



CLIMATE **READY** *BOSTON*

Green Ribbon Commission
06.01.2016

CLIMATE READY BOSTON GOAL

Generate solutions for resilient buildings, neighborhoods, and infrastructure to help Boston and its metro region prosper in the face of long-term climate change impacts, including sea level rise, coastal and stormwater flooding, and extreme temperatures.

CLIMATE READY BOSTON COMPONENTS

I. Climate Consensus

Science-based consensus re likely ranges for future change climate impacts across multiple risks for several future time periods (e.g., 2030s, 2060s/2070s, and 2100).

II. Vulnerability Assessment

Comprehensive assessment of current and potential future risks facing Boston's physical assets and systems, including buildings, infrastructure and environmental systems.

III. Resilience Initiatives

Set of actions to enhance Resilience in Critical Resilience Focus Areas, where Resilience actions are not currently being taken or planned and multiple vulnerabilities exist.

IV. Implementation Roadmap

Report that offers recommendations for execution, potentially including funding sources, incentives, legal/regulatory changes, community engagement, and local/regional coordination.

CONTENTS

Climate Projection Consensus

Preliminary Vulnerability Assessment

Preliminary Resilience Initiatives

Seaport Case Study

CLIMATE PROJECTION CONSENSUS

Boston Research Advisory Group



Sea Level Rise



Storms

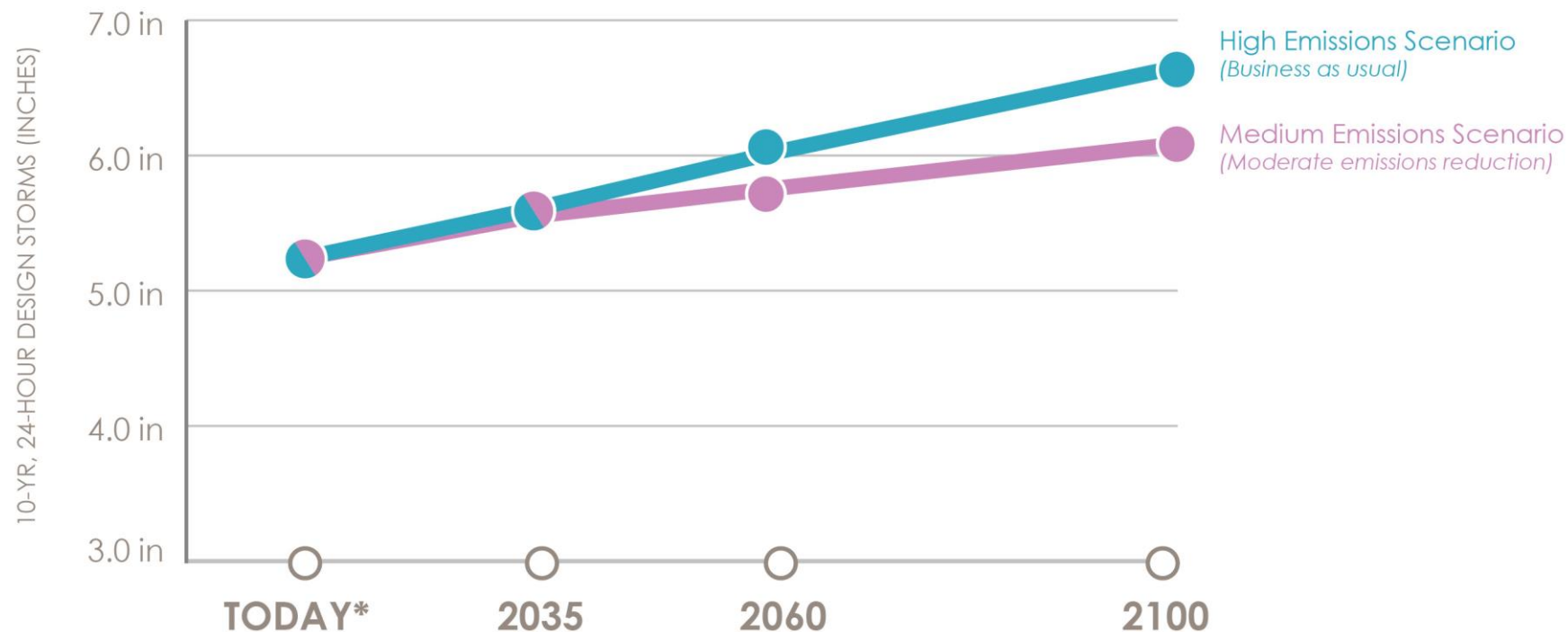


Extreme Temperatures



Extreme Precipitation

RAINFALL FROM STORMS WILL INCREASE

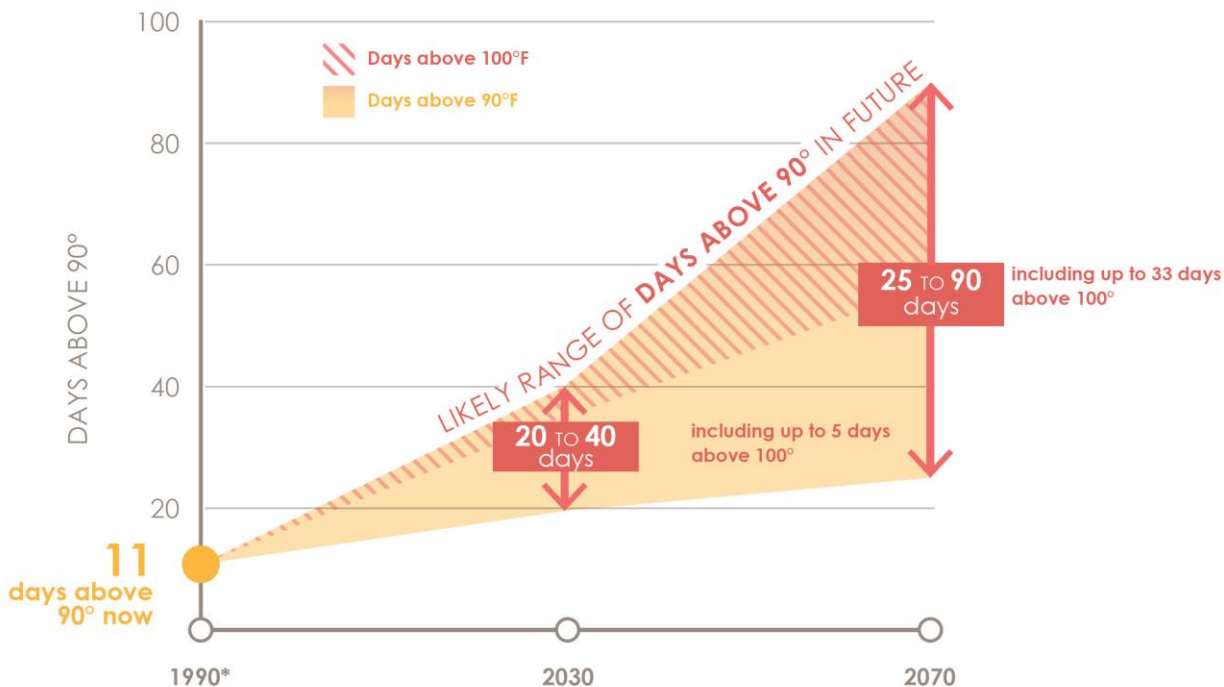


* "Today" baseline represents historical average from 1948-2012

Confidence intervals are not available for these projections but are likely large, so these numbers should be considered as the middle of a large range

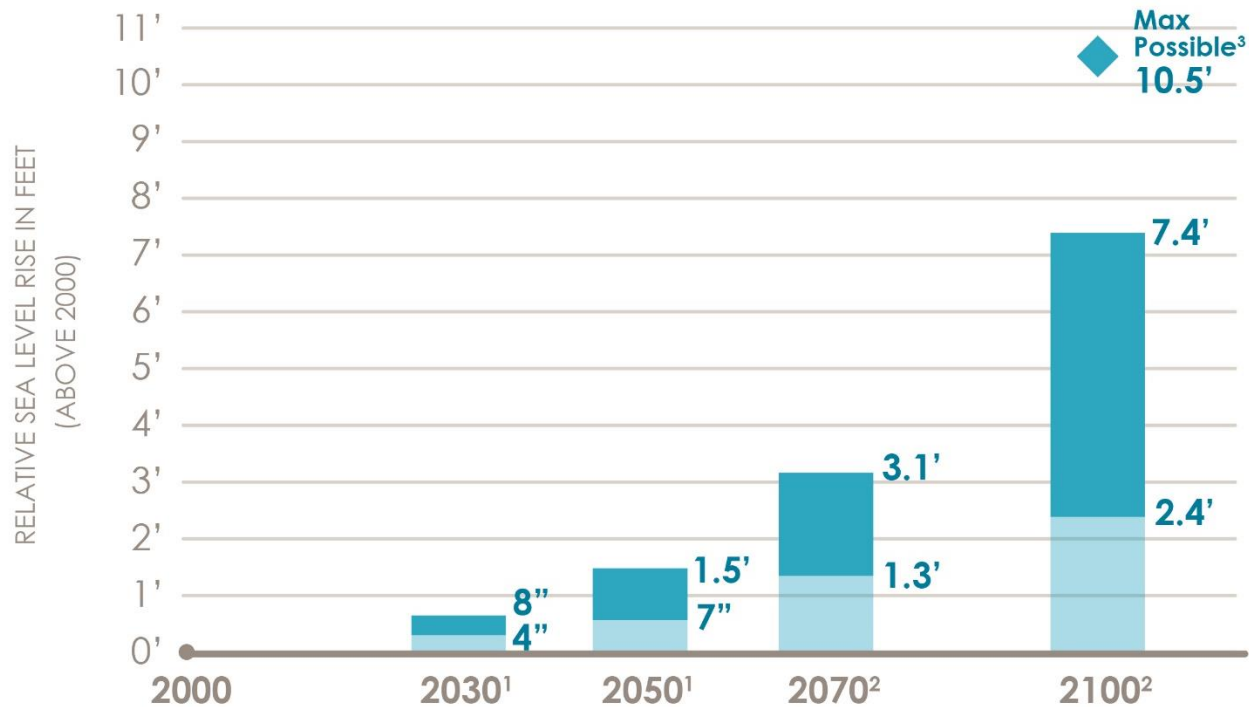
Data Source:
Boston Water & Sewer Commission

THE NUMBER OF VERY HOT DAYS WILL INCREASE



* Baseline represents historical average from 1971-2000
Upper values from high emissions scenario. Lower values from low emissions scenario.

RELATIVE SEA LEVEL IN BOSTON WILL RISE



1 - Likely under all emission scenarios

2 - Likely under moderate to high emission scenarios

3 - Low probability under high emission scenario

Data Source: BRAG Report

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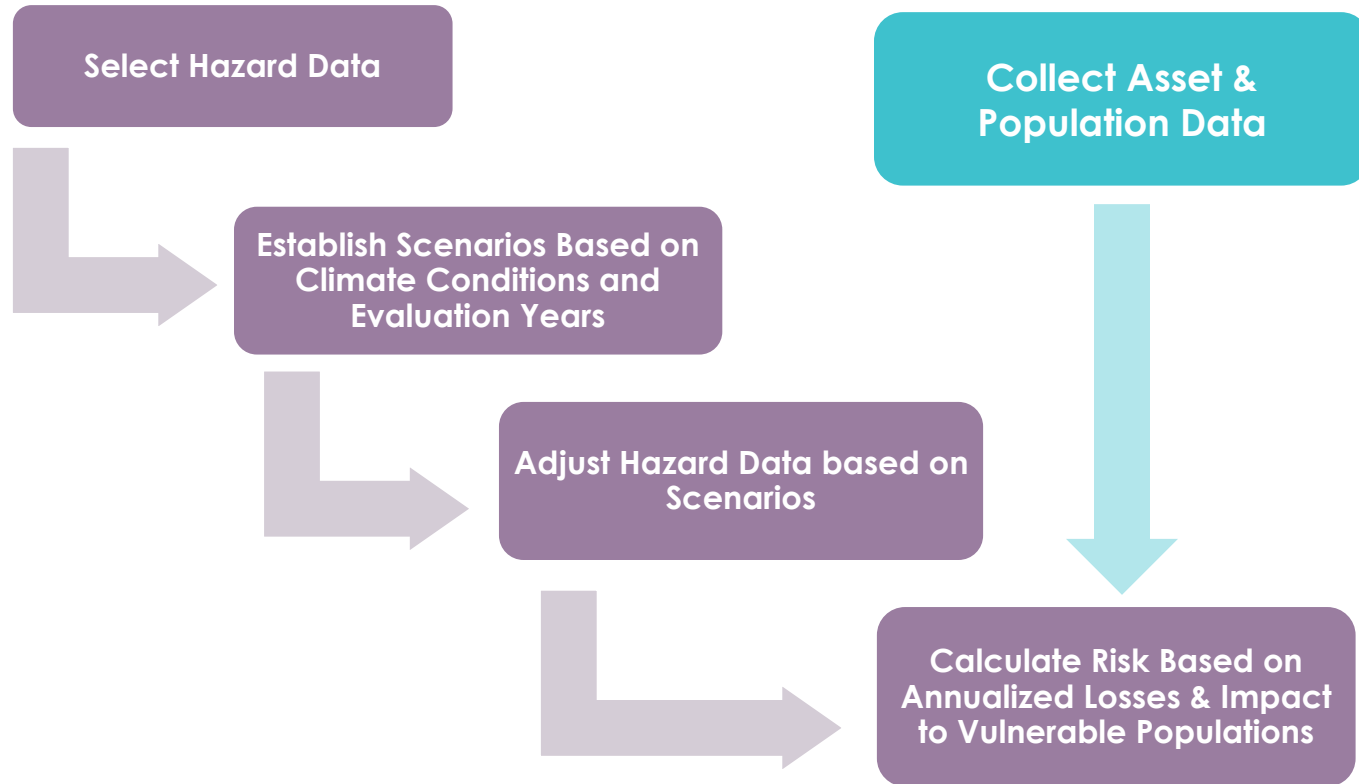
Climate Projection Consensus

Preliminary Vulnerability Assessment

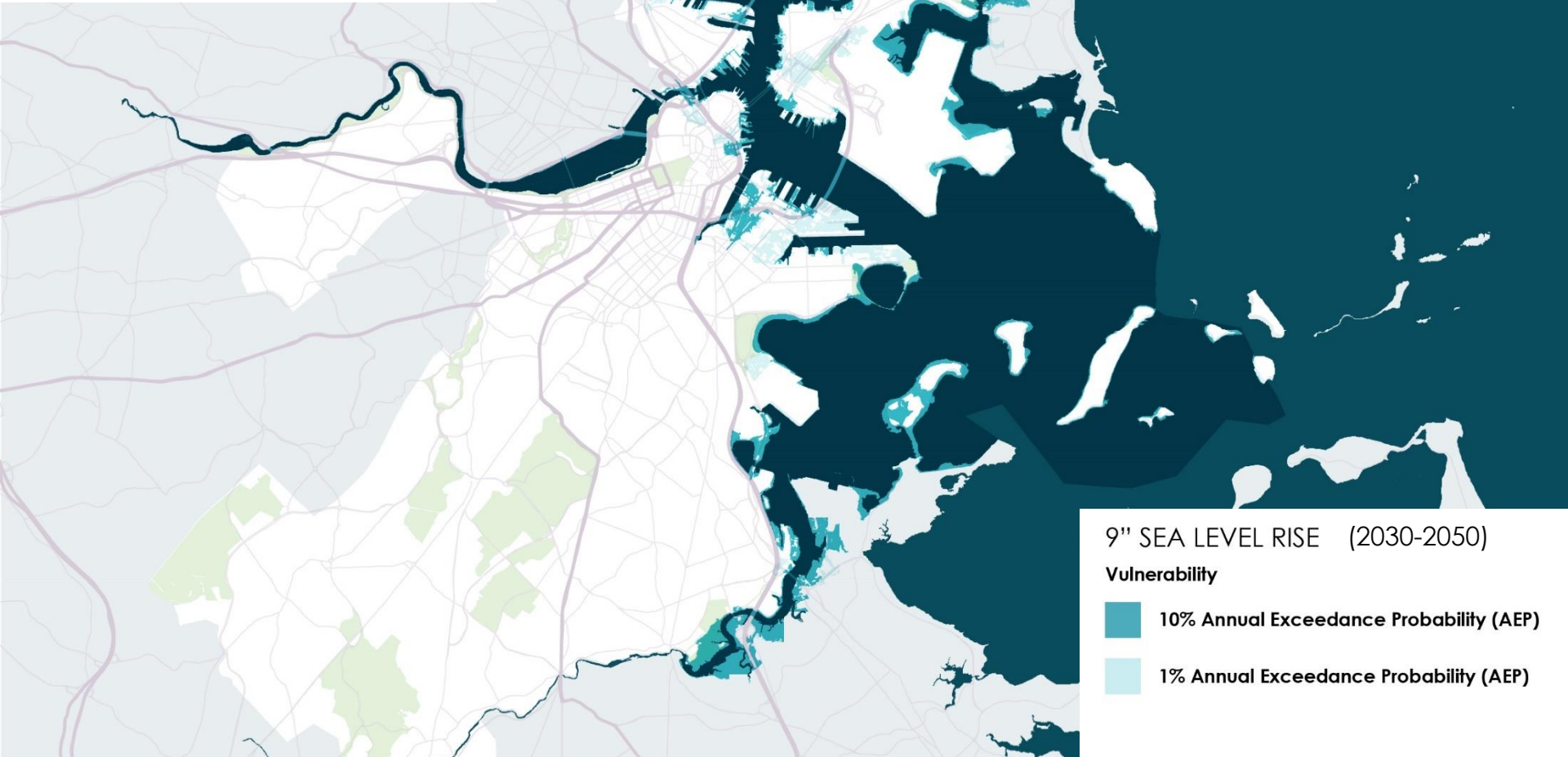
Preliminary Resilience Initiatives

Seaport Case Study

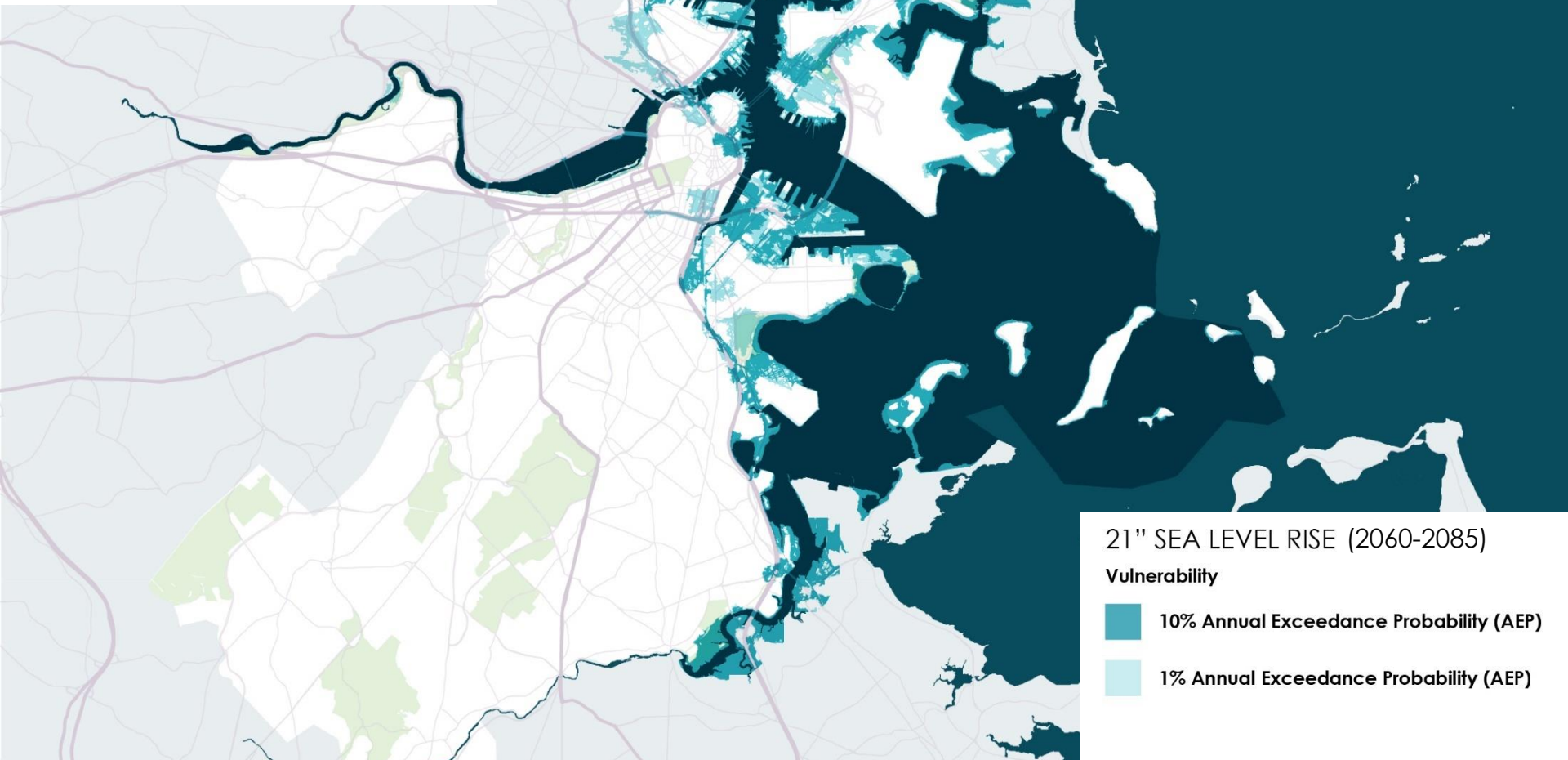
VULNERABILITY ASSESSMENT OVERVIEW



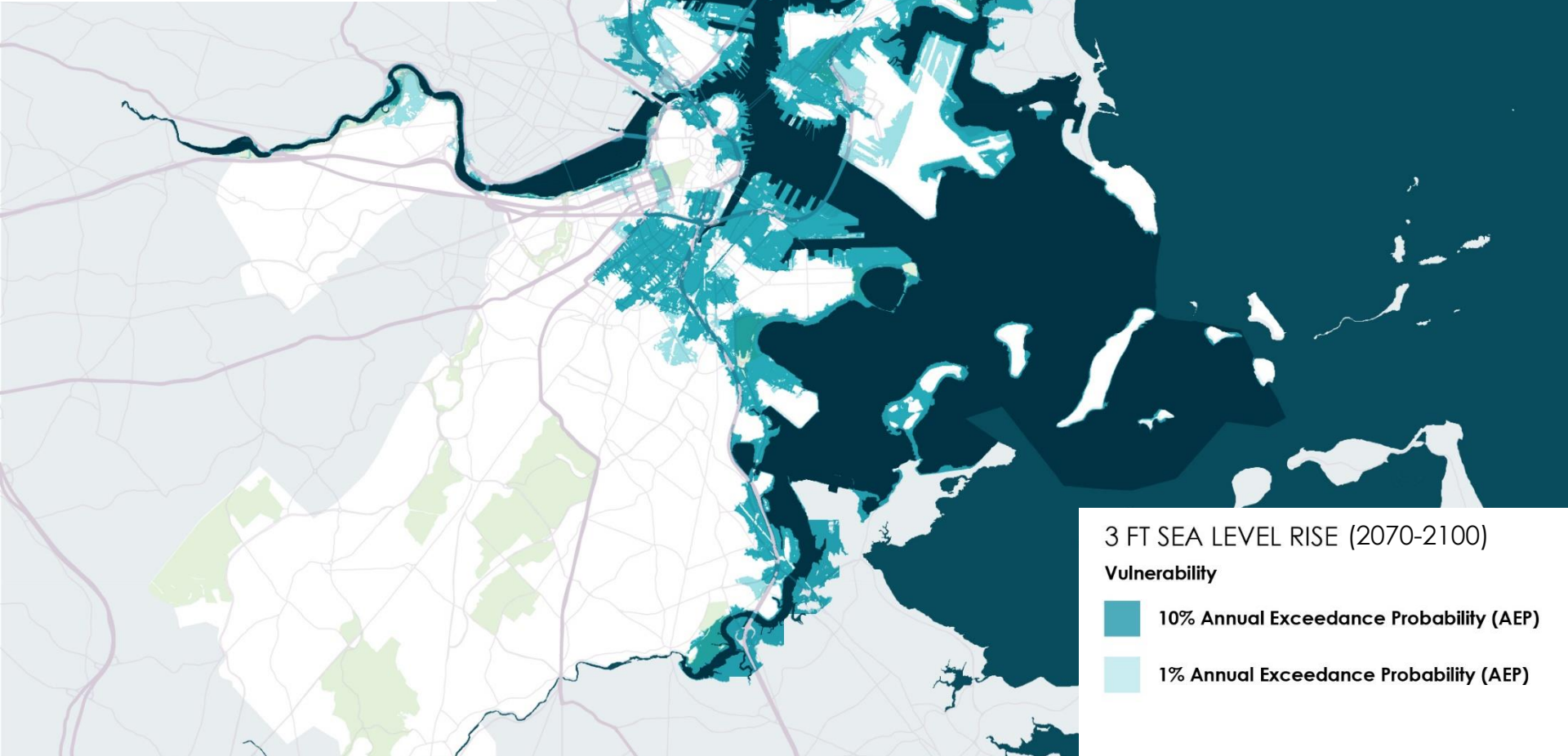
CLIMATE READY BOSTON FLOOD EXTENT MAPS



CLIMATE READY BOSTON FLOOD EXTENT MAPS

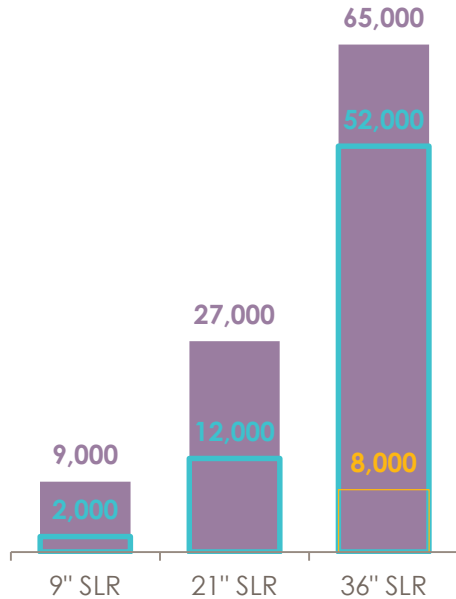


CLIMATE READY BOSTON FLOOD EXTENT MAPS

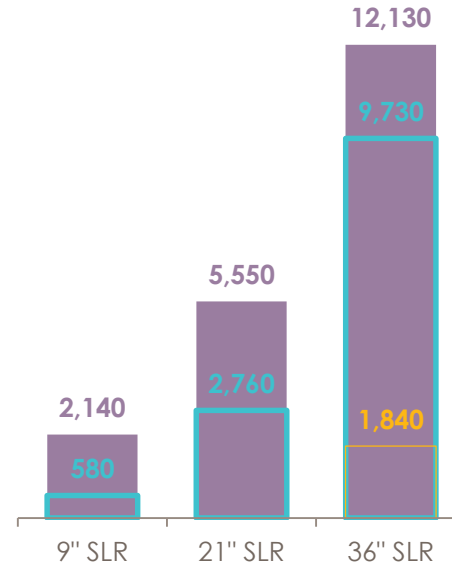


CITYWIDE FLOOD IMPACTS

EXPOSED POPULATION



EXPOSED BUILDINGS

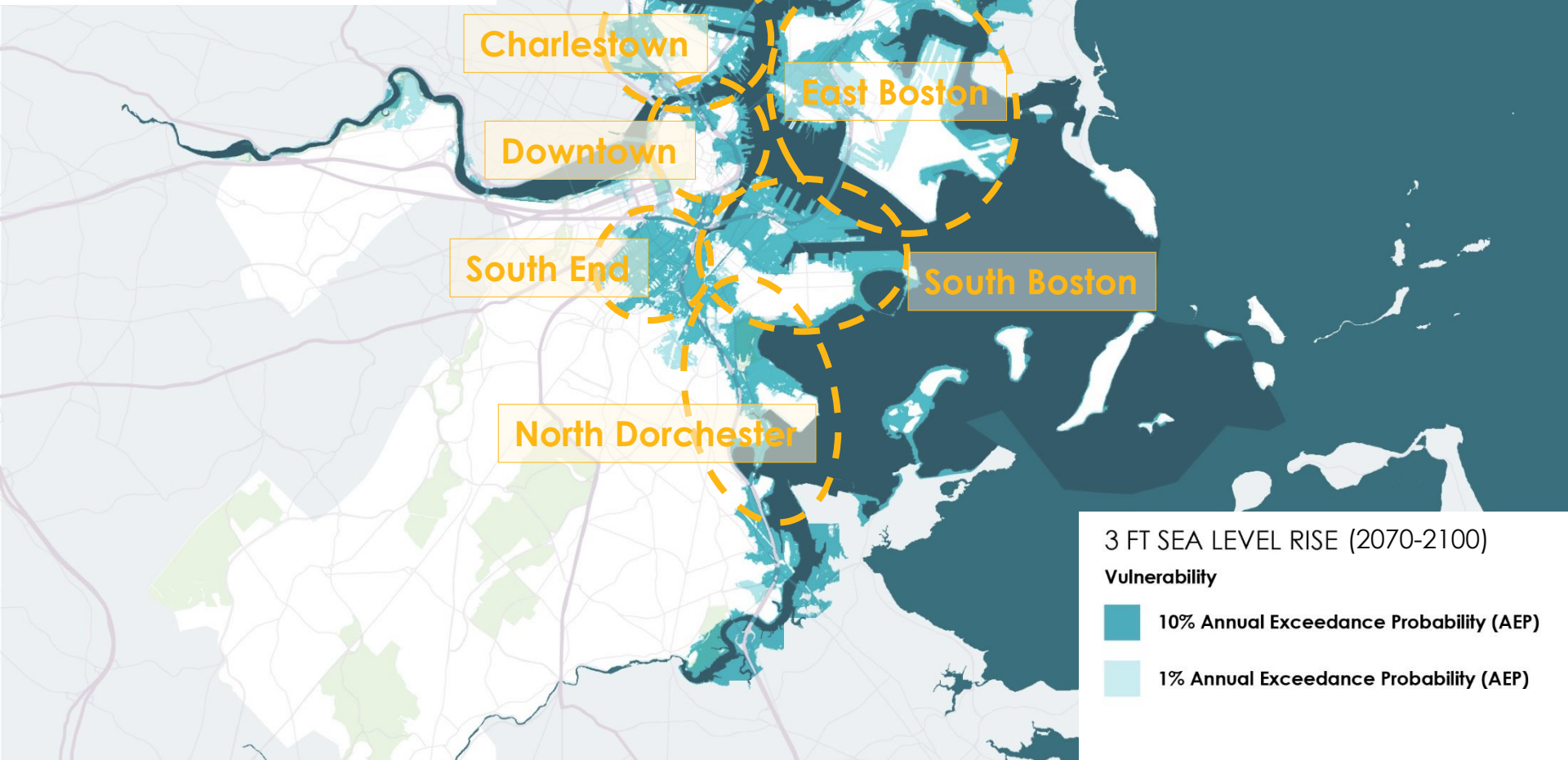


■ 1% AEP* □ 10% AEP* □ AVG. MONTHLY HIGH TIDE

*Annual Exceedance Probability

CLIMATE READY BOSTON

COASTAL FOCUS AREAS



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RESILIENCE INITIATIVES PRINCIPLES



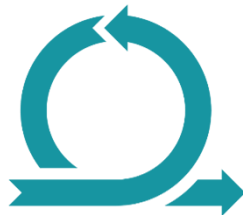
SUPPORT **MULTIPLE BENEFITS** WITH EACH ACTIVITY



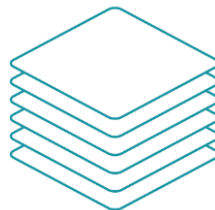
MAKE IMPROVEMENTS AS PART OF **NATURAL BUILDING CYCLES**, AND **ADDRESS MARKET FAILURES**



INCORPORATE LOCAL INVOLVEMENT IN DESIGN AND DECISION-MAKING

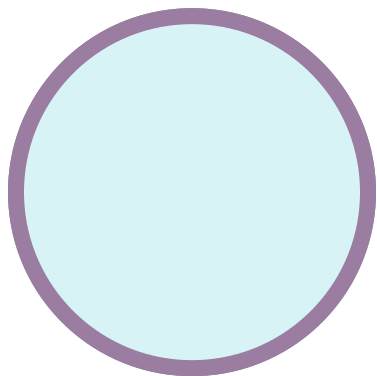


DEVELOP **ADAPTIVE AND FLEXIBLE STRATEGIES**



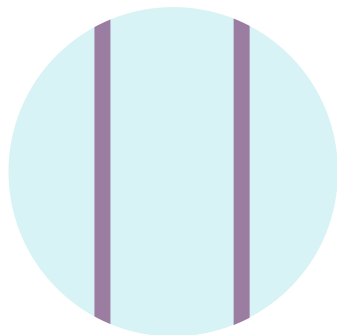
WORK IN LAYERS FOR INDEPENDENTLY EFFECTIVE SOLUTIONS

RESILIENCE INITIATIVES LAYERS



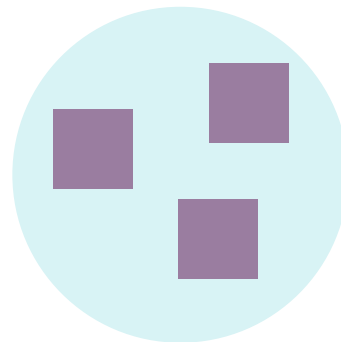
Protected Shores

Interventions to prevent harbor flooding; protect against storm surge; minimize upland wave zones; and raise coastal edge elevations



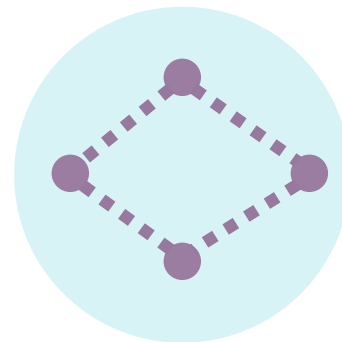
Resilient Infrastructure

Modification of existing infrastructure or creation of new infrastructure to allow effective functioning under future climate conditions.



Adapted Buildings

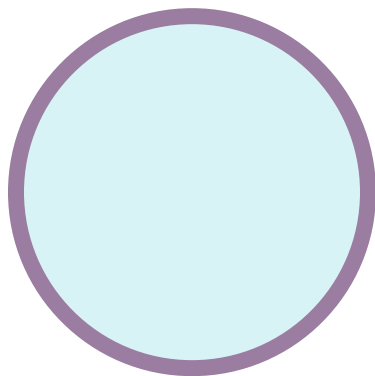
Efforts to retrofit existing buildings to be more resilient or to build resilient new buildings



Prepared & Connected Communities

Planning efforts and operational protocols that increase communities', facilities', and institutions' ability to thrive under future climate conditions.

RESILIENCE INITIATIVES LAYERS



Protected Shores

Strategies

1. District flood defenses
2. Harbor-wide protection

RESILIENCE INITIATIVES LAYERS

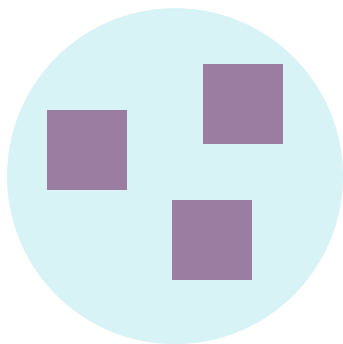


Resilient Infrastructure

Strategies

1. Common planning and design standards
2. Green infrastructure expansion
3. Natural infrastructure protection & expansion
4. Energy system redundancy and decentralization
5. Adaptation of existing infrastructure systems
 - Water and sewer
 - Transportation
 - Energy
 - Communication

RESILIENCE INITIATIVES LAYERS

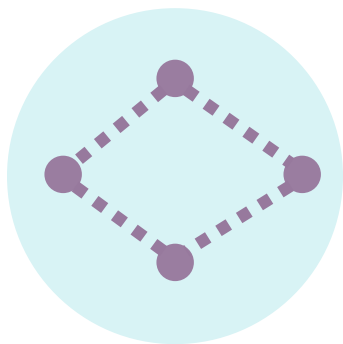


Adapted Buildings

Strategies

1. Support for building retrofits
2. Standards for new buildings
3. Flood insurance reform

RESILIENCE INITIATIVES LAYERS



Prepared & Connected Communities

Strategies

1. Climate projection consensus
2. Engagement of at-risk stakeholders
3. Preparedness planning for vulnerable populations
4. Small businesses and institution support
5. Economic development through resilience

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9" SEA LEVEL RISE

1% Annual Exceedance Probability (AEP)

Police Station

Other essential facilities   

Emergency Medical Services,
Emergency Operations Center,
Emergency Shelter, Other Medical

Tunnel entrances

Hospital (n/a in Seaport)

Evacuation Routes

Roads * _____

* Some raised roads are above the flooding, but not indicated on the maps due to limits of analysis.



21" SEA LEVEL RISE (2060-2085)

Vulnerability

- 10% Annual Exceedance Probability (AEP)
- 1% Annual Exceedance Probability (AEP)

Vulnerable to 10% AEP
Vulnerable to 1% AEP
Less Vulnerable

Police Station

Fire Station

Other essential facilities

Emergency Medical Services,
Emergency Operations Center,
Emergency Shelter, Other Medical

MBTA Station Entrances

In the Seaport, most of these are Silver
Line stops - some are station entrances
and other are at-grade stops

Tunnel entrances

Schools & Colleges

Hospital (n/a in Seaport)

Parks

Evacuation Routes

Roads *

* Some raised roads are above the flooding, but
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36" SEA LEVEL RISE (2070-2100)

Vulnerability

10% Annual Exceedance Probability (AEP)

1% Annual Exceedance Probability (AEP)

Vulnerable to 10% AEP
Vulnerable to 1% AEP
Less Vulnerable

Police Station

Fire Station

Other essential facilities

Emergency Medical Services,
Emergency Operations Center,
Emergency Shelter, Other Medical

MBTA Station Entrances

In the Seaport, most of these are Silver
Line stops - some are station entrances
and other are at-grade stops

Tunnel entrances

Schools & Colleges

Hospital (n/a in Seaport)

Parks

Evacuation Routes

Roads *

* Some raised roads are above the flooding, but
not indicated on the maps due to limits of analysis.



MONTHLY HIGH TIDE 36" SEA LEVEL RISE (2070-2100)



Vulnerable to
Average Monthly Highest Tide
Less vulnerable to
Average Monthly Highest Tide

Police Station

Fire Station

Other essential facilities

Emergency Medical Services,
Emergency Operations Centers,
Emergency Shelter, Other Medical

MBTA Station Entrances

In the Seaport, most of these are Silver
Line stops - some are station entrances
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Tunnel entrances

Schools & Colleges

Hospital (n/a in Seaport)

Parks

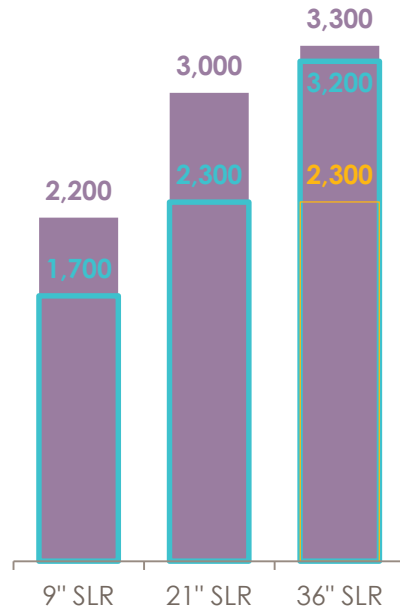
Evacuation Routes

Roads *

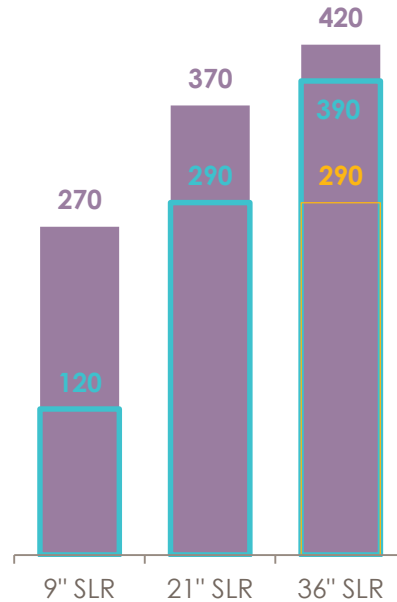
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SEAPORT FLOOD IMPACTS

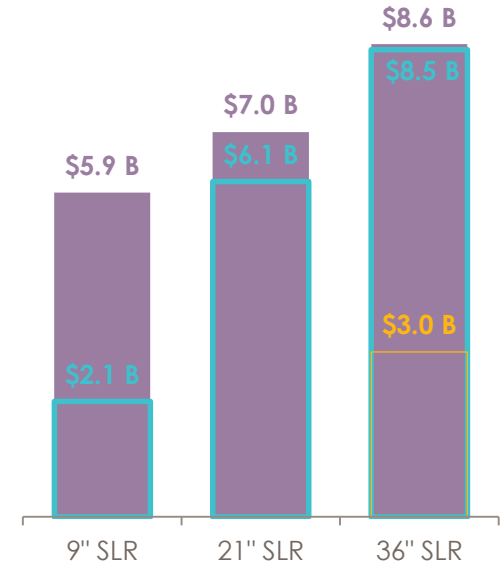
EXPOSED POPULATION



EXPOSED BUILDINGS



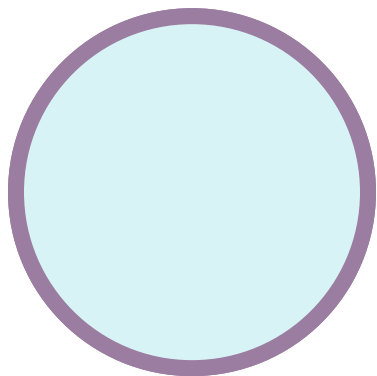
BUILDING REPLACEMENT VALUE



■ 1% AEP* □ 10% AEP* □ AVG. MONTHLY HIGH TIDE

*Annual Exceedance Probability

RESILIENCE INITIATIVES LAYERS



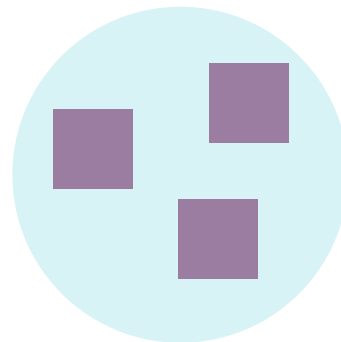
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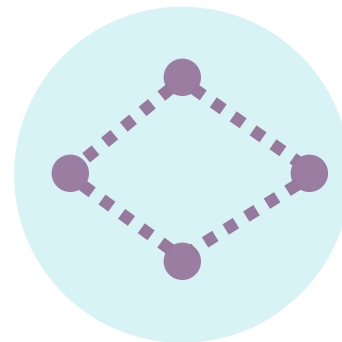
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Adapted Buildings

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Prepared & Connected Communities

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FLOOD DEFENSES

Seaport District

Illustrative Elevated Shoreline Defense



Layer
Protected Shores

FLOOD DEFENSES

East Boston

CHELSEA

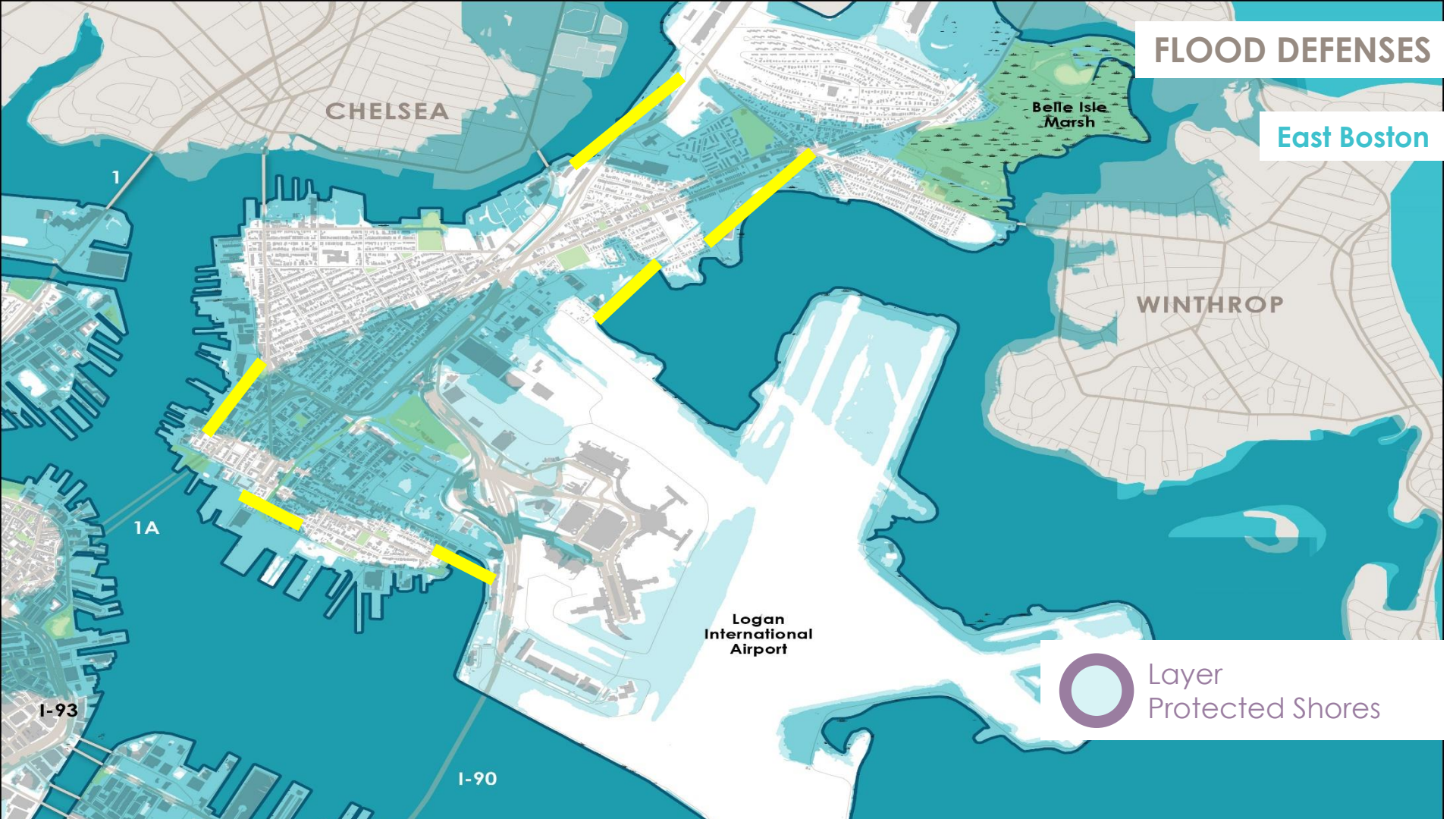
Belle Isle Marsh

WINTHROP

Logan International Airport



Layer Protected Shores



RESILIENT INFRASTRUCTURE

Logan
Airport

I-90

South
Station

I-90

Convention
Center

Retrofit
Existing
Infrastructure

Add Resilience
Infrastructure



Layer 2
Resilient Infrastructure

Castle
Island

ADAPTED BUILDINGS

Seaport District

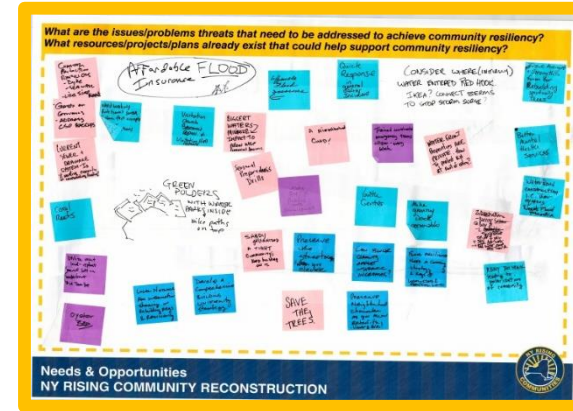


Layer 3
Adapted Buildings

PREPARING SOCIALLY VULNERABLE POPULATIONS

South Boston

Socially Vulnerable Groups	South Boston Population	% of South Boston
Total Population	33,600	
Older Adults (65+)	3,200	10%
Children (<5)	4,900	14%
People with Disabilities	3,000	9%
Low to No Income	8,200	24%
People of Color	7,100	21%



Connected & Prepared
Communities

A Resilient Seaport District



Protected Shores

Resilient Infrastructure

Adapted Buildings

Connected & Prepared Communities



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