Long term planning for NJ Coastal Resiliency: Coastal Flood Exposure Assessment and Salt Marsh Migration under future sea level rise

Richard Lathrop, Lisa Auermuller, Jeanne Herb, Marjorie Kaplan, James Trimble, John Bognar & Jennifer Rovito

Rutgers
Center for Remote Sensing & Spatial Analysis
Edward J. Bloustein School of Planning and Public Policy

Rutgers
School of Environmental and Biological Sciences
Climate and Environmental Change Initiative

Jacques Cousteau
National Estuarine Research Reserve

NOAA Coastal Services Center
LINKING PEOPLE, INFORMATION, AND TECHNOLOGY
Coastal Community Resiliency Progression

Understand the Issues

Assess Risk and Vulnerability

Plan for the Future

Implement and Adapt
Regional factors will influence relative sea level rise for specific coastlines.

Graphic from USGS 2001 http://woodshole.er.usgs.gov/project-pages/cvi/
Rising sea level is a physical reality that is impacting the New Jersey and the entire Mid-Atlantic coastline. Predicted future rates are expected to increase to 12 mm/yr (or 0.5 in/yr). This means that by 2050 sea level rise is expected to rise by approximately 1 foot and by 2100 sea level rise is projected to rise about 3 feet along the Jersey shore.

The mean sea level trend over the past century is 3.99 millimeters/year (0.15 in/yr) which is equivalent to a change of 1.31 feet in 100 years. Graphic Credit: NOAA

http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8534720%20Atlantic%20City,%20NJ
Global Mean SLR Scenarios

We have very high confidence (>9 in 10 chance) that global mean sea level will rise at least 0.2 meters (8 inches) and no more than 2.0 meters (6.6 feet) by 2100.

Projection of sea level rise from 1990 to 2100, based on temperature projections for different Green House Gas emissions scenarios.

SOURCE: NRC 2010
Vermeer and Rahmstorf (2009).
## SLR Scenarios

R. Lathrop, R. Kopp and M. Kaplan

<table>
<thead>
<tr>
<th>2050 Projection</th>
<th>Low</th>
<th>High</th>
<th>Higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOAA Average</td>
<td>1.0</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td>RU Miller/Kopp (2013)</td>
<td>1.1</td>
<td>1.9</td>
<td>2.2</td>
</tr>
<tr>
<td>Mean of NOAA and M/K</td>
<td>1.0</td>
<td>1.7</td>
<td>2.4</td>
</tr>
<tr>
<td>Consensus Values</td>
<td>1.0</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>CFE Values: % Chance of SLR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>exceeding this value</td>
<td>85%</td>
<td>8%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2100 Projection</th>
<th>Low</th>
<th>High</th>
<th>Higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOAA Average</td>
<td>2.3</td>
<td>4.5</td>
<td>7.5</td>
</tr>
<tr>
<td>RU Miller/Kopp (2013)</td>
<td>2.5</td>
<td>4.9</td>
<td>5.8</td>
</tr>
<tr>
<td>Mean NOAA and M/K</td>
<td>2.4</td>
<td>4.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Consensus Values</td>
<td>2.5</td>
<td>5.0</td>
<td>7.0</td>
</tr>
<tr>
<td>CFE Values: % Chance of SLR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>exceeding this value</td>
<td>80%</td>
<td>10%</td>
<td>0.8%</td>
</tr>
</tbody>
</table>

Available at NJAdapt.org
Information and tools to support place-based decision-making
Graphic adapted from
North Atlantic Coast
Comprehensive Study
U.S. Army Corps of Engineers
Coastal Storm Risk Management
Planning Center of Expertise
April 1, 2010
Sea Oaks Golf Course
Little Egg Harbor, NJ 08087
Co-Sponsored by:

Prepating Your Community in the Face of a Changing Climate

Background

Global climate change is one of the most pressing challenges facing coastal communities today.

The Intergovernmental Panel on Climate Change concluded in February 2007 that it is "unequivocal" that Earth’s climate is warming, and that it is "very likely" (a greater than 90 percent certainty) that the heat-trapping emissions from the burning of fossil fuels and other human activities have caused "most of the observed increase in globally averaged temperatures since the mid-twentieth century".

According to the Union for Concerned Scientists, "the Northeast and the rest of the world face continued warming and more extreme climate-related changes to come—changes that could dramatically alter the region’s economy, landscape, character, and quality of life." They go on to state, "By the end of this century, global sea level is projected to rise 7 to 14 inches under a lower emissions scenario and 19 to 28 inches under a higher-emissions scenario. Several lines of evidence indicate that these projections may be quite conservative. Even under these projections, many areas of the densely populated Northeast coast face substantial increases in the extent and frequency of coastal flooding and are at increased risk of severe storm-related damage.

This conference provided an opportunity for municipal leaders, scientists, resource managers, engineers, and others interested in the consequences of climate change to meet and discuss the latest science-based information, highest priority needs, and next steps.

Conference Goals

- To facilitate a dialogue on key issues facing New Jersey’s coastal estuaries related to climate change and sea level rise.
- To present sample adaptation tools and strategies.
- To share information amongst local stakeholders.

Workshop Survey Results:
The audience of coastal decision makers highlighted their perceived need for place-based information and decision support tools to inform land use planning, floodplain management and emergency management in the face of accelerating sea level rise.
Using the NJFloodMapper to Understand your Current and Future Risk

In order to answer the evaluation questions on current and future risk and hazard, the NJFloodMapper visualizes different inundation routes, FEMA flood maps (regional Flood Zones and Flood Elevation Maps) and the impacts of Super Storm Sandy. The site is also an on-the-ground photo visualization of the first-hand experience at iconic Jersey Shore locations.

Additional data layers to explore include economic vulnerability, the potential cost of flood damage, and percentage of confidence.

The NJFloodMapper uses a Google Maps-based website to provide a user-friendly tool to help community decision makers and residents understand the potential flood risks. You can print your maps or share them using the "share" button.

Explore the website at: NJFloodMapper.org

To access go to NJFloodMapper.org
# Applying a Instructional Systems Design Model

<table>
<thead>
<tr>
<th>Analyze Audience</th>
<th>Design Product</th>
<th>Develop Product</th>
<th>Launch Product</th>
<th>Evaluate Product &amp; Process</th>
</tr>
</thead>
</table>
| Front-end Evaluation | Formative Evaluation  
(assess users needs & desires for improved decision making) |  |  | Summative Evaluation  
(assess if products work & are useful) |

- **Front-end Evaluation**: Assess users needs & desires for improved decision making.
- **Formative Evaluation**: Get feedback on design criteria, storyboards, prototypes, beta products, etc., as often as possible & is needed.
- **Summative Evaluation**: Assess if products work & are useful.
Front-End and Formative Evaluation

Web-based Sea Level Rise Mapping Usability Testing
Prepared by: Lisa Auer Muller, Watershed Coordinator
Jacques Cousteau National Estuarine Research Reserve

Introduction:
The Jacques Cousteau National Estuarine Research Reserve (JC NERR) and Rutgers Center for Remote Sensing and Spatial Analysis (CRSSA) are partners on an effort to develop an interactive website which will display coastal vulnerability due to sea level rise. As a first step in this effort, existing web-based sea level rise mapping tools were evaluated by potential end users, known as “usability testing.” This online evaluation method measures the effectiveness of digital products with members of a target audience. Usability testing is undertaken in order to (1) verify appeal of various designs, (2) verify effectiveness of various designs, (3) determine usefulness of content, and (4) determine how to best display data so that it’s useful to the data users.

Methods:
Members of the “target audience” were recruited through an email sent to the JC NERR “Coastal Decision Makers” contact database. Twelve individuals participated in the usability testing on September 29, 2010. From here on in, these twelve individuals will be referred to as “evaluators.”

Five websites and one online “report” were evaluated. These were selected to provide the widest variety of mapping platforms, display approaches, functionalities, and options to the evaluators.

One online report was chosen as an example of a type of product that could be created as a map-based output.

In an effort to understand the variety of perspectives with which the evaluators were reviewing the web-based tools, each evaluator was asked to introduce themselves. Evaluators gave their name, affiliation, and the reason why they were interested in viewing sea level rise information. They were also asked to comment on how they might use a sea level rise mapping website in their coastal decision-making position.

A laptop with wireless internet connection was provided for each evaluator. These laptops were “bookmarked” with each of the web-based tools to increase the ease of navigation to each of the websites. Efforts were also made to ensure the laptops were also updated with the latest versions of internet tools such as “Google Earth,” “JavaScript,” etc.
Leveraging federal assets for local application
Sea Level Rise and Coastal Flooding Impacts

The purpose of this data viewer is to provide coastal managers and scientists with a preliminary look at sea level rise and coastal flooding impacts. The viewer is a screening-level tool that uses nationally consistent data sets and analyses. Data and maps provided can be used at several scales to help gauge trends and prioritize actions for different scenarios.

Use the six tabs at the top of the legend (ex. “Facilities”) to explore visualizations of sea level rise. The slider bar in each tab can be used to examine the impacts of multiple sea level rise scenarios. The overview text directly below the legend describes individual impacts. Additional documents and links provide further detail.

Disclaimer
The data and maps in this tool illustrate the scale of potential flooding on the area location, and do not account for...
By overlaying facility locations on a map that depicts sea level rise, a community can identify the potential impact that sea level rise can have on vulnerable locations.

The location of various community facilities are depicted on this map.

Understanding the Map

Additional Information
Use the slider bar above to see how various levels of sea level rise will impact this area.

Levels represent inundation at high tide. Areas that are hydrologically connected are shown in shades of blue (darker blue = greater depth).

Low-lying areas, displayed in green, are hydrologically "unconnected" areas that may flood. They are determined solely by how well the elevation data captures the area’s hydraulics. A more detailed analysis of these areas is required to determine the susceptibility to flooding.

Use the slider to view a simulation of sea level rise at this location.
Assessing New Jersey’s Exposure and Vulnerability to Sea Level Rise and Coastal Flooding

To help meet the needs of local governments interested in enhancing coastal resiliency in their communities, Rutgers University developed the Coastal Flooding Exposure (CFE) Assessment and the NJDEP developed the Coastal Vulnerability Index (CVI).

As the graphic below illustrates, the CFE strictly maps flooding exposure with the intention for later use in the assessment of vulnerability as a separate step. The CVI combines aspects of environmental vulnerability (a, b, e & f) along with flooding exposure (c & d). Depending on your intended use, one or the other products may be more applicable.

\[
CFE = a + b + c
\]

Where CFE =
(a) Flood Prone Areas
(b) Storm Surge (SLOSH)
(c) Nuisance Coastal Flooding

\[
CVI = a + b + c + d + e + f
\]

Where CVI =
(a) Geomorphology
(b) Slope (% Rise)
(c) Flood Prone Areas
(d) Storm Surge (SLOSH)
(e) Drainage
(f) Erosion
NJ Coastal Flooding Exposure (CFE)

- Objective: An integrated statewide assessment to address questions such as which areas of the state are most exposed to coastal hazards now or might be in the future under sea level rise.
- The assessment distinguishes three classes of geographic areas: Moderate, High and Extreme exposure.
- The logic was such that areas exposed to flooding on a more frequent basis were given a higher ranking. Thus the ranking incorporates the probability or likelihood of the area being flooded.
  - For example, even though a Category 3 storm surge has higher flooding elevations, the likelihood of occurrence is lower than a Category 1 storm surge and therefore the Category 3 flood area was given a lower exposure ranking.
- Extreme exposure areas are those that are exposed to relatively frequent flooding. In addition, the Extreme exposure areas also include those areas subject to the most powerful wave impacts.
**NJ Coastal Flooding Exposure: projecting into the future**

<table>
<thead>
<tr>
<th>Flooding Hazard</th>
<th>Present</th>
<th>2050</th>
<th>2100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FEMA Special Flood Hazard Areas (SFHA)</strong></td>
<td>Extreme: V zone High: 1% A zone Moderate: 0.2% (X) zone</td>
<td>Extreme: V zone High: 1% A zone + 2’ Moderate: 0.2% (X) zone + 2’</td>
<td>Extreme: V zone High: 1% A zone + 5’ Moderate: 0.2% (X) zone + 5’</td>
</tr>
<tr>
<td><strong>SLOSH Storm Surge</strong></td>
<td>Extreme: N/A High: SLOSH Cat 1 Moderate: SLOSH Cat 3</td>
<td>Extreme: N/A High: SLOSH Cat 1 + 2’ Moderate: SLOSH Cat 3 + 2’</td>
<td>Extreme: N/A High: SLOSH Cat 1 + 5’ Moderate: SLOSH Cat 3 + 5’</td>
</tr>
<tr>
<td><strong>NOAA/NWS Shallow coastal flooding (SCF)</strong></td>
<td>Extreme: SCF High: N/A Moderate: N/A</td>
<td>Extreme: SCF + 1’ High: SCF + 2’ Moderate: SCF + 2.5’</td>
<td>Extreme: SCF + 2.5’ High: SCF + 5’ Moderate: SCF + 7’</td>
</tr>
</tbody>
</table>
NJ Coastal Flooding Exposure - Present

New Jersey Coastal Flooding Exposure

<table>
<thead>
<tr>
<th>Category</th>
<th>2000</th>
<th>2050</th>
<th>% change</th>
<th>2100</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ac)</td>
<td>Area (ac)</td>
<td>% change</td>
<td>Area (ac)</td>
<td>% Change</td>
</tr>
<tr>
<td>Moderate</td>
<td>197,433</td>
<td>183,329</td>
<td>-7.1</td>
<td>165,833</td>
<td>-16.0</td>
</tr>
<tr>
<td>High</td>
<td>148,060</td>
<td>165,272</td>
<td>+11.6</td>
<td>185,489</td>
<td>+25.3</td>
</tr>
<tr>
<td>Extreme</td>
<td>234,224</td>
<td>271,784</td>
<td>+16.6</td>
<td>310,608</td>
<td>+32.6</td>
</tr>
<tr>
<td>Total</td>
<td>579,717</td>
<td>620,385</td>
<td>+7.0</td>
<td>661,930</td>
<td>+14.2</td>
</tr>
</tbody>
</table>
## NJ Coastal Flooding Exposure

### Exposure Levels

- Water
- Moderate
- High
- Extreme

### Map

Data sourced from FEMA, NOAA, and NWS
Created at the Rutgers University Center for Remote Sensing and Spatial Analysis
Map created by Eden Basnaaventura under the direction of Dr. Richard G. Lathrop, Jr.

### Infrastructure

<table>
<thead>
<tr>
<th>Infrastructure</th>
<th>Moderate (M)</th>
<th>High (H)</th>
<th>Extreme (E)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Miles of road affected</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Major Roads (miles)</td>
<td>382</td>
<td>270</td>
<td>45</td>
<td>697</td>
</tr>
<tr>
<td>Evacuation Routes (miles)</td>
<td>297</td>
<td>249</td>
<td>58</td>
<td>604</td>
</tr>
<tr>
<td># of facilities affected</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>10</td>
<td>17</td>
<td>4</td>
<td>31</td>
</tr>
<tr>
<td>Coastal Energy Facilities</td>
<td>12</td>
<td>15</td>
<td>1</td>
<td>28</td>
</tr>
<tr>
<td>Schools</td>
<td>180</td>
<td>119</td>
<td>2</td>
<td>301</td>
</tr>
<tr>
<td>Fire Stations</td>
<td>99</td>
<td>90</td>
<td>6</td>
<td>195</td>
</tr>
<tr>
<td>Law Enforcement</td>
<td>46</td>
<td>44</td>
<td>3</td>
<td>93</td>
</tr>
<tr>
<td>Long Term Care / Assisted Living Facilities</td>
<td>20</td>
<td>11</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Hospitals</td>
<td>7</td>
<td>6</td>
<td>0</td>
<td>13</td>
</tr>
</tbody>
</table>

### Socially vulnerable populations

- Total Population (in persons using 2010 Census): 428,769, 333,923, 150,959, 913,651
- Zero Vehicle Households (persons 2010 Census): 26,642, 29,549, 6,007, 62,198
- Over 65 years in age (persons 2010 Census): 52,121, 39,420, 22,606, 114,147

### Known Contaminated Sites (NJDEP)

- Active Sites with Confirmed Contamination: 197, 269, 24, 490
- Total (including pending sites): 1261, 1501, 193, 2955

### M-H-E categories combined

<table>
<thead>
<tr>
<th>Property parcels affected</th>
<th># affected</th>
<th>$ Land value (in 2013 $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Properties</td>
<td>20,154</td>
<td>$26,555,293,664</td>
</tr>
<tr>
<td>Industrial Properties</td>
<td>3,934</td>
<td>$8,960,318,156</td>
</tr>
<tr>
<td>Residential Properties (includes Apartments)</td>
<td>335,873</td>
<td>$129,057,872,992</td>
</tr>
<tr>
<td>Total Combined</td>
<td>359,961</td>
<td>$164,573,484,812</td>
</tr>
</tbody>
</table>

### Property parcels affected

<table>
<thead>
<tr>
<th>Category</th>
<th>2000</th>
<th>2050</th>
<th>2100</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ac)</td>
<td>Area (ac)</td>
<td>% change</td>
</tr>
<tr>
<td>Moderate</td>
<td>197,433</td>
<td>183,329</td>
<td>-7.1</td>
</tr>
<tr>
<td>High</td>
<td>148,060</td>
<td>165,272</td>
<td>+11.6</td>
</tr>
<tr>
<td>Extreme</td>
<td>234,224</td>
<td>271,784</td>
<td>+16.6</td>
</tr>
<tr>
<td>Total</td>
<td>579,717</td>
<td>620,385</td>
<td>+7.0</td>
</tr>
</tbody>
</table>
Tidal Marsh Retreat

Marsh builds up vertically through accretion

Marsh migrates horizontally

*Note: In the model, "elevations" are determined by mean tide level (MTL) and spring tide range of each cell.

Tidal Marsh Retreat

Modeling the Fate of New Jersey’s Salt Marshes Under Future Sea Level Rise
Modeling the Fate of New Jersey’s Salt Marshes Under Future Sea Level Rise

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>Baseline</th>
<th>1 ft SLR</th>
<th>2 ft SLR</th>
<th>3 ft SLR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>acres</td>
<td>% change</td>
<td>acres</td>
<td>% change</td>
</tr>
<tr>
<td>Tidal salt marsh</td>
<td>213,977</td>
<td>0 -4.5%</td>
<td>204,34</td>
<td>0 -4.6%</td>
</tr>
<tr>
<td>Unimpeded marsh retreat</td>
<td>16,631</td>
<td>NA</td>
<td>28,220</td>
<td>NA</td>
</tr>
<tr>
<td>Impeded marsh retreat</td>
<td>1,955</td>
<td>NA</td>
<td>2,980</td>
<td>NA</td>
</tr>
<tr>
<td>Marsh conversion: uncon. shore</td>
<td>320</td>
<td>+0.1%</td>
<td>326</td>
<td>+0.1%</td>
</tr>
<tr>
<td>Marsh conversion: open water</td>
<td>9,316</td>
<td>+4.4%</td>
<td>9,455</td>
<td>+4.5%</td>
</tr>
</tbody>
</table>

![Projected Salt Marsh Change by 2050](image-url)
Maintaining/restoring salt marshes long term

Landward edge: strategies to retain flexibility for unimpeded landward migration

Marsh platform: strategies to maintain elevation capital in the form of vertical accretion rates equal to or greater than projected sea level rise

Seaward edge: strategies to reduce lateral erosion due to enhanced wave energy
CoastalResilience.org
Restoration Explorer for New Jersey
Getting to Resilience
A Community Planning Evaluation Tool

This online self assessment process is a tool to assist communities to reduce vulnerability and increase preparedness by linking planning, mitigation, and adaptation. Through this assessment you will find out how your preparedness can be worth valuable points through FEMA’s Community Rating System and Sustainable Jersey.

Plan for your community’s future in the face of climate change

HOW DO I GET TO RESILIENCE?
Enabling communities to be prepared and more resilient.

Map Flood Vulnerability
This user-friendly online flood mapper will help you better visualize your community’s susceptibility to flooding and sea level rise.

Assemble Municipal Plans
The Community Plan Checklist includes a list of municipal and county documents that may assist you in the completing your evaluation.

Complete the Evaluation
Identify planning, mitigation, and adaptation opportunities to reduce vulnerability to flooding and sea level rise and build capacity for community resilience.

Discover Links with Other Municipal Programs
This tool will help you identify connections between preparedness and programs like FEMA’s Community Rating System, Hazard Mitigation Planning and Sustainable Jersey.

Explore Related Resources
Additional tools and best management practices that will help you with vulnerability assessments, outreach, integrated planning, storm preparedness and mitigation.

Plan for the Future
Visualization & Information capture through map/graphics

Flood Exposure Profile
Help jump-start your community discussions about hazard impacts with maps of your area that show people, places, and assets exposed to coastal flooding. The map data and the discussions spurred from these maps are valuable and applicable to a variety of community planning processes—from comprehensive land-use to hazards mitigation and conservation planning.

NJ FloodMapper
The NJ FloodMapper is a user-friendly visualization tool for local communities who need to make decisions concerning flooding hazards and sea level rise. This website should be used to promote enhanced preparedness and land use planning decisions with considerations for possible future conditions.

Preparedness Assessment
Getting To Resilience
This online self-assessment process is a tool to assist communities to reduce vulnerability and increase preparedness. Through this assessment you will find out how your preparedness can be worth valuable points through FEMA's Community Rating System and Sustainable Jersey. Also the outputs provided at the completion of the questionnaire can strengthen local/county all-hazards and emergency operations plans.
NJAdapt Coastal Flood Exposure Profiler

This map shows population density for areas in or near coastal flood hazard areas. The more people exposed to coastal flooding, the more potential for harm.
Municipal Profiles

“map-packs”

Coastal County Snapshots

Contributing Partners: NODA Ocean for Coastal Management

Overview In Action

Coastal County Snapshots turn complex data into easy-to-understand stories, complete with charts and graphs. Users select a coastal county of interest and the website does the rest, providing information that can help communities become more resilient to coastal hazards.

Local officials can use the snapshots as a planning tool to assess their county’s resilience to flooding and understand the benefits provided by natural resources. The handouts generated by the snapshots can be a helpful educational tool when working with governing bodies and citizen groups.

Features

- Assesses a county’s exposure and resilience to flooding
- Analyzes a county’s dependence on the ocean or Great Lakes for a healthy economy
- Examines the benefits a county receives from its wetlands
- Compares

DigitalCoast
OFFICE FOR COASTAL MANAGEMENT
Summative Evaluation

How useful are these tools?
How can they be improved?
Welcome to the Ocean County 2013 Hazard Mitigation Plan Project Website

Implement and Adapt
Coastal Community Resiliency Progression

1. Understand the Issues
2. Assess Risk and Vulnerability
3. Plan for the Future
4. Implement and Adapt
We have a handle on these aspects from a geospatial perspective.

Potential for impact/loss (assets at risk)

We have a much weaker geospatial information base on aspects of resiliency.

Graphic adapted from North Atlantic Coast Comprehensive Study
U.S. Army Corps of Engineers
Coastal Storm Risk Management Planning Center of Expertise
Jie Gong of Rutgers School of Engineering is employing mobile LiDAR to map building footprints, elevation and post-storm damage to inform rebuilding and recovery efforts.
Design Considerations in Floodproofing

The most effective method of floodproofing is to elevate all activities which are not compatible with water above flood elevation. To do this:

- Design requirements standards,
- Design 1 Hydrostatic wave load debris, impact
- Flood elevation
- Site factors

Elevate all activities which are not compatible with water above flood elevation.

Properly anchor all foundations to prevent flood water washing them out and also to avoid floatation of the structure if the flood waters get too high.

Provide openings or break-away wall sections to allow free passage of water.
Closing Thoughts: Information

• Our efforts at developing geospatial information and tools relevant for place-based decision-making
• The NJ Coastal Flood Exposure assessment represents one approach at assessing coastal flood hazard statewide.
• While we have a good handle on mapping coastal flood hazard exposure, we have a ways to go on assessing sensitivity and adaptive capacity: 2 key aspects of resilience.
• Maintaining NJ’s Salt Marsh long term will require consideration of both seaward edge erosion, vertical accretion as well as landward progression
Closing Thoughts: Tools

• WebGIS tools, such as *NJFloodMapper*, can provide access to critical place-based information on coastal flood exposure and potential vulnerability.

• Leveraging national-scale effort with locally-refined geospatial data and functionality is a good model.
  – Providing a local scale – municipal focus
  – Adding local data and functionality requested by the community

• The user-centered design process was central to that elusive goal of “virtual accessibility.”
  – Fostered connection to target audience.
  – Promoted greater acceptance once tool was released.

• Even with great tools still need a personal touch through in-the-field outreach and assistance
Key Websites:

- Coastal Flood Exposure Profiler
  - Njadapt.org
- NJFlood Mapper: visualizing SLR
  - NJFloodMapper.org
- Getting To Resilience: A Community Planning Evaluation Tool
  - Prepareyourcommunitynj.org
- NJ Climate Adaptation Alliance
  - Climatechange.rutgers.edu