



# RESILIENT CAMBRIDGE

Preparing for Climate Change

December 1, 2021



# Climate Change: Shifting Risks

## Extreme Heat



Days over 90°F to triple by 2030. By 2070, there could be more than 2 months in a year over 90°F.

## Extreme Rain



Flooding from rain more frequent and more severe

## Sea Level Rise/ Storm Surge

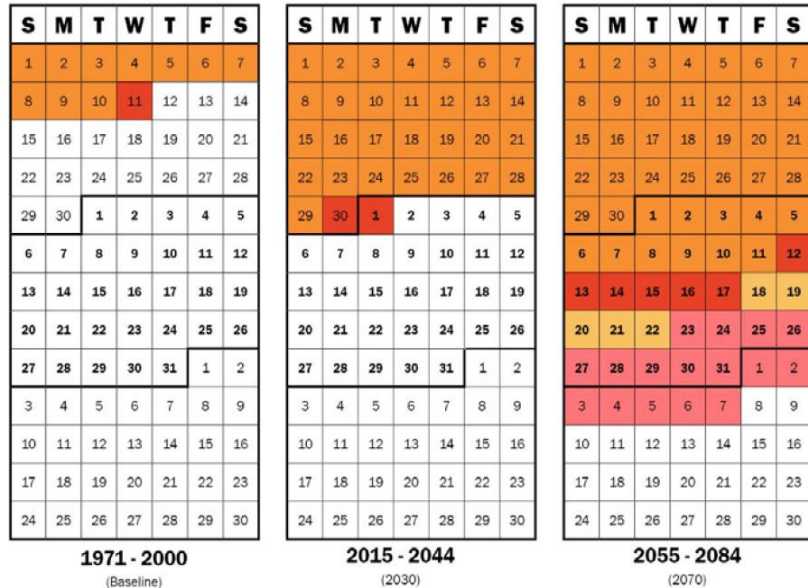


Sea level rise and larger storm surge in Boston Harbor will overtop and flank the Mystic and Charles River dams



# Increasing Heat

## Warm Averages, Higher Temps, More Heat Waves



■ Above 90°F - Low Scenario  
 ■ Above 90°F - High Scenario  
 ■ Above 100°F - Low Scenario  
 ■ High 100°F - High Scenario

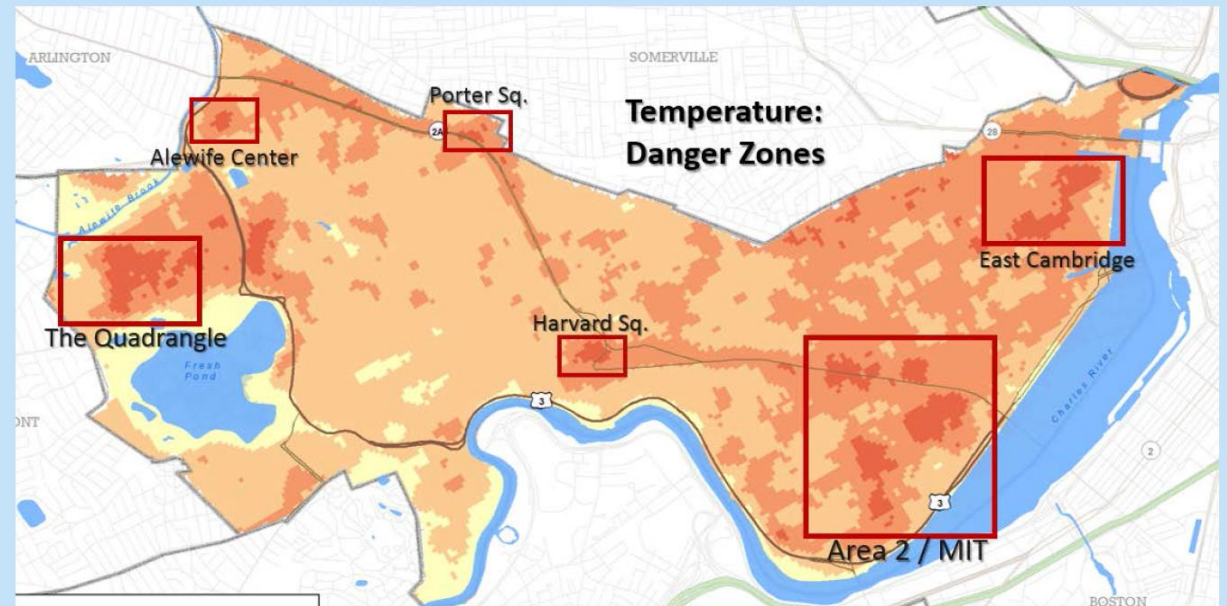
\*Summer is considered to be the 91 days of June through August

**By 2030, the number of days above 90° F could triple**

- Stress on human health
- Stress on infrastructure

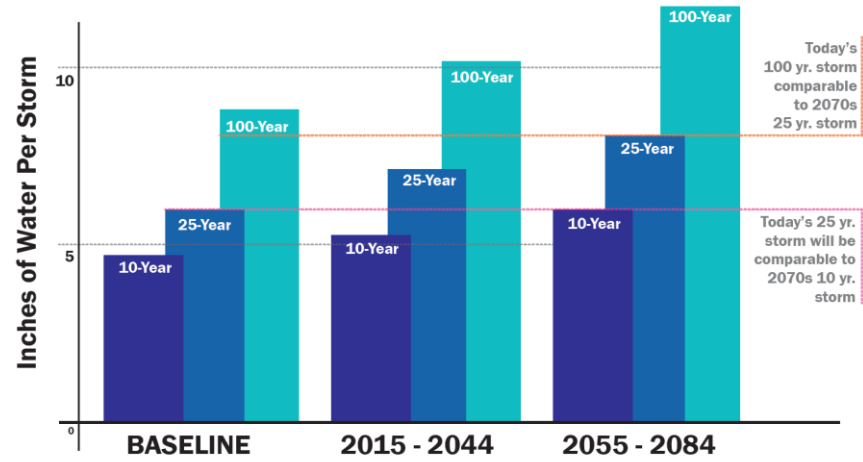
### Urban Heat Island Effect Magnifies Ambient Temperature

- Darker impervious surfaces – pavement & roofs -- absorb heat
- Areas with large amounts of impervious surface and lacking tree canopy tend to be heat islands

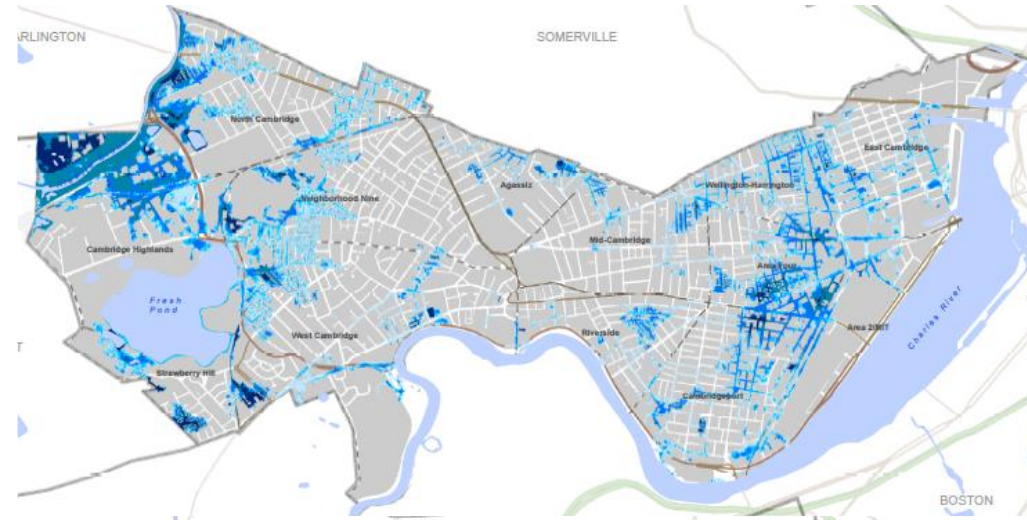


# Increasing Precipitation

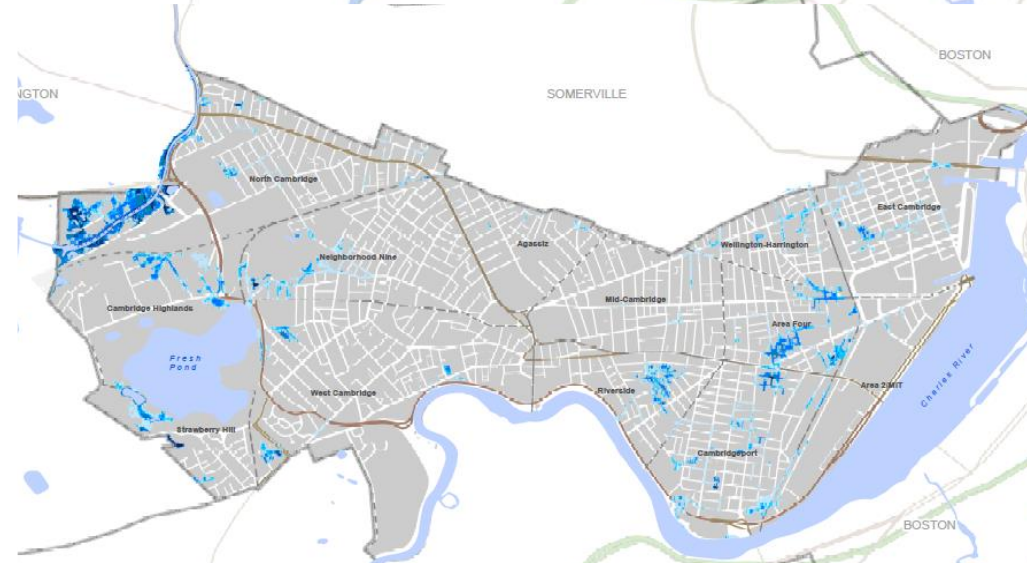
## Extreme rates, Increasing frequency



(per 24 hr. event)



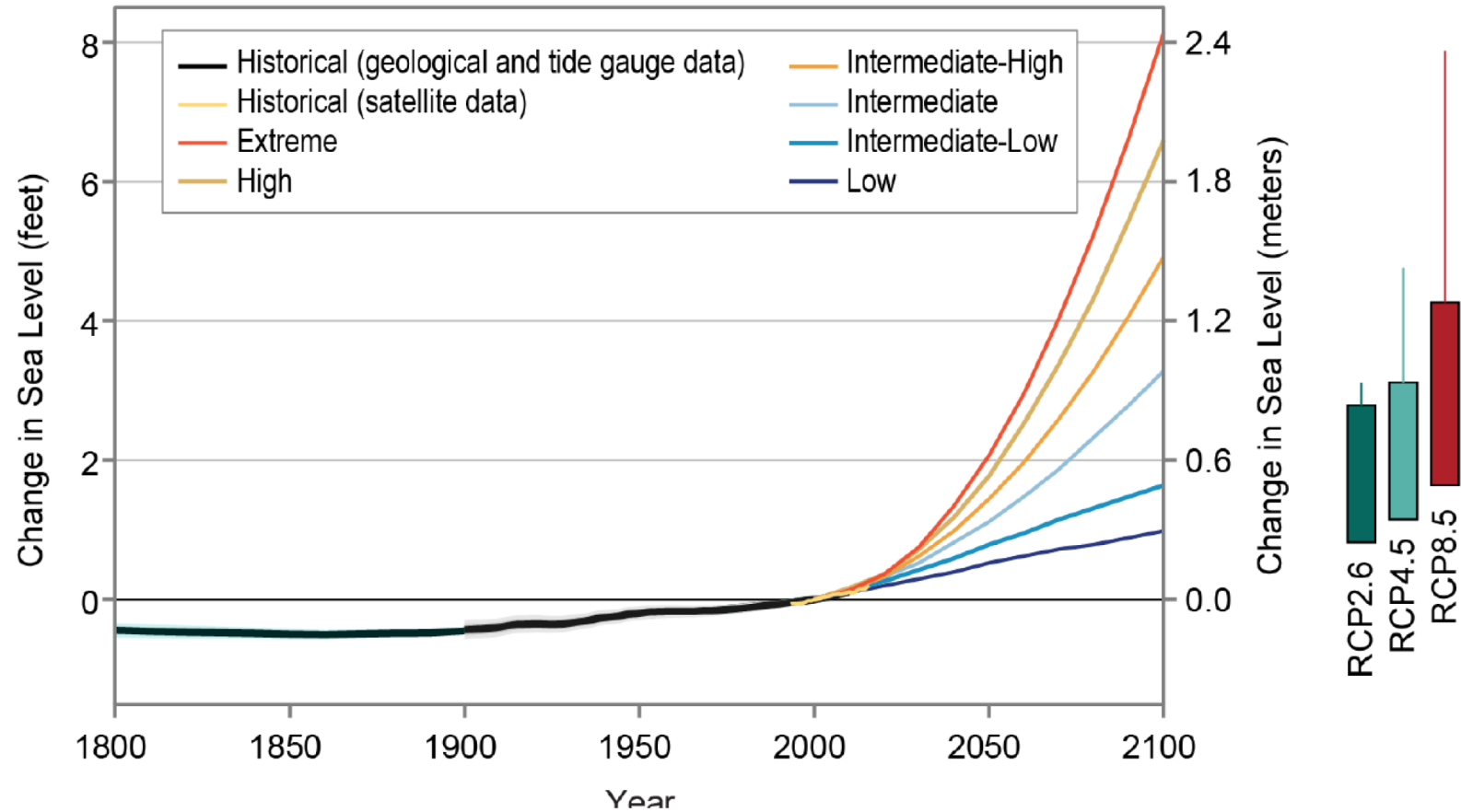
(per 24 hr. event)



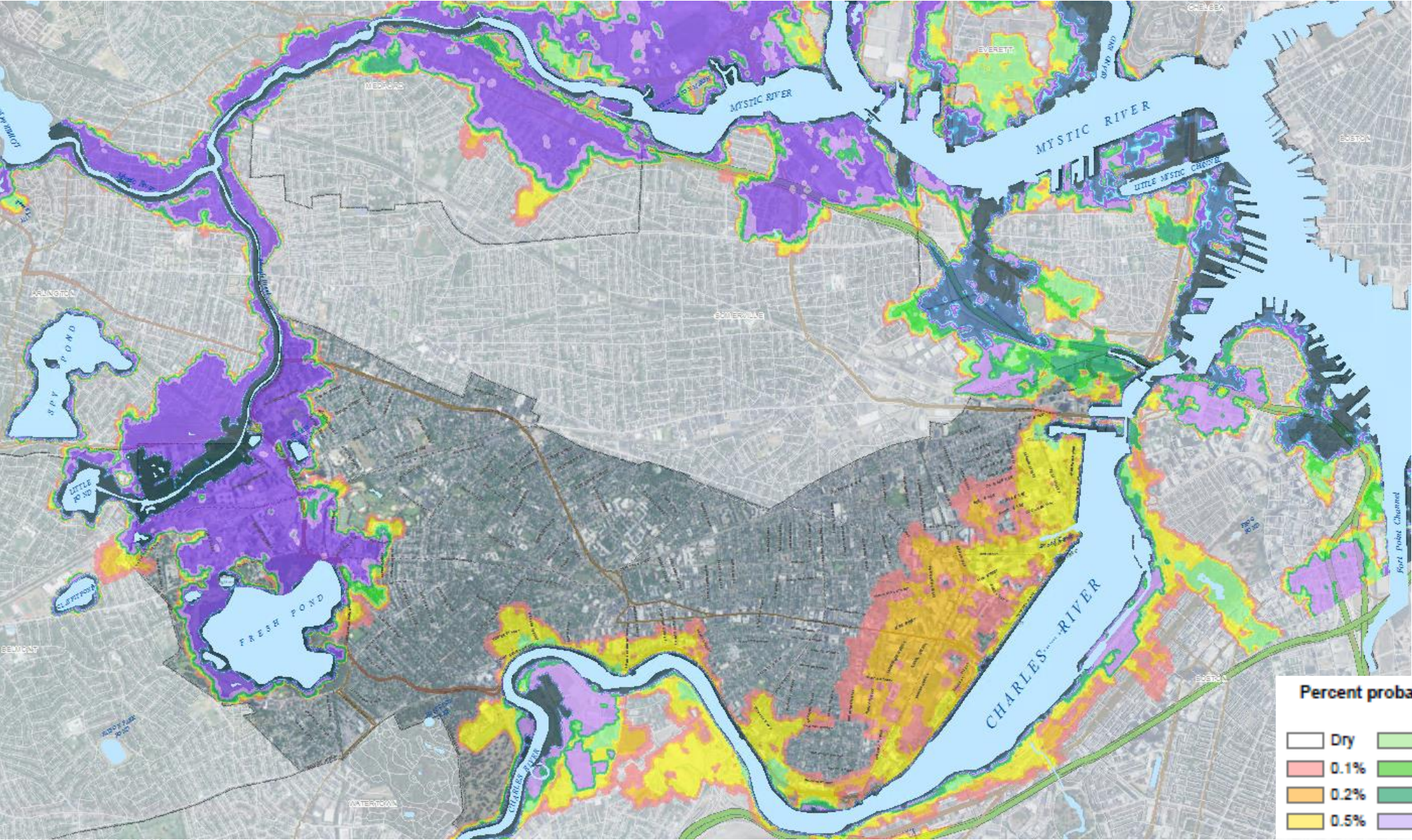
# Rising Sea Levels

## Higher Tides and Storm Surges

### Historical and Projected Global Average Sea Level Rise



# Rising Sea Level: Emergence of storm surge flooding risk by 2070

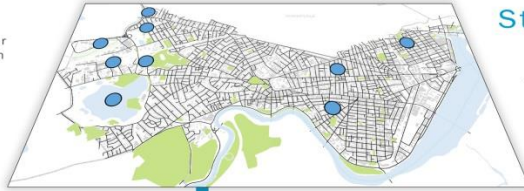


Based on Boston Harbor Flood Risk Model (BHFRM)  
MassDOT & Woods Hole Group  
• ADCIRC & SWAN

# Climate Stress Test: What Happens If No Action Taken

## Water

Fresh Pond Reservoir  
New St Pump Station

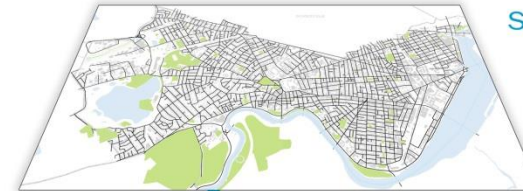


## Storm Water

Separated Stormwater  
CAM 400 (Alewife)  
CAM 004 (Alewife)  
Western Flagg (Charles)  
Lechmere (Charles)  
D46 (Alewife)

Combined Sewer  
CAM 017 (Charles)  
Cam 001

## Water



## Storm Water

## Roadway

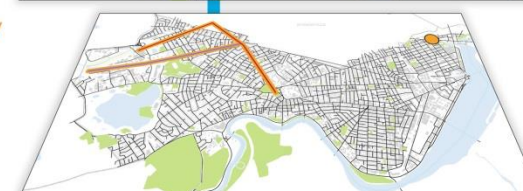
Concord Tpke, Broadway  
Memorial Drive, Land Blvd  
BU Rotery / Reid Overpass  
Cambridge St Underpass  
Monsignor O'Brien Hwy  
Alewife Brook Pkwy  
Massachusetts Ave  
Lars Anderson Bridge  
Longfellow Bridge  
Eliot Bridge  
Fresh Pond Pkwy



## Transit

Alewife-Davis-Porter Rail Line  
Fitchburg Commuter Rail  
Central-Kendall Rail Line  
Central Square Bus Hub  
MBTA #66 Bus Route  
Lechmere T & Rail Line  
Central Square T Station  
Kendall T Station  
Alewife T Station  
Porter Square Station

## Roadway

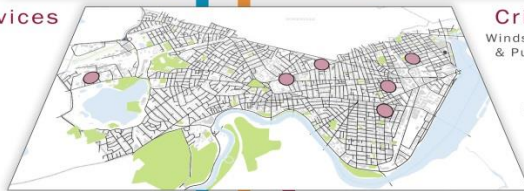


## Transit

Porter-Harvard Rail Line  
Lechmere-Science  
Park Rail Line  
Alewife-Davis-Porter  
Rail Line  
Fitchburg Commuter  
Rail Line

## Critical Services

Youville Hospital  
Fire Company 2  
Fire Department  
Headquarters



## Critical Services

Windsor Street Health Center  
& Public Health Department  
Police Headquarters  
Professional Ambulance  
Services Office

## Critical Services

Cambridge Water  
Department building  
(the City's Emergency  
Operations Center)

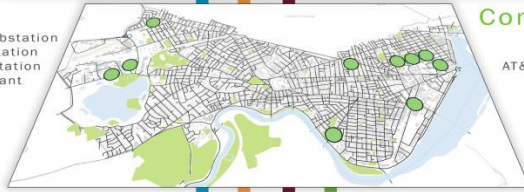


## Critical Services

Public Health Department  
building on Windsor Street  
Police Headquarters  
Professional Ambulance  
Services office  
Fire Department  
headquarters

## Energy

North Cambridge Substation  
Brookford St Take Station  
Third St. Regulator Station  
MIT Cogeneration Plant  
Putnam Substation  
Prospect Substation

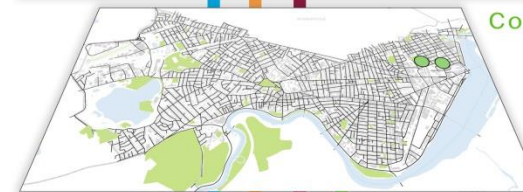


## Communication

City Emergency Com  
Center (Police HQ)  
AT&T Data Hub/300 Bent St  
BBN Data Hub/CO-LOC:  
10-12 Moulton St  
AT&T Office/Long Line  
Switch: 250 Bent St

## Energy

Third Street  
Regulator Station

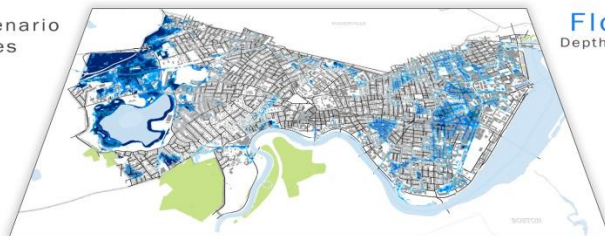


## Communication

City Emergency  
Communications  
Center (Police HQ)



2070s Scenario  
11.7 inches  
rainfall in  
24 hours



## Flood Risk

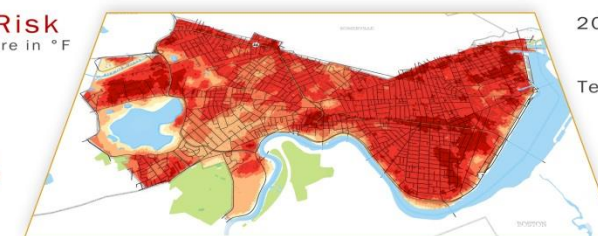
Depth of flooding (ft)

|           |               |
|-----------|---------------|
| 0 - 0.5   | Lightest Blue |
| 0.5 - 1.0 | Light Blue    |
| 1.0 - 2.0 | Medium Blue   |
| 2.0 - 3.0 | Dark Blue     |
| > 3.0     | Darkest Blue  |

## Heat Risk

Temperature in °F

|           |                 |
|-----------|-----------------|
| < 80      | Lightest Yellow |
| 80 - 85   | Light Yellow    |
| 85 - 90   | Yellow          |
| 90 - 95   | Light Orange    |
| 95 - 100  | Orange          |
| 100 - 110 | Dark Orange     |
| > 110     | Red             |



2070s Scenario  
Estimated  
Ambient  
Temperature on  
100 °F Day



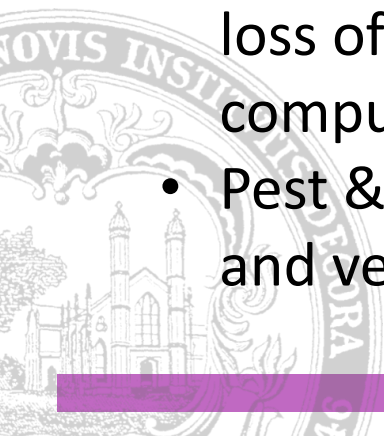
# Impacts of Concern

## *Direct*

- Flood damage to building structures and systems
- Flood damage to vehicles
- Flood damage to documents, paper & digital
- Health impacts, e.g. heat stroke, respiratory effects from mold, vector-borne disease
- Power outage to buildings, e.g., loss of refrigeration, AC, computers
- Pest & disease effects on trees and vegetation

## *Indirect*

- Loss of business continuity, i.e. office or retail closures, lost wages, lost revenue
- Transportation disruption, i.e. MBTA shutdown
- Supply chain disruptions
- Employee personal impacts, e.g. property damage, access to childcare or school, health effects
- Internet & communications outage





# Approach to climate change preparedness & resilience

## Reduce Risk



## Prepare for Unavoidable Risks

- Reduce urban heat islands
- Increase flood storage & conveyance
- Install storm surge barriers
- Elevate structures

- Be transparent and open about risks, share data
- Plan for extremes and new normals
- Coordinate planning initiatives
- Engage stakeholders & community
- Develop strategies for people, buildings, infrastructure, and ecosystem
- Implement at different scales
- Coordinate and engage regionally

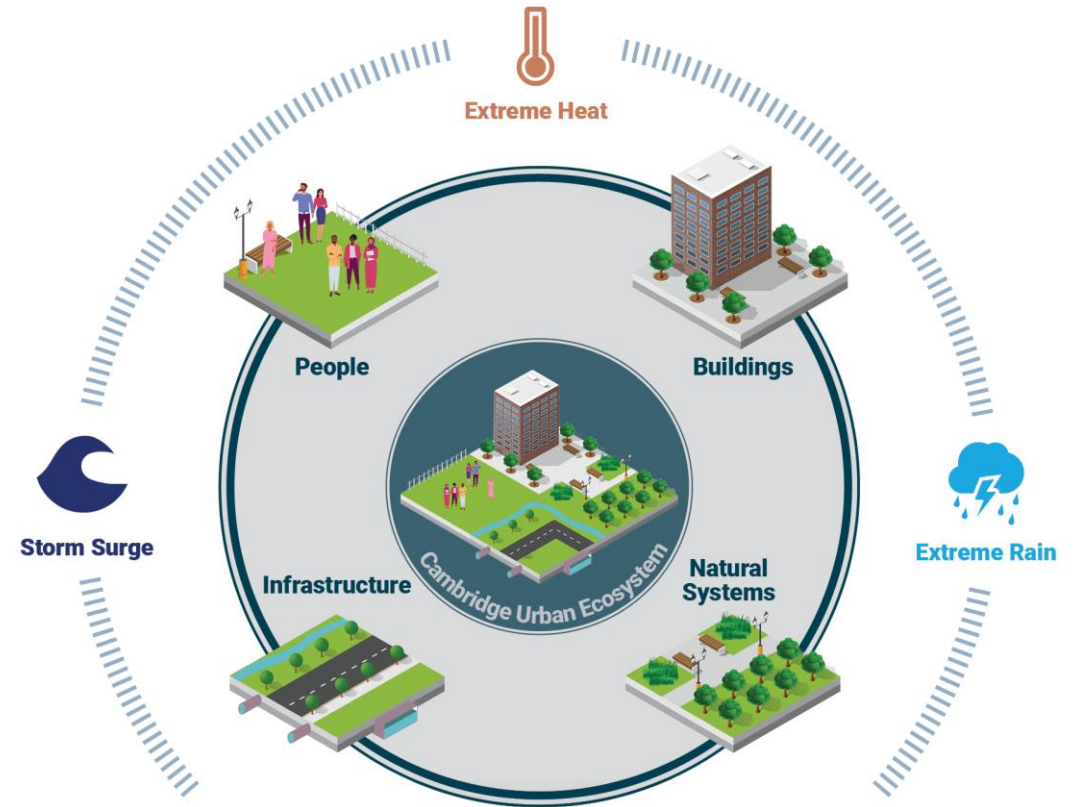


# Resilient Cambridge Strategies

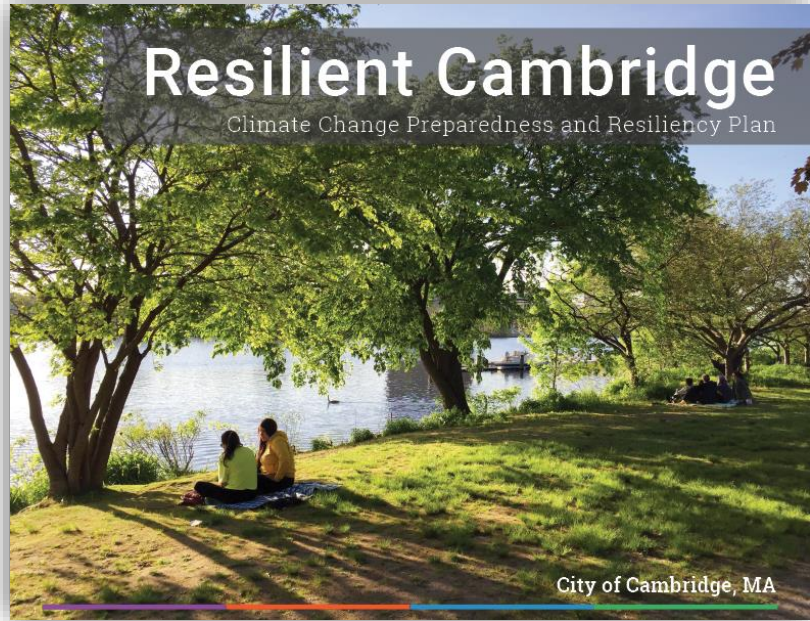
34 strategies organized around four categories

- Closer Neighborhoods
- Better Buildings
- Stronger Infrastructure
- Greener City

Discusses regional considerations



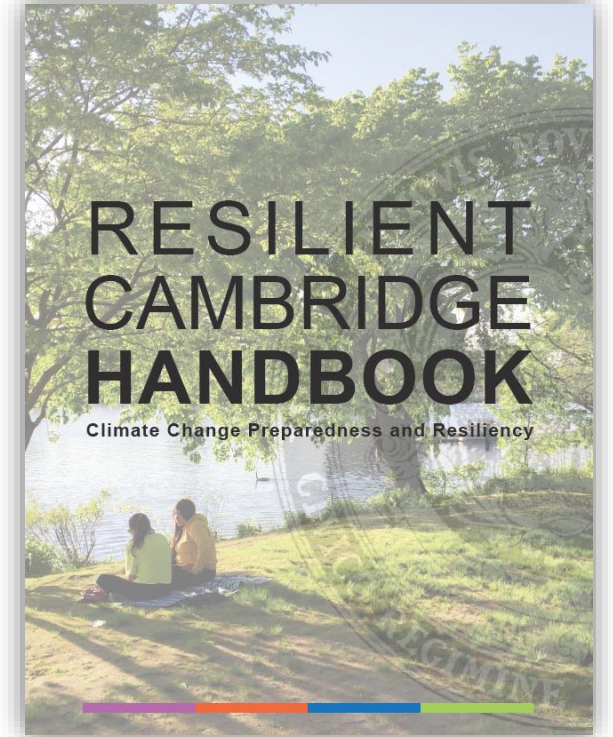
# What we produced: Resilient Cambridge



Plan



Technical reports



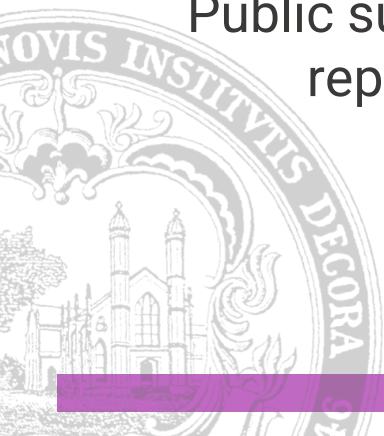
Handbook



# What we produced: Additional materials



Public summary report



## Story Maps



Flood Risk



Heat Risk

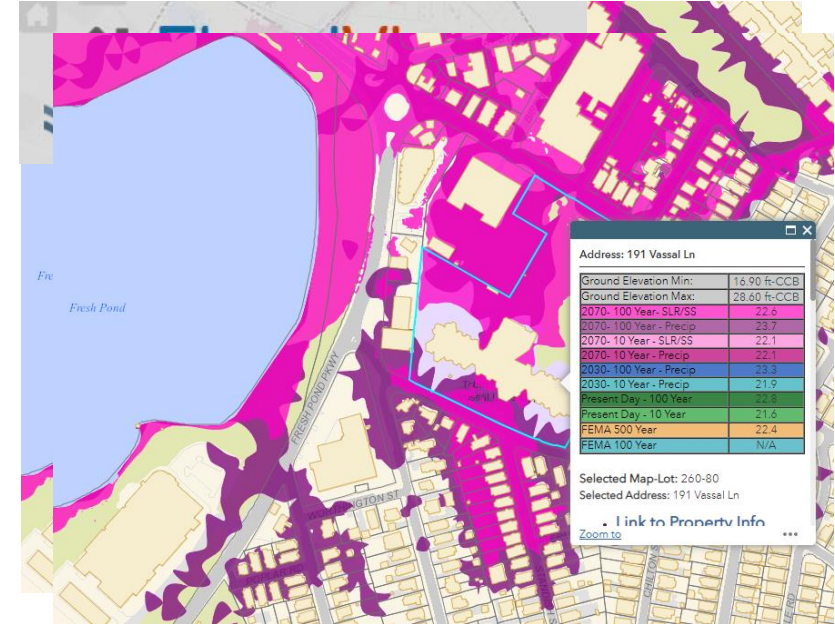


Flood Strategies



Heat Strategies

Click to add



FloodViewer:  
potential flooding  
by parcel

# Related Processes

## Envision Cambridge – Community Development Department

- Climate Resilience Zoning Task Force
  - Proposing codification of 2070 flood risk standards and Cool Factor
- Cambridge Street Planning Study

## Urban Forest Master Plan – Public Works Department

- Expanded urban forest staff and budget
- Update to Tree Protection Ordinance
- Increased tree plantings
- Witness Tree project with Harvard Forest
- Miyawaki micro-forests
- Ongoing urban forest assessments

## Community Health Improvement Plan – Public Health Department

- Community social resilience priority
- Community Resilience Manager



# Social Resilience

## Social infrastructure

- the assets that shape our social interactions
- Sociologist Eric Klinenberg loosely defines *social infrastructure* “as the physical elements of community that act as a conduit to bring people together and build social capital.”

- Parks
- Plazas
- Libraries
- Streetscape  
s
- Retail
- Community  
centers



## Social Capital/Connectedness



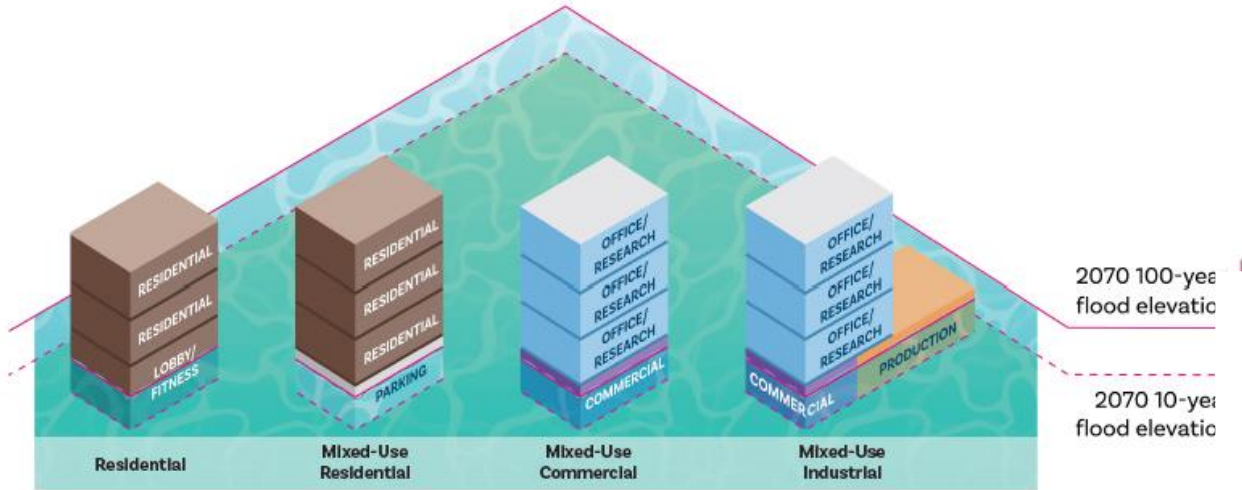
Cambridge Community Corps



Cambridge Community Center

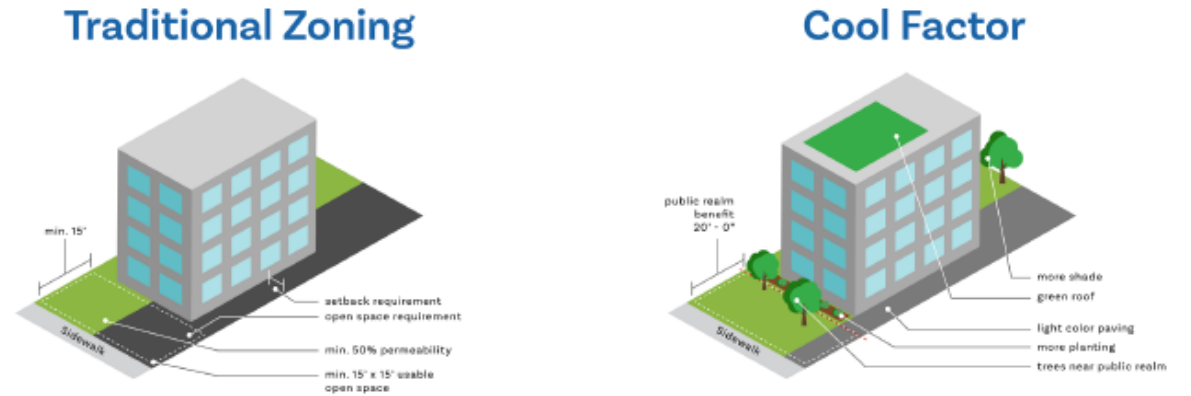
# Climate Resilience Zoning

| Residential                                                                                                                                                                                                  |                                                                                                                                                                                             | Non-Residential                                                                                                                                                                                    |                                                                                                                                                                                                                                    | Envision Prototypes |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Residential                                                                                                                                                                                                  | Mixed-Use Residential                                                                                                                                                                       | Mixed-Use Commercial                                                                                                                                                                               | Mixed-Use Industrial                                                                                                                                                                                                               |                     |
| <ul style="list-style-type: none"> <li>Housing must be elevated or floodproofed</li> <li>Garage levels can be floodproofed or floodable</li> <li>Elevate or protect utilities and major equipment</li> </ul> | <ul style="list-style-type: none"> <li>Housing must be elevated</li> <li>Commercial or retail uses can be floodproofed</li> <li>Elevate or protect utilities and major equipment</li> </ul> | <ul style="list-style-type: none"> <li>Office uses can be floodproofed</li> <li>Commercial or retail uses can be floodproofed</li> <li>Elevate or protect utilities and major equipment</li> </ul> | <ul style="list-style-type: none"> <li>Office uses can be floodproofed</li> <li>Commercial, industrial, or retail uses can be floodproofed</li> <li>Elevate or protect utilities, major equipment, and chemical storage</li> </ul> |                     |



Codify Future Flood Elevations

## Cool Factor Site Rating System



✓ Open Space   
 ✓ Permeability   
 +   
 ✓ Shade   
 ✓ Cool Surfaces   
 ✓ Planting



# New Construction



- Designed to 2070 flood elevations
- All residential units second floor and higher
- Community room on top floor
- Passive House standards for energy efficiency and passive thermal resilience

HRI/Finch Cambridge Affordable Housing Project, Concord Avenue



# Stronger Infrastructure/Gray Infrastructure



The Port Infrastructure Project



Springfield Street High Solar Reflectance Coating

# Greener City/Green Infrastructure



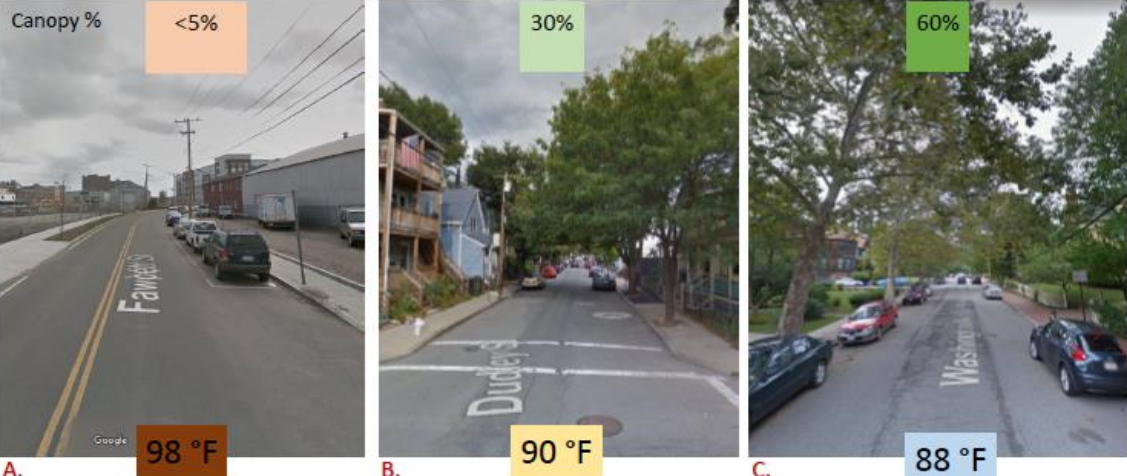
Urban Forest Master Plan



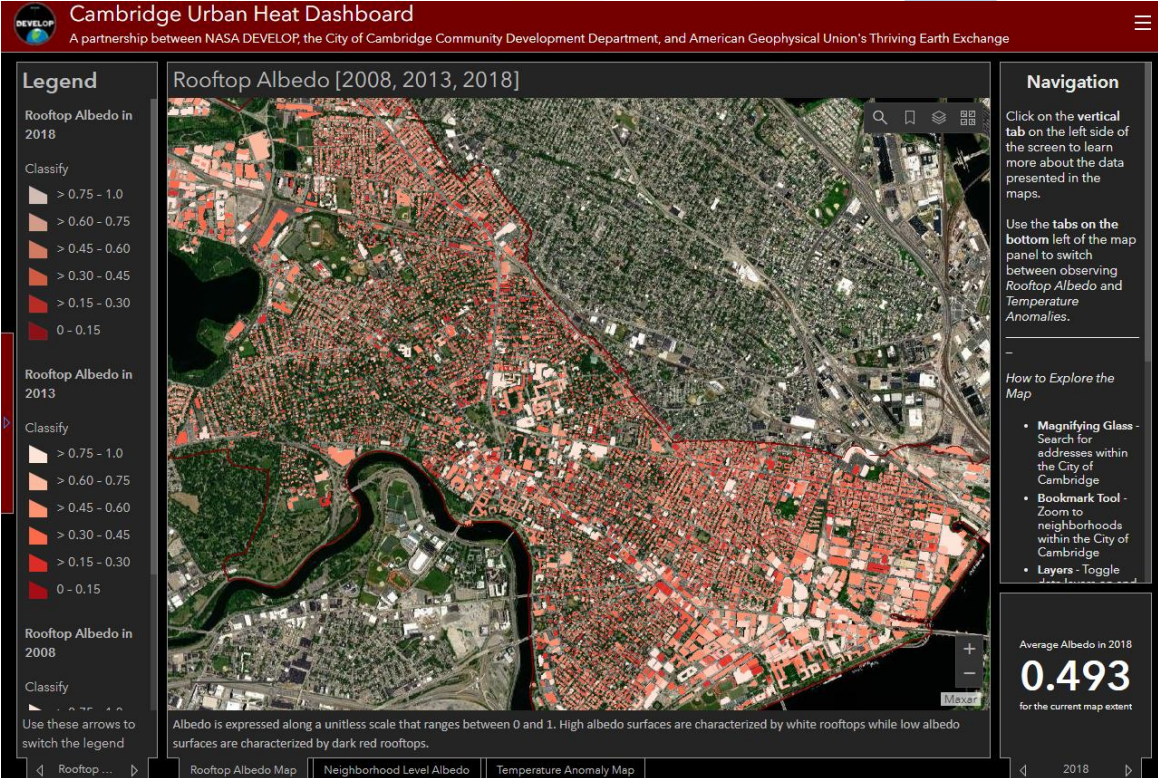
Triangle Park

- Binney Street, First Boulevard, Land Boulevard
- 1 acre
- Naturalized forest habitat
- 400 new trees, 15 species
- In construction

# Shade & Solar Reflectance



- On a 90 degree day, tree canopy cools streets up to 10 degrees F or more
- Based on urban heat island mapping



- Rooftop albedo mapped for 2008, 2013, 2018
- 30% increase in albedo, 2008-2018
- LEED green building requirement & availability of high SRI roofing products
- Dr. Mehdi Heris, American Geophysical Union/Thriving Earth Exchange, & NASA Develop

# A vision for a healthy forest

## Shaded Storefronts

People chat on the streets and shop longer at their local businesses.

## Cool Corridors

People walk, bike and run to work because the streets are shaded and comfortable.

## Energy Efficiency

Trees help reduce energy costs related to heating and cooling throughout the year.

## Collective Action

Private property owners plant and care for trees, collectively contribute to a resilient urban forest.

## Engaged Homeowners

Homeowners take advantage of the Back-of-Sidewalk program, planting front-yard trees that provide shade on sidewalks too narrow for street trees.

## Habitat Connectivity

Birds, insects and small mammals find homes and food in the robust urban forest.

## Reduced Heat

38% of the city is significantly cooled from additional tree planting.

CAMBRIDGE COMMON

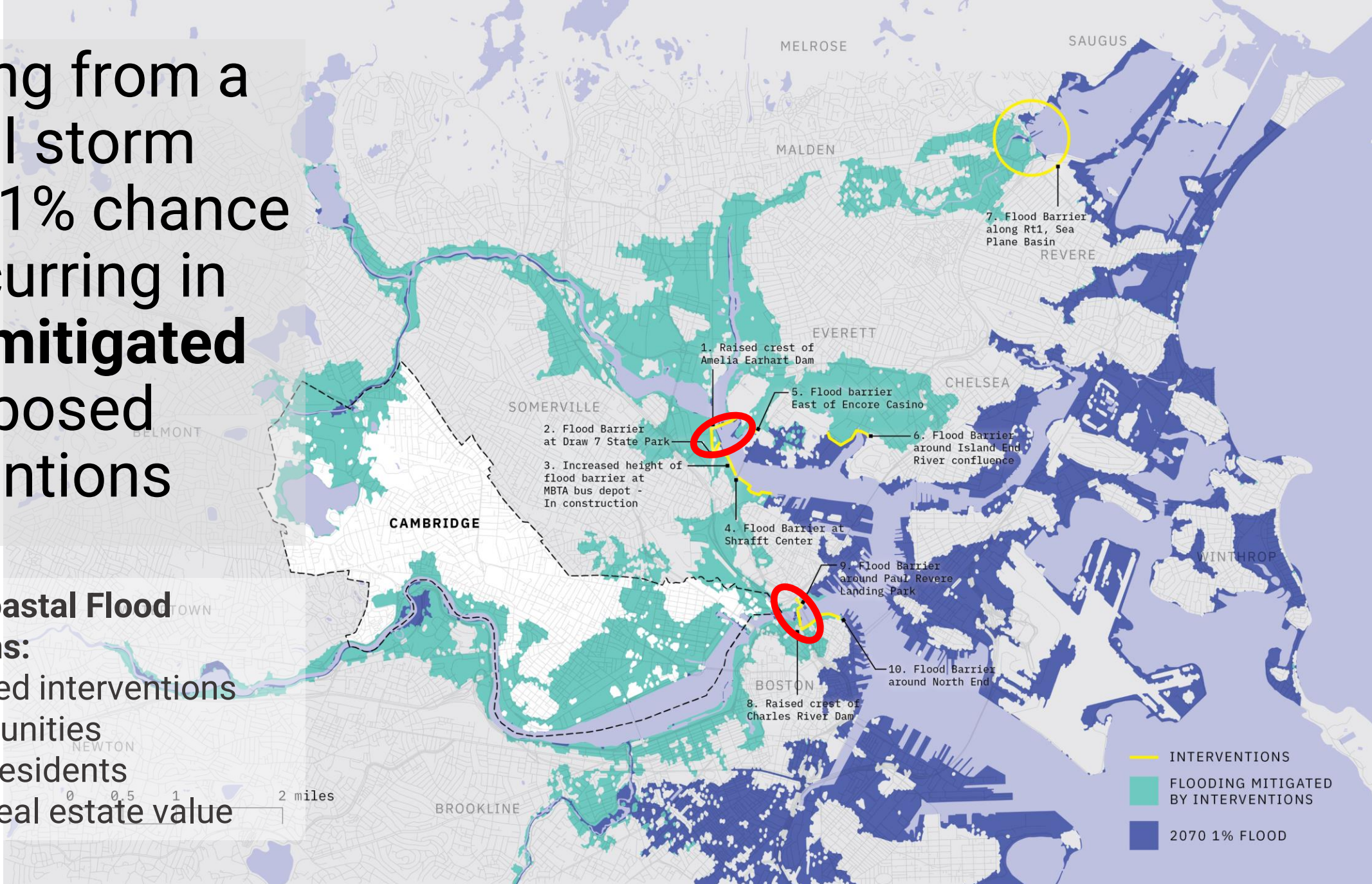
PORTER SQUARE

CHARLES RIVER

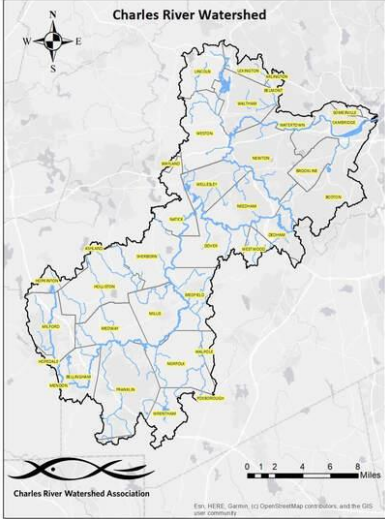
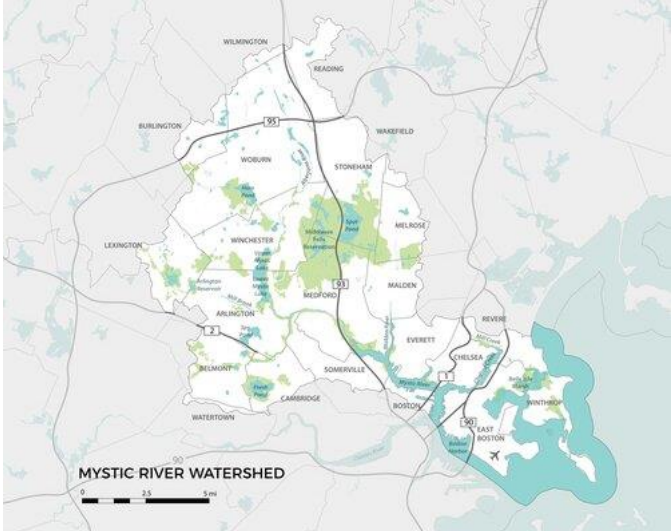
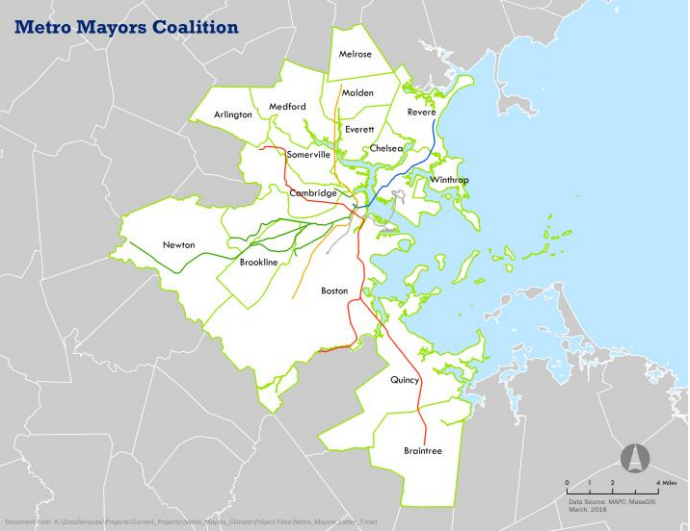
# Flooding from a coastal storm with a 1% chance of occurring in 2070, mitigated by proposed interventions

## Regional Coastal Flood Interventions:

- 10 targeted interventions
- 12 communities
- 108,000 residents
- \$60B of real estate value



# Regional Climate Collaborations



## Metro Mayors Climate Task Force

- 15 inner core communities
- Coordinated by MAPC
- Building Resilience to Climate-driven Heat in Metro Boston

## Resilient Mystic Collaborative

- 21 watershed communities
- Coordinated by MyRWA
- Upper Mystic Stormwater Project
- Social resilience work group
- Lower Mystic Storm proofing critical infrastructure
- Regional storm surge protection

## Charles River Climate Compact

- 23 communities
- Coordinated by CRWA
- Current focus is on upper watershed stormwater management



# Thank you!

To learn more, visit:

[www.cambridgema.gov/ResilientCambridge](http://www.cambridgema.gov/ResilientCambridge)

or contact John Bolduc, [jbolduc@cambridgema.gov](mailto:jbolduc@cambridgema.gov)

