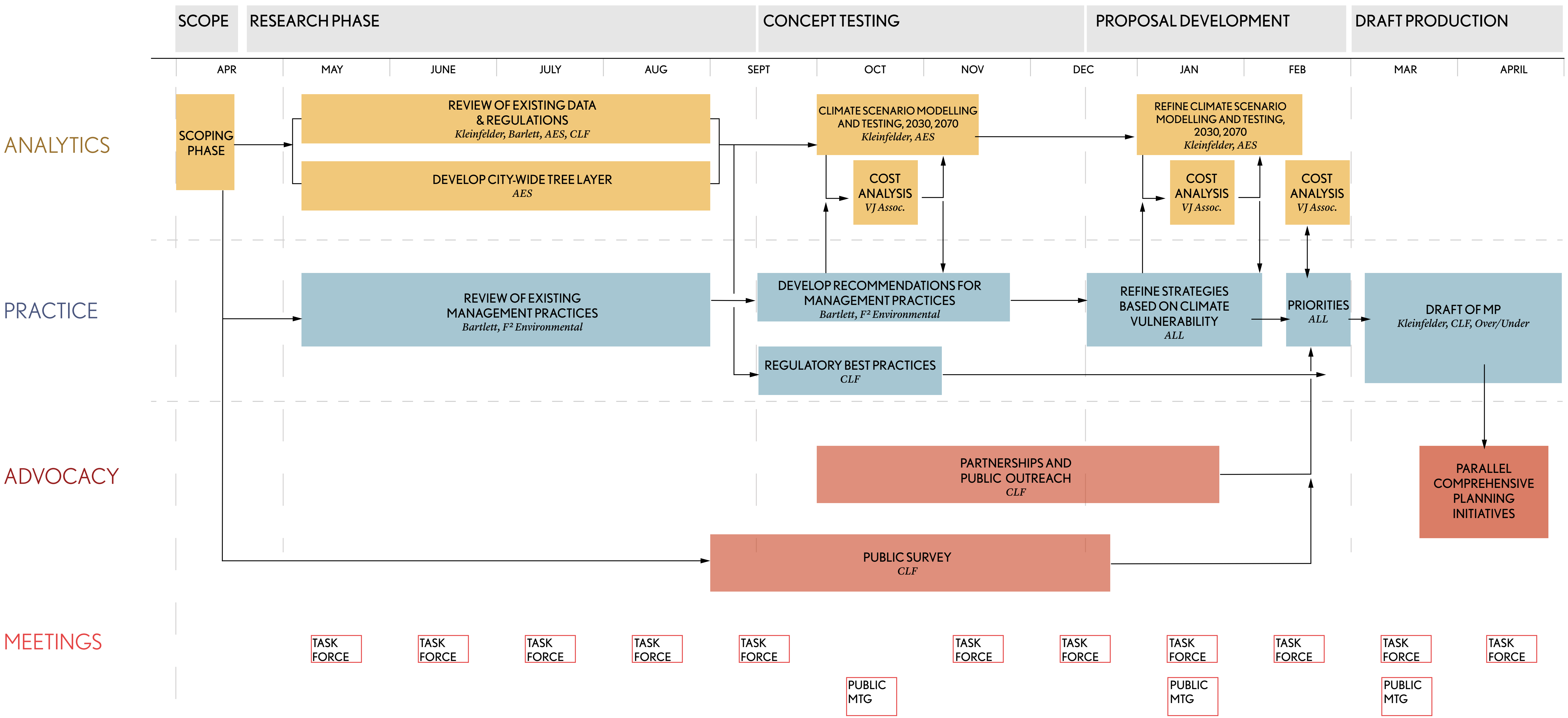
Cambridge Urban Forest Master Plan

Task Force Meeting #6

November 29, 2018

An independent quality control analysis of the LiDAR data that is the foundation of this analysis does not materially change the previously reported findings.

To ensure comparable data in the future UVM will prepare an independent analysis of canopy change which will be appended to this study.


SCOPE
RESEARCH PHASE
CONCEPT TESTING
PROPOSAL DEVELOPMENT
DRAFT PRODUCTION
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APRIL
ANALYTICS
PRACTICE
ADVOCACY
MEETINGS
SCOPING PHASE
REVIEW OF EXISTING DATA & REGULATIONS
Kleinfelder, Barlett, AES, CLF
DEVELOP CITY-WIDE TREE LAYER
AES
CLIMATE SCENARIO MODELLING AND TESTING, 2030, 2070
Kleinfelder, AES
COST ANALYSIS
VJ Assoc.
REFINE CLIMATE SCENARIO MODELLING AND TESTING, 2030, 2070
Kleinfelder, AES
COST ANALYSIS
VJ Assoc.
COST ANALYSIS
VJ Assoc.
REVIEW OF EXISTING MANAGEMENT PRACTICES
Bartlett, F² Environmental
DEVELOP RECOMMENDATIONS FOR MANAGEMENT PRACTICES
Bartlett, F² Environmental
REFINE STRATEGIES BASED ON CLIMATE VULNERABILITY
ALL
PRIORITIES
ALL
DRAFT OF MP
Kleinfelder, CLF, Over/Under
REGULATORY BEST PRACTICES
CLF
PARTNERSHIPS AND PUBLIC OUTREACH
CLF
PARALLEL COMPREHENSIVE PLANNING INITIATIVES
PUBLIC SURVEY
CLF
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FROM RESEARCH TO TESTING

SOILS ANALYSIS

CLIMATE MODEL

RESPONSE STRATEGIES

PLANNING SYNERGIES

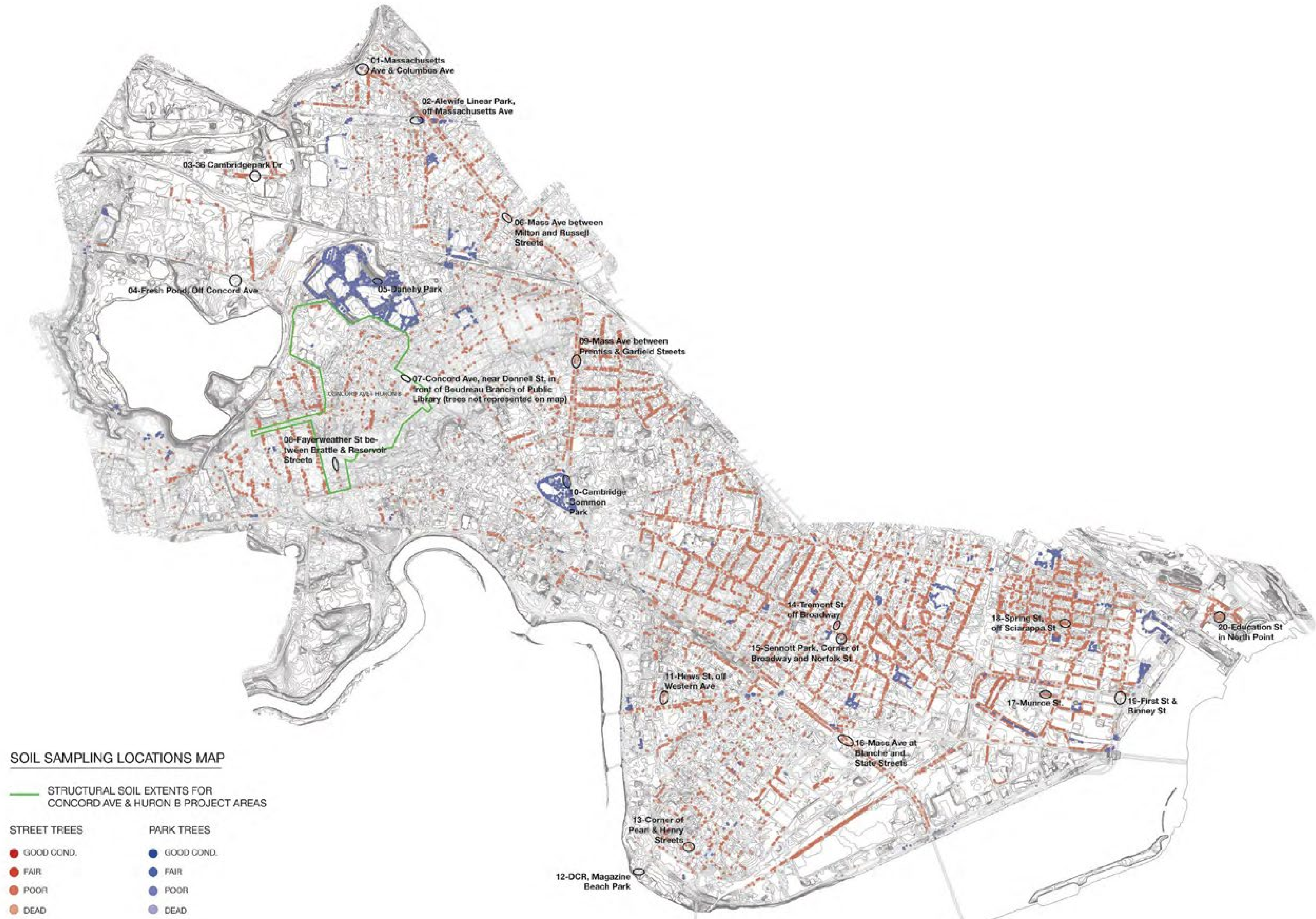
Overall soil condition for street trees is fair to poor, showing high compaction, low nutrient cycling, and poor drainage characteristics.

Soil condition can limit tree vitality.

Some limiting factors can be remediated through management practices.

INITIAL ANALYSIS RESULTS

20 sample sites



The following limiting factors to tree health were found:

Compaction — 16 of 20 sites had severe compaction

Low nutrient levels — 12 sites had little to no available nitrogen

Poor drainage — 7 sites showed poor drainage 2'-3' below surface

Texture — General inconsistency of soils materials, presence of construction debris

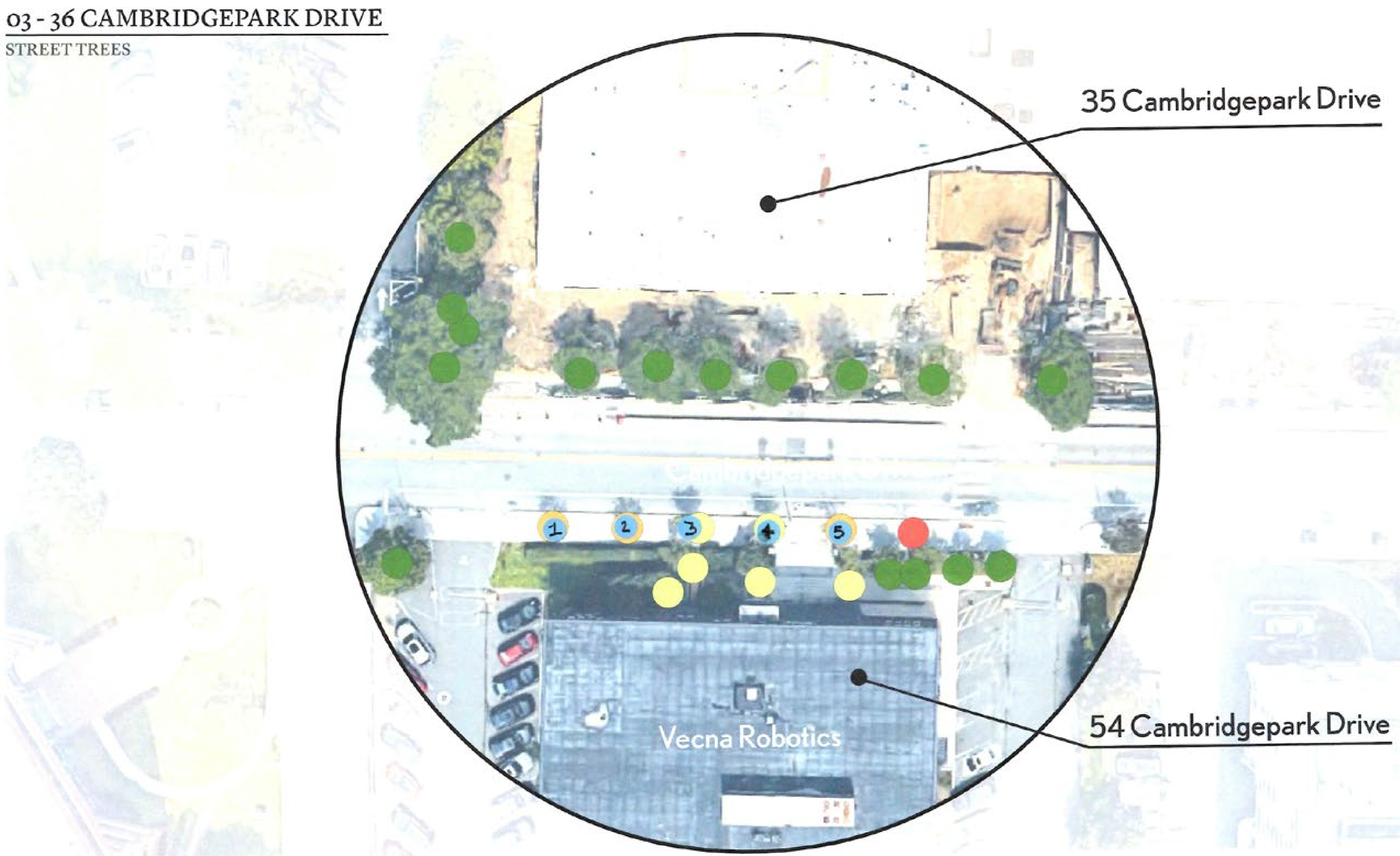
Possible remediation measures:

Compaction — Aeration can loosen soils

Low nutrient levels — Compost can be added

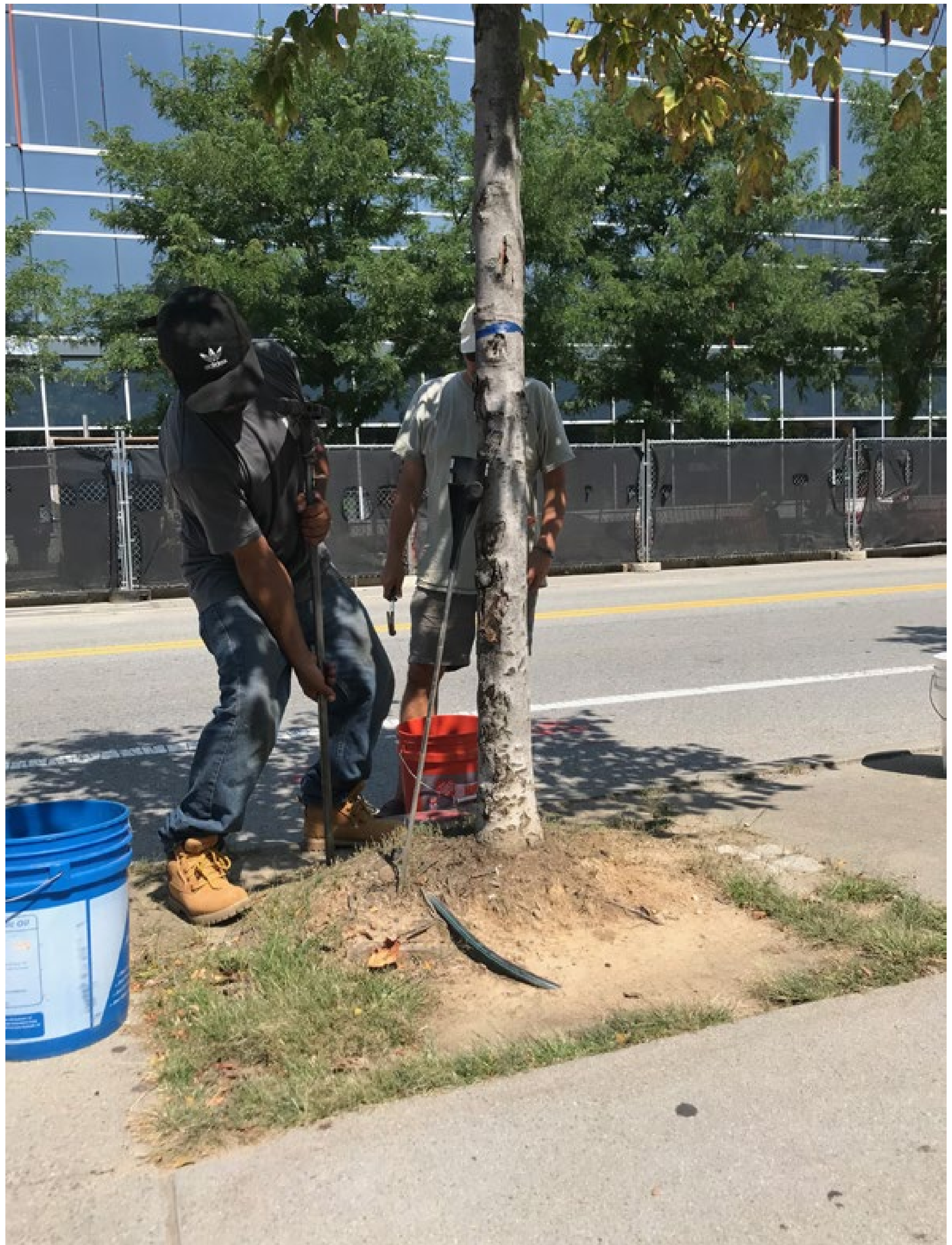
Poor drainage — Can't be addressed post-planting

Texture — Compost can have some effect but difficult to address post-planting



1 Soil sample location

ANALYSIS SITES
Site 3 photos - compaction example



Site 3 Datasheets

F² ENVIRONMENTAL DESIGN LLC

TEST RESULTS

Location 3

	EXISTING CONDITION	DESIRABLE RANGE	COMMENTS
Biology			
Protozoa			
Amoeba	1,500.13	>20,000	Low
Flagellates	3,001.34	>20,000	Low
Ciliates	0.00	<45	
Nutrient Cycling Capacity from Microbial Activity	<25 lbs Nitrogen/acre		
Bacterial Biomass and Diversity	665.88	>300	
Fungal Biomass	150.73	>1,500	
Hyphal Diameter	2.75	>2.5	
Location 3 0-12"			
CEC	7.6	>10	
PH	6.7	6.5-7.0	
OM	3.8	4-8%	
Soluble Salts	0.12	<0.6	
Sand	66.90%		
Silt	25.10%		
Clay	8.00%		
Clay, Silt, VF Sand	38.30%		
Lead	4.80	<22	
Location 3 12"-24"			
CEC	8.3	>10	
PH	6.2	6.5-7.0	
OM	4.2	4-8%	
Soluble Salts	0.26	<0.6	
Sand	66.80%		
Silt	23.20%		
Clay	9.90%		
Clay, Silt, VF Sand	40.20%		
Lead	4.8	<22	
Location 3 24"-36"			
CEC	7.2	>10	
PH	6.4	6.5-7.0	
OM	3.7	4-8%	
Soluble Salts	0.27	<0.6	
Sand	67.70%		
Silt	20.40%		
Clay	11.90%		
Clay, Silt, VF Sand	38.70%		
Lead	10.7	<22	

Soil Detail

Report prepared for:
F2 Environmental Design
Eric T. Fleisher
PO Box 292
null
Pottersville, NJ 07979 USA

For interpretation of this report please contact your local Soil Steward or the lab.

Report Sent:
Sample #: 03-11892
Unique ID: Cambridge Loc 3
Plant: trees
Season: summer
Invoice Number: 4688
Sample Recieved: 06 Sep 2018

SOIL FOODWEB NEW YORK
17 Clinton St.
Center Moriches, NY 11934 United States
631-750-1553
soilfoodwebny@aol.com
http://soilfoodwebnewyork.com

Assay Name	Result	Units	Desired Level	Commentary
Organism Biomass Data				
Dry Weight	0.92	N/A	0.45 to 0.85	Add organic matter to build soil structure, increase water holding capacity.
Active Fungi	1.96	µg/g	> 150.00	Fungal activity low, foods may be required. -
Total Fungi	150.73	µg/g	> 1,500.00	Low fungal biomass, foods and biology may be required. -
Hyphal Diameter	2.75	µm	> 2.50	Good balance of fungi. -
Active Bacteria	34.88	µg/g	> 30.00	Bacterial activity within normal levels.
Total Bacteria	665.88	µg/g	> 300.00	Good bacterial biomass. -
Actinobacteria	0.00	µg/g		
Organism Biomass Ratios				
TF:TB	0.23		5.00 to 10.00	Too bacterial for indicated plant.
AF:TF	0.01		> 0.10	Low fungal activity, foods may be required.
AB:TB	0.05		> 0.10	Low bacterial activity, foods may be required.
AF:AB	0.06		5.00 to 10.00	Bacterial dominated, becoming more bacterial.
Protozoa (Protists)				
Flagellates	3,001.34	number/g	> 20,000.00	Lacking species diversity.
Amoebae	1,500.13	number/g	> 20,000.00	
Ciliates	0.00	number/g	< 45.00	
Nitrogen Cycling Potential	<25	lbs/acre		Nitrogen levels dependent on plant needs. Estimated availability over a 3 month period
Nematodes				
Nematodes	0.42	number/g	> 10.00	Low numbers, low diversity. Root feeding nematodes are present. Improving soil structure, introducing predatory nematodes and increasing mycorrhizal colonization can help suppress root feeders.
Bacterial	0.13	number/g	> 4.00	
Fungal	0.00	number/g	> 4.00	
Fungal/Root	0.05	number/g	< 1.00	
Predatory	0.00	number/g	> 2.00	
Root	0.23	number/g	< 1.00	
Mycorrhizal Fungi				
ENDO		%	> 40	-
ECTO	24.00	%	> 40	Low colonization, foods may be required.
Ericoid		%	> 40	
Miscellaneous Testing				
E.coli	Not Ordered	CFU/g	< 800.00	For most areas, the maximum E.coli CFU/g is 800 - 1000. Please check your local regulations for more information. -
pH	Not Ordered			
Organic Matter	Not Ordered			
Electrical Conductivity	Not Ordered	µS/cm	< 1000.00	

UMass Extension

Soil and Plant Nutrient Testing Laboratory
203 Paige Laboratory
161 Holdsworth Way
University of Massachusetts
Amherst, MA 01003
Phone: (413) 545-2311
e-mail: soiltest@umass.edu
website: soiltest.umass.edu

Soil Test Report

Prepared For:
Andrea Fillippone
F2 Environmental Design
PO Box 292
Pottersville, NJ 07979

andrea@f2environmentaldesign.com
908-413-1957

Sample Information:
Sample ID: Cambridge Loc #3 0-12"
Order Number: 40083
Lab Number: S180904-307
Area Sampled:
Received: 9/4/2018
Reported: 9/12/2018

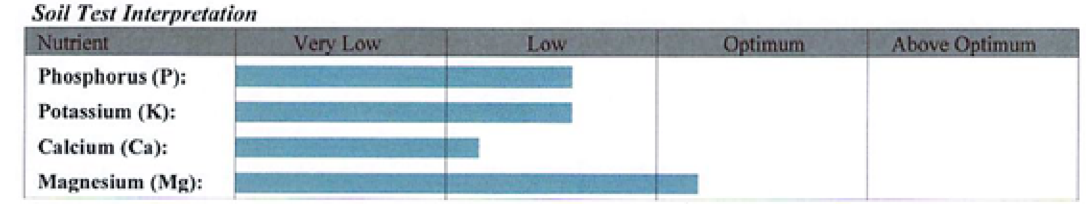
Results

Analysis	*Value Found*	*Optimum Range*
Soil pH (1:1, H2O)	6.7	
Modified Morgan extractable, ppm		
Macronutrients		
Phosphorus (P)	3.2	4-14
Potassium (K)	79	100-160
Calcium (Ca)	572	1000-1500
Magnesium (Mg)	63	50-120
Sulfur (S)	8.6	>10
Micronutrients *		
Boron (B)	0.2	0.1-0.5
Manganese (Mn)	2.0	1.1-6.3
Zinc (Zn)	5.5	1.0-7.6
Copper (Cu)	0.3	0.3-0.6
Iron (Fe)	4.1	2.7-9.4
Aluminum (Al)	48	<75
Lead (Pb)	4.8	<22

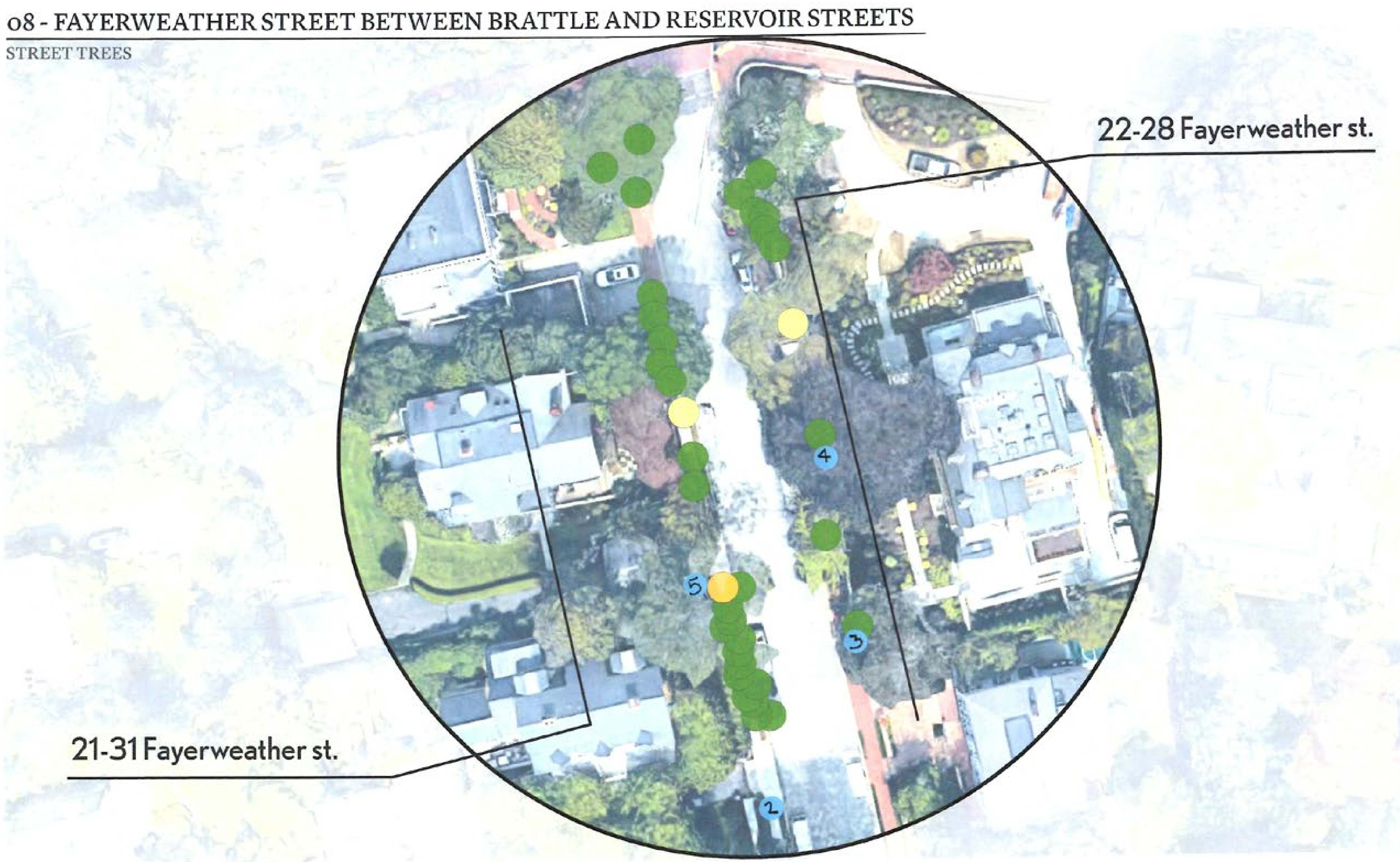
Analysis	*Value Found*	*Optimum Range*
Cation Exch. Capacity, meq/100g	7.6	
Exch. Acidity, meq/100g	4.0	
Base Saturation, %		
Calcium Base Saturation	38	50-80
Magnesium Base Saturation	7	10-30
Potassium Base Saturation	3	2.0-7.0
Scoop Density, g/cc	1.13	
Optional tests		
Soil Organic Matter (LOI), %	3.8	
Soluble Salts (1:2), dS/m	0.12	<0.6

* *Micronutrient deficiencies rarely occur in New England soils; therefore, an Optimum Range has never been defined. Values provided represent the normal range found in soils and are for reference only.*

Soil Test Interpretation

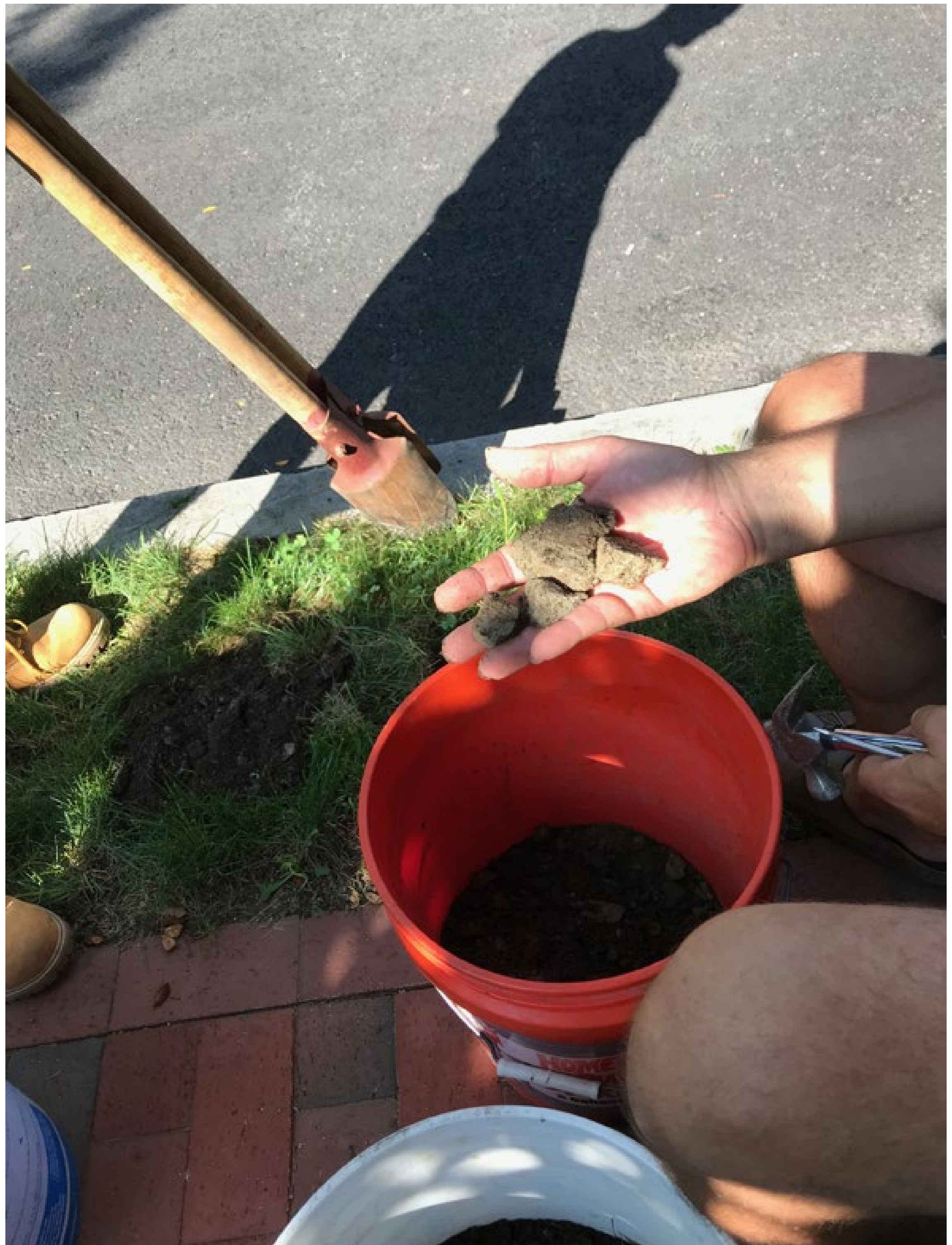


11 of 56 *Sample ID: Cambridge Loc #3 0-12"* *Lab Number S180904-307*



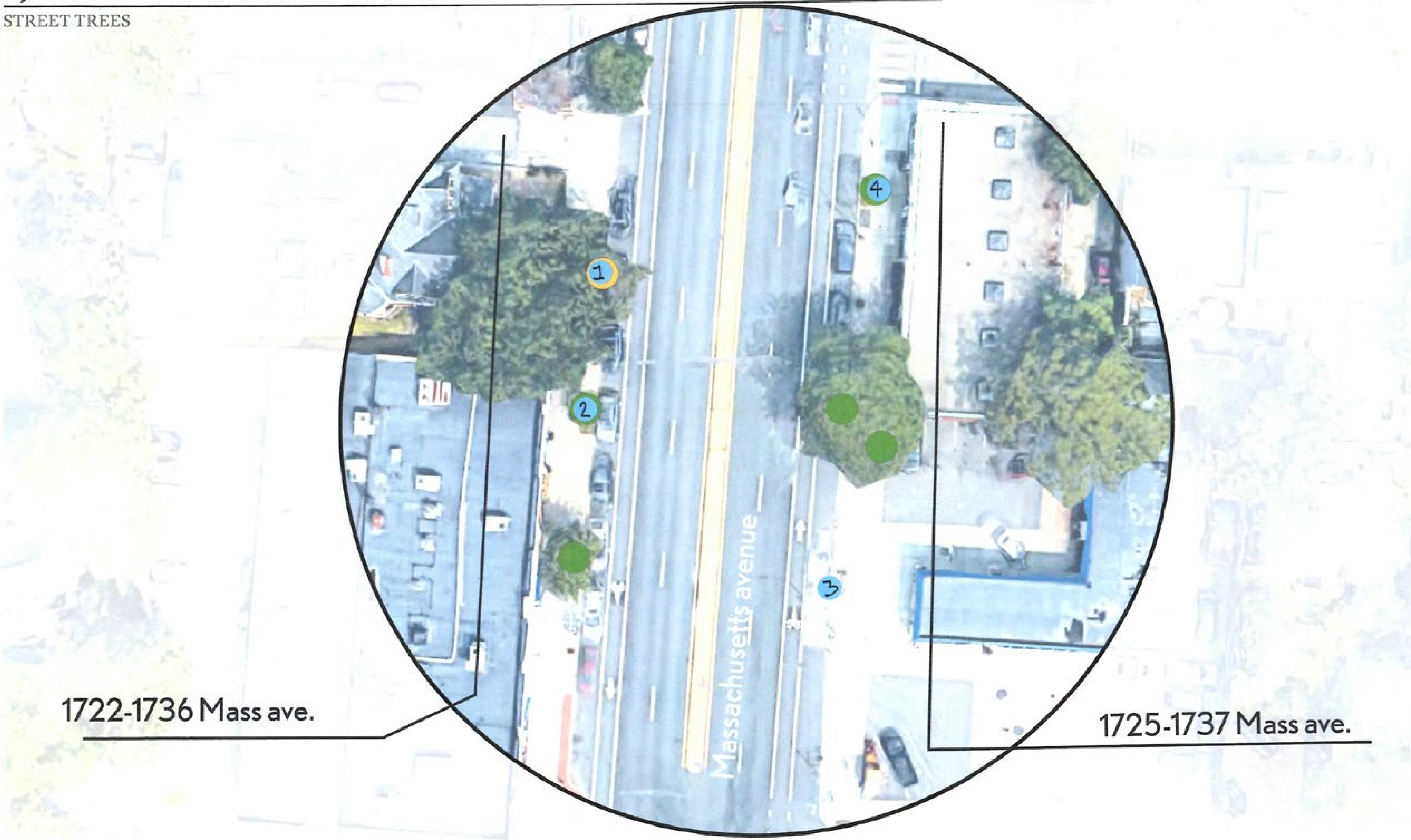
1 Soil sample location

Site 8 photos - poor drainage example



09 - MASSACHUETTS AVENUE BETWEEN PRENTISS AND GARFIELD STREETS

STREET TREES



1 Soil sample location

Site 9 photos - poor soils: sandy, dry

FROM RESEARCH TO TESTING

SOILS ANALYSIS

CLIMATE MODEL

RESPONSE STRATEGIES

PLANNING SYNERGIES

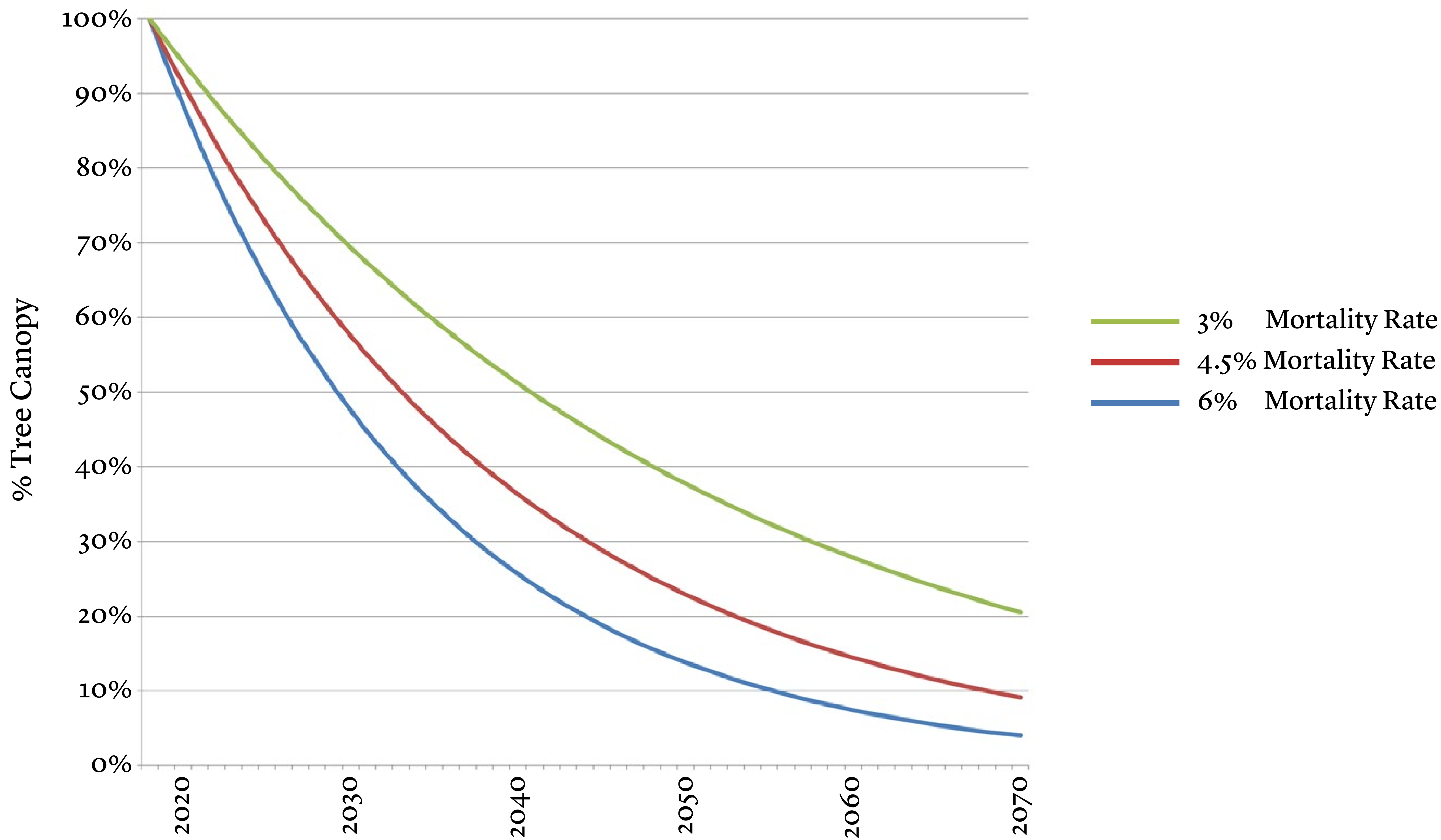
The increased threat of **pests and diseases** associated with a warming environment was found to have a **significant impact on tree mortality**.

Drought was found to have a potentially moderate impact on the existing tree canopy.

The findings from this simulation will inform city-wide tree **species recommendations** and include location-specific selection criteria, for example, planting only **flood tolerant species** in flood-prone areas.

BASELINE SCENARIOS LOSS RATE

With a 4.5% annual mortality rate, 56% of the canopy remains in 2030, and 9% remains in 2070



Drivers of tree mortality

1. **Pests and Diseases**

   Increasing severity of existing pests & diseases

   Species were assigned low, average or high pest & disease loading

2. **Temperature Increase**

   Cambridge will move from hardiness zone 6b to 7a by 2070 *

   - 2030: 5 species will be removed:

     Black Ash, Bigtooth Aspen, Pin Cherry, Balsam Fir, Red Pine, and Tamarack. Only Red Pine has significant numbers in Cambridge (4.2 acres)

   - 2070: 11 species will be removed

*Melillo, J. M., T.C. Richmond, and G.W. Yohe (eds). 2014.

BASELINE SCENARIO PARAMETERS

Each tree species was evaluated for pests/disease loading, flood and drought tolerance average lifespan, hardiness zone,

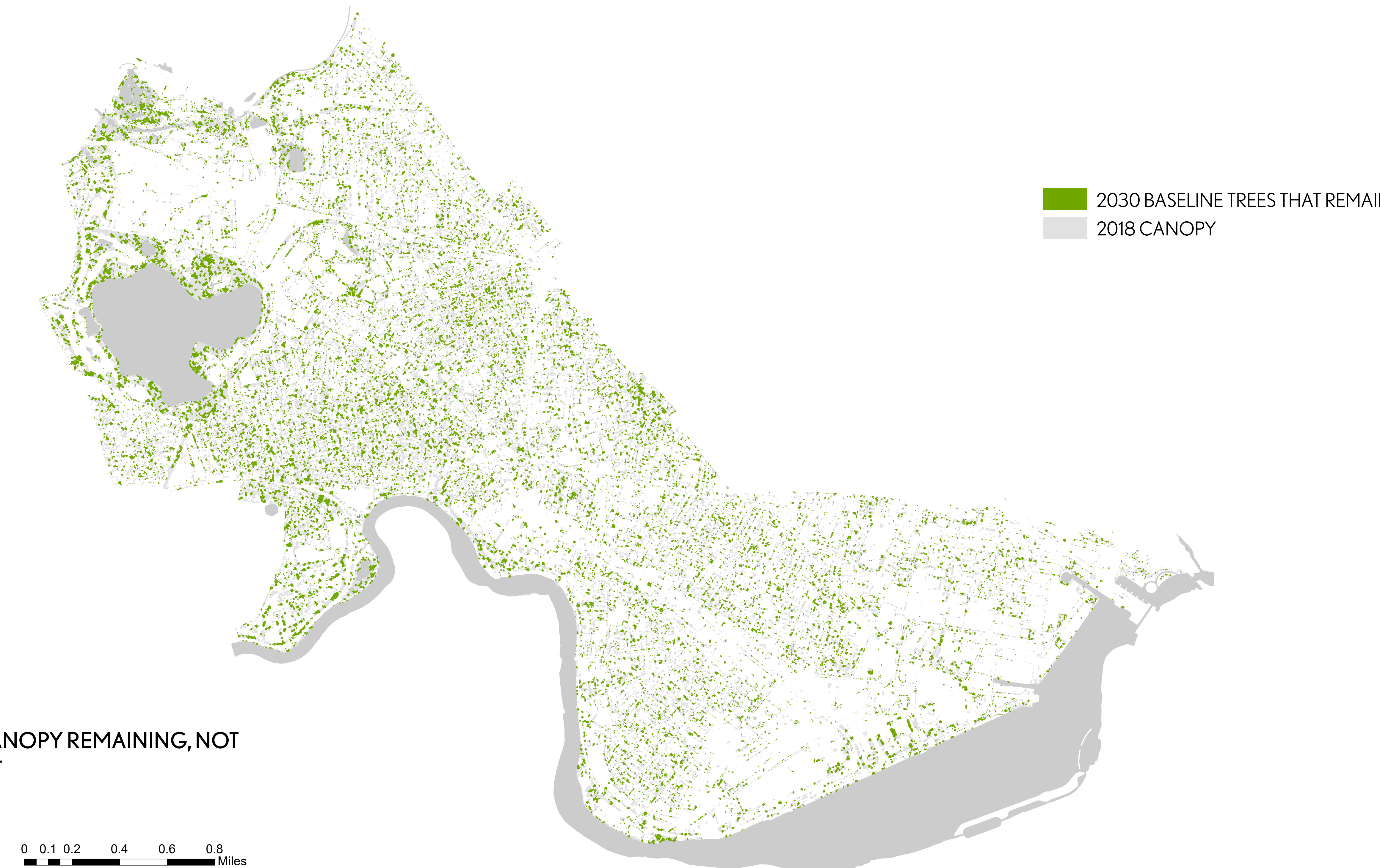
	Total Count in 5% Sample	% of Sample Population	% Dead Condition in Sample	% Fair Condition in Sample	% Good Condition in Sample	% Poor Condition in Sample	Average Lifespan	Hardiness Zones (Cambridge in Zone 6b)	Outside Hardiness Zone 6b in 2018?	Outside Hardiness Zone 7a (assume in 2070)?	Flood Tolerance Summary	Drought Final	Summary Pest/Disease Annual Mortality Level by 2030 (change up or down from 4.5% based on pest/disease load, based on red and orange columns)
Alder-Common	11	0.3%	0.00%	0.00%	100.00%	0.00%	100.00	3-7			Intermediate	Moderate	4.50%

Beech Bark Disease	Chestnut Blight	Anthracnose	Dutch Elm Disease	Emerald Ash Borer	Gypsy Moth	Hemlock Wooly Adelgid	Large Aspen Tortrix	Pine Shoot Beetle	Winter Moth	White Pine Blister Rust	Elongate Hemlock Scale	Needlecast	Butternut Canker	Asian Longhorned Beetle	Balsam Wooly Adelgid	Beech Leaf Disease	Oak Wilt	Spruce Beetle	Southe Pine Beetl
					Y		Y												

EXAMPLE PORTION OF THE SPECIES PARAMETER TABLE

BASELINE SCENARIO IMPACT

41.4% of the 2018 canopy remains (gross loss assuming no replanting) — resulting in **10.5% total canopy cover** — in 2030. When compared to the baselineof 56% remaining canopy, this is an additional decrease of 26.1%.



REPRESENTATIVE MAP OF THE CANOPY REMAINING, NOT MEANT TO BE SPATIALLY EXPLICIT

BASELINE SCENARIO IMPACT

Which species thrive and which do not? (Percent that survive)

Common thornless honeylocust	51%
Norway maple	39%
Red Maple	38%
Pin Oak	39%
Northern Red Oak	40%
London Planetree	38%
Littleleaf Linden	38%
Callery pear	37%
Zelkova	65%

Most Common Species
Cambridge 2030

Amur maackia	68%
Ginkgo	66%
Magnolia	66%
Buckthorn	66%
Japanese tree lilac	64%
Zelkova	64%
Black locust	63%
Kentucky coffeetree	60%
Amur cork tree	59%

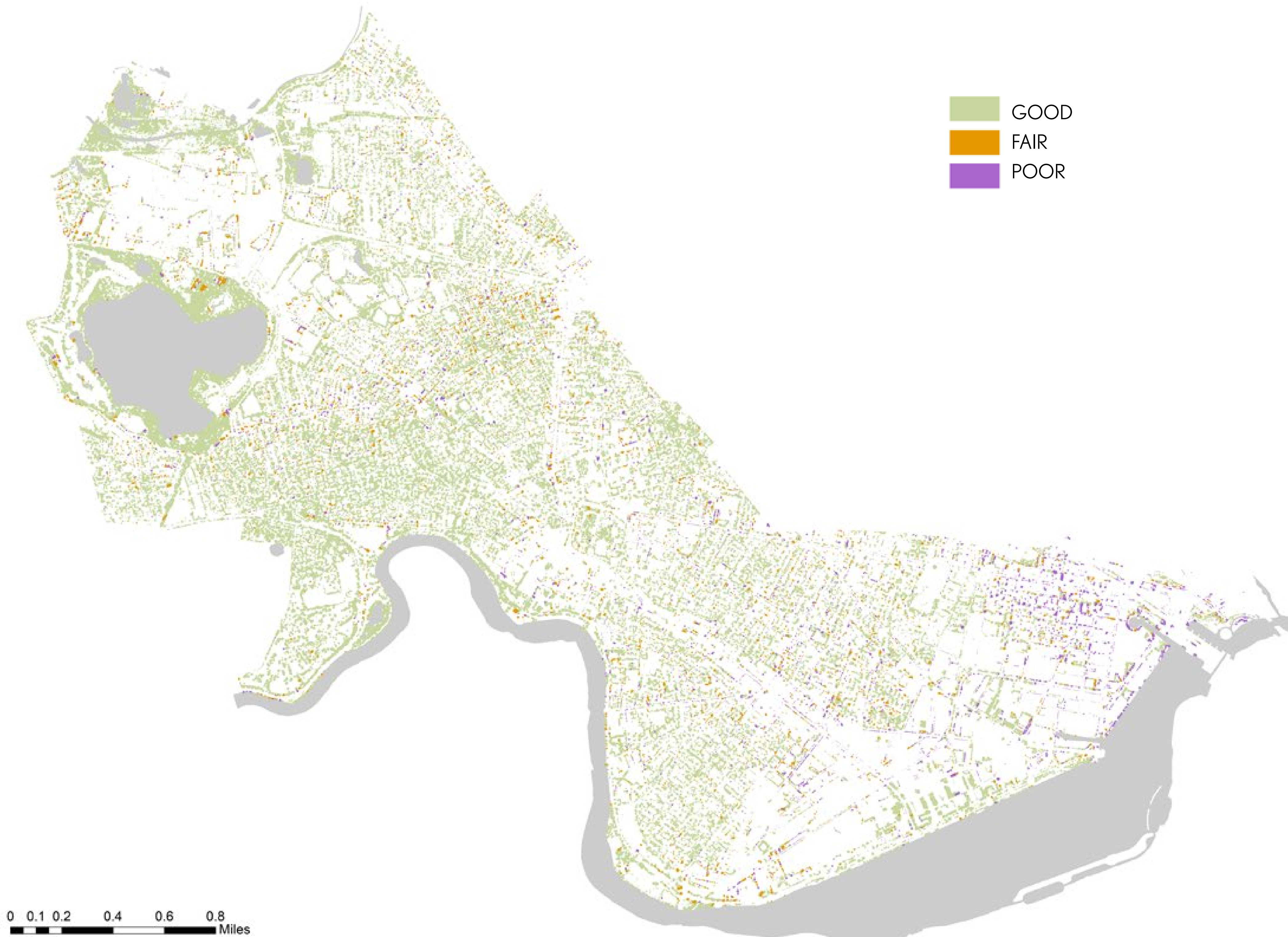
Best Performers
Cambridge 2030

Paperbark maple	9%
Amur maple	9%
Grey birch	11%
Poplar	11%
Slippery elm	14%
Eastern cottonwood	14%
Tartarian Maple	15%
Siberian Elm	16%
Eastern Hemlock	19%

Worst Performers
Cambridge 2030

EXTREME EVENTS PARAMETERS: TREE CONDITION

Tree condition was extrapolated from the 2018 LIDAR data and was used to evaluate how trees would fare in extreme events.



Event:

Moderate drought event to occur once every 30 yrs within the 2035-2064 timeframe (Hayhoe et al 2006)

Droughts are defined as deficits of 10% or more in monthly soil moisture relative to the climatological mean.   Moderate drought durataion is approximately 3-6 months.

Lower Bound:

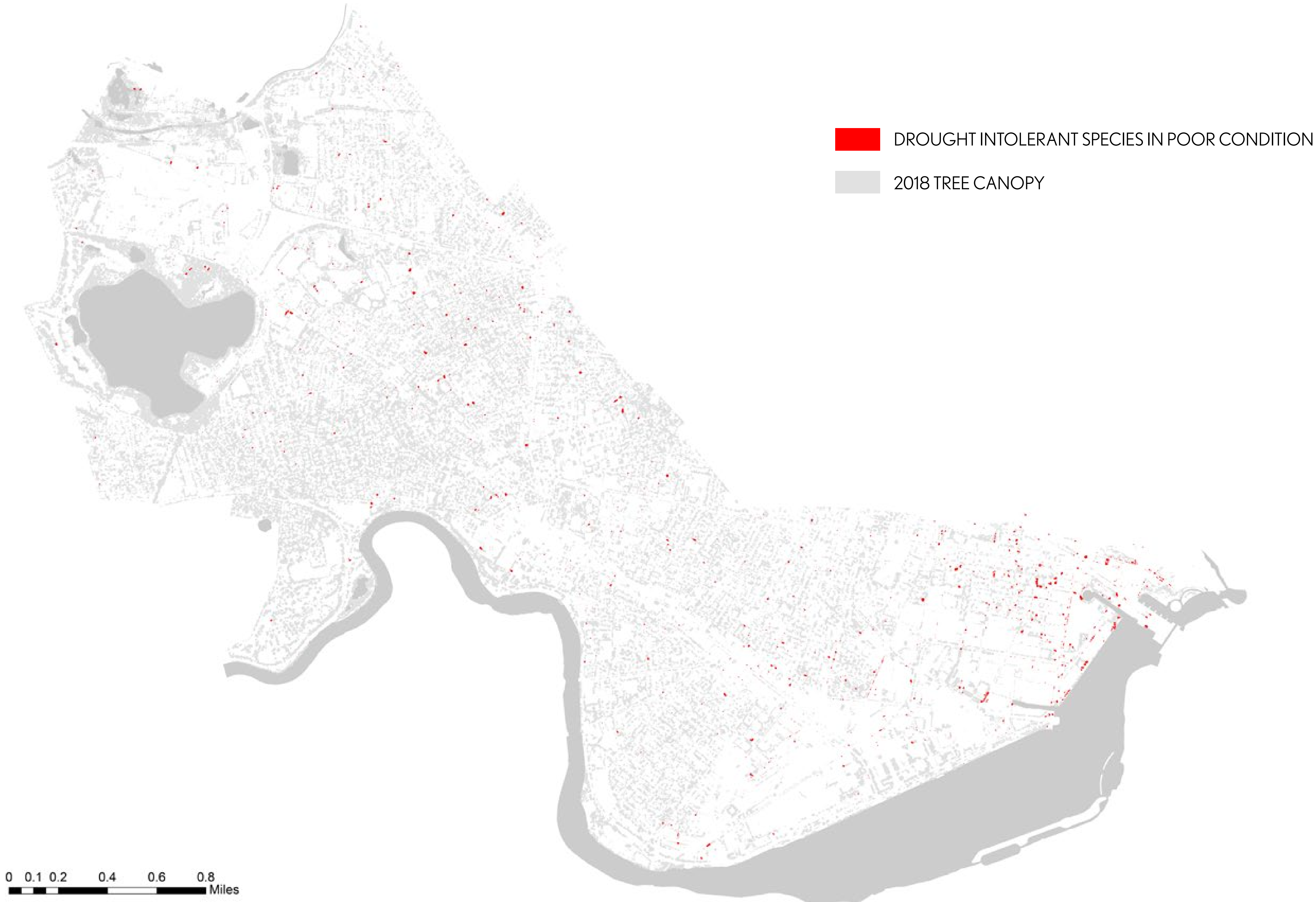
Drought- intolerant trees in poor condition will experience mortality.

Upper Bound:

Drought- intolerant trees in poor and fair condition and moderate drought tolerant trees in poor condition will experience mortality.

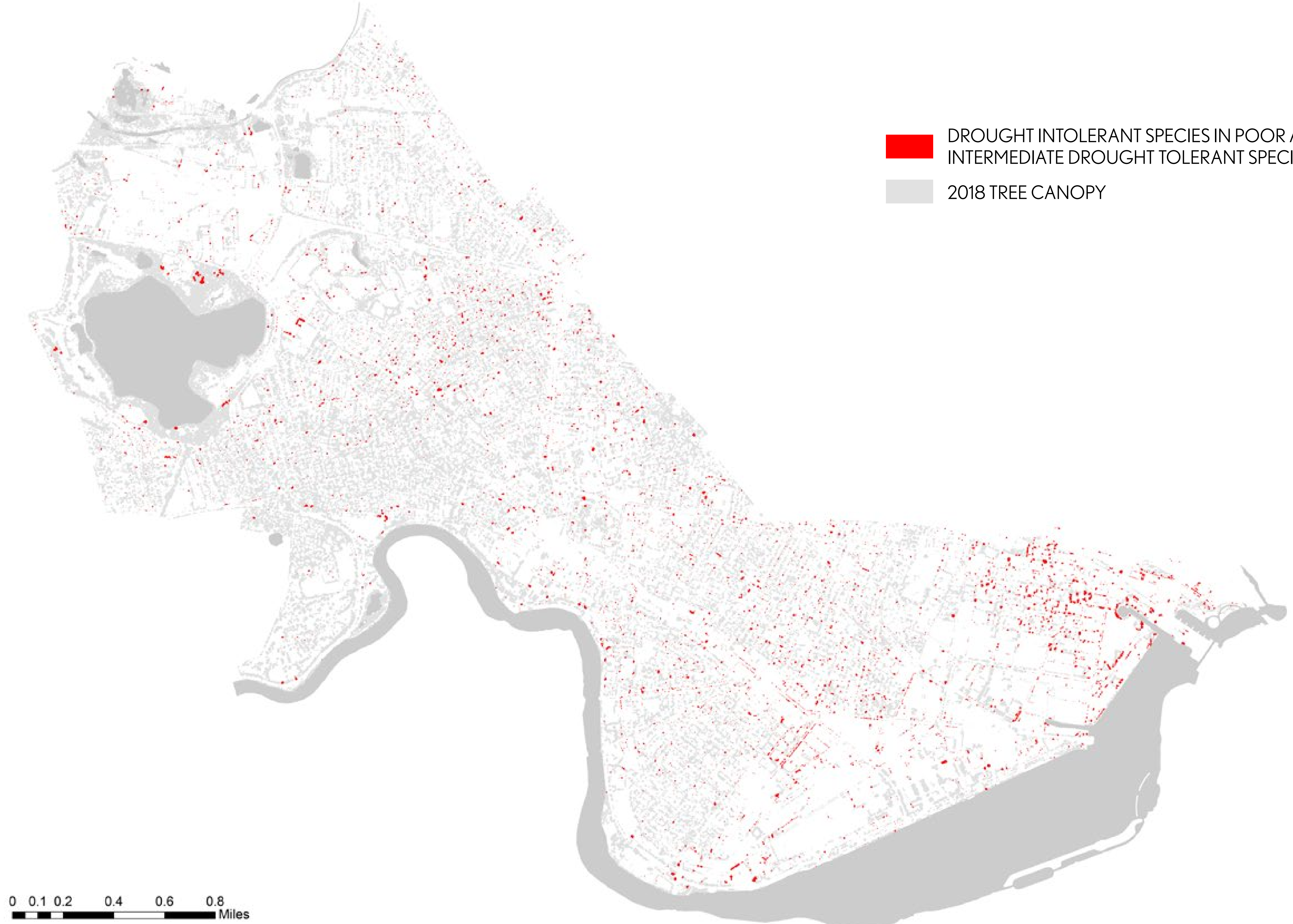
EXTREME EVENT PARAMETERS : MODERATE DROUGHT

The lower bound of the moderate drought event resulted in 1.9% additional mortality from the 2030 baseline scenario.— resulting in **10.3% total canopy cover** — in 2030.



EXTREME EVENT PARAMETERS : MODERATE DROUGHT

The upper bound of the moderate drought event resulted in 9.0% additional mortality from the 2030 baseline scenario— resulting in **9.5% total canopy cover** — in 2030.



DROUGHT INTOLERANT SPECIES IN POOR AND FAIR CONDITION
INTERMEDIATE DROUGHT TOLERANT SPECIES IN POOR CONDITION

2018 TREE CANOPY

Best and Worst Performers in 2030 (additional mortality from 2030 baseline)

Percent change

Common thornless honeylocust	0%
Norway maple	0%
Red maple	3 -8%
Pin oak	0-33%
Northern red oak	4-7%
London planetree	0%
Littleleaf linden	0-32%
Callery pear	0-21%
Zelkova	0-13%

Most Common Cambridge 2030

Eastern Hemlock	35%
American Linden	19%
Eastern White Pine	18%
White Ash	10%
Grey Birch	9%
Magnolia	8%
Hornbeam	7%
Tree of Heaven	7%
American Hornbeam	4%

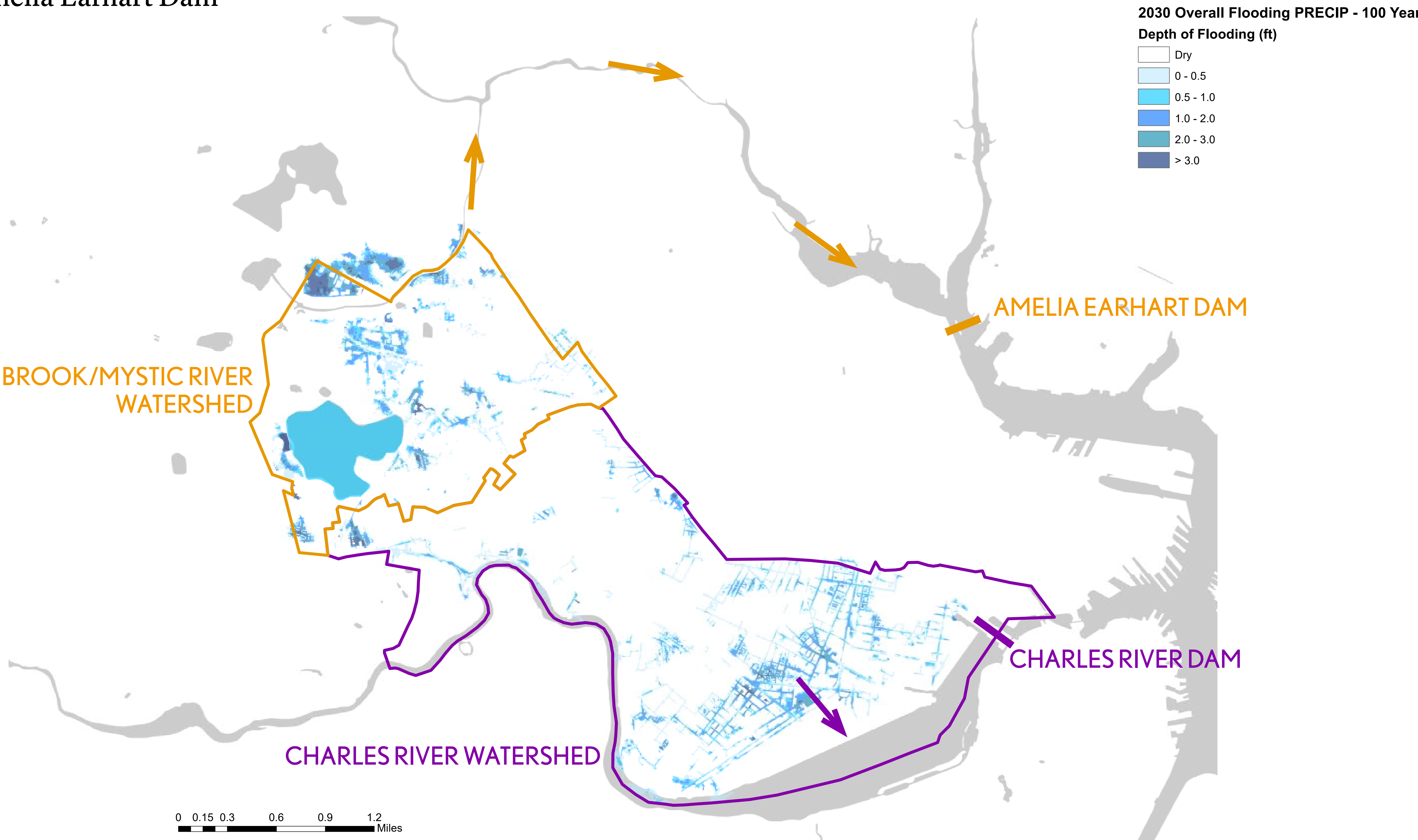
Worst Performers Lower Bound

Eastern hemlock	59%
Ash	37%
American linden	21%
Red maple	20%
Eastern white pine	20%
Cherry	17%
Austrian pine	17%
Katsura	17%
Crabapple	16%

Worst Performers Upper Bound

EXTREME EVENTS: FLOODING

One-third of Cambridge is part of the Alewife Brook watershed and discharges through the Amelia Earhart Dam



FROM RESEARCH TO TESTING

SOILS ANALYSIS

CLIMATE MODEL

RESPONSE STRATEGIES

PLANNING SYNERGIES

Today, Cambridge has **25.3%** of its land area covered by canopy.

Cambridge has had an average net loss of **31 acres** of canopy cover every year.

At this rate, canopy cover will be **16.2% in 2030**.

Factoring in climate change, it may be **10.5% in 2030** but with a moderate drought it could be 9.5%

There are two primary approaches to reversing the current trend of urban forest contraction —

Stem the loss of existing trees

Grow Canopy by planting new trees

STEM LOSS

Cambridge canopy trends in regional context

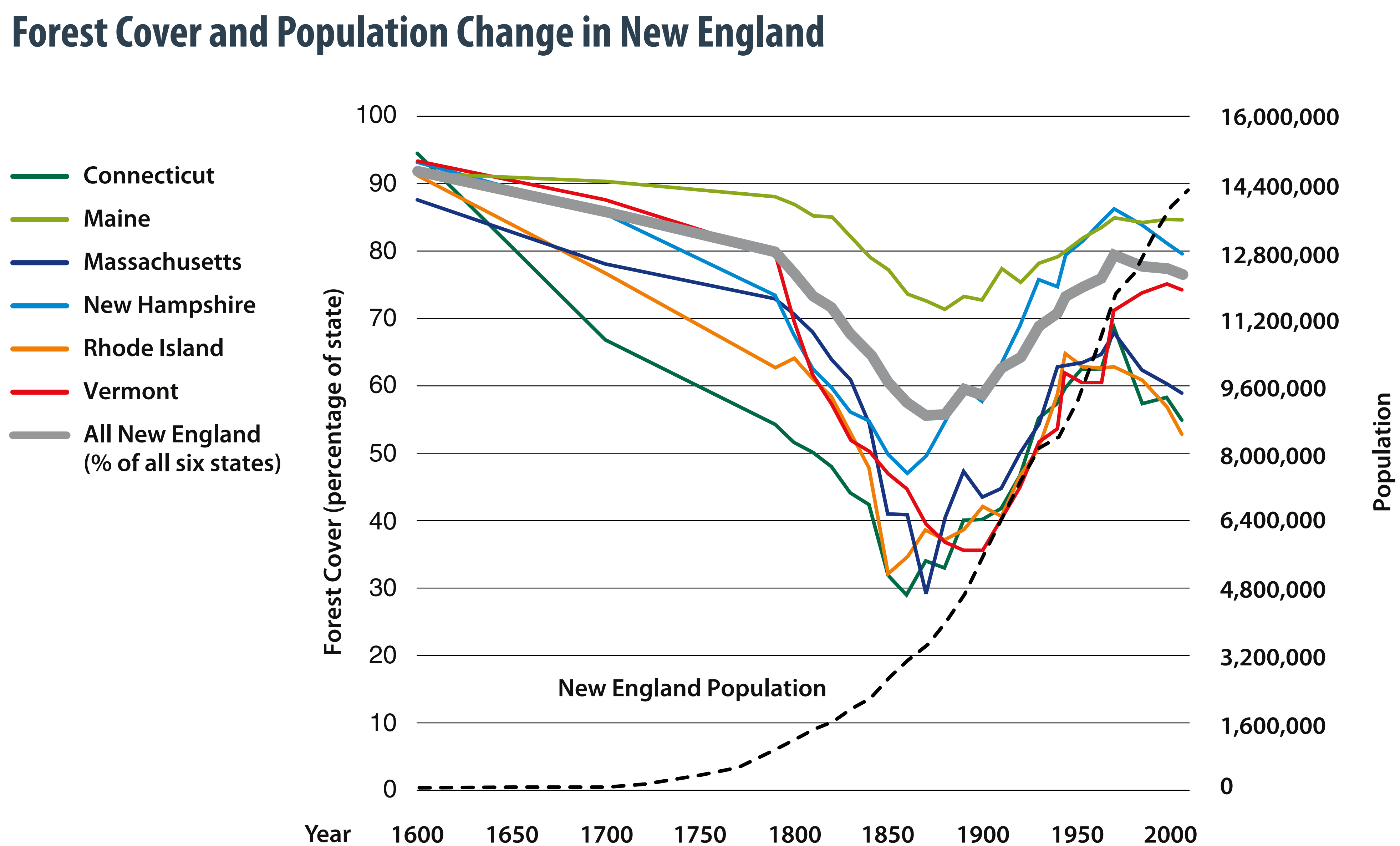


FIGURE 1: *Long-term trends in forest cover and human population in the six New England states shows that even as the population grew, forest cover increased between 1850 and the early 2000s. In recent years, forest cover has again declined due to conversion of forests to developed land.*

Source: "Changes to the Land: Four Scenarios for the Future of the Massachusetts Landscape", Harvard Forest, Thompson, et. al., 2014

STEM LOSS

Impacts of planting cycles in residential development

Properties with homes built around 1920 have unusually high percentage of tree canopy. These trees are now likely reaching maturity. Development tapered off after 1930 so we can surmise that the residential canopy will also begin to taper off as those trees age.

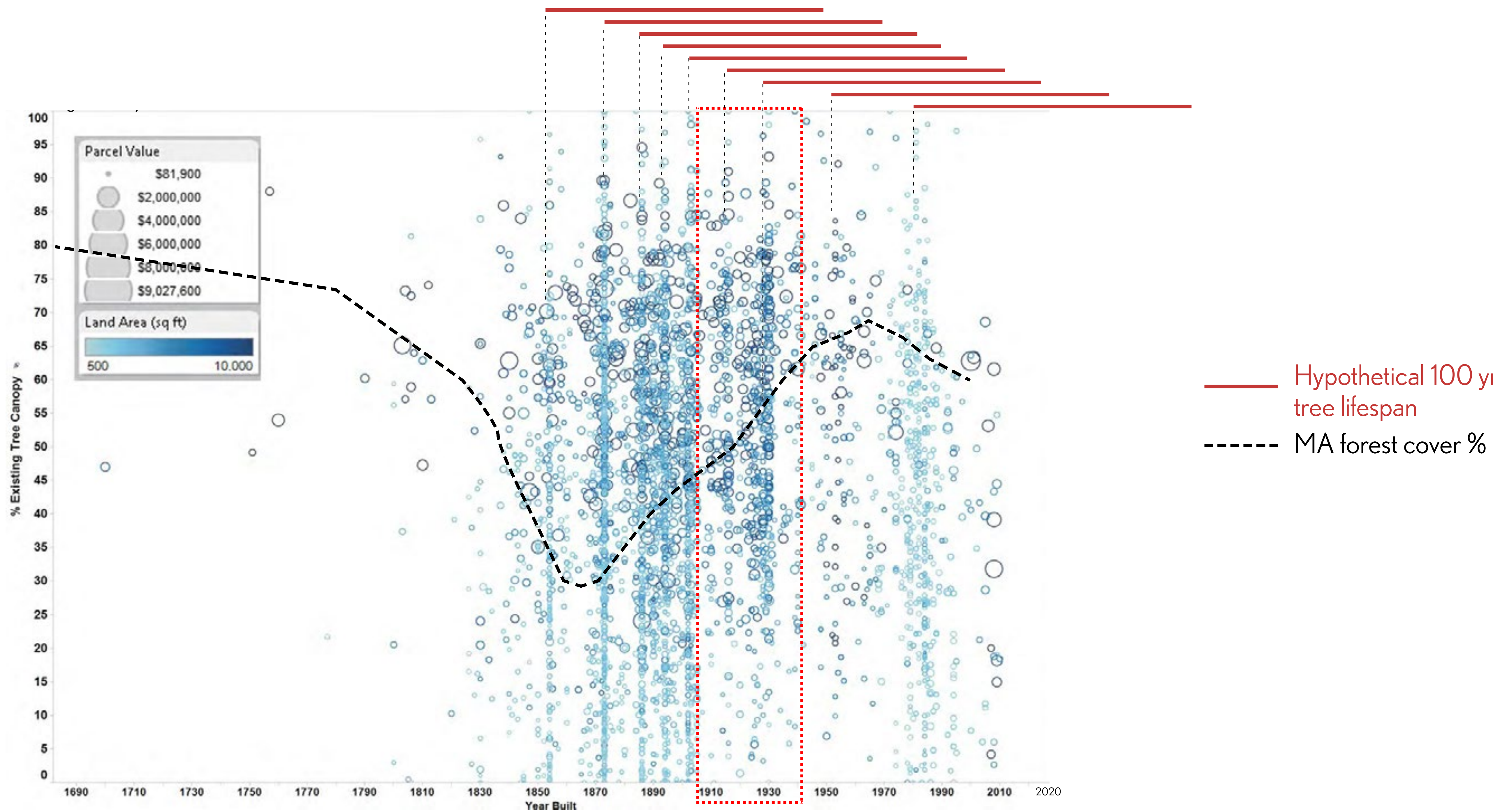
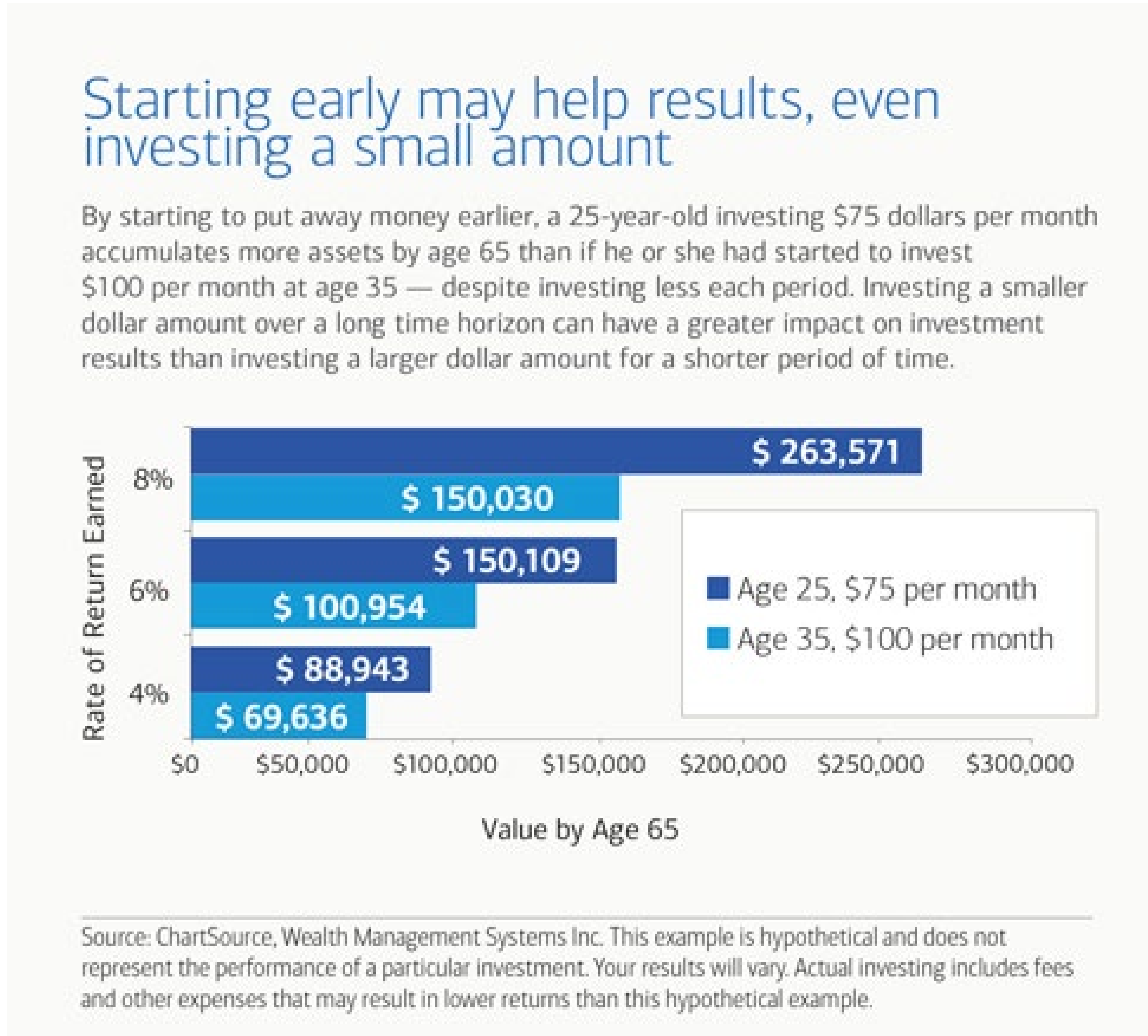


Figure 8: % Existing Tree Canopy in relation to year built, parcel value, and land area for single family residential parcels.

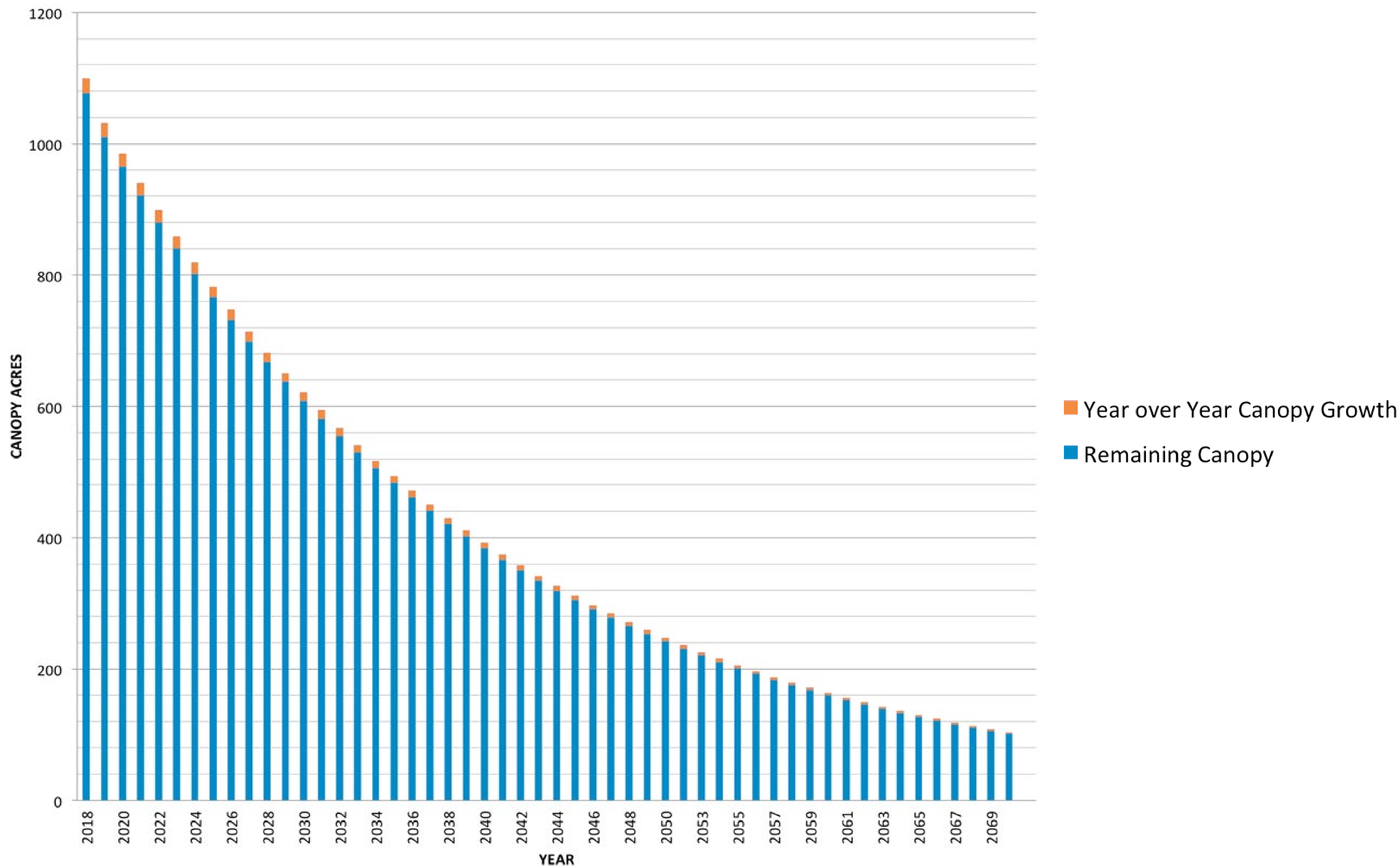
Source: UVM, "A Report on the City of Cambridge's Existing and Possible Tree Canopy", 6/1/12

GROW CANOPY
Planting trees is like retirement investment; starting early counts



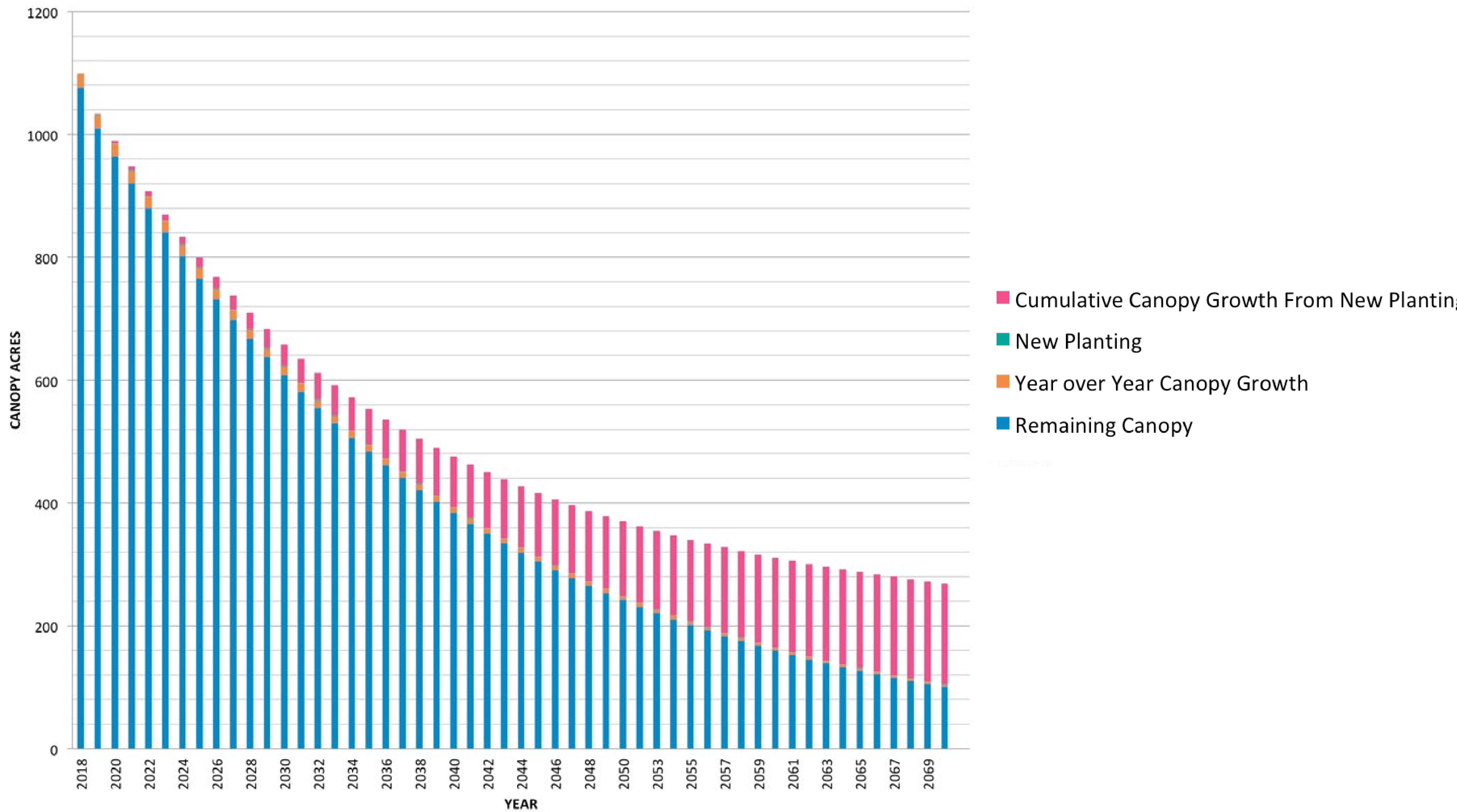
STEMMING LOSS AND GROWING CANOPY

Mortality rate unchanged (6.5%/yr) + No new plantings



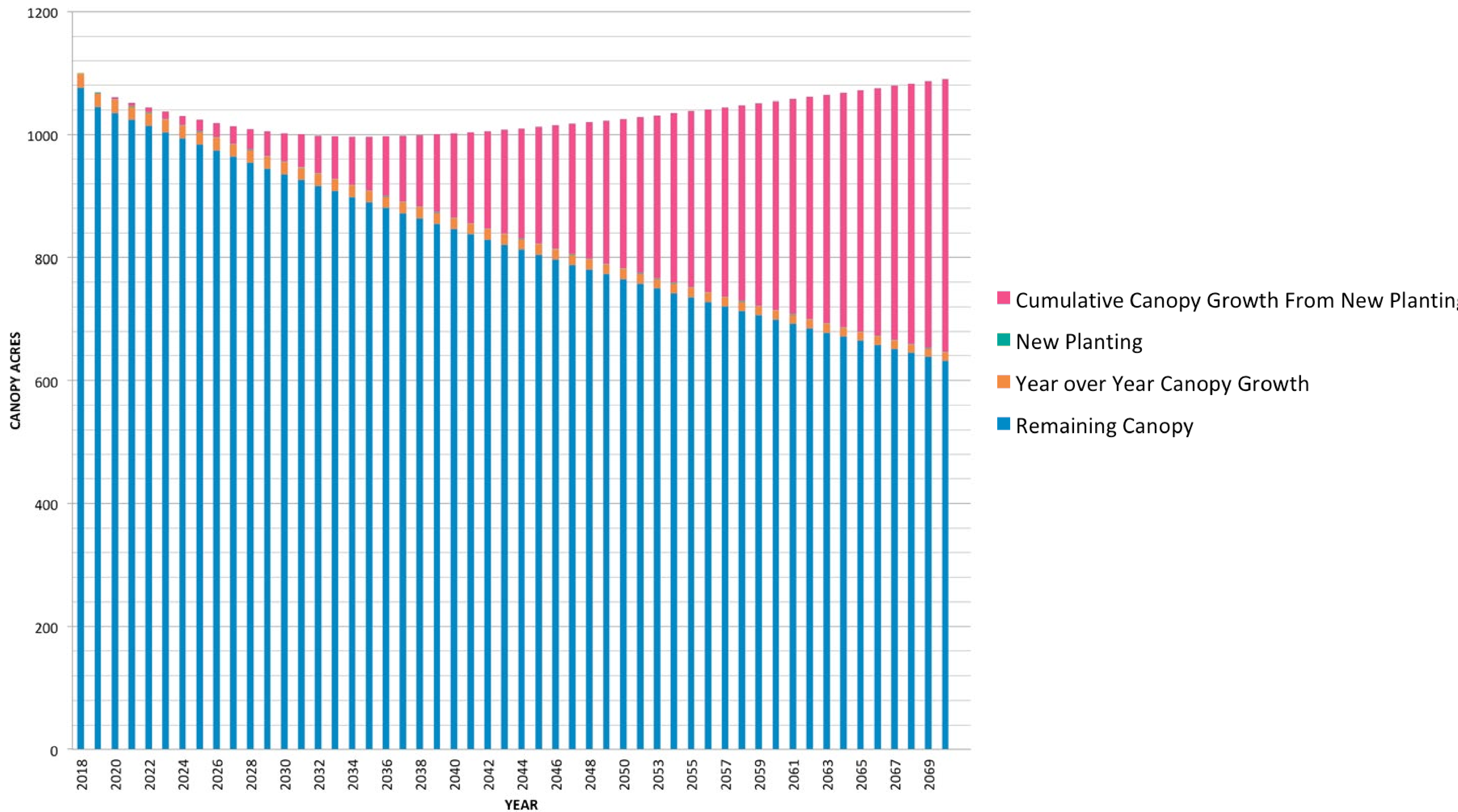
STEMMING LOSS AND GROWING CANOPY

Mortality rate unchanged (6.5%/yr) + Grow Canopy (2,500 trees/yr)



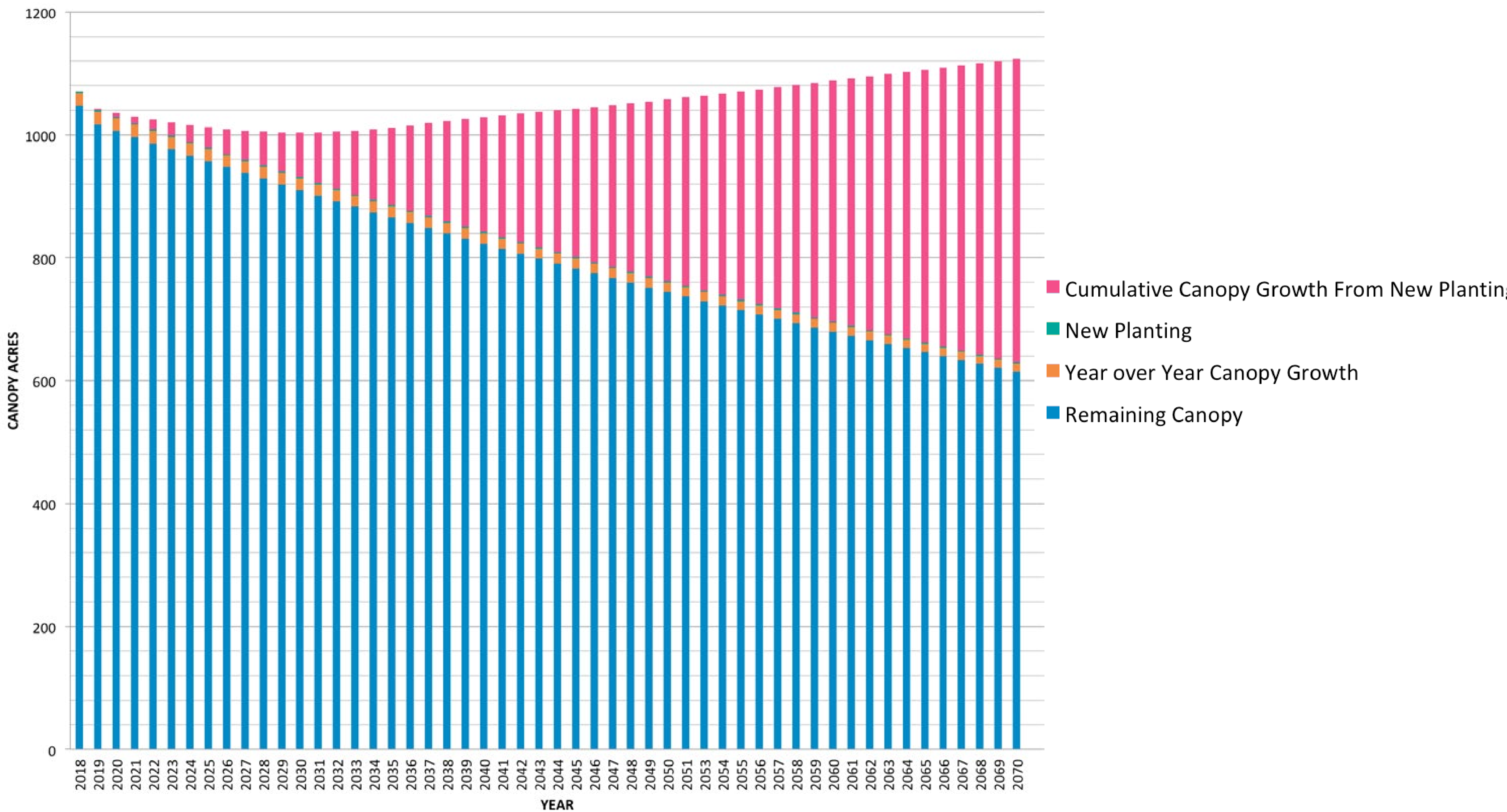
STEMMING LOSS AND GROWING CANOPY

Stem Loss (3%/yr) + Grow Canopy (2,500 trees/yr)



STEMMING LOSS AND GROWING CANOPY

Stem Loss (3%/yr) + Grow Canopy (5,000 trees/yr for 5 yrs then 2,500 trees/yr)



DECISION FRAMEWORK

VISION	GOALS	EVALUATIVE CRITERIA	BASELINE	2030 TARGET	2070 TARGET
To build, maintain, and sustain a healthy, connective urban forest at a time when the urban forest is more important than ever before.	**People** A forest that contributes to residents' well-being and residents who contribute to the forest well-being	Enhance shading and cooling			
		Improve pedestrian thermal comfort	Ambient sidewalk temperatures, Connectivity		
		Reduce urban heat island effects	Degrees relative to city avg		
		Increase equity in distribution of canopy cover	Canopy cover by vulnerable population		
		Create pleasing environments	Well-being/stress levels (survey)		
		Increase residents' awareness of value of trees	Engagement, program adoption (survey)		
		Enhance citywide stormwater management	Rainfall interception		
		Increase carbon sequestration	Carbon capture rates		
	Trees A healthy forest whose trees live longer and thrive during predicted changing climate conditions	Improve soils health	Soil quality index		
		Improve tree health	% trees in good health		
		Improve street tree lifespan	Avg life of street tree		
	Forest A forest that supports a resilient, connected ecosystem	Enhance habitat	Canopy connectivity, species census		
		Diversify forest composition	City diversity index		
		Improve disaster response (noreaster, drought)	Projected impact and recovery rates		

STRATEGY MATRIX

			STRATEGIES: Policy				Planning/Design					Practices				Outreach/Other		
			Strengthen Current Tree Protection Ordinance	Formalize City Practices	Strenghten Zoning Requirements	Strengthen City Planting Programs and Incentives	Align with Envision Cambridge and CCPR planning studies	Restrict Street Tree Planting to Only Suitable Areas	Create New Opportunities for Street Tree Planting	Implement City-Wide Planting Plan to Focus Efforts	Site New Parks/Open Spaces Strategically	Improve City Planting Practices	Improve City Maintenance and Care Practices	Implement Soils Management Program	Monitor Tree Canopy and Adapt	Invest in Educational Programs	Build Community Partnerships	Seek Alternative Green Strategies
GOALS	**ACTION**	**RESPONSE**	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
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		Commercial land conversion	•		•	•	•		•					•			•	
		Residential loss				•												
		Poor tree condition		•				•				•	•	•	•	•	•	
	Grow canopy	Public	•	•	•	•	•		•	•	•	•	•	•	•			
		Private	•		•	•	•											•
Enhance shading and cooling/ improve pedestrian thermal comfort	**Curb loss**	Narrow sidewalks						•										
		Inadequate soil volume												•				
	Grow canopy	Public	•	•	•	•	•		•	•	•	•	•	•	•			
		Private	•		•	•	•									•	•	•
Create pleasing environments/ increasing wellbeing improving public health	**Grow canopy**	Public	•	•	•	•	•		•	•	•	•	•	•	•			
		Reach	•		•	•	•									•	•	•
Ecological connectivity	**Grow canopy**	Public	•	•	•	•	•		•	•	•	•	•	•	•			
		Private	•		•	•	•									•	•	•
Diversify forest composition		New Species List								•					•			
Improve Soil and Tree Health												•	•	•	•	•		
Improve Street Tree Lifespan				•				•				•	•	•	•	•	•	
Improve Disaster Response				•			•			•		•			•	•	•	
Increase Resident Awareness of Value of Trees																•	•	

STRATEGY MATRIX

STRATEGIES

GOALS	ACTION	RESPONSE	1 Strengthen Current Tree Protection Ordinance	2 Formalize City Practices	3 Strengthen Zoning Requirements	4 Strengthen City Planting Programs and Incentives	5 Align with Envision Cambridge and CCPR planning studies	6 Restrict Street Tree Planting to Only Suitable Areas	7 Create New Opportunities for Street Tree Planting	8 Implement City-Wide Planting Plan to Focus Efforts	9 Site New Parks/Open Spaces Strategically	10 Improve City Planting Practices	11 Improve City Maintenance and Care Practices	12 Implement Soils Management Program	13 Monitor Tree Canopy and Adapt	14 Invest in Educational Programs	15 Build Community Partnerships	16 Seek Alternative Green Strategies
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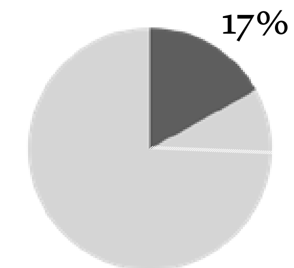
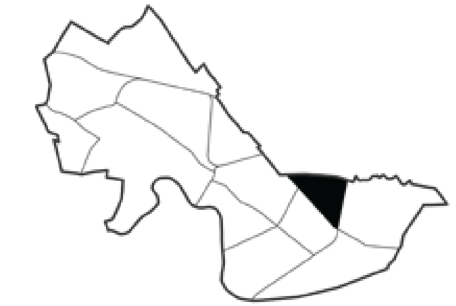
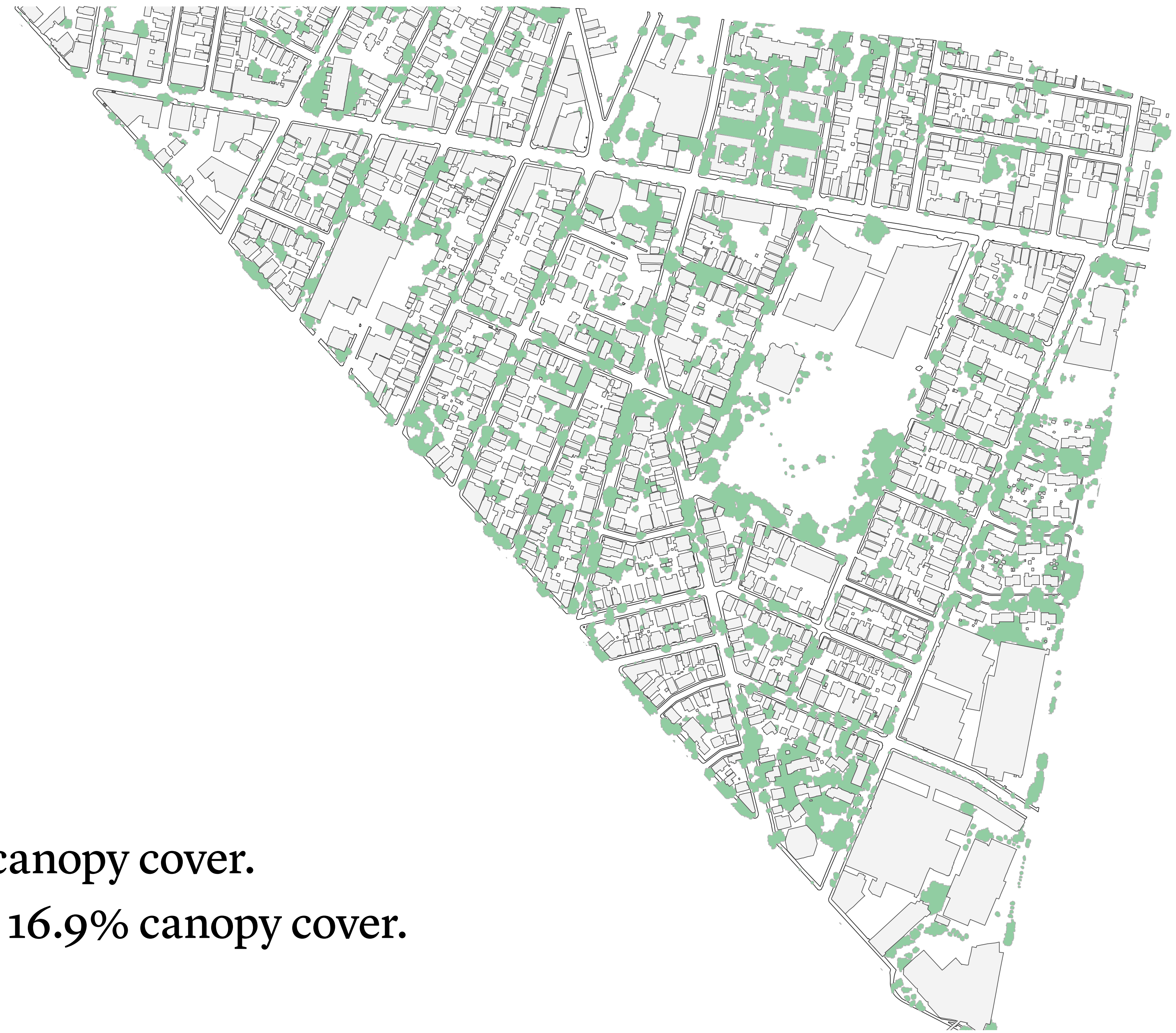
		Private	•		•	•	•									•	•	•
Diversify forest composition		New Species List								•					•			

NEIGHBORHOOD CASE STUDY

Where is there opportunity for planting?





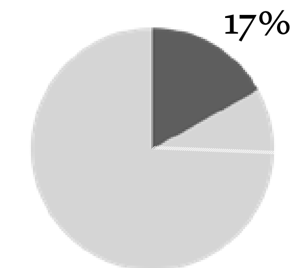


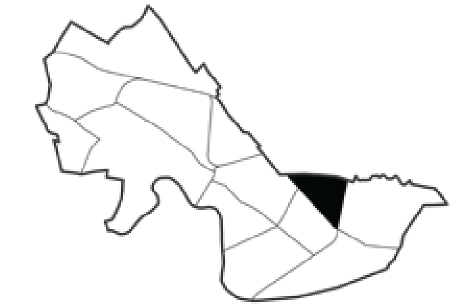
R.O.W. has 29.3% canopy cover.

Neighborhood has 16.9% canopy cover.

NEIGHBORHOOD CASE STUDY

Planting in the ROW does not sufficiently increase canopy cover





If R.O.W. planted with 645 trees, after 20 yrs

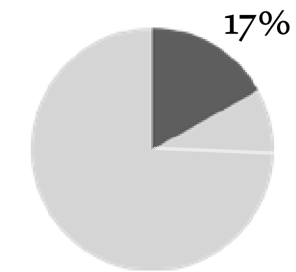
-the R.O.W. canopy cover would be 38%.

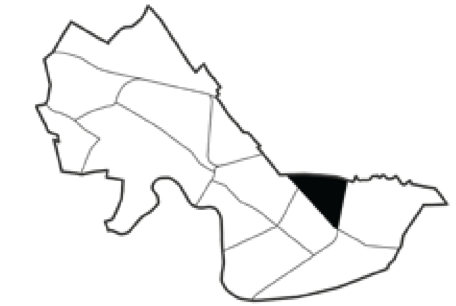
-the neighborhood canopy cover would be 20%.

(assuming new tree has 20' diameter canopy after 20 years)

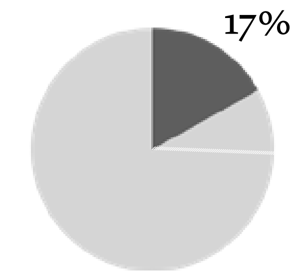
NEIGHBORHOOD CASE STUDY

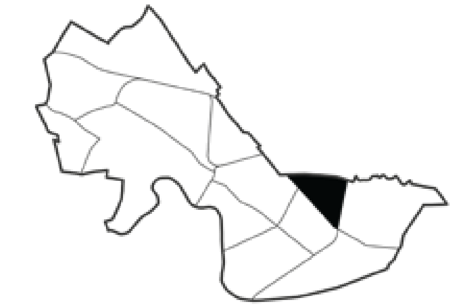
To increase overall canopy cover more, we need to plant in residential yards, commercial areas, etc.

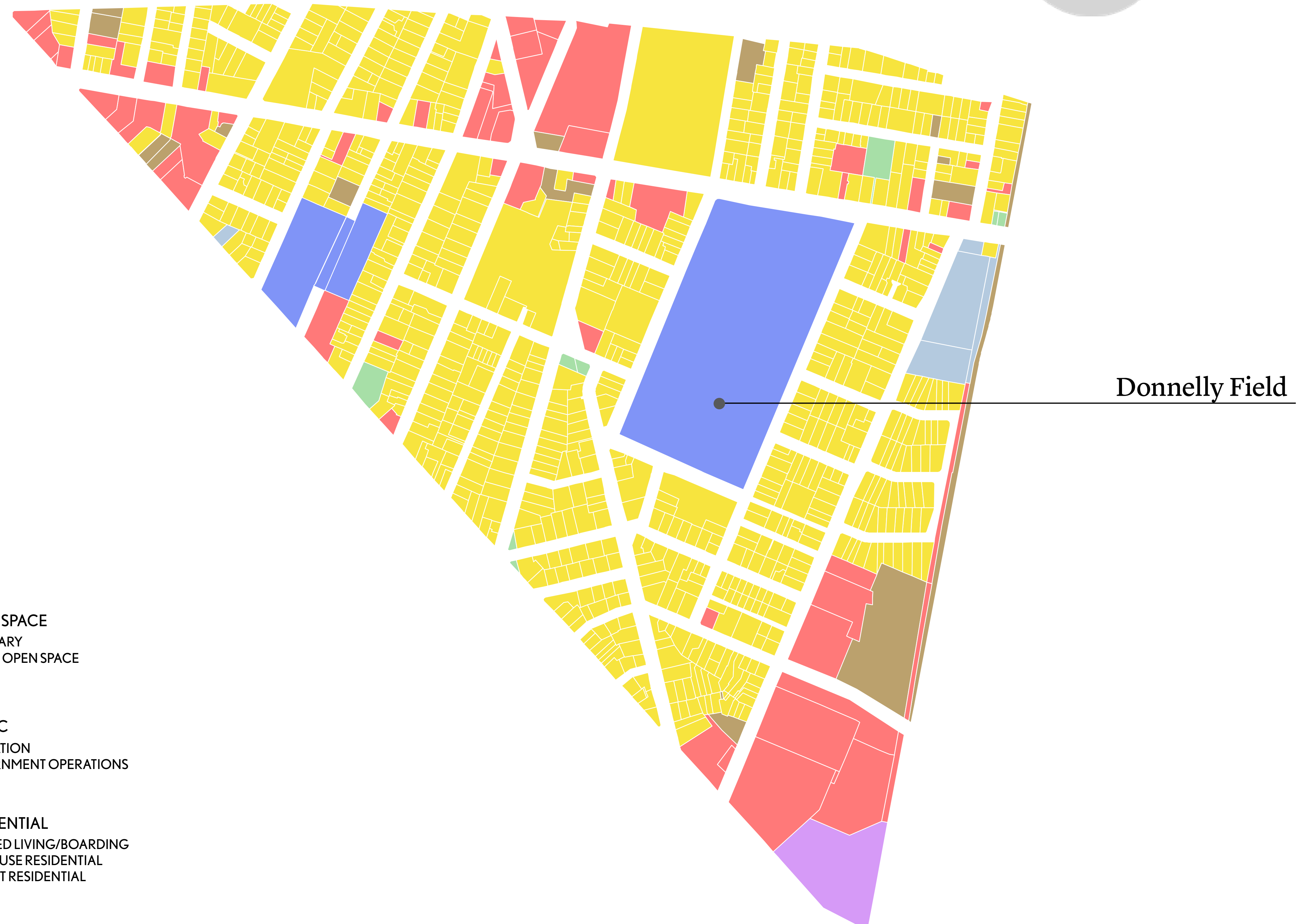




NEIGHBORHOOD CASE STUDY
Wellington-Harrington land use







COMMERCIAL
MIXED USE COMMERCIAL
OFFICE
OFFICE/R&D
PRIVATELY-OWNED OPEN SPACE
VACANT COMMERCIAL

INDUSTRIAL
MIXED USE INDUSTRIAL
UTILITY
VACANT INDUSTRIAL

INSTITUTIONAL
CHARITABLE/RELIGIOUS
EDUCATION RESIDENTIAL
HEALTH
HIGHER EDUCATION
MIXED-USE EDUCATION

OPEN SPACE
CEMETARY
PUBLIC OPEN SPACE

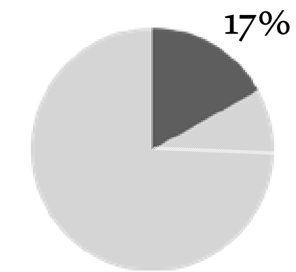
PUBLIC
EDUCATION
GOVERNMENT OPERATIONS

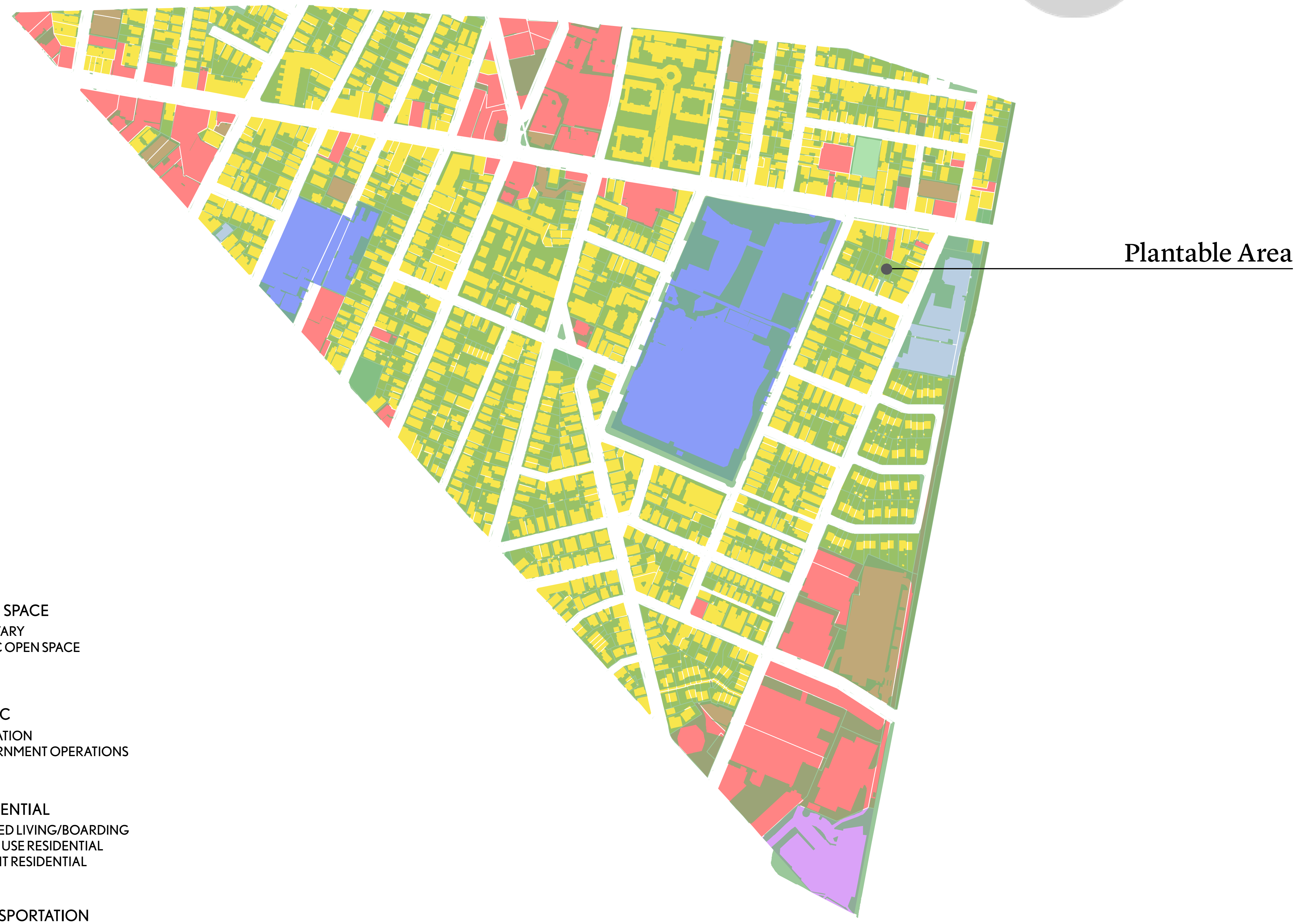
RESIDENTIAL
ASSISTED LIVING/BOARDING
MIXED USE RESIDENTIAL
VACANT RESIDENTIAL

TRANSPORTATION

NEIGHBORHOOD CASE STUDY

The majority of plantable area is on residential property





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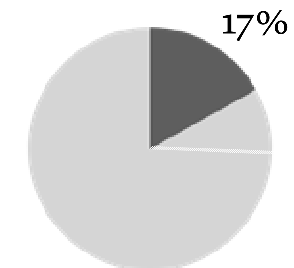
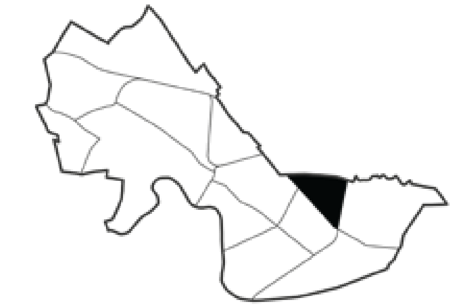
TRANSPORTATION

NEIGHBORHOOD CASE STUDY

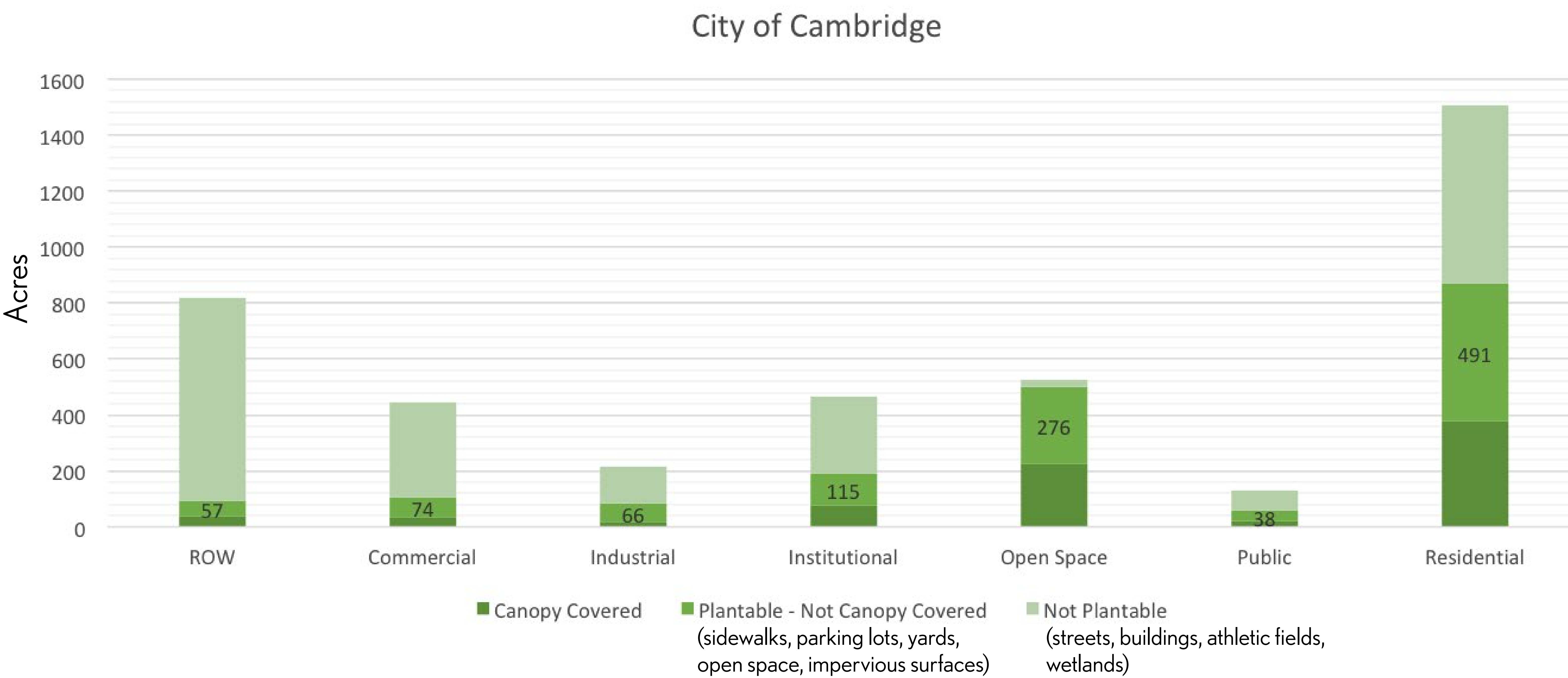
Additional strategies to increase canopy cover





BEYOND MUNICIPAL TREES

The opportunities for planting are greatest on residential and open space land use types.



STRATEGY MATRIX

GOALS	ACTION	RESPONSE	STRATEGIES: Policy — 1 Strengthen Current Tree Protection Ordinance	2 Formalize City Practices	3 Strengthen Zoning Requirements	4 Strengthen City Planting Programs and Incentives	Planning/Design — 5 Align with Envision Cambridge and CCPR planning studies	6 Restrict Street Tree Planting to Only Suitable Areas	7 Create New Opportunities for Street Tree Planting	8 Implement City-Wide Planting Plan to Focus Efforts	9 Site New Parks/Open Spaces Strategically	Practices — 10 Improve City Planting Practices	11 Improve City Maintenance and Care Practices	12 Implement Soils Management Program	13 Monitor Tree Canopy and Adapt	Outreach/Other — 14 Invest in Educational Programs	15 Build Community Partnerships	16 Seek Alternative Green Strategies
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		Residential loss				•												
		Poor tree condition		•				•				•	•	•	•	•	•	
	Grow canopy	Public	•	•	•	•	•		•	•	•	•	•	•	•			
		Private	•		•	•	•											•
Enhance shading and cooling/ improve pedestrian thermal comfort	**Curb loss**	Narrow sidewalks						•										
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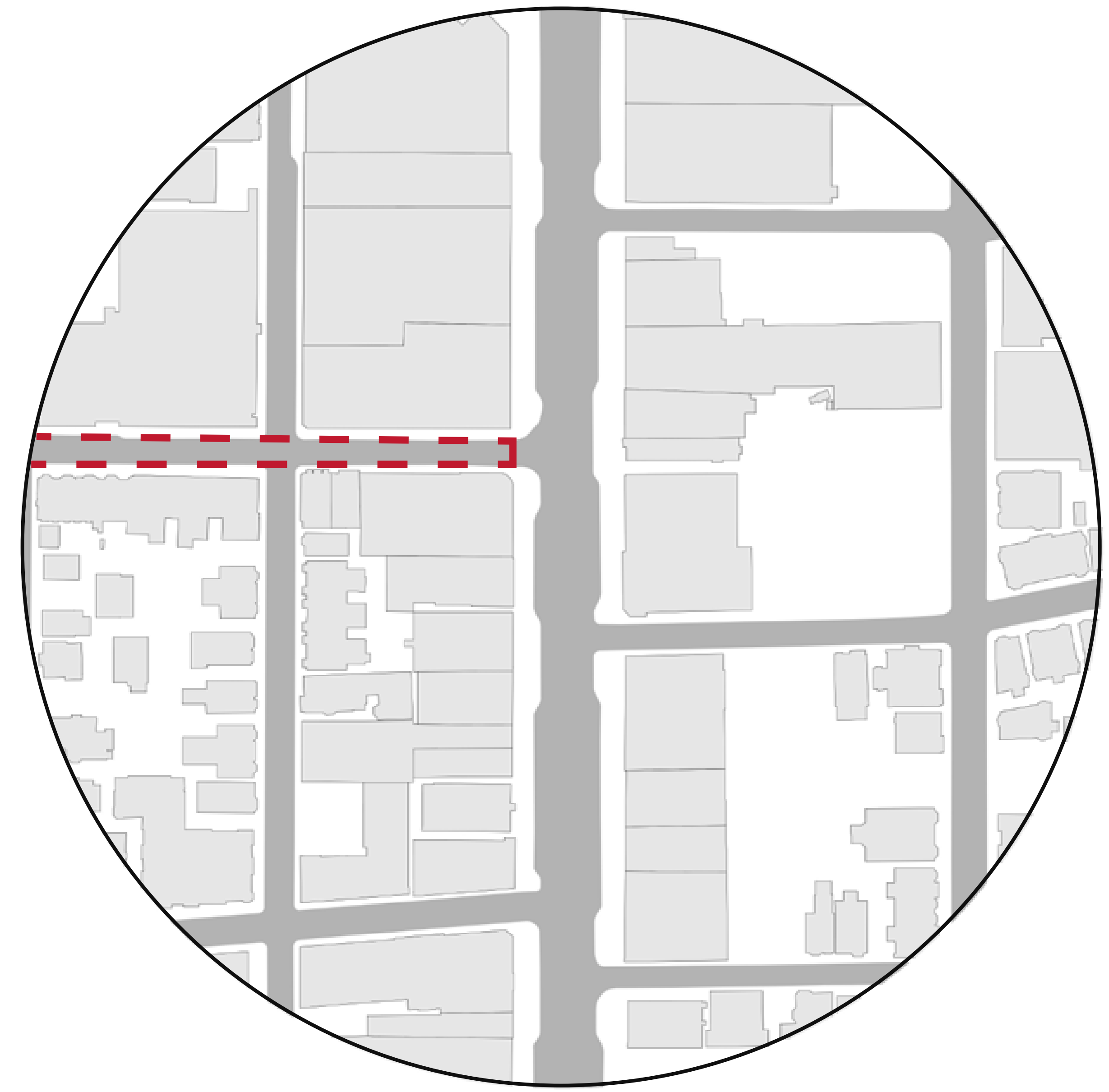
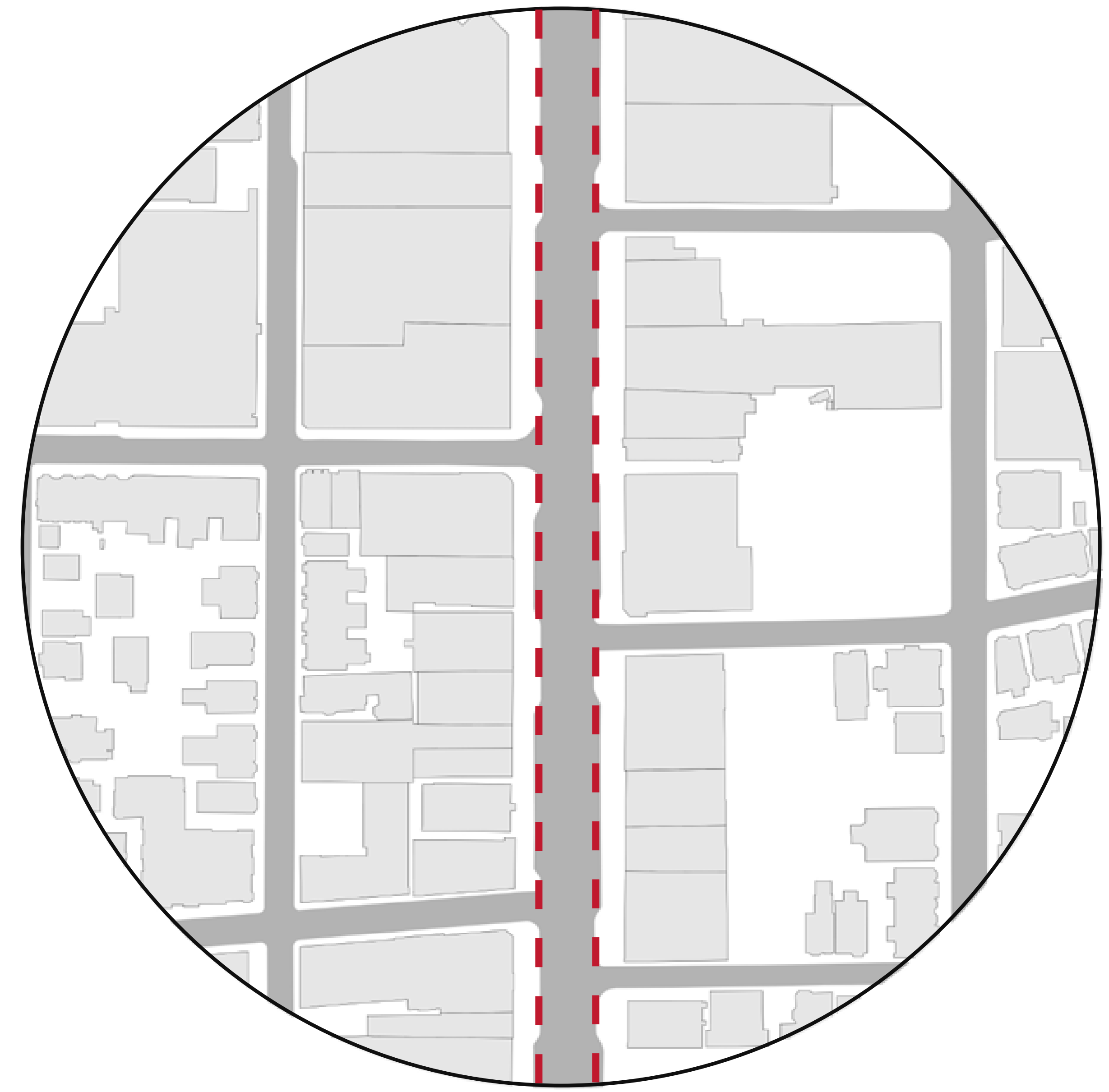
		Reach	•		•	•	•									•	•	•
Ecological connectivity	**Grow canopy**	Public	•	•	•	•	•		•	•	•	•	•	•	•			
		Private	•		•	•	•									•	•	•
Diversify forest composition		New Species List								•					•			

STREETSCAPE DESIGN

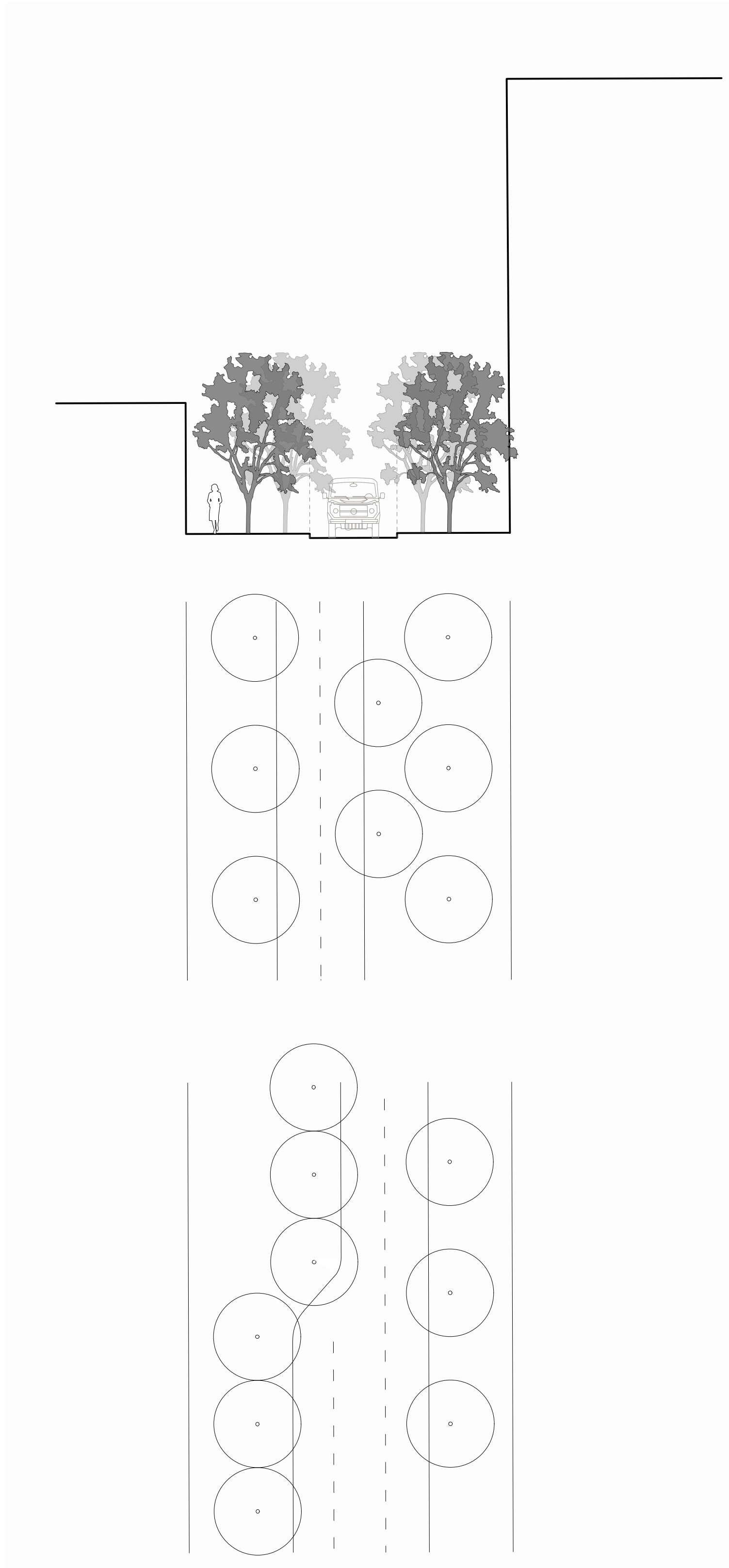
Narrow commercial street

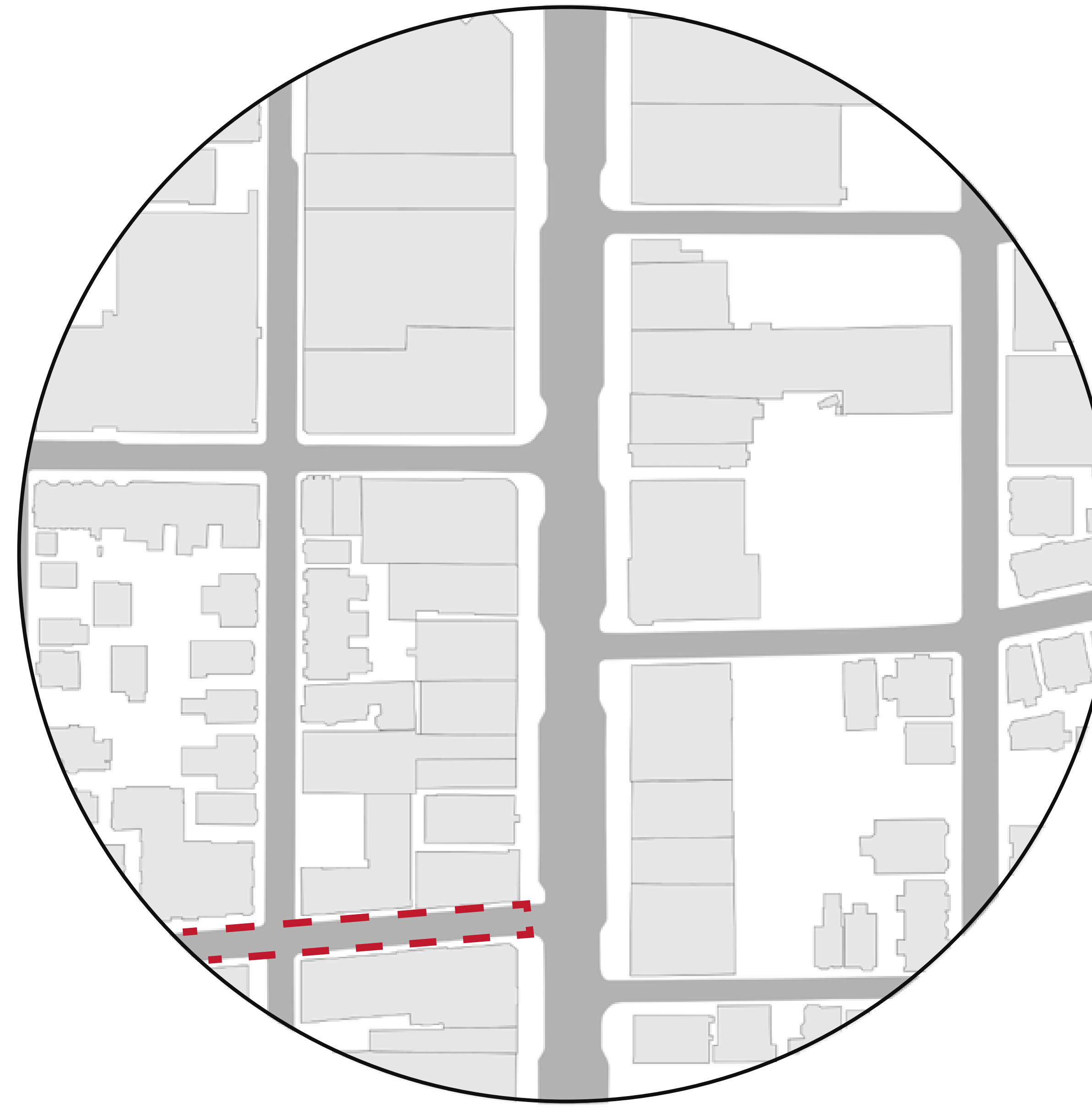


STREETSCAPE DESIGN
Major commercial avenue

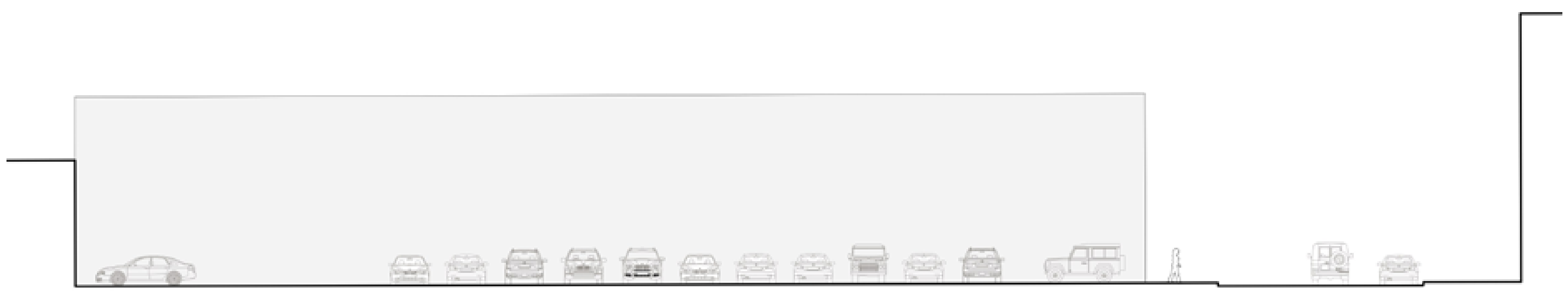


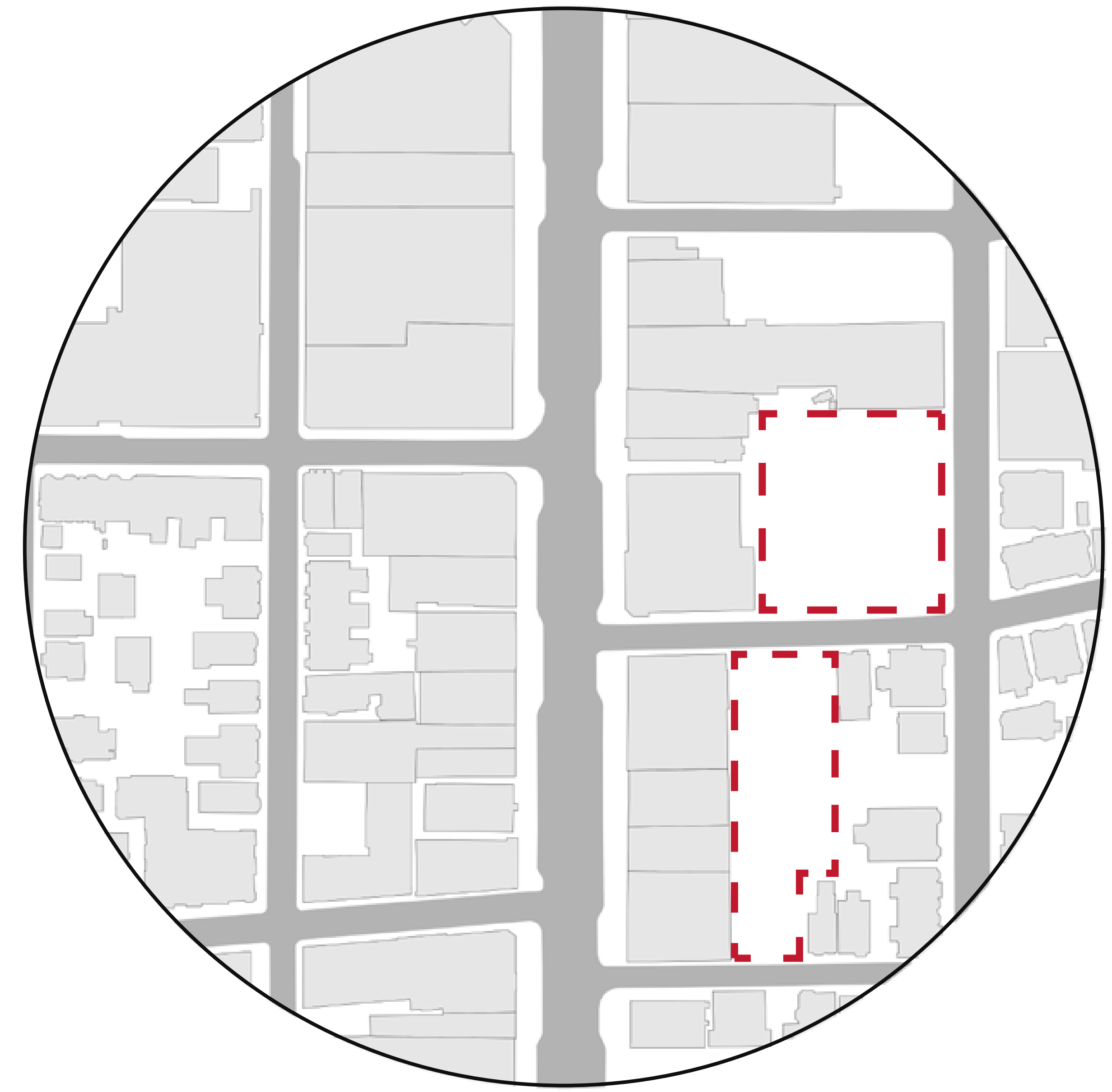
STREETSCAPE DESIGN
Shared street





STREETSCAPE DESIGN
Parking lot





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		Private	•		•	•	•									•	•	•
Diversify forest composition		New Species List								•					•			

IMPROVE ECOLOGICAL CONDITIONS

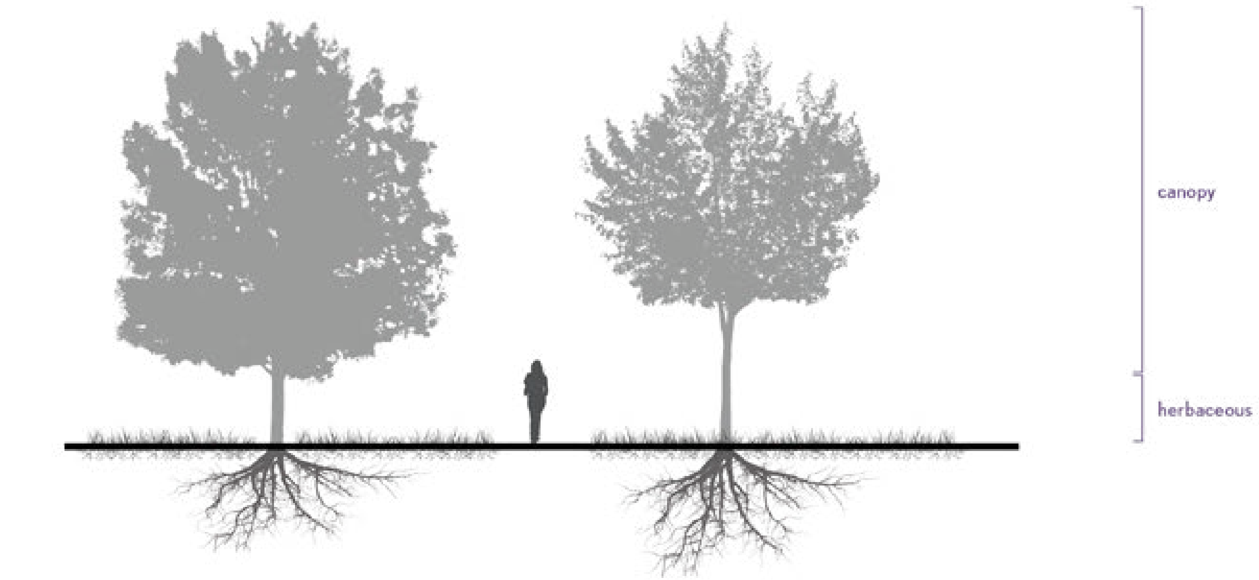
Planting design

SAVANNA

5-50% Canopy cover

Structure: 2 layers
- *canopy*
- *herbaceous*

Little root interaction



FOREST

50-100% Canopy cover

Structure: 4 layers
- *canopy*
- *subcanopy*
- *shrub*
- *herbaceous*

Significant tree root interaction

HYBRID

30-35% Canopy cover

Structure: 3 layers
- *canopy*
- *subcanopy*
- *herbaceous*

Continuous soil volume to promote tree root interaction

FROM RESEARCH TO TESTING

SOILS ANALYSIS

CLIMATE MODEL

RESPONSE STRATEGIES

PLANNING SYNERGIES

			STRATEGIES															
			Policy				Planning/Design					Practices				Outreach/Other		
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		Private	•		•	•	•									•	•	•
Diversify forest composition		New Species List								•					•			

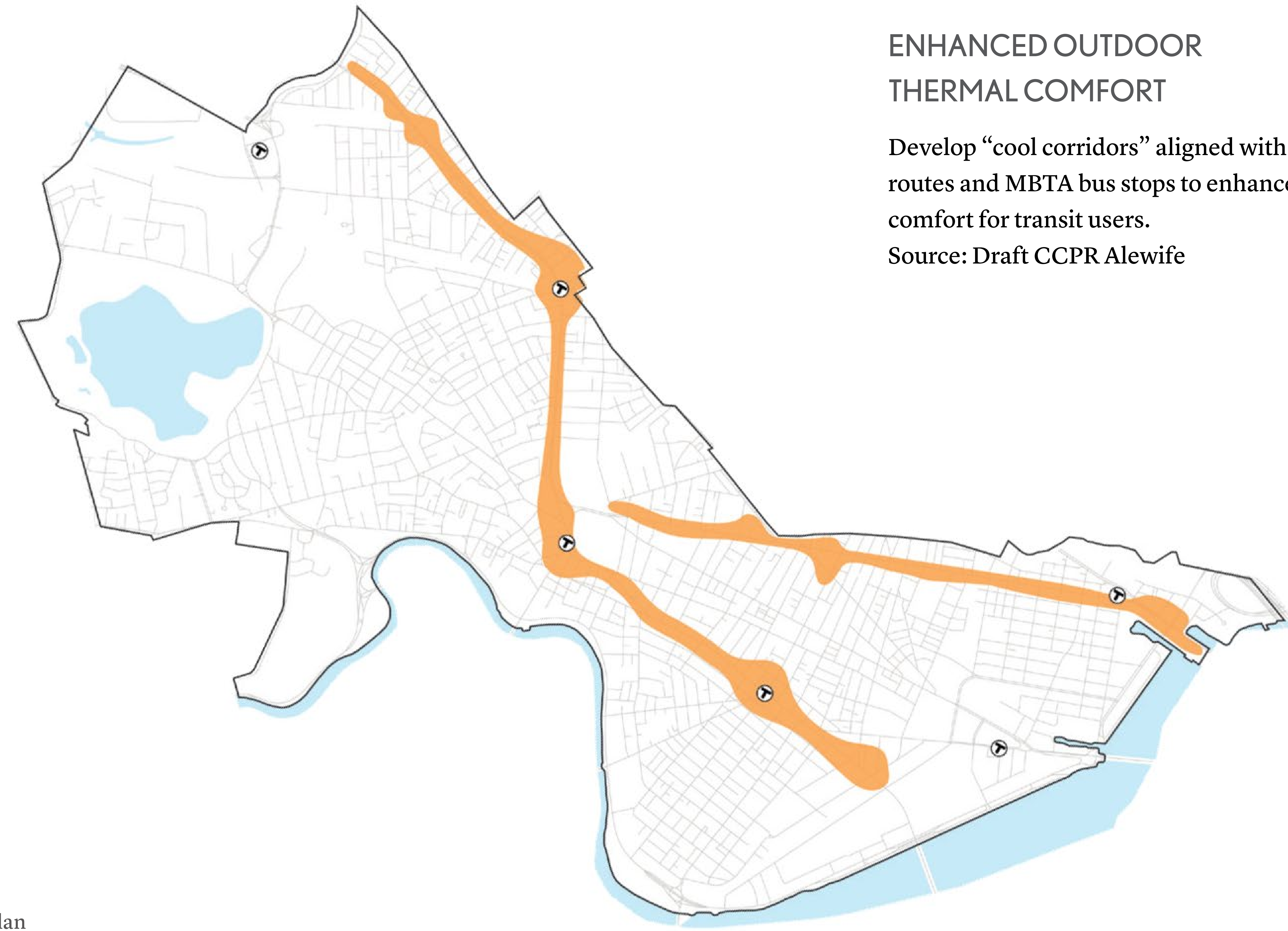
ENVISION – OPEN SPACE NETWORK

Where do you plant to enhance shading and cooling?

Source: Envision Plan

ENVISION – CORRIDORS

Where do you plant to enhance shading and cooling?



Source: Envision Plan

ENHANCED OUTDOOR THERMAL COMFORT

Develop "cool corridors" aligned with bike and pedestrian routes and MBTA bus stops to enhance outdoor thermal comfort for transit users.
Source: Draft CCPR Alewife

CITY EXISTING AND PROPSOED BIKE NETWORK

Where do you plant to enhance shading and cooling?

Off-street path
Separated bike facility
Lower volume/speed
Existing facility not in bicycle priority network

Source: Cambridge City Bike Plan

MOST USED RUNNING ROUTES

Where do you plant to enhance shading and cooling?

Source: Cityways, MIT Senseable City Lab

MOST USED WALKING ROUTES

Where do you plant to enhance shading and cooling?

Source: Cityways, MIT Senseable City Lab

MOST USED CYCLING ROUTES

Where do you plant to enhance shading and cooling?

Source: Cityways, MIT Senseable City Lab

ALIGN URBAN FOREST GOALS AND CITY PLANNING GOALS

Green corridors create a network to link squares, transportation networks and open spaces

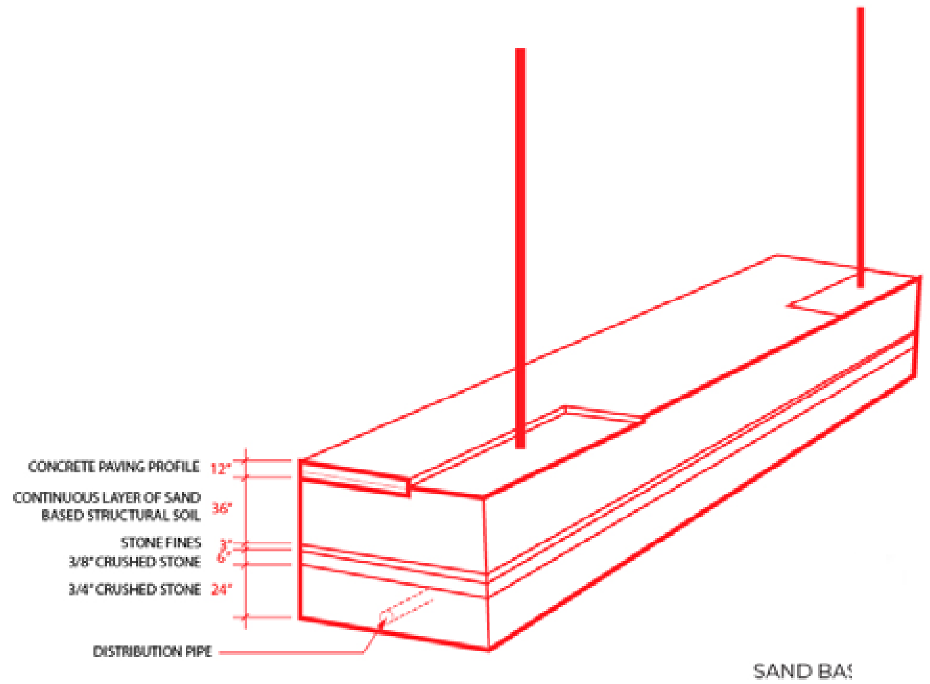
ALIGN URBAN FOREST GOALS AND CITY PLANNING GOALS

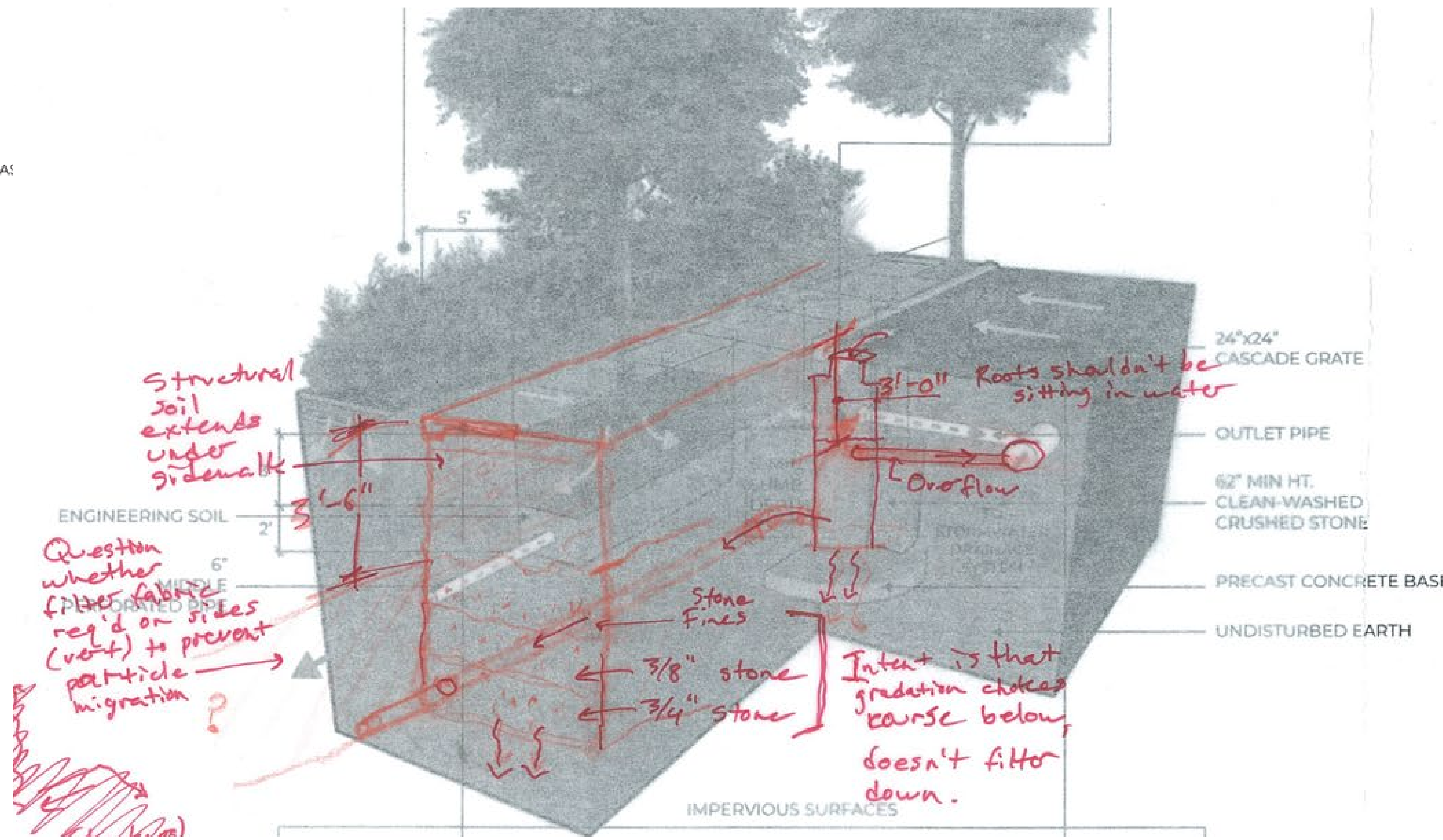
Green corridors create a network to link squares, transportation networks and open spaces

- Park, cemetery, private & public open spaces
- Athletic fields
- Rooftop parks
- Golf courses
- Squares
- Bus routes
- Bus shelters
- The most used cycling routes
- Hubway stations
- Primary arteries - Streets
- Primary arteries - Waterfront
- Secondary Network
- Canopy

CCPR: LINK RESILIENCE AND HORTICULTURAL SUPPORT

Tree plantings as part of stormwater management system





PUBLIC COMMENT

TASK FORCE MEETING SCHEDULE

JUNE 12	Introduction
JUNE 28	RESEARCH: Regulation and Management
JULY 26	RESEARCH: Goal Setting
AUGUST 30	RESEARCH: Ongoing Analysis + Climate Modeling
SEPTEMBER 27	RESEARCH: Summary of Findings
OCTOBER 25	Cancelled
NOVEMBER 29	TESTING: Baseline Change Model
DECEMBER 20	TESTING: Impact Analysis
JANUARY 31	PROPOSAL DEVELOPMENT
FEBRUARY 28	PROPOSAL DEVELOPMENT
MARCH 28	DRAFT DOCUMENTATION
APRIL 25	DRAFT DOCUMENTATION

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