1.3.12 DIMENSIONAL FORM

DIMENSIONAL FORM

Project Address: 290 Binney Street **Application Date:** 15 March 2022

	Existing	Allowed or Required (max/min)	Proposed	Permitted
Lot Area (sq ft)	60,548	N/A	N/A	
Lot Width (ft)	N/A	N/A	N/A	
Total Gross Floor Area (sq ft)	0	429,836	429,836	
Residential Base	N/A	N/A	N/A	
Non-Residential Base	0	429,836	429,836	
Inclusionary Housing Bonus	N/A	N/A	N/A	
Total Floor Area Ratio	N/A*	N/A*	N/A*	
Residential Base	N/A	N/A	N/A	
Non-Residential Base	N/A*	N/A*	N/A*	
Inclusionary Housing Bonus	N/A	N/A	N/A	
Total Dwelling Units	N/A	N/A	N/A	
Base Units	N/A	N/A	N/A	
Inclusionary Bonus Units	N/A	N/A	N/A	
Base Lot Area / Unit (sq ft)	N/A	N/A	N/A	
Total Lot Area / Unit (sq ft)	N/A	N/A	N/A	
Building Height(s) (ft)	±56'-0"	Up to 250'-0"	Up to 250'-0"	
Front Yard Setback (ft)	N/A	N/A	N/A	
Side Yard Setback (ft)	N/A	N/A	N/A	
Side Yard Setback (ft)	N/A	N/A	N/A	
Rear Yard Setback (ft)	N/A	N/A	N/A	
Open Space (% of Lot Area)	See attached	See attached	See attached	
Private Open Space	See attached	See attached	See attached	
Permeable Open Space	See attached	See attached	See attached	
Other Open Space (Specify)	See attached	See attached	See attached	
Off-Street Parking Spaces	See attached	See attached	See attached	
Long-Term Bicycle Parking	See attached	See attached	See attached	
Short-Term Bicycle Parking	See attached	See attached	See attached	
Loading Bays	0	N/A	2	

Use space below and/or attached pages for additional notes:

** Pursuant to City Council Ordinance No. 2020-17, Section 14.33 of the Zoning Ordinance was amended to provide that "…there shall be no maximum floor area ratio for any project utilizing Infill GFA (including Utility Project GFA)."

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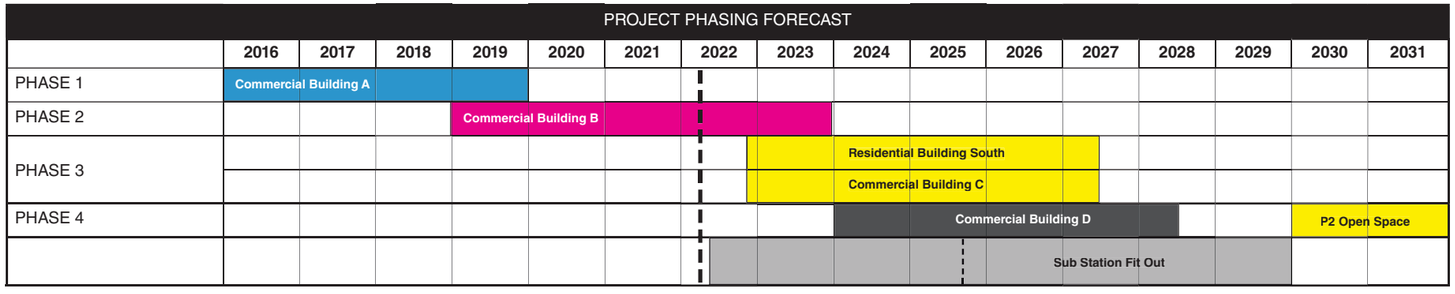
1.3.13 PROPOSED DRDAP SCHEDULE

PROPOSED DRDAP SCHEDULE

PROPOSED SCHEDULE			
	Residential Building South	**Commercial Building C**	**Commercial Building D**
DRDAP: SD	Q1 2022	Q1 2022	Q1 2022
DRDAP: DD	Q2 2022	Q2 2022	Q2 2022
DRDAP: CD	Q3 2022	Q3 2022	Q3 2022
Enabling/Utilities	Q2-Q3 2022	Q2-Q3 2022	Q2-Q3 2022
Demolition	Q1-Q2 2023	Q1-Q2 2023	Q1-Q2 2024
Foundation	Q2-Q3 2023	Q2-Q3 2023	Q1-Q2 2025
Structure	Q2-Q3 2025	Q4 2023	Q3-Q4 2025
Building Completion	Q2-Q3 2027	Q2-Q3 2026	Q1-Q2 2028
Landscape Completion	Q2-Q3 2027	Q2-Q3 2027	Q1-Q2 2028
**All dates subect to change*			
***Note all dates reflect start of proposed activities, save milestones noted as "Completion"*			



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PROPOSED OPEN SPACE

DESIGN REVIEW OPEN SPACE (2022/03)(BY PHASE ACCOUNTING)

	PH 1	PH 2	PH 3	PH 4		TOTAL
PHASE 1 REQUIRED (OS)	**35,504**					**35,504**
145 BROADWAY (OS)	8,114					8,114
6TH STREET CONNECTOR	19,569					19,569
(W) EW CONNECTOR	7,328					7,328
(PARCEL 2) PHASE 1 SUBTOTAL						**35,011**
6TH STREET CONNECTOR (OUTSIDE MXD)	19,790					19,790
PHASE 1 PROVIDED (PARCEL 2)	**54,801**					**54,801**
PHASE 1 OS (EXCESS)	**19,297**					
PHASE 2 REQUIRED (OS) *ASD PARCEL 4						
325 MAIN STREET (OS)						0
ENHANCED PLAZA AREA		2,562				2,562
KENDALL SQUARE ROOFTOP GARDEN		25,340				25,340
ROOFTOP CONNECTOR TERRACES		2,916				2,916
PH2 PROVIDED		30,818				**30,818**
PHASE 2 OS (EXCESS)		**30,818**				
PHASE 3 PROVIDED (OS)						
DANIEL LEWIN PARK (IVA)			4,955			**4,955**
DANIEL LEWIN PARK (IVB)			5,297			**5,297**
PH3 PROVIDED						**10,252**
PHASE 3 OS (EXCESS)			**10,252**			
PHASE 4 REQUIRED (OS) **						**96,185**
CENTER PLAZA				28,741		**28,741**
COMMERCIAL C				5,751		**5,144**
COMMERCIAL D				18,325		**18,325**
RESIDENTIAL				7,745		**7,745**
***RETAIL				607		**607**
(SE) EW CONNECTOR				6,866		**6,866**
ENHANCED OS AREA				4,589		**4,589**
E SERV DRIVE WOONERF AREA	AREA FOR ACCT.			4,570		NOT INC.
W SERV DRIVE WOONERF AREA	AREA FOR ACCT.			3,259		NOT INC.
PHASE 4 (PARCEL2) (PROPOSED)				80,453		**72,017**

PHASE 1 OS (EXCESS)	**19,297**					**19,297**
PHASE 2 OS (EXCESS)		**30,818**				**30,818**
PHASE 3 OS (EXCESS)			**10,252**			**10,252**
TOTAL OS (PROVIDED)						**101,566**
OS OVER REQUIRED						**5,381**

TOTAL OVERALL OS (EXCESS)	**36,199**

TOTAL PARCEL 2 OS	**107,028**

* ASD See Ames Street District Article 14	**GFA**	**REQUIRED**	
** COMMERCIAL C (OS) INFILL GFA (8:100)	424,565	**33,965**	**33,965**
** RETAIL (OS) INFILL GFA (10:100)	5,271	**527**	**527**
** COMMERCIAL D (OS) INFILL GFA (8:100)	370,164	**29,613**	**29,613**
** RETAIL (OS) INFILL GFA (10:100)	7267	(EXEMPT:BIKE VALET)	
** RESIDENTIAL (OS) INFILL GFA (8:100)	400,000	**32,000**	**32,000**
** RETAIL (OS) INFILL GFA (10:100)	800	**80**	**80**
***Retail OS (607) subtracted from Comercial C (5751) Provided OS forP4 Proposed total			**96,185**

PARCEL 2 TRACT

Commercial Building A
Phase I
(Parcel 2)

Commercial Building B
Phase II
(Parcel 4)

Commercial Building C
Residential Building South
Commercial Building D
(Parcel 2)

Daniel Lewin Park Tract IVA and IVB (Parcel 3)
Rooftop connector terraces area in the ASD (Parcel 4) not represented in this graphic

Phase I. Open Space
Phase I. Enhanced OS.
Phase II. Enhanced OS.
Phase II. Rooftop OS.
Phase IV. Open Space
Phase IV. Enhanced OS.

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PROPOSED OPEN SPACE

DESIGN REVIEW OPEN SPACE SUMMARY (2022/03)

DEVELOPMENT PROGRAM SUMMARY BY USE (GFA)					
	Residential Building South	Commercial Building C	Commercial Building D		TOTAL
COMMERCIAL GFA	0	424,565	370,164		**794,729**
RETAIL/ACTIVE USE GFA***	800	5,271	*7,267*		**6,071**
RESIDENTIAL GFA***	420,000	0	0		**420,000**
TOTAL NET NEW GFA	420,800	429,836	370,164		**1,220,800**

*Note GFA as defined in Article 2.0 of the Cambridge Zoning Ordinance
**Note Commercial Building D Commercial GFA provided net of 62,576 of existing GFA
***Note Residential Building South middle income of 20,0000 SF is classified as exempt, as is bicycle parking of 7,267 SF in Commercial Building D

PARCEL 2 OPEN SPACE CALCULATION SUMMARY					
	Residential Building South	Commercial Building C	Commercial Building D	Retail	TOTAL OS
REQUIRED	32,000	33,965	29,613	607	**96,185**
PROVIDED	7,745	5,144	18,325	607	**31,821**
VARIANCE	-24,255	-28,821	-11,288	0	-64,364
*Required values calculated according to 8SF per 100SF of GFA for Office and Biotechnology Uses and Multifamily Residential Uses **Required values calculated according to 10SF per 100SF of GFA for Retail and Consumer Service Uses					
OPEN SPACE AREAS (PARCEL 2)					
(SE) EW CONNECTOR	PHASE 3				6,866
CENTER PLAZA	PHASE 4				28,741
ENHANCED OS AREAS	PHASE 4				4,589
SUBTOTAL					**40,196**
ENHANCED OPEN SPACE AREAS (OUTSIDE OF PARCEL 2)					
DANIEL LEWIN PARK (IVA)	PHASE 3				4,955
DANIEL LEWIN PARK (IVB)	PHASE 3				5,297
SUBTOTAL					**10,252**
EXCESS ENHANCED OPEN SPACE AREAS (OUTSIDE OF PARCEL 2)					
6TH STREET CONNECTOR	PHASE 1 (145 BROADWAY)				19,297
SUBTOTAL					**19,297**
TOTAL PROVIDED	(31,821+40,196+10,252+30,042)				**101,566**
VARIANCE	(OPEN SPACE OVER REQUIRED)				**5,381**

ADDITIONAL EXCESS ENHANCED OPEN SPACE AREAS (OUTSIDE OF PARCEL 2)		
ENHANCED PLAZA AREA	PHASE 2 (325 MAIN STREET)	2,562
KENDALL SQUARE ROOFTOP GARDEN	PHASE 2 (325 MAIN STREET)	25,340
ROOFTOP CONNECTOR TERRACES	PHASE 2 (325 MAIN STREET)	2,916
SUB TOTAL		**30,818**
TOTAL EXCESS OPEN SPACE		**36,199**

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1.3.14 PROPOSED OPEN SPACE

OPEN SPACE (IDCP)

DEFINITION OF OPEN SPACE

Open spaces, as described in this document, and reinforced by Article 14, are described in the following ways:

1. Portion of a lot or other area of land associated with and adjacent to a building for a group of buildings in relation to which it serves to provide light and air, or scenic, recreational or similar purposes. Such space shall, in general, be available for entry and use by the occupants of the building(s) with which it is associated, and at times to the general public, but may include a limited proportion of space so located and treated as to enhance the amenity of development by providing landscape features, screening or buffering for the occupants or neighbors or a general appearance of openness. Open space shall include parks, plazas, lawns, landscaped areas, decorative plantings, pedestrian ways as listed in Section 14.45 of the Zoning Ordinance, active and passive recreational areas, including playgrounds and swimming pools.

2. Parks, gardens and plazas reserved for public use and enjoyment as guaranteed through one or more of the following:

- Retention by the CRA.
- Dedication to and acceptance by the City or other public entity.
- Easements or deed restrictions over such land sufficient to ensure its perpetual reservation for public open space purposes.
- Dedication, by covenant or comparable legal instrument to the community use of the residents, lessees and visitors to the MXD District for reasonable amounts of time on a regular basis.
- Lease agreements of 99 years or longer from the private developer or owner to the City or other public entity.

3. Open space on the development lot. Some or all of this required open space may be designated and also serve as open space.
4. Pocket parks, bike paths and enhanced planting zones created through modification of roadways as part of the ALTA cycle track.
5. Circulation elements including stairs, elevators, elevated plazas or pathways used to enhance connection to and between publicly accessible spaces.
6. Spaces that are not considered as open spaces, as described in this document and reinforced by the Zoning Ordinance are:

- Streets, parking lots, driveways, service roads, loading areas, and areas normally inaccessible to pedestrian circulation beneath pedestrian bridges, decks or shopping bridges.

EXISTING MXD PARCEL AREAS & OPEN SPACE

EXISTING MXD DEVELOPABLE PARCEL AREA (P)		
P2		445,825
P3		229,558
P4		257,824
LOUGHREY WALKWAY (WITHIN MXD)		19,569
GRAND JUNCTION + BINNEY ST PARK		77,361
TOTAL EXISTING MXD AREA (±SF)		1,010,596

EXISTING OPEN SPACE (OS) TOTALS		
P2		148,825
P3		77,429
P4		141,247
LOUGHREY WALKWAY (WITHIN MXD)		19,569
GRAND JUNCTION + BINNEY ST PARK		77,361
TOTAL EXISTING MXD OS (±SF)		462,021

EXISTING OPEN SPACE (OS) TOTALS		
(BROADWAY PARK)@BLUE GARAGE		13,970
(BINNEY PARK)@BLUE GARAGE		7,815
KENDALL SQUARE ROOFTOP GARDEN	ASD	25,340
KENDALL PLAZA	ASD	14,372
GALAXY PARK	ASD	18,664
75 AMES ST OPEN SPACE	ASD	6,867
DANIEL LEWIN PARK (CENTER ONLY)	ASD	5,297
DANIEL LEWIN PARK (WEST)		4,955
DANIEL LEWIN PARK (EAST)		7,341
ORIGINAL BROAD OPEN SPACE (7CC)		5022
WHITEHEAD PLAZA		10,930
GRAND JUNCTION		27,300
BINNEY STREET PARK		50,061
LOUGHREY WALKWAY (WITHIN MXD)		19,569
LOUGHREY WALKWAY (OUTSIDE OF MXD)		19,790

TOTAL EXISTING PUBLIC OS (±SF)	237,293

REQUIRED	PROVIDED
100K	TOTAL EXISTING PUBLIC OPEN SPACE
100,000	**237,293±SF**
15% OF TOTAL MXD AREA	TOTAL EXISTING OPEN SPACE
151,585	**462,021±SF**
AMES STREET DISTRICT*	**OPEN SPACE**
53,000	**70,540±SF**

REQUIRED OPEN SPACE VS. PROVIDED OPEN SPACE

AMENDMENT #2 OPEN SPACE

EXISTING MXD DEVELOPABLE PARCEL AREA (P)		
P2		445,825
P3		229,558
P4		257,824
LOUGHREY WALKWAY (WITHIN MXD)		19,569
GRAND JUNCTION + BINNEY ST PARK		77,361
TOTAL EXISTING MXD AREA (±SF)		1,010,596

PROPOSED OPEN SPACE (OS) TOTALS		
P2		151,590
P3		73,456
P4		141,247
LOUGHREY WALKWAY (WITHIN MXD)		19,569
GRAND JUNCTION + BINNEY ST PARK		77,361
TOTAL EXISTING MXD OS (±SF)		463,223

PROPOSED OPEN SPACE (OS) TOTALS		
(BROADWAY PARK)@BLUE GARAGE		~~13,970~~
(BINNEY PARK)@BLUE GARAGE		~~7,815~~
P2 ENHANCED OPEN SPACE		82,011*
KENDALL SQUARE ROOFTOP GARDEN	ASD	25,340
ROOFTOP CONNECTOR TERRACES	ASD	2,916*
KENDALL PLAZA	ASD	14,372
GALAXY PARK	ASD	18,664
75 AMES ST OPEN SPACE	ASD	6,867
DANIEL LEWIN PARK (CENTER ONLY) (IVA)	ASD	5,297*
DANIEL LEWIN PARK (WEST) (IVB)		4,955*
DANIEL LEWIN PARK (EAST)		7,341
ORIGINAL BROAD OPEN SPACE (7CC)		5022
WHITEHEAD PLAZA		10,930
GRAND JUNCTION		27,300
BINNEY STREET PARK		50,061
LOUGHREY WALKWAY (WITHIN MXD)		19,569
LOUGHREY WALKWAY (OUTSIDE OF MXD)		19,790

TOTAL PROPOSED PUBLIC OS (±SF)	300,435

REQUIRED	PROVIDED
100K	TOTAL PROPOSED PUBLIC OPEN SPACE
100,000	**300,435*±SF**
15% OF TOTAL MXD AREA	TOTAL PROPOSED OPEN SPACE
151,589	**463,223*±SF**
AMES STREET DISTRICT*	**OPEN SPACE**
53,000	**73,456*±SF**

REQUIRED OPEN SPACE VS. PROVIDED OPEN SPACE

Total enhanced open space also includes enhancements to Daniel Lewin Park Tract IVA and IVB. Rooftop connector terraces area in the ASD were revised, accounting for final design and areas associated with the MBTA headhouse and rooftop connector terraces adjacent to the 325M project approaching completion. Parcel 2 enhanced open space remains unchanged.

DESIGN REVIEW OPEN SPACE (2022/03)

EXISTING MXD DEVELOPABLE PARCEL AREA (P)		
P2		445,825
P3		229,558
P4		257,824
LOUGHREY WALKWAY (WITHIN MXD)		19,569
GRAND JUNCTION + BINNEY ST PARK		77,361
TOTAL EXISTING MXD AREA (±SF)		1,010,596

PROPOSED OPEN SPACE (OS) TOTALS		
P2		155,186
P3		73,456
P4		141,247
LOUGHREY WALKWAY (WITHIN MXD)		19,569
GRAND JUNCTION + BINNEY ST PARK		77,361
TOTAL EXISTING MXD OS (±SF)		468,115

PROPOSED OPEN SPACE (OS) TOTALS		
(BROADWAY PARK)@BLUE GARAGE		~~13,970~~
(BINNEY PARK)@BLUE GARAGE		~~7,815~~
P2 ENHANCED OPEN SPACE		107,028
KENDALL SQUARE ROOFTOP GARDEN	ASD	25,340
ROOFTOP CONNECTOR TERRACES	ASD	2,916*
KENDALL PLAZA	ASD	14,372
GALAXY PARK	ASD	18,664
75 AMES ST OPEN SPACE	ASD	6,867
DANIEL LEWIN PARK (CENTER ONLY) (IVA)	ASD	5,297
DANIEL LEWIN PARK (WEST) (IVB)		4,955
DANIEL LEWIN PARK (EAST)		7,341
ORIGINAL BROAD OPEN SPACE (7CC)		5022
WHITEHEAD PLAZA		10,930
GRAND JUNCTION		27,300
BINNEY STREET PARK		50,061
LOUGHREY WALKWAY (WITHIN MXD)		19,569
LOUGHREY WALKWAY (OUTSIDE OF MXD)		19,790

TOTAL PROPOSED PUBLIC OS (±SF)	325,452

REQUIRED	PROVIDED
100K	TOTAL PROPOSED PUBLIC OPEN SPACE
100,000	**325,452±SF**
15% OF TOTAL MXD AREA	TOTAL PROPOSED OPEN SPACE
151,589	**468,115±SF**
AMES STREET DISTRICT*	**OPEN SPACE**
53,000	**73,456±SF**

REQUIRED OPEN SPACE VS. PROVIDED OPEN SPACE

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1.3.14 PROPOSED OPEN SPACE

OPEN SPACE COMPARISON

OPEN SPACE (OS) COMPARISONS AMENDMENT #1 /AMENDMENT #2 / DESIGN REVIEW

IDCP AMENDMENT #1 OPEN SPACE

(OS) COMMERCIAL BUILDING A (PHASE I)

REQUIRED	**35,504 ±SF**
PROVIDED	**54,801 ±SF**
145 BROADWAY (OS)	8,114 ±SF
(SW) EW CONNECTOR (EASEMENT C)	7,328 ±SF
6TH ST CONNECTOR (WITHIN MXD)	19,569 ±SF

(OS) COMMERCIAL BUILDING B (PHASE 2)

REQUIRED	**0 (ASD)**
PROVIDED	**27,501 ±SF**
KENDALL SQUARE ROOFTOP GARDEN*	18,789 ±SF
ENHANCED OS PLAZA AREA	2,562 ±SF
ENHANCED OS TERRACE	4,750 ±SF
ENHANCED OS TERRACE (PENDING MBTA)	1,400 ±SF

RESIDENTIAL BUILDING SOUTH (PHASE 2)

REQUIRED	**28,000 ±SF**
PROVIDED*	**32,070 ±SF**

RESIDENTIAL BUILDING NORTH (PHASE 3)

REQUIRED	**5,600 ±SF**
PROVIDED*	**16,895 ±SF**

PARCEL 2 AMD#1 ENHANCED (OS) 64,593 ±SF

* Denotes OS calculations made for IDCP AMENDMENT #1 via Lot calculations

IDCP AMENDMENT #2 OPEN SPACE

(OS) COMMERCIAL BUILDING A (PHASE I)

PROVIDED	**54,801 ±SF**
PHASE 1 OPEN SPACE EXCESS	**19,297 ±SF**

(OS) COMMERCIAL BUILDING B (PHASE 2)

****PROVIDED (UPDATE)**	**30,818 ±SF**
KENDALL SQUARE ROOFTOP GARDEN	25,340 ±SF
ROOFTOP CONNECTOR TERRACES***	2,916 ±SF
ENHANCED OS PLAZA AREA	2,562 ±SF
PHASE 2 OPEN SPACE EXCESS	**30,818 ±SF**

DANIEL LEWIN PARK (IVA) WEST	4,955 ±SF
DANIEL LEWIN PARK (IVB) CENTER	5,297 ±SF
PHASE 3 OPEN SPACE EXCESS	**10,252 ±SF**

(OS) COMMERCIAL BUILDING C (PHASE4)
(OS) RESIDENTIAL BUILDING SOUTH (PHASE 4)

PROVIDED	**30,000 ±SF**
CENTER PLAZA	30,000 ±SF

(OS) COMMERCIAL BUILDING D (PHASE 4)

PROVIDED	**17,000 ±SF**
(NE) EW CONNECTOR	7,000 ±SF
(SE) EW CONNECTOR	10,000 ±SF
REQUIRED	**96,180 ±SF**
PROVIDED	**107,860 ±SF**
TOTAL OPEN SPACE EXCESS	**11,680 ±SF**

PARCEL 2 AMD #2 ENHANCED (OS) 82,011 ±SF > AMD#1 17,418 ±SF

Pursuant to City Council Ordinance No. 2020-17, Section 14.33 of the Zoning Ordinance was amended to provide that "...there shall be no maximum floor area ratio for any project utilizing Infill GFA (including Utility Project GFA)." All of the GFA reflected in this application is Infill GFA, and therefore there are no maximum floor area ratio requirements for the buildings described herein.

** Denotes OS calculation updates made after IDCP Amendment 2 for 325 Main St Design Review

*** Includes the removal of 700 SF for retail uses on the terrace

DESIGN REVIEW OPEN SPACE (2022/03)

(OS) COMMERCIAL BUILDING A (PHASE I)

PROVIDED	**54,801 ±SF**
PHASE 1 OPEN SPACE EXCESS	**19,297 ±SF**

(OS) COMMERCIAL BUILDING B (PHASE 2)

****PROVIDED (UPDATE)**	**30,818 ±SF**
KENDALL SQUARE ROOFTOP GARDEN	25,340 ±SF
ROOFTOP CONNECTOR TERRACES***	2,916 ±SF
ENHANCED OS PLAZA AREA	2,562 ±SF
PHASE 2 OPEN SPACE EXCESS	**30,818 ±SF**

DANIEL LEWIN PARK (IVA) WEST	4,955 ±SF
DANIEL LEWIN PARK (IVB) CENTER	5,297 ±SF
PHASE 3 OPEN SPACE EXCESS	**10,252 ±SF**

(OS) COMMERCIAL BUILDING C (PHASE4)

PROVIDED	**5,144 ±SF**

(OS) RESIDENTIAL BUILDING SOUTH (PHASE 4)

PROVIDED	**7,745 ±SF**

(OS) COMMERCIAL BUILDING D (PHASE 4)

PROVIDED	**18,325 ±SF**
RETAIL	607 ±SF
CENTER PLAZA	28,741 ±SF
(SE) EW CONNECTOR	6,866 ±SF
****(NE) EW CONNECTOR	-
*****ENHANCED OS AREA	4,589 ±SF
REQUIRED	**96,185 ±SF**
PROVIDED	**101,566 ±SF**
OPEN SPACE EXCESS	**5,381 ±SF**
TOTAL OPEN SPACE EXCESS	**36,199 ±SF**
TOTAL PARCEL 2 OS	**107,028 ±SF**

PARCEL 2 DESIGN REVIEW (OS) 107,028 ±SF > AMD#1 42,435 ±SF

** Denotes OS calculation updates made after IDCP Amendment 2 for 325 Main St Design Review

*** Includes the removal of 700 SF for retail uses on the terrace

****Area now included in over Proposed Commercial Building D OS

*****Pavement areas along the East Service Drive

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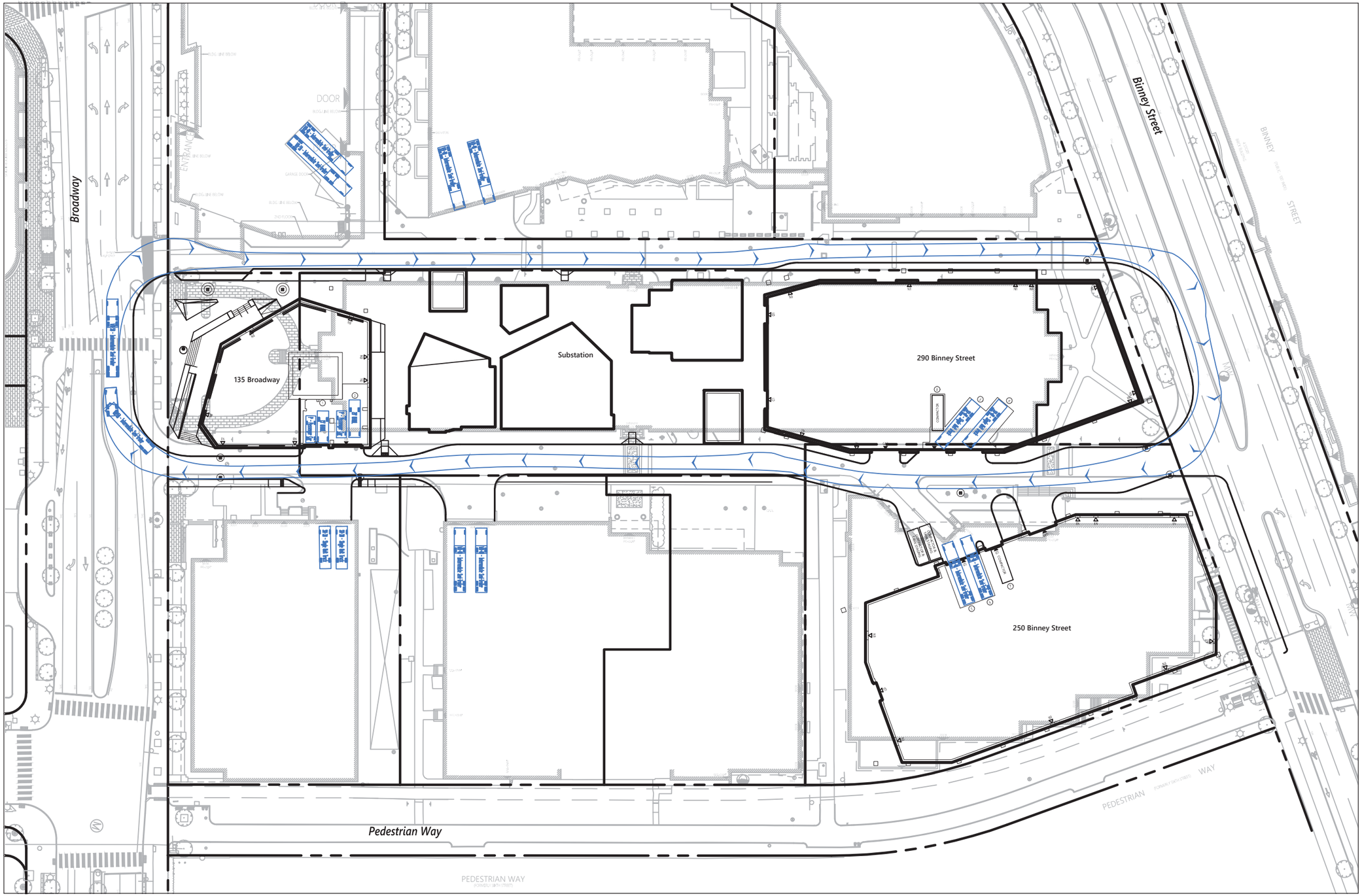
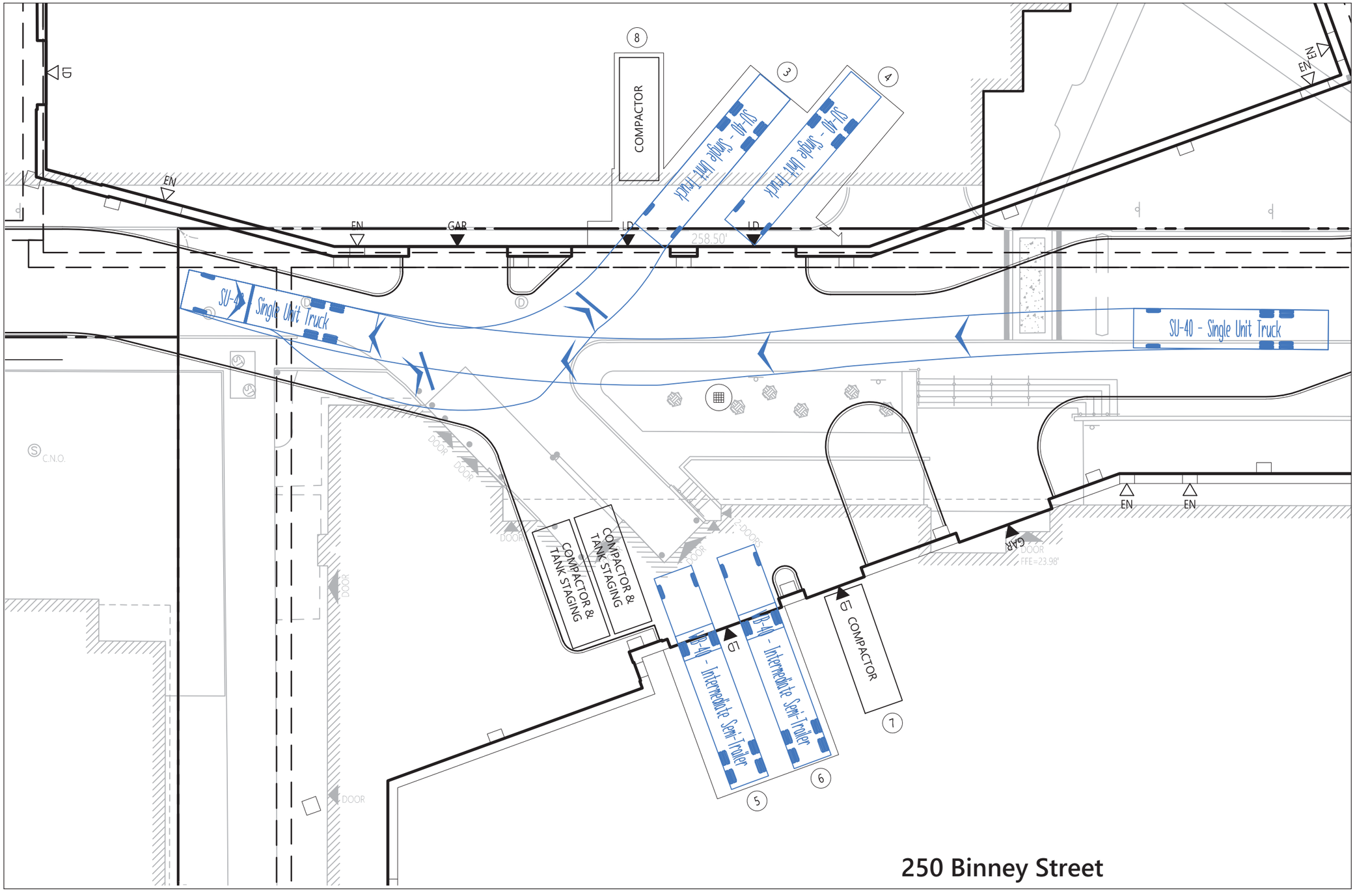
1.4 LOADING AND ACCESS

SITE PLAN



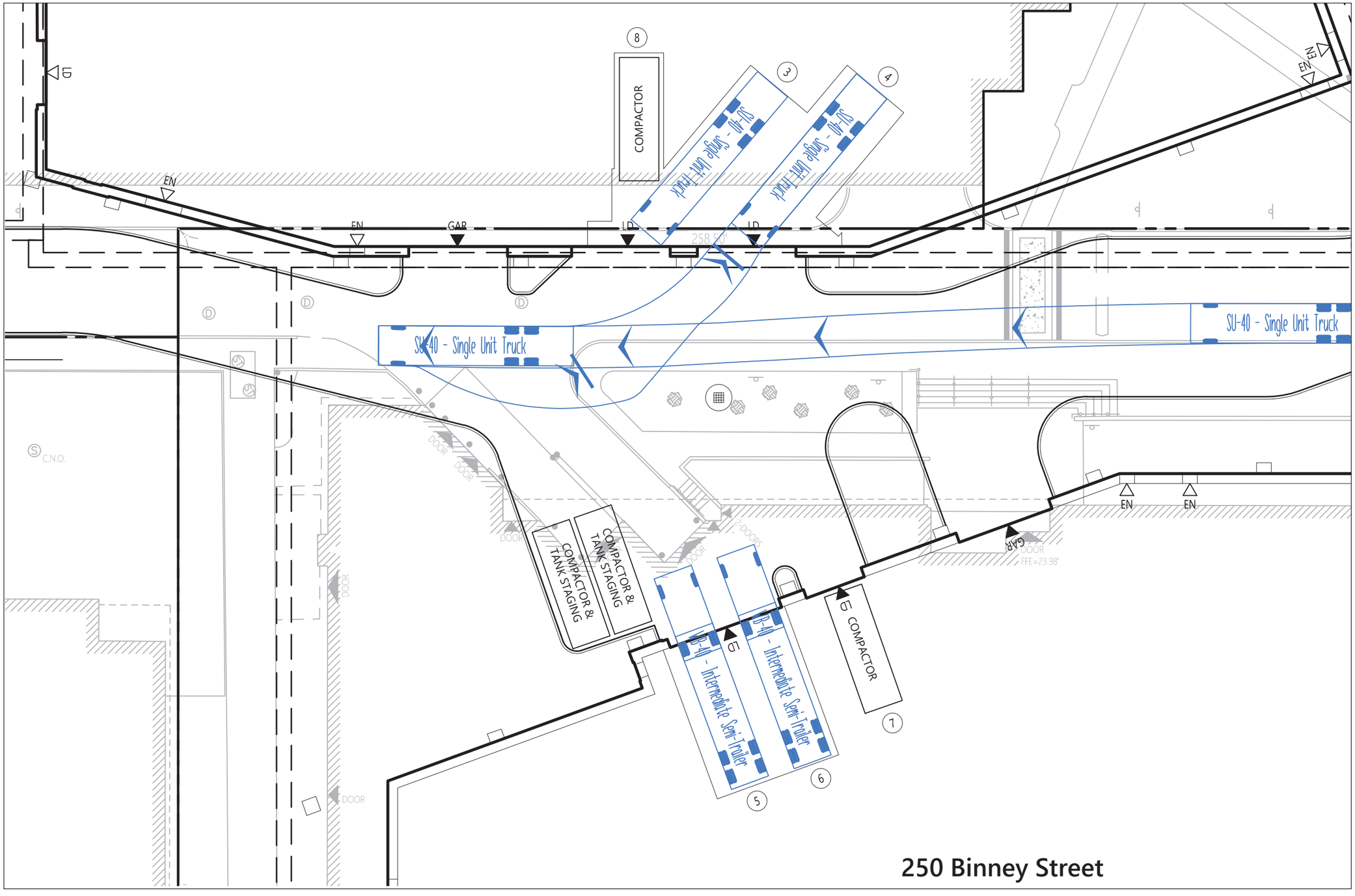
1.4 LOADING AND ACCESS

OPTION 1



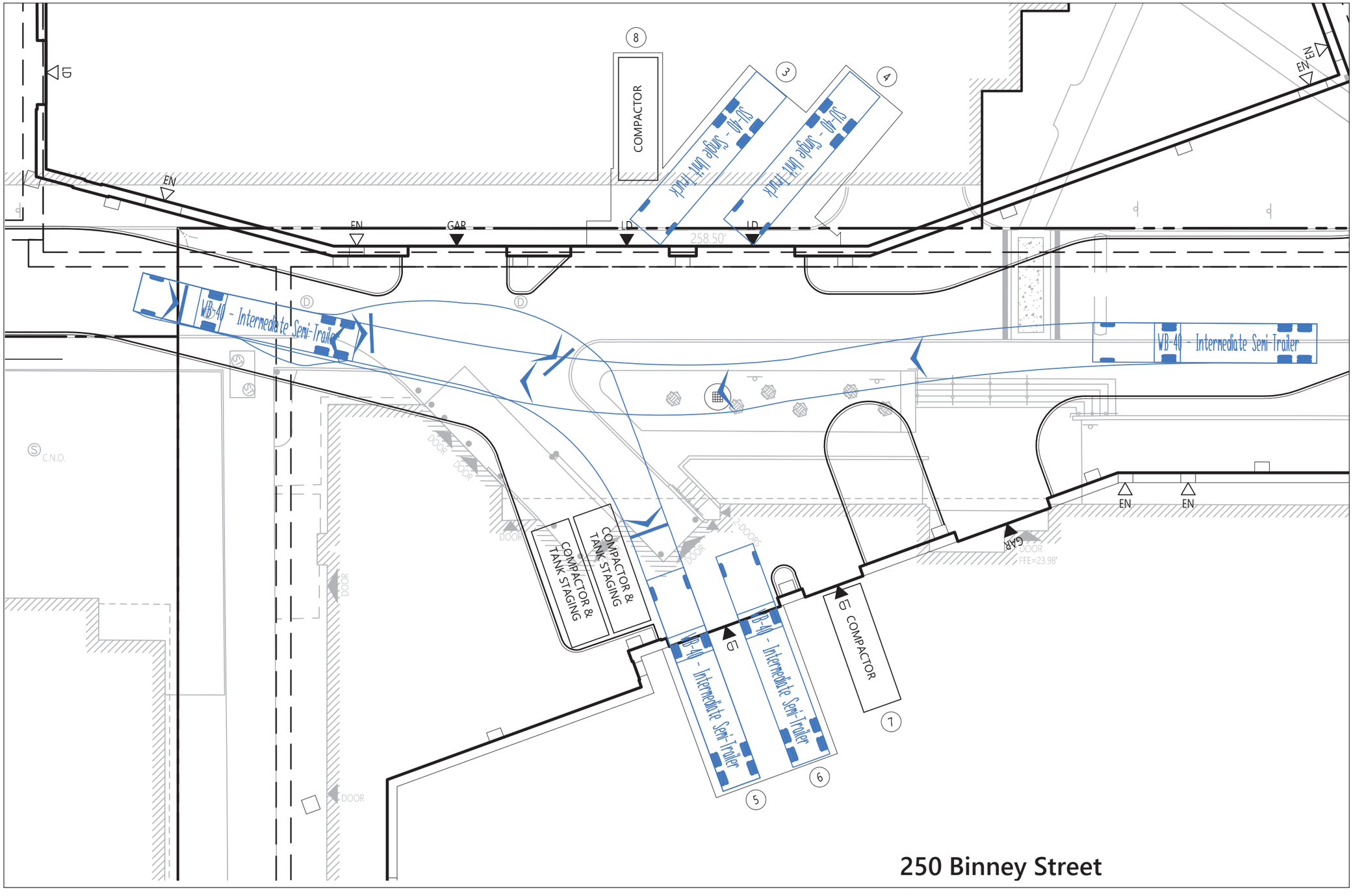
1.4 LOADING AND ACCESS

OPTION 2



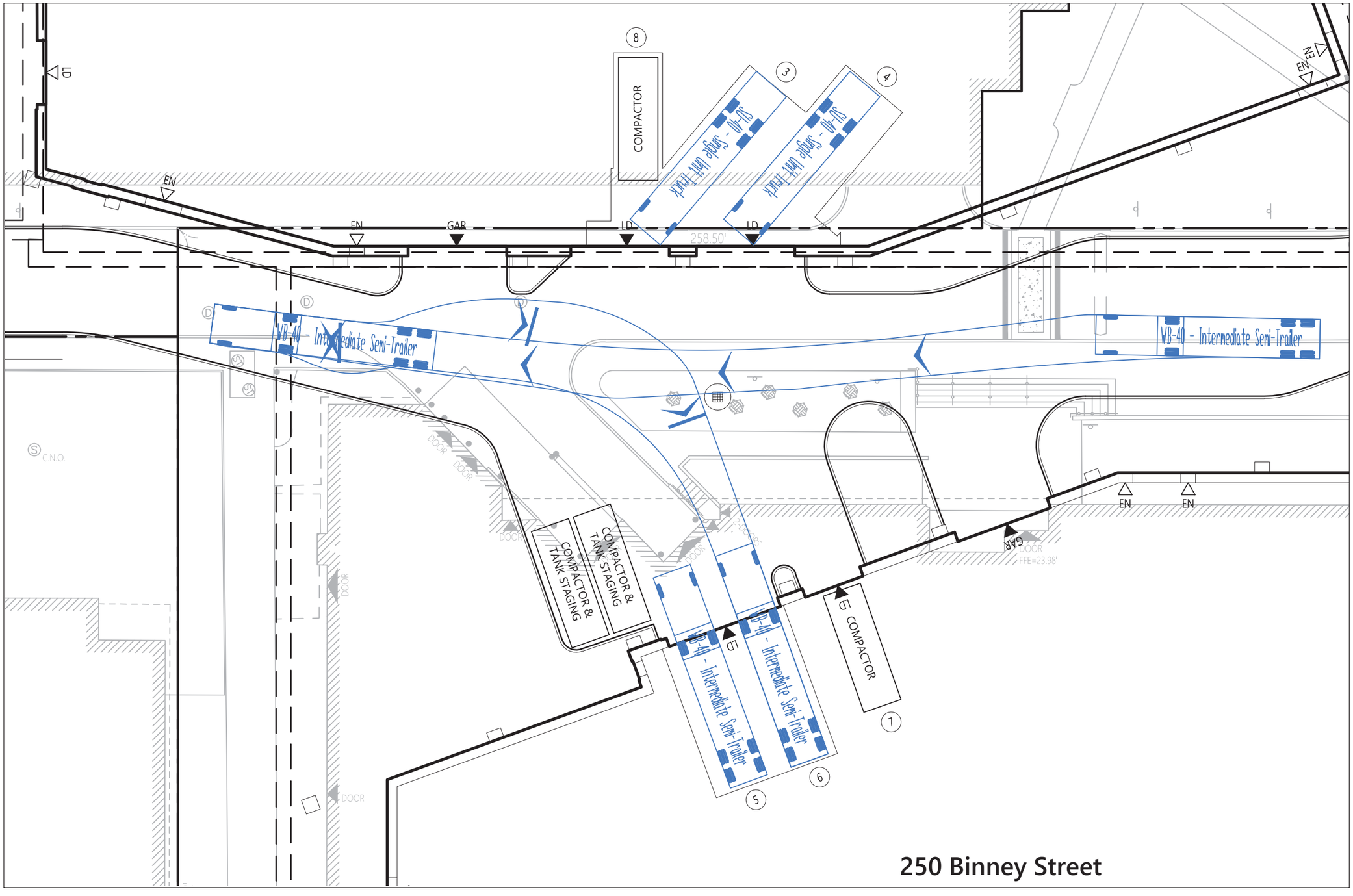
1.4 LOADING AND ACCESS

OPTION 3



1.4 LOADING AND ACCESS

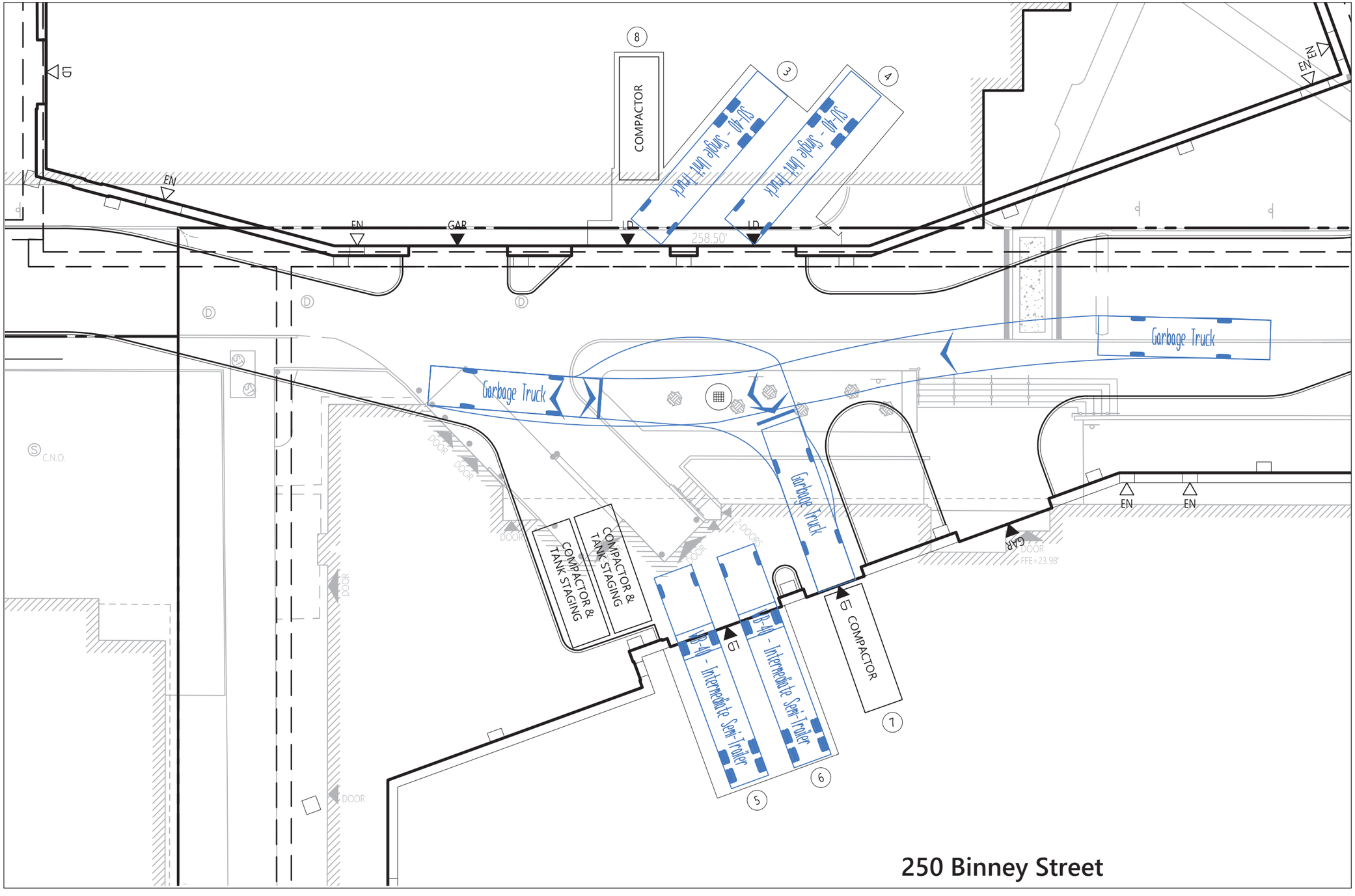
OPTION 4



250 Binney Street

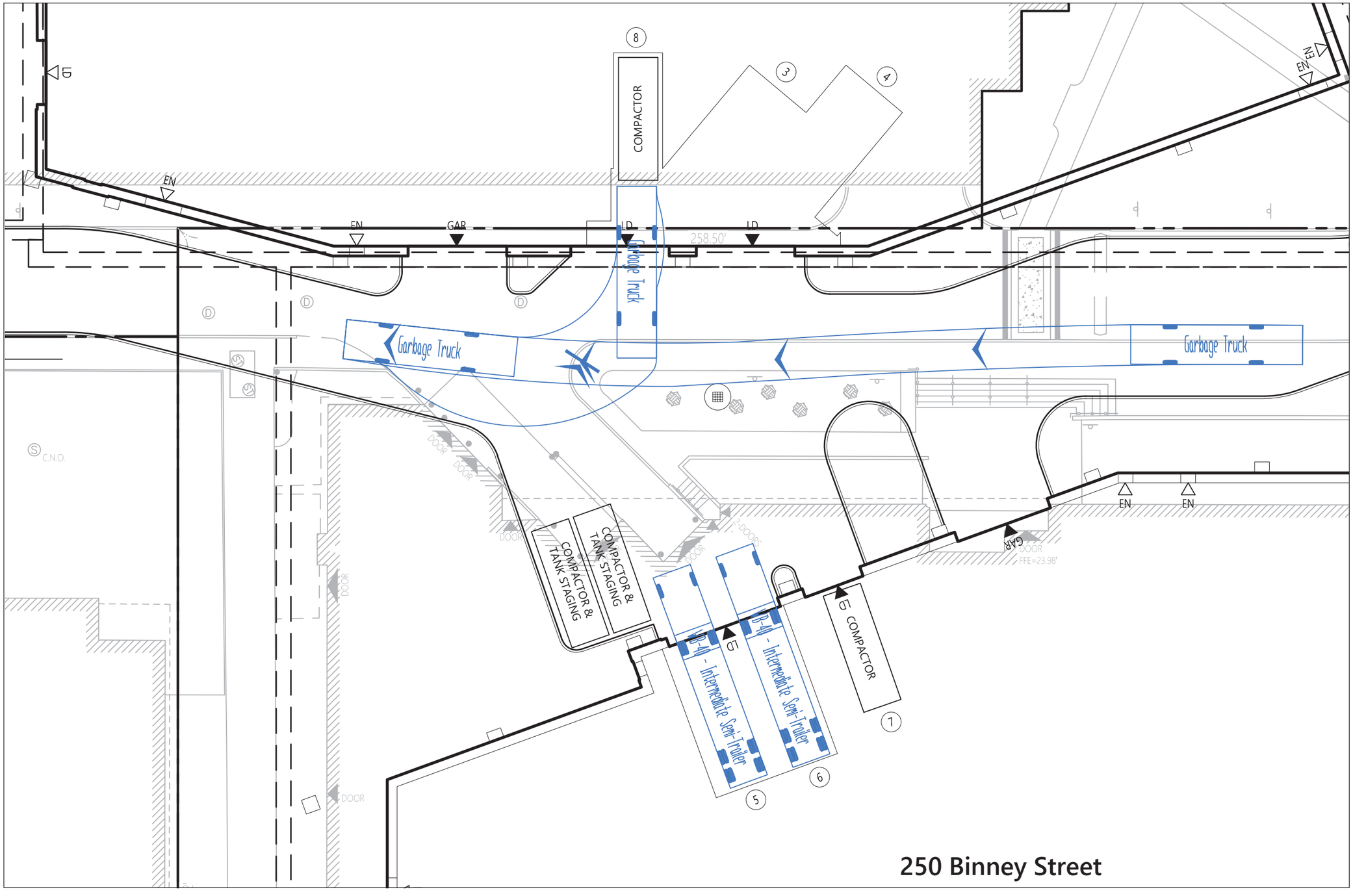
1.4 LOADING AND ACCESS

OPTION 5



1.4 LOADING AND ACCESS

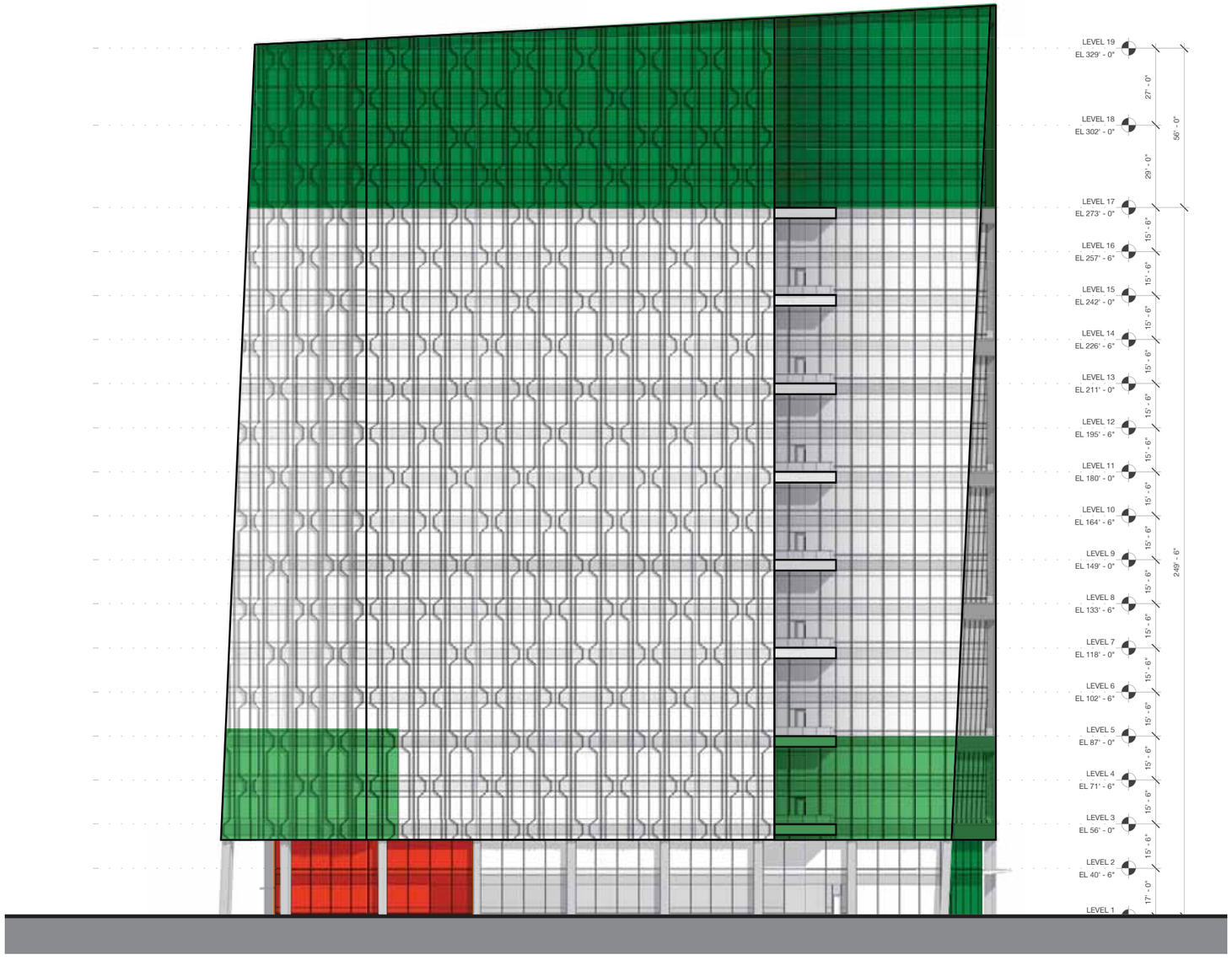
OPTION 6

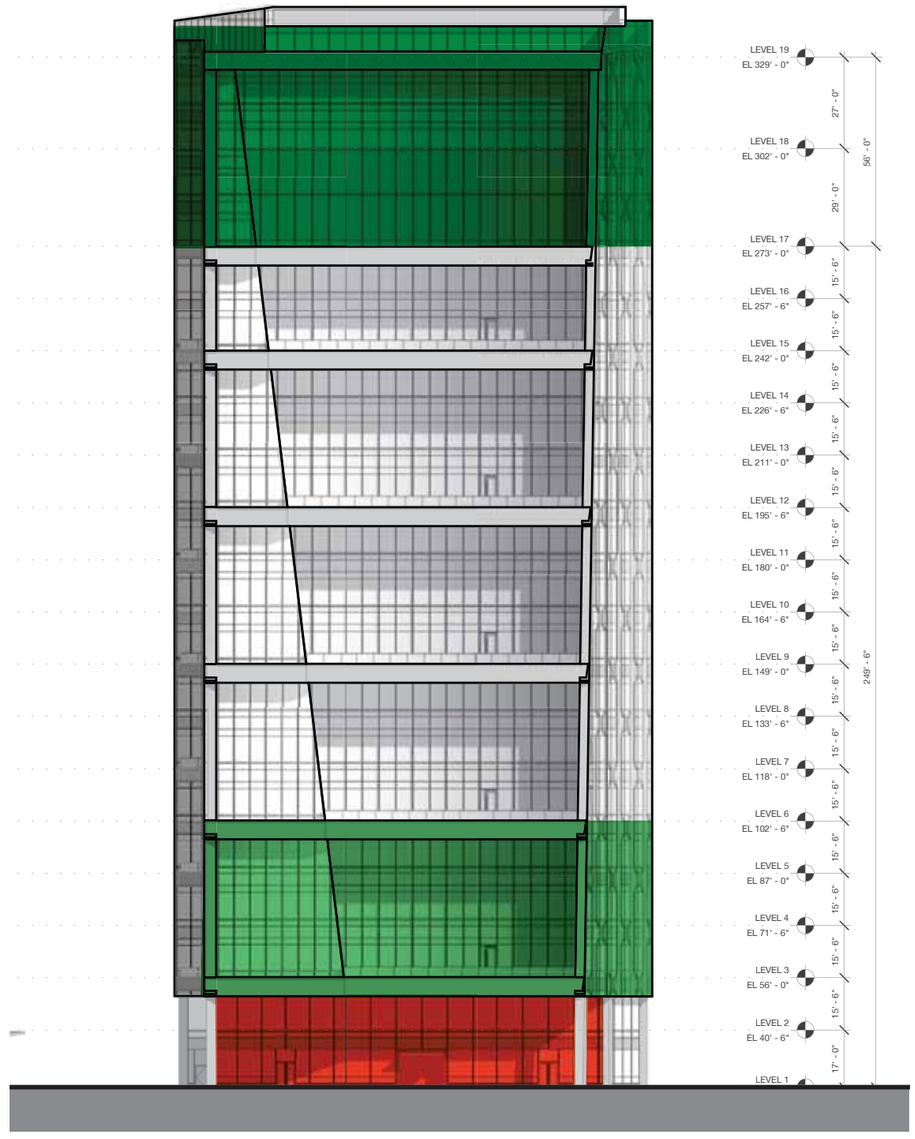


1.5 SIGNAGE

Building signage zone

Retail signage zone





* Floor elevations are measured from sea level

EAST ELEVATION

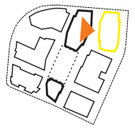
0' 10' 20' 40'

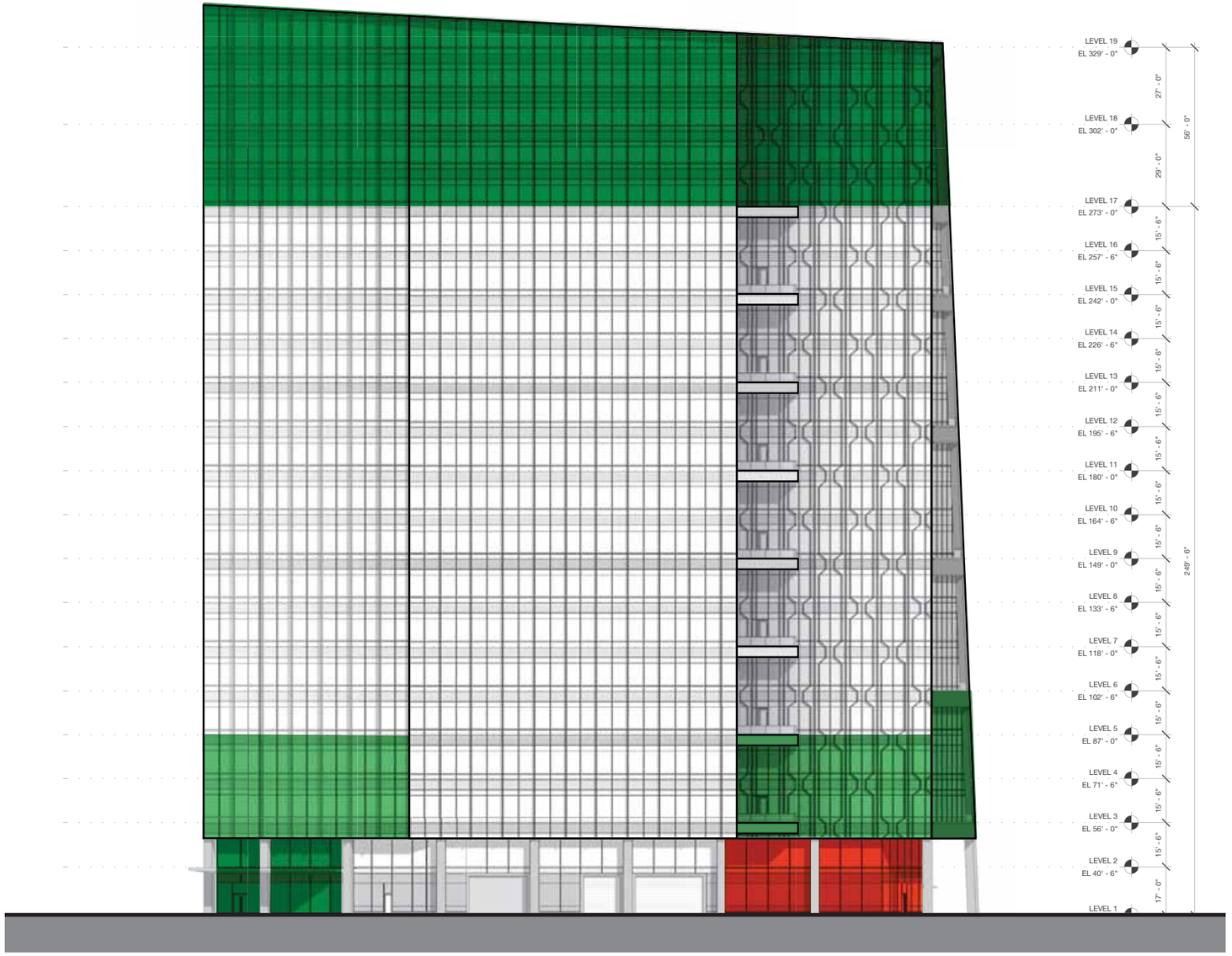
SOUTH ELEVATION

0' 10' 20' 40'

1.5 SIGNAGE

Building signage zone
Retail signage zone

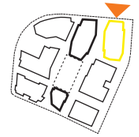


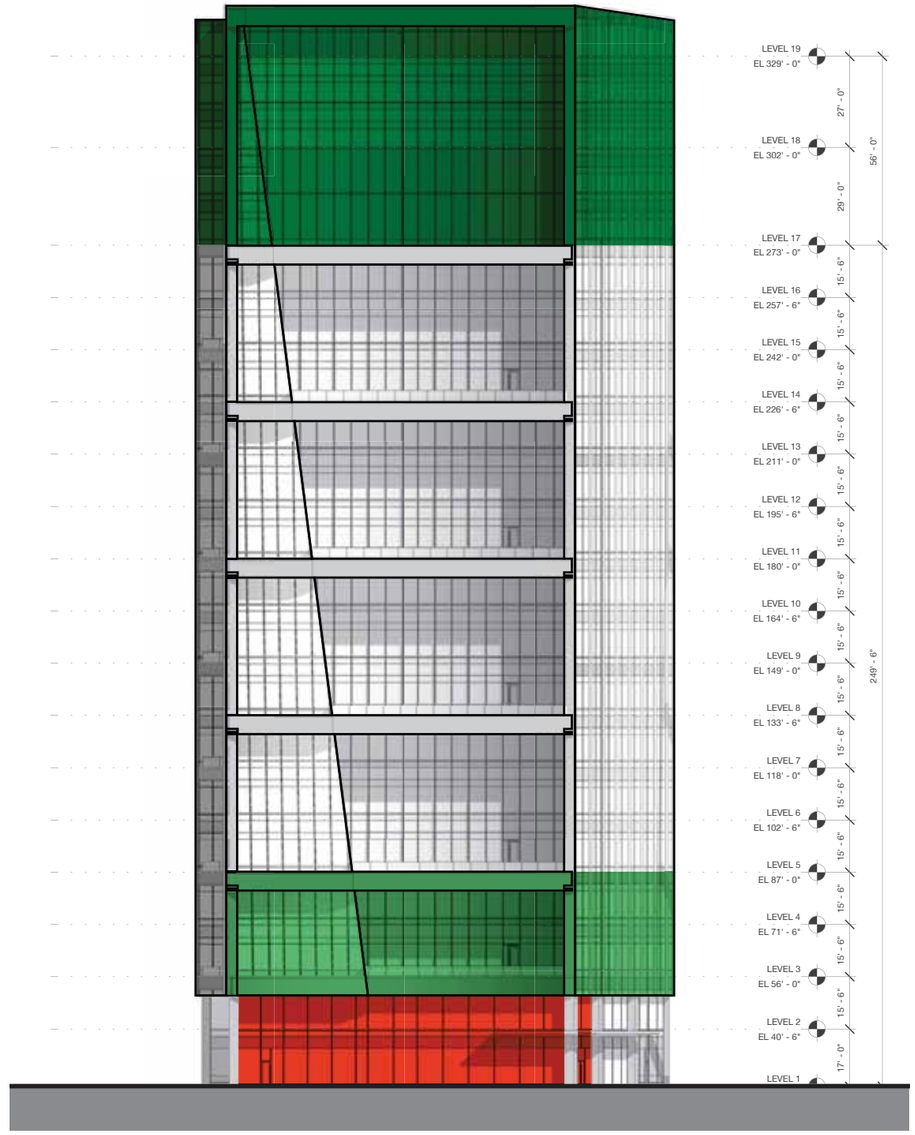


* Floor elevations are measured from sea level

WEST ELEVATION

0' 10' 20' 40'





NORTH ELEVATION

0' 10' 20' 40'

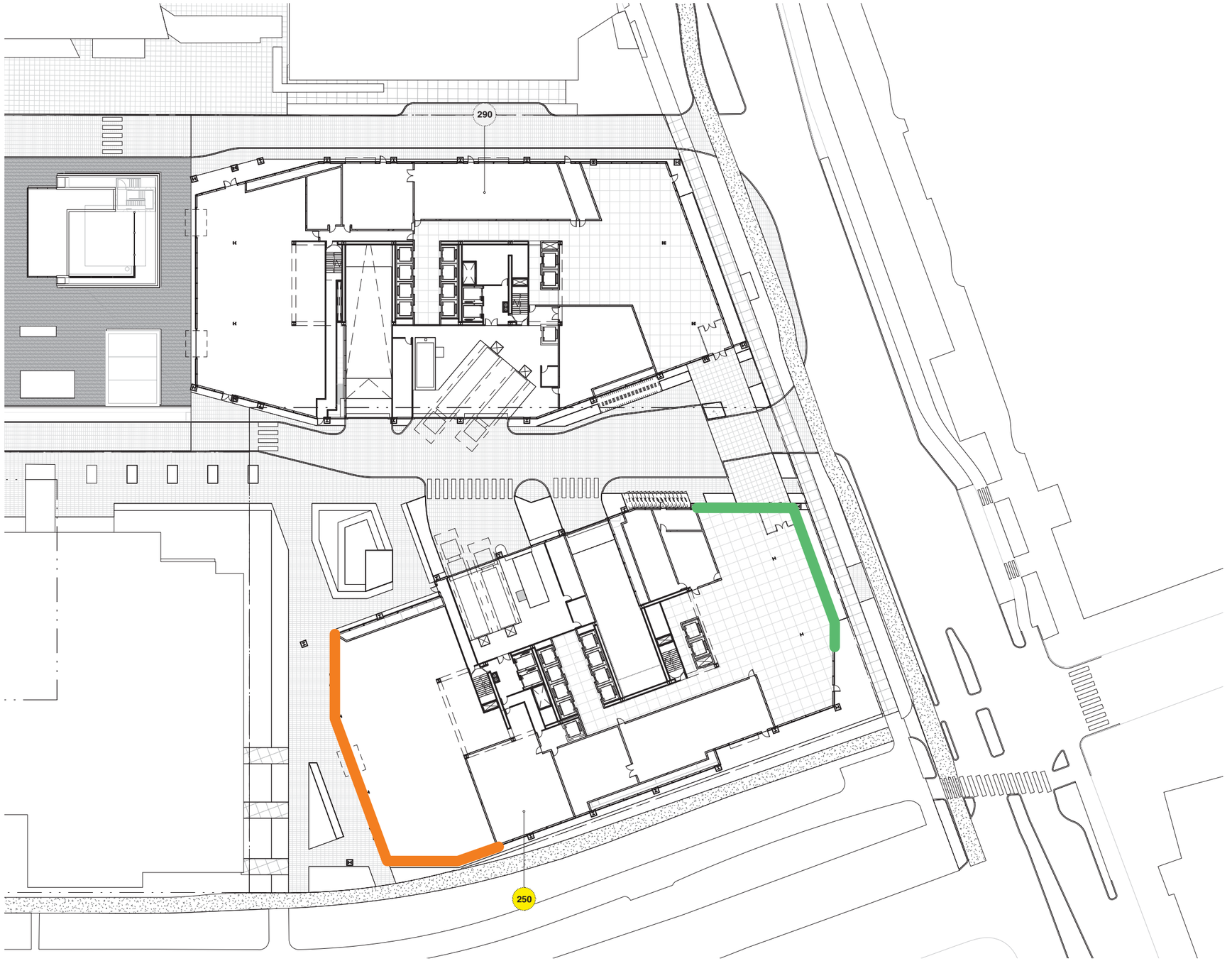
1.5 SIGNAGE

PRELIMINARY RETAIL AND BUILDING SIGNAGE PLAN

Building signage zone

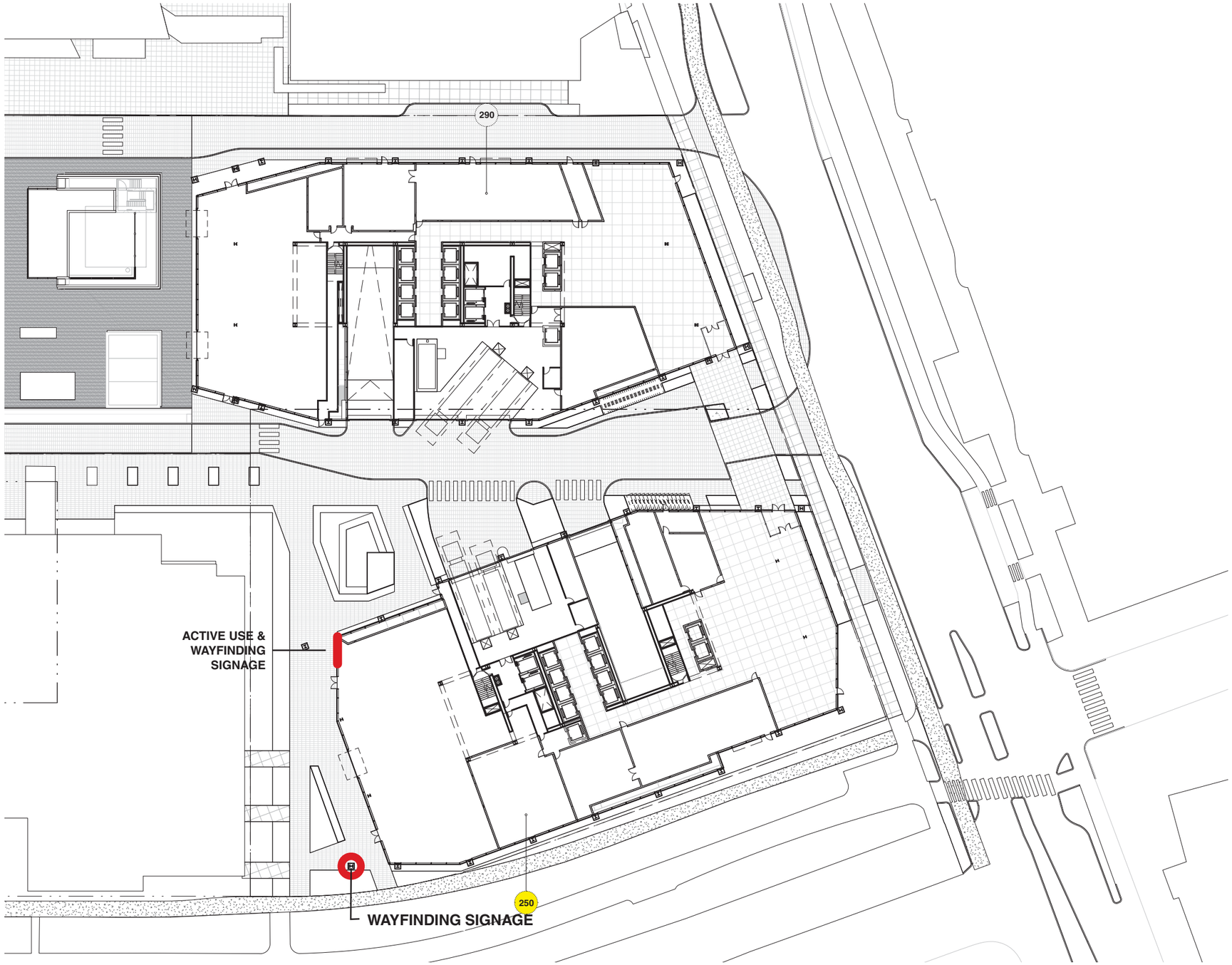
Retail signage zone

0’ 40’



1.5 SIGNAGE

PRELIMINARY PUBLIC AMENITY WAYFINDING SIGNAGE PLAN

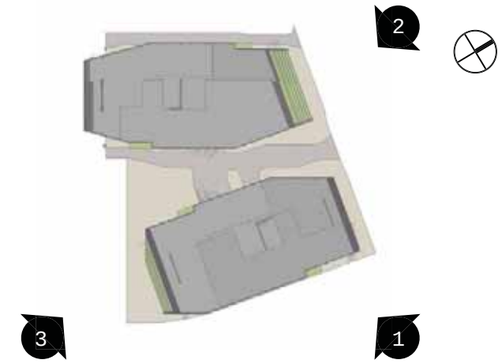


0’ 40’

1.6 ARCHITECTURAL LIGHTING

DESIGN NARRATIVE:

THE ARCHITECTURAL LIGHTING DESIGN USES SUBTLE STRATEGIES TO HIGHLIGHT AND COMPLIMENT DESIGN FEATURES OF THE ARCHITECTURAL DESIGN WHILE BEING SENSITIVE TO KENDALL SQUARE AND THE SURROUNDING NEIGHBORHOODS. ALL EXTERIOR LIGHTING WILL BE DIMMABLE. EXTERIOR LIGHTING IS PROPOSED FOR THE TERRACES, THE FAÇADE, AND THE GROUND PLANE SURROUNDING THE BUILDING. LIGHTING AT THE GROUND PLANE WILL HELP INSURE A SAFE AND INVITING ENVIRONMENT FOR NIGHTTIME USE, WHILE AVOIDING OVERLIGHTING AND GLARE. LIGHTING WILL BE PROVIDED AT THE TERRACES AS REQUIRED BY MASSACHUSETTS STATE BUILDING CODE. FAÇADE LIGHTING WILL BE INCORPORATED INTO THE BUILDING FAÇADE TO REINFORCE THE ARCHITECTURAL DESIGN, AND AS A CIVIC GESTURE TO THE KENDALL SQUARE NEIGHBORHOOD. THE BUILDING WILL PARTICIPATE IN A “LIGHT CURFEW” SO THAT FAÇADE LIGHTING IS SHUT OFF, AND ALL OTHER LIGHTS WHICH CAN BE SAFELY DIMMED ARE SET TO A LOWER OUTPUT AT AN APPROPRIATE TIME IN THE EVENING WHEN IT IS TIME FOR THE NEIGHBORHOOD TO REST.



KEY PLAN

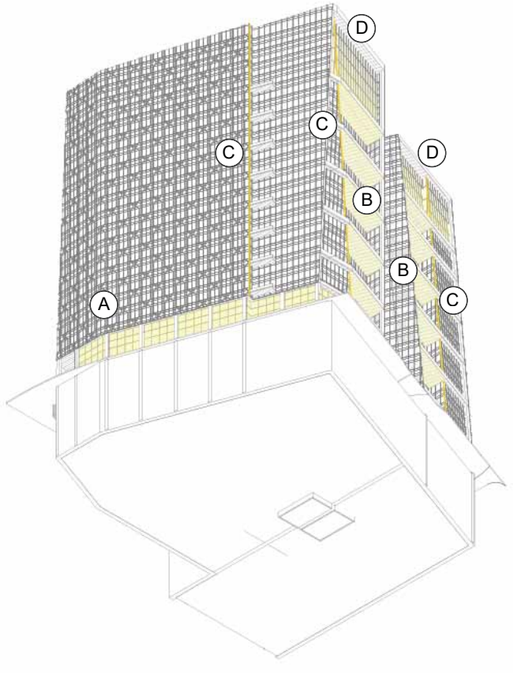
LIGHTING ELEMENTS:

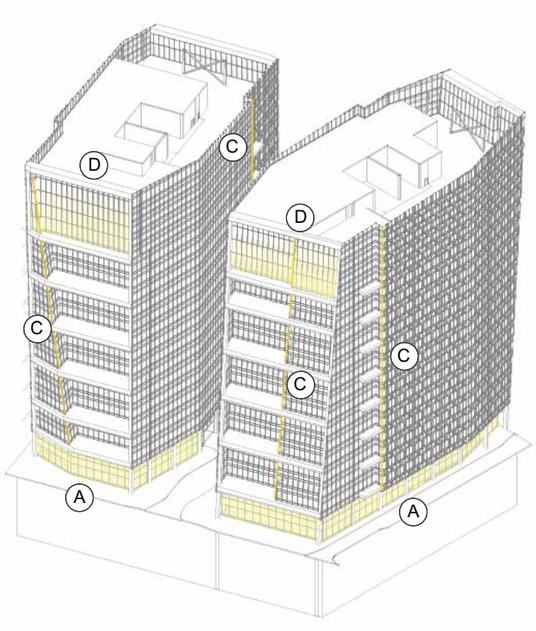
A. INTERIOR LIGHTING TO ACTIVE GROUND PLANE

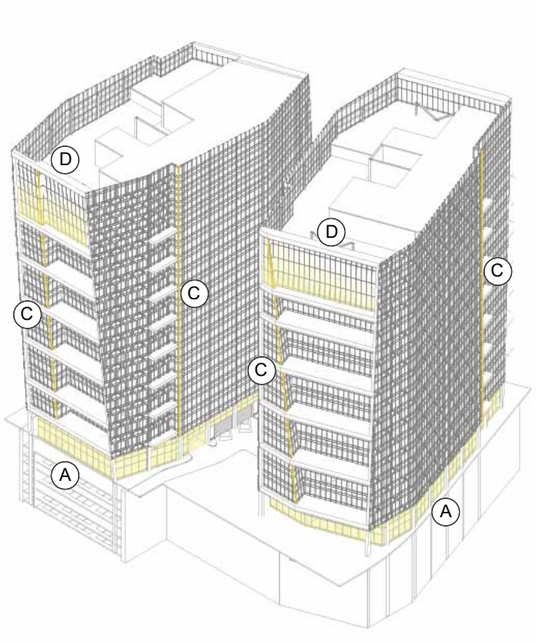
B. EMPHISIZE SOFFITS ON NORTH/SOUTH FACADE

C. LINEAR LIGHT AT CORNERS OF MASSING SHIFTS TO EMPHASIZE MAJOR MASSING MOVES

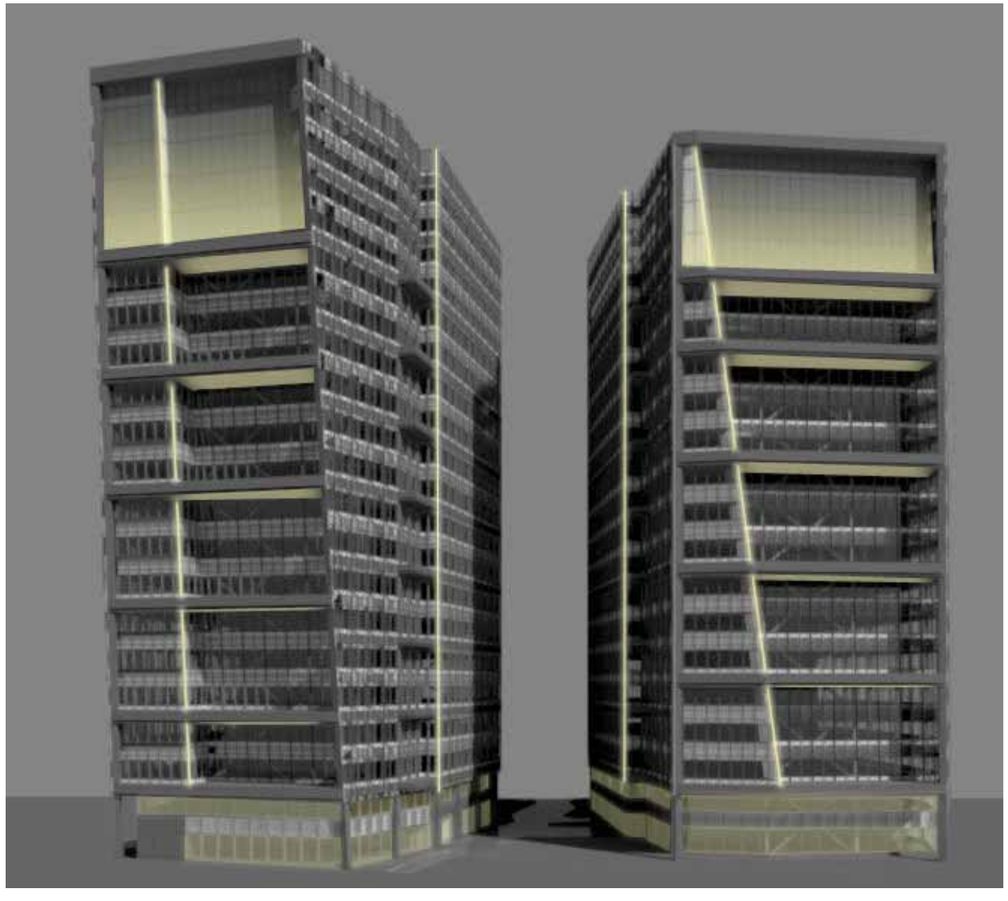
D. EMPASIZED CROWN ON NORTH/SOUTH FACADE



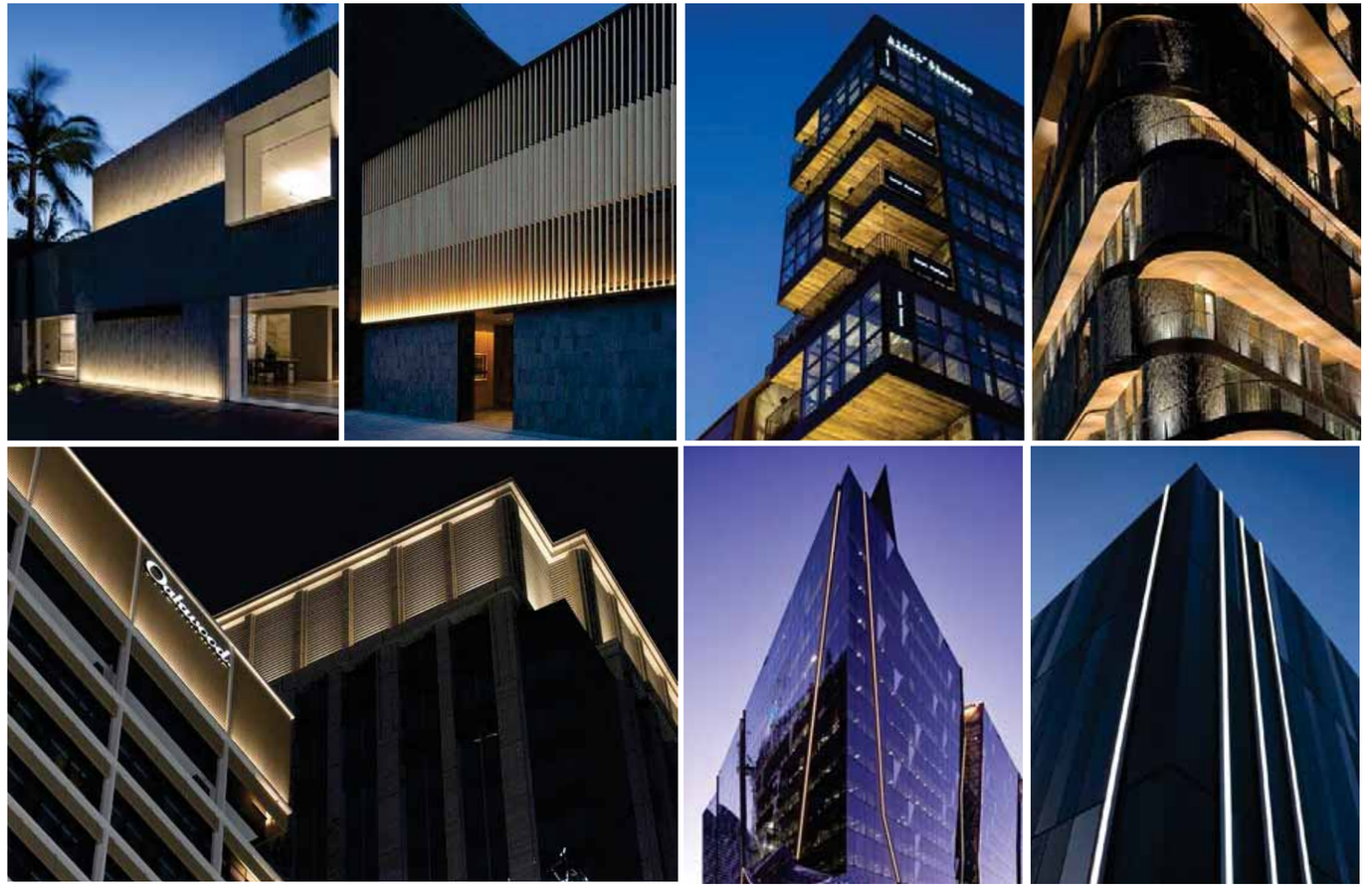




1.6 ARCHITECTURAL LIGHTING



BUILDING LIGHTING DESIGN (VIEW FROM BINNEY ST)



LIGHTING STRATEGY PRECEDENTS (CROWN, TERRACES, ACCENT)

1.7 STRUCTURAL SYSTEM

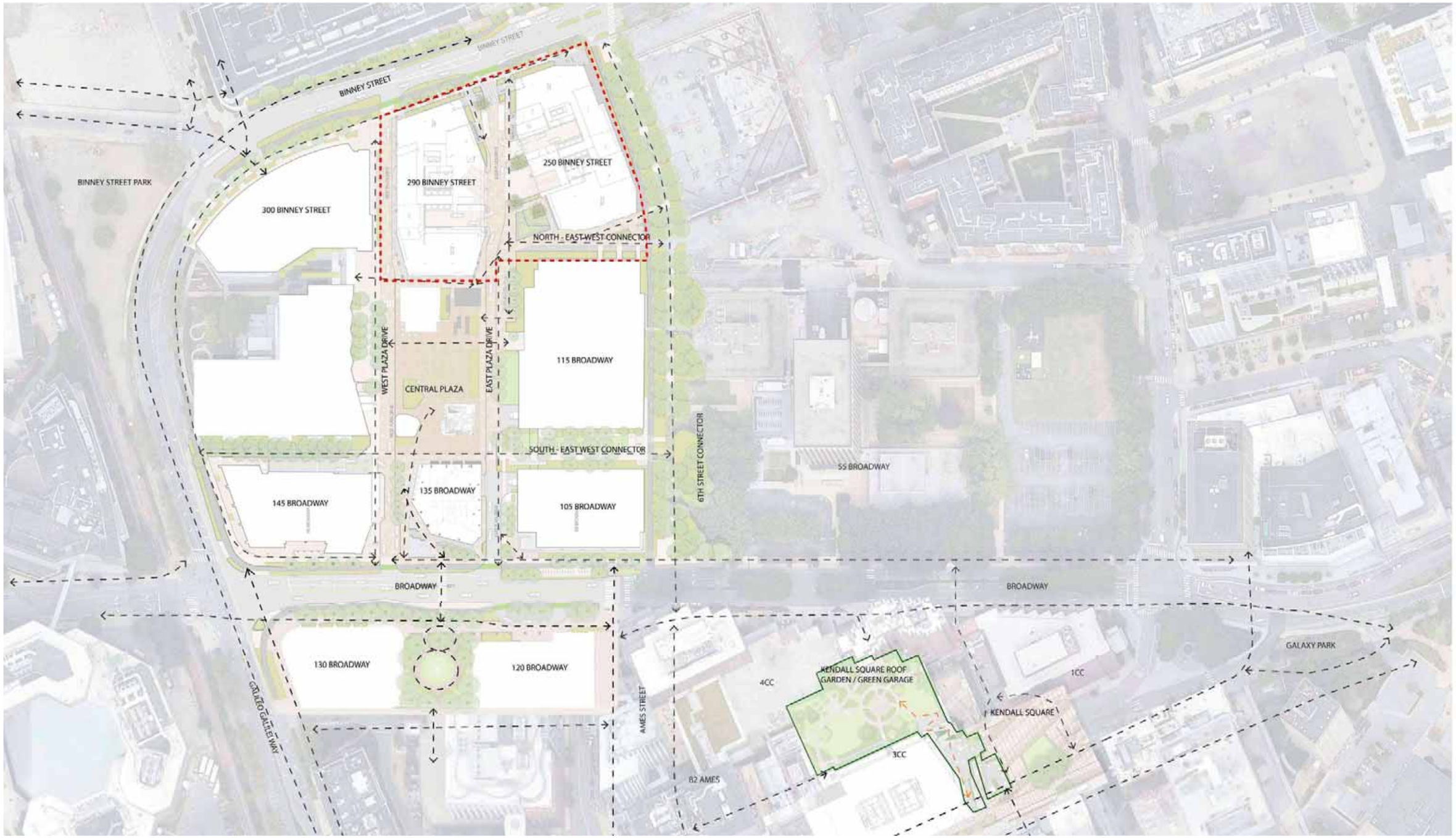
DESIGN NARRATIVE:

THE PROPOSED STRUCTURAL SYSTEM OF 290 AND 250 BINNEY STREET IS AN UP-DOWN CONSTRUCTION METHOD, SLURRY WALL FOUNDATION, ALL STEEL BUILDING INCLUDING A STEEL BRACE FRAME CORE AND COMPOSITE STEEL/CONCRETE CORE COLUMNS. THIS SYSTEM IS VERY SIMILAR TO THE CONSTRUCTION METHODS OF 145 BROADWAY. PLEASE SEE TO THE IMAGES BELOW OF 145 BROADWAY FOR REFERENCE.

2. LANDSCAPE

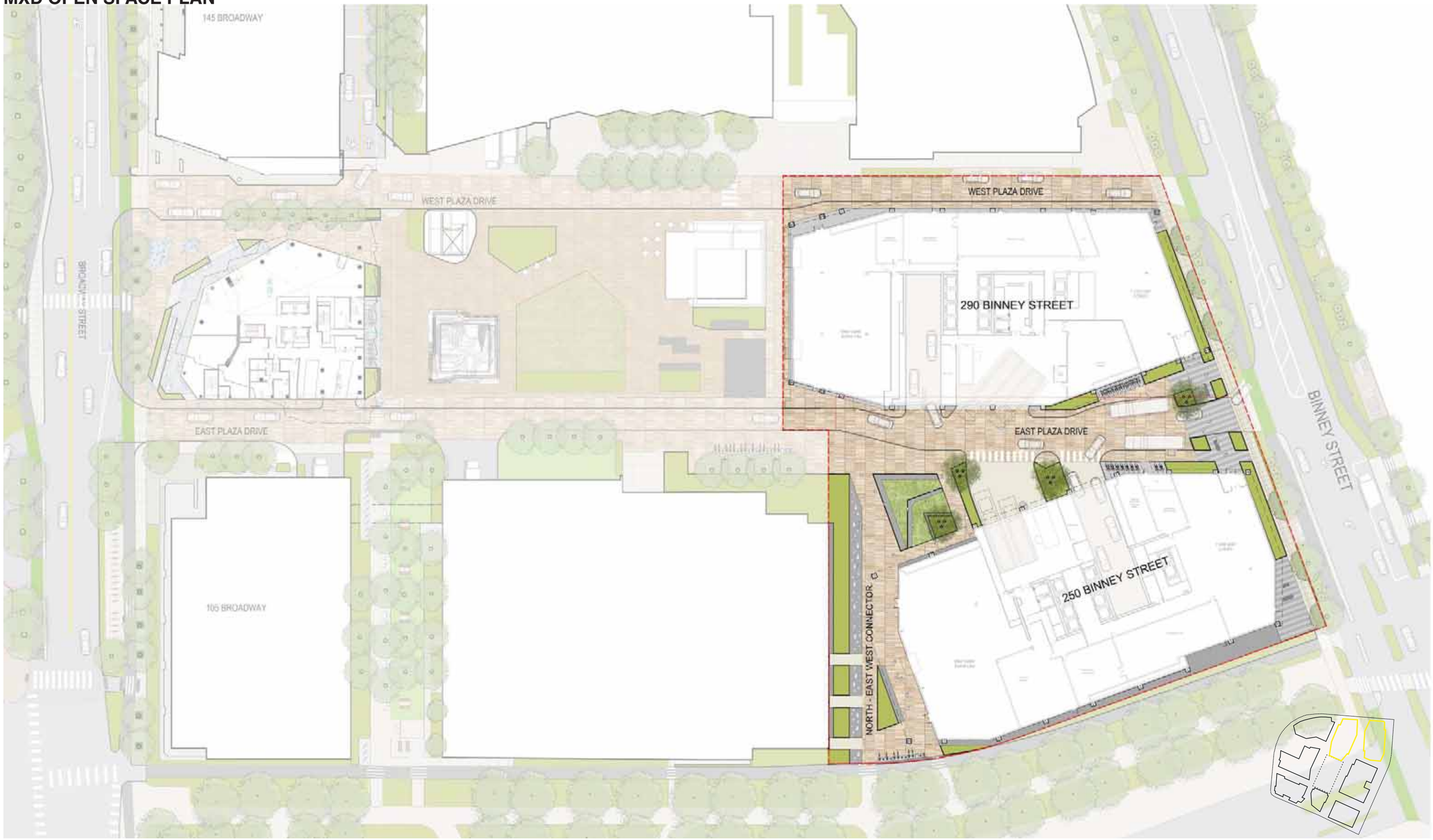
2.1 OPEN SPACE OVERVIEW

DISTRICT CONNECTIONS



2.1 OPEN SPACE OVERVIEW

MXD OPEN SPACE PLAN



2.1 OPEN SPACE OVERVIEW

OPEN SPACE SUMMARY

BINNEY STREETSCAPE

The Binney Streetscape will follow the completed ALTA streetscape plans. It includes a continuation of the cycle track, side walk, new street trees with understory planting and pedestrian seating areas. On the project side of the side walk, there will be a planted buffer between the side walk and building.



EAST PLAZA DRIVE

The East Plaza Drive is a one-way drive aisle heading south from Binney Street to Broadway. Within the MXD commercial site for both buildings the drive includes: drop-offs to accommodate cars or buses, parking garage entry / egress and service entries. The paving of the drive will seek consistency with the Center Plaza paving creating an attractive and inviting environment for both cars and pedestrians. The drive will have curbs within the MXD commercial site to guide vehicular traffic and protect designed pedestrian routes supported by consistent site lighting to provide a safe environment for cars and pedestrians. Planted areas with focal trees will add to creating and an attractive and inviting experience while providing a buffer of varying degrees between buildings and pedestrian areas.



NORTH - EAST WEST CONNECTOR

The north - east west connector provides another important mid-block pedestrian connection from the 6th Street Connector to the East plaza Drive and Center Plaza. On the building side of the connector, the ground level will have a large bike valet /active use area. The connector will be strengthened on the south edge visually by a long dry garden of crushed stone, boulders and lighting positioned over the existing underground steam line. The north west end of the connector has the best solar orientation and as a result a stepped sun terrace is envisioned to take advantage of mid -afternoon sun with views to Center Plaza.



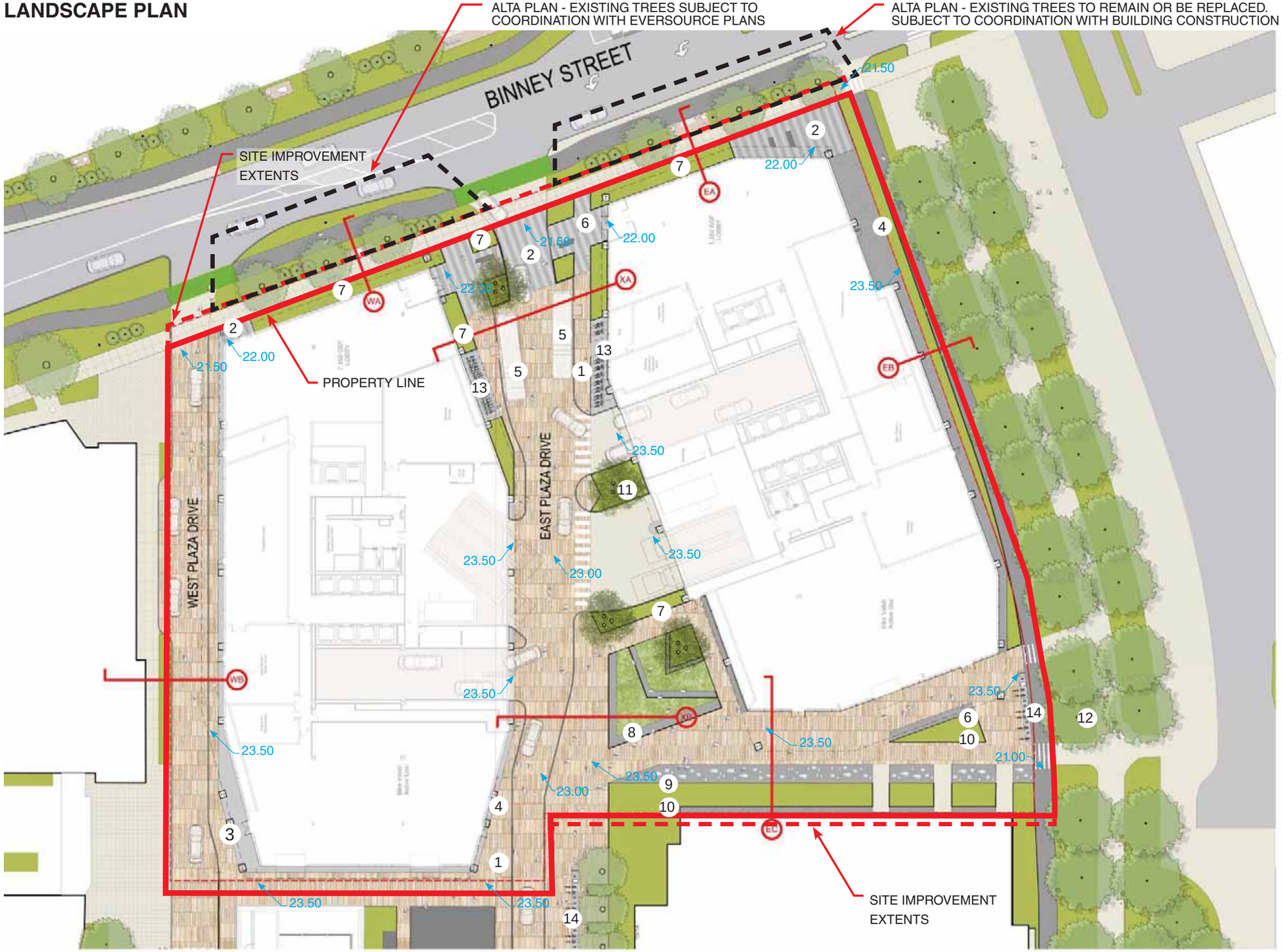
WEST PLAZA DRIVE

The west plaza drive is a one-way drive aisle heading north from Broadway to Binney Street. This drive is envisioned to be a primary pedestrian way between Broadway and Binney. The paving of the drive will seek consistency with the Center Plaza paving creating an attractive and inviting environment for both cars and pedestrians. The drive will have curbs within the MXD commercial site to guide vehicular traffic and protect designed pedestrian routes supported by site lighting to provide a safe environment for cars and pedestrians.



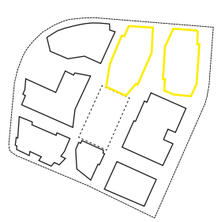
2.2 LEVEL 01 GROUND PLANE

LANDSCAPE PLAN



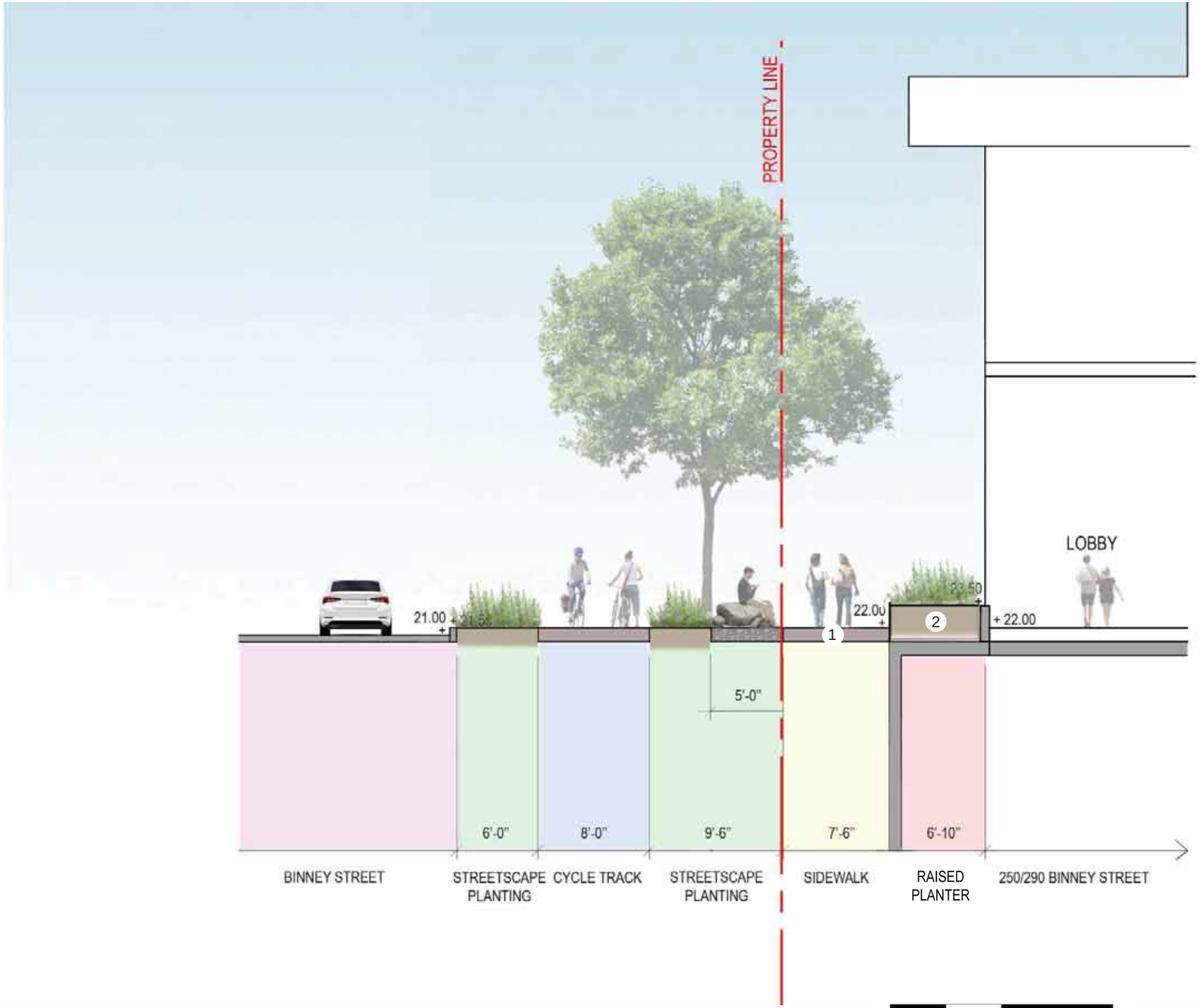
LEGEND

1. PLAZA PAVING - PUBLIC REALM
2. BUILDING ENTRY PAVING
3. BUILDING PAVING TO COORDINATE WITH PAVERS
4. DECORATIVE CRUSHED STONE
5. BUILDING DROP-OFF
6. RAISED SEATING
7. RAISED PLANTERS
8. STEPPED SUN LAWN
9. DRY GARDEN
10. ON GRADE PLANTING
11. PROPOSED TREES
12. EXISTING TREES
13. SHORT TERM BIKE PARKING (36)
14. BIKE SHARE



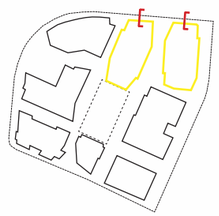
2.2 LEVEL 01 GROUND PLANE

LANDSCAPE SECTION A



LEGEND

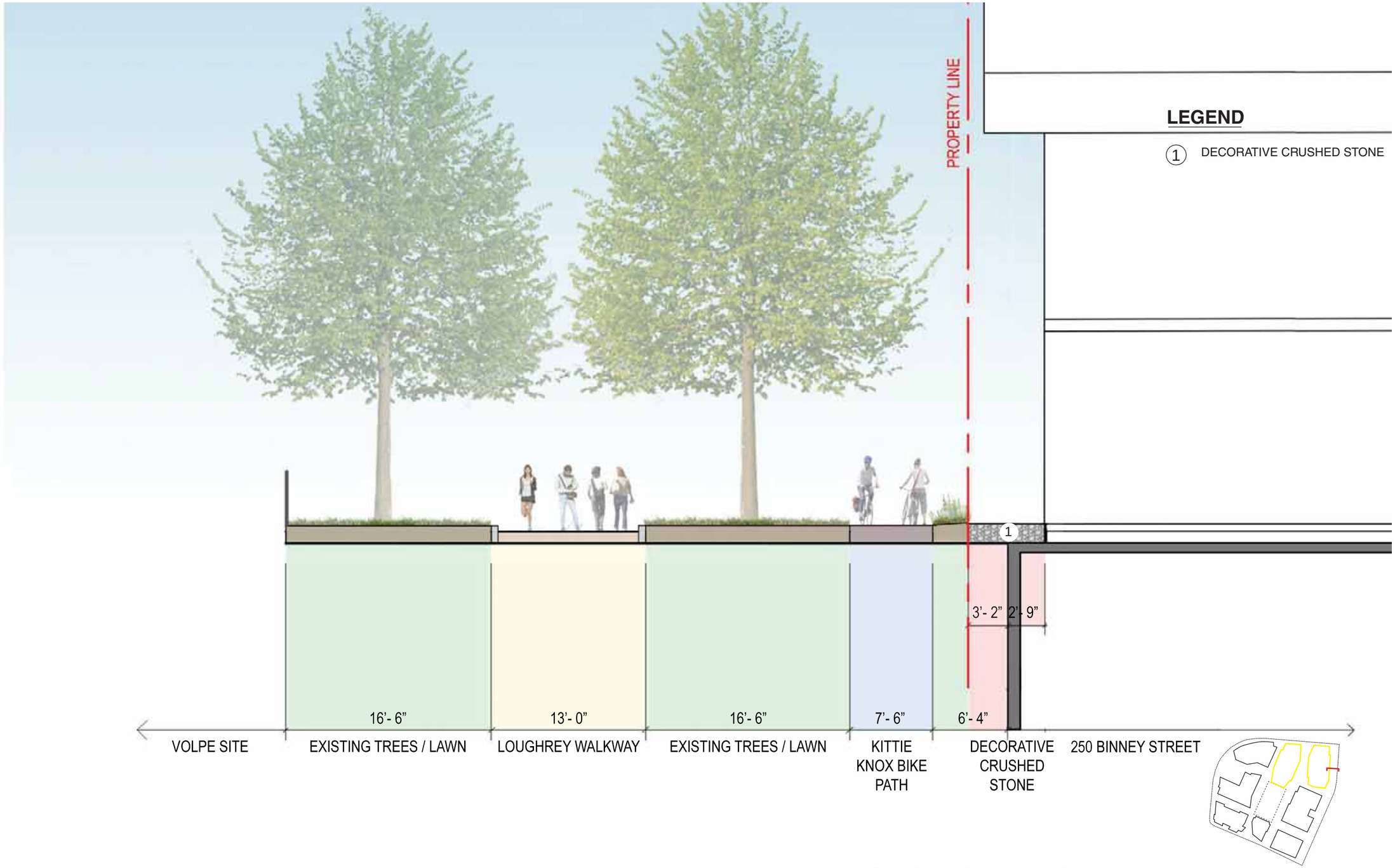
1. CAST IN PLACE CONCRETE - PEDESTRIAN
2. RAISED PLANTERS



0' 4' 8' 16'

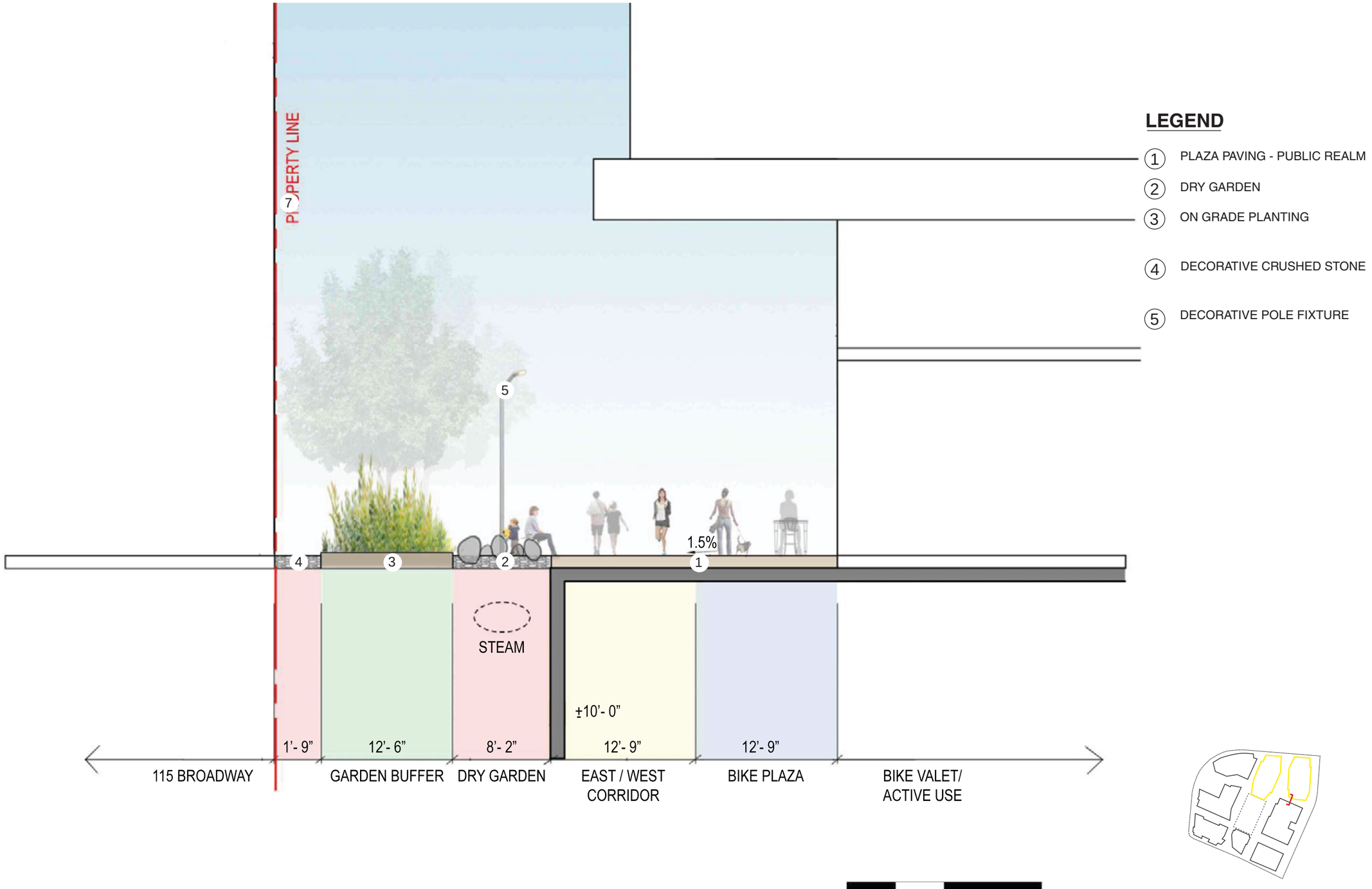
2.2 LEVEL 01 GROUND PLANE

LANDSCAPE SECTION B



2.2 LEVEL 01 GROUND PLANE

LANDSCAPE SECTION C



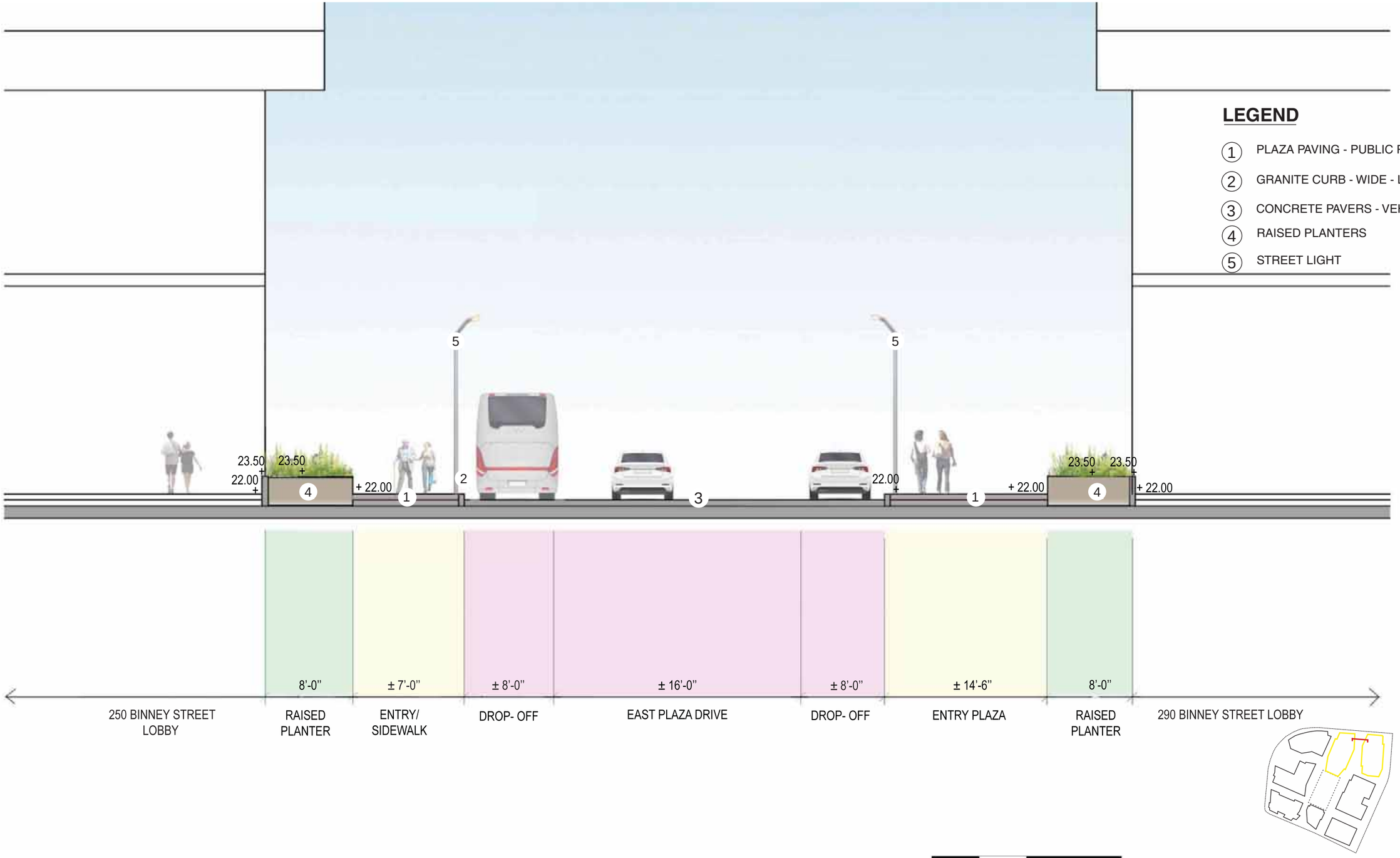
LEGEND

1. PLAZA PAVING - PUBLIC REALM
2. DRY GARDEN
3. ON GRADE PLANTING
4. DECORATIVE CRUSHED STONE
5. DECORATIVE POLE FIXTURE

0' 4' 8' 16'

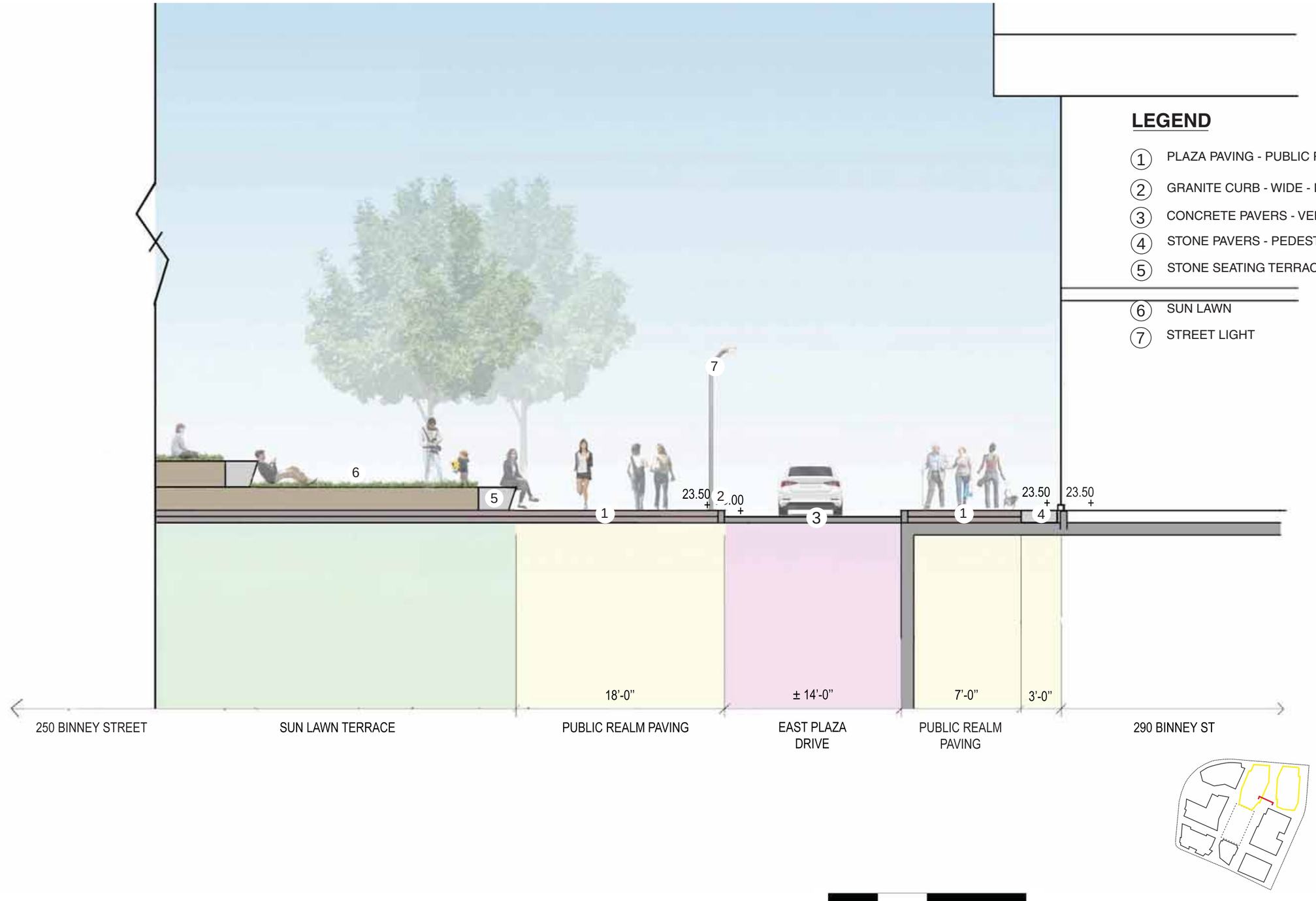
2.2 LEVEL 01 GROUND PLANE

LANDSCAPE SECTION D



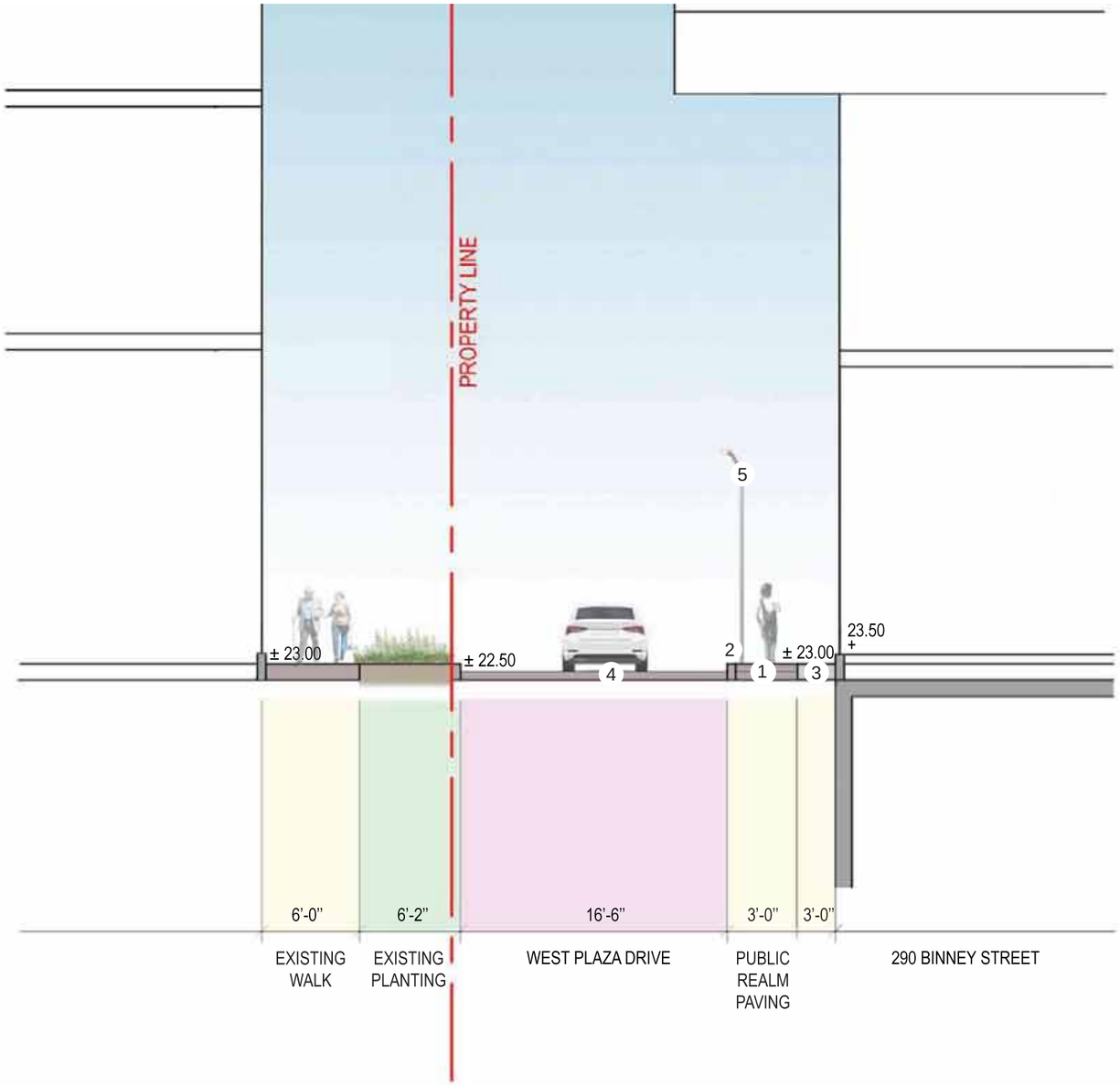
2.2 LEVEL 01 GROUND PLANE

LANDSCAPE SECTION E



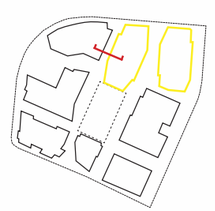
2.2 LEVEL 01 GROUND PLANE

LANDSCAPE SECTION F



LEGEND

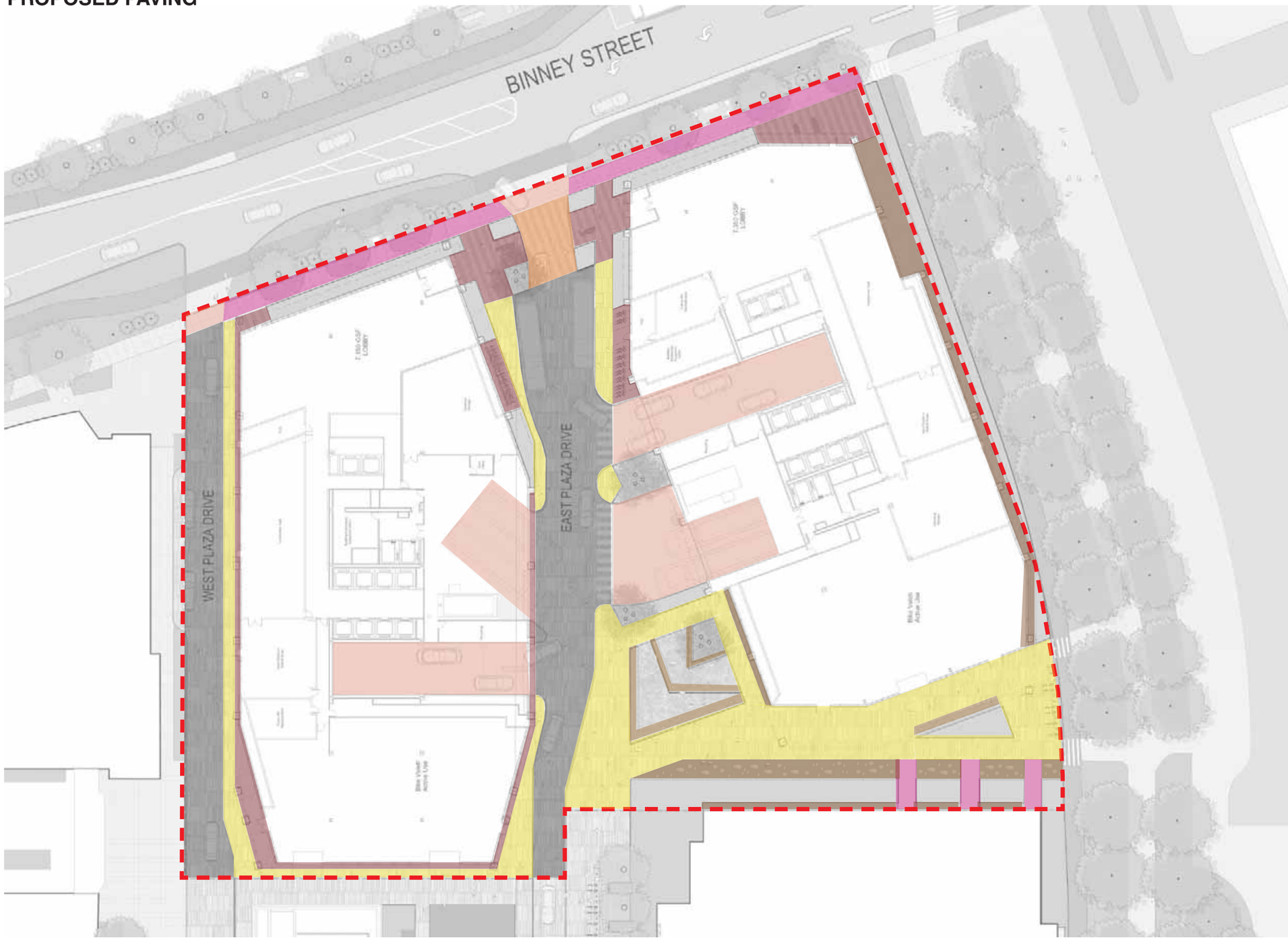
1. PLAZA PAVING - PUBLIC REALM
2. GRANITE CURB - WIDE - LANDSCAPE
3. STONE PAVERS - PEDESTRIAN
4. CONCRETE PAVERS - VEHICULAR
5. STREET LIGHT



0' 4' 8' 16'

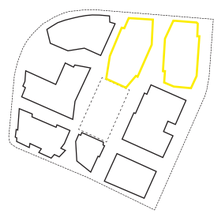
2.2 LEVEL 01 GROUND PLANE

PROPOSED PAVING



PAVING LEGEND

- TYPE I - PEDESTRIAN PAVING - STONE
- TYPE II - PEDESTRIAN PAVING - STONE
- TYPE III - DECORATIVE CRUSHED STONE PAVING
- TYPE IV - PEDESTRIAN PAVING - CONCRETE
- TYPE V - VEHICULAR PAVING - CONCRETE PAVERS
- TYPE VI - VEHICULAR PAVING - STONE PAVERS
- TYPE VII - VEHICULAR PAVING - CONCRETE
- TYPE VIII - RAISED SEAT WALLS - STONE



2.2 LEVEL 01 GROUND PLANE

PAVING PRECEDENTS

PEDESTRIAN PAVING - STONE

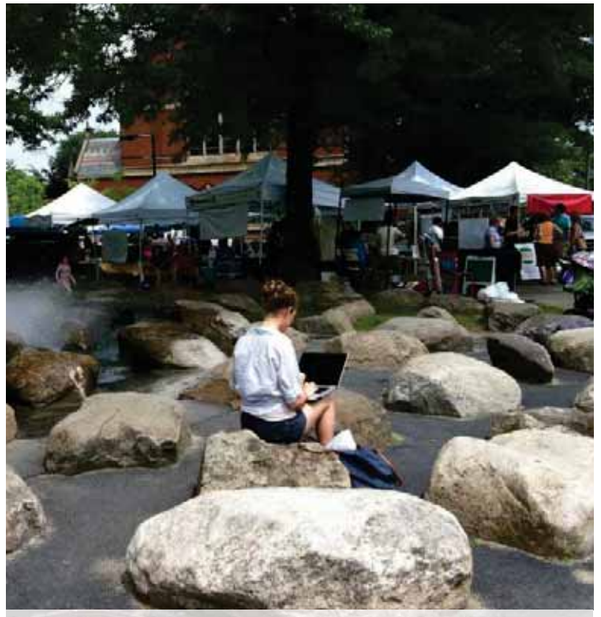
PEDESTRIAN PAVING - STONE

VEHICULAR PAVING - CONCRETE PAVERS

DECORATIVE CRUSHED STONE

RAISED SEATWALLS - PRECAST

RAISED SEATWALLS - STONE



DRY GARDEN - SUMMER

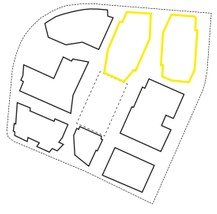
DRY GARDEN - WINTER

2.2 LEVEL 01 GROUND PLANE

PROPOSED PLANTING

PLANTING LEGEND

- SPECIMEN TREES
- TYPE I - SHRUB PLANTING - RAISED PLANTERS
- TYPE II - SHRUB PLANTING - AT - GRADE
- TYPE III - LAWN



2.2 LEVEL 01 GROUND PLANE

PLANTING PRECEDENTS

BINNEY STREETSCAPE

RAISED PLANTING

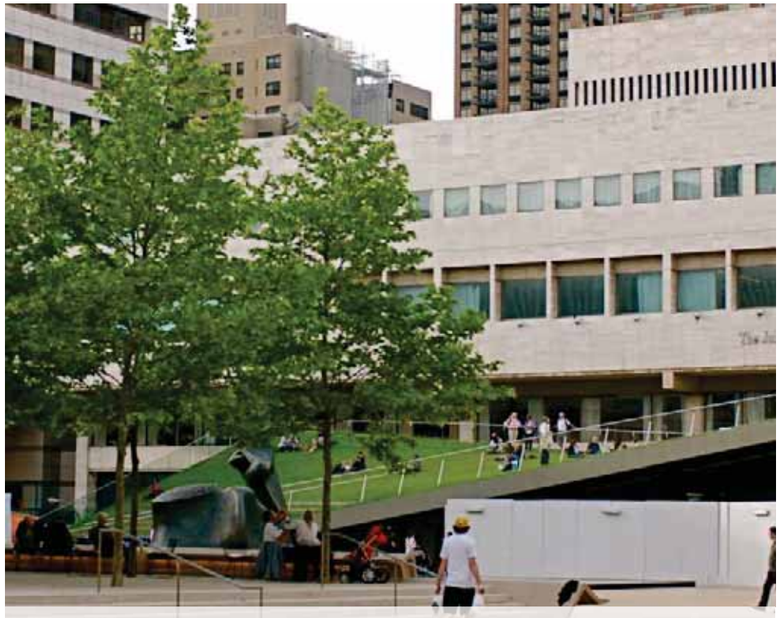
DRY GARDEN PLANTING

SPECIMEN TREES

LOUGHREY WALKWAY

RAISED PLANTERS

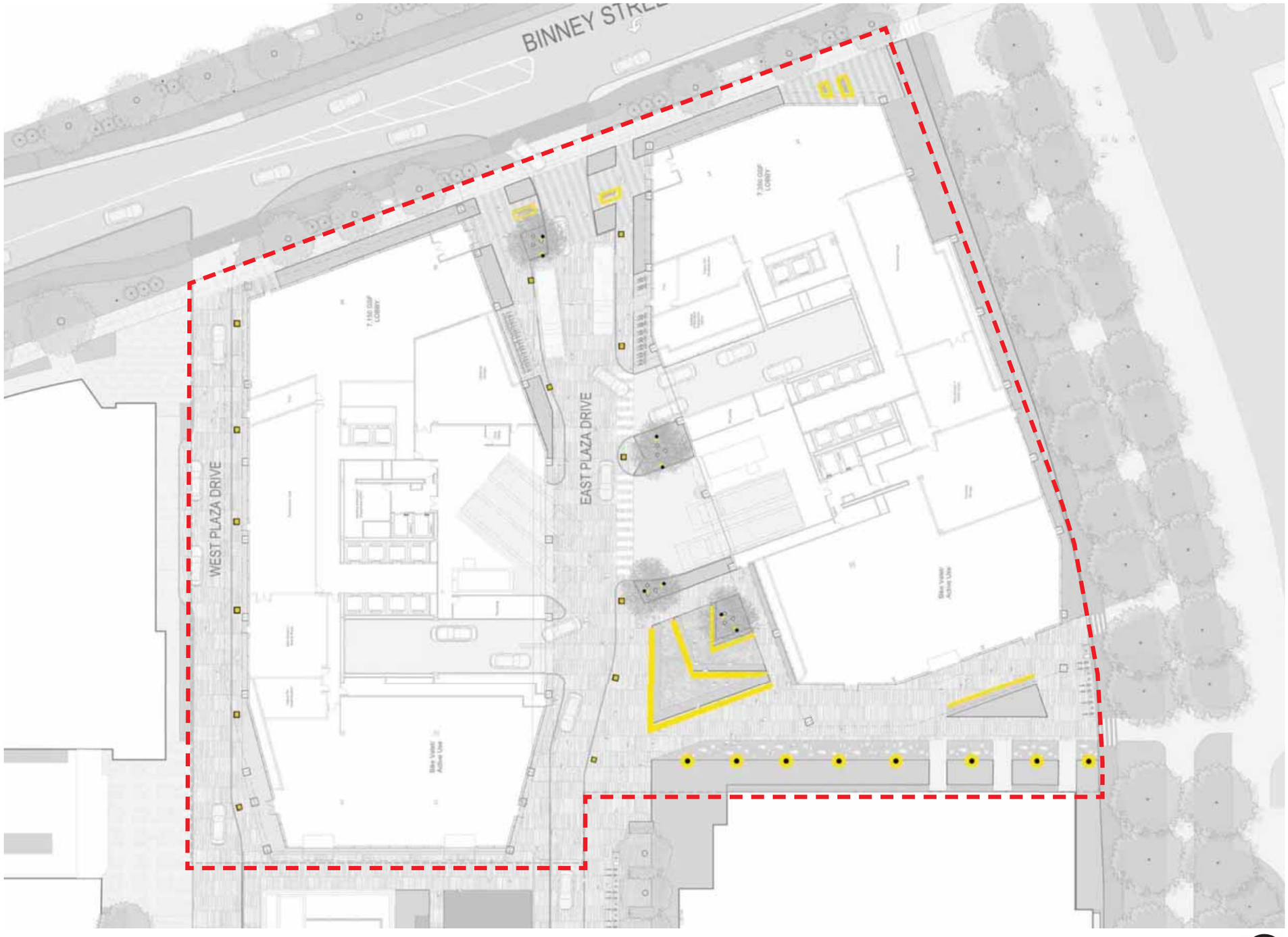
SUN LAWN



SUN LAWN

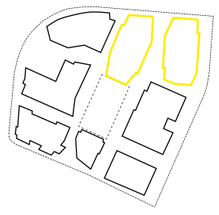
2.2 LEVEL 01 GROUND PLANE

PROPOSED SITE LIGHTING



LEGEND

- TYPE I - PLAZA DRIVE STREET LIGHT
- TYPE II - 8-12' POLE
- TYPE III - FLUSH MOUNTED UPLIGHTS
- TYPE IV - SEATING WITH INTEGRATED LIGHTING



2.2 LEVEL 01 GROUND PLANE

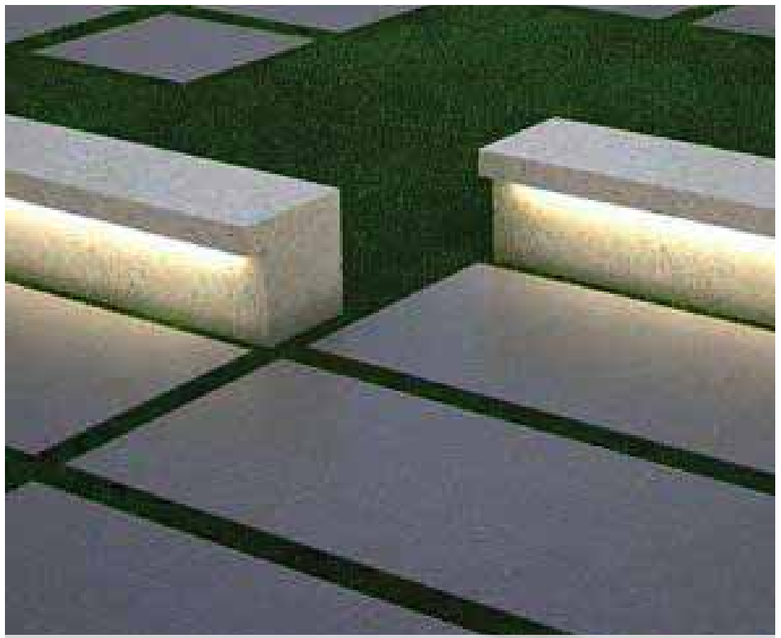
LIGHTING PRECEDENTS

PLAZA DRIVE LIGHT

POLE LIGHT

FLUSH MOUNTED UPLIGHTS

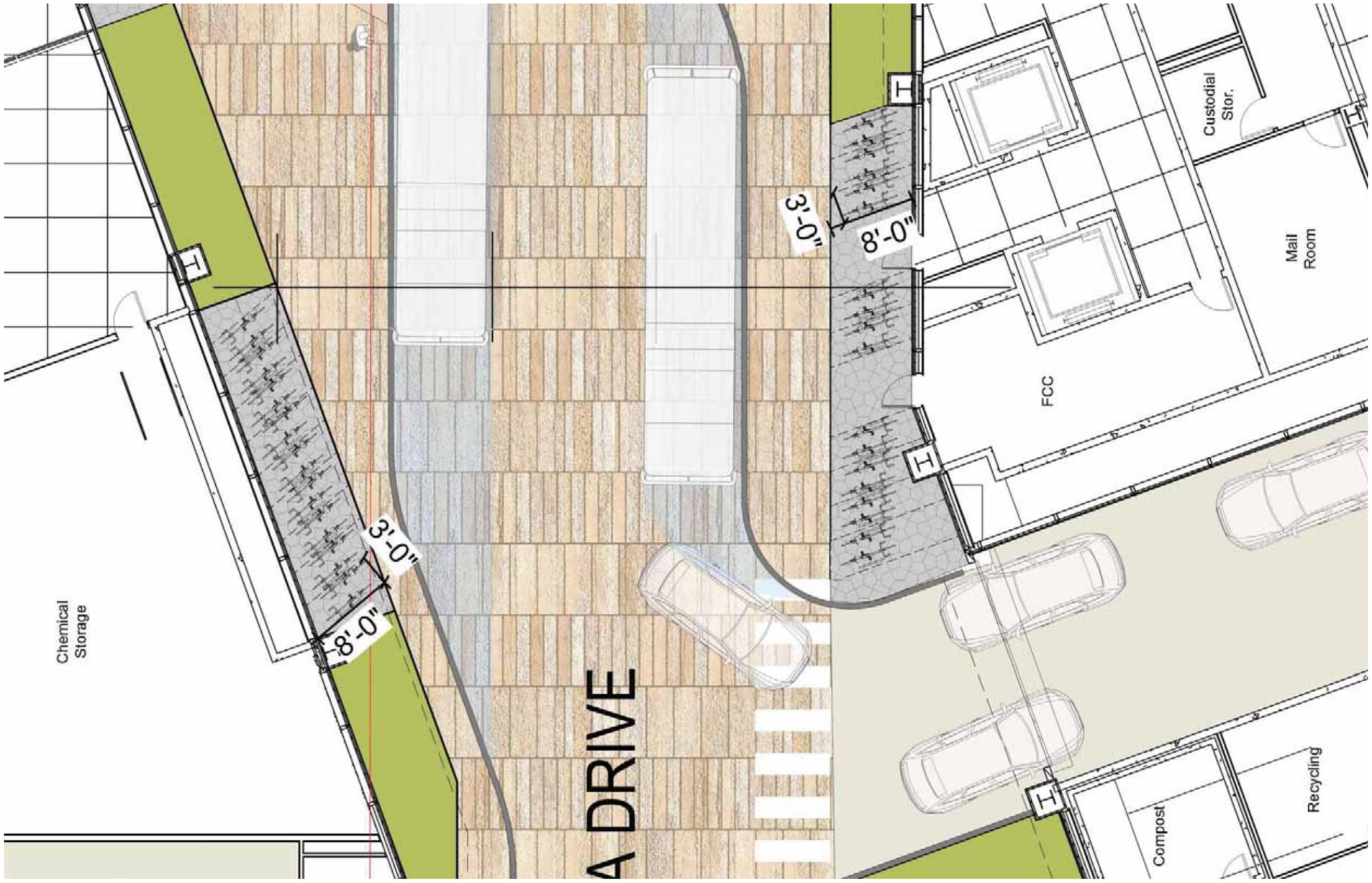
SEATING WITH INTEGRATED LIGHTING



SEATWALL WITH INTEGRATED LIGHTING

2.2 LEVEL 01 GROUND PLANE

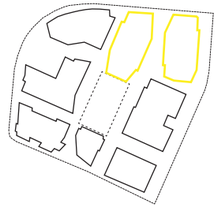
SHORT TERM BIKE PARKING ENLARGEMENT PLAN



TOTAL SHORT TERM BIKE PARKING: 36

WEST BUILDING - 18

EAST BUILDING - 18



10'

3. ENVIRONMENTAL IMPACT

3.1 PEDESTRIAN WIND ASSESSMENT

600 Southgate Drive
Guelph ON Canada
N1G 4P6

Tel: +1.519.823.1311
Fax: +1.519.823.1316
E-mail: solutions@rwdi.com

January 5, 2022

Ian Hatch
Project Manager

BXP – Boston Properties
800 Boylston Street
Suite 1900
Boston, MA 02199-8103
Email: ihatch@bxp.com

Re: Pedestrian Wind Conditions – Summary of Comments
135 Broadway
RWDI Reference No. 2200459

Dear Ian,

RWDI has carried out detailed pedestrian wind modeling for the residential and commercial development proposed at 135 Broadway, in Boston, MA. A report summarizing the results and recommendations from our work was issued on October 22, 2021.

Following submission of this document, RWDI has received updated massing information for the 135 Broadway residential building on December 3, 2021, and for the Commercial Buildings C & D (290 & 250 Binney Street) on December 6, 2021. From our review of this information, we confirm that the updated design of the buildings will not have a significant impact on the results presented in our October 2021 report. As such, the conclusions and recommendations in the report remain unchanged.

It is RWDI's understanding that unsafe and/or uncomfortable pedestrian conditions identified in the study will be mitigated by the design team with the implementation of appropriate wind control measures.

Respectfully submitted by:
RWDI

Sonia Beaulieu, M.Sc., PMP, P.Eng.
Senior Project Manager / Principal

Sreeyuth Lal, Ph.D.
Technical Coordinator

3.1 PEDESTRIAN WIND ASSESSMENT

FINAL REPORT

135 BROADWAY

CAMBRIDGE, MA

PEDESTRIAN WIND STUDY
RWDI # 2200459
October 22, 2021

SUBMITTED TO

Michael Tilford
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Ian Hatch
Project Manager
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EXECUTIVE SUMMARY

RWDI was retained to conduct a pedestrian wind assessment for the proposed 135 Broadway development in Cambridge, MA (Image 1).

The following document summarizes the findings and results from our analyses. Wind comfort and safety conditions resulting from the study are shown on site plans in Figures 1 through 3. The associated wind speeds are listed in Table 1.

These results can be summarized as follows:

Wind Safety:

- Wind speeds that meet the RWDI wind safety criterion are predicted at all but one assessed location at grade-level. One location above grade (at the Level 38 rooftop terrace of the residential building) also failed to meet the safety target.

Wind Comfort:

- Wind speeds at all areas during the summer, and at most areas during the winter, are anticipated to be suitable for the intended use at all assessed locations on and around the site of the proposed development. During the winter, higher-than-desired wind speeds are anticipated at a few localized areas around the proposed office buildings.
- At the Level 6 podium terrace of the residential building, calm winds suitable for passive usage are anticipated at most areas during the summer. However, higher-than-desired wind speeds are anticipated at the south side of the Level 6 podium terrace and also at all assessed locations on the Level 38 rooftop terrace.
- Wind control measures that can be used to achieve the desired wind speeds at all grade and above-grade areas are described within the report.

3.1 PEDESTRIAN WIND ASSESSMENT

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135 BROADWAY
RWDI #2200459
October 22, 2021

1 INTRODUCTION

RWDI was retained to conduct a pedestrian wind assessment for the proposed 135 Broadway development in Cambridge, MA. The project (site shown in Image 1) involves the construction of two 400,000 SF/289 ft tall office buildings and one 400,000 SF/430 ft tall residential tower on a land parcel located at the intersection of Binney Street and Galileo Way. The existing site features a multi-level parking garage and a two-story office building.

The objective of the study was to assess the effect of the proposed development on local pedestrian wind conditions and to provide recommendations for minimizing adverse effects, if needed. The assessment focused on critical pedestrian areas, including public sidewalks and building terraces.

This report presents the project objectives, approach and the main results from RWDI's assessment and provides conceptual wind control measures, where necessary.

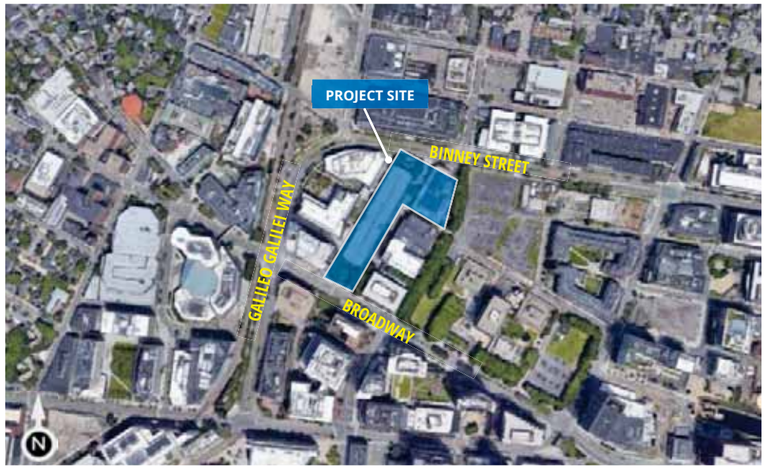


Image 1: Aerial View of Site and Surroundings (Photo Courtesy of Google™ Earth)

3.1 PEDESTRIAN WIND ASSESSMENT

BACKGROUND AND APPROACH

2 BACKGROUND AND APPROACH

2.1 Generalized Wind Flows

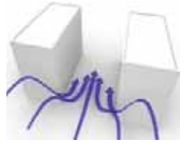
In our discussion of wind conditions, reference may be made to the following generalized wind flows (Image 2):

DOWNWASHING

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.

CORNER ACCELERATION

When winds approach at an oblique angle to a tall façade and are deflected down, a localized increase in the wind activity or corner acceleration can be expected around the exposed building corners at pedestrian level.



CHANNELING EFFECT

When two buildings are situated side by side, wind flow tends to accelerate through the space between the buildings due to channeling effect caused by the narrow gap.

Image 2: Generalized Wind Flows

If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity. Design details such as; setting back a tall tower from the edges of a podium, deep canopies close to ground level, wind screens, tall trees with dense landscaping, etc. (Image 3) can help reduce wind speeds. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.

Podium/tower setback, canopy, landscaping and wind screens (left to right)

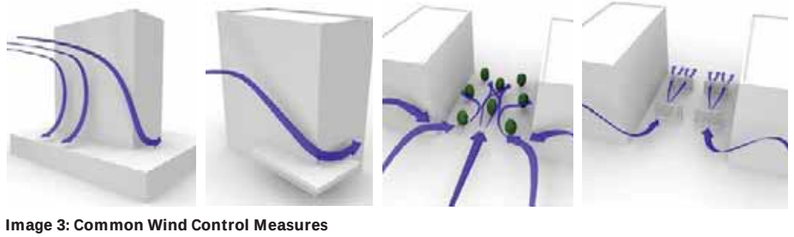


Image 3: Common Wind Control Measures

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2.2 Physical Modeling

To assess the wind environment around the proposed project, a 1:300 scale model of the site and surroundings was constructed. The model reflected the proposed development in the context of surrounding existing buildings (Image 4). The wind tunnel model included all relevant surrounding buildings and topography within an approximately 1200 ft radius of the study site. The wind and turbulence profiles in the atmospheric boundary layer beyond the modelled area were also simulated in RWDI's wind tunnel.

The wind tunnel model was instrumented with 142 specially designed wind speed sensors to measure mean and gust speeds at a full-scale height of approximately 5 ft above local grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 directions in a 10-degree increments. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the mean wind speed at a reference height above the model. The placement of wind measurement locations was based on our experience and understanding of the pedestrian usage for this site.

3.1 PEDESTRIAN WIND ASSESSMENT

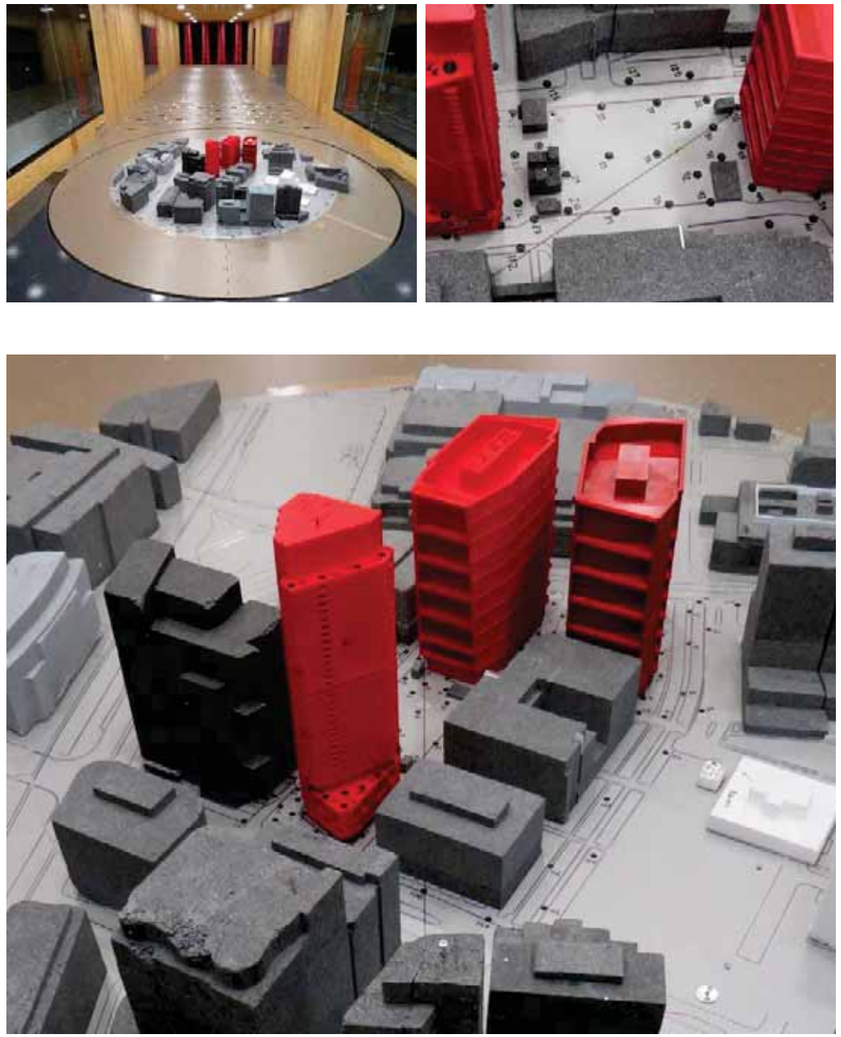

Image 4: Wind Tunnel Study Model – Proposed Configuration

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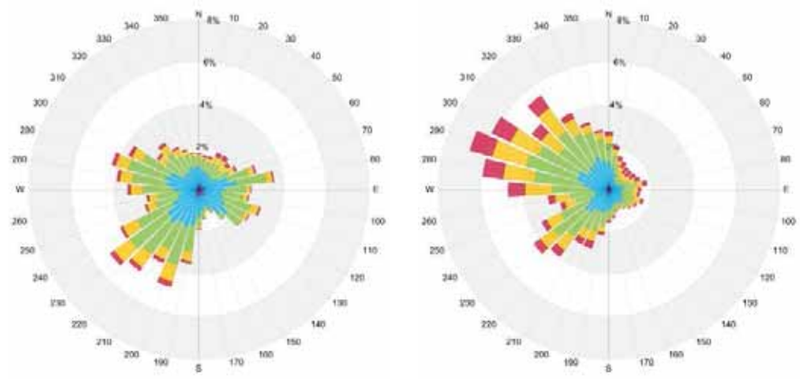
2.3 Meteorological Data

Wind statistics recorded at Boston Logan International Airport between 1990 and 2019, inclusively, were analyzed for the Summer (May through October) and Winter (November through April) seasons. Image 5 graphically depicts the directional distributions of wind frequencies and speeds for these two seasons. The most common wind directions are those between south-southwest and north-northwest. Winds from the east-northeast to the east-southeast are also strong but less frequent. In the case of strong winds, west-northwest, northwest, west and northeast are the dominant wind directions. Strong winds of a mean speed greater than 20 mph measured at the airport (at an anemometer height of 30 ft) occur for 3.9% and 11% of the time during the summer and winter seasons, respectively, and they are primarily from the southwest through northeast directions.

Wind statistics were combined with wind tunnel data to predict the frequency of occurrence of full-scale wind speeds, which were then compared with the wind criteria for pedestrian comfort and safety.



Summer (May – October) Winter (November – April)

Wind Speed (mph)	Probability (%) Summer	Winter
Calm	2.7	2.3
1-5	8.3	6.1
6-10	36.1	27.7
11-15	36.2	34.2
16-20	12.8	18.7
>20	3.9	11.0

Image 5: Directional Distribution of Winds Approaching Boston Logan International Airport between 1990 and 2019

2.4 Wind Criteria

The RWDI pedestrian wind criteria, which have been developed by RWDI through research and consulting practice since 1974, are used in the current study. These criteria have been widely accepted by municipal authorities as well as by the building design and city planning community. Regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can affect a person's perception of the wind climate. Therefore, comparisons of wind speeds for the existing and proposed building configurations are the most objective way in assessing local pedestrian wind conditions. In general, the combined effect of mean and gust speeds on pedestrian comfort can be quantified by a Gust Equivalent Mean (GEM).

Comfort Category	GEM Speed (mph)	Description
Sitting	≤ 6	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper without having it blown away
Standing	≤ 8	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
Strolling	≤ 10	Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park
Walking	≤ 12	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 12	Strong winds of this magnitude are considered a nuisance for all pedestrian activities, and wind mitigation is typically recommended

Notes:
(1) GEM Speed = max (Mean Speed, Gust Speed/1.85) and Gust Speed = Mean Speed + 3*RMS Speed;
(2) Wind conditions are considered to be comfortable if the predicted GEM speeds are within the respective thresholds for at least 80% of the time between 6:00 and 23:00. Nightly hours between 0:00 and 5:00 are excluded from the wind analysis for comfort since limited usage of outdoor spaces is anticipated; and,
(3) Instead of standard four seasons, two periods of summer (May to October) and winter (November to April) are adopted in the wind analysis, because in a cold climate such as that found in Cambridge, there are distinct differences in pedestrian outdoor behaviors between these two-time periods.

Safety Criterion	Gust Speed (mph)	Description
Exceeded	> 56	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

Notes:
(1) Based on an annual exceedance of 9 hours or 0.1% of the time for 24 hours a day; and,
(2) Only gust speeds need to be considered in the wind safety criterion. These are usually rare events, but deserve special attention in city planning and building design due to their potential safety impact on pedestrians.

3 RESULTS AND DISCUSSION

The predicted wind conditions are shown on site plans in Figures 1 through 3 located in the "Figures" section of this report. These conditions and the associated wind speeds are also represented in Table 1, located in the "Tables" section. The following is a detailed discussion of the suitability of the predicted wind conditions for the anticipated pedestrian use of each area of interest.

Wind conditions comfortable for walking or strolling are appropriate for sidewalks and walkways as pedestrians will be active and less likely to remain in one area for prolonged periods of time. Lower wind speeds conducive to standing are preferred at main entrances where pedestrians are apt to linger. It is generally desirable for wind conditions on areas intended for passive activities, such as terraces and plaza areas, to be comfortable for sitting or standing for more than 80% of the time in the summer. During the winter, the area would not be used frequently and increased wind activity would be considered appropriate.

3.1 Pedestrian Safety

Wind speeds that meet the RWDI wind safety criterion are predicted at all but one grade-level location, namely at the northwest corner of the 250 Binney Street West office tower (Location 49 in Figure 3). One above-grade location was also identified as exceeding the safety criterion (i.e., Location 141 at the Level 38 rooftop terrace in Figure 3).

Mitigation measures involving landscaping, wind screens and/or deep canopies should be considered for these areas, as illustrated in Images 6 and 7.

3.2 Pedestrian Comfort

3.2.1 Grade Level (Locations 1 through 131)

Wind speeds on and around the site of the proposed development are anticipated to be comfortable for walking, standing or sitting during the summer (Figure 1), which is suitable for the intended use. During the winter, wind speeds around the residential building are anticipated to remain comfortable for the intended use. Uncomfortable wind speeds are however anticipated at a few locations around the western corners of the 250 Binney Street West building and in the gap between the two office buildings (Figure 2). These conditions are due to a combination of: 1) downwashing and corner acceleration of the prevailing westerly and northwesterly winds around the western corners of the 250 Binney Street West building, and 2) channeling of prevailing winds between the two office buildings, as shown schematically in Image 2. Examples of mitigation solutions that could be pursued to improve conditions are illustrated in Image 6.

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Image 6: Example Images of Recommended Wind Control Measures at the Grade Level such as Landscaping, Wind Screens and Canopies

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3.2.2 Terraces (Locations 132 through 142)

During the summer, calm wind speeds suitable for standing are anticipated at most areas of the Level 6 podium terrace of the residential building (Figure 1). However, higher-than-desired wind speeds suitable for strolling or walking are anticipated at the south side of the Level 6 podium terrace (Locations 133 and 134 in Figure 1) and at the Level 38 rooftop terrace (Locations 139 through 142 in Figure 1).

During the winter, generally higher wind speeds are anticipated on the terraces, some of which are anticipated to be uncomfortable (i.e., at the southwest corner of Level 6 podium terrace). These conditions may however be considered acceptable by the project team if limited use of the terraces is anticipated during the colder months.

General wind control measures to achieve lower wind speeds at the terraces include tall guardrails, wrap-around canopies, trellises, wind screens and/or landscaping, example images of which are shown in Image 7.

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Image 7: Example Images of Recommended Wind Control Measures on the Terraces such as Landscaping, Trellises, Wind Screen and Tall Guardrails

REFERENCES

4 REFERENCES

1. ASCE Task Committee on Outdoor Human Comfort (2004). *Outdoor Human Comfort and Its Assessment*, 68 pages, American Society of Civil Engineers, Reston, Virginia, USA.

2. Williams, C.J., Hunter, M.A. and Waechter, W.F. (1990). "Criteria for Assessing the Pedestrian Wind Environment," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.36, pp.811-815.

3. Williams, C.J., Soligo M.J. and Cote, J. (1992). "A Discussion of the Components for a Comprehensive Pedestrian Level Comfort Criteria," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.41-44, pp.2389-2390.

4. Soligo, M.J., Irwin, P.A., and Williams, C.J. (1993). "Pedestrian Comfort Including Wind and Thermal Effects," *Third Asia-Pacific Symposium on Wind Engineering*, Hong Kong.

5. Soligo, M.J., Irwin, P.A., Williams, C.J. and Schuyler, G.D. (1998). "A Comprehensive Assessment of Pedestrian Comfort Including Thermal Effects," *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.77&78, pp.753-766.

6. Williams, C.J., Wu, H., Waechter, W.F. and Baker, H.A. (1999). "Experiences with Remedial Solutions to Control Pedestrian Wind Problems," *Tenth International Conference on Wind Engineering*, Copenhagen, Denmark.

7. Lawson, T.V. (1973). "Wind Environment of Buildings: A Logical Approach to the Establishment of Criteria", *Report No. TVL 7321*, Department of Aeronautic Engineering, University of Bristol, Bristol, England.

8. Durgin, F. H. (1997). "Pedestrian Level Wind Criteria Using the Equivalent average", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol. 66, pp.215-226.

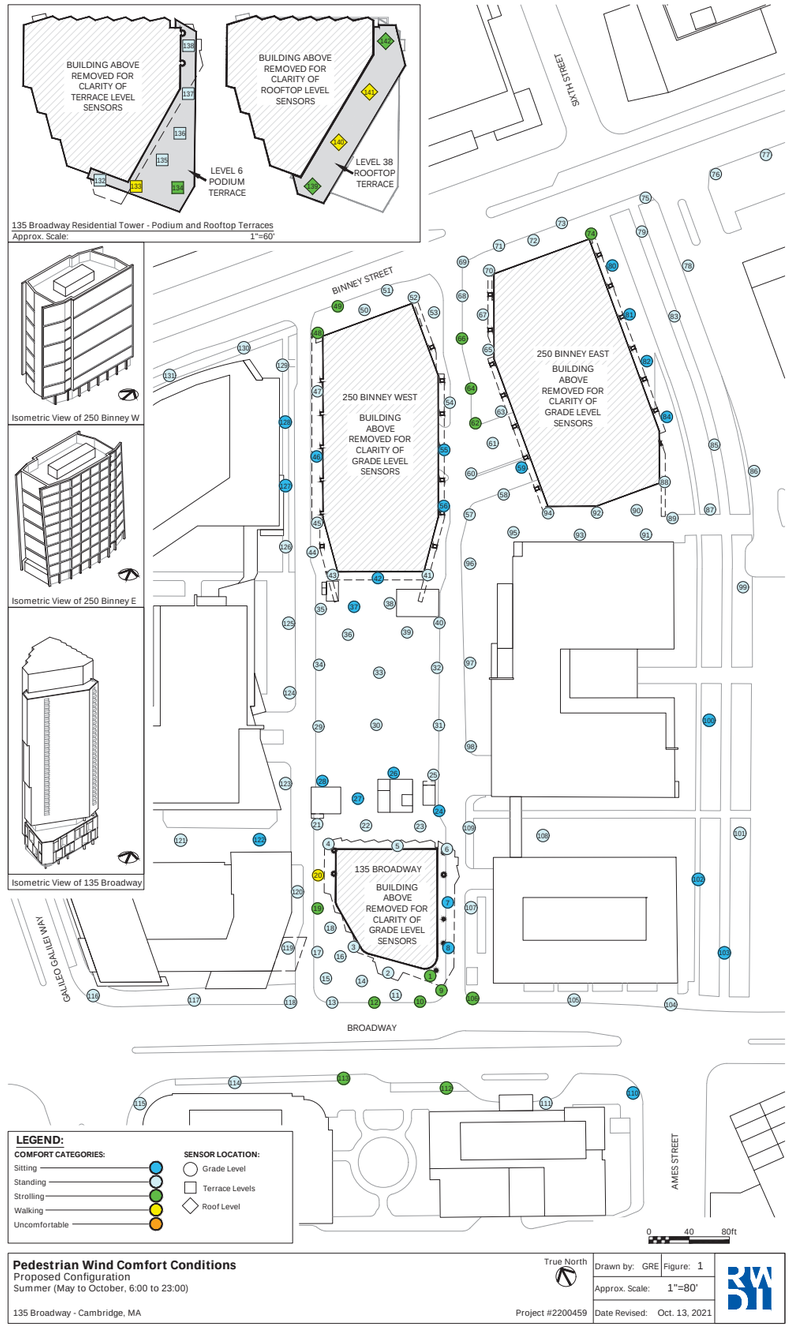
9. Wu, H. and Kriksic, F. (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, Vol.104-106, pp.397-407.

10. Wu, H., Williams, C.J., Baker, H.A. and Waechter, W.F. (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004,* Nashville, Tennessee.

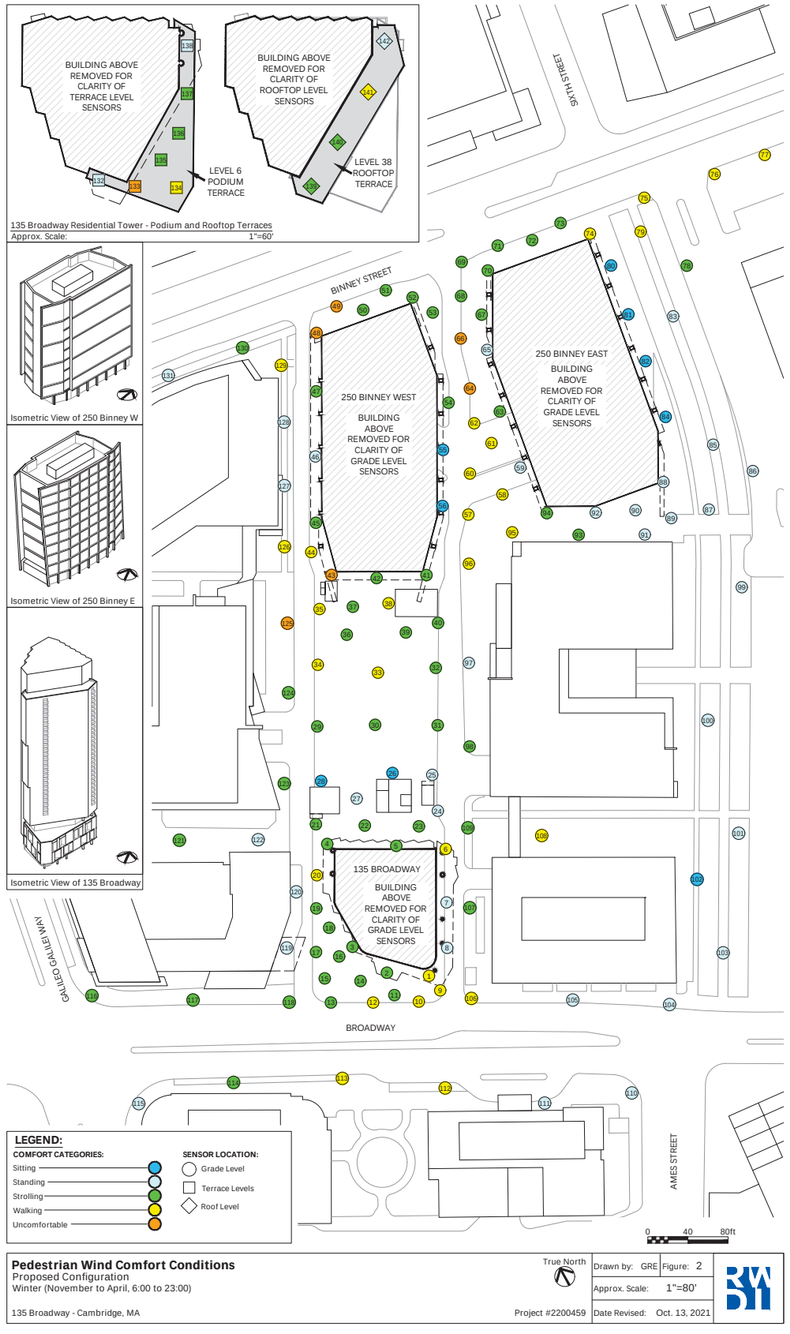
3.1 PEDESTRIAN WIND ASSESSMENT

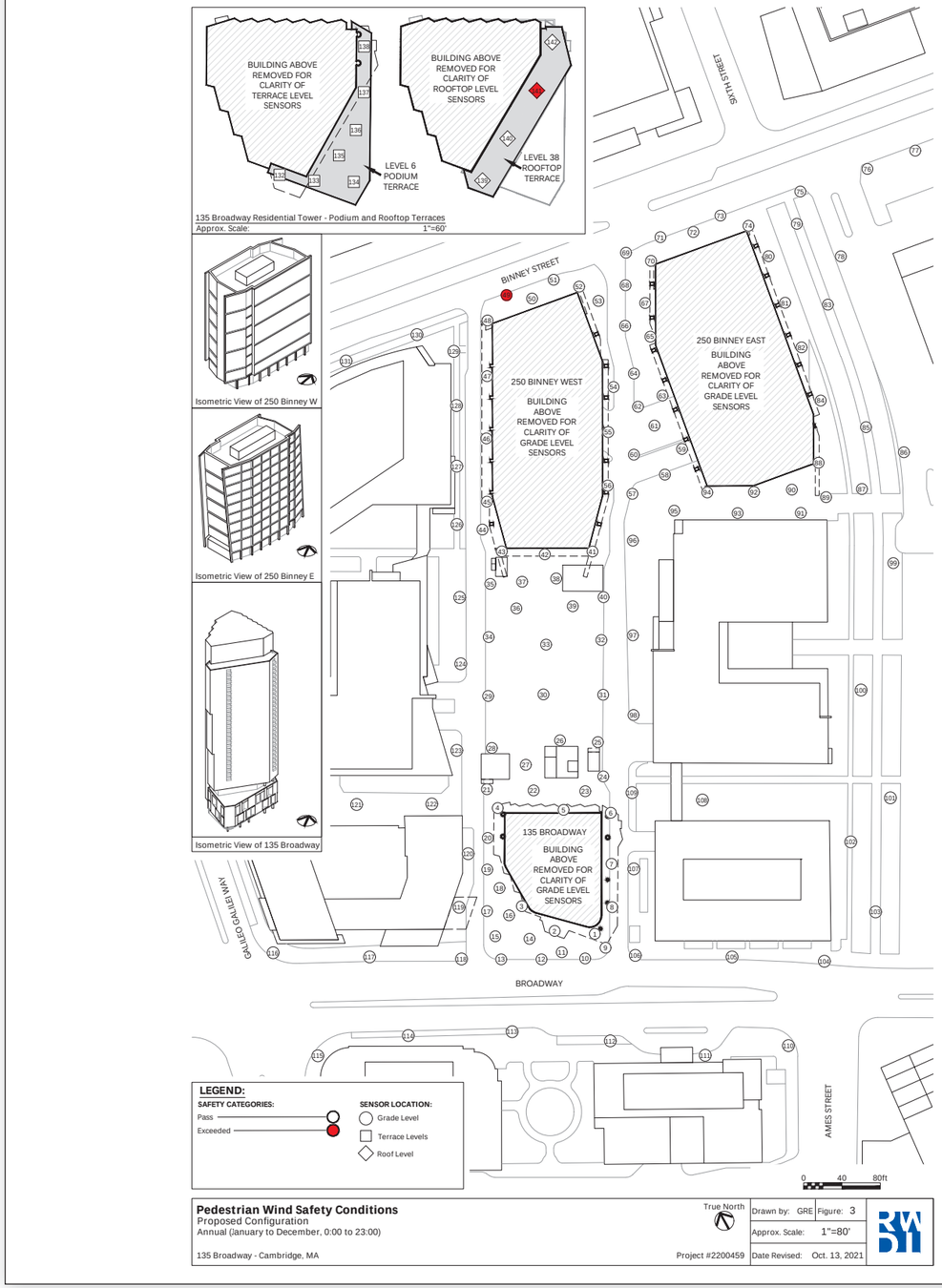
FIGURES

FIGURES



3.1 PEDESTRIAN WIND ASSESSMENT





3.1 PEDESTRIAN WIND ASSESSMENT

TABLES

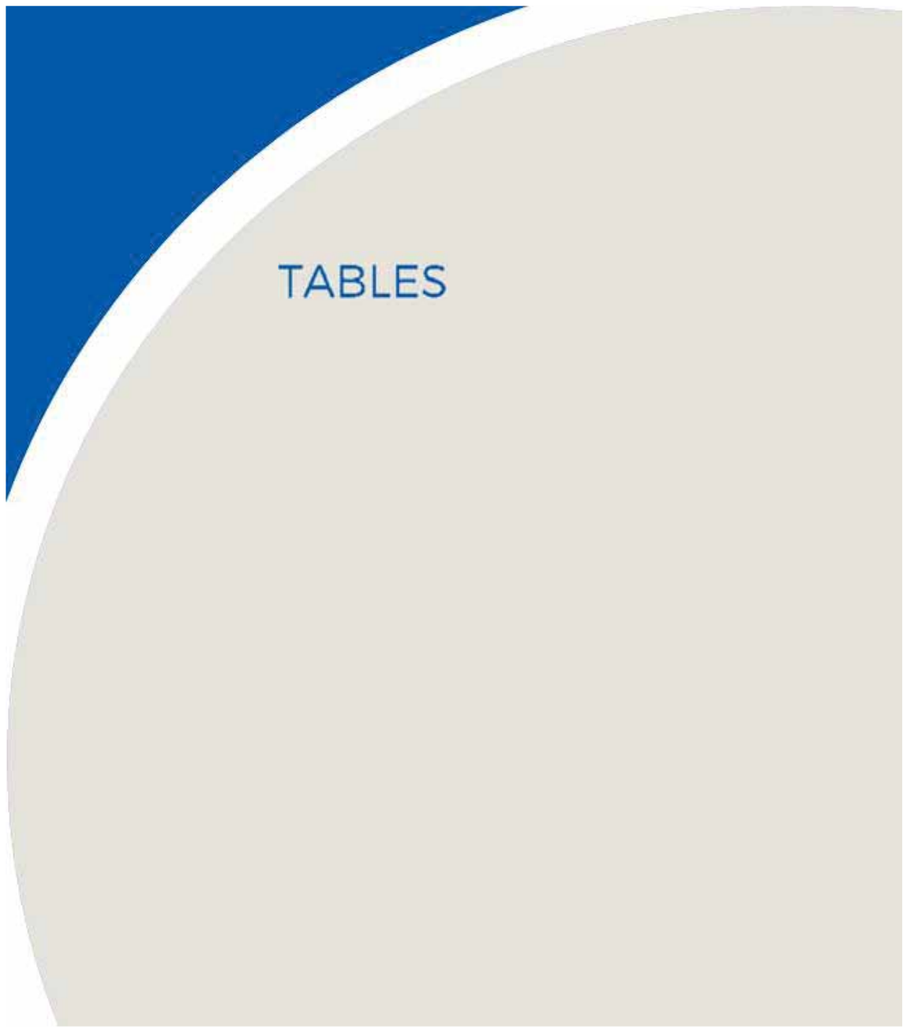


Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
1	Proposed	10	Strolling	12	Walking	43	Pass
2	Proposed	8	Standing	9	Strolling	35	Pass
3	Proposed	7	Standing	9	Strolling	42	Pass
4	Proposed	8	Standing	10	Strolling	40	Pass
5	Proposed	7	Standing	9	Strolling	35	Pass
6	Proposed	8	Standing	11	Walking	44	Pass
7	Proposed	6	Sitting	7	Standing	26	Pass
8	Proposed	6	Sitting	7	Standing	29	Pass
9	Proposed	10	Strolling	12	Walking	43	Pass
10	Proposed	9	Strolling	11	Walking	39	Pass
11	Proposed	8	Standing	10	Strolling	38	Pass
12	Proposed	9	Strolling	11	Walking	40	Pass
13	Proposed	8	Standing	10	Strolling	39	Pass
14	Proposed	7	Standing	9	Strolling	36	Pass
15	Proposed	8	Standing	9	Strolling	38	Pass
16	Proposed	7	Standing	9	Strolling	41	Pass
17	Proposed	8	Standing	9	Strolling	39	Pass
18	Proposed	8	Standing	10	Strolling	42	Pass
19	Proposed	9	Strolling	10	Strolling	43	Pass
20	Proposed	11	Walking	12	Walking	47	Pass
21	Proposed	7	Standing	9	Strolling	38	Pass
22	Proposed	8	Standing	10	Strolling	39	Pass
23	Proposed	7	Standing	9	Strolling	37	Pass
24	Proposed	6	Sitting	7	Standing	34	Pass
25	Proposed	7	Standing	8	Standing	30	Pass
26	Proposed	5	Sitting	6	Sitting	24	Pass
27	Proposed	6	Sitting	8	Standing	31	Pass

3.1 PEDESTRIAN WIND ASSESSMENT

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
28	Proposed	5	Sitting	6	Sitting	24	Pass
29	Proposed	8	Standing	10	Strolling	43	Pass
30	Proposed	7	Standing	10	Strolling	43	Pass
31	Proposed	7	Standing	9	Strolling	38	Pass
32	Proposed	7	Standing	9	Strolling	40	Pass
33	Proposed	8	Standing	11	Walking	47	Pass
34	Proposed	8	Standing	11	Walking	43	Pass
35	Proposed	7	Standing	11	Walking	40	Pass
36	Proposed	7	Standing	10	Strolling	40	Pass
37	Proposed	6	Sitting	9	Strolling	35	Pass
38	Proposed	7	Standing	11	Walking	45	Pass
39	Proposed	7	Standing	10	Strolling	43	Pass
40	Proposed	7	Standing	10	Strolling	43	Pass
41	Proposed	7	Standing	10	Strolling	39	Pass
42	Proposed	6	Sitting	9	Strolling	37	Pass
43	Proposed	8	Standing	13	Uncomfortable	48	Pass
44	Proposed	8	Standing	11	Walking	43	Pass
45	Proposed	7	Standing	10	Strolling	40	Pass
46	Proposed	6	Sitting	8	Standing	35	Pass
47	Proposed	7	Standing	9	Strolling	36	Pass
48	Proposed	10	Strolling	14	Uncomfortable	53	Pass
49	Proposed	10	Strolling	14	Uncomfortable	57	Exceeded
50	Proposed	7	Standing	10	Strolling	42	Pass
51	Proposed	7	Standing	10	Strolling	42	Pass
52	Proposed	7	Standing	9	Strolling	38	Pass
53	Proposed	8	Standing	10	Strolling	51	Pass
54	Proposed	7	Standing	9	Strolling	41	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
55	Proposed	5	Sitting	6	Sitting	24	Pass
56	Proposed	4	Sitting	6	Sitting	22	Pass
57	Proposed	8	Standing	12	Walking	47	Pass
58	Proposed	8	Standing	11	Walking	43	Pass
59	Proposed	6	Sitting	7	Standing	31	Pass
60	Proposed	8	Standing	11	Walking	43	Pass
61	Proposed	8	Standing	12	Walking	45	Pass
62	Proposed	9	Strolling	12	Walking	47	Pass
63	Proposed	7	Standing	9	Strolling	37	Pass
64	Proposed	10	Strolling	13	Uncomfortable	52	Pass
65	Proposed	7	Standing	8	Standing	40	Pass
66	Proposed	10	Strolling	13	Uncomfortable	51	Pass
67	Proposed	7	Standing	9	Strolling	42	Pass
68	Proposed	7	Standing	9	Strolling	39	Pass
69	Proposed	8	Standing	10	Strolling	39	Pass
70	Proposed	8	Standing	10	Strolling	42	Pass
71	Proposed	8	Standing	10	Strolling	42	Pass
72	Proposed	7	Standing	10	Strolling	40	Pass
73	Proposed	8	Standing	10	Strolling	42	Pass
74	Proposed	9	Strolling	12	Walking	44	Pass
75	Proposed	8	Standing	12	Walking	42	Pass
76	Proposed	8	Standing	11	Walking	45	Pass
77	Proposed	8	Standing	11	Walking	44	Pass
78	Proposed	8	Standing	10	Strolling	48	Pass
79	Proposed	8	Standing	12	Walking	46	Pass
80	Proposed	5	Sitting	5	Sitting	37	Pass
81	Proposed	6	Sitting	6	Sitting	32	Pass

3.1 PEDESTRIAN WIND ASSESSMENT

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
82	Proposed	6	Sitting	6	Sitting	32	Pass
83	Proposed	8	Standing	8	Standing	45	Pass
84	Proposed	6	Sitting	6	Sitting	41	Pass
85	Proposed	7	Standing	8	Standing	43	Pass
86	Proposed	7	Standing	8	Standing	44	Pass
87	Proposed	7	Standing	8	Standing	40	Pass
88	Proposed	7	Standing	7	Standing	36	Pass
89	Proposed	7	Standing	8	Standing	35	Pass
90	Proposed	8	Standing	8	Standing	37	Pass
91	Proposed	8	Standing	8	Standing	39	Pass
92	Proposed	7	Standing	8	Standing	40	Pass
93	Proposed	8	Standing	10	Strolling	43	Pass
94	Proposed	8	Standing	10	Strolling	43	Pass
95	Proposed	8	Standing	11	Walking	45	Pass
96	Proposed	8	Standing	12	Walking	49	Pass
97	Proposed	7	Standing	8	Standing	37	Pass
98	Proposed	7	Standing	9	Strolling	39	Pass
99	Proposed	7	Standing	7	Standing	38	Pass
100	Proposed	6	Sitting	7	Standing	35	Pass
101	Proposed	7	Standing	8	Standing	34	Pass
102	Proposed	6	Sitting	6	Sitting	31	Pass
103	Proposed	6	Sitting	7	Standing	30	Pass
104	Proposed	7	Standing	8	Standing	34	Pass
105	Proposed	7	Standing	8	Standing	35	Pass
106	Proposed	10	Strolling	12	Walking	42	Pass
107	Proposed	7	Standing	9	Strolling	40	Pass
108	Proposed	8	Standing	12	Walking	43	Pass

Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
109	Proposed	8	Standing	10	Strolling	40	Pass
110	Proposed	6	Sitting	8	Standing	30	Pass
111	Proposed	7	Standing	8	Standing	30	Pass
112	Proposed	9	Strolling	12	Walking	40	Pass
113	Proposed	10	Strolling	11	Walking	42	Pass
114	Proposed	7	Standing	9	Strolling	39	Pass
115	Proposed	7	Standing	8	Standing	35	Pass
116	Proposed	8	Standing	10	Strolling	37	Pass
117	Proposed	7	Standing	9	Strolling	35	Pass
118	Proposed	8	Standing	10	Strolling	38	Pass
119	Proposed	7	Standing	8	Standing	36	Pass
120	Proposed	8	Standing	8	Standing	35	Pass
121	Proposed	7	Standing	10	Strolling	48	Pass
122	Proposed	6	Sitting	8	Standing	38	Pass
123	Proposed	8	Standing	9	Strolling	45	Pass
124	Proposed	8	Standing	10	Strolling	43	Pass
125	Proposed	8	Standing	14	Uncomfortable	48	Pass
126	Proposed	8	Standing	12	Walking	42	Pass
127	Proposed	6	Sitting	8	Standing	37	Pass
128	Proposed	6	Sitting	7	Standing	37	Pass
129	Proposed	8	Standing	12	Walking	45	Pass
130	Proposed	7	Standing	9	Strolling	36	Pass
131	Proposed	7	Standing	8	Standing	40	Pass
132	Proposed	7	Standing	8	Standing	35	Pass
133	Proposed	11	Walking	13	Uncomfortable	50	Pass
134	Proposed	9	Strolling	11	Walking	45	Pass
135	Proposed	8	Standing	10	Strolling	42	Pass

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Table 1: Pedestrian Wind Comfort and Safety Conditions

Location	Configuration	Wind Comfort				Wind Safety	
		Summer		Winter		Annual	
		Speed (mph)	Rating	Speed (mph)	Rating	Speed (mph)	Rating
136	Proposed	8	Standing	10	Strolling	41	Pass
137	Proposed	8	Standing	9	Strolling	41	Pass
138	Proposed	7	Standing	7	Standing	35	Pass
139	Proposed	10	Strolling	9	Strolling	49	Pass
140	Proposed	11	Walking	10	Strolling	51	Pass
141	Proposed	12	Walking	11	Walking	57	Exceeded
142	Proposed	10	Strolling	8	Standing	45	Pass

Season	Months	Hours
Summer	May - October	6:00 - 23:00 for comfort
Winter	November - April	6:00 - 23:00 for comfort
Annual	January - December	0:00 - 23:00 for safety

Configurations

Proposed: Proposed development with existing surroundings

Comfort Speed (mph)	
(20% Seasonal Exceedance)	
≤ 6	Sitting
7 - 8	Standing
9 - 10	Strolling
11 - 12	Walking
> 12	Uncomfortable

Safety Speed (mph)	
(0.1% Annual Exceedance)	
≤ 56	Pass
> 56	Exceeded

600 Southgate Drive
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E-mail: solutions@rwdi.com

November 19, 2021

Ian Hatch
Project Manager

BXP – Boston Properties
800 Boylston Street
Suite 1900
Boston, MA 02199-8103
Email: ihatch@bxp.com

Re: Pedestrian Wind Conditions – Summary of Comments
135 Broadway
RWDI Reference No. 2200459

Dear Ian,

RWDI has carried out detailed pedestrian wind modeling for the residential and commercial development proposed at 135 Broadway, in Boston, MA. A report summarizing the results and recommendations from our work were issued on October 22, 2021.

Following submission of this document, RWDI has received updated massing information for the commercial towers on November 16, 2021. From our review of this information, we confirm that the results and recommendations presented in our final report are still appropriate and remain unchanged.

It is RWDI's understanding that unsafe and/or uncomfortable pedestrian conditions identified in the study will be mitigated by the design team with the implementation of appropriate wind control measures.

Respectfully submitted by:
RWDI

Sonia Beaulieu, M.Sc., PMP, P.Eng.
Senior Project Manager / Principal

3.2 SHADOW STUDY

EQUINOX

Equinox (March 21 & September 21 EST)

March 21 and September 21 are the Spring and Fall Equinoxes, respectively, when the length of daytime and nighttime are equal. The net new shadow for these conditions are depicted at the right. At 9:00 AM, the Residential Building South will cast net new shadow towards the west-northwest that will fall on the rooftop of Commercial Building A. Commercial Buildings C and D will cast net new shadow to the west-northwest that will fall across Binney Street. At 12:00 PM, the sun is in the south-southeasterly sky and shadows are cast towards the north-northwest. The majority of new shadow from the Residential Building South fall within the Project Site, with some new shadow cast onto the West Service Drive. At noon, net new shadows from Commercial Buildings C and D fall onto the East and West Service Drives, and onto Binney Street. At 3:00 PM, the sun is in the southwestern sky and shadows are cast to the northeast. The Residential Building South is expected to cast some net new shadow within the Project Site, with some new shadow cast on the East Service Drive. Commercial Buildings C and D will cast net new shadow to the north-northeast across Binney Street, along the northern end of the 6th Street Connector, and onto the adjacent Volpe parcel.

FIGURE 7.11A - MARCH 21, 9:00 AM

RS Residential South
CC Commercial Building C
CD Commercial Building D

N

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.2 SHADOW STUDY

FIG. 7.11

EQUINOX MARCH 21 & SEPTEMBER 21 (EST)

FIGURE 7.11B - MARCH 21, 12:00 PM

FIGURE 7.11C - MARCH 21, 3:00 PM

New Shadow
Existing Shadow
New Shadow over open space
Existing Shadow over open space
Commercial Building A
Commercial Building B
Volpe Shadows
Proposed Buildings
Open space
(related to project study)

MXD INFILL DEVELOPMENT CONCEPT PLAN 223

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.2 SHADOW STUDY

SUMMER SOLSTICE

Summer Solstice (June 21 EST)

June 21 is the summer solstice and the longest day of the year where the sun is highest in the sky. On this day, the Project casts the least amount of net new shadow, the majority of which is cast within the Project Site. At 9:00AM, net new shadows associated with the Residential South Building are cast to the west, and largely fall within the Project Site. Commercial Building C casts net new shadow within the Project Site, and onto the east Service Drive. Commercial Building D casts net new shadow to the west onto the rooftops of existing buildings, and onto an incremental portion of Galileo Galilei Way. At 12:00 PM, the sun is high in the southern sky and casts the shortest shadows of the day towards the north-northeast. The majority of new shadow from the Residential South Building falls within the Project Site on the East Service Drive and the rooftop of existing buildings. At noon, Commercial Buildings C and D will cast some net new shadow on to the East Service Drive and onto Binney Street. At 3:00 PM, the sun is in the western sky and shadows are cast towards the east-northeast. The majority of new shadow from the Residential Building South falls within the Project Site onto the East Service Drive and the rooftop of existing buildings. Commercial Buildings C and D will cast some net new shadow on to the East Service Drive, Binney Street, the Sixth Street Connector, and the adjacent Volpe Parcel.

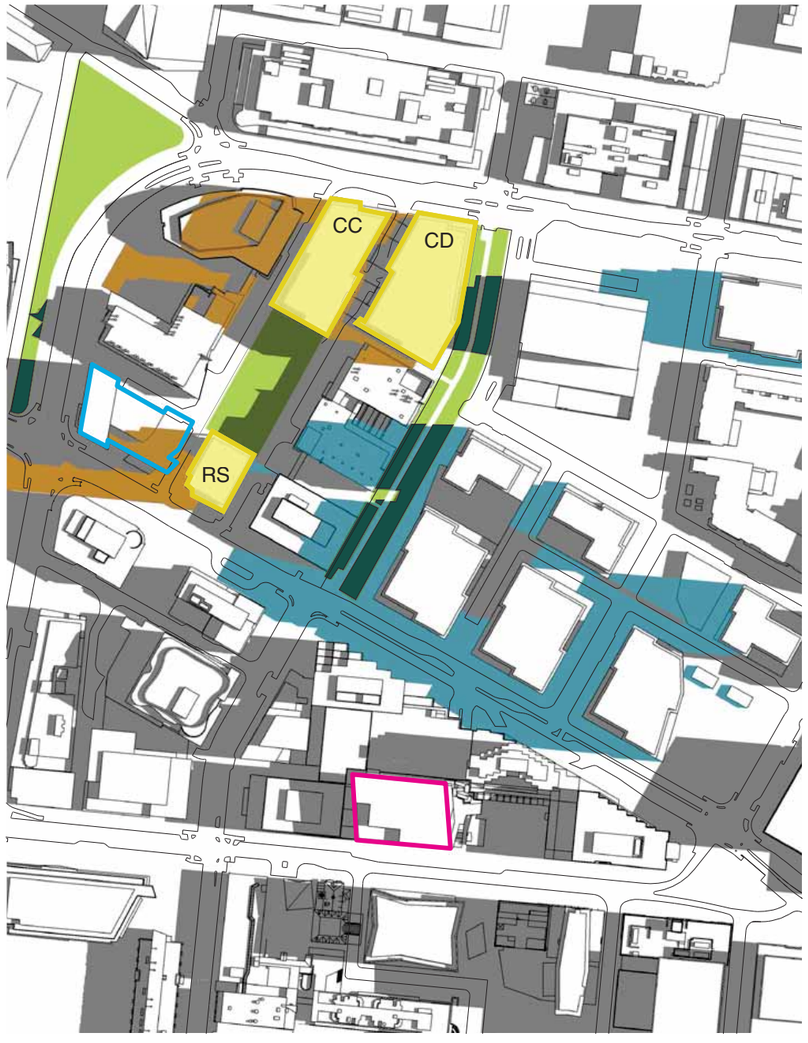

FIGURE 7.12A - JUNE 21, 9:00 AM

N

RS Residential South
CC Commercial Building C
CD Commercial Building D

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.2 SHADOW STUDY

SUMMER SOLSTICE JUNE 21 (EST)

FIG. 7.12

FIGURE 7.12B - JUNE 21, 12:00 PM

FIGURE 7.12C - JUNE 21, 3:00 PM

New Shadow
Existing Shadow
New Shadow over open space
Existing Shadow over open space
Commercial Building A
Commercial Building B
Volpe Shadows
Proposed Buildings
Open space
(related to project study)

MXD INFILL DEVELOPMENT CONCEPT PLAN

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* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.2 SHADOW STUDY

FALL

October 21 EST

At 9:00 AM, the sun is low in the southeast sky resulting in long shadows to the northwest. The Residential Building South will net new cast shadows to the west-northwest onto an incremental portion of the West Service Drive, and onto the rooftop of Commercial Building A. Commercial Buildings C and D will cast limited net new shadow onto Binney Street and Galileo Galilei Way. At 12:00 PM, the sun is in the southern sky and shadows will be cast nearly due north. The Residential Building South will cast incremental net new shadow onto the East Service Drive, and onto a sliver of Galileo Galilei Way. At noon, the Commercial Buildings C and D will cast net new shadows onto the West and East Service Drives, onto Binney Street, and onto the existing buildings across Binney Street. At 3:00 PM, shadows cast from the Project are long, and extend in the northeast direction. Net new shadows from the Residential Building South fall onto the East Service Drive. Commercial Buildings C and D are expected to cast net new shadow onto the West and East Service Drives, onto Binney Street, onto the existing buildings across Binney Street and onto the northern corner of the adjacent Volpe Parcel.

FIGURE 7.13A – OCT 21, 9:00 AM

N

RS Residential South
CC Commercial Building C
CD Commercial Building D

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.2 SHADOW STUDY

FALL OCT 21 (EST)

FIG. 7.13

FIGURE 7.13B - OCT 21, 12:00 PM

FIGURE 7.13C - OCT21, 3:00 PM

New Shadow
Existing Shadow
New Shadow over open space
Existing Shadow over open space
Commercial Building A
Commercial Building B
Volpe Shadows
Proposed Buildings
Open space
(related to project study)

MXD INFILL DEVELOPMENT CONCEPT PLAN

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* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.2 SHADOW STUDY

WINTER SOLSTICE

Winter Solstice (December 21 EST)

December 21 is the winter solstice and the shortest day of the year, where the sun is low in the sky. Therefore, Cambridge experiences the longest shadows of the year on this day, and many of the adjacent sidewalks and public spaces are already subsumed in existing shadow. At 9:00 AM, the sun is low in the southeast sky resulting in long shadows to the northwest. At this time net new shadows cast by the Project are largely covered by existing shadows. At 12:00 PM, the Project will create new shadow primarily over building rooftops to the north, however Commercial Buildings C and D will cast limited net new shadow onto Binney Street. At 3:00 PM, the sun is low in the southwest sky and the existing landscape is heavily covered in existing shadow. At this time net new shadows cast by the Project are largely covered by existing shadows.

FIGURE 7.14A - DECEMBER 21, 9:00 AM

N

RS Residential South
CC Commercial Building C
CD Commercial Building D

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.2 SHADOW STUDY

WINTER SOLSTICE DECEMBER 21 (EST)

FIG. 7.14

FIGURE 7.14B - DECEMBER 21, 12:00 PM

FIGURE 7.14C - DECEMBER 21, 3:00 PM

New Shadow
Existing Shadow
New Shadow over open space
Existing Shadow over open space
Commercial Building A
Commercial Building B
Volpe Shadows
Proposed Buildings
Open space
(related to project study)

MXD INFILL DEVELOPMENT CONCEPT PLAN

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* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

7.3 NOISE

The noise impact assessment evaluated the potential noise impacts associated with the Project's activities, including mechanical equipment and loading activities. This section discusses the fundamentals of noise, noise impact criteria, noise analysis methodology, and potential noise impacts. Noise monitoring was previously conducted to determine existing ambient sound levels.

The Project includes the construction of the Residential Building South at 135 Broadway, Commercial Building C at 290 Binney Street (250 feet), and Commercial Building D at 250 Binney Street, all of which are located on the North Parcel. The locations of the proposed Project components are consistent with the previously contemplated noise assessment that analyzed existing ambient sound levels associated with the existing daytime and nighttime activities and mechanical equipment along the south and north side of the existing Blue Garage (refer to Figure 7.16 – Receptor Locations). This section demonstrates that the Project will continue to comply with City of Cambridge's noise control ordinance (Municipal Code, Chapter 8.16).

7.3.1 FUNDAMENTALS OF NOISE

Noise is defined as unwanted or excessive sound. Sound becomes unwanted when it interferes with normal activities such as sleep, communication, work, or recreation. How people perceive sound depends on several measurable physical characteristics, which include the following:

- Intensity - Sound intensity is often equated to loudness.
- Frequency - Sounds are comprised of acoustic energy distributed over a variety of frequencies. Acoustic frequencies, commonly referred to as tone or pitch, are typically measured in Hertz. Pure tones have all their energy concentrated in a narrow frequency range.

Sound levels are most often measured on a logarithmic scale of decibels (dB). The decibel scale compresses the audible acoustic pressure levels which can vary from the threshold of hearing (zero dB) to the threshold of pain (120 dB). Because sound levels are measured in dB, the addition of two sound levels is not linear. Adding two equal sound levels creates a 3 dB increase in the overall level. Research indicates the following general relationships between sound level and human perception:

- A 3 dB increase is a doubling of acoustic energy and is the threshold of perceptibility to the average person.
- A 10 dB increase is a tenfold increase in acoustic energy but is perceived as a doubling in loudness to the average person.

The human ear does not perceive sound levels from each frequency as equally loud. To compensate for this phenomenon in perception, a frequency filter known as A weighted [dB(A)] is used to evaluate environmental noise levels. Table 7-1 presents a list of common outdoor and indoor sound levels.

A variety of sound level indicators can be used for environmental noise analysis. These indicators describe the variations in intensity and temporal pattern of the sound levels. The following is a list of common sound level descriptors used for environmental noise analyses:

- L90 is the sound level which is exceeded for 90 percent of the time during the time period. The L90 is generally considered to be the ambient or background sound level.

Outdoor Sound Levels	Sound Pressure (μPa)*		Sound Level dB(A)**	Indoor Sound Levels
	6,324,555	-	110	Rock Band at 5 m
Jet Over Flight at 300 m		-	105	
	2,000,000	-	100	Inside New York Subway Train
Gas Lawn Mower at 1 m		-	95	
	632,456	-	90	Food Blender at 1 m
Diesel Truck at 15 m		-	85	
Noisy Urban Area—Daytime	200,000	-	80	Garbage Disposal at 1 m
		-	75	Shouting at 1 m
Gas Lawn Mower at 30 m	63,246	-	70	Vacuum Cleaner at 3 m
Suburban Commercial Area		-	65	Normal Speech at 1 m
	20,000	-	60	
Quiet Urban Area—Daytime		-	55	Quiet Conversation at 1 m
	6,325	-	50	Dishwasher Next Room
Quiet Urban Area—Nighttime		-	45	
	2,000	-	40	Empty Theater or Library
Quiet Suburb—Nighttime		-	35	
	632	-	30	Quiet Bedroom at Night
Quiet Rural Area—Nighttime		-	25	Empty Concert Hall
Rustling Leaves	200	-	20	
		-	15	Broadcast and Recording Studios
	63	-	10	
		-	5	
Reference Pressure Level	20	-	0	Threshold of Hearing

TABLE 7-1 COMMON OUTDOOR AND INDOOR SOUND LEVELS

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

7.3.2 METHODOLOGY

The noise analysis evaluated the potential noise impacts associated with the Project's mechanical equipment and loading/service activities. The noise analysis included measurements of existing ambient background sound levels and a qualitative evaluation of potential noise impacts associated with the proposed mechanical equipment (e.g., energy recovery units, cooling towers, etc.) and loading activities. The study area was evaluated and sensitive receptor locations in the vicinity of the Project were identified and examined. The site layout and building design, as it relates to the loading area and management of deliveries at the Project Site were also considered. The analysis considered sound level reductions due to distance, proposed building design, and obstructions from surrounding structures.

Receptor Locations

The noise analysis included an evaluation of the study area to identify nearby sensitive receptor locations, which typically include areas of sleep and areas of outdoor activities that may be sensitive to noise. The noise analysis identified eight nearby sensitive receptor locations in the vicinity of the Project. As shown on Figure 7.15, the receptor locations include the following:

- R1 – Residence Inn Hotel;
- R2 – Marriott Hotel;
- R3 – Eastgate Apartments;
- R4 – Lofts at Kendall Square Apartments;
- R5 – Pedestrian Walkway (connecting Broadway and Binney St); and
- R6 – Public green space south of Cambridge Center garage.
- R7 – The Kendall Hotel
- R8 – SOMA Residential Building (Building #4)

These receptor locations, selected based on land use considerations, represent the most sensitive locations in the vicinity of the Project Site.

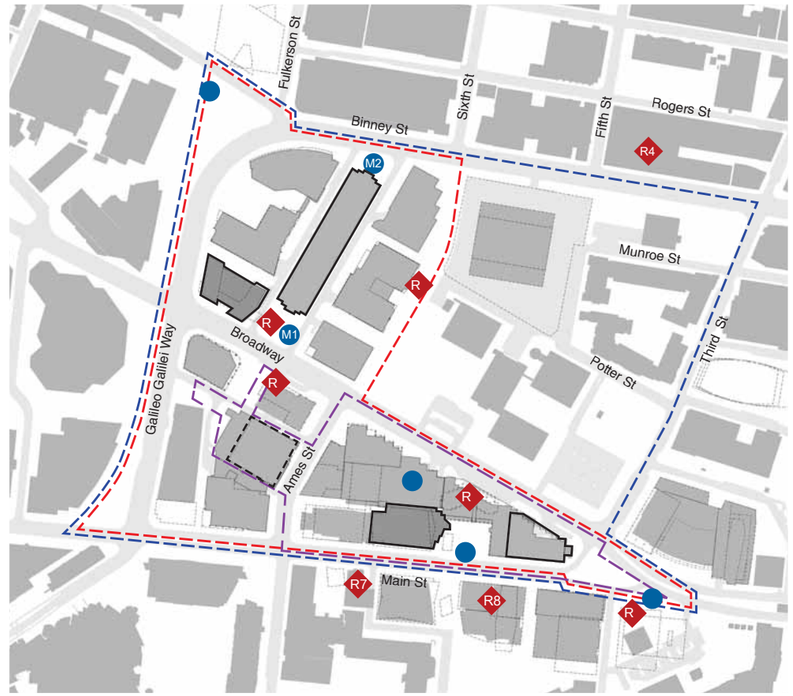

FIGURE 7.15 - RECEPTOR LOCATIONS

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

7.3.3 CITY OF CAMBRIDGE NOISE IMPACT STANDARDS

The City has developed noise standards that establish noise thresholds deemed to result in adverse impacts. The noise analysis for the Project used these standards to evaluate whether the proposed development will generate sound levels that result in potential adverse impacts.

The noise standards are provided under Chapter 8.16 of the City of Cambridge Municipal Code (Noise Ordinance). These standards establish maximum allowable sound levels based upon the land use affected by the proposed development. Table 7-2 summarizes the maximum allowable sound levels that should not be exceeded. For a residential zoning district, the maximum noise level affecting residential uses shall not exceed the Residential Noise Standard. The single number equivalent noise standard for a residential use is 60 dB(A) for daytime periods (7:00 AM to 6:00 PM) and 50 dB(A) during other times of the day.

The City of Cambridge noise control regulation considers construction sound levels to be an impact to residential land uses if the L10 sound level is in excess of 75 dB(A) or the Lmax sound level is in excess of 86 dB(A) measured at the lot of the affected property.

	Residential Area		Residential in Industrial		Commercial Area	Industry Area
Octave Band Center Frequency (Hz)	Daytime	Other Times	Daytime	Other Times	Anytime	Anytime
31.5	76	68	79	72	79	83
63	75	67	78	71	78	82
125	69	69	69	69	69	69
250	62	52	68	57	68	73
500	56	46	62	51	62	67
1,000	50	40	56	45	56	61
2,000	45	33	51	39	51	57
4,000	40	28	47	34	47	53
8,000	38	26	44	32	44	50
Single Number Equivalent, dB(A)	60	50	65	55	65	70

Source: City of Cambridge Municipal Code, Chapter 8.16, Table 8.16.060E.

TABLE 7-2 CITY OF CAMBRIDGE NOISE STANDARDS BY ZONING DISTRICT

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

7.3.4 EXISTING NOISE CONDITIONS

Existing sound level measurements were conducted using Type 1 sound analyzers (Larson Davis 831 and SoundExpert LxT) to establish existing ambient conditions. Measurements were conducted during the weekday daytime period (approximately 9:00 AM to 11:00 AM) and late-night period (1:00 AM to 3:00 AM) in the vicinity of the Project Site on July 21, 2016. Supplemental measurements were conducted during the daytime (1:00 PM to 3:00 PM) on April 9th, 2018 and during the late-night period (1:00 AM to 3:00 AM) on April 10th, 2018. The monitoring program consists of five short-term monitoring locations, as shown in Figure 7.15. In addition, a 24-hr measurement was conducted in an open lot located at the corner of Binney Street and Fulkerson Street (M4). During the daytime period, the measured sound levels data under existing conditions were composed of noise from construction activities and vehicles on local roadways, such as Binney Street, Broadway, and Main Street. The nighttime period sound levels were generally associated with mechanical equipment from nearby buildings. The existing measured sound level data are presented in Table 7-3. The measured L90 sound levels range from approximately 56 dB(A) to 64 dB(A) during the daytime period and from 53 dB(A) to 59 dB(A) during the nighttime period. The result of the noise monitoring program indicates that the daytime sound levels within the study area are currently exceeding the City of Cambridge's daytime standard of 60 dB(A) along Broadway and Main Street. The existing sound levels during the nighttime period exceed the City's nighttime standard of 50 dB(A) for residential use at all evaluated locations.

	City of Cambridge Residential District Noise Standard*		Measured L90 Sound Levels	
Monitoring Location	**Daytime**	**Nighttime**	**Daytime**	**Nighttime**
M1 – Broadway	60	50	**62**	**59**
M2 – Binney Street	60	50	60	**59**
M3 – Broadway/Main Street	60	50	58	**55**
M4 – Lot at Binney St/Fulkerson St	60	50	60	**58**
M5 – Main Street	60	50	**64**	**53**
M6 – Green Garage	60	50	56	**53**

TABLE 7-3 EXISTING AMBIENT SOUND LEVELS, DB(A)

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

7.3.5 FUTURE NOISE CONDITIONS

The noise analysis evaluated the potential noise impacts associated with the Project's proposed mechanical equipment and loading activities. The analysis determined the potential sound level impacts at the nearby sensitive receptor locations.

MECHANICAL EQUIPMENT

Since the Project is in the early stages of the design process, the specific details related to the final selection of mechanical equipment are unknown at the time of this noise assessment. Based on preliminary design plans, the anticipated mechanical equipment associated with the Project are expected to include the following:

- Emergency generators
- Air handling units
- Exhaust fans;
- Chillers; and
- CEnergy recovery units

The mechanical equipment will be located within screening walls on the rooftop or in mechanical rooms of the proposed buildings. During the design and selection process, the appropriate low-noise mechanical equipment will be selected, including potential noise mitigation measures, such as acoustical enclosures and/or acoustical silencers. The Project will incorporate noise attenuation measures necessary to comply with City of Cambridge's noise criteria at the sensitive receptor locations.

In addition to being located within acoustical screening walls or within a penthouse, the mechanical systems would be strategically located on the rooftop, utilizing the height of the proposed buildings in providing noise attenuation. Noise attenuation could be achieved by the Project's building design as the heights of the Project's buildings are similar or greater than the height of nearby sensitive receptors. The rooftops of the Project's buildings will serve as a barrier and break the direct line of exposure between the noise sources and nearby sensitive receptors. With the proposed mechanical equipment located on the rooftop or within a penthouse, the sound levels associated with the Project's mechanical equipment are expected to be negligible at the surrounding sensitive receptor locations. With greater distances and impeding building structures, receptors located further away from the Project are expected to experience lower sound levels associated with the Project's noise sources.

The Project components may require an emergency generator for life safety purposes such as emergency exit lighting. The determination of specific generator parameters, such as the sizes and locations will be made during the building design process. The Project will be required to adhere to Massachusetts Department of Environmental Protection's (MassDEP's) regulations that require such equipment to be certified and registered. As part of the air permitting/certification process, the Project will be required to meet additional noise requirements described in MassDEP regulations under the Codes of Massachusetts Regulations (310 CMR 7.00). When the details of the emergency generator are developed, the Applicant will submit the appropriate permit/certification application to MassDEP, which would include noise mitigation measures (such as acoustic enclosures and exhaust silencers) that are necessary to meet MassDEP's noise criteria.

Service and Loading Activities

Off-street designated loading areas will be provided for loading and service activities associated with the Project. The loading areas will be located within the ground level of the proposed buildings, with the exception of Commercial Building B, which is serviced from a below-grade loading dock, accessed from Broadway. The loading dock activities will be managed so that service and loading operations do not impact traffic circulation on the adjacent local roadways. Since loading and service activities will be enclosed within the proposed buildings and operations will be managed, noise impacts to nearby sensitive receptor locations are expected to be negligible.

Impact on Proposed Residential Use

The results of the noise monitoring program indicate existing exterior sound levels exceed the City's noise standards. Noise attenuation measures are limited since the Project consists of one multi-level residential building, and noise walls are not a feasible measure for receptors at high heights. The Project will consider measures to minimize the impacts to interior sound levels even though the City's noise ordinance does not provide interior noise standards.

The proposed buildings will be designed to incorporate building materials with the appropriate sound transmission class to minimize the impacts to the interior sound levels of the proposed residential units. Substantial sound level reductions are considered achievable since general construction material typically provides 20 decibels of attenuation. The building design would consider restricting exposure to exterior noise environment, such as limiting operable windows or balconies and providing central climate control systems.

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.3 NOISE IMPACT ANALYSIS

Construction Activity

The construction activity associated with the Project may temporarily increase nearby sound levels due to the use of heavy machinery. Heavy machinery is expected to be used intermittently throughout the Project's construction phases, typically during daytime periods. The construction activities that will generate the highest sound levels may include demolition, site excavation and grading, and construction of the foundation for the proposed buildings. A construction management program will be developed with the City for each phase of the Project to ensure that the applicable noise regulation is met.

The Project will implement mitigation measures to reduce or minimize noise from construction activities. Construction vehicles and equipment would be required to maintain their original engine noise control equipment specific mitigation measures may include the following:

- Construction equipment would be required to have installed and properly operating appropriate noise muffler systems.
- Appropriate traffic management techniques would be implemented during the construction period would mitigate roadway traffic noise impact.
- Proper operation and maintenance, and prohibition of excessive idling of construction equipment engines, would be required.

Therefore, construction noise levels are proposed to be mitigated to the greatest extent possible.

Conclusion of Noise Impact Assessment

The noise analysis evaluated the sound levels associated with the Project. This analysis determined that the sensitive receptor locations in the vicinity of the Project Site currently experience sound levels exceeding the City's daytime and nighttime noise standards. Due to the anticipated location of the proposed equipment within screening walls on the rooftop, the sound levels associated with the Project's mechanical equipment are expected to have no adverse noise impacts at nearby sensitive receptor locations. While impacts of emergency generators are also expected to be negligible, a separate MassDEP permitting process will allow for further review of this equipment at a later date. The Project is designed such that the loading areas will be enclosed, which will attenuate sound levels associated with the loading activities. As a result of the preliminary design, the Project's operations will have no adverse noise impacts at nearby sensitive receptor locations.

The noise evaluation demonstrates that the existing ambient sound levels exceed the City's noise standards. As a result, the design of the Residential Building South will incorporate sufficient acoustical material with the appropriate sound transmission class rating to minimize impacts to interior sound levels within the residential units.

7.4 EXHAUST RE-ENTRAINTMENT REVIEW

The Project Change proposes to consolidate the approved residential GFA formerly located at 135 Broadway (Residential Building South) and 290 Binney Street (Residential Building North) into one residential building located at 135 Broadway. The total residential GFA located in the Residential Building South will be consistent with Concept Plan Amendment #1, however the building will be up to 38 floors, which is an increase in four floors compared to the massing analyzed in the Concept Plan Amendment #1.

The location of the current Residential Building South is consistent with the location analyzed in the Concept Plan Amendment #1, which is nearby existing and proposed laboratory buildings. Previously, the Applicant had engaged RWDI to evaluate the potential air quality impacts that neighboring laboratory buildings might have on the Residential Building South among other Project components. To mitigate predicted air impacts on the Residential Building South from existing exhaust stacks the analysis recommended locating the air intakes at the roof level along the southern, Broadway facing building facade. The additional building height proposed should result in a positive impact on minimum dilution levels. If operable windows are used, the analysis also recommended that the building mechanical systems should be capable of maintaining a slight positive pressure to avoid drawing in air from the stacks. The Residential Building South Massing depicted in this Concept Plan Amendment #2 is conceptual, however as the Project component advances through design review these recommendation will be considered.

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.6 TREE MITIGATION AND PROTECTION PLAN

TREE PROTECTION PLAN

FIGURE 3.12

INFILL DEVELOPMENT CONCEPT PLAN

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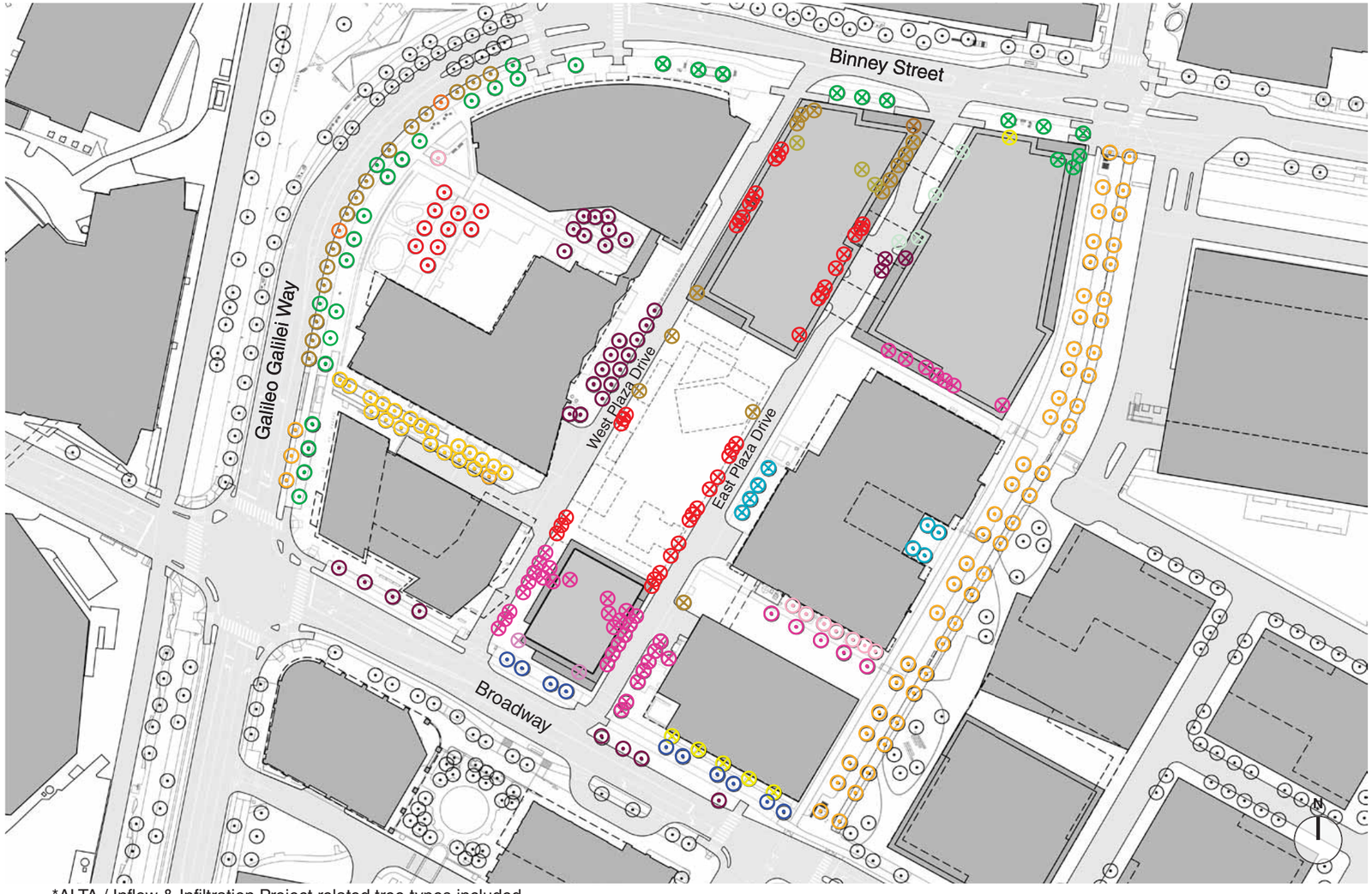
* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.4 TREE MITIGATION AND PROTECTION PLAN

EXISTING TREE IDENTIFICATION AND SPECIES TYPE

FIGURE 3.13



*ALTA / Inflow & Infiltration Project related tree types included

- Acer saccharinum (Silver Maple)
- Acer japonicum (Japanese Maple)
- Quercus rubra (Red Oak)
- Gleditsia triacanthos (Honey Locust)
- Betula nigra (River Birch)
- Crataegus crus-galli (Thornless Hawthorne)
- Zelkova serrata (Zelkova)
- Tilia cordata (Little-Leaf Linden)
- Platanus x acerifolia (Londonplane tree)
- Pinus nigra (Austrian Pine)
- Tilia tomentosa (Silver Linden)
- Prunus serrulata (Cherry)
- Ulmus americana (American Elm)
- Ulmus parvifolia (Chinese Elm)
- Magnolia (Magnolia)

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.4 TREE MITIGATION AND PROTECTION PLAN

EXISTING TREE CONDITION ASSESSMENT

FIGURE 3.14

INFILL DEVELOPMENT CONCEPT PLAN

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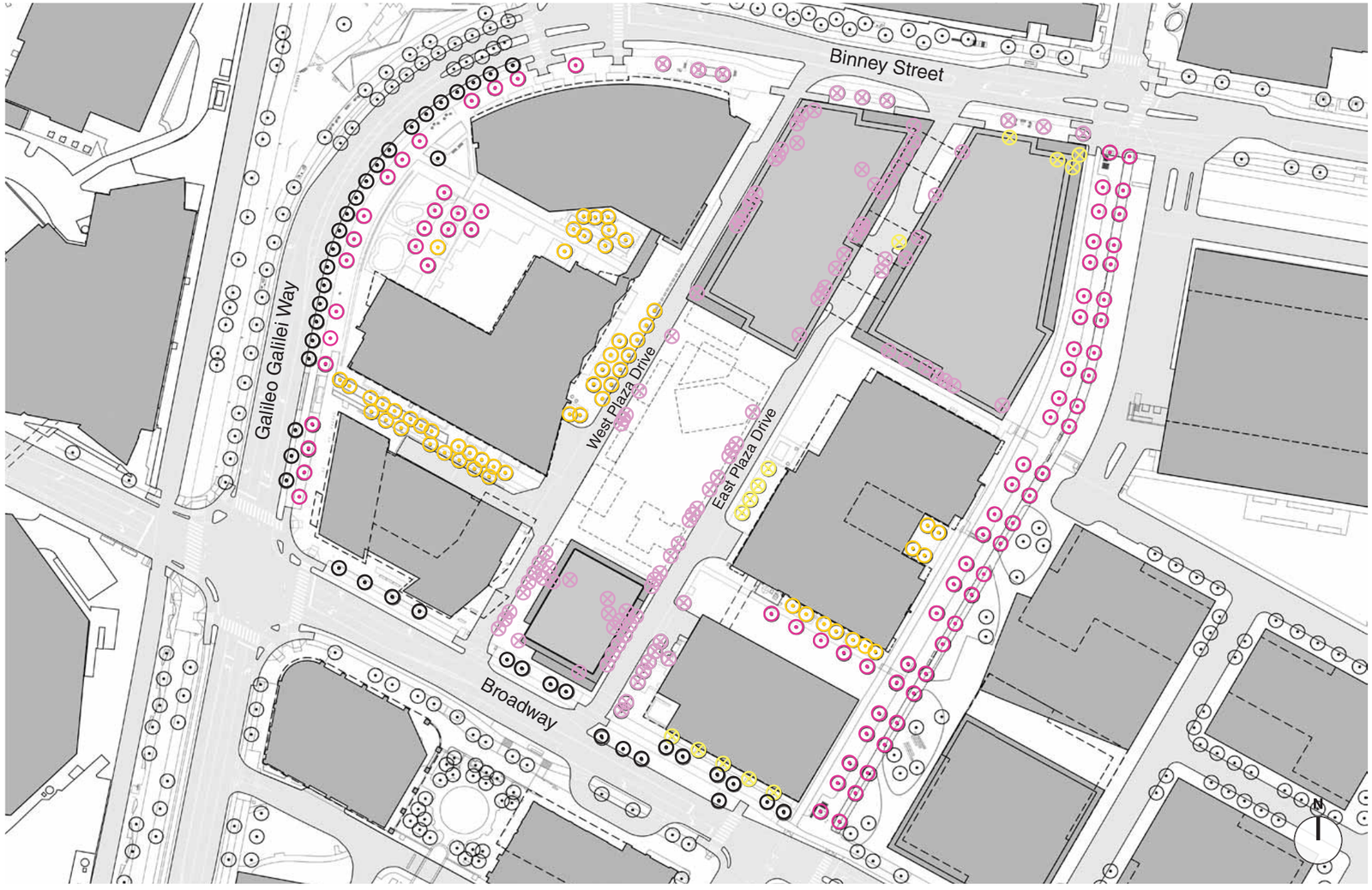
* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

3.4 TREE MITIGATION AND PROTECTION PLAN

EXISTING SIGNIFICANT TREES (6” DBH+)

FIGURE 3.15



ALTA / Inflow & Infiltration Project related Trees
Significant Tree to Remain (Trees with a DBH of 6” or higher)
Removal of Significant Tree (Trees with a DBH of 6” or higher)
Tree to Remain (DBH of Lower than 6”)
Removal of Tree(DBH of Lower than 6”)

* This page is from the ‘IDCP Amendment 2 Conforming Document’ issued 14 January, 2022

3.4 TREE MITIGATION AND PROTECTION PLAN

PROPOSED AND PROTECTED TREES

FIGURE 3.16

ALTA / Inflow & Infiltration Project related Trees

Trees for Protection

Proposed Trees

Parcel 2 Existing Trees

*Proposed Trees Design Review

INFILL DEVELOPMENT CONCEPT PLAN

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* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

5.4 TRAFFIC DEMAND MANAGEMENT PLAN

The proposed TDM measures aim to reduce drive-alone trips, or single occupancy vehicles (SOVs), by encouraging employees, residents and visitors to use alternative modes of transportation. Overall, the goal of the proposed TDM Plan is to reduce the use SOVs by encouraging carpooling and van pooling, bicycle commuting and walking, and increased use of the Kendall Square public transportation system by employees and residents.

The following TDM measures were completed concurrent with the issuance of the Certificate of Occupancy for Commercial Building A:

- Provided the initial $6 million payment for the KSTEP Fund.
- 100% Design Plans for reconstruction of Binney Street and Galileo Galilei Way between the Sixth Street and Broadway, including improvements at the intersection of Galileo Galilei Way/Broadway and respective approaches of Galileo Galilei Way;.
- 100% Design Plans for reconstruction of Broadway between Ames Street and Galileo Galilei Way.
- Improved the Sixth Street Connector Pathway by providing separated pedestrian and bicycle facilities while maintaining the mature trees along the existing pathway.
- Installed wayfinding and real-time transit screens in the Commercial Building A lobby and the Marriott plaza.
- Joined the Charles River Transportation Management Association (TMA); and
- Finance the purchase and installation of two (2) 19 dock Bluebikes Stations.

The following TDM measures <u>will be completed</u> prior to the issuance of a certificate of occupancy for Commercial Building B:

- The Applicant should construct no more than $400,000 in improvements to the MBTA Red Line Outbound Station on the north side of Main Street.
- Fund one large (i.e., 23-dock) Bluebikes system to further support the public bicycle sharing system in Kendall Square and mitigate the impacts of additional development at 325 Main Street.
- Implement a real-time parking availability system within the Applicant's commercial parking facilities, in coordination and as approved by TP&T, the CDD and the CRA.
- Implement a parking management practice or plan that permits parkers to pay by the day, instead of monthly, to encourage commuters not to drive every day, and shall offer this or a comparable program to tenants of the MXD.
- Provide real-time transit screens in the in Commercial Building B lobby.

TDM measures specific to the residential component, are identified below:

- Make available a minimum of 10 car-sharing parking spaces for a vehicle-sharing company. As demand dictates additional car-sharing vehicles will be added over time. Provide additional designated car-sharing parking spaces within and/or nearby by KSURP parking garages, if deemed feasible. (These are designated and priority spaces for car-sharing users arriving for short-periods of time which is different than car-sharing spaces that "live" in the parking garages.
- Provide electric vehicle (EV) charging stations (1 EV space per 100 auto parking spaces) and preferential parking to alternative fuel vehicles, as dictated by the market.
- Offer each adult member of each household (up to 2) upon move-in a Charlie Card valued at the cost of a 50 percent bus/subway pass (subject to fare increases) for three consecutive months. This benefit will end after 3 months for the household and begins anew upon unit turnover.
- Offer each adult member of each household (up to 2) upon move-in a 1- year Gold-Level Bluebikes membership. This benefit will end after one year for the household and begins anew upon unit turnover.
- Provide air pumps and other bike tools in the bicycle storage room.
- Join the Charles River Transportation Management Association (TMA)
- Provide free EZRide Shuttle sticker for each adult member of each household each year.
- Charge parking (market rate) separately from the residential rent, in order to remind tenants how much they pay for parking. The Permittee shall provide the summary of on-site parking fees to the TP&T.
- Either install a real-time multi-modal transportation display screen to help

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people decide which mode to choose for each trip (transit, carsharing vehicle, Bluebikes bike share, etc.), or establish a transportation information center located in an area that is central, visible, convenient, and equally accessible to all residents and visitors. The center will feature information on:

- Available pedestrian and bicycle facilities in the vicinity of the site
- MBTA maps, schedules, and fares
- Area shuttle map and schedule, if one exists
- “Getting Around in Cambridge” map and other CitySmart materials (available at the Cambridge Community Development office)
- Location of bicycle parking
- Bluebikes regional bikeshare system
- Carsharing
- Ride-matching
- Other pertinent transportation information

- Designate a Transportation Coordinator (TC) for each residential building or the site to manage the TDM program. The TC will also oversee the marketing and promotion of transportation options to all residents at the site in a variety of ways:
- Posting information in a prominent location in the building and on the Project’s website, social media, and property newsletters.
- Responding to individual requests for information in person and via phone and email.
- Performing annual transportation surveys.
- Require the TC to compile and distribute up-to-date information explaining all transportation options to all new residents as part of their New Resident Packet. The packets will contain information on both the range of options available to any building manager programs to support the use of these options and will include:
    - Available pedestrian and bicycle facilities in the vicinity of the site
    - MBTA maps, schedules, and fares
    - Area shuttle map and schedule, if one exists
    - “Getting Around in Cambridge” map and other CitySmart materials
    - Location of bicycle parking
    - Bluebikes regional bikeshare system
    - Carsharing
    - Ride-matching
    - Other pertinent transportation information
- Require that the TC will be on-site during a minimum of two (2) hours per week and will be available during other times to residents via email and telephone. Email and phone information for the TC will be posted in the transportation information center.

5.4.1 PROPOSED TRAFFIC MONITORING

The CRA has been conducting an annual traffic study and analysis of Kendall Square for the past 20 years, in compliance with the 1994 Section 61 findings. In 2020, the CRA published an updated transportation report of the monitoring program to reflect the evolution of Cambridge’s transportation priorities in the complex multi-modal urban environment of Kendall Square. The improved study reported on vehicular traffic counts, as well as more holistically reporting on multi-modal data, including counts for bicycles including bikeshare, transit and bus services, crash data, as well as travel behavior. The report included transportation and development data for the KSURP area, as well as for the broader Kendall Square neighborhood.

Specific changes to the report include:

- Updated scope to include the broader Kendall Square neighborhood
- Analysis of PTDM data to assess transportation travel behavior and mode share
- Data on ridership and service for both subway and bus services in Kendall Square
- Boarding information from the EZRide shuttle
- KSURP parking garage data collection and analysis
- Bicycle counts at cordon locations and analysis of bikeshare data
- Crash data analysis
- Curbside use analysis for Main Street and Broadway

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6.0 INTRODUCTION

This chapter details the existing and proposed utility infrastructure that will service the Project. In addition to presenting the existing infrastructure and outlining early discussions with the City of Cambridge, the anticipated utility demands and impact on the local infrastructure is discussed. Early phases of the Concept Plan include investments by the City in the local infrastructure to improve utility capacity for development. The Applicant will implement measures to reduce impacts of the proposed infill development on the existing utility systems. These include employing a district-wide stormwater management approach to reduce the stormwater effluent off-site, mitigating Infiltration and Inflow (I/I) in the sewer system to increase available capacity for new wastewater flows, and applying water conservation measures to reduce demands on the potable water system.

CHAPTER UPDATES

The following section summarizes minor refinements to this Section since the Concept Plan Amendment #1.

- **Stormwater:** The existing and proposed stormwater calculations have been updated to reflect as-built conditions associated with Commercial Building A at 145 Broadway, and the proposed conditions associated with Commercial Building B at 325 Main Street. In addition, the proposed district stormwater management approach has been updated to eliminate permeable pavers, but will continue to explore the use of green roofs, landscaped areas, and subsurface infiltration to manage stormwater as detailed in the Figures herein.
- **Sanitary Sewer/Domestic Water:** The existing and proposed sanitary sewer and domestic water calculations have been updated to reflect the under construction conditions at Commercial Building B at 325 Main Street, and the proposed conditions associated with Residential Building South at 135 Broadway, Commercial Building C at 290 Binney Street, and Commercial Building D at 250 Binney Street.
- **Vulnerability Assessment:** The vulnerability assessment has been expanded to include projected flood elevations along Binney Street, Broadway Street and Main Street. While not a component of the Project, the relocation of the Eversource electrical substation will serve the Cambridge community and improve the resilience of the area electrical grid for decades to come.

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6.1 EXISTING INFRASTRUCTURE

6.1.1 STORMWATER

The existing MXD District is a densely developed, predominantly impervious urban area. The majority of the roadways in the area have separated storm drainage utilities for private and public stormwater runoff conveyance. The Cambridge Department of Public Works (CDPW) owns and maintains the extensive system of catch basins, manholes, and drain pipes. The District's catchment area drains to the Lower Charles River Basin via a 54-inch drain outfall at Broad Canal Way.

The Project will be required to meet the stormwater management standards of both the CDPW and the Massachusetts Department of Environmental Protection (DEP). To evaluate the proposed hydrologic conditions, an existing condition model was created in Hydro CAD as a baseline for evaluation. Table 6-1 shows the impervious and pervious land covers in the existing condition, as well as the resulting runoff rate and volume for the 2-year design storm.

The following is a list of existing storm drain services that are located adjacent to each project Component, which are also shown in Table 6-1.

Commercial Building A (145 Broadway):

- 54-inch main in Broadway (Construction is underway to replace 54-inch main with a 4.5' x 6.5' culvert)
- 30-inch main in Galileo Galilei Way

Commercial Building B (325 Main Street):

- 21-inch main in Main Street
- 18-inch main in Main Street

Residential Building South (Blue Garage):

- 54-inch main in Broadway (Construction is underway to replace 54-inch main with a 4.5' x 6.5' culvert)
- 18-inch service in East Service Drive
- 24-inch service in West Service Drive

Commercial Building C (290 Binney Street):

- 24-inch main in Binney Street
- 18-inch service in East Service Drive
- 12-inch service in West Service Drive

Commercial Building D (250 Binney Street):

- 24-inch main in Binney Street
- 18-inch service in East Service Drive
- 24-inch main in Pedestrian Way

Project Component	Existing Site Impervious Area (SF)	Existing Site Pervious Area (SF)	Existing Site Runoff Rate 2-year, 24-hour Design Storm (CFS)	Existing Site Runoff Volume 2-year, 24-hour Design Storm (AF)
Phase 1 Commercial Building A	27,707	10,155	2.09	0.164
Phase 2 Commercial Building B	28,823	0	2.03	0.150
Phase 3 Residential Building South	6,398	10,273	1.04	0.061
Phase 3 Commercial Building C	23,350	9,293	2.40	0.147
Phase 4 Commercial Building D	45,947	8,883	4.24	0.267
TOTAL	**132,225**	**38,604**	**11.80**	**0.789**

TABLE 6-1 EXISTING SITE HYDROLOGY

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6.1.2 SANITARY SEWER

The District is serviced by several separated sewer systems, as well as a large combined sewer main, as shown in Figure 6.1. The CDPW owns and maintains the local sanitary sewer system, which discharge to the Massachusetts Water Resources Authority (MWRA) conveyance system to the Deer Island Wastewater Treatment Plant. Wastewater flows from the Project will travel northeasterly by CDPW gravity flow sanitary sewer mains to the MWRA's system located in Cardinal Medeiros Avenue. During dry-weather conditions, the gravity mains in the area have sufficient capacity to support the Project. During wet weather conditions, some capacity issues arise as I/I takes capacity in the system from the wastewater. This will be mitigated through a program to remove I/I relative to the estimated wastewater generation of the Project.

The following is a list of the existing sanitary sewer mains adjacent to each Project Component:

Commercial Building A (145 Broadway):

- 21-inch main in Broadway
- 24-inch main in Galileo Galilei Way

Commercial Building B (325 Main Street):

- 10-inch main in Main Street
- 18-inch main in Main Street

Residential Building South (Blue Garage):

- 21-inch main in Broadway

Commercial Building C North (290 Binney Street):

- 30-inch main in Binney Street
- 98-inch combined sewer main in Binney Street

Commercial Building D North (250 Binney Street):

- 30-inch main in Binney Street
- 98-inch combined sewer main in Binney Street

6.1.3 DOMESTIC WATER

Domestic water and fire protection services in the District provided by infrastructure owned and maintained by the Cambridge Water Department (CWD) are shown in Figure 6.2. There are several transmission and local supply lines throughout the neighborhood to service the various Project components. The local supply system generally has high flow rates, but has water pressure that is typically lower than that required for tall developments. Booster pumps may be required to achieve nominal pressure in the domestic water and fire protection services for each Project component

The following is a list of the existing water mains adjacent to each Project Component:

Commercial Building A (145 Broadway):

- 16-inch main in Broadway
- 30-inch main in Broadway
- 16-inch main in Galileo Galilei Way

Commercial Building B (325 Main Street):

- 12-inch main in Main Street
- 12-inch main in Main Street

Residential Building South (Blue Garage):

- 16-inch main in Broadway
- 30-inch main in Broadway

Residential Building North (Blue Garage):

- 16-inch main in Binney Street
- 12-inch main in Binney Street

In addition, there are several water and fire protection services, which serve the existing buildings in the District. Services that are intended to remain active will be protected during the construction phase of this Project. There is also an existing private hydrant that is serviced by a water line running under the Blue Garage. This line will be maintained as part of this Project, and the CDW will be allowed unrestricted access to the line and hydrant at all times.

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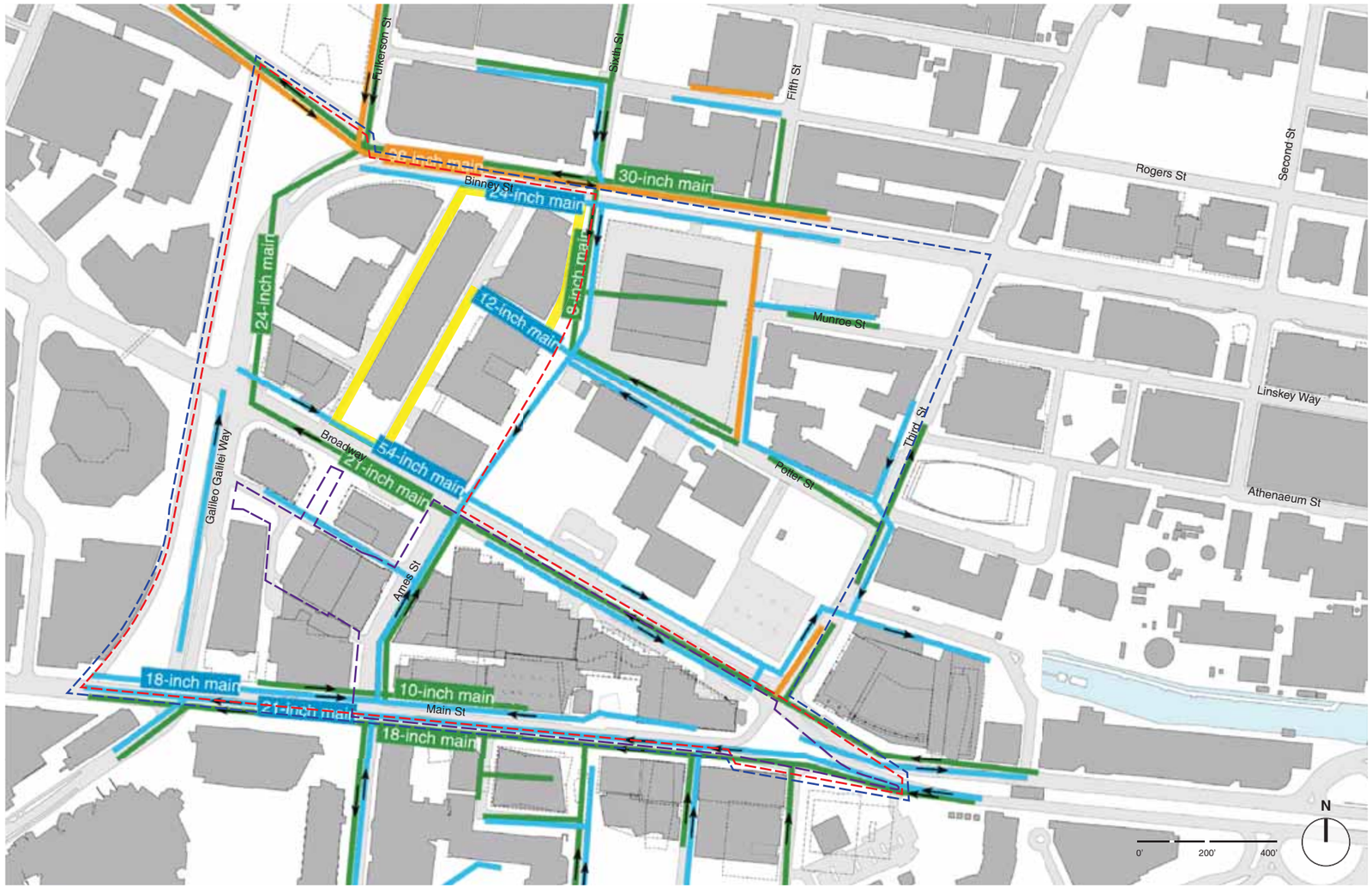
3.6 INFRASTRUCTURAL REPORT

EXISTING STORMWATER AND SEWER INFRASTRUCTURE FIGURE 6.1



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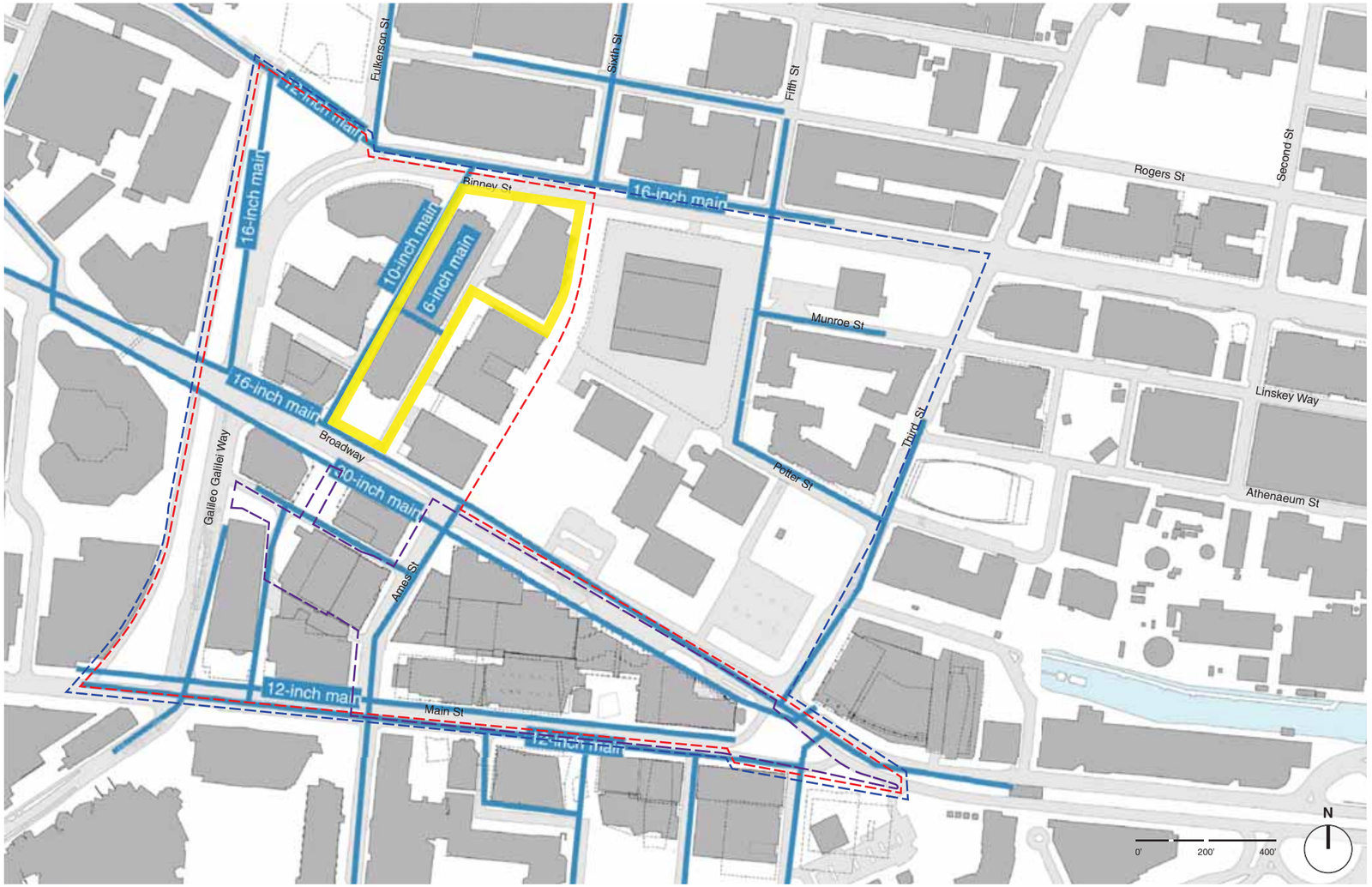
3.6 INFRASTRUCTURAL REPORT

EXISTING WATER INFRASTRUCTURE

FIGURE 6.2



MXD INFILL DEVELOPMENT CONCEPT PLAN

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6.2 PROPOSED INFRASTRUCTURE IMPROVEMENTS

6.2.1 STORMWATER IMPROVEMENTS

In addition to reviewing and approving any new private connections to existing infrastructure, the CDPW reviews and approves the stormwater management strategies of larger developments in the City. CDPW requires that new projects mitigate stormwater such that the peak rate and volume of stormwater runoff in the post-development condition during a 25-year design storm are equal to or lower than that of the pre-development condition for the 2-year design storm. In the existing condition, there are no stormwater management systems implemented throughout the Project Site that reduce the peak rate or total volume of runoff. Therefore, the Project will greatly improve stormwater contributions to the CDPW stormwater infrastructure by meeting the required mitigation thresholds.

To improve the quality, rate, and volume of runoff from the Project, the Applicant has designed preliminary stormwater management systems, which meet the City's requirements. As an infill project, there is limited opportunity to expand ground level landscaping to improve the hydrologic condition.

Therefore, the Applicant is exploring the use of green roofs to reduce the percentage of impervious cover for the Project. In addition, the Applicant is proposing an integrated stormwater management system for the Project that includes subsurface infiltration systems. The site at Commercial Building B introduces many challenges to infiltrate, including limited site area and the location adjacent to the MBTA red line tunnel and the City's right-of-way. Infiltration will be designed to the extent feasible at this location and will be supplemented by internal stormwater holding tanks. By applying this approach, the Applicant will meet or exceed the required stormwater mitigation standards set forth by the City of Cambridge and DEP. Table 6-2 provides the conceptual stormwater management system proposed for each Project Component. Figure 6.3A and Figure 6.3B provide a graphic display of the integrated stormwater management approach from this Project.

PROJECT COMPONENT	PROPOSED SITE IMPERVIOUS AREA (SF)	PROPOSED SITE PERVIOUS AREA (SF)[1]	INFILTRATION SYSTEM CAPACITY (CF)[2]	PROPOSED SITE RUNOFF RATE 25-YEAR, 24-HOUR DESIGN STORM (CFS)	PROPOSED SITE RUNOFF VOLUME 25-YEAR, 24-HOUR DESIGN STORM (AF)
Phase 1 Commercial Building A	27,707	10,155	2,106	2.00	0.164
Phase 2 Commercial Building B	28,823	0	5,926	2.15	0.227
Phase 3 Residential Building South	12,459	4,212	1,600	0.82	0.168
Phase 3 Commercial Building C	32,643	0	2,800	2.24	0.366
Phase 4 Commercial Building D	54,830	0	4,750	4.12	0.615
TOTAL	**156,462**	**14,367**	**17,218**	**11.33**	**1.540**

1. Green roofs included in proposed site pervious area

TABLE 6-2 PROPOSED SITE HYDROLOGY

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In addition to mitigating runoff flow rates and volumes, the Applicant is responsible for reducing the Phosphorus loads from the Project Site to the CDPW stormwater infrastructure to comply with the Lower Charles River Total Phosphorus Total Maximum Daily Load (TMDL) that requires the removal of 80 percent of Total Phosphorus. Applicant has developed several methods for reducing the Total Phosphorus. These include non-structural methods, increased landscape coverage and green roof installation, enhanced street sweeping program, on-site catch basin cleaning program, and an enhanced organic waste and leaf litter collection program for fall months. These methods can reduce Phosphorus export rates by up to 17 percent according to Attachment 2 of Appendix F of the Massachusetts Small MS4 General Permit (MS4). These nonstructural, Phosphorus pretreatment strategies will supplement the infiltration based, filter cartridge, or tank based structural treatment systems. Subsurface infiltration structures are the most effective means for removing Phosphorus from the Project Site, as well as reducing peak rate and total discharge of runoff off-Site.

Site and building roof runoff will be directed to the subsurface infiltration systems or rainwater detention/reuse tanks. In order to meet the stormwater peak rate requirements, set by the CDPW, the infiltration systems are designed to hold and infiltrate over 1-inch of runoff from the contributing area. A 1-inch treatment capacity will reduce phosphorus loads by 92 percent from the impervious contributing area. The entire Project Site area will drain to a structural Phosphorus mitigation measure sized to remove at least 80 percent of Total Phosphorus and therefore it is expected that the Project will meet the required DEP reduction targets.

6.2.2 SANITARY SEWER

Table 6-3 details the current wastewater generation estimate based on the DEP Sewer Connection and Extension Regulations, 310 CMR 15.203.f by building use with the latest KSURP building program. The Project is estimated to generate 196,152 of net new wastewater relative to the existing condition. As required by the CDPW, each Project component will have a sanitary holding tank capable of retaining the 8-hour peak sanitary flow from the building. The volume of each sanitary holding tank will be coordinated with the CDPW. In addition, all drainage from enclosed vehicular parking and loading will be treated with an MWRA approved gas/oil separator. If a portion of Project's program includes restaurant use, then a grease trap will be installed to pretreat kitchen wastewater effluent, thereby minimizing the potential impact to the CDPW sanitary sewer system.

The City of Cambridge is required to remove I/I from its sanitary sewer system by the MADEP in an effort to reduce and eliminate the potential for Combined Sewer Overflows (CSOs) to Massachusetts waterways. The CDPW is responsible for coordinating I/I removal for developments in Cambridge that generate greater than 15,000 GPD of wastewater, at a ratio of 4 gallons of I/I per GPD of wastewater. As such, the Applicant will coordinate an I/I removal plan with the CDPW before the individual buildings are occupied. Table 6-4 shows the estimated I/I removal for each project Component based on the estimated wastewater generation, which totals 784,608 gallons. The Applicant has previously completed an I/I removal project for the CDPW in 2019 titled "East Cambridge Sewer Separation". The completed work removed 269,969 GPD of I/I mitigation. The Applicant is currently constructing a culvert in Broadway for future I/I mitigation titled "Kendall Culvert". The final I/I removal volumes will be determined at the Design Review stage for each building and in consultation with CDPW.

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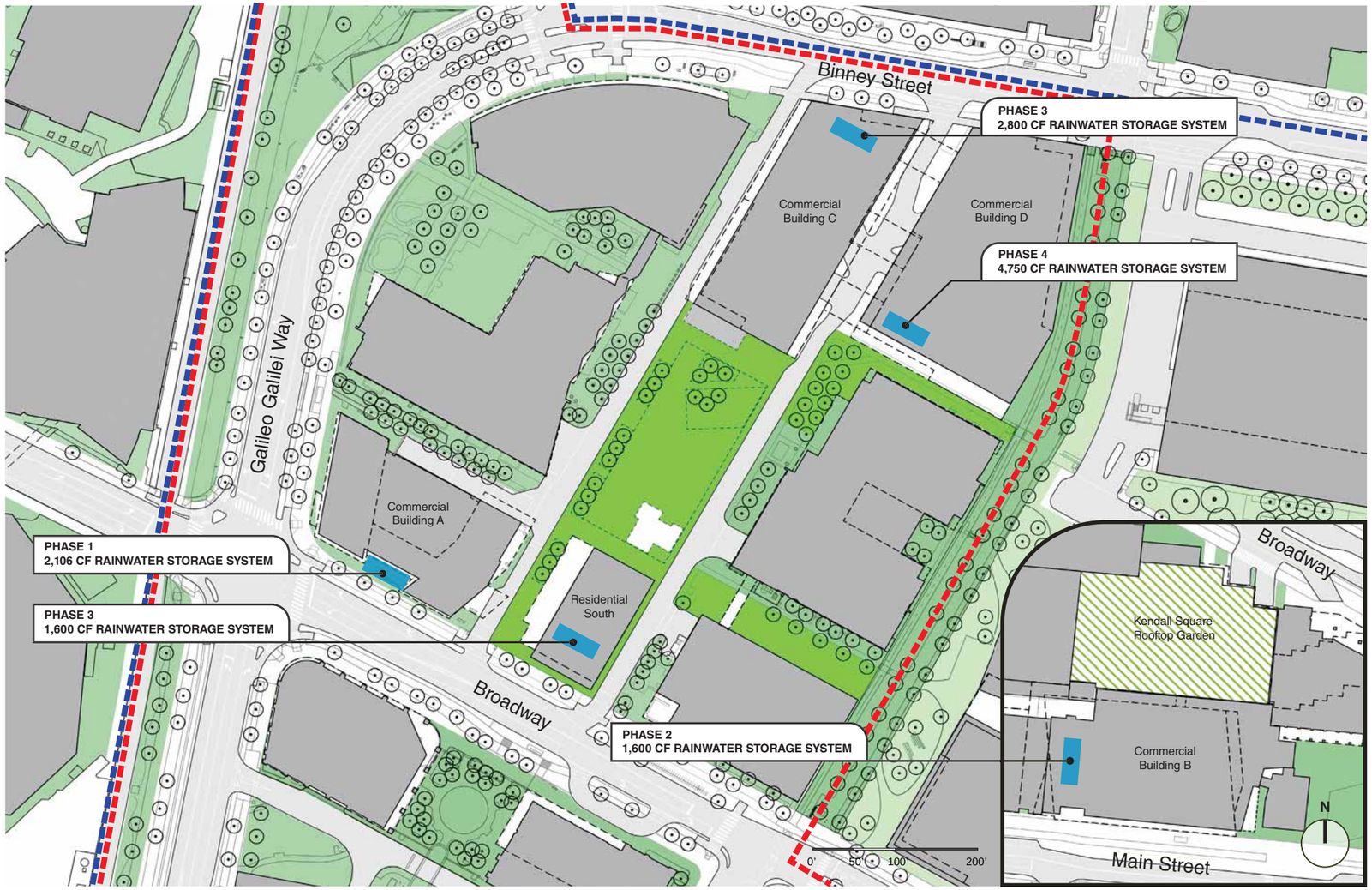
3.6 INFRASTRUCTURAL REPORT

PARCEL 2 - STORMWATER MANAGEMENT

FIG 6.3



Open Spaces
Green Roofs
Infiltration System

PARCEL 4 - 325 MAIN ST- STORMWATER MANAGEMENT

Locations of rainwater storage systems are subject to change depending on site logistics

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TABLE 6-3 ESTIMATED WASTEWATER GENERATION FOR THE PROJECT

COMPONENT[1]	USE	QUANTITY	FLOW RATE (GPD)	SEWAGE GENERATION (GPD)
New Project-Related Sewage Generation				
Phase 1 Commercial Building A	Office	432,914	75/1,000 sf	32,469
	Retail	2,872	50/1,000 sf	144
	Restaurant	207	35/seat	7,245
Commercial Building A Total				*39,858*
Phase 2 Commercial Building B	Office	345,423	75/1,000 sf	25,906
	Retail	20,000	50/1,000 sf	1,000
	Restaurant	500	35/seat	17,500
Commercial Building B Total				*44,406*
Phase 3 Residential Building South	Residential	635	110/bdrm	69,850
Residential South Total				*69,850*
Phase 3 Commercial Building C	Office	409,500	75/1,000 sf	30,712
	Retail	2,500	50/1,000 sf	125
Commercial Building C Total				*30,837*
Phase 4 Commercial Building D	Office	444,776	75/1,000 sf	33,358
	Retail	5,800	50/1,000 sf	*290*
Commercial Building D Total				*33,648*
Broad Institute Office Conversion	Office	14,000	75/1,000 sf	1,050
Broad Institute Total				1,050
Total New Project-Related Sewage Generation				**219,649**
Existing Sewage Generation to be Removed				
145 Broadway	Commercial	(78,636)	(75/1,000 sf)	(5,898)
325 Main Street	Commercial	(74,901)	(75/1,000 sf)	(5,618)
	Retail	(30,956)	(50/1,000 sf)	(1,548)
	Restaurant	(164)	(35/seat)	(5,740)
250 Binney Street	Commercial	(62,576)	(75/1,000 sf)	(4,693)
Total New Project-Related Sewage Generation				**219,649**
Net New Wastewater Generation				**196,152**

TABLE 6-4 CURRENT PROJECT I/I REMOVAL BY PROJECT COMPONENT

PROJECT COMPONENT[1]	NET NEW WASTEWATER GENERATION (GPD)	I/I REMOVAL REQUIREMENTS (GALLONS)
Phase 1 Commercial Building A Net New	33,960	135,840
Phase 2 Commercial Building B Net New	31,500	126,000
Phase 3 Residential Bldg. South Total	69,850	279,400
Phase 3 Commercial Building C	30,837	123,348
Phase 4 Commercial Building D	28,955	115,820
Broad Institute Office Conversion	1,050	4,200
Total	**151,332**	**605,328**

1. I/I removal is not required for the Innovation Space Conversion because it will generate the same amount of wastewater as the existing office space.

gpd = gallons per day

bdrm = bedroom

* assumes 25 sf per seat

**assumes 1.5 bedrooms per unit

1. The Innovation Space Conversion component is not included because it will generate the same amount of wastewater as the existing office space.

6.2.3 DOMESTIC WATER

During the MEPA review process, the CWD provided initial confirmation that the local water infrastructure should have sufficient capacity to serve the Project. The water demand for each Project component is initially estimated by applying a 10% consumption factor to the wastewater generation estimate. Therefore, the estimated Project water demand over the existing condition is equal to 215,767 GPD. The estimate for each Project Component is shown in Table 6-5. As discussed in Section 8, Sustainability, to meet the Project's sustainability goals, water conservation measures will be implemented for each Project Component to greatly reduce the water demand. Preliminary discussions with the CWD during the MEPA review process did not elucidate any capacity issues in the District to serve the Project for both domestic water and fire protection services. The Applicant will evaluate the need for domestic and fire protection booster pumps to compensate for any deficiencies in the water pressure in the water mains adjacent to each Project component. Hydrant flow tests conducted in the field will be used to make this evaluation. Where possible, redundant domestic water and fire protection services will be connected to a separate supply main, otherwise isolation valves will be installed to ensure that domestic water and fire protection services are not interrupted by isolated service issues. All existing domestic water and fire protection service lines that require removal will be cut and capped at the main, as required by the CWD.

TABLE 6-5 ESTIMATED WATER DEMAND BY PROJECT COMPONENT

PROJECT COMPONENT[1]	WATER DEMAND (GPD)
Phase 1 Commercial Building A Net New	37,356
Phase 2 Commercial Building B Net New	34,650
Phase 3 Residential Bldg. South Total	76,835
Phase 3 Commercial Building C Net New	33,921
Phase 4 Commercial Building D Net New	31,850
Broad Institute Office Conversion	1,155
Total Water Demand	**215,767**

1. The Innovation Space Conversion component is not included because it will have the same potable water demand as the existing office space

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6.3 VULNERABILITY ASSESSMENT

The Applicant has coordinated with the City of Cambridge to identify the capacity issues in the stormwater infrastructure serving the District. The Applicant is particularly concerned with the potential for inland flooding due to stormwater system surcharges, especially in context with the expected changes in precipitation patterns and sea level rise and storm surge. Using the City's latest flood modeling projections, the Applicant has identified the target finished floor elevations (FFEs) that would reduce the risk of the Project being impacted by sea level rise/storm surge flooding, and precipitation based from the 2070 100-year storm event. For Commercial Building A, Commercial Building C and Residential Building South, the 100-year flooding event projected for the year 2070 is approximately El. 20.20 Cambridge City Base (CCB). For Commercial Building B, the 2070 100-year flood event projection is approximately El. 20.30 CCB. According to the City's flood projections, Commercial Building D is not vulnerable to sea level rise/storm surge or precipitation based flooding from the 2070 100-year storm event.

The DPW recommends that building finish floor elevations be designed to the 2070 10-year flooding event projections, while being designed to recover from the 2070 100-year flooding elevations. The ability to recover was defined as locating critical infrastructure susceptible to flood damage above the 2070 elevation. These elevations do not take into consideration a precipitation event occurring concurrently with a storm surge event. For the 10-year storm with the impacts of climate change in 2070, minor flooding is expected in Broadway at Galileo Galilei Way, and along Main Street, and stormwater infrastructure will have limited capacity for increased flows. The flooding will be greatly exacerbated during a concurrent storm surge event propagating through the stormwater system. The Applicant will work with the City to review and confirm the appropriate FFE prior to design review for each Project component.

The Applicant intends to design all Project components to meet or exceed the recommended planning flood elevations. Figure 6.4 shows the recommended design flood elevations for the 2070 100-year design events as they relate to the existing topography. To account for the probability of a concurrent precipitation event with storm surge propagation in stormwater infrastructure, the Applicant will study additional resiliency measures. These measures may include oversized stormwater conveyance infrastructure, backflow preventers on effluent stormwater pipes, watertight internal gravity piping to the second floor, and the district wide stormwater management strategies, which greatly reduce the rate and volume of site stormwater effluent providing capacity for runoff from the remaining catchment area.

As flooding is expected to worsen over time, the Applicant will continuously review the latest design recommendations and literature to determine if/when portable flood protection systems, such as Portadam or the Aquafence Flood Barrier System, should be implemented on-site to increase the Project's resiliency. Similarly, the sanitary sewer system is expected to experience greater capacity issues from I/I with changes in precipitation patterns. To mitigate risk from sanitary sewer surcharge, backflow preventers will be installed on building sewer laterals, internal gravity piping will be watertight to the second floor, offline sanitary holding tanks will hold building wastewater during surcharge conditions, and the Project will address I/I as outlined in Section 6.2.2.

Minor flooding is expected along Main Street, but is not anticipated to impact the Kendall Plaza or the MBTA Redline Outbound Headhouse. The Applicant is committed to working with the MBTA to explore and improve the resiliency of the MBTA Redline Outbound Headhouse to flooding. The Applicant will explore potential measures to assist the MBTA with making its transit facilities in the KSURP area more resilient to inland flooding due to extreme precipitation. Conceptual, potential measures aimed at making the Kendall Square station more resilient to flooding could include trench drains with greater capacity than the existing systems, which could be installed at all entrances to the station to redirect more runoff from the area away from staircases to the station platforms. A more intensive, but effective means of flood protection would be mobile flood barriers. These walls can be stored by the MBTA on-site for use when flooding from extreme storm events are predicted. The flood barriers could be installed at station entrances around ground level utility vaults and adjacent to air intake/exhaust to greatly minimize the potential for flooding to effect operations of the station.

At the request of the City of Cambridge, and in response to growing demand for electricity in Cambridge the Project accommodates the relocation of an electrical an Eversource electrical substation. Re-siting this electrical substation is required to accommodate growth in Kendall Square, but will serve the Cambridge community and improve the resilience of the area electrical grid for decades to come.

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

FLOODING FROM 100-YEAR STORM SURGE AND PRECIPITATION EVENT

FIGURE 6.4

Source: City of Cambridge GIS, Harvard University, City of Boston, City of Cambridge, MassGIS, Esri, HERE, Garmin, INCREMENT P, Intermap, USGS, EPA https://www.arcgis.com/apps/webappviewer/index.html?id=1d30c73456d246f48daf8489405c6629

2070 - 100 Year - SLR/SS Flooding Extent
2070 - 100 Year - Extent of Flooding

MXD Boundary
KSURP Boundary
Ames Street District ASD

MXD INFILL DEVELOPMENT CONCEPT PLAN 207

* This page is from the 'IDCP Amendment 2 Conforming Document' issued 14 January, 2022

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4. SUSTAINABILITY

4.1.1 TABLE OF CONTENTS / PROJECT DESCRIPTION

Commercial East

250 Binney Street Cambridge, MA 02142

Design Review Filing

Article 14.74: 'Sustainability'
&
Article 22.20: 'Green Building Requirements'

Table of Contents:

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Sustainable Design Consulting
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Project Description

Commercial East (250 Binney Street), part of the MXD Infill Development Concept Plan (the "Concept Plan") within the Kendall Square Urban Renewal Plan (KSURP), is meeting the Article 22.20 requirement with a minimum of LEED Gold certification under the LEEDv4 Core and Shell rating system. The project scorecard for Commercial East will develop over the course of design, possible points may be achieved, and any updates to this report will be included in subsequent submissions or applications.

Commercial East at 250 Binney Street is proposed as part of Phase 4 of the Concept Plan. The redevelopment of Commercial East consists of a new, up to 16 story (±250') commercial building of up to approximately 431,288 GFA.

The team has committed to pursue formal LEED certification for the development. Additionally, because all portions of the project will be built as a campus with combined site and infrastructure elements the team will is looking into pursuing certification under a LEED Master Site. This will allow the project to show compliance with various LEED elements from a "campus approach".

General Project Information (Commercial East – 250 Binney Street)

SITE AND BUILDING AREA	
Total Site Area within the LEED Project Boundary (LPB)	TBD
Total Gross Floor Area	438,555 Gross Floor Area (GFA)
Retail Square Feet	7,267 GFA
Commercial Square Feet	431,288 GFA
Building Footprint	30,476 SF
TRANSPORTATION	
Parking Spaces	736
Long-Term Bike Storage	LEED requirement: 68 spaces
Short-Term Bike Storage	LEED requirement: 4 spaces

4.1.2 GREEN BUILDING PROFESSIONAL AFFIDAVIT / ENERGY AND EMISSIONS

GREEN BUILDING PROJECT CHECKLIST • ARTICLE 22.000 • GREEN BUILDING REQUIREMENTS

Affidavit Form for Green Building Professional
Special Permit

Green Building
Project Location: 250 Binney Street, Cambridge, MA

Green Building Professional

Name: CHRISTOPHER F. SCHAFFNER
☐ Architect
☒ Engineer
License Number: MASSACHUSETTS 37211 MECHANICAL
Company: THE GREEN ENGINEER, INC.
Address: 23 BRADFORD ST CONCORD MA 01742
Contact Information
Email Address: CHRIS@GREENENGINEER.COM
Telephone Number: 978-369-8978

I, CHRISTOPHER F. SCHAFFNER, as the Green Building Professional for this Green Building Project, have reviewed all relevant documents for this project and confirm to the best of my knowledge that those documents indicate that the project is being designed to achieve the requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.

(Signature) 5/6/21 (Date)

Attach either:

☒ Credential from the applicable Green Building Rating Program indicating advanced knowledge and experience in environmentally sustainable development in general as well as the applicable Green Building Rating System for this Green Building Project.

☐ If the Green Building Rating Program does not offer such a credential, evidence of experience as a project architect or engineer, or as a consultant providing third-party review, on at least three (3) projects that have been certified using the applicable Green Building Rating Program.

Greenhouse Gas Emissions
250 Binney Street

Energy Consumption	Area Light (kWh)	Misc. Equipment (kWh)	Space Heating (kWh)	Space Heating (Therm)	Space Cooling (kWh)	Pump & Aux (kWh)	Heat Rejection (kWh)	Ventilation Fans (kWh)	DHW (kWh)	Exterior Usage (kWh)		Total Electricity (kWh)	Total Natural Gas (Therm)	Total Energy (MBTU)
MA Energy Code Baseline	1,693,770	3,701,970	0	820,940	1,276,331	1,600,316	27,907	6,254,196	135,283	12,076		14,701,849	820,940	132,271
Proposed Design	1,693,770	3,701,970	5,062,478	88,212	1,554,913	1,312,301	25,632	6,078,515	95,016	12,076		19,536,671	88,212	75,500
Savings	0	0	-5,062,478	732,728	-278,582	288,015	2,275	175,681	40,267	0		-4,834,822	732,728	**56,772**
% Savings												-33%	89%	**43%**

Greenhouse Gas Emissions	Area Light (tons of CO2)	Electric Misc. Equipment (tons of CO2)	Electric Space Heating (tons of CO2)	Gas Space Heating (tons of CO2)	Space Cooling (tons of CO2)	Pump & Aux (tons of CO2)	Heat Rejection (tons of CO2)	Ventilation Fans (tons of CO2)	DHW (tons of CO2)	Exterior Usage (tons of CO2)		Electricity GHG Emission (tons)	Natural Gas GHG Emission (tons)	Total GHG Emissions (tons)
MA Energy Code Baseline	557	1,218	0	4,802	420	527	9	2,058	45	4		4,837	4,802	9,639
Proposed Design	557	1,218	1,666	516	512	432	8	2,000	31	4		6,428	516	6,944
Savings	0	0	-1,666	4,286	-92	95	1	58	13	0		-1,591	4,286	**2,696**
% Savings														**28%**

Conversion:
MWH to Lbs of CO2 (Electricity) 658 ISO New England CO2 Emission factor: 658 lb of CO2 per MWH reduction in electricity use
MBTU to Lbs of CO2 (Natural Gas) 117 Direct GHG Emissions Factor for the US from EPA
Lbs to Short Tons 0.0005

2,696 tons of GHG Emissions Savings is equivalent to GHG Emissions from:

6,775,581 Miles driven by an average passenger vehicle

OR

325 homes' energy use for one year

OR

2,979,844 Pounds of coal burned

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4.1.2 GREEN BUILDING PROFESSIONAL AFFIDAVIT / ENERGY AND EMISSIONS

Greenhouse Gas Emissions

250 Binney Street

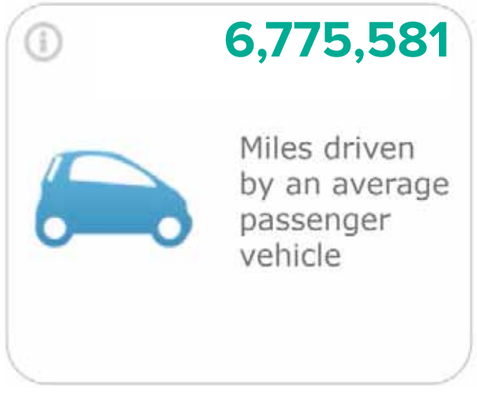
Energy Consumption	*Area Light (kWh)*	*Misc. Equipment (kWh)*	*Space Heating (kWh)*	*Space Heating (Therm)*	*Space Cooling (kWh)*	*Pump & Aux (kWh)*	*Heat Rejection (kWh)*	*Ventilation Fans (kWh)*	*DHW (kWh)*	*Exterior Usage (kWh)*		*Total Electricity (kWh)*	*Total Natural Gas (Therm)*	*Total Energy (MBTU)*
MA Energy Code Baseline	1,693,770	3,701,970	0	820,940	1,276,331	1,600,316	27,907	6,254,196	135,283	12,076		14,701,849	820,940	132,271
Proposed Design	1,693,770	3,701,970	5,062,478	88,212	1,554,913	1,312,301	25,632	6,078,515	95,016	12,076		19,536,671	88,212	75,500
Savings	0	0	-5,062,478	732,728	-278,582	288,015	2,275	175,681	40,267	0		-4,834,822	732,728	**56,772**
% Savings												-33%	89%	**43%**

Greenhouse Gas Emissions	*Area Light (tons of CO2)*	*Electric Misc. Equipment (tons of CO2)*	*Electric Space Heating (tons of CO2)*	*Gas Space Heating (tons of CO2)*	*Space Cooling (tons of CO2)*	*Pump & Aux (tons of CO2)*	*Heat Rejection (tons of CO2)*	*Ventilation Fans (tons of CO2)*	*DHW (tons of CO2)*	*Exterior Usage (tons of CO2)*		*Electricity GHG Emission (tons)*	*Natural Gas GHG Emission (tons)*	*Total GHG Emissions (tons)*
MA Energy Code Baseline	557	1,218	0	4,802	420	527	9	2,058	45	4		4,837	4,802	9,639
Proposed Design	557	1,218	1,666	516	512	432	8	2,000	31	4		6,428	516	6,944
Savings	0	0	-1,666	4,286	-92	95	1	58	13	0		-1,591	4,286	**2,696**
% Savings														**28%**

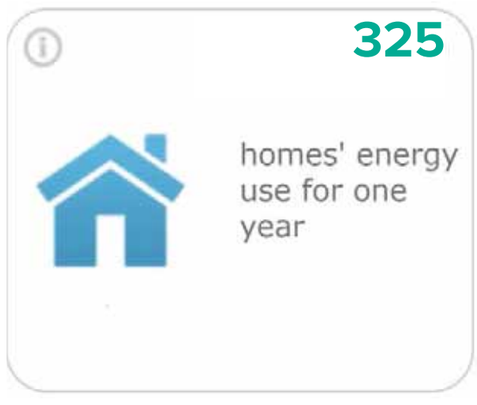
Conversion:

MWH to Lbs of CO2 (Electricity)	658	ISO New England CO2 Emission factor: 658 lb of CO2 per MWH reduction in electricity use
MBTU to Lbs of CO2 (Natural Gas)	117	Direct GHG Emissions Factor for the US from EPA
Lbs to Short Tons	0.0005	

2,696 tons of GHG Emissions Savings is equivalent to GHG Emissions from:



OR



OR

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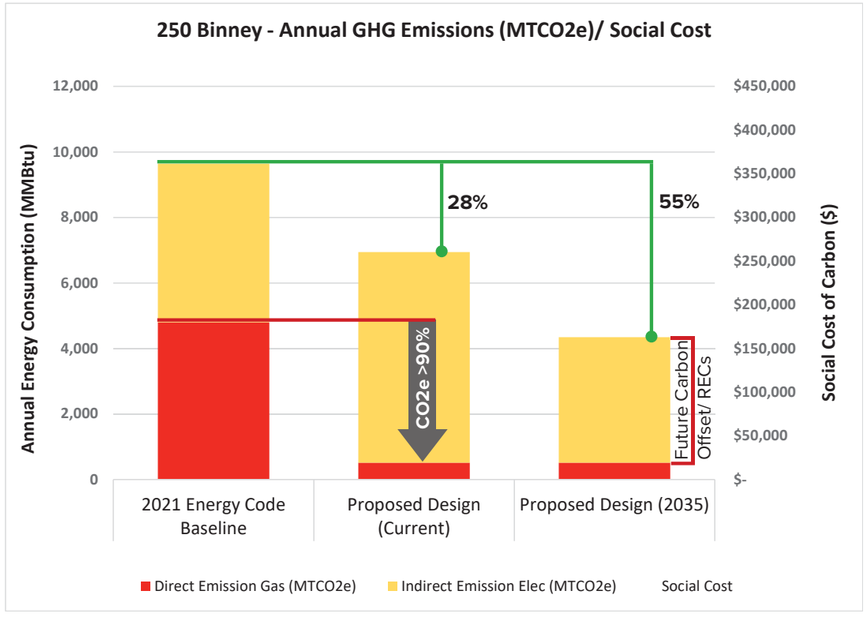
Transition to Carbon Neutrality

Annual GHG Emissions

The Basis of Design HVAC system was selected in alignment with the State of Massachusetts's and City of Cambridge's carbon neutrality goals. The proposed design consists of 100% Outside Air AHUs with Konvekta heat recovery system, all air-VAV with reheat in the lab spaces and 4-pipe Fan Coil Units/ Heat Pumps in the future office spaces. The water-side HVAC consists of high-efficiency water-cooled centrifugal chillers plus a heat recovery chiller as well as a hybrid hot water heating system, including high-efficiency gas-fired condensing boilers and air-to-water heat pump system, which is sized for approximately 20% of the boiler plant capacity.

The hybrid heating system was implemented to reduce the project dependence on the fossil fuel heating. With the current available technologies and the site condition, these laboratory buildings will not be able to be 100% electric and the boiler plant needs to be included; however, utilizing the Konvekta heat recovery system and Air-to-water heat pump for supplemental heating reduces the project's carbon footprint significantly and helps with transitioning to an all-electric system in the future. As the grid gets cleaner, the carbon footprint of the project reduces; as shown in the following graphs, the estimated GHG emissions of the proposed design in year 2035 (assuming a GHG rate of 392 lbs CO2e per MWh of electricity) would be more than 50% less that the Energy Code Baseline.

The hybrid system cannot be modeled in eQuest; therefore, a 8,760-hour spreadsheet calculation was performed: the capacity and efficiency of the air to water heat pump was calculated at each hour and the boiler consumption was adjusted accordingly. The electricity for the heat pumps was added to the total energy consumption. The preliminary analysis showed that the annual fossil fuel consumption and its associated GHG emissions will be reduced by 85-90%.



Social Cost of Carbon: "EPA and other federal agencies use estimates of the social cost of carbon (SC-CO2) to value the climate impacts of rule-makings. The SC-CO2 is meant to be a comprehensive estimate of climate change damages and includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning."
In this analysis, GHG savings are based on regional rates, and the environmental impact of the building was calculated for one year of operation. In order to evaluate the impact of climate change at a social level, the "Social Cost" of carbon was used as an additional metric. The EPA values this cost at $42/ton CO2e for year 2021 with a 3% average discount rate.

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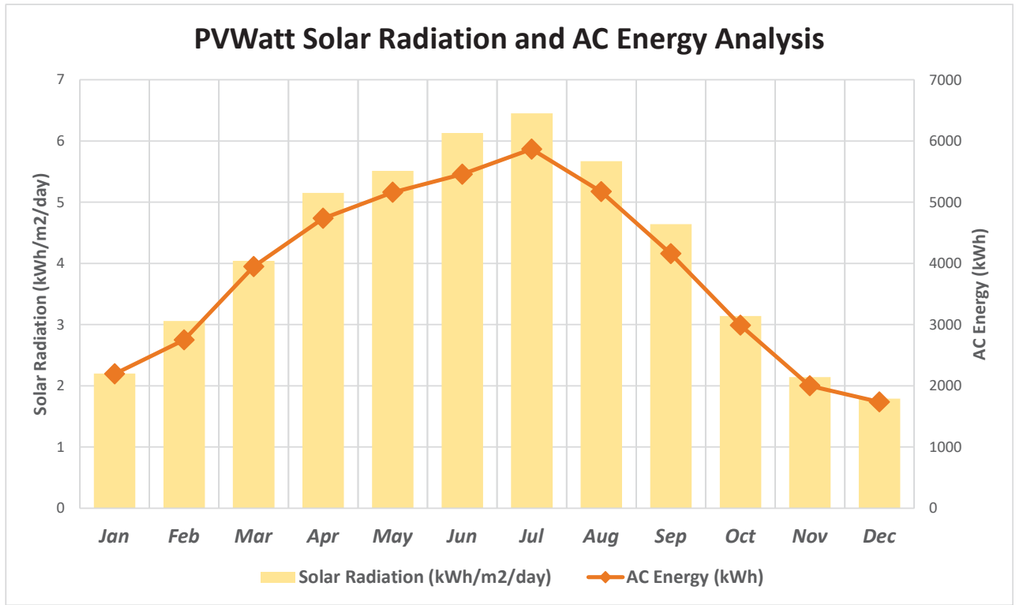
4.1.2 GREEN BUILDING PROFESSIONAL AFFIDAVIT / ENERGY AND EMISSIONS

Renewable Energy | Solar PV



RESULTS

Print Results

46,162 kWh/Year*

System output may range from 44,306 to 47,842 kWh per year near this location.
Click HERE for more information.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Value ($)
January	2.20	2,195	415
February	3.06	2,750	520
March	4.04	3,948	746
April	5.15	4,735	895
May	5.51	5,161	975
June	6.13	5,456	1,031
July	6.45	5,865	1,109
August	5.67	5,170	977
September	4.64	4,158	786
October	3.14	2,989	565
November	2.14	2,000	378
December	1.79	1,736	328

(PVWatts Calculation) - 250 Binney St

System Data:		**Annual Energy Savings:**
Building Location	Cambridge, MA	Generated Electricity from PV Array
Roof Area Available	2,500 SF	**46,162** kWh
System DC Power(kW)	40	
Array Tilt Angle	3	Annual Electricity Consumption
Array Azimuth Angle	180	**14,499,481** kWh
		% Generation/ Consumption
Inverter Efficiency	96%	**0.32%**

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4.1.3 WATER MANAGEMENT / COOL ROOFS

Water Management

Pursuant to Article 14.74 (b) of the Cambridge Zoning ordinance, the Project will reduce overall potable water use and reduce wastewater generation compared to a conventional development through installation of low-flow plumbing fixtures and high-efficiency irrigation systems. The Project is currently targeting a minimum 30% water use reduction compared to conventional plumbing fixtures (per Energy Policy Act of 1992 fixture performance requirements). Additionally, all water-consuming appliances will be ENERGY STAR certified at the most current version of the applicable standard.

The landscape design will incorporate native and adaptive vegetation and the design of the irrigation system will target, at minimum, a 50% reduction in potable water use when compared to a mid-summer baseline using high-efficiency irrigation systems with controllers and moisture sensors. Non-potable water use strategies, such as rainwater reuse will be considered for irrigation. In addition, the landscape design will consist mostly of local, drought resistant species to minimize or eliminate the need for irrigation over the lifetime of the Project. Landscape areas will be designed to hold as much rainwater as practicable. The Applicant is also considering the use of rainwater capture for irrigation and the incorporation of green roofs and a rainwater harvesting tank for the building.

The Project will largely maintain the existing site drainage, replacing existing impervious rooftop and hardscape in kind on-site. The Project will be required to mitigate stormwater runoff to comply with City and MassDEP standards. Stormwater infrastructure will be designed and installed for the Project to reduce the runoff discharge rate and improve the quality of the runoff to the City's stormwater system and the Charles River basin.

As the design progresses, the design team will continue to analyze the potential to further increase the Project's potable water consumption, both indoors and outdoors.

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Cool Roofs

Pursuant to Article 14.74 (c) of the Cambridge Zoning ordinance, the Project is taking several steps to include building-specific strategies to help reduce the Project's impact on the local urban heat island effect. The project aims to achieve this using a light-colored roofing membrane with a minimum initial solar reflective index (SRI) of 82 (or three-year aged SRI of 64), hardscape materials with an initial solar reflectance (SR) of 0.33 or greater (or three-year aged SR of 0.28), and a below-grade parking structure that greatly reduces the uncovered and impervious surface area needed for the Project's required parking.

The Applicant is also exploring the use of green roof cover, where feasible. Vegetation and shading structures will also be employed to shade the building and outdoor spaces, where possible. The roof membrane on all Project Components will be a high albedo roof product, excluding any green roof areas. All vehicle parking supporting the Project will

The Applicant understands the City Council approved a zoning petition on May 3, 2021 that would require installation of green roofs, or bio-solar roofs on future construction and significant rehab of buildings that are 20,000 square feet and larger. The Applicant is taking this requirement into account as the design advances for the remaining phases of the Project.

4.1.4 MONITORING / ROOFTOP EQUIPMENT NOISE MITIGATION

Monitoring

Pursuant to Article 14.74 (d) of the Cambridge Zoning Ordinance, the Applicant has a robust internal program for tracking building energy use over time, using Energy Star Portfolio Manager and other tools. The Project will include an energy management system to monitor operation of equipment or systems that are not already directly metered for electric or gas use. There will also be a centrally monitored electronic metering network in the base building design that is capable of being expanded to accommodate and document the future tenant sub-metering.

In compliance with the Cambridge Building Energy Use Disclosure Ordinance, Chapter 8.67 of the Municipal Code, the Applicant will report energy use.

Lastly, as mentioned in the 'Commissioning' section of this report, the Project will be implementing monitoring-based commissioning plan which will allow the building operators to track energy consumption, detect faulty equipment operations, and identify / address unusual energy consumption trends as they occur.

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Rooftop Equipment Noise Mitigation

Pursuant to Article 14.74 (e) of the Cambridge Zoning Ordinance, the MEPFP system located near, discharging at, or on the roof shall be selected to be low sound models to reduce their sound emissions, where such selections are possible during the design process. In general, equipment will have variable speed drives to reduce equipment capacity and lower sound emissions when the equipment needs to operate at a lower capacity. Furthermore, equipment shall include sound attenuators, equipment enclosures, and noise barriers to mitigate sound emissions to adjacent buildings and the surrounding community to comply with the City of Cambridge Noise Ordinance at full capacity operations and produce even lower sound levels when the demands from the building and equipment capacity are reduced.

4.1.5 COMMISSIONING / RESILIENCY

***NOTE: FOR ADDITIONAL INFORMATION ON RESILIENCY PLEASE REFER TO SECTION 4.1.13**

Commissioning

Pursuant to Article 22.24.2 of the Cambridge Zoning Ordinance, the Applicant will pursue commissioning in line with LEED v4 Fundamental and Enhanced Commissioning requirements. The commissioning agent will perform the scope of work required to comply with the prerequisite in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC & R systems, as they relate to energy, water, indoor environmental quality, and durability. Enhanced commissioning scope will include reviewing the Owner's Project Requirements, and the Basis of Design, creating, distributing and implementing a commissioning plan, performing a design review of the project documents, reviewing contractor submittals, witnessing on-site installations and testing and performing commissioning of installed HVAC, lighting, lighting controls and domestic hot water systems. Monitoring-based commissioning in line with LEED v4 Enhanced Commissioning Option 1 Path 2: Enhanced and Monitoring-Based Commissioning will also be pursued. Monitoring-based commissioning allows the building operators to track energy consumption, detect faulty equipment operations, and identify / address unusual energy consumption trends as they occur.

The Applicant will also be pursuing envelope commissioning in line with LEED v4 Enhanced Commissioning Option 2: Envelope Commissioning. The building envelope commissioning agent will perform the scope of work required to comply with the credit in accordance with ASHRAE Guideline 0–2005 and the National Institute of Building Sciences (NIBS) Guideline 3–2012, Exterior Enclosure Technical Requirements for the Commissioning Process, as they relate to energy, water, indoor environmental quality, and durability.

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Resiliency

The Applicant has studied the vulnerability of the infill development sites for the potential of precipitation-based inland flooding events. Potential building design resiliency measures being considered include limiting basement areas, and other improvements that may mitigate potential flooding. Additionally, ground floor finish elevations for the Project will be raised to the greatest extent possible to reduce the risk of internal flooding. Flood-resilient materials will be specified for first floor uses, where practicable.

Flood prevention techniques could include: sealed wall penetrations for cable and electrical lines; watertight door barriers; septic line backflow prevention valves, sump pumps, and discharge pumps—all of which could be connected to auxiliary external generator connections or resilient backup power. In addition, the Project is anticipated to include green roofs/roof gardens where feasible, and roofing membranes with high SRI to reduce the volume of storm water runoff and reduce solar heat gain/minimize air conditioning loads, respectively. Additionally, high-performance curtain wall is being considered to maximize views and daylighting of interior spaces, thus reducing overall lighting loads and associated internal heat gains, which has a direct impact on the space cooling load. As climate change analysis shows, the rising temperature increases the space cooling demand in the Cambridge climate; therefore, any strategy that can reduce the space cooling demand is considered an adaptive strategy for climate change.

On-site renewable energy, and a district energy network also provide opportunities for added resiliency during periods of power loss during storms. While the KSURP area is served by underground utility power lines and gas mains, and as such, is not normally effected by storms that disrupt power or gas transmissions, according to Massachusetts Department of Energy Resources (DOER), the Kendall Square Cogeneration Station (the "Cogeneration Station)") has been registered by the ISO-NE as a black start generation asset that can operate in island mode to provide both electricity to the Cambridge grid and thermal energy to the KSURP area in the event of a grid outage.

On-site combined heat and power (CHP), or solar PV, generally will operate in phase with the incoming utility power and needs incoming power to synchronize phase delivery. In "island mode", generators and CHP systems can be made to operate independently of the grid and self-synchronize power phasing with on-site solar. However, this approach is normally used in large-scale shelter locations only, when long-term operation may be needed to protect a group of people.

In most cases, the proposed commercial building will shut down and send occupants home in storm-related power failure scenarios. Any generators provided will most likely be optional standby generators that are sized to maintain server room or process operations only. The capacity provided by solar PV, even if the available space is maximized, will not provide all power needed for normal operations. A CHP system could be used to provide limited ongoing operation, but the economics of such a system when compared to the likelihood of repeated power outages in the Kendall Square area would not be favorable. Storm response actions and resiliency measures will be incorporated into tenant guidelines, including guidance related to tenant fit out of commercial space, particularly those located on the lower floors.

4.1.6 HEALTH AND WELLNESS / EMBODIED CARBON

Health and Wellness

Human health and wellness are addressed in the Project through design, operations, and occupant behavior. Within the Project, special attention will be given to address human health and comfort during construction and once the building is occupied. This will be accomplished by implementing pollutant reduction strategies, using non-toxic materials, providing fresh air to occupants, installing individual lighting and heating controls, and by providing natural daylight and views to outdoor green spaces. Tenant Design and Construction Guidelines will include comfort related requirements such as installing CO2 sensors in all regularly occupied spaces.

The Applicant is also exploring the use of principles of the WELL and/or Fitwel Building Standards, which place human health and wellness at the center of design and can encourage and educate future tenants on healthy living practices. Active design principles, encouraging physical and social activity, will be employed where possible. The Project site will include vibrant spaces where people can safely walk, bike, use transit, and access open spaces. Ground level outdoor spaces will be easily accessible to both building occupants and visitors alike.

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Embodied Carbon

The Applicant understands that, while CO_2 emissions are a major concern related to a building's operation, many of the prominent building materials commonly used in the built environment include a carbon-intensive life cycle that needs to be considered if the Project is to accurately assess the carbon impact of the building.

To quantify the embodied carbon impact of the Project, the design team will be performing a whole-building life cycle analysis (LCA) using tools like Athena, Tally, or One Click LCA. Additionally, the design team will ensure that the specifications call for materials and products with high-recycled content and have no or very minimal carbon impact by using the Embodied Carbon Calculator in Construction (EC3) Tool. The team will also use environmental product declarations (EPDs) to assess individual product's embodied carbon impact.

Lastly, products that sequester carbon (i.e. wood) will be used, where practicable.

4.1.7 LEED SCORECARD / GREEN BUILDING NARRATIVE

LEED Scorecard

Commercial East at 250 Binney Street (the “Project”) was reviewed for compliance using the USGBC’s LEED for Core & Shell (LEED-CS), version 4 rating system. The Project is targeting **66** out of a possible 110 credit points with an additional **32** credit points still undergoing evaluation to determine feasibility of achievement. By targeting **66** credit points, the Project anticipates meeting the City of Cambridge requirement to be LEED v4 Gold ‘certifiable’. In addition to the City of Cambridge requirements, the Project will be registered under the LEED-CS v4 rating system and will be pursuing formal certification with the USGBC.

The team will continue to evaluate design options against LEED requirements with the goal to design and construct a building that minimizes its impact on the environment, creates an engaging and healthy space for occupants and reduces operating costs. Several credits remain designated as ‘Maybe’ due to the uncertainty of future design decisions, which is common at this phase of the Project. The team will continue to evaluate LEED credits to pursue to ensure enough of a "point cushion" to ensure the LEED Gold requirement is met.

The USGBC recently released the beta version of the LEEDv4.1 rating system which is intended to serve as an update to (and improvement upon) LEEDv4. Recent guidance issued by the USGBC allows LEEDv4 projects to substitute any prerequisite or targeted credit for the LEEDv4.1 equivalent. Credits these buildings intend to pursue using the LEED v4.1 criteria have been denoted with (LEEDv4.1) adjacent to the credit name within the scorecard below and ensuing credit narratives.

Y	M	N			
1	0	0	**Integrative Process**		1
1			Credit 1	Integrative Process	1
19	1	0	**Location and Transportation**		20
		N	Credit 1	LEED for Neighborhood Development Location	
2			Credit 2	Sensitive Land Protection	2
3			Credit 3	High Priority Site	3
6			Credit 4	Surrounding Density and Diverse Uses	6
6			Credit 5 (LEEDv4.1)	Access to Quality Transit	6
	1		Credit 6 (LEEDv4.1)	Bicycle Facilities	1
1			Credit 7 (LEEDv4.1)	Reduced Parking Footprint	1
1			Credit 8 (LEEDv4.1)	Electric Vehicles	1
5	5	1	**Sustainable Sites**		11
Y			Prereq 1	Construction Activity Pollution Prevention	Required
1			Credit 1	Site Assessment	1
	1	1	Credit 2	Site Development - Protect or Restore Habitat	2
	1		Credit 3	Open Space	1
	3		Credit 4 (LEEDv4.1)	Rainwater Management	3
2			Credit 5	Heat Island Reduction	2
1			Credit 6	Light Pollution Reduction	1
1			Credit 7	Tenant Design and Construction Guidelines	1
5	6	0	**Water Efficiency**		11
Y			Prereq 1	Outdoor Water Use Reduction	Required
Y			Prereq 2	Indoor Water Use Reduction	Required
Y			Prereq 3	Building-Level Water Metering	Required
1	2		Credit 1	Outdoor Water Use Reduction	3

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2	3		Credit 2	Indoor Water Use Reduction	5
1	1		Credit 3	Cooling Tower Water Use	2
1			Credit 4	Water Metering	1
18	11	4	**Energy and Atmosphere**		33
Y			Prereq 1	Fundamental Commissioning and Verification	Required
Y			Prereq 2	Minimum Energy Performance	Required
Y			Prereq 3	Building-Level Energy Metering	Required
Y			Prereq 4	Fundamental Refrigerant Management	Required
6			Credit 1	Enhanced Commissioning	6
10	8		Credit 2	Optimize Energy Performance	18
	1		Credit 3	Advanced Energy Metering	1
		2	Credit 4	Demand Response	2
	1	2	Credit 5	Renewable Energy Production	3
	1		Credit 6	Enhanced Refrigerant Management	1
2			Credit 7	Green Power and Carbon Offsets	2
3	7	4	**Materials and Resources**		14
Y			Prereq 1	Storage and Collection of Recyclables	Required
Y			Prereq 2	Construction and Demolition Waste Management Planning	Required
	4	2	Credit 1 (LEEDv4.1)	Building Life-Cycle Impact Reduction	6
1		1	Credit 2 (LEEDv4.1)	BPDO – EPD	2
	1	1	Credit 3 (LEEDv4.1)	BPDO - Sourcing of Raw Materials	2
1	1		Credit 4 (LEEDv4.1)	BPDO – Material Ingredients	2
1	1		Credit 5 (LEEDv4.1)	Construction and Demolition Waste Management	2
7	0	3	**Indoor Environmental Quality**		10
Y			Prereq 1	Minimum Indoor Air Quality Performance	Required
Y			Prereq 2 (LEEDv4.1)	Environmental Tobacco Smoke Control	Required
Y			Prereq 3	Minimum Acoustic Performance	Required
2			Credit 1	Enhanced Indoor Air Quality Strategies	2
3			Credit 2 (LEEDv4.1)	Low-Emitting Materials	3
1			Credit 3	Construction Indoor Air Quality Management Plan	1
		3	Credit 4	Daylight	3
1			Credit 5	Quality Views	1
6	0	0	**Innovation**		6
1			Credit 1	Innovation: Purchasing - Lamps	1
1			Credit 2	Innovation: O&M Starter Kit	1
1			Credit 3	Exemplary Performance: Heat Island Effect	1
1			Credit 4	Exemplary Performance: EPDs / Material Ingredients	1
1			Credit 5	Pilot Credit: Integrative Analysis of Building Materials	1
1			Credit 6	LEED Accredited Professional	1
2	2	0	**Regional Priority (earn up to 4 points)**		4

4.1.7 LEED SCORECARD / GREEN BUILDING NARRATIVE

1			Credit 1	Regional Priority Credit: LTc3 High Priority Site (2 points)	1
	1		Credit 2	Regional Priority Credit: SSc4 Rainwater Management (2 points)	1
	1		Credit 3	Regional Priority Credit: WEc2 Indoor Water Use Reduction (4 points)	1
1			Credit 4	Regional Priority Credit: EAc2 Optimize Energy Performance - 17% (8 points)	1

66	32	12	TOTALS	Possible Points: 110

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LEED Narrative

Pursuant to Article 22.25.1 (b) of the Cambridge Zoning Ordinance, the Project meets the LEEDv4 Core & Shell Minimum Program Requirements, required, Prerequisites, and targeted Credits through the following strategies:

Integrative Process (IP)

IP Credit 1 Integrative Process — 1 credit point

The Project will meet the intent of this credit through identification of cross discipline opportunities to design a sustainable building project. Sustainable design focused meetings will be conducted in early design to assist the team in establishing shared sustainable design and energy / water efficiency goals for the project. Early design phase energy modeling is being conducted to review systems synergies and assess areas where energy loads may be significantly reduced. A water use analysis will be conducted to aid in establishing water use reduction targets.

The Project will continue to conduct interdisciplinary early meetings focusing on sustainability. These meetings will include the ownership group, architect, MEP engineer, energy analyst, and sustainability expert. An initial workshop was conducted in March 2021.

Location and Transportation (LT)

LT Credit 2 Sensitive Land Protection — 2 credit points

The Project will meet the credit requirements by locating the building on land that has been previously developed.

LT Credit 3 High Priority Site — 3 credit points

The Project will meet Option 2 requirements by being located on a site in a U.S. Department of Housing and Urban Development's Difficult Development Area as shown in the map below.

Additionally, the Project site soils are contaminated and will require remediation.

4.1.7 LEED SCORECARD / GREEN BUILDING NARRATIVE

LT Credit 4 Surrounding Density and Diverse Uses (LEEDv4.1) 6 credit points
The Project meets Option 1 for Surrounding Density by being located in an area with an average density greater than 35,000 sf/acre. The Project meets Option 2 for Diverse Uses by being located within ½ mile walking distance of at least 9 publicly available diverse uses in at least three separate use categories.

The Project is located within ½ mile of the following 9 diverse uses:

Category	Use Type	# of Diverse uses	Business Name	Distance (mi.)
Food Retail	Grocery Store	1	Brothers Marketplace	0.4 mi.
Community Serving Retail	Convenience Store	2	Fresh Mart	0.5 mi.
	Hardware Store	3	Fran-Dan Corporation	0.4 mi.
	Other Retail	4	MIT COOP @Kendal Sq.	0.3 mi.
Services	Restaurant	5	B.GOOD	0.3 mi.
	Health Club	6	Cambridge Athletic Club	0.4 mi.
	Bank	7	Bank of America Financial Center	0.3 mi.
Civic and Community Facilities	Police or Fire station	8	Cambridge Police Dept.	0.3 mi.
	Public Park	9	Danny Lewin Park	0.3 mi.

LT Credit 5 Access to Quality Transit (LEEDv4.1) 4 credit points
The Project is located within ½ mile walking distance of the Kendall/MIT MBTA station. This transit station provides occupants with access to 445 weekday rides and 264 weekend rides via the MBTA Redline, and MBTA bus lines 64, 68, 85 and CT2 which is greater than the 360 weekday and 216 weekend trips required for 6 points.

LT Credit 6 Bicycle Facilities (LEEDv4.1) *1 maybe point*
Short term and long-term bike storage will be provided for the building occupants and visitors. The quantity of short-term and long-term bike parking will meet the minimum LEED requirements as Cambridge bike parking requirements are more stringent. The Owner is evaluating the possibility of providing shower facilities accessible by building occupants (including any future retail employees). To achieve the point, a minimum of 4 total exterior short-term and 68 total covered long-term bicycle

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storage spaces are needed for visitors and regular occupants of the Project. Additionally, 10 total shower and changing facilities will need to be provided for use by building occupants. The immediate neighborhood provides a direct connection to a local bicycle network that links to a variety of services with pedestrian and cyclist access.

The Project will meet City of Cambridge requirements for bike storage.

LT Credit 7 Reduced Parking Footprint (LEEDv4.1) 1 credit point
A new, underground parking garage is proposed to provide on-site parking for employees and visitors. The new parking garage will provide up to 736 parking spaces for the Project which results in a >41% reduction to the baseline number of parking spaces calculated from the ratios set forth in the LEED reference guide.

LT Credit 8 Green Vehicles (LEEDv4.1) 1 credit point
The Owner has committed to provide EV charging stations to satisfy the LEED credit by providing EV charging stations for 5% of the total parking capacity. There are 736 parking spaces that will be provided. For those spaces, the Owner will outfit 5% as electric vehicle charging stations (37), 10% with electric vehicle charging station infrastructure (74), or a combination of both electric vehicle charging stations and electric vehicle-ready spaces to meet the credit requirements.

Sustainable Sites (SS)

SS Prerequisite 1: Construction Activity Pollution Prevention Required
The construction manager will be required to submit and implement an appropriate SWPPP/Erosion and Sedimentation Control (ESC) Plan for construction activities related to the construction of the Project. The ESC Plan will conform to the erosion and sedimentation requirements of the applicable NPDES regulations and specific municipal requirements for the City of Cambridge. Additionally, the ESC Plan will address management and containment of dust and particulate matter generated by on site demolition and construction activities.

SS Credit 1: Site Assessment 1 credit point
A comprehensive site assessment was completed as part of the MXD Infill Development Concept Plan. The design team will continue to study topography, hydrology, climate, vegetation, soils, human use, and human health effects specific to the Project to inform the design.

SS Credit 2: Site Development – Protect or Restore Habitat *1 maybe point*
The Owner is considering making a donation to a qualified Land Trust equivalent to $0.20 per square foot of project site area. A decision on whether this credit will be pursued will likely not occur until the Construction Phase.

SS Credit 3: Open Space *1 maybe point*
The project design will prioritize providing as much physically accessible outdoor space as possible. Once the landscape design progresses further, calculations will be performed to determine if the open space provided is equal to at least 30% of the total site area.

SS Credit 4: Site Development – Rainwater Management *3 maybe points*
The Project will implement a stormwater management plan that decreases the volume of stormwater runoff and the peak runoff rate by capturing and treating runoff using acceptable best management practices (BMP's). Some of the BMP's being considered are as follows:

- *Subsurface infiltration systems*
- *Rainwater harvesting and reuse*
- *Stormwater detention tanks*
- *Pervious landscaped areas*

4.1.7 LEED SCORECARD / GREEN BUILDING NARRATIVE

- *Deep sump, hooded catch basins*

The Project must comply with the Mass DEP Stormwater Management Policy, as well as reduce the peak rate for the 25-year design storm in the post-development condition to meet the two-year predevelopment condition, as required by Cambridge Department of Public Works (CDPW). Therefore, the Project will greatly improve stormwater contributions to the CDPW stormwater infrastructure by meeting the required mitigation thresholds.

SS Credit 5 Heat Island Reduction — 2 credit points
The roof and non-roof hardscape materials will include light-colored surfaces to reduce the overall heat island effect impact on the project site. The roof membranes will be high albedo roof products with an initial SRI value of 82 minimum. The inclusion of a green roof will be further studied as the design progresses. Paving materials will target an initial SR value of 0.28 minimum. All parking associated with the Project will be located undercover.

SS Credit 6 Light Pollution Reduction — 1 credit point
The Project will meet uplight and light trespass requirements by complying with the LEED v4 BUG Rating method. To meet credit requirements, the site lighting will not exceed the LEEDv4 allowable luminaire backlight, uplight and glare ratings for Lighting Zone 3.

SS Credit 7 Tenant Design and Construction Guidelines — 1 credit point
Tenant Design and Construction Guidelines will be developed outlining the sustainable design and energy efficiency measures in the core and shell phases and providing detailed guidance for the future tenants to design and build in alignment with the project sustainability goals. Information will also be included to assist tenants in pursuing LEED certification for their spaces. The team will encourage tenants to pursue LEED and/or WELL certification as part of their build out.

Water Efficiency (WE)

WE Prerequisite 1 Outdoor Water Use Reduction, 30% — Required
The Project will meet the minimum requirement of a 30% reduction in potable water use for irrigation. The Project is still evaluating if permanent irrigation will be included as part of the Project. If permanent irrigation is included for the Project, it will use efficient technology such that water use will show a minimum 50% reduction against a LEED baseline.

WE Prerequisite 2 Indoor Water Use Reduction, 20% Reduction — Required
Through the specification of low flush and flow and high efficiency plumbing fixtures, the Project will reduce potable water consumption by at least 20% over the baseline calculated for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements.

WE Prerequisite 3 Building Level Water Metering — Required
The Project will meet the requirements of this prerequisite by installing permanent water meters that measure the total potable water use of the building and associated grounds. In addition to installing the meters, The Owner will commit to sharing water usage data with the USGBC for a five-year period beginning on the date the Project accepts LEED certification or typical occupancy, whichever comes first.

WE Credit 1 Outdoor Water Use Reduction (LEEDv4.1) — 1 credit point, *2 maybe points*
The landscape design will incorporate native and adaptive plantings and the design of the irrigation system (if included in Project scope) will target at least a 50% reduction (1 point) in potable water use when compared to a mid-summer baseline using high controller efficiency and moisture sensors.

As the design progresses, the team will continue to analyze approaches to potentially achieve 75% (2 points) or 100% (3 points) reductions in potable water use for irrigation.

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WE Credit 2 Indoor Water Use Reduction — 2 credit points, *3 maybe points*
Through the specification of low flow and high efficiency plumbing fixtures, the Project will implement water use reduction strategies that at a minimum result in a 30% reduction in potable water use annually when compared to EPA baseline fixtures for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements.

Additional analysis will be performed will more aggressive water-saving fixtures to determine if the higher thresholds can be achieved.

WE Credit 3 Cooling Tower Water Use (LEEDv4.1) — 1 credit point, *1 maybe point*
The Project will conduct a one-time potable water analysis for the cooling tower water and calculate the cycles of concentration. Through increasing the level of treatment in the make-up and/or condenser water, the Project will achieve the calculated maximum number of cycles before any of the parameters analyzed exceed their maximum allowable levels of concentration. The control parameters that are required to be assessed are: Ca, total alkalinity, SiO_2, Ci, and conductivity.

The team will analyze the potential for using non-potable water for cooling tower makeup and/or increasing the treatment of the cooling tower makeup water to achieve 25% more cycles.

WE Credit 4 Water Metering — 1 credit point
To support water management and identify opportunities for additional water savings, the Project will include permanent water meters for a minimum of two water subsystems.

Energy and Atmosphere (EA)

EA Prerequisite 1 Fundamental Commissioning and Verification — Required
A commissioning agent will be engaged by the Owner for purposes of providing fundamental commissioning services for the building energy-related systems by the end of Design Development. The commissioning agent will perform the scope of work required to comply with the prerequisite in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC & R systems.

The commissioning agent (CxA) will be independent of the project's design and construction management teams. The commissioning agent will report findings to the Owner. The Owner's Project Requirements and the Basis of Design documents will be provided to the CxA for review.

The following systems will be included in the Commissioning scope of work:

- Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems
- HVAC controls
- Lighting controls
- Electrical systems
- Domestic hot water systems
- Plumbing and pumps
- Building Automation System
- PV (if applicable)

EA Prerequisite 2 Minimum Energy Performance — Required
To meet the prerequisite, the Project's building performance will demonstrate a minimum of 2% improvement in energy use by cost when compared to a baseline building's performance as calculated using the rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2010. The Project is also required to meet the MA Energy Code and MA Stretch Energy Code requirements. Comprehensive, iterative energy modeling will be used to explore design options to meet all Code

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requirements and to provide substantiation for the LEED application. Energy performance goals have been established and will be monitored throughout the design phase.

EA Prerequisite 3 Building Level Energy Metering — Required
To meet the requirements of this prerequisite, the Project will install whole building energy meters for gas and electricity. In addition to installing the meters, the Project will commit to sharing energy usage data with the USGBC for a five-year period beginning on the date it accepts LEED certification or typical occupancy, whichever comes first.

EA Prerequisite 4 Fundamental Refrigerant Management — Required
CFC based refrigerants will not be used in the Project's HVAC & R systems.

EA Credit 1 Enhanced Commissioning — 6 credit points
In addition to EApr1 Fundamental Commissioning and Verification requirements, Option 1 Path 2 Enhanced and Monitoring-Based Commissioning and Option 2 Building Envelope Commissioning will be pursued by the Project. The Owner will engage a commissioning agent to review the proposed design and verify the building systems meet the Owner's expectations and requirements.

The following commissioning process activities in addition to those required under EA Prerequisite Fundamental Commissioning and Verification will be completed by the commissioning agent, in accordance with ASHRAE Guideline 0–2005 and ASHRAE Guideline 1.1–2007 for HVAC&R systems, as they relate to energy, water, indoor environmental quality, and durability:

- Review contractor submittals.
- Verify inclusion of systems manual requirements in construction documents.
- Verify inclusion of operator and occupant training requirements in construction documents.
- Verify systems manual updates and delivery.
- Verify operator and occupant training delivery and effectiveness.
- Verify seasonal testing.
- Review building operations 10 months after substantial completion.
- Develop an on-going commissioning plan.

Requirements for enhanced and monitoring-based commissioning will be included in the OPR and BOD.

EA Credit 2 Optimize Energy Performance — 10 credit points, *8 maybe points*
For this submission, the Project is carrying an estimate that the building will perform 21% better on an annual energy cost basis than the ANSI/ASHRAE/IESNA Standard 90.1-2010 baseline building. We anticipate these percentages to increase as a result of the team's commitment to energy efficiency to meet the MA State Stretch Energy Code. Please see the Net Zero Narrative report for more information.

The team recognizes the importance of energy efficiency and will continue to evaluate opportunities reduce energy use and increase points within the Energy & Atmosphere category, specifically within the Optimize Energy Performance credit.

EA Credit 3: Advanced Energy Metering — *1 maybe point*
Advanced energy meters will be considered for installation as part of the base building. If this credit is pursued, tenants would be capable of independently measuring energy consumption for all systems dedicated to their space (electricity, chilled and or condenser water for cooling, hot water for heating, etc.) on a floor-by-floor basis.

EA Credit 5: Renewable Energy Production — *1 maybe point*
On-site renewable energy systems (i.e. PV) are being considered to potentially offset 1% (1pt) of the predicted annual energy costs for the Project. Additional analysis is required to determine if the installation of PV is cost-effective.

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EA Credit 6 Enhanced Refrigerant Management — *1 maybe point*
The HVAC equipment installed in the base building uses low-impact refrigerants that have low global warming and ozone depletion potential. Calculations will be run to determine compliance once equipment selections have been made.

EA Credit 7: Green Power and Carbon Offsets — 2 credit points
The Owner will purchase green power and carbon offsets through a 5-year contract to offset a minimum of 100% of the Project's energy use with renewable sources.

Materials and Resources (MR)

MR Prerequisite 1 Storage and Collection of Recyclables — Required
Storage of collected recyclables will be accommodated in a designated recycling area within the Project. Recyclable materials collected will include mixed paper, corrugated cardboard, glass, plastics, and metals, and the safe disposal of at least two of the following: batteries mercury-containing lamps, and/or electronic waste.

MR Prerequisite 2 Construction and Demolition Waste Management Planning — Required
The Project will meet the requirements of this prerequisite by including a Construction Waste Management section in Division 1 of the project manuals. The specifications will include direction for the construction manager to submit and implement a compliant waste management plan for the duration of construction. Waste diversion goals for the Project will include at least five materials targeted for diversion.

MR Credit 1 Building Life-Cycle Impact Reduction (LEEDv4.1) — *4 maybe points*
The Owner is considering engaging the architect to conduct a whole-building life-cycle assessment for the Project. If the analysis is performed, it would be used to refine the design accordingly such that it demonstrates that the structures and enclosures achieve at least a 5% reduction in a minimum of three of the six impact categories when compared to a baseline building. One of the impact categories must be global warming potential. The remaining impact categories that would be assessed are depletion of the stratospheric ozone layer, acidification, eutrophication, formation of tropospheric ozone and depletion of nonrenewable energy resources.

MR Credit 2 BPDO: Environmental Product Declarations (LEEDv4.1) — 1 credit point
The Project will achieve this credit via Option 1. The technical specifications will include direction for the construction manager and their sub-contractors to provide and submit materials and products Environmental Product Declarations that conform to ISO 14025, 14040, 14044, and EN 15804 or ISO 21930 and have at least a cradle to gate scope. The team will work to provide documentation for 10 different permanently installed products sourced from at least 3 different manufacturers.

MR Credit 3 BPDO: Sourcing of Raw Materials (LEEDv4.1) — *1 maybe point*
The technical specifications will include information for applicable products and materials to meet one of the following extraction criteria (as applicable): Extended producer responsibility, Bio-Based materials, FSC wood, Materials reuse, Recycled Content, and/or regionally extracted and manufactured (within 100 miles of the project site). The Project will attempt this credit, but compliance cannot be assured until well into construction of the building.

MR Credit 4 BPDO: Material Ingredients (LEEDv4.1) — 1 credit point, *1 maybe point*
The Project will pursue Option 1 and Option 2 for product and material disclosure, and by selecting products and materials with third party confirmation of reduced hazardous substances. The project manuals will include the information and direction for the construction manager and their sub-contractors to provide and submit materials and products documentation identifying the chemical

4.1.7 LEED SCORECARD / GREEN BUILDING NARRATIVE

make-up. The documentation may be Health Product Declarations, Cradle-to-Cradle or Declare certification. The team will provide documentation for 10 different permanently installed products sourced from at least 3 different manufacturers.

MR Credit 5 C&D Waste Management (LEEDv4.1) 1 credit point, *1 maybe point*
The Project will meet the requirements of this credit by including a Construction Waste Management section in Division 1 of the project manuals. The specifications will include direction for the construction manager to attempt to divert a minimum of 50% of the demolition and construction waste generated on site from area landfills. On-site separation of waste will be prioritized as part of the strategy to meet this credit.

To achieve an additional point, the Project will need to generate less than 10 lbs/sf of total waste (construction and demolition).

Indoor Environmental Quality (IEQ)

IEQ Prerequisite 1 Minimum IAQ Performance Required
The Project's mechanical systems are being designed to exceed the requirements of ASHRAE Standard 62.1-2010 sections 4 through 7. The mechanical engineer will complete a ventilation rate procedure (VRP) calculator to verify compliance for the Project. Outdoor airflow monitors will be included in the Project.

IEQ Prerequisite 2 Environmental Tobacco Smoke Control (LEEDv4.1) Required
Smoking will be prohibited in the Project and within 25' of the building. Signage will be posted within 10' of all building entrances to indicate the interior and exterior no-smoking policy.

IEQ Credit 1 Enhanced Indoor Air Quality Strategies 2 credit points
The Project is being designed to incorporate permanent entryway systems, properly enclosed and ventilated chemical use/storage areas, and compliant filtration media (MERV 13+).

Additionally, the Project anticipates providing ventilation rates that are at least 30% above the minimum requirements of ASHRAE 62.1-2010.

IEQ Credit 2 Low Emitting Materials 3 credit points
The Project will achieve this credit through meeting the compliance criteria for the following compliant categories: interior paints and coatings, adhesives and sealants, flooring, ceilings, insulation, and composite wood. Intending to achieve at least 4 categories for 3 points.

IEQ Credit 3 Construction Indoor Air Quality Management Plan 1 credit point
The project manuals will include direction for the Construction Manager to develop and implement an Indoor Air Quality Management plan in compliance with applicable control measures as stated in the SMACNA IAQ Guidelines for Occupied Buildings under construction 2nd Edition, 2007 ANSI/SMACNA 008-2008 Chapter 3. Additional measures will be implemented to ensure absorptive materials will be protected from moisture damage.

IEQ Credit 8 Quality Views 1 credit point
A direct line of sight to the outdoors and/or atrium will be provided for 75% of the regularly occupied floor area of the Project. 75% of the regularly occupied floor area will also have quality views to the outdoors which will include multiple lines of sight; unobstructed views; views to landscaped areas, sky, pedestrian walkways, and streetscapes.

Innovation (IN)

Inc1 Innovation: Purchasing - Lamps 1 credit point

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The Project will achieve one innovation point by complying with LEED Innovation Credit: Purchasing – Lamps, which requires that the calculated average mercury content for the Project be below 35 picograms of Hg per lumen hour. The Project will be 100% LED.

Inc2 Innovation, O & M Starter Kit 1 credit point
The Owner will develop and implement compliant Green Cleaning and Integrated Pest Management policies that will ensure reduce the use of chemical inputs and provide increased human health and wellbeing during operation.

INc3 Exemplary Performance: SSc5 Heat Island Reduction 1 credit point
The Project will achieve Exemplary Performance for Heat Island Reduction by meeting both Option 1: Roof and Nonroof and Option 2: Parking Under Cover.

INc4 Innovation, TBD 1 credit point
The Project is exploring several options to achieve this Innovation credit and are confident that a path will be found to earn all innovation credits. Options include, but are not limited to, exemplary performance in MRc2/3 BPDO: Environmental Product Declarations/Material Ingredients, Green Building Education, Occupant Comfort Survey, Social Equity within the Project team, Safety First policies, or Beauty and Design WELL feature compliance.

INc5 Pilot: Integrative Analysis of Building Materials 1 credit point
The Project will specify, purchase, and install three different permanently installed products that have a documented qualitative analysis of potential health, safety, and environmental impacts of the product over its life cycle.

INc6 LEED Accredited Professional 1 credit point
Many members of the team are LEED Accredited Professionals (APs).

Regional Priority (RP)

Regional Priority Credits (RPCs) are established by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs, an additional credit is awarded to the project. LEEDv4 RPCs applicable to the Cambridge area include: LTc3 High Priority Site (2 points), SSc4 Rainwater Management (2 points), WEc2 Indoor Water Use Reduction (4 points), EAc2 Optimize Energy Performance (17%/8 points), EAc5 Renewable Energy Production (3%/2 points), and MRc1 Building Life-Cycle Impact Reduction (2 points).

The Project is currently tracking the following RPCs:

EAc2 Optimize Energy Performance	1 credit point
LTc3 High Priority Site	1 credit point
SSc4 Rainwater Management	*1 maybe point*
WEc2 Indoor Water Use Reduction	*1 maybe point*

4.1.8 ENERGY MODEL REPORT

ATTACHMENT A
Energy Model Report

Environmental Performance Analysis

Blue Garage Commercial

250 Binney Street, Cambridge, MA

July 2, 2021

Prepared for: Boston Properties

Prepared by: enviENERGY Studio

4.1.8 ENERGY MODEL REPORT

Executive Summary

The purpose of this energy study is to investigate the project compliance with the Massachusetts Energy Code requirements and to evaluate the impacts of several architectural and mechanical systems on the project overall energy use and cost. The minimum requirements of ASHRAE 90.1-2013 (Energy Code Baseline) and the proposed design assumptions for each building, are listed in the Energy Modeling Assumptions tables. As demonstrated in the report, in order to reduce the annual energy consumption of each building, the design team will implement a series of integrated strategies. The studies and analyses presented here focus on aspects of energy efficiency, thermal comfort, water conservation and GHG reduction that are most applicable to the early stages of design.

This energy analysis shows that all Proposed Design buildings meet and exceed the LEED v4 Minimum Energy Performance and MA Energy Code requirements.

	Electricity (kWh)	Natural Gas (Therms)	Total Site Energy (MBTU)	Total Source Energy (MBTU)	Total Site Energy Cost ($)	Performance Savings	
						Site Energy	Source Energy
B250- Energy Code Baseline	14,701,849	820,940	132,267	226,695	$ 3,620,932		
B250- Proposed Design	19,536,671	88,212	75,500	195,963	$ 3,639,436	42.9%	13.6%

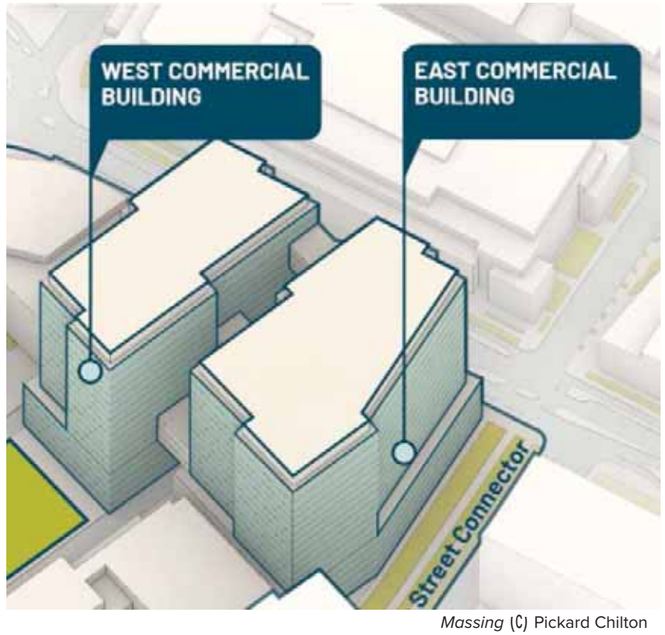
Methodology

The DOE2.3 based energy simulation program, eQuest 3.65, has been used in this analysis to generate the estimated annual energy savings associated with each proposed option. The building geometries are based on the preliminary massing, and the window-to-wall ratios are estimated based on the current design.

Please note that the proposed estimated energy performance and cost are not predictions of actual energy consumption or costs for the proposed design after construction. The actual energy use will differ from these estimates due to the variations in occupancy patterns and schedules, weather conditions, and building operation and maintenance, but the energy modeling results should serve as an accurate comparison tool.

The following energy models were generated:

- **Massachusetts Stretch Energy Code Baseline:** Following the Appendix G – Performance Rating Method and Mass Amendments to IECC 2018, the envelope, HVAC, lighting, and service water heating systems are modified to meet the minimum requirements of ASHRAE 90.1-2013 Standard. This model is used as the baseline for MA Energy Code analysis. Per C406.1 Requirements, both baseline and proposed models include three additional efficiency measures: (1) 10% reduction in lighting power density; (2) 10% increase in the HVAC system efficiencies; (3) Reduced air infiltration.
- **LEED v4 Baseline:** Per USGBC guidelines, LEED projects that are subject to alternative energy codes stringent than ASHRAE 90.1-2010 are allowed to demonstrate additional energy performance improvements. In this analysis, ASHRAE 90.1-2013 model was used as the baseline case for LEED. An additional 2-3% savings can be applied to the estimated LEED performance savings.
- **Proposed Options:** The proposed design represents the actual design.



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4.1.8 ENERGY MODEL REPORT

Energy Performance Analysis

Introduction

The project consists of two (2) core and shell lab/office buildings; It is assumed that 60% of the gross floor area in each commercial building is allocated to laboratory spaces and the rest will be office, common and back-of-house areas. The design team has divided the building elements into passive, building envelope, and active, MEP systems, and implemented measures so that the overall building envelope meets and exceeds the IECC 2018 envelope performance recommendations before introducing any active energy efficiency measures.

The proposed design incorporates the following energy conservation measures:

- High-performance window system; U-0.24 and SHGC-0.25
- High-efficiency LED light fixtures
- High-efficiency water-cooled centrifugal chillers with VSD
- High-efficiency cooling towers
- Konvekta Heat Recovery system
- Variable speed pumping systems
- Hybrid heating system: High-efficiency gas-fired condensing boilers plus air-to-water heat pump
- Low-flow plumbing fixtures

Setpoints

Setpoints were entered identically in both the baseline and proposed models. See below for the temperature setpoints used.

Office and Laboratory:			
Heating set point:	70˚ F	Heating setback:	66˚ F
Cooling set point:	75˚ F	Cooling setback:	80˚ F
Storage and Mechanical:			
Heating set point:	60˚ F	Heating setback:	60˚ F

Internal Gains

The interior lighting power densities in the commercial energy models has been modeled based on the building-area-method, following Table C405.3.2 of Massachusetts Amendments and a 10% reduction in the interior lighting power densities was applied as one of the C406 ECMs.
Automatic lighting controls for daylight utilization and for occupancy are accounted for in the analysis. In both the proposed and the baseline models, daylight controls are input per the minimum requirements of Section 9.4. As the occupancy sensors are assumed to match the code minimum, no additional credit has been taken.
End uses such as computers and receptacles and laboratory equipment are included as process gains. These are inputs to reflect the design team's understanding of the anticipated equipment usage and are identical between the baseline and the proposed models.
The occupancy reflects the design team's understanding of the typical number of people that will be in the building and is identical in the baseline and proposed models.

Building Envelope

The vertical elements of the envelope primarily consist of curtainwall system. In this preliminary analysis, the overall window area is approximately 41% of the building exterior wall area. High performance insulated glazing throughout with the overall window assembly U-value of 0.24 and SHGC of 0.25. The opaque area consists of insulated spandrel panels with an overall U-value of 0.10.

Mechanical Systems

The commercial building HVAC system will consist of 100% OA AHUs with Konvekta Energy Recovery Ventilators (modeled with 60% effectiveness) and Fan Coil Units which will be designed to provide heating, cooling, and ventilation for the building, meeting the requirements of ASHRAE 55, ASHRAE 62.1 and ASHRAE 90.1. Ventilation air will be provided by variable volume Energy Recovery Air Handling Units and future tenants will have the flexibility of installing 4-pipe Fan Coil Units or other terminal units. High-efficiency water-cooled centrifugal chillers will provide chilled water to the AHUs and FCUs. The hot water will be heated by a hybrid system including air-to-water heat pump system and high efficiency condensing gas boilers.

4.1.8 ENERGY MODEL REPORT

Energy Modeling Assumptions | 250 Binney Street

		Laboratory/ Office 60%/40%	Stretch Energy Code Baseline ASHRAE 90.1-2013 + MA Amendments		Proposed Design (BOD)
Envelope	**Windows**		Metal framing (fixed): U-value of 0.42; SHGC-0.40		BOD: 100% Curtainwall Upper levels(Triple-pane Glass): U-0.28 or lower; SHGC-0.30
	Window-To-Wall Ratio		40%		41%
	Roof		Insulation entirely above deck; R-30 c.i.; U-value of 0.032		R-30 c.i.; U-value of 0.032
	Slab-on-grade		Unheated: R-15 for 24 inch		Meets ASHRAE 90.1-2013 requirements
	Infiltration (Mandatory)		**C406 ECM #1:** Reduced air infiltration in accordance with C406.9 - 0.25 CFM/SF of building envelope		**C406 ECM #1:** Reduced air infiltration in accordance with C406.9 - 0.25 CFM/SF of building envelope and commitment to pressurization testing
	Exterior Walls		Steel-framed: R-13 + R-10 c.i.; U-0.055		Curtainwall system with continuous insulation behind mullion and spandrel; U-0.10
Interior Loads	**Occupancy**		Office: 250 SF/ Person Lab: 400 SF/ Person		Office: 250 SF/ Person Lab: 400 SF/ Person
	Interior Lighting		**C406 ECM#2:** 10% reduction per C406.3 0.64 W/SF Office **(0.576 W/SF)** 1.33 W/SF Laboratory **(1.197 W/SF)** 0.84 W/SF Lobby **(0.756 W/SF)**		**10% reduction per C406.3 (with lease agreement)** 0.576 W/SF Office 1.197 W/SF Laboratory 0.756 W/SF Lobby
	Plug Load		Office: 0.90 -1.1 W/SF (50% turndown) Lab: 4 W/SF (Including Fume Hoods)		Office: 0.90 -1.1 W/SF (50% turndown) Lab: 4 W/SF (Including Fume Hoods)
	Elevator Load		Each car at 11 kW		Each car at 11 kW
DHW	**Low-Flow Hot Water Fixtures**		LEED v4 Baseline		Target at least 30% reduction
	Water Heater type & Efficiency		Electric resistance		Electric Heaters

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4.1.8 ENERGY MODEL REPORT

Energy Modeling Assumptions | 250 Binney Street

		Laboratory/ Office 60%/40%	Stretch Energy Code Baseline ASHRAE 90.1-2013 + MA Amendments		Proposed Design (BOD)
Primary HVAC System	System Type		System #7: VAV with reheat; Chilled water; Hot water		Ventilation: 100% OA AHUs + Konvekta Heat Recovery Lab: All-air VAV with reheat Office: FCUs/ Heat Pump
	Cooling Type & Efficiency		Water-cooled Centrifugal; ≥600 tons: 0.560 FL, 0.500 IPLV **C406 ECM#3:** 10% increase in minimum efficiencies per C406.2: 0.513 FL; 0.4851 IPLV		Variable Speed Centrifugal Chillers Full Load Efficiency = 0.560 kW/Ton; 0.355 NPLV ARI Condition: FL 0.520 kW/Ton; 0.340 NPLV **C406.2: 10% improvements to be targeted**
	Heating Type & Efficiency		Gas-fired Boiler; 82% efficiency **C406 ECM#3:** 10% increase in minimum efficiencies per C406.2: 90%		Condensing Boilers, 92% EFF, plus an air-to-water heat pump (sized at 20-25% of the heating capacity) **C406.2: 10% improvements in thermal efficiency is achieved**
	HW Supply Temperature & Control		180˚ F; OA Temperature Control		140 ˚ F; OA Temperature Control
	Hot Water ΔT		50˚ F		40˚ F
	HW Pumps		Primary only; variable speed		Primary and Secondary; variable speed pumps
	CHW Supply Temperature & Control		44˚ F; OA Temperature Control		42˚ F; OA Temperature Control
	Chilled Water ΔT		12˚ F		16˚ F
	CHW Pumps		variable speed on secondary pump		Primary; Variable speed pumps
	Cooling Towers		Variable speed fans		Variable speed fan
	CW Design Supply Temperature		Boston: 7.5˚ F approach = 78.5 ˚ F with 10˚ F rise		Design WB: 78˚ F; 85˚ F with 10˚ F rise
Air-Side HVAC	Ventilation		8 ACH (occupied)/ 4 ACH (unoccupied) in lab Energy Recovery was not modeled for the lab system, following section 6.5.7.2. Office meets ASHRAE 62.1 requirements and is equipped with energy recovery (50% Effectiveness)		8 ACH (occupied)/ 4 ACH (unoccupied) in lab 20 CFM/person in office Konvekta heat recovery system
	Supply Fan Control and Sizing		Primary System: Variable Volume Supply-air-to-room-air temp of 17F in lab and 20F in office		Variable Volume; Cycling fans on FCUs

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4.1.8 ENERGY MODEL REPORT

Energy Modeling Assumptions | C406 Energy Conservation Measures

Per the Massachusetts Amendments to IECC 2018, buildings following ASHRAE 90.1 or IECC shall comply with at least three Energy Conservation Measures listed under Section C406.1. The following ECMs are proposed for and were implemented in both the Baseline and Proposed case models.

The Commercial Buildings 250 and 290 incorporate the following energy conservation measures:

- ECM#1: Reduced air infiltration in accordance with Section C406.9: Per IECC 2018, the tested air leakage rate of the building thermal envelope should not be greater than 0.40 CFM/SF of building envelope, at a pressure differential of 0.3 inch water gauge (75 pa). Per Section 406.9, this tested infiltration rate should not be greater than 0.25 CFM/ SF of the building envelope. Following the ASHRAE 90.1-2016 Appendix G Guidelines, this rate was converted to an appropriate units for the simulation program, which are 0.0538 CFM/SF in the baseline models and 0.0336 CFM/SF in the proposed design models.
- ECM#2: More efficient HVAC performance in accordance with Section C406.2: The Baseline energy model utilizes centrifugal chillers and natural gas-fired boilers, following the ASHRAE 90.1-2016 Appendix G, requirements. The cooling efficiency of chillers and the thermal efficiency of HW Boilers were increased by 10% in the Baseline Case models. The Proposed Design utilizes centrifugal chillers and condensing gas-fired boilers. The cooling and heating efficiency of the proposed systems exceed the IECC 2018 requirements by at least 10%.
- ECM#3: Reduced lighting power in accordance with Section C406.3: The interior lighting power densities were modeled following the requirements of the Massachusetts Amendments along with an additional 10% reduction in both Baseline and Proposed case models.

C402.1.5 Envelope Calculation

250 Binney Street

	Area or Perimeter		IECC 2018	Proposed	
Envelope Component (Vertical)	Baseline	Design	U-or F- value	U-or F- value	
Framed Insulated Wall	171543	0	0.064		
% Framed Insulated Wall	70%	0%			
Curtainwall - Opaque	0	144,587	0.064	0.100	
% Curtainwall - Opaque	0%	59%			
Windows	73,519	100,475	0.38	0.240	
% Windows	30%	41%			
Total Vertical Area/Normalized Area	245,062	245,062	38,916	38,573	
Vertical UA			**0.159**	**0.157**	**0.88%**
Roof		44,690	0.032	0.032	
Whole Building UA (vertical + horizontal)			40,346	40,003	
Whole Building U-value			**0.139**	**0.138**	**0.85%**

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4.1.8 ENERGY MODEL REPORT

Energy Simulation Results | 250 Binney Street

Energy Modeling Run Options	Interior Lighting	Misc. Equipment	Space Heating	Space Cooling	Heat Rejection	Pumps & Aux.	Ventilation Fans	Exterior Lighting	Domestic HW	Space Heating	MA Stretch Energy Code: Total Site Energy	MA Stretch Energy Code: Energy Savings Compared to Baseline	LEED v4 Alternative Path: Total Energy Cost	LEED v4 Alternative Path: Energy Cost Savings Compared to Baseline
	kWh	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*	*kWh*	*Therms*	*MBTU*	*Compared to ASHRAE 2013+ three ECMs required by Mass. Amendments*	*$*	*Compared to ASHRAE-90.1-2013*
ASHRAE 90.1-2013 (LEED v4)	1,863,048	3,701,970	0	1,422,470	28,214	1,617,832	6,254,442	12,076	135,283	900,848	141,395		$ 3,774,628	
MA Stretch Energy Code	1,693,770	3,701,970	0	1,276,331	27,907	1,600,316	6,254,196	12,076	135,283	820,940	132,267		$ 3,620,932	*(a)*
Proposed Design (BOD)	1,693,770	3,701,970	5,062,478	1,554,913	25,632	1,312,301	6,078,515	12,076	95,016	88,212	75,500	**42.9%**	$ 3,639,436	**3.6%**

Energy Modeling Run Options	LEED v4 Alternative Energy Performance Metric Path (EAPc95): Total Source Energy	Source Energy Savings	Direct Emission	Indirect Emission	Total Emission	Total CO2 Emission Savings	Alternative Metric Savings	EUI (kBTU/SF): Site	EUI (kBTU/SF): Source
	MBTU	*Compared to ASHRAE-90.1-2013*	Gas (kg CO2e)	Elec (kg CO2e)	kg of CO2e	*Compared to ASHRAE-90.1-2013*	*Compared to 2013*		
ASHRAE 90.1-2013 (LEED v4)	238,273		4,784,404	3,598,763	8,383,167		***Average (2 highest of a,b,c)***	***268***	***451***
MA Stretch Energy Code	226,695	***(b)***	4,360,012	3,518,942	7,878,954	***(c)***		***250***	***429***
Proposed Design (BOD)	195,963	**17.8%**	468,496	4,676,174	5,144,671	**38.6%**	**28.2%**	***143***	***371***

Energy Modeling Runs:

- Baseline: ASHRAE 90.1-2013, Appendix G plus Massachusetts Amendments to IECC 2018
- Proposed Design (BOD): 41% WWR; High-performance glazing (overall assembly: U-0.24, SHGC-0.25); Insulated spandrel panels with U-value of 0.10; High-efficiency Chillers and Boilers; Konvekta Heat Recovery; Air-to-Water heat pump

LEED v4 Alternative Compliance Path

The Alternative Compliance Path (ACP), which was introduced as a Pilot credit (EApc95) under LEED v4 rating system, let the high-performance buildings utilize performance metrics other than the energy cost to comply with LEED v4 minimum and optimize energy performance criteria. This approach is beneficial to those projects that are in States with higher utility rates such as Massachusetts. Per ACP requirements, four (4) metrics should be calculated for the Baseline and Proposed cases: Energy Cost, Energy Source, Greenhouse Gas Emissions, and (if available) Time Dependent Valuation (TDV) – TDVs are only available in California. The percent savings will be the average of the two highest-performing metrics using equal weighting, and LEED points are awarded according to Table 1 under EA credit Optimize Energy Performance.

As shown above, the estimated annual energy cost savings is significantly lower than the annual energy cost savings because the proposed design utilizes an air-to-water heat pump system which can provide the heating hot water for off peak season, and therefore, the annual electricity consumption of the proposed case is higher than the baseline case while its gas consumption is significantly lower; that results in a significant GHG emissions savings but decrease the estimated energy cost savings.

Utility Rates
Electricity: *$0.1809/kWh (2019 Eversource's G3 rates)*
Gas: *$1.1684/ therm (Eversource's G53 rate structure)*

Site to Source Energy Factors (Mass. Amendments to IECC 2018)
Electricity: *2.80*
Gas: *1.05*

Greenhouse Gas Emission Factors (EPA- Used only for LEED):
Electricity (New England): *70.13 kg/MMBTU*
Gas (US Average): *53.11 kg/MMBTU*

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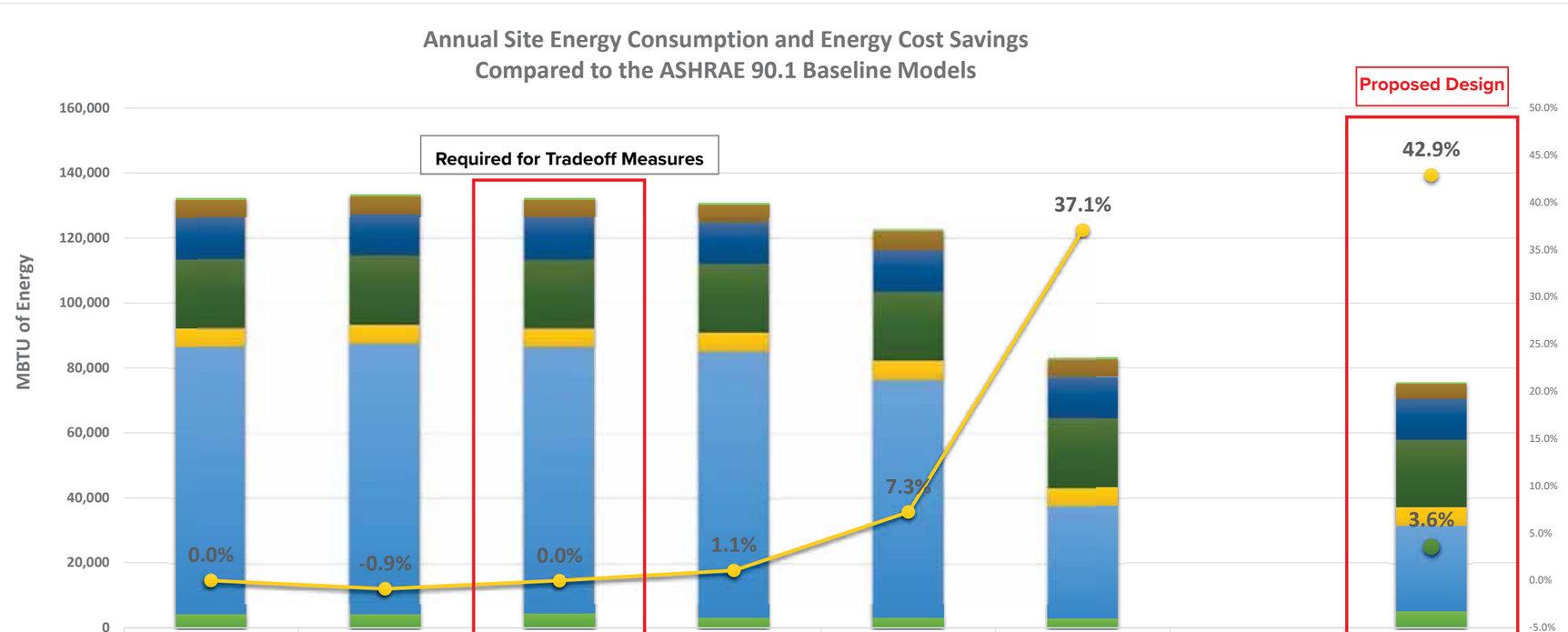
4.1.8 ENERGY MODEL REPORT

Energy Simulation Results | 250 Binney Street



	MA Energy Code Baseline	Design Wall	Design Windows	Design Chillers	Design Boilers	Lab Heat Recovery		Proposed Design (BOD)
Domestic HW	462	462	462	462	462	462		324
Pumps & Aux.	5,462	5,571	5,619	5,450	6,001	5,368		4,479
Heat Rejection	95	96	98	93	93	83		88
Misc. Equipment	12,630	12,630	12,630	12,630	12,630	12,630		12,630
Ventilation Fans	21,350	21,340	21,250	21,250	21,250	21,250		20,750
Interior Lighting	5,781	5,781	5,781	5,781	5,781	5,781		5,781
Space Heating	82,090	83,130	81,940	81,940	73,209	34,629		26,100
Space Cooling	4,356	4,375	4,463	3,197	3,197	2,961		5,307
Energy Use Savings (Compared to Stretch Code)	0.0%	-0.9%	0.0%	1.1%	7.3%	37.1%		42.9%
Energy Cost Savings (Compared to 2013)								3.6%

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4.1.9 NET ZERO NARRATIVE

The Green Engineer
Sustainable Design Consulting

www.greenengineer.com

ATTACHMENT B
Net Zero Narrative

23 Bradford St., Concord, MA 01742

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Green Building Requirements
Net Zero Narrative

Last Updated – 2/23/2021

Introduction

The "Net Zero Narrative" is required for projects subject to Green Building Requirements, Section 22.20 of the Cambridge Zoning Ordinance. The requirement is based on the recommendations of the City's Net Zero Action Plan (adopted in 2015), which seeks to neutralize greenhouse gas emissions in Cambridge by 2050. This plan sets a timeframe of 2025 for most new construction to be designed to a "net zero" standard, meaning that on an annual basis, all greenhouse gas emissions resulting from building operations are offset by carbon-free energy production. In the meantime, the goal is to reduce greenhouse gas emissions to the maximum extent possible, and to design and develop buildings to adapt to net zero emissions in the future.

This Net Zero Narrative is provided for advisory review only. It is intended to inform City staff and officials on how the Net Zero Action Plan has influenced the design of the project, and to begin a dialogue so that all parties can better understand what building improvements are possible and what the major barriers are to achieving net zero emissions. As research, design, and development of the project continues to unfold, this narrative must be updated and included in the submission for the Building Permit and Certificate of Occupancy.

Example Narrative Template

This document provides an example format for the Net Zero Narrative as a guide for developers and designers. Variations are appropriate to account for the unique conditions of a case. However, any Net Zero Narrative must include the components set forth in Paragraph (c), Section 22.25.1 of the Zoning Ordinance:

(1) anticipated building envelope performance, including roof, foundation, walls and window assemblies, and window-to-wall ratio;
(2) anticipated energy loads, baseline energy simulation tool assumptions, and proposed energy targets, expressed in terms of site energy use intensity ("EUI"), source EUI, and total greenhouse gas emissions;
(3) description of ways in which building energy performance has been integrated into aspects of the Green Building Project 's planning, design, and engineering, including building use(s), orientation, massing, envelope systems, building mechanical systems, on-site and off-site renewable energy systems, and district- wide energy systems;
(4) description of the technical framework by which the Green Building Project can be transitioned to net zero emissions in the future (acknowledging that such a transition might not be economically feasible at first), including future net zero emissions options for building envelope, HVAC systems, domestic hot water, interior lighting, and on- and off-site renewable energy sources;
(5) description of programs provided by local utility companies, government agencies, and other organizations that provide technical assistance, rebates, grants, and incentives that can assist in achieving higher levels of building performance, summarizing which entities have been contacted and which programs could be utilized in the Green Building Project; and
(6) assessment of the technical and financial feasibility to meet the projected HVAC and domestic hot water demands of the building as noted above in (2) using energy systems that do not consume carbon-based fuels on-site compared to code-compliant energy systems that consume carbon-based fuels on-site, which shall include the cost of installation, maintenance and upkeep of the energy system and its components (incorporating programs and incentives as noted above in (5).

4.1.9 NET ZERO NARRATIVE

Project Profile

Development Characteristics

Lot Area (sq.ft.):	TBD
Existing Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Commercial Building D: Manufacturing/lab building.
Proposed Land Use(s) and Gross Floor Area (sq.ft.), by Use:	Commercial Building D: Commercial office/lab and ground floor retail.
Proposed Building Height(s) (ft. and stories):	Commercial Building D: Up to 17 stories (±250')
Proposed Dwelling Units:	N/A
Proposed Open Space (sq.ft.):	Between Commercial Buildings C and D the Project will construct the approximately 56,000 square feet of new open space known as the "Center Plaza".
Proposed Parking Spaces:	The Project will construct two, below-grade connected parking garages beneath Commercial Building C and Commercial Building D that will accommodate 1,584 total parking space.
Proposed Bicycle Parking Spaces (Long-Term and Short-Term):	Commercial Building D: 96 Long-term spaces / 26 Short-term spaces

Net Zero Narrative |250 Binney Street

Submitted By: enviENERGY Studio
Date of Submission: 06/11/2021 (UPDATED 01/20/2022)

Green Building Rating System

Choose the Rating System selected for this project:

LEED-Leadership in Energy & Environmental Design (U.S. Green Building Council)					
Rating System & Version:	LEED v4 BD+C: Core and Shell	***Seeking Certification?****	**Yes**	No	TBD
Rating Level:	LEED Gold	***64***			

Enterprise Green Communities					
Rating System & Version:	N/A	***Seeking Certification?****	Yes	**No**	TBD
Rating Level:	N/A	***# of Points:***	N/A		

Passive House Institute US (PHIUS) or Passivhaus Institut (PHI)					
Rating System & Version:	N/A	***Seeking Certification?****	Yes	**No**	TBD

**NOTE: Certification is not required through the Green Building Requirements. However, you may choose to indicate if the Project Team intends to pursue formal certification through these Green Building Rating Programs (or their affiliates).*

4.1.9 NET ZERO NARRATIVE

Proposed Project Design Characteristics

Building Envelope

Assembly Descriptions:

Roof:	R-30 Insulation entirely above deck ; U-0.032
Foundation:	Meets Energy Code
Exterior Walls:	Curtainwall system with continuous insulation behind mullion and spandrel; U-0.10
Windows:	Triple-pane windows; U-0.24
Window-to-Wall Ratio:	41%
Other Components:	Targeted building infiltration rate of 0.25 CFM/sf (at 75 pa)

Envelope Performance:

Provide estimates of the thermal transmittance (U-value) for the building envelope compared to "Baseline" standards required by the Massachusetts Stretch Energy Code, latest adopted edition.

	Proposed		*Baseline*	
	Area (sf)	*U-value*	*Area (sf)*	*U-Value*
Window	100,475	0.24	73,519	0.38
Wall	144,587	0.10	171,543	0.064
Roof	44,690	0.032	44,690	0.032

Envelope Commissioning Process:

The Applicant will pursue envelope commissioning in line with LEED v4 Enhanced Commissioning Option 2: Envelope Commissioning.

Net Zero Narrative |250 Binney Street

Submitted By: enviENERGY Studio
Date of Submission: 06/11/2021 (UPDATED 01/20/2022)

Building Mechanical Systems

Systems Descriptions:

Space Heating:	100% OA air handling units with HW heating coils will provide ventilation to the office spaces and ventilation, heating and cooling to the laboratory spaces. Future office spaces will be conditioned by 4-pipe FCUs or similar systems. HW will be supplied by gas-fired boilers and modular air-to-water heat pumps to provide 20-25% of the heating capacity. Infrastructure and space are provided for future tenants to install these modules based on their need and to be able to transition to all-electric heating in the future when feasible.
Space Cooling:	Centrifugal water-cooled chillers will provide CHW to AHUs and FCUs
Heat Rejection:	High-efficiency heat rejection plant with variable speed fans on cooling towers.
Pumps & Auxiliary:	All variable speed pumping systems
Ventilation:	100% OA Air Handling Units equipped with energy recovery system
Domestic Hot Water:	Gas-fired condensing heater with >90% efficiency
Interior Lighting:	LED fixtures in core spaces C406.3 measure: a 10% reduction in LPD values listed in MA Amendments is targeted
Exterior Lighting:	LED fixtures
Other Equipment:	Office: 0.9-1.1 W/SF process load associated with office equipment Lab: 4 W/SF associated with laboratory equipment

Systems Commissioning Process:

The Applicant will pursue commissioning in line with LEED v4 Fundamental and Enhanced Commissioning requirements. The commissioning agent will perform the scope of work required to comply with the prerequisite in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC & R systems. Enhanced commissioning scope will include reviewing the owner's project requirements, and the basis of design, creating, distributing and implementing a commissioning plan, performing a design review of the project documents, witnessing on-site installations and testing and performing commissioning of installed HVAC, lighting, lighting controls and domestic hot water systems.

4.1.9 NET ZERO NARRATIVE

Building Energy Performance Measures

Overview

Broadly describe the ways in which building energy performance has been integrated into the following aspects of the project's planning, design, engineering, and commissioning. More detail on specific measures can be provided in appendices.

Land Uses:	The site has been previously developed and it is classified as a Difficult Development Area by the US Department of Housing and Urban Development. The selected site will provide access to the public transportation, bicycle network and facilities.
Building Orientation and Massing:	The building massing is developed and optimized based on the orientation that is dictated by the existing site and will provide access to view and daylight for majority of the future occupied spaces. Fenestration area is optimized for the Project to minimize thermal losses and to bring in sufficient daylight into the spaces.
Envelope Systems:	High performing envelope which meets and exceeds the IECC 2018 – C402.1.5 requirements. It includes continuous insulation on walls and roofs, high performing glazing assemblies and decreased infiltration rates.
Mechanical Systems:	Variable Volume 100% OA Air-Handling Units with HW and CHW coils; High-efficiency water-cooled centrifugal chillers; High-efficiency gas-fired boilers; energy recovery system.
Renewable Energy Systems:	The Project's roofs are being designed as solar ready and the team is continuing to evaluate economics for solar. Due to the nature of the Project, part of the roof will be occupied by large mechanical systems. On areas of the roof free of mechanical systems and with good solar availability, the potential of installing photovoltaic panels is under evaluation.
District-Wide Energy Systems:	The project will not be connected to the district steam because the emission data is not readily available and per the team's experience with evaluating Vicinity Steam and its environmental impacts for other similar projects, the overall GHG emissions for a building connected to the district steam will not be significantly better than a stand-alone building due to the fact that steam is generated via a non-renewable fuel source; therefore, it will not help the project to meet the City's Net Zero goals in the future.
Other Systems:	EV charging stations will be provided for 5% of the total parking capacity.

Net Zero Narrative |250 Binney Street

Submitted By: enviENERGY Studio
Date of Submission: 06/11/2021 (UPDATED 01/20/2022)

Integrative Design Process

Describe how different parties in the development process (owners, developers, architects, engineers, contractors, commissioning agents) have collaborated in the design. Include the Basis of Design and Owner's Project Requirements and describe how they have been informed by planning activities such as meetings or design charettes. Describe how continuing collaborative processes will inform Schematic/Design and Construction Documents.

The project team is pursuing the LEED Integrative Process credit for this project, and therefore, energy models were developed during the conceptual design phase. The project team for the overall master site development, including the ownership group, architects, Civil and MEP engineers, as well as the sustainability consultants and energy modelers met several times in the early stages of planning and design to discuss the project overall energy, sustainability, and environmental goals.
The preliminary and conceptual energy models were developed early on to investigate the project's compliance with the LEED v4 Minimum and Optimize Energy Performance criteria and the Massachusetts Stretch Energy Code requirements and to estimate the project site and source energy use and cost as well as the GHG emissions. As a result of these analyses, the design team proposed and evaluated additional energy conservation measures to improve the building overall performance and decided to improve the overall performance of the building envelope.

Green Building Incentive Program Assistance

Describe any programs applicable to this project that would support improved energy performance or reduced greenhouse gas emissions, and which of those programs have been contacted and may be pursued. Programs may be offered by utility companies, government agencies, and other organizations, and might include rebates, grants, financing, technical assistance, and other incentives.

The Project has had multiple engagements with local utility representatives and is planning to participate in all relevant energy-efficiency incentive programs. An initial MassSave kickoff/energy charrette will be conducted in Spring 2021. The project will be participating in the Mass Save Integrated Design Path for Large Buildings as well as the EV make-ready program.

4.1.9 NET ZERO NARRATIVE

Net Zero Scenario Transition

Describe the technical framework by which the project can be transitioned to net zero greenhouse gas emissions in the future, acknowledging that such a transition might not be economically feasible at first. This description should explain the future condition and the process of transitioning from the proposed design to the future condition.

	Net Zero Condition:	***Transition Process:***
Building Envelope:	Additional insulation can be added behind the spandrel panels if necessary but potentially upgrades to the building envelope will be insignificant.	N/A
HVAC Systems:	Replacing the fossil-fuel heating systems with all-electric equipment. It may not be feasible to develop these laboratory buildings as 100% electric at the moment but with new technologies, the transition to an all-electric system is feasible.	Utilizing energy recovery systems with higher effectiveness Heat-recovery chillers Air-source heat pumps in office spaces Air-to-water heat pump
Domestic Hot Water:	The Domestic Hot Water system can be replaced with electric Heat Pump heaters	
Lighting:	All LED light fixtures with advanced lighting control systems	The base building will utilize LED fixtures and the future tenants will be required to meet the targeted LPDs which can be achieved by utilizing all/ mostly LED fixtures. At the end of life of fixtures, with potential new technologies, lighting upgrades may result in additional savings.
Renewable Energy Systems:	Due to the limited roof area, an on-site renewable system may not be feasible for laboratory projects.	When the building is all-electrified and the Grid is clean, the project can achieve carbon neutrality.
Other Strategies:	Plug loads and other process equipment: in a laboratory building, receptacle loads represent a significant percentage of the building annual energy consumption. Utilizing high-efficiency equipment and implementing advanced control strategies to reduce these loads will have a significant impact on the building overall energy performance and environmental footprint.	As new technologies emerge, the office and lab equipment might be replaced with new and low-energy ones and the plug-load control strategies may improve. Additionally, implementing control strategies for the lab fume hoods (i.e. controlled by occupancy or Indoor Air Quality sensors) will help the project with achieving NZE goals.

Net Zero Narrative |250 Binney Street

Submitted By: enviENERGY Studio
Date of Submission: 06/11/2021 (UPDATED 01/20/2022)

Energy Systems Comparison

Overview

This section should describe the results of an analysis comparing the technical and financial feasibility to meet the projected HVAC and domestic hot water demands of the building using energy systems that do not consume carbon-based fuels on-site compared to code-compliant energy systems that consume carbon-based fuels on-site.

As design progresses, the project team will investigate implementation of strategies to reduce the project dependence on the fossil fuel heating. With the current available technologies and the site condition, these laboratory buildings will not be able to be 100% electric and the boiler plant needs to be included; however, utilizing the following technologies can help the project to reduce its carbon footprint significantly and transition to an all-electric system in the future. These technologies will be evaluated as design progresses:

- Konvekta or other energy recovery systems with similar performance
- Air-to-water heat pump for supplemental heating
- Electric heat pump in office spaces (during tenant design)
- Heat recovery chillers

Assumptions

Describe what building energy systems were included and excluded in your analysis and why.

	Included in analysis?		***Describe the systems for which this was analyzed or explain why it was not included in the analysis:***
	Yes	***No***	
Solar Photovoltaics:	x		Majority of the roof area will be covered by laboratory mechanical equipment and therefore, limited area will be available. As design progresses, the feasibility of roof-mounted solar array will be investigated.
Solar Hot Water:		x	It is not feasible for this size and type building.
Ground-Source Heat Pumps (Geothermal):		x	These buildings will be located over a parking garage and over/ adjacent to the Eversource Electrical Substation and therefore, locating geothermal boreholes under and adjacent to these structures will not be feasible.

4.1.9 NET ZERO NARRATIVE

Water-Source Heat Pumps:		x	It will be investigated as design progresses.
Air-Source Heat Pumps:	x		Electrification at the water-side was studied.
Non-Carbon-Fuel District Energy:		x	Not Analyzed.
Other Non-Carbon-Fuel Systems:	x		Partial electrification of the hot water plant is feasible and it was analyzed as part of the proposed design. 100% electrification of the HW plant was analyzed under the Future Net Zero Analysis.

Non-Carbon-Fuel Scenario

100% electric laboratory may not be a feasible option at the moment but a partial electrification with a help of heat-recovery chillers and air-to- water heat pumps is achievable. In the proposed design option, infrastructure and space has been provided for the partial electrification and it is assumed that the future tenants will install the air source heat pumps. The energy modeling results presented for the proposed design in this narrative, includes those future heat pumps and they are sized for 25% of the heating plant capacity. It is estimated that the non-peak space heating will be provided by the air source heat pumps and the boiler plant will run only when the outdoor air falls below zero and only at the peak heating condition. This design strategy can result in an approximately 90% reduction in the GHG emissions associated with the fossil fuel when compared with the Stretch Energy Code baseline.

In the NZE option, it is assumed that technologies will be available in the future for a 100% electrification of the heating plant via heat pump systems that can run at low outdoor air temperature while maintaining their efficiencies. It was also assumed that there will be an increase in the efficiencies for lighting and equipment loads and that the service hot water will be provided by heat pump heaters.

Net Zero Narrative |250 Binney Street

Submitted By: enviENERGY Studio
Date of Submission: 06/11/2021 (UPDATED 01/20/2022)

Solar-Ready Roof Assessment

The purpose of this assessment is to determine the technical feasibility of solar energy system installation, either as part of the proposed project or in the future. It is helpful to supplement this narrative with a plan depicting the information provided.

Total Roof Area (sq. ft.):	***44,690***
Unshaded Roof Area (sq. ft.):	Majority of the roof will be covered by the mechanical equipment which will shade the uncovered areas. Per our preliminary analysis, approximately 2,500 SF might be unshaded and available for solar PV array.
Structural Support:	The roofs will be PV/Solar ready for the areas identified with good solar access. The team is continuing to evaluate economics for solar/PV.
Electrical Infrastructure:	The design team will take electrical infrastructure into account while evaluating the economics for solar/PV on the roofs.
Other Roof Appurtenances:	Majority of mechanical equipment for a lab building will occupy the roof area. As the design of the roof progresses, the design team will locate HVAC equipment strategically to provide an unshaded area for potentially future solar PV arrays or green roof. Preliminary estimates show that approximately 5-10% of the roof area can be used in the initial PV analysis.
Solar-Ready Roof Area (sq. ft.):	Per the initial analysis, the area is approximately 2,500-3,000 SF. The final area provided as solar-ready may change as the building design progresses.
Capacity of Solar Array:	37-40 kW DC. The annual generated electricity is 0.24% of the building annual electricity consumption.
Financial Incentives:	There are federal and state (SMART) incentives available for eligible PV generation systems. These incentives programs are continuously changing. Therefore, this analysis will be performed at the time of PV system design.
Cost Feasibility:	Installed cost: $3.0/Watt Total cost of PV and installation is estimated to be at $120,000 for the 40 kW array. Without any incentives this will provide a simple payback of 14 years based on an annual generation of 46,200 kWh renewable energy.

4.1.9 NET ZERO NARRATIVE

Results

Briefly summarize the results of the analysis and how it has informed the design of the project. Also include figures for the "Non-Carbon-Fuel Scenario" in the concluding Summary Table at the end of the Net Zero Narrative. Attachments can be provided with more specific figures and metrics regarding installation, maintenance, and upkeep costs (exclusive *of operating fuel expenses), but a full report is not necessary.*

TBD	*Proposed Design*		*Non-Carbon-Fuel Scenario*	
	Installation Cost	*Maintenance Cost*	*Installation Cost*	*Maintenance Cost*
Space Heating				
Space Cooling				
Heat Rejection				
Pumps & Aux.				
Ventilation				
Domestic Hot Water				
(Financial Incentives)				
Total Building Energy System Cost				

The project team utilized energy benchmarking tools and database such as Lab21 and Cambridge Building Energy Use Disclosure Ordinance (BEUDO) to establish an energy performance benchmark and a predicted Energy Use Intensity (pEUI) for the commercial buildings. After narrowing down the building parameters in the Lab21 benchmarking tool to reflect the current design, the outcomes are three peer buildings with an average source EUI of 414 kBtu/SF. This comparison shows that the current design with a predicted source EUI of approximately 371 kBTU/SF is low energy when compared to the benchmarking data. The site pEUI for the 250 Binney laboratory is estimated at 143 kBtu/SF which is significantly lower than the BEUDO average EUI of 250 kBTU/SF.
This energy analysis shows that this building will have a significantly better energy performance as compared to the MA Stretch Energy Code baseline case. Throughout the design process, the design team will use three performance metrics in their decision making around energy use in the design process: site energy use, source energy use, and greenhouse gas emissions.

Net Zero Narrative |250 Binney Street

Submitted By: enviENERGY Studio
Date of Submission: 06/11/2021 (UPDATED 01/20/2022)

Anticipated Energy Loads and Greenhouse Gas Emissions

Assumptions

Describe the assumptions and methodology used to conduct preliminary energy modeling and set energy targets for the project. Specifically describe what components of the building were included and excluded.

Energy models were developed for 250 Binney Street project to investigate its compliance with the Massachusetts Energy Code and to evaluate the impact of several energy conservation measures on the building overall energy use, cost, and GHG emissions in the early stage of design.

250 Binney Street will be a new Core and Shell, Laboratory/ Office building, in Cambridge, MA. The building program includes 60% laboratory and 40% office spaces. Using the guidelines outlined in Appendix G of ASHRAE 90.1-2013 and Massachusetts Amendments, the Stretch Energy Code baseline and proposed building design were modeled following Tables G3.1 in terms of the space use classification, schedules, building envelope, lighting, thermal blocks, HVAC systems, service hot water system, and receptacle and other loads.

The building geometry is based on the preliminary massing. The vertical elements of the envelope primarily consist of a curtainwall system. The overall window area is estimated at 42% of the building exterior wall area but may change as design progresses, considering compliance with the requirements of the new Massachusetts Amendments to Energy Code. High performance insulated glazing is expected to be installed throughout.

The building is expected to be occupied during extended office hours throughout the year, with some partial occupancy during weekends. The peak occupancy density is estimated to be 250 GSF/person in the office and 400 GSF/person in Lab spaces. The HVAC system will operate 24/7.

The interior lighting power densities in both the baseline and proposed case models follow the building-area-method approach and are consistent with the new Massachusetts amendments. End uses such as computers, receptacles, and lab equipment are included as equipment gains. These are inputs to reflect the design team's understanding of the anticipated equipment usage and are identical between the baseline and the proposed models.

4.1.9 NET ZERO NARRATIVE

Annual Projected Energy Consumption and Greenhouse Gas (GHG) Emissions

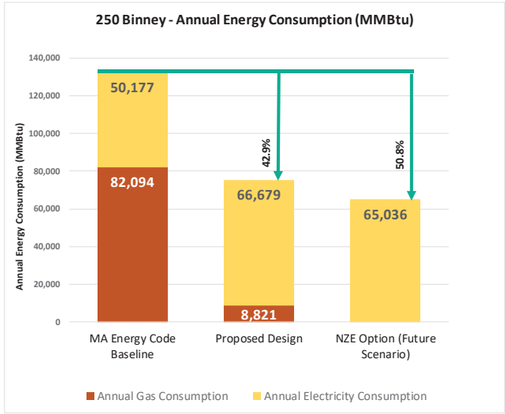
The preliminary energy modeling results should be shown in a concluding table format similar to what is shown at the end of this document. It should compare the "baseline building" (Massachusetts Stretch Energy Code) to the proposed design, as well as the future "net zero" scenario described later in this narrative.

	Baseline Building		Proposed Design		Future Net Zero Scenario	
	MMBTU	% of Total	MMBTU	% of Total	MMBTU	% of Total
Space Heating	82,090	62.1%	26,100	34.6%	24,335	37.4%
Space Cooling	4,356	3.3%	5,307	7.0%	4,246	6.5%
Heat Rejection	95	0.1%	88	0.1%	61	0.1%
Pumps & Aux.	5,462	4.1%	4,479	5.9%	3,135	4.8%
Ventilation	21,350	16.1%	20,750	27.5%	17,634	27.1%
Domestic Hot Water	462	0.3%	324	0.4%	227	0.3%
Interior Lighting	5,781	4.4%	5,781	7.7%	4,625	7.1%
Exterior Lighting	41	<1%	41	<1%	33	<1%
Misc. Equipment	12,630	9.5%	12,630	16.7%	10,740	16.5%
	$US, kBTU/SF		$US, kBTU/SF	% Reduction from Baseline	$US, kBTU/SF	% Reduction from Baseline
Site EUI (kBTU/SF)	250		143	42.9%	123	50.8%
Source EUI (kBTU/SF)	429		371	13.5%	345	19.7%
Total Electricity (kWh)	14,701,849		19,536,671	-33%	19,055,242	-30%
Total Gas Use (Therms)	820,940		88,212	89%	0	100%
Total Energy Use (MMbru)	132,271		75,500	42.9%	65,036	50.8%
Total Energy Cost ($US)	$3,620,932		$3,639,436	-0.5%	$3,447,093	
	kWh or Therms	% Total Energy	kWh or Therms	% Total Energy	kWh or Therms	% Total Energy
On-Site Renewable Energy Generation	-	-	-	-		
Off-Site Renewable Energy Generation	-	-	-	-		
	MTons CO_2 [/SF]		MTons CO_2 [/SF]	% Reduction from Baseline	MTons CO_2[/SF]	% Reduction from Baseline
GHG Emissions	9,639		6,944	28%	6,269	35%
GHG Emissions per SF	0.0182		0.01314	28%	0.0118	35%

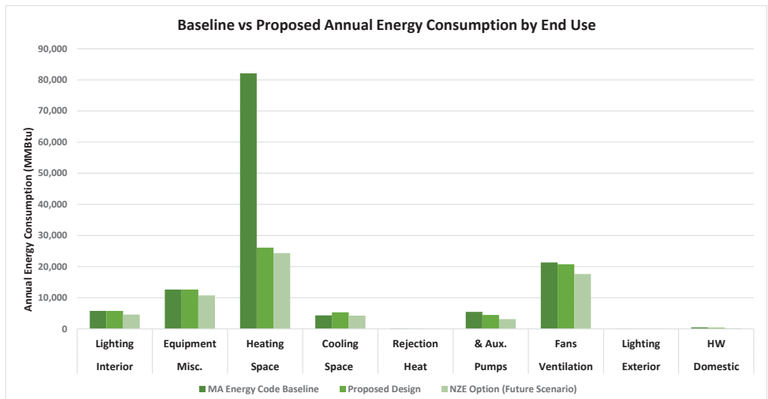
Net Zero Narrative |250 Binney Street

Submitted By: enviENERGY Studio
Date of Submission: 06/11/2021

Example Chart 1:



Example Chart 2:



4.1.10 GREEN BUILDING REQUIREMENTS CHECKLIST

The Green Engineer
Sustainable Design Consulting

www.greenengineer.com

ATTACHMENT C
Green Building Requirements Checklist

Green Building Project Checklist

Green Building Project Location: 250 Binney Street, Cambridge, MA

Applicant

Name: _____

Address: _____

Contact Information

Email Address: _____

Telephone #: _____

Project Information (select all that apply):

- ☐ New Construction – GFA: _____
- ☐ Addition – GFA of Addition: _____
- ☐ Rehabilitation of Existing Building – GFA of Rehabilitated Area: _____
  - ☐ Existing Use(s) of Rehabilitated Area: _____
  - ☐ Proposed Use(s) of Rehabilitated Area: _____
- ☐ Requires Planning Board Special Permit approval
- ☐ Subject to Section 19.50 Building and Site Plan Requirements
- ☐ Site was previously subject to Green Building Requirements

Green Building Rating Program/System:

- ☒ Leadership in Energy and Environmental Design (LEED) – Version: LEED version 4
  - ☒ Building Design + Construction (BD+C) – Subcategory: Core and Shell Development
  - ☐ Residential BD+C – Subcategory: _____
  - ☐ Interior Design + Construction (ID+C) – Subcategory: _____
  - ☐ Other: _____
- ☐ Passive House – Version: _____
  - ☐ PHIUS+
  - ☐ Passivhaus Institut (PHI)
  - ☐ Other: _____
- ☐ Enterprise Green Communities – Version: _____

4.1.10 GREEN BUILDING REQUIREMENTS CHECKLIST

Project Phase

☒ **SPECIAL PERMIT**

Before applying for a building permit, submit this documentation to CDD for review and approval.

Required Submissions

All rating programs:

- ☒ Rating system checklist
- ☒ Rating system narrative
- ☒ Net zero narrative (see example template for guidance)
- ☒ Affidavit signed by Green Building Professional with attached credentials – use City form provided (Special Permit)

4.1.11 GREEN BUILDING REQUIREMENT CERTIFICATIONS

Green Building Requirements

250 Binney Street Green Building Report – Certification for Design Review Stage

Status: The Community Development Department (CDD) received the Green Building Report (GBR) for the Design Review stage for 250 Binney Street (part of the MXD Infill Development Concept Plan within the Kendal Square Urban Renewal Plan). Pursuant to Section 22.25.1 of the Zoning Ordinance, CDD staff have reviewed the project's GBR and provide the following Determination, Summary of Compliance, and Comments.

CDD Determination: The documentation provided by the Applicant is adequate and demonstrates compliance with the Green Building Requirements applicable to the Design Review stage. A revised submission, with additional documentation will be required at the Building Permit and Certificate of Occupancy stages.

Project Summary: This project is subject to the City's Green Building requirements, which mandate meeting the LEED Gold requirements. Based on the documents submitted, the project is expected to achieve LEED Gold certification with 66 points. The project is seeking LEED certification with USGBC.

Summary of Compliance:

Green Building Professional Affidavit Certification
Christopher Schaffner, LEED AP BD+C of The Green Engineer, Inc., has been identified as the Green Building Professional for the project. The affidavit states that this professional has reviewed all relevant documents for this project and confirm to the best of their knowledge that those documents indicate that the project has been planned and designed to achieve the LEED requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.

LEED Rating System Checklist, LEED and Net Zero Narrative

- Rating System: LEED v4 BD+C - LEED Master Site.
- Energy use reduction = 42.9% reduction below the stretch code baseline (ASHRAE 90.1-2013).
- Energy cost saving = 3.6% reduction compared to baseline ASHRAE 90.1-2013.
- Energy use savings = 45.9% reduction compared to baseline ASHRAE 90.1-2013.
- Site EUI (Stretch Code standards) = 143 kBTU/SF-yr.
- Source EUI (Stretch Code standards) = 371 kBTU/SF-yr.
- GHG emissions reduction = 28% reduction.
- LEED categories and their credit points:
  - Integrative Process – 1 point
  - Location and Transportation – 19 points
  - Sustainable Sites – 5 points
  - Water Efficiency – 5 points
  - Energy and Atmosphere – 18 points
  - Materials and Resources – 3 points
  - Indoor Environmental Quality – 7 points
  - Innovation – 6 points
  - Regional Priority – 2 points

Total credit points = 66 points

Comments:
The Planning Board looks holistically at the sustainability aspects of all building types and uses. CDD staff do provide comments and recommendations to the Planning Board on how proposed buildings might further improve their energy performance, reduce GHG emissions and reduce their embodied carbons and or go beyond the minimum green building requirements. Staff believe the following comments/recommendations are relevant to this project and should also be considered:

1. Considering the extent of paved area for the entire MXD, staff recommend rainwater management strategies including capture and reuse system for flushing plumbing fixtures or landscape irrigation. The applicant plans to include rainwater collection and reuse for cooling towers and/or irrigation for each building. More details on the system shall be provided at the Building Permit submission.

2. Staff recommend using a centralized heat pump for heating/cooling and to include domestic hot water. The project team has noted this recommendation and will put under consideration.

3. Maximize selection of environmentally preferable building products and components beyond LEED requirements. The applicant has committed to optimizing the product and material selection to exceed the minimum LEED requirements, where possible. The design teams are also cognizant of the fact that embodied carbon emissions are also a major concern. They will be performing a whole-building life cycle analysis (LCA) to account for emissions generated by building construction and materials by using LCA assessment tools and obtain environmental product declarations (EPDs) for materials selection.

4. Staff recommend pursuing WELL building standards, or Fitwel guidelines to demonstrate the Applicant's commitment to occupants' health and wellbeing. While the applicant has not committed to formally pursuing these standards, they note their intention to implement features, strategies, and principles of these standards where appropriate. For example, the applicant has committed to including MERV 13 filtration in the project.

5. Staff recommend pursuing a higher than 50% diversion of construction and demolition waste (C&D).

6. Staff also recommend pursuing enhanced refrigerant management to demonstrate commitment to reducing impacts of ozone depletion and global warming potential GWP.

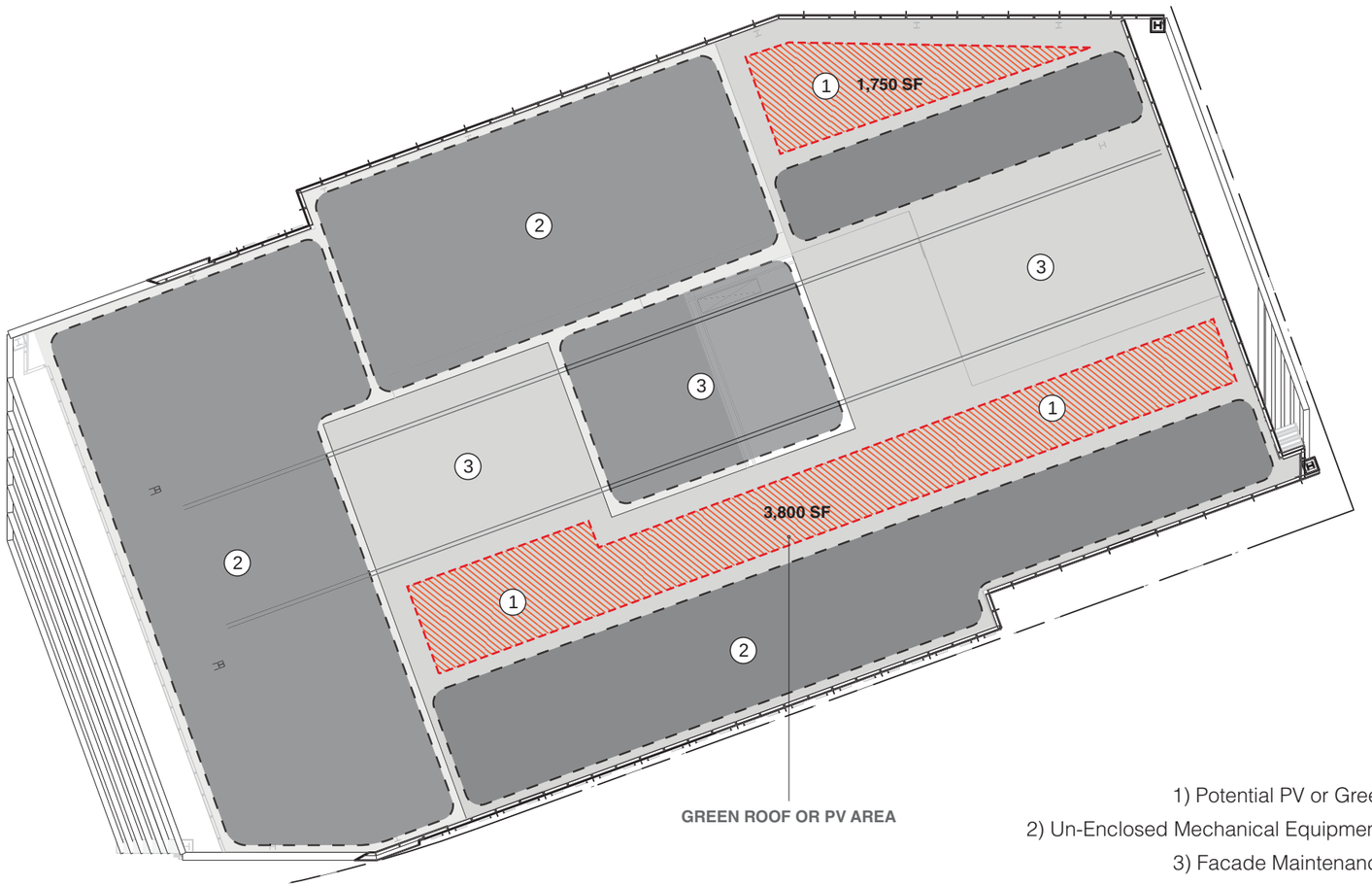
7. Future updates from the applicant should include the following:
   a. Pursuant to Article 22, the applicant shall provide updated preliminary energy modeling to staff at the Building Permit and Certificate of Occupancy stages.
   b. For the Building Permit phase, the applicant has committed to providing a sustainable design specification section and emission levels for composite wood products, paints, sealants, and finishes, as well as those for carpet, carpet pads and adhesives.

Finally, Staff appreciate incorporating the triple glazing system as part of the building envelope and for planning on having envelope commissioning for the system.

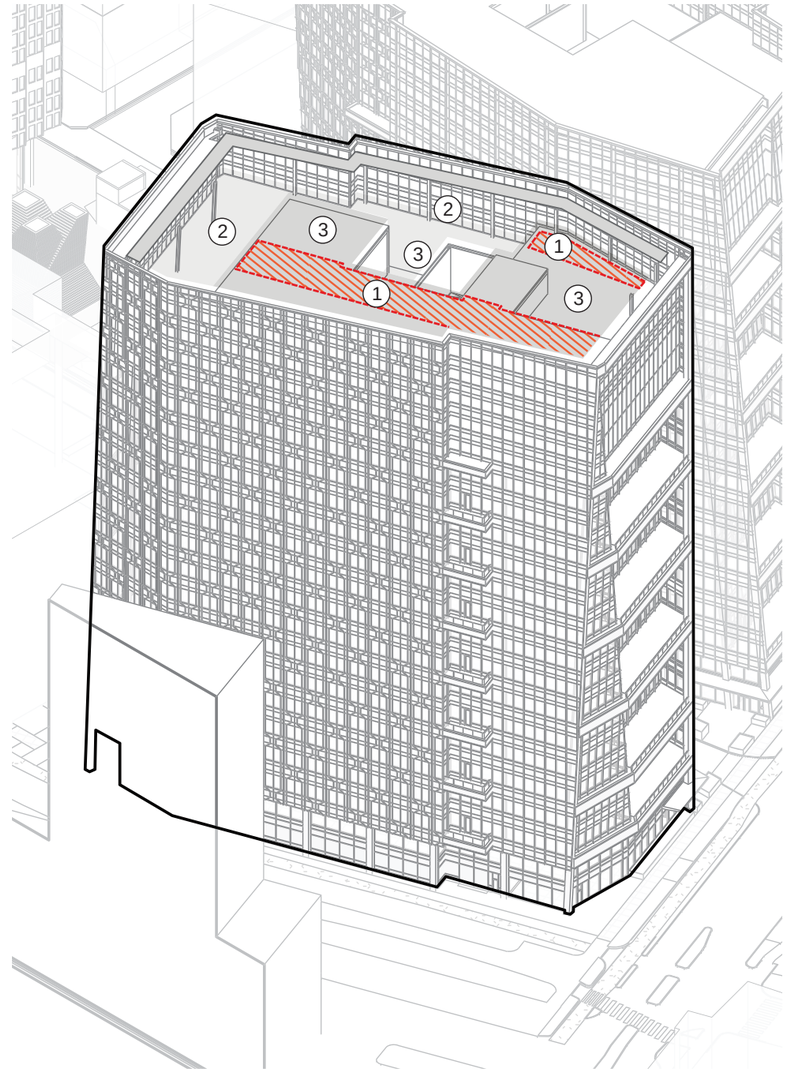
4.1.12 GREEN ROOF ORDINANCE

ROOF PLAN

NOTE: The solar ready and green roof sections are offered to demonstrate how 250 Binney could offer a solar array or green roof in the future. We are anticipating to provide solar, pending further design development. All mechanical spaces are intended as 'Day One' spaces to be utilized immediately. This plan represents 5,550 SF of rooftop eligible for City of Cambridge Ordinance No. 2020-25, of which we intend to comply with the 80% required green or solar roof requirements by allocating 4,440 SF towards this purpose.



1) Potential PV or Green Roofs
2) Un-Enclosed Mechanical Equipment Space
3) Facade Maintenance Areas



AXONOMETRIC

ROOFTOP KEY

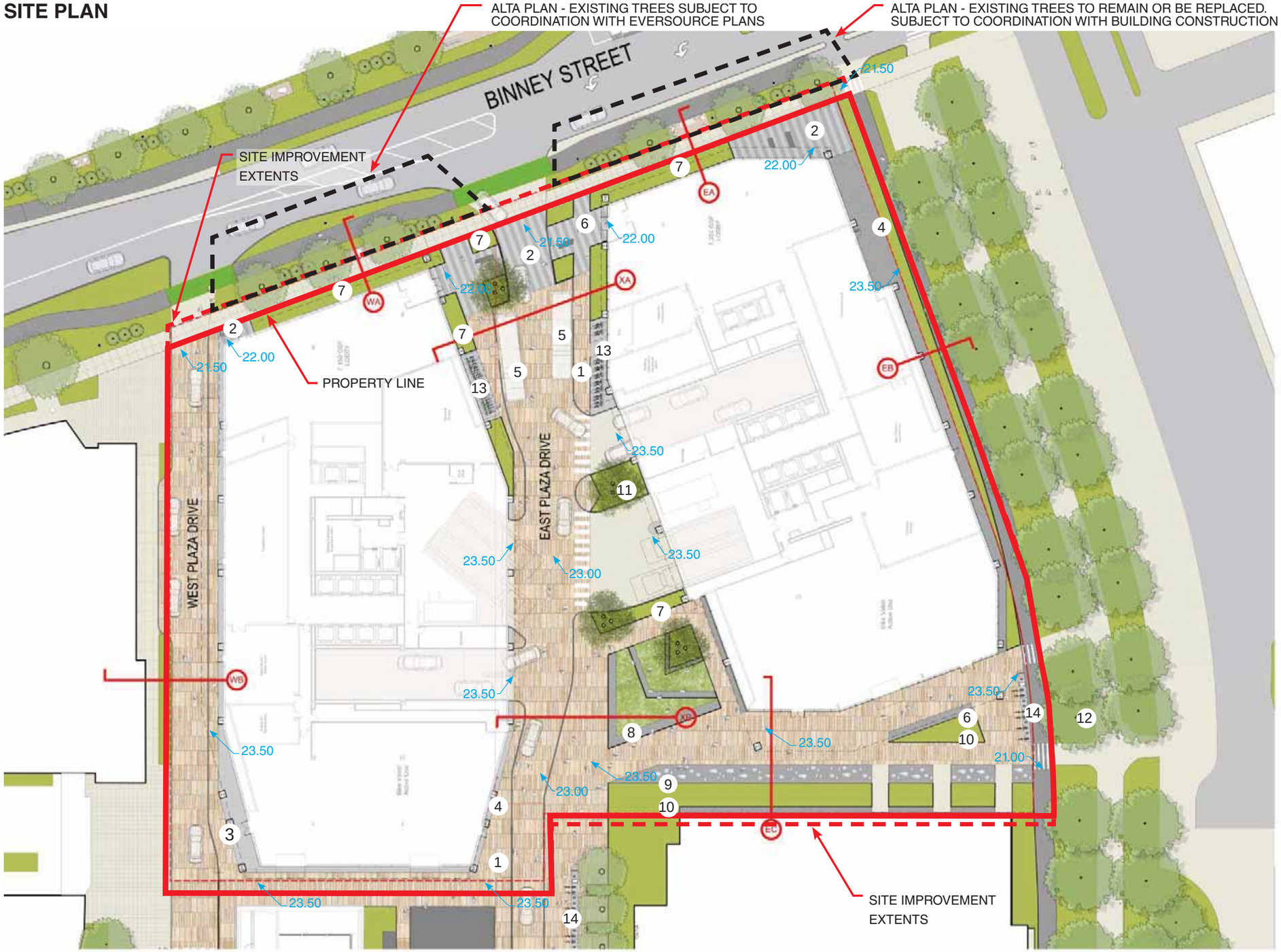
1) PV or Green Roofs
2) Un-Enclosed Mechanical Equipment Space
3) Facade Maintenance Catwalk

CITY OF CAMBRIDGE ORDINANCE NO. 2020-25:

- Section 22.35.2 Section (A): "At least 80% of the roof area of the building as measured in plan view, excluding those portions of the roof listed below, shall be devoted to Green Roof Area, Biosolar Green Roof Area, or Solar Energy Systems.
  1. Areas having a slope greater than 3 in 12 or twenty-five percent (25%).
  2. Areas designed and managed for use by building occupants or the general public.
  3. Vehicular parking decks.
  4. Chimneys, water towers, air conditioning equipment, elevator bulkheads, skylights, ventilators and other necessary features appurtenant to buildings which are usually carried above roofs and are not used for human occupancy, in addition to conduit, visual and acoustical screening, access routes for maintenance and service, and other areas that must be clear of obstruction to comply with applicable building and safety codes."
- Locations labeled as (1) in the plan above are the zones not excluded by ordinance exceptions stated above and intended to meet the 80% PV or Green Roof requirement. Locations labeled as (2) or (3) are excluded by Section 22.35.3.A.4. Both ends of the plan shown in light grey are not roof surfaces and are not to be included in roof calculations.

4.1.13 PRELIMINARY SITE GRADING AND RESILIENCY

SITE PLAN



LEGEND

1. PLAZA PAVING - PUBLIC REALM
2. BUILDING ENTRY PAVING
3. BUILDING PAVING TO COORDINATE WITH PAVERS
4. DECORATIVE CRUSHED STONE
5. BUILDING DROP-OFF
6. RAISED SEATING
7. RAISED PLANTERS
8. STEPPED SUN LAWN
9. DRY GARDEN
10. ON GRADE PLANTING
11. PROPOSED TREES
12. EXISTING TREES
13. SHORT TERM BIKE PARKING (36)
14. BIKE SHARE