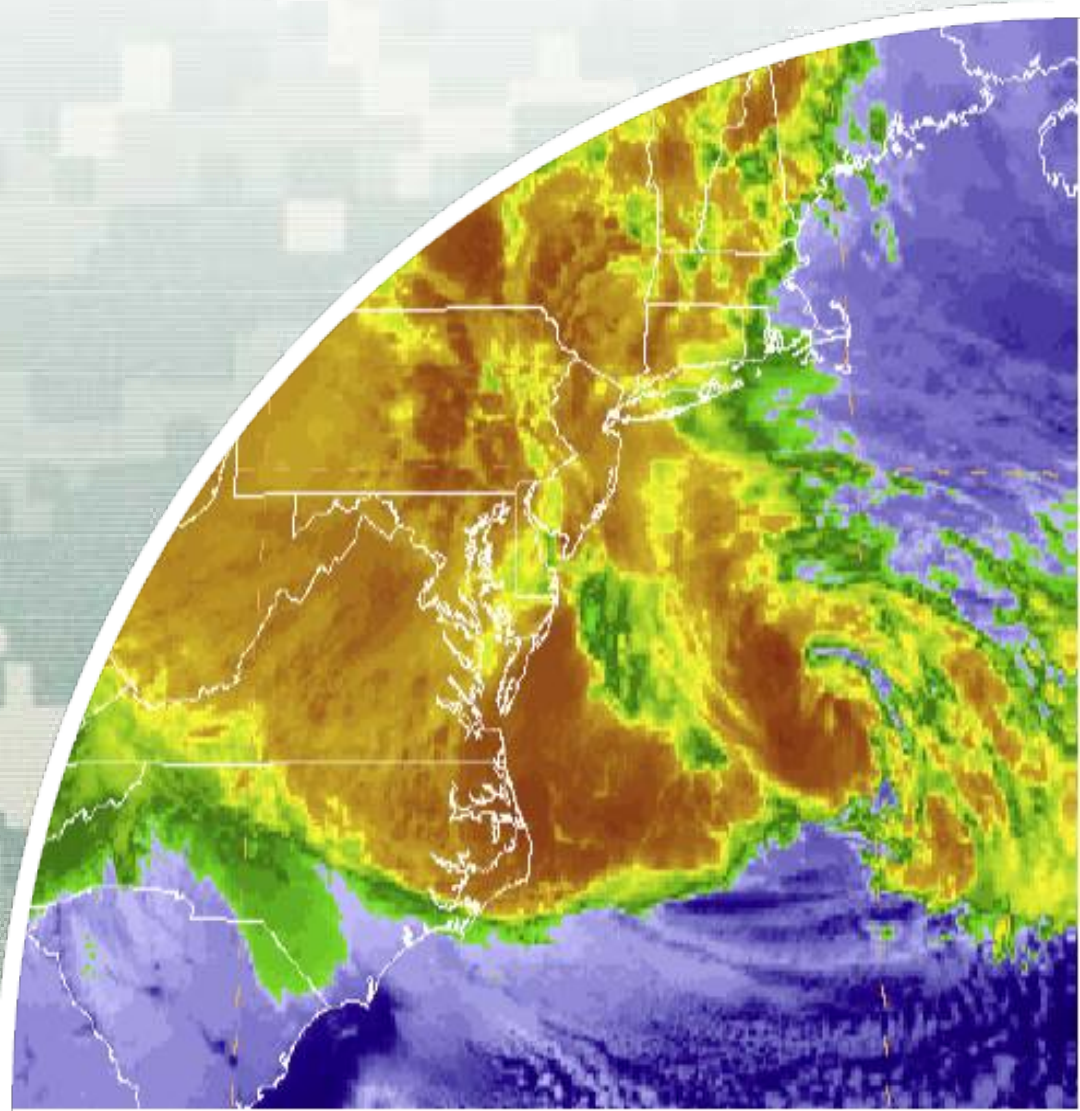


North Atlantic Coast Comprehensive Study

Draft Analyses Webinar: Risk, Exposure, and Vulnerability

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

4 April 2014



Speakers

- Amy Guise
Chief, Planning Division, Baltimore District
Chief, North Atlantic Coast Comprehensive Study
(NACCS) Command Center
- Dave Robbins
Project Manager, NACCS
- Julie Rosati
U.S. Army Engineer Research & Development
Center (ERDC)
Natural and Nature-Based Features (NNBF)
Team, NACCS



NACCS Background

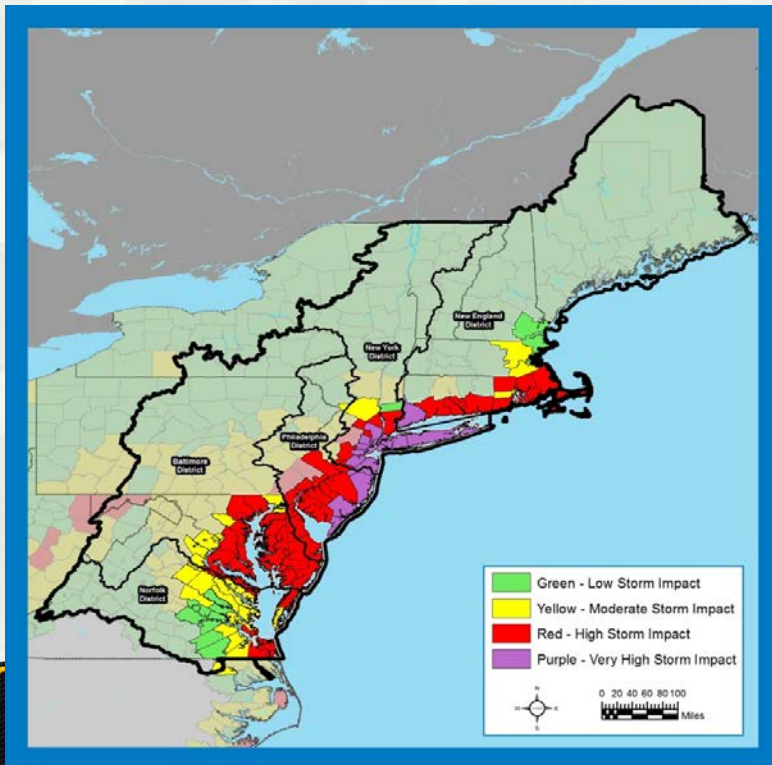
- ❑ Hurricane/Post-Tropical Cyclone Sandy moved to the U.S. Atlantic Ocean coastline 22-29 October 2012
- ❑ Affected entire U.S. east coast: 24 States from Florida to Maine; New Jersey to Michigan and Wisconsin
- ❑ Areas of extensive damage from coastal flooding: New Jersey, New York, Connecticut
- ❑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



NACCS 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 January 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



Technical Teams

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



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Products

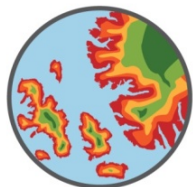
- ❑ Coastal Framework
 - Regional scale
 - Collaborative
 - Opportunities by region/state
 - Identify **range of potential solutions** and parametric costs by region/state
 - Identify activities warranting additional analysis and social/institutional barriers
- ❑ **Not a Decision Document**
 - No NEPA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



NACCS Framework

COASTAL FLOOD RISK, EXPOSURE, AND VULNERABILITY

Compile Flood Probability Data



Exposure and Vulnerability Assessments



Identify High Vulnerability Areas



COASTAL STORM RISK REDUCTION MANAGEMENT MEASURES

Identify Risk Management Measures



Categorize Measures by Shoreline Type



Develop Generic Designs and Parametric Cost Estimates



DRAFT COASTAL RISK MANAGEMENT FRAMEWORK



TIER 1 – REGIONAL SCALE ASSESSMENT
Measures Applied According to Shoreline Type

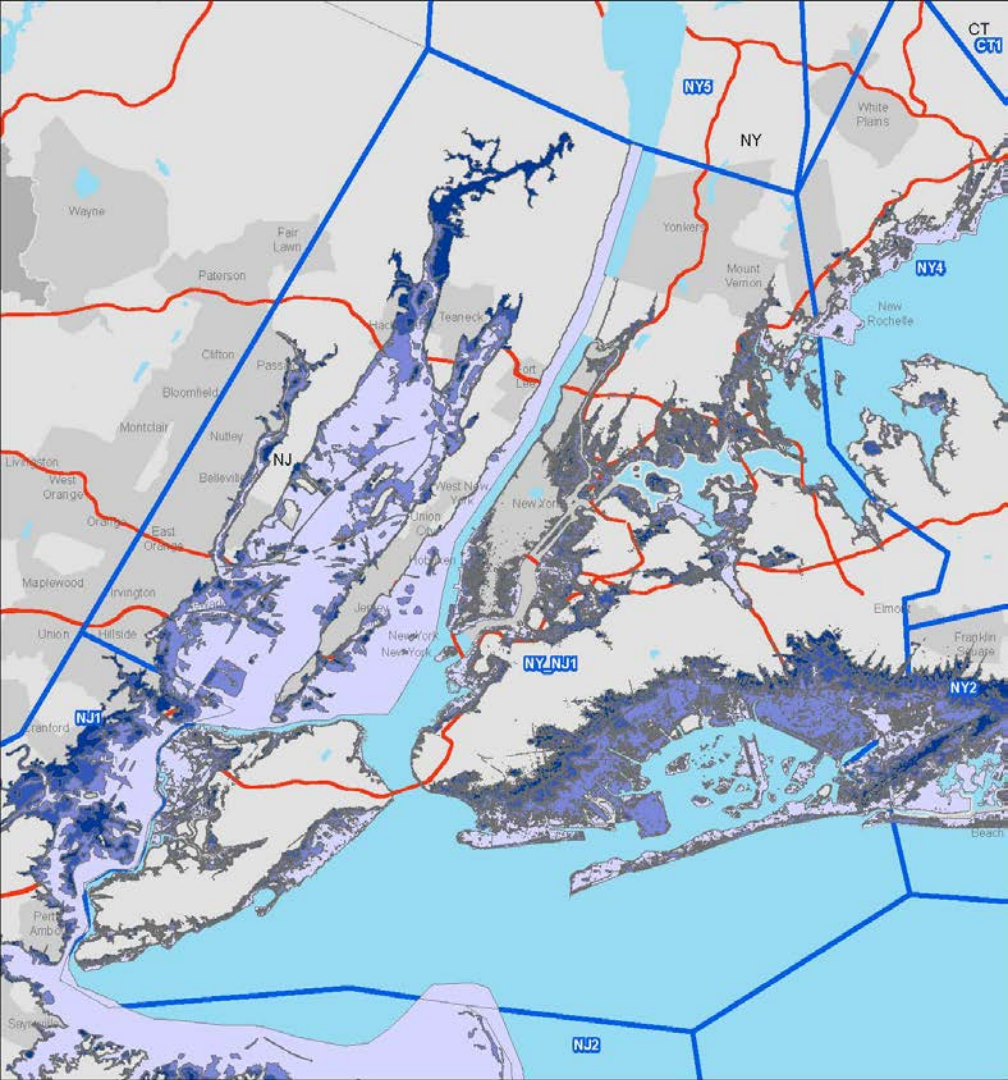


TIER 2 – LOCAL SCALE ASSESSMENT
Incorporates Existing and Planned Activities
Considers Combinations of Measures

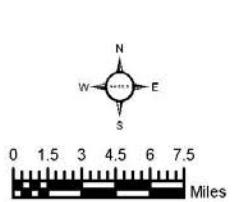
INTERAGENCY COLLABORATION AND PUBLIC OUTREACH

- **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?

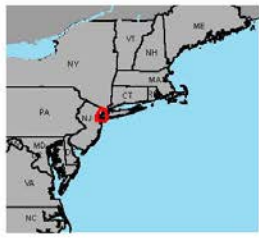




Extent of Inundation

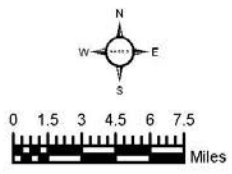


- Cat 1 Maximum Inundation Extent
- Cat 2 Maximum Inundation Extent
- Cat 3 Maximum Inundation Extent
- Cat 4 Maximum Inundation Extent
- NACCS Planning Reaches
- Interstate Highways
- Cities

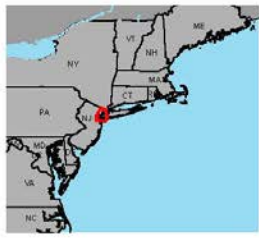


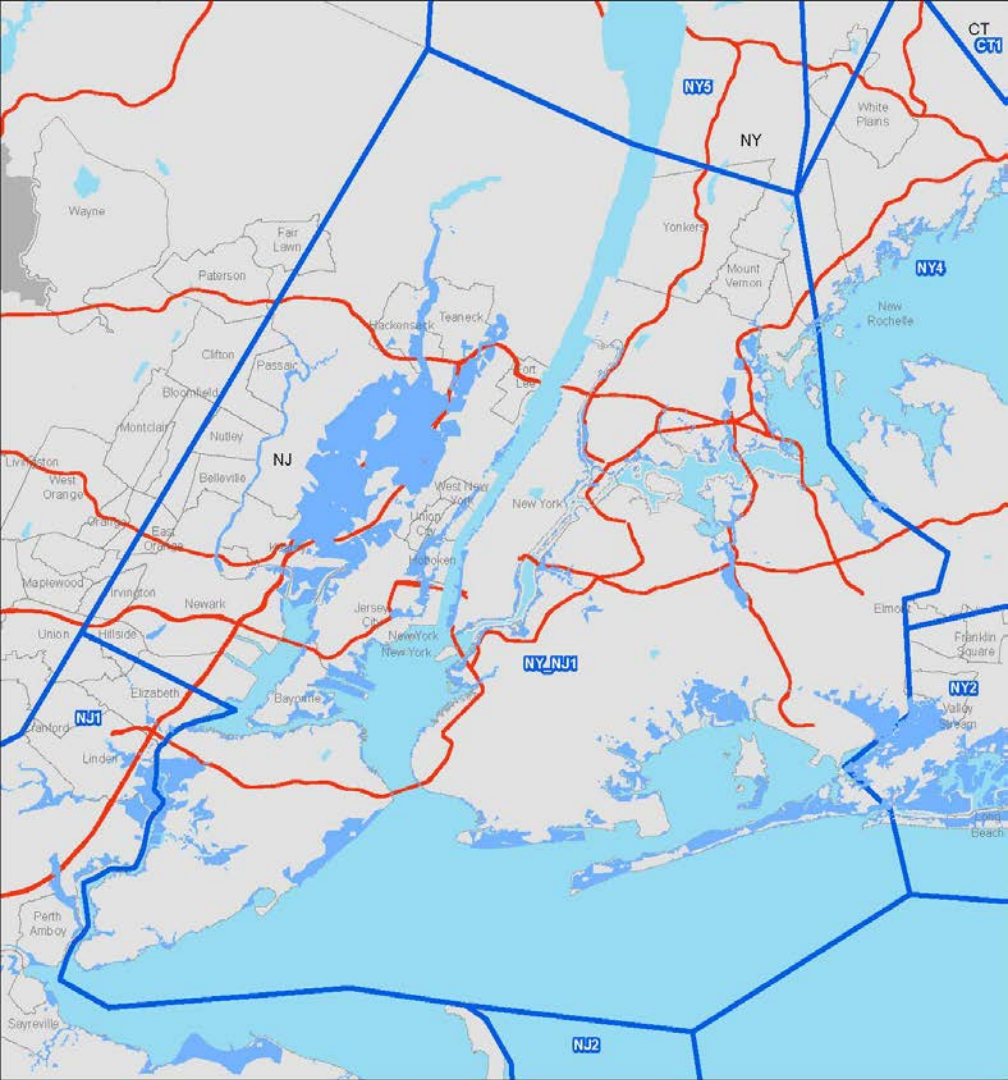


Extent of Inundation

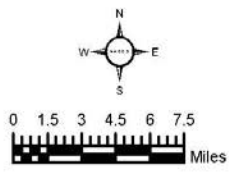


- 100yr +3ft Water Surface
- FEMA 100yr Water Surface
- NACCS Planning Reaches
- Interstate Highways
- Cities

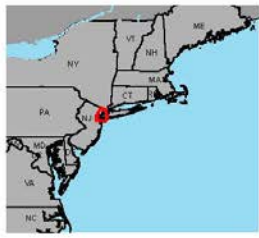




Extent of Inundation



- 10yr_water_surface
- NACCS Planning Reaches
- Interstate Highways
- Cities



Exposure Assessment

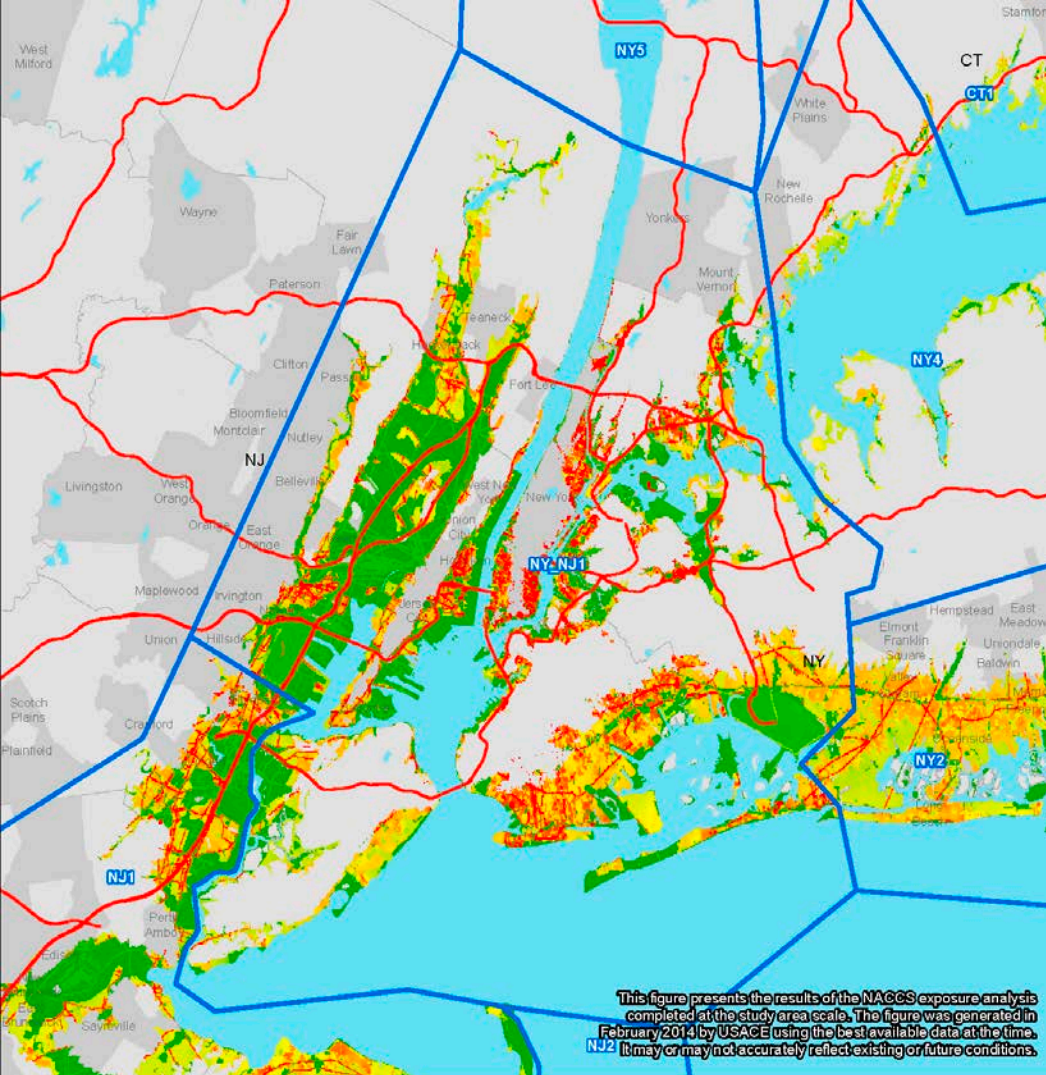
■ Exposure Indices

- **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)

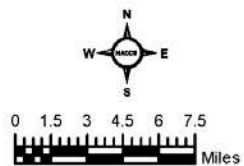
■ Mapping

- 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



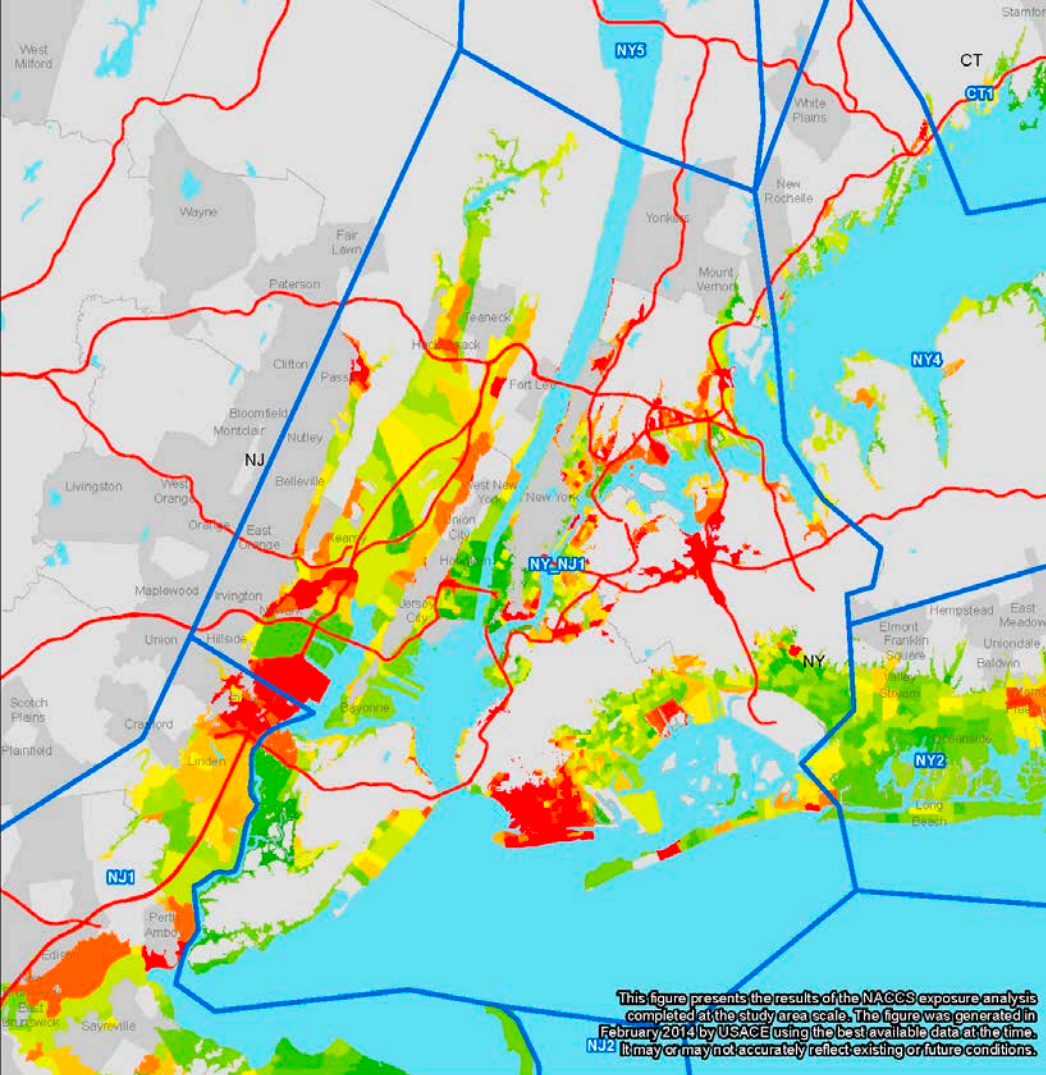


Population & Infrastructure Exposure

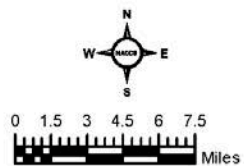


- High Exposure
- Low Exposure
- Cities
- Interstate Highways
- NACCS Planning Reaches



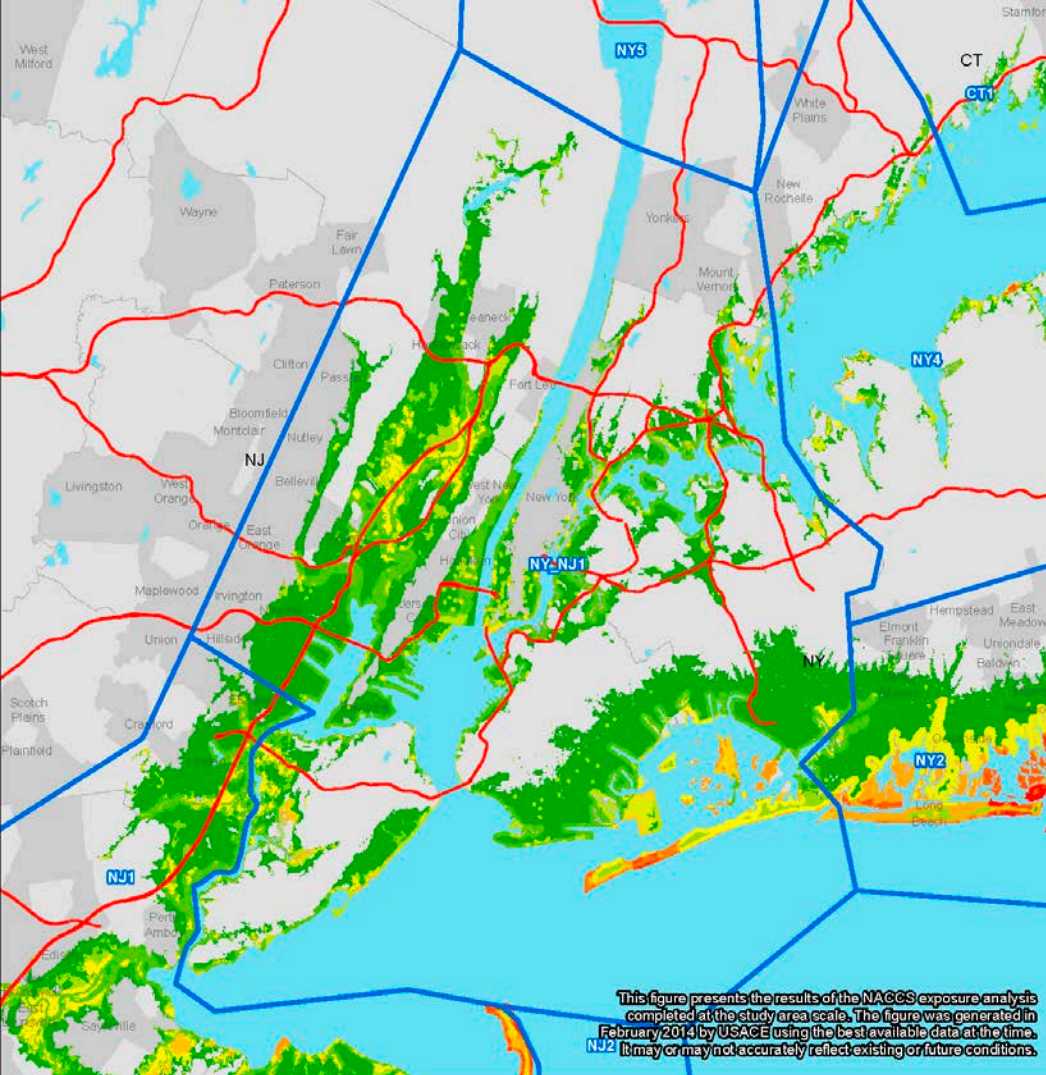


Social Exposure



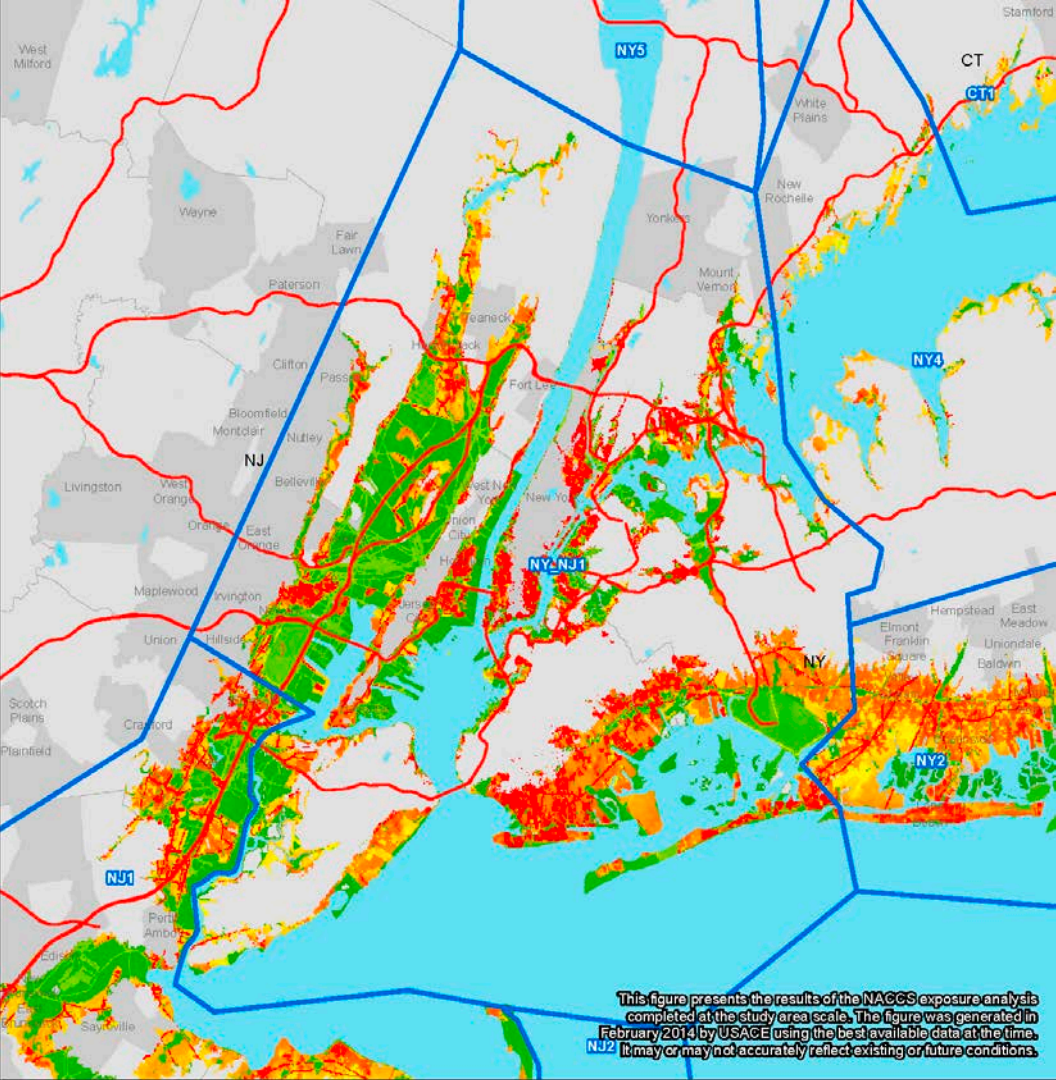
- High Exposure
- Low Exposure
- Cities
- Interstate Highways
- NACCs Planning Reaches



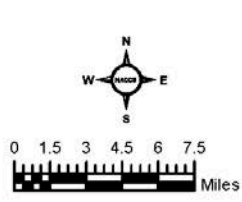


Environmental/ Cultural Exposure





Composite Exposure



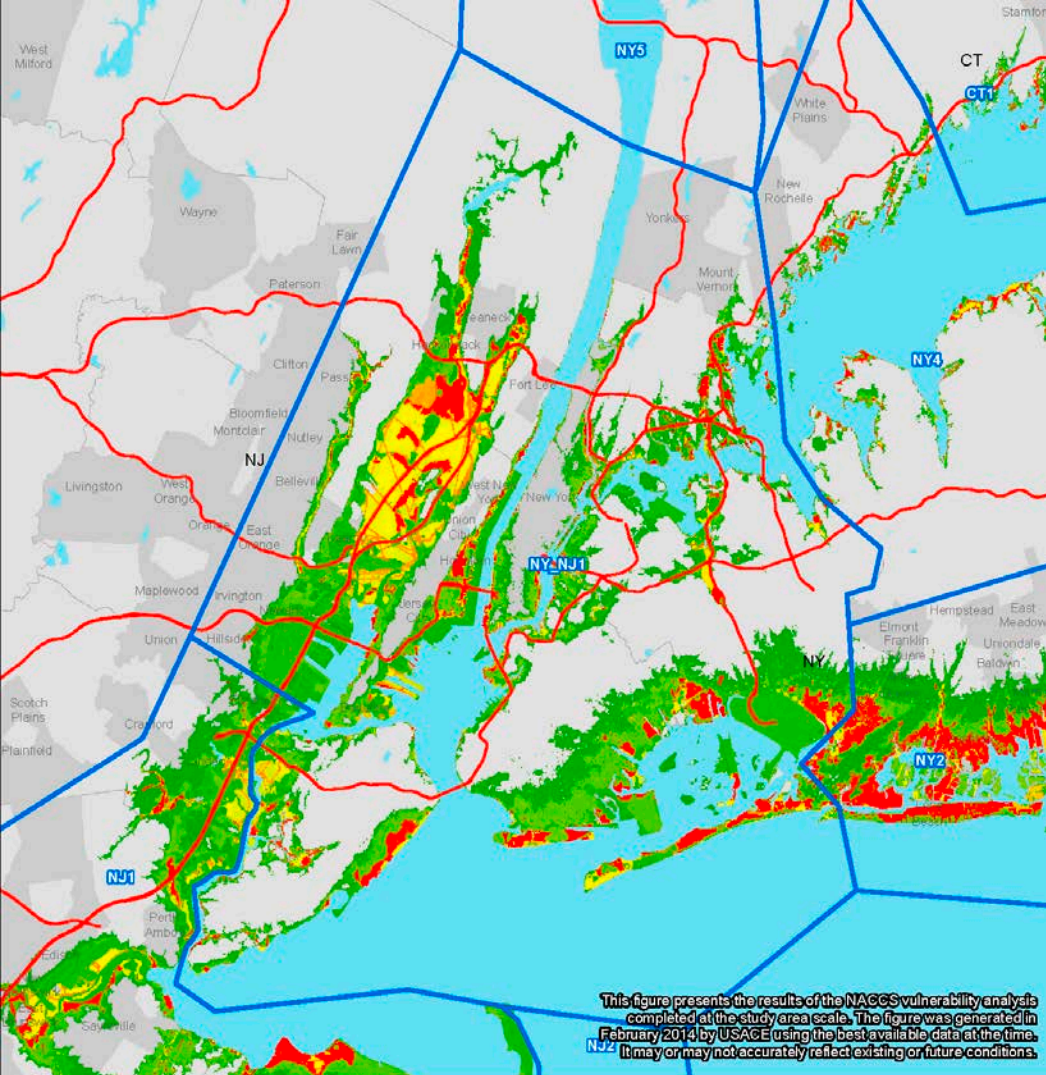
- High Exposure
- Low Exposure
- Cities
- Interstate Highways
- NACCS Planning Reaches



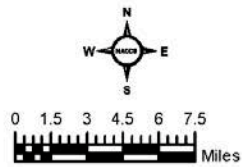
Vulnerability Assessment

- 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

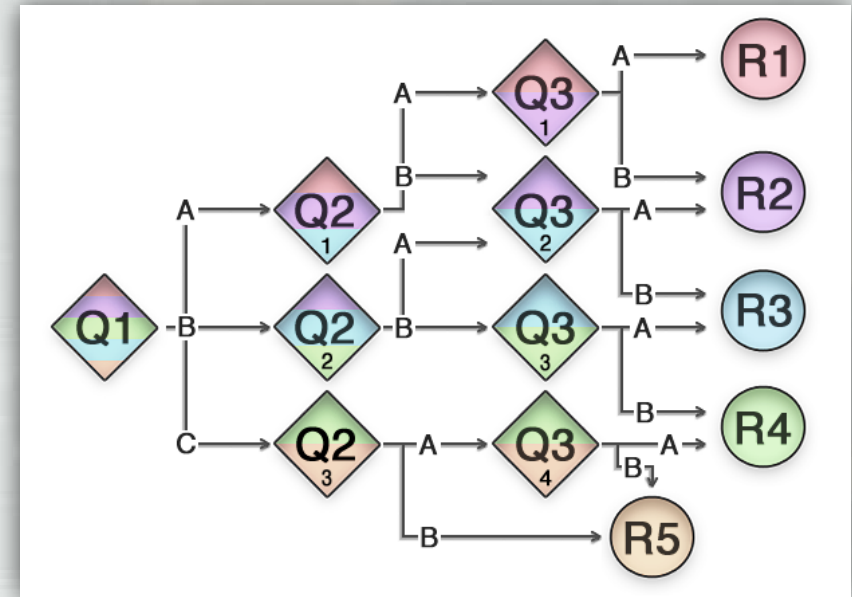


-  High Vulnerability
-  Low Vulnerability
-  Cities
-  Interstate Highways
-  NACCS Planning Reaches



Capturing the Community's Perspective of System Vulnerability

- Develop a “questioning tree” that facilitates the development of user-valued weightings of valued system functions.
- Engage the NACCS team and Agency Subject Matter Experts and guide them through the weightings development.
- Engage the community and capture the range of values associated with the various vulnerability metrics so that we can inform the development of a vulnerability framework at the community scale.



Resilience

- How can we **quantify resilience** of an integrated coastal system (ICS)?
Incorporate:
 - Natural and Nature-Based Features (NNBF)
 - Engineering Projects
 - Community Values
- What are the **best practices** for assessing, operating and maintaining a resilient coastal system?



Quantifying Resilience in Integrated Coastal Systems

Julie Rosati, Martin Schultz, Ernie Smith
U.S. Army Engineer Research & Development Center
Coastal & Hydraulics Laboratory

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Resilience The ability of a system to retain, recover, and adapt to achieve functional performance under the stress of disturbances.

Assessing Resilience Analyzing information to make decisions regarding the planning, design, construction, and management of integrated coastal systems so that the performance goals and objectives of that system can be achieved most cost-effectively.

Managing Resilience Influencing system response by planning and preparing for adverse events, implementing maintenance and recovery plans, and adapting new functions specifically conditioned on the disturbance.

A Bayesian network illustrates how the resilience of a system can be calculated based on the probability of a hazard, the physical response of the system, integrated system response as it influences the functional performance, and the natural/anthropogenic capacity of the system to recover to meet the functional objective within the required time period.

- Hazard: coastal storms, and wind.
- Physical response of the system: total water level, waves, currents, hazardous currents, wind, and waves affecting navigability; total water level as it affects bridge clearances, wharf access, etc.
- Functional performance: reduction in channel depth through shoaling; hazardous currents, wind, and waves affecting navigability; total water level as it affects bridge clearances, wharf access, etc.
- Robustness objective: required functionality of the coastal system.
- Rapidity objective: time period allowed for recovery of the coastal system.

The figure shows a conceptual example of a barrier island system that incorporates engineering projects, environmental restoration, and community involvement.

Operating and Maintaining this Integrated Coastal System such that it would increase in resiliency would include:

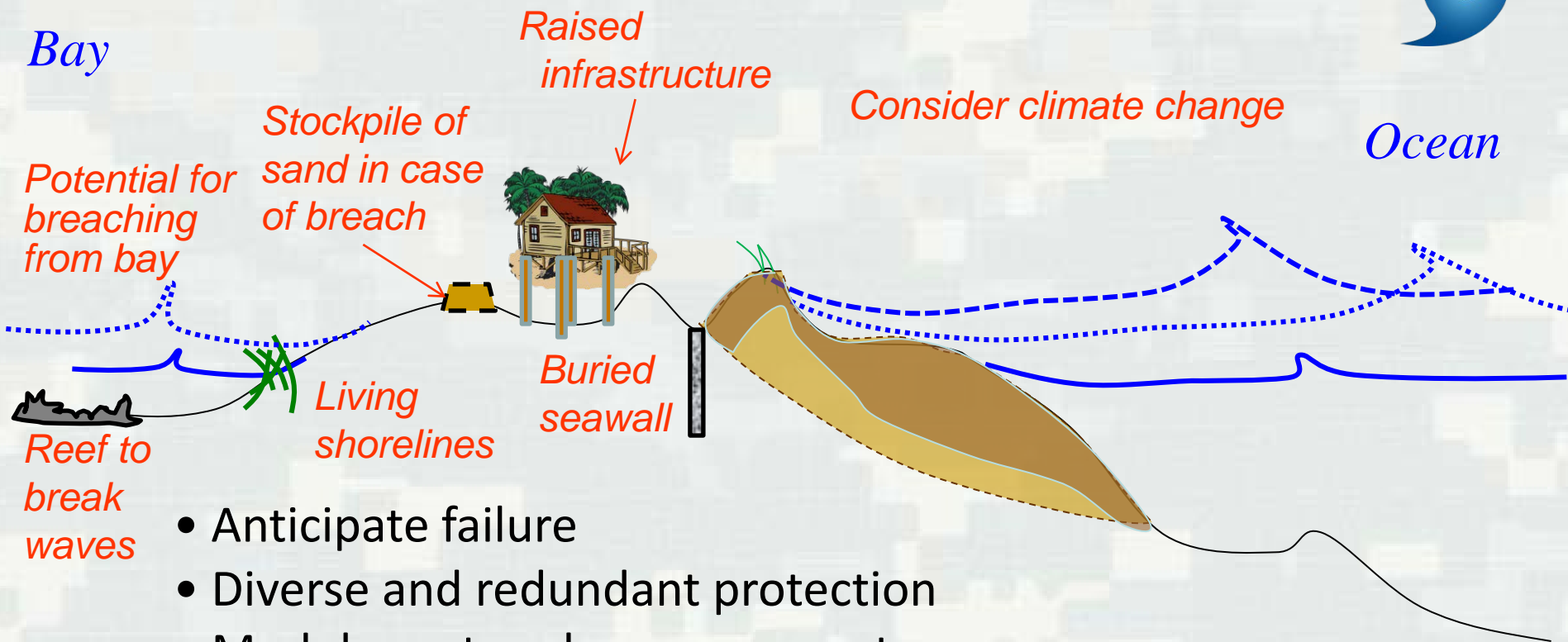
- Anticipating the "weak links" in the system and developing strategies to rapidly address and mitigate damage and/or failure.
- Providing diverse and redundant protective such that the functioning portion of the system does not depend on any single component.
- Ensuring that the system includes modular networks such that if one state, and natural levels such that the community accurately understands their risks and can engage to increase their resiliency.
- Providing readily-available information for decision-making at local, state, and national levels such that the community accurately understands their risks and can engage to increase their resiliency.

Key

- Shoaling: caused in part by beach erosion
- Channel depth
- Wave structure
- Consider dune change
- Living structures
- Subsidence
- Coast

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Example of Resilient Practices for Reducing Coastal Risks



- Anticipate failure
- Diverse and redundant protection
- Modular networks –components are independent of, and complement each other.
- Information is accessible for decision-making



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Resilience Pilot Study at Jamaica Bay

- Schultz et al.'s (2012) Methodology for quantifying ICS resilience applied to Jamaica Bay as pilot study
- Utilizing NACCS storm forcing calculations



What Happens Next?

- The NACCS team will receive comments for integration into the NACCS report
 - ▶ Mid-April 2014
- Integration
 - ▶ Mid-April/May 2014
- Draft Final Report production
 - ▶ June 2014
- Final USACE vertical team review
 - ▶ July - December 2014
- Submit to Congress
 - ▶ **January 2015**



Review Information

- Review documents are DRAFT and NOT FOR DISTRIBUTION
- Download the documents via AMRDEC
 - ▶ See email from No-Reply@amrdec.army.mil
- Review the draft analyses documentation
- Follow the link to the feedback form
 - ▶ Keep the feedback questions in mind during your review
 - ▶ Complete the online feedback form
- Tune into subject-specific webinars
- All feedback forms due by **April 14, 2014**



What Happens Next?

- ▶ Technical Challenges with accessing document and comment forms?
- ▶ General issues or for further coordination?
- ▶ Contact via email:

Dave Robbins

Baltimore District, USACE

Email: David.W.Robbins@usace.army.mil



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Questions



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