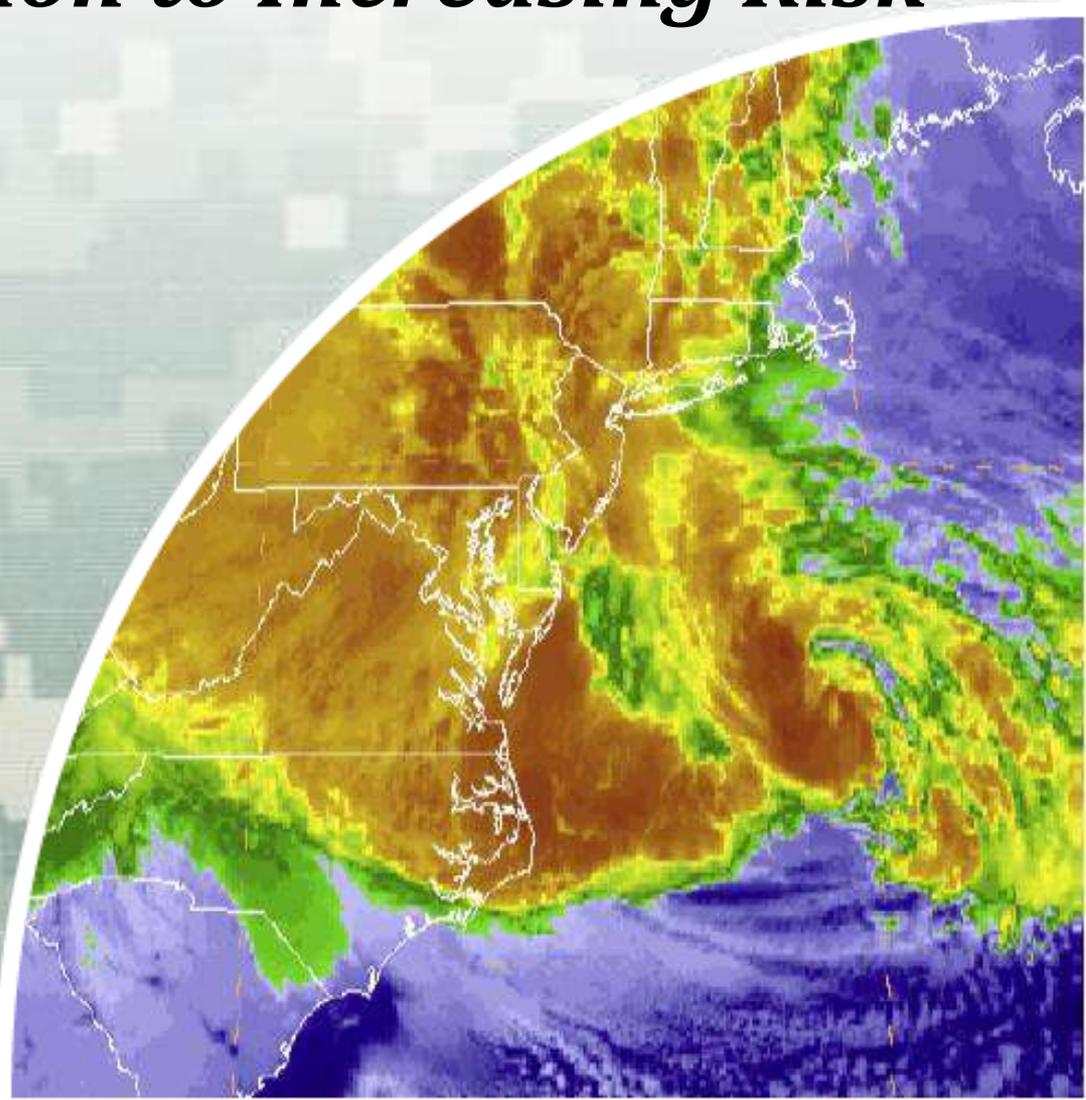


North Atlantic Coast Comprehensive Study: *Resilient Adaption to Increasing Risk*

U.S. Army Corps of Engineers
National Planning Center for Coastal
Storm Risk Management

25 February 2014



Outline

- Background and Sandy's Impact
- Study Technical Components and Products
- NACCS Framework and Plan Formulation
 - ▶ Planning Reaches
 - ▶ Exposure and Vulnerability
 - ▶ Management Measures and Resilient Approaches
 - ▶ Future Scenarios
- Advantages and Limitations
- Future/Study Timeline



Background

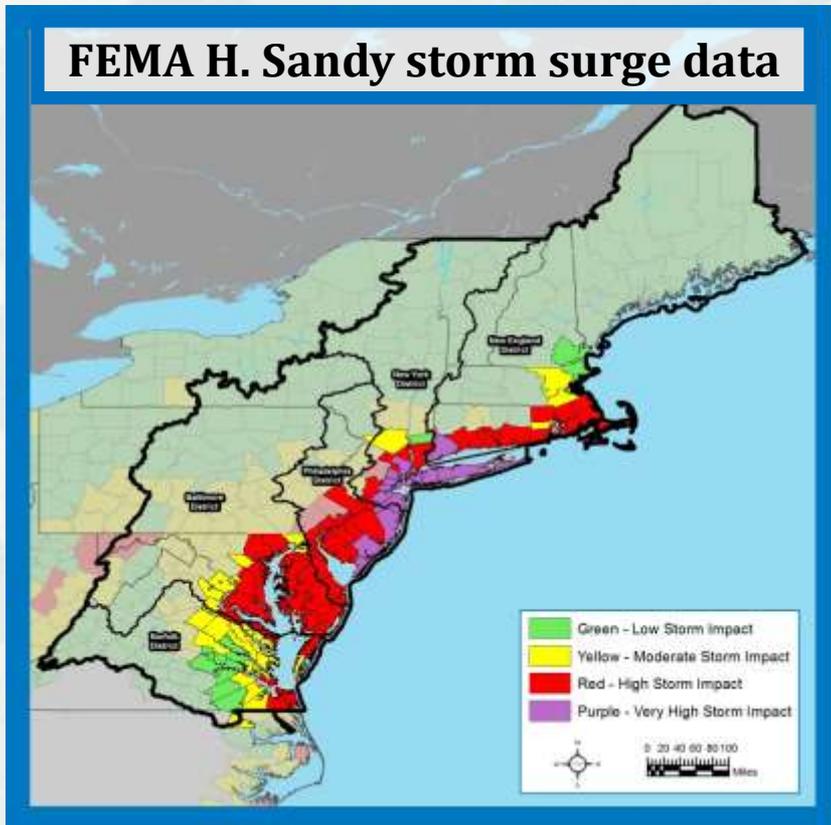
- ❑ Hurricane/Post-Tropical Cyclone Sandy moved to the U.S. Atlantic Ocean coastline 22-29 October 2012
- ❑ Affected entire U.S. east coast: 24 States from Florida to Maine; New Jersey to Michigan and Wisconsin
- ❑ Areas of extensive damage from coastal flooding: New Jersey, New York, Connecticut
- ❑ Public Law 113-2 enacted 29 January 2013



Background

“That using up to \$20,000,000* of the funds provided herein, the Secretary shall conduct a **comprehensive study** to address the flood risks of **vulnerable coastal populations** in areas that were affected by Hurricane Sandy within the boundaries of the North Atlantic Division of the Corps...” (*\$19M after sequestration)

- Complete by Jan 2015



Goals

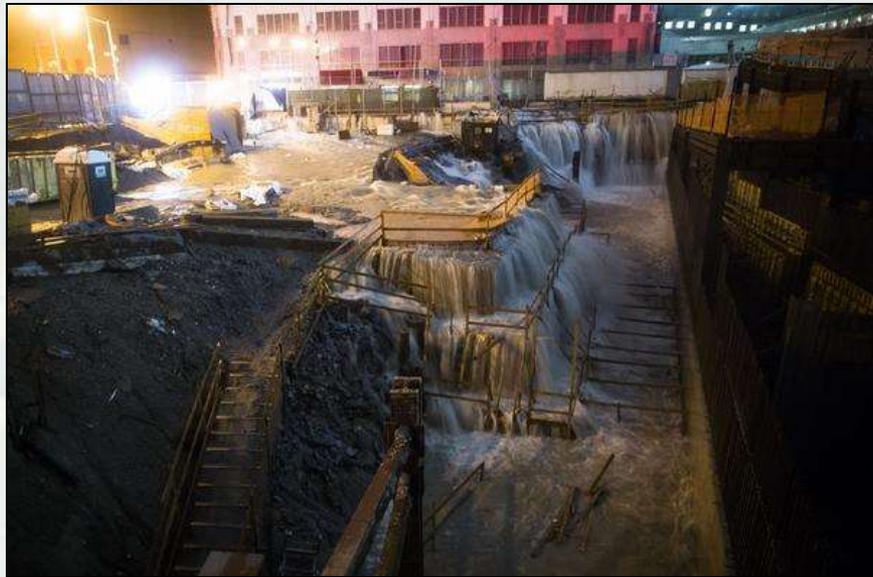
- Provide a **Risk Reduction Framework**, consistent with USACE-NOAA Rebuilding Principles
- Support **Resilient Coastal Communities** and robust, sustainable coastal landscape systems, considering future sea level rise and climate change scenarios, to reduce risk to vulnerable population, property, ecosystems, and infrastructure



Hurricane Sandy's Impact

- \$65 Billion in damages and economic loss
- 159 fatalities in U.S.
- 8.5 billion customers lost power
- 650,000 homes damaged or destroyed
- 13 States with major Disaster declaration

Source: Hurricane Sandy
Rebuilding Task Force, 2013



Technical Teams

- ❑ **USACE Enterprise**
- ❑ **Agency Subject Matter Experts**
 - Engineering
 - Economics
 - Environmental, Cultural, and Social
 - Sea Level and Climate Change
 - Plan Formulation
 - GIS and Geospatial Analyses



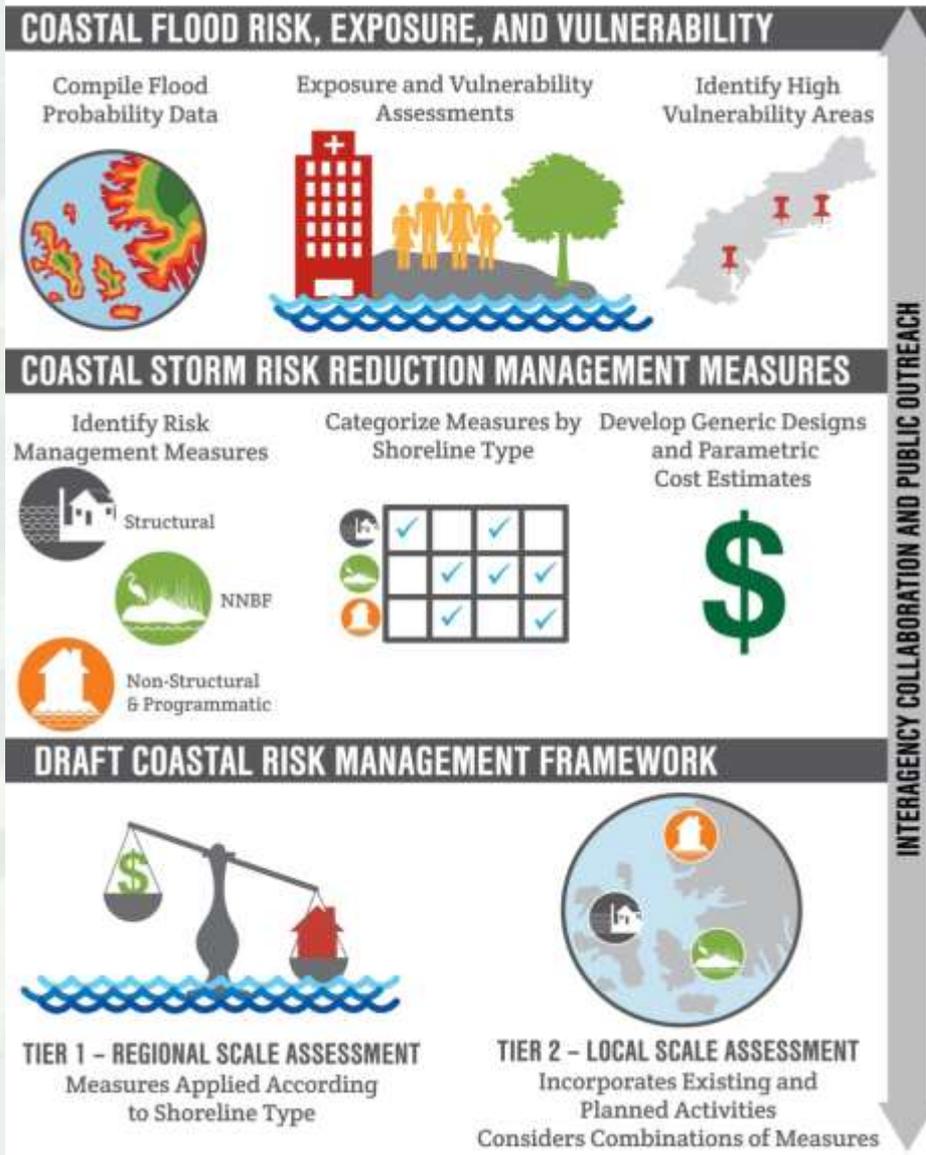
Photo credit unknown

Products

- ❑ **Coastal Framework**
 - Regional scale
 - Collaborative
 - Opportunities by region/state
 - Identify range of potential solutions and parametric costs
 - Identify activities warranting additional analysis and social/institutional barriers
- ❑ **Not a Decision Document**
 - No NEPA
 - No Recommendations



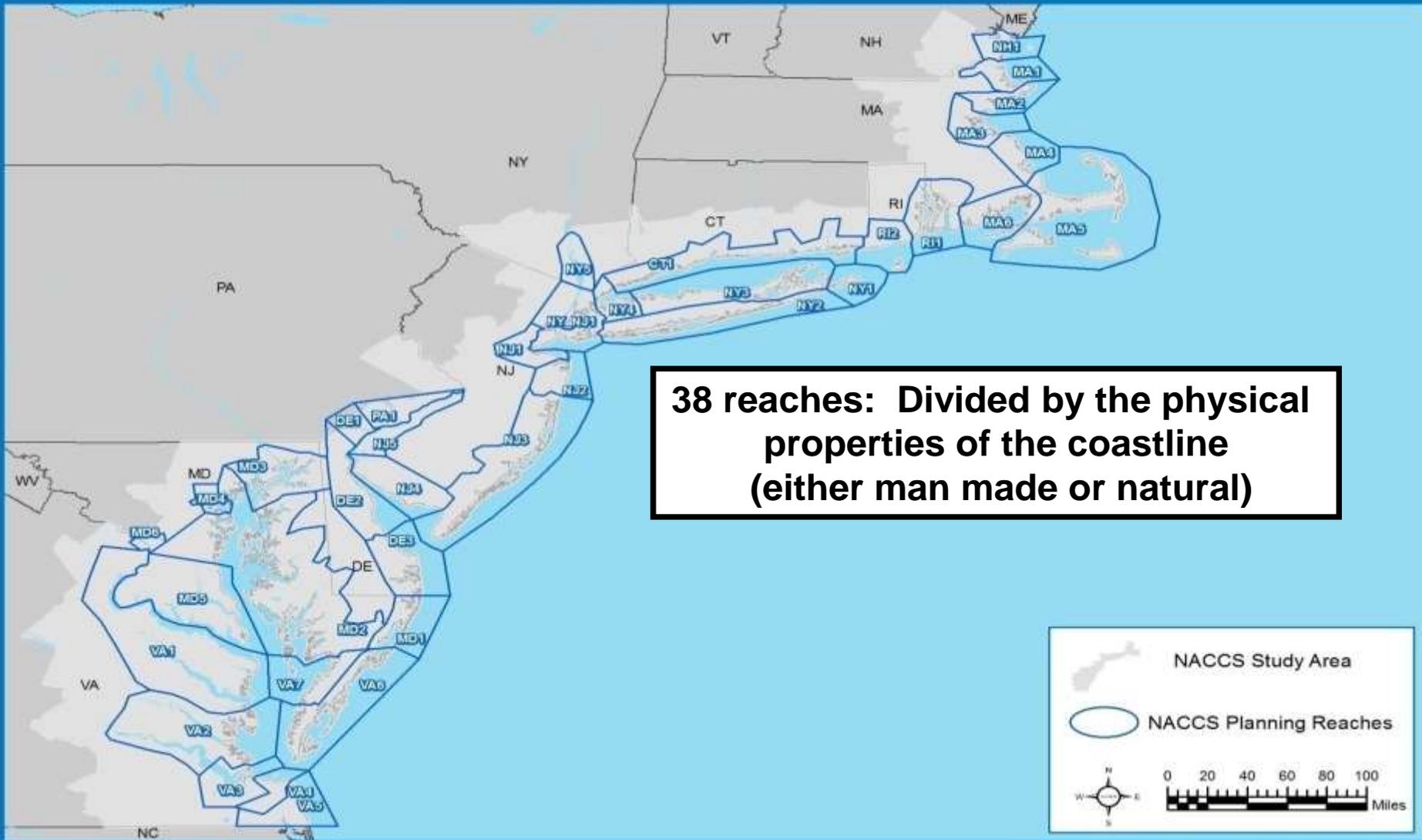
NACCS Framework



- **Who and what** is exposed to flood risk?
- **Where** is the flood risk?
- What are the **appropriate strategies** and measures to reduce flood risk and how do they align with **each other and other regional plans**?
- What is the **relative cost** of a particular measure compared to the anticipated risk reduction?
- What **data are available** to make a **RISK INFORMED** decision?
- What **data gaps exist/can be closed** through the NACCS?



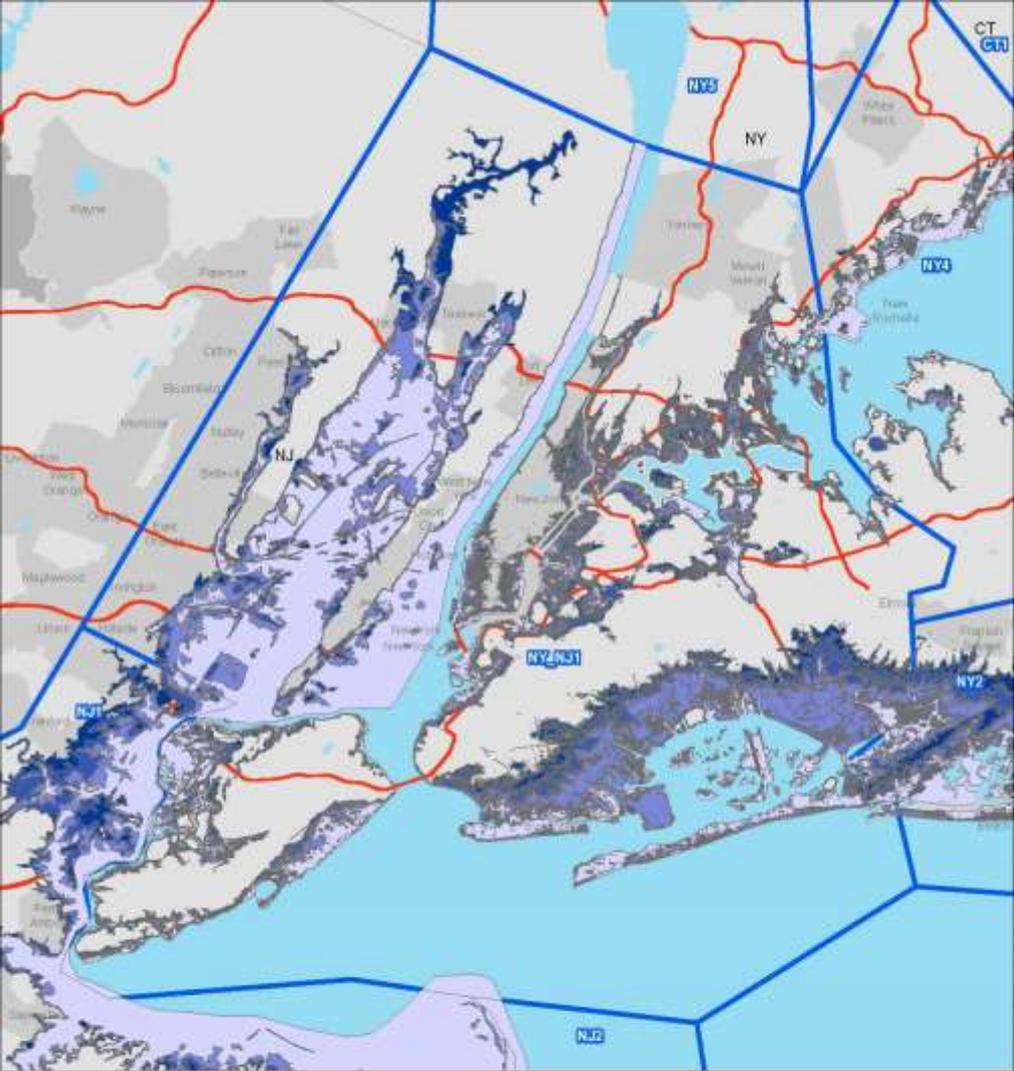
NACCS Planning Reaches



38 reaches: Divided by the physical properties of the coastline (either man made or natural)

NACCS New York Planning Reaches

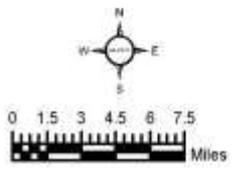




Extent of Inundation



Extent of Inundation



- 100yr +3ft Water Surface
- FEMA 100yr Water Surface
- NACCs Planning Reaches
- Interstate Highways
- Cities



Exposure Assessment

■ Exposure Indices

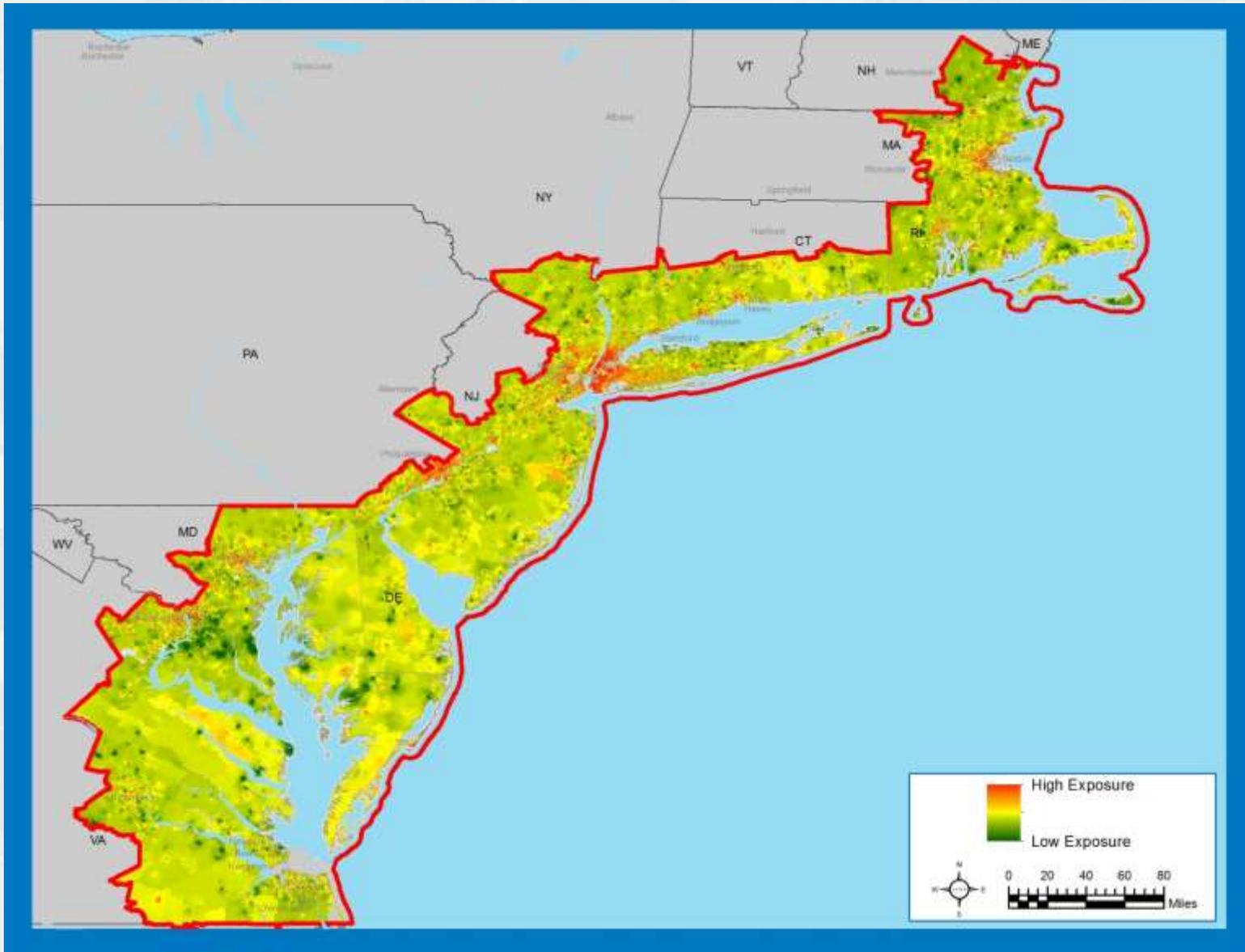
- **Population density and infrastructure** (number of people and infrastructure in communities subject to flooding)
- **Socio-economic groups** (populations that may have more difficulty preparing and responding to flooding)
- **Environmental/Cultural** (critical habitat, wetlands and other environmental and cultural resources)

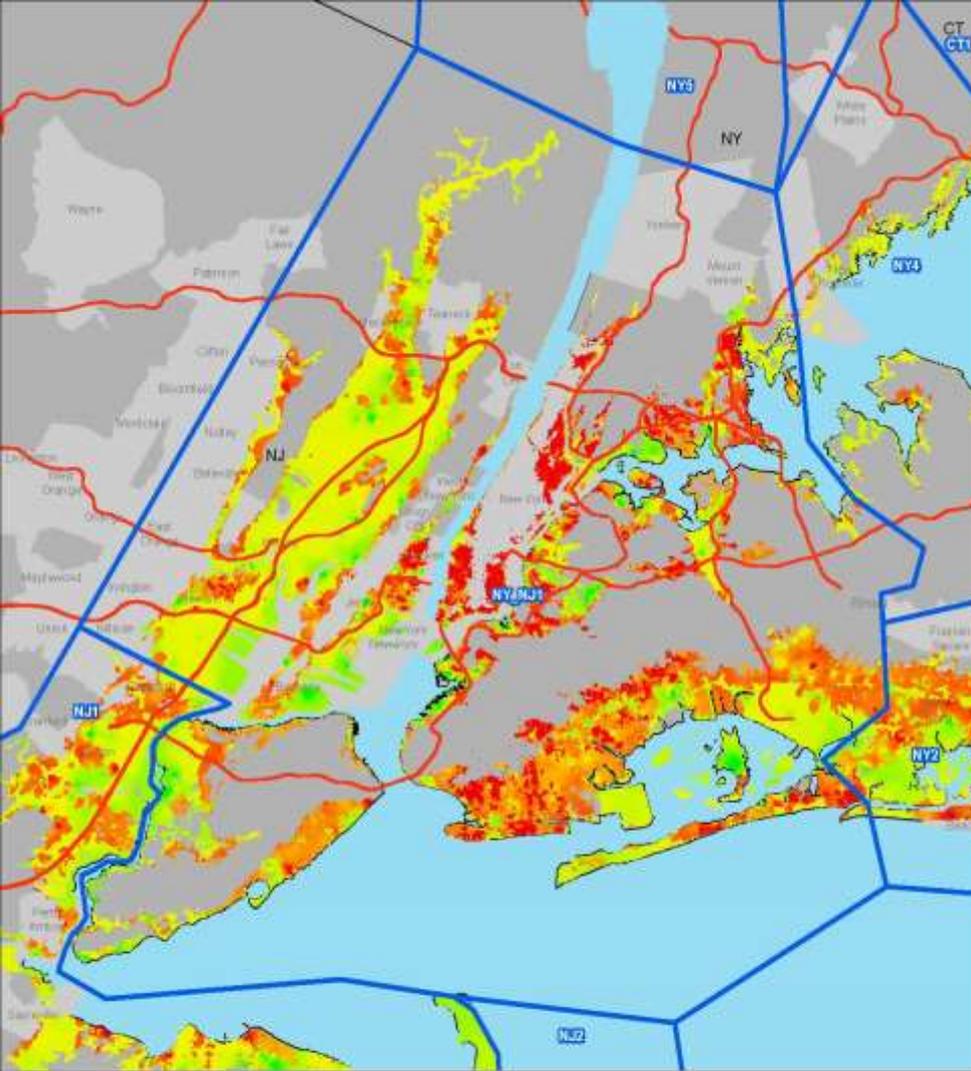
■ Mapping

- Relative higher exposure = highly populated areas and urban centers
- Boston, NY/northern NJ metropolitan area including Nassau County, Connecticut shoreline, Monmouth and Cape May Counties, the upper Delaware Bay portion of NJ

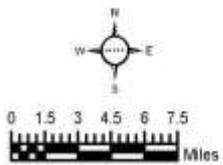


Exposure Assessment

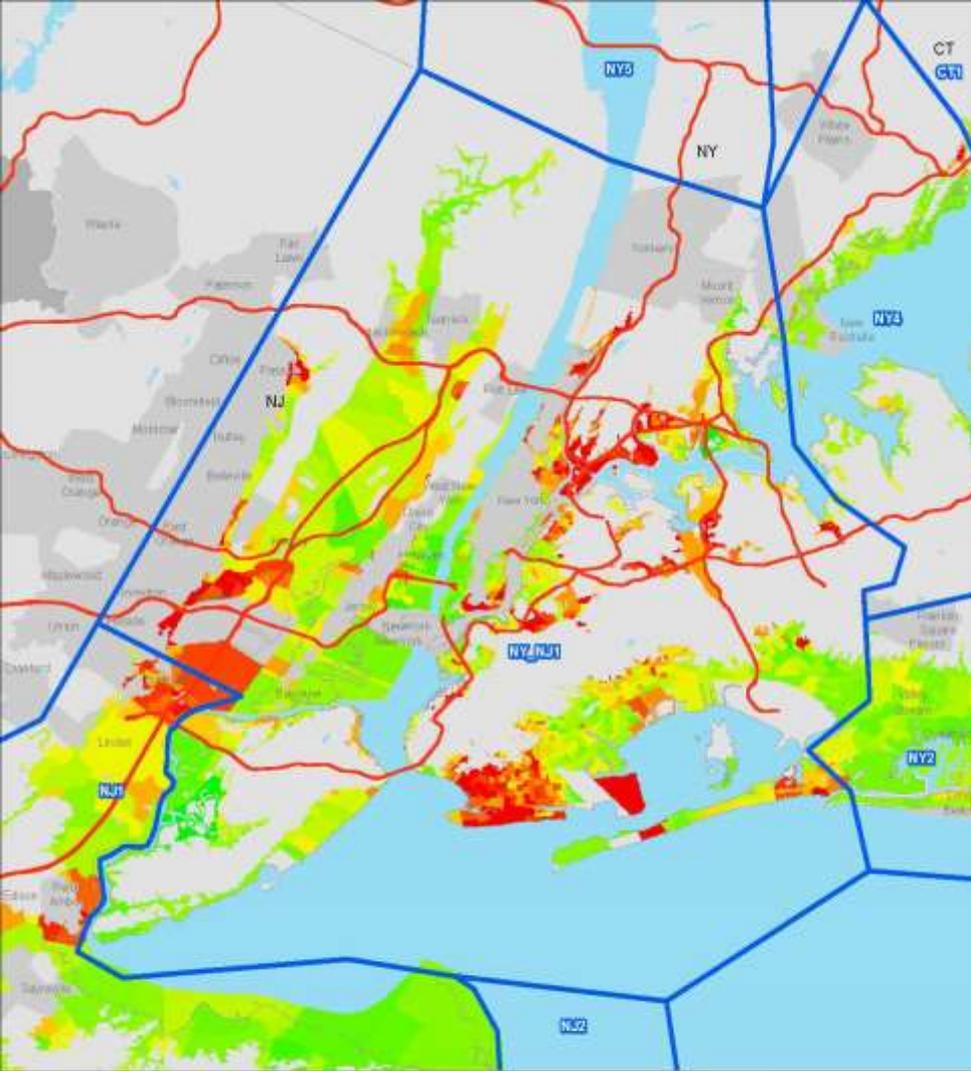


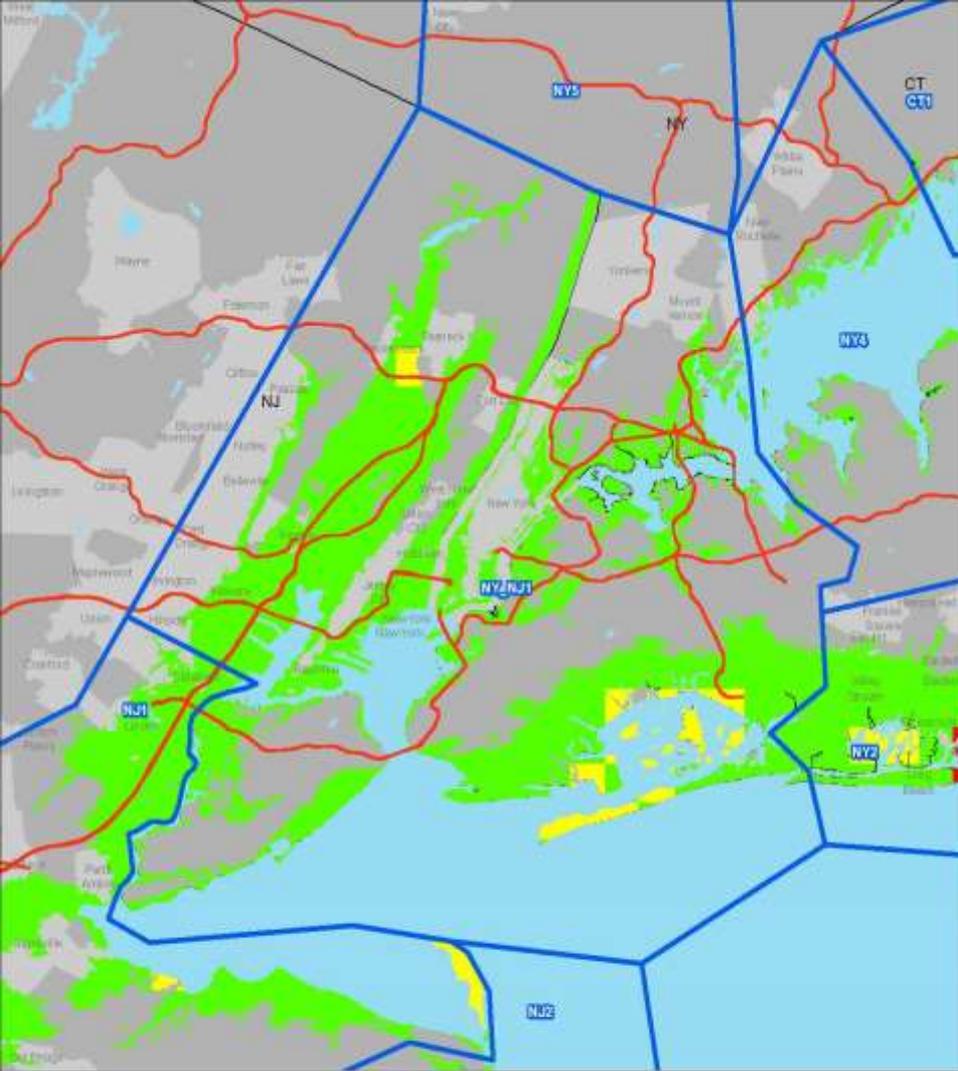


Population & Infrastructure Exposure

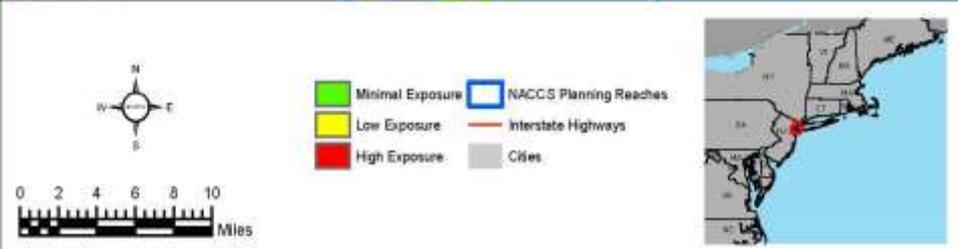


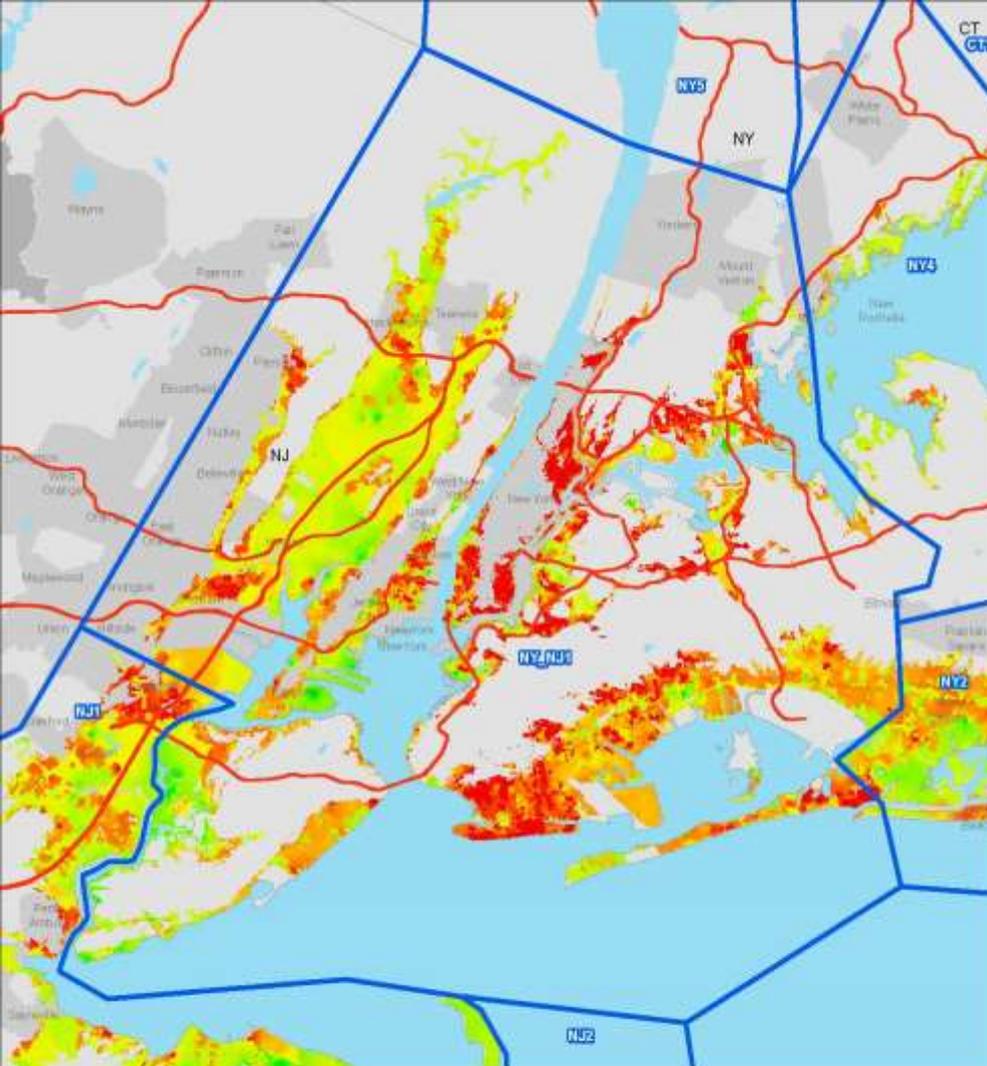
Social Vulnerability Exposure



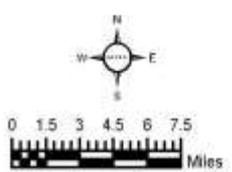


Environmental/ Cultural Exposure





Composite Exposure



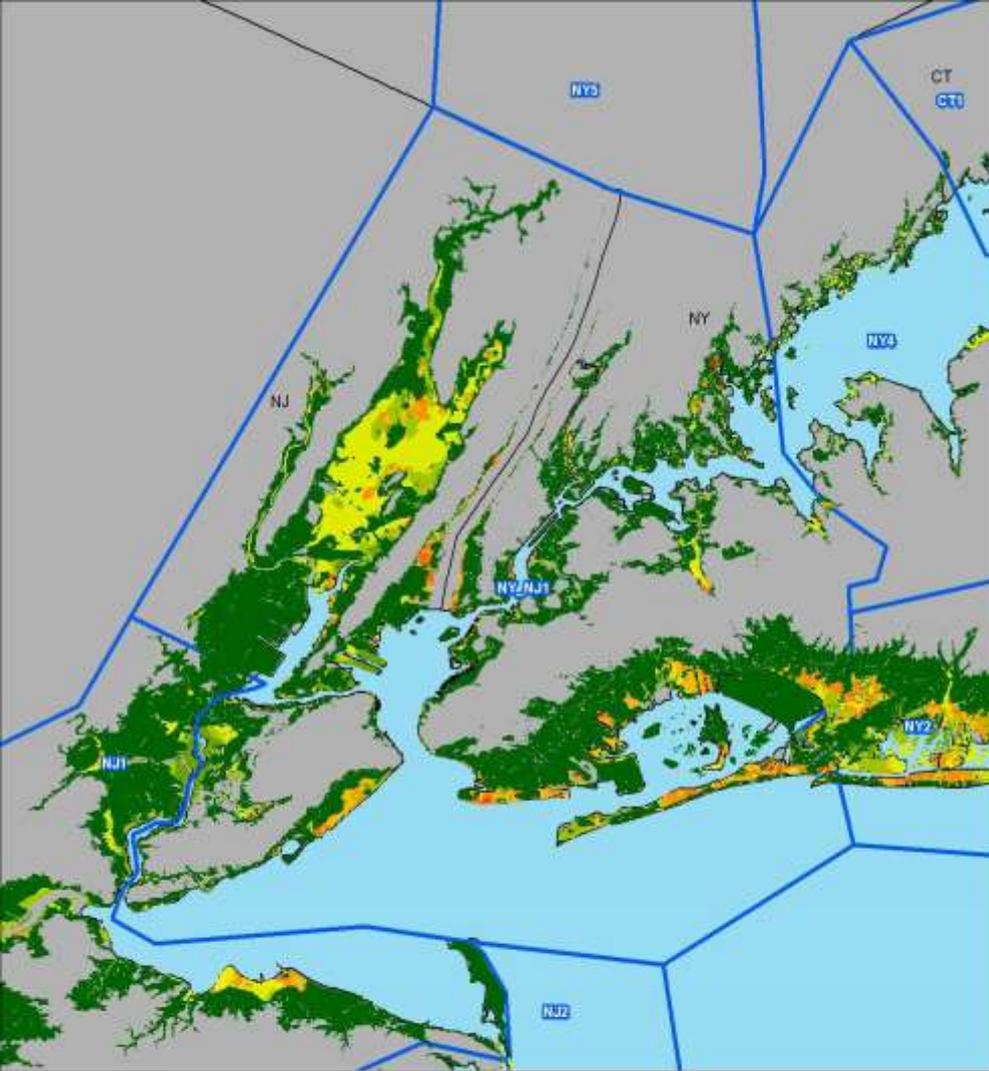
-  NACCS Planning Reaches
-  Interstate Highways
-  High Exposure
-  Low Exposure
-  Cities



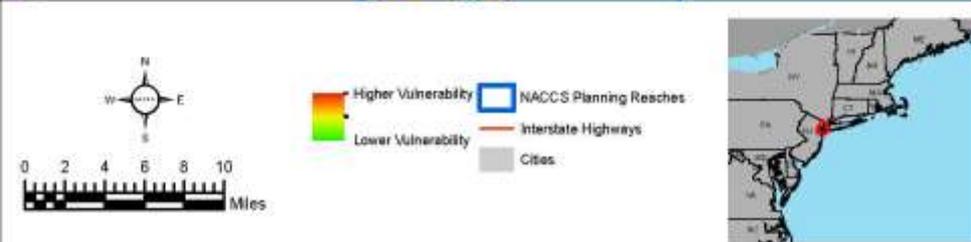
Vulnerability Assessment

- Greater vulnerability based on proximity to flooding source
- Exposure * Probability of Flooding
 - ▶ Multiply value in each pixel of the composite exposure grid by the probability of flooding
- Additional metrics would need to be considered at smaller scales





Vulnerability Assessment



Risk Reduction Measures

■ Structural

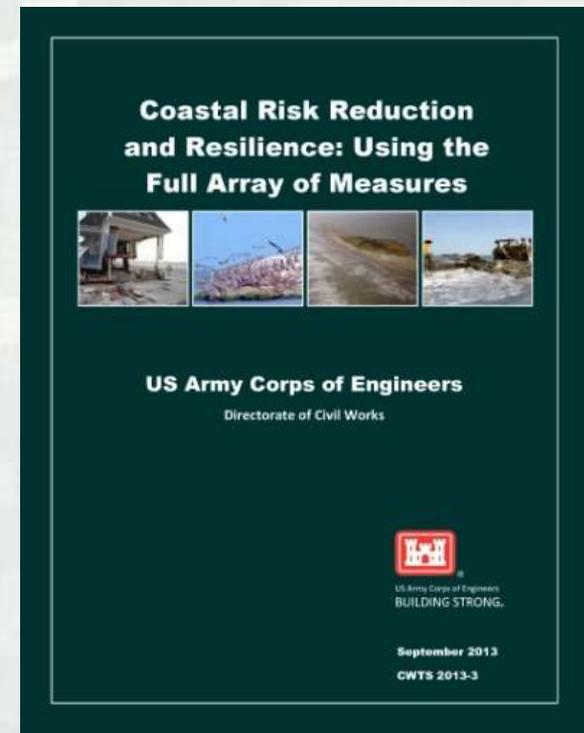
- Storm surge barriers, levees, breakwaters, groins, beach fill, dunes
- **Natural and nature-based features** (e.g. living shorelines, wetlands, oyster reefs, Sub-Aquatic Vegetation restoration)

■ Non-Structural

- Floodproofing, elevation, acquisition
- Evacuation, flood warning systems

■ Policy/Programmatic

- Floodplain management, land use planning
- State/Local Coastal Zone Policies, Flood Insurance Programs
- Natural resources/surface water management



<http://www.corpsclimate.us/ccacrrr.cfm>



Coastal Risk Reduction and Resilience Measures

Measure	Definition	Effect	Examples
Natural	Created through the action of physical, biological, geologic, and chemical processes operating in nature	Shoreline erosion control, wave and surge attenuation, especially in low-energy environments; additional resilience benefits; dynamic behavior and response affect performance with respect to objectives	Barrier islands, dunes, reefs, wetlands, marsh islands and riparian corridors 
Nature-Based	Products of planning, engineering design, and construction incorporating natural processes that contribute to coastal risk reduction and resilience	Shoreline erosion control, wave and surge attenuation, especially in low-energy environments; dynamic behavior and response affect performance with respect to objectives	
Non-Structural	Products of public policy, management and regulatory practices; may include pricing schemes, planning, engineering design, and construction	Modify or avoid the impacts of the hazard (vs. modifying the hazard); relatively predictable level of performance with respect to objectives	Structure acquisitions or relocations, flood proofing, implementing flood warning systems, flood preparedness planning, use regulations, development restrictions within the greatest flood hazard areas, elevated development, managed retreat, evacuation, buyout and leaseback 
Structural	Products of planning, engineering design, and construction	Shoreline erosion control, wave and surge attenuation, reduced flooding; relatively predictable level of performance with respect to objectives	Levees, storm surge barrier seawalls, groins, revetments, and near-shore breakwaters 

Future Scenarios

■ **Climate Change and Sea Level Rise**

- Sea level is increasing throughout the study area
- Increased populations and infrastructure exposed to storm surge and frequency of flooding
- Shorelines are changing in response to sea level rise
- Historic erosion patterns will continue and accelerate

■ **Socioeconomic**

- Population is aging (i.e. more difficult to evacuate/relocate during flooding)
- Population is increasing (more people exposed to flooding)
- Importance of operating channels and ports will become more critical to regional and national economy

■ **Environmental**

- Habitats subject to more stress with population increase, climate change, and other effects



Future Scenarios

Sea level rise* evaluated for the years 2018, 2068, 2100 and 2118

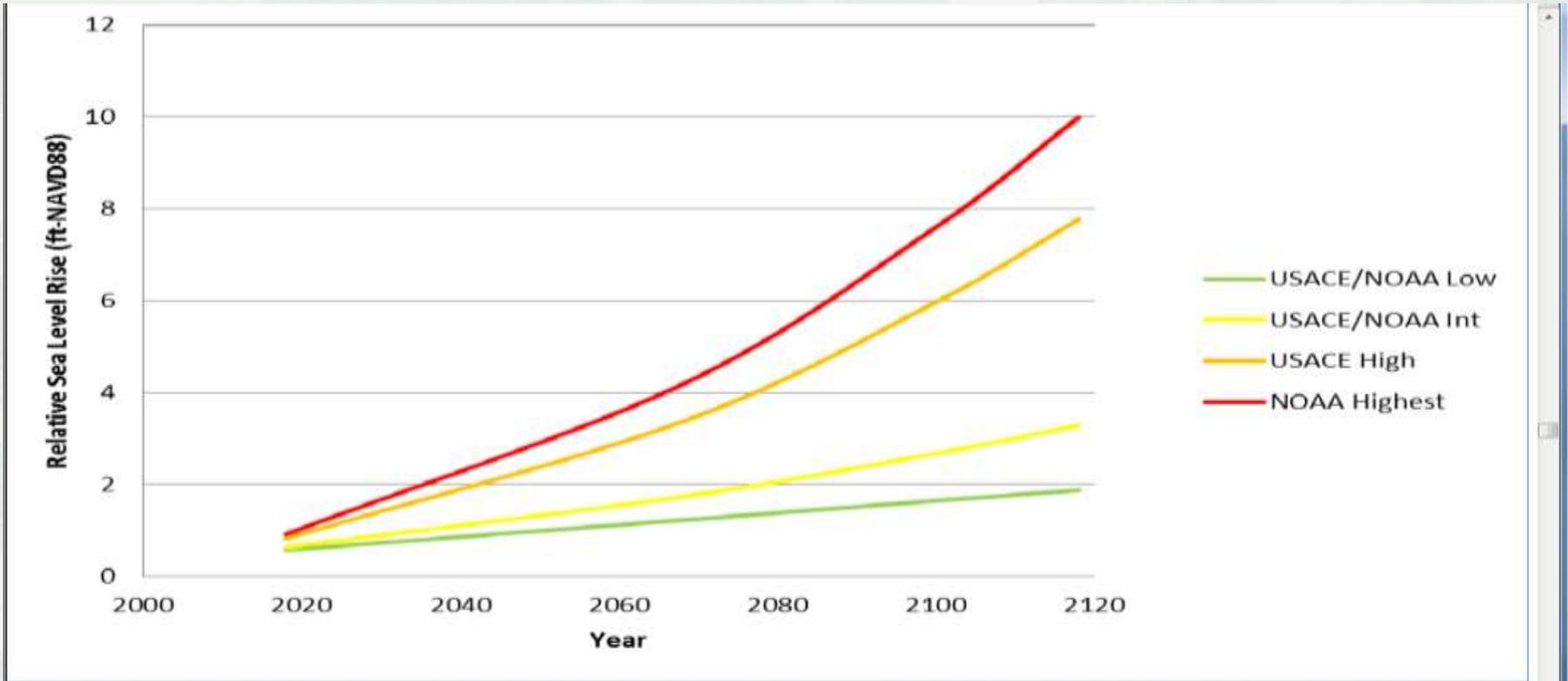


Figure V-1. Relative sea level rise for Sandy Hook, NJ for USACE and NOAA sea level change

*SLR evaluated using both USACE's Engineer Circular (EC) 1165-2-212 (low, intermediate high) and NOAA 's highest SLR scenarios



Considerations

Advantages

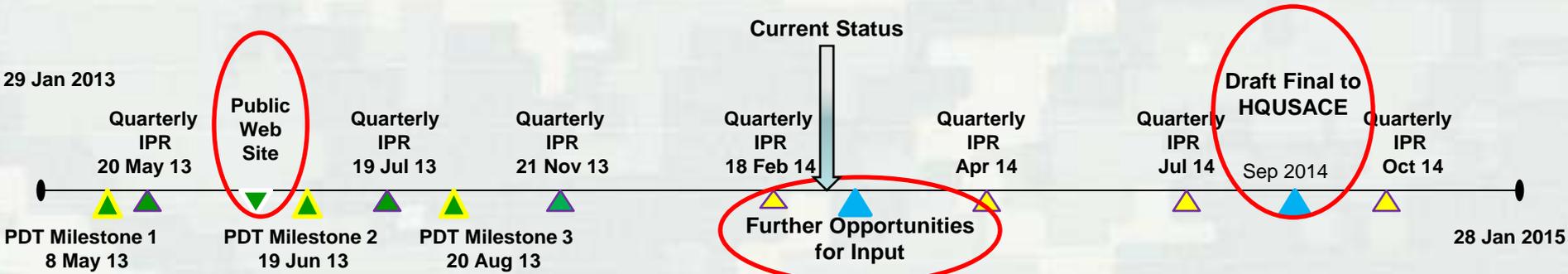
- Allows for some automation
- Can be replicated at multiple scales
- Can identify general areas of interest for further investigation
- Presents areas of relatively higher exposure/vulnerability

Limitations

- Very coarse analysis
- Developing weights can be challenging
- Cannot present site specific issues/solutions
- Requires consistent datasets



Schedule Overview



Develop draft PMP and SOW (NLT 15 Mar; approved 27 Mar 13)

Phase 1 [Months 1-14]
 Interagency & NGO coordination to assemble existing/future conditions. Assessment & formulation of measures
ATR and HQUSACE Review of Draft Analyses

Phase 2 [Months 15-18]
 Interagency & international validation & collaboration

Phase 3 [Months 19-24]
 Finalize comprehensive report & submit to Congress (January 2015)

- PHASE 1 Products**
- Coastal Geographic Information System Geodatabase & Analysis
 - Sea Level Rise and Vulnerability Assessment & Maps
 - Identification of risk and preliminary approaches for system resilience

- PHASE 2 Products**
- Align with other Regional Plans
 - Receive interagency, partner and international comments
 - Institutional Barriers
 - Additional Analyses that may be warranted.

- PHASE 3 Products**
- Storm Suite Modeling
 - Economic Depth-Damage Estimation Tool
 - Submission of final report to Congress

