North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk

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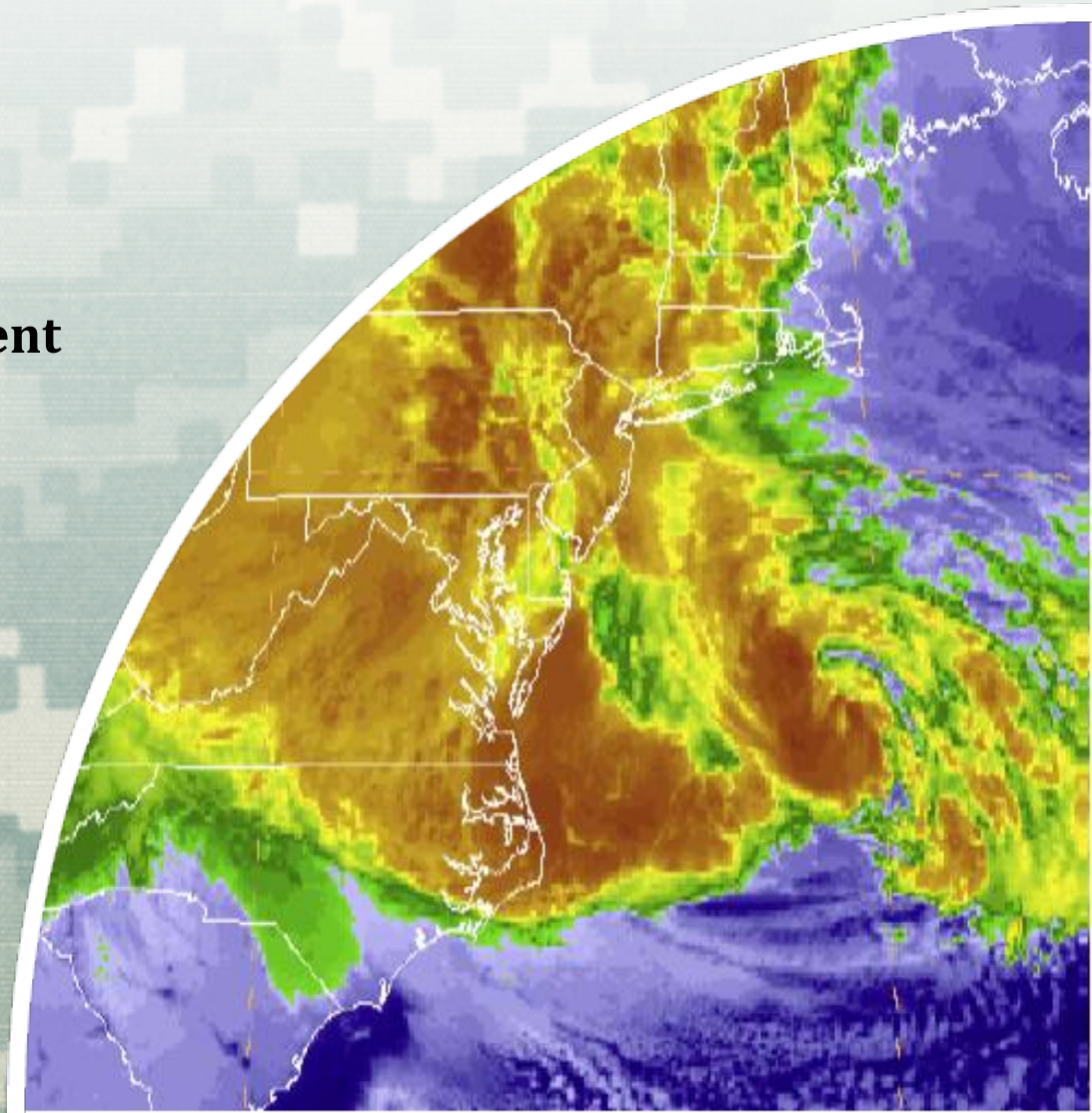

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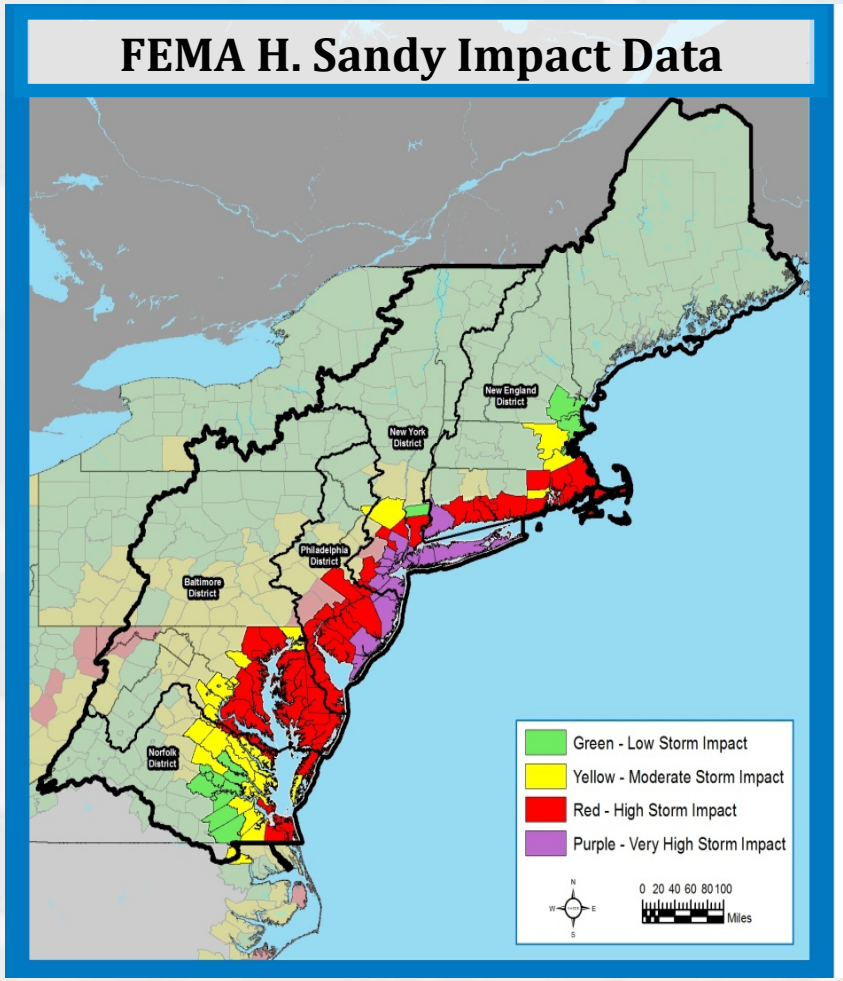
Outline

- Background
- Findings
- Outcomes
  - Coastal Storm Risk Management Framework
  - Technical Products
- Opportunities for Coastal Resilience Integration
  - Chesapeake Bay Example
- Summary

Background:
North Atlantic Coast Comprehensive Study



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…*

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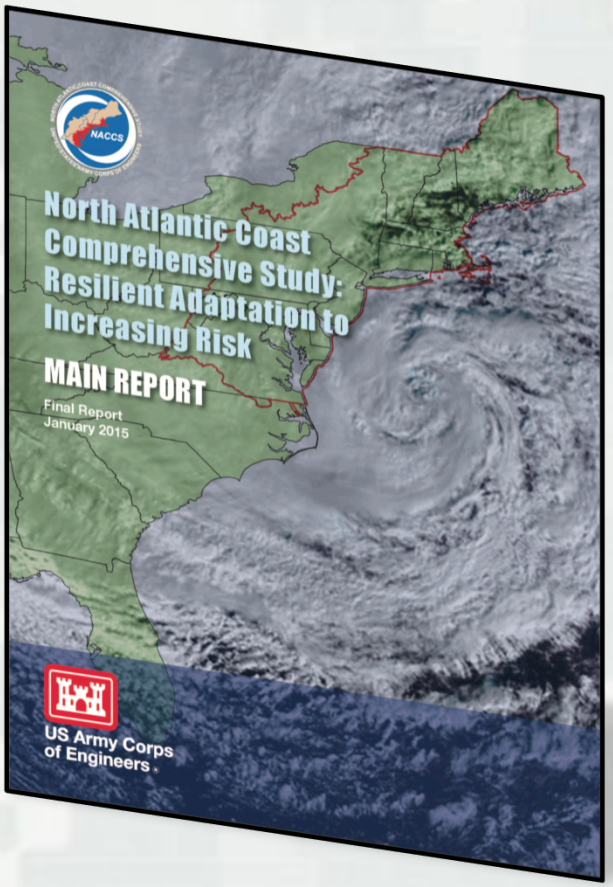
Background: North Atlantic Coast Comprehensive Study



www.nad.usace.army.mil/CompStudy

- 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

Background: 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)

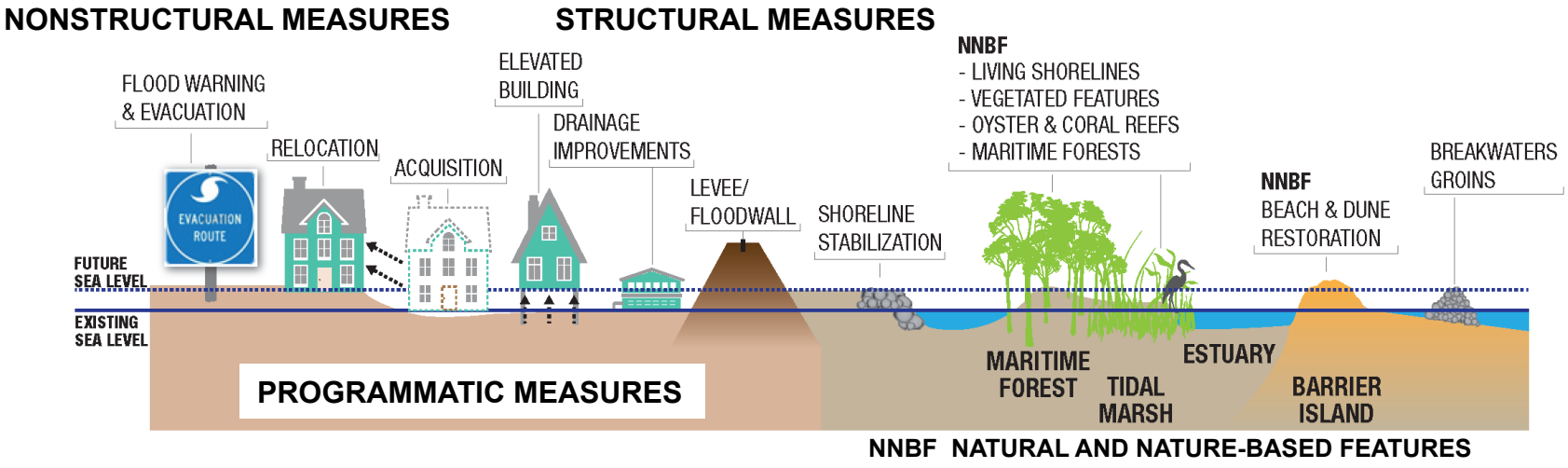
➢ Alignment

- 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

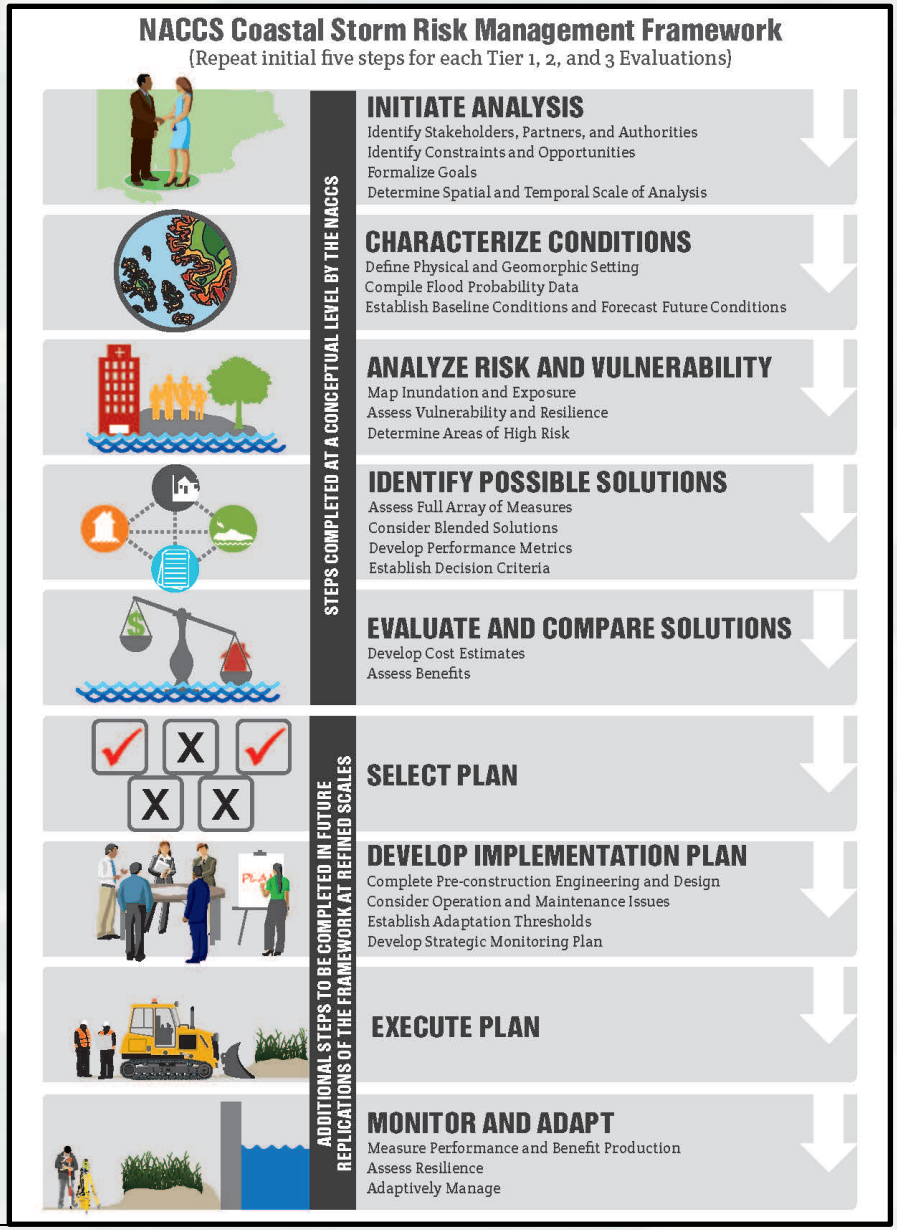
- **Shared responsibility, and shared tools**, between all levels of Government and partnerships
- Rethink approaches to **adapting to risk**
- Resilience and sustainability must consider a **combination and blend** of measures

Full Array of Coastal Storm Risk Management Measures



Outcomes: Coastal Storm Risk Management Framework

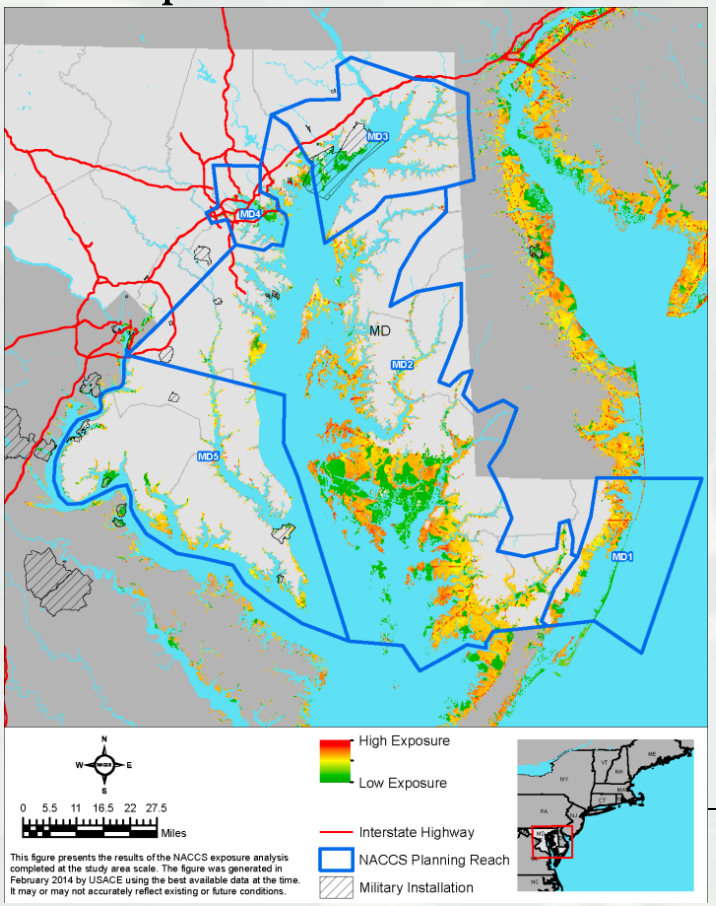
- Managing coastal storm risk is a shared responsibility
- The Framework is:
  - A 9-step process
  - Customizable for any coastal area or watershed and other regions
  - Repeatable at state and local scales
- Who/what is exposed to flood risk?
- Where is the flood risk?
- What are the appropriate strategies 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?



Coastal Storm Risk Management Framework

Flood Exposure & Risk Assessment

- **Coastal Flood Hazard**
  - SLOSH CAT1-4 Maximum of Maximum
  - FEMA DFIRM
  - 10-percent-annual chance



- **Exposure Indices**
  - **Population density and infrastructure** (number of people and infrastructure in communities subject to flooding)
  - **Socioeconomic groups** (populations that may have more difficulty preparing and responding to flooding)
  - **Environmental & Cultural** (critical habitat, wetlands and other areas that maintain resiliency during flooding; key cultural resources subject to flooding)
  - **Composite**

Technical Product: Climate Change

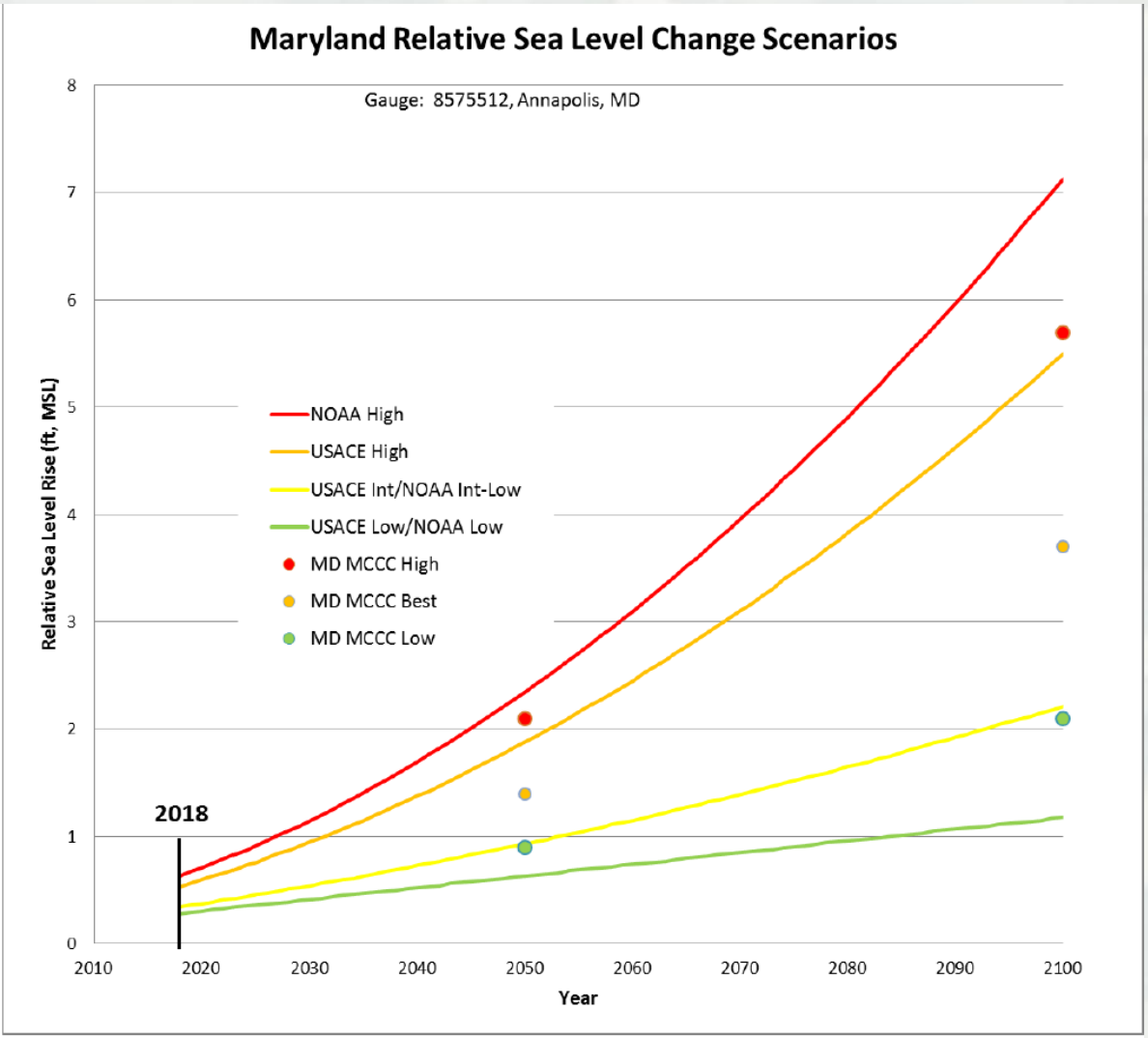


Figure 6. Relative Sea Level Change for Annapolis, MD for USACE and NOAA Scenarios and the State of Maryland.

- Evaluations for:
  - Current (2018)
  - 50-years (2068)
  - 2100

  (Intergovernmental Panel on Climate Change)

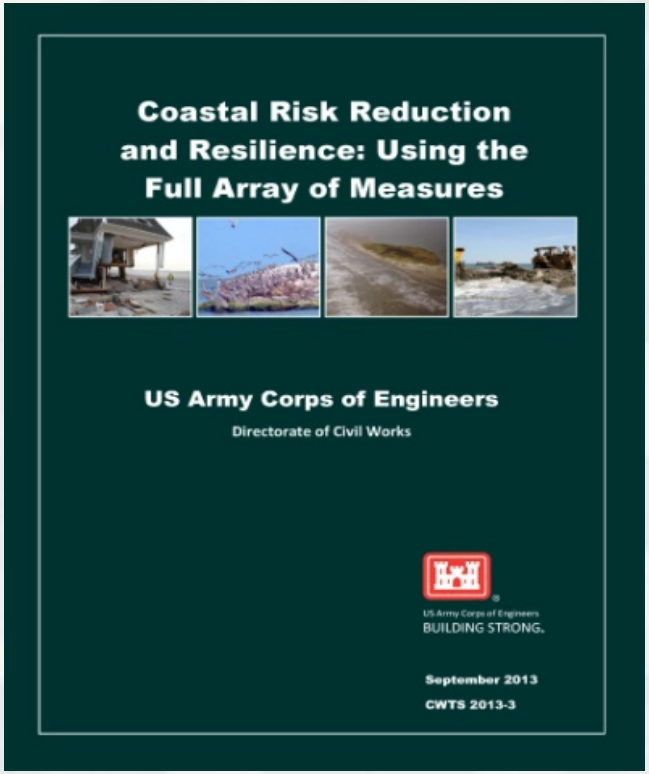
- SLC evaluation: USACE Engineer Circular 1100-2-8162 (low, intermediate, high scenarios) and NOAA's highest

Technical Product: Climate Change

- Evaluated USACE and NOAA relative sea level change scenarios at 26 NOAA WL gage locations across NAD/NACCS study area
  - NACCS Appendix A
- NACCS Flood Exposure and Risk Assessment and comparisons of NACCS and state and local SLC scenarios
  - NACCS Appendix D
- GIS mapping of relative sea level change in 50 and 100 years with projected future development densities
  - NACCS Planning Reach Map Book
- Statistical analysis of historical and future extreme water levels with sea level change
  - ERDC TR-14-7
- Climate change adaptation planning concepts
  - Procedures to Evaluate Sea Level Change: Impacts, Responses, and Adaptation (USACE ETL 1100-2-1)
  - Non-stationarity – the future may be substantially different than the past
  - Uncertainty – climate change and sea level change
    - Consideration of a range of possible future scenarios
    - Precipitation patterns and effects farther inland may result in increasing risk
    - Adaptive management

Technical Products: Array of Measures

- **Structural**
  - Storm surge barriers
  - Levees, breakwaters, shoreline stabilization
  - Natural and Nature-Based Features (e.g., beaches and dunes, living shorelines, wetlands, oyster reefs, SAV restoration)
- **Non-Structural** (e.g., floodproofing, acquisition and relocation, flood warning, etc.)



- **Programmatic** (e.g., floodplain management, land use planning, State/municipal policy, natural resources, surface water management, education, flood insurance programs, etc.)

Technical Products: Management Strategies

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

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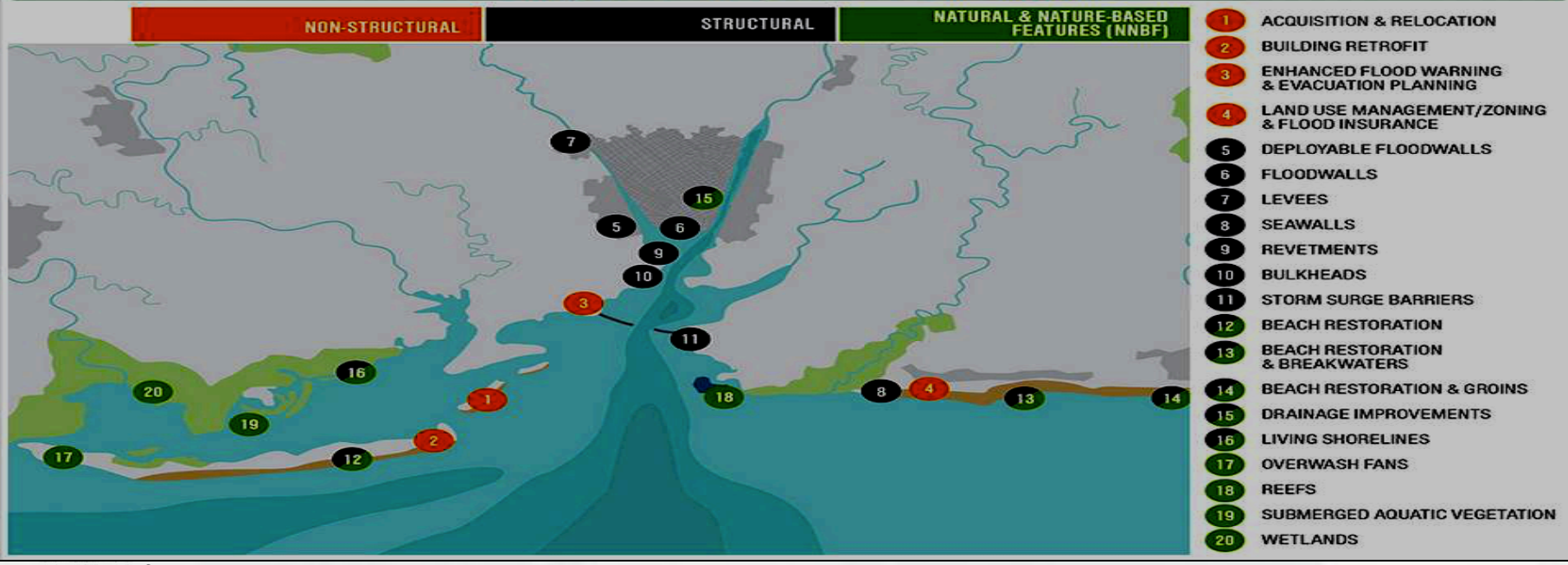
www.nad.usace.army.mil/CompStudy

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

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



Technical Products: Sediment, GIS & Condition Reports

➢ Conceptual Regional Sediment Budget

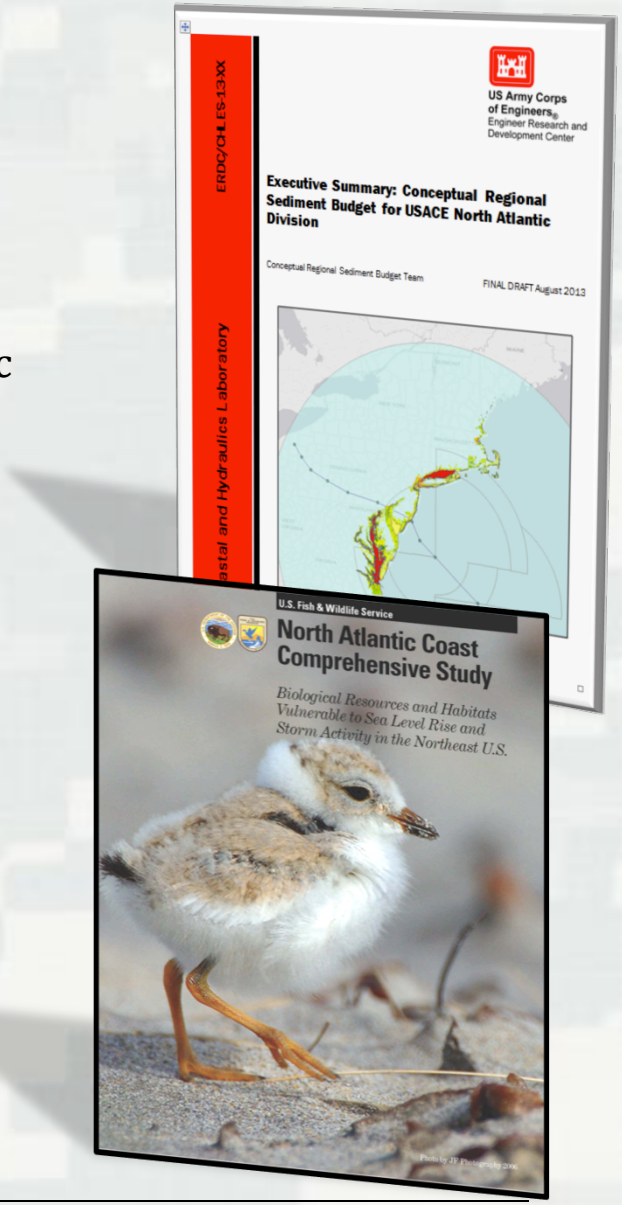
- Patterns and rates of sediment transport
- Engineering activities such as dredging and placement, and volumetric change for coastal and estuarine regions
- Web-based and identifies opportunities for projects/strategic placements

➢ Coastal Geographic Information System Geo-database

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

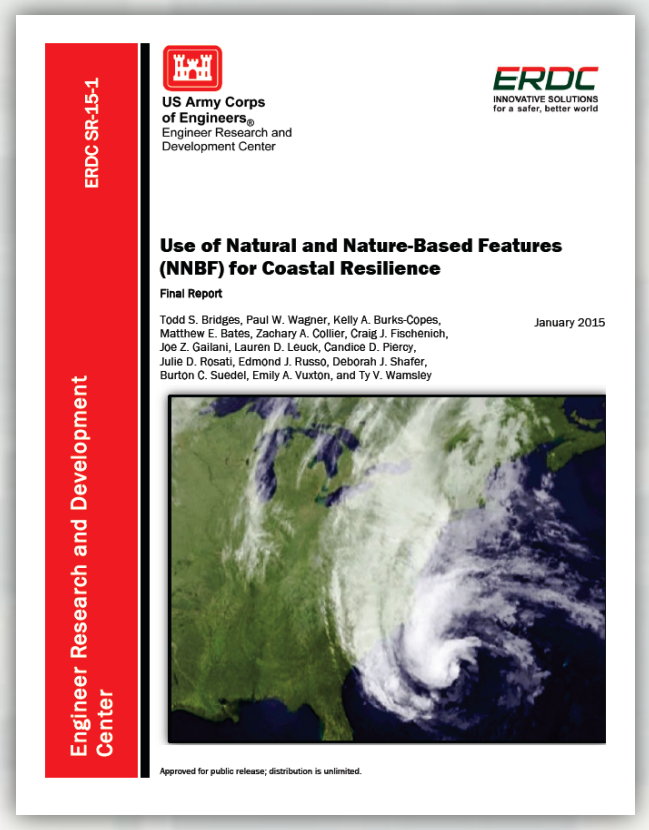
➢Condition Reports

- Species and habitat vulnerability
- Coastal Resources Management Guide
- State-by-State Appendices



Technical Products

- Natural and Nature-Based Features (NNBF)
  - Characterization
  - Data Integration and Metrics for NNBFs
  - Evaluation and Case Studies
  - Policy Implications and Path Forward
- Get the entire report (480 pages):
  - www.nad.usace.army/CompStudy and/or
  - www.EngineeringWithNature.org



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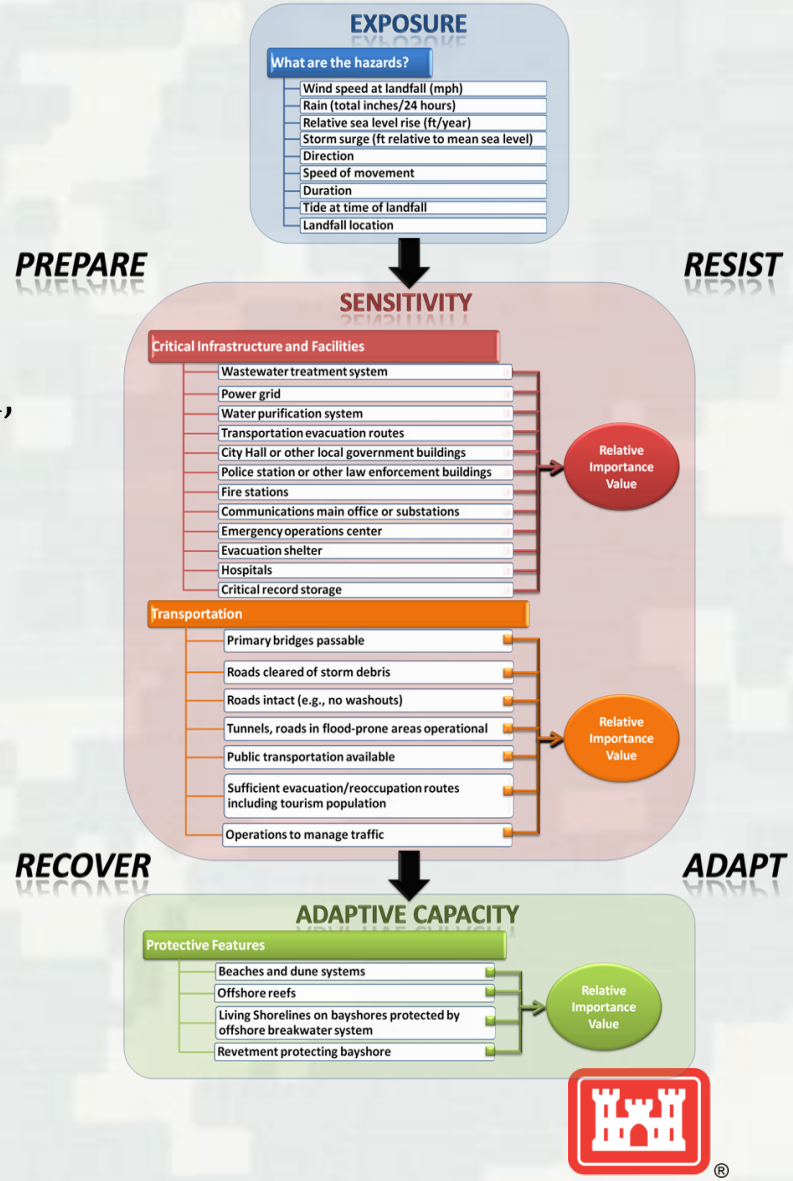
Technical Products: Community Resilience

Capturing a Community's Sense of Vulnerability

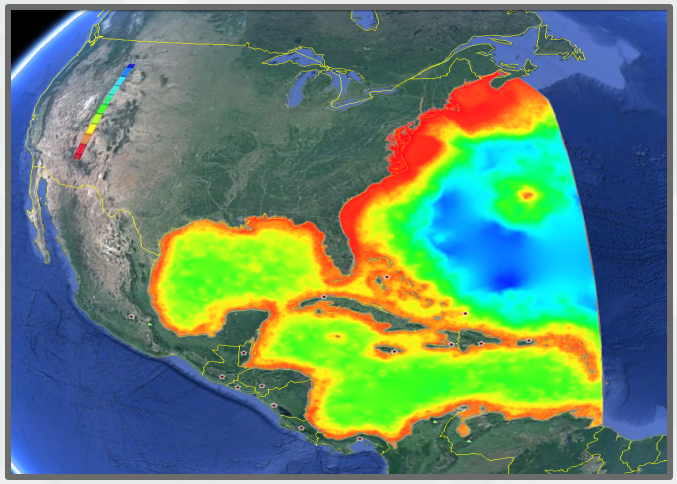
- **Community resilience** is the capability to **anticipate** risk, **limit** impact, and **bounce back** rapidly through survival, adaptability, evolution, and growth in the face of turbulent change
- **Self-Assessment Steps**:
  1. Define spatial and temporal boundaries
  2. Identify benchmark and future storms
  3. Identify critical infrastructure and facilities and a recovery goal for each
  4. Identify transportation issues
  5. Identify protective features
  6. Calculate the overall community resilience rating

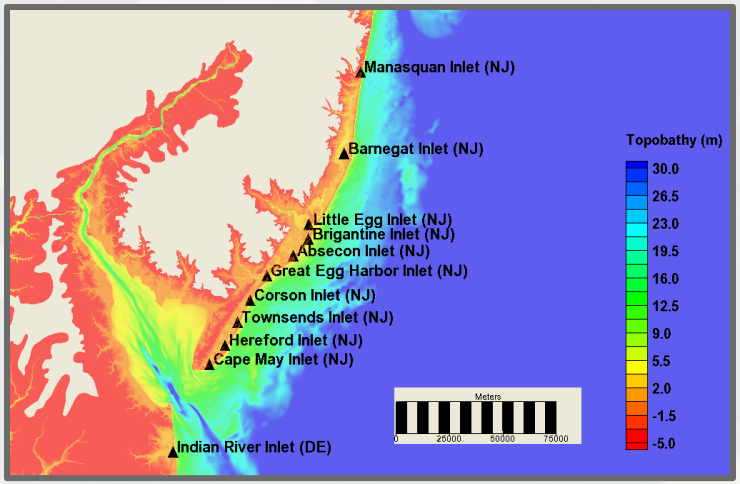


Technical Product: Modeling

➢ 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





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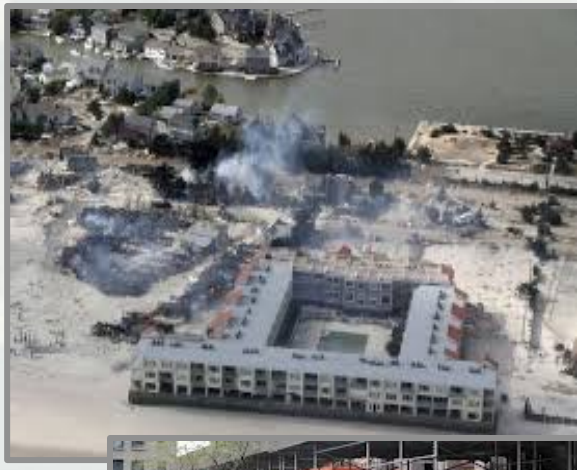
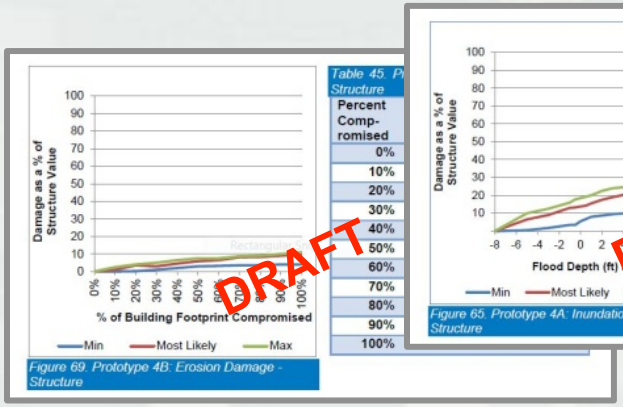
Technical Product: Economic Analyses

➢ Economics

- 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 of power/ fuel shortages, mental and physical health effects)





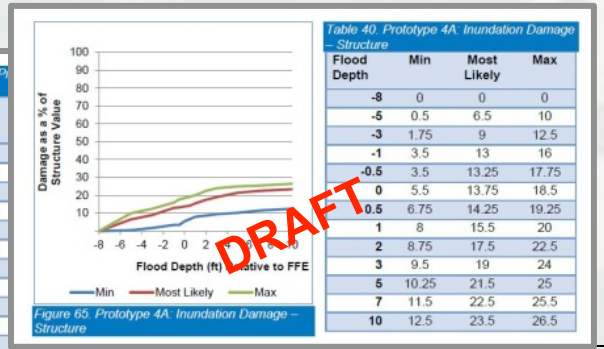


Table 40. Prototype 4A: Inundation Damage – Structure

Flood Depth	Min	Most Likely	Max
-8	0	0	0
-5	0.5	6.5	10
-3	1.75	9	12.5
-1	3.5	13	16
-0.5	3.5	13.25	17.75
0	5.5	13.75	18.5
0.5	6.75	14.25	19.25
1	8	15.5	20
2	8.75	17.5	22.5
3	9.5	19	24
5	10.25	21.5	25
7	11.5	22.5	25.5
10	12.5	23.5	26.5

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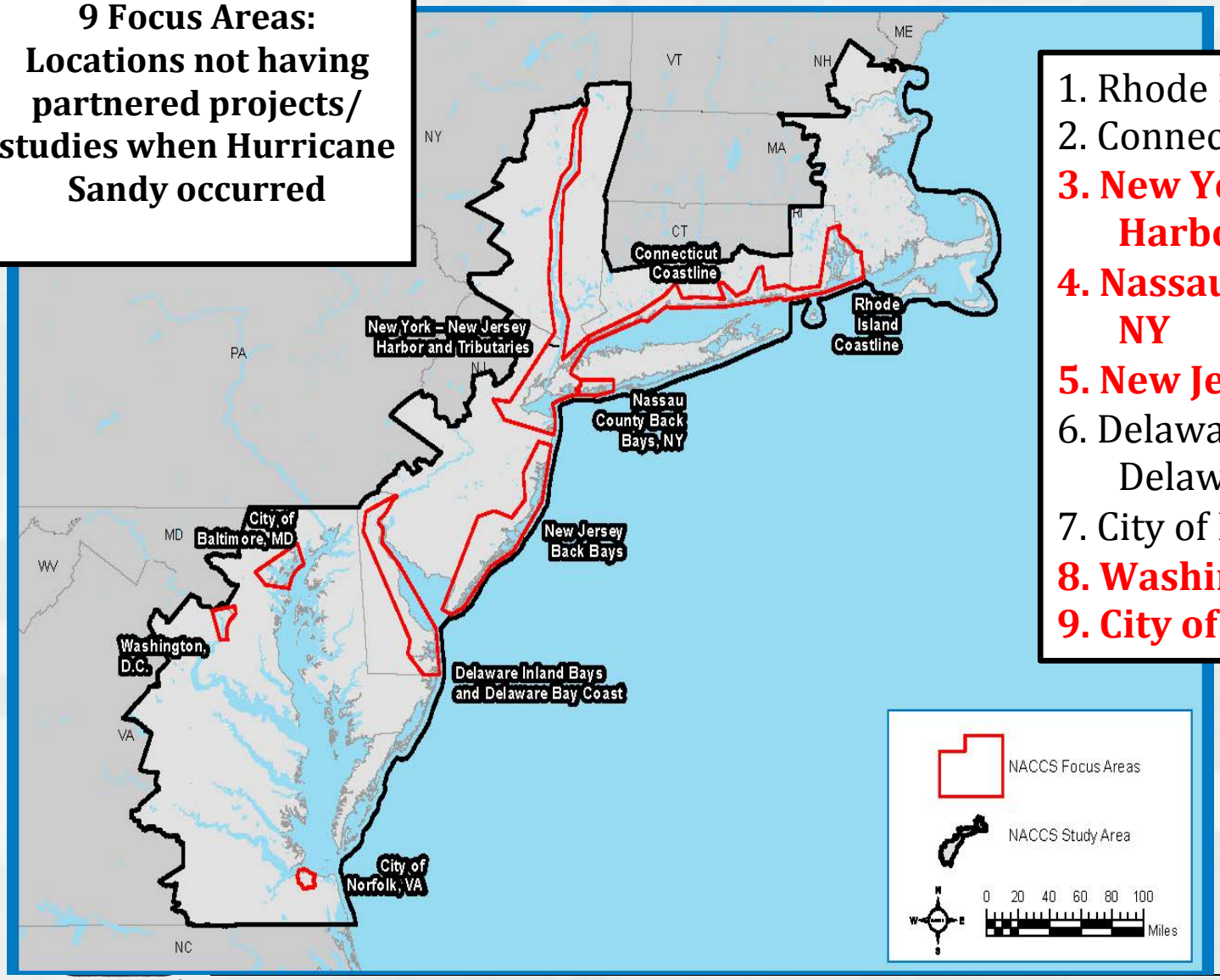
Opportunities for Coastal Resilience Integration

- 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 for Coastal Resilience Integration

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 for 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;

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

Integration of Strategic Coastal Investments

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

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…**

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g & Planned Risk

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2013 2015 2020 2025

Opportunities for Coastal Resilience Integration

A Chesapeake Bay Example

National Actions

- Chesapeake Bay Agreement Climate Resilience Goal
  - Prepare interagency and publically vetted strategies
  - Forecast and report with bi-annual Action Plans

- DoD Resilience
  - Assess coastal installations vulnerability and risk
  - Apply suite of solutions to 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.

Opportunities for Coastal Resilience Integration

A Chesapeake Bay Example

State Actions

- MD Silver Jackets Interagency Coastal Workshop (March 2015)

- Integrating Riverine Risk
  - Chesapeake Bay Watershed - 2 River Basin Commissions
  - Apply NACCS framework to Susquehanna River as a pilot FY16

Local Actions

- Establish Local Flood Proofing Teams
  - Model on USACE National Nonstructural Flood Proofing Committee
  - Utilize USACE Flood Plain Management Services and Planning Assistance to States Programs

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

Summary

"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