

Township of Middletown

“Getting to Resilience”

Recommendations Report

Prepared by the Jacques Cousteau National Estuarine Research Reserve



February 2015

Recommendations based on the “Getting to Resilience” community evaluation process.



Table of Contents

Introduction.....	3
Methodology.....	4
Recommendations.....	5
Outreach.....	5
Mitigation.....	8
Municipal Organization.....	10
FEMA Mapping.....	11
Planning.....	14
Coastal Hazard Incorporation in Planning.....	21
Municipal Master Plan Example.....	21
Mapping.....	23
Other Suggested Maps.....	25
Sea Level Rise & Surge Vulnerability.....	26
CRS Sections That Likely Have Current Points Available	28
Appendix.....	36
Middletown Historical Erosion Information.....	47

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 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 Coastal 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 started as a facilitated discussion regarding the Township's resilience strengths and challenges. Middletown is a Federal Emergency Management Agency (FEMA) Community Rating System (CRS) participant and currently has a Class 6 ranking. Officials are hoping to move Middletown up to a Class 5. Middletown participates in numerous partnerships that aid in resiliency. Middletown works hand in hand with Monmouth County to plan for and respond to disaster events. Middletown also participates in the Bayshore Group, a collective of the Office of Emergency Managers (OEMS) from Highlands to Keyport, where information and resources are shared. Naval Weapons Station Earle is within the municipal boundaries of Middletown. Earle and Middletown have some shared services and Township staff feel they can rely on Earle for assistance when needed during emergency events. The Sandy Hook Unit of the Gateway National Recreation Area is not contiguous to the rest of Middletown but is nonetheless part of the Township. Sandy Hook contains a Coast Guard Station, providing another resource for emergency response within Middletown's boundaries.

Middletown still has not fully recovered from damages caused by Hurricane Irene. Irene had much heavier rainfall than Sandy, resulting in heavy riverine flooding that caused major bridge and roadway washouts. Some of this infrastructure has yet to be repaired. Middletown officials noted that Sandy would have brought far worse damages if it had similar rates of rainfall to Irene. The Township has numerous streams that require cleaning to reduce clogging and subsequent flooding. Cleaning requires complicated permitting and would sometimes need to be done in partnership with neighboring municipalities. However, even with clean streams, heavy precipitation in conjunction with storm surge have the potential to bring flooding into areas that did not see flooding in either Sandy or Irene as the two hazards would amplify one another. Middletown Office of Emergency Management has kept in depth records of flooding extents to track flood prone areas that may not be easily identified in GIS mapping.

Officials noted that the neighborhood of North Middletown is surrounded by a protective levee that prevented flooding during Sandy. Officials had concern that this levee is not factored into modeling of storm surge, sea level rise, or flood insurance maps. Modeling for storm surge and sea level rise indicate the area protected by the levee will experience flooding, a situation contradicted by documented storm events where no flooding took place. Due to the success of this levee, the Township is currently working with the United States Army Corps of Engineers (USACE) to design and build a levee and floodgate to protect Port Monmouth. The Township is hoping to build a dune system in neighboring Leonardo. Port Monmouth was particularly hard hit during Sandy. The Port Monmouth Firehouse endured 4 feet of flooding during the storm. Luckily, most of the equipment was saved. A senior village containing 96 units suffered substantial damage to 40 units. The Township amended the zoning ordinance for this site to encourage more resilient development outside the floodplain. A new development of 110 units has been approved to replace the existing damaged development.

However, Middletown has found that planning for resiliency presents another set of obstacles. While the Reconstruction, Rehabilitation, Elevation, and Mitigation (RREM) Program is providing residents with opportunities to elevate their homes to reduce flood risk, planning for the impacts of this program at a municipal level is challenging. It is difficult for planners to know who will rebuild, who will return to their homes, and who will stay. As Middletown is mostly built out, planners are tasked with the redevelopment or infill development of areas between developed sites. However, previous plans to create economic development areas also may be at odds with known vulnerabilities. With the RREM program in place, many homes are being elevated. Emergency officials have concerns that residents of these homes will choose to ride out future storms rather than listening to evacuation orders.

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 Middletown this team included Jason Greenspan (Planning Director), Charles Rogers (OEM Director), Charles Ehret (OEM Operations Chief), John Baree (Assistant Planner), Amy Samnikiloau (Assistant Director of Community Development), and Victor Wymbs (Assistant Director of Public Works). 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 questionnaire was started with the Township on November 6th, 2014. JC NERR staff met with six representatives of Middletown. A discussion of the Township's resilience strengths and challenges began the meeting and section one of the questionnaire was completed. On December 12th, the questionnaire was completed with five representatives of Middletown 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 to help assist the Township of Middletown's decision makers as the Township works to recover from Superstorm Sandy and 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 its residents. Many recommendations in this report are connected to the CRS program as it helps communities save money and become better prepared.

OUTREACH

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

Middletown is already a member of the Community Rating System. However, Middletown 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 and businesses for natural risks. Past outreach efforts should be examined and revisited if they were successful.

It would be beneficial to develop 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 its 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.

Middletown should consider developing a collection of outreach projects in anticipation of future storm events. The outreach should cover all necessary information such as evacuation routes, safety procedures, and recovery operations. This action could be undertaken through a PPI and would help Middletown 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.

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

After Sandy, Township staff has held talks and discussions on various flood related topics. As Middletown is a coastal community, creating a collection of annual outreach projects that covers these topics will be beneficial to elevating resident's knowledge of different risks associated to living in a floodplain. 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. 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. Create and maintain a Flood Information section of the Township website through the PPI.

Currently, flood and storm related information is hosted on the Middletown OEM page. While there is great information at this location, it could be boosted and organized to highlight flooding and coastal hazard risks according to CRS outreach criteria. It would be beneficial to host this information under it's own tab on the homepage of the Township website to ensure it is easily found. The PPI should be

responsible for this section of the website and should update it with care to ensure eligibility for CRS credits in the Outreach section. This tab should also 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 like finding a resident's Base Flood Elevation. 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>. 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 Getting to Resilience meetings, Township staff noted that some lenders and real estate agents disclose information about hazards associated with properties being considered for purchase. To ensure that this process continues and to establish congruence of methodology regarding these disclosures, a hazard disclosure policy could be established. The Township would then be able to dictate what information must be shared with potential buyers and set 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://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

MITIGATION

6. Consider being 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. For more information, visit <http://www.stormready.noaa.gov/howto.htm>. Middletown officials conveyed that they have strong storm preparedness operations that may already qualify for StormReady status. Having the Township achieve StormReady status would set a good example to residents to also become prepared. 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

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. 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.

Due to buildout, Middletown has limited areas of land left that still have natural floodplain functions, mainly restricted to wetlands. Natural floodplains can absorb runoff and mitigate flooding issues. This can be done utilizing a variety of techniques including wetlands restoration, planting natural vegetation, reducing sediment compaction, and creating a natural profile. Middletown has already applied for land acquisition in the past. 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 \$112 million in 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. Middletown should identify, map, and keep data on areas of coastal erosion and consider creating erosion protection programs.

Township staff noted that the Bayshore beaches are consistently experiencing erosion, requiring replenishment of sand and the consideration of changing the current groin configuration. 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 (sea level rise, surge) should be defined. The Township should make an effort to identify, document, and quantify the areas of erosion. Over the last 150 years, the oceanfront and bayfront shoreline positions have undergone various changes. Acquiring erosional rates and shoreline positions can be done through several avenues including the Stockton Coastal Research Center's beach profile data set (<http://intraweb.stockton.edu/eyos/page.cfm?siteID=149&pageID=9>) and the USGS Coastal Shoreline Change data set (<http://marine.usgs.gov/dsasweb/#>). A short erosional dataset review is included in the appendix using these two resources. Further information regarding Sandy Hook shoreline positions can be found through the National Park Service's Integrated Resource Management Applications page where studies regarding Sandy Hook are easily searchable. <https://irma.nps.gov/App/>

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, unwanted 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 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. 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. Utilize sea level rise and storm surge mapping to identify possible roadways at risk to sea level rise.

Sea level rise and storm surge modeling of Middletown indicates several roadways that may become impassable during future coastal hazard events. Some of these roadways may currently be at an elevation to avoid flooding but others may not. The Township could identify roadways where flooding is indicated and survey for elevation. This information could be used for identification of flooding hazards, in evacuation planning or flood response, and as a catalyst for road raising infrastructure upgrades.

MUNICIPAL ORGANIZATION

11. 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 by 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, information from these memories can be made available for all municipal staff. This information should 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

12. Back up all municipal planning documents and other critical materials.

In the event of a disaster, important information and documentation that could be used to guide the Township to recovery needs to be available. In order to ensure this takes place, 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. Have Township municipal officials participate in FEMA training courses.

While going through the GTR questionnaire, it was noted that FEMA accredited trainings may be useful to Township officials. 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 <http://www.fema.gov/training-1> and for independent 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

14. Utilize the Community Vulnerability Assessment Tool, Risk and 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. <http://csc.noaa.gov/digitalcoast/training/roadmap>
- The Risk and Vulnerability Assessment Tool is used to identify people, property, and resources that are at risk of injury, damage, or loss from hazardous incidents or natural hazards. <http://csc.noaa.gov/digitalcoast/training/roadmap>
- 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>

FEMA MAPPING

15. Work with FEMA, the National Hurricane Center (NHC), and USGS to have the levee around North Middletown reflected on mapping for the FIRM, SLOSH, and Sandy Surge extent mapping.

North Middletown is protected by a levee that prevented flooding during Sandy. However, mapping from FEMA shows that North Middletown flooded, likely due to an error in the input of high water marks and lack of information about the levee's design specifications. Conversely, the FIRM mapping and SLOSH mapping for North Middletown also does not reflect the protection provided by the levee. Middletown should work with FEMA's regional office to have the North Middletown levee represented on mapping for past events, FIRM mapping, and forecast models such as SLOSH. FEMA has established methods for mapping levees in the FIRM. For more information on FEMA's levee seclusion mapping, visit <https://www.fema.gov/media-library/assets/documents/101364>.

The CRS also has specific qualifications for crediting flood protection efforts concerning levees in terms of warning systems for possible levee failure in Section 620. Middletown should explore the possibility of additional CRS points in this category. For more information on Levee credit requirements, visit 620-1 of the CRS Coordinator's Manual.

http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf

In the event that the North Middletown levee does not meet standards to reduce FIRM mapping, it is recommended that residents are notified. Residents may not choose to elevate due to lack of flooding and damage during Sandy, but the increase in Base Flood Elevations may result in dramatic increases in flood insurance premiums. Some residents may then choose to elevate to reduce flood insurance costs. It should be noted that the mapping included in the appendix of this document is based off of information from FEMA, USGS, and the National Hurricane Center (NHC) and therefore is not reflecting the North Middletown levee.

16. Adopt the latest version of FEMA's flood maps and rewrite elevation and freeboard requirements in the Floodplain Management Ordinance or in a new Flood Damage Prevention Ordinance as based upon the Best Available Flood Hazard Data or the most stringent version of FEMA's flood maps.

The Township should amend the current Floodplain Management Ordinance by using language available in the current NJ DEP recommended Ordinance. Also, by writing new requirements as related to the Best Available Flood Hazard Data, it should allow for change over time as FEMA's maps are redrawn regularly. While it had been decades since FEMA had remapped the FIRMs in our area, the remapping process was long overdue and can be anticipated to take place with a much 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 adding "or the most stringent version of FEMA's flood maps" to this ordinance, higher standards may be instituted that may result in the town becoming more resilient. For example, the Advisory Base Flood Elevation maps may have a more expansive V-zone than the 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 references Advisory Base Flood Elevations as being a possible stricter section in several areas. Likewise, a higher freeboard requirement than the 1 foot state standard may result in a safer community and would increase points in the Community Rating System. 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. Both actions can result in a large amount of CRS points in the Higher Regulatory Standards section. For more information on Freeboard credit requirements, visit 430-10 of the CRS Coordinator's Manual. 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

17. Ensure the public is aware of any changes to FEMA's flood maps as they are updated and 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 that the correct information is disseminated by the Township. For every release of a map update, the Township could make a public announcement to its citizens and businesses 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. Including information on what changes occur when new maps are released on the Township's Flood Information 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/flood-risk-tools/tool-descriptions> and the new data layer is being developed as part of the preliminary FIRM process. This data is in draft form now but will be released at the www.region2coastal.com website soon. The more familiar the citizens and businesses are with the maps, the more likely they will take appropriate actions.

18. Make sure all flood maps are available on the town website, at Town Hall, and at the local libraries.

Middletown has made Flood Insurance Rate Maps (FIRMs) available in the past at the Township Municipal Complex but must ensure that these maps remain 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 and businesses are informed. Maintaining a link to FEMA’s website on the Township website is highly recommended and should highlight a section that deals specifically with flooding and other storm hazards.

PLANNING

19. Consider creating a Township specific Continuity of Operations Plan.

A Continuity of Operations Plan (COOP) is separate from an Emergency Operations Plan and ensures that primary essential functions continue to be performed before, during, and after a wide range of emergencies. It is developed and maintained to enable each department, agency, and other governmental entity to continue to function effectively in the event of a threat or occurrence of any disaster or emergency that could potentially disrupt governmental operations and services. A COOP can protect essential facilities, equipment, vital records, and other assets. It can reduce or mitigate disruptions to operations. It can facilitate decision-making during an emergency. JC NERR is able to provide example COP plans from the Borough of Avalon

(http://www.prepareyourcommunitynj.org/media/27952/Avalon_COOP_COG.pdf) and Brick Township. FEMA also provides a Continuity Plan Template (<http://www.fema.gov//media-library/assets/documents/90025>) that can be used as a starting point for local governments.

20. Focus on including numerous possible mitigation projects in the Monmouth County Multi-Jurisdictional Hazard Mitigation Plan update and incorporate those projects into the Capital Improvements Plan.

With Monmouth County going through an Multi-Jurisdictional Hazard Mitigation Plan update, it is important to have numerous Township officials and staff come together to identify potential mitigation projects for Middletown. 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. Middletown 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>. While the current County Plan update may have progressed past the point of including new projects, new projects could be included in the next 5 year update or in a municipal specific hazards mitigation plan.

21. Create an action plan for precipitation flooding events.

Middletown frequently receives flooding during heavy rain events at numerous locations, prompting 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 certain 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 or undersized stormwater pipes which could be addressed in the Stormwater Management Plan. Such mitigation actions could then be included in the All Hazards Mitigation Plan. Middletown OEM stated they keep information on precipitation driven flooding, allowing the basis for the creation of an action plan.

22. Create a shoreline management plan and consider a dune protection ordinance

The Township has seen a high erosion rate take place on the beaches of the bayshore. The beaches and dunes were recently replenished in several locations by the United States Army Corps of Engineers (USACE). In order to maintain this important coastal protection feature, maintain access points, and conserve environmental services, it would be helpful to develop a shoreline management plan. The shoreline management plan should work in conjunction with the Open Space, Recreation, and Conservation Master Plan to ensure that the shoreline and beach are able to be utilized for many years without being too costly to maintain. It is important to note that two thirds of the border of Middletown is occupied by shoreline, representing a large area in need of management. In order to protect the dune grass on the recently established dune and to allow it to grow the dune, the Township should also consider a dune protection ordinance to allow for signs to be posted with possible fines to keep people off of the dunes.

23. Middletown should identify sea level rise as a hazard in municipal plans and consider disclosing hazard risks.

Middletown will experience impacts due to sea level rise and like all potential hazard impacts, this risk should be identified in town plans to ensure proper action. Historical rates of sea level rise should be defined 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 1.3 feet along the Jersey Shore. By 2100, the “best” estimate for sea level rise is 3.1 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. Several counties have included sea level rise in their All Hazard Mitigation plans. Monmouth County’s All Hazards Mitigation Plan rewrite includes a broad discussion of sea level rise and the impact it has on other coastal hazards such as erosion. Once this plan is locally adopted, other local plans should reflect sea level rise as a hazard as well.

24. 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, 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”.

25. Begin the long term planning process to prepare for sea level rise.

Middletown, like most other coastal municipalities, will experience impacts from sea level rise in the form of regular tidal flooding and heightened storm impacts, requiring mitigation actions. Planning and informed decision making can start now. 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.

JC NERR recommends Middletown 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 Middletown, 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 Middletown 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, seawalls, tide gates, the marina, 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:

- **Protection** involves hard structures such as sea walls 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.
- **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.
- **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.

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>). Middletown 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 Getting to Resilience 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 – Create scientific fact sheets about climate change addressing 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

- 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.
- 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.

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.

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.

Middletown 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, Middletown 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.

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 rediscussed in the Master Plan under the corresponding sections.

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. Many of the recommendations in this municipal master plan example are closely tied to goals already addressed in the current Township Master Plan. 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 lynchpin, 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 Township of Middletown's 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 Middletown, 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.

Middletown 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 river beaches and wetlands at low elevations, both important habitats, would be lost to even a modest rise in sea level and erosion of the riverfront 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 will be available for future download. These maps can and should 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 its 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 sea 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 Middletown concerning 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 Middletown 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 will be available soon from JC NERR.

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 Middletown 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. 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 Township of Middletown towards resiliency, risk will always exist. By overlaying hazards such as sea level rise and surge with population information, infrastructure, and building footprints, the Township 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 Middletown to make decisions on protecting certain resources through retrofitting historical 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 four major themes:

- Flooding (which shows the flooding hazards individually)
- 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. 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

While most of the Township of Middletown is significantly elevated above sea level, fluctuations in sea level through surge events and trends towards higher sea level are still of great significance for areas bordering shorelines and especially for low lying areas along the bayshore. Analysis of SLOSH maps show that as hurricane strength increases, potential surge impacts will increase in scope and severity. SLOSH models indicate flooding should be expected on a similar scale of Sandy for powerful Category 1 hurricanes though modeling does show a slightly greater extent around North Middletown, Port Monmouth, and Belford. SLOSH models for Category 2 and 3 storms show increased vulnerability and intensity. Areas that had inundation depths of 0-3 feet during a Category 1 storm are capable of depths of 6 to 9 feet in a Category 2 storm. Areas that had depths of 3-6 feet are capable of depths greater than 9 feet. The extent of the flooding only increases slightly along the Navesink, mainly up McClees Creek, Poricy Brook, and Shadow Lake. However, the extent increases dramatically in the bayshore communities. Flooding moves further south in North Middletown, Port Monmouth, Belford, and Leonardo, extending past Route 36 in North Middletown, Port Monmouth, and Belford. Route 36 is a critical evacuation route for the area. SLOSH maps for Category 3 show an extreme scenario. Areas that were flooded during Sandy and even some that did not see any flooding have the potential to be submerged with over 9 feet of floodwaters. The extent of the surge also increases even further inland in the bayfront communities. North Middletown, Port Monmouth, and Belford are almost entirely covered by greater than 9 feet of floodwaters.

For all surge scenarios, Sandy Hook is almost entirely flooded. During Category 1 storms, only large dunes are not submerged. During Category 2 storms, Sandy Hook is entirely submerged. Category 3 SLOSH portrays a scenario where almost all of Sandy Hook is under floodwaters greater than 9 feet. Luckily Sandy Hook contains very few buildings and none are currently public residential. It is important to note that in all SLOSH mapping for Category 1, 2, and 3, the critical evacuation route of Route 36 is threatened by surge. As storm strength increases, the likelihood of safe use of this evacuation route decreases. In addition, several firehouses and EMS locations are in the floodplain for large hurricane events. Belford appears most at risk with several emergency facilities impacted. Although storms of this magnitude are very rare for our area, they remain a possibility that requires attention and planning.

The relatively low end scenario of one foot of sea level rise will result in regular inundation of the higher wetlands surrounding Pews Creek, Compton Creek, Ware Creek, and the Swimming River. Other areas bordering the waterfront will see smaller beach buffers. It is important to note that although one foot of sea level rise does not result in flooding of streets or neighborhoods and is limited to natural areas, the impact of storm related flooding will be increased. The inundation of wetlands will result in less ability of the wetlands to absorb floodwaters from both coastal flooding and precipitation events. 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.

Total sea level rise projections for New Jersey.			
	Total cm	Total inches	Total feet
2050 best	40	16	1.3
2050 low	23	9	0.7
2050 high	60	24	2.0
2100 best	96	38	3.1
2100 low	50	20	1.6
2100 high	147	58	4.8

All values with respect to a year 2000 baseline.

NJ sea level rise projection ranges and best estimates. Miller AK, Kopp RE, Horton BP, Browning JV and Kemp AC. 2013. A geological perspective on sea-level rise and its impacts along the U.S. mid-Atlantic coast. *Earth's Future* 1(1):3-18.

Two feet of sea level rise further increases flooding of the low lying natural areas of Middletown. In addition, several small areas of infrastructure begin to flood regularly. Wilson Avenue, Brainard Avenue, Griggs Avenue, Main Street, Creek Road, Campbell Avenue, and Plymouth Avenue in Port Monmouth have stretches that will see tidal inundation. Burlington Avenue in Leonardo looks to have a small stretch of flooding as well. Many roadways that end near wetlands or creeks may see regular flooding beginning to approach community borders. Three feet of sea level rise largely impacts the same areas flooded at two feet of sea level rise with a few instances of the aforementioned locations having larger sections of roadways impacted. In all three sea level rise scenarios, critical infrastructure appears to be safe from regular inundation.

Though North Middletown is protected by a levee, mapping does indicate flooding of much of the community at three feet of sea level rise along the north and east borders. Mapping indicates that many of these areas will be below the threat of rising sea level for one and two feet as well but may be protected by the levee. It is important to note that during Sandy, this neighborhood did not flood so mapping is likely flawed. However, the fact that large portions of the community will be located below regular tidal flooding levels means that North Middletown is heavily reliant on the levee for protection. Its failure would result in large scale flooding problems.

It would be beneficial for the Township to analyze mapping and look at the elevation of roadways and bridges over creeks and marshes that will be impacted by sea level rise to determine if the infrastructure at those locations is properly elevated. LIDAR elevation mapping has a limit on resolution so certain locations may have roadways that are elevated safely above flooding levels but may be mapped as being in danger of flooding. These include Normandy Road over Swimming River, Navesink Road over McClees Creek, Locust Avenue over Claypit Creek, Center Avenue over Wagner Creek, Broadway over Compton Creek, and Bray Avenue over Pews Creek. Several bridges represent connections to neighboring municipalities and therefore analysis of elevations should be done in conjunction with the neighboring town to ensure that the route is still passable beyond Middletown municipal limits. This includes Normandy Road, Center Avenue, and Bray Avenue.

Any level of inundation due to regular tidal flooding will have impacts on emergency response and day to day operations of municipal staff and citizens. Sea level rise will also result in greater impact of storm events as a surge atop a higher sea level will have a greater impact than the same surge atop a lower sea level. Necessary adaptation to sea level rise and the heightening of other hazards such as surge must be taken into account when planning for the future.

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 Middletown based off of the answers given in our Getting to Resilience questionnaire, discussions with JCNERR staff, and reviews of the Township Master Plan and other documents. These sections represent the current state of the Township but also include planned projects, uncompleted projects, and recommended actions deemed to be within the Township'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.

- **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)
- **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)
- **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)

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)

- **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)
- **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)
- **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)

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 2.5.12.5.2)
- **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 EMI courses on retrofitting or grants programs (GTR 5.8)

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)
- **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)

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, 5.12)
- **Deed restrictions (DR):** Up to 50 points extra credit for legal restrictions that ensure that 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, 5.12)
- **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)
- **Natural Shoreline Protection (NSP):** Up to 120 points for programs that protect natural channels and shorelines. (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).

- **Emergency warning dissemination (EWD):** Up to 75 points for disseminating flood warnings to the public. (notes from GTR meetings)
- **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. (notes from GTR meetings)
- **Critical facilities planning (CFP):** Up to 75 points for coordinating flood warning and response activities with operators of critical facilities. (notes from GTR meetings)
- **Protection of critical facilities (PCF):** Up to 80 points for protecting facilities that are critical to the community. (GTR 4.7, notes from GTR meetings)
- **Freeboard (FRB):** Up to 500 points for a freeboard requirement. (GTR 5.4)
- **Foundation Protection (FDN):** Up to 80 points for engineered foundations. (GTR)
- **Coastal A Zone Requirements (CAZ):** Up to 500 points if all new buildings in the coastal A Zone must meet the requirements for buildings in V Zones and for openings in A Zones ()
- **Special Flood-related Hazard Regulations (SHR):** Up to 370 points for higher regulatory standards in areas subject to coastal erosion. (GTR 1.3)
- **Other higher standards (OHS):** Up to 100 points for other regulations (GTR 2.9, 2.11, 4.9)
- **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)

- **Regulations administration (RA):** Up to 67 points for having trained staff and administrative procedures that meet specified standards. (GTR 5.6, 5.8)

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, 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))

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

- **Watershed Management 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, 2.3, 2.4, 3.3, 3.4, 3.5)
- **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 and 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)

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 5.7)

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 are maintained.

- **Capital improvement program (CIP):** up to 70 points for having a capital improvement program that corrects drainage problems. (GTR)
- **Coastal Erosion Protection Maintenance (EPM):** up to 100 points for maintaining erosion protection programs in communities with coastal erosion prone areas. (GTR 1.3, 5.12)

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, 4.5.2, 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, 4.3)

- **Emergency warning dissemination (EWD):** Up to 75 points for disseminating flood warnings to the public. (GTR 2.9, 2.11, 4.3, 4.7, 4.9)
- **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 4.6 (could be done))
- **EWD9:** 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 other automated backup system for receiving flood warnings. (GTR 4.11)
- **LFW7:** 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 other automated backup system for receiving flood warnings, provided that the community has coordinated with NOAA and there are arrangements for issuing warnings about levee failures. (GTR 4.11)

Section 620: Levees: To encourage communities to properly inspect and maintain levees and to identify impending levee failures in a timely manner, disseminate warnings to appropriate floodplain occupants, and coordinate emergency response activities to reduce the threat to life and property.

- **Levee Failure Warning (LFW):** Up to 50 points for disseminating warning to the public. (GTR 2.9, 2.11, 4.9)
- **Levee 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 levee failure warning is issued and for having a plan to provide transportation to secure locations. (GTR 2.9, 2.11, 2.12, 4.7, 4.8, 4.9, 4.9.6)
- **Levee Failure Threat Recognition System (LFR):** Up to 30 points for having a system to advise the emergency manager when there is threat of a levee's failure or overtopping (GTR 4.6, 4.7 (could be done))

Appendix

1 foot of Sea Level Rise Middletown Township

Legend

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

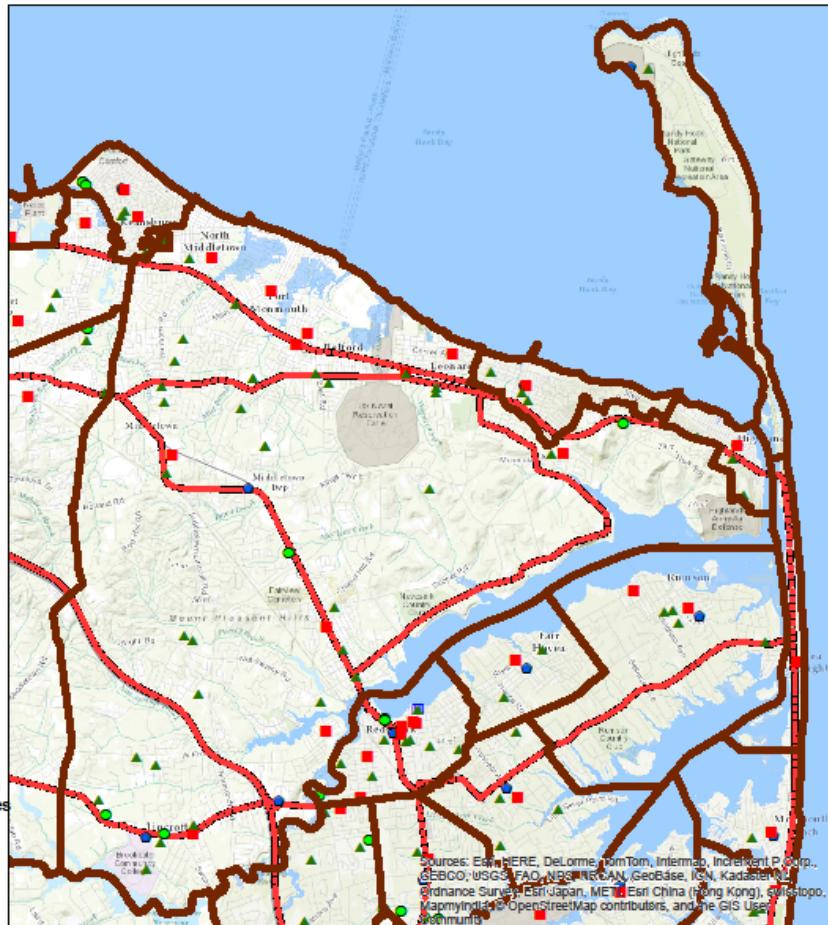
0 0.75 1.5 3 Miles

Year 2010 Population: 66522

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

CRSSA



2 feet of Sea Level Rise Middletown Township

Legend

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

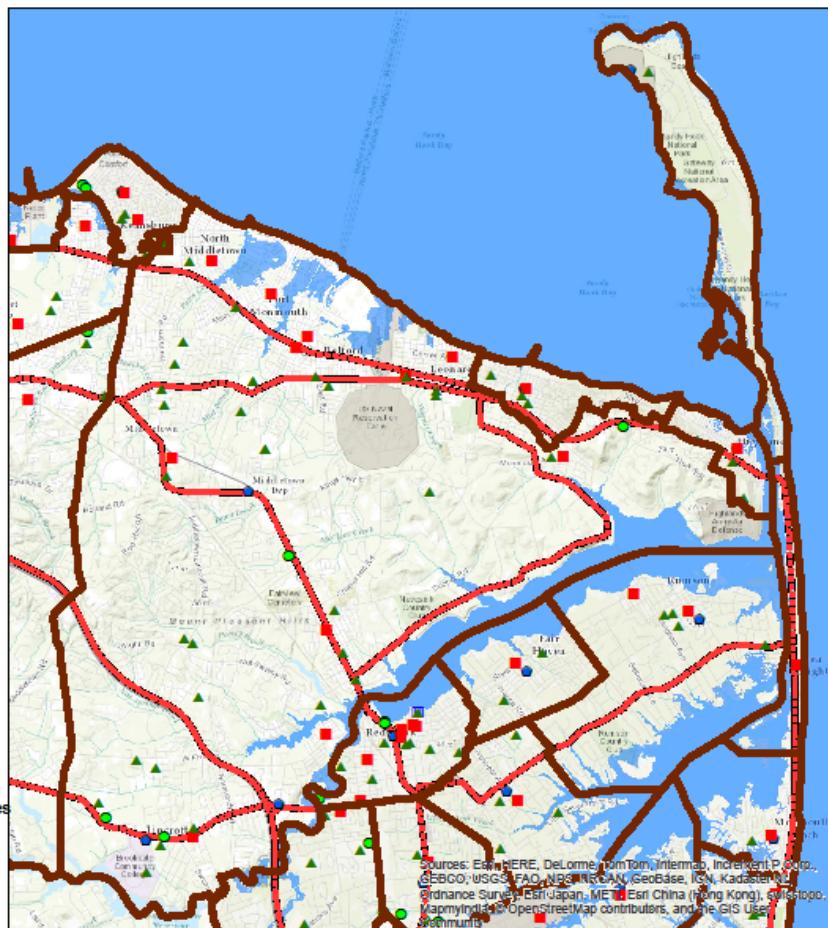
0 0.75 1.5 3 Miles

Year 2010 Population: 66522

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CRSSA



3 feet of Sea Level Rise Middletown Township

Legend

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

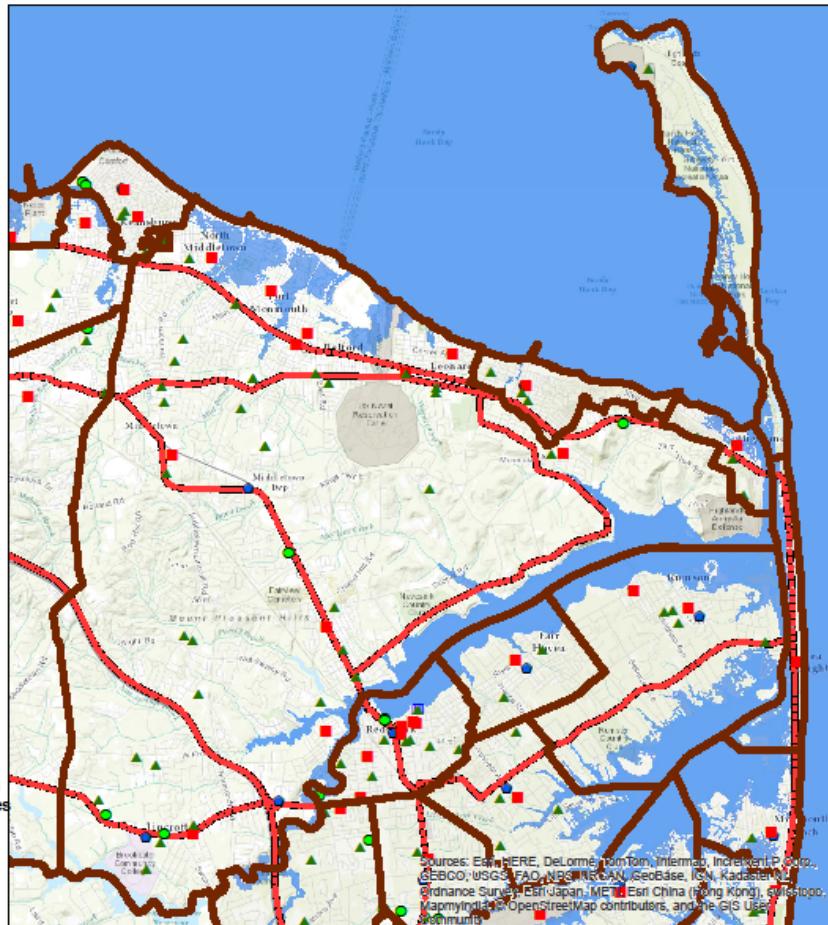
0 0.75 1.5 3 Miles

Year 2010 Population: 66522

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CRSSA



Category 1 SLOSH Model Middletown Township

Legend

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

Category 1 SLOSH

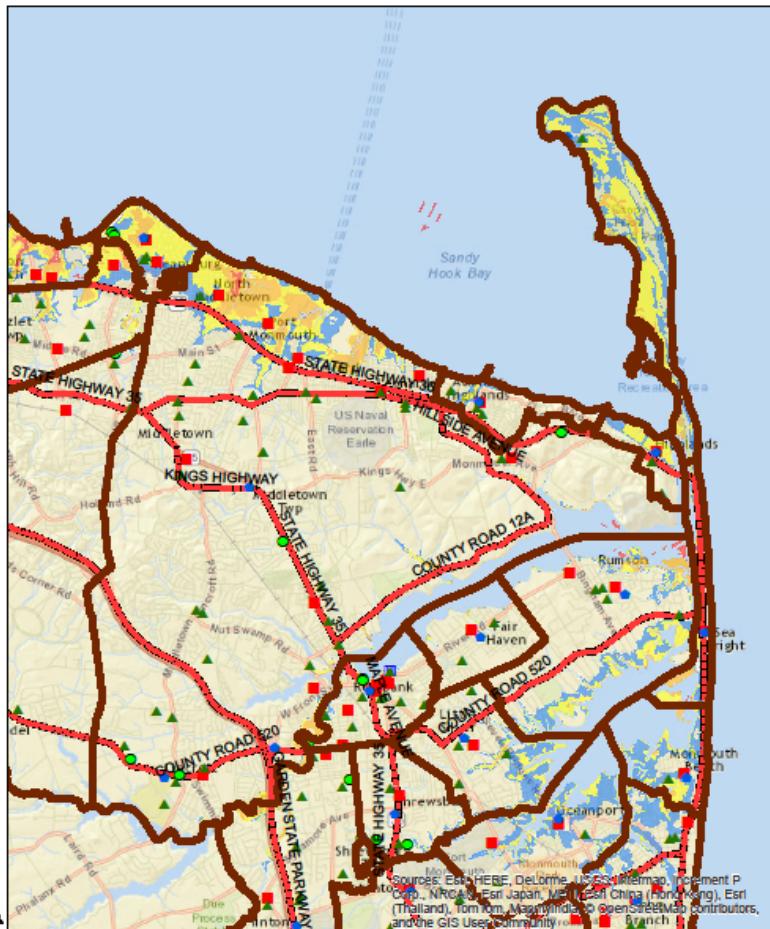
- 0 - 3 Feet Above Ground Level
- 3 - 6
- 6 - 9
- > 9

0 1.5 3 Miles

Year 2010 Population: 66522

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

Map Authors: Rachael Sacatelli and Bryan Serino
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and Spatial Analysis



Sources: Esri HERE, DeLorme, USGS, MapInfo, Inc., Esri, NRCAS, Esri Japan, MGRS, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia.com, openStreetMap contributors, and the GIS User community.

Category 2 SLOSH Model Middletown 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 1.5 3 Miles

Year 2010 Population: 66522

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Category 3 SLOSH Model

Legend

Municipality

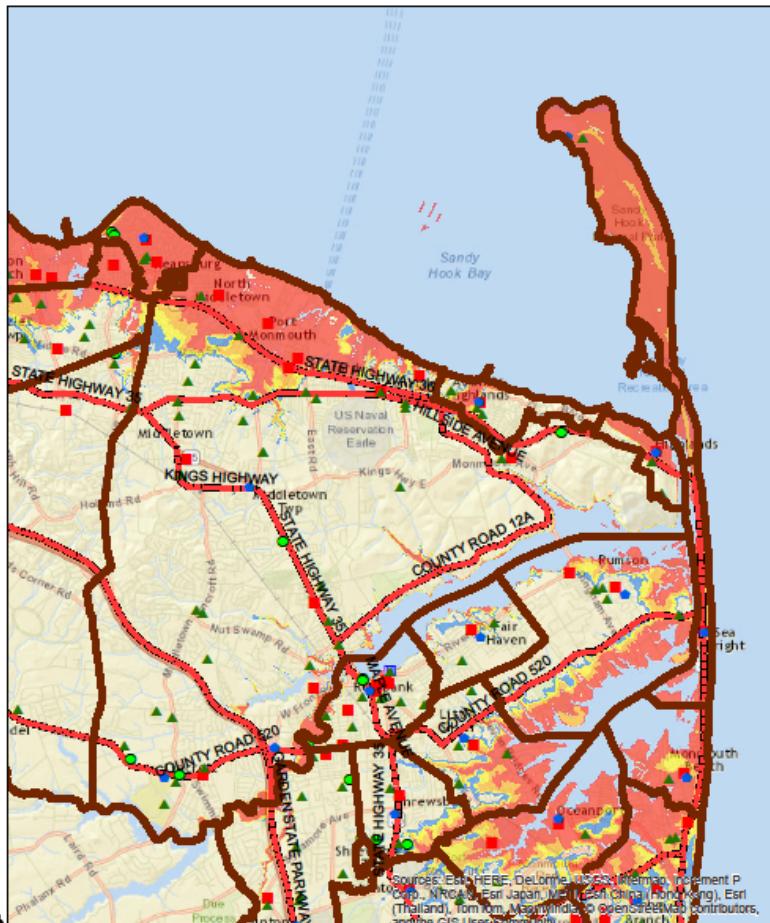
- ▲ Schools
- Assisted Living
- Law Enforcement
- Hospitals
- Fire Stations

Category 3 SLOSH

A horizontal number line representing distance in miles. The line starts at 0 and ends at 3 Miles. It is marked with six tick marks, including the start and end points. The tick marks are labeled 0, 1.5, and 3 Miles. The distance between each tick mark is 0.5 miles.

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**Marsh Retreat at 1 feet
of Sea Level Rise
Middletown Township**

Legend

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

Marsh Retreat at 1ft SLR

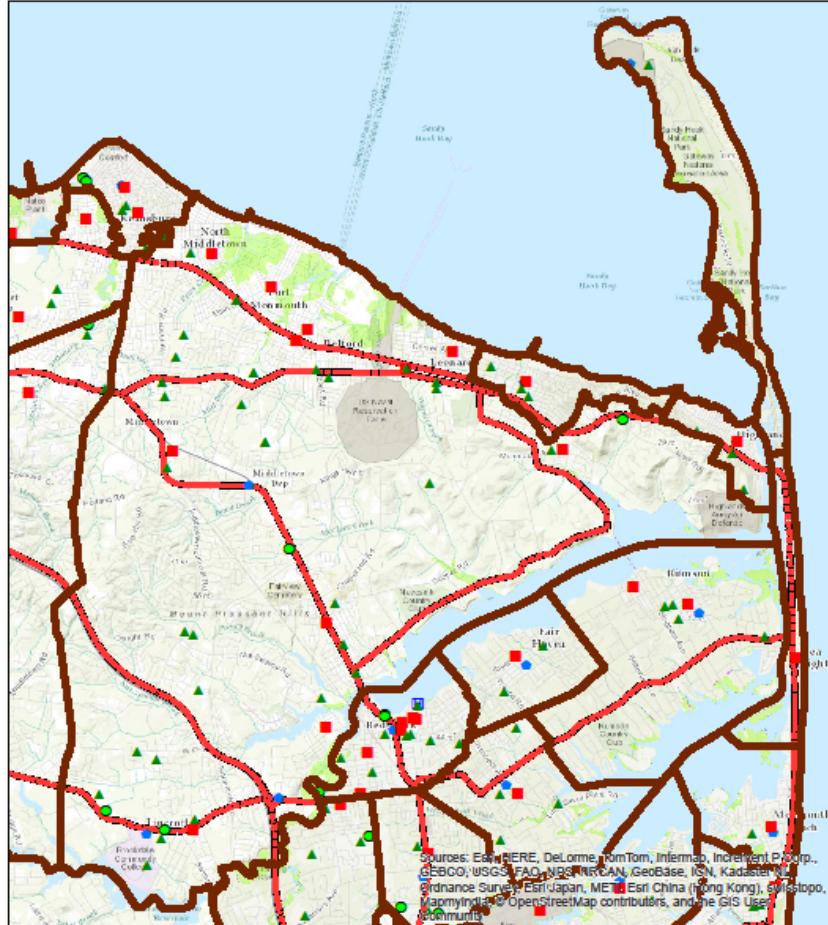
- Unimpeded Marsh Retreat Zone
- Impeded Marsh Retreat Zone
- Marsh Conversion: Unconsolidated Shore
- Marsh Conversion: Open Water
- Unchanged Tidal Marsh

0 0.75 1.5 3 Miles

Year 2010 Population: 66522

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

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



**Marsh Retreat at 2 feet
of Sea Level Rise
Middletown Township**

Legend

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

Marsh Retreat at 2ft SLR

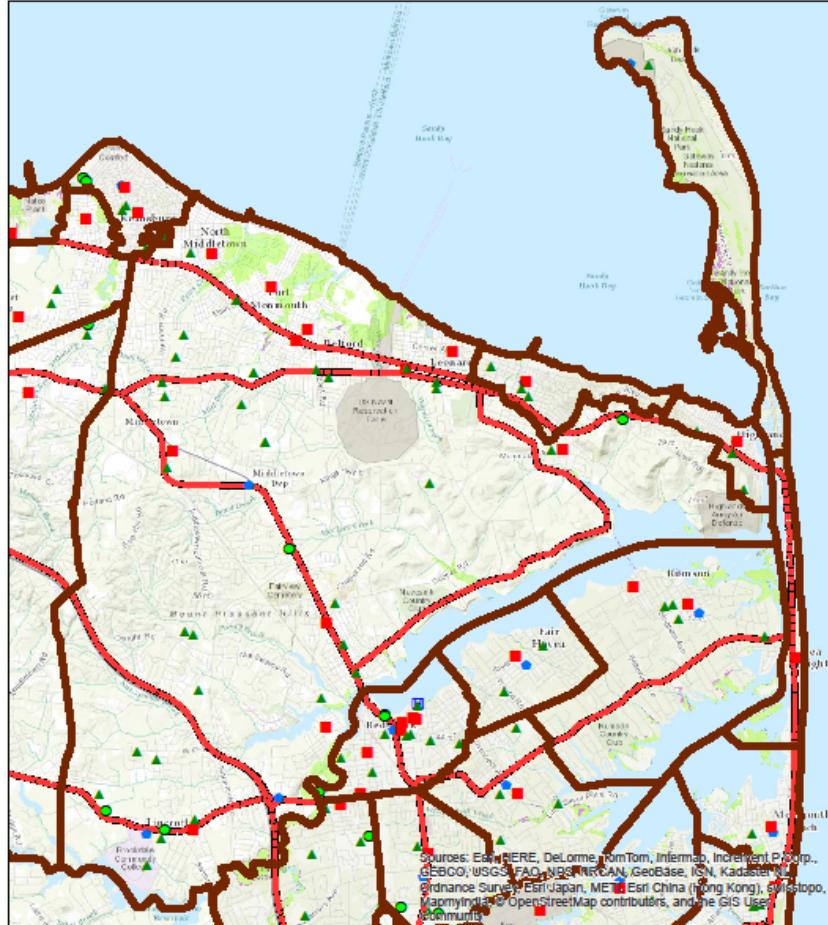
- Unimpeded Marsh Retreat Zone
- Impeded Marsh Retreat Zone
- Marsh Conversion: Unconsolidated Shore
- Marsh Conversion: Open Water
- Unchanged Tidal Marsh

0 0.75 1.5 3 Miles

Year 2010 Population: 66522

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 Middletown Township

Legend

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

Marsh Retreat at 3ft SLR

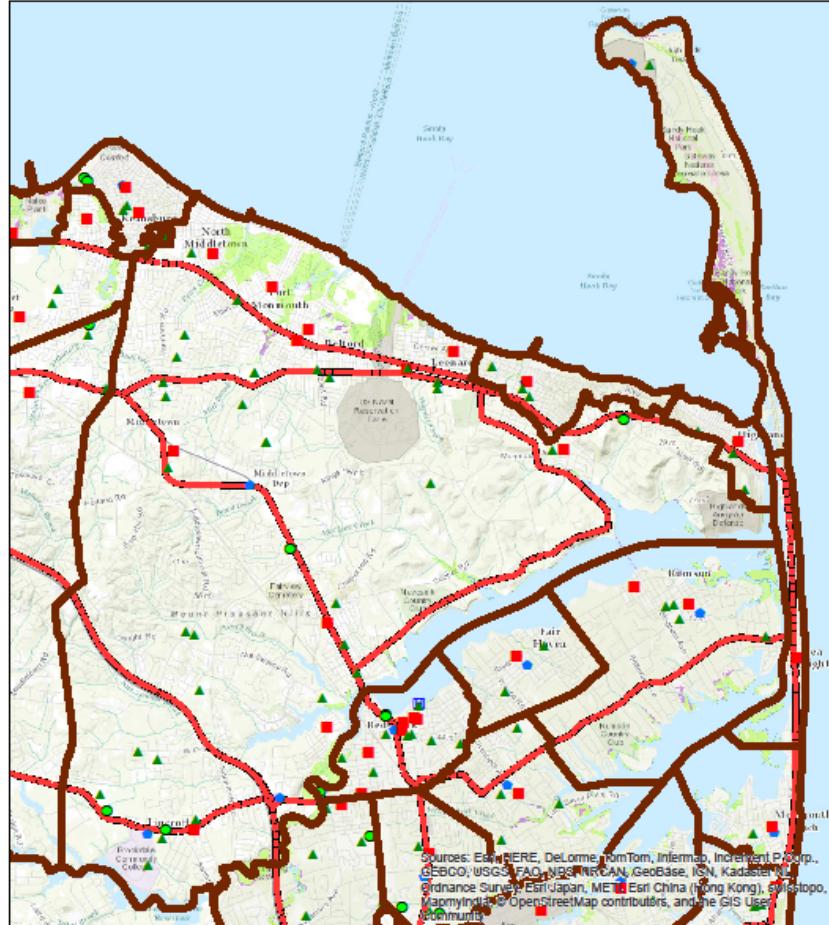
- Unimpeded Marsh Retreat Zone
- Impeded Marsh Retreat Zone
- Marsh Conversion: Unconsolidated Shore
- Marsh Conversion: Open Water
- Unchanged Tidal Marsh

0 0.75 1.5 3 Miles

Year 2010 Population: 66522

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**FEMA's PFIRM Flood
Zones for New Jersey
Middletown 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 2 4 Miles
Year 2010 Population: 66522

This map shows the extents of FEMA's latest flood insurance 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.

Map Authors: Rachael Sacatelli and Bryan Serino
Rutgers, New Brunswick
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and Spatial Analysis

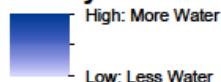


Sandy Storm Surge Middletown Township

Legend

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

Sandy Storm Surge



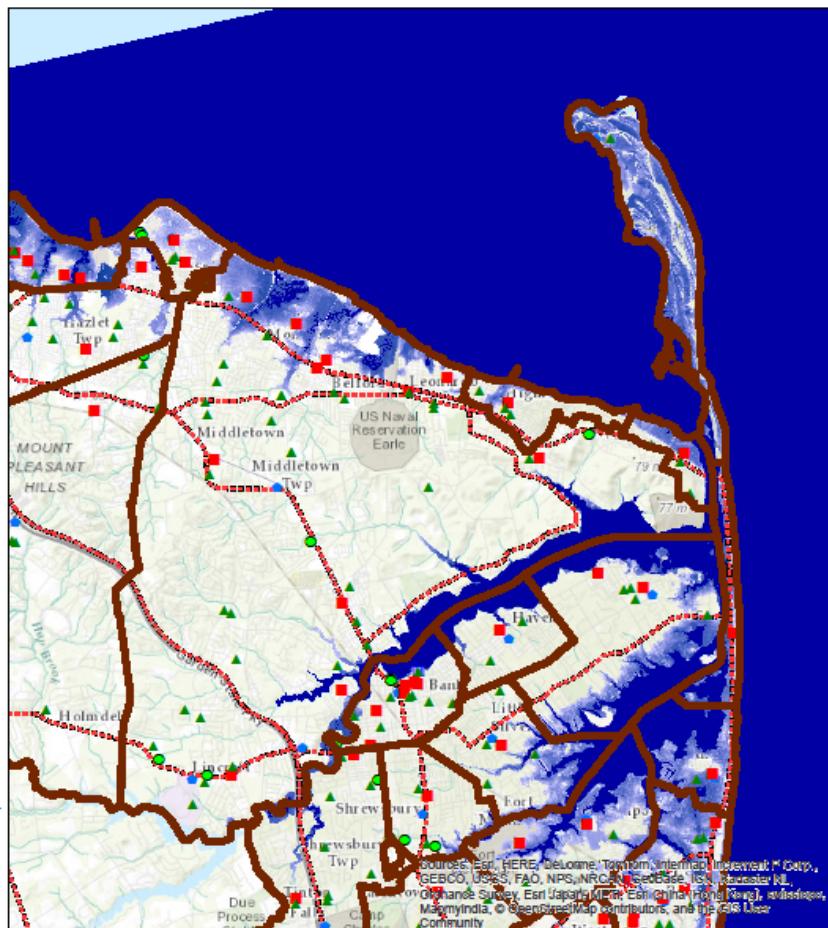
0 0.75 1.5 3 Miles

Year 2010 Population: 86522

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

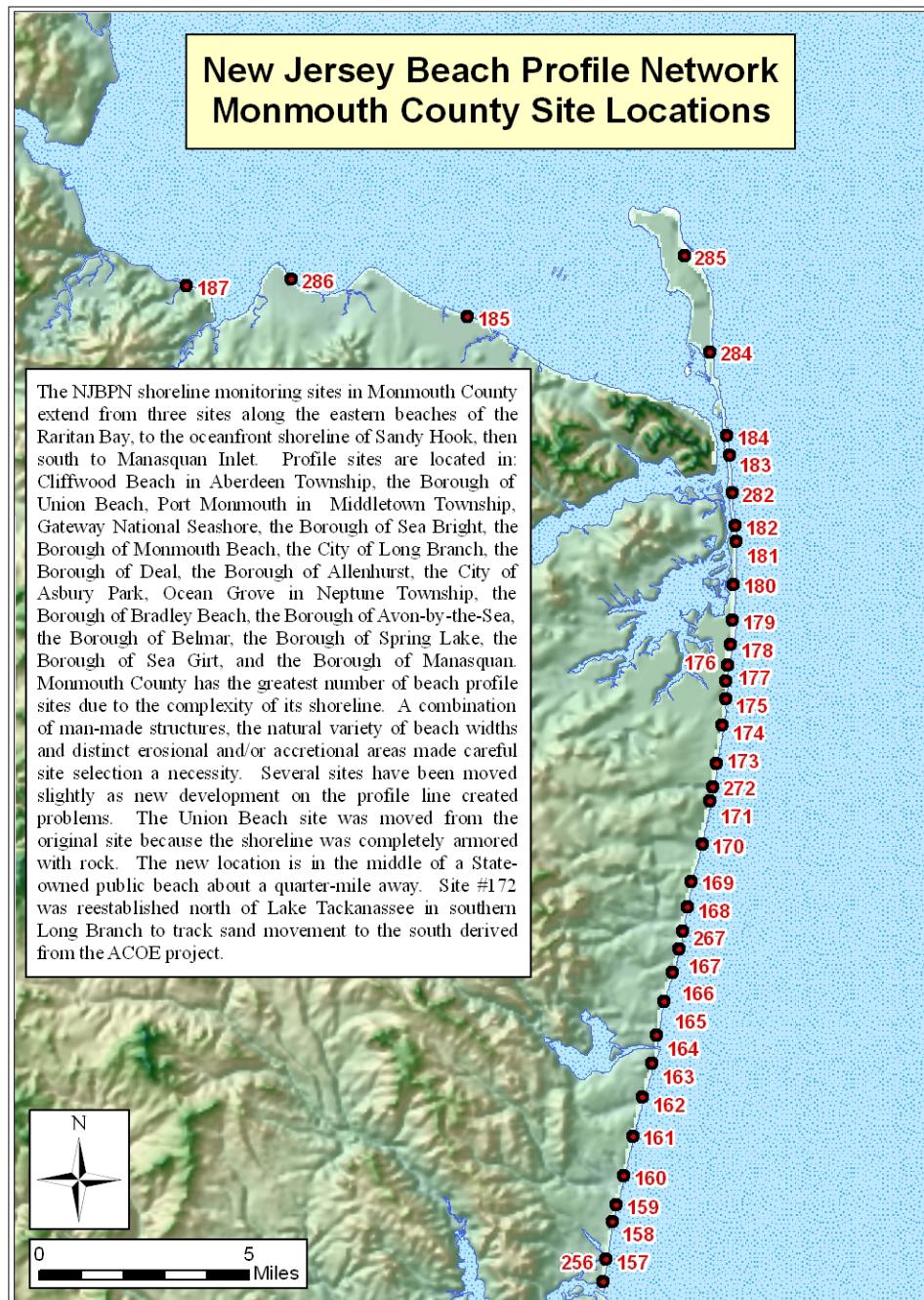
CRSSA



Middletown Historical Erosion Data

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 Middletown Township or neighboring areas that influence Township 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.

The Raritan Bay shoreline continues to erode slowly at two of the three sites with no impact seen below a depth of 2 feet in the bay due to short-period, low-amplitude waves breaking on the shoreline. Monmouth County parks system is preparing to restore the scrap and rubble-core dune along the park shoreline at Site 185. The New York District ACOE has plans in various states of readiness for Port Monmouth, Leonardo (flooding), Union Beach, Highlands (flooding) and Keyport (flooding) shorelines and associated low-lying areas. These projects have been authorized by the WRDA of 2007. Most are in alternatives analysis up to the final Preconstruction, Engineering and Design (PED) phase leading to

construction when funding is available. These five Raritan Bay projects have the majority of the funds slated for flood abatement and storm surge associated with strong northeast storms.

Link to full report:

http://intraweb.stockton.edu/eyos/coastal/content/docs/2011_NJBPN_report/monmouthco2011.pdf

Monmouth County, Beach Volume & Shoreline Position Changes Over 25 Years

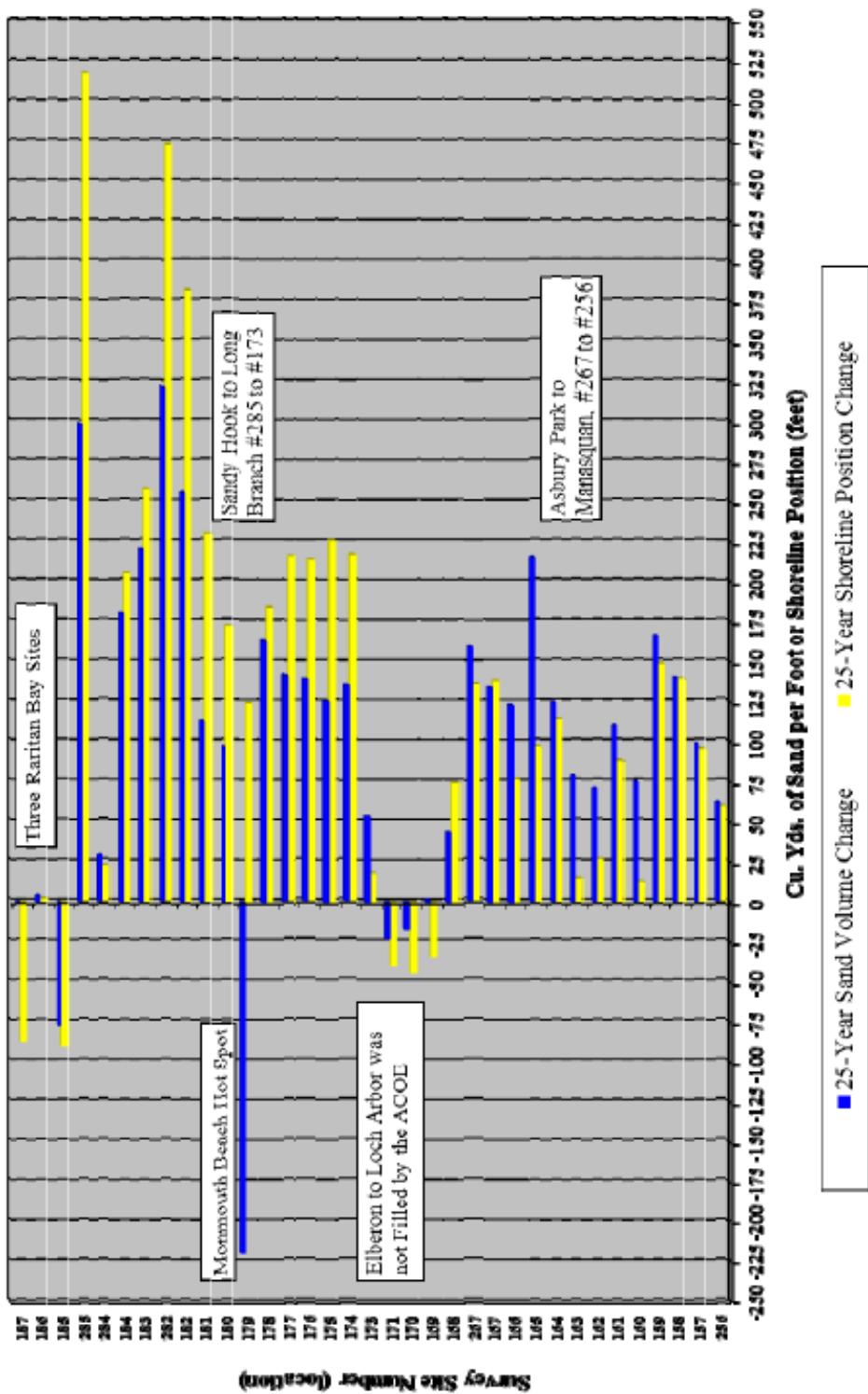


Figure 2. The graph above shows the 25-year changes in shoreline position and volume for all 36 of the Monmouth County survey sites. Many of the sites show the influence of the Federal beach nourishment project and subsequent maintenance fill that was added to several locations in response to the 1997 storm. Though there was a substantial loss of sand in the El Nino year of 2009 and 2010, the county remains in "good shape" for volume and shoreline position when compared to the 1986 conditions. Certainly, beach nourishment is credited for the successes in Monmouth County. Only a few locations suffer from erosion and those areas were either not included of the Federal project, or are adjacent to a coastal structure that blocks the littoral flow of sand.



Figure 14: Shown above is the view looking southeast from on top of the scarp at the Spy House Museum in Port Monmouth, NJ.

New Jersey Beach Profile Network #185 - Spy House, Port Monmouth, Monmouth County

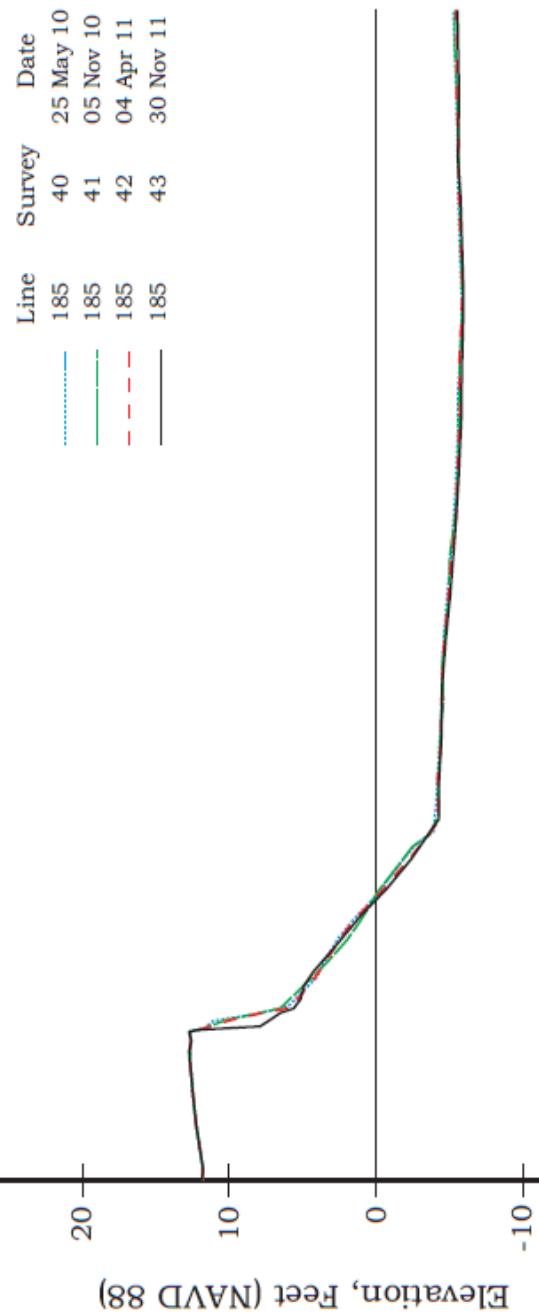


Figure 15: The fall 2011 survey occurred after both Hurricane Irene and a strong northeast storm Oct. 29, 2011. The Raritan Bay sites react to northeasters more than a hurricane due to the wind fetch and shoreline orientation. The sand volume decreased by 10.81 yds³/ft. largely due to a 0.24-foot decrease in bay bottom elevation across 1,000 feet (300 to 1,355 feet). The shoreline retreated 3 feet.



SPY HOUSE MUSEUM – SITE 185

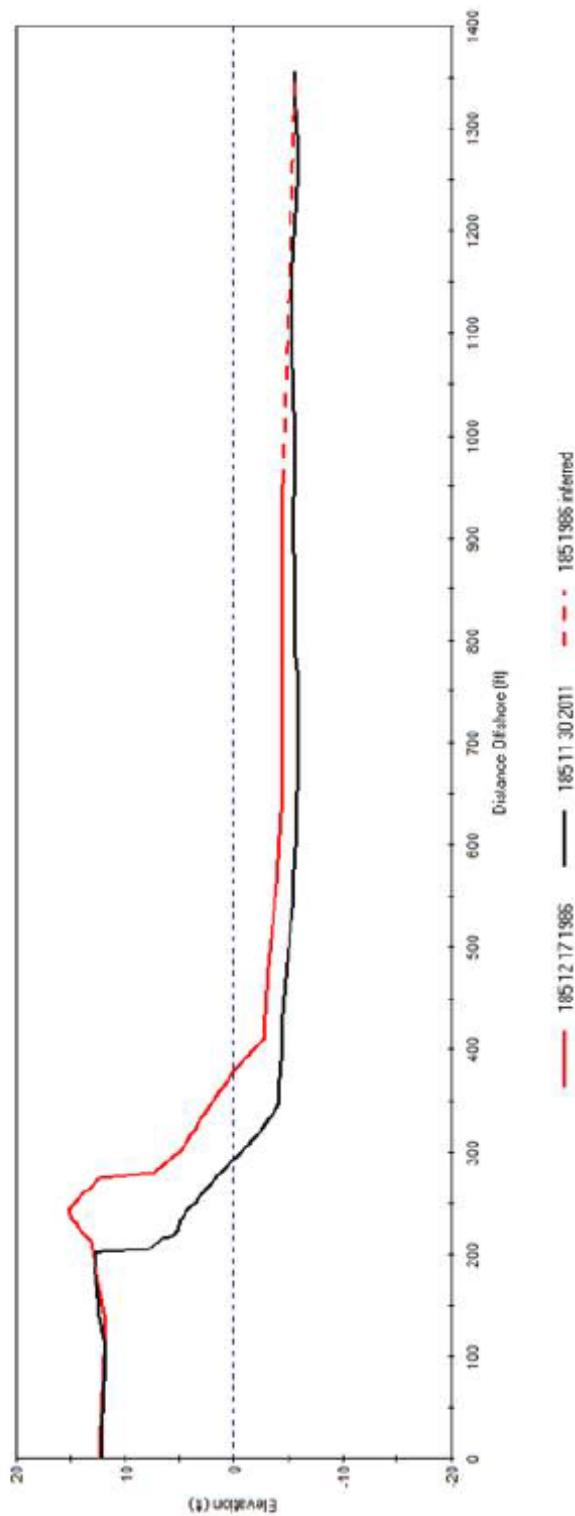


Figure 16. Though some recovery occurred in 1993, this site is in a long-term erosional trend including the nearshore. (Left photo October 11, 1989 [view to the west]; right photo November 30, 2011 [view to the west]).



25-Year Coastal Changes at Site 185, Spy House, Port Monmouth, Monmouth Co.

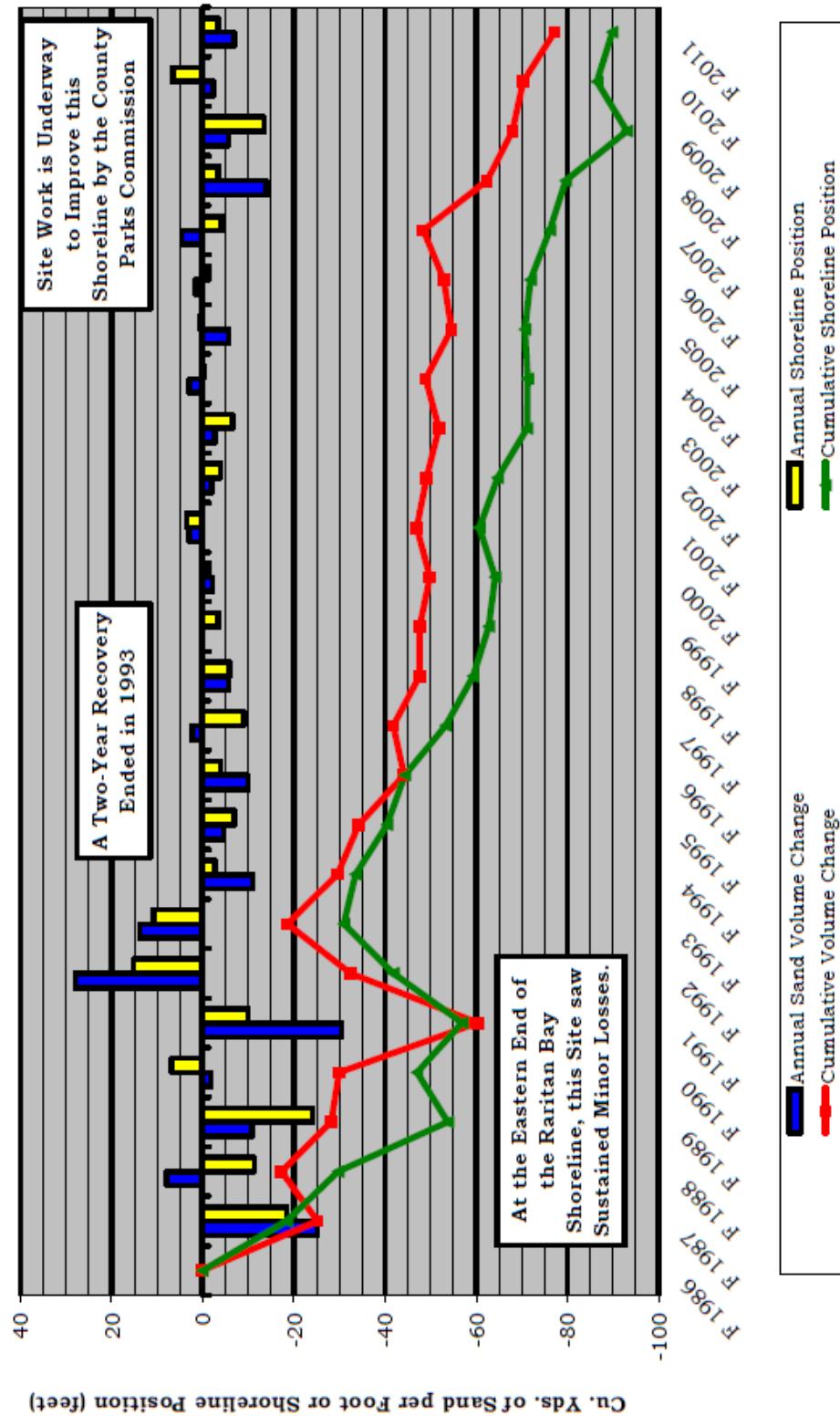


Figure 17. Large losses to the beach and dune occurred in 1989. A lack of adequate beach width inhibits dune and bluff stability here allowing this site to be susceptible to damages from northeast storm-generated waves.

Site 285, Sandy Hook National Seashore – October 6, 2011



Figure 18: Shown above is the view looking north from the wrack line at Gunnison Beach, in Sandy Hook National Seashore, NJ.

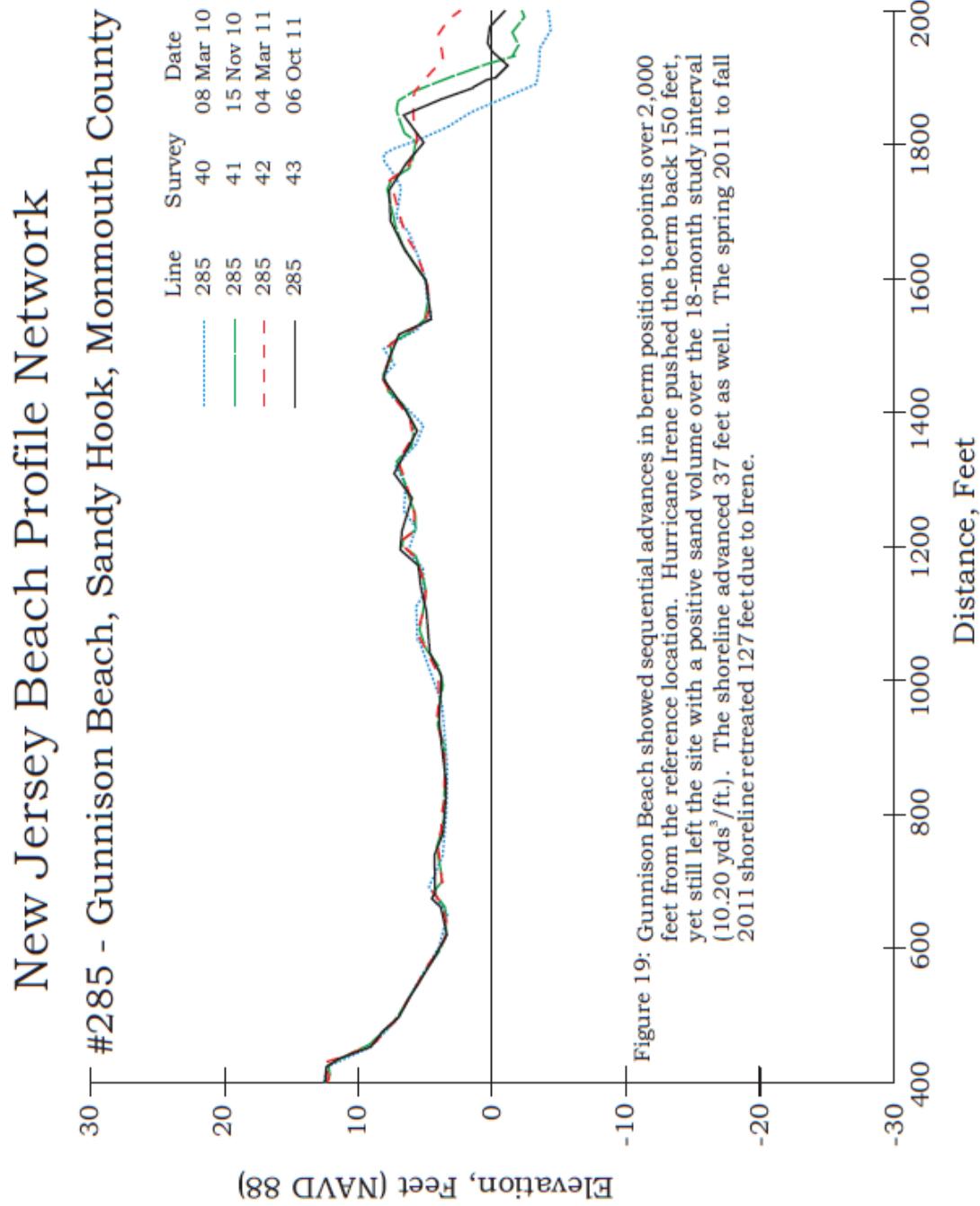


Figure 19: Gunnison Beach showed sequential advances in berm position to points over 2,000 feet from the reference location. Hurricane Irene pushed the berm back 150 feet, yet still left the site with a positive sand volume over the 18-month study interval (10.20 yds³/ft.). The shoreline advanced 37 feet as well. The spring 2011 to fall 2011 shoreline retreated 127 feet due to Irene.

SANDY HOOK NATIONAL SEASHORE – SITE 285

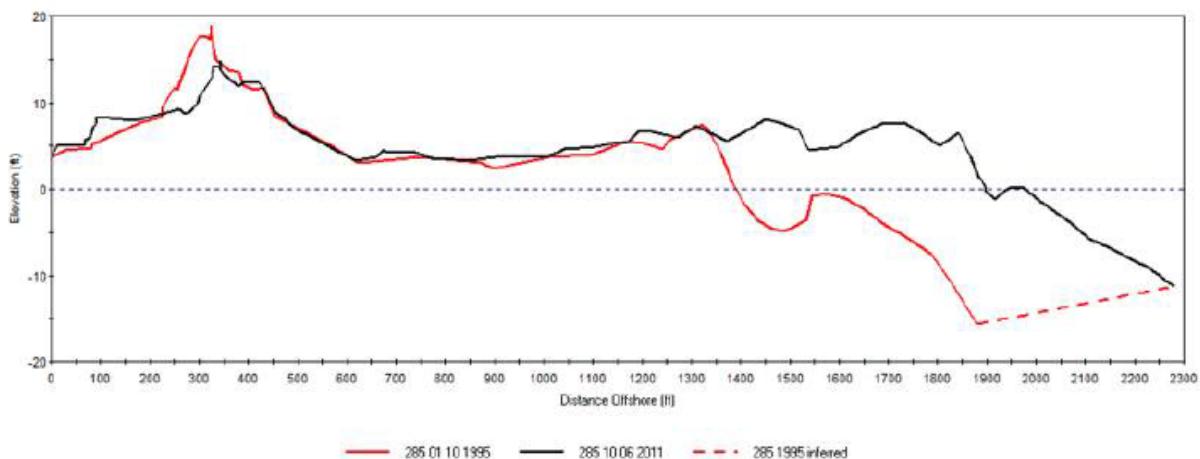


Figure 20. This site has continually gained sand with the exception of the time period from 1995 to 2001 where some of the dune material was redistributed onto the berm. (Left photo January 10, 1995 [view to the southeast]; right photo October 6, 2011 [view to the southeast]).



17-Year Coastal Changes at Site 285, Gunnison Beach, Sandy Hook, Monmouth Co.

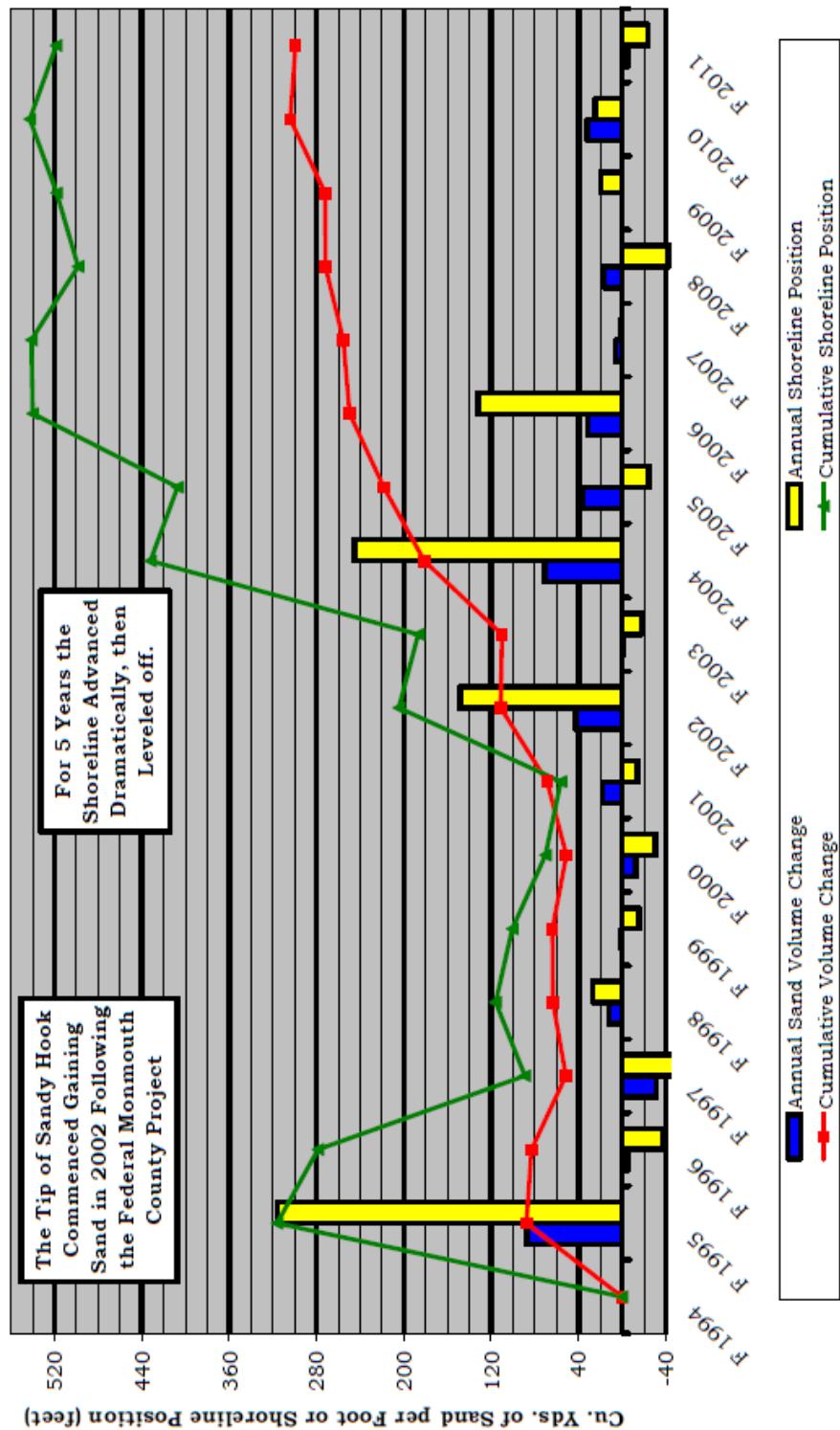


Figure 21. This shoreline has been accretional since the NY District Corps of Engineers completed its beach restoration in Monmouth County in 1999. Sand moves north along the Sandy Hook shoreline adding to the northern spit that curves into New York Harbor. The average sand volume increase between the two profile sites in the park ($5.18 \text{ yds}^3/\text{ft.}$) multiplied by the distance in feet between the two sites provides a total accretional volume of sand nearly equal to the loss volume experienced along the 21 miles of nourishment project shoreline (2,554,464 cubic yards).

Site 284, Sandy Hook National Seashore Parking Lot E – October 6, 2011

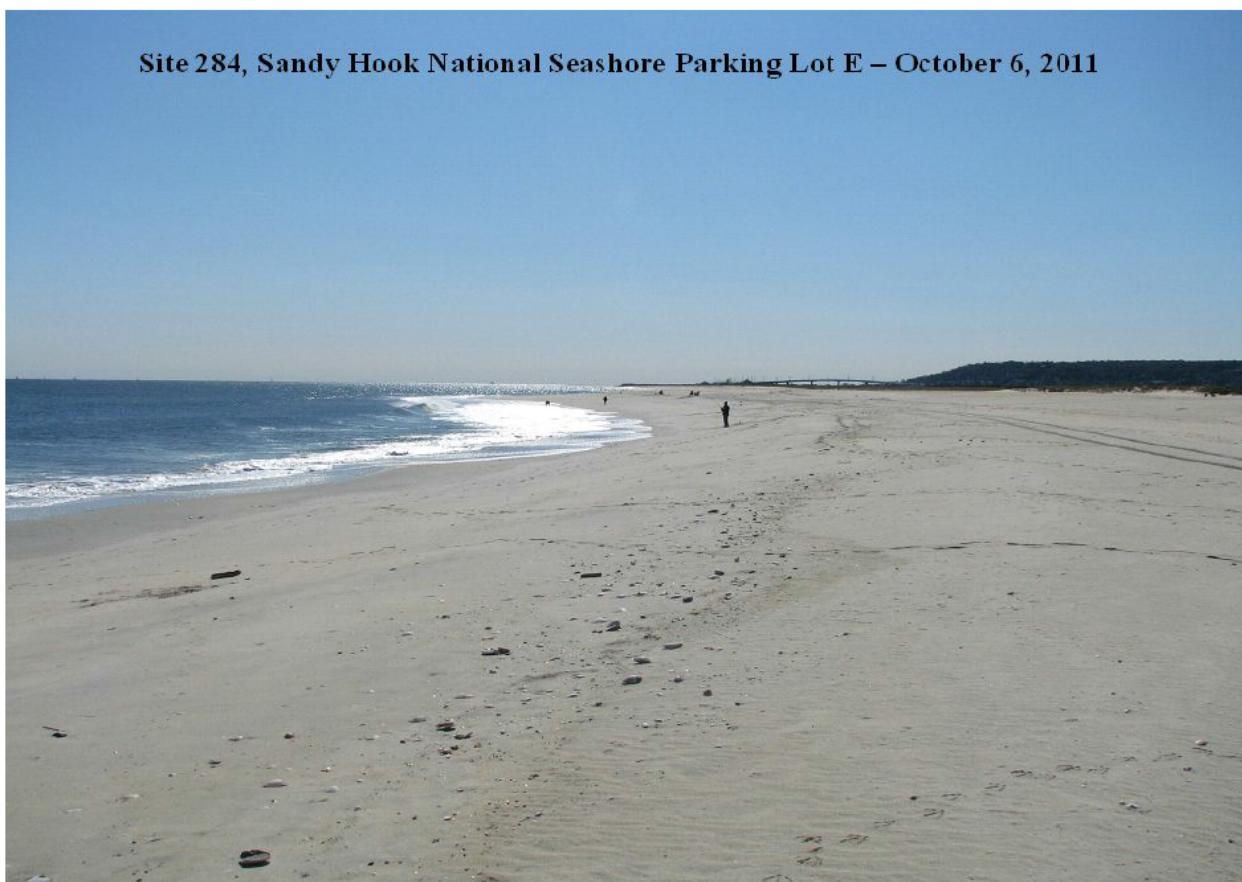


Figure 22. Shown above is the view looking south from the berm near parking lot E in Sandy Hook National Seashore, NJ.

New Jersey Beach Profile Network

#284 - Parking Lot E, Sandy Hook, Monmouth County



-20 — Figure 23: The southern Sandy Hook site suffered considerable berm and serious offshore erosion between surveys 42 and 43. The offshore loss was on-going as the three pre-Irene cross sections show. The net decrease in sand volume was 68.95 yds³/ft. with a 85-foot shoreline retreat. The only positive change was a small sand volume added to the seaward dune toe by Irene.

SANDY HOOK NATIONAL SEASHORE, PARKING LOT E – SITE 284

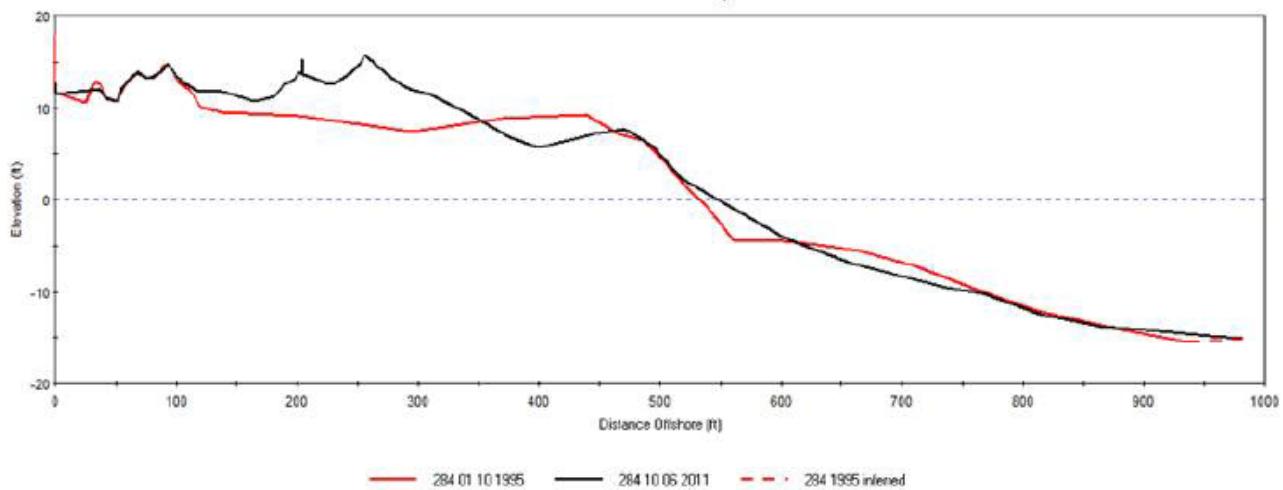


Figure 24. Sand dunes have developed on the former berm following the Monmouth County Federal beach nourishment project. Sand was placed at this location through a cooperative effort between the USACE and US Park Service in 2002. (Left photo January 10, 1995 [view to the southeast]; right photo October 6, 2011 [view to the south]).



17-Year Coastal Changes at Site 284, Parking Lot E, Sandy Hook, Monmouth Co.

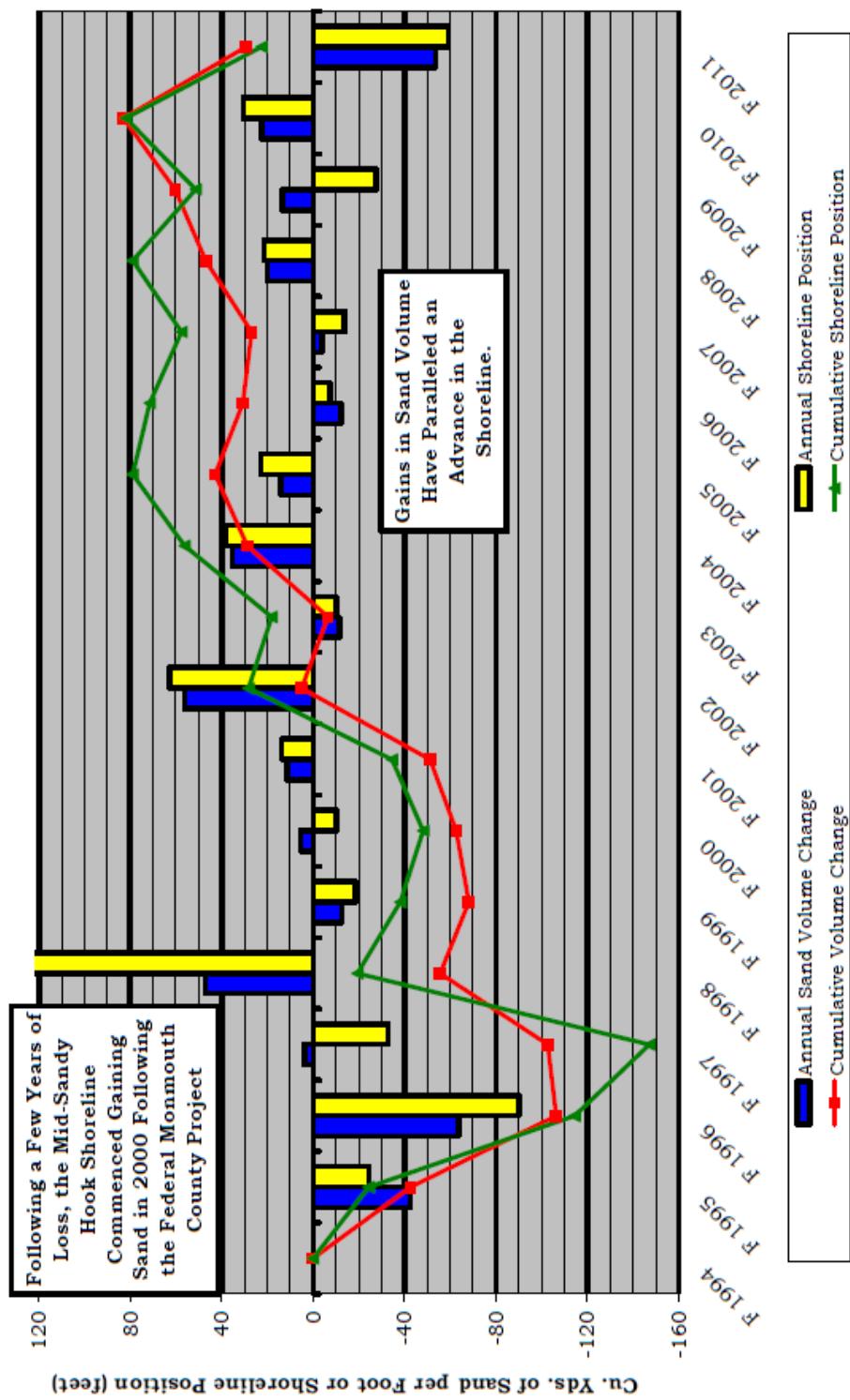


Figure 25. This profile is positioned nearly half way between the park entrance site (#184) and Gunnison Beach (#285). Shoreline retreat was recorded between 1994 and 1997 and indicates that the Federal beach nourishment project sand did not immediately appear along this portion of the Atlantic shoreline. By 1998, an advance of over 100 feet was attributed to sand that had moved northward from the Sea Bright section of the Federal project.

Site 184, Sandy Hook National Seashore Highlands Beach – October 6, 2011



Figure 26. Shown above is the view looking south from the berm at Highlands Beach in Sandy Hook National Seashore, NJ.

New Jersey Beach Profile Network 30 T#184 - Highlands Beach, Sandy Hook, Monmouth County

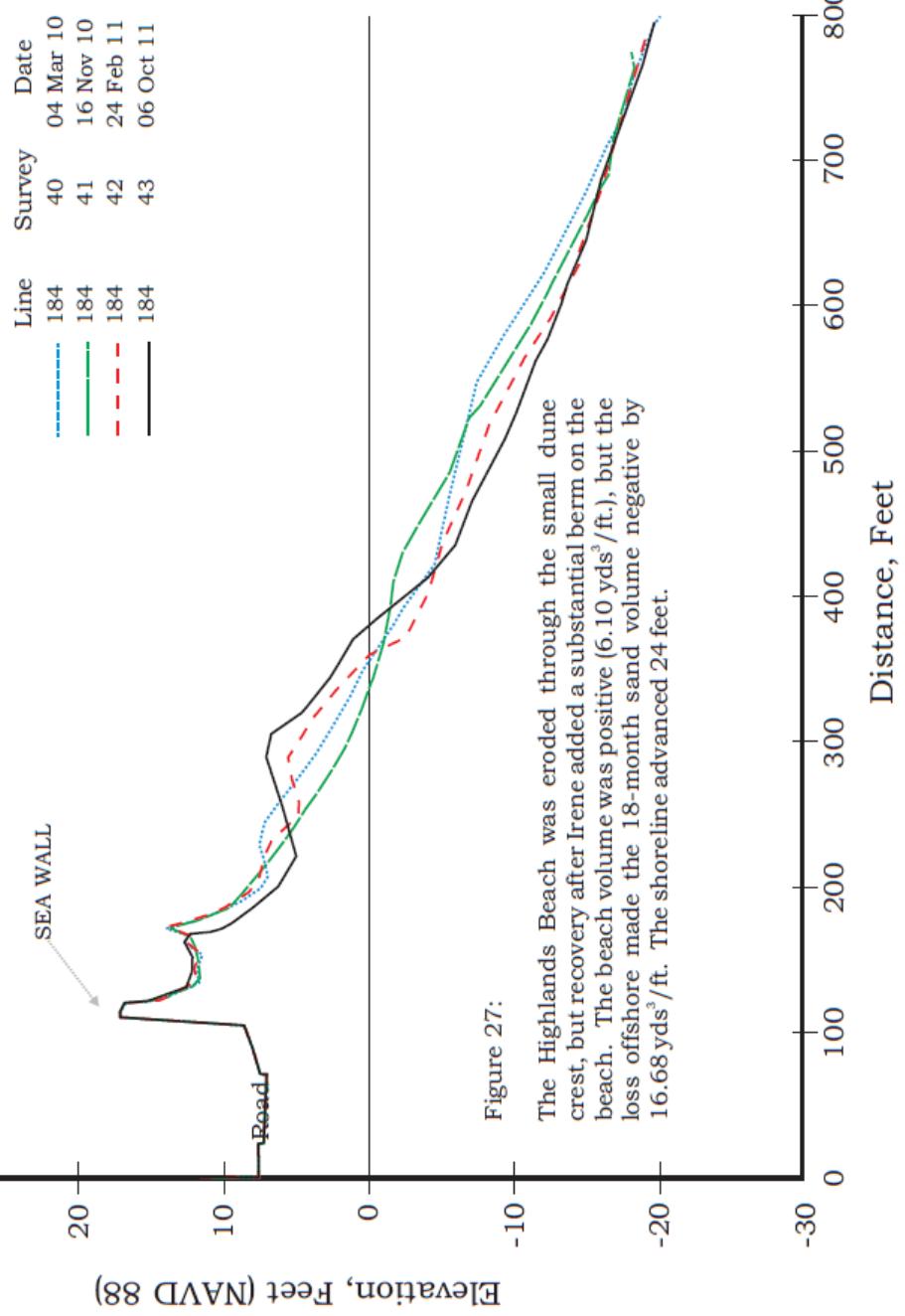


Figure 27:

The Highlands Beach was eroded through the small dune crest, but recovery after Irene added a substantial berm on the beach. The beach volume was positive (6.10 yds³/ft.), but the loss offshore made the 18-month sand volume negative by 16.68 yds³/ft. The shoreline advanced 24 feet.

SANDY HOOK HIGHLANDS BEACH – SITE 184

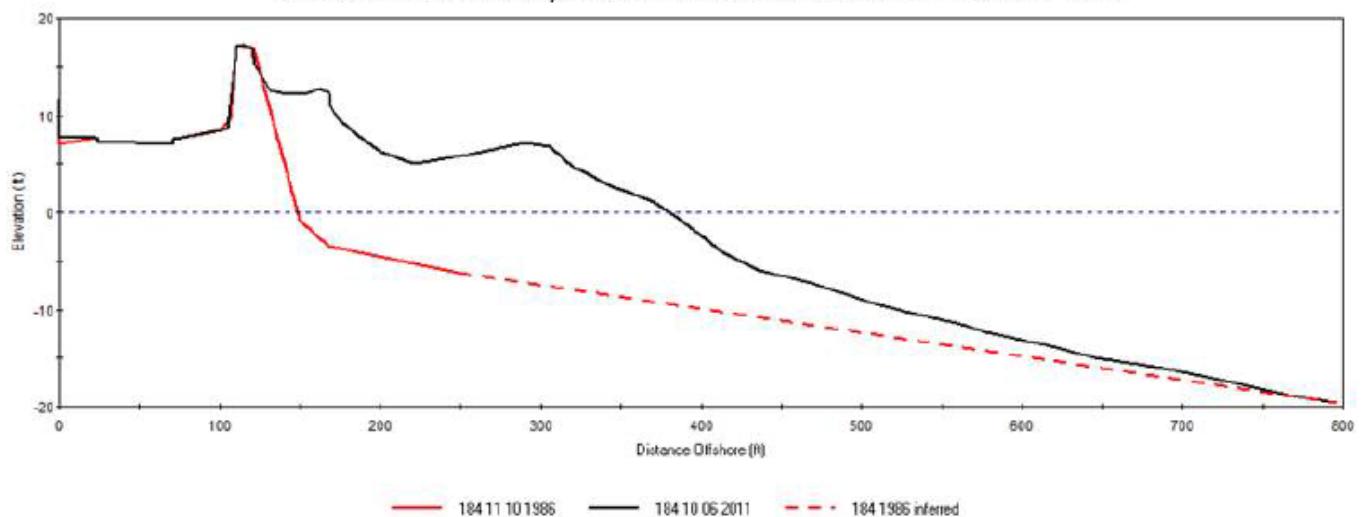


Figure 28. This site has gained in volume and the shoreline has significantly advanced seaward since the Monmouth County 1996 Federal beach nourishment project was constructed and follow-up 2002 maintenance fill. (Left photo October 5, 1987 [view to the north]; right photo October 6, 2011 [view to the north]).



25-Year Coastal Changes at Site 184, Highlands Beach, Sandy Hook, Monmouth Co.

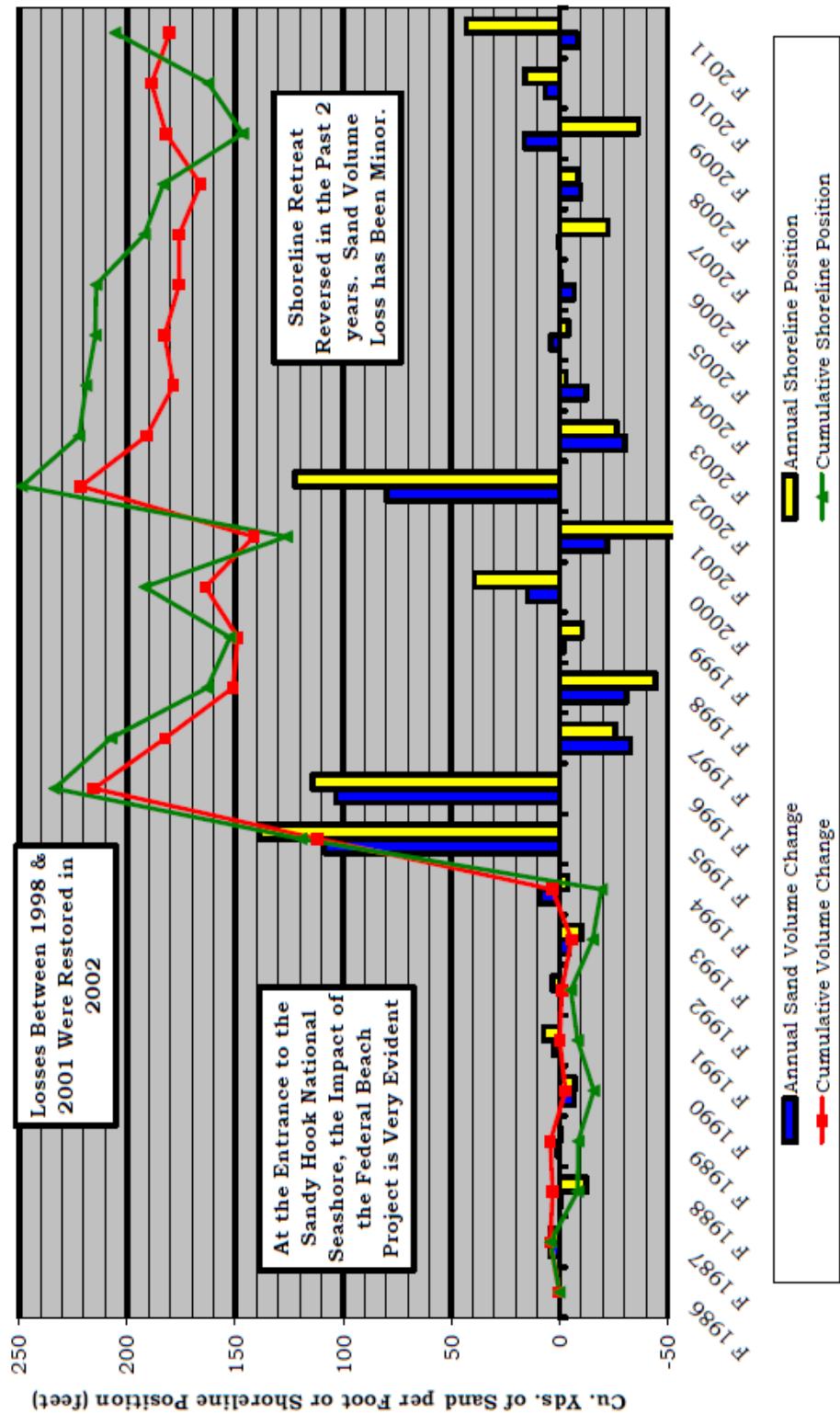


Figure 29. During the early surveys, there was no dry beach at this location. Dramatic changes began in 1995 when sand began to accumulate along the rocks and by 1996, the shoreline advanced seaward by 253 feet with the help of sand placement from an offshore source. Losses following the beach fills are attributed to sand moving northward and depositing in other sections of the Sandy Hook shoreline.

Historical Shoreline Positions

An examination of USGS shoreline information (limited to oceanfront shoreline positions) shows that Sandy Hook has meandered east and west of it's current shoreline position while lengthening further northward. Around 1836, Sandy Hook was either an island or attached to the mainland at Highlands though historical records indicate this was not the normal position of the Hook but the result of a powerful storm. However, by 1855, the Hook reattached to Sea Bright. The shoreline position has meandered since that time period but has grown since the mid 1990's as a result of the inclusion of beach replenishment sands to the south. To examine Sandy Hook shoreline positions further using this dataset, visit <http://marine.usgs.gov/dsasweb/#>. For recent visualizations of Sandy Hook littoral movements during the past 20 years, visit [Google Earth Engine](#).