Climate Change Vulnerability Assessment Update

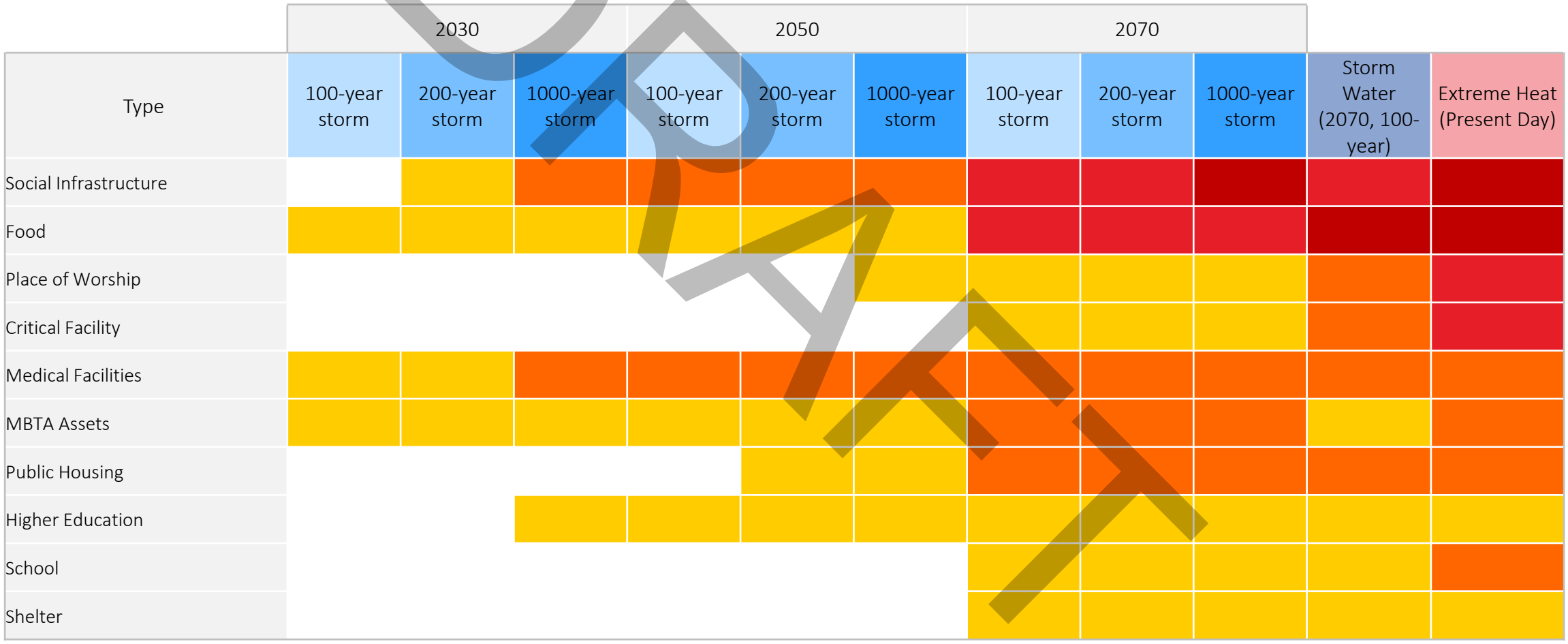
Summary Deck

City of Somerville Climate Forward

Key Findings

Asset Exposure Matrix

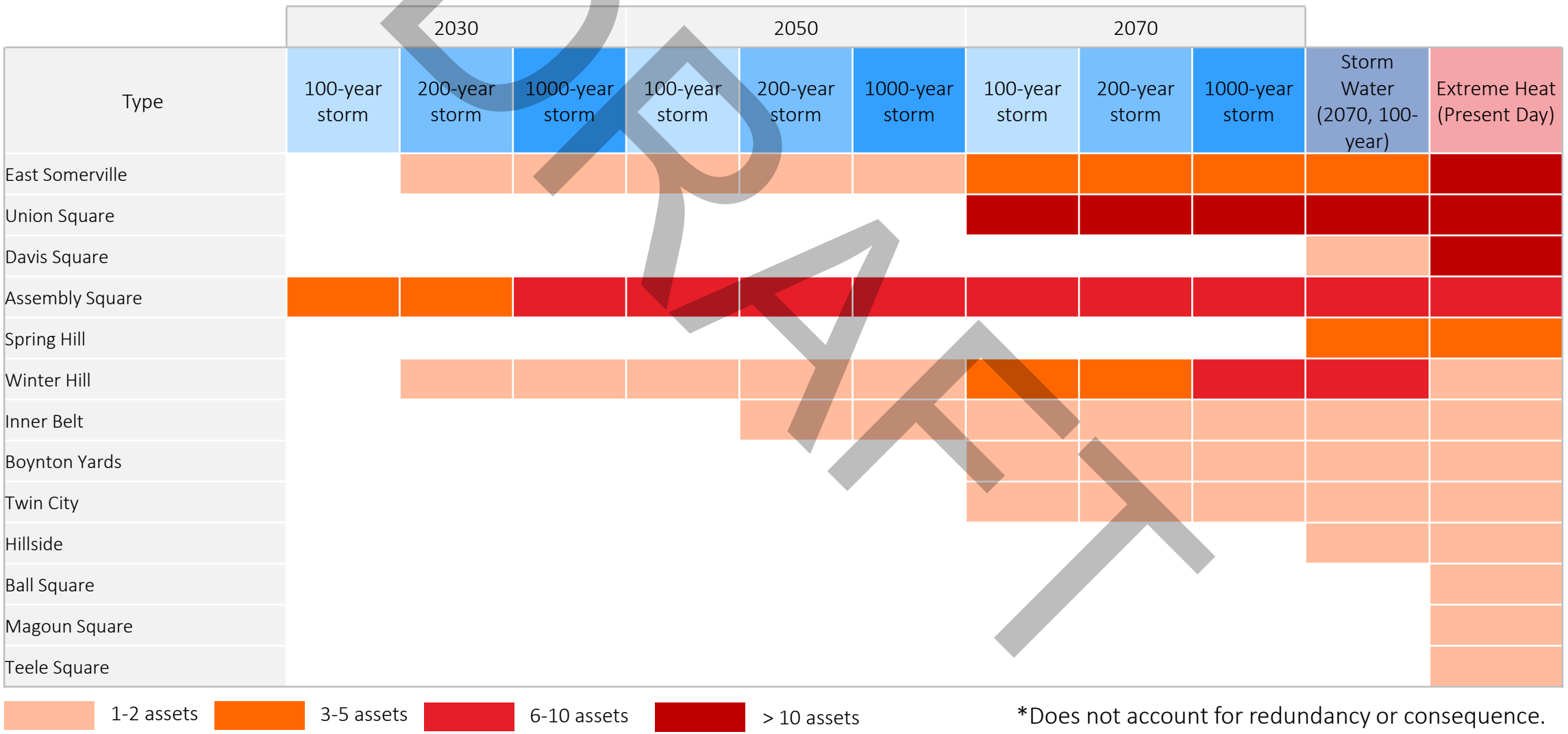
Exposure Count by Infrastructure Type



*Does not account for redundancy or consequence.

Asset Exposure Matrix

Exposure Count by Neighborhood



*Does not account for redundancy or consequence.

Summary

General:

- 50% of Somerville assets are projected to be exposed to one or more hazards through 2070.
- Union Square, East Somerville, and Davis Square have the most assets exposed to one or more hazards.

Flooding:

- Union Square, Assembly Square, and Winter Hill have the most assets exposed to both stormwater and coastal flooding.
- Coastal flooding impacts as early as 2030 in Assembly, East Somerville, and Winter Hill, including the following assets: Elizabeth Peabody House, Cambridge Health Alliance: Union Square Family Health, Mass General Brigham, Assembly Station, Stop & Shop (across from Foss Park), and Trader Joe's (Assembly).
- Inner Belt may experience flooding as early as 2030 if the Schrafft's Center flood pathway is not protected.
- By 2050, Assembly is exposed to significant flooding across all three storm scenarios.
- New modeling (MC-FRM) presents a flood path that extends from Cambridge northeast through Union Square in 2070 under all storm scenarios. This will expose critical infrastructure previously only identified for stormwater risk.
- Multiple medical facilities are projected to be exposed to coastal flooding as early as 2030 including CHA: Union Square Family Health, Primary Care Assembly Square, Mass General Brigham.

Heat:

- 82.3% of Somerville is considered a hot spot, meaning its LST is in the 95th state-wide percentile.
- Union Square, East Somerville, and Davis Square have the most assets exposed to high temperatures.
- Areas exposed to extreme heat are also often exposed to projected stormwater flooding. These overlapping hazards are concentrated in areas with more impervious surface area and less green space, including Inner Belt, Union Square, Brick Bottom, Twin City Plaza.

Key Built Environment Impacts from the 2017 Climate Change Vulnerability Assessment

- **Amelia Earhart Dam** could be regularly flanked by coastal storm events as early as 2035 casing coastal flood impacts to the **Ten Hills and East Somerville & Assembly Square neighborhoods**.
- The **Somerville Fire Department Headquarters and Emergency Operations Center** and the **Police Department Headquarters** are projected to be exposed to precipitation-based flooding impacts and are expected to experience increasing impacts from the 10-year and 100-year storms.
- ~~Minimal projected impacts to the hospital and healthcare facilities.~~
- **The District Court and District Attorney's Office** projected to experience impacts from both sea level rise and storm surge as well as precipitation-based flooding.
- **Routes I-93 and 28, Assembly Square Station, the Commuter Rail, the Orange Line, and the Commuter Rail Maintenance facility** in addition to several bike paths and bus stops at risk of coastal flooding as early as 2030 with significant impacts by 2070.
- **Routes I-93 and 28, Assembly Square Station, Davis Square Station and the proposed Green Line** extension and associated stations could experience significant impacts from rainfall events.
- **Somerville's combined sewer overflows (CSOs)** are susceptible to increased inundation from coastal flood events. Inundation of CSO infrastructure can result in the discharge of raw sewage and present a serious public health risk from pollution of flood waters.
- ~~**Albert F Argenziano School at Lincoln Park**~~ **and Capuano Early Childhood Center will be exposed to flood hazards.**

Key:

Consistent Finding (finding remains true from 2017 to 2023)

~~**Finding from 2017 CCVA that is no longer valid (changes described on next slide)**~~

Updated and New Impacts

- **Coastal flooding will extend into Union Square with depths up to 10 ft.** starting in 2070 under a 100-year storm event scenario. This will expose social infrastructure assets including St. Patrick's Women's Shelter, James Hagan Manor, Somerville Action Agency of Somerville (CAAS) amongst others.
- Critical facilities previously identified to experience stormwater inundation are anticipated to experience greater depths such as the Police Headquarters, Union Square Fire Station, Albert F Argenziano School at Lincoln Park, and Union Square Station. Therefore, all interventions should be designed to offer a higher level of protection for these assets to account for the increased risk.
- Multiple medical facilities are projected to be exposed to coastal flooding as early as 2030 including CHA: Union Square Family Health, Primary Care Assembly Square, Mass General Brigham.
- Additional critical social infrastructure organizations are projected to be exposed to coastal flooding as early as 2030 including the Elizabeth Peabody House, Partners for Youth with Disabilities, Somerville-Cambridge Elder Services, amongst others.
- Additional food resources will be exposed to coastal flooding as early as 2030 including Trader Joes (2030, 100-year), Stop & Shop (2030, 200-year), and Green City Growers (2070, 100-year).

Potential Physical Interventions

	Action	Addressed Hazard(s)	Priority Area(s)
Built Environment / Grey Infrastructure	Partner with MBTA to Install 'Green Bus Stops' to reduce Urban Heat Island effect and Capture Stormwater		1. Somerville Ave. and Route 28 in Inner Belt 2. Union Square 3. Brick Bottom 4. Boynton Yards 5. Twin City Plaza
	Increase Drainage Capacity in Alignment with the Citywide Flood Mitigation and Water Quality Master Plan		1. East Somerville (Pearl St.) 2. Assembly Square 3. Winter Hill (Jaques St. Corridor) 4. Union Square (Lincoln Park Area, Lake St. Duck Village)
Natural Environment / Green Infrastructure	Increase Tree Canopy to Reduce Heat Island Effects and Improve Air Quality		1. West Assembly Square 2. Washington St. extending from Union Square to East Somerville
	Utilize Green Infrastructure to Mitigate Flood and Heat Risk to Exposed Elderly, Supportive, and Public Housing Facilities		1. Cobble Hill Apartments 2. St. Patrick's Women's Shelter 3. Hagan Manor 4. Mystic View Apartments 5. Properzi Manor 6. Capen Court 7. Visiting Nurse Senior Living Community (Hillside) 8. Somerville Homeless Coalition (Davis Square)
	Increase Green and Open Space in Areas with Significant Impervious Surface Area		1. Inner Belt 2. Brick Bottom 3. Twin City Plaza 4. Union Square

Potential Planning and Programming Actions

Focus	Action
Policy & Regulation	• Update zoning to include resilience requirements for new development and major renovations (e.g. Boston Coastal Flood Resilience Overlay District or Cambridge Resilient Zoning & Cool Factor Score), including more stringent water harvesting and reuse requirements to support stormwater management • Update city design requirements to require resilience interventions for streetscape improvements • Connect resilience goals with key economic development areas to take advantage of on-going development (Assembly, Inner Belt) • Develop a strategic managed retreat masterplan
Education & Advocacy	• Develop online mapping platform and design criteria to support community in making investments in resilience • Advocate for statewide building code updates • Advocate for bonds awarded for the coastal flood protection including those needed at Schraffts and the new flood pathway in Union Square • Develop a monitoring program by installing sensors and monitors to study which interventions are most effective • Educate residents about the importance of flood insurance and encourage residents outside of the regulatory floodplain to buy it
Social Vulnerability	• Develop a method to systematically identify and prioritize project investments in socially vulnerable communities (for example by using CDC Social Vulnerability Index analysis) • Invest in upgrading City buildings for greater resilience and work with the community to identify if there is a need for resilience hubs to support community needs • Apply for FEMA HMGP and BRIC funding to mitigate risk to critical assets and build community-wide resilience
Placemaking	• Create a public art program, possibly partnering with local schools, to design creative shade structures for the community • Develop a pilot ‘cool (and dry) streets’ program in key areas to encourage resilient street-scape design
Energy Resilience	• Study energy resilience in more detail / work with utilities to truly understand the capacity of the grid and the potential resilience concerns if the grid is overloaded • Conduct a microgrid / district energy feasibility study • Expand energy retrofits (especially in affordable and public housing) to improve thermal comfort in residential and commercial properties
Green Infrastructure	• Develop a cool roofs and green roofs program for commercial properties • Consider opportunities to support pavement removal / conversion, especially for residential properties with paved yards

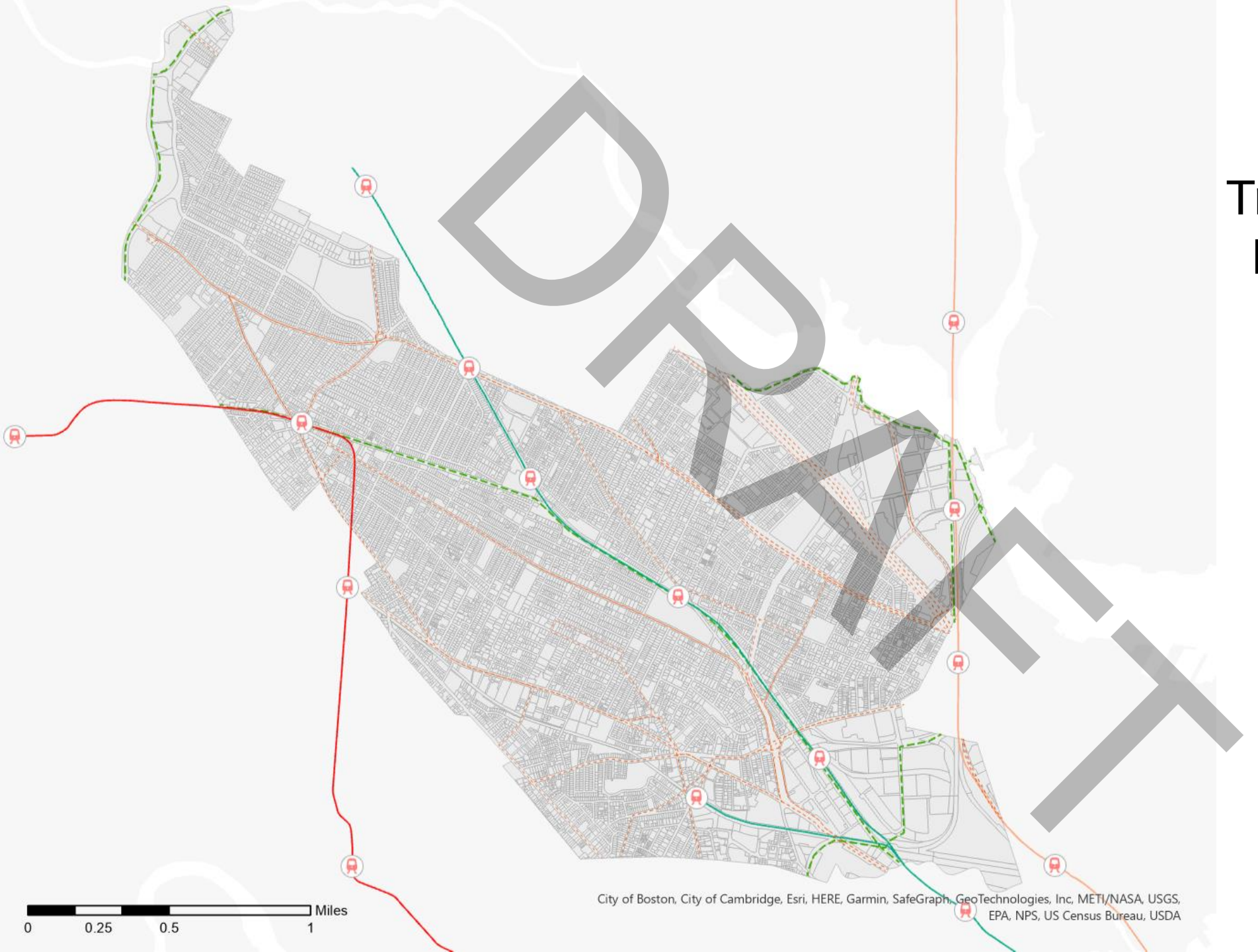
Inventory

Hazards and Inventory

Hazard	Coastal Flooding	Stormwater Flooding	Heat
Metric	Inundation (Depth)	Inundation (Depth)	Land Surface Temperature Index (LST)
Time-Horizon	2030, 2050, 2070	2030, 2070	Present Day
Scenario	100-year storm 200-year storm 1000-year storm	10-year storm (24 hr.) 100-year storm (24 hr.)	N/A

- Church
- Synagogue
- Library
- Hospital (Satellite)
- Hospital (Other)
- School Health Center
- Hospital
- School
- University
- Police
- Fire
- Long Term Care Facility
- Care Facility (Other)
- Community Organization
- Electric Charging Station
- MBTA Station
- Bus Station
- Public Housing

Public Transportation Infrastructure



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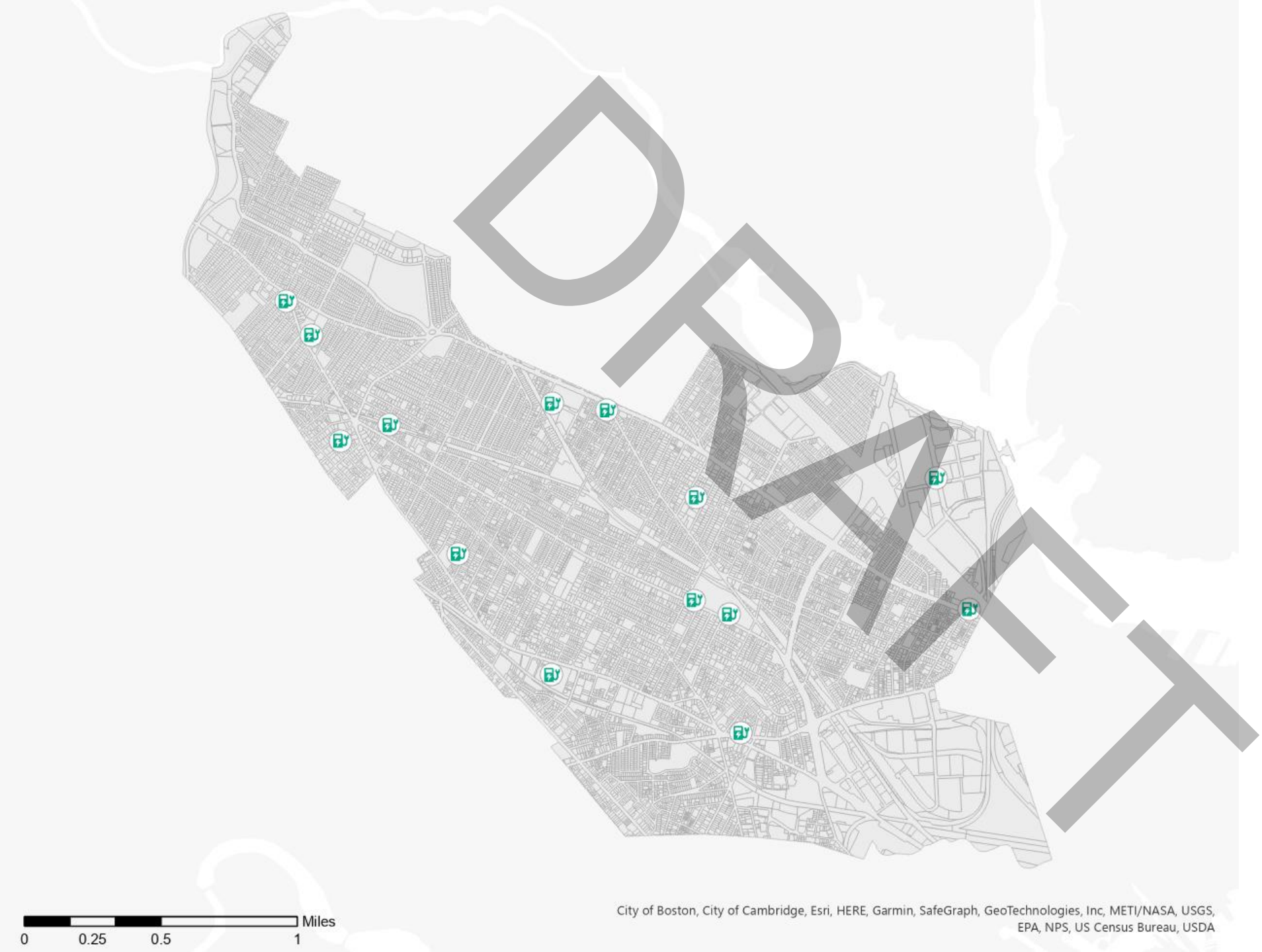
EV Charging Stations



EV Charging Station

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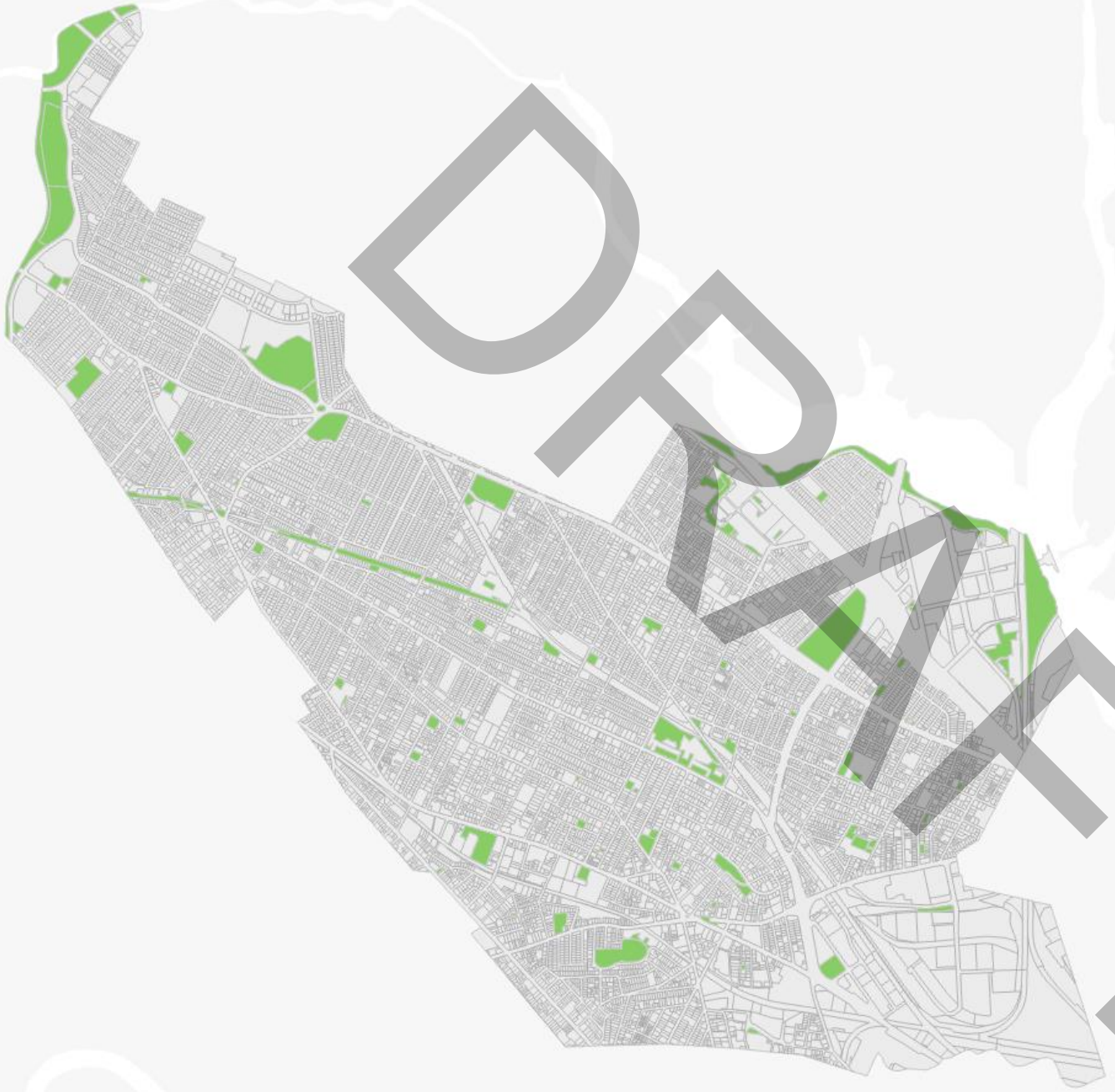
Open Space



Open Space

0 0.25 0.5 1 Miles

City of Boston, City of Cambridge, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

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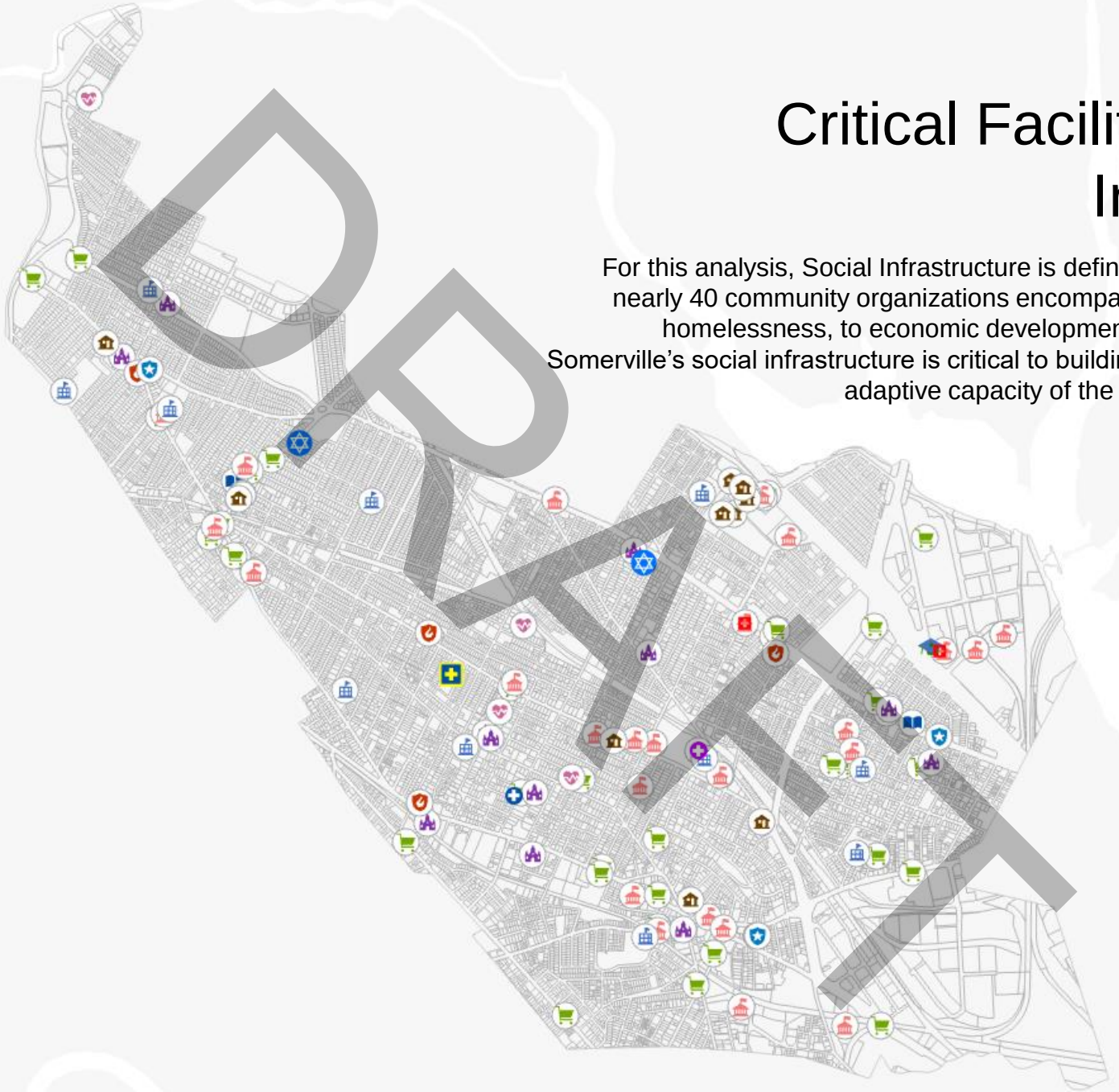
Critical Facilities & Social Infrastructure

For this analysis, Social Infrastructure is defined as libraries, places of worship, and nearly 40 community organizations encompassing a diverse range of focuses from homelessness, to economic development, to access to healthcare. Preserving Somerville's social infrastructure is critical to building social resilience and increasing the adaptive capacity of the City in the face of a changing climate.



- Church
- Synagogue
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- Hospital (Satellite)
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- School Health Center
- Hospital
- School
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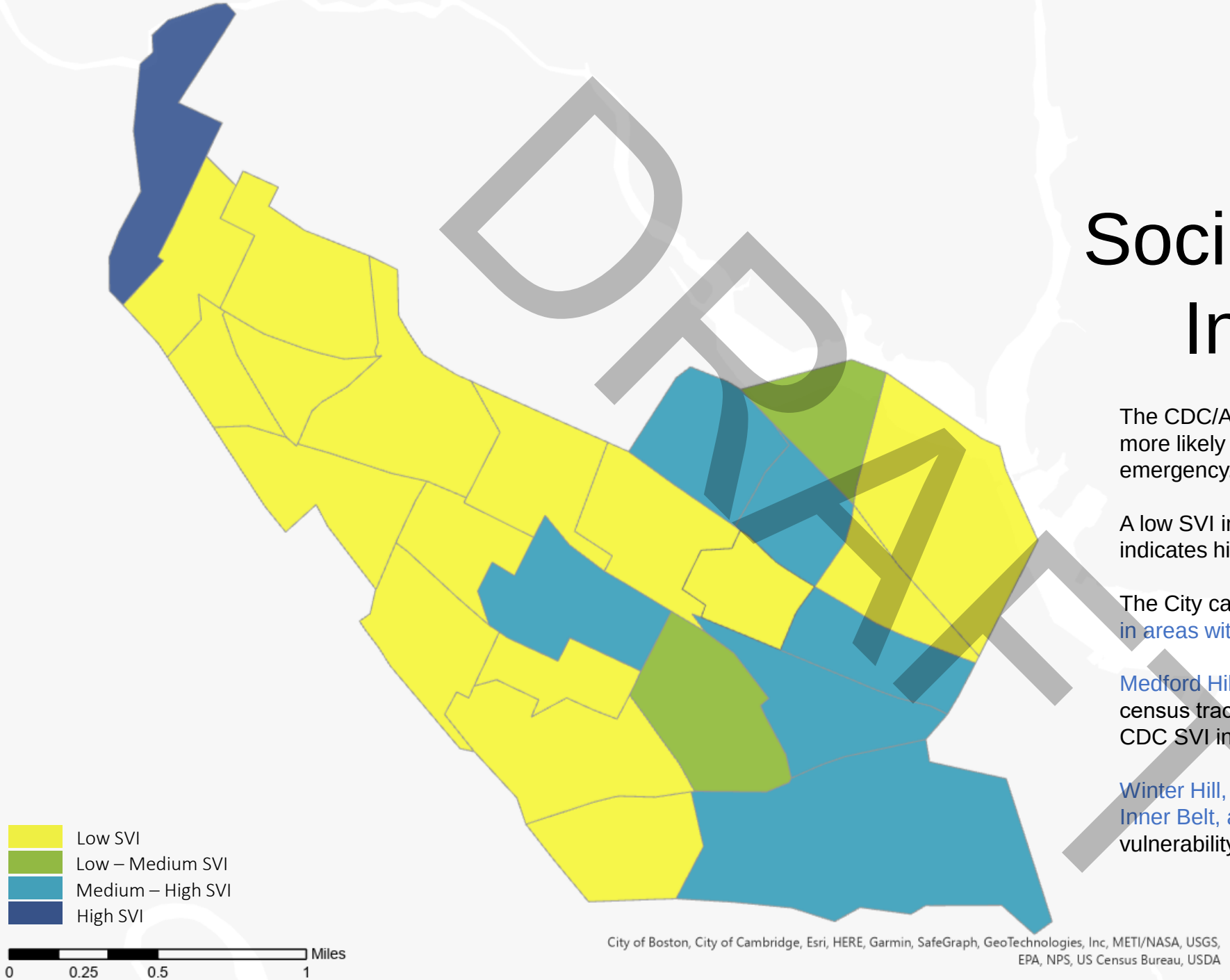
- Police
- Fire
- Long Term Care Facility
- Care Facility (Other)
- Community Organization
- Public Housing

0 0.25 0.5 1 Miles

Social Vulnerability



CDC/ATSDR

Social Vulnerability Index (National)

The CDC/ATSDR SVI helps identify communities that are more likely to need support before, during, and after an emergency.

A low SVI indicates lower social vulnerability. A high SVI indicates higher social vulnerability.

The City can use the CDC SVI to prioritize implementation in areas with higher social vulnerability.

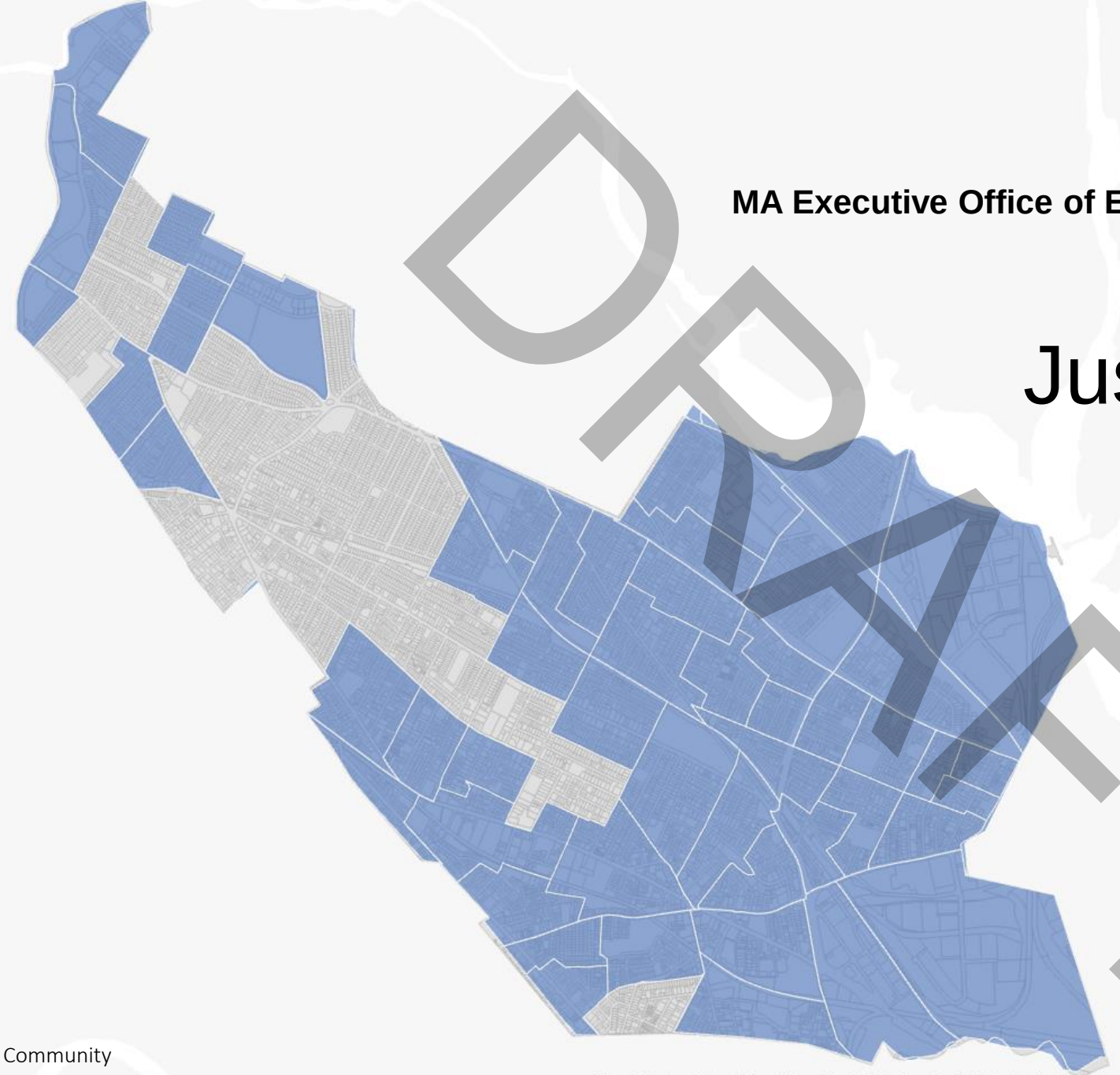
Medford Hillside: Census Tract 25017350702 is the only census tract in Somerville with a nationally rated ‘High’ CDC SVI index score.

Winter Hill, East Somerville, Brick Bottom, Boynton Yards, Inner Belt, and Spring Hill have medium-high social vulnerability.

Priority Neighborhoods & Infrastructure Types by Exposure and Relative Social Vulnerability

Social Vulnerability
- Lower SVI
- Medium SVI
- Higher SVI

	Extreme Heat (present)	Coastal Flooding 2030	Coastal Flooding 2050	Coastal Flooding 2070	Stormwater (2070)
Neighborhoods with the Most Exposed Assets (count)	1. Union Square 2. East Somerville 3. Davis Square	1. Assembly Square 2. East Somerville 3. Winter Hill	1. Assembly Square 2. East Somerville 3. Winter Hill	1. Union Square 2. Assembly Square 3. Winter Hill	1. Union Square 2. Assembly Square 3. Winter Hill
Infrastructure Types with the Most Exposed Assets (count)	1. Social Infrastructure 2. Food 3. Critical Facilities	1. Medical Facilities 2. Food 3. Transportation	1. Medical Facilities 2. Social Infrastructure 3. Food	1. Social Infrastructure 2. Food 3. Public Housing	1. Food 2. Social Infrastructure 3. Public Housing



MA Executive Office of Energy and Environmental Affairs (EEA)

Environmental Justice Populations

MA 2020 Environmental Justice (EJ) Populations are 2020 Census block groups across the state that meet one or more criteria pertaining to income level, English language proficiency, and self-identified race.

Much of Somerville meets the EEA criteria for an EJ community, notably Medford Hillside, Winter Hill, Assembly, East Somerville, Brick Bottom, Boynton Yards, Inner Belt, and Spring Hill, Union Square, and Ward Two.

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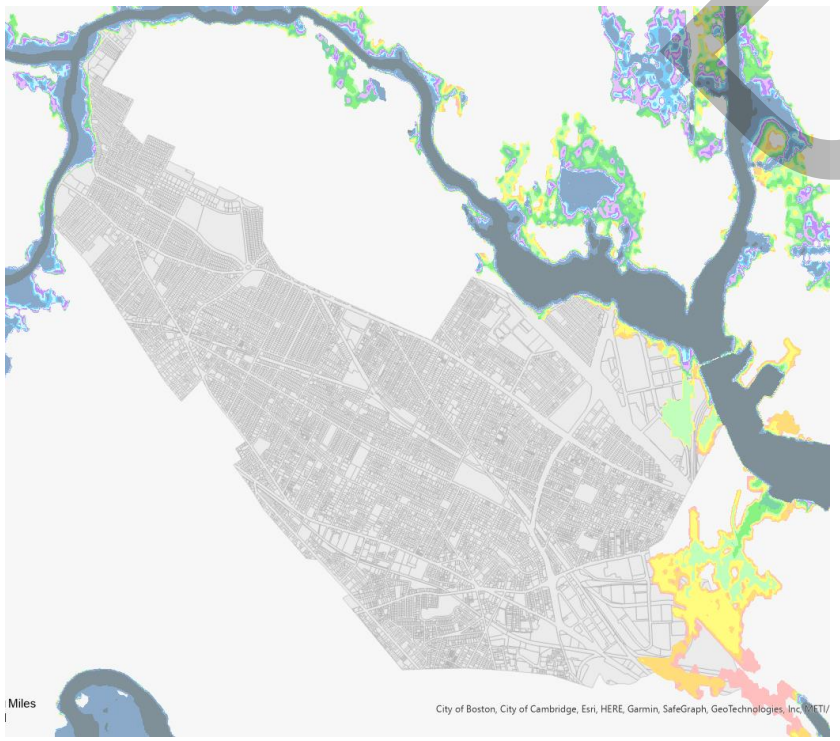
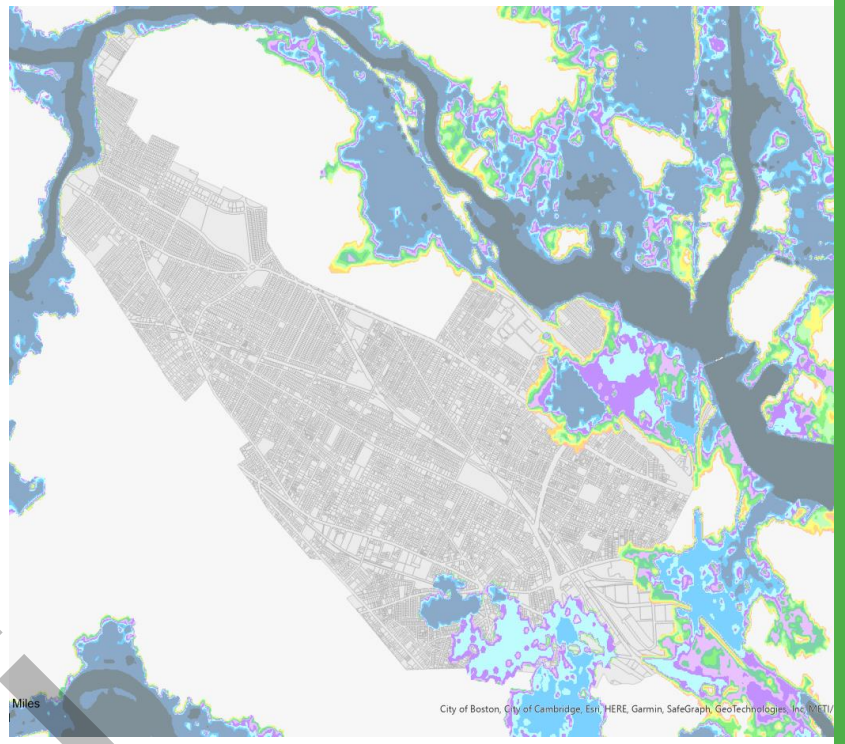
Coastal Flooding

100-year Coastal Flood Depths

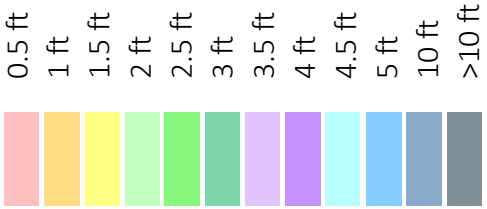


2030

2050



2070



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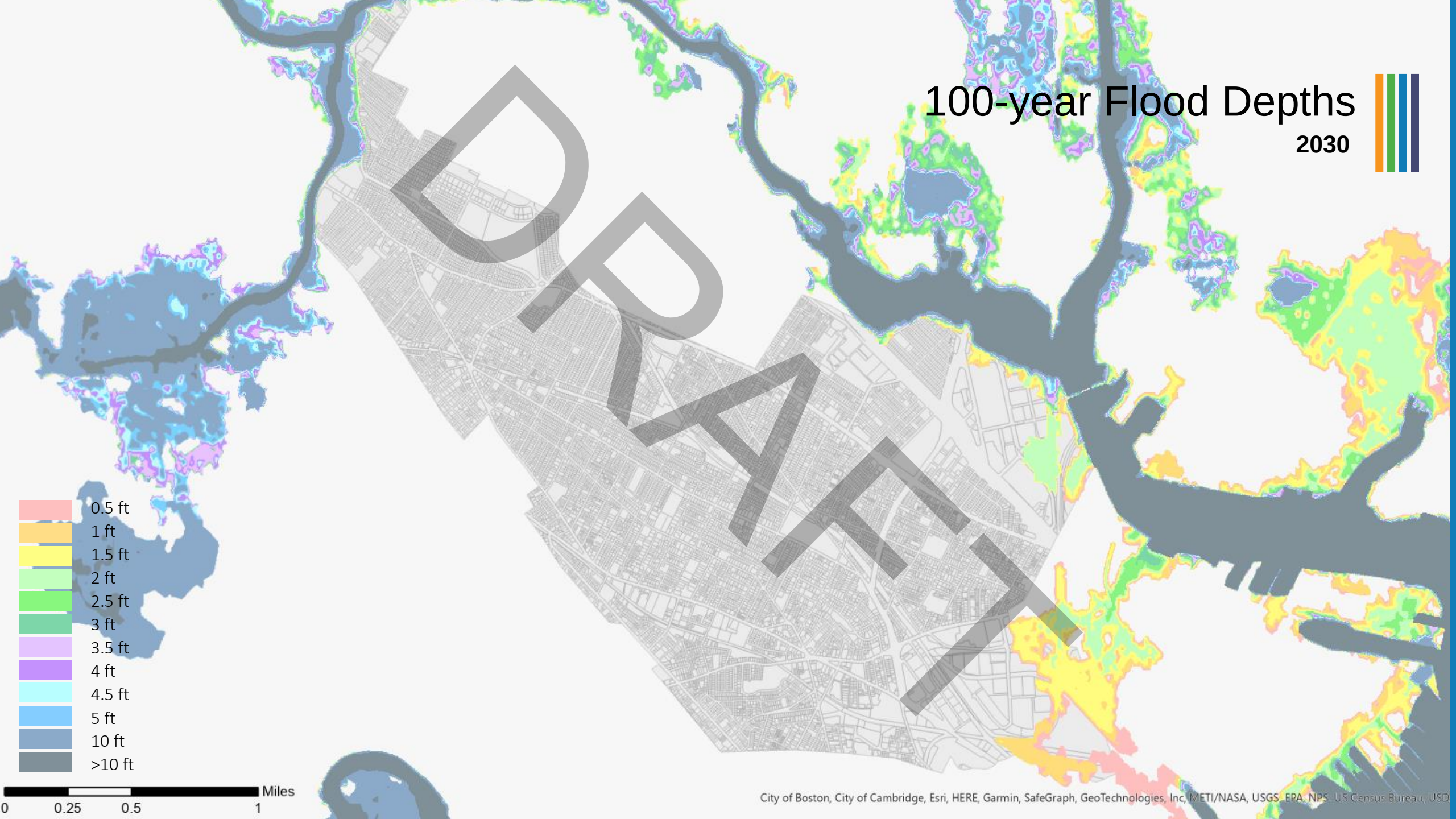
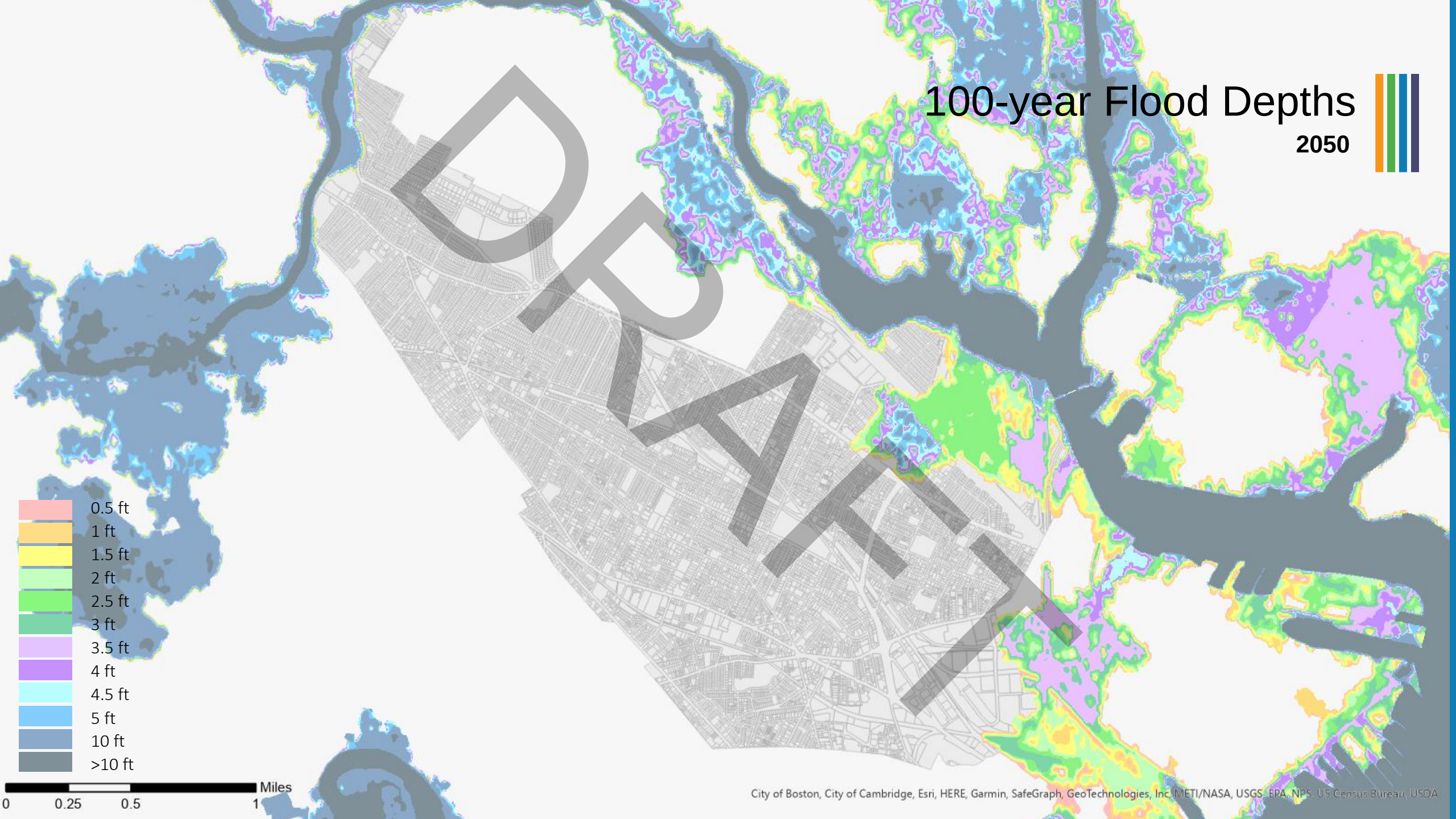
100-year Flood Depths

2030



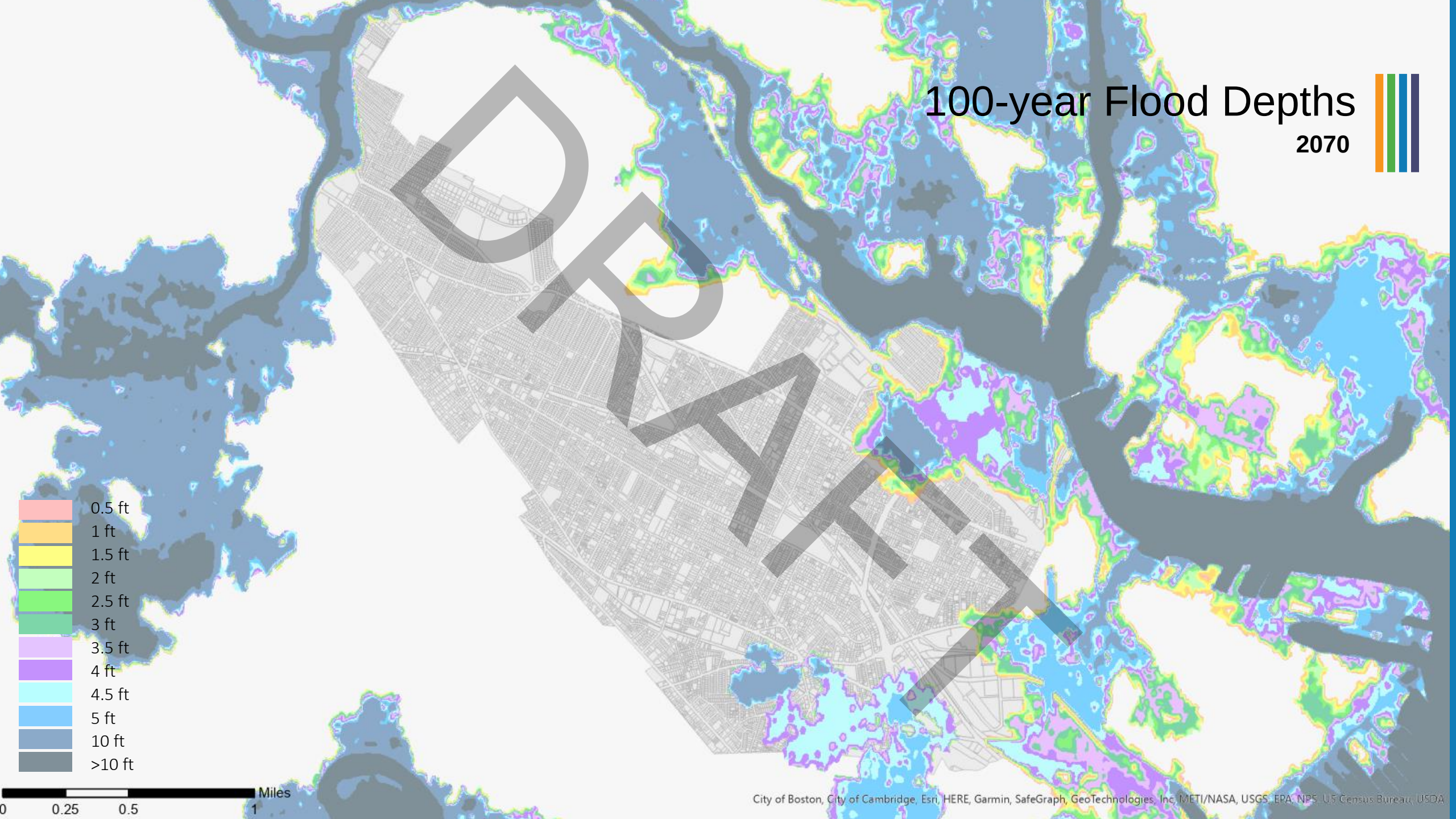
100-year Flood Depths

2050



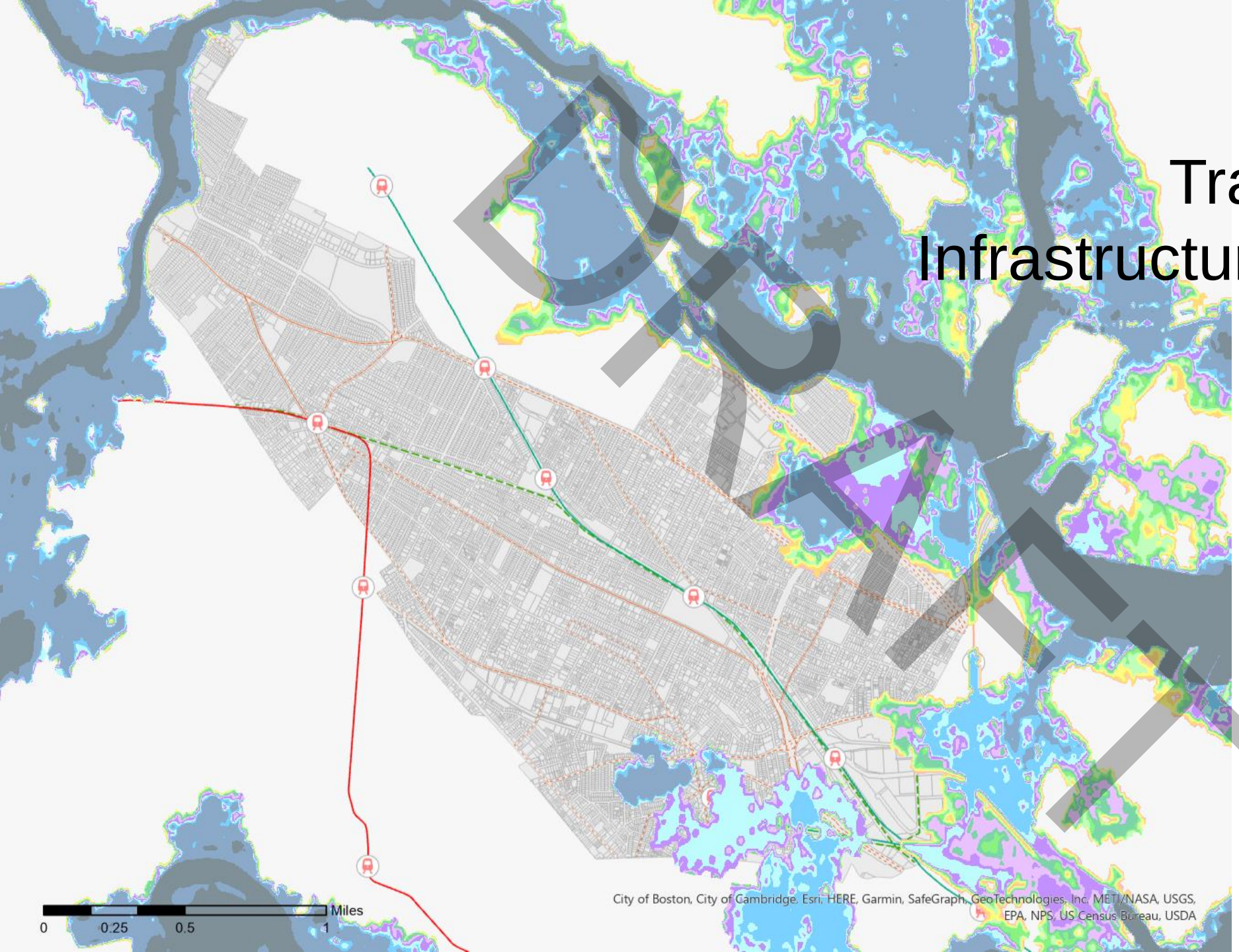
100-year Flood Depths

2070



2070 100-year

Transportation Infrastructure Exposure



- 0.5 ft
- 1 ft
- 1.5 ft
- 2 ft
- 2.5 ft
- 3 ft
- 3.5 ft
- 4 ft
- 4.5 ft
- 5 ft
- 10 ft
- >10 ft

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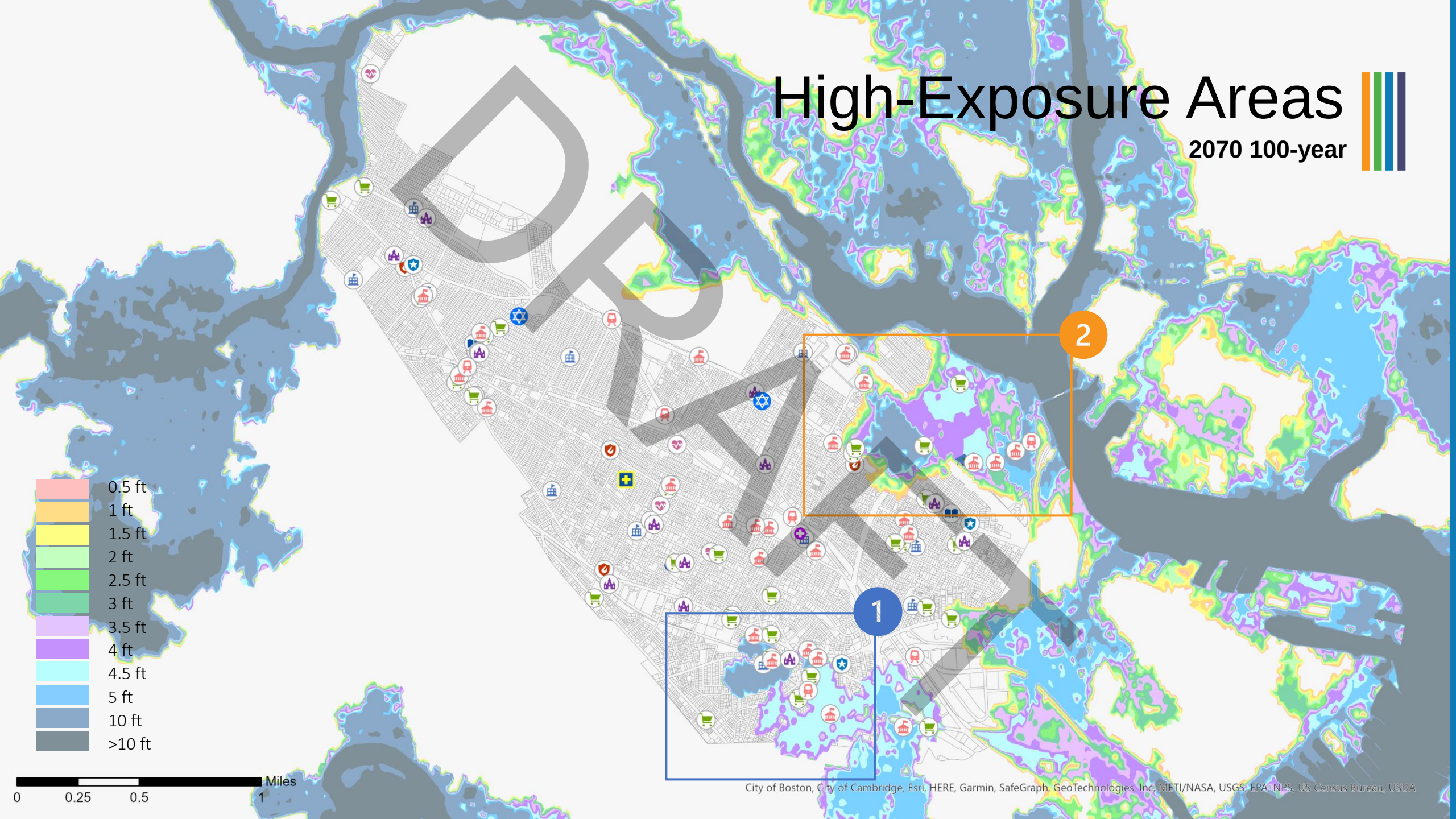
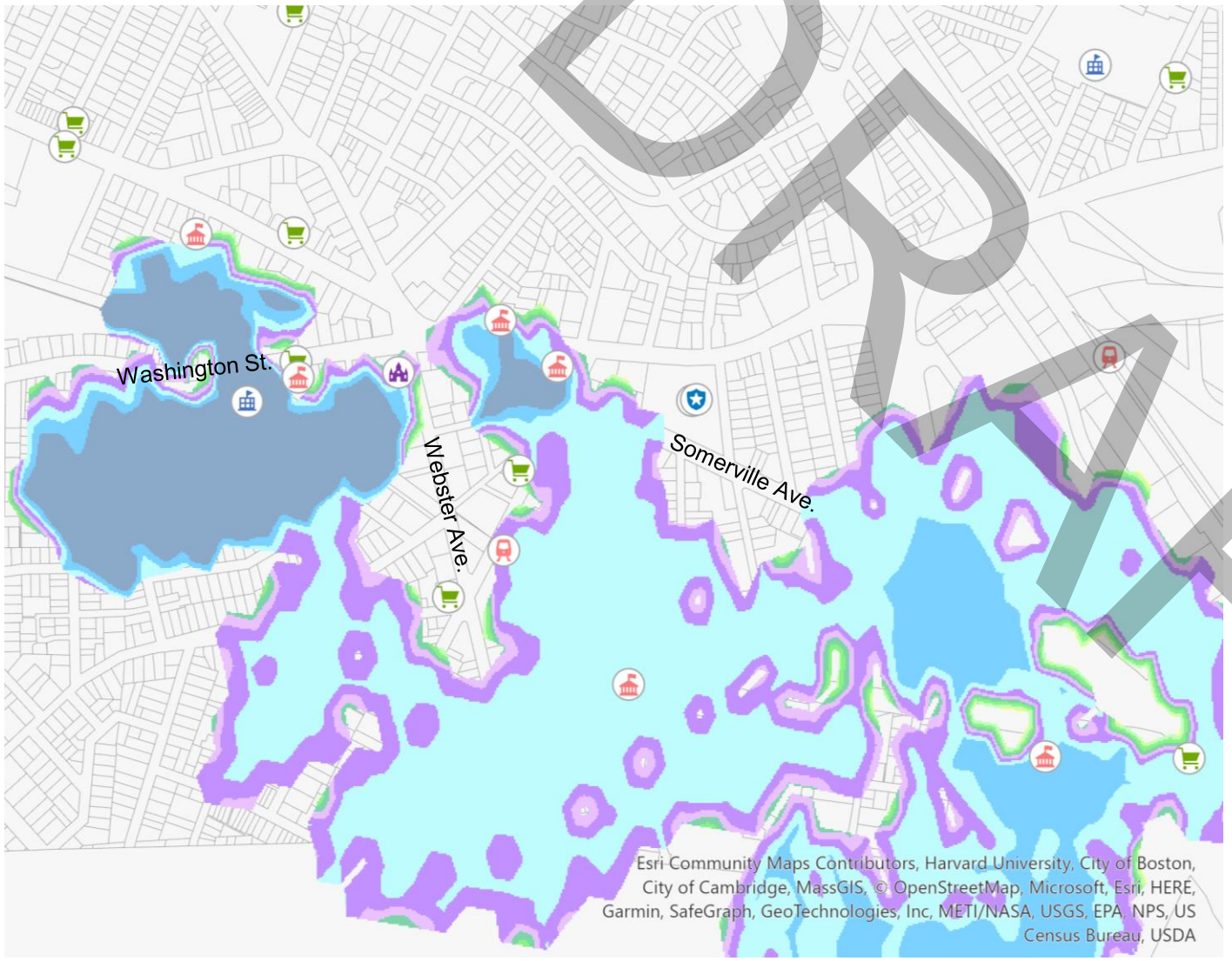
High-Exposure Areas

2070 100-year



Union Square

2070 100-year



- New flood path will extend into Union Square from Cambridge.
- Up to 10 ft. of inundation anticipated.
- Police and fire Stations, shelters, community organizations, and public housing units will be exposed.

0.5 ft
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3 ft
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10 ft
>10 ft

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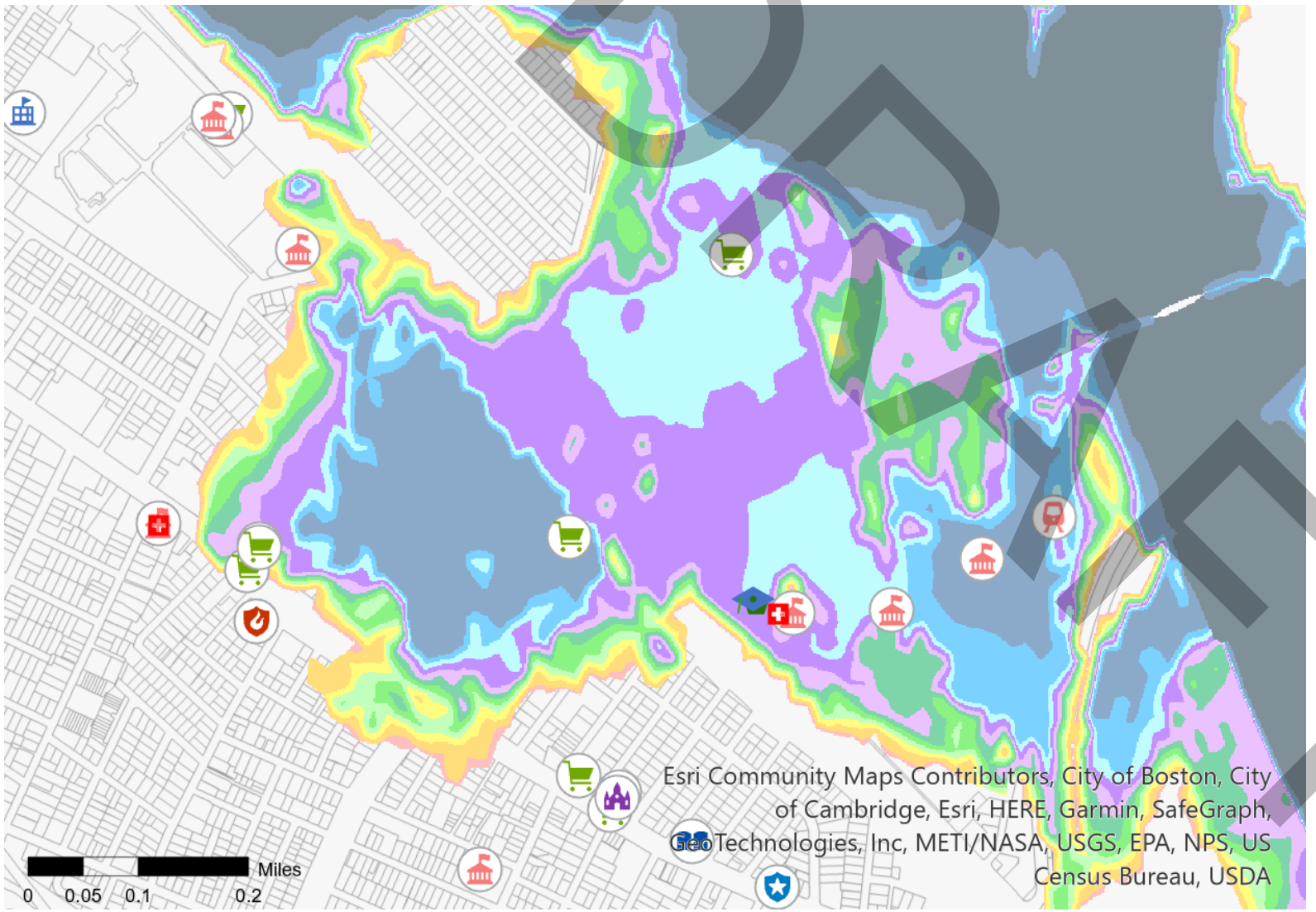
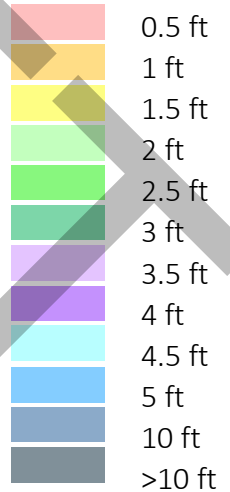
Assembly Square

2070 100-year





- Up to 10 ft. of inundation anticipated.
- Transportation, food, healthcare, community organizations, and education facilities will be affected.

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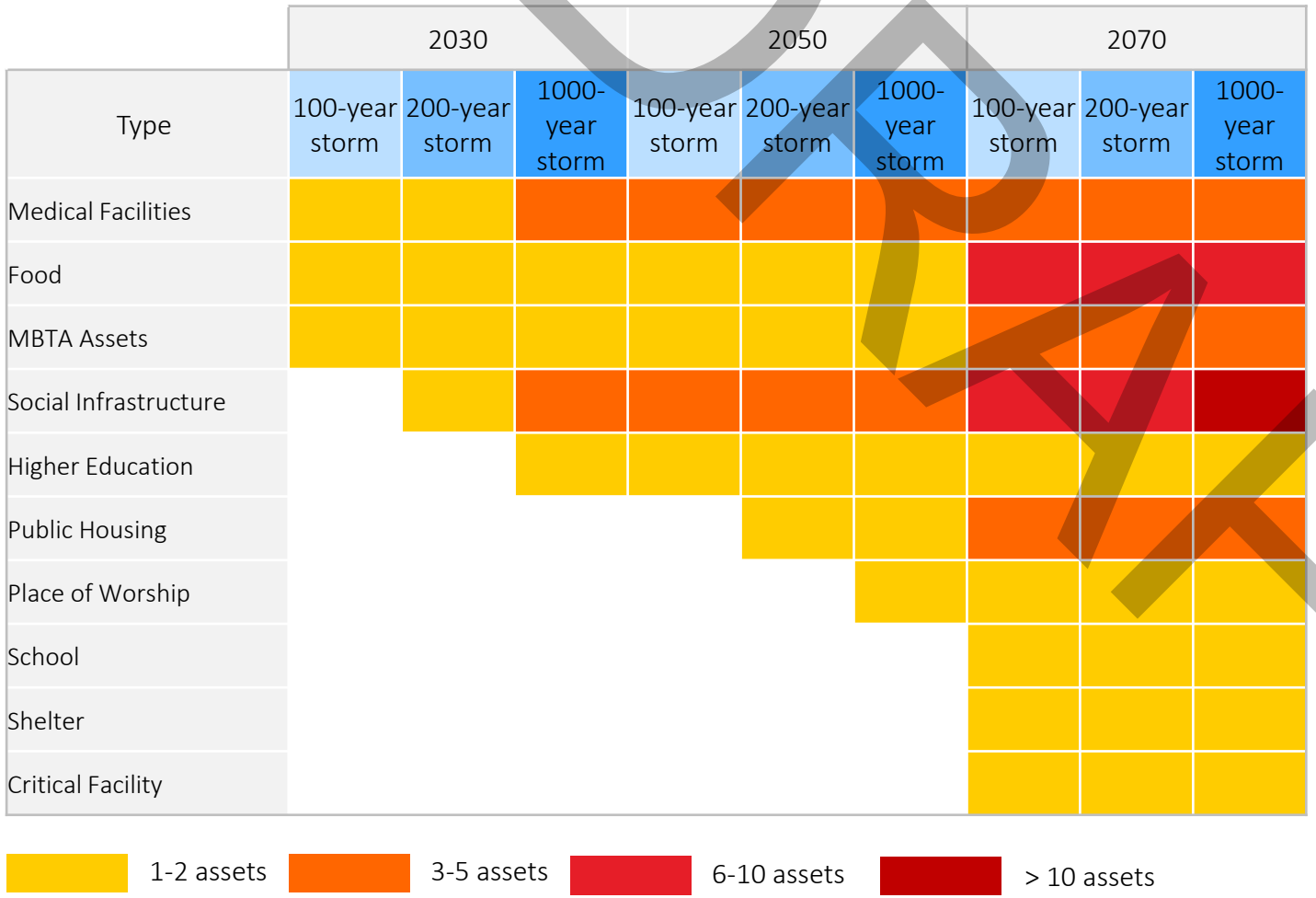
Coastal Flooding Asset Exposure Matrix

Exposure Count by Infrastructure Type



- Number of exposed critical infrastructure assets will more than double by 2070.
- Social infrastructure, food resources, and medical facilities will be most exposed.

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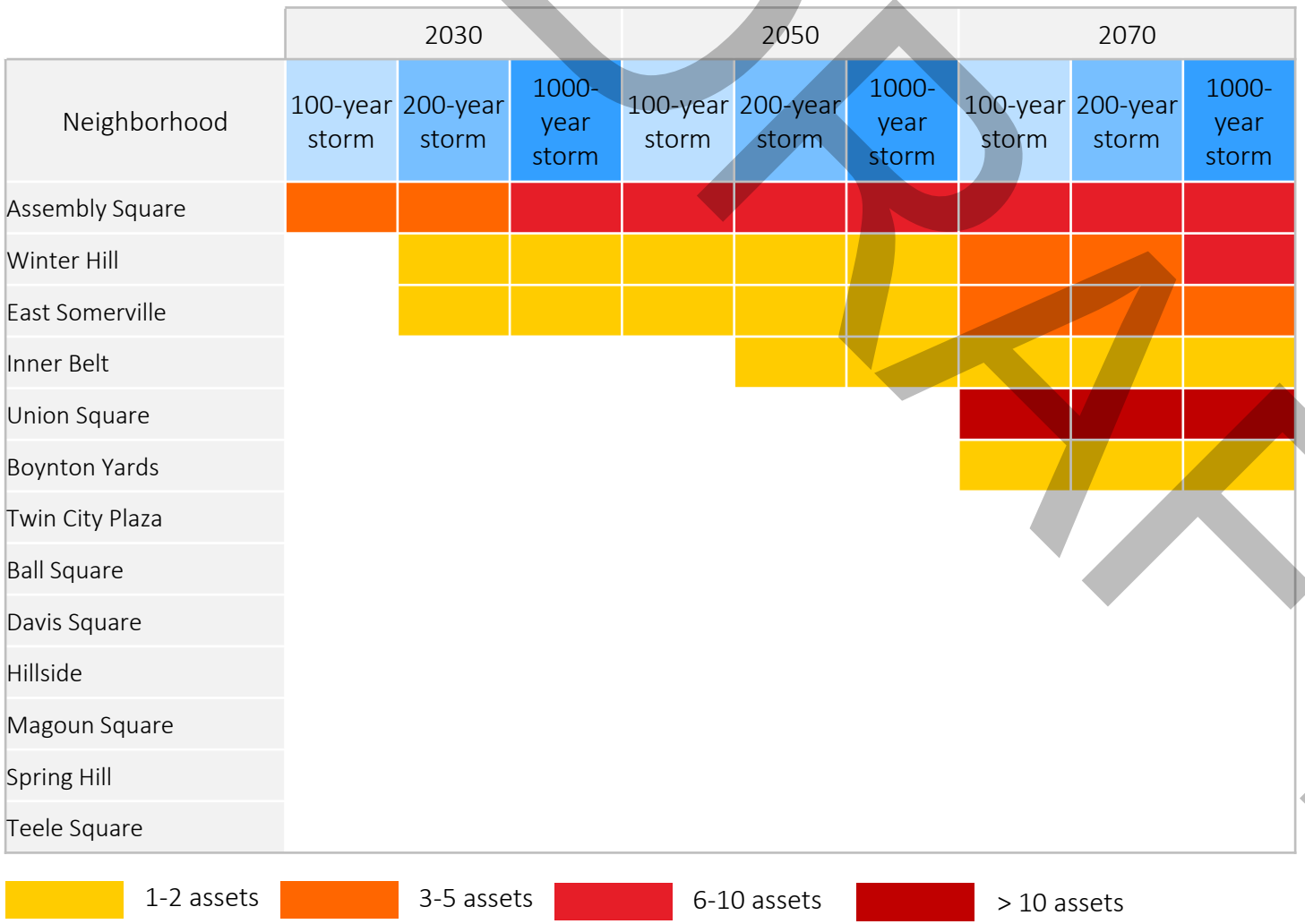
Coastal Flooding Asset Exposure Matrix

Exposure Count by Neighborhood



- Assembly Square, East Somerville, and Winter Hill will experience coastal flooding impacts as early as 2030.
- By 2070, a new flood path will extend into Union Square.

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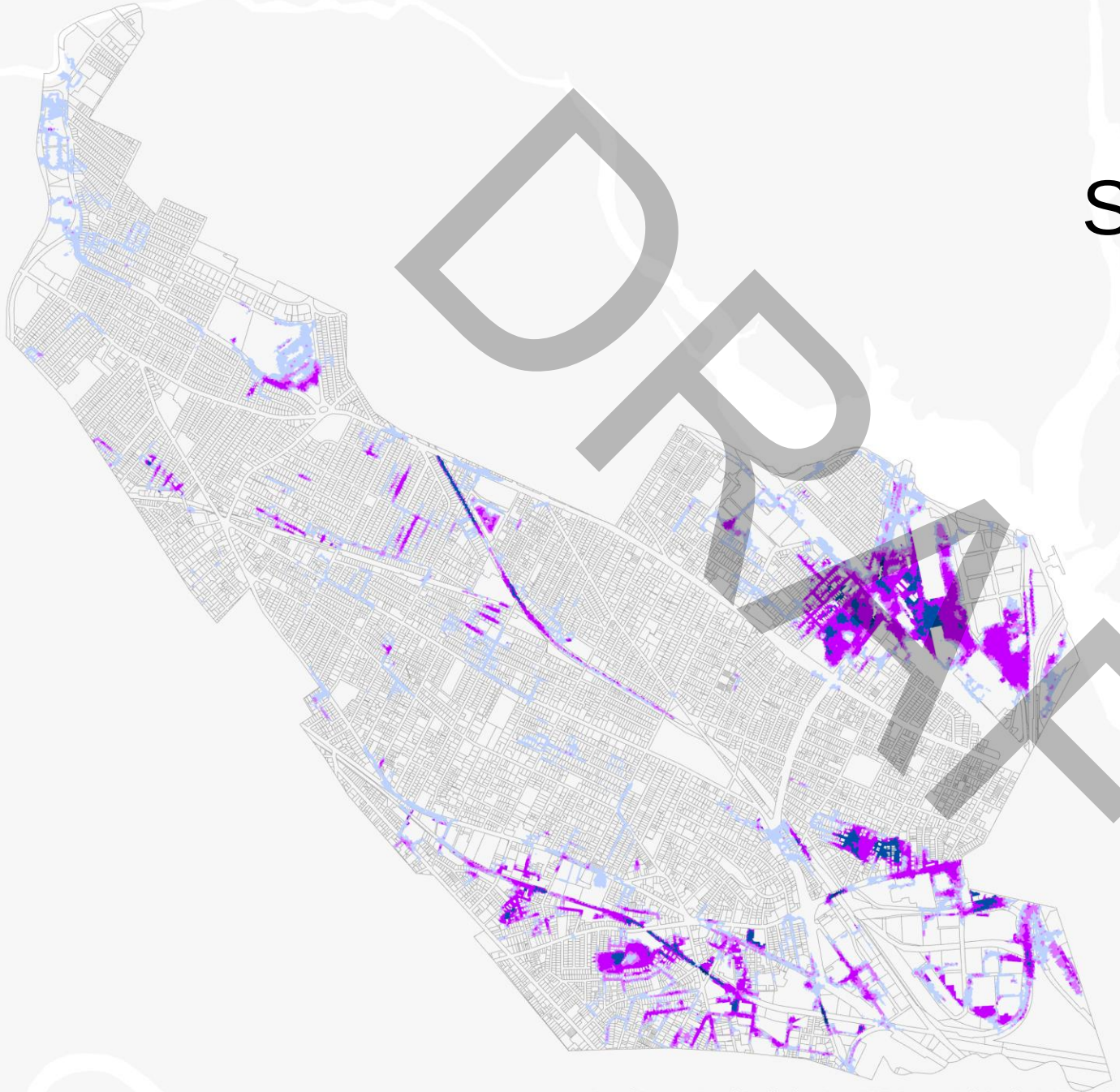
Stormwater Flooding

Stormwater Depths

2030 10-year, 24-hour



DRAFT

- 0.5 ft
- 1 ft
- 2.5 ft
- 5 ft
- 10 ft

Miles
0 0.25 0.5 1

City of Boston, City of Cambridge, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

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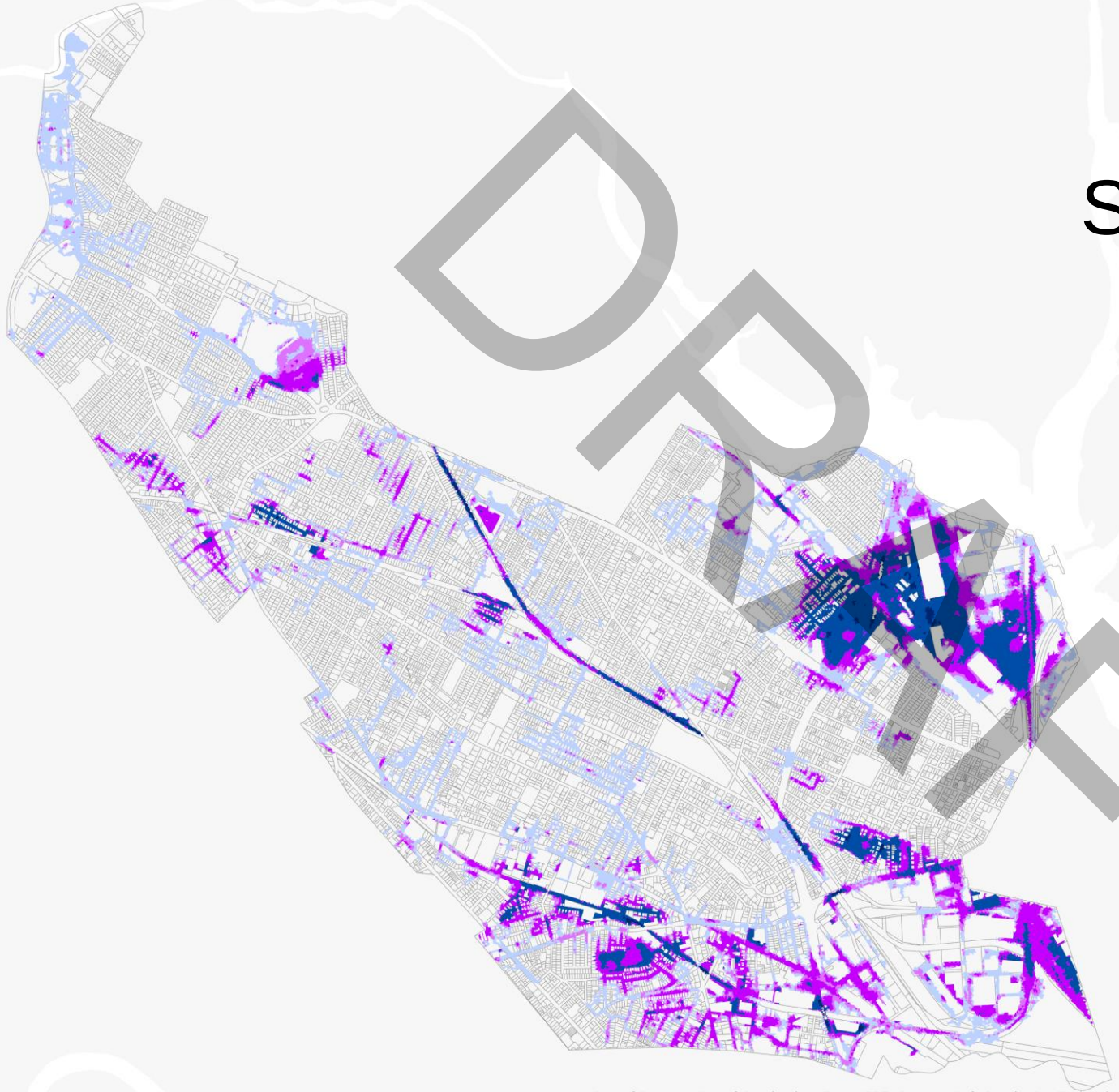
Stormwater Depths

2070 100-year, 24-hour



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2.5 ft
5 ft
10 ft

0 0.25 0.5 1 Miles

City of Boston, City of Cambridge, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

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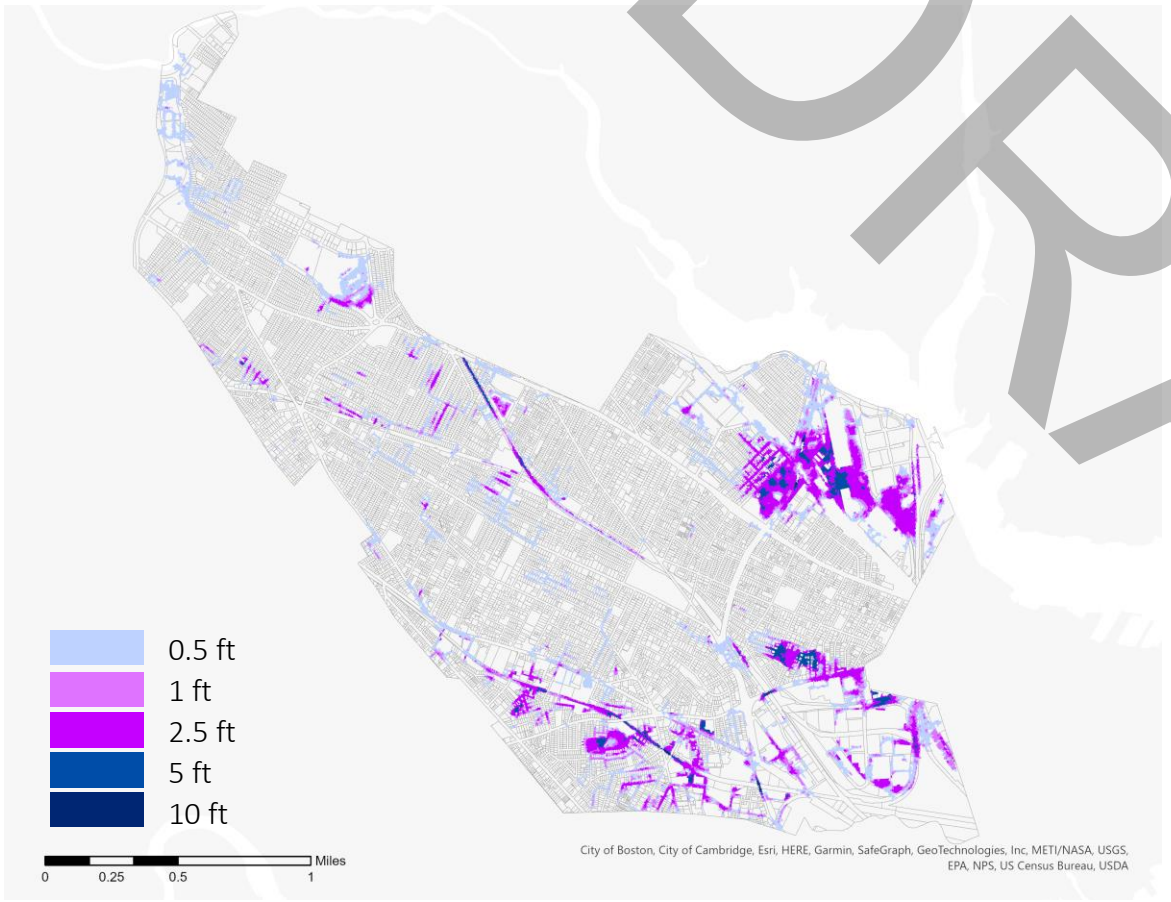
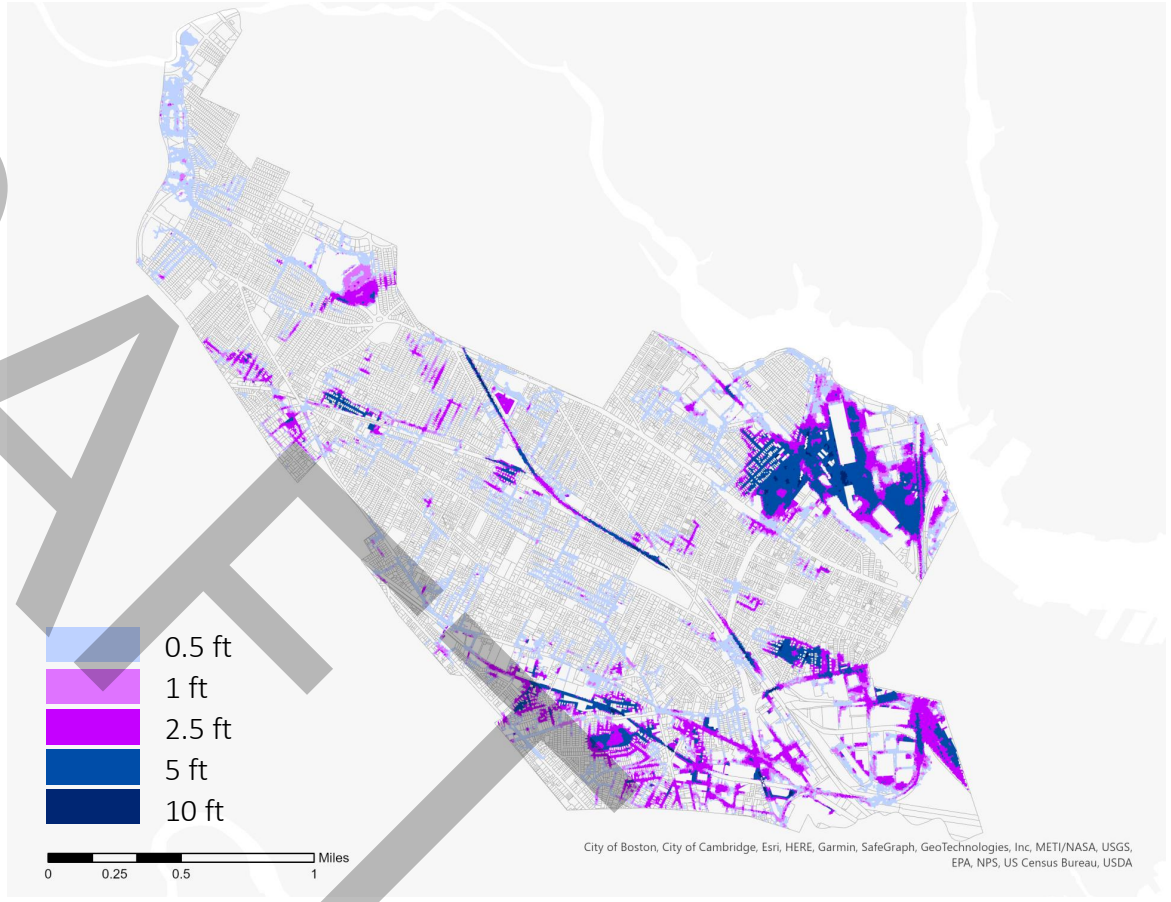
Stormwater Flood Depths

24-hour Storm Event



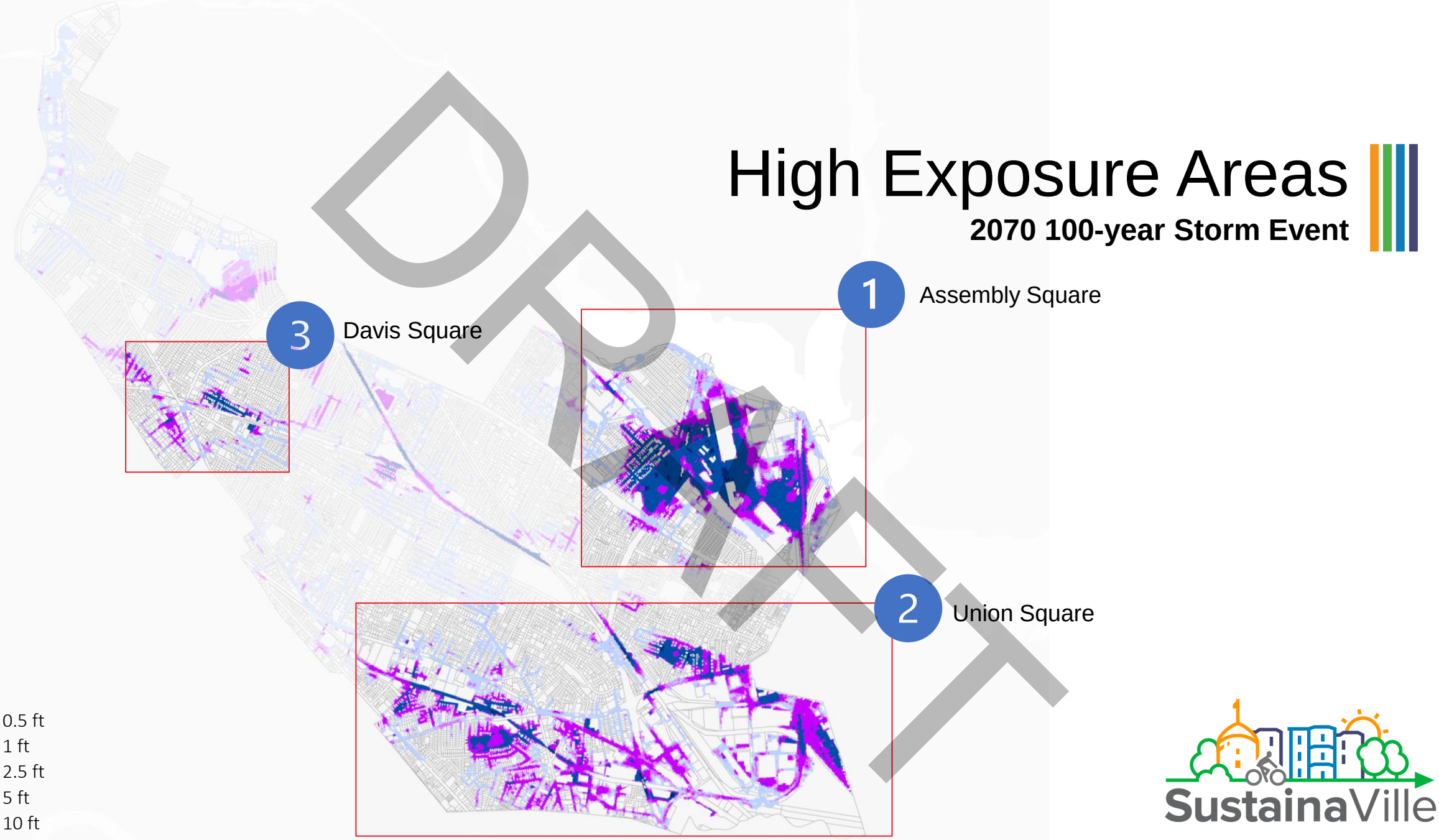
2030 (10-year)



2070 (100-year)

High Exposure Areas

2070 100-year Storm Event



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Assembly

Stormwater Depths
2070 100-year Storm Event

- Anticipated depths greater than 5ft.
- Exposed healthcare facilities.
- Exposed to both coastal and stormwater flooding.

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Union Square

Stormwater Depths

2070 100-year Storm Event

- Critical facilities previously identified to experience stormwater inundation (2017) are anticipated to experience greater depths.
- Anticipated depths greater than 5ft.
- Significant critical facilities, community organizations, and residential exposure.

0.5 ft
1 ft
2.5 ft
5 ft
10 ft

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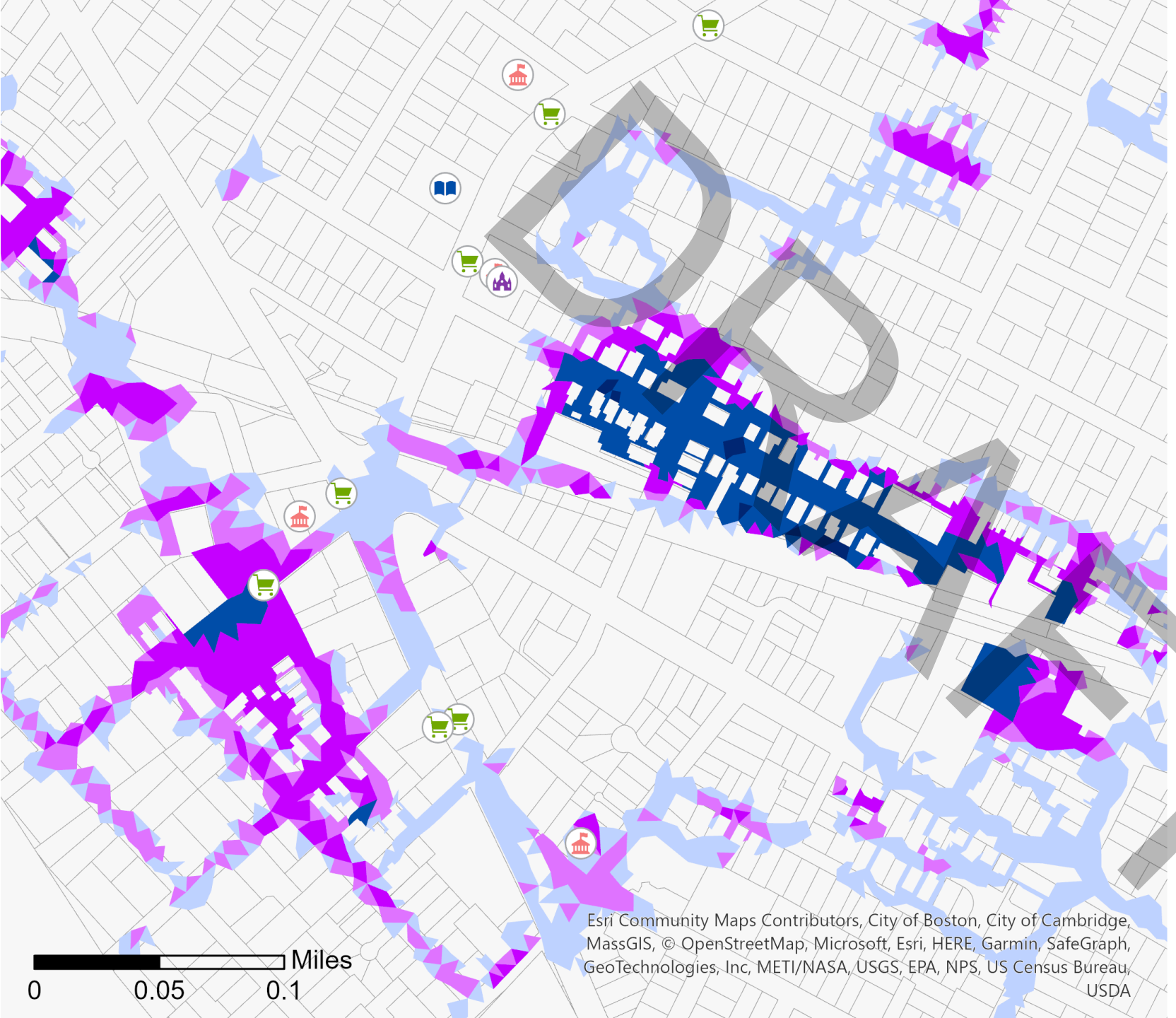

Davis Square

Stormwater Depths 2070 100-year Storm Event

- Concentration of exposed food resources.
- Depths will increase to greater than 5ft. by 2070.

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Stormwater Flooding Asset Exposure Matrix

Exposure Count by Infrastructure Type and Neighborhood

Type	2030, 10-year	2070, 100-year
Food	> 10 assets	> 10 assets
Social Infrastructure	> 10 assets	> 10 assets
Critical Facility	3-5 assets	3-5 assets
Place of Worship	3-5 assets	3-5 assets
Public Housing	3-5 assets	3-5 assets
Medical Facilities	1-2 assets	3-5 assets
Higher Education	1-2 assets	1-2 assets
MBTA Assets	1-2 assets	1-2 assets
School	1-2 assets	1-2 assets
Shelter	1-2 assets	1-2 assets

Neighborhood	2030, 10-year	2070, 100-year
Union Square	> 10 assets	> 10 assets
Assembly Square	6-10 assets	6-10 assets
Winter Hill	3-5 assets	6-10 assets
East Somerville	3-5 assets	3-5 assets
Spring Hill	3-5 assets	3-5 assets
Inner Belt	1-2 assets	1-2 assets
Ball Square	1-2 assets	1-2 assets
Hillside	1-2 assets	1-2 assets
Twin City Plaza	1-2 assets	1-2 assets
Boynton Yards		1-2 assets
Davis Square		1-2 assets
Magoun Square		
Teele Square		

1-2 assets 3-5 assets 6-10 assets > 10 assets

Greatest Infrastructure Exposure:

1. Food Resources
2. Social Infrastructure
3. Public Housing

Greatest Neighborhood Exposure:

1. Union Square
2. Assembly Square
3. Winter Hill

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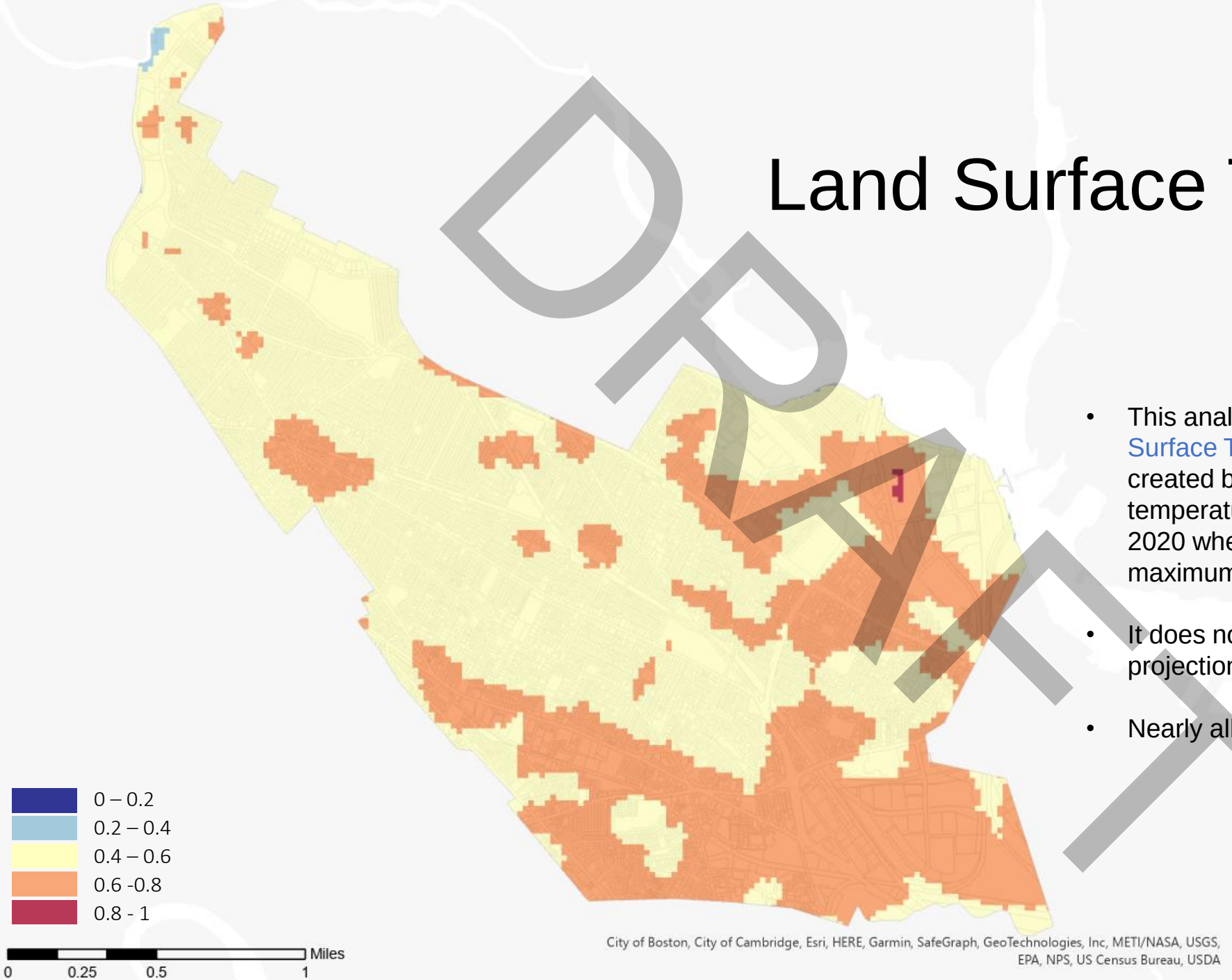
Heat

Land Surface Temperature (LST) Index



- This analysis utilized the MAPC's Land Surface Temperature (LST) Index which was created by combining estimates of surface temperature from days in 2018, 2019, and 2020 where the daily air temperature maximum exceeded 70 degrees Fahrenheit.
- It does not incorporate future climate projections.
- Nearly all the city has moderate to high LST.

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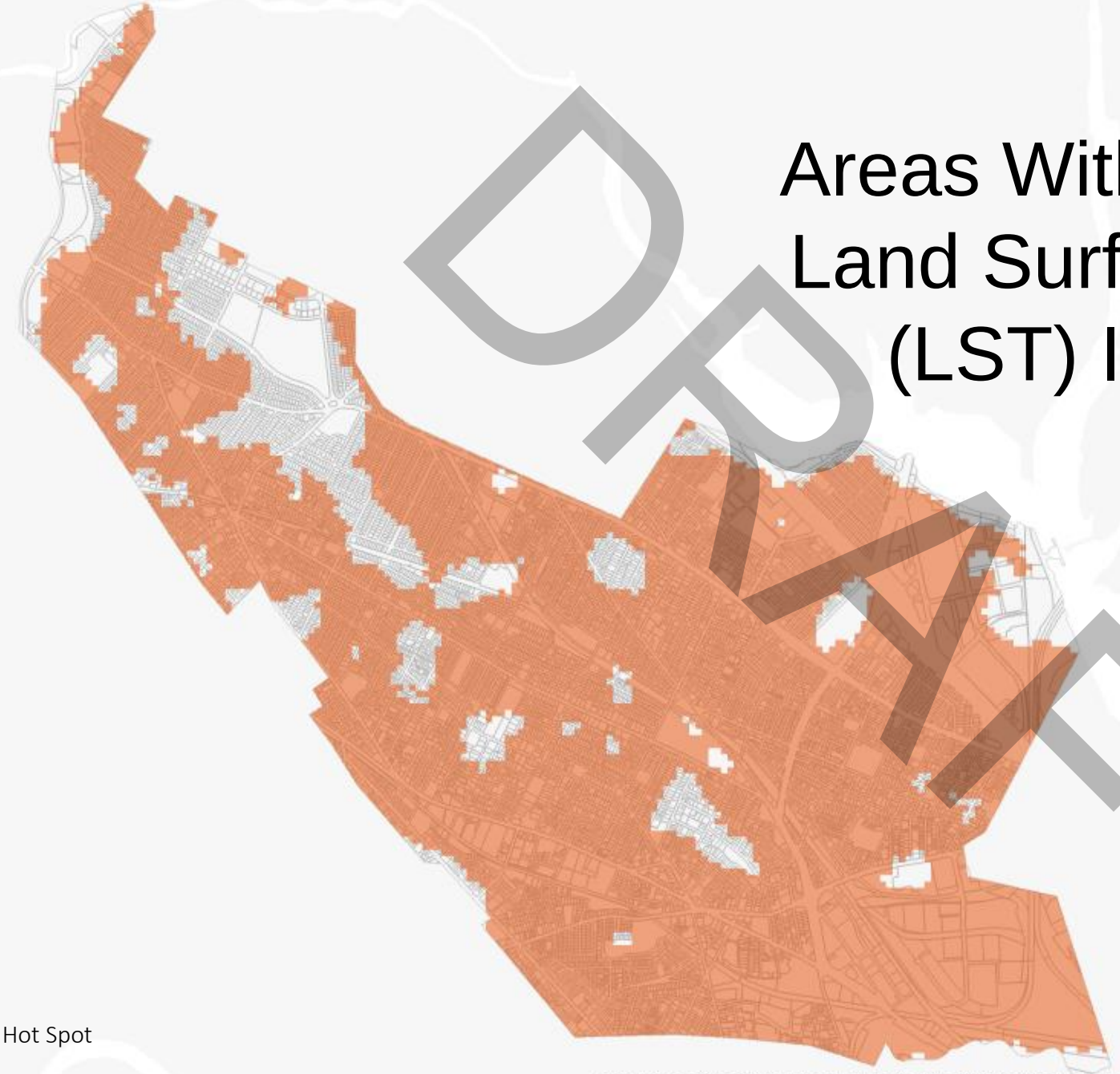
Areas With the Highest 5% Land Surface Temperature (LST) Index (Statewide)



- 'Hot Spots' are areas with the highest 5% of LST indices across the State.
- 82.3% of Somerville is considered a hot spot. This means nearly 4/5th of Somerville is within the 95th percentile of LST Index across the state.

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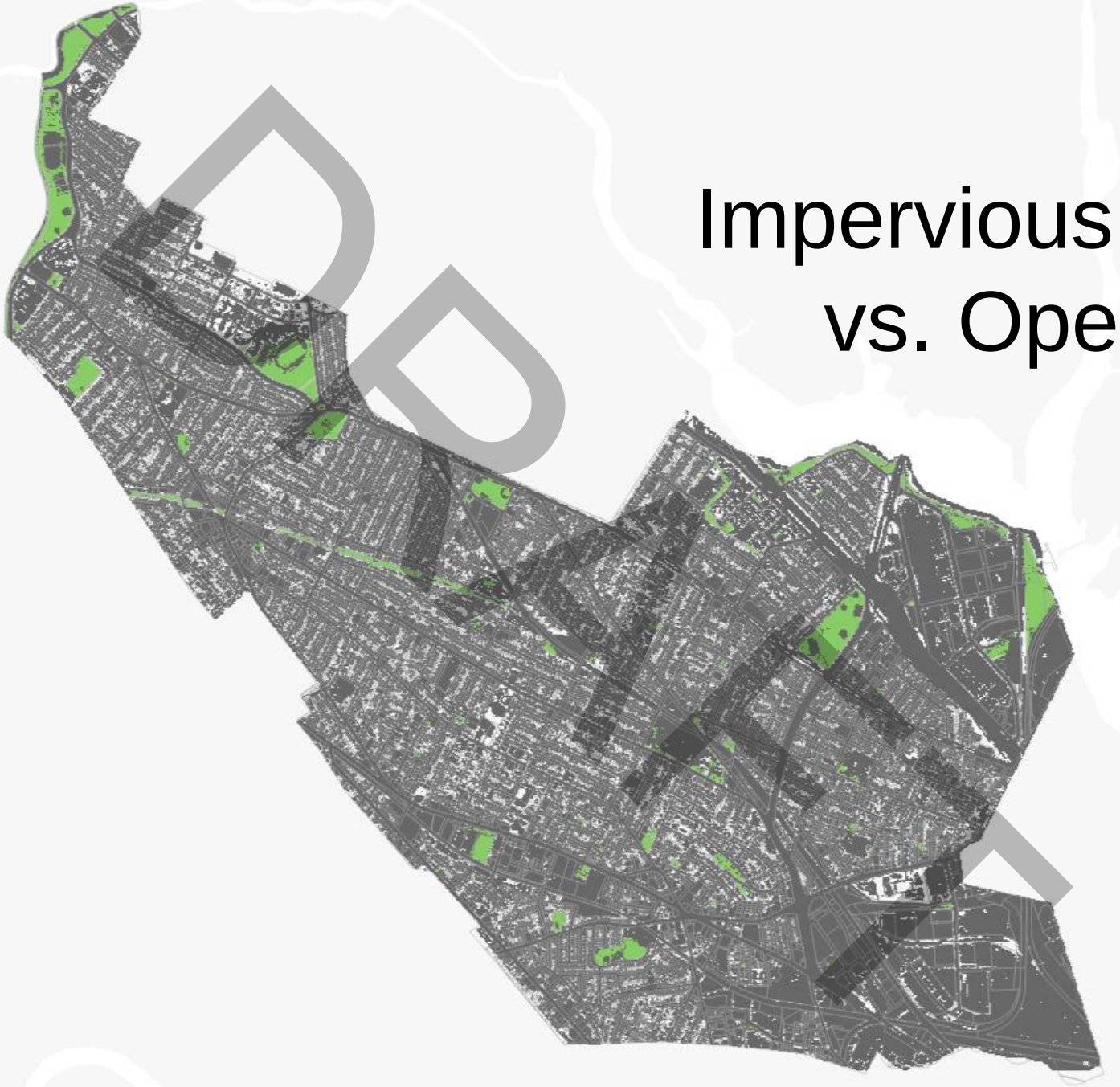
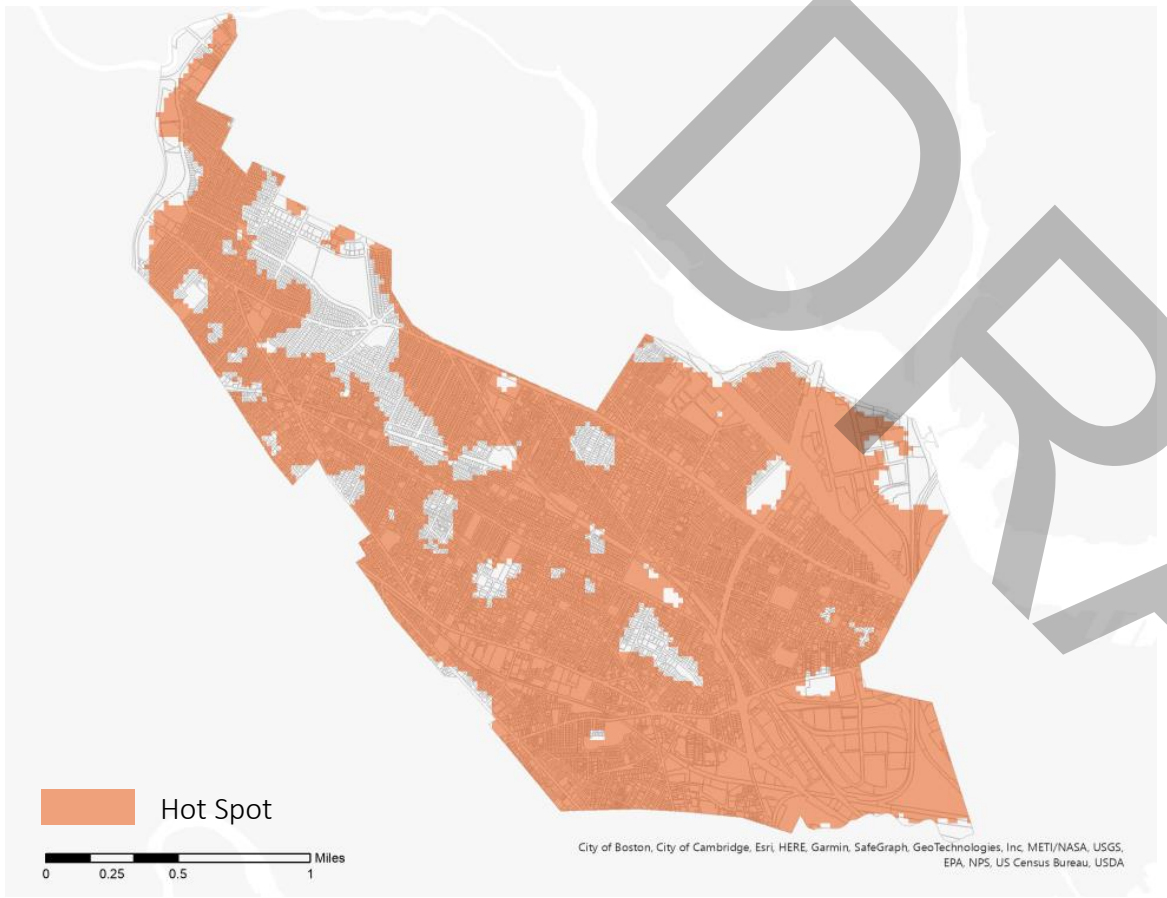
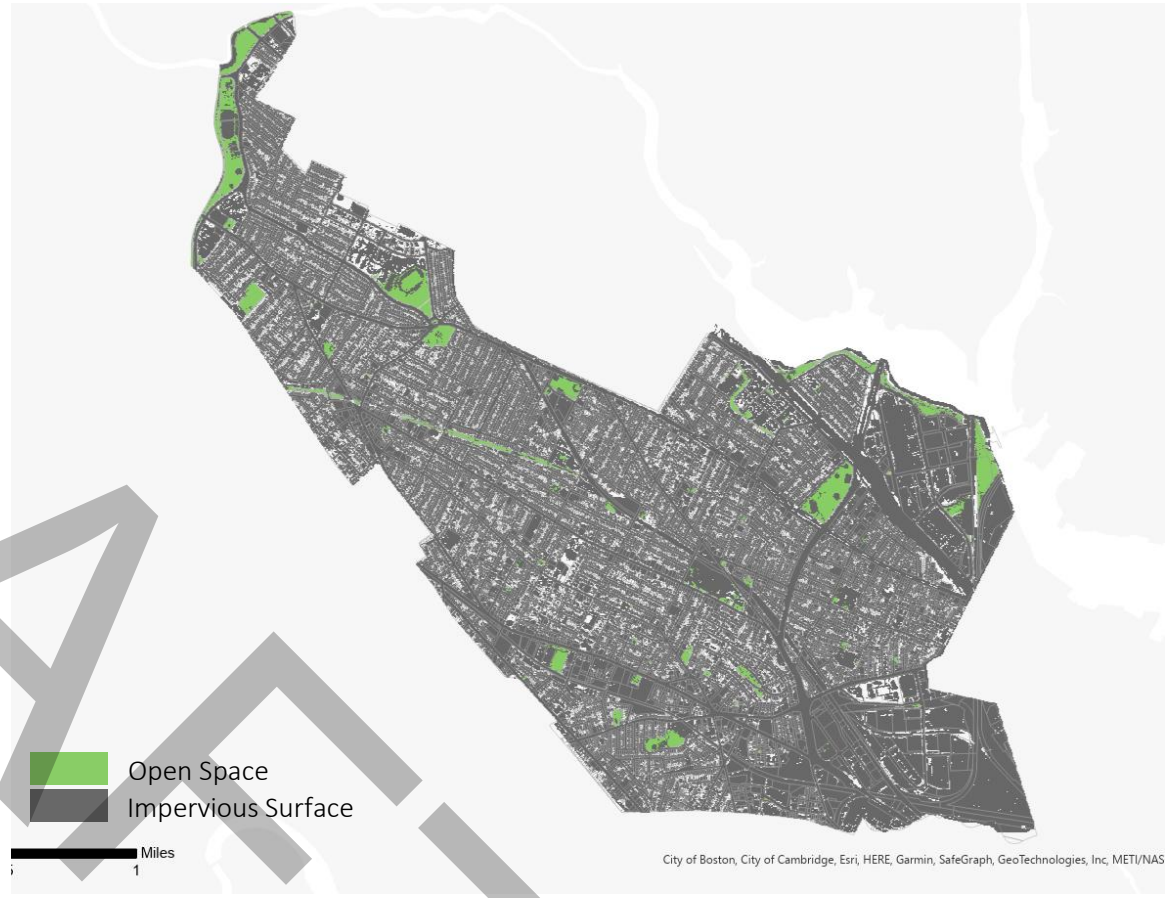
Impervious Surface vs. Open Space



Open Space
Impervious Surface

0 0.25 0.5 1 Miles





Top 5% of Land Surface Temperature Indices State-wide

Open Space and Impervious Surface

- Impervious surfaces, like concrete and asphalt, contribute to the urban heat island effect by absorbing and storing more heat from the sun compared to natural surfaces like green spaces or tree cover.
- Neighborhoods and assets with higher LST indices are concentrated in areas with more impervious surface.

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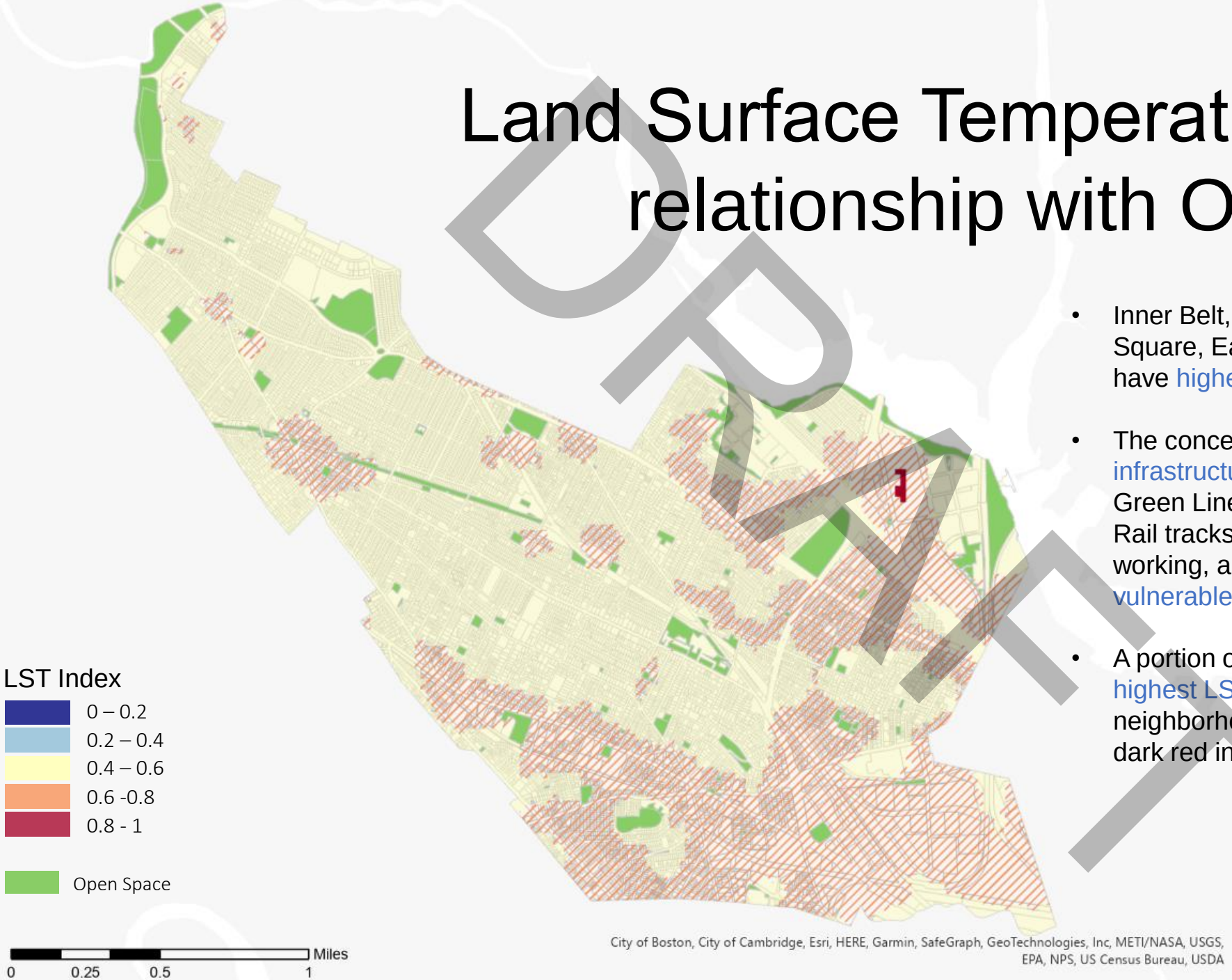
Land Surface Temperature Index's relationship with Open Space



- Inner Belt, Brick Bottom, Twin City Plaza, Union Square, East Somerville, and Assembly Square have higher LST indices and less green space.
- The concentration of paved transportation infrastructure, comprising Routes 1 and I-93, the Green Line Extension, and MBTA Commuter Rail tracks, in Inner Belt makes residents living, working, and commuting nearby particularly vulnerable to heat exposure.
- A portion of Assembly Square maintains the highest LST within the city. It is the only neighborhood with a LST over 0.8 marked by dark red in the map shown below.

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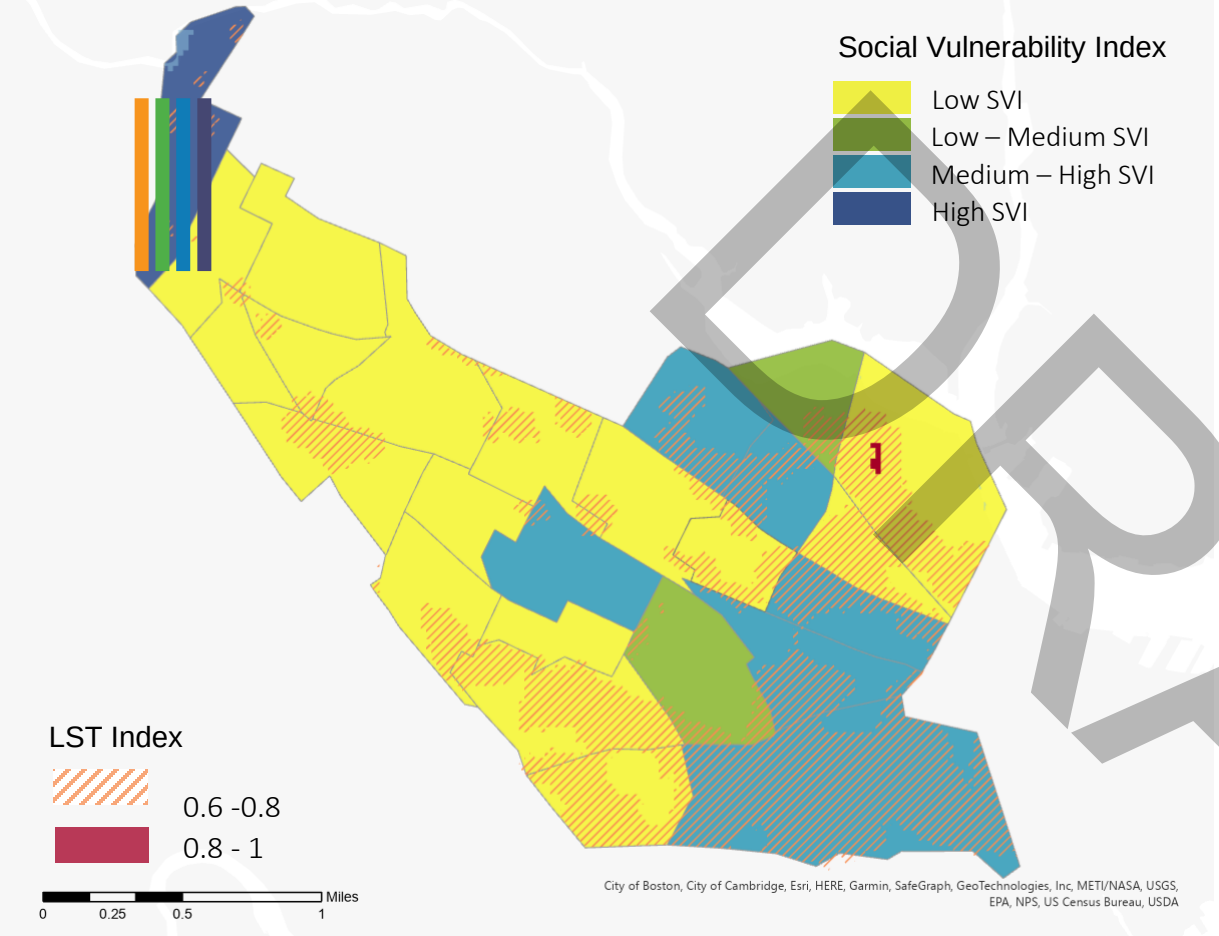

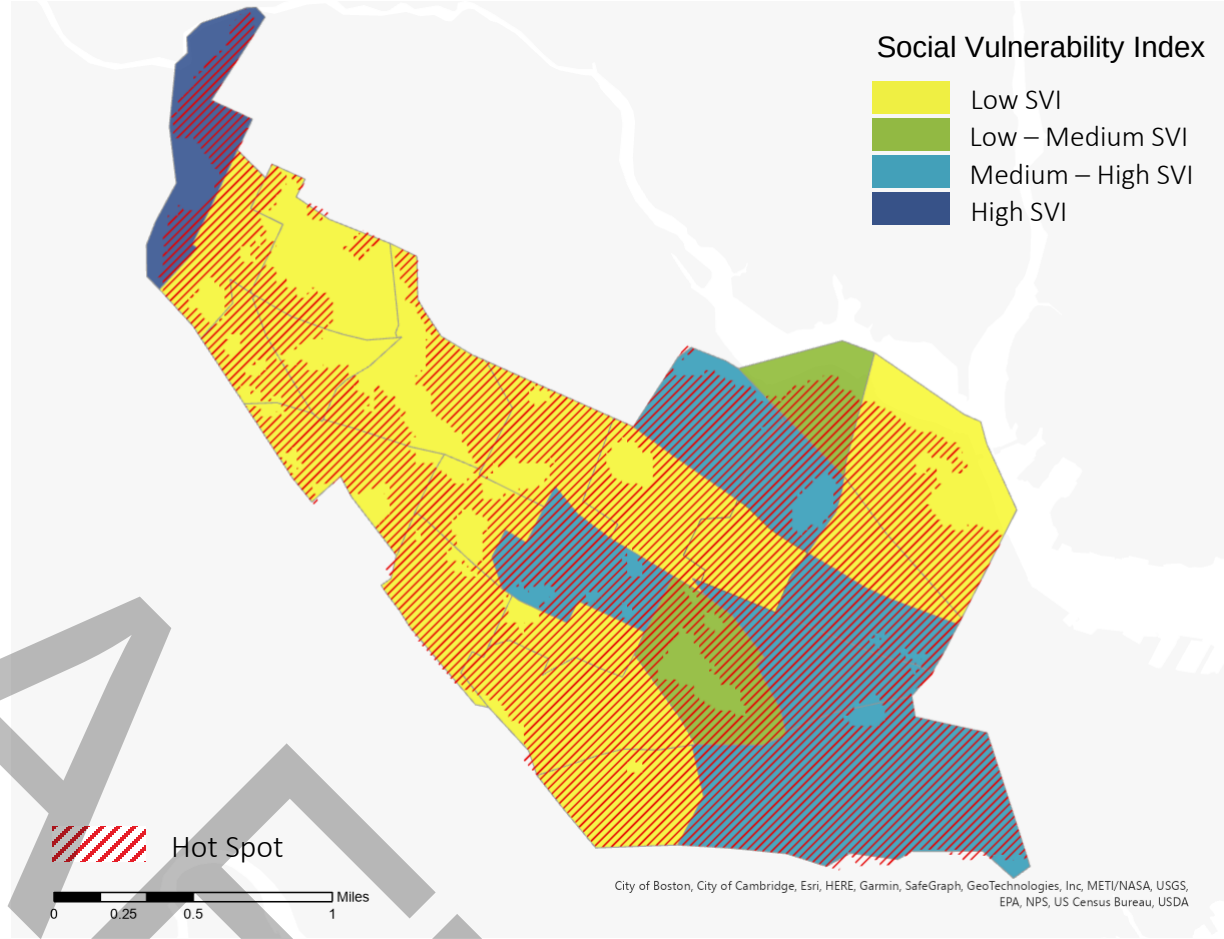

SVI compared to Medium to High LST Index (LST >0.6)

SVI compared to Hot Spots (Top 5% State-wide LST Index)

- Neighborhoods with relatively higher SVIs often overlap with areas with greater heat exposure.
- Neighborhoods such as Brick Bottom, Inner Belt, Twin City Plaza, Union Square, and Winter Hill have relatively higher social vulnerability compared to the city while also being projected to experience higher LST indices.
- Intensified heat disproportionally impacts socially vulnerable populations including those with existing medical conditions, seniors, and those dependent on public transportation.

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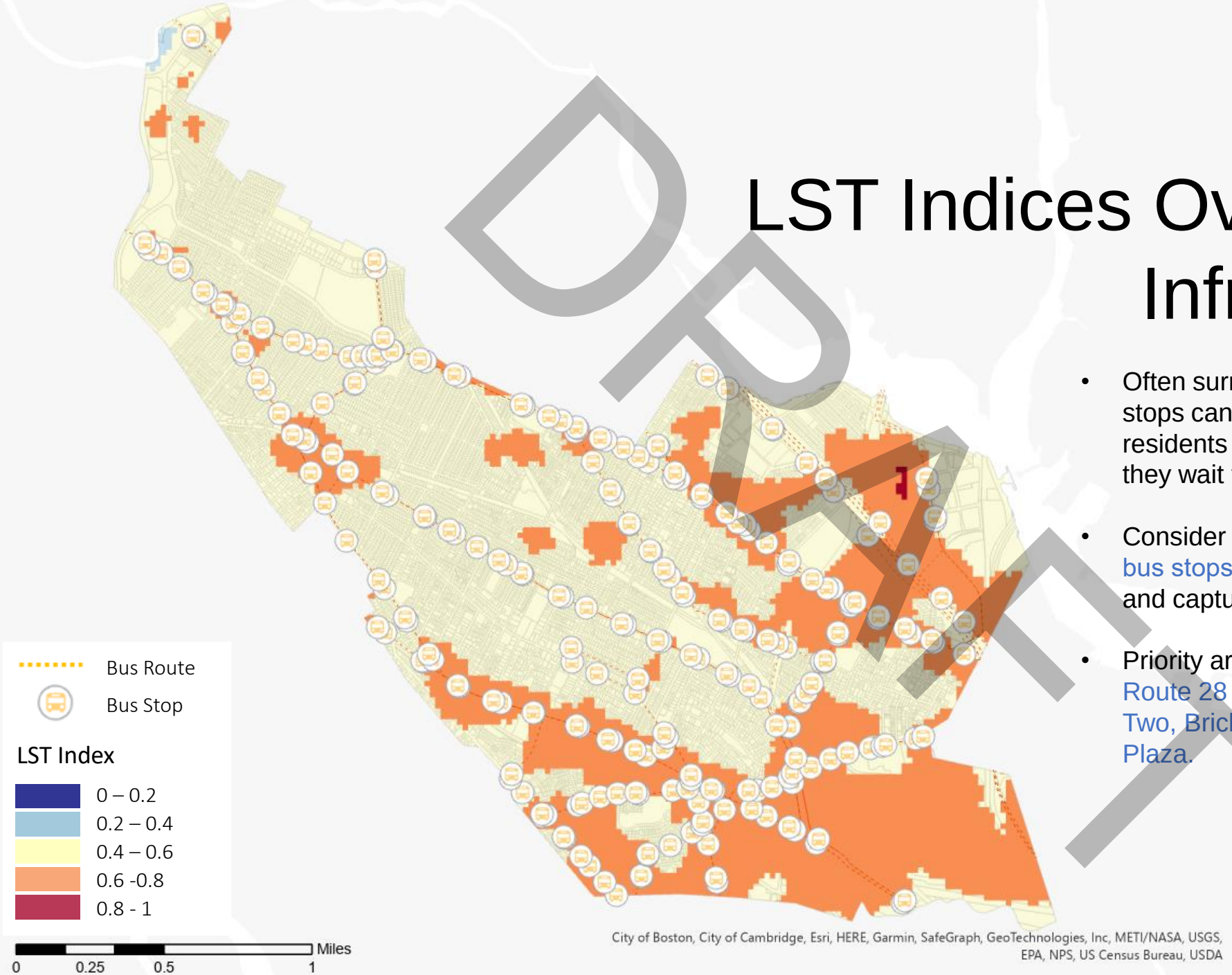
Heat & Transportation

LST Indices Overlaid Bus Infrastructure



- Often surrounded by impervious surfaces, bus stops can become micro heat islands, leaving residents exposed to high temperatures as they wait for public transportation.
- Consider partnering with MBTA to install ‘green bus stops’ to reduce urban heat island effect and capture stormwater.
- Priority areas include Somerville Ave. and Route 28 in Inner Belt, Union Square, Ward Two, Brick Bottom, Boynton Yards, Twin City Plaza.

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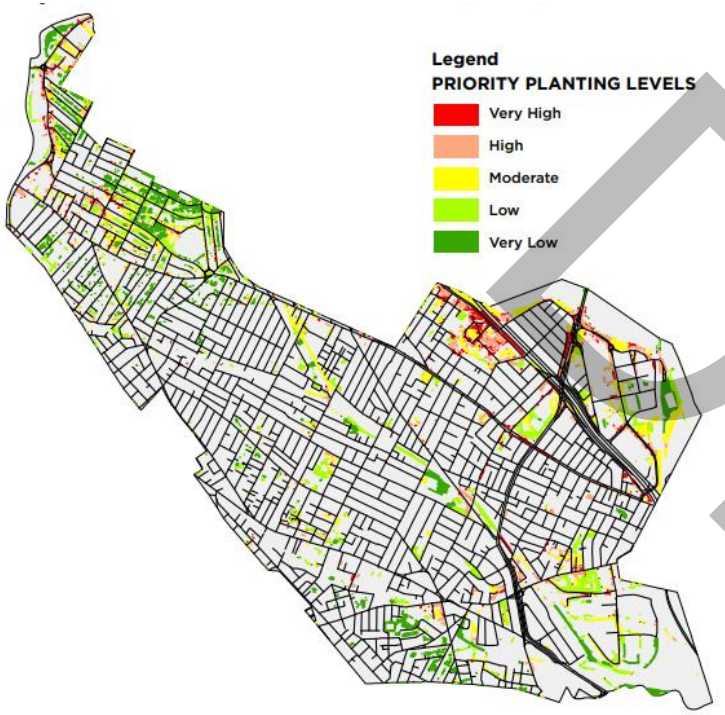
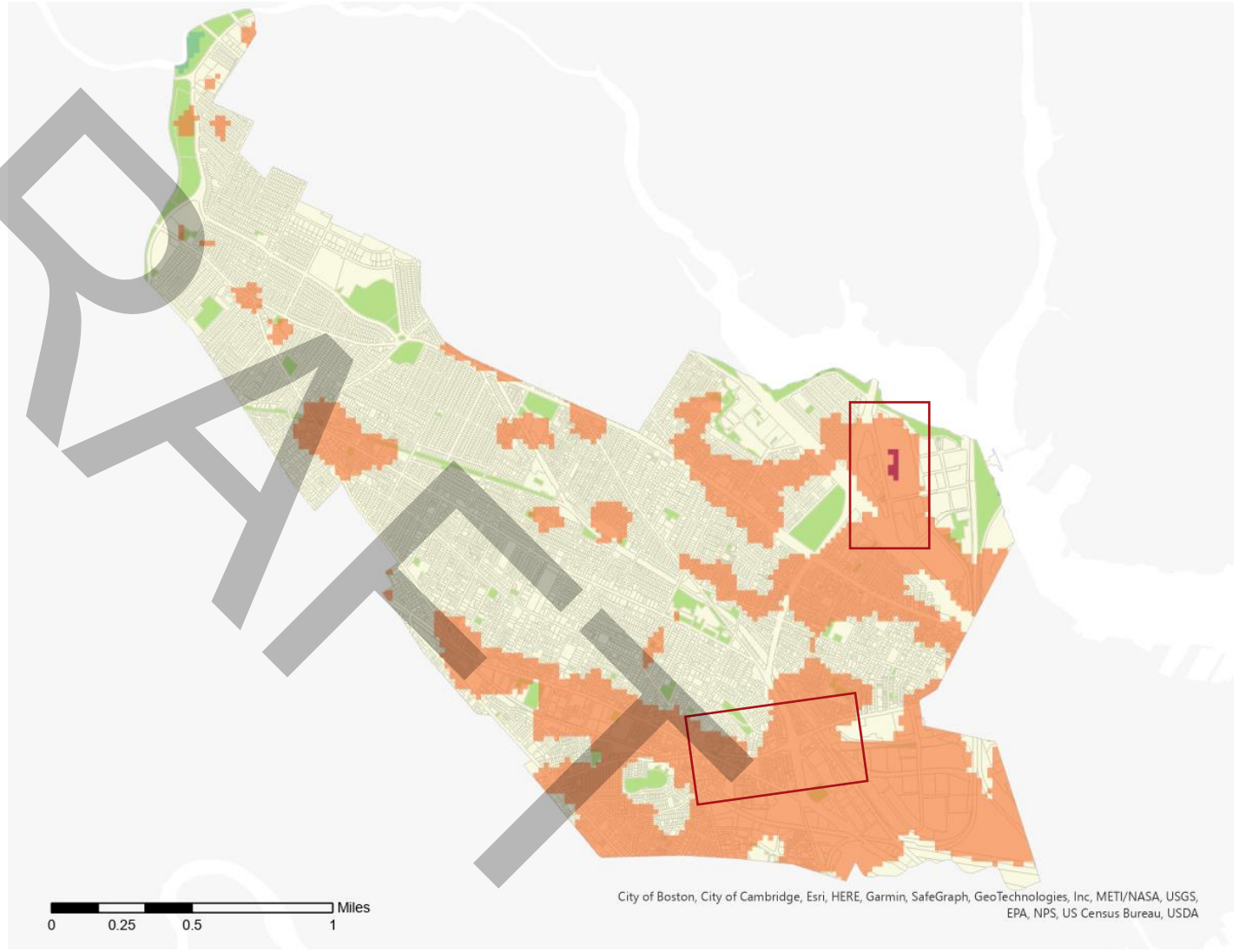


Priority planting locations outlined in the Urban Forest Management Plan (2021)

Prioritize planting locations in areas experiencing extreme heat



Key Heat Findings

Neighborhood	Extreme Heat (Present Day)
Davis Square	
East Somerville	
Union Square	
Assembly Square	
Spring Hill	
Ball Square	
Boynton Yards	
Hillside	
Inner Belt	
Magoun Square	
Teele Square	
Twin City	
Winter Hill	

Type	Extreme Heat (Present Day)
Social Infrastructure	
Food	
Place of Worship	
Critical Facility	
Medical Facilities	
Public Housing	
School	
MBTA Assets	
Shelter	
Higher Education	

1-2 assets 3-5 assets 6-10 assets > 10 assets

Greatest Neighborhood Exposure:

1. Union Square
2. East Somerville
3. Davis Square

Greatest Infrastructure Exposure:

1. Social Infrastructure
2. Food Resources
3. Critical Facilities

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