12.0 168 MASSACHUSETTS AVENUE

12.1 Project Description

As noted in Chapter 1, increasing the number of available dormitories on campus will improve retention rates, enhance the quality of life for Berklee students, and strengthen collaboration and community-building within a highly diverse student body. More on-campus housing will also make the college more attractive to international students and female students. College officials, neighbors, and the City of Boston have agreed that Berklee should strive to house approximately half of its students; accomplishing this goal will require accommodations for an additional 1,200 people.

In an effort to begin to address this goal, Berklee is proposing the 168 Massachusetts Avenue project. This chapter includes a description of the project site, its surroundings and the environmental impacts of the project.

12.1.1 Project Site

As previously described, acquired in the spring of 2009 from an affiliate of The First Church of Christ, Scientist, the buildings at 154-174 Massachusetts Avenue (with approximately 15,000 sf of existing space) provide an opportunity for Berklee to address its most pressing housing and academic needs. The site is bounded by Belvidere Street to the north, Saint Germain Street to the south, Massachusetts Avenue to the west, and an alley to the east. The site is approximately 14,141 sf and currently includes a McDonalds, another restaurant and administration and classroom space for the college. The existing buildings will be demolished to allow construction of the new project.

12.1.2 Development Program

Referred to collectively as 168 Massachusetts Avenue, the project proposes an approximately 155,000-sf mixed-use building that will accommodate a new approximately 350-bed residence hall, 400-seat campus dining facility and student performance venue, music technology spaces, and ground floor retail. The building will be approximately 192 feet tall. Information about the urban design aspects of the project can be found in Section 5.2.5. Figures 12.1-1 to 12.1-6 show renderings and elevations of the project. Preliminary floor plans are provided in Appendix F.

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Figure 12.1-1

Rendering
Looking South

William Rawn Associates
Architects, Inc.
Boston, MA

Berklee college of music

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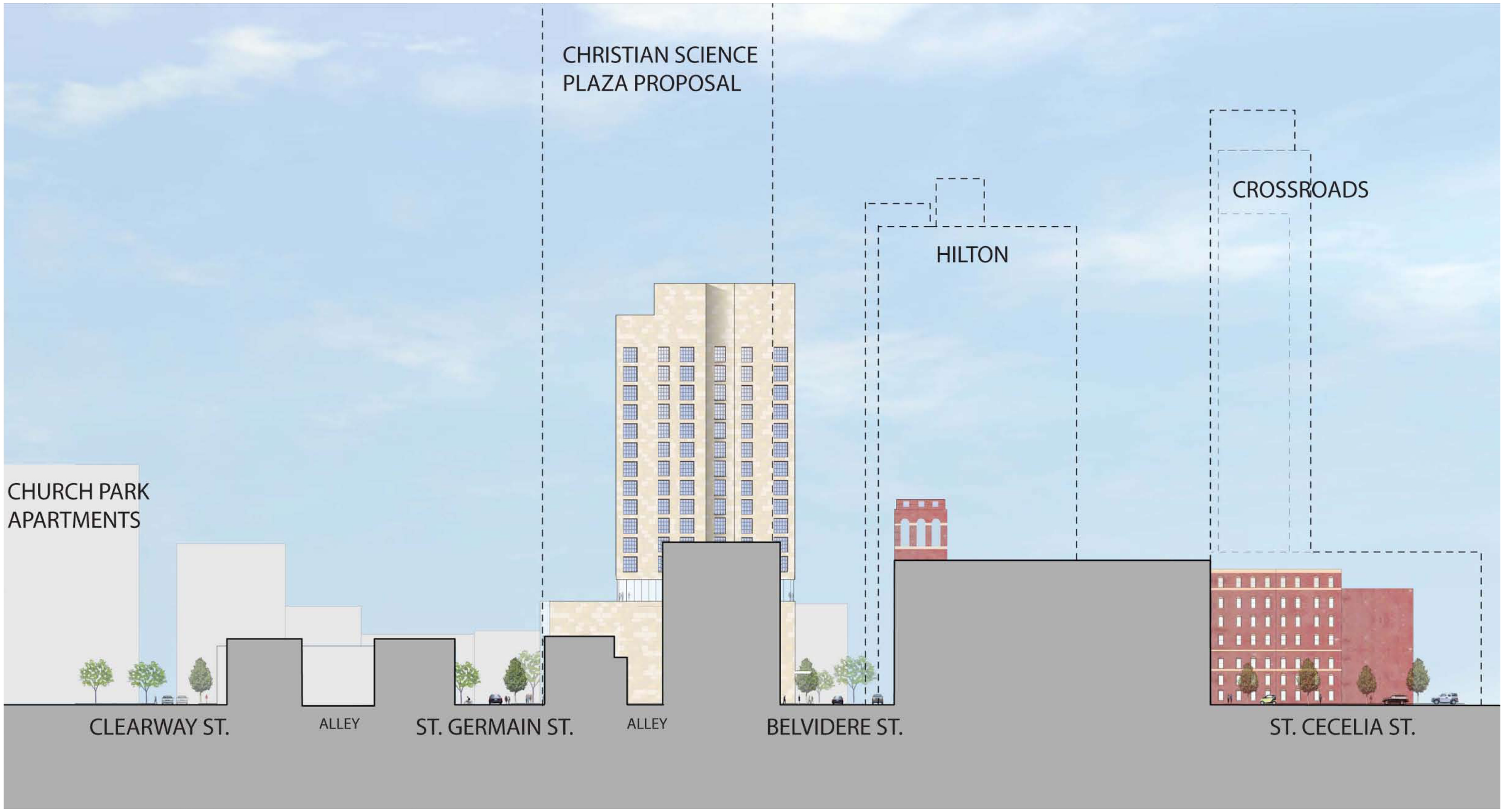
Figure 12.1-2
Rendering
Looking North

William Rawn Associates
Architects, Inc.
Boston, MA



Berklee college of music

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Figure 12.1-3
East Elevation

William Rawn Associates
Architects, Inc.
Boston, MA

Berklee college of music

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Figure 12.1-4
North Elevation

William Rawn Associates
Architects, Inc.
Boston, MA

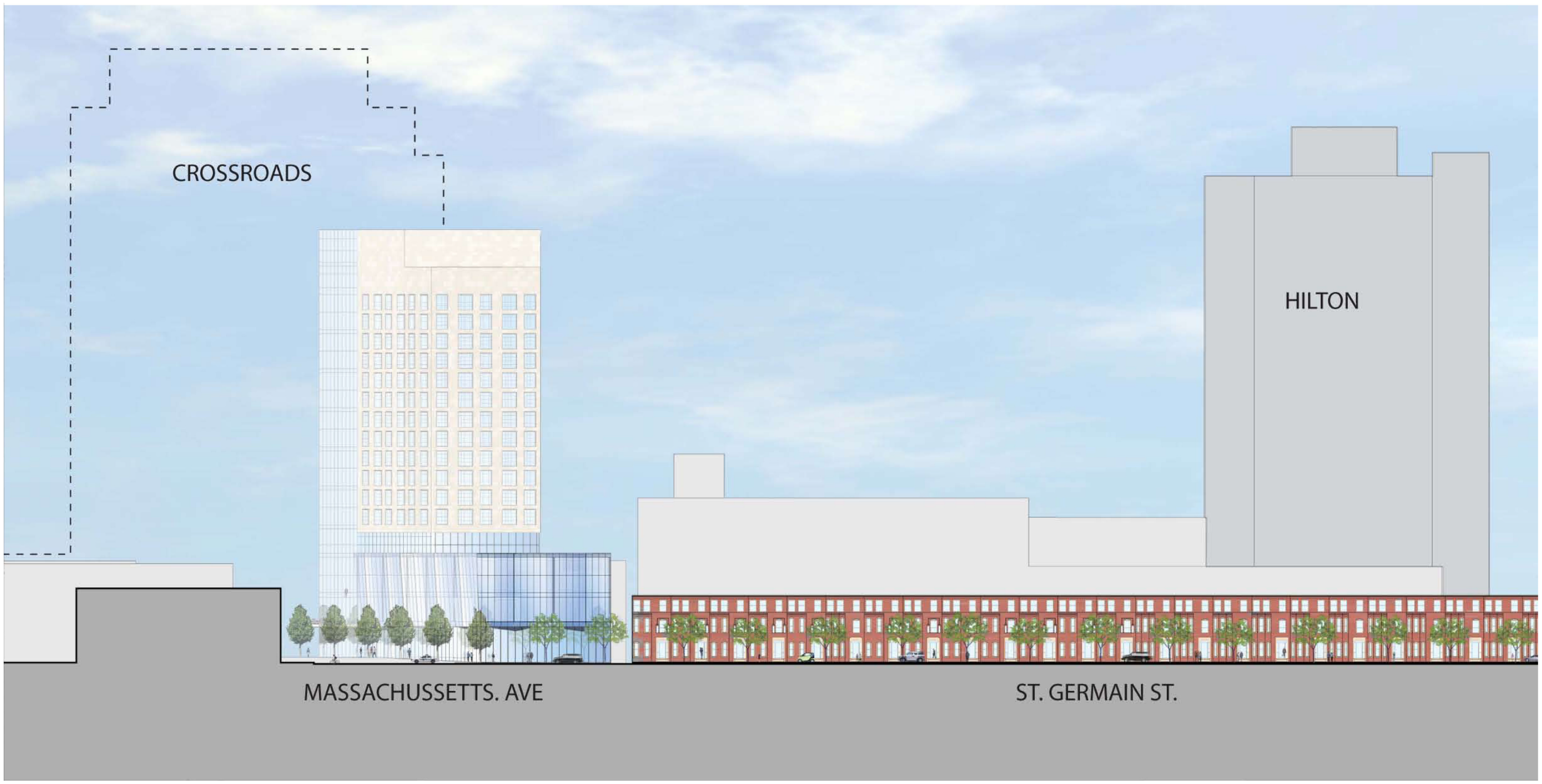

Figure 12.1-5
South Elevation

William Rawn Associates
Architects, Inc.
Boston, MA

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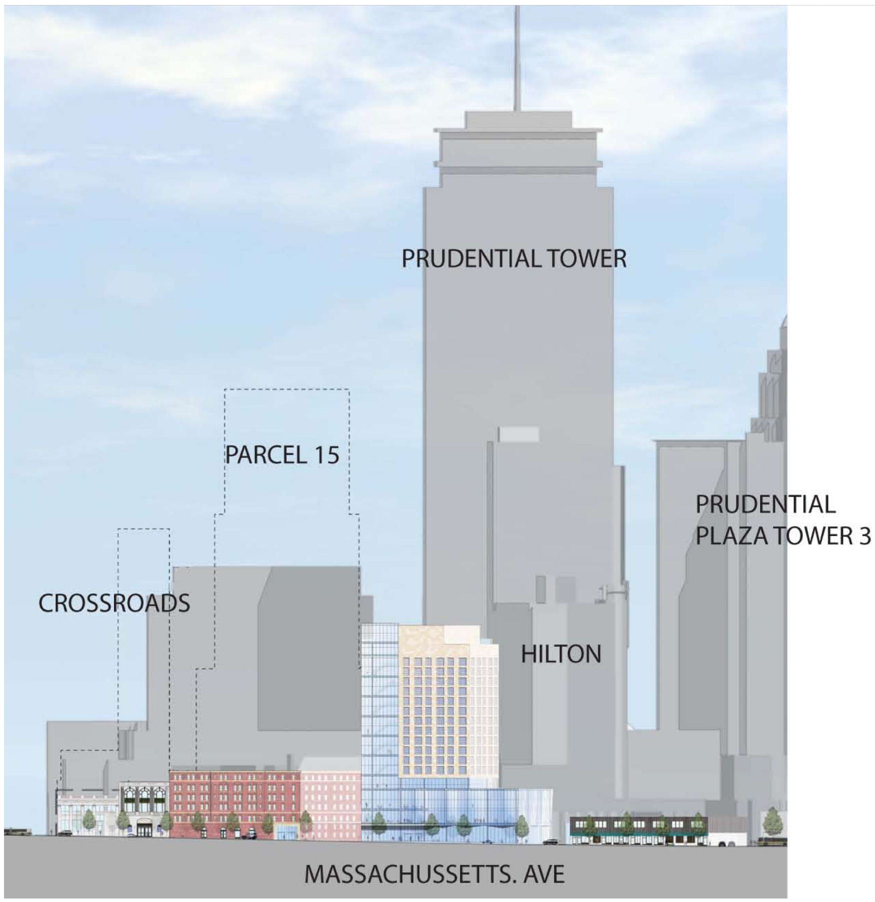

Figure 12.1-6
West Elevation

William Rawn Associates
Architects, Inc.
Boston, MA

12.2 Legal Information

12.2.1 Legal Judgments Adverse to the Proposed Project

Berklee is unaware of any legal judgments or actions pending that concern the project.

12.2.2 History of Tax Arrears on Property

Berklee is not in tax arrears in connection with any property owned within the City of Boston.

12.2.3 Evidence of Site Control/Nature of Public Easements

By deed dated April 16, 2009, recorded at the Suffolk County Registry of Deeds in Book 44815, Page 48, Berklee College of Music, Inc. acquired fee title to the project site from the Church Realty Trust.

Based on the completed survey of the project site, there are no public easements into, through, or surrounding the project site.

12.2.4 Consistency with Zoning Regulations

Large Project Review

Because the project involves new construction in excess of 50,000 square feet of Gross Floor Area, the project is subject to Large Project Review. Under the Mayor's Executive Order dated October 10, 2000, and amended on April 3, 2001, regarding mitigation for development projects, the Mayor may appoint an Impact Advisory Group to advise the BRA on mitigation measures for projects undergoing Large Project Review. In connection with the project's Large Project review, the project will also be subject to: (i) Boston Civic Design Commission review; (ii) the green building requirements of Article 37 of the Code; and (iii) Groundwater Conservation Overlay District requirements.

Zoning District

The project site is located within the Massachusetts Avenue/Belvidere Street Protection Area (the "Mass Ave Protection Area") of the Huntington Avenue/Prudential Center District (Map 1D), and also within the Restricted Parking Overlay District and the Groundwater Conservation Overlay District. Zoning relief will be required in connection with the project, and is anticipated to be obtained via approval of Berklee's Institutional Master Plan.

Uses

Pursuant to the Code's Section 41-17 and Appendix B to Article 41: (i) the project's first floor retail uses are either allowed as-of-right or conditional (with respect to certain restaurant uses); and (ii) the project's music technology, cafeteria and dormitory uses are conditional college or university uses. The project's uses will accordingly require zoning relief. Although the project site is located within the Restricted Parking Overlay District, the project will include no off-street parking spaces and therefore requires no Restricted Parking Overlay District conditional use permit.

Building Dimensions

Within the Mass Ave Protection Area, the maximum building height is 75 feet with Large Project Review and the maximum Floor Area Ratio ("FAR") is 4.0 with Large Project Review. Certain street wall height, setback and rear yard requirements also apply within the Mass Ave Protection Area. At approximately 192 feet and with an FAR of up to 11.4, the project will require relief from these dimensional requirements.

Other Requirements

The project will be designed to comply with requirements for work in the Groundwater Conservation Overlay District and will be subject to BRA design review and to the Code's signage requirements.

12.2.5 MEPA Review

The project exceeds no MEPA review thresholds and accordingly will not trigger MEPA review.

12.3 Regulatory Controls and Permits

Table 12.3-1 presents a preliminary list of permits and approvals from governmental agencies that are expected to be required for the project, based on currently available information. It is possible that only some of these permits or actions will be required, or that additional permits or actions will be required.

Permits and approvals that may be required for the Project are as follows:

Table 12.3-1 Anticipated Permits, Reviews and Approvals

AGENCY	PERMIT
FEDERAL	
Federal Aviation Administration	Determination of No Hazard to Air Navigation (if required)
STATE	
Department of Environmental Protection	Notice of Demolition/Construction/Fossil Fuel (if required)
CITY OF BOSTON	
Boston Redevelopment Authority	Article 80B Large Project Review/Article 80D Institutional Master Plan Review

Table 12.3-1 Anticipated Permits, Reviews and Approvals (continued)

AGENCY	PERMIT
Boston Transportation Department	Construction Management Plan/Transportation Access Plan Agreement
Boston Landmarks Commission	Demolition Delay Review
Public Improvement Commission	Specific Repairs/ Licenses/Discontinuances (if required)
Boston Water and Sewer Commission	Site Plan Review/General Service Application/Water and Sewer Connection Permits
Public Works Department	Curb Cut Permit(s)
Joint Committee on Licenses	Flammable Storage License (if required)
Inspectional Services Department	Demolition/Building Permits

12.4 Schedule

Demolition and site work is anticipated to begin in September 2011. The project will be substantially complete by August 2013.

12.5 Transportation

The overall transportation analysis for the Berklee IMP is presented previously in Chapter 7, comprising an evaluation of the transportation network supporting the Berklee campus, including vehicle traffic volumes, operations and access, on- and off-street parking, available public transportation options, the pedestrian environment, bicycle amenities, and loading/service activities. Both existing and projected future conditions (with and without implementation of the IMP) are addressed, and any potential transportation impacts, both positive and negative, that are expected in the future with the proposed IMP Projects in place, are identified. In addition, potential improvements and mitigation strategies necessary to minimize any negative transportation impacts of the IMP and enhance the supporting transportation system are described, including Transportation Demand Management (TDM) strategies for the IMP to supplement and complement TDM initiatives currently implemented by Berklee.

This section reviews the IMP transportation findings pertinent to the 168 Massachusetts Avenue project, and presents more detailed examination of transportation aspects that are specific to the project, its design and its operation. The project is located on the southeast corner of Belvidere Street at Massachusetts Avenue and will provide a total of approximately 155,000 sf. The project includes an approximately 350-bed residence hall and 400-seat dining hall and student performance space, as well as approximately 5,000 sf of ground floor retail/restaurant space. The project also includes approximately 7,000 sf of common lobby and loading type space, while the remaining approximately 19,000 sf will be new music technology spaces.

Due to its location on Massachusetts Avenue, between Belvidere Street and Saint Germain Street, the project abuts the Massachusetts Avenue/Belvidere Street/Haviland Street intersection, one of the three study intersections identified in the BTD Scoping Determination. Therefore, the PNF analysis focuses on the roadway and sidewalk conditions in the vicinity of the intersection, as well as the sections on Massachusetts Avenue, Belvidere Street, Saint Germain Street and Saint Cecelia Street serving the project site.

12.5.1 Mode Share and Trip Generation

Only 3.5 percent of students access the campus by car (three percent drive-alone) compared to over 23 percent of staff/faculty (almost 19 percent drive-alone). Faculty and staff also make greater use of transit as a commuting mode at almost 54 percent, compared to approximately 40 percent of students. However, 46 percent of students walk to the campus, compared to 5 percent of staff/faculty. When combining walk and transit modes, over 86 percent of students arrive on campus on-foot, compared to 59 percent of faculty and staff. Bicycle mode share is about the same for both groups at 5.5 to 6 percent.

For the 168 Massachusetts Avenue project, the addition of student housing and dining on the site will reduce commuter trips by students, although there will be an increase in non-auto trips over the course of the day in the vicinity of the site. These trips will comprise trips between other buildings and land uses on- and off-campus, which will be accomplished largely on-foot. There will also be a small increase in the number of staff related to the building, causing only a negligible change in trip generation.

12.5.2 Vehicular Traffic Operations

The future traffic projections and level of service analysis are presented in detail in Sections 7.4.1 and 7.4.2 of the IMP, respectively. Because there will be no meaningful change in auto trip generation under the IMP, and because the impact of other planned projects and background growth is the same with or without implementation of the IMP, the Future 2016 No-Build (without IMP) and Future 2016 Build (with IMP) traffic volumes are essentially the same. Accordingly, there is no increase in delay or decline in LOS grade under Future conditions as a result of the IMP, and the 168 Massachusetts Avenue project will have no meaningful traffic impact.

The Massachusetts Avenue/Belvidere Street/Haviland Street intersection, immediately adjacent to the 168 Massachusetts Avenue project, currently operates at overall LOS B and C in the morning and evening peak hours, respectively, and is expected to operate at LOS C during both peaks under the Future 2016 No-Build and Build conditions. All movements will continue to operate at LOS C or better, with the exception of the Belvidere Street approach which is expected to continue to operate at LOS E during both peak periods, for both Existing and Future No-Build and Build analysis scenarios.

In conjunction with the development of potential pedestrian improvements at this location, described in Section 12.5.5, Berklee will evaluate the traffic signal phasing and timing in coordination with BTD to identify potential enhancements of traffic operations.

12.5.3 Parking

Berklee owns or provides virtually no parking on campus today. The 168 Massachusetts Avenue project does not include any new parking, and the project will continue to sustain the relatively low auto mode-share of staff and faculty and the negligible parking demand by students.

As discussed in Section 12.5.7, some limited changes in curbside regulations and parking control on Belvedere Street abutting the project are proposed to facilitate the provision of off-street loading and alleviate traffic flow in that area.

12.5.4 Public Transportation

As described in detail in Section 7.2.4 of the IMP, the project is very well served by public transportation, with numerous high-frequency services available within a five-minute walking distance of the site. Because the project will house approximately 350 students on campus, it will result in a reduction of students commuting to the campus, with a corresponding reduction in transit use. This is largely a peak hour phenomenon, and in the off-peak periods it is expected that there will be some increase in transit ridership associated with resident students leaving 168 Massachusetts Avenue for non-academic related trips. Current transit service is more than adequate to meet any related change in demand.

12.5.5 Pedestrian Access

Walking is the preferred commuting mode for approximately 46 percent of Berklee's student population and five percent of the staff/faculty, and, when combined with commuters using transit, over 86 percent of students arrive and depart the campus on foot. Because most Berklee facilities are located within a ten-minute walk of each other, and many are much closer, there is steady pedestrian traffic among them throughout the day. Student activity and pedestrian circulation is facilitated primarily by the public sidewalks and crosswalks on streets in and around the Berklee campus.

While the number of pedestrians traveling to and from the campus is not expected to change significantly, and indeed will likely decrease as a result of the provision of student housing on campus, the synergy of pedestrian movement between the campus buildings will continue. Therefore, because of its student housing and dining components, pedestrian activity over the course of the day in the vicinity of the project will likely increase.

The site plan for the project is presented in Figure 12.5-1. The building will be accessed via the sidewalks on streets abutting the site, in particular Massachusetts Avenue, Belvidere Street and Saint Germain Street, and their connecting crosswalks. The residence hall, dining hall and music technology space will be served by a single lobby located on the Massachusetts Avenue frontage, towards the Belvidere Street end, and the entrance doorways will be sheltered by a street-level canopy. The doorway for the retail unit will also be located on the Massachusetts Avenue frontage, towards the Saint Germain Street end.

As noted in Section 7.2.5 of the IMP, the concentration of the college's facilities along Boylston Street and Massachusetts Avenue south of Boylston Street results in heavy use of sidewalks along these streets by the Berklee community. The first two blocks of Massachusetts Avenue south of Boylston Street are heavily traveled, particularly the block in front of 150 Massachusetts Avenue and the Berklee Performance Center at 136 Massachusetts Avenue. This is a popular gathering location during good weather, known to students as the Berklee Beach.

These crowded conditions will be significantly relieved by the construction of the project, owing to the setback of the new building from the existing back of sidewalk. The existing 15-foot wide sidewalk along the Massachusetts Avenue frontage will be widened to 20 feet; the barely 7-foot sidewalk on the Belvidere Street frontage will be widened to 9 feet, and the existing 10-foot sidewalk on Saint Germain Street will be widened to 12 feet. These expansions of the sidewalk area will not only enhance the pedestrian environment for users of the new building and passers-by, but will also provide alternative locations to relieve the crowding at Berklee Beach.

In addition, although not part of the project itself, the removal of the first floor addition on the Belvidere Street frontage of 150 Massachusetts Avenue will re-capture the original sidewalk on that side of Belvidere Street, providing a width varying from 12 to 16 feet. This change will realize a substantial improvement to the pedestrian environment in the vicinity, and will afford significant relief to pedestrian accommodations at the corners of the blocks and in the vicinity of the relevant crosswalk waiting areas.

Berklee has already implemented streetscape and sidewalk improvements on Boylston Street between Hemenway Street and Massachusetts Avenue, transforming the pedestrian environment along that key pedestrian route. The sidewalk improvements associated with the project reflect Berklee's on-going commitment to the pedestrian environment, which will be further explored as and when each of the other IMP project designs are advanced.

As pedestrian safety is a top priority for the IMP, pedestrian improvements at adjacent study intersections will be explored in association with each IMP project. For the 168 Massachusetts Avenue project, a range of potential pedestrian and safety improvements have been identified for the Massachusetts Avenue/Belvidere Street/Haviland Street intersection. As discussed in Section 7.2.5 of the IMP, pedestrian level of service (PLOS) at this location is PLOS E for the Massachusetts Avenue crosswalks and PLOS D for the Belvidere Street crosswalk, reflecting average delays of 30 to 60 seconds for pedestrians. Further, it is noted that the crosswalk at Haviland Street is not provided with pedestrian

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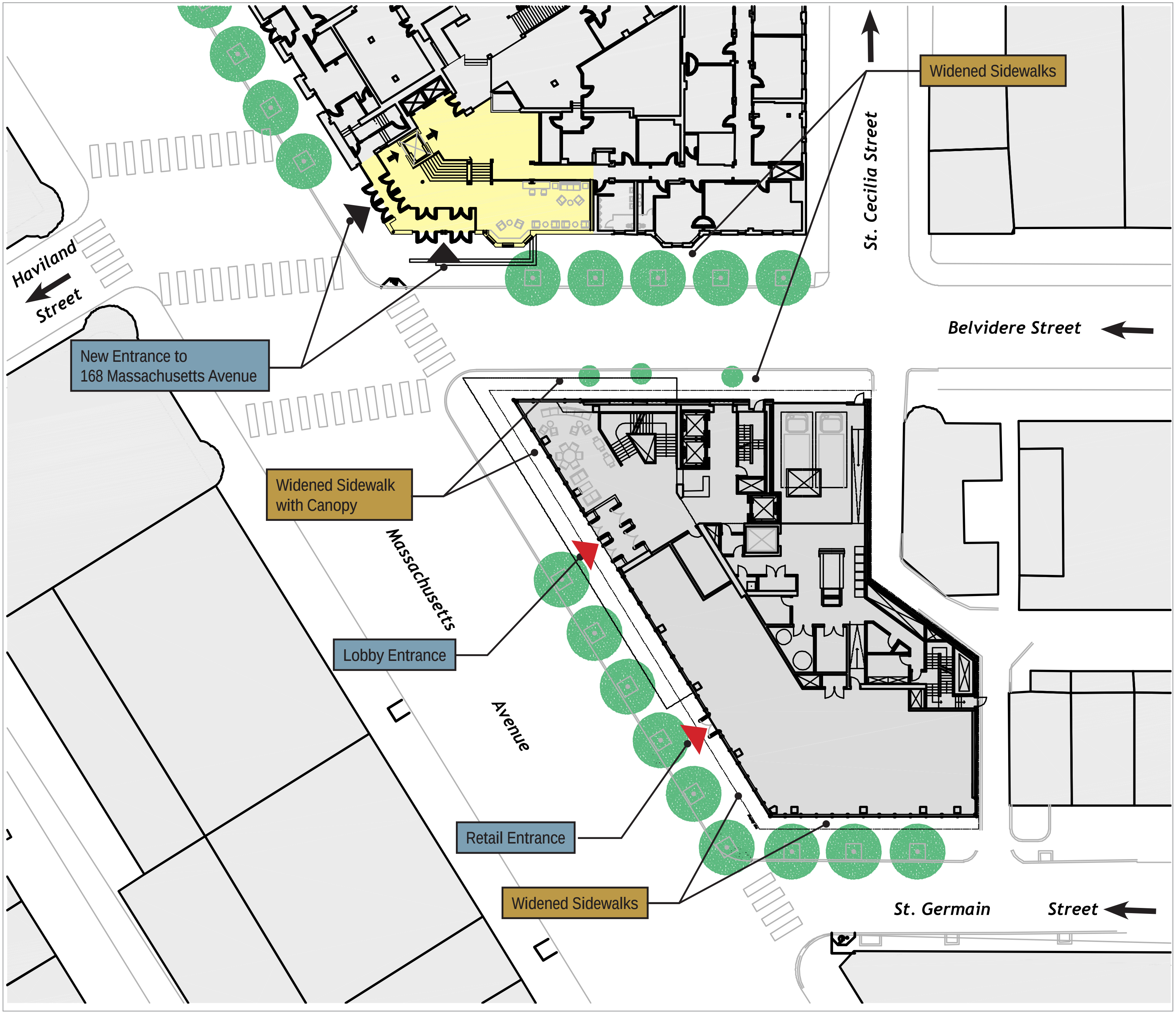

Figure 12.5-1
168 Massachusetts Ave
Site Plan

Vanasse Hangen Brustlin, Inc.

signals, despite the fact that it is located within a signalized intersection. This results in a hazardous situation where many pedestrians assume that drivers will yield to pedestrians in the crosswalk.

Potential improvements at this location that could be considered in coordination with the BTD and, where appropriate, the MBTA, are illustrated in Figure 12.5-2, and include the following:

1. Consider evaluation of signal timing/phasing for potential efficiencies, potentially reducing vehicle and pedestrian delays.

2. Consider pedestrian signal heads at the Haviland Street crosswalk and incorporate in the pedestrian phase to provide control of that crosswalk.

3. Consider displaying Walk signals for Belvidere Street and Haviland Street crosswalks concurrently with Massachusetts Avenue vehicle Green phase, as well as including them in the existing exclusive pedestrian phase, to improve PLOS.

4. Consider curb extensions to enlarge pedestrian waiting areas, reduce crosswalk lengths and improve visibility and safety for pedestrians.

5. Consider realigning the Massachusetts Avenue crosswalks on the north and south sides of the intersection to a perpendicular orientation to provide increased coverage of pedestrian desire lines, and also shorten crosswalk.

6. Consider expanding and repositioning the existing northbound bus stop on Massachusetts Avenue to eliminate the current overlap with the Massachusetts Avenue crosswalk at Belvidere Street.[1]

All sidewalks abutting and in the immediate vicinity the 168 Massachusetts Avenue site will be reconstructed at the completion of project construction.

Further pedestrian and safety improvements will be explored in association with other IMP projects, including opportunities for widened sidewalks. In relation to the Crossroads project, several potential improvements have been identified at the Massachusetts Avenue/Boylston Street and Boylston Street/Saint Cecilia intersection. At the former intersection, potential improvements include signal timing/phasing changes to reduce vehicle and pedestrian delays, and the provision of curb extensions at selected locations to enlarge pedestrian waiting areas, reduce crosswalk lengths and improve visibility and safety

[1] The MBTA is currently performing an evaluation of potential improvements to the #1 bus route, which may include consolidation and/or relocation of bus stops.

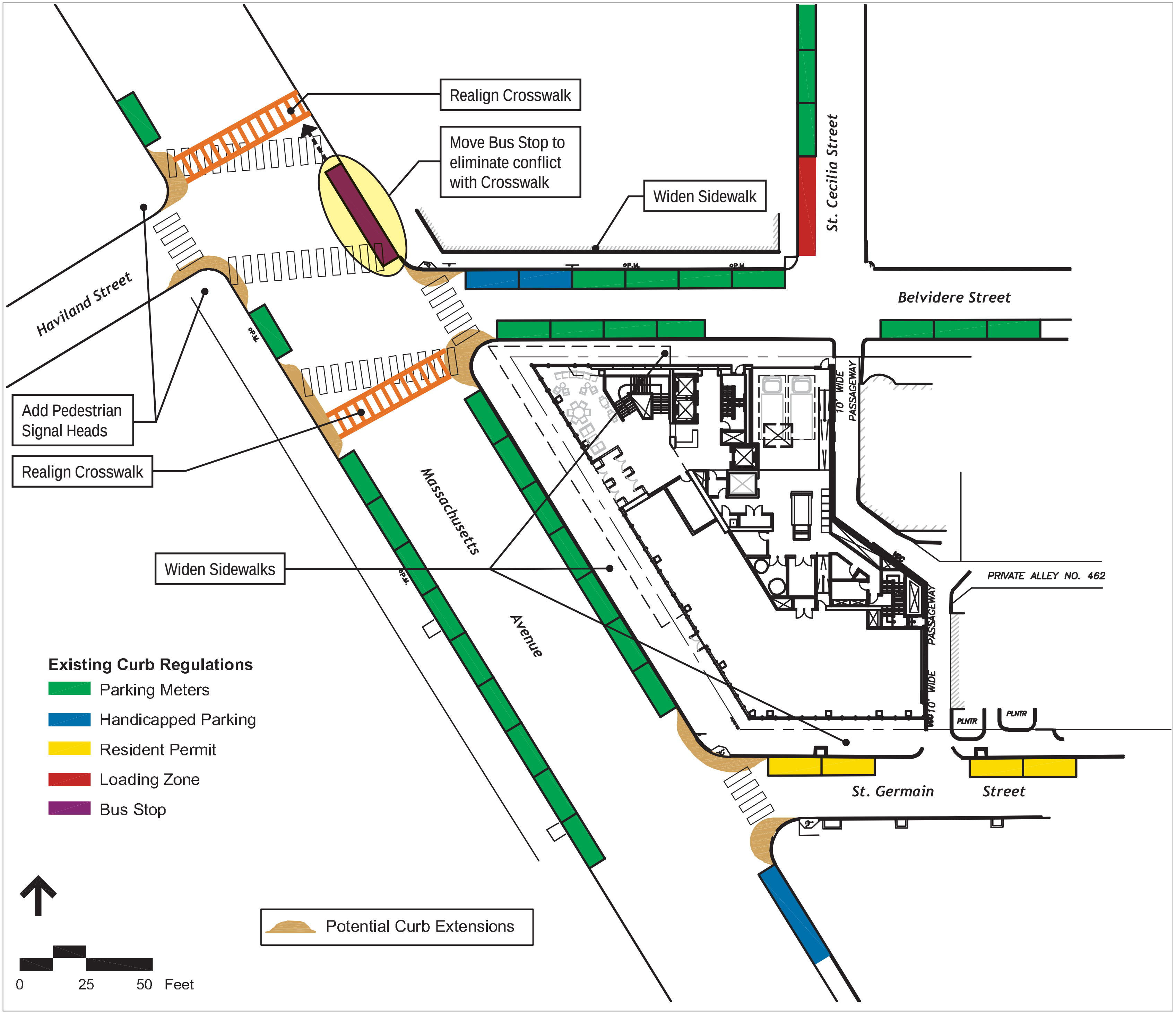

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Figure 12.5-2
168 Massachusetts Ave
Potential Pedestrian
Improvements

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for pedestrians. At the latter intersection, potential improvements include the closure of the initial section of Cambria Street to eliminate the existing pedestrian island and consolidate the existing two pedestrian crossings into one ADA compliant crosswalk.

12.5.6 Bicycle Accommodations

Bicycle racks are provided in various locations throughout the campus. In combination, there are currently more than 130 bicycle racks on Berklee property and nearby on City sidewalks. Indeed, Berklee recently collaborated with the Boston Bikes program and invested $5,000 to install approximately 30 new bicycle racks on City sidewalks around the campus. However, observations of the bicycle racks indicate heavy usage, particularly in front of the Berklee Performance Center at 136 Massachusetts Avenue, evidenced by bicycles often being locked to railings and street furniture.

New bicycle racks will be provided on the sidewalks in the vicinity of the project to provide for the short-term parking needs of the new building and to relieve the heavy existing demand in nearby locations. The substantial widening of the sidewalks around the project will yield significantly increased space for these racks, and Berklee will work with the BTD and BRA to identify specific locations.

In addition, Berklee is planning to build a centralized secure outdoor bike storage area for approximately 125 bicycles, located just east of and behind the existing 130 Massachusetts Avenue building. The facility would be fenced-in and have card access.

12.5.7 Loading and Servicing

There will be some increased delivery and trash removal needs associated with the new residential tower and the relocated and expanded dining facilities at the project. Servicing needs in the vicinity of the project site, based on existing delivery characteristics, are summarized in Table 12.5-1, including frequency, time of day, truck type, and current on-street loading location.

Table 12.5-1 Servicing Summary for the Project

Existing On-Street Location	Vehicle Type	Frequency	Time
Cambria Street	Trash Compactor	1 per week	
Belvidere Street	SYSCO Tractor-Trailer	4 per week	12-1 pm (Monday) 6-7 am (rest of week)
Saint Cecilia Street	Hood Box Truck	3 per week	5 -6 am
Saint Cecilia Street	Sid Warner	Daily	6-7 am

Table 12.5-1 Servicing Summary for the Project (continued)

Existing On-Street Location	Vehicle Type	Frequency	Time
Saint Cecilia Street	Bread van/small truck	Daily	
Saint Cecilia Street	Uniform van/small truck	1 per week	4 am (Wednesday)
Saint Cecilia Street	Pepsi small truck	1 per week	
Massachusetts Avenue	Pepsi truck for vending	3 per week	

As shown in the site plan (Figure 12.5-1), the project will include an enclosed, off-street loading dock, which will eliminate the majority of on-street loading activity, with the exception of food deliveries by SYSCO tractor-trailer trucks. In such constrained urban situations, it is rarely possible to accommodate tractor-trailer trucks off-street, and indeed the limited frequency of such deliveries at this location does not warrant the inefficiency of providing off-street accommodation, even if it could be accommodated physically.

The loading dock will include two bays, capable of accommodating two 30-foot single unit trucks simultaneously, albeit that both bays will be occupied at the same time on only limited occasions. The loading dock will be more than adequate to accommodate the majority of servicing needs, although deliveries and pick-up by USPS, UPS and FedEx small trucks and vans are expected to continue to be made on-street, consistent with current practice throughout the downtown area. The SYSCO tractor-trailer will continue to stage deliveries on Belvidere Street at the eastern end of the site frontage, as it does today.

Maneuvering needs for trucks entering and leaving the loading dock are illustrated in Figures 12.5-3, 12.5-4 and 12.5-5. Figure 12.5-3 shows pick-up by a 35-foot trash truck, while Figures 12.5-4 and 12.5-5 show 30-foot single unit trucks using both loading dock bays. As shown, to accommodate truck maneuvers, it will be necessary to eliminate three existing parking meter spaces on the north side of Belvidere Street. In addition, it is recommended that one parking meter space be eliminated on the south side of Belvidere Street to provide additional length for a tractor-trailer truck to stage deliveries on-street without encroaching on the entrance to the alley at the rear of the building.

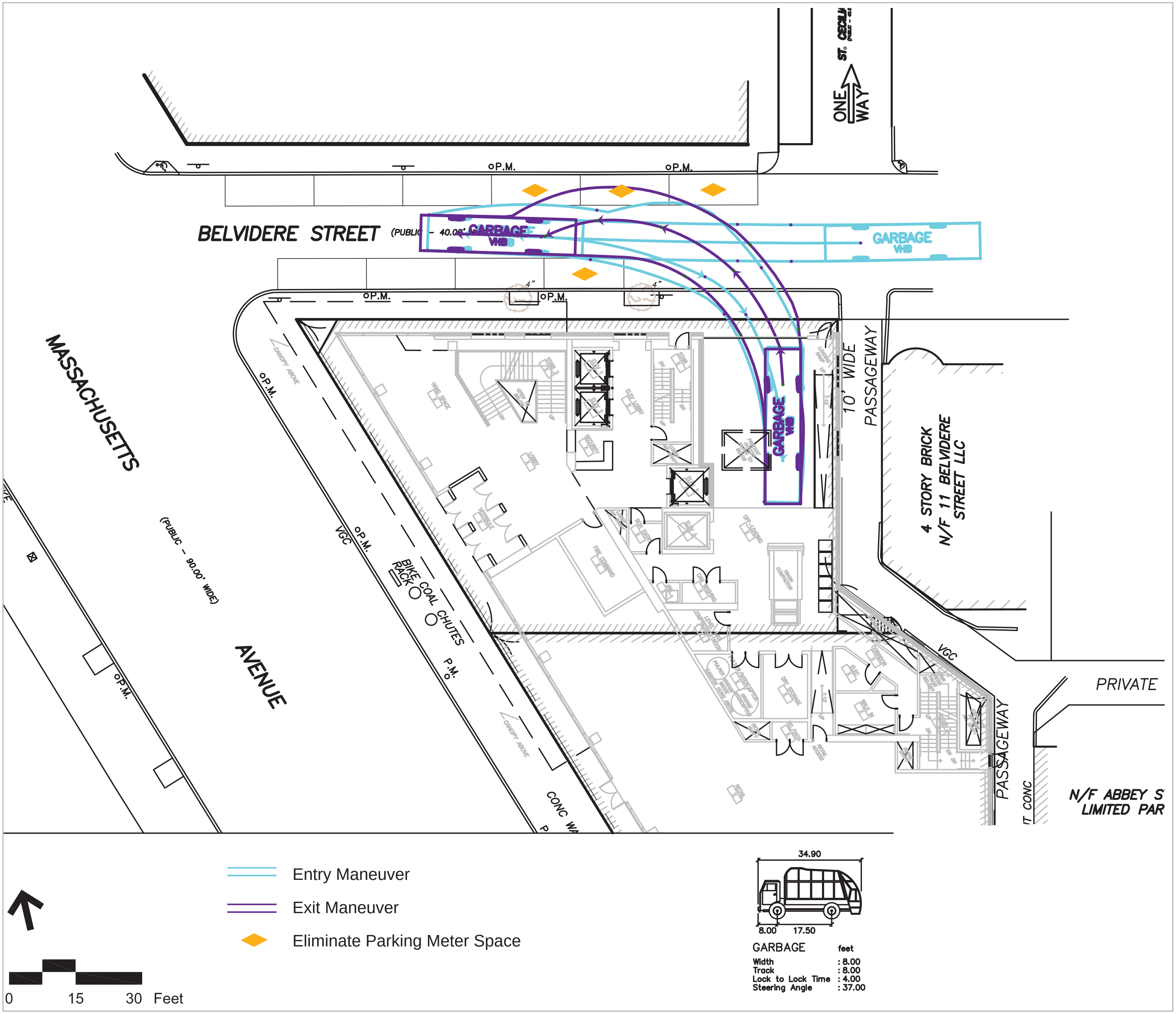

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Figure 12.5-3
168 Massachusetts Ave
Loading Truck Maneuvers
Garbage Truck

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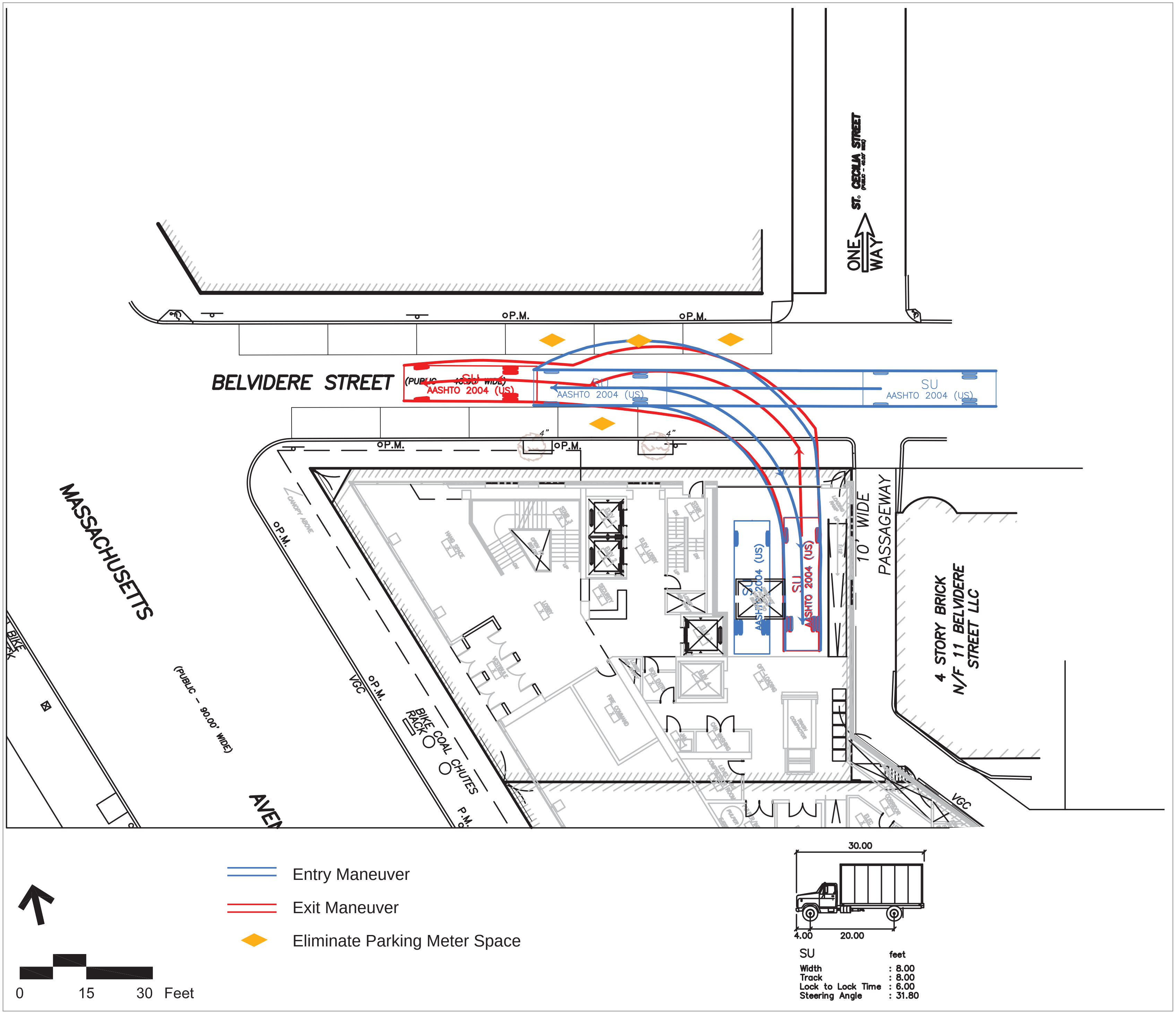

Figure 12.5-4
168 Massachusetts Ave
Loading Truck Maneuvers
Single Unit Truck-Bay 1

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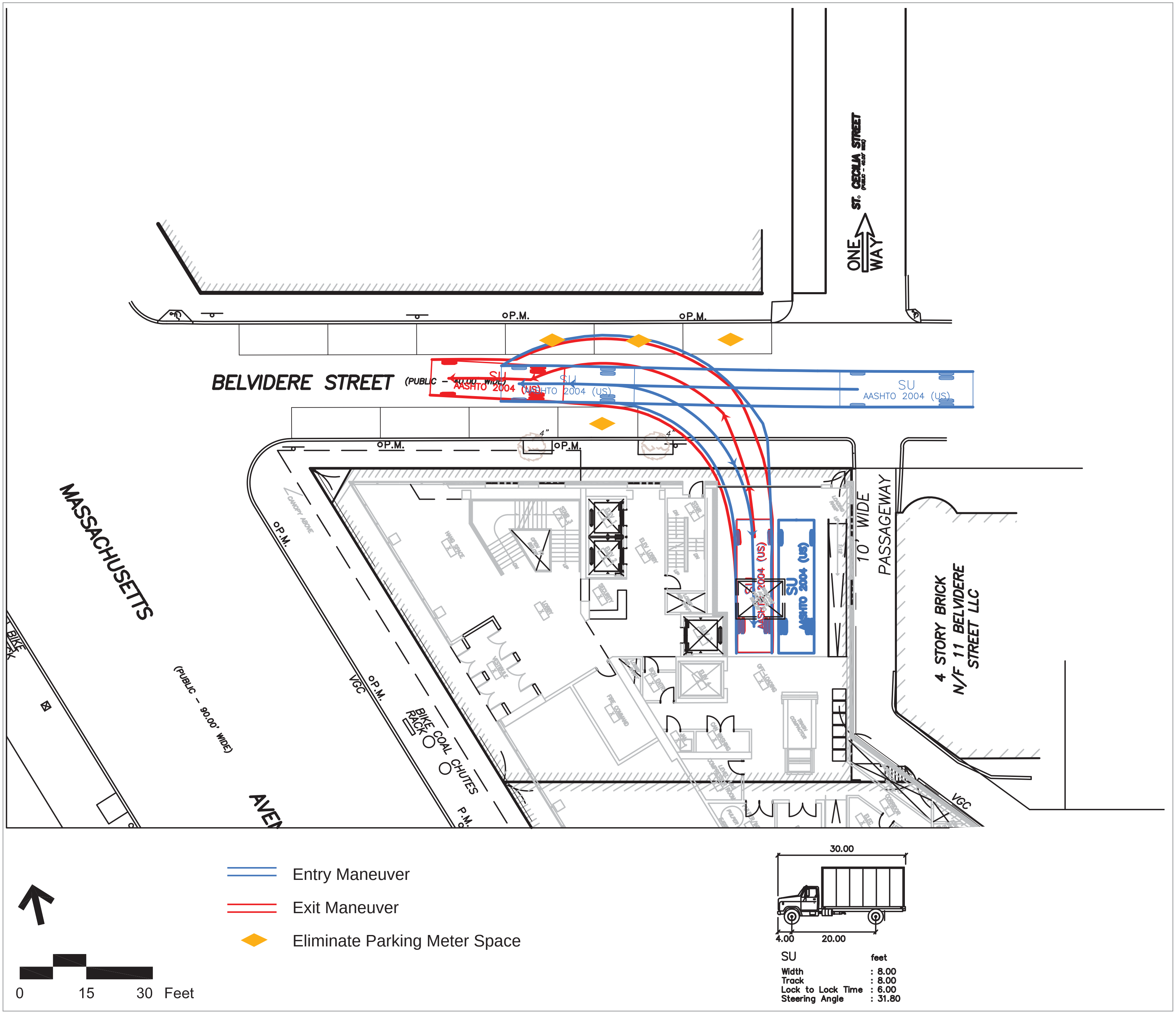

Figure 12.5-5
168 Massachusetts Ave
Loading Truck Maneuvers
Single Unit Truck-Bay 2

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Finally, the project will introduce move-in/move-out activity associated with the new student residences. As described in Section 7.5.3.1 of the IMP, move-in activity typically occurs during Labor Day weekend at the beginning of September, while move-out activity occurs more spread out during early May as students have completed their final examinations. A specific plan will be developed for the project to manage these operations and minimize the impact to local streets. It is anticipated that Berklee will rent parking meters spaces in the vicinity of the building for the two or three days during the school year when move-in/move-out occurs. Move-in/move-out will be restricted to certain times of day, depending on day-of-week. Campus security details will be on duty, and the front and side of the building will be kept clear for move-in/move-out operations. Students will be required to find street or garage parking once their vehicle has been unloaded into the residence hall.

12.5.8 Transportation Demand Management

Berklee's current Transportation Demand Management (TDM) initiatives are described in Section 7.5.2 of the IMP. Berklee will continue to promote and improve its TDM program to benefit its faculty, staff and students. In an effort to discourage single-occupancy vehicle use, Berklee will continue to encourage commuters to use alternative modes of transportation, including public transit, carpooling, bicycling and walking. As no new parking will be provided as part of the IMP, and no material increase in auto-trip generation is expected, the benefits of TDM programs will continue to reduce Berklee-related traffic already on the local roadway network, yielding further improvements in mode choice as have been accomplished over the past five years or so. This on-going strategy will apply to and will benefit the project as it does for the entire IMP.

12.6 Environmental Protection Component

12.6.1 Wind

12.6.1.1 Introduction

A pedestrian wind study was conducted on the proposed project.

The study involved wind simulations on a 1:400 scale model of the proposed building and surroundings. These simulations were conducted in one of RWDI's boundary-layer wind tunnels for the purpose of quantifying local wind speed conditions and comparing to appropriate criteria for gauging wind comfort in pedestrian areas. The criteria recommended by the Boston Redevelopment Authority were used in this study. The following paragraphs include a description of the methods and the results of the wind tunnel simulations.

The wind analysis shows that wind conditions with and without the project are similar and are generally suitable for walking, standing or sitting. With the construction of the project, annual winds will not worsen at any location to uncomfortable or dangerous.

12.6.1.2 Overview

Major buildings, especially those that protrude above their surroundings, often cause increased local wind speeds at the pedestrian level. Typically, wind speeds increase with elevation above the ground surface, and taller buildings intercept these faster winds and deflect them down to the pedestrian level. The funneling of wind through gaps between buildings and the acceleration of wind around corners of buildings may also cause increases in wind speed. Conversely, if a building is surrounded by others of equivalent height, it may be protected from the prevailing upper-level winds, resulting in no significant changes to the local pedestrian-level wind environment. The most effective way to assess potential pedestrian-level wind impacts around a proposed new building is to conduct scale model tests in a wind tunnel.

The consideration of wind in planning outdoor activity areas is important since high winds in an area tend to deter pedestrian use. For example, winds should be light or relatively light in areas where people would be sitting, such as outdoor cafes or playgrounds. For bus stops and other locations where people would be standing, somewhat higher winds can be tolerated. For frequently used sidewalks, where people are primarily walking, stronger winds are acceptable. For infrequently used areas, the wind comfort criteria can be relaxed even further.

12.6.1.3 Methodology

Information concerning the project site and surroundings was derived from: site photographs; information on surrounding buildings and terrain; and site plans and elevations of the proposed development provided by representatives of William Rawn Associates Architects. The following configurations were simulated:

- No Build: includes future surroundings with existing buildings on the 168 Massachusetts Avenue site; and

- Build: includes the proposed 168 Massachusetts Avenue and future surroundings.

As shown in Figures 12.6-1 and 12.6-2, the wind tunnel model included the proposed development and relevant surrounding buildings and topography within a 1,600-foot radius of the study site. As requested by the BRA, the surrounding buildings include the proposed Christian Science Plaza developments, the Civic Vision massing for Air Rights Parcels 12 and 15, the current Trinity proposal for Parcel 13, and the proposed IMP massing of the other two Berklee IMP Projects (Crossroads and 161-171 Massachusetts Avenue).

The mean speed profile and turbulence of the natural wind approaching the modeled area were also simulated in RWDI's boundary layer wind tunnel. The scale model was equipped with 71 specially designed wind speed sensors that were connected to the wind tunnel's data acquisition system to record the mean and fluctuating components of wind

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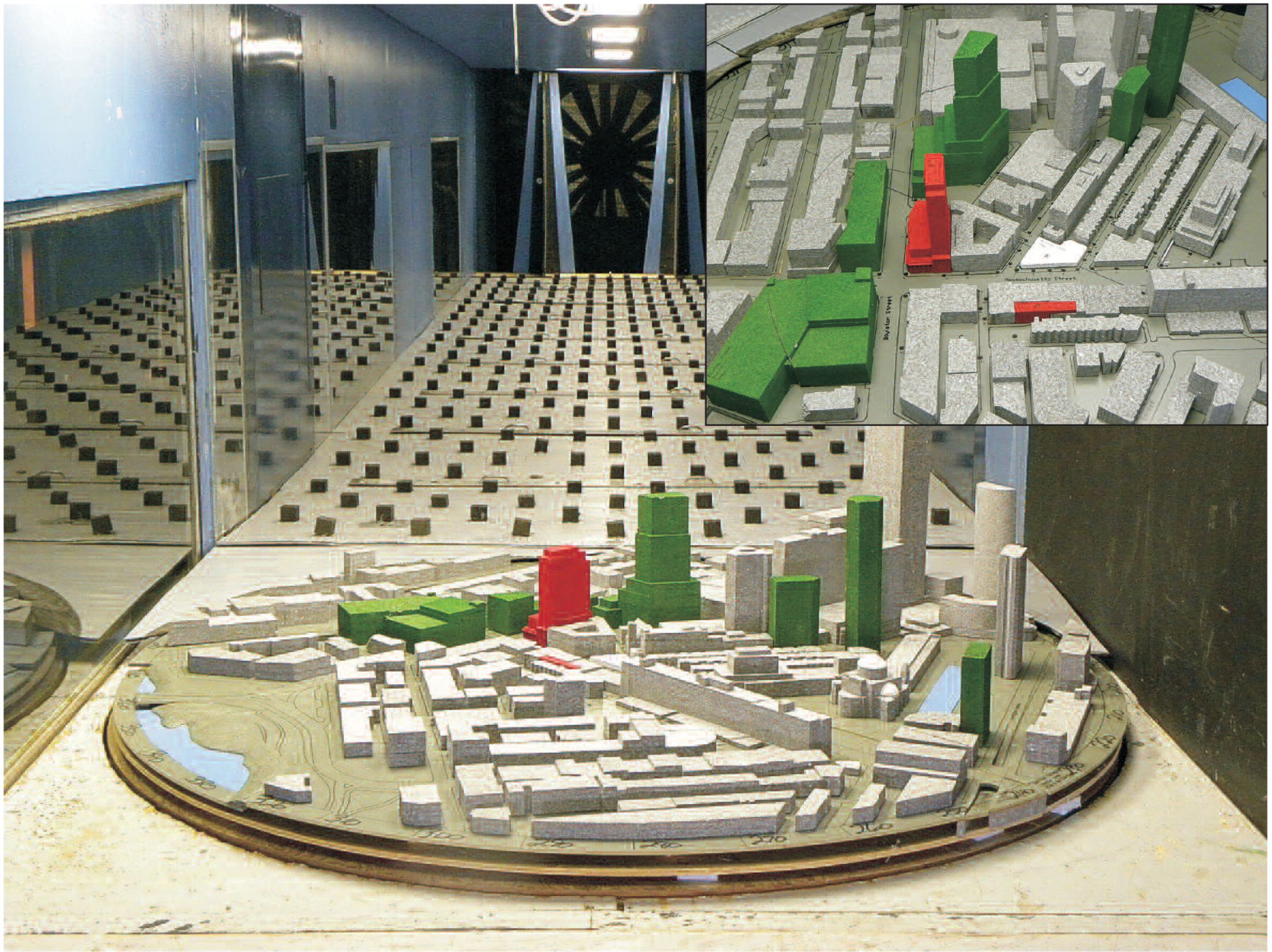

Figure 12.6-1
Wind Tunnel Study Model - No Build

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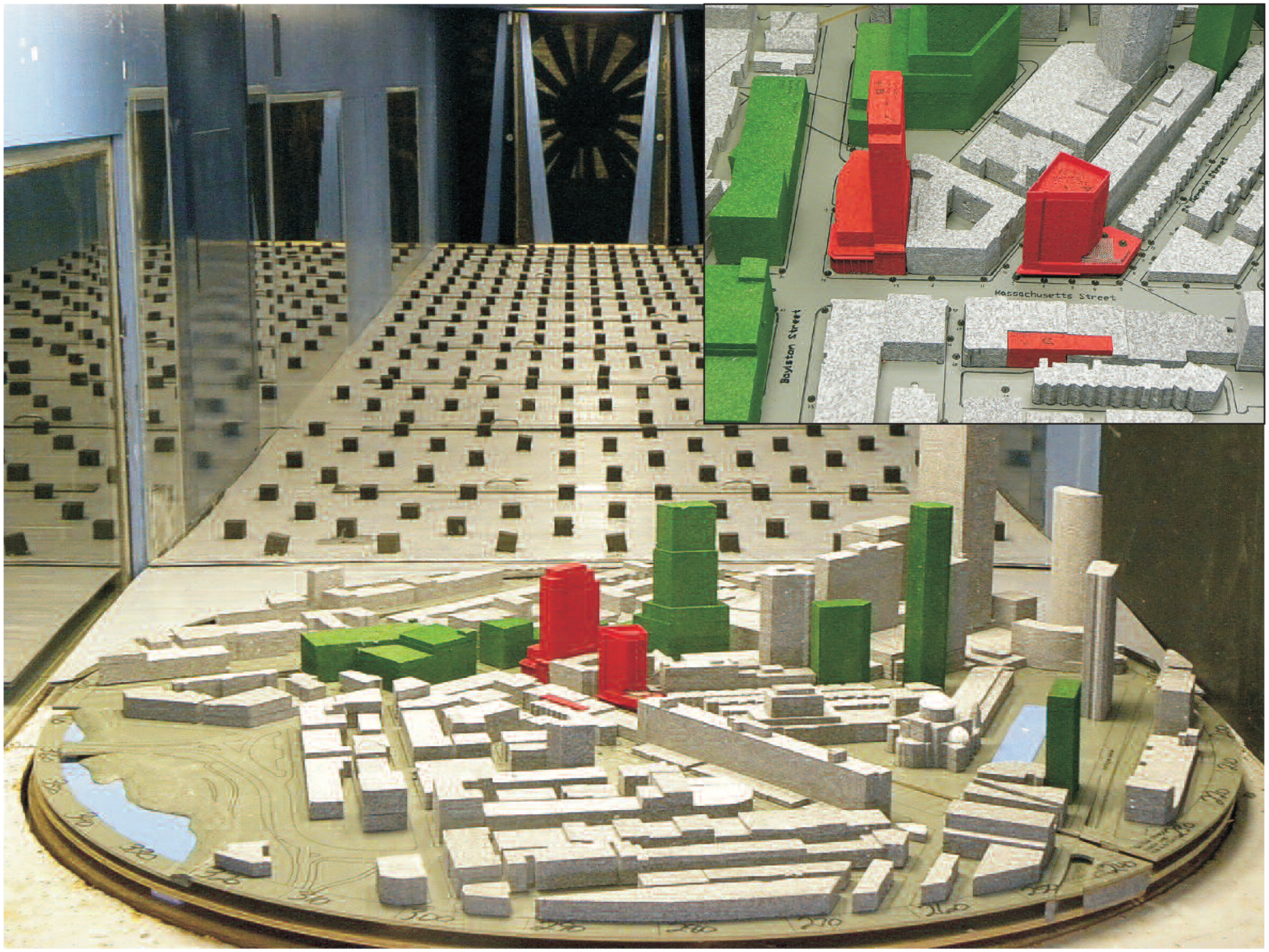

Figure 12.6-2
Wind Tunnel
Study Model - Build

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speed at a full-scale height of five feet above grade in pedestrian areas throughout the study site. Wind speeds were measured for 36 wind directions, in 10 degree increments, starting from true north. The measurements at each sensor location were recorded in the form of ratios of local mean and gust speeds to the reference wind speed in the free stream above the model. The results were then combined with long-term meteorological data, recorded during the years 1973 to 2008 at Boston's Logan International Airport, in order to predict full scale wind conditions. The analysis was performed separately for each of the four seasons and for the entire year, as required by the BRA.

Figures 12.6-3, 12.6-4 and 12.6-5 present "wind roses", summarizing the annual and seasonal wind climates in the Boston area, based on the data from Logan Airport. The left-hand wind roses, in Figures 12.6-3 and 12.6-4, are based on all observed wind readings for the given season, while the right-hand wind roses are based on strong winds for one percent of the time. The upper wind roses in Figure 12.6-3, for example summarize the spring (March, April, and May) wind data. In general, the prevailing winds at this time of year are from the west-northwest, northwest, west, southwest and east. In the case of strong winds, however, the most common wind direction is northeast and west.

On an annual basis (Figure 12.6-5), the most common wind directions are those between southwest and northwest. Winds from the east and east-southeast are also relatively common. In the case of strong winds, northeast and west-northwest are the dominant wind directions.

This study involved state-of-the-art measurement and analysis techniques to predict wind conditions at the study site. Nevertheless, some uncertainty remains in predicting wind comfort. For example, the sensation of comfort among individuals can be quite variable. Variations in age, individual health, clothing, and other human factors can change a particular response of an individual. The comfort limits used in this report represent an average for the total population and are typically used for BRA required wind studies as described below. Also, unforeseen changes in the project area, such as the construction or removal of buildings, can affect the conditions experienced at the site. Finally, the prediction of wind speeds is necessarily a statistical procedure. The wind speeds reported are for the frequency of occurrence stated (one percent of the time). Higher wind speeds will occur but on a less frequent basis.

12.6.1.4 Pedestrian Wind Comfort Criteria

The 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

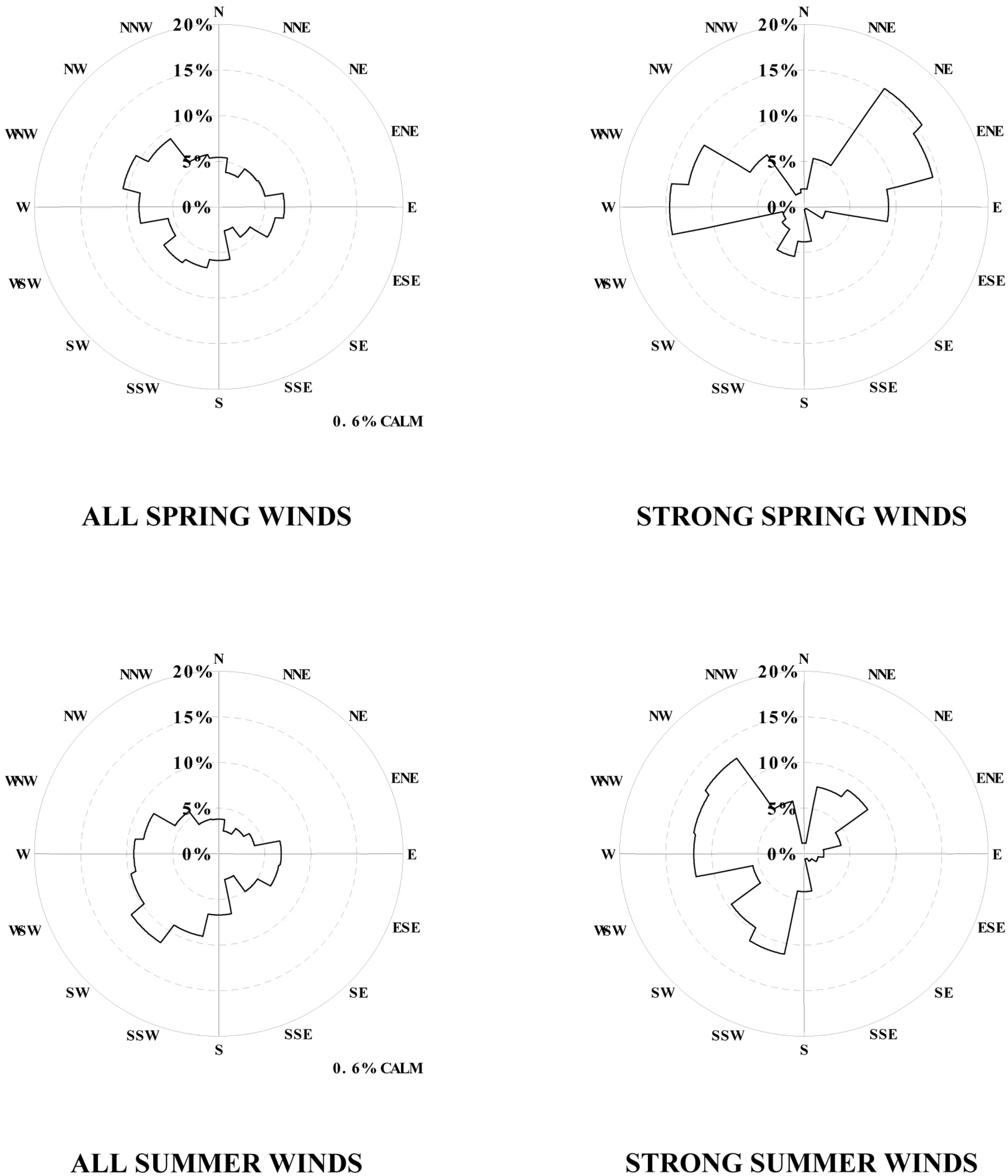

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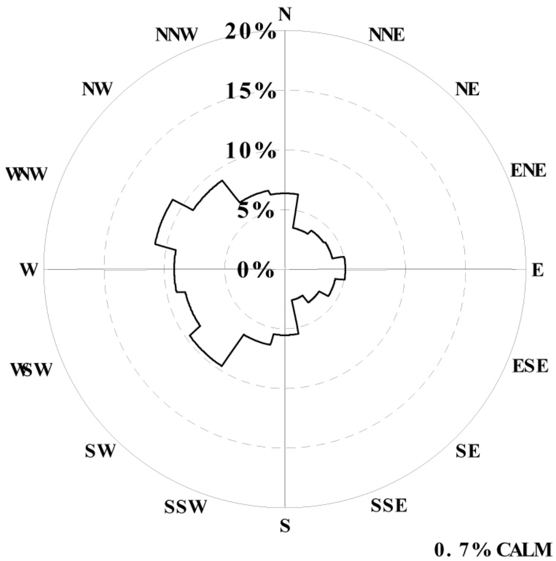
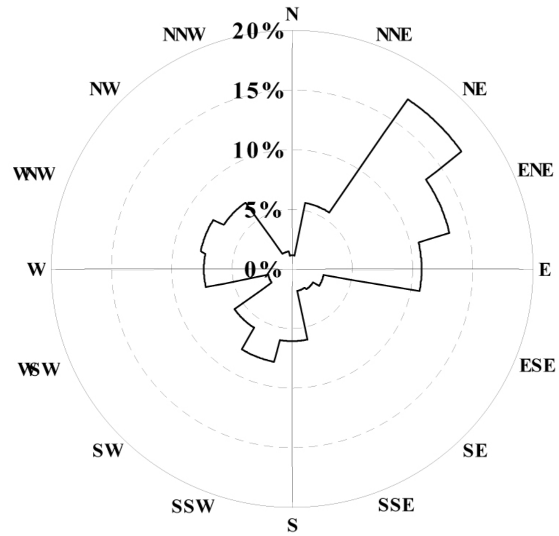
Figure 12.6-3

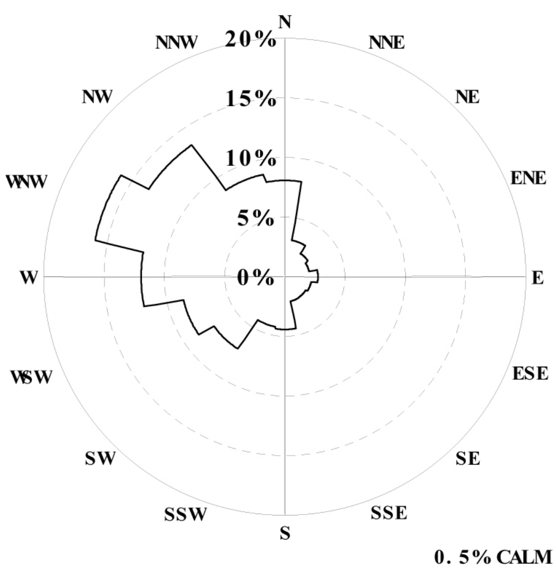
Directional Distribution of Spring and Summer Winds – Logan International Airport (1945-1998)



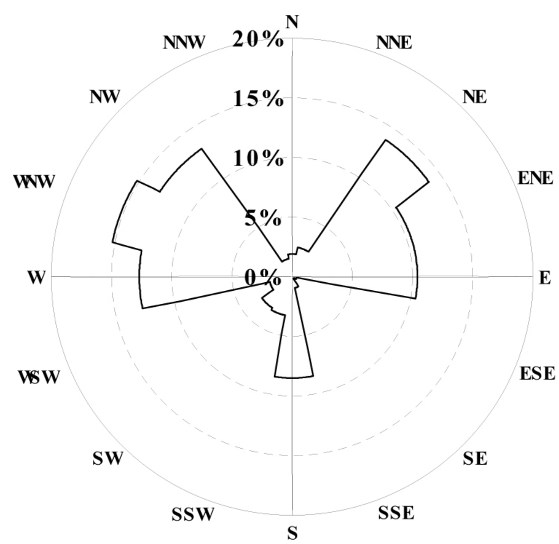
ALL FALL WINDS



STRONG FALL WINDS



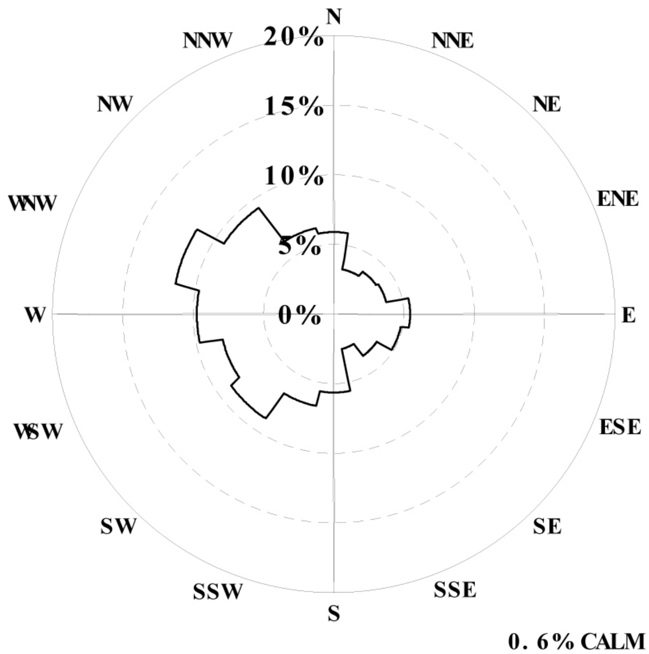
ALL WINTER WINDS



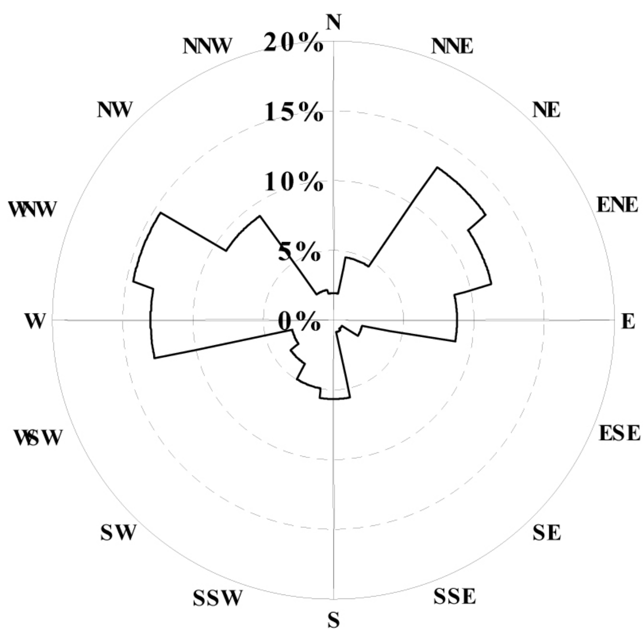
STRONG WINTER WINDS

Figure 12.6-4

Directional Distribution of Fall and Winter Winds – Logan International Airport (1945-1998)



ALL ANNUAL WINDS



STRONG ANNUAL WINDS

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Figure 12.6-5

Directional Distribution of Annual Winds – Logan International Airport (1945-1998) determine the acceptability of specific locations is based on the work of Melbourne[2]. This set of criteria is used to determine the relative level of pedestrian wind comfort for activities such as sitting, standing, or walking (see Table 12.6-1). The criteria are expressed in terms of benchmarks for the one-hour mean wind speed exceeded one percent of the time (i.e., the 99-percentile mean wind speed).

Table 12.6-1 BRA Mean Wind 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.

The wind climate found in a typical downtown location in Boston is generally comfortable for the pedestrian use of sidewalks and thoroughfares and meets the BRA effective gust velocity criterion of 31 mph. However, without any mitigation measures, this wind climate is frequently unsuitable for more passive activities such as sitting.

12.6.1.5 Test Results

Appendix G presents the mean and effective gust wind speeds for each season as well as annually. Figures 12.6-6 and 12.6-7 shows the wind comfort conditions at each wind measurement location based on the annual winds. In Boston, the summer and fall winds tend to be more comfortable than the annual winds, while the winter and spring winds are less comfortable than the annual winds. The following summary of pedestrian wind comfort is based on the annual winds for each configuration tested, except where noted below in the text.

The wind analysis shows that wind conditions with and without the project are similar and are generally suitable for walking, standing or sitting. With the construction of the project, annual winds will not worsen at any location to uncomfortable or dangerous. The uncomfortable wind conditions at Locations 13, 14, 17, 18, 24, 29, 47 and 58 are anticipated to exist in both the No Build and Build conditions without any mitigation measures designed into nearby buildings.

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

Figure 12.6-6
Pedestrian Wind Conditions - Build

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Berklee college of music

Institutional Master Plan

Figure 12.6-7

Pedestrian Wind Conditions - No Build

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Project Entrances and Sidewalks (Locations 1 through 7)

No Build

With the existing building in place (at the project site), wind conditions were predicted to be suitable for standing at Locations 1 through 5 and suitable for sitting at Locations 6 and 7 on an annual basis (see Figure 12.6-6).

The effective gust criterion was not exceeded annually or for any season.

Build

With the proposed 168 Massachusetts Avenue project in place, wind conditions on an annual basis at Locations 1 through 7 were suitable for walking or better. Specifically, wind conditions at the entrances (Locations 2 and 4) were predicted to be suitable for standing or walking on an annual basis at the project site. Wind conditions along the sidewalks (Locations 1, 3, 5, 6 and 7) were suitable for walking or better on an annual basis.

The effective gust criterion was not exceeded annually or for any season.

Crossroads Entrances and Sidewalks (Locations 8 through 19)

No Build

Wind conditions at the entrances (Locations 13 and 14) to the future Crossroads building were predicted to be uncomfortable on an annual basis without the construction of the 168 Massachusetts Avenue project (assuming no mitigation measures being employed). Wind conditions were predicted to be suitable for sitting or standing at Locations 9, 10, and 15 on an annual basis (see Figure 12.6-6). Locations 8, 11, 12, 16 and 19 were suitable for walking and Locations 17 and 18 were predicted to be uncomfortable on an annual basis, respectively.

The effective gust criterion was exceeded at Location 18 annually, and during the spring and winter seasons, at Location 17 in the winter only (see Appendix G).

Build

Pedestrian level wind conditions are similar for both the No-Build and Build conditions. The construction of the 168 Massachusetts Avenue project does not cause additional uncomfortable or unacceptable pedestrian wind conditions on an annual basis.

Wind conditions along the sidewalks (Locations 8 through 12, 15, 16 and 19) were suitable for walking or better annually. Wind conditions were predicted to remain uncomfortable at Locations 13, 14, 17 and 18, and suitable for sitting, standing or walking annually at Locations 8 through 12, 15, 16, and 19 on an annual basis (see Figure 12.6-7).

The effective gust criterion was exceeded at Location 14 during the winter and at Locations 17 and 18 during the winter and spring (see Appendix G) without specific mitigation.

Massachusetts Avenue and Boylston Street (Locations 20, 21, 22, 40, 41, 42, 45 through 63)

No Build

Wind conditions were generally suitable for sitting, standing or walking annually, with the exception of Locations 47 and 58 along Massachusetts Avenue, which were overall predicted to be uncomfortable except during the summer without specific mitigation.

Unacceptable gust wind speeds were predicted for Location 47 during the winter (see Appendix G).

Build

Similar to the No Build conditions, with the construction of the 168 Massachusetts Avenue project, winds generally suitable for sitting, standing or walking were predicted annually, with the exception of Locations 47 and 58, which were predicted to be uncomfortable on an annual basis.

The effective gust criterion was exceeded at Location 47 during the winter, similar to the No Build conditions, without specific mitigation.

Off-site Walkways (Locations 23 through 39, 43, 44, 64 through 71)

No Build

Annual wind conditions were generally suitable for sitting, standing or walking in the surrounding area. The exceptions were along Scotia and Belvidere Streets (Locations 23, 24 and 29), where uncomfortable winds were predicted annually and/or during the spring and winter seasons.

Unacceptable gust wind speeds were predicted for Locations 23 and 24 during the winter season without specific mitigation.

Build

Wind conditions for the Build scenario were similar to the No Build conditions, and were generally suitable for sitting, standing or walking on an annual basis. The exceptions were Locations 24 and 29 where uncomfortable winds conditions were predicted on an annual basis, which is similar to the conditions without the 168 Massachusetts Avenue project. Wind conditions at Location 23 were predicted to be uncomfortable during the spring and winter, but suitable for walking annually.

The project improved wind conditions at Locations 23 and 24 for all seasons for the equivalent gust criterion, an improvement from the No Build conditions.

12.6.1.6 Summary

Wind conditions at the project were predicted to be suitable for walking or better on an annual basis. The design team has included a canopy which extends beyond the tower in some areas, improving pedestrian wind conditions. In addition to the horizontal canopies, a setback (at Locations 2 and 4) has been included in the current design to help reduce horizontal winds on the entrances along Massachusetts Avenue.

The wind analysis shows that wind conditions with and without the project are similar and are generally suitable for walking, standing or sitting. With the construction of the project, annual winds will not worsen at any location to uncomfortable or dangerous.

In addition, the annual gust speed will not worsen to unacceptable at any of the studied locations. The annual gust speed will improve from unacceptable to acceptable at one location.

12.6.2 Shadow

12.6.2.1 Introduction and Methodology

As is typically required by the BRA, a shadow impact analysis was conducted to investigate shadow impacts from the project during three time periods (9:00 am, 12:00 noon, and 3:00 pm) during the summer solstice (June 21), autumnal equinox (September 21), vernal equinox (March 21), and the winter solstice (December 21). In addition, shadow studies were conducted for the 6:00 pm time period during the summer solstice and autumnal equinox.

The shadow analysis presents the existing shadow and new shadow that would be created by a building constructed as-of-right on the site, as well as net new shadow beyond the as-of-right shadow from the proposed project, illustrating the incremental impact of the project. The analysis focuses on public open spaces, adjacent neighbors such as Saint Cecilia Church, and the sidewalks adjacent to and in the vicinity of the project site. As the project will create a new, taller structure that is different from what currently exists on the site, new areas of shadow are inevitable. Shadows have been determined using the applicable Altitude and Azimuth data for Boston, as is typically requested by the BRA.

As requested by the BRA, the base "existing condition" includes buildings proposed on the Turnpike Air Rights parcels and those proposed on the Christian Science Plaza.

Figures showing the as-of-right shadow and net new shadow from the project are provided in Appendix C.

12.6.2.2 Vernal Equinox (March 21)

At 9:00 am, shadow will be cast in a northwesterly direction. As-of-right shadow cast from 168 Massachusetts Avenue will be cast onto portions of Massachusetts Avenue and Belvidere Street and their sidewalks. The net new shadow extends beyond the as-of-right shadow and is cast onto a portion of Massachusetts Avenue and its western sidewalk, as well as a small portion of Haviland Street. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

At 12:00 pm, shadows will be cast in a northerly direction. As-of-right shadow is cast across a portion of Belvidere Street and its sidewalks, and a minor portion of Saint Cecilia Street and its western sidewalk. Net new shadow from the building will generally be cast onto the Berklee-owned 150 Massachusetts Avenue building. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

At 3:00 pm, shadows will be cast in a northeasterly direction. As-of-right shadow will be cast across a minor portion of Belvidere Street and its northern sidewalk, a small portion of Saint Cecilia Street and its sidewalks, as well as a portion of Saint Cecilia Church. Net new shadow will be cast onto minor portions of Belvidere Street and its sidewalks, Saint Cecilia Street and its sidewalks, and portions of Saint Cecilia Church. No new shadow will be cast on open spaces in the surrounding area.

12.6.2.3 Summer Solstice (June 21)

At 9:00 am, shadows will be cast in a westerly direction. As-of-right shadow and net new shadow will be cast across Massachusetts Avenue and its sidewalks. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

At 12:00 pm, shadows will be cast in a northerly direction. As-of-right shadow will be cast across a minor portion of Belvidere Street and its southern sidewalk. Net new shadow will be cast across Belvidere Street and its northern sidewalk, as well as a portion of Massachusetts Avenue’s eastern sidewalk in front of the building. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

At 3:00 pm, shadows will be cast in a northeasterly direction. As-of-right shadow will be cast across a small portion of Belvidere Street and its southern sidewalk. Net new shadow will be cast across a portion of Belvidere Street and its northern sidewalk, as well as a minor portion of Saint Cecilia Street and its sidewalks. Net new shadow may also be cast onto a portion of the southern façade of Saint Cecilia Church. No new shadow is cast on open spaces in the surrounding area.

At 6:00 pm, shadows will be cast in an easterly direction. As-of-right and net new shadow will be cast onto a portion of Belvidere’s Street southern sidewalk. Additional shadow will generally fall onto nearby rooftops. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

12.6.2.4 Autumnal Equinox (September 21)

At 9:00 am, shadows will be cast in a northwesterly direction. As-of-right shadow will be cast across Massachusetts Avenue and its sidewalks. Net new shadow will be cast across Massachusetts Avenue and its sidewalks, a minor portion of Haviland Street, and a portion of the open space at 7 Haviland Street. No new shadow will be cast on Saint Cecilia Church.

At 12:00 pm, shadows will be cast in a northerly direction. As-of-right shadow will be cast across a portion of Belvidere Street and its northern sidewalk. Net new shadow will only fall on the roof of 150 Massachusetts Avenue. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

At 3:00 pm, shadows will be cast in a northeasterly direction. As-of-right shadow will be cast across a minor portion of Belvidere Street and its northern sidewalk, a small portion of Saint Cecilia Street and its sidewalks, as well as a portion of Saint Cecilia Church. The as-of-right shadows will be extended in these same areas with the net new shadow. No new shadow will be cast on open spaces in the surrounding area.

At 6:00 pm, most of the area will be in shadow. As-of-right and net new shadow will fall across rooftops in the surrounding area, including a small portion of Saint Cecilia Church. No new shadow will be cast on open spaces in the surrounding area.

12.6.2.5 Winter Solstice (December 21)

The winter solstice creates the least favorable conditions for sunlight in New England. The sun angle during the winter is lower than in any other season, causing the shadows in urban areas to elongate and be cast onto large portions of the surrounding area.

At 9:00 am during the winter solstice, as-of-right shadow will be cast onto Massachusetts Avenue and its sidewalks. Net new shadow will be cast onto small portions of Belvidere Street and Boylston Street, as well as their sidewalks. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

At 12:00 pm, shadows will be cast in a northerly direction. As-of-right shadow will be cast onto small portions of Belvidere Street and its northern sidewalk, and Saint Cecilia Street and its northern sidewalk. Net new shadow will only fall onto the rooftop of 150 Massachusetts Avenue. No new shadow is cast on open spaces in the surrounding area or Saint Cecilia Church.

At 3:00 pm, much of the site and surrounding area is already in existing shadow. As-of-right shadow will be cast onto the rooftops immediately east of the project, as well as a minor portion of Saint Cecilia Church. Net new shadow will be cast onto rooftops, including 150 Massachusetts Avenue and Saint Cecilia Church. No new shadow is cast on open spaces in the surrounding area.

12.6.2.6 Conclusions

The shadow analysis looked at the shadow created from a building on the project site built as-of-right, as well as the proposed building. No new shadow will be cast onto surrounding open spaces during 13 of the 14 time periods studied, or on Saint Cecilia Church during nine of the 14 time periods studied.

For both conditions, new shadow was cast onto the surrounding streets and their sidewalks. Shadow is cast onto Saint Cecilia Church five of the 14 time periods studied by a building built as-of-right as well as by the proposed project building. Shadow from the proposed project will cast a shadow on the Berklee-owned open space at 7 Haviland Street during one of 14 time periods studied.

12.6.3 Daylight

12.6.3.1 Introduction and Summary of Analysis

The purpose of the daylight analysis is to estimate the extent to which a proposed project will affect the amount of daylight reaching the streets and the sidewalks in the immediate vicinity of the project site. As is typically required by the BRA, the daylight analysis for the project considers both existing and proposed daylight conditions as well as those of the surrounding area.

The project site is currently occupied by two buildings and the site abuts existing buildings. Although the development of the project will result in increased daylight obstruction at the site over existing conditions, the resulting conditions are typical of a densely developed area and are similar to daylight obstruction values associated with other existing buildings in the vicinity of the project site.

12.6.3.2 Methodology

The daylight analysis was performed using the Boston Redevelopment Authority Daylight Analysis (BRADA) computer program. This program measures the percentage of sky-dome that is obstructed by a project, and is a useful tool in evaluating the net change in obstruction from existing to build conditions at a specific site.

Using BRADA, a silhouette view of the building is taken at ground level from the middle of the adjacent city streets centered on the proposed building. The façade of the building facing the viewpoint, including heights, setbacks, corners and other features, is plotted onto a base map using lateral and elevation angles. The two-dimensional base map generated by BRADA represents a figure of the building in the "sky dome" from the viewpoint chosen. Due to the constraints of the BRADA program, the setbacks of the building may be simplified or the building may be divided into sections in some cases. The BRADA program calculates the percentage of daylight that will be obstructed on a scale of 0% to 100% based on the width of the view, the distance between the viewpoint and the building, and the massing and setbacks incorporated into the design of the building; the lower the number, the lower the percentage of obstruction of daylight from a given viewpoint.

As mentioned, the BRA typically requests that the analysis treats the following elements as controls for data comparison:

- Existing Conditions;
- Proposed Conditions; and
- The Context of the Area.

Viewpoints were chosen along Belvidere Street (Viewpoint 1), Massachusetts Avenue (Viewpoint 2), and St. Germain Street (Viewpoint 3). The daylight analysis examined daylight obstruction from the three locations for the existing and proposed conditions. Additionally, this study considered area context points to provide a basis of comparison to existing conditions in the surrounding area. These area context viewpoints were taken along Belvidere Street (AC1) looking north; Massachusetts Avenue (AC2 and AC3) looking west; and St. Germain Street (AC4) looking north. The viewpoints are illustrated on Figure 12.6-8.

12.6.3.3 Daylight Analysis Results

The results for each viewpoint under each alternative condition are described in Table 12.6-2. Figures 12.6-9 through 12.6-11 illustrate the BRADA results for each analysis and are located at the end of this section.

Table 12.6-2 Viewpoint Locations

Viewpoint Locations		Existing Conditions	Proposed Conditions
Viewpoint 1	Belvidere Street looking south	48.4%	76.0%
Viewpoint 2	Massachusetts Avenue looking east	25.7%	68.5%
Viewpoint 3	St. Germain Street looking north	40.7%	72.3%
Area Context Points			
AC1	Belvidere Street looking north	80.4%	
AC2	Massachusetts Avenue looking west	57.2%	
AC3	Massachusetts Avenue looking west	64.2%	
AC4	St. Germain Street looking north	53.3%	

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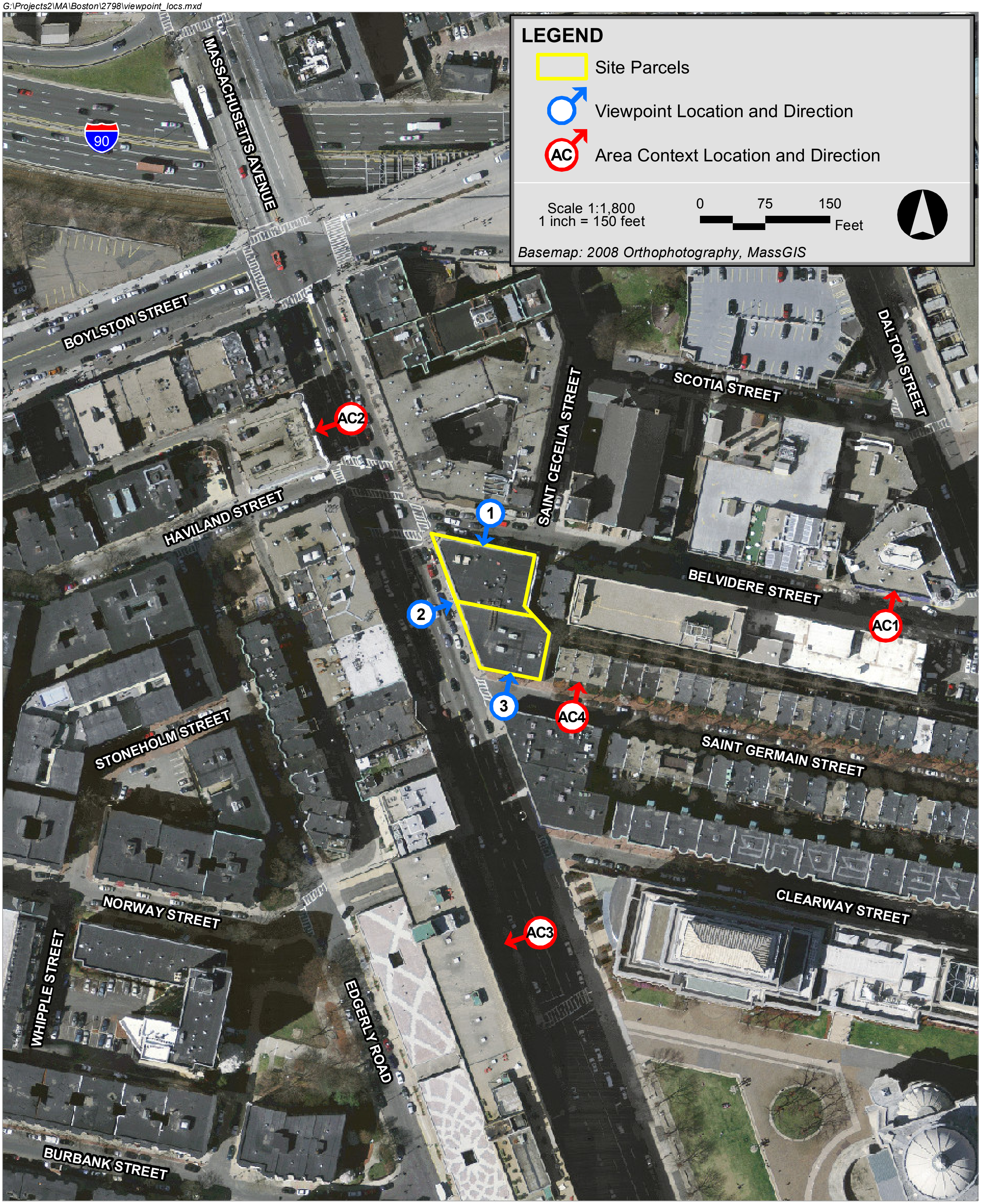
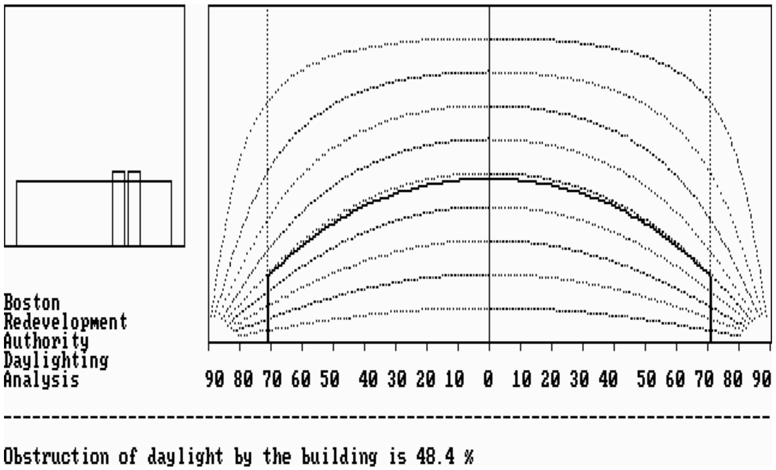
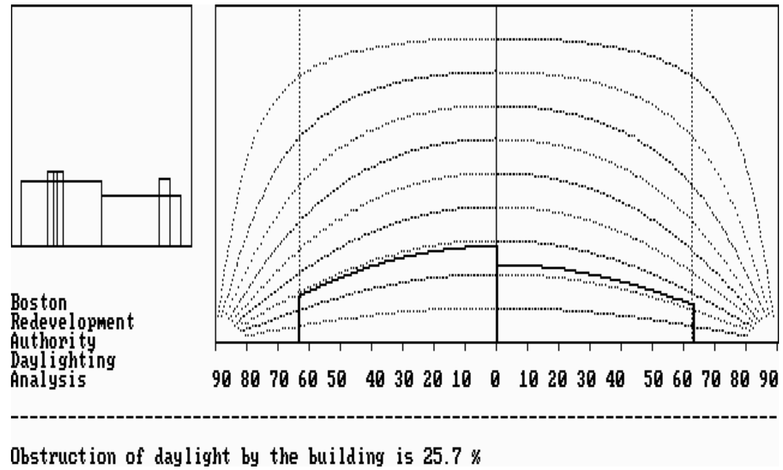


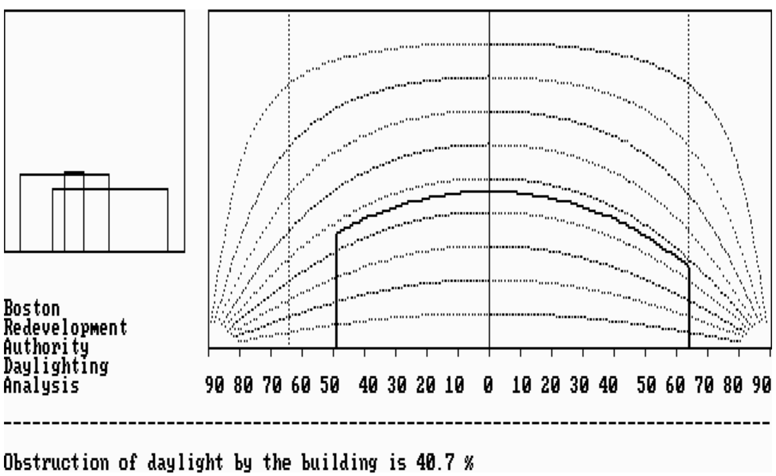
Figure 12.6-8
Daylight Analysis, Viewpoint Locations



Viewpoint 1 – Existing Site from Belvidere Street facing south



Viewpoint 2 – Existing Site from Massachusetts Avenue facing east

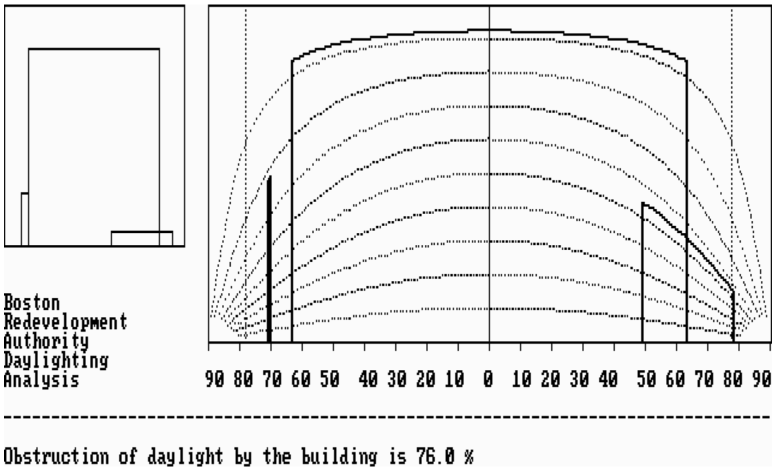


Viewpoint 3 – Existing Site from St. Germain facing north

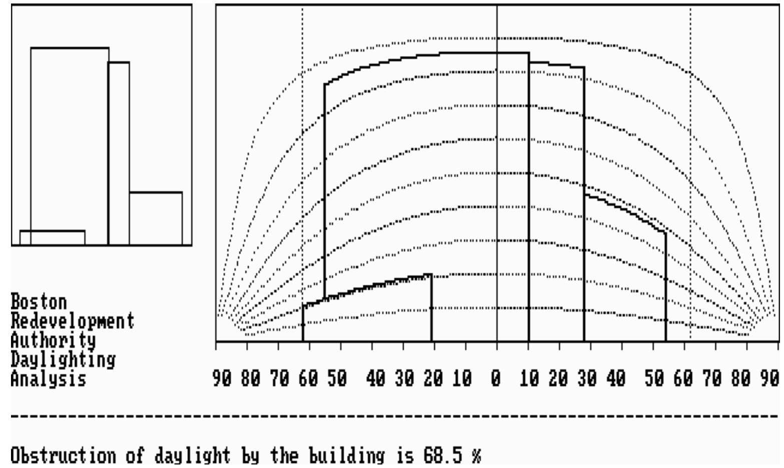
Figure 12.6-9

Daylight Analysis
Existing Viewpoints
1, 2, 3

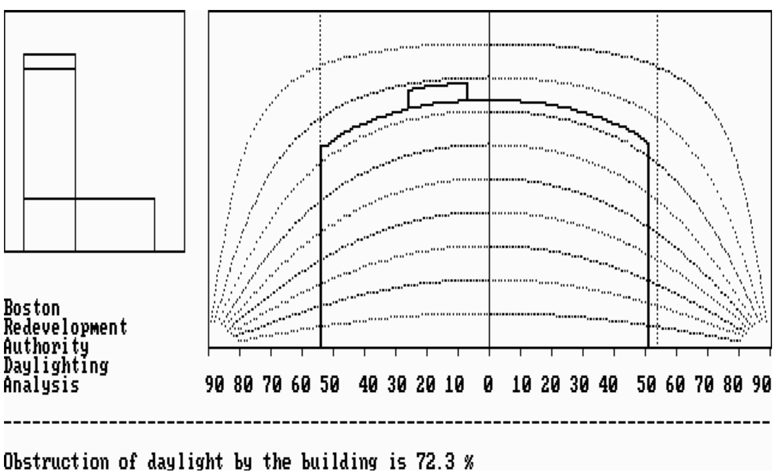
Epsilon Associates Inc.



Viewpoint 1 – Proposed Site from Belvidere Street facing south



Viewpoint 2 – Proposed Site from Massachusetts Avenue facing east

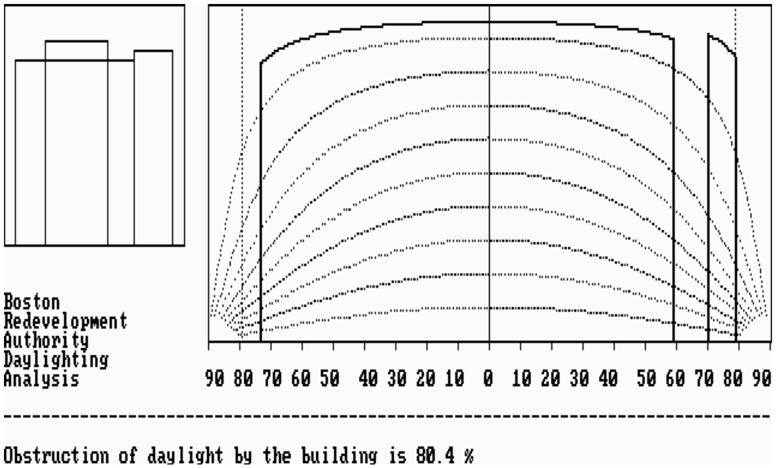


Viewpoint 3 – Proposed Site from St. Germain facing north

Figure 12.6-10

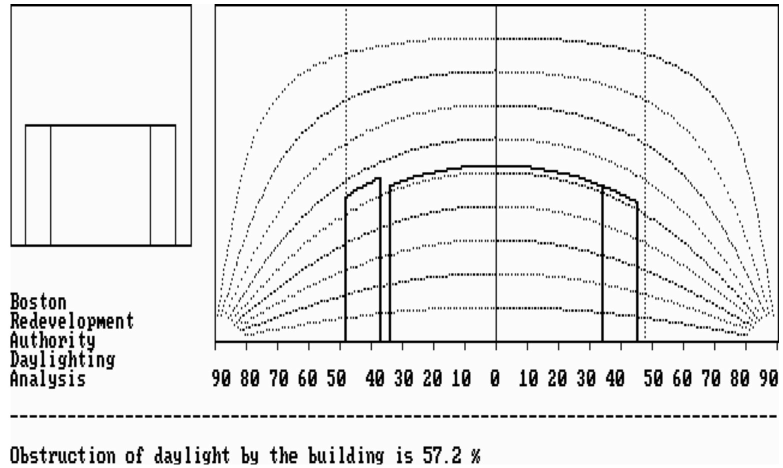
Daylight Analysis
Proposed Viewpoints
1, 2, 3

AC1 (Hilton on Belvidere Street)



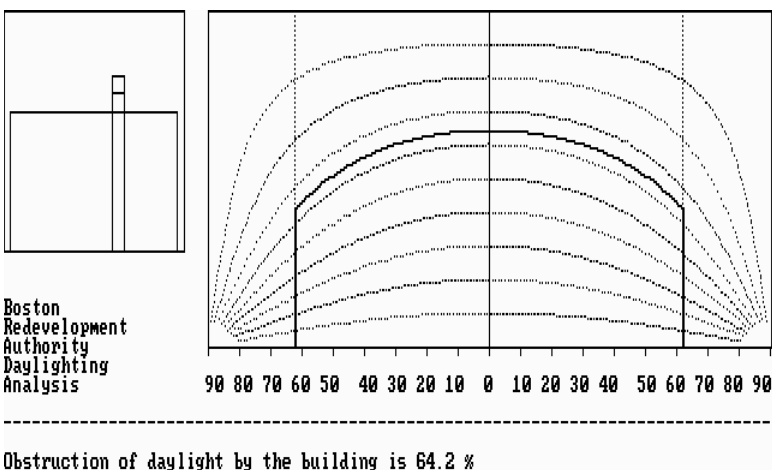
Area Context 1 – Belvidere Street facing north

AC2 (Massachusetts Avenue)



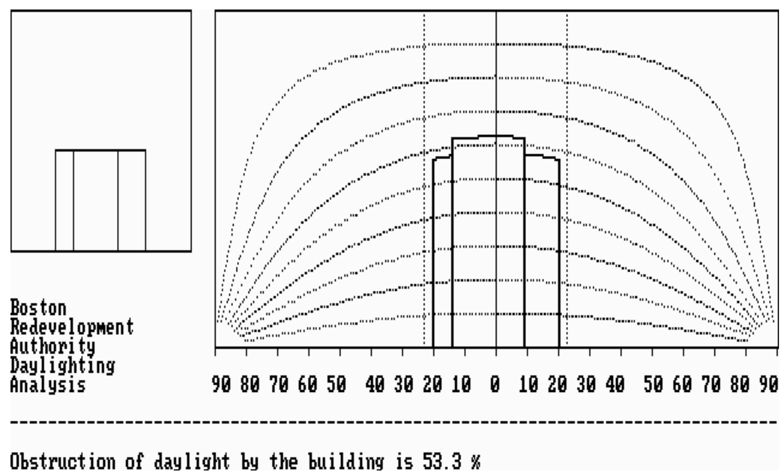
Area Context 2 – Massachusetts Avenue facing west

AC3 (Massachusetts Avenue)



Area Context 3 – Massachusetts Avenue facing west

AC4 (Residence on St. Germain Street)



Area Context 4 – St. Germain Street facing north

Figure 12.6-11

Daylight Analysis
Area Context
Viewpoints

Belvidere Street – Viewpoint 1

Belvidere Street runs along the northern edge of the project site. Viewpoint 1 was taken from the center of the street looking south. The existing daylight obstruction value is 48.4%. With the development of the project the daylight obstruction value will increase to 76.0%, which is similar to daylight obstruction values found in the surrounding area and typical of dense urban areas. The daylight obstruction value is higher than the other viewpoints due to the narrow street and minimal setback of the tower portion of the proposed building.

Massachusetts Avenue – Viewpoint 2

Massachusetts Avenue runs along the western edge of the project site. Viewpoint 2 was taken from the center of Massachusetts Avenue looking east at the site. The existing daylight obstruction value at the site is 25.7% due to the large width of the street and the short heights of the existing buildings. The development of the project will increase the daylight obstruction value at the site to 68.5%, which is similar to daylight obstruction values found in the surrounding area.

St. Germain Street – Viewpoint 3

St. Germain Street runs along the southern edge of the project site. Viewpoint 3 was taken from the center of the street looking north at the project site. The existing daylight obstruction value at the site is 40.7%. The development of the project will increase daylight obstruction values at the site to 72.3% due to the narrow width of the street and the proposed streetwall, but this higher percentage is comparable to daylight obstruction values found in the surrounding area and is typical of dense urban areas.

Area Context Views

The project site is located between two areas with contrasting building heights. To the east of the project site, the area is characterized by taller high-rise existing buildings such as the Hilton Hotel, the Sheraton Hotel, the Prudential Building, and Christian Science Administration Building. To the north, west, and south of the project site are lower rise buildings and residential buildings. The project's daylight obstruction values are similar to the daylight obstruction values in the area.

To provide a larger context for a specific comparison of daylight conditions, obstruction values were calculated from four area context points. The daylight conditions ranged from 53.3% on St. Germain Street between Massachusetts Avenue and Dalton Street (AC4) to 80.4% at the Hilton Hotel on Belvidere Street (AC1). In comparison, daylight obstruction values for the project range from 68.5% to 76.0%.

12.6.3.4 Conclusions

The daylight analysis conducted for the project describes existing and proposed daylight obstruction conditions at the project site and in the surrounding area. The project design sets some taller portions of the building back from the streets, thus reducing the impact on pedestrian's views of the sky. The results of the BRADA analysis indicate that while the development of the project will result in increased daylight obstruction at the site over existing conditions, the resulting conditions generally will be consistent with the area context.

12.6.4 Solar Glare

At this time, it is anticipated that the facades of the project will not be primarily of highly reflective materials that would result in adverse impacts from reflected solar glare.

12.6.5 Air Quality

12.6.5.1 Introduction

An air quality analysis was conducted to determine the impact of pollutant emissions from combustion and mobile source emissions generated by the project. A microscale analysis is typically performed to evaluate the potential air quality impacts of carbon monoxide (CO) due to traffic flow around the project area. In addition, for stationary sources (i.e. combustion stacks, and garage vents), United States Environmental Protection Agency (EPA) approved air dispersion models were used to estimate ambient concentrations of nitrogen oxides (NOx), particulate matter (PM-10 and PM-2.5), and sulfur dioxide (SO_2), in addition to CO. The impacts were added to monitored background values and compared to the Federal National Ambient Air Quality Standards (NAAQS). The standards were developed by EPA to protect the human health against adverse health effects with a margin of safety.

The modeling methodology was developed in accordance with the latest Massachusetts Department of Environmental Protection (MassDEP) modeling policies and Federal modeling guidelines.[3] The air quality analysis results show that CO, NOx, PM-10, PM-2.5, and SO_2 concentrations at all receptors studied are well under NAAQS thresholds.

The analysis shows that impacts from the Project are under NAAQS thresholds. Modeling assumptions and backup data for results presented in this section are provided in Appendix H.

[3] 40 CFR 51 Appendix W, Guideline on Air Quality Models, 70 FR 68228, Nov. 9, 2005

12.6.5.2 Methodology

Microscale Analysis

For projects in Boston, the BRA typically requires the analysis of the effect on air quality of the increase in traffic generated by the project. The Proponent is required to analyze local effects of the potential increase in traffic on ambient air quality near specific intersections. This "microscale" analysis is required for the project at intersections where 1) project traffic would impact intersections or roadway links currently operating at Level of Service (LOS) D, E, or F or would cause LOS to decline to D, E, or F; 2) project traffic would increase traffic volumes on nearby roadways by 10% or more (unless the increase in traffic volume is less than 100 vehicles per hour); or, 3) the project will generate 3,000 or more new average daily trips on roadways providing access to a single location.[4] The microscale analysis involves modeling of carbon monoxide (CO) emissions from vehicles idling at and traveling through both signalized and unsignalized intersections. Predicted ambient concentrations of CO for the build and no-build cases are compared with federal (and state) ambient air quality standards for CO.

The microscale analysis typically examines ground-level CO impacts due to traffic queues in the immediate vicinity of a project. CO is used in microscale studies to indicate roadway pollutant levels since it is the most abundant pollutant emitted by motor vehicles and can result in so-called "hot spot" (high concentration) locations around congested intersections. NAAQS have been established by the EPA for CO to protect the public health (known as primary standards). These standards do not allow ambient CO concentrations to exceed 35 parts per million (ppm) for a one-hour averaging period and 9 ppm for an eight-hour averaging period, more than once per year at any location. The widespread use of CO catalysts on late-model vehicles has reduced the occurrences of CO hotspots. Air quality modeling techniques (computer simulation programs) are typically used to predict CO levels for both existing and future conditions to evaluate compliance of the roadways with the standards. The analyses followed the procedure outlined in the EPA's intersection modeling guidance.[5]

The microscale analysis has been conducted using the latest versions of EPA MOBILE6.2, CAL3QHC, and AERMOD to estimate CO concentrations at sidewalk receptor locations.

Baseline (2010) and future year (2015) emission factor data calculated from the MOBILE6.2 model, along with traffic data, were input into the CAL3QHC program to determine CO concentrations due to traffic flowing through the selected intersections. AERMOD was used

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[4] BRA, Development Review Guidelines, 2006.

[5] U.S. EPA, Guideline for Modeling Carbon Monoxide from Roadway Intersections; EPA-454/R-92-005, November 1992.

to estimate potential ground-level impacts due to emissions from the loading dock vent and combustion sources.

CAL3QHC and AERMOD results were then added to background CO values of 1.7 ppm (one-hour) and 1.3 ppm (eight-hour), as provided by MassDEP, to determine total air quality impacts due to the project. This value was compared to the NAAQS for CO of 35 ppm (one-hour) and 9 ppm (eight-hour).

Intersection Selection

An analysis of the intersections from the traffic study was conducted (see Chapter 7, Transportation). Microscale modeling was performed for the intersections included in the traffic analysis:

- the intersection of Massachusetts Avenue and Boylston Street, and Cambria and Boylston Street (analyzed together); and
- the intersection of Massachusetts Avenue, Haviland Street, and Belvidere Street.

As described in Chapter 7, the 2016 No Build and Build traffic conditions are essentially the same.

Emissions Calculations (MOBILE6.2)

The EPA MOBILE6.2 computer program was used to estimate motor vehicle emission factors on the roadway network. Emission factors calculated by the MOBILE6.2 model are based on motor vehicle operations typical of daily periods. The Commonwealth's statewide annual Inspection and Maintenance (I&M) program was included, as well as the state specific vehicle age registration distribution. The input files for MOBILE6.2 for the existing (2011) and build year (2016) are provided by MassDEP. As is typical, minor edits to the files were necessary to allow the program to output emission factors for the various speeds used in the analyses.

The current version of MOBILE6.2 does not explicitly calculate idle emissions. However, idle emissions can be obtained from a vehicle speed of 2.5 miles per hour (mph) (the lowest speed MOBILE6 will model). The resulting emission rate given in (grams/mile) is then multiplied by 2.5 mph to estimate idle emissions (in grams/hour). Moving emissions are calculated based on actual speeds at which free-flowing vehicles travel through the intersections. A speed of 30 mph is used for all free-flow traffic. Speeds of 10 and 15 mph were used for right (and U-turns) and left turns, respectively.

Winter CO emission factors are typically higher than summer for CO. Therefore winter vehicular emission factors were conservatively used in the microscale analyses.

Receptors & Meteorology Inputs

Sets of up to 90 receptors were placed in the vicinity of each of the modeled intersections. Receptors extended approximately 100 to 200 feet on the sidewalks along the roadways approaching the intersection. The roadway links and receptor locations of the modeled intersections are presented in Figures 12.6-12 and 12.6-13.

For the CAL3QHC model, limited meteorological inputs are required. Following EPA guidance[6], a wind speed of one meter per second, stability class D (4), and a mixing height of 1,000 meters were used. To account for the intersection geometry, wind directions from 0° to 350°, every 10° were selected. A surface roughness length of 321 cm corresponding to "City Land Use – Central Business District" was selected.[7]

Impact Calculations (CAL3QHC)

The CAL3QHC model predicts one-hour concentrations using queue-links at intersections based on worst-case meteorological conditions and traffic input data. The one-hour concentrations were scaled by a factor of 0.7 to estimate 8-hour concentrations.[8] The CAL3QHC methodology was based on EPA CO modeling guidance. Signal timings were provided directly from the traffic modeling runs. Travel speeds were estimated based on field observations, traffic data, and queue links at the intersections. The CAL3QHC input parameters are described in Appendix H.

Stationary Source Analysis

AERMOD Modeling Methodology

The most recent version of the EPA AERMOD refined dispersion model (Version 09292) was selected to predict concentrations from the stationary sources related to the project. AERMOD is the EPA's preferred model for regulatory applications. The use of AERMOD provides the benefits of using the most current algorithms available for steady state dispersion modeling.

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6 U.S. EPA, *Guideline for Modeling Carbon Monoxide from Roadway Intersections.* EPA-454/R-92-005, November 1992.

7 U.S. EPA, *User's Guide for CAL3QHC Version 2: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections*. EPA –454/R-92-006 (Revised), September 1995

8 U.S. EPA, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources; EPA-454/R-92-019, October 1992

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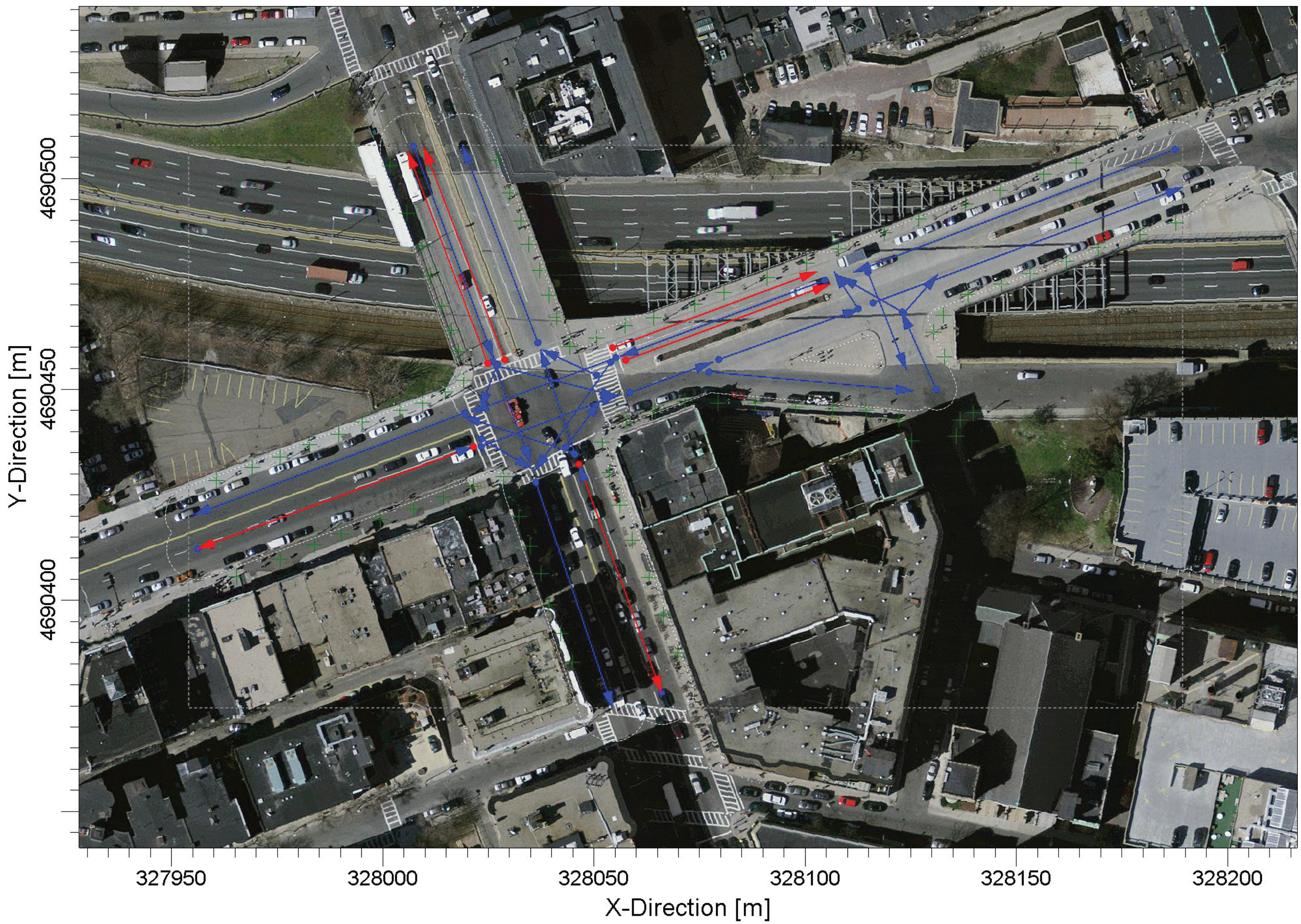

Figure 12.6-12

Link and Receptor Locations for CAL3QHC modeling of Intersection 1: the intersection of Massachusetts Avenue, Boylston Street, and Cambria Street

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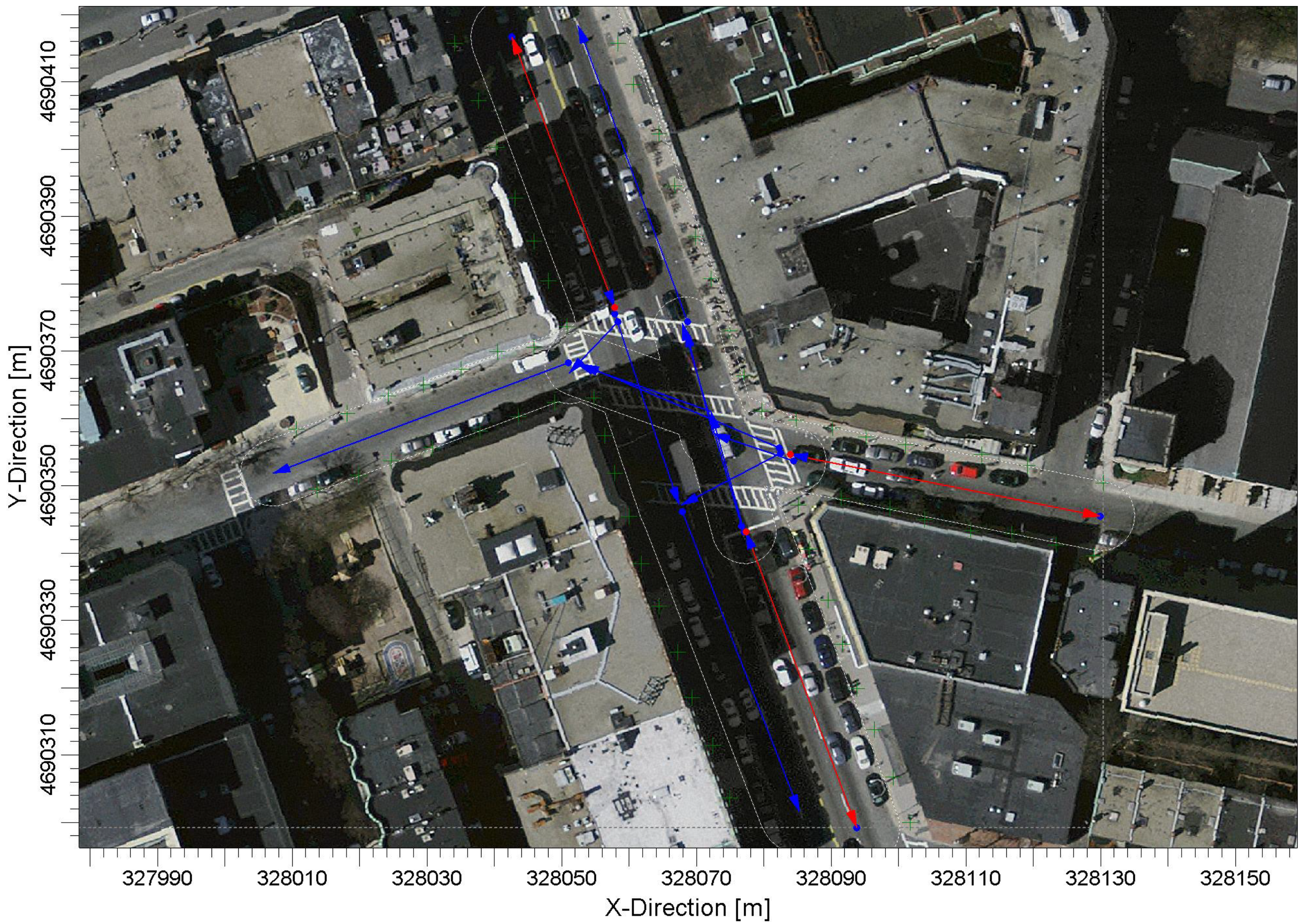

Figure 12.6-13

Link and Receptor Locations for CAL3QHC modeling of Intersection 2: the intersection of Massachusetts Avenue, Haviland Street, and Belvidere Street

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The ISC-AERMOD View graphical user interface (GUI) Version 6.7.1, created by Lakes Environmental, was used to facilitate model setup and post-processing of data. The AERMOD model was selected for this analysis for the reasons listed below:

- it is the required EPA model for all refined regulatory analyses for receptors within 50 km of a source;
- it is a refined model for facilities with multiple sources, source types, and building-induced downwash;
- it uses actual representative hourly meteorological data;
- it incorporates direction-specific building parameters which can be used to predict impacts within the wake region of nearby structures;
- it allows the modeling of multiple sources together to predict cumulative downwind impacts;
- it provides for variable emission rates;
- it provides options to select multiple averaging periods between one-hour and one year (scaling factors can be applied to adjust the one-hour impact to a peak impact less than one-hour); and
- it allows the use of large Cartesian and polar receptor grids, as well as discrete receptor locations.

Regulatory default options adopted for the model include:

- *Use stack-tip downwash (except for building downwash)*. Stack-tip downwash is an adjustment of the actual stack release height for conditions when the gas exit velocity is less than 1.5 times the wind speed. For these conditions, the effective release height is reduced a bit, based on the diameter of the stack and the wind and gas exit velocity. This option applies to point sources only, such as emergency generators, cooling towers, boiler units and garage vents.
- *Use the missing data and calms processing routines*. The model treats missing meteorological data in the same way as the calms processing routine, i.e., it sets the concentration values to zero for that hour, and calculates the short term averages according to EPA's calms policy, as set forth in the Guideline. Since only one-hour averages are being used, concentrations predicted with calm or missing data would not affect model results.

Non-default options were used to model horizontally emitting sources, such as garage vents. Additionally, the non-default conversion of NOx to NO_2 using the Plume Volume

Molar Ratio Method was selected. This option utilizes actual coinciding hourly ozone data to accurately model the chemical transformation of NOx to NO_2. Hourly ozone data from the nearest monitor location at Harrison Avenue were used.

The AERMOD model is able to assign sources to a rural or urban category to allow specified urban sources to use the effects of increased surface heating under stable atmospheric conditions. The urban dispersion classification was selected based on a visual inspection of the area within a three kilometer radius of the project site. A population estimate of 645,000 was obtained from the U.S. Census website (www.census.gov) and is used in the AERMOD model to estimate the urban boundary layer height.

The regional meteorology in Boston is best approximated with meteorological data collected by the nearby Boston Logan International Airport in East Boston, MA. The station is located approximately three miles (5.1 km) to the east-northeast of the project site at an elevation of 15 feet (4.6 m) above mean sea level. This station is the closest site for which extensive meteorological data are available which are representative of similar topographic influences that affect the proposed site. Five years (2005-2009) of hourly surface data collected at the station include wind speed and direction, temperature, cloud cover and ceiling height. Upper air data from Gray, Maine was processed along with the surface data. The processed meteorological files for use in AERMOD were provided by MassDEP. These files have been used on other AERMOD applications in the area for review by MassDEP and are presumed to be of sufficient quality for regulatory applications.

A network of 1,572 receptors was used for the refined AERMOD modeling analysis. A nested grid of Cartesian receptors centered on the project was used. The entire modeling domain encompassed 16 square kilometers. The spacing of the receptors was as follows:

- An area 200 meters by 200 meters with receptors spaced every 20 meters.
- An area 500 meters by 500 meters with receptors spaced every 50 meters.
- An area 1.0 kilometers by 1.0 kilometers with receptors spaced every 100 meters.
- An area 2.0 kilometers by 2.0 kilometers with receptors spaced every 200 meters.

Terrain data were obtained from the U.S.G.S National Map Seamless Server (www.seamless.usgs.gov) according to guidance set forth by EPA.[9] Source, building, and receptor elevations were processed using the AERMAP processor by way of the Lakes AERMOD View interface. Figure 12.6-14 presents the source and receptor locations, as well as the buildings used in the GEP stack height/downwash analysis described below.

[9] U.S. EPA, AERMOD Implementation Guide, March 19, 2009.

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Figure 12.6-14

AERMOD Stationary Source, Receptor, and Building Locations

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Stationary Sources

Stationary sources of air pollution are typically units that combust fuel. In this case, these sources consist of heating units, electrical generating units, etc.

Heating Equipment

There are two current design alternatives for the heat/hot water boilers. The preferred option is for six 2 MMBTU/hr heating/hot water boilers to be installed on the new building. The alternative design is for eight 3 MMBTU/hr units. All units will be natural gas-fired and located in a mechanical area on the roof of the building. The units are expected to be exhausted through individual stacks.

The boilers will be either within or well below the requirements of MassDEP's Environmental Results Program (ERP) since individual estimated heat inputs are within or below the 10 to 40 MMBtu/hour ERP range. However, emissions were conservatively estimated for each boiler based on the MassDEP Boiler ERP program emission limits. Dispersion modeled impacts from the heating units were estimated from exhaust stacks 10 feet above the individual building roof heights above ground level, or as determined by the architect. For all impacts, the heating equipment is assumed to be in operation 24 hours per day, seven days per week. Detailed calculations and stack parameters are presented in Appendix H.

All boilers are expected to be below the ERP limits of 10 MMBtu/hour. Therefore, registration with MassDEP would not be required.

Emergency Generator

Current design plans are for one 800-kilowatt emergency generator to be installed on the building to be constructed. The unit will provide life safety and standby emergency power to the building. The unit will be diesel-fired and located in a mechanical area on the roof of the building. The generator is assumed to be designed such that its exhaust stack extends at least 10 feet above the individual building roof height above ground level.

Typically, the generator will operate for approximately one hour each month for testing and general maintenance. The ERP regulation applies to new emergency generators greater than 37 kW. The regulation is similar to the boiler ERP in that new engines are subject to emission standards, recordkeeping, certification, and compliance with the MassDEP noise policy. Since the generator maximum rating capacity is greater than the ERP limit of 37 kW, it will be subject to the new ERP program. Per the ERP, the generator owner will limit operation of the generator to less than 300 hours per year and submit a certification form to MassDEP within 60 days of installation.

Emissions were estimated for the emergency generator based on vendor supplied data. Comparable equipment was assumed where not provided by the MEP engineers. The generator is assumed to operate 300 of 8,760 hours per year in the modeling for annual averaging times. Detailed calculations and stack parameters are presented in Appendix H.

Cooling Towers

There are two current design alternatives for the heat/hot water boilers. The preferred design is for a single-cell cooling tower, capable of providing 400 tons of cooling, to be installed on the building to be constructed. The alternative design is for a dual-cell cooling tower, capable of 800 tons of cooling. These units will remove the excess heat generated by the building's mechanical equipment. All units will be located on the roof of the building.

Only emissions of particulate matter are assumed to be produced by the cooling tower cells. The cooling towers are assumed to operate at 100% capacity for 8,760 hours per year. Emissions of all other pollutants from the cooling towers are expected to be negligible.

Emissions and exhaust parameters were based on vendor supplied data and/or engineering judgment. Detailed calculations are presented in Appendix H.

Loading Dock Exhaust Vent

A dual bay loading dock with mechanical ventilation will be part of the proposed building. Carbon monoxide monitors are typically installed within enclosed areas idling vehicles to insure that levels of CO do not exceed health standards. At this time, it is unclear if monitors will be used to control abatement ventilation when necessary.

Emissions from the loading dock were calculated using MOBILE6.2 and an estimate of the total idling time permitted under Massachusetts law (90 MGL Section 16A). It was conservatively assumed that the dock would be 100% utilized from 7:00 am to 4:00 pm and that trucks would idle for five minutes per hour, the Massachusetts legal limit.

To provide a conservative assumption for emissions from the loading dock, an emission rate from MOBILE6.2 of 2.5 mph was conservatively assumed for a midpoint year of 2013. As is accepted, the 2.5 mph emission rate in gram/mile is multiplied by 2.5 mph to get an idling emission rate in mass/time. The higher of the summer or winter factors were used, depending on pollutant. Additionally, emission factors were weighted such that only factors for heavy duty gasoline and heavy duty diesel vehicle classes (MOBILE6.2 designations HDGV and HDDV) were used for dock emissions.

High velocity air intake louvers and the dock entry will supply make-up air for the dock's ventilation systems. Based on mechanical estimates, a total ventilation air requirement of 5,600 cubic feet per minute per square foot was used. A single vent is expected to be exiting vertically at four feet above the roofline and is assumed to be 30″x20″ or 4.2 sf in area.

Detailed calculations, assumptions, and exhaust parameters are presented in Appendix H.

GEP Stack Height Analysis

The Good Engineering Practice (GEP) stack height evaluation of the facility has been conducted in accordance with the EPA revised Guidelines for Determination of Good Engineering Practice Stack Height (EPA, 1985). A GEP stack is sufficiently high to avoid aerodynamic downwash effects from nearby buildings or structures. As defined by the EPA guidelines, the formula for computing GEP stack height is the greater of:

1. 65 meters, or

2. for stacks constructed after January 12, 1979,

$$H_{GEP} = H_b + 1.5L$$

where H_{GEP} = GEP stack height,

H_b = Height of adjacent or nearby structures,

L = Lesser of height or maximum projected width of adjacent or nearby building (*i.e.*, the critical dimension), and nearby is within 5L of the stack from downwind (trailing edge) of the building.

The GEP formula was applied to the project. Facility grade is approximately at mean sea level. The EPA's Building Profile Input Program Prime Version (BPIP-Prime) was run to confirm the GEP height and to calculate building dimensions for use in AERMOD.

The point sources subject to building influences are the boiler stacks, dock vents, the cooling towers, and the emergency generator stacks.

The proposed boiler stacks, the cooling towers, dock vents, and emergency generator stacks are all below GEP height; therefore, building downwash effects were considered in the air quality modeling. The AERMOD model determines when and if to include downwash in its calculations. In addition, if downwash applies, the AERMOD downwash algorithm will be used to estimate concentrations in the building cavity areas.

12.6.5.3 Background Concentrations

To estimate background pollutant levels representative of the area, the most recent air quality monitor data reported on the EPA's AIRData website (http://www.epa.gov/air/data) was obtained for 2007 to 2009. MassDEP guidance specifies the use of the latest three years of available monitoring data from within 10 km of the project site.

The Clean Air Act allows for one exceedance per year of the CO and SO_2 short-term NAAQS per year. The highest second-high accounts for the one exceedance. Annual NAAQS are never to be exceeded. The 24-hour PM-10 standard is not to be exceeded more than once per year on average over three years. To attain the 24-hour PM-2.5 standard, the three-year average of the 98th percentile of 24-hour concentrations must not exceed 35 $\mu g/m^3$. For annual PM-2.5 averages, the average of the highest yearly observations was used as the background concentration. A new one-hour NO_2 standard was recently promulgated. To attain this standard, the three-year average of the 98th percentile of the maximum daily one-hour concentrations must not exceed 188 $\mu g/m^3$.

Background concentrations were determined from the closest available monitoring stations to the proposed development. The closest monitor is less than one mile away at Kenmore Square. A summary of the background air quality concentrations are presented in Table 12.6-3.

Table 12.6-3 Observed Ambient Air Quality Concentrations and Selected Background Levels

Pollutant	Averaging Period	Station	2007	2008	2009	Background Level	NAAQS
SO_2 ($\mu g/m^3$)	1-Hour (a)	BOS	93.6	75.4	65.0	93.60	195
	3-Hour	BOS	88.4	62.4	49.4	88.40	1,300
	24-Hour	BOS	52.0	46.8	23.4	52.00	365
	Annual	BOS	10.9	10.4	6.5	10.92	80
CO ($\mu g/m^3$)	1-Hour	BOS	1824.0	1938.0	1596.0	1938.00	40000
	8-Hour	BOS	1482.0	1482.0	1254.0	1482.00	10000
NO_2 ($\mu g/m^3$)	1-Hour (b)	BOS	126.0	133.5	112.8	133.48	188
	Annual	BOS	38.7	41.4	37.8	41.36	100
PM-10 ($\mu g/m^3$)	24-Hour	BOS	40.0	53.0	69.0	69.00	150
	Annual	BOS	21.6	23	20.6	23.00	50
PM-2.5 ($\mu g/m^3$)	24-Hour (c)	BOS	31.7	26	19.1	25.60	35
	Annual (d)	BOS	11.43	11.14	8.98	10.52	15

Notes:
(a) Background level for one-hour SO_2 is the three-yr maximum of the average one-hour values.
(a) Background level for one-hour NO_2 is the three-yr maximum of the average one-hour values.
(c) Background level for 24-hour PM-2.5 is the average concentration of the 98th percentile for three years.
(d) Background level for Annual PM-2.5 is the average concentration of three years.
BOS = Kenmore Square, Boston, MA
SO_2 reported in PPM. Converted using one ppm = 2600 $\mu g/m^3$.
NO_2 reported in PPM. Converted using one ppm = 1880 $\mu g/m^3$.
CO reported in PPM. Converted using one ppm = 1140 $\mu g/m^3$.

For use in the microscale analysis, background concentrations of CO in ppm were required. The corresponding maximum background concentrations in ppm were 1.7 ppm for one-hour and 1.3 ppm for eight-hour CO.

12.6.5.4 Air Quality Results

Microscale Analysis

The results of the maximum one-hour predicted CO concentrations from CAL3QHC are provided in Tables 12.6-4 and 12.6-5 for the 2011 and 2016 scenarios. Eight-hour average concentrations are calculated by multiplying the maximum one-hour concentrations by a factor of 0.7.[10]

Table 12.6-4 Summary of Microscale Modeling Analysis (Existing 2011)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
One-Hour					
Massachusetts Ave. / Haviland St. / Belvidere St.	AM	0.90	1.7	2.6	35
	PM	1.20	1.7	2.9	35
Massachusetts Ave. / Boylston St. / Cambria St.	AM	1.60	1.7	3.3	35
	PM	1.60	1.7	3.3	35
Eight-Hour					
Massachusetts Ave. / Haviland St./Belvidere St.	AM	0.63	1.3	1.93	9
	PM	0.84	1.3	2.14	9
Massachusetts Ave. / Boylston St / Cambria St.	AM	1.12	1.3	2.42	9
	PM	1.12	1.3	2.42	9
Notes: CAL3QHC eight-hour impacts were conservatively obtained by multiplying one-hour impacts by a screening factor of 0.7.					

[10] U.S. EPA, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources; EPA-454/R-92-019, October 1992

Table 12.6-5 Summary of Microscale Modeling Analysis (No-Build and Build 2016)

Intersection	Peak	CAL3QHC Modeled CO Impacts (ppm)	Monitored Background Concentration (ppm)	Total CO Impacts (ppm)	NAAQS (ppm)
One-Hour					
Massachusetts Ave./Haviland St./Belvidere St.	AM	1.10	1.7	2.8	35
	PM	1.10	1.7	2.8	35
Massachusetts Ave./Boylston St. / Cambria St.	AM	1.30	1.7	3	35
	PM	1.40	1.7	3.1	35
Eight-Hour					
Massachusetts Ave. / Haviland St. / Belvidere St.	AM	0.77	1.3	2.07	9
	PM	0.77	1.3	2.07	9
Massachusetts Ave. / Boylston St. / Cambria St.	AM	0.91	1.3	2.21	9
	PM	0.98	1.3	2.28	9

Notes:

CAL3QHC eight-hour impacts were conservatively obtained by multiplying one-hour impacts by a screening factor of 0.7.

The results of the one-hour and eight-hour maximum modeled CO ground-level concentrations from CAL3QHC were added to EPA supplied background levels for comparison to the NAAQS. These values represent the highest potential concentrations at the intersection as they are predicted during the simultaneous occurrence of "defined" worst case meteorology. The highest one-hour traffic-related concentration predicted in the area of the project, for the modeled conditions (1.6 ppm) plus background (1.7 ppm), is 2.3 ppm for the 2011 case (at Massachusetts Avenue and Boylston Street). The highest eight-hour traffic-related concentration predicted in the area of the project for the modeled conditions (1.1 ppm) plus background (1.3 ppm) is 2.4 ppm for the 2011 case. Both concentrations are well below the one-hour NAAQS of 35 ppm and the eight-hour NAAQS of 9 ppm.

When adding the high-second highest AERMOD-predicted one-hour CO concentrations from the stationary sources for the future build case (79 $\mu g/m^3$, 0.07 ppm), the one-hour modeled concentration from moving vehicles (1.6 ppm) plus background (1.7 ppm) is 2.4 ppm. The total future build concentration includes the highest second-high predicted concentrations from AERMOD for the loading dock exhaust vent, the heating boilers, and the emergency generators. This combined value is also well below the one-hour NAAQS standard of 35 ppm.

Similarly, when adding the high-second highest AERMOD-predicted eight-hour CO concentrations from the stationary sources for the future build case (42 $\mu g/m^3$, 0.04 ppm), the eight-hour modeled concentration from moving vehicles (1.1 ppm) plus background (1.3 ppm) is 2.4 ppm. These values are also below the eight-hour NAAQS standard of 9.0 ppm.

This is a highly conservative estimate, since the added values are irrespective of time and space (i.e., the modeled and background concentrations occur at different times and at different locations).

It would be expected that any other mitigation measures implemented to improve traffic flow at any of the modeled intersections would result in further improved air quality impacts.

Stationary Source Analysis

In addition to the microscale analysis, a cumulative impact analysis was also conducted for comparison to the NAAQS for SO_2, NOx, PM-10, and PM-2.5. This analysis addresses emissions from the project's heating boilers, emergency generators, cooling towers, and the loading dock vent.

Since there were preferred and alternative configurations of the boilers and cooling towers, four combinations of sources were included:

- Preferred: Preferred boiler configuration (six), preferred cooling tower (single cell), emergency generator, and loading dock vent;
- Alternative: Alternative boiler configuration (eight), alternative cooling tower (dual cell), emergency generator, and loading dock vent;
- Mixed 1: Alternative boiler configuration (eight), preferred cooling tower (single cell), emergency generator, and loading dock vent; and
- Mixed 2: Preferred boiler configuration (six), alternative cooling tower (dual cell), emergency generator, and loading dock vent.

Worst case maximum predicted impacts from these source groups were added to monitored background values obtained from the EPA AIRData website and MassDEP and compared to the NAAQS.

Table 12.6-6 presents the cumulative modeling results for the stationary sources plus monitored background values. The total impacts when combined with background are below the NAAQS for all pollutants and averaging periods.

12.6.5.5 Conclusions

Using conservative estimates, the CO concentrations at the nearest receptors for impacts from the intersection, the heating boilers, and emergency generator units, plus monitored background values, are well under the CO NAAQS thresholds. In addition, maximum cumulative impacts from the heating boilers, loading dock vent, cooling towers, and emergency generators plus monitored background values are also below the NAAQS thresholds for SO_2, NOx, PM-10, and PM-2.5.

Table 12.6-6 Summary of NAAQS Stationary Source Modeling Analysis

Preferred Configuration (6 Boilers, 1 Cooling Tower, Emergency Genset, Loading Dock Vent)

AMBIENT AIR QUALITY STANDARDS								
Pollutant	Avg Time	H/ H2H	Max. Modeled Conc. ($\mu g/m^3$)	Back-ground Conc.[5] ($\mu g/m^3$)	Total ($\mu g/m^3$)	MAAQS/ NAAQS ($\mu g/m^3$)	Year	% of AAQS
SO_2	1-HR [1]	H	0.43	93.60	94.03	195	05-09	48%
	3-HR	H2H	0.37	88.40	88.77	1300	2009	7%
	24-HR	H2H	0.20	52.00	52.20	365	2006	14%
	ANN	H	0.03	10.92	10.95	80	2007	14%
CO	1-HR	H2H	42.24	1938.00	1980.24	40000	2009	5%
	8-HR	H2H	26.17	1482.00	1508.17	10000	2005	15%
NO_2	1-HR [2]	H	149.69	[6]	149.69	188	05-07	80%
	ANN	H	3.08	41.36	44.44	100	2009	44%
PM_{10}	24-HR	H2H	2.18	69.00	71.18	150	2006	47%
	ANN	H	0.55	23.00	23.55	50	2007	47%
$PM_{2.5}$	24-HR [3]	H	2.30	25.60	27.90	35	05-09	80%
	ANN [4]	H	0.54	10.52	11.06	15	05-09	74%

Table 12.6-6 Summary of NAAQS Stationary Source Modeling Analysis (continued)

Alternative Configuration (8 Boilers, 2 Cooling Towers, Emergency Genset, Loading Dock Vent)

AMBIENT AIR QUALITY STANDARDS								
Pollutant	Avg Time	H/ H2H	Max. Modeled Conc. ($\mu g/m^3$)	Back-ground Conc.(5) ($\mu g/m^3$)	Total ($\mu g/m^3$)	MAAQS/ NAAQS ($\mu g/m^3$)	Year	% of AAQS
SO_2	1-HR (1)	H	0.61	93.60	94.21	195	05-09	48%
	3-HR	H2H	0.51	88.40	88.91	1300	2006	7%
	24-HR	H2H	0.28	52.00	52.28	365	2006	14%
	ANN	H	0.06	10.92	10.98	80	2007	14%
CO	1-HR	H2H	79.30	1938.00	2017.30	40000	2009	5%
	8-HR	H2H	42.09	1482.00	1524.09	10000	2005	15%
NO_2	1-HR (2)	H	152.06	(6)	152.06	188	05-07	81%
	ANN	H	4.54	41.36	45.90	100	2009	46%
PM_{10}	24-HR	H2H	3.61	69.00	72.61	150	2006	48%
	ANN	H	0.98	23.00	23.98	50	2007	48%
$PM_{2.5}$	24-HR (3)	H	3.78	25.60	29.38	35	05-09	84%
	ANN (4)	H	0.97	10.52	11.49	15	05-09	77%

Mixed Configuration 1 (8 Boilers, 1 Cooling Tower, Emergency Genset, Loading Dock Vent)

AMBIENT AIR QUALITY STANDARDS								
Pollutant	Avg Time	H/ H2H	Max. Modeled Conc. ($\mu g/m^3$)	Back-ground Conc.(5) ($\mu g/m^3$)	Total ($\mu g/m^3$)	MAAQS/ NAAQS ($\mu g/m^3$)	Year	% of AAQS
SO_2	1-HR (1)	H	0.61	93.60	94.21	195	05-09	48%
	3-HR	H2H	0.51	88.40	88.91	1300	2006	7%
	24-HR	H2H	0.28	52.00	52.28	365	2006	14%
	ANN	H	0.06	10.92	10.98	80	2007	14%
CO	1-HR	H2H	79.30	1938.00	2017.30	40000	2009	5%
	8-HR	H2H	42.09	1482.00	1524.09	10000	2005	15%
NO_2	1-HR (2)	H	152.06	(6)	152.06	188	05-07	81%
	ANN	H	4.54	41.36	45.90	100	2009	46%
PM_{10}	24-HR	H2H	3.54	69.00	72.54	150	2006	48%
	ANN	H	0.97	23.00	23.97	50	2007	48%
$PM_{2.5}$	24-HR (3)	H	3.74	25.60	29.34	35	05-09	84%
	ANN (4)	H	0.96	10.52	11.47	15	05-09	76%

Table 12.6-6 Summary of NAAQS Stationary Source Modeling Analysis (continued)

Mixed Configuration 2 (6 Boilers, 2 Cooling Towers, Emergency Genset, Loading Dock Vent)

AMBIENT AIR QUALITY STANDARDS								
Pollutant	Avg Time	H/ H2H	Max. Modeled Conc. ($\mu g/m^3$)	Back-ground Conc.[5] ($\mu g/m^3$)	Total ($\mu g/m^3$)	MAAQS/ NAAQS ($\mu g/m^3$)	Year	% of AAQS
SO_2	1-HR [1]	H	0.43	93.60	94.03	195	05-09	48%
	3-HR	H2H	0.37	88.40	88.77	1300	2009	7%
	24-HR	H2H	0.20	52.00	52.20	365	2006	14%
	ANN	H	0.03	10.92	10.95	80	2007	14%
CO	1-HR	H2H	42.24	1938.00	1980.24	40000	2009	5%
	8-HR	H2H	26.17	1482.00	1508.17	10000	2005	15%
NO_2	1-HR [2]	H	149.69	[6]	149.69	188	05-07	80%
	ANN	H	3.08	41.36	44.44	100	2009	44%
PM_{10}	24-HR	H2H	2.25	69.00	71.25	150	2006	47%
	ANN	H	0.57	23.00	23.57	50	2007	47%
$PM_{2.5}$	24-HR [3]	H	2.36	25.60	27.96	35	05-09	80%
	ANN [4]	H	0.56	10.52	11.08	15	05-09	74%

Notes:

(1) Form of one-hour SO_2 NAAQS is the three-year average of the 99th percentile of the maximum daily one-hour concentrations. Five year average can be used as a surrogate value (EPA, 2010)

(2) Form of one-hour NO_2 NAAQS is the three-year average of the 98th percentile of the maximum daily one-hour concentrations. Five year average can be used as a surrogate value (EPA, 2010)

(3) Form of 24-hour PM-2.5 NAAQS is the three-year average of the 98th percentile of the daily average concentrations. Five year average of the maximum 24-hour concentrations at each receptor is used to meet this standard. (EPA, 2010)

(4) Form of annual PM-2.5 NAAQS is the annual average concentration. The five-year average of the maximum annual concentrations at each receptor is used to meet this standard. (EPA, 2010)

(5) Background concentrations and selection are presented in Table 12.6-3.

(6) NO_2 background concentrations are added to modeled concentrations on an hour-by-hour basis. Thus background is included in the modeled value.

12.6.6 Noise

12.6.6.1 Introduction

This section includes a noise analysis for the project, including a noise-monitoring program to determine existing noise levels and an estimate of future noise levels when the project is in operation. The scope of the analysis is consistent with BRA requirements for noise studies.

The analysis indicates that predicted noise levels from project mechanical equipment with appropriate noise mitigation will be below the most stringent City of Boston Noise Zoning requirements for nighttime and daytime residential zones.

12.6.6.2 Noise Terminology

There are several ways in which sound (noise) levels are measured and quantified. All of them use the logarithmic decibel (dB) scale. The following information defines the noise measurement terminology used in this analysis.

The decibel scale is logarithmic to accommodate the wide range of sound intensities found in the environment. A property of the decibel scale is that the sound pressure levels of two separate sounds are not directly additive. For example, if a sound of 50 dB is added to another sound of 50 dB, the total is only a three-decibel increase (to 53 dB), not a doubling to 100 dB. Thus, every three dB change in sound levels represents a doubling or halving of sound energy. Related to this is the fact that a change in sound levels of less than three dB is imperceptible to the human ear.

Another property of decibels is that if one source of noise is 10 dB (or more) louder than another source, then the total sound level is simply the sound level of the higher source. For example, a source of sound at 60 dB plus another source of sound at 47 dB is 60 dB.

The sound level meter used to measure noise is a standardized instrument. It contains "weighting networks" to adjust the frequency response of the instrument to approximate that of the human ear under various circumstances. One network is the A-weighting network (there are also B- and C-weighting networks). The A-weighted scale (dBA) most closely approximates how the human ear responds to sound at various frequencies. Sounds are frequently reported as detected with the A-weighting network of the sound level meter. A-weighted sound levels emphasize the middle frequency (i.e., middle pitched – around 1,000 Hertz sounds), and de-emphasize lower and higher frequency sounds.

Because the sounds in our environment vary with time, they cannot simply be described with a single number. Two methods are used for describing variable sounds. These are exceedance levels and the equivalent level, both of which are derived from a large number of moment-to-moment A-weighted sound level measurements. Exceedance levels are values from the cumulative amplitude distribution of all of the sound levels observed during a measurement period. Exceedance levels are designated L_n, where n can have a value of 0 to 100 percent. For example:

- L_{90} is the sound level in dBA exceeded 90 percent of the time during the measurement period. The L_{90} is close to the lowest sound level observed. It is essentially the same as the residual sound level, which is the sound level observed when there are no obvious nearby intermittent noise sources.

- L_{50} is the median sound level: the sound level in dBA exceeded 50 percent of the time during the measurement period.

- L_{10} is the sound level in dBA exceeded only 10 percent of the time. It is close to the maximum level observed during the measurement period. The L_{10} is sometimes called the intrusive sound level because it is caused by occasional louder noises like those from passing motor vehicles.

- L_{max} is the maximum instantaneous sound level observed over a given period.

L_{eq}, the equivalent level, is the level of a hypothetical steady sound that would have the same energy (i.e., the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. The equivalent level is designated L_{eq} and is also A-weighted. The equivalent level represents the time average of the fluctuating sound pressure, but because sound is represented on a logarithmic scale and the averaging is done with linear mean square sound pressure values, the L_{eq} is mostly determined by occasional loud, intrusive noises.

By using various noise metrics, it is possible to separate prevailing, steady sounds (the L_{90}) from occasional, louder sounds (L_{10}) in the noise environment or combined average levels (L_{eq}). This analysis of sounds expected from the project treats all noises as though they will be steady and continuous and hence the L_{90} exceedance level was used. In the design of noise control treatments, it is essential to know something about the frequency spectrum of the noise of interest. Noise control treatments do not function like the human ear, so simple A-weighted levels are not useful for noise-control design. The spectra of noises are usually stated in terms of octave band sound pressure levels, in dB, with the octave frequency bands being those established by standard. To facilitate the noise-control design process, the estimates of noise levels in this analysis are also presented in terms of octave band sound pressure levels.

Baseline noise levels were measured in the vicinity of the proposed buildings and were compared to predicted noise levels that were derived based on information provided by the manufacturers of representative mechanical equipment or estimated from the equipment's capacity.

12.6.6.3 Noise Regulations and Criteria

The primary set of regulations relating to the potential increase in noise levels is the City of Boston Zoning District Noise Standards (City of Boston Code – Ordinances: Section 16–26 Unreasonable Noise and City of Boston Air Pollution Control Commission Regulations for the Control of Noise in the City of Boston). Results of the baseline ambient noise level survey and the modeled noise levels were compared to the City of Boston Zoning District Noise Standards. Separate regulations within the Standard provide criteria to control different types of noise. Regulation 2 is applicable to the effects of the completed proposed buildings and was considered in this noise study. Table 12.6-7 includes the Zoning District Standards.

The Massachusetts Department of Environmental Protection (MassDEP) regulates community noise by its Noise Policy: DAQC policy 90-001. The MassDEP policy limits source sound levels to a 10-dBA increase in the ambient measured noise level (L_{90}) at the project property line and at the nearest residences. The policy further prohibits pure tone conditions—when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by three decibels or more.

Table 12.6-7 City of Boston Zoning District Noise Standards, Maximum Allowable Sound Pressure Levels

Octave Band Center	Residential Zoning District		Residential-Industrial Zoning District		Business Zoning District	Industrial Zoning District
Frequency (Hz)	Daytime (dB)	All Other Times (dB)	Daytime (dB)	All Other Times (dB)	Anytime (dB)	Anytime (dB)
32	76	68	79	72	79	83
63	75	67	78	71	78	82
125	69	61	73	65	73	77
250	62	52	68	57	68	73
500	56	46	62	51	62	67
1000	50	40	56	45	56	61
2000	45	33	51	39	51	57
4000	40	28	47	34	47	53
8000	38	26	44	32	44	50
A-Weighted (dBA)	60	50	65	55	65	70

Notes:
- Noise standards are extracted from Regulation 2.5, City of Boston Air Pollution Control Commission, "Regulations for the Control of Noise in the City of Boston", adopted December 17, 1976.
- All standards apply at the property line of the receiving property.
- dB and dBA based on a reference pressure of 20 micropascals.
- Daytime refers to the period between 7:00 am and 6:00 pm daily except Sunday.

12.6.6.4 Baseline Noise Environment

An ambient noise level survey was conducted to characterize the existing "baseline" acoustical environment in the vicinity of the project. The proposed project is located at 168 Massachusetts Avenue near its intersection with Belvidere Street. Existing noise sources in the vicinity of the project include: vehicular traffic (including trucks) on the local roadways; nearby construction activity (daytime only); pedestrian traffic; mechanical equipment located on the surrounding buildings; and the general din of the city.

12.6.6.5 Noise Measurement Locations

The selection of the sound monitoring receptor locations was based upon a review of the current land use in the area of the project site. Four noise-monitoring locations were selected as representative locations to obtain a sampling of the ambient baseline noise environment. The measurement locations are depicted in Figure 12.6-15 and are described below.

- Location M1 is on Massachusetts Avenue, across the street from the project site.
- Location M2 is on Edgerly Road between Haviland Street and Stoneholm Street, across from a playground.
- Location M3 is next to the entrance of the Saint Cecilia Church on Saint Cecilia Street.
- Location M4 is on Saint Germain Street between Massachusetts Avenue and Dalton Street.

12.6.6.6 Noise Measurement Methodology

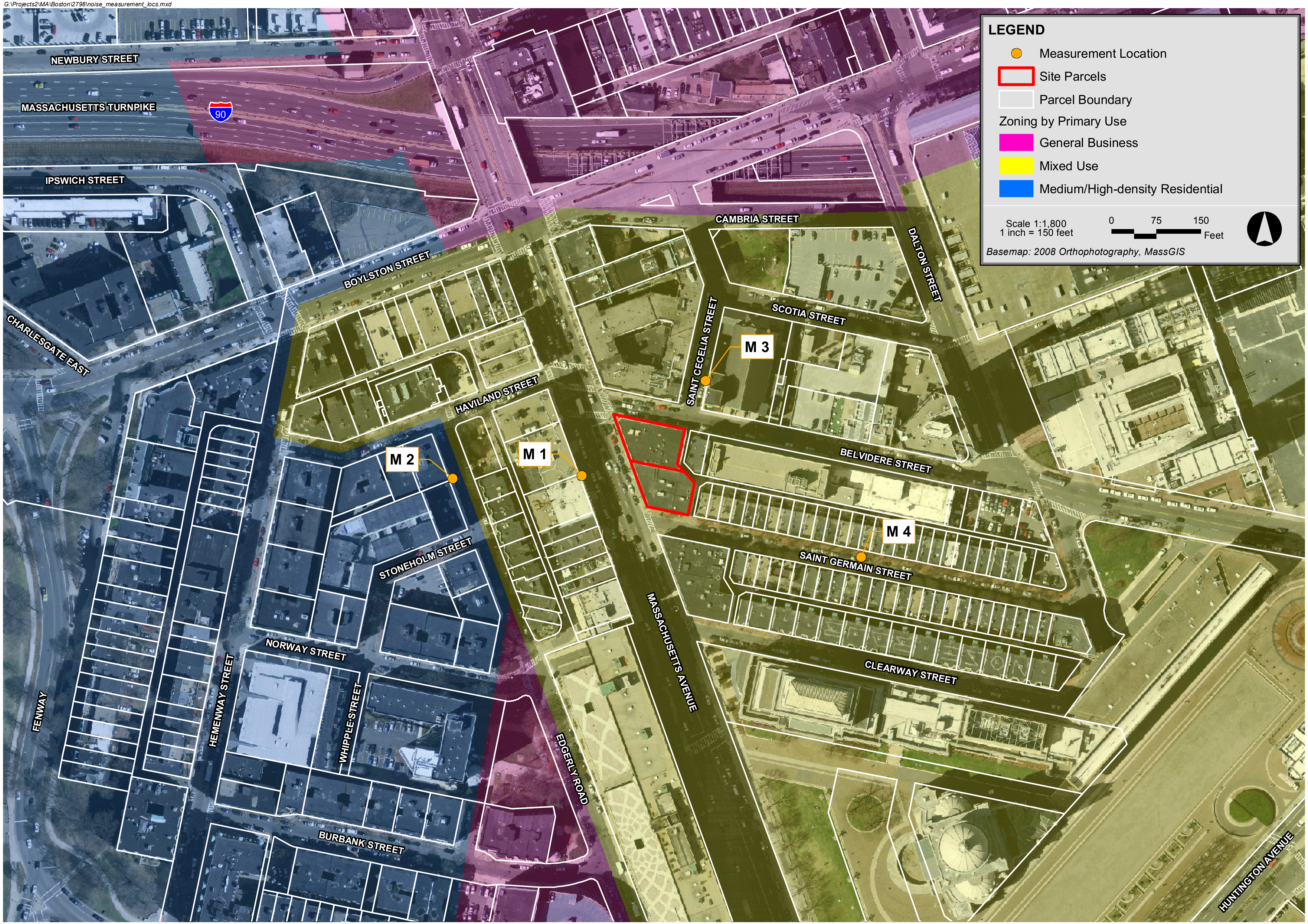
Sound level measurements were taken for 20 minutes per location during the daytime (12:30 pm to 3:30 pm) on December 30, 2010, and during nighttime hours (12:00 am to 2:00 am) on December 31, 2010. Since noise impacts are greatest at night when existing noise levels are lowest, the study was designed to measure community noise levels under conditions typical of a "quiet period" for the area. Daytime measurements were scheduled to exclude peak traffic conditions.

The sound levels were measured at publicly accessible locations at a height of five feet above the ground. The measurements were made under low wind conditions and roadway surfaces were either dry or slightly moist due to melting snow. Unofficial observations about meteorology, including wind speed, temperature, and humidity, as well as land use in the community, were made solely to characterize the existing sound levels in the area and to estimate the noise sensitivity at properties near the proposed project.

12.6.6.7 Measurement Equipment

A Larson Davis Model 831 sound level meter was used to collect ambient sound pressure level data. This instrumentation meets the "Type 1 - Precision" requirements set forth in American National Standards Institute (ANSI) S1.4 for acoustical measuring devices. The microphone was tripod-mounted at a height of five feet above ground and statistical descriptors (L_{eq}, L_{90}, etc.) were calculated for each 20-minute sampling period. Octave band levels for this study correspond to the same data set processed for the broadband levels. The measurement equipment was calibrated in the field before and after the surveys with an acoustical calibrator which meets the standards of IEC 942 Class 1L and ANSI S1.40-1984.

G:\Projects2\MA\Boston\2798\noise_measurement_locs.mxd



Berklee college of music

Institutional Master Plan

Figure 12.6-15
Sound Level
Measurement Locations

Epsilon ASSOCIATES INC.

12.6.6.8 Baseline Ambient Noise Levels

The existing ambient noise environment is impacted primarily by vehicular traffic on nearby roadways, building exhaust systems, construction (daytime only), and pedestrian activity. Baseline noise monitoring results are presented in Table 12.6-8, and summarized below.

- The daytime residual background (L_{90}) measurements ranged from 48 to 58 dBA;
- The nighttime residual background (L_{90}) measurements ranged from 47 to 54 dBA;
- The daytime equivalent level (L_{eq}) measurements ranged from 52 to 67 dBA; and
- The nighttime equivalent level (L_{eq}) measurements ranged from 49 to 69 dBA.

12.6.6.9 Overview of Potential Project Noise Sources

The primary sources of sound exterior to the proposed buildings will be cooling towers, condensing units (chillers), water pumps, and air handling units. The analysis considered the possibility of a "Central Plant" that could provide sufficient heating and cooling load for both the proposed 168 Massachusetts Avenue and the existing 150 Massachusetts Avenue buildings. Such an assumption would generate worst-case scenarios for noise emissions. It should be noted that a Central Plant is being studying by Berklee as an option, but is not part of the proposed project at this time. A summary of the major mechanical equipment proposed for the project is presented in Table 12.6-9. Noise emissions from the primary sources, as estimated from the equipment's capacity or from manufacturer-provided specifications, are also presented in Table 12.6-9, which includes broadband (dBA) sound power levels, as well as octave band sound levels when available.

The cooling tower will be located on the roof of the proposed building at an approximate elevation of 200 feet. Much of the remaining mechanical equipment for the building will be housed within a louvered mechanical penthouse just below the roof, including a 1,000 kW emergency diesel generator, with exhaust ducts and vents exiting at roof-level. There will be secondary noise sources including hot water heaters and various exhaust fans, but those are expected to have much lower sound levels (10 dBA or more) than the other, larger pieces of equipment and were not considered in this analysis. It is understood that the two 1,500 kVA electrical services will be housed in a transformer vault located on the ground floor or in the basement, and are not expected to contribute to the overall exterior sound level.

Mitigation will be applied to multiple sources as needed to ensure compliance with the noise regulations. An approximately 15-foot-tall parapet will be constructed on all sides of the upper-most roof, providing some mitigation to rooftop sources. The emergency generator exhaust noise will be controlled using a critical-grade exhaust silencer. To further limit impacts from the generator, the required periodic routine testing is expected to occur

Table 12.6-8 Baseline Ambient Noise Measurements

							Octave Band Center Frequency (Hz)								
Location and Period	Start	L_{10}	L_{50}	L_{90}	L_{eq}	L_{max}	32	63	125	250	500	1000	2000	4000	8000
	Time	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)	L_{90} (dB)
M1 Day	1:17 PM	70	64	58	67	87	70	65	58	55	54	54	50	42	34
M2 Day	1:48 PM	58	53	51	55	73	61	55	51	49	48	46	41	32	22
M3 Day	3:05 PM	61	59	58	60	77	63	61	57	54	53	55	48	34	23
M4 Day	12:32 PM	54	50	48	52	70	55	53	48	47	45	44	39	32	23
M1 Night	12:03 AM	73	63	54	69	87	62	57	54	52	50	50	45	34	22
M2 Night	12:26 AM	51	50	49	50	67	56	52	53	49	46	44	37	32	24
M3 Night	12:50 AM	57	54	51	56	74	58	57	54	51	49	48	41	29	21
M4 Night	1:17 AM	51	48	47	49	64	53	48	47	48	45	42	37	31	23

Notes:

1. Daytime weather: Temperature = 440 F, RH = 35%, skies sunny, winds 0-2 mph.
   Nighttime weather: Temperature = 350 F, RH = 50%, clear skies, winds 0-2 mph.
2. Some Road Surfaces were dry, others were moist due to melting snow piles.
3. All sampling periods were approximately 20 minutes duration.
4. Daytime measurements were collected on December 30, 2010.
   Nighttime measurements were collected in the early morning on December 31, 2010.

Table 12.6-9 Reference Equipment Noise Levels – Per Unit

Noise Source	Form of Data	Ref. Distance (feet)	Overall Level	Sound Levels (dB) per Octave Band Center Frequency (Hz)									No.	Location	Capacity
			(dBA)	32	63	125	250	500	1000	2000	4000	8000			
Cooling Tower[1]	Sound Power	NA	**99**	N/A	104	102	103	97	93	86	81	78	1	Roof	800-ton
Modular Chiller[2]	Sound Power	NA	**101**	N/A	97	98	99	95	95	95	91	84	2	Penthouse	800-ton
Primary Chilled Water Pump[3]	Sound Power	NA	**96**	85	86	87	89	89	92	89	85	79	2	Penthouse	800 gpm
Condenser Water Pump[3]	Sound Power	NA	**93**	82	83	84	86	86	89	86	82	76	2	Penthouse	1200 gpm
Boiler[4]	Sound Power	NA	**71**	79	78	73	67	66	64	62	62	62	8	Penthouse	3,000 mbh
Boiler Pump[3]	Sound Power	NA	**79**	68	69	70	72	72	75	72	68	62	8	Penthouse	150gpm
System Pump[3]	Sound Power	NA	**96**	85	86	87	89	89	92	89	85	79	2	Penthouse	1360gpm
MAU-1 Laundry[5]	Sound Power	NA	**81**	N/A	N/A	82	85	78	77	69	66	57	1	Penthouse	2000 cfm
AHU-6[6]	Sound Power	NA	**95**	N/A	90	90	96	93	88	86	80	74	1	Penthouse	15,600 cfm
Emergency Generator – Mechanical[7]	Sound Power	23	**95**	N/A	83	95	92	89	90	90	84	83	1	Penthouse	800kW/ 1000kVA
Emergency Generator – Exhaust[7]	Sound pressure	3.28	**117**	N/A	101	121	123	112	108	107	97	82	1	Roof	800kW/ 1000kVA

Notes:

1. BAC Series 3000 #3412C-2 Two-Cell Cooling Tower with single 25HP fan per BAC Cooling Tower Selection Program (Release 6.10 NA); with Directivity of Large Vertical Exhaust Stack per Edison Electric Institute (EEI) Electric Power Plant Environmental Noise Guide, Table 4.19
2. Multistack MS80T 800-ton Centrifugal Chiller [(10) 80-ton units] per "Hoover & Keith: Noise Control for Buildings and Manufacturing Plants" (sec 7-6; eq. 7-3)
3. Primary Pump Selections Document provided by Mark Holmquist of William Rawn Associates, Architects, Inc on 1/5/2011; Hoover & Keith: Noise Control for Buildings & Manufacturing Plants; Table 7-12
4. Aerco BMK-3.0LN using EEI Table 4.2: Sound Power Levels of Main Steam Boilers
5. BESB500-4-1-FC Centrifugal Impellar Fan used on Exhausto Mechanical Dryer Venting System (MDVS)
6. Trane Performance Climate Changer, Direct-Drive Plenum 3-Fan Configuration
7. Caterpillar Model C32 Diesel Generator; 1,000 kW, 100%Load

during daytime hours when background sound levels are highest. Acoustical louvers are expected to be installed to mitigate the sound associated with the mechanical equipment in the penthouse. A summary of the additional noise mitigation proposed for the project is presented in Table 12.6-10.

12.6.6.10 Modeling Methodology

Anticipated noise impacts associated with the project were predicted at the nearest residences around the project site using the CadnaA noise calculation software. This software uses the ISO 9613-2 industrial noise calculation methodology. CadnaA allows for octave band calculation of noise from multiple noise sources, as well as for computation of diffraction around building edges and multiple reflections off parallel buildings and solid ground areas. In this manner, all significant noise sources and geometric propagation effects are accounted for in the noise modeling.

It was assumed for the purposes of this preliminary model that the floor and ceiling of the penthouse were made of untreated concrete and that the open penthouse walls were fitted with non-acoustic louvers.

12.6.6.11 Future Sound Level of Project

An initial analysis considered all of the mechanical equipment without the emergency generator running to simulate typical operating conditions at nearby residences. A second analysis combined the mechanical equipment and the emergency generator to reflect worst-case conditions during brief, routine, daytime testing of the generator. A final analysis was conducted for the emergency generator operating alone to simulate a grid power failure, during which time it is assumed the remaining mechanical equipment will not be operating. The results of nighttime and daytime future project sound level impacts at the closest residences are shown in Tables 12.6-11 and 12.6-12, respectively. For the sake of brevity, the detailed tables only show results at the closest residential location (M1). Since sound levels at Location M1 meet all criteria (with mitigation), the more distant locations will also meet the City of Boston noise regulations.

Table 12.6-10 Attenuation Values Used for Sound Level Modeling (dB)

Noise Source	Form of Mitigation	Octave Band Center Frequency (Hz)							
		63	125	250	500	1000	2000	4000	8000
Penthouse Equipment[1]	Acoustical Louvers	5	10	16	21	28	30	27	15
Emergency Generator – Exhaust[2]	Exhaust Silencer	23	38	35	26	26	32	26	20

[1] Transmission Loss of Acraflow Series 600/16 Acoustical Louvers (or similar)

[2] Noise Reduction of Maxim Super Critical Grade Chamber Type Silencer (or similar) with improved mid-range performance

Table 12.6-11 Nighttime Future Project Sound Level Impacts at Closest Residences[1]

Octave Bands	Residential Nighttime Noise Standard	Without Additional Mitigation		With Additional Mitigation	
		All Equipment Running - No Emergency Generator	Emergency Generator Only	All Equipment Running - No Emergency Generator[3]	Emergency Generator Only[4]
	(dB)	(dB)	(dB)	(dB)	(dB)
32 Hz	68	NA[2]	NA[2]	NA[2]	NA[2]
63 Hz	67	57	40	54	38
125 Hz	61	56	50	50	44
250 Hz	52	**57**	48	45	46
500 Hz	46	**53**	45	37	43
1000 Hz	40	**51**	**45**	31	39
2000 Hz	33	**40**	**43**	27	32
4000 Hz	28	**36**	**33**	25	27
8000 Hz	26	24	18	26	20
Broadband (dBA)	50	**55**	50	41	44
Compliance with the City of Boston Noise Regulation?		No	No	Yes	Yes

Future Project + Background Sound Level (dBA)	58	56	55	55
Incremental Increase Over Background (dBA)	3	1	0	0
Compliance with MassDEP Noise Policy (<10dBA)?	Yes	Yes	Yes	Yes

1. Closest Residences along Massachusetts Avenue (Location M1)
2. Sound Power Level Data not available for 32Hz Octave Band
3. Acoustic Louvers Installed
4. Acoustic Louvers and Improved Generator Exhaust Silencer Installed

Note: Bold values indicate an exceedance of the noise standard

Table 12.6-12 Daytime Future Project Sound Level Impacts at Closest Residences[1]

Octave Bands	Residential Daytime Noise Standard	All Equipment Running During Daytime Emergency Generator Test	
		Without Additional Mitigation	With Additional Mitigation[3]
	(dB)	(dB)	(dB)
32 Hz	76	NA[2]	NA[2]
63 Hz	75	57	54
125 Hz	69	57	51
250 Hz	62	57	49
500 Hz	56	54	44
1000 Hz	50	52	40
2000 Hz	45	45	33
4000 Hz	40	38	29
8000 Hz	38	25	27
Broadband (dBA)	60	56	46
Compliance with the City of Boston Noise Regulation?		No	Yes

Future Project + Background Sound Level (dBA)	59	56
Incremental Increase Over Background (dBA)	3	0
Compliance with MassDEP Noise Policy (<10dBA)?	Yes	Yes

1. Closest Residences along Massachusetts Avenue (Location M1)
2. Sound Power Level Data not available for 32Hz Octave Band
3. Acoustic Louvers and Improved Generator Exhaust Silencer Installed

12.6.6.12 Conclusions

To ensure compliance with applicable noise regulations, the following mitigation efforts will be implemented:

- Acoustic louvers with a transmission loss similar to that specified in Table 12.6-10 will be installed on all four penthouse walls.

- The emergency generator exhaust will be fitted with a super critical-grade muffler whose noise reduction is similar to that specified in Table 12.6-10.

Predicted mechanical equipment noise levels from the project at each receptor location, taking into account attenuation due to distance, structures, and noise control measures, are all below the MassDEP criteria of 10 dBA over the quietest nighttime sound levels. Additionally, the project's mechanical equipment will not create or exacerbate any pure tone conditions when combined with existing nighttime background sound levels that do not already exist currently.

When the aforementioned mitigation efforts are included, the predicted sound levels from project-related equipment are expected to remain below 44dBA, well within the most stringent nighttime residential zoning limits for the City of Boston (50 dBA or less) at the nearest residential receptors. It should be noted that the existing ambient background levels immediately surrounding the project already exceed 50 dBA without any contribution from the project.

At this time, the mechanical equipment and noise controls are conceptual in nature. During the final design phase of the project, mechanical equipment and noise controls will be specified and designed to meet not only the 50 dBA limit, but also the corresponding octave band limits. Additional mitigation may include absorptive paneling or equipment enclosures, as needed.

12.6.7 Solid and Hazardous Waste

12.6.7.1 Hazardous Waste

Classification and Removal of Hazardous Materials

Prior to commencement of the work, investigations will be performed at the site and in the existing buildings to evaluate the presence of contaminated soils, groundwater, asbestos, lead paint, or other hazardous materials that may exist. If such materials are present, they will be characterized based on the type, composition, and level of the contaminants. Work plans will be prepared by appropriately licensed professionals to identify the means and methods for safe removal and legal disposal or recycling of these materials.

Abatement and disposal of hazardous materials (or hazardous waste) discovered in the existing buildings will be performed prior to demolition of the buildings by specialty contractors experienced and licensed in removing and handling these materials.

Excess soils generated from excavations on site and not reused on site will be legally transported off site and disposed of in accordance with the Massachusetts Contingency Plan and other applicable regulatory requirements. Disposal of excess excavated soil materials will be tracked via Bills of Lading or other methods, as required to ensure their proper and legal transport and disposal in accordance with MassDEP regulations.

12.6.7.2 Solid Waste

The project will generate solid waste typical of residential development with dining facilities. Solid waste generated by the project will be between approximately 389.2 tons per year (see Table 12.6-13).

Table 12.6-13 Estimated Solid Waste Generation

Unit Type	Program	Generation Rate	Solid Waste (tons per year)
Residence Hall	350 beds	4 lbs/bed/day	255.5
Dining Hall	400 seats	1 lb/seat/day	73.0
Retail	5,000 sf	5.5 tons/1,000 sf/year	27.5
Music Technology/ Common	26,000 sf	0.007 lb/sf/day	33.2
Total Proposed Solid Waste Generation			**389.2**

Solid waste will include wastepaper, cardboard, glass, bottles, food waste, and other waste typical of residential uses and dining facilities. Each residential floor will have a trash room, and Berklee staff will collect the trash and move it to the dumpster in the loading area of the building on a regular basis. There will be a dumpster/compactor for trash at the loading dock. Trash from the dining hall and music technology space will be collected regularly and transported to the loading dock.

With the exception of "household hazardous wastes" typical of residential uses (e.g., cleaning fluids), hazardous wastes will not be generated.

12.6.7.3 Recycling

A portion of the waste will be recycled, as described further in Section 12.6.7.3. Berklee plans to roll out single-stream recycling campus-wide in April 2011, making it easier for recycling to occur throughout the project. Each residential floor will include space in the trash room for recycling, and will possibly include a 95-gallon recycling container.

Recycling will be picked up on a regular basis and transported to the loading dock area. Recycling from the dining hall and other spaces will also be collected regularly. In addition, Berklee is studying the possibility of using a composting vendor for food waste from the dining hall.

12.6.8 Flood Hazard Zones/Wetlands

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map indicates the FEMA Flood Zone Designations for the site (City of Boston, Community Panel Number 25025C 0077 G). The project site is located outside of the 100-year floor zone.

The site is developed and does not contain wetlands.

12.6.9 Geotechnical/Groundwater Impacts

12.6.9.1 Introduction

This section based on information provided by Haley & Aldrich describes existing site conditions, subsurface soil and groundwater conditions, planned below-grade construction activities for the project, procedures for monitoring and protecting adjacent structures and maintaining groundwater levels in the project area during excavation and foundation construction, and following construction completion.

12.6.9.2 Existing Site Conditions

The project site is currently occupied by two, one-story buildings situated on the east side of Massachusetts Avenue that are registered at 154-162 Massachusetts Avenue and 168-174 Massachusetts Avenue. Belvidere Street borders the site to the north, Massachusetts Avenue to the west, and Saint Germain Street to the south; along the east side of the site and separated by a 10-foot wide passageway, are two buildings registered as 8 Saint Germain Street and 11 Belvidere Street. Ground surface along the Massachusetts Avenue side of the project is approximately El. 22 Boston City Base (BCB) at the north end, sloping down gradually to about El. 19 BCB at the south end of the project.

Each existing building on the project site has a below-grade basement level that is at approximately El. 12 BCB. A portion of the basement of the building at 154-162 Massachusetts Avenue extends out beyond the west façade of the building, beneath the Massachusetts Avenue sidewalk to the curb and is believed to have been originally used as a vault to receive and store coal needed to heat the building. Each existing building is supported on wood pile foundations that likely extend 25 to 35 feet below the basement levels into the underlying natural subsurface soils. Where existing buildings conflict with proposed construction, the existing buildings will be demolished and removed to accommodate the project.

12.6.9.3 Subsurface Soil and Bedrock Conditions

Based on subsurface data obtained at the site during a test boring and test pit exploration program undertaken for the project, and available subsurface data collected by others in the immediate project area, the general subsurface profile is listed in Table 12.6-14 in order of increased depth below the ground surface.

Table 12.6-14 Subsurface Soil and Bedrock Conditions in Project Area

Generalized Subsurface Strata	Approximate Depth Below Ground Surface to Top of Stratum (ft)	Approximate Thickness (ft)
Miscellaneous (Urban) Fill	Not Applicable	10 to 18
Organic Soil Deposits	14 to 18	3 to 4
Glaciofluvial (Sand) Deposits	10 to 21	17 to 28
Marine (Clay) Deposits	37 to 41	80 to 82
Glacial Deposits and Bedrock	118 to 132	Not Applicable

Generalized descriptions of the strata are described below:

- *Miscellaneous (Urban) Fill* – The project site consists of filled land reclaimed from the former Back Bay tidal flats during the late 1800s. The composition of this material varies, but typically consists of loose to medium dense, brown to gray, well graded gravel with sand and/ or medium dense brown silty sand with gravel and/or medium dense yellow brown sandy silt with gravel, and having varying amounts of concrete, cinders, metal, brick, and other miscellaneous materials. Buried building demolition debris, rubble from pre-existing buildings, and remnant foundation walls, slabs and utilities may also be encountered within and beneath the footprint of the existing buildings which currently occupy the site.

- *Organic Soil Deposits* – The Organic Soil Deposits consist of medium stiff brown fibrous peat to medium stiff gray organic soil with gravel.

- *Glaciofluvial (Sand) Deposits* – The Glaciofluvial (Sand) Deposits consist of medium dense to very dense gray poorly graded to well graded sand with gravel.

- *Marine (Clay) Deposits* – The clay, known locally as Boston Blue Clay, is very stiff to hard at the top of the stratum ("crust"), becoming softer with depth, and is generally described as olive gray to gray lean clay with occasional seams of sandy silt/silty sand.

- *Glacial Deposits and Bedrock* – A very stiff gray lean clay with sand and gravel (Glaciomarine Deposits) to very dense gray sandy silt with gravel (Glacial Till Deposits) was encountered below the Marine deposits. Bedrock is anticipated to be encountered below the Glacial Deposits at depths of about 130 feet.

12.6.9.4 Existing Groundwater Conditions

The project site is located in Boston's Groundwater Conservation Overlay District GCOD, which includes those areas in Boston having wood pile supported buildings that are potentially susceptible to the possible effects of depressed groundwater levels. Groundwater levels need to be above the tops of the wood piles to keep the piles submerged and lessen the potential for the wood to decay. Groundwater levels in the vicinity of the project site are monitored by the Boston Groundwater Trust, an entity that tracks and reports groundwater levels in the GCOD.

Recent groundwater level measurements in observation wells in proximity to the project site have ranged from El. 6 to El. 9.5 (BCB), which are somewhat higher than groundwater levels measured elsewhere in the GCOD. Groundwater levels at and near the site could be influenced by leakage into and out of sewers, storm drains, water utilities, and other below grade structures, and environmental factors such as precipitation, season, and temperature.

12.6.9.5 Proposed Foundation and Below Ground Construction

The project will include construction of an above-grade tower with two underground levels. Construction of the underground structure and building foundations will require an excavation extending to the limits of the property and from current ground surface (El. 19 to El. 22 BCB) to El. -18 BCB, which corresponds to a depth of about 40 feet below current ground surface. The bottom of the excavation is anticipated to terminate within the Glaciofluvial (Sand) Deposits, the design bearing strata for the new building's foundation system. The foundation system selected for the new building is anticipated to be comprised of a reinforced concrete mat slab foundation.

In advance of the excavation and foundation construction, an excavation support system will be installed around the perimeter of the entire site to control the limits of the excavation, mitigate adverse impacts to adjacent properties, control groundwater seepage, and maintain current groundwater levels outside the excavation. Although the wall system has not yet been selected, it is anticipated to consist of a continuous interlocking steel sheetpile wall installed from ground surface and sealed into the relatively impervious Marine Deposits anticipated below the bottom of excavation.

Because of the nature of the near surface fill soils, pre-excavation will be performed in advance of installing the excavation support wall. The intent of the pre-excavation is to remove foundations and other buried obstructions from former site buildings that could interfere with installation of the excavation support walls. The project will seek a license from the City to install the excavation support walls in the public right-of-way along the two sides bordered by Massachusetts Avenue and Saint Germain Street.

Due to the depth of excavation, which will be made using conventional methods, lateral bracing of the walls will be required as the excavation is advanced down to foundation subgrade level. Lateral bracing of the excavation support wall will be by internal systems, likely comprised of up to three levels of steel beam struts spanning opposing walls and across corners; external bracing (tiebacks) will not be allowed.

Temporary dewatering will be required inside the excavation to remove groundwater and precipitation during excavation and foundation construction. The relatively watertight excavation support wall will prevent any significant withdrawal of groundwater from beyond the excavation limits. A temporary construction dewatering permit will be obtained from governing agencies prior to discharge of dewatering effluent from the site. Chemical testing of the effluent will be conducted in accordance with permit criteria prior to discharge to municipal systems.

The proposed below-grade construction, which will extend approximately 30 feet below groundwater levels, will be fully waterproofed and designed to resist hydrostatic pressures. In this manner, the below-grade construction will be designed to not adversely affect (lower) long-term groundwater levels.

12.6.9.6 Potential Impacts During Excavation and Foundation Construction

Potential impacts during excavation and foundation construction include impacts to area groundwater levels and ground and building movements due to excavation. Additionally, construction activities will generate ground vibrations, dust, and noise. The excavation support wall and foundation design and construction will be conducted to limit potential adverse impacts, especially to adjacent structures and to groundwater levels.

12.6.9.7 Mitigation Measures

Provisions will be incorporated into the design and construction procedures to limit potential adverse impacts, including the following:

- ♦ The design team will conduct studies, prepare designs and specifications, and review contractor's submittals for conformance to the project contract documents with specific attention to protection of nearby structures and facilities and to maintaining existing groundwater levels. In particular, selection of building foundation systems and excavation support systems and their details will be made taking into consideration mitigation of adverse temporary and long-term effects outside the site.

- Performance criteria will be established in the project specifications for the excavation support systems with respect to movements, water-tightness and the construction sequence of the below-grade portion of the work. The contractor will be required to employ, and modify as necessary, construction methods and take necessary steps during the work to protect nearby buildings and other facilities.

- Performance criteria will be established for protection of groundwater levels in the vicinity of the project. The contractor will be required to modify construction methods and take necessary steps during the work to not lower groundwater levels outside the limits of the site.

- Geotechnical instrumentation will be installed and monitored during the below-grade portion of the work to observe the performance of the excavation, adjacent buildings and structures, and area groundwater levels. Groundwater observation wells will be monitored prior to and during construction activities. When construction begins, groundwater observation wells will be monitored regularly for the duration of the below-grade construction period.

- The project is within the Groundwater Conservation Overlay District (GCOD), and therefore will implement systems of groundwater recharge. The project will be required to recharge the equivalent of one inch of stormwater over the entire impervious area of the site into the ground. Berklee will coordinate with the Boston Groundwater Trust.

12.6.10 Construction Impacts

Due to the proximity of the project site to Massachusetts Avenue, careful scheduling will be required for material removal and delivery. Planning with the City and neighborhood will be essential to the successful development of the project.

A Construction Management Plan (CMP) will be submitted to the Boston Transportation Department (BTD) for review and approval. The CMP will define truck routes which will help to minimize the impact of trucks on local streets. The construction contractor will be required to comply with the details and conditions of the approved CMP.

Construction methodologies that ensure public safety and protect nearby businesses will be employed. Techniques such as barricades, walkways, painted lines, and signage will be used as necessary. Construction management and scheduling—including plans for construction worker commuting and parking, routing plans and scheduling for trucking and deliveries, protection of existing utilities, maintenance of fire access, and control of noise and dust—will minimize impacts on the surrounding environment.

The proposed construction staging plan will be designed to secure the perimeter and isolate the construction while providing safe access for pedestrians and vehicles during normal day-to-day activity and emergencies. Some construction activities will require use of the adjacent streets. Berklee's construction manager will coordinate any use of streets with the BTD through the Construction Management Plan.

12.6.10.1 Construction Methodology

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

As the design of the project progresses, Berklee and its construction team will meet with BTD to discuss the specific location of barricades, the need for lane closures, pedestrian walkways, and truck queuing areas. This will be incorporated into the Construction Management Plan which will be submitted to BTD for approval prior to the commencement of the new construction work.

Information related to the proposed project's foundation is provided in Section 12.6.9.5.

12.6.10.2 Construction Schedule

The Proponent anticipates demolition of the existing buildings and units to begin in September 2011 with new construction following shortly thereafter in October 2011. The project will be complete by August 2013.

Typical construction hours will be from 7:00 am to 6:00 pm, Monday through Friday, with most shifts ordinarily ending at 3:30 pm. No sound-generating activity will occur before 7:00 am. If longer hours, additional shifts, or Saturday work is required, the construction manager will place a work permit request to the Boston Air Pollution Control Commission and BTD in advance. Notification should occur during normal business hours, Monday through Friday. It is noted that some activities such as finishing activities could run beyond 6:00 pm to ensure the structural integrity of the finished product; certain components must be completed in a single pour, and placement of concrete cannot be interrupted.

12.6.10.3 Construction Staging/Public Safety/Access

Access to the site and construction staging areas will be provided in the CMP.

It may be necessary to occasionally occupy pedestrian walkways and parking lanes on Massachusetts Avenue, Belvidere Street and Saint Germain Street. Secure fencing, signage, and covered walkways may be employed to ensure the safety and efficiency of all pedestrian and vehicular traffic flows.

Although specific construction and staging details for each phase of construction have not been finalized, Berklee and its construction management consultants will work to ensure that staging areas will be located to minimize impacts to pedestrian and vehicular flow. Secure fencing and barricades will be used to isolate construction areas from pedestrian traffic adjacent to the site. In addition, sidewalk areas and walkways near construction activities will be well marked and lighted to protect pedestrians and ensure their safety. Public safety for pedestrians on abutting sidewalks will also include covered pedestrian walkways when appropriate and, if required, the suspension of the use of certain sidewalks during the most hazardous periods of overhead work activity during the construction of the superstructure. If required by BTD and the Boston Police Department, police details will be provided to facilitate traffic flow. All construction procedures will be designed to meet all Occupational Safety and Health Administration (OSHA) safety standards for specific site construction activities.

12.6.10.4 Construction Mitigation

Berklee intends to follow City and MassDEP guidelines that will direct the evaluation and mitigation of construction impacts. As part of this process, Berklee and its construction team will evaluate the Commonwealth's Clean Air Construction Initiative.

The CMP will be submitted to BTD for review and approval prior to issuance of a Building Permit. The CMP will include detailed information on construction activities, specific construction mitigation measures, and construction materials access and staging area plans to minimize impacts to abutters and the local community. The CMP will also define truck routes which will help minimize the impact of trucks on City and neighborhood streets.

In addition, Berklee will install "Don't Dump - Drains to Boston Harbor" plaques at storm drains that are replaced or installed by the project.

12.6.10.5 Construction Employment and Worker Transportation

The number of workers required during the construction period will vary. It is anticipated that approximately 300 construction jobs will be created over the life of the project. Berklee will make reasonable good-faith efforts to have at least 50% of the total employee work hours be for Boston residents, at least 25% of total employee work hours be for minorities and at least 10% of the total employee work hours be for women. In addition, Berklee will enter into a jobs agreement with the City of Boston.

To reduce vehicle trips to and from the construction site, minimal construction worker parking will be available at the site and all workers will be strongly encouraged to use public transportation and ridesharing options. The Proponent and contractor will work aggressively to ensure that construction workers are well informed of the public transportation options serving the area. Space on-site will be made available for workers' supplies and tools so they do not have to be brought to the site each day.

12.6.10.6 Construction Truck Routes and Deliveries

The construction team will manage deliveries to the site during morning and afternoon peak hours in a manner that minimizes disruption to traffic flow on adjacent streets. The construction team will provide subcontractors and vendors with Construction Vehicle & Delivery Truck Route Brochures in advance of construction activity. "No Idling" signs will be included at the loading, delivery, pick-up and drop-off areas.

Berklee will coordinate with BTD to designate access routes for truck deliveries and truck routes which will be established in the CMP.

Truck traffic will vary throughout the construction period, depending on the activity. Construction truck routes to and from the project site for contractor personnel, supplies, materials, and removal of excavations required for the project will be coordinated with BTD. Truck access during construction will be determined by the BTD as part of the Construction Management Plan. These routes will be mandated as a part of all subcontractors' contracts for the project. Traffic logistics and routing are planned to minimize community impacts.

12.6.10.7 Construction Air Quality

Short-term air quality impacts from fugitive dust may be expected during demolition, the early phases of construction and during excavation. Plans for controlling fugitive dust during demolition, construction and excavation include mechanical street sweeping, wetting portions of the site during periods of high wind, and careful removal of debris by covered trucks. The construction contract will provide for a number of strictly enforced measures to be used by contractors to reduce potential emissions and minimize impacts. These measures are expected to include:

- Using wetting agents on areas of exposed soil on a scheduled basis;
- Using covered trucks;
- Minimizing spoils on the construction site;
- Monitoring of actual construction practices to ensure that unnecessary transfers and mechanical disturbances of loose materials are minimized;
- Minimizing storage of debris on the site; and
- Cleaning street and sidewalk periodically with water to minimize dust accumulations.

12.6.10.8 Construction Noise

Berklee is committed to mitigating noise impacts from the construction of the project. Increased community sound levels, however, are an inherent consequence of construction activities. Construction work will comply with the requirements of the City of Boston Noise Ordinance. Every reasonable effort will be made to minimize the noise impact of construction activities.

Mitigation measures are expected to include:

- Instituting a proactive program to ensure compliance with the City of Boston noise limitation policy;
- Using appropriate mufflers on all equipment and ongoing maintenance of intake and exhaust mufflers;
- Muffling enclosures on continuously running equipment, such as air compressors and welding generators;
- Replacing specific construction operations and techniques by less noisy ones where feasible;
- Selecting the quietest of alternative items of equipment where feasible;
- Scheduling equipment operations to keep average noise levels low, to synchronize the noisiest operations with times of highest ambient levels, and to maintain relatively uniform noise levels;
- Turning off idling equipment; and
- Locating noisy equipment at locations that protect sensitive locations by shielding or distance.

12.6.10.9 Construction Vibration

All means and methods for performing work at the project site will be evaluated for potential vibration impacts on adjoining property, utilities, and adjacent existing structures. Acceptable vibration criteria will be established prior to construction, and vibration will be monitored, if required, during construction to ensure compliance with the agreed-upon standard.

12.6.10.10 Construction Waste

Solid Wastes

Berklee will reuse or recycle construction materials to the greatest extent feasible. Construction procedures will allow for the segregation, reuse, and recycling of materials. Materials that cannot be reused or recycled will be transported in covered trucks by a contract hauler to a licensed facility, per the MassDEP regulations for Solid Waste Facilities, 310 CMR 16.00.

Hazardous Wastes

Hazardous materials encountered during construction will be handled according to local, state and federal regulations.

It is not anticipated that excess soil will be generated as a result of the project development. However, should excess excavated soil be generated it will be managed in accordance with MassDEP policy and the Massachusetts Contingency Plan.

12.6.10.11 Protection of Utilities

Existing public and private infrastructure located within the public right-of-way will be protected during construction. The installation of proposed utilities within the public way will be in accordance with the MWRA, BWSC, Boston Public Works, Dig Safe, and the governing utility company requirements. All necessary permits will be obtained before the commencement of the specific utility installation. Specific methods for constructing proposed utilities where they are near to, or connect with, existing water, sewer and drain facilities will be reviewed by BWSC as part of its plan review process.

12.6.10.12 Rodent Control

A rodent extermination certificate will be filed with the building permit application to the City. Rodent inspection monitoring and treatment will be carried out before, during, and at the completion of all construction work for the proposed project, in compliance with the City's requirements. Rodent extermination prior to work start-up will consist of treatment of areas throughout the site. During the construction process, regular service visits will be made.

12.6.10.13 Wildlife Habitat

The site is currently developed and, as such, the proposed project will not impact wildlife habitats as shown on the National Heritage and Endangered Species Priority Habitats of Rare Species and Estimated Habitats of Rare Wildlife.

12.7 Sustainability

This section provides a discussion of the sustainability efforts Berklee will pursue related to the 168 Massachusetts Avenue project. Additional information regarding Berklee's sustainability efforts campus-wide can be found in Chapter 9.

Berklee is committed to developing buildings that are sustainably designed, energy efficient, environmentally conscious and healthy for the faculty, staff and students. As required under Article 37 of the Boston Zoning Code, projects that are subject to Article 80B, Large Project Review, shall be Leadership in Energy and Environmental Design (LEED) certifiable. There are seven categories in the LEED certification guidelines: Sustainable

Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation in Design Process and the additional Regional Priority Credits. The project is targeting several credits which span the seven categories and enable the project to meet the Zoning requirement as described below. The LEED NC v2009 checklist is included in Appendix I.

The project is anticipated to meet the Silver Certification threshold with 52 credit points. However, there are 24 credits, listed in italics below, still being considered to determine if appropriate.

Sustainable Sites

The project site is in a dense urban neighborhood close to several public transportation options. The proposed design includes leased retail space on the ground floor. There is no new parking associated with this development.

Prerequisite 1 Construction Activity Pollution Prevention

The Construction Manager shall submit and implement an Erosion and Sedimentation Control (ESC) Plan for construction activities related to the demolition of existing and the construction of the new building specific to this project. The ESC Plan shall conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit and specific municipal requirements for the City of Boston.

Credit 1 Site Selection

The proposed project site is located on previously developed urban site parcels in Boston Proper.

Credit 2 Development Density and Community Connectivity

The proposed project site is in the Fenway/Kenmore neighborhood of Boston bordering on the Back Bay neighborhood. The surrounding community is replete with housing, restaurants, shops, grocery stores, educational and religious institutions, performance venues and other community amenities. In addition, the Boston Public Library is a short walk away.

Credit 3 Brownfield Redevelopment

The proposed project site may be classified as a Brownfield Site and will be assessed for hazardous materials.

Credit 4.1 Alternative Transportation, Public Transportation Access

The Hynes Convention Center Green line MBTA subway station is located approximately 0.1 miles from the project site. There is a bus stop outside the subway station that functions as a hub/transfer station for several bus routes many of which pass directly by or in close proximity to the project site. Other MBTA stations in close proximity include the Symphony Green line station (0.3 miles), the Prudential Green line station (0.3 miles), and the Mass Ave Orange line station (0.4 miles). Additionally, the Back Bay Commuter Rail station and Orange line MBTA station is located 0.7 miles away.

Credit 4.4 Alternate Transportation Parking Capacity

There is no parking (existing or new) associated with this project.

Credit 5.1 Site Development, Protect or Restore Habitat

The plantings on the vegetated roof will be considered for contributions to restoring natural habitat.

Credit 5.2 Site Development, Maximize Open Space

The overall area of the vegetated roof and the hardscape pedestrian walks contribute to urban open space.

Credit 6.2 Stormwater Design, Quality Control

The stormwater will be treated prior to release into the municipal storm sewer system as described below in Section 12.10.4. Additionally, the roof above the dining area is vegetated and will help mitigate storm water runoff.

Credit 7.1 Heat Island Effect, Non-Roof

The project will use sidewalk surfacing materials that meet or exceed SRI value limits.

Credit 7.2 Heat Island Effect, Roof

The roof over the dining area shall be vegetated and the roof on the high rise buildings shall be a high-albedo roof membrane with an SRI of 78 minimum. Together the vegetated roof and the high albedo roof are expected to cover at least 75% of the roof area.

Water Efficiency

The project will specify low flow and high efficiency plumbing fixtures to achieve Water Efficiency.

Prerequisite 1 Water Use Reduction, 20% Reduction

Through the use of low flow and high efficiency plumbing fixtures, the project shall implement water use reduction strategies that use 20% less water than the water use baseline calculated for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements.

Credits 1.1 and 1.2 Water Efficient Landscaping, Reduce by 50%, No Potable Use or No Irrigation

The project will not have a permanent irrigation system. The vegetated roofs will have drought tolerant plant materials that may require occasional watering by hand.

Credit 3 Water Use Reduction

Specified fixtures will include high efficiency toilets and urinals, low flow lavatory faucets and ultra low flow shower heads. The project goal is an overall water savings of 30% above the calculated baseline.

Energy and Atmosphere

The building systems shall be designed to optimize energy performance and will not use refrigerants that are harmful to the environment. The owner shall engage a Commissioning Agent to confirm the building systems are installed and function as intended and designed.

Prerequisite 1 Fundamental Commissioning of the Building Energy Systems

A third party Commissioning Agent (CxA) shall be engaged by the owner for purposes of providing both basic and enhanced commissioning services for the building energy related systems including heating, ventilation, air condition, and refrigeration (HVAC & R), lighting and domestic hot water systems. The CxA shall verify the building systems are installed, calibrated and performing to the building owner's project requirements.

Prerequisite 2 Minimum Energy Performance

The building performance rating shall demonstrate a minimum of a 10% improvement compared to the baseline building performance calculated using the rating method in Appendix G of ANSI/ASHREA/IESNA Standard 90.1-2007. A whole building energy simulation will demonstrate the projected energy savings for the project.

Prerequisite 3 Fundamental Refrigerant Management

The specifications for refrigerants used in the building HVAC & R systems shall NOT permit the use of CFC based refrigerants.

Credit 1 Optimize Energy Performance

The proposed building systems shall target a performance level of a minimum of 20% improvement over a baseline building performance rating. The team shall develop a whole building energy model to demonstrate the expected performance rating of the designed building systems.

Credit 3 Enhanced Commissioning

The Commissioning Agent (CxA) shall be engaged during the design process. The CxA's role shall include reviewing the owner's project requirements, creating, distributing and implementing a commissioning plan, and performing a design review of the design development and construction documents.

Credit 4 Enhanced Refrigerant Management

Long life high-efficiency mechanical equipment shall be specified for the HVAC systems and the refrigerants specified for the systems shall have low Ozone-depletion and Global warming potentials.

Credit 5 Measurement and Verification

The Berklee College of Music may choose to develop and implement a measurement and verification plan.

Credit 6 Green Power

The Berklee College of Music may choose to purchase 'green power' via a 2-year renewable energy contract to provide a minimum of 35% of the building's electricity from renewable sources.

Materials and Resources

Throughout the construction phase of the project, the contractor shall endeavor to divert Construction & Demolition waste from area landfills and procure materials that have recycled content and/or are manufactured locally.

Prerequisite 1 Storage and Collection of Recyclables

Storage of collected recyclables shall be accommodated throughout the building.

Credits 2.1 and 2.2 Construction Waste Management

Prior to the start of construction, the Construction Manager (CM) shall prepare a Construction Waste Management plan. The CM shall endeavor to divert as much demolition debris and construction waste from area landfills as possible with a goal of achieving 75% diversion.

<u>Credits 4.1 Recycled Content 10% (post-consumer & ½ pre-consumer)</u>

The project specifications shall require materials to include pre- and or post-consumer recycled content. During construction, materials submittals shall include a document indicating the percentage of both pre and post consumer recycled content. The CM shall track the recycled content for each material with a project goal to achieve 10% recycled-content materials based on overall project materials costs.

<u>Credits 4.2 Recycled Content 20% (post-consumer & ½ pre-consumer)</u>

During construction, materials submittals shall include a document indicating the percentage of both pre and post consumer recycled content. The CM shall track the recycled content for each material with a project target to achieve 20% recycled-content materials based on overall project materials costs.

<u>Credit 5.1 Regional Materials, 10% Extracted, Processed and Manufactured Regionally</u>

The project specifications shall indicate which materials are to be extracted, harvested, recovered and manufactured within a 500 mile radius of the job site. The project team's goals is that 10% of the materials used be regional materials. The CM shall track the source location for each material with a project target to achieve 10% regional materials based on overall project materials costs.

<u>Credits 5.2 Recycled Content 20% Extracted, Processed and Manufactured Regionally</u>

Construction materials submittals shall include a document indicating the location of the materials procured. The CM shall track the regional materials with a project target to achieve 20% regional materials based on overall project materials costs.

<u>Credit 7 Certified Wood</u>

The Berklee College of Music may use a minimum of 50% FSC certified wood for wood permanently installed inside the building envelope.

Indoor Environmental Quality

The air quality shall be monitored during the construction phase of the project and likely prior to occupancy. Low emitting materials will be used throughout construction to maintain and improve air quality. The building occupants will be able to maintain a comfortable environment through access to thermal and lighting controls.

Prerequisite 1 Minimum IAQ Performance

The building mechanical systems are designed to meet or exceed the requirements of ASHRAE Standard 61.1-2007 sections 4 through 7 and/or applicable building codes.

Prerequisite 2 Environmental Tobacco Smoke (ETS) Control

The building will be a non-smoking environment.

Credit 1 Outdoor Air Delivery Monitoring

The project shall incorporate permanent CO2 sensors and measuring devices to provide feedback on the performance of the HVAC system. Devices shall be programmed to generate an alarm when the conditions vary by 10% from a set point.

Credit 3.1 Construction IAQ Management Plan (during construction)

The Construction Manager shall develop an Indoor Air Quality Management Plan for the construction and pre-occupancy phases of the project to meet/exceed the recommended Control Measures of the SMACNA IAQ Guidelines for Occupied buildings Under Construction 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter3). Absorptive materials stored on site shall be protected from moisture damage.

Credit 3.2 Construction IAQ Management Plan (before occupancy)

After the completion of construction and prior to occupancy, Berklee may decide to conduct baseline IAQ testing to demonstrate that contaminant maximum concentrations are not exceeded.

Credits 4.1 Low-Emitting Materials, Adhesives & Sealants

The specifications will include requirements for adhesives and sealants to meet low Volatile Organic Compounds (VOC) criteria for adhesives and sealants.

Credits 4.2 Low-Emitting Materials, Paints and Coatings

The specifications will include requirements for paints and coatings to meet low VOC criteria for paints and coatings.

Credits 4.3 Low-Emitting Materials, Flooring Systems

The specifications will include requirements for hard surface flooring materials to be FloorScore certified and carpet systems shall comply with the Carpet Institute Green label program.

Credit 4.4 Low Emitting Materials, Composite Wood and Agrifiber Products

The project team shall endeavor to use composite wood and agrifiber products that contain no added urea-formaldehyde.

Credit 5 Indoor Chemical and Pollutant Source Control

The project team shall design to minimize and control the entry of pollutants into the building and to contain chemical use areas.

Credit 6.1 Controllability of Systems, Lighting

It is the intent of the design to provide individual lighting controls for regularly occupied spaces. The controls may include vacancy/occupancy sensors and day light dimming controls. Multi-occupant user spaces such as classrooms shall have multi-level lighting controls for modifying light levels as necessary for the various uses.

Credit 6.2 Controllability of Systems, Thermal Comfort

It is the intent of the design to provide individual temperature controls for regularly occupied spaces.

Credit 8.1 Daylight and Views, Daylight for 75% of the spaces

It is the intent of the design to locate regularly occupied spaces along the perimeter of the floor plate with ample vision glass to achieve daylight for 75% of the areas.

Credit 8.2 Daylight and Views, Views for 90% of the spaces

It is the intent of the design to locate regularly occupied spaces along the perimeter of the floor plate with ample vision glass to achieve views for 90% of the areas, below-grade music technology spaces excepted.

Innovation & Design Processes

The team has identified several possible ID credits which are listed below, (limited to 5 ID credits total).

Credit 1 Exemplary Performance for SSc4.1

The project site is located on several bus routes with a frequency of service resulting in over 200 transit rides per day.

Additional ID credits under consideration

Exemplary Performance for MRc2.2 Construction Waste Management: Due to the high volume of demolition debris, there is a high likelihood the CM could divert 95% of the construction waste by weight from area landfills.

Green Housekeeping: Building Facilities/Maintenance shall implement a cleaning program that uses 'green' cleaning products.

Low Mercury lighting: Building Facilities/Maintenance shall establish a lighting purchasing plan to limit the levels of mercury containing lamps purchased for the building.

Credit 2 LEED Accredited Professional (required ID credit for LEED certification)

A LEED AP shall provide administrative services to oversee the LEED credit documentation process.

Regional Priority Credits

Regional Priority Credits (RPC) are established LEED credits designated by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs, an additional credit is awarded to the project. RPCs applicable to the Boston area include: SSc3, SSc6.1, SScC7.1 EAc2 and MRc1.1. This project anticipates two RPCs: SSc3 Brownfield Redevelopment and SSc7.1-Heat Island Effect, Non-Roof.

12.8 Urban Design

Berklee brings vitality to Massachusetts Avenue on a daily basis while benefitting from the vibrant energy of the area's street life. The 168 Massachusetts Avenue project can help define a new center of gravity for the college, creating an urban campus on Massachusetts Avenue that connects students, faculty, and their city. The building will also contribute to a neighborhood context that can guide subsequent development, providing a transition for the future iconic Crossroads project proposed at Massachusetts Avenue and Boylston Street.

The design of the 168 Massachusetts Avenue project has been guided by Berklee's goal of creating a more transparent and engaging presence within the city. The proposed mixed-use building will incorporate architectural features and exterior façade materials that will help enliven the pedestrian experience and enhance the character of both the Berklee urban campus and the surrounding neighborhood. The lower "podium" portion of the building incorporates the more public functions of the program, with extensive glazing at the ground floor lobby/retail space and at the large dining and informal performance space on the second and third floors to enliven the public realm and animate the street. The curtain wall at the dining/performance space will have canted and faceted glass that serves to provide necessary acoustical deflection inside for music, while also bringing visual excitement to the streetscape along Massachusetts Avenue and Saint Germain Street.

The residence hall program of the project sits above the podium in a tower element on the north side of the site, with the residential floors visually separated from below by an all-glass enclosed fourth floor housing practice rooms and a small fitness center. The rooftop of the southern portion of the podium will also feature an outdoor terrace and green roof for use by students via the fourth floor of the building. The green roof will feature a screen of foliage and/or other materials to provide aesthetic and auditory privacy to the residential properties on Saint Germain Street. The façade material considered for the residence hall has centered around two materials—variegated limestone or bronze-colored stainless steel. Both are warm, natural materials that impart a sense of timelessness and stability, each having an inherent variety in color and tone that also gives liveliness to the building without trying to draw attention to itself. The large punched windows of the dormitory bedrooms will have a loft-like character, reflective of the "artistic loft" sensibility of Berklee's music students. Double-height student lounges at the corner of Massachusetts Avenue and Belvidere Street create a special vertical glass element; each common room, serving approximately 60 students, incorporates communicating stairs that enhance a greater sense of community between two residential floors. At the top of the building, a 20-foot setback on the south façade forms a two-step profile and helps visually break up the massing at the skyline.

A discussion of the pedestrian experience around the project, including the improved and widened sidewalks, as well as a discussion of the building massing are provided in Section 5.2.7.

12.9 Historic and Archaeological Resources

Immediately adjacent to the project site are a number of inventoried properties, including Saint Cecilia Church and properties along Saint Germain Street. Chapter 8 provides more information about historic resources in the vicinity of the project site.

Adjacent historic properties will not be impacted by shadow from the project during most of the time periods studied, as described in Section 8.3 and 12.6.2. During four time periods, during the afternoon and evening hours, new shadow from the project will be cast on some of the inventoried properties on Saint Germain Street, mostly on rooftops. Additional information on impacts to historic resources in the vicinity of the project site is provided in Section 8.3.

A review of the Inventory of Historic and Archaeological Assets identified no known archaeological resources are located within the project site. In addition, the project site is located on previously disturbed urban land, therefore, it is unlikely that significant archaeological sites remain.

12.10 Infrastructure Systems

The infrastructure analysis addresses the proposed project's impact on the capacity and adequacy of the existing water, sewage, and drainage utility systems. The following sections describe the capacity of the existing utility infrastructure surrounding the site and explain how these systems will service the proposed project.

12.10.1 System Connections

Berklee will coordinate with the Boston Water and Sewer Commission (BWSC) on the design of the proposed water, drainage, and sewer connections. All appropriate permits and approvals will be acquired prior to construction. Utility connections will be designed to minimize any effects within the surrounding area and existing business operations. Based on the analysis there is adequate sewage capacity in the area. The results of the pending BWSC flow tests will determine if there is sufficient water supply.

12.10.2 Sewage/Storm Water Systems

12.10.2.1 Existing Conditions

The existing sewer and drainage system infrastructure that services the project site and surrounding area is owned and operated by the BWSC (see Figure 12.10-1).

Within Massachusetts Avenue, a 15-inch combined sewer line exists and ultimately discharges through the Boston Main Drainage Tunnel to the Massachusetts Water Resource Authority's Deer Island Wastewater Treatment Plant.

Within Belvidere Street a 12-inch sewer line exists and connects to the West Side Interceptor which ultimately discharges to the Massachusetts Water Resource Authority's Deer Island Wastewater Treatment Plant.

Within Belvidere Street a 15-inch storm drain exists and becomes a combined sewer system that runs parallel to the Charles River containing Combined Sewer Overflows and ultimately discharges to the Massachusetts Water Resource Authority's Deer Island Wastewater Treatment Plant.

12.10.2.2 Proposed Sewage Generation

The project's sewage generation rates were estimated using Massachusetts State Environmental Code (Title 5) 310 CMR 15.203. The Code lists typical generation rates for the sources listed in Table 12.10-1.

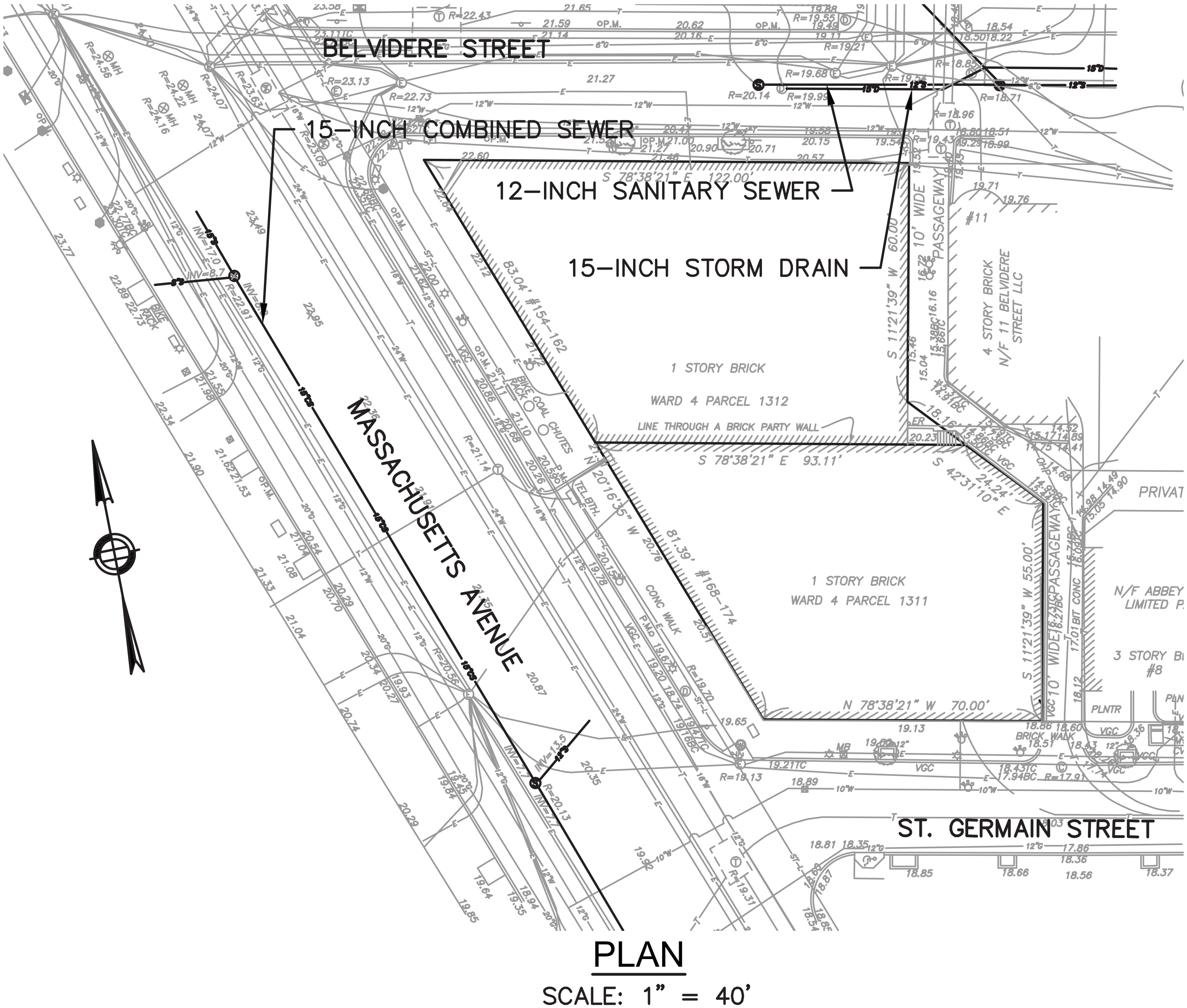


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Figure 12.10-1

Existing Sanitary and Storm Drain Systems

Nitsch Engineering

Table 12.10-1 Sewage Generation

Use	Area (sf)	Units	Sewage Generation Rate	Total gpd
College Dormitory*		350 Beds	65 gpd/bed	22,750
Retail	5,000		50 gpd/1,000 sf	250
Music Technology	19,000		75 gpd/1,000 sf	1,425
Total				**24,425**

*Includes dining hall wastewater generation.

The proposed project is expected to produce a total effluent sewage discharge of approximately 24,425 gpd. A Massachusetts Department of Environmental Protection (MassDEP) Sewer Connection Permit is not anticipated at this time.

12.10.2.3 Sanitary Sewer System Capacity Analysis

An analysis was performed on the sanitary sewer lines the project may utilize. Information on the combined sewer line that runs within Massachusetts Avenue and the sanitary sewer line that runs within Belvidere Street were obtained for the analysis. Pipe diameters and inverts were taken from an existing conditions survey prepared by Feldman Land Surveyors. The flow capacity for each segment was analyzed using the Manning equation.

The 15-inch combined sewer main in Massachusetts Avenue has a capacity of 2.02 million gallons per day (mgd).

The 12-inch sewer main in Belvidere Street has a capacity of 2.95 mgd. Based on the peak flow estimate, the project will not substantially burden the existing sewage system. Calculations are presented in Table 12.10-2.

Table 12.10-2 Sewer Hydraulic Capacity Analysis

STREET	SIZE	SLOPE (ft/ft)	MANNING'S n	EXISTING CAPACITY MGD	EXISTING CAPACITY GPM	PROPOSED PEAK FLOW (GPM)
Massachusetts Avenue	15	.002	0.012	2.02	1,405	*17.0+/-*
Belvidere Street	12	.014	0.012	2.95	2,051	*17.0+/-*

12.10.2.4 Sewer/Stormwater Connections

The project's sewage and storm water flows will be kept separate per BWSC requirements, connecting to the appropriate mains respectively within Massachusetts Avenue and/or Belvidere Street. Although the existing sewer line within Massachusetts Avenue is a combined system, the BWSC and the City of Boston are attempting to separate stormwater and waste water over time to prevent periodic overflows of combined sewer and stormwater into receiving waters, and to reduce the sewage treatment burden at Deer Island.

12.10.2.5 Sewer/Stormwater Mitigation

In order to minimize sewage generation, the project will meet all applicable code requirements for the installation of low-flow fixtures. Stormwater run-off rates will not exceed existing rates given that the amount of proposed impervious area will mimic existing conditions. The implementation of several Best Management Practices (e.g. deep sump catch basins, oil/water separators, and an operation and maintenance plan) onsite will significantly improve the quality of stormwater run-off.

The project will also implement a system of groundwater recharge that satisfies the requirements if the Groundwater Conservation Overlay District. Berklee will coordinate with the BWSC and BGwT.

12.10.3 Water Supply System

12.10.3.1 Existing Conditions

Water to the project area is delivered through interconnected network water distribution systems, designated as Southern Low Service (SLS) Systems and Southern High Service (SHS) Systems. SLS systems are generally used to meet domestic water needs and street hydrant demand. SHS systems are generally used as the main supply to the low-pressure service system and supply water for building fire protection systems.

The SLS and SHS systems are integrally connected to form loops that allow major water demands to be fed from more than one direction. Looping allows each distribution system to function at optimum efficiency and provides a measure of safety and redundancy in the event of a water main break.

Adjacent to the site are 12-inch high and 12-inch low service water mains in Belvidere Street. There are 16-inch high, 12-inch low, and 24-inch low service water mains in Massachusetts Avenue and a 10-inch low service water main in Saint Germain Street (see Figure 12.10-2). Hydrant flow tests will be conducted as part of the project design to assist the plumbing and fire protection engineers with their designs.

12.10.3.2 Anticipated Water Consumption

The project's water demand is estimated at 110% of the sewage generation. Average potable water demand for the project is estimated at 26,868 gpd.

12.10.3.3 Water System Connections

Proposed connections are expected to be to the low pressure system for domestic water and the high pressure system for fire protection. The project will connect to any system adjacent to the site as recommended by the BWSC. All former water connections not utilized will be cut and capped at the main.

12.10.3.4 Additional Utilities Connections

The site is serviceable with electric, telephone, cable, and gas services within Massachusetts Avenue, Belvidere Street, and Saint Germain Street. All proposed utility connections will be coordinated with each respective utility provider.

12.10.4 Stormwater/Water Quality

In February of 2008, the MassDEP revised their Stormwater Management Standards to better address water quality and water quantity issues associated with project sites. The revisions promote increased stormwater recharge, treatment of more runoff from polluting land uses, low impact development (LID) techniques, pollution prevention, the removal of illicit discharges, and improved operation and maintenance of stormwater best management practices (BMPs).

A brief explanation of each standard and the project's compliance is provided below.

Standard #1: No new stormwater conveyances may discharge untreated stormwater directly to or cause erosion in wetlands or waters of the Commonwealth.

Compliance: The proposed design will comply with Standard #1. There will be no untreated stormwater discharges. All discharges will be treated prior to connection to the BWSC system.

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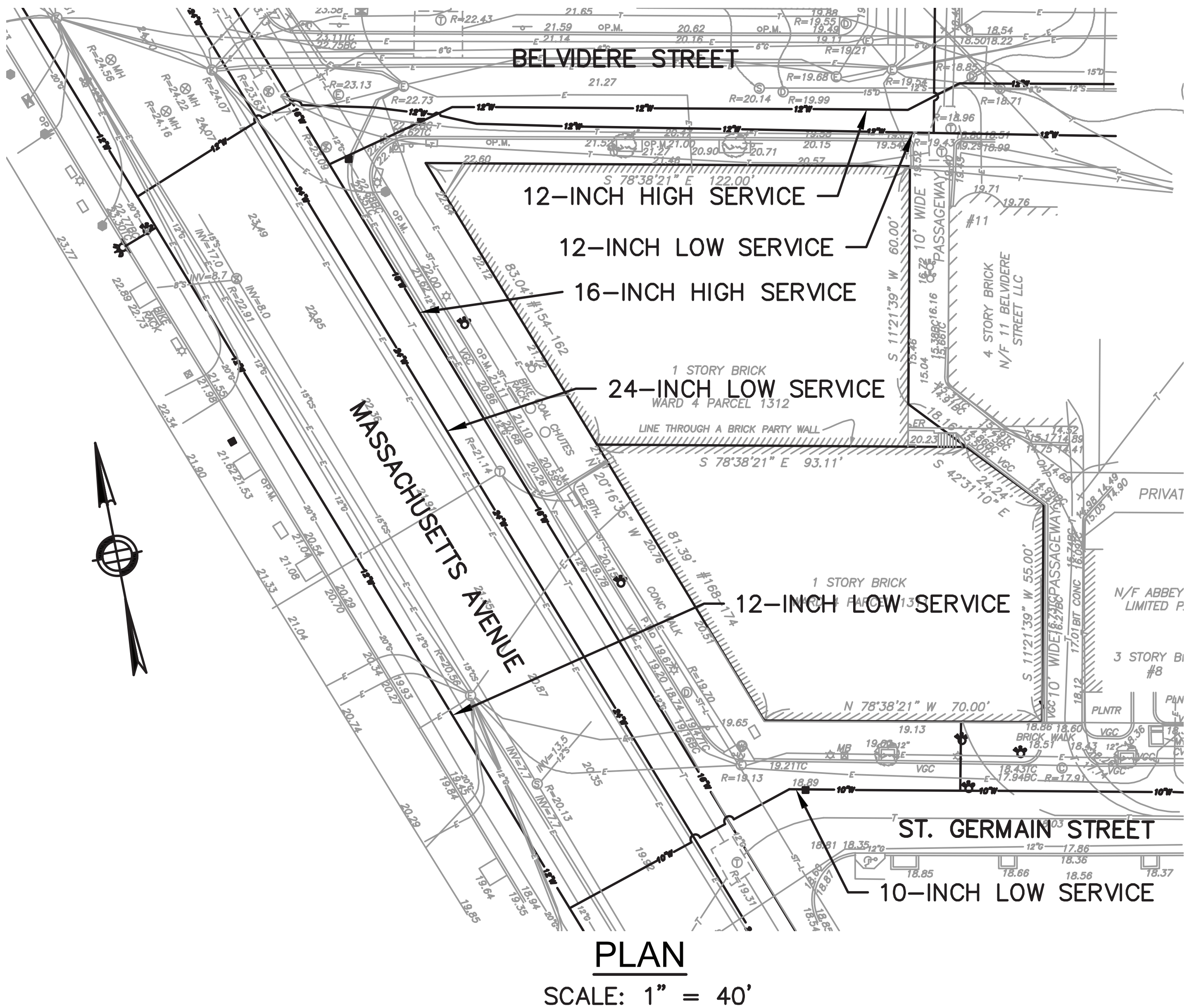

Figure 12.10-2

Existing Water Systems

Nitsch Engineering

Standard #2: Post-development peak discharge rates do not exceed pre-development rates on the Site either at the point of discharge or down-gradient of the property boundary for the 2- and 10-year 24-hour design storms. The project's stormwater design will not increase flooding impacts off-site for the 100-year design storm.

Compliance: The proposed design will not increase the impervious area compared to the pre-development condition. Therefore, the post-development peak discharge rate will be equal to or less than the pre-development discharge rate.

Standard #3: The annual groundwater recharge for the post-development site must approximate the annual recharge from the existing site conditions, based on soil type.

Compliance: As there is no increase in impervious area, the project is not required to provide additional groundwater recharge. However, due to the project lying within the Groundwater Conservation Overlay District, the project will be required to recharge a portion of the stormwater runoff.

Standard #4: For new development, the proposed stormwater management systems must achieve an 80% removal rate for the site's average annual load of Total Suspended Solids (TSS).

Compliance: To the maximum extent possible, the project's stormwater management system will remove 80 percent of the post-development site's average annual TSS load. Deep-sump hooded catch basins and water quality inlets, as needed, will be sized to meet the requirement.

Standard #5: If the site contains land uses with higher potential pollutant loads, specific BMPs must be used to treat and recharge stormwater runoff from the site.

Compliance: The project site does not contain any areas with higher potential pollutant loads. Therefore, the standard is not applicable to this project.

Standard #6: Stormwater discharges near or to critical areas require the use of source control, pollution prevention measures and specific BMPs to properly treat and recharge stormwater runoff from the site.

Compliance: The project does not discharge stormwater near or to critical areas. Therefore, the standard is not applicable to this project.

Standard #7: Redevelopment of previously developed sites must meet the Stormwater Management Standards to the maximum extent practicable.

Compliance: The project intends to meet or exceed all Stormwater Management Standards.

Standard #8: Erosion and sediment controls must be designed into the project to minimize adverse environmental effects.

Compliance: The project will comply with this standard. Sedimentation and erosion controls will be incorporated as part of the design of this project and employed during on-site construction.

Standard #9: A long-term operation and maintenance plan is required to ensure proper maintenance and functioning of the stormwater management system.

Compliance: An Operations and Maintenance Plan including long-term BMP operation requirements will be prepared to ensure proper maintenance and functioning of the system.

Standard #10: All illicit discharges to the stormwater management system are prohibited.

Compliance: No illicit discharges will be introduced into the stormwater management system.

12.11 Coordination with Other Agencies

12.11.1 Architectural Access Board Requirements

The project will comply with the requirements of the Architectural Access Board and the standards of the Americans with Disabilities Act.

12.11.2 Massachusetts Historical Commission

The project will comply with Section 106 of the National Historic Preservation Act (36 CFR 800) and State Register Review (950 CMR 71) to the extent applicable.

12.11.3 Boston Landmarks Commission

The project is subject to the City of Boston's Demolition Delay Ordinance (Article 85 of the Boston Zoning Code). Prior to the commencement of demolition, the project will prepare an Article 85 Application for buildings proposed for demolition that are over 50 years of age and submit the applications to the Boston Landmarks Commission.

12.11.4 Other Permits and Approvals

Section 12.3 lists agencies from which permits and approvals for the project will be sought.