



## Resilience initiatives at the Port of Providence: 2010 - present

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# Coastal infrastructure: Critical, complex, constrained



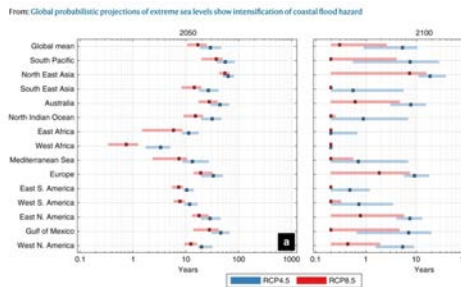
**Critical - Economic engines at every scale**

**Complex – Multiple stakeholders across space and time**

**Constrained - Dependent on specific and environmentally-sensitive locations**

*(Asariotis and Benamara 2012; Notteboon and Winkelmann 2003; EPA 2011; AAPA 2013)*

# Climate change presents big challenges



Graph from Vousdoukas et al, 2018, Hurricane Sandy photos courtesy Mary Lee Clanton, Port of NYNJ

Downing of East and West tropical storms



Sea levels to rise 0.5 - 3.5 meters by 2100

Annual storm event of 2100

Increased precipitation

(Bender et al. 2010; Grinsted et al. 2013; Rahmstorf 2010; Emanuel 2013; IPCC 2012; Tebaldi et al. 2012, Vousdoukas et al 2019)

# Storm impacts on coastal infrastructure are wide ranging

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Photograph GP\_11

## **1) Direct damages**

(e.g., structures, equipment, freight, land, etc.)

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## **2) Indirect costs**

(e.g., lost wages, business interruptions, cleanup costs, knock-on effects throughout supply chain)

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## **Rotten Meat From Katrina Still in Gulfport Neighborhood**

"It's nine months now. They say, 'Well, you ought to be used to it by now.' You ain't gonna get used to that smell. My gosh," said resident Gary Tatum.

The meat had been stored at the Port of Gulfport. Katrina washed it in to yards covering an eight block span. The meat in the yards has been picked up, but the meat in hard-to-see areas has not.

## **3) Intangible consequences**

(e.g., quality of life, environmental damages, loss of essential services)

# Who bears the cost of storm damage?



■ Costs shared ■ Port pays ■ External stakeholders pay

Direct damages (n=38)



Indirect costs (n=24)



Intangible consequences (n=56)



0% 20% 40% 60% 80% 100%

Becker, A. H., P. Matson, M. Fischer and M. D. Mastrandrea (2015). "Towards seaport resilience for climate change adaptation: Stakeholder perceptions of hurricane impacts in Gulfport (MS) and Providence (RI)." *Progress in Planning* 99: 1-49.

# Barriers to adaptation

“...you can't control most risk models...”  
 (Environmental Specialist)

“Money! I think that is the magical answer to everything – if we had the money, or if we had the money allocated appropriately.”

“For the last 7- 8 years, we had one side of the (half) of the agency where we couldn't say the words : global warming or climate change, where the other half bought in.”  
 (Safety Planner)

(Safety Planner)

“The infrastructure is only a certain height, so how do you change that at this point?” (Port director)

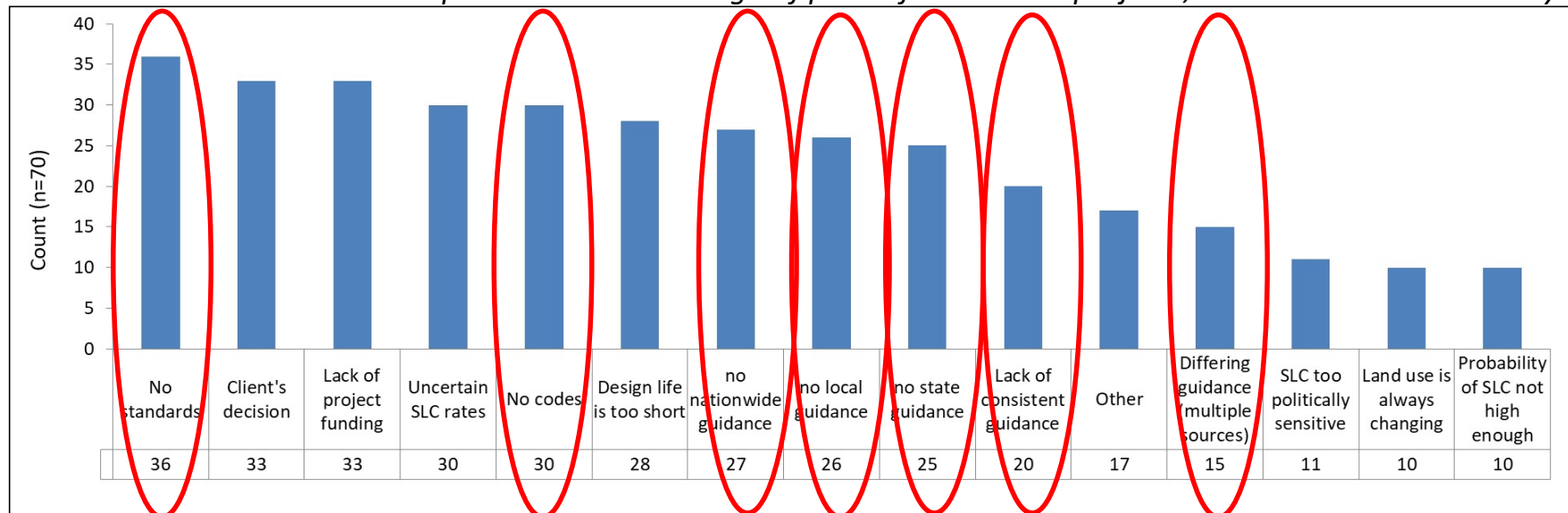
Interviews with 30 port staff from 15 North Atlantic seaports



# No clear guidance for infrastructure design

***Our 2018 survey of N. American maritime infrastructure engineers reports that only 9% of organizations use a policy/planning document that communicates how SLC should be incorporated into design***

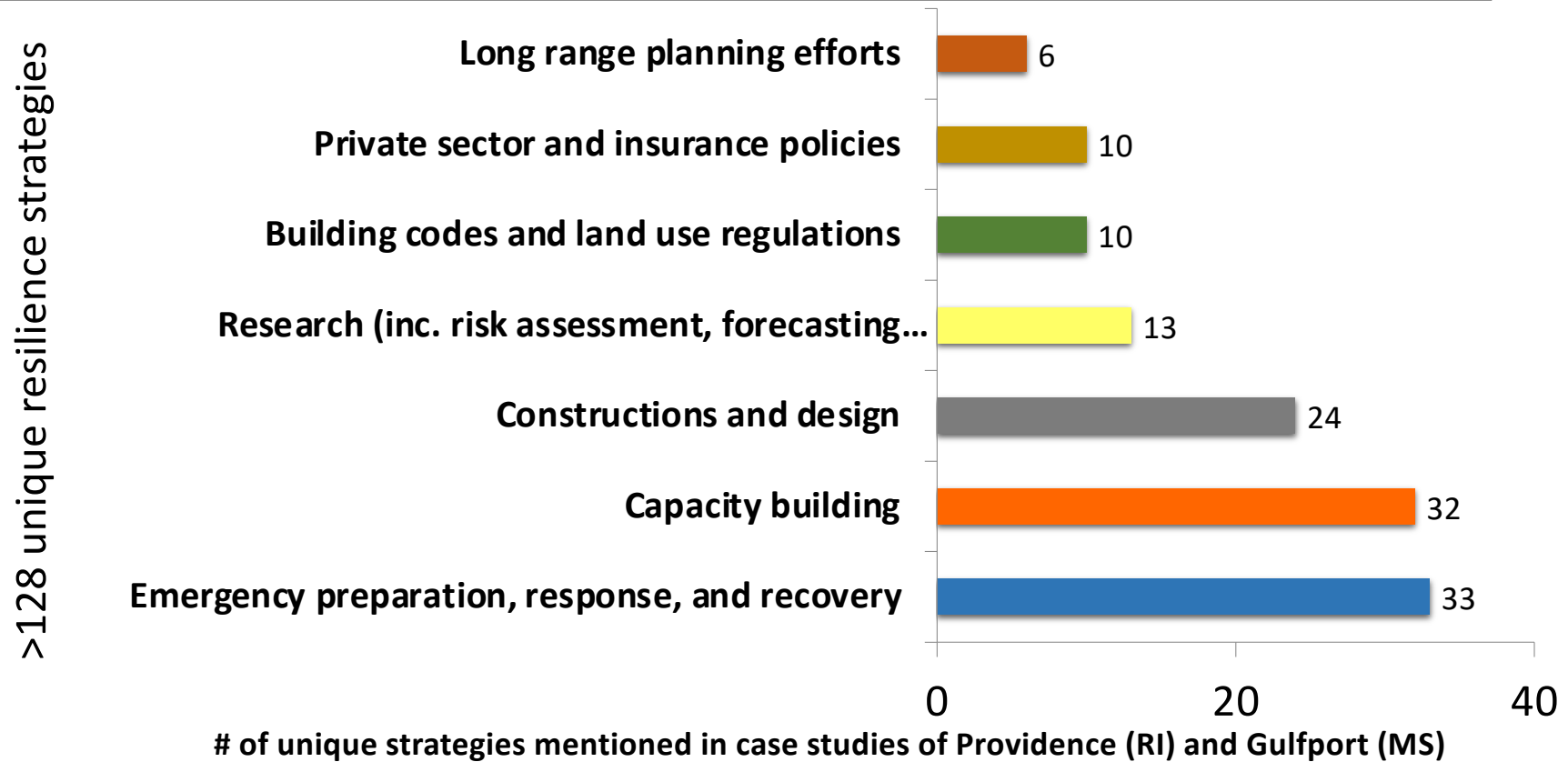
*In cases where SLC is not incorporated into the design of port infrastructure projects, what are the reasons why?*







# Good news: There's plenty can be done!



STAKEHOLDER GROUPS BEST POISED TO IMPLEMENT STRATEGIES



**All types of stakeholders have something to contribute to address their collective interest in resilience**

# Port of Providence

- Intersection of two major interstate highways (Rt. 95 and 195)
- Adjacent to major medical/health complex
- Historically filled land
- 40' Deepwater Channel dredged in 2005
- Very protected harbor
- Access to rail (double stack)
- Access to pipelines
- Relatively few residential neighbors (separate by highway and hurricane barrier)
- Supplies jet fuel, home heating oil, other products
- Susceptible to 20'+ storm surge + SLR + waves

1500 Acres  
~25 businesses  
46<sup>th</sup> port in US (2019)  
~3000 jobs



# Port Area Businesses

## ProvPort

- **New England Petroleum (petroleum)**  
Lehigh Cement (cement)
- **Sea-3 Providence (propane)**
- Schnitzer Steel (scrap metal)
- Univar USA (chemicals)
- Morton Salt (road salt)
- Mid-American Salt (road salt)
- Grimaldi Lines (used autos)
- Washington Mills (minerals)
- McInnis Cement (cement)

## Independent Terminals

- **Shell (fuels)**
- **Sprague (fuels, asphalt, salt, NG)**
- Holcim (aggregate)
- **Hudson (asphalt)**
- Sims Metal Mgmt (scrap metal)
- **Narragansett Improvement (asphalt)**
- Univar (2<sup>nd</sup> location) (chemicals)
- Morton Salt (2<sup>nd</sup> location) (road salt)
- Rhode Island Recycled Metals

## Other

- Starwood Energy (power plant)
- Stericycle (hazardous waste)
- National Grid (LNG production/storage)
- Narragansett Bay Commission (wastewater treatment)



\* No Port Authority

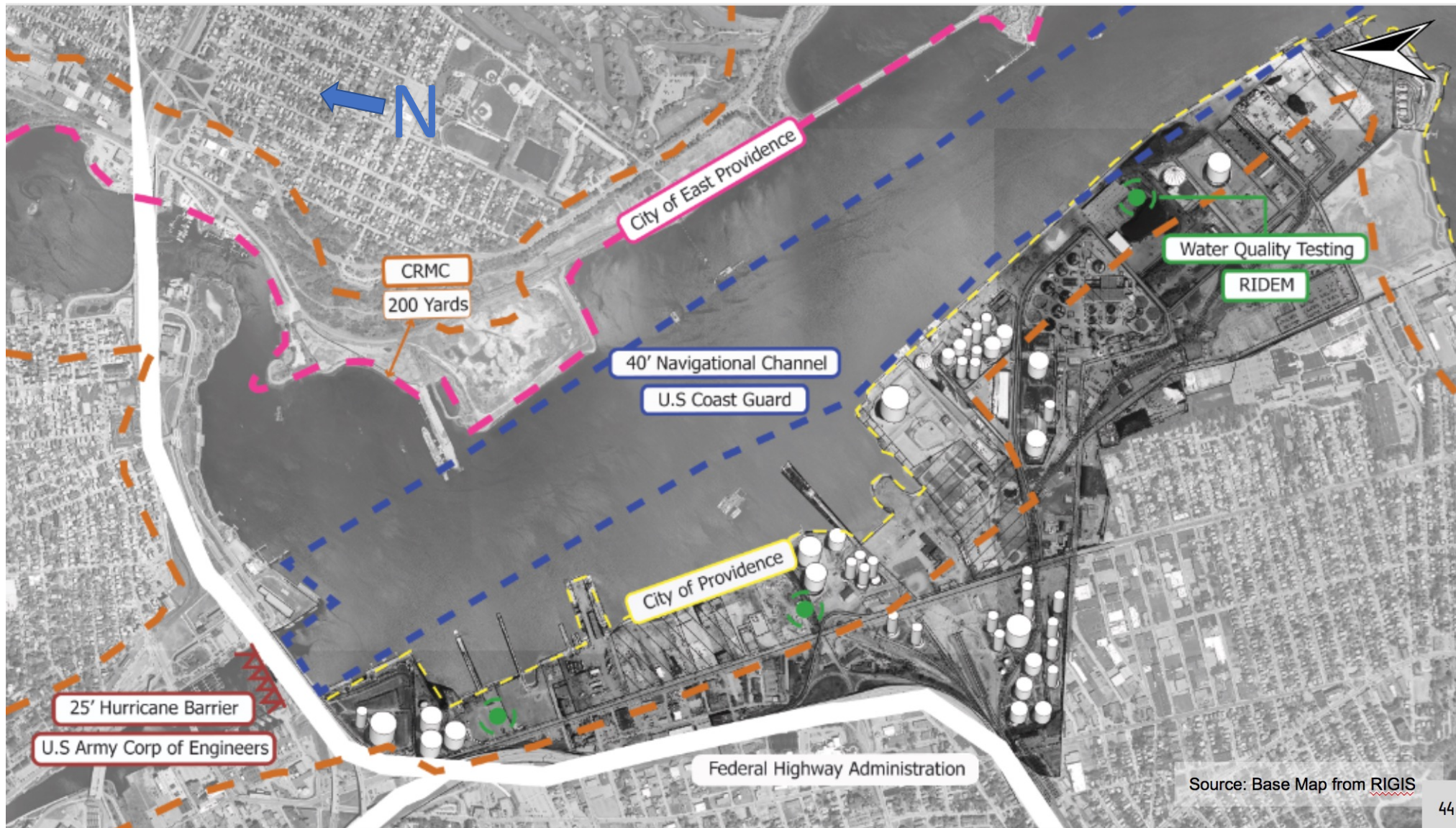












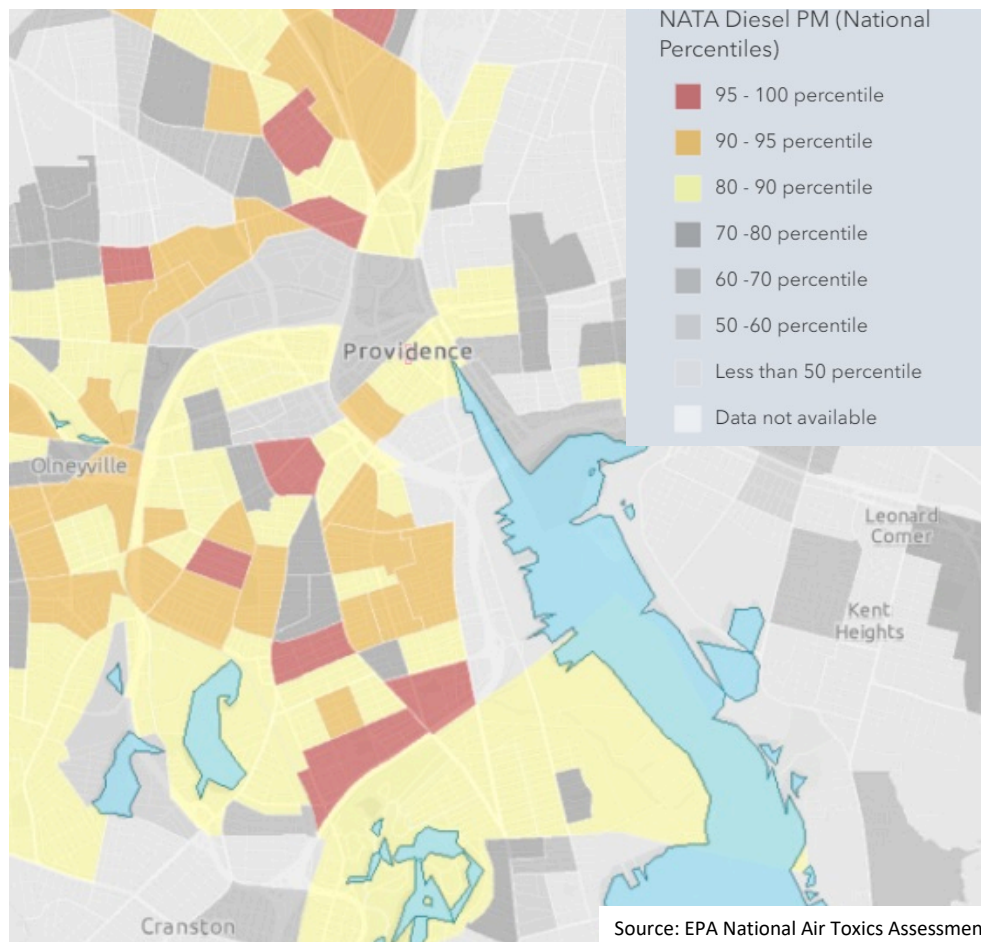
Source: Base Map from [RIGIS](#)

# Key Port of Providence Stakeholders

- Environmental Justice:
  - City Racial and Environmental Justice Committee, Washington Park Neighborhood Association, Environmental Justice League of RI (EJLRI)
- Industry Groups:
  - ProvPort (Waterson Terminal Services), Working Waterfront Alliance (Advocacy Solutions)
- City Agencies:
  - Dept. of Sustainability; Dept. of Economic Development; Dept. of Planning; Harbor Management Commission
- State Agencies:
  - RIDOT, CommerceRI, Admin & Planning (Freight), Environment, Health, CRMC, RIDEM
- Federal Agencies:
  - EPA, USACE, USCG
- Other
  - Narragansett Bay Commission
  - Johnson & Wales University
  - Save The Bay, Conservation Law Foundation



# Near-port communities



## Near-port communities:


- 15,000 people within 1/2 mile
- 74% people of color
- 61% low-income families
- 18% English not primary language

1) Provide decision makers with a tool for understanding Rhode Island's marine commercial/industrial uses and infrastructure.

2) Provides municipalities, state agencies, and the private sector with a snap-shot in time (July 2008) of how 17 of Rhode Island's waterfronts used the parcels that are adjacent to Type 5 (Commercial and Recreational Harbors) and Type 6 (Maritime Industries and Commercial Navigation) waters




**Dataset at:** <http://www.rigis.org/datasets/ports-and-commercial-harbors>  
**Full Report at:** [https://www.crc.uri.edu/download/coast\\_ph\\_report.pdf](https://www.crc.uri.edu/download/coast_ph_report.pdf)




## Rhode Island Ports & Commercial Harbors

A GIS-based Inventory of Current Uses and Infrastructure  
August 2010

Written by:  
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# Providence Port-Community Working Group 2017 - present

- Formation of the “Port-Community Working Group”
  - Led by City Planning; EPA now in supporting role
  - Growing participation
  - Meet quarterly
- Waterson Terminal Services joined Green Marine
- EPA Truck Study complete
- DERA award for truck & CHE replacement
- RI DEM: Air monitoring and EJ engagement w. EPA funding underway
- RI AG: new public access to waterfront; scrap facility enforcement



# Moving Forward

- Material handling/storage BMPs
- Improved storm water management
- Truck routing and parking
- Increased public water access
- More clean/green business
- Emergency preparedness
- Resilience planning
- Community co-determination
- Establish port authority?



## Case Study: Providence Pilot



Photo by Ayla Fox for the Narragansett Bay Estuary Program

### Background

This case study provides an overview of a community-port collaboration pilot project conducted in Providence, Rhode Island over roughly a one-year period starting in 2017. In addition to Providence, pilot projects were conducted in Savannah, New Orleans, and Seattle and were collectively known as the Near-Port Community Capacity Building Project. Pilot communities received technical assistance and utilized the draft [Community-Port Collaboration Toolkit](#) developed as part of the [EPA Ports Initiative](#).

three meetings over two days: (1) a conversation with near-port residents and tribal representatives, hosted by EJLRI and held at a local public school; (2) a meeting with ProvPort and other business stakeholders, held at ProvPort offices; and (3) an all-stakeholder meeting held at the Narragansett Bay Commission.

The first meeting, hosted by EJLRI, surfaced a wide range of community priorities for improving health and quality-of-life in near-port neighborhoods and for building a sustainable economy that works in harmony with community residents and the environment.

[www.epa.gov/community-port-collaboration/community-port-collaboration-pilot-projects](http://www.epa.gov/community-port-collaboration/community-port-collaboration-pilot-projects)

# Decision support tools to stimulate transformational thinking: Port of Providence Pilot Study (2015)



- 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)



8-3-15 workshop



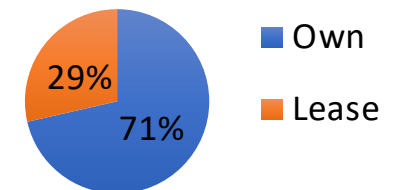
## Methodology

Guided by steering committee

- Initial Survey
- ½ Day workshop
- Follow-up survey

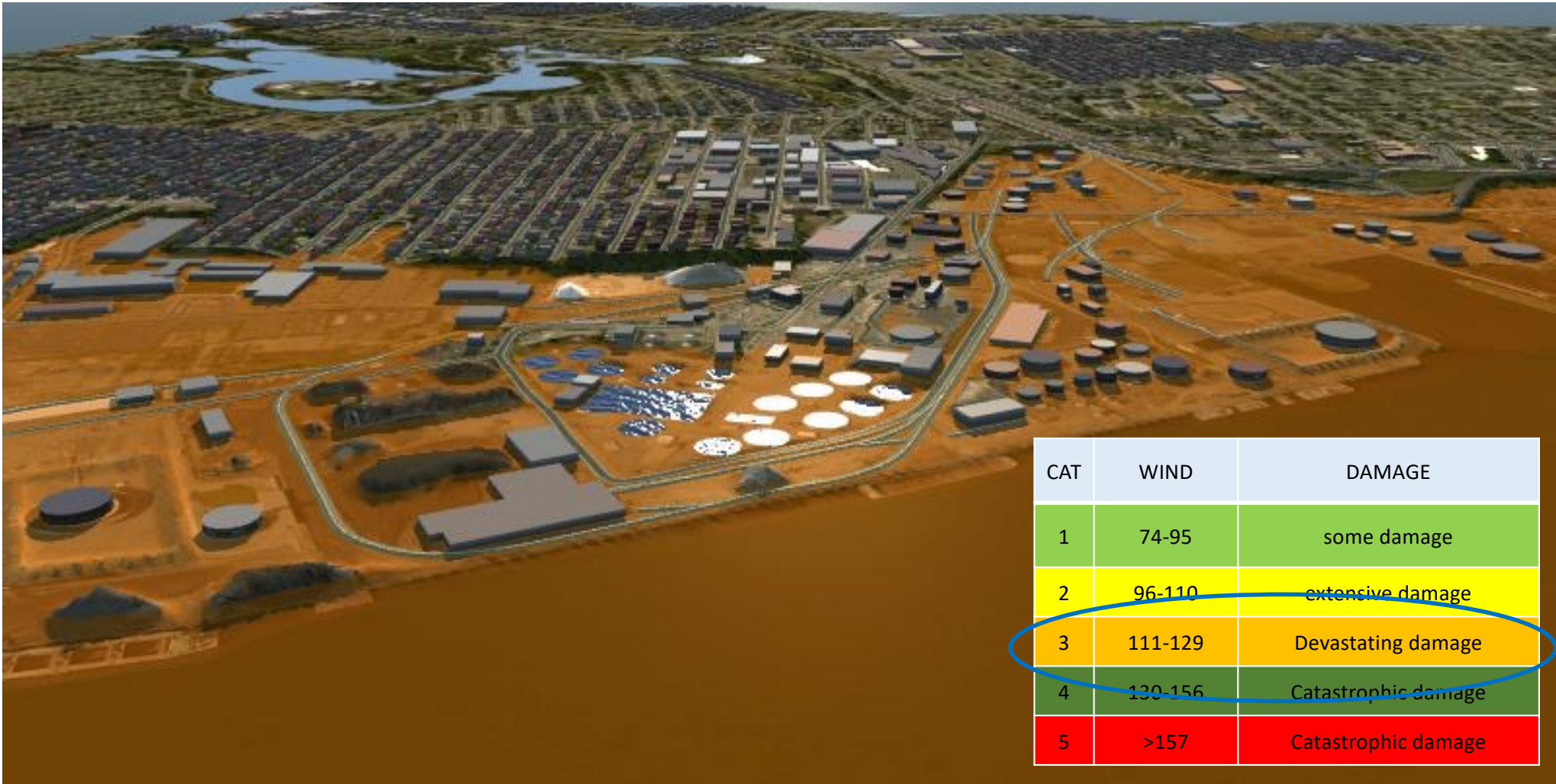
Private Firms	Local Government
Sims Metal Management	Providence Emergency Management Agency
Moran Shipping	City of East Providence Planning
Providence Working Waterfront Alliance	City of Providence Planning*
Narragansett Improvement	<b>State Government</b>
McAllister Towing	RI Coastal Resources Management Council*
Exxon Mobil	RI Statewide Planning
Shnitzer Steel Industries	CommerceRI*
Rhode Island Oil Heat Institute	Narragansett Bay Commission
Quonset/Davisville Development Corporation*	<b>Federal Government</b>
FM Global	US Maritime Administration*
National Grid	Federal Highway Administration*
Hudson Asphalts	US Coast Guard*
Capital Terminals	US Army Corps of Engineers*
Motiva	<b>Academia/NGO</b>
Northeast Pilots	RI Coastal Resources Center/RI Sea Grant/GSO*
P & W Railroad	Save the Bay

## Property Status





## Support Tool 1- Storm Visualizations



CAT	WIND	DAMAGE
1	74-95	some damage
2	96-110	extensive damage
3	111-129	Devastating damage
4	130-156	Catastrophic damage
5	>157	Catastrophic damage

# Discussion of Hurricane Impacts

## *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



**Do Nothing** – No change to port resilience.

**Accommodate** – Improvements to current port infrastructure to increase resilience.

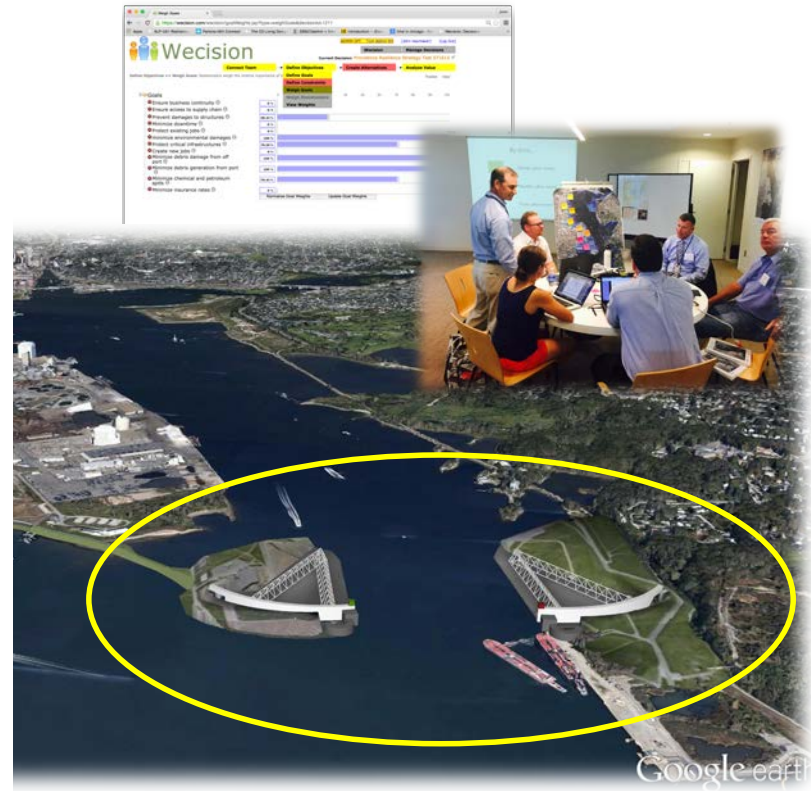
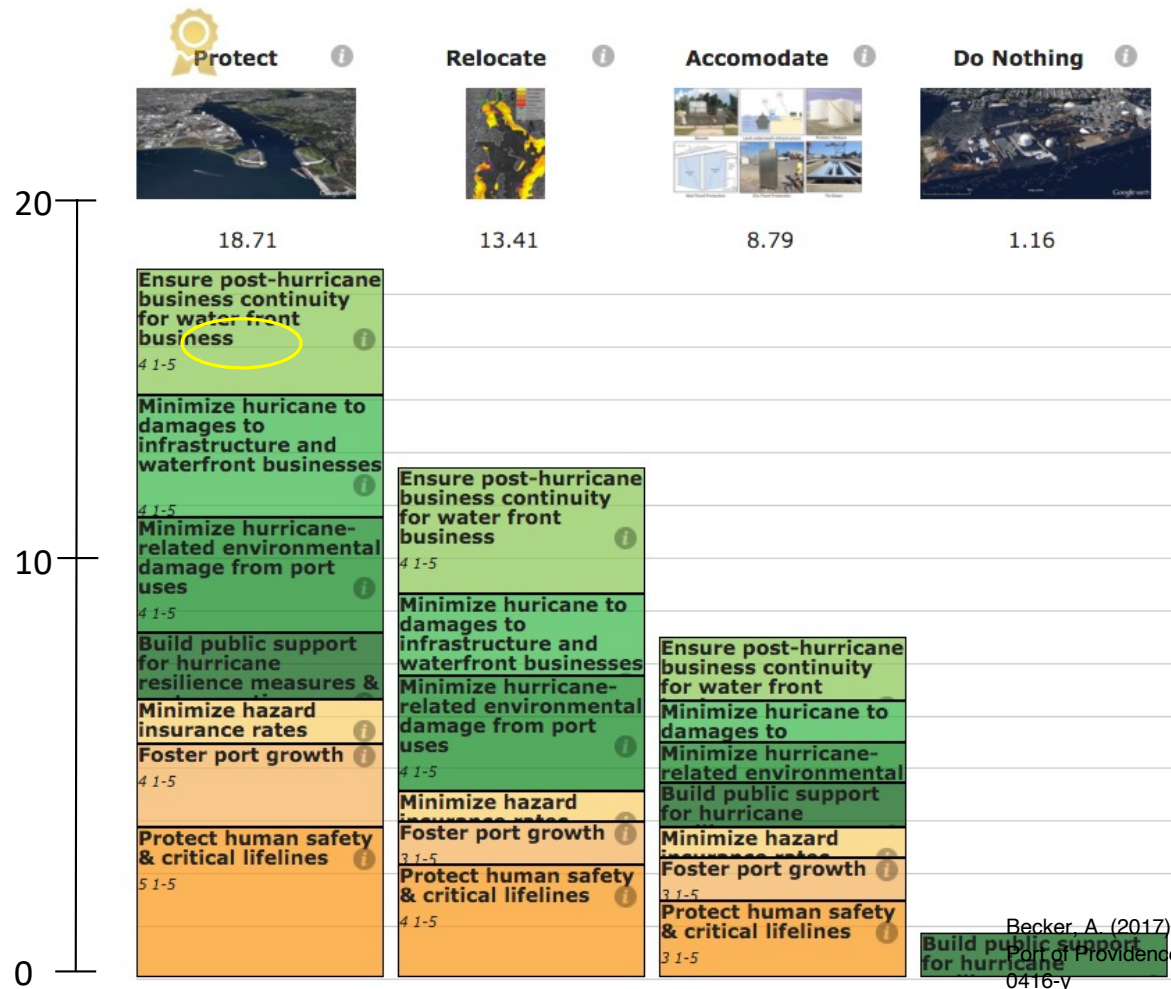
**Relocate** – Moving port uses to less vulnerable location.

**Protect** – New storm barrier for Providence Harbor.

Google earth

(Kates, Travis, and Wilbanks 2012, p. 7156; Cheong 2011; L. Drenkers, J. Campbell, and Spradley 1999)

# Support Tool 3 – Wecision tool



Becker, A. (2017). Using boundary objects to stimulate transformational thinking: storm resilience for the Port of Providence, Rhode Island (USA). *Sustainability Science*, 12(3), 477-501. doi:10.1007/s11625-016-0416-y

# Other efforts ...

- Metro Bay Special Area Management Plan
- RI-CHAMP study of Providence Critical Infrastructure and storm scenarios ([www.richamp.org](http://www.richamp.org))
- Providence Resilience Partnership (<http://providenceresilience.org/>)
- URI Landscape Architecture Studio project (2014)
  - Protect, Integrate, Connect
  - (PDF available upon request)



Images: Students of LAR 444 Studio, 2014

# Thank you!

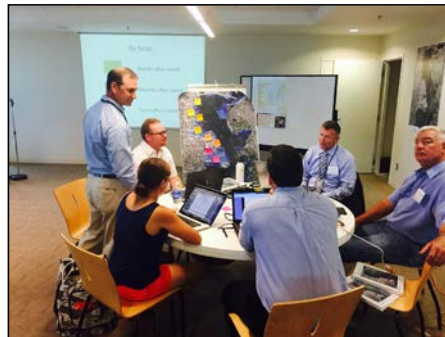


Image by Peter Stempel, Marine Affairs Visualization Lab

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