Township of Neptune
"Getting to Resilience"
Recommendations Report

Prepared by the Jacques Cousteau National Estuarine Research Reserve

September 2016

Recommendations based on the "Getting to Resilience" community evaluation process.

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Introduction

The Getting to Resilience (GTR) questionnaire was originally developed and piloted by the New Jersey Department of Environmental Protection's Office of Coastal Management in an effort to foster municipal resiliency in the face of flooding, coastal storms, and sea level rise. The questionnaire was designed to be used by municipalities to assist reduce vulnerability and increase preparedness by linking planning, mitigation, and adaptation. Originally developed by the State of New Jersey's Coastal Management Program, the Getting to Resilience process was later adapted by the Coastal Training Program of the Jacques Cousteau National Estuarine Research Reserve (JC NERR), converted into a digital format, and placed on an interactive website. Further improving the questionnaire, the JC NERR added linkages to evaluation questions including the National Flood Insurance Program's (NFIP) Community Rating System (CRS), Hazard Mitigation Planning, and Sustainable Jersey. While this website is publicly available, through the facilitated Getting to Resilience process, JC NERR Community Resilience Specialists enhance the outcomes of the evaluation by providing community-specific recommendations, guided discussions with municipal representatives, a vulnerability analysis, and municipal plan reviews.

The Getting to Resilience process in Neptune began in the spring of 2015 after JC NERR staff had discussed the opportunities provided by Getting to Resilience. Once the Township agreed to take part, JC NERR staff met with municipal leaders for a discussion of their resilience strengths and challenges. Neptune is located in Monmouth County, comprised of numerous unincorporated communities including Shark River Hills, the Gables, Sea View Island, North Island, Bradley Park, Mid Town, West Neptune, and Ocean Grove which is partially owned by the local Camp Meeting Association. These neighborhoods have diverse populations, geography, and community identities. The Township is bordered by Shark River and Shark River Bay to the south, Tinton Falls to the west, and Asbury Park and Ocean Township to the north. Ocean Grove is Neptune's only oceanfront community and is bordered by Wesley Basin and Asbury Park to the north and Fletcher Basin and Bradley Beach to the south. Bradley Beach, Neptune City, and Avon by the Sea form the remainder of Neptune's eastern border. The Township is roughly 8.6 square miles, with approximately half of that area being water.

Neptune's communities are often easily distinguishable by the local geography. Shark River Hills is comprised of hilly terrain, reaching from the Shark River Bay up to elevations over 100 feet. Ocean Grove is fairly flat, resting between 10 to 25 feet above sea level. Other areas of the Township have remnant low lying areas from former small creeks that once flowed through the area. Many of these creeks were dammed and modified to create the small coastal basins that are prevalent in Monmouth County including Wesley Basin, Fletcher Basin, and Alberta Basin in Neptune. As such, they are prone to occasionally flooding during heavy precipitation events. Alberta Basin has overtopped its banks on occasion, resulting in flooding of the surrounding neighborhood and areas to the east in Bradley Park and southeast into neighboring Neptune City. Fletcher Basin is also prone to overtopping its banks during heavy rain. Neptune Township is responsible for the outfall of Fletcher Basin. Shark River is prone to flash flood events in the areas inland of Shark River Bay. These basins and waterfront areas have been the focus of several mitigation projects.

The Township has had some limited success in acquiring grant funding to undertake mitigation projects to increase resiliency along the edges of coastal basins with more success in funding for the main waterfront areas. This has included funding from Federal Emergency Management Association's (FEMA) Hazard Mitigation Grant Program (HMGP), the National Resources Conservation Service (NRCS) Emergency Watershed Program, FEMA's Pre Disaster Mitigation (PDM) Program, and FEMA's Hazard Mitigation Assistance Program. The Township is also pursuing Blue Acres funding, working to find residents interested in selling their property in high risk areas. Alberta Basin, a small interior basin that has had numerous flooding incidents, is receiving attention in the form of approximately 1 million dollars of PDM funding to correct outfall issues, dredge the Basin, undertake landscaping, and implement erosion control devices. Fletcher Basin and Wesley Basin have both received funding for de-silting in the past. A portion of the retaining wall on Wesley Basin has also been replaced. The remaining concrete retaining wall is in need of repair replacement. The Township is searching for a funding mechanism. A temporary fix of the outfall pipe was completed by Neptune post-Sandy but a permanent fix is needed and is being sought by the Lake Commission, Asbury Park, and Neptune.

South Concourse Road improvements have been funded through FEMA's FMA program for flood mitigation through additional drainage, road elevation, and backflow preventers. Neptune has applied to FEMA for funding improvements of South Riverside Drive. These improvements would include backflow preventers, other stormwater upgrades, bulkhead construction, and public access improvements. This stretch of land in Shark River Hills was actually created with fill in the 1920's. Over time, fill sites tend to compact and "sink", making them vulnerable to flooding events.

Neptune has experienced significant storm impacts from numerous events, largely focused on low lying and waterfront areas. Hurricane Donna, the 1992 nor'easter, and Superstorm Sandy were among the strongest flooding events. The 1992 nor'easter resulted in a 9'1" stormtide while Sandy resulted in a 14'3" stormtide. These were coastal storm events, but Neptune is also prone to precipitation driven flooding in heavy rain events in the aforementioned basins and creeks in the Township. In order to foster more resilient building practices and reduce some of the confusion caused by differences in building requirements associated with the various forms of FEMA's Flood Insurance Rate Maps (FIRMs) such as the Advisory Baseflood Elevation map (ABFE), the Work Map, and the Preliminary Flood Insurance Rate Maps (PFIRM), Neptune has adopted a Township wide building code of Base Flood Elevation 12'. This results in areas that are AE 10' having 2 feet of freeboard and those that are AE 11' having 1' of freeboard, meeting the state requirement of 1 foot of freeboard in some areas while exceeding it in others.

Neptune is a member of FEMA's Community Rating System (CRS) and has a ranking of Class 6, resulting in a 20% discount on resident's flood insurance premiums. Neptune is also enrolled in the Sustainable Jersey program and Tree City USA program. Neptune has numerous parks, recreational areas, and water access locations. The Township has several areas of focus for revitalization or redevelopment and is preparing for a Master plan update. Past efforts and current opportunities should allow Neptune to continue to improve their resilience.

Methodology

The GTR questionnaire is broken into five sections: Risk and Vulnerability Assessments, Public Engagement, Planning Integration, Disaster Preparedness and Recovery, and Hazard Mitigation Implementation. In order to efficiently answer all of the questions within the questionnaire, participation from a wide array of municipal officials and staff is encouraged. These can include administrators, floodplain managers, emergency managers, stormwater managers, public works officials, town engineers, and appointed and elected officials. For Neptune, this team included Leanne Hoffman (Director of Engineering and Planning), Sean Areia (Assistant Engineer), Megan Stanley (CME Associates, consultant for Municipal Public Access Planning and post-Sandy grants), Vito Gadaleta (Business Administrator, CRS Coordinator), William Doolittle (Director of Code and Construction), Wayne Rode (Public Works), and George Waterman (Assistant Land Use Administrator, Assistant EMS Coordinator, Zoning Officer). The questions in the GTR questionnaire were answered collectively by this group with JC NERR staff recording answers and taking notes on the discussions connected to each question.

The Getting to Resilience process was started with the Township on May 28, 2015. JC NERR staff met with six representatives of Neptune. A discussion of the Township's resilience strengths and challenges began the meeting and current and future coastal hazard risk and vulnerability mapping was reviewed. On July 14th, the questionnaire was completed with five representatives of Neptune meeting with JC NERR staff.

Upon completion of the GTR questionnaire, JC NERR staff analyzed the answers provided by the Township staff, linkages provided by the GTR website, notes taken during the discussion of questions, various municipal plans and ordinances, and mapping of risks, hazards, and vulnerabilities provided by Rutgers University and the NJ Floodmapper website. After reviewing all of this information, this recommendations report was drafted by JC NERR staff to help assist Neptune Township's decision makers as the Township works to become more resilient.

Recommendations

The Community Rating System (CRS) is a FEMA program, designed to reward communities for taking steps to reduce flooding risk. These activities and elements include public information, mapping, regulation, flood damage reduction, and warning and response initiatives. Actions under these categories are eligible for points that are added up to designate where the community is "rated" according to class rankings of 10 through 1. For each class the community moves up, they receive a reduction in flood insurance premiums of 5%. This can result in serious deductions for flood insurance costs for the community and it's residents. Many recommendations in this report are connected to the CRS program as it helps communities save money and become better prepared. Neptune is a Class 6 community with a 20% reduction in flood insurance premiums. The Township is currently in review and striving toward a Class 5.

OUTREACH

1. Make sure all outreach programs are quantified and catalogued according to CRS standards.

Neptune is already a member of the Community Rating System at a Class 6. However, Neptune should examine the current number of outreach programs it runs and determine what it would take to gain additional CRS points by adding more or expanding current efforts. Outreach should include information about the natural and beneficial functions of floodplains. Particularly after Sandy, residents throughout the impacted area have been looking for as much information as possible. A well organized and efficient outreach program can provide validated information from a trusted source and better prepare residents for natural risks. Past outreach efforts should be examined and revisited if they were successful.

Neptune is in the process of developing a Program for Public Information (PPI) which would help to organize outreach and continue to include the current methods and avenues for outreach. A PPI is a researched, organized, and implemented program for public outreach that is seen as having a seven step process. These steps are Establish a PPI Committee, Assess the Community's Public Information Needs, Formulate Messages, Identify Outreach Projects to Convey the Messages, Examine Other Public Information Initiatives, Prepare a PPI Document, and Implement, Monitor and Evaluate the Program. If done correctly, a PPI will make outreach initiatives more effective and can gain CRS credits in numerous categories besides outreach. Although a PPI is not eligible for credit on it's own, it acts as a multiplier in many CRS sections if the PPI is used to oversee outreach development. For guidance on establishing a PPI, visit http://crsresources.org/files/300/developing_a_ppi_for_credit_under_the_crs_2014.pdf. For more information on Outreach Projects, visit http://crsresources.org/files/300/outreach_projects_for_credit_under_the_crs_2014.pdf. For more information on Outreach Projects credit requirements, visit page 330-2 of the CRS Coordinator's Manual. http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

2. Develop a pre-flood plan for public information projects that will be implemented during and after a flood.

Neptune should consider developing a collection of outreach projects in anticipation of future flooding events. The outreach should cover all necessary information such as evacuation routes, safety procedures, and recovery operations. This action could be undertaken through the PPI and would help Neptune save time and energy leading up to, during, and after a flooding event as outreach will already have been prepackaged and prepared for dispersal. Pre-flood planning should take place with careful coordination with the community's emergency manager. Examples of messages include evacuation routes, shelter locations, "Turn Around Don't Drown," when it is safe to go back, don't enter a flooded building until it has been cleared by an inspector, get a permit for repairs, substantial damage rules, mitigation opportunities during repairs, and information on mitigation grants. Many of these messages can be sampled and expanded upon from Neptune's 2014 Public Outreach document. Pre-flood planning is eligible for CRS credits under Flood Response Preparations. For more information on Flood Response Preparations credit requirements, visit page 330-9 of the CRS Coordinator's Manual . (http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

3. Make the public talks that took place post-Sandy about flood zones, flooding risk, building recommendations, etc into annual meetings.

After Sandy, Township and County staff have held talks and discussions on various flood related topics. By continuing to discuss the importance of planning for flooding, the Township can set an example to its residents and businesses that readiness for disaster events should be maintained, even in relatively "quiet" times. A PPI can ensure these talks are well placed and effective. Well publicized and attended talks can reduce the workload on Township staff that would otherwise need to give numerous one on one meetings. Suggested topics could include science behind storm surge, Base Flood Elevations, and elevating buildings to increase resiliency and reduce flood insurance rates. Additionally, these meetings can become an action in the Monmouth County Multi-Jurisdictional Hazard Mitigation Plan.

A PPI can ensure these talks are well placed and effective. Well publicized and attended talks can reduce the workload on Township staff that would otherwise need to give numerous one on one meetings. However, continuing to have staff available for one on one meetings is highly recommended as it is highly beneficial and earns CRS credits in the Regulations Administration section. For more information on Outreach Projects credit requirements, visit page 330-2 of the CRS Coordinator's Manual. For more information on the Regulations Administration credit requirements, visit page 430-40 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

4. Maintain the Flood Warning section of the Emergency Services website through the PPI.

The Emergency Services website contains a wide variety of flood related information posted under a Flood Warnings link (http://www.neptunetownship.org/departments/emergency-services/floodplain-management-floods-and-what-do-about-it). While the information is very worthwhile, it may be difficult for residents to navigate and find what they are looking for. A reorganization of the page may make the outreach to the residents more effective. The PPI should be responsible for this section of the website and should update it with care to ensure eligible for CRS credits in the Outreach section. This tab should also continue to highlight the link to the FEMA Region II website, http://www.region2coastal.com/. This website hosts Flood Insurance Rate Maps and a wide variety of other information that can further educate residents. By directing residents to this site, it can help reduce the workload on Township staff that may have been asked to assist the public with simple items. The Flood Information section could also include pdf versions of CRS approved outreach brochures as well. The Monmouth County Planning Department has collected and received CRS approval for many outreach materials and they can be found on their website: http://co.monmouth.nj.us/page.aspx?Id=4382. The page includes mapping for surge events for category 1 and 2 storms but could be expanded to add mapping supplied by this report for category 3 storms as well as other maps such as sea level rise. For more information on Outreach Projects credit requirements, visit page 330-2 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

5. Create a coastal hazard disclosure policy.

Disclosure of known flood, erosion, or other coastal hazard risks at the time of property transfer is an important educational effort consistent with an NAI or No Adverse Impact (http://www.floods.org/index.asp?menuID=460) attitude. Some States (such as Florida and California) have disclosure requirements. If a disclosure is required for property in a flood or coastal hazard area, the seller is required to notify potential buyers of the risks and these risks can be factored into the purchase decision. If there is a shore protection structure on coastal property for sale, a disclosure policy could also require that prospective buyers be made aware of the issues surrounding such structures—their drawbacks, negative impacts, and the need for monitoring and maintenance. This type of policy can help sellers avoid transferring known adverse impacts that become unpleasant surprises to buyers.

During the Getting to Resilience process, Township staff expressed interest in hazard disclosure policies. The City of Lambertville recently used an ordinance to amend the General Code to include "Real Estate Disclosure of the Special Flood Hazard Area."

"Disclosure of a property's potential flood hazard to prospective buyers must be made by the owner, his/her representative or real estate agent. Notification to the prospective buyer or tenant includes a clear statement in writing informing him/her if the building or structure is all or in part mapped within the Special Flood Hazard Area (1% annual chance flood) on the effective FEMA Flood Insurance Rate Map and if the prospective buyer would have a potential obligation to purchase flood insurance (structure and/or contents) to satisfy a Federally backed mortgage. The words "Flood insurance is required for a Federally backed mortgage" must be used on the disclosure if the building or structure is all or in part of the Special Flood Hazard Area. The disclosure must be a separate document from the seller's disclosure and is distinct from whether the seller experienced a flood while in ownership of the building or structure; for potential renters, the disclosure shall note if the landlord has experienced flooding during his/her ownership. The notice should state that additional information is available from the City of Lambertville's Construction Office. (Ord. No. 22-2015)"

The Township should consider enacting a local hazard disclosure policy and could consider using the City of Lambertville's language. Having a local hazard disclosure policy will ensure that information is being shared with potential buyers and that there are guidelines for the education of new residents concerning their flooding risk. Disclosing these risks to the public using various techniques also may result in CRS credits in the Outreach Projects and Hazard Disclosure sections. For more information on Outreach Projects credit requirements, visit page 330-2 of the CRS Coordinator's Manual. For more information on Hazard Disclosure credit requirements, visit page 340-2 of the CRS Coordinator's Manual. http://www.fema.gov/media-library-data/1406897194816-fc66ac50a3af94634751342cb35666cd/FIA-15_NFIP-Coordinators-Manual_2014.pdf

MITIGATION

6. Utilize sea level rise to identify possible roadways at risk.

Sea level rise and storm surge mapping indicates several roadways that may become impassable during flooding events. Some of these roadways may be adequately raised to avoid flooding but others may not. The Township could identify roadways where flooding is indicated and survey for elevation of the road. In the 2014 Public Outreach Program document "What YOU Do Before, During, and After a Flood", a listing is already provided of streets that are projected to be flooded during specific base flood events. The same methodology used to create this listing could be used to analyze sea level rise risk to roadways. This information could be used for identification of flooding hazards, information that could be used to supplement evacuation planning or flood response, or as a catalyst for road raising infrastructure upgrades. Redevelopment and infrastructure upgrades should also take sea level rise and storm surge information into account.

7. Create a detailed mitigation plan for areas that experience repetitive loss.

Repetitive loss properties can be a large burden on towns over time. By creating a mitigation plan for these areas, the Township may identify new strategies to tackle this issue, pinpoint at what point in time in the future that buyouts of these properties may be prudent, and achieve CRS credits in the Repetitive Loss Area Analysis section if CRS approved steps are taken. Furthermore, enacting mitigation for repetitive loss areas opens up a wide variety of CRS credits. The CRS requires separate reports for each specific area of repetitive loss with an additional reporting requirement. This plan can be included in the municipal annex section of the Monmouth County Multi-Jurisdictional Hazard Mitigation Plan if those actions result in identifying projects that would reduce the risk of flooding or other hazards within the Township. This will allow for associated mitigation actions to be eligible for future funding. For more information on Repetitive Loss Area Analysis credit requirements, visit page 510-29 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

8. Consider returning any properties acquired through Blue Acres or other buyout or acquisition programs to natural floodplain functions.

In Neptune, there are limited areas of land left that still have natural floodplain functions, mainly restricted to parks and wetlands. Floodplains can absorb runoff and mitigate flooding issues. Returning lands to natural floodplain function can be done utilizing a variety of techniques including wetlands restoration, planting natural vegetation, reducing sediment compaction, and creating a natural profile. Returning acquired land to natural floodplain functions can achieve significant CRS credits in the Natural Functions Open Space (NFOS) section. Funding for mitigation projects like this could be available by applying for a portion of the funding available through the Federal Emergency Management Agency (FEMA) in two recently announced Hazard Mitigation Assistance (HMA) grant programs: Flood Mitigation Assistance (FMA) and Pre-Disaster Mitigation (PDM). For more information on Natural Functions Open Space credit requirements, visit page 420-13 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

9. Neptune should continue to identify, map, and keep data on areas of coastal erosion and consider creating erosion protection programs or instituting higher regulations for building in areas subject to coastal erosion.

Erosion can become a problem in coastal areas. Areas that should be closely monitored could include any waterfront that is not bulkheaded and has experienced erosion. Factors that could amplify erosion such as sea level rise and surge should be defined. The Township should make an effort to identify, document, and quantify areas of erosion. Over the last 150 years, the oceanfront and bayfront shoreline positions have undergone various changes. Identifying erosional hot spots and their potential impacts on homes and infrastructure can allow for mitigation actions that may prevent erosion from becoming a future problem. Additionally, deposition from shoaling and runoff can also be problematic for stormwater management near outfall pipes and navigation in waterways. Erosional hot spots could then be monitored for change, allowing for more ability to request funding for shoreline restoration projects. This information should be used to supplement a Shoreline Management Plan. It would be beneficial to explore expanding beach profiling already being done by the Stockton Coastal Research Center.

Ongoing monitoring may also present a stronger case for funders when the Township seeks support for shoreline restoration or dredging projects. Keeping information on coastal erosion can result in CRS credit in the Erosion Data Maintenance (EDM) section. In addition, this information will be valuable to monitor the success of any mitigation projects instituted to reduce erosion such as a possible breakwater, sand backpass system, or living shoreline projects. Additionally, erosion monitoring can be included in the capabilities section of a hazard mitigation plan. For more information on the Erosion Data Maintenance credit requirements, visit page 27 of Management of Coastal Erosion Hazards. http://www.fema.gov/media-library-data/20130726-1755-25045-9869/crs_credit_coastal_erosion.pdf

10. Make the commitment to grow and maintain the dune system post-replenishment and bolster it with additional plantings.

"Coastal dunes form the first line of protection for the communities behind them (e.g. uplands and wetlands such as interdunal swales and bayside tidal marshes), by reducing the energy of storm waves. Dunes play a vital role in protecting coastal areas from erosion, coastal flooding and storm damage, as well as sheltering properties and ecosystems behind them from wind and sea spray and protecting the tidal wetlands on the bayside of barrier islands. During Hurricane Sandy, communities protected by larger, more well established (vegetated) dunes suffered much less damage than did those lacking this important defense."
("Dune it Right!" http://gcuonline.georgian.edu/wootton_l/why_are_dunes_important.htm)

The Christie administration has made dune systems a priority for storm protection after their ability to mitigate wave damages was displayed during Superstorm Sandy. While much of the New Jersey coastline had some sort of dune system, continuous dunes with a wide base and significant height were most effective at blocking wave action and overwash. The United States Army Corps of Engineers (USCACE) has recently finished a beach replenishment project in Ocean Grove. Although dunes were not included in the project design, the community has built small dunes. However, this dune system will require

maintenance and should be expanded to form a larger, continuous dune line. Ocean Grove's Camp Meeting Association should plan to bolster its dune system over time by adding additional species of plants, under guidance from Neptune Township officials. Dune plants create an expansive root system that helps to hold sand in place and build the dune over time. A greater variety of dune plants will not only allow for a stronger dune system but a diverse dune ecosystem and a more aesthetically pleasing beachfront. Building, maintaining, and strengthening dunes with vegetation are mitigation actions that could be included in a hazard mitigation plan.

PREPAREDNESS

11. Work with Monmouth County and neighboring municipalities to expand sheltering options.

It is vital to have backup plans in the event that the primary county shelters are full, the county is unable to provide the necessary services at those shelters, or routes to those shelters are cut off. Storm shelters would need to be outside of the floodplain and be built to withstand high winds and other storm hazards. As a significant portion of Neptune is classified as a flood zone, these shelters would need to be in placed in areas outside of the reach of potential floodwaters (beyond the limits of the 500 year floodplain where possible to ensure maximum safety). Neptune has worked very closely with the County in the past to ensure plenty of shelter availability and options during future disaster events. These efforts should continue. The Neptune Township Senior Center is a designated shelter. Neptune also works with the local Board of Education. In prior incidents, the Neptune High School has also been used as a shelter location. Shelters should have backup power and fuel supplies. Sheltering should include options for special needs, pets, other variables. The 2014 Public Outreach Program document "What YOU Do Before, During, and After a Flood" notes that sheltering for pets is not available in Neptune. Past storm events have shown many residents choose not to evacuate to shelters if they cannot bring their pets, potentially putting them in harm's way. Sheltering must also take non-natural disaster events into account such as possible hazmat situations. Memorandums of agreement may be an effective tool to shelter residents in neighboring municipalities outside of the floodplain.

12. Continue to back up all municipal planning documents and other critical materials.

The municipal complex is outside of the 100 year floodplain but there is always the possibility of unforseen events that could result in damage or loss of important materials. In the event of a disaster, important information and documentation that could be used to guide the Township to recovery needs to be accessible. In order to ensure sustained availability, all municipal planning documents, outreach associated with disaster events, and other critical materials should be backed up at offsite locations or in "cloud" networks.

13. Establish a flood warning system

With the use of mapping information, elevation surveys, and personal knowledge of flooding events, Neptune has the capability to identify flood prone areas, conditions that result in flooding of those areas,

and the severity and reach of flooding during coastal storm events. By combining this information with warning system such as Nixle or reverse 9-1-1, Neptune can target and alert residents in flood zones that flooding is expected in their neighborhood when warnings are released from the National Weather Service or National Hurricane Center.

Neptune could also take advantage of the various tide and stream gauges in the area to create an automated system. When the gauge reads predetermined tidal or stage heights, a warning could be triggered in corresponding neighborhoods known to flood during those conditions. A full listing of the United States Geological Survey (USGS) stream and tide guages for the area can be found at http://waterdata.usgs.gov/NJ/nwis/current?type=flow. In Neptune's 2014 Public Outreach Program document "What YOU Do Before, During, and After a Flood", the USGS stream gauges at Jumping Brook and Shark River are identified. The Township could add the Belmar gauge in the Shark River as a tidal gauge to follow during coastal flooding events by using the following link: http://waterdata.usgs.gov/nwis/uv/?site_no=01407770.

The Silver Jackets program has assisted with such efforts in other states and may be a good resource. NJ Silver Jackets is USACE led with State (New Jersey Department of Environmental Protection (NJDEP)/New Jersey Office of Emergency Management (NJOEM)) priorities. Jason Miller from the Philadelphia District is the USACE contact. More information can be found at http://www.nfrmp.us/state/factNewJersey.cfm. Such a system could be eligible for credit for Flood Threat Recognition. For more information on Flood Threat Recognition credit requirements, visit page 610-5 of the CRS Coordinator's Manual. http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

14. Maintain efforts to update the special needs database.

While the Township, County, and State have undertaken efforts to identify residents that would need assistance during an evacuation, it is important to revisit these efforts and expand upon them in order to keep the list updated to ensure resident safety. Neptune should continue to refer special needs residents to Register Ready. Once a resident registers they will get email reminders to update their information. Each municipality can receive a login and password to access those who registered in their town. This is usually done by the law enforcement in the town. If Township staff have any questions or issues with the program they can contact lppgoepm@gw.njsp.org. For more information on Register Ready, visit http://www.state.nj.us/njoem/plan/special_needs7.html

15. Work to become designated as a StormReady Community by the National Weather Service.

The National Weather Service has created a community preparedness program to assist towns as they develop plans for a wide variety of severe weather events. This program provides guidance on hazardous weather identification, warning systems, and creating public readiness. This guidance can in turn be used to help inform possible mitigation actions for Hazard Mitigation planning. The program is currently in hiatus due to lack of funding but should be revived in the future as funding is reallocated. For more information, visit http://www.stormready.noaa.gov/howto.htm. Becoming a StormReady Community results in CRS credits. For more information on the StormReady Community credit requirements, visit

page 610-17 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

MUNICIPAL ORGANIZATION

16. Transfer personal knowledge, documents, and other records of coastal storm and flooding event damages to digital format and place on a shared Township computer drive to allow for access and sharing between multiple municipal departments.

Memories of historical storm events, specifically ones that were not documented by state and federal agencies, are useful tools that can be used to plan for impending storms. However, it is vital that the information from these memories be available for all Township staff. This information can be gathered and documented from current municipal staff, past municipal staff, and public input and may be very useful to identify past surge extents, conditions that caused amplification of storm damages, and vulnerable areas not shown by mapping. Meetings to allow for public input on historic storm damage extents may also earn CRS credits in the Outreach section. Hard copies of documents and other records should also be digitized for preservation and access. Having all storm and flooding related information on a shared drive will help educate the staff and allow for access without having to coordinate an exchange of information. For more information on Outreach Projects credit requirements, visit page 330-2 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

17. Have Township municipal officials participate in FEMA training courses.

While going through the GTR questionnaire, it was expressed that some Township officials had not taken advantage of FEMA trainings for certification. FEMA offers in person training and independent study programs. To find more information about in person training topics and dates please visit http://training.fema.gov/ and for independant study programs please visit http://training.fema.gov/is/. Through the Coastal Training Program, the JC NERR offers free courses for municipal staff and elected/appointed officials. JC NERR is willing to work with the Township to understand training needs and provide relevant courses when possible. Having municipal officials trained on various topics and techniques can result in CRS credits in the Regulations Administration (RA) section though it may require SID codes. For more information on Regulations Administration credit requirements, visit page 430-40 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

18. Utilize the Community Vulnerability Assessment Tool, Hazard Assessment Tool, and HAZUS-MH to identify potential hazards, risks, and vulnerabilities and keep mapping information on file.

There are numerous hazard, risk, and vulnerability assessment tools available to municipalities. It is recommended that the members of the municipal staff are familiar with the use of these tools. The importance of identifying hazard, risk, and vulnerability cannot be overstressed. Use of these tools can

be beneficial in the CRS, hazard mitigation planning, creating municipal plans, zoning, and writing construction codes.

· The Community Vulnerability Assessment Tool is used to conduct a community vulnerability assessment to a wide range of hazards. It is often used in conjunction with the Risk and Vulnerability Assessment. The Using Flood Exposure Maps webinar is designed to give participants the ability to create local maps using the Coastal Flood Exposure Mapper and then use those maps to engage stakeholders in discussions directed toward improving community resilience to coastal flooding.
http://coast.noaa.gov/digitalcoast/training/flood-exposure
The platform discussed in this webinar was the base of the design for the New Jersey specific tool, NJ Adapt. http://sugar.rutgers.edu/latest/#/configure

· The Hazard Assessment Tool is a risk assessment process which will help identify hazards, profile hazard events, inventory assets, and estimate losses.
http://www.fema.gov/hazard-mitigation-planning-risk-assessment

· HAZUS-MH is a software package that uses models and Geographic Information Systems (GIS) technology for estimating physical, economic, and social impacts from various hazards such as floods and hurricanes. http://www.fema.gov/hazus

· Additional non-regulatory tools are being developed by FEMA and can be accessed on www.region2coastal.com. Included in these tools is a Coastal Flood Risk Assessment which provides estimates of potential flood damage based on the new coastal flood study results using FEMA's Hazus loss estimation software . Draft versions of these tools are currently available by county at http://www.region2coastal.com/community-officials/flood-risk-tools/. For more information about the datasets and product descriptions visit http://www.region2coastal.com/community-officials/flood-risk-tools/tool-descriptions/

FEMA MAPPING

19. Adopt the latest version of FEMA's flood maps as they are released and explore the different options for maintaining high standards for building height requirements while maximizing CRS points.

Neptune recently updated the Flood Hazard Areas Ordinance in April 2013. The Township may want to consider writing new requirements as related to the Best Available Flood Hazard Data, as it should allow for change over time as FEMA's maps are redrawn. The FEMA floodplain remapping process can be anticipated to take place with higher frequency in the future. Best Available Flood Hazard Data is defined by NJ DEP as the most recent available flood risk guidance FEMA has provided. The Best Available Flood Hazard Data may be depicted on but not limited to Advisory Flood Hazard Area Maps, Work Maps or Preliminary FIS and FIRM. For more information on NJ DEP recommended Flood Damage Prevention Ordinances, visit http://www.nj.gov/dep/floodcontrol/modelords/modelde-bestavail.doc.

By maintaining the language "or the most stringent version of FEMA's flood maps" to this ordinance, higher standards may be instituted that may result in the Township becoming more resilient. For example, the Advisory Base Flood Elevation maps may have a more expansive V-zone or higher base

flood elevations than future Flood Insurance Rate Maps. By requiring building to adhere to the stricter requirements of the Advisory Base Flood Elevation maps, more homes will be built to higher standards. The current ordinance already discusses using the Advisory Base Flood Elevation maps or the 0.2% annual chance flood, whichever is more restrictive, as the standard for building. An amended ordinance may also include some of the newer information coming out on FEMA's maps including the Limit of Moderate Wave Action (LiMWA). That information can also be used to enhance the building standards in the form of higher freeboard requirements (higher freeboard requirements in areas that are within the LiMWA areas). Both actions can result in a large amount of CRS points in the Higher Regulatory Standards section.

Another option that Neptune could consider is basing all building height requirements off of the 1% annual chance base flood elevation while exceeding the state's 1 foot freeboard. Depending on the current 0.2% annual chance flood or the Advisory Base Flood Elevation maps and the chosen number of feet of freeboard, the change could result in the same or greater level of protection from the current Township requirement to build to 12' BFE. However, choosing a low freeboard requirement that reduces building height restrictions should be avoided. Each additional foot of freeboard requirement will gain additional points in the Community Rating System, to as high as 500 points. The Freeboard credits are located in the section of Higher Regulatory Standards. Neptune should explore the different options for building height requirements to ensure the maintenance of high building standards for flood protection while earning the maximum number of points in the Community Rating System. For more information on the Higher Regulatory credit requirements, visit 430-2 of the CRS Coordinator's Manual. http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

20. Ensure the public is aware of any changes to FEMA's flood maps as they are updated and adopted as well as if those updates result in changes to the Township's building requirements.

Ensuring that the information on the maps is understood by all municipal leaders and staff prior to discussions with the public is critical to ensure the correct information disseminated by the Township. For every release of a map update, the Township could make a public announcement to its citizens and detail if any changes were made to the prior map, including if additional information such as the Limit of Moderate Wave Action has been added. Notifying the public of a new map product is an example of outreach that can be done by the Township's PPI, raising the potential for CRS points. Including information on what changes occur when new maps are released on the Township's Flood Warning webpage may help to alleviate questions the public may have as each map is updated, thereby reducing the workload on Township staff.

The new RISK map products from FEMA include a GIS layer depicting the "changes since last FIRM" which will help the Township in describing the changes in flood zones on individual properties and for the Township as a whole. A description of this data set can be found at: http://www.region2coastal.com/community-officials/flood-risk-tools/tool-descriptions/ and the new data layer is being developed as part of the preliminary FIRM process. The more familiar the citizens and businesses are with the maps, the more likely they will take appropriate actions.

21. Continue to keep all flood maps are available on the Township website, at Township Hall, and at the local libraries.

Neptune has made Flood Insurance Rate Maps (FIRMs) available and should ensure that these maps continue to be accessible and easy to find. Having the most up to date FEMA issued floodplain maps available at numerous locations in different forms of dispersal is critical to ensuring your citizens are informed and has the added benefit of allowing for CRS credits in the Outreach section. Maintaining the link to FEMA's Region II website on the Flood Warning section of the website is highly recommended. Some municipalities have trained librarians to direct and lead residents through the FEMA Region II website. The Township provides FIRM information upon request regarding FIRM zonal designation and base flood elevation. Having librarians trained to handle this work can reduce the workload on Township staff. For more information on Outreach Projects credit requirements, visit page 330-2 of the CRS Coordinator's Manual.
http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

SUSTAINABLE JERSEY

Sustainable Jersey is a certification program for municipalities in New Jersey that want to go green, save money, and take steps to sustain their quality of life over the long term. Neptune is enrolled in the Sustainable Jersey program. The following Sustainable Jersey recommendations are taken from the answers to the Getting to Resilience questionnaire.

22. Climate Adaptation: Flooding Risk

This Sustainable Jersey action, under the category of "Climate Adaptation," is designed to help communities identify: 1) your community's vulnerability to flooding impacts (both coastal and inland) and 2) ways to improve your community's overall resilience. This action focuses on the various causes of flooding that could impact a community, either now or in the future, including increased precipitation, increased frequency of heavy precipitation events, sea level rise and storm surge. Completion of this action item counts for a total of 20 Certification Points and as a Priority Action and will serve as a prerequisite for future companion Sustainable Jersey actions related to flooding and resiliency.

This recommendation report is an in-depth look at the Township's linkages to other programs (provided on www.prepareyourcommunitynj.org) and the Township's plans and ordinances. Documentation for this action needs to include a signed list of members of a Flooding Risk Team formed to focus on the town's flooding risk issues, the maps viewed, and the town's assessment. The team that worked on Getting to Resilience is listed in the methodology section of this report. As the maps in the appendix of this document were viewed at the first meeting while going through the Getting to Resilience questionnaire, and are comprised from the same data as the maps on NJFloodmapper, they may be submitted for documentation. The section of this report that is labeled Sea Level Rise and Surge Vulnerability may be used as the description of the town's analysis of the use of the NJFloodMapper tool, as this section highlights many of the points talked about while going through Sea Level Rise maps of 1-3 feet and Storm Surge maps for Categories 1-3. The Township is however responsible for writing the 300

word summary of the discussion on the flood risk maps and risk to the community. For more information on this action visit, http://www.sustainablejersey.com/actions-certification/actions/#/open/action/513.

23. Natural Resource Inventory

The Natural Resource Inventory (NRI), also known as an Environmental Resource Inventory (ERI), serves as an index of natural resources and is a compilation of text and visual information about the natural resource characteristics and environmental features of an area. It provides baseline documentation for measuring and evaluating resource protection issues. The NRI is an important tool for environmental commissions, planning boards, and zoning boards of adjustment. A municipality will earn 20 points toward Sustainable Jersey certification for a Natural Resource Inventory completed from within 10 years of the June submission deadline or for an older Inventory that has been reviewed and updated from within 10 years of the June submission deadline. For more information on this action visit, http://www.sustainablejersey.com/actions-certification/actions/#open/action/60.

24. Open Space Plans

An Open Space and Recreation Plan, OSRP, (also referred to as the Open Space Plan, OSP) is a comprehensive document that guides municipal, county, and/or regional open space protection and preservation. The Plan tells how and why open space will be protected and provides a framework for implementation. An OSRP identifies and examines open space, recreation needs and other resources that are important to the municipality, and lays out a plan of action to protect and maintain these places. A municipality will earn 10 points toward Sustainable Jersey Certification for having and Open Space and Recreation Plan. The Township has already written an Open Space Plan. For more information on this action visit, http://www.sustainablejersey.com/actions-certification/actions/#open/action/61.

PLANNING

25. Update the Evacuation Plan to include more information.

Evacuation Plans are critical planning documents designed to ensure efficient movement of citizens to safe locations prior to and during disaster events. The current Evacuation Plan can be updated to include more information in order to create a more thorough document. Information that could be added includes what evacuation routes are prone to flooding during events that exceed historical records, the necessary time frame to evacuate areas of residents and tourists, and conditions that would spur lane reversal. Emergency managers are already aware of much of this information, requiring only adding this personal knowledge to the plan update. This plan should be updated with input from the county and neighboring municipalities which rely upon the evacuation routes through the Township. For more information on possible information to include in evacuation planning, visit https://www.emergencymanagementontario.ca/english/emcommunity/response_resources/plans/mass_evacuation_plan_annex.html or http://www.gov.pe.ca/photos/original/EMO_MUN_EMG.pdf .

26. Focus on including numerous possible mitigation projects in future Hazard Mitigation Plan updates and incorporate those projects into the Capital Improvements Plan.

When Monmouth County goes through a Multi-Jurisdictional Hazard Mitigation Plan update, it is important to have numerous Township officials and staff come together to identify potential mitigation projects for Neptune. Sandy has shown the need for numerous potential projects but funding is always an issue. By including these "wish list" projects in the Multi-Jurisdictional Hazard Mitigation Plan, it leaves the door open for grant programs to fund the projects. Adding additional resilience projects could allow for them to be funded through future Hazard Mitigation funding opportunities. Projects that are not listed in the Multi-Jurisdictional Hazard Mitigation Plan will struggle to find funding sources. A crosswalk of possible mitigation projects should be included in the Capital Improvements Plan which should be updated during the Master Plan rewrite. Neptune could reference FEMA's "Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards" for mitigation project ideas. https://www.fema.gov/media-library/assets/documents/30627. Since the current County Plan update has been recently approved by FEMA new projects could be included in the next 5 year update or in a municipal specific hazards mitigation plan.

27. Create a Shoreline Management Plan.

Neptune Township contains a wide variety of shorelines including river, creek, bay, and ocean shorelines. As shorelines are dynamic systems, it is important to have a well researched and documented plan that takes into account the forces at play and the desired uses for the beaches, parks, and neighboring shoreline areas. The Shoreline Management Plan should work in conjunction with the Recreation Master Plan and Public Access Plan to ensure that the shoreline and beach are able to be utilized for many years without being too costly to maintain. Access points, dredging, beach replenishment, dune construction, dune plantings, and wetland projects should all be taken into consideration.

28. Create an action plan for precipitation flooding events.

Neptune occasionally receives flooding during heavy rain events, specifically near creeks and lakes. Smaller rain events can also produce flooding when there are stormwater tidal backflow problems at low lying portions of the Township. This flooding can prompt street closures and emergency response. By drawing upon the knowledge of past events and topographical information, an action plan could be created to identify how much rain it takes to create flooding at vulnerable locations. When heavy rain events are forecast, the Township would be able to preemptively prepare staff and resources to address the anticipated issues. In addition, the development of this action plan could result in the understanding of the cause for flooding, possibly allowing mitigation of causes such as clogged, undersized, or backflow prone stormwater pipes. Such mitigation actions could then be included in the Multi-Jurisdictional Hazards Mitigation Plan.

29. Neptune should identify long-term inundation caused by sea level rise as a hazard in municipal plans and consider disclosing hazard risks.

Neptune will experience impacts due to sea level rise and like all potential hazard impacts, this risk should be identified in Township plans to ensure proper response. Flooding, storm severity, storm frequency, and sea level rise are combined hazards. Historical rates of sea level rise should be defined as part of this action and future predicted sea levels should be taken into account when making land use decisions, construction standards, etc. The historical rate of sea level rise along the New Jersey coast over the past half century was 3-4 mm/yr (or 0.12 -0.16 in/yr), while projected future rates are expected to increase. In the recent paper entitled "A geological perspective on sea-level rise and its impacts along the U.S. mid-Atlantic coast" Miller and Kopp state that for 2050, the "best" estimate for sea level rise is 1.5 feet along the Jersey Shore. By 2100, the "best" estimate for sea level rise is 3.5 feet along the Jersey coast. "Best" refers to a 50% likelihood of that level of sea level rise occurring, meaning that actual sea levels may be lower or higher than the "best" estimates.

While sea level rise is a monumental challenge to coastal areas, the challenge cannot be tackled until it is properly identified. Monmouth County has included sea level rise in their Multi-Jurisdictional Mitigation plan, setting the example that should be followed by Neptune as a municipal specific All Hazard Mitigation Plan is written. Once this takes place, other local plans should reflect sea level rise as a hazard as well. This should include the recommended hazard disclosure policy (GTR recommendation #5). Disclosing these risks to the public using various techniques also may result in CRS credits in the Outreach Projects and Hazard Disclosure sections. For more information on Outreach Projects credit requirements, visit page 330-2 of the CRS Coordinator's Manual. For more information on Hazard Disclosure credit requirements, visit page 340-2 of the CRS Coordinator's Manual. http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

30. Examine municipal plans, strategies, and ordinances and consider rewriting sections to include the previous recommendations or reflect the risks, hazards, and vulnerabilities explored in the Getting to Resilience process.

In order to fully embrace resiliency, municipal plans, strategies, or ordinances should incorporate resiliency recommendations and findings. These should include the Municipal Master Plan (last updated in 2011), All Hazards Mitigation Plan, Floodplain Management Plan, Evacuation Plan, Emergency Response Plan, Continuity of Operations Plan, Disaster Recovery Plan, Post Disaster Redevelopment Plan, Capital Improvements Plan, Economic Development Plan/Strategy, Coastal Plan, Shoreline Restoration Plan, Open Space Plan, Stormwater Management Plan, Historic Preservation Plan, Zoning Ordinance, Flood Damage Prevention Ordinance, and Building Code. If these plans, strategies, or ordinances do not currently exist, it is highly recommended the Township move to create them. Further content regarding this recommendation can be found below in the section titled, "Coastal Hazard Incorporation in Planning". Rewriting certain planning documents such as Floodplain Management Plans, Evacuation Plans, Stormwater Management Plans could involve the creation of actions that in turn should be included in hazard mitigation plans.

Beginning the Long-term Planning Process for Sea Level Rise

Neptune, like most other coastal municipalities, will experience impacts from sea level rise in the form of regular tidal flooding, heightened storm impacts, and saltwater intrusion of aquifers and freshwater systems, requiring mitigation actions. The range of options include buyouts, elevating properties, and hardening techniques to name a few, but the use of these options must be weighed, discussed, and decided upon.

The Blue Acres program is currently being administered by the NJDEP throughout the state and other buyout programs are also available. It would be prudent to look into repetitive loss properties that will also be threatened by sea level rise in the future to determine if buyouts of these properties would be an effective way to plan for sea level rise. If the Township feels that buyouts are not a good option, mitigation strategies should be investigated. However, not only will the individual mitigation options need to be examined, but the time frame of their effectiveness should be a factor. Cost-benefit analysis should accompany all mitigation projects to ensure that the lifespan of the mitigation and effectiveness when compared to rate of sea level rise is weighed against anticipated protection. In some instances, it may be determined that the cost of protecting already flood prone areas against sea level rise will be less effective than property acquisition. This may lead the Township to reconsider mitigation measures such as buyout programs. Again, these decisions will not be easy ones to make but it is critical that the decisions do take place.

Guilford, CT Example

JC NERR recommends Neptune consider learning from the resiliency planning process undertaken by Guilford, CT and described in "Town of Guilford Community Coastal Resilience Plan Report of Options to Increase Coastal Resilience":
(http://www.ci.guilford.ct.us/pdf/Coastal%20Resilience%20Plan,%20Report%20&%20Options.pdf).

The goal of their Coastal Resilience Plan was to address the current and future social, economic and ecological resilience of the Town of Guilford to the impacts of sea level rise and anticipated increases in the frequency and severity of storm surge, coastal flooding, and erosion. The Town has drafted the report of options for increased coastal resilience as a step toward developing a Community Coastal Resilience Plan.

The four basic steps of the Coastal Resilience Plan are:

1. Generate awareness of coastal risk;
2. Assess coastal risks and opportunities;
3. Identify options or choices for addressing priority risks and vulnerabilities (short term); and
4. Develop and implement an action plan to put selected options or choices into place (long term).

Similar to Neptune, Guilford's coastal neighborhoods are diverse and it is likely that each will be faced with a combination of vulnerabilities to sea level rise and the increased incidence and severity of coastal storms. A combination of adaptation measures will therefore be necessary in each neighborhood in order to reduce risks and increase resilience. Likewise, neighborhood-scale resilience planning will likely be important. Steps should be taken to evaluate individual adaptation measures and determine how comprehensive solutions can be developed and implemented for building coastal resilience.

A comprehensive risk and vulnerability assessment for Neptune Township should include the following municipal sectors:

- Social – Residents, business community, and visitors.
- Economic – Residential Properties, commercial/industrial businesses, municipal resources, tourism, and future development.
- Infrastructure – Roads, bridges, railroads, stormwater, tide gates, marinas, and municipal facilities.
- Utilities – Public and private water supplies, septic systems, telecommunications, and electricity.
- Emergency Services – Fire, police, medical, sheltering, evacuation/egress.
- Natural Systems – Tidal wetlands and other coastal landforms.

When considering options for coastal resilience, the following three types of adaptation responses are typically considered:

- **Accommodation** implies that people continue to use the land at risk but do not attempt to prevent the land from being flooded. This option includes erecting emergency flood shelters, elevating buildings on piles and elevating roadways.
- **Protection** involves hard structures such as seawalls and dikes, as well as soft solutions such as dunes and vegetation, to protect the land from the sea so that existing land uses can continue.
- **Retreat** involves no effort to protect the land from the sea. The coastal zone is abandoned and ecosystems shift landward. This choice can be motivated by excessive economic or environmental impacts of protection. In the extreme case, an entire area may be abandoned.

Examples of adaptation measures considered in Guilford's plan include management of coastal real estate and structures, shoreline protection and management of coastal and nearshore lands, roadway alterations, and protection or replacement of water supply wells and septic systems. All these adaptation measures are presented with a variety of options for consideration.

Neptune may also gain some planning insight from the public participation process associated with Guilford's resiliency planning. Guilford found their public believes that physical changes are needed to address sea level rise and increase coastal resilience, but that there are societal and institutional obstacles. Common themes noted from the public comments included:

- Coastal resilience planning – and many of the solutions that are implemented – may be best accomplished at the neighborhood scale; and neighborhood planning groups may need to be organized to begin looking at appropriate solutions;
- The tax base associated with coastal properties would need to be preserved in the short

term and then some of the tax base may need to be shifted in the long term;
- Education and technical assistance are needed and desired by homeowners, and education could also be accomplished in the schools;
- Comprehensive solutions will be needed such as: addressing water and wastewater at the same time in neighborhoods where these systems will struggle or fail; ensuring that roadway improvements in one location are effective because improvements are also made elsewhere in the transportation network; and working on coordinated roadway and railroad improvements.

In thinking of their own public participation in resilience planning, Neptune could likely expect similar themes to emerge and could be prepared to offer the long-term planning options that may be under consideration by the municipality.

Salem, Massachusetts Example

Additionally, Salem, Massachusetts recognized the importance of being prepared for climate change and produced a Climate Change Vulnerability Assessment and Adaptation Plan (Plan). The Plan investigates some of the most serious climate change impacts, the resulting stresses to different sectors in the City, and outlines project ideas to address some of the most critical issues. The goal for this plan was to identify immediate, actionable adaptation priorities, and incorporate these into existing and future projects and policies.

This Plan was intentionally designed to focus on four of the most critical climate change impacts on six sectors in the City, and to prioritize the vulnerabilities to help inform which actions will give the greatest benefit for Salem. The four key climate change impacts are extreme heat events, extreme precipitation events, sea level rise, and storm surge. The six sectors assessed in this Plan are critical building infrastructure, water, energy, stormwater, transportation, and vulnerable populations.

Highlights of Salem's approach included having a diverse stakeholder group involved and engaged in the planning process and engaging the public and business in the implementing of new projects and policies as a result of the plan. Additionally, section 4 of the plan lays out adaptation strategies to address Salem's priority vulnerabilities. The plan can be found at: http://www.cakex.org/sites/default/files/documents/SalemClimateChangePlan.pdf.

NOAA's "Adapting to Climate Change: A Planning Guide for State Coastal Managers" Example

Included in a 2010 NOAA's Office of Ocean and Coastal Resource Management manual titled, "Adapting to Climate Change: A Planning Guide for State Coastal Managers" is a thorough discussion of adaptation strategies and methods (http://coastalmanagement.noaa.gov/climate/docs/adaptationguide.pdf). Neptune could consider some of the options presented in this document for long and short-term resiliency planning. Many of these suggestions complement the suggestions provided earlier in this GTR Recommendations report:

Impact Identification and Assessment

- Research and Data Collection – Predict possible social and economic effects of climate change on communities. Calculate cost-to-benefit ratios of possible adaptation measures. Encourage adaptation plans that are tailored to specific industries.
- Monitoring – A comprehensive monitoring program that incorporates multiple tools and considers a variety of systems and processes can provide input to the vulnerability assessment and adaptation strategy.
- Modeling and Mapping – Map which areas are more or less susceptible to sea level rise in order to prioritize management efforts.

Awareness and Assistance

- Outreach and Education – Disseminate and make scientific fact sheets about climate change available to community members, visitors, elected officials, businesses and industries. Use multiple forms of communication such as news media, radio, brochures, community meetings, social networks, blogs and websites.
- Real Estate Disclosure – The disclosure of a property's vulnerability to coastal hazards enables potential buyers to make informed decisions reflecting the level of impacts they are willing and able to accept.
- Financial and Technical Assistance – Provide flood insurance discounts for properties that exceed floodproofing standards by one or two feet. Encourage hazard mitigation by providing grants to areas that implement adaptation measures.

Growth and Development Management

- Zoning – Zoning can be used to regulate parcel use, density of development, building dimensions, setbacks, type of construction, shore protection structures, landscaping, etc. It can also be used to regulate where development can and cannot take place, making it an invaluable tool in efforts to protect natural resources and environmentally sensitive areas and guide development away from hazard-prone areas.
- Redevelopment Restrictions – Combining restrictions with acquisition/demolition/relocation programs provides safer options to property owners in the wake of the loss of or damage to their homes or businesses.
- Conservation Easements – A conservation easement is a legal agreement between a landowner and a land trust or government agency that can be used to restrict development in sensitive and hazard-prone areas.
- Compact Community Design – The high density development suggested by compact community design can allow for more opportunities to guide development away from sensitive and hazard-prone areas.

Loss Reduction

- Acquisition, Demolition, and Relocation – The most effective way to reduce losses is to acquire hazard-prone properties, both land and structures, demolish or relocate structures, and restrict all future development on the land.
- Setbacks – Setbacks can protect structures from hazards by keeping the structures away from a property's most vulnerable areas.

- Building Codes – Building codes that regulate design, construction, and landscaping of new structures can improve the ability of structures in hazard-prone areas to withstand hazard events.
- Retrofitting – Existing structures can be protected from hazards through retrofitting.
- Infrastructure Protection – Infrastructure protection entails fortification against the impacts of climate change.
- Shore Protection Structures – Shore protection structures protect existing development allowing it to stay in place. They often damage or destroy other valuable coastal resources and create a false sense of security; nevertheless in some cases, for the purposes of protecting existing development, there may be no other acceptable or practical options.

Shoreline Management

- Beach Nourishment – Beach nourishment is the process of placing sand on an eroding beach, typically making it higher and wider, to provide a buffer against wave action and flooding.
- Dune Management – Dunes may be restored or created in conjunction with a beach nourishment project or may be managed as part of a separate effort.
- Sediment Management – Dredging and placing sediment, building shore protection structures and other structures that trap or divert sediment.
- Regulation and Removal of Shore Protection Structures – To protect the natural shoreline and the benefits it provides, regulations can be used to limit shoreline hardening as well as promote alternative forms of protection.
- Rolling Easements – Rolling easements are shoreline easements designed to promote the natural migration of shorelines. Typically, rolling easements prohibit shore protection structures which interfere with natural shoreline processes and movement, but allow other types of development and activities. As the sea rises, the easement moves or "rolls" landward, wetland migration occurs, and public access to the shore is preserved.
- Living Shorelines – Living shorelines can be effective alternatives to shore protection structures in efforts to restore, protect, and enhance the natural shoreline and its environment. Living shorelines use stabilization techniques that rely on vegetative plantings, organic materials, and sand fill or a hybrid approach combining vegetative plantings with low rock sills or living breakwaters to keep sediment in place or reduce wave energy.

Coastal Ecosystem Management

- Ecological Buffer Zones – Ecological buffers are similar to setbacks (and may be included within setbacks) but are typically designed to protect the natural environment by providing a transition zone between a resource and human activities.
- Open Space Preservation and Conservation – Open space preservation and conservation can be accomplished through the management of lands dedicated as open space through a number of the measures previously discussed, such as zoning, redevelopment restrictions, acquisition, easements, setbacks, and buffers.

- Ecosystem Protection and Maintenance – In the context of coastal adaptation, ecosystem protection largely involves the protection of tidal wetlands and other ecosystems. The facilitation of wetland migration is an important aspect of this.
- Ecosystem Restoration, Creation, and Enhancement – Similar to the above, ecosystem restoration and creation can replace tidal wetlands that are lost to sea level rise.

Water Resource Management and Protection

- Stormwater Management – Drainage systems may be ill-equipped to handle the amount of stormwater runoff that will accompany the more intense rainfall events expected in the future, and those in low-lying areas will be further challenged by losses in elevation attributed to rising sea levels.
- Water Supply Management – Climate change will negatively affect both water quantity and quality, and coastal populations will continue to grow, so water supply managers must be prepared to respond to associated challenges to water supply.

Coastal Hazard Incorporation in Planning

Incorporation of coastal hazards into municipal planning is highly recommended to accurately reflect the risks of coastal living. Life in coastal communities largely revolves around weather and water conditions and planning should include consideration for current and future coastal hazards. While including information on coastal hazards in Emergency Response Plans and Evacuation plans is an easy connection to make, the path to incorporation of coastal hazards into documents such as a Master Plan may be more challenging to realize. However, to foster a community of resiliency, it is important to keep hazards in mind throughout all planning documents. The Master Plan should be used to catalogue and document the goals of all other planning documents. The following is an example of how identification of coastal hazards can be introduced to a Municipal Master Plan through the Floodplain Management section. This sort of language and related content can be utilized in various other planning documents and then discussed in the Master Plan under the corresponding sections. The Neptune Township Master Plan was last updated in 2011.

Municipal Master Plan Example

The following excerpts are adapted from a comprehensive plan for Worcester County in Maryland, the equivalent to a municipal master plan. This comprehensive plan incorporates coastal hazards throughout the entire document to form an integrated approach to resiliency. Coastal hazards are often identified in the document as “current and anticipated challenges”. Individual sections (such as the Floodplain Management section given in this example) identify objectives and recommendations that should be mirrored in individual plans (a Floodplain Management Plan in this example). In doing so, all municipal plans are organized under the master plan and share the same language and goals. If choosing to update the Floodplain Management Plan, it is highly recommended to do so by following the guidelines set in Section 510 of the CRS which can result in large CRS credits. Refer to the following link for the Worcester County Comprehensive Plan for more ideas and examples of a planning document drafted with resiliency in mind. http://www.co.worcester.md.us/cp/finalcomp31406.pdf

Sample Introduction

Realizing that air, water, and land could be overused and despoiled, the plans organized within this document increasingly moved toward resource protection. If such damage occurred, local residents' quality of life and tourism, the economic linchpin, would suffer. Preserving the Township's natural resources and character will therefore, continue to be this plan's main purpose.

The plan's purpose is to provide the following:
1. An official statement of goals, objectives, policies and aspirations for future growth, development and the quality of life;
2. A set of guidelines for the government and private sectors to maximize the Township's quality of life;
3. A strategy addressing current and anticipated challenges ; and
4. Sufficient policy guidance to effectively manage natural, human and financial resources.

Sample Floodplain Management Section

Floodplains, lands along waterways subject to flooding, locally have low relief and sedimentary soils. Floodplains are defined by how often they flood. A 100-year floodplain has a 1% probability of flooding in a given year and is not tidally influenced. Local flooding can occur in major storm events. Many areas of the Neptune Township' 100-year floodplain are highly developed. Residential, industrial, and commercial uses exist within this floodplain. Most of the time a floodplain is available for use. However, during floods they can be dangerous. Superstorm Sandy reinforced this fact. Floods injure people physically and emotionally and cause economic damage. Beyond this, emergency personnel are put at risk when called upon to rescue flood victims. In Neptune, flooding must be taken very seriously. To protect public safety and property, limiting future building in floodplains and stringent construction standards will help reduce injuries and property damage. Federal, state, and local policies should be consistent to implement this approach.

Objectives

The Township's objectives for floodplain protection are:
• Limit development in floodplains
• Reduce imperviousness of existing and future floodplain development where possible
• Preserve and protect the biological values and environmental quality of tidal and non-tidal floodplains, where reasonable and possible to do so.

Developed floodplains have a reduced capacity to absorb stormwater, resulting in increased flooding. For example, development results in new impervious surfaces (roads, sidewalks, roofs, etc.), which limit the effectiveness of the floodplain by reducing the land's absorption capacity. This increases the potential for flooding. It is therefore important that the natural floodplain

character be maintained, wherever reasonable, to promote public safety, to reduce economic losses, and to protect water quality and wildlife habitat.

Neptune faces additional flooding issues. Several areas of the Township commonly flood during storms with heavy precipitation. Sea level rise will increase flooding hazards as stormwater systems will become less effective. New Jersey is particularly vulnerable to sea level rise. During this century, as sea level rises, shorelines could retreat significantly in parts of the Township. Narrow bay beaches and wetlands at low elevations, all important habitats, would be lost to even a modest rise in sea level and erosion would increase. Currently, the state recognizes a right to protect shores with hard structures (e.g. riprap). As sea level rises, these hard structures will prevent "migration" of beaches and wetlands, and these natural features will be lost.

Programs and Policies

Flooding from coastal storms is a serious threat to life and property with the potential for extensive damage and disruptions. To reduce potential damage, the county is developing a hazard mitigation plan. This first step will provide guidance for pre-disaster activities. The second phase of addressing disasters is to develop a post disaster plan. Confusion and rapid decision-making follow a disaster. Advance planning can position the Township to reduce its exposure to future disasters and reduce the need for ad hoc decision-making. Superstorm Sandy has taught us that effective post-disaster planning is necessary for an effective recovery process.

Recommendations

1. Work with federal and state agencies to regularly update the Township floodplain maps, with first priority being areas that are mapped as 100-year floodplain without base flood elevation established.
2. Limit new development and subdivisions in the floodplain.
3. Promote uses, such as open space easements, natural areas, and recreational open space to reduce impervious surfaces in floodplains.
4. Work to acquire properties in the lowest lying portions of the 100-year floodplain, and return them to a natural state.
5. Reevaluate the effectiveness of the current floodplain protection regulations.
6. Discourage the location of new homes and roadways in the "V" or wave velocity zone and the 100-year floodplain.
7. Work with the county to complete a hazard mitigation plan for flooding, wildfire, and other natural hazards.
8. Develop and implement a post-disaster recovery and reconstruction plan to facilitate recovery and to reduce exposure to future disasters.
9. Consider code changes that will limit impervious surfaces.
10. Develop a sea level rise response strategy (including a two foot freeboard requirement for properties exposed to flooding and discourage further shoreline hardening).

Mapping

The following maps can be found in the appendices of this document. Maps were either requested by Township staff or recommended by JC NERR staff during GTR meetings. As part of updates to the Getting to Resilience website, the site will host community profiles that include municipal mapping profile packets that are available for future download. These maps can be used to help write and update the Municipal Master Plan, All Hazards Mitigation Plan, Floodplain Management Plan, Evacuation Plan, Emergency Response Plan, Continuity of Operations Plan, Disaster Recovery Plan, Post Disaster Redevelopment Plan, Capital Improvements Plan, Economic Development Plan/Strategy, Coastal Plan, Shoreline Restoration Plan, Open Space Plan, Stormwater Management Plan, Historic Preservation Plan, Zoning Ordinance, Flood Damage Prevention Ordinance, and Building Code.

Sea Level Rise 1-3 feet with Critical Facilities

Over the past hundred years, sea level has risen slightly higher than one foot in New Jersey. Due to a variety of factors including melting land ice and thermal expansion, it is anticipated that the rate of sea level rise will increase substantially in the future. While sea level rise poses it's own threat to coastal communities, it also will increase the severity of storm surge and erosion. By examining sea level rise maps, the Township can better understand future flooding risk and plan accordingly. As a portion of the Township is near current sea level, including some municipal property, Sea Level Rise maps should be utilized heavily for municipal planning documents.

Storm Surge (SLOSH Category 1, SLOSH Category 2, & SLOSH Category 3)

SLOSH or Sea, Lake, and Overland Surge from Hurricanes is a computerized model from the National Hurricane Program. SLOSH takes into account various factors to compute surge inundation above ground level or simple inundation. These factors include storm size, storm pressure, storm speed, storm path, wind speed, bathymetry, and topography. With this set of factors, SLOSH determines the worst surge impacts that can be expected from hurricanes according to category. SLOSH maps are vital tools for Emergency Operations Center managers for making decisions about evacuation orders, timing of evacuation, and staging of emergency equipment prior to tropical weather systems.

Marsh Migration 1-3 feet

Marsh reaction to seal level rise has been mapped according to the Sea Level Affecting Marshes Model (SLAMM). Marshes provide various environmental and storm protection functions to communities and should be preserved. As sea level rises, many marshes will convert to open water or tidal mud flats. However, if suitable land is connected to current marshes, conversion of ecosystems may occur which could allow marshes to "migrate" further inland in balance with sea level. Upland areas that are deemed to be suitable marsh migration areas should be identified and preserved if possible and barriers to marsh migration should be eliminated. In doing so, the environmental and storm protection functions of marshes may persist despite sea level rise.

Preliminary Flood Insurance Rate Map

FEMA's Preliminary Flood Insurance Rate Map (PFIRM) represents the current best available data for Neptune concerning the 1% and 0.2% flooding scenarios. Base Flood Elevations and wave modeling are established for the 1% flood. Flood Insurance Rate Maps should be used to assist in zoning and building code decisions. Additional mapping information about floodplain maps can be accessed off of FEMA's www.Region2Coastal.com.

Sandy Surge Extent

FEMA has mapped the limits of the storm surge caused by Superstorm Sandy. This map can be used as a reference for this historical flooding event.

Other Suggested Maps

Preliminary Flood Insurance Rate Map Table

FEMA's Preliminary Flood Insurance Rate Map (PFIRM) represents the current best available data for Neptune concerning 1% and 0.2% flooding scenarios. This table displays the coverage for the 0.2% zone, AE zone, and VE zone in terms of square miles and percent coverage. This table can be used to better understand the Township's floodplain and be used as reference for various decisions concerning zoning, building, etc. This table should be available in the future at www.prepareyourcommunitynj.org under the municipal maps tab.

Repetitive Loss & Severe Repetitive Loss

Repetitive Loss and Substantial Damage maps can be used to identify "problem" areas. Depending on the location and size of these areas, the Township can make decisions about how to prevent repetitive loss from occurring. These options can range from utilizing Blue Acres funding and returning the properties to a natural state to creating protective infrastructure projects in order to help protect from risk.

Shoreline Change

Shorelines are constantly in a state of change, be it from tidal fluctuations or erosional and depositional forces. Shoreline change can create large scale shifts in risk. Erosion may move shoreline closer to buildings and infrastructure, reducing natural buffers and heightening impacts. Deposition that moves shorelines or near shore features such as sandbars may in turn reduce rates of flow of streams and stormwater management systems and cause greater risk of precipitation driven flooding. Deposition can also cause navigation hazards to waterways and navigation channels. The Restoration Explorer tool (http://maps.coastalresilience.org/newjersey/) includes information on rate of shoreline retreat or accretion. This information can be used to advise the writing of a shoreline management plan or serve as the catalyst to explore shoreline restoration projects. Shoreline Change maps can identify trends and should be incorporated into appropriate municipal plans.

Overlays of Hazards and Populations, Infrastructure, and Building Footprints
Though it is the goal of this report to guide the Borough of Neptune towards resiliency, risk will always exist. By overlaying hazards such as sea level rise and surge with population information, infrastructure, and building footprints, the Borough will be able to identify areas of highest risk and plan accordingly.

Natural Resources, Historical Resources, Cultural Resources, & Economic Resources
Mapping of a community's resources is an extremely useful tool, not only for creating a catalogue of a community's strengths, but also for identifying areas that should be protected. Overlaying hazards such as sea level rise and surge may lead Neptune to make decisions on protecting certain resources through retrofitting historic buildings or protecting natural resources by allowing for natural floodplain functions.

Additional Mapping Resources
NJADAPT (www.NJAdapt.org) is a New Jersey-based website being built to host and apply climate science and impacts data. The objective of the NJADAPT platform is to provide communities with the ability to develop municipal profiles of various risks that may potentially impact their areas by making climate projection data for NJ more accessible. The initial development of the platform has been supported by the New Jersey Recovery Fund and NOAA.

The Flood Exposure Profiler is the first tool developed as part of the larger All Climate Hazards tools being developed through the NJADAPT initiative. The Profiler is broken into three major themes:

- Society (demographic data that shows information about populations, businesses, and employees)
- Infrastructure (provides information on facility and infrastructure locations that should be considered when planning for disaster events),
- Environment (data on coastal land use areas - marsh, open space, land use land cover).

Each of the profiles allow you to see the themed data and then overlay a hazard layer of your choice to see what the potential impacts may be. The hazard layers include SLOSH for Categories 1-4, NJ Coastal Flooding Exposure (CFE), Sea Level Rise for 1-6 feet, Coastal Vulnerability Index, Shallow Coastal Flooding, FEMA Flood Zones, and Sandy Surge Extent. This tool allows you to create maps that you can then package and share links to or create pdfs from for further use.

Sea Level Rise and Surge Vulnerability

Neptune includes a wide variety of communities and landforms, many in close proximity to or by water. Fluctuations in tidal levels through surge events and rising sea levels are significant even for areas bordering wetlands and creeks. Scientists anticipate the arrival of one foot of sea level rise before 2050. As sea level rise is expected to accelerate this century, three feet of sea level rise is very likely before 2100. In the table below, the “low”, “high”, and “best” estimates for sea level rise projections for New

Jersey for the years 2050 and 2100 are displayed. “Best” refers to a 50% likelihood of that level of sea level rise occurring.

	Sea-level rise (feet)		
	Global	Bedrock	Shore
2030 central	**0.5**	**0.7**	**0.8**
2030 low	0.3	0.5	0.6
2030 high	0.7	1.0	1.1
2030 higher	0.9	1.2	1.4
2050 central	**0.8**	**1.3**	**1.5**
2050 low	0.5	0.9	1.1
2050 high	1.3	1.8	1.9
2050 higher	1.6	2.1	2.3
2100 central	**2.5**	**3.1**	**3.5**
2100 low	1.4	2.2	2.5
2100 high	4.0	4.6	4.9
2100 higher	4.6	5.5	5.9
2100 collapse	8.7	9.7	10.1

NJ sea level rise projection ranges and best estimates. K.G. Miller, R.E. Kopp, B.P.Horton, J.V. Browning, and A.C. Kemp, 2013, A geological perspective on sea - level rise and its impacts along the U.S. mid - Atlantic coast. Earth’s Future 1: 3 - 18, doi:10.1002/2013EF000135

Modeling for 1 and 2 feet of sea level rise indicates many natural wetlands along Shark River’s waterfront will experience regular inundation but most of the developed areas of Neptune are not impacted directly. Sea level rise mapping for 3 feet of sea level rise indicates that wetlands will experience increased impacts but some of the Township’s developed areas may be at risk. Riverside Drive, Beverly Drive, Fairview Place, Hillcrest Avenue, Melrose Avenue, Albany Road, Waterview Court, South Concourse, and West Concourse are indicated to have portions of their stretch prone to flooding at 3 feet of sea level rise. Several of these locations have mitigation projects dedicated to flooding issues.

Recent studies on sea level rise have indicated that higher rates of sea level rise might take place due to the collapse of ice sheets in the Antarctic. Higher rates of sea level rise could threaten a much larger portion of Neptune, particularly in the areas surround Shark River Bay. As sea level projections are dynamic, Neptune should continue to be informed by the latest science-based data.

Analysis of SLOSH maps show that as hurricane strength increases, potential surge impacts will increase in scope and severity. Although Sandy had wind speeds associated with a Category 1 hurricane, SLOSH maps projected a lower surge event than what was witnessed during Sandy. In that mapping, only roadways immediately along the shoreline of Shark River are projected to flood, mostly with depths of 0-3 feet of water. These roadways include Brighton Avenue, North Riverside Drive, South Riverside Drive, West Concourse, and South Concourse. SLOSH models indicate flooding should be expected to exceed Sandy’s flood levels for powerful Category 2 hurricanes. Areas that have inundation depths of 0-3 feet or 3-6 feet during a Category 1 storm are capable of depths of 6-9 feet or greater than 9 feet in a Category 2 storm. In this scenario, flooding not only worsens in terms of depth but expanse as flood waters reach further inland, including all of Seaview Island and the connecting area to the north bound by Route 35

and Boston Road. Though Route 35 might possibly be passable in a lifted emergency vehicle, flooding in Belmar will be more intense on Route 35 and movements along this evacuation route should be directed to the north. In addition, the blocks bordering Fletcher Lake are flooded, extending as far north as Embury Avenue and as far west as Lawrence Avenue. Most flooding depths are 0-3 feet but Central Avenue and Broadway are expected to see depths of 3-6 feet where they directly border the Lake. A small portion of the Whitesville neighborhood at Heck Avenue and Embury Avenue between Ridge Avenue and Memorial Drive is also expected to flood with 0-3 feet of water.

In a Category 3 storm, the flooding extent does not expand much in the area surround Shark River but the flooding depths dramatically increase. Most areas around the waterfront are subject to floodwaters greater than 9 feet. Route 35 would be completely impassable, Rt. 18 may become flooded where it crosses the Shark River, and Highway 33 will be flooded where it approaches Ocean Grove. All three are evacuation routes for Neptune. Roughly 50% of Ocean Grove will be flooded and the areas that are not flooded will be cut off from the rest of the Township as a significant portion of the Midtown neighborhood would experience flooding as well, reaching from Main Street to Route 35. It should be noted that this scenario places the Midtown School, an evacuation shelter, in the floodplain as well as the fire station on Highway 33. There are also several assisted living locations that may be at risk. Although storms of this magnitude do not occur regularly, they remain a possibility that requires attention and planning.

CRS Sections That Likely Have Available Current Points

The following sections of the Community Rating System will likely contain credit points that are available for Neptune based off of the answers given in our Getting to Resilience questionnaire, discussions with JC NERR staff, and reviews of Township planning documents. These sections represent the current state of the Township but also include planned projects, uncompleted projects, and recommended actions deemed to be within Neptune's reach. However, these projects may need to be complete in order to be granted credit. It is likely that the Outreach Projects in Section 330 will be highly achievable and less costly than other sections within the CRS. The following sections do not represent guaranteed points for the CRS but are likely achievable to a certain degree and should be investigated to determine the costs and benefits of the required actions when submitting to the CRS. When working with your CRS coordinator, we recommend inquiring about the following sections.

Section 310: Elevation Certificates: To maintain correct federal emergency management agency (FEMA) Elevation Certificates and other needed certifications for new and substantially improved buildings in the Special Flood Hazard Area (SFHA).

- **Maintaining Elevation Certificates (EC):** Up to 38 points for maintaining FEMA elevation certificates on all buildings built in the special SFHA after the date of application to the CRS. All communities applying to the CRS must apply for this element. (GTR 1.14)

- **Maintaining Elevation Certificates for Post-FIRM Buildings (ECPO):** Up to 48 points for maintaining EC on buildings built before the date of application to the CRS but after the initial date of the FIRM. (GTR (Could be done))
- **Maintaining Elevation Certificates for Pre-FIRM Buildings (ECPR):** Up to 30 points for maintaining elevation certificates on buildings built before the initial date of the FIRM. (GTR (Could be done))

Section 320: Map Information Service: To provide inquirers with information about the local flood hazard and about flood-prone areas that need special protection because of their natural functions.

- **Basic Firm Information (MI1):** 30 points for providing basic information found on a FIRM that is needed to accurately rate a flood insurance policy. (GTR 1.7, 2.5)
- **Additional Firm Information (MI2):** 20 points for providing information that is shown on most FIRMS, such as protected coastal barriers, floodways, or lines demarcating wave action. (GTR 1.7, 2.5)
- **Problems Not Shown on the FIRM (MI3):** Up to 20 points for providing information about flood problems other than those shown on the FIRM. (GTR 1.7, 2.5)

Section 330: Outreach Projects: To provide the public with information needed to increase flood hazard awareness and to motivate actions to reduce flood damage, encourage flood insurance coverage, and protect the natural functions of floodplains. (GTR 4.4)

- **Outreach projects (OP):** Up to 200 points for designing and carrying out public outreach projects. Credits for individual projects may be increased if the community has a Program for Public Information (PPI). (GTR 2.4, 2.5.1, 2.5.2, 2.7, 2.8, 2.9, 2.11, 2.14, 4.9)
- **Flood response preparations (FRP):** Up to 50 points for having a pre-flood plan for public information activities ready for the next flood. Credits for individual projects may be increased by the PPI multiplier. (GTR 2.4, 2.7, 2.8, 2.9, 2.11, 4.9)
- **Program for Public Information (PPI):** Up to 50 points added to OP credits and up to 20 points added to FRP credits, for projects that are designed and implemented as part of an overall public information program. (GTR 2.4, 2.7, 2.8)
- **Stakeholder delivery (STK):** Up to 80 points added to OP credits for having information disseminated by people or groups from outside the local government. (GTR 2.4, 2.7, 2.8)

Section 340: Hazard Disclosure: To disclose a property's potential flood hazard to potential buyers before the lender notifies them of the need for flood insurance.

- **Disclosure of the flood hazard (DFH):** Up to 25 points if real estate agents notify those interested in purchasing properties located in the Special Flood Hazard Area (SFHA) about the flood hazard and the flood insurance purchase requirement. An additional 10 points are provided if the disclosure program is part of a Program for Public Information credited under Activity 330 (Outreach Projects). (GTR 2.5.2 (Could be instituted as a requirement))
- **Other disclosure requirements (ODR):** Up to 5 points for each other method of flood hazard disclosure required by law, up to a maximum of 25 points. (GTR 2.5.2)
- **Real estate agents' brochure (REB):** Up to 8 points if real estate agents are providing brochures or handouts that advise potential buyers to investigate the flood hazard for a property. An additional 4 points are provided if the disclosure program is part of a Program for Public Information credited in Activity 330 (Outreach Projects). (GTR 2.5.2 (Could be required))
- **Disclosure of other hazards (DOH):** Up to 8 points if the notification to prospective buyers includes disclosure of other flood-related hazards, such as erosion, subsidence, or wetlands. (GTR 1.4, 2.5.2 (Could be instituted as a requirement))

Section 350: Flood Protection Information: To provide more detailed flood information than that provided by outreach products.

- **Flood protection library (LIB):** 10 points for having 10 Federal Emergency Management Agency publications on flood protection topics housed in the public library. (GTR 2.5.1, 2.5.2, 2.15)
- **Locally pertinent documents (LPD):** Up to 10 points for having additional references on the community's flood problem or local or state floodplain management programs housed in the public library. (GTR 2.5.1, 2.5.2)
- **Flood protection website (WEB):** Up to 76 points for providing flood protection information via the community's website. An additional 29 points are provided if the website is part of a Program for Public Information (credited under Activity 330 (Outreach Projects)). (GTR 2.5.1, 2.5.2, 2.7, 2.8, 2.9, 2.11, 4.7, 4.9)

Section 360: Flood Protection Assistance: To provide one-on-one help to people who are interested in protecting their property from flooding.

- **Property protection advice (PPA):** Up to 25 points for providing one-on-one advice about property protection (such as retrofitting techniques and drainage improvements). An additional 15 points are provided if the assistance program is part of a Program for Public Information (credited under Activity 330 (Outreach Projects)). (GTR 5.7)

- **Advisor training (TNG):** 10 points if the person providing the advice has graduated from the EMI courses on retrofitting or grants programs. (GTR 5.8 (could get training if not trained yet))

Section 410: Floodplain Mapping: To improve the quality of the mapping that is used to identify and regulate floodplain management.

- **New Study (NS):** Up to 290 points for new flood studies that produce base flood elevations or floodways. (GTR 1.1, 1.7 (Could be eligible if other elevation studies have been or are going to be done))
- **Higher Study Standards (HSS):** Up to 160 points if the new study was done to one or more standards higher than the FEMA mapping criteria. (GTR 1.4, 1.7)
- **Floodplain mapping of special flood-related hazards (MAPSH):** Up to 50 points if the community maps and regulates areas of special flood related hazards. (GTR 1.1, 1.3, 1.7, 2.5 (Could be done))

Section 420: Open Space Preservation: To prevent flood damage by keeping flood-prone lands free of development, and protect and enhance the natural functions of floodplains.

- **Open space preservation (OSP):** Up to 1,450 points for keeping land vacant through ownership or regulations. (GTR 3.3, 5.9)
- **Natural shoreline preservation (NSP):** Up to 120 points for programs that protect natural channels and shorelines. (GTR 3.3, 5.9)
- **Deed restrictions (DR):** Up to 50 points extra credit for legal restrictions that ensure parcels credited for OPS will never be developed. (GTR 3.3, 5.9)
- **Natural functions open space (NFOS):** Up to 350 points extra credit for OPS-credited parcels that are preserved in or restored to their natural state. (GTR 3.3, 3.5, 5.9)
- **Special flood-related hazards open space (SHOS):** Up to 50 points if the OSP credited parcels are subject to one of the special flood-related hazards or if areas of special flood related hazard are covered by low density zoning regulations. (GTR 1.3, 3.3, 5.9)
- **Open space incentives (OSI):** Up to 250 points for local requirements and incentives that keep flood-prone portions of new development open (GTR 3.3, 5.9)

Section 430- Higher Regulatory Standards: To credit regulations to protect existing and future development and natural floodplain functions that exceed the minimum criteria of the National Flood Insurance Program (NFIP).

- **Other higher standard (OHS):** Up to 100 points for other regulations. (GTR 2.9, 2.11, 4.9)

- **Special Flood-related Hazard Regulations (SHR):** Up to 370 points for higher regulatory standards in areas subject to coastal erosion. (GTR 1.3)
- **Emergency warning dissemination (EWD):** Up to 75 points for disseminating flood warnings to the public. (GTR discussions)
- **Flood response operations (FRO):** Up to 115 points with 10 points awarded for maintaining a database of people with special needs who require evacuation assistance when a flood warning is issued and for having a plan to provide transportation to secure locations. (GTR discussions)
- **Critical facilities planning (CFP):** Up to 75 points for coordinating flood warning and response activities with operators of critical facilities. (GTR discussions)
- **Protection of critical facilities (PCF):** Up to 80 points for protecting facilities that are critical to the community. (GTR 4.7)
- **Regulations administration (RA):** Up to 67 points for having trained staff and administrative procedures that meet specified standards. (GTR 3.4.5, 3.5.4, 3.5.5, 3.6.1, 3.7.1, 5.6, 5.8)
- **Freeboard (FRB):** Up to 500 points for a freeboard requirement. (GTR 5.4, 5.5)
- **Foundation Protection (FDN):** Up to 80 points for engineered foundations. (GTR (likely already done))
- **Coastal A Zone Requirements (CAZ):** Up to 500 points if if all new buildings in the coastal A Zone must meet the requirements for buildings in V Zones and for openings in A Zones (This requirement is being instituted in NJ in 2016)
- **State Mandated Standards (SMS):** Up to 20 points for a state-required measure that is implemented in both CRS and non-CRS communities in that state. (freeboard)

Section 440: Flood Data Maintenance: The community must maintain all copies of Flood Insurance Rate Maps issued for that community.

- **Additional Map Data (AMD):** Up to 160 points for implementing digital or paper systems that improve access, quality, and/or ease of updating flood data within the community. (GTR 1.7, 1.16, 2.5)
- **FIRM Maintenance (FM):** Up to 15 points for maintaining copies of all FIRMs that have been issued for the community. (GTR 1.7, 2.5)
- **Erosion Data Maintenance (EDM):** up to 20 points for maintaining coastal erosion data. (GTR 1.3, 2.1 (could be done with beach profile data))

Section 450: Stormwater Management: To prevent future development from increasing flood hazards to existing development and to maintain and improve water quality.

- **Watershed Master Plan (WMP):** Up to 315 points for regulating development according to a watershed management master plan (WMP). (GTR 1.13)

Section 510: Floodplain Management Planning: To credit the production of an overall strategy of programs, projects, and measures that will reduce the adverse impact of the hazard on the community and help meet other community needs.

- **Floodplain management planning (FMP):** 382 points for a community-wide floodplain management plan that follows a 10-step planning process. (GTR 1.13, 2.4, 3.3, 3.4, 3.5, 3.7)
- **Repetitive Loss Area Analysis (RLAA):** Up to 140 points for a detailed mitigation plan for a repetitive loss area. (GTR 1.11, 1.12, 1.13, 2.1 (could be done))
- **Natural Floodplains Function Plan (NFP):** 100 points for adopting plans that protect one or more natural functions within the community's floodplain. (GTR 1.13)

Section 520: Acquisition & Relocation of buildings : To encourage communities to acquire, relocate, or otherwise clear existing buildings out of the flood hazard area. Up to 2,250 points based on the number of buildings that fit the criteria and have been acquired or relocated. (GTR 1.11, 1.12 (could be done))

Section 530: Flood Protection: To protect buildings from flood damage by retrofitting the buildings so that they suffer no or minimal damage when flooded, and/or constructing small flood control projects that reduce the risk of flood waters reaching the buildings.

- **Flood protection project technique used (TU_):** Credit is provided for retrofitting techniques or flood control techniques. Retrofitting technique used: Points are provided for the use of elevation (TUE), dry floodproofing (TUD), wet floodproofing (TUW), protection from sewer backup (TUS), and barriers (TUB) Structural flood control technique used: Points are provided for the use of channel modifications (TUC), and storage facilities (TUF). (GTR 5.3, 5.7)

Section 540: Drainage System Maintenance: To ensure that the community keeps its channels and storage basins clear of debris so that their flood carrying and storage capacity and maintained.

- **Capital improvement program (CIP):** up to 70 points for having a capital improvement program that corrects drainage problems. (GTR 3.7)
- **Coastal Erosion Protection Maintenance (EPM):** Up to 100 points for maintaining erosion protection programs in communities with coastal erosion prone areas. (GTR 1.3)

Section 600: Warning and Response: The activities in this series focus on emergency warnings and response, because adequate notification combined with a plan for how to respond can save lives and prevent and/or minimize property damage. The activities emphasize coordinating emergency management functions with a community's other floodplain management efforts, such as providing public information and implementing a regulatory program. Separate, parallel activities are included for levees (Activity 620) and dams (Activity 630). Credit points are based on threat recognition, planning for a subsequent emergency response, and ongoing testing and maintenance. Up to 790 points. (GTR 4.2, 4.4)

Section 610: Flood Warning and Response: To encourage communities to ensure timely identification of impending flood threats, disseminate warnings to appropriate floodplain occupants, and coordinate flood response activities to reduce the threat to life and property. (GTR 4.5, 4.5.1, 4.5.2, 4.5.3, 4.5.4)

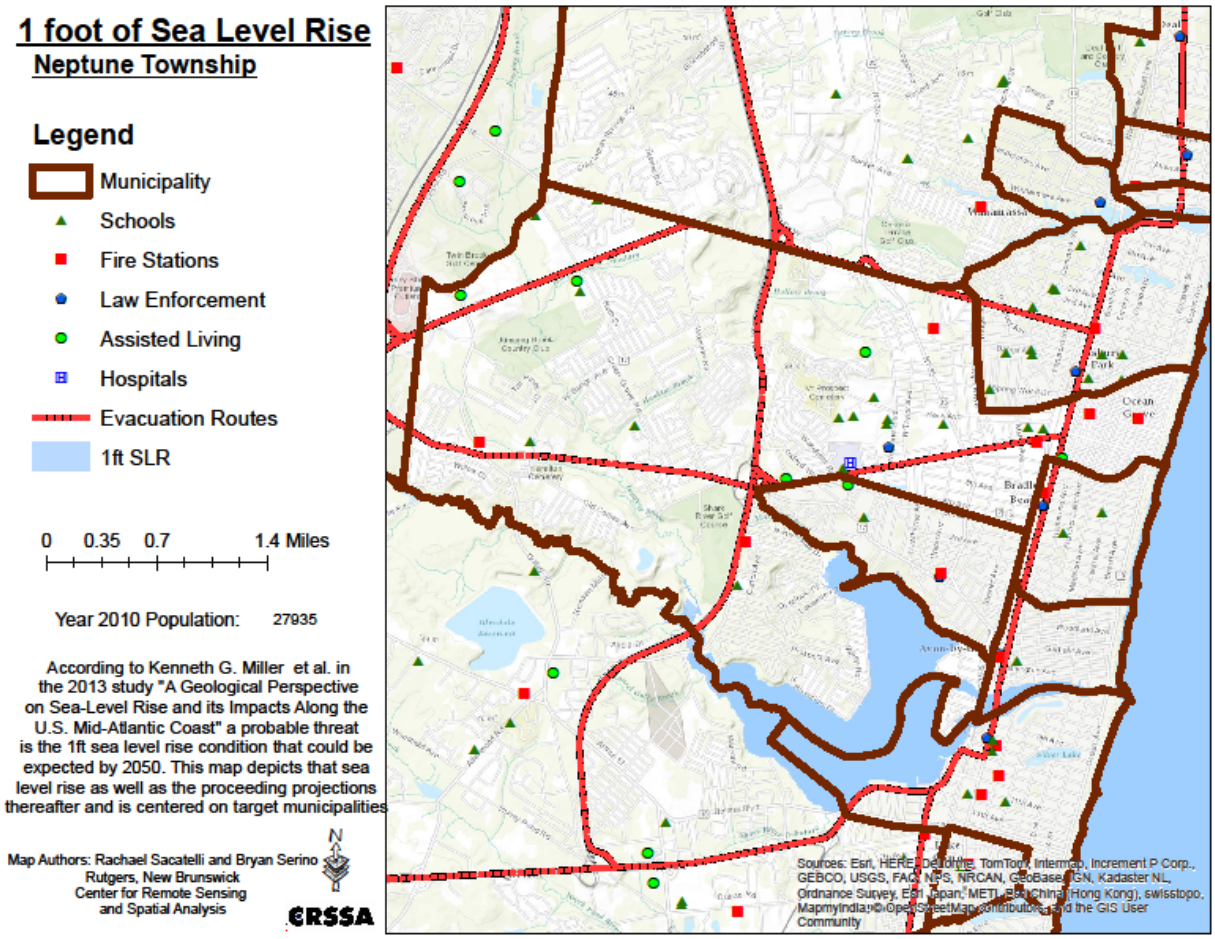
- **Flood response operations (FRO):** Up to 115 points with 10 points awarded for maintaining a database of people with special needs who require evacuation assistance when a flood warning is issued and for having a plan to provide transportation to secure locations. (GTR 2.9, 2.11, 2.12, 4.8, 4.9, 4.9.6)
- **Flood threat recognition system (FTR):** Up to 75 points for a system that predicts flood elevations and arrival times at specific locations within the community (GTR 1.7 (could be done))
- **Emergency warning dissemination (EWD):** Up to 75 points for disseminating flood warnings to the public. (GTR 2.9, 2.11, 4.7, 4.9)
- **DFW7 :** 10 points, if all schools, hospitals, nursing homes, prisons, and similar facilities that need flood warning have NOAA weather radio receivers and at least one automated backup system for receiving flood warnings, provided that the community has coordinated with NOAA and there are arrangements for issuing warnings about dam failures. (GTR 4.11)
- **Critical facilities planning (CFP):** Up to 75 points for coordinating flood warning and response activities with operators of critical facilities. (GTR 2.11, 4.7, 4.9)
- **StormReady community (SRC):** 25 points for designation by the National Weather Service as a StormReady community (GTR 4.1, 4.6 (Could become designated))

Section 630: Dams: To encourage communities to provide dam safety information to communities and to encourage communities, in turn, to provide timely identification of an impending dam failure, disseminate warnings to those who may be affected, and coordinate emergency response activities to reduce the threat to life and property. (Neptune is downstream of a high hazard dam and therefore eligible for points in Section 630)

· **Dam Failure Warning (LFW):** Up to 35 points for disseminating warning to the public. (GTR 2.9, 2.11, 4.7, 4.9)

· **Dam Failure Response Operations (LFO):** Up to 30 points with 5 points awarded for maintaining a database of people with special needs who require evacuation assistance when a dam failure warning is issued and for having a plan to provide transportation to secure locations. (GTR 2.9, 2.11, 2.12, 4.8, 4.9, 4.9.6)

Appendix


1 foot of Sea Level Rise
Neptune Township
Legend
Municipality
Schools
Fire Stations
Law Enforcement
Assisted Living
Hospitals
Evacuation Routes
1ft SLR
0 0.35 0.7 1.4 Miles
Year 2010 Population: 27935
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 Authors: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
Center for Remote Sensing and Spatial Analysis
N
CRSSA
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

Neptune Township

Legend

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

0 0.35 0.7 1.4 Miles

Year 2010 Population: 27935

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

N

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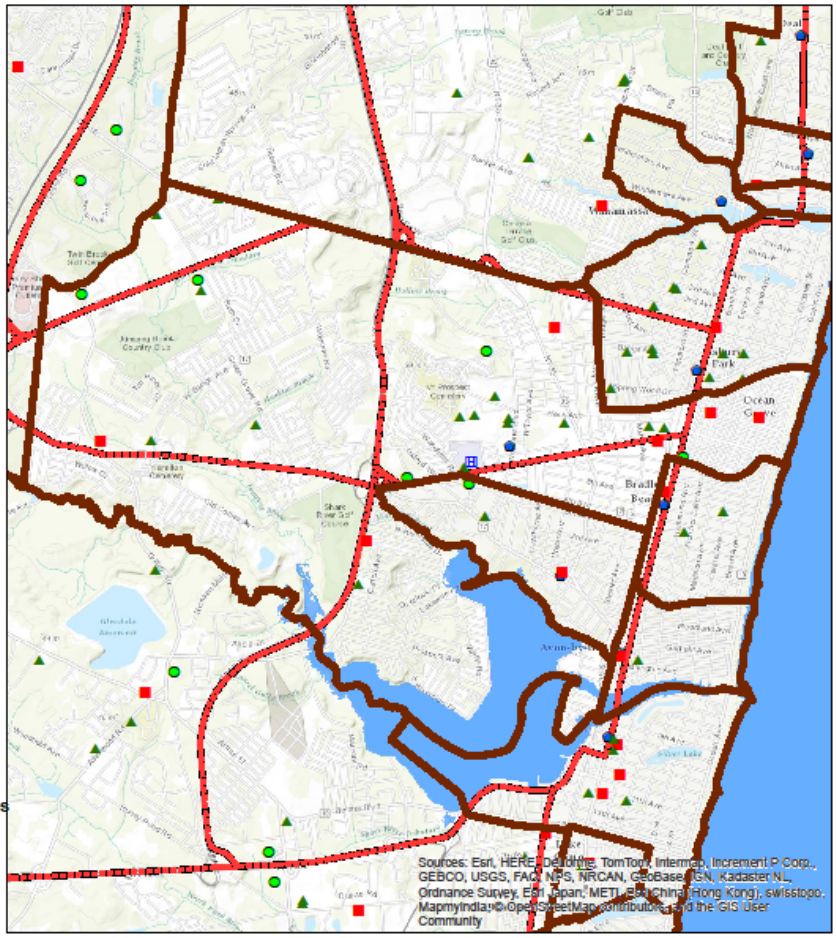

3 feet of Sea Level Rise

Neptune Township

Legend

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

0 0.35 0.7 1.4 Miles

Year 2010 Population: 27935

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

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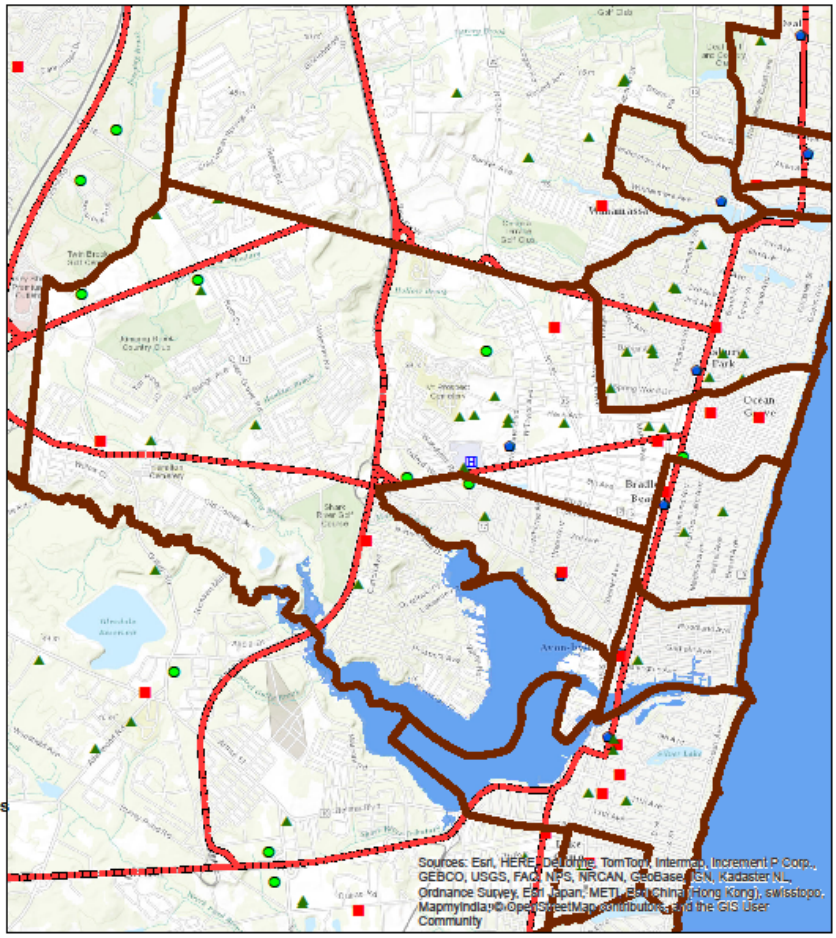

Category 1 SLOSH Model
Neptune Township

Legend

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

Category 1 SLOSH

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

0 0.9 1.8 Miles

Year 2010 Population: 27935

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.

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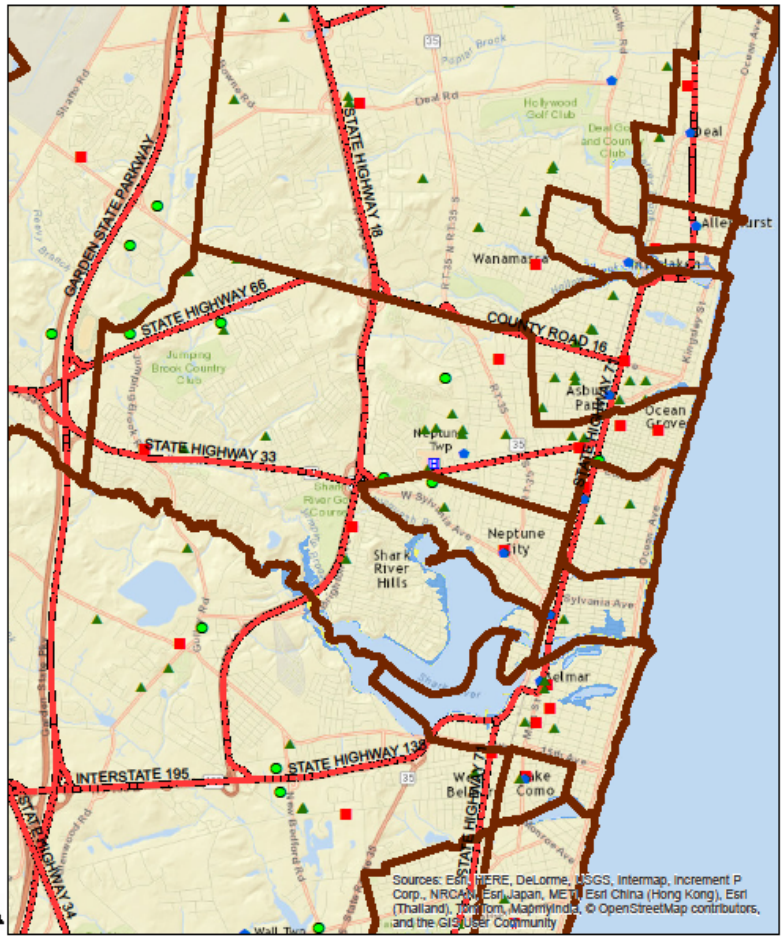

Category 2 SLOSH Model
Neptune Township

Legend

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

Category 2 SLOSH

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

0 0.9 1.8 Miles

Year 2010 Population: 27935

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.

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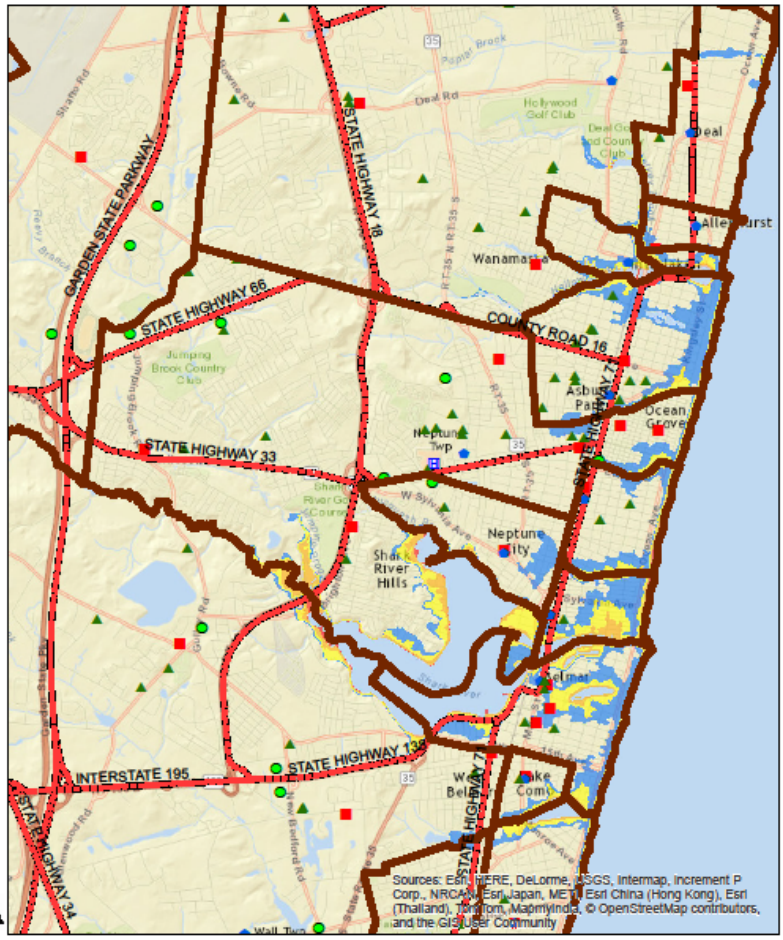

Category 3 SLOSH Model
Neptune Township

Legend

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

Category 3 SLOSH

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

0 0.9 1.8 Miles

Year 2010 Population: 27935

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.

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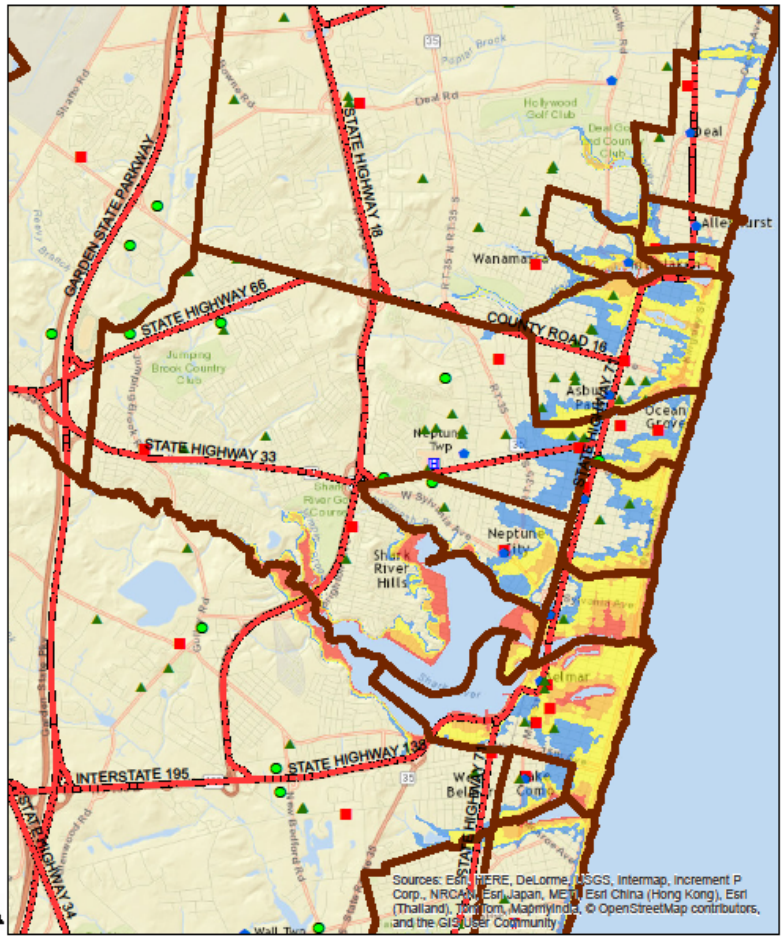

Marsh Retreat at 1 feet of Sea Level Rise Neptune Township

Legend

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

Marsh Retreat at 1ft SLR

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

0 0.375 0.75 1.5 Miles

Year 2010 Population: 27935

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.

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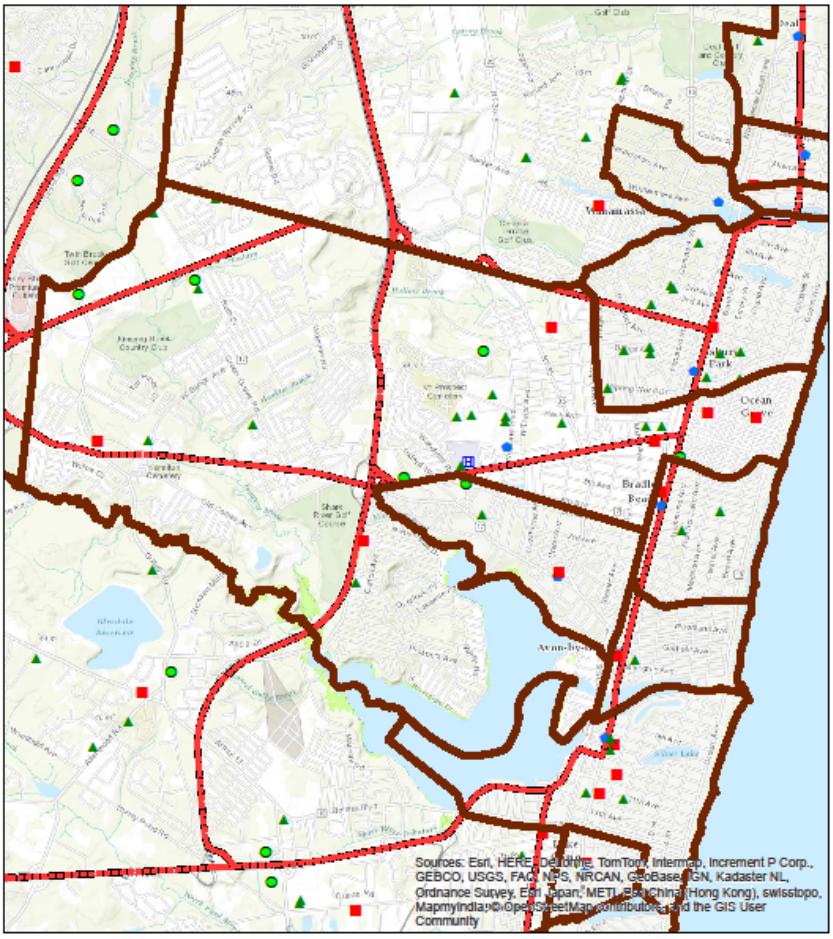

Marsh Retreat at 2 feet of Sea Level Rise Neptune Township

Legend

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

Marsh Retreat at 2ft SLR

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

0 0.375 0.75 1.5 Miles

Year 2010 Population: 27935

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.

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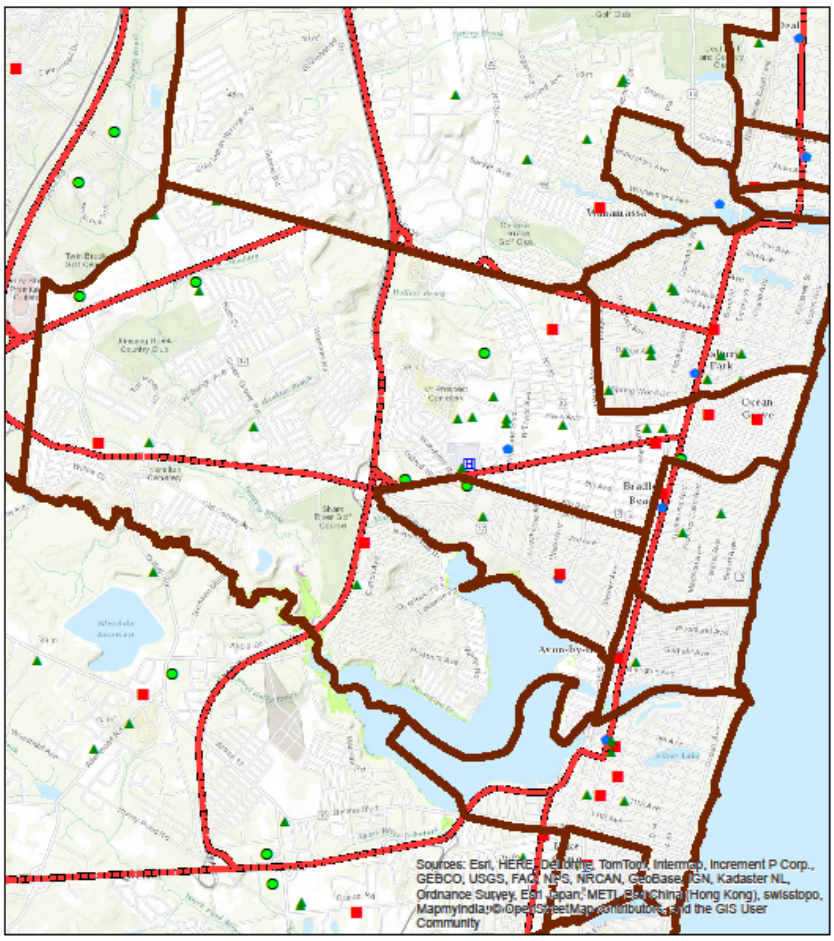
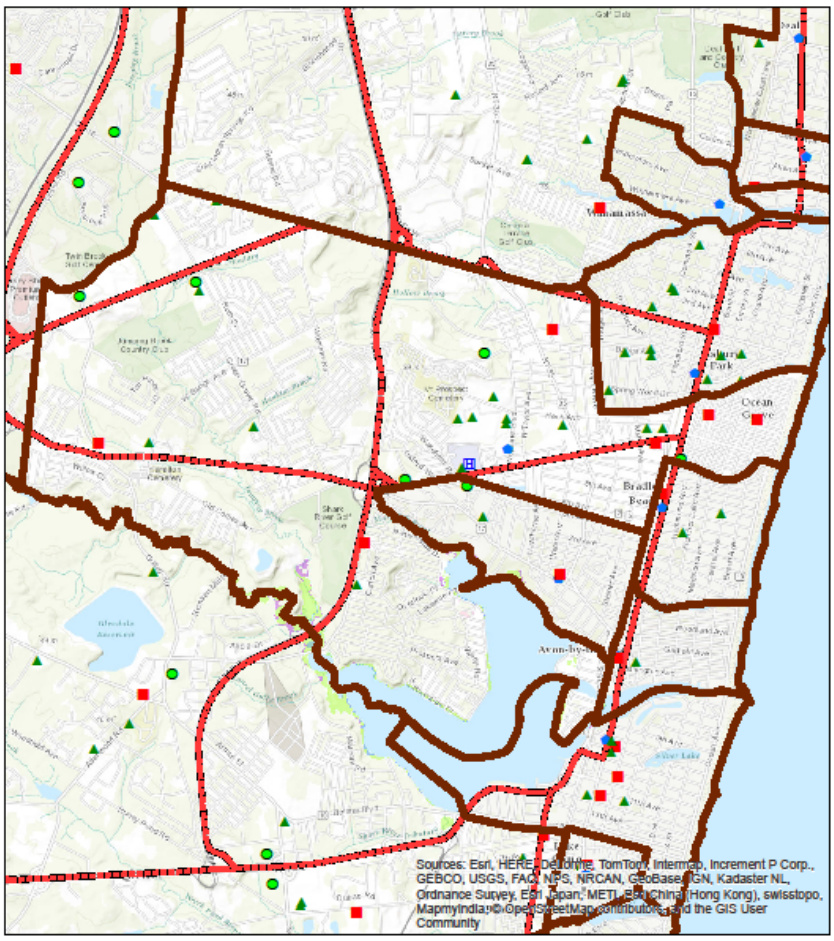


Marsh Retreat at 3 feet of Sea Level Rise Neptune Township



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

0 0.375 0.75 1.5 Miles

Year 2010 Population: 27935

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.

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Center for Remote Sensing
and Spatial Analysis

CRSSA

FEMA's PFIRM Flood Zones for New Jersey
Neptune Township

Legend

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

PFIRM

- Zone X - 0.2% Annual Chance
- A
- AE
- AO
- D
- VE

0 1 2 Miles

Year 2010 Population: 27935

This map shows the extents of FEMA's latest flood insureance rate maps for the state of New Jersey. The numerical label in the zones portrays the static ABFE zone. Please refer to the index for more information.

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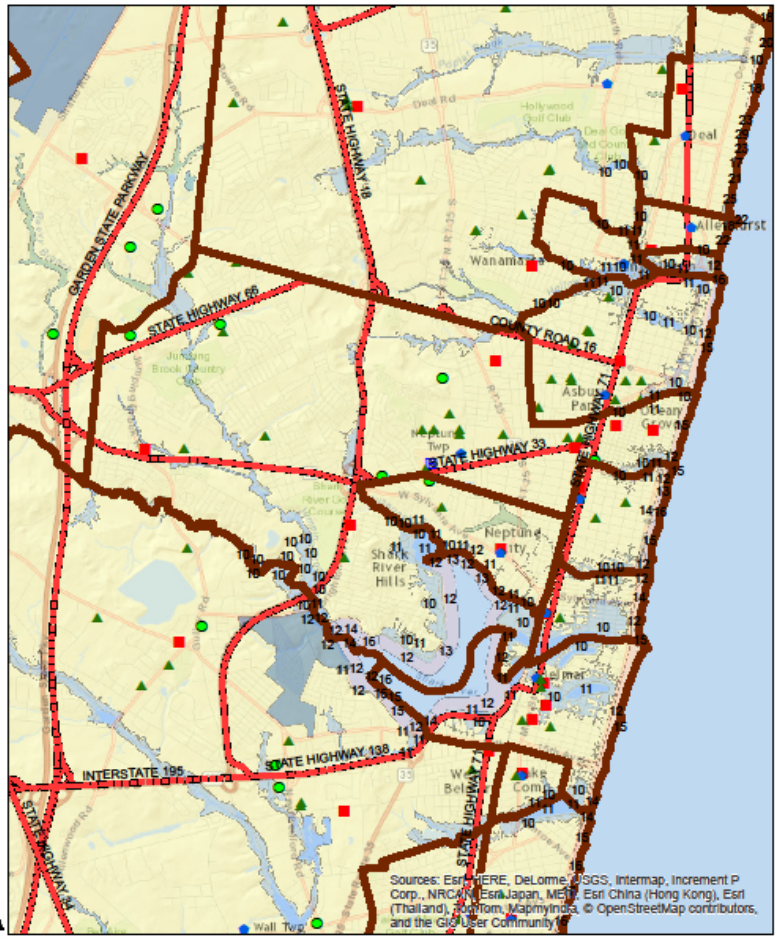
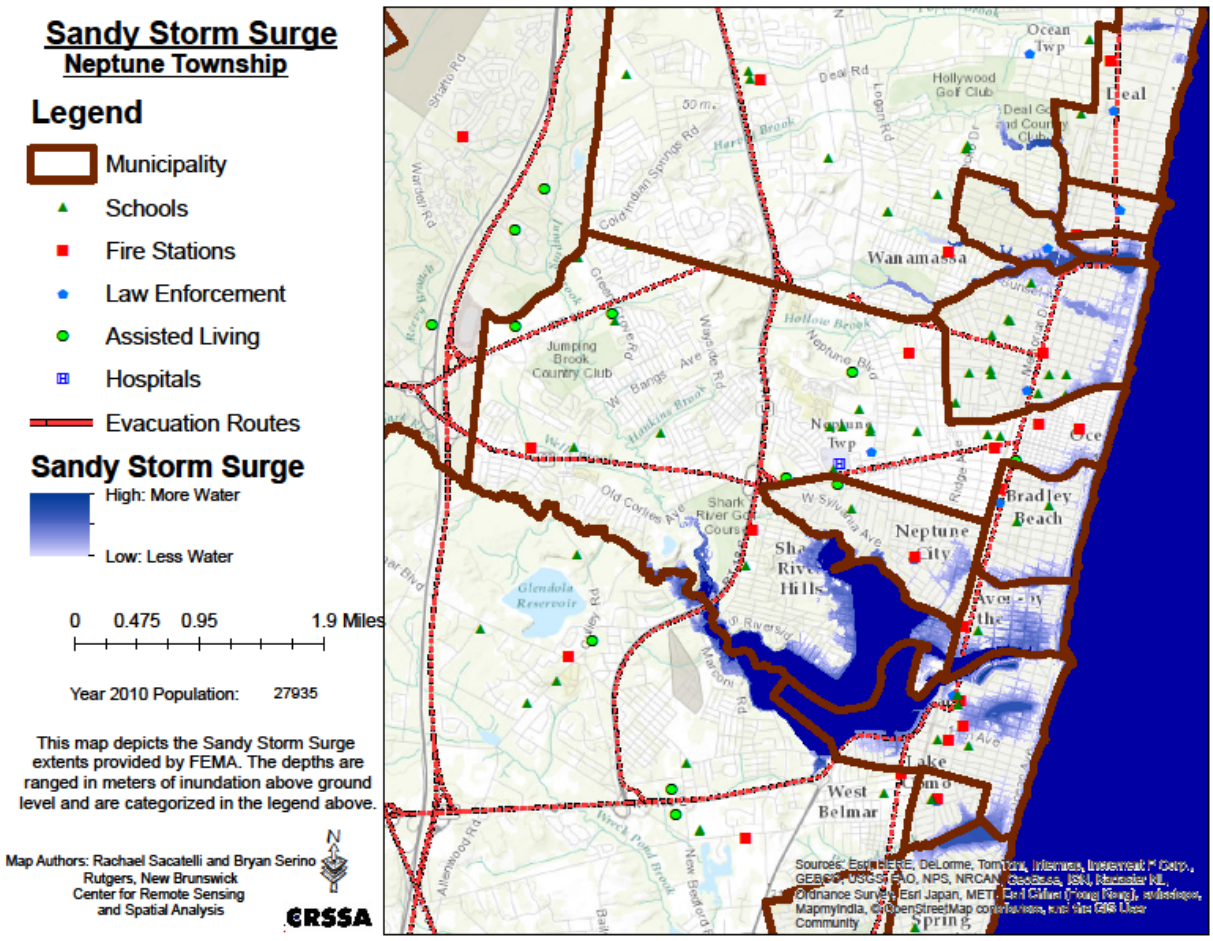



Sandy Storm Surge
Neptune Township
Legend
Municipality
Schools
Fire Stations
Law Enforcement
Assisted Living
Hospitals
Evacuation Routes
Sandy Storm Surge
High: More Water
Low: Less Water
0 0.475 0.95 1.9 Miles
Year 2010 Population: 27935
This map depicts the Sandy Storm Surge extents provided by FEMA. 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
N
CRSSA
Ocean Twp
Deal
Hollywood Golf Club
Wanamassa
Jumping Brook Country Club
Neptune Twp
Bradley Beach
Neptune City
Shark River Hills
Glendola Reservoir
West Belmar
Lake
Spring
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

Neptune Historical Erosion Data

Beach-Dune Performance Assessment of
New Jersey Beach Profile Network (NJBPN) Sites at
Between Manasquan Inlet and Allenhurst, New Jersey
Related to FEMA DR-JI 4086 Declared for Hurricane Sandy

The following information has been taken from the 25 year report of 2011 from the Coastal Research Center of the Richard Stockton College of New Jersey. The following information is that which refers to Neptune or neighboring areas that influence Neptune's erosional rates.

December 5, 2012

The Richard Stockton College of NJ Coastal Research Center (CRC) has initiated a post-storm survey and assessment of the New Jersey shoreline in response to severe beach erosion resulting from the impact and landfall of Hurricane Sandy. The analysis for the southern 15 survey sites starting at the Manasquan Inlet, moving north to Darlington Avenue in the Borough of Deal, NJ. The field work was completed November 12, 2012 as clean-up work continued to clear Ocean Avenue and surrounding streets of sand. This excavated material was being returned to the beach and is included in the survey cross section since it is now part of the post-Sandy beach. This initial report is focused on the impact to municipal dunes and beaches from Hurricane Sandy. The damage details have been organized specific to each municipal segment of the county shoreline starting at Manasquan Inlet and ending at the northern profile site in Deal, NJ. The coastal segment between Manasquan Inlet to Asbury Park was the section of shoreline where the New York District Army Corps of Engineers conducted its Phase II Shore Protection Project between 1999 (initial contract for Manasquan to Shark River) and 2001 (second contract for Shark River to Asbury Park). No subsequent maintenance work has been conducted in this reach. The 2011 CRC 25-year report evaluated the sand quantity remaining within this reach at the 13 sites within the project extent at between 55% and 135% of the initial placement volume. Redistribution among the various groin fields along the reach seems to have influenced the amount of sand still present.

In general terms the beach erosion was significantly worse on the north side of the storm. Southern Cape May County faired best with limited overwash, dune scarping and loss of beach elevation. Damages increased towards the region of landfall with moderate dune breaches, especially in southern Ocean City area, and damages to southern Absecon Island's oceanfront properties. Dune breaches, loss and scarping of dunes, beach width and elevation continued north into Brigantine. From the natural area of Holgate north along the remainder of the Jersey coast the intensity of breaches and overwash and erosion of the dunes, beaches and damage to oceanfront property increased dramatically. Since this part of the Monmouth County shoreline is developed on a coastal plain bluff of far greater geologic age with no barrier beaches and divided by small rivers that have become freshwater lakes due to sand (and development) closing the "estuary" to tidal flow, the damage due to coastal flooding was dominated by the quantity of wave run-up that crossed the beach and dune system before flowing inland among the structures. Each of the "estuary" lakes was breached badly and flooded with salt water. At each one crews were both pumping out the flood waters and excavating at the drainage weir

to find the exit pipeline to the ocean to allow normal freshwater discharge again. Prior to development, a major storm like Sandy would flood these lakes with salt water and the combination of freshwater run-2 off and the storm surge flood would rip open the bay-mouth barrier beach allowing a brief period of tidal exchange after the storm until the normal wave action re-built the bay-mouth barrier again. Historically data supports this contention occurring as late as 1922 when Manasquan Inlet closed to tidal flow and remained closed until the ACOE built the pair of inlet jetties in 1931. In between the "estuary" lakes the storm surge overwhelmed the beach/dune system in most places destroying the boardwalk or promenade transporting huge volumes of sand landward by as much as two blocks from Ocean Avenue (the shore-parallel roadway). The sites at Allenhurst/Loch Arbor and southern Deal are included to show the contrast between the nourished project beaches and the armored and non-nourished shoreline north of Asbury Park.

Beach/Dune Damage Assessment by Municipal Island Segment:

To measure the erosion, pre-existing New Jersey Beach Profile Network (NJBPN) monitoring sites were used to provide an accurate comparison and assessment of storm-related shoreline and beach volume changes. Using the data from the fall 2012 NJBPN survey, completed in Monmouth County by October 4, 2012, provides a good baseline for damages that occurred during the hurricane. Data collected at the 15 oceanfront beach profile locations was completed November 12, 2012 using RTK GPS and extended from the reference location, across the dunes, beach and into the surf to wader depth. Swimming was not done to increase the speed of data collection. By the 12th, it was clear that sand recovery was well under way as a berm had been deposited on the erosional surface generated by Sandy with a substantial offshore bar present in water less than 5 feet deep offshore. However, massive amounts of sand had been transported inland and were being returned to the beach. This was especially bad in Manasquan, Spring Lake, and southern Ocean Grove.

Profile Locations: The following sites were surveyed during September and October 2012 and post-Sandy on November 12, 2012 (Figure 1).
*Below is a map showing the location of each profile. NJBPN 256 Pompano Ave. Manasquan

NJBPN 163 5th Ave. Belmar
NJBPN 157 Riddle Way Manasquan
NJBPN 164 Sylvania Ave. Avon-by-the Sea
NJBPN 158 Trenton Ave. Sea Girt
NJBPN 165 McCabe Ave. Bradley Beach
NJBPN 159 New York Ave. Sea Girt
NJBPN 166 Ocean Pathway Ocean Grove
NJBPN 160 Salam Ave. Spring Lake
NJBPN 167 3rd Ave. Asbury Park
NJBPN 161 Brighton Ave. Spring Lake
NJBPN 267 7th Ave. Asbury Park
NJBPN 162 18th Ave. Belmar
NJBPN 168 Corlies Ave. Allenhurst

NJBPN 169 Darlington Ave. Deal

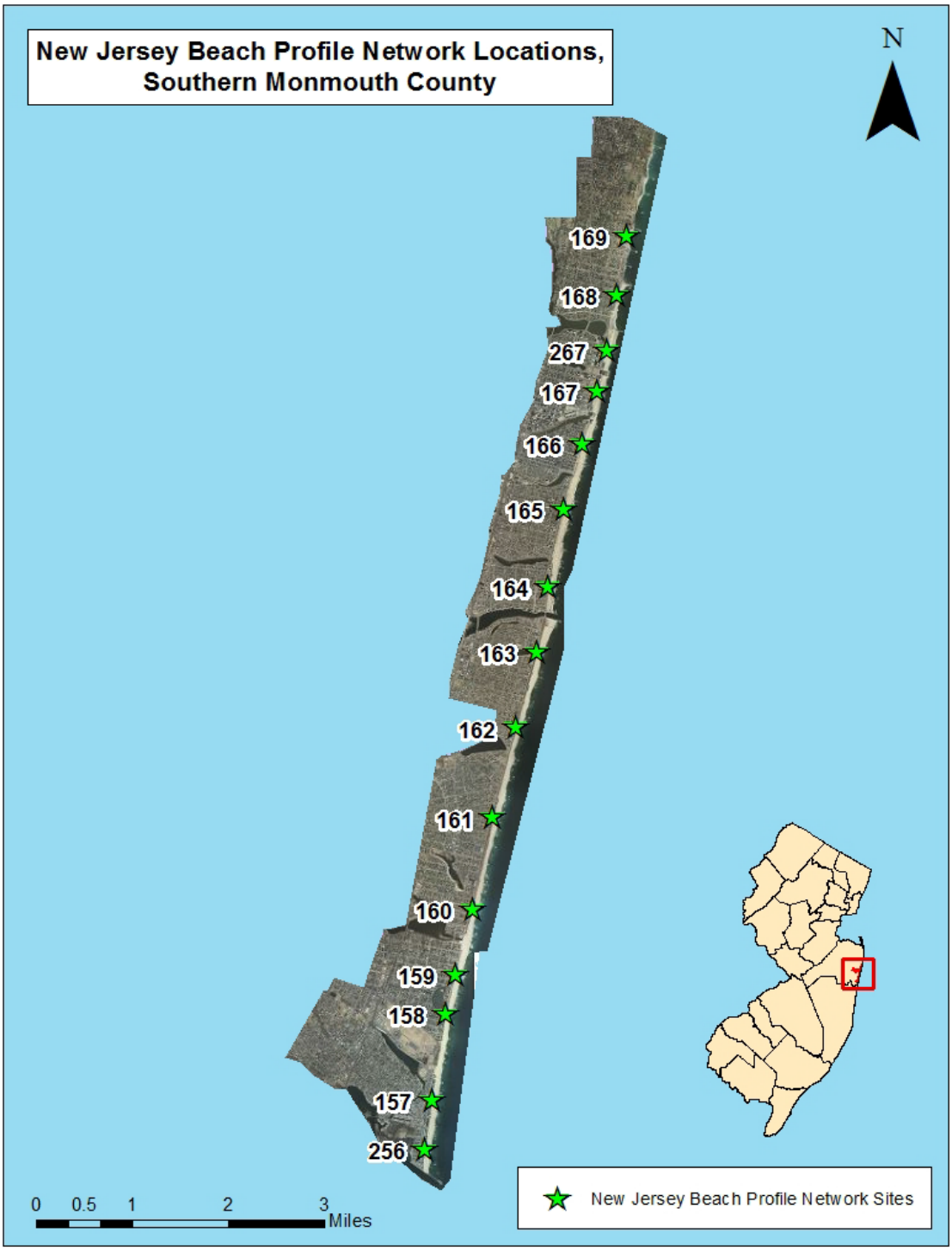


Figure 1. NJBPN Profile Locations, between Manasquan Inlet and Deal, Monmouth County, New Jersey

Manasquan Borough;

Manasquan is located at the southern limit of the NY District's massive Monmouth County beach restoration project and positioned just north of the Manasquan Inlet. Developed at the turn of the 20th Century, many small homes populate the former primary dune between the ocean and First Avenue. Prior to the ACOE project, the Borough had established a small dune system seaward of the paved promenade that is in front of the oceanfront homes This was primarily in response to the December 1992 northeast storm that last damaged the community. Litigation over the dune height, width and access pathways limited the enthusiasm for enlarging the dune's footprint in spite of the Borough's winning the litigation. Sandy broke through the dune line and passed over the promenade into the initial row of homes. Since there are frequently more than one dwelling between the promenade and First Avenue, a great deal of moderate damage was done as water, sand and debris were forced between the narrow passages between buildings. Vast amounts of sand and debris clogged First Avenue such that the oceanfront area was still closed to the public and barely passable on November 12th. There was a substantial offshore bar and a new recovery berm in the process of building. The sand was very coarse and contained abundant pebbles originally derived from bluff erosion over the centuries. There are two cross sections in Manasquan. No promenade remained at Pompano Avenue with tiny remnant dunes present at Riddle Way. A ridge of excavated sand had been built along the alignment of the promenade at the south end of the Borough Beach.

Sea Girt Borough;

Sea Girt is divided into two parts, each with a profile site. The southern site at Trenton Avenue typifies the coastal bluff with major homes and a wide, reasonably high dune landward of the boardwalk that protected the bluff face from erosion and kept the overwash out of the street ends. Some overwash had occurred at Trenton Avenue, but was well on its way to clean-up. The boardwalk had been damaged at Trenton Avenue, but otherwise survived. A dune had grown seaward of the boardwalk since the ACOE project, but it had been eroded away. The northern half is represented by the New York Avenue site where a shore-parallel Ocean Avenue allows vehicle access to the boardwalk and beach for public access. Homes exist across Ocean Avenue. Here there were no dunes, Sandy's waves washed over the beach, across the boardwalk and down the streets a block inland. Tidal flooding also entered by way of Wreck Pond, the second "estuary" lake north of Manasquan Inlet. Crews were at work trying to clear a vast sand deposit from the tidal weir gate and were pumping flood water out of Wreck Pond. This "estuary" still retains a small aspect of the old, natural bay-mouth barrier inlets once common to Monmouth County. That aspect had clearly been utilized by the Hurricane Sandy forces.

Spring Lake;

Two cross sections located in Spring Lake showed that the dune, developed decades ago landward of the boardwalk, was also insufficient to protect the town landward of it. Storm wave up-rush went under the boardwalk, hit the dunes, was force upward and lifted the entire Spring Lake boardwalk off excellent concrete supports and eventually deposited most of it in Ocean Avenue. Hurricane Irene had previously damage some of the structure the August previously in 2011, and the walk had recently been re-surfaced with composite decking. The CRC observed that the steel tie-down pieces had rusted to nearly nothing since 1944 (?) and as a result meant that the entire boardwalk deck assembly was held in place

essentially by gravity. Large quantities of sand had been transported onto Ocean Avenue and down many side streets. Large scale damage to homes was not evident; however flooding by the water level was evident. The “estuary” lake (Lake Como) between Spring Lake and Belmar was likewise being both pumped out and excavated to locate and clear the drainage weir to the ocean. 5

Belmar;

Belmar has two survey sites, one at 18th Avenue and the second at 5th Avenue near Shark River Inlet. The Belmar beach has a boardwalk between it and Ocean Avenue that suffered damage but was still largely present. Sand was in Ocean Avenue and was partially cleared. Belmar would push up a sand ridge in the late fall to act as a minor storm barrier, but it is not known if that had been accomplished prior to Sandy. The beach width had been reduced, but berm growth was underway with offshore bars present at all locations along this reach. Shark River Inlet separates Belmar from Avon-by- the-Sea and was a major source of storm surge flooding to low-lying parts of all communities surrounding this estuary. This was clearly in evidence by the rows of debris piled along the streets, observed in some detail since both highway drawbridges were up and out of service requiring the crew to detour to Highway 35 inland.

Avon-by-the-Sea;

Avon has one site located at Sylvania Avenue where damage to the boardwalk was extensive extending to the structures adjacent to the boardwalk. Sand occupied Ocean Avenue with evidence of wave damage to businesses on the far side of the roadway. Avon had a “landscaped” dune that did little to protect the infrastructure, so once the waves crossed the beach, there was little to prevent them from dissipating their energy on the infrastructure. The same offshore bar and recovery berm was present on the beach here as everywhere else.

Bradley Beach;

The McCabe Avenue site had some damage, but fared better than most locations. The dunes did survive in places and kept the worst of wave impacts out of the City. Storm surge flooding did occur with damage to some structures and boardwalk sections. Sand was being hauled back to the beach which was recovering with a berm and bar close to the shoreline.

Ocean Grove;

The southern half of Ocean Grove was still in the process of having Ocean Avenue cleared of a thick sand deposit with the material being hauled back to the beach. The boardwalk was broken up and the dune system was gone. To the north of Main Street, things improved with remnant dunes in place, little sand in the street and an intact boardwalk. At Ocean Pathway the dune remained as did the large, open, but roofed over seating area seaward of the boardwalk. The dune remained with the instrument monument about 1.5 feet from the scarp.
Asbury Park;

The Federal project beach in Asbury Park had no dune, but the sand was ramped up to the elevation of the boardwalk. As a consequence, at both survey sites there was minor decking damage, some railings destroyed and the majority of the wave energy passed over the boardwalk into Ocean Avenue. Sand was in front of business establishments on the landward side of the boardwalk with flow at each street end. Sand was being hauled to the 7th Avenue site where sieving equipment was separating debris from the sand prior to it being returned to the beach. Sand recovery from offshore was also well underway.

Allenhurst – Loch Arbor;

The site #168 at Allenhurst sits on top of an ancient concrete wall that drops vertically to the sand beach. There is a wooden walk elevated above the road just landward of the concrete wall. It was at this site that we came to realize the 6 power of Hurricane Sandy's wave forces. The boardwalk is 20 feet above sea level, behind a vertical concrete wall located about 100 feet from the low tide line on the beach. About 50 feet of the boardwalk was stripped from the supports and shifted toward the roadway with ample evidence that waves had moved across the lawns of the major houses further landward. A well-clipped hedge was pushed over landward with debris threaded through it and the grass landward was dying from salt water with loads of small debris all over it. Down below, the beach was present, ramped up to the wall's base. Two massive slabs of concrete had settled downward and slightly outward at the base indicating that failure was threatened during the height of the storm. There was a recovery berm and offshore bar along the entire segment between the Deal boundary groin and the Deal Lake flume. Loch Arbor is only a two-block shoreline with half public beach and half in private ownership. There has been a long history of storm waves washing through the private beach club into Deal Lake. This clearly had occurred as the road across the "estuary" lake bay mouth barrier was still closed. Deal Lake is the largest of the now-closed stream estuaries along the Monmouth County Shoreline. It has been mapped as open to the tide flow as late as 1880, but closed by 1889. There was no paved road across the bay mouth sand bar until after 1920 according to the earliest aerial photography. There is a sizable weir and boxed flume carrying freshwater seaward to drain the lake. This was still functioning though sand had spilled into the lake at the seaward end. No Federal Project sand was deposited along this short segment, but over the past 13 years material has escaped by the large terminal groin in Asbury Park enhancing this small reach.

Southern Deal;

Deal is divided from Allenhurst by a massive boxed pair of groins that retain all sand on the Allenhurst beach, letting none past to the north. The Darlington Avenue site is about a mile north into Deal and was picked because there was a pocket beach centered at Darlington Avenue extending several blocks in either direction. The sediment bluff, once exposed 25 years ago had been armored by individual property owners over time with timber bulkhead "seawalls". The beach varied little over time. The wave forces over-matched the newer timber structures smashing them to rubble and exposing an erosional scarp in the bluff sediments. In 50 years, I have never observed so much of the Cretaceous sediments that comprise the Monmouth County uplands exposed to view. The retreat at the top of the bluff was about 25 feet of loss to the oceanfront property owners in a very irregular pattern. Those who chose to

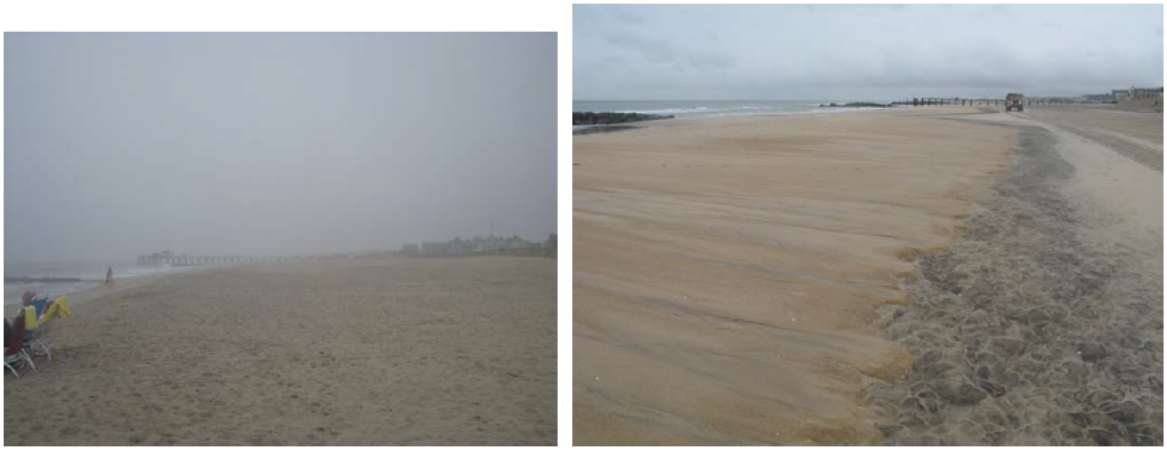
build a beach cabana at or near the sand at the base of the bluff lost it to splintered wood. One was concrete and suffered the same fate because the storm undermined its foundation. Old structural relicts, never seen earlier were exposed on the lower beach with a bar offshore where the sand had been carried and deposited. With the erosion noted in the bluff, this little beach likely gained sand volume the time-honored way by storm erosion of the bluff sediments.

Individual Site Descriptions:

Each location was surveyed following Hurricane Sandy on November 12 and 13, 2012. The profile line was covered using RTK-GPS with data points on the dune, beach and shallow offshore regions. In all cases, the very visible offshore bar could not be reached due to water depth and wave action. The sand loss figures apply to the dune/beach system only and do not account for a percentage of sand dragged offshore by Sandy's waves, to return later in time. This recovery process was clearly already underway. A berm and small bars had already attached to the shoreline above low tide.

Link to full report:
http://intraweb.stockton.edu/eyos/coastal/content/docs/sandy/SouthernMonmouth.pdf

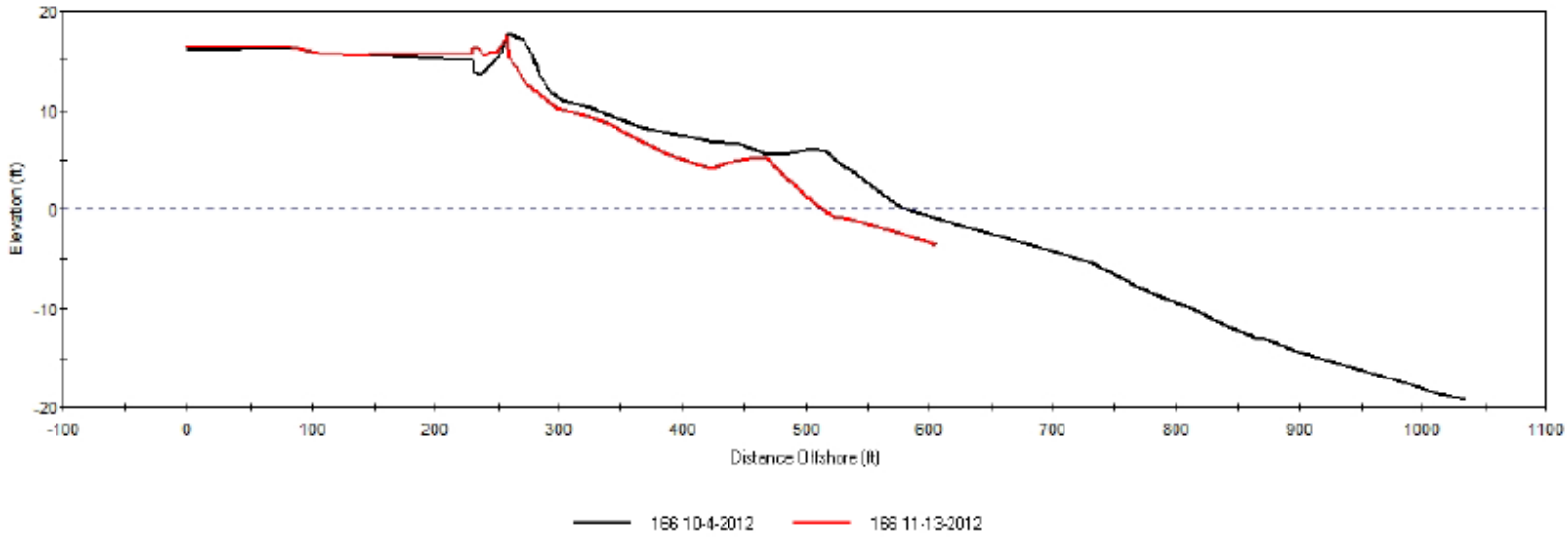
NJBPN 166 – Ocean Pathway, Ocean Grove



The photographs above were taken on October 4, 2012 (left) and November 13, 2012 (right).

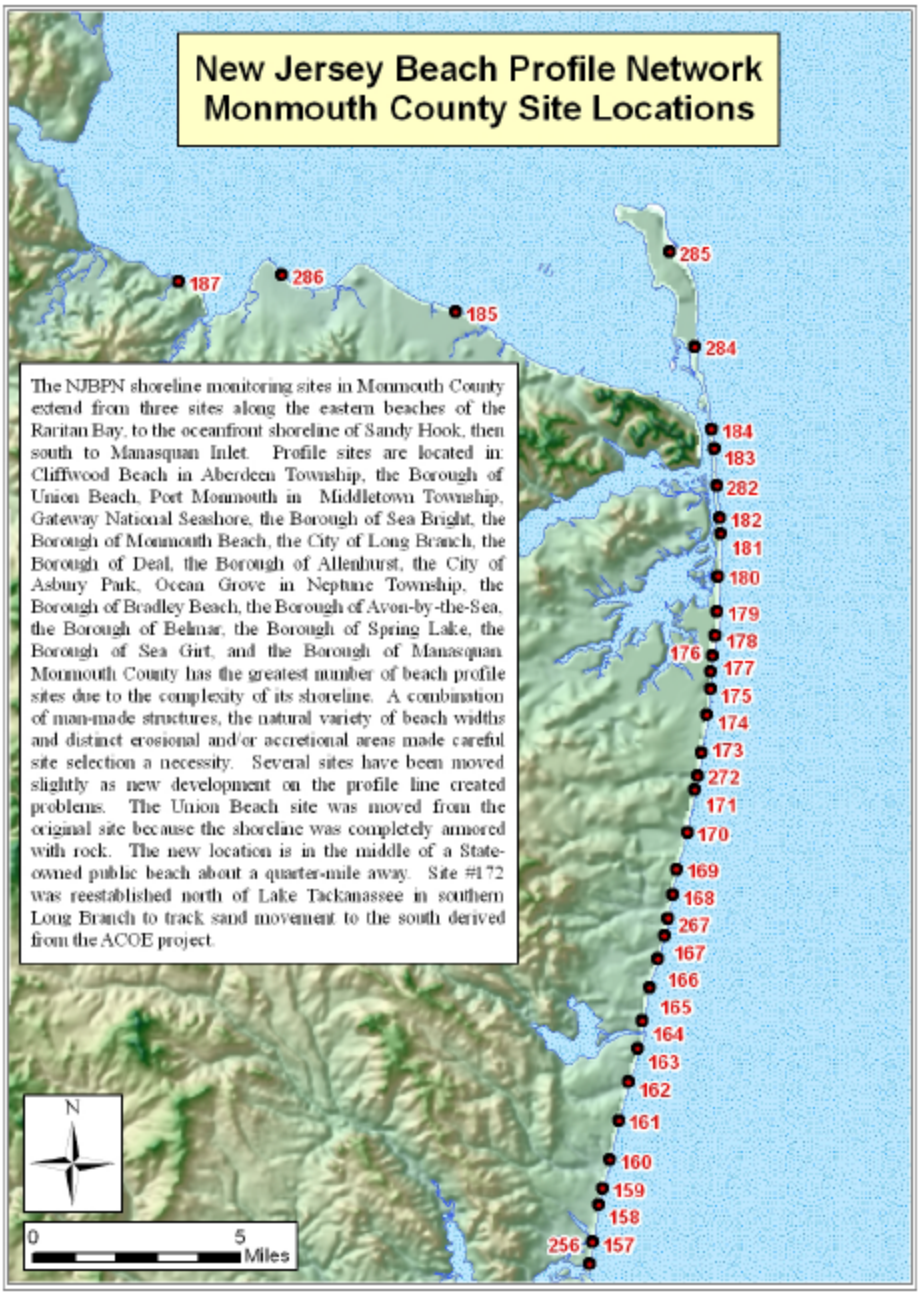
Figure 6. The dunes along the northern Ocean Grove shoreline survived as partial sections, example below, but were removed south of Main Street. Sand was being excavated from Ocean Avenue and carted back to the beach (vehicle in right photo above). The post-Sandy photograph illustrates the recovery as of November 13th as a coarse, yellow-colored sand was building back onto the beachface as bars were developing offshore.

Pre vs. Post Sandy
Site 166
Ocean Pathway, Ocean Grove



Stockton's Coastal Research Center 25 Year Report for Monmouth County

The following information has been taken from the 25 year report of 2011 from the Coastal Research Center of the Richard Stockton College of New Jersey. The following information is that which refers to Neptune or neighboring areas that influence Neptune's erosional rates.



"Monmouth County contains 36 profile stations, making it the most densely surveyed county. There are three sites along the Raritan Bay shoreline and the complexity of coastal construction along the Atlantic

shoreline demanded a greater number of profile stations to cover the variety of coastal shoreline features present in the county.

Monmouth County received the benefit of the largest, most expensive and most comprehensive beach nourishment project ever in the United States beginning in 1994. Completed by the New York District Army Corps of Engineers (USACE) for $210,000,000, this project continued in three phases until the year 2000. In all, 21 miles of the county shoreline were restored with a 100-foot wide berm and a dune system built in all locations where practical (a total of 6.1 million cubic yards of sand). The only gaps in the entire project where no sand was placed on the beaches were in the communities of Loch Arbor, Allenhurst, Deal and Elberon because these communities would/could not provide the necessary real estate easements from owners. This fact divides the restored shoreline into two filled segments: one from the Sandy Hook National Seashore south to the Long Branch/Elberon boundary; then no fill to the Asbury Park boundary; and the second segment from Asbury Park to the Manasquan Inlet. The National Park Service also piggybacked onto the Federal project operations and placed sand onto the erosional zone within the Sandy Hook Park boundary, thus adding to the length of the fill.

Maintenance fills have been completed following two strong storms in 1998, hot-spot erosion in Monmouth Beach in 1997 and 2002, and in southern Long Branch in March 2009. The southern Long Branch project extended south of West End Avenue and north toward Broadway Avenue. Funds in the amount of $2,961,000, $3,305,000 and $1,316,000 were appropriated for Fiscal Years 2006, 2007 and 2008, respectively. This funding was used to design and construct approximately 2400 linear feet of beach re-nourishment in South Long Branch. Since completion in 2001, the southern segment (Asbury to Manasquan) has not required maintenance.

TREND ANALYSES: To celebrate the 25 years of surveying each site had the computations generated for the annual fall-to-fall changes in shoreline position and sand volume across the length of the survey and a set of graphs made to show the annual changes, then the cumulative summation of each year's gain or loss to generate trends similar to the select few done in 2010. The trend analysis extends back 17 years for those cross sections added when the program went to twice annually in 1994.

The sites within the Federal project's two zones of construction all show the scope of the project's impact on the shoreline and sand volume available to the site. Many sites, especially, between Asbury Park and Manasquan Inlet have trends in sand volume over 100% of the sand volume initially placed. While the trend is downward in Long Branch and Sea Bright, it must be remembered that those in opposition to this project earnestly predicted that "All the Sand would be GONE" in 3-5 years. The surveys support a far different result with sites like McCabe Avenue in Bradley Beach (103% of placed volume) and Brighton Avenue in Spring Lake (135% of placed volume 12 years after the project without any further maintenance. The maximum value is 325% of the placed volume remaining at 5th Avenue in Belmar due to the presence of the Shark River jetty and a very low initial need for sand placed by the USACE. The low for the retention occurred in Ocean Grove with 59% remaining 12 years later.

Site 179, Cottage Road, in Monmouth Beach has been an enigma due to persistent, rapid loss of sand deposits. Observations made the past two years may lead to possible reasons. There is a massive stone

groin protecting the Monmouth Beach Club property positioned about 500 feet south of this site. In the absence of northeast storms the dominant littoral currents are directed to the north, so the sand moves north away from the groin and the Cottage Road site and is not being replaced by significant material traveling north around the groin. By the fall 2009 survey the site was devoid of sand, the dune was gone and the beach was wet at low tide, not far from the conditions existing here prior to the beach fill. Following the 2009-2010 winter storm season, sand had reappeared as a dry beach fronting the rocks, a minimal, but significant improvement when compared to the fall 2009 survey situation. The littoral currents were reversed by the northeasters and were increased in magnitude during the storms. However, the groin protecting the Beach Club served to impound
the sand and did not allow sediment to pass further south and the profile site beach accumulated sand during the period of severe weather. If this is the case, this location will be a perpetual "Hot Spot" for erosion.

Though there was a substantial loss of sediment from the beaches of Monmouth County in the 2009-2010 winter storm season, the county remains over 13 million cy of sand above the amounts in the 1993 beaches (Figure 7). However, between 2010 and 2011 the storm trend reversed with Hurricane Irene and one significant northeast storm in late October 2011 yielding a small but hopeful positive sand volume increase (174,000 cubic yards). The CRC has computed a loss rate number for the 21 miles of USACE managed beaches and without any further sand volume added, the emplaced fill will be 100% gone in 56 years by 2068.

Examination of the sand transport rate into the National Seashore at Sandy Hook has shown that the entire sand volume loss between Elberon. Long Branch, Monmouth Beach and the park boundary with Sea Bright is seen as deposition between the park boundary and Gunnison Beach site (that DOES NOT count any of the sand north of Gunnison to the tip of the Sandy Hook spit). If the sand does leave the northern developed Monmouth County shoreline it will be located in the growth added to the National Seashore.

Thus far no significant funding has been appropriated to conduct maintenance beach nourishment projects for Monmouth County. Suitable sand dredged from the maintained channel in the Shrewsbury River estuary was pumped across the barrier and seawall to add sand to the Monmouth Beach (55,000 cy) erosional hot spot (Site 179). No other beach restoration projects have been authorized by local municipal governments.

Link to full report:
http://intraweb.stockton.edu/eyos/coastal/content/docs/2011_NJBPN_report/monmouthco2011.pdf

Figure 105. Shown above is the view looking northeast from the dune at Ocean Pathway in Ocean Grove, NJ.

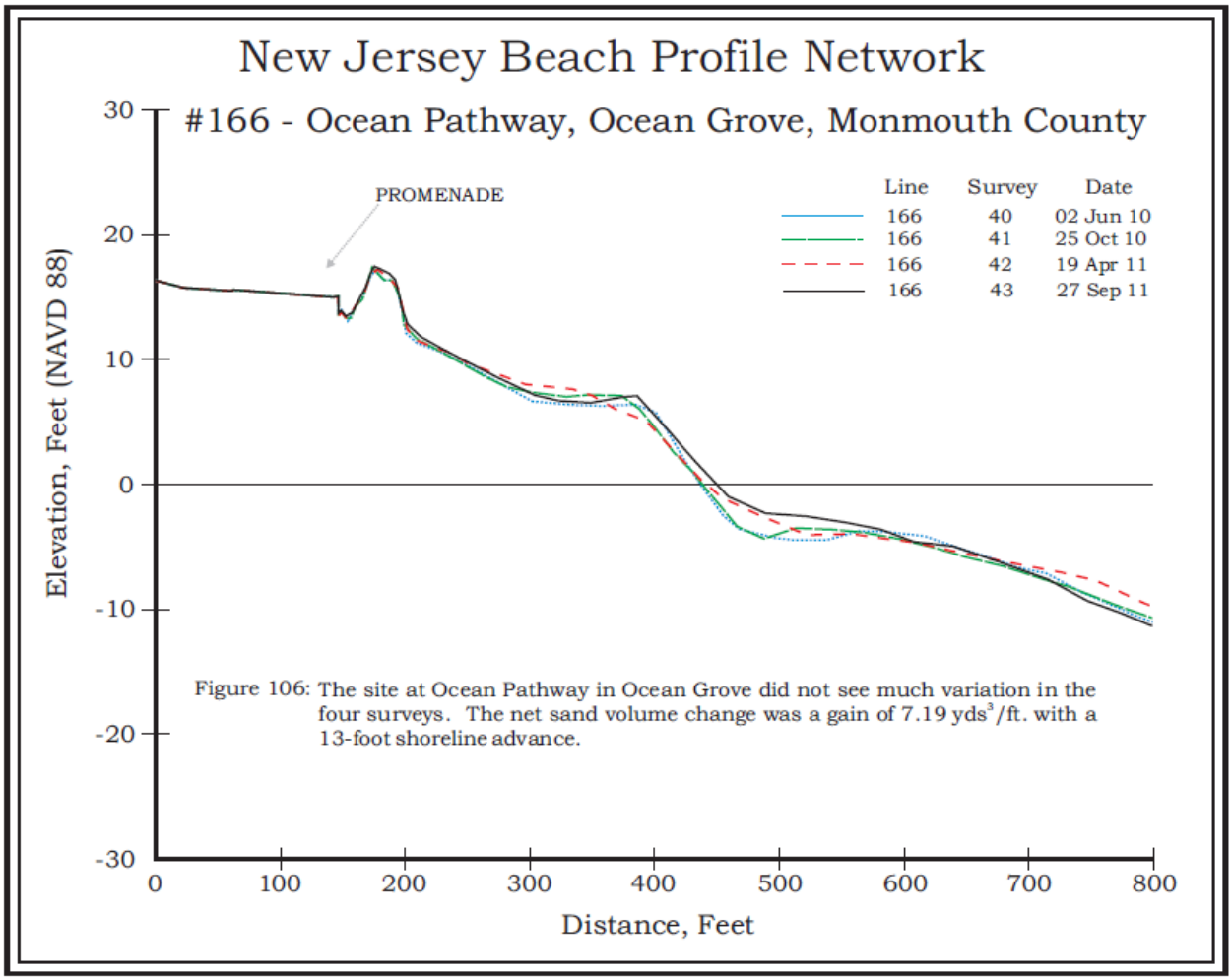


Figure 106: The site at Ocean Pathway in Ocean Grove did not see much variation in the four surveys. The net sand volume change was a gain of 7.19 yds^3/ft. with a 13-foot shoreline advance.

OCEAN PATHWAY, OCEAN GROVE– SITE 166

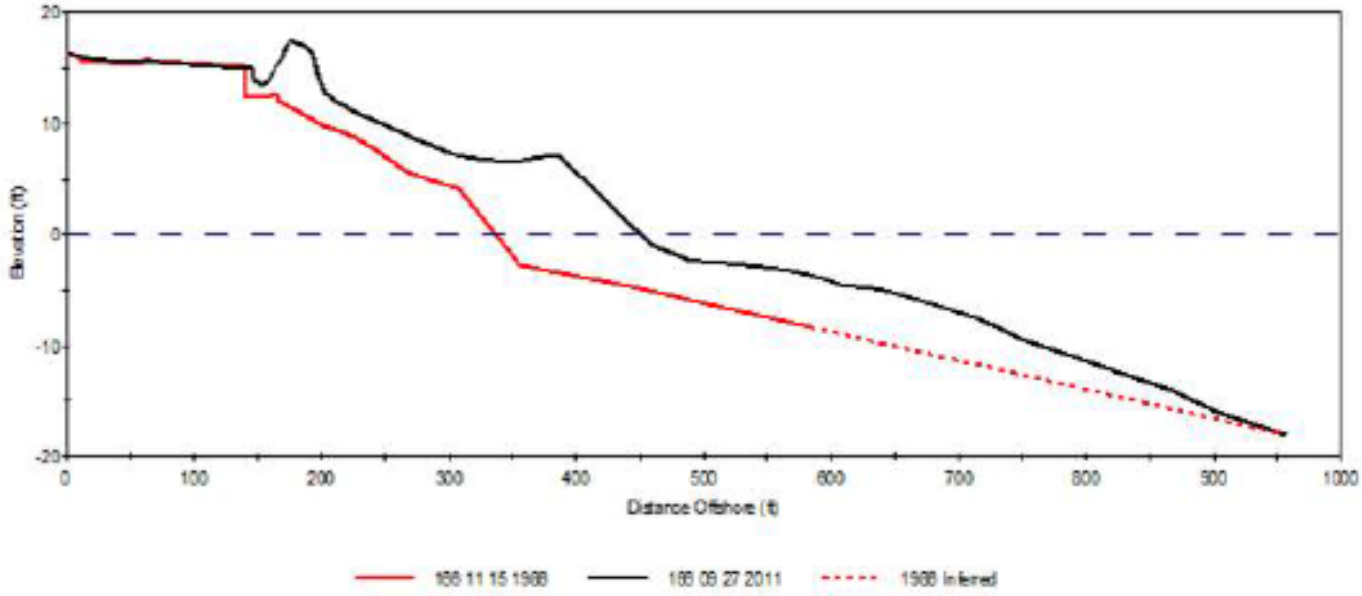


Figure 107. The USACE completed a beach nourishment project in 1999 which attributed to greater than a 300-ft advance of the shoreline. This site has remained relatively stable and no maintenance sand has been added here. Left photo October 14, 1988 [view to the northeast]; right photo September 27, 2011 [view to the northeast]).

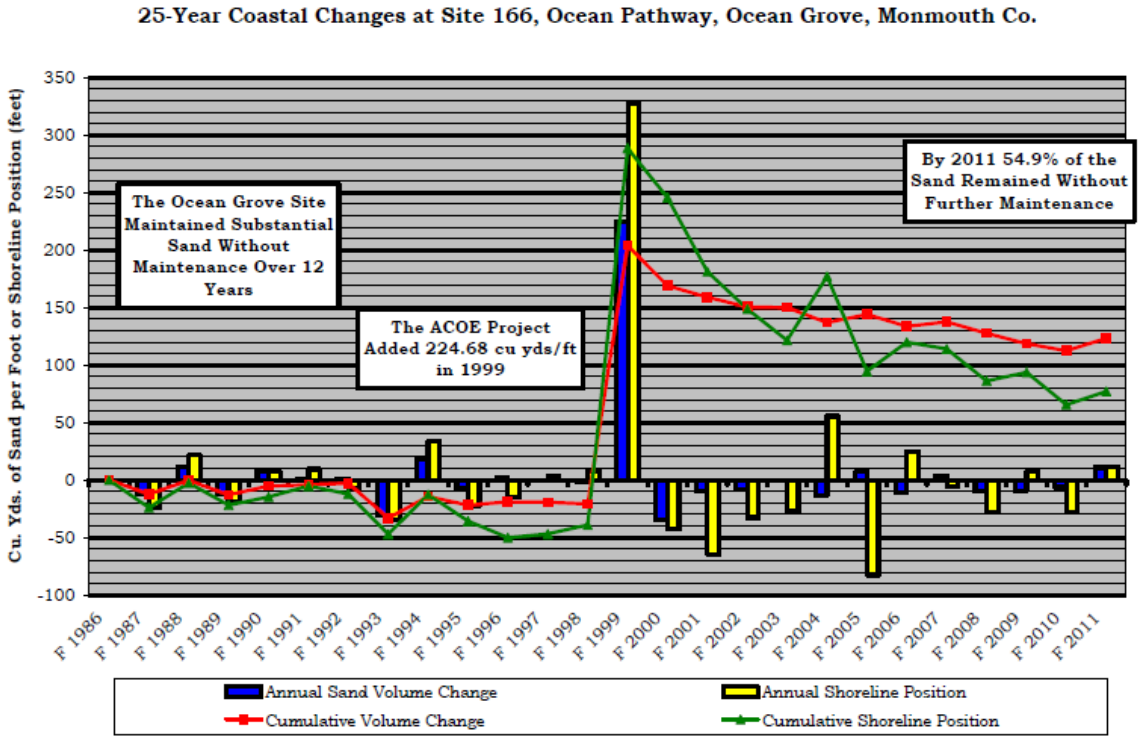


Figure 108. The extended period of slow shoreline retreat ended in 1999 with a better than 300-foot advance in the position with the fill project construction. Since 2000 there has been a pattern of slow sand volume loss and shoreline retreat which continued through 2011. By 2011 54.9% of the sand remained from the ACOE fill in 1998.

USGS Historical Shoreline Data

For a longer look back at shoreline data for Neptune's oceanfront, the USGS has compiled a listing of the shoreline data for our area. You can access these different surveys at http://marine.usgs.gov/coastalchangehazardsportal/.

Zoom in on Neptune, select Shoreline Change, select Historical Shoreline Positions and analyze the different shorelines. You can click on each for information about when that shoreline position was sampled. The earliest data appears to be for 1839. As you will see, the shoreline position has not moved dramatically over time, but has meandered landward and seaward. The 1839 shoreline was similar to the current shoreline but was further seaward in the southern few blocks of Ocean Grove. In 1866, the shoreline had retreated half the distance to the current dune line. Retreat continued through 1934 when the shoreline was near the current dune line. In 2000, the shoreline was seaward of the current position, resting near the middle of the groins in the intertidal zone. This largely due to a large replenishment project that took place in the late 1990's.