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IDEA FUSION

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Engineering & Technology



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Hampton Roads
Infrastructure Planning
Challenges

September 13, 2016

Sea level rise (SLR) infrastructure planning requires coordination between public and private entities



Infrastructure Working Group (IWG):

- Government Facilities
- Sector Specific Agencies
- Transportation Systems
- Water and Wastewater Systems

Private Infrastructure Committee (PIC):

- Commercial
- Communications
- Energy
- Healthcare

Phase 1: Data Gathering



- IWG reviewed pertinent studies in Hampton Roads and other areas of U.S on SLR including:
 - US DOT Gulf Coast Study Phase 2: Identifying Transportation Assets in Mobile, Alabama
 - USACE North Atlantic Coast Comprehensive Study
 - National Institute of Standards and Technology, Community Resilience Planning Guide
 - Sea Level Rise and Recurrent Flooding Response Plan, Analytical Framework, Federal Highway Administration
 - Preliminary Engineering Feasibility Report Pretty Lake Watershed, City of Norfolk Flooding Contract
- PIC investigated current state of SLR planning in private infrastructure with presentations from the energy, transportation and healthcare sectors.

Phase 2: Case Study Selection and Analysis



- Selection of case study location
- Selection of SLR scenarios
- Identification of critical infrastructure within case study area, including evaluation of dependencies and interdependencies
- Consideration of barriers to SLR planning and strategies to overcome barriers
- Lessons learned
- Recommendations

Infrastructure Working Group Evaluation Matrix

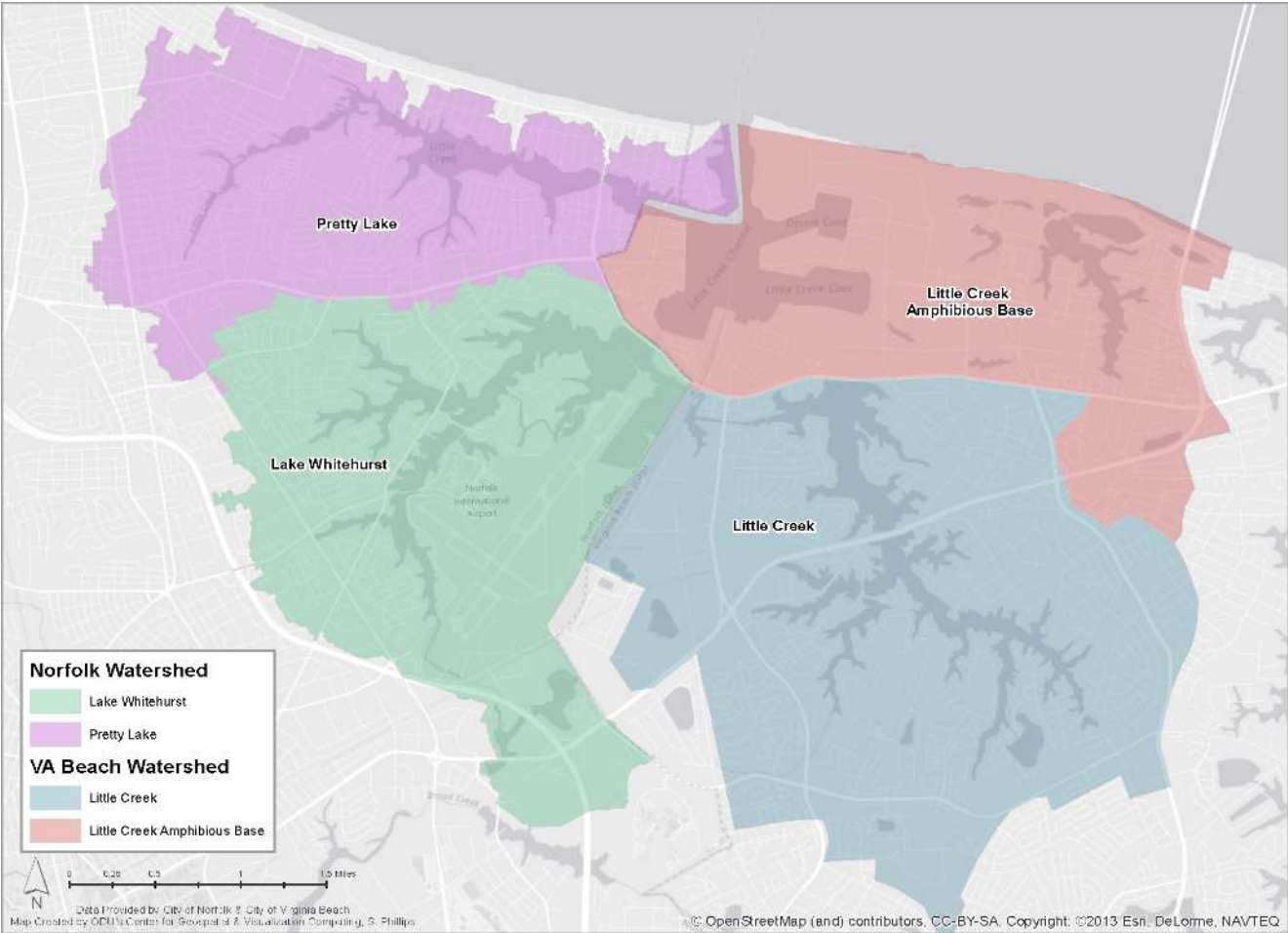


Assessing Criticality and Vulnerability - Hampton Roads, Virginia													
Infrastructure Planning Working Group, Hampton Roads Intergovernmental Planning Pilot Project													
Final Version 13 July 2015													
Factor Weights	Screen	Screen	Screen	2	1	1	2	2	3	1	2		
	Feasibility	Data Availability	More than 1 Agency (Ownership &/or Regulation)	More than 1 Municipality (Location)	At least 1 Private Utility	Lack of Redundancy	Known Problem Area	Evacuation Route	National Security Impact	Votes (7/13/15 End of Meeting)	Regional Economic Impact		Score
Little Creek and upstream lakes	1	1	1	1	1	0	1	0	0	7	0		12
HRBT & Approaches	0	1	1	1	1	0	0	1	1		1		0
Hampton Blvd. (NIT, NOB, ODU; Lafayette River Br approaches)	1	1	1	0	1	0	1	0	1	4	1		12
Sentara/Fort Norfolk/Brambleton/Mid-Town Tunnel Area	1	1	1	0	1	0	1	1	0	1	1		8
Atlantic Ave and/or Laskin in VB	1	1	0	0	1	1	1	0	0		1		0
Port Access to NIT (& VIG & PIT off of Hampton)	1	1	0	0	1	0	1	0	1		1		0
Elizabeth River Shipyards (incl'g PNSY)	1	0	1	1	1	0	1	0	1		1		0
Wetlands as it relates to fishing industry	0	1	1	1	1	1	1	0	0		1		0
Surry Nuclear Power Plant	0	0	1	0	1	1	0	0	1		1		0
Newport News Reservoir	1	1	0	1	1	1	1	0	0		1		0
Newport News Shipbuilding (HII)	1	0	1	0	1	1	1	0	1		1		0
Langley	1	0	1	0	1	1	1	0	1		1		0
NOB	1	0	1	0	1	1	1	0	1		1		0
Airport (ORF)	1	0	1	0	1	0	1	0	0		1		0
Norfolk & Portsmouth Beltline	1	0	1	1	1	0	0	0	0		1		0
										12			

Selection Focus:

- Illuminate the challenges of whole of government and community planning
- Includes as many agencies at federal, state and local level

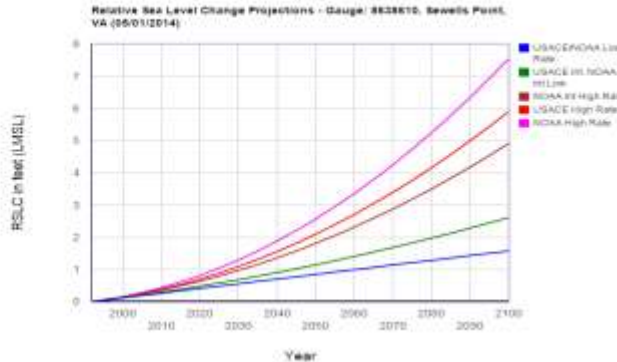
Pretty Lake / Little Creek Case Study Area



Virginia Beach SLR/RF Analysis
8636610, Sewells Point, VA
NOAA's Published Rate: 0.01457 feet/yr
All values are expressed in feet relative to LMSL

Year	USACE Low NOAA Low	USACE Int NOAA Int Low	NOAA Int High	USACE High	NOAA High
1992	0.00	0.00	0.00	0.00	0.00
1998	0.04	0.04	0.06	0.08	0.08
2000	0.12	0.12	0.13	0.14	0.16
2009	0.19	0.20	0.24	0.25	0.28
2010	0.20	0.21	0.25	0.26	0.30
2015	0.24	0.26	0.30	0.32	0.37
2020	0.27	0.29	0.35	0.37	0.43
2025	0.29	0.32	0.39	0.42	0.49
2030	0.31	0.34	0.42	0.45	0.53
2035	0.32	0.36	0.45	0.48	0.57
2040	0.33	0.37	0.47	0.50	0.60
2045	0.34	0.38	0.48	0.51	0.62
2050	0.34	0.38	0.49	0.52	0.64
2055	0.35	0.39	0.50	0.53	0.65
2060	0.35	0.39	0.50	0.53	0.66
2065	0.35	0.39	0.50	0.53	0.66
2070	0.35	0.39	0.50	0.53	0.66
2075	0.35	0.39	0.50	0.53	0.66
2080	0.35	0.39	0.50	0.53	0.66
2085	0.35	0.39	0.50	0.53	0.66
2090	0.35	0.39	0.50	0.53	0.66
2095	0.35	0.39	0.50	0.53	0.66
2100	0.35	0.39	0.50	0.53	0.66

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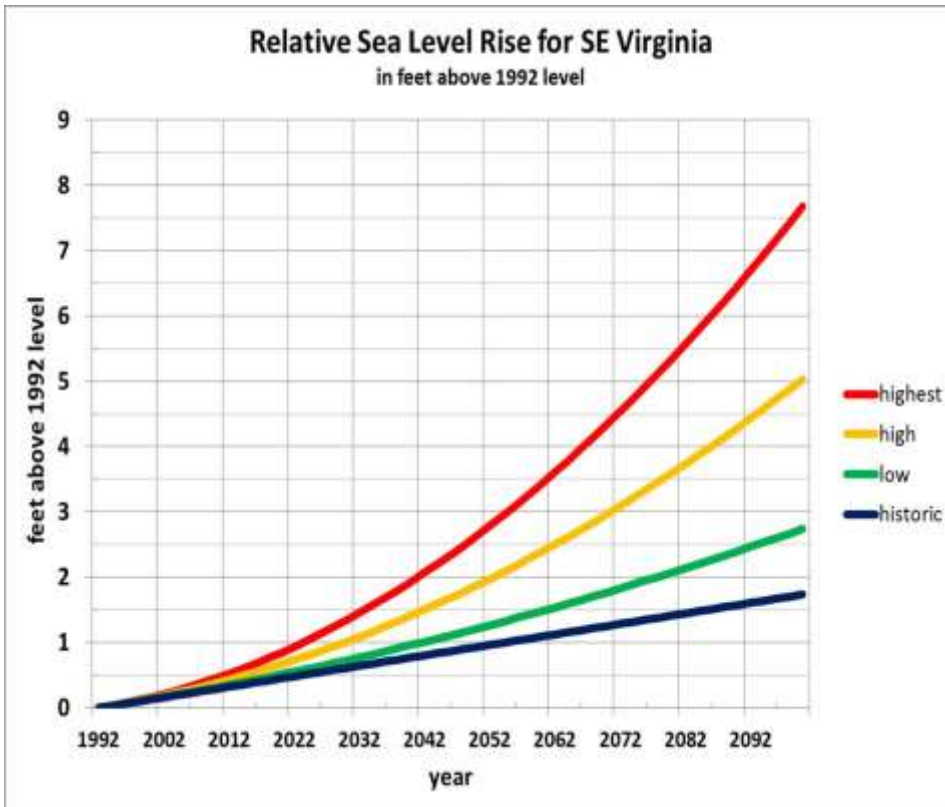


Selection of Sea Level Rise Scenarios

USACE and NOAA Relative Sea Level Rise Projections at Sewell's Point, 1 May 2014



VIMS Relative Sea Level Rise Projections for Southeast Virginia



Final Scenario Selection:

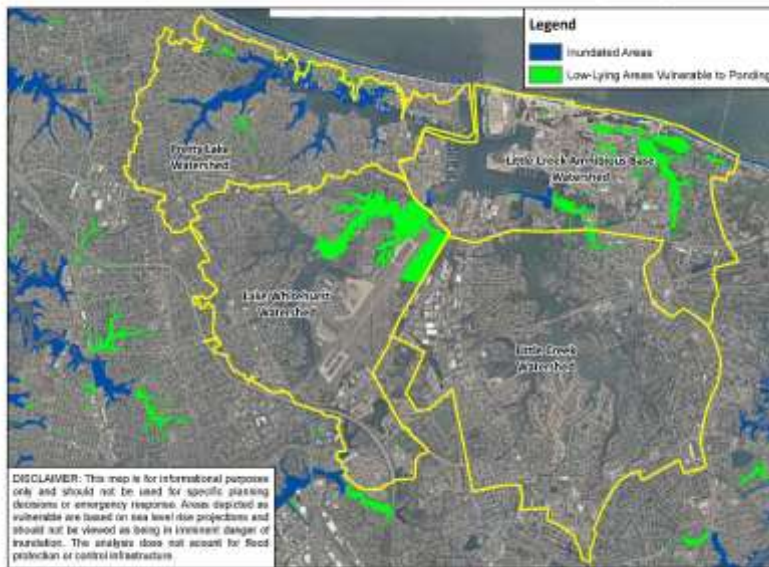
1.5 feet of sea level rise

3.0 feet of sea level rise

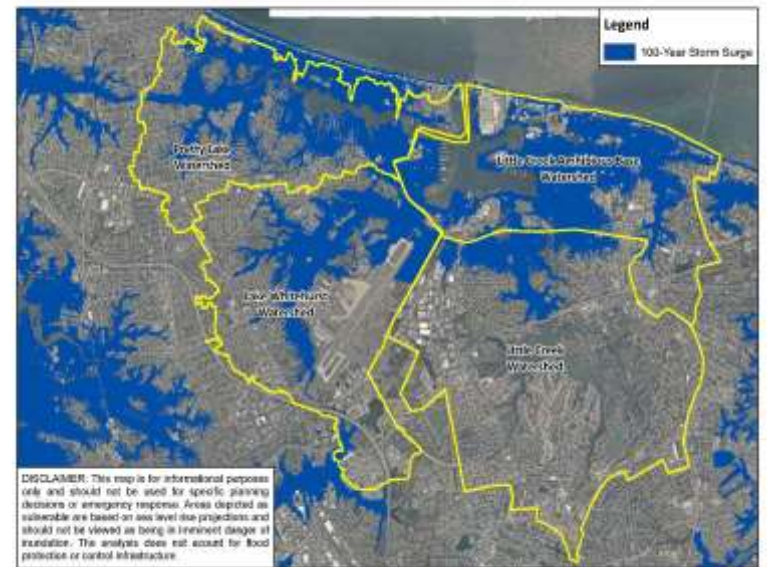
1.5 and 3.0 feet of sea level rise with “impact of 100 year flood”



DRAFT Map - 3' of Sea Level Rise Above Current Mean Higher High Water



DRAFT Map - 3' of Sea Level Rise with 100-year Storm Surge



Critical infrastructure dependencies and impacts of SLR



Critical Infrastructure and Internal Factors	External Dependencies (Threat to Internal Operations - Critical Baseline Factor)																	
	City Water Supply	City Water Distribution	Electricity	Gas	Communications - Data/Internet	Communications - Voice	Transportation - Air	Transportation - Roads	Transportation - Rail	Transportation - Vessel	City Sanitary Piping	WQSD Treatment	Medical Facilities	Federal Facilities - LZs Crest Base	Emergency Services	Vehicle Fuel	Power Generation	Transmission external to region
Electricity																		
Control House /Relay Equipment																		
Substation Equipment																		
Distribution lines																		
Transmission lines																		
Staff/Vehicles																		
Communications (Data)																		
City of VA Beach (Sanitation)																		
collection system																		
Power																		
Pumping stations																		
Force Main																		
Staff																		
Communications																		
Computer Systems																		
vehicles																		
Sustenance & supplies																		

Scenario 1 - SLR 100	Scenario 2 - SLR 100	Scenario 3 - SLR 100	Scenario 4 - SLR 100	Scenario 5 - SLR 100	Scenario 6 - SLR 100	Scenario 7 - SLR 100	Scenario 8 - SLR 100	Scenario 9 - SLR 100	Scenario 10 - SLR 100
<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>	<p>Communications Data</p> <p>Staff</p> <p>Control House</p> <p>Substation Equipment</p> <p>Distribution Lines</p> <p>Transmission Lines</p> <p>Staff/Vehicles</p> <p>Force Main</p> <p>Power</p> <p>Collection System</p> <p>WQSD Treatment</p> <p>Medical Facilities</p> <p>Federal Facilities - LZs</p> <p>Emergency Services</p> <p>Vehicle Fuel</p> <p>Power Generation</p> <p>Transmission external to region</p>



Barriers to implementation of SLR infrastructure adaptation:



- Identification of infrastructure, interdependencies & vulnerabilities
- Private industry needs to know what SLR to plan for
- Uncertainty on how public and private organizations will work together
- Proprietary information, how will it be shared and protected;
- Codes regarding construction standards related to SLR vary by city, a regional or Commonwealth code should be implement
- Underwriter insurance requirements may differ from code requirements
- Financial/funding barriers
- Institutional governance barriers

Successful strategies to overcome barriers:



- *Data Gathering:* This strategy also led into self-education and learning and information sharing strategies.
- *Networking/formal partnerships:* Break down institutional stove piping barriers using department and sector based structures of agencies to coordinate & share information (engineers/planner).
- *Leadership:* Start conversations and opportunities for organizations to work together.
- *Funding and Policy and Management Changes:* The region will have more success by working together than independently.

Lessons Learned



- Adaptive redevelopment will be a key strategy moving forward in preparation for climate change. As infrastructure is replaced or upgraded, we need to consider climate change.
- Planning processes and prioritization are important. There is a difference between vulnerability and criticality and planning must consider both aspects.
- Infrastructure dependencies and interdependencies need to be understood for complete analysis of climate change impacts on any sector of the system
- Collaboration between regional government entities is necessary as SLR does not recognize government boundaries

Sample Recommendations from IWG



- A viable long term strategy is needed that recognizes the region is at risk, and that SLR will be a significant challenge.
- A regional entity needs to “own” SLR and be the responsible thought leader
- A collaborative process that uses the best practices of civic science is necessary to engages all stakeholders
- Create benchmarking and tracking for assessing the performance and engagement of the Hampton Roads Region in the face of SLR

Sample Recommendations from PIC



- Inclusion of private industry and the Federal agencies in collaborative problem solving for infrastructure impacted by SLR is critical for the region
- Private industry needs reliable information and guidance on SLR planning scenarios and they should be standardized across the region
- Develop regional building codes that mitigate future impacts of SLR
- Develop industry outreach programs to increase awareness in small and mid-sized companies.
- Import climate change/resiliency recommendations from other regions



Use existing studies and guides to frame the work for your community

Adapt them to your community

Look to communities similar to yours and what resources they have adopted.

- Department of Homeland Security Critical Infrastructure Resources
- U.S. Department of Transportation, Federal Highway Administration, Gulf Coast Study, Phase 2
- National Institute of Standards and Technology, Community Resilience Guide
- Climate Action/Resiliency Plans Guides: New Orleans and Southeast Florida



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Question
Thank you!

