Scaling Resilient Natural Systems: Watershed, Municipality, Site

New Jersey Coastal & Climate Resilience Conference
March 10, 2026

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RAMBOLL

Speaker Introductions

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Senior Landscape Architect,
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Rob Pirani
Director,
NY-NJ Harbor & Estuary Program at
the Hudson River Foundation

Angela Andersen
Resilience Project Manager,
Long Beach Township

Brett Branco, PhD
Executive Director,
Science and Resilience Institute at
Jamaica Bay

Ramboll in brief

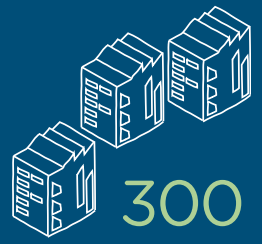
Ramboll is a global architecture, engineering, and consultancy company, delivering expertise and sustainable solutions to clients and partners.

Our ownership by **The Ramboll Foundation** ensures the long term and independent development of Ramboll, its employees, and the communities we serve.

Our experts create sustainable solutions across **Buildings, Transport, Water, Environment & Health, Architecture & Landscape, Energy and Management Consulting**.

Across the world, Ramboll combines local experience with a global knowledgebase to create sustainable societies where people and nature flourish.

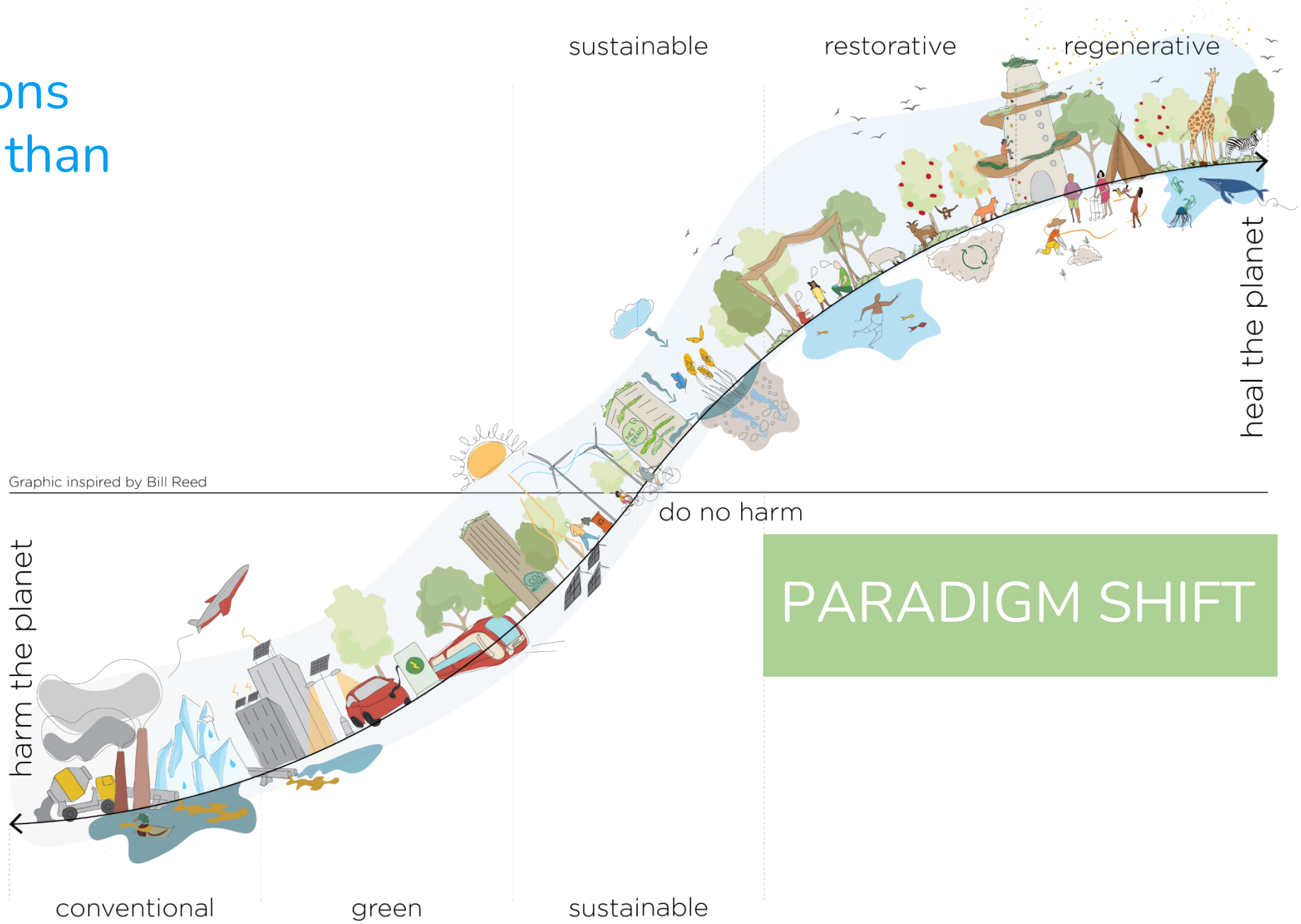
We call it:
Bright ideas. Sustainable change.



300
global offices in 35 countries; 70 offices across three countries in the Americas

18,000 employees
2,100 people in the Americas

Create solutions that do more than ”do no harm”

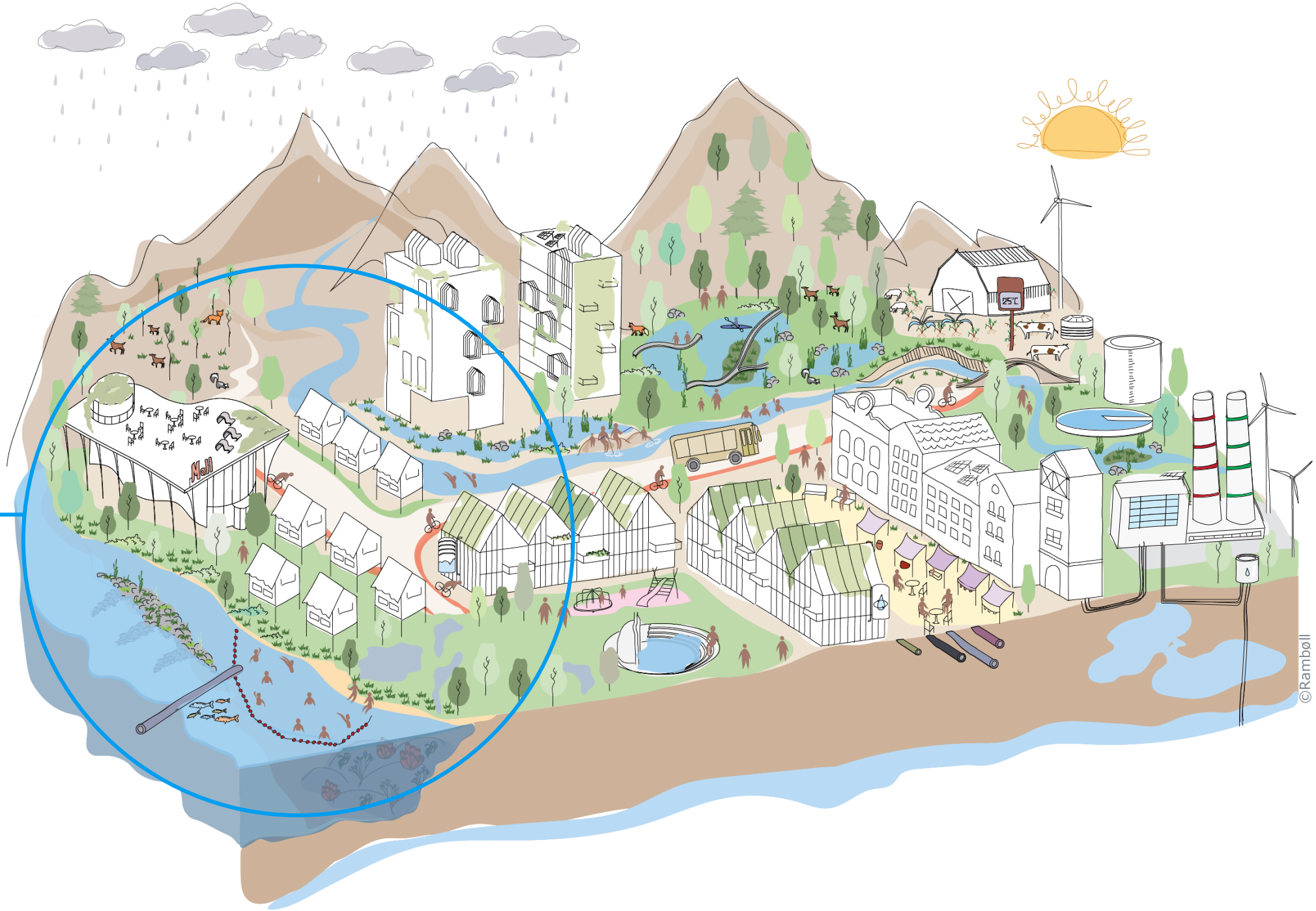


PARADIGM SHIFT

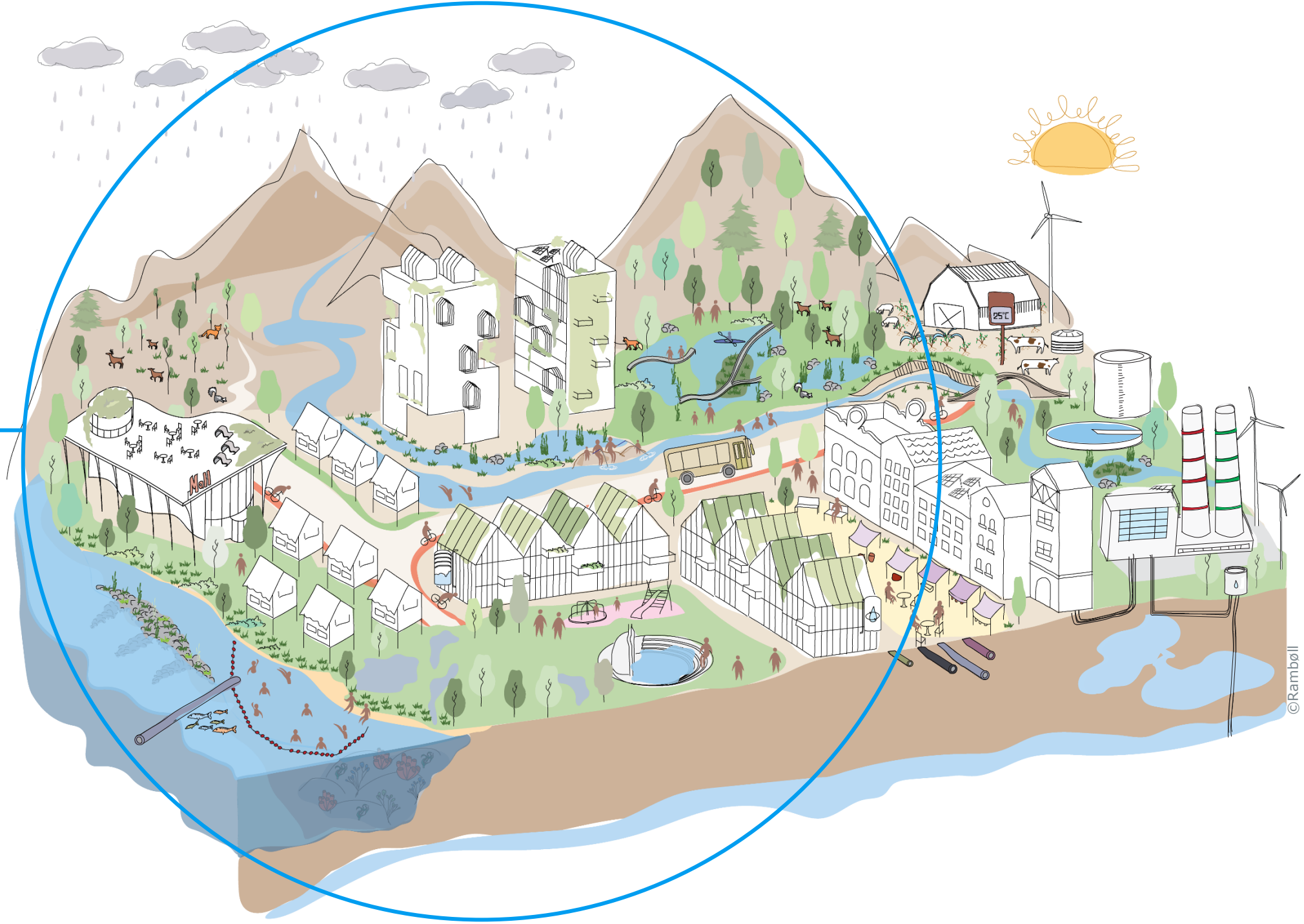
Your work is always part of a bigger whole

A single shoreline project

A system of municipal policies and programs



Networked within a wide-reaching watershed



Site Scale

Lake Welch Wetland Restoration

- Located within Harriman State Park (New York)
- Water quality concerns, HABs treatment and WWTP facility improvements
- Wetland restoration of degraded lagoon and design of wetland stormwater treatment system
- Site-specific design driven by
  - Adjacent Chestnut Oak Forest
  - Native wetland community composition and hydrophytic vegetation design

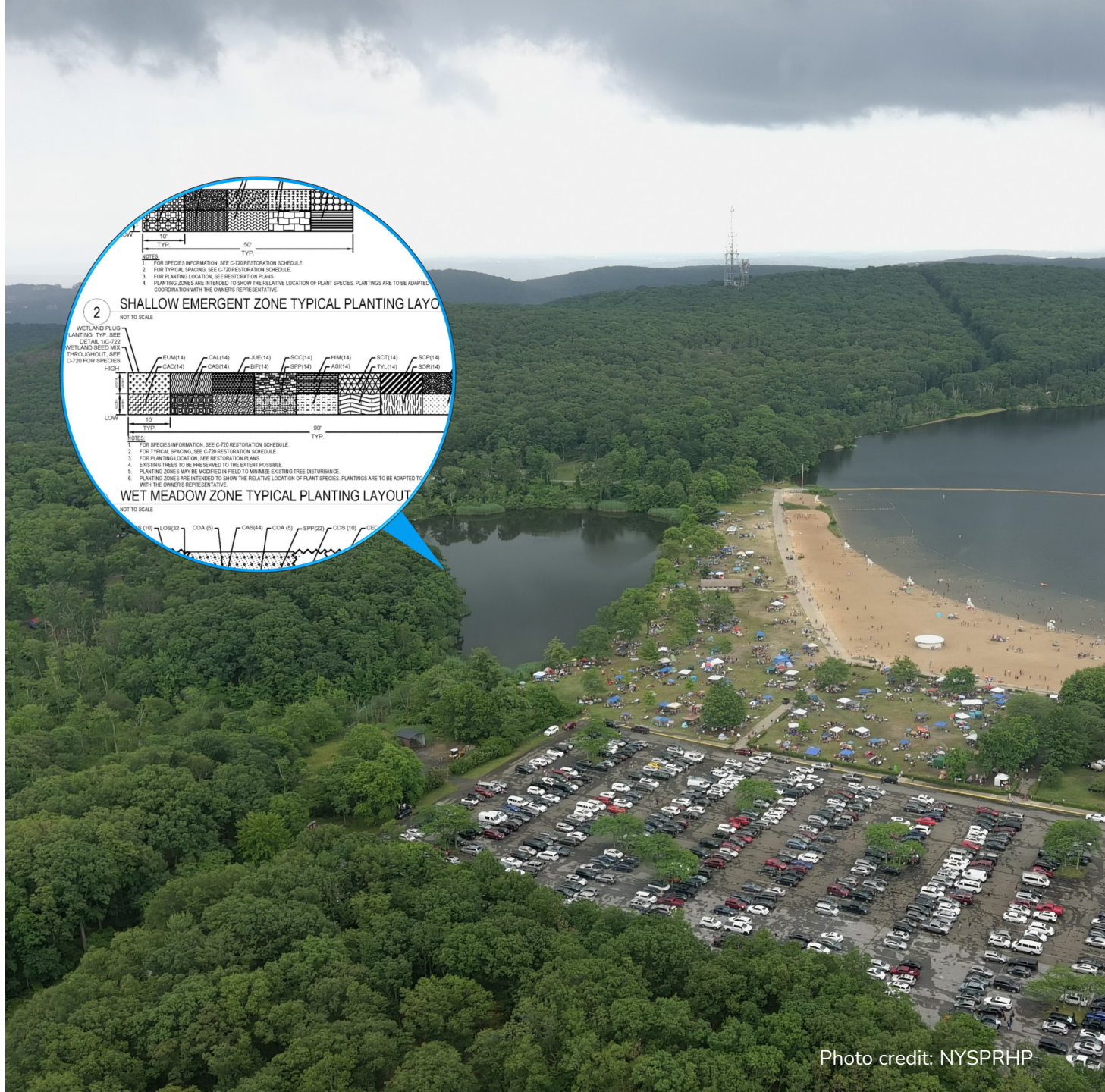
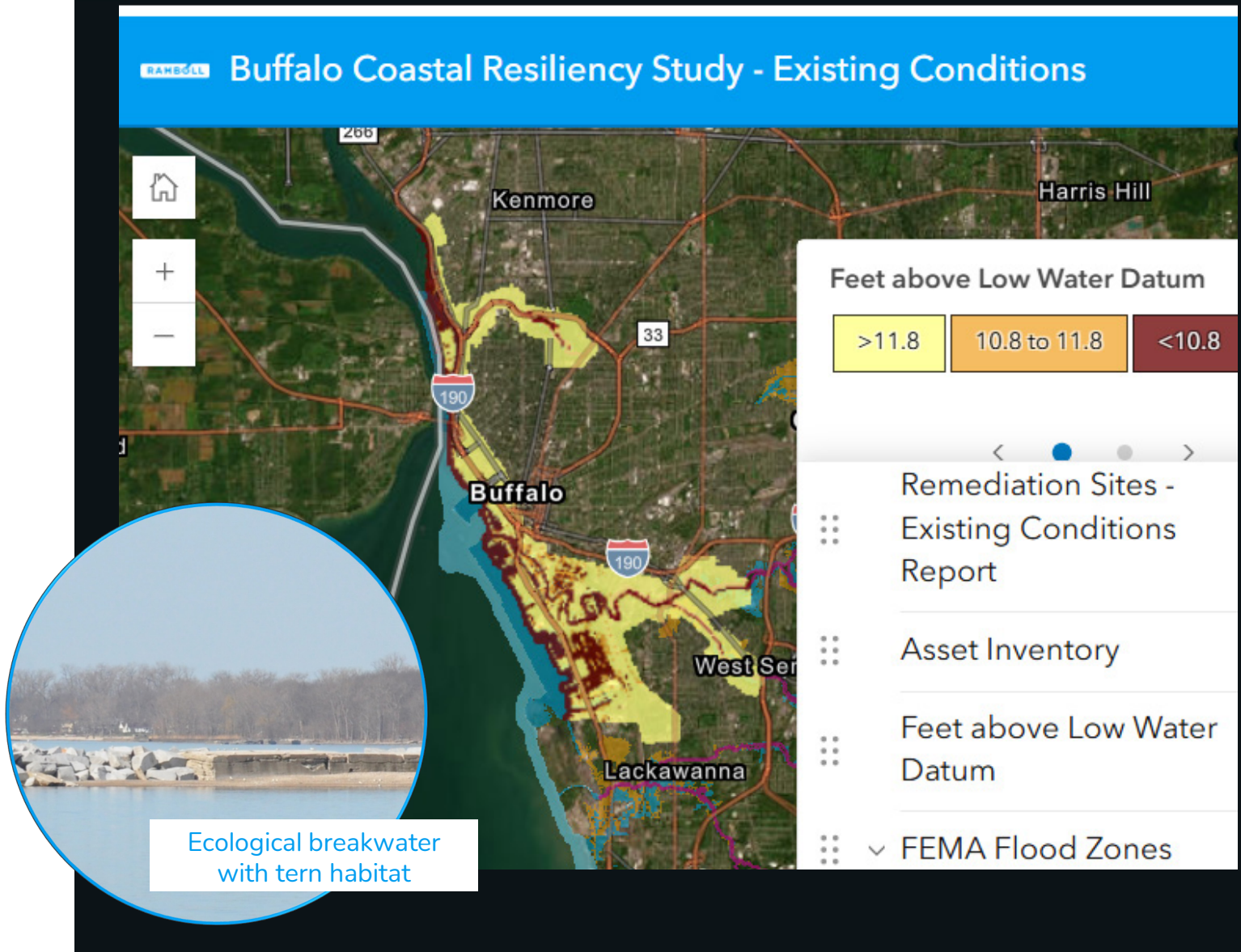


Photo credit: NYSPRHP

Municipal Scale

Buffalo Coastal Resilience

- Flooding resiliency study for the City of Buffalo, NY for Buffalo Niagara Waterkeeper
- Help mitigate long-term coastal flooding risks associated with storm surge and seiche events in a changing climate
- Evaluated extensive coastal and inland areas to create profile of community vulnerability to flooding and sewer discharge backflows
- Designed a network of conceptual projects to address flooding with engineered nature-based solutions

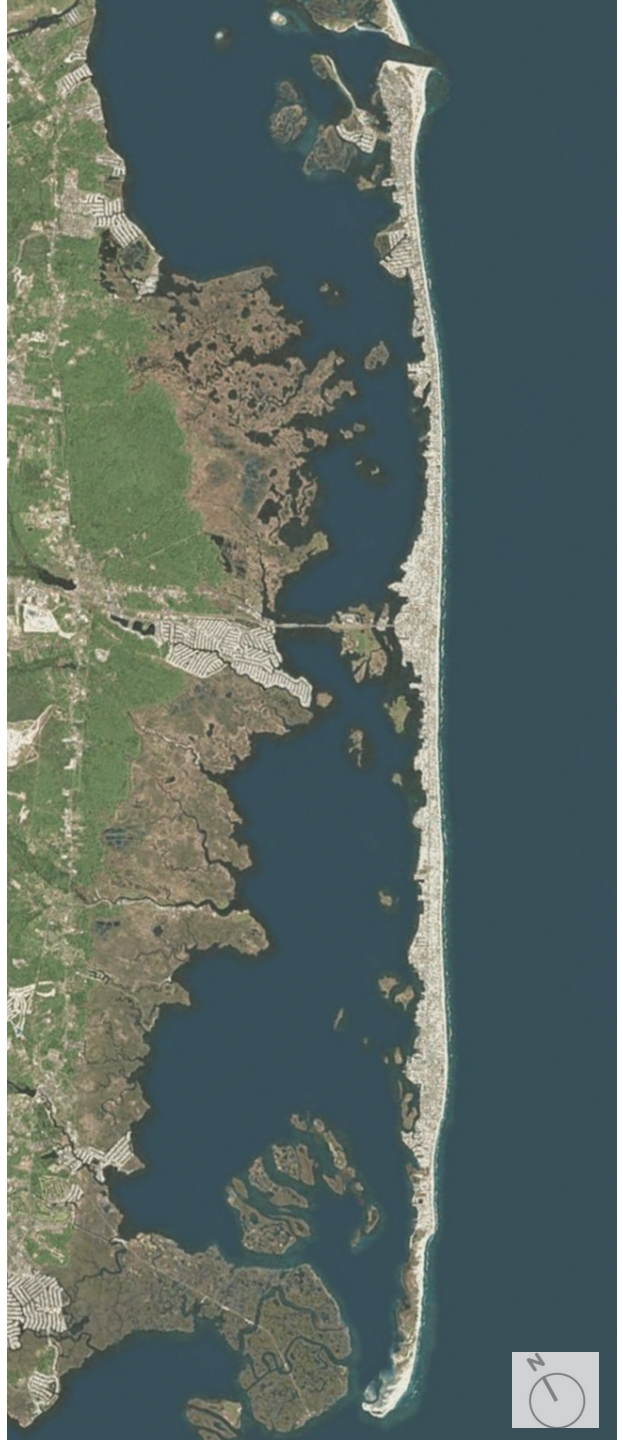


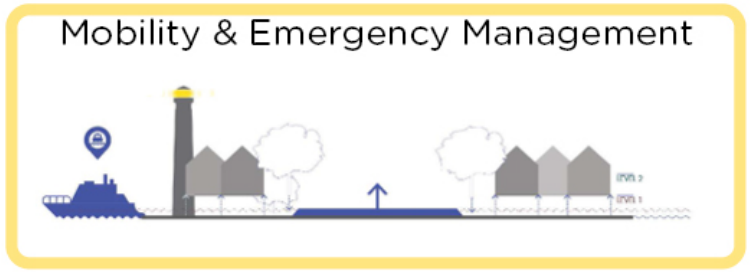
Ecological breakwater with tern habitat

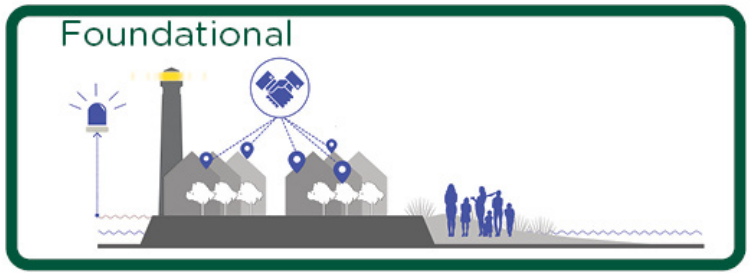
Watershed Scale

Resilient Long Beach Island

- Island-wide resilience effort with 6 municipalities, stakeholders, residents, county
- Collaborations across municipal boundaries and services
- Aligning with various and differing priorities
- Planning for resilience in unprecedented change
- Resilient LBI Action Plan for short-term, long-term projects, and foundational capacity-building for many audiences







Thank you.

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Scaling Resilient Natural Systems

For the Hudson-Raritan Estuary

March 2026

HUDSON RIVER FOUNDATION

NY/NJ HARBOR & ESTUARY PROGRAM

Hudson-Raritan Estuary

360,000 Square KM Watershed

5,500 Square KM Watershed for Harbor Estuary

14 Million People

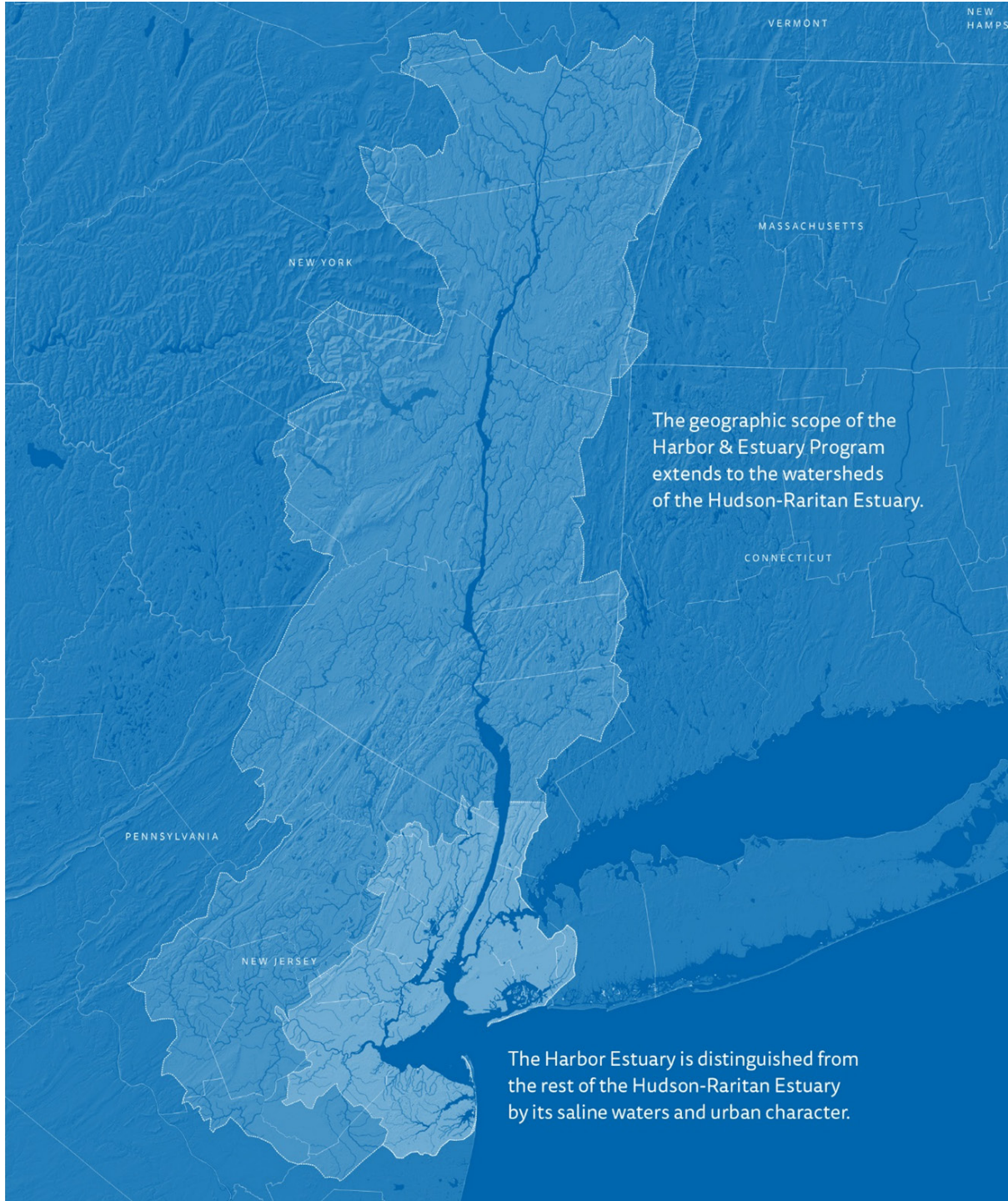
^ 30 Percent of Shoreline is Hardened and 85% of Coastal Wetlands Have Been Lost

25 Major Treatment Plants Discharging 2 Billion GPD

200,000 Port/Maritime Workers

2 States, 11 Sewerage Agencies, and Hundreds of Units of Local Government

^ 150 Stewardship Organizations



New York - New Jersey Harbor & Estuary Program

Misson: Engaging people, partners, and communities to collaboratively advance understanding, improve stewardship, and enhance our shared waters and watersheds.

Roles:

- Convene estuary stakeholders
- Support applied science
- Advance best practices
- Provide for community engagement
- Attract and allocate funding

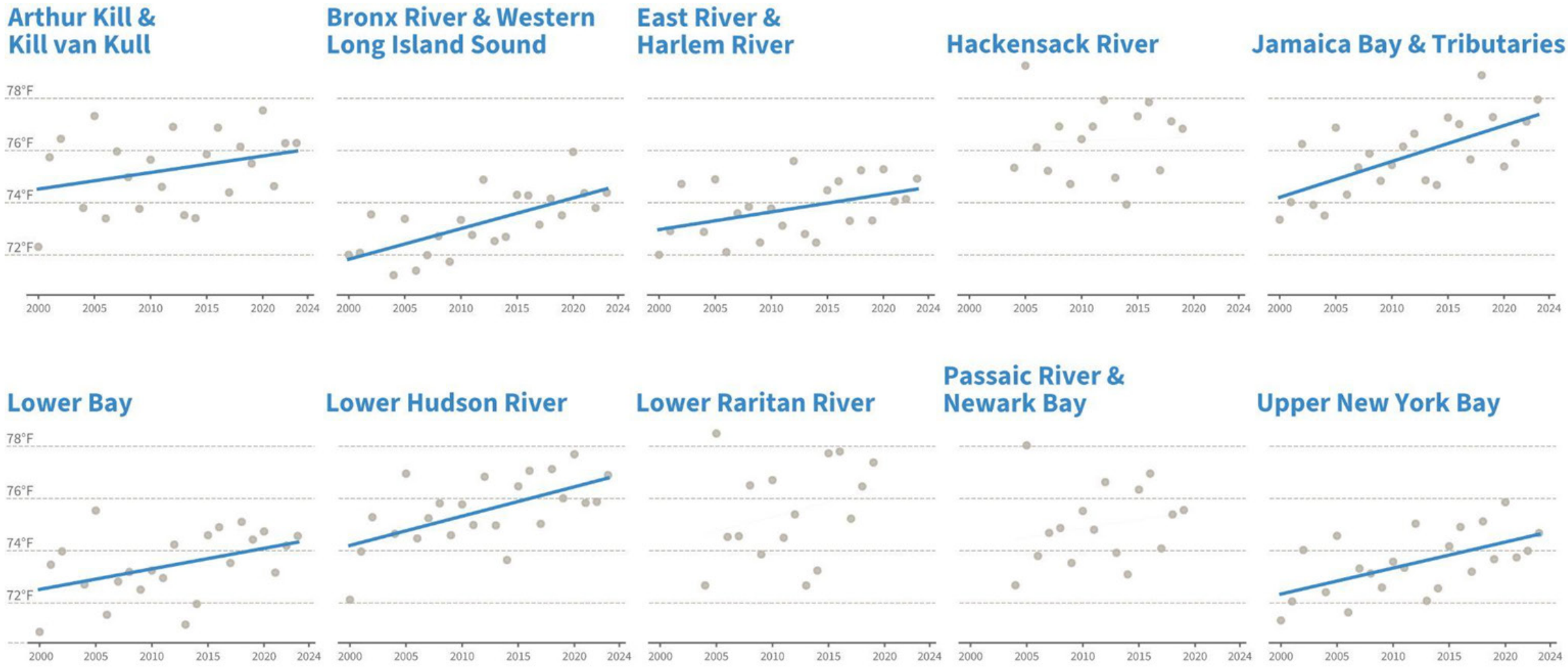
Five Long Term Goals

- Water Quality
- Habitat and Ecological Health
- Public Access and Stewardship
- Port and Maritime
- Community Engagement

https://www.hudsonriver.org/ccmp

Water Quality Summer Water Temperature

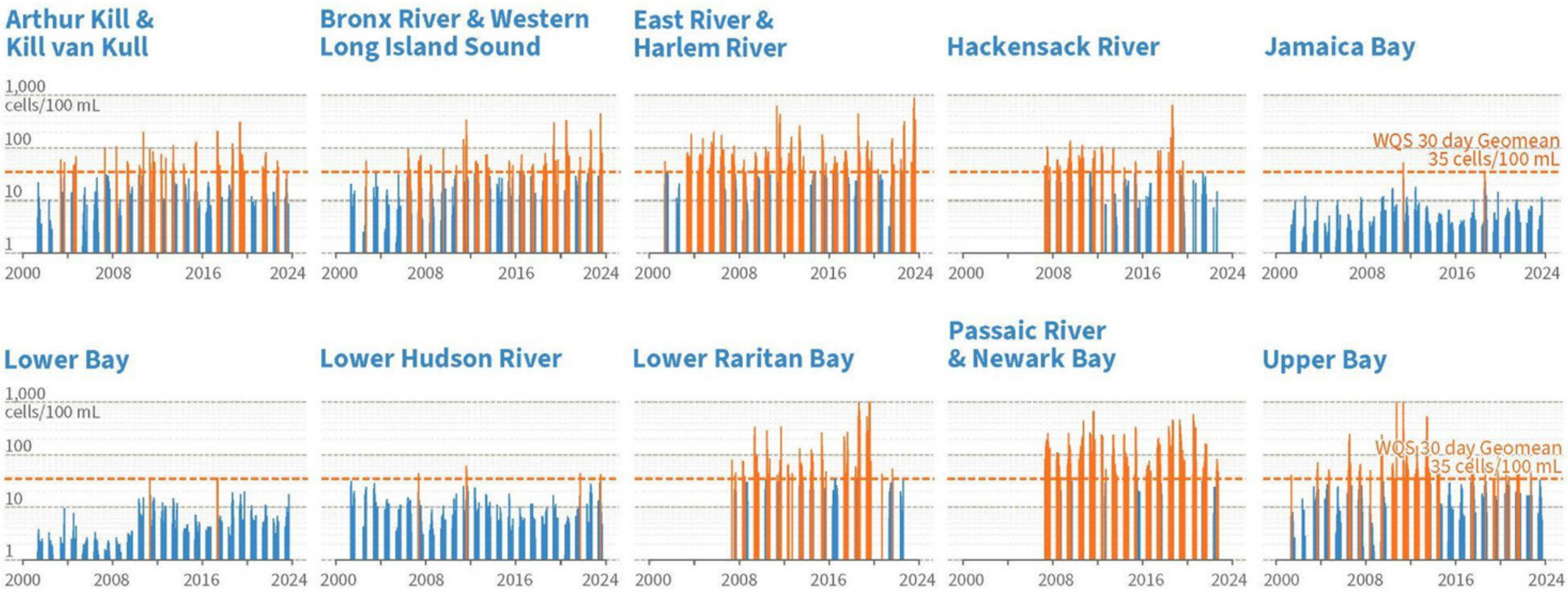
Declining ↘



Data source: NYCDEP + NJ HDG

Water Quality Enterococcus

Variable trends ~

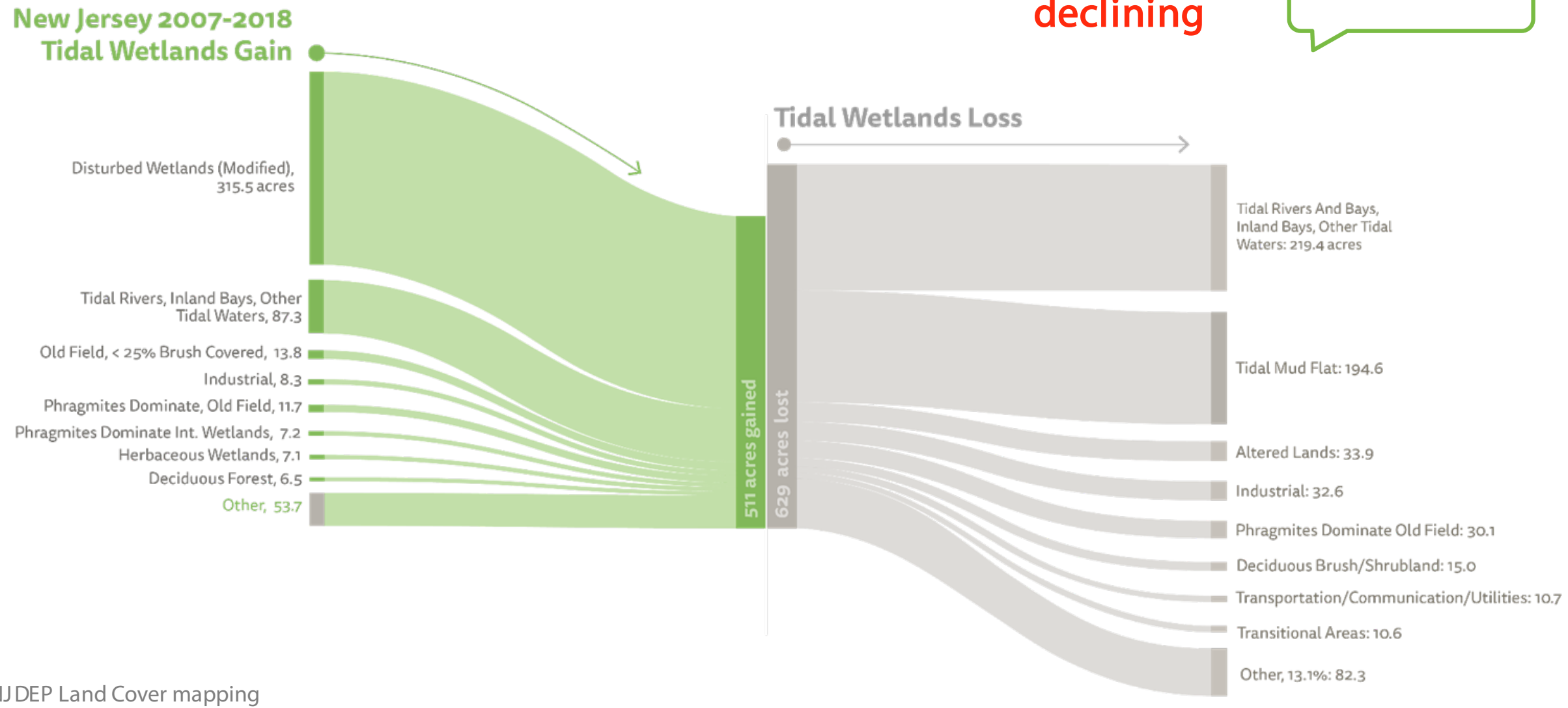


Data source: NYCDEP + NJ HDG

Tidal Wetlands, New Jersey

New Jersey had **118 fewer acres** of wetlands in 2018 than in 2007.

Short term trend: declining ↘



NJ DEP Land Cover mapping

OBJECTIVE A EXTREME WEATHER

Maximize clean water and other benefits through integrated adaptation approaches

Action A-1 Advance watershed plans and/or pilot projects that aim to reduce flood risk and improve water quality

Action A-2 Support the management and maintenance of green stormwater infrastructure and natural and nature-based resiliency features

OBJECTIVE A TARGET CHARACTERISTICS

Progress on key target ecosystem characteristic goals of the Hudson Raritan Estuary Comprehensive Restoration Plan

ACTION A-2. Improve aquatic connectivity by addressing hysical barriers to aquatic life such as dams and culverts

OBJECTIVE D EXTREME WEATHER

Advance understanding and incorporation of the impacts of recurring extreme weather events on habitat management

ACTION D-1
Evaluate and integrate habitat conservation and restoration with coastal protection

OBJECTIVE B DREDGED MATERIALS

Advance beneficial reuse of dredged materials to enhance habitat, especially shallow water restoration practices

ACTION B-1 Assess performance of structured shallow water habitat over time and advance new shallow water enhancement opportunities

BUILDING COMMUNITY CAPACITY FOR RESILIENCY

Five grants totaling $450,000 awarded in 2023. **$563,498** leveraged from grantees to date.

Up to $ 350,000 will be granted in 2026 for four – six grants.

Focus on integrating watershed management, flood resiliency, and clean water goals

GROUNDWORK Hudson Valley

Citizen Advocacy to Promote Flood and Coastal Resilience in Southwest Yonkers

Program overview April through September, 2024

December 12, 2024

Scaling Resilient Natural Systems

For the Hudson-Raritan Estuary

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https://www.hudsonriver.org/ccmp

HUDSON RIVER FOUNDATION

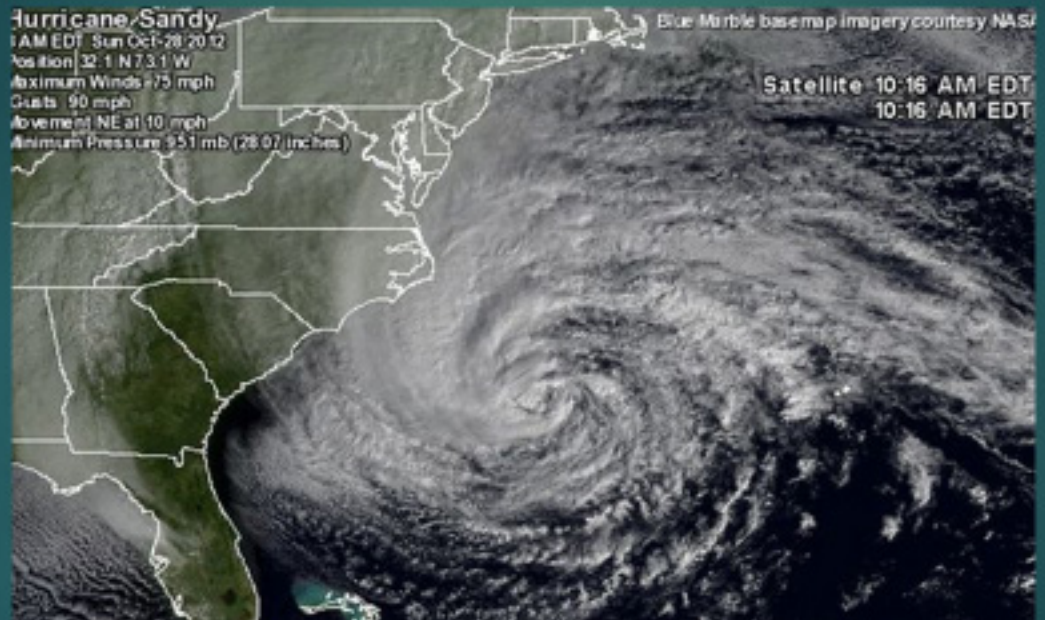
NY/NJ HARBOR & ESTUARY PROGRAM

SCALING RESILIENT NATURAL SYSTEMS

Angela C. Andersen

Resilience Project Manager
Long Beach Township Field Station, NJ

And then along came Sandy



2012
Shifted priorities & changed terminology

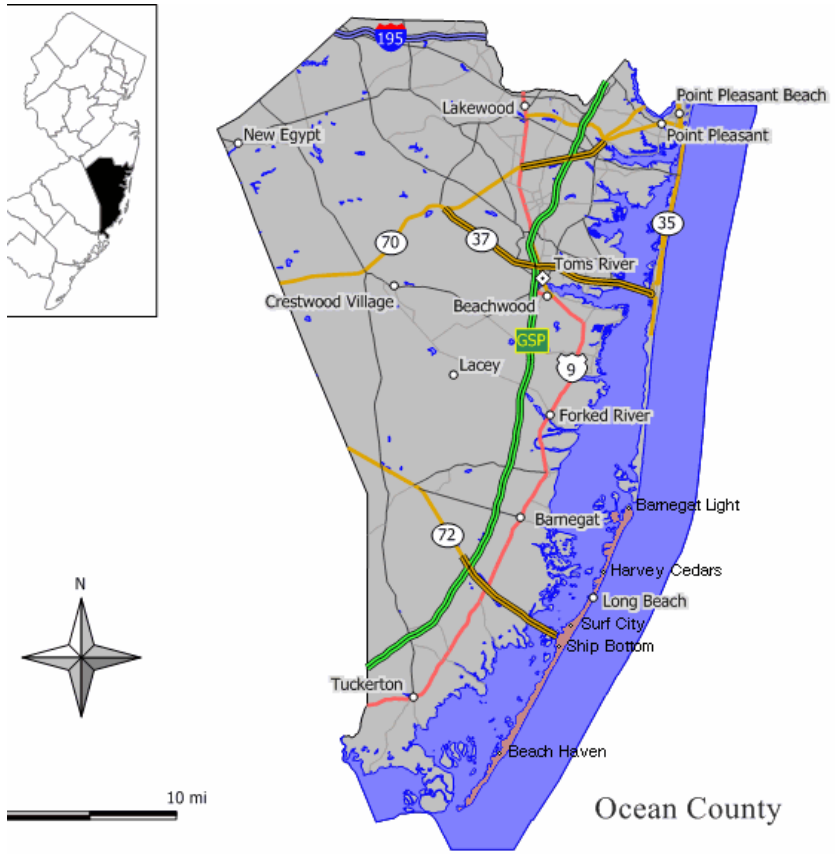
LBI & Barnegat Bay-Little Egg Harbor Bay watershed & estuary- Manahawkin Bay- established NEP 1995-Barnegat Bay Partnership

The Barnegat Bay-Little Egg Harbor **estuary** 42-linear miles 3 inlets Little Egg Harbor Inlet north past Barnegat light inlet to Point Pleasant Canal

The b-bay is created and protected by barrier islands

Fresh water from rivers and groundwater meets the ocean producing (**brackish- estuary**)

LBI-- double duty : **creating** and **protecting** the estuary.



- **Sub watershed/ creeks provided fresh water to the system as well as sediment.**
- **The lack of soil-sediment coming into the system is realized in diminishing wetlands/bay islands**
- **NJ Bay Island Initiative shedding light on importance of protecting marsh islands**
- **Increased sand-sediment coming in the inlets from replenishment**
- **Sediment migration and management is critical to resilience planning**

Long Beach Island

by the #'s

1 island

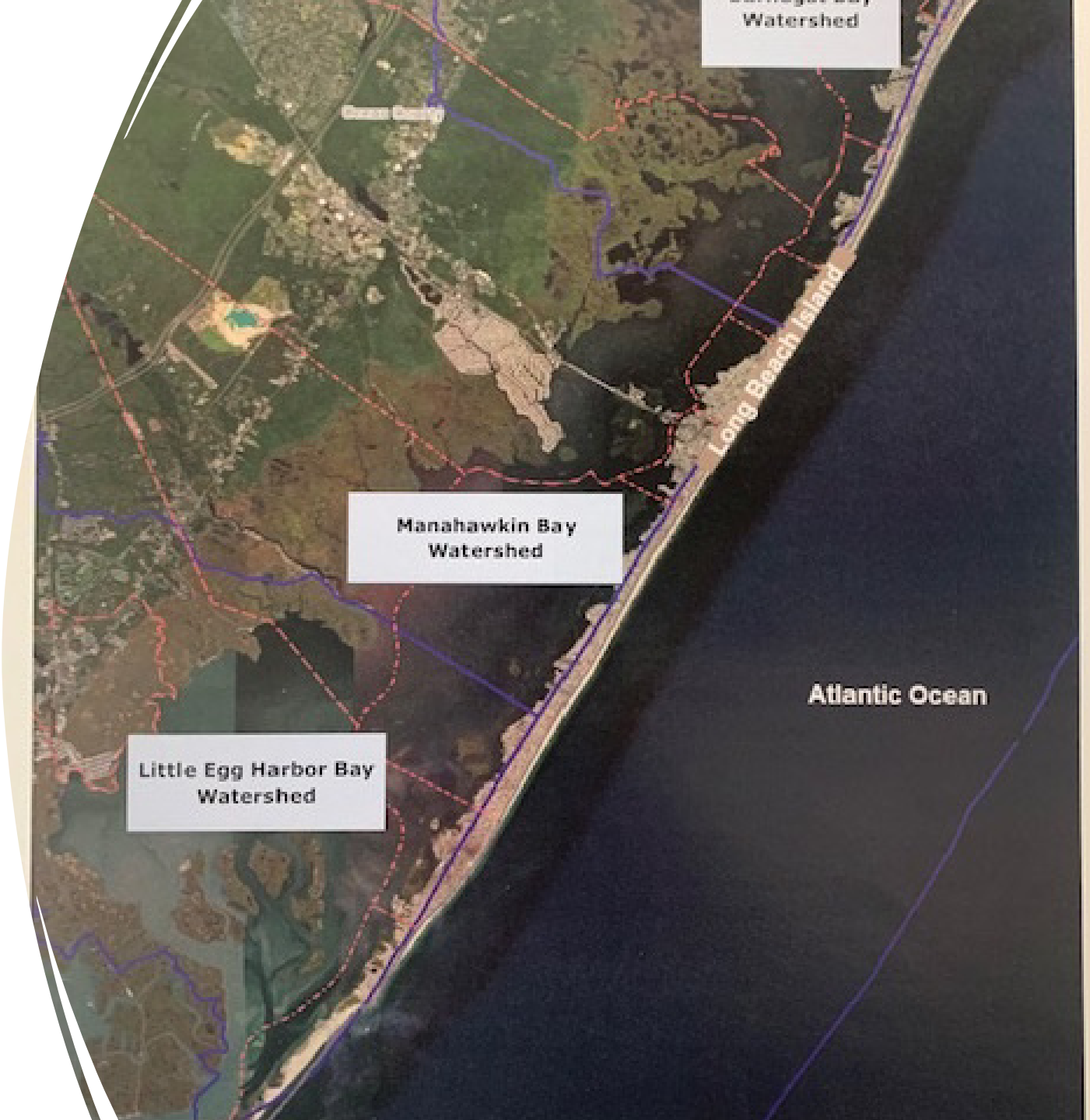
6 towns

3 bays

2 inlets

1 ocean

12 rivers/creeks



LBT 12 non contiguous miles of the 18 mile island

Regional Resilience Planning 6 towns

LBT applied for RNJ funding (2018)

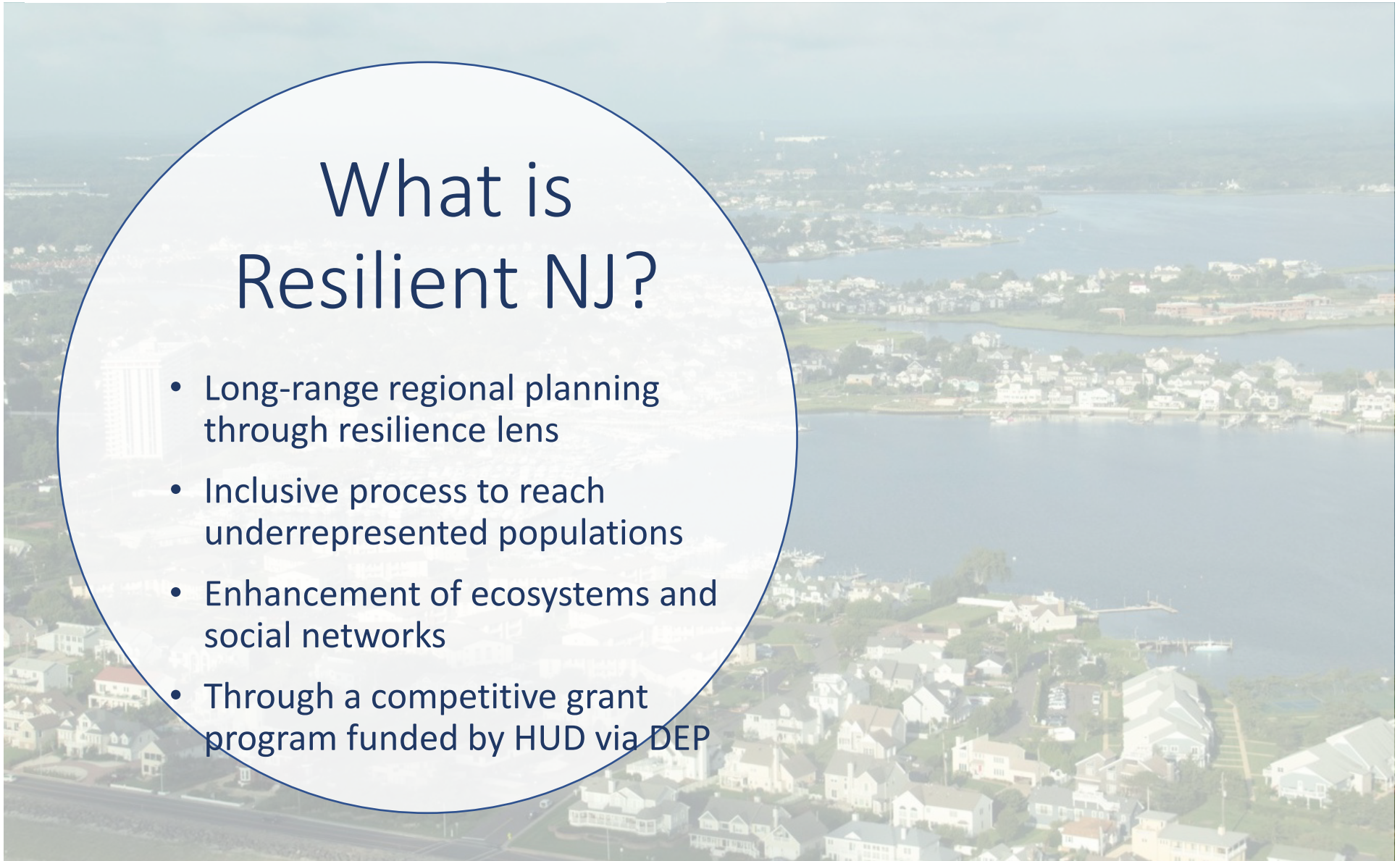
RESILIENCE became the name of the game

"Coastal Resilience" means building the ability of a community to "bounce back" after hazardous events such as hurricanes, coastal storms, and flooding – rather than simply reacting to impacts. "
or is it also developing the ability of a community to "bounce forward"

This is where our resilience story started.

Resilient NJ

State of New Jersey
Department of Environmental Protection
Bureau of Climate Resilience Planning



What is Resilient NJ?

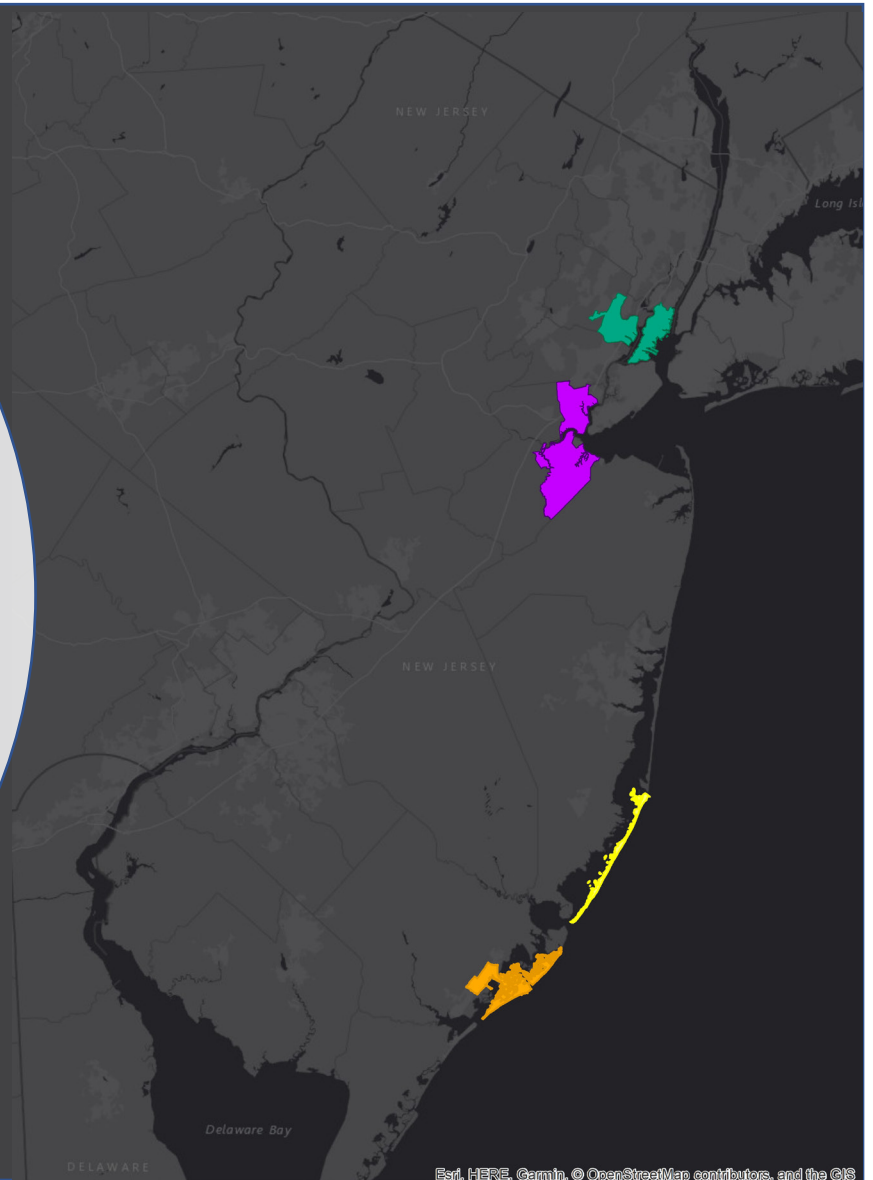
- Long-range regional planning through resilience lens
- Inclusive process to reach underrepresented populations
- Enhancement of ecosystems and social networks
- Through a competitive grant program funded by HUD via DEP

Resilient NJ

State of New Jersey
Department of Environmental Protection
Bureau of Climate Resilience Planning

Planning Regions est. 2018

- Jersey City (Prime), Bayonne, Hoboken, Newark, HOPES, Ironbound Community Corporation
- Long Beach Township (Prime), Barnegat Light, Beach Haven, Harvey Cedars, Ship Bottom, Surf City, Long Beach Island Community Center
- Middlesex County (Prime), Perth Amboy, Woodbridge, Sayreville, South River, Old Bridge, Lower-Raritan Water Partnership
- Ventnor (Prime), Brigantine, Atlantic City, Margate, Longport, Northfield, Pleasantville, Atlantic County, American Red Cross



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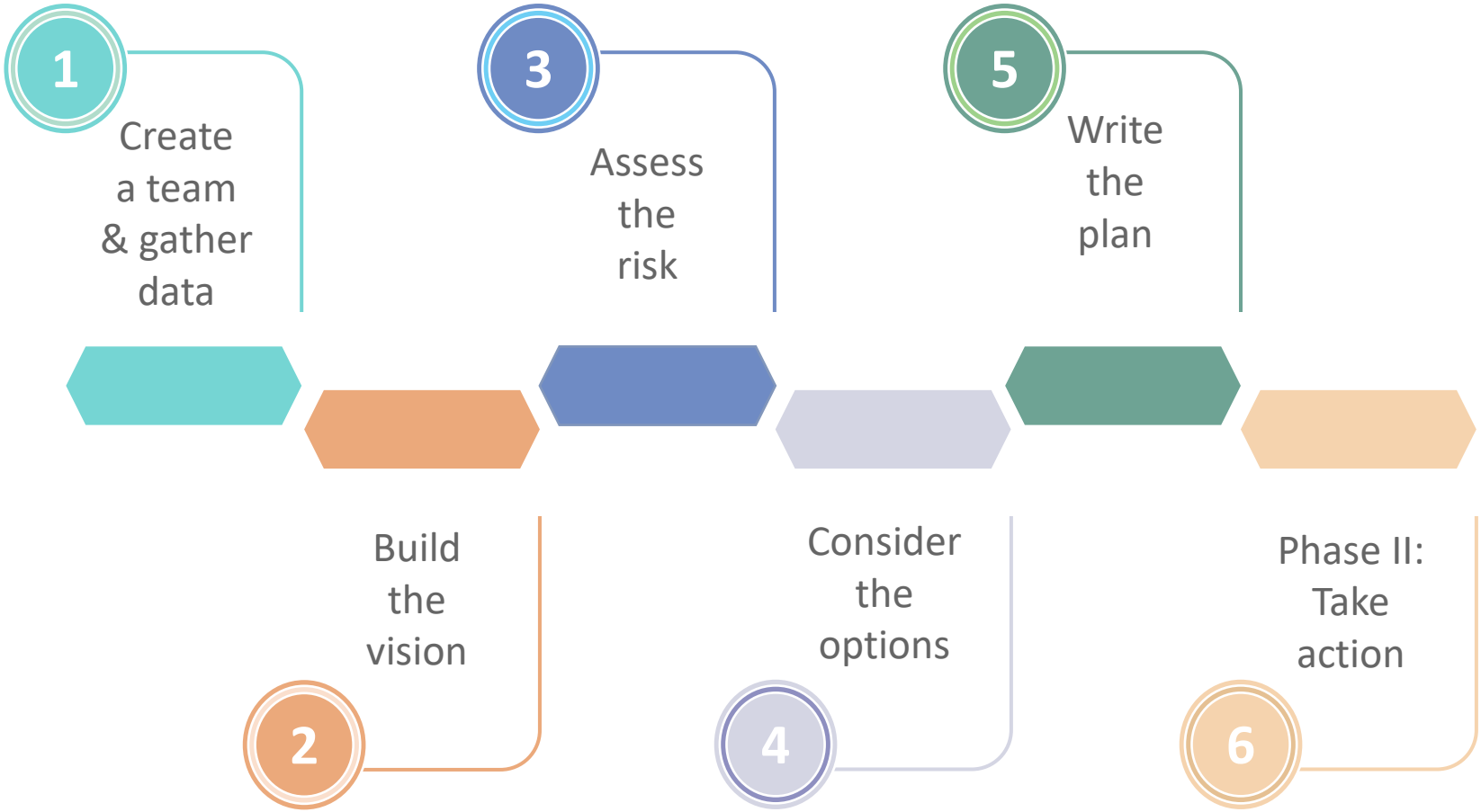
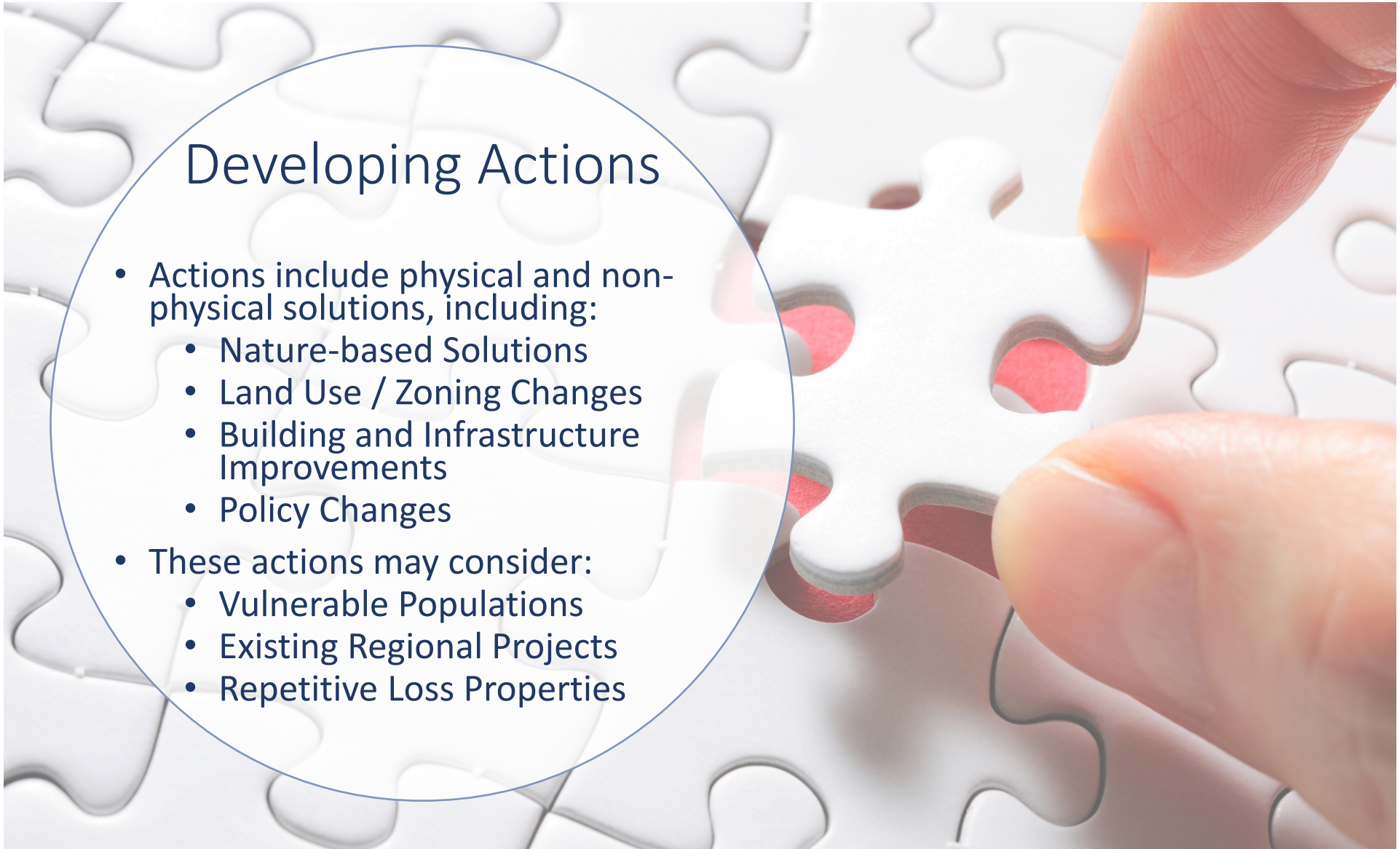
From Planning to Action: The Process



Coastal Vulnerability Assessment

- Each region performed a vulnerability assessment to determine the risks under each flooding condition. (***fun fact:LBI was the first to do a regional CVA in 2017- OLA- which help qualify us for this RNJ/RLBI funding)***
- Assessment will include analyses of asset impacts considering **islandwide/ town specific critical facilities**, natural, cultural, housing, infrastructure, economic, health-based assets and emergency management and mobility issues.

Resilient NJ



Developing Actions

- Actions include physical and non-physical solutions, including:
  - Nature-based Solutions
  - Land Use / Zoning Changes
  - Building and Infrastructure Improvements
  - Policy Changes
- These actions may consider:
  - Vulnerable Populations
  - Existing Regional Projects
  - Repetitive Loss Properties

The plan is a roadmap of ideas that will require the reality of **feasibility & funding for implementation**

along with continued community input and raising awareness

Be Keen to Observe- sunny day flooding

What resilient actions looks like: Nature based solutions mean mimicking natural systems

Photo 8: Courtesy of Dr. Josh Moody. Photo showing coir logs stabilizing sediment and supporting vegetation growth at eroded marsh

Photo 9: Courtesy of Danielle McCulloch. Photo showing oyster shell bags protecting eroded edges of spartina patches and supporting new growth at Gandys Beach, NJ.

LBT Shell Recycling (designed by Jetty Rock Foundation) for oyster reef &bay islands/ shoreline restoration . Bonus: diverting post consumer food waste from landfill

Mobility- Emergency Management and planning includes public accessability

Expand and Enhance Public Access for all

LBI Shuttle: increased mobility decreased congestion and reduction in air pollution
Gators get you a dune over

Infrastructure improvements- stormwater and sewer: pipes, pumps, basins & outflow backflow preventers

NJ Bay Island Initiative (NJBII) - coalition formed to focus on the bay islands which protect our communities (njbayislands.org)

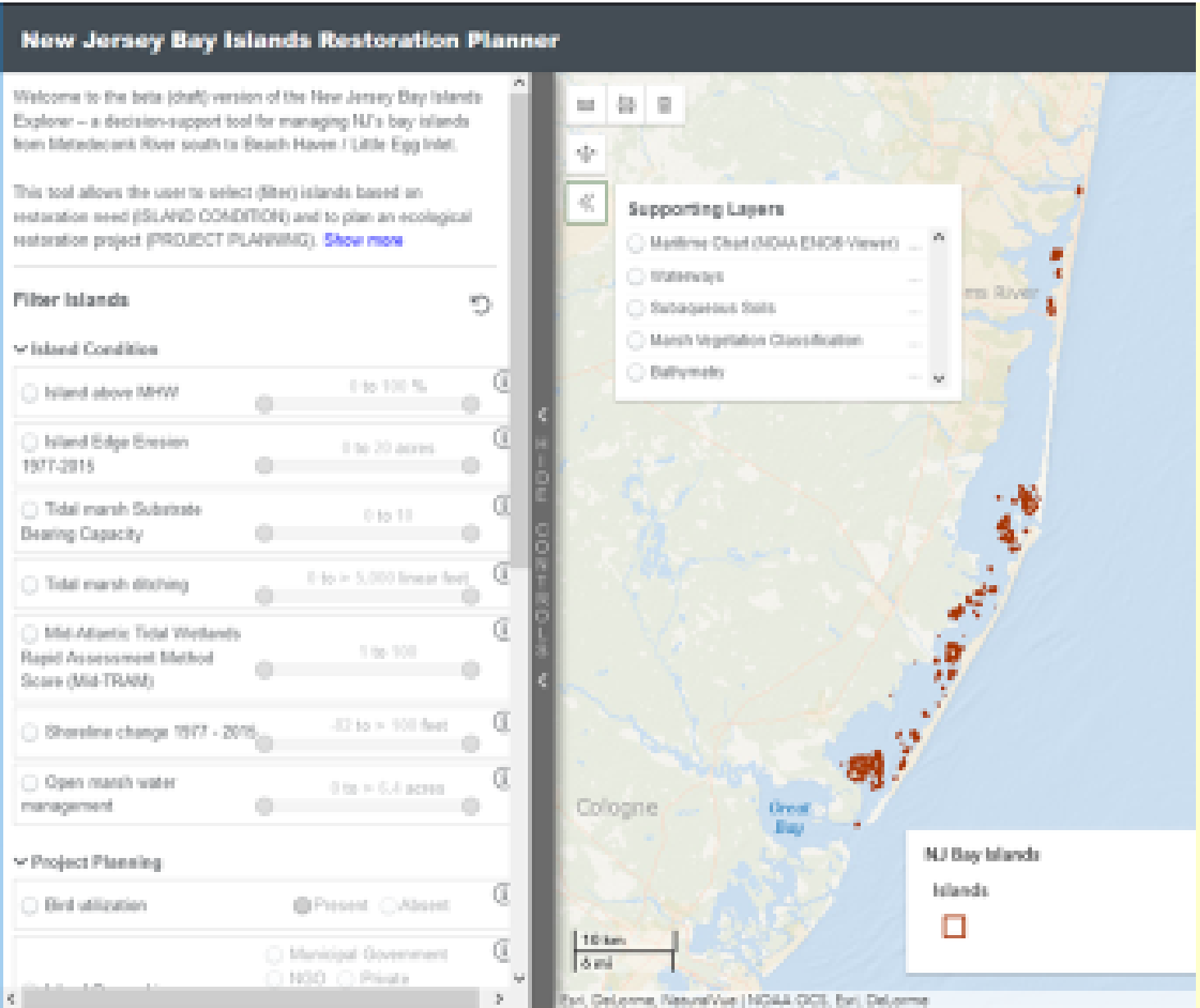
Formed in 2020 to ensure the **resilience of both the natural habitats & developed communities**

Taking a **regional & coordinated approach** to bay island assessment & restoration.

Long-term goal to manage **bay islands as a system** & pursue a **variety of habitat enhancement** & restoration projects to address multiple needs.

New Jersey Bay Islands Restoration Planner

NJBIRP: Characterize Islands & Prioritize Restoration



- Current NJBIRP focus: islands within Barnegat Bay (Manasquan Inlet to Little Egg Inlet)
- Developed as a decision-support tool to prioritize island restoration for the New Jersey Bay Islands Initiative (NJBII)
- NJBII composed of federal, state, county, municipal, academic, and non-governmental partners
  - Goal to manage bay islands as a system
- NJBII selected islands could feed into CERAP tool as areas for restoration
- 2020-2021 Identified 92 subaerial islands & 13 submerged islands

prioritizing strategies to build a resilient community

Concepts to Consider:

- **Alignment with vision** of each town- Master plans, ordinances, FMP, CRS
- **Risk Reduction capacity-** how effective is current strategy and is it equitable island wide?
- **Cost Efficiency-** Where is the funding and how do we get it?
- **Regional Capacity** – who will do the work- need DPW and staff training- Academic and Agency partnerships.
- **Permitting**–*regional* resilience permitting to match the regional resilience planning? Vs individual permit for each action and site
- **Environmental Enhancements- maintenance and monitoring-** will it work in a sustained way long term
- **Adaptability Over Time-** as weather patterns change- what are long term strategies and trends
- **Community Support-** homeowners associations, NGO's, local biz
- **Stable Funding source**– Community Resilience Fund- similar to an open space trust? But with long term stewardship. Bonds…..

- **The Prevailing need**
- Education Education Education
- Outreach- to bayfront homeowners
- Community Networking

RLBI Plan Implementation

Action:

-Protect critical infrastructure

(DPW, Beach Patrol, OCUA, Verizon)

-Mitigate flooding in high prone/repetitive areas

(mobility on evacuation route)

what can communities and individuals do

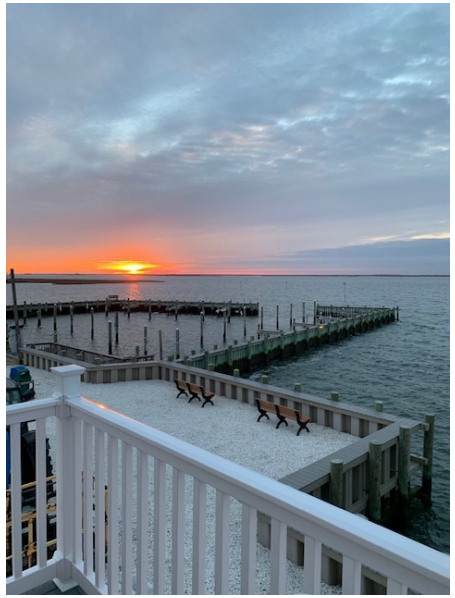
- Book Ends of our barrier island: ocean dunes to bay islands/marshes

everything in between

  - Plan beach grass and natives
  - Native plantings on private properties
  - Rain Barrels and Gardens

  - Improved drainage systems- pumps and flood valves
  - Natural shorelines
  - Bay Island restoration and increasing wetlands capacity
  - Tracking sediment migration

  - Weather /tides know how
  - Emergency management plan for home and family



#followtheshell (Oyster Recycling Program)

@theoysterfarmers (2017 film)

www.njbayislands.org
www.njcoastalresilience.org

- 127 W. Osborn Ave
- Holgate
- @lbtfieldstation
- www.lbtfieldstation.com
- andersen@longbeachtownship.com

Scaling Resilient Natural Systems: The Site Scale

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Earth and Environmental Sciences

Brooklyn College and CUNY Graduate Center

2026 New Jersey Coastal and Climate Resilience Conference, March 10, 2026

West Pond Shoreline Before

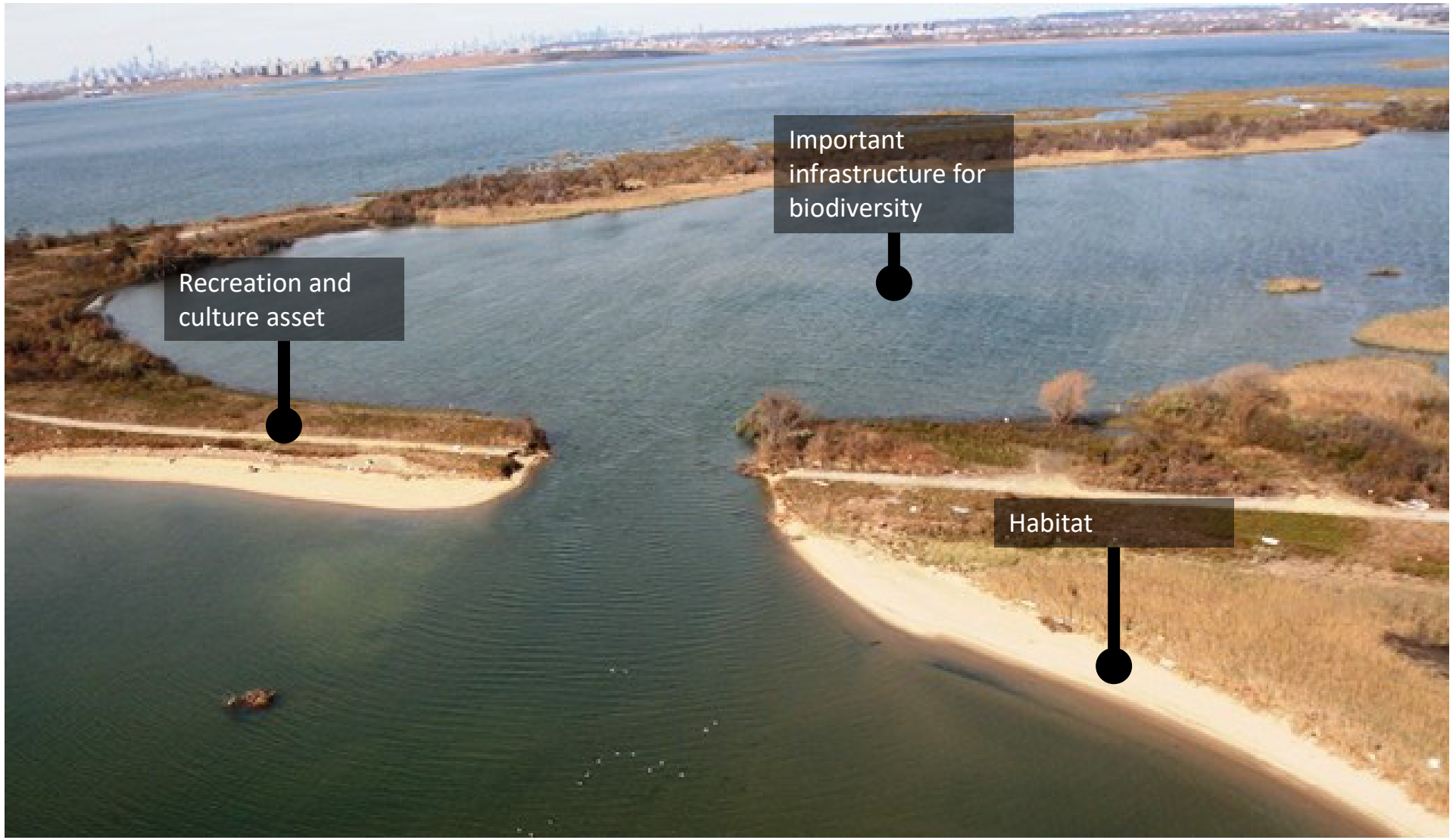


Photo: National Park Service

West Pond Shoreline Concept

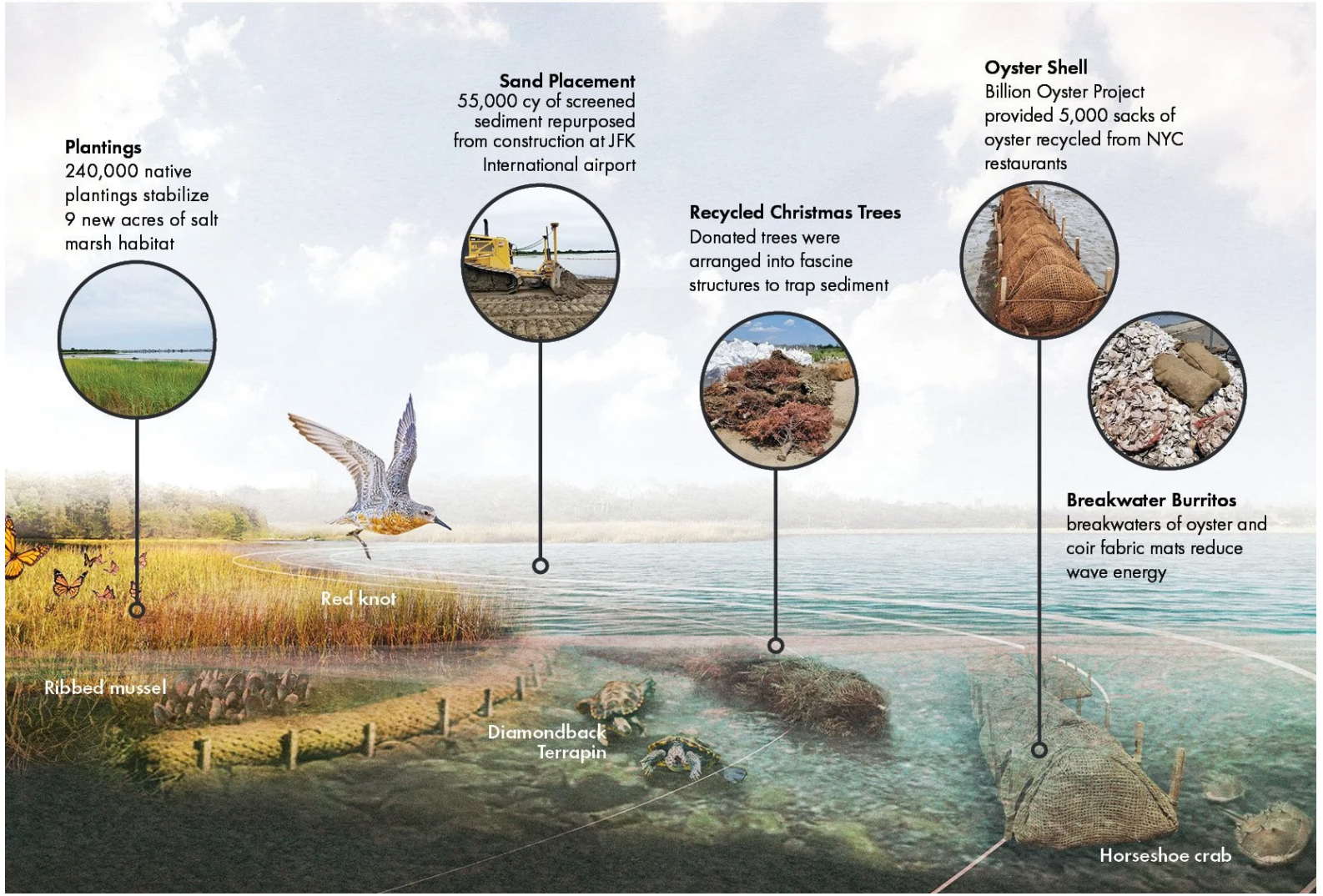


Image Credit: Dirtworks

West Pond Shoreline Concept

Image Credit: Dirtworks

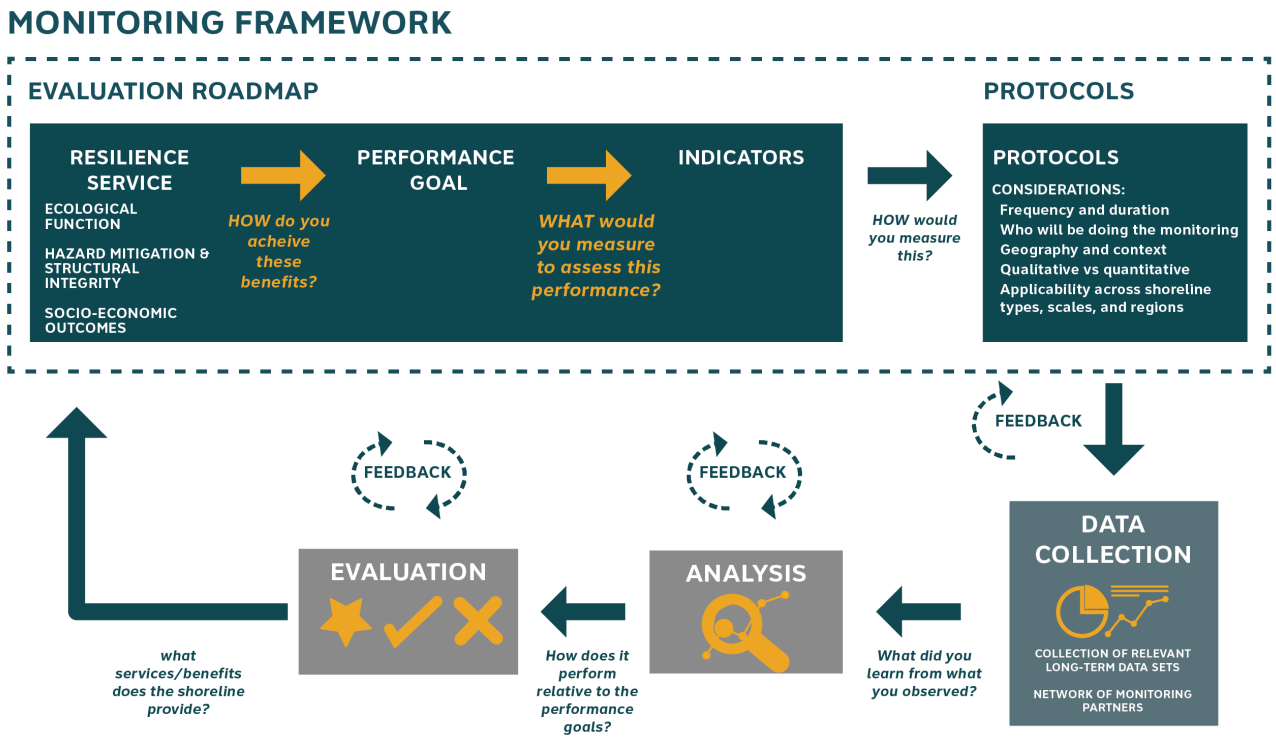
West Pond Shoreline After

Image Credit: Jamaica Bay Rockaway Parks Conservancy

Baywide Context

Image from Google Maps

Monitoring


MONITORING FRAMEWORK
EVALUATION ROADMAP
PROTOCOLS
RESILIENCE SERVICE
ECOLOGICAL FUNCTION
HAZARD MITIGATION & STRUCTURAL INTEGRITY
SOCIO-ECONOMIC OUTCOMES
HOW do you acheive these benefits?
PERFORMANCE GOAL
WHAT would you measure to assess this performance?
INDICATORS
HOW would you measure this?
PROTOCOLS
CONSIDERATIONS:
Frequency and duration
Who will be doing the monitoring
Geography and context
Qualitative vs quantitative
Applicability across shoreline types, scales, and regions
FEEDBACK
DATA COLLECTION
COLLECTION OF RELEVANT LONG-TERM DATA SETS
NETWORK OF MONITORING PARTNERS
What did you learn from what you observed?
FEEDBACK
ANALYSIS
How does it perform relative to the performance goals?
FEEDBACK
EVALUATION
what services/benefits does the shoreline provide?

Stewardship

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Scaling Challenges

Regional Context

- Interactions and sequencing
- Sediment movement
- Unintended interactions

Monitoring

- For what purpose?
- For how long?
- How will results be shared?
- With what resources?

Stewardship

- Who will care for the site?
- Who has the capacity and training?
- Are their resources?

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Thank you

Panel Discussion

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