

# North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk

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21 October 2015

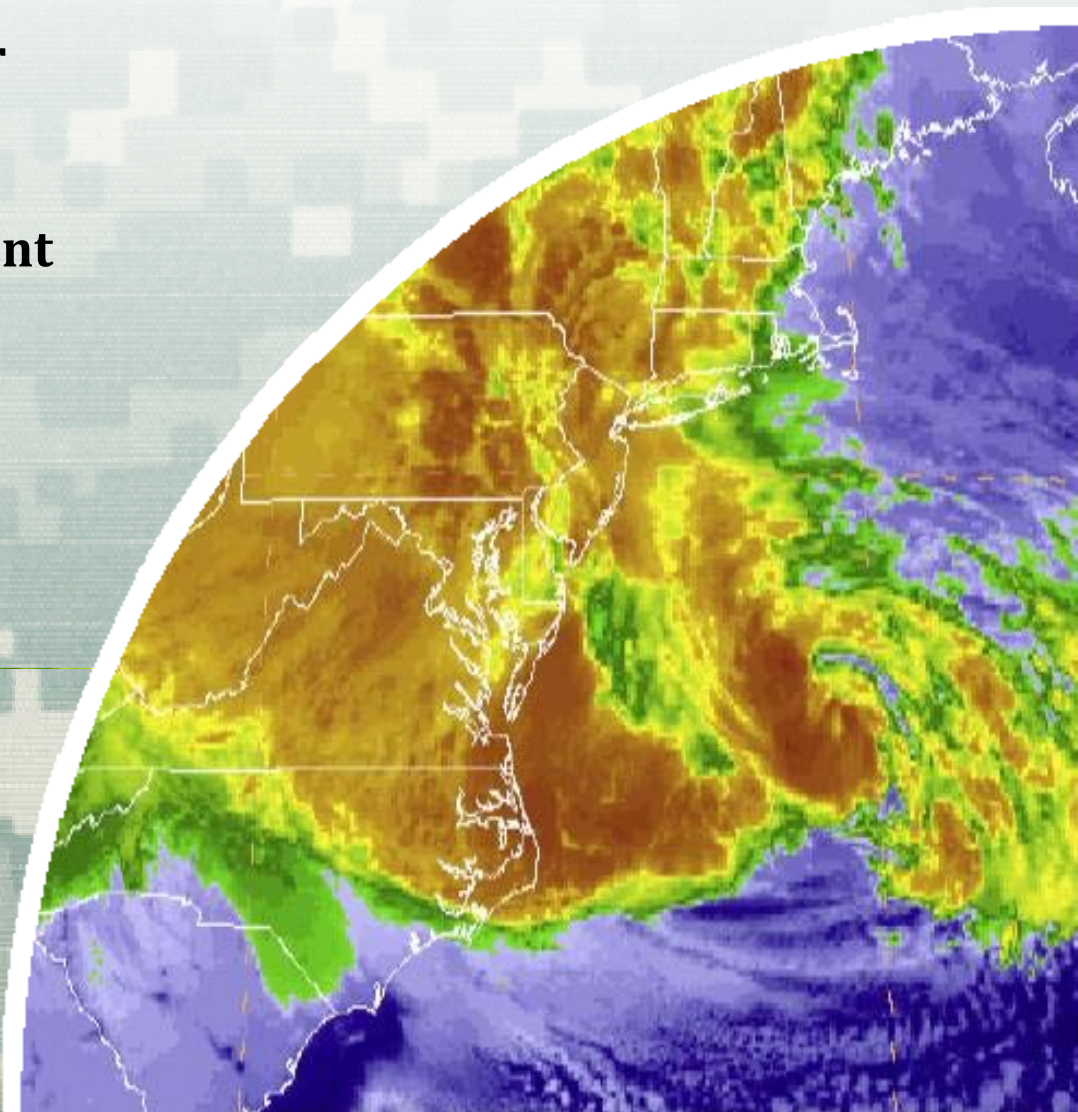


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US Army Corps of Engineers  
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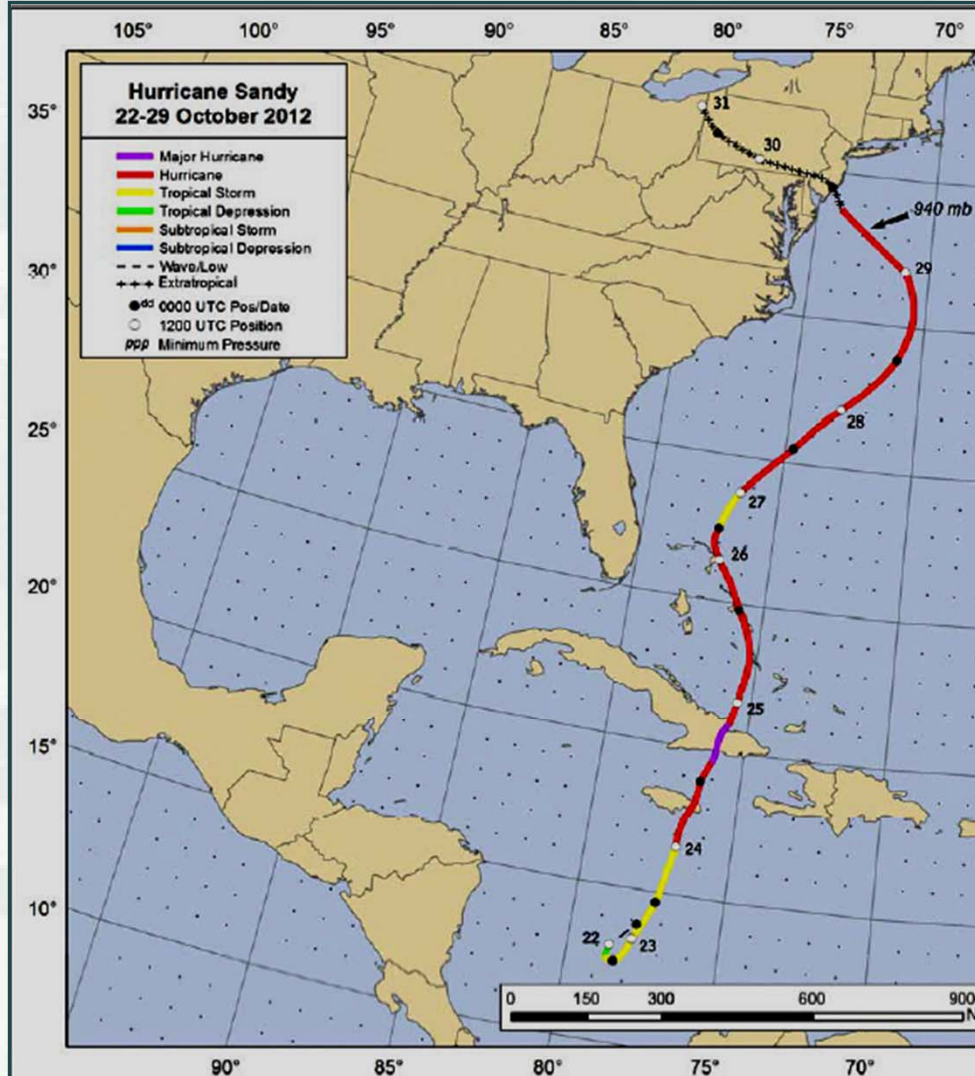


# Outline

- Background
- Collaboration and Alignment
- Findings
- Outcomes
  - Coastal Storm Risk Management Framework
  - Technical Products Supporting the Framework
- Opportunities
  - Focus Areas Warranting Additional Analysis
  - Coastal Resilience
- Summary



# Background



- Sandy originated in the Caribbean on 22 October 2012
- Severely impacted Jamaica, Cuba, Haiti, Dominican Republic, and Cuba, reaching the USA Atlantic coastline 29 October
- In the USA, effects extended from Florida to Maine, and west to Great Lakes
- States of New Jersey, New York, and Connecticut greatly impacted; NY-NJ Harbor devastated by catastrophic surge



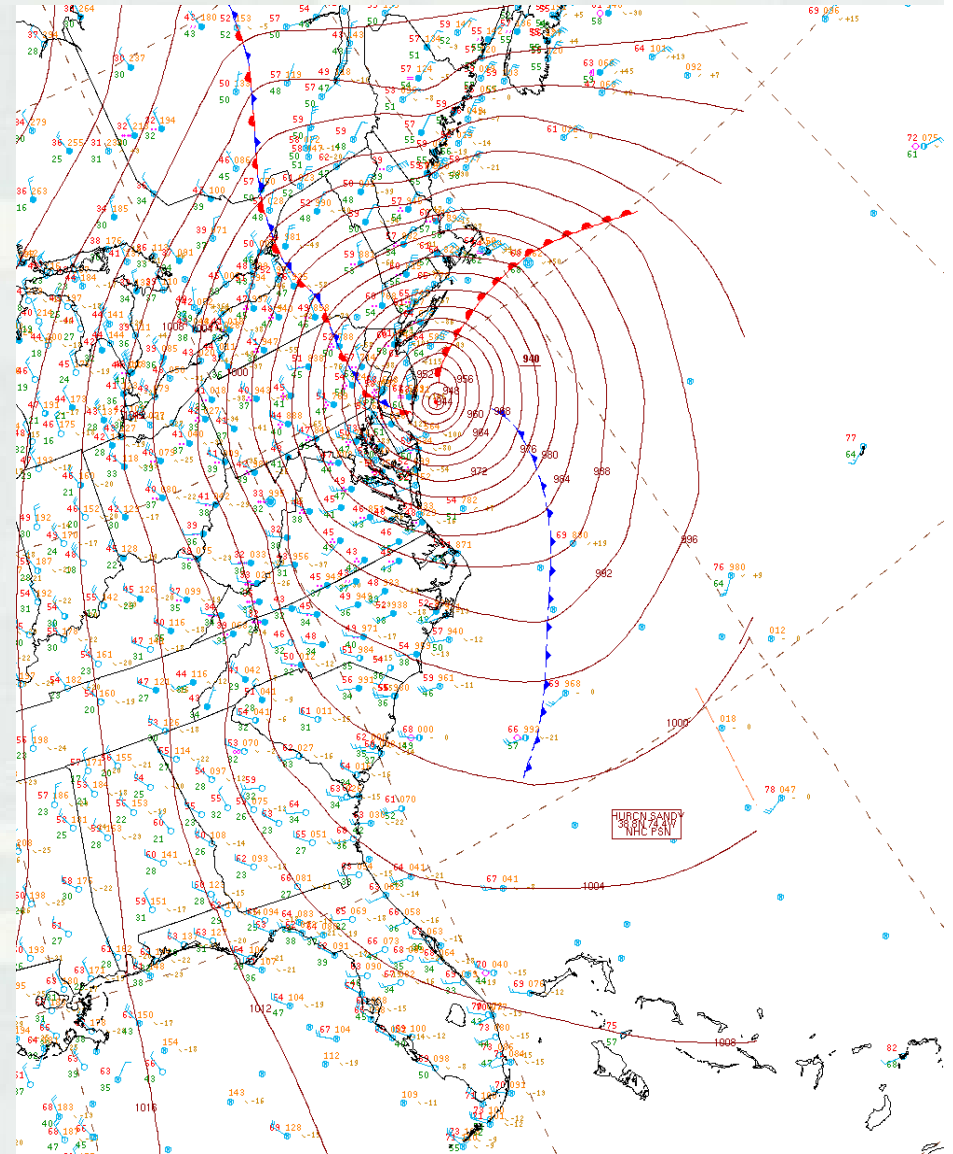
National Hurricane Center 12 Feb 2013





# Background: Storm Characteristics

- Approximate size → 800 to 1,000 miles across
- Radius of maximum winds → greater than 100 mi
- Minimum Pressure:
  - Lowest ever recorded in north Atlantic Ocean → 940 mb
  - Pressure at landfall → 948 mb



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# Background: Sandy's Impact in the USA

## ➤ Human

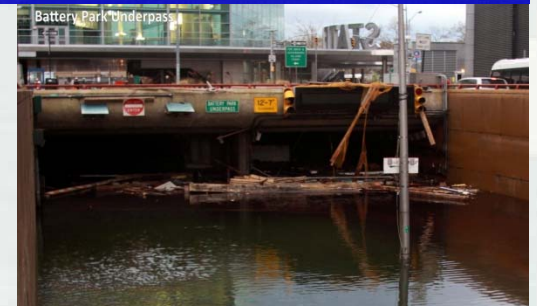
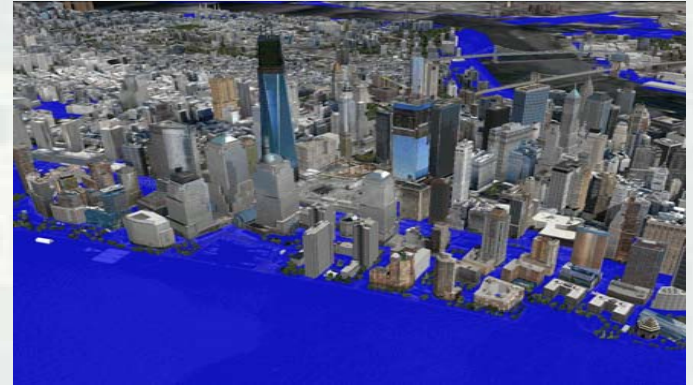
- 159 lives lost
- 500,000 mandatory evacuations
- 20,000 temporary shelter
- Extensive community dislocations

## ➤ Economic

- \$65B in damages
- 650,000 houses damaged/destroyed

## ➤ Infrastructure: Loss off

- Telecommunications, transit
- Fuel, power



**\*US Army Corps of Engineers – Partnered projects  
credited with an estimated  
\$1.9B in damages prevented**



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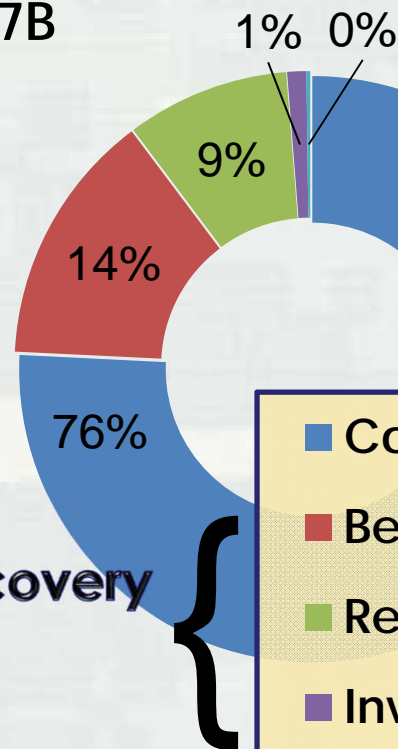
# Background: Public Law 113-2 Disaster Relief Appropriations Act 2013

Total Appropriation \$47.9B

HUD \$15.20B

DOT \$12.42B

DHS \$11.47B



**USACE  
Sandy Recovery  
Program  
\$5.1B**



127 STAT. 4

PUBLIC LAW 113-2—JAN. 29, 2013

## Public Law 113-2 113th Congress

### An Act

Jan. 29, 2013  
[H.R. 152]

Making supplemental appropriations for the fiscal year ending September 30, 2013, to improve and streamline disaster assistance for Hurricane Sandy, and for other purposes.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums are appropriated, out of any money in the Treasury not otherwise appropriated, for the fiscal year ending September 30, 2013, and for other purposes, namely:*

Disaster Relief  
Appropriations  
Act, 2013.

## DIVISION A—DISASTER RELIEF APPROPRIATIONS ACT, 2013

### TITLE I

- Construction of flood risk reduction projects
- Beach repair and restoration
- Repair of navigation channels and structures
- Investigations and studies
- General expenses

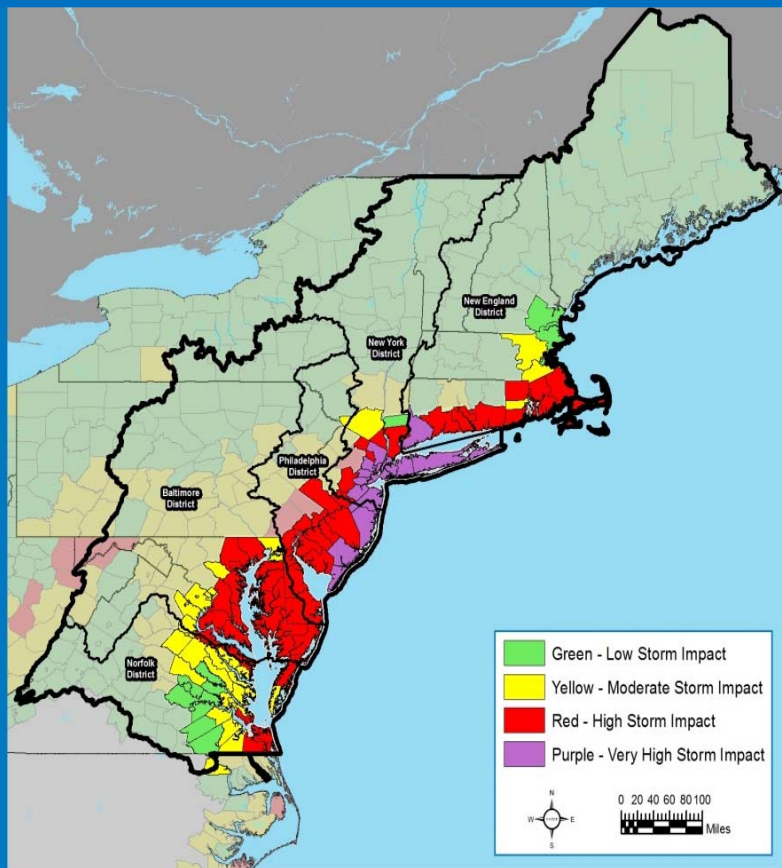
For an additional amount for "Commodity Assistance Program" for the emergency food assistance program as authorized by section 2034 of the Emergency Food Assistance Act of 2008 (7 U.S.C. 2034), \$6,000,000: *Provided*, That notwithstanding any other provisions of the Emergency Food Assistance Act of 2008, the Secretary of Agriculture may allocate additional amounts for administrative expenses from resources specifically appropriated, transferred, or reprogrammed to restore States resources used to assist families and individuals displaced by Hurricane Sandy among the States without regard to sections 204 and 214 of such Act (7 U.S.C. 2098, 2115): *Provided further*, That such amount is designated by the Congress as being for an emergency requirement pursuant to section 251(b)(2)(A) of the Balanced Budget and Emergency Deficit Control Act of 1985.



# Background:

## North Atlantic Coast Comprehensive Study

### FEMA H. Sandy Impact Data

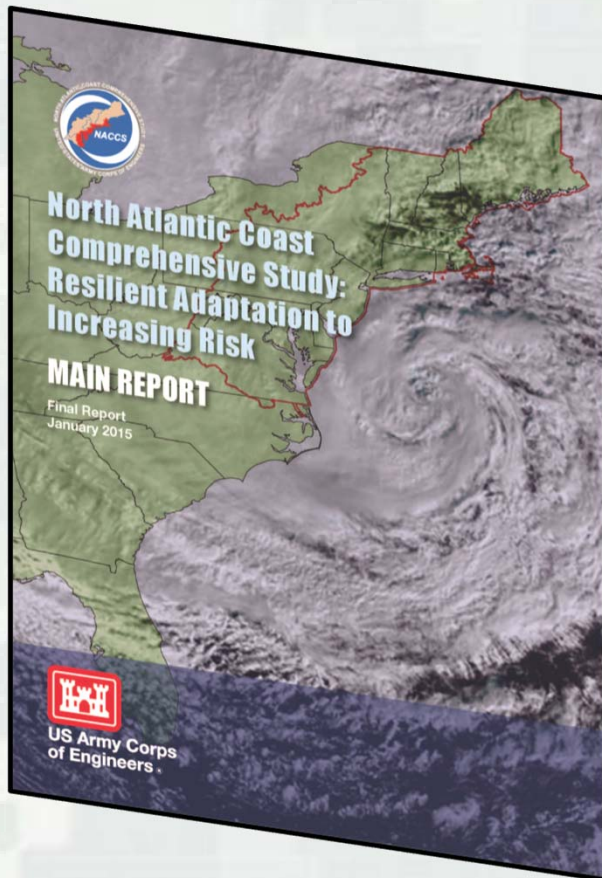


### Status

- Ongoing Sandy Program Implementation
- 28 Jan 2015 Final Report publically released
- 29 Jan 2013 PL 113-2: *... 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...*



# Background: North Atlantic Coast Comprehensive Study



[www.nad.usace.army.mil/CompStudy](http://www.nad.usace.army.mil/CompStudy)



- Addresses the legislative direction for a comprehensive plan to address vulnerable coastal communities
- Formalized and consistent approach/framework for more detailed, site specific coastal evaluations
- Integrates state-of-the-science techniques and collaboration
- Equips and links a broad audience and all levels of government with data, tools, and other stakeholders to make INFORMED coastal risk management decisions

## NACCS is *not*:

- A decision document authorizing design and construction
- A NEPA document evaluating impacts of any specific solution
- A USACE-only application





# Collaboration and Alignment

## ➤ Agency, Interagency, and Tribal Collaboration

- USACE High Level Senior Governance Team/Enterprise Project Delivery Team/Strong Project Management
- Interagency correspondence/ technical working meetings/panel discussions
- Subject Matter Experts embedded in team
- Federal Register notices and public website
- Interagency Webinar Collaboration Series (2013-2014)
- Roll Out Webinars for Regional Partners (2 & 9 Feb 2015)

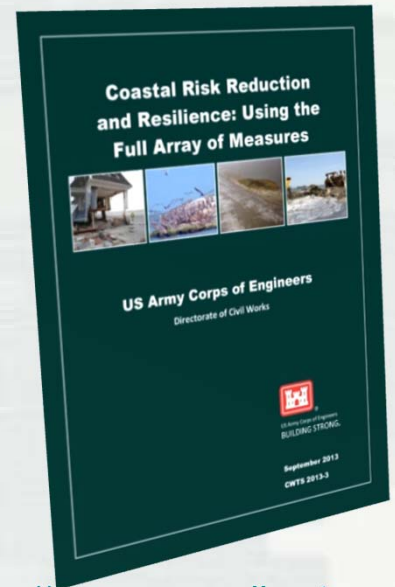
## ➤ Alignment

- President's Climate Action Plan
- Sandy Task Force "Hurricane Sandy Rebuilding Strategy"
- OMB Legislative Review Memorandum with Federal Agencies
- Sandy Regional Infrastructure Resilience Coordination



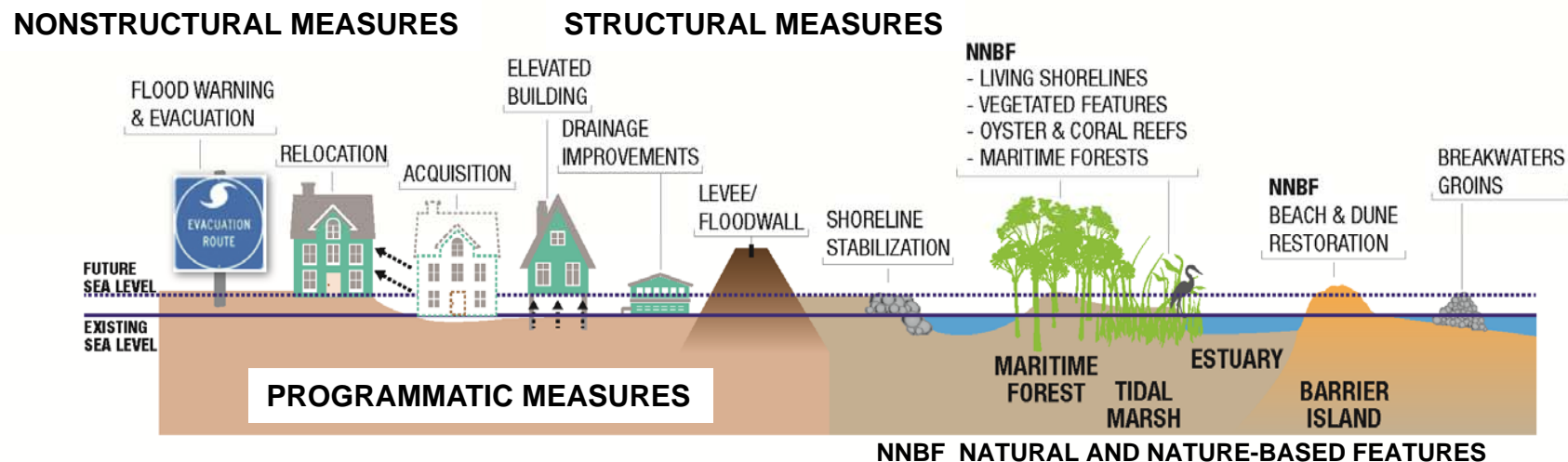
# Findings

- **Shared** responsibility of all levels of Government and partnerships
- Rethink approaches to **adapting to risk**
- Resilience and sustainability must consider a **combination and blend** of measures



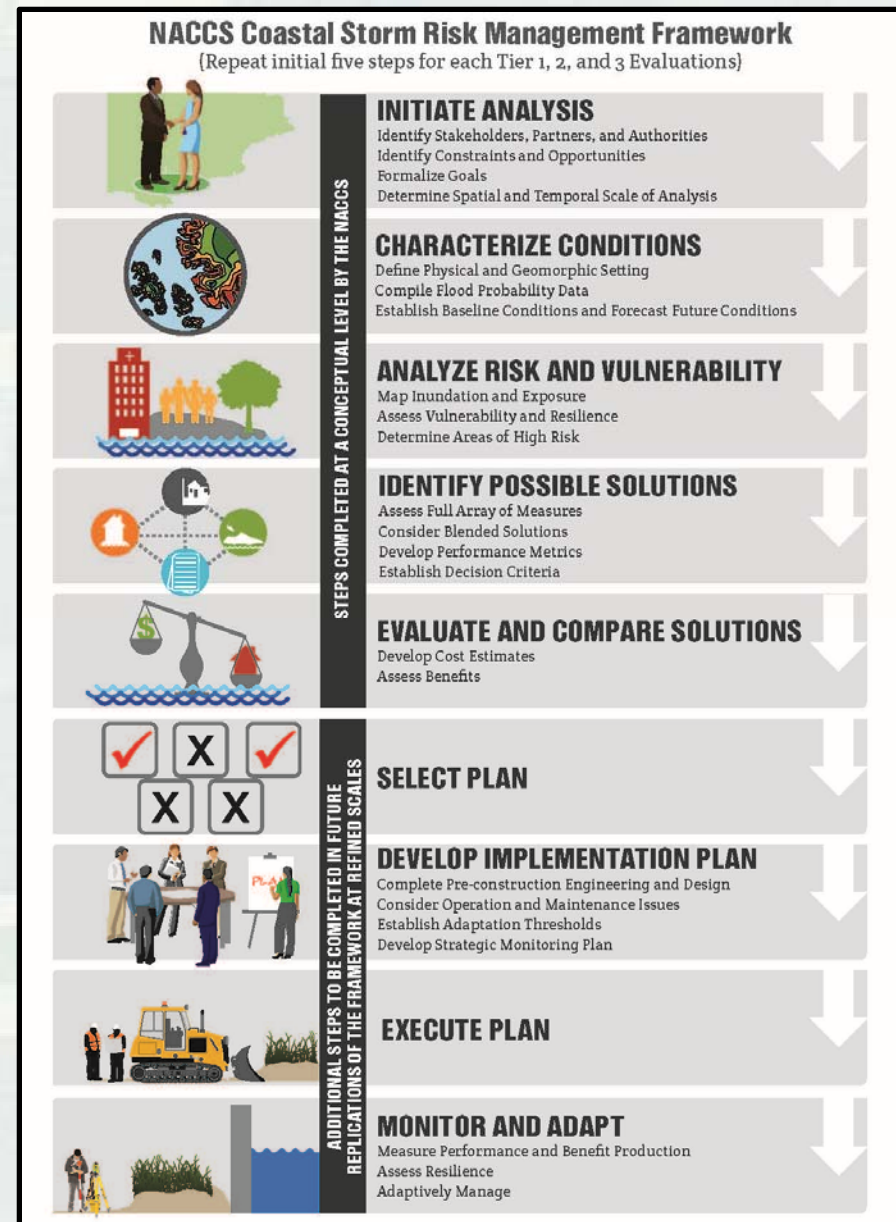
<http://www.corpsclimate.us/ccacrrr.cfm>

## Full Array of Coastal Storm Risk Management Measures



# Outcomes: Coastal Storm Risk Management Framework

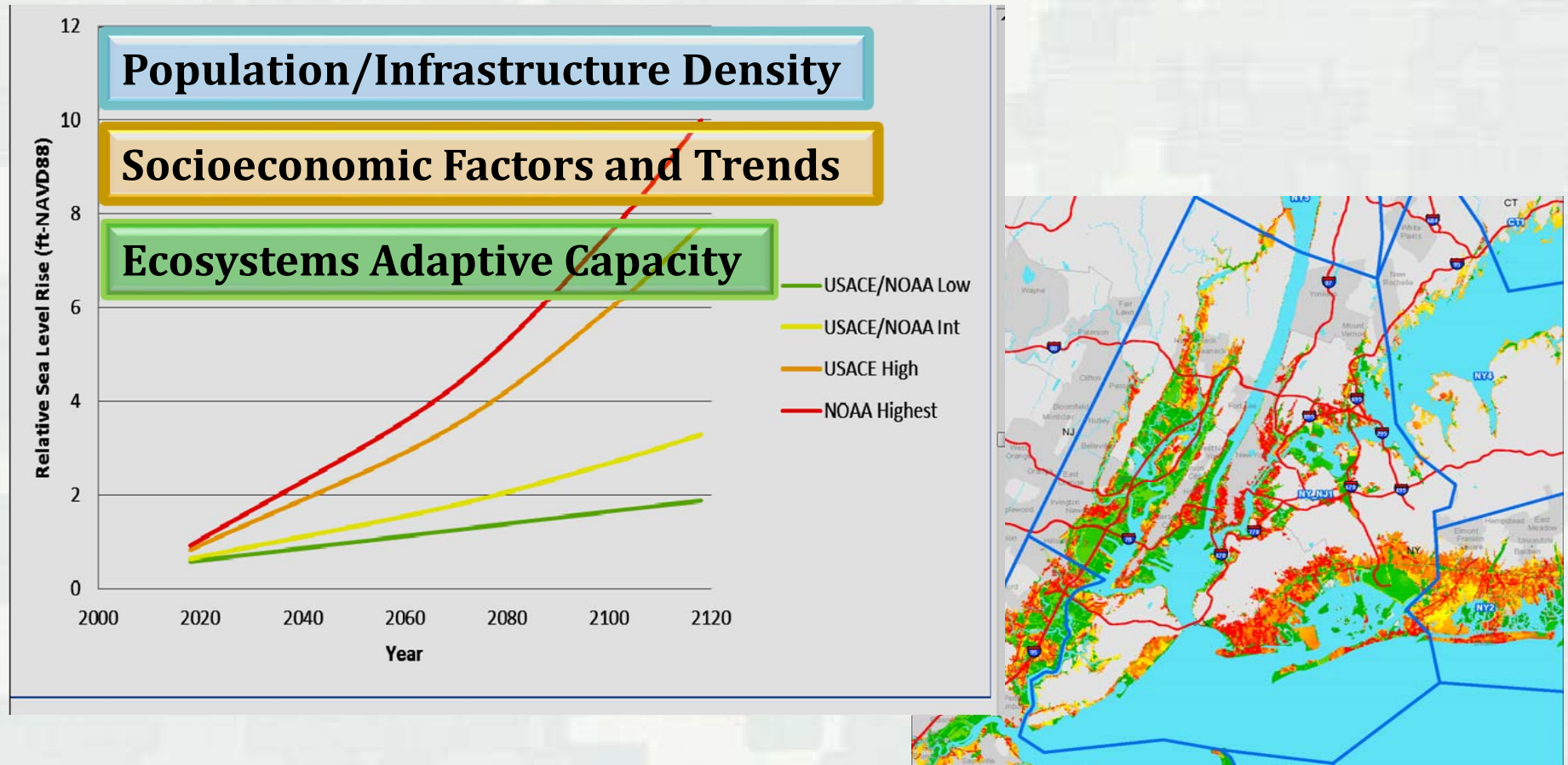
- Managing coastal storm risk is a shared responsibility
- The Framework is:
  - A 9-step process
  - Customizable for any coastal area or watershed and other regions
  - Repeatable at state and local scales
- Who/what is exposed to flood risk?
- Where is the flood risk?
- What are the appropriate strategies and measures to reduce flood risk?
- What is the relative cost of a particular strategy compared to the anticipated risk reduction?
- What data are available to make risk informed decisions?
- What is the residual risk?





# Outcomes: CSRM Framework

## Future Scenarios and Flooding Exposure



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



\* USACE Engineer Circular (EC) 1165-2-212  
\*\* Intergovernmental Panel on Climate Change scenario



# Outcomes: Technical Products

Multiple products, planning tools, and models were developed to assist decision makers as they Implement the Coastal Storm Risk Management Framework

Atlantic Coast x

www.nad.usace.army.mil/CompStudy

### Quick Clicks: North Atlantic Coast Comprehensive Study Report and Related Documents

NACCS Main Report	Physical Depth Damage Summary
Appendix A	Use of Natural and Nature-Based Features
Appendix B	Conceptual Regional Sediment Budget for North Atlantic Division
Appendix C	Planning Reach Mapbook
Appendix D (State appendices)	Numerical Modeling Simulations
Study Synopsis, January 2015	Institutional and Other Barriers Report
NACCS Stakeholder Webinar   Audio file (.mp3 format)	Environmental and Cultural Resources Conditions Report
Press Release	Barrier Island Sea Level Rise Inundation Assessment Report

A full listing of NACCS files can be found in the left column below, under "Report and Products."

### Risk Management Strategies for Coastal Communities

NON-STRUCTURAL	STRUCTURAL	NATURAL & NATURE-BASED FEATURES (NNBF)
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	

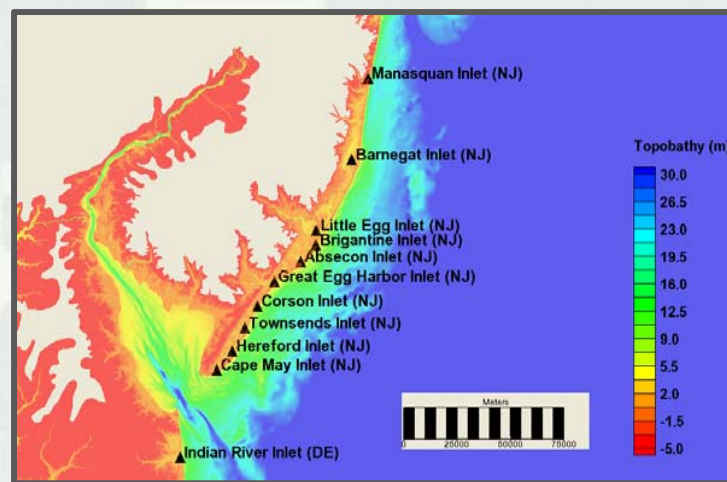
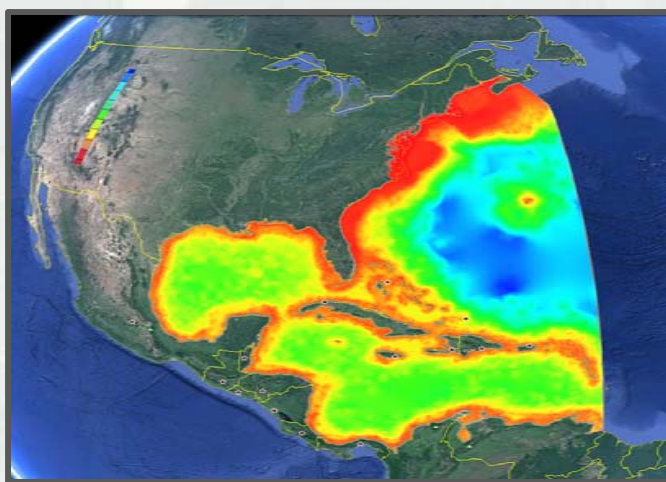
- ACQUISITION & RELOCATION
- BUILDING RETROFIT
- ENHANCED FLOOD WARNING & EVACUATION PLANNING
- LAND USE MANAGEMENT/ZONING & FLOOD INSURANCE
- DEPLOYABLE FLOODWALLS
- FLOODWALLS
- LEVEES
- SEAWALLS
- REVETMENTS
- BULKHEADS
- STORM SURGE BARRIERS
- BEACH RESTORATION
- BEACH RESTORATION & BREAKWATERS
- BEACH RESTORATION & GROINS
- DRAINAGE IMPROVEMENTS
- LIVING SHORELINES
- OVERWASH FANS
- REEFS
- SUBMERGED AQUATIC VEGETATION
- WETLANDS



# Technical Products Supporting the Framework

## ➤ Regional Storm Suite Modeling

- Joint probability of Hurricane Sandy and historical coastal storm forcing parameters for the east coast region from Maine to Virginia as a primary requirement for project performance evaluation
- Focus on storm winds, waves and water levels for both tropical and extra-tropical storm events
- Application of high-resolution numerical models in a tightly integrated modeling system with user friendly interfaces
- Provides for a robust, standardized approach to establishing the risk of coastal communities to future occurrences of storm events





# Technical Products Supporting the Framework

## Natural and Nature-Based Features

### Rockaway Inlet to East Rockaway Inlet - Jamaica Bay General Reformulation



- Evaluate performance during Sandy
- Identify storm resilient features
- Provide tools for benefit evaluation and calculation of resilience
- Integrate nature-based features in coastal risk management systems
- Federal, State, Tribal, and Municipal partners; regional stakeholders; academia; NGO's; international engineering/science community
- Task Force Initiative: Rebuild by Design
- Rockefeller Foundation Initiative: Structures of Coastal Resilience



# Technical Products Supporting the Framework

## ➤ Conceptual Regional Sediment Budget

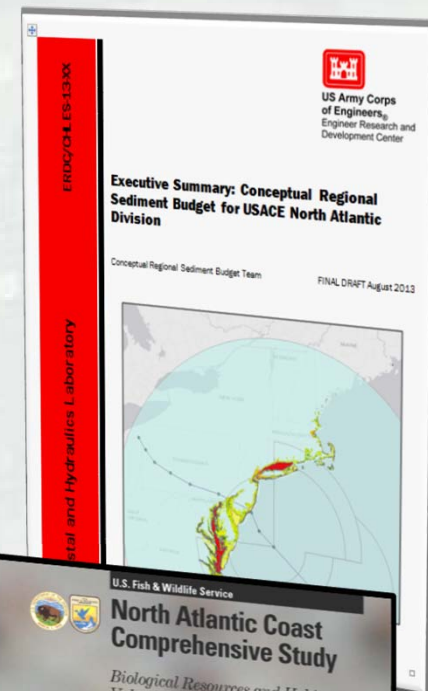
- Patterns and rates of sediment transport
- Engineering activities such as dredging and placement, and **volumetric change for coastal and estuarine regions**
- **Web-based** and identifies opportunities for projects/strategic placements

## ➤ Coastal Geographic Information System Geo-database

- All non-sensitive **data layers** used for the NACCS
- Range from boundary files to inundation mapping

## ➤ US Fish and Wildlife Service

- Planning Aid Report
- Species and Habitat vulnerability

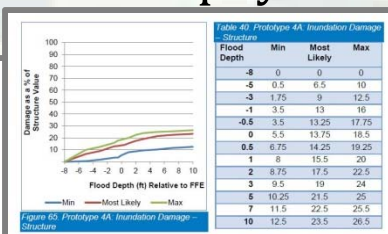
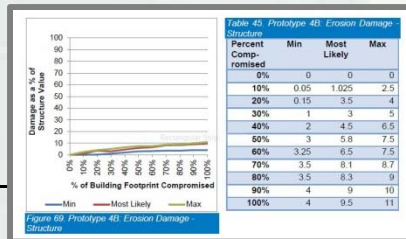




# Technical Products Supporting the Framework

## ➤ Economic Depth-Damage Estimation Tool

- Measurement of **direct physical effects** of Hurricane Sandy and their **economic consequences** to create depth-damage functions to better estimate the effects of coastal storms
- Assessment of **loss of life** from Sandy to modify Corps flood impact model to estimate depth-fatality relationships for coastal storms
- Development of **depth-emergency cost** and **infrastructure damage** relationships and estimation and description of emergency costs incurred
- Estimation of **second and third order effects** (e.g., loss of labor, economic losses from power/fuel shortages, mental and physical health effects)





# Opportunities

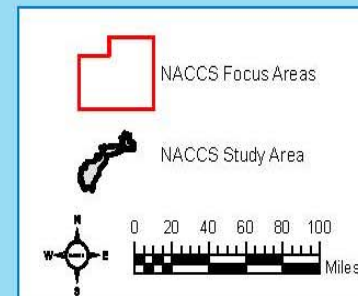
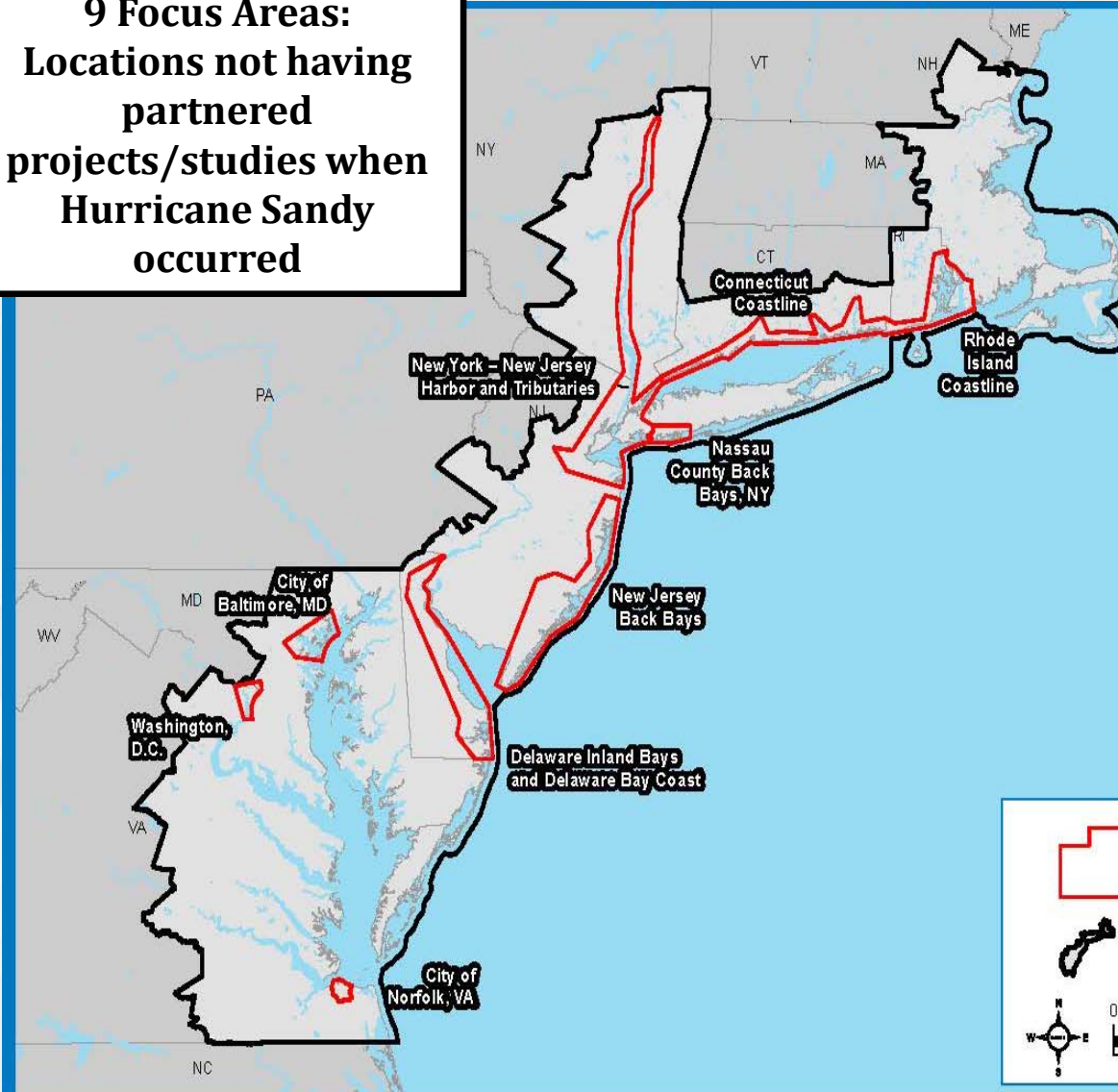
- Mitigate future risk with **improve pre-storm planning**
- Identify acceptable **flood risk at a community** and state scale
- **Prioritize** critical infrastructure
- **Rebuild with redundancy**
- Develop **creative incentives** to promote use of resilience measures
- Utilize a **collaborative regional governance structure**
- Develop **Public-Private Partnerships** for coastal risk management
- Integrate **natural-based features** in coastal risk management systems
- Encourage design **flexibility and adaptive management**



# Opportunities: FY16 PresBud NACCS Focus Areas

**9 Focus Areas:**  
Locations not having  
partnered  
projects/studies when  
Hurricane Sandy  
occurred

1. Rhode Island Coastline
2. Connecticut Coastline
3. **New York - New Jersey Harbor and Tributaries**
4. Nassau County Back Bays, NY
5. **New Jersey Back Bays**
6. Delaware Inland Bays and Delaware Bay Coast
7. City of Baltimore, MD
8. Washington, D.C.
9. **City of Norfolk, VA**



# Opportunities: Coastal Resilience Integration

## 9 Focus Areas Integrated Strategies

**FY16 President's Budget Request: NACCS Focus Areas New Start**  
USACE-Sponsor Feasibility Studies and/or Comprehensive Plans;  
Technical Assistance

USACE-Sponsor  
Design and  
Construction

**NACCS Products:** Geospatial Database; Numerical Modeling of Extreme Water Levels; Economic Depth-Damage Functions; Environmental and Cultural Resources Conditions Report; Conceptual Regional Sediment Budget; Vulnerability, Resilience, Natural and Nature-Based Features Assessment and Metric Development

### Regional Partnerships & Collaboration

Housing and Urban Development (HUD)  
Northeast Regional Ocean Council (NROC)

Sandy Regional Infrastructure  
Resilience Coordination (SRIRC)

Mid-Atlantic Regional Association  
Coastal Ocean Observing System  
(MARACOOS)

Northeastern Regional Association of  
Coastal  
Ocean Observing Systems (NERACOOS)

Department of Interior – NFWF Grants  
Chesapeake Bay Resilience Co-Lead  
Rebuild By Design and more...

### Ongoing USACE Activities

- \*Vulnerability Assessments, Resilience and Climate Change Adaptation Planning
- \*Technical Assistance to States and installations; Public-Private Partnership initiatives
- \*Limited & General Reevaluation Reports
- \*Continuing Authorities Program and Operation & Maintenance activities
- \*Flood Control and Coastal Emergency projects
- \*National Hurricane Program

**Integration of  
Strategic Coastal  
Investments**

**State  
Implementation  
of Ongoing & Planned Risk  
Reduction**

2013

2015

2020

2025



# Climate Resilience: How to Prepare a Region

## A Chesapeake Bay Example

### National Actions

- Chesapeake Bay Agreement Climate Resilience Goal
  - Set interagency goals
  - Prepare interagency and publically vetted strategies
  - Forecast and report with bi-annual Action Plans
- DoD Resilience
  - Coastal installations require same assessment of vulnerability and risk
  - Application of suite of solutions where NNBF may provide resilience to training mission through buffers, preservation of shoreline, etc.
- Federal Agency Implementation of Federal Flood Risk Standard
  - Assist USFWS, GSA, USGS and others
  - Assess vulnerability and risk, apply flood standard to refuges, location of government buildings, assist in data collection, etc.



# Climate Resilience: How to Prepare a Region

## A Chesapeake Bay Example

### State Actions

- MD Silver Jackets Coastal Workshop (State Pilot) 11-12 March 2015
  - Coastal Communities: Planning for Resilience
  - Interagency session participation
- Integrating Riverine Risk
  - Chesapeake Bay Watershed - 2 River Basin Commissions
  - Apply NACCS framework to Susquehanna River as a pilot FY15-16

### Local Actions

- Establish Flood Proofing Teams (Regions, Counties, or Districts) \*
  - Model on USACE National Nonstructural Flood Proofing Committee
  - Utilize Flood Plain Management Services and Planning Assistance to States Programs
  - Example: Lycoming County, PA Nonstructural Plan



\* <http://www.usace.army.mil/Missions/CivilWorks/ProjectPlanning/nfpc.aspx>



# Summary

"The North Atlantic Coast Comprehensive Study is an unprecedented effort by the U.S. Army Corps of Engineers in collaboration with our partners to develop a coastal plan that considers future sea levels and climate change. The report provides a framework for communities that will arm them for the reality of future extreme weather."

Jo-Ellen Darcy  
Assistant Secretary of the Army  
for Civil Works

"Hurricane Sandy brought to light the reality that coastal storms are intensifying and that sea-level and climate change will only heighten the vulnerability of coastal communities. Coastal storm risk management is a shared responsibility, and we believe there should be shared tools used by all decision makers to assess risk and identify solutions. This report provides those tools."

Brig. Gen. Kent D. Savre  
Commanding General  
U.S. Army Corps of Engineers  
North Atlantic Division

