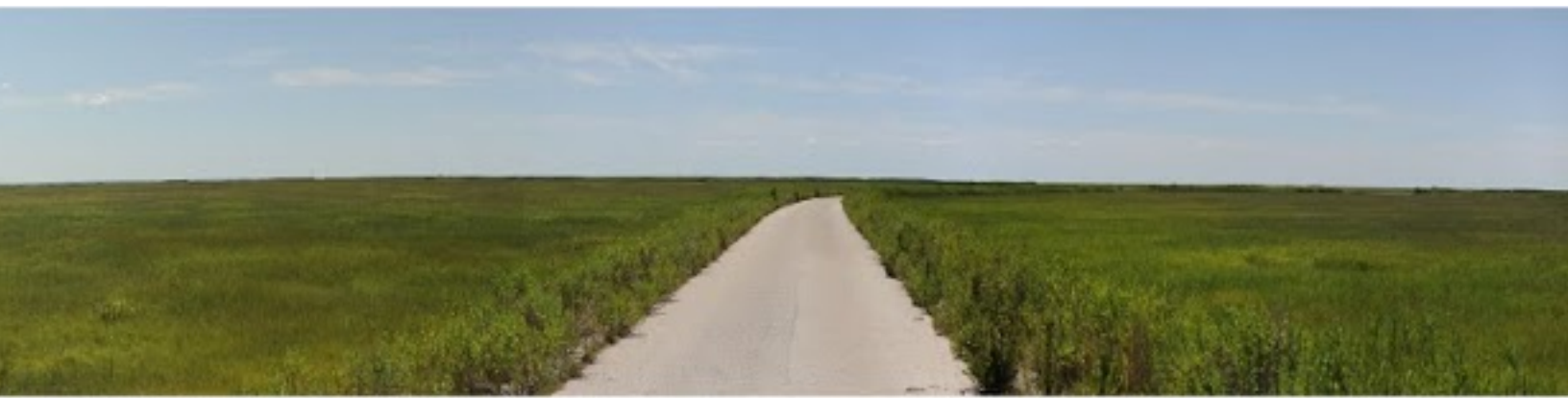


# Maurice River Township *“Getting to Resilience”* Recommendations Report

Prepared by the Jacques Cousteau National Estuarine Research Reserve in  
partnership with New Jersey Future

March 2015



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



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## **Introduction**

The Getting to Resilience questionnaire was originally developed and piloted by the New Jersey Department of Environmental Protection's Office of Coastal Management in an effort to foster municipal resiliency in the face of flooding, coastal storms, and sea level rise. The questionnaire was designed to be used by municipalities to assist in reducing 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 can enhance the outcomes of the evaluation by providing community-specific recommendations, guided discussions with municipal representatives, a vulnerability analysis, and municipal plan reviews.

When Superstorm Sandy came to shore in October of 2012 it was the sixth extreme high tide over the course of two years for Maurice River Township. The flooding from Sandy was widespread, causing damage to homes, marinas, shipping channels, and fishing and oyster beds. In some areas Sandy was the catalyst that weakened susceptible infrastructure, such as roads and dikes, leading to increased vulnerability to future storm and tidal surge. One dike in particular that protects Matts Landing Road was breached during Sandy, but was fixed temporarily. The same dike was breached again in late December of 2012 and with every tide the road behind it, Matt's Landing Road, flooded causing more and more damage until the road became impassable. Access to Matts Landing was limited during this time as the only way for property owners to reach their property was via a bike path. The repairs to the dike and road were not complete until April of 2013. This is one of the areas that Maurice River Township has identified and is investigating for future mitigation and increased resilience.

As part of a combined letter of agreement between Maurice River Township and New Jersey Future, New Jersey Future outlined a scope of services that would be provided to the town through their Local Recovery Planning Manager Program. These services included providing guidance, technical assistance, project management, and staff support to develop and implement effective long term recovery and resilience strategies; assist Maurice River Township to rebuild in a manner that anticipates and responds to future severe storms and sea level rise; and to promote planning principles that were endorsed in town resolution requesting that NJ Future provide a Local Recovery Planning Manager.

The JC NERR's participation with Maurice River is highlighted under *Task 5.1 Existing Conditions Analysis and Vulnerability Assessment* of the "Letter of Agreement between Maurice River Township and New Jersey Future". The recommendations given by JC NERR at the end of the Getting to Resilience process are part of this task that add to the deeper evaluation that NJ Future will be doing

as the Vulnerability Assessment of Maurice River Township. The assessment will be based on detailed mapping of the characteristics described in part 1 of the “Elements of a Vulnerability Assessment” summary attached to the Letter of Agreement. The assessment shall evaluate potential impacts of a range of hazards (coastal storm events/flood patterns, category 1-4 hurricanes, erosion, flooding, sea level rise, storm surge) for past events, existing conditions, and year 2030, 2050, 2100 planning horizons.

The Getting to Resilience process started as a facilitated discussion regarding the Township’s strengths, weaknesses, and hurdles concerning resiliency. Maurice River identified the townships older infrastructure, small tax base (and therefore limited funding), and lack of maintenance of infrastructure such as roads, dikes, and levees by entities other than the township as weaknesses and hurdles. One of the largest strengths identified was the township’s ability to solve issues together as a community. The municipal leaders also expressed an interest in joining FEMA’s Community Rating System, which offers flood insurance discounts to the municipality.

A large portion of Maurice River Township’s economic stimulator, including fishing and shellfish industries, are along the Maurice River. Like much of Cumberland County’s bayshore these areas are vulnerable to sea level rise, storm surge, and flooding. Much has been protected over time with the use of dikes, berms, and levees. While these systems protect the assets behind them their potential failure puts the properties that they were built to protect at risk. Additionally, the properties and marinas that are along the coast rely on these protective systems to keep roadways passable. These built up areas can experience a slow and steady settling of their sediments due to compaction. This can lead to subsidence of streets and lots. To protect these areas Maurice River Township, in conjunction with other local municipalities, have investigated expanding their dike and berm system to create a line of protection from flooding.

Maurice River Township identified their greatest challenges to resiliency as the financing and permitting of projects. As Maurice River Township is small and has a limited tax base, funding of projects is very difficult. The municipal budget and staff have already been stressed by the recovery effort after Sandy and there are very few resources left to either enact resiliency projects or find funding for resiliency projects. When or if a resiliency project is decided on, the time and resources needed to obtain all the appropriate permits needs to be considered as a factor in the project implementation. Working with neighboring communities, Maurice River Township has contributed to the Cumberland County Delaware Bayshore Recovery Plan. Within this plan are strategies for implementing projects and identifying potential funding sources. The plan is the result of goals that the recovery committee, a group of elected officials and residents, identified before determining the specific projects that would support and accomplish them. Within this plan there are four categories; Intergovernmental Relations, Tourism and Economic Development, Infrastructure, and Shoreline Protection and Coastal Management. Understanding the challenges that Maurice River identified, as well as the work that went into the creation of the Cumberland County Delaware Bayshore Recovery Plan, was important to take into consideration when planning this recommendations report. Where applicable, the recommendations of this report reference and complement the Cumberland County Delaware Bayshore Recovery Plan.

## **Methodology**

The Getting to Resilience (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 Maurice River this team included Gordon Gross (Construction & Zoning Official, OEM), Ben Stowman (Land Use Board Chair), Tiffany CuvIELLO (Professional Planner), and Andrew Sarclette (Mayor). The questions in the GTR questionnaire were answered by the municipality with JC NERR staff recording answers and taking notes on the discussions connected to each question.

The first meeting with Maurice River Township took place on April 30th. JC NERR met with two representatives of Maurice River Township and started going through the Getting to Resilience questionnaire. At this initial meeting all sections of the questionnaire were covered, with a few questions left unanswered for a later meeting. On May 7th, the questionnaire was completed with three representatives of Maurice River Township and a discussion of the township's resilience strengths and weaknesses took place.

Upon completion of the GTR questionnaire, JC NERR staff analyzed the answers provided by Maurice River Township, linkages provided by the GTR website, notes taken during the discussion of questions, the Cumberland County Delaware Bayshore Recovery Plan, and mapping of risks, hazards, and vulnerabilities provided by Rutgers University and the NJFloodmapper website. After reviewing all of this information, this recommendations report was drafted to help assist Maurice River Township decision makers as the Township works to recover from Superstorm Sandy and become more resilient.

## **Recommendations**

***1. Investigate the potential for creating a multi-jurisdictional Program for Public Information that can work with the Bayshore Resiliency and Sustainability Education and Outreach Intergovernmental Relations subcommittee.***

Maurice River Township expressed an interest in joining FEMA's Community Rating System (CRS). The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. One of the biggest sections to receive points in is Public Outreach, and it is under this section that the points for creating a Program for Public Information (PPI) exists. 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.

Some of these steps may already be taking place within the Bayshore Resiliency and Sustainability Education and Outreach Intergovernmental Relations Subcommittee. The description of this project states,

“The purpose of the project is to provide increased awareness and education about the issues of rising sea levels, coastal resiliency and mitigation options and strategies along Cumberland County’s Delaware Bayshore in New Jersey. Public engagement with the issues and hazards presented by rising sea levels and erosion is instrumental in creating sustainable, resilient communities along the Bayshore.”

“The project will use for community education and outreach the information developed by the Office of Emergency Management (state/county/local) on Erosion Hazard zones and the U.S. Army Corps of Engineers’ surge maps, which capture all risk areas.”

These goals align with the purpose of a PPI. If done correctly, a PPI will make outreach initiatives more effective and can gain CRS credits in numerous categories besides outreach. For guidance on establishing a PPI, visit [http://crs2012.org/uploads/docs/300/developing\\_a\\_ppi\\_2-24-12.pdf](http://crs2012.org/uploads/docs/300/developing_a_ppi_2-24-12.pdf).

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

Maurice River should examine the current number of outreach programs it runs and what it would take to gain additional points by adding more or expanding on those that currently take place. Outreach should include information about the natural and beneficial functions of floodplains. Particularly after Sandy, residents throughout the impacted area have been looking for as much information as possible. A well organized and efficient outreach program can provide validated information from a trusted source and better prepare residents for natural risks. Outreach is one of the easiest sections to gain points in the CRS and one Maurice River should focus on heavily. Establishment of a PPI would again help this process to maintain efficiency. 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](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

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

Maurice River Township should consider developing a collection of outreach projects in anticipation of future flooding events. The outreach should cover all necessary information such as evacuation routes, safety procedures, and recovery operations. This action could be undertaken through a PPI for additional CRS credits, helping the township 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. Pre-flood planning is eligible for CRS credits under Flood Response Preparations. For more information on Flood Response Preparations credit requirements, visit page 330-9 of the CRS Coordinator’s Manual .

[http://crsresources.org/files/2013-manual/crs\\_manual\\_508\\_ok\\_5\\_10\\_13\\_bookmarked.pdf](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

***4. Make sure all flood maps are available on the town website, at Municipal Hall, and the closest public library.***

Having the most up to date FEMA issued floodplain maps available at numerous locations in different forms of dispersal is critical to ensuring your citizens are informed and has the added benefit of allowing for CRS credits in the Outreach section specifically for the town website and public library. 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 coastal hazards. 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](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

***5. Transfer personal knowledge of coastal storm and flooding event damages to digital format 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, it is vital that the information from these memories be available for all municipal staff. This information can be gathered and documented from current municipal staff, past municipal staff, and public input and may be very useful to identify past surge extents, conditions that caused amplification of storm damages, and vulnerable areas not shown by mapping. Meetings to allow for public input on historic storm damage extents may also earn CRS credits in the Outreach section. Hard copies of documents and other records should also be digitized for preservation and access. 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](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

***6. Maurice River Township should identify, map, and keep data on areas of coastal erosion and consider creating erosion protection programs or instituting higher regulations for building in areas subject to coastal erosion.***

Erosion can quickly become a problem in coastal areas. These areas could include any waterfront that is not bulkheaded and has experienced erosion. Factors that could amplify erosion (sea level rise, surge) should be defined. Throughout the Mid-Atlantic, the erosion of wetlands has been heavily documented. Maurice River Township has topographic and maritime maps that go back many years at it’s disposal, as well as google historical data. These maps show where areas of the coastline has been eroding. Much of the Township is bordered by or protected by wetlands, the Township should make

an effort to locate areas of erosion in their wetlands to identify possible problem areas. 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. A related challenge is unwanted deposition from shoaling and runoff can also be problematic for storm water management, navigation in waterways, and access to docks. Large-scale replenishment projects often change the erosional patterns of beaches as well so a change should be expected after each Beach and/or Dune Restoration project in Maurice River Township identified in the Cumberland County Delaware Bayshore Recovery Plan is completed. Having information on the patterns prior to these project can be used to gauge the project's success and help to improve the design for future replenishment projects. The American Littoral Society through grants coming from DOI/NFWF have sand replenishment projects at both Moores Beach and Thompsons Beach. They have as part of both major projects the element of monitoring which way the sand migrates after placement. From some already completed work at Moores Beach they have advance indications of the sand erosion and deposition patterns in the area. Keeping information on coastal erosion can result in CRS credit in the Erosion Data Maintenance (EDM) section. 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](http://www.fema.gov/media-library-data/20130726-1755-25045-9869/crs_credit_coastal_erosion.pdf)

While answering the Getting to Resilience questionnaire it was identified that there are maps and or studies of the bay possessed by the Army Corps of Engineers and NJDEP. These maps should be collected, put into electronic format, and made available to the municipality for future planning purposes.

In the Cumberland County Delaware Bayshore Recovery Plan there is the Creek Maintenance Dredging project which identifies the efficiency of a comprehensive study of the dredging needs of all creeks by the U.S. Army Corps of Engineers. This study is an example of the type of data that should be kept on record by the community for future planning purposes.

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

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. An amended ordinance may also include some of the newer information coming out on FEMA's maps including the Limit of Moderate Wave Action (LiMWA). That information can also be used to enhance the building standards in the form of higher



freeboard requirements (higher freeboard requirements in areas that are within the LiMWA areas). Both actions can result in a large amount of CRS points in the Higher Regulatory Standards section. It is also recommended that Maurice River Township consider exceeding the state's 1 foot freeboard requirement to provide better protection during storm events and to provide a buffer for expected sea level rise. While municipal staff are informally urging homeowners to build to the 1 foot freeboard requirement, an official requirement would allow for credit in the Freeboard section of Higher Regulatory Standards. 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](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

**8. 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 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 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. For example, Preliminary FIRMs for Cumberland County were just released on April 29th, 2014. Notifying the public of this new map product is an example of outreach that can be done by the township's PPI raising the potential for CRS points. Including information on what changes occur when new maps are released on a township Flood Information webpage may help to alleviate questions the public may have as each map is updated, thereby reducing the workload on municipal 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. In addition, FEMA is also developing a RISK map product called "Flood Depth Grids and Water Surface Elevation Change Grids" which shows the depth of the 1% annual chance flood for any given location within the study area. A description of these data sets can be found at: <http://www.region2coastal.com/flood-risk-tools/tool-descriptions> and the new data layers are 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](http://www.region2coastal.com) website soon. The draft data for Cumberland County can be downloaded from [http://content.femadata.com/Public/Draft\\_Non\\_Regulatory\\_Flood\\_Risk\\_Products/Cumberland/](http://content.femadata.com/Public/Draft_Non_Regulatory_Flood_Risk_Products/Cumberland/). The more familiar the citizens are with the maps, the more likely they will take appropriate actions.

**9. Continue to maintain StormReady Community status as designated 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>. Maurice River Township has been listed as a StormReady Community in the past but must update their standing. Being listed as 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](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

***10. Maurice Township should identify sea level rise as a hazard in town plans and consider disclosing hazard risks to potential buyers and real estate agents.***

Even with the lowest level of predicted sea level rise, Maurice River will experience significant impacts in the near future. Historical rates of sea level rise should be defined as part of this action and future predicted sea levels should be taken into account when making land use decisions, construction standards, etc. The historical rate of sea level rise along the New Jersey coast over the past half century was 3-4 mm/yr (or 0.12 -0.16 in/yr), while projected future rates are expected to increase. In the recent paper entitled "A geological perspective on sea-level rise and its impacts along the U.S. mid-Atlantic coast" Miller and Kopp state that for 2050, the "best" estimate for sea level rise is 1.3 feet along the Jersey Shore. By 2100 sea level rise the "best" estimate 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. 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](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

***11. Maurice River Township should ensure future infrastructure and protection projects take sea level rise projections into consideration.***

While roads, berms, and levees have been identified for improvements and restoration in the Cumberland County Delaware Bayshore Recovery Plan the best way to ensure longevity in the lifespan of these projects is to consider future conditions caused by sea level rise. As these projects protect people, property, and vital evacuation routes and have already been identified through the in-depth process of writing the Cumberland County Delaware Bayshore Recovery Plan it is critical that future conditions are considered before the project is funded and implemented. Considering these conditions can not only improve the length of time these projects are able to function, but can potentially save the township money in the future as the lifespan of the infrastructure is increased.

***12. 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 large CRS credits in the Repetitive Loss Area Analysis section (and more if mitigation actions are initiated). Many of Maurice River's homes were built prior to the release of the current building code and therefore, are more prone to damage in flooding and storm events. Creating a plan for these buildings as well can help to transition these properties towards better resiliency. 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](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)

**13. 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 good that the members of 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 area 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>
- Additional non-regulatory tools are being developed by FEMA and can be accessed on [www.region2coastal.com](http://www.region2coastal.com). Included in these tools is a Coastal Flood Risk Assessment which provides estimates of potential flood damage based on the new coastal flood study results using FEMA's [Hazus loss estimation software](#). Draft versions of these tools are currently available by county at <http://www.region2coastal.com/flood-risk-tools>. While the Cumberland County Annual\_Loss\_Hazus tool is not yet available, it will be included on the site in the near future at [http://content.femadata.com/Public/Draft\\_Non\\_Regulatory\\_Flood\\_Risk\\_Products/Cumberland/](http://content.femadata.com/Public/Draft_Non_Regulatory_Flood_Risk_Products/Cumberland/). For more information about this and other non-regulatory tools please visit <http://www.region2coastal.com/flood-risk-tools/tool-descriptions>.

**14. Have township municipal officials participate in FEMA training courses.**

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

***15. 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".

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

Maurice River Township, like most other coastal municipalities, will experience future impacts from sea level rise in the form of regular tidal flooding and heightened storm impacts. Maurice River Township's large size results in a large number of properties, facilities, and infrastructure that will eventually need to have a plan in place to mitigate or respond to these heightened flooding threats. With such a large area to cover, the need for careful planning and informed decisions cannot be understated. While smaller municipalities may have the capability to react to issues as they arise, Maurice River Township will need to preemptively decide on actions and begin to carry them out. The range of options are bountiful, ranging from buyouts to elevating properties to hardening techniques 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. It is important to note that as sea level rises, the competition for buyout programs will be higher and funding may become more limited. If the Township still feels that buyouts are not a good option, mitigation strategies will need to be looked

into. However, not only will the individual mitigation options need to be examined, but the time frame of their effectiveness will need to be determined as well. 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 buyout programs. Again, these decisions will not be easy ones to make but it is critical that the decisions do take place.

JC NERR recommends Maurice River Township 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 to 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 Maurice River Township, 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 Maurice River Township should include the following municipal sectors:

- Social – Residents, business community, and visitors.
- Economic – Residential Properties, commercial/industrial businesses, municipal resources, tourism, and future development.
- Infrastructure – Roads, bridges, railroads, stormwater, dikes, levees, berms, marinas, municipal facilities, seawalls, and tide gates.
- 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:

- **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.
- **Accommodation** implies that people continue to use the land at risk but do not attempt to prevent the land from being flooded. This option includes erecting emergency flood shelters, elevating buildings on piles and elevating roadways.
- **Protection** involves hard structures such as 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.

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>). Maurice River Township could consider some of the options presented in this document for long and short-term resiliency planning. Many of these suggestions complement the suggestions provided earlier in this GTR Recommendations report:

#### **Impact Identification and Assessment**

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

#### **Awareness and Assistance**

- Outreach and Education – 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.



Maurice River Township 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, Maurice River Township 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 towns 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 Municipal Master Plan. Refer to the link below for the Worcester County Comprehensive Plan for more ideas and examples of a planning document drafted with resiliency in mind. <http://www.co.worcester.md.us/cp/finalcomp31406.pdf>

### **Sample Introduction**

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

*The plan's purpose is to provide the following:*

- 1. An official statement of goals, objectives, policies and aspirations for future growth, development and the quality of life;*
- 2. A set of guidelines for the government and private sectors to maximize the county'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. Areas of the township's 100-year floodplain are highly developed. Both residential 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 Maurice River, 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.*

*Maurice River Township, with its low relief, faces additional flooding issues. Several areas of the Township commonly flood during storms. Sea level rise will increase flooding hazards. New Jersey is particularly vulnerable to sea level rise. During this century, as sea level rises, shorelines could retreat significantly in parts of Maurice River Township. Narrow bay beaches and wetlands at low elevations, both important habitats, would be lost to even a modest rise in sea level. 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 federal 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 construction in the floodplain.*
- 3. For new development, encourage the dedication of 100-year floodplains (not including wetlands) to open space.*
- 4. Promote uses, such as golf courses, open space easements, natural areas, and recreational open space to reduce impervious surfaces in floodplains.*
- 5. Work to acquire properties in the 100-year floodplain, and return them to a natural state.*
- 6. Reevaluate the effectiveness of the current floodplain protection regulations.*
- 7. Discourage the location of new homes and roadways in the "V" or wave velocity zone and the 100-year floodplain.*

8. *Work with the county to complete a hazard mitigation plan for flooding, wildfire, and other natural hazards.*
9. *Develop and implement a post-disaster recovery and reconstruction plan to facilitate recovery and to reduce exposure to future disasters.*
10. *Participate in the Community Rating System to receive flood insurance premium credits.*
11. *Consider code changes that will limit impervious surfaces.*
12. *Develop a sea level rise response strategy (include a two foot freeboard requirement for properties exposed to flooding and discourage shoreline hardening).*

## **Mapping**

The following maps can be found in the appendices of this document and were either requested by Township staff or recommended by JC NERR staff during GTR meetings. In the near future, the Getting to Resilience website, [www.prepareyourcommunitynj.org](http://www.prepareyourcommunitynj.org), will host community profiles that include municipal mapping 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.

### **Maps Recommended During GTR Meetings:**

#### ***Sea Level Rise 1-3 feet with Critical Facilities (provided in Appendix)***

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 much of Maurice River Township is near current sea level, Sea Level Rise maps should be utilized heavily for municipal planning documents.

#### ***Storm Surge (SLOSH Category 1, SLOSH Category 2, & SLOSH Category 3) (provided in Appendix)***

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 Maurice River Township 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](http://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**

#### ***Repetitive Loss & Severe Repetitive Loss***

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

#### ***Overlays of Hazards and Populations, Infrastructure, and Building Footprints***

Though it is the goal of this report to guide Maurice River Township 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 the Township 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 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**

As much of Maurice River Township is at or near current sea level, fluctuations in sea level through surge events and trends towards higher sea level are of great significance. Analysis of SLOSH maps show that as hurricane strength increases, potential surge impacts will increase in scope and severity as one would expect. SLOSH models indicate we should expect flooding on a similar scale of Sandy for powerful Category 1 hurricanes. SLOSH models for Category 2 and 3 storms show flooding covering roughly 25% of the town for a Category 2 storm and 30% of the town in a Category 3 storm. Both scenarios flood the critical evacuation route of Route 47 and the capillary roads into Heislerville. Although storms of this magnitude are very rare for our area, they remain a possibility that requires attention and planning.

Even the relatively low end scenario of one foot of sea level rise will require adaptation of portions of the route between Port Elizabeth and Leesburg, as this area will see fairly regular tidal inundation.

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 the amount of additional sea level rise.

<b>Total sea level rise projections for New Jersey.</b>			
	Total cm	Total inches	Total feet
<b>2050 best</b>	<b>40</b>	<b>16</b>	<b>1.3</b>
2050 low	23	9	0.7
2050 high	60	24	2.0
<b>2100 best</b>	<b>96</b>	<b>38</b>	<b>3.1</b>
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.

Three feet of sea level rise will result in amplified tidal inundation of the route between Port Elizabeth and Leesburg, as well as regular tidal flooding of Heislerville and Delmont. Any level of inundation due to regular tidal flooding will have large scale impacts on emergency response. Sea level rise will also result in greater impact of storm events as a surge atop a higher sea level will be more dramatic 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. The information provided in this recommendations document is the JC NERR part of the in depth Vulnerability Assessment that NJ Future is doing for Maurice River Township. While going through the tasks in the “Letter of Agreement...” New Jersey Future will be digging deeper into these vulnerabilities, sea level rise and storm surge, as well as the other hazards described in the introduction of this recommendation document..

### **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 Maurice River based off of the answers given in our Getting to Resilience questionnaire, discussions with JCNERR staff, and reviews of other documents. These sections represent the current state of the Township but also include planned projects or uncompleted projects we are aware of. However, these projects may need to be complete in order to be granted credit. These sections do not represent guaranteed points for the CRS but are likely achievable to a certain degree and should

be investigated when submitting to the CRS. When working with your CRS coordinator, we recommend inquiring about the following sections.

**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 2.5)

**Section 330: Public outreach:** 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.

- **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, 2.8, 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, 2.8, 2.11, 4.9)
- **Program for Public Information (PPI):** Up to 80 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)
- **Stakeholder delivery (STK):** Up to 50 points added to OP credits for having information disseminated by people or groups from outside the local government. (GTR 2.4)

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

- **Flood protection library (LIB):** 10 points for having 10 Federal Emergency Management Agency publications on flood protection topics housed in the public library. (GTR 2.5.1, 2.15)
- **Locally pertinent documents (LPD):** Up to 10 points for having additional references on the community's flood problem or local or state floodplain management programs housed in the public library.
- **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)

**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)

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

- **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)

**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 5.9, 5.12)
- **Natural shoreline protection (NSP):** Up to 120 points for programs that protect natural channels and shorelines. (GTR 3.3, 5.9)
- **Deed restrictions (DR):** Up to 50 points extra credit for legal restrictions that ensure that parcels credited for OPS will never be developed.
- **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, 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, 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).

- **Protection of critical facilities (PCF):** Up to 80 points for protecting facilities that are critical to the community. (GTR 4.7)

**Section 440: Flood Data Maintenance:** To make community floodplain data more accessible, current, useful, and/or accurate so that the information contributes to the improvement of local regulations, insurance rating, planning, disclosure, and property appraisals.

- **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)

**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):** Up to 382 points for a community wide FMP that follows a 10 step planning process. Step 2 is to involve the public. (GTR 2.3, 3.3, 3.3.2)

**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.

- **Emergency warning dissemination (EWD):** Up to 75 points for disseminating flood warnings to the public. (GTR 2.11, 2.12, 4.3, 4.7, 4.9)
  - **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)
- **Flood response operations (FRO):** Up to 115 points with 10 points awarded for maintaining a data base 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 4.8, 4.9, 4.9.6)
- **Critical facilities planning (CFP):** Up to 75 points for coordinating flood warning and response activities with operators of critical facilities. (GTR 2.11, 2.12, 4.7, 4.9)
- **StormReady community (SRC):** 25 points for designation by the National Weather Service as a StormReady community. (GTR 4.1, 4.6)

**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 the warning to the public. (GTR 2.11, 4.9)
  - **LFW 7:** 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)
- **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 2.12, 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 a threat of a levee's failure or overtopping. (GTR 4.6, 4.7)

FEMA's definition of a Levee - A levee is a structure, usually an earthen embankment, designed and constructed using sound engineering practices, to contain, control, or divert flood waters in accordance with a designated risk reduction level. (Page 620-2 of the 2013 CRS Coordinator's Manual)

## **Additional CRS Resources and Information**

The CRS Resources webpage (<http://crsresources.org/>) has information, worksheets, forms, tables, handouts, checklists, training information, etc. There is a resource for almost every activity/element that CRS gives credit for. Click through the links at the top of the page (<http://crsresources.org/>) to see what will benefit your community. The following links are also available on the CRS Resources webpage.

- Information on Training & Video's (including Webinars) can be found at:  
<http://crsresources.org/training/>
- The "Application Letter of Interest and CRS Quick Check" can be found at:  
<http://crsresources.org/quick-check/>
- The 2013 NFIP CRS Coordinator's Manual can be found at:  
[http://crsresources.org/files/2013-manual/crs\\_manual\\_508\\_ok\\_5\\_10\\_13\\_bookmarked.pdf](http://crsresources.org/files/2013-manual/crs_manual_508_ok_5_10_13_bookmarked.pdf)
- The CRS Community Self Assessment can be found at:  
<http://www.crs2012.org/self-assessment/>
- The following information was taken from the May 18th, 2014 "FEMA (Federal Emergency Management Agency) Weekly Digest Bulletin" which can be found at:  
[http://crsresources.org/files/100/newsletters/2014-April\\_MayNFIP\\_CRS%20Update.pdf](http://crsresources.org/files/100/newsletters/2014-April_MayNFIP_CRS%20Update.pdf)

### **Another Look at Elevation Certificates**

As CRS communities know, participation in the CRS requires that a community "maintain completed FEMA Elevation Certificates showing the 'finished construction' elevations for all buildings constructed or substantially improved in the Special Flood Hazard Area (SFHA)" after the date of its application to the CRS.

Further, the community must review all the certificates that it collects to be sure that they are filled out completely and correctly. Pages 310-7 and 310-8 of the *CRS Coordinator's Manual* include checklists to help communities review the 2006, 2009, and 2012 Elevation Certificates.

Because correct and complete Elevation Certificates are so valuable to effective floodplain management, and are also a good indicator of a community's implementation of its program, the CRS works continually to improve its process for assessing the Elevation Certificates and for helping communities better use this tool. To this end, a new step is

introduced in the 2013 *Coordinator's Manual*. Under Activity 310 (Elevation Certificates), communities now must submit a list of all permits issued for new buildings and substantial improvements in the SFHA since the last visit, along with copies of all Elevation Certificates.

These modifications were described in previous issues of this newsletter [see *March 2013, page 3; and May 2013, page 3*], but here is a recap of what to expect and suggestions for making your first cycle verification visit under the 2013 *Coordinator's Manual* go smoothly.

--Have ready a list (digital or paper) of all permits issued for new construction and substantial improvements in the SFHA (or your regulatory floodplain) since your last cycle verification visit. In most cases you should not include permits for areas outside the SFHA, or permits for less-than-substantial improvements.

Talk to your ISO/CRS Specialist about permit list specifics before your visit, to ensure that you are prepared, especially if your community is regulating floodplain development outside the SFHA.

--Have ready copies (paper or digital) of the Elevation Certificates for all of the properties on the list. Be sure the copies of the Elevation Certificates can be correlated to the permit list.

--Your ISO/CRS Specialist will collect all the Elevation Certificates. He or she will then select a random sample of 30 of them, and review them. Your EC credit is based on this initial sample. If you have issued fewer than 30 permits, then all your Elevation Certificates will be reviewed.

--EC credit will be based on the first review of the sample of Elevation Certificates. Regardless of the EC credit determination, minimal CRS participation requires that at least 90% of a community's Elevation Certificates be complete and correct. If the review of the sample indicates a less-than-90% correct rate, your community will be given a chance to correct all the ECs.

--All Elevation Certificates that were not reviewed during the sampling process will be retained by the CRS. At a later date, when the centralized Elevation Certificate review project has been completed [see "*Tidbits from the Task Force,*" on page 5] all the collected Elevation Certificates will be scanned and reviewed, and your community will receive comments on them.

--Remember that, for some properties on your permit list, you may need to provide a V-Zone design certification or a Floodproofing Certificate *[see the article on page 3 of the May 2013 issue]*.

After your first visit under the 2013 *Coordinator's Manual*, each annual recertification will need to be accompanied by a fresh permit list and copies of all the Elevation Certificates (and other certifications) for properties on the list. But even though your visit may be a year or two away, you may want to begin a list now and organize your Elevation Certificates accordingly. Many communities say that organizing and submitting Elevation Certificates each year works better than having to get everything organized just before the cycle visit.

If you have any questions about Elevation Certificates, contact your ISO/CRS Specialist.

# Appendix

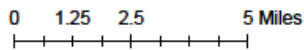
## Maurice River Township 1 Feet of Sea Level Rise

### Legend

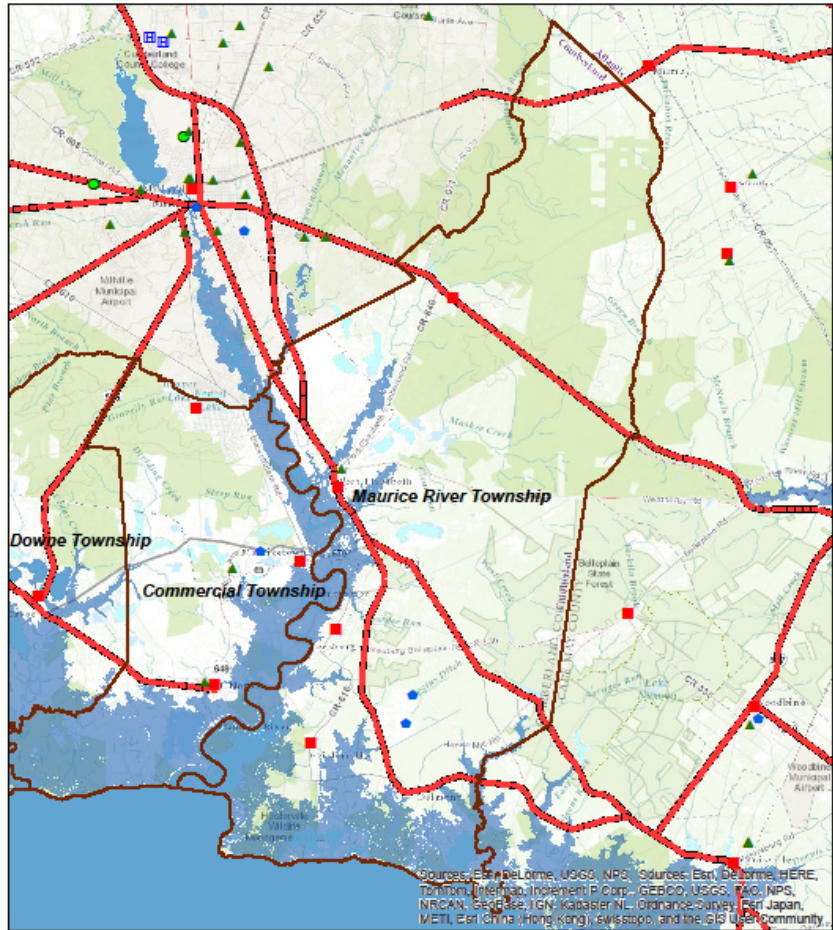
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- H Hospitals
- Evacuation Routes
- 1ft SLR

Year 2010 Population: 7976

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 and is centered on target municipalities.



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



Sources: ESRI, DeLorme, USGS, NPS, Source: Esri, DeLorme, HERE, TomTom, Intermap, Invertek P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Sea-Base, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri (China), Hong Kong, Swisstopo, and the GIS User Community.

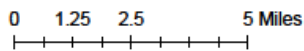
## Maurice River Township 2 Feet of Sea Level Rise

### Legend

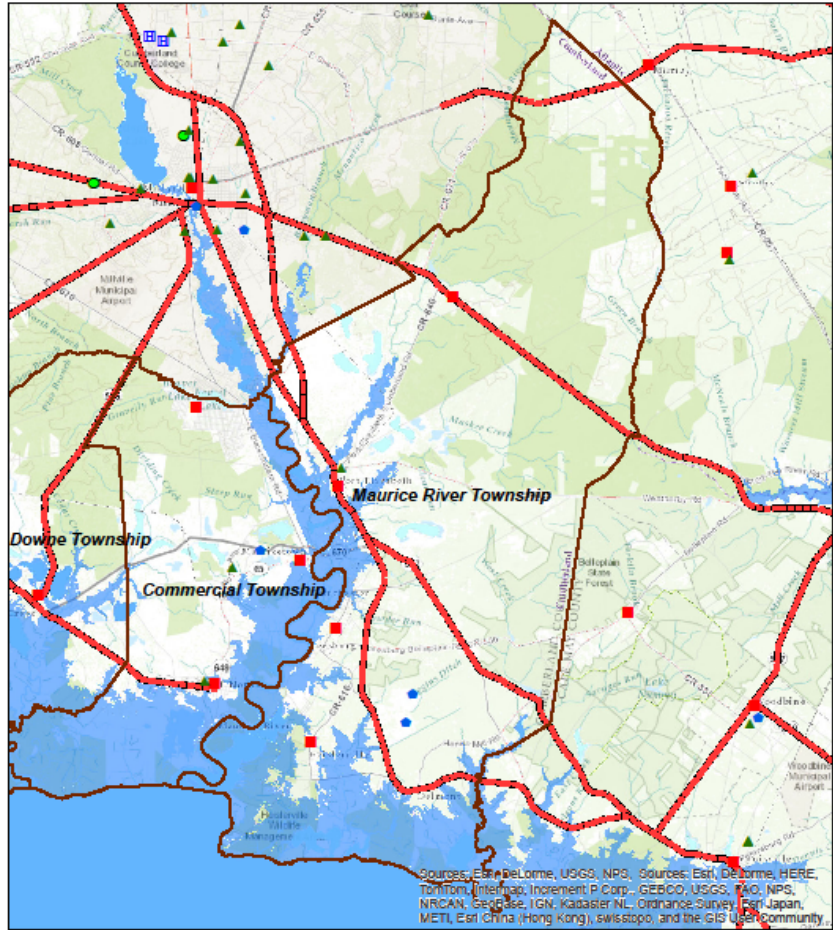
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- H Hospitals
- Evacuation Routes
- 2ft SLR

Year 2010 Population: 7976

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 and is centered on target municipalities.



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Rutgers, New Brunswick  
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and Spatial Analysis



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

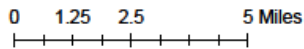
## Maurice River Township 3 Feet of Sea Level Rise

### Legend

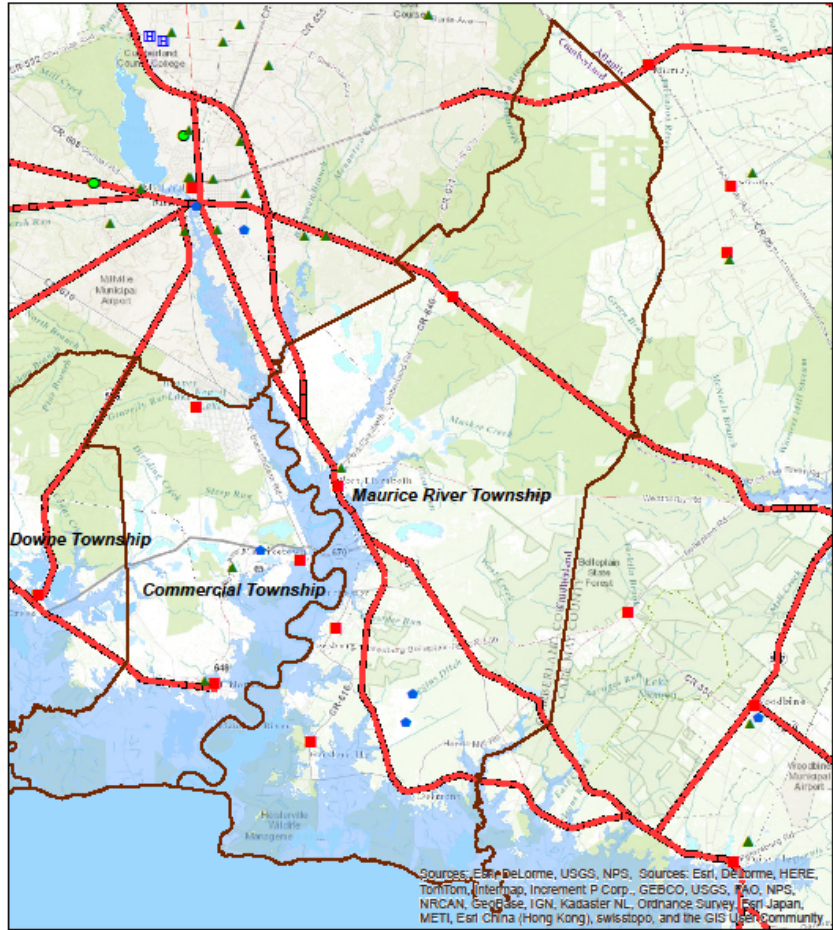
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- H Hospitals
- Evacuation Routes
- 3ft SLR

Year 2010 Population: 7976

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 and is centered on target municipalities.



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Center for Remote Sensing  
and Spatial Analysis



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**Maurice River Township  
Category 1 SLOSH Model**

**Legend**

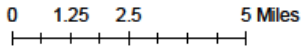
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- Hospitals
- Evacuation Routes

**Category 1 SLOSH**

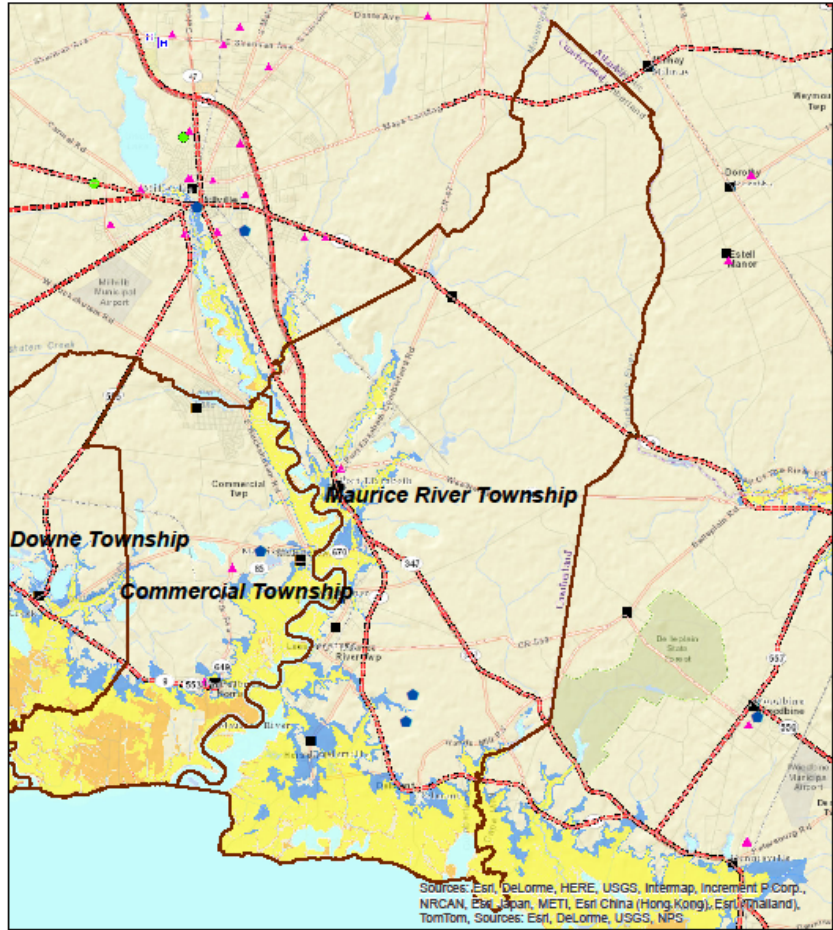
- 0 - 3 Feet Above Ground Level
- 3 - 6
- 6 - 9
- > 9

Year 2010 Population: 7976

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



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



Sources: Esri, DeLorme, HERE, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Zhejiang), TomTom, Sources: Esri, DeLorme, USGS, NPS

**Maurice River Township  
Category 2 SLOSH Model**

**Legend**

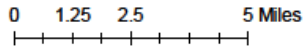
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- Hospitals
- Evacuation Routes

**Category 2 SLOSH**

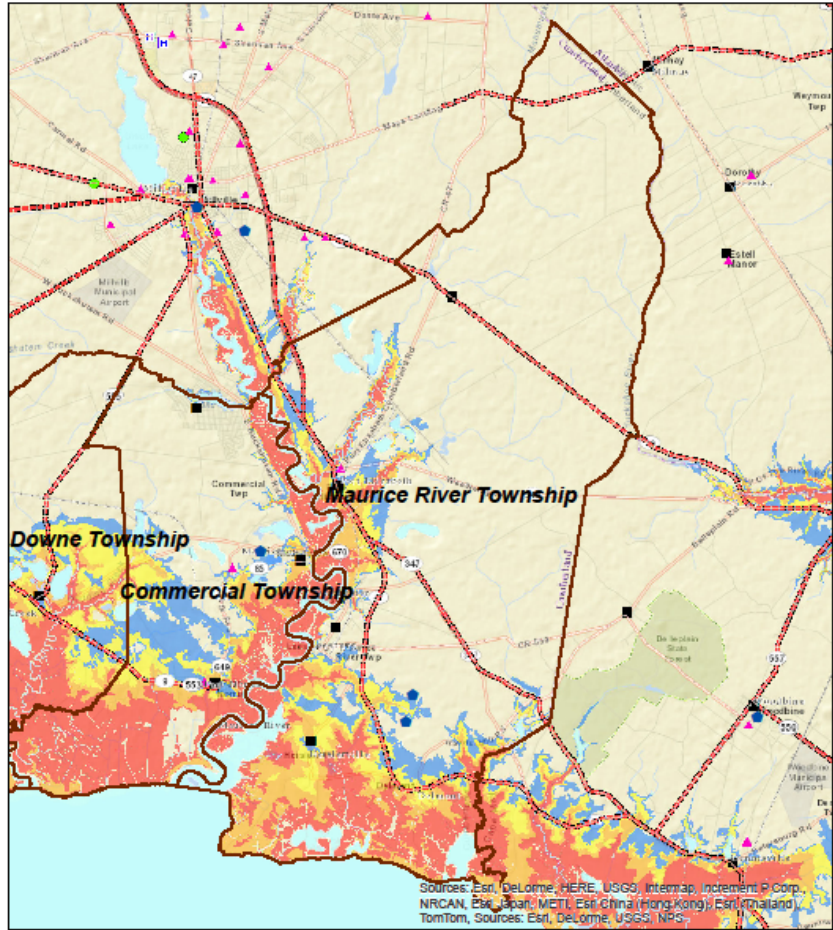
- 0 - 3 Feet Above Ground Level
- 3 - 6
- 6 - 9
- > 9

Year 2010 Population: 7976

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



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Center for Remote Sensing  
and Spatial Analysis



Sources: Esri, DeLorme, HERE, USGS, Intermap, increment P Corp., NRCAN, Esri, Japan, METI, Esri, China (Hong Kong), Esri, Thailand, TomTom, Sources: Esri, DeLorme, USGS, NPS...

**Maurice River Township  
Category 3 SLOSH Model**

**Legend**

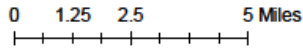
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- Hospitals
- Evacuation Routes

**Category 3 SLOSH**

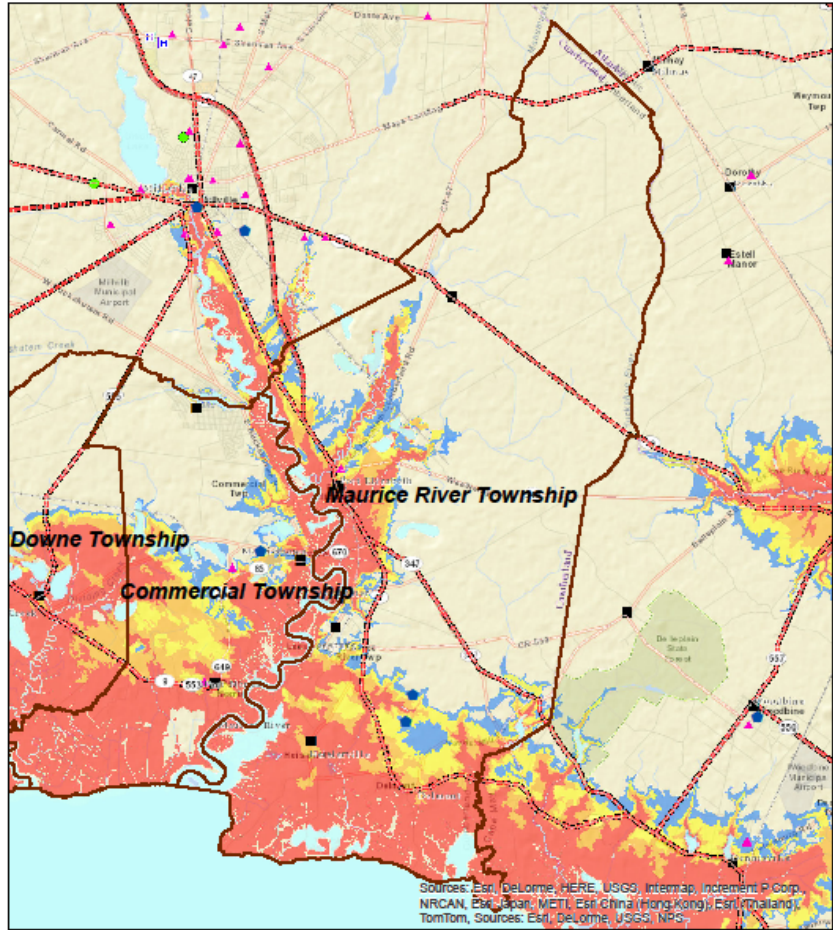
- 0 - 3 Feet Above Ground Level
- 3 - 6
- 6 - 9
- > 9

Year 2010 Population: 7976

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



Map Author: Bryan Serino  
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and Spatial Analysis



Sources: Esri, DeLorme, HERE, USGS, Intermap, increment P Corp., NRCAN, Esri, Swis, METI, Esri, China (Hong Kong), Esri, Swis, TomTom, Sources: Esri, DeLorme, USGS, NPS...

## Marsh Retreat at 1 feet of Sea Level Rise Maurice River Township

### Legend

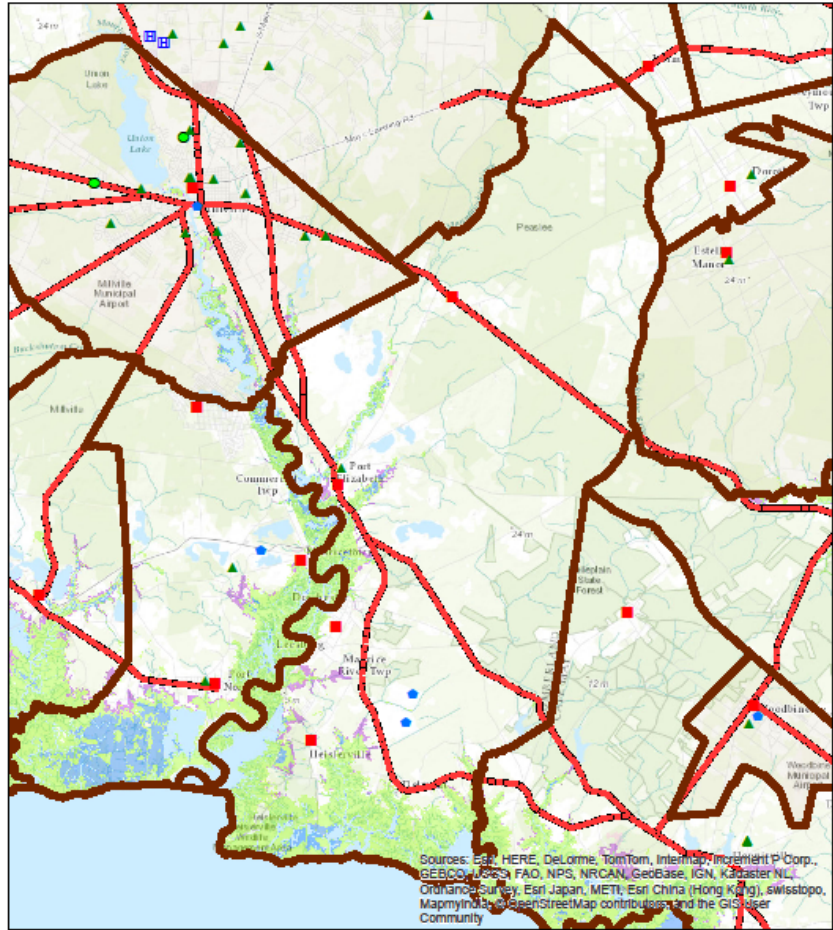
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- Hospitals
- Evacuation Routes
- Marsh Retreat at 1ft SLR**
- Unimpeded Marsh Retreat Zone
- Impeded Marsh Retreat Zone
- Marsh Conversion: Unconsolidated Shore
- Marsh Conversion: Open Water
- Unchanged Tidal Marsh

0 1.25 2.5 5 Miles

Year 2010 Population: 7976

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  
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## Marsh Retreat at 2 feet of Sea Level Rise Maurice River Township

### Legend

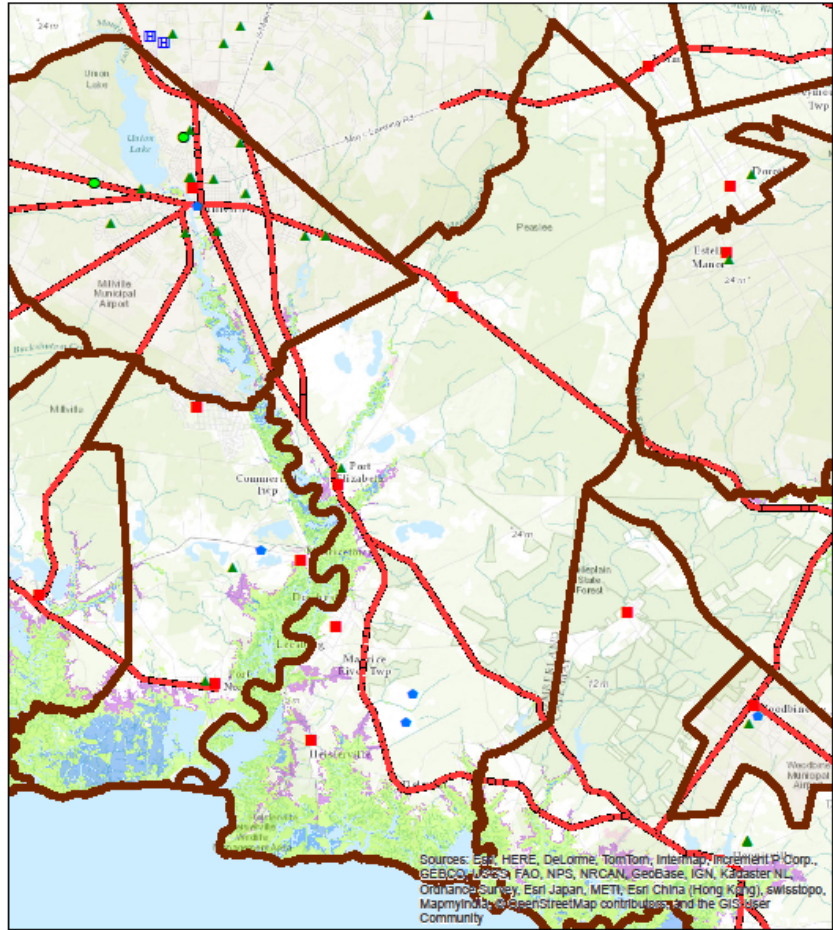
- Municipality
- ▲ Schools
- Fire Stations
- Law Enforcement
- Assisted Living
- Hospitals
- Evacuation Routes
- Marsh Retreat at 2ft SLR**
- Unimpeded Marsh Retreat Zone
- Impeded Marsh Retreat Zone
- Marsh Conversion: Unconsolidated Shore
- Marsh Conversion: Open Water
- Unchanged Tidal Marsh

0 1.25 2.5 5 Miles

Year 2010 Population: 7976

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

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Center for Remote Sensing  
and Spatial Analysis



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

## Marsh Retreat at 3 feet of Sea Level Rise Maurice River Township

### Legend

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

Evacuation Routes

### Marsh Retreat at 3ft SLR

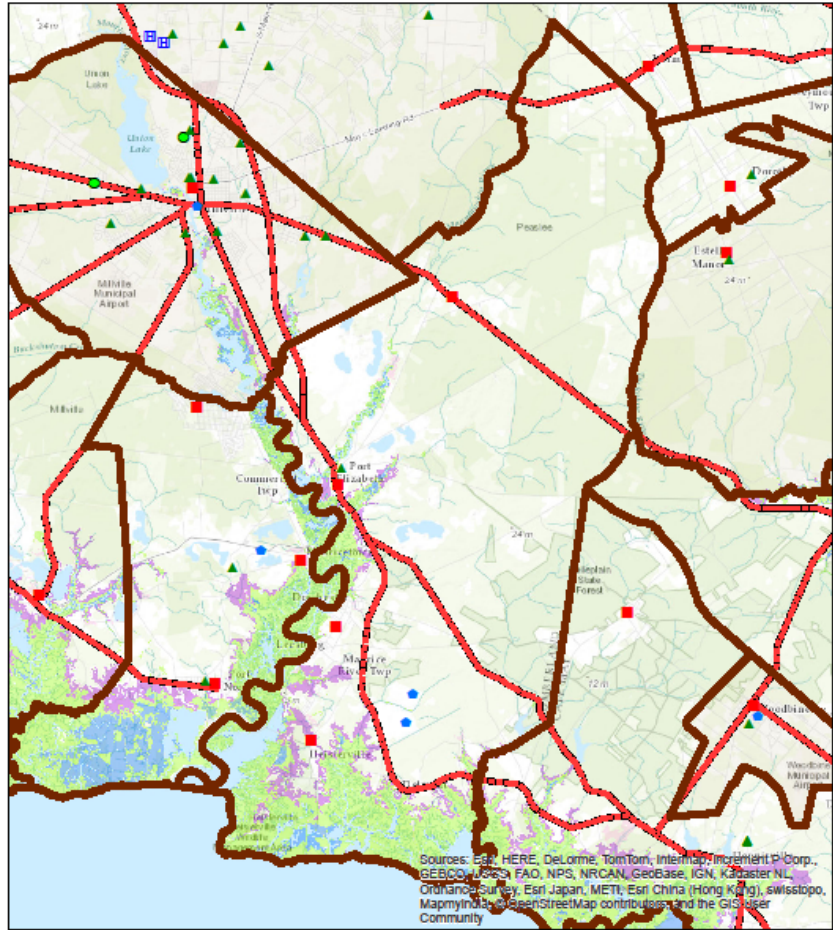
- Unimpeded Marsh Retreat Zone
- Impeded Marsh Retreat Zone
- Marsh Conversion: Unconsolidated Shore
- Marsh Conversion: Open Water
- Unchanged Tidal Marsh

0 1.25 2.5 5 Miles

Year 2010 Population: 7976

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

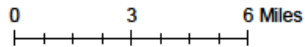
**FEMA's PFIRM Flood  
Zones for New Jersey  
Maurice River Township**

**Legend**

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

**PFIRM**

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



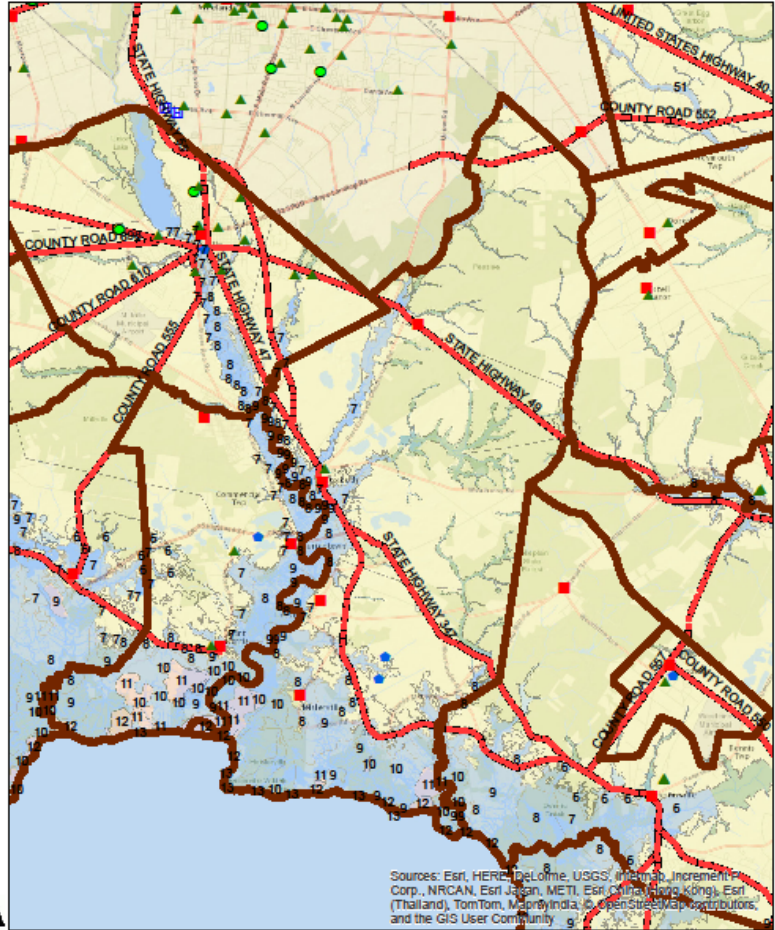
Year 2010 Population: 7976

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  
Center for Remote Sensing  
and Spatial Analysis



Sources: Esri, HERE, DeLorme, USGS, Imagery, Incremental P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Taiwan), TomTom, Mapbox, and the GIS User Community

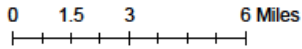
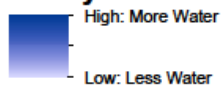


# Sandy Storm Surge Maurice River Township

## Legend

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

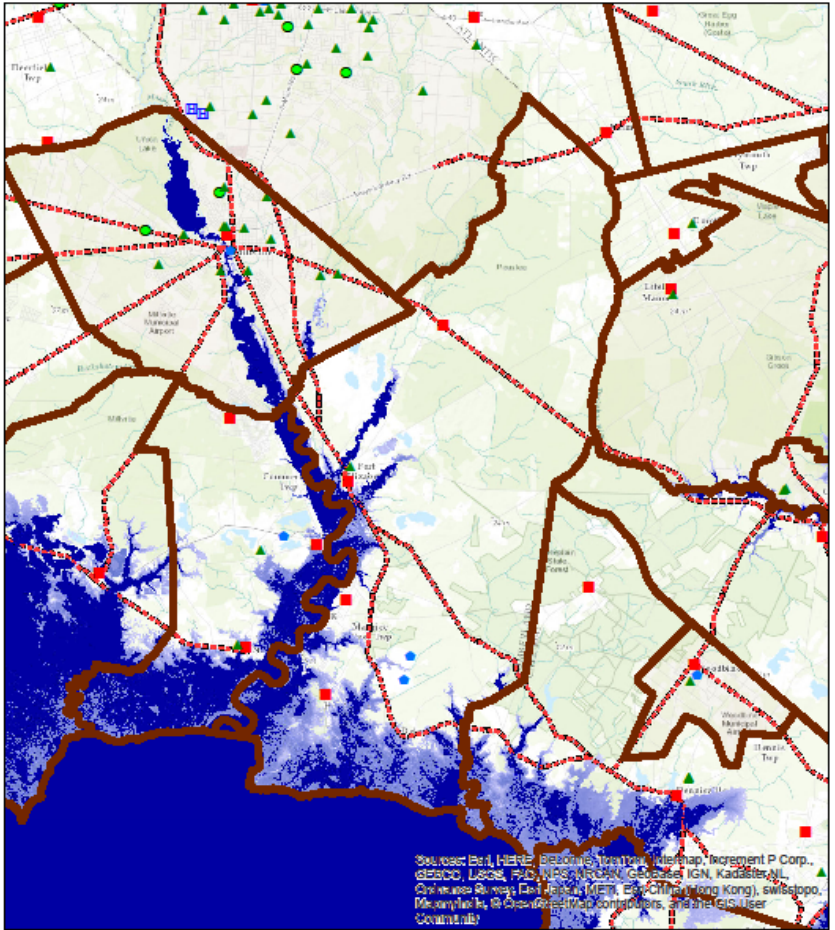
## Sandy Storm Surge



Year 2010 Population: 7976

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



Source: Esri, HERE, DeLorme, WorldWind, Mapbox, Incorem P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GEBCO, IGN, Kartena, CNR, Swisstopo, GEBCO, METI, Esri, China (Hong Kong), Swisstopo, Mapbox, and OpenStreetMap contributors, and the GIS User Community