

# CLIMATE READY BOSTON



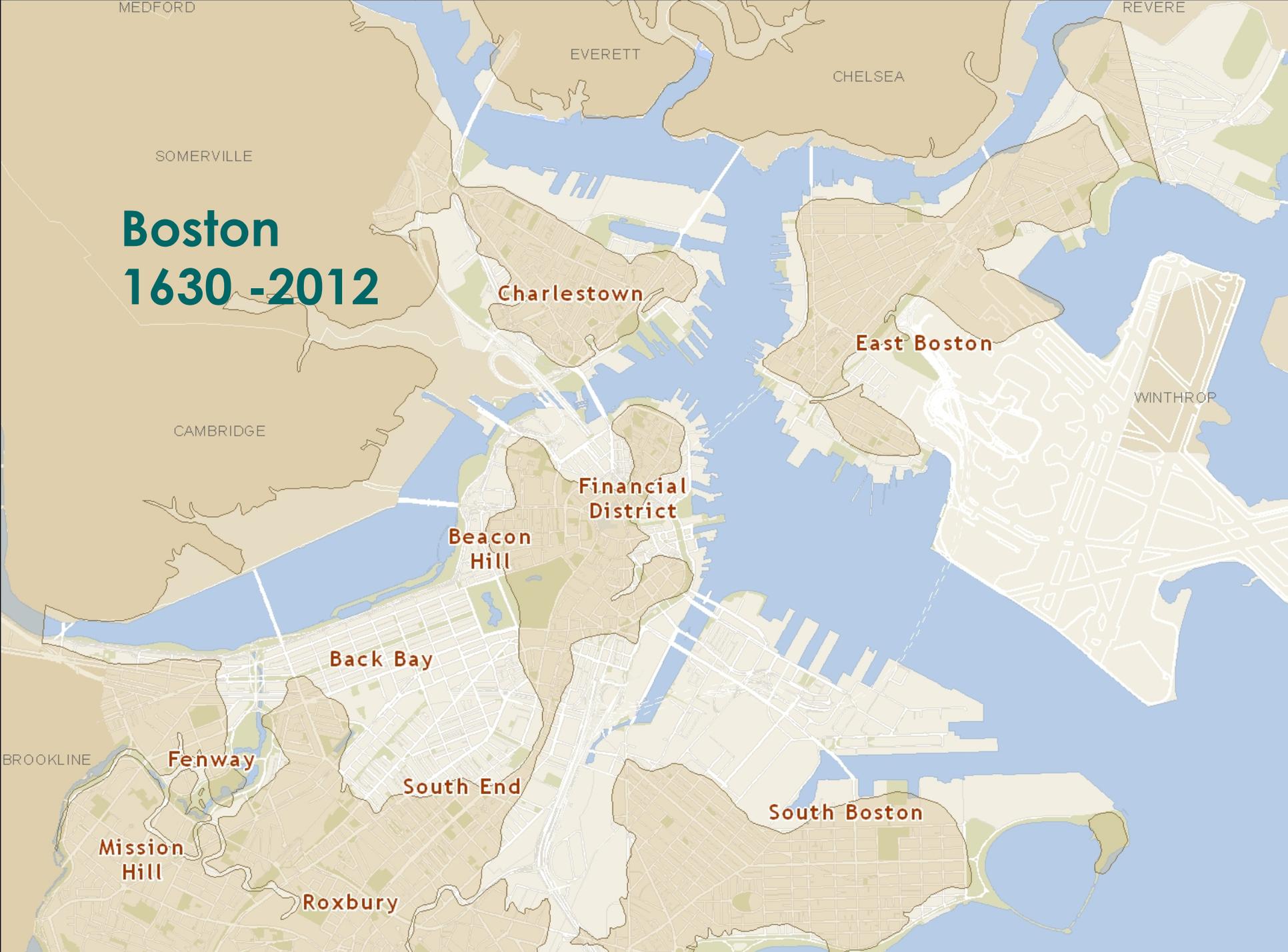
GREENOVATE  
BOSTON

*Brian R. Swett, Chief of Environment, Energy and Open Space, City of Boston*  
**email** [EnvironmentalEnergy@cityofboston.gov](mailto:EnvironmentalEnergy@cityofboston.gov) **web** [www.cityofboston.gov/EEOS/](http://www.cityofboston.gov/EEOS/) &  
[www.greenovateboston.org](http://www.greenovateboston.org)

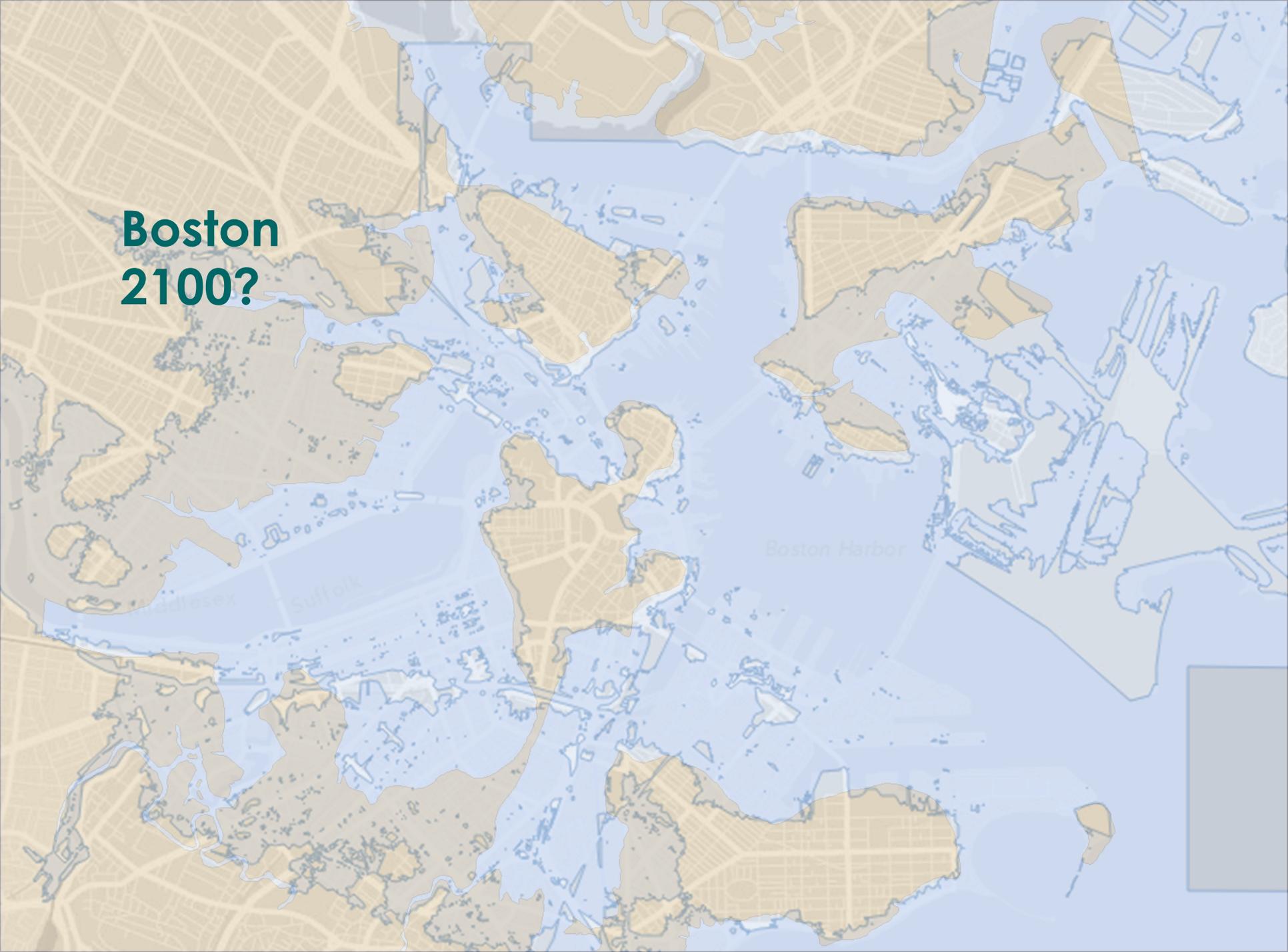
**Boston**  
**1630**



# Boston 1630 - 2012



**Boston  
2100?**

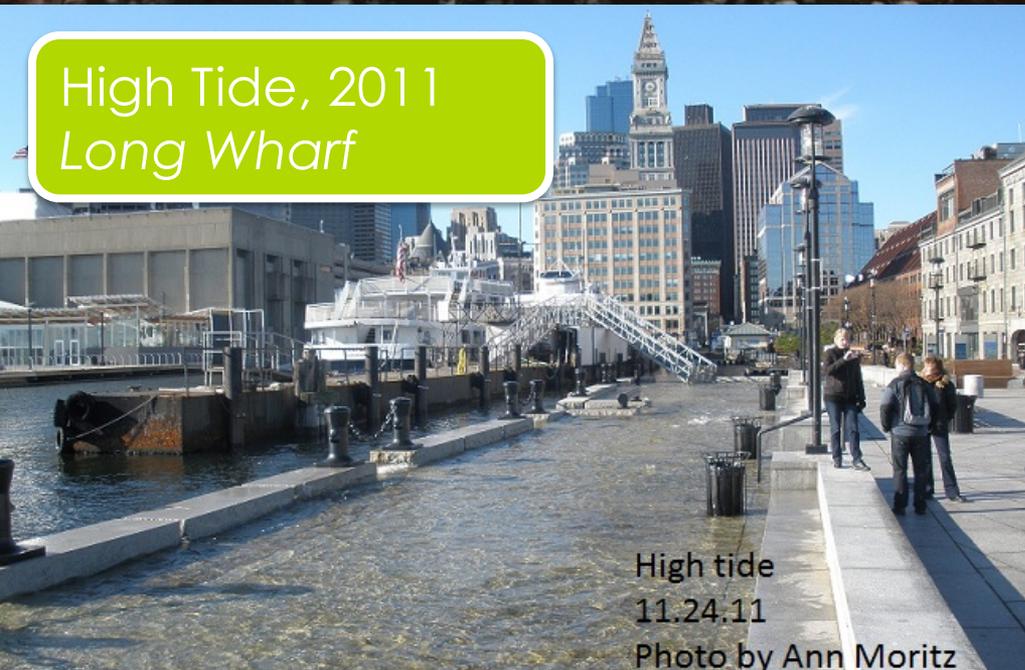




Winter Storm Hercules, 2014  
*Christopher Columbus Park*



Hurricane Sandy, 2012  
*Long Wharf & Morrisey Blvd*



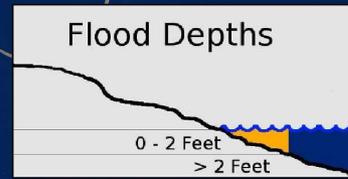
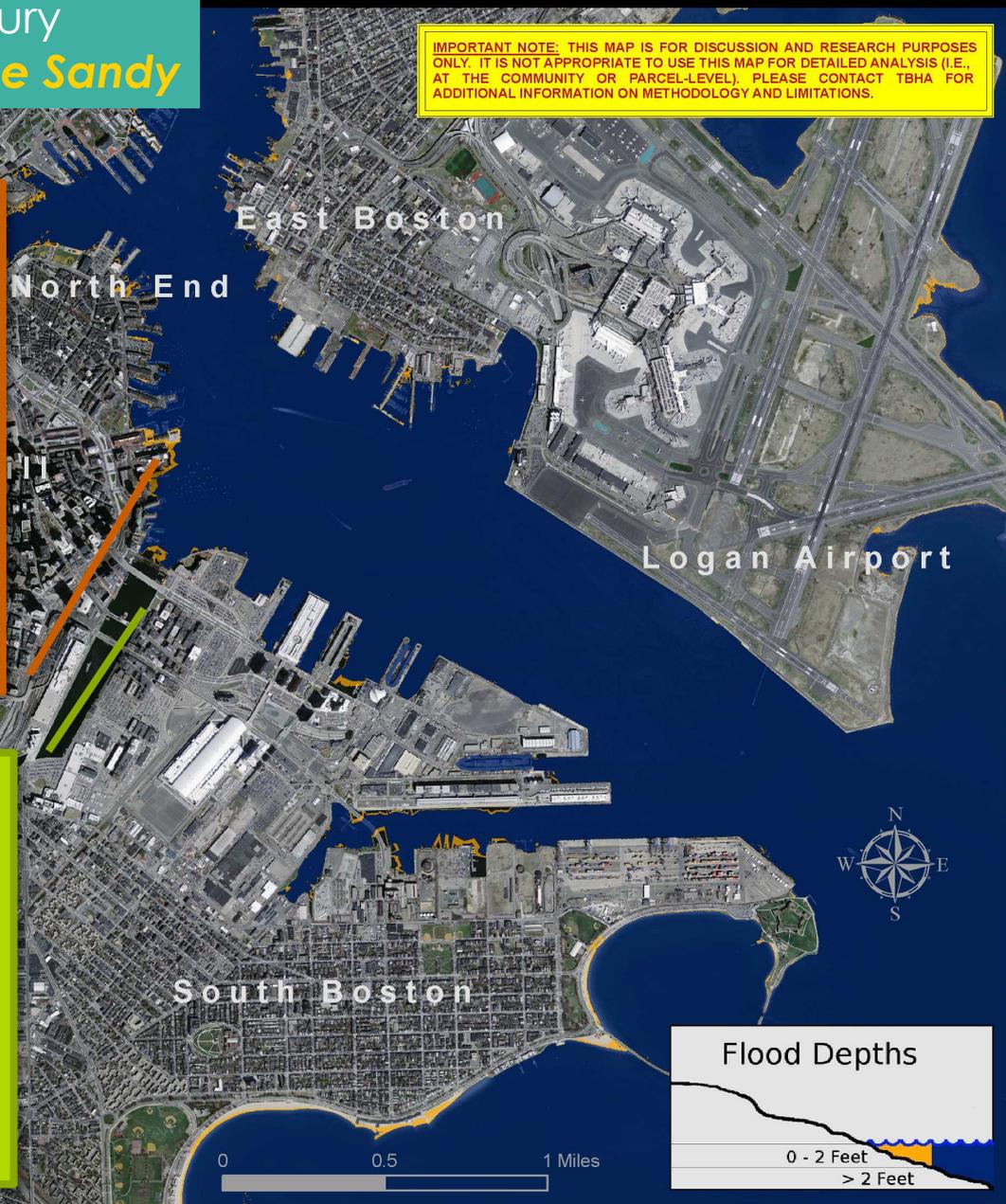
High Tide, 2011  
*Long Wharf*

High tide  
11.24.11  
Photo by Ann Moritz



Mean High High Water +2.5 feet  
 Projected to occur by mid-century  
*Similar to flooding from Hurricane Sandy*

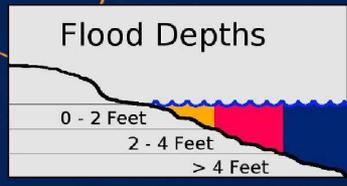
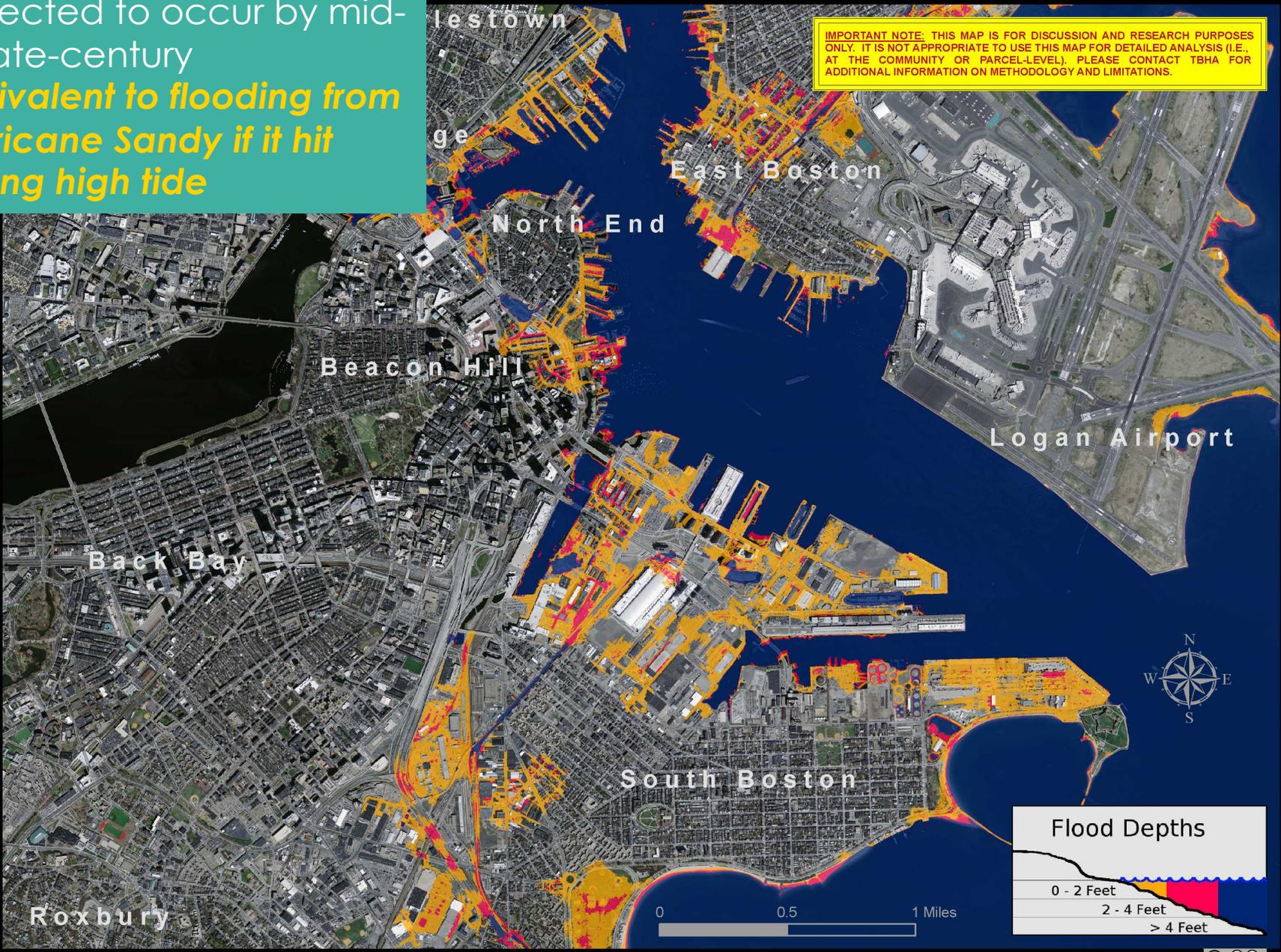
**IMPORTANT NOTE:** THIS MAP IS FOR DISCUSSION AND RESEARCH PURPOSES ONLY. IT IS NOT APPROPRIATE TO USE THIS MAP FOR DETAILED ANALYSIS (I.E., AT THE COMMUNITY OR PARCEL-LEVEL). PLEASE CONTACT TBHA FOR ADDITIONAL INFORMATION ON METHODOLOGY AND LIMITATIONS.



TBHA\_2010\_SLR\_Forum\_18-Jul-2011\_cw

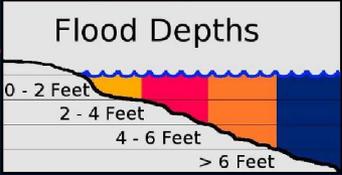
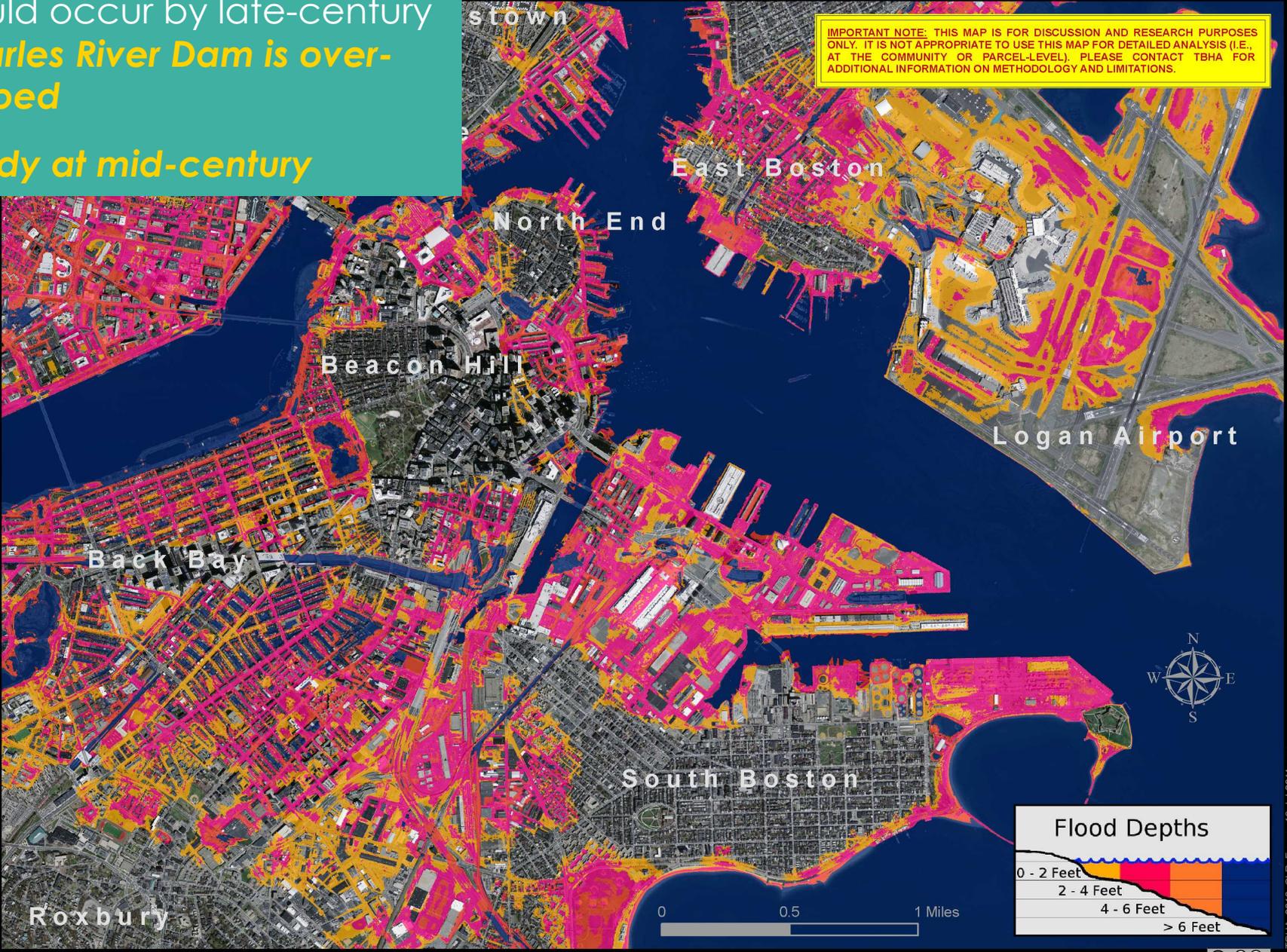
Mean High High Water +5'  
 Projected to occur by mid-  
 to late-century  
**Equivalent to flooding from  
 Hurricane Sandy if it hit  
 during high tide**

**IMPORTANT NOTE: THIS MAP IS FOR DISCUSSION AND RESEARCH PURPOSES ONLY. IT IS NOT APPROPRIATE TO USE THIS MAP FOR DETAILED ANALYSIS (I.E., AT THE COMMUNITY OR PARCEL-LEVEL). PLEASE CONTACT TBHA FOR ADDITIONAL INFORMATION ON METHODOLOGY AND LIMITATIONS.**



Mean High High Water + 7.5'  
 Could occur by late-century  
**Charles River Dam is over-  
 topped**  
**Sandy at mid-century**

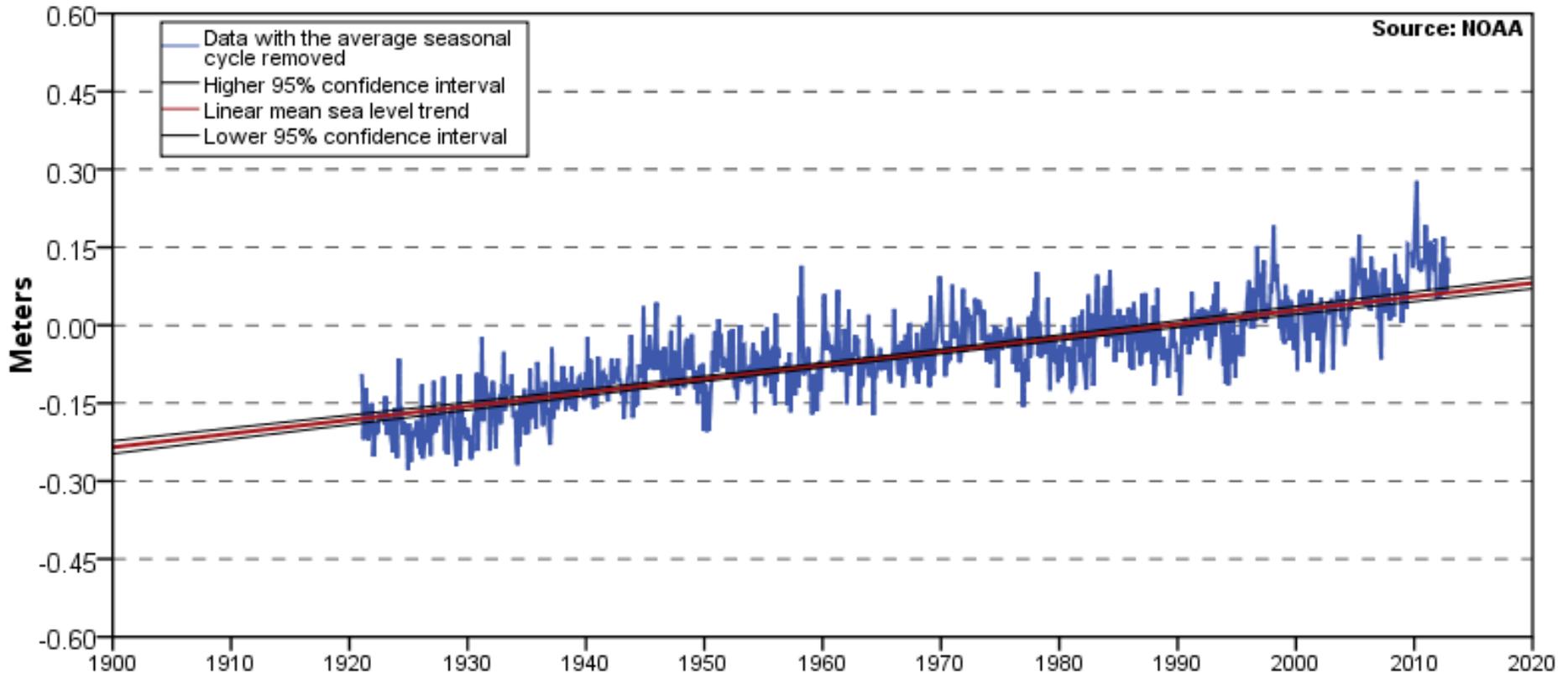
IMPORTANT NOTE: THIS MAP IS FOR DISCUSSION AND RESEARCH PURPOSES ONLY. IT IS NOT APPROPRIATE TO USE THIS MAP FOR DETAILED ANALYSIS (I.E., AT THE COMMUNITY OR PARCEL-LEVEL). PLEASE CONTACT TBHA FOR ADDITIONAL INFORMATION ON METHODOLOGY AND LIMITATIONS.



# Sea-level $\approx 10''$ over past 100 yrs

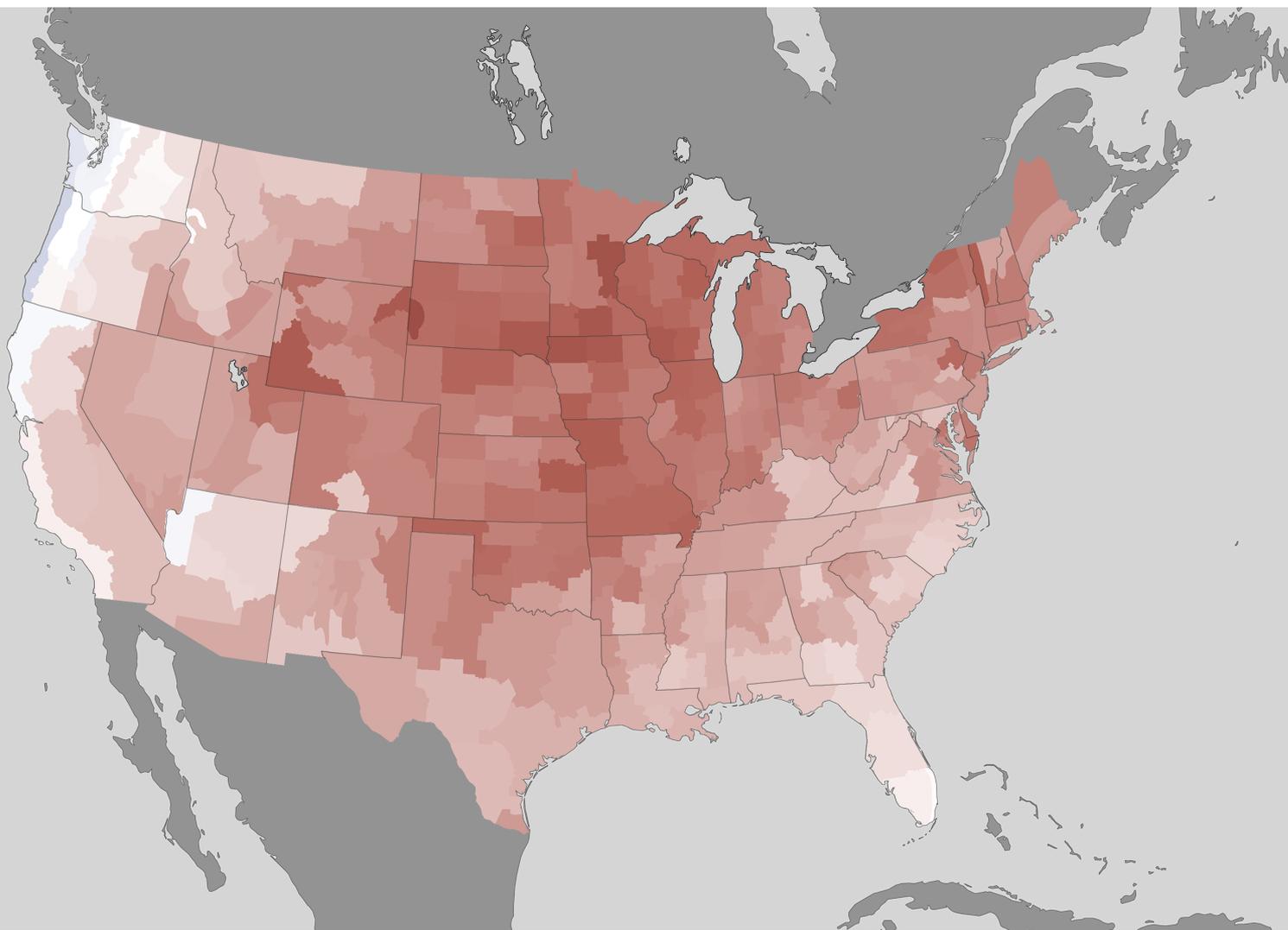
## Boston Harbor Tide Gauge

Boston, MA  $2.63 \pm 0.18$  mm/yr



**2012 was the warmest year on record  
in the U.S. by one full degree**

**By 2047, the coldest years will be  
warmer than today's warmest.**



Difference from average temperature (°F)  
-8 0 +8

**-8**

**Difference from the average temperature (°F) 2012**

**+8**

# City of Boston's focus on Climate Preparedness from 2007-2012

## Infrastructure

- BWSC 25-year Asset Management Plan
- Local Energy Assurance Planning
- Complete Streets
- Internal Climate Preparedness Working Group

## Neighborhoods

- Tree Planting
- Hazard Mitigation Plan Update
- TBHA Sea Level Rise Forum and Community Meetings

## Buildings

- Climate Preparedness Questionnaire



**Solar Powered Fueling Stations for Emergency Vehicles at 400 Frontage Road 120 kW**

**Deer Island Constructed to Withstand 2 Feet of Sea-Level Rise**



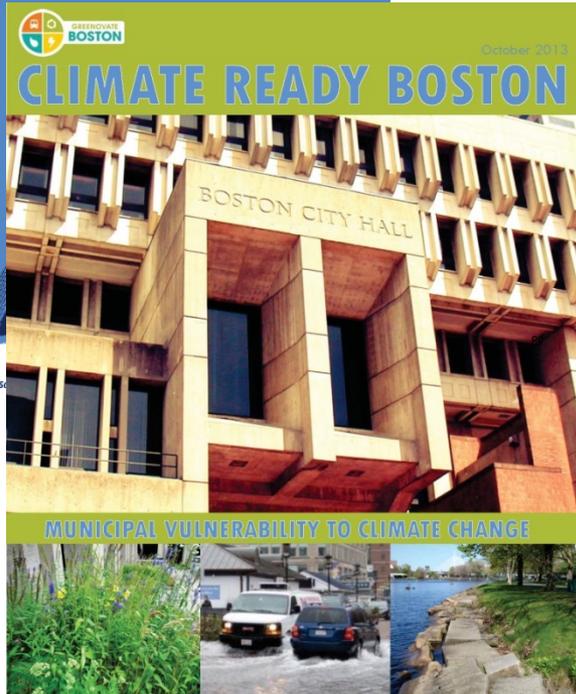
**Solar Powered Traffic Signals Along Evacuation Route**

# Climate Ready Boston

Feb. 2013

## BUILDING RESILIENCE IN BOSTON

"Best Practices" for Climate Change Adaptation and Resilience for Existing Buildings



## Planning

- Climate Preparedness Task Force in City Hall
- Green Ribbon Commission working group focused on climate adaptation

## Existing Buildings

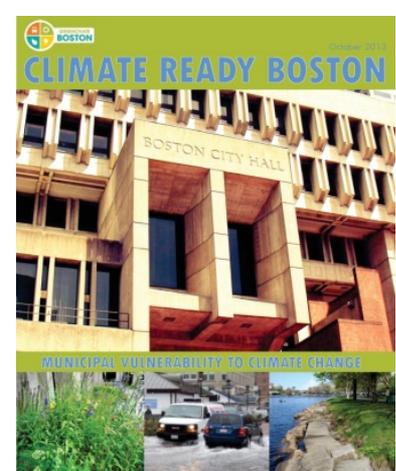
- Assess vulnerabilities of buildings and infrastructure through BRA survey
- Better enforcement of flood proofing building standards

## New Buildings

- Incorporate climate change adaptation guidelines into Article 80
- Wetlands Ordinance and new floodplain maps

## Emergency Response

- Review emergency operation planning



# Municipal Vulnerability to Climate Change

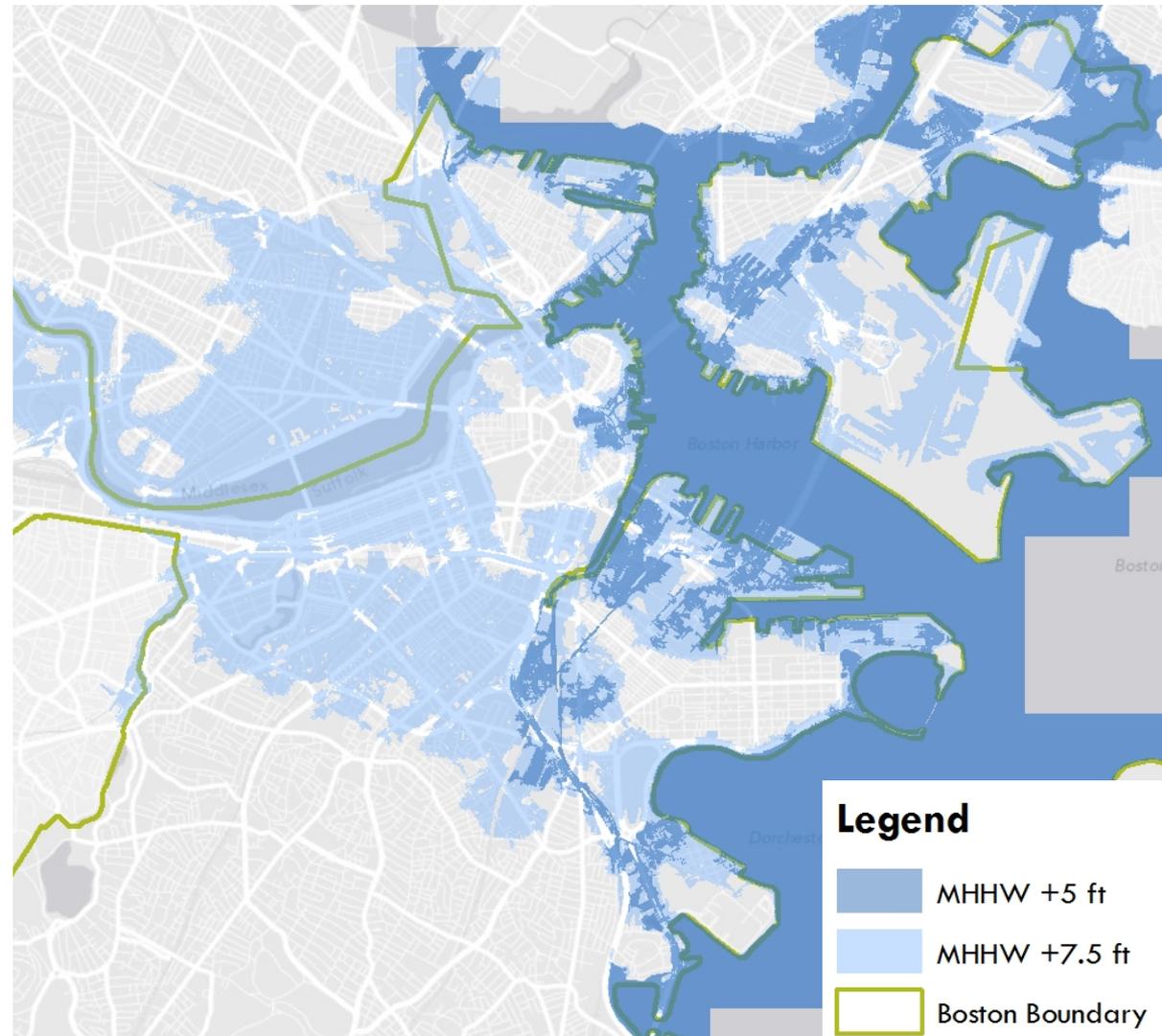
**Facilities and Capital Planning**

**Transportation and Water Infrastructure**

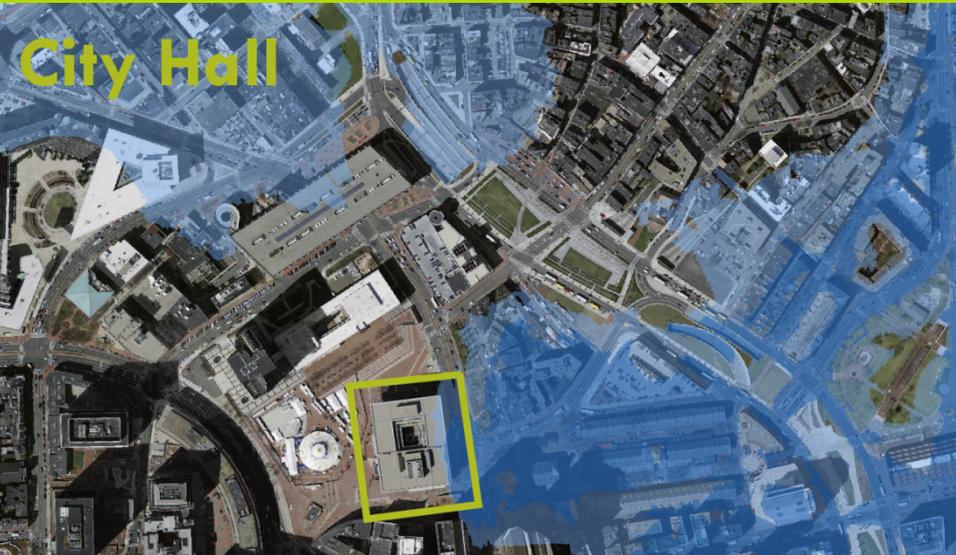
**Neighborhoods**

**Public Health and Heat**

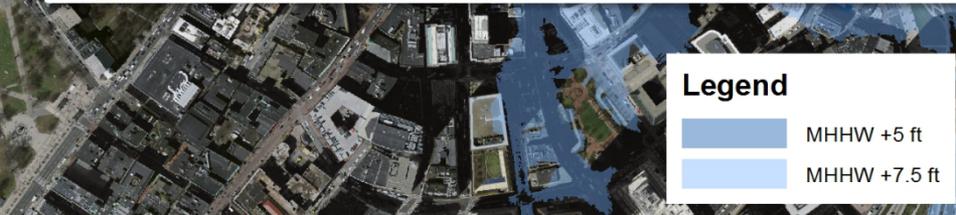
**State and Federal Coordination**



# Finding 1: Climate preparedness must be an important and explicit criterion in the City's capital planning. The City's critical IT, communications and transportation centers need particular attention



**Budget Office now requires capital project proposals to include climate preparedness**



## Finding 2: The effects of rising temperatures should be a high priority.

### **Increasing summer temperatures will require**

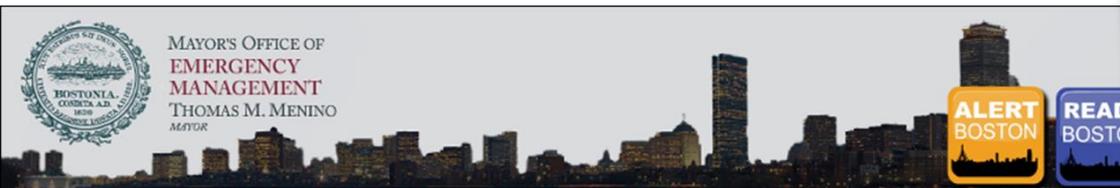
- Additional supplies (drinking water, shade or spray tents, etc.)
- Operational planning decisions such as adjusting the location or hours of programs in minimize excessive heat and sun exposure
- Increase access to AC or large fans (most BCYF gyms do not have AC; gyms are often used as emergency shelter operations)



*Image Credit: John Tlumacki/Globe Staff*

**Finding 3: Municipal emergency plans should be reviewed and practiced in light of the expanded risks posed by climate change.**

# Finding 4: Education, engagement, and communications—within City government and with the community—are essential for preparing for both the short-term and long-term effects of climate change.



 MAYOR'S OFFICE OF  
EMERGENCY  
MANAGEMENT  
THOMAS M. MENINO  
MAYOR

## EMERGENCY PREPAREDNESS TWITTER CHAT

DISCUSS THE IMPORTANCE OF EMERGENCY PREPAREDNESS.  
LEARN SIMPLE STEPS IN PLANNING FOR AN EMERGENCY.  
DISCOVER HOW TO KEEP FOOD SAFE AND HEALTHY DURING DISASTER.

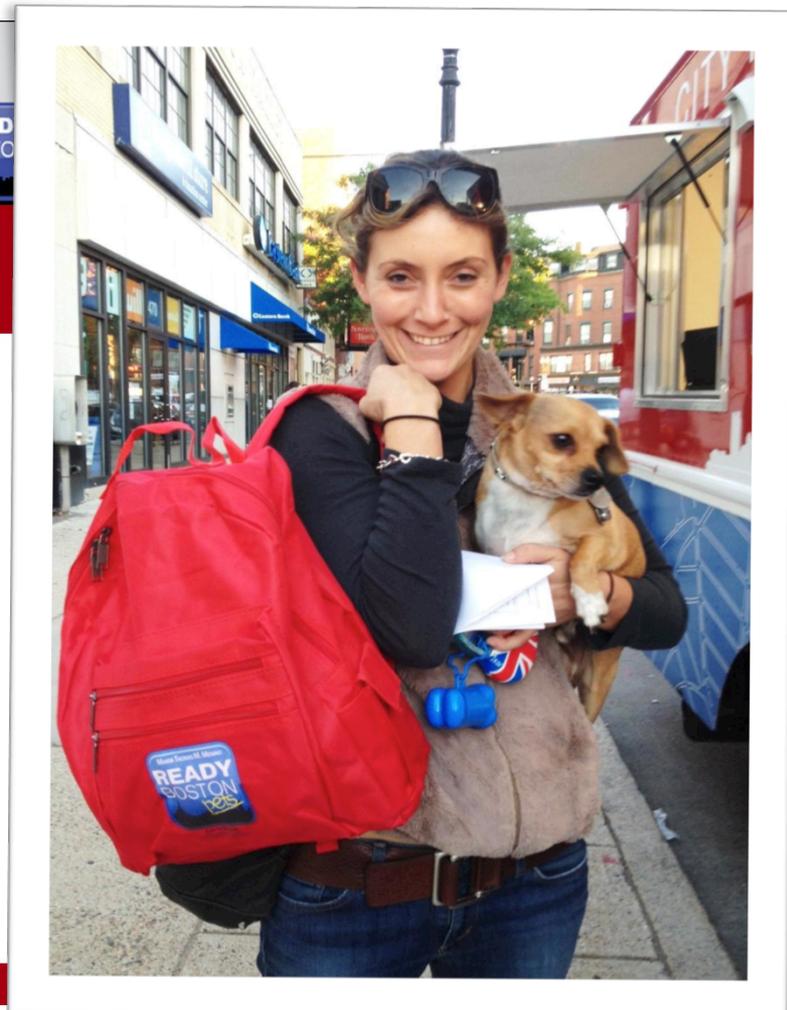
### FRIDAY, SEPTEMBER 27TH: 2PM-3PM

HOSTED BY: @READYBOSTON @NOTIFYBOSTON @HEALTHYBOSTON @GREENOVATEBOS

FOLLOW & TWEET QUESTIONS TO: #READYBOS

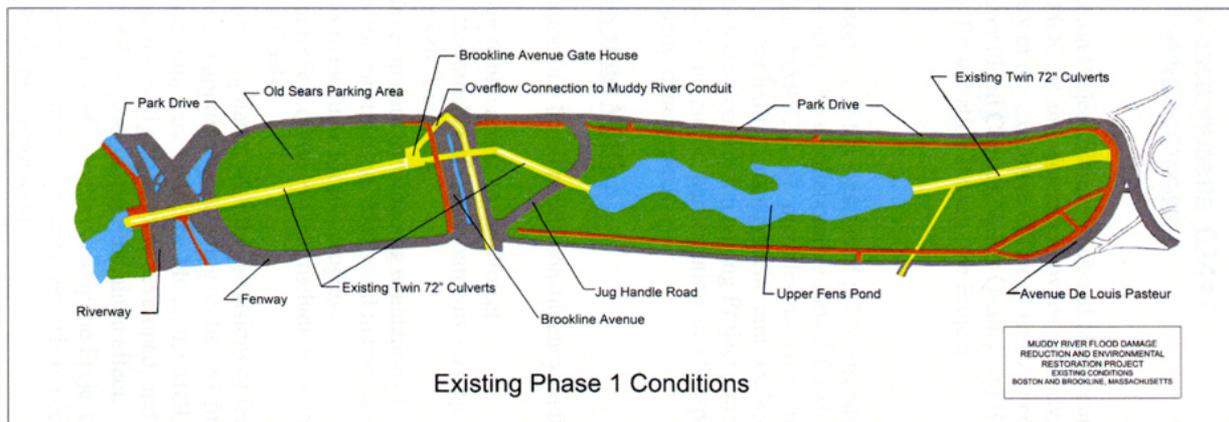
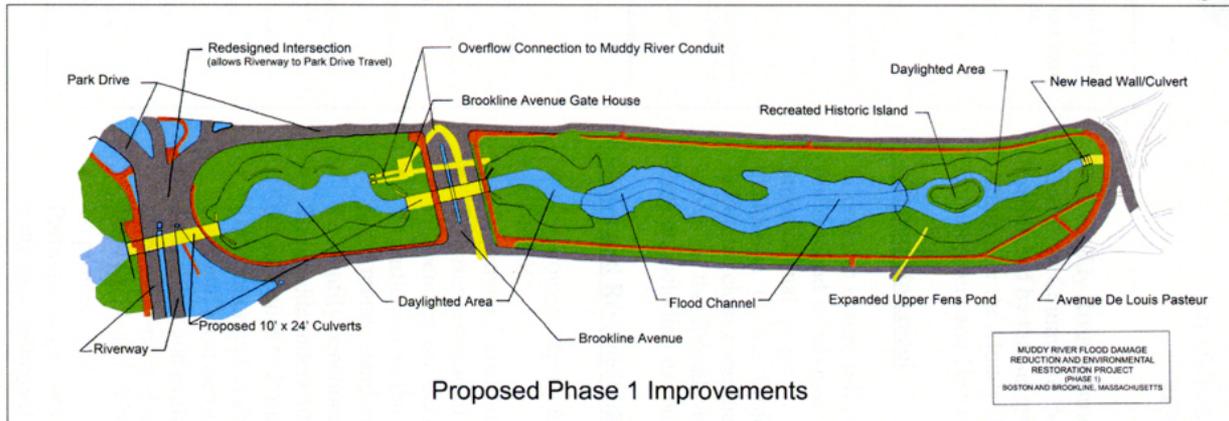




# Finding 5: Close coordination with regional, Commonwealth, and federal partners is necessary to address cross-jurisdictional infrastructure vulnerability

## Muddy River Flood Damage Reduction and Environmental Restoration Project



**Project** The 3.5 mile-long Muddy River is part of Boston's famed Emerald Necklace, part of a 1,100 acre chain of parks and waterways designed by Frederick Law Olmsted. The two-phase restoration project, which began in January 2013, will provide environmental and aesthetic improvements to ensure the Muddy River's continued health and prosperity.

**Project Features**

Flood Protection	New landscaping and crossways
Improved traffic patterns	Preservation and restoration of shoreline

For more information go to: [www.nae.usace.army.mil/Missions/ProjectsTopics/MuddyRiver.aspx](http://www.nae.usace.army.mil/Missions/ProjectsTopics/MuddyRiver.aspx)

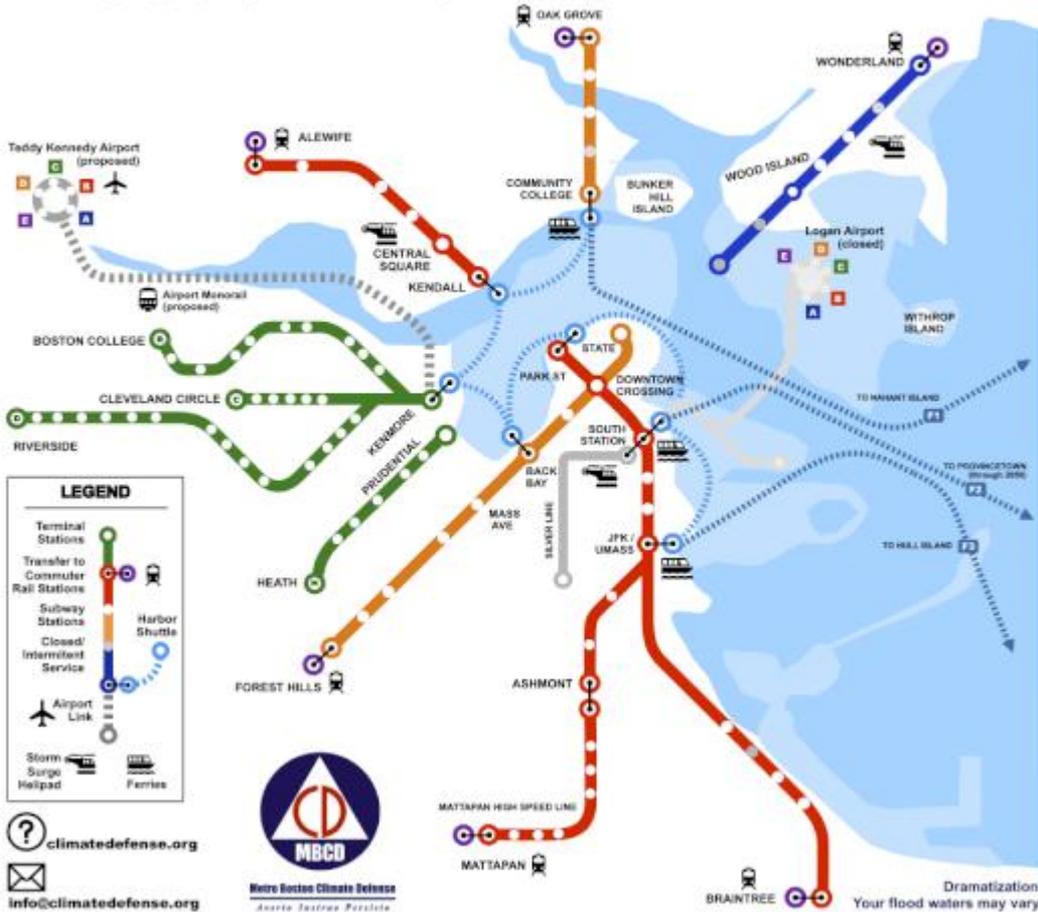


# Challenge/Opportunity State Infrastructure in Boston

## CHANGE OF SERVICE

### METRO BOSTON CLIMATE DEFENSE

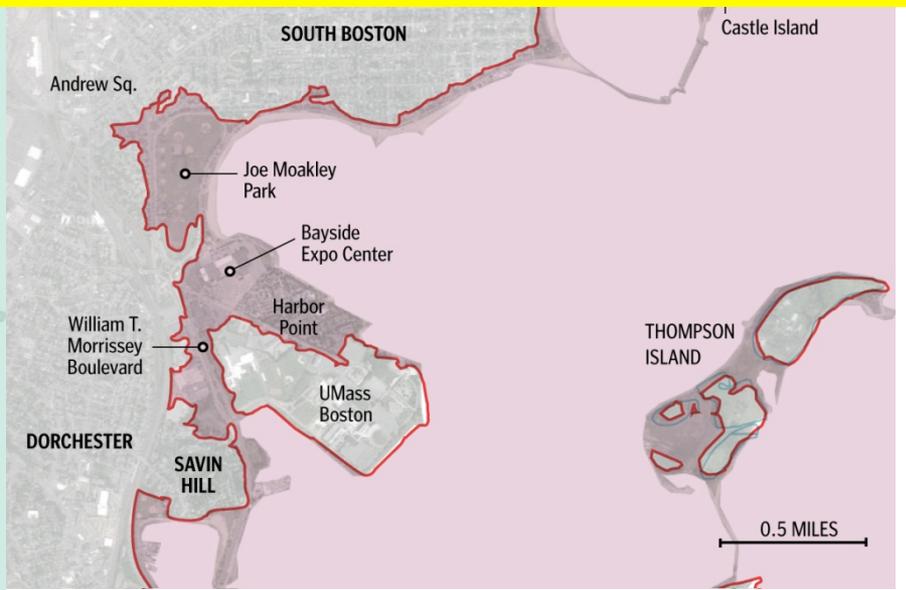
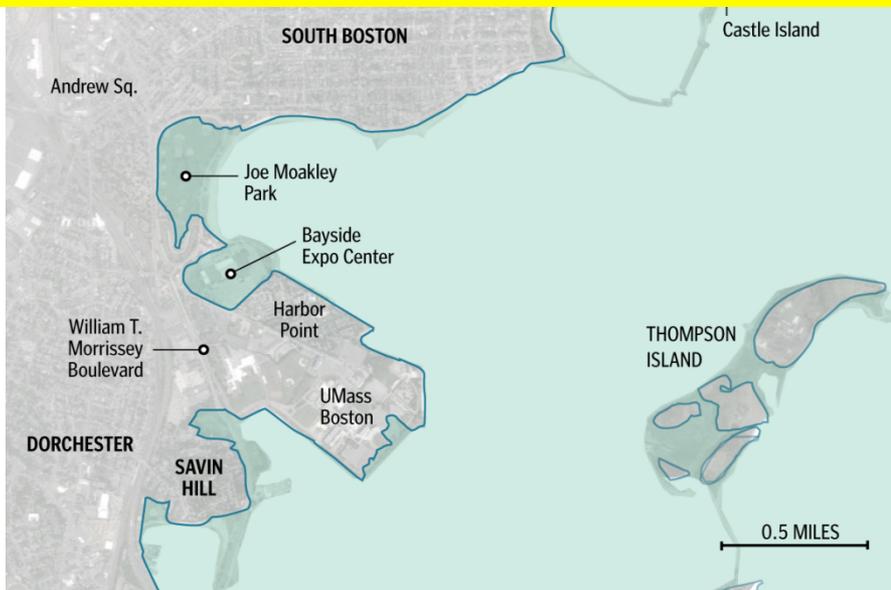
**T** to **B** ?



Dramatization  
Your flood waters may vary



# Climate Change Not Considered



## **2013 FEMA Coastal Study Process**

---

- Issues with transect-based modeling
- Dynamic flood hazard modeling
  - ADCIRC: 2-dimensional hydrodynamic model
  - SWAN: simulates nearshore waves
- Currently being used by MassDOT & others

**NOTES TO USERS**

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage systems or small creeks. The information may require additional investigation for purposes of flood insurance.

To obtain more detailed information, users are advised to consult the Flood Hazard Boundary Study (FHBS) and Flood Hazard Insurance Study (FHIS) maps for the area shown. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

General Note: Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

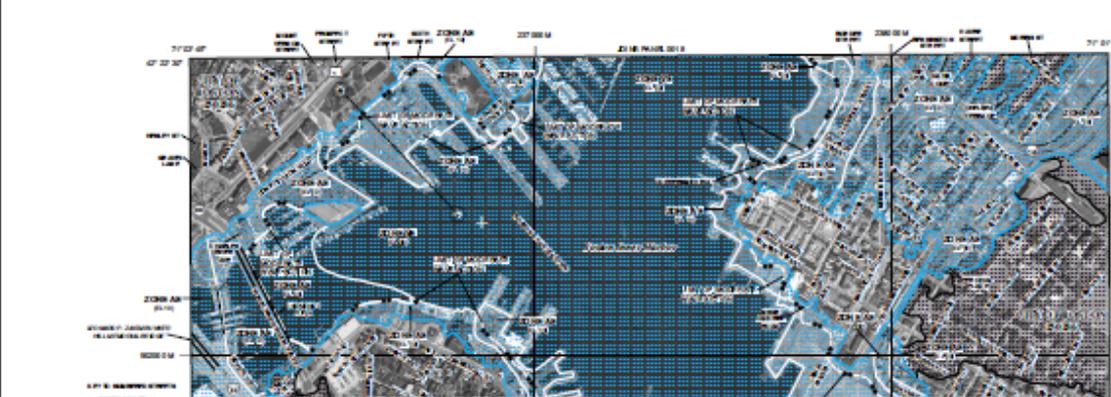
The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.



**LEGEND**

**SPECIAL FLOOD HAZARD AREAS (SPECIAL SUBJECT TO INSURANCE BY THE NATIONAL FLOOD INSURANCE PROGRAM)**

The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-01** Special Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Boundary Study (FHBS) maps show the Flood Hazard Boundary (FHB) and the Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-02** Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-03** Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-04** Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-05** Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-06** Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-07** Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**2009-08** Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps. The Flood Hazard Insurance Study (FHIS) maps show the Flood Hazard Insurance Study (FHIS) maps.

**FLOODING AREAS IN 2009-10**

**OTHER FLOODING AREAS**

**2009-01** Other Flooding Areas (2009-01) maps show the Other Flooding Areas (2009-01) maps. The Other Flooding Areas (2009-01) maps show the Other Flooding Areas (2009-01) maps. The Other Flooding Areas (2009-01) maps show the Other Flooding Areas (2009-01) maps.

**2009-02** Other Flooding Areas (2009-02) maps show the Other Flooding Areas (2009-02) maps. The Other Flooding Areas (2009-02) maps show the Other Flooding Areas (2009-02) maps. The Other Flooding Areas (2009-02) maps show the Other Flooding Areas (2009-02) maps.

**2009-03** Other Flooding Areas (2009-03) maps show the Other Flooding Areas (2009-03) maps. The Other Flooding Areas (2009-03) maps show the Other Flooding Areas (2009-03) maps. The Other Flooding Areas (2009-03) maps show the Other Flooding Areas (2009-03) maps.

**2009-04** Other Flooding Areas (2009-04) maps show the Other Flooding Areas (2009-04) maps. The Other Flooding Areas (2009-04) maps show the Other Flooding Areas (2009-04) maps. The Other Flooding Areas (2009-04) maps show the Other Flooding Areas (2009-04) maps.

**2009-05** Other Flooding Areas (2009-05) maps show the Other Flooding Areas (2009-05) maps. The Other Flooding Areas (2009-05) maps show the Other Flooding Areas (2009-05) maps. The Other Flooding Areas (2009-05) maps show the Other Flooding Areas (2009-05) maps.

**2009-06** Other Flooding Areas (2009-06) maps show the Other Flooding Areas (2009-06) maps. The Other Flooding Areas (2009-06) maps show the Other Flooding Areas (2009-06) maps. The Other Flooding Areas (2009-06) maps show the Other Flooding Areas (2009-06) maps.

**2009-07** Other Flooding Areas (2009-07) maps show the Other Flooding Areas (2009-07) maps. The Other Flooding Areas (2009-07) maps show the Other Flooding Areas (2009-07) maps. The Other Flooding Areas (2009-07) maps show the Other Flooding Areas (2009-07) maps.

**2009-08** Other Flooding Areas (2009-08) maps show the Other Flooding Areas (2009-08) maps. The Other Flooding Areas (2009-08) maps show the Other Flooding Areas (2009-08) maps. The Other Flooding Areas (2009-08) maps show the Other Flooding Areas (2009-08) maps.

**2009-09** Other Flooding Areas (2009-09) maps show the Other Flooding Areas (2009-09) maps. The Other Flooding Areas (2009-09) maps show the Other Flooding Areas (2009-09) maps. The Other Flooding Areas (2009-09) maps show the Other Flooding Areas (2009-09) maps.

**2009-10** Other Flooding Areas (2009-10) maps show the Other Flooding Areas (2009-10) maps. The Other Flooding Areas (2009-10) maps show the Other Flooding Areas (2009-10) maps. The Other Flooding Areas (2009-10) maps show the Other Flooding Areas (2009-10) maps.

	Current FIRM (2009)	Preliminary FIRM	Change
Land Area (acres)	1,634	3,360	+1,726
Buildings	950	3,093	+2,143
Housing Units	8,800	17,804	+9,004
Businesses	248	4,450	+4,202

Only coastal structures that are identified to provide protection from the 1 percent annual chance flood are shown on this map. However, all structures within the inundation area are subject to flooding. For purposes of coastal flood hazard analysis and mapping, are present in the FEMA database in the "On" status.



**NATIONAL FLOOD INSURANCE PROGRAM**

**SUFFOLK COUNTY, MASSACHUSETTS (ALL JURISDICTIONS)**

**PANEL 01 OF 176 (SEE MAPS FOR FIRM PANEL LAYOUT)**

**PRELIMINARY NOVEMBER 15, 2013**

Map Number: 2502C000U  
Map Revised

Federal Emergency Management Agency

# *Current Climate Preparedness Planning & Initiatives*

---

- **2014 Climate Action Plan Update**
- **Neighborhood Planning**
- **City/University Climate Partnership**
- **National Preparedness Month**
- **Regional Climate Preparedness Summit**

# Green & Resilient Buildings

**Article 37 - Green Building Zoning**  
based on LEED, 2007 - Private  
Construction 1<sup>st</sup> in nation

Stretch Energy Code, 2010  
**20% BETTER energy performance**

**Energy Positive** Housing

Climate Change **Preparedness and  
Resilience** Checklist

Building Energy **Reporting and  
Disclosure** Ordinance

**Mayor's Carbon Cup**



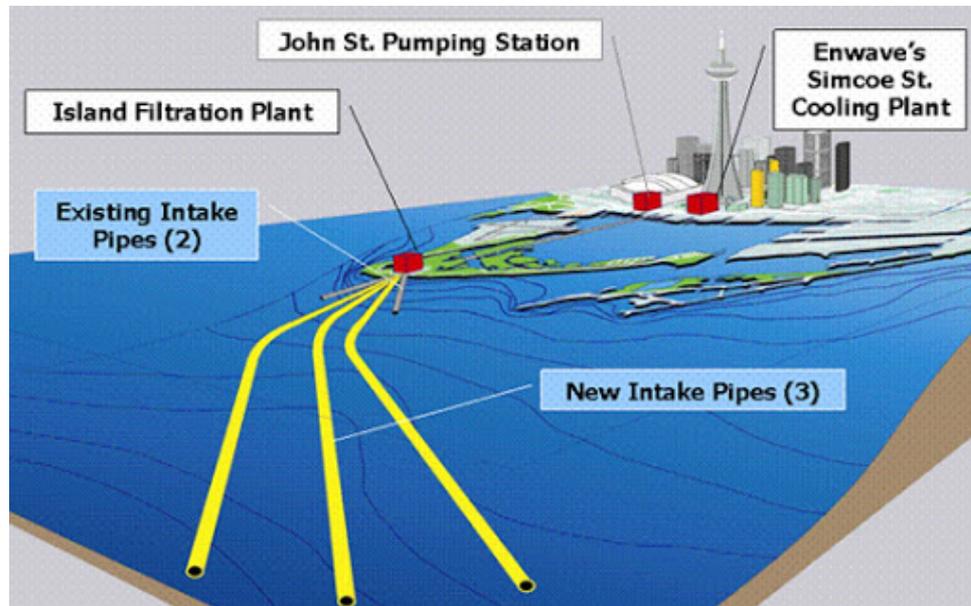
# District Energy in Boston

## Today

- City-wide District Energy Planning
- Longwood Medical Area
- Green steam

## Tomorrow

- Deep water cooling
- Anaerobic Digestion
- Local CHP
- Sewerage heat loss recovery
- Trigeneration distribution infrastructure



Toronto's Deep Water Cooling System





We have options.



# Thank You

**Brian R. Swett**

*Chief of Environment, Energy and Open Space*  
[EnvironmentalEnergy@cityofboston.gov](mailto:EnvironmentalEnergy@cityofboston.gov)



Like us on Facebook –  
[Greenovate Boston](#)



Follow us on Twitter -  
[@GreenovateBos](#)