maintains a staff member for the given function.

Table 4-2
Jurisdictional Administrative and Technical Capabilities

Jurisdiction	Planner(s) or Engineer(s) with knowledge of land development and management practices	Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Planner(s) or Engineer(s) with an understanding of natural and/or human caused hazards	Floodplain manager	Surveyors	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or HAZUS	Scientists familiar with the hazards of the community	Emergency Manager	Grant Writers
Monmouth County	ã	ã	ã		ã	ã	ã		ã	ã
Aberdeen Township	ã	ã	ã	ã	ã	ã	ã		ã	
Allenhurst Borough	ã	ã	ã		ã	ã			ã	ã
Allentown Borough		ã	ã						ã	ã
City of Asbury Park	ã	ã	ã	ã	ã	ã	ã		ã	ã
Atlantic Highlands Borough	ã	ã	ã		ã	ã	ã		ã	ã

Table 4-2
Jurisdictional Administrative and Technical Capabilities

Jurisdiction	Planner(s) or Engineer(s) with knowledge of land development and management practices	Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	Planner(s) or Engineer(s) with an understanding of natural and/or human caused hazards	Floodplain manager	Surveyors	Staff with education or expertise to assess the community's vulnerability to hazards	Personnel skilled in GIS and/or HAZUS	Scientists familiar with the hazards of the community	Emergency Manager	Grant Writers
Avon-by-the-Sea Borough	ã	ã	ã	ã	ã	ã		ã	ã	ã
Belmar Borough	ã	ã	ã		ã	ã			ã	ã
Bradley Beach Borough	ã	ã		ã		ã			ã	
Brielle Borough	ã	ã	ã	ã	ã				ã	ã
Colts Neck Township	ã	ã	ã						ã	
Deal Borough	ã	ã			ã				ã	ã
Eatontown Borough	ã	ã	ã		ã	ã	ã		ã	
Fair Haven Borough	ã	ã							ã	ã
Farmingdale Borough	ã					ã			ã	
Freehold Borough		ã				ã			ã	ã
Freehold Township	ã	ã	ã		ã	ã	ã	ã	ã	
Hazlet Township	ã	ã	ã			ã			ã	
Highlands Borough	ã	ã	ã			ã	ã		ã	
Holmdel Township	ã	ã	ã	ã	ã	ã		ã	ã	ã
Howell Township	ã	ã	ã	ã		ã	ã		ã	
Interlaken Borough		ã							ã	
Keansburg Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Keyport Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Lake Como Borough	ã	ã		ã	ã	ã			ã	
Little Silver Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
City of Long Branch	ã	ã		ã	ã	ã			ã	ã
Manalapan Township	ã	ã	ã	ã		ã			ã	
Manasquan Borough		ã	ã			ã			ã	ã
Marlboro Township	ã	ã	ã	ã	ã	ã	ã		ã	ã
Matawan Borough	ã	ã	ã			ã			ã	ã
Middletown Township	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Millstone Township	ã	ã	ã	ã	ã	ã	ã		ã	ã
Monmouth Beach Borough	ã	ã	ã	ã	ã	ã	ã		ã	ã
Neptune Township	ã	ã	ã			ã	ã		ã	ã

Table 4-2 Jurisdictional Administrative and Technical Capabilities										
Jurisdiction	**Planner(s) or Engineer(s) with knowledge of land development and management practices**	**Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure**	**Planner(s) or Engineer(s) with an understanding of natural and/or human caused hazards**	**Floodplain manager**	**Surveyors**	**Staff with education or expertise to assess the community's vulnerability to hazards**	**Personnel skilled in GIS and/or HAZUS**	**Scientists familiar with the hazards of the community**	**Emergency Manager**	**Grant Writers**
City of Neptune	ã	ã					ã		ã	
Ocean Township	ã	ã	ã	ã	ã	ã	ã		ã	ã
Oceanport Borough	ã	ã	ã		ã				ã	ã
Red Bank Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Rumson Borough	ã	ã	ã	ã	ã	ã	ã		ã	ã
Sea Bright Borough	ã	ã	ã		ã			ã	ã	ã
Sea Girt Borough	ã	ã	ã	ã	ã	ã		ã	ã	ã
Shrewsbury Borough	ã	ã	ã	ã	ã		ã		ã	ã
Spring Lake Borough	ã	ã	ã	ã		ã	ã	ã	ã	ã
Spring Lake Heights Borough	ã	ã	ã		ã	ã			ã	
Tinton Falls Borough	ã	ã	ã			ã			ã	
Union Beach Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Upper Freehold Township	ã	ã	ã	ã	ã	ã	ã		ã	
Wall Township	ã	ã	ã	ã	ã	ã	ã		ã	ã
West Long Branch Borough	ã	ã	ã		ã				ã	ã
Monmouth University	ã	ã	ã							ã

Fiscal Capability

The ability of a local government to implement mitigation activities is also associated with the funding available for policies and projects. Funding for such initiatives is often locally based revenue and financing, as well as outside grants. Costs associated with mitigation activities range from staffing and administrative costs to the actual cost of the mitigation project.

Table 4-3 provides a summary of the fiscal capabilities currently in place in each participating jurisdiction. The checkmark (ã) indicates that the financial resource is available in the local jurisdiction for mitigation purposes.

Table 4-3
Jurisdictional Fiscal Capabilities

Jurisdiction	Community Development Block Grants (CDBG)	Capital Improvements Project Funding	Authority to Levy Taxes for Specific Purposes	Fees for Water, Sewer, Gas, or Electric Service	Impact Fees for Homebuyers or Developers for New Developments/Homes	Incur Debt through General Obligation Funds	Incur Debt through Special Tax and Revenue Bonds	Incur Debt through Private Activity Bonds	Withhold Spending in Hazard-Prone Areas	Other
Monmouth County	ã	ã	ã		ã	ã	ã			
Aberdeen Township	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Allenhurst Borough	ã	ã	ã	ã	ã	ã	ã			
Allentown Borough	ã	ã	ã	ã		ã				
City of Asbury Park	ã	ã	ã	ã	ã	ã	ã	ã	ã	
Atlantic Highlands Borough	ã	ã	ã	ã	ã	ã	ã		ã	
Avon-by-the-Sea Borough	ã	ã	ã	ã		ã	ã		ã	
Belmar Borough	ã	ã	ã	ã	ã	ã	ã			
Bradley Beach Borough	ã	ã	ã	ã		ã	ã			
Brielle Borough	ã	ã	ã	ã	ã	ã	ã			
Colts Neck Township		ã	ã		ã	ã	ã		ã	
Deal Borough	ã	ã	ã	ã		ã	ã			
Eatontown Borough	ã	ã	ã	ã	ã	ã	ã			
Fair Haven Borough	ã	ã					ã			
Farmingdale Borough	ã	ã	ã	ã		ã	ã			
Freehold Borough	ã	ã	ã	ã		ã	ã	ã		
Freehold Township	ã	ã	ã	ã	ã	ã				
Hazlet Township	ã	ã	ã		ã	ã				
Highlands Borough	ã	ã		ã	ã					
Holmdel Township		ã	ã	ã	ã	ã				
Howell Township	ã	ã	ã	ã		ã	ã			
Interlaken Borough		ã	ã	ã		ã	ã			
Keansburg Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Keyport Borough		ã	ã	ã		ã				
Lake Como Borough	ã	ã		ã		ã				
Little Silver Borough		ã				ã				
City of Long Branch	ã	ã			ã	ã				
Manalapan Township	ã	ã	ã			ã	ã			
Manasquan Borough		ã	ã	ã		ã	ã			

Table 4-3
Jurisdictional Fiscal Capabilities

Jurisdiction	Community Development Block Grants (CDBG)	Capital Improvements Project Funding	Authority to Levy Taxes for Specific Purposes	Fees for Water, Sewer, Gas, or Electric Service	Impact Fees for Homebuyers or Developers for New Developments/Homes	Incur Debt through General Obligation Funds	Incur Debt through Special Tax and Revenue Bonds	Incur Debt through Private Activity Bonds	Withhold Spending in Hazard-Prone Areas	Other
Marlboro Township	ã	ã	ã		ã	ã	ã	ã	ã	ã
Matawan Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	
Middletown Township	ã	ã				ã	ã	ã		
Millstone Township	ã	ã	ã		ã	ã				
Monmouth Beach Borough	ã	ã	ã			ã				
Neptune Township	ã	ã	ã	ã	ã	ã	ã			
City of Neptune	ã	ã	ã	ã	ã					
Ocean Township		ã			ã	ã				
Oceanport Borough	ã	ã	ã		ã	ã	ã			
Red Bank Borough	ã	ã	ã	ã	ã	ã	ã			
Rumson Borough	ã	ã	ã	ã	ã	ã	ã		ã	
Sea Bright Borough						ã				
Sea Girt Borough	ã	ã	ã	ã	ã	ã	ã	ã	ã	ã
Shrewsbury Borough		ã	ã		ã					
Spring Lake Borough	ã	ã	ã	ã		ã	ã			
Spring Lake Heights Borough	ã	ã	ã	ã		ã	ã			
Tinton Falls Borough		ã	ã	ã	ã	ã	ã	ã	ã	ã
Union Beach Borough	ã	ã	ã	ã	ã	ã	ã			
Upper Freehold Township	ã		ã		ã	ã				
Wall Township	ã	ã		ã		ã	ã			
West Long Branch Borough	ã	ã	ã			ã	ã			
Monmouth University						ã				

Conclusion

This capability assessment finds that Monmouth County and the other fifty participating jurisdictions which submitted completed capability questionnaires collectively have a significant level of legal, technical, and fiscal tools and resources necessary to implement hazard mitigation strategies.

Capabilities and Resources – State of New Jersey

The State's Plan includes an evaluation of the State's overall pre and post hazard mitigation policies, programs, and capabilities; the policies related to development in hazard prone areas; and the State's funding capabilities. The Monmouth County Multi-Jurisdictional Hazard Mitigation Plan incorporates many of the resources identified in the State Plan to demonstrate the capabilities present for local jurisdictions to consider in the development of local hazard mitigation. The State Plan should be referred to directly for more specifics (on the web at www.state.nj.us/njoem/)

Emergency management in the State of New Jersey is under the direct control of the **Governor**, who is conferred specific emergency powers under the New Jersey Constitution and statues. The Superintendent of the State Police, a Division within the New Jersey Department of Law and Public Safety, is the **State Director of Emergency Management**.

The **Emergency Management Section** facilitates the flow of information to and from the various Bureaus supervised and serves as a conduit for communication with other Divisions. The Section is also responsible for planning, directing and coordinating emergency operations within the State which are beyond local control.

The **Recovery Bureau** supervises the Preparedness, Mitigation and Public Assistance units and three regional coordinators.

- The Preparedness Unit disseminates preparedness information in advance of a disaster or potential disaster.
- The Mitigation Unit undertakes hazard mitigation planning and the review of mitigation projects in advance of potential disasters, and is also activated during and immediately after disasters to evaluate existing and proposed mitigation measures in the affected areas. They make applicants aware of FEMA mitigation grant programs, and conduct training sessions and workshops and participate in public meetings to facilitate grant processes.
- The Public Assistance Unit accepts and reviews applications for funds for emergency work submitted by local individuals, households and businesses as well as from local governments during and immediately after a disasters.
- Regional Coordinators are the primary liaisons for NJOEM with the County Emergency Management Coordinators for seven contiguous counties in their assigned region (north, central, and south).

The State has an **Emergency Operations Center** which is activated and staffed whenever a disaster occurs, or is predicted to occur. The State's Emergency Operations Plan addresses the State's response to any disaster or emergency and provides the basis for coordinated emergency operations involving disaster planning, response, recovery and mitigation.

NJOEM staffing is limited, and this has historically hampered the NJOEM in addressing hazard mitigation initiatives in all its program goals. NJOEM capabilities are often supplemented by staff in other state offices and departments with unique capabilities (for example, regarding certain hazards or IT/GIS capabilities), including but not limited to the New Jersey Department of Environmental Protection, the New Jersey Office of Information Technology/GIS.

New Jersey has several funding sources for conducting hazard mitigation projects. For example, grants for flood mitigation projects may be obtained through the New Jersey Office of Emergency Management for planning and projects.

Capital needs of the state are primarily funded through three methods, which may be used singularly or in combination. They are:

- Pay-as-you-go capital outlays used primarily for renovations and preservation of state properties, highway, and mass transit improvements and environmental projects.
- General obligation bond funds, used to finance more expensive capital construction projects such as new facilities and must yield substantial benefits for the present and future generations (these funds must be authorized by the stateôs voters)
- Lease or lease-purchase is an alternate method of financing capital construction by allowing the state to occupy a facility and, over a defined period of time, secure ownership.

The remainder of this section summarizes key funding sources (as related to hazard mitigation) outlined in Section F of the state plan (beginning on page 98 of the main text).

The Stateôs Transportation Trust Fund provides funding for upkeep and maintenance of state highways, tunnels, bridges, public transit systems and goods movement systems.

A 1996 state bond act authorized the Dredging and Containment Facility Fund for dredging projects for New Jerseyôs ports and waterways, including funds to develop environmentally safe methods for managing dredged material.

In 1989, the Railroad Right of Way Preservation Fund was established to provide funds for acquiring or preserving rail corridors for future use.

The Statewide Transportation and Local Bridge Bond Act of 1999 provided funds for transportation projects. Roughly half of the funding was set aside for grants to county and municipal governments for the costs of the rehabilitation and improvement of structurally deficient bridges carrying county or municipal roads, including railroad overhead bridges. The remainder is available for other projects such as transit, statewide bridge repair, rail freight, airports, bikeways, and interchange improvement projects.

The NJDEP, with the New Jersey Environmental Infrastructure Trust, is responsible for three major capital programs affecting wastewater: the Environmental Infrastructure Financing Program, the Pinelands Infrastructure Trust Fund and the Sewage Infrastructure Improvement Act, all of which may potentially be used to mitigate natural hazards for vulnerable wastewater treatment and collection systems.

The New Jersey DEP has funds available for grants to organizations to conduct watershed planning, monitoring, and implementation. An effective program of local and on-site storm water management is critical to reducing flood hazards. Since 1997, the Clean Water Environmental Infrastructure Financing Program has provided zero interest loans to communities for stormwater management.

The Natural Resources Bond Act of 1981 provided grant funding for high hazard dam rehabilitation, including engineering studies and designs for 30 high hazard publicly owned dams.

The Green Acres, Clean Water, Farmland and Historic Preservation Bond Act of 1992 authorized the issuance of New Jersey state bonds to finance a renewable loan program for dam restoration.

The Emergency Flood Control Fund provides 50 percent matching grants to counties and municipalities of up to $1 million per project for the acquisition, development, construction and maintenance of structural flood control facilities.

The 1995 Green Acres, Farmland and Historic Preservation, and Blue Acres Bond Act established a fund in the NJDEP for acquiring lands in the floodway of the Passaic River.

Intermittent high hazard areas, such as floodplains, are effectively used for public recreation, even active recreation such as playing fields, provided that adequate vegetation, contouring and drainage are installed to prevent ponding. Capital investment in public open space and recreation land has been provided largely from Green Acres bond programs and federal grant funds. In addition, some capital funding stems from other sources. While Green Acres acts as the purchasing agent for many open space and recreational projects, administration of the properties is conducted primarily by the Division of Parks and Forestry and the Division of Fish and Game in the NJDEP. This is supplemented by the Garden State Preservation Trust Fund Account (also for land acquisition and recreational development).

State Resources

This capability assessment finds that the State of New Jerseyôs various departments collectively have a significant level of legal, technical, and fiscal tools and resources necessary to implement hazard mitigation strategies.

Capabilities and Resources – Federal

The Federal government offers a wide range of funding and technical assistance programs to help make communities more disaster resistant and sustainable. Many of these are included in Table 4.4, the Federal Technical Assistance and Funding matrix. Programs associated with the construction or reconstruction of housing and businesses, public infrastructure (transportation, utilities, water, and sewer), and supporting overall hazard mitigation and community planning objectives are emphasized in the matrix. Some programs are disaster-specific, activated by a Presidential Disaster Declaration under the provisions of the Stafford Act. Also included are programs or grants that are not specifically disaster related.

Federal Resources

FEMA has developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are briefly described.

How-to Guides. Some communities in Monmouth County have chosen not to participate in the planning process at this time, but could participate during future updates of the plan. Those communities can find additional information about the hazard mitigation planning process on the FEMA web site. FEMA has developed a series of nine ñhow-to guidesò to assist States, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides mirror the four major phases of hazard mitigation planning used in the development of the Monmouth County Multi-Jurisdictional Hazard Mitigation Plan. The last five how-to guides address special topics that arise in hazard mitigation planning such as using benefit-cost analysis and integrating man-made hazards. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements.

Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. FEMA, DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation, and shows State and

local governments how they can develop and achieve mitigation goals within the context of FEMAôs post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

Mitigation Resources for Success CD. FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for State and local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

A Guide to Federal Aid in Disasters. FEMA 262, April 1995. When disasters exceed the capabilities of State and local governments, the Presidentôs disaster assistance program (administrated by FEMA) is the primary source of Federal assistance. This handbook discusses the procedures and process for obtaining this assistance, and provides a brief overview of each program.

The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that companies can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a companyôs ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to Monmouth County industries and businesses located in hazard prone areas.

Important Websites

The following are important websites that provide focused access to valuable planning resources for communities interested in sustainable development initiatives.

- http://www.fema.gov - Web site of the Federal Emergency Management Agency includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.

- http://www.planning.org ï Web site of the American Planning Association, a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.

- http://www.ibhs.org ï Web site of the Institute for Business and Home Safety, an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Online resources provide information on natural hazards, community land use, and ways you can protect your property from damage.

Federal Technical Assistance and Funding

The Federal government offers a wide range of funding and technical assistance programs that communities can access to assist in their long-term recovery. Some of these programs are geared to disaster preparedness and mitigation planning, while the focus of others is the long-term vitality of the communities. To assist communities in their rebuilding efforts and to better prepare for the future, the

information in Table 4-4 is divided under the headings of conservation and environment, economic development, emergency management, historic preservation, housing, infrastructure, and mitigation.

For further information on these and other Federal programs, see the Catalog of Federal Domestic Assistance (CFDA) available on online at http://12.46.245.173/cfda/cfda.html.

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
CONSERVATION & ENVIRONMENT								
DOC; NOAA	Habitat Conservation	Cooperative grants to support a wide variety of research, habitat restoration, construction, management and public education activities for marine and estuarine habitats.	To benefit US fisheries, conserve protected resources, and add to the economic and social well being of the nation.	Local governments, universities and colleges, Indian Tribes, private profit and non-profit research and conservation organizations and individuals.	State coordinating official.	Submit application through Grants.gov. Proposals are evaluated for technical merit, soundness of design, competency of applicant to perform the proposed work, potential contribution of the project to national goals and appropriateness and reasonableness of costs.	90 days prior to the start date of the project.	Regional or local office. http://www.nmfs.noaa.gov/regional.htm
DOC; NOAA; Marine Fisheries Service	Unallied Management Costs	Cooperative grants to support management activities for high priority marine and estuarine resources.	To provide economic, sociological, public policy and other information needed by administrators for conserving and managing fishery resources and protected species in their environment.	Local governments, universities and colleges, Indian Tribes, private profit and non-profit research organizations and individuals.	State coordinating official.	Submit application through Grants.gov. Proposals are evaluated for technical merit, soundness of design, competency of applicant to perform the proposed work, potential contribution of the project to national goals and appropriateness and reasonableness of costs.	90 days prior to the start date of the project.	Southeast Federal Program Officer http://www.nmfs.noaa.gov/regional.htm (727) 824-5304.
DOD; USACE	Beach Erosion Control Projects	Specialized services to design and construct projects under a cost share method.	To protect beach and shore erosion through projects not specifically authorized by Congress.	Political subdivisions of the state and other responsible local agencies.	Consult with the nearest District Engineer.	Formal letter to District Engineer. Approval is subject to the availability of funds.	None.	Corps of Engineers District Office. http://www.usace.army.mil/howdoi/where.html
DOI; FWS	Conservation Grants Private Stewardship for Imperiled Species	Grants to fund voluntary restoration management, or enhancement of habitat on private lands for endangered, threatened, proposed, candidate or other at risk species.	To provide Federal financial and other assistance to individuals and groups engaged in local, private and voluntary conservation efforts to be carried out on private lands that benefit species listed or proposed as endangered or threatened.	Sponsored organization, individuals/families, specialized groups, public non-profit institutions/organizations, private non-profit institutions/organizations, small business, profit organizations and other private institutions/organizations.	See www.grants.gov or http;//endangered.fws.gov/grants/private_stewardship/index.html	See www.grants.gov or http;//endangered.fws.gov/grants/private_stewardship/index.html	See www.grants.gov or http://endangered.fws.gov/grants/private_stewardship/index.html	Regional or local office. http://endangered.fws.gov/grants/private_stewardship/index.html

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
CONSERVATION & ENVIRONMENT								
DOI; FWS	North American Wetland Conservation Fund	Grants to acquire real property interest in lands and water, including water rights, and to restore, manage, and/or enhance wetland ecosystems and other habitats for migratory birds, and other fish and wildlife.	To provide grant funds for wetland conservation projects.	Public or private organizations or to individuals who have developed partnerships to carry our wetland conservation projects.	Grants.gov	Submit applications.	March and July of each year.	Regional or local office. http://www.fws.gov/birdhabitat/Grants/NAWCA/CouncilAct.shtm
DOI; National Park Service	Save America's Treasures	Project Grants to protect and preserve nationally significant historical sites and wall as nationally significant collections of intellectual and cultural artifacts.	To provide matching grants for preservation and/or conservation work on nationally significant intellectual and cultural artifacts and nationally significant historical structures and sites.	Intrastate, interstate, local agencies, public or private non-profit institutions/organizations, public or private colleges and universities, including state colleges and universities and federally recognized Indian tribes.	Contact Save American Treasures at http://www.cr.nps.gov/hps/treasures/ (202) 513-7270, ext. 6.	Contact Save American Treasures at http://www.cr.nps.gov/hps/treasures/ (202) 513-7270, ext. 6.	Contact Save American Treasures at http://www.cr.nps.gov/hps/treasures/ (202) 513-7270, ext. 6.	Contact Save American Treasures at http://www.cr.nps.gov/hps/treasures/ or (202) 513-7270, ext. 6.
EPA; Office of Brownfields Cleanup and Redevelopment, Office of Solid Waste and Emergency Response	Brownfields Assessment and Cleanup Cooperative Agreements.	A revolving loan fund and project grants to provide funding to inventory, characterize, assess and conduct planning and community involvement related to Brownfield sites; to capitalize a revolving loan fund and provide sub-grants to carry out cleanup activities at	To assist in the expansion, redevelopment, or reuse of sites complicated by the presence of a hazardous substance, pollutant, or contaminant.	A general purpose unit of local government, a land clearance authority or a quasi – government entity acting under the authority of the local government, a regional council or a group of general purpose units of government, a	EPA Regional Office. http://www.epa.gov/epahome/locate2.htm	Competitive grant program. See Grant Announcement available from EPA.	Contact Regional Office. http://www.epa.gov/epahome/locate2.htm	Brownfields Regional Office Coordinator, Dallas, Texas (214) 665-6737. http://www.epa.gov/epahome/locate2.htm

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CONSERVATION & ENVIRONMENT								
		the sites; and, to carry out cleanup activities on land owned by the grant recipient.		redevelopment agency, Indian Tribes, and non-profit organizations (subject to conditions).				
EPA, Office of Water	Regional Wetland Program Development Grants	Project Grants to encourage wetland program development by promoting the coordination and acceleration of research, investigations, experiments, training, demonstration, survey and studies related to the causes, effects, extent, prevention, reduction and elimination of water pollution.	To assist State, Tribal, local government agencies and interstate/intertribal entities to build capacity to protect, manage and restore wetlands.	Tribes, local governments, interstate agencies and intertribal consortia.	EPA Regional Office.	EPA Regional Office will review grant application and any grants will be awarded by the regional Administrator.	Contact EPA Regional Office. http://www.epa.gov/epahome/locate2.htm	EPA Regional Office, Wetland Coordinator. http://www.epa.gov/epahome/locate2.htm
USDA; Forest Service	Forest Land Enhancement Program	Project Grants for technical assistance to develop management plans, educational programs and assistance to increase awareness, and cost-share assistance to implement sustainable forestry practices on the ground.	Sustainable management of non-industrial private forests and other rural land suitable for sustainable forest management.	State Forestry Agencies and Landowners, managers of non-industrial private forests lands, nonprofit organization, consultant foresters, universities, other state, local and private organization and agencies.	State Forestry Agency. http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml	The State must prepare a State Priority Plan that is approved by the Forest Service. After Approval a property owner is eligible for cost share assistance.	Deadlines are determined by State Forestry Agencies. http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml	Regional or local office of US Forest Service. http://www.fs.fed.us/spf/coop/programs/loa/flep.shtml

Table 4-4: Federal Technical Assistance and Funding								
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CONSERVATION & ENVIRONMENT								
USDA; Forest Service	Urban and Community Forestry Program	Project grants for assistance in urban forestry programs.	To plan for, establish, manage and protect trees, forests, green spaces and related resources in and adjacent to cities and towns.	State Forestry, interested members of the public, private nonprofit organizations in urban and community forestry programs in cities and communities.	Contact Regional Offices.	Contact Regional Offices.	Contact Regional Offices. http://www.fs.fed.us/ucf/	Regional or local office of US Forest Service. http://www.fs.fed.us/ucf/

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
ECONOMIC DEVELOPMENT								
DOC; EDA	Economic Adjustment Assistance	Project Grants to help local interests design and implement strategies to adjust or bring about changes in the economy.	Aids the long-range economic development of areas with severe unemployment, and low family income problems, aids in the development of public facilities and private enterprises to create new, permanent jobs.	Economic Development Districts, cities or other political subdivisions of the state or a consortium of political subdivisions, Indian tribes or a consortium of Indian tribes, institutions of higher learning or a consortium of such institutions, or public or non-profit organizations or association acting in cooperation with the political subdivisions.	Meet with EDA's Economic Development Representative (EDR) to determine whether the preparation of a project proposal is appropriate.	After meeting with EDR the Regional Director will decide whether to invite an application. More information will be given at that time.	Continuing basis.	Regional or Local Office. http://www.eda.gov/Contacts/Contacts.xml
DOC; EDA	Economic Development Support for Planning Organizations	Project grants to establish economic development strategies designed to reduce unemployment and increase incomes.	To strengthen economic development planning capacity.	Economic Development Districts, Indian Tribes, units of local government, institutions of higher education and private non-profit organizations.	Submit a letter of interest, a statement of distress and a proposed work program not to exceed 10 pages and SF 424 to regional or Local Office.	Following invitation by agency a formal application is made to the regional office and to the EDA state representative.	None.	Regional or Local Office. http://www.eda.gov/Contacts/Contacts.xml
DOD; Office of Economic Adjustment	Growth Management Planning Assistance	To provide project grants to assist local governments to undertake community economic adjustment planning activities.	Planning in response to the establishment or expansion of Department of Defense military Installation.	Local governments or regional organizations.	http://www.oea.gov	Application is reviewed and approved by the Department of Defense's Office of Economic Adjustment.	None.	Regional or Local Office. http://www.eda.gov/Contacts/Contacts.xml
DOL	Disaster Unemployment Assistance	Direct Payments for Specified Use; Provision of	Disaster Unemployment Assistance provides financial assistance to	In order to qualify for this benefit your employment	An applicant should consult the office or officials designated as	Claims should be filed in accordance with the state's instructions published in announcements about the availability	Applications for DUA must be filed within 30 days after the date of the SWA	More information about this program and where to apply for benefits under this

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ECONOMIC DEVELOPMENT								
		Specialized Services.	individuals whose employment or self-employment has been lost or interrupted as a direct result of a major disaster declared by the President of the United states. Before an individual can be determined eligible for Disaster Unemployment Assistance, it must be established that the individual is not eligible for regular unemployment insurance benefits (under any state or federal law). The program is administered by states as agents of the federal government.	or self-employment must have been lost or interrupted as a direct result of a major disaster and you must have been determined not eligible for regular state unemployment insurance. With exceptions for persons with an injury and for self-employed individuals performing activities to return to self-employment, individuals must be able to work and available for work, which are the same requirements to be eligible for state unemployment insurance benefits.	the single point of contact in his or her State for more information on the process the State requires to be followed in applying for assistance, if the State has selected the program for review.	of Disaster Unemployment Assistance, or contact the State Unemployment Insurance agency.	announcement regarding availability of DUA. When applicants have good cause, they may file claims after the 30-day deadline. However, no initial application will be considered if filed after the 26th week following the declaration date.	program is available at: http://workforcesecurity.doleta.gov/unemploy/disaster.asp To determine your eligibility for unemployment insurance (UI) benefits, you should contact the state unemployment insurance agency in the state where you are located as soon as possible after becoming unemployed. In some states, you can now file a claim by telephone and the Internet.
EDA	Economic Development and Adjustment Program, Sudden and Severe Economic Dislocation (Title IX)	Grants	To help States and localities to develop and/or implement strategies that address adjustment problems resulting from sudden and severe economic dislocation.	States, Localities, Non-Profit Organizations, and Indian Tribes.	Information regarding EDA's program procedures, regulations, and other requirements are available at EDA's website, www.eda.gov	Project grants can be funded in response to natural disasters including improvements and reconstruction of public facilities.	Contact the Disaster Recovery Coordinator, Economic Adjustment Division.	Disaster Recovery Coordinator, Economic Adjustment Division, EDA, DOC, Herbert C. Hoover Building, Washington, DC 20230. Telephone: 800.345.1222 or 202.482.6225. http://www.doc.gov/eda/html/prgtitle.htm
FHWA;	Development and Promotion	Advisory Services and Counseling,	Promote and plan for the development and	Local government Agencies,	Regional or Local Office.	Personal Conference or Explanation of Problem.	None.	Regional or Local Office. http://www.marad.dot.gov/w

Table 4-4: Federal Technical Assistance and Funding								
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ECONOMIC DEVELOPMENT								
Maritime Administration	of Ports and Intermodal Transportation	Technical Information.	utilization of domestic waterways, ports and port facilities.	Metropolitan Planning Organizations, Public Port and Intermodal Authorities, Trade Associations and Private Intermodal and Terminal Operators.				elcome/regional%20off_directory.html
HUD; Community Planning and Development	Community Development Block Grants / Brownfields Economic Development Initiative	Project Grants to carry out economic development projects on contaminated building s or land.	To return Brownfields to productive economic use.	Units of local government.	Application Procedures will be published in Notice of Funding Availability in the Federal Register.	The Process will be published in Notice of Funding Availability in the Federal Register.	Deadline will be published in Notice of Funding Availability in the Federal Register.	Regional or local Office. http://www.hud.gov/offices/cpd/economicdevelopment/programs/bedi/index.cfm
HUD; Office of Community Planning and Development	Community Development Block Grants Section 108 Loan Guarantees	Guaranteed/Insured Loans for financing of economic development, housing rehabilitation, public facilities, and large scale physical development projects.	To provide communities with a source of financing for economic development, housing rehabilitation, public facilities, and large scale physical development projects.	Metropolitan Cities and Urban Counties.	See 24 Code of Federal regulations, Section 570.704 for application requirements.	See 24 Code of Federal regulations, Section 570.704 for application process.	Continuing basis.	Regional or Local Office. http://www.hud.gov/offices/cpd/communitydevelopment/programs/108/index.cfm
HUD; Office of Community Planning and Development	Community Development Block Grants / Technical Assistance Program	Project Grants (Cooperative Agreements) to transfer skills and knowledge of planning, developing and administering CDBG programs to eligible block grant entities.	To help units of local government, Indian tribes and area wide planning organizations to plan, develop and administer local CDBG programs.	Units of local government, national or regional non-profit organizations that have membership comprised predominantly of entities or officials of entities of CDBG recipients, professional and technical service companies, public or private non-profit organizations	In answer to competitions and solicitations. They will be detailed in the Federal Register.	Applicants will be notified of acceptance or rejections.	Deadlines are in solicitation documents.	Regional or Local Office. http://www.hud.gov/offices/cpd/communitydevelopment/programs/index.cfm

Table 4-4: Federal Technical Assistance and Funding								
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ECONOMIC DEVELOPMENT								
				including educational institutions and area-wide planning organizations.				
HUD; Policy Development and Research	Hispanic-Serving Institutions Assisting Communities	Project Grants for neighborhood revitalization, housing and economic development projects.	To assist Hispanic serving institutions of higher education to expand their role and effectiveness in addressing community development needs in their localities, consistent with the purposes of Title 1 of the housing and Community Development Act of 1974.	Nonprofit accredited Hispanic serving institutions of higher education that are on the US Dept. of Educations list of eligible HSI's or certify that they meet the statutory definition of an HIS.	Application Procedures will be published in Notice of Funding Availability in the Federal Register.	The Process will be published in Notice of Funding Availability in the Federal Register.	Deadline will be published in Notice of Funding Availability in the Federal Register.	HUD Office of University Partnerships http://www.oup.org/ (202) 708-3061.
HUD; Policy Development and Research	Historically Black Colleges and Universities Program	Project Grants for those activities that are eligible for CDBG funds as listed in 24 Code of Federal regulations, part 570, subpart C, particularly paragraphs 570,201 through 570.206.	To assist historically black colleges and universities to expand their role and effectiveness in addressing community development needs in their localities, including neighborhood revitalization, housing, and economic development, principally for persons of low-moderate income.	Historically Black Colleges and Universities as determined by the U.S. Dept. of Education.	Application Procedures will be published in Notice of Funding Availability in the Federal Register.	The Process will be published in Notice of Funding Availability in the Federal Register.	Deadline will be published in Notice of Funding Availability in the Federal Register.	HUD Office of University Partnerships http://www.oup.org/ (202) 708-3061.
USDA; Rural Utilities Service	Assistance to High Energy Cost Rural Communities	Project Grants and Direct loans use to acquire construct, extend, upgrade and improve energy generation, transmission, or distribution facilities in rural communities where the average	Assistance to rural communities with extremely high energy costs.	Political subdivisions of states, for-profit and non-profit businesses, cooperatives, association, organization, and other entities organized under	Application Procedures will be published in Notice of Funding Availability in the Federal Register.	Grants Awarded on a Competitive Basis.	Deadline will be published in Notice of Funding Availability in the Federal Register.	DOA Electric Program http://www.usda.gov/rus/electric/regs/fedreg.htm (202) 720-9545.

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ECONOMIC DEVELOPMENT								
		expenditure on home energy cost is at least 275% of the national average		the laws of States, Indian tribes, tribal entities, and individuals.				
USDA; Rural Business-Cooperative Service	Business and Industry Loans	Direct Loans and Guaranteed/Insured Loans. Direct Loans for modernization, development cost, purchasing and developing land, easements, tights-of-way, buildings, facilities, leases or materials, purchasing equipment, leasehold improvements, machinery and supplies, and pollution control and abatement equipment. Guaranteed Loans are for the same actions mentioned above plus for agricultural production, when not eligible for the Farm Service Agency farmer program assistance and when it is part of an integrated business also involved in the processing of agricultural products.	To assist public, private and cooperative organizations, Indian Tribes or individuals in rural areas to obtain quality loans for the purpose of improving, developing or financing business, industry, and employment and improving the economic and environmental climate in rural communities including pollution abatement controls.	A cooperative, corporation, partnership, trust or other legal entity organized and operated on a profit or nonprofit basis, an Indian tribe, a municipality, county or other subdivision of state or individuals in rural areas.	Rural Development State Office.	Contact the Rural Development State Office or the State Coordinating Agency. http://www.rurdev.usda.gov/recd_map.html	Not Applicable.	Rural Development State Office. http://www.rurdev.usda.gov/recd_map.html
USDA; Rural Utilities	Community Connect Grant	Project grants for the deployment of broadband	To encourage community oriented connectivity in rural	Indian Tribe or tribal organization, local units of	Application in accordance with 7 Code of Federal	Grants Awarded on a Competitive Basis.	Deadline will be published in Notice of Funding Availability in the Federal Register.	DOA Telecommunications Program http://www.usda.gov/rus/tel

Table 4-4: Federal Technical Assistance and Funding								
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ECONOMIC DEVELOPMENT								
Service	Program	transmission services to critical community facilities, rural residents and rural businesses and for the construction, acquisition, expansion, and/or operation of a community center which would provide such services free to residents for at least 2 years.	areas where such service does not currently exist.	government or other legal entity, including cooperatives or private corporations of limited liability companies organized on a for profit or nonprofit basis, and have the legal authority to own and operate the broadband facilities as proposed in its application, to enter into contracts and to comply with federal statutes and regulations.	regulations, Section 1739.			ecom/index.htm (202) 720-9554.
USDA; Rural Housing Service	Community Facilities Loans and Grants	Guaranteed/Insured Loans, Direct Loans or Project Grants for community facilities such as child care facilities, food recovery and distribution centers, assisted living facilities, group homes, mental health clinics, shelters and education facilities. Projects comprise community, social, cultural, transportation, industrial park sites, fire and rescue	To construct, enlarge, extend or otherwise improve community facilities providing essential service to rural residents.	City and County agencies, political and quasi-political subdivisions of the state, associations including corporations, Indian tribes and existing private corporations which are operated on a not-for-profit basis, have or will have the authority necessary for constructing operating and maintaining the proposed facility or service and for	Obtain SF-424 from the rural Development Area Office for a pre-application.	The pre-application is reviewed by the Rural Development area office and state office and the applicant is advised whether to file an application.	None.	Regional or local office. http://www.rurdev.usda.gov/rd/pubs/pa1557.htm

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ECONOMIC DEVELOPMENT								
		services, access ways, and utility extensions. All facilities must be for public use.		obtaining, giving security for and repaying the loans, and are unable to finance the project fro its own resources or through commercial credit at a reasonable rate.				
USDA; Cooperative State Research, Education, and Extension Service	Community Food Projects	Project grants a comprehensive approach to develop long term solutions to help ensure food security in communities by linking the food sector to community development, economic opportunity, and environmental enhancement (50/50 program).	To support the development of community food projects designed to meet the food needs of low income people; increase the self-reliance of communities in providing their own needs; and promote comprehensive responses to local food, farm, and nutrition issues.	Private nonprofit entities.	Application Procedures will be published in Notice of Funding Availability in the Federal Register.	The Process will be published in Notice of Funding Availability in the Federal Register.	Deadline will be published in Proposal Solicitation in the Federal Register.	DOA Competitive Research Grants and Awards Management (202) 401-1761.
USDA	Livestock Assistance Program	Direct Payments.	To provide direct payments to eligible livestock producers who suffered grazing losses due to drought, hot weather, disease, insect infestation, fire, hurricane, flood, fire, earthquake, severe storm, or other disasters during the 2000 crop year. Benefits will be provided to eligible livestock producers only in those counties where a severe natural disaster occurred. A county must have been approved as a primary disaster area under a Secretarial	Citizens of, or legal resident alien in the United States; a farm cooperative, private domestic corporation, partnership, or joint operation in which a majority interest is held by the members, stockholders, or partners who are citizens of, or legal resident alien of the United States; Indian tribe or tribal organization of the Indian Self-		Applicants visit the county or parish Farm Service Agency (FSA) office in the eligible county or parish to make application, certify eligibility and report percent of grazing loss, number of grazing acres, and number of eligible livestock by type and weight on Form CCC-740.	Sign-up for assistance under the 2000 LAP began January 18, 2000. Date for ending the sign-up will be determined at a later date.	Regional or Local Office: Consult the local phone directory for location of the nearest county FSA office. If no listing, contact the appropriate State FSA office listed in the Farm Service Agency section of Appendix IV of the Catalog or on the WEB at http://www.fsa.usda.gov/edso/ Headquarters Office: Department of Agriculture, Farm Service Agency, Production, Emergencies, and Compliance Division, Emergency Preparedness and Program Branch, Stop

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ECONOMIC DEVELOPMENT								
			disaster designation or Presidential disaster declaration after January 1, 2000, and subsequently approved for participation in the Livestock Assistance Program (LAP) by the Deputy Administrator for Farm Programs.	Determination and Education Assistance Act; any organization under the Indian Reorganization Act or Financing Act; and economic enterprise under the Indian Financing Act of 1974.				0517, 1400 Independence Avenue SW., Washington, DC 20250-0517. Telephone: (202) 720-7641. http://www.fsa.usda.gov
USDA; Rural Business-Cooperative Service	Renewable Energy Systems and Energy Efficient Improvements Program	To create a program to make direct loans, loan guarantees and grants to agricultural producers and rural businesses to help reduce energy costs and consumption.	To create a program to make direct loans, loan guarantees and grants to agricultural producers and rural businesses to help reduce energy costs and consumption and help meet the nation's critical energy needs.	Agricultural producer or rural small business.	Rural Energy Coordinator in the State.	Application must be submitted to the rural Energy Coordinator who will score it and submit to the National Office. The Highest scored application nationally will receive funding.	Continual sign-up process.	The Rural Business-Cooperative Service State Office.
USDA; Rural Business–Cooperative Service	Rural Business Enterprise Grants	Project Grants to create, expand or operate rural distance learning networks or programs for education, job training instruction related to potential employment, job advancement; development, construction, acquisition, land, buildings, plants, equipment, access streets and roads, parking areas, utility extensions, water supply, waste water	To facilitate the development of small emerging business, industry and related employment for improving the economy of rural areas.	Public bodies and nonprofit corporations serving rural areas.	From the Rural Business Cooperative Service or the State Coordinating Agency.	The pre-application is filed with the local office. After review it will be reviewed and processed by the State office.	None.	Regional or local office.

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
ECONOMIC DEVELOPMENT								
		disposal facilities, refinancing, services and fees or to establish a revolving loan fund.						
USDA; Rural Business–Cooperative Service	Rural Business Opportunity Grants	Project grants to be used to assist in economic development of rural areas by providing technical assistance, training, and planning for business and economic development.	To promote sustainable economic development in rural communities with exceptional needs.	Public bodies, nonprofit corporations, Indian tribes and cooperatives with members that are primarily rural residents and that conduct activities for the mutual benefit of their members.	From the Rural Development State office or the State Coordinating Agency.	Applications will be scored and awards announce.	None.	Regional or local office.
USDA; Rural Business–Cooperative Service	Rural Cooperative Development Grants	Project Grants to facilitate the creation or retention of jobs in rural area through the development of new rural cooperative, value added processing and rural business.	To improve economic conditions in rural areas through cooperative development.	Nonprofit corporation and institutions of higher learning.	From the Rural Business Cooperative Service or the State Coordinating Agency.	The National Office reviews all applications, scores and ranks them.	Published in Federal Register.	Regional or local office.
USDA; Rural Business–Cooperative Service	Rural Economic Development Loans and Grants	Direct Loans and Project Grants for project feasibility studies, start-up costs, incubator projects and other reasonable costs for the purpose of fostering rural development.	For rural economic development and job creation projects.	Electric and telephone utilities that have current loans with the Rural Utilities Service or rural telephone Bank loans or guarantees outstanding.	Rural Development State Office.	See 7 Code of Federal Regulation, Section 1703.34.	None.	Regional or local office.
USDA; Farm Service Agency	Tree Assistance Program	Direct payments with unrestricted use to tree, bush and vine owners who have trees, bushes and vines lost to a natural disaster, to replant or rehabilitate said	To assist producers whose trees, bushes or vines are damaged or destroyed in natural disasters.	Individual owners.	A form provided by FSA; a written estimate of the number or trees, bushes or vines lost or damaged which is prepared by the owner or someone who is a qualified expert, as determined	The County Committee makes recommendations and eligibility determinations on those determinations that it wants to recommend to a higher approval official.	To be announced.	Regional or local office.

Table 4-4: Federal Technical Assistance and Funding								
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ECONOMIC DEVELOPMENT								
		vegetation and produce annual crops for commercial.			by the county Committee; the number of acres on which the loss was suffered; and sufficient evidence of the loss o allow the County Committee to calculate whether an eligible loss occurred.			
USTREAS	Casualties, Disasters, and Theft	Tax relief.	The program offers tax relief for casualty losses that result from the destruction of, or damage to your property from any sudden, unexpected, or unusual event such as a flood, hurricane, tornado, fire, earthquake or even volcanic eruption.	A victim of a Presidentially declared disaster and you must be a taxpayer who is interested in receiving tax information and preparation assistance.	Contact IRS, http://www.irs.gov/taxtopics/tc515.html	Casualty losses are claimed on Form 4684 (PDF), *Casualties and Thefts*. Section A is used for personal–use property and Section B is used for business or income-producing property. If personal-use property was destroyed or stolen, you may wish to refer to Publication 584, *Casualty, Disaster, and Theft Loss Workbook*, to help you catalog your property. If the property was business or income-producing property, refer to Publication 584B (PDF), *Business Casualty, Disaster, and Theft Loss Workbook*.	Check website, http://www.irs.gov/pub/irs-pdf/p547.pdf	For additional information contact: Internal Revenue Service Tax forms and Publications W:CAR:MP:FP 1111 Constitution Ave NW Washington, DC 20224. http://www.irs.gov/taxtopics/tc515.html

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
EMERGENCY MANAGEMENT								
DHS	Community Disaster Loans	Loan.	To provide loans subject to Congressional loan authority, to any local government that has suffered substantial loss of tax and other revenue in an area in which the President designates a major disaster exists. The funds can only be used to maintain existing functions of a municipal operating character and the local government must demonstrate a need for financial assistance	Applicants must be in a designated major disaster area and must demonstrate that they meet the specific conditions of FEMA Disaster Assistance Regulations 44 CFR Part 206, Subpart K, Community Disaster Loans.		Upon declaration of a major disaster, application for a Community Disaster Loan is made through the Governor's Authorized Representative to the Regional Director of FEMA. The Associate Director of the Response and Recovery Directorate approves or disapproves the loan. The Designated Loan Officer will execute a Promissory Note with the applicant. The promissory note must be co-signed by the State, or if the State cannot legally co-sign the note, the local government must pledge collateral security.	The loan must be approved in the fiscal year of the disaster or the fiscal year immediately following.	Regional or Local Office. http://www.dhs.gov
DHS	Disaster Legal Services	Legal assistance.	To provide legal assistance to individuals affected by a major Federal disaster.	Low-income individuals, families, and groups.	An applicant should consult the office or official designated as the single point of contact in his or her State for more information on the process the State requires to be followed in applying for assistance, if the State has selected the	Upon declaration of an emergency or major disaster, individuals and households may register an application for assistance with FEMA via a toll-free number or by visiting a Disaster Recovery Center.	Not applicable.	Regional or Local Office. http://www.dhs.gov

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
EMERGENCY MANAGEMENT								
					program for review.			
DHS	Disaster Unemployment Assistance	Direct Payments for Specified Use; Provision of Specialized Services.	To provide special federally funded weekly benefits to workers and self-employed individuals who are unemployed as a direct result of a Presidentially-declared major disaster, and who are not eligible for regular Unemployment Insurance benefits paid by States.	Disaster victims who have experienced direct loss of employment as a result of a Presidentially-declared major disaster designated for DUA.	From the local State Workforce Agency (SWA).	Upon declaration of a major disaster declaration designated for DUA, individuals may apply with their local State Workforce Agency (SWA).	Generally, applications for DUA must be filed within 30 days after the date of the SWA announcement regarding availability of DUA. When applicants have good cause, they may file claims after the 30-day deadline. However, no initial application will be considered if filed after the 26th week following the declaration date.	Regional or Local Office.
DOC; NOAA; Marine Fisheries Service	Fisheries Disaster relief	Cooperative Grants (75/25)	Assessment of the effects of Commercial Fishery failures, restoring fisheries, preventing future failures and assisting fishing communities affected by failures.	Fishing Communities.	National Marine Fisheries Service (NMFS).	Submit completed forms to NMFS through Grants.GOV	120 days before start of project.	National Marine Fisheries Service. http://www.nmfs.noaa.gov/
DOD	Emergency Rehabilitation of Flood Control Works or Federally Authorized Coastal Protection Works	Repair of Flood Control or Coastal Protection Works.	To assist in the repair and restoration of flood control works damaged by flood, or federally authorized hurricane flood and shore protection works damaged by extraordinary wind, wave, or water action.	Owners of damaged flood protective works, or State and local officials of public entities responsible for their maintenance, repair, and operation must meet current guidelines to become eligible for Public Law 84-99 assistance.	District Engineer or Corps of Engineers	Written application by letter or by form request if such form is locally used by the District Engineer of the Corps of Engineers.	Thirty days after a flood or unusual coastal storm.	Regional or Local Office: U.S. Army Corps of Engineers Division or District Engineers. Headquarters Office: Commander, U.S. Army Corps of Engineers, Attn: CECW-OE, Washington, DC 20314. Telephone: (202) 272-0251. FTS is not available. http://www.usace.army.mil/business.html
SBA	Economic Injury Disaster Loans	Loans to businesses suffering economic injury from Presidential, SBA, or Agricultural Disaster.	To provide working capital to small business, small agricultural cooperatives or nurseries who have actual economic injury.	Business owners who have suffered economic injury.	SBA Disaster Office.	File with nearest SBA Disaster Office.	Deadline established after each declaration.	SBA Disaster Office.

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
EMERGENCY MANAGEMENT								
SBA	Physical Disaster Loans	Loans to victims of declared disasters for uninsured or otherwise uncompensated physical damage.	To repair or replace damaged or destroyed real and/or personal property to its pre-damage condition. The loan limit may increase by 20% to provide protective measures.	Loans to homeowners, renters, business and non-profit organizations who have suffered physical loss do to a Presidential or SBA declared disaster.	SBA Disaster Office.	File with nearest SBA Disaster Office.	60 days from disaster declaration unless extended by SBA.	SBA Disaster Office.
USDA	Direct Housing, Natural Disaster Grants and Loans	Repair or replace damaged Property.	To meet emergency assistance needs not provided by FEMA Programs.	Very-Low income owner-occupants of rural housing in declared disaster areas. Must be 62 years or older.	Rural Development Field Office of the applicants County.	Complete Form 410-4 and return to field office.	From Date of Declaration until appropriated funds are exhausted.	U.S.D.A. Rural Development Field Office.
USDA	Disaster Reserve Assistance	Direct Payments for Specified Use.	To provide emergency assistance to eligible livestock owners, in a State, county, or area approved by the Secretary or designee, where because of disease, insect infestation, flood, drought, fire, hurricane, earthquake, hail storm, hot weather, cold weather, freeze, snow, ice, and winterkill, or other natural disaster, a livestock emergency has been determined to exist.	An established producer or husbandry of livestock or a dairy producer. a farm cooperative, private domestic corporation, partnership, or joint operation in which a majority interest is held by the members, stockholders, or partners who are citizens of, or legal resident aliens of the United States. Any Indian tribe or tribal organization of the Indian Self-Determination and Education Assistance Act. Any organization under the Indian Reorganization Act or Financing Act.	Visit the county FSA office in the eligible county.	Applicants visit the county FSA office in the eligible county to make application, certify eligibility and report feed loss, feed available, and eligible livestock related to the disaster occurrence; and (2) applicants also receive authority to participate in the program as provided by the approving official.	Feeding periods for the disaster reserve assistance program begin (a) the first day of the 1996 crop year in counties approved for 1995 or 1996 livestock feed programs; (b) the date the producer filed an application, if the natural disaster began after the beginning of the 1996 crop year; the date of the occurrence for sudden natural disasters that occurred after the beginning of the 1996 crop year.	Regional or Local Office http://www.fsa.usda.gov
USDA	Emergency Loans	Direct Loans.	To assist established (owner or tenant) family farmers, ranchers and aquaculture operators with loans to cover losses resulting from	Be an established family farmer, rancher, or aquaculture operator (either tenant-operator or owner-operator), who was conducting a farming operation at the	Consult the appropriate FSA State office.	Application Form FSA 410-1 provided by the Farm Service Agency must be presented, with supporting information, to the FSA county office serving the applicant's	Deadline for filing applications for actual loss loans is 8 months from the date of declaration/designation for both physical and production losses. Applicants should consult the FSA county office	Regional or Local Office http://www.fsa.usda.gov

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
EMERGENCY MANAGEMENT								
			major and/or natural disasters, which can be used for annual farm operating expenses, and for other essential needs necessary to return disaster victims' farming operations to a financially sound basis in order that they will be able to return to private sources of credit as soon as possible.	time of occurrence of the disaster either as an individual proprietorship, a partnership, a cooperative, a corporation, or a joint operation. Have suffered qualifying crop loss and/or physical property damage caused by a designated natural disaster. Be a citizen of the United States or legal resident alien, or be operated by citizens and/or resident aliens owning over a 50 percent interest of the farming entity. Have sufficient training or farming experience in managing and operating a farm or ranch. Be a capable manager of the farming, ranching, or aquaculture operations.		county. FSA personnel assist applicants in completing their application forms. This program is excluded from coverage under OMB Circular No. A-110.	serving their area for application deadlines.	

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HISTORIC PRESERVATION								
DOI; National Park Service	Civil War Battlefield Land Acquisition Grants	Grants for Fee simple acquisition of land, or for the acquisition of permanent protective interests in land at Civil War Battlefields.	To preserve threatened civil war battlefields.	Local governments or private non-profit organization in partnership with local governments.	SF 424 and attached documents including hard copies of proposals. See application requirements for list of attachments.	File forms with National Park Service Office.	Ongoing.	National Park Service. http://www.nps.gov/
DOI; National Park Service	National Maritime Heritage Grants	Education activities and preservation activities or projects, such as: 1) activities associated with acquiring ownership of, or responsibility for, historic maritime properties for preservation purposes; 2) preservation planning; 3) documentation of historic maritime properties; 4) protection and stabilization of historic maritime properties; 5) preservation restoration, or rehabilitation of historic maritime properties; 6) maintenance of historic maritime properties; and 7) reconstruction or reproduction of well-documented historic maritime properties.	To preserve historic maritime resources and increase public awareness and appreciation.	Local governments and private non-profit organizations.	National Maritime Initiative.	State Historical Preservation Office or National Maritime Initiative.	Contact State Historical Preservation Office or National Maritime Initiative.	National Park Service Office, National Maritime Initiative. http://www.cr.nps.gov/Maritime/
DOI; National Park Service	Technical Preservation Service	Advisory services and counseling, dissemination of technical information, provision of specialized services.	To assist local governments and owners of certified historical structures to preserve and maintain properties.	Local governments and individuals.	Historic Preservation Certification Application through Appropriate State Official or NPS Office.	File through State Official or NPS Office.	None.	National Park Service Office. http://www.nps.gov/

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
DHS	Disaster Housing Assistance To Individuals And Households In Presidential Declared Disaster Zones	Direct Payments for Specified Use.	To provide assistance to affected individuals and households within Presidential-declared disaster zones to enable them to address disaster-related housing and other necessary expenses and serious needs, which cannot be met through other forms of disaster assistance, insurance, or through other means.	Individuals and households, in areas declared an emergency or major disaster by the President, whose primary residence has been damaged or destroyed and whose losses are not covered by insurance are eligible to apply for this program. Must be a citizen of the United States, a non-citizen national, or a qualified alien.	An applicant should consult the office or official designated as the single point of contact in his or her State for more information on the process the State requires to be followed in applying for assistance, if the State has selected the program for review.	A Presidential Disaster or Emergency Declaration must be issued, before individuals and households can register an application for assistance with FEMA via a toll-free number or by visiting a Disaster Recovery Center.	Generally, individual and household applications for disaster assistance must be filed within 60 days of the disaster declaration.	Regional or Local Office.
DHS	Disaster Housing Program	Grant.	The Disaster Housing Program provides housing assistance in the form of a grant to individuals whose homes sustained damage as a result of a Presidentially declared disaster. To qualify for assistance, the damaged home must be your primary residence, and be	Applicant must be a national, citizen or dual citizen of the US whose home was destroyed or damaged by a Presidentially declared major disaster.	Contact FEMA.	Individuals can apply for assistance by calling 1-800-621-FEMA. Insured homeowners should first file a claim with their home insurer before contacting FEMA. An inspection is performed and a determination is made on	Contact FEMA.	Additional general information can be found at: http://www.fema.gov/tabs_disaster.shtm

Table 4-4: Federal Technical Assistance and Funding

Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
			located in the disaster-declared area. If insured, a claim should be filed. This program provides grants for lodging expense reimbursement, minimal home repairs and rental assistance. A determination of the types of housing assistance you are eligible to receive will be made if you apply.			your eligibility for one of the following types of assistance: Lodging expense reimbursement, minimal home repairs, rental assistance and Mortgage and Rental Assistance.		
DHS	Federal Assistance To Individuals And Households-Disaster Housing Operations	Direct Payments for Specified Use.	To address disaster-related housing needs of individuals and households suffering hardship who are within an area declared as a disaster zone, by the President.	Individuals and households, in areas declared an emergency or major disaster by the President, whose primary residence has been damaged or destroyed and whose losses are not covered by insurance are eligible to apply for this program. The individual or a member of the household must be a citizen of the	An applicant should consult the office or official designated as the single point of contact in his or her State for more information on the process the State requires to be followed in applying for assistance, if the State has selected the program for review.	Upon declaration of an emergency or major disaster, individuals and households may register an application for assistance with FEMA via a toll-free number or by visiting a Disaster Recovery Center.	Generally, individual and household applications for disaster assistance must be filed within 60 days of the disaster declaration.	Regional or Local Office.

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
				United States, a non-citizen national, or a qualified alien.				
DOI, Bureau of Indian Affairs	Indian Housing Assistance	Construction of housing, technical assistance to establish housing plans and determine extent and use of the Bureau's housing Improvement Program.	To eliminate substantially substandard Indian owned to inhabited housing for very low income individuals living in tribal service areas.	Individual members of Federally recognized tribes or tribal governments or organizations.	An informal conference should be scheduled with Bureau of Indian Affairs. Applications for Tribes or Tribal organizations should be submitted to Bureau of Indian affairs local office. Individuals may submit applications to the Bureau or to the tribal Servicing Housing Office.	Process is determined through annual Tribal work plan.	For Tribes or Tribal Organizations there is no deadline. For individuals the deadline is set at the local office.	Regional or Local Office of the Bureau of Indian Affairs.
HUD	Community Development Block Grant (CDBG)	Grant.	To develop viable urban communities by providing decent housing and a suitable living environment. Principally for low-to moderate-income individuals.	Eligible CDBG grant recipients include States, units of general local government (city, county, town, township, parish, village or other general purpose political subdivision determined to be eligible for assistance by the Secretary), the District of Columbia, Puerto Rico, Guam, the Virgin Islands, American Samoa, the Commonwealth of the Northern Marianas, and	http://www.hud.gov/offices/cpd/about/cpd_programs.cfm	Community Development activities that meet long-term needs. These activities can include acquisition, rehabilitation, reconstruction of properties and facilities damaged by a disaster, and redevelopment of disaster affected areas.	Consolidated Plans may be submitted between November 15 and August 16 of each fiscal year in which the State will administer funds.	State and Small Cities Division, Office of Block Grant Assistance, CPD, HUD, 451 7th Street, S.W., Washington, DC 20410-7000. Telephone: 202.708.3587. http://www.hud.gov/bdfy2000/summary/cpd/cdbg.htm

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
				recognized Native American tribes and Alaskan Native villages.				
HUD	Demolition and Revitalization of Severely Distressed Public Housing (HOPE VI)	Demolition of all or parts of severely distressed public housing projects, relocation cost of affected resident, disposition activities, rehabbing of units or community facilities, development of new units or community facilities, homeownership activities, acquisition activities, management improvements and administrative cost, community and supportive services.	To fund revitalization of severely distressed public housing developments.	Public housing authorities and Indian Housing Authorities, plus local governments for HOPE VI Main Street Grants.	Submission requirements and application are listed in Notice of Federal Assistance in the Federal Register.	HUD HQ reviews the application and rates them. Highest rated applications are funded.	As indicated in the Federal Register Notice.	HUD local or regional Office.
HUD	Mortgage insurance-Homes for Disaster Victims	Guaranteed / Insured Loans.	To insure lenders against losses on mortgage loans used to finance purchase or reconstruction of one-family home that will be the principal residence of a borrower that is a victim of a disaster.	Individuals and Families that are victims of a disaster designated by the President.	Mortgagee submits Application to HUD Field Office.	Mortgagee submits Application to HUD Field Office.	None.	HUD local or regional Office.

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
HUD	Rehabilitation Mortgage Insurance	Guaranteed / Insured Loans.	To insure lenders against losses on mortgage loans for 1 to 4 unit structures used to finance the purchase of a structure and land and rehabilitate the structure; the purchase, relocation and rehabilitation of a structure from another site; refinance existing debt and rehabilitating a structure; finance the rehabilitating of a structure.	Individual purchasers.	A HUD Approved Lending Institution	Review by Lending Institution.	None.	HUD local or regional Office.
HUD	Rural housing and Economic Development	Grants for Capacity Building, Support of Innovative Housing and Economic Development Activities.	To build capacity for rural housing and economic development activities in rural areas.	Local Rural Non-Profit Organizations, Community Development Corporations, Indian Tribes, State agencies.	Submission requirements and application are listed in Notice of Federal Assistance in the Federal Register	As indicated in the Federal Register Notice.	As indicated in the Federal Register Notice.	HUD local or regional Office.
HUD	Self-Help Homeownership Opportunity Program (SHOP)	Land Acquisition and Infrastructure Improvements	To facilitate and encourage innovative homeownership opportunities were homeowner are low-income and contribute a significant	National or regional non-Profit Organizations or Consortia.	Submission requirements and application are listed in SHOP Notice of Federal Assistance in the Federal Register.	As indicated in the Federal Register Notice.	As indicated in the Federal Register Notice.	HUD local or regional Office.

Table 4-4: Federal Technical Assistance and Funding

Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
			amount of sweat equity.					
HUD	Supplemental Loan Insurance-Multifamily Rental Housing	Financing of repairs, additions and improvements to multifamily projects, group practice facilities, hospitals and nursing homes already insured by HUD.	To insure lenders against losses on loans to finance additions and improvements to eligible properties.	Owners of Multifamily projects or facilities subject to mortgage insured by HUD or individual s/families and owners of multifamily projects.	HUD Multifamily HUB and Program Center.	Pre-application conference and then submittal of formal application through HUD approved mortgage.	Case-by-case basis.	HUD local or regional Office.
USDA	Direct Housing-Natural Disaster	Direct loans.	To assist qualified lower income rural families to meet emergency assistance needs resulting from natural disaster to buy, build, rehabilitate, or improve dwellings in rural areas. Funds are only available to the extent that funds are not provided by the Federal Emergency Management Agency (FEMA). For the purpose of administering these funds, natural disaster	Applicants must be without adequate resources to obtain housing or related facilities. Applicants must be unable to secure the necessary credit from other sources at prevailing terms and conditions for residential financing.	Rural Development Field office.	Applicants must file Form RD 410-4 at the Rural Development field office serving the county where the dwelling is located. This program is excluded from coverage under OMB Circular No. A-110.	Applicants must file applications from the date of declaration/designation and until supplemental appropriated funds are exhausted.	Regional or Local Office. Consult your local telephone directory under United States Department of Agriculture for Rural Development field office number. If no listing, contact appropriate Rural Development State Office at: http://www.rurdev.usda.gov/recd_map.html.

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
			will only include those areas identified by a Presidential declaration.					
USDA; Rural Housing Service	Farm Labor Housing Loans and Grants	Project grants and Guaranteed/insured Loans for the construction, repair or purchase of year-around or seasonal housing; acquiring land and making improvements for housing; developing related support facilities.	To provide decent, safe and sanitary low-rent housing and related facilities for domestic farm laborers.	Farmers, farm family partnerships, family farm corporations, or an association of farmers.	Applicant must furnish the following information: the number of farm laborers currently being used in the area; the kind of labor performed; the future need for labor; the kind, condition, and adequacy of current housing; the ownership of current housing; the ability of workers to pay rent; and information that it is unable to provide housing from its own resources or terms and conditions that would enable it to provide labor housing.	Applications will be scored and reviewed by State and National Offices.	None.	Regional or Local Office of Rural housing Service. http://www.rurdev.usda.gov/rhs/
USDA; Rural Housing Service	Rural Housing Preservation Grants	Loans, grants or other assistance to individual homeowners, rental properties or coops to pay any part of the cost for repair and rehabilitation of structures.	To assist very low- and low-income residents individual homeowners, rental property owners (single/multi-unit and consumer cooperative housing projects to complete necessary repairs and rehabilitation of dwellings.	Political subdivision of state, public non-profit corporation, or Indian tribal Corporations authorized to receive and administer housing preservation grants, private nonprofit corporations, or consortia.	Contact your regional or local office.	Consult with Rural Development Office prior to application and submit pre-application. An Environmental Impact Assessment is required.	See Federal Register of Notice of Funds Availability.	Regional or Local Office of Rural housing Service. http://www.rurdev.usda.gov/rhs/
USDA; Rural Housing Service	Section 538 Rural rental Housing Guaranteed Loans	Guaranteed/Insured Loans to supply affordable multi-family housing in rural areas.	To encourage private and public lenders to make loans for affordable rental properties.	Lenders.	Lender provides documentation required by RHS.	RHS will review applications for compliance and issue conditional Commitment of guarantee with conditions. Once	See Federal Register of Notice of Funds Availability.	Regional or Local Office of Rural housing Service. http://www.rurdev.usda.gov/rhs/

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
HOUSING								
						Conditions are met the final Contract of guarantee will be issued.		
USDA; Rural Housing Service	Very Low-Income housing Repair Loans and Grants	Direct Loans and Project Grants to Very-Low Income Homeowners in rural areas to repair, improve or modernize their dwellings or to remove health and safety hazards.	To make essential repairs to homes to make them safe and remove health hazards.	Applicant must own and occupy the home in a rural area, have sufficient income to repay a loan, be 62 years of age or older and be unable to repay a loan for that part of the assistance that comes as a grant.	Rural Development State or District Office.	The Loan must be submitted to RHS field office serving county where structure is located.	None.	Regional or Local Office of Rural housing Service. http://www.rurdev.usda.gov/rhs/
USDA; Rural Housing Service	Very Low to Moderate Income Housing Loans	Direct and Guaranteed Loans to buy, build, or improve applicant's permanent residence. New manufactured loans on a permanent site may also be approved.	To assist very low, low-income, and moderate households to obtain modest, decent, safe, and sanitary housing for use as a permanent residence in a rural area.	Very low, low-income, and moderate households.	For Direct Loans the application is made to the local Rural Development Office. For Guaranteed Loans application is made to the lender.	For Direct Loans the Rural Development Office makes a decision within 30 – 60 days. For Guaranteed Loans the decision is made within 3 days.	None.	Regional or Local Office of Rural housing Service. http://www.rurdev.usda.gov/rhs/

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
INFRASTRUCTURE								
DHS	National Dam Safety Program	State grants distributed directly to State dam safety programs.	To reduce the risks to life and property from dam failure in the United States through the establishment and maintenance of an effective national dam safety program to bring together the expertise and resources of the Federal and non-Federal communities in achieving national dam safety hazard reduction.	For a State to be eligible for primary assistance under the National Dam Safety Program, the State dam safety program must be working toward meeting the following criteria: The authority to review and approve plans and specifications to construct, enlarge, modify, remove, and abandon dams; the authority to perform periodic inspections during dam construction to ensure compliance with approved plans and specifications. All inspections be performed under the supervision of a State-registered professional engineer with experience in dam design and construction.	www.fema.gov/fima/damsafe	States wishing to participate in the National Dam Safety Program must submit a proposal with their application package including a program narrative statement, goals and objectives, performance measures, travel budget and related activities.	Applications should be submitted to FEMA by November 30 of each fiscal year.	*Headquarters Office*: Director, National Dam Safety Program, Mitigation Directorate, FEMA, DHS, 500 C Street SW., Washington, DC 20472; Telephone: (202) 646-3885. Additional information is available on the National Dam Safety Program web site, www.fema.gov/fima/damsafe
DOC; EDA	Grants for Public Works and Economic Development Facilities	Project grants for water and sewer improvements, industrial access roads, industrial and business parks, port facilities, railroad sidings, distance	To promote long-term economic development in areas experiencing substantial economic stress.	Cities, counties, institutions of higher education or a consortium of institutions of higher education, other political subdivision, Indian Tribes,	The Economic Development Representative servicing the state or EDA.	Meet with EDR. If deemed appropriate the applicant will be invited to apply.	30 days after invitation.	Regional or Local Office. http://www.eda.gov/Contacts/Contacts.xml

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
INFRASTRUCTURE								
		learning facilities, skill-training facilities, redevelopment of brown fields, eco-industrial facilities, business incubator facilities, and telecommunication infrastructure improvement needed for business retention and expansion.		Economic Development Districts and non-profit organizations.				
DOC; National Telecommunication and Information Administration	Public Telecommunications Facilities Planning and Construction	Grants for planning and construction of public telecommunications facilities.	To assist in the planning, acquisition, installation, and modernization of public telecommunications facilities through planning grants and matching construction grants.	Public or noncommercial educational broadcast station, noncommercial telecommunication entity, non-profit foundation, corporation, institution or association organized primarily for educational or cultural purposes, local government, tribal government or an agency thereof, or a political or special purpose subdivision of the state.	Request from agency or go to the web at: www.ntia.doc.gov/ptfp.	File application form, project narrative, project budget forms, relevant exhibits, CD-511, CD 346, SF 424B, and SF LLL. Contact State telecommunications agency where applicable.	See annual notification in the Federal Register.	Regional or Local Office. http://www.ntia.doc.gov/
DOD; USACE	Flood Control Works / Emergency Rehabilitation	Provision of Specialized Services.	To assist in the repair and restoration of public works damaged by flood, extraordinary wind, wave, or water action.	Owners of damaged flood protective works, or State and local officials of public entities responsible for their maintenance, repair, and operation.	Regional or Local Office: U.S. Army Corps of Engineers Division or District Engineers.	The Corps provides public works and engineering support to supplement State and local efforts toward the effective and immediate response to a natural disaster.	Thirty days after a flood or unusual coastal storm.	Program Manager PL 84-99 USACE, 20 Massachusetts Ave, N.W. Washington, DC 20314 Telephone: 202.761.0001. http://www.spd.usace.army.mil/hqpam.html
DOD; USACE	Protection of Essential Highways, Highway Bridge Approaches and Public Works	Protection of highways, highway bridges, essential public works, churches, hospitals, schools and other	To provide bank protection for locations endangered by flood-caused erosion.	Political subdivision of states and other responsible local agencies established under state law with full authority and ability to	Formal letter to District Engineer.	Consult with District Engineer.	None.	Regional or Local Office. http://www.usace.army.mil/business.html

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
INFRASTRUCTURE								
		non-profit public services.		undertake legal and financial responsibilities.				
DOI; Bureau of Reclamation	Water Desalination Research and Development Program	Demonstration and development projects and related activities.	To develop cost-effective, technically efficient and implementable methods by which water can be produced.	Local entities, public/nonprofit institutions/organizations, other public institutions/organizations.	A proposal solicitation is announced by the Bureau of Reclamation.	There will be a general solicitation d one for pilot plants or demonstration projects, SF 424 and DI-2010 forms are required.	Varies, contact Bureau of Reclamation.	Bureau of Reclamation http://www.usbr.gov/ (303) 445-2432.
FHWA; FAA	Airport Improvement Program	Project Grants and advisory services and counseling.	Integrated airport system planning and airport master planning, construction and rehabilitation at public-use airports.	Counties, municipalities, other public agencies, Indian tribes, private owners of public-use reliever airports or airports having at least 2,500 passengers boarding annually and receiving scheduled passenger aircraft.	Contact the States single-point contact for aviation.	Pre-application is filed with the FAA office and reviewed regionally and/or in Washington D.C.	January 31 or another date specified in the Federal Register.	Regional or Local Office. http://www.faa.gov/about/office_org/
FHWA; FTA	Federal transit Capital Investment Grants	Formula Grants and Project Grants.	To assist in financing the acquisition, construction, reconstruction and improvement of facilities, rolling stock and equipment for use in public transportation service.	Municipalities and other subdivisions of the state, public agencies and instrumentalities of one or more states, public corporations. Boards and commissions.	Federal Transportation Authority or State single point of contact.	Applicant should contact the State single point of contact.	Contact FTA.	Regional or local office. http://www.fta.dot.gov/4_ENG_HTML.htm
FHWA; FTA	Transit Planning and Research	Project Grants, Technical Information, and Training.	Increase public ridership, improve safety and emergency preparedness, improve capital operating efficiencies, protect the environment	Public bodies, non-profit institutions, local agencies, universities and legally constituted public agencies and operators of public transportation services, and non-profit organizations.	Federal Transportation Authority.	Pre-Application Coordination.	None.	Associate Administrator for Research, Demonstration and Innovation, FTA (202) 366-4209. http://www.fta.dot.gov/4_ENG_HTML.htm

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
INFRASTRUCTURE								
			and promote energy independence.					
FHWA	Transportation: Emergency Relief Program	Special funding and technical assistance to States and Federal agencies.	To provide aid for repair of Federal-aid roads.	State highway/transportation agency or Federal agency.	www.fhwa.dot.gov	It is the responsibility of individual States to request ER funds for assistance in the cost of necessary repair of Federal-aid highways damaged by natural disasters or catastrophic failures. A notice of intent to request ER funds filed by the State Department of Transportation with the FHWA Division Office located in the State will initiate the ER application process.	Contact FHWA.	Director, Office of Engineering, FHWA, DOT, 400 7th Street, S.W., Washington, DC 20590. Telephone: 202.366.4655. http://www.fhwa.dot.gov/programadmin/erelief.html
USDA; Rural Utilities Service	Water and Waste Disposal Systems for Rural Communities	Project Grant, Direct Loans, guaranteed/Insured Loans for the installation, repair, improvement or expansion of rural water facilities including distribution lines, well pumping facilities and cost related thereto, and the installation, repair, improvement, or expansion or rural waste disposal facilities including the collection, and treatment of	To provide basic human amenities, alleviate health hazards and promote orderly growth of rural area.	Municipalities, counties and other political subdivisions of a states, such as authorities, associations, cooperatives, corporations operated on a not for profit basis, and federally recognized tribes. Serving rural businesses and rural residents.	Local USDA Rural Development Office.	Application is reviewed at the local level and forwarded to Rural Development State Director for review.	None.	Regional or local office. http://www.rurdev.usda.gov/recd_map.html

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
INFRASTRUCTURE								
		sanitary, storm and solid wastes.						
USDA; Rural Utilities Service	Water and Waste Disposal Loans and Grants (Section 306C)	Project Grants, Direct Loans to construct enlarge, extend or otherwise improve community water or waste systems; extend lines; and connect individual residences to the system.	Provide water and waste disposal facilities and services to low income rural communities whose residents face significant health risks.	Local levels of government, federally recognized tribes and non-profit associations. Per capita income may not exceed 70% of national average, unemployment rate is not less than 125% of national average, and residents must face significant health risks due to not having access to an affordable community water and/or waste disposal system.	Local USDA Rural Development Office.	Application is reviewed at the Rural Development State office and must compete on a national basis for review.	None.	Regional or local office. http://www.rurdev.usda.gov/recd_map.html

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
DHS	Emergency Management Performance Grants (EMPG)	Formula Grants.	To encourage the development of comprehensive emergency management, including for terrorism consequence management, at the State and local level and to improve emergency management planning, preparedness, mitigation, response, and recovery capabilities.	Funding provided to States, which can be used to educate people and protect lives and structures from natural and technological hazards.	An applicant should consult the office or official designated as the single point of contact in his or her State for more information on the process the State requires to be followed in applying for assistance, if the State has selected the program for review. Technical assistance is available for application preparation from the FEMA Regional Offices.	Applications must be submitted online using the OJP GMS and must contain information and meet the requirements outlined in the program guidelines and application kit.	Applications will be made available on December 2, 2004, and must be received by ODP no later than January 16, 2005.	Office of Financial Management, FEMA, 500 C Street, S.W., Washington, DC 20472 Telephone: 202.646.7057. http://www.fema.gov
DHS	Flood Mitigation Assistance Program	Grants to States.	To help States and communities plan and carry out activities designed to reduce the risk of flood damage to structures covered under contracts for flood insurance.	The State or community must first develop (and have approved by FEMA) a flood mitigation plan that describes the activities to be carried out with assistance provided under this program. The plan must be consistent with a comprehensive strategy for mitigation activities, and be adopted by the State or community following a public hearing.	Applications can be obtained from the State Hazard Mitigation Officer. Eligible projects include acquisition, elevation, or relocation of National Flood Insurance Program (NFIP)-insured structures, especially those that have been repetitively flooded or substantially damaged.	The State Hazard Mitigation Officer applied to the Federal Emergency Management Agency for annual funds.	Annual.	Risk Reduction Branch, Mitigation Division, FEMA, DHS 500 C Street SW., Washington, DC 20472; Telephone: (202) 646-2856. Additional information is available on FEMA's web site, www.fema.gov/fima/planfma.shtm

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
DHS	Hazard Mitigation Grant Program	Grants.	To prevent future losses of lives and property due to disasters; to implement State or local hazard mitigation plans; to enable mitigation measures to be implemented during immediate recovery from a disaster; and to provide funding for previously identified mitigation measures to benefit the disaster area.	State and local governments; certain private and nonprofit organizations or institutions; Indian tribes or authorized tribal organizations; and Alaska Native villages or organizations.	For more information on where to obtain application go to website, http://www.fema.gov/fima/hmgp/hmgp_ref.shtm	Eligible applicants apply for the program through the State, as the State administers the program. Applicants are encouraged to contact the State Hazard Mitigation Officer for details. Each State has a hazard mitigation administrative plan that explains procedures for administering the HMGP. When the State requests a disaster declaration, it must also request that HMGP funding be made available. Individuals applying for a Hazard mitigation Grant can do it through their communities.	The State will submit all selected local applications or summaries to the Regional Director within 90 days after the State Hazard Mitigation Plan is approved. (Approximately 9-18 months after disaster declaration.)	Branch Chief, Risk Reduction Branch, Mitigation Division, FEMA, DHS, 500 C Street SW., Washington, DC 20472; Telephone: (202) 646–2856. Additional information is available on FEMA's web site, www.fema.gov
DHS	National Flood Insurance Program	Formula grants to States.	To enable persons to purchase insurance against physical damage to or loss of buildings and/or contents therein caused by floods, mudslide (i.e.,	Flood insurance can be made available in any community (a State or political subdivision thereof with authority to	Contact State Hazard Mitigation Officer for details.	Community officials must submit an NFIP eligibility application form, which is available from the FEMA, together with: copies of adopted	Communities with one or more identified special flood hazard areas must enter the program within 1 year after the	Regional or Local Office. Contact the appropriate FEMA regional office, or the State office responsible for coordinating the program's activities.

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
			mudflow), or flood-related erosion, thereby reducing Federal disaster assistance payments, and to promote wise floodplain management practices in the Nation's flood-prone and mudflow- prone areas.	adopt and enforce floodplain management measures for the areas within its jurisdiction) that submits a properly completed application to FEMA.		floodplain management measures meeting the minimum standards of 44 CFR Section 60.3(a), 60.3(b), 60.3(c), 60.3(d), and/or 60.3(e), as appropriate for the type of flood hazards identified; a list of any incorporated communities within the applicant's boundaries; and estimates of population and, by kind, of buildings situated in the known flood-prone areas of the community. Such Applications should be submitted to the Mitigation Directorate, FEMA, Washington, DC 20472. This program is excluded from coverage under OMB Circular No. A-110.	identification of those areas or else prohibitions against Federally related financial assistance for acquisition or construction purposes in identified special flood hazard areas take force. Once the community does qualify, after the prescribed date, these prohibitions are removed. Adequate floodplain management measures must be in effect within 6 months of the date that the special flood hazard area is identified and within 6 months of the date flood water surface elevations are provided.	
DHS	Public Assistance Program	Grants to States and Communities.	To provide supplemental assistance to States, local governments, and certain private nonprofit organizations to	State and local governments and any political subdivision of a State, Indian tribes, and Alaskan Native	An applicant should consult the office or official designated as the point-of-contact in the State for more information.	Application for Public Assistance (PA) is made through the Governor's Authorized Representative	A Request for Public Assistance is normally submitted by the applicant within 30 days	Public Assistance Branch, Recovery Division, FEMA, DHS, 500 C Street SW., Washington, DC 20472; or the State Emergency office. Additional information is available on FEMA's web site, http://www.fema.gov/rrr/pa/

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
			alleviate suffering and hardship resulting from major disasters or emergencies declared by the President.	villages are eligible. Also eligible are private nonprofit organizations that operate educational, utility, emergency, or medical facilities, or that provide custodial care or other essential services of governmental nature to the general public. As a condition of grants under the Stafford Act, applicants are encouraged to mitigate natural hazards.		to the FEMA Regional Director in accordance with FEMA Disaster Assistance Regulations, 44 CFR 206, except as provided in Part 206.35(d) for emergency declarations involving primarily Federal responsibility.	of a declaration.	
DOC; NOAA; NWS	Automated Flood Warning Systems	Funding for creating, renovating, or enhancing Automated Flood Warning Systems.	To provide funding to communities with flood or flash flood problems that affect safety of life and property for warning systems.	Counties, municipalities, educational institutions and non-profit organizations.	http://www.ofa.noaa.gov %7Egrants/appkit.html. Applicants must also provide statement of work, project description and detailed budget narrative and justification.	Submit to: NOAA/NWS, 1325 East-West Highway, AFWS Program Manager, W/OS31, Room 13396, Silver Spring, MD. 20910.	Check with local NWS Office.	AFWS Operations Manager (631) 224-0112.
DOC; Census Bureau	Census Geography	Provide Computer generated set of maps for use in conducting surveys.	Showing results of surveys geographically, determine names and current boundaries of selected statistical areas.	Interested persons, organizations and government agencies.	Written request.	None.	None.	Regional or Local Census Bureau Office http://www.census.gov/field/www/

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
DOC; NOAA	Geodetic Surveys and Services	To provide national, coordinated spatial reference system at various specified intervals which provide scale, orientation, coordinated positions and elevation of specific points for use in surveying, boundary delineations and demarcation, mapping, planning, and development.	To provide assistance to State local and regional agencies in the development and implementation of Multipurpose Land Information Systems/Geographic Information Systems pilot projects and spatial reference system development and/or enhancement and height modernization.	Local, municipal, universities and regional agencies.	NOAA Grants Management Division (301) 713-3228.	45-90 day review time after submittal of all documents.	Must be submitted at least 90 days in advance of desired effective date.	NOAA Grants Management Division http://www.ago.noaa.gov/grants/ (301) 713-3228.
DOD; USACE	Flood Control Projects	Design and construction of projects.	To reduce flood damages through projects not specifically authorized by Congress.	Political subdivisions of States, or other responsible agencies established under state law. Project must be engineering feasible, complete within itself and economically justified. Non-federal sponsor will share equally in feasibility study, project cost,	Formal Letter to District Engineer From A Prospective Sponsoring Agency.	Consult with the District Office.	None.	District Office. http://www.usace.army.mil/howdoi/where.html

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
				provide a cash contribution for land enhancement benefits and for features other than flood control, prevent future encroachments which might interfere with function and maintain the project.				
DOD; USACE	Flood Plain Management Services	Advisory Services and Counseling; Dissemination of Technical Information.	To promote appropriate recognition of flood hazards in land and water us planning and development through the provision of flood and floodplain related data, technical services and guidance.	Political subdivisions of States, other non-public organizations and the public.	None needed. A letter should be sent to the District Engineer of the Corps of Engineers.	Send letter of Request.	None.	District Office. http://www.usace.army.mil/howdoi/where.html
DOD; USACE	Snagging and Clearing for Flood Control	Design and construction of projects. Non-federal sponsor must provide land, easement, right-of-way; provide costs in excess of the Federal limit; maintain project; Hold US free from damages; cost share for land enhancement or special benefits; prevent future	To reduce flood damages.	Political subdivisions of States, or other responsible agencies established under state law.	Formal Letter to District Engineer From A Prospective Sponsoring Agency.	Consult with the District Office.	None.	District Office. http://www.usace.army.mil/howdoi/where.html

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
		encroachments which will interfere with proper functioning of project.						
DOI	National Fire Plan - Wildland Urban Interface Community Fire Assistance	Project Grants; Use of Property, Facilities, and Equipment; Provision of Specialized Services; Advisory Services and Counseling; Dissemination of Technical Information; Training.	To implement the National Fire Plan and assist communities at risk from catastrophic wildland fires by providing assistance in the following areas: Provide community programs that develop local capability including; assessment and planning, mitigation activities, and community and homeowner education and action; plan and implement hazardous fuels reduction activities, including the training, monitoring or maintenance associated with such hazardous fuels reduction activities, on federal land, or on adjacent nonfederal land for activities that mitigate the threat of catastrophic fire to communities and natural resources in high risk areas; enhance local and small business employment opportunities for rural communities; enhance the knowledge and fire protection capability of	States and local governments at risk as published in the Federal Register, Indian Tribes, public and private education institutions, nonprofit organizations, and rural fire departments serving a community with a population of 10,000 or less in the wildland/urban interface.	Contact the appropriate State Office or the National Interagency Fire Center's web site at: http://www.nifc.gov.	Wildland Urban Interface Community Assistance is coordinated by Bureau State and Field Offices. No specific application forms apply, except for grants awarded, the standard application forms furnished by the Federal agency and required by 43 CFR Part 12, Subpart C, "Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments," and 43 CFR Part 12, Subpart F, "Uniform Administrative Requirements for Grants and Agreements With Institutions of Higher Education, Hospitals, and	None.	Regional or Local Office. http://www.blm.gov/nhp/index.htm http://www.nifc.gov

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
			rural fire districts by providing assistance in education and training, protective clothing and equipment purchase, and mitigation methods on a cost share basis.			Other Nonprofit Organizations", must be used by this program.		
DOI; National Park Service	Technical Preservation Services	Advisory Services, Technical Information, Specialized Services.	Technical information is provided to assist local governments and owners to preserve and maintain historic properties.	Local governments and individuals.	State historic Preservation Office.	Apply through appropriate state official or NPS Regional Office.	None.	Regional or local office.
USDA; Natural Resources Conservation Service	Soil Survey	Dissemination of Technical Information.	Soil surveys for planners, environmentalists, engineers, zoning commissions, tax commissions, homeowners, farmers, ranchers, developers, landowners and operators.	Individuals and Groups that have a need for soil survey.	Contact Natural Resources conservation Service Office.	Request from Natural Resources Conservation Service District Office	None	Natural Resources Conservation Service District Office http://www.nrcs.usda.gov/
USDA; Natural Resources Conservation Service	Watershed Protection and Flood Prevention	Project Grants sharing the cost of watershed protection measures, flood prevention, agricultural water management, sediment control, wildlife, recreation and in extending long term credit for these projects. Advisory Services and Counseling in	Project Grants sharing the cost of watershed protection measures, flood prevention, agricultural water management, sediment control, wildlife, recreation and in extending long term credit for these projects. Advisory Services and Counseling in designing and installing watershed works of improvement.	Counties, groups of counties, municipalities, towns or townships, soil and water conservation districts, flood prevention or flood control districts, Indian tribes or tribal organizations, and non-profit agencies with authority under state law to carry out,	Standard Application obtained from NRCS.	Details available in State and field offices of NRCS.	None.	Natural Resources Conservation Service District Office http://www.nrcs.usda.gov/

Table 4-4: Federal Technical Assistance and Funding								
Agency	Program	Type of Assistance/ Projects Funded	Purpose	Eligible Applicants	Where To Obtain Application	Application Process	Application Deadline	For More Information
MITIGATION								
		designing and installing watershed works of improvement.		maintain and operate watershed works of improvement.				
USDA; Natural Resources Conservation Service	Watershed Surveys and Planning	Technical assistance for planning activities to help solve water and land related resource problems.	To help solve problems of upstream rural community flooding, water quality improvement, wetland preservation and drought management.	Local water resource agency concerned with water and related land resource development, counties, municipalities, towns or townships, Indian Tribe and Tribal Organizations, and non-profit organizations.	NCRS Offices and Letter of request Addressed to State Conservationist.	NCRS Offices and Letter of request Addressed to State Conservationist.	None.	Natural Resources Conservation Service District Office http://www.nrcs.usda.gov/

SECTION 5 - MITIGATION GOALS

Goals were developed by taking into consideration both state and jurisdictional goals for mitigation. None of the goals or actions in this County plan contradicts the goals of the State Hazard Mitigation Plan. In fact, the Monmouth County Multi-Jurisdictional Hazard Mitigation Plan Goals are in support of furthering the State's goals in many ways.

New Jersey State Hazard Mitigation Plan Goals

As outlined in the New Jersey State Hazard Mitigation Plan (2005), the State's goals are:

1. Protect life
2. Protect property
3. Promote a sustainable economy
4. Protect the environment
5. Increase public preparedness

Monmouth County Multi-Jurisdictional Hazard Mitigation Plan Goals

The Monmouth County Multi-Jurisdictional Hazard Mitigation Plan Goals are long-term statements of what the participating jurisdictions hope to achieve over time through implementation of the plan. They are based on the findings of the risk assessment, and will apply to each jurisdiction adopting this plan.

1. Promote disaster-resistant development.
2. Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters.
3. Reduce the possibility of damage and losses due to drought.
4. Reduce the possibility of damage and losses due to flooding caused by floods, hurricanes and nor'easters.
5. Reduce the possibility of damage and losses due to earthquakes.
6. Reduce the possibility of damage and losses due to lightning strikes.
7. Reduce the possibility of damage and losses due to coastal erosion and wave action.
8. Reduce the possibility of damage and losses due to dam failure.
9. Reduce the possibility of damage and losses due to landslides.
10. Reduce the possibility of damage and losses due to wildfires.
11. Reduce the possibility of damage and losses due to winter storms.
12. Reduce the possibility of damage and losses due to extreme temperatures.
13. Reduce the possibility of damage and losses due to tornadoes and high winds caused by windstorms, hurricanes and nor'easters.
14. Reduce the possibility of damages to emergency and critical facilities from damage due to flooding, storm surge, wildfires, and extreme winds.

SECTION 6 - RANGE OF ALTERNATIVE MITIGATION ACTIONS CONSIDERED

The following table represents a full range of types of mitigation actions to address each of the hazards identified in this plan. At a working session of the Core Planning Group on April 4, 2008, participating jurisdictions considered this range of actions and identified a mitigation strategy for their jurisdiction. Mitigation actions will be identified and analyzed for a comprehensive range of mitigation actions and projects for each hazard, and address reducing the effects of hazards on both new and existing buildings and infrastructure.

The next section of this plan, entitled, "Action Item Evaluation and Prioritization" will explain the criteria used by Core Planning Group members to evaluate and prioritize this range of actions.

Table 6-1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
1	Promote disaster-resistant development.	1.A	Join the National Flood Insurance Program (for non-participating or suspended communities).
		1.B	Ensure that local comprehensive plans incorporate natural disaster mitigation techniques by requiring a courtesy- review of draft plans by the County Emergency Management Agency.
		1.C	Explore the need for hazard zoning and high-risk hazard land use ordinances.
		1.D	Organize an annual event / fair for homeowners, builders and county and local jurisdictions that includes sale of NOAA weather radios, dissemination of information brochures about disasters and building retrofits, demonstration of ñdefensible-spaceò concept and fire resistant construction materials (for roofs/exterior finishes and inflammable coverings for openings like chimneys and attics) etc.
		1.E	Develop a stormwater management plan that includes subdivision regulations to control run-off; both for flood reduction and to minimize saturated soils on steep slopes that can cause landslides.
2	Build and support local capacity to enable the public to prepare for, respond to, and recover from disasters.	2.A	Expand and disseminate GIS and other hazard information on the internet.
		2.B	Create a mitigation outreach program that helps residents prepare for disasters.
		2.C	Develop a plan and seek funding for backup electric and telecommunications systems in local government-owned critical facilities.
		2.D	Support and fund Community Emergency Response Team (CERT) programs that also include a mitigation component.
		2.E	Create a virtual and physical library that contains all technical studies, particularly natural resources.
		2.F	Expand GIS to collect and develop more sophisticated hazard mapping. Use information to update plan. Ensure information will be available to the public and to relevant communities and agencies.

Table 6-1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
		2.G	Provide training for inspection and enforcement of adopted codes and ordinances.
3	Reduce the possibility of damage and losses due to drought.	3.A	Encourage citizens to implement water conservation measures by distributing water saving kits which include replacement shower heads, flow restrictors, and educational pamphlets which describe water saving techniques. Also encourage conservation by offering rebates for ultra-low-flow toilets.
		3.B	Modify rate structure to influence consumer water use including: increasing rates during summer months and imposing excess use charges during times of water shortage.
		3.C	Reduce water use for landscaping by imposing mandatory water-use restrictions during times of water shortage. Also, develop a demonstration garden to exhibit water conservation techniques.
		3.D	Publish and distribute pamphlets on water conservation techniques and drought management strategies.
		3.E	Develop and adopt an emergency water allocation strategy to be implemented during severe drought.
		3.F	Implement water metering and leak detection programs followed by water main repair/replacement to reduce losses.
		3.G	Encourage beneficial re-use of treated wastewater effluent through cooperative projects with dischargers, agriculture and other major water users to distribute or provide this alternative source of water.
4	Reduce the possibility of damage and losses due to flooding caused by floods, hurricanes, and norôeasters.	4.A	Join the National Flood Insurance Program. As a participant, floodplains within the participating community will be identified and mapped. In return, the participating community will become eligible for flood insurance as long as the local governing body adopts and enforces a floodplain ordinance.
		4.B	Limit uses in floodways to those tolerant of occasional flooding, including but not limited to agriculture, outdoor recreation, and natural resource areas.
		4.C	Develop a Countywide gauging and warning system for flash and riverine flooding.
		4.D	Continue to implement best management practices for floodplain areas.
		4.E	Identify and document repetitively flooded properties. Explore mitigation opportunities for repetitively flooded properties, and if necessary, carry out acquisition, relocation, elevation, and flood-proofing measures to protect these properties.
		4.F	Conduct a routine stream maintenance program (for currently non-participating communities) and seek financial assistance to clean-out stream segments with heavy sediment deposits. (i.e., this could be through participating in the Monmouth County/ Bridge Commission routine stream maintenance program)

Table 6-1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
		4.G	Develop specific mitigation solutions for flood-prone roadways and intersections in conjunction with State DOT. Develop a work plan for when sites will be surveyed and what role can the local government play in selection and implementation of mitigation activities (e.g. any monetary or contextual support through the local capital improvement plan).
		4.H	Implement identified stormwater recharge, rate or volume projects identified in Regional Stormwater Management Plans to decrease ñflashò in streams during/after storm events.
5	Reduce the possibility of damage and losses due to earthquakes.	5.A	Retrofit old/dilapidated critical facilities.
		5.B	Public awareness through video/brochures about simple steps homeowners can take to mitigate damage.
		5.C	Examine provisions for earthquake resistant retrofits for existing structures and infrastructure, paying particular attention to unreinforced masonry structures built prior to the adoption of building codes requiring earthquake resistant design for new construction.
6	Reduce the possibility of damage and losses due to lightning strikes	6.A	Carry out inventory of compliance with existing local codes/standards, especially for critical facilities.
		6.B	Adopt building safety codes such as National Fire Protection Association (NFPA) -780 Standard for the Installation of Lightning Protection Systems (1997).
		6.C	Public awareness/outreach regarding use of ground outlets and surge protectors in homes and businesses.
7	Reduce the possibility of damages and losses due to coastal erosion and wave action.	7.A	Establish an erosion setback line which is located landward of the first stable natural vegetation at a specified distance based on the long-term rate of erosion.
		7.B	Implement V Zone construction requirements for new development located in Coastal A Zones (for communities not currently implementing these requirements)
8	Reduce the possibility of damage and losses due to dam failures.	8.A	Enforce participation in/compliance with National and NJDEP Dam Safety Programs.
		8.B	Investigate sources of funding to assist private dam owners to complete required repairs/maintenance. Investigate low interest loans to owners and/or jurisdiction acting as guarantor of private ownersô loans.
		8.C	Notify owners of property in dam break inundation areas of risks, implement restrictions for new development in these areas.
9	Reduce the possibility of damage and losses due to landslides.	9.A	Create comprehensive geological mapping to areas prone to landslides and rockslides.
		9.B	Locally identify and map specific areas of potential slope failure and limit future development in these areas.
		9.C	Develop a public outreach program that addresses the economic impacts of landslides on personal property.

Table 6-1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
		9.D	Consider adopting a steep slope ordinance, if one is not already in place, to regulate development on these higher risk areas.
		9.E	Develop a vegetation management plan. Proper vegetation can supply slope-stabilizing root strength, and facilitate in intercepting precipitation. Establishing and maintaining appropriate vegetation of areas above the bluff slope may be the single most important and cost-effective mitigation measure available.
10	Reduce the possibility of damage and losses due to wildfires	10.A	In consultation with NJFFS and local Forest Firewardens, develop mapping of wildland/urban interface areas.
		10.B	Develop inventory of addresses for route alerting during wildfire emergencies that require public warning and information.
		10.C	In consultation with NJFFS and local Forest Firewardens, review local EOPs for possible wildfire components regarding Fire-Rescue, Alert Warning Communications, and Evacuation.
		10.D	Prescribed burning for hazard reduction.
		10.E	Initiate a public outreach program for homeowners.
		10.F	Retrofit buildings with fire resistant materials.
		10.G	Community brush and debris removal and hazard fuels reduction.
		10.H	Firewise landscaping in higher risk areas.
		10.I	Mitigation for streets, highways, and roads that provide key fire access and fuelbreaks.
11	Reduce the possibility of damage and losses due to winter storms.	11.A	Promote (or purchase, for critical facilities) NOAA weather radios.
		11.B	Educate residents about driving in winter storms and handling winter-related health effects
		11.C	Ice and windstorm-resistant trees and landscaping practices to reduce tree-related hazards
		11.D	Bury utility lines to avoid power outage due to winter storms (if risk is very high then only this action might be cost-effective)
12	Reduce the possibility of damage and losses due to extreme temperatures.	12.A	Develop and distribute outreach tools for homeowners and building permit applicants on protection of structures against cold weather damage and proper maintenance of heating/cooling systems.
		12.B	Review existing emergency response plans for enhancement opportunities: work with social support agencies, homeowners associations and general public to develop and implement monitoring and warning systems focused on vulnerable populations and provision of adequate shelter facilities.

Table 6-1
Types of Actions Considered to Achieve Mitigation Goals

Goals		Actions	
Goal Number	**Description**	**Action Number**	**Description**
13	Reduce the possibility of damage and losses due to tornadoes and high winds caused by windstorms, hurricanes and norĉeasters.	13.A	Adopt an ordinance to require safe rooms in mobile home parks
		13.B	Provide low interest loans (or other form of financial assistance) for building safe rooms.
		13.C	Provide technical assistance for building safe rooms.
		13.D	Adopt an ordinance to require hurricane clips on new construction.
		13.E	Install hurricane clips and wind shutters on existing development-particularly emergency facilities and shelters built before existing codes were adopted to offer some degree of wind protection.
14	Reduce the possibility of damages to emergency facilities from flooding, wind damage and wildfire damage.	14.A	Conduct a study to determine the year-built and level of protection (flood, surge, wind) for each emergency facility.
		14.B	On completion of 11.A, seek funding for mitigation projects for emergency facilities not currently designed for protection from flooding and high wind.

SECTION 7 - ACTION ITEM EVALUATION AND PRIORITIZATION

This section includes information regarding the methodology and process followed by participating jurisdictions to evaluate and prioritize unique hazard mitigation actions for their particular communities.

The action item evaluation and prioritization was undertaken during a working session of the Core Planning Group on April 4, 2008, and by individual JATs. After reviewing the many types of possible action items suggested in Section 6, and adding any new items that might be unique for their community, each participant was asked to select a manageable number of action items which they felt their jurisdiction could reasonably commit to achieving in the next five years (the first plan maintenance cycle). For jurisdictions who did not submit documentation at the April 4, 2008 meeting, additional time was allowed. In the end, the County and 52 of its 53 municipalities evaluated and identified at least one action item for the first plan maintenance cycle.

In order to evaluate and prioritize the mitigation actions, participants identified the ***benefits*** and ***costs*** of each action using a planning concept called ñSTAPLEEò (as presented in FEMA document #286-5, STAPLEE Method B). Their evaluation methodology is presented below in Table 7-1.

Table 7-1
STAPLEE Criteria

S Social	Is the action unfair to one section of the community over others? If yes, it is a social cost associated with the action. If the implementation of the action helps achieve a social goal of the community, it is a social ***benefit*** associated with the action.
T Technical	Is the action a good technical solution to the problem? If yes, it is a ***benefit*** associated with the action. The better the solution, the higher the ***benefits***.
A Administrative	Is the action difficult to implement because of the administrative problems associated? If yes, it is an administrative ***cost***.
P Political	Is the action politically favored? If yes, it is a ***benefit.*** If the action is likely to be politically unacceptable, it is a ***cost*** associated with the action.
L Legal	Are there perceived legal problems in implementing the action? If yes, it is a ***cost*** associated with the action.
E Economic	Does implementing the action make economic sense? Are the ***costs*** too prohibitive? If yes, it is a cost associated with the action.
E Environmental	Does the action have adverse environmental effects? If yes, it is a ***cost*** associated with the action.

Now using the STAPLEE factors discussed above for each action, each jurisdiction rated the overall benefits and costs of each action they had selected, and assigned priorities. To determine overall ñ*benefits*ò for a certain action, each jurisdiction considered individual social, technical, administrative, political, legal, economic, and environmental benefits for the action and then indicated whether the net benefits, overall, could be characterized as high, medium, or low. To determine overall ñ*costs*ò for a certain action, each jurisdiction considered individual social, technical, administrative, political, legal, economic, and environmental costs for that action and then indicated whether the net costs, overall, could be characterized as high, medium, or low. These overall ó*benefits'* and ó*costs'* were noted on the worksheet, and the jurisdictions prioritized each action based on its overall benefits and costs (i.e., an action with High benefits and Low costs should be High priority).

All action items not selected for prioritization by a given community after considering the STAPLEE factors received a low priority. In the future, communities may still seek to pursue actions from Section 6 (and associated studies, funding, etc. for these actions) which they evaluated but did not select for prioritization at this time.

Appendix D contains prioritization sheets completed by each participant for their selected actions. Each participant identified at least one action item for implementation.

All participating jurisdictions who will be adopting this plan will undertake the following high priority public outreach actions at a minimum:

- Each participating jurisdiction will add a link on their jurisdictionôs web page to the County mitigation planning website, if they have not already done so as part of the plan development process.
- Participating jurisdictions will conduct annual interviews and/or smaller meetings with civic groups, the public and other stakeholders. This will be accomplished through incorporating discussion of the mitigation plan into other regularly attended meetings.
- Participating jurisdictions will consider annual flyers, newsletters, newspaper advertisements, and Radio/TV announcements, and will implement some or all of the above at the discretion of the jurisdiction.

The next section in this plan, entitled "Implementation Strategy," will expand upon the prioritization step by identifying the hazard addressed, if the action applies to new and/or existing assets, the primary agency responsible for action item completion, any existing local planning mechanisms through which the action item will be implemented, target date for completion, estimated cost, and funding source.

SECTION 8 - IMPLEMENTATION STRATEGY

The implementation strategy developed by participants for selected and prioritized action items is community-specific for each participant. Participants were asked to identify an implementation strategy for the action items they selected and prioritized (in Section 7) for their respective communities.

The implementation strategy developed by each participant was based on each participantôs qualitative analysis of social, technical, administrative, political, legal, economic, and environmental benefits and costs associated with each selected action.

Each community addressed how the actions will be implemented and administered. For each selected and prioritized action item, participants identified the hazard addressed, if the action applies to new and/or existing assets, the primary agency responsible for action item completion, any existing local planning mechanisms through which the action item will be implemented, target date for completion, estimated cost, and funding source.

All action items not selected for prioritization by a given community after considering the STAPLEE factors received a low priority. In the future, communities may still seek to pursue actions from Section 6 (and associated studies, funding, etc. for these actions) which they evaluated but did not select for prioritization at this time.

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Appendix E contains community-specific implementation strategies.

SECTION 9 - PLAN MAINTENANCE

It is required by FEMA (as per 44 CFR Part 201.6(c)(4)(i) that, *"[The plan maintenance process shall include a section describing the] method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle."* A formal plan maintenance process must take place to ensure that the Hazard Mitigation Plan remains an active and pertinent document. Regularly scheduled evaluations during the five-year cycle are important to assess the effectiveness of the program and to reflect changes that may affect mitigation priorities.

URS Corporation (URS), as the consulting company, was able to provide the Core Planning Group with guidance on potential means to satisfy the requirement for plan maintenance procedures. However, it was the members of the Steering Committee who were in the best position to define the process. URS submitted a Guidance Memorandum (Guidance Memorandum #3 ï Plan Maintenance Procedures to summarize FEMA requirements for plan monitoring, evaluation, and updates. The memorandum was distributed on February 15, 2008.

At a meeting of the Steering Committee on March 19, 2008, plan maintenance issues were discussed, feedback was obtained, and collective decisions were made regarding the plan maintenance strategy for this hazard mitigation plan. The information presented below represents these decisions, as provided to URS. These methods will ensure that regular review and updating of the Hazard Mitigation Plan will occur.

The Monmouth County Office of Emergency Management will take the lead role in the coordinating the overall plan maintenance effort, with ongoing support and feedback from the Steering Committee.

Monitoring the Plan

An important step in any mitigation planning process is to document the method by which the Core Planning Group will monitor the Hazard Mitigation Plan throughout the five-year period of record. To accomplish this objective, the Steering Committee has elected to prepare **Annual Work Progress Monitoring Reports**, compiling responses prepared by entities responsible for implementing mitigation actions (as identified in the Mitigation Strategy). Progress Monitoring Reports shall be prepared by each participating jurisdiction and submitted on an annual basis to MCOEM, beginning one year from the date of FEMAôs approval of the Final plan. MCOEM will follow-up on the collection of these forms as needed. Work progress reports shall be the FEMA How-To #4 (FEMA 386-4), Worksheet #1, Progress Report. Each participating jurisdiction will be responsible for downloading the form from the FEMA web site (How-To #4 is currently posted at: http://www.fema.gov/plan/mitplanning/howto4.shtm). Using the FEMA Progress Reports will answer the following questions:

- the hazard mitigation action(s) that the agency is responsible for
- the supporting agencies/entities responsible for implementation;
- a delineation of the various stages of work along with timelines (milestones should be included);
- whether the resources needed for implementation, funding, staff time and technical assistance are available, or if other arrangements must be made to obtain them;
- the types of permits or approvals necessary to implement the action;
- details on the ways the actions will be accomplished within the organization;
- whether the duties will be assigned to agency staff or contracted out;
- the current status of the project; and
- any issues that may hinder implementation.

Evaluating the Plan

Post adoption, a mitigation plan should be evaluated on a regular basis in order to assess the effectiveness of the plan's implementation and to reflect changes that may affect the mitigation priorities.

To accomplish this objective, the Steering Committee will convene once per year for an **Annual Plan Evaluation Meeting**. Plan Evaluation Meetings will be conducted within three months after each annual batch of Progress Reports are due (see "Monitoring", above). At each Plan Evaluation Meeting, the Steering Committee will review Progress Reports, and use the following criteria to evaluate the plan:

- do the goals and objectives address current and expected conditions?
- has the nature and magnitude of risks changed?
- are the current resources appropriate for implementing the plan?
- are there any implementation problems (such as technical, political and/or legal), or coordination issues with the other agencies and/or Committee members?
- have the outcomes occurred as expected?
- have the agencies and other Committee partners participated as proposed?; and
- where shortcomings are identified, what can be done to bring things back on track?

They will also discuss progress with regard to plan integration, and any comments received on the plan from municipalities, the public, and/or other stakeholders.

Following each Annual Plan Evaluation Meeting, the MCOEM will prepare meeting minutes summarizing the outcome of the evaluation meeting. MCOEM will distribute meeting minutes to all Steering Committee members via email, and will post meeting minutes on the web site.

Updating the Plan

As part of the process to maintain FEMA mitigation funding eligibility, a plan update must always be submitted to NJOEM/FEMA for their review. This must occur within five years of the plan's approval by FEMA (and during subsequent five-year cycles thereafter).

To accomplish this objective, the Steering Committee elected to have the MCOEM take the lead on Plan updates, with support from the Steering Committee members. MCOEM will conduct **Update Appraisals** with the Steering Committee. During the Update Appraisal, the Steering Committee will evaluate the current Plan, Annual Progress Reports, and Annual Plan Evaluation Meeting Minutes. MCOEM will conduct the Update Appraisals at 3.5 years from the date of FEMA's approval of the Final plan, and at the same point in time during subsequent five-year windows (i.e., from the date of FEMA's approval of the final plan, Update Appraisals will occur at Year 3.5, Year 8.5, Year 13.5, etc.). The Steering Committee has selected Year 3.5 as the point for the Update Appraisals to ensure that sufficient time (18 months) will be available to update the document within the five year cycle, should a major rewrite be necessary.

The plan update will not only involve a comprehensive review and evaluation of each section of the plan, but also a discussion of the results of evaluation and monitoring activities detailed in the Plan Maintenance section of the previously approved plan. Plan updates may validate the information in the previously approved plan, or may involve a major plan rewrite. A plan update cannot be an annex referring to the previously approved plan; it must stand on its own as a complete and current plan.

Other criteria that will be considered during the update include:

- if changing situations have modified goals/objectives/actions and/or hazards;
- if additional information is available to perform more accurate vulnerability assessments;
- if it is determined that participating jurisdictions wish to be added to and/or removed from the Plan; or
- if it is determined that the Plan no longer addresses current and expected future conditions.

At the time of the update, MCOEM shall consult with FEMA for the latest Guidance in place regarding plan updates to ensure that the latest criteria are addressed in the update process.

MCOEM will initiate the updates immediately upon completion of the Update Appraisal, with support from the Steering Committee. MCOEM shall be responsible for completing the updates 90 days prior to the end of the five-year cycle, and for submitting the updated plan to NJOEM and FEMA.

Plan updates will be posted on the County web site, and made available in hard copy at the MCOEM offices.

Public Participation in Plan Maintenance

As per 44 CFR Part 201.6 (c)(4)(iii) states, *"[The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process."* To meet this requirement, the new Hazard Mitigation Plan should describe what opportunities the public will have during the plan's periodic review to comment on the progress made to date and on any proposed plan revisions.

The following array of activities was selected by selected by the Steering Committee during the March 19, 2008 meeting:

- MCOEM will continue to maintain the mitigation planning website and document repositories.
- Each participating jurisdiction will add a link on their jurisdiction's web page to the County mitigation planning website, if they have not already done so as part of the plan development process.
- MCOEM will lead efforts to prepare an annual fact sheet on the plan. This fact sheet will be submitted via email to Planning Group members for posting on community notice boards, at a minimum, and preferable supplemented with distribution at meetings as applicable. MCOEM will post the fact sheet on the county mitigation plan web site.
- Participating jurisdictions will conduct annual interviews and/or smaller meetings with civic groups, the public and other stakeholders. This will be accomplished through incorporating discussion of the mitigation plan into other regularly attended meetings.
- Participating jurisdictions will consider annual flyers, newsletters, newspaper advertisements, and Radio/TV announcements, and will implement some or all of the above at the discretion of the jurisdiction.

Participating jurisdictions are responsible for keeping track of any comments they receive on the plan, and bringing these forward to the Steering Committee to discuss during Annual Evaluation Meetings.

Plan Integration

As per 44 CFR Part 201.6(c)(4)(ii), *"[The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate."*

To meet this requirement, the new Hazard Mitigation Plan should indicate how mitigation recommendations will be integrated into job descriptions, or existing planning mechanisms such as comprehensive plans, capital improvement plans, zoning and building codes, site reviews, permitting and other planning tools, where such tools are appropriate. In other words, ñplan integrationò can be thought of as the process whereby each local government will incorporate the plan findings and projects into their governing systems.

URS Corporation (URS), as the consulting company, was able to provide guidance on potential means to satisfy the requirement for plan integration procedures. However, it was the members of the Steering Committee who were in the best position to define the process. URS submitted a Guidance Memorandum (Guidance Memorandum #3 ï Plan Integration) to MCOEM on August 7, 2007, to summarize FEMA requirements for integrating the plan into other local planning mechanisms. It was also posted to the mitigation planning web site soon after for review by Core Planning Group members, the public, and other stakeholders.

The Steering Committee discussed plan integration at their meeting on March 19, 2008 and noted the following capabilities in relation to mitigation planning and opportunities to integrate the mitigation plan into daily activities. Progress with regard to Plan Integration will be on the agenda for each Annual Plan Evaluation Meetings.

Participating jurisdictions currently use comprehensive land use planning, capital improvements planning and building codes to guide and control development. After the Hazard Mitigation Plan is formally adopted, these existing mechanisms will have hazard mitigation strategies integrated into them, as follows:

- Within six months after adoption of the Hazard Mitigation Plan, Core Planning Group members for each participating jurisdiction will issue a letter to each of its communityôs department heads to solicit their support and explore opportunities for integrating hazard mitigation planning objectives into their daily activities. Specifically, letters can include:
  - Many participating jurisdictions have Master Plans, General or Comprehensive Plans. In participating jurisdictions where Master Plans, General or Comprehensive Plans exist, Core Planning Group members will work with their respective planning departments to educate them on the Hazard Mitigation Plan and encourage that on the next updates of such plans, hazard mitigation for natural hazards is addressed.
  - Many participating jurisdictions have local building departments responsible for building code enforcement and review of site plans. Local jurisdictions enforce the state-adopted IBC (which is currently the International Building Code 2006 ï New Jersey Edition). In these communities, Core Planning Group Members can coordinate with their respective building departments to ensure that they have adopted and are enforcing the minimum standards established in the current State-adopted IBC NJ edition.
  - Many participating jurisdictions participate in FEMAôs National Flood Insurance Program and as such have local floodplain management ordinances. In these communities, Core Planning Group Members can coordinate with their respective Floodplain Administrator to determine if enforcement beyond FEMA minimum requirements would be prudent for the community.

- In participating jurisdictions with local zoning ordinances, Core Planning Group members can work with their zoning boards to educate them on the Hazard Mitigation Plan and encourage consideration of low occupancy, low-density zoning in hazard areas, when practicable.

The Core Planning Group facilitates its duties by using existing processes and resources while implementing the plan and fulfilling the mitigation goals. An important step in any mitigation implementation process is to take advantage of tools and procedures that are already in place. Because the mechanisms are in-place and familiar to local officials, tapping into existing resources will alleviate the workload and accelerate the implementation process, particularly if the implementation phase calls for expanding existing agency mandates or departmental funds, for instance, or creating new programs later on.

By completing the previously-distributed Capability Assessment Questionnaires, each participating jurisdiction should have a clear understanding of their unique local capabilities and resources.

The following bullets provide ways that the hazard mitigation plan can be integrated into local planning mechanisms:

- **Departmental or organizational work plans, policy, and procedural changes.** Updating the work plans, policies, or procedures to include hazard mitigation concepts and activities can help integrate the plan into daily operations. These changes can include how major development projects and subdivision reviews are addressed in hazard-prone areas or ensure that hazard mitigation concerns are considered in the approval of major capital improvement projects.

- **Job descriptions.** Working with department or agency heads to revise job descriptions of government staff to include mitigation-related duties could further institutionalize hazard mitigation. This change would not necessarily result in great financial expenditures or programmatic changes. For example, adding hazard mitigation into job descriptions for a community planner, floodplain manager, emergency manager, building code official, or water resources engineer in the Public Works Department:

- **Capital and operational budgets.** Instead of solely relying on funding from hazard mitigation programs or other external sources of grant monies, jurisdictions might consider a line item for mitigation project funding in their capital or operational budgets. Having a line item in these budgets may not guarantee funding every year, but it is certainly easier to get the money allocated if it is already there. Examples include:
  - A revolving fund to finance a buyout program.
  - A low-interest loan program to fund retrofits.

- **Executive Orders, ordinances, and other directives.** The governing body or local executive often has the authority to issue directives to require departments and agencies to carry out certain hazard mitigation actions. Using one of these mechanisms, the governing body or executive can direct department heads to provide progress reports to the planning team on the hazard mitigation initiatives that the departments are responsible for carrying out.

- **Comprehensive planning.** Adding a hazard element to the comprehensive plan is one of the most effective mechanisms to institutionalize hazard mitigation for new construction. A primary benefit of combining these processes is that they both influence the location, type, and characteristics of physical growth, specifically buildings and infrastructure. While planning in

and of itself may not be regulatory, it uses regulatory mechanisms (zoning, development ordinances, etc.) for implementing goals and objectives. Additionally, in many parts of the country, the comprehensive planning process is an established activity that is already familiar to the public, and it usually generates a great deal of interest and public participation.

Examples of using existing resources to accomplish mitigation include:

- The Department of Public Works could adopt more rigorous procedures for inspecting and cleaning debris from streams and ditches. Instead of cleaning only after storms or complaints from citizens, the Department could require inspections of streams and ditches at least semi-annually.
- The Planning Department could add hazard vulnerability to subdivision and site plan review criteria and incorporate any necessary actions at the planning stage.
- A Community conservation society or other interested voluntary organization could perform inventories of historic sites in hazard areas that might require special treatment to protect them from specific hazards.
- State agencies can lend their time, expertise and funds to the implementation of hazard mitigation projects. Make sure the planning teamôs list of state contacts is very broad, as the resources of one state agency may be unknown to another.
- Colleges and universities can provide technical expertise to projects that may require Geographic Information System (GIS), engineering, planning or other technical assistance. They can also provide meeting space, laboratories and other logistical support.
- Jurisdictions can apply to participate in the Community Rating System (CRS). CRS is part of the NFIP and reduces flood insurance premiums to reflect what a community does above and beyond the NFIPôs minimum standards for floodplain regulation. CRS rewards communities for what they are doing, as well as provide an incentive for new flood protection activities, such as; preserve open space in the floodplain; enforce higher standards for safer new development; maintain drainage systems; and inform people about flood hazards, flood insurance, and how to reduce flood damage.
- Stormwater Management Plans: As part of the municipal stormwater permitting program, all municipalities can adopt a stormwater management plan and implementing stormwater management ordinance. The plan and ordinance incorporate design and operating standards for stormwater volume, ground water recharge and water quality control as set forth in NJDEP regulations. Ideally a developer should meet the standards onsite; however, the municipality can allow offsite mitigation if it adopts a mitigation plan within the larger stormwater plan. Through this mitigation process, a municipality can direct a developer to correct or alleviate an existing flooding problem. The Stormwater Management Rule also sets up a regional stormwater management planning process where stormwater management can be addressed on a watershed level. Through this process, more stringent design standards could be adopted to further reduce stormwater and flooding. Once a regional stormwater management plan is adopted, each affected municipality must amend its municipal stormwater management plan to incorporate standards specific to that waterway. Municipal stormwater management plans become part of the municipal master plan and are revisited every six years.

SECTION 10 - FOR MORE INFORMATION

If you have any questions or comments on the Multi-Jurisdictional Hazard Mitigation Plan for Monmouth County, New Jersey, additional information can be obtained by contacting:

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