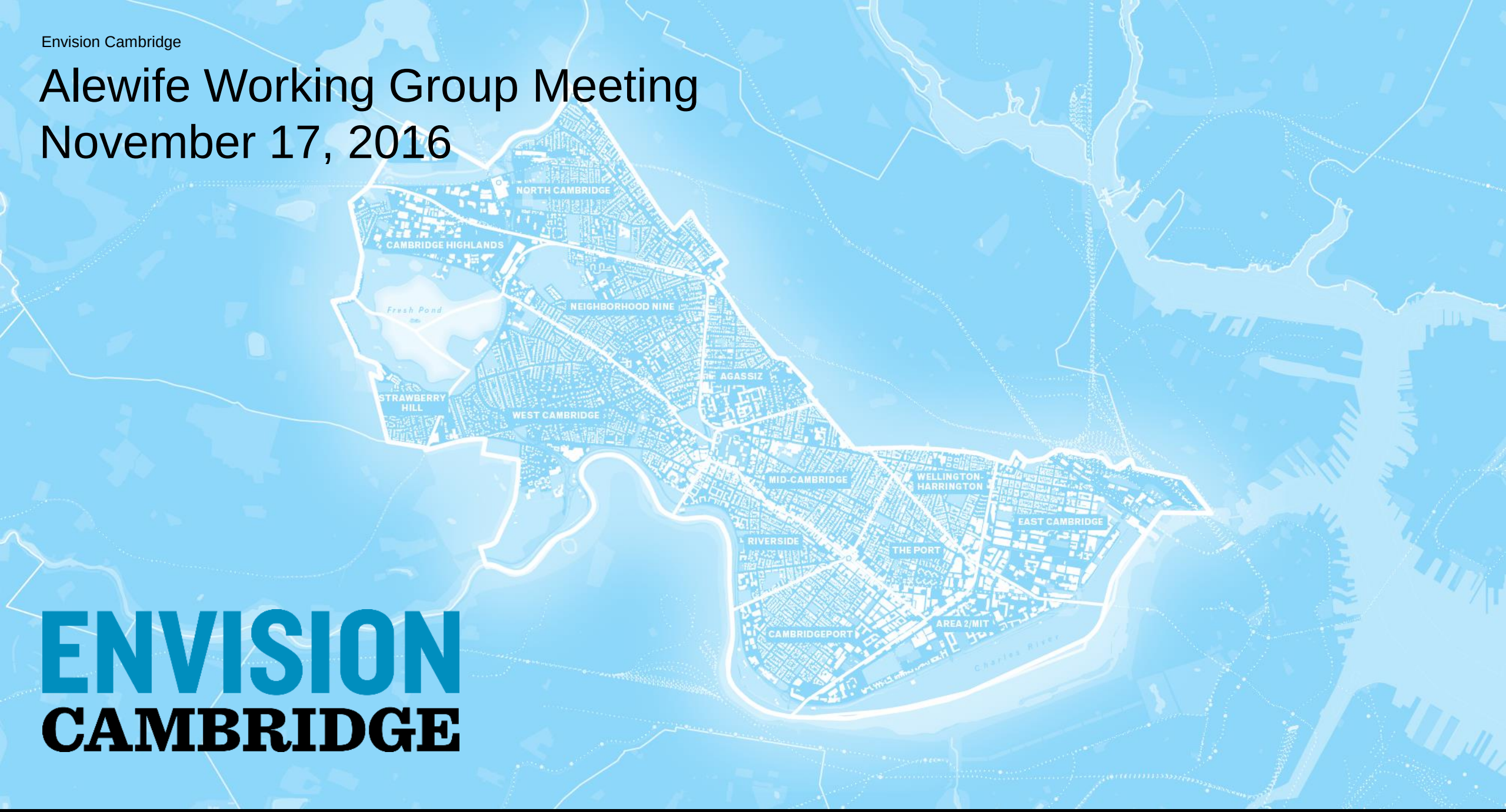
Alewife Working Group Meeting
November 17, 2016



ENVISION CAMBRIDGE

Agenda

Existing Conditions

Planning Frameworks for Climate & Environment

Environmental Issues and Opportunities

- Energy
- Water
- Air Quality
- Trees and Natural Ecology
- Materials and Waste

Discussion

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Discussion

What we've heard from past Working Group meetings

- Parks and open spaces are places where recreation and resilience planning can come together.
- Jerry's Pond is an opportunity to reconnect people to nature.
- Need to implement recommendations in the short-term; 20 years is too late.
- Stop building in floodplain.
- Mitigate flood risk in creative ways to turn climate change risks into educational opportunity.
- **Issues are like dials on a dashboard; all are significant. We need to seek a balance between them all.**

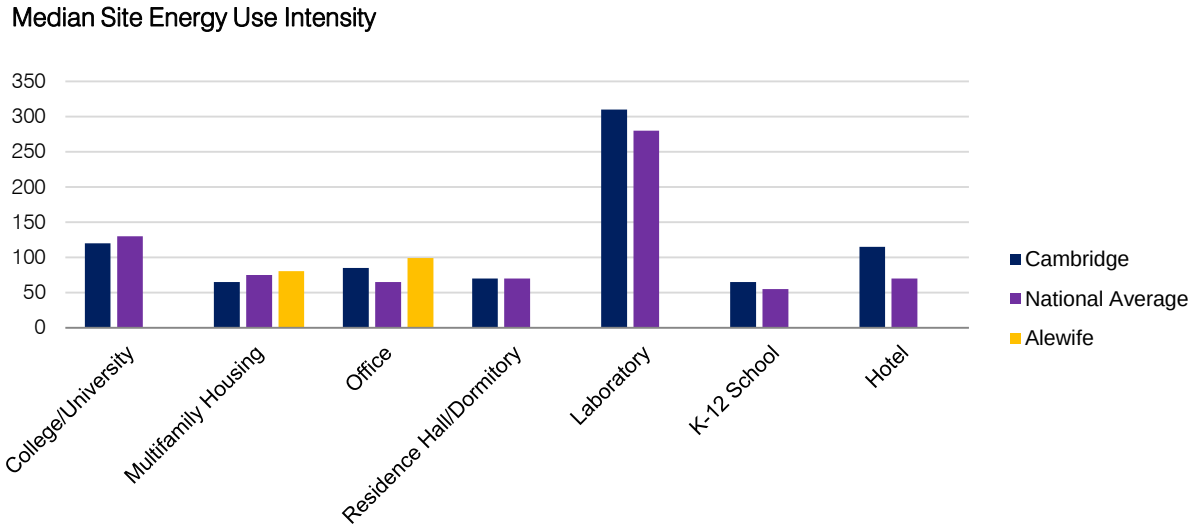
Alewife Visioning Workshop, Tobin School, July 21, 2016.

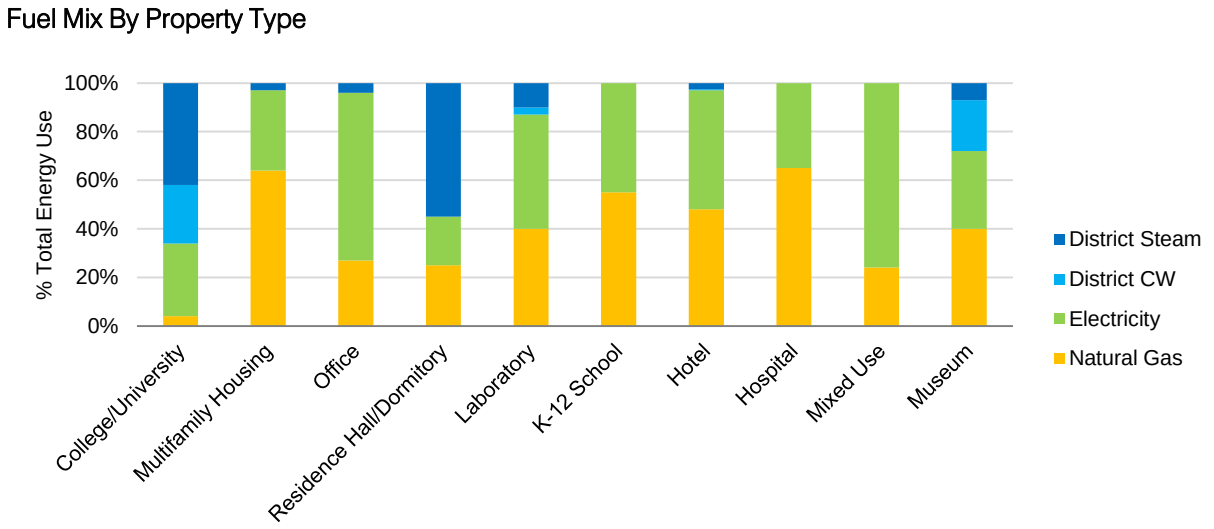
Note: These discussion points may reflect individual viewpoints and do not necessarily reflect the consensus view of the Working Group. They are being highlighted for discussion purposes only.

Energy

Building Energy Use

- 55 Alewife buildings reporting their energy use to the City have higher energy use intensity (per square foot), compared to the median for similar buildings in Cambridge
- Natural gas for heating/hot water is the leading source of GHG emissions for multifamily residential buildings
- Electricity is the largest energy source for office and mixed use buildings
- There is no cogeneration or district energy in the Alewife area

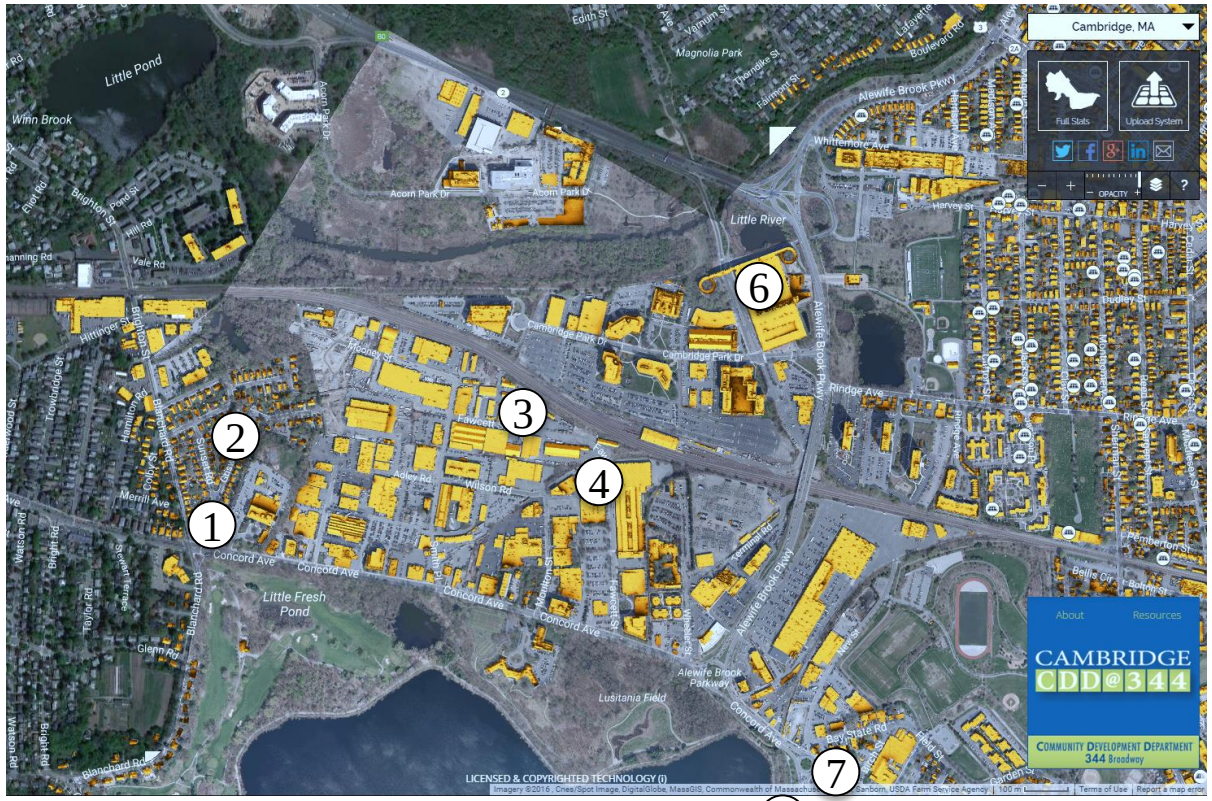




Energy

Solar Potential

- 4.5 MW Solar photovoltaics are installed in Cambridge today (<1% of technical potential)
- PV could provide nearly 20 percent of citywide electricity consumption (322-341 GWh/yr)
- Alewife has high potential with future development and existing buildings with large roof areas
- Alewife has five PV installations with plans for two more:
    1. Residential, 3 kW
    2. Residential, 2 kW
    3. Commercial, 61 kW
    4. Commercial, 80 kW
    5. Sullivan Water Treatment Plant, 171 kW
    6. Future Commercial, approx. 2.6 MW (Alewife Station)
    7. Future Commercial (Tobin/Vassal Lane Upper Schools)

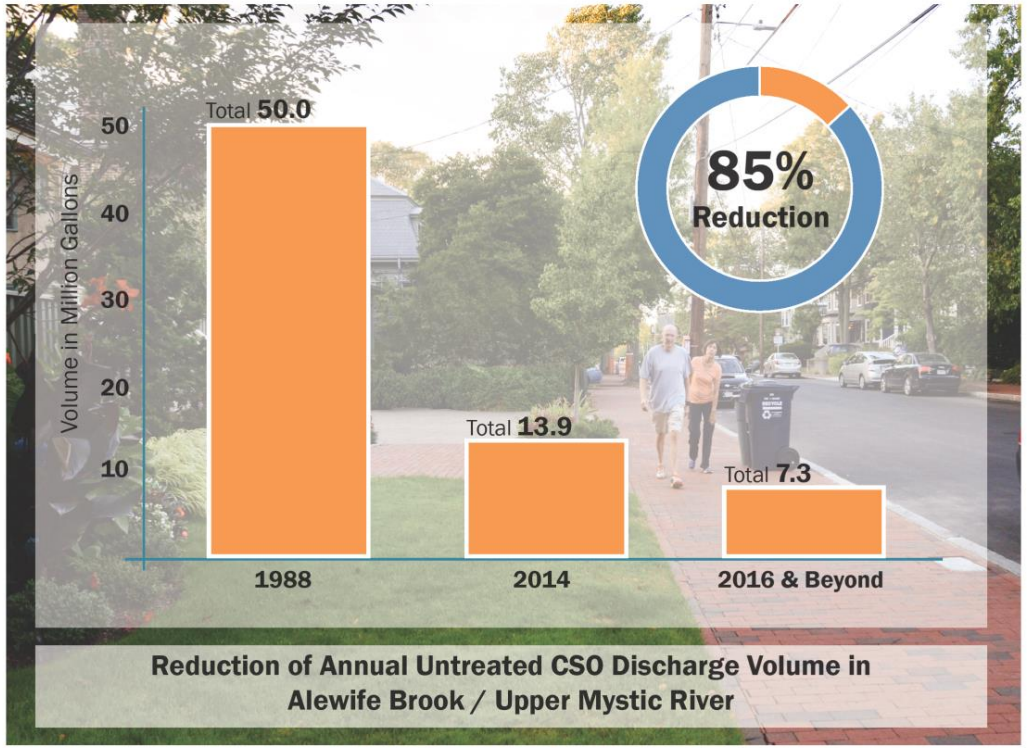


www.mapdwell.com/en/solar/cambridge

Stormwater

Water Quality

- Water quality is a key priority for the City, and work to date to improve stormwater management has made a significant improvements for the Charles River and Mystic River / Alewife Brook
- Non-point source pollution continues to be the biggest problem for Alewife Brook
  - Deposition of fertilizers, herbicides, oil, grease, salt, bacteria from animal waste and sediments, especially from construction sites are the most common consequences of non-point source pollution
- CSO events can still occur and discharge untreated sewerage into Alewife Brook



Source: MWRA CSO Annual Report 2015

Stormwater

Sewer Separation Plan

Approximately 40% of the collection system owned and maintained by Cambridge has been separated since the 1930s. The City is continuing separation efforts to:

- Improve the quality of waterways in Cambridge
- Reduce or eliminate combined sewer overflows
- Reduce or eliminate sanitary sewer backups
- Reduce flooding

Sewer separation has been completed throughout most of Alewife; separation projects to continue in surrounding neighborhoods to reduce flooding and adverse public health impacts.

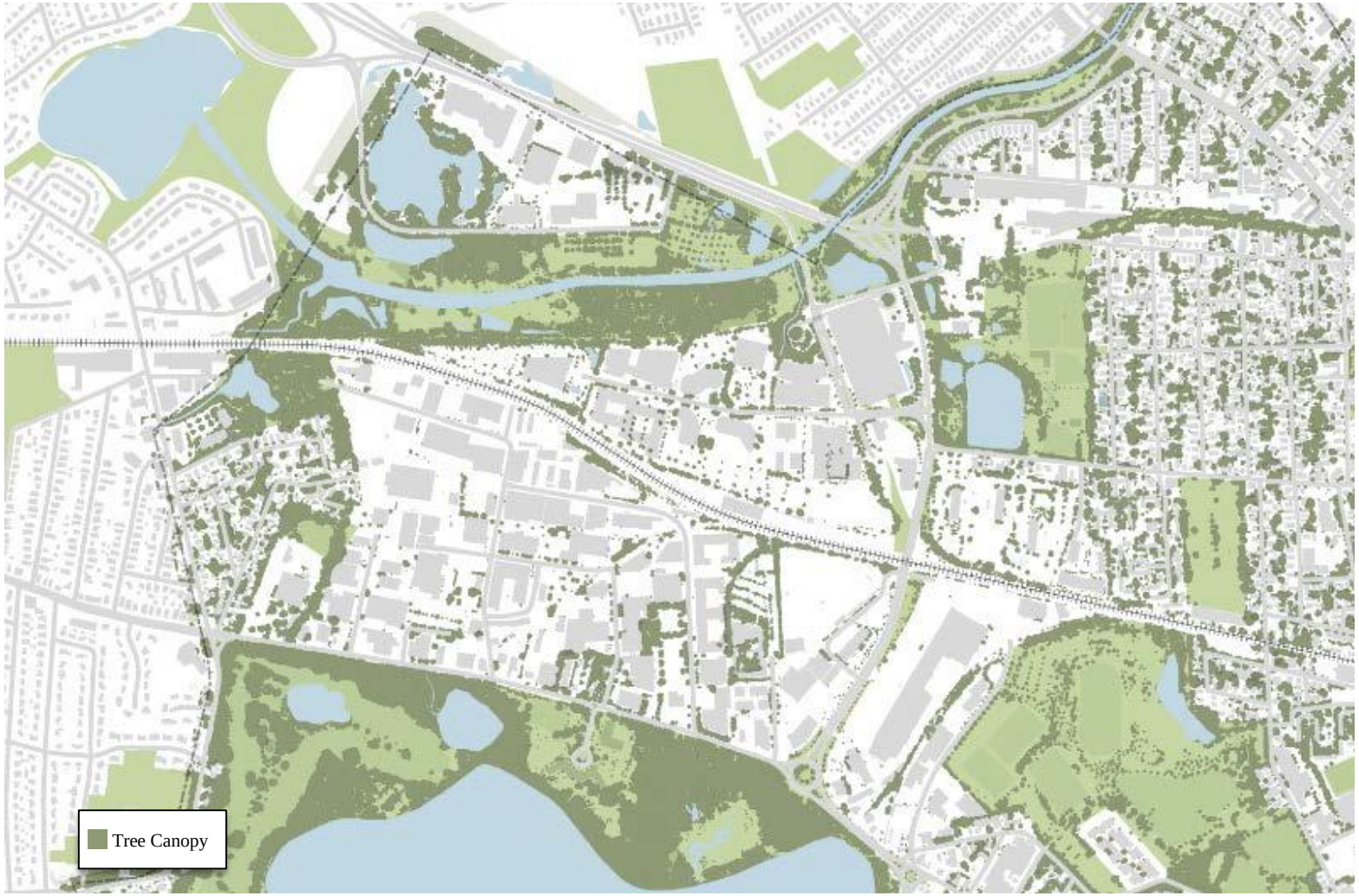
Stormwater

Impervious Surfaces

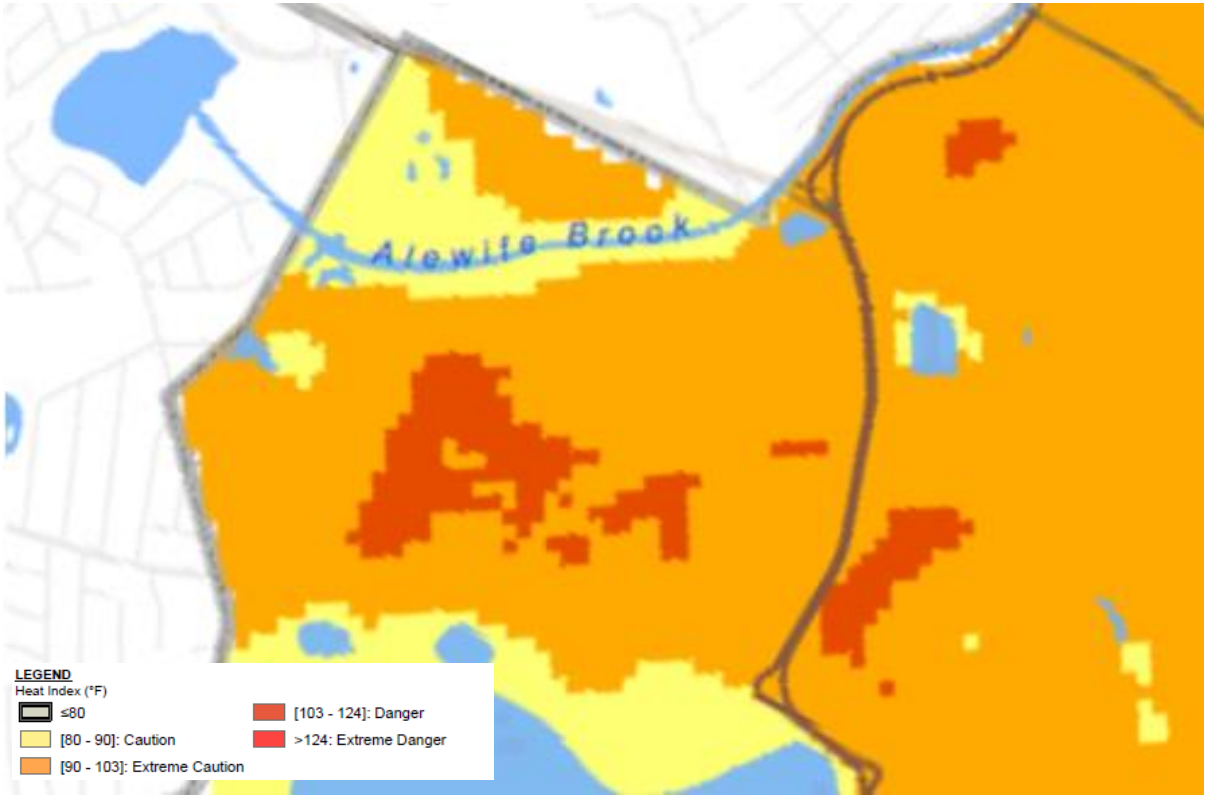
- 73% of the land area in Cambridge Highlands is impervious (excluding open spaces)
- High water table limits potential for infiltration; reducing impervious surfaces is just one part of a stormwater management solution
- Reducing impervious surfaces can also help address urban heat island effect, and quality of the public realm

Trees and Natural Resources

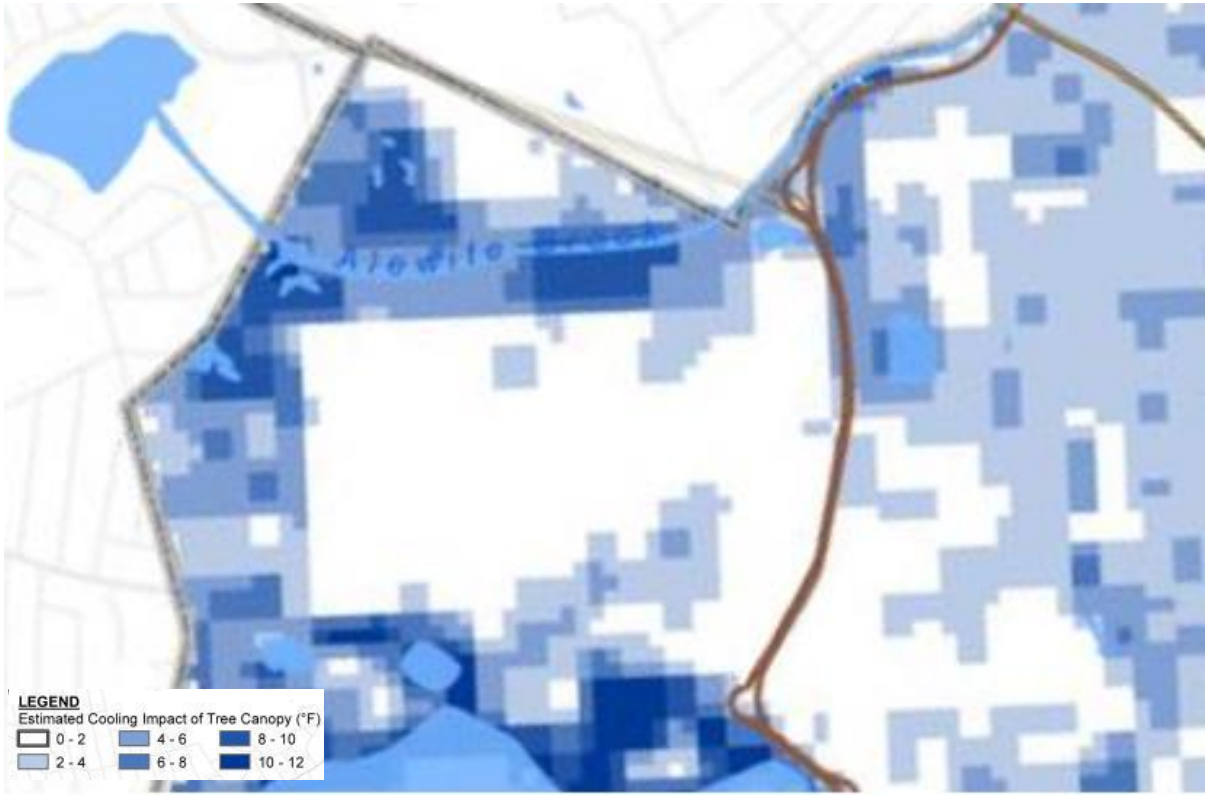
- Cambridge's tree canopy covers approximately 30% of the citywide land area – much less in the developed portions of Alewife.
- Alewife is surrounded by the two largest conservation areas in Cambridge: Fresh Pond Reservation and Alewife Reservation
- However, the developed portion of Alewife is lacking tree canopy coverage compared to the rest of Cambridge, which exacerbates urban heat island effect and local air quality



Trees and Natural Resources



2030 Heat Projection

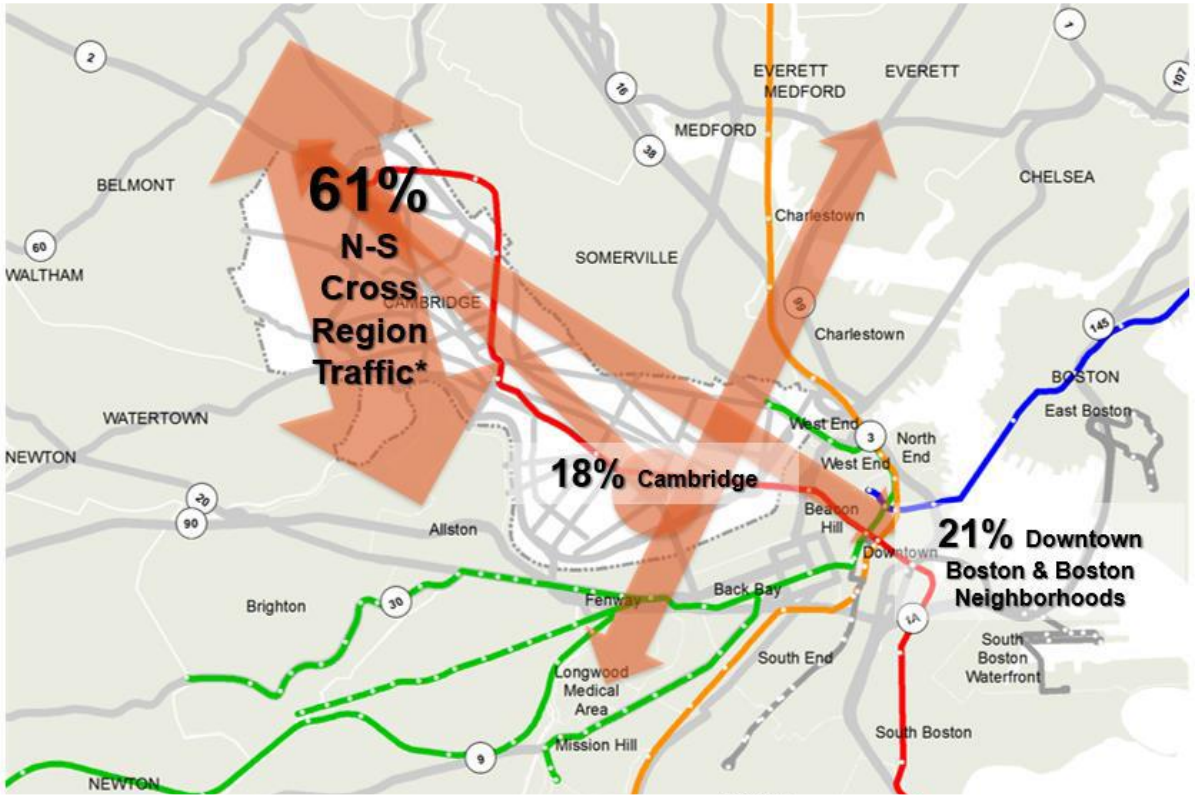


Cooling Impact of Tree Canopy

Increasing tree canopy could help address urban heat impact in Alewife – even more important when considering the heat-related impacts of climate change.

Air Quality

- High traffic volumes through Alewife contribute to local air quality challenges (particulate matter)
- Only 18% of estimated Alewife traffic goes to/from Cambridge itself
- Over 60% is other cross-region traffic



*Based on interpretation of 2010 CTPS regional travel demand model data

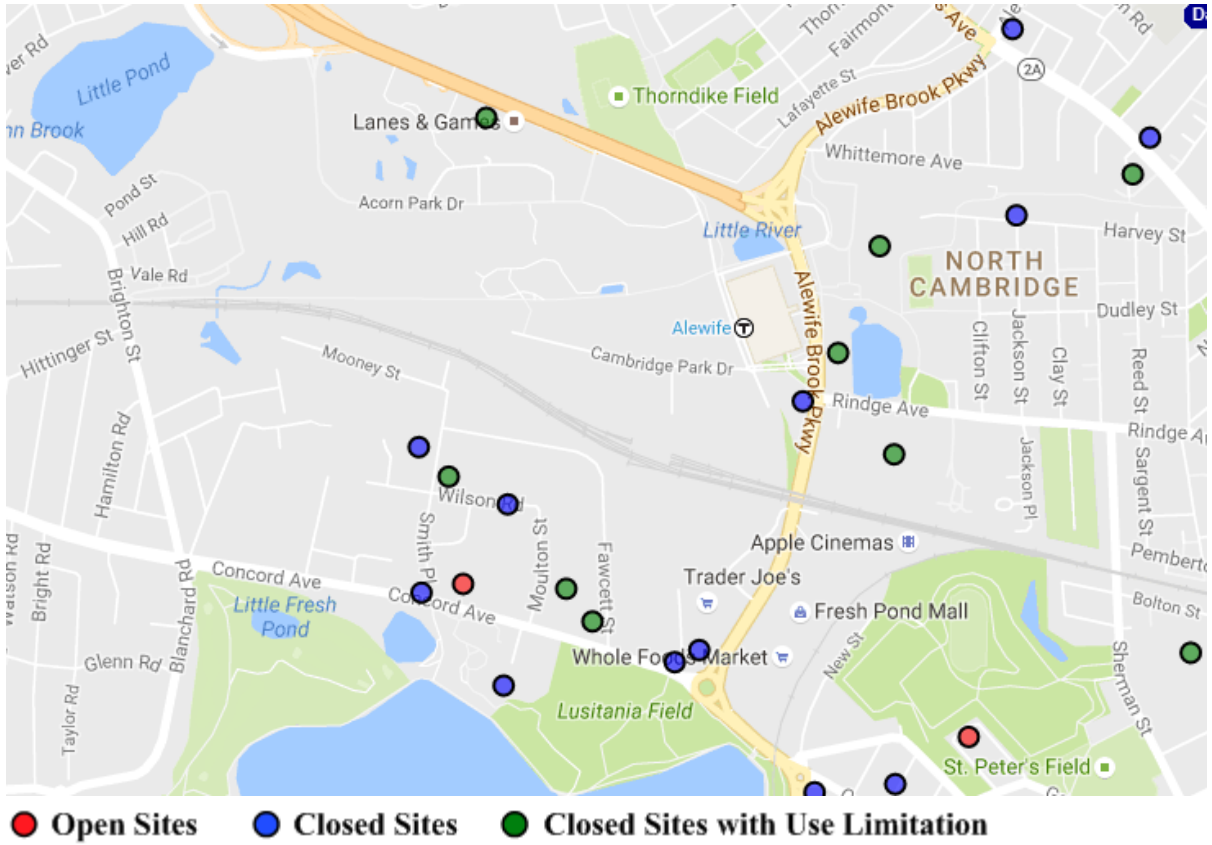
Materials and Waste

Contaminated Sites

- Contaminated sites in Alewife can complicate and/or increase the costs of redevelopment or reuse of parcels due to the presence or potential presence of hazardous substances, pollutants, or contaminants.
- Unlike some other communities, the presence of contamination has not been a deterrent to redevelopment given the high cost of land.

Solid Waste

- Commercial buildings are served by various private haulers
- Curbside Compost Pilot is available in the Monday collection district, adjacent to Alewife



There are several known contaminated sties in Alewife, including some with activity and use limitations (MassDEP).

Alewife Development: Opportunities & Challenges

Opportunities

- Alewife is nested in between large scale open spaces and natural resources which provides an foundation for networked green infrastructure
- The area has a higher propensity for change compared to other neighborhoods citywide which makes it possible to realize near-term solutions
- Numerous development opportunities on large parcels also provide a critical mass for district-level solutions
- Alewife could serve as a model for fully integrating sustainability and resilience planning priorities in Cambridge
- Future developments could be designed to provide shelter-in-place when the energy grid and transit are temporarily off line

Challenges

- Flooding expected to be increasingly frequent and expansive, resulting both from precipitation and sea level rise. SLR will also continue beyond 2070
- Potential ground contamination
- High proportion of impervious surfaces due to existing surface parking
- Other than redevelopment, no clear mechanism for greening Alewife's privately owned impervious areas
- No potential to completely store our way out of future flood risk; will need to accommodate periodic flooding (i.e., be able to clean up and recover)
- Extreme heat will be much more common and impactful, affecting both the indoor and outdoor environment

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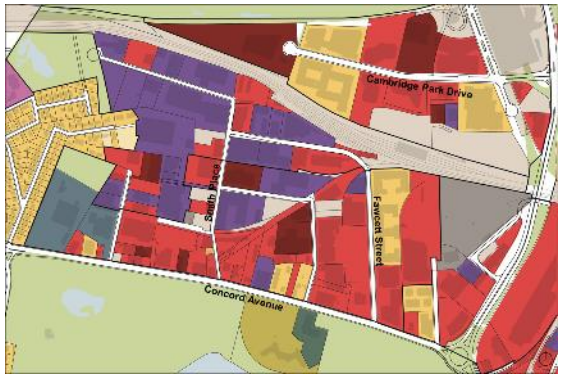
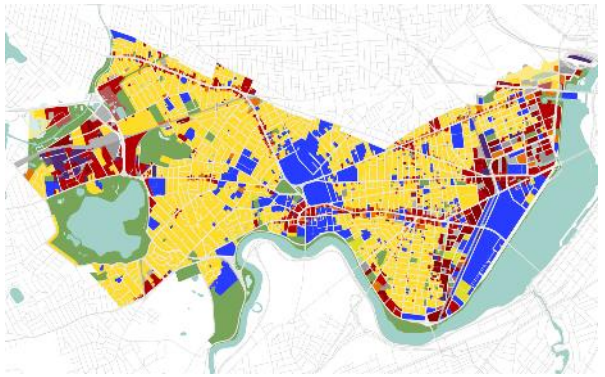
Discussion

Scales of Influence and Impact

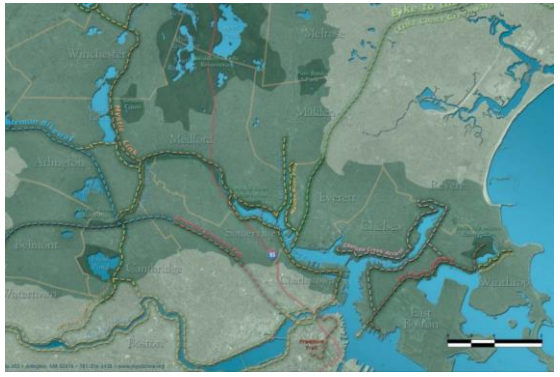
Parcels
Homes, businesses, and other points of interest



Alewife Planning Area
Neighborhoods and places, parks and trails



City of Cambridge
Infrastructure systems and the local environment



Boston Metropolitan Area
Regional infrastructure and environmental systems

Integrating Climate & Environment into Citywide Vision

Planning for Future Conditions

Temperature

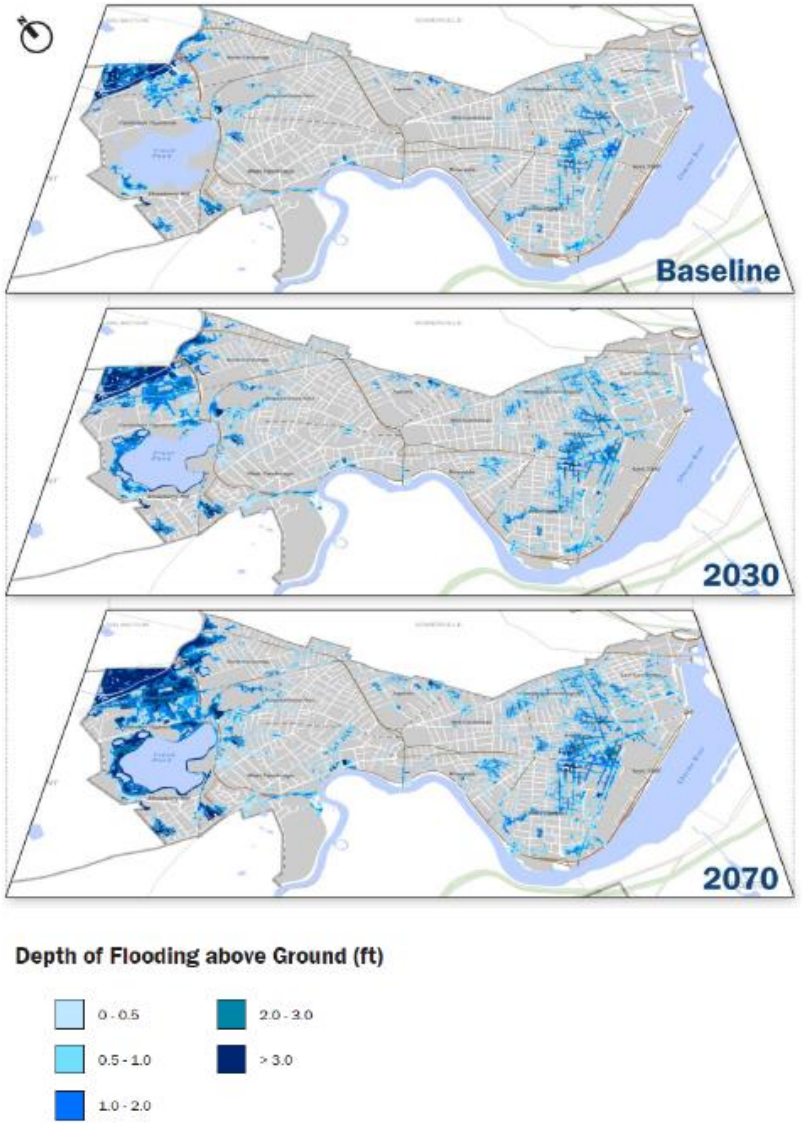
- Number of days over 90 degrees will nearly triple by 2030
- Heat waves projected to be more likely and frequent
- Significant for vulnerable populations without access to cooling options

Precipitation

- Occurrence of high volume rain storms is predicted to increase by 2030
- Increase in volume and frequency of rain storms increases extent and likelihood of flooding

Sea Level Rise / Storm Surges

- Models predict up to 8 inches of sea level rise by 2030
- Biggest concern is overland flooding from precipitation



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- Climate Change Preparedness & Resilience

Discussion

Energy

Objective: Reduced GHG emissions and enhanced resilience

Example Parcel Strategies

- Reduce building energy consumption (increase insulation and glazing requirements)
- Promote energy efficient systems (LED lighting, high performance HVAC)
- Reduce carbon-intensity of energy supply (solar)
- Deploy demand management (building controls)

Example District Strategies

- Reduce carbon-intensity of energy supply (community shared solar, cogeneration)
- Provide low-carbon district energy (district heating and cooling, ground source heat pumps)
- Deploy demand management (energy storage)

Large rooftops, particularly on new buildings, provide good opportunities for solar PV, including systems that can have community shared ownership.

Stormwater

Objective: Water conservation, clean waterways, and reliable drinking supply

Example Parcel Strategies

- Reduce stormwater runoff (green/blue roofs, cisterns, high performing tree pits)
- Reduce potable water consumption (native plantings, rainwater reuse, efficient fixtures)

Example District Strategies

- Reduce stormwater runoff (rain gardens, filtration strips, pocket parks, sewer separation)
- Reduce potable water consumption (native plantings)

Green and blue roofs can be deployed as part of an integrated stormwater management system (Philadelphia Water Department)

Air Quality

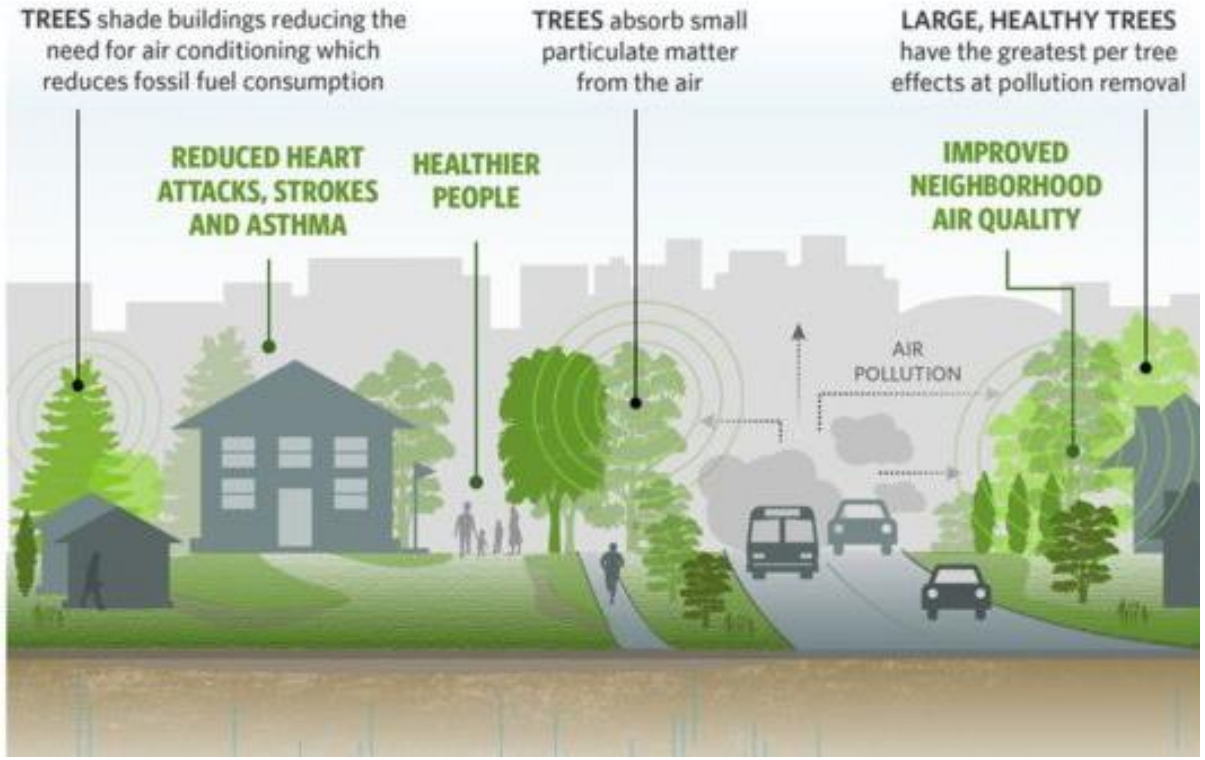
Objective: Health and well being

Example Parcel Strategies

- Minimize air polluting emissions (avoid or minimize VOCs, on-site combustion of fossil fuels)
- Improve indoor air quality and thermal comfort (high efficiency filters, indoor plants)

Example District/Regional Strategies

- Minimize air polluting emissions (heat pumps and other low carbon heat sources)
- Improve indoor air quality and thermal comfort (street trees for shading)
- Reduce vehicle emissions (transportation demand management, pollution controls, electric vehicles)



Tree planting can help tackle urban air pollution (Image: The Nature Conservancy)

Trees and Natural Ecology

Objective: Stormwater management, urban heat island mitigation, biophilic benefits, and habitat protection

Example Parcel Strategies

- Provide access to nature (design for views and connectivity, provide habitat areas)
- Enhance thermal comfort (install reflective roofs, plant trees for shading and wind blocking)

Example District Strategies

- Integrate nature (design for views, reclaim street space for trees and plantings, provide habitat areas)
- Enhance outdoor thermal comfort (plant trees, set building design guidelines, install high albedo pavements, reduce pervious surfaces)

Materials and Waste

Objective: Soil remediation, zero waste goals, circular economy

Example Parcel Strategies

- Improve soil quality and foster brownfields remediation (bioremediation, phytoremediation)
- Minimize waste sent to landfills (encourage C&D recycling, require buildings to design for organics collection, small bin composting systems)

Example District Strategies

- Improve soil quality and foster brownfields remediation (bioremediation, phytoremediation)
- Minimize waste sent to landfills (source separation, site C&D processing)
- Foster a circular economy (urban farms, community composting, anaerobic digestion)

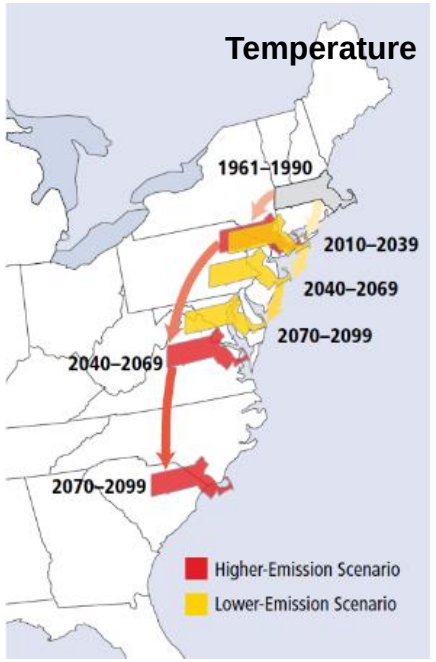
Phytoremediation is a low-cost, plant-based method that can be used to remove soil contaminants.

Climate change preparedness and resilience

Impacts of climate change

- Cambridge is more vulnerable to increasing heat and precipitation-driven flooding in the near future than to sea level rise and coastal storm surges.

- Alewife is likely to be the first of Cambridge neighborhoods to experience SLR/SS flooding as early as 2045.



Increased temperature and urban heat island

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)

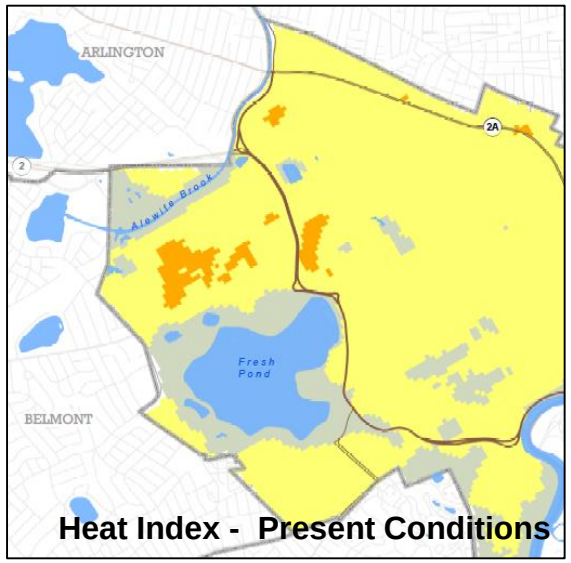
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

2015 - 2044
(2030)

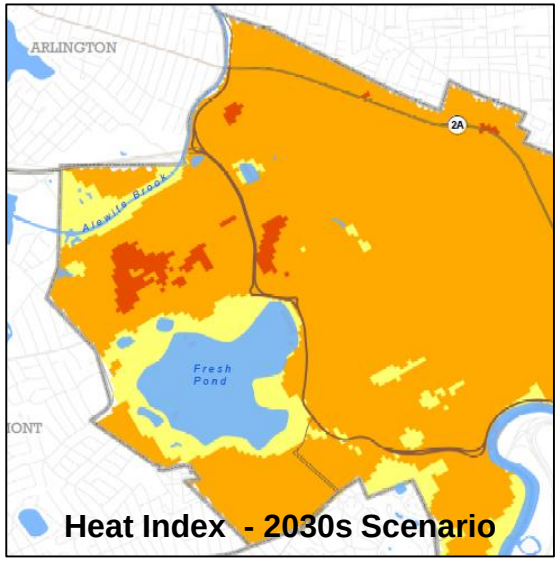
S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

2055 - 2084
(2070)

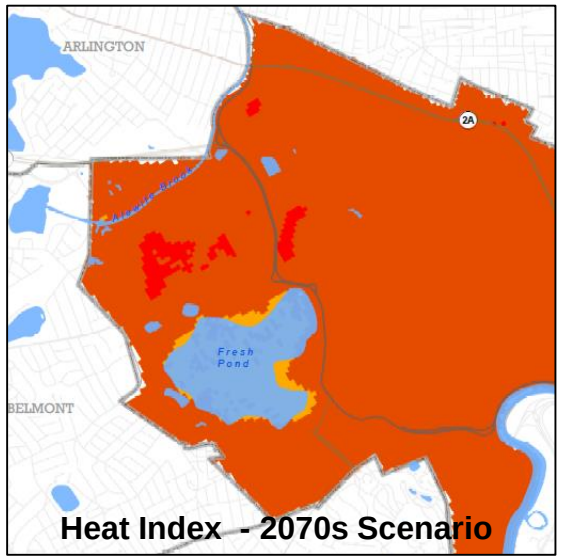
- Above 90°F - Low Scenario
- Above 90°F - High Scenario
- Above 100°F - Low Scenario
- High 100°F - High Scenario



Heat Index - Present Conditions



Heat Index - 2030s Scenario

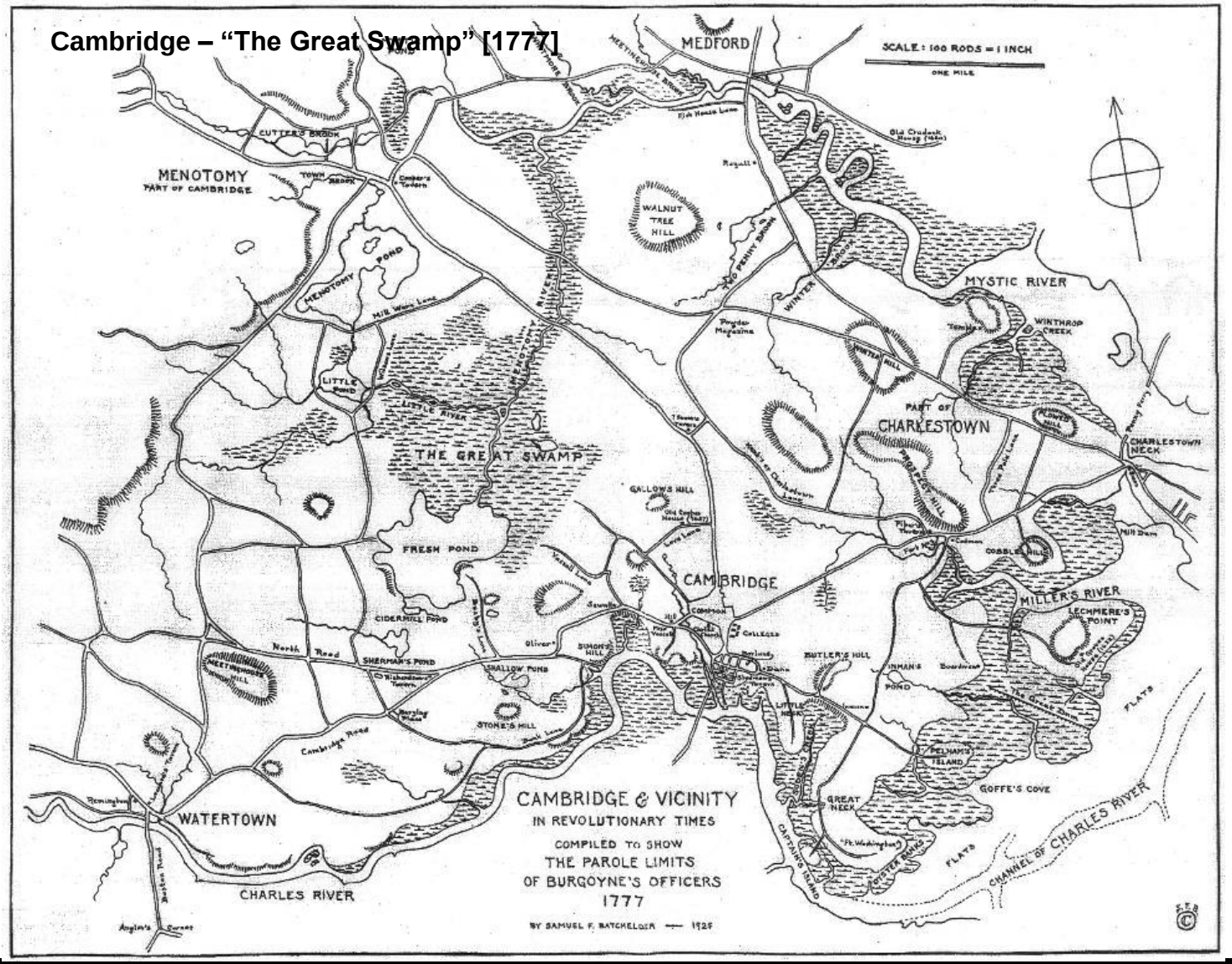


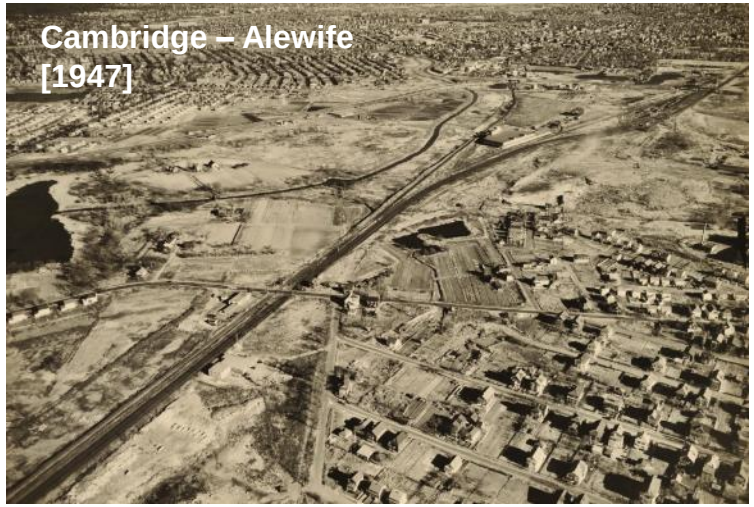
Heat Index - 2070s Scenario

LEGEND
Heat Index (°F)

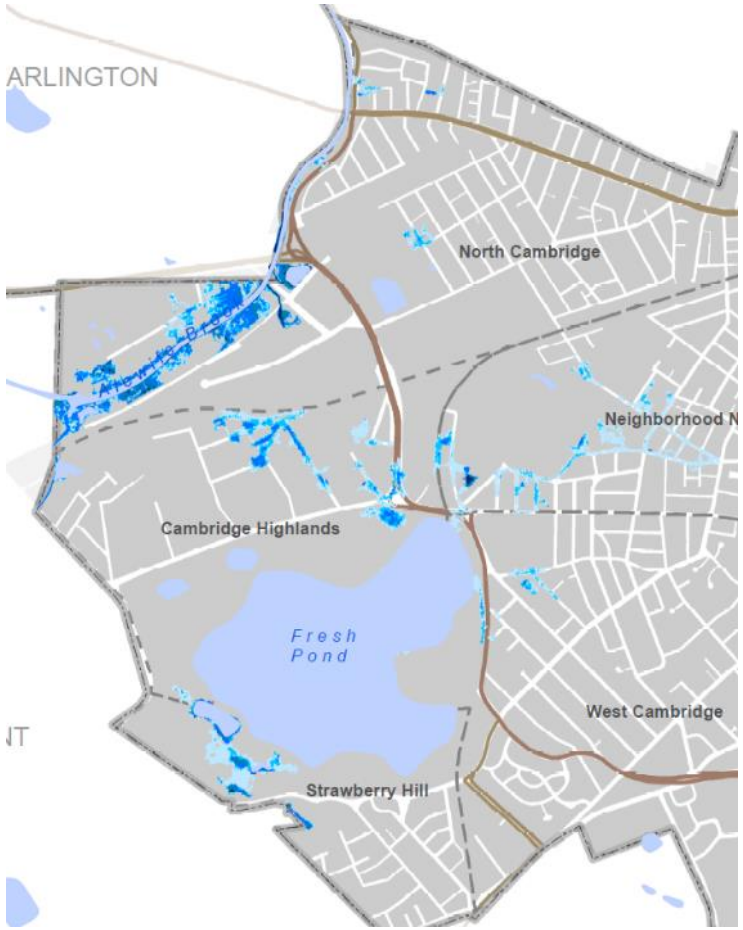
- ≤80
- [80 - 90]: Caution
- [90 - 103]: Extreme Caution
- [103 - 124]: Danger
- >124: Extreme Danger

Past land form

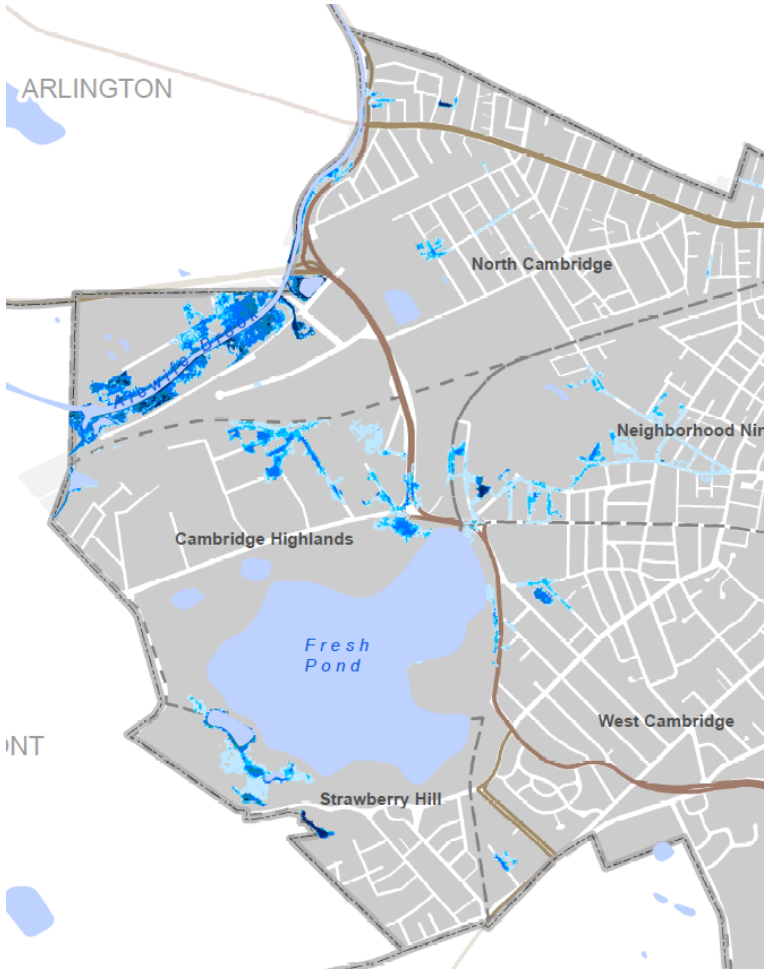




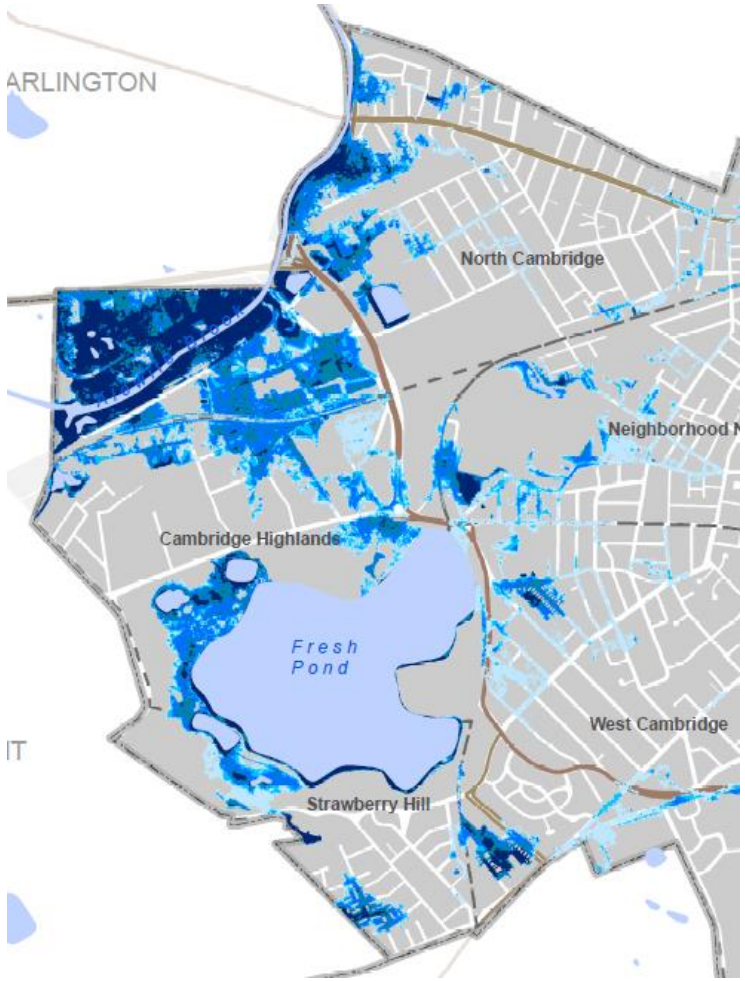
Expected flooding volume



Present 10-yr storm



10-yr storm by 2030
Additional 17 MG Flood Volume

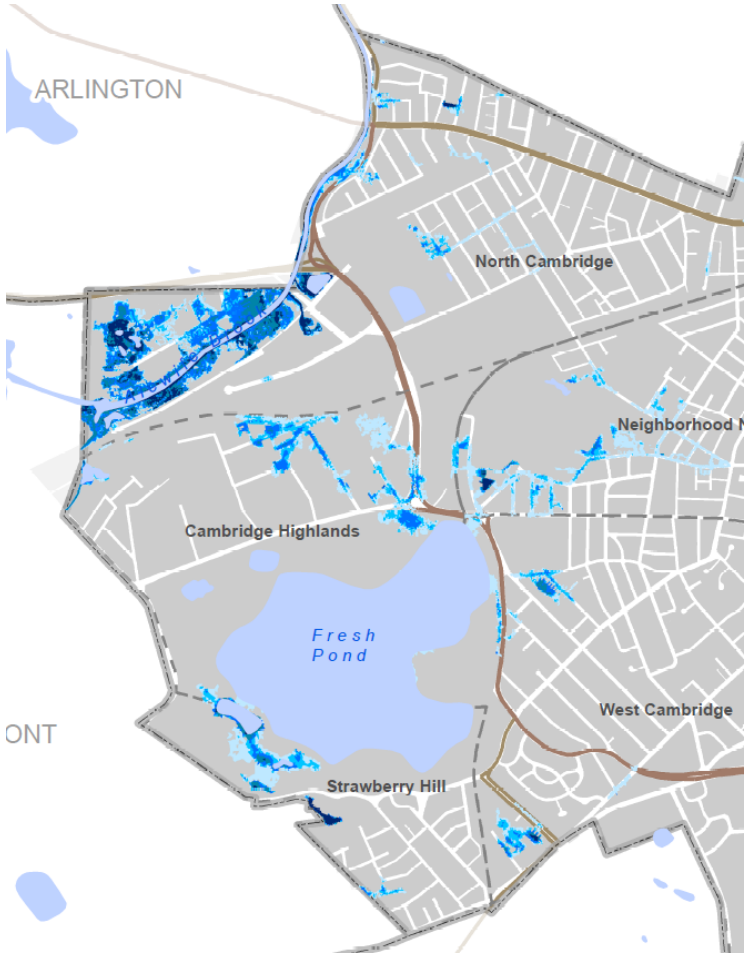


100-yr storm by 2030
Additional 200 MG Flood Volume

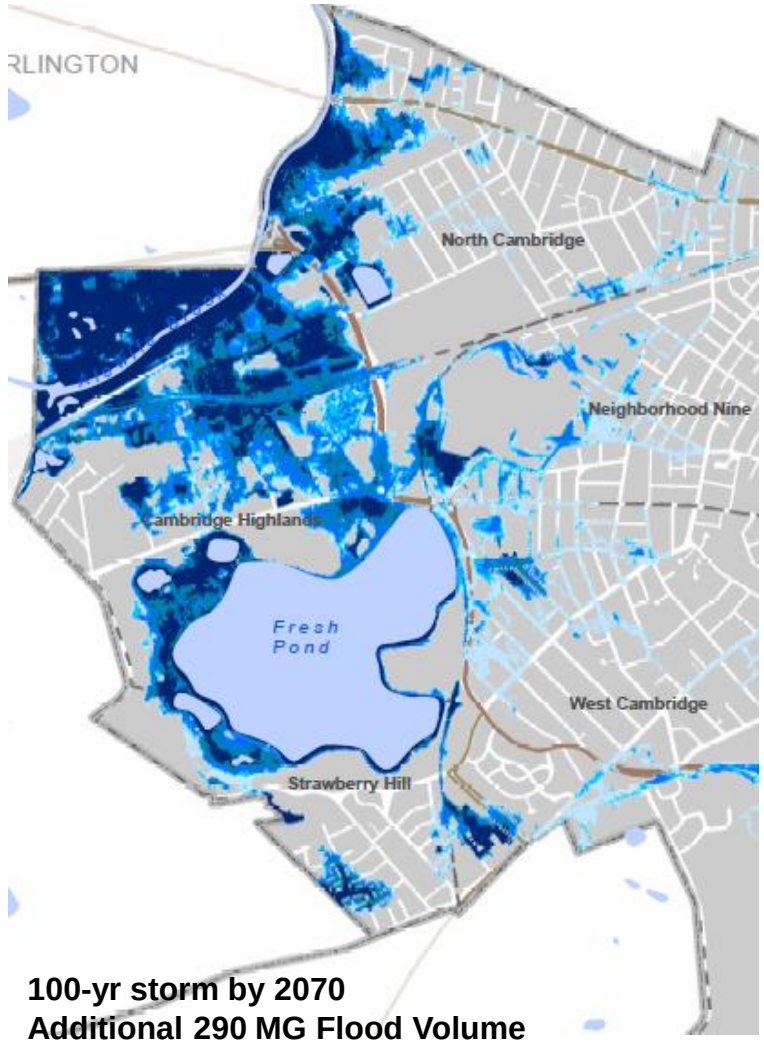
Source: Kleinfelder, City of Cambridge Climate Change Preparedness & Resiliency (CCPR) Plan, November 2016

Expected flooding volume

Present 10-yr storm



10-yr storm by 2070
Additional 35 MG Flood Volume



100-yr storm by 2070
Additional 290 MG Flood Volume

Source: Kleinfelder, City of Cambridge Climate Change Preparedness & Resiliency (CCPR) Plan, November 2016

Sea level rise and storm surge flooding

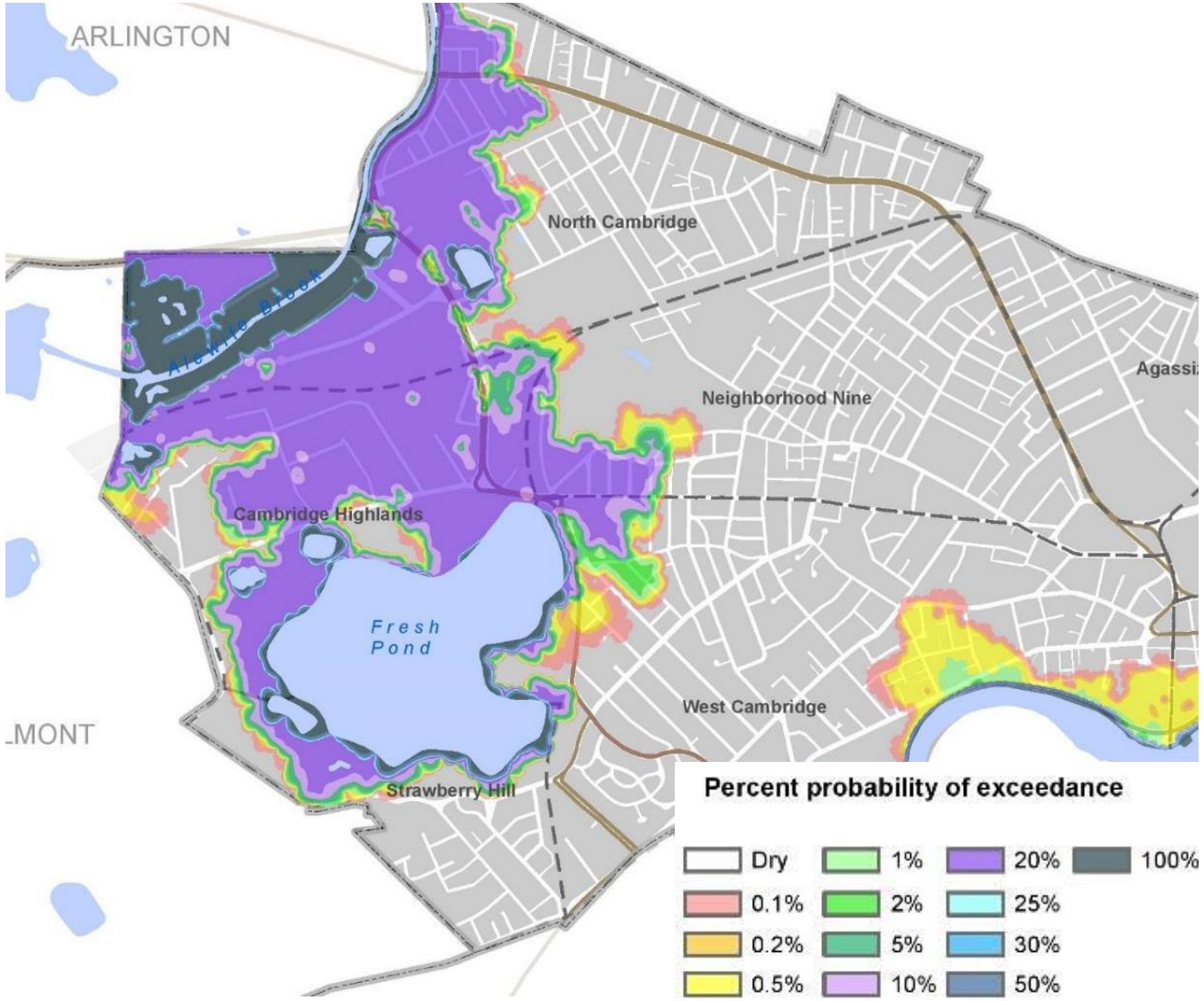
Amelia Earhart Dam

At 1% (100-yr):

- Flanked in 2045-2050
- Overtopped in 2055-2060

At 0.2% (500-yr):

- Flanked in 2030-2035
- Overtopped in 2040



Cumulative Risk of flooding

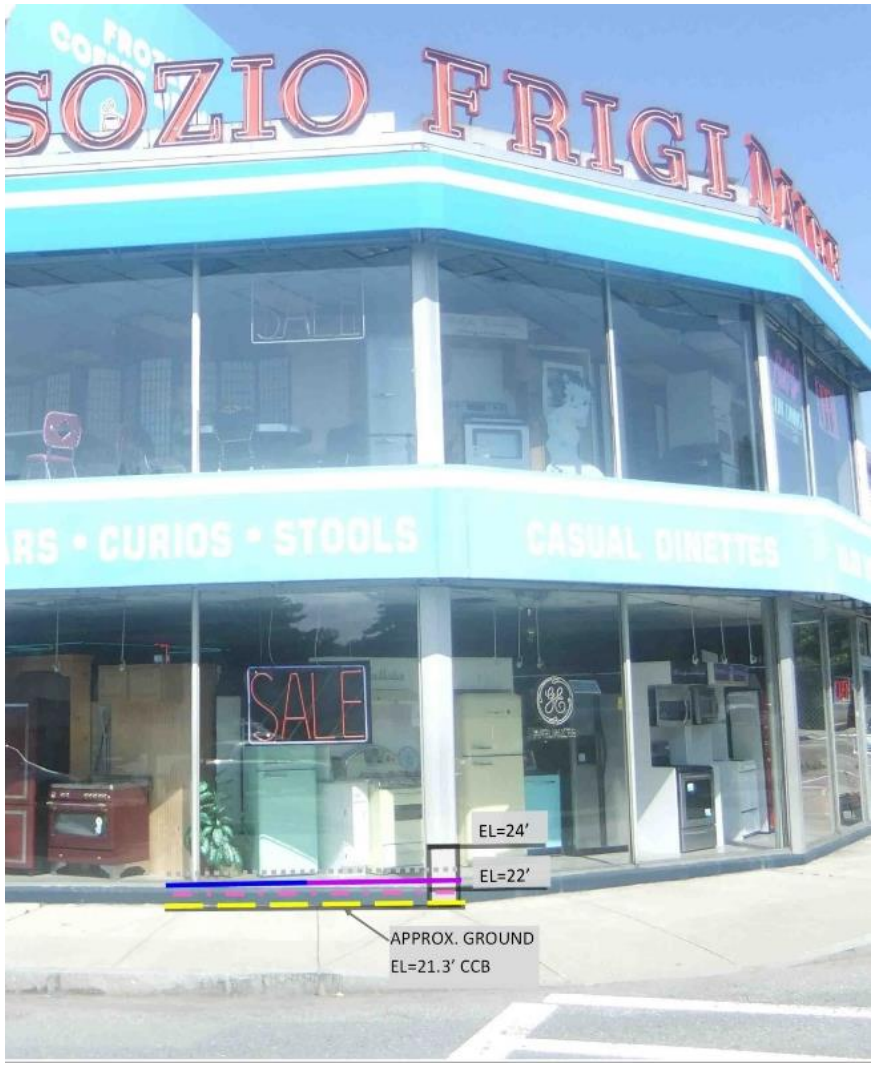
Table 6-1. Probability of Natural Hazard Event Occurrence for Various Periods of Time

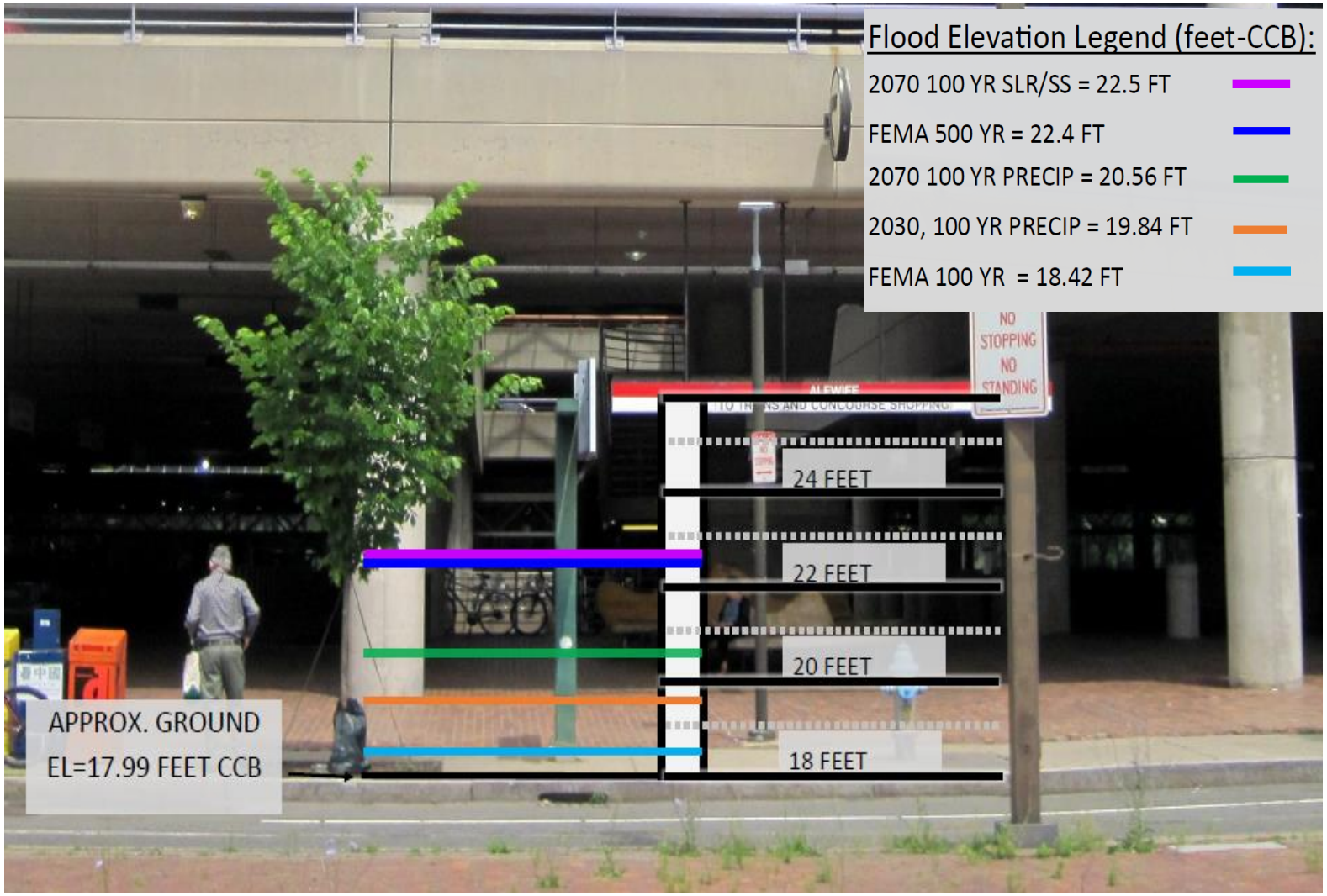
Length of Period (Years)	Frequency – Recurrence Interval					
	10-Year	25-Year	50-Year	100-Year	500-Year	700-Year
1	10%	4%	2%	1%	0.2%	0.1%
10	65%	34%	18%	10%	2%	1%
20	88%	56%	33%	18%	4%	3%
25	93%	64%	40%	22%	5%	4%
30	96%	71%	45%	**26%**	6%	4%
50	99+%	87%	64%	39%	10%	7%
70	99.94+%	94%	76%	**51%**	13%	10%
100	99.99+%	98%	87%	63%	18%	13%

The percentages shown represent the probabilities of one or more occurrences of an event of a given magnitude or larger within the specified period. The formula for determining these probabilities is $P_n = 1-(1-P_a)^n$, where P_a = the annual probability and n = the length of the period.

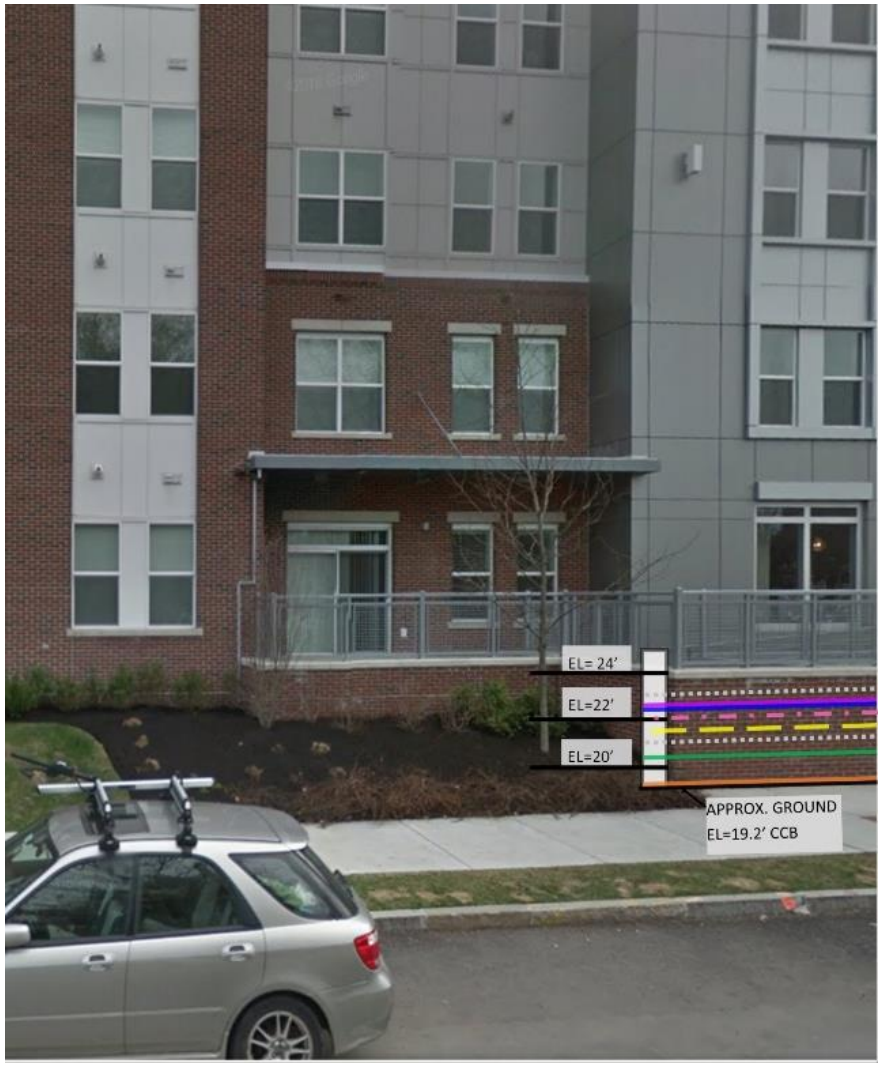
The bold blue text in the table reflects the numbers used in the example in this section.

Flood elevations

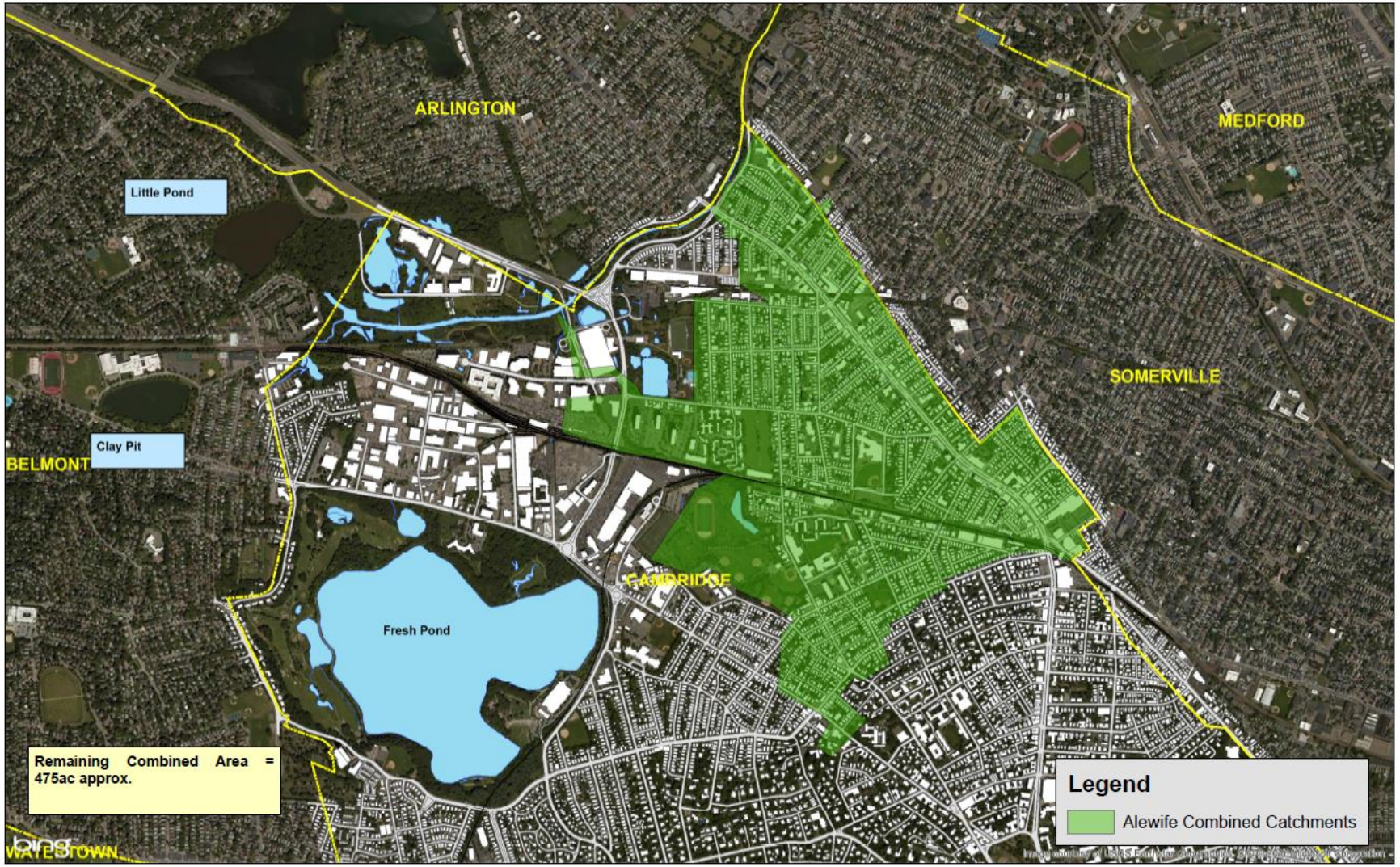




Flood elevations

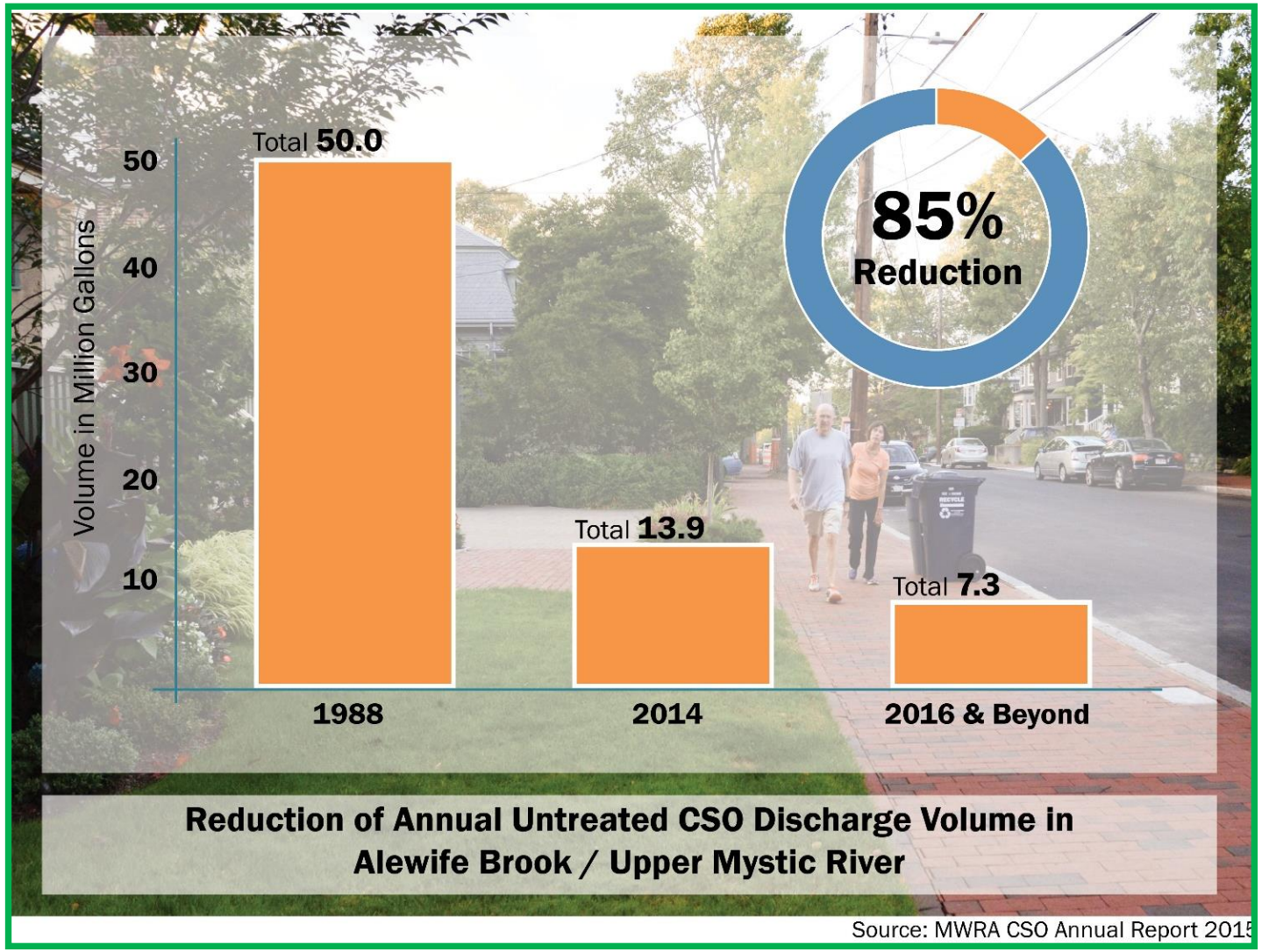


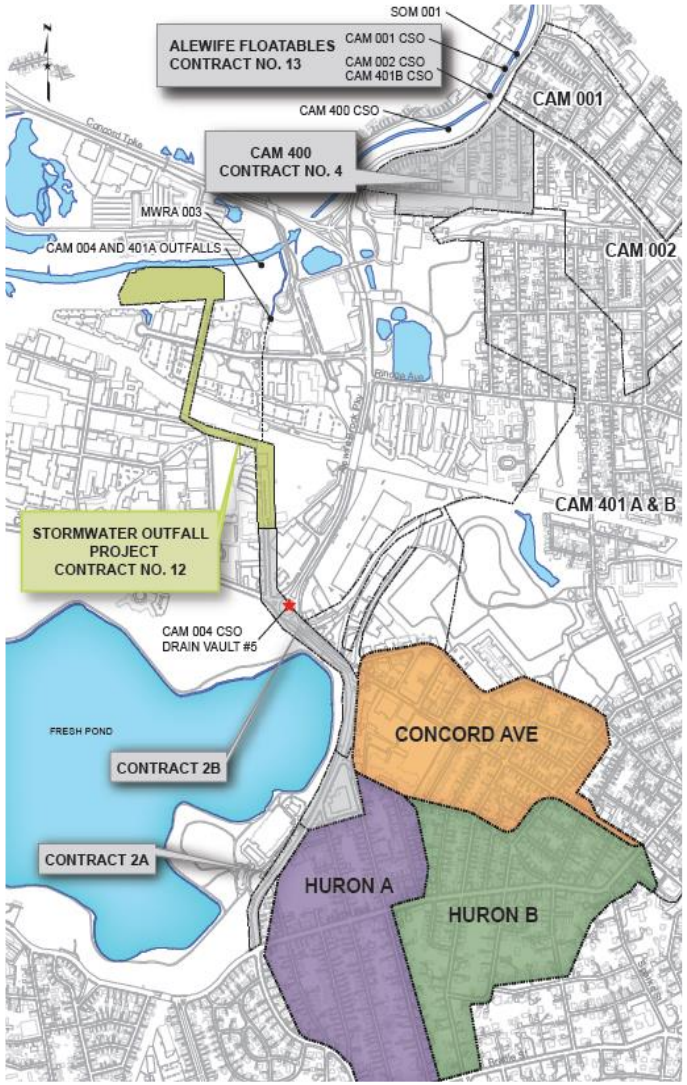
Sewer separation



Source: Kleinfelder, City of Cambridge Climate Change Preparedness & Resiliency (CCPR) Plan, November 2016

Sewer separation

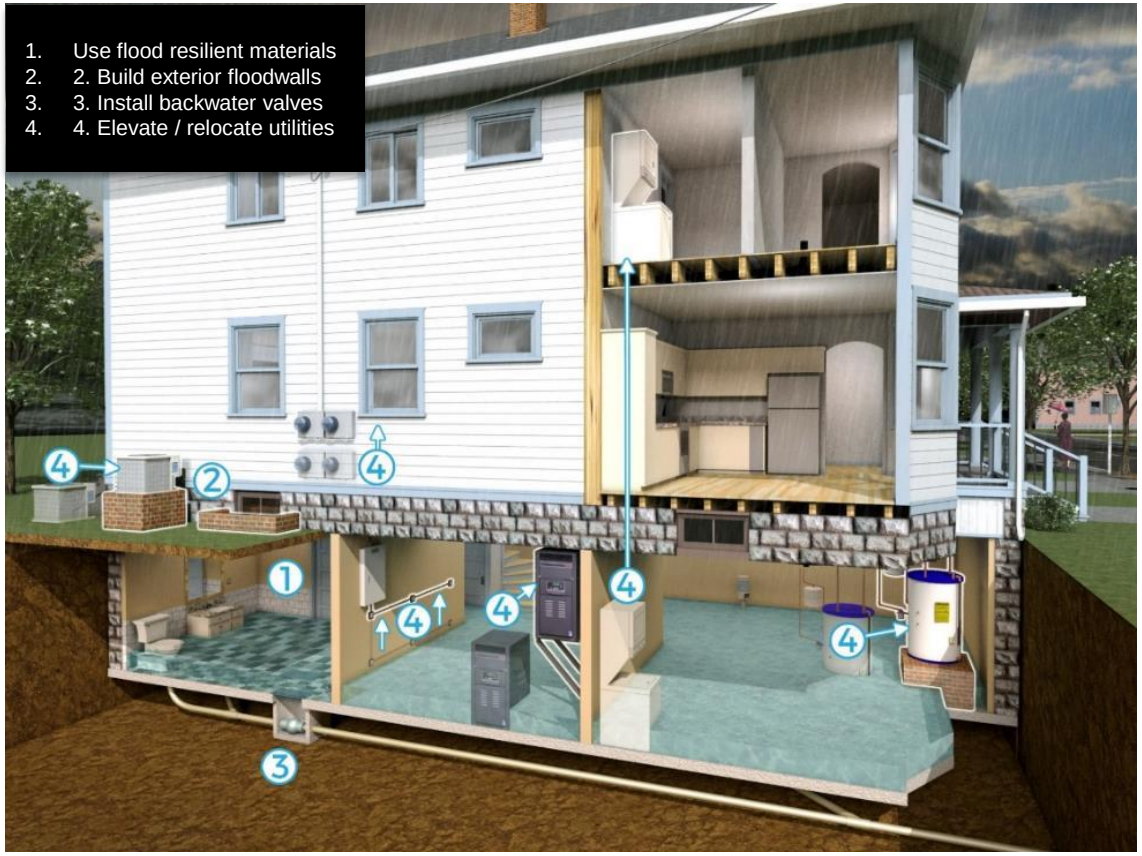




Private development stormwater management

- Store on site the difference between the 2 yr 24 hr preconstruction runoff and the 25 yr 24hr post construction runoff
- Manage stormwater runoff such that there is a reduction of 80% TSS from site and a 65% reduction of P from Site.
- Manage sewer discharge so as to ensure no increase in CSOs or SSOs.
- **Build to the 2030 1% event with a recovery plan for the 2070 1% event** (updated based upon CCVA Report)

Examples of building-level resilience measures



Agenda

Existing Conditions

Planning Frameworks for Climate & Environment

Environmental Issues and Opportunities

- Energy
- Water
- Air Quality
- Trees and Natural Ecology
- Materials and Waste

Discussion

Discussion

- Of the issues and opportunities presented today, which are the highest priority?
- What other priorities and considerations should be taken into account?
- What is the potential for development-by-development vs. district-scale solutions?
- What actions can be taken in the short-term?
- How can enhanced environmental strategies be put in place?

Volunteers “depaving” a parking lot in Portland, Oregon to install a rain garden.
(Image: @elementaltech)