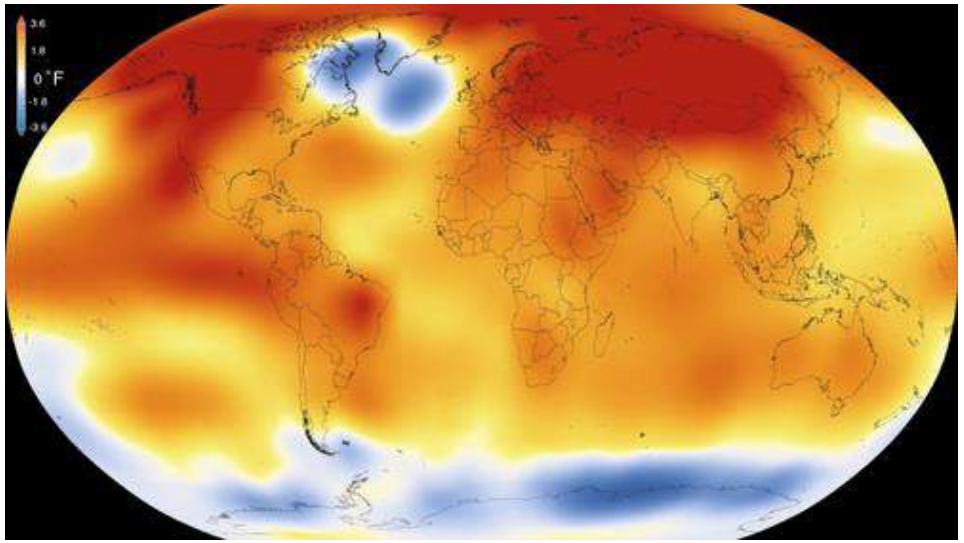
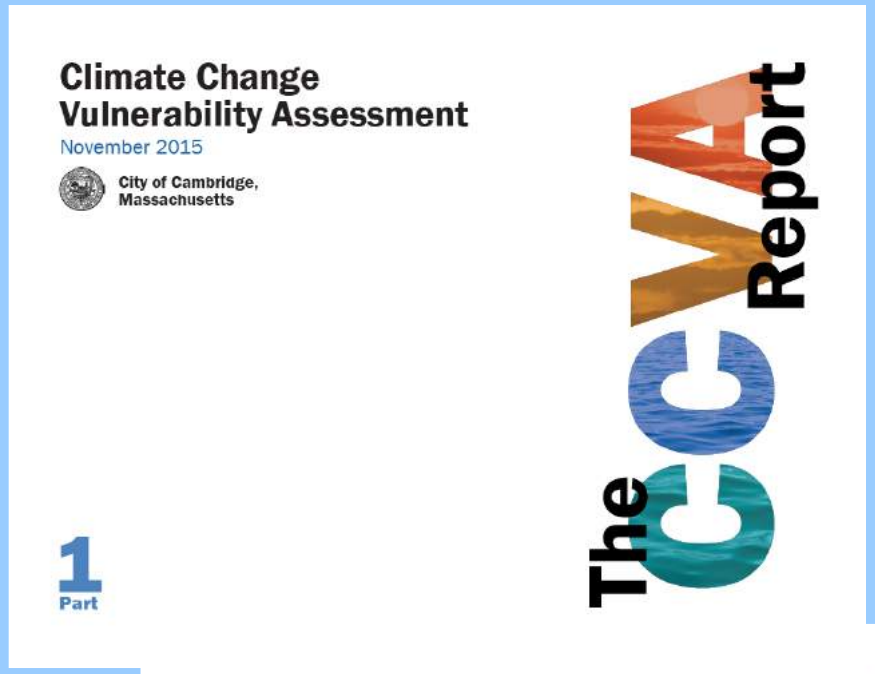
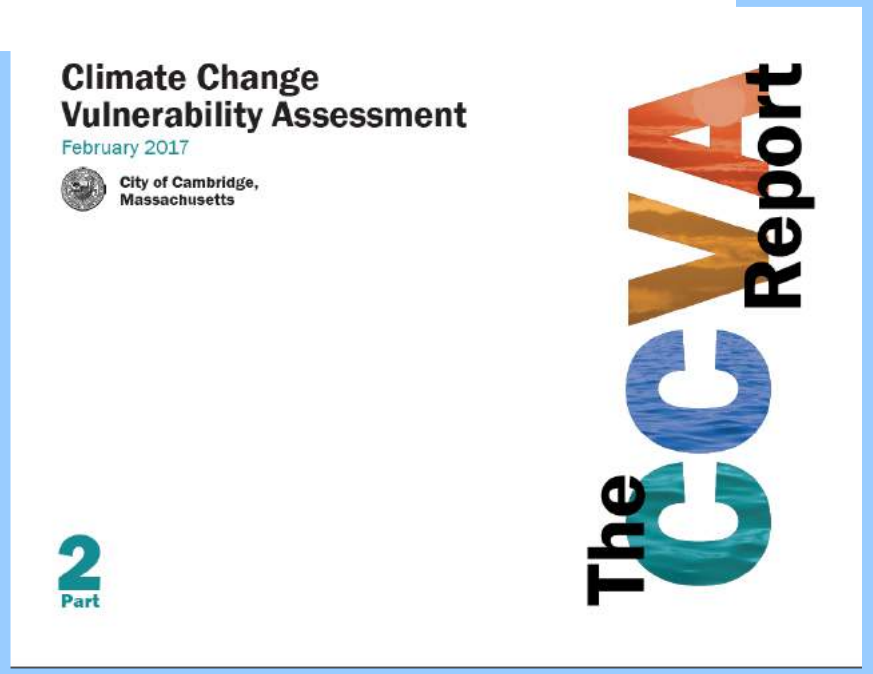
Seeing Together:
Using Climate Change Science to Align Local Action in Cambridge, MA, USA

June 20, 2018

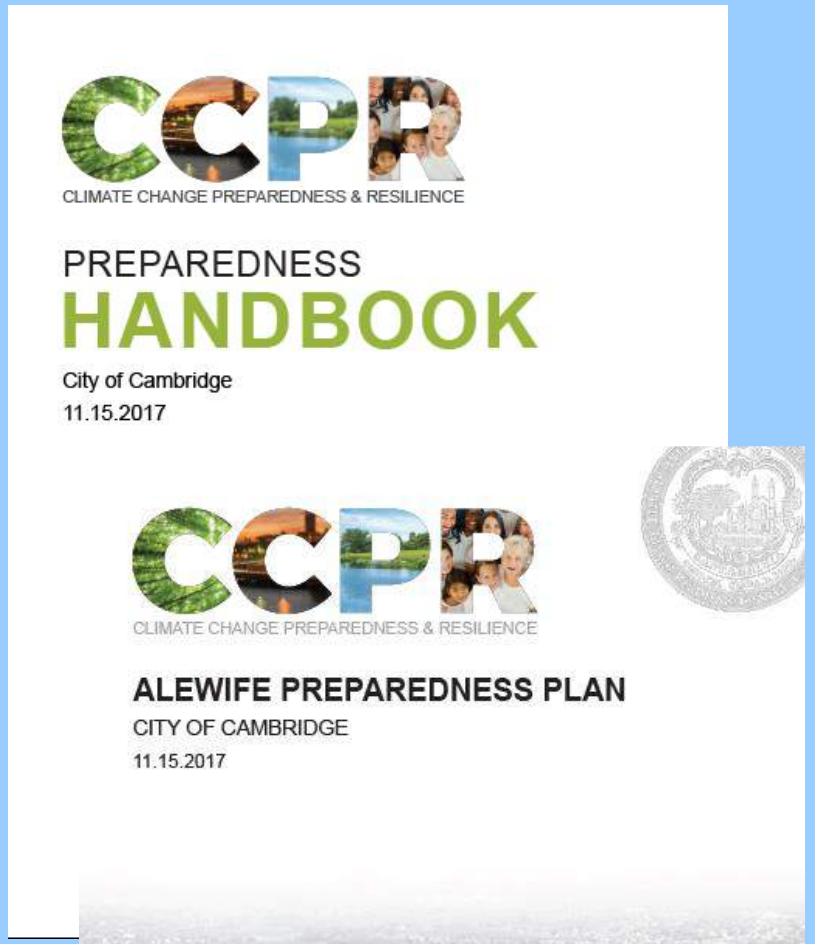
ICLEI World Congress 2018
Building Resilience at the Local Level







http://www.cambridgema.gov/climateprep



Completed *Climate Change Vulnerability Assessment (CCVA)*, Parts 1 & 2

Climate Change Preparedness & Resilience (CCPR) Plan underway

- First neighborhood plan completed for Alewife
- Second neighborhood plan in progress for The Port
- Citywide plan due Summer 2019

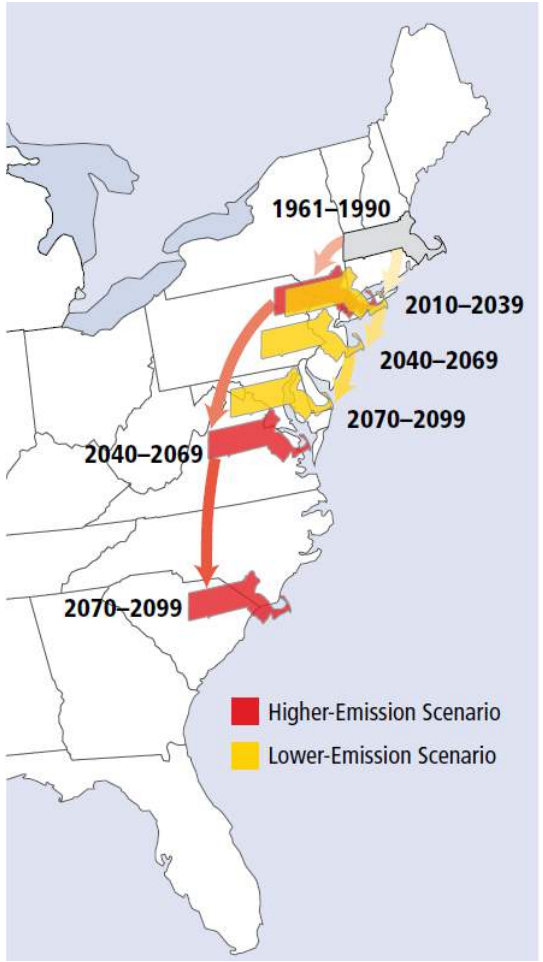
CCVA/CCPR Principles

- Use the best available climate science
- Bring the community and key stakeholders along with the City to develop a mutual understanding of climate change impacts
    - Involve stakeholders, residents, and businesses early through public meetings, presentations, focus groups, and advisory committees
    - Share all data and analyses
    - Make the debate about what actions to pursue
- Engage neighboring cities and the state to initiate and coordinate actions

Define Climate Scenarios

What to plan for?

Temperature



Precipitation

More extreme events

Sea Level Rise (SLR)

Process

- Interdisciplinary consultant team led by Kleinfelder
- Statistical downscaling of global climate models with Dr. Katharine Hayhoe to forecast 2030 and 2070 temperature, humidity, & precipitation
- Sea level rise projections from National Climate Assessment
- Expert Advisory Panel review
- Technical Advisory Committee

Increasing Temperatures – Increasing Heat Vulnerability

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

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

1971 - 2000
(Baseline)

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

2015 - 2044
(2030)

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
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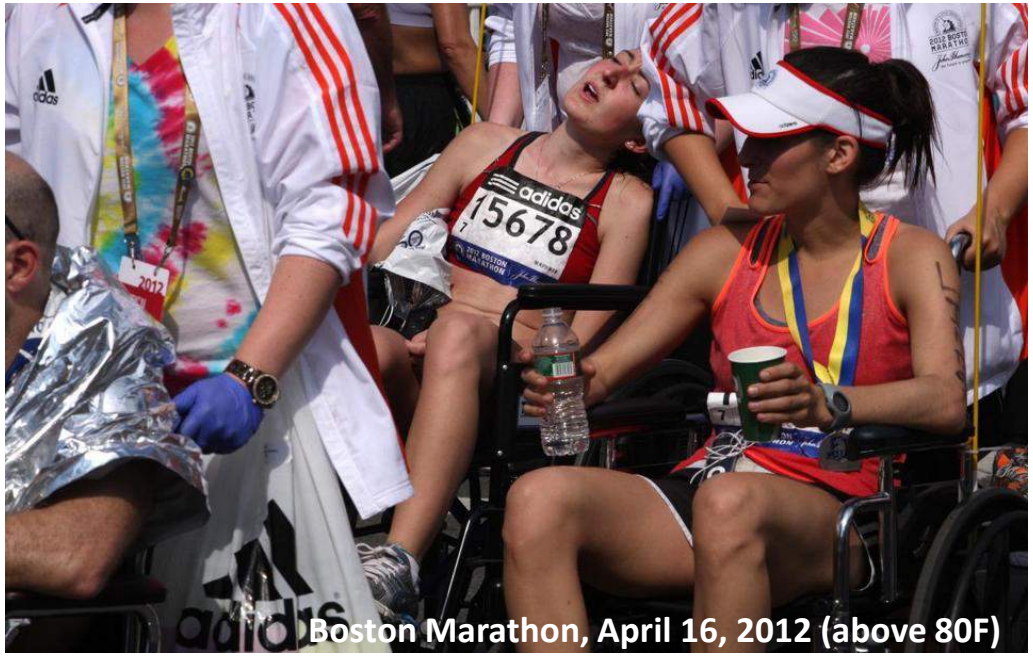
2055 - 2084
(2070)

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

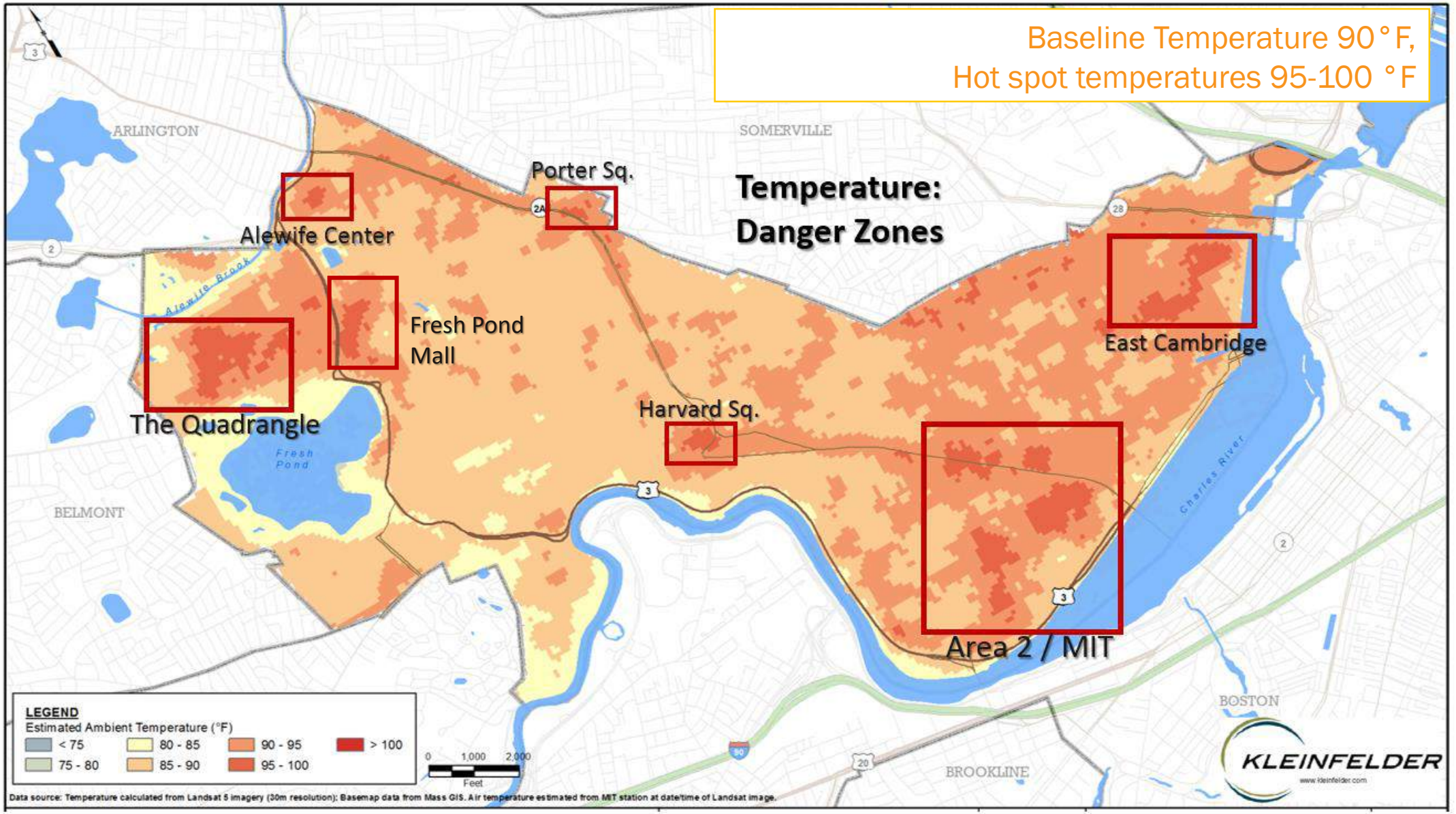


Boston Marathon, April 16, 2012 (above 80F)

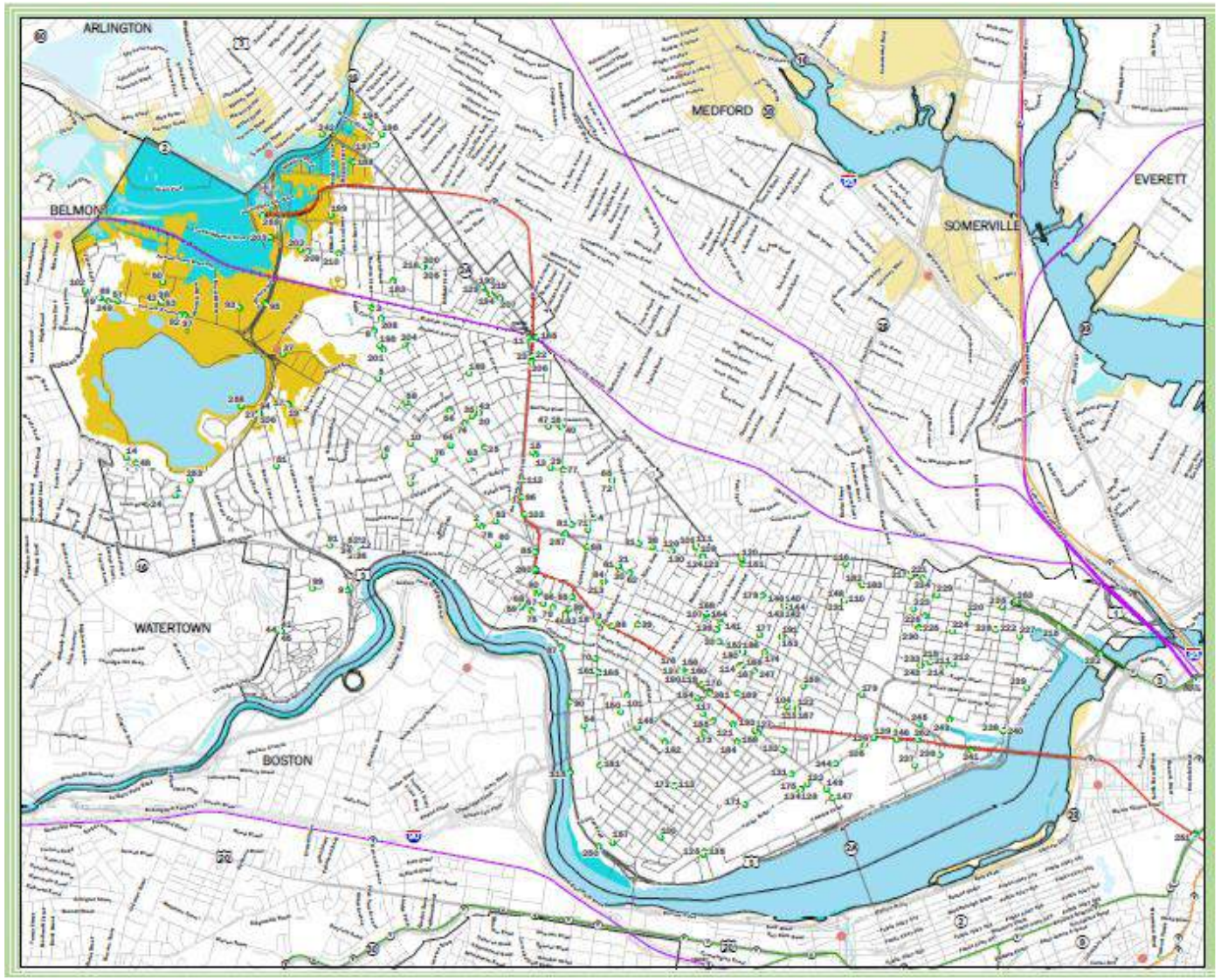
- More frequent & longer heat waves
- Temperatures exacerbated by urban heat island affect
- Extreme hot days will shift most areas from “cautious” for human health to “extreme caution”
- Average temperatures will be warmer

Urban Heat Islands Exacerbate Heat Vulnerability

Based on Landsat data and modeling



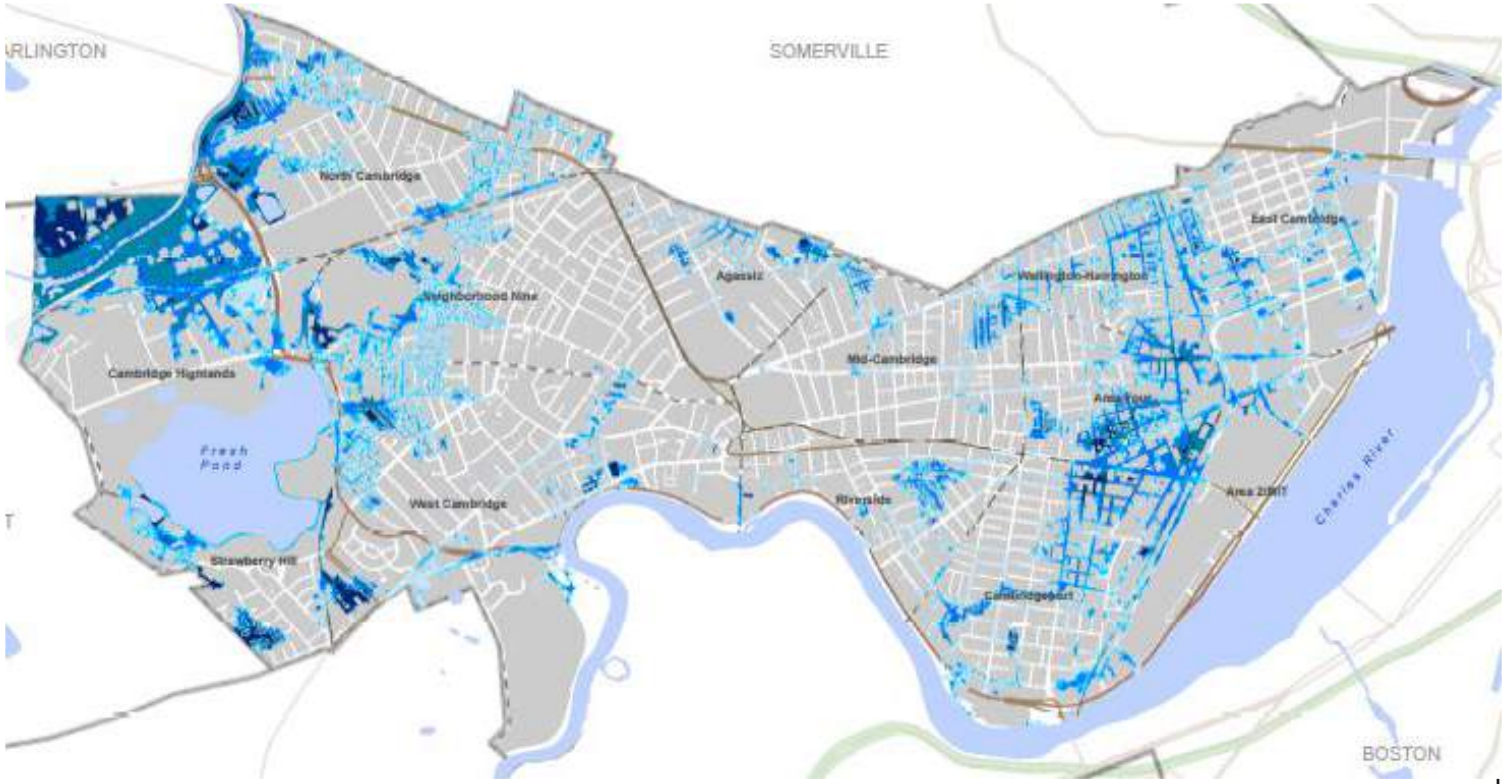
City of Cambridge – Historic Precipitation Flood Risk



FEMA maps showed limited precipitation based flooding, but did not account for future climate conditions

Precipitation Flooding 2070

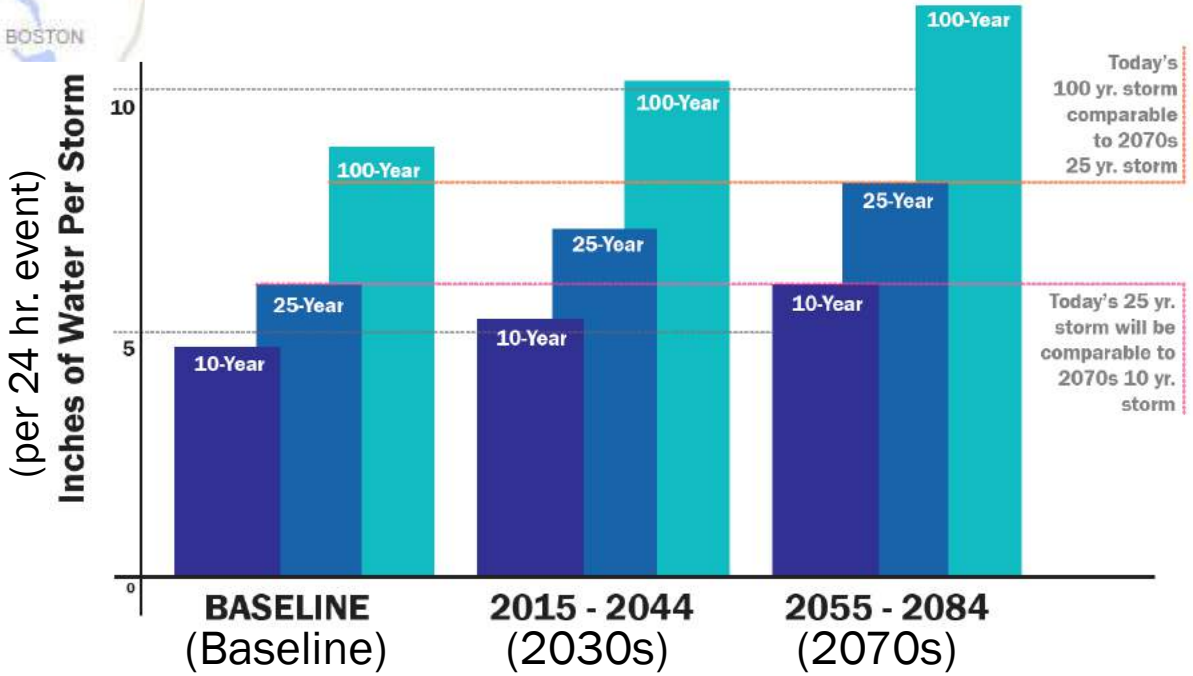
High Emissions Scenario
Based on ICM-2D Model



Depth of flooding above ground (ft)

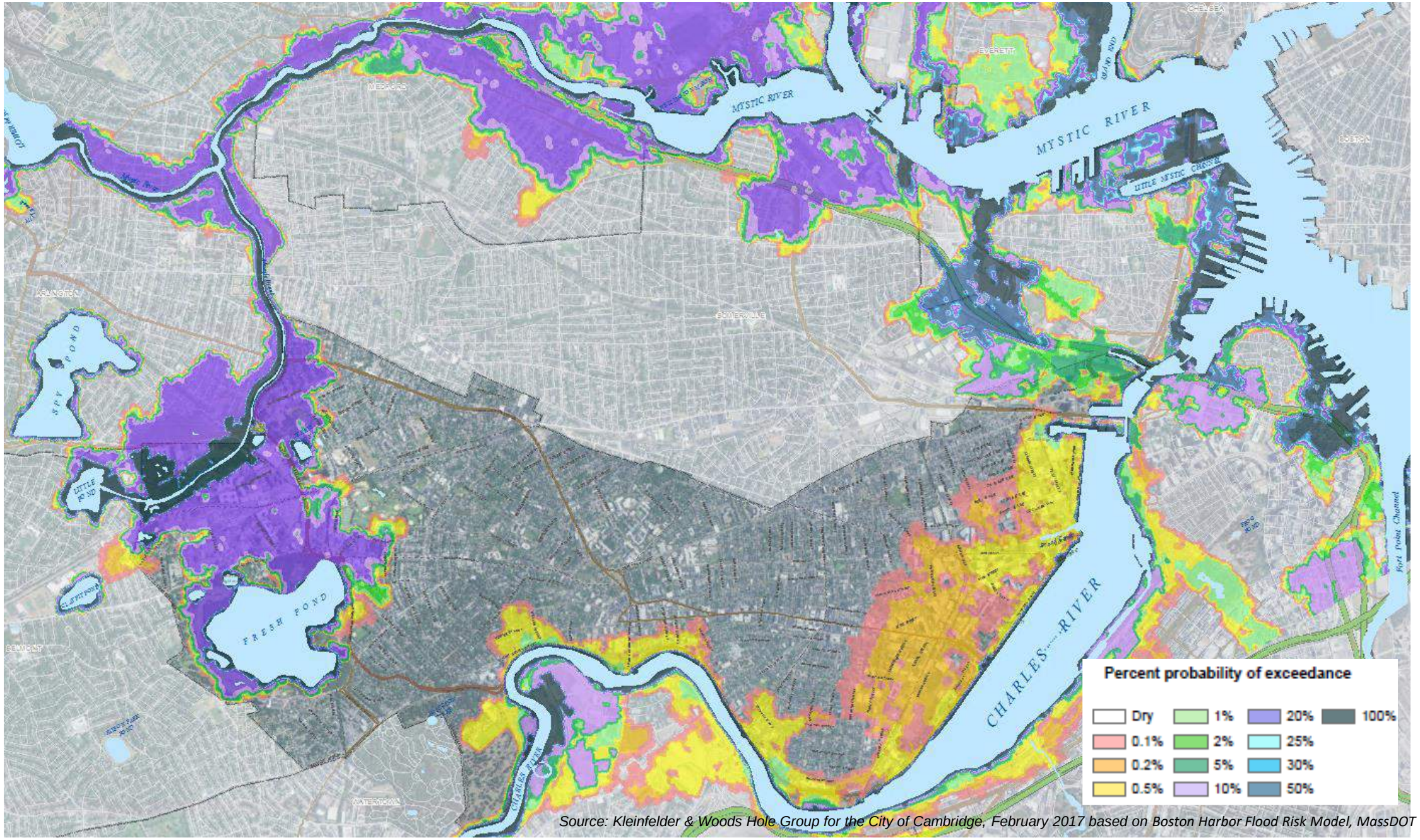
- 0 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- > 3.0

Source: Kleinfelder for the City of Cambridge, 2017



(Source: Kleinfelder based on ATMOS projections November 2015)

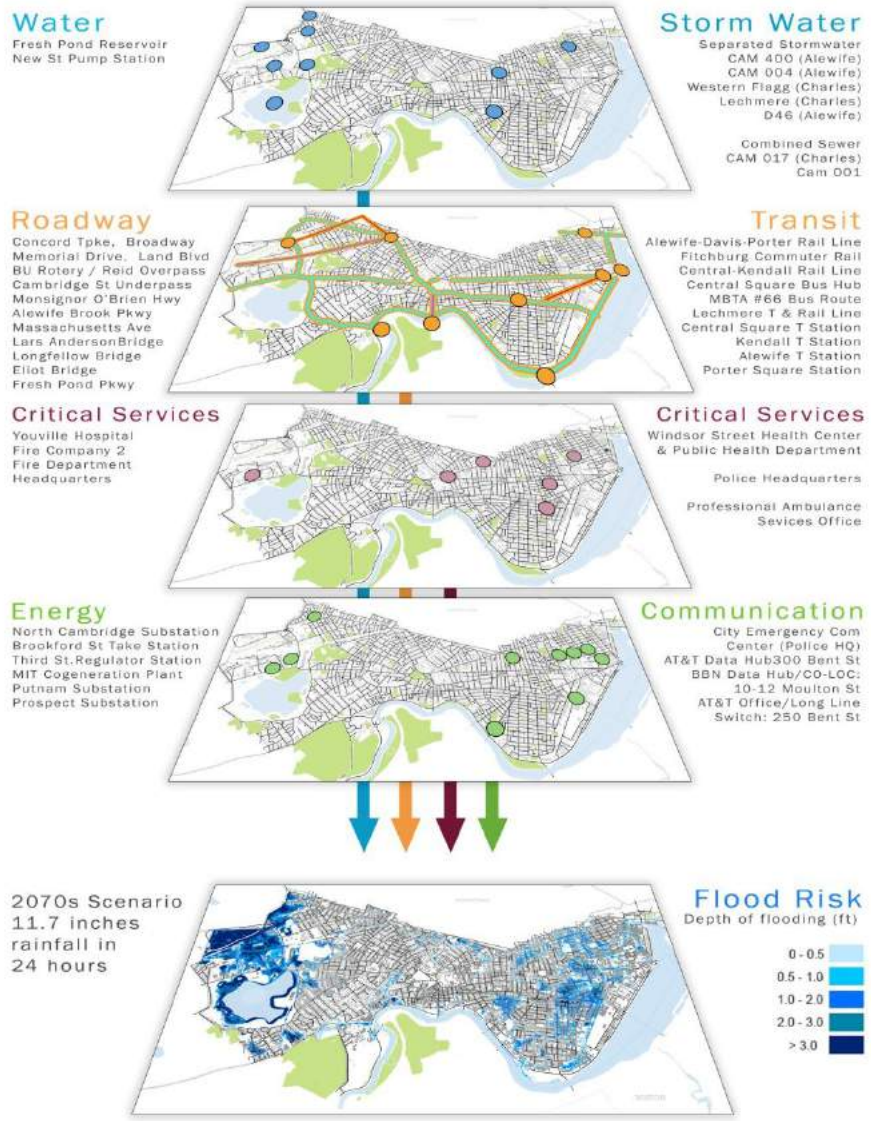
Sea Level Rise / Storm Surge Risks – 2070 Boston Harbor Flood Risk Model



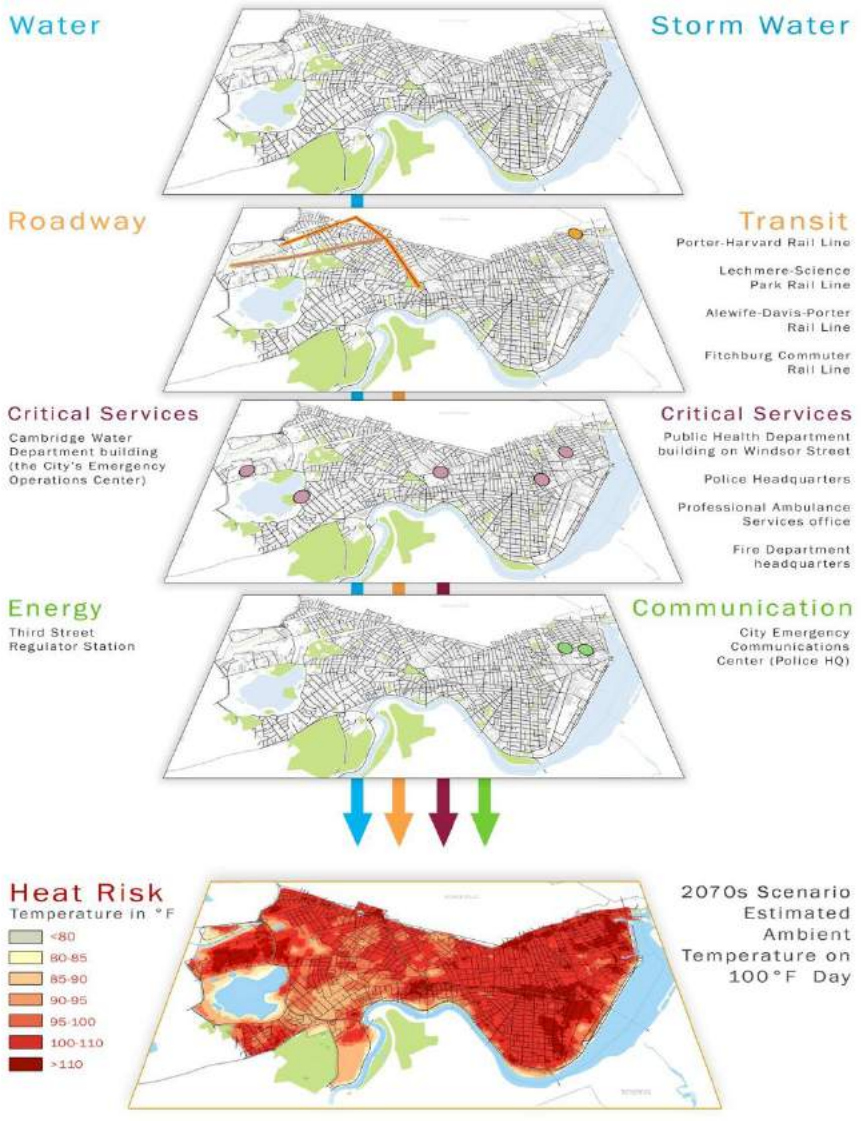
Source: Kleinfelder & Woods Hole Group for the City of Cambridge, February 2017 based on Boston Harbor Flood Risk Model, MassDOT

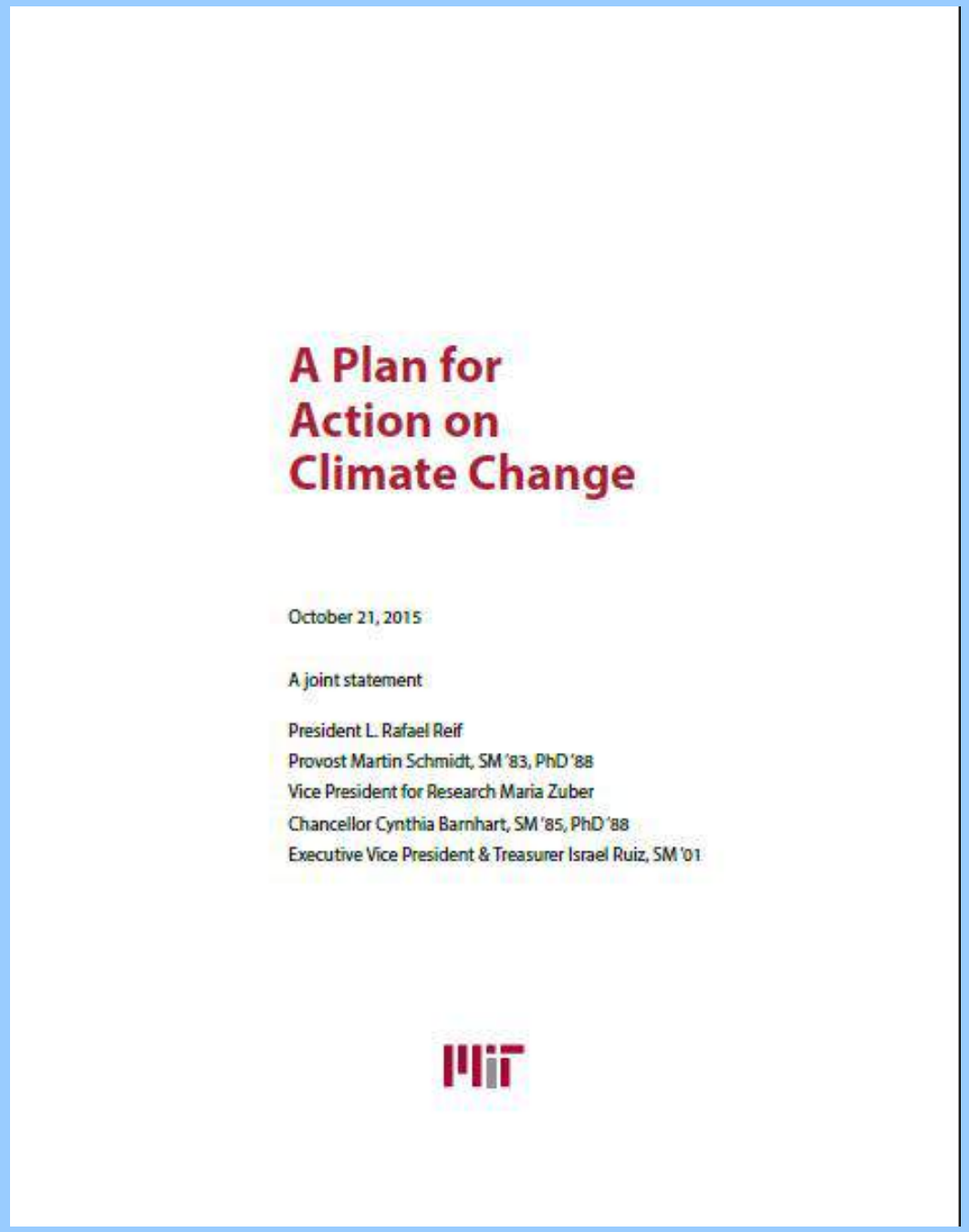
Climate Stress Test

Flooding stress test



Heat stress test

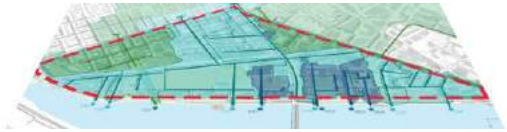




In 2015, MIT adopted climate action plan to minimize greenhouse gas emissions and devise pathways to adapt to climate change

Massachusetts Institute of Technology

MIT Campus Resiliency Framework

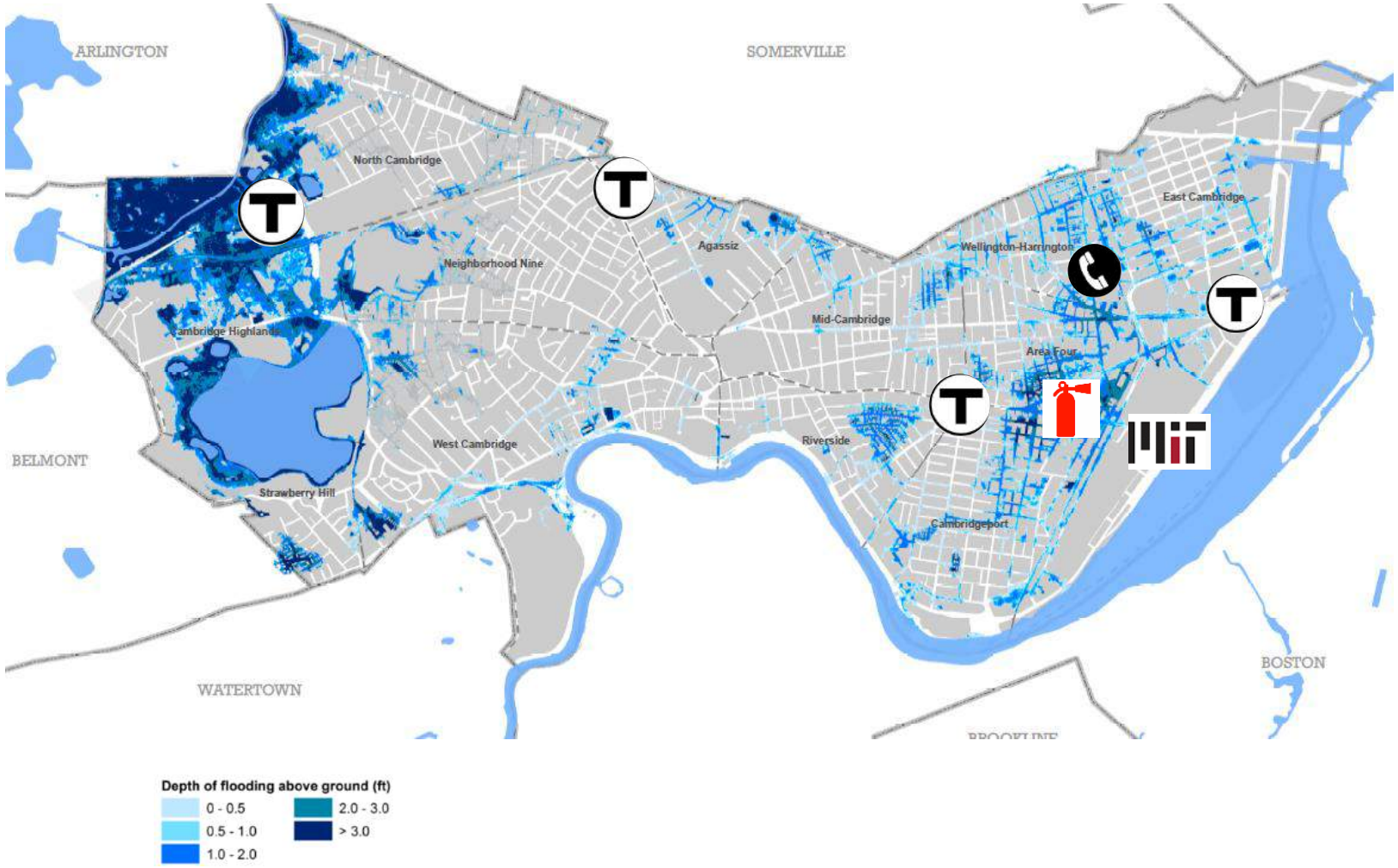


COMMUNITY	**22,000 people**
BUILDINGS / EQUIPMENT	**170 buildings**
UTILITIES	**15 utilities**
SITE SYSTEMS	**168 acres**

Inter-dependent Systems: Campus and City Scale

Source: Brian Goldberg, MIT

Inter-dependent Systems: Campus and City Scale



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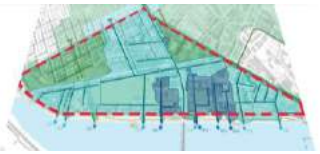
UTILITIES		15 utilities
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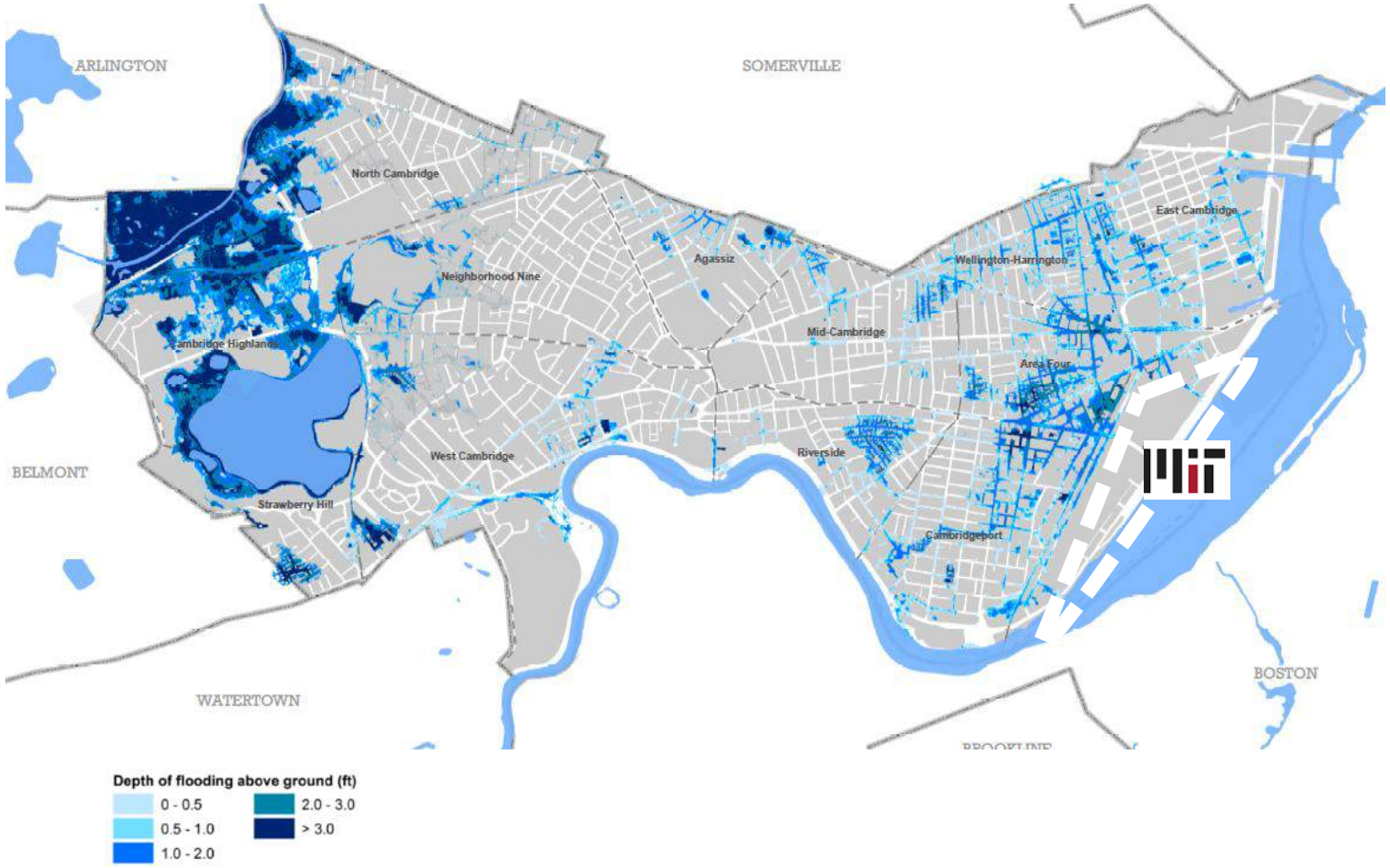
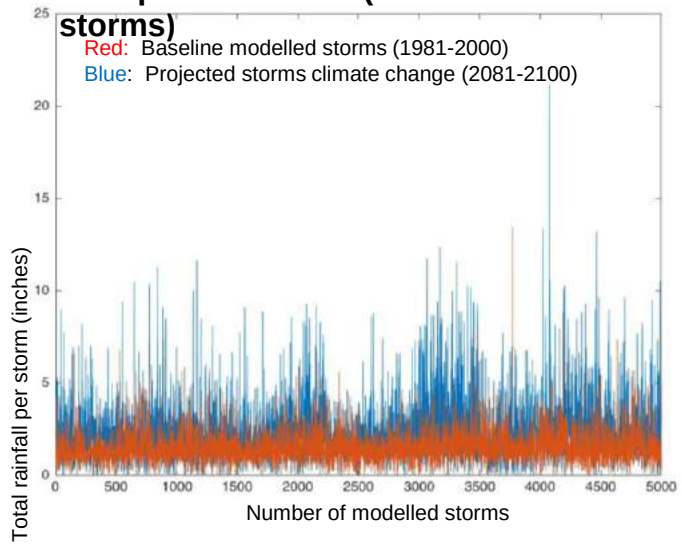
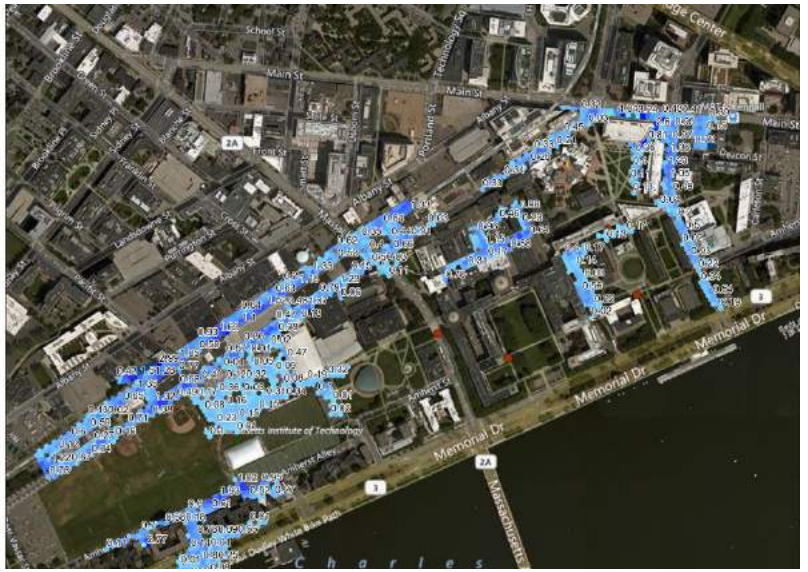
- City of Cambridge Climate Vulnerability Assessment, 2015

Understanding Precipitation Flood Risks



Modelling of Future Cambridge Precipitation Totals (24 hour storms)



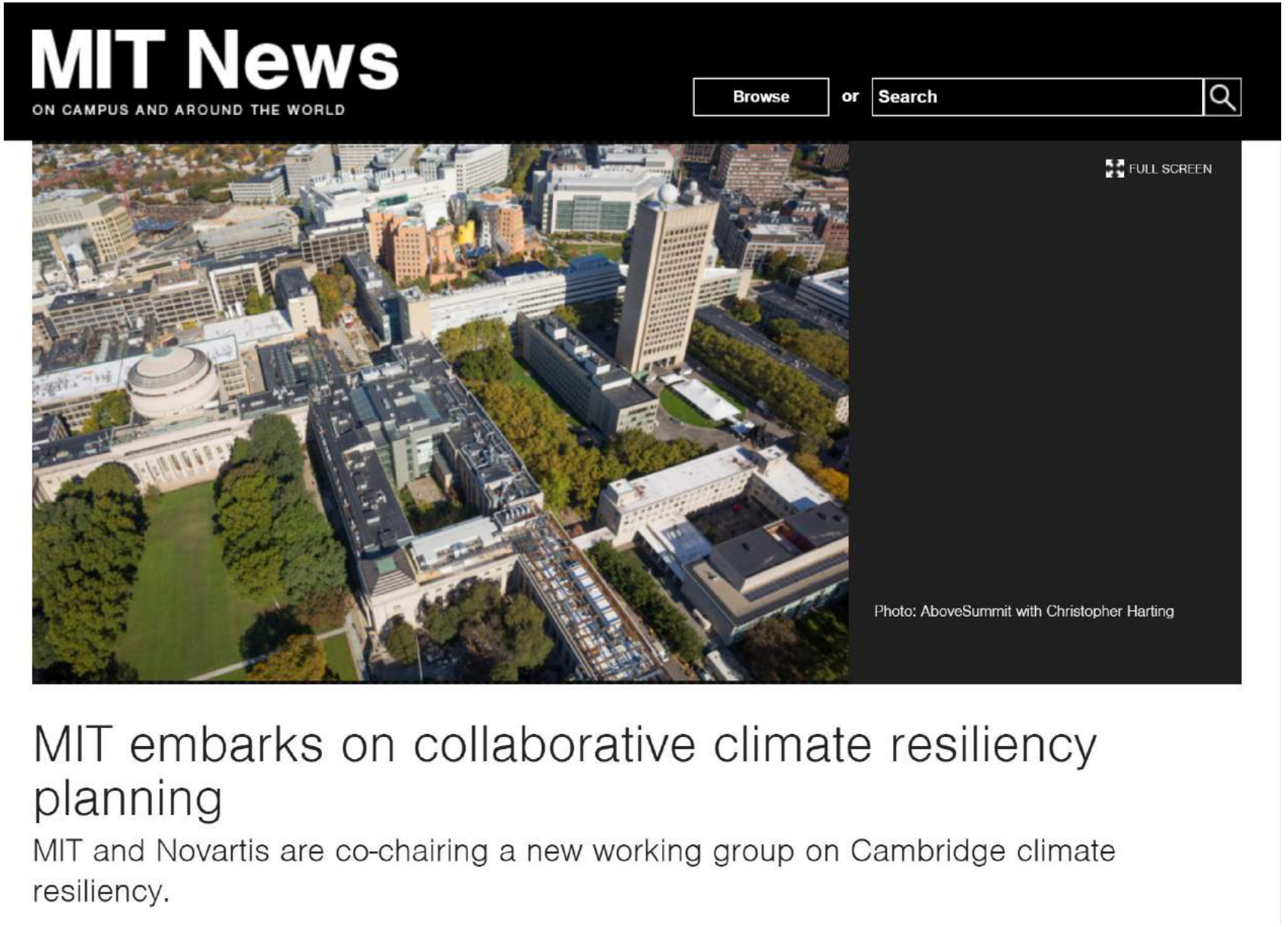


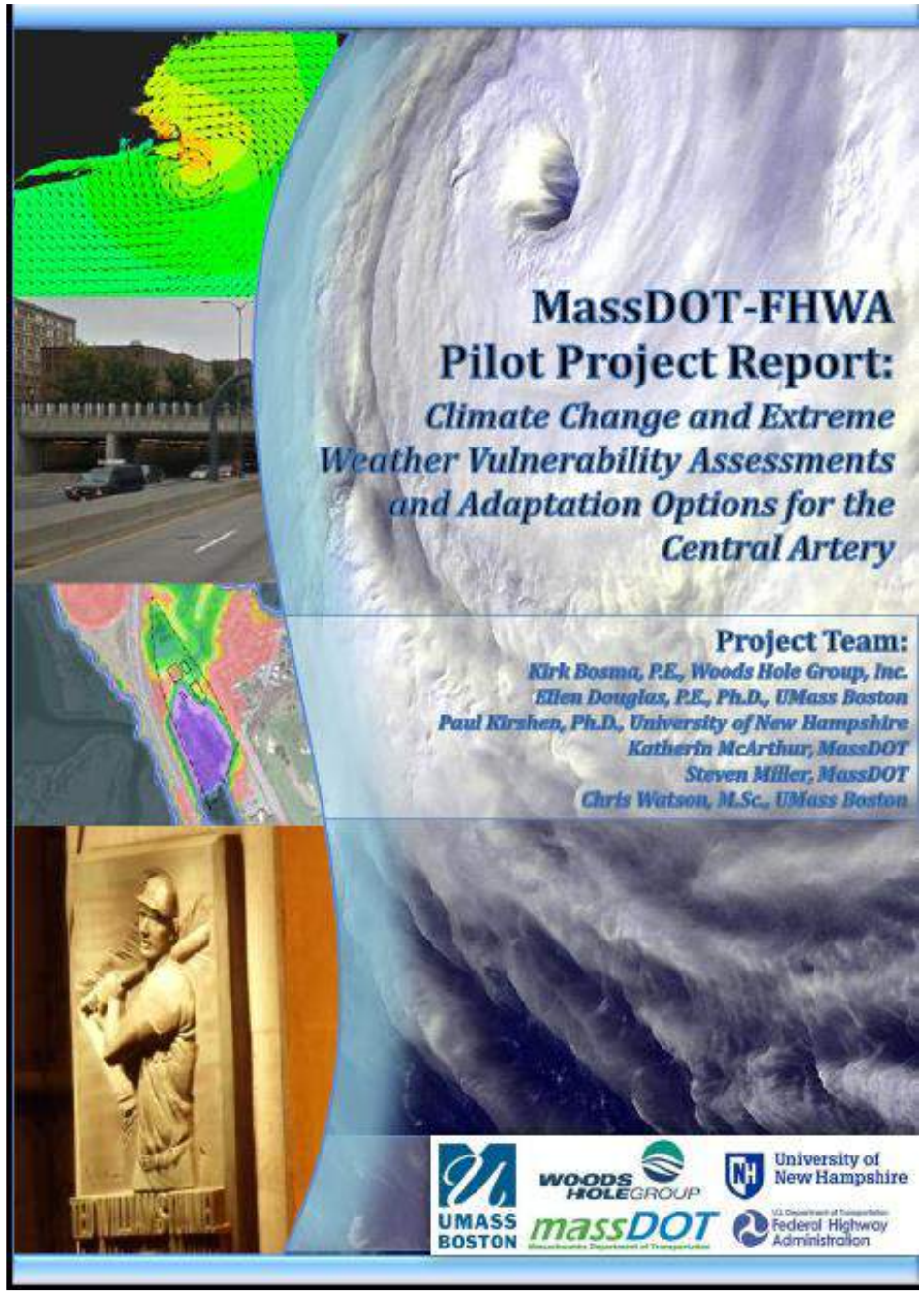
- **1% or 100 year storm (2070); 11.7 inches over 24 hours**
- City of Cambridge Climate Vulnerability Assessment (2015)

SAMPLE OUTPUTS MIT Flood Vulnerability Study (In-Progress 2017)

CAMBRIDGE COMPACT FOR A SUSTAINABLE FUTURE

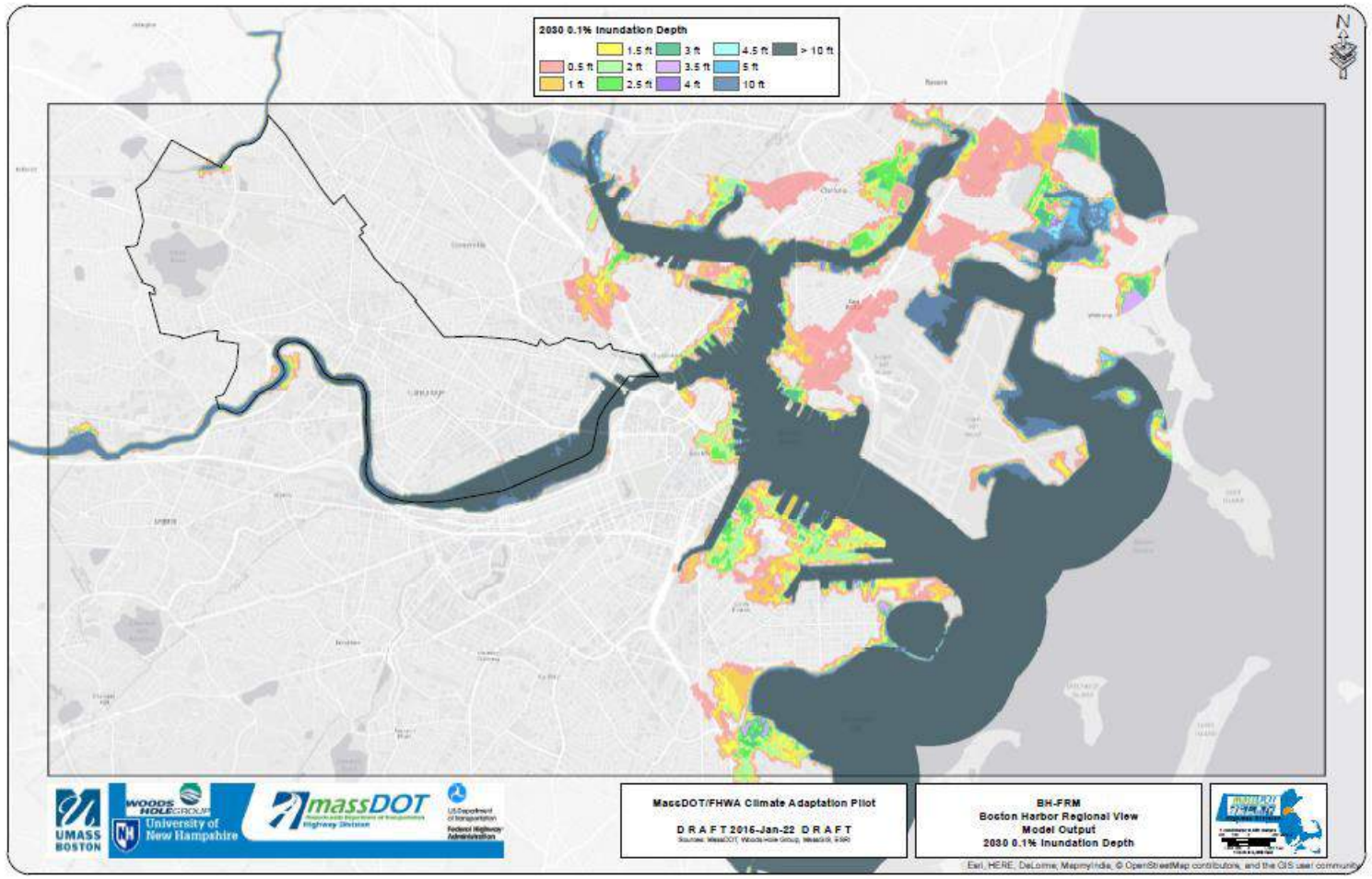
- City of Cambridge
- Harvard University
- MIT
- Novartis
- Boston Properties
- Biogen
- Alexandria Real Estate
- BioMed Realty
- Cambridge Redevelopment Authority
- Eversource
- Homeowner's Rehab, Inc.
- Amgen
- CDM Smith
- Draper Laboratory



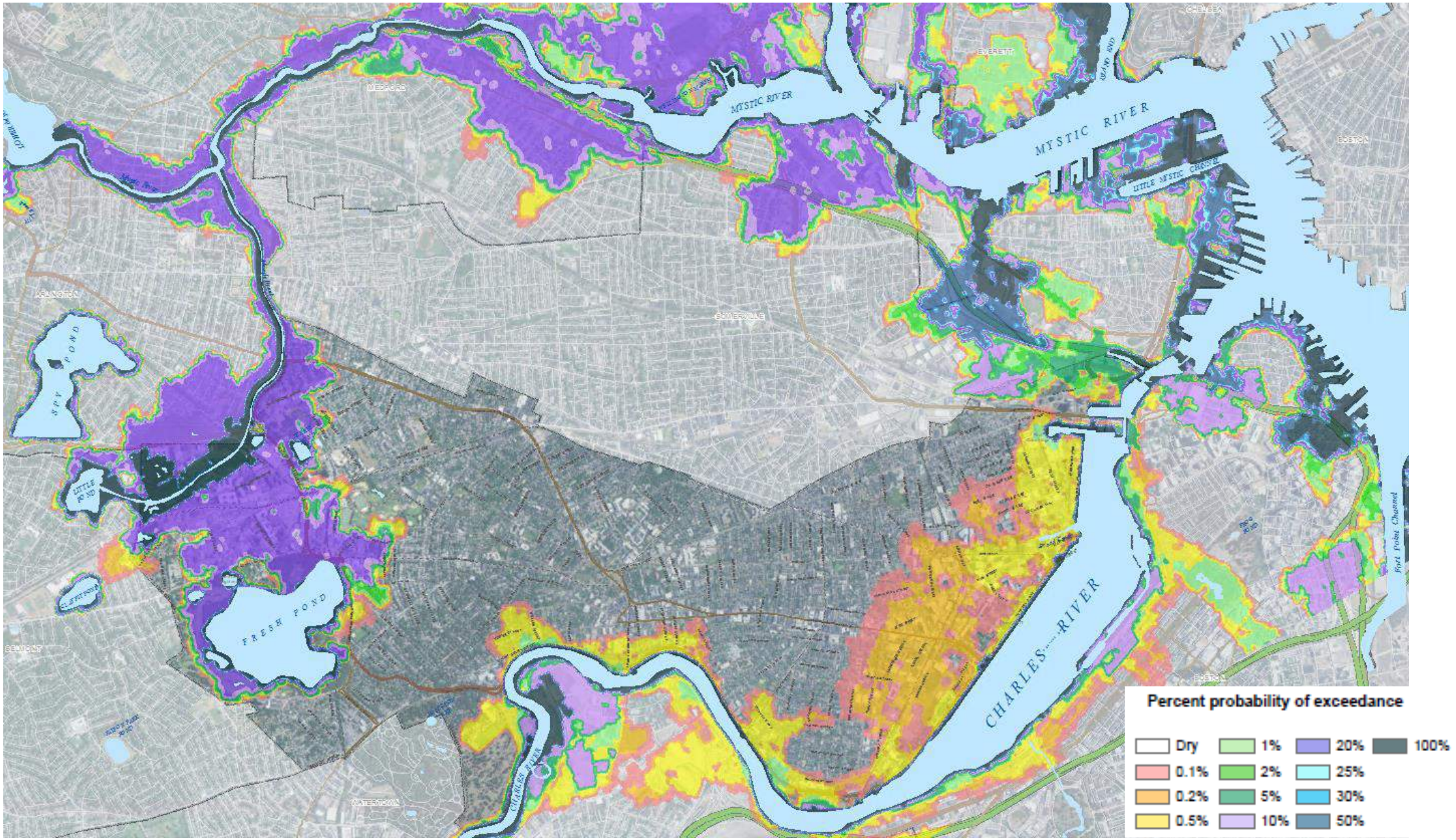


MassDOT – Boston Harbor Flood Risk Model

- Extended model to Mystic River and Cambridge
- Consistent regional model of sea level rise & storm surge flood risks



Storm Surge: A New, Future Flood Risk for Cambridge in 2070



Source: Kleinfelder & Woods Hole Group for the City of Cambridge, February 2017 based on Boston Harbor Flood Risk Model, MassDOT

Regional Coordination & Engagement

Metro Mayors Climate Change Preparedness Commitment

- 15 metro Boston cities and towns
- Coordinated by regional planning agency – MAPC
- Capacity building
- Vulnerability assessments
- Best practice and information sharing
- Joint implementation

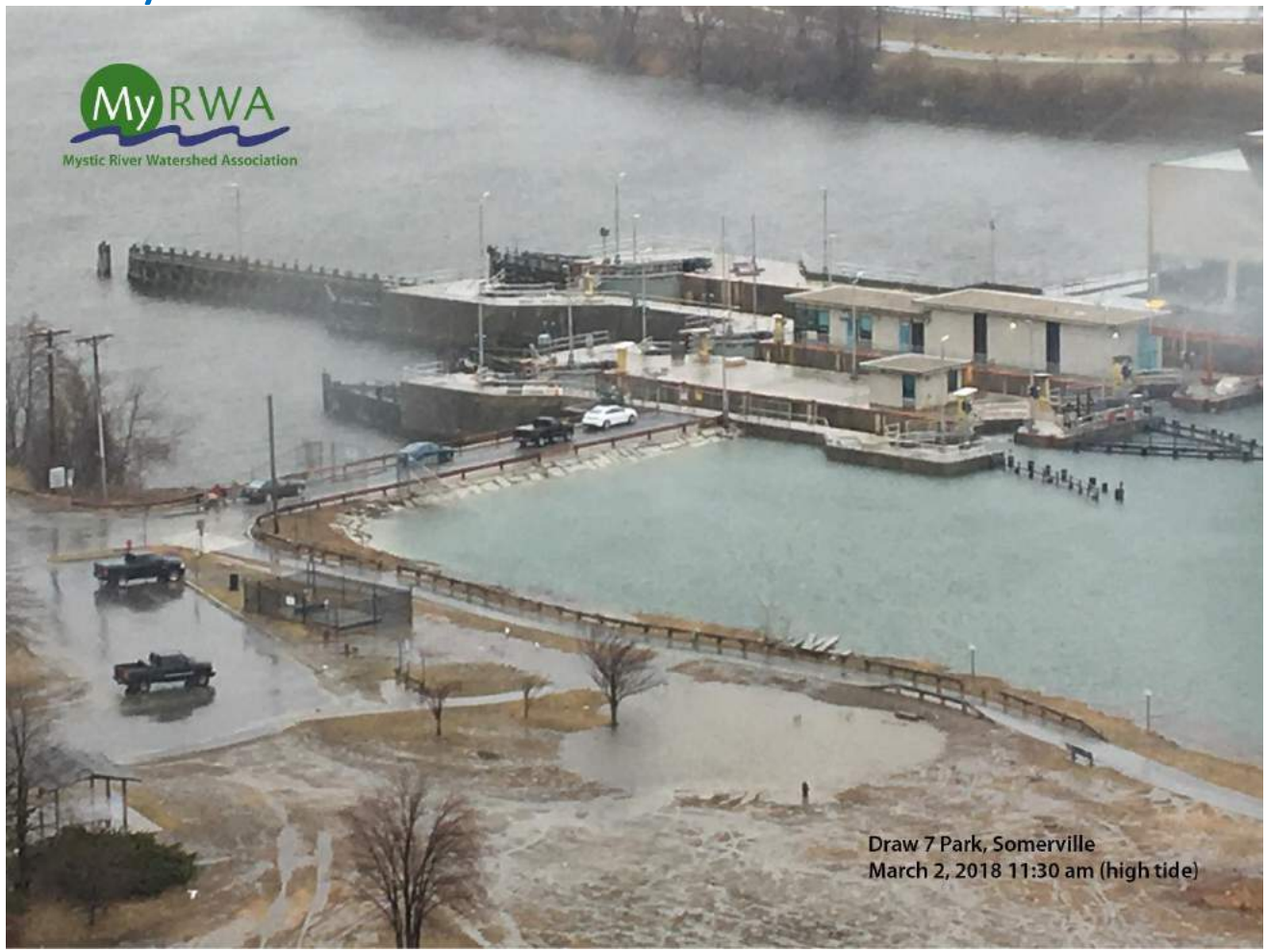
http://www.mapc.org/climate-preparedness

Projects

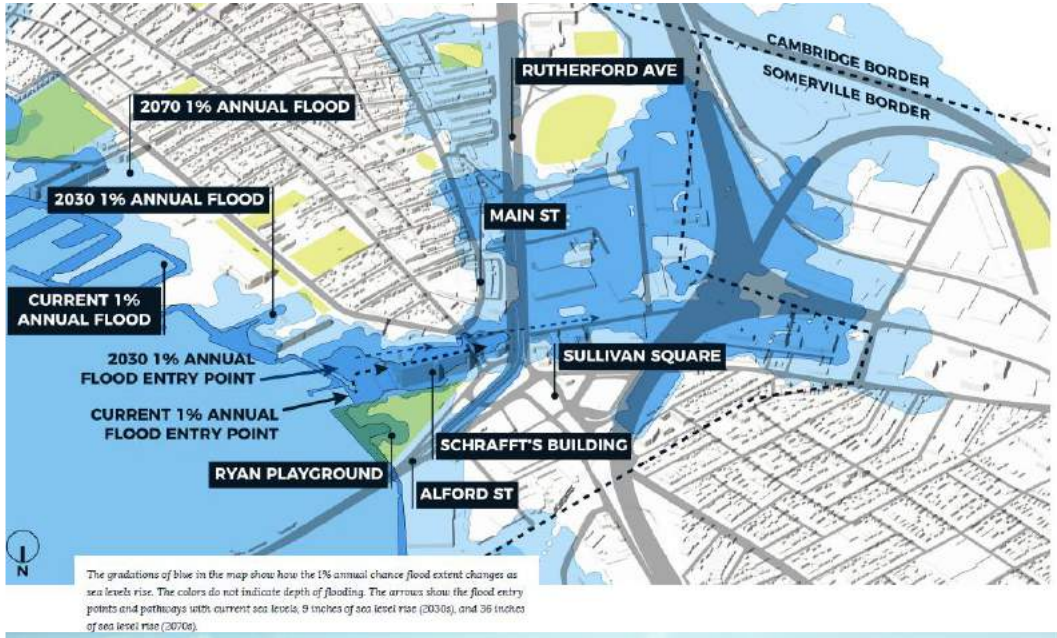
- Trust for Public Land Climate Smart Cities
- Regional urban forest canopy mapping & USFS training
- Mystic River Coastal Resilience Project
- Climate Ready Boston plans for Charlestown & East Boston

Regional Opportunities to Build Storm Surge Barriers

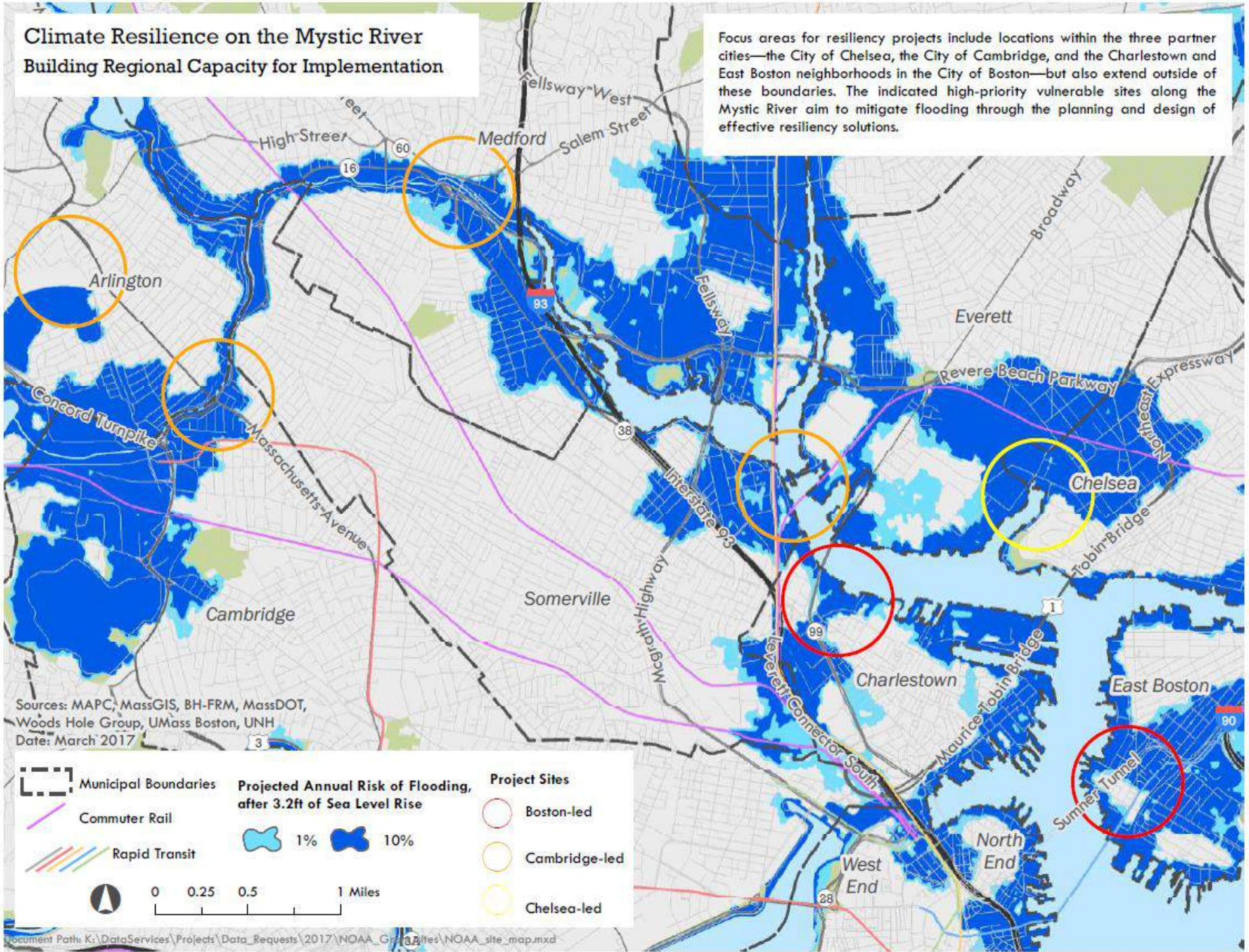
Draw 7 Park, Somerville at Amelia Earhart Dam on Mystic River

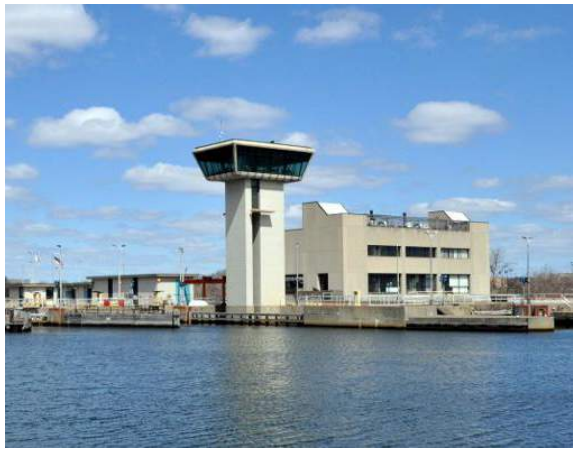


Charlestown (Boston) at Schrafft Center



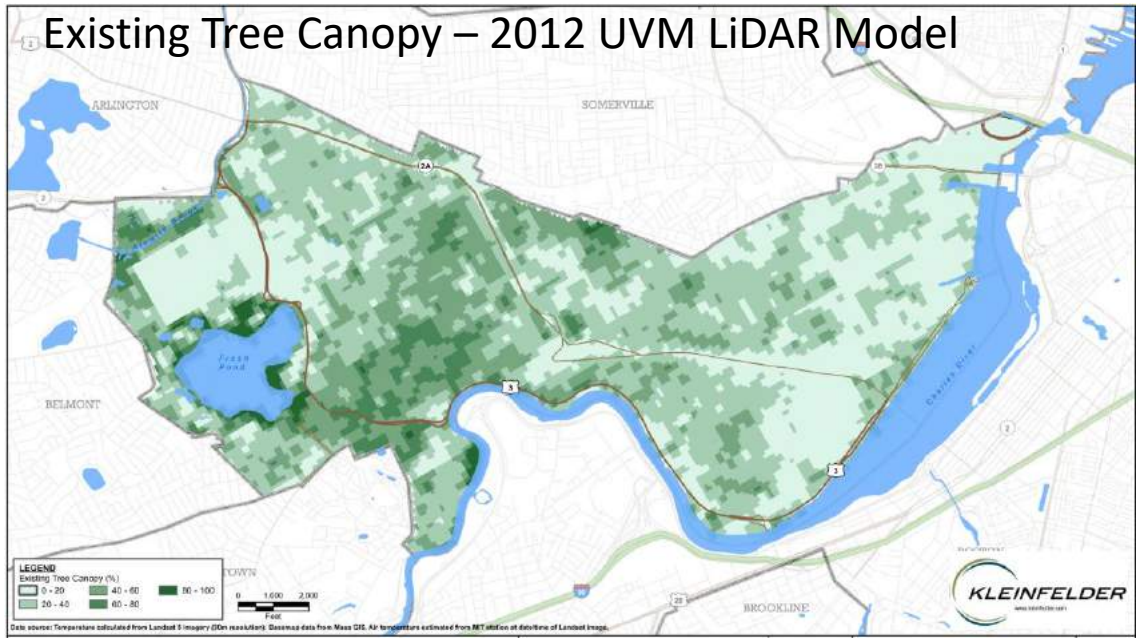
Regional Flood Risk Mitigation Planning





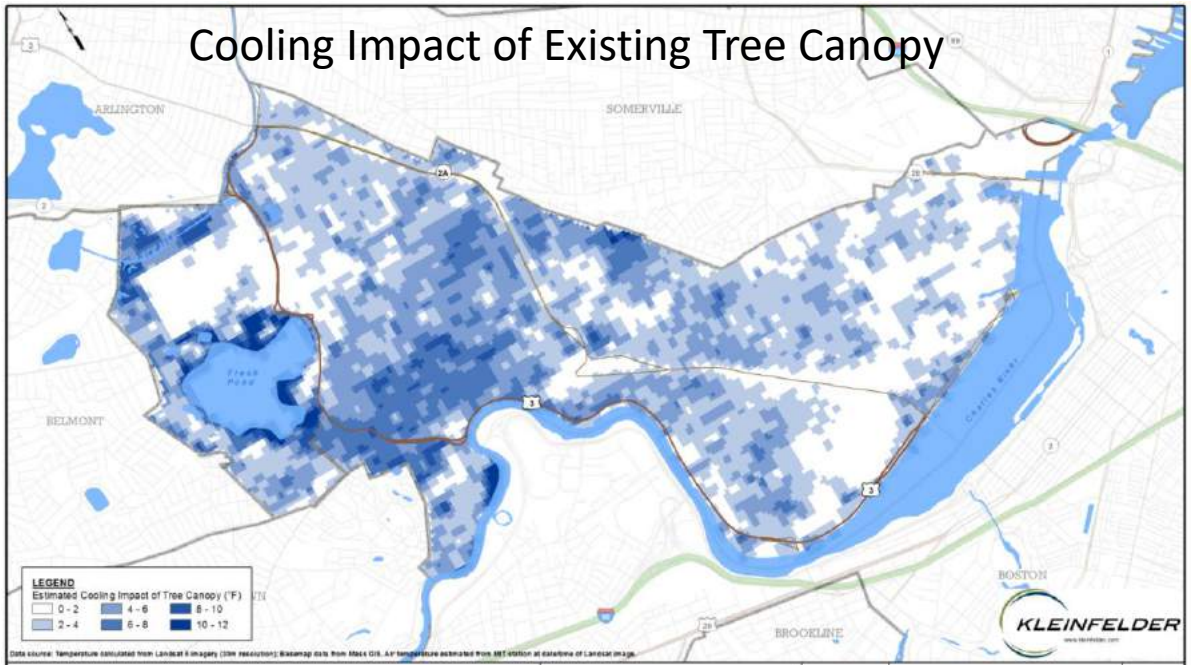
Amelia Earhart Dam (Source: MaUSHarbors.com)

Estimating Cooling Impact of Existing Urban Forest Canopy

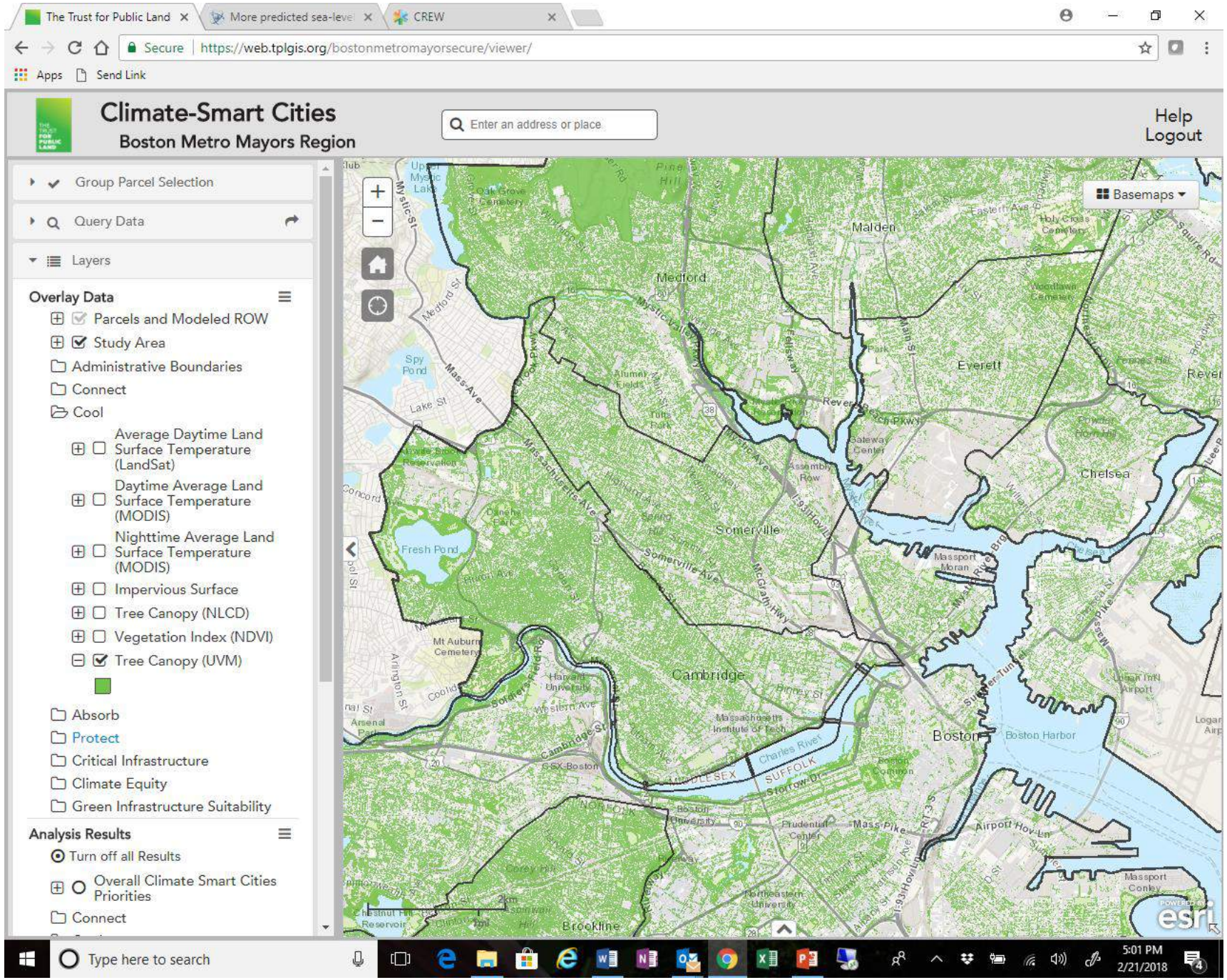


Cell Resolution: 30 meters x 30 meters (100’ ft x 100’ ft)

Calculated Cooling Impact:
+1% tree canopy increase relates to 0.12°F of cooling



Source: Appendix D Urban Heat Island Protocol for Mapping Temperature Projections, Kleinfelder for the City of Cambridge, November 2015



Boston Metro Mayors Climate Smart Cities Tool

- Tree canopy cover – 2014
- Developed by Trust for Public Land with Metropolitan Area Planning Council

Cambridge Climate Change Preparedness & Resilience
http://www.cambridgema.gov/climateprep

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