

The background of the slide is a photograph of a coastal landscape. In the foreground, there is a concrete walkway with several palm trees. A few people are sitting on a bench near the water's edge. The ocean is visible in the middle ground, and a rocky breakwater extends into the water. The sky is overcast with grey clouds. A white rectangular border frames the central text area.

# Brave the Storm: Strategies for Coastal Resilience

AUGUST 11, 2021





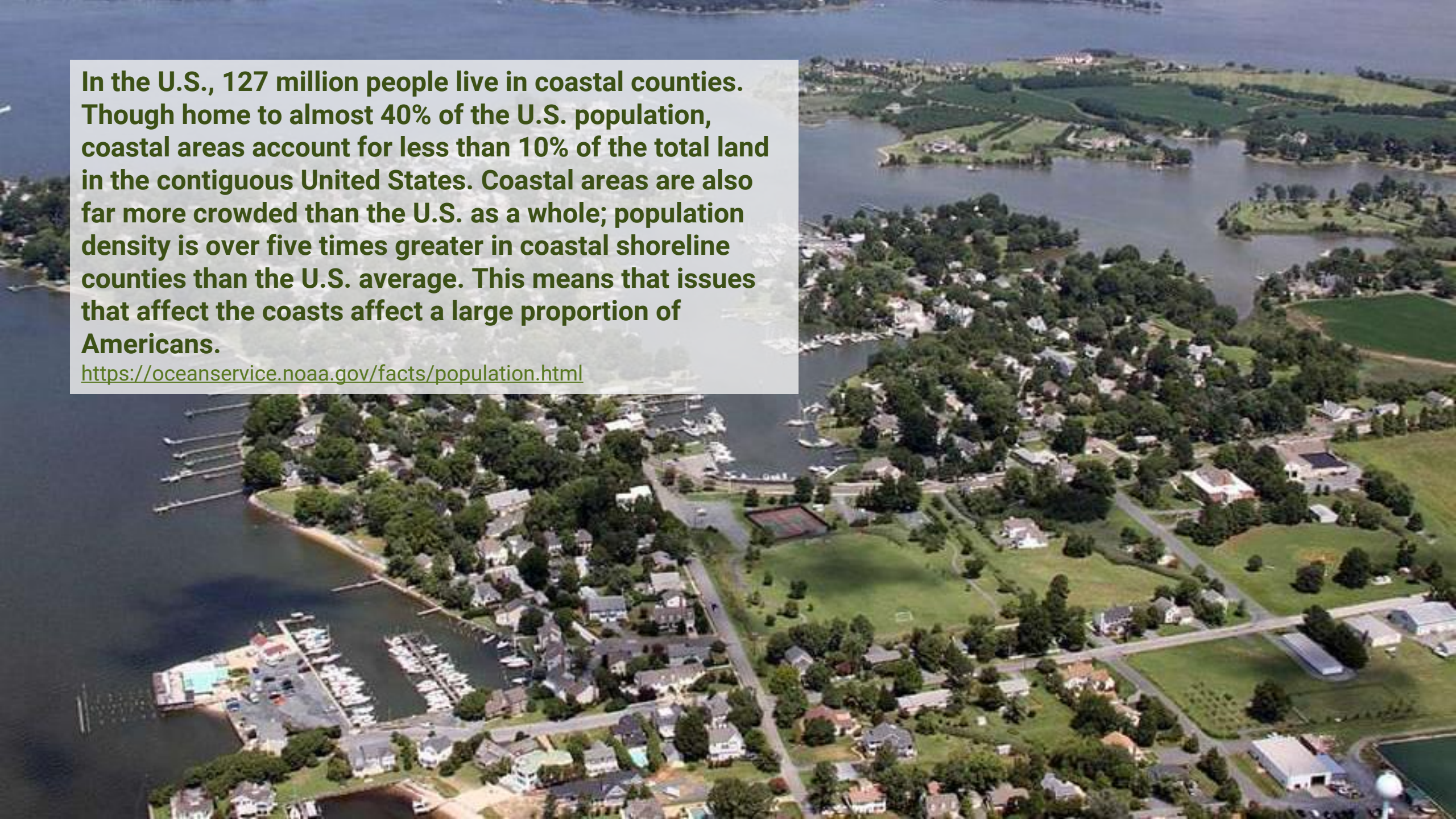
**James Moore**  
**Global Solutions Director**  
Cities & Places Jacobs  
Moderator





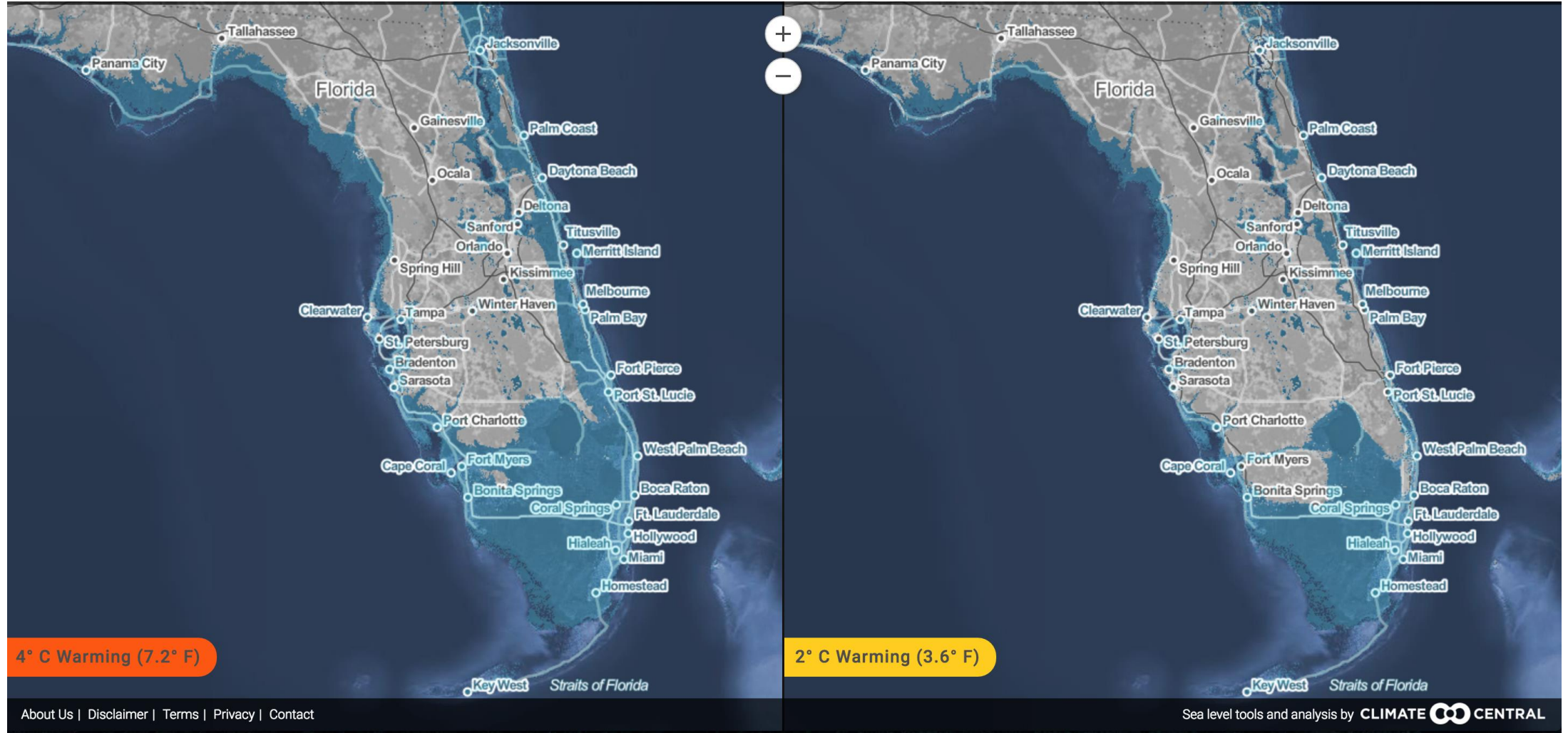
**In the U.S., 127 million people live in coastal counties. Though home to almost 40% of the U.S. population, coastal areas account for less than 10% of the total land in the contiguous United States. Coastal areas are also far more crowded than the U.S. as a whole; population density is over five times greater in coastal shoreline counties than the U.S. average. This means that issues that affect the coasts affect a large proportion of Americans.**

<https://oceanservice.noaa.gov/facts/population.html>





# Coastal Resilience Challenges: Sea Level Rise





# Current Impacts: Tidal Flooding & Water Infrastructure





# Future Impacts: Permanent Inundation



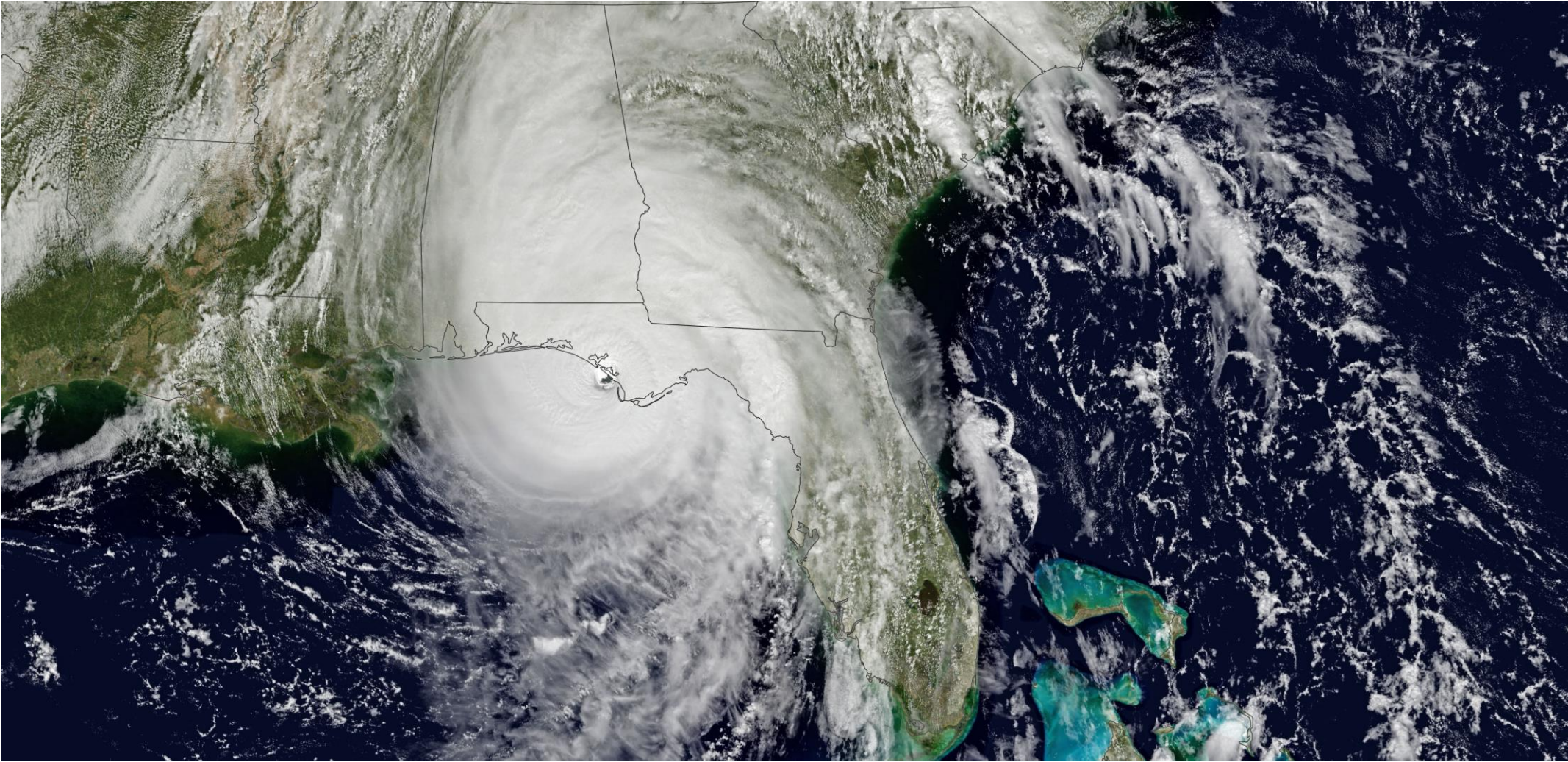


# Coastal Resilience Challenges: Intensified Rain Events





# Coastal Resilience Challenges: Intensified Storm Events









# Impacts: Increased Wind Damage





# Impacts: Increased Storm Surge





# Impacts: Increased Flooding





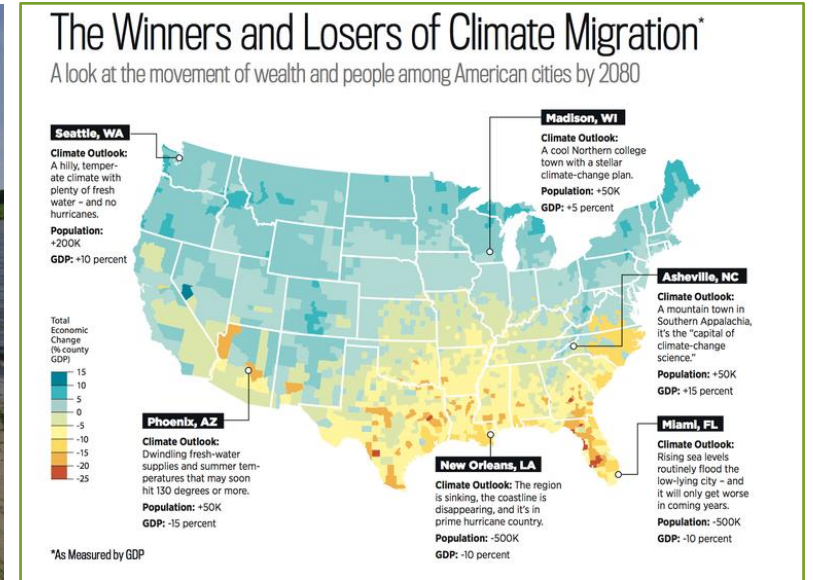
# Coastal Resilience Responses



Harden



Mitigate / Adapt



Migrate / Retreat



# Harden / Protect

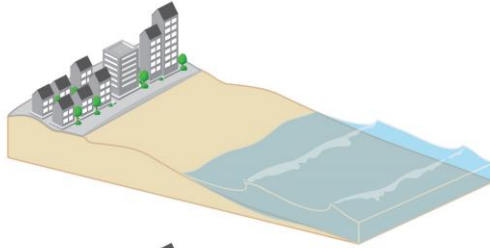




# Mitigate / Adapt

## Minimal Defense

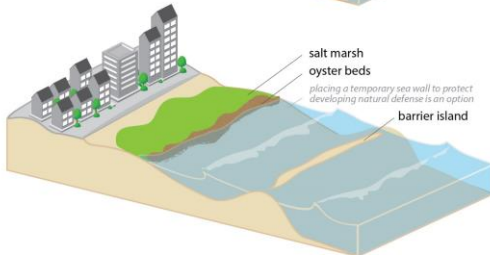
Many communities have developed right along the ocean with only minimal natural defenses from a small strip of beach between them and the ocean.



## Natural

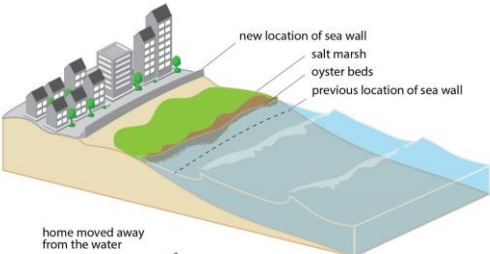
Natural habitats that can provide storm and coastal flooding protection include salt marsh, oyster and coral reefs, mangroves, seagrasses, dunes, and barrier islands. A combination of natural habitats can be used to provide more protection, as seen in this figure.

Communities could restore or create a barrier island, followed by oyster reefs and salt marsh. Temporary infrastructure (such as a removable sea wall) can protect natural infrastructure as it gets established.



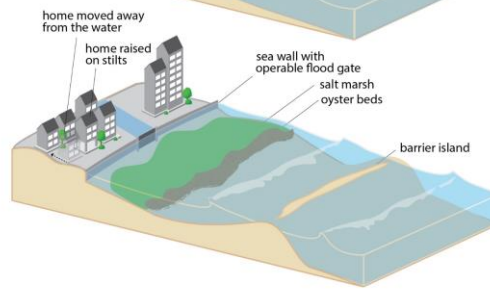
## Managed Realignment

Natural infrastructure can be used to protect built infrastructure in order to help the built infrastructure have a longer lifetime and to provide more storm protection benefits. In managed realignment, communities are moving sea walls farther away from the ocean edge, closer to the community and allowing natural infrastructure to recruit between the ocean edge and the sea wall.



## Hybrid

In the hybrid approach, specific built infrastructure, such as removable sea walls or operable flood gates (as shown here) are installed simultaneously with restored or created natural infrastructure, such as salt marsh and oyster reefs. Other options include moving houses away from the water and/or raising them on stilts. The natural infrastructure provides key storm protection benefits for small to medium storms and then when a large storm is expected, the built infrastructure is used for additional protection.



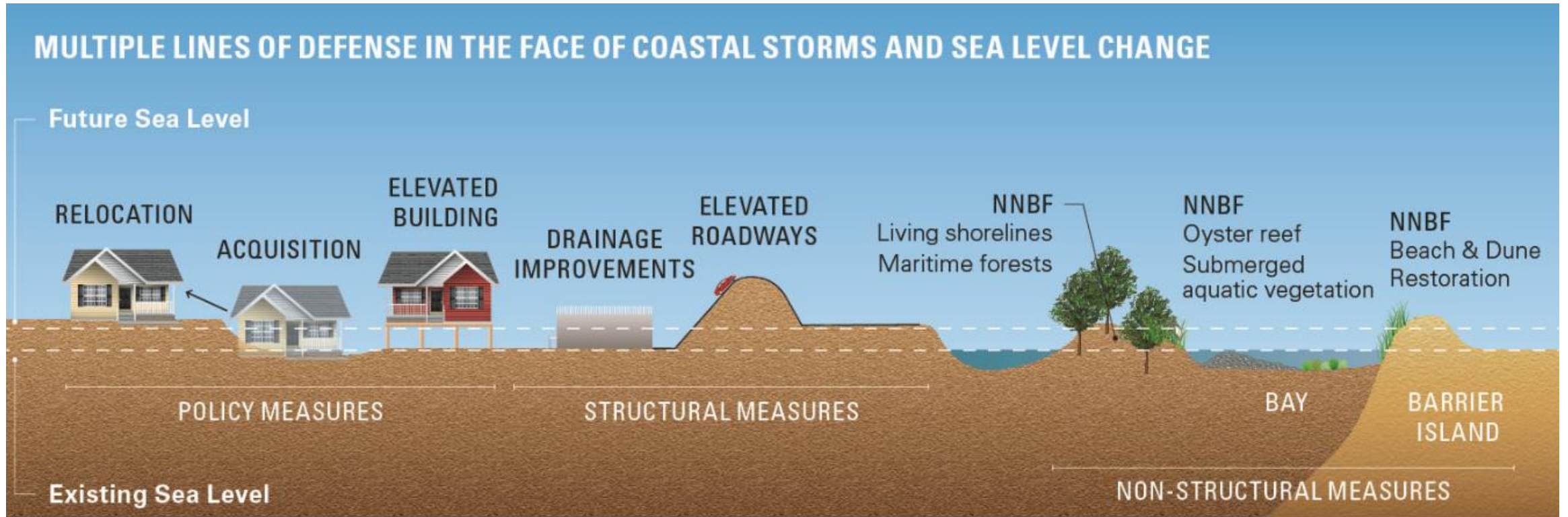


# Migrate /Retreat





# In Practice: Combining Multiple Approaches







**Dr. Lynette Cardoch**  
Director of Resilience & Adaptation  
Moffatt & Nichol



# Tackling Uncertainty

- › Temporal uncertainty
- › Non-stationarity



# Miami-Dade Back Bay Coastal Storm Risk Management Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement



Draft Feasibility Study  
May 29, 2020



## LOCAL NEWS

Christina Vazquez, Reporter

Published: September 15, 2020 1:31 pm  
Updated: September 15, 2020 4:59 pm

Tags: Miami-Dade County

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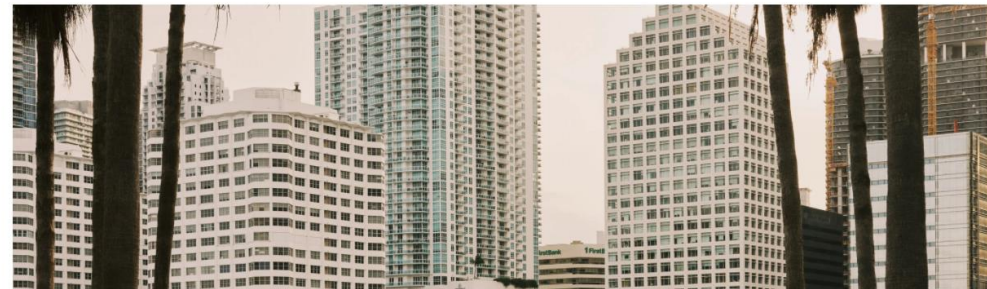
- ▶ Saving companies \$420 million on travel
- ▶ Pre-negotiated hotel rates for business travelers
- ▶ Become a member for free

## Army Corps of Engineers proposes flood wall to fortify Miami-Dade coastline



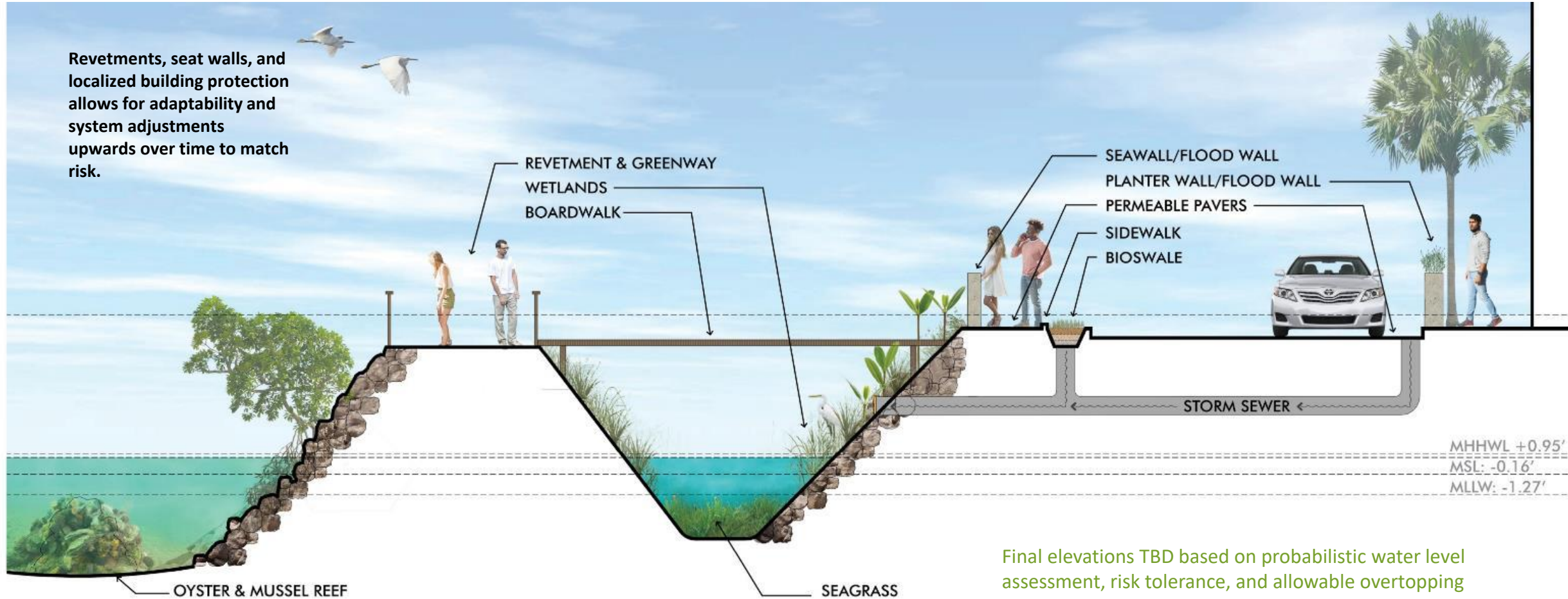
## A 20-Foot Sea Wall? Miami Faces the Hard Choices of Climate Change.

A proposal to construct barriers for storm surge protection has forced South Floridians to reckon with the many environmental challenges they face.





# Opportunities - 2030

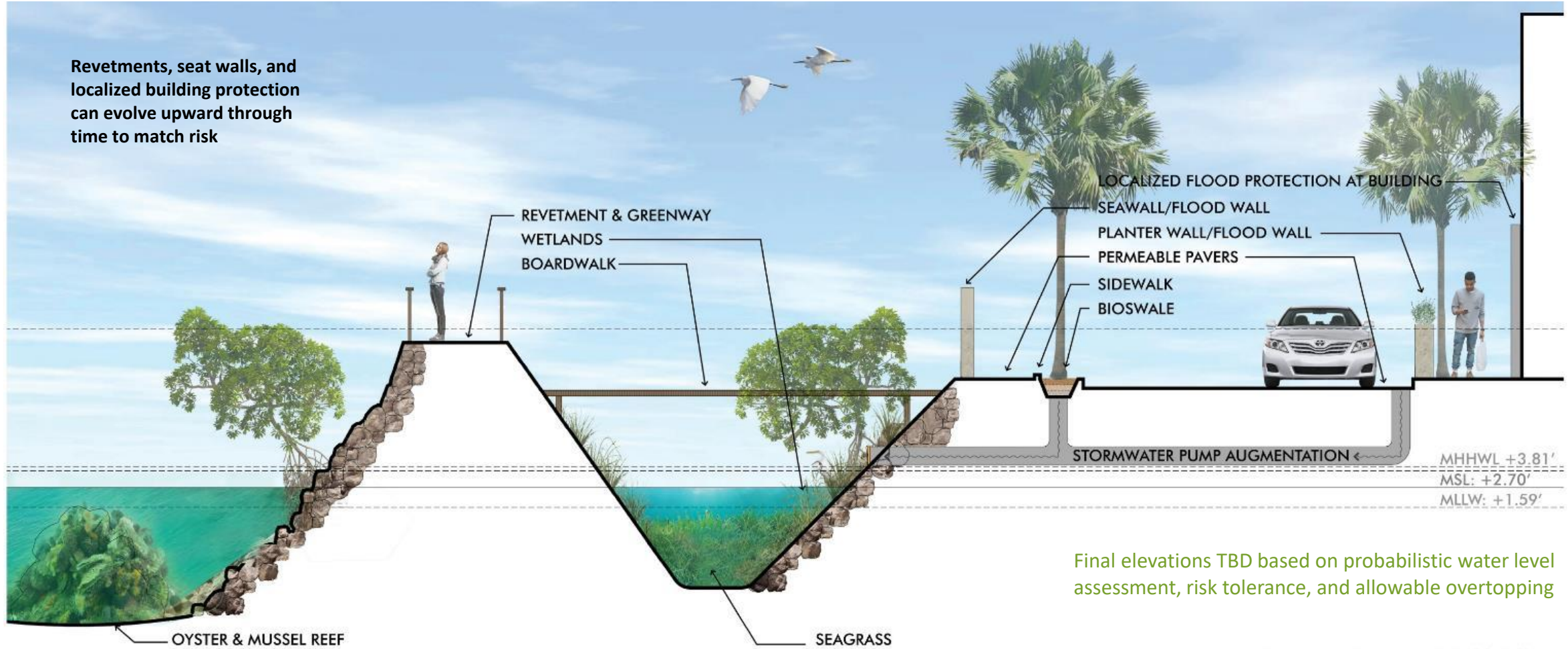


Final elevations TBD based on probabilistic water level assessment, risk tolerance, and allowable overtopping



# Opportunities - 2079

Revetments, sea walls, and localized building protection can evolve upward through time to match risk



Final elevations TBD based on probabilistic water level assessment, risk tolerance, and allowable overtopping



# Promenade Plan View





# Promenade Section





# Promenade Section







**Dr. Jalonne L. White-Newsome**  
CEO/Founder  
Empowering a Green Environment  
and Economy





"The purpose of resilience is not  
to build the capacity  
to endure more harm"



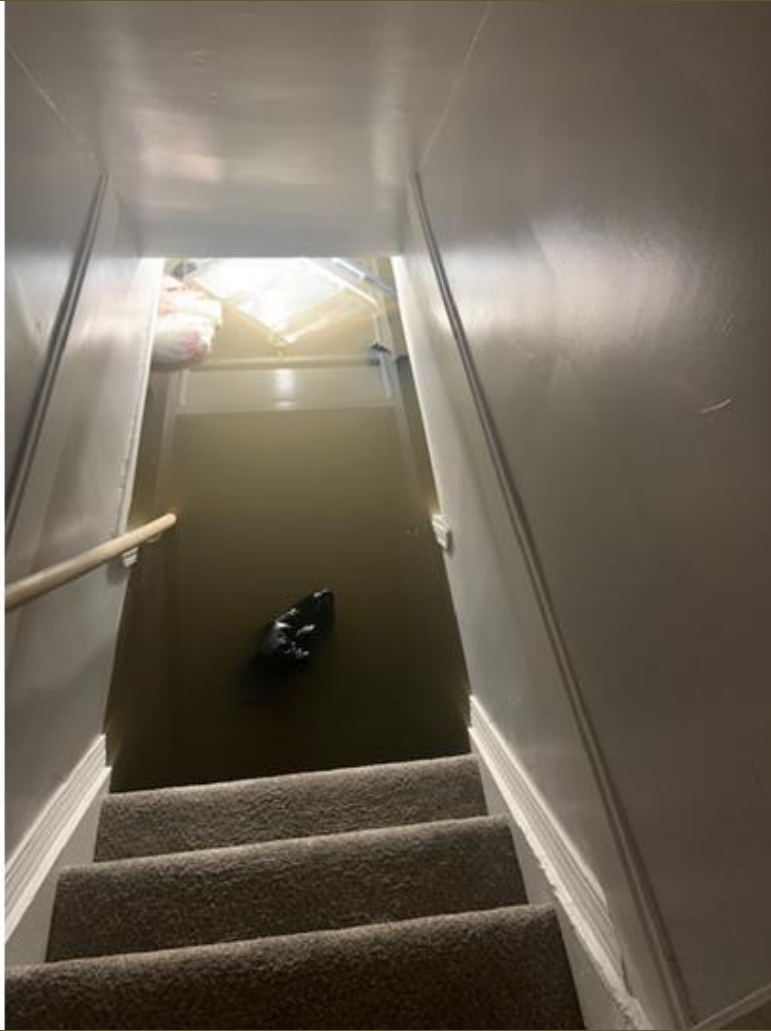


## Profiles of Populations Socially Vulnerable to Floods

(adapted from Table 1, National Academy of Sciences, 2019)

Characteristic	Experienced impacts from flooding
Age – children and elderly	<ul style="list-style-type: none"> <li>• Higher mortality</li> <li>• Higher morbidity</li> <li>• Higher mental trauma during and post-flood</li> <li>• Lower recovery rates</li> </ul>
Race, immigration status, language - Nonwhite, recent immigrants, undocumented immigrants, non-native English speakers	<ul style="list-style-type: none"> <li>• Higher death and injury rates</li> <li>• Negative post-flood health outcomes</li> <li>• Less flood insurance</li> <li>• Lower trust in authority for post-flood assistance</li> </ul>
Income - poor	<ul style="list-style-type: none"> <li>• Limited mitigation and recovery resources</li> <li>• Limited post-flood housing</li> <li>• Higher post-flood health impacts</li> <li>• Disproportionately reside in flood-prone areas</li> <li>• Differential rates of flood exposure, evacuation, and return</li> <li>• Lower recovery rates</li> </ul>
Housing Tenure - renters	<ul style="list-style-type: none"> <li>• Limited flood mitigation funding</li> <li>• Less access to post-disaster housing programs</li> <li>• Lower post-flood return rate</li> </ul>
Transportation - Household lacking vehicle access	<ul style="list-style-type: none"> <li>• Evacuation barriers</li> </ul>
Education - Low educational attainment	<ul style="list-style-type: none"> <li>• Lower flood awareness and understanding of flood mitigation</li> <li>• Lower rates of flood insurance coverage and settlements</li> </ul>





Failing Infrastructure: Increases Vulnerability





**Liquid Waste - Annual Number of Sanitary Sewer Overflows events from Metro Vancouver sewers**

Performance Monitoring Dashboard / Services / Liquid Waste / Annual Number of Sanitary Sewer Overflows events from Metro Vancouver sewers

The sanitary sewer system should not experience overflows during wet weather. However, some sanitary sewers overflow during heavy rains when excessive amounts of rainwater or groundwater enter the sewer system. Metro Vancouver relies on its municipal members to monitor and maintain their sewers and connections to keep excessive amounts of rainwater and groundwater out of the sanitary sewer system. Year-to-year changes in the number of overflows is a result of both the amount and intensity of rainfall, as well as the success of municipal sewer maintenance efforts that target rainwater inflow and groundwater infiltration.



Non-Weather Related	<b>35</b>
Wet Weather Related	<b>39</b>
Wet Weather Related: <1.5 year return period storm	<b>39</b>
Wet Weather Related: >1.5 year return period storm	<b>14</b>

As found in the Annual Work Plan [Liquid Waste: Policy, Planning & Analysis \(page 234\)](#).

**Failing Infrastructure: Exacerbates Injustice**





Article

# “We’re Just Sitting Ducks”: Recurrent Household Flooding as An Underreported Environmental Health Threat in Detroit’s Changing Climate

Natalie R. Sampson <sup>1,\*</sup>, Carmel E. Price <sup>2</sup>, Julia Kassem <sup>2</sup>, Jessica Doan <sup>1</sup> and Janine Hussein <sup>1</sup>

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Received: 24 October 2018; Accepted: 16 December 2018; Published: 20 December 2018



**Abstract:** Recurrent inland urban flooding is an understudied phenomenon that warrants greater attention, particularly in post-industrial cities where aging infrastructure, disinvestment, and climate change threaten public health. We conducted semi-structured interviews in 2017–2018 with 18 Detroit residents experiencing recurrent household flooding. We used standard qualitative coding analysis to generate 30 theoretically- and in vivo- derived themes related to flood experience, socioeconomic and health factors, and household, community, and policy interventions for reducing environmental exposures before, during, and after flood events. Snowball sampling yielded interviewees across both high- and low-risk areas for flood events, indicating vulnerability may be widespread and undocumented in formal ways. Residents described exposure to diverse risk factors for chronic and infectious diseases, particularly for seniors and young children, and emphasized stressors associated with repeated economic loss and uncertainty. Opinions varied on the adequacy, responsibility, and equity of local and federal relief funding and programs. We expand knowledge of flood-related vulnerability, offer innovative suggestions for risk communication based on residents’ experiences, and recommend additional research for documenting patterns of recurrent flooding and response, even for precipitation events that are not characterized as extreme or disaster-level in the media or by agencies. These findings should guide local public health, emergency preparedness, sustainability, water and sewage, and community leaders in post-industrial cities.

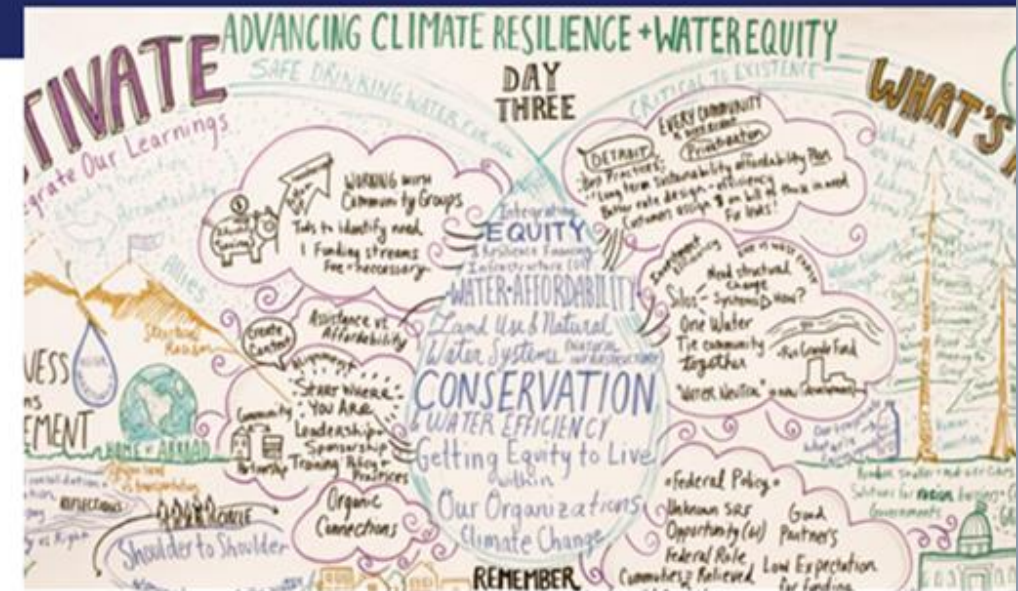
**Keywords:** flooding; water; infrastructure; climate change; vulnerability; risk communication; disinvestment

COMMENTARY

# White-Newsome: Racism has made water hazardous to our health, but climate leaders are hopeful the Biden-Harris administration will bring change

January 21, 2021

Environment



# Failing Infrastructure: Allows Unaccountability



# strategies for equitable resilience must include:

- Partnership
- Tools
- Practice
- A.D.A.P.T.-ING







# SECTOR ACTIONS TO DRIVE AND EJ/CJ AGENDA THAT PRIORITIZES HUMAN HEALTH & WELL-BEING

ACTION/SECTOR	INDUSTRY	GOVERNMENT	ACADEMIA
<b>PLANNING</b>	Provide financial support to local governments to develop the appropriate modeling for climate planning	Use screening tools developed by academics to prioritize and focus resource distribution	Provide granular data to educate industrial partners on actual impact/provide gov't information to create stronger policy
<b>DATA CAPTURE &amp; USE</b>	Work with academia to gather data that quantifies the layers of vulnerability in communities	Open channels for citizen scientific data to drive policy formation	Equity-focused research activities purposed to provide support & direct response during a crisis
<b>ENGAGEMENT</b>	Create the opportunity to hear and support action around community-generated solutions	Convene cross-sector stakeholders, including public health practitioners at every table	Collect and elevate stories and voices of impacted communities to inform industrial and gov't policies
<b>SCOPING</b>	Take time to understand the community context	Acknowledge the existing stressors and what functions are exacerbating injustice	Climate research agendas should be a balance of discovery and power-sharing with community scientists.

# Partnership

**PEOPLE**

Shape the agenda. Demand Accountability. Centered in the Policy Solutions



# Tools

## Choice Points (Making Decisions)

A decision-making framework that can be used to advance equity and counteract the implicit and explicit biases that negatively shape decisions made within public bureaucracies.

- *What are the decision-making points that affect outcomes?*
- *What decisions/actions may be reinforcing the status quo, implicit bias, and inequities?*
- *What alternative actions could produce different outcomes?*
- *Which actions will best advance equity and inclusion?*
- *What reminders, supports, and accountability systems can be structured into routine practices to keep equity a high priority?*

## Social Equity Criteria (Measuring Decisions)

- **Procedural Fairness** – involves the examination of problems or issues related to due process, equal protection & the application of eligibility requirements within policies and programs.
- **Quality/Process Equity** – involves a review of the level of consistency in the quality of existing services delivered to groups and individuals.
- **Access/Distributional Equity** – involves a review of current policies, services, and practices to determine the level of access to services/benefits and an analysis of reasons for inequitable access.
- **Outcomes** – involves an examination of whether policies and programs have the same impact for all groups and individuals served.



# Practice

7 Promising Practices for  
Advancing Equitable Climate  
Resiliency in Planning  
(Forthcoming, Fall 2021)

**Advocacy and solidarity**

**Applied learning**

**Applying critical data sources**

**Expanding the toolbox and  
technical assistance**

**People-centered**

**Shared learning**

**Using racial equity analysis**



Policymakers, Designers, Planners must....

Acknowledge harm

Demand accountability

Address Racism, Power & Privilege

Prioritize Equity

Transform Systems



**Catherine Reilly**  
Senior Development Director  
Brookfield





# Case Study: Pier 70, San Francisco, CA







## Former Shipyard



# INTRODUCTION

## SITE CONTEXT



I-280

THE DOGPATCH

AMERICAN INDUSTRIAL CENTER

ILLINOIS STREET

20TH STREET HISTORIC CORE

22ND STREET

CRANE COVE PARK

20TH STREET

BLDG 2

SHIP REPAIR

FORMER POTRERO POWER PLANT

BLDG 12

28-ACRE SITE

BLDG 21

BLDG 6

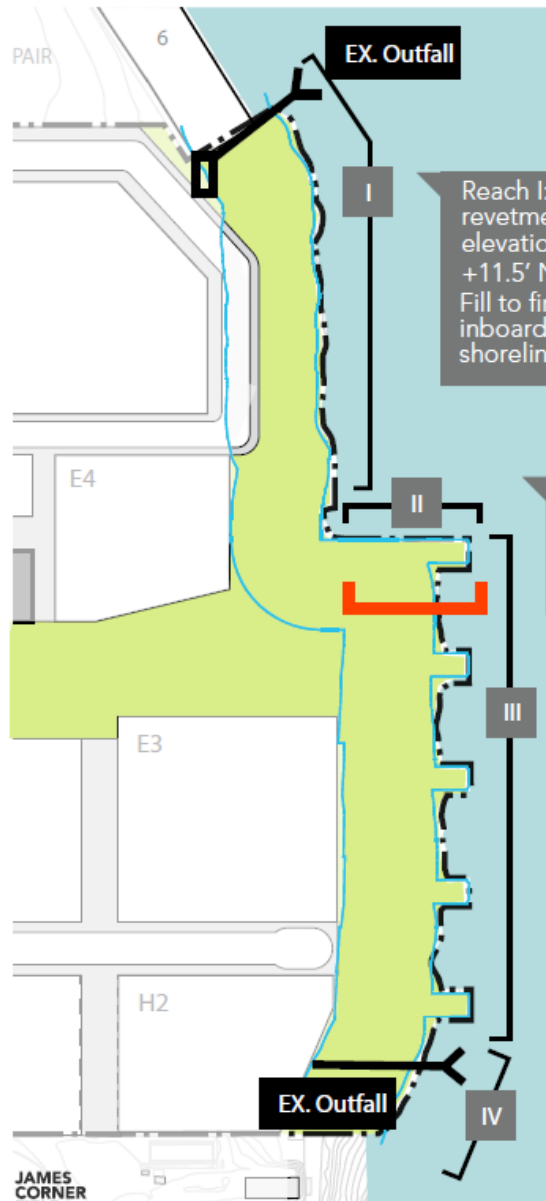
HISTORIC PIER 70







# PIER 70 SHORELINE IMPROVEMENT

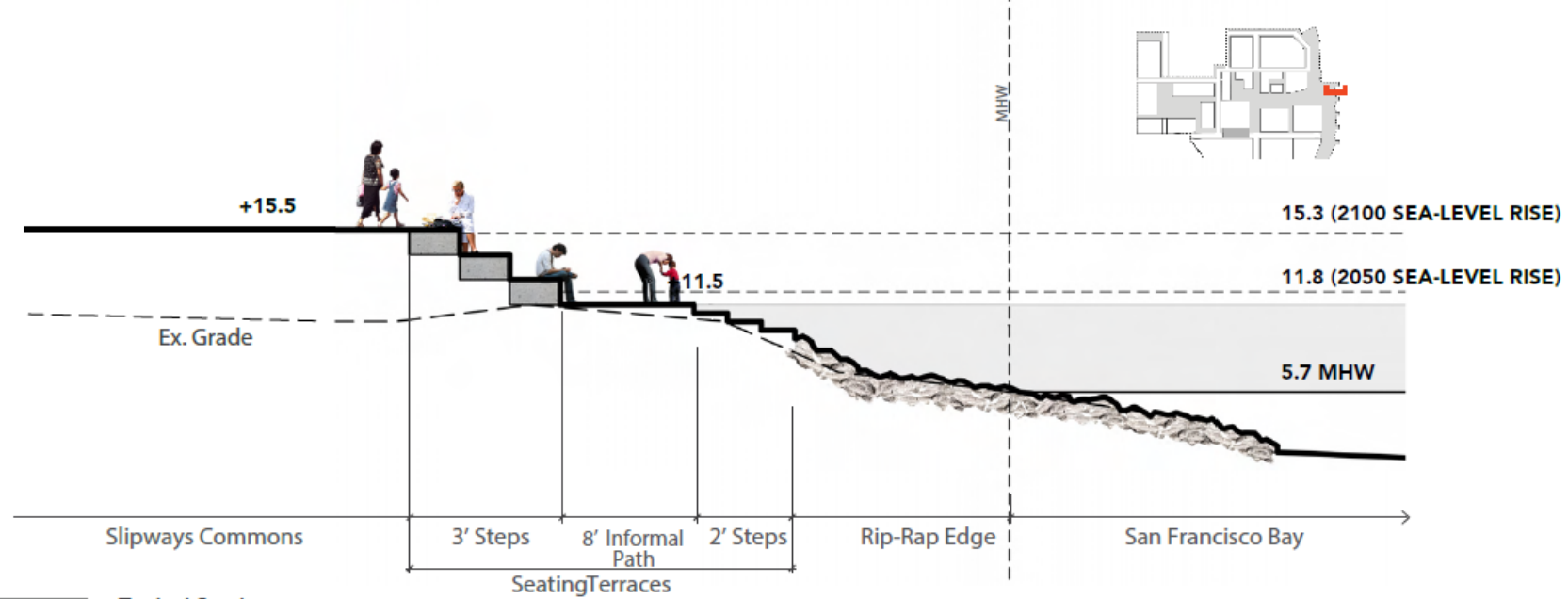


**Reach I:** Rip-rap revetment at MHW to elevations +11.0' to +11.5' NAVD  
Fill to finish grade inboard of continuous shoreline path.

**Reach II:** Bulkhead wall repair or replacement.  
Alternative 1: Sheet Pile Wall.  
Alternative 2: Soldier Pile Wall

**Reach III:** Repair existing slope protection with armored stone and crushed rock leveling course  
Rip-rap revetment, hardscape steps, or cantilevered/pile platform for +11.5' NAVD  
Fill to finish grade inboard of continuous shoreline path.

**Reach IV:** Improve revetment to between +11.5 and +12.0 NAVD. Above +12.0, revetment or concrete block mats.



Typical Section

Water Level	NAVD88 (feet)
Mean High Water	5.7
Mean Higher High Water	6.4
<b>Upland Base Flood Elevation</b>	
100-Year Flood	9.4
100-Year Flood 2050 (12" - 24")	10.8 - 11.8
100-Year Flood 2100 (36" - 66")	12.8 - 15.3
<b>Shoreline Base Flood Elevation</b>	
100-Year Flood	11.7 - 13.4
100-Year Flood 2050 (12" - 24")	12.7 - 15.4
100-Year Flood 2100 (36" - 66")	14.7 - 18.9

\* Range shown for 2050 and 2100 includes projected and high scenarios of sea level rise from National Research Council NRC (2012) Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future.

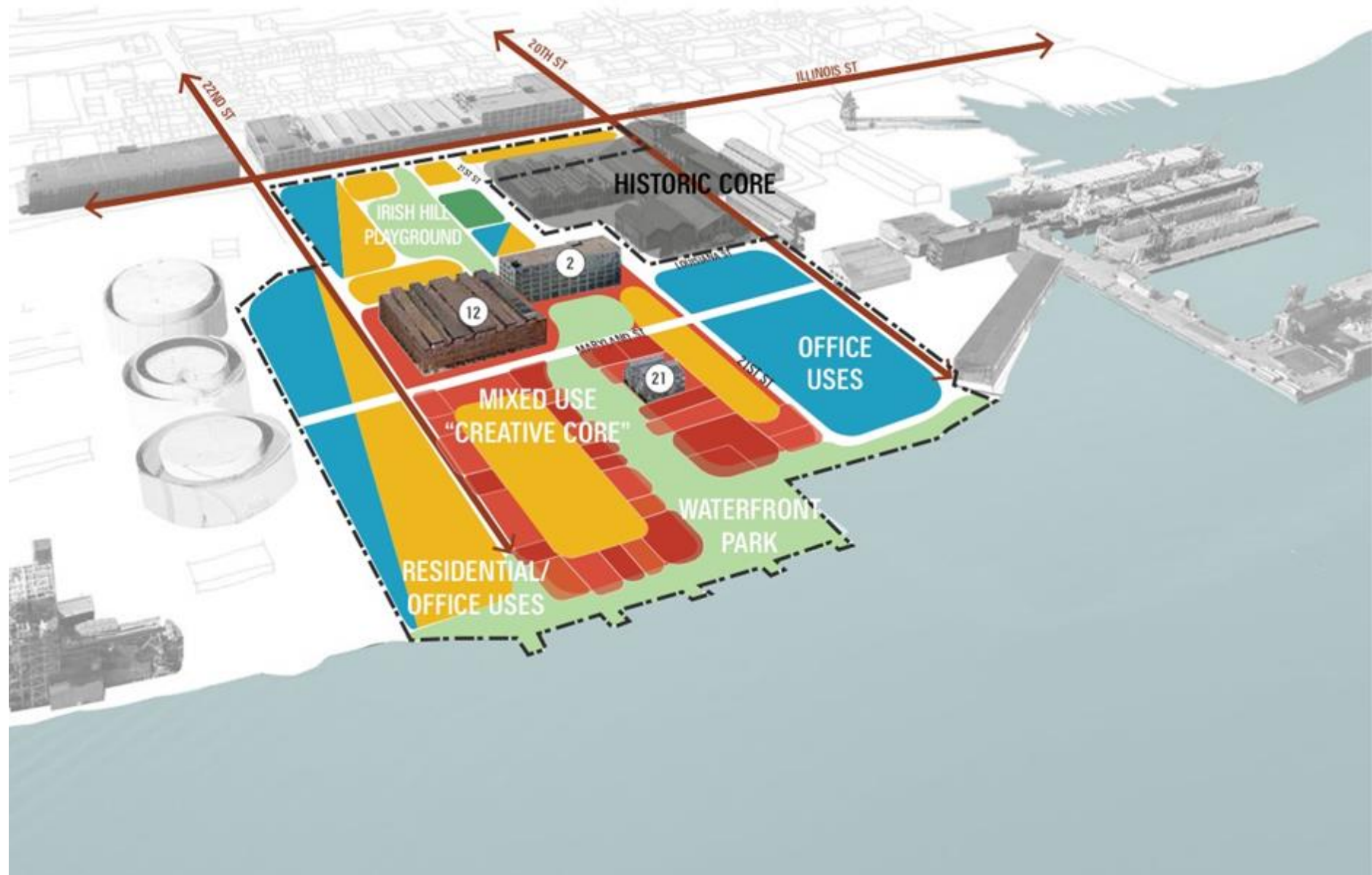


# PLACES WATERFRONT TERRACE LAWN





# Historic Buildings





# Building 12





# Building 15



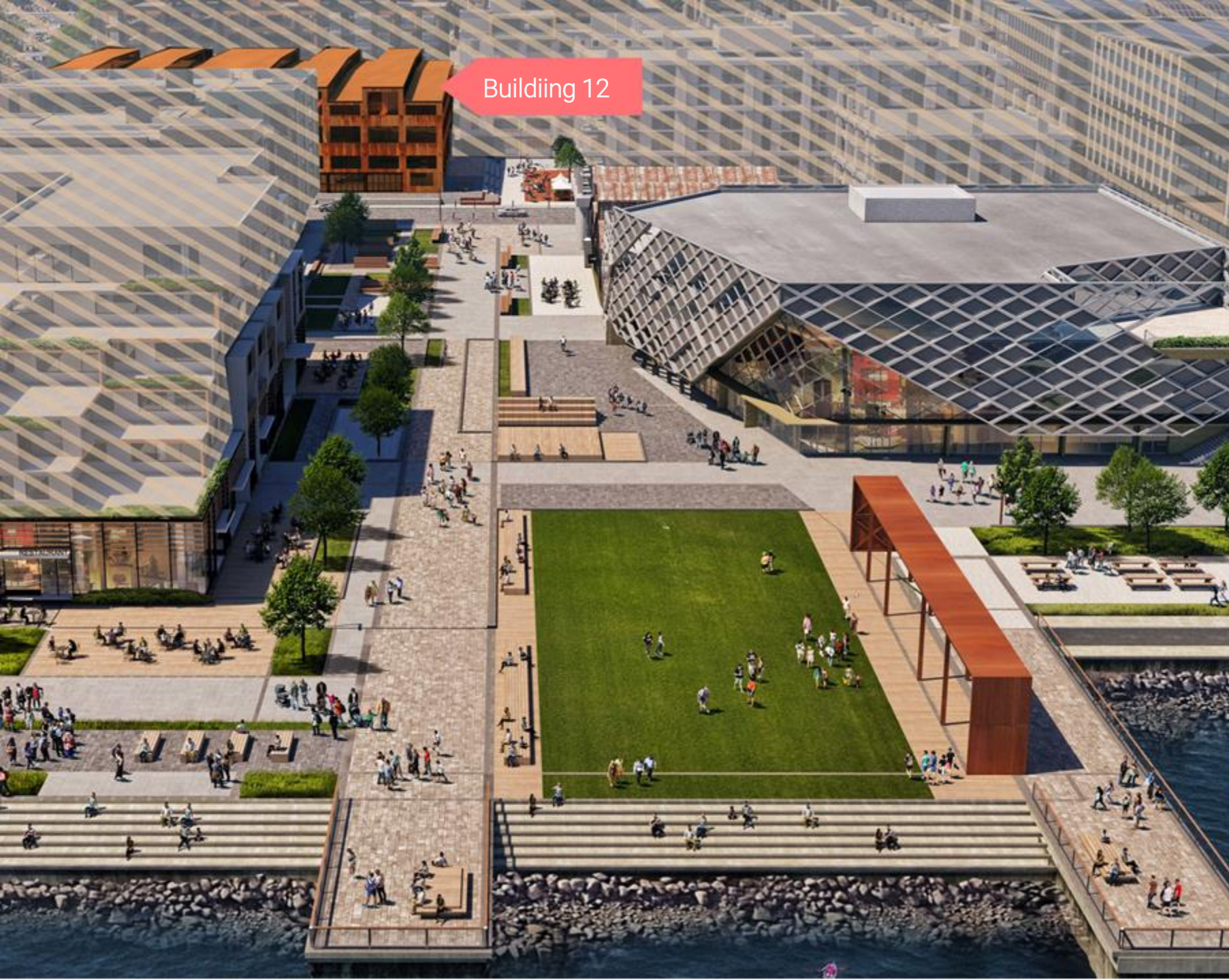


# Building 21





Building 12





# Funding Sources

- Initial Construction for First 100 Year Protection
  - Developer fronts money for initial construction.
  - Port uses special taxes on the project (community facilities district tax) and tax increment to reimburse the developer and pay for feasibility gaps for historic rehabilitation.
- Future Sea Level Rise Improvements
  - Separate CFD special tax will kick in in future for to be determined sea level rise improvements. Can be used outside project area.
- Parks Maintenance
  - Project self-funds through another CFD special tax for maintenance of parks.



# Moderated Discussion



**Dr. James Moore**

Global Solutions Director  
Cities & Places, Jacobs  
(Moderator)



**Dr. Jalonne White-Newsome**

Founder  
Empowering a Green  
Environment & Economy



**Catherine Reilly**

Senior Development Director  
Brookfield Properties



**Dr. Lynette Cardoch**

Director, Resilience & Adaptation  
Moffatt & Nichol





Q & A

Questions?