Center for Integrated Life Sciences and Engineering
Boston University

July 18, 2014

Expanded Project Notification Form

Submitted by **Trustees of Boston University**

Submitted to **Boston Redevelopment Authority**

Prepared by **Fort Point Associates, Inc.**

in association with: **Payette**

Tetra Tech, Inc.

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Nitsch Engineering, Inc.

RWDI, Inc.

BOSTON UNIVERSITY

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PROJECT SUMMARY

CHAPTER 1: PROJECT SUMMARY

1.1 PROJECT IDENTIFICATION

Project Name: The Center for Integrated Life Sciences and Engineering (CILSE)

Address/Location: 610 Commonwealth Avenue, Boston, MA 02215

1.2 PROJECT SITE

Trustees of Boston University (the "Proponent") proposes to construct the Center for Integrated Life Sciences and Engineering (the "Project") at 610 Commonwealth Avenue on a 23,600 square-foot (0.54 acre) parcel (the "Site"). The Site is located approximately 0.3 miles from Kenmore Square and is bounded by Commonwealth Avenue to the north, Morse Auditorium to the east, the existing physics and biology research laboratories at 3-5 Cummington Mall to the south, and Boston University (the "University") Grounds South open space, which is associated with the College of Communication located at 640 Commonwealth Avenue, to the west. The Site is located directly adjacent to the Massachusetts Bay Transportation Authority's (the "MBTA") Blandford Mall Green Line Station and is approximately 0.3 miles west of the MBTA's Kenmore Green Line Station in Kenmore Square. MBTA bus routes run in both directions along Commonwealth Avenue. See Figure 1-1, Locus Plan and Figure 1-2, Aerial View.

1.3 PROJECT SUMMARY

The Project will replace an existing surface parking lot on Commonwealth Avenue with a state-of-the-art, nine-story building containing up to 145,000 square feet of gross floor area (GFA) that will primarily house research facilities in systems neuroscience (the science of the brain), synthetic biology (the science of modifying living systems to improve human health), and cognitive neuroimaging (imaging and mapping the structures and functions of the brain). The University now boasts one of the nation's largest clusters of basic and applied scientists advancing synthetic biology and systems neuroscience research to address critical health challenges. The University has a tremendous need for additional research and laboratory space to support its Systems Neuroscience and Synthetic Biology programs. However, most core faculty are currently scattered across campus and/or located in functionally obsolete facilities. This Project will address an urgent need to construct a coordinated, visionary research center housed within a modern and sustainable facility that will serve as a hub of innovation for the Greater Boston and Massachusetts research community and life science industries.

The Project will bring together outstanding scientists and engineers from across the University to work collaboratively on systems neuroscience and synthetic biology challenges. The building will also house the Cognitive Neuroimaging Center (the "Center"), a state-of-the-art Center with powerful imaging technology that will serve as a shared core resource for human neuroimaging research at the University.

The Project at capacity will house research labs for approximately 160 researchers, post-doctoral students and staff, and 270 graduate students. While it is not expected that there will be an increase in the number of graduate students, the Project will attract world-class faculty and secure new research funding that will increase opportunities and the quality of education for graduate students at the new facility.

The Site is currently a surface parking lot with 60 permitted spaces for University employees, faculty, and staff. Vehicles that currently use this lot will be redirected to University parking facilities in the vicinity of the Project in accordance with the campus-wide Transportation Master Plan.

The pedestrian realm in the heart of the University's Central Campus will be improved by the Project. The Project will provide new open space along with streetscape improvements such as bicycle parking, benches, and new lighting on the Project Site. The Project will provide approximately 69 bicycle parking spaces on Site. The Project will replace the existing ramp to Morse Auditorium with a new indoor, limited use elevator at the rear of the pocket park. The elevator will provide a direct connection to the rear entrance at the southwest corner of Morse Auditorium. There will also be a number of renovations to 3-5 Cummington Mall that are necessary to provide improved pedestrian and facilities connections with the Project.

Construction of the Project is expected to begin in May 2015 and to be completed in December 2016.

1.4 CONSISTENCY WITH INSTITUTIONAL MASTER PLAN

The Project was listed as a Proposed Institutional Project in the First Amendment to the Boston University Charles River Campus 2013 – 2023 Institutional Master Plan ("First Amendment"). The First Amendment was approved by the Boston Redevelopment Authority (BRA) on November 14, 2013 and by the Boston Zoning Commission on December 11, 2013. It went into effect on January 4, 2014. The Project is consistent with the Proposed Institutional Project as described in the First Amendment in terms of its location, size, and proposed uses.

1.5 PUBLIC REVIEW PROCESS

Concurrent with the submission of this Expanded Project Notification Form to the Boston Redevelopment Authority (BRA), the Proponent will meet with BRA Staff and present the Project to the Boston University Community Task Force. The Proponent looks forward to working with the BRA, the community, and the City of Boston on this project.

1.5.1 ARTICLE 80 REVIEW PROCESS

This document is being submitted to the BRA as part of the Article 80B, Large Project Review process. A scoping session and a community meeting are expected to occur during the public comment period and prior to the issuance of a Scoping Determination.

This Project was included in the First Amendment, which went into effect on January 4, 2014. In the First Amendment, the University identified the need for additional life sciences and engineering research and laboratory space to keep pace with the burgeoning bioengineering industry.

As discussed in this document, the Project massing is similar to what was presented in the First Amendment and is within the approved zoning envelope for building area and (total) height.

Following submission of this Expanded Project Notification Form to the BRA, the Proponent will meet with city agencies and present the Project at a combined Boston University Community Task Force (the "Task Force") and public meeting. The Proponent is requesting that the BRA issue a Scoping Determination waiving further review for the Project.

1.5.2 BOSTON CIVIC DESIGN COMMISSION

The Proponent will meet with the Boston Civic Design Commission (BCDC) to review and discuss the Project plans. The Proponent anticipates that BCDC will vote to approve the Project.

1.5.3 BOSTON UNIVERSITY TASK FORCE

The Task Force is comprised of 15 representatives from areas surrounding the Charles River Campus (the "Campus"). For 25 years, the Task Force has reviewed all of the University's master plans and development projects. Members of the Task Force include the following individuals:

- Pamela Beale (Chair)
- Paul Berkeley
- Paul Creighton
- James Hynes
- Yvette Lancaster
- Amy Mahler
- Archie Mazmanian
- Terri North
- Norman O'Grady
- Richard Ong
- Shlomo Pinkas
- Victor Themo
- Elizabeth Walsh
- Steven Wasserman
- Alan Weinberger

The Proponent will schedule three Task Force meetings that are open to the public during the course of the Article 80B review. The University held a pre-filing meeting with the Task Force on May 21. Two additional Task Force Meetings will be scheduled in August and September 2014.

1.6 PUBLIC AND COMMUNITY BENEFITS

Since its founding, the University has been committed to, and is an integral part of, the growth and development of the City of Boston. The University continues to make a significant effort to coordinate its goals and objectives with those of the City, and is committed to maintaining and improving all property it acquires and to serving the residents of the City by making educational programs of the highest quality available and accessible.

Through direct and indirect spending of the University, its employees, students, and their visitors, the University's economic impact on the Commonwealth of Massachusetts totaled nearly $3.9 billion in FY 2012 with $1.1 billion spent in the City of Boston. From an employment perspective, the University accounted for a total of 42,427 jobs in the Commonwealth, 13,790 of which were located in Boston. This total includes 25,110 individuals who were directly employed by the University and an additional 17,317 jobs that resulted from University spending.

The University makes significant annual contributions to local communities through a combination of direct payments and service, which includes real estate taxes, payments in lieu of taxes, linkage payments, scholarships, fees and permits, police services, rubbish removal and street cleaning, and donated use of athletic and recreation facilities. Between

FY2003 and FY2013, the University has paid approximately $52.2 million in real estate property taxes and linkage payments, and $49.1 million to the City of Boston for voluntary payments in lieu of taxes. Combined payments to the City have totaled approximately $101.3 million.

Boston University has also contributed more than $4.9 million between FY2007 and FY2013 to the Commonwealth Avenue Improvement and Beautification Project in collaboration with city, state, and federal agencies.

In addition to direct and indirect economic benefits to the City's economy, the University has offered more than $143 million in scholarships through the Boston Scholars Program, recently renamed the Thomas M. Menino Scholarship Program, which provides approximately 25 full-tuition, four-year scholarships to graduates of Boston public high schools.

The University also actively seeks ways to reduce demand on city services. Through its own Police Department, the University brings additional security to the entire campus area, 24 hours a day, seven days per week, responding to calls both inside and outside campus boundaries. It also oversees the daily maintenance of the local MBTA stations and city sidewalks and streets around the campus, provides snow removal during winter months, plants and repairs street trees, and conducts pest control.

The Project will provide substantial benefits to the City and its residents including the following:

- Redevelopment of a surface parking lot into a high-quality state-of-the-art academic laboratory for integrated life sciences and engineering research;
- Maintenance of the position of the University and the region on the cutting edge of systems neuroscience and synthetic biology research opportunities;
- Consolidation of two major related University research activities into one building with new facilities for state-of-the-art research activities;
- Generation of approximately $27 million/year in grant activity;
- Creation of an energy efficient and environmentally friendly building for scientific research;
- Improvement and rejuvenation of the streetscape of Commonwealth Avenue with increased pedestrian activity within the academic campus;
- Enhancement of open space and public amenities that improve pedestrian accessibility in the neighborhood;

- Approximately 1,039 direct construction jobs and 971 indirect construction jobs; and 160 permanent jobs will be created as a result of this project.[1]

1.7 SUMMARY OF ANTICIPATED PERMITS AND APPROVALS

The following table is a list of anticipated approvals for the Project.

Table 1-1: Anticipated Project Approvals

Agency	Permit Approval
Local	
Boston Redevelopment Authority (BRA)	• Article 80 B Large Project Review • Cooperation Agreement • Development Impact Project Agreement • Schematic Design Approval • Design Development Approval • Construction Document Approval • Certificate of Compliance with Article 80 • Certificate of Consistency with IMP • Certificate of Completion
Boston Civic Design Commission	• Recommendation to the BRA Board
Boston Transportation Department	• Transportation Access Plan Agreement • Construction Management Plan
Boston Water and Sewer Commission	• Site Plan Approval • Sewer Connection Permit
Massachusetts Historical Commission	• Determination of No Adverse Effect/MOA
Inspectional Services Department	• Building Permit • Certificate of Occupancy
Boston Public Works Department	• Street Opening Permit
Boston Public Improvement Commission	• Specific Repair Plan

[1] Construction jobs based on the Regional Input-Output Modeling System (RIMS II), US Department of Commerce, Bureau of Economic Analysis, 2010.

State	
Department of Environmental Protection	• Notice of Construction • Air Quality Permit • Sewer Connection Permit
Massachusetts Water Resource Authority	• Sewer Use Permit
Federal	
Environmental Protection Agency	• National Pollution Discharge Elimination System • Stormwater Notice of Intent
Federal Aviation Administration	• Crane Permit

1.8 PROJECT TEAM

Table 1-2: Project Team

Proponent	Boston University One Silber Way Boston, MA 02215 Gary W. Nicksa Senior Vice President for Operations (617) 353-6500 nicksa@bu.edu Paul Rinaldi Assistant Vice President Facilities Management and Planning (617) 353-6520 prinaldi@bu.edu
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	Kyle Greaves, Associate Planner (617) 357-7044 X200 kgreaves@fpa-inc.com
Architecture/Landscape/Site Planning/MEP	Payette 290 Congress Street Boston, MA 02210 Charles S. Klee, AIA, LEED AP, Partner (617) 895-1310 cklee@payette.com
Transportation	Tetra Tech, Inc. One Grant Street Framingham, MA 01701 Mike Hall Senior Project Manager (508) 903-2038 Michael.hall@tetratech.com
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Civil Engineering	Nitsch Engineering, Inc. 2 Center Plaza #430 Boston, MA 02108 Gary Pease, LEED AP BD+C Vice President (617) 338-0063 gpease@nitscheng.com
Wind	RWDI, Inc. 650 Woodlawn Road West Guelp, Ontario N1K 1B8

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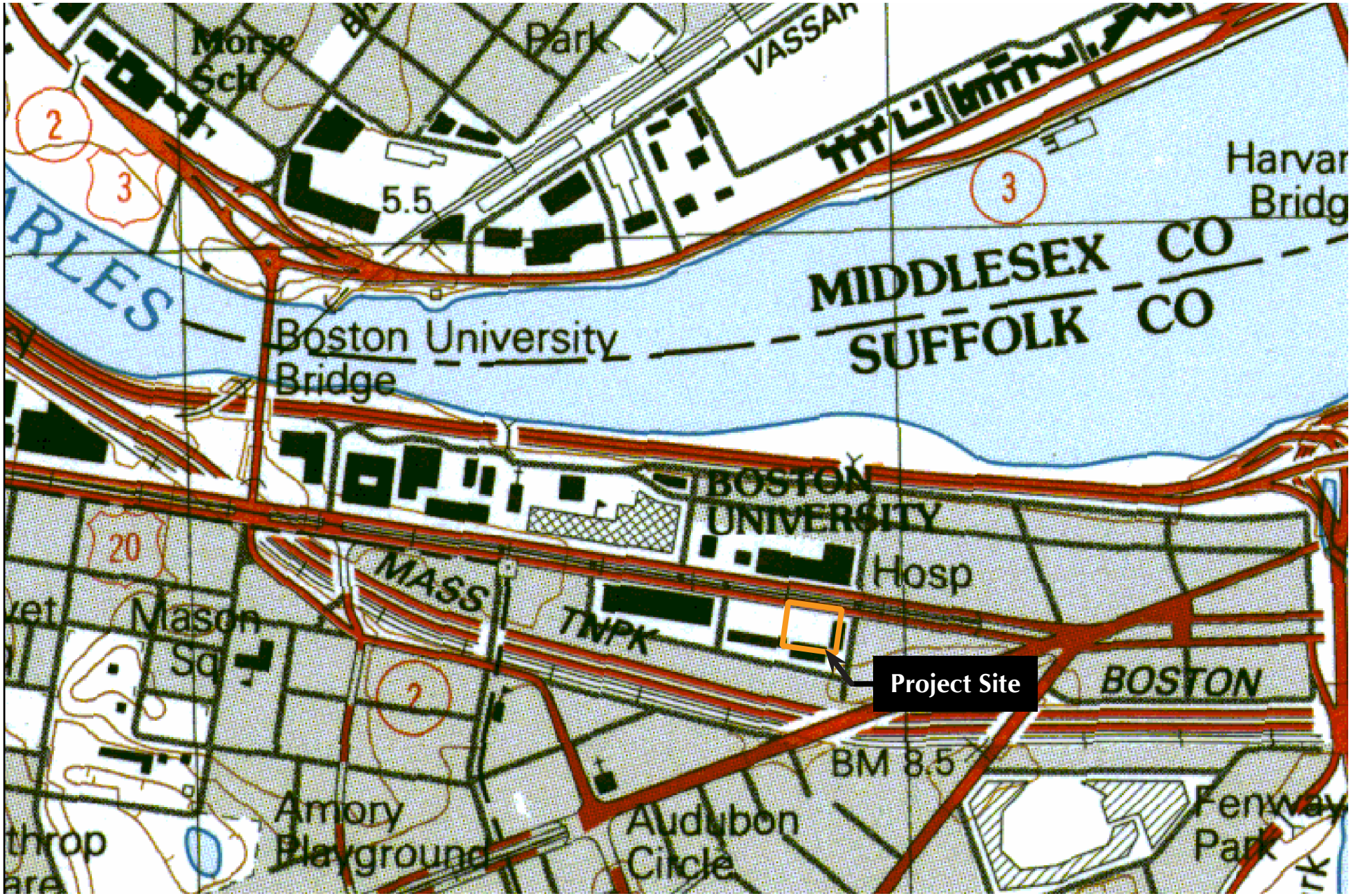
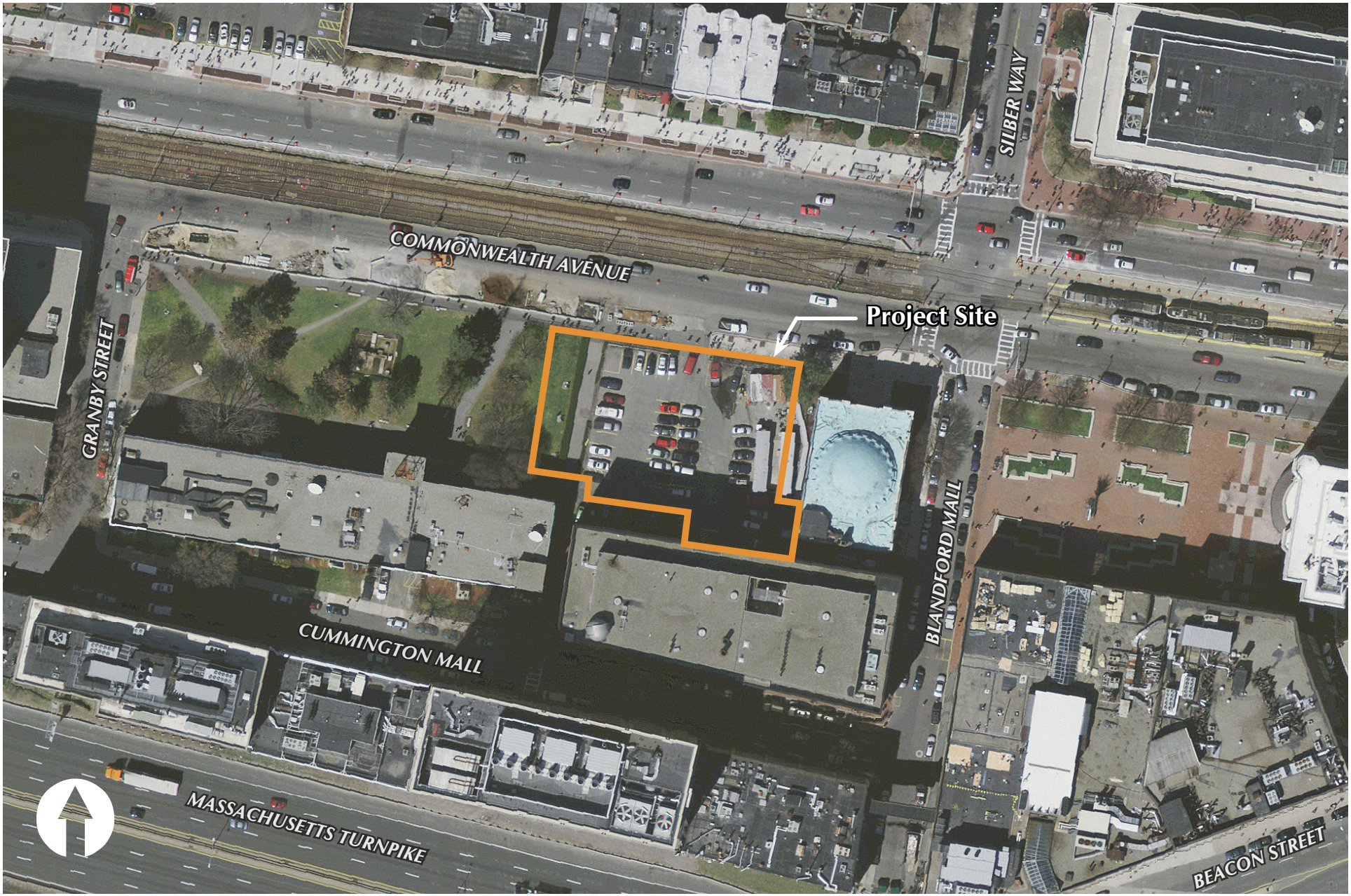


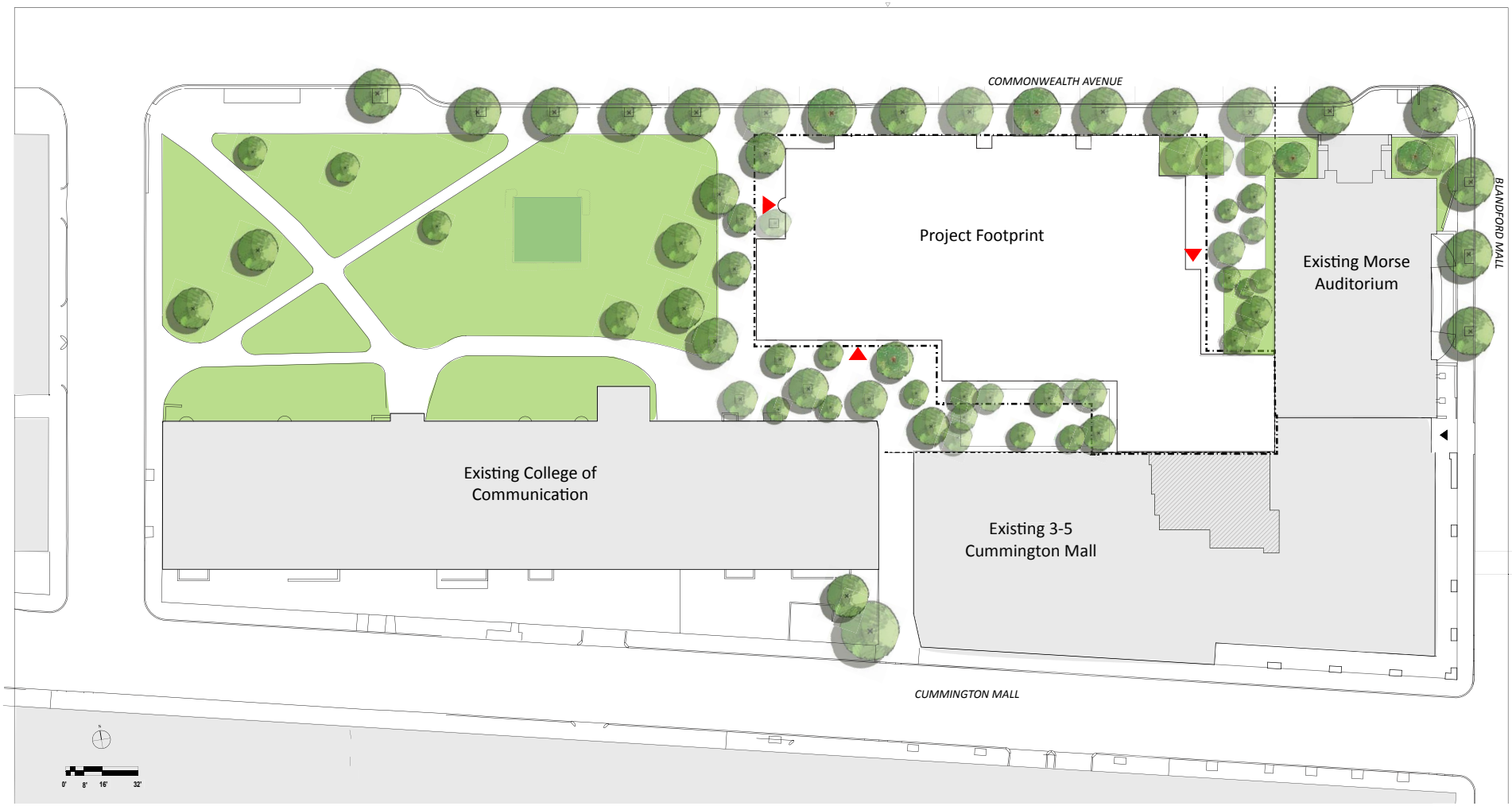
610 Commonwealth Avenue
Boston, MA

Figure 1-1
Locus Map
Source: USGS, 2001



610 Commonwealth Avenue
Boston, MA

Figure 1-2
Aerial View
Source: Mass GIS, 2009



610 Commonwealth Avenue
Boston, MA

Figure 1-3
Project Site Plan
Source: Payette, 2014

Chapter 2

PROJECT DESCRIPTION

CHAPTER 2: PROJECT DESCRIPTION

2.1 PROJECT SITE AND SURROUNDINGS

The Project Site consists of an existing surface parking lot and open space located at 610 Commonwealth Avenue, 0.3 miles west of Kenmore Square, and in the heart of the University's Central Campus. The Site is bounded by Morse Auditorium to the east, 3-5 Cummington Mall to the south, and Boston University Ground South ("Grounds South"), and an open space associated with the College of Communications, to the west. The University owns Grounds South, all of the buildings along Cummington Mall, and all of the buildings along Blandford and Hinsdale Mall. In addition, the University owns the majority of the buildings along Commonwealth Avenue from Kenmore Square to the Boston University Bridge. A variety of shops and restaurants are accessible by foot, bicycle, and public transportation along Commonwealth Avenue and in Kenmore Square. See Figure 2-1, Oblique View of Project Site and Figures 2-3 to 2-6, Existing Conditions Photographs.

2.2 EXISTING CONDITIONS

The Project Site, which totals approximately 23,600 square feet (sf), is currently occupied by open space and a surface parking lot with 60 permitted parking spaces. Development of the Project will require removal of the existing parking lot, and interior and exterior renovations at 3-5 Cummington Mall to allow for direct connections to the Project. See Figure 2-2, Existing Conditions Plan.

2.3 PROPOSED PROJECT

The Project will provide academic, office, and research space for faculty, staff, and students of the University's interdisciplinary Systems Neuroscience and Synthetic Biology departments. The faculty that will move to the new building were selected based on their expressed interest in participating in interdisciplinary collaborations. The Project will specifically include dedicated research lab space, shared lab support, faculty offices, and administration spaces, as well as a seminar room, conference and meeting rooms, computer labs, and typical building support areas (including restrooms, utility rooms, mechanical rooms, and common areas). Lab space for research groups will be right-sized to accommodate current research and program growth. As designed, each research floor will have the capacity to support three Principal Investigators (PIs), which will provide opportunities for collaboration.

The Project will strengthen existing pedestrian connections between the Project Site and Cummington Mall, create new internal connections between the Project and 3-5 Cummington Mall, and enhance pedestrian activity along Commonwealth Avenue. The

building will contain active ground floor uses that include participant research space, lobby space, meeting rooms and conference space, and other public amenities. A courtyard will be created on the south side of the building between 3-5 Cummington Mall and the Project, and a pocket park will be constructed on the east side of the building between the Project and Morse Auditorium. New open space will be directly accessible from the building's ground floor and from adjacent buildings.

As described in Table 2-1, the Project is consistent with the IMP Amendment massing. The total building footprint is approximately 20,164 sf, covering 85 percent of the Site. The total gross floor area (GFA) of the building as calculated under Boston's zoning code is approximately 145,000 sf, and the Project's Floor Area Ratio (FAR) is 5.7.

Table 2-1: Project Program

Project Component	Dimensions/Count
Total Project Site	23,600 sf (0.54 acres)
Building Footprint Area	20,164 sf
Gross Floor Area (Per Zoning)	145,000 sf
Floor Area Ratio (Per Zoning)	5.7
Stories	9 Stories
Program Overview (Typical Lab Floor): Office Space Write-Up Laboratory/Lab Services Core Services Collaboration **Total:**	 3,300 sf 2,500 sf 5,250 sf 3,000 sf 1,500 sf **15,550 sf** per research floor
Program Overview (Ground Floor): Center for Human Imaging CILSE Collaboration Space Building Support Spaces **Total:**	 7,000 sf 3,000 sf 4,500 sf **14,500 sf**
Bicycle Parking	53 Covered/Indoor Spaces 16 Uncovered Spaces
Height	140 feet

2.3.1 BUILDING PROGRAM

The proposed footprint for the Project is approximately 20,164 sf. The majority of the ground floor will be dedicated to the Cognitive Neuroimaging Center (the "Center"), a state-of-the-art Center with powerful imaging technology that will serve as a cross-disciplinary core resource for Human Neuroimaging research at the University. Office space and academic meeting rooms located along the northern elevation of the Project will be available to students, staff, and faculty. Additional

ground floor uses will include restrooms, changing rooms, a bicycle storage room, and building support rooms. See Figure 2-7, Ground Floor Plan.

The primary entrance to the Project will be located on the west elevation of the building north of the colloquioum space and fronting Grounds South. Two additional points of access and egress will be positioned on the south elevation east of the colloquium space, and one will be located on the east elevation providing access to the pocket park between the Project and Morse Auditorium. The Project's entrance on the west elevation of the building will activate and engage Grounds South. The Project will also enhance the existing pedestrian route from Commonwealth Avenue to Cummington Mall, including internal and external connections with the Physics and Biology Research Building. These physical connections will strengthen the University's Science and Research Campus and will maintain consistency with future potential plans for realignment of Cummington Mall and connecting open spaces as indicated in the IMP. On-site bicycle parking will be provided at the ground level. The Project will provide 53 indoor/covered bicycle parking spaces, 16 outdoor bicycle parking spaces, and two showers/changing rooms within the building.

According to the Federal Emergency Management Agency (FEMA), the Project Site is not contained in a flood zone, however the building's major mechanical systems will be located on the second and third floors of the building to increase resiliency and to reduce the risk of damage to critical infrastructure as a result of future severe storm or flooding events. This is also an efficient way to meet the building's considerable air-handling needs. There will be no basement level. See Figure 2-8, Second Floor Plan and Figure 2-9, Third Floor Plan.

The top six floors will be built to reflect the needs of Synthetic Biology or Systems Neuroscience department faculty. The current design of the typical laboratory floor reinforces an interdisciplinary approach and ensures future flexibility by using a standard design for all six research floors. The west end of each floor will house faculty and staff offices, which will be accessible to students and visitors. Depending on the nature of the research, the lab spaces will allow limited access to those on the research teams. Within the lab zone, a service elevator will provide a direct link to the service bay and, on three levels, the abutting 3-5 Cummington Mall building. The number of synthetic biology and systems neuroscience laboratory floors and their location within the top six floors in the Project will be defined through the design development process. See Figure 2-10, Typical Synthetic Biology Floor Plan, and Figure 2-11, Typical Systems Neuroscience Floor Plan.

The remainder of each floor, accessible only by authorized researchers and staff, will be divided into three zones for low, medium, and high intensity research. The

high intensity zones (e.g. wet labs) will be stacked on top of each other at the rear of the building, creating efficiencies within the building and allowing researchers, graduate students, and post-doctoral scholars' access to related College of Engineering and College of Arts & Sciences facilities on Cummington Mall. A secure pedestrian connection will link two floors of 3-5 Cummington Mall with the Project, improving accessibility between the research buildings for authorized personnel.

The low and medium-intensity research spaces on these floors will have few load bearing walls or other structural members. These spaces will be relatively open, which will encourage flexibility and will accommodate future reconfiguration of the space to meet the changing needs of the research teams. See Figures 2-7 through 2-12, Floor Plans.

2.3.2 RENOVATIONS TO 3-5 CUMMINGTON MALL

The Project will create new physical connections to the adjacent 3-5 Cummington Mall building (a five-story building that houses research in physics and biology). Small sections of the north elevation of 3-5 Cummington Mall, currently used as classroom space, classroom support space, and office space, will be renovated to accommodate new internal pedestrian and facilities connections between 3-5 Cummington Mall and the Project at the ground level and on floors four and five.

2.3.3 PARKING AND CIRCULATION

Vehicular

The Site is currently occupied by a surface parking lot with access from Commonwealth Avenue for 60 permitted spaces that provide parking for staff and faculty of the University. Consistent with the University's Transportation Management Plan (TMP), the Project will redistribute the 60 cars within the University-owned parking facilities in the vicinity of the Site. Faculty and staff will be encouraged to park at the Warren Towers garage (464 spaces), the surface parking lot at 766 Commonwealth Avenue (87 Spaces), or spaces in the western end of the Campus at the Student Village. Visitors to the Site can utilize existing metered parking located along the north and south sides of Commonwealth Avenue, or they may park at the University owned pay-on-entry parking facility located at the corner of Commonwealth Avenue and Deerfield Street. See Figure 2-13, Circulation and Access Plan. See Chapter 5, Transportation, for a full description of existing and proposed transportation conditions.

Loading and Service

Delivery and service vehicles will utilize a reconfigured loading dock that is part of 3-5 Cummington Mall, located off Blandford Mall behind Morse Auditorium. The loading dock has the capacity to support the additional building and will be reconfigured to accommodate Morse Auditorium, 3-5 Cummington Mall, and the Project. See Figure 2-13, Circulation and Access Plan.

Bicycle

The Project aims to encourage bicycle use and reduce parking demand on the Site. The Project's proximity to the MBTA Green Line and bus lines will reduce single occupancy vehicle trips to the Site. A total of 69 secure bicycle parking spaces will be provided on the Site. Fifty-three spaces will be provided in a bicycle storage room located on the southern elevation of the building and will be accessible through the courtyard. Sixteen additional outdoor spaces will be accommodated in exterior bicycle racks located on the south and eastern sides of the building. The interior, secure spaces will be available to students, staff, and faculty. Visitors to the Site will use the exterior bicycle racks. See Figure 2-13, Circulation and Access Plan.

The Project will provide showers and changing rooms on the ground floor of the building for those who commute to the Project by bicycle. Bicycle lanes are currently provided along the north and south side of Commonwealth Avenue in the vicinity of the Site.

Accessibility

All of the Project's main entrances will be located at ground level and will be universally accessible. The Project will replace the existing ramp to Morse Auditorium with a new indoor, limited use elevator at the rear of the pocket park. The elevator will provide a direct connection to the rear entrance at the southwest corner of Morse Auditorium.

2.3.4 OPEN SPACE AND LANDSCAPING

In accordance with the provisions in the IMP, the Project is designed to reinforce the University's linear Campus and to create a variety of open spaces that enrich the streetscape by supporting different scales and levels of interaction.

At the largest scale, the Project will improve Grounds South in front of the College of Communications by replacing a parking lot with the west elevation of the Project. The Project will begin to create the sense of an urban room that encloses the Grounds South in preparation for the long-term plan that will connect the core

Campus and Commonwealth Avenue to Cummington Mall. The Project's main entrance, meeting space, and offices are located along the west elevation to create a sense of connection between the interior uses and exterior open space. In addition to the connectivity provided via the entrance, the colloquium space may be designed with operable openings that permit the interior space to connect seamlessly to Grounds South. An updated pedestrian pathway will also improve the connection between Commonwealth Avenue and Cummington Mall.

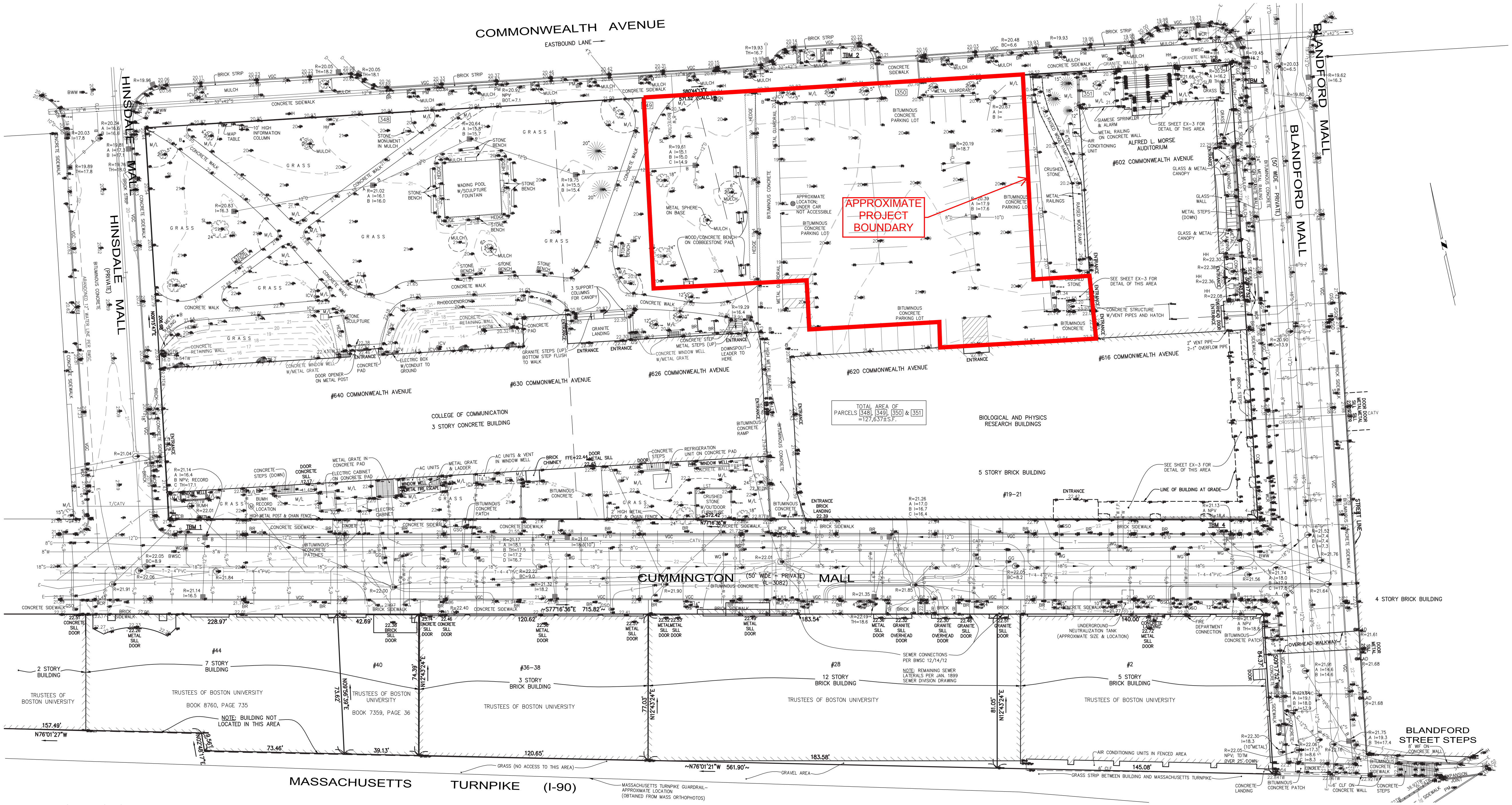
To the east of the building a new pocket park will create a unique, functional landscape that will engage the public realm, but will be more intimate and smaller in scale than the landscape associated with Grounds South. Functionally, the pocket park will provide access to Morse Auditorium, but it is also intended to be an occupiable space and a destination for students, faculty and visitors. In lieu of the existing ramp, the Project will include a new indoor limited use elevator at the rear of the pocket. There will be hardscape elements suitable for pedestrian use, complemented by softer natural elements, which will create an attractive area to congregate. The project proposes to preserve the existing ivy growing on that façade to the greatest extent possible.

On the south façade of the building the Project preserves a volume of space that will form a courtyard between the Project and 3-5 Cummington Mall. Unlike the pocket park and Grounds South, the courtyard is proposed as a quiet contemplative landscape that will more likely be viewed from the adjacent workspaces and interior lobby than occupied directly.

Plantings on the Site will be native species, select ornamental species, and groundcover that maintains the planted character of the Campus and preserve the sun-filled lawn of the existing Grounds South. See Figure 2-14, Landscape Plan.

610 Commonwealth Avenue
Boston, MA

Figure 2-1
Oblique View of Project Site
Source: Payette



UTILITY INFORMATION STATEMENT

1. THE SUB–SURFACE UTILITY INFORMATION SHOWN HEREON IS COMPILED BASED ON FIELD SURVEY INFORMATION, RECORD INFORMATION AS SUPPLIED BY THE APPROPRIATE UTILITY COMPANIES, AND PLAN INFORMATION SUPPLIED BY THE CLIENT, IF ANY; THEREFORE WE CANNOT GUARANTEE THE ACCURACY OF SAID COMPILED SUB–SURFACE INFORMATION TO ANY CERTAIN DEGREE OF STATED TOLERANCE. ONLY PHYSICALLY LOCATED SUB–SURFACE UTILITY FEATURES FALL WITHIN NORMAL STANDARD OF CARE ACCURACIES.

2. THE LOCATIONS OF UNDERGROUND PIPES, CONDUITS, AND STRUCTURES HAVE BEEN DETERMINED FROM SAID INFORMATION, AND ARE APPROXIMATE ONLY. COMPILED LOCATIONS OF ANY UNDERGROUND STRUCTURES, NOT VISIBLY OBSERVED AND LOCATED, CAN VARY FROM THEIR ACTUAL LOCATIONS.

3. ADDITIONAL BURIED UTILITIES/STRUCTURES MAY BE ENCOUNTERED.

4. THE STATUS OF UTILITIES, WHETHER ACTIVE, ABANDONED, OR REMOVED, IS AN UNKNOWN CONDITION AS FAR AS OUR COMPILATION OF THIS INFORMATION.

5. IT IS INCUMBENT UPON INDIVIDUALS USING THIS INFORMATION TO UNDERSTAND THAT COMPILING UTILITY INFORMATION IS NOT EXACT, AND IS SUBJECT TO CHANGE BASED UPON VARYING PLAN INFORMATION RECEIVED AND ACTUAL LOCATIONS.

6. THE ACCURACY OF MEASURED UTILITY INVERTS AND PIPE SIZES IS SUBJECT TO FIELD CONDITIONS, THE ABILITY TO MAKE VISUAL OBSERVATIONS, DIRECT ACCESS TO THE VARIOUS ELEMENTS AND OTHER MATTERS.

7. THE PROPER UTILITY ENGINEERING/COMPANY SHOULD BE CONSULTED AND THE ACTUAL LOCATIONS OF SUBSURFACE STRUCTURES SHOULD BE VERIFIED IN THE FIELD (V.I.F.) BEFORE PLANNING FUTURE CONNECTIONS. CONTACT THE DIG SAFE CALL CENTER AT 1–888–344–7233, SEVENTY–TWO HOURS PRIOR TO EXCAVATION, BLASTING, GRADING, AND/OR PAVING.

LEGEND

AD	AREA DRAIN	12"	DECIDUOUS TREE WITH TRUNK DIAMETER
	CATCH BASIN	12"	CONIFEROUS TREE WITH TRUNK DIAMETER
D	DRAIN MANHOLE	M/L	MULCH/LANDSCAPING
E	ELECTRIC MANHOLE	AC	AIR CONDITIONING UNIT
M	MISCELLANEOUS MANHOLE	21x60	SPOT ELEVATION
S	SEWER MANHOLE	FFE=	FINISHED FLOOR ELEVATION
T	TELEPHONE MANHOLE	22x84	TOP OF WALL ELEVATION
GV	GATE VALVE; UNIDENTIFIED	CLF	CHAIN LINK FENCE
GSO	GAS SHUT–OFF	WIF	WROUGHT IRON FENCE
GG	GAS GATE	VGC	VERTICAL GRANITE CURB
WG	WATER GATE	WCR	WHEELCHAIR RAMP
BWSC	BOSTON WATER AND SEWER COMMISSION	LST	LANDSCAPE TIMBER
BWW	BOSTON WATER WORKS	WW	WINDOW WELL W/METAL GRATE
ICV	IRRIGATION CONTROL VALVE	R=	RIM ELEVATION EQUALS
PIV	POST INDICATOR VALVE	I=	INVERT ELEVATION EQUALS
	FIRE HYDRANT	TH=	TOP OF HOOD ELEVATION EQUALS
CO	CLEAN–OUT	BC=	BOTTOM OF CHANNEL ELEVATION EQUALS
	LIGHT POLE	NPV	NO PIPES VISIBLE
HH	HAND HOLE	TDTM	TOO DEEP TO MEASURE
SL	SPOT LIGHT; FLUSH TO GROUND	CATV	UNDERGROUND CABLE TELEVISION LINE
B	BOLLARD	D	UNDERGROUND DRAIN LINE
P	PARKING METER POST; NO METER	E	UNDERGROUND ELECTRIC LINE
PM	PARKING METER	G	UNDERGROUND GAS LINE
S	SIGN POST	S	UNDERGROUND SEWER LINE
ECB	EMERGENCY CALL BOX	T	UNDERGROUND TELEPHONE LINE
BR	BICYCLE RACK	W	UNDERGROUND WATER LINE

NOTES

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6.) AS OF THE DATE OF THIS PLAN, RECORD STREET LIGHTING PLANS HAVE NOT BEEN RECEIVED.

BENCHMARKS SET:

TBM 1: X CUT ON HOLD DOWN–BOLT ON FIRE HYDRANT NEAR INTERSECTION OF CUMMINGTON MALL AND HINSDALE STREET; ELEVATION=23.88 (BCB)

TBM 2: X CUT ON HOLD–DOWN BOLT ON FIRE HYDRANT ON COMMONWEALTH AVENUE IN FRONT OF PARKING LOT NEXT TO MORSE AUDITORIUM; ELEVATON=23.13 (BCB)

TBM 3: X CUT ON HOLD–DOWN BOLT ON FIRE HYDRANT AT INTERSECTION OF COMMONWEALTH AVENUE AND BLANDFORD STREET; ELEVATION=22.69 (BCB)

TBM 4: X CUT ON HOLD–DOWN BOLT ON FIRE HYDRANT AT INTERSECTION OF CUMMINGTON MALL AND BLANDFORD STREET; ELEVATION=24.26 (BCB)

DEED REFERENCES

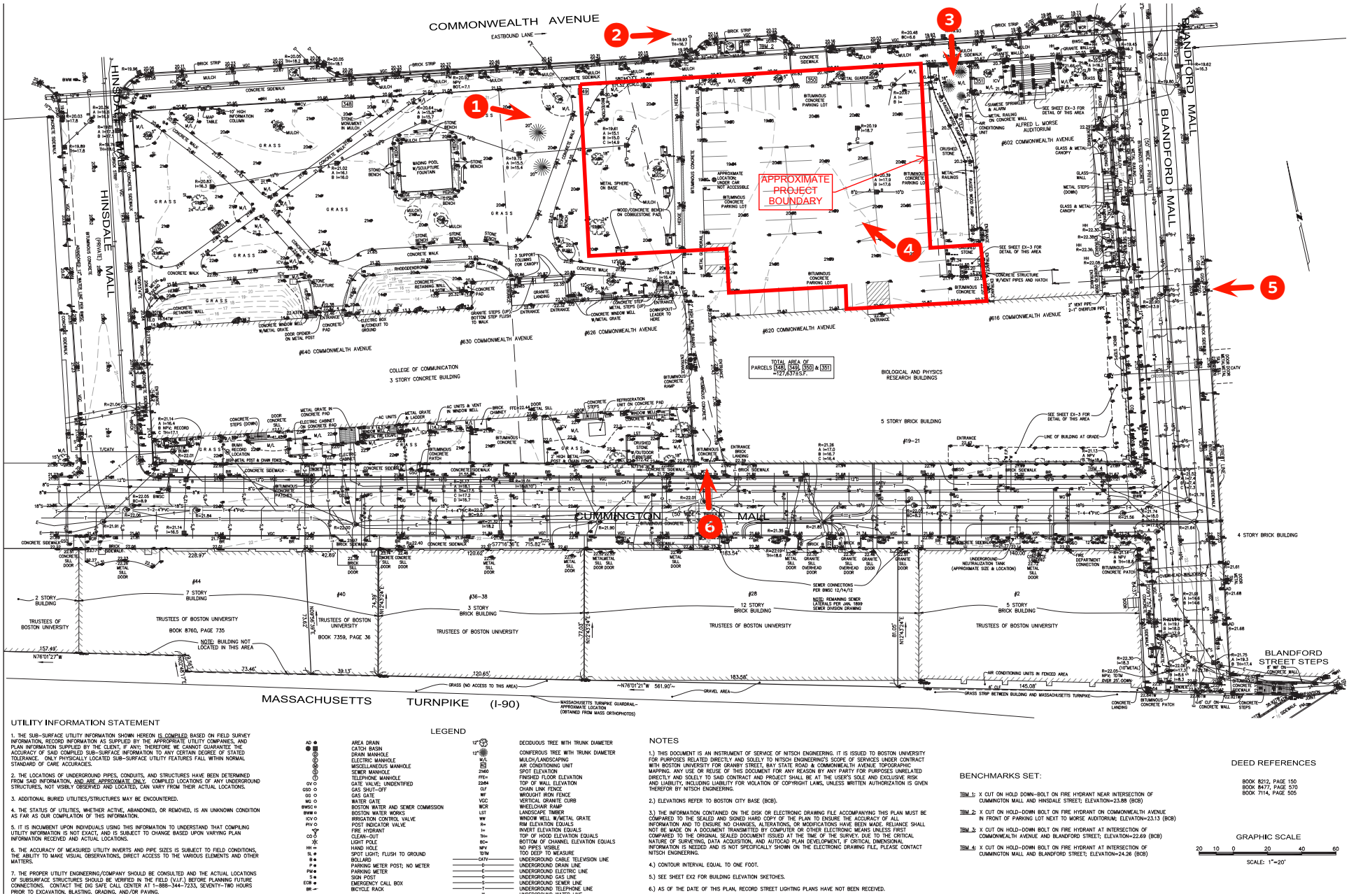
BOOK 8212, PAGE 150
BOOK 8477, PAGE 570
BOOK 7114, PAGE 505

GRAPHIC SCALE

20 10 0 20 40 60

SCALE: 1"=20'

Figure 2-2
Existing Conditions Plan
Source: Nitsch Engineering, Inc., 2014



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LEGEND

AREA DRAIN
CATCH BASIN
DRAIN MANHOLE
ELECTRIC MANHOLE
MISCELLANEOUS MANHOLE
SEWER MANHOLE
TELEPHONE MANHOLE
GATE VALVE; UNIDENTIFIED
GAS SHUT-OFF
GAS GATE
WATER GATE
BOSTON WATER AND SEWER COMMISSION
BOSTON WATER WORKS
IRRIGATION CONTROL VALVE
POST INDICATOR VALVE
FIRE HYDRANT
CLEAN-OUT
LIGHT POLE
HAND HOLE
SPOT LIGHT; FLUSH TO GROUND
BOLLARD
PARKING METER POST; NO METER
PARKING METER
SIGN POST
EMERGENCY CALL BOX
BICYCLE RACK
DECIDUOUS TREE WITH TRUNK DIAMETER
CONIFEROUS TREE WITH TRUNK DIAMETER
MULCH/LANDSCAPING
AIR CONDITIONING UNIT
SPOT ELEVATION
FINISHED FLOOR ELEVATION
TOP OF WALL ELEVATION
CHAIN LINK FENCE
WROUGHT IRON FENCE
VERTICAL GRANITE CURB
WHEELCHAIR RAMP
LANDSCAPE TIMBER
WINDOW WELL W/METAL GRATE
RIM ELEVATION EQUALS
INVERT ELEVATION EQUALS
TOP OF HOOD ELEVATION EQUALS
BOTTOM OF CHANNEL ELEVATION EQUALS
NO PIPES VISIBLE
TOO DEEP TO MEASURE
UNDERGROUND CABLE TELEVISION LINE
UNDERGROUND DRAIN LINE
UNDERGROUND ELECTRIC LINE
UNDERGROUND GAS LINE
UNDERGROUND SEWER LINE
UNDERGROUND TELEPHONE LINE

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DEED REFERENCES

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BOOK 8477, PAGE 570
BOOK 7114, PAGE 505

GRAPHIC SCALE

20 10 0 20 40 60

SCALE: 1"=20'

610 Commonwealth Avenue
Boston, MA

Figure 2-3
Photographic Locations Plan
Source: Fort Point Associates, Inc., 2014

Photograph 1: View of Project Site along Commonwealth Avenue from the west

Photograph 2: View looking east along Commonwealth Avenue

610 Commonwealth Avenue
Boston, MA

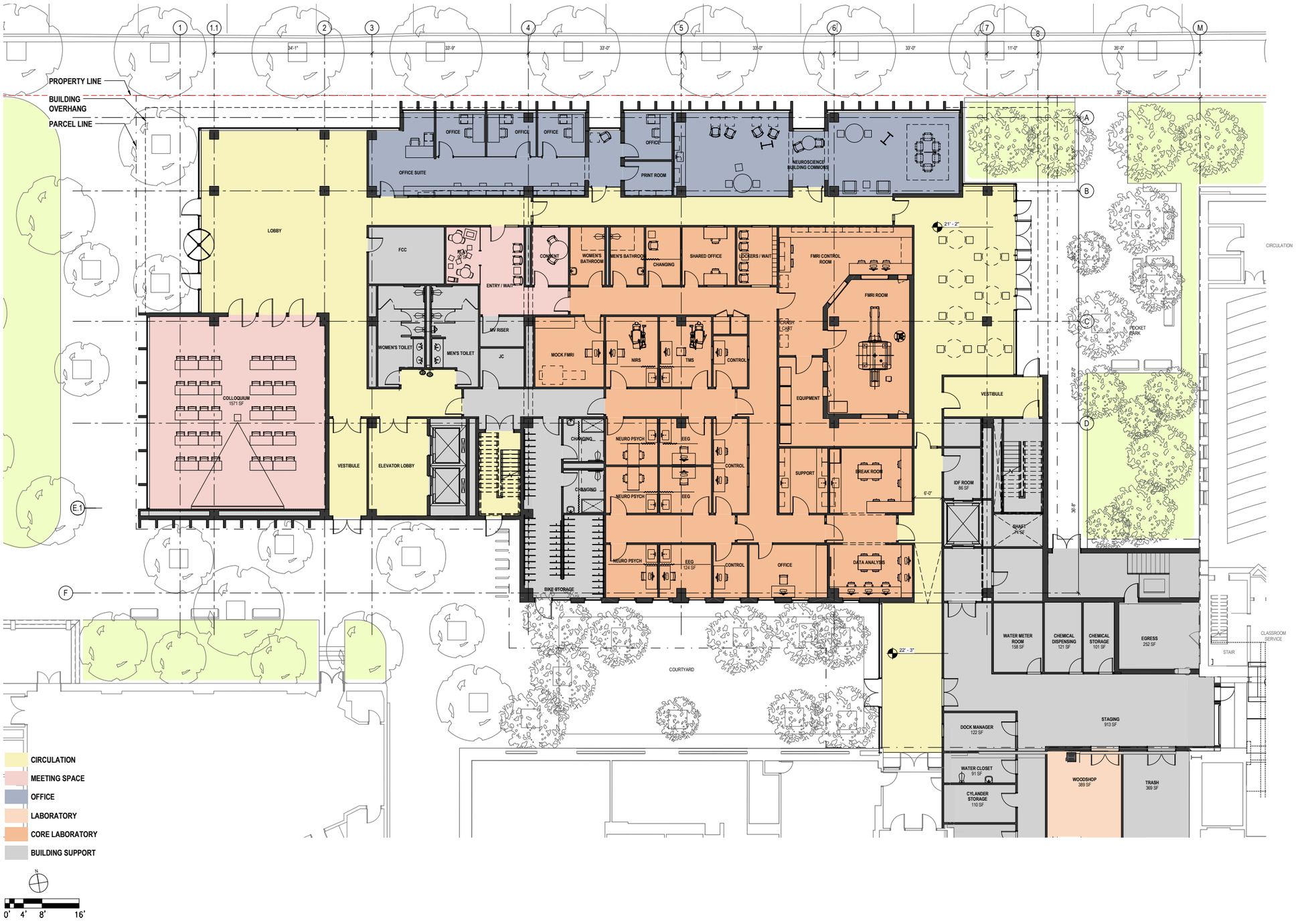
Figure 2-4
Existing Conditions Photographs
Source: Fort Point Associates, Inc., 2014

Photograph 3: Universal access ramp in between the Project Site and Morse Auditorium

Photograph 4: Existing surface parking lot on the Project Site as seen from the southeast corner of the Site

Photograph 5: Loading dock between Morse Auditorium and 3-5 Cummington Mall as seen from Blandford Mall

Photograph 6: North/south pedestrian path between the College of Communication 3-5 Cummington Mall



610 Commonwealth Avenue
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Figure 2-7
Ground Floor Plan
Source: Payette, 2014

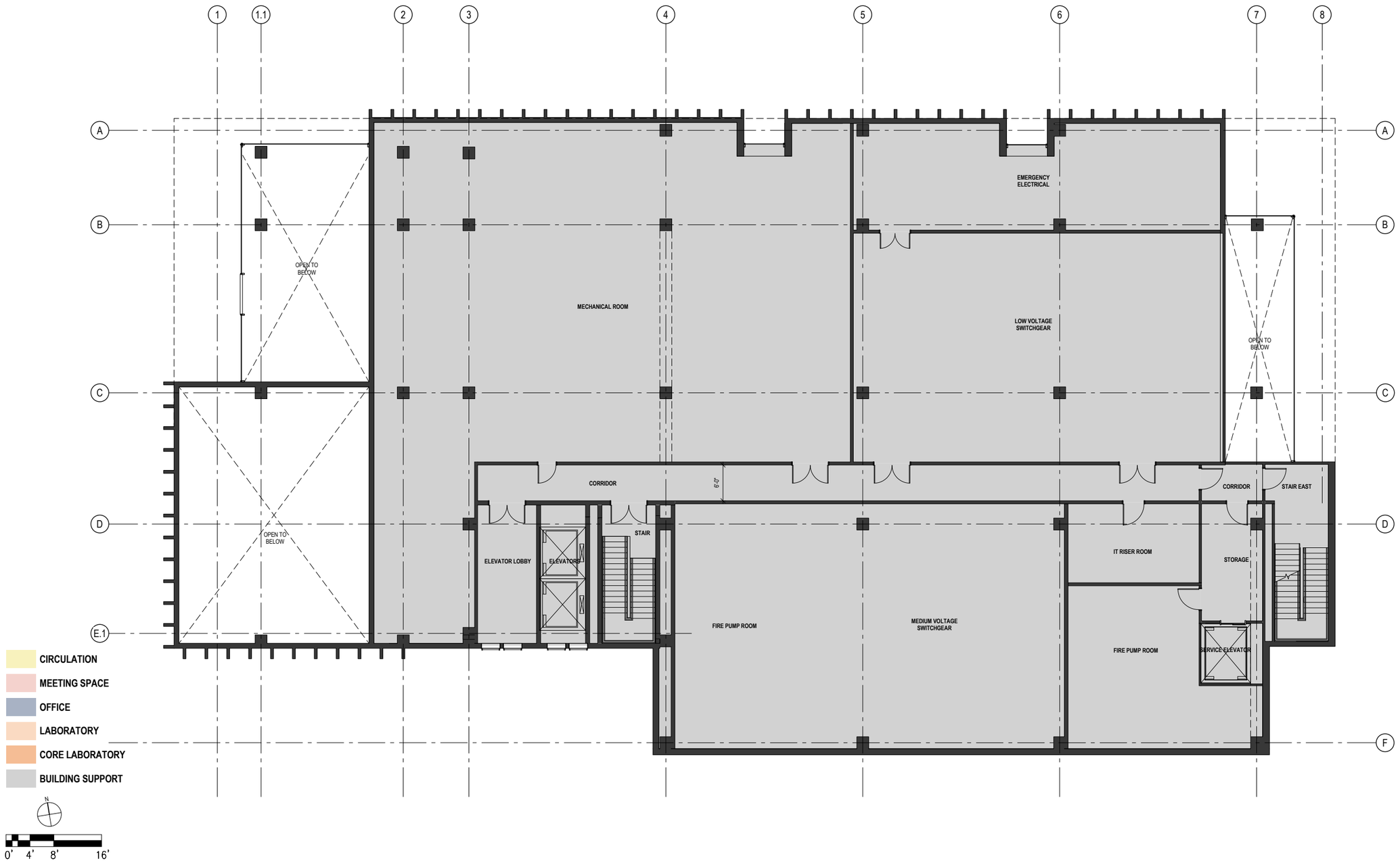


Figure 2-8
Second Floor Plan
Source: Payette, 2014

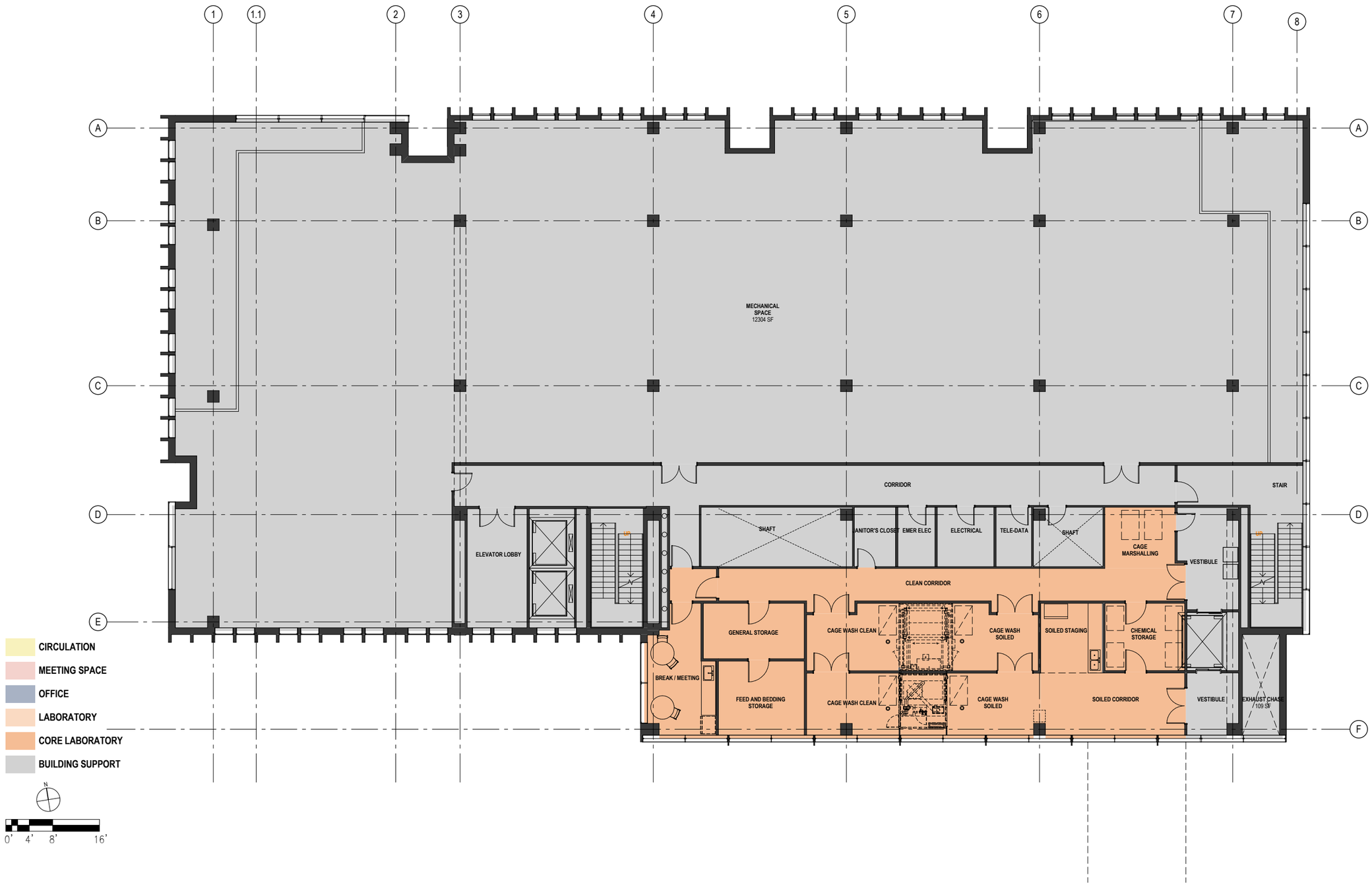


Figure 2-9
Third Floor Plan
Source: Payette, 2014


1
1.1
2
3
4
5
6
7
8
A
B
C
D
E.1
E
F
UP
DN
FEC
CIRCULATION
MEETING SPACE
OFFICE
LABORATORY
CORE LABORATORY
BUILDING SUPPORT
N
0'
4'
8'
16'

Figure 2-11
Typical Systems Neuroscience Floor Plan
Source: Payette, 2014

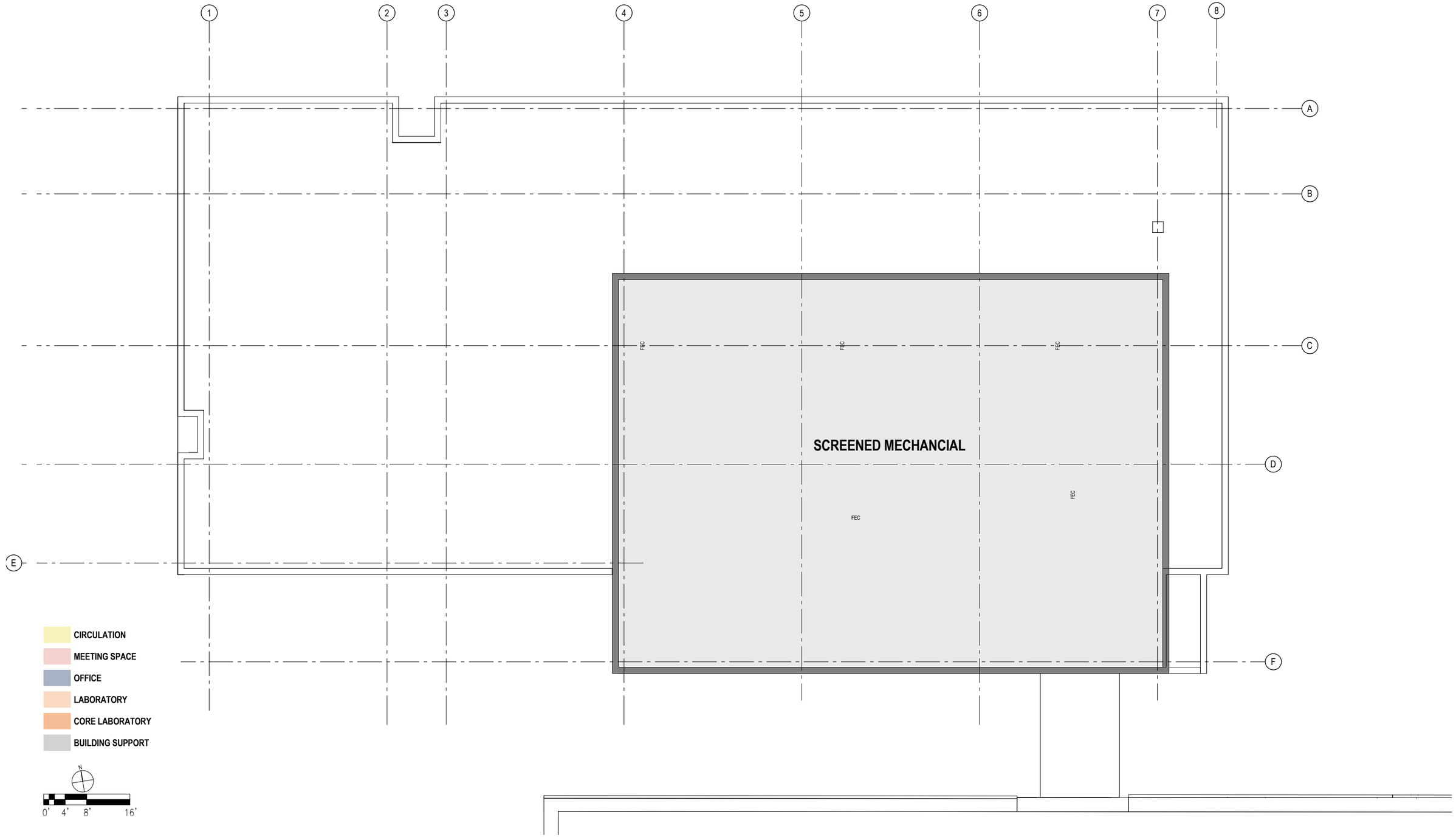
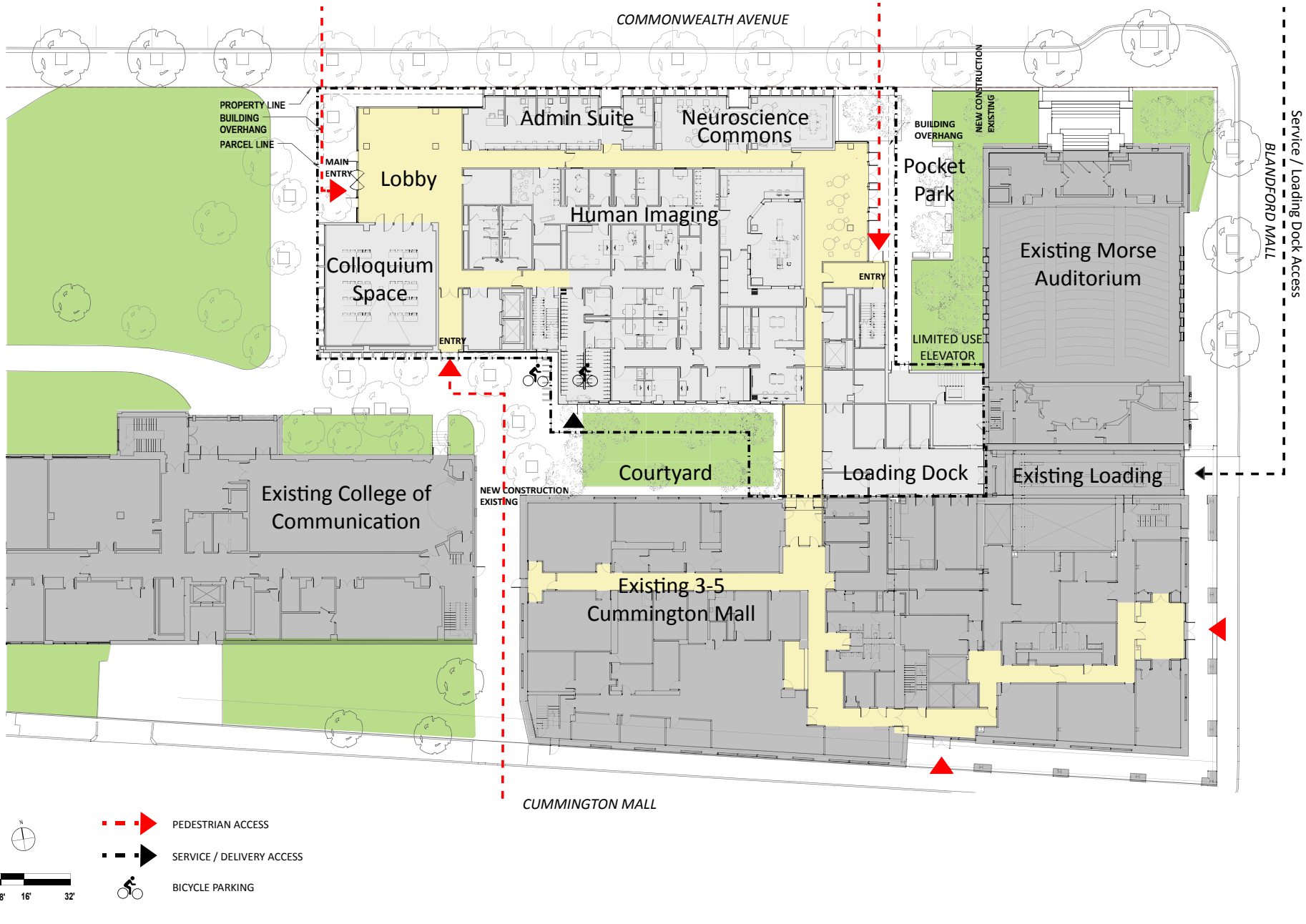


Figure 2-12
Roof Plan
Source: Payette, 2014



610 Commonwealth Avenue
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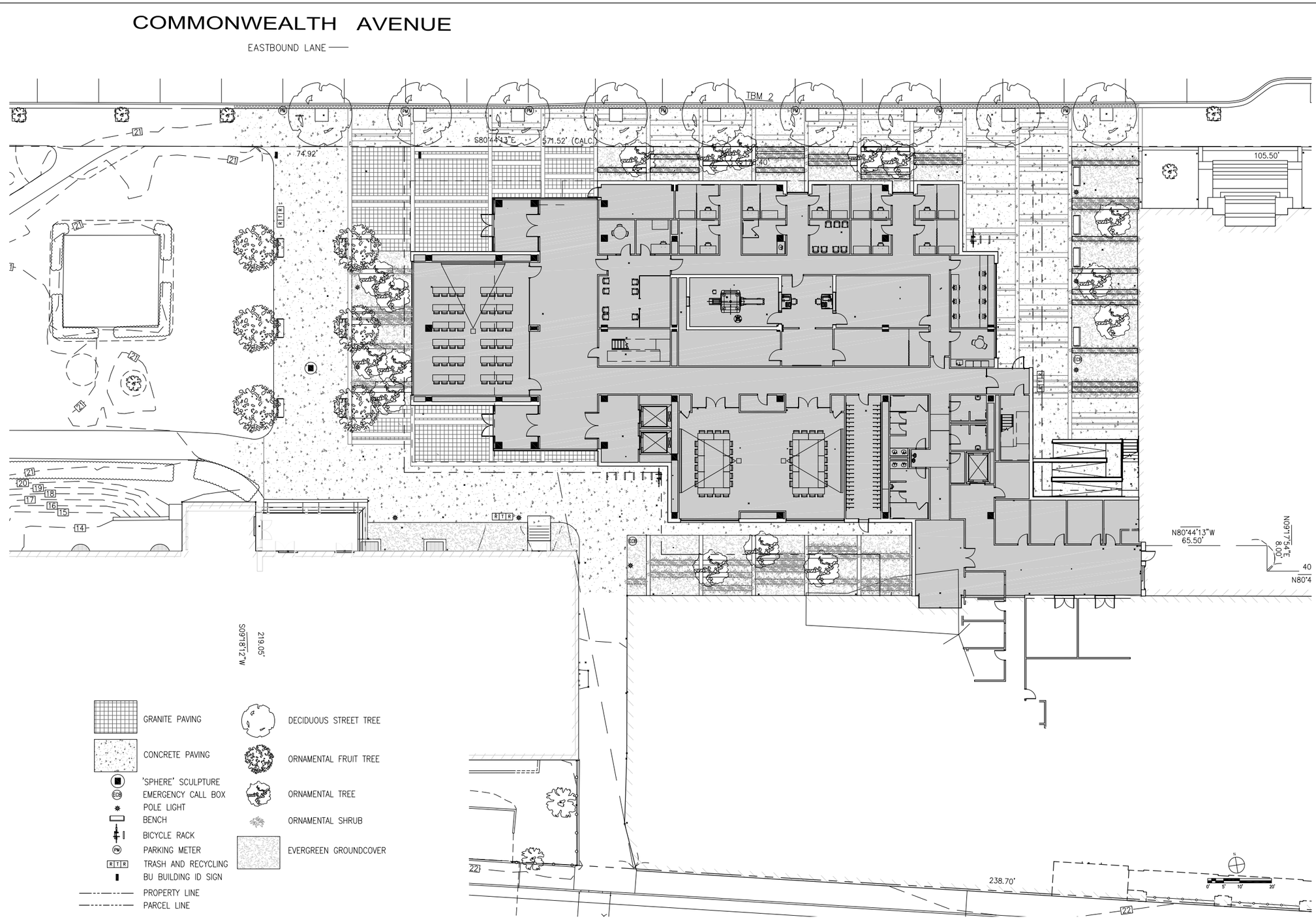
Figure 2-13
Circulation and Access Plan
Source: Payette, 2014



610 Commonwealth Avenue
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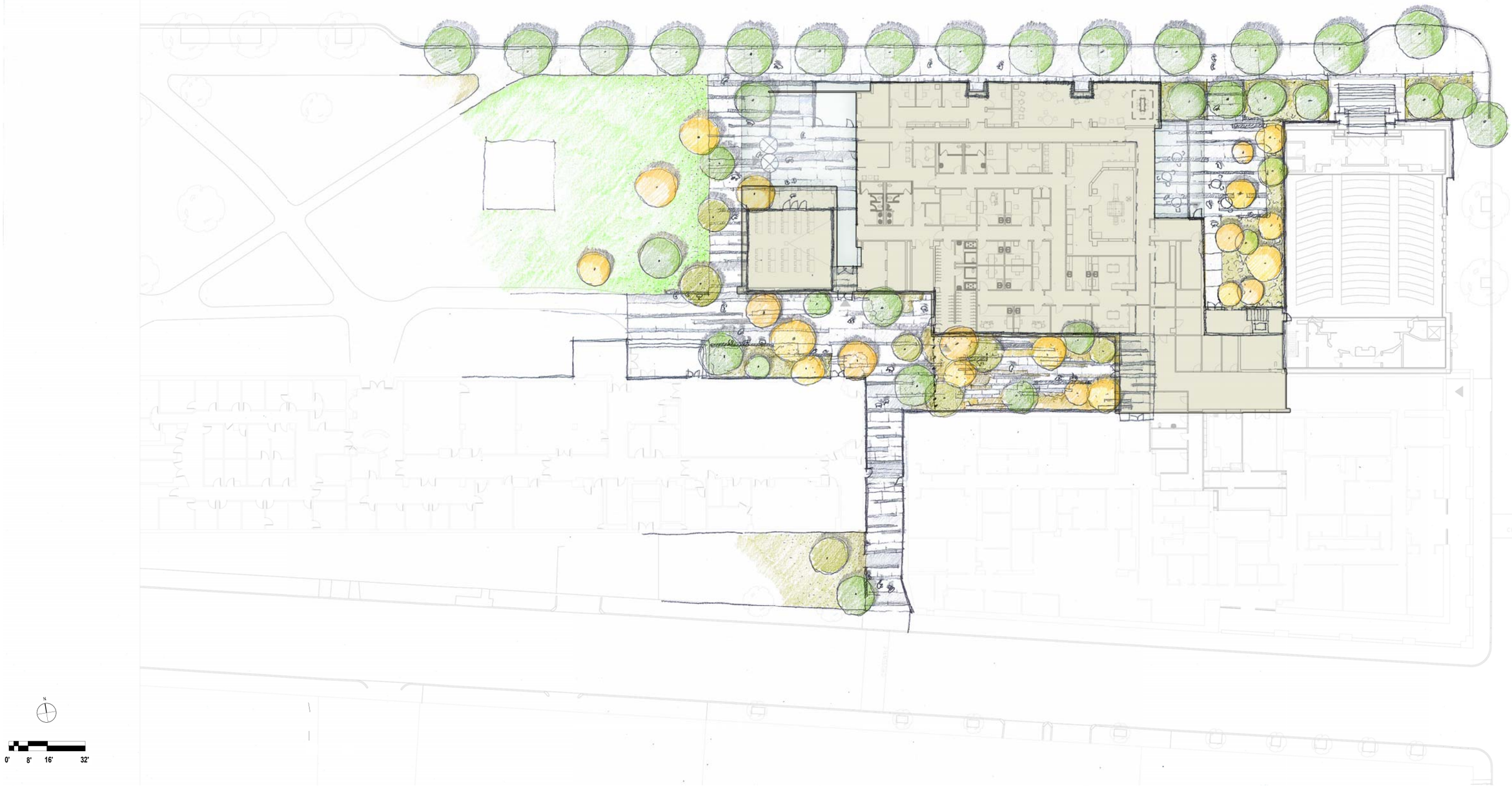
Figure 2-14
Landscape Plan
Source: Payette, 2014



610 Commonwealth Avenue
Boston, MA

Figure 2-14
Landscape Plan
Source: Payette, 2014

Chapter 3

URBAN DESIGN

CHAPTER 3: URBAN DESIGN

3.1 INTRODUCTION

This Project will address an urgent need by the University to construct a consolidated, visionary research center that will provide academic, office, and research space for faculty, staff, and students of the University's interdisciplinary Systems Neuroscience and Synthetic Biology departments. The Project is consistent with key elements of the Boston University Charles River Campus 2013 – 2023 Institutional Master Plan (the "IMP") and the Boston University Charles River Campus 2013 – 2023 Institutional Master Plan Urban Design Supplement (the "Urban Design Supplement").

Currently, the stretch of Commonwealth Avenue between Hinsdale Mall and Blandford Mall is a comprised of a collection of low-rise industrial buildings and emerging science and research buildings. As described in the First Amendment to the Boston University Charles River Campus 2013 – 2023 Institutional Master Plan (the "First Amendment"), the Project replaces existing surface parking with new urban infill. When the Project is completed it will support the long-term vision for the newly pedestrianized Cummington Mall, strengthen the University's Science and Research Campus, improve the public realm, and activate ground floor uses and the streetscape along Commonwealth Avenue.

3.2 MASSING

The Project is located in a part of the University's Central Campus that is characterized by a wide variety of buildings that are primarily rectilinear, but that vary substantially in height and style. At 140 feet tall, the Project is approximately 50 feet shorter than the tallest building in the immediate vicinity, but it is significantly taller than the iconic Morse Auditorium ("Morse"), which is 74 feet tall. See Table 3-1, Building Heights in the Vicinity of the Project.

Table 3-1: Building Heights in the Vicinity of the Project

Building	Height (feet)
Warren Towers (700 Commonwealth Avenue)	196 feet
College of Communications (640 Commonwealth Avenue)	47 feet
Morse Auditorium (602 Commonwealth Avenue)	74 feet

Building	Height (feet)
School of Management (595 Commonwealth Avenue)	166 feet
Graduate Student Residence (580 Commonwealth Avenue)	125 feet
Engineering Research Building (44 Cummington Mall)	122 feet
Life Science and Engineering Building (24 Cummington Mall)	167 feet

The shallow dome atop Morse Auditorium presents a noteworthy exception to the manner in which virtually all the other neighboring buildings meet the sky. In spite of its relatively small scale, Morse anchors the corner of Commonwealth Avenue and Blandford Mall and commands a significant amount of the visual attention on the Site. See Figure 3-4, Perspective Looking Southwest. One of the urban design objectives of the Project, therefore, is to reinforce the urban fabric and streetscape along Commonwealth Avenue while simultaneously creating a complimentary backdrop for Morse that does not compete with it. For this reason, the Project is deliberately simple in its massing. Its compact, restrained exterior is designed to look like one singular building block at first glance. This simple geometry is then refined through deep cutouts into the first three stories at the building's two primary corners. The uniform height of these cutouts is intended to be referential to the scale of a number of important visual references in the vicinity of the Site: the row-houses on the north side of Commonwealth Avenue, the entablature of Morse, and the podium of Warren Towers. This creates a sense of scale that is compatible with Morse and breaks down the façade so that it is welcoming at the pedestrian level. This interplay between the simplicity of the articulation of the façade, in combination with the gesture of the cutouts along Commonwealth Avenue, provides a balance between the varied massing in the area and creates a restrained counterpoint to Morse.

On the upper floors, where the building's rectilinear volume meets the sky, a pair of narrow, six-story seams on the north, east, and west façades break down the primary mass of the box into several discrete pieces (See Figure 3-3, Elevated Perspective). Two identical seams, further down on the north façade, also subdivide the primary volume where it meets the street. On the south elevation of the building, a secondary box housing laboratory support functions (typically a more opaque part of the research program) partially engages the primary volume where it directly abuts 3-5 Cummington Mall, leaving a courtyard space between the two buildings. See Figure 3-2, Project Site Plan, and Figures 3-3 through 3-6, Perspectives.

The Project creates a space for Morse Auditorium that preserves its object-like quality and ensures that it maintains its prominence on Commonwealth Avenue. By anchoring the street edge, the Project allows Morse to stand independently, signifying its significance. While Morse was designed with a party wall in anticipation of its neighbors, the Project

creates a small pocket park between the buildings that further allows Morse stand on its own as a significant and autonomous structure. This pocket park also allows for improved accessibility to the rear of Morse and preserved the view of its ivy-covered west façade.

At the northwest, the building's corner cut-out entrance faces the Grounds South. By locating the main entrance to the building on the west façade and fronting onto Grounds South, the Project acknowledges Commonwealth Avenue through its broad expanse of glazing and addresses the Campus. Working in conjunction with the College of Communication, the Project activates the open space by creating an outdoor room and front yard that is at once both part of the Campus and part of the City.

The Proponent's decision to locate the main entrance to the Project fronting Grounds South is the first step in realizing the long-term concepts proposed in the Urban Design Supplement to the Institutional Master Plan. Looking well beyond the 10-year window of the IMP, the University envisions that Grounds South will connect Commonwealth Avenue and Cummington Mall, and will create strong north/south connections that are currently lacking on the Campus.

3.3 CHARACTER AND MATERIALS

The building's architectural character is strongly influenced by its location and position, which do not readily allow the structure to be seen or approached head-on. It is almost always experienced by approaching one of its corners, making two facades visible simultaneously. In response, the building has been designed with emphasis on the composition of the building as a series of corners, or pairs of façades. Each corner utilizes a set of common design elements but has a particular configuration that is specific to its location on the Site.

The façades are articulated through the use of a repetitive system of continuous, projecting vertical fins, approximately four inches in width and spaced three to eight feet apart depending on location. Between the fins, frameless windows alternate with glazed, insulated spandrel panels (for energy efficiency) that are located between each floor. They create an appearance that is slightly reflective, but mostly transparent when viewed from straight on. When the building is viewed on an oblique angle and at a distance, however, the individual fins and green color of building seams coalesce into a dynamic and articulated surface taking their cues from the limestone facades of the signature Ralph Adams Cram building at the heart of the University's Campus. From one perspective, the building is light and transparent. From another it is solid and substantial, which reflects its role as a prominent institutional structure at the gateway to the University's Central Campus. See Figures 3-3 through 3-6, Perspectives.

While the exact nature and geometry of the fins have not yet been finalized, the Proponent is considering materials such as prefabricated, ultra high-performance concrete panels and

glass fiber reinforced concrete that is evocative of the Campus's most distinguished limestone structures, yet is distinct from Morse's prominent marble facade. See Figure 3-7, Building Section and Figures 3-8 through 3-11, Elevations.

3.4 VIEWS

The Project will impact the current view of Morse as seen from the west on Commonwealth Avenue, however the cutout on the building's northeast corner, adjacent to Morse expands the perceived boundary of the new pocket park shared between the two buildings. Here, as one walks towards Morse from the west, the view southward into the pocket park opens much sooner than it would were the corner coincident with the faces of the building above. This space is further activated by entrances into both Morse and the new Project towards the rear of the pocket park. See Figures 3-3 through 3-6, Perspectives.

The largest cutout is located at the Project's northwest corner where the building entrance faces Grounds South and Commonwealth Avenue. The building's transparent façade at this corner creates a direct visual connection that will enhance sightlines into the lobby and will bring pedestrian activity to both the streetscape and Grounds South.

The Project will also impact the current view of Morse from east of the Site across Blanford Mall where Morse is in the immediate foreground. From this viewpoint, the simple repetitive nature of the Project's upper façade serves as neutral backdrop for the historically significant Morse. The Project works in conjunction with the Metcalf Science Center and the Graduate Student Residences at 580 Commonwealth Avenue to create an urban room, Boston University Grounds East (Grounds East), in which Morse is the prominent occupant.

3.5 OPEN SPACE AND LANDSCAPING

In accordance with provisions in the Institutional Master Plan, the Project is designed to reinforce the University's linear Campus and create a variety of open spaces that enrich the streetscape by supporting different scales, levels of intimacy, and interaction.

The Site for the Project is largely defined by the linear spaces around the building perimeter, so the landscaping associated with the Project is designed to soften hard edges and provide an attractive, human-scaled environment for pedestrian travel adjacent to the building. Around the building, the landscaping provides a relatively subtle palette of ground cover and textures that are punctuated by significant groupings of new trees.

3.5.1 COMMONWEALTH AVENUE STREETSCAPE

Along Commonwealth Avenue, the Project will bring the landscaping more in line with the University's streetscape treatment that currently exists on the north side of Commonwealth Avenue. New street trees will improve the existing conditions along this heavily traveled section of Commonwealth Avenue. Due to the narrower width of the public way along the

south side of Commonwealth Avenue it may not be possible to include the planting beds seen on the other side of the street, but the signature brick infill along the street edge will help define a buffer zone between the walkway and the street.

3.5.2 GROUNDS SOUTH

The Project will bring coherence to the Grounds South by reinforcing its eastern boundary and eliminating the existing parking lot. Through careful landscaping and a reorganization of circulation to the College of Communication's entrance, the open space will become a vibrant, occupiable social space.

Trees along on the west façade of the Project will develop a high canopy above the walkway that creates a covered path to the Project's main entrance, the College of Communication, and Cummington Mall. The trees will be planted in a casual, rather than formal, manner with some trees planted within the hardscape and others planted adjacent in the Grounds South lawn. The trees will define a boundary to the Grounds South lawn, and will create a natural transition from the scale of the building to the scale of the Grounds South landscape. The trees also set the stage for the future-planned Campus open space that will provide north-south connections to the existing science and research buildings along Cummington Mall. This open space will support a broad range of outdoor activities including passive recreation, social gatherings, formal receptions, and even outdoor instruction. The future open space will be an extension of the Campus buildings that front onto it and will connect the Project to the rest of the proposed IMP buildings. See Figure 3-12, Landscape Plan.

Trees species selected for Grounds South could include large robust maples and oaks, as well as select ornamental specimens such as tulip trees, sweetgum, redbud, and hawthorn that will provide spring and fall color.

3.5.3 POCKET PARK

To the east of the building, the pocket park will create a unique, functional landscape that will engage the public realm, but will be more intimate and smaller in scale than the landscape associated with Grounds South. Functionally, the pocket park will provide access to Morse Auditorium, but it is also intended to be an occupiable space and a destination for students, faculty and visitors.

The space will be divided into three zones of landscaping that will relate both to Morse and the Project. The first zone fronting Commonwealth Avenue will connect to the landscape in front of Morse. This zone will define a threshold between the public realm and the campus and could include ground cover and crab apple trees that would extend the existing Morse landscaping into the entry of the pocket park.

The second zone at the center of the pocket park will consist primarily of hardscaped areas that will support pedestrian circulation and access from Commonwealth Avenue into the building's east entrance, and will create an outdoor meeting and gathering space for students and faculty.

The third zone is located at the rear of the pocket park and will include landscaping and some hardscape that will extend the pedestrian connection to the rear entrance of Morse. In lieu of the existing ramp, the Project will construct a new indoor limited use elevator at the rear of the pocket park that will provide a direct connection to the rear entrance at the southwest corner of Morse Auditorium.

Ground cover in the third zone might be configured to run up the rear façade of the pocket park adjacent to the new glass accessible entrance. Trees species selected for the third zone in this area could include species such as river birch with light, diaphanous canopies that thrive in low-light and space constrained conditions.

3.5.4 COURTYARD

On the south façade of the building the Project preserves a volume of space that will form a courtyard between the Project and 3-5 Cummington Mall. Unlike the pocket park and Grounds South, the courtyard is proposed as a quiet, contemplative landscape that will more likely be viewed from the adjacent workspaces and interior lobby than occupied directly. See Figure 3-12, Landscape Plan. The Courtyard will include trees planted in a pattern that provides continuity with the Grounds South landscaping. Tree species selected for the courtyard could include species such as river birch with light, diaphanous canopies that thrive in low-light and space constrained conditions.

3.6 PEDESTRIAN ENVIRONMENT/VEHICULAR CIRCULATION

Research facilities require tightly controlled environments to maintain the security and integrity of the internal research spaces. This makes it difficult to accommodate an interior circulation plan that is as open and inviting to the general public and larger University population as can be achieved with other institutional buildings. To overcome these programmatic limitations the Project has thoughtfully and carefully organized the ground floor plan to bring visual interest and pedestrian activity to the Commonwealth Avenue streetscape.

The majority of the ground floor is organized around the Cognitive Neuroimaging Center that will include Functional Magnetic Resonance Imaging (FMRI), and Electroencephalography (EEG) for human subjects. This program will bring visitors to the building throughout the day and well into the evening (currently schedules indicate operation between 8:00 AM and 10:00 PM). Although these programs will encourage a certain amount of activity, the actual research rooms must be isolated from external

influences and so will not be visible to the outside world. Recognizing this, the design accommodates these functions within center of the ground floor, and keeps the edges along the building perimeter of the ground floor available for more dynamic and engaging program elements.

Located in the north of the building and on the east façade will be administrative office space and neuroscience building commons space, a dedicated meeting, collaboration, and individual work space for neuroscience researchers, staff, and students affiliated with the neuroscience program.

On the west façade, the building's main entrance will connect the Project to Grounds South and the College of Communication. Located to the south of the main entrance, the Colloquium Space will be a high-performance meeting and large group work room that will provide interior and exterior connections to the lobby space and Grounds South. The Colloquium Space is intended to serve building occupants and the greater University community, and will play a central role in the Project's function as a hub for Boston-area neuroscience research, spanning multiple campuses and healthcare institutions.

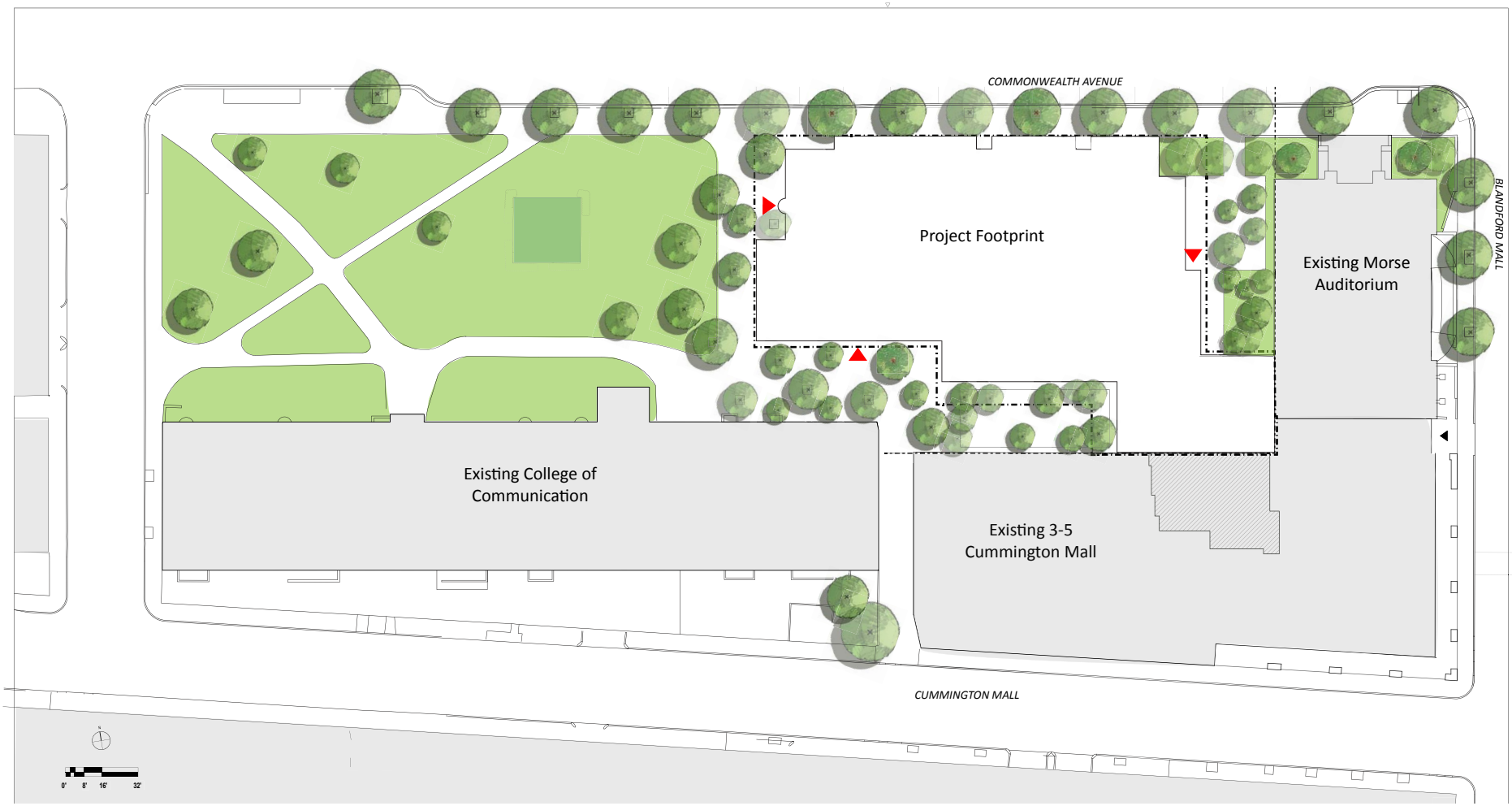
The Project proposes a network of internal and external paths that further will allow pedestrians to navigate the entire depth of the block between Cummington Mall and Commonwealth Avenue via a new interior, public circulation network. In the north-south direction, the transparent Project lobby that runs across the entire depth of the building provides a physical and visual connection through the Project to Cummington Mall. Additional entrances on both the west and the south facades of the building will allow pedestrians to travel through the Project's lobby en-route to Cummington Mall. See Figure 3-13, Circulation and Access Plan.

In the east-west direction, the ground floor plan accommodates a secondary circulation corridor that extends from the pocket park to the main lobby. A corridor leading from the neuroscience building commons at the northeast corner of the building will connect the Project to an existing entrance to 3-5 Cummington Mall (currently accessed from the parking lot) at the southeast corner of the building. The proposed circulation patterns will greatly improve the pedestrian experience for staff, students, and visitors navigating this emerging portion of the University's Central Campus as it adapts and changes to accommodate the long term vision for the area.

The Project will be serviced through modifications to an existing loading facility located between Morse and 3-5 Cummington Mall, which is accessed from Blanford Mall. This strategy eliminates the need for vehicular circulation on the Site proper, insofar as the loading dock and associated functions can be both visually and physically isolated from the most public parts of the Site.

610 Commonwealth Avenue
Boston, MA

Figure 3-1
Neighborhood Context
Source: Fort Point Associates, Inc., 2014



610 Commonwealth Avenue
Boston, MA

Figure 3-2
Project Site Plan
Source: Payette, 2014

610 Commonwealth Avenue
Boston, MA

Figure 3-3
Elevated Perspective
Source: Payette, 2014

610 Commonwealth Avenue
Boston, MA

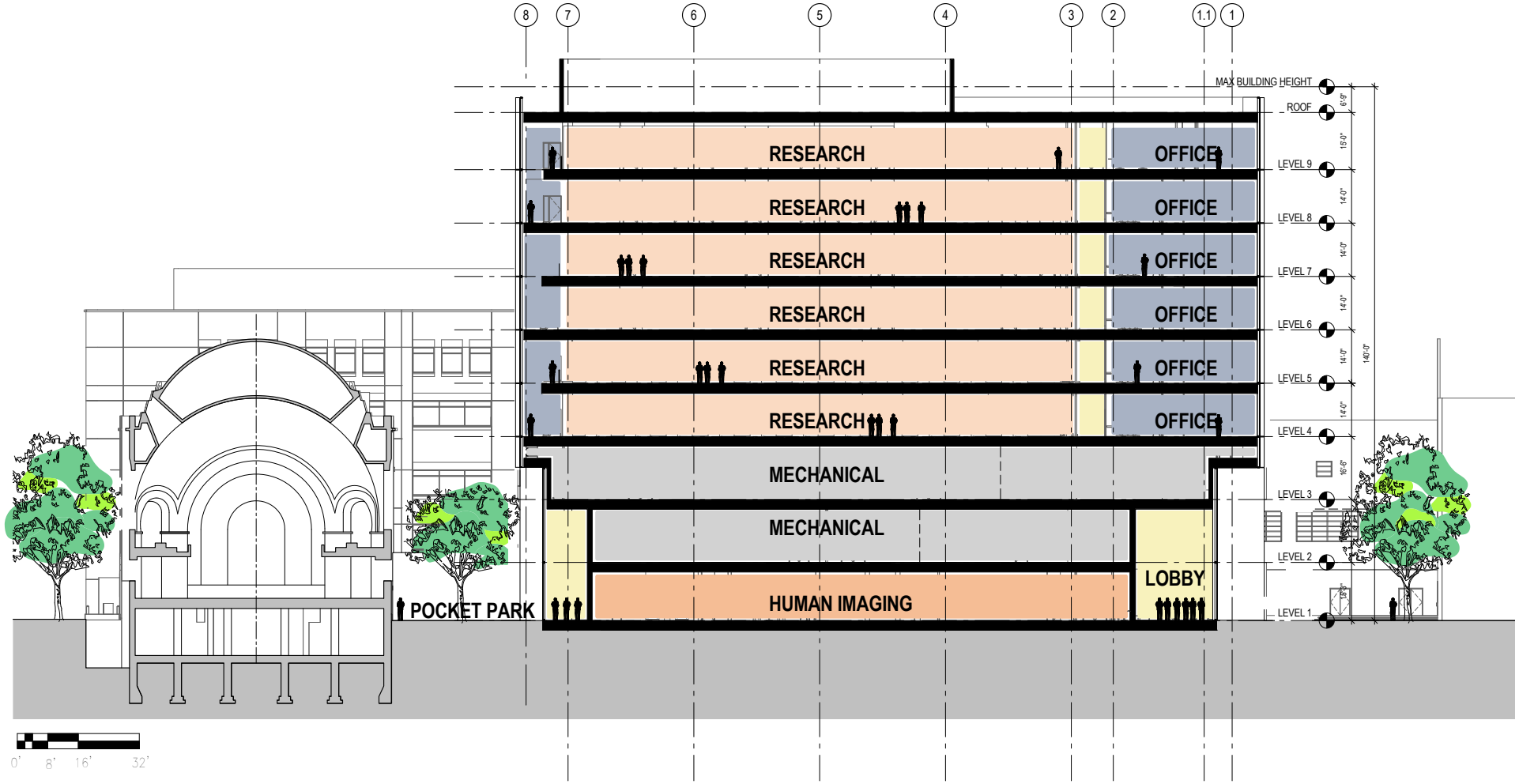
Figure 3-4
Perspective Looking Southeast
Source: Payette, 2014

610 Commonwealth Avenue
Boston, MA

Figure 3-5
Perspective Looking East
Source: Payette, 2014

610 Commonwealth Avenue
Boston, MA

Figure 3-6
Perspective Looking Southwest
Source: Payette, 2014



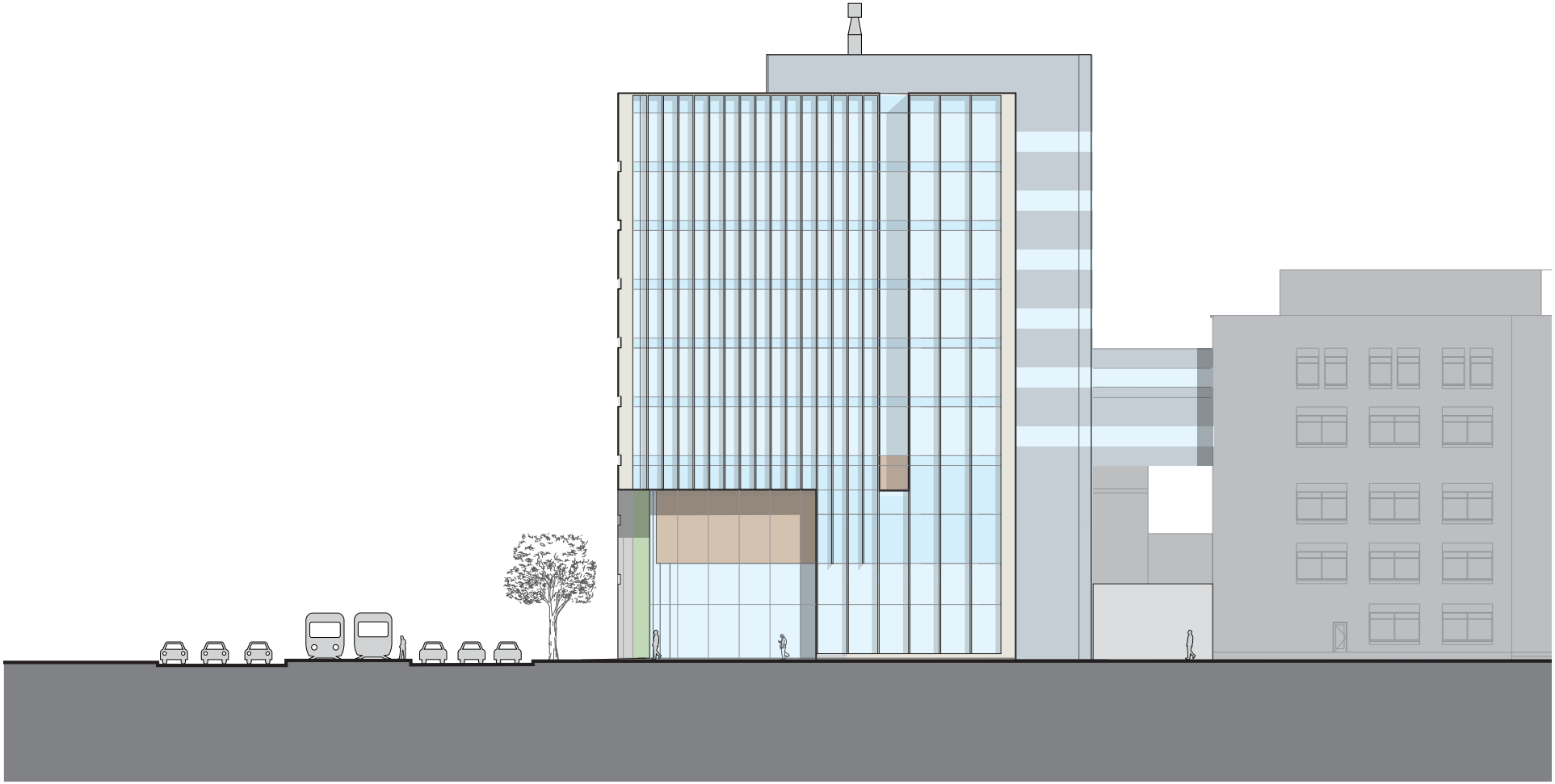
610 Commonwealth Avenue
Boston, MA

Figure 3-7
Building Section
Source: Payette, 2014

0′ 8′ 16′ 32′

610 Commonwealth Avenue
Boston, MA

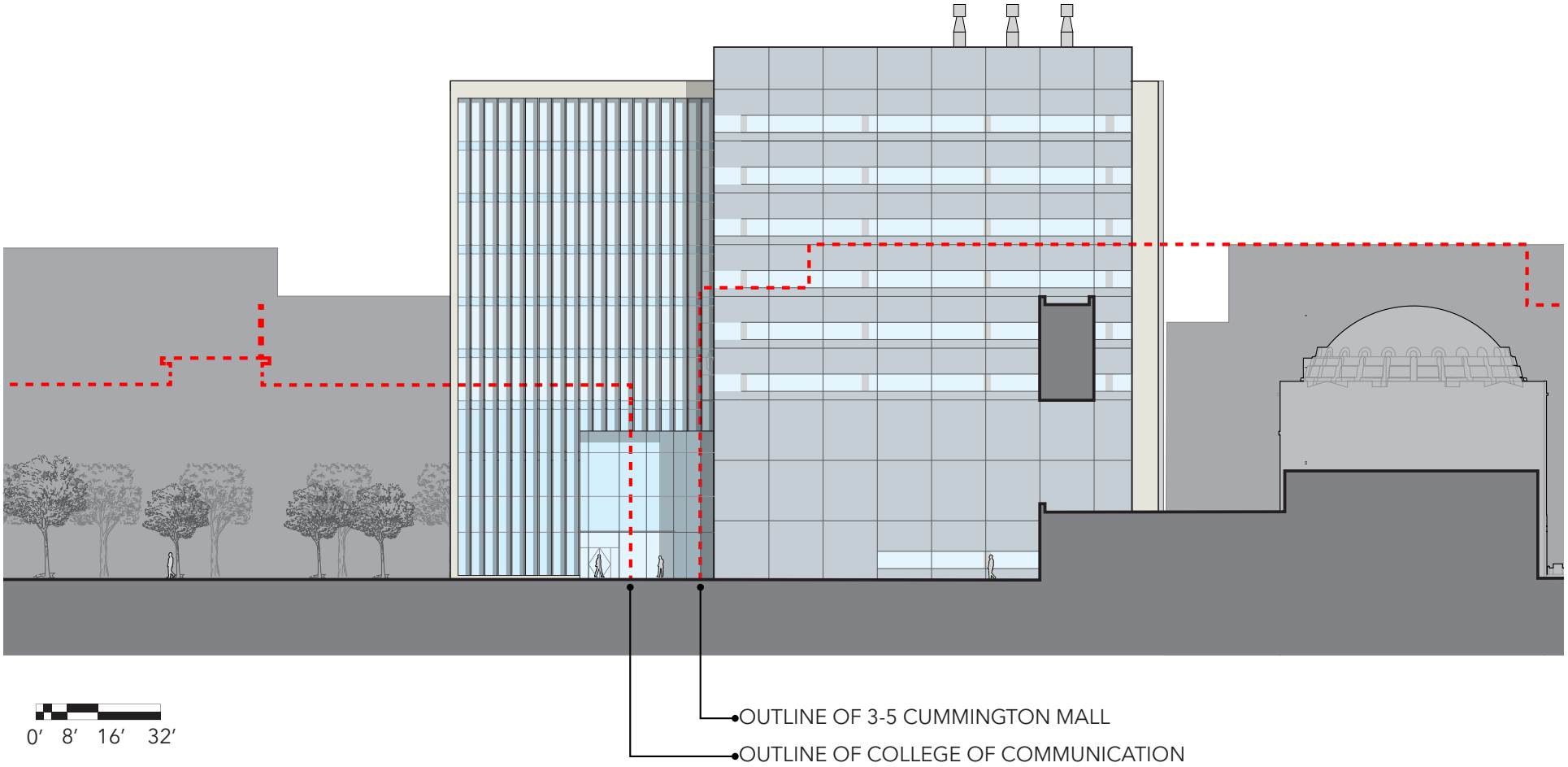
Figure 3-8
North Elevation
Source: Payette, 2014



0′ 8′ 16′ 32′

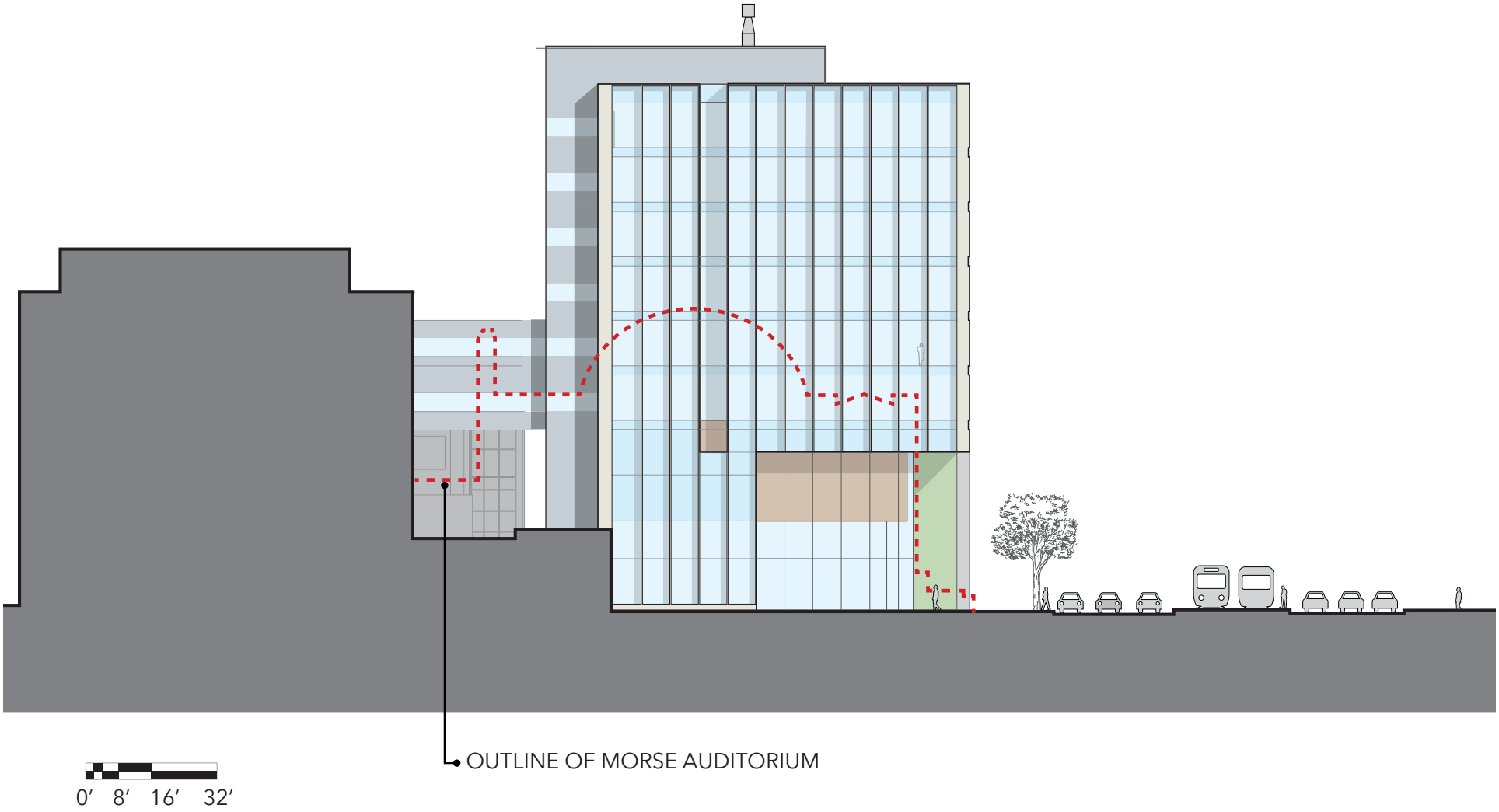
610 Commonwealth Avenue
Boston, MA

Figure 3-9
West Elevation
Source: Payette, 2014



610 Commonwealth Avenue
Boston, MA

Figure 3-10
South Elevation
Source: Payette, 2014

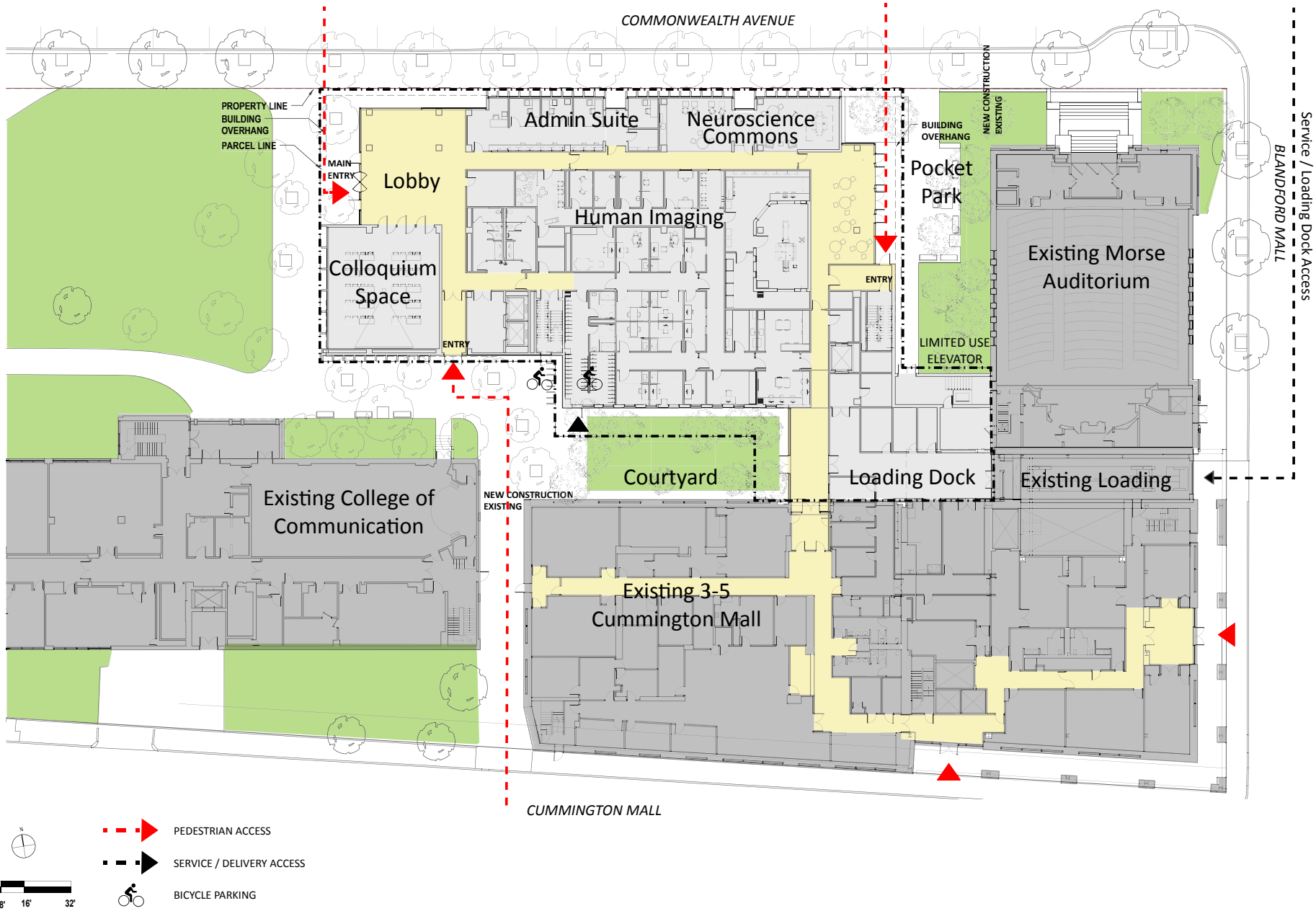


610 Commonwealth Avenue
Boston, MA

Figure 3-11
East Elevation
Source: Payette, 2014

610 Commonwealth Avenue
Boston, MA

Figure 3-12
Landscape Plan
Source: Payette, 2014



610 Commonwealth Avenue
Boston, MA

Figure 3-13
Circulation and Access Plan
Source: Payette, 2014

Chapter 4

SUSTAINABILITY

CHAPTER 4: SUSTAINABILITY

4.1 SUSTAINABLE DESIGN

The Project will incorporate multiple sustainability initiatives into its construction and operation. The Leadership in Energy and Environmental Design ("LEED") rating system will be used as a framework to measure the various sustainable features of the Project. This system is divided into the following categories: Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Air Quality, Innovation in Design, and Regional Priority Credits. The project team has used a LEED Checklist to illustrate that the Project is working towards 58 LEED credits under the LEED BD&C-NC 2009 rating system, which places the Project comfortably within range of LEED Silver certification. See Figure 4-1, LEED Checklist.

The Project, which is subject to Section 80B, Large Project Review of the Boston Zoning Code (the "Code"), must also comply with Article 37 of the Code, Boston's Green Building Regulations. The purpose of Article 37 is to ensure that major building projects are planned, designed, constructed, and managed to minimize adverse environmental impacts; to conserve natural resources; to prepare for climate change; to promote a more sustainable city; and to enhance the quality of life in Boston. The narrative below demonstrates that the Project is in compliance with Article 37. A completed Climate Change Preparedness and Resiliency Checklist can be found in Appendix B. As the Project is in the early design process, some of these strategies are expected to evolve with the design of the building.

4.2 ARTICLE 37/LEED COMPLIANCE

4.2.1 SUSTAINABLE SITES

The Project is located in a dense, urban environment, which is beneficial for attaining the majority of site-related credits. Proximity to public transportation, absence of new parking, abundant bicycle storage, and everyday services available within walking distance serve to discourage the building users' reliance on automobile use.

Prerequisite 1: Construction Activity Pollution Prevention

An Erosion and Sedimentation Control Plan will be developed and implemented for all construction activities associated with the Project.

Credit 1: Site Selection

The Project will be constructed on previously developed land that is currently used as a surface parking lot for 60 vehicles. Redeveloping the Site will activate the Commonwealth Avenue streetscape and will further strengthen the University's growing life sciences and engineering programs.

Credit 2: Development Density and Community Connectivity

The City of Boston has an average population density of 12,900 people per square mile[1]. The Project is within 0.5 miles of dense residential development and at least 10 basic services, including restaurants, banks, markets, and pharmacies, among others. Sidewalks currently link the Project with these various services.

Credit 4.1: Alternative Transportation – Pubic Transportation Access

The Project will not provide any parking on Site, and instead seeks to reduce the use of vehicular transportation by providing alternative transportation options for faculty, staff, and graduate students that work at or visit the Site. The Site is directly adjacent to the Blandford Mall Green Line station and bus routes that run in both directions along Commonwealth Avenue. The Project is within 0.25 miles of a BU Campus Shuttle stop and proposes to provide storage on Site for 69 bicycles.

Credit 4.2: Alternative Transportation – Bicycle Storage and Changing Rooms

The Project will provide exterior parking for 16 bicycles on the southern and eastern sides of the building. An internal bicycle storage room with a capacity for 53 bikes will be located on the south side of the building and will be accessible from the courtyard. There will be two changing rooms/showers within the Project.

Credit 4.4: Alternative Transportation – Parking Capacity

The Project will not replace or provide parking on Site and will aggressively promote alternative and sustainable modes of transportation by providing bicycle parking spaces, leveraging the Site's proximity to existing bicycle lanes, and by encouraging the use of public transportation.

Credit 6-1: Stormwater Design: Quantity Control

The Project proposes to implement a stormwater management plan that results in a 25 percent decrease in the volume of stormwater runoff from a two-year, 24-hour storm event. The design team is looking at locations for a stormwater detention

[1] US Census State and County Quickfacts: http://quickfacts.census.gov/qfd/states/25/2507000.html

system that will be sized to perform as indicated above, and will be used for landscape irrigation.

Credit 7.1-7.2: Heat Island Effect

Reducing the heat island effect has been categorized as a regional priority for Boston. The Project will utilize roofing materials with a solar reflective index (SRI) equal to or greater than the minimum SRI values for at least 75 percent of the roof surface. The Project will also plant shade trees along the hardscaped elements on Site.

4.2.2 WATER EFFICIENCY

The Project will use low-flow fixtures, and landscaping will be designed with native, drought-tolerant vegetation that requires minimal drip irrigation. These measures will increase the water efficiency for the Project and reduce the burden on municipal water supply and wastewater systems.

Prerequisite 1: Water Use Reduction – 20% Reduction

Water use reduction is an important goal for the Project since there is the potential for significant water use in laboratory projects. The Project will specify plumbing fixtures in the building to achieve a minimum 30 percent reduction in water use over an established baseline through low-flow water-closets, low-flow showers and low-flow sinks. These measures will increase the water efficiency for the Project and reduce the burden on municipal water supply and wastewater systems.

Credit 1: Water Efficient Landscaping

The Project's landscaping will consist of drought-tolerant native species that will reduce potable water consumption for irrigation by 50 percent from a calculated mid-summer baseline case.

Credit 3: Water Use Reduction – 30% Reduction

An additional two points are assumed because the Project will strive to utilize water saving measures that will reduce water use by an additional 10 percent over Prerequisite 1, for a 30% total reduction in water use over the established baseline.

4.2.3 ENERGY AND ATMOSPHERE

Energy efficiency is central to the Project's design. The Project will comply with the Commonwealth's Stretch Energy Code and as such, will reduce energy use from the established baseline by 30%. High-efficiency mechanical systems, Energy Star rated equipment, and a hydronic management system are among the energy efficiency

strategies that will be employed. The Projects building envelope has been designed to exceed ASHRAE 90.1 performance standards.

Prerequisite 1: Fundamental Commissioning of Building Energy Systems

A qualified commissioning agent will review the Project to ensure that the Project's energy related systems are installed, calibrated, and perform properly at peak efficiency.

Prerequisite 2: Minimum Energy Performance

The Project proposes to exceed the minimum energy performance standards (10% improvement in building performance over a baseline building performance rating).

Prerequisite 3: Fundamental Refrigerant Management

The Project proposes to use zero CFC-based refrigerants in the air conditioning, laboratory equipment, IT/data, and mechanical rooms.

Credit 1: Optimize Energy Performance

Energy efficiency is central to the Project's design. The Project will comply with the Commonwealth's Stretch Energy Code and will reduce energy use from the baseline energy conservation by approximately 30%. The Project will employ innovative systems to manage energy consumption that will reduce the overall environmental impact of this building.

The Project design concentrates energy-intensive operations in the smallest possible area and has stacked these high intensity zones on top of each other at the rear of the building in order to create efficiencies by avoiding laboratory ventilation where it is not needed. The Project will utilize hydronic management systems that provide increased control over the Project's cooling load by controlling the energy used for dehumidifying and re-heating the air. The building envelope is expected to exceed the ASHRAE 90.1 performance standards by more than 20%.

Additional strategies to increase the energy efficiency of the Project include low-level general lighting, occupancy sensors, and nighttime setbacks that will reduce ventilation rates and energy consumption in laboratory equipment when they are unoccupied.

Credit 3: Enhanced Commissioning

The Project will implement enhanced commissioning processes both during design and construction to ensure that systems are operating properly and at peak efficiency. An independent commissioning authority will be involved early in the

process and will facilitate commissioning design and documentation review. As the Project nears completion, additional oversight and training will be provided to ensure systems are operational and staff are properly trained.

Credit 4: Enhanced Refrigerant Management

Where applicable, the Project will utilize heating, ventilation, air conditioning, and refrigeration that minimize or eliminate the emission of pollutants and compounds that contribute to ozone depletion and global climate change.

4.2.4 MATERIALS AND RESOURCES

The construction process has a significant impact on the amount of materials and resources that are both consumed and wasted. The Project will require recycling to divert materials from landfills during the construction process. Efforts will be made to utilize regionally sourced materials. These efforts will support the local economy and will minimize harmful emissions and energy consumption caused by transporting materials.

Material usage will focus on products and materials that minimize the building occupants exposure to volatile organic compounds (VOCs). Priority will be given to materials that are sustainably sourced and maximize the use of recycled content where possible. This effort includes using Forest Stewardship Council (FSC) certified lumber and recycled steel.

MR Prerequisite 1: Storage and Collection of Recyclables

The Project is part of the University's recycling program. As required by the City of Boston, recyclables will be collected through a system located in a convenient and central location on each floor of the building.

Credit 2: Construction Waste Management – Divert 75% from Disposal

The Project will strive to document a 75% diversion rate of construction waste from disposal in landfills. All contractors being considered for the Project will have a current Construction Waste Management Plan. These plans will include knowledge of local options for diversion and a program for documenting the diversion rate for construction waste.

Credit 4: Recycled Content – 10% (Post-Consumer + ½ Pre-Consumer)

The Project will strive to use building materials with a minimum of 10% recycled content.

Credit 5: Regional Materials – 10% Extracted, Processed, and Manufactured Regionally

A minimum of 10% of the building materials for the Project will be sourced from within 500 miles of the Project.

Credit 7: Certified Wood

The Project will use a minimum of 50% wood-based materials and products that are certified by the FSC.

4.2.5 INDOOR ENVIRONMENTAL QUALITY

Enhancing the indoor air quality in buildings is critical to the comfort and well being of the occupants. The quality of indoor air is linked to allergies, asthma, and other health ailments. The Project will meet the indoor air quality performance standards as required by sections 4 through 7 of ASHRAE Standard 62.1-2007.

Prerequisite 1: Minimum Indoor Air Quality Performance

The Proponent is deeply committed to designing an indoor environment that provides a healthy building for faculty, staff, and students. The Project will meet the indoor air quality performance standards as required by sections 4 through 7 of ASHRAE Standard 62.1-2007.

Prerequisite 2: Environmental Tobacco Smoke (ETS) Control

Smoking will be prohibited within the building and within 25 feet of building entrances.

Credit 2: Increased Ventilation

The building will be designed to run on a Dedicated Outdoor Air System (DOAS), and will qualify for additional air handling credits. The DOAS provides 100% outside air processed through 95% efficient air handling filter units.

Credit 3.1: Construction IAQ Management Plan – During Construction

The Proponent will develop an indoor Air Quality Management Plan during the design phase that will be implemented during construction to minimize the impacts of construction activities on air quality.

Credit 4.1: Low-Emitting Materials – Adhesives and Sealants

The Project will use low-emitting adhesives and sealants to maintain air quality and ensure a healthy environment for construction workers and building occupants.

Credit 4.2: Low-Emitting Materials – Paints and Coatings

The Project will use low-emitting paints and coatings to maintain air quality and ensure a healthy environment for construction workers and building occupants.

Credit 4.3: Low-Emitting Materials – Flooring Systems

Flooring products will be selected to reduce the quantity of indoor air contaminants and to ensure there are no odors or irritants that are harmful to the well-being of installers or occupants.

Credit 4.4: Low-Emitting Materials – Composite Wood and Agrifiber Products

Composite wood and agrifiber products that will be used on the interior of the building will be selected to reduce the quantity of indoor air contaminants and to ensure there are no odors or irritants that are harmful to the well-being of installers or occupants.

Credit 7.1: Thermal Comfort – Design

Where HVAC systems are needed onsite they will be designed to meet ASHRAE Standard 55-2004 and to promote the comfort of building occupants.

Credit 8.2: Daylight and Views - Views

To provide building occupants with a connection to the outdoors and natural daylighting, the Project will provide 90% of all regularly occupied spaces with a direct line of sight to the outdoor environment.

4.2.6 INNOVATION IN DESIGN

The Project is planning on achieving Innovation in Design credits for design features not explicitly categorized in the LEED rating system. Specific credits are being still being identified, and will be updated in the Draft Green Building Report that will be submitted after final design approval.

Credit 1.1: SS 41. Alternative Transportation – Public Transportation

The Project should receive exemplary performance for being located within 0.5 miles of at least two existing subway lines and within 0.25 miles of at least two or more stops for public or campus bus lines.

Credit 1.2: Innovation in Design: Envelope Commissioning

The exterior envelope will be commissioned by an independent third-party agent to ensure that it meets thermal performance, moisture mitigation and air-tightness performance requirements.

Credit 1.3: Innovation in Design: Fume Hood Commissioning

While fume hood commissioning is not an innovative practice, the Proponent proposes to include a tracer gas containment test (ASHRAE 110), which would achieve an exemplary performance credit.

Credit 1.4: Innovation in Design: Resiliency

The design of the Project has taken into account the threat of flooding and increased sea levels and has moved all the major electrical, plumbing and HVAC systems to an elevated mechanical space on the second and third levels of the building. This removes the significant infrastructure from below or at grade to minimize the chance of damage to equipment during a flood event.

Credit 1.5: Innovation in Design: EBOM EQp3 & EQc3.1

The Project will develop and implement a green cleaning policy for the building and Site that addresses the green cleaning credits as detailed under EBOM EQp3 & EQc3.1.

Credit 2: LEED Accredited Professional

The Project team includes at least one LEED Accredited Professional with the architecture firm, Payette, Inc.

4.2.7 REGIONAL PRIORITY CREDITS

The Project will achieve three LEED Regional Priority Credits for addressing sustainability challenges deemed critical to the project area by the U.S. Green Building Council.

Credit 1.2: Regional Priority: SSc6.1 – Stormwater Design (Quantity Control)

The Project will achieve an additional credit for designing a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the 2-year, 24-hour design storm.

Credit 1.3: Regional Priority: SSc7.1 – Heat Island Effect (NonRoof)

The Project will achieve an additional credit for using landscaping to reduce the urban heat island effect on at least 50% of the hardscape materials on Site.

Credit 1.3: Regional Priority: SSc7.2 – Heat Island Effect (Roof)

The Project will achieve an additional credit for using roofing materials with a solar reflective index (SRI) equal to or greater than the minimum SRI values for a minimum of 75% of the roof surface.

4.2.8 BOSTON ARTICLE 37 GREEN CREDITS

Although the Project will not pursue any of the Boston Green Building Credits, the Project will meet the Boston Public Health Commission prerequisites as noted below.

Credit p1: Retrofit Diesel Construction Vehicles

In order to reduce emissions, all construction vehicles will be retrofitted diesel vehicles.

Credit p2: Outdoor Construction Management Plan

In order to control contaminants and pollutants during construction, the contractor will develop an outdoor construction management plan including at a minimum wheel washing, site vacuuming, truck covers, and anti-idling signage.

Credit p3: Integrated Pest Management Plan

The Project will employ an Integrated Pest Management Plan to reduce the impacts of rodents and insects that are disturbed during construction of the Project.

LEED 2009 for New Construction and Major Renovations

Project Checklist

Boston University, Center for Integrated Life Sciences and Engineering

May 27, 2014

Sustainable Sites — Possible Points: 26

Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
1			Credit 1	Site Selection	1
5			Credit 2	Development Density and Community Connectivity	5
	1		Credit 3	Brownfield Redevelopment	1
6			Credit 4.1	Alternative Transportation—Public Transportation Access	6
1			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
		3	Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
2			Credit 4.4	Alternative Transportation—Parking Capacity	2
		1	Credit 5.1	Site Development—Protect or Restore Habitat	1
	1		Credit 5.2	Site Development—Maximize Open Space	1
1			Credit 6.1	Stormwater Design—Quantity Control	1
		1	Credit 6.2	Stormwater Design—Quality Control	1
1			Credit 7.1	Heat Island Effect—Non-roof	1
1			Credit 7.2	Heat Island Effect—Roof	1
	1		Credit 8	Light Pollution Reduction	1

Water Efficiency — Possible Points: 10

Y			Prereq 1	Water Use Reduction—20% Reduction	
2	2		Credit 1	Water Efficient Landscaping	2 to 4
	2		Credit 2	Innovative Wastewater Technologies	2
2	2		Credit 3	Water Use Reduction	2 to 4

Energy and Atmosphere — Possible Points: 35

Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
10	9		Credit 1	Optimize Energy Performance	1 to 19
	1	6	Credit 2	On-Site Renewable Energy	1 to 7
2			Credit 3	Enhanced Commissioning	2
2			Credit 4	Enhanced Refrigerant Management	2
	3		Credit 5	Measurement and Verification	3
		2	Credit 6	Green Power	2

Materials and Resources — Possible Points: 14

Y			Prereq 1	Storage and Collection of Recyclables	
		3	Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
		1	Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	Construction Waste Management	1 to 2
		2	Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	?	N			
1	1		Credit 4	Recycled Content	1 to 2
1	1		Credit 5	Regional Materials	1 to 2
		1	Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

Indoor Environmental Quality — Possible Points: 15

Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
	1		Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increased Ventilation	1
1			Credit 3.1	Construction IAQ Management Plan—During Construction	1
	1		Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
1			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
1			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
1			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
	1		Credit 5	Indoor Chemical and Pollutant Source Control	1
	1		Credit 6.1	Controllability of Systems—Lighting	1
		1	Credit 6.2	Controllability of Systems—Thermal Comfort	1
1			Credit 7.1	Thermal Comfort—Design	1
	1		Credit 7.2	Thermal Comfort—Verification	1
		1	Credit 8.1	Daylight and Views—Daylight	1
1			Credit 8.2	Daylight and Views—Views	1

Innovation and Design Process — Possible Points: 6

1			Credit 1.1	Innovation in Design: Exem. Perf. Public Transportation	1
1			Credit 1.2	Innovation in Design: Envelope Commissioning	1
1			Credit 1.3	Innovation in Design: Fume Hood Commissioning	1
1			Credit 1.4	Innovation in Design: Resilancy	1
1			Credit 1.5	Innovation in Design: Green Cleaning/Grey Water/Education/Other	1
1			Credit 2	LEED Accredited Professional	1

Regional Priority Credits — Possible Points: 4

	1		Credit 1.1	Regional Priority: Brownfield Redevelopment (SSc3)	1
1			Credit 1.2	Regional Priority: Stormwater Design, Quantity Control (SSc6.1)	1
1			Credit 1.3	Regional Priority: Heat Island Effect, Nonroof (SSc7.1)	1
1			Credit 1.4	Regional Priority: Heat Island Effect, Roof (SSc7.2)	1

Total — Possible Points: 110

Y	?	N
58	30	22

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

Figure 4-1
LEED Checklist
Source: U.S. Green Building Council, 2014

Chapter 5

TRANSPORTATION

CHAPTER 5: TRANSPORTATION

5.1 INTRODUCTION

The Site is located at 610 Commonwealth Avenue, which is on the south side of Commonwealth Avenue, approximately 150 feet west of the intersection of Commonwealth Avenue with Blandford Mall and Silber Way. The Site is currently occupied by a small surface parking lot that has right-in/right-out access from Commonwealth Avenue eastbound. The surface lot contains 60 spaces, and only University permit holders are allowed to park at this location.

5.1.1 PROJECT DESCRIPTION

The Project is comprised of approximately 145,000 square feet (sf) of gross floor area (GFA) that will house academic, meeting, and research space on nine floors, including two floors that will be primarily used to house the building's mechanicals. For a more detailed description of the Project, refer to Chapter 2, Project Description.

5.1.2 STUDY AREA

The Project will not have a significant impact on the existing transportation network. The facility will have excellent connections to the existing pedestrian, bicycle, and transit infrastructure along Commonwealth Avenue. Traffic will not travel to and from the Site, as vehicular parking will not be provided. Permit holders that currently use the Site for daily parking needs will be relocated to nearby Boston University owned and operated parking facilities, which will require a redistribution of existing traffic in the immediate vicinity of the Site. As described in more detail below, it is expected that the drivers who currently park at the Site will be relocated to the garage at 700 Commonwealth Avenue or the surface lot at 766 Commonwealth Avenue. It is anticipated that some of the faculty and staff who will be employed at the proposed facility will be new employees, and that some of these new employees may travel to the Charles River Campus (the "Campus") via automobile. It is expected that these employees will also park at the facilities at 700 or 766 Commonwealth Avenue.

Due to the limited number of the traffic impacts, the following intersections will be included in the traffic study area:

- Kenmore Square;
- Commonwealth Avenue at Silber Way/Blandford Mall;

- Commonwealth Avenue at Granby Street;
- Commonwealth Avenue at Cummington Mall;
- Commonwealth Avenue at St. Mary's Street;
- Commonwealth Avenue at University Road/Carlton Street;
- Mountfort Street at St. Mary's Street;
- Mountfort Street at Carlton Street;
- Bay State Road at Silber Way; and
- Bay State Road at Granby Street.

5.1.3 METHODOLOGY

The recently adopted Boston University Charles River Campus 2013–2023 Transportation Master Plan (TMP) provides a detailed summary of the existing traffic conditions along the Commonwealth Avenue corridor and in the vicinity of the Site. It is not expected that the traffic conditions have changed significantly since the time of the TMP, therefore, the "existing" conditions reported in this analysis will reflect the existing conditions from the TMP.

The analysis year for the Project will be 2022 (consistent with the TMP) and the future baseline conditions (i.e., the "no-build" case for this Project) will reflect the 2022 conditions documented in the TMP. The future "build" case for this analysis will include the necessary traffic volume adjustments to the 2022 TMP volumes to account for the redistribution of the traffic that currently travels to/from the Site in addition to any "new" trips to the Campus that may be associated with the Project.

5.2 EXISTING CONDITIONS

5.2.1 PEDESTRIAN

There are excellent pedestrian facilities in the vicinity of the Project Site. Along the south side of Commonwealth Avenue, between Hinsdale Mall and Blandford Mall and along the Site frontage, there is an 18-foot wide sidewalk that is in good condition (reconstructed as part of the Commonwealth Avenue Improvement and Beautification Project). The nearest location of a pedestrian crosswalk to travel across Commonwealth Avenue is at the intersection of Commonwealth Avenue and Blandford Mall/Silber Way, approximately 150 feet east of the Site. At this intersection, crosswalks and handicapped accessible ramps are provided across all four legs of the intersection. Pedestrian signal equipment is also provided at this intersection.

In the vicinity of the Site, pedestrian volumes along and across Commonwealth Avenue are substantial, however the wide sidewalks on both sides of Commonwealth Avenue are generally adequate to accommodate the pedestrian traffic.

Appendix A, Transportation Technical Appendix, includes copies of Figures 9B, 10B and 11B from the TMP that illustrate the morning, midday, and afternoon peak pedestrian volumes in the vicinity of the Site. Appendix A also includes copies of Figures 12B and 13B, which illustrate the existing pedestrian facilities in the portions of the Campus near the Site.

5.2.2 BICYCLE

Similar to pedestrian facilities, there are excellent bicycle facilities in the vicinity of the Site. There are painted bicycle lanes on the north and south sides of Commonwealth Avenue, which were installed in a collaborative effort by the City of Boston and the University as part of the Commonwealth Avenue Improvement and Beautification Project.

Outdoor bicycle racks are generously supplied in the vicinity of the Site. Within an approximate 500-foot radius of the Site, there is storage capacity for 227 bicycles. See Figure 5-1, Existing Bicycle Storage Facilities in the Vicinity of the Project.

5.2.3 PUBLIC TRANSPORTATION

There are several public transportation services within proximity of the Site that are operated by the Massachusetts Bay Transportation Authority (MBTA). These services include:

- Green Line Trolley Service (B Branch);
- Bus Service (Route 57); and
- Commuter Rail Service (Framingham/Worcester Line).

MBTA Green Line

The MBTA Green Line B Branch provides trolley service between Boston College and Government Center stations (Note: Government Center Station closed through March, 2016). The B Branch operates on six-minute headways in the morning and afternoon peak periods, and on nine-minute headways during off-peak periods. The closest inbound/outbound station on the Green Line to the Project Site is the Silber Way/Blandford Mall station, located at the intersection of Commonwealth Avenue/ Silber Way/Blandford Mall. This station is approximately 300 feet from the Project Site.

MBTA Bus Service

The primary MBTA bus route serving the Campus is the Route 57 Bus, which provides service between Watertown Square and Kenmore Square. The buses operate on six-minute headways in the morning and afternoon peak periods and on 11-minute headways during off-peak periods. The closest inbound/outbound bus stops for the Route 57 bus are located at the intersection of Commonwealth Avenue/Silber Way/Blandford Mall, approximately 300 feet from the Site.

MBTA Commuter Rail

The Framingham/Worcester Line of the MBTA Commuter Rail service stops at the Yawkey Station, which is located approximately 600 feet from the Project Site. The MBTA recently (March 2014) completed improvements at the station that added a second platform and converted the station from a part-time use to a full-time use. Forty-one trains per day on the Framingham/Worcester Line stop at the station (21 inbound and 20 outbound).

Boston University Shuttle (BUS)

In addition to services provided by the MBTA, the University operates a shuttle service (the "BUS") that connects the Campus to the Boston University Medical Campus to facilitate travel and collaboration for students and faculty in both campuses. The BUS has several stops in the Campus, including one located in close proximity to the Project Site at the intersection of Commonwealth Avenue/Silber Way/Blandford Mall.

The BUS is free for users and operates five days per week between 7:00 AM and 12:00 AM. During peak periods (7:00 – 10:00 AM and 4:00 – 8:00 PM) on Monday through Friday, the BUS operates on 10-minute headways. During off-peak times it operates with 20- minute headways.

Starting in the fall of 2011, the University made live BUS tracking available on BU Maps (www.bu.edu.maps) so that users have real-time information for bus locations traveling along the route. The real-time tracking is available on personal computers and on iPhones via an application developed by BU Mobile.

The most recent passenger data for the BUS, collected in the fall 2011 semester, indicates that the BUS provides service to over 5,800 passengers per day, which translates to approximately 1.6 million passenger trips per year when including services provided during the summer semesters. Figure 5-2, Existing Intersection Level of Service Results.

5.2.4 PARKING

Off-Street Parking

As noted previously, the Project Site includes an existing surface parking lot where University parking permit holders are allowed to park. There are 60 spaces at the existing lot, which will be relocated by the Project. Other University-owned parking facilities in the area include:

- 464-space parking garage at Warren Towers (700 Commonwealth Avenue);
- 117-space garage at 575 Commonwealth Avenue;
- 269-space garage at the School of Management (595 Commonwealth Avenue);
- 126-space surface lot at 665 Commonwealth Avenue;
- 138-space parking garage at 730-750 Commonwealth Avenue; and
- 83-space surface lot at 766 Commonwealth Avenue.

On-Street Parking

In the vicinity of the Site, there is on-street metered parking along both sides of Commonwealth Avenue except on the south side of Commonwealth Avenue between Cummington Mall and Hinsdale Mall, where on-street parking is prohibited at all times. The parking meters on Commonwealth Avenue are a mix of 2-hour and 4-hour meters. There are also 4-hour parking meters located along both sides of Silber Way and Bay State Road.

Parking meters along Blandford Mall, Cummington Mall, and Hinsdale Mall were removed when these streets became private ways owned by the University and were consequently converted from vehicle to pedestrian use (except for authorized vehicles).

5.2.5 VEHICULAR TRAFFIC

As noted above, the existing traffic conditions in the vicinity of the Site and within the traffic study area are not expected to have changed significantly since the time that the traffic analysis for the Master Plan was completed. Therefore, for the purposes of this study, the existing traffic conditions reported below are excerpted from the results presented in the TMP. Those results are based on the geometric configurations and traffic volumes shown on Figures 3, 4, and 5 of the TMP, copies of which are provided in Appendix A, Transportation Technical Appendix.

Level of Service

Level of Service (LOS) is a term used to describe the quality of the traffic flow on a roadway at a particular point in time. It is an aggregate measure of travel delay, travel speed, congestion, driver discomfort, convenience, and safety based on a comparison of roadway facility capacity to travel demand. Operating levels of service are reported on a scale of A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. LOS A represents free-flow conditions with little or no traffic delays, while LOS F represents a forced-flow condition with long delays and traffic demands exceeding roadway capacity.

LOS C is often cited as a design standard for rural roadways and LOS D is often used for urban roadways. When trying to establish minimum "acceptable" level of service thresholds for existing roadways, however a number of factors must be considered. These include existing operating levels of service at other similar and nearby facilities, the duration of the peak traffic periods, the feasibility and cost of providing roadway capacity increases, and applicable state and local regulations.

Roadway operating levels of service are calculated following procedures defined in the 2000 *Highway Capacity Manual*, published by the Transportation Research Board. For both signalized and unsignalized intersections, the operating level of service is based on travel delay. Delay can be measured in the field, but is generally calculated as a function of the traffic volume; quality of traffic progression; the green ratio; the cycle length; the v/c (volume/capacity) ratio; and the capacity of each intersection approach, as appropriate for signalized intersections. Delay at unsignalized intersections is calculated for side street or minor street approaches and for left turns from Commonwealth Avenue. Delays at unsignalized intersections are influenced by the traffic volume levels on the major and minor streets surrounding that intersection.

The delay-based level of service thresholds provided in the 2000 *Highway Capacity Manual* are summarized for signalized and unsignalized intersections in Table 5-1.

Table 5-1: Intersection Level of Service Criteria

Level of Service	Average Delay per Vehicle (Seconds)	
	Signalized	**Unsignalized**
A	≤10.0	≤10.0
B	10.1 to 20.0	10.1 to 15.0
C	20.1 to 35.0	15.1 to 25.0
D	35.1 to 55.0	25.1 to 35.0
E	55.1 to 80.0	35.1 to 50.0
F	>80.0	>50.0

Note: "≤" = Less than or equal to
"> " = Greater than

Source: *Highway Capacity Manual*, Special Report 209, Transportation Research Board, National Research Council, Washington, DC, 2000.

Existing Traffic Operations

Peak hour traffic operations were evaluated using the SYNCHRO 6.0 software, which is the standard traffic analysis and simulation tool used by the Boston Transportation Department (BTD). The results of the analysis are summarized in Table 5-2, which provides overall LOS, delay, and volume-to-capacity ratio results for the signalized intersections that were evaluated. Table 5-2 also displays the LOS, delay, and volume-to-capacity ratio results for the side street traffic moments at unsignalized intersections.

As Table 5-2 indicates, the existing condition at each study intersection is at LOS D or better in both the morning and afternoon peak hours. The one exception is at Kenmore Square, where at the afternoon peak hour the LOS was determined to be LOS E, with an average delay of 70 seconds per vehicle and a volume-to-capacity ratio just below 1.00 (0.98), indicative of an intersection operating at capacity.

Table 5-2: Existing Intersection Level of Service Results

Location	AM Peak Hour			PM Peak Hour		
	Delay[1]	v/c[2]	LOS[3]	Delay[1]	v/c[2]	LOS[3]
Signalized Intersections						
Commonwealth Avenue & Carlton Street	0.71	28.2	C	0.69	12.1	B
Commonwealth Avenue & St. Mary's Street	0.37	15.0	B	0.42	7.0	A
Commonwealth Avenue & Cummington Mall	0.30	12.6	B	0.46	16.3	B
Commonwealth Avenue & Granby Street	0.37	9.0	A	0.41	11.7	B
Commonwealth Avenue & Silber Way	0.38	8.3	A	0.47	10.3	B
Commonwealth Avenue & Beacon Street (Kenmore Square)	0.88	44.5	D	0.98	70.4	E
Mountfort Street & Carlton Street	0.39	17.8	B	0.37	14.5	B
Mountfort Street & St. Mary's Street	0.46	48.4	D	0.61	49.6	D
Unsignalized Intersections						
Bay State Road & Granby Street						
Bay State Road EB R	9.2	0.02	A	12.2	0.11	B
Bay State Road WB LT	10.8	0.25	B	16.0	0.38	C
Bay State Road & Silber Way						
Bay State Road WB LTR	9.9	0.38*	A	9.3	0.31*	A
Silber Way NB LT	8.4	0.10*	A	8.7	0.17*	A

[1] Delay = Average delay in seconds per vehicle

[2] v/c = Volume to capacity ratio

[3] LOS = Level of Service

* = Indicates that Degree Utilization was used in place of volume to capacity ratio

5.3 PROJECT IMPACTS

5.3.1 VEHICULAR TRAFFIC

In order to assess the potential traffic impacts of the Project on the study area roadway network, traffic capacity analyses of future conditions with and without the Project (i.e., the "No-Build" and "Build" conditions) were undertaken. The following assumptions were used to generate traffic volumes and roadway networks that were used for the model and analysis of the No-Build and Build cases:

No-Build

- Future analysis year of 2022 (consistent with the TMP);
- 2022 morning and afternoon peak hour volumes projected for the TMP's future year analysis; and
- Roadway and signal improvements at the Project study area intersections that were assumed for the 2022 TMP analyses.

Build

- Future analysis year of 2022;
- 2022 morning and afternoon peak hour volumes from the TMP with the following adjustments:
    - Redistribution of peak hour trips travelling to/from the existing surface parking lot at the Site to other University parking facilities; and
    - New trips associated with University employment increases expected at the Project.
- Fifty percent of the 60 permit holders parking at the existing surface lot arrive or depart during the morning or afternoon peak hour;
- Approximately 160 University employees (faculty/staff) will work at the facility, of which 100 will be existing employees transferred from other campus facilities. The additional 60 are expected to be new hires.
- Employees will travel to and from the proposed building in accordance the current modal split at the Campus that was documented in the TMP.

2022 No-Build

Morning and afternoon peak hour traffic volumes for the future No-Build analysis case are illustrated on Figures 28 and 29 from the TMP, copies of which have been provided in Appendix A, Transportation Technical Appendix. The future TMP volumes include the following traffic growth factors:

- 0.25 percent per year regional background growth rate (2.5 percent total growth) from 2012 to 2022. The 0.25 percent annual growth rate is consistent with requirements outlined by the BTD at the time of the TMP.
- 2.5 percent growth in University employment between 2012 and 2022. This translates to approximately 150 new employees.
- Traffic from other known projects that are proposed in the vicinity of the Campus. Those projects include the following:

- Kenmore Square mixed-use project;
- Hotel project at 121 Brookline Ave; and
- Residential project at 60-66 Brainerd Road

Table 5-3 provides a summary of the future No-Build traffic operations at the study area intersections. These are the same analytical results that were reported in Table 23 of the TMP. Notable results in Table 5-3 include Kenmore Square, where operations are projected to be LOS E in the morning peak hour (approaching capacity) and LOS F in the afternoon peak (over capacity). In the afternoon peak hour, the volume-to-capacity ratio is forecast to be 1.03, indicating that the intersection will be approximately three percent over capacity. The traffic model results also indicate that the average delay at Kenmore Square will be 87 seconds in the afternoon peak period, seven seconds above the LOS E/LOS F threshold of 80 seconds.

Table 5-3: Future (2022) No-Build Intersection Level of Service Results

Location	AM Peak Hour			PM Peak Hour		
	Delay[1]	v/c[2]	LOS[3]	Delay[1]	v/c[2]	LOS[3]
Signalized Intersections						
Commonwealth Avenue & Carlton Street	0.74	24.5	C	0.72	39.0	D
Commonwealth Avenue & St. Mary's Street	0.41	5.1	A	0.44	7.8	A
Commonwealth Avenue & Cummington Mall	0.32	12.7	B	0.48	15.2	B
Commonwealth Avenue & Granby Street	0.40	8.0	A	0.42	11.8	B
Commonwealth Avenue & Silber Way	0.41	8.4	A	0.49	10.9	B
Commonwealth Avenue & Beacon Street	0.95	57.4	E	1.03	87.2	F
(Kenmore Square)						
Mountfort Street & Carlton Street	0.91	32.6	C	0.65	23.8	C
Mountfort Street & St. Mary's Street	0.47	25.9	C	0.63	40.6	D
Unsignalized Intersections						
Bay State Road & Granby Street						
Bay State Road EB R	0.01*	6.7	A	0.01*	6.7	A
Bay State Road WB LT	0.26*	8.4	A	0.26*	8.4	A

Location	AM Peak Hour			PM Peak Hour		
	Delay[1]	v/c[2]	LOS[3]	Delay[1]	v/c[2]	LOS[3]
Bay State Road & Silber Way						
Bay State Road WB LTR	0.16*	10.2	B	0.16*	10.2	B
Silber Way NB LT	0.11*	8.5	A	0.11*	8.5	A

[1] Delay = Average delay in seconds per vehicle

[2] v/c = Volume to capacity ratio

[3] LOS = Level of Service

* = Indicates that Degree Utilization was used in place of volume to capacity ratio

2022 Build

As noted above, there are two components that were considered when developing the traffic projections associated with the Project: (1) relocation of existing trips to parking locations in the vicinity of the Site, and (2) new trips to the Campus associated with employment created by the Project.

Relocated Trips

For the purpose of this analysis, it was assumed that 50 percent (30 drivers) of the 60 University parking permit holders that use the existing surface lot arrive or depart in the peak hours. The arrival/departure pattern of these drivers was assumed to be the same as the pattern documented in the TMP (i.e., approximately 40 percent from the east via Kenmore Square or Bay State Road and approximately 60 percent from the west, north, and south via Commonwealth Avenue eastbound). These trips were "reassigned" to the study area roadway network to arrive or depart at the two University parking facilities expected to absorb these permit holders:

- Warren Towers Garage at 700 Commonwealth Avenue; and
- Surface lot at 766 Commonwealth Avenue.

Figure 5-3 illustrates the locations of the Warren Towers Garage and the surface lot at 766 Commonwealth Avenue in relation to the Site.

Given the proximity of the Warren Towers Garage to the existing Site, it was assumed that 2/3 of these drivers (20 of the 30) will park at this facility. The remaining 10 drivers were reassigned to the surface lot at 766 Commonwealth Avenue.

New Trips

The University anticipates that approximately 160 faculty and staff will be employed at the Project. Of these employees, approximately 100 positions will be existing employees relocated from existing facilities on the Campus and approximately 60

will be new employees. Only the 60 new employee positions will be used to determine the trip generation for the Project, as the existing employees who drive to the Campus have already been accounted for in the traffic counts performed for the TMP.

To estimate the number of peak hour trips associated with the 60 new employees, trip generation rates from the Institute of Transportation Engineers (ITE) *Trip Generation* publication (9th Edition, 2012) were used. Specifically, the morning and afternoon peak hour rates per employee for Land Use Code (LUC) 550 University/College. Once the ITE-based trip generation estimates were determined, they were adjusted to reflect the urban location of the Campus, as the ITE rates were derived from data collected at suburban or rural campuses. The adjustments were made by applying the Campus modal split data documented from the TMP to the ITE estimates. See Table 5-4 for a summary of modal splits on the Campus.

Table 5-4: Charles River Campus Modal Splits

Transportation Mode	Percent of Commuters
Single Occupancy Vehicles	44.2%
Public Transportation (MBTA)	31.4%
Walk	13.5%
Bicycle	6.0%
Car/Van Pools	2.3%
Other	2.6%
Total	**100%**

Consistent with the table above, the trip generation estimates were calculated using the ITE rates and were adjusted by multiplying the results by 44.2% to determine the number of new vehicle trips to the Campus. These trips were then assigned to the study area roadway network using the same arrival/departure pattern to/from the Campus used to reassign the trips to the existing Site. The new trips were assumed to park at the same two University parking facilities that are expected to absorb parkers displaced from the existing surface parking lot on the Site. Similarly, it was assumed that 2/3 of the new employees who will work at the facility and who drive to the Campus will park at the Warren Towers Garage and 1/3 of these employees will park at the 766 Commonwealth Avenue surface lot.

As shown in the summary of the trip generation estimates/calculations provided in Table 5-5. It is expected that a maximum of 21 new vehicle trips to the Project will occur in the morning peak and 22 new vehicle trips to the Project will occur at the evening peak. Although the number of new vehicular trips projected to travel to/from campus in the peak periods is relatively small, the estimates are conservative in nature for two reasons:

(1) The future traffic analysis in the TMP already assumed an increase of approximately 150 employees at the Campus, so assuming 60 new employees at the CILSE facility is in essence "double counting" the University's employment increases assumed for 2022 traffic analyses.

(2) The existing non-vehicular mode shares (i.e., walking, bicycles and public transit) remain constant in the future rather than increasing due to implementation of the University's Transportation Demand Management (TDM) program as described in the TMP.

Table 5-5: Project Trip Generation Summary

Analysis Period	ITE Rate (per Employee)[1]	Unadjusted Trip Generation Estimate[2]	BU Campus Modal Split Adjustment Factor[3]	Adjusted Trip Generation Estimate
AM Peak	0.75	47	0.44	21
PM Peak	0.79	50	0.44	22

[1] Source: ITE *Trip Generation*, 9th Edition, 2012; LUC 550 – University/College.

[2] Based on 60 New Employees expected at the CILSE facility

[3] Source: Boston University *Charles River Campus 2013-2023 Transportation Master Plan*, January 2013.

Figures 5-4, Existing AM Peak Hour Site Trips and Figure 5-5, Existing PM Peak Hour Site Trips illustrate the AM and PM peak hour trips associated with the Project (combination of new and reassigned trips). The volumes shown on these two graphics were combined with Figures 28 and 29 of the TMP (see Appendix A) to illustrate the Build scenario traffic volumes. The morning and afternoon peak hour Build condition volumes for the Project are illustrated on Figures 5-6, Future 2022 AM Peak Hour Traffic Volumes and Figure 5-7, Future 2022 PM Peak Hour Traffic Volumes.

Peak hour traffic capacity analyses using the traffic volume shown on Figures 5-6 and 5-7 were performed using the Synchro 6.0 traffic modeling software. The results of those analyses are summarized in Table 5-6. The analysis results indicate that there will not be a change in LOS at study area intersections between the 2022 No-Build and Build scenarios in either peak hour with the Project.

Table 5-6: Future (2022) Build Intersection Level of Service Results

Location	AM Peak Hour			PM Peak Hour		
	Delay[1]	v/c[2]	LOS[3]	Delay[1]	v/c[2]	LOS[3]
Signalized Intersections						
Commonwealth Avenue & Carlton Street	0.74	23.3	C	0.72	31.4	C
Commonwealth Avenue & St. Mary's Street	0.42	4.4	A	0.45	9.4	A
Commonwealth Avenue & Cummington Mall	0.31	11.6	B	0.49	16.4	B
Commonwealth Avenue & Granby Street	0.39	7.8	A	0.42	14.9	B
Commonwealth Avenue & Silber Way	0.41	8.5	A	0.49	10.9	B
Commonwealth Avenue & Beacon Street (Kenmore Square)	0.96	59.1	E	1.04	90.1	F
Mountfort Street & Carlton Street	0.91	40.3	D	0.65	29.3	C
Mountfort Street & St. Mary's Street	0.49	30.6	C	0.64	40.7	D
Unsignalized Intersections						
Bay State Road & Granby Street						
Bay State Road EB R	0.01*	6.7	A	0.08*	7.0	A
Bay State Road WB LT	0.24*	8.2	A	0.24*	8.5	A
Bay State Road & Silber Way						
Bay State Road WB LTR	0.40*	10.1	B	0.32*	9.4	A
Silber Way NB LT	0.11*	8.5	A	0.18*	8.7	A

[1] Delay = Average delay in seconds per vehicle

[2] v/c = Volume to capacity ratio

[3] LOS = Level of Service

* = Indicates that Degree Utilization was used in place of volume to capacity ratio

5.3.2 PEDESTRIAN

Impacts on pedestrian facilities and circulation are expected to be minimal. Many of the students arriving to the Project are likely to already be travelling by foot along this portion of Commonwealth Avenue. The Project will provide good pedestrian connections between the main entrance and the sidewalks on Commonwealth Avenue. These connections will include a fully handicapped accessible path between the building and the Commonwealth Avenue sidewalk. Figure 3-14, Site

Access and Circulation Plan, illustrates the proposed pedestrian walkways serving the Site.

5.3.3 BICYCLE

Bicycle storage capacity for a total of 70 bicycles is planned at the Project Site. Of the 69 spaces, storage for 53 bicycles will be provided indoors in a secure bike room and storage for 16 bicycles will be provided outside of the building. Additionally, a minimum of two shower/changing facilities will be provided at the proposed facility and available to those who ride bicycles to the Site.

The proposed bicycle storage capacity is generally consistent with the City's guidelines for bike storage at academic facilities, which specifies 0.5 spaces of secure/covered bike parking per 1,000 sf of development. Because large portions of two of the floors of the building are needed to house the building's mechanical systems, the actual occupiable square footage in the building is approximately 137,000 sf, (145,000 sf – 8,000 sf for mechanicals = 137,000 sf). Based on the City's guidelines, bicycle storage for 68 bicycles is required to support a building of 137,000 sf. Therefore, the amount of storage provided will meet the City's guidelines.

If the University finds that this level of bicycle capacity is not sufficient once the facility is open and operating, additional bicycle storage may be provided. Due to the substantial amount of bicycle parking in the vicinity of the Site, it is anticipated that some users of the Project will utilize nearby bicycle parking facilities, in addition to those provided on the Site. See Figure 5-1, Existing Bicycle Facilities in the Vicinity of the Project.

5.3.4 PUBLIC TRANSPORTATION

Impacts on MBTA public transportation services (Green Line, Route 57 Bus, and Commuter Rail) are not expected to be significant. According to MassDEP ride share data that was summarized in the TMP, 31 percent of all commuters traveling to/from the Campus use public transportation.

As noted above, it is anticipated that there will be approximately 160 employee positions (faculty and staff) at the proposed facility, 60 of which will be new hires. Based on the current mode splits at the Campus, 31 percent of the 60 new hires, or 19 employees, are projected to use public transportation. Even if all of these new employees arrived/departed the Campus during the peak hours, there would be a maximum of 20 new transit trips on either the Green Line, the Route 57 bus, or on the Framingham/Worcester commuter rail line. As it is likely that these commuters will arrive or depart at various times over the course of the peak hour rather than at the exact same time, and because they may be traveling in different directions on

the service lines (i.e., inbound vs. outbound), it is unlikely that any one Green Line trolley, Route 57 bus, or commuter rail train would experience a net increase greater than one or two new passengers because of the Project.

5.3.5 PARKING

Off-Street Parking

The elimination of the 60 spaces at the existing surface lot at 610 Commonwealth Avenue will not result in impacts to the on-street parking supply in the adjacent area. Current users of the surface lot are University parking permit-regulated drivers who typically park for longer periods of time, and are not likely to use the on-street metered parking spaces along Commonwealth Avenue, Silber Way, or Bay State Road. These parkers will instead be directed to park at other off-street facilities in the area operated by the University.

The University expects that the current parking permit holders that use the existing surface lot at the Site will be relocated to two University-owned parking facilities that are also in the East/Central Campus area. Those facilities are:

- Warren Towers garage located at 700 Commonwealth Avenue. The garage has a capacity of 464 spaces and is located one block west of the Project Site (see Figure 5-3); and

- Surface parking lot located at 766 Commonwealth Avenue. This lot has a capacity of 87 spaces and is located just east of Carlton Street and three blocks west of the Site (see Figure 5-3).

Between these two parking facilities, there is Site. In the unlikely event that both of these facilities are at capacity during peak parking demand periods, however, permit holders will be directed to park in the garage at the Agganis Arena in West Campus. The garage is available to University permit holders during the day and on non-event evenings. The capacity of the Agganis garage is 640 spaces and there is enough available capacity to accommodate all of the permit holders at 610 Commonwealth Avenue, if necessary.

On-Street Parking

During certain phases of construction (e.g., during the steel erection phase), up to 16 parking meters on the south side of Commonwealth Avenue between Hinsdale Mall and Blandford Mall will need to be rented from the City in order to create a work zone and truck delivery zone for the Site. After construction of the Project is completed, the on-street parking along the south side of Commonwealth Avenue will be restored to the existing conditions with no permanent loss of metered spaces

occurring. A more detailed description of the construction phase parking impacts will be provided in the Draft Construction Management Plan (CMP).

5.3.6 LOADING AND SERVICE

The Project will be serviced via the existing service bay located on the north side of the University-owned Physics and Biology Research Building at 3-5 Cummington Mall. This service bay is accessed from Blandford Mall, which is a private way and is limited to use by pedestrians, bicycles, and authorized vehicles. Currently, trucks are able to back into the service bay from Blandford Mall to make deliveries. This will not change when the Project is built, as adequate distance will be provided between 3-5 Cummington Mall and the Project for trucks to maneuver to and from the service bay. The proposed elevated pedestrian connection between the buildings will facilitate the movement of materials between the service bay at 3-5 Cummington Mall and the Project.

A copy of Figure 22 from the TMP, which illustrates the location of the 3-5 Cummington Mall service bay, is provided in the Appendix A, Transportation Technical Appendix.

5.4 TRANSPORTATION DEMAND MANAGEMENT/SUSTAINABILITY

The University, through its Parking & Transportation Services Office, has implemented a number of measures to reduce the number of vehicles on campus and increase use of sustainable modes for commuters at the Campus. The University's TDM program includes the following elements: alternative transportation modes, parking management, and enhanced strategies, which are described below.

5.4.1 ALTERNATIVE TRANSPORTATION MODES

The University offers a wide breadth of transportation options for students, staff, and visitors. Alternative transportation modes available to the University community are described below.

Ride Matching Program

The University provides a ride-matching service for car and van pools. University faculty and staff can conveniently participate in the ride-matching services by completing an on-line Ride-Matching form on the Parking Services website: http://www.bu.edu/parking/alt/rideshare.

MBTA Pass Program

University employees can purchase MBTA monthly passes through by payroll deduction on a pre-tax basis.

Student MBTA Semester Pass and Corporate Pass Programs

University students can purchase Semester MBTA Passes through the Parking & Transportation Services Office via the University website. The semester pass is good for four months and affords students an 11 percent discount off the regular monthly MBTA pass costs.

Boston University Shuttle (BUS)

The University provides a free shuttle bus service for faculty, staff, and students that connects the Campus with the University Medical Campus. This service allows students from either campus to travel between the campuses for academic or other purposes without having to use a private vehicles.

Bicycle Facilities

Over the past 10 years, the University has installed a significant number of bicycle storage racks or bicycle rooms throughout the Campus making bicycle travel to the Campus (and within the Campus) convenient for users. All institutional projects will provide an appropriate amount of bicycle storage as part of the Project's development program.

The Center for Integrated Life Sciences and Engineering will provide parking for approximately 69 bicycles as part of the Project (53 indoors and 16 outside the facility).

Bicycle Safety

In an effort to promote bicycle safety and responsibility on-campus, students are encouraged to register their bicycles with the University's Parking & Transportation Services Office. Students can register their bicycles with the Parking & Transportation Services Office on-line at: http://www.bu.edu/bikesafety/bike-registration. The Boston University Police Department (BUPD) co-sponsors bicycle sales/raffles with the George Sherman Union where the BUPD bicycle officers or Community Policing officers discuss bicycle safety. BUPD staff are made available for bicycle safety clinics upon request by any University staff, faculty, or student group. In addition, bicycle safety and security are discussed at Residence Assistant and Residence Hall Association meetings throughout the year. There is also a student bicycle club, BU Bikes, that focuses on improving the cycling experience for

the greater University community. Information regarding current initiatives can be found at http://www.bu.edu/sustainability/what-you-can-do/join-a-club/bu-bikes/.

Car Share

Zipcar (http://www.zipcar.com/) offers short-term use of private vehicles for members who reserve cars. Typically, the vehicles are parked in designated spots in off-street lots that must be accessible 24-hours a day. Currently, there are seven Zipcars within the Campus area and an additional 15 Zipcar vehicles located in Boston or Brookline within a short walking distance of the Campus. Zipcar also offers specific programs designed for universities and students. Information pertaining to these programs can be found at: http://www.zipcar.com/universities/.

Walking

Approximately 76 percent of undergraduates live on Campus, often traveling on foot to classes and activities held on the Campus. The University forecasts that the number of undergraduates living on Campus will stabilize at around 75 percent in the future.

5.4.2 PARKING MANAGEMENT

The University employs several parking management measures to discourage vehicle trips to the University, described below.

Parking Fees

Fees are charged for all University Parking Permits for faculty, staff, and students (i.e., there is no free parking at the Campus). Annual parking permit fees for University employees range from $1,156 (Green permits) to $1,650 (Brown Permits). Student parking fees range from $845 (day time commuter) to $1,206 (overnight). The University has increased parking permit fees by 28 percent for Green Permits and by 33 percent for Brown Permits since 2003. Student parking permit fees have increased by 31 percent (daytime commuter) and 37 percent for overnight permits since the TMP was approved in August 2012.

Limit Student Parking

As described in the TMP, the University actively restricts the number of parking permits issued to undergraduate students.

Limiting Construction of New Parking Spaces

Over the course of the last two Master Plans, the University limited the number of new spaces provided at institutional projects or constructed new buildings with no parking. The Project will not include any new parking spaces as part of the building program, and will result in a net loss of 60 spaces at the Campus.

5.4.3 ENHANCED STRATEGIES

The University is considering a number of additional measures to be implemented during the TMP period to achieve its goal of reducing the number of commuters who arrive in single occupancy vehicles and to manage future parking demands as parking supplies on campus shrink. The strategies under consideration include:

- Maintaining appropriate parking fees to discourage employees and students from traveling to the Campus in single occupancy vehicles;
- Providing a parking permit discount for employees who are in a current car/van pool or who form a new car pool;
- Creating designated spaces for car or van-pools at highly desirable parking locations within the Campus. It is anticipated that this "preferential" parking initiative will have the most influence on driver behavior if implemented in the central Campus area;
- Providing limited preferential parking for drivers of hybrid or electric vehicles;
- Developing a tiered system for the daily parking permits where drivers desiring to park in lots or garages located in the central Campus area are charged higher fees than their colleagues who park in west Campus;
- Institute a policy where employees who live within a certain radius of the University will no longer be eligible to purchase a parking permit Campus (for example 1 mile or less); and
- Start a "Try the T" program, where employees who currently drive alone to campus and have a Green parking permit are given a MBTA pass for free to test taking public transportation to work for 30 days.

5.5 RELATIONSHIP TO TRANSPORTATION MASTER PLAN

The Project is consistent with Transportation Goals #2 and #3 of the TMP.

Transportation Goal #2*: Increase the use of sustainable modes by employees and students currently commuting to the Campus in single occupancy vehicles.*

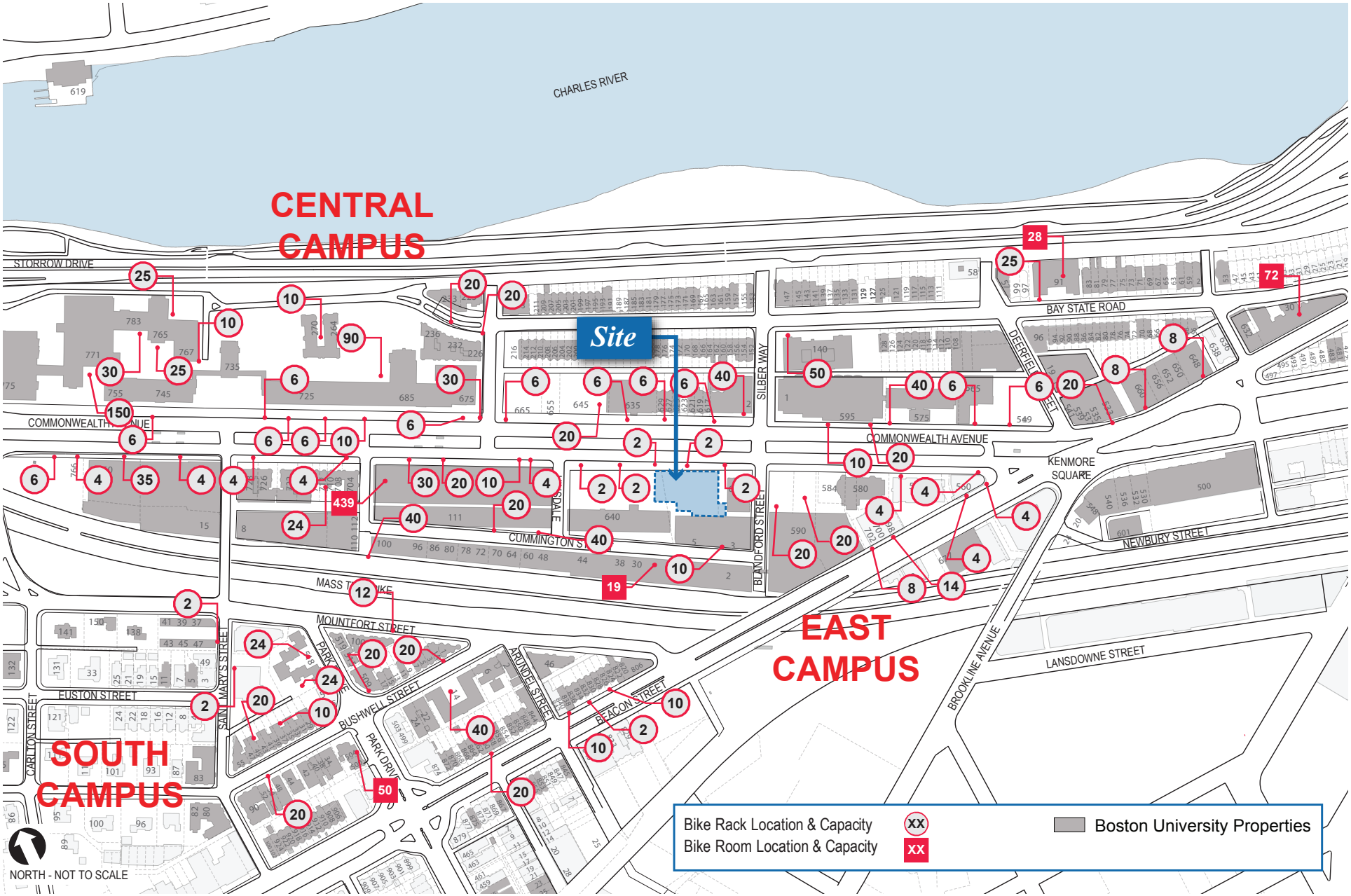
The Project will help the University to realize the objectives of Goal #2 by:

- Promoting alternative modes of commuting by providing secure bicycle storage for 70 bicycles at the Site;
- Providing at least two (2) shower/changing room facilities at the proposed facility for use by commuters who ride their bicycles to the Site; and
- Reducing the number of available parking spaces at the Campus by 60 spaces.

Transportation Goal #3: *Minimize the University's traffic and parking impacts on adjacent communities.*

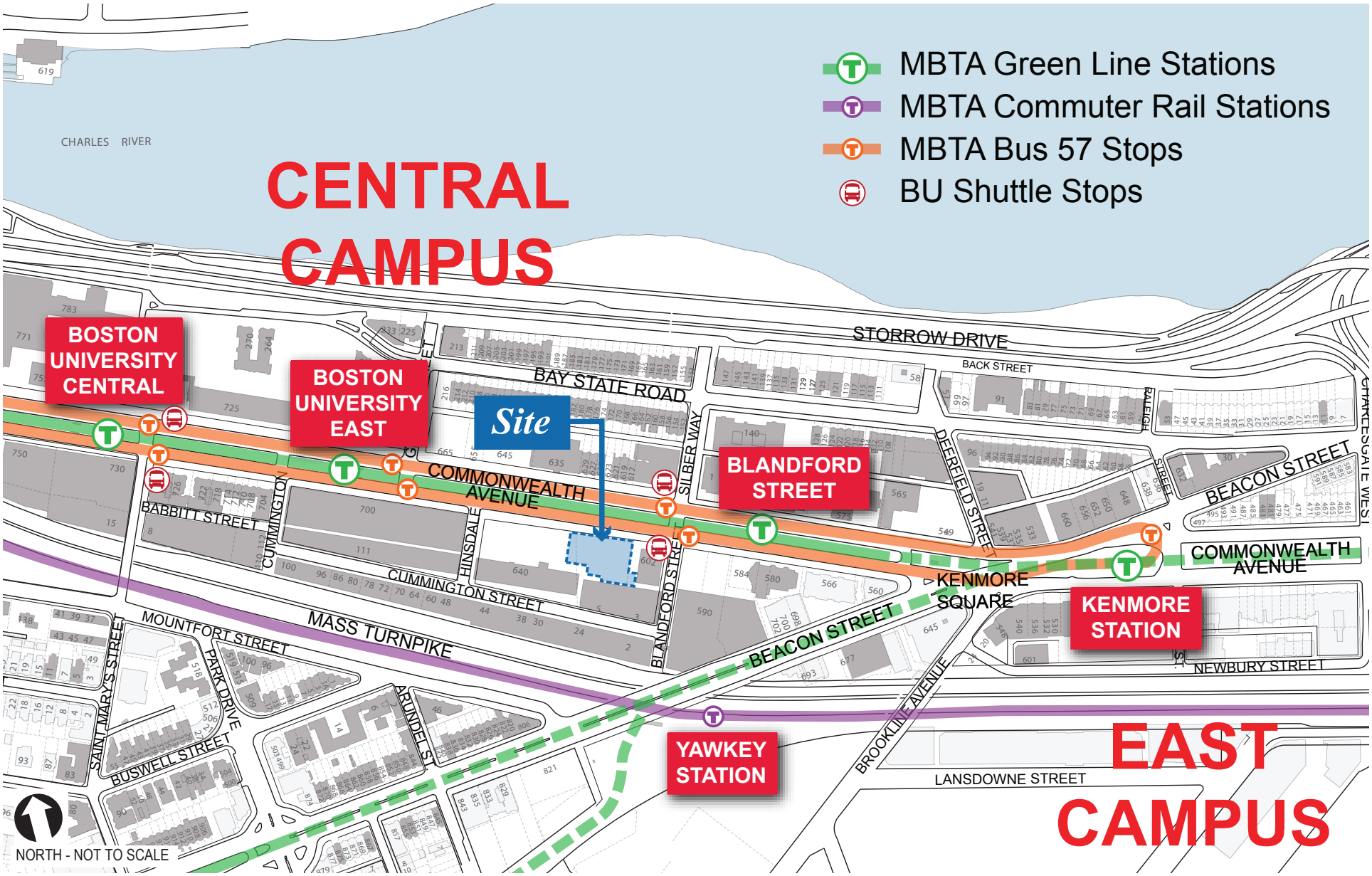
The Project will help the University to realize the objectives of Goal #3 by:

- Reducing the number of available parking spaces at the Campus by 60 spaces.
- Providing alternative parking for University permit holders at other facilities within the Campus' existing parking system.



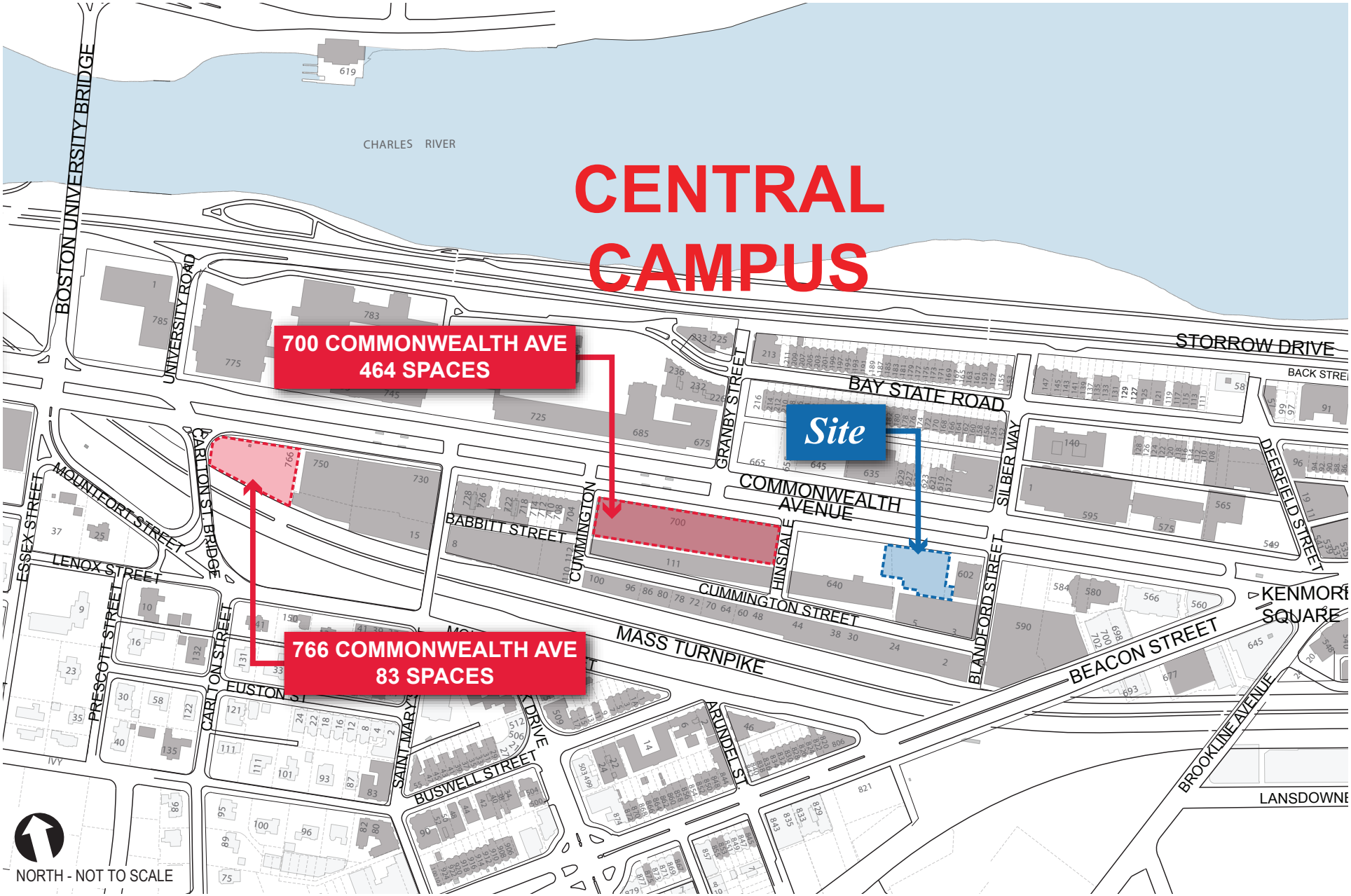
610 Commonwealth Avenue
Boston, MA

Figure 5-1
Existing Bicycle Facilities in the Vicinity of the Project Site
Source: Tetra Tech, Inc., 2014



610 Commonwealth Avenue
Boston, MA

Figure 5-2
Existnig Public Transportation Facilities in the Vicinity of the Project Site
Source: Tetra Tech, Inc., 2014



610 Commonwealth Avenue
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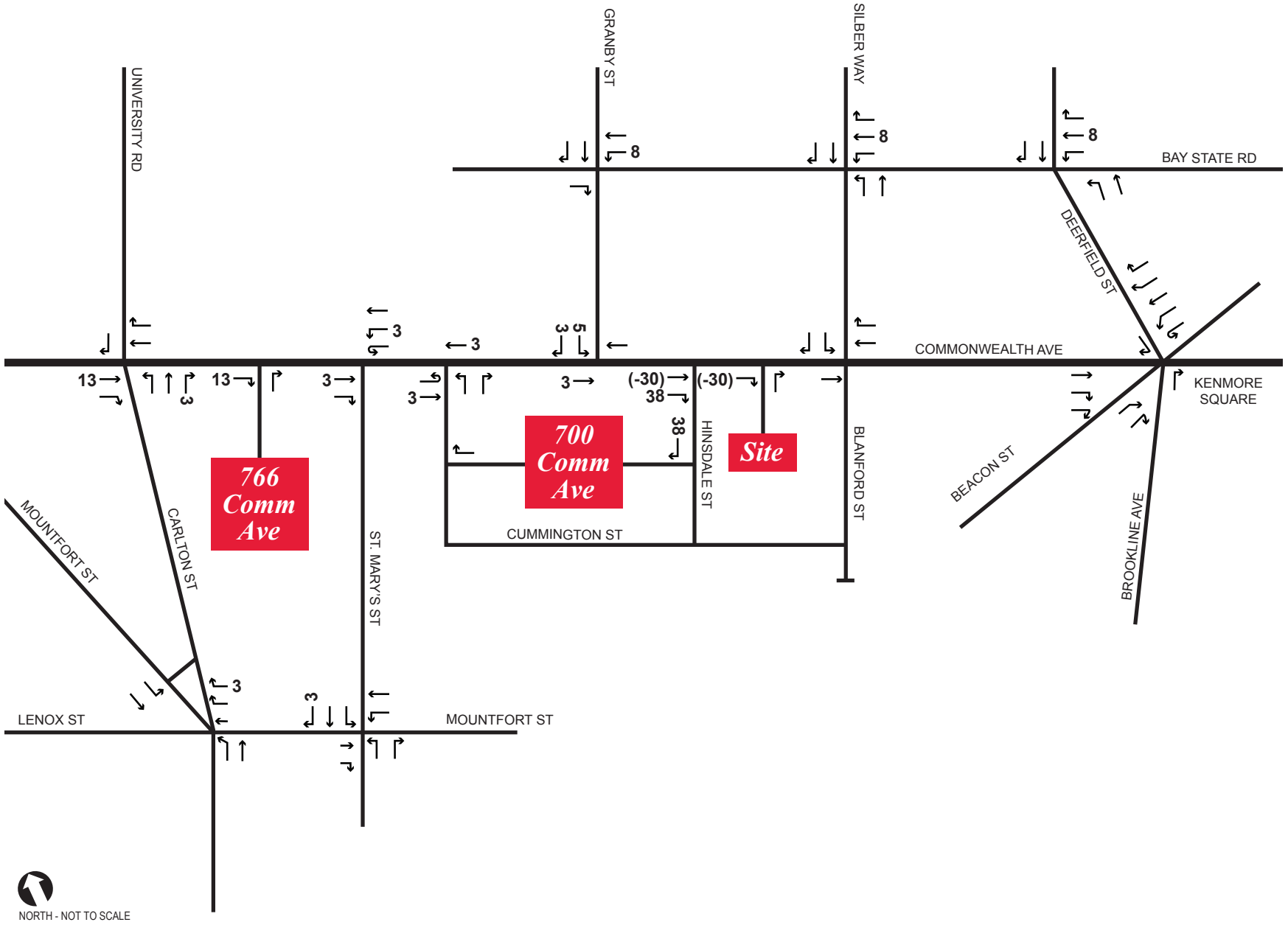
Figure 5-3
Location of BU Parking Facilities for Displaced Permit Holders
Source: Tetra Tech, Inc., 2014



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Boston, MA

Figure 5-4
Existing AM Peak Hour Site Trips
Source: TetraTech, Inc., 2014

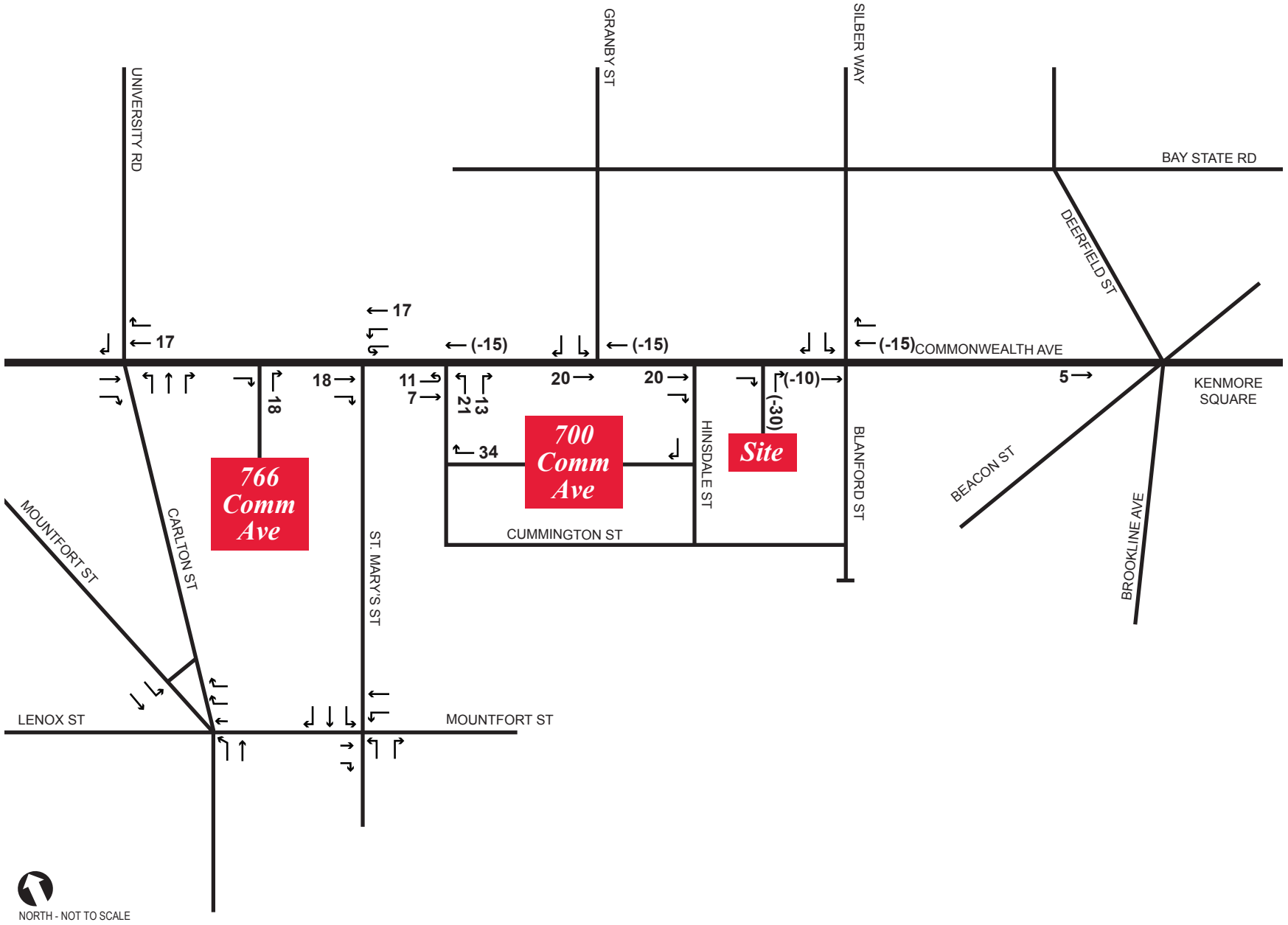

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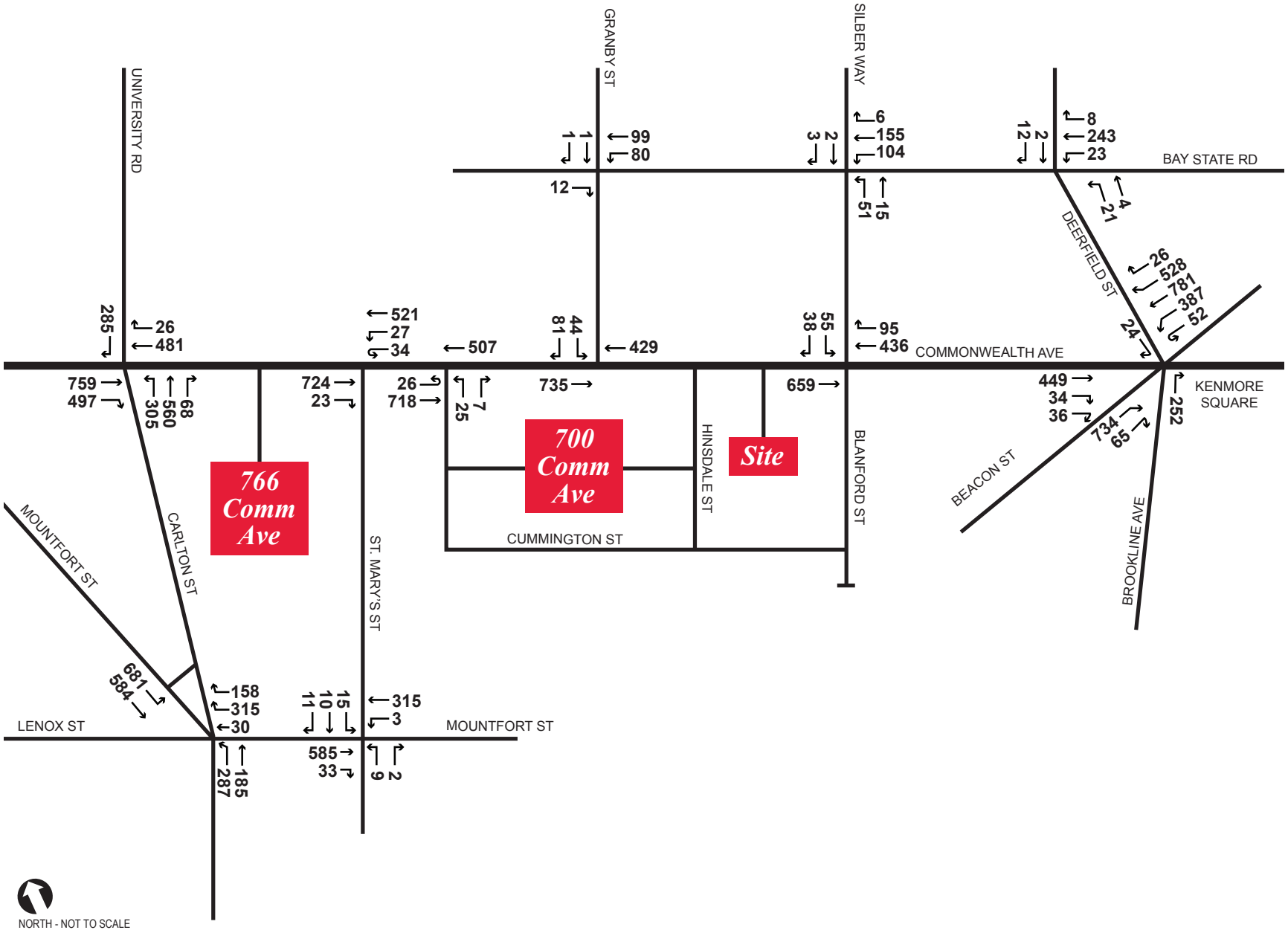
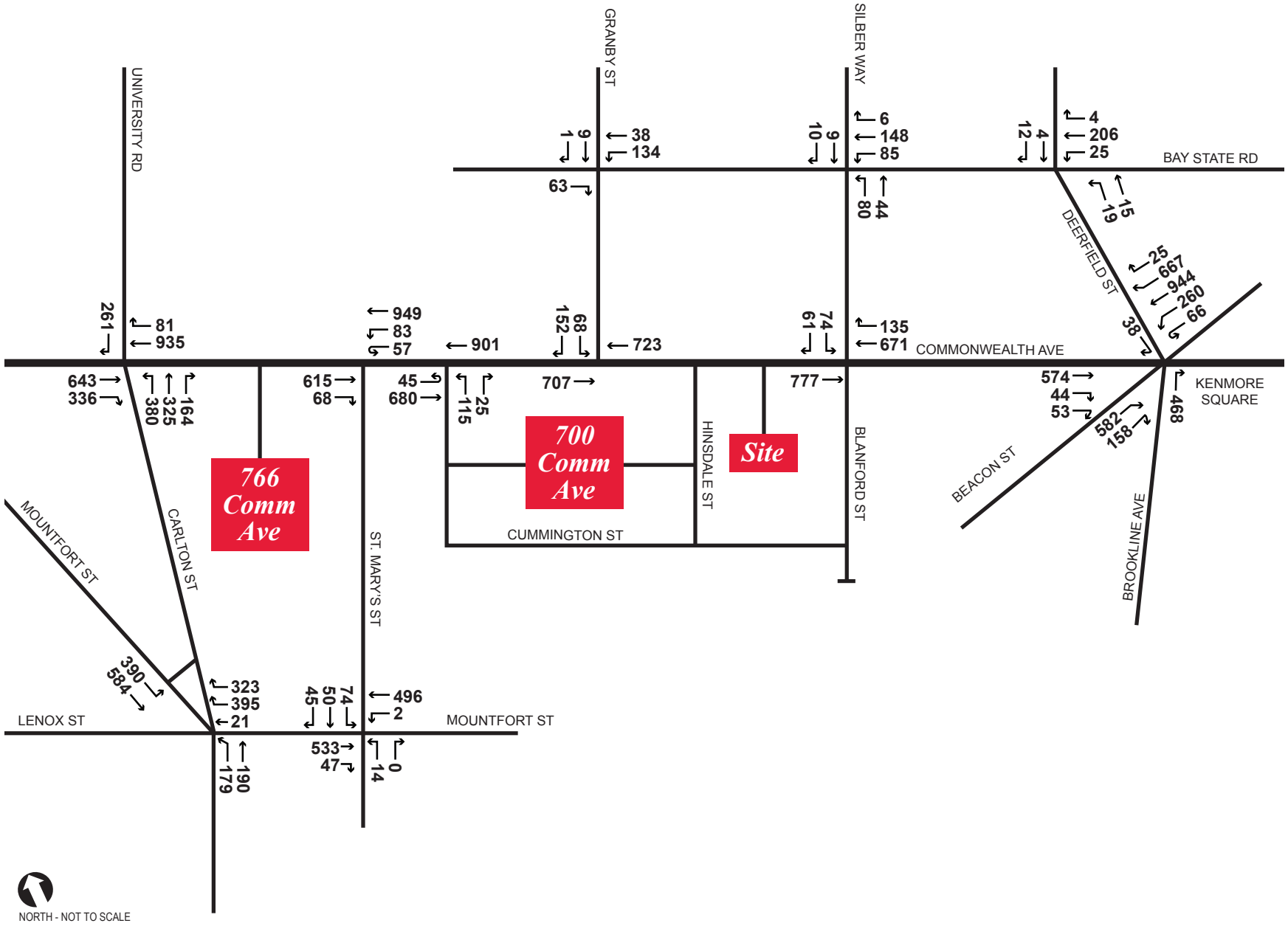
Figure 5-5
Existing PM Peak Hour Site Trips
Source: TetraTech, Inc., 2014



610 Commonwealth Avenue
Boston, MA

Figure 5-6
Future 2022 Build AM Peak Hour Traffic Volumes
Source: TetraTech, Inc., 2014



610 Commonwealth Avenue
Boston, MA

Figure 5-7
Future 2022 Build PM Peak Hour Traffic Volumes
Source: TetraTech, Inc., 2014

Chapter 6

ENVIRONMENTAL

CHAPTER 6: ENVIRONMENTAL

6.1 INTRODUCTION

The Project will be built in full compliance with local, state, and federal environmental regulations and will substantially improve the environmental conditions of the Site. The Project will not create undue wind, shadow, noise, solar glare, or air quality impacts in the surrounding areas. Should any contaminated soils be encountered during construction, they will be remedied as required. An appropriate construction management plan (CMP) will be prepared prior to commencement of construction to avoid and mitigate construction impacts.

6.2 WIND

The Site includes an existing surface parking lot situated along Commonwealth Avenue, the spine of the University's Charles River Campus (the "Campus"). This portion of the Campus is characterized by a wide variety of low to mid-rise institutional and academic buildings, as well as open campus spaces. The proposed building will be nine stories tall with main entrances located along the west façade. The tallest portion of this building is approximately 350 feet away from the nearest residential, non-academic use located to the north of the Site on Bay State Road.

A qualitative assessment predicted for the Project was undertaken through computer modeling techniques to estimate the pedestrian environment around the proposed development in the context of the existing and future conditions. Special attention was paid to the Grounds South, where a high level of pedestrian activity occurs. The analysis was based on a review of regional long-term meteorological data for the Boston area, conceptual design drawings of the proposed building, engineering discretion, and the results of computer-generated computation. The results of these analyses were measured against the Boston Redevelopment Authority (BRA) standards for acceptable wind conditions and are described below. Note that this analysis did not include the effects of landscaping on the pedestrian environment. The full Pedestrian Wind Review report is contained in Appendix C, Wind Study.

6.2.1 RESULTS SUMMARY

Data from 1984 to 2013 reveals that the prevailing winds in the Boston area originate from the west-northwesterly (WNW) direction with winds from the southwest (SW) occurring less frequently. Strong winds with speeds exceeding 15 mph often originate from the northeast (NE), in addition to the two above mentioned directions. Based on the local wind directionality and the built

environment in the area, winds from the west-northwest, southwest, and northeast were selected for computerized study. The prevailing winds from all three directions were simulated for the No Build and Build scenarios for the proposed building. The study model included sufficient massing detail, but did not include any landscaping detail that would impact the pedestrian wind flows in the area. These preliminary wind conditions would be further refined and quantified with greater accuracy if a wind tunnel study is required.

The impact of the Project on existing surrounding pedestrian wind comfort is predicted to be minimal. On an annual basis, conditions at Grounds South are expected to be generally comfortable for walking, standing, or sitting. When winds approach the Site from the southwest, pedestrian comfort in the build scenario is expected to improve in Grounds South, while wind speeds along Cummington Mall and Hinsdale Mall are expected to remain unchanged. The conditions at the building entrances are expected to be comfortable for standing or sitting with occasional higher winds comfortable for walking.

When winds approach the Site from the northeast, pedestrian comfort in Grounds South, and along Cummington Mall and Blandford Mall in the build scenario are expected to remain unchanged. The conditions at the building entrances should be comfortable for standing or sitting with occasional higher winds comfortable for walking.

The Project will have a localized impact on pedestrian comfort when winds approach the Site from the west-northwest. Pedestrian comfort levels in the build scenario to the east of the proposed building in the pocket park will experience slightly higher wind speeds comfortable for walking. Due to the effect of downwashing that occurs when tall façades redirect wind to grade level, localized high wind speeds are expected at the west corners of the proposed building for winds approaching from the west-northwest. The high wind activity at the corners of the building will not affect the Grounds South, which will remain appropriately comfortable. During the summer when trees in the park have full foliage, calmer wind speeds in Grounds South and along Cumming Mall are expected.

Overall the preliminary wind study reveals that the wind microclimates around the Project are expected to be comfortable for the intended usage. Higher than desired wind speeds are likely to occur around the northwest and southwest corners of the building, at the location of the main entrances. Mitigation measures, including landscaping and façade detailing, will be explored as the design of the building advances to increase pedestrian comfort when approaching and using the entrances on the west elevation, and when using the pocket park on the east elevation of the building. The influence of the Project will not extend to the surrounding streets.

Since this analysis was conducted in May 2012 the building has been shifted 10 feet closer to Commonwealth Avenue to its north, however this design change should not significantly affect the wind conditions around the proposed building. The wind conditions around the building in its new position will remain similar to formerly predicted conditions. Conditions on Commonwealth Avenue will be comfortable for walking in general, and the landscaped pocket park between the proposed project and 3-5 Cummington will remain comfortable for standing.

6.3 SHADOW

A shadow analysis was conducted for the Project to evaluate the potential shadow impacts in the vicinity of the Site. Table 6-1, Shadow Study Dates and Times identifies the dates and times for which the shadow conditions have been simulated. This section describes the shadow areas and their potential impacts on nearby properties. The results of the shadow analysis are graphically illustrated in Figures 6-1 through 6-4, Shadow Studies. All existing shadow is shown in grey, net new shadow is shown in blue, and net new shadow within existing shadow is shown in light blue.

Table 6-1: Shadow Study Dates and Times

Date	Time
Vernal Equinox – March 21st	9:00 AM, 12:00 PM, 3:00 PM
Summer Solstice – June 21st	9:00 AM, 12:00 PM, 3:00 PM, 6:00 PM
Autumnal Equinox – September 21st, EDT	9:00 AM, 12:00 PM, 3:00 PM, 6:00 PM
Winter Solstice – December 21st, EDT	9:00 AM, 12:00 PM, 3:00 PM

Vernal Equinox – March 21st

At 9:00 AM, new shadow from the Project is cast in a northwesterly direction with shadows falling on portions of the lawn, sidewalk, and street in front of the College of Communication. New shadow from the Project also falls onto Commonwealth Avenue and the MBTA right-of-way.

At noon, new shadow from the Project is cast due north onto the sidewalk, Commonwealth Avenue and the MBTA right-of-way.

At 3:00 PM, new shadow from the Project is cast in a northeasterly direction, falling onto the sidewalk, Commonwealth Avenue and the MBTA right-of-way. New shadow from the Project also falls on the northwest corner of Morse Auditorium.

Summer Solstice – June 21st

At 9:00 AM, new shadow from the Project is cast in a westerly direction and falls entirely onto the College of Communication lawn.

At noon, new shadow from the Project is cast to the north falling onto the sidewalk and Commonwealth Avenue.

At 3:00 PM, new shadow from the Project is cast in a northeasterly direction and falls onto parts of Commonwealth Avenue and Blandford Mall. New shadow from the Project also falls on the northwest corner of Morse Auditorium.

At 6:00 PM, new shadow from the Project is cast in a southeasterly direction with shadow falling on Morse Auditorium, Blandford Mall, and the portions of the Metcalf Center.

Autumnal Equinox – September 21st, EDT

At 9:00 AM, new shadow from the Project is cast in a northwesterly direction and falls on portions of the lawn, sidewalk, and street in front of the College of Communication. New shadow from the Project also falls onto Commonwealth Avenue and the MBTA right-of-way.

At noon, new shadow from the Project is cast due north onto Commonwealth Avenue and the MBTA right of way.

At 3:00 PM, new shadow from the Project is cast in a northeasterly direction, falling almost entirely onto the intersection of Commonwealth Avenue and Blandford Mall/Silber Way.

At 6:00 PM, new shadow from the Project is cast in a northeasterly direction, but falls entirely within existing shadows cast by Warren Towers, 3-5 Cummington Mall and the College of Communication.

Winter Solstice – December 21st, EDT

At 9:00 AM, new shadow from the Project is cast in a northwesterly direction and falls onto portions of the sidewalk and street on Commonwealth Avenue westbound. New shadow from the Project also falls onto buildings and a surface parking lot owned by the University on the north side of Commonwealth Avenue.

At noon, new shadow from the Project is cast to the north and falls onto a portion of the sidewalk on the north side of Commonwealth Avenue, opposite the Project.

At 3:00 PM, new shadow from the Project is cast in a northeasterly direction and falls onto a portion of the University's Science and Mathematics building opposite the Project at the intersection of Commonwealth Avenue and Silber Way.

Conclusions

The shadow study for the Project was completed using computer modeling and color rendering to illustrate the new shadow created by the Project.

- The largest area of new shadow impact will fall onto the street, sidewalk, and MBTA right of way along Commonwealth Avenue to the northwest and northeast of the Project Site.

- There will be some new shadow impacts on the Grounds South in front of the College of Communication in the early morning hours during the spring and fall months. However, during the late morning and early afternoon, there are no new shadow impacts when the use of this open space is greatest.

- This analysis reveals that there is already a shadow cast onto Morse Auditorium, particularly when the sun is at its lowest point in the winter months.

6.4 DAYLIGHT

A daylight study was conducted to assess the impact of the Project on the sky dome as visible from the street level. At a maximum height of 140 feet, the Project is appropriately scaled for the surrounding buildings on Commonwealth Avenue. The Project will replace an existing surface parking lot, and will therefore obstruct more daylight than the existing conditions.

6.4.1 METHODOLOGY

The daylight analysis was performed utilizing the Boston Redevelopment Authority Daylighting Analysis (BRADA) computer program.[1] The BRADA program calculates the percentage of the daylight that will be obstructed by a given building based on building and site dimensions, street width, and the defined vantage point. The viewpoint for this analysis was the middle of Commonwealth Avenue. The daylight analysis was performed as seen from the center of Commonwealth Avenue only, as all other sides of the building directly abut another structure or do not front onto a street. Additionally, an analysis was performed for the existing conditions to measure the percentage of daylight that is currently obstructed by the five-story building at 3-5 Cummington Mall. A low percentage indicates that less daylight will be obstructed than a higher percentage.

6.4.2 RESULTS

Results from the BRADA analysis indicated current daylight obstruction of 20.9% for existing conditions as seen from the center of Commonwealth Avenue. The existing surface parking lot does not obstruct any daylight, however the building at 3-5 Cummington Mall sits directly behind the Site and does currently obstruct some daylight as seen from Commonwealth Avenue. Results from the BRADA analysis indicated that there will be

[1] BRADA method developed by Harvey Bryan and Susan Stuebing, computer program developed by Ronald Fergle, Massachusetts Institute of Technology, Cambridge, MA, September, 1985.

68.1% percent daylight obstruction by the Project as seen from the center of Commonwealth Avenue. Therefore, the net increase in daylight obstruction with the construction of the proposed building will be 47.1%. See Figure 6-5, Existing Conditions Daylight Analysis and Figure 6-6, Build Conditions Daylight Analysis.

6.5 SOLAR GLARE

A solar glare analysis is intended to measure potential reflective glare from the buildings onto streets, public open spaces, and sidewalks in order to determine the likelihood of visual impairment or discomfort due to reflective spot glares.

The Project's exterior materials consist of stone-faced prefabricated panels and low-energy glass. The Project design will incorporate vertical architectural elements and non-reflective materials to help mitigate solar glare along Commonwealth Avenue. Additionally, the Project has been designed and oriented so that the largest glass façade faces north, further reducing any potential adverse solar glare impacts or solar heat buildup in the nearby buildings.

6.6 AIR QUALITY

This section provides a qualitative review of potential air quality sources and impacts from the Project. Air quality impacts from construction operations are addressed in Section 6.12.6, Construction Air Quality.

6.6.1 EXISTING AIR QUALITY

The Project is not expected to adversely impact air quality in the vicinity of the Project Site. There is an existing parking lot on Site that has approximately 60 parking spaces for University Permit holders. The Project will not include any new parking spaces as part of the building program, and will result in a net loss of 60 spaces at the Campus. University permit holders that currently park on the Site will be relocated to underutilized off-street University parking in the vicinity of the Project.

6.6.2 PARKING SOURCES

The Site is currently covered with a surface parking lot that provides approximately 60 parking spaces. The Project will remediate and enliven the Site with a mixture of interdisciplinary academic, meeting and research space for faculty, staff, and students in neuroscience and systems/synthetic biology, in addition to providing publicly-accessible open space and pedestrian realm improvements, such bicycle parking, benches, and new seating on Site. The Project will provide approximately 53 covered or indoor bicycle parking spaces and 16 outdoor bicycle parking spaces. No vehicle parking spaces will be provided on Site. The Project aims to encourage bicycle use and reduce parking demand. Combined with the Project's proximity to

the MBTA Green line and bus lines, air pollution from vehicle sources will be minimized.

6.6.3 TRAFFIC SOURCES

During a typical day, there is not expected to be a change in the level of service of surrounding intersections after the Project is built. Given the Project's proximity to public transit and bicycle orientation, the Project will redistribute the 60 existing parking spaces on Site to University-owned parking facilities within the vicinity of the Project. Faculty and staff will be encouraged to park at the Warren Towers Garage (464 spaces), or the surface parking lot at 766 Commonwealth Avenue (83 Spaces). Visitors to the Site can utilize existing metered parking located along the north and south sides of Commonwealth Avenue, or they can park at the University owned pay-on-entry parking facility located at the corner of Commonwealth Avenue and Deerfield Street. See Chapter 5, Transportation, for a full description of existing and proposed transportation conditions.

Transportation Demand Management (TDM) strategies are a significant component of this Project and are anticipated to assist in minimizing adverse air quality impacts. As described in Section 5.4, the Project will utilize the following Transportation Demand Management initiatives to encourage employees and visitors to access the Site via alternative means of transportation that have lesser impacts on overall air quality for the Project.

- Promote public transit and dissemination of transit information;
- Provide a ride-matching service for car and van pools;
- Provide secure, indoor bicycle storage for employees and students; and
- Provide publically accessible outdoor bicycle storage for the Project's visitors.

6.6.4 BUILDING OPERATION SOURCES

The emergency generator as well as the building's significant mechanical systems will be vented on the roof, however it is not expected that these building operations will contribute to changes in air quality.

6.7 NOISE

The Proponent does not anticipate an increase in noise impacts associated with the academic, administrative or research uses at the Site. The Boston Air Pollution Control Commission regulates noise in the City of Boston based on zoning and land use

classification. The regulations define fixed noise limits for daytime and nighttime use of equipment serving the building (for institutional areas, a maximum level of 60 decibels ("dBA") for daytime use and 50 dBA for nighttime use is enforced). These levels are sound limits for equipment assessed at the boundaries of the Project. The limits apply to equipment that operates on a significant basis to serve the building, such as air conditioning equipment and fans. In addition to the overall sound level requirements, the regulations list specific octave band frequency limits for daytime and nighttime periods.

The majority of the Project's mechanicals will be located within the interior of the second and third floors, with a minimal number of condensing and venting units located on the roof. Based on general equipment design, the rooftop equipment is not expected to produce significant sound levels at the building property line, though noise control measures will be provided if required. Rooftop screens will conceal vents and condensing units, and will provide some acoustical dampening.

6.8 FLOOD HAZARDS AND ACECS

In the past decade, climate change adaptation has gained national attention as a critical environmental factor that must be addressed in new development projects. In Boston, sea level rise has become a serious concern as recent weather patterns and future modeling are demonstrating that the impact of storms on the City are likely to continue to intensify.

As part of its administration of the National Flood Insurance Program (NFIP), the Federal Emergency Management Agency (FEMA) publishes flood hazard maps, called Flood Insurance Rate Maps (FIRM). The purpose of a FIRM is to show the areas in a community that are subject to flooding and the risk associated with these flood hazards. The most recent FIRM maps for this area were published in 2009 (Community Panel 25025C0076G). According to FEMA, the Site is not contained in a flood zone. Beginning in late 2013, FEMA began to release preliminary updated FIRM maps, however, a new map for the Site is not yet available.

No Areas of Critical Environmental Concern (ACEC) of State Certified Vernal Pools exist on the Site. Likewise, the Site is not included on the list of Estimated Habitats for Rare Wildlife.

6.9 GROUND WATER

Data obtained from the on-site monitoring well indicates that groundwater levels range from El. 8 to El. 10 BCB (approximately 10 to 12 feet below grade).

The Project is not located within the Groundwater Conservation Overlay District (GCOD). The proposed structure does not include any levels below grade. The structure will not cause the groundwater to rise, pond, or be lowered in the surrounding area and will have no long-term groundwater pumping.

6.10 GEOTECHNICAL

Based on available information in the area and two borings conducted in the summer of 2013, the general soil conditions from the ground surface down, listed below. The top of bedrock is located approximately 200 feet below the ground surface.

Table 6-2: Soil Conditions

Soil Unit	Approximate Thickness (ft)
Fill	14 – 15
Organics	5 – 7
Sand	15 – 20
Clay	150+

6.10.1 FOUNDATION SUPPORT

The proposed building does not consist of any levels below grade. The new foundations are planned to consist of either pressure-injected-footings bearing in the sand unit or drilled minipiles that derive their support by friction in the sand and clay deposits.

6.10.2 BELOW-GRADE EXCAVATION FOR BUILDING CONSTRUCTION

Since no basement is planned, the excavation will not extend below the groundwater table (approximately 10 feet or more below grade). Open cut slopes or excavation support systems, such as trench boxes or soldier pile and lagging, are typical for shallow excavations.

If temporary dewatering is required during construction, a National Pollutant Discharge Elimination System permit for temporary construction dewatering will be obtained for discharge of dewatering effluent.

6.10.3 GEOTECHNICAL INSTRUMENTATION

A geotechnical monitoring program will be implemented prior to and during construction and will likely consist of settlement monitoring of adjacent buildings.

6.11 SOLID AND HAZARDOUS MATERIALS

In the future, the Proponent plans to obtain Site specific information regarding environmental conditions of excavated soils to evaluate the presence of oil and hazardous materials. Foundation construction for the new building may generate soil requiring off Site transport. Chemical testing of the material will be required by receiving facilities to identify

chemical constituents and any contaminants present. Chemical testing of the material will be conducted prior to construction, in accordance with facility requirements.

Any material leaving the Site will be required to be legally transported in accordance with local, state, and federal requirements. In addition, any regulated soil conditions related to oil and hazardous materials will be managed in accordance with appropriate Massachusetts Department of Environmental Protection ('MA DEP") regulatory requirements.

6.12 CONSTRUCTION IMPACTS

The following section describes the impacts likely to result from the Project's construction and steps that will be taken to avoid or minimize environmental and transportation-related impacts. The Proponent will designate a construction manager who is responsible for developing a construction phasing plan and for coordinating construction activities with all appropriate regulatory agencies. The Project's geotechnical consultant is providing consulting services associated with foundation design recommendations, preparing geotechnical specifications and reviewing the construction contractor's proposed procedure.

6.12.1 CONSTRUCTION MANAGEMENT PLAN

The Proponent will comply with applicable state and local regulations governing construction of the Project. The Proponent will require that the general contractor comply with the CMP developed in consultation with and approved by the Boston Transportation Department (BTD) prior to the commencement of construction. The construction manager will be bound by the CMP, which will include detailed information about construction activities, specific construction mitigation measures, construction materials, and access and staging area plans to minimize the impact on the surrounding neighborhood and pedestrian environment.

Construction methodologies that ensure public safety and protect nearby residents will be employed. Techniques such as temporary barricaded walkways and signage will be used. Construction management and scheduling will minimize impacts on the surrounding environment and will include plans for construction worker commuting, routing plans for trucking and deliveries, and control of noise and dust.

6.12.2 CONSTRUCTION ACTIVITY SCHEDULE

The construction period for this Project is expected to last approximately 20 months in duration. It is anticipated that construction will start on or before May 2015 and last through December 2016. Typical construction hours will be from 7:00 AM to 6:00 PM, Monday through Friday. Weekend or off hour activity would be the exception and would take place to minimize impact on vehicular and pedestrian traffic during delivery of large construction equipment (i.e. cranes, excavation

equipment, etc.) as may be necessary to meet permitting restrictions. No truck idling, construction activity, or staging after 6:00 PM and before 7:00 AM will be allowed.

6.12.3 PERIMETER PROTECTION/PUBLIC SAFETY

The CMP will describe any necessary sidewalk closures, pedestrian re-routings, and barrier placements and/or fencing deemed necessary to ensure safety around the perimeter of the Site. Barricades and secure fencing will be used to isolate construction areas from pedestrian traffic along Commonwealth Avenue to the west. The Proponent will continue to coordinate with all pertinent regulatory agencies and representatives of the surrounding neighborhoods to ensure they are informed of any changes in construction activities.

6.12.4 CONSTRUCTION TRAFFIC IMPACTS

Truck traffic will vary throughout the construction period, depending on the activity. Truck traffic will be heaviest during the excavation and concrete foundation work. During this period, it is expected that an average of approximately 15 trucks will arrive and leave the Site throughout the day. Thereafter, truck traffic will range on average between five to eight trucks spread evenly throughout the day.

Potential truck routes have been proposed to minimize the traffic impacts and to govern where construction trucks access and egress the Site. The anticipated truck routes to the Site are shown on Figure 6-7, Construction Truck Circulation Plan.

- **From the West**: Trucks approaching from the west on the Massachusetts Turnpike (I-90) will be directed to exit at the Allston/Brighton tolls to Cambridge Street, westbound to Harvard Avenue, southbound to Brighton Avenue and eastbound to Commonwealth Avenue until the Site.

- **From the North and South:** Trucks approaching from the north and south will be directed to take the Southeast Expressway (I-93) to I-90 west to the Allston/Brighton tolls then follow the route designated from the west.

Please note that specific truck routes will be discussed with BTD and will be reflected on the staging and logistics drawings to be included in the final CMP. Construction contracts will include clauses restricting truck travel per BTD requirements. Primary access to and egress from the site will be restricted to gates approved by BTD.

6.12.5 CONSTRUCTION WORKER PARKING

The number of workers required for the construction of the Project will vary depending upon the stage of construction. The general contractor will be responsible for educating all construction workers about public transit options and encouraging the use of High Occupancy Vehicles (HOVs). As part of the program to promote public transportation, the following mitigation measures will be implemented:

- Prohibit personnel from parking at the Site during construction;
- Encourage construction personnel to utilize public transportation. Due to the proximity of the MBTA Green Line and Kenmore Station in Kenmore, a substantial level of public transportation use is anticipated by workers;
- Post transit schedules and maps at the jobsite;
- Provide lock-up facilities for work tools to make public transportation more convenient and desirable for workers; and
- Write terms and conditions related to workforce parking and public transportation into each subcontract.

These measures will be incorporated into the CMP for the Project, which will be reviewed by the BTD prior to commencement of construction activities.

Should some of the workers choose to drive to the Site, there is parking available at off-street commercial parking lots owned by the University; the two closest commercial lots are located at the corner of Commonwealth Avenue and Deerfield Street. The lots are pay-on-entry facilities and are not currently fully utilized during the week. Because the majority of the construction workforce will arrive prior to the AM peak traffic period and depart prior to the PM peak period, these trips are not expected to have an appreciable impact on the local transportation system.

6.12.6 CONSTRUCTION AIR QUALITY

Construction activities may generate fugitive dust, which will result in a localized increase of airborne particle levels. Fugitive dust emission from construction activities will depend on such factors as the properties of the emitting surface (e.g. moisture content), meteorological variables, and construction practices employed.

To reduce emission of fugitive dust and minimize impact on the local environment the construction contractor will adhere to a number of strictly enforceable mitigation measures, which may include:

- Use wetting agents to control and suppress dust from construction debris;
- Ensure that all trucks traveling to and from the Site will be fully covered;
- Remove construction debris regularly;
- Monitor construction practices closely to ensure any emissions of dust are negligible;
- Clean streets and sidewalks to minimize dust and dirt accumulation; and
- Wheel-wash trucks before they leave the Site during the excavation phase.

6.12.7 CONSTRUCTION NOISE IMPACTS

Intermittent increases in noise levels will occur in the short-term during construction, however construction work will comply with the requirements of the City of Boston noise ordinance. Although there are no residential buildings proximate to the Site, this issue will be carefully addressed to ensure that any construction related noise will not impact the surrounding academic and research buildings.

The proposed construction processes for the Project will be designed around the constraints at the Site. Construction will occur during the daytime hours as defined by Boston Noise Regulations (7:00 AM to 6:00 pm except Sundays). In some instances, second shifts may be required. When these events arise, all required permits will be in place and the Department of Neighborhood Services will be notified.

Every reasonable effort will be made to minimize the noise impact of construction activities. Mitigation measures will include:

- Schedule work during daytime hours;
- Schedule construction activities to avoid the simultaneous operation of the noisiest construction activities and reduce impacts during potential second shift operations;
- Use appropriate mufflers on all equipment and providing ongoing maintenance of intake and exhaust mufflers;
- Maintain muffler enclosures on continuously operating equipment, such as air compressors and welding generators;
- Turn off idling equipment;

- Select the quietest practical items of equipment (electric instead of diesel powered equipment); and

- Replace specific construction operations with less noisy ones where feasible and practical.

6.12.8 SEDIMENT CONTROL

During excavation and construction, erosion, and sediment control measures will be implemented to minimize the transport of Site soils to off-site areas and the BWSC storm drain system. The existing catch basins will be protected with filter fabric or silt sacks to remove sediment from runoff. These controls will be inspected and maintained throughout the construction phase until all areas of disturbance have been stabilized through the placement of pavement, structure, or vegetative cover.

Other sediment controls, which will be implemented as needed during construction, will include the following:

- Stacked hay bales and/or silt fence barriers to be installed at the base of the stockpiled soils and at erosion-prone areas throughout the construction phase of the Project;

- Erosion controls will be maintained and replaced as necessary to ensure their effectiveness;

- Where necessary, temporary sedimentation basins will be constructed to prevent the transport of sediment off-site; and

- Measures to control dust will be implemented during excavation – all debris will be property contained on the Site.

6.12.9 PEST AND RODENT CONTROL

Construction and demolition activities can disturb rodent habitat, eliminating food, shelter, and movement routes. Since the existing Site is currently used as a parking lot and there are no structures on Site, the proposed construction activity is not expected to increase rodent activity in the vicinity. The contractor will file a rodent extermination certificate along with the building permit application to the City. Rodent inspection, monitoring, and treatment in compliance with the City's requirements will be carried out before, during, and at the completion of all construction work for the Project.

6.13 HISTORIC RESOURCES

Consistent with the Boston University Charles River Campus 2013 – 2023 Institutional Master Plan (IMP), Boston University is committed to integrating sensitive designs into their future projects in order to maintain and enhance the value of historic resources on and around the Campus. Historic resources relevant to the Project at 610 Commonwealth Avenue are discussed in the sections below.

6.13.1 HISTORIC RESOURCES ON THE PROJECT SITE

The Site is currently used as a surface parking lot. No historic resources are located on Site, and no archeological resources are known to exist on the Site.

6.13.2 HISTORIC RESOURCES IN THE VICINITY OF THE PROJECT SITE

A number of historic resources are proximate to the Site and will inform the design and layout of the Project. Inventoried below are historic resources that are listed on the Massachusetts Historical Commission's Inventory of Historic and Archaeological Assets of the Commonwealth within one-quarter mile of the Project Site. Additionally, a number of resources have been identified that are not currently nationally or locally designated, but that are eligible for designation and/or have been identified by the University as historically significant (See Figure 6-8, Historic Resources). In the Boston University Preservation Plan, the University asserts the value of the historic resources surrounding the Campus. The University and Payette, Inc., the architectural firm managing the design of the Project, have delicately designed the Project to be contextually appropriate and sensitive to the historic resources in the area, specifically in relation to Morse Auditorium.

Morse Auditorium

Alfred L. Morse Auditorium was built in 1903 as Temple Adath Israel. When the congregation relocated in 1967, the University acquired the building and renamed it in honor of a University benefactor in 1971. Morse Auditorium has been in use as a large lecture hall, meeting space, and performing venue ever since. Morse Auditorium has been determined to be eligible for listing on the National Register. Located directly adjacent to the Site, Morse Auditorium is the only historic resource in the vicinity of the Project that may be directly affected by the Project.

The Project will impact the current view of Morse Auditorium as seen approaching from the west on Commonwealth Avenue, however the design elements of the Project are intended to honor and enhance the views of Morse Auditorium from the north and east of Commonwealth Avenue. According to Whitehall's book, *Boston: A Topographic History,* and Salzman's book, *Buildings and Builders: An Architectural History of Boston University,* Morse Auditorium's façade and notable

dome were not intended to be viewed as an object building from the west along Commonwealth Avenue. Morse was built to anchor the street corner at a time when it was expected that residential development akin to Bay State Road would adjoin the building and extend west down Commonwealth Avenue. The development never came and Commonwealth Avenue remained dominated by trolley cars and automobile dealers until the University began to purchase vacant lots and develop what has become the University's Charles River Campus.

In lieu of neighboring development, the western, ivy clad cast-in-place concrete wall has become a distinctive feature of the building. To the extent that it is feasible and not detrimental to the façade, the intent of the design is to maintain and/or re-plant the ivy as part of this Project.

As described in section 6.3, the shadow study demonstrates that there is already a shadow cast onto Morse Auditorium, particularly when the sun is at its lowest point during the winter months. The Project will cast some new shadow on Morse in the evening during the summer months. Chapter 3, Urban Design, provides more detail about the design features of the Project and their relationship and impacts on Morse Auditorium.

Bay State Road/Back Bay West Architectural District

Designated as a Local Historic District in 1979, the Bay Sate Road/Back Bay West Architectural Conservation District ("the District") includes approximately 200 properties along Bay State Road. Most buildings in the District were constructed in the late 19th century in a variety of revival styles and have been well maintained and improved by the University and private owners. The Project will have no impact on the buildings in this District.

Charles River Basin Historic District

The Charles River Basin Historic District (the "Basin") was designated in 1978 as a National Register District and is a significant feature of the University's Campus and Boston as a whole. Though the Basin has undergone significant changes in the past, it has been preserved as an attractive promenade from which spectacular views of the Boston and Cambridge skylines are visible. The Basin includes the vibrant and well-used Charles River Esplanade, which was listed on the National Register as a District in 1978 and was designated as a Local Landmark in 2009. The Basin also includes portions of the Charles River Reservation Parkway, which includes over 17 miles of parkland extending from Boston to Weston. Separated from the Project by several major roadways, including Storrow Drive and Commonwealth Avenue, the Project will have no adverse affect on the Basin.

Fenway Park

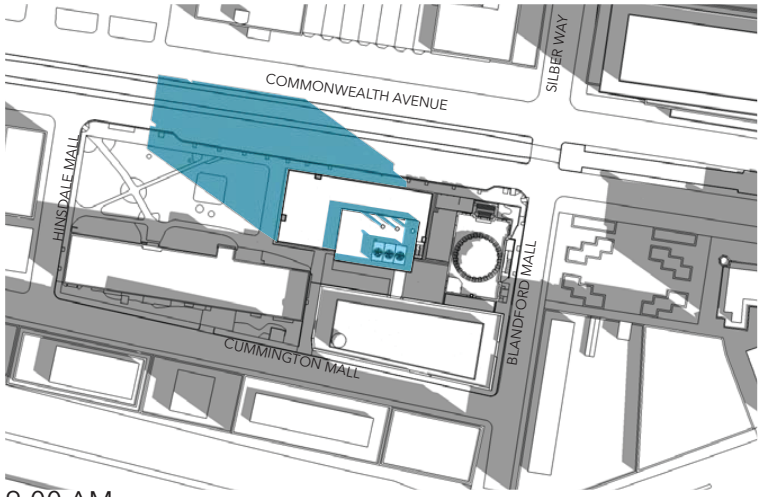
Fenway Park was listed on the National Register as an Individual Property in 2012, and includes three properties on Yawkey Way, Brookline Avenue, and Lansdowne Street. Celebrating its centennial in 2012 and home to the 2013 World Champions, the Boston Red Sox, Fenway Park is a cultural phenomenon of Boston and the greater Northeast. Fenway Park is disconnected from the Site by Brookline Avenue, Beacon Street, and the Massachusetts Turnpike. The Project will not jeopardize or adversely impact Fenway Park's historical character.

Sert Complex

The Sert Complex sits just outside of a quarter-mile from the Site. Designed by Josep Lluis Sert in the 1960s, this complex of three buildings includes the University's School of Law, Mugar Library, and the George Sherman Union. Located in the University's Central Campus, it is an artifact of the controversial Brutalist style of architecture common of the time period. Though not nationally or locally recognized for historic significance, the University is committed to maintaining the integrity of this central feature of the Campus. The Project will not have any adverse affects on the Sert Complex.

Marsh Chapel

Designed in the Gothic Revival style by Ralph Adams Cram in the 1930s, Marsh Chapel continues to be the center of religious life for the University. The chapel and plaza, located in the center of the Campus will not be adversely affected by the Project.



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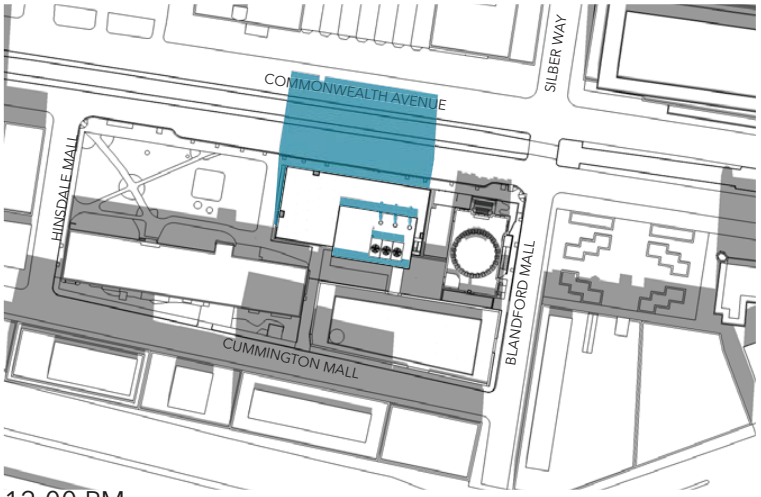

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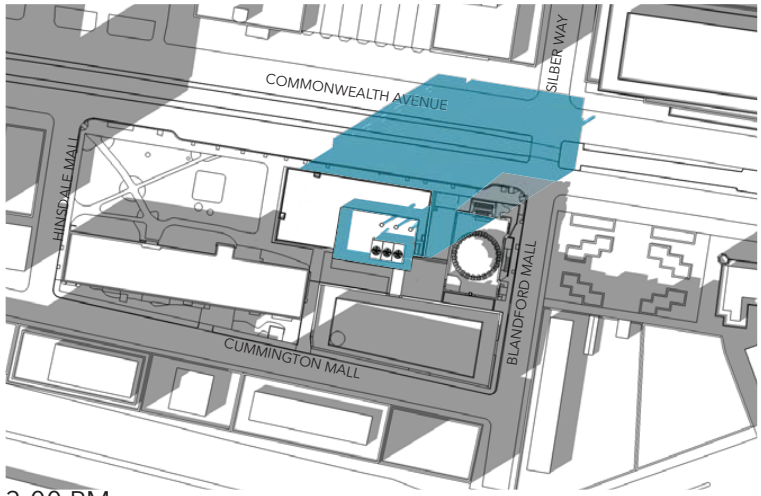

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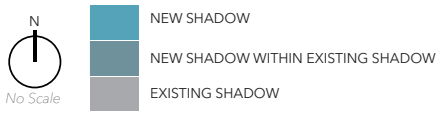
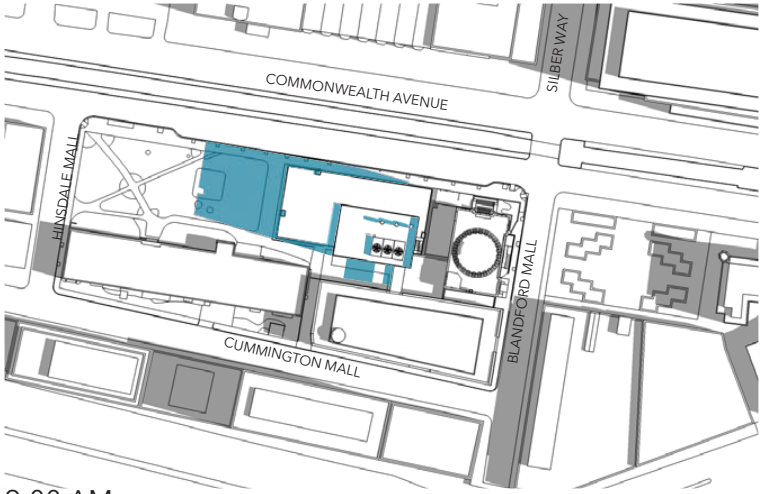


610 Commonwealth Avenue
Boston, MA

Figure 6-1
Shadow Studies, March 21
Source: Payette, 2014



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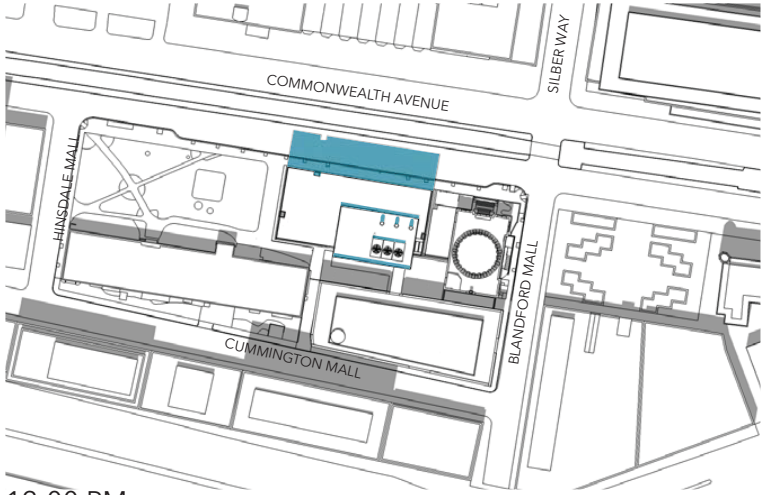

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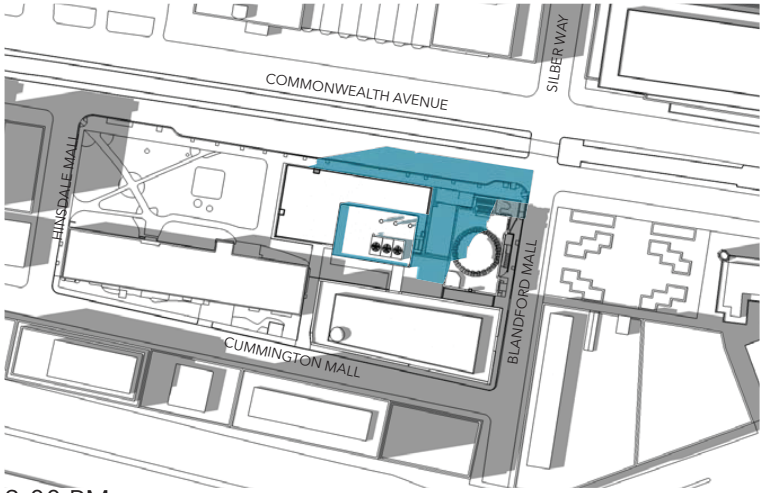

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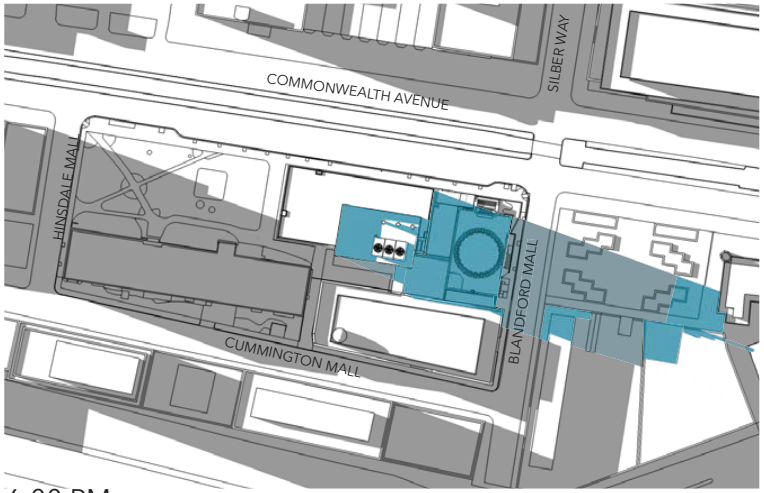

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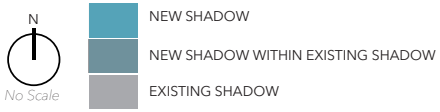

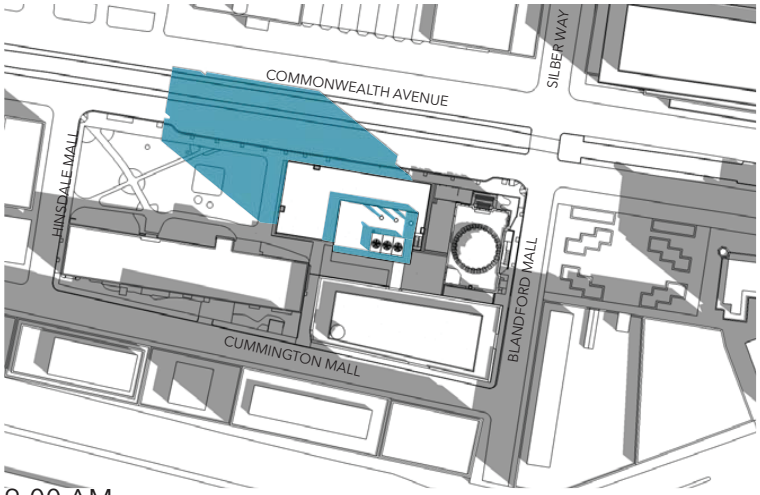

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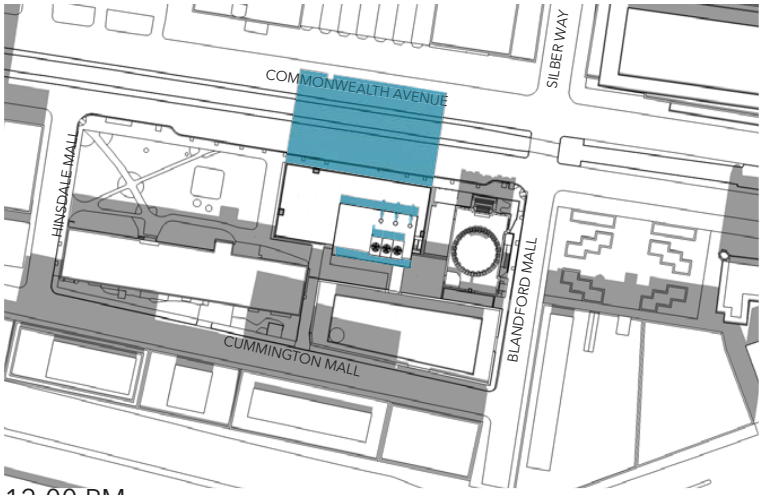

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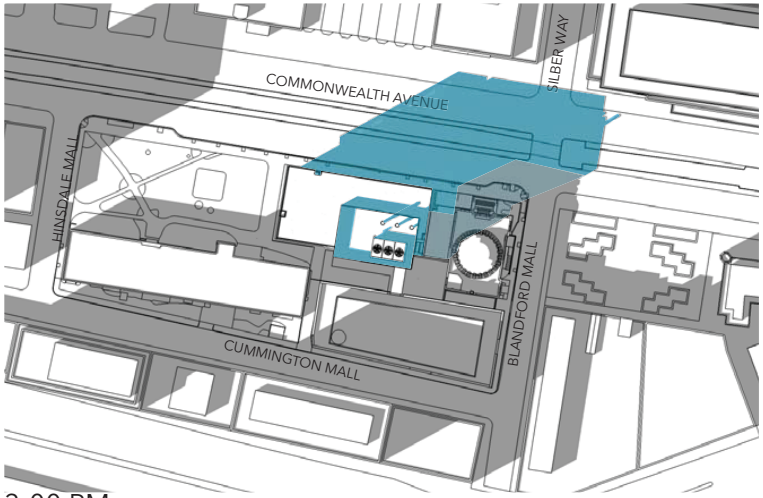

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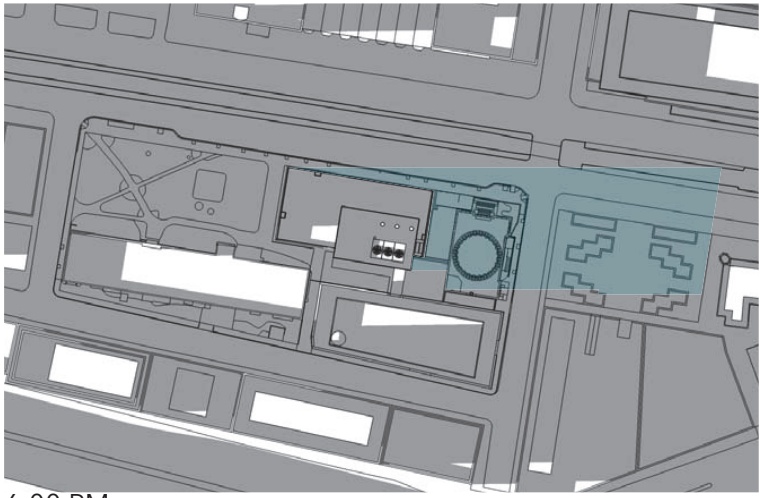

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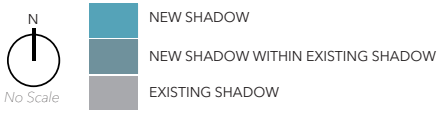
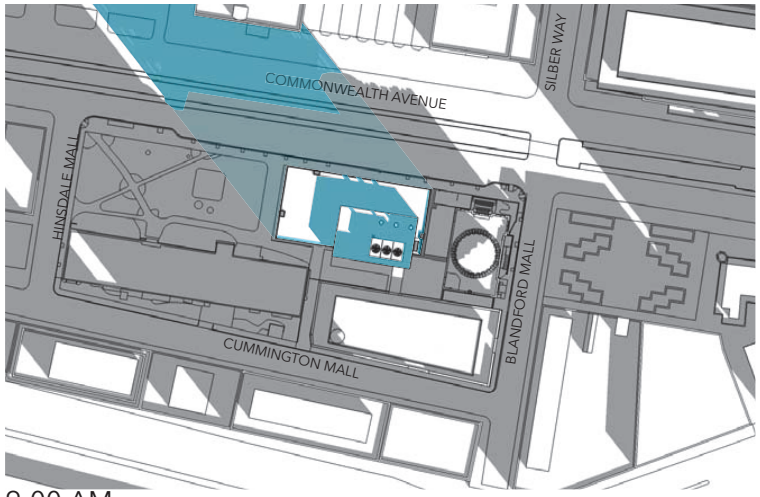


Figure 6-3
Shadow Studies, September 21
Source: Payette, 2014



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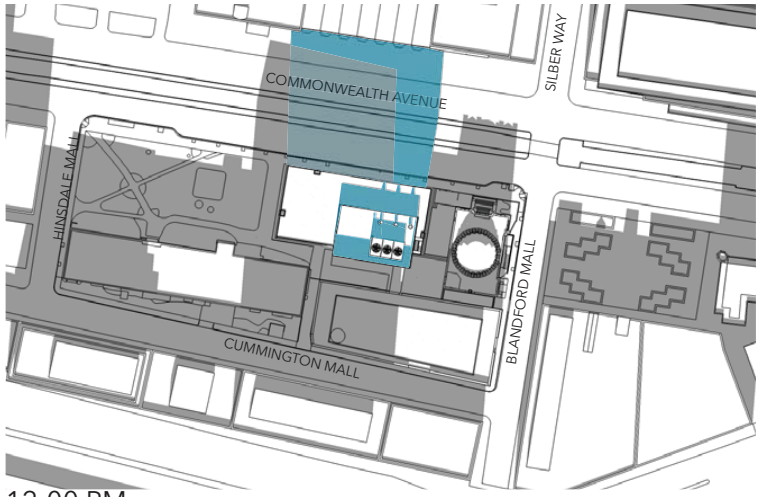

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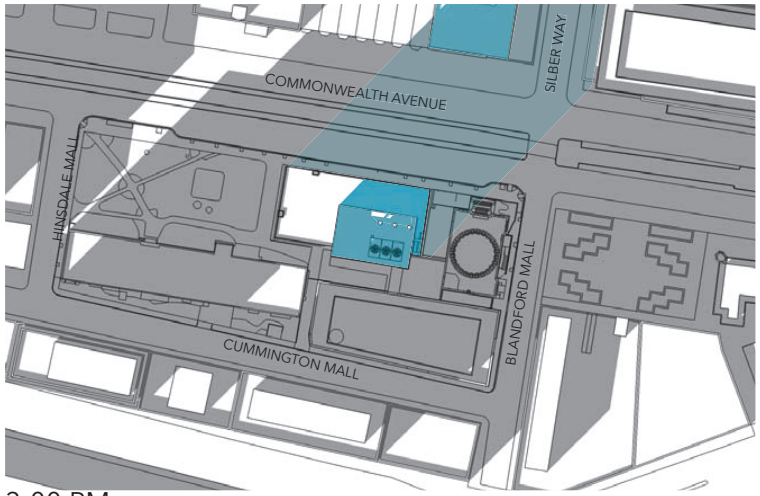

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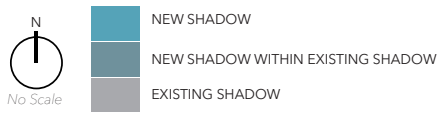
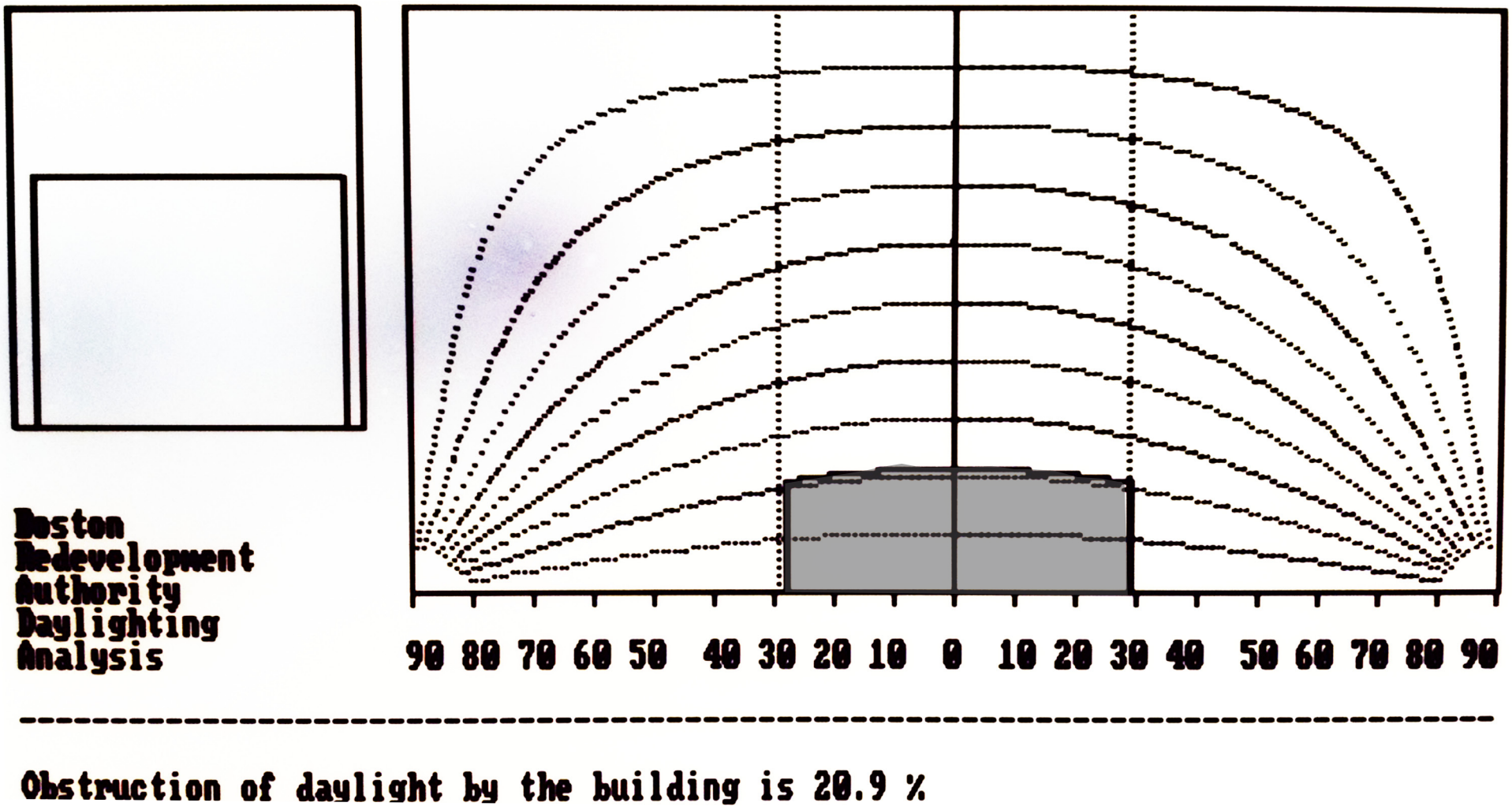


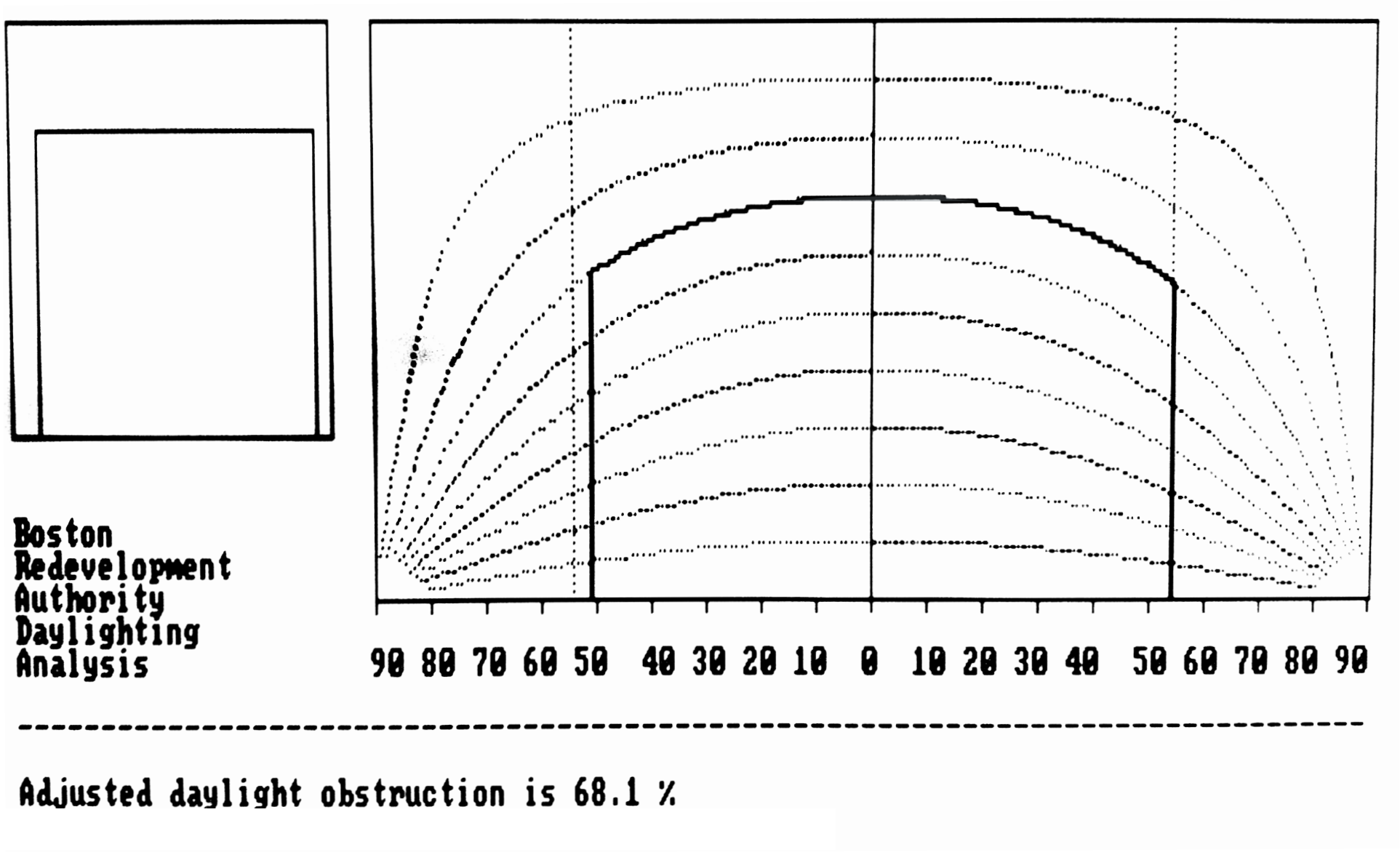
610 Commonwealth Avenue
Boston, MA

Figure 6-4
Shadow Studies, December 21
Source: Payette, 2014



610 Commonwealth Avenue
Boston, MA

Figure 6-5
Existing Conditions Daylight Analysis
Source: Fort Point Associates, Inc., 2014



610 Commonwealth Avenue
Boston, MA

Figure 6-6
Build Conditions Daylight Analysis
Source: Fort Point Associates, Inc., 2014

610 Commonwealth Avenue
Boston, MA

Figure 6-7
Construction Truck Circulation Plan
Source: For Point Associates, Inc., 2014

610 Commonwealth Avenue
Boston, MA

Figure 6-8
Historic Resources
Source: Fort Point Associates, Inc., 2014

Chapter 7

INFRASTRUCTURE

CHAPTER 7: INFRASTRUCTURE

7.1 INTRODUCTION

This chapter outlines the existing utilities surrounding the Project Site, the connections required to provide service to the Project, and any impacts on the existing utility systems that may result from the construction of the Project. The following utility systems are discussed herein:

- District heating and cooling
- Sewer
- Domestic water
- Fire protection
- Drainage
- Electricity
- Telecommunications

The Project, located on an existing surface parking lot, is comprised of approximately 145,000 square feet (sf) of gross floor area (GFA) that will house academic, meeting, and research space on nine floors. The Project Site is located on the University's Charles River Campus ("the Campus") and is bounded by Commonwealth Avenue to the north, Morse Auditorium and Blandford Mall to the east, 3-5 Cummington Mall to the south and Boston University Grounds South to the west.

7.2 HEATING AND COOLING SYSTEMS

The building will generate its own on-Site heating and cooling via use of boilers, chillers and cooling towers. Heating will be accomplished via hot water, condensing style, boilers and circulating pumps. Cooling will be accomplished via module style chillers and roof mounted, evaporative, cooling towers.

Additional boilers will be provided to generate the necessary high pressure steam for the sterilization program/devices of the building. A portion of the high pressure steam will be steeped down to low pressure to be utilized for humidification.

7.3 WASTE WATER

7.3.1 EXISTING SEWER SYSTEM

Existing Boston Water and Sewer Commission ("BWSC") and private sanitary sewer mains are located in Commonwealth Avenue, Blandford Mall, and Cummington

Mall. There is an 18-inch University sanitary sewer main in Cummington Mall, which flows easterly to the 18-inch University sanitary sewer main in Blandford Mall. The 18-inch University sanitary sewer main in Blandford Mall flows northerly to the 32-inch by 42-inch BWSC sanitary sewer main in Commonwealth Avenue. The 32-inch by 42-inch sanitary sewer flows easterly to the 20-inch sanitary sewer in Beacon Street, increasing to a 24-inch sanitary sewer main, and then connects to the 66-inch Massachusetts Water Resource Authority ("MWRA") Charles River Valley Sewer in Saint Mary's Street. The Charles River Valley Sewer ultimately flows to the MWRA Deer Island Waste Water Treatment plant for treatment and disposal. See Figure 7-1, BWSC Sewer and Stormwater System Map.

7.3.2 WASTEWATER GENERATION

The Project's waste water generation rates were estimated using several methods. The office space was estimated using the Massachusetts Division of Water Pollution Control Sewer System Extension and Connection Permit Program from 314 CMR 07.15. The estimated flow from office space is 75 gallons per day (GPD) per 1,000sf. Typical generation values are conservative values for estimating the sewage flows from new construction. The existing Site is a parking lot and does not produce any sewage flows.

Laboratories can produce variable amounts of wastewater depending on the type of lab and its required water usage. Therefore, 314 CMR 07.15 is not used to determine wastewater generation for the laboratory portions of the proposed Project. There is no formally recognized formula for estimating wastewater generation rates in research and lab areas. These estimates are empirical and are taken from typical pH neutralization calculations estimating quantity of water to be treated and are based on fixture counts and types. Table 7-1 provides the projected flow rate sizing based on pH neutralization calculations.

Table 7-1: pH Neutralization Design Criteria

Flow Rate Sizing	
Item	Flow Rate Gallons/Hour (GPH)
Laboratory Sinks	5
Under Counter Glass Washer	30
Steam Sterilizers/Autoclave	130
Large Sterilizer	15
Central Large Capacity Glass Washer	55
Cage Washer (Walk-in)	120
Autoclave (Walk-in)	900
Bottle and Rack Washer	30

Sewer flows from the visitor center and human neuroimaging center on the ground floor were estimated using the American Society of Plumbing Engineers (ASPE) Plumbing Engineer Design Handbook, Volume 2, Tables 8-8 and 8-9.

The projected wastewater flow has been calculated over a yearly basis, as the facility will not be used 365 days per year. The majority of the building usages is estimated to be five days/week, 10 hours/day. The autoclave usage is estimated at 2.5 days/week, with no more than six cycles per day of usage. One autoclave cycle is estimated to be no more than one hour. The University also recognizes 18 holidays, which results in a building usage of approximately 49 weeks per year. Table 7-2 describes the total projected sewage generation due to the Project.

Table 7-2: Proposed Yearly Project Wastewater Generation

Room Use	Size	Estimated Value	Daily Flow (gpd)	Usage	Yearly Flow (gallons)	Source
Synthetic Biology - 2 floors						
Office	3000 SF	75 gpd / 1,000 SF	225	5 days/week x 49 weeks/year	55,125	314 CMR 7.15
Lab (including Lab, Workstation)	17 sinks	5 gph x 10 hrs/day	850	5 days/week x 49 weeks/year	208,250	pH Neutralization Sizing
Core Lab (and Collaboration)	6 sinks	5 gph x 10 hrs/day	300	5 days/week x 49 weeks/year	73,500	pH Neutralization Sizing
Proposed Sewer Flow per floor					336,875	x 2 Floors
Proposed Total Sewer Flow - Synthetic Biology					**673,750**	
Neuroscience – 4 Floors						
Office	3000 SF	50 gpd / 1,000 SF	225	5 days/week x 49 weeks/year	55,125	314 CMR 7.15
Lab (including Lab, Workstation)	8 sinks	5 gph x 10 hrs/day	400	5 days/week x 49 weeks/year	98,000	pH Neutralization Sizing
Core Lab (and Collaboration)	5 sinks	5 gph x 10 hrs/day	250	5 days/week x 49 weeks/year	61,250	pH Neutralization Sizing
Core Lab (and Collaboration)	2 Autoclaves	130 gph x 6 hr/day	1,560	2.5 days/week x 49 weeks/year	191,100	pH Neutralization Sizing
Proposed Sewer Flow per floor					405,475	x 4 Floors
Proposed Total Sewer Flow - Neuroscience					**1,621,900**	

Mechanical Space						
Mechanical Space	N/A	N/A	N/A			
Steam Sterilizers / Autoclave	2 Autoclaves	130 gph x 6hrs/day	1,560	2.5 days / week x 49 weeks/year	191,100	pH Neutralization Sizing
Proposed Sewer Flow – Mechanical					**191,100**	
Human Imaging/Lobby - Ground floor						
Visitor Center	88 visitors	5.3 gpd / visitor	466	5 days/week x 49 weeks/year	114,268	ASPE Table 8-9
Administrative / Imaging Center	10 employees	10.6 gpd/ employee	106	5 days/week x 49 weeks/year	25,970	ASPE Table 8-8
Proposed Total Sewer Flow - Ground Floor					**140,238**	
Proposed Total Yearly Sewer Flow – Project (gallons)					**2,626,988**	
Proposed Total Daily Sewer Flow – Project (gallons)					**7,197**	

Notes:
Gallons Per Hour = (GPH)
Gallons Per Day = (GPD)
Gallons Per Year = (GPY)

7.3.1 SEWER CAPACITY AND IMPACTS

The Project's impact on the existing BWSC systems in Cummington Mall, Blandford Mall, and Commonwealth Avenue was analyzed. The existing sewer system hydraulic capacity calculations are presented in Table 7-3.

Table 7-3: Sewer Hydraulic Capacity Analysis

Manhole (BWSC Number)	Length (ft)	Inv. (up)	Inv. (down)	Slope (%)	Dia. (inches)	Manning's Number	Flow Capacity (cfs)	Flow Capacity (MGD)
Cummington Mall								
DMH 6 TO DMH 7	250	9.20	8.20	0.4%	18	0.013	6.64	4.29
DMH 6 TO DMH 7	158	8.10	7.80	0.2%	18	0.013	4.58	2.96
Minimum Flow Analyzed:							4.58	2.96

Manhole (BWSC Number)	Length (ft)	Inv. (up)	Inv. (down)	Slope (%)	Dia. (inches)	Manning's Number	Flow Capacity (cfs)	Flow Capacity (MGD)
Blandford Mall								
DMH 8 TO DMH 10	245	7.30	6.50	0.3%	18	0.013	37.95	24.53
DMH 10 to 32x42 Sewer	20	6.40	6.30	0.5%	18	0.013	46.96	30.35
						Minimum Flow Analyzed:	37.95	24.53
Commonwealth Avenue								
DMH 13 TO DMH 12	263	7.10	6.60	0.2%	32 X 42	0.013	28.41	18.37
DMH 12 TO DMH 17	250	6.50	6.00	0.2%	32 X 42	0.013	29.14	18.84
						Minimum Flow Analyzed:	28.41	18.37

Notes:
1. Manhole numbers were taken from BWSC Sewer system Map no. 22H.
2. Invert elevations were taken from BWSC Sewer system Map no. 22H and the existing conditions plan entitled "Topographic Plan, 2-44 Cummington Mall, Boston, Massachusetts", dated 5/23/2013, prepared by Nitsch Engineering.
3. Flow Calculations based on Manning Equation
4. Elevations refer to Boston City Base (BCB).

Results shown in Table 7-3 indicate the hydraulic capacity of the 18-inch sanitary sewer in Cummington Mall, 18-inch sanitary sewer system in Blandford Mall, and the 32-inch by 42-inch sanitary sewer in Commonwealth Avenue. The minimum hydraulic capacity is 2.96 million gallons per day (MGD) or 4.58 cubic feet per second (cfs) for the 18-inch system in Cummington Mall, 24.53 MGD or 37.95 cfs for the 18-inch system in Blandford Mall, and 18.37 MGD or 28.41 cfs for the 32-inch by 42-inch system in Commonwealth Avenue. Based on an average daily flow estimate for the Proposed Project of 7,197 GPD or 0.007 MGD; and with a factor of safety of 10 (total estimate = 0.007 MGD x 10 = 0.07 MGD), no capacity problems are expected for the systems in Cummington Mall, Blandford Mall, and/or Commonwealth Avenue.

7.3.2 PROPOSED SEWER SYSTEM

The Proponent will coordinate with the BWSC on the design and capacity of the proposed connections to the sewer system. The Project is expected to generate an increase in wastewater flows of approximately 7,197 GPD gallons per day. Approval for the increase in sanitary flow will come from BWSC.

Prior to discharge to BWSC sanitary sewer mains, all laboratory waste drainage will pass through an active chemical pH neutralization system with a sampling port prior

to connection to sanitary sewer. The system will be designed in accordance with 248 CMR 10.13 and will be sized for 10 minute retention time. The system will have its own digital controller with digital outputs and a paper recorder. The system will contain a digital database, which can be uploaded as required. System alarms will be monitored by the building management system (BMS). The neutralization system will have two round tanks and will have MWRA approved sampling ports and system controller outputs. Two 800 gallon holding tanks in series will be provided based on the anticipated number of lab sinks.

The sewer services for the Project will connect to the existing private sanitary sewer mains located in Cummington Mall and/or Blandford Mall, and/or the existing BWSC sanitary sewer main in Commonwealth Avenue.

Improvements and connections to the BWSC infrastructure will be reviewed as part of the BWSC's Site plan review process for the Project. This process will include a comprehensive design review of the proposed service connections, an assessment of Project demands and system capacity, and the establishment of service accounts.

7.4 WATER SYSTEM

7.4.1 EXISTING WATER SYSTEM

Water for the Site will be provided by the BWSC. There are five water systems within the city that provide service to portions of the city based on ground surface elevation. The five systems are southern low (commonly known as low service), southern high (commonly known as high service), southern extra high, northern low, and northern high. Existing BWSC water mains are located in Cummington Mall, Blandford Mall, and Commonwealth Avenue. There is an eight-inch southern low main in Cummington Mall. There is an eight-inch southern low main in Blandford Mall. There is a 12-inch Southern Low Main in Commonwealth Avenue See Figure 7-2, BWSC Water System Map.

BWSC record flow test data containing actual flow and pressure for hydrants within the vicinity of the Site was requested by the Proponent. Hydrant flow data was available for one hydrant near the Site. The existing hydrant flow data is available in Table 7-4. As the design progresses, the Proponent will request hydrant flows be conducted by BWSC adjacent to the Site, as hydrant flow data should be less than a year old to be used as a design tool.

Table 7-4, Existing Hydrant Flow Data

Flow Hydrant Number	Date of Test	Static Pressure (psi)	Residual Pressure (psi)	Total Flow (gpm)	Flow (gpm) at 20 psi
H32 Commonwealth Avenue	4/13/2014	70	64	2,004	6,297

Note: Data provided by BWSC, April 15, 2014

7.4.2 ANTICIPATED WATER CONSUMPTION

The Project's water demand estimate for domestic services is based on the Project's estimated sewage generation, described in the section above. A conservative factor of 1.1 (110%) is applied to the estimated average daily wastewater flows to account for consumption, system losses and other usages to estimate an average daily water demand for the office portions of the Project. In total, the Project's estimated domestic water demand is 7,917 gpd. The water for the Project will be supplied by the BWSC systems in Cummington Mall, Blandford Mall, and/or Commonwealth Avenue.

7.4.3 PROPOSED WATER SERVICE

The domestic and fire protection water services for the Project will connect to one of the existing BWSC water mains in Cummington Mall, Blandford Mall, and/or Commonwealth Avenue.

7.4.4 WATER SUPPLY CONSERVATION AND MITIGATION MEASURES

Measures to reduce water consumption will be incorporated into the Project Design. Aeration fixtures and appliances will be chosen for water conservation qualities. In public areas, sensor operated faucets and toilets will be installed.

New water services will be installed in accordance with the latest local, state, and federal codes and standards. The Project will comply with the Commonwealth's Stretch Energy Code and as such, will reduce energy use from the baseline energy conservation by approximately 30%. Backflow preventers will be installed at both domestic and fire protection service connections. New meters will be installed with Meter Transmitter Units ("MTU's") as part of the BWSC's Automatic Meter Reading ("AMR") system.

The State Building Code requires the use of water-conserving fixtures. Water conservation measures such as low-flow toilets and restricted flow faucets will help reduce the domestic water demand on the existing distribution system. The

installation of sensor-operated sinks with water conserving aerators and sensor-operated toilets in all non-residential restrooms will be incorporated into the design plans for the Project.

7.5 STORM DRAINAGE

7.5.1 EXISTING STORM DRAINAGE SYSTEM

There are existing BWSC and private storm drain mains in Cummington Mall, Blandford Mall, and Commonwealth Avenue. There is a 12-inch University storm drain main in Cummington Mall. There is a 12-inch private storm drain main in Blandford Mall. There are two 15-inch BWSC storm drain mains in Commonwealth Avenue. The 12-inch University storm drain main in Cummington Mall, which flows westerly, increases to a 15-inch storm drain main, which flows westerly and then northerly to the storm drain main in southern portion of Commonwealth Avenue. The 15-inch storm drain main in the southern portion of Commonwealth Avenue, which flows westerly, increases to a 27-inch storm drain main, and flows to the 84-inch by 89-inch MWRA combined sewer main in Commonwealth Avenue. The 84-inch by 89-inch MWRA combined sewer main, which flows northerly, is eventually directed to Deer Island Waste Water Treatment Plant for treatment and disposal, or, during times of high flow, to the combined sewer overflow that directs flow into the Charles River.

The 12-inch University storm drain main in Blandford Mall flows northerly to the 18-inch BWSC storm drain main at the intersection of Commonwealth Avenue and Blandford Mall. The 15-inch storm drain main in Commonwealth Avenue flows easterly to the 18-inch storm drain main at the intersection of Commonwealth Avenue and Blandford Mall. The 18-inch storm drain main which flows easterly, increases to a 21-inch storm drain main, then to a 24-inch storm drain main, and then to a 30-inch storm drain main. The 30-inch storm drain main flows easterly to the 108-inch by 132-inch Muddy River Conduit in Deerfield Street. The 108-inch by 132-inch storm Muddy River Conduit flows northerly and increases to a 116-inch by 120-inch storm drain main that ultimately discharges to the Charles River.

The existing Site consists of a paved parking lot and open space and is approximately 64-percent (64%) impervious. The Site has a closed drainage system and stormwater is collected by catch basins on Site. Stormwater not collected by catch basins flows from the Site to the catch basins in Commonwealth Avenue and the adjacent University Grounds South, as well as to the crushed stone beds by the walkway adjacent to Morse Auditorium.

7.5.2 PROPOSED STORM DRAINAGE SYSTEM

The Project does not include below-ground space, and the Site is not located within the Groundwater Conservation Overlay District as established by Article 32 of the City of Boston Zoning Code. The existing Site consists of a paved parking lot and open space and is approximately 64-percent (64%) impervious. The amount of impervious area at the Site will slightly increase compared to the existing condition due to the Project and will be mostly building roof, paved walkway, and lawn. The Project will be designed to maintain or reduce the existing peak rates and volumes of stormwater discharge and stormwater runoff from the Site as well as promote runoff recharge. The change from parking to roof runoff will serve to improve overall water quality in stormwater discharges.

The Project will be designed to infiltrate one-inch of stormwater runoff from impervious areas into the ground in accordance with BWSC requirements. The proposed stormwater management system will include a closed drainage system that collects stormwater from the building roof and area drains. These measures will contribute to reduced phosphorous output to the Charles River.

Improvements and connections to BWSC infrastructure will be reviewed as part of the BWSC's Site plan review process. The process will include a comprehensive design review of the proposed service connections, and assessment of Project demands and system capacity.

7.5.3 MITIGATION MEASURES

The Project will not adversely affect the water quality of nearby water bodies. Erosion and sediment control measures will be implemented during construction to minimize the transport of Site soils to off-site areas and BWSC storm drain systems. During construction, existing catch basins will be protected with filter fabric, straw bales, and/or crushed stone to provide for sediment removal from runoff. These controls will be inspected and maintained throughout the construction phase until the areas of disturbance have been stabilized through the placement of pavement, structure, or vegetative cover.

All necessary dewatering will be conducted in accordance with applicable MWRA and BWSC discharge permits. Once construction is complete, the Project will be in compliance with local and state stormwater management policies, as described below.

7.6 ELECTRICAL SERVICES

A new 13.8kV electric service from NSTAR is anticipated to support the building. Space for NSTAR's equipment will be accommodated in the building. The substation design will follow NSTAR's requirements and will be in a main-tie-main arrangement with primary utility metering

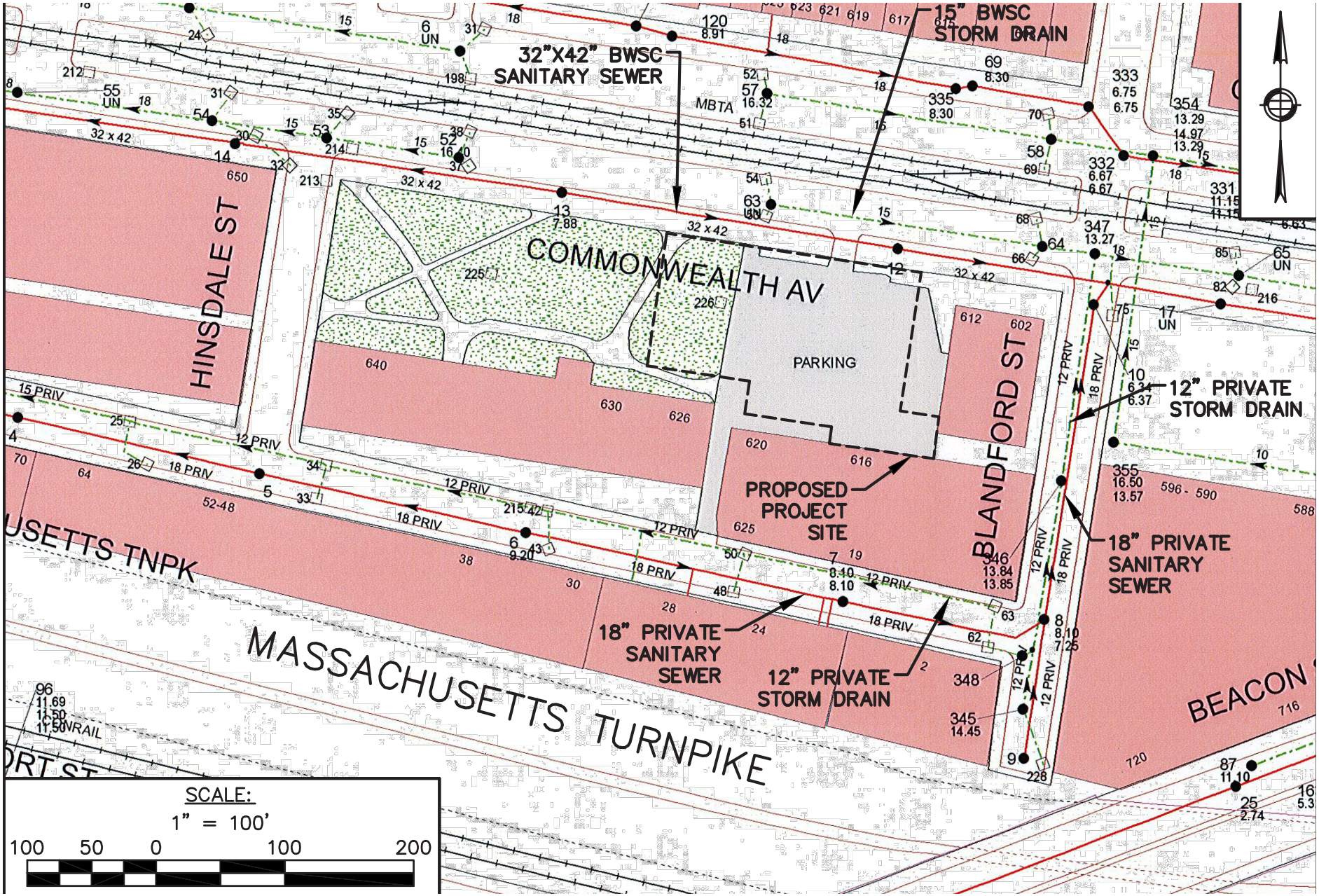
7.7 TELECOMMUNICATIONS SYSTEM

It is recommended that two separate service entrances are provided each with fiber and copper per University standards. The primary service entrance will consist of 6-4" conduits and secondary 4-4" conduits from opposite direction.

7.8 UTILITY PROTECTION DURING CONSTRUCTION

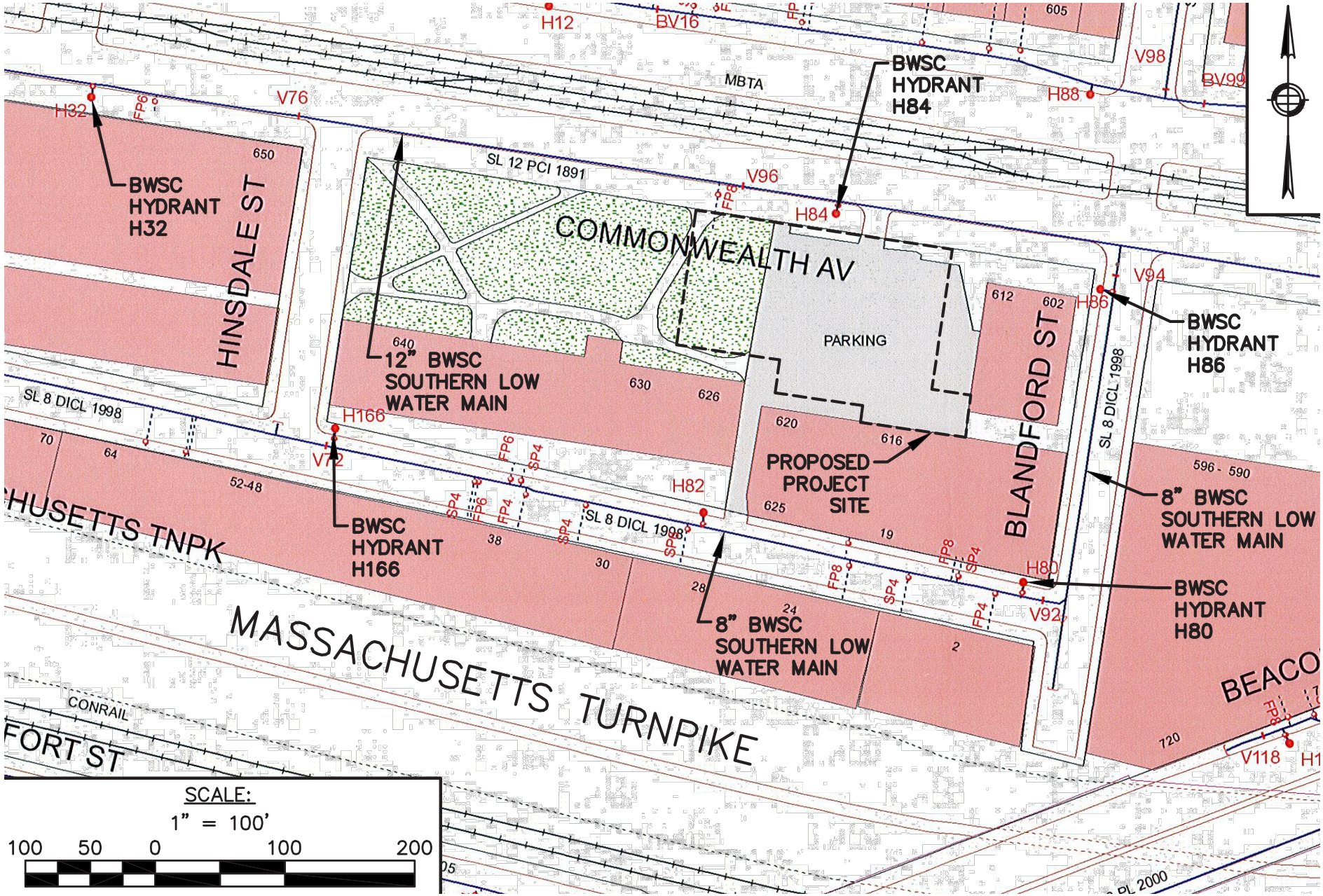
Existing public and private infrastructure located within nearby public rights-of-way will be protected during Project construction. The installation of proposed utility connections within public ways will be undertaken in accordance with BWSC, Boston Public Works Department, the Dig-Safe Program, and applicable utility company requirements. Specific methods for constructing proposed utilities where they are near to, or connect with, existing water, sewer, and drain facilities will be reviewed by the BWSC as part of its Site Plan Review process. All necessary permits will be obtained before the commencement of work.

The Proponent will continue to work and coordinate with the BWSC and the utility companies to ensure safe and coordinated utility operations in connection with the Project.



610 Commonwealth Avenue
Boston, MA

Figure 7-1
BWSC Sewer and Stormwater System Map
Source: Boston Water and Sewer Commission, 2014



610 Commonwealth Avenue
Boston, MA

Figure 7-2
BWSC Water System Map
Source: Boston Water and Sewer Commission, 2014

Appendix A

TRANSPORTATION TECHNICAL APPENDIX

P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Morning Pedestrian Peak Hour Volumes (East).ai

CHARLES RIVER

CENTRAL CAMPUS

STORROW DRIVE

UNIVERSITY ROAD

COMMONWEALTH AVENUE

HINSDALE

CUMMINGTON STREET

BLANDFORD STREET

MASS TURNPIKE

MOUNTFORT STREET

LENOX STREET

EUSTON STREET

CARLTON STREET

SAINT MARYS STREET

PARK DRIVE

BUSHWELL STREET

ARUNDEL STREET

BEACON STREET

BAY STATE ROAD

DEERFIELD STREET

KENMORE SQUARE

NEWBURY STREET

BROOKLINE AVENUE

LANSDOWNE STREET

BACK BAY FENS

SOUTH CAMPUS

EAST CAMPUS

NORTH - NOT TO SCALE

66 59 35 107 301 78 39 83 115 319 145 1 6 79 357 54 109 221 26 367 198 182 2 270 148 210 133 183 435 224 19 92 140 39

Boston University Properties

Pedestrian Crossings

BOSTON UNIVERSITY

TETRATECH

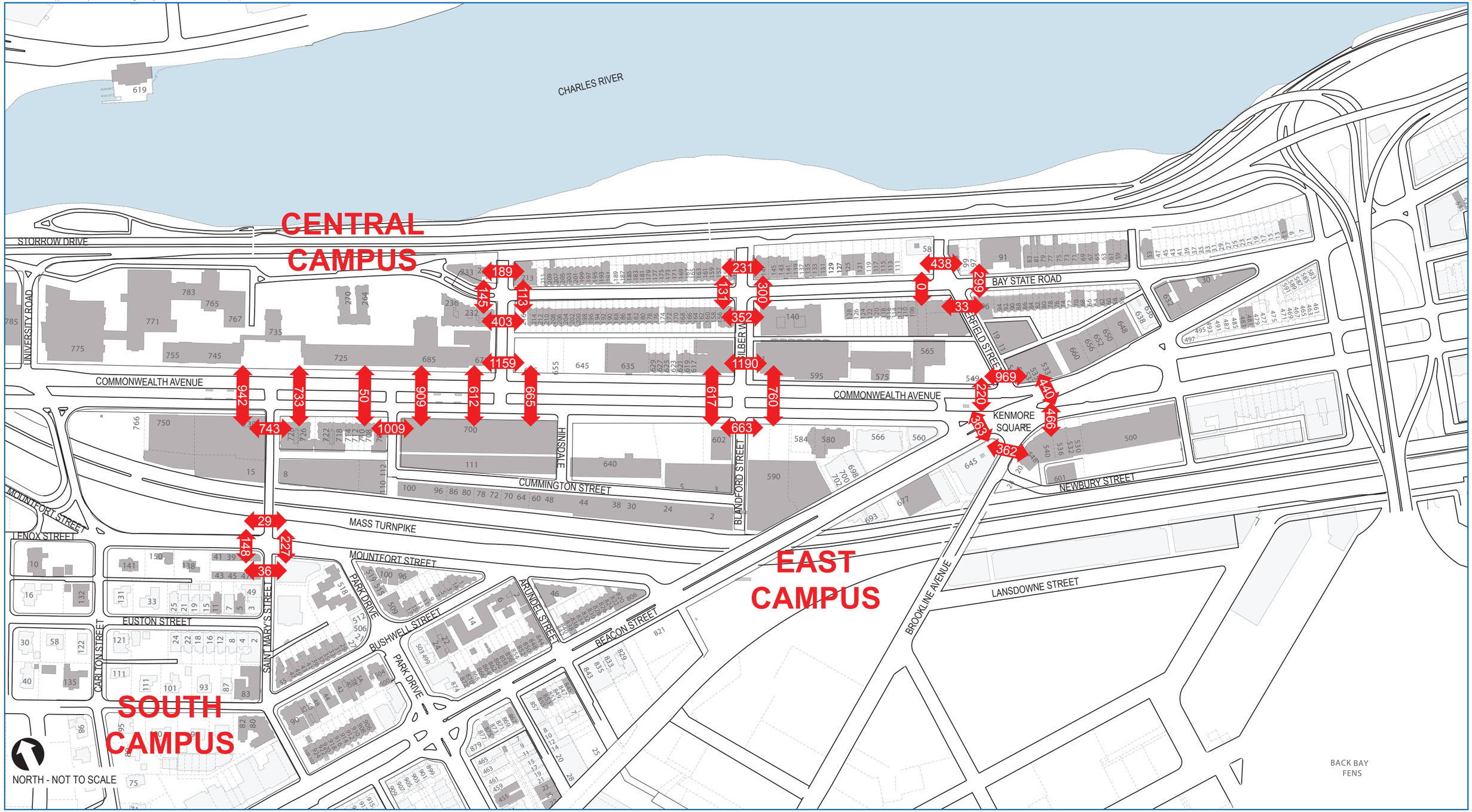
One Grant Street
Framingham, MA 01701-9005
508.903.2000
www.tetratech.com

Boston University Charles River Campus
2013-2023 Master Plan

Existing Morning Peak Hour Pedestrain Volumes

Figure 9B

P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Mid-day Pedestrian Peak Hour Volumes (East).ai



BOSTON UNIVERSITY

Boston University Properties

Pedestrian Crossings

Boston University Charles River Campus
2013-2023 Master Plan

Existing Mid-day Peak Hour Pedestrain Volumes

Figure 10B

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P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Afternoon Pedestrian Peak Hour Volumes (East).ai

CHARLES RIVER

STORROW DRIVE

CENTRAL CAMPUS

UNIVERSITY ROAD

COMMONWEALTH AVENUE

HINSDALE

CUMMINGTON STREET

BLANDFORD STREET

MASS TURNPIKE

MOUNTFORT STREET

LENOX STREET

EUSTON STREET

CARLTON STREET

SAINT MARYS STREET

PARK DRIVE

BUSHWELL STREET

ARUNDEL STREET

BEACON STREET

SOUTH CAMPUS

EAST CAMPUS

BAY STATE ROAD

DEERFIELD STREET

KENMORE SQUARE

NEWBURY STREET

BROOKLINE AVENUE

LANSDOWNE STREET

BACK BAY FENS

NORTH - NOT TO SCALE

160 144 129 267 237 149 166 312 407 0 6 222 967 961 682 323 19 886 642 392 408 944 485 658 698 988 261 202 364 416 423 40 192 247 56

Boston University Properties

Pedestrian Crossings

BOSTON UNIVERSITY

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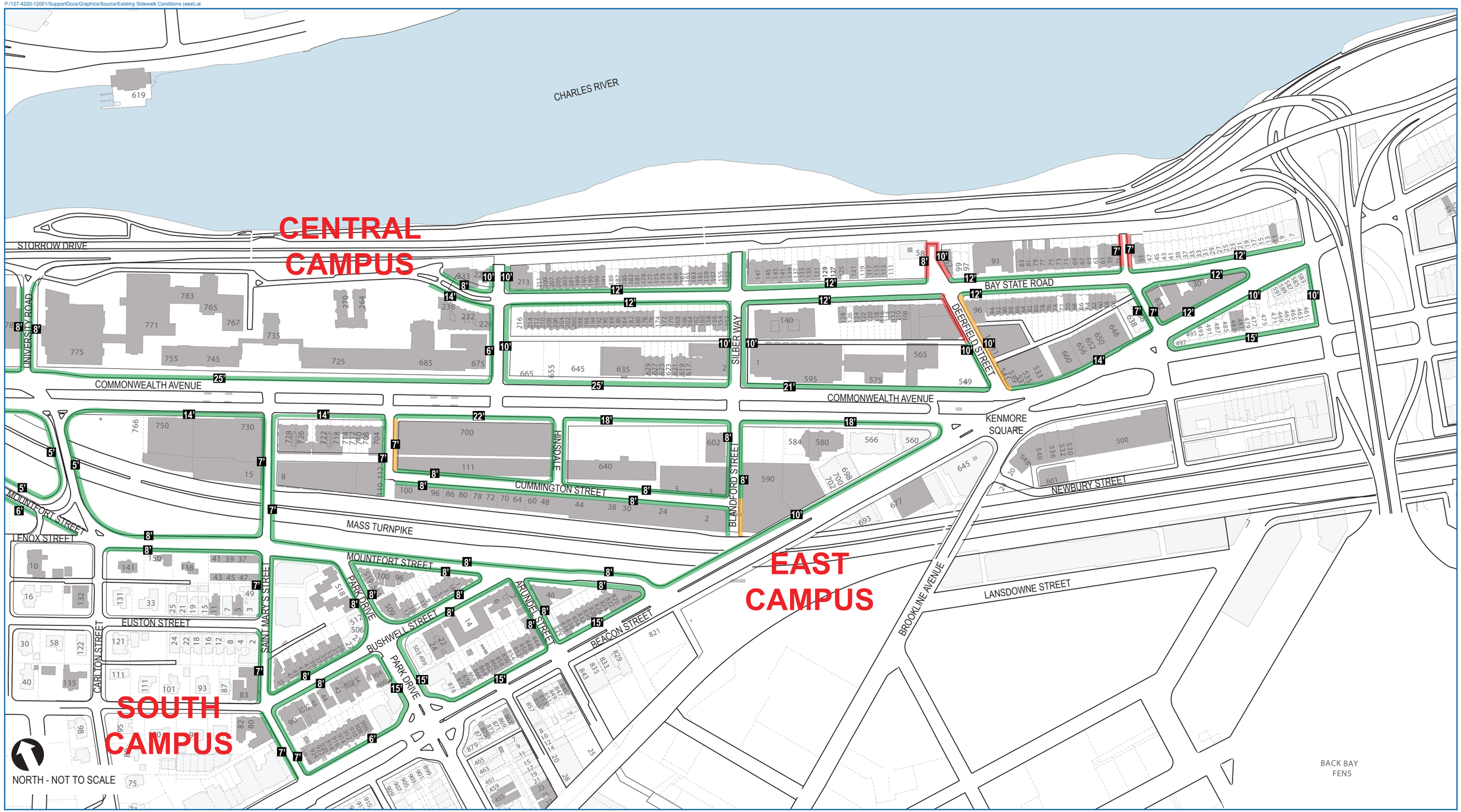
Boston University Charles River Campus
2013-2023 Master Plan

Existing Afternoon Peak Hour Pedestrain Volumes

Figure 11B

P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Sidewalk Conditions (east).ai



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508.903.2000
www.tetratech.com

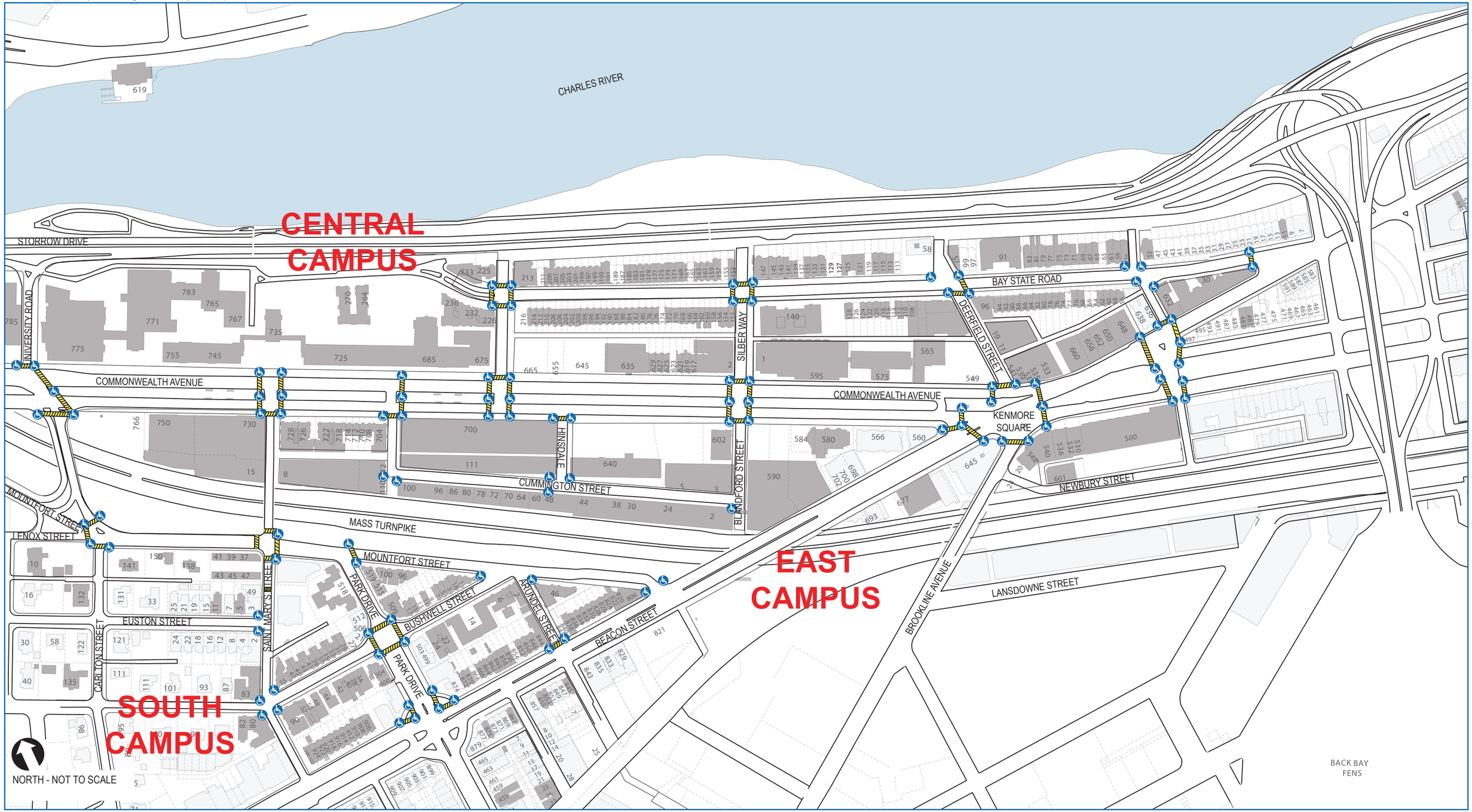
- Boston University Properties
- Good Sidwalk Conditions
- Fair Sidewalk Conditions
- Poor Sidewalk Conditions
- xx' Average Sidewalk Width

Boston University Charles River Campus
2013-2023 Master Plan

Existing Sidewalk Conditions

Figure 12B

P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Pedestrian Accessibility Facilities (east).ai



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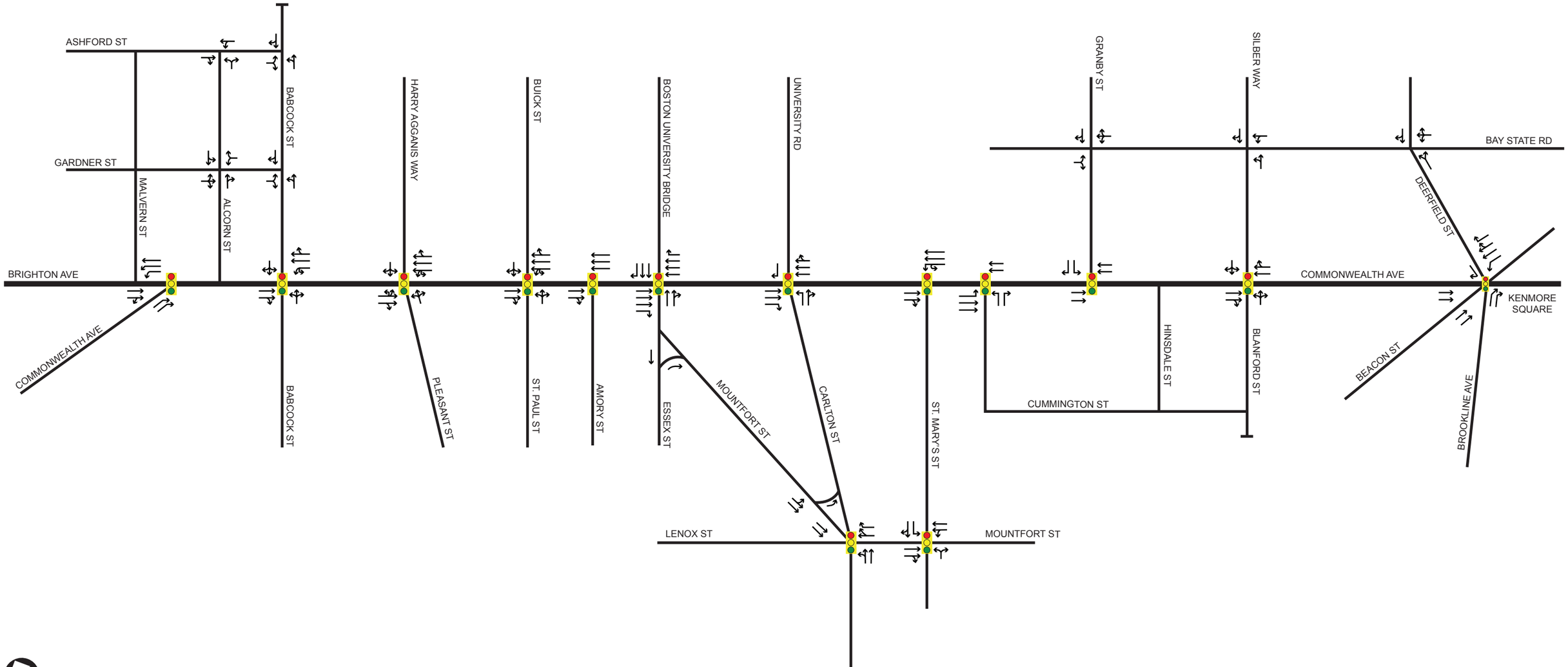
Boston University Properties
Wheelchair Ramps
Crosswalks

Boston University Charles River Campus
2013-2023 Master Plan

Existing Pedestrian Accessibility Facilities

Figure 13B

P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Lane Configurations.ai



NORTH - NOT TO SCALE

Existing Traffic Signal

BOSTON UNIVERSITY

Boston University Charles River Campus
2013-2023 Master Plan

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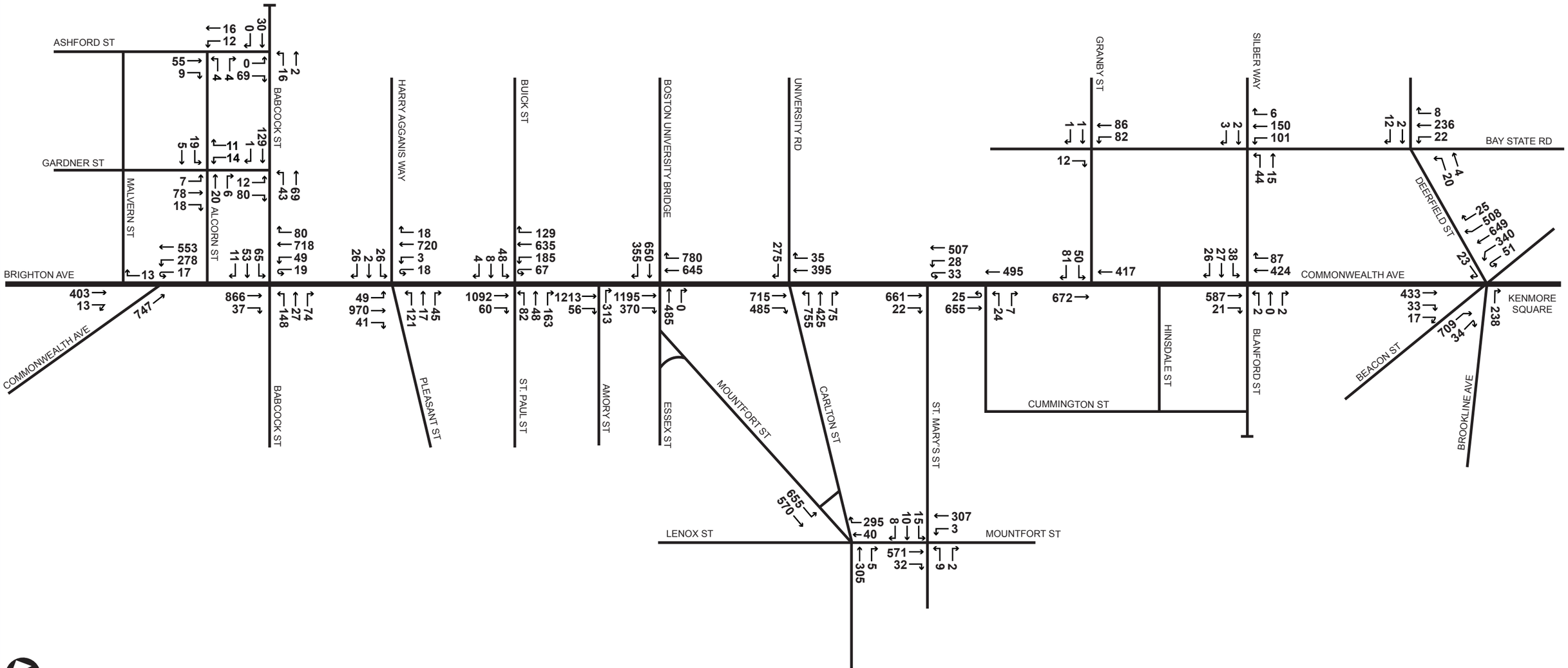
Existing Lane Configurations

Figure 3

P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Morning Peak Hour Traffic Volumes.ai



NORTH - NOT TO SCALE

Boston University Charles River Campus
2013-2023 Master Plan

Existing Morning Peak Hour Traffic Volumes

Figure 4

BOSTON UNIVERSITY

TETRA TECH
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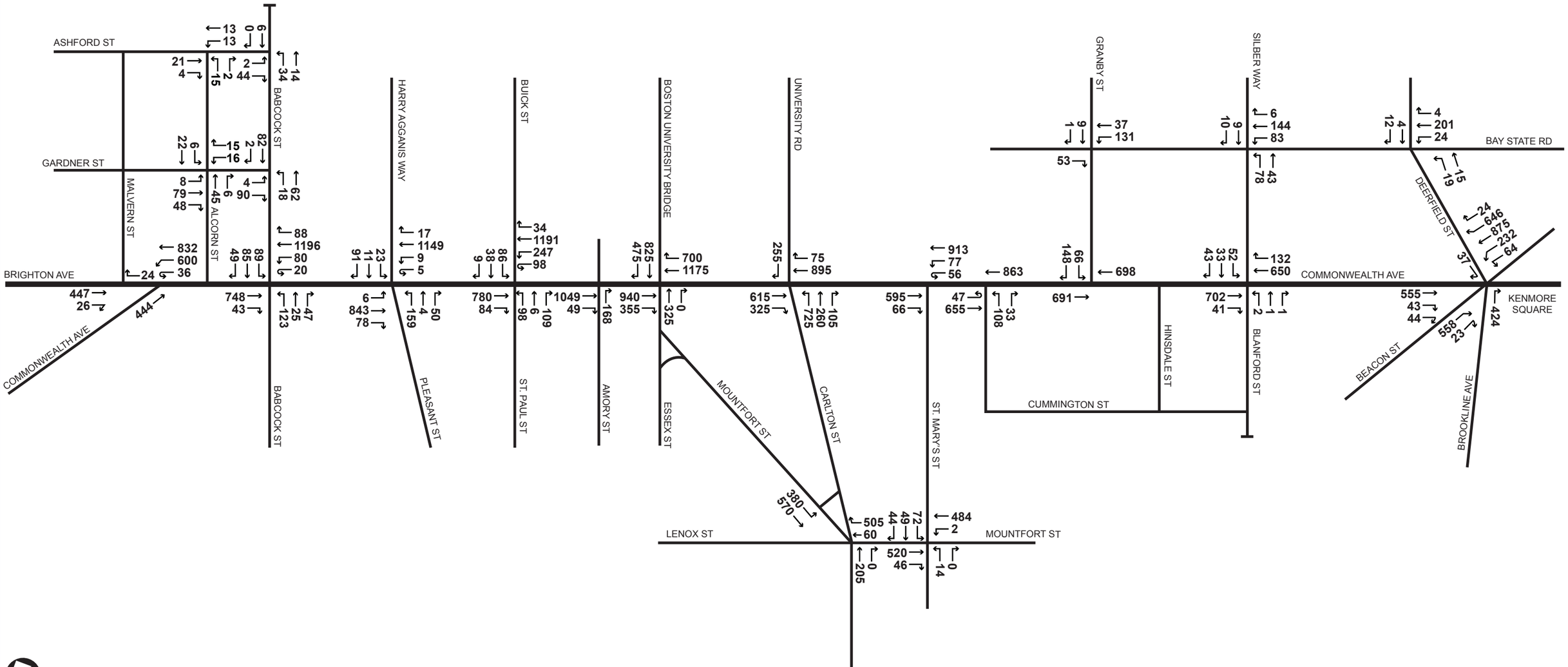
P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Afternoon Peak Hour Traffic Volumes.ai



NORTH - NOT TO SCALE

Boston University Charles River Campus
2013-2023 Master Plan

Existing Afternoon Peak Hour Traffic Volumes

Figure 5

BOSTON UNIVERSITY

TETRA TECH
One Grant Street
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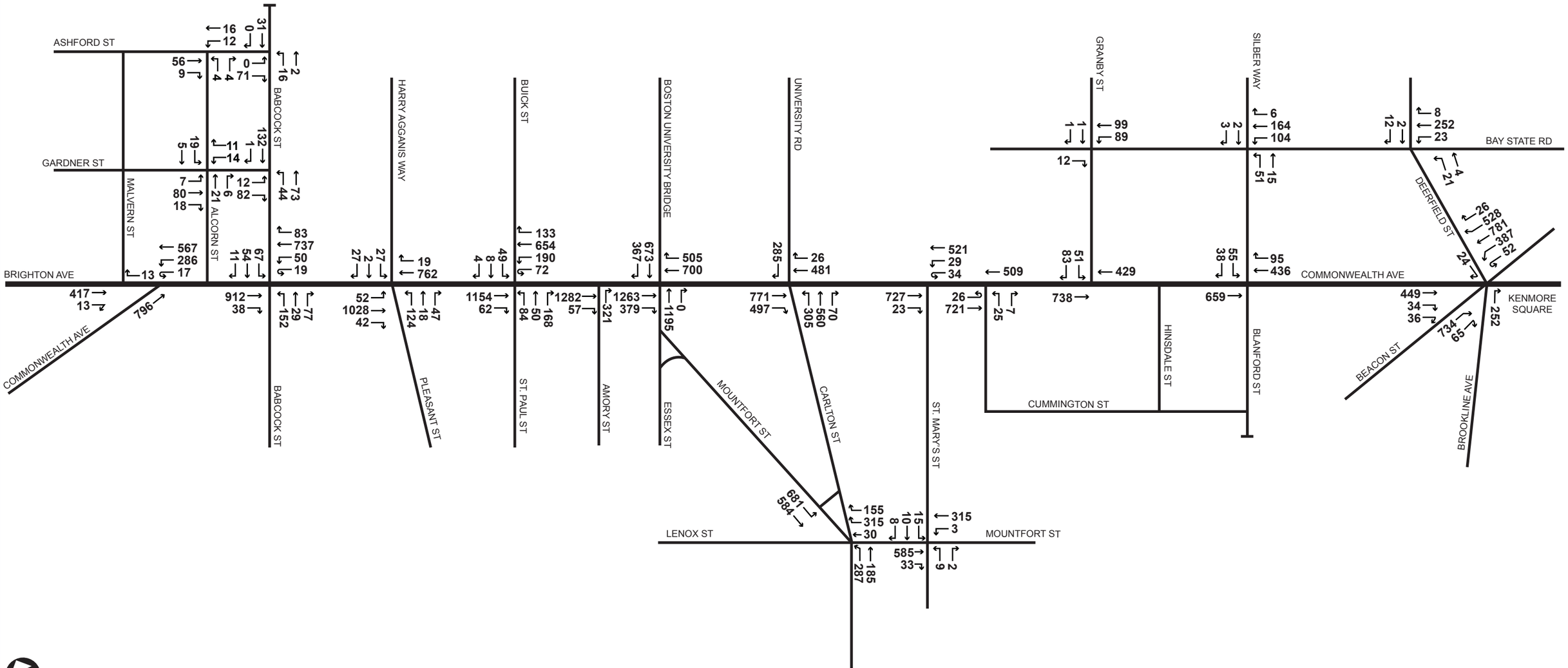
P:/127-4220-12001/SupportDocs/Graphics/Source/Future 2022 Morning Peak Hour Traffic Volumes.ai



BOSTON UNIVERSITY

TETRA TECH

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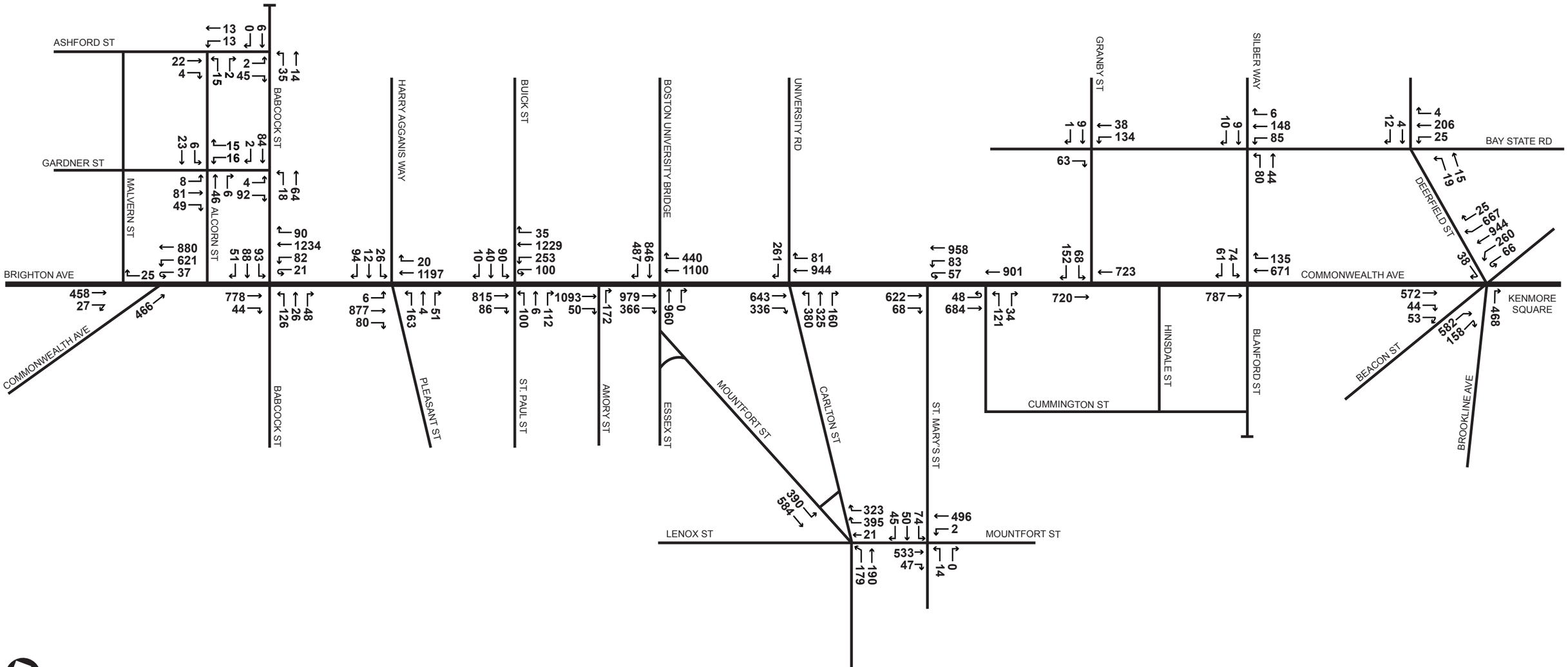
Boston University Charles River Campus
2012-2022 Master Plan

Future (2022) Morning Peak Hour Traffic Volumes

Figure 28

P:/127-4220-12001/SupportDocs/Graphics/Source/Future 2022 Afternoon Peak Hour Traffic Volumes.ai



NORTH - NOT TO SCALE

BOSTON UNIVERSITY

TETRA TECH

One Grant Street
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508.903.2000
www.tetratech.com

Boston University Charles River Campus
2012-2022 Master Plan

Future (2022) Afternoon Peak Hour Traffic Volumes

Figure 29

P:/127-4220-12001/SupportDocs/Graphics/Source/Existing Loading & Service Areas.ai

WEST CAMPUS

SERVICE BAY 2 DOORS
SERVICE BAY 3 DOORS
240' SIGNED LOADING ZONE
SERVICE BAY 4 DOORS
SERVICE BAY 2 DOORS
SERVICE BAY 2 DOORS
LARGE LOADING DOCK
HIGH PLATFORM SERVICE BAY 3 DOORS
SERVICE BAY 1 DOOR
SERVICE BAY 1 DOOR
SERVICE BAY 2 DOOR
SERVICE BAY 2 LARGE DOORS
LOADING DOCKS 2 LARGE DOORS 2 SMALL DOORS
SERVICE BAY 2 DOORS
LOADING DOCK 1 DOOR
SERVICE BAY 1 DOOR
SERVICE BAY 1 DOOR

ASHFORD STREET
GARDNER STREET
BABCOCK STREET
HARRY AGGANIS WAY
SOLDIERS FIELD ROAD
MASSACHUSETTS TURNPIKE
BUICK STREET
COMMONWEALTH AVENUE
NAPLES ROAD
WINSLOW ROAD
ADAMS STREET
ELBA STREET
OSBORNE ROAD
ABBOTTSFORD ROAD
MANCHESTER ROAD
COPLEY STREET
WINSHIELD ROAD
THATCHER STREET
EGMONT STREET
DRUMMER STREET
WORTHINGTON ROAD
LENOX STREET
ESSEX STREET
MOUNTFORT STREET
CARLTON ST. BRIDGE
COTTAGE FARM ROAD
MASON STREET
PRESCOTT STREET
ST. PAUL STREET
EWE STREET
FREEMAN STREET
AMORY STREET
IVY

CENTRAL CAMPUS

SERVICE BAY
SERVICE BAY
SERVICE BAY
1 VERY LARGE SERVICE BAY DOOR
SERVICE BAY 2 SMALL DOORS
LOAD ZONE
SERVICE BAY 1 DOOR
SERVICE BAY 2 DOOR
LOAD ZONE
50' LOAD ZONE
LOAD DOCK
50' LOAD ZONE

BOSTON UNIVERSITY BRIDGE
UNIVERSITY ROAD
STORROW DRIVE
GRANBY STREET
BAY STATE ROAD
SILBER WAY
FENWAY
BACK STREET
BEACON STREET
CHARLESGATE WEST
CHARLESGATE EAST
MARLBOROUGH ST
(WESTBOUND)
(EASTBOUND)
COMMONWEALTH AVENUE
KENMORE SQUARE
NEWBURY STREET
TURNPIKE EXTENSION
IPSWICH STREET
BABBITT STREET
CUMMINGTON STREET
LINSDALE
BLANDFORD STREET
1 LOADING DOCK - TO OPEN FALL 2012
LOADING ZONE 5 SPACES FOR FOOD TRUCKS
SERVICE BAY 1 DOOR
BROOKLINE AVENUE
LANSDOWNE STREET
SERVICE BAY 2 DOORS
SERVICE BAY 2 SMALL DOORS
SERVICE BAY
50' LOAD ZONE
LOADING AREAS*
MT. MARK'S STREET
PARK DRIVE
ARLINGTON ST.
NEW YORK CENTRAL RAILROAD
TURNPIKE
BACK BAY FENS

SOUTH CAMPUS

EAST CAMPUS

NORTH - NOT TO SCALE

* = "Loading Areas" appear to be used for loading and unloading, but have normal sized doors and no specific signage.

Boston University Properties
Building to be Removed

BOSTON UNIVERSITY

TETRATECH
One Grant Street
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Boston University Charles River Campus
2013-2023 Master Plan

Existing Loading & Service Areas

Figure 22

Appendix B

CLIMATE CHANGE PREPAREDNESS AND RESILIENCY CHECKLIST

Climate Change Preparedness and Resiliency Checklist for New Construction

In November 2013, in conformance with the Mayor's 2011 Climate Action Leadership Committee's recommendations, the Boston Redevelopment Authority adopted policy for all development projects subject to Boston Zoning Article 80 Small and Large Project Review, including all Institutional Master Plan modifications and updates, are to complete the following checklist and provide any necessary responses regarding project resiliency, preparedness, and to mitigate any identified adverse impacts that might arise under future climate conditions.

For more information about the City of Boston's climate policies and practices, and the 2011 update of the climate action plan, *A Climate of Progress*, please see the City's climate action web pages at http://www.cityofboston.gov/climate

In advance we thank you for your time and assistance in advancing best practices in Boston.

Climate Change Analysis and Information Sources:

1. Northeast Climate Impacts Assessment (www.climatechoices.org/ne/)
2. USGCRP 2009 (http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/)
3. Army Corps of Engineers guidance on sea level rise (http://planning.usace.army.mil/toolbox/library/ECs/EC11652212Nov2011.pdf)
4. Proceeding of the National Academy of Science, "Global sea level rise linked to global temperature", Vermeer and Rahmstorf, 2009 (http://www.pnas.org/content/early/2009/12/04/0907765106.full.pdf)
5. "Hotspot of accelerated sea-level rise on the Atlantic coast of North America", Asbury H. Sallenger Jr*, Kara S. Doran and Peter A. Howd, 2012 (http://www.bostonredevelopmentauthority.org/planning/Hotspot of Accelerated Sea-level Rise 2012.pdf)
6. "Building Resilience in Boston": Best Practices for Climate Change Adaptation and Resilience for Existing Buildings, Linnean Solutions, The Built Environment Coalition, The Resilient Design Institute, 2103 (http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf)

Checklist

Please respond to all of the checklist questions to the fullest extent possible. For projects that respond "Yes" to any of the D.1 – Sea-Level Rise and Storms, Location Description and Classification questions, please respond to all of the remaining Section D questions.

Checklist responses are due at the time of initial project filing or Notice of Project Change and final filings just prior seeking Final BRA Approval. A PDF of your response to the Checklist should be submitted to the Boston Redevelopment Authority via your project manager.

Please Note: When initiating a new project, please visit the BRA web site for the most current Climate Change Preparedness & Resiliency Checklist.

A.1 - Project Information

Project Name:	*The Center for Integrated Life Sciences and Engineering (CILSE)*
Project Address Primary:	*610 Commonwealth Avenue, Boston, MA 02215*
Project Address Additional:	
Project Contact (name / Title / Company / email / phone):	*Gary W. Nicksa/ Senior Vice President for Operations/ Boston University/nicksa@bu.edu/ (617) 353-6500*

A.2 - Team Description

Owner / Developer:	*Trustees of Boston University*
Architect:	*Payette*
Engineer (building systems):	*Payette*
Sustainability / LEED:	*Payette*
Permitting:	*Fort Point Associates, Inc.*
Construction Management:	*TBD*
Climate Change Expert:	*Payette*

A.3 - Project Permitting and Phase

At what phase is the project – most recent completed submission at the time of this response?

PNF / Expanded PNF Submission	Draft / Final Project Impact Report Submission	BRA Board Approved	Notice of Project Change
Planned Development Area	BRA Final Design Approved	Under Construction	Construction just completed:

A.4 - Building Classification and Description

List the principal Building Uses:	*Research, Academic, Office, Meeting*
List the First Floor Uses:	*Human Imaging, Meeting/Colloquium Space, Academic, Building Support and Circulation*

What is the principal Construction Type – select most appropriate type?

Wood Frame	Masonry	**Steel Frame**	Concrete

Describe the building?

Site Area:	*23,600 SF*	Building Area:	*20,164 SF*
Building Height:	*140 Ft.*	Number of Stories:	*9 Flrs.*
First Floor Elevation (reference Boston City Base):	*21'2" Elev.*	Are there below grade spaces/levels, if yes how many:	*No*

A.5 - Green Building

Which LEED Rating System(s) and version has or will your project use (by area for multiple rating systems)?

Select by Primary Use:	**New Construction**	Core & Shell	Healthcare	Schools
	Retail	Homes Midrise	Homes	Other
Select LEED Outcome:	Certified	**Silver**	Gold	Platinum

Will the project be USGBC Registered and / or USGBC Certified?

Registered:	*Yes*	Certified:	*Yes*

A.6 - Building Energy

A Building energy model associated with this project has not been completed yet.

What are the base and peak operating energy loads for the building?

Electric:	*3,766 (kW)*	Heating:	*9250 (MMBtu/hr)*
What is the planned building Energy Use Intensity:	*Open Laboratories: 6 W/sf Laboratory Support: 16 W/sf (kbut/SF or kWh/SF)*	Cooling:	*75 (Tons/hr)*

What are the peak energy demands of your critical systems in the event of a service interruption?

Electric:	*3013 (kW)*	Heating:	*11850(CF/H)*
		Cooling:	*925 (Tons/hr)*

What is nature and source of your back-up / emergency generators?

Electrical Generation:	*800 (kW)*		Fuel Source:	*Diesel*
System Type and Number of Units:	Combustion Engine	Gas Turbine	Combine Heat and Power	*(Units)*

B - Extreme Weather and Heat Events

Climate change will result in more extreme weather events including higher year round average temperatures, higher peak temperatures, and more periods of extended peak temperatures. The section explores how a project responds to higher temperatures and heat waves.

B.1 - Analysis

What is the full expected life of the project?

Select most appropriate:	10 Years	25 Years	**50 Years**	75 Years

What is the full expected operational life of key building systems (e.g. heating, cooling, ventilation)?

Select most appropriate:	10 Years	25 Years	**50 Years**	75 Years

What time span of future Climate Conditions was considered?

Select most appropriate:	10 Years	25 Years	**50 Years**	75 Years

Analysis Conditions - What range of temperatures will be used for project planning – Low/High?

8/90 Deg.

What Extreme Heat Event characteristics will be used for project planning – Peak High, Duration, and Frequency?

90.6 Deg.	*1.5 Days*	*Events / yr.*

What Drought characteristics will be used for project planning – Duration and Frequency?

14 Days	*1 Events / yr.*

What Extreme Rain Event characteristics will be used for project planning – Seasonal Rain Fall, Peak Rain Fall, and Frequency of Events per year?

48 Inches / yr.	*6.6 Inches*	*2 Events / yr.*

What Extreme Wind Storm Event characteristics will be used for project planning – Peak Wind Speed, Duration of Storm Event, and Frequency of Events per year?

3 second gust at 33 feet above ground Wind	*Every 3 seconds*	*50 Year Storm*

B.2 - Mitigation Strategies

What will be the overall energy performance, based on use, of the project and how will performance be determined?

Building energy use below code:	*30%*
How is performance determined:	Whole building energy model

What specific measures will the project employ to reduce building energy consumption?

Select all appropriate:	**High performance building envelop**	**High performance lighting & controls**	**Building day lighting**	**EnergyStar equip. / appliances**
	High performance HVAC equipment	**Energy recovery ventilation**	No active cooling	No active heating
Describe any added measures:				

What are the insulation (R) values for building envelop elements?

Roof:	*R = 30*	Walls / Curtain Wall Assembly:	*R = 20*
Foundation:	*R = NA*	Basement / Slab:	*R = 15*
Windows:	*R = 4 / U = 0.25*	Doors:	*R = 2 / U = 0.5*

What specific measures will the project employ to reduce building energy demands on the utilities and infrastructure?

	On-site clean energy / CHP system(s)	Building-wide power dimming	Thermal energy storage systems	Ground source heat pump
	On-site Solar PV	On-site Solar Thermal	Wind power	**None**
Describe any added measures:	Occupancy sensors for mechanical and lighting systems to reduce building energy demand in areas not occupied.			

Will the project employ Distributed Energy / Smart Grid Infrastructure and /or Systems?

Select all appropriate:	Connected to local distributed electrical	Building will be Smart Grid ready	Connected to distributed steam, hot, chilled water	Distributed thermal energy ready

Will the building remain operable without utility power for an extended period?

	Yes	If yes, for how long:	*24 Hours*
If Yes, is building "Islandable?	No		
If Yes, describe strategies:			

Describe any non-mechanical strategies that will support building functionality and use during an extended interruption(s) of utility services and infrastructure:

Select all appropriate:	**Solar oriented – longer south walls**	Prevailing winds oriented	External shading devices	**Tuned glazing.**
	Building cool zones	Operable windows	Natural ventilation	Building shading
	Potable water for drinking / food preparation	Potable water for sinks / sanitary systems	Waste water storage capacity	**High Performance Building Envelop**
Describe any added measures:				

What measures will the project employ to reduce urban heat-island effect?

Select all appropriate:	**High reflective paving materials**	**Shade trees & shrubs**	**High reflective roof materials**	Vegetated roofs
Describe other strategies:				

What measures will the project employ to accommodate rain events and more rain fall?

Select all appropriate:	On-site retention systems & ponds	**Infiltration galleries & areas**	vegetated water capture systems	Vegetated roofs
Describe other strategies:				

What measures will the project employ to accommodate extreme storm events and high winds?

Select all appropriate:	**Hardened building structure & elements**	**Buried utilities & hardened infrastructure**	Hazard removal & protective landscapes	**Soft & permeable surfaces (water infiltration)**
Describe other strategies:	Locating the mechanical plantrooms at levels 2 and 3 protects the equipment in the event of an extreme storm.			

C - Sea-Level Rise and Storms

Rising Sea-Levels and more frequent Extreme Storms increase the probability of coastal and river flooding and enlarging the extent of the 100 Year Flood Plain. This section explores if a project is or might be subject to Sea-Level Rise and Storm impacts.

C.1 - Location Description and Classification:

Do you believe the building to susceptible to flooding now or during the full expected life of the building?

No	The site is not located in a flood zone, according to the most recent FIRM maps

Describe site conditions?

Site Elevation – Low/High Points:	*Boston City Base Elev.* *High (21.06 Ft.)* *Low (19.5 Ft.)*
Building Proximity to Water:	*900 Ft.*

Is the site or building located in any of the following?

Coastal Zone:	*No*	Velocity Zone:	*No*
Flood Zone:	*No*	Area Prone to Flooding:	*No*

Will the 2013 Preliminary FEMA Flood Insurance Rate Maps or future floodplain delineation updates due to Climate Change result in a change of the classification of the site or building location?

2013 FEMA Prelim. FIRMs:	*No*	Future floodplain delineation updates:	*No*

What is the project or building proximity to nearest Coastal, Velocity or Flood Zone or Area Prone to Flooding?

900 Ft.

If you answered YES to any of the above Location Description and Classification questions, please complete the following questions. ***Otherwise you have completed the questionnaire; thank you!***

C - Sea-Level Rise and Storms

This section explores how a project responds to Sea-Level Rise and / or increase in storm frequency or severity.

C.2 - Analysis

How were impacts from higher sea levels and more frequent and extreme storm events analyzed:

Sea Level Rise:	*Ft.*	Frequency of storms:	*per year*

C.3 - Building Flood Proofing

Describe any strategies to limit storm and flood damage and to maintain functionality during an extended periods of disruption.

What will be the Building Flood Proof Elevation and First Floor Elevation:

Flood Proof Elevation:	*Boston City Base Elev.(Ft.)*	First Floor Elevation:	*Boston City Base Elev. (Ft.)*

Will the project employ temporary measures to prevent building flooding (e.g. barricades, flood gates):

	Yes / No	If Yes, to what elevation	*Boston City Base Elev. (Ft.)*
If Yes, describe:			

What measures will be taken to ensure the integrity of critical building systems during a flood or severe storm event:

Systems located above 1st Floor.	Water tight utility conduits	Waste water back flow prevention	Storm water back flow prevention

Were the differing effects of fresh water and salt water flooding considered:

Yes / No

Will the project site / building(s) be accessible during periods of inundation or limited access to transportation:

Yes / No	If yes, to what height above 100 Year Floodplain:	*Boston City Base Elev. (Ft.)*

Will the project employ hard and / or soft landscape elements as velocity barriers to reduce wind or wave impacts?

Yes / No

If Yes, describe:

Will the building remain occupiable without utility power during an extended period of inundation:

Yes / No	If Yes, for how long:	*days*

Describe any additional strategies to addressing sea level rise and or sever storm impacts:

C.4 - Building Resilience and Adaptability

Describe any strategies that would support rapid recovery after a weather event and accommodate future building changes that respond to climate change:

Will the building be able to withstand severe storm impacts and endure temporary inundation?

Select appropriate:	*Yes / No*	Hardened / Resilient Ground Floor Construction	Temporary shutters and or barricades	Resilient site design, materials and construction

Can the site and building be reasonably modified to increase Building Flood Proof Elevation?

Select appropriate:	*Yes / No*	Surrounding site elevation can be raised	Building ground floor can be raised	Construction been engineered
Describe additional strategies:				

Has the building been planned and designed to accommodate future resiliency enhancements?

Select appropriate:	*Yes / No*	Solar PV	Solar Thermal	Clean Energy / CHP System(s)
		Potable water storage	Wastewater storage	Back up energy systems & fuel
Describe any specific or additional strategies:				

Thank you for completing the Boston Climate Change Resilience and Preparedness Checklist!

Appendix C

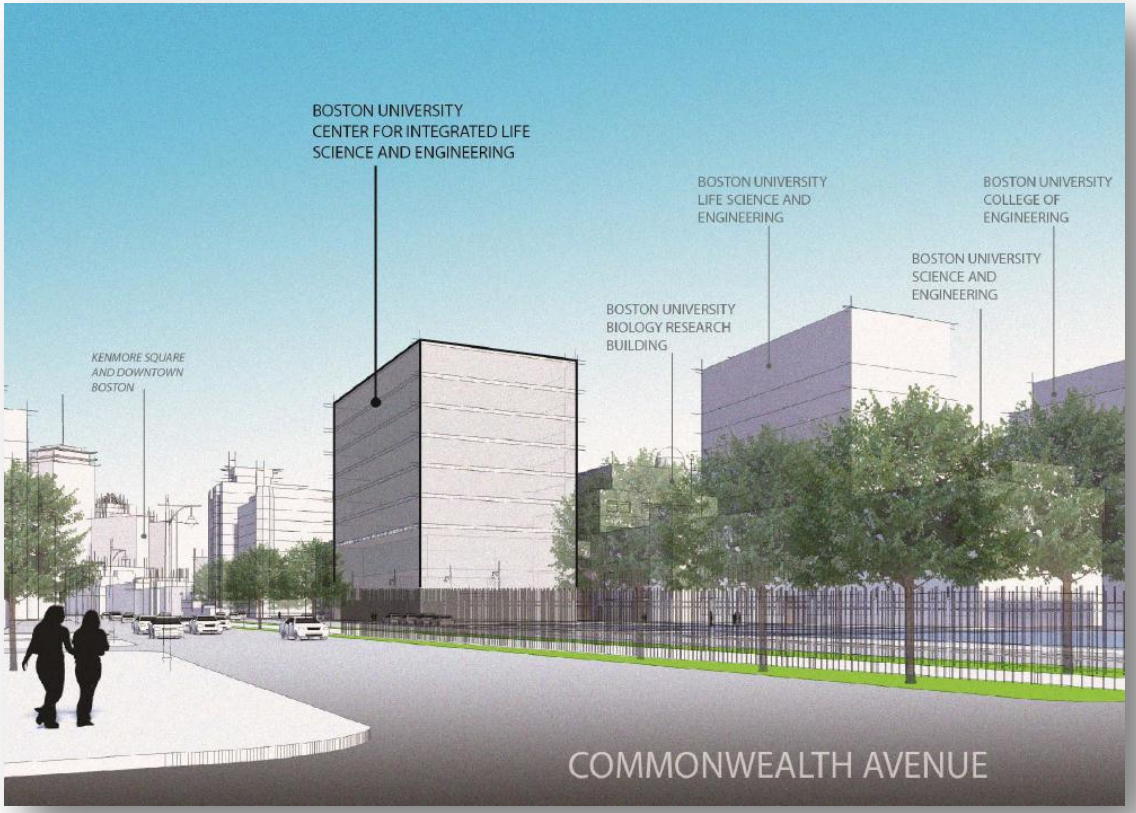
WIND STUDY

Boston University Center for Integrated Life Sciences and Engineering (CILSE)

Boston, Massachusetts

Pedestrian Wind Review

RWDI #1401738
May 13, 2014



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1. Introduction

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to assess the pedestrian wind conditions for the proposed Boston University Center for Integrated Life Sciences and Engineering (CILSE) project in Boston, Massachusetts. The objective of this qualitative analysis was to estimate the pedestrian environment around the proposed development when it is added to the existing and future surroundings. Detailed wind tunnel testing will be performed by RWDI at a later stage of design

This qualitative assessment is based on the following :

- a review of regional long-term meteorological data for the Boston area;
- design drawings received by RWDI in April 2014;
- our engineering judgment and knowledge of wind flows around buildings [1] [2];
- use of software developed by RWDI (*WindEstimator*[2]) for estimating the potential wind comfort conditions around generalized building forms;
- our experience of wind tunnel modelling of various building projects in Boston; and,
- The use of RWDI's proprietary Computational Fluid Dynamics (CFD) software *Virtualwind*™ for visualizing wind flow patterns.

Prior to wind tunnel testing, this qualitative approach provides a screening-level estimation of potential wind comfort conditions and identifies anticipated areas of accelerated wind speeds or areas of relative calm. To quantify the wind comfort conditions or refine any conceptual wind control measures, physical scale model tests in a boundary layer wind tunnel facility will be performed later in the project. Note that other wind issues, such as those relating to door pressures, stack effect, exhaust re-entrainment, etc. are not considered in the scope of this assessment.

[1] C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999). "Experience with Remedial Solutions to Control Pedestrian Wind Problems". *10th International Conference on Wind Engineering*. Copenhagen, Denmark.
[2] H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004). "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions". ASCE Structure Congress 2004. Nashville, Tennessee.

2. Site Information

The proposed site, as shown in Figure 1, is located in Boston, south of Commonwealth Avenue and west of Blandford Mall. Currently the area is occupied by an open parking lot bordered by Alfred L. Morse auditorium to the east, Physics and Biological Research Building (3-5 Cummington Mall) to the south and Boston university Grounds South to the west. The area is surrounded by low to mid-rise developments in all directions with Charles River to the north and downtown Boston far northeast.

The proposed CILSE building will be nine stories tall with the main entrances situated along the west façade, along the University Grounds South. There will be a small pocket park between the CILSE and Morse Auditorium buildings and a garden along the south building boundary.

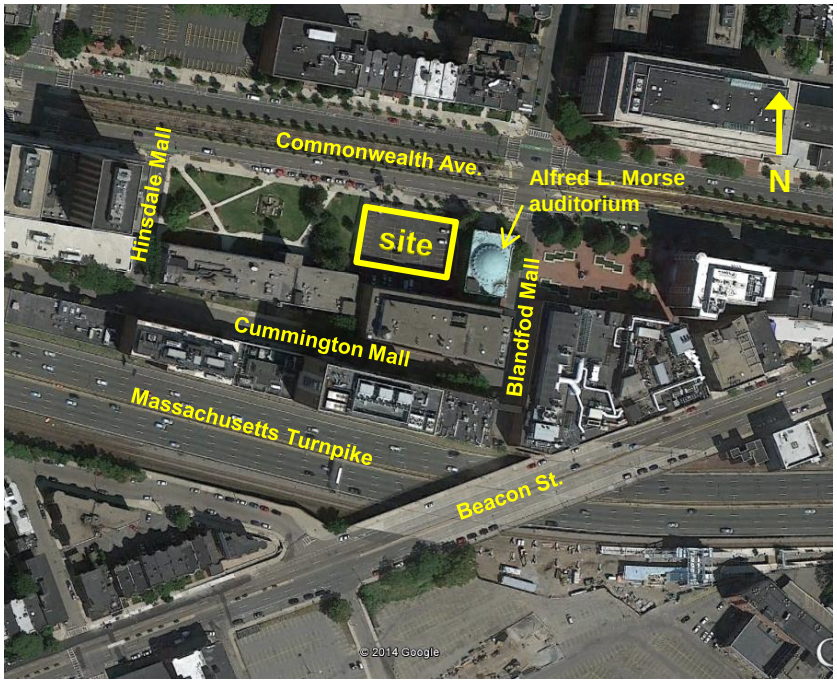


Figure 1 - Aerial View of Site
(Courtesy of GoogleEarth™)

3. Meteorological Data

Meteorological data in the form of a wind rose is provided below in Figure 2. This data represents the annual wind climate in the Boston area, at the Boston Logan International Airport for the period 1984 to 2013, inclusively.

The prevailing winds in the area originate from the west-northwesterly direction. Winds from the southwest are also frequent. Strong winds of speeds greater than 15 mph frequently originate from the northeast, in addition to the previously mentioned directions.

Based on the local wind directionality and the orientation of the buildings and streets in the area, winds from the west-northwest, southwest and northeast were selected for the Virtualwind™ simulations. Simulating these wind directions will provide the most representative wind impacts on pedestrian areas around the site.

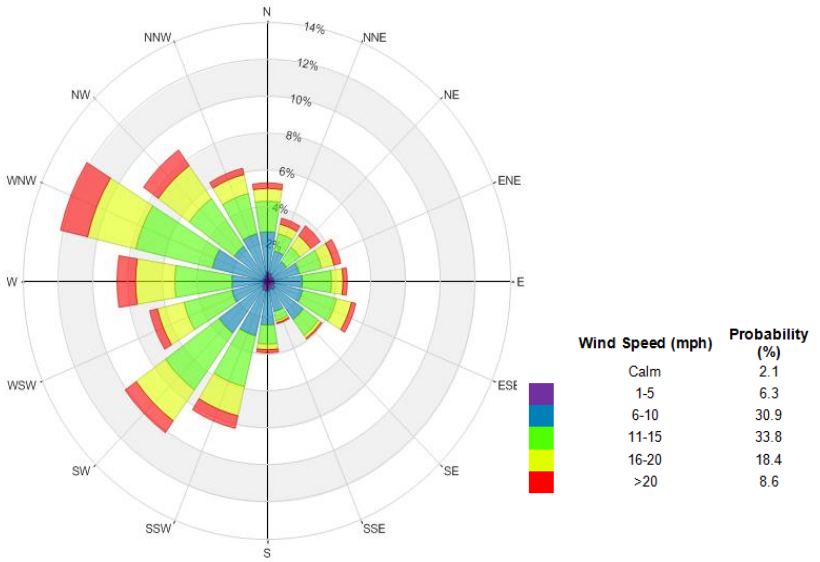


Figure 2 - Annual Winds

4. Computer Model

Wind flows around the proposed development and its surroundings were simulated using Virtualwind™, which is a proprietary software developed by RWDI for the qualitative assessment of pedestrian wind conditions.

The prevailing winds from the west-northwest, northeast and southwest were simulated for the No Build and Build scenarios for the proposed Boston University CILSE development (shown below), and the immediate existing surroundings. Both site configurations are illustrated in Figures 3a and 3b.

The models, illustrated below, included sufficient massing details that would affect wind flows in the area. **Landscaping was not included in the computer model**.

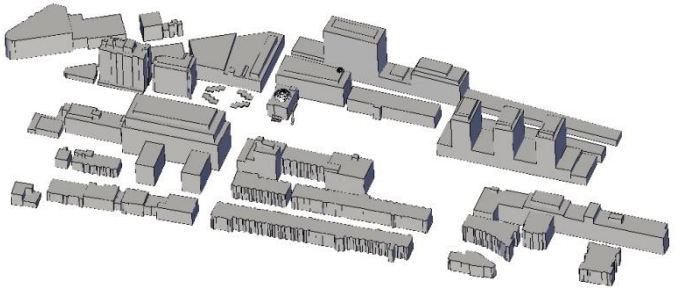


Figure 3a - Computer Model of No Build Configuration

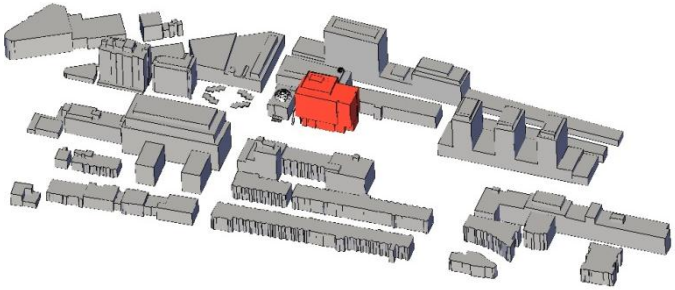


Figure 3b - Computer Model of Build Configuration

5. RWDI Wind Comfort Criteria

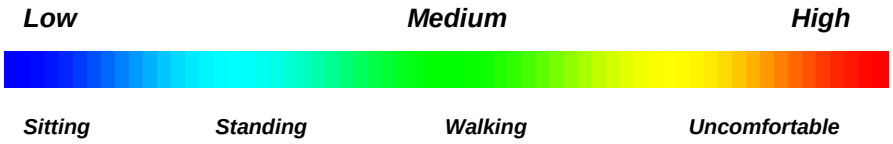
The Boston Redevelopment Authority (BRA) has adopted two standards for assessing the relative wind comfort of pedestrians. First, the BRA wind design guidance criterion states that an effective gust velocity (hourly mean wind speed +1.5 times the root-mean-square wind speed) of 31 mph should not be exceeded more than one percent of the time. The second set of criteria used by the BRA to determine the acceptability of specific locations is based on the work of Melbourne[3]. This set of criteria is used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking. The criteria are expressed in terms of benchmarks for the 1-hour mean wind speed exceeded 1% of the time (i.e., the 99-percentile mean wind speed). They are as follows:

Table 1: BRA Mean Wind Speed Criteria*	
Dangerous	> 27 mph
Uncomfortable for Walking	>19 and <27 mph
Comfortable for Walking	>15 and <19 mph
Comfortable for Standing	>12 and <15 mph
Comfortable for Sitting	<12 mph

* Applicable to the hourly mean wind speed exceeded one percent of the time.

[3] Melbourne, W.H., 1978, "Criteria for Environmental Wind Conditions", Journal of Industrial Aerodynamics, 3 (1978) 241 – 249.

In the *Virtualwind*™ simulations, the colour of dark or light blue represents low wind speed areas comfortable for sitting or standing; green indicates medium wind speeds comfortable for walking, and yellow regions are associated with higher winds speeds that are uncomfortable for walking. The red regions are associated with the highest wind speed regions that may not be suitable for pedestrian usage.



6. Results

The following is a description of the suitability of wind conditions during predominant northeast, southwest and west-northwest winds. The discussion includes wind activity at grade around the site and proposed development. Wind flows are explained, and conceptual mitigation measures are described where necessary.

The results of CFD simulations are presented in this report in the form of still images of color contours of wind speeds for the west, northwest and northeast wind directions. The results correspond to a horizontal plane approximately 5 ft above grade level. These images are for the average wind conditions and actual wind speeds vary with time.

We note that these preliminary wind conditions will be further refined and quantified with greater accuracy in the upcoming wind tunnel studies.

6.1 Results – Northeast Winds

Winds approaching the existing site from northeast direction are expected to lead to conditions generally comfortable for standing or sitting in the park to the west of the site. Slightly higher wind speeds, comfortable for walking, are expected along Cummington Mall, Hinsdale Mall and Blandford Mall.

In the Build configuration, conditions in the park to the west of the new building, as well as along Cummington Mall and Hinsdale Mall, are expected to remain unchanged. The conditions at the building entrances should be comfortable for standing or sitting with occasional higher winds comfortable for walking.

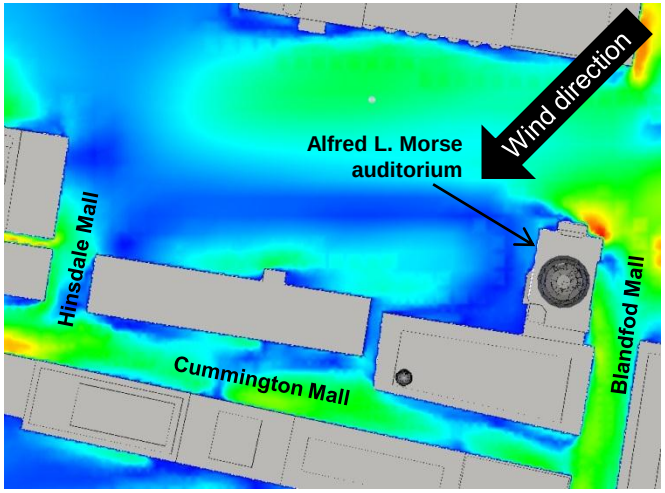
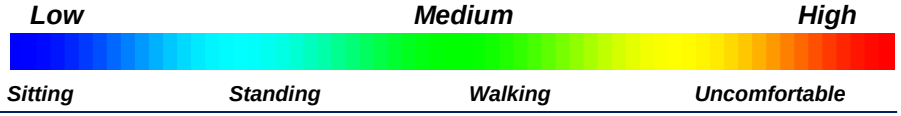


Figure 4a – No Build Configuration

Figure 4b - Build Configuration



6.2 Results – Southwest Winds

When winds approach the existing site from southwestern directions, conditions generally comfortable for standing or better are expected at the park to the west of the building. Slightly higher wind speeds, comfortable for walking, are anticipated along Cummington Mall and Hinsdale Mall with localized wind accelerations at the building corners near the intersection of the two streets. This is a result of channeling flows, as the approaching winds are re-directed along these streets.

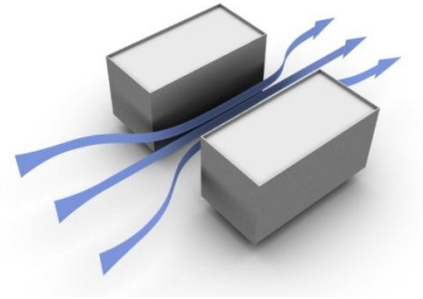


Figure 5 - Channeling Flow

In the Build configuration, areas with high wind speeds along Cummington Mall and Hinsdale Mall are expected to remain unchanged, while comfort conditions are expected to improve in the park to the west of the proposed building. The conditions at the building entrances are expected to be comfortable for standing or sitting with occasional higher winds comfortable for walking.

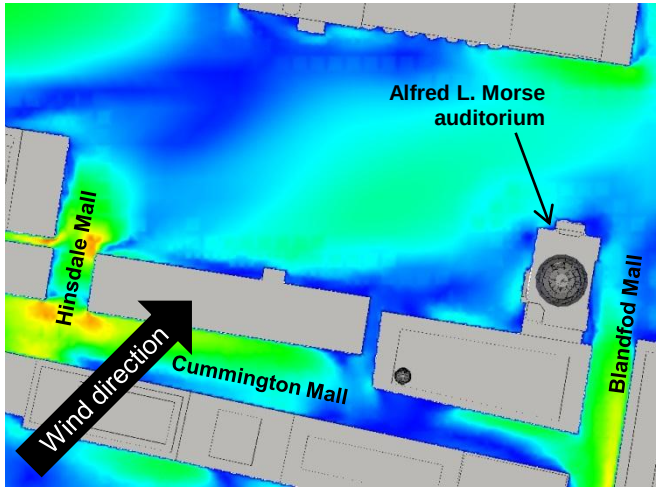


Figure 6a - No Build Configuration

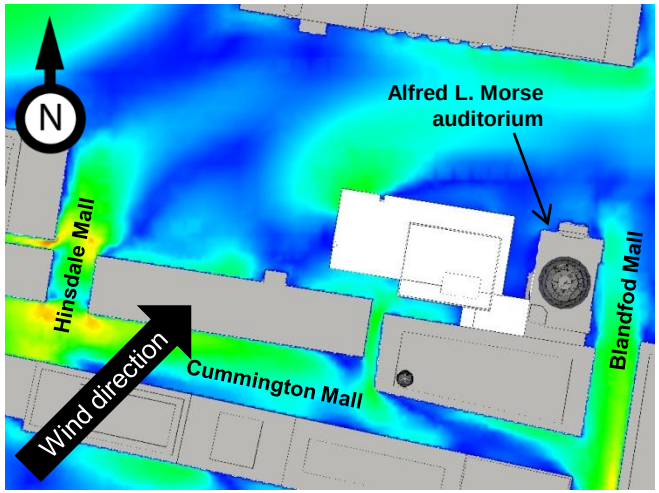
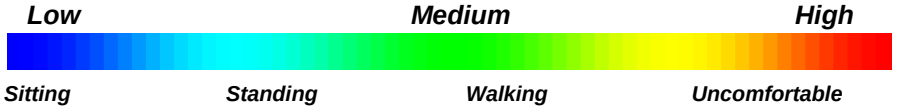


Figure 6b - Build Configuration



6.3 Results – West-Northwest Winds

When winds approach the existing site from the west-northwest, pedestrian wind conditions generally comfortable for sitting or standing are anticipated at the park to the west of the site, as well as at some areas along Cummington Mall to the south. Slightly higher wind speeds, comfortable for walking, are expected to occur at areas to the west of the Alfred L. Morse auditorium, and near the intersection of Cummington Mall with Hinsdale Mall and Blandford Mall. These conditions are illustrated in Figure 7a.

In the proposed site configuration, localized high wind speeds are expected at the corners of the proposed building. Wind conditions could be potentially uncomfortable for walking at these locations. This wind activity is expected as a result of downwashing effect that occur when tall building facades redirect winds at high elevations down to grade level. These winds subsequently accelerate around the building corners (see Figure 7), thereby resulting in high wind activity. Given that the main entrances are located at the northwest and southwest corners, lower wind speeds would be prescribed in these areas for comfort and to avoid difficulties of door operability. In our experience, design features such as street trees and façade detailing can help to mitigate these conditions. Approaches to address this will be developed as the design progresses.

The conditions at the large park to the west of the building, small park to the east of the building and courtyard to the south, are expected to be comfortable for walking or better, which is appropriate

Figure 7 - Downwashing

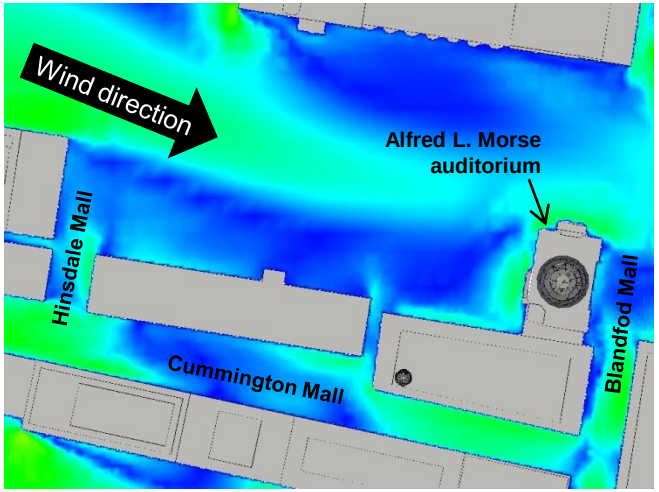


Figure 8a – No Build Configuration

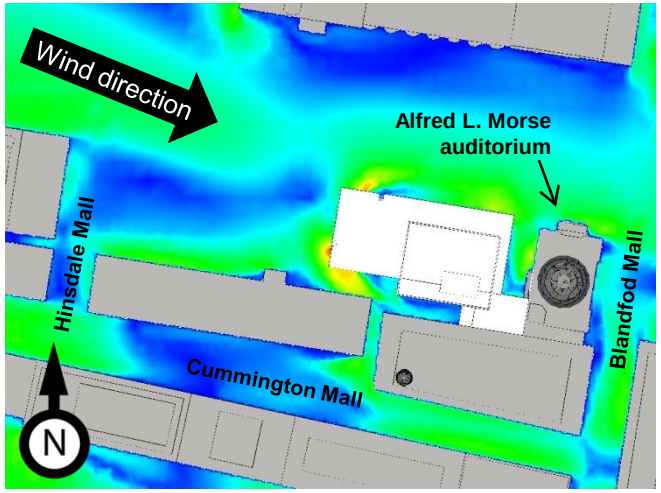
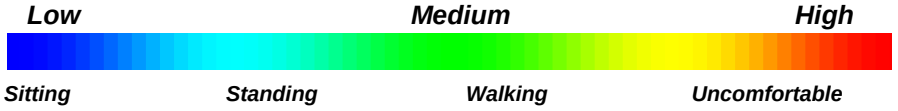


Figure 8b – Build Configuration



6.4. Results Overview and Recommendations

On an annual basis, conditions at the park to the west of the proposed building are expected to be generally comfortable for walking, standing or sitting. During summer, when the trees in the park have full foliage, calmer wind speeds and more comfortable conditions are expected. Wind speeds along Cummington Mall and Hinsdale Mall and at the intersection of the two are expected to be comfortable for walking most of the time. However, potentially uncomfortable winds are predicted to occur occasionally in these areas.

The addition of the proposed Boston University CILSE building is expected to have a localized influence on wind conditions in the area. Generally, areas with high wind speeds are expected at the perimeter and especially around the corners of the proposed building, where the main entrances are located. This would create conditions uncomfortable for walking which is higher than desired.

Any hard or soft landscaping proposed to the west of the building, as well as refinements to the building design, are expected to reduce the higher wind activity expected in these areas. Wind control elements may include trees, bushes, porous wind screens and canopies (see examples in Figure 9 and 10).

Features such as canopies or trellises on the west facade would reduce the impact of the downwashing flows by redirecting winds away from the grade level. The area upwind of the main wind direction is a park which is expected to have trees and vegetation during summer. This is an effective wind control measure during summer. Placement of various screens, which can be in the form of street art in the park area can help dissipating the strong incoming winds from the west-northwest at grade level. Screens would aid in wind control during the winter as well, when trees lose their foliage.

We note that these preliminary wind conditions will be further refined and quantified with greater accuracy in the upcoming wind tunnel tests.

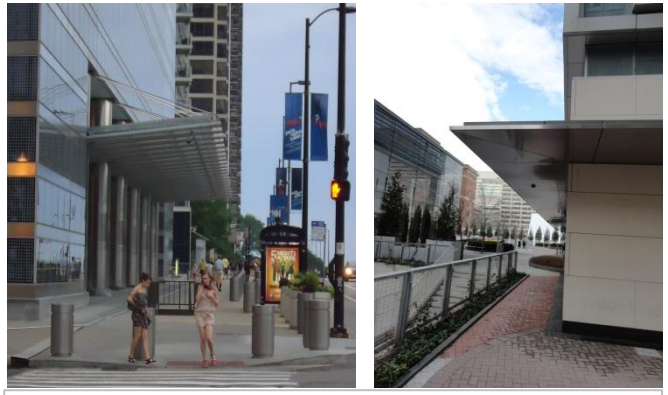


Figure 9 - Examples of Canopies

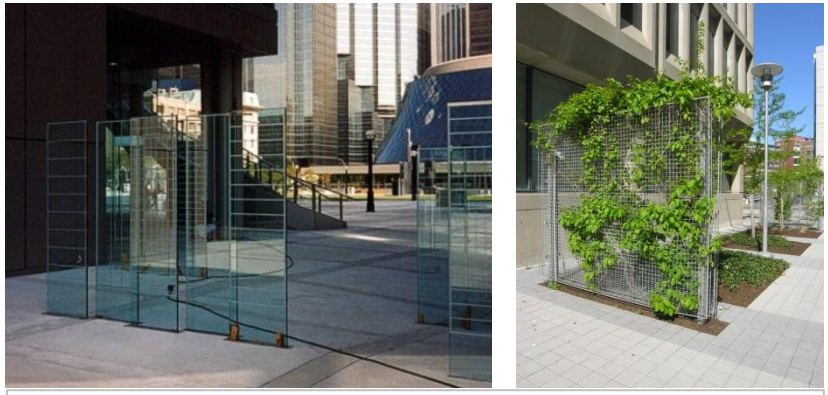


Figure 10 - Examples of Screens

7. Summary

RWDI was retained to assess the pedestrian wind conditions for the proposed Boston University Center for Integrated Life Sciences and Engineering in Boston, Massachusetts. A qualitative analysis was conducted to estimate the pedestrian wind conditions around the proposed development when it is added to the existing surroundings. Three significant wind directions were simulated in this assessment and the resulting wind conditions predicted. Where required, mitigation concepts have been recommended.

Overall, the wind microclimate around the development are expected to be comfortable for the intended usage. Higher than desired wind speeds are likely to occur around the corners of the proposed building, at the location of the main entrances. These conditions are expected to be improved with the addition of trees and other hard and soft landscaping elements in the park to the west of the building, as well as facade detailing that is in progress. Additionally, localized wind control measures such as canopies, wind screens and vegetation, as detailed in the previous sections, are also anticipated to enhance pedestrian wind conditions.

The influence of the proposed building does not extend to the surrounding streets. Existing wind conditions on Cummington Mall, Hinsdale Mall and Blandford Mall are expected to remain unchanged with the addition of the proposed project.

This report gives a qualitative assessment of the wind microclimate on and around the proposed development. Future wind tunnel tests will include a statistical analysis and detailed meteorological data, in order to quantify and refine these preliminary findings.

8. Applicability of Results

In the event of any significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the design considered in this report. It is the responsibility of others to contact RWDI to initiate this process.