



Floodplain Management Plan

Borough of Keansburg
Monmouth County, New Jersey

Floodplain Management Plan **DRAFT**

September 8, 2015

Prepared for:

Borough of Keansburg
Monmouth County, New Jersey

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*The original of this document was signed
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Executive Summary

This plan is intended to identify and assess flood hazards within the Borough of Keansburg, establish goals and objectives for floodplain management, and to present a series of actions designed to minimize flooding and mitigate the impacts from flooding in the future. This Floodplain Management Plan was funded using Phase II- Post Sandy Planning Assistance Grant Funding from the New Jersey Department of Community Affairs and will be incorporated as an element of the Borough's Master Plan.

This plan has been organized according to the guidelines of the 2013 National Flood Insurance Program Community Rating System Coordinator's Manual to receive credit points in the FEMA Community Rating System Program and follows the 10-step planning process outlined in the manual. The planning process was conducted through a committee consisting of public members as well as Borough employees and officials. The committee met frequently throughout the planning process to discuss each step of the plan and provide input on suggested activities and actions.

To assess the problems and flood hazards impacting the Borough of Keansburg, a review was done of all relevant planning studies, documents, and relevant zoning ordinances. Outside stakeholder agencies were contacted to see if they had any input on the planning process. Historical flooding events, repetitive loss properties and known flood hazards were reviewed to determine problem areas within the Borough. Much of this work was completed utilizing the Borough's newly created Geographic Information Systems (GIS) program.

Possible activities to mitigate the impacts of flooding in the community were discussed. The committee determined a list of goals for the Keansburg Floodplain Management Plan and determined a prioritized list of action items from the list of possible activities, using the goals as guidance. Monmouth County's recently updated Hazard Mitigation Plan was also used as a reference when determining proposed activities.

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I. INTRODUCTION

PURPOSE AND SCOPE

This plan has been prepared as the Borough of Keansburg's Floodplain Management Plan (FMP) and will be incorporated as an element of the Borough's Master Plan and reviewed and adopted by the Borough's governing body. The FMP identifies and assesses flood hazards within the Borough, establishes the goals and objectives for floodplain management in Keansburg, and presents a series of actions designed to minimize flooding and mitigate the impacts from flooding in the future. The FMP evaluates the need and potential options for wetland restoration and maintenance and/or other engineering control measures to mitigate potential storm surge in those areas of the Borough that may be vulnerable. The FMP also includes recommendations for the Borough's current Floodplain Development Protection Ordinance. The Floodplain Management Plan is designed to receive points under FEMA's Community Rating System Program.

FLOODPLAIN MANAGEMENT PLANNING

Floodplain management is defined by FEMA as the operation of a community program of preventive and corrective measures to reduce the risk of current and future flooding, resulting in a more resilient community. While FEMA has minimum floodplain management standards for communities participating in the National Flood Insurance Program (NFIP), adopting higher standards will lead to safer, stronger, more resilient communities.

COMMUNITY RATING SYSTEM

The Community Rating System (CRS) is a voluntary incentive program of the National Flood Insurance Program (NFIP) that provides participating communities with discounted flood insurance premium rates for undertaking community floodplain management activities that exceed the minimum NFIP requirements. Flood insurance premium rates are discounted in increments of 5%, reflecting the reduced flood risk resulting from community actions in four categories: public information, mapping and regulations, flood damage reduction, and flood preparedness. The three goals of the Community Rating System Program are:

1. Reduce flood damage to insurable property;
2. Strengthen and support the insurance aspects of the NFIP; and
3. Encourage a comprehensive approach to floodplain management.

ORGANIZATION OF THE PLAN

This plan has been organized according to the guidelines of the 2013 National Flood Insurance Program Community Rating System Coordinator's Manual to maximize the amount of points available for credit in the Community Rating System Program. This Floodplain Management Plan follows the 10- step planning process outlined in the manual:

- Step 1: Organize
- Step 2: Involve the public
- Step 3: Coordinate
- Step 4: Assess the hazard
- Step 5: Assess the problem
- Step 6: Set goals
- Step 7: Review possible activities
- Step 8: Draft an action plan
- Step 9: Adopt the plan
- Step 10: Implement, evaluate, revise



II. BOROUGH OF KEANSBURG PROFILE

The Borough of Keansburg is located in northern Monmouth County along the Raritan Bay. It is bordered to the north by beachfront and the Raritan Bay, to the west by Waackaack Creek and Hazlet Township, to the east by Middletown Township, and to the south by Route 36 and Hazlet Township.

Keansburg is a developed community that's close proximity to New York City and location along major transportation routes made it a popular resort destination in the 19th and early 20th century.

Today, the predominant land use in Keansburg is residential, consisting of mostly single family homes. Commercial activity in Keansburg is centered around the downtown area along Main and Church Streets

and the waterfront amusement and restaurant district at the end of Carr Avenue. The main commercial attraction within the Borough is the amusement and water park along the waterfront near Point Comfort. In 2005, the entire Borough was designated as an area in need of rehabilitation.

Keansburg is approximately 1 square mile of land, of which approximately 98% is located within a flood hazard zone. Of Keansburg's total land area, 0.7 square miles drain into the Raritan Bay and the remaining 0.3 square miles discharge directly into Waackaack Creek. The 22 acres of the Borough bordering the waterfront are classified as a critical environmental site. Additionally, the entire Borough is located within the Coastal Area Facility Review Act (CAFRA) zone. Keansburg is a low-lying Bayshore community and is subject to flooding from surface runoff, tidal events, nor'easters, hurricanes and tropical storms. Flooding is also affected by tidal action in the Raritan Bay, severe coastal erosion experienced throughout the Borough, and nuisance flooding due to rain during a high tide event.

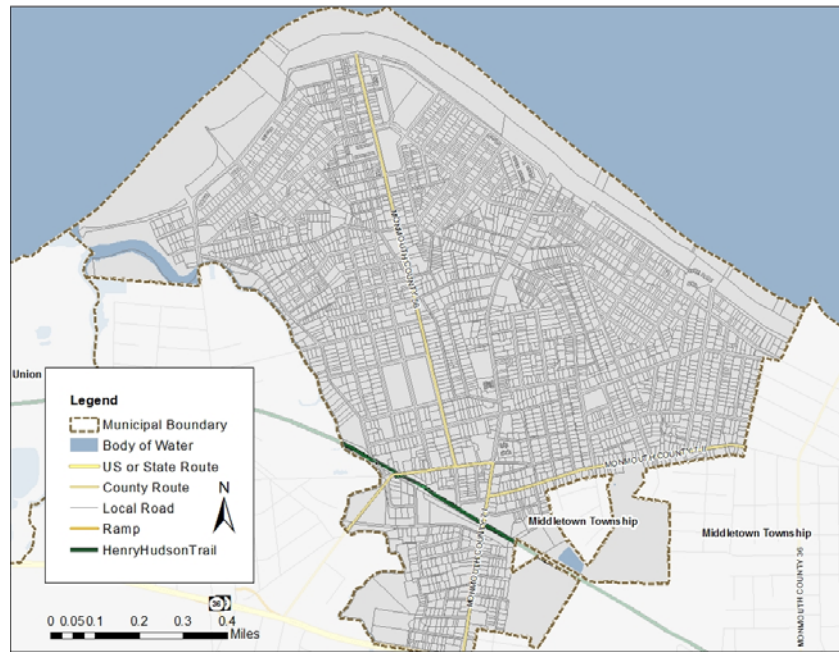


Figure 1. Borough Map

The Borough of Keansburg has a moderate climate with hot, humid summers and cold winters. The Borough is located in the Coastal Climate Zone, one of New Jersey's five zones (Office of the New Jersey State Climatologist, Rutgers University). In the coastal zone, seasonal temperature fluctuations are less prone to extremes due to the high heat capacity of the Atlantic Ocean. During the fall months, temperatures in Keansburg will remain slightly warmer than inland due to the warm ocean water nearby. Similarly, during the spring and early summer months, temperatures will often be cooler than further inland.

POPULATION TRENDS

The 2015 Keansburg Master Plan Reexamination Report found that the overall density and distribution of the population and land use patterns within the Borough of Keansburg had not changed substantially since the last reexamination report in 2012. The total population of the Borough as of the US Census in 2010 was 10,105, and decreased to 10,097 in 2012 (according to the 2012 American Community Survey estimates). These estimates do not take into consideration changes in population as a result of Hurricane Sandy.

III. PROJECT ORGANIZATION & PUBLIC MEETINGS

T & M Associates assisted the Borough of Keansburg in preparing this Floodplain Management Plan, as the appointed Borough Planner and Borough Engineer. The planning process was conducted under the supervision of Stanley Slachetka, P.P., A.I.C.P., the Borough Planner.

The planning process was conducted through a Floodplain Management Plan Steering Committee consisting of both Borough staff and representatives of the public. The Committee was formed by Borough Council Resolution #15-042A on March 25, 2015 and met on weekly basis from July 30th, 2015 to August 27th, 2015 to discuss the existing hazards and problems related to flooding in the Borough, review potential goals and hazard mitigation activities, prepare an action plan, and make recommendations to revise existing Borough Ordinances. The resolution forming the Floodplain Management Plan Steering Committee can be found in Appendix A and outlines of all steering committee meetings are located in Appendix B. The following are the members of the Floodplain Management Plan Steering Committee:

- Public Officials:
 - Mayor Thoms Foley
 - Thomas Cusick, Borough Clerk/ Housing and Community Development
 - Ed Striedl, Construction Official, Floodplain Manager, Zoning, Code Enforcement
 - Chief James Pigott, Police/ OEM
 - James Falco, Department of Public Works
 - Francis Mullan, T&M Associates/ Engineering
- Members of the Public:
 - Arthur Boden, Resident
 - Chief Raymond O'Hare, Resident
 - Ginger Rogan, Resident
 - Dennis O' Keefe, Resident

In addition to the Steering Committee meetings, a separate public information meeting was held during the initial stages of planning on August 10, 2015. This meeting was publicly advertised via postings in Borough Hall and on the Borough website and was open to all members of the public. The public was informed of the proposed Floodplain Management Plan and was given the opportunity to provide input and recommendations.

A second open public meeting was held on September 14, 2015. The draft Floodplain Management Plan was made available on the Borough website and the public was encouraged to provide input on the recommended plan.

Additional information on these meetings can be found in Appendix C.

IV. COORDINATION

EXISTING DOCUMENTS

It is important to coordinate floodplain management goals with other planning and community development goals in the Borough of Keansburg. As part of the planning process, the following documents were reviewed:

- 1982 Monmouth County Growth Management Plan
- 1988 Master Plan
- 2003 Master Plan Reexamination Report
- 2005 Beachway Avenue Waterfront Redevelopment Plan
- 2006 Main Street Node, Carr and Raritan Avenues, Route 36 Gateway Redevelopment Plan
- 2012 Stormwater Master Plan and Capital Improvement Recommendations
- 2012 Master Plan Reexamination Report
- 2013 Monmouth County Master Plan
- 2014 Monmouth County Multi-Jurisdictional Natural Hazard Mitigation Draft Plan
- Borough of Keansburg Emergency Management Guide
- 2014 Borough of Keansburg Strategic Recovery Planning Report

Information from the following documents was identified as important to the floodplain management planning process:

1988 Master Plan

The following objectives of the 1988 Master Plan, as endorsed by the 2012 and 2003 Reexamination Reports, support floodplain management planning within the Borough of Keansburg.

- Secure the public's safety from fire, flood, panic, and other natural and man-made disasters with particular emphasis on preserving and maintaining the integrity and protective features of the Borough beach-dune system
- Encourage the most appropriate use of land consistent with its suitability for development
- Provide sufficient space in appropriate locations for residential, recreational, commercial, and open space use
- Protect wetlands and areas with scenic, cultural and recreational values
- Guide waterfront development to maintain visual and pedestrian access to the Bayshore for the general public while encouraging development that is suitably

scaled, compatible with public facilities and services, and appropriate to a waterfront location

2005 Beachway Avenue Waterfront Redevelopment Plan

The following objectives of the Beachway Avenue Waterfront Redevelopment Plan are relevant to this floodplain management plan:

- Establish the Keansburg waterfront as a destination point for the region;
- Enhance public access to waterfront recreation uses;
- Maintain views of the coastline and enjoyment for the public;
- Address existing and future traffic, environmental, and flooding issues that could result from redevelopment
- Undertake infrastructure improvements involving water and sewer lines, streets, curbs, sidewalks, and parking

2006 Main Street Node, Carr and Raritan Avenues, Route 36 Gateway Redevelopment Plan

The following objectives of the Main Street Node, Carr and Raritan Avenues, Route 36 Gateway Waterfront Redevelopment Plan are relevant to this floodplain management plan:

- Establish the Keansburg waterfront as a destination point for the region;
- Enhance public access to waterfront recreation uses;
- Maintain views of the coastline and enjoyment for the public;
- Develop land use and building requirements specific to the redevelopment parcels that are sensitive to the adjoining neighborhoods;
- Address existing and future traffic, environmental, and flooding issues that could result from redevelopment;
- Undertake infrastructure improvements involving water and sewer lines, streets, curbs, sidewalks, and parking

2012 Stormwater Master Plan and Capital Improvement Recommendations

The purpose of the Borough Stormwater Master Plan is to provide the Borough with a multi-year, multi-phase drainage capital improvement program and budget to improve the overall Borough stormwater collection system.

The Plan also outlines the construction of two stormwater pump stations and construction contracts for six bayfront outfalls. Furthermore, this Plan recommends a drainage improvement program in order for the new pump stations and outfalls to have a significant impact on flooding within the Borough. Recommendations include

improvements at Raritan Avenue, Beacon Light Avenue, Beachway Avenue, Twilight Avenue, and Carr Avenue at the Fishing Pier Outfall.

2014 Strategic Recovery Planning Report

The Strategic Recovery Planning Report was adopted in 2014 to serve as a blueprint to guide the recovery of the Borough of Keansburg from the effects of Hurricane Sandy and to reduce vulnerabilities to future storms. Community vulnerabilities exacerbated by Sandy were identified as:

- The loss of fuel exposed residents to the dangers of cold fall nights;
- The loss of power and cell phone service impacted the communication between emergency personnel;
- Breaches and gaps in the Borough's dune system allowed stormwater to reach the community;
- Residences and businesses located in low-lying areas close to Raritan Bay and the Waackaack Creek were especially vulnerable to flooding;
- Regular moon tide inundation has increased as a result of stream siltation from Hurricane Sandy;
- Damages to roads and flooding throughout the Borough hindered the capacity of emergency response vehicles;
- Many local businesses (mainly centralized on Carr Avenue, but also on Main Street and Church Street), were unable to recover and left empty store frontage throughout the Borough's commercial centers;

Keansburg also identified the following opportunities as created by Sandy:

- Promoting public awareness of hazard mitigation and resiliency issues;
- Focusing public agencies on community vulnerabilities to hazards such as flooding;
- Encouraging regional solutions to flood- and storm-related impacts;
- Ensuring that future capital projects are designed and constructed to incorporate features that are resilient to storm- and flood-related impacts; and
- Encouraging/supporting the use of sustainable development techniques and green building design in future development and redevelopment.

Monmouth County Multi-Jurisdictional Natural Hazard Mitigation Plan

The Monmouth County Multi-Jurisdictional Natural Hazard Mitigation Plan (HMP) identifies natural hazards that could affect the County's jurisdictions, evaluates the risks

associated with these hazards, identifies the mitigation actions to lessen the impacts of a disaster on Monmouth County communities, and prioritizes them based on the municipal master plans and other planning documents. Monmouth County employed a multi-jurisdictional approach to develop the plan, and every municipality in the County was invited to participate as an equal partner with the County.

As part of its participation in the HMP outreach process, the Borough of Keansburg has identified that in the aftermath of Hurricane Sandy, the Borough is concerned with the following recovery actions:

1. Hazard Zoning Ordinances: Develop and enact hazard zoning ordinances to better protect the Borough from natural disasters.
2. Develop a plan in which variances are specifically allowed on foundations of newly built structures.
3. Develop mitigation steps to reduce damage and losses due to flooding, through the control of stormwater flow and a more efficient drainage system.
4. Outreach Program: Improve the currently implemented outreach program to help residents prepare for disasters and to stay informed on potential low-cost, small-scale mitigation activities.
5. Emergency Backup Power: Develop a plan and seek funding for emergency backup electricity in critical care facilities.
6. Stormwater Pump Stations: Install three new flood-proofed stormwater pump stations in the Borough with a permanent backup power generator at each and to flood proof two existing pump stations and install a backup generator at each station. This should also include removing and replacing the existing deteriorated stormwater collections infrastructure.
7. Police Department Relocation: Relocate the police headquarters and emergency operation center from 179 Carr Avenue to a vacant property located at a more advantageous location, 331 Carr Avenue, in the Borough.
8. Flood Proofing: Extend the bulkhead for the entire length of Waackaack Creek as well as expand on the previously completed extents of dredging of the creek to increase its stormwater storage capacity.
9. Improved Shoreline and Dunes: Improve 2.6 miles of beach that is 200 feet wide that was substantially damaged due to Hurricane Sandy by increasing the height and width of the dunes to the 100-year storm elevation. Also included in this project is dune maintenance, which involves planting dune grass and maintaining beach access points.
10. Home Elevation: Elevation of approximately 3,843 homes to reflect new FEMA FIRM maps.

11. Tree Maintenance: Tree trimming and pruning of shade trees along streets in the community to prevent downed power lines; increase effectiveness of Public Works to clear trees in the event of a storm.
12. Purchasing of vacant homes throughout the Borough for flood mitigation.

Since adoption of the 2009 HMP and during the aftermath of Hurricane Sandy, the County underwent an extensive process of updating the HMP to incorporate post Hurricane Sandy elements of mitigation planning. A draft plan was released for review in October 2014, which was subsequently approved the Borough of Keansburg via Resolution #15-037 on March 25, 2015, and by FEMA on April 14, 2015.

COORDINATION WITH OUTSIDE AGENCIES

Notices were sent to the following groups, commissions, municipalities, and agencies soliciting data or information related to flooding, as well as any specific actions the agency or organization has undertaken that may affect flooding. Agencies and organizations who were contacted are as follows:

- Middletown Township
- Borough of Union Beach
- Hazlet Township
- Monmouth County Planning Department
- Monmouth County Office of Emergency Management
- Borough of Keansburg Police Department
- New Point Comfort Fire Co. No. 1
- Keansburg Emergency Medical Services
- Freehold Soil Conservation District
- North Jersey Transportation Planning Authority
- Natural Resources Conservation Service
- NJ Coastal Management Program
- US Army Corps of Engineers- New York District
- American Red Cross
- Clean Ocean Action
- American Littoral Society
- Jacques Cousteau National Estuarine Research Reserve
- Shore Builders Association of Central Jersey
- Comcast Cable
- New Jersey American Water

- JCP &L
- New Jersey Department of Environmental Protection
- Bayshore Regional Watershed Council

A sample of the letter sent out to all the above mentioned stakeholders, agencies, and individuals can be found in Appendix D. Many agencies responded and discussed information that could be beneficial to the Borough's Plan. An example of this work is the various mapping provided by the Jacques Cousteau Reserve and the Rutgers University Center for Remote Sensing and Spatial Analysis (CRSSA). A log of all agencies contacted, along with their responses can be found in Appendix E.

V. FLOOD HAZARD ASSESSMENT

FLOODING HISTORY

Description of Known Flood Hazards

The Flood Insurance Rate Map (FIRM) for the Borough of Keansburg is currently in the process of being updated. The Effective FIRM maps dated September 25, 2009 can be found in Appendix F. The Advisory Base Flood Maps, which were adopted shortly after Hurricane Sandy, can be found in Appendix G. The new Preliminary FIRM maps issued on January 31, 2014 indicate that the vast majority of the Borough is located within the Special Flood Hazard Area, with the exception of a small area to the far south of the Borough and another in the northwest. Keansburg's Municipal Building, Police Department, and Fire Departments are located within the 100 year floodplain on the preliminary FIRM. Additionally, the Borough Water and Desalination Plants, as well as the Public Works Site is located within the 500 year floodplain. The Preliminary FIRM map for the Borough is identified in Figure 2 and in Appendix H. The Borough adopted the Advisory Base Flood Elevation maps in May 2013 by Ordinance 1535. This ordinance allows the Borough to use "the best available data," and as such Keansburg has been using the Preliminary Maps for base flood elevations.

Keansburg is a low-lying, Bayshore community and is subject to flooding from surface runoff, tidal events, and rain, hurricanes and tropical storms. Additionally, the Borough can experience flooding from tidal action in the Raritan Bay, and experiences severe erosion along the Bayshore. Approximately 98% of the Borough is located within the Special Flood Hazard Area, with the majority of development located within the AE zone, which is susceptible to flooding during a 100 year storm event, but is not susceptible to wave action impacts, as in the VE zone designation, which can be found along the border of Keansburg and the Raritan Bay.

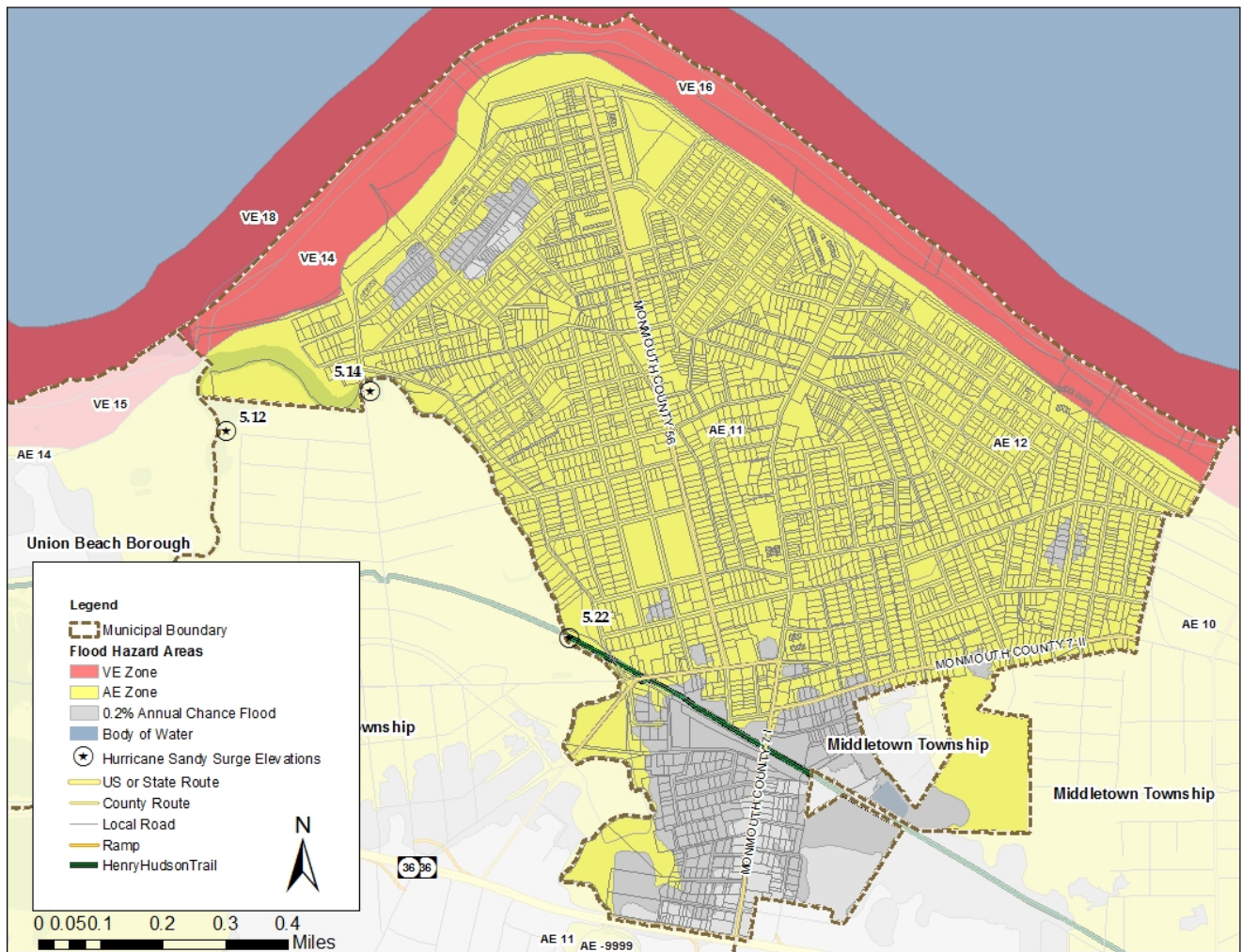


Figure 2. Preliminary FIRM

There are two designated flood zones in Keansburg, the VE Zone and AE Zone. VE Zones are areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. Wave heights are three feet or greater. Base Flood Elevations (BFEs) are derived from detailed hydraulic analyses and are indicated by the elevation provided. Among other criteria, the lowest horizontal structural member of a proposed structure must be located above the BFE in V Zones. AE Zones are areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. A graphic depiction of the flood zones can be found below in Figure 3.

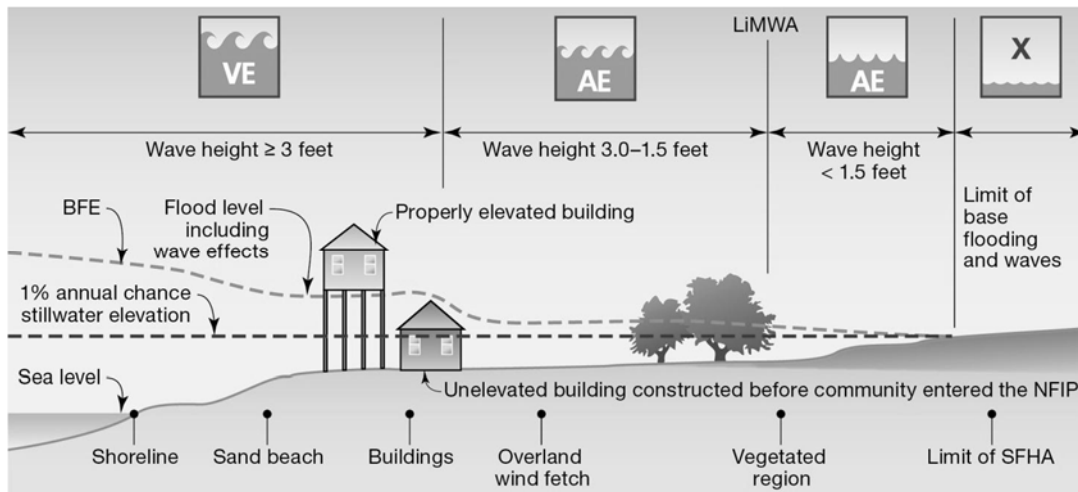


Figure 3. Flood Hazard Area Description

The Borough of Keansburg is bordered to the north by the Raritan Bay and to the west by Waackaack Creek. Almost all of Keansburg is susceptible to flooding from the Raritan Bay and the Creek. Additionally, Keansburg regularly floods during rain events occurring at high tide. While the installation of new pump stations has helped to alleviate this flooding in some areas, the currently existing pump stations are undersized and old drainage systems cause this problem to continue. Specific areas of the Borough that were identified by the Floodplain Management Committee to flood during high tide rain events include:

- Forest Ave – approx. 1 ft. of water
- Shore Blvd – near Twilight Ave & Lawrence Ave
- Woodland and Shore Blvd. – water level floods to curb
- Center Ave by Fireman’s Park- approx. 9 – 10 inches.
- Lawrence Ave (this area experienced the biggest breach during Sandy)
- Lincoln Ave
- Myrtle Ave
- Garfield and Ramsey – approx. 6-8 in of water
- The site of the old police building (179 Carr Avenue)

During Hurricane Sandy, heavy winds and rains, a record tidal surge, and waves brought food waters ranging from two to six feet in depth and inundating approximately 50% of the structures in the Borough. Additionally, the protective dunes

along the Bayfront were severely damaged and breached in four separate locations. Hurricane Sandy made landfall along the coast of New Jersey on October 29, 2012, causing major flooding and destruction. This event has become the flood of record (the highest flood recorded) for much of New Jersey and New York. Where available, Hurricane Sandy Surge Elevations were mapped throughout the Borough of Keansburg and surrounding communities and are noted on the Preliminary FIRM map located in Figure 2 above and in Appendix H. A map of the Sandy Surge Extent was provided by the Jacques Cousteau National Estuarine Research Reserve and can be found in Appendix I. Sandy surge elevations are generally slightly less than the preliminary FIRM BFE in which they are located.

Historical Flooding Events

Keansburg is susceptible to flooding from the Raritan Bay as well as localized flooding during high tide rain events. Some of the major storm events that have affected the Borough and the greater Monmouth County area are described briefly below:

- September 14 – 15, 1944: A Category 2 hurricane passed within 47 miles of the coast of New Jersey in September 1944, producing wind velocities over 100 mph and a maximum tidal elevation of 7.4 feet at the gage in Sandy Hook.
- Hurricane Donna: On September 12, 1960 Hurricane Donna was classified as a Category 2 hurricane when it reached Monmouth County. Wind speeds of up to 110 mph were recorded as was a maximum tidal elevation of 8.6 feet at Sandy Hook.
- The Ash Wednesday Storm: A nor'easter struck the coast of New Jersey lasting 3 days and 5 tidal cycles from March 6- 8, 1962 and causing massive amounts of destruction including 10 deaths in the state of New Jersey.
- Hurricane Belle: On August 9, 1976, Hurricane Belle impacted New Jersey as a Category 1 hurricane with wind speeds of up to 90 mph. In Asbury Park, 2.56 inches of rain was recorded as having fallen in a 24-hour period.
- March 1984: This nor'easter coincided with astronomically high tides and caused flooding, erosion, and damage to roads and boardwalks.
- Hurricane Gloria: On September 27, 1985, Hurricane Gloria came onshore in Long Island, NY as a Category 2 hurricane. The storm caused extensive power outages through New Jersey and forced people to be evacuated from their homes. However, coastal flooding was minimized as the peak storm surge arrived during low tide.

- The Perfect Storm: The Perfect Storm, also known as the Halloween Storm, was a nor'easter that caused coastal flooding on October 31, 1991.
- The Storm that Stole Christmas: A nor'easter struck the coast of New Jersey on December 11, 1992 and continued to impact the area through eleven (11) tidal cycles, causing extensive beach erosion and 3 to 5 ft. storm surge.
- Tropical Storm Floyd: Tropical Storm Floyd impacted New Jersey on July 16, 1999. Heavy rains coincided with high tide to exacerbate flooding. However, the greatest impacts were felt away from coastal areas in Bergen and Somerset Counties.
- Tropical Storm Irene: Tropical Storm Irene produced heavy rains from August 27-28, 2011, causing tidal flooding and beach erosion, making it the costliest storm in New Jersey after Hurricane Floyd prior to Hurricane Sandy.
- Hurricane Sandy: Hurricane Sandy made landfall in Brigantine on October 29, 2012, becoming the costliest natural disaster in the State of New Jersey and second only to Hurricane Katrina nationwide. The coastal areas of Monmouth and Ocean Counties were among the hardest hit with record breaking high tides and wave action. Many homes throughout the coastal communities were destroyed or impacted by severe flooding. All communities within Monmouth County faced power outages, some lasting up to two (2) weeks.



Figure 4. Damage from Hurricane Sandy

Storms with Repetitive Loss

Using repetitive loss data provided by FEMA, areas generally affected by flooding were identified throughout the Borough of Keansburg. A repetitive loss property is classified as one which has experienced two or more claims of more than \$1,000 that have been paid by the National Flood Insurance Program (NFIP) within any 10 year period since 1978. To protect the privacy of homeowner's individual repetitive loss properties were not mapped, but rather a 200 foot buffer was created around each repetitive loss property and any parcel falling in the buffer area with similar conditions as the identified repetitive loss property was categorized as in an area generally affected by flooding. The main areas affected by flooding throughout the Borough of Keansburg are as follows:

- 1) Either side of Carr Avenue from Oak Street to Terrace Place, extending from Creek Road to Main Street and Beachway Avenue
- 2) Either side of Twilight from its northern terminus to Park Avenue
- 3) The area bounded by Bay Avenue, Raritan Avenue, Center Avenue, an Highland Avenue

The average number of repetitive losses per repetitive loss property in the Borough of Keansburg is two (2). The average pay-out per loss for a repetitive loss property in the Borough is \$28,205.22, with an average total pay-out per property of \$58,596.25 for all losses.

DESCRIPTION OF FUTURE EVENTS FOR OTHER HAZARDS

In addition to flooding, Keansburg is susceptible to a number of other hazards. While the intent of this plan is to focus on flood hazards, it is important to identify and recognize other hazards that impact the Borough. Information on other hazards was taken from the 2014 Draft Monmouth County Multi-Jurisdictional All-Hazards Mitigation Plan.

Coastal Erosion

Coastal erosion occurs when more sediment is lost than is gained at a particular location. Coastal erosion can result from natural or man-made causes, including sea level rise, flooding, strong wave action or large storms, some types of shore protection structures, some land uses, and other alterations to the natural environment. Coastal erosion can occur gradually, as shorelines recede over a period of time or can be caused by a rapid recession of shoreline due to another hazard event. Erosion increases the vulnerability of near-shore structures to damage from storms and flooding events.

Keansburg is susceptible to erosion along the Raritan Bayfront and Waackaack Creek. The impacts of coastal erosion can be lessened by implementing living shoreline techniques and undertaking a variety of shoreline protection and dune stabilization measures.

Climate Change

The Borough of Keansburg will be affected by increasing sea levels along the Raritan Bay. The effects of sea level rise will be more pronounced in low-lying areas of the Borough and will exacerbate problems with flooding. Additionally, severe storm events are predicted to become more frequent as the climate warms. The impacts of climate change in the future will depend on the rate which sea level rises and human actions and response to the threats caused by climate change. Sea level rise will worsen the impacts of storm surges on the Borough of Keansburg.

Dam Failure

There are no dams in the Borough of Keansburg; therefore, the probability of a dam failure is low.

Drought

A drought is a period of low or no precipitation in a given area. The severity of the drought depends on the length of time, geographic reach, regional water supply demands, and the impact of other hazards, such as extreme heat. There is a low probability of severe drought conditions occurring in Keansburg, due to Borough's relatively low elevation and abundant groundwater supply; although short term, less severe droughts may be more likely. If extended drought conditions do occur in Keansburg, the Borough may be subject to restricted water usage and other regulations. Recent periods of drought in New Jersey include:

- October 1997
- 1998- 1999
- October 2001- 2002
- August- September 2008
- August to October 2010

Earthquake

The probability of a significant, damaging earthquake in Keansburg is low. While low magnitude earthquakes do occur throughout New Jersey on a fairly regular basis, most earthquakes impacting Keansburg will have only minor effects. The greatest

probability of an earthquake occurrence in New Jersey exists in the northern portion of the State near the Ramapo Fault. All of Keansburg's critical facilities are now designed per FEMA required geotechnical/ earthquake standards.

Extreme Temperature

Keansburg is highly susceptible to both extreme heat and extreme cold events. Long periods of extreme temperatures can overstress power supply systems, resulting in brown-outs or black outs and leaving residents without heat or air conditioning. Generally, the impact on humans of extreme weather events is minimal, with the exception of the very young and elderly populations, who are more susceptible to the health impacts of extreme temperatures. If the population of Keansburg continues to age, the vulnerability to extreme temperature events will increase. Improved weather forecasting, community warnings, and community preparedness can help to reduce the risks of extreme weather events to vulnerable populations.

Extreme Cold

Extreme cold events often accompany a winter storm or occur soon after. Prolonged exposure to the cold can cause frostbite or hypothermia. Recent periods of extreme cold in Keansburg include:

- Jan 14- 29, 2003
- Jan 9-11, 2004
- Jan 16- 18, 2009
- Jan 23, 2014
- Jan 4, 7, & 22, 2014

Extreme Heat

Keansburg is more likely to experience extreme heat than extreme cold events. Extreme heat events occur during the summertime when the weather in Keansburg is substantially hotter and/or more humid than the Borough average for that time of year. Recent periods of extreme heat include:

- July 4- 11, 1999
- August 1-3, 2006
- June 7-10, 2008
- July 5-7, 2010
- July 21- 24, 2011
- July 17- 18, 2012
- July 18-19, 2013

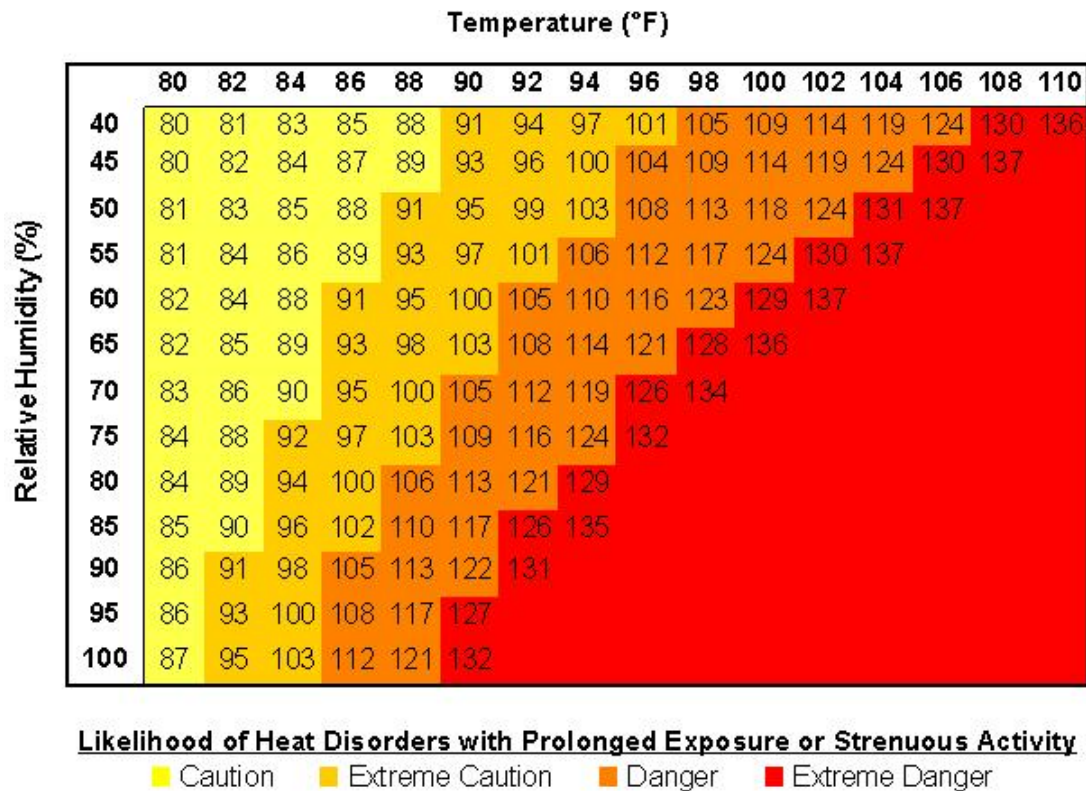


Figure 5. NOAA National Weather Service Heat Index

Extreme Wind

Extreme wind can occur alone or with other natural hazards, often occurring during thunderstorms. The impacts of extreme winds can be critical and can include flying debris and downed trees and power lines. The probability of future extreme wind events is high, with an average of 5- 10 extreme wind events occurring each year in the Central New Jersey region. The Borough of Keansburg has seen damage in recent years due to wind, mainly on trees, telephone poles and power lines, which have resulted in fires on occasion. Recent extreme wind events in Monmouth County, New Jersey include:

- Thunderstorm on September 9, 1998
- Thunderstorm on August 7, 2000
- Thunderstorm on August 2, 2002
- Thunderstorm on July 22, 2003
- January 18, 2006
- Thunderstorm on August 17, 2007
- February 13, 2008

- March 5, 2008
- March 13, 2010
- Hurricane Irene, August 27- 28, 2011
- Hurricane Sandy, October 29, 2012

Hurricanes, Tropical Storms, & Nor'easters

Hurricanes, tropical storms, and nor'easters are events consisting of a number of damaging hazards including heavy precipitation, high winds, wave action, storm surge, coastal flooding, and coastal erosion. All of New Jersey, including the Borough of

Keansburg, falls within the Hurricane

Susceptible Region,

and there is a 18-24% chance of

experiencing a tropical storm or

hurricane event between June and

November of any given year in

Monmouth County. Since 1850, thirty-

six (36) Hurricane or Tropical Storm

tracks have passed within 75 miles of

Monmouth County. Nor'easters generally occur during the winter months and are named after the wind direction of the storm. They tend to last for more than one tidal cycle, often generating flooding events. Severe storms that have impacted the Borough of Keansburg with flood damages were discussed in the Historical Flooding Events section of this document.



Figure 6. Flooding and damage due to Hurricane Sandy

Landslide

The probability of a landslide event in the Borough of Keansburg is low.

Lightning

Keansburg is susceptible to lightning events, but not as much as other areas of the United States, particularly the Southeast. The probability of future lightning events in Keansburg is certain, however, lightning often occurs with other natural hazards, such as thunderstorms.

Storm Surge

All coastal areas are at high risk for storm surge. The severity of storm surge is generally related to the severity of the storm making landfall, as well as the tidal and lunar cycles.

Tornado

The probability of a tornado in Keansburg is low. If a tornado is to occur, it is most likely to do so between March and August, forming in the late afternoon or early evening at the trailing edge of a thunderstorm.

Wave Action

All immediate coastal and shoreline areas along the Atlantic Ocean and inland bays are at risk from wave action. Waves are generally caused by wind and storm events, even those which remain offshore, and generally the more severe the storm, the more destructive waves become. All of Keansburg's coast along the Raritan Bay lies within a VE zone, meaning that during a 100 year storm event breaking waves can exceed three feet.

Wildfire

Wildfires typically occur in unoccupied, rural, or forested areas and happen during the fall and spring when it is hot and dry. In New Jersey, 99% of wildfires are caused by human activity. Due to the developed nature of the Borough of Keansburg, the probability of wildfires occurring is low.

Winter Storms

Although the Borough of Keansburg is located south of the typical boundary between freezing and non-freezing precipitation during the wintertime, there is a high probability of occurrence of winter storms in the Borough of Keansburg, with Monmouth County averaging approximately 25 - 26 inches of snowfall annually. Winter storms generally occur from November through mid- April, with the peak season being December through March. Winter storms can consist of blizzards, heavy snow, sleet, and/or ice storms.

Winter storms can result in downed trees, damaged vegetation, transportation accidents, road closings, stranded travelers, power outages, and a depletion of heating supplies. They can cause major disruptions to transportation, commerce, and electrical power. Recent winter storm events that have impacted the Borough of Keansburg include:

- January 6-8, 1996
- February 16-17, 2003
- January 22, 2005
- February 17, 2007
- December 26, 2010
- November 7-8, 2012

SPECIAL FLOOD RELATED HAZARDS

There are many special localized situations in which flooding or flood-related problems do not fit the national norm for riverine and coastal floodplain management. These special flood-related hazards include:

Uncertain Flow Paths

Alluvial fans, moveable bed streams, channel migration, and other floodplains where the channel shifts during a flood are classified as uncertain flow paths. This hazard is not an issue in Keansburg.

Closed Basin Lakes

Lakes that have a small or no outlet that may stay above flood stage for weeks, months, or years are called closed basin lakes. This hazard is not relevant to Keansburg.

Ice Jams

Ice jams, also known as ice dams, typically occur in late winter or early spring when a frozen river begins to thaw. Blocks of ice break free and can accumulate at bends in the river, mouths of tributaries, or near structures such as bridge piers. The ice can restrict the flow of a river and cause flooding upstream. A flash flood type event can also occur downstream if the ice jam suddenly breaks free. Although the Raritan Bay can freeze in winter months, the threat of flooding from ice jams in the Borough of Keansburg is low due to the width, depth and tidal nature of the Bay. However, there is a high likelihood of damage to structures such as bulkheads, docks and piles from floating ice. Additionally, ice jams could occur in Waackaack Creek.

Land Subsidence

Along the East Coast, land is sinking towards sea-level in a process known as subsidence. This will accelerate the impacts of sea level rise, causing actual water levels to be much higher than some predicted estimates.

Mudflow hazards

Mudflow hazards are identified as a river, flow, or inundation of liquid mud down a hillside, usually as a result of a dual condition of loss of brush over and the subsequent accumulation of water on the ground, preceded by a period of unusually heavy or sustained rain. This is not considered to be a threat in Keansburg.

Coastal Erosion

This hazard was discussed in the previous section. It has a large impact on the Borough of Keansburg.

Tsunamis

Tsunamis are large ocean waves typically caused by an earthquake, landslide, or underwater volcano. Although Tsunamis are far more likely on the west coast, there are three DART (Deep-ocean Assessment and Reporting of Tsunamis) monitoring stations off the coast of New Jersey, near the Hudson Canyon.

VI. PROBLEM ASSESSMENT

FEMA is currently in the process of updating the Flood Insurance Rate Map (FIRM) for the Borough of Keansburg. The updated Preliminary FIRM indicates that the majority of the Borough is located within the 100-year Special Flood Hazard Area. A total of 2,679 residential homes and 99 commercial buildings are located within the SFHA. Table 1 below indicates the total structures, properties, and land area located within both the 100-year and 500-year floodplains. The table also shows the percentage of each category that is located within the 100-year floodplain to get a better understanding of how much of the Borough is vulnerable to flooding.

Table 1: Floodplain Property Data

	Borough Total	100- Year Floodplain	500- year Floodplain¹	100- Year + 500- Year Floodplain	Percent Located within the 100- Year Floodplain
Structures	3,329	2,976	264	3,240	89.40%
Properties	3,469	3,189	245	3,434	91.93%
Land Area (acres)²	557.91	469.02	66.15	535.15	84.07%

1. This does not include the area within the 100-year floodplain.

2. Land area only includes land parcel areas. Waterways and roads are not included in this area.

All of Keansburg’s critical facilities, with the exception of the Bolger Middle School, are located within either the 100-year or 500-year floodplain including the Municipal Building, Police Department, Fire Department, Water Treatment and Desalination Plant and Public Works Site. It is critical that these facilities be protected from flooding so valuable equipment is not destroyed and emergency services can be provided during and after storm events. The Borough’s only sanitary sewer pump stations is also located within the SFHA. During Hurricane Sandy the New Point Fire Station and EMS Building took on 4 feet of water, but has since reopened. The Police Department Building faced severe damage during Hurricane Sandy and is in the process of being relocated to a less-flood prone area and built to withstand the 500-year storm event. FEMA recommends that any critical facility be properly flood-proofed or elevated to withstand the 500-year storm event. A map showing the Borough’s critical facilities and the Special Flood Hazard Areas can be found in Appendix K. At the time of this Plan, the Borough was in the process of obtaining flood insurance for on all eligible Borough owned properties. All Borough owned properties have current and up-to-date elevation certificates at this time.

HAZARD IMPACT

Borough residents and first responders are particularly vulnerable to the impacts of flooding in Keansburg. Residents who live within the SFHA should be encouraged to take all necessary precautions to ensure their homes are safe from flood hazards. In addition to the possible damage to buildings and other infrastructure, there is the possibility of injury or even death to residents or responders who could get trapped in a flooded building or swept away in fast moving floodwaters. The Borough and its residents must also be aware of the potential impacts to public health from flooding. Mold will quickly develop in many structures and cause respiratory issues for those attempting to rebuild. Debris from damaged and demolished structures could also contain hazardous materials such as mold, lead or asbestos. Early warning and evacuation, as well as making the necessary preparations to protect facilities from flooding, can protect the health and safety of residents and emergency workers and facilitate a rapid response and recovery from future flood events. The Borough prepared an Emergency Operating Procedures Manual earlier this year and is currently deciding whether they will pursue grant funding for a Debris Management Plan. These documents address hazard preparedness issues and minimize their impacts to the maximum extent practical.

Many of the hazards to which Keansburg is vulnerable generally occur concurrently with flooding. Areas that are susceptible to flooding will only increase in their vulnerability as impacts due to sea level rise become greater in the future. Homes which are not raised above the base flood elevation are particularly vulnerable to flood related hazards, as are areas prone to flooding but not located within the SFHA. The Borough of Keansburg should work with FEMA to ensure that all flood maps illustrate an accurate portrayal of flood risk within the community. Currently, the Borough of Keansburg has adopted FEMA's Advisory Base Flood Elevations, which were released in December 2012. However, in adopting the Advisory Base Flood Elevations, the ordinance reads that the Borough will use the "best available data" to determine BFE. At this time, the Preliminary FIRMs are being utilized as such.

Repetitive loss areas indicate portions of the Borough where the risk of flooding may be higher as indicated by multiple flood insurance claims filed on a single property. The average number of losses per repetitive loss property within Keansburg is two (2) and the highest concentration of these properties are located in the center of the Borough, along the Carr Avenue Corridor. The Repetitive Loss Areas can be found mapped in Appendix J.

Category 1, 2, & 3 SLOSH models for the Borough of Keansburg were run by the Jacques Cousteau National Estuarine Research Reserve (JCNER) to estimate storm surge heights and wind resulting from historical, hypothetical, or predicted hurricanes. SLOSH is a computer model developed by the National Weather Service (NWS) and stands for Sea, Lake, and Overland Surge from Hurricanes. It is important to note that the SLOSH model does not include rainfall amounts, river flow, or wind-driven waves and accuracy is generally within 20% (NOAA).

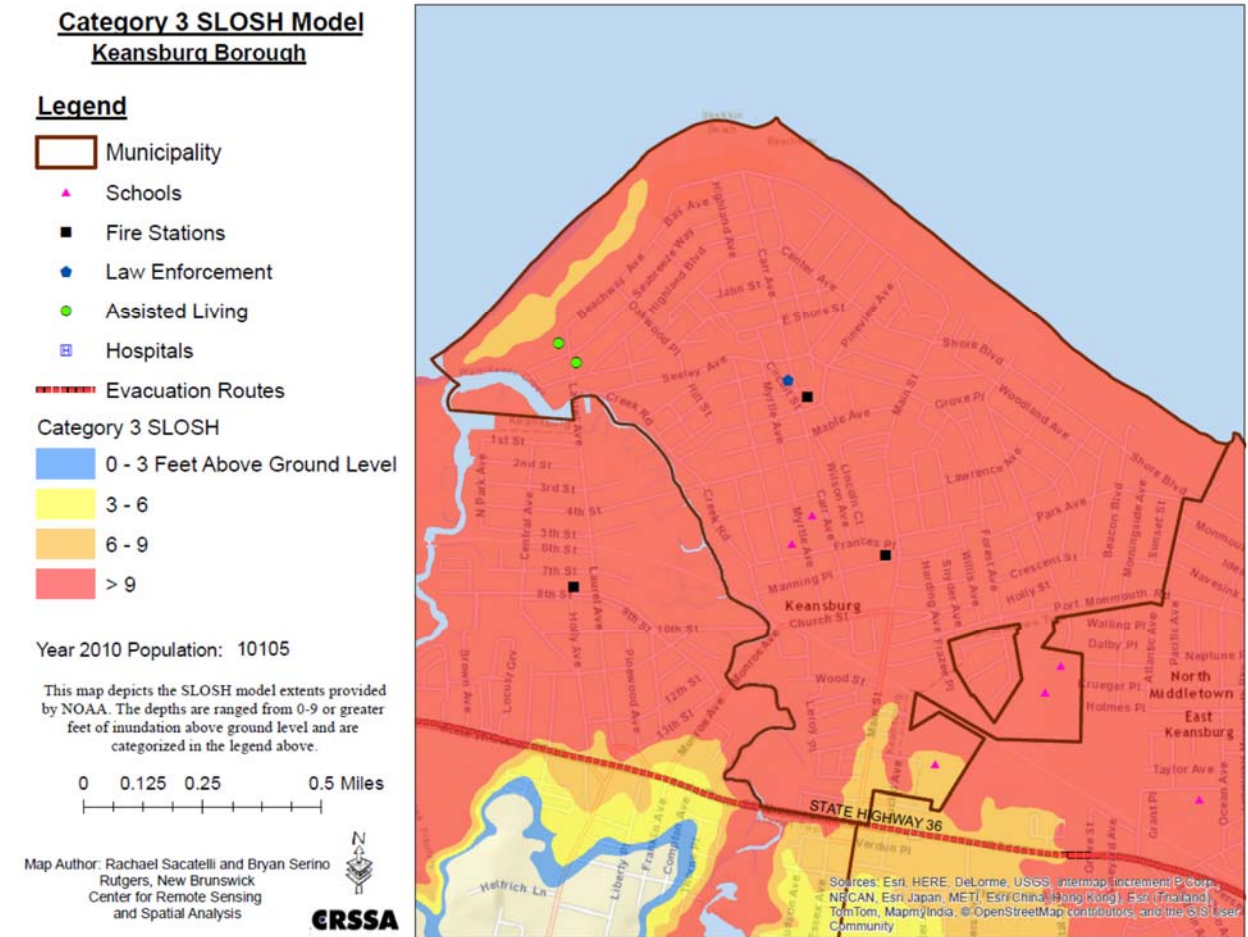


Figure 7. Category 3 SLOSH Model

As depicted in the maps found in Appendix J, during a Category 1 storm event storm surge would be above ground level throughout the majority of the Borough, with the exception of the dune areas along the Bayshore and the very southern portion of the Borough. Along the Carr Avenue Corridor from Beachway Avenue to Washington Avenue, surge levels are predicted to reach 9 feet above ground level. During a Category 2 storm event, storm surge would inundate the entire Borough, with surge

levels exceeding 9 feet in a little over half of Keansburg. During a Category 3 storm, surge levels would exceed 9 feet in almost all of Keansburg Borough, with the exception of a small area around Main Street in the very southern portion of the Borough and along the dunes on the western border. However, in both of these areas, storm surge is predicted to be within 6 to 9 feet above ground level. Keansburg is highly susceptible to storm surge during any major storm event. The Borough is predominately residential, and as such, much of the areas that will be affected by storm surge are residential areas.

The impacts of Sea Level Rise on the Borough of Keansburg were also analyzed by JCNERR. A one foot increase in sea level rise will encroach on the Borough of Keansburg's boundaries with the Raritan Bay and also the Waackaack Creek. A small area of Keansburg's tidal marsh along the western border with Hazlet on Waackaack Creek will convert to Open Water. A two feet increase in sea level rise water will further encroach on the land area of Keansburg along all of the water boundaries. With two feet of sea level rise, a small portion of the tidal marsh along the Waackaack Creek near the southern border of the Borough will begin to retreat, as well as some marsh conversion to open water near the mouth of the River. Three feet of sea level rise will encroach on all shorelines within the Borough. Additionally, a small portion of the Borough from Sunset Street to the eastern border between Shore Blvd and Crescent Street will be under water. Much of the tidal marsh will continue to remain; with the small area of conversion to open water near the mouth of the Waackaack Creek and the area of marsh retreat near the southern border of the Borough. Sea level rise maps and marsh retreat maps can be found in Appendices M and N, respectively. Sea level rise and marsh retreat will most severely impact the beaches and natural buffer systems within the Borough of Keansburg.

The Borough of Keansburg has an established land use pattern and is essentially a fully developed community. As such, there are not many viable options for major changes to zoning and development regulations. However, the Borough should consider adopting stricter regulations to limit the impacts of flooding and protect those residents building in flood zones.

HISTORICAL DAMAGE

All NFIP claims from 1978 to the present in the Borough of Keansburg were mapped with a 200 foot buffer; including all parcels within that buffer, to protect the privacy of

the property owners. Almost all of the Borough's SFHA falls within the flood insurance claim area, as illustrated in Appendix M.

Hurricane Sandy caused the most damage of any storm in recent history. During Hurricane Sandy, Keansburg experienced major impacts from wind, storm surge, and flooding. Floodwaters of up to six feet in depth inundated approximately 50 percent of the structures in the Borough. The protective dunes along the Bayshore were breached in four separate locations and all 2.6 miles of dunes were substantially damaged. Residents of the Borough were without power for up to 14 days and a total of 40,400 cubic yards of debris was generated from the disaster.

The storm forced the evacuation of hundreds of Borough residents from their homes. A total of 347 properties within the Borough sustained substantial damage during the storm. A structure is considered substantially damaged when the total costs of restoring the structure to its before damaged condition would equal or exceed 50% of the structure market value. Additionally, five homes within the Borough were destroyed.

The Borough's Police Department building suffered damages rendering it inoperable. There were extensive damages to Keansburg's parks and 22 roads within the Borough faced significant damage, preventing the circulation of emergency vehicles. Water and sewer mains were damaged at seven locations throughout Keansburg by storm surge from Sandy. The damaged water and mains occurred at: 42 Snyder Avenue; Forest and Park Avenues; Shore and Woodland Avenues; Lawrence and Woodside Avenues; 193 Carr Avenue; 288 Carr Avenue; and 48 Forest Avenue. A sewer pump station at 120 Main Street was inundated by 5 feet of storm surge during Hurricane Sandy. Although the facility continued to operate during the storm, meters and electric equipment were damaged.

The Keansburg Waterfront Library fronts the Sandy Hook Bay and was damaged by high winds and flooding during Hurricane Sandy. The Keansburg Historical Society Building was also damaged during Hurricane Sandy. Approximately 4 feet of water flooded the building. The contents of the building were also damaged or destroyed. The East and West Bay Walks, located along Beachway Avenue were also damaged by high winds during Sandy. This fishing pier and various parking areas throughout Keansburg were also damaged.

ECONOMIC IMPACTS

The economic impacts of any major flooding event in the Borough of Keansburg will continue to be greatly felt. As a result of the destruction and damages due to Hurricane Sandy, Keansburg faces a significant financial burden. The Borough as a whole has sustained a 5.3% loss in home values and tax revenue. A total of 1,291 properties faced reduced property values resulting from Hurricane Sandy.

Local businesses were impacted in a variety of ways from temporary business disruption to severe damage from winds, flooding, and storm surge. At the time of this report, some businesses had yet to reopen; while others had invested to make their structures more storm resilient. The amusement park and waterpark faced severe damage but were open for the next summer season.

Due to the large percentage of residential homes within the Borough, the majority of flood damage within Keansburg has been, and will continue to be, to residential properties. The cost of flood damage to residential property is generally covered by insurance pay-outs and owner out of pocket expenses.

The average flood insurance pay-out for a repetitive loss property within the Borough of Keansburg is \$28,205.22. If, and when, property owners can no longer pay their taxes and/or decide to abandon their property prior to making necessary repairs, there has been and will continue to be a potential impact on the tax base of the Borough due to flooding events.



Figure 8. Homes with damage from Hurricane Sandy

Additionally, economic impacts of flooding to the Borough are felt in the cost of debris staging and removal, municipal facility repair, and personnel costs during the event. The impact of costs to the community would depend on the severity and longevity of the event as well as reductions in the tax base due to property loss or migration.

NATURAL FEATURES

Keansburg is a predominately built-out community. However, there are a few parks throughout the Borough, as well as the beachfront; and a Conservation Recreation Zone District which was established to promote the conservation of valuable natural resources and prevent environmental degradation. This zone district is intended to coordinate with State procedures and policies shaping land development which have been enacted through the Waterfront Development Act and the Coastal Area, Facilities Review Act to control the destructive development of beaches, dunes, and tidal wetlands; and to regulate the use of these areas to ensure that they continue to secure the public safety from flood and other natural disasters. Permitted uses with the CR District include:

1. Passive or low intensity recreational uses such as swimming, fishing, or boating which do no impact adversely on beaches, dunes, or wetlands.
2. Municipal or County parks and open space.
3. Docks, piers, moorings, marinas, boat launches and related water dependent recreation or transportation facilities for which required Waterfront Development Permits and Coastal Area Facility Review Act Permits have been issued by the New Jersey Department of Environmental Protection.
4. Access-ways to the water's edge provided such routes are limited and do not impair the integrity of beaches, dunes or wetlands.
5. Structures deemed necessary by the local, State, or Federal governments for shore protection and flood prevention.

The following parcels within the Borough of Keansburg are located within the CR Conservation Overlay Zone District:

Table 2: Conservation Overlay Zone District Parcels

Block	Lot	Location	Ownership
168	5.02	89 Wood Street	Private
184	5	Beachfront	Borough of Keansburg
184	7	Beachway Ave	Private
161	1	Monroe Ave	Borough of Keansburg
161	2	107 Monroe Ave	Private
163	5.01	Wood Ave	Private
163	14	Meadowland	Borough of Keansburg
1.03	1	Meadowland	Private
183	1	Beachway Ave	Private
183	2	Beachway Ave	Private
163	15		Borough of Keansburg

Much of the beachfront is located within the Conservation Overlay Zone District. In addition to this area, there are three (3) parks in the Borough. They are

- Donohue Park- located at the intersection of Seeley & Carr Avenue
- Forest Park- located at Forest & Park
- Hill St Park- at the dead end of Garfield, near Hill Street

There are many areas of wetlands throughout Keansburg, located along the Bayfront and Waackaack Creek. Most of these areas are located within the Conservation Overlay District. The parks, beachfront, and creek banks can act as natural buffers and absorb storm surge without any harm to buildings. The beachfront creates a natural buffer around the Borough and acts as the first line of defense against flooding from the bay. It is important that the Borough maintain such areas as open space.

During Hurricane Sandy, Waackaack Creek became severely eroded and laden with silt and sand that was washed in from the Bayshore beaches. As a result, areas of roadway located along the creek began to collapse. In addition, the structural integrity of surrounding residential properties has been compromised, posing an imminent threat to life, health, and public safety. Furthermore, the bulkhead and ground in the vicinity of Waackaack Creek sustained damage and collapsed as a result of Hurricane Irene, affecting the road and grounds around the bulkhead. The damage was located at an area of 200 linear feet long along Creek Road. The damaged area was surrounded by homes and other improved property and was also a danger to vehicles travelling through the area as well as the general public. This damage to the bulkhead was exacerbated and further diminished by Hurricane Sandy. Portions of the Creek were

dredged in 2014, however it is the position of Borough officials that an increased extent of dredging would prevent and/or reduce the severity future losses.

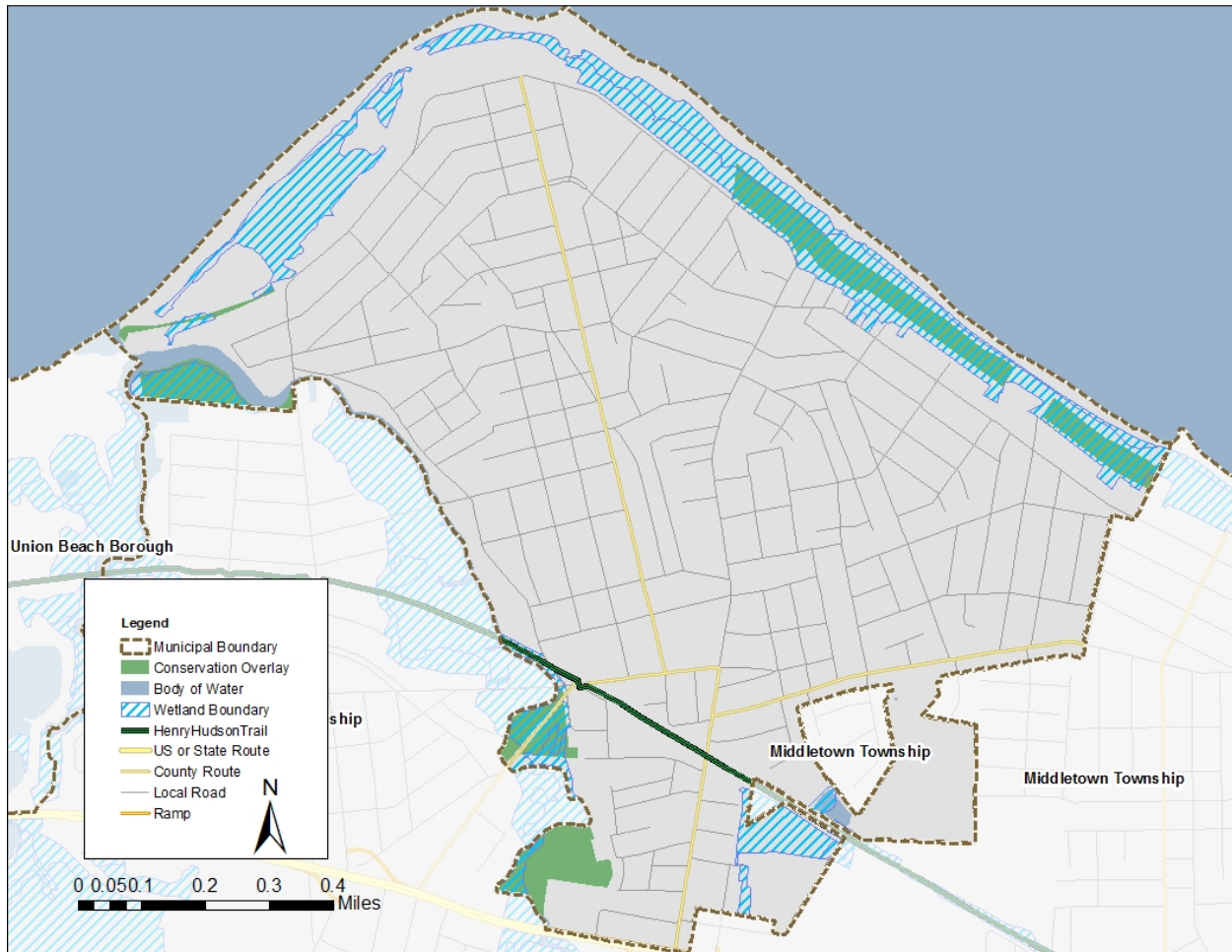


Figure 9. Natural Features Map

FUTURE FLOODING IMPACTS

As previously indicated, the Borough of Keansburg is a predominantly built-out community. Due to existing development and current regulations, there is little vacant land available for new development. However, due to a surge of vacancies and a number of foreclosures after Hurricane Sandy, there is potential for a number of redevelopment projects throughout Keansburg. The Borough should continue to enforce the existing development standards and maintain its open spaces and natural

features. This is critical to maintaining permeable surfaces and limiting stormwater runoff.

However, as sea levels rise and marshes retreat, Keansburg could become more vulnerable to impacts from flooding. The overall impacts of flooding on the community will be contingent on how effectively the Borough mitigates current vulnerabilities and plans for future conditions. It is imperative that the Borough utilize this Floodplain Management Plan as a valuable tool to plan for the future.

VII. GOALS

Over the course of the various Floodplain Management Plan Steering Committee meetings, the Committee discussed the goals that the Borough would like to achieve with the Floodplain Management Plan to increase resiliency and mitigate future storm events. The following is a list of the goals agreed upon by the Committee:

1. Secure the public's safety from flood, panic, and other natural and man-made disasters with particular emphasis on preserving and maintaining the integrity and protective features of the Borough's beach-dune system.
2. Promote public awareness of hazard mitigation and resiliency issues and provide adequate resources to Borough residents and business owners so they are properly informed of the natural hazards they face and the precautions they can take to protect their properties.
3. Utilize various planning tools and programs to better prepare for and respond to floods and other natural disasters.
4. Maintain and protect dunes, wetlands, and other natural areas.
5. Protect, update, and ensure that Borough infrastructure and critical facilities are able to withstand future hazard events and remain operational during and after such events.
6. Encourage and support the use of sustainable development techniques, green building design, native landscaping, and encourage the use of pervious cover in future development and redevelopment.
7. Promote regional coordination between Local, County, State, and Federal Governments and OEMs, FEMA, and the National Flood Insurance Program; to identify community vulnerabilities, promote regional resiliency to hazard events, and coordinate post-disaster recovery efforts.

VIII. POSSIBLE FLOODPLAIN MANAGEMENT ACTIVITIES

As part of the planning process, all existing and potential floodplain management activities and measures to mitigate property damage and impacts to community infrastructure were reviewed. The benefits, costs and general feasibility of each action were considered prior to making a recommendation to proceed with the action. Many of the proposed activities coincide with actions recommended in the 2014 Monmouth County Multi-Jurisdictional All Hazards Mitigation Plan. All activities and measures have been grouped into the following six mitigation strategies: Preventative Measures, Property Protection, Natural Resource Protection, Emergency Services, Structural Projects and Public Information. The findings are as follows.

PREVENTIVE

Preventive activities keep flood problems from getting worse by limiting the use and development of flood-prone areas through planning, land acquisition, or regulation. These activities are generally administered by the Borough building, zoning, planning, and code enforcement offices.

Floodplain mapping and data

The Borough of Keansburg has been studied and its flood-prone areas mapped by FEMA in entirety. FEMA is currently in the process of updating the flood maps for the Borough. Additionally, the Borough is developing Geographic Information Systems (GIS) to increase the community's resiliency and enable them to better prepare for, respond to and recover from disasters. The components of GIS will support facilities and public works infrastructure, land information, and floodplain management-related data layers and applications. This will be done as part of the Round 2 Post-Sandy Planning Assistance Grant program.

Open Space Preservation

The opportunity for future open space preservation in Keansburg is small, due to the fact that it is largely built-out. However, there are already parks and areas of preserved open space scattered through-out the community, including much of the beachfront and all properties located within the CR Zone District. While the opportunity for future open space preservation within the Borough is low, measures should be taken to ensure that existing areas of open space within the Borough remain as such. Homeowners

interested in pursuing property buyouts for repetitive loss properties can potentially add scattered plots of preserved land to the Borough.

Floodplain Regulations

Floodplain Regulations are in place throughout the Borough by zoning and development regulations at the local, county, state, and federal levels.

Erosion Setbacks

This should be addressed along the Creek. There is a lot of erosion on Creek Rd and Lawrence Ave.

Planning and Zoning

Keansburg is a predominately built out community and as such, zoning ordinances to limit development within the floodplain are not feasible. The Borough can, however, promote resiliency by regulating impervious cover and by allowing for residences to be built above the base flood elevation. In the aftermath of Hurricane Sandy, the Borough of Keansburg adopted the Advisory Base Flood Elevations put out by FEMA. The Borough has ordinances regulating Dune areas, including the establishment of a dune conservation area. Additionally, Keansburg has a flood damage prevention ordinance. The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation plan recommends that the Borough of Keansburg undertake the following actions:

- Develop flood hazard zoning ordinances to better protect the borough from natural disasters. The proposed ordinances will prevent future losses due to damages from natural disasters and better protect the health and safety of the Borough residents.
- Develop a plan to allow variances on foundations of newly built structures. This will result in reduced future storm damages to residential structures, personal property, and will protect public health and safety during future events; possibly resulting in the reduction of millions of dollars in clean-up cost to the Borough and potentially hundreds of millions in damage to private property
- Develop ordinances to restrict landscaping water usage in times of drought. This will prevent over use of the Borough's water resources and decrease the Borough's dependency on outside water services providers.

Stormwater Management

The Pump Station on Beaconlight Road is hard to access. A road should be put in for better access.

Drainage System Maintenance

The Keansburg Department of Public Works should regularly check for blocked storm drains and remove sediment and debris as necessary. From April to September the DPW systematically cleans basins every Wednesday.

Building Codes

The Borough of Keansburg has adopted an ordinance requiring that the best available data be used for determining base flood elevations. Currently, this means that new construction or substantially damaged structures must be built to the base flood elevation as indicated on the Preliminary FIRMs. The Floodplain Management Plan Committee suggested that additional regulations be added to require all mechanical equipment to be elevated and that the existing impervious coverage regulations be better enforced.

Tree Trimming

The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation Plan recommends that the Borough of Keansburg undertake tree trimming and pruning to prevent downed power lines which can contribute to power outages during severe storms. The loss of power can be devastating to the community as was observed during Hurricane Sandy. The losses avoided due to loss of power can be in the hundreds of thousands to millions of dollars per year.

PROPERTY PROTECTION

Property protection activities are usually undertaken by property owners on a building-by-building or parcel basis.

Relocation

The Borough Police Department will be relocated to 331 Carr Avenue, an area of the Borough far less prone to flooding than its current location. However, the wholesale acquisition and relocation of residential properties located within flood prone areas is not practical in the Borough of Keansburg. Individual lots within the Borough are relatively small, without room for relocation of a structure on the same lot, and the Borough is fully developed with no potential for relocation elsewhere in the Borough.

Acquisition

The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation Plan recommends that the Borough of Keansburg purchase vacant homes which are repeatedly devastated by storms to convert to their natural state. The proposed mitigation activities could potentially result in tens of millions of dollar in reduction in future storm damages to residential structures and personal property.

Building Elevation

Requiring that structures within the flood hazard area be elevated to at least the highest regulatory standard is the best method for reducing flood problems and losses in the Borough of Keansburg. Keansburg requires that structures be elevated using the “best available” data, which currently means using the Preliminary FIRMs as the standard. The elevation of 3,843 hoes within the Borough to higher standards and elevations are recommended actions in the 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation Plan. Elevating these homes will result in reduced future storm damages to residential structures and personal property.



Figure 10. Existing home elevated to meet BFE standards in Keansburg

Retrofitting

Keansburg is in the process of relocating their Police Building. This building will be built to the 500 year flood elevation. The Borough should encourage commercial properties within Keansburg to utilize flood-proofing techniques and provide information to property owners on filling basements and installing flood vents. As property owners utilize these techniques, they should be encouraged to get new elevation certificates.

Sewer Backup Protection

Keansburg is equipped with separate storm and sanitary sewers. There are no known sewer overflow points or locations of excessive infiltration. The Borough has undertaken a project to clean and inspect its entire Sanitary Sewer System, for anticipated completion in early 2016.

Insurance

Keansburg participates in the National Flood Insurance Program. Homeowners are encouraged to maintain flood insurance to protect against loss of structure and contents in case of flooding. The Borough of Keansburg can reduce the flood insurance rates for property owners through participation in the Community Rating System program. This plan is intended to gain additional points in the program.

NATURAL RESOURCE PROTECTION

Natural resource protection activities preserve or restore natural areas or the natural functions of floodplain and watershed areas. They are implemented by a variety of agencies including parks, recreation, or conservation agencies and organizations.

Wetlands Protection

Due to the built out nature of Keansburg, there are very few areas of wetlands left within the Borough. Most areas of wetlands within Keansburg are located in the Conservation Recreation Zone District. The State regulates wetlands protection through NJDEP freshwater and coastal wetland permit programs.

Erosion and Sediment Control

Soil erosion and sediment control is regulated through New Jersey's Soil Erosion and Sediment Control Act and is administered by the Freehold Soil Conservation District.

There is a lot of erosion around the area of the Waackaack Creek that should be stabilized and mitigated.

Natural Area Preservation

Areas of snow fencing have been and should continue be installed to preserve the dune areas.

Natural Area Restoration

The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation plan recommends that the Borough of Keansburg improve 2.6 miles of 200 feet wide beach that was substantially damaged by Hurricane Sandy. The HMP recommends increasing the height and width of the dunes to the 100 year storm elevation as well as dune maintenance planting dune grass and maintaining access points. The goal of this project is to protect lives and property from flood inundation and flood hazards of the Raritan River, to reduce the need for emergency services during flood events and to reduce or eliminate repetitive flooding of these homes thereby reduce claims under the NFIP. The proposed improvements will protect the Borough from storm surges and limit the access points of stormwater into the Borough. The Floodplain Management Plan Committee suggested that the height and width of the dunes be further increased to meet the minimum requirements of the 540 sq. ft. rule as per FEMA mapping requirements the Levee Analysis Mapping Program (LAMP).

Water Quality Improvement

Green infrastructure techniques can be used to promote resiliency in the Borough of Keansburg and improve the water quality entering Raritan Bay. Green infrastructure uses permeable surfaces, landscape formations, and plant material to intercept stormwater runoff before it enters storm drains by promoting infiltration. Its use can promote resiliency by mitigating flooding and helping the township to quickly recover from storms. Additionally, green infrastructure captures runoff pollution and prevents it from entering waterways. The Borough's Green Team is in the process of designing a rain garden with rain barrels as a demonstration site in Keansburg. Additionally, impervious coverage is regulated in the zoning ordinance. However, the Floodplain Management Plan Committee felt there was much room for improvement in the enforcement of this ordinance. The New Jersey DEP also regulates water quality.

Coastal Barrier Protection

Keansburg is located along the Raritan Bay and has an extensive dune system in place along the waterfront. The beachfront and dunes are protected by dune conservation areas.

Environmental Corridors

This is not applicable to the Borough of Keansburg.

Natural Functions Protection

Dunes and wetlands are important protection against flooding. They act as buffers. The Borough DPW is in the process of installing snow fencing around the dunes to protect them from people walking over them.

EMERGENCY SERVICES

Emergency services are measures taken during an emergency to minimize its impact. These measures are usually the responsibility of municipal or county emergency management staff and the owners or operators of major or critical facilities.

Hazard Threat Recognition

Prior to storm events, warnings are issued by the National Weather Service.

Hazards Warning

The Borough of Keansburg already alerts its residents to hazards through a Reverse 911 calling system and News Channel 12 Broadcasts. Additionally the Borough website and AM radio can be used for hazard warnings. Early warnings give residents time to prepare for the hazard and evacuate if necessary, resulting in reductions to the loss of life and property from an event.

Hazards Response Operations

The Borough adopted an Emergency Operations Procedures Manual in 2015 to set forth general policies and procedures to be carried out by municipal and volunteer entities in order to provide the citizens of the Borough with an effective integrated emergency response plan.

Critical Facilities Protection

All of Keansburg's critical facilities with the exception of the Department of Public Works Building are located within the SFHA. The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation plan recommends the following actions to protect critical facilities in Keansburg:

- Relocate the police headquarters and emergency operation center from 179 Carr Avenue to a more advantageous and less flood-prone property in the Borough. As a result of Hurricane Sandy, police vehicles and equipment in the borough were damaged and response services were hindered because of the flood waters, debris and power outages. The relocation of the police building would allow the department to run an effective response to future emergency, and reduce risk to equipment and personnel.
- Develop a plan to acquire funding for emergency backup power generators in critical care facilities and stormwater pump stations. This will aid the borough in acquiring funding for emergency power generators to be installed in crucial care facilities. During major storms like Hurricane Sandy these facilities were not adequate enough to sustain life without power. Residents were transferred to hospitals at the boroughs expense, which was in the hundreds of thousands of dollars. Backup power generation will allow these facilities to act as emergency shelters during storm events and prevent unnecessary costs to the borough and protect health and safety of its residents.

Health and Safety Maintenance

Clearing streets and removing debris after a flood event is the responsibility of the Borough Department of Public Works. The Borough is coordinating with Monmouth County to join a network of building inspectors to allow for a quicker inspection of structures after a storm event. The Floodplain Management Plan committee felt that better coordination with the County should be addressed for reentry after a storm event.

STRUCTURAL PROJECTS

Structural projects keep flood waters away from an area with a levee, reservoir, or other flood control measure. They are usually designed by engineers and managed or maintained by the public works staff.

Reservoirs

This is not applicable to the Borough of Keansburg.

Bulkheads

The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation Plan recommends that Keansburg extend bulkheads for the entire length of Waackaack Creek as well as dredge the creek to increase stormwater storage capacity. Improvements will protect the borough from storm surges and limit the access points of the stormwater into the borough. This work is needed to safeguard lives and property from imminent hazard of floodwater and erosion. The committee felt that the Bridges at Laurel Ave, 4th Street, and 10th Street in Keansburg should also be raised.

Levees/ floodwalls

The Borough should petition FEMA and the Federal Government to redesign the dunes. If the project was designated as an approved levee, the Borough would benefit from a BFE reduction. However, it does not have a solid core. The dunes should be redone to current standards.

Diversions

This is not applicable to the Borough of Keansburg.

Stormwater Pumps

The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation Plan recommends installing three new flood proofed stormwater pump stations in the Borough with a permanent back-up generator at each. Additionally, two existing pump stations would be flood proofed and have backup generators installed. The Hazard Mitigation Plan also recommends removing and replacing the existing deteriorated stormwater collections infrastructure to protect against pump station failure in the event of power loss and/or flooding and to ensure continued operation of the Borough's stormwater conveyance system.

Channel Modifications

The creek was dredged last year. However, the Floodplain Management Plan Committee feel the channel could be extended for the entire length of Waackaack Creek.

Storm Drain Improvements

There are currently five (5) construction projects underway. The committee would like to see more projects and upgrades wherever possible.

PUBLIC INFORMATION

Public Information activities advise property owners, potential property owners and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains. In Keansburg, these activities are implemented largely by the Borough's construction official and CRS coordinator.

Map Information

Copies of the FIRM maps are available for the public to review in the Borough Construction Office. Ed Striedl, the Borough's construction official, is available to explain the maps as needed. A log should be kept of information provided to residents who come in to view maps or who call with questions for CRS credit documentation. Additionally, Borough residents can be directed to the Region 2 Coastal website for more information.

Outreach Projects

The Borough has a presence at community events such as movie nights and the National Night Out and provides flyers at these events on flooding and hazard response. The 2014 Draft Monmouth County Multi-Jurisdictional All Hazards Mitigation Plan recommends the Borough create an outreach program to help residents prepare for disasters. The proposed outreach program will help to better prepare the borough residents for natural disasters.

Real Estate Disclosure

To date the Borough has had a difficult time coordinating with local realtors. Ways in which the Borough can reach out to local realtors informing them of Keansburg's flood hazards and the information available to them should be investigated.

Library

The Monmouth County Library System keeps current FEMA publications on flooding, which Keansburg gets CRS credit for as a participating municipality in the Monmouth County Library System.

Technical Assistance

Ed Striedl, Borough construction official and CRS coordinator, provides technical information on a daily basis to anyone who calls or visits his office. Additionally, pamphlets and flood information are provided throughout the Borough.

Environmental Education

The Keansburg Green Team does a number of community education and outreach activities. They are currently in the process of constructing a rain garden and installing rain barrels on Borough property.

IX. ACTION PLAN

The previous chapter presented a wide range of possible floodplain management activities to address the goals established by the Floodplain Management Plan Steering Committee. This chapter presents an Action Plan that describes which activities should be implemented, who is responsible for implementing the activity, the deadline for completing the activity, the proposed budget and the funding source. The Committee realizes that there are many proposed activities, and that not all activities can be completed immediately based on available funds. The Borough should initially focus on those projects that are economically feasible and will aid in the recovery and resiliency of the Borough. The following priority levels were therefore established:

- High Priority – Activities in this category are critical to protecting the Borough’s critical facilities and creating a more resilient community. The benefits of these activities far outweigh the costs. Funding for these projects is currently in place or there is the high likelihood for grant funds to be secured in the near future. It is recommended that the majority of these projects be completed prior to the next hurricane season.
- Medium Priority – Activities in this category are necessary to increase the Borough’s resiliency and provide flood protection. Benefits outweigh the costs; however, funding has not yet been secured for those activities with physical improvements. The Borough should continue to seek grants and other funding sources for these activities. It is recommended that these projects be completed in the next three years as funding becomes available.
- Low Priority – Activities in this category will mitigate hazard risks for the Borough and are cost-effective. However, it is understood that these projects are not as critical as those identified as high or medium priority and that funding may be difficult to obtain for some of the larger construction projects.
- Ongoing – Activities in this category are required on a continuous or regular basis to be effective. These activities do not require special funds outside of the Borough’s standard budget.

The following is the recommended Action Plan for the Borough of Keansburg:

PREVENTATIVE MEASURES

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source
Update the Floodplain Management Plan	High	Borough Staff and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)
Create an automated and expedited system for zoning and construction permit administration	High	Borough Staff and T&M Associates	October 2015	\$25,000	NJDCA Grant (secured)
			2016		Borough General Funds
Develop a Geographic Information System (GIS) Program	High	Borough Staff and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)
Update Zoning Ordinances related to flooding, grading and stormwater management	Medium	Borough Staff and T&M Associates	Ongoing	Borough Staff Time	NJDCA Grant & Borough General Funds
Continue participation in the Community Rating System (CRS) Program and work to upgrade to the next class.	Ongoing	Ed Striedl	October 2015	Borough Staff Time	Borough General Funds
Continue to enforce building codes to require building, renovations, and re-building to be built using best available data	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds
Incorporate the principles of the 2014 Multi-Jurisdictional All Hazard Mitigation Plan into the Borough Master Plan	Medium	Borough Staff and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)
Maintain and clean the Borough drainage system, streams, and ditches.	Ongoing	Department of Public Works	April-October	Borough Staff Time	Borough General Funds
Undertake tree trimming and pruning	Ongoing	Department of Public Works	Ongoing	Borough Staff Time	Borough General Funds

PROPERTY PROTECTION

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source
Adopt requirements to maintain the best available data for base flood elevation for properties within the Borough	Ongoing	Ed Striedl	Ongoing	Borough Staff Time	Borough General Funds
Continue to participate in the National Flood Insurance Program	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds
Elevate 2,500 homes within the Borough to higher standards and elevations	Medium	Homeowners	Ongoing	Will vary by home	Potential HMGP, RREM, ICC
Relocate the Police Station to the 500 year flood elevation	High	Borough Staff, T&M Associates & Project Architect (Goldstein Partnership)	Anticipated Completion by 12/31/16	Final budet subject to Bid Results (ongoing)	FEMA / Borough Funds

NATURAL RESOURCE PROTECTION

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source
Continued maintenance of the dunes and Creek dredging projects	High	United States Army Corp of Engineers/ NJDOT	Ongoing	TBD	United States Army Corp of Engineers & the State of New Jersey
Continue snow fencing and dune maintenance program	Ongoing	DPW	Ongoing	Borough Staff Time	Borough General Funds

EMERGENCY SERVICES

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source
Prepare a Debris Management Plan	Medium	Borough Staff and T&M Associates	TBD	\$20,000	NJDCA Grant
Relocate the Police Headquarters (see also property protection)	High	Borough Staff, T&M Associates & Project Architect (Goldstein Partnership)	Anticipated Completion by 12/31/16	Final budet subject to Bid Results (ongoing)	FEMA / Borough Funds
Acquire emergency backup generators for critical care facilities	High	Borough Staff and T&M Associates	Ongoing	TBD	TBD
Maintain the Borough's various hazard warning systems and educate the public on these systems	Ongoing	Borough Office of Emergency Mgmt.	Ongoing	Borough Staff Time	Borough General Funds
Develop a GIS database and user interface to aid with Emergency Management activities	High	Borough Staff and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)

STRUCTURAL PROJECTS

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source
Extend bulkheads for the entire length of Waackaack Creek and dredge the entire Creek.	Medium	Blue Acres and NJDOT	As funding becomes available	TBD	The State of New Jersey
Redesign the dunes to be a certifiable dune system.	Medium	United States Army Corp of Engineers	As funding becomes available	TBD	USACOE
Develop a GIS database and user interface to catalog and inventory all infrastructure owned by the Borough to build a Borough- wide Capital Improvement Program	High	Borough Staff and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)
Install three new flood proofed stormwater pump stations with permanent backup generators	Medium	Borough Staff and T&M Associates	As funding becomes available	TBD	Potential HMGP
Flood proof the existing two stormwater pump stations	Medium	Borough Staff and T&M Associates	As funding becomes available	\$320,000	HMGP

PUBLIC INFORMATION

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source
Implement the GIS program and it available to the public	High	Borough Staff and T&M Associates	October 2015	Borough Staff Time	Borough General Funds
Maintain flood information section on the Borough website	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds
Maintain the Borough's reverse 911 system to assist in communication for all hazards and increase the Borough's presence on social media	Ongoing	Police and School District	Ongoing	Borough Staff Time	Borough General Funds
Send out information of flood hazards and flood insurance with tax and water bills	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds
Send an annual letter to all real estate companies, lending agencies, and insurance companies on available flood information	Medium	Borough staff	Ongoing	Borough Staff Time	Borough General Funds
Continue Police, Fire, OEM and Borough outreach and local events	Ongoing	Borough staff	Ongoing	Borough Staff Time	Borough General Funds
Support the initiatives of the Borough's Green Team	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds

X. PLAN IMPLEMENTATION & MAINTENANCE

It is anticipated that this Plan will be introduced to the Borough Planning Board on September 14, 2015 and then adopted on October 12 2015. The Plan will also be adopted by the Borough Council by a formal Resolution on September 24, 2015.

This Floodplain Management Plan is intended to be a dynamic document, adapting to changes in flood hazards and the needs of the Borough of Keansburg. The recommendations and actions identified in this plan should be implemented by the designated lead for each action item as funding and resources become available. Changes in future conditions and funding availability may determine the timeline for when some actions get implemented. As the plan is evaluated each year and updated every five years, the goals and objectives of this plan should also be evaluated and revised as necessary.

The Borough's CRS Coordinator will be responsible for monitoring the plan and ensuring that the Floodplain Management Plan Steering Committee will meet at least once per year to aid with the yearly plan evaluation. The original members of the committee will remain, unless they wish to be replaced; in which case a like representative will replace them. The committee will review the plan on an annual basis to evaluate changes to hazard conditions, goals and objectives, and progress made towards objectives. The committee will identify any necessary changes or revision to the plan. The annual review will include:

- A review of the original plan;
- Identification of any flood, hurricane, or other disaster that has impacted Keansburg since the last review;
- Review of action items from the original plan, including what has been accomplished;
- Discussion on why actions have not been completed;
- Where vulnerabilities have increased, identify why and what additional measures can be taken to decrease the vulnerability of that area to flood hazards;
- Recommendations for new projects or revised action items; and
- Survey of available resources to address action items.

This Floodplain Management Plan will be updated every five years and reviewed for CRS credit according to the CRS Coordinator's Manual in effect at the time. The 5-year update must include the following steps to retain CRS credit:

- The update must be conducted by a committee;

- A public meeting must be conducted to review and receive comments on the draft update;
- Review of new studies, reports, and technical information of the community's needs, goals, and plans for the area;
- New floodplain or hazard mapping;
- Identification of additional repetitive loss properties or completed mitigation projects;
- Discussion of any major flood or other disasters that have occurred since the plan was adopted;
- Review of any other changes in flooding conditions or development exposed to flooding or other hazards;
- Goals must be evaluated to determine if they are still appropriate;
- The action plan will be revised to account for projects that have been completed, dropped, or changed, and for changes in the hazard and problem assessments; and
- The update shall be adopted by the community's governing body.

Appendix A: Ordinance Forming Steering Committee

BOROUGH OF KEANSBURG
MUNICIPAL COUNCIL & REDEVELOPMENT AGENCY
March 25, 2015
Meeting Minutes

Resolutions:

RESOLUTION # 15-042A Creation of Flood Plain Management Committee

BE IT RESOLVED by the Borough Council of the Borough of Keansburg, County of Monmouth and State of New Jersey as follows:

THAT, the following be and they are hereby appointed as members of the Borough of Keansburg Flood Plain Management Committee

Mayor Thomas Foley, Councilman Arthur Boden

Borough Manager – Chief Raymond O’Hare

Borough Clerk/Housing and Community Development – Thomas Cusick

Construction Official, Floodplain Manager, Planning/Zoning, Code Enforcement – Ed Striedl

Police/OEM – Chief James Pigott or designee

Department of Public Works – Dennis O’Keefe or designee

Parks and Recreation – Ginger Rogan

T&M Associates/Engineering – Francis Mullan, P.E. or designee

The committee shall select from its members a chair, by majority vote of the committee. Committee members shall review and provide input concerning the development of the Floodplain Management Plan which is being developed by the Township’s Engineering Consultant, T&M Associates. The committee shall adopt a formal meeting schedule at the first meeting. All meetings shall be open to the public and advertised upon the Borough’s webpage.

That a certified copy of this resolution be forwarded to the Francis Mullan, T & M Associates and the members stated above.

Open to the Public:

Mr. Cusick asked for a roll call vote to open the meeting to the public

Roll Call

Appendix B: Steering Committee Meeting Outlines

Borough of Keansburg
Floodplain Management Plan
Committee Meeting
Thursday, July 30, 2015

The Keansburg Floodplain Management Committee held a committee meeting on July 30, 2015 at 2 pm. An ad notifying of same was posted on the Borough web site. In attendance were the following:

1. Dan Mattson, T & M Associates, Borough Engineer
2. Ed Striedl, Keansburg CFM
3. Jim Falco, Public Works
4. James Pigott, Chief of Police
5. Ginger Rogan, OEM Deputy
6. Ray O'Hare, Borough Manager
7. Christine Bell, T & M Associates

Christine Bell led the meeting and discussed the following:

This Floodplain Management Plan will be written following the process outlined by the *Community Rating System (CRS)*. This process consists of 10 steps. At this meeting **Step # 4, Assess the Hazard** was discussed. The main hazard in Keansburg for the purpose of this Floodplain Management Plan is flooding.

Assess the Hazard:

Flooding generally occurs throughout the town when it rains during a high tide. New pump stations have helped to reduce the time roads remain flooded. Some areas that generally flood include:

- Forest Ave – approx. 1 ft. of water
- Shore Blvd – near Twilight Ave & Lawrence Ave
- Woodland and Shore Blvd. – water level floods to curb
- Center Ave by Fireman's Park- approx. 9 – 10 inches.
- Lawrence Ave (this area experienced the biggest breach during Sandy)
- Lincoln Ave
- Myrtle Ave
- Garfield and Ramsey – approx. 6-8 in of water
- The site of the old police building

Residents know if streets will badly flood during a rainstorm by watching and listening to the weather reports and reviewing the applicable tide charts and calendars. Other issues causing flooding in the Borough include old pipes and an old drainage system.

The effective FIRM map, ABFE, and Preliminary FIRM map include most of Keansburg within the Special Flood Hazard Area. Areas in V zones are located along the Bayfront. The V (velocity) zone is the area where waves greater than 3 feet are likely during 100 year storm event. Much of the rest of Keansburg is located in the AE zone, which is an area that will flood during 100 year storm event. There is no Coastal A zone located in Keansburg. However, the Coastal A zone is the area between A & V zone, where waves less than 3 feet are possible. The new NJ Building Code will make it mandatory that homes within the coastal A zone are built to V zone standards.

SLOSH models provided by JCNERR show that during Category 1, 2, & 3 storms events, much of the Borough would be impacted by storm surge.

Coastal erosion is another flood hazard which has a large impact on the Borough of Keansburg. Areas prone to erosion include: Woodland Ave, Seeley Ave, Beachway, Shore Blvd, Creek Rd, Murray lane, and Roland St.

The 2014 Monmouth County All Hazards Mitigation Plan, of which Keansburg is a participating municipality, addresses all hazards within the Borough.

The next meeting of the Floodplain Management Plan Committee will be August 6th at 10am. The meeting was adjourned at 2:50 pm.

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Borough of Keansburg
Floodplain Management Plan
Committee Meeting
Thursday, August 6th, 2015

The Keansburg Floodplain Management Committee held a committee meeting on August 6th, 2015 at 10 am. An ad notifying of same was posted on the Borough web site. In attendance were the following:

1. Dan Mattson, T & M Associates, Borough Engineer
2. Ed Striedl, Keansburg CFM
3. Jim Falco, Public Works
4. James Pigott, Chief of Police
5. Ginger Rogan, Resident
6. Christine Bell, T & M Associates

Christine Bell led the meeting and discussed the following:

Assess the Problem:

Problems occur from development in the flood hazard area. Identify problems relevant to each flood related hazard discussed in Assess the Hazard:

1. Impact on life, safety, and the need for warning and evacuations

- a. Evacuation procedures
 - i. Fire departments walk door-to-door notifying residents to evacuate (used to get reimbursed from FEMA, do not any longer)
 - ii. There are two (2) reverse 911 systems used by the schools and police department
 - iii. OEM notifies residents via Chanel 12 news, outside sirens, and on social media
 - iv. Schools and Fire houses are used as shelters
- b. Emergency Operating Procedures- manual was updated in 2015
- c. Re-entry
 - i. Once flooding has receded residents are allowed to return
 - ii. Information on Borough website
 - iii. After Sandy, when homes were placard-ed an additional informational sheet was attached.
 - iv. Dennis Pinno from Hazlet is coordinating a pool of inspectors to come into hard hit areas and get inspections completed quickly
 - v. Coordination with the County after Sandy was key

2. Public health and health hazards

- a. Mold- New Jersey has no mold regulations, this is a huge problem
 - i. Will not recognize national/ international code
 - ii. Borough requests that rentals have testing done prior to C.O.
- b. Standing Water & Sewage
 - i. Stormwater drain-down times depend on tide schedule
 - ii. Sewer clean out opens and can potentially surcharge
- c. Storm Damaged & Debris
 - i. Have permit to use existing -large vacant lot as debris collection area
 - ii. Borough is considering writing Debris Management Plan
 - iii. County monitored debris site during past events

d. Abandoned Residences

- i. Issues for long term maintenance
- ii. Over-growth/Maintenance on properties
- iii. Tax liens

3. **Critical facilities and infrastructure**

- a. Municipal Building- in flood zone, no flood waters during Sandy or Irene
- b. Police Department- flooded during Sandy, in the process of moving to a less flood-prone location and will be built to 500 year flood
- c. Fire Department- New Point Fire Dept. and EMS had 4 feet of water during Sandy
- d. Public Works Site- in flood zone
- e. Sewer Pump Stations-
 - i. 2 stormwater pump stations flooded during Sandy
 - ii. One (1) Sanitary Sewer Pump Station was flooded, but maintained functionality
- e.f. Many parks had to be rebuilt after Sandy
- f.g. Schools- St. Ann's elementary school had flooding in the basement
- g.h. Nursing Homes- all were okay except for Ocean View, has not been reopened.
- h.i. The old Shamrock Site on Route 36, east of Main Street Intersection is a designated spot to move municipal and civilian cars for storage during flood events
- i.j. The water treatment plant is not in the flood zone
- k. Flood Insurance on Borough owned buildings-
 - i. ~~i.~~ In the process of acquiring for all eligible buildings-
 - i.ii. ~~i.ii.~~ All currently have elevation certificates

4. Economy and major employers

- a. Economic impacts due to high flood insurance costs
- b. Loss of Jobs
 - i. Bayside had to evacuate due to lack of electricity- has since installed a 30,000 kilowatt generator on roof
 - ii. Beverly Hills Manor- still vacant, never cleaned out
- c. Amusement and Water Park have been rebuilt, but they sustained significant damage

5. Number and types of affected buildings

	Borough Total	100- Year Floodplain	500- year Floodplain	100- Year + 500- Year Floodplain	Percent Located within the 100- Year Floodplain
Structures	3,329	2,976	264	3,240	89.40%
Properties	3,469	3,189	245	3,434	91.93%
Land Area (acres)	557.91	469.02	66.15	535.15	84.07%

6. Historical damage

- a. Repetitive Loss
- b. All NFIP claims
- c. Areas with lots of flood damage: Carr Ave, Forest Ave, Lincoln Ave, Shore Blvd near Lawrence
- d. Hurricane Sandy
 - i. 347 substantially damaged properties- now possibly up to 370 with no information on many homes stiff
 - ii. 22 roads damaged
 - iii. Water and sewer mains damaged at 7 locations
- e. People who receive money from FEMA or Flood Insurance should be required to build to highest standards in order to receive money in future

7. Development, redevelopment, and population trends

- a. Hopefully less damage in future as any development or redevelopment will have to be built to compliance of higher standards. Additionally, the dunes have been repaired.
- b. Surge of vacancies after storm
- c. The number of foreclosures is a huge issue with a lasting impact. There are a number of short sales. These do not help the community.

| The next meeting of the Floodplain Management Plan Committee will be August 13th at 10 -am. There will be a public information session on Monday, August 10th, at 6 pm. The meeting was adjourned at 10:50 am.

Borough of Keansburg
Floodplain Management Plan
Committee Meeting
Thursday, August 13th, 2015

The Borough of Keansburg Floodplain Management Committee held a meeting on August 13, 2015 at 10 am. The meeting was posted on the Borough website. In attendance were the following:

1. Dan Mattson, T & M Associates
2. Ginger Rogan, Resident
3. James Falco, DPW
4. Christine Bell, T & M Associates
5. Kathy Burgess, Code Enforcement and Construction

Christine Bell led the meeting and discussed the following:

Setting Goals:

The goals should set the context for the subsequent review of floodplain management activities and drafting of the action plan. They should incorporate or be consistent with other community goals for the affected areas. The goals must address all flood-related problems identified in the "Assess the Problem" step. Activities must fall under the following categories:

1. Preventive
2. Property Protection
3. Natural Resource Protection
4. Emergency Services
5. Structural Projects
6. Public Information

Relevant goals from Keansburg's planning documents were discussed for their relevancy and whether they should be included as goals. Discussion points are in bold italics. Goals discussed include:

1988 Master Plan

- Secure the public's safety from fire, flood, panic, and other natural and man-made disasters with particular emphasis on preserving and maintaining the integrity and protective features of the Borough beach-dune system. ***This should be included, minus the fire bit for this plan.***
- Encourage the most appropriate use of land consistent with its suitability for development. ***Relevant, but should be worded differently.***
- Protect wetlands and areas with scenic, cultural and recreational values. ***This should be elaborated to include dunes and maintenance.***

2005 Beachway Avenue Waterfront Redevelopment Plan

- Enhance public access to waterfront recreation uses. ***Not relevant to this plan.***
- Maintain views of the coastline and enjoyment for the public; ***Not relevant to this plan.***
- Undertake infrastructure improvements involving water and sewer lines, streets, curbs, sidewalks, and parking. ***This should be discussed in the context of flooding issues.***

2006 Main Street Node, Carr and Raritan Avenues, Route 36 Gateway Redevelopment Plan

- Enhance public access to waterfront recreation uses; ***Not relevant to this plan.***
- Maintain views of the coastline and enjoyment for the public; ***Not relevant to this plan.***
- Develop land use and building requirements specific to the redevelopment parcels that are sensitive to the adjoining neighborhoods; ***Not relevant to this plan.***

- Undertake infrastructure improvements involving water and sewer lines, streets, curbs, sidewalks, and parking. ***This should be discussed in the context of flooding issues.***

2014 Strategic Recovery Planning Report

- Promoting public awareness of hazard mitigation and resiliency issues; ***This should be a goal of the Floodplain Management Plan.***
- Focusing public agencies on community vulnerabilities to hazards such as flooding; ***This should be incorporated into a goal of the Floodplain Management Plan.***
- Encouraging regional solutions to flood- and storm-related impacts; ***This should be incorporated into a goal of the Floodplain Management Plan.***
- Ensuring that future capital projects are designed and constructed to incorporate features that are resilient to storm- and flood-related impacts; and ***This should be incorporated into a goal of the Floodplain Management Plan.***
- Encouraging/supporting the use of sustainable development techniques and green building design in future development and redevelopment. ***This should be a goal of the Floodplain Management Plan.***

Other Potential goals were discussed for their relevancy and whether they should be included as goals. Discussion points are in bold italics. Goals discussed include:

- Reduce loss from flood damage and other hazards through codes and standards. ***Included in already stated goals.***
- Educate stakeholders and the public about floodplain management and stormwater management. ***Included in already stated goals.***
- Protect the natural resources and qualities of the Township, including wetlands, stream corridors, open space, and areas with scenic, cultural, and recreational values. ***Incorporate this goal with the addition of dune protection.***
- Protect, ***update,*** and ensure that Borough infrastructure and critical facilities are able to withstand future hazard events and remain operational during and after such events. ***This should be included as a goal of the Floodplain Management Plan.***
- Secure the public's safety from floods and other natural hazards. Adapt efforts accordingly to reflect updated flood levels and data from FEMA and NOAA. ***This is covered elsewhere.***
- Utilize various planning tools and programs to better prepare for and respond to floods and other natural disasters. ***This should be included as a goal of the Floodplain Management Plan.***
- Reduce flood damage, including damage to life, property and the environment. ***This is covered elsewhere.***
- Protect the natural resources and qualities of the Borough, including freshwater and saltwater wetlands, floodplains, stream corridors, open space, steep slopes, and areas with scenic, cultural, and recreational values. ***This is covered elsewhere.***
- Ensure that Borough infrastructure and critical facilities are able to withstand future flood events and remain operational during and after such events. ***This is covered elsewhere.***
- Provide adequate resources to Borough residents and business owners so they are properly informed of the natural hazards they face and the precautions they can take to protect their properties. ***This should be included.***
- Provide public information resources to Township residents and business owners so they are informed of the natural hazards within the community and the precautions they can take to protect their properties. ***This is covered elsewhere.***
- Reduce Flooding by Preventing Tidal Backflow. ***Not relevant.***
- Facilitate and upgrade stormwater facilities for proper drainage. ***This is covered elsewhere.***

- Decrease wave wash over by maintaining beach and dune program. ***This is covered elsewhere.***
- Review latest technology for flood reduction. ***This is covered elsewhere.***
- Reduce losses by promoting retrofitting or elevating flood prone structures. ***This is covered elsewhere.***
- Promote public education on all measures for flood safety and loss reduction. ***This is covered elsewhere.***
- Reduce impermeable surface area to facilitate drainage. ***Native plantings and pervious cover should be encouraged throughout the Borough.***
- Reduce losses by continuing to develop and improve the existing warning system and maintain it as well as hold drills and table top exercises to test the plan. ***This is covered elsewhere.***
- Update Evacuation Plan and other Hazard Plans. ***This has been recently completed.***
- Acquire open space property located in the Floodplain to prevent development. ***There is little available open space in Keansburg.***

The ***following goals*** were determined by the Floodplain Management Plan Committee to be included in the 2015 Keansburg Floodplain Management Plan:

1. Secure the public's safety from flood, panic, and other natural and man-made disasters with particular emphasis on preserving and maintaining the integrity and protective features of the Borough's drainage and beach-dune system.
2. Promote public awareness of hazard mitigation and resiliency issues and provide adequate resources to Borough residents and business owners so they are properly informed of the natural hazards they face and the precautions they can take to protect their properties.
3. Utilize various planning tools and programs to better prepare for and respond to floods and other natural disasters.
4. Maintain and protect dunes, wetlands, and other natural areas.
5. Protect, update, and ensure that Borough infrastructure and critical facilities are able to withstand future hazard events and remain operational during and after such events.
6. Encourage and support the use of sustainable development techniques, green building design, native landscaping, and encourage the use of pervious cover in future development and redevelopment.
7. Promote regional coordination between Local, County, and State Governments and OEMs to identify community vulnerabilities, promote regional resiliency to hazard events, and coordinate post-disaster recovery efforts.

Keansburg
Floodplain Management Plan
Committee Meeting
Thursday, August 20th, 2015

The Keansburg Floodplain Management Plan Committee held a committee meeting on August 20th, 2015 at 10 am. The meeting was posted on the Borough website. In attendance were the following:

1. Christine Bell, T&M Associates
2. Dan Mattson, T&M Associates
3. Ginger Rogan, Resident
4. James Falco, DPW
5. Ed Striedl, Keansburg CFM (*via phone*)

Christine Bell led the meeting and discussed the following:

Review Possible Activities: The plan reviews different activities that could prevent or reduce the severity of the problems described in the Assess the Problem section. This is a systematic review of a wide range of activities to ensure that all possible measures are explored, not just the traditional approaches of flood control, acquisition, and regulation of land use. The review, including the pros and cons of each activity, must be included in the plan document. Figure 510-4 was distributed and lists some of the types of activities that could be reviewed under each of the six credited categories.

The Borough of Keansburg is a zoned community with a Master Plan, Zoning Ordinance and Subdivision Ordinance. Building construction is regulated through the adoption of model codes including the International Residential Code. The community is well established and for all intent built out, with construction occurring as redevelopment. Land use patterns within the Borough are well established.

As the Borough's guiding documents relate to Floodplain Management, it would not be appropriate for the land use plan or zoning ordinance to deter or prohibit development in the flood zone since a majority of the housing stock is within the flood zone and these areas are already fully developed. The chief flooding problem in Keansburg is Pre-FIRM housing that was constructed without consideration

for flood risk and nuisance flooding during high-tide rain events. Therefore, the focus should be on promoting resiliency and flood compliance. The Borough continues to enforce the elevations on the “best available data” FIRM maps in order to be conservative and promote a higher level of flood safety. Existing Borough Planning documents were examined including the Master Plan. The goals and objectives of the Land Use Plan were discussed as they relate to floodplain management planning. Since the community is fully developed amending the land use plan will do little to alter development in the floodplain. The credited categories and activities were discussed as follows:

1. **Preventive**- activities which keep flood problems from getting worse.
 - a. **Floodplain mapping and data**- FEMA has studied the entire town and the entire floodplain is mapped and currently in the process of being updated. Mapping will be done by T&M as part of the Phase II Post Sandy Planning Assistance Grant Program.
 - b. **Open space preservation**- Almost all existing open space consists of beachfront and conservation recreation zone district and several parks throughout the Borough.
 - c. **Floodplain regulations**- Are in place throughout the Borough by zoning and development regulations at the local, county, state, and federal levels.
 - d. **Erosion setbacks**- could be useful for Creek Rd and Lawrence Rd. There is no written requirement to require bulk heading to prevent erosion.
 - e. **Planning and zoning**- The community is built out. Zoning ordinances have limited ability to prevent new development in the floodplain. They can however promote resiliency by regulating impervious cover and allowing for residences to be built or reconstructed above base flood elevation
 - f. **Stormwater management**- The Pump Station on Beacon Light Rd is has limited access
 - g. **Drainage system maintenance**- The DPW cleans basins every wed. from April until Sept.
 - h. **Building codes**:
 - i. Requires homes to be elevated using best available data
 - ii. Should add additional requirements like requiring mechanical systems to be elevated
 - i. **Tree Trimming**- HMP Action: Tree Trimming and pruning to prevent downed power lines
2. **Property Protection**- Activities that are usually undertaken by property owners on a building-by-building or parcel basis.
 - a. **Relocation**- Police Building is being relocated.

- b. **Acquisition-** Not feasible on a large scale, however some homes have been purchased on Garfield, Francis, and Greenwood is in the works, additionally the Borough has pursued funding for additional property acquisitions along Creek Road via the Blue Acres grant program
 - c. **Building elevation-** this should be encouraged and is the best method for reducing flood problems and losses.
 - i. Newly constructed or substantially damaged buildings are required to comply with the best available data for base flood elevations
 - ii. Additionally, the state requires one foot of freeboard; and as part of its Flood Hazard Regulations the Borough flood code also requires a 1 foot freeboard.
 - iii. HMP action to raise 3,843 homes in the Borough.
 - d. **Retrofitting-** The Borough Police Building will be built to the 500 year flood elevation. Only commercial buildings are able to flood proof their buildings. For residential structures- encourage owners to fill basements to grade, install flood vents, and then get new elevation certificates
 - e. **Sewer backup protection-** The Borough has undertaken a project to clean and inspect its entire Sanitary Sewer system, this is anticipated to be completed in early 2016.
 - f. **Insurance-** insure against potential flood losses. Do not have to be in the flood zone for flood insurance.
 - i. Increase the Borough's rating in the CRS program
 - ii. Encourage residents to maintain flood insurance, even if they are not in a flood zone.
 - iii. Interact with residents informing them to pay close attention to their flood insurance policies.
3. **Natural Resource Protection-** activities which preserve or restore natural areas or the natural functions of floodplain and watershed areas.
- a. **Wetlands protection-** Wetlands protection through the NJDEP freshwater and coastal wetland permit programs are in place and are state regulations. Conservation Recreation zone also protects wetlands.
 - b. **Erosion and sediment control-** Regulated through the Freehold Soil Conservation District
 - c. **Natural area preservation-** Install snow fence

- d. **Natural area restoration-** Increase height and width of the dunes- to the 100 year storm elevation is not enough. Should be increased to meet 450 rule per the FEMA Mapping requirements and the LAMP program.
 - e. **Water quality improvement-** Impervious coverage is regulated in zoning ordinance. However, this should be enforced. NJDEP regulates water quality.
 - f. **Coastal barrier protection-** Existing dune system acts as natural barrier
 - g. **Environmental corridors-** This is not applicable to Keansburg
 - h. **Natural functions protection-** dunes and wetlands important
4. **Emergency Services-** measures that are taken during an emergency to minimize its impact. Usually the responsibility of city or county emergency management staff and the owners or operators of major or critical facilities.
- a. **Hazard threat recognition-** warnings issued by the National Weather Service
 - b. **Hazard warning-** Keansburg warns residents through Reverse 911 and News Channel 12
 - c. **Hazard response operations-** The Borough adopted an emergency operations procedure manual in 2015.
 - d. **Critical facilities protection-** Currently in the process of relocating the police headquarters from 179 Carr Avenue to 331 Carr Ave. Would like to acquire emergency backup power generators for critical care facilities and stormwater pump stations.
 - e. **Health and safety maintenance-** Clearing streets and removing Debris is performed through the Borough Department of Public Works. Borough is coordinating with County to join network of building inspectors. Better coordination with County could be discussed for reentry after a storm event.
5. **Structural Projects-** These projects keep flood waters away from an area with a levee, reservoir, or other flood control measures. They are usually designed by engineers and managed or maintained by public works staff.
- a. **Reservoirs-** Not applicable
 - b. **Bulkheads-** HMP action: Extend bulkhead for the entire length of Waackacck Creek as well as dredge the creek to increase stormwater storage capacity. Bridges should also be replaced and raised.
 - c. **Levees/floodwalls-** Petition FEMA and Federal Government to redesign the dunes. If the project was designated as an approved levee, the Borough would benefit from BFE reduction. However, it does not have a solid core. It should be redone to current standards.

- d. **Diversions-** Prevent blockage of flood waters
 - e. **Storm Water Pumps-** An action from the HMP was to install three new flood proofed stormwater pump stations in the Borough with a permanent back-up generator at each and flood proof the two existing pump stations.
 - f. **Channel modifications-** The Creek was dredged last year.
 - g. **Storm drain improvements-** upgrade where possible, would like to see more projects, Shore Blvd and E. Shore Blvd, 5 current construction projects.
6. **Public Information-** Activities which advise property owners, potential property owners, and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of local floodplains. They are usually implemented by a public information office. Michael Gardner spoke to what the Borough is already doing or plans to do.
- a. **Map information**
 - i. The Building department (Ed Striedl) explain maps to residents as requested on a regular basis.
 - b. **Outreach projects**
 - i. Hand out flyers at Borough events
 - ii. Recently participated in the National Night Out
 - iii. Create an outreach program to help residents prepare for disasters
 - c. **Real estate disclosure-** Ed Striedl could use some help in figuring out a plan to reach local realtors such as an annual letter sent to lending agencies, real estate companies, and insurance companies informing them they can get flood info from the building office
 - d. **Library-** the Monmouth County OEM coordinates with the Monmouth County Library system, in which Keansburg participates, to ensure materials on flooding are available for residents in all branches of the County library.
 - e. **Technical Assistance-** provided by the building department (Ed) on a daily basis
 - f. **Environmental education-** There is a Borough Green Team run by Jim Falco. They are in the process of building a demonstration rain garden and rain barrels.

Borough of Keansburg
Floodplain Management Plan
Committee Meeting
Thursday August 27th, 2015

The Keansburg Floodplain Management Plan Committee held a committee meeting on August 27th, 2015 at 10 am. The meeting was posted on the Borough website. In attendance were the following:

1. Christine Bell, T&M Associates
2. Dan Mattson, T&M Associates
3. Ginger Rogan, Resident
4. James Falco, DPW
5. Ed Striedl, Keansburg CFM
6. Chief Raymond O'Hare, Resident

Christine Bell led the meeting and discussed the following:

Action Plan: A wide range of possible floodplain management activities were discussed at the previous meeting to address the goals established by the Floodplain Management Plan Steering Committee. Proposed actions were identified and discussed as per the review of possible activities. Comments and changes to the proposed action plan identified at the committee meeting are marked in bold italics. Each action item was tied to a goal of the Floodplain Management Plan. The Goals of the Floodplain Management Plan are:

1. Secure the public's safety from flood, panic, and other natural and man-made disasters with particular emphasis on preserving and maintaining the integrity and protective features of the Borough's beach-dune system.
2. Promote public awareness of hazard mitigation and resiliency issues and provide adequate resources to Borough residents and business owners so they are properly informed of the natural hazards they face and the precautions they can take to protect their properties.
3. Utilize various planning tools and programs to better prepare for and respond to floods and other natural disasters.
4. Maintain and protect dunes, wetlands, and other natural areas.
5. Protect, update, and ensure that Borough infrastructure and critical facilities are able to withstand future hazard events and remain operational during and after such events.
6. Encourage and support the use of sustainable development techniques, green building design, native landscaping, and encourage the use of pervious cover in future development and redevelopment.
7. Promote regional coordination between Local, County, State, and Federal Governments and OEMs, FEMA, and the National Flood Insurance Program; to identify community vulnerabilities, promote regional resiliency to hazard events, and coordinate post-disaster recovery efforts.

An Action Plan will be established that describes which activities should be implemented, who is responsible for implementing the activity, the deadline for completing the activity, the proposed budget and the funding source; with the following priority levels:

- High Priority – Activities in this category are critical to protecting the Borough’s critical facilities and creating a more resilient community. The benefits of these activities far outweigh the costs. Funding for these projects is currently in place or there is the high likelihood for grant funds to be secured in the near future. It is recommended that the majority of these projects be completed prior to the next hurricane season.
- Medium Priority – Activities in this category are necessary to increase the Borough’s resiliency and provide flood protection. Benefits outweigh the costs; however, funding has not yet been secured for those activities with physical improvements. The Borough should continue to seek grants and other funding sources for these activities. It is recommended that these projects be completed in the next three years as funding becomes available.
- Low Priority – Activities in this category will mitigate hazard risks for the Borough and are cost-effective. However, it is understood that these projects are not as critical as those identified as high or medium priority and that funding may be difficult to obtain for some of the larger construction projects.
- Ongoing – Activities in this category are required on a continuous or regular basis to be effective. These activities do not require special funds outside of the Borough’s standard budget.

PREVENTATIVE MEASURES

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source	Meets Goal #
Update the Floodplain Management Plan	High	Borough Staff and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)	3
Create an automated and expedited system for zoning and construction permit administration	High	Borough Staff and T&M Associates	October 2015	\$25,000	NJDCA Grant (secured)	3
Develop a Geographic Information System (GIS) Program	High	Borough Staff and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)	3
Update Zoning Ordinances related to flooding, grading and stormwater management	High Medium	Borough Staff and T&M Associates	October 2015	Borough Staff Time	Borough General Funds	3

Continue participation in the Community Rating System (CRS) Program and consider upgrading to the next class.	Ongoing	Borough Staff	October 2015	Borough Staff Time	Borough General Funds	3
Continue to enforce building codes to require building, renovations, and re-building to meet the best available data	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds	3
Resist granting variances for building and impervious coverage	Ongoing	Borough Planning and Zoning Boards	Ongoing	Borough Staff Time	Borough General Funds	3, 6
Incorporate the principles of the 2014 Multi- Jurisdictional All Hazard Mitigation Plan into the Borough Master Plan	Medium	Borough Staff <i>and T&M Associates</i>	<i>October 2015</i>	<i>\$50,000</i>	<i>NJDCA Grant (secured)</i>	3, 7
Develop a GIS database and user interface to catalog and inventory all infrastructure owned by the Borough, including roadways and its stormwater and sanitary sewer collection systems. The will include up-to-date GPS mapping of the utility infrastructure, as well as inventory and classification of the road network to build a Borough-wide capital improvement plan.	High	Borough and T&M Associates	October 2015	\$50,000	NJDCA Grant (secured)	3, 7 <i>Move to structural</i>
Maintain and clean the Borough drainage system, streams and ditches	Ongoing	Department of Public Works	Ongoing	Borough Staff Time <i>April-Oct</i>	Borough General Funds	4
Undertake tree trimming and pruning <i>Used to have chipping program but no more.</i>	Ongoing	Department of Public Works	Ongoing	Borough Staff Time	Borough General Funds	4

Cooperate with board of ed. on maintenance						
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PROPERTY PROTECTION

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source	Meets Goal #
Adopt requirements to maintain the best available data for base flood elevation for properties within the Borough	High Ongoing	Borough Staff		Borough Staff Time	Borough General Funds	3
Continue to participate in the National Flood Insurance Program	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds	3
Elevate 3,843 2,500 homes within the Borough to higher standards and elevations	Ongoing Medium	Homeowners	Ongoing	Varies	HMGP, RREM, ICC, private sources	2,3
Increase the flood resiliency of critical facilities including the relocation of the Police Building to the 500 year flood level	High	Dan Mattson will provide info				5

NATURAL RESOURCE PROTECTION

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source	Meets Goal #
Increase the height and width Continue maintenance of the dunes. Dredge the creek.	Medium	Army Corp of Engineers NJDOT	These items were completed last year. Ongoing		USACOE NJDOT	1
Continue snow fencing and dune maintenance program	High Ongoing	DPW	Ongoing		General Funds	1

EMERGENCY SERVICES

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source	Meets Goal #
Prepare a Debris Management Plan	High	Borough Staff and T&M Associates		Potential Funding	NJDCA	7
Relocate the Police Headquarters	High	Borough Staff and T&M Associates			FEMA/ Borough	5
Acquire emergency backup power generators for critical care facilities	High	Borough Staff and T&M Associates	Ongoing		HMGP	5
Maintain the Borough's various hazard warning systems and educate the public on these systems	Ongoing	Borough Staff	Ongoing	Borough Staff Time	Borough General Funds	2,5

STRUCTURAL
PROJECTS

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source	Meets Goal #
Extend bulkheads for the entire length of Waackaack Creek and dredge the <i>entire</i> creek	Medium	Borough Staff/Contractor <i>Blue Acres/ NJDOT</i>			HMGP	1
Redesign the dunes to the 450 ft. LAMP Standards <i>to be a certifiable dune system</i>	Medium	USACOE			USACOE	1
Install 3 new flood proofed stormwater pump stations with permanent back-up generators and <i>(SPLIT)</i> flood proof the existing 2 stormwater pump stations.	Medium					5
	Medium	T&M and HMGP		\$320,000	HMGP	5

PUBLIC
INFORMATION

Action Item	Priority	Responsible Party	Deadline	Budget	Funding Source	Meets Goal #
Implement the GIS program and make available to the public	High	Borough Staff and T&M Associates	October 2015	Borough Staff Time	Borough General Funds	2
Maintain reverse 911 system to assist in communication for all hazards. Social Media	Ongoing	Police and Schools	Ongoing	Borough Staff Time	Borough General Funds	2
Continue Police, Fire, OEM and Borough outreach and local events	Ongoing	Borough staff	Ongoing	Borough Staff Time	Borough General Funds	2
Send an annual letter to all real estate companies, lending agencies, and insurance companies on available flood information	Ongoing	Borough staff	Ongoing	Borough Staff Time	Borough General Funds	2
Support Green Team Initiatives	Ongoing	Borough staff	Ongoing	Borough Staff Time	Borough General Funds	2
Send out flood info in tax and water bills	Ongoing	Borough staff	Ongoing	Borough Staff Time	Borough General Funds	2

Appendix C: Public Meetings Information



CALENDAR



NEWS



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Flood Plan Committee Meeting

August 6 @ 10:00 am - 11:00 am

The **FLOOD PLAIN MANAGEMENT COMMITTEE** WILL
MEET AT 10 am AT BOROUGH HALL
August 6th, 13th, 20th & 27th

**THE PUBLIC HEARINGS FOR THE
FLOOD PLAIN MANAGEMENT PLAN:**

WILL TAKE PLACE August 10th and September 14th
at 6:00 pm at Borough Hall

+ [GOOGLE CALENDAR](#)

+ [ICAL EXPORT](#)

Details

Date:

August 6

Time:

10:00 am - 11:00 am



CALENDAR



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FLOOD PLAIN MANAGEMENT HEARING

August 10 @ 6:00 pm - 6:30 pm

**THE PUBLIC HEARINGS FOR THE
FLOOD PLAIN MANAGEMENT PLAN:**

WILL TAKE PLACE August 10th and September 14th
at 6:00 pm at Borough Hall

[+ GOOGLE CALENDAR](#)

[+ ICAL EXPORT](#)

Details

Date:

August 10

Time:

6:00 pm - 6:30 pm

[« Flood Plan Committee Meeting](#)

[Planning Board Meeting »](#)



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FLOOD PLAIN COMMITTEE MEETING

August 20 @ 10:00 am - 11:00 am

The **FLOOD PLAIN MANAGEMENT COMMITTEE** WILL
MEET AT 10 am AT BOROUGH HALL
August 6th, 13th, 20th & 27th

**THE PUBLIC HEARINGS FOR THE
FLOOD PLAIN MANAGEMENT PLAN:**

WILL TAKE PLACE August 10th and September 14th
at 6:00 pm at Borough Hall

+ GOOGLE CALENDAR

+ ICAL EXPORT

Details

Date:

August 20

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CALENDAR



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FLOOD PLAIN MANAGEMENT COMMITTEE

August 27 @ 10:00 am - 11:00 am

The **FLOOD PLAIN MANAGEMENT COMMITTEE** WILL

MEET AT 10 am AT BOROUGH HALL

August 6th, 13th, 20th & 27th

**THE PUBLIC HEARINGS FOR THE
FLOOD PLAIN MANAGEMENT PLAN:**

WILL TAKE PLACE August 10th and September 14th

at 6:00 pm at Borough Hall

+ [GOOGLE CALENDAR](#)

+ [ICAL EXPORT](#)

Details

Date:

August 27

Time:

10:00 am - 11:00 am



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Month

Events for August 2015

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
26	27	28 Movies in the Park	29	30	31	1
2	3	4 NATIONAL NIGHT OUT Special Meeting Movies in the Park- Aug. 4 CANCELLED for National Night Out Event	5	6 Flood Plan Committee Meeting	7	8
9	10	11	12	13	14	15

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	FLOOD PLAIN MANAGEMENT HEARING Planning Board Meeting	Movies in the Park		SUMMER CONCERT SERIES FLOOD PLAIN COMMITTEE MEETING		
16	17	18 Movies in the Park	19 Recreation Committee Meeting	20 FLOOD PLAIN COMMITTEE MEETING SUMMER CONCERT SERIES	21	22 Local Beach Sweep
23	24	25 Movies in the Park	26 Council Meeting	27 FLOOD PLAIN MANAGEMENT COMMITTEE SUMMER CONCERT SERIES	28	29
30	31	1	2	3	4	5

« July

September »

+ EXPORT MONTH'S EVENTS

KEANSBURG HEADLINES

[Hot Rods & Food Trucks Coming Saturday, August 8](#)

Classic Cars and Food Trucks will pull into Keansburg Amusement Park and Runaway Rapids on Saturday, August 8 from 11 a.m. to 6 p.m.



[Keansburg, NJ Named a Top10 Most Affordable Beach Town By REALTOR Magazine](#)

REALTOR Magazine listed Keansburg, NJ among its top most affordable beach towns to buy a house in the country.

KEANSBURG CALENDAR

[Flood Plan Committee Meeting](#)

August 6 @ 10:00 am - 11:00 am

[FLOOD PLAIN MANAGEMENT HEARING](#)

August 10 @ 6:00 pm - 6:30 pm

[Planning Board Meeting](#)

August 10 @ 6:30 pm - 7:00 pm

[Movies in the Park](#)

August 11 @ 8:30 pm - 10:00 pm

[SUMMER CONCERT SERIES](#)

August 13 @ 7:00 am - 8:30 pm

[View All Events](#)

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Keansburg, New Jersey 07734 • (732)787-0215

Appendix D: Sample Letter to Outside Agencies



YOUR GOALS. OUR MISSION.

February 4, 2015

Stephanie Murray, Mayor
Middletown Township
1 Kings Highway
Middletown, NJ 07748

Dear Mayor Murray;

The Borough of Keansburg is currently in the process of preparing a Floodplain Management Plan to be incorporated as an element of the Borough Master Plan. The Floodplain Management Plan will identify and assess flood hazards within the Borough, establish the goals and objectives for floodplain management in Keansburg, and present a series of actions designed to minimize flooding and mitigate the impacts from flooding in the future. The Plan is being funded through a Post-Sandy Planning Assistance Grant issued by the New Jersey Department of Community Affairs (DCA). As we continue to recover from the effects of Superstorm Sandy, the Borough has prioritized flood prevention and mitigation as key elements of its post-Sandy planning strategy. The project implements recommendations of the Strategic Recovery Planning Report (SRPR) adopted by the Borough Council in June of 2014.

As part of the Floodplain Management planning process, we are seeking the input of valued stakeholders to develop a foundation for assessing known hazards and flood impacts in Keansburg. We would appreciate any information from your organization regarding flood hazards in the Borough of Keansburg and/ or anything your agency or organization is doing that may affect flooding or properties in flood-prone areas. Additionally, we would like to invite you, or another representative of your agency or organization to become more actively involved in our floodplain management planning process. Your input and involvement in this planning process is important to help identify key floodplain management issues affecting the Borough of Keansburg and to establish goals and objectives to make Keansburg more resilient to flooding events in the future.

Please contact Christine Bell, Staff Planner, T&M Associates at 732-671-6400 or cbell@tandmassociates.com on or before February 20, 2015 if you have any comments, suggestions, input, or would like to set up a meeting to discuss the floodplain management plan in greater detail.

Sincerely,

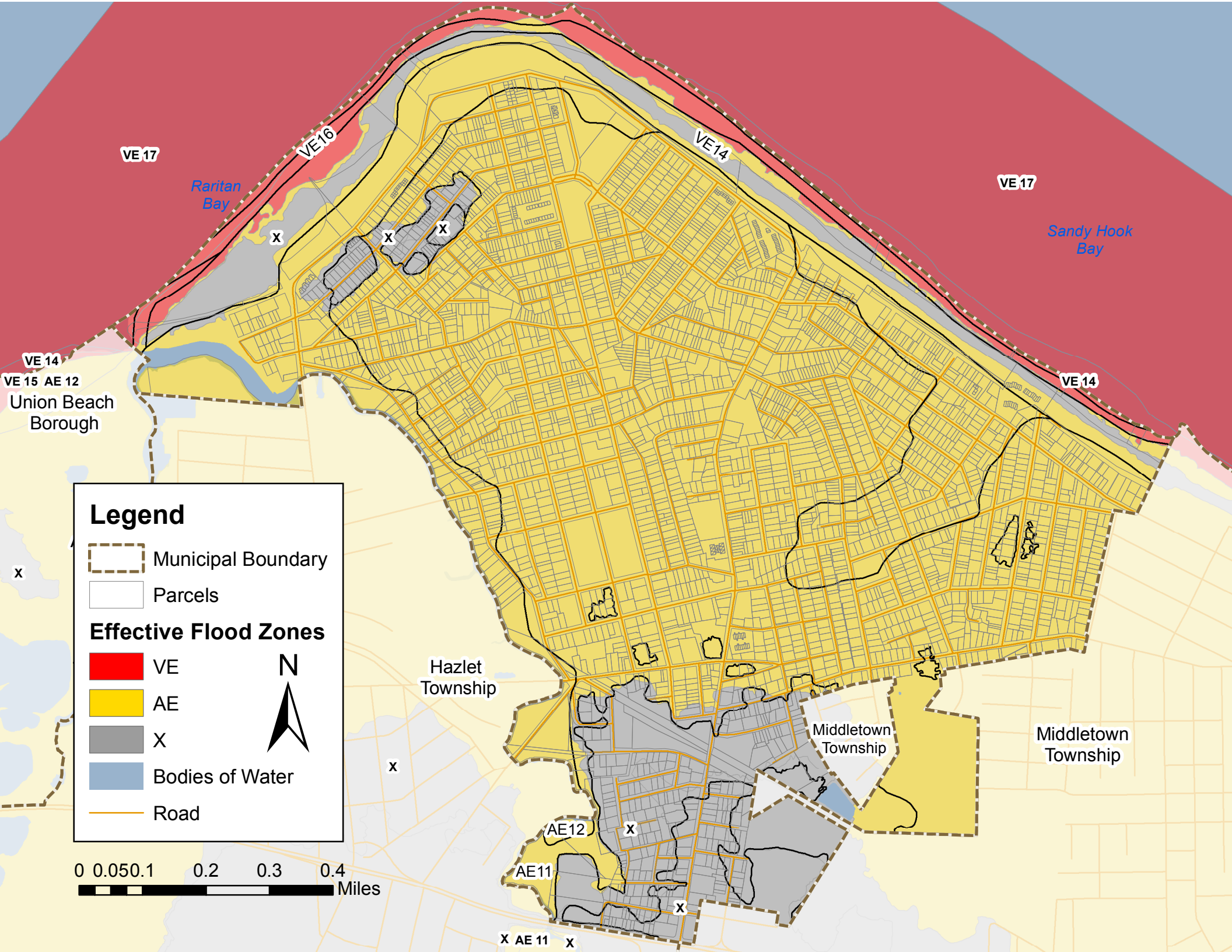
T & M Associates

FRANCIS W. MULLAN, P.E., C.M.E.
KEANSBURG BOROUGH ENGINEER

Appendix E: Log of Stakeholder Interactions

Organization	Contact	Sent	Responded
Middletown Township	Stephanie Murray	2/5/2015	
Borough of Union Beach	Paul J. Smith Jf.	2/5/2015	
Hazlet Township	James DiNardo	2/5/2015	
Monmouth County Planning Department - Community Rating System User Group	Joe Barris	2/5/2015	Responded by email - sent us County draft HMP
Monmouth County Office of Emergency Management	Margaret Murnane Brooks	2/5/2015	Responded by email - will assist in any way possible
Borough of Keansburg Police Department	James K. Pigott	2/5/2015	
Keansburg Fire Company No. 1		2/5/2015	
New Point Comfort Fire Co. No. 1		2/5/2015	
Keansburg Emergency Medical Services		2/5/2015	
Freehold Soil Conservation District	Ines Zimmerman	2/5/2015	
North Jersey Transportation Planning Authority	Zenobia Fields	2/5/2015	
Natural Resources Conservation Service - Somerset State Office	David Lamm	2/5/2015	Responded by email may be able to provide review and comment on the study as it progresses
NJ Coastal Management Program		2/5/2015	
FEMA Region II	Howard Wolf	2/5/2015	Responded with a phone call - needed to further explain purpose of proposed Plan
US Army Corps of Engineers - New York District		2/5/2015	
American Red Cross - Jersey Coast Chapter		2/5/2015	
Clean Ocean Action	Cindy Zipf	2/5/2015	
American Littoral Society	Helen Henderson	2/5/2015	Responded with a phone call - 30 min phone conversation, followed with email information on stormwater regulations
Jacques Cousteau National Estuarine Research Reserve	Christopher Huch	2/5/2015	sent JCNERR mapping. Met in person on 1/22/15 at CRS user group to discuss plans
Shore Builders Association of Central Jersey	Gina Woolley	2/5/2015	
Comcast Cable	Lawrence Fary	2/5/2015	
New Jersey American Water	Paul Richards	2/5/2015	
JCP&L	William Uellner	2/5/2015	
New Jersey Department of Environmental Protection	John H. Moyle	2/5/2015	
New Jersey Department of Environmental Protection	Joseph Ruggeri	2/5/2015	

Appendix F: Effective FIRM Map



VE 17

VE 16

VE 14

VE 17

Raritan Bay

Sandy Hook Bay

x

x

x

VE 14

VE 15 AE 12

Union Beach Borough

VE 14

Legend

Municipal Boundary

Parcels

Effective Flood Zones

VE

AE

X

Bodies of Water

Road



0 0.05 0.1 0.2 0.3 0.4 Miles

Hazlet Township

Middletown Township

Middletown Township

AE 12

AE 11

x AE 11 x

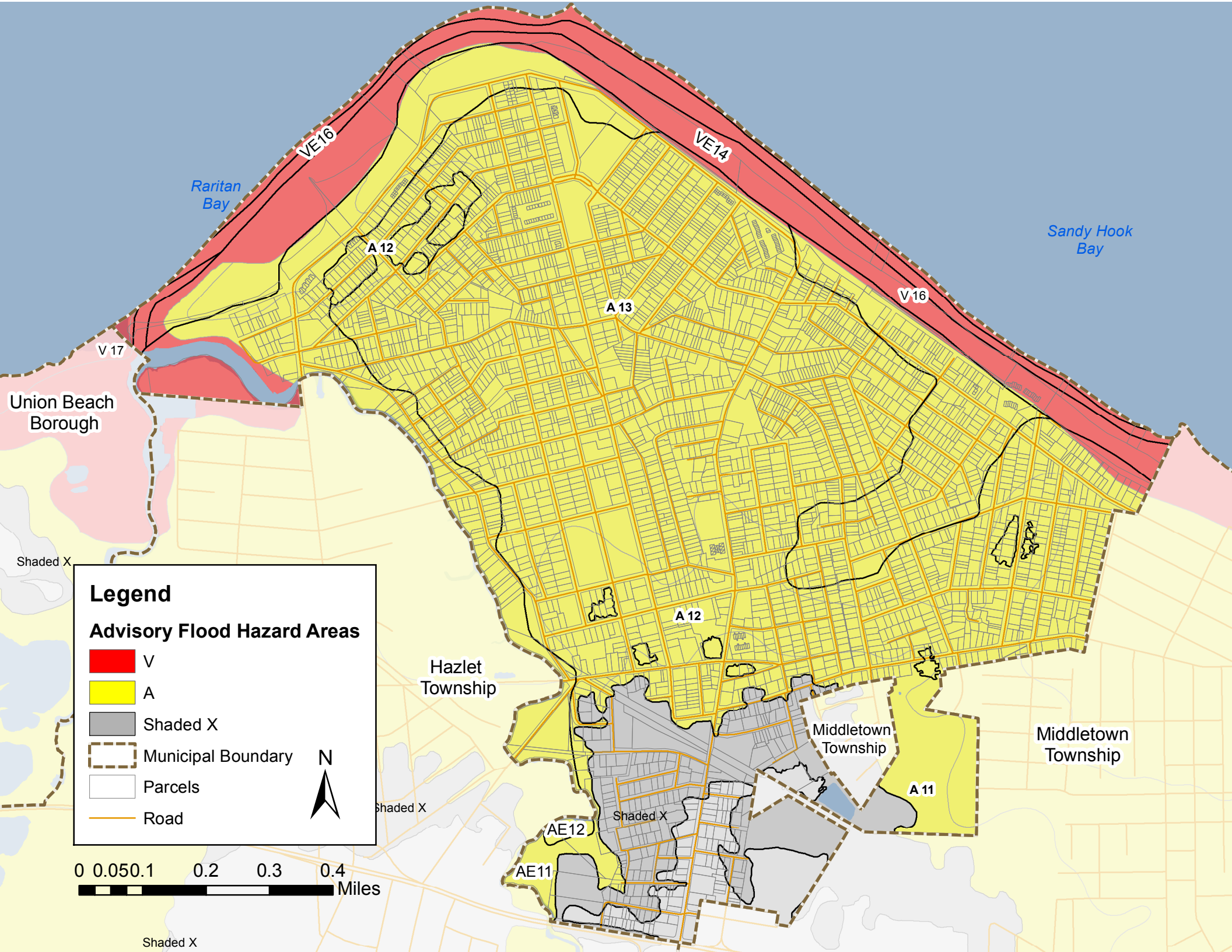
x

x

x

x

Appendix G: Advisory Base Flood Map



Raritan Bay

Sandy Hook Bay

VE16

VE14

V16

V17

A12

A13

Union Beach Borough

Shaded X

A12

Hazlet Township

Middletown Township

Middletown Township

A11

AE12

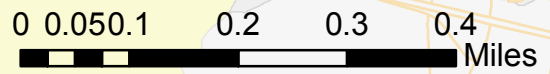
AE11

Shaded X

Legend

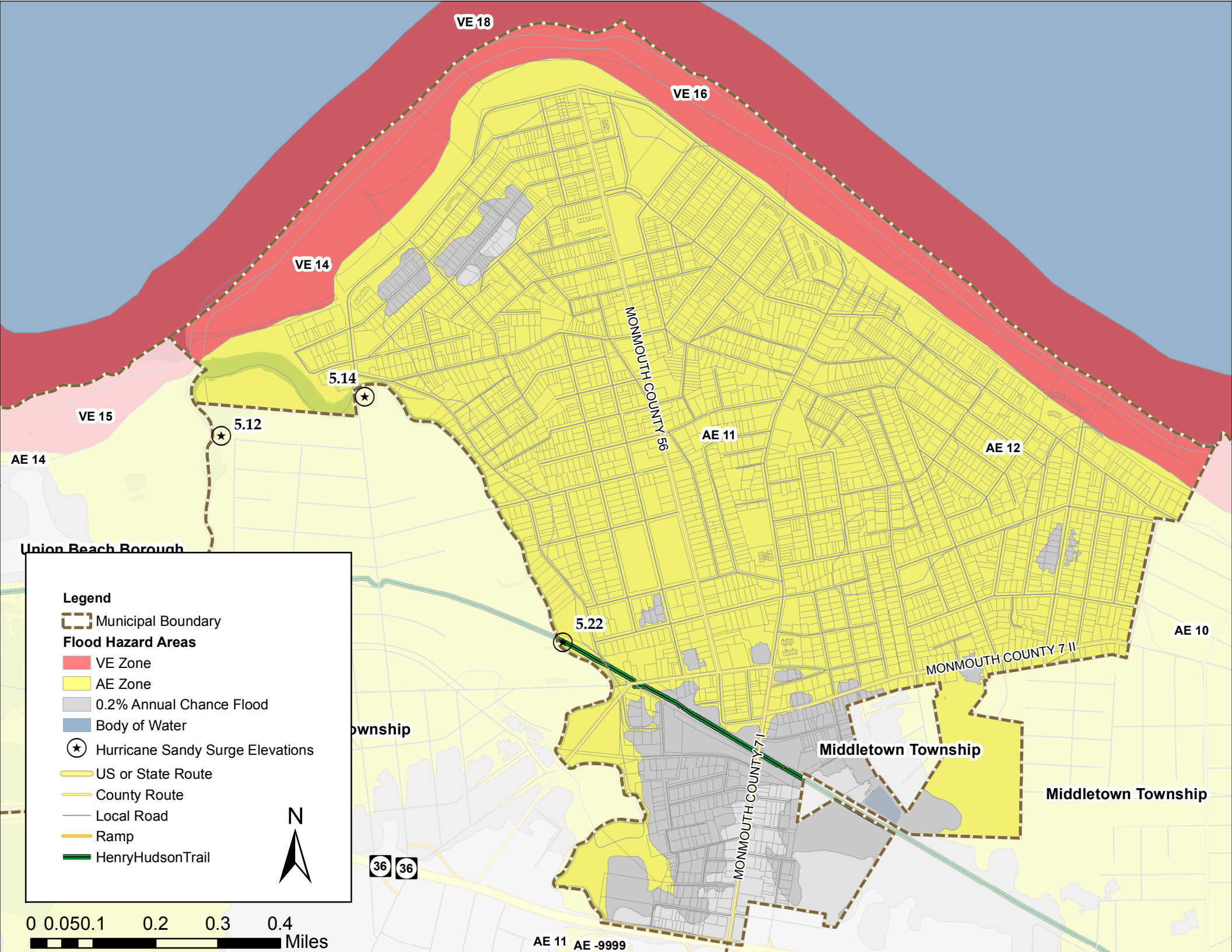
Advisory Flood Hazard Areas

- V
- A
- Shaded X
- Municipal Boundary
- Parcels
- Road














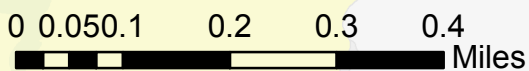
Shaded X

Appendix H: Preliminary FIRM Map



Legend

-  Municipal Boundary
- Flood Hazard Areas**
-  VE Zone
-  AE Zone
-  0.2% Annual Chance Flood
-  Body of Water
-  Hurricane Sandy Surge Elevations
-  US or State Route
-  County Route
-  Local Road
-  Ramp
-  HenryHudsonTrail



AE 11 AE -9999

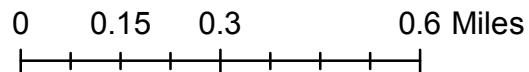
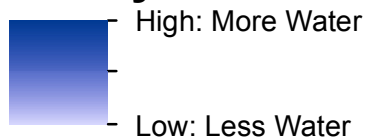
Appendix I: Sandy Surge Extents

Sandy Storm Surge Keansburg Borough

Legend

-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes

Sandy Storm Surge



Year 2010 Population: 10105

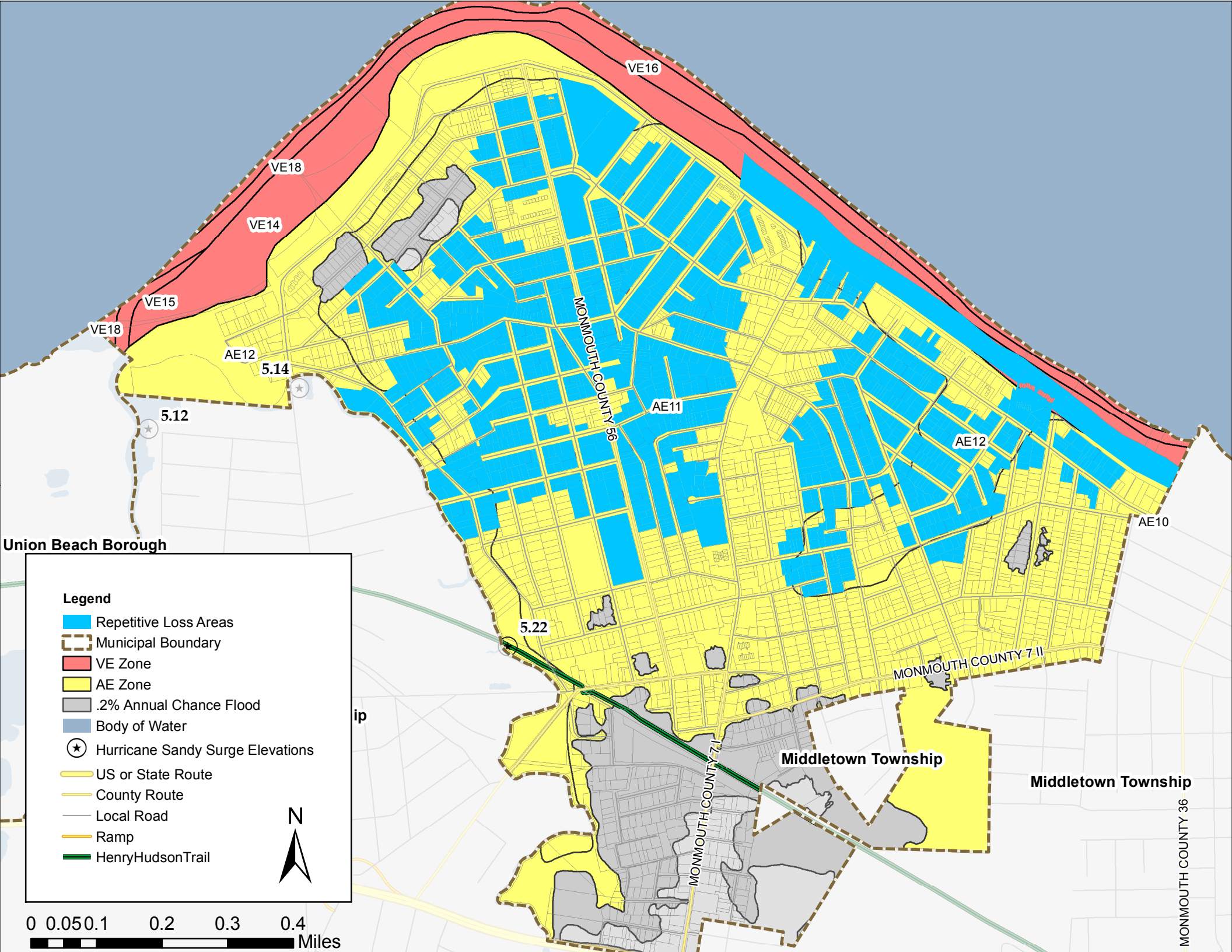
This map depicts the Sandy Storm Surge extents provided by FEMA. The depths are ranged in meters of inundation above ground level and are categorized in the legend above.

Map Authors: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis



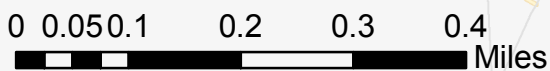
Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Appendix J: Repetitive Loss Areas Map



Legend

- Repetitive Loss Areas
- Municipal Boundary
- VE Zone
- AE Zone
- .2% Annual Chance Flood
- Body of Water
- ★ Hurricane Sandy Surge Elevations
- US or State Route
- County Route
- Local Road
- Ramp
- Henry Hudson Trail



VE18

VE15

VE14

VE16

AE12

5.14

5.12

MONMOUTH COUNTY 56

AE11

AE12

AE10

5.22

MONMOUTH COUNTY 7 II

MONMOUTH COUNTY 7 I

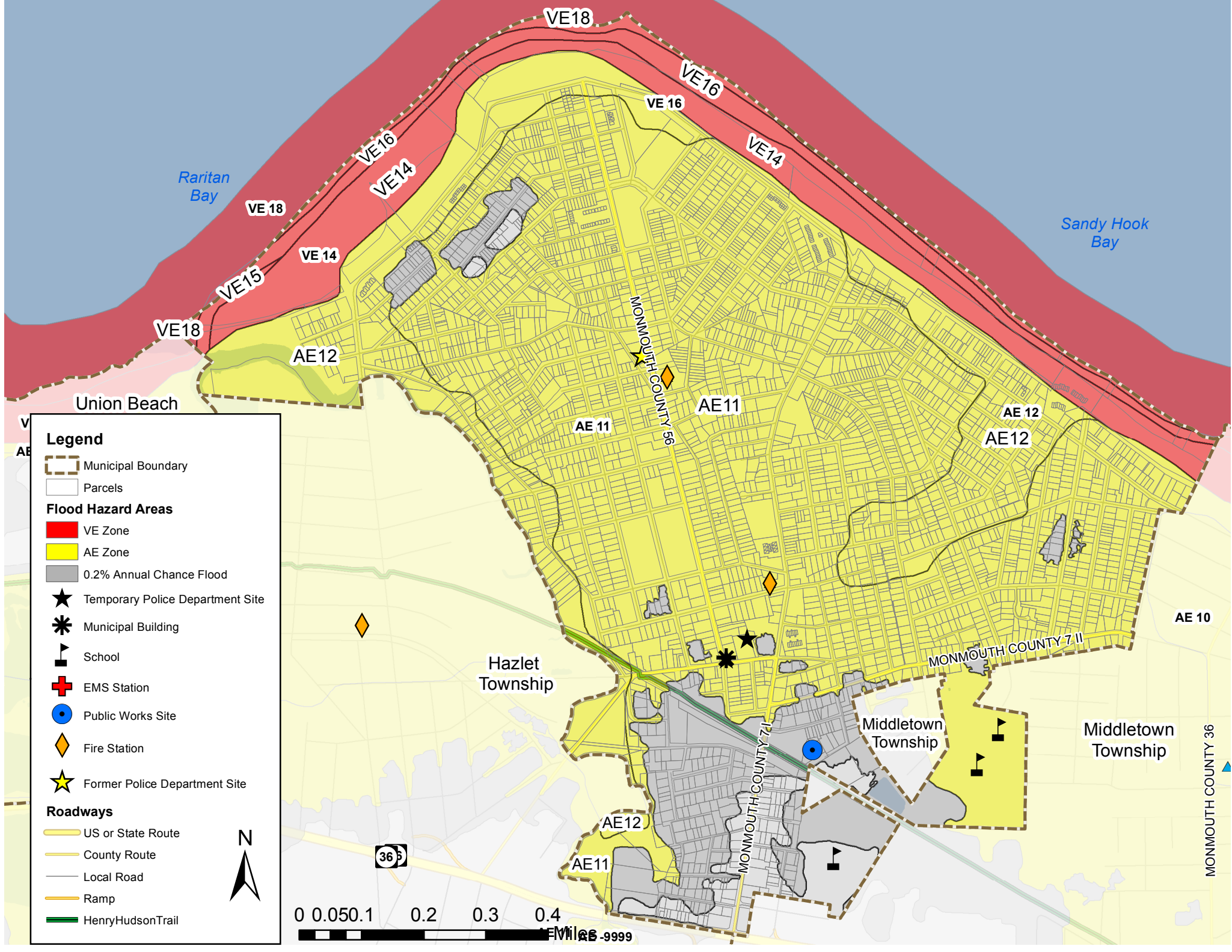
MONMOUTH COUNTY 36

Union Beach Borough

Middletown Township

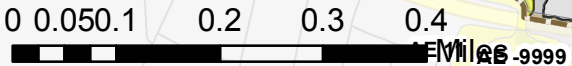
Middletown Township

Appendix K: Critical Facilities Map



Legend

- Municipal Boundary
- Parcels
- Flood Hazard Areas**
- VE Zone
- AE Zone
- 0.2% Annual Chance Flood
- Temporary Police Department Site
- Municipal Building
- School
- EMS Station
- Public Works Site
- Fire Station
- Former Police Department Site
- Roadways**
- US or State Route
- County Route
- Local Road
- Ramp
- HenryHudsonTrail



VE
AE

Union Beach

Raritan Bay

Sandy Hook Bay

Hazlet Township

Middletown Township

Middletown Township

VE18

VE18

VE14

VE16

VE14

VE18

VE16

VE16

VE14

AE12

AE11

AE11

AE12

AE12

AE10

AE12

AE11

MONMOUTH COUNTY 56

MONMOUTH COUNTY 71

MONMOUTH COUNTY 711

MONMOUTH COUNTY 36

36


FW116-9999

Appendix L: SLOSH Maps





Category 1 SLOSH Model

Keansburg Borough

Legend

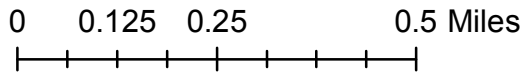
-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes

Category 1 SLOSH

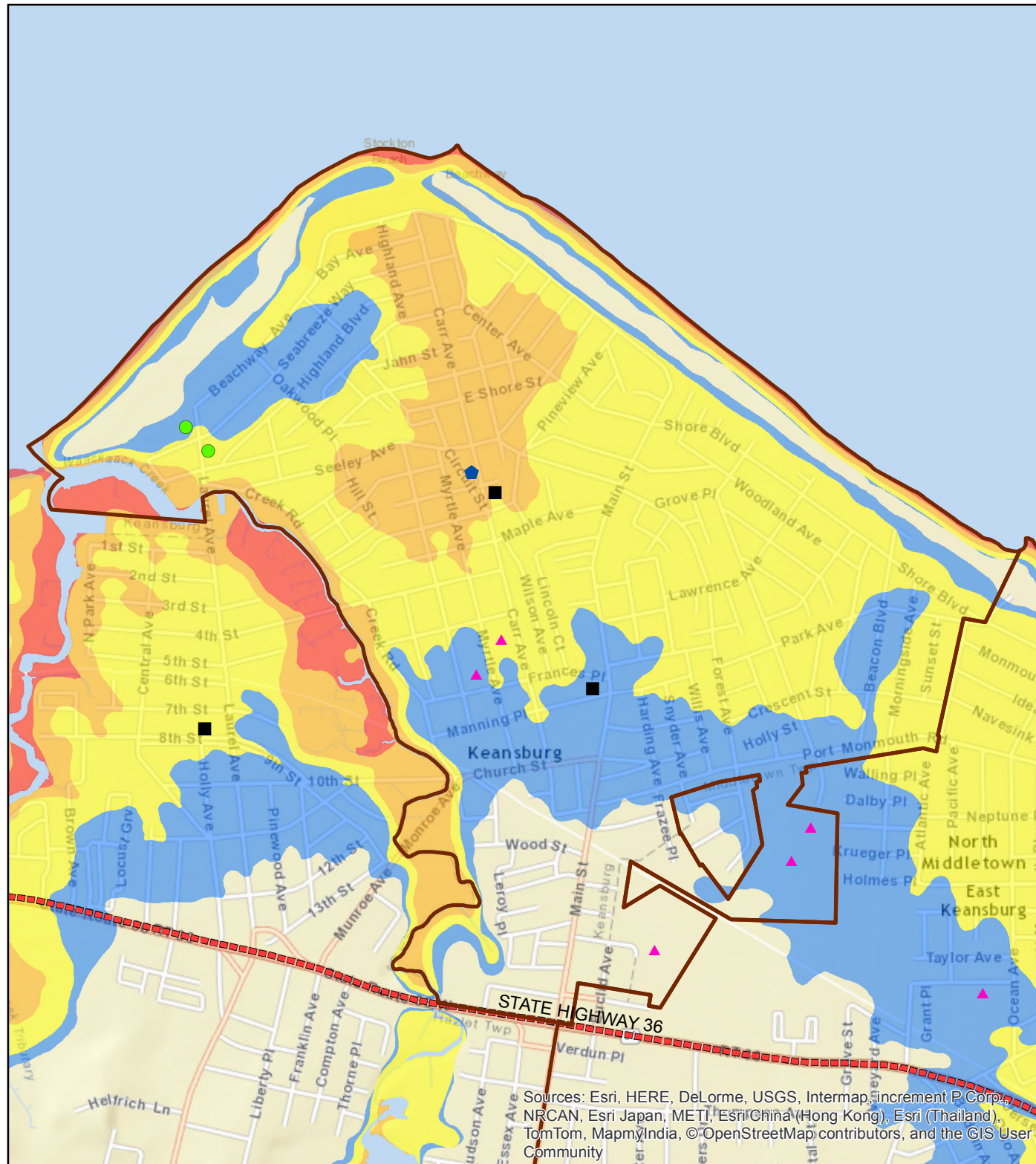
-  0 - 3 Feet Above Ground Level
-  3 - 6
-  6 - 9
-  > 9

Year 2010 Population: 10105

This map depicts the SLOSH model extents provided by NOAA. The depths are ranged from 0-9 or greater feet of inundation above ground level and are categorized in the legend above.



Map Author: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis






Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community





Category 2 SLOSH Model

Keansburg Borough

Legend

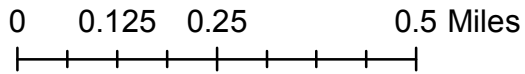
-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes

Category 2 SLOSH

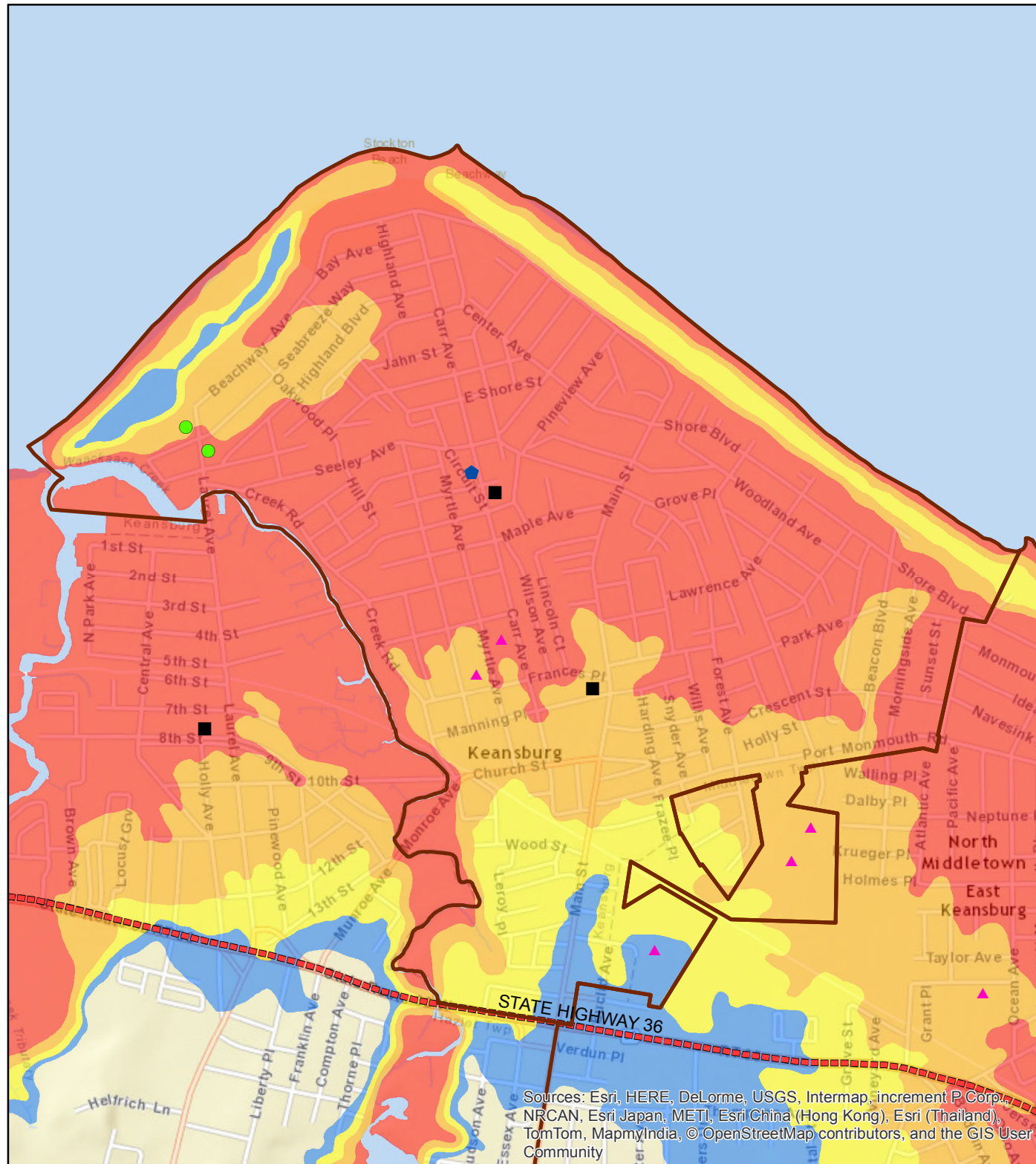
-  0 - 3 Feet Above Ground Level
-  3 - 6
-  6 - 9
-  > 9

Year 2010 Population: 10105

This map depicts the SLOSH model extents provided by NOAA. The depths are ranged from 0-9 or greater feet of inundation above ground level and are categorized in the legend above.



Map Author: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis





Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community





Category 3 SLOSH Model

Keansburg Borough

Legend

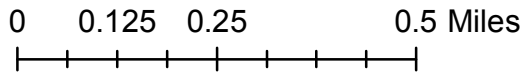
-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes

Category 3 SLOSH

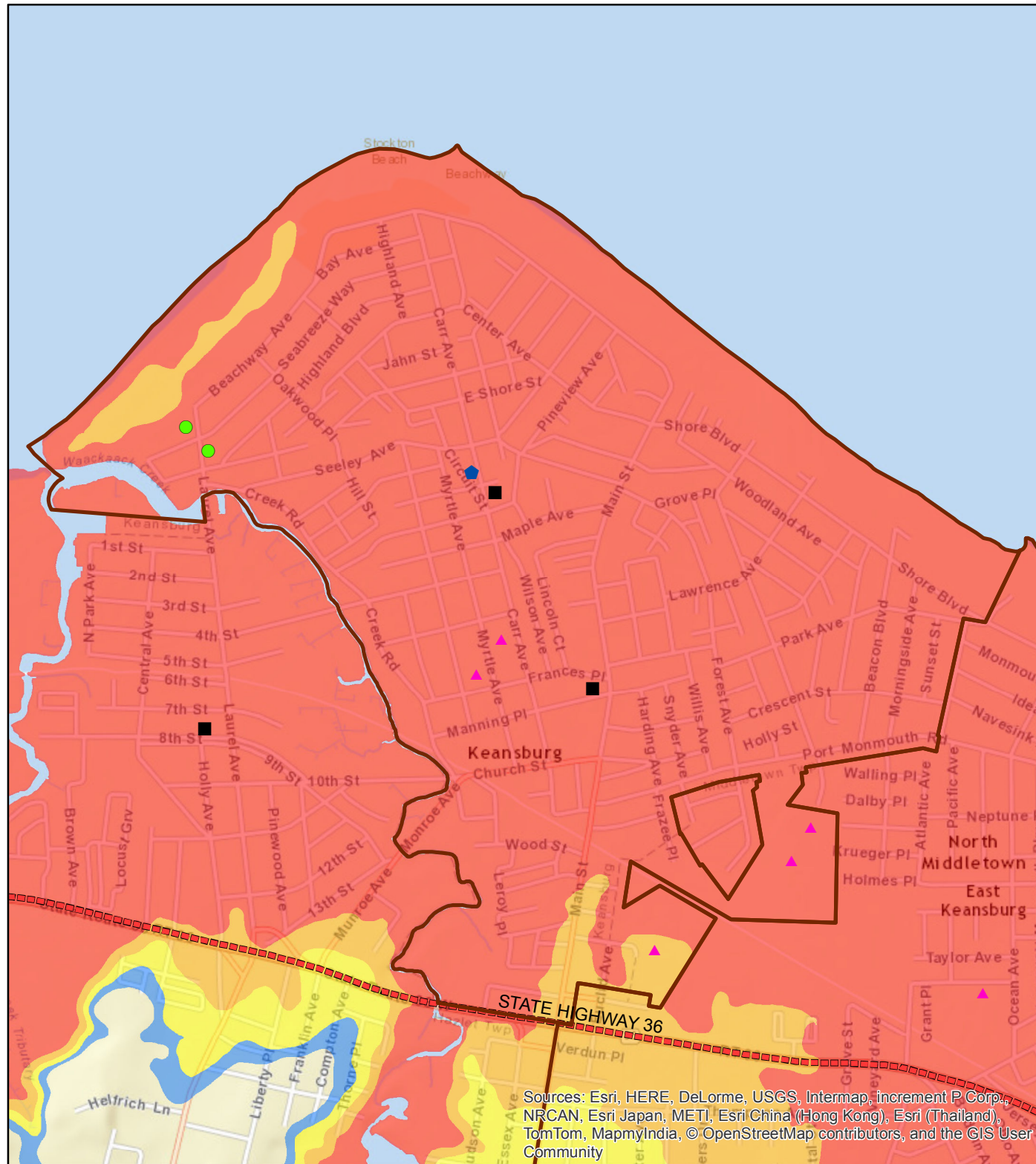
-  0 - 3 Feet Above Ground Level
-  3 - 6
-  6 - 9
-  > 9

Year 2010 Population: 10105

This map depicts the SLOSH model extents provided by NOAA. The depths are ranged from 0-9 or greater feet of inundation above ground level and are categorized in the legend above.



Map Author: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis











Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Appendix M: Sea Level Rise Maps

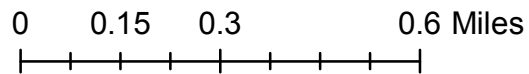
1 Foot of Sea Level Rise Keansburg Borough

Legend

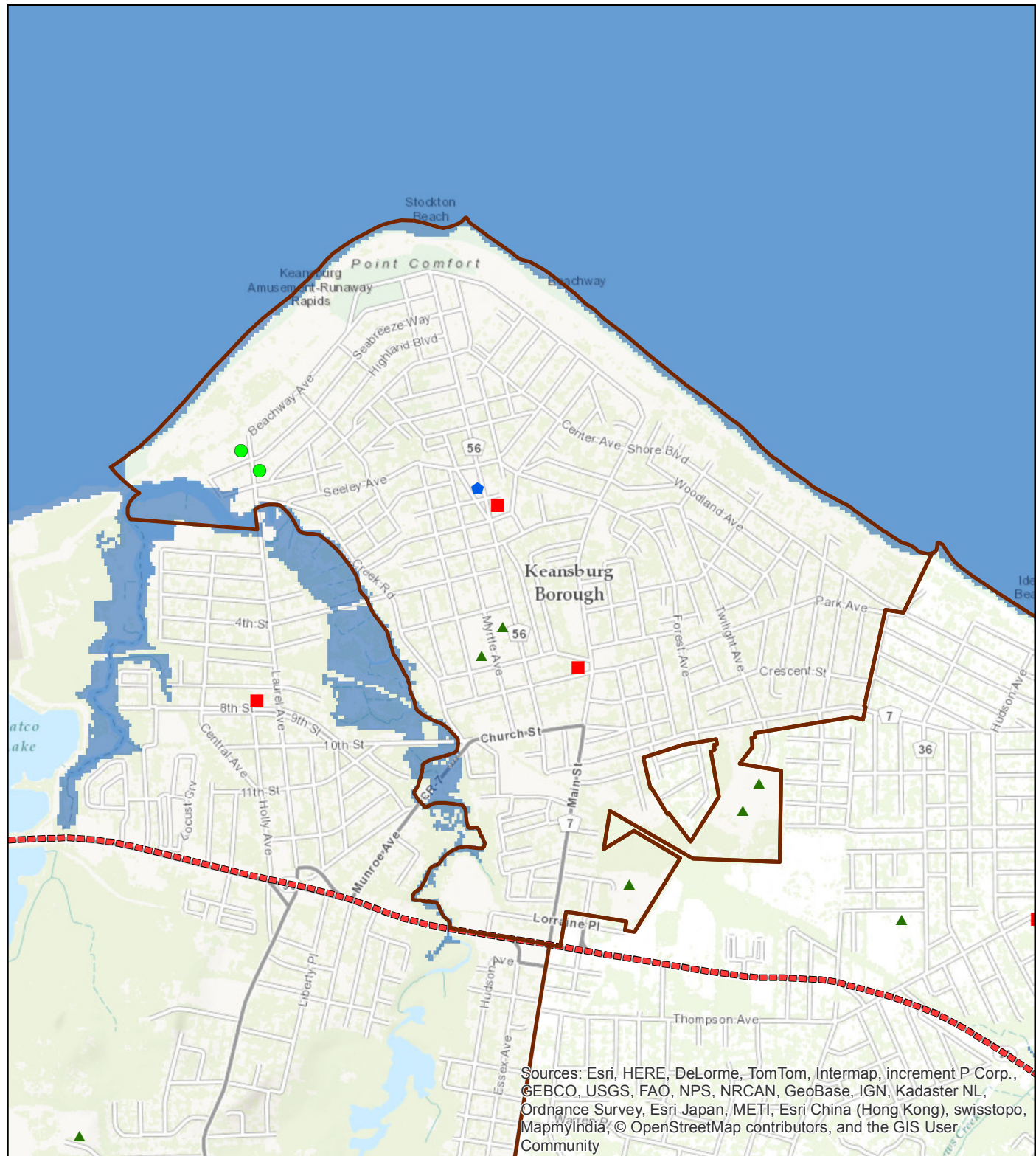
-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes
-  1ft SLR

Year 2010 Population: 10105

According to Kenneth G. Miller et al. in the 2013 study "A Geological Perspective on Sea-Level Rise and its Impacts Along the U.S. Mid-Atlantic Coast" a probable threat is the 1ft sea level rise condition that could be expected by 2050. This map depicts that sea level rise as well as the proceeding projections thereafter and is centered on target municipalities.










Map Author: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

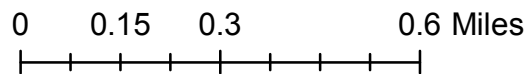
2 Feet of Sea Level Rise Keansburg Borough

Legend

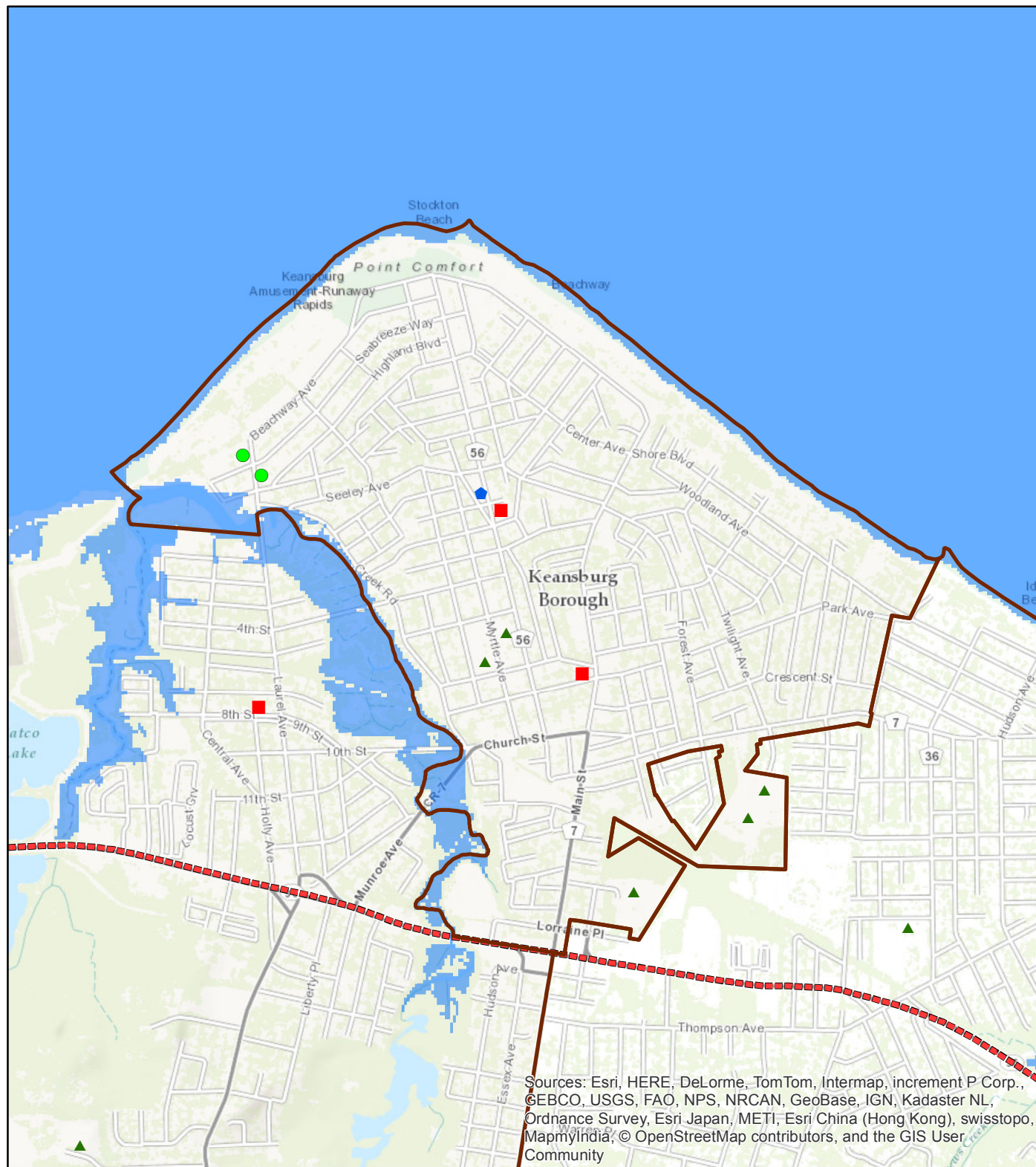
-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes
-  2ft SLR

Year 2010 Population: 10105

According to Kenneth G. Miller et al. in the 2013 study "A Geological Perspective on Sea-Level Rise and its Impacts Along the U.S. Mid-Atlantic Coast" a probable threat is the 1ft sea level rise condition that could be expected by 2050. This map depicts that sea level rise as well as the proceeding projections thereafter and is centered on target municipalities.










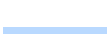
Map Author: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

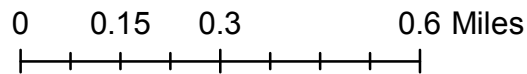
3 Feet of Sea Level Rise Keansburg Borough

Legend

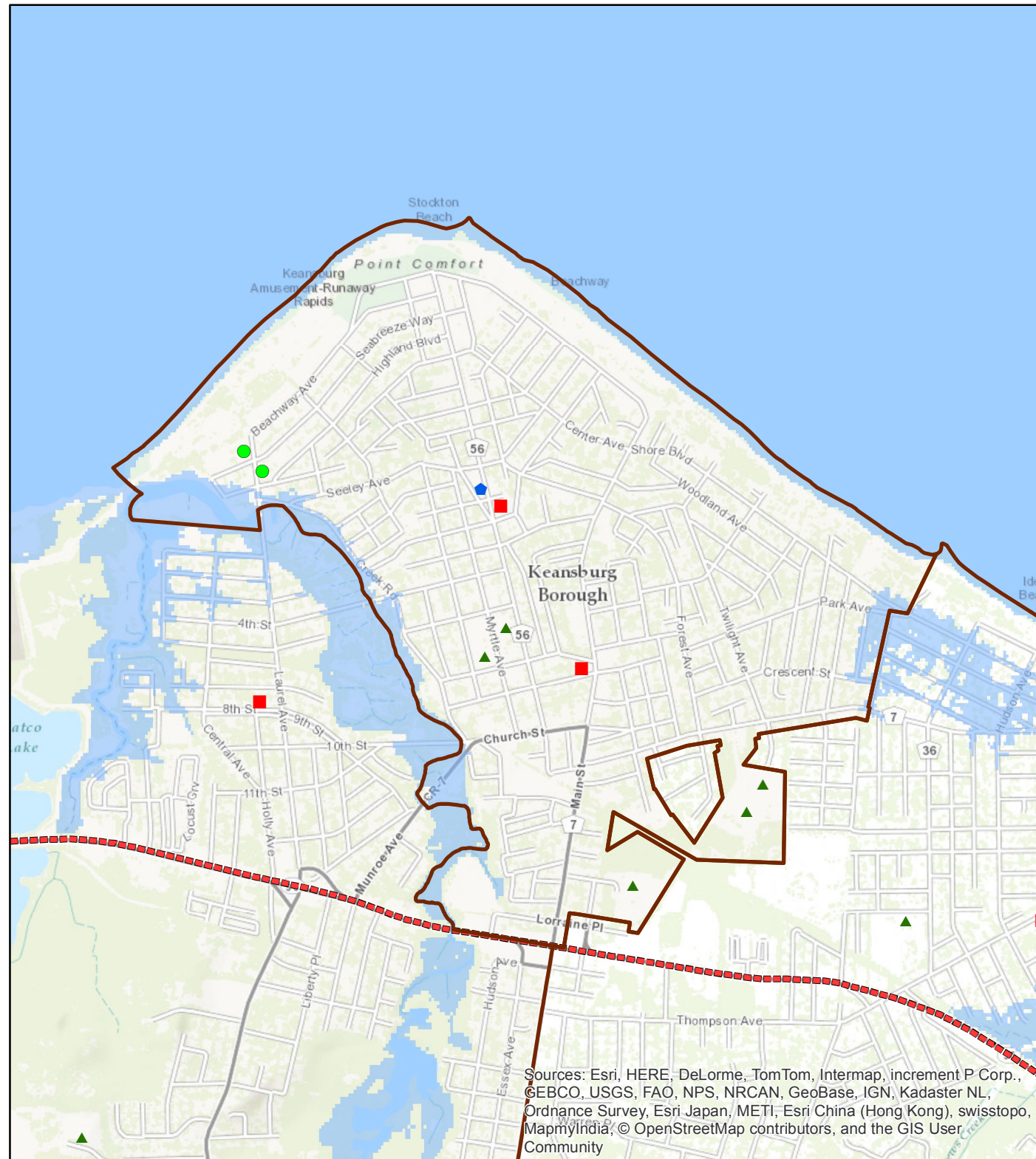
-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes
-  3ft SLR

Year 2010 Population: 10105

According to Kenneth G. Miller et al. in the 2013 study "A Geological Perspective on Sea-Level Rise and its Impacts Along the U.S. Mid-Atlantic Coast" a probable threat is the 1ft sea level rise condition that could be expected by 2050. This map depicts that sea level rise as well as the proceeding projections thereafter and is centered on target municipalities.



Map Author: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis










Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community






Appendix N: Marsh Retreat Maps

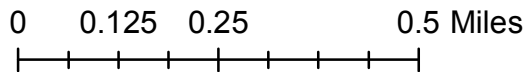
Marsh Retreat at 1 feet of Sea Level Rise Keansburg Borough

Legend

-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes

Marsh Retreat at 1ft SLR

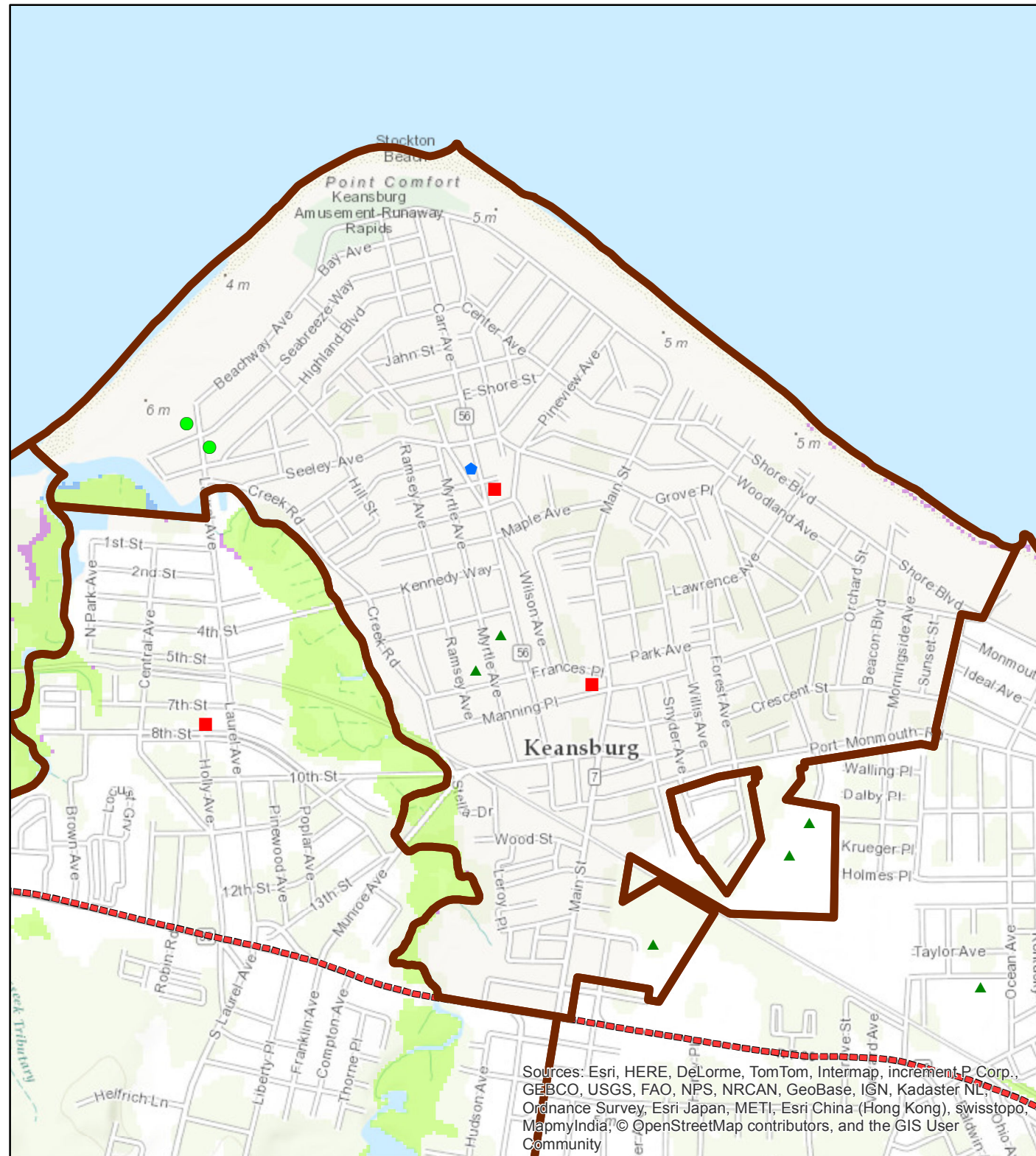
-  Unimpeded Marsh Retreat Zone
-  Impeded Marsh Retreat Zone
-  Marsh Conversion: Unconsolidated Shore
-  Marsh Conversion: Open Water
-  Unchanged Tidal Marsh



Year 2010 Population: 10105

According to Kenneth G. Miller et al. in the 2013 study "A Geological Perspective on Sea-Level Rise and its Impacts Along the U.S. Mid-Atlantic Coast" a probable threat is the 1ft sea level rise condition that could be expected by 2050. This map depicts the marsh retreat caused by sea level rise centered on target municipalities.








Map Author: Rachael Sacatelli
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis








Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

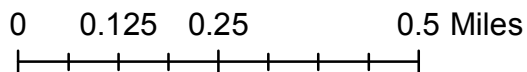
Marsh Retreat at 2 feet of Sea Level Rise Keansburg Borough

Legend

-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes

Marsh Retreat at 2ft SLR

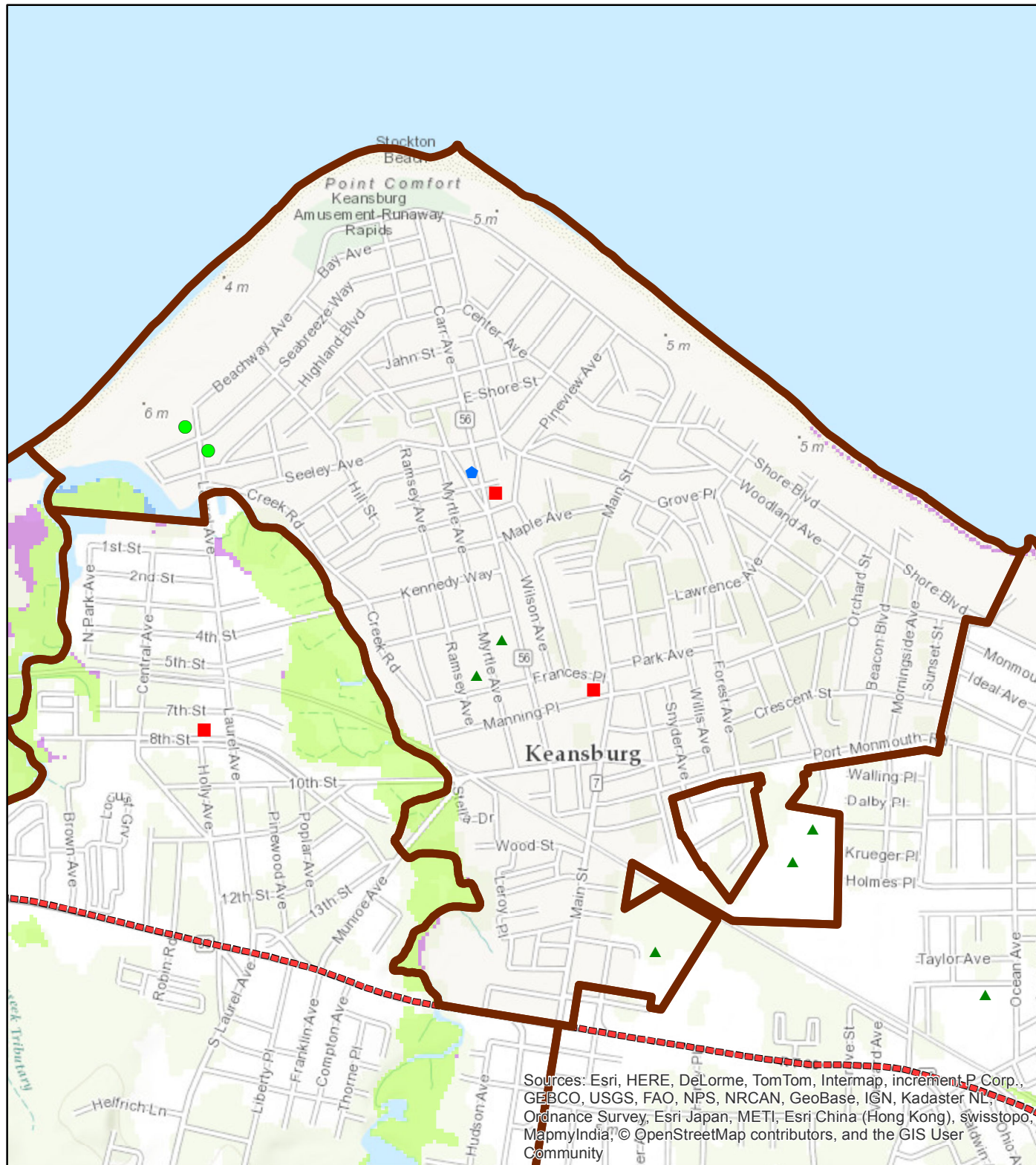
-  Unimpeded Marsh Retreat Zone
-  Impeded Marsh Retreat Zone
-  Marsh Conversion: Unconsolidated Shore
-  Marsh Conversion: Open Water
-  Unchanged Tidal Marsh



Year 2010 Population: 10105

According to Kenneth G. Miller et al. in the 2013 study "A Geological Perspective on Sea-Level Rise and its Impacts Along the U.S. Mid-Atlantic Coast" a probable threat is the 1ft sea level rise condition that could be expected by 2050. This map depicts the marsh retreat caused by sea level rise centered on target municipalities.








Map Author: Rachael Sacatelli
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis








Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

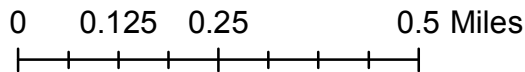
Marsh Retreat at 3 feet of Sea Level Rise Keansburg Borough

Legend

-  Municipality
-  Schools
-  Fire Stations
-  Law Enforcement
-  Assisted Living
-  Hospitals
-  Evacuation Routes

Marsh Retreat at 3ft SLR

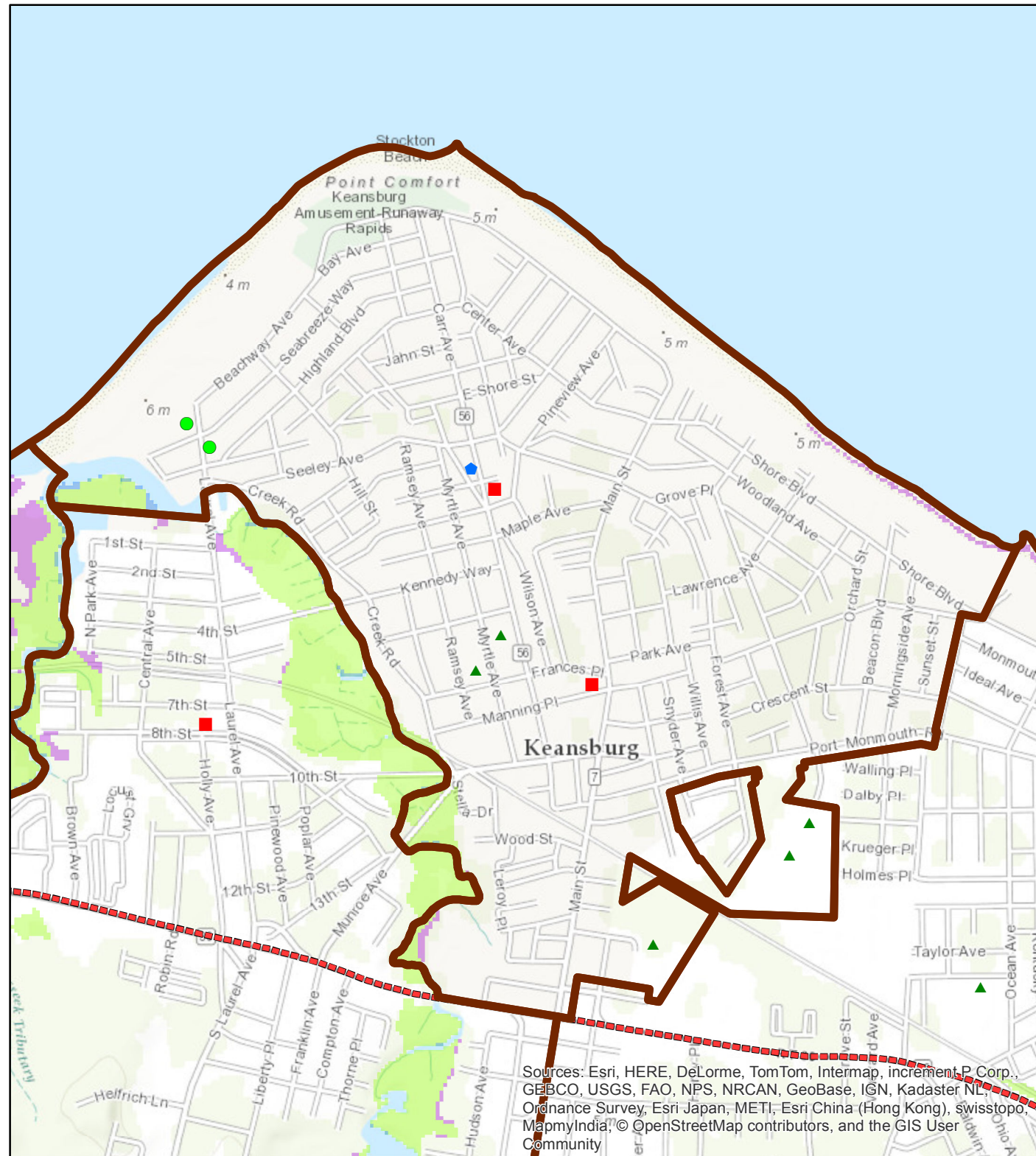
-  Unimpeded Marsh Retreat Zone
-  Impeded Marsh Retreat Zone
-  Marsh Conversion: Unconsolidated Shore
-  Marsh Conversion: Open Water
-  Unchanged Tidal Marsh



Year 2010 Population: 10105

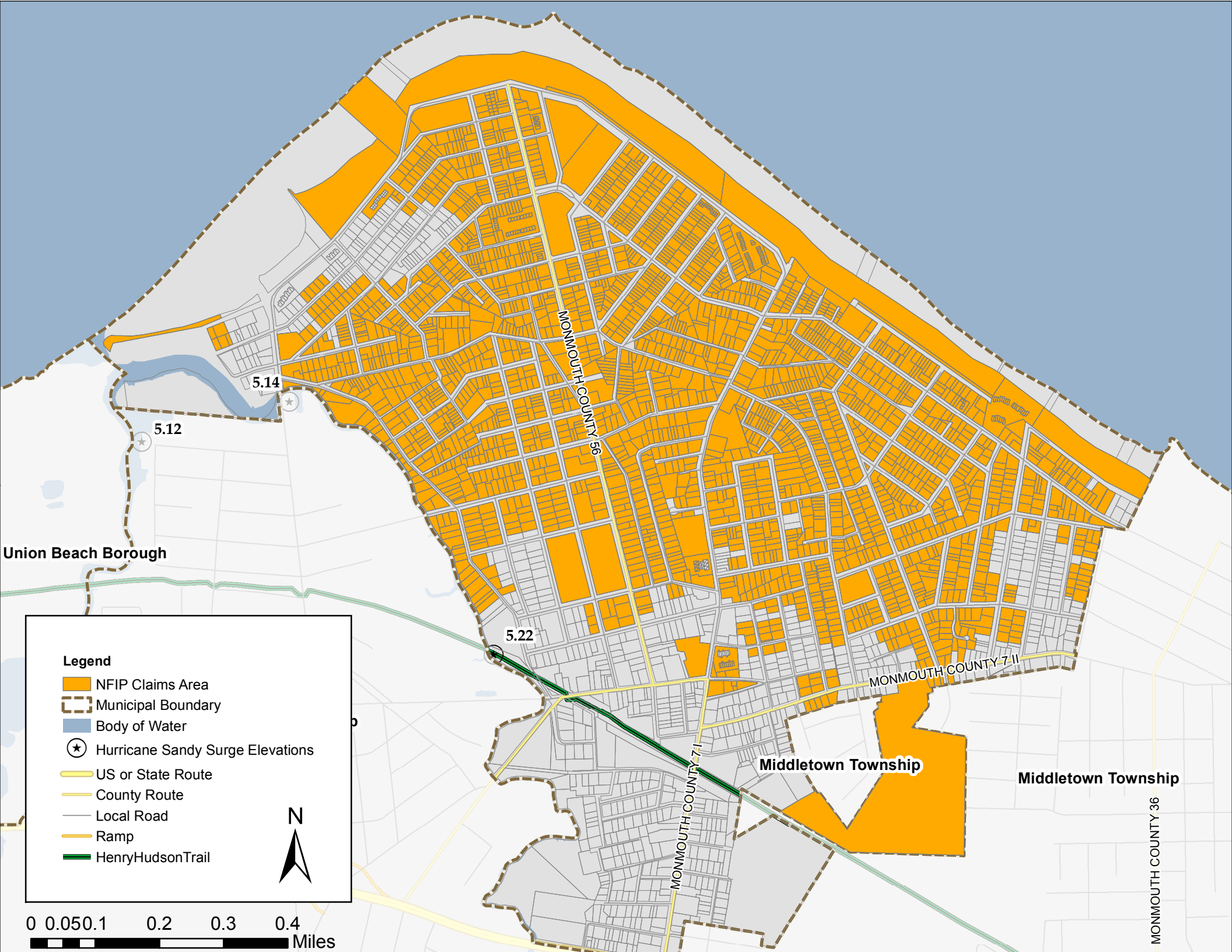
According to Kenneth G. Miller et al. in the 2013 study "A Geological Perspective on Sea-Level Rise and its Impacts Along the U.S. Mid-Atlantic Coast" a probable threat is the 1ft sea level rise condition that could be expected by 2050. This map depicts the marsh retreat caused by sea level rise centered on target municipalities.

Map Author: Rachael Sacatelli
Rutgers, New Brunswick
Center for Remote Sensing
and Spatial Analysis












Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Appendix O: NFIP Claim Areas Map



Legend

-  NFIP Claims Area
-  Municipal Boundary
-  Body of Water
-  Hurricane Sandy Surge Elevations
-  US or State Route
-  County Route
-  Local Road
-  Ramp
-  Henry Hudson Trail



0 0.05 0.1 0.2 0.3 0.4
Miles

Appendix P: Natural Features Map

