Township of Elsinboro

Getting to Resilience Recommendations Report

August, 2016

Prepared by Sustainable Jersey for
the Township of Elsinboro
619 Salem Fort Elfsborg Road
Elsinboro, NJ 08079

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Section I. Introduction

The "Getting to Resilience - Recommendations Report" provides a series of suggested actions to help strengthen flood resiliency in the Township of Elsinboro, New Jersey. The report includes an overview of the Getting to Resilience (GTR) tool, describes Elsinboro's GTR process, and offers recommendations that will help the township advance its flood resiliency goals and objectives.

GTR is designed to help New Jersey coastal municipalities evaluate their level of preparedness for future flood risks and offers recommendations to improve preparedness through integrated planning, hazard mitigation, and adaptation plans and policies. Sustainable Jersey facilitated the GTR process in Elsinboro through a National Fish & Wildlife Foundation (NFWF) grant, a program managed by the NJ Department of Environmental Protection's (NJDEP) Office of Coastal and Land Use Planning, to provide tools and technical assistance to municipalities for building ecological solutions to coastal community hazards (BESCCH). The GTR has become an important first step towards municipal flood disaster preparedness and resilience in New Jersey.

Getting to Resilience: A Community Planning Evaluation Tool

The Getting to Resilience (GTR) questionnaire was originally developed and piloted by the NJDEP'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 identify potential vulnerabilities to flooding, and increase preparedness by linking planning, mitigation, and adaptation. The questionnaire was later adapted by the Coastal Training Program of the Jacques Cousteau National Estuarine Research Reserve (JCNERR), converted into a digital format, and placed on an interactive website. JCNERR further amended the GTR by adding linkages to local, state and federal programs that offer credits or points for conducting some of the activities referenced in the questionnaire, including the National Flood Insurance Program's (NFIP) Community Rating System (CRS) program as well as the Sustainable Jersey municipal certification program. The GTR is available on a publicly accessible website (www.prepareyourcommunity.org) where any municipality can complete and create a report based on the results at any time.

The GTR questions are organized into five sections that focus on the various aspects of municipal resilience. These include:

- Risk & Vulnerability Assessments
- Public Engagement
- Planning Integration
- Disaster Preparedness & Recovery
- Hazard Mitigation Implementation

While the GTR questionnaire can be completed by any local official or citizen, the questions cover a broad spectrum of disciplines and expertise and the questionnaire is best completed through a collaborative approach with a team of experts. The ideal process starts with the designation of multi-disciplinary team of experts familiar with the municipality's current plans, policies and programs related to flood management and resiliency, e.g. the master plan, flood prevention ordinance, hazard mitigation plan, etc. The actual process consists of 1-2 meetings where participants collectively answer the GTR

questions in the five resiliency categories. Recommended participants include land use planners, hazard mitigation planners, emergency managers, floodplain managers, natural resource planners, municipal engineers, elected officials, zoning and permitting officials, public works officials, business administrators, and municipal clerks. By having these key individuals work together, municipal leaders can empower all of the relevant parties to collaborate on implementing recommendations for building long-term flood resilience. In many cases, the simple act of convening these individuals can help to "break down the silos" that often divide what should be interrelated disciplines and fields—a key step needed when working to build long-term community resilience.

Expert facilitation of the GTR is also offered to municipalities by JCNERR, Sustainable Jersey and other organizations. Facilitated support provides added expertise and assistance in the process, and typically includes mapping future flood hazards to help the municipality begin to assess potential vulnerabilities. The facilitated process also provides municipal leaders with a customized set of well-vetted recommendations and resources to make these suggested next steps more actionable (this report).

What is Resilience?

The Elsinboro Getting to Resilience process was facilitated by Sustainable Jersey, a nonprofit organization that provides tools, training and financial incentives to support communities in their sustainability efforts.

Sustainable Jersey defines municipal resilience as "the ability of a community to adapt and thrive in the face of extreme events and stresses." Through its municipal outreach and collaboration with partners across the state, Sustainable Jersey recognized the need for a big picture strategy to chart the path towards municipal resilience, and to provide a shared framework for discussing resiliency with stakeholders, including communities, local and state officials, academic institutions and organizations. The Municipal Resilience Cycle (Figure 1) illustrates five iterative phases municipalities should move through to increase their resiliency. The GTR sits within both Steps 1 and 2 of the Municipal Resilience Cycle, by focusing on emergency preparedness and launching a discussion regarding risk and vulnerability to future flood events.

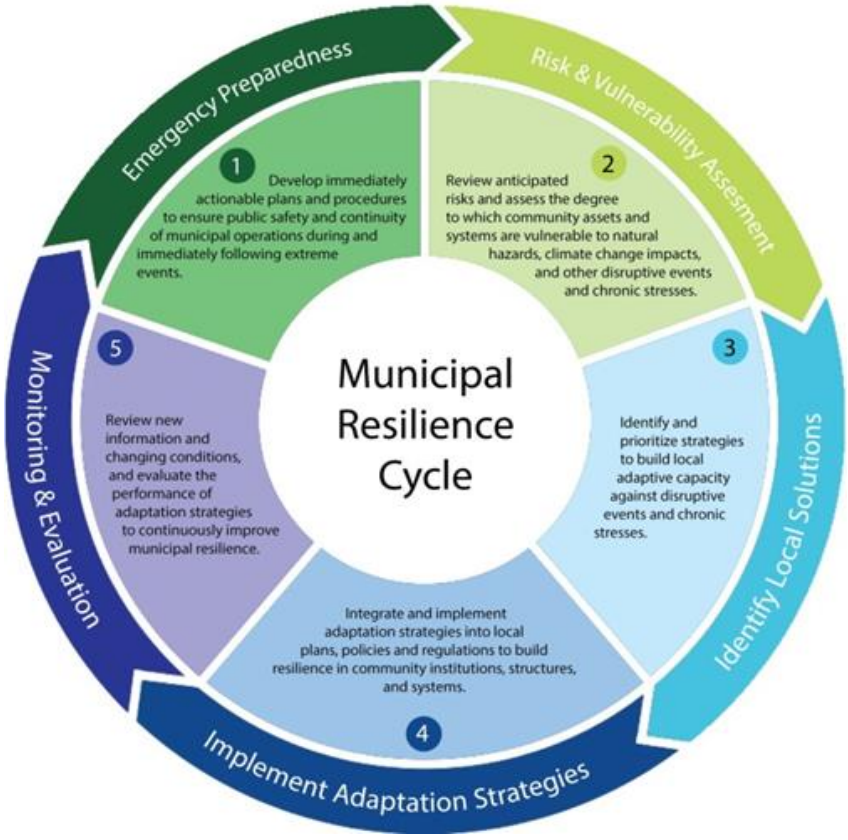

Figure 1. Municipal Resilience Cycle (Sustainable Jersey, 2014).

Section II. Township of Elsinboro– Background

Elsinboro is an historic Delaware Bay community located on the banks of the Delaware and Salem Rivers in western Salem County. Elsinboro is the site of the First English Settlement in New Jersey-1641. Elsinboro Township borders Lower Alloways Creek Township, Pennsville Township and the City of Salem. Elsinboro Township is comprised of over 13 square miles of land, much of which consists of wetlands and agriculture. Elsinboro Township has a population of 1,036 persons. The municipality's population trend over the last decade can be seen as an average -0.51% decrease in population each year (- 5.1% over ten years), according to the most recent (2010) U.S. Census data.

Elsinboro GTR Municipal Committee and Process Participants

Elsinboro convened a group of municipal representatives and community leaders to participate in the GTR process facilitated by Sustainable Jersey. The meeting was held on August 4th, 2016 at the Elsinboro Municipal Building. The meeting attendees are shown in Table 1, below.

Table 1. Elsinboro GTR Participants.

Participant	Title	Affiliation
Sean Elwell	Mayor / Fire Chief	Township of Elsinboro
Douglas Hogate	Township Committeeman	Township of Elsinboro
George Pannis	Emergency Management Coord.	Township of Elsinboro
Robert Klein	Deputy OEM	Township of Elsinboro
Rick Brown	Planner	NJ DEP
Jack Heide	Resiliency Manager	Sustainable Jersey

Sustainable Jersey facilitated the GTR process to include the following steps:

1) Review of relevant municipal and multi-jurisdictional documents, plans and reports (completed by Sustainable Jersey in advance of meeting with municipal committee), including:
    - Updated Master Plan (2007),
    - Flood Damage Prevention Ordinance (2006),
    - Oakwood Beach Feasibility Study (1999),
    - Mitigation Plan for Four New Jersey Counties[1] (2015), and
2) Discussion of Elsinboro's flood resiliency successes and challenges (August 4th meeting).
3) Preparation of flood hazard mapping visualization materials (completed by Sustainable Jersey following the meeting with the municipal committee).
4) Completion of GTR questionnaire (August 4th meeting).
5) Compilation of notes, and targeted research into unanswered questions or concerns at the meeting (completed by Sustainable Jersey following the in-person meeting).
6) Preparation of recommendations report based upon municipal responses to the GTR questionnaire and the discussions generated at the meeting (completed by Sustainable Jersey).

[1] Counties include Camden, Gloucester, Salem, and Cumberland Counties.

Review of Existing Municipal Flood Resiliency Efforts

Prior to completing the GTR questionnaire, Sustainable Jersey staff asked the members of the Elsinboro municipal committee to reflect on a few open-ended prompts regarding the township's flood resiliency efforts up until that point. A summary of the discussion is provided below.

Elsinboro flood resiliency successes

- Several flood resiliency upgrades and capital investments:
    - Replaced generator in police station, as a result of lessons learned during Sandy – old generator caught fire, causing emergency situation in police department.
    - Renovated police headquarters to bring dispatch and CCTV surveillance (housed in flood-prone areas on Tonnelle Avenue) out of harm's way, next to Town Hall.
    - Invested in generator for Town hall (should be installed within 3 months). Once this is completed, will have new location for emergency operations center.
- Learned importance of having regular communication, especially prior to storm events. Will work to ensure that at least one decision maker from every department is included in disaster preparedness and short-term response meetings.
- Acquired a boat to ensure emergency personnel are able perform rescues and/or deliver mobile generators, as needed, especially to hospital.

Elsinboro flood resiliency challenges

- Unable to stop flooding issues on River Road, West Side Avenue of Route 1/9. If municipality were ever to experience a storm even during high tide on a full moon, can only expect disastrous flooding impacts.
- Affluent residents living along River Road have high expectations/demands of municipality – believe community needs protection from a seawall, for example.
- Ensuring flood protection along the entire New Jersey "Gold Coast" along the Salem River would require all municipalities to come together. Would likely need a seawall spanning from Edgewater all the way down to Hoboken.

Municipal Flood Hazards

Elsinboro's Getting to Resilience process was followed by a coastal vulnerability assessment, which provides a detailed assessment of future flood hazards and their potential impact on the township's assets. This report provides a summary of those future flood risks to give readers a better understanding of the context of which this report and recommendations were made. (See the maps in Appendix A). The flood hazard maps were obtained from NJ Flood Mapper (http://njfloodmapper.org/), an interactive mapping website produced in collaboration with the NOAA Coastal Services Center through a partnership with JCNERR and the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA), Rutgers University. The flood hazard maps provided include:

- ***Sea level rise projections*** of 1 to 6 feet of additional sea level rise above today's Mean Higher High Water (MHHW) line[2].

[2] The Mean Higher High Water (MHHW) line is determined by calculating the average of the higher observed high water heights in each tidal day, based on measurements collected over two decades.

- ***Hurricane storm surge*** including Sandy surge extent, as well as inundation and depth derived from the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model[3] showing localized impacts of a Category 1 or Category 4 hurricane.
- ***Preliminary Flood Insurance Rate Maps (PFIRMs)*** showing high risk areas in the community subject to inundation from the 1% annual chance flood with established BFE designations, areas subject to high velocity wave action (a 3-foot breaking wave), and areas of moderate coastal flood risk.
- ***Projected 2050 Special Flood Hazard Areas*** (SFHA) integrates the current FEMA designation for SFHA with a range of 2050 sea level rise projections.
- ***Marsh Migration*** maps showing the expected transition between wetland types along tidal rivers as a result of projected sea level rise.

The maps reveal that a considerable portion of the township is located within the FEMA-designated floodplain. According to flood prediction maps provided by the Meadowlands Environmental Research Institute (MERI)[4], a large area of lowlands in the southern half of the community is dependent on storm surge protection provided by tide gates strategically located throughout the Meadowlands District. These mitigation measures would be completely overtopped with a storm surge exceeding five feet. During Hurricane Sandy, a MERI water monitoring station located at the Barge Club Marina in Carlstadt, indicated that water levels peaked at an elevation of just over 8 feet.

It is important to note that the sea level rise maps reviewed for this report are not associated with a specific time horizon. However, a leading publication describing future flood risks across the Mid-Atlantic (a 2013 study prepared by Rutgers climate scientists Kenneth Miller, Robert Kopp et al in an effort to "down-scale" global sea level rise prediction models)[5, 6] provides a strong scientific basis for municipal officials to plan for future sea level rise impacts to their community in the very near future. The publication suggests that "relative sea level will rise at bedrock locations like the Battery by 22 cm [8.7 inches] by 2030, 40 cm [16 inches] by 2050, and 96 cm [38 inches] by 2100." Estimates provided for sites along New Jersey's coastal plains are even high, given localized subsidence (land sinking) due to ground water extraction and compaction.

All of the projected flood hazard maps above are intended to be high-level screening tools to introduce the magnitude and extent of flood hazard events and sea level rise to the community. See the township's Coastal Vulnerability Assessment for a more comprehensive assessment of future flood hazards and vulnerabilities.

Section III. Recommendations for "Getting to Resilience"

This section offers recommended actions, policies and strategies that can help strengthen Elsinboro's overall resilience to the risks of future sea level rise and coastal storm events. Recommendations are

[3] The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model evaluates hundreds of data points on hurricane pathways, rainfall, surge height, barometric pressure, water pressure, and other variables to derive predicted inundation scenarios for a given area, for each of the five storm classifications in the Saffir-Simpson Hurricane Intensity Scale.

[4] http://meri.njmeadowlands.gov/maps/

[5] http://onlinelibrary.wiley.com/doi/10.1002/2013EF000135/full

[6] Note: this study is being updated, new sea level rise projections are expected in 2016.

based upon the township's responses to the GTR questionnaire, a review of Elsinboro's municipal documents, and the discussion at the facilitated meeting. The key recommendations include critical next steps towards resiliency either by virtue of their importance, available funding or ease of implementation. Other recommendations are provided for the township's consideration; they are considered equally important for coastal resiliency.

Key Recommendations

1. *Amend the township's Flood Damage Prevention Ordinance to include New Jersey's required freeboard, or higher, if deemed appropriate.* By updating the flood damage prevention ordinance, municipal officials will create consistency in regulations for building and rebuilding in flood hazard areas. The current freeboard requirement in New Jersey mandates that all new structures built within FEMA-designated Special Flood Hazard Areas (SFHA) be built one foot above base flood elevation (BFE). This rule also applies when rebuilding of substantially damaged structures in the SFHA. Some NJ communities have decided to increase the freeboard to 2 or 3 feet above BFE based upon the flood risks and vulnerabilities in their community. *Communities can also receive CRS points under section 430(b) by completing this activity.*

   Resources

   - NJ DEP "Best Available Science" model Flood Damage Prevention Ordinance (version D & E), available on the NJDEP Flood Control webpage (http://www.nj.gov/dep/floodcontrol/modelord.htm)

2. *Enroll in the NFIP Community Rating System (CRS) program.* The CRS program awards points for emergency preparedness and flood risk reduction activities that are credited toward reduced flood insurance premiums for all floodplain property owners in the participating community. Participation in the CRS program not only increases local resiliency, but can provide substantial savings in flood insurance for publicly owned facilities, as well as private residences and businesses across the municipality.

   Resources

   - Numerous web-based technical guides and manuals are available on the FEMA website, and can be found through a simple search of "FEMA Community Rating System."
   - For specific questions or technical assistance, contact the NJDEP Flood Unit at 609-202-2296.

3. *Publicize the availability of flood hazard maps to a broad range of community stakeholders.* While the municipality makes the FEMA PFIRMs available at its Town Hall, few community members are likely to take advantage of this service. To provide improved accessibility of floodplain information, consider publishing flood hazard maps, fact sheets, and emergency preparedness information on the municipal website.

4. *Review all the automated responses provided in the township's Getting to Resilience Linkages Report.* Municipal officials should review the entire set of automated responses provided by the online GTR platform, www.prepareyourcommunitynj.org. In particular, focus on recommendations provided for questions to which the GTR committee responded "no" by

filtering the entire Linkages Report to show only "Things to Consider." A PDF version of the township's automated recommendations is attached as Appendix B of this report.

Other Resiliency Measures to Consider

The following additional recommendations emerged from the township's GTR process, and are organized according to the GTR section headings and questions.

A. Risk & Vulnerability Assessments

- *A1. Ensure that the municipality's history of coastal flood hazards and disasters are fully documented, and establish a procedure for documenting future flood impacts.* Local anecdotes and observations of flood events and impacts are an important source of data for disaster response and recovery, as well as emergency preparedness and anticipation of future risks. While municipal officials may have a sound grasp of local problem areas, a written account of damages suffered during flooding events can help accelerate the process of compiling reimbursement and grant application documentation. The observations could include interviews, reports and images compiled into a single document.
  Communities can receive CRS points under section 320 by completing this activity.

- *A2. Document community assets subject to impacts from future flood hazards in the multi-jurisdictional hazard mitigation plan.* Identifying vulnerable assets in the multi-jurisdictional hazard mitigation plan can encourage regional cooperation in addressing future, projected coastal flood hazards, such as sea level rise and increased coastal storm impacts, while also identifying specific municipal projects worthy of future funding opportunities.

  Suggestions

  - Elsinboro Township finished a Coastal Vulnerability Assessment in 2016. The results of the assessment, which include the future impacts of sea level rise and major storm events, should be integrated into the Elsinboro Annex of the 2015 Mitigation Plan for Four New Jersey Counties.

B. Public Engagement

- *B1. Conduct targeted outreach to residents in the floodplain at least once per year.* Residents should be informed of flood risks in the community, municipal emergency preparedness activities, and their role in protecting families and assets from flood damages on an annual basis. This kind of community engagement effort will support on-going flood resiliency by ensuring that floodplain residents know their risks and take responsibility for implementing individual and household level risk reduction strategies.

  Suggestions

  - Consider circulating an annual, special issue newsletter that provides an easy, go-to resource for local floodplain information, including key contacts, relevant resources, instructions and advice for common situations and informational content on flood hazard risk reduction, emergency preparedness and local hazard mitigation efforts.

- Install high water marks in key community gathering places to catalyze community discussion of flood resiliency and the need for long-term planning.
  Communities can receive CRS points under section 330 by completing this activity.

C. Planning Integration

- *C1. Include an objective in the municipal Master Plan to identify and address climate-related risks, vulnerabilities and opportunities in the township.* Experts across New Jersey agree that changes in the global climate translate into a specific set of challenges – and opportunities – for which local officials should plan. By recognizing the role climate change may play in local governance, local officials can build long-term resilience across all municipal policies and programs. The first step in developing these policies is to recognize climate change and resiliency as a desired objective in the master plan.

- *C2. Include future flood hazard scenarios in the municipal master plan with short-term and long-term strategies for protecting these areas*. As the primary planning policy document for the community, the master plan should identify areas in the community that are likely to be impacted by future flood hazards, and offer measures to mitigate damages and protect the community's assets and properties.

  Suggestions

  - Include maps of projected sea level rise and future storm events in the land use plan and conservation plan elements of the municipal master plan.
  - Identify natural resources that serve as protective flood mitigation measures (e.g. wetlands), and provide recommendations for maintenance and management in the conservation plan element.
  - Identify planning policies to mitigate flood damage and protect properties from future flooding, including sea level rise and extreme storm events, in the land use plan element.

- *C3. Cross-reference flood risks and vulnerabilities in relevant sections of the municipal master plan, emergency operations plan and all hazards mitigation plan.* Community flood risks are influenced largely by land use and development patterns that are grounded in local master plan policies. Hazard mitigation plans provide strategies to reduce these risks, but typically are stand-alone documents that rely upon structural mitigation measures, with little regard to land use and policy measures. Integrating flood risks and hazard mitigation into all local policy documents, especially master plans and hazard mitigation plans, ensures a coordinated, complementary approach to mitigation, and avoids potential conflicts from competing goals and interests.

  Resource

  - *Integrating Hazard Mitigation Into Local Planning, Case Studies and Tools for Community Officials*, FEMA, 2013

D. Disaster Preparedness & Recovery

- *D1. Consider developing an Emergency Debris Management Plan and integrating the plan into the municipality's Emergency Operations Plan and Continuity of Operations Plan.* Every municipality in New Jersey should have an Emergency Debris Management Plan, which can be part of its comprehensive Emergency Management Plan. Municipal officials are encouraged to conduct pre-disaster planning and prepare emergency debris management plans, which should be reviewed and updated annually, and coordinated with county solid waste officials and the county Office of Emergency Management. Municipalities should also consider sharing these plans with adjacent municipalities and entering into shared services agreements wherever appropriate to ensure adequate staffing, equipment, and services during the disaster and immediately afterwards.

  Resources

  - *Disaster Debris Management Planning Tool Kit for New Jersey Municipalities, New Jersey Department of Environmental Protection*, November 2015 (http://www.nj.gov/dep/dshw/toolkit.pdf)

E. Hazard Mitigation Implementation

- *E1. Ensure construction and permitting officials have completed training in FEMA's Coastal Construction Manual.* Local permitting officials provide one of the first lines of defense for protecting community officials from risky construction in high hazard areas. FEMA's Coastal Construction Manual and relevant training offerings provide a comprehensive source of information about hazard identification, siting decisions, regulatory requirements, economic implications, and risk management. The manual also describes design, construction, and maintenance practices that, when followed, will increase the durability of residential buildings in the harsh coastal environment and reduce economic losses associated with coastal natural disasters.

  Resource

  FEMA P-55, Coastal Construction Manual: Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas, 4th Edition (2011), FEMA, 2011

- *E2. Identify natural resources that provide protective flood mitigation, such as tidal marshes, and include the management and protection of these resources in the master plan and regulatory documents.* Coastal wetlands can provide beneficial ecosystem services to lessen the impact of coastal flood hazards. In many cases, they serve as a first line of defense, limiting the force of waves from coastal storm surges. These systems should be mapped by the municipality, and possible policy and regulatory requirements should be developed to ensure their protection and long-term management.

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Appendix A. Elsinboro Township, NJ: Coastal Flood Hazard Exposure Maps

Contents

FEMA's Preliminary (2014) Flood Insurance Rate Map (Figures 1)

FEMA's Flood Insurance Rate Maps (FIRMs) designate areas in the community determined high risk by FEMA flood insurance specialists, including the 1% annual chance floodplain. Officially known as the "base" floodplain or "Special Flood Hazard Area" (SFHA), these areas have a 1% chance of flooding in any given year[1]. The latest map layers were developed over several years, due to interruptions in flood insurance studies caused be Superstorm Sandy. As such, local officials and their technical staff have received extensive outreach regarding the *Preliminary* Flood Insurance Rate Maps (or, PFIRMs), currently under review.

These maps are developed to designate areas in the community considered high risk by FEMA flood insurance specialists. Once officially adopted, they become the effective Flood Insurance Rate Maps (FIRMs), and are used to determine flood insurance premium rates as well as regulatory and management standards for properties located in the floodplain.

Almost all of Elsinboro is located within a FEMA-designated floodplain. Specific map designations within Elsinboro include:

[1] The general public often calls the 1% annual change flood a "100-year" flood. However, risk communication experts advise against this, as it can mislead stakeholders into believing these areas will only be subject to flooding once per century.

- Zone AE (shown in blue) representing the area subject to inundation from a flood that has a 1-percent chance of occurring in any given year (also known as the 1% annual chance flood)[2] with 1-3 feet of water expected above the highest adjacent grade (the highest point of the ground level immediately next to a building);
- Zone VE (shown in pink) representing the area subject to high velocity wave action (defined as a three foot breaking wave) from the 1% annual chance flood; and
- Zone X (shown in beige) representing areas of moderate coastal flood risk outside the 1% annual chance flood up to the 0.2% annual chance flood level.

[2] Note: These layers provide an established Base Flood Elevation (BFE), shown in feet. BFEs indicate the water surface elevation resulting from a flood that has a 1-percent chance of occurring in any given year

Figure 1. Preliminary Flood Insurance Rate Maps for Elsinboro, NJ (Source: NJ Flood Mapper).

Current Day Mean Higher High Water (Figures 2)

Figure 2 shows the extent of current sea level in areas adjacent to tidal waterways. The darker shades of blue depict increased depth of water.

Figure 2. Extent of Current Day Mean High High Water line for Elsinboro, NJ (Source: NJ Flood Mapper).

Observed Sea Level Rise (Figure 3)

Data on historical trends in sea level rise are collected in regional tide gauges. The tide gauge located nearest to Elsinboro is the tide gauge located in Philadelphia, PA along the Delaware River. Here, the mean sea level has risen approximately a tenth of an inch (2.84 mm) per year, or the equivalent of approximately 11 inches per century. The red trend line in Figure 3 (below) shows the 95% confidence interval based on monthly mean sea level data from 1900 to 2015.

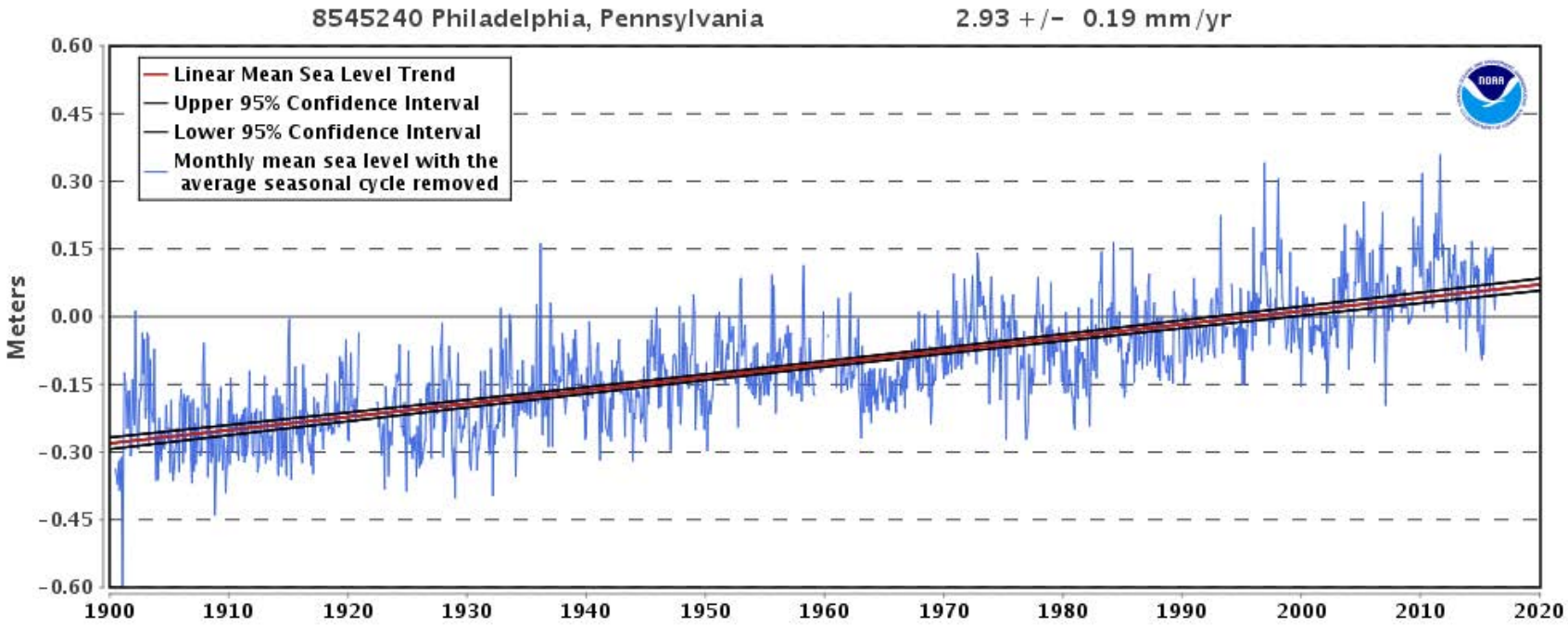

Figure 3. Mean Sea Level Trend at Philadelphia, PA (NOAA, 2015).

Projected Sea Level Rise (Figures 4-5)

Climate scientists have estimated that sea levels will continue to rise, and predict an increase in the pace at which it will occur. The following maps show the expected inland reach of inundation as a result of rising sea levels at various one-foot increments. Figures 4 to 5 illustrate predicted inundation patterns in Elsinboro, given an additional 1 foot and 3 feet of future sea level rise above today's MHHW line. To help

municipal officials better understand these future flood hazards, NJ Flood Mapper's visualizations show "hydrologically connected" areas (e.g., part of an existing water body such as the ocean, river, creek, or bay) in blue, seamlessly connected to open water; darker shades of blue correspond to increasingly deeper water levels. Low-lying areas, those not connected to a water body (described as "hydrologically unconnected" in NJ Flood Mapper), show depressions in the local topography that are likely to experience frequent flooding given future sea level rise conditions; these are illustrated in green.

Figure 4. Inundation from 1 foot of sea level rise in Elsinboro, NJ (Source: NJ Flood Mapper).

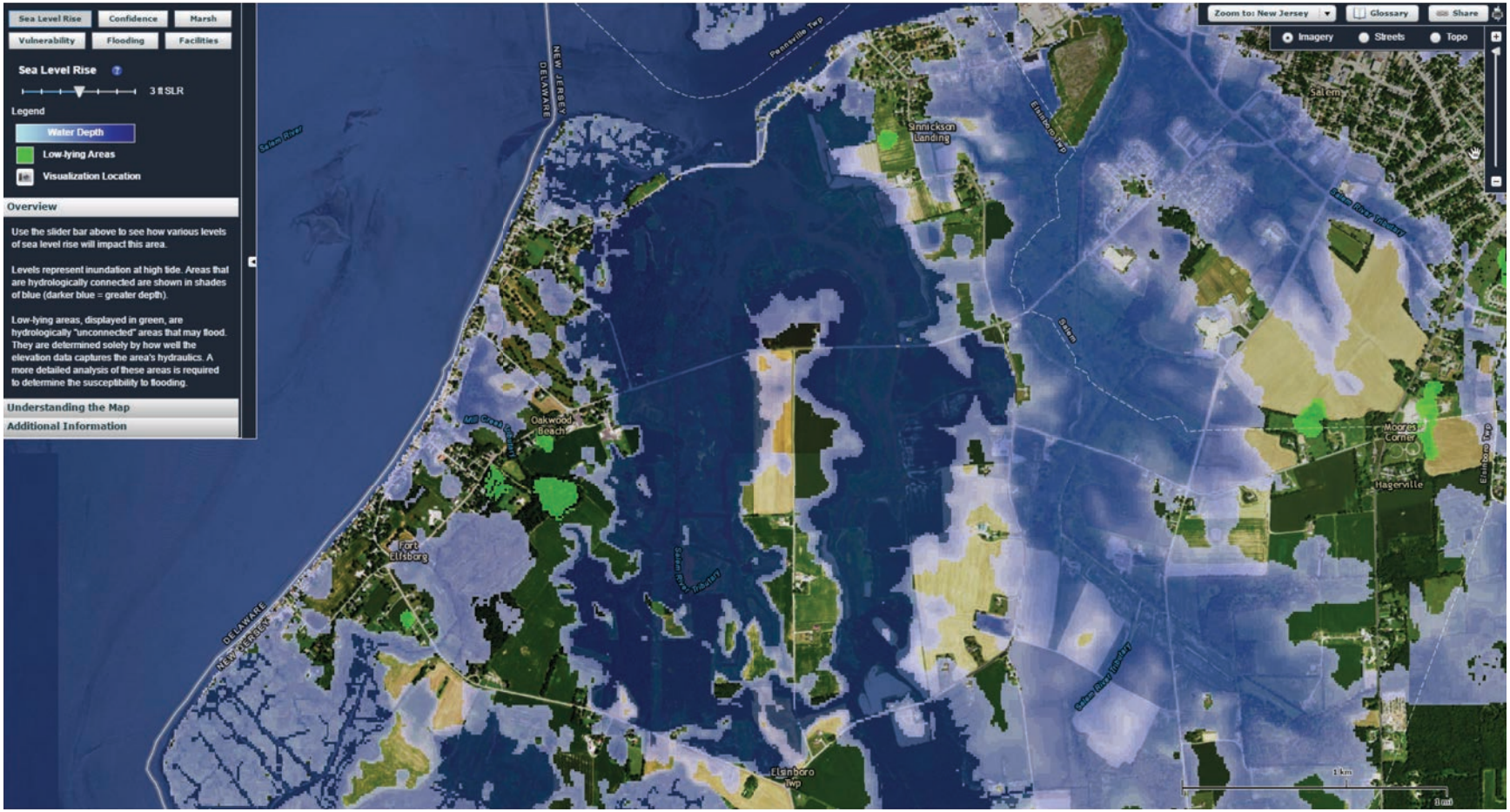

Figure 5. Inundation from 3 feet of sea level rise in Elsinboro, NJ (Source: NJ Flood Mapper).

Category 1 Hurricane Storm Surge (Figures 6)

Hurricane storm surge visualizations available on NJ Flood Mapper are derived from the Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model[3]. Figures 6 show a composite inundation scenario for the extent and depth of flooding that can be expected in Elsinboro for a Category 1 hurricane. The maps are color coded at three-foot intervals with 0-3 feet of flooding shown in blue, and deeper water levels shown in yellow, orange and red.

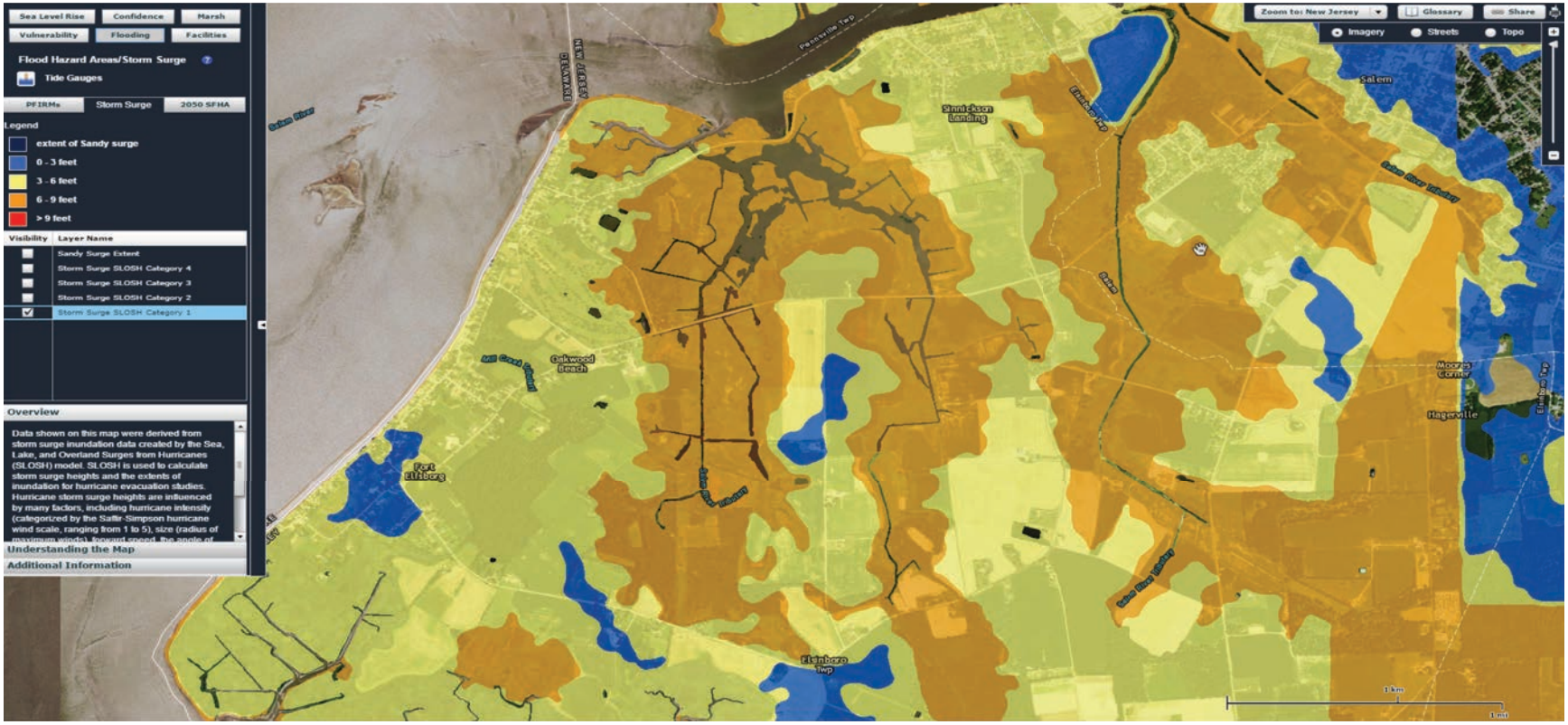

Figure 6. CAT1 Hurricane surge extent in North Bergen, NJ, at current sea levels (Source: NJ Flood Mapper).

[3] The Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model evaluates hundreds of data points on hurricane pathways, rainfall, surge height, barometric pressure, water pressure, and other variables to derive predicted inundation scenarios for a given area, for each of the five storm classifications in the Saffir-Simpson Hurricane Intensity Scale.

Marsh Migration (Figures 7-8)

The marshland complex located alongside the Delaware Bay and found throughout the municipality can be considered an important flood protection and hazard mitigation asset for the community of Elsinboro. A key ecosystem benefit provided by wetlands buffering tidal rivers is wave attenuation, which serves to lessen the strength and impact of high velocity wave action. While Elsinboro is not located in direct proximity to coastal wave action, the resiliency benefits provided by these wetlands should not go unrecognized. Unfortunately, increases in sea level put the long-term health of these ecosystems at risk due to increased salinity and other factors. Figures 7 to 8, below, show predicted ecosystem shifts from today's sea level to a potential rise of 3 feet. Portions of today's tidal marshes (in green) are expected be permanently flooded and become open water (show in blue), while large swaths are expected to convert to tidal mudflats (shown in teal).

Figure 7. Marsh extent in Elsinboro, NJ, at current sea levels (Source: NJ Flood Mapper).

Figure 8. Marsh extent in Elsinboro, NJ, with 3 additional feet of sea level rise (Source: NJ Flood Mapper).