Humble Hummocks

Designing a 'Hedge' Against Future Storm Surge to Improve Water Supply Resiliency

New England Water Environment Association
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CAMBRIDGE WATER DEPARTMENT

kmdg
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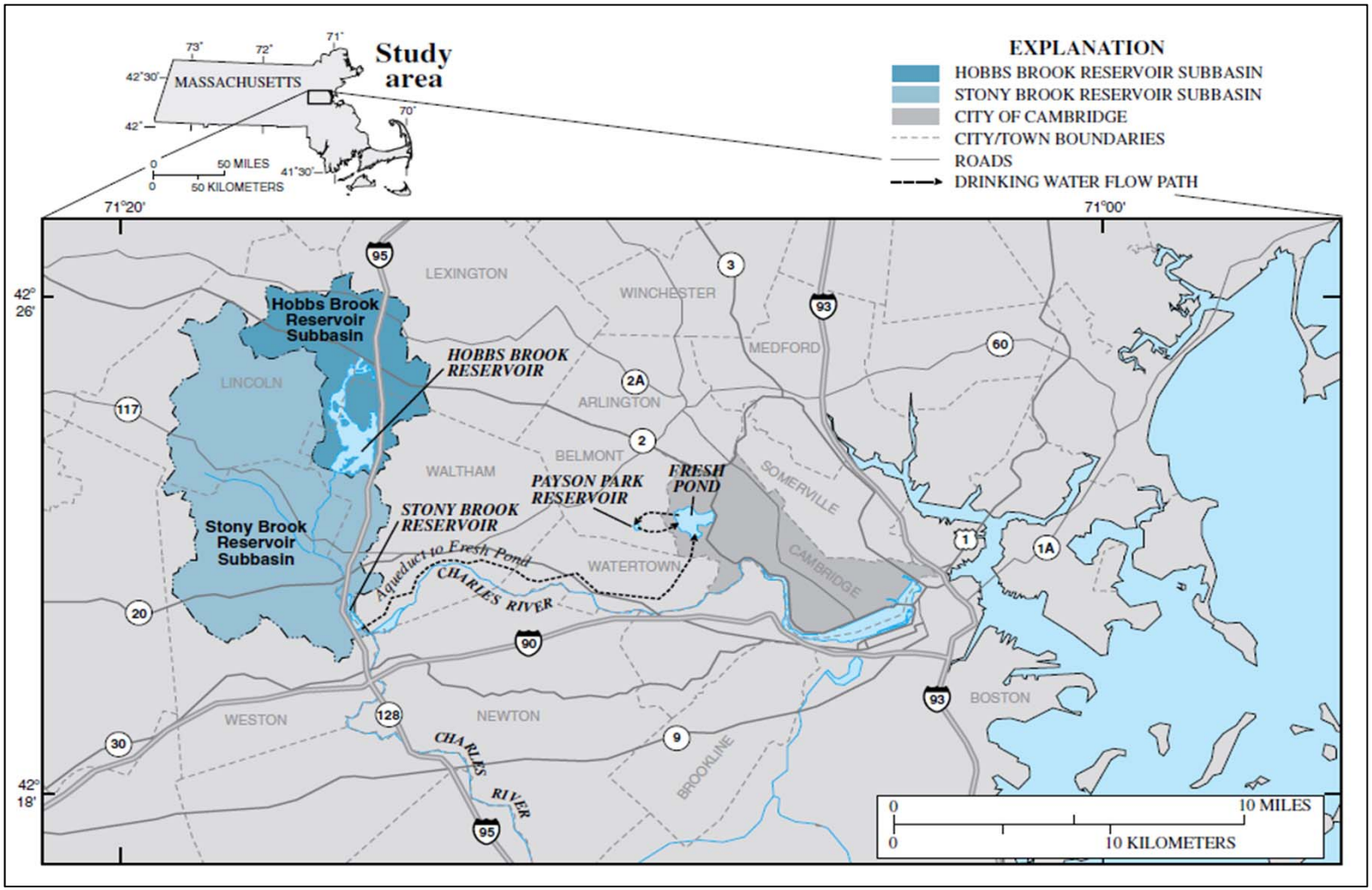
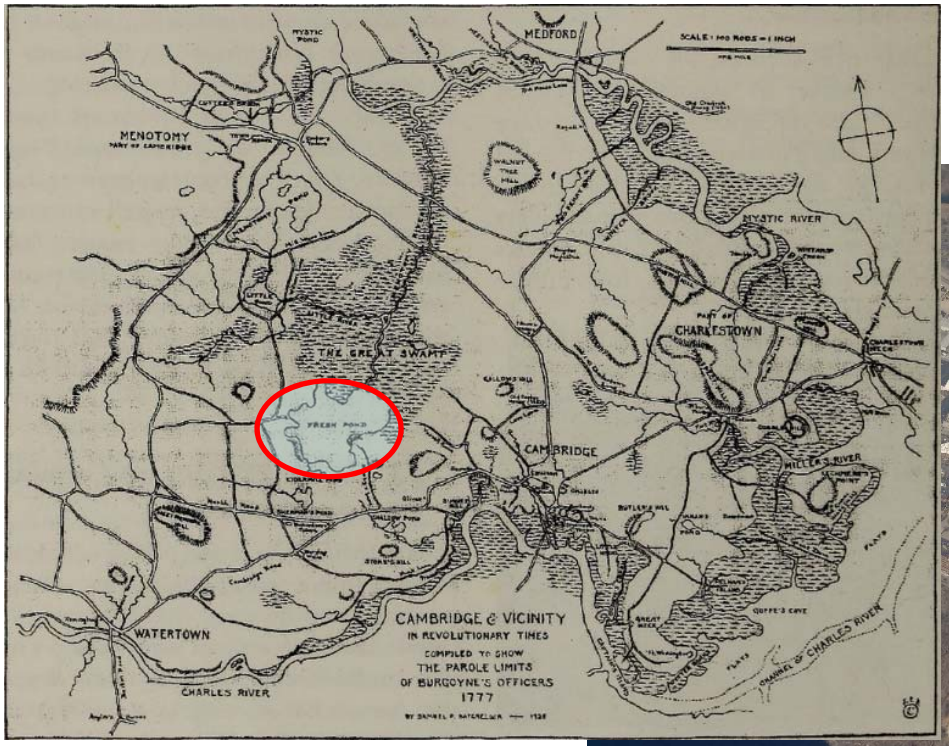
Outline

1. City of Cambridge's Water Supply
2. Fresh Pond Reservoir & Reservation
3. Fresh Pond Drainage Improvements Project
4. Citywide Climate Change Vulnerability Assessment
5. Citywide Preparedness/Resiliency Plan
6. Site Design Adaptation = Citywide Climate Adaptation
7. Fresh Pond Project Implementation & Construction

City of Cambridge Water Supply System



Fresh Pond Reservoir



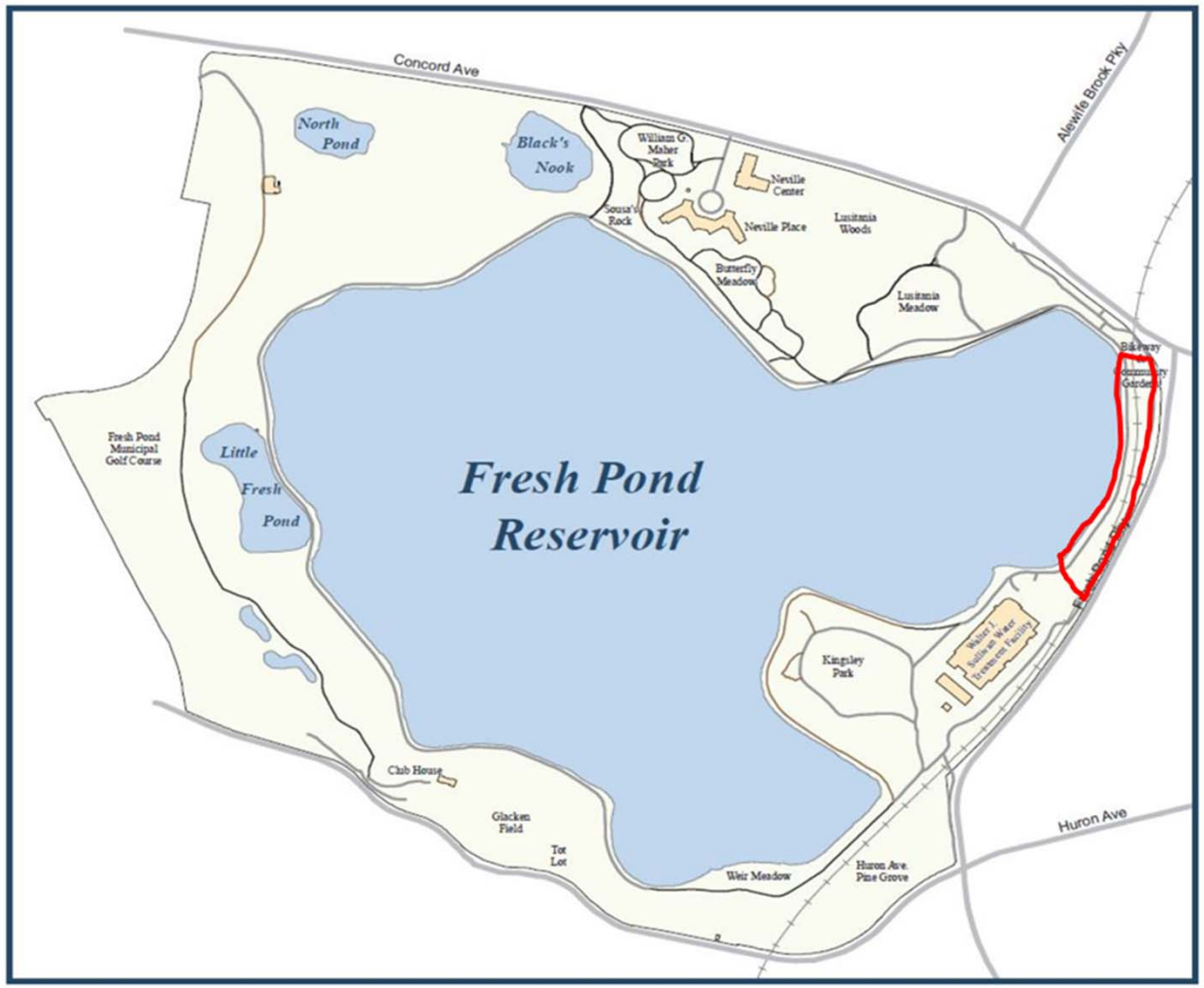
Fresh Pond Master Plan Vision Statement:

"… protecting and enhancing both the water quality of the Fresh Pond Reservation and its open space and naturalistic character …"

"… preservation of water quality, recreational open spaces, natural green spaces, wildlife habitat and a refuge from hectic urban life …"

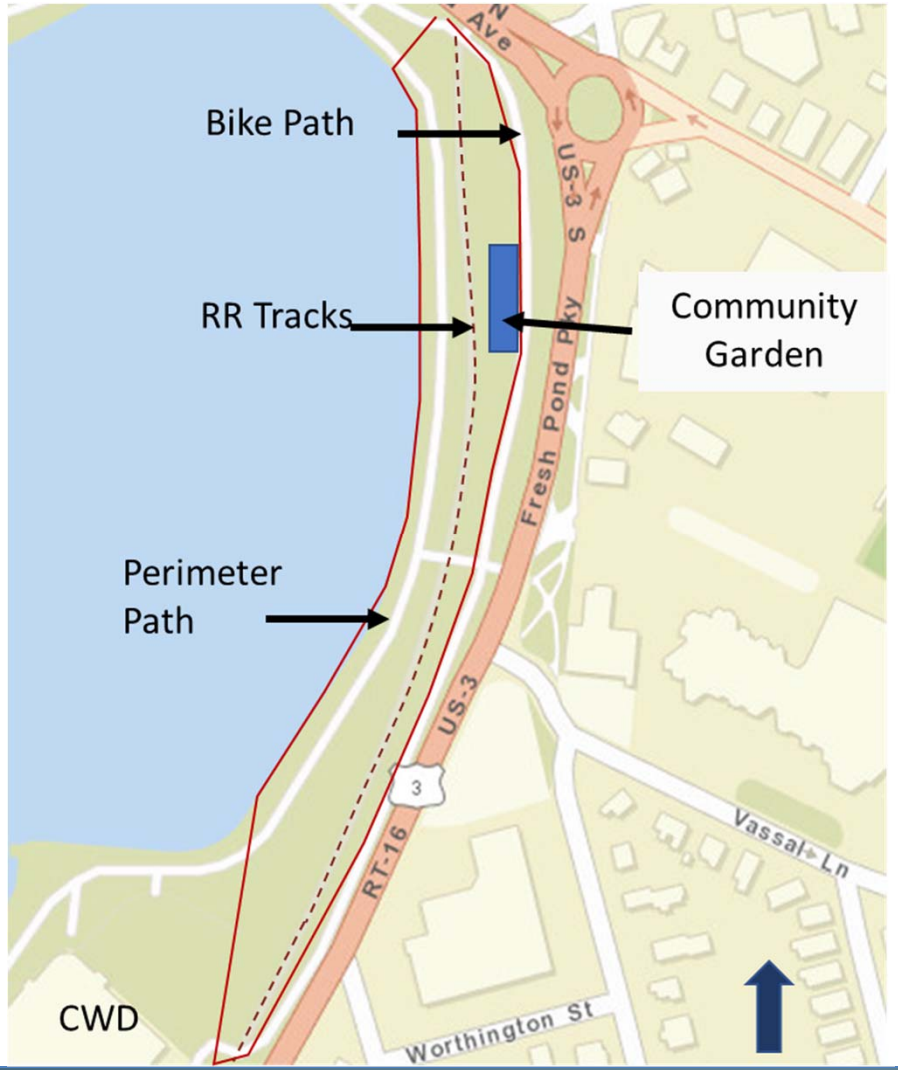
Fresh Pond Reservation Projects

Drainage/Community Gardens Improvements Project



Project Issues & Constraints

- Narrow corridor
- Abandoned rail line
- Invasive species/tree preservation
- Pedestrian traffic
- Community Garden improvements needed



Issue: Water quality & drainage

Flooding and poor drainage cause untreated stormwater to flow to Fresh Pond, as well as puddles, uneven pavement and winter icing safety hazards.

Issue: Old railroad corridor adjacent to Pond

Cut-through path – exposed & compacted soils, not ADA compliant

Debris and invasive plants in rail bed

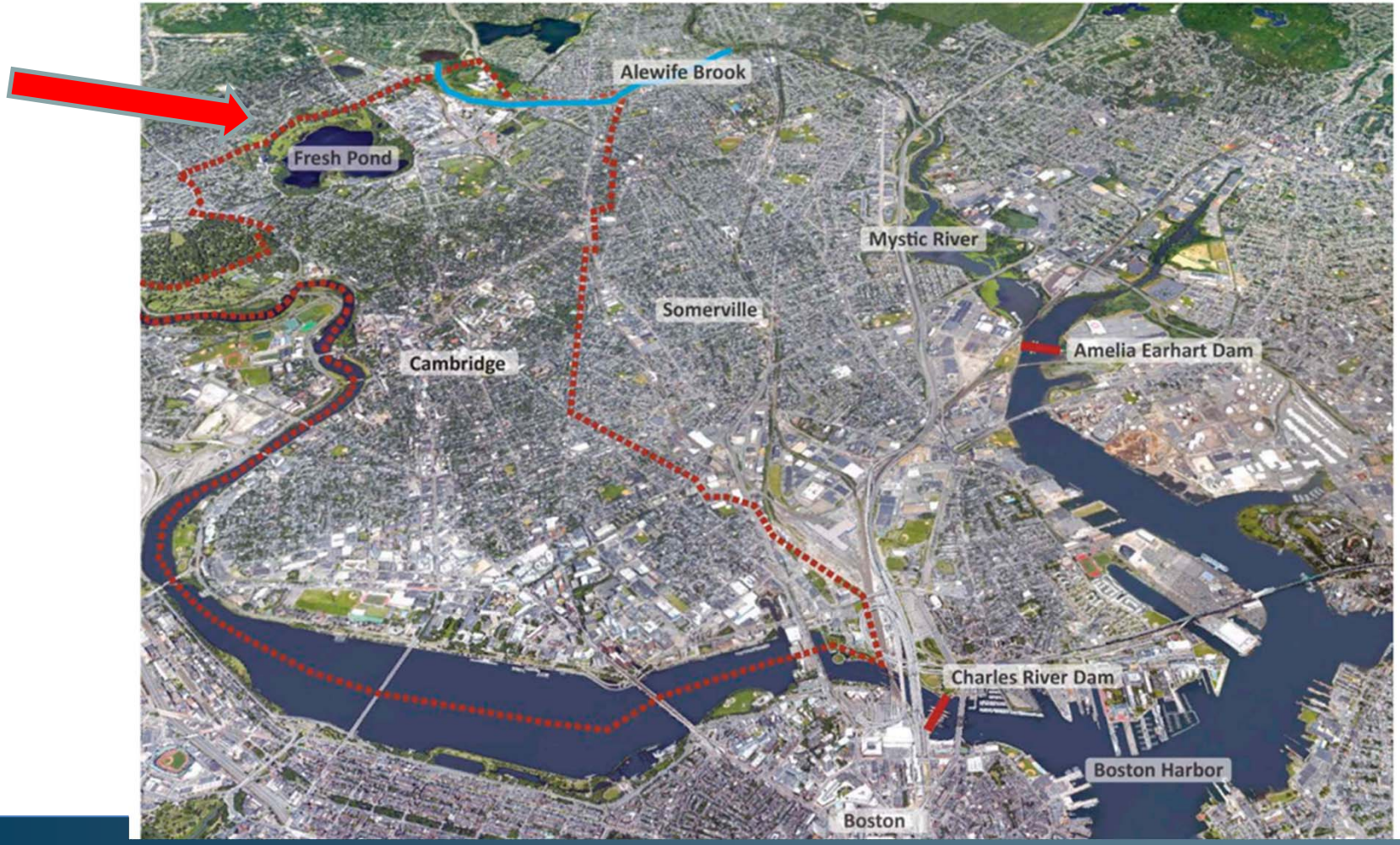
Issue: Existing Community Garden

Old Community Garden had poor drainage and poorly defined plots, was hard to access, and was not ADA compliant.

FP Drainage/Community Garden Project Goals:

- Protect Fresh Pond water quality
- Repurpose & improve former rail corridor
- Improve perimeter path drainage & safety
- Buffer path users from Parkway noise
- Expand & improve Community Garden
- Make Garden accessible for all
- Create & restore habitat

Concurrent Citywide Effort – Climate Change Preparedness Planning

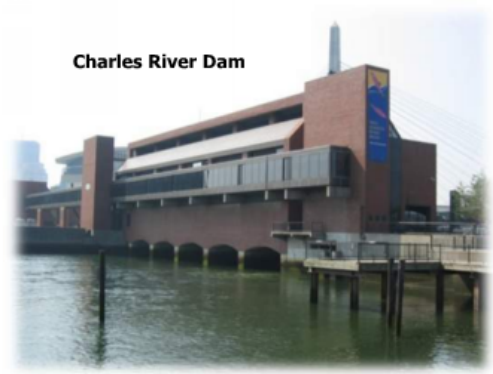


Source: Google Maps

1st Phase – Climate Change Vulnerability Assessment

Flooding Impacts at the Dams

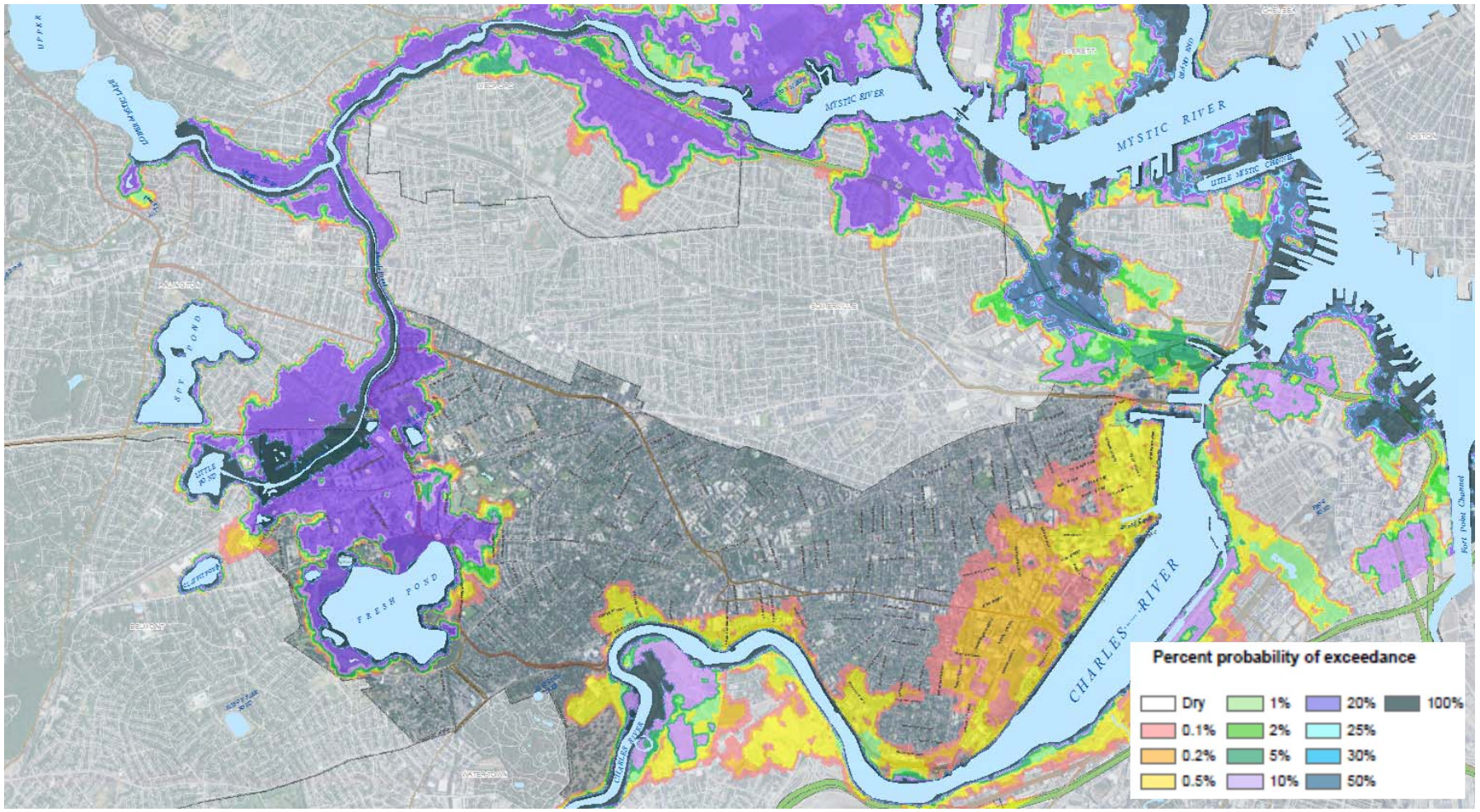
(Assuming high rate of SLR)



- At 1% (100-yr):
  - Flanked in 2055-2060
  - Overtopped in 2065
- At 0.2% (500-yr):
  - Flanked in 2045
  - Overtopped in 2050

- At 1% (100-yr):
  - Flanked in 2045-2050
  - Overtopped in 2055-2060
- At 0.2% (500-yr):
  - Flanked in 2030-2035
  - Overtopped in 2040

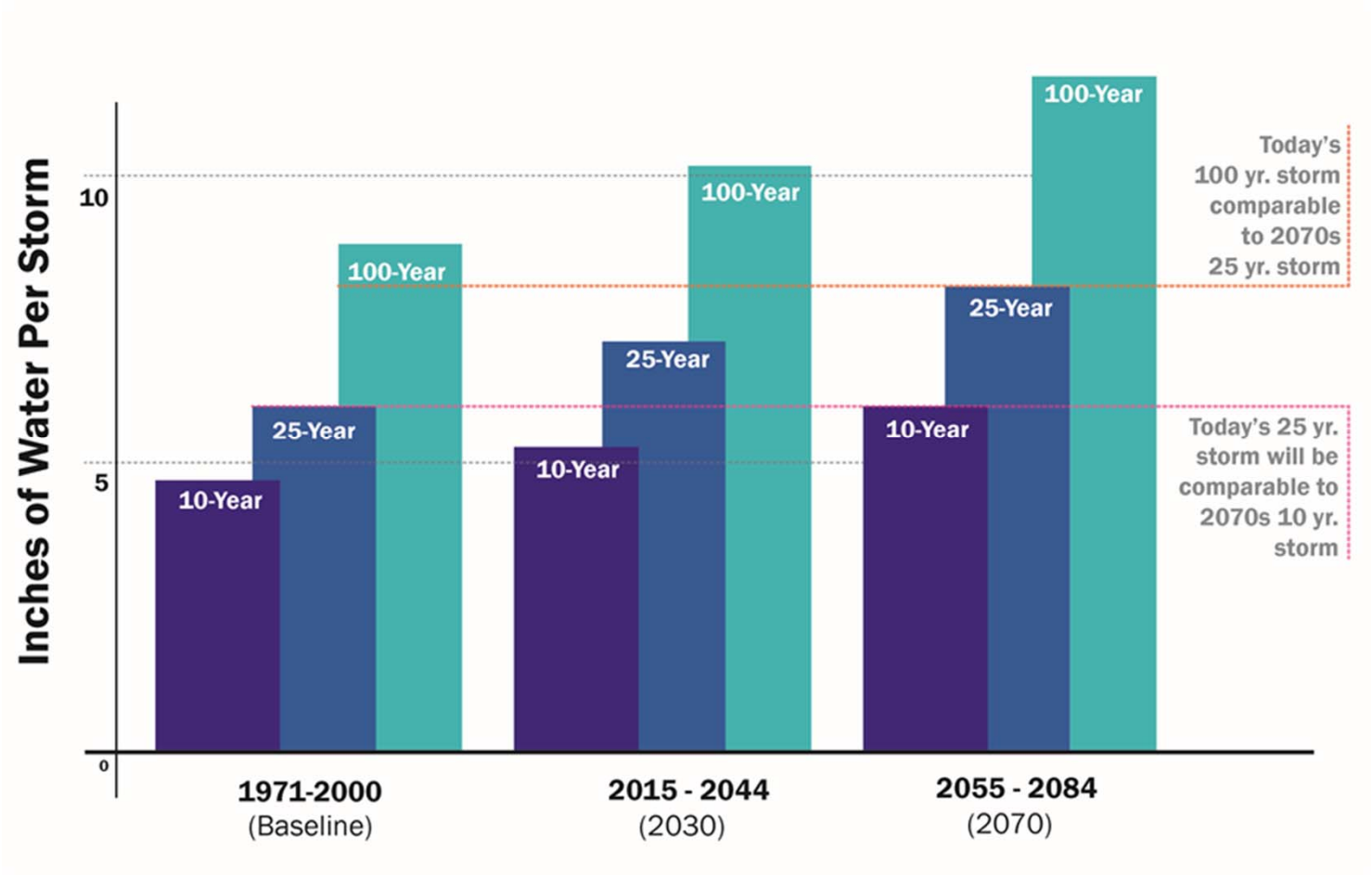
Storm Surges from Boston Harbor will reach Alewife after 2030



Source: Kleinfelder & Woods Hole Group for the City of Cambridge, February 2017

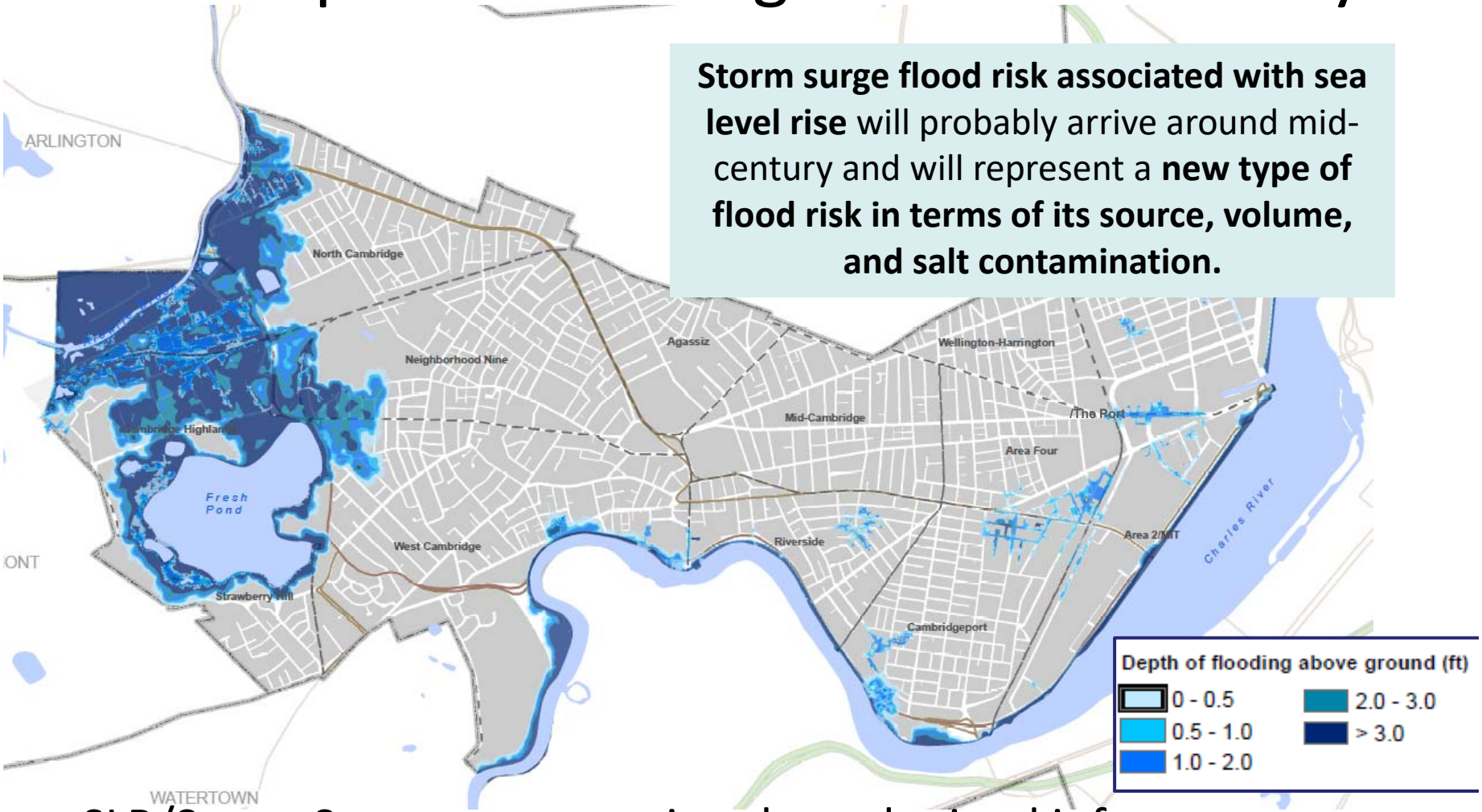
Sea Level Rise/Storm Surge Risk - 2070

Precipitation Impacts



2070 Depth of Flooding for 1% Probability

Storm surge flood risk associated with sea level rise will probably arrive around mid-century and will represent a **new type of flood risk in terms of its source, volume, and salt contamination.**

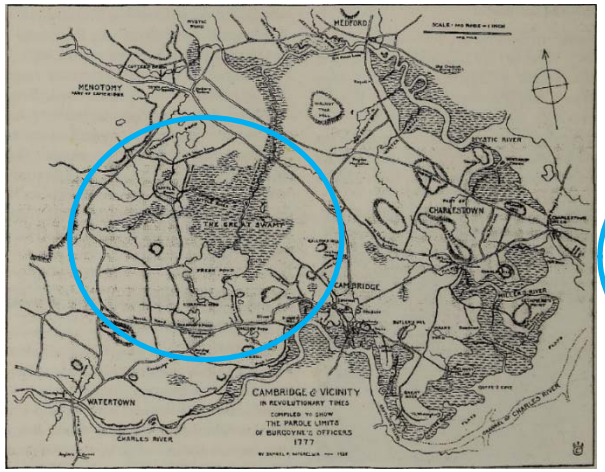


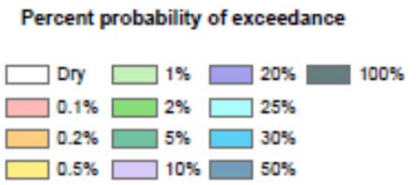
SLR/Storm Surge + propagation through piped infrastructure

Source: Kleinfelder based on WHG & MWH analyses, October 2015

CCVA Findings (2015)

- While farthest from Boston Harbor, the Alewife Fresh Pond area is at greatest risk of storm surge flooding by 2070.
- Fresh Pond Reservoir: on "most vulnerable infrastructure" list.

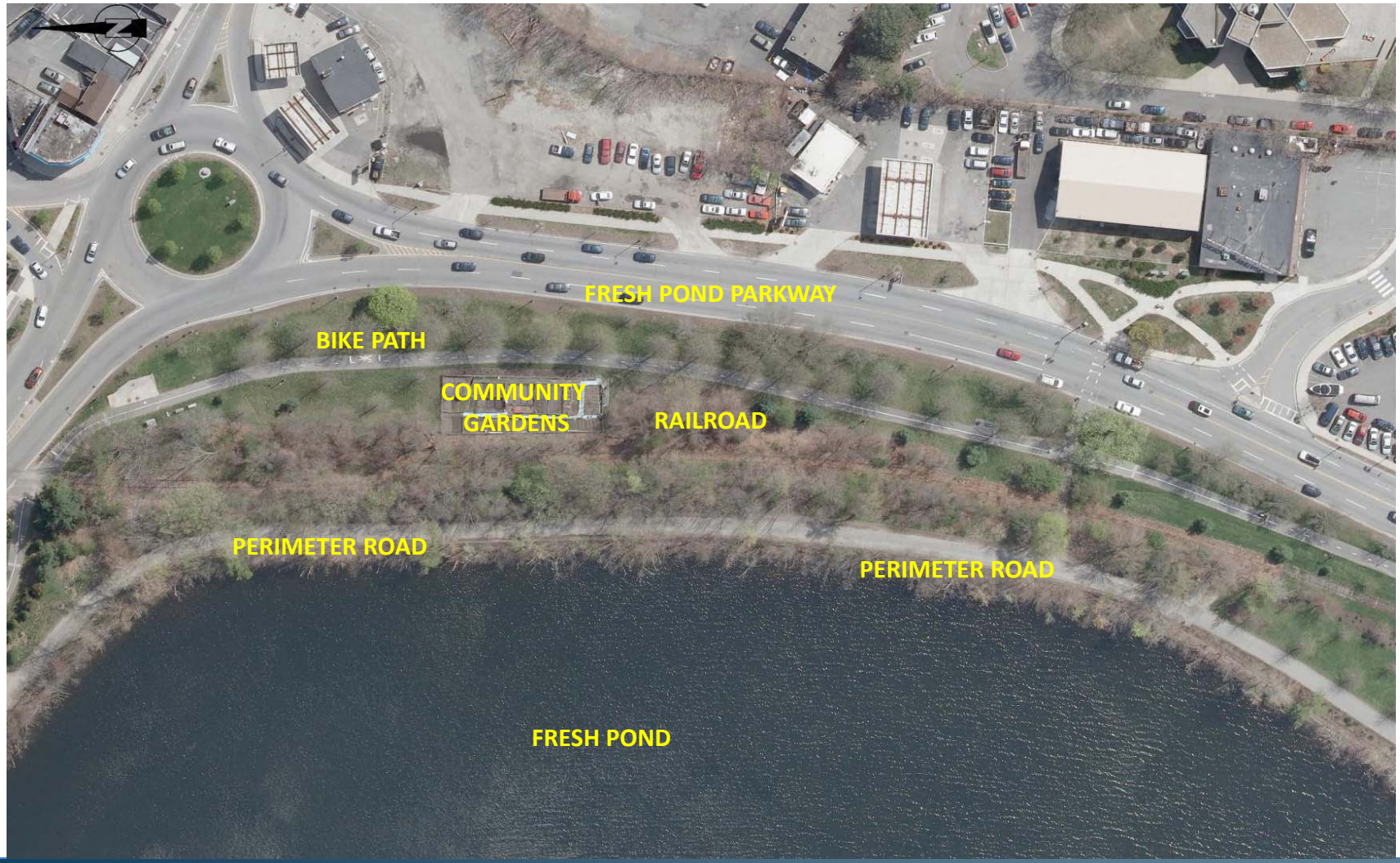




Sea Level Rise/Storm Surge Risk - 2070

Source: Kleinfelder & Woods Hole Group for the City of Cambridge, February 2017

Meanwhile, back at the Reservation …



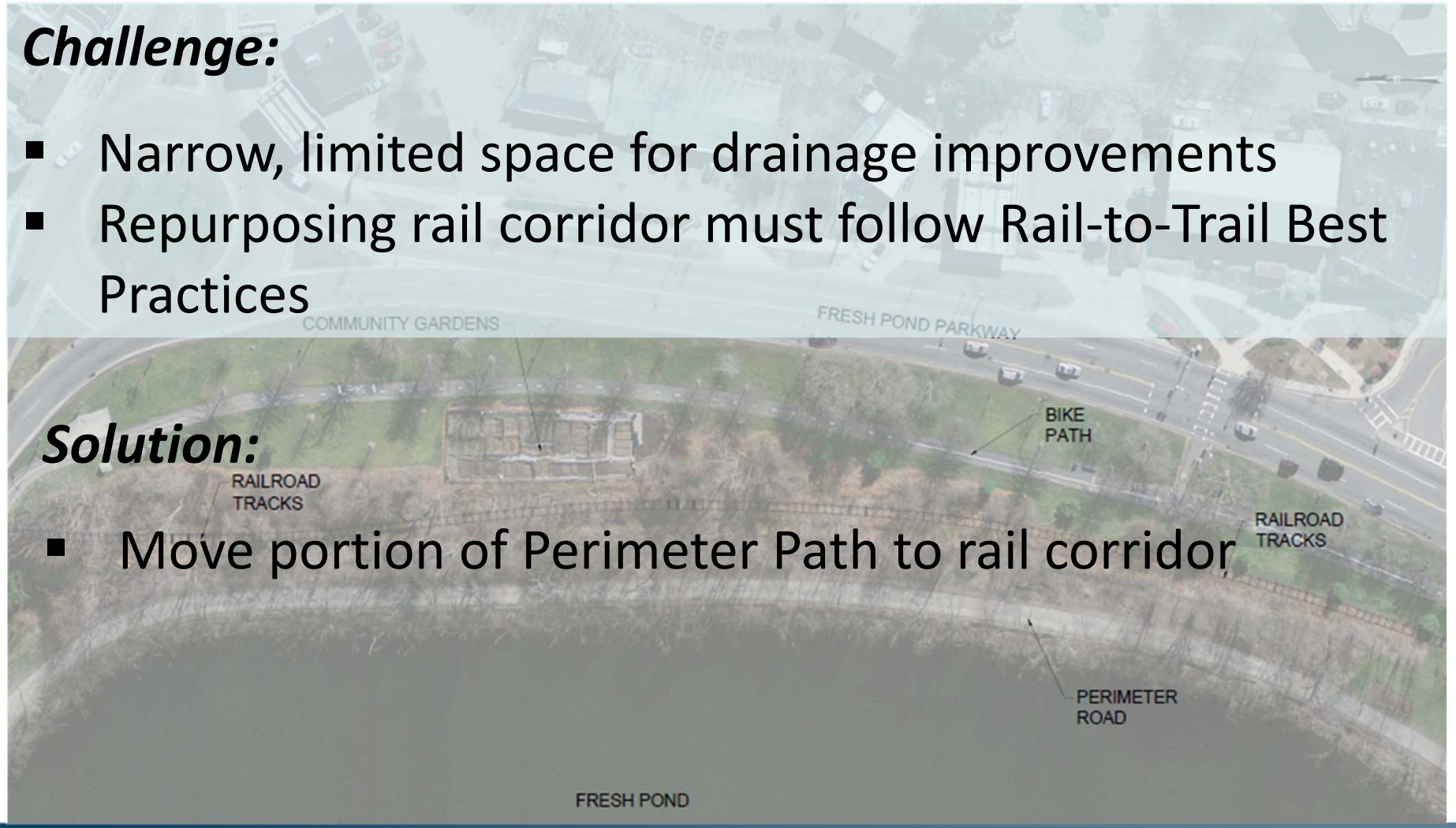
Project Challenges & Design Solutions:

Challenge:

- Narrow, limited space for drainage improvements
- Repurposing rail corridor must follow Rail-to-Trail Best Practices

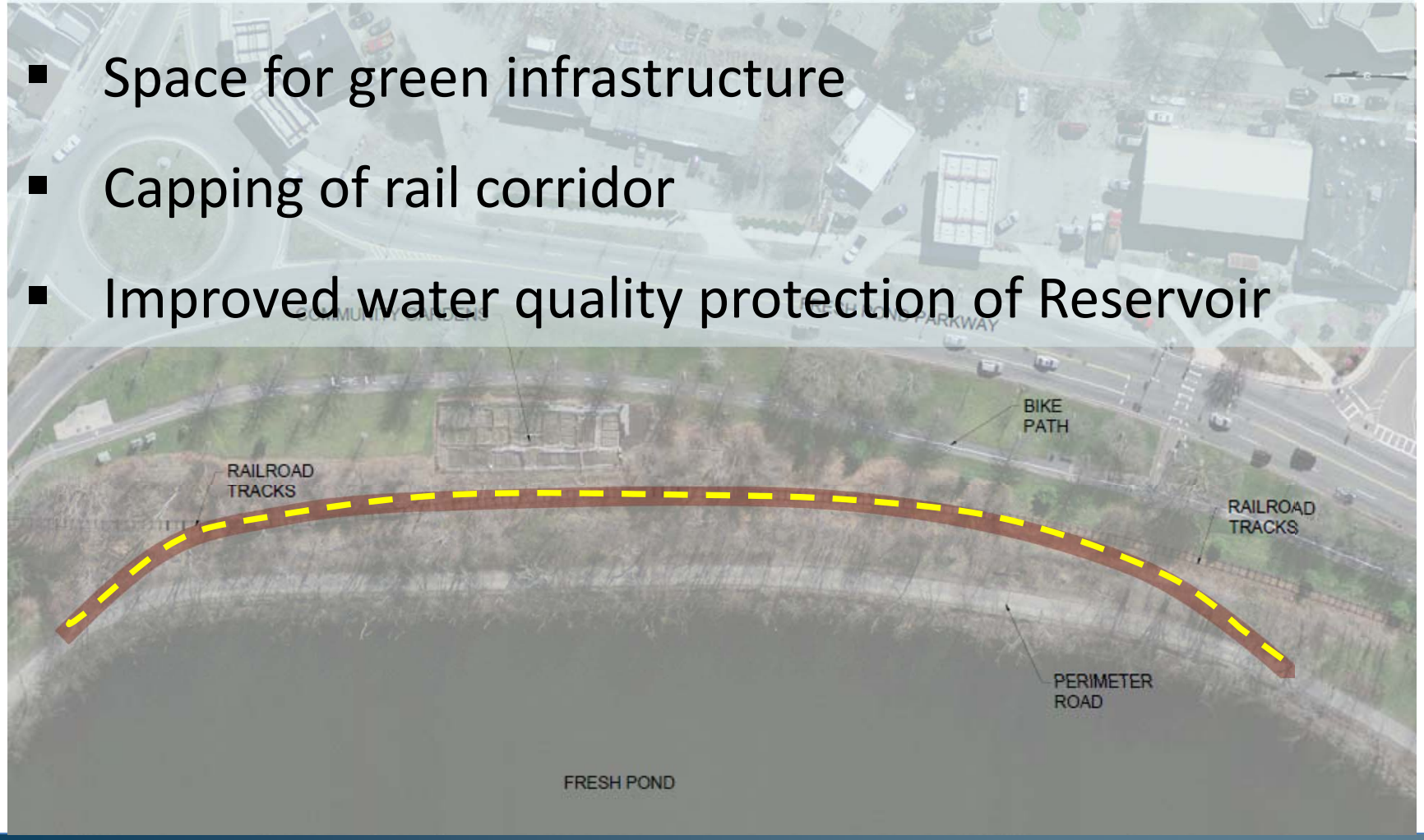
Solution:

- Move portion of Perimeter Path to rail corridor



“Rail-to-Trail” Path Relocation Benefits:

- Space for green infrastructure
- Capping of rail corridor
- Improved water quality protection of Reservoir



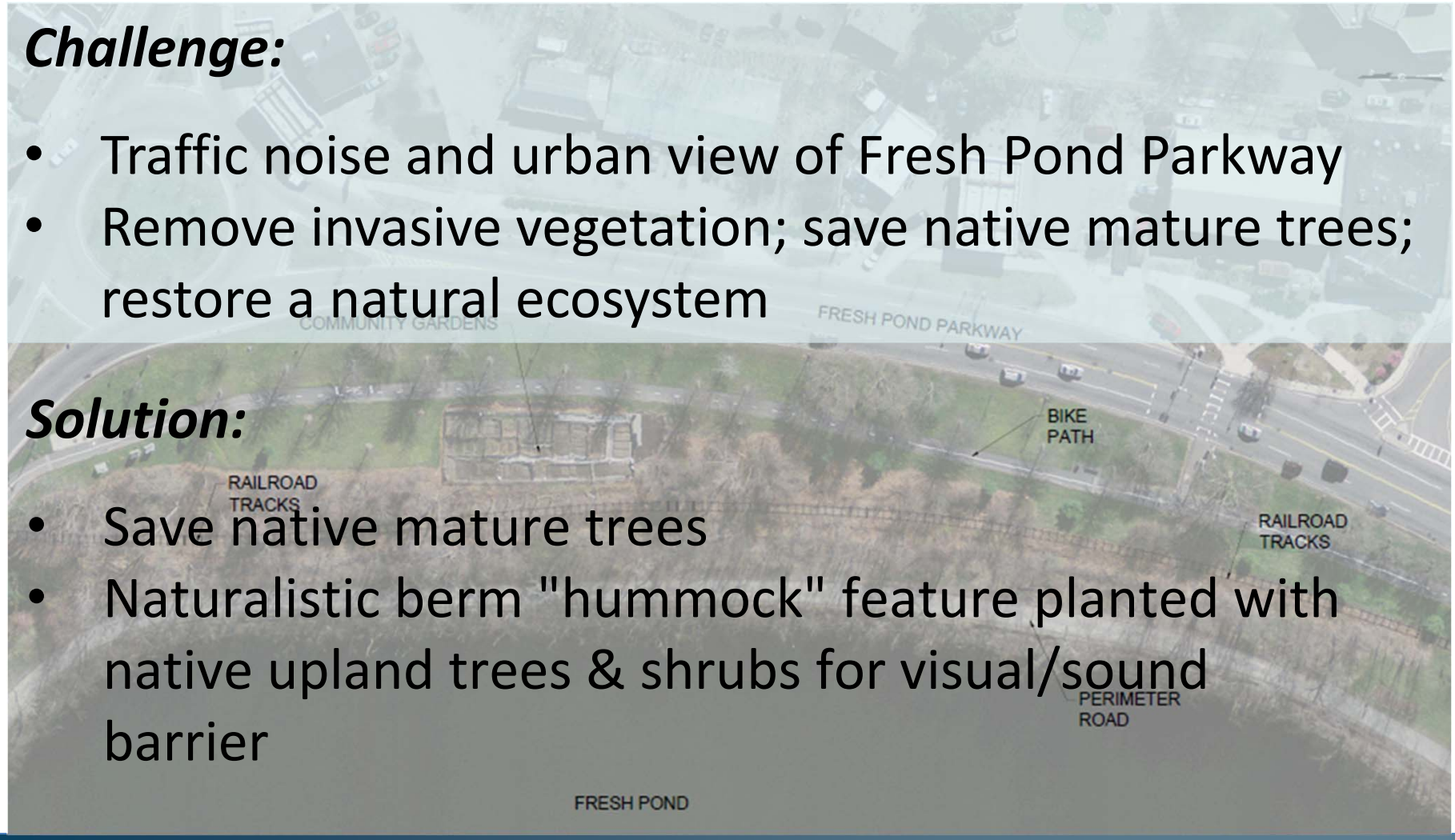
Project Challenges & Design Solutions:

Challenge:

- Traffic noise and urban view of Fresh Pond Parkway
- Remove invasive vegetation; save native mature trees; restore a natural ecosystem

Solution:

- Save native mature trees
- Naturalistic berm "hummock" feature planted with native upland trees & shrubs for visual/sound barrier

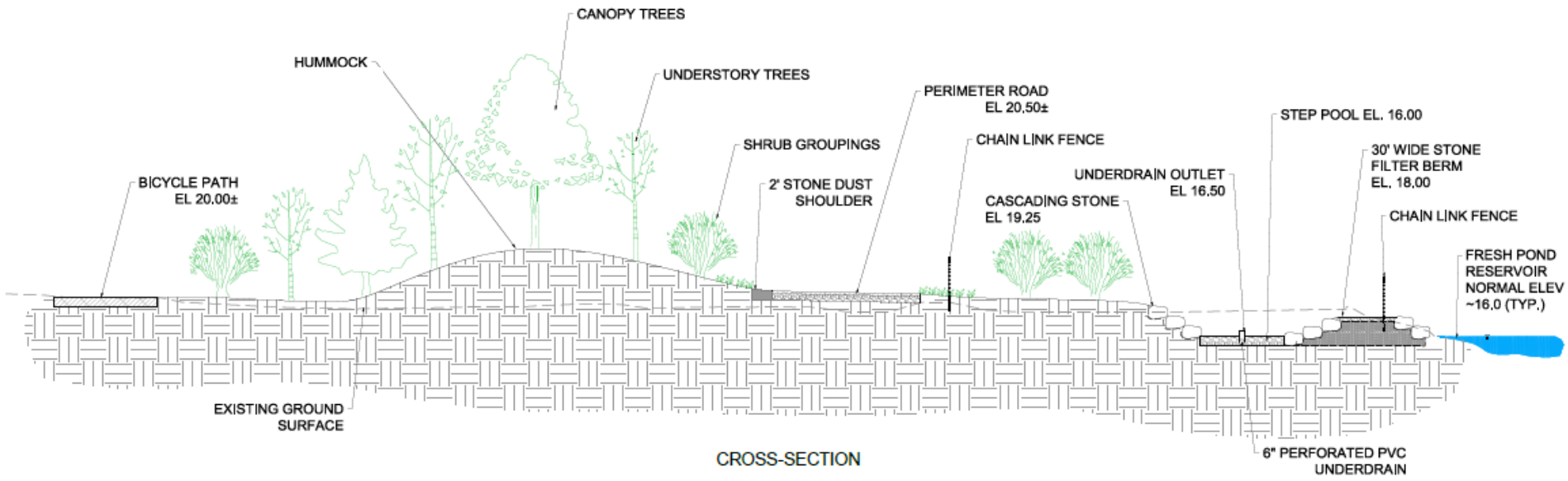


Proposed Design Solution: Hummocks & Bioswale

Rendering by:

kmdg KLOPFER MARTIN DESIGN GROUP

Proposed Design Solution: Hummocks & Bioswale



Source: Kleinfelder

Meanwhile, back at 344 Broadway …

CAMBRIDGE
CDD@344
COMMUNITY DEVELOPMENT DEPARTMENT
344 Broadway

Cambridge CCPR Vision

The Cambridge Climate Change Preparedness & Resilience Plan will:

Protect the lives and livelihoods of members of the Cambridge community that are at risk from climate change impacts and, in the process, enhance the well-being of the Cambridge community.

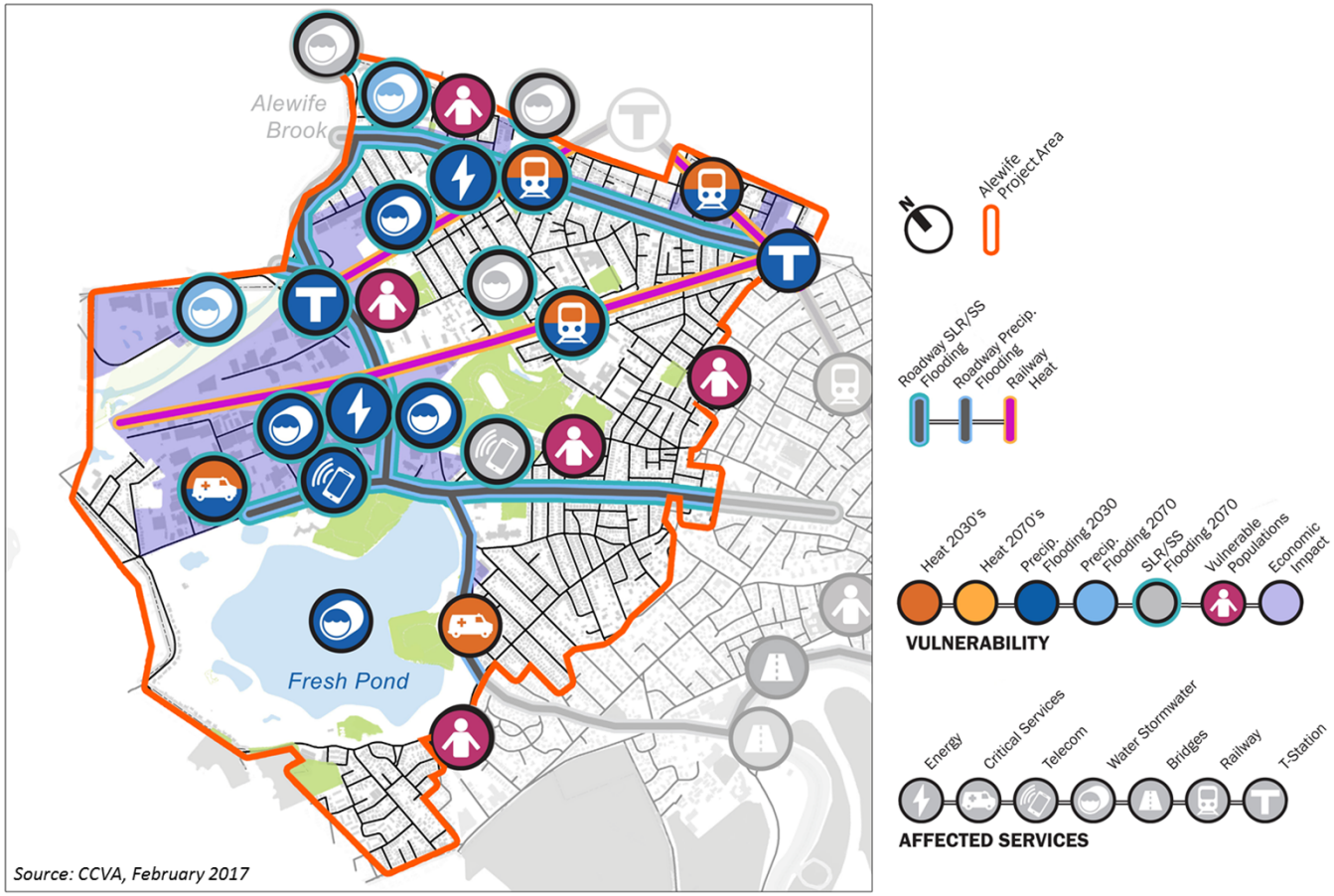
CLIMATE CHANGE PREPAREDNESS & RESILIENCE

ALEWIFE PREPAREDNESS PLAN

CITY OF CAMBRIDGE

Assets, people & businesses most at risk

- Alewife serves as the regional hub for several key infrastructure systems
- Key critical assets are likely to experience increased flooding and heat wave impacts



CCPR Resilience Strategies

A **A Prepared Community**: Strategies to strengthen community, social, and economic resilience.

B **Adapted Buildings:** Strategies to protect buildings against projected climate change impacts.

C **Resilient Infrastructure:** Strategies to ensure continued service or a speedy recovery from community-wide infrastructure systems.

D **Resilient ecosystems:** An enhanced living environment integrating air quality, waterways, green infrastructure, and the urban forest as a system resilient to climate impacts.

Resilience Strategy Evaluation Criteria

- **Impact***:* Is the strategy technically effective?
- **Affordable:** Is the implementation cost feasible?
- **Equitable:** Will the strategy be fair to all?
- **Wellness:** Will the strategy improve public health and safety?
- **Feasible**: Is the strategy politically, legally, and financially realistic?
- **Integrated**: Is the strategy aligned with Net Zero & Envision?
- **Sustainable**: Does the strategy mitigate climate change?

C Resilient Infrastructure

Strategies to ensure continued service or a speedy recovery from community-wide infrastructure systems.

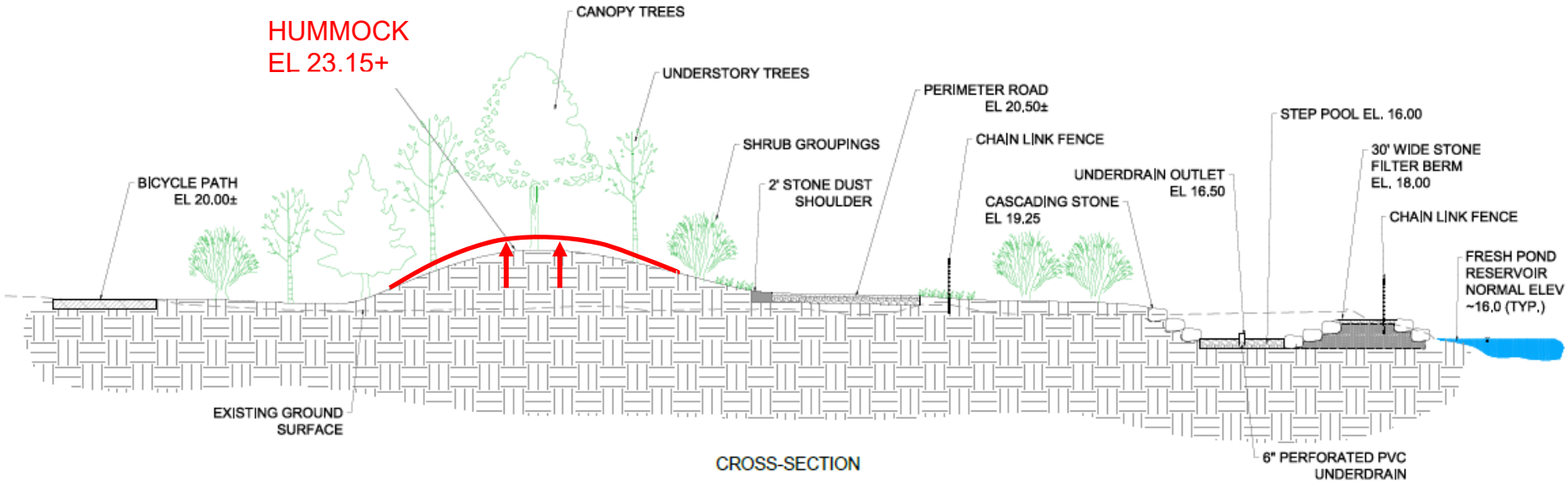
PROTECTING FRESH POND

[SOURCE: CCPR, 2017]

Evaluate building a vegetated berm at elevation 23.15 feet CCB* along the Fresh Pond Golf Course. This strategy could effectively protect the Fresh Pond Reservoir for up to the 2070 100-year sea level rise / storm surge flooding.

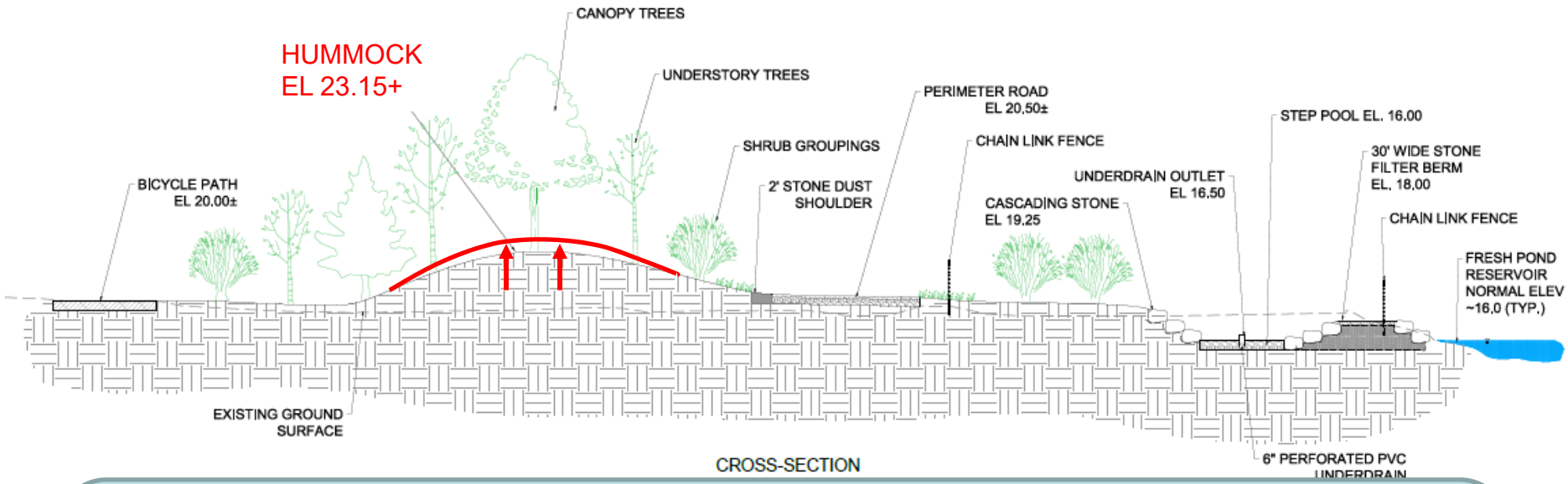
*Cambridge city-base datum

Site Design Adaptation Supports Citywide Resiliency Plan



Elevating the hummocks slightly to 23.15’ or higher protects Fresh Pond from the 2070 100-year sea level rise/storm surge flooding.

Site Design Adaptation Supports Citywide Resiliency Plan



Resilient Infrastructure:

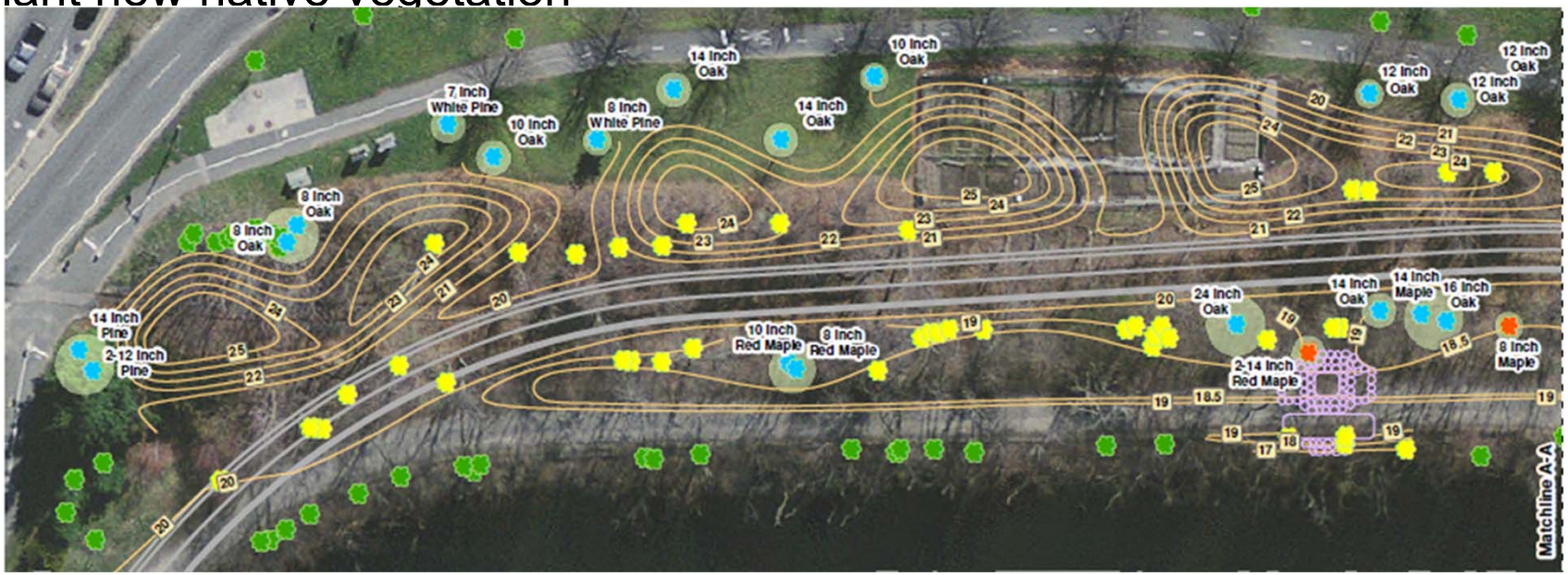
Strategies to ensure continued service or a speedy recovery from community-wide infrastructure systems.

Final Project Implementation – Relocate Path onto Railroad

- Remove & Cap Railroad Right-of-Way
  - MASSDEP Rail-to-Trail Best Practices
  - Within Treadway, place potentially contaminated soils under pavement or stone dust
  - Outside of Treadway, discourage use through plantings and fencing

Final Project Implementation – Tree Protection

- Protect mature native trees
- Remove invasive species & restore native habitat
- Plant new native vegetation



Final Project Implementation

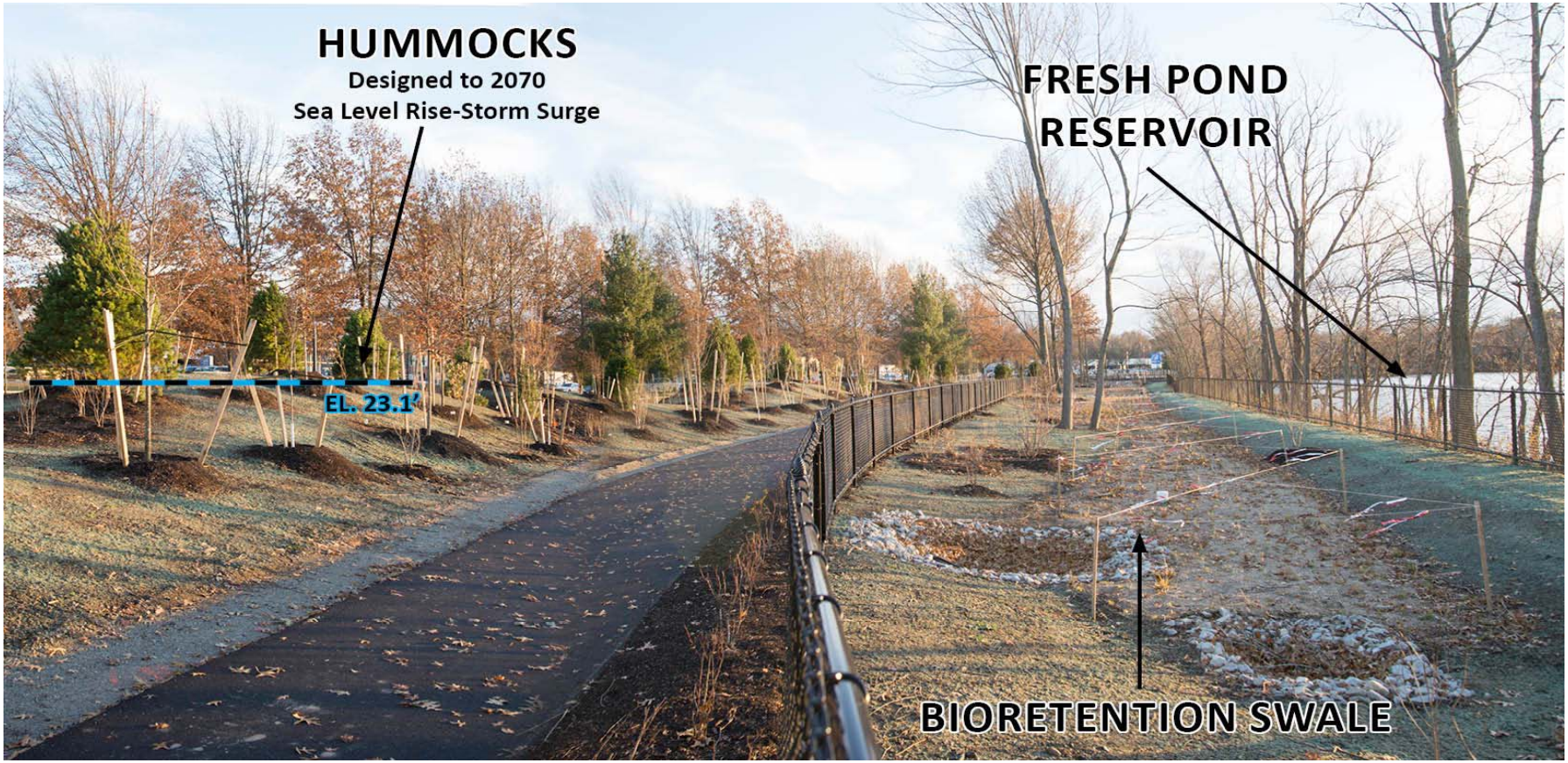
- Protect mature native trees
- Remove invasive species & restore native habitat
- Plant new native vegetation

Final Project Implementation – Protect Water Quality

Final Project Implementation – Accessibility

- New access path replaces cut-through
- Community Gardens moved closer to entrance
- Larger garden with accessible beds

Final Project Implementation – Screening & Flood Protection



Acknowledgements

- City of Cambridge
  - Jennifer LeTourneau, Conservation Director (Public Works; Community Gardens Program)
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- Project Partners
  - Klopfer Martin Design Group (Landscape Design)
  - Argus Construction (Construction Contractor)

CCVA/CCPR plan Partners-

https://www.cambridgema.gov/CDD/Projects/Climate/climatechangeresilianceandadaptation

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To learn more:

http://www.cambridgema.gov/climateprep

https://www.cambridgema.gov/Water/freshpondreservation