More holistic planning for long-term coastal resilience? Port of Providence Demonstration Project

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Green Boats and Ports for Blue Waters III Workshop
URI
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How can a more holistic approach to planning reduce climate risks within the environmental, social, economic, and political landscape?

- Framing the problem
- Our team’s approach
- Use of three boundary objects
- Discussion/results/next steps
Coastal hazard challenges for Rhode Island

Doubling of Cat 4 and 5 tropical storms

1-in-100 year storm event of today

Sea levels to rise 0.75 – 1.9 meters by 2100

1-in-3 year storm event of 2100

Inland flooding

(Bender et al. 2010; Grinsted et al. 2013; Rahmstorf 2010; Emanuel 2013; IPCC 2012; Tebaldi et al. 2012)
Coastal Hazards - A Wicked Problem

- Complex issue that defies complete definition
- No formal solutions
- Any resolution generates further issues
- Solutions are neither good nor bad, but the best that can be done at the time.

Uncertain rates of change
Feedback loops
Misaligned incentives
Unclear funding streams
Complex adaptation options

(Rittel and Webber 1973; Brown et al. 2010)
(Ward 2001; Bryson 2004; Few, Brown, and Tompkins 2007; Chapin et al. 2010; Tompkins, Few, and Brown 2008)
Tools to Stimulate Transformational Thinking

- Maps, repositories, performances, software tools, etc.
- Allow groups with different perspectives, backgrounds, or motivations to work together without prior consensus
- Jumpstart dialogue, lead to co-production of strategies, more successful policy and implementation

Understand and comment on storm scenario & consequences

Review long-range transformational resilience concept

Review possible long-range “resilience goals” for the port and weigh importance of each using multi-criteria decision support tool

(Star 2010; Star and Griesemar 1989)
Port of Providence
1500 Acres
30 businesses
46th port in US
~3000 jobs

Methodology
Guided by steering committee
½ Day workshop
  15 private sector
  12 public sector (local, state, fed)
  2 research/academia
Introduced three boundary objects and discussion
Tool 1
Storm Visualizations
What are the cascading consequences?

Cat 3 Scenario

• ‘Direct hit’
• 1938 hurricane, but shifted ~ 80 mi East
• Superstorm Sandy without the ‘left hook’

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<tr>
<td>1</td>
<td>74-95</td>
<td>some damage</td>
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<td>96-110</td>
<td>extensive damage</td>
</tr>
<tr>
<td>3</td>
<td>111-129</td>
<td>Devastating damage</td>
</tr>
<tr>
<td>4</td>
<td>130-156</td>
<td>Catastrophic damage</td>
</tr>
<tr>
<td>5</td>
<td>&gt;157</td>
<td>Catastrophic damage</td>
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• GIS Visualization of 21 ft “bathtub” inundation

• Assumes Fox Point Barrier not overtopped

• Only shows passive level of surge

• Does not show expected 6-10’ wave action

Based on RIGIS, 2013 DEM derived from a 1-meter resolution digital elevation model originally produced as part of the Northeast LiDAR Project in 2011.
Example Visualization: ProvPort
Example Visualization: Metals Recycling, Inc.
Example Visualization: Motiva Enterprises
Example Visualization: Sprague Energy
Example Visualization:
Wilkes-Barre Pier (Capital Terminals, E. Providence)
Key Impacts of Hurricane

**Weeks**
- Loss of critical facilities cripples business
- Energy supply compromised (hospitals, institutions, etc.)
- Raw wastewater discharge
- Debris cleanup, debris obstructions, debris as battering ram

**Months**
- Damaged roads and rail disrupt commerce
- Debris/sedimentation require surveying, restrict navigation
- Bulkhead/pier damage result in permitting delays & repair
- Erosion of riverbank leads to sediment loading of deep channel

**Years**
- Long-term environmental impacts to Narragansett Bay
- Economic impacts, but little clarity over their nature
- Risks to competitiveness of port if perceived as vulnerable to storms
- Increase in insurance rates could force business to leave
Tool 2 –
Long-term resilience planning concepts

*Introduce and discuss three “transformational concepts”*

“...Those that are adopted at a much larger scale or intensity, those that are truly new to a particular region or resource system, and those that transform places and shift locations.”

(Kates, Travis, and Wilbanks 2012, p. 7156; Cheong 2011; J. Dronkers, J. Campbell, and Spradley 19...
1. Accommodate –
Site-specific improvements to increase resilience

- Elevate Utilities and Generator
- Elevate Land
- Flood berms
- Flood proof

https://www.walthers.com/prodimage/0933/09330000003168.gif
2. Relocate –
Move port uses to less vulnerable location.

Exxon Mobile Berth

Exxon Mobile Terminal
Elevation ~ 50ft
3. Protect –
New storm barrier for Providence Harbor.
1) How well does each concept meet each “resilience goal”?  
2) How important is each goal to you?  

• Ensure post-hurricane **business continuity** for waterfront business  
• **Minimize hurricane damage** for infrastructure and waterfront business  
• Minimize hurricane-related **environmental damage** from port uses.  
• Build **public support** for port resilience  
• Minimize **hazard insurance** rates  
• Foster **port growth**  
• Protect **human safety & critical lifelines**
Preliminary findings

• No long-term plan for major hurricane events
• Difficult to entice private business to participate when next steps are not clear
• No clear champion (gov’t or private) to take the lead on long-term planning
• Stakeholders found it difficult to engage, as costs were not addressed
• Boundary objects effective, percolating through system, need some improvements
Research Team

Leads
Evan Matthews, Port of Davisville, Chair of Steering Committee
Dr. Austin Becker, URI, Project co-lead
Dr. Rick Burroughs, URI, Project co-lead
Dr. John Haymaker, Area Research, Wecision lead
Mark Amaral, Lighthouse Consulting, Workshop Facilitator

Steering Committee
Dan Goulet, CRMC
Corey Bobba, FHWA
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Katherine Touzinsky, USACE
Pam Rubinoff, CRC/RI Sea Grant
Kevin Blount, USCG
Bill McDonald, MARAD
Meredith Brady, RIDOT
John Riendeau, CommerceRI
David Everett, City of Providence Dept. of Planning
Chris Witt, RI Statewide Planning

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Questions?

Hurricane Sandy photos courtesy Mary Lee Clanton, Port of NYNJ

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www.portofprovidenceresilience.org
Extra Slides Below
Preliminary Recommendations

• Revise tools and workshop methodology and re-test
• Create database of experts and best practices to include in resilience dialogues
• Create ad hoc stakeholder group to initiate formal dialogue around long-term resilience planning for the port and engage with existing climate efforts in the state
• Create "post-storm rebuilding goals and strategies"
• Identify business-continuity opportunities before the storm hits (e.g., contingency contracts, debris disposal)
• Conduct economic assessment of "port shutdown"
The Ports of Rhode Island

Providence
Quonset/Davisville
Newport
Point Judith
The W-3 Port/Maritime Industrial Waterfront District is intended to promote maritime industrial and commercial uses within the areas of Providence’s waterfront, protect the waterfront as a resource for water-dependent industrial uses, and facilitate the renewed use of a vital waterfront.

All permitted and special uses shall be part of a marine enterprise or dependent on access to the water.

There are still some grandfathered uses that do not meet this standard.
Type 6: Industrial Waterfronts and Commercial Navigation Channels

Areas that are used to accommodate commercial and industrial water-dependent and water-enhanced activities
Areas of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. Also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year floods, shallow flooding areas with average depths of less than one foot, or drainage areas less than 1 square mile.

Areas with 1% annual chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.

The base floodplain where base flood elevations are provided.

Areas with 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.

River or stream flood hazard areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.

Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Base flood evaluations derived from detailed analyses are shown at selected intervals within these zones.
The Port of Providence

- $340 Million in economic benefits to RI (2008)
- 744 jobs (2008)
- ProvPort: 1,722 Jobs (2015); $211.5 Million output
- Average Salary ~$54,000/ year
Long Term Resilience Strategies

1. **Do Nothing** – No change to port resilience.
2. **Accommodate** – Improvements to current port infrastructure to increase resilience.
3. **Relocate** – Moving port uses to less vulnerable location.
4. **Protect** – New storm barrier for Providence Harbor.

*Discussion -> goals and preferences*
1. Do Nothing – No change to port resilience

Advantages
- Low/no upfront costs
- No disruption until storm event(s) occur
- Easy
- Allows for investments in other priorities

Disadvantages
- Major catastrophe after each storm event
- Businesses leaving the State
- Major environmental damage to Narragansett Bay
- Channel closing for weeks/months
- Impacts to state’s energy supplies
1. Do Nothing – No change to port resilience
## 2. Accommodate – Site-specific improvements to increase resilience

### Advantages
- Costs can be incremental
- Site-specificity
- Low-cost options
- Single business could improve its own resilience
- Could address SLR
- Does not disrupt port system as a whole

### Disadvantages
- Limited in ability to protect against major storm
- Does not address interdependent uses
- Storm could result in high levels of environmental damages
- Few tested examples for industrial waterfronts
- Less likely to protect navigation channel from debris
3. Relocate
Move port uses to less vulnerable location.

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<th>Pts.</th>
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<td>1000’ from 30-40’ water</td>
<td>2</td>
</tr>
<tr>
<td>1000’ from 10-20’ water</td>
<td>1</td>
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<tr>
<td>1000’ from Type 6 waters</td>
<td>2</td>
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<td>Current land use industrial</td>
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</tr>
<tr>
<td>Current land use vacant</td>
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<tr>
<td>Industrial zoning in place</td>
<td>1</td>
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<tr>
<td>&gt;1 mile from highway exit</td>
<td>1</td>
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<tr>
<td>&lt;1000’ from rail line</td>
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Providence ~ 21ft
Quonset ~ 15ft
Newport ~ 14ft
### 3. Relocate – Moving port uses to less vulnerable location.

#### Advantages
- Removes hazardous materials from floodplain
- Tested strategy has been implemented elsewhere
- Opens floodplain as public waterfront space and/or environmental remediation
- Can account for SLR
- Reduces debris in navigation channel after storm
- Improves water quality to Providence Harbor

#### Disadvantages
- Disrupts port network
- Limited land availability
- High costs
- May impact communities around relocation sites
- Complexities from dependence on utilities (e.g., pipelines, rail, highway)
- May displace environmental damages to other places
4. Protect – Storm barrier for Providence Harbor.

**Advantages**
- Protects during all major events
- New public uses can be integrated (e.g., on berm)
- Does not disrupt shipping
- Creates safe harbor for new business
- Tested solution
- Very long term solution
- Frees up land in City through removal of current barrier system

**Disadvantages**
- Impacts of sea level rise are not addressed
- May impact tidal flows (water quality)
- Impacts sediment flow, water quality, discharge from watershed (sedimentation of navigation channel)
- High upfront costs
- May impact view of Bay
- May require pumping due to increased freshwater flows
# RESILIENCE GOALS REVIEW

1. Ensure post-hurricane business continuity for waterfront business
2. Minimize hurricane damage for infrastructure and waterfront business
3. Minimize hurricane-related environmental damage from port uses.
4. Build public support for hurricane resilience measures & port operations
5. Minimize hazard insurance rates
6. Foster port growth
7. Protect human safety & critical lifelines

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<th>CONCEPTS</th>
<th>G1</th>
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**LESS EFFECTIVE** 1 2 3 4 5 **MORE EFFECTIVE**
Aug. 3 Workshop Agenda

Scenarios
  a. Super Storm Sandy and the PNYNJ
  b. What the science says could happen in Providence
  c. Consequences of Cat 3 in weeks/months/years

Long term resilience concept alternatives
  a. Present Wecision tool
  b. Three long term resilience concept alternatives
  c. Compare proposed long term resilience goals to concept alternatives

Conclusion
Adjourn for cocktails (Sponsor: Providence Working Waterfront Alliance)
Rhode Island Hurricanes: Historical Record

- 37 hurricanes within 50 mi of RI since 1851
- ≈ 4 year return period
- ≈ 22.8% chance of hurricane per year
Save the Bay Center
8-3-15
28 participants

Photos: John Haymaker