Boston Metropolitan Area Coastal Study

US Army Corps of Engineers Coastal Flood Risk Management Watershed Study, in partnership with the MA Executive Office of Energy and Environmental Affairs, and MAPC

Stakeholder Working Group Meeting #3

May 11, 2023

US Army Corps of Engineers®
New England District

Executive Office of Energy and Environmental Affairs

MASSACHUSETTS OFFICE OF COASTAL ZONE MANAGEMENT

MAPC



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Meeting Guidelines

Agenda

Welcome & Introductions (5 min.)

Project Updates (25 min.)

- *Summary of findings from Segment 1 – Shared Vision Milestone*
- *Draft Shared Vision Statement*
- *Identified Problems, Opportunities, Objectives, and Constraints*

Introduction to Segment 2 – Recommendations Milestone of the Study (20 min.)

- *Key components & timeline*
- *Overview of Segment 2 process*

Q&A and Comments, Wrap Up, and Next Steps (10 min.)

Meet the Project Team

Project Lead

U.S. Army Corps of Engineers, New England District

Barbara Blumeris, Project Manager /Planner)

Hande McCaw, Coastal Engineer

Christine San Antonio, Biologist

Paul Morelli, GIS Specialist

Marc Paiva, Cultural Resources

Jenny Palacio, Economics

Bennett Newlove, Civil Engineering

Maureen Davi, Real Estate

Non-Federal Sponsor

MA Executive Office of Energy and Environmental Affairs

(co-lead) Mia Mansfield, Director of Climate Adaptation and Resilience

(co-lead) Lisa Engler, Director for the Office of Coastal Zone Management

Joanna Yelen, CZM Boston Harbor Regional Coordinator

Patricia Bowie, CZM Coastal Resiliency Specialist

Carolyn Meklenburg, MVP Greater Boston Regional Coordinator

Engagement Facilitator

Metropolitan Area Planning Council

Van Du, Senior Environmental Planner

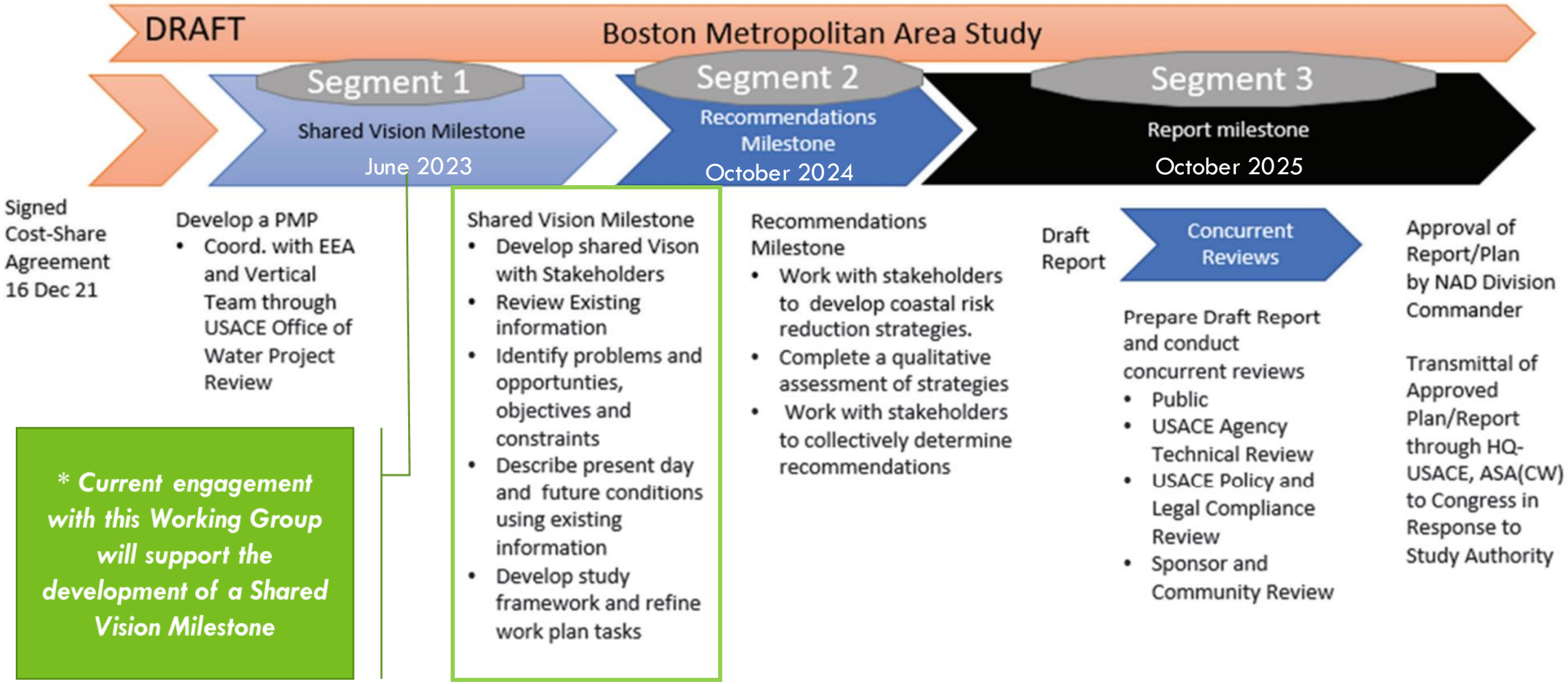
Kat Kobylt, Clean Energy and Environmental Planner

What is the Boston Metro Area Coastal Study?

- A broad strategic plan and guiding framework for the region to identify and implement coastal flood risk management projects
- A planning effort to gather buy-in from various stakeholders in the region
- Study outcomes will include recommended risk management strategies, but will not result in a specific project development plan

In comparison, the City of Boston Coastal Storm Risk Management Feasibility study is a project development effort that will recommend specific projects for USACE to implement and construct. Both projects have similar stakeholders, so you may hear from both project teams!

Study's Milestones and Timeline



Outreach and Collaboration During Segment 1

*** Facilitated by EEA and MAPC**

Regional Working Group

- **Federal:** EPA, Department of Agriculture (NRCS), Department of Commerce (NMFS), Department of the Interior (USFWS), NPS, FEMA, USGS, HUD
- **State:** DCR, MassDOT, MWRA, MEMA, MBTA, DEP
- **Coastal municipalities** in the study area
- **Watershed organizations:** CRWA, MyRWA, NepRWA
- **Nonprofits and advocacy:** Greenroots, Boston Harbor Now, Harborkeepers
- **Tribal Government:** Mashpee Wampanoag Tribe, Wampanoag(Aquinnah), Narraganset
- **Independent Public Authority:** Massport, BWSC

Interviews and Focus Groups

Follow-up conversations with Working Group members, and others (inland communities, additional community-based organizations, nonprofits, advocacy groups, and academia, *tribal governments)

Summary of Findings

- **Support the development of information for the Shared Vision Milestone**
- **Build consensus**

Stakeholder Engagement: What We've Heard

Study Area Problems	Study Area Opportunities
• Threats to natural resources • Impacts to emergency services and life safety • Flood impacts to buildings, transportation, stormwater infrastructure, communities, open space, and recreational resources • Time and future retreat: how long do we have?	• Leveraging and developing best practices • Improving public access to natural resources and the waterfront • Nature based solutions (including parks, living shorelines, and more) and their co-benefits • Protecting priority populations • Create a resilient working port and foster economic growth • Education for utility providers, developers, and the public • Improve regional collaboration and develop regional solutions where appropriate • Proactively plan for evacuations, post-disaster recovery, and managed retreat

Stakeholder Engagement: What We've Heard

Study Area Objectives (draft)	Study Area Constraints & Considerations (draft)
• Reduce risk of coastal flooding and damage to assets and critical infrastructure of all kinds • Reduce life and health safety risk • Protect ? or improve ? natural resources, and to the extent practicable, public access to open space and recreation • Center equity, support Environmental Justice communities, avoid strategies that displace socially vulnerable communities, and avoid negative impacts for local tribes • Develop regional strategies where appropriate	<u>Constraints and Considerations</u> • There is a limit to our ability to eliminate flooding • Funding limitations • To the extent practicable, avoid unintended side-effects like exacerbating stormwater flooding in inland communities, or significantly increasing emissions • Regulatory and permitting considerations • Jurisdiction of each organization and agency • No regional or county level government • Social ramifications of retreat for vulnerable populations • Existing conditions: low-lying neighborhoods built on saltmarsh, contaminated soils, degraded shoreline infrastructure • Align with the state climate agenda and goals

Study's Shared Vision Statement

Communities adjacent to Boston Harbor have strong historic, cultural, economic, environmental, and recreational connections to the area. As coastal storm flooding increases with sea level change, the region's built and natural assets are at risk including:

- residences
- businesses
- critical facilities and infrastructure
- historic and archaeological resources
- open space and recreation
- natural resources (e.g., beaches, dunes, and salt marshes)

The Commonwealth of Massachusetts and other stakeholders in the coastal Boston Metropolitan area envision a future where the region can collaboratively build on existing efforts to manage flood risks and foster resilience of natural resources and habitats in and around Boston Harbor. This study, as a strategic framework, will inform future decision-making on the technical and financial resources necessary to build an equitable and resilient future in the face of a changing environment.

Problems and Opportunities

Problem Statement: Current or future negative conditions

- Coastal storm and tidal flooding causing damage to structures and infrastructure in the flooded area
- Impacts to natural and historic resources due to flooding
- Population at risk (life safety), current and future flooding will put people at risk
- Sea level change impacts to shoreline marshes and intertidal habitat as water levels rise along the hardened urban shoreline
- Flooding causing damage to vulnerable and Environmental Justice communities with fewer resources to recover

Opportunities Statement: Desirable future conditions

- Improving public access to natural resources and the waterfront
- Nature based solutions (including parks, living shorelines, and more) and their co-benefits
- Positive benefits to EJ communities
- Maintain resilient working ports and foster economic growth
- Develop regional solutions where appropriate

Objectives and Constraints

Objectives: should address an identified problem and/or opportunity and be measurable and attainable

- Reduce risk of coastal storm and tidal flooding and damage to assets and critical infrastructure of all kinds
- Reduce life and health safety risk
- Improve, to the extent practicable, public access to open space and recreation
- Moderate, to the extent practicable, impacts to salt marsh ecosystems
- Benefit Environmental Justice communities

Constraints: statements about things you want to avoid doing, or things you cannot change or impact, while meeting your objectives

- To the extent practicable, avoid unintended side-effects like exacerbating stormwater flooding in inland communities, or significantly increasing emissions
- To the extent practicable, foster consistency with coastal storm risk management plans developed by other federal, state, and local agencies within the study area
- Avoid any disproportionate adverse impacts to EJ communities

Additional Considerations Identified by Stakeholders for Plan Formulation

- Consider how solutions align with the state climate agenda and goals
- Consider ability of solutions to adapt to changing conditions
- Consider magnitude of a solution cost, as funds are limited at the local level
- Consider stakeholder acceptability of solution(s)
- Consider jurisdiction of organizations and agencies for solution implementation
- Consider how current permit and regulatory requirements might limit solutions
- Consider that there is currently no regional or county level government for regional plan implementation
- Consider social ramifications of gentrification and retreat
- Consider existing conditions including low-lying neighborhoods built on saltmarsh, contaminated soils, degraded shoreline infrastructure



Let's pause for questions & comments

USACE PLANNING PROCESS

Segment 1: Steps to Shared Vision Milestone:

Step 1: Specification of problems and opportunities, along with identification of objectives and constraints and Development of the "Shared Vision for the study area"

Step 2: Inventory, forecast, and analysis of relevant conditions,(identify flood risk and consequences)

Step 3: Start identification of measures

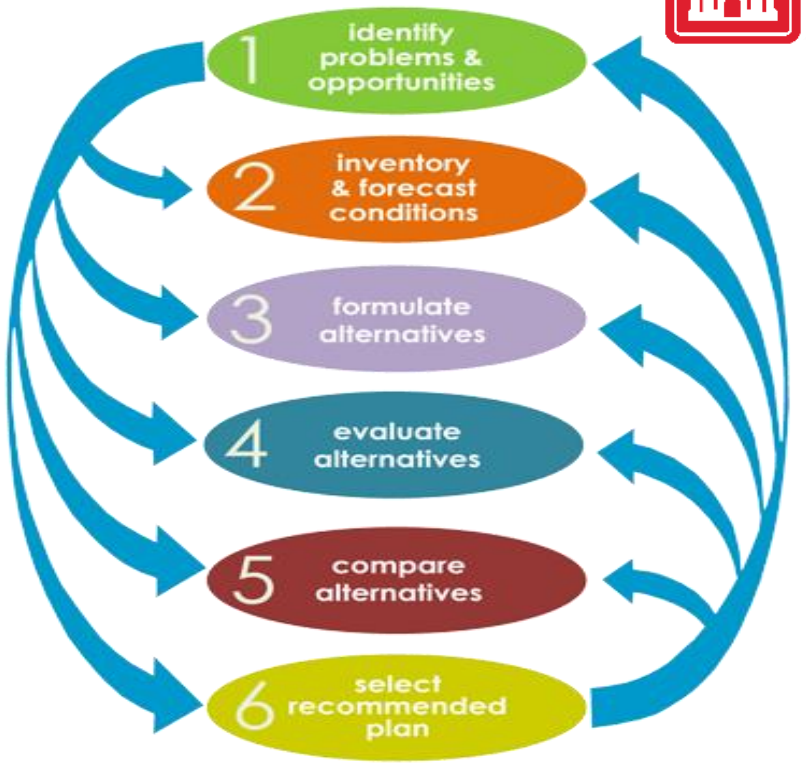
Segment 2: Steps to Recommendations Milestone:

Step 3: Continue measures screening and formulate an array of measures/strategies

Step 4: Evaluation and refinement of measures/strategies

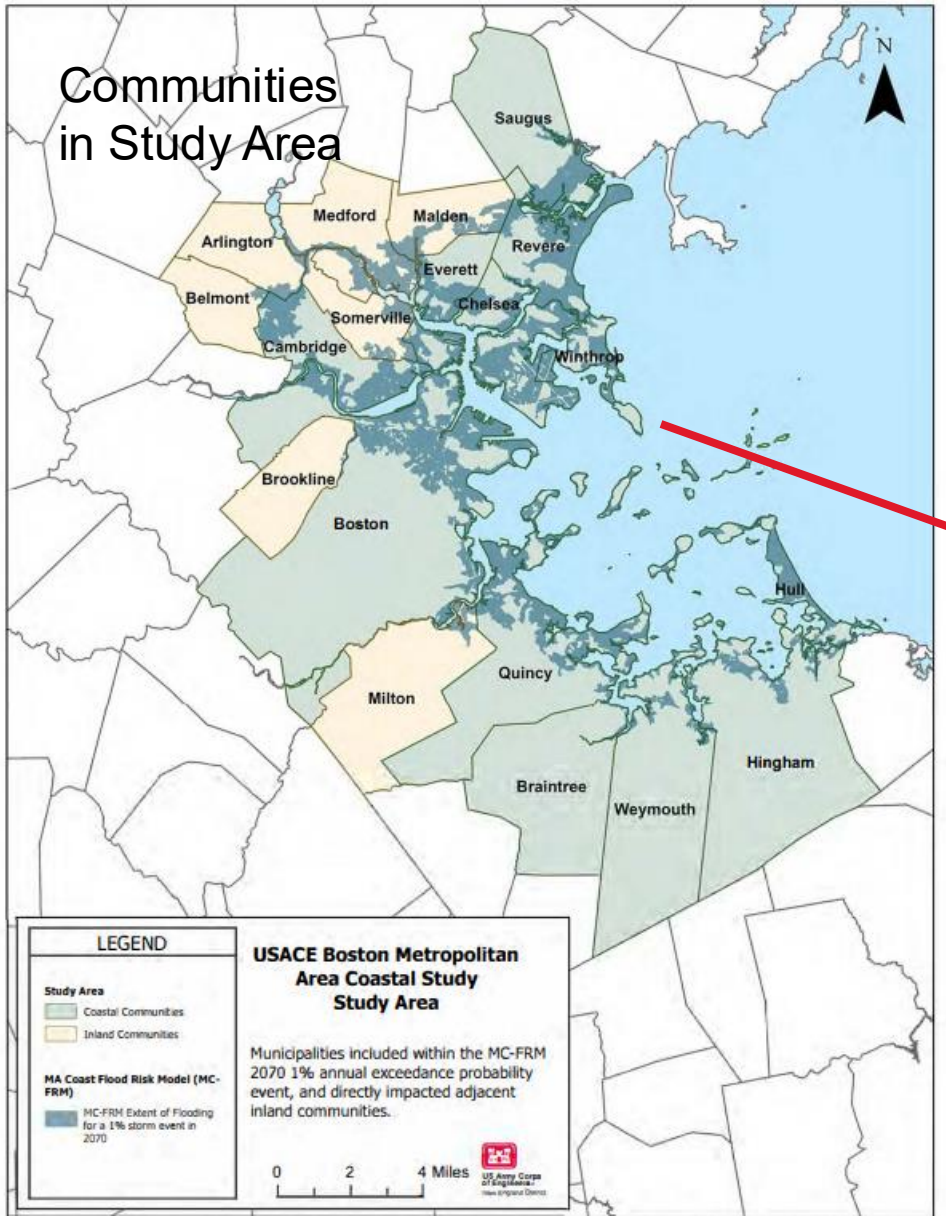
Step 5: Comparison

Step 6: Selection of recommended measures/strategies

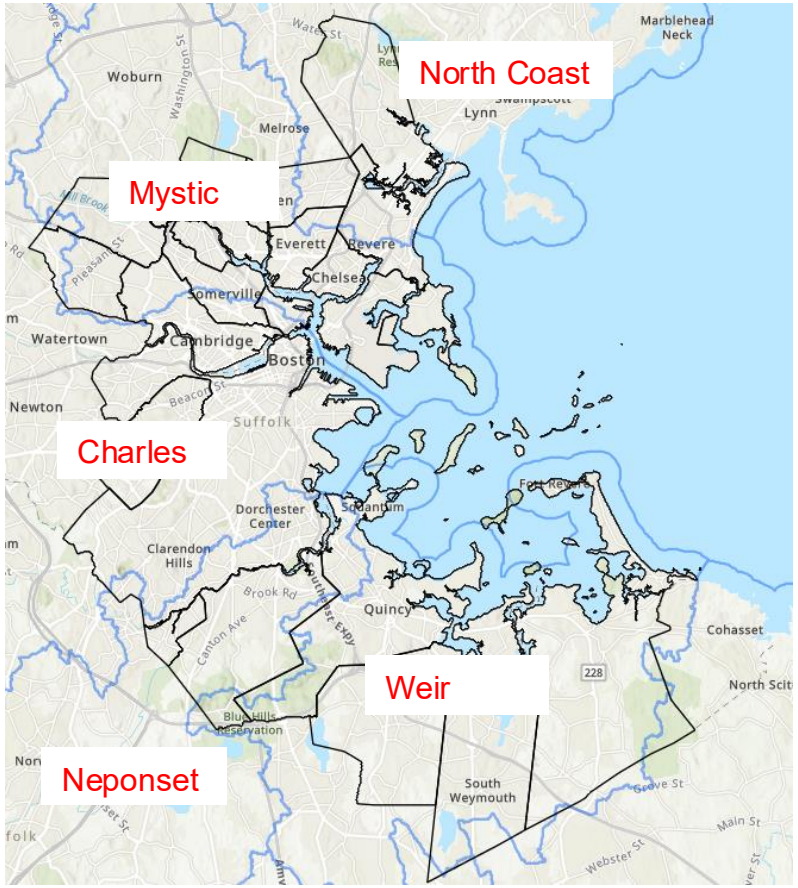


Arrows indicate steps may be revisited as knowledge increases – **this is an iterative process**

STUDY AREA AND PLANNING UNITS FOR STUDY



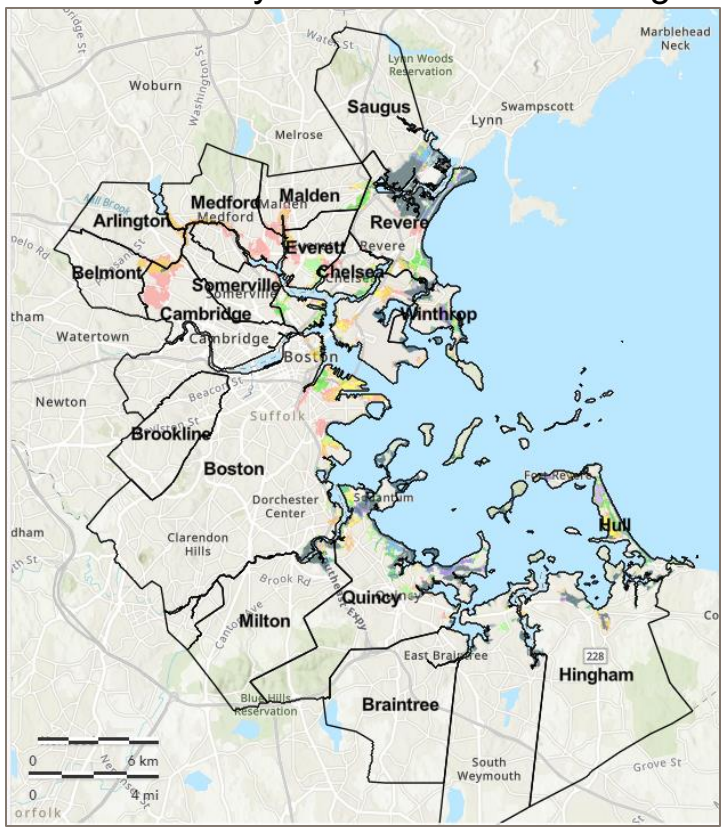
For Metro Study Regional Planning Units are coastal areas of the watersheds shown below



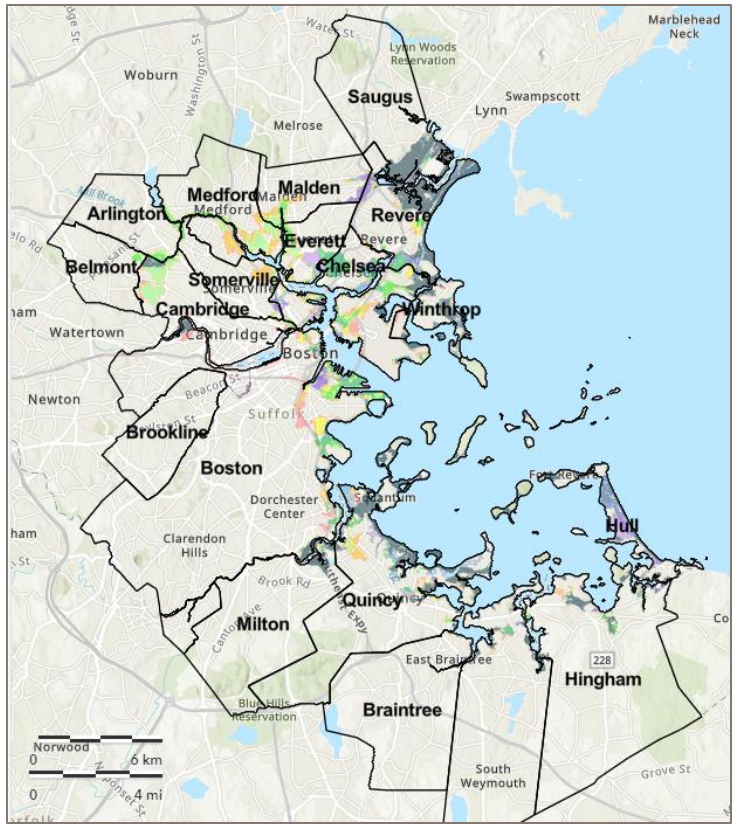
Coast-sheds: North Coast, Mystic, Charles, Neponset, Weir

Region Wide Coastal Storm Flood Hazard

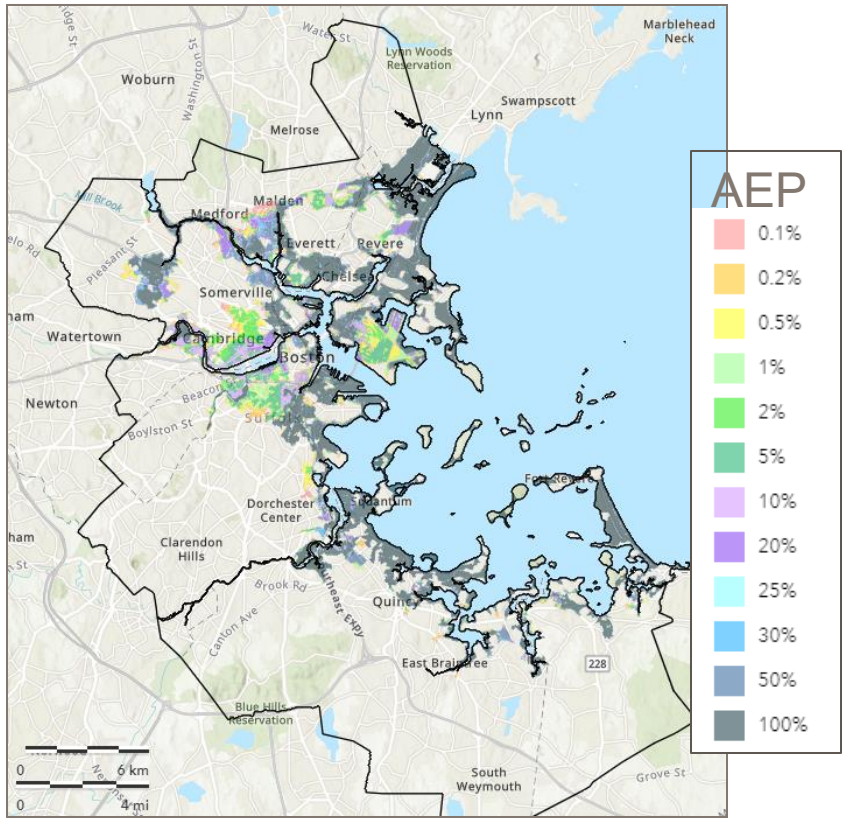
Present Day Coastal Storm Flooding



1.2 ft SLC Coastal Storm Flooding



4.3 ft SLC Coastal Storm Flooding

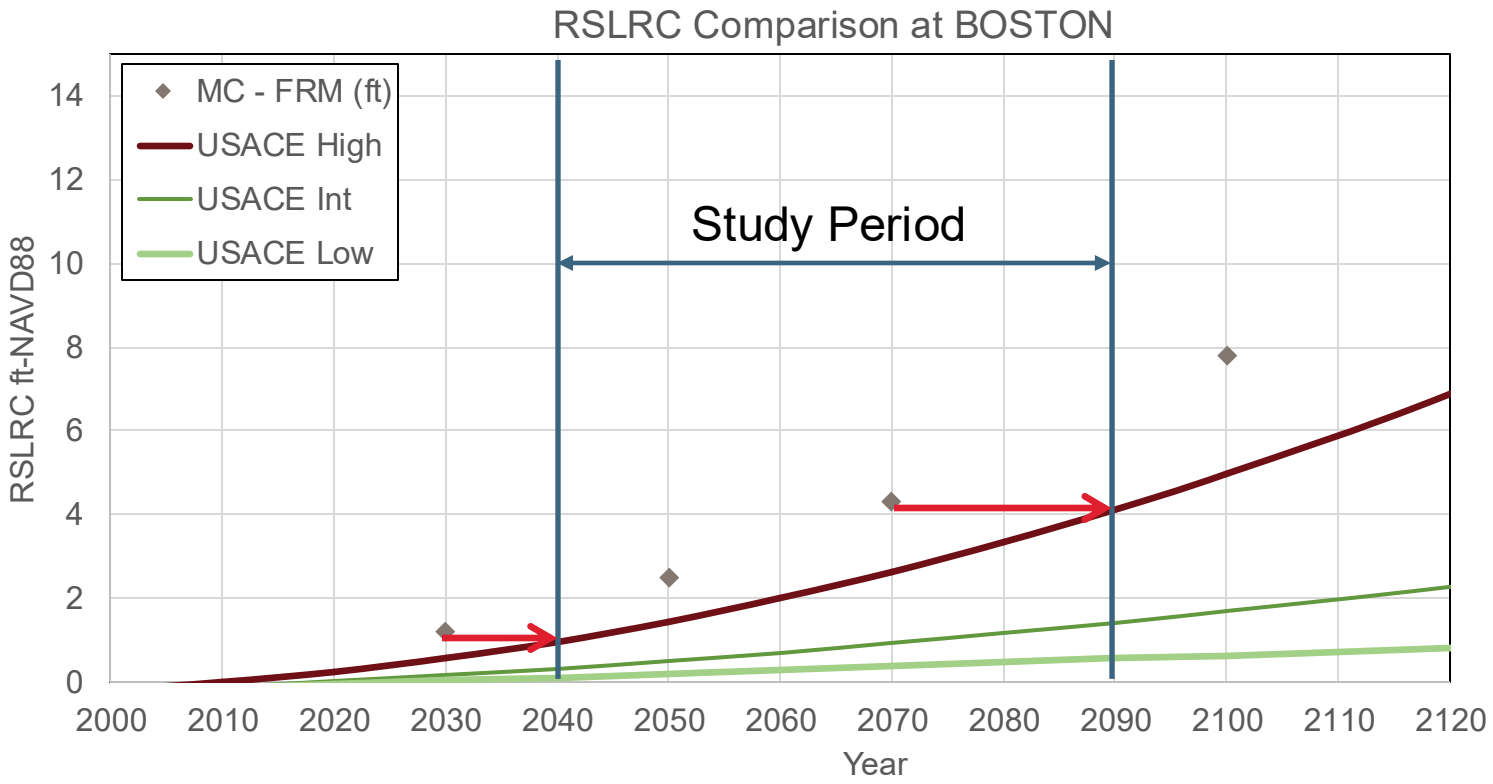


Massachusetts Coastal Flood Risk Model (MC-FRM)

- Forecast of future conditions, consider a range of annual exceedance probability events that incorporate sea level change

Sea Level Change Forecast: Planning Horizon

Near Term: 1.2 feet of SLC 2030 MC-FRM, equates to 2040 USACE High
Long Term: 4.3 feet of SLC 2070 MC-FRM, equates to 2090 USACE High



Plan Formulation Process

- Develop initial set of measures to manage coastal flood risk for the study area
  - A management measure is a feature or activity at a specific location that addresses one or more of the planning objectives
  - The three basic types of measures are structural, non-structural, and natural or nature-based
- Measures will be screened initially using existing knowledge and educated judgment to develop a set of measures to carry forward, screening will consider effectiveness (the extent to which a measure meets the objective), efficiency (the extent to which a measure is a cost-effective means of meeting the objective), and implementable (from a technical or environmental perspective)
- Measures can be combined or used alone to create an array of risk management strategies to evaluate further

Evaluation Process

Evaluate the identified array of risk management strategies including :

- Concept level design (watershed scale)
- Rough order of magnitude and parametric cost estimates
- Further consider technical feasibility
- Outline general real estate requirements
- Evaluate benefits and impacts of the strategies using the four accounts
  - National Economic Development (NED)
  - Environmental Quality (EQ)
  - Regional Economic Development (RED)
  - Other Social Effects (OSE)

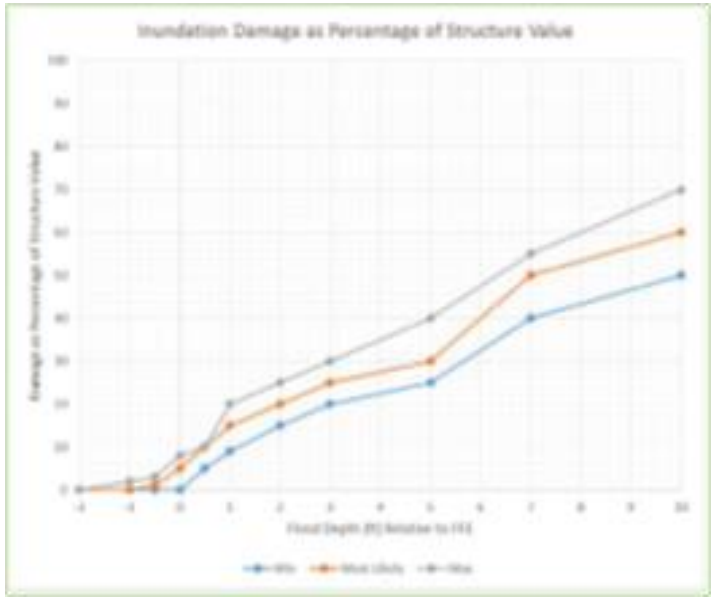
Evaluation: Four Accounts to be used to facilitate and display the effects of the measures/strategies

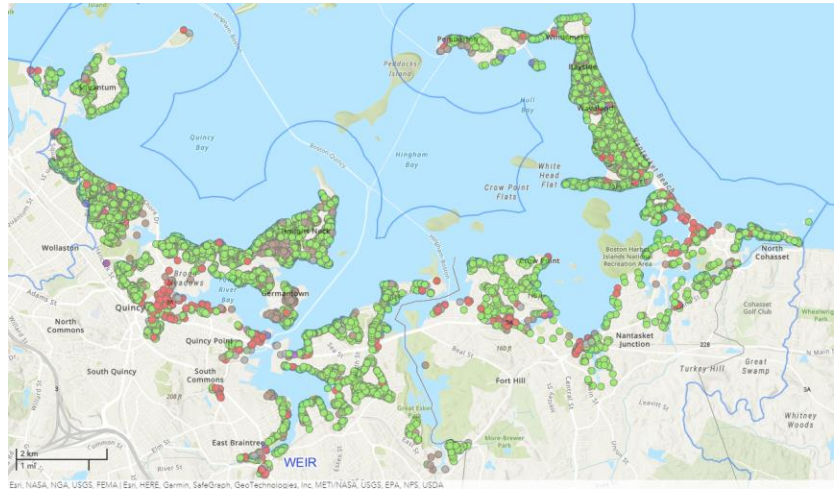
Four Principles and Guidelines Accounts	Examples for Segment 2 consideration
National Economic Development (NED)	• Direct Physical Damage to buildings (structure damage and content loss) • Estimated Expected Annual Damages for present day and in future with SLC
Environmental Quality (EQ)	• Environnmental Resources - impacts to important habitats/expressed in numeric units or described in non-numeric terms • Cultural Resources - impacts to historic properties and archaeological resources expressed in non-monetary units
Regional Economic Development (RED)	• Qualitative assessment of regional economic impact - losses in regional employment / output because the physical capital stock has been degraded, or increases due to expenditure of constructions funds stimulating regional economy (non-monetary units)
Other Social Effects (OSE)	• Adverse effects to community/population at risk, avoid disproportionate impacts to Environmental Justice communities • Damage to critical infrastructure

Estimating National Economic Development (NED) Damages

Approach: Use USACE National Structures inventory database along with storm water levels from the MC-FRM modeling and depth damage curves to provide a planning level estimate of structure and content damages ($) by census block for each coast-shed







Weir coast-shed (dots portray structure inventory database)

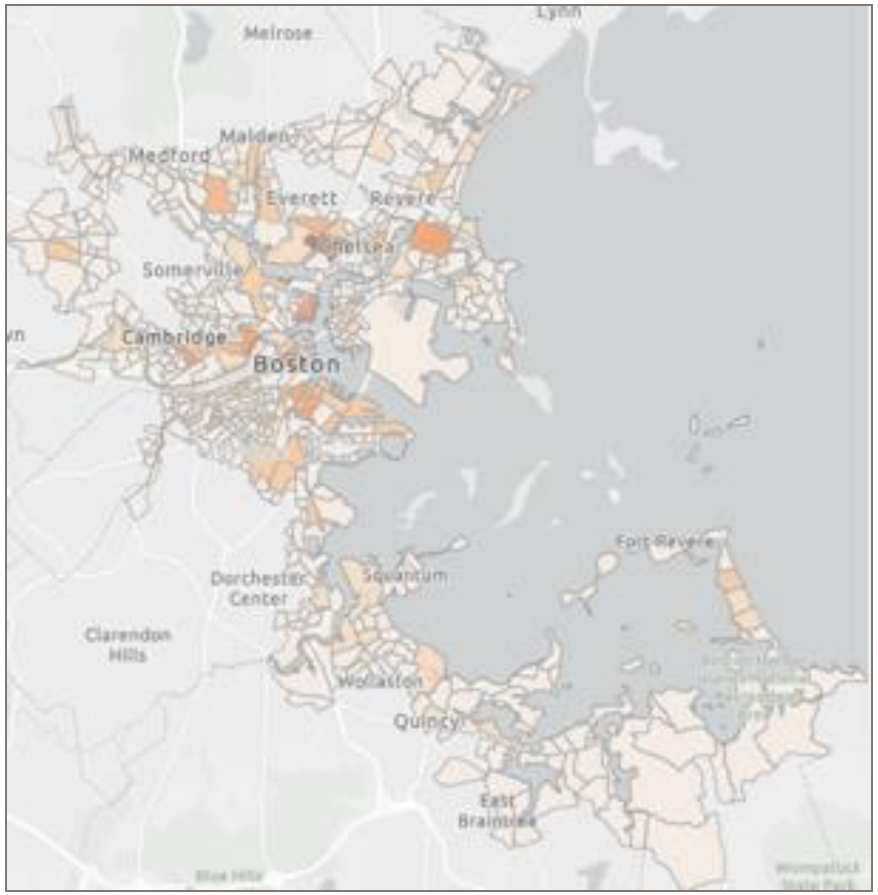
Evaluation:

- Consider building types
- Use of USACE damage curves developed during the North Atlantic Coastal Comprehensive study
- Calculate expected annual damages for selected future SLC scenarios with and without risk management measures/strategies

Visualizing Damage Estimates

- Block Groups are statistical divisions of census tracts, are generally defined to contain between 600 and 3,000 people, and are used to present data

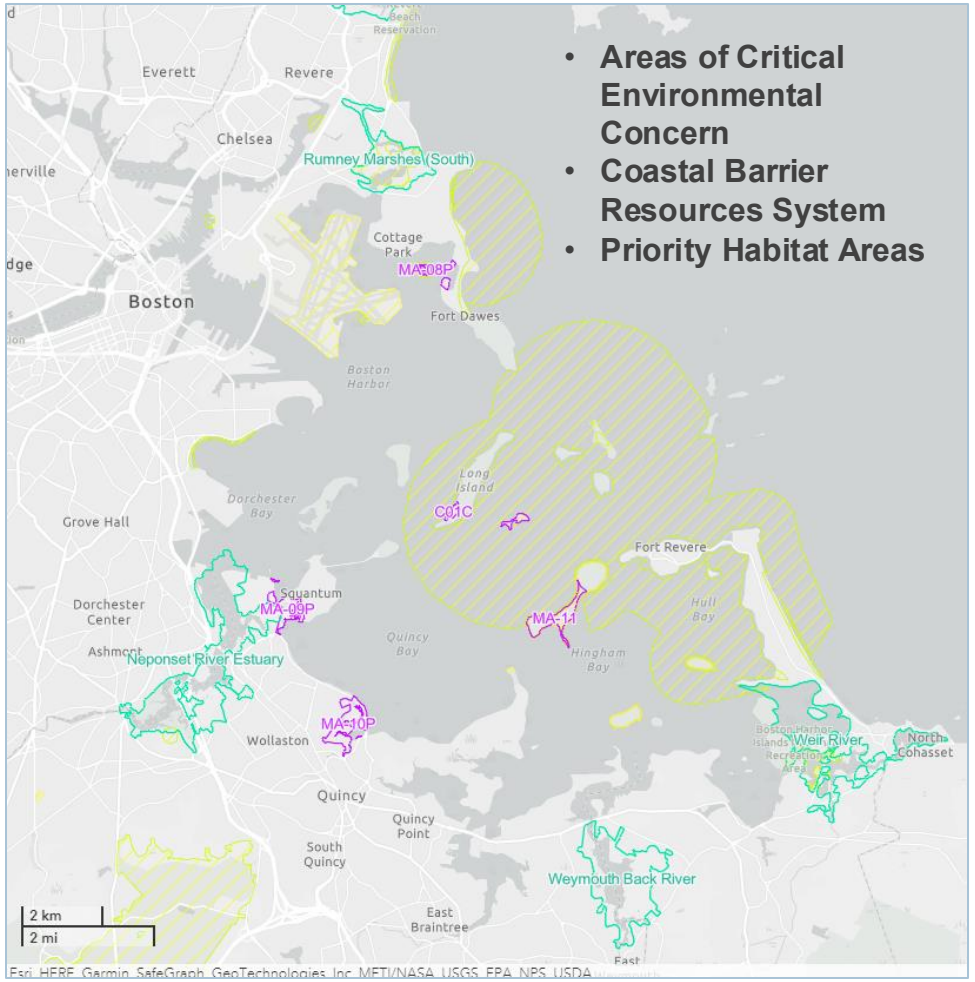
- Block Group approach to be used in the study to display expected annual damage estimates, allows for visualization of damages



Census Block – Example only

EQ Account: Environmental Resources

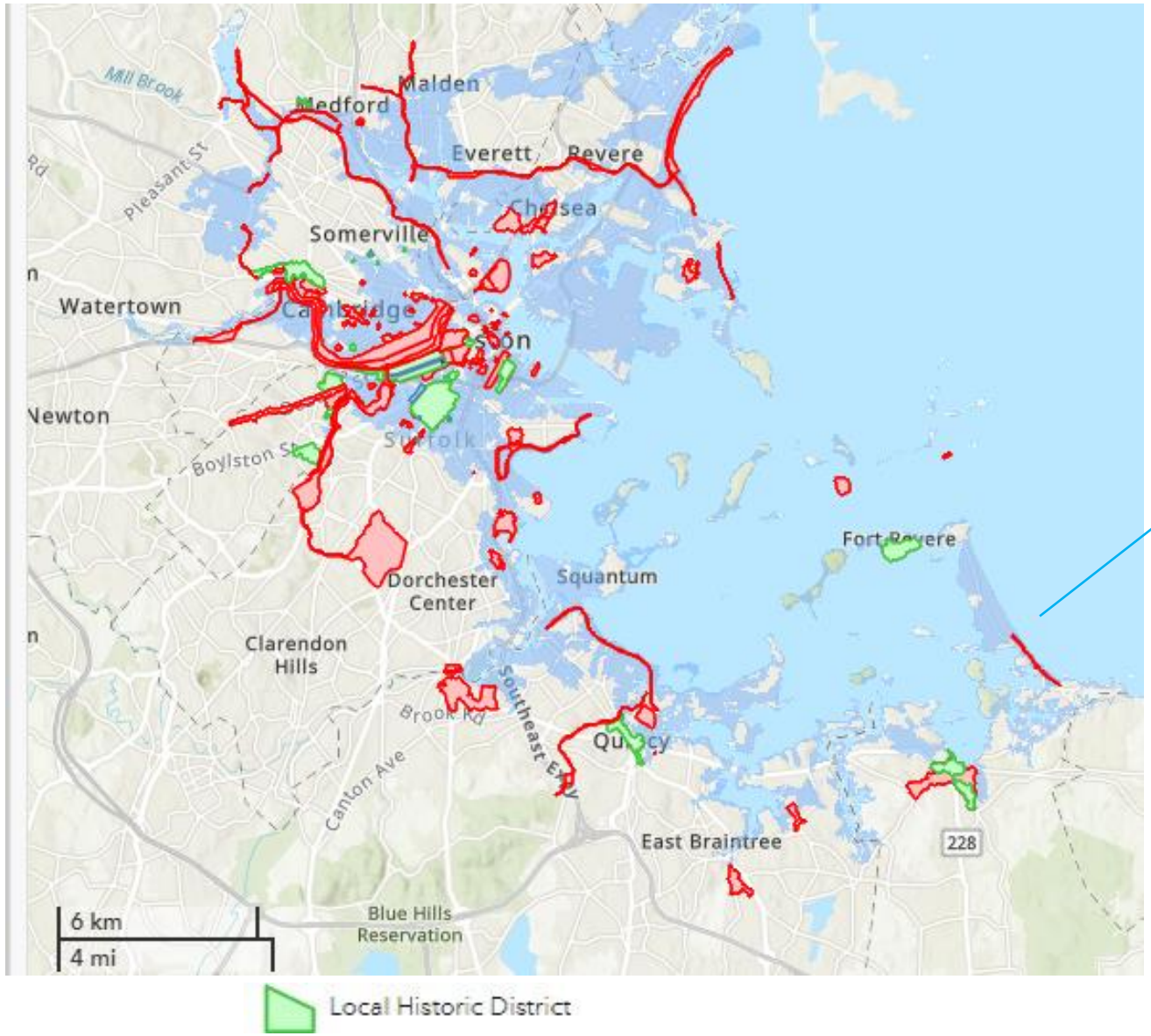
Habitat Type	Description	Number of Discrete Areas in 1000-year 4.3 ft SLC
Areas of Critical Environmental Concern (ACEC)	Designated by the state; areas protected due to their valuable environmental, cultural, and recreational resources	4
Coastal Barrier Resource Areas (CBRA)	Coastal barriers protected for their natural resources by restricting federal funding to CBRAs	2
CBRA Otherwise Protected Areas	Category of coastal barriers that are mostly held for conservation and/or recreation purposes	3
Priority Habitats	Habitat for all state-listed rare species, both plants and animals; codified under the Massachusetts Endangered Species Act (MESA)	17

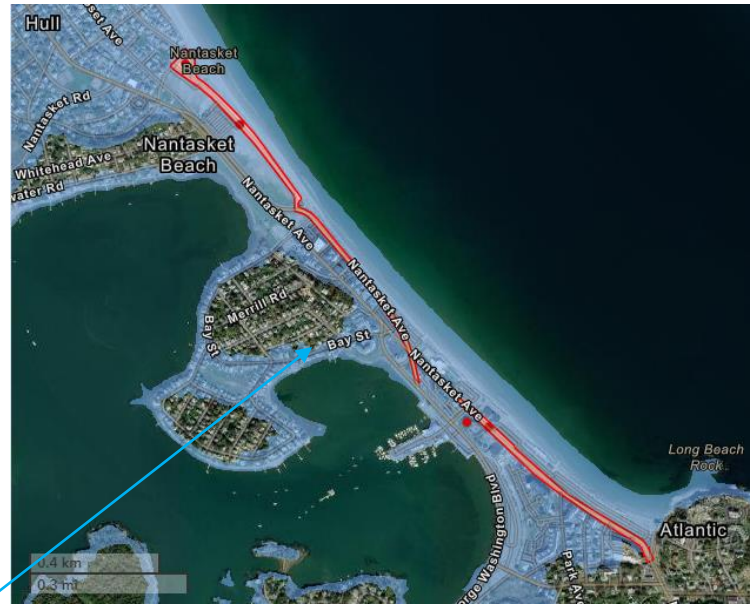


Evaluation:

- Identify and qualitatively assess environmental impacts/benefits of strategies based on available information
- Protected areas (particularly the ACECs) encompass the largest wetland and saltmarsh systems within the study footprint

EQ Account: Cultural Resources





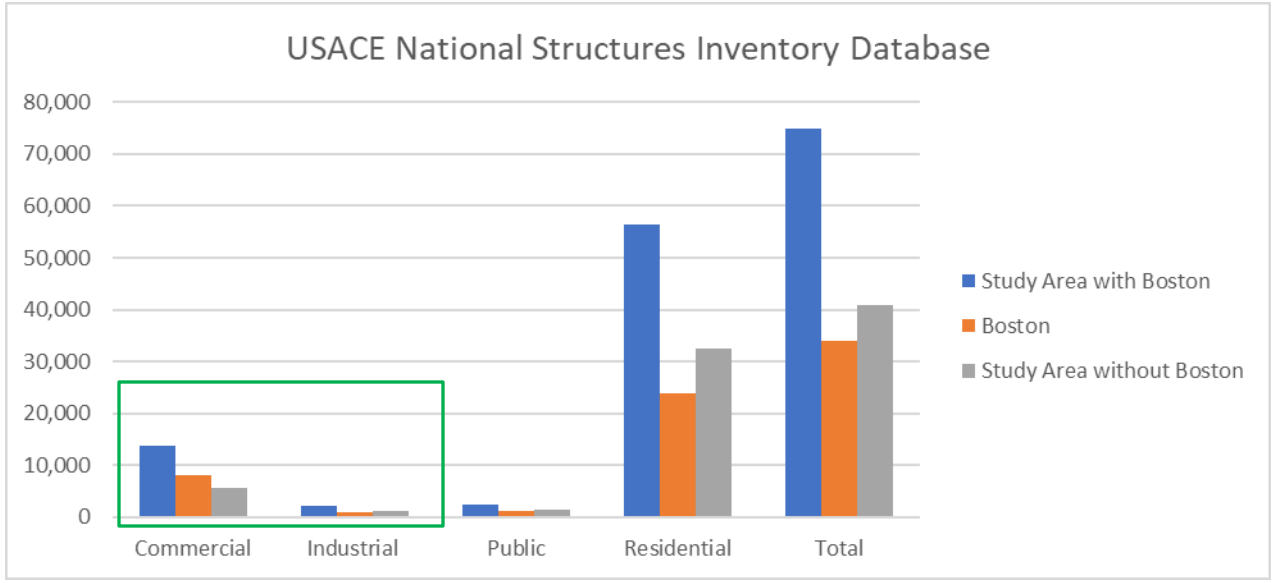
Example: National Register of Historic Places

Hull Shore Drive National Register Historic District, Hull, MA

Evaluation:

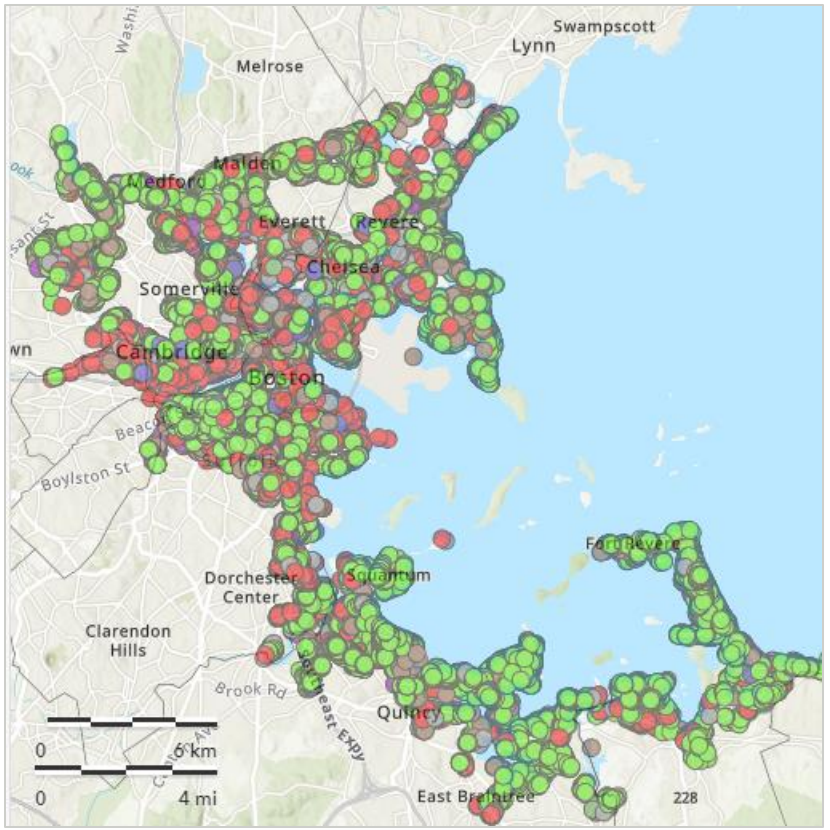
- Historic properties
- Archaeological resources
- Cultural Sites or landscapes
- Identify and qualitatively assess impacts/ benefits of strategies based on available information

Regional Economic Development (RED)



RED account – identify commercial and industrial buildings with damages for with and without project condition scenarios to characterize RED impacts

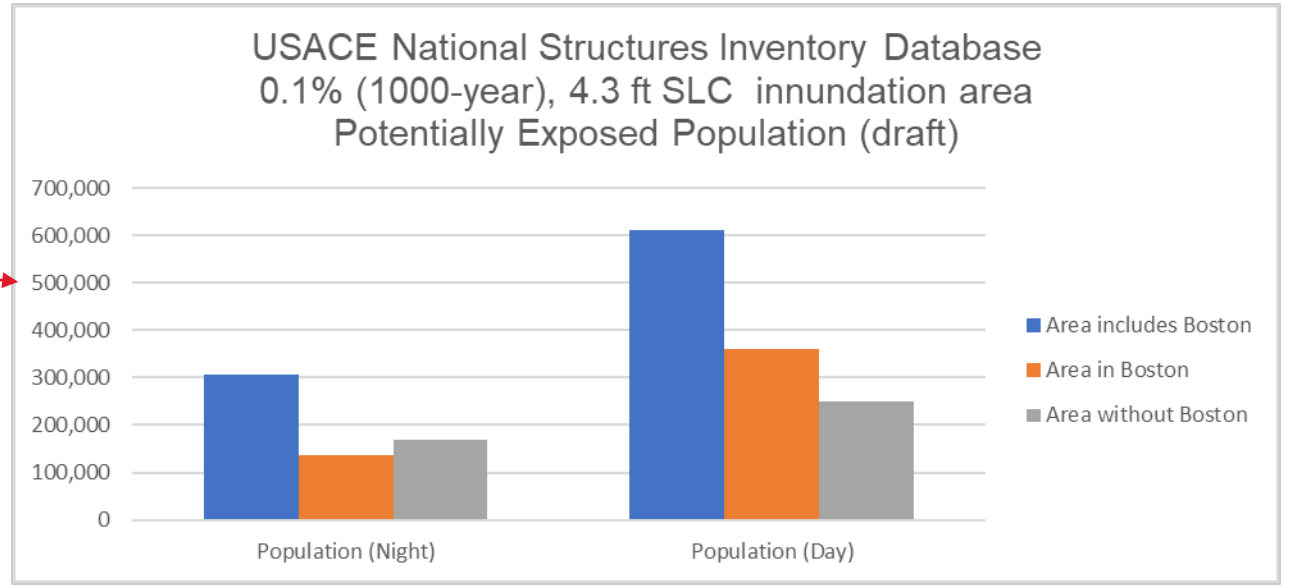
Study Area



Commercial
Industrial

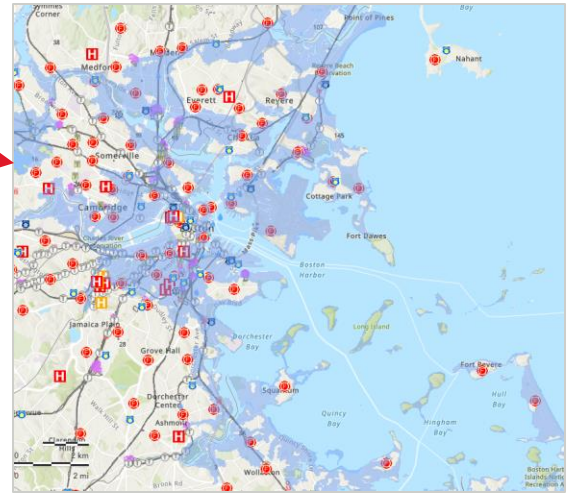
Other Social Effects Account (OSE)

- Estimate population at risk under with and without project condition scenarios to characterize OSE impacts



- Identify EJ communities and any disproportionate adverse impacts

- Estimate critical Infrastructure at risk under with and without project condition scenarios to characterize OSE impacts including:
  - Fire stations,
  - Police stations
  - Hospitals
  - Massachusetts Bay Transportation Authority (MBTA) infrastructure
  - Water and wastewater facilities





Let's pause for questions & comments

Potential Measures

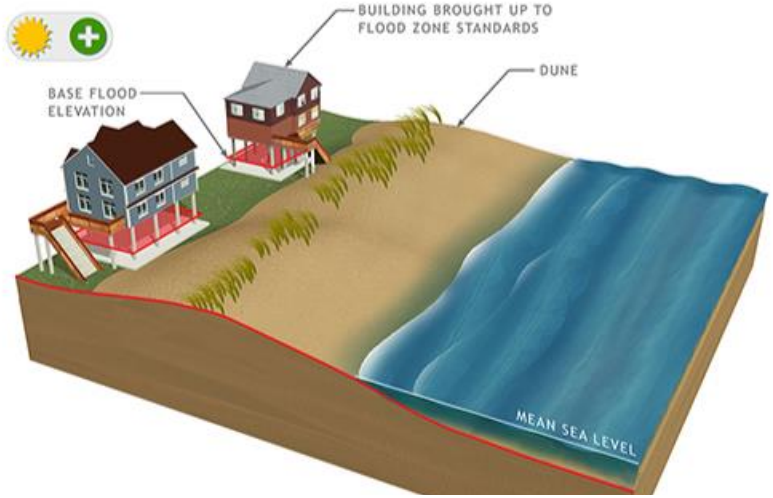
Determine what measures work best for which situations (some example measures below).

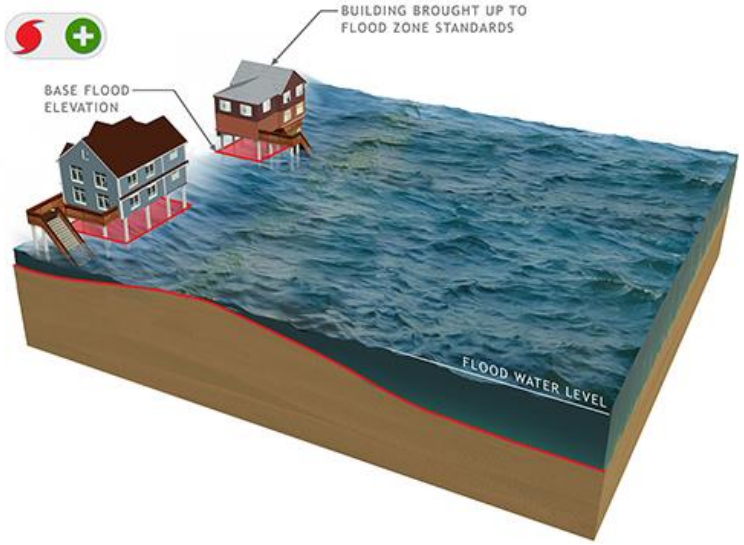
- **Accommodation Measures:** elevated structures, structure floodproofing, elevated roads
- **Defense Measures**: Floodwalls, raised seawalls, levees, breakwaters, tide gates, storm surge barriers*
- **Natural Nature-Based Measures**: beach/dune nourishment, wetland creation, living shorelines, reefs, etc.
- **Managed Retreat Measures**: managed retreat from high-risk coastal areas, acquisition and removal of vulnerable structures, relocation of vulnerable infrastructure
- **Local Regulatory Measures**: re-zoning, etc.
- **Strategy(s)**: use measures to form strategies for study area

**Harbor wide flood barrier measure previously ruled out by stakeholders due to acceptability and cost, however, consider smaller-scale storm surge barriers during plan formulation and screening process.*

Accommodation Measure: Example Structure Elevation

Elevated Structures







- Elevation of a structure is usually limited to smaller residential and commercial buildings.
- Whether a structure may be elevated depends on a number of factors, including the foundation type, wall type, size of structure, condition, etc.

Accommodation Measure: Elevated Roadway

Elevate roadway to limit inundation caused by flooding

- Consider if adequate horizontal space to construct road improvements and tie back to existing grade
- Consider compatibility with adjacent driveway and street grades
- Ensure higher roads don't channel flood waters to homes and stores at lower elevations



Credit: City of Miami

Accommodation Measure: Open Space and Elevated lands

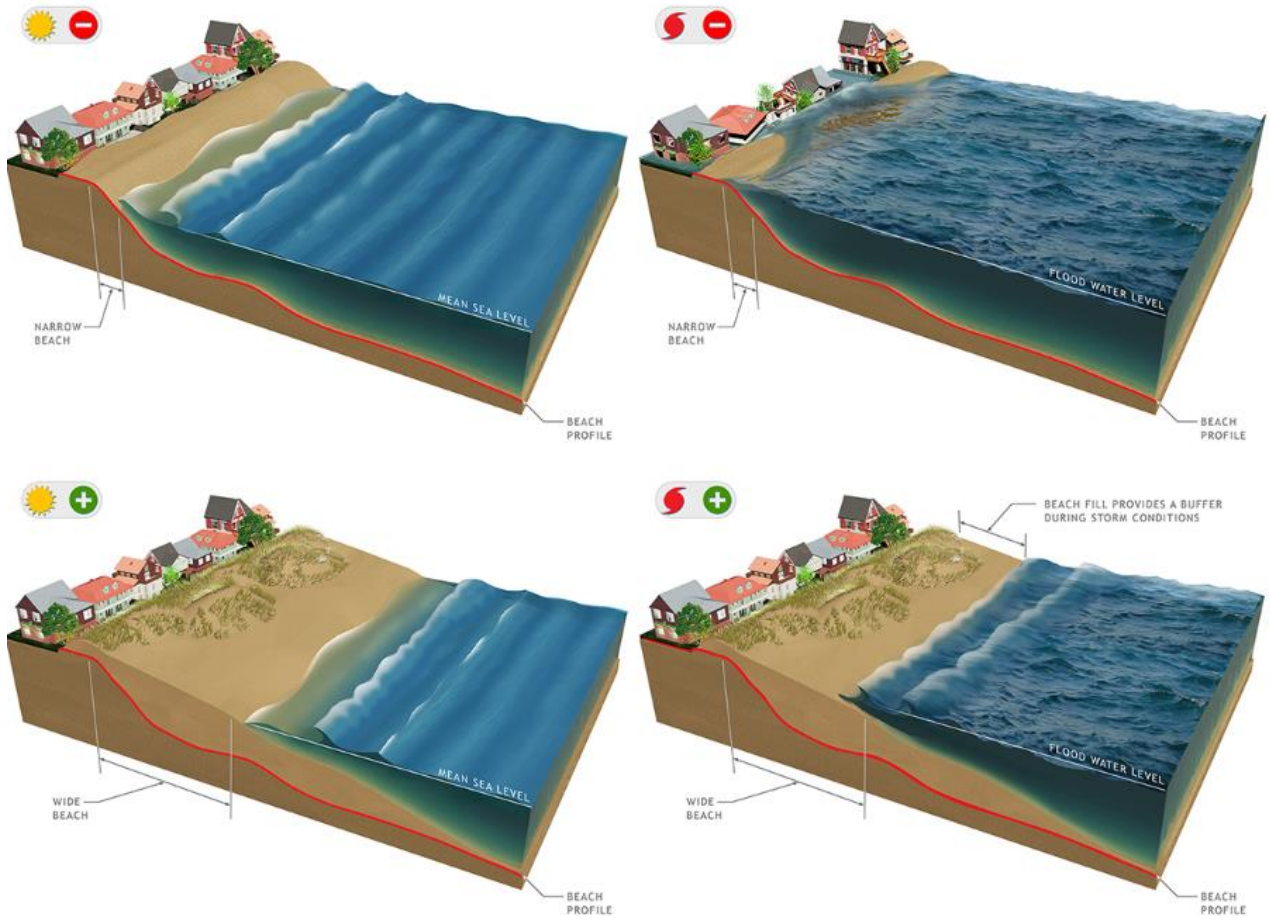
Use of open space, elevated parkland, and resilient features to increase recreational opportunities and respond to coastal flooding risks.

- Example Moakley Park, Boston
  - Langone Puopolo Park, Boston

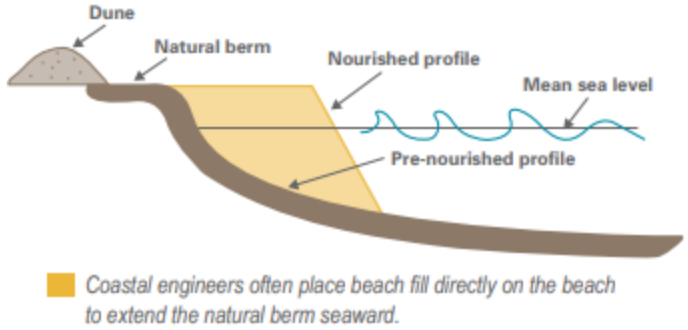




Natural and Nature Based Measure: One Example: Beach and Dune Nourishment







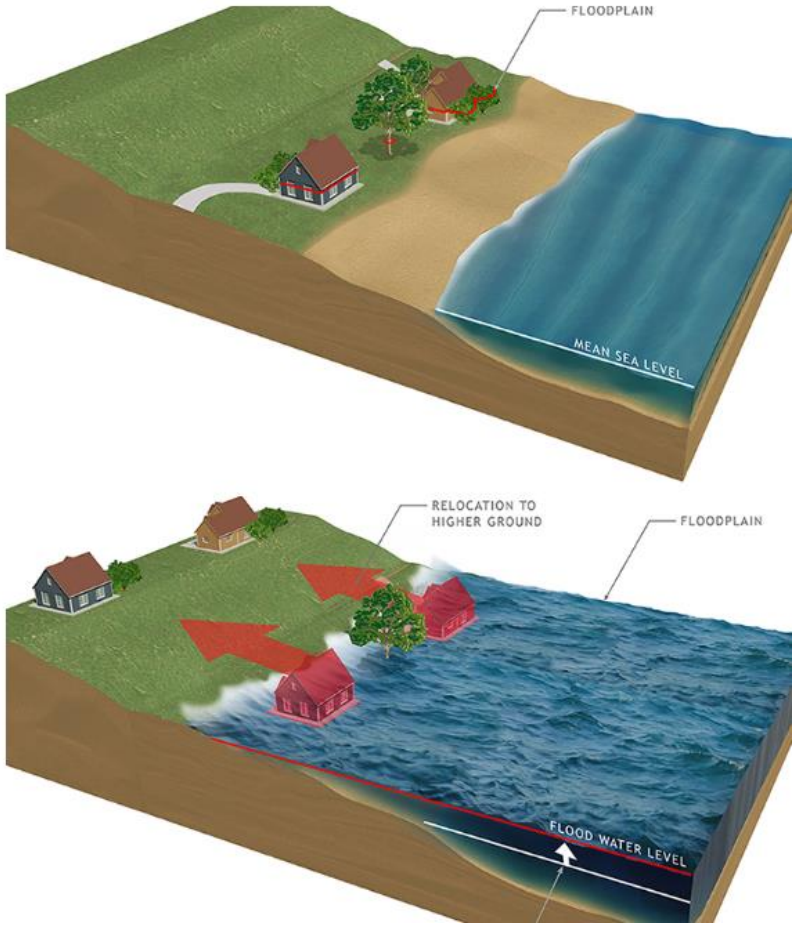
Coastal engineers often place beach fill directly on the beach to extend the natural berm seaward.

Example: Increasing the berm width (beach fill provides a buffer during a storm event)

Managed Retreat Measure: Acquisition or Relocation

Buyout/Acquisition involves purchase and removal of flood damageable structures and creates open space

Relocation involves moving the structure or infrastructure to another location away from flood hazards (requires an adequate upland area)



Relocation

Defense Measure: Example Flood Wall





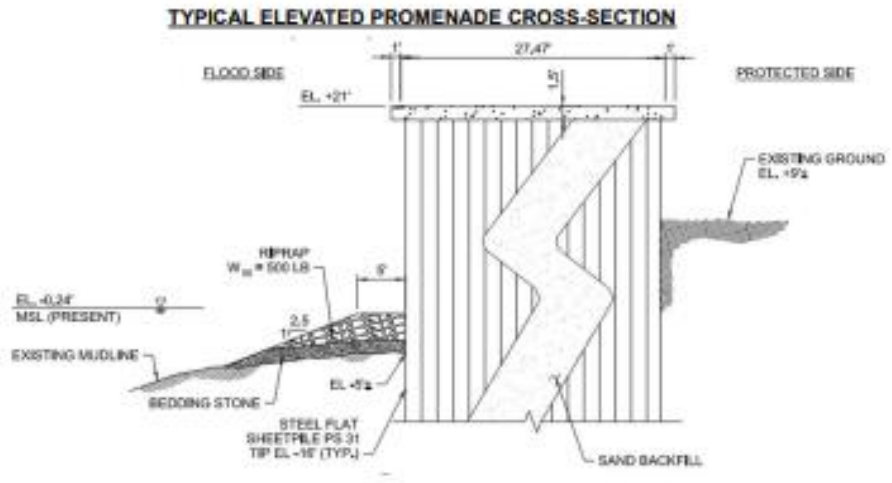
Figure VIII-5. Typical Floodwall Construction

- Floodwalls are structures used to prevent flooding with limited space for construction.

Defense Measure: Floodwall and Elevated Promenade

- The elevated promenade concept seeks to preserve a waterfront space and view that is available to the public yet still able to provide flood risk reduction.

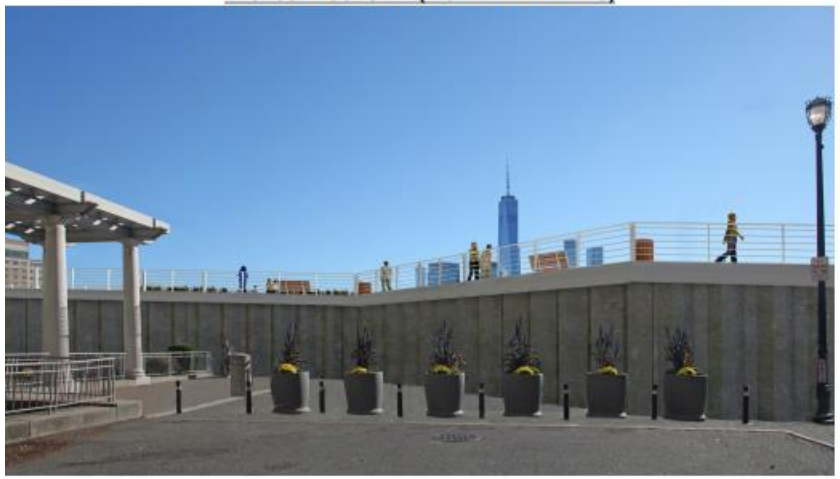
- The elevated promenade could be constructed along a shoreline to replace an existing promenade or create a new promenade.



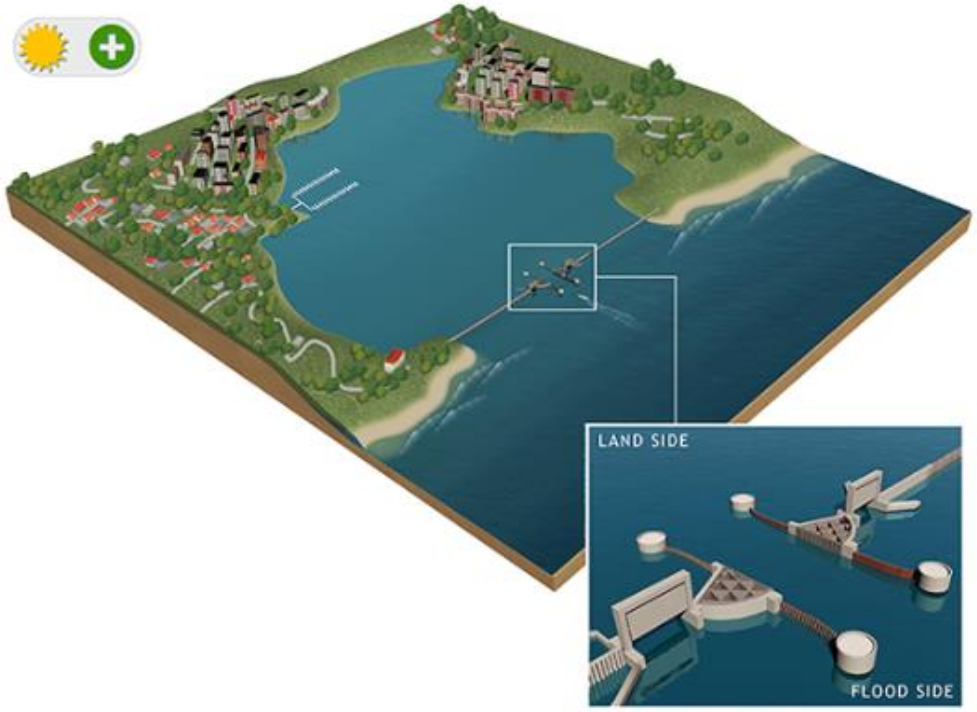
EXISTING CONDITION (ACTUAL PHOTO)

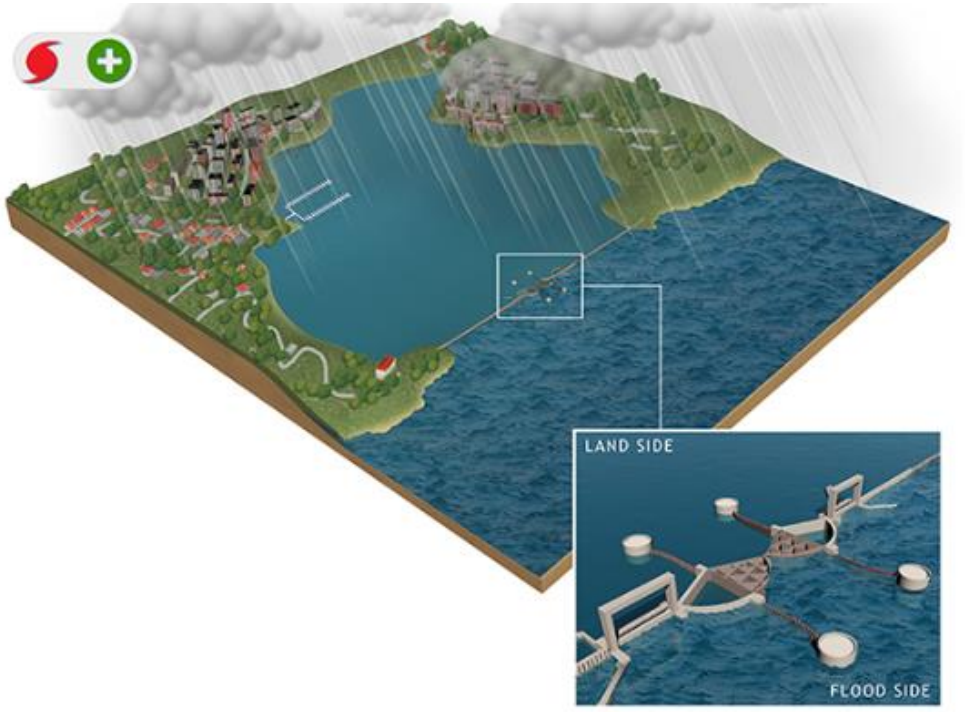


PROPOSED CONCEPT (DIGITAL RENDERING)



Defense Measure: Example small-scale Storm Surge Barrier (not harbor-wide)





- Storm surge barriers are typically opened during normal conditions to allow for navigation and saltwater exchange with the estuarine areas landward of the barrier and then closed when storm surges expected to exceed a certain level.

Timeline for Recommendations Milestone (Segment 2)

June 2023 – January 2024

- **Formulate Risk Management Strategies**
  - Identify and screen risk management measures
- **Conduct Coastal Engineering Assessment**
  - High tide flooding assessment
  - Model risk reduction measures with MC-FRM Model

January – June 2024

- **Concept Design**
  - Develop 10% design and parametric cost estimates
- **Evaluate risk management strategies**
- **Outline of real estate interests for risk management strategies**

June – November 2024

- **Develop Strategic Roadmap and Recommendations**
  - Compare risk management strategies
  - Identify recommended actions
- **Recommendations Milestone Meeting**



Proposed stakeholder engagement (June 2023 – November 2024)

- ❑ Quarterly Working Group meetings
- ❑ Additional focus groups (academic groups, Environmental Justice communities, tribal governments, etc.)
- ❑ Public survey
- ❑ Virtual public forum
- ❑ *What else?*

Wrap Up & Next Steps

- Continue to share feedback on these slides through **May 19**

- Next working group meeting anticipated Summer 2023

- **EEA Climate Resilience Updates**
  - Draft 2023 **State Hazard Mitigation and Climate Adaptation Plan** will be shared with FEMA for review in June, for authorization by September
  - **MVP 2.0 Planning** applications are due May 19, for funding to reset your resilience plan priorities and implement a "seed project".
  - CZM anticipates releasing the **FY24 Coastal Resilience Grant Program Request for Responses** later this spring. See www.mass.gov/service-details/coastal-resilience-grant-program for more information.

Let's Keep the Conversation Going!

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