



Township of Brick

Hazard Mitigation Plan Element



Adopted March 30, 2016

Prepared For:

Township of Brick

Ocean County, New Jersey

Prepared By:





TABLE OF CONTENTS

Section 1: Overview	1
Purpose and Background.....	1
Introduction.....	1
Section 2: Community and Hazard Profile	4
Community Context.....	4
Hazards of Concern.....	5
Flooding and Storm Surge	5
Coastal Erosion	15
Sea Level Rise.....	16
Additional natural Hazards	18
Inventory of Past and Current Mitigation Efforts:	18
Section 3: Mitigation Needs and Strategies	21
Sustainable Landuse Planning	21
Managing Development near waterways and in low lying areas.....	21
Dune, wetland and other natural area protection	25
Reducing threats of Coastal Erosion.....	25
Improving Private Property Protection.....	26
Managing Potential Drawbacks of Elevated Homes.....	27
Working with Limited development sites.....	27
Housing Deficiencies Preventing Safe Shelter	28
Mobile Home Safety	28
Protective Infrastructure and Capital Investments	29
Evacuation and Access Road Improvements	30
Dedicated Emergency Operations Center:	31
Permanent Emergency Shelter(s):	32
Equipment/Management Needs:	32
Protecting Critical Facilities from Storm Surge and Sea level Rise:	32
Stormwater and drainage infrastructure and maintenance:.....	34
Impervious Surfaces	34
Addressing Remaining Damage and Impacts	36



Limited Recovery/Resilience Funding and Resources36

Section 4: Action Plan - Road Map for Recovery and Resilience 39

LIST OF FIGURES

Figure 1. Floodplains in the Township of Brick8

Figure 2. 1% Annual Chance Flood Areas For The V-Zone In The Township.....11

Figure 3. Flood Hazard Vulnerability in the Township of Brick.....12

Figure 4. Storm Surge Vulnerability in the Township of Brick14

Figure 5. Coastal Vulnerability Index in the Township of Brick17

Figure 6. Flood Exposure by Land Use Category in the Township of Brick23

LIST OF TABLES

Table 1. Estimated General Building Stock Exposure to All Flood Hazard Areas22

Table 2. Total Land Area in the Flood Hazard Areas (Acres).....22

Table 3. NFIP Policies, Claims and Repetitive Loss Statistics26



SECTION 1: OVERVIEW

PURPOSE AND BACKGROUND

This Hazard Mitigation Element of the Master Plan has been prepared in accordance with the Municipal Land Use Law, N.J.S.A. 40:55D-28b(16) and was adopted on March 30, 2016 by the Township of Brick Planning Board as an element of the Township of Brick Master Plan.

INTRODUCTION

The Township of Brick's (Township) coastal location and abundance of waterways creates numerous opportunities for prosperity but these same features also position the community for greater risk from natural hazards. In particular the Township is subject to severe coastal storms including hurricanes, tropical storms, and Nor'easters that cause multiple potential

hazards such as heavy rainfall, coastal and riverine flooding, coastal erosion, storm surge and sea level rise. To address the risks to life and property from these hazards the Post Sandy Planning Grant Program has presented the Township an opportunity to create a linkage between the existing Ocean County Hazard Mitigation Plan and the Township of Brick Floodplain Management Plan by adopting this Hazard Mitigation Plan as an element to the Township Master Plan. This Hazard Mitigation Plan Element (HMPE) provides an opportunity to incorporate additional Township-specific analysis to better understand potential hazards and vulnerabilities and to support municipal initiatives and strategies that help mitigate risks and support public safety and community resilience.

In late 2012 Superstorm Sandy (Sandy) struck the northeastern United States causing over \$70 billion in widespread damages. According to the Township's 2014 Strategic Recovery Planning Report, the significant damages resulted in Sandy becoming the second-costliest hurricane in U.S. History. Sandy's dangerous combination of storm surge, coastal and riverine flooding, heavy precipitation, and strong winds caused considerable damage in the Township including the destruction of homes, businesses, infrastructure, municipal facilities and the impairment of the local economy. In the wake of such costly impacts communities face numerous challenges related to short term recovery and long term resilience from future storms. Among them is the need for improved local planning that effectively incorporates hazard mitigation into all areas of community development and decision making. Successfully aligning and integrating hazard mitigation planning with traditional land use and master planning provides a key mechanism for creating more comprehensive resilience, public safety and overall improved quality of life.

Purpose: The HMPE assesses the local impacts of natural hazards and is intended to guide local decisions related to sustainable land use and development strategies, enhanced capital improvement planning, public safety, updated regulatory standards and additional measures for improving the Township's ability to withstand and recover from future hazards. The development of this HMPE will:





- Expand on existing hazard mitigation and land use planning efforts
- Establish long range planning recommendations and short-term mitigation and resiliency actions
- Employ current FEMA best management practices for integrating hazard mitigation into local planning
- Provide a platform for all areas of community and economic development to account for identified hazards and risks.
- Create increased cost-effectiveness for the community through coordinated planning
- Create opportunities to educate residents on local hazards and preventative measures.

PLAN INTEGRATION, COORDINATION AND BUILDING BLOCK APPROACH

PLANNING COORDINATION AND PROCESS

This HMPE is a component of a larger initiative undertaken by the Township to improve the integration of hazard mitigation with community development and local decision-making. This effort included the concurrent development of a series of township-specific working documents that create a framework for reducing vulnerabilities to hazards, increasing safety, and limiting damages to both public and private property. Each plan leverages the findings and analysis of the other planning efforts and fulfills a unique role in a comprehensive approach to hazard mitigation and community resilience. The following documents were developed concurrently with cross-utilization of experts and stakeholders:



- Township of Brick Master Plan: Hazard Mitigation Plan Element
- Township of Brick Floodplain Management Plan
- Township of Brick Repetitive Loss Area Analysis
- Township of Brick Neighborhood Plans
- Township of Brick Capital Improvement Plan
- Township of Brick Master Plan: Green Buildings and Sustainability Element

The development of the HMPE was led by the Township’s Master Plan Sub-committee consisting of four members of the Planning Board and supported by a public engagement process. As a result this plan incorporates a wealth of local knowledge and ensures that recommendations align with the goals and preferences of the community.

The methodology and associated tasks incorporated into the development of the Hazard Mitigation Plan Element are outlined below:

- ✓ Review of existing plans and studies including but not limited to:
 - 2007 Township of Brick Master Plan inclusive of all master plan elements
 - 2014 Ocean County Multi-Jurisdictional All Hazard Mitigation Plan
 - 2014 Township of Brick Strategic Recovery Planning Report
 - 2014 Township of Brick “Getting to Resilience” Recommendations Report
 - Ocean County Long Term Community Recovery Plan
 - Township of Brick Codes and Ordinances
 - New Jersey State Hazard Mitigation Plan



- Strategies for Flood Risk Reduction for Vulnerable Coastal Populations Around Barnegat Bay
- ✓ Existing conditions analysis documenting trends and the current status of the community including population/demographics, land use, development, and the regulatory environment.
- ✓ Examination of past and recent hazard events and development of profiles for each potential hazard incorporating findings from concurrent planning efforts
- ✓ Assessment of community health and safety issues and specific geographic areas of concern related to identified hazards.
- ✓ Public outreach and engagement efforts to incorporate local knowledge and values into the planning process. Public engagement included meetings, surveys, and workshops.
- ✓ Development of a series of needs and opportunities to improve hazard mitigation and address identified issues.
- ✓ Establishment of a road map of strategies and actions to create long-term resiliency and address short-term recovery and community health/safety needs.

GOALS

The community's overarching hazard mitigation goals provide the foundation for identifying and implementing appropriate mitigation strategies and actions. The series of goals presented in this HMPE have been developed to reflect community values, existing conditions, known hazards and vulnerabilities. Through collaborative discussions, stakeholder engagement, reviews of existing plans and studies, and a focused intention toward comprehensive community resilience, the Township of Brick established the following goals to guide the development of the HMPE:

1. Reduce threats and damage from natural hazards to protect life, property, critical facilities and infrastructure.
2. Integrate hazard mitigation planning with other planning mechanisms to enhance or support floodplain management, capital improvement planning and create a decision-making tool for land use and development policies.
3. Protect environmental resources and maintain their natural ability to increase flood protection, manage stormwater and improve overall community resilience.
4. Ensure that local government operations are not significantly disrupted by hazardous events.
5. Improve communications and public education to foster all sectors of the community working together to create a hazard-resilient community.
6. Identify and plan for future conditions including sea level rise to establish long-term community resilience.



SECTION 2: COMMUNITY AND HAZARD PROFILE



The following section provides a brief overview of select existing conditions which are pertinent to natural hazards, risks and mitigation throughout the community. This section builds on, rather than replicates, information found in other sections of the Master Plan and as such includes only those conditions directly relevant to hazard mitigation. For more detailed information on specific topics or conditions please refer to the corresponding chapters or elements of this Master Plan.

COMMUNITY CONTEXT

The Township of Brick is located in northeastern Ocean County, New Jersey within the Atlantic Coastal Plain. The Township's 32.3 square miles of land areas include interconnected forests, wetlands, fields, and coastal areas. Largely defined by its coastal and waterfront landscapes, including a barrier island, the Township's 53.2 miles of privately owned waterfront property is the most of any municipality in New Jersey. Waterfront areas in the Township include 1.79 miles along the barrier island, 39.5 miles of riverfront property and 11.93 miles of bay front property. The Township today is predominantly a residential community with significant appeal for visitors and vacation home owners due to its coastal features and attractions. The Township initially experienced slow growth and was predominantly a summertime recreational area until the opening of the Garden State Parkway in 1955. In the years that followed, the Township experienced a peak development period, particularly in the 1980's, that led to a substantial population increase and the establishment of a suburban growth pattern. The Township's development pattern is characterized by commercial spokes extending outward from the Town Center along major transportation corridors with pockets of medium-density residential development nestled among the areas' natural features and waterways.



The Township has a temperate climate resulting in relatively warm summers and moderate winters. The average annual temperature in the Township is 53 degrees Fahrenheit (°F) with temperatures rarely exceeding 100 degrees Fahrenheit and rarely falling below 0°F. Precipitation averages approximately 50 inches annually, with July and August being the wettest months and snowfall averaging approximately 25 inches each year.

HAZARDS OF CONCERN

The Township is subject to severe coastal storms including hurricanes, tropical storms, and Nor'easters that originate in tropical or sub-tropical waters of the Atlantic Ocean. These severe coastal storms along with inland thunderstorms are the primary cause of the major hazard risks for the Township including coastal and riverine flooding, coastal erosion, and sea level rise. The Township is also vulnerable to strong wind, storm surge effects and heavy rainfall as a result of these storms. Past storm events have caused significant damage to the built and natural environment in the Township and have exposed risks and opportunities for improvement in local land use, development and capital improvement planning.

Mitigating and managing these potential risks will likely increase in importance as recent data and projections indicate that these events may become more frequent in the future and could be exacerbated by coastal erosion and future sea level rise associated with climate change. Understanding the nature, extent and potential impacts of these hazards is critical for mitigating risk and creating sustainable settlement patterns. The potential hazards and related impacts faced by Township residents are broadly discussed below along with an examination of current conditions that may contribute to or exacerbate hazard vulnerabilities. For more detailed information related to these hazards please refer to the Township's 2015 Floodplain Management Plan.

FLOODING AND STORM SURGE

Flood events are the most frequent hazard in the Township and are primarily caused by coastal storms such as hurricanes, tropical storms, Nor'easters and severe thunderstorms. The coastal environment, frequent weather events and natural hydrology of the Township create inherent vulnerabilities to both coastal and riverine flooding from Barnegat Bay, the Atlantic Ocean, and multiple rivers and creeks. The Township of Brick is located within two primary watershed areas with the northern portion of the Township draining to the Manasquan Watershed and the southern portion draining to the Barnegat Bay Watershed. Significant waterways with the potential for flooding include the headwaters of the Barnegat Bay and numerous tributaries to the Manasquan River Watershed and the Metedeconk Watershed, along with Beaver Dam Creek, North Branch Beaver Dam Creek, Kettle Creek, Cedar Bridge Branch, and Long Causeway Branch.

FLOOD TYPES AND DAMAGING FORCES

Three primary flood events impact the Township and are defined according to FEMA as follows:

Riverine Flooding: Riverine flooding occurs along water channels (rivers, streams, creeks etc.) and includes overbank and flash flooding. Channels are defined, ground features that carry water through and out of a watershed and when they receive too much water, the excess flows over its banks and inundates low-lying areas. Heavy precipitation, large snow melt, and excessive stormwater runoff all contribute additional water to channels over a relatively short period of time and increase the likelihood of riverine flooding.



Coastal Flooding: Coastal flooding occurs as land areas along the ocean coast and other inland waters become submersed due to storm surge and rising seawater over and above normal tide action. Coastal flooding is predominantly caused by coastal storms (hurricanes, tropical storms, and Nor'easters) however hurricanes cause the most severe tidal flood threat due to the potential for high tides, strong waves, and coastal flood damage. Coastal flooding creates many of the same problems as riverine flooding but also presents additional issues related to beach erosion; loss or submergence of wetlands and other coastal ecosystems; saltwater intrusion; high water tables; loss of coastal recreation areas, beaches, protective sand dunes, parks, and open space; and damage to coastal structures such as sea walls, piers, bulkheads, bridges, or buildings.



Storm Surge: Storm surges contribute to coastal and inland flooding through strong wind, increased water elevations and large waves causing dune overwash, tidal elevation rise in inland bays and harbors, and backwater flooding through coastal river mouths.

FORCES AT WORK

Damages and public safety risks associated with flooding are the result of several primary actions exerted during a flood. The following actions are prime contributors to flood risk and damage as identified by FEMA:

- *Hydrostatic forces* are created by the weight of standing or slowly moving water against a structure and are one of the main causes of flood damage. Many structures are not designed to withstand lateral forces from standing water and basements can be particularly susceptible to these forces as they must also withstand the weight of saturated soils. (FEMA Unit 1: Floods and Floodplain Management).
- *Hydrodynamic forces* are created by fast moving water and can damage buildings through direct impact and by dragging action as water runs along the structures side. High-velocity flows are capable of causing significant damage including destroying walls, knocking buildings off of foundations, and carrying large amounts of dangerous debris. High-velocity flows are typically associated with storm surge, Tsunamis, floodwater outflow, and strong currents parallel to the shoreline. (FEMA Coastal Construction Manual: Volume 1)
- *Waves* can affect coastal buildings in multiple waves including breaking waves, wave run-up, wave reflection and deflection, and wave uplift. Breaking waves have the potential to cause the most damage as the force created by waves breaking against a vertical surface can be 10 times greater than the force of high winds during a coastal storm. (FEMA Coastal Construction Manual: Volume 1)
- *Flood-borne debris* is capable of significant damage including destroying masonry walls, wood-framing among other structural components. Debris carried during flood events and storms typically includes decks, steps, ramps, breakaway wall panels, portions of or entire houses, heating oil and propane tanks, cars, boats, decks and pilings from piers, fences, erosion control structures, and many other types of smaller objects. (FEMA Coastal Construction Manual: Volume 1)



- *Stormwater Runoff* is a result of local drainage issues created as precipitation and flood waters are unable to absorb into the ground and instead accumulate or flow downhill causing flood concerns. Local conditions (impervious surfaces, terrain, grading, soil quality etc.) can increase the amount of runoff and require intervention to protect life and property. Stormwater runoff is typically managed by a closed conveyance system that channels water away from an urban area to surrounding streams however if insufficiently controlled, stormwater runoff can substantially increase the risks and damage during a flood event.

OVERVIEW OF FLOOD OCCURRENCE AND AREAS OF RISK

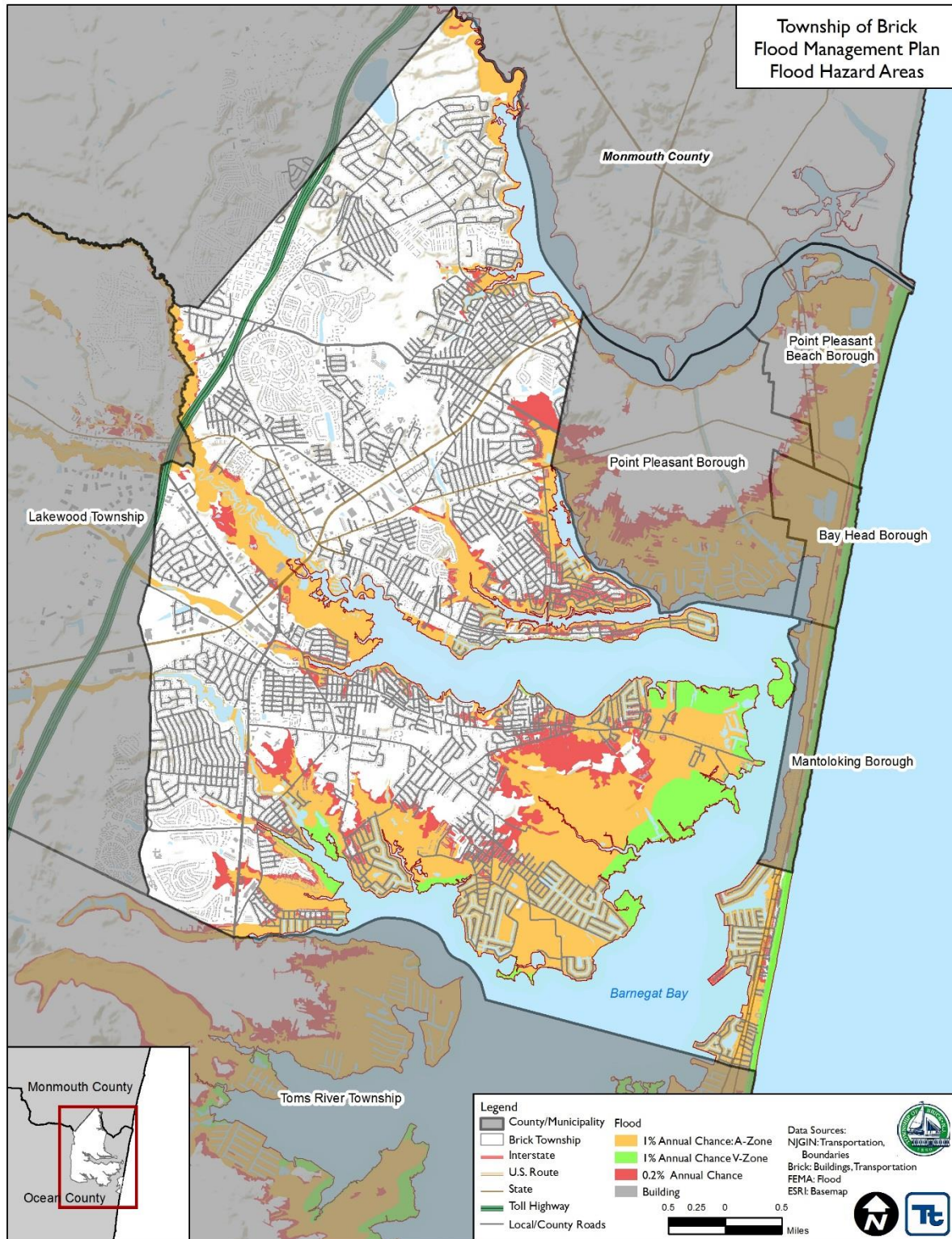
Flooding is a relatively common occurrence for the Township and can occur any time of the year. According to the New Jersey Office of Emergency Management, areas of greatest risk occur in known floodplains where lives and properties are in danger when rivers or streams overflow from intense or prolonged rainfall and/or ice or debris jams and inundate adjacent parcels. Coastal areas are also among the greatest risks for flood damage in particular the portions of the Township subject to high-velocity waves and storm surge.

One method for assessing flood frequency and severity for particular areas is measured by the probability that a certain water flow level will be equaled or exceeded in a given year. Two of the most common probabilities used in flood management are the 100-year and 500-year flood levels which correspond to a 1% chance and 0.2% chance of being equaled or exceeded in any given year, respectively. The areas within the 1% annual chance flood areas have a higher chance of becoming inundated during storm events and this area is used as the regulatory boundary by many agencies including the NFIP to determine the need for flood insurance. Also referred to as the Special Flood Hazard Area (SFHA), this boundary is a convenient tool for assessing vulnerability and risk in flood-prone communities. The Township's coastal areas along its eastern edge as well as those parcels proximate to inland waterways make up the Township's most at risk areas for damage from 1% and 0.2% annual chance flood levels. Approximately 20% of structures in the Township are located in the 1% annual chance floodplain.

The 1% annual chance (both A and V-zones) and 0.2% annual chance flood zones throughout the Township are identified in Figure 1.



Figure 1. Floodplains in the Township of Brick





RIVERINE AND INLAND FLOOD LOCATIONS

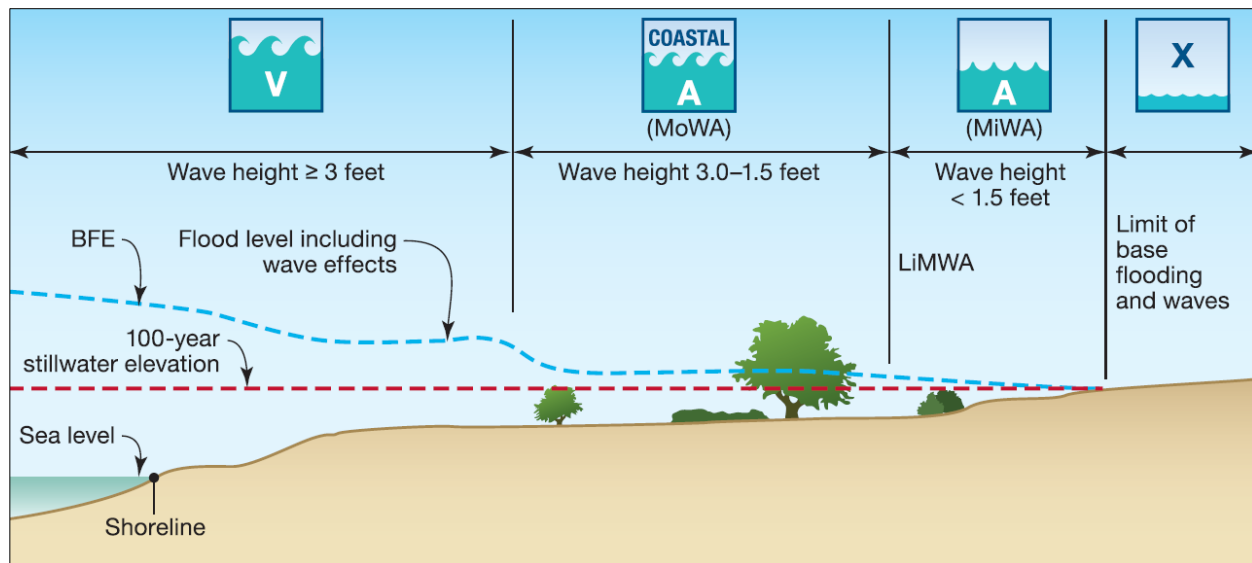
While much of the Township is subject to riverine, flash, and stormwater flooding, the conditions in some areas cause, or contribute to, increased vulnerabilities to flooding. Historically the Metedeconk River has been the most frequent source of riverine flooding in the Township. Flooding also occurs along the Manasquan River, Barnegat Bay, Cedar Bridge Branch, and Beaverdam Creek, although most typically due to the high percentage of impervious cover from land use, poor drainage facilities in the surrounding areas, and improper grading from development. Sawmill Creek and Kettle Creek are also potential sources of inland flooding. A combination of factors including proximity to water bodies, extent of paved areas, natural area degradation and inadequate or non-existent stormwater management and drainage systems significantly increase inland and riverine flood risk for residents and structures in these parts of the Township.

COASTAL FLOOD LOCATIONS

Coastal flooding has been an ongoing issue in the Township with homes and infrastructure located along the Barrier Island and Barnegat Bay at continued risk for flood damage. Coastal portions of the Township experience varying flood risks depending on a combination of factors including the proximity to ocean waters and the conditions of the natural and built environment. According to the Township's 2014 Getting to Resilience Recommendations Report, flooding from the Barnegat Bay as well as storm surge and overwash flooding from the Atlantic Ocean are the primary causes of coastal flood risk. Both the Normandy Beach and Mandalay Park sections of the Township have also experienced coastal flooding issues.

FEMA flood insurance rate maps (FIRMs) identify areas at risk for coastal hazards by dividing areas into categories by the potential wave height or wave depth that could occur. These areas are classified in FEMA's 2011 Coastal Construction Manual as follows:

- Coastal High Hazard Area (V Zone): This is the portion of the special flood hazard area (SFHA) that is subject to high-velocity wave action typically determined by either wave height (3 feet or greater) or wave run-up depths (3 feet or greater).
- Zone A/AE: This zone comprises portions of the SFHA that are not within the Coastal High Hazard Area. In coastal areas Zone AE is divided by the limit of moderate wave action (LiMWA) which represents the landward limit of the 1.5-foot wave (FEMA 2011). The LiMWA separates Zone AE into two groups:
 - Moderate Wave Action Area (Coastal Zone A): This is the area between the end/limit of Zone V and the LiMWA. Subject to wave heights between 1.5 and 3 feet during the base flood.
 - Minimal Wave Action (Zone A): This is the inner portion of zone A/AE and is the area between the LiMWA and the landward limit of Zone A/AE and is subject to wave heights **less than 1.5 feet** during the base flood.



Source: FEMA 2011

Coastal High Hazard Areas (V zones) have a greater chance of experiencing coastal flooding, wave damage, storm surge, and coastal erosion during a storm event. Figure 2 provides a visual representation of the 1% annual chance flood areas for the V-Zone in the Township.



Figure 2. 1% Annual Chance Flood Areas For The V-Zone In The Township

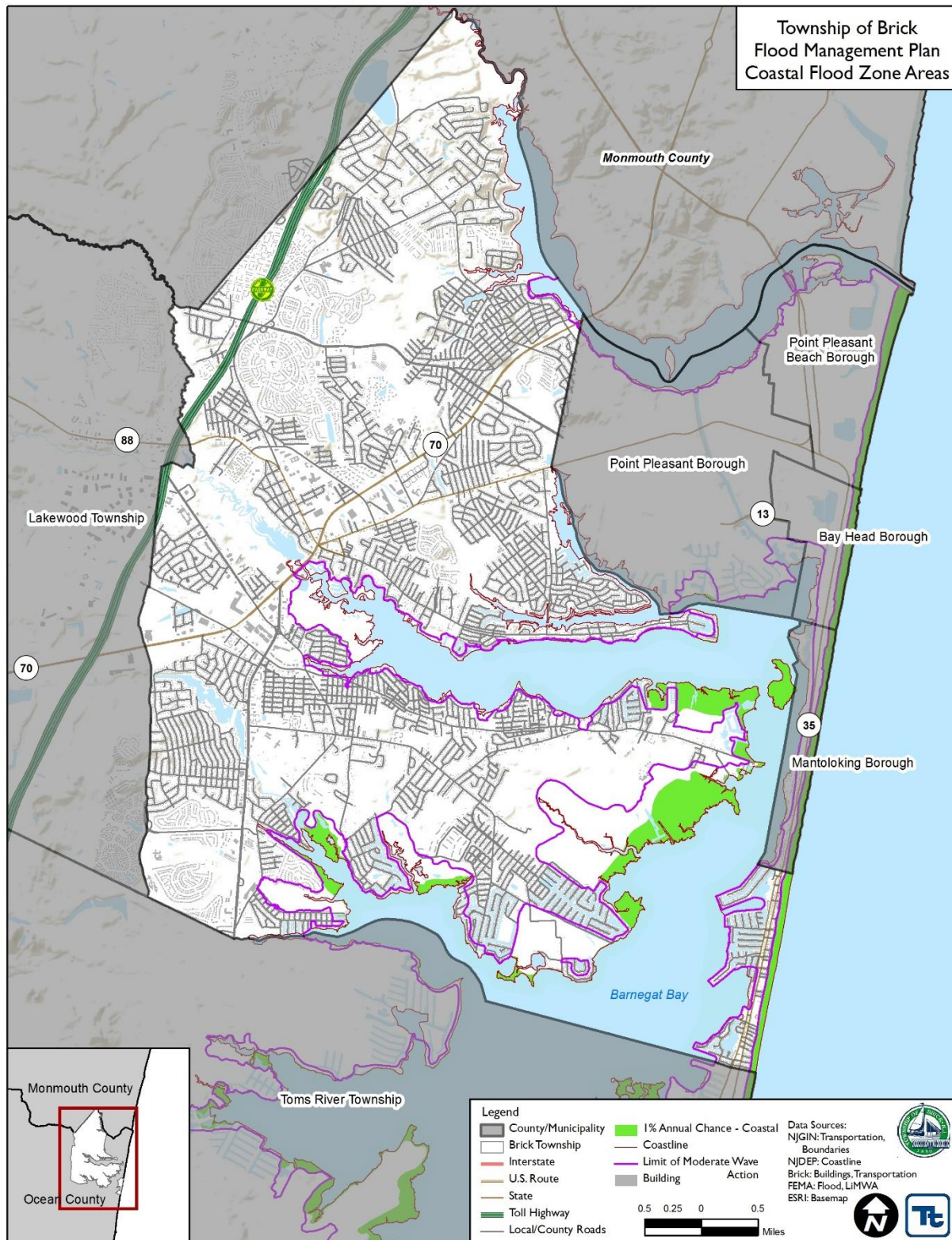
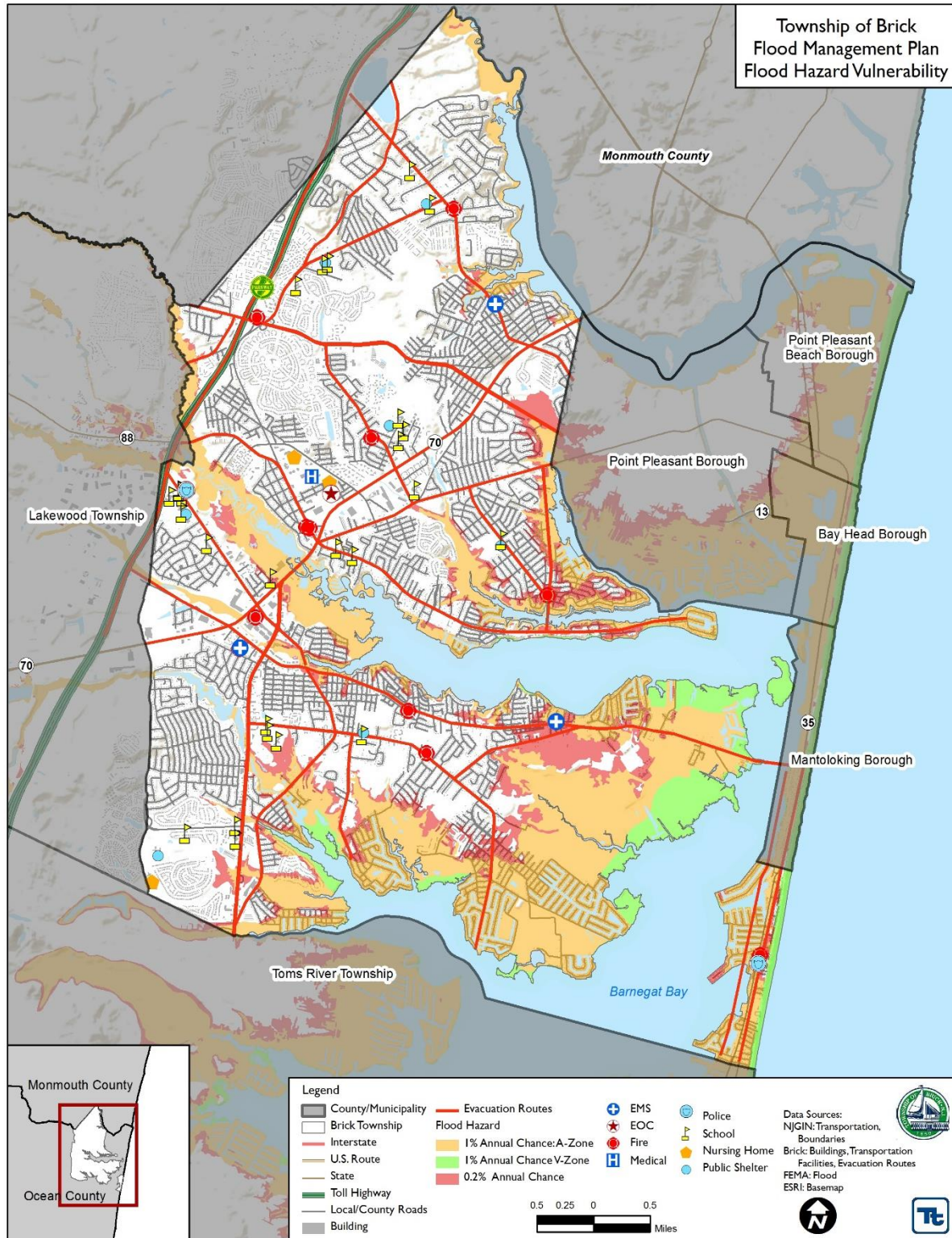




Figure 3. Flood Hazard Vulnerability in the Township of Brick



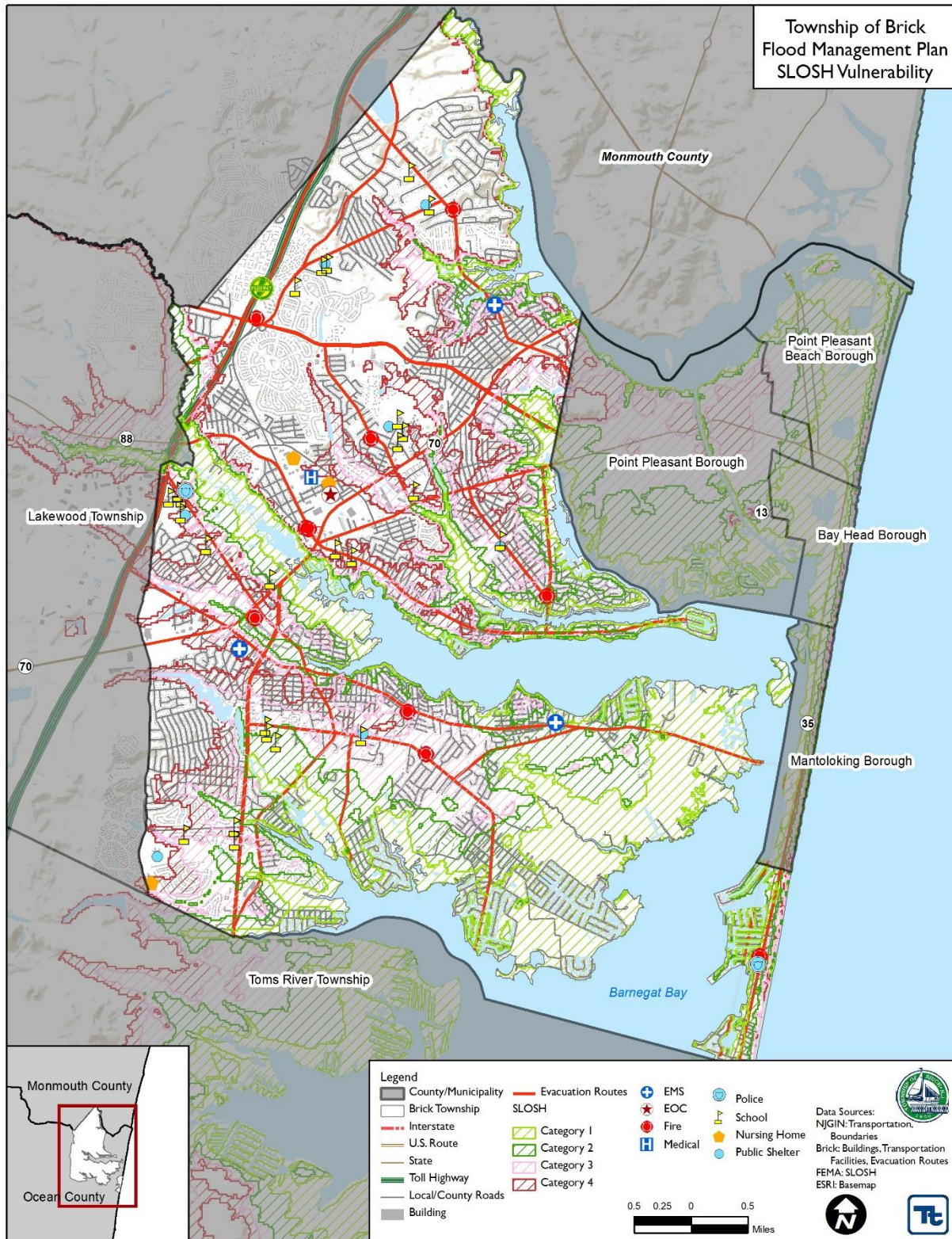


STORM SURGE AREAS

Storm surge, caused by severe coastal storms and resulting high winds, high tides and large waves, contributes significantly to coastal flooding. The National Weather Service has developed the Sea, Lake and Overland Surge from Hurricanes (SLOSH) inundation maps which represent potential storm surge flooding from worst-case combinations of hurricane direction, forward speed, landfall point, and high astronomical tide. It does not include riverine flooding caused by hurricane surge or inland freshwater flooding. To assess the Township's exposure to the hurricane/tropical surge, a spatial analysis was conducted using the SLOSH model and the potential inundation areas were grouped into Saffir/Simpson Hurricane Intensity Scale Categories as follows: Category 1 and 2 (dangerous), Category 3 (devastating), and Category 4 (catastrophic). Figure 4 illustrates the SLOSH zones in the Township which represent specific areas experiencing increased risk for future storm surge damage.



Figure 4. Storm Surge Vulnerability in the Township of Brick





PAST FLOOD EVENTS AND FUTURE DAMAGE POTENTIAL

The recently completed Floodplain Management Plan documented a minimum of 80 known flood events, including FEMA disaster declarations, which have impacted the Township between 1971 and 2015. These events included inland and coastal flooding and were caused by varying combinations of hurricane, tropical storm, Nor'easter, severe storms, high tides, and heavy rain. Additional information on past flood events can be found in the Township's Floodplain Management Plan.

According to the Ocean County Hazard Mitigation Plan (OC HMP), historic flood damage in the Township has been considerable, including 316 repetitive loss events and \$213,707,753 in losses paid to property owners, which is among the highest in Ocean County. Superstorm Sandy provides the most current, and likely most severe, reminder of the ever-present local flood risk. FEMA's 2014 Flood Insurance Study indicates that the Township was particularly hard hit by Superstorm Sandy which brought nearly a foot of rain, 90 mph wind gusts, and extreme storm surges amplified by a full moon and 20% higher than normal high tides. The impacts were dramatic including massive property and infrastructure damage, beach erosion, dune loss, isolated residents and impairment of the local economy. Infrastructure deficiencies, including underperforming stormwater systems, low bulkheads and a lack of surge barriers, as well as low-lying structures and flooded evacuation routes all contributed to greater community vulnerability and increased damages. Areas of Barnegat Bay and along the Atlantic Ocean on the Barrier Island were particularly vulnerable to the effects of Superstorm Sandy.

Due to its coastal environment, network of waterways, and history of flood events, the Township and its people and properties are undoubtedly vulnerable to future flood hazards. Current information indicates that the Township will continue to experience direct and indirect impacts of flood events annually that may induce secondary hazards such as coastal erosion, storm surge in coastal areas, infrastructure deterioration or failure, utility failures, power outages, water quality and supply concerns, and transportation delays, accidents, and inconveniences.

COASTAL EROSION

Ongoing coastal erosion affects all shorelines in the Township and is a major contributor to public safety concerns, property damage and environmental degradation. Accelerated by severe coastal storms, storm surge and flooding, coastal shorelines change constantly in response to local conditions including sand size/density, wind, waves, tides, sea-level fluctuation, seasonal and climatic variations, and human alterations. As dunes, bluffs and other natural coastal resources erode, the Township's buildings, roads, infrastructure, natural resources, and wildlife habitats are all placed at increasing risk for damage from severe storms.

Some communities elect to improve the stabilization of coastal areas through the use of protective measures (seawalls, bulkheads, revetments, rip-rap, gabions, groins and dredging); however, while initially beneficial for property owners, the rate of coastal erosion typically increases following many of these interventions. To counteract the negative impact of these hardened structures, alternative forms of shoreline stabilization that provide more natural forms of protection can be used including beach nourishment and dune restoration.

The properties most at risk to coastal erosion are those located within 200 feet of an erodible shoreline and its beaches which according to the OC HMP include 292 parcels in the Township (0.5% of total parcels in the municipality). The Township's 1.79 miles of oceanfront property on the barrier island and 11.93 miles of bayfront



property creates numerous areas vulnerable to coastal erosion and related safety risks and property damage. Ongoing coastal erosion has the potential to exacerbate existing flood and storm surge risks as protective beach and dunes are lost. During Superstorm Sandy, dune failures on the Barrier Island allowed for overwash and additional property damage in several areas illustrating the potential damage that could occur in the future without effective erosion controls.

The 2012 New Jersey Beach Profile Network (NJBPN) noted that dune maintenance measures have typically been conducted electively by individual property owners without municipal oversight or management. The Township has begun addressing this concern through beach replenishment initiatives after this vulnerability was underscored during Superstorm Sandy. Without proactive intervention, coastal erosion will remain a serious hazard for the community. Not only does ongoing erosion exacerbate coastal flooding and storm surge vulnerabilities but it also places the Township's economy at risk from lost property, reduced tax base and impairment of tourism and vacation rentals.

SEA LEVEL RISE

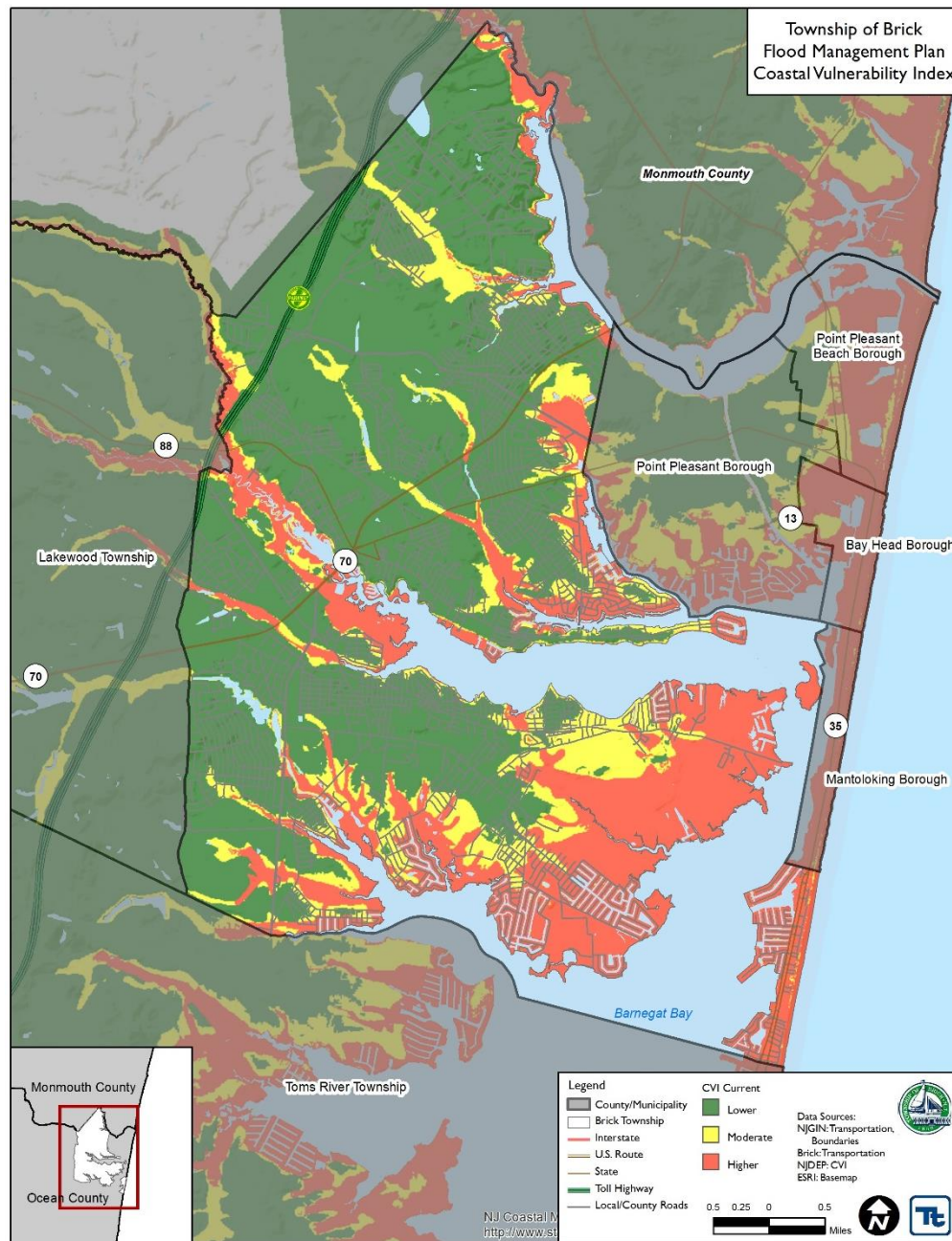
Sea level rise is primarily the result of thermal expansion as the oceans warm and land-based ice (glaciers and polar ice caps) melts and increases the volume of water in the earth's oceans. Sea level rise can be measured globally by monitoring average global sea level trends or locally by monitoring the height of water along the coast relative to a specific point on land. If projections prove accurate, potential increases in sea level rise may heighten threats for coastal communities in the future. Like coastal erosion, sea level rise has the potential to change local conditions and increase flood risk by narrowing the distance between the built environment and high tides, storm surge, and large waves. Sea level rise can alter the frequency and duration of coastal flood events by permanently increasing the inland extent of coastal floodplains thus exposing previously safe areas to major flood risks. In addition, sea level rise stands to create additional impacts for the Township including accelerated coastal erosion, narrowing and loss of stability of the barrier island, and loss of critical habitat.

NOAA, in partnership with FEMA, USACE, the U.S. Global Change Research Program (USGCRP), and the White House Council on Environmental Quality (CEQ) has created a set of map services and related tools intended to assist communities and the public in evaluating the potential risks from future sea level rise. These tools were used to evaluate and map the potential expansion of the 1% annual chance coastal floodplain due to various increases in the sea level projections for the years 2050 and 2100. This information is accessible using the online "Sea Level Rise Planning Tool" viewer at: <http://www.globalchange.gov/browse/sea-level-rise-tool-sandy-recovery#overlay-context>

The U.S. Geological Survey's coastal vulnerability index (CVI) provides a tool for assessing the relative susceptibility of coasts-to-sea-level rise. The CVI utilizes a series of variables including geomorphology, regional coastal slope, tide range, wave height, relative sea-level rise, and shoreline erosion and accretion rates to provide an overview of potential sea level rise changes in coastal regions. The figure below illustrates the Township's CVI and identifies specific areas along the coast with higher vulnerability ratings. For additional information on the Township's CVI please refer to the 2015 Floodplain Management Plan.



Figure 5. Coastal Vulnerability Index in the Township of Brick



The Township, with input from Jacques Cousteau National Estuarine Research Reserve and to align with the State of New Jersey Hazard Mitigation Plan, selected two NOAA sea level rise scenarios to examine. The 2050 Intermediate-High and the Highest NOAA sea level rise scenarios were selected to account for the full range of potential impacts understanding that other knowledgeable agencies have adopted sea level rise projects for NJ based on alternate geological perspectives (NJ sea level rise projection ranges and best estimates. Miller AK, Kopp RE, Horton BP, Browning JV and Kemp AC. 2013. A geological perspective on sea-level rise and its impacts along



the U.S. mid-Atlantic coast. Earth's Future 1(1):3-18) which indicates much higher rates of sea level rise pending potential glacial ice sheet collapse beginning in Antarctica (Jacques Cousteau Estuarine Research Reserve).

ADDITIONAL NATURAL HAZARDS

While flooding, coastal erosion, and sea level rise are the primary hazards facing the Township, other potentially hazardous events can occur. The following hazards have been identified for the Township in the Ocean County Hazard Mitigation Plan:

- **Drought:** The Township of Brick is located in the Coastal North Drought Region of the County and has experienced drought events that negatively impact stream flows, lake/reservoir storage, and groundwater levels.
- **Earthquakes:** All municipalities in Ocean County share the same risk for earthquakes. Factors contributing to earthquake risk include the county's sandy soils, which are prone to the liquefaction, as well as the wood frame residences and mobile homes that are less protected.
- **Extreme Temperature:** Extreme temperatures occur during winter and summer seasons in Ocean County.
- **Tornadoes/wind storms:** These storm types can occur throughout Ocean County however are relatively rare.
- **Winter Storms:** The entire state of New Jersey is subject to Winter Storms which are a regular occurrence in Ocean County and should be considered highly likely.

INVENTORY OF PAST AND CURRENT MITIGATION EFFORTS:

The Township has worked diligently to improve hazard mitigation and foster resilience efforts throughout the community. The Township plans to continue these efforts through additional infrastructure upgrades and enhancements, updated mitigation planning, assistance to impacted property owners, and an application to the Community Rating System (CRS) program. Previous sections or elements of this Master Plan already identify some goals and objectives for natural hazard planning including implementing the Open Space and Recreation Plan, encouraging the continued municipal acquisition and recreational development of vacant waterfront property, implementing the Conservation Plan for environmentally sensitive lands, improving surface and groundwater quality through the completion of the Sewerage Infrastructure Improvement Act requirements, and more.

Provided below is a summary of some of the key efforts currently taking place in the Township:

- **County HMP:** Adoption of the Ocean County HMP which includes goals, objectives, policies, and actions focused on reducing the extent, frequency and impacts of flooding.
- **Flood Insurance:** Participation in the NFIP and adoption of flood damage prevention regulations. Preparation to participate in the NFIP administered Community Rating System (CRS) to improve floodplain management and reduce flood insurance premiums for policy holders in recognition of community activities that exceed the minimum NFIP requirements.
- **Regulatory Tools:** The Township utilizes a number of local ordinances to regulate the use, design, and site planning of development projects including: Stormwater Management Ordinance, Floodplain Management Ordinance, Natural Hazard Ordinance, Environmental Assessment Ordinance, Riparian Buffer Ordinance, Dune Preservation Ordinance, Threatened and Endangered Species Ordinance, Tree



Protection Ordinance, Development permit/Site Plan Review, Zoning Ordinance, Subdivision Ordinance, and Building Code

- **CAFRA:** The Township of Brick is also federally regulated by the Coastal Areas Facility Review Act (CAFRA). The CAFRA Zone is New Jersey's coastal zone in which NJDEP has the authority to approve the location, design, and construction of major facilities with the intention of protecting coastal resources.
- **Flood Warning System:** The Township currently utilizes a County-wide flood warning system consisting of a network of precipitation gages, tide gages along the coastline, and stream gages that all constantly monitor potential flood conditions. This information is fed into a USGS forecasting program, which assesses the flood threat based on the amount of flow recorded by the devices.
- **Sustainable Land Use planning:** Given the current limitations on available development sites and growing vacancies in strip malls, the Township has committed to more sustainable land use practices. Future growth and development will be focused on infill and mixed-use redevelopment of existing areas to utilize existing infrastructure, prevent environmental degradation and increase quality of life.
- **Open space preservation:** Open space preservation efforts have been underway for many years in the Township and have successfully preserved approximately 3,000 acres. The Township uses an open space tax and other programs to provide funding for new acquisitions of open space. Many valuable areas of open space and other natural resources have been successfully preserved which not only provide environmental value but have also increased the community's flood protection.
- **Beach and Dune Protection Program** areas on the barrier island along the ocean are defined and regulated under the New Jersey Coastal Management Plan.
- **Social Media:** The Township provides storm and hazard updates via social media.
- **Emergency Checks for seniors:** The Township has reached out and performed emergency checks and evacuation procedures for senior communities. The community is proactively increasing its understanding of the locations of seniors and vulnerable populations to improve emergency response and public safety.
- **Technical Assistance:** Engineering department provides assistance to residents in achieving compliance with regulations.
- **Current and Future Projects:** The Township has also undertaken several recent projects including:
 - Application for HMGP funding to install generators at the Municipal Complex, Department of Public Works, and Police substation/Pioneer Hose Fire Company Barrier Island Forward Command Post. Additional generators are still needed for other facilities.
 - Post storm cleaning and flushing of all outfalls and storm drains (1,682) identified in the Sandy floodplain.
 - Implementing beach erosion and stabilization control projects in high risk areas and areas subject to storm surge scouring
 - Implementing resilient (i.e., greater than pre-Superstorm Sandy levels) beach replenishment measures including construction of 25' high dunes and extension of the beach by about 200 feet
 - Installing man-made flood control structures in coastal risk areas including the installation of a steel seawall
 - Working on adding cell phone numbers to Reverse 9-1-1 to alert both full-time and seasonal property owners of potentially hazardous conditions
 - Improving protection for key roads including Route 35 and 70 via the steel seawall project and NJ DOT improvements to drainage systems



Despite these efforts much of the Township's residents, visitors and built environment remain at risk from the various impacts of coastal storms and resulting hazardous events and additional strategies are needed.



SECTION 3: MITIGATION NEEDS AND STRATEGIES

The hazards described above, and their associated impacts, create some of the Township's primary risks to public safety and long-term resilience. The following section outlines the most critical issues and needs related to natural hazards currently facing the Township. These issues help to highlight opportunities for improvement and identify potential actions to mitigate future hazards.

Identified recovery and resilience needs include opportunities for sustainable land use planning; building stock and tax base protection; capital improvement planning; critical facilities improvements; stormwater management; recovery/resilience funding and resources; communication improvements and access to education, training, and resources. Details on each of these needs are described below and presented with associated Township objectives and strategies.

SUSTAINABLE LANDUSE PLANNING

As a coastal community with numerous inland waterways, beachfront and riverside development is prevalent in the Township. While there are challenges and limitations when developing waterfront areas (e.g., grading, wildlife habitat, regulatory restrictions, wetlands etc.), the appeal of the community has led to significant development proximate to water and other natural resources. The attraction of the Township's coastal and waterfront areas has created economic health for the community but also places properties and infrastructure in these low-lying waterfront areas at a very high risk of flooding from coastal storms and future sea level rise. The Township will continue its pursuit of sustainable land use strategies that acknowledge the local importance of waterfront development while making affirmative steps to increase property and environmental protection for existing and future development. Sustainable land use planning, in the context of hazard mitigation, include steps to safely manage existing development in or near hazard areas, restrict new development in hazard areas, protect natural areas and their hazard mitigation benefits, and plan for changing future conditions such as sea level rise.

MANAGING DEVELOPMENT NEAR WATERWAYS AND IN LOW LYING AREAS

Beach front and waterfront properties are some of the most desirable and valuable in the Township. These properties, however, are also often located in floodplains and are some of the most at-risk for flooding, storm surge and sea level rise. Floodplains are lowland areas adjacent to waterways that are typically subject to frequent flooding. The Township currently has 4,861 acres, or 29% of the total land area, located in the 1% annual chance floodplain, including 7,488 structures. These structures not only heighten flood risks for residents in the immediate area but they can also act as obstructions during flood events which increases the potential for flood damage for neighboring areas. A summary of building stock exposed as well as land area exposed to various flood scenarios is provided in Tables 1 and 2, below.



Table 1. Estimated General Building Stock Exposure to All Flood Hazard Areas

Hazard	Number of Structures Exposed	% of Total	Total RCV Exposed	% of Total	Total Tax Ratable Exposed	% of Total
1-percent Annual Chance Flood Event	7,488	18.5%	\$3,481,039,250	18.6%	\$1,418,745,677	13.2%
0.2% Annual Chance Flood Event	10,166	25.1%	\$4,659,704,863	24.8%	\$2,440,230,651	22.7%
SLOSH Category 1	5,005	12.4%	\$2,313,165,139	12.3%	\$917,559,002	8.5%
SLOSH Category 2	11,395	28.1%	\$5,180,357,074	27.6%	\$3,080,119,761	28.6%
SLOSH Category 3	19,230	47.5%	\$8,676,175,170	46.3%	\$4,993,605,576	46.4%
SLOSH Category 4	25,494	63.0%	\$11,221,622,025	59.8%	\$6,422,371,185	59.7%
2050 Intermediate-High Scenario Sea-Level Rise	9,237	22.8%	\$4,215,445,897	22.5%	\$1,745,934,419	16.2%
2050 Highest Scenario Sea-Level Rise	10,105	25.0%	\$4,581,928,097	24.4%	\$2,222,444,719	20.7%

Source: FEMA 2015, NJOEM 2013, NOAA 2012, Brick Township

Note: % - Percent

RCV – Replacement Cost Value

Table 2. Total Land Area in the Flood Hazard Areas (Acres)

Hazard	Area (acres)	% of Total
1-percent Annual Chance Flood Event	4,861.2	29.0%
0.2% Annual Chance Flood Event	5,956.1	35.6%
SLOSH Category 1	3,313.3	19.9%
SLOSH Category 2	6,030.5	36.0%
SLOSH Category 3	8,743.1	52.2%
SLOSH Category 4	10,848.9	64.8%
2050 Intermediate-High Scenario Sea-Level Rise	5,220.3	31.2%
2050 Highest Scenario Sea-Level Rise	5,535.8	33.0%

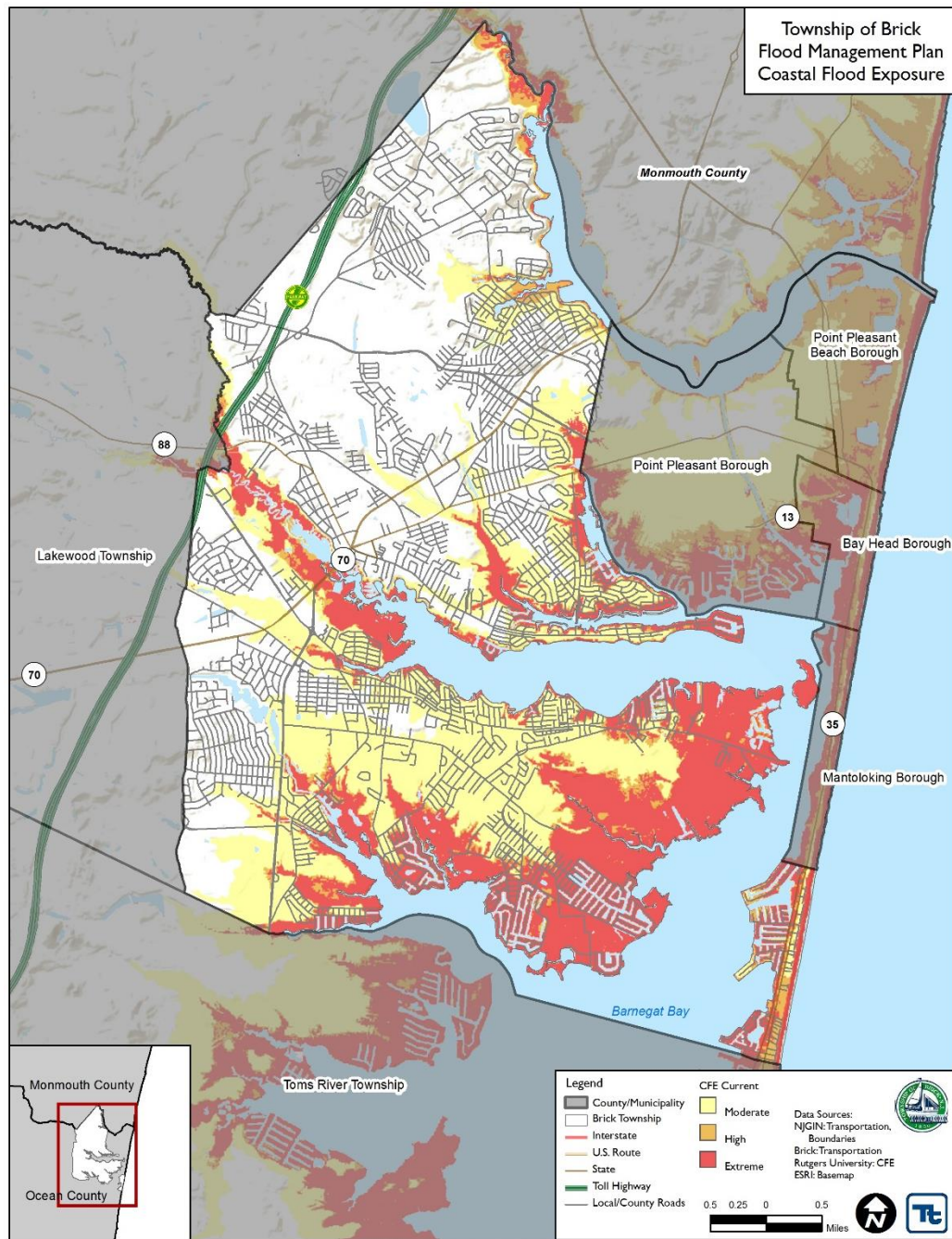
Source: FEMA 2015, NJOEM 2013, NOAA 2012, NJGIN

Note: % - Percent; Cumulative analysis conducted.

The recently developed Floodplain Management Plan assessed the exposure of various areas of the Township to flooding based on the frequency of flood events and the potential for powerful wave impacts. Developed areas along the Barrier Island and those close to the Barnegat Bay and Metedeconk River and their smaller tributaries were identified as having a high or extreme exposure to coastal flooding due to their location. Numerous low-lying neighborhoods in these areas stand to experience significant flooding from major coastal storms. The figure below illustrates flooding exposure by land use category in the Township.



Figure 6. Flood Exposure by Land Use Category in the Township of Brick



Source: NJADAPT 2015

Note: CFE Coastal Flood Exposure

With more than 18% of structures in the 1% floodplain, future flood events pose a significant threat to public safety and the local economy including the potential loss of over \$1.4 billion in property and tax base. Land use strategies and actions should be adopted that protect, or where feasible relocate, existing structures while controlling new development in floodplains and near waterways to improve long-term flood safety. Efforts may



include strategic acquisitions and/or relocations of flood-prone properties, promotion of safer target growth areas, protection of natural areas, participation in the NFIP Community Rating System, as well as enforcement of all codes and ordinances.

Objective and Strategies

Objective: Promote sustainable land use and development patterns that acknowledge the importance of waterfront development while making affirmative steps to minimize property damage, improve public safety, and protect environmental resources

Strategies:

- Restrict new development in hazardous areas through regulatory enforcement, site plan review, property acquisition, and incentives.
- Continue to enforce minimum National Flood Insurance Program requirements
- Continue to enforce the adopted International Building Code, and all periodic updates, to require that the construction or improvement of structures utilizes modern methods for improving safety.
- Join the Community Rating System (CRS) program and implement pro-active measures that will assist residents with reduced flood insurance costs
- Create an inventory of structures located in floodplains and their current elevation status
- Continue to identify any remaining hazardous sites or natural areas for potential acquisition. Prioritize the identification and acquisition of flood-prone properties as well as sites that may serve as flood retention areas or constructed wetlands. Identify additional funding opportunities to support any future acquisitions as current funding is limited.
- Continue to assist homeowners participating in voluntary acquisition programs with relocation within the Township.
- Continue to promote and direct future development to safer areas identified for infill and higher density mixed-use development such as the Town Center.
- Utilize SLOSH, CVI and other available data sources to identify properties and facilities at-risk for future storm surge and sea level rise. Update the Master Plan Land Use Element to encourage clustering and higher density development in the Town Center and other appropriate growth areas. Promote the relocation of at-risk buildings to these target growth areas.



DUNE, WETLAND AND OTHER NATURAL AREA PROTECTION

The land use pattern of the Township places many structures and paved areas proximate to natural resources including wetlands, forests and vegetated areas along waterways. These resources when left undisturbed provide natural flood and stormwater protection benefits including flood storage, improved water infiltration into the ground, reduced flood water velocity, storm surge protection, pollution filtration, erosion prevention, among others. These services however can easily become jeopardized by man-made development practices such as improper grading, excessive paving, clearing of riparian areas, and open space loss among others. The loss of natural hazard mitigation benefits has occurred in parts of the community where structures and paved areas have replaced open spaces and natural areas. These losses, including degrading wetlands in Barnegat Bay, contribute to greater vulnerability to flood events.



As these natural hazard mitigation benefits are lost, more expensive and often less effective man-made solutions are sought including seawalls, levees, stormwater management systems among others. While often effective in the short term, these solutions are not ideal as they require significant initial investments, ongoing maintenance, and can exacerbate hazardous conditions if designed poorly. Preserving natural resources and their ability to mitigate hazardous impacts should be a pivotal component of the Township's efforts to establish long term resilience. Wherever feasible, natural areas should continue to be protected and utilized to their fullest hazard mitigation potential, development practices that degrade natural resources should be prevented and the preservation of additional open spaces should be continuously pursued.

Objective and Strategies

Objective: Restore, enhance and protect natural areas with flood protection benefits including riparian areas, wetlands, and dune systems among others.

Strategies:

- Prohibit development or degradation of important natural areas including wetlands, forests, riparian areas among others
- Continue to identify, acquire and protect valuable natural areas
- Pursue additional funding to restore degraded wetlands in Barnegat Bay
- Identify opportunities to increase the effectiveness of natural areas in mitigating hazards. Potential actions include creation or improvement of stormwater retention areas, removal of invasive species, planting of native vegetation along streambanks among others.
- Continue to pursue and incentivize open space easements, transfer of development rights and other strategies for permanent protection of sensitive areas

REDUCING THREATS OF COASTAL EROSION



Coastal erosion, like flooding, will continue to be an ongoing problem along many portions of the Township’s coastline. According to the Township’s Strategic Planning Recovery Report, six coastal areas have been identified as subject to erosion caused primarily by severe storms including: Cedar Bridge Manor Park, North Riverside Drive, Cedar Island Bayfront, Dock Road Beach, Mallard Park Beach and Bay Harbor Beach. Eroding coastlines directly threaten coastal homes, businesses and infrastructure and stands to increase damages from future storm surge, sea level rise and coastal flooding. The Ocean County Hazard Mitigation Plan identified 292 parcels in the Township that are located within 200 feet of an erodible shoreline. If erosion is left uncontrolled these properties will remain at the highest risk for future damage. Effective mitigation strategies should be pursued to help protect properties and infrastructure in these areas from threats associated with future coastal storms and flood events.

Objective and Strategies	
Objective:	Reinforce and protect dune systems, coastal wetlands and other natural coastal protective measures
Strategies:	<ul style="list-style-type: none"> • Continue to carefully monitor, document and map erosion in coastal areas • Prevent improper grading, dune alterations and other development practices that increase risks for residents and properties near erodible coastlines • Continue to pursue coastal flood and storm surge projects that reduce the rate of erosion. Support ongoing beach replenishment and dune protection projects and identify funding and opportunities for additional measures.

BUILDING STOCK AND TAX BASE PROTECTION

Limiting development near water is only one component of increased flood protection as effective design and building methods can also help to reduce flood damage and protect structures, even in very hazardous locations. Unfortunately some older structures, roads and facilities in the Township were not originally constructed to maximize hazard protection thus leaving homes and key evacuation routes vulnerable to the impacts of flood waters.

IMPROVING PRIVATE PROPERTY PROTECTION

According to the American Community Survey, the largest number of homes in the Township were built between 1970 and 1989 (46.6%) with a significant number also being built between 1940 and 1969 (35.6%). Only 4.8% of homes were constructed after 2000, and the relatively older housing stock of the Township includes many homes that, despite close proximity to waterways and coastlines, have not been designed or built with the most modern and effective building techniques or protective measures.

Historic flood damage in the Township has been considerable including 104 repetitive loss properties and \$255,386,689 in losses paid to property owners which is among the highest in Ocean County.

Table 3. NFIP Policies, Claims and Repetitive Loss Statistics

Municipality	# Policies (1)	# Claims (Losses) (1)	Total Loss Payments (2)	# Rep. Loss Prop. (1)	# Severe Rep. Loss Prop. (1)	# Policies in the 1-percent Flood Boundary (3)
Brick Township	4,083	3,471	\$255,386,689	109	3	3,381



Source: FEMA Region 2, 2014

(1) Policies, claims, repetitive loss and severe repetitive loss statistics provided by FEMA Region 2, and are current as of 12/31/2014.

Please note the total number of repetitive loss properties includes the severe repetitive loss properties. The number of claims represents claims closed by 12/31/14.

(2) Total building and content losses from the claims file provided by FEMA Region 2.

(3) The policies inside and outside of the flood zones is based on the latitude and longitude provided by FEMA Region 2 in the policy file.

Notes: FEMA noted that where there is more than one entry for a property, there may be more than one policy in force or more than one GIS possibility.

A zero percentage denotes less than 1/100th percentage and not zero damages or vulnerability as may be the case.

While some level of flood risk is inevitable for properties near waterways, structural and protective investments, such as home elevations and flood-proofing, can deliver greater safety and help to reduce the magnitude of future damages. A bittersweet outcome of the rebuilding process following Superstorm Sandy has been a recent increase in the number of elevated homes in the Township. While the damage to these properties was tragic, many property owners have seized the opportunity to increase their home's ability to withstand future events. Some have elevated their home as required by the NFIP however others have undertaken the improvements electively. While the elevation of these homes is a substantial gain, some homeowners have rebuilt without elevating and others that were not significantly damaged by Sandy remain noncompliant and at risk for flooding during future events.

Undertaking these types of improvements can be a large financial burden leaving many property owners without the necessary means to increase the safety of their home. Secondary home owners may experience even greater difficulty in receiving funding assistance as they are often excluded from traditional recovery programs. The Township conducted a survey of homes to identify potential candidates for voluntary elevation and has been providing support to homeowners in securing funding and technical assistance to implement mitigation improvements. Additional efforts have been underway to improve resilience including the elevation of utilities and wet or dry flood proofing for structures for properties that have submitted permits to the Township construction department as a part of the pre-approval process. The Township should continue providing and expand this technical assistance to continue to make the community more resilient.

MANAGING POTENTIAL DRAWBACKS OF ELEVATED HOMES

Identifying strategies to support additional home elevations is a key opportunity for improved safety and resilience. However new home elevations also come with additional potential risks that must be planned for and addressed. Ensuring that spaces below elevated homes are used only as storage or garages, and not livable space, is essential to protecting public safety. If illegally converted into bedrooms or living space, these low areas become extremely dangerous during flood events. Newly elevated homes can also sometimes negatively impact the views and other aesthetic considerations for neighboring properties. Design and regulatory measures are currently in place and other controls are being explored that can help maximize the flood safety benefits of home elevations while finding creative solutions that reduce any negative impacts for neighboring properties.

WORKING WITH LIMITED DEVELOPMENT SITES

The increased pace of development after the opening of the Garden State Parkway in the late 1950's created immediate opportunities for large scale commercial growth and new residential neighborhoods. Following this extensive development in the latter half of the 20th century, there are now few large development sites remaining. Of the limited vacant sites in the Township most have environment constraints that restrict



development including large areas of tidal and freshwater wetlands. Without the availability of large development areas in the community it is difficult to strategically relocate many, if any, homes to safer locations. Even if they could be moved, relocating waterfront development inland would significantly detract from the local economy and coastal character. In light of these limitations, greater importance should be placed on identifying opportunities to increase structural resilience, drainage features and other improvements to improve safety and retain the tax base.

HOUSING DEFICIENCIES PREVENTING SAFE SHELTER

Some homes in the Township lack essential facilities and services that create unsafe conditions for residents. According to the American Community Survey, current deficiencies in the Township include 557 housing units without telephone service, 588 housing units without complete kitchen facilities, and 153 housing units without complete plumbing facilities. Without adequate telephone, kitchen, and plumbing services a home is unable to support proper sheltering in place during an emergency by limiting access to information, help and basic necessities. These unsafe or outdated housing conditions present daily safety risks that are magnified during flooding and other disaster events. The Township should work diligently to ensure all homes contain the necessary systems to allow for sheltering in place when necessary.

MOBILE HOME SAFETY

According to the American Community Survey, the Township has 117 mobile homes which, while not inherently dangerous, do create unique vulnerabilities during flooding or other emergencies. Without the structural stability of a traditional home, mobile homes must be carefully located away from floodplains and other hazard areas to reduce the risk of washouts, isolation or other catastrophic failure. Mobile home owners should be educated about safe evacuation routes and procedures in advance of disaster events.

Objective and Strategies

Objective: Increase the resilience of existing and future building stock to promote public safety and preserve the tax base

Strategies:

- Promote additional elevations and protective measures for homes and structures in vulnerable areas. Encourage elevations of structures that exceed NFIP minimum requirements and the implementation of wet or dry flood proofing. Consider utilization of incentives to encourage these additional protective measures including height bonuses, tax abatements, streamlined permitting among others.
- Encourage private investments in the elevation of utility and building control systems to ensure essential services are available during an emergency.
- Continue to identify potential voluntary elevation candidates and funding opportunities. Consider a second survey or other outreach that pays particular attention to identifying second-home owners who are otherwise ineligible for traditional assistance programs.
- Continuously monitor the use of spaces below elevated first floors to verify it remains as storage or garage use only.
- Continue to explore options to prevent or mitigate negative impacts of elevations on neighboring properties. Development of design guidelines or other regulatory controls could be considered.
- Continue to enforce the adopted International Building Code, and all periodic updates, to require that the construction or improvement of structures utilizes modern methods for improving safety.



Objective and Strategies

- Proactively inspect all structures being re-built after a disaster to ensure compliance with building codes and other regulations.
- Consider the creation of a resiliency officer or position who would conduct a mitigation-focused evaluation during the review of site and development plans and building permits.
- Assist homeowners with deficient facilities (telephone, kitchen, plumbing) in making improvements to allow for safe shelter in place during an emergency. Provide technical assistance, guidance and support for identifying potential funding sources.

Objective: Ensure the protection of residents living in mobile homes and incorporate the unique conditions of mobile home living into emergency planning and response.

Strategies:

- Prevent mobile home siting or parking in areas subject to hazardous conditions
- Ensure mobile home residents are informed of potential hazardous risks and appropriate evacuation procedures

CAPITAL IMPROVEMENT PLANNING

PROTECTIVE INFRASTRUCTURE AND CAPITAL INVESTMENTS

The impacts to the Township during Sandy included substantial damage to both natural and man-made protective measures including dune systems, beaches, roads, bulkheads and more. These assets, and their protective capabilities became compromised during the storm and as a result catastrophic damage occurred to vulnerable homes, businesses and other infrastructure. These impacts have underscored the need to not only repair but also improve protective measures throughout the Township to reduce damage and public safety risks during any future disasters. A particular area of concern is the beach erosion and dune loss suffered during Sandy which has greatly increased flood risks for coastal properties and infrastructure. Key systems, including water/sewer utilities and roads, were also damaged and are in need of greater protection. Lagoons and waterways received enormous amounts of sediment and debris during the storm which has reduced the flood storage capacity throughout the Township. Bulkheads of low or varying heights throughout the Township may also have contributed to local flood risks and damage. Bulkheads with different heights proximate to one another can be problematic if fast moving flood waters come into contact with a high bulkhead and are directed along the surface towards and over the top of an adjacent lower bulkhead.

The Township should continue to utilize all available resources to evaluate these conditions and identify additional protective infrastructure and capital improvement projects. Evaluation of potential projects should include periodic updates to the Township Capital Improvement Plan and a focused effort to identify additional sources of funding sources to assist with implementation. Projects for consideration should span the breadth of potential options and include but not be limited to additional beach and dune enhancements, bulkheads, seawalls, sediment removal, among others.



Objective and Strategies

Objective: Pursue protective infrastructure projects that will help to address current and future risks to public safety and long-term resilience

Strategies:

- Continue to identify and support additional protective measures including road elevations, drainage improvements, flood gates, floodwalls, levees, shoreline stabilization and erosion controls, structural protection measures and improved maintenance strategies
- Continue to support current and planned projects including beach replenishment, steel revetment installation, BTMUA water and sewer improvements, and road improvements
- Upon completion of the dune restoration, continue to monitor and protect the condition of the dune system and vegetation. Prevent private alterations to dunes and beaches that will increase erosion or reduce protective benefits.
- Consider planting additional vegetation to strengthen dunes. Provide ongoing maintenance to support the growth of appropriate vegetation and allow root systems to improve the protective capacity of the dunes.
- Implement mitigation projects identified in the Township's series of resiliency plans (FMP, OC HMP, SRPR, Getting to Resilience Recommendations Report etc) and supported by the best available data and analysis. Identify funding and pursue projects including sediment removal, levee and bulkhead construction, revetments, channelization and other measures where appropriate.
- Assess the conditions of bulkheads throughout the Township to determine potential areas of risk for future failure. Identify areas with bulkheads of low height or varying heights and assess any resulting flood risks. Address height disparities and promote higher bulkheads where appropriate.
- Develop a public funding strategy that identifies additional funding sources for protective measures. The public funding strategy should evaluate opportunities at the County, State and Federal level and should include the identification of target funding sources, project prioritization, political outreach, and grant writing.
- Update capital improvement planning to ensure that future projects are required to be constructed with storm- and flood resilient features

Objective: Restore waterways and expand flood capacity to improve protection, stormwater management and quality of life

Strategies:

- Identify waterways and areas with known sediment accumulation and related flood problems. Assess the feasibility of performing sediment and debris removal in target areas to increase flood capacity. Identify feasible practices for disposing of dredge spoils prior to undertaking any such projects.
- Explore the possibility of dredging lagoons with known sediment accumulation to improve protection for nearby properties and improve conditions for boating and recreation.

EVACUATION AND ACCESS ROAD IMPROVEMENTS

During Sandy, several neighborhoods in the Township became dangerously isolated as primary access and evacuation routes were inundated with flood water and rendered impassable. For neighborhoods with only a few access roads, the flooding of key bridges and roads creates major safety risks as residents and emergency responders are prevented from entering or evacuating the areas. One example is South Drive, which provides the only vehicular access to or from the Princeton Avenue Peninsula. South Drive sits only a few feet above sea level and during major storms and heavy rainfall portions have historically become inundated and damaged with floodwater dangerously isolating residents. "Snake" Road (made up of Mandalay Road, Pilot Drive, Holly Avenue, and Knoll Crest Avenue) is another primary access and evacuation route with historic flood concerns. Snake Road



has flooded approximately six times since 2012, preventing access or evacuation. Routes 70 and 35, two major transportation routes, suffered major damage during Superstorm Sandy further degrading emergency response efforts and safe evacuations. Mantoloking Road runs parallel to the Metedeconk River and is another major transportation route at risk for flooding. During Sandy, a breach on the Barrier Island created an inlet which inundated another primary evacuation route dangerously isolating residents. According to the Township's 2014 Getting to Resilience Recommendations Report, future hurricanes and resulting storm surge are likely to continue flooding the evacuation routes on the barrier island, including significant portions of the roadway surrounding the Mantoloking Bridge. Mainland evacuation routes would also be impacted by these hurricanes including Rt 70, Brick Boulevard, and Lakewood Road which would likely flood during Category 1, 2, and 3 storms.

The Township recognizes the importance of protecting these evacuation routes and primary thoroughfares to help ensure public safety during future hazards. The Township should update Capital Improvement plans to identify and prioritize protective road improvements. In addition, the Township should continue to explore funding opportunities and the subsequent implementation of protective measures for key transportation routes including elevations, crowning or relocation to help ensure public safety and emergency response capability during an emergency.

Objective and Strategies

Objective: Create safe and reliable transportation routes for all areas of the Township

Strategies:

- Identify improvement projects for evacuation routes that are at-risk for future flooding and damage. Update the capital improvement plan and pursue funding to prioritize the elevation of at-risk evacuation routes
- Assess appropriate measures for protecting additional flood-prone roads including elevations, hardening, crowning, relocation and bridge/culvert improvements.
- Continue to monitor the best available data regarding storm surge and future sea level rise. Incorporate these findings into capital improvement planning and mitigation projects to ensure roads are not only safe from current hazards but will also remain safe as conditions change.
- Promote public knowledge of evacuation routes and proper evacuation procedures including education programs and improved signage. Regularly report the status of all road improvements projects to the public.
- Work with FEMA to prioritize evacuation route elevations for HMGP project funds.

CRITICAL FACILITY AND OPERATIONS IMPROVEMENTS

DEDICATED EMERGENCY OPERATIONS CENTER:

During disaster events Township officials and emergency responders utilize shared space in the municipal building as a temporary Emergency Operations Center (EOC). The EOC serves as the primary command post during a hazardous event and should be designed to optimize procedures necessary to ensure public safety. During Superstorm Sandy the temporary EOC in the municipal building served a vital purpose however the space is shared with general government operations which can cause logistical and operational inefficiencies. A dedicated Township EOC should be pursued that will help to maximize public safety and emergency response capabilities in the future while also improving collaboration with county, state and federal officials during emergencies.



PERMANENT EMERGENCY SHELTER(S):

Ocean County does not have an official Red Cross shelter and instead relies upon transitional reception areas and the adaptation of other structures for impromptu sheltering. During an emergency this creates additional strain on resources and requires that critical decisions regarding safe shelter locations be made quickly and under high stress. Identifying a site to serve as a permanent shelter would improve emergency management and public safety during all future hazards. The Township should lobby the County to establish a permanent shelter to help ensure that residents know where to go during an emergency while also providing opportunities for education and training on disaster preparedness and evacuation procedures.

EQUIPMENT/MANAGEMENT NEEDS:

The addition of new and upgraded equipment for critical Township facilities is a priority. One of the most essential needs is for permanent backup power generation for several key facilities including the municipal building, temporary shelter locations, permanent shelter location(s) (if/when completed), and EOC (if/when completed). Upgraded communication equipment is also needed for Township officials including hand-held communication devices (e.g., walky-talkies) with longer battery lives and improved functionality. Improvements to the Township's phone service to allow for the filtering of calls by location and priority may also improve emergency response capability. Additional needs for emergency responders include boats (i.e., john boats), high-wheeled vehicles, and updated equipment management protocols to ensure proper use and maintenance of essential equipment.

PROTECTING CRITICAL FACILITIES FROM STORM SURGE AND SEA LEVEL RISE:

The Township's critical facilities (municipal building, police, fire, health facilities etc.) are generally located away from flood prone areas with the exception of one fire station along Midstreams Road which is located close to the floodplain. Despite relatively safe locations, future hurricanes, storm surge and sea level rise could still impact these facilities. According to the Getting to Resilience Recommendations Report, there are currently several schools and fire stations that sit within the potential inundation areas shown by the Category 2 and 3 SLOSH maps. If these areas become inundated by flooding during a future hurricane it could represent a serious risk to public health and safety. In addition, Superstorm Sandy's storm surge damaged all 26 of the Township's pump stations. Ten of these pump stations were flooded impairing the Township's ability to provide an essential service to the community. Critical facilities should be evaluated for potential damage from future storm surge and proactive steps taken to relocate and/or increase structural protection to ensure essential services are not disrupted.

Rising sea levels may also place additional properties and infrastructure in coastal areas at greater risk for future damage. As reported in the Township's Strategic Recovery Planning Report, areas near the Metedeconk River, Barnegat Bay, and Atlantic Ocean are all highly vulnerable to future sea level rise such that a relatively low 1-foot rise in sea level would place homes and infrastructure systems under water. Existing potable water intakes could also become compromised by rising sea levels and allow for salt water intrusion thus jeopardizing the Township's supply of fresh water. Sea level rise also has the potential to exacerbate risks from other hazards as it increases the frequency of floods and rate of erosion. While mitigation measures (elevations, floodproofing etc.) can be effective against current conditions, the Township's risks may still increase if sea level rise undermines the effectiveness of these improvements. As such all mitigation strategies should be designed to account for the potential of sea level rise to ensure mitigation investments are also effective against future conditions.



Objective and Strategies

Objective: Improve the resilience of critical facilities to enhance their functionality before, during and after a hazardous event

Strategies:

- Acquire and install additional backup generators for critical facilities to maintain reliable power sources and prevent disruption in essential services
- Identify opportunities to provide redundancy for key systems including evacuation routes, backup power, utilities, and communications
- Identify any municipal facilities with essential equipment or systems located below the base flood elevation. Prioritize the elevation of any electrical systems, building controls, generators among others systems above the base flood elevation to ensure continued operations of critical facilities during storm events.
- Utilize SLOSH, CVI and other available resources to identify critical facilities that may be at risk from future storm surge and sea level rise. For at-risk facilities, identify potential sites for relocation, update capital improvement planning, and relocate structures when feasible.

Objective: Provide for enhanced emergency management resources to support emergency preparedness and response

Strategies:

- Work to identify an appropriate location for the construction of a permanent Emergency Operations Center
- Conduct a survey of local emergency response and municipal departments to identify a comprehensive list of equipment and equipment management needs. Develop a priority investment plan based on the relative importance of identified needs and purchase new equipment as feasible.
- Develop an equipment management plan and policy document
- Improve materials and resources available to emergency responders and municipal officials to improve disaster management. Improvements to consider include enhanced inundation maps, electric grid maps, communication procedures, field mapping capabilities, and data management and filing systems.
- Pursue improvements to the Township's phone service to allow for the filtering of calls by location and priority during emergency events.

Objective: Improve local sheltering facilities and planning to improve public safety during and after a flood

Strategies:

- Work to identify a location for a permanent County emergency shelter
- Assist homeowners who lack essential facilities (telephone, kitchen, plumbing etc.) with improvements to allow for safe shelter in place during an emergency. Prioritize these improvements for funding through the CDBG Rehabilitation Program
- Continue to identify vulnerable populations who may require additional or priority assistance during a future disaster. Conduct additional outreach and create a list of individuals with special needs including the elderly, disabled, non-english speakers, mobility challenged, mobile home residents among others



The severity of risks to public safety and property from a flood depends not only on the amount, depth and velocity of water that accumulates, but also on the land's ability to manage this water. Proper management of stormwater and runoff typically includes a combination of natural and man-made solutions. While natural stormwater management solutions via ground infiltration, wetland retention, riparian buffers and other vegetated areas are ideal, structural drainage systems are usually necessary to provide additional management capacity. Development in the Township has exceeded the capacity, and in some cases degraded the ability, of the natural environment to effectively manage stormwater during major events. While some areas of the Township have the necessary systems in place, other areas are unable to safely manage runoff due to a combination of factors including the intensity of development, historic building practices, gaps in essential infrastructure, and impaired natural areas. Additional stormwater management improvements should be implemented that provide new systems for area's with existing deficiencies, improve the performance of existing systems and promote long-term hazard mitigation and community resilience.

STORMWATER AND DRAINAGE INFRASTRUCTURE AND MAINTENANCE:

The Township of Brick contains 8,862 storm drains, 941 outfalls, and 23 detention basins. These stormwater management systems and features vary in design and complexity throughout the Township. More recently developed areas of the Township typically include modern drainage systems capable of managing runoff effectively through storm drains, conveyance and retention areas. Some older neighborhoods however have poor or non-existent stormwater management systems that cannot control runoff or conduct proper drainage. In some of these neighborhoods, curbs, sidewalks and storm drains are absent allowing uncontrolled runoff to increase flood risk and damage. The location and design of stormwater systems are also problematic in some areas of the Township where outfalls can become submerged from rising tides and storm surge. Some catch basins have also backed up and overflowed into nearby properties during heavy precipitation and storm events. Flapper valves have been installed at numerous locations in the Township to prevent backflow of outfall pipes but have not been installed consistently throughout problem areas. Flapper valves also present challenges related to maintenance and installation compatibility with older infrastructure.

A combination of solutions should be sought for these parts of town where the stormwater system fails to control runoff causing the accumulation of flood waters and increased risks for public safety and property damage. Supplementing natural processes with modern structural solutions and best management practices can greatly reduce safety risks and environmental deterioration. Modern stormwater controls including drainage systems, flapper valves, retention areas, green infrastructure (e.g. bioswales, riparian areas etc.), and updated maintenance plans can all contribute to minimizing the negative impacts of runoff.

IMPERVIOUS SURFACES

Expanding development and paved surfaces in the Township significantly change local water resource management and increase vulnerabilities to flash flooding and urban flooding. FEMA reports that in an undisturbed natural environment, up to 90 percent of rainfall infiltrates into the ground however in most developed areas up to 90 percent of rainfall becomes stormwater runoff. This occurs as natural areas are replaced with impervious surfaces that prevent water from absorbing into the ground and creating more runoff moving more quickly. Fast moving runoff leads to more flood damage and public safety risks. In addition, as natural areas are developed, runoff is no longer slowed or filtered by vegetation and leads to accelerated streambank erosion,



sediment buildup and the pollution of waterways. Combined with reduced ground infiltration waterways struggle to maintain healthy flow levels while also building up sediment which further increases flood risk and the need for stream management including debris and sediment removal.

Portions of the Township have experienced significant development and growth in impervious surfaces which restricts the environment's ability to naturally manage and filter flood water and runoff as described above. These hazardous conditions should be reduced by strategically protecting open spaces, wetlands and other natural areas and supporting their ability to naturally manage flood water through ground infiltration, flood storage, and native vegetation that slows velocity, controls erosion and removes sediment.

Objective and Strategies

Objective: Improve stormwater management practices to reduce flood damage, improve water quality, and promote long-term hazard mitigation and community resilience

Strategies:

- Install new and innovative stormwater systems for areas with deficiencies and improve the performance of existing systems
- Identify areas which lack adequate drainage features including curbs, sidewalks, storm drains, correctly sized culverts, or other effective drainage features. Develop specific improvement projects and update the Township's capital improvement plan
- Identify outfalls which become submerged and storm drains which back up during floods. Develop specific improvement projects including installation of flapper valves, sediment and debris removal among others and update the Township's capital improvement plan
- Develop and implement improved maintenance practices and procedures for stormwater management to prevent reactionary maintenance and ensure proper functionality. Update Best Management Practices section of the Stormwater Management Plan.
- Identify opportunities for new or improved stormwater collection areas, ponds, constructed wetlands drainage easements, and debris removal in target areas to improve stormwater management

Objective: Encourage or incentivize low impact development practices for new development and as retrofits for existing development.

Strategies:

- Promote private low impact design landscape improvements that reduce runoff, manage stormwater on-site and create positive uses for the water. Practices to be encouraged include removal of impervious surfaces, installation of permeable paving, planting of vegetative buffers along waterways, constructed wetlands, rain gardens, vegetated roofs, and on-site retention areas.
- Create local incentives to encourage on-site stormwater improvements. Incentives could include height bonuses, tax reductions/abatements, streamlined permitting among others
- Reduce impervious surfaces for all Township property and promote reduction of impervious surfaces by private property owners
- Restrict the amount of impervious surface in all new developments and/or increase required open spaces

RESOURCE LIMITATIONS AND UNMET RECOVERY NEEDS



ADDRESSING REMAINING DAMAGE AND IMPACTS

Following a disaster, and before focusing on long-term resilience, it is essential to address any lingering recovery needs. As previously mentioned, the local devastation during Superstorm Sandy was immense. Despite significant investments and recovery efforts, some impacts have yet to be fully addressed. The primary issues remaining from Sandy are related to unrepaired property damage and increased vacancy. The Township's Getting to Resilience Recommendations Report indicates that Sandy was responsible for a loss of \$422 million in tax ratables which will take years to restore. In addition, the Township's Strategic Recovery Planning Report identified 202 abandoned homes as of early 2014. Some vacancies are primary residences however others are second homes which are often disqualified from accessing financial recovery resources. A strategy to address remaining damages and vacancies should focus on identifying resources (e.g., potential funding opportunities) and providing technical assistance and regulatory support to property owners struggling to recover. Economic development strategies including business recruiting, incentives, acquisition strategies among others can also contribute to finding new productive uses for vacant properties.

LIMITED RECOVERY/RESILIENCE FUNDING AND RESOURCES

Identifying and securing appropriate funding to meet the diverse recovery and resilience needs of a community is a complex challenge. While funding support becomes available from a variety of sources following a disaster including federal (e.g. FEMA, SBA, NFIP), state, and local programs, much of this funding is restricted to specific uses, timelines and other requirements. As such, nearly all communities end up with a gap between real recovery needs and available funding. Some needs, such as funding support for secondary homeowners owners or economic recovery initiatives, are often difficult to fund following a disaster. In addition, the Township wrestled with administrative and regulatory requirements of certain recovery programs resulting in rejections for reimbursement requests and resulting financial burdens.

Identifying additional funding to both fill remaining recovery gaps and to establish greater future resiliency is a key component of long-term hazard mitigation. The Township should also strive to educate local officials on the programmatic requirements, procedures and eligibility criteria of recovery programs and develop filing procedures in advance of future storms to ease the financial and administrative burdens of recovery.

Objective and Strategies

Objective: Address any remaining damage and unmet needs from Hurricane Sandy and work to restore the tax base

Strategies:

- Identify funding opportunities to support the rehabilitation of remaining damaged homes and businesses. Importance should be placed on identifying funding for secondary home owners who are often excluded from recovery resources.
- Identify additional resources to support the implementation of appropriate recovery projects
- Acquire vacant property and pursue methods to restore productive use. Vacant property outside of flood prone areas should be considered for use as a sending zone for relocating properties out of hazardous areas. Land swaps or other methods could be explored to incentive the relocation of flood prone homes.
- Provide incentives and technical assistance to help property owners struggling to rehabilitate homes.



Objective and Strategies

- Develop business recruitment and tourism marketing strategies to support economic recovery and new development in appropriate areas.

Objective: Build additional capacity in administering and complying with federal recovery programs to ease the burdens of recovery

Strategies:

- Educate local officials on the requirements, procedures and eligibility criteria of recovery resources and programs.
- Develop data management, grant reporting, and filing procedures in advance of future storms to expedite recovery and ease municipal financial and administrative burdens.

COMMUNICATION IMPROVEMENTS AND ACCESS TO EDUCATION, TRAINING AND RESOURCES

An informed and educated public is one of the greatest assets a community can have when establishing long-term hazard resilience. Informed citizens are much safer citizens as they understand the risks facing the community and the appropriate procedures to follow during an emergency. The Township of Brick recognizes the need to improve public education and to ensure residents access to latest information and resources. These resources can include informational guides (e.g., how to shelter-in-place, evacuation procedures, storm preparation manuals etc.), training (regulations, funding programs, information on known hazards), as well as maps and signs depicting evacuation routes, shelters and other community facilities. Collectively these resources will help prepare residents prior to emergencies as well as help them navigate recovery more effectively.

The Township also recognizes the need to improve access to information and communications during a hazardous event. Improved resources such as maps, data management systems among others are needed to help emergency responders and public officials safely manage community needs during an emergency. In addition, a system to constantly communicate with both full-time and seasonal residents regarding potential hazardous situations is needed.

Objective and Strategies

Objective: Enhance communication with the public and neighboring communities before, during and after emergencies.

Strategies:

- Create a series of educational materials related to hazard safety prior to future flooding. Potential topics for educational guides include evacuation routes and procedures, local shelter options, sheltering in place procedures, options for flood-proofing or protecting private property, grant programs, current projects among others. Guides should be made available in multiple locations including Town Hall, schools, police and fire stations as well as any newly created emergency operations center and shelters.
- Develop and conduct training programs and/or events to inform residents about potential hazards, impacts, evacuation procedures, mitigation/resilience projects, grant programs among other topics.
- Pursue improved communication strategies including website updates, expanded social media, smart phone utilization (apps etc.), improved evacuation signage, and reverse 9-1-1



Objective and Strategies

- Improve communications between neighboring municipalities before, during and after events. Explore opportunities to collaborate with other communities including data sharing, resource sharing, coordinated planning, special events among others.

Objective: Build capacity among local businesses to improve disaster preparedness, public safety, and reduce damage and recovery time

Strategies:

- Encourage critical businesses (grocery, gas stations, medical centers etc.) to install emergency power backup
- Assist businesses in developing post disaster recovery plans/strategies



SECTION 4: ACTION PLAN - ROAD MAP FOR RECOVERY AND RESILIENCE

The following section provides a guide for the implementation of proposed strategies and actions. Prioritization, timeframe, and lead agencies are included to assist with implementation and local decision making.

Strategy/Action	Priority	Timeframe	Lead Agencies
MANAGING DEVELOPMENT NEAR WATERWAYS AND IN LOW LYING AREAS			
Restrict new development in hazardous areas through regulatory enforcement, site plan review, property acquisition, and incentives.	High	Ongoing	Land Use Management/Planning Board
Continue to enforce minimum National Flood Insurance Program requirements	High	Ongoing	Building Department
Continue to enforce the adopted International Building Code, and all periodic updates, to require that the construction or improvement of structures utilizes modern methods for improving safety.	High	Ongoing	Building Department
Join the Community Rating System(CRS) program and implement proactive measures that will assist residents with reduced flood insurance costs	High	Short	Land Use Management/Planning Board
Create an inventory of structures located in floodplains and their elevation status	Medium	Short	Land Use Management/Planning Board
Continue to identify any remaining sites for potential acquisition. Prioritize the identification and acquisition of flood-prone properties as well as sites that may serve as flood retention areas or constructed wetlands. Identify additional funding opportunities to support any future acquisitions as current funding is limited.	High	Ongoing	Land Use Management/Planning Board
Continue to assist homeowners participating in voluntary acquisition programs with relocation within the Township.	High	Ongoing	Land Use Management/Planning Board
Continue to promote and direct future development to safer areas identified for infill and higher density mixed-use development such as the Town Center.	High	Ongoing	Land Use Management/Planning Board
Utilize SLOSH, CVI and other available data sources to identify properties and facilities at-risk for future storm surge and sea level rise. Update the Master Plan Land Use Element to encourage clustering and higher density	High	Short	Land Use Management/Planning Board



Strategy/Action	Priority	Timeframe	Lead Agencies
development in the Town Center and other appropriate growth areas. Promote the relocation of at-risk buildings to these target growth areas.			
DUNE, WETLAND AND OTHER NATURAL AREA PROTECTION			
Prohibit development or degradation of important natural areas including wetlands, forests, riparian areas among others	High	Ongoing	Land Use Management/Planning Board
Continue to identify, acquire and protect valuable natural areas	High	Ongoing	Land Use Management/Planning Board
Pursue additional funding to restore degraded wetlands in Barnegat Bay	Medium	Short	Land Use Management/Planning Board
Identify opportunities to increase the effectiveness of natural areas in mitigating hazards. Potential actions include creation or improvement of stormwater retention areas, removal of invasive species, planting of native vegetation along streambanks among others.	Medium	Short	Engineering/Land Use Management/Planning Board
Continue to pursue and incentivize open space easements, transfer of development rights and other strategies for permanent protection of sensitive areas	Medium	Ongoing	Land Use Management/Planning Board
REDUCING THREATS OF COASTAL EROSION			
Continue to carefully monitor, document and map erosion in coastal areas	Medium	Ongoing	Land Use Management/Planning Board
Prevent improper grading, dune alterations and other development practices that increase risks for residents and properties near erodible coastlines	High	Ongoing	Building Department/ Land Use Management/Planning Board
Continue to pursue coastal flood and storm surge projects that reduce the rate of erosion. Support ongoing beach replenishment and dune protection projects and identify funding and opportunities for additional measures.	High	Ongoing	Engineering
BUILDING STOCK AND TAX BASE PROTECTION			
Promote additional elevations and protective measures for homes and structures in vulnerable areas. Encourage elevations of structures that exceed NFIP minimum requirements and implementation of wet or dry flood proofing. Consider utilization of incentives to encourage these	High	Long	Land Use Management/Planning Board



Strategy/Action	Priority	Timeframe	Lead Agencies
additional protective measures including potential height bonuses, tax abatements, streamlined permitting among others.			
Encourage private investments in the elevation of utility and building control systems to ensure essential services are available during an emergency.	High	Short	Land Use Management/Planning Board
Continue to identify potential voluntary elevation candidates and funding opportunities. Consider a second survey or other outreach that pays particular attention to identifying second-home owners who are otherwise ineligible for traditional assistance programs.	High	Short	Land Use Management/Planning Board
Continuously monitor the use of spaces below elevated first floors to verify it remains as storage or garage use only.	High	Ongoing	Code Enforcement
Continue to explore options to prevent or mitigate negative impacts of elevations on neighboring properties. Development of design guidelines or other regulatory controls could be considered.	Low	Ongoing	Land Use Management/Planning Board
Continue to enforce the adopted International Building Code, and all periodic updates, to require that the construction or improvement of structures utilizes modern methods for improving safety.	High	Ongoing	Building Department
Proactively inspect all structures being re-built after a disaster to ensure compliance with building codes and other regulations.	Medium	Ongoing	Building Department
Consider the creation of a resiliency officer or position who would conduct a mitigation-focused evaluation during the review of site and development plans and building permits.	Low	Short	Land Use Management/Planning Board
Assist homeowners with deficient facilities (telephone, kitchen, plumbing) in making improvements to allow for safe shelter in place during an emergency. Provide technical assistance, guidance and support for identifying potential funding sources.	Medium	Short	Building Department
Prevent mobile home siting or parking in areas subject to hazardous conditions	High	Ongoing	Land Use Management/Planning Board
Ensure mobile home residents are informed of potential hazardous risks and appropriate evacuation procedures	Medium	Ongoing	Land Use Management/Planning Board

PROTECTIVE INFRASTRUCTURE AND CAPITAL INVESTMENTS



Strategy/Action	Priority	Timeframe	Lead Agencies
Continue to identify and support additional protective measures including road elevations, drainage improvements, flood gates, floodwalls, levees, shoreline stabilization and erosion control, structural protection measures and improved maintenance strategies	Medium	Long	Engineering
Continue to support current and planned projects including beach replenishment, steel revetment installation, BTMUA water and sewer improvements, and road improvements	High	Short	Engineering
Upon completion of dune restoration, continue to monitor and protect the condition of the dune system and dune vegetation. Prevent private alterations to dunes and beaches that will increase erosion or reduce protective benefits.	High	Ongoing	Engineering/Land Use Management/Planning Board
Consider planting additional dune vegetation to strengthen dunes. Provide ongoing maintenance to support the growth of appropriate vegetation and allow root systems to improve the protective capacity of the dunes.	High	Short	Engineering/Land Use Management/Planning Board
Implement mitigation projects identified in the Township's series of resiliency plans and supported by the best available data and analysis. Identify funding and pursue projects including sediment removal, levee and bulkhead construction, revetments, channelization and other measures where appropriate.	Varied	Varied	Engineering/Land Use Management/Planning Board
Assess the conditions of bulkheads throughout the Township to determine potential areas of risk for future failure. Identify areas with bulkheads of low height or varying heights and assess any resulting flood risks. Address height disparities and promote higher bulkheads where appropriate.	Medium	Long	Engineering
Develop a public funding strategy that identifies additional funding sources for protective measures. The public funding strategy should evaluate opportunities at the County, State and Federal level and should include the identification of target funding sources, project prioritization, political outreach, and grant writing.	Low	Short	Land Use Management/Planning Board
Update capital improvement planning to ensure that future projects are required to be constructed with storm- and flood resilient features	High	Short	Land Use Management/Planning Board/Engineering



Strategy/Action	Priority	Timeframe	Lead Agencies
Identify waterways and areas with known sediment accumulation and related flood problems. Assess the feasibility of performing sediment and debris removal in target areas to increase flood capacity. Identify feasible practices for disposing of dredge spoils prior to undertaking any such projects.	High	Short	Land Use Management/Planning Board/Engineering
Explore the possibility of dredging lagoons with known sediment accumulation to improve protection for nearby properties and improve conditions for boating and recreation.	High	Short	Land Use Management/Planning Board/Engineering
EVACUATION AND ACCESS ROAD IMPROVEMENTS			
Identify improvement projects for evacuation routes at-risk for future flooding and damage. Update capital improvement plan and pursue funding to prioritize the elevation of evacuation routes	High	Short	Engineering
Assess appropriate measures for protecting additional roads including elevations, hardening, crowning, relocation and bridge improvements.	Medium	Long	Engineering
Continue to monitor the best available data regarding storm surge and future sea level rise. Incorporate these findings into capital improvement planning and mitigation projects to ensure roads are not only safe from current hazards but will also remain safe as conditions change.	Medium	Ongoing	Land Use Management/Planning Board/Engineering
Promote public knowledge of evacuation routes and proper evacuation procedures including education programs and improved signage. Regularly report the status of all road improvements projects to the public.	High	Short	Public Safety
Work with FEMA to prioritize the elevation of evacuation routes for limited HMGP project funds.	High	Short	Planning Board
CRITICAL FACILITY AND OPERATIONS IMPROVEMENTS			
Acquire and install additional backup generators for critical facilities to maintain reliable power sources and prevent disruption in essential services	High	Short	Public Works/Planning Board
Identify opportunities to provide redundancy for key systems including evacuation routes, backup power, utilities, and communications	Medium	Short	Land Use Management/Planning Board/Engineering



Strategy/Action	Priority	Timeframe	Lead Agencies
Identify any municipal facilities with essential equipment or systems located below the base flood elevation. Prioritize the elevation of any electrical systems, building controls, generators among others systems above the base flood elevation to ensure continued operations of critical facilities during storm events.	High	Short	Land Use Management/Planning Board/Engineering/Public Works
Utilize SLOSH, CVI and other available resources to identify critical facilities that may be at risk from future storm surge and sea level rise. For at-risk facilities, identify potential sites for relocation, update capital improvement planning, and relocate structures when feasible.	Medium	Long	Land Use Management/Planning Board
Work to identify an appropriate location for the construction of a permanent Emergency Operations Center	Medium	Long	Public Safety/Land Use Management/Planning Board
Conduct a survey of local emergency response and municipal departments to identify a comprehensive list of equipment and equipment management needs. Develop a priority investment plan based on the relative importance of identified needs and purchase new equipment as feasible.	High	Short	Public Safety
Develop an equipment management plan and policy document	High	Short	Planning Board/Public Safety
Improve materials and resources available to emergency responders and municipal officials to improve disaster management. Improvements to consider include enhanced inundation maps, electric grid maps, communication procedures, field mapping capabilities, and data management and filing systems.	Medium	Short	Planning Board/Public Safety
Pursue improvements to the Township's phone service to allow for the filtering of calls by location and priority during emergency events.	High	Short	Planning Board/Public Safety
Work to identify a location for a permanent County emergency shelter	Medium	Long	Planning Board/Public Safety /American Red Cross/Ocean County OEM
Assist homeowners with deficient facilities (telephone, kitchen, plumbing) in making improvements to allow for safe shelter in place during an emergency. Prioritize these improvements for funding through the CDBG Rehabilitation Program	Medium	Short	Building Department



Strategy/Action	Priority	Timeframe	Lead Agencies
Continue to identify vulnerable populations who may require additional or priority assistance during a future disaster. Conduct additional outreach and create a list of individuals with special needs including the elderly, disabled, non-english speakers, mobility challenged, mobile home residents among others	Medium	Short	Public Safety
STORMWATER MANAGEMENT			
Install new and innovative stormwater systems for areas with deficiencies and improve the performance of existing systems	High	Ongoing	Engineering/Land Use Management/Planning Board
Identify areas which lack adequate drainage features including curbs, sidewalks, storm drains, properly sized culverts, among others. Develop specific improvement projects and update the Township's capital improvement plan	High	Long	Engineering/Public Works/Land Use Management/Planning Board
Identify outfalls which become submerged and storm drains which back up during floods. Develop specific improvement projects including installation of flapper valves, sediment and debris removal among others and update the Township's capital improvement plan	High	Short	Engineering
Develop and implement improved maintenance practices and procedures for stormwater management to prevent reactionary maintenance and ensure proper functionality. Update Best Management Practices section of the Stormwater Management Plan.	High	Ongoing	Engineering/Public Works/Land Use Management/Planning Board
Identify opportunities for new or improved stormwater collection areas, ponds, constructed wetlands drainage easements, and debris removal in target areas to improve stormwater management	High	Short	Engineering/Public Works/Land Use Management/Planning Board
Promote private low impact design landscape improvements that reduce runoff, manage stormwater on-site and create positive uses for the water. Practices to be encouraged include removal of impervious surfaces, installation of permeable paving, planting of vegetative buffers along waterways, constructed wetlands, rain gardens, vegetated roofs, and on-site retention areas.	Medium	Short	Land Use Management/Planning Board/Engineering
Create local incentives to encourage on-site stormwater improvements. Incentives could include height bonuses, tax reductions/abatements, streamlined permitting among others	Medium	Short	Land Use Management/Planning Board



Strategy/Action	Priority	Timeframe	Lead Agencies
Reduce impervious surfaces for all Township property and promote reduction of impervious surfaces by private property owners	High	Short	Land Use Management/Planning Board/Engineering
Restrict the amount of impervious surface in all new developments and/or increase required open spaces	Medium	Ongoing	Land Use Management/Planning Board
RESOURCE LIMITATIONS AND UNMET RECOVERY NEEDS			
Identify funding opportunities to support the rehabilitation of remaining damaged homes and businesses. Importance should be placed on identifying funding for secondary home owners who are often excluded from recovery resources.	Medium	Short	Land Use Management/Planning Board
Identify additional resources to support the implementation of appropriate recovery projects	Medium	Short	Land Use Management/Planning Board
Acquire vacant property and pursue methods to restore productive use. Vacant property outside of flood prone areas should be considered for use as a sending zone for relocating properties out of hazardous areas. Land swaps or other methods could be explored to incentive the relocation of flood prone homes.	Medium	Long	Land Use Management/Planning Board
Provide incentives and technical assistance to help property owners struggling to rehabilitate homes.	Medium	Short	Land Use Management/Planning Board
Develop business recruitment and tourism marketing strategies to support economic recovery and new development in appropriate areas.	Low	Short	Land Use Management/Planning Board
Educate local officials on requirements, procedures and eligibility criteria of recovery resources and programs.	High	Short	Planning Board
Develop data management, grant reporting, and filing procedures in advance of future storms to expedite recovery and ease municipal financial and administrative burdens.	High	Short	Administration, Finance & Public Affairs
COMMUNICATION IMPROVEMENTS AND ACCESS TO EDUCATION, TRAINING AND RESOURCES			
Create a series of educational materials related to hazard safety and procedures prior to future flooding. Potential topics for educational guides include evacuation routes and procedures, local shelter options, sheltering in place procedures, options for floodproofing or protecting	Medium	Short	Planning Board



Strategy/Action	Priority	Timeframe	Lead Agencies
private property, grant programs, current projects among others. Guides should be made available in multiple locations including Town Hall, schools, police and fire stations as well as any newly created emergency operations center and shelters.			
Develop and conduct training programs and/or events to inform residents about potential hazards, impacts, evacuation procedures, mitigation/resilience projects, grant programs among other topics.	High	Short	Public Safety
Investigate options for improved communication methods including website updates, expanded social media, smart phone utilization (apps etc.), improved evacuation signage, reverse 9-1-1, and website improvements	Medium	Short	Public Safety/Administration, Finance & Public Affairs
Improve communications between neighboring municipalities before, during and after events. Explore opportunities to collaborate with other communities including data sharing, resource sharing, coordinated planning, special events among others.	Medium	Ongoing	Public Safety/Planning Board/ Administration, Finance & Public Affairs
Encourage critical businesses (grocery, gas stations, medical centers etc.) to install emergency power backup	Low	Short	Planning Board
Assist businesses in developing post disaster recovery plans/strategies	Low	Short	Planning Board

Notes:

Timeframe

Short 1-5 years

Long 5 years or greater

Ongoing



APPENDIX 1 - ACRONYMS

ACS	American Community Survey
BFE	Base Flood Elevation
BTMUA	Brick Township Municipal Utilities Authority
CAFRA	Coastal Areas Facility Review Act
CDBG	Community Development Block Grant
CDBG-DR	Community Development Block Grant – Disaster Recovery
CRS	Community Rating System
CVI	Coastal Vulnerability Index
EMS	Emergency Medical Services
EOC	Emergency Operation Center
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMP	Flood Management Plan
HMP	Hazard Mitigation Plan
HMPE	Hazard Mitigation Plan Element
LiMWA	Limit of Moderate Wave Action
NA or N/A	Not Available/Not Applicable
NFIP	National Flood Insurance Program



NJ	New Jersey
NJBPN	New Jersey Beach Profile Network
NOAA	National Oceanic and Atmospheric Administration
OC	Ocean County
OC HMP	Ocean County Hazard Mitigation Plan
SFHA	Special Flood Hazard Area
SLOSH	Sea, Lake and Overland Surge from Hurricanes
TETRA TECH	Tetra Tech, Inc.
USACE	U.S. Army Corps of Engineers



APPENDIX 2 - DEFINITIONS

This resource defines terms that are used in or support the HMPE.

100-year flood – A flood that has a 1-percent chance of being equaled or exceeded in any given year. This flood event is also referred to as the base flood. The term "100-year flood" can be misleading; it is not the flood that will occur once every 100 years. Rather, it is the flood elevation that has a 1- percent chance of being equaled or exceeded each year. Therefore, the 100-year flood could occur more than once in a relatively short period of time. The 100-year flood, which is the standard used by most federal and state agencies, is used by the National Flood Insurance Program (NFIP) as the standard for floodplain management to determine the need for flood insurance.

500-year flood – A flood that has a 0.2-percent chance of being equaled or exceeded in any one year.

Asset – Any man-made or natural feature that has value, including but not limited to people, buildings, infrastructure (such as bridges, roads, and sewer and water systems), and lifelines (such as electricity and communication resources or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks).

Base Flood – Flood that has a 1-percent probability of being equaled or exceeded in any given year. It is also known as the 100-year flood.

Base Flood Elevation (BFE) – Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The BFE is used as the standard for the National Flood Insurance Program.

Building – A structure that is walled and roofed, principally aboveground and permanently fixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Building Codes – Regulations that set forth standards and requirements for construction, maintenance, operation, occupancy, use, or appearance of buildings, premises, and dwelling units. Building codes can include standards for structures to withstand natural disasters.

Community Rating System (CRS) – CRS is a program that provides incentives for National Flood Insurance Program communities to complete activities that reduce flood hazard risk. When the community completes specific activities, the insurance premiums of these policyholders in communities are reduced.

Critical Facility – Facilities that are critical to the health and welfare of the population and that are especially important following a hazard.

Debris – The scattered remains of assets broken or destroyed during the occurrence of a hazard. Debris caused by a wind or water hazard event can cause additional damage to other assets.



Duration – The length of time a hazard occurs.

Essential Facility – A facility that is important to ensure a full recovery of a community or state following

Exposure – The number and dollar value of assets that are considered to be at risk during the occurrence of a specific hazard.

Extent – The size of an area affected by a hazard or the occurrence of a hazard.

Flood Elevation – Height of the water surface above an established datum (for example, the National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or mean sea level).

Flood Hazard Area – Area shown to be inundated by a flood of a given magnitude on a map.

Flood Insurance Rate Map (FIRM) – Map of a community, prepared by the FEMA that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Floodplain – Any land area, including a watercourse, susceptible to partial or complete inundation by water from any source.

Frequency – A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1-percent chance of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Goals – General guidelines that explain what you want to achieve. They are usually broad policy-type statements, long term in nature, and represent global visions.

Geographic Information Systems (GIS) – A computer software application that relates data regarding physical and other features on the earth to a database to be used for mapping and analysis.

Hazard – A source of potential danger or an adverse condition that can cause harm to people or cause property damage. For this risk assessment, priority hazards were identified and selected for the pilot project effort. A natural hazard is a hazard that occurs naturally (such as flood, wind, and earthquake). A man-made hazard is one that is caused by humans (for example, a terrorist act or a hazardous material spill). Hazards are of concern if they have the potential to harm people or property.

Hazard Mitigation – Sustained actions taken to reduce or eliminate the long-term risk and effects that can result from the occurrence of a specific hazard. For example, building a retaining wall can protect an area from flooding.

Hazard Mitigation Plan – A collaborative document in which hazards affecting the community are identified, vulnerability to hazards assessed, and consensus reached on how to minimize or eliminate the effects of these hazards.



Hazard Profile – A description of the physical characteristics of a hazard, including a determination of various descriptors including magnitude, duration, frequency, probability, and extent.

Infrastructure – The public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, transportation system (such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry docks, piers and regional dams).

Intensity – A measure of the effects of a hazard occurring at a particular place.

Magnitude – A measure of the strength of a hazard occurrence. The magnitude (also referred to as severity) of a given hazard occurrence is usually determined using technical measures specific to the hazard. For example, ranges of wind speeds are used to categorize tornados.

Mitigation Plan – A plan that documents the process used for a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in a state or community. The plan includes a description of actions to minimize future vulnerability to hazards. This plan should be developed with local experts and significant community involvement.

National Flood Insurance Program (NFIP) – Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 Code of Federal Regulations (CFR) §60.3.

Objectives – Objectives define strategies or implementation steps to attain the identified goals. Unlike goals, objectives are specific and measurable.

Ordinance – A term for a law or regulation adopted by local government.

Outflow – Associated with coastal hazards and follows water inundation creating strong currents that rip at structures and pound them with debris, and erode beaches and coastal structures.

Planning – The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Preparedness – Actions that strengthen the capability of government, citizens, and communities to respond to disasters.

Probability – A statistical measure of the likelihood that a hazard event will occur.

Public Education and Outreach Programs – Any campaign to make the public more aware of hazard mitigation and mitigation programs, including hazard information centers, mailings, public meetings, etc.

Recovery – The actions taken by an individual or community after a catastrophic event to restore order and lifelines in the community.



Regulation – Most states have granted local jurisdictions broad regulatory powers to enable the enactment and enforcement of ordinances that deal with public health, safety, and welfare. These include building codes, building inspections, zoning, floodplain and subdivision ordinances, and growth management initiatives.

Repetitive Loss Property – A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least \$1,000 each have been paid within any 10-year period since 1978.

Replacement Value – The cost of rebuilding a structure. This cost is usually expressed in terms of cost per square foot and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

Resources – Resources include the people, materials, technologies, money, etc., required to implement strategies or processes. The costs of these resources are often included in a budget.

Risk – The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard occurring and resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to occurrence of a specific type of hazard. Risk also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine – Of or produced by a river (for example, a riverine flood is one that is caused by a river overflowing its banks).

Scale – A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scour – Removal of soil or fill material by the flow of floodwaters. This term is frequently used to describe storm-induced, localized, conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Special Flood Hazard Area (SFHA) – An area within a floodplain having a 1-percent or greater chance of flood occurrence in any given year (that is, the 100-year or base flood zone); represented on FIRMS as darkly shaded areas with zone designations that include the letter "A" or "V."

Stakeholder – Stakeholders are individuals or groups, including businesses, private organizations, and citizens, that will be affected in any way by an action or policy.

Structure – Something constructed (for example, a residential or commercial building).

Transportation Systems – One of the lifeline system categories. This category includes: airways (airports, heliports, highways), bridges, tunnels, roadbeds, overpasses, transfer centers; railways (tracks, tunnels, bridges, rail yards, depots), and waterways (canals, locks, seaports, ferries, harbors, dry docks, piers).



Utility Systems – One of the lifeline systems categories. This category includes potable water, wastewater, oil, natural gas, electric power facilities and communication systems.

Vulnerability – Description of how exposed or susceptible an asset is to damage. This value depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power. If an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect affects can be much more widespread and damaging than direct affects.

Watershed – Area of land that drains down gradient (from areas of higher land to areas of lower land) to the lowest point; a common drainage basin. The water moves through a network of drainage pathways, both underground and on the surface. Generally, these pathways converge into streams and rivers, which become progressively larger as the water moves downstream, eventually reaching an estuary, lake, or ocean.

Zone – A geographical area shown on a National FIRM that reflects the severity or type of flooding in the area.

Zoning Ordinance – Designation of allowable land use and intensities for a local jurisdiction. Zoning ordinances consist of two components: a zoning text and a zoning map.