Expanded Project Notification Form

Klarman Hall / G2 Pavilion at Harvard Business School

Submitted to:

BOSTON REDEVELOPMENT AUTHORITY
One City Hall Square
Boston, MA 02210

Submitted by:

HARVARD UNIVERSITY

OCTOBER 2, 2015

Expanded Project Notification Form

Klarman Hall / G2 Pavilion at Harvard Business School

Submitted to:

Boston Redevelopment Authority

Submitted by:

Harvard University

In conjunction with:

Epsilon Associates, Inc.
William Rawn Associates, Architects, Inc.
Atelier Ten
Haley & Aldrich, Inc.
Nitsch Engineering
Reed Hilderbrand LLC
R.G. Vanderweil Engineers, LLP
Walsh Brothers

October 2, 2015

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General Information

1.0 GENERAL INFORMATION

1.1 Introduction and Project Background

The President and Fellows of Harvard College ("Harvard" or "Harvard University"), on behalf of the Harvard Business School (HBS) (the "Proponent"), propose the phased construction of two new buildings, Klarman Hall and G2 Pavilion (the "Project") on the site of the existing Burden Hall and adjacent parking lot located in the southeast corner of the HBS campus immediately east of Spangler Center. See Figure 1-1 for an aerial locus map.

As described in the Ten Year Institutional Master Plan (IMP) for Harvard's campus in Allston approved in 2013, the Project involves the construction of two new academic buildings more suitable for HBS's current needs to replace HBS's Burden Hall, a building not listed in the State and National Registers of Historic Places and/or included in the Inventory of Historic and Archaeological Assets of the Commonwealth. Built in 1971, Burden Hall, although too small for many of HBS's current gatherings and lacking certain characteristics that limit HBS's ability to host global events and create a first-class learning environment, is used for class capstone events, student run conferences, faculty and guest lectures, and academic and alumni gatherings.

The Project, consistent with Harvard's IMP, will replace Burden Hall with up to approximately 105,100 square feet of new construction (up to approximately 76,100 net new square feet) to meet HBS's current needs, to be constructed in two phases. The first phase will consist of approximately 81,100 square feet of new construction immediately south of the existing Burden Hall. This two-story structure with one below-grade concourse level, will house a modern, media-equipped auditorium seating approximately 1,000 (the size of one MBA class), and foyer, reception, meeting and service space to support world-class convening. The second phase of the Project includes the demolition of Burden Hall and replacement with an approximately 18,000 to 24,000 square foot one to two-story facility with one below-grade level (known herein as the G2 Pavilion), containing meeting and classroom space to be closely integrated with the new auditorium in Klarman Hall. The Project will be smaller than what was proposed in the IMP. Improvements to outdoor space will also be included in the Project, including new pathways and green spaces along Kresge Way, between Klarman Hall and Spangler Center, and an extension of the HBS Central Green. There will be no new parking associated with the Project.

A more detailed description of the Project is included in Chapter 2, Project Description.

This Expanded Project Notification Form (PNF) is being submitted to the Boston Redevelopment Authority (BRA) by Harvard on behalf of HBS in accordance with Article 80B of the Boston Zoning Code to initiate Large Project Review.

HARVARD | BUSINESS | SCHOOL
KLARMAN HALL

Figure 1-1: Aerial Locus Map
Expanded PNF

Source: Epsilon Associates, Inc.

1.2 Harvard Business School Background, Mission, and Objectives

The Harvard Business School was established in 1908 with a 15 member faculty, 33 regular students, and 47 special students. Initially housed across several buildings on Harvard's Cambridge campus, HBS moved into a consolidated campus in Allston adjacent to Harvard's athletic facilities in the 1920s. Over time, Harvard has acquired additional lands in Allston for a variety of purposes, including growth of the Harvard Business School and general administrationservices associated with the University, such as printing, campus police, and the University shuttle service. The HBS campus encompasses approximately 40 acres in Allston.

Over 100 years after its founding, the Harvard Business School's academic program is focused on three areas:

1. Doctoral Programs - Nine full-time programs leading to a PhD or Doctor of Business Administration (DBA) degree;

2. Executive Education - More than 95 programs preparing talented professionals from all over the world for new levels of leadership in their careers and within their organizations; and

3. Master of Business Administration (MBA) Program - An intensive, two-year residential program leading to an MBA degree.

The mission of HBS is to educate leaders who make a difference in the world.

1.3 Project Team

Project Name:	Klarman Hall/G2 Pavilion at Harvard Business School
Location:	Harvard Business School Campus Allston, MA
Proponent:	President and Fellows of Harvard College acting by and through Harvard Business School Holyoke Center, Suite 900 1350 Massachusetts Avenue Cambridge, MA 02138 Drew Faust, President, Harvard University Nitin Nohria, Dean, HBS Angela Crispi, Executive Dean for Administration, HBS Andy O'Brien, Chief of Operations, HBS

Proponent Contact:	Harvard Business School Shad Hall 70 North Harvard Street Boston, MA 02163 (617) 496-3534 Andy O'Brien Paul Dietel Tom Koch
Architect:	William Rawn Associates, Architects, Inc. 10 Post Office Square, Suite 1010 Boston, MA 02109 (617) 423-9205 Bill Rawn Cliff Gayley Mark Scott
Landscape Architect:	Reed Hilderbrand LLC Landscape Architecture 130 Bishop Allen Drive Cambridge, MA 02139 (617) 923-2422 Adrian Nial Brie Mendozza
Permitting and Historic Resources Consultant:	Epsilon Associates, Inc. 3 Clock Tower Place, Suite 250 Maynard, MA 01754 (978) 897-7100 Cindy Schlessinger Geoff Starsiak
Civil Engineer:	Nitsch Engineering 2 Center Plaza, Suite 430 Suite 430 Boston, MA 02108 (617) 338-0063 Nicole Holmes Caroline McManus

MEP Engineer:	R.G. Vanderweil Engineers, LLP 274 Summer Street Boston, MA 02210 (617) 423-7423 Shelley Vanderweil Sarah Vaughan
Geotechnical and Hazardous Waste Consultant:	Haley & Aldrich, Inc. 465 Medford Street, Suite 2200 Boston, MA 02129 (617) 886-7400 Bryan Sweeney
Sustainability Consultant:	Atelier Ten 45 East 29th Street, 4th Floor New York, NY 10003 (212) 254 4500 Nico Kienzl Leanora Paniccia
Construction Manager:	Walsh Brothers 210 Commercial Street Boston, MA 02109 (617) 878-4800 Michael Mallett

Chapter 2
Project Description

2.0 PROJECT DESCRIPTION

2.1 Existing Site

The site of the Project is located in the southeast corner of the HBS campus immediately east of Spangler Center and west of Kresge Way. The site includes a surface parking lot and, to the north of the lot, Burden Hall. Burden Hall is an approximately 29,000 square foot academic building that includes a 766-seat auditorium that is used for class capstone events, student run conferences, faculty and guest lectures, and academic and alumni gatherings. Burden's auditorium is too small for many of HBS's current gatherings, and the Hall's lack of foyer and meeting space, support facilities, and accessibility, limit HBS's ability to host global events and create a first-class learning environment. Burden Hall was not built as part of the McKim, Mead and White campus, and is a windowless building lacking a positive relationship with campus open spaces, pedestrian paths, and buildings. It is disconnected from other campus academic and student buildings, and does not contribute to a positive participant experience, or campus life. It constricts views and pedestrian connections between the HBS Central Green, the focus of the academic campus, and Kresge Way, an important pedestrian route. Built in 1971, Burden Hall is not listed in the State and National Registers of Historic Places and/or included in the Inventory of Historic and Archaeological Assets of the Commonwealth. At the end of this chapter, see Figure 2-1 for an existing site plan and Figures 2-2 and 2-3 for images of the existing conditions around the site.

2.2 Description and Program

The Project includes construction of two new buildings, Klarman Hall and G2 Pavilion, to replace the existing Burden Hall which will be demolished.

Klarman Hall will include approximately 81,100 square feet, with two above-grade levels and one below-grade level. The building will include a mezzanine balcony level in the hall, and a catwalk area above the occupied floors. The below-grade level will include a tunnel connection to Spangler Center. The primary program element will be an approximately 1,000-seat auditorium for large campus events, speakers, conferences and cultural shows. In addition, the building will include a lobby within a glass Winter Garden on the north side facing the central HBS campus, overflow lobby spaces to the west and south of the hall, basement shell and support spaces (including mechanical spaces, dressing rooms, a Green Room, storage and a small office for building staff) and technical support spaces. Figures 2-4 to 2-16 at the end of this chapter include a proposed site plan, floor plans, sections, elevations and a circulation plan. Klarman Hall will be built prior to the demolition of Burden Hall so that HBS will have a large auditorium available at all times.

The G2 Pavilion is proposed to include a one to two story structure with one below-grade level totaling approximately 18,000 sf to 24,000 sf. The Pavilion may include meeting or classroom space, and will connect to Klarman Hall. The design is still being determined, but when it is available, the G2 Pavilion will go through design review.

The Project is smaller than the proposed project described in the IMP—approximately to 34,900 sf to 40,900 sf smaller.

Separate from the Project, but related to improvements that will be required to the parking lot, Kresge Way will be redesigned to simplify and clarify this busy campus gateway. Improvements include: a new bicycle terrace, relocation of the guard shack, relocated taxi area, and new landscaping.

The Accessibility Checklist is included as Appendix A.

2.3 Consistency with Zoning

The Project site is located within the Harvard University Institutional Sub-district of the Allston Neighborhood District and also within Harvard's IMP Area. "College or University" uses are allowed uses within this subdistrict. Prior to the issuance of a building permit, the BRA must issue a Certificate of Compliance pursuant to Section 80B-6 of the Zoning Code and a Certificate of Consistency pursuant to Section 80D-10 of the Zoning Code stating the Project is consistent with the University's IMP. Section 2.4, below, describes Harvard's IMP.

2.4 Consistency with Harvard University IMP

Harvard has been filing Institutional Master Plans for its Allston campus since 1989. Most recently, Harvard filed an Institutional Master Plan Notification Form (IMPNF) in October 2012 to start the process of the review and approval of a new Ten Year Institutional Master Plan (IMP) for Harvard's campus in Allston. Harvard submitted its new IMP on July 26, 2013 [revised in October 2013] in response to the BRA's Scoping Determination on the IMPNF. The BRA Board voted to approve the IMP on October 17, 2013. The Zoning Commission approved the IMP on November 21, 2013.

The Klarman Hall/G2 Pavilion project was included as a Proposed Institutional Project (referred to as the "Harvard Business School Burden Hall Replacement Project") as part of the approved 2013 IMP filing. The IMP described the project as follows:

> HBS intends to replace Burden Hall with approximately 140,000 square feet of new construction, to be phased in two closely consecutive stages so that the School will have a large auditorium at all times. The first phase will consist of approximately 110,000 sf of new construction immediately south of existing Burden, on the south edge of the Central Green, east of the Spangler Center. Similar in height to Spangler Center, this three-story structure with two below-grade concourse levels, will house a modern, media-equipped auditorium seating approximately 1,000, the size of one MBA class, and foyer, reception, meeting and service space to support world-class convening. It will connect to the Spangler Center, the center of MBA student life, and to academic buildings at the concourse (tunnel) level. Foyer and reception areas activated by social and study space will overlook the Central Green and create an attractive entrance from East Drive. As

part of this project, Harvard will create the east end of the new Spangler Way, and provide for vehicular access and drop-off to the facility from East Drive. Service and deliveries will be primarily through Batten Way to Central Receiving and the tunnel system. Up to 60 parking spaces in the Spangler Lot displaced by the building construction will be relocated within the lot or to adjacent parking facilities by restriping these facilities.

The second phase of Burden Replacement will demolish Burden Hall and replace it with an approximately 30,000 sf two-story facility below grade, containing meeting and classroom space closely integrated with the new auditorium to the south. As part of this project, the Central Green will extend eastward to East Drive, joining two important campus precincts. A small pavilion on the Green is envisioned as a "jewel" in the landscape, inspired by the existing Class of 1959 Chapel, a successful complement to the Georgian-influenced buildings on campus.

As described in more detail in Section 2.2 above, the currently proposed Project is consistent with, although smaller than, the project as it was described in the approved IMP. The Project, as currently proposed, has been presented to the Allston Task Force.

2.5 Community Benefits

Community benefits for Harvard's projects in Allston are part of a broader discussion of community benefits related to the University's IMP for its Allston Campus and were discussed and negotiated on that basis rather than on a project-by-project basis. The IMP that was approved by the BRA Board in October 2013 included a comprehensive master plan for community benefits with significant commitments in the areas of public realm, education programming, workforce development, and housing.

2.6 Regulatory Controls and Permits

2.6.1 Applicability of MEPA

Harvard filed a Draft Environmental Impact Report (EIR) in December 2013 and a Final EIR in August 2014 for the University's Allston Master Plan. In October 2014, the Secretary of Energy and Environmental Affairs issued a Certificate finding that the Final EIR adequately and properly complied with the MEPA regulations. As part of the Special Review Procedures (SRP) established for the review of the University's Allston Master Plan, Harvard is required to file a Project Commencement Notice (PCN) for each project within the IMP area. A PCN for the Klarman Hall project will be filed in fall 2015.

2.6.2 Permits and Approvals

Table 2-1 presents a preliminary list of local, state, and federal permits and approvals that may be required for the Project. The list is based on current information about the Project and is subject

to change as the design of the Project advances. Some of the permits listed may not be required, while there may be others not listed that will be needed.

Table 2-1 Preliminary List of Permits and Approvals

Agency	Approval
City	
Boston Redevelopment Authority	Article 80 Large Project Review
Boston Civic Design Commission	Design Review
Boston Water and Sewer Commission	Site Plan Review/General Service Application/Water and Sewer Connector Self-Certification
Boston Transportation Department	Construction Management Plan/Transportation Access Plan Agreement
Boston Inspection Services Department	Demolition/Building Permits
State	
Executive Office of Environmental Affairs	Massachusetts Environmental Policy Act – Project Commencement Notice
Federal	
Environmental Protection Agency	NPDES Stormwater Construction General Permit (if required)

2.7 Legal Information

2.7.1 Legal Judgments Adverse to the Proposed Project

There are no legal judgments adverse to the proposed Project.

2.7.2 History of Tax Arrears on Property

Harvard does not have a history of tax arrears on property that it owns in the City of Boston.

2.7.3 Evidence of Site Control/Nature of Public Easements

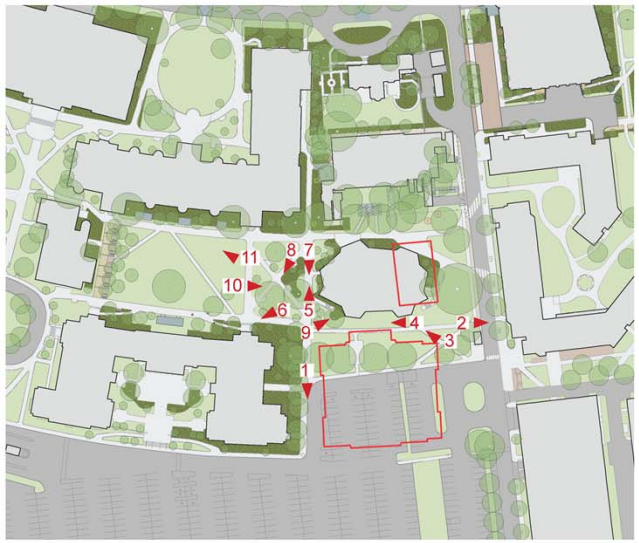
The Project site is owned by Harvard University.

2.8 Schedule

HBS anticipates that site work will begin during the first quarter of 2016, with the completion of Klarman Hall by August 2018. The construction of the G2 Pavilion would follow the completion of Klarman Hall and demolition of Burden Hall.

Figure 2-1: Existing Site Plan
Expanded PNF

Source: William Rawn Associates, Architects, Inc.



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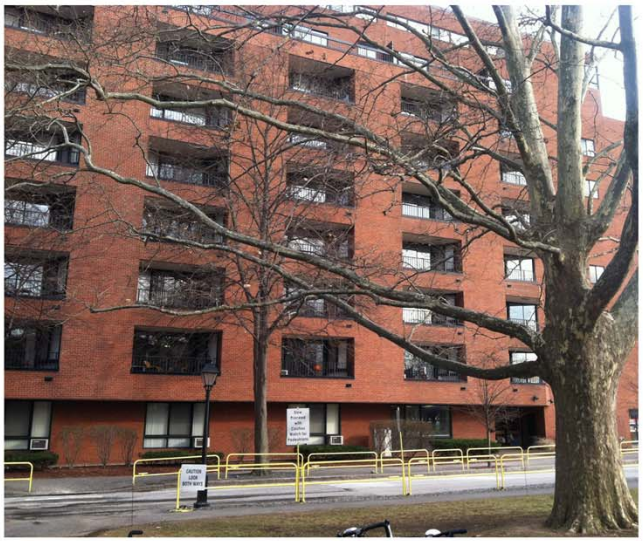

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Figure 2-2: Existing Site Photographs

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

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Figure 2-3: Existing Site Photographs

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

Figure 2-4: Proposed Site Plan

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

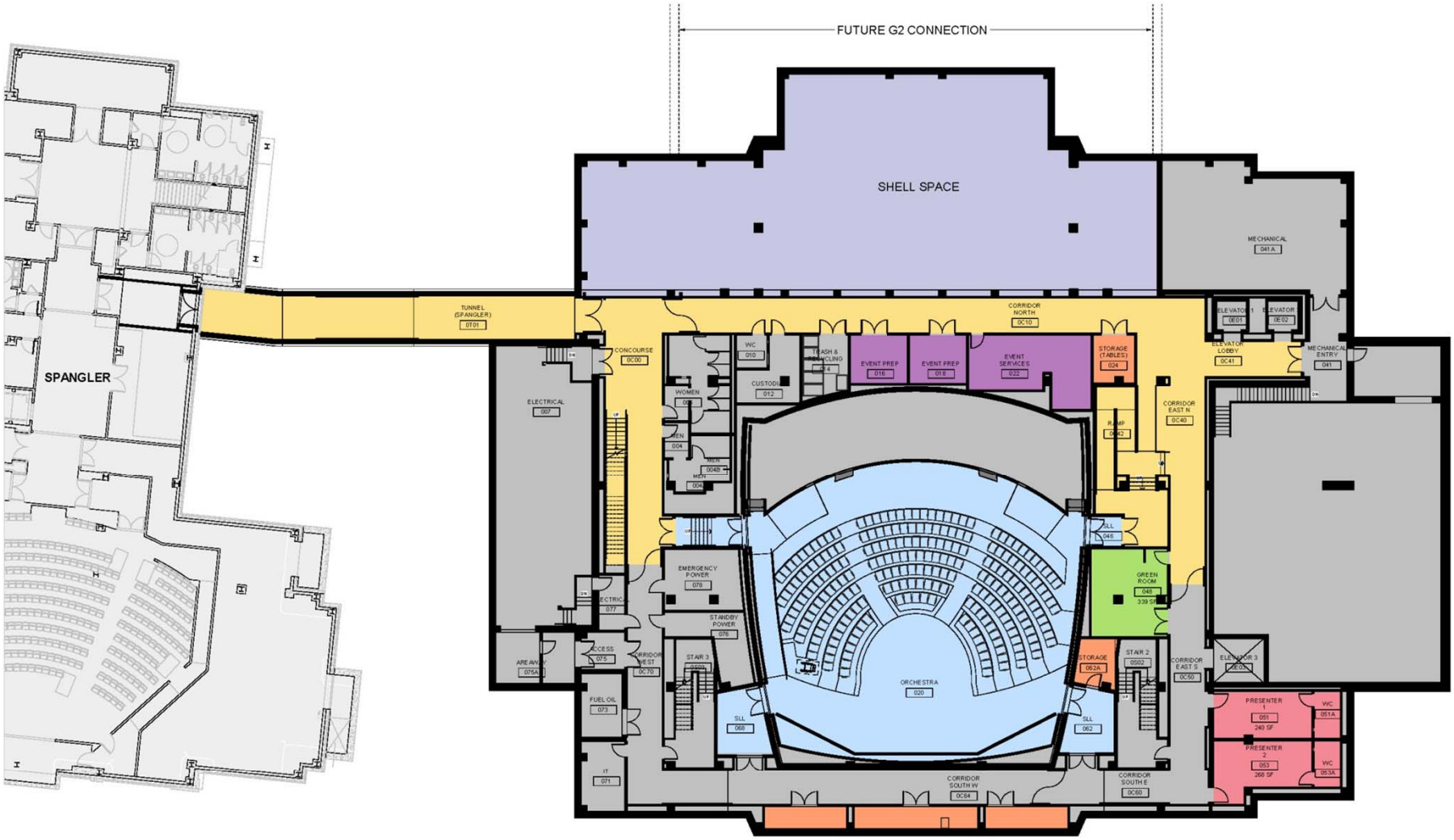


Figure 2-5: Floor Plan: Level B1

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

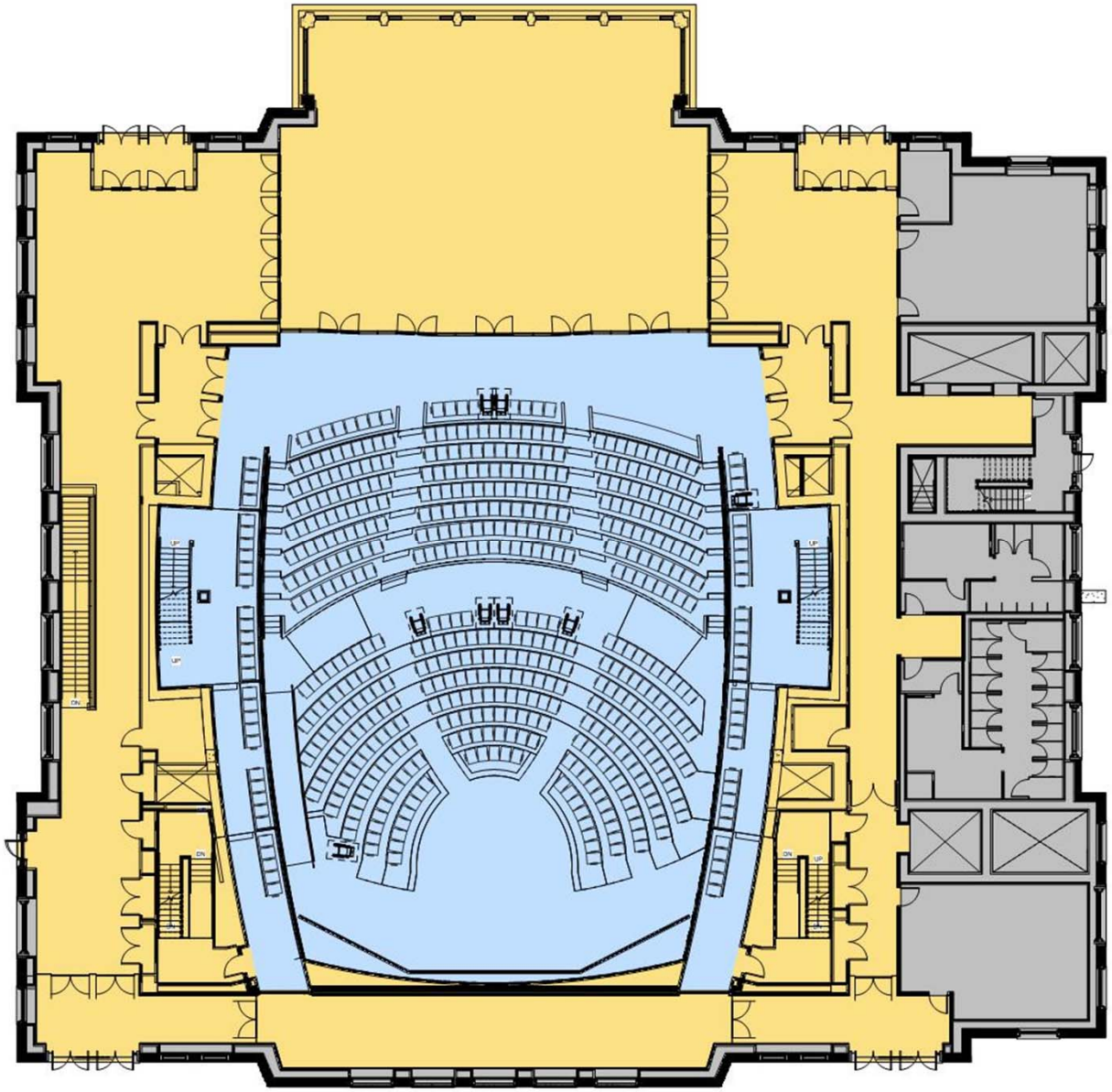


Figure 2-6: Floor Plan: Level 1

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

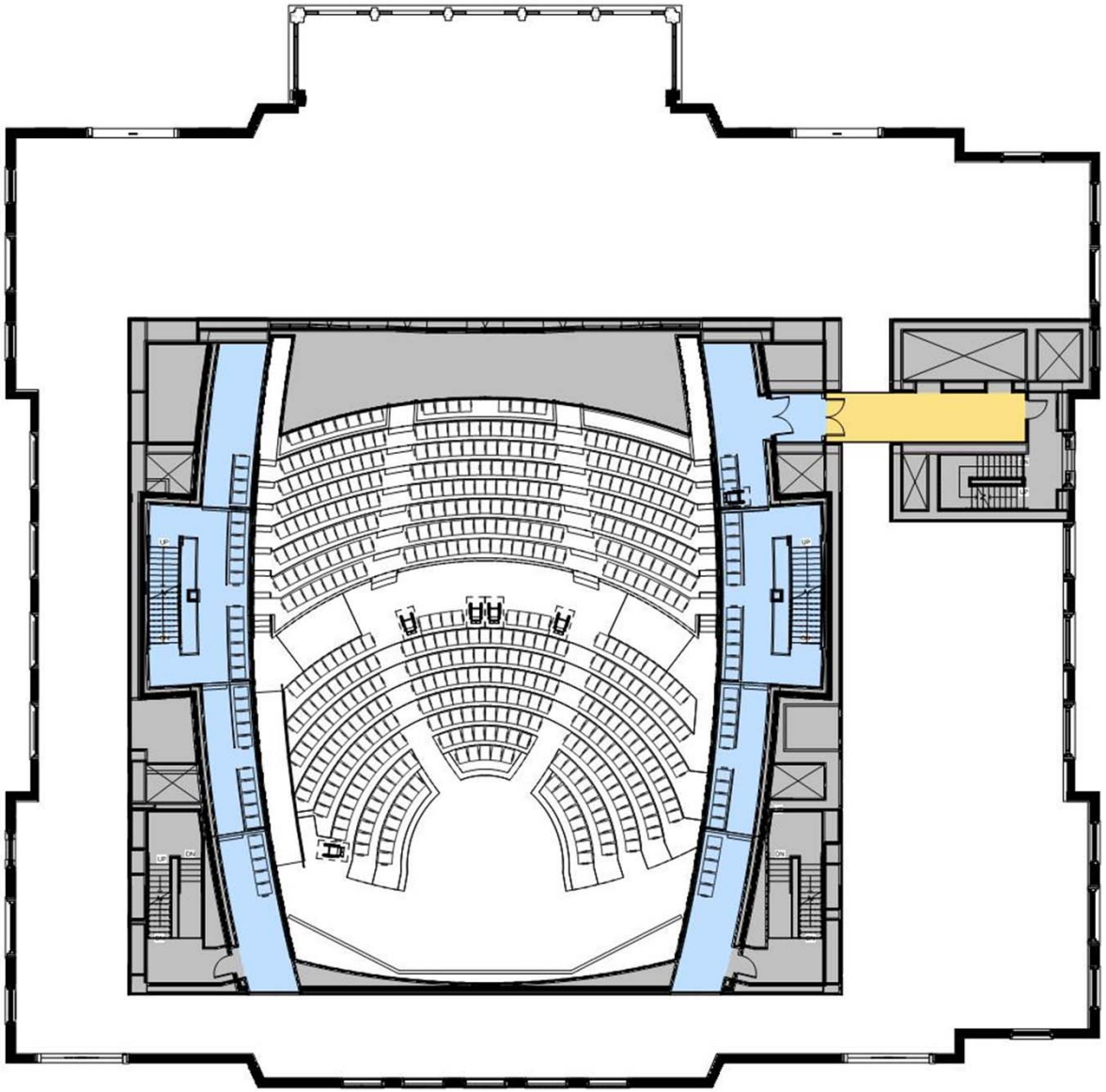


Figure 2-7: Floor Plan: Level 1M

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

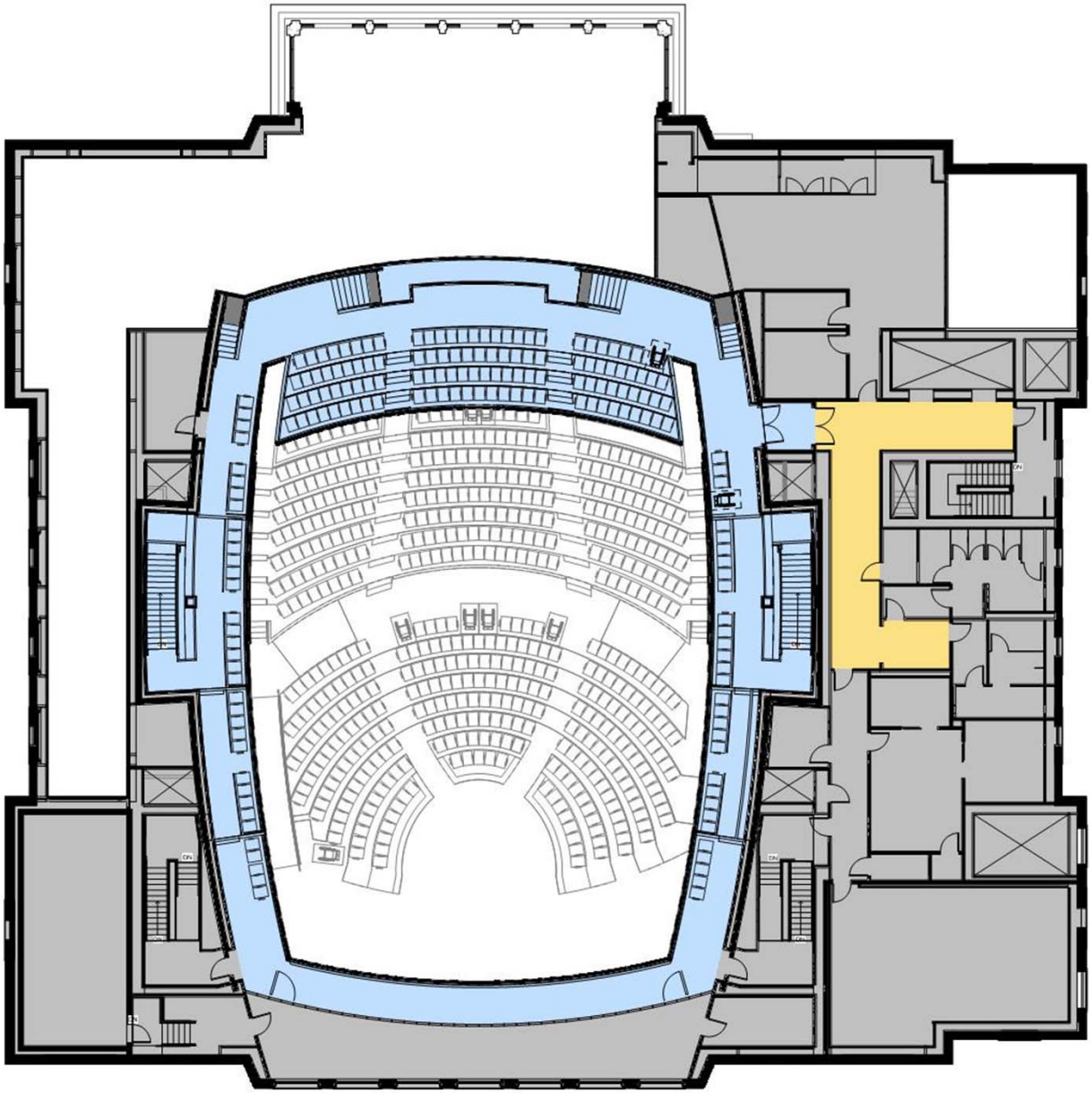


Figure 2-8: Floor Plan: Level 2
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

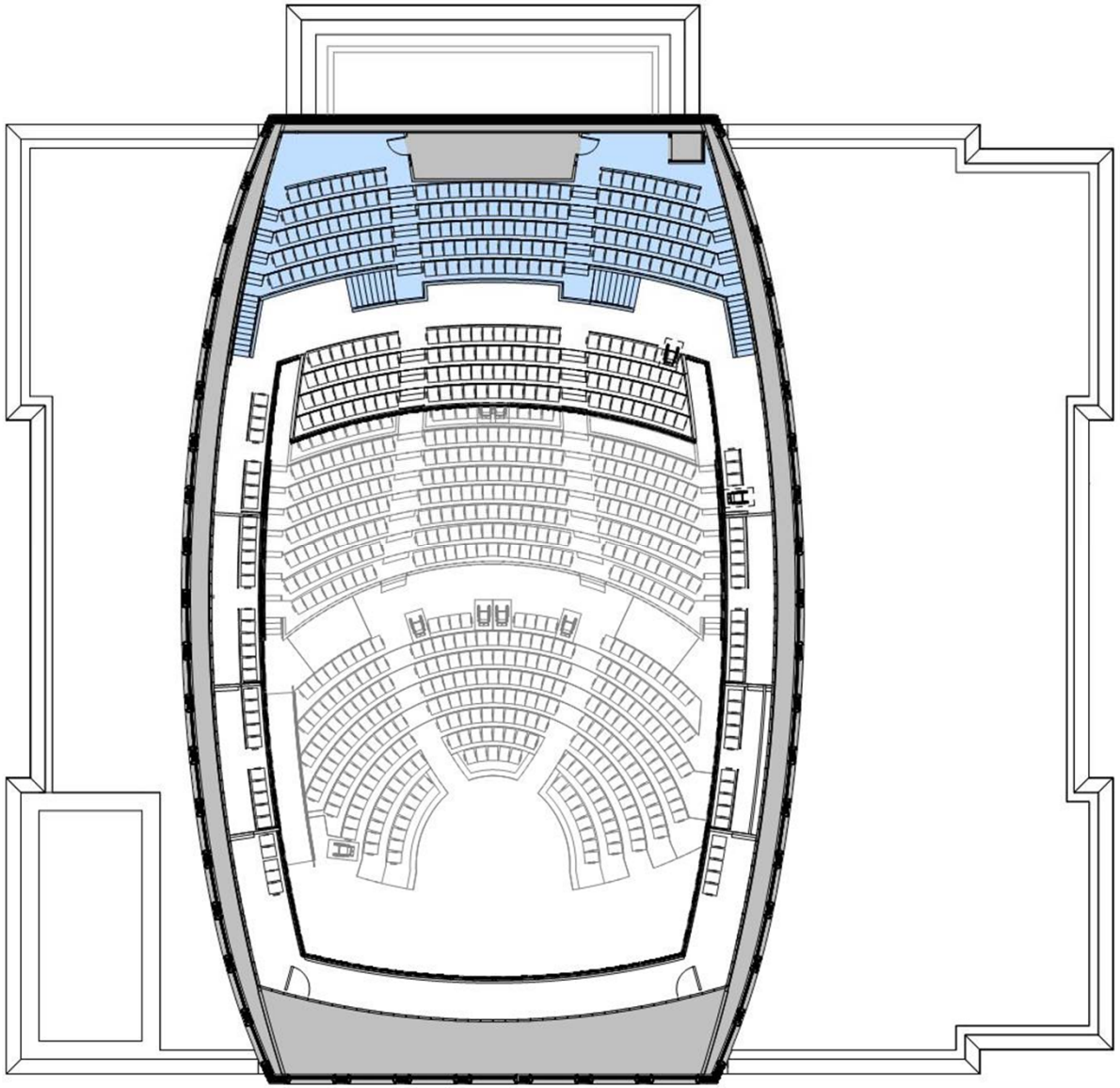


Figure 2-9: Floor Plan: Level Rear Balcony

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

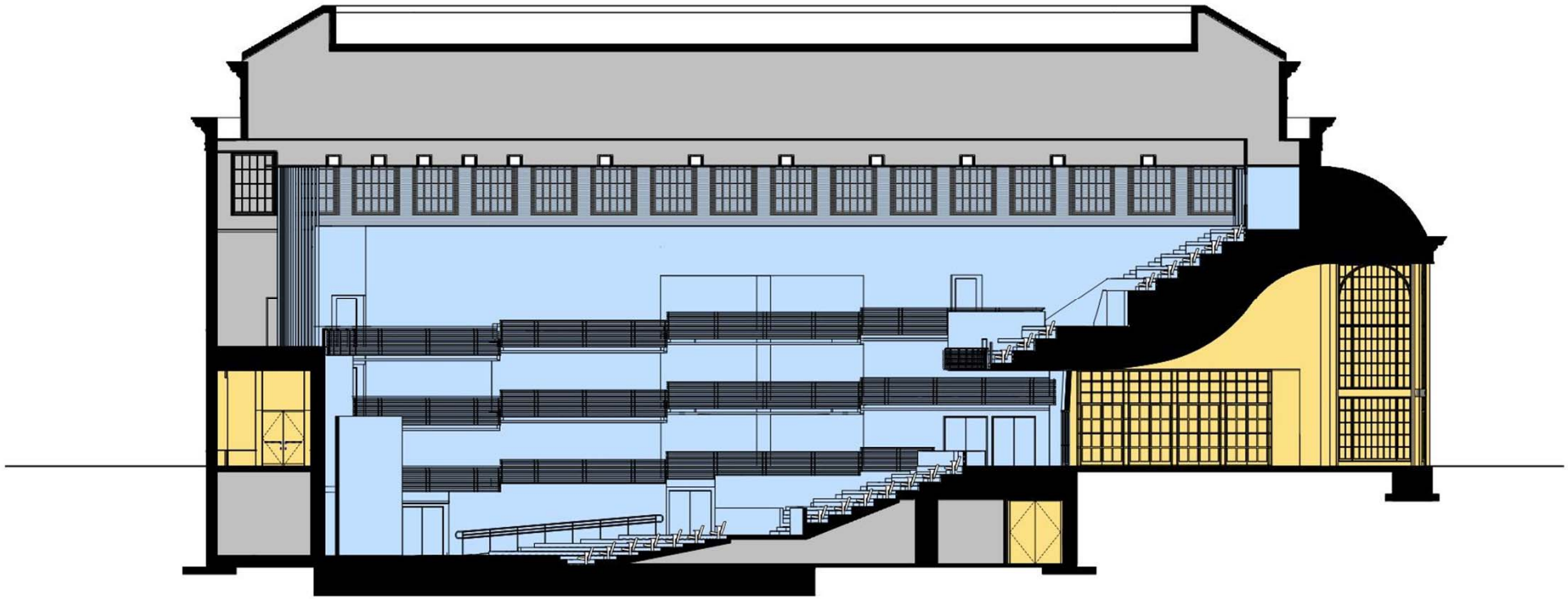


Figure 2-10: North – South Building Section

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

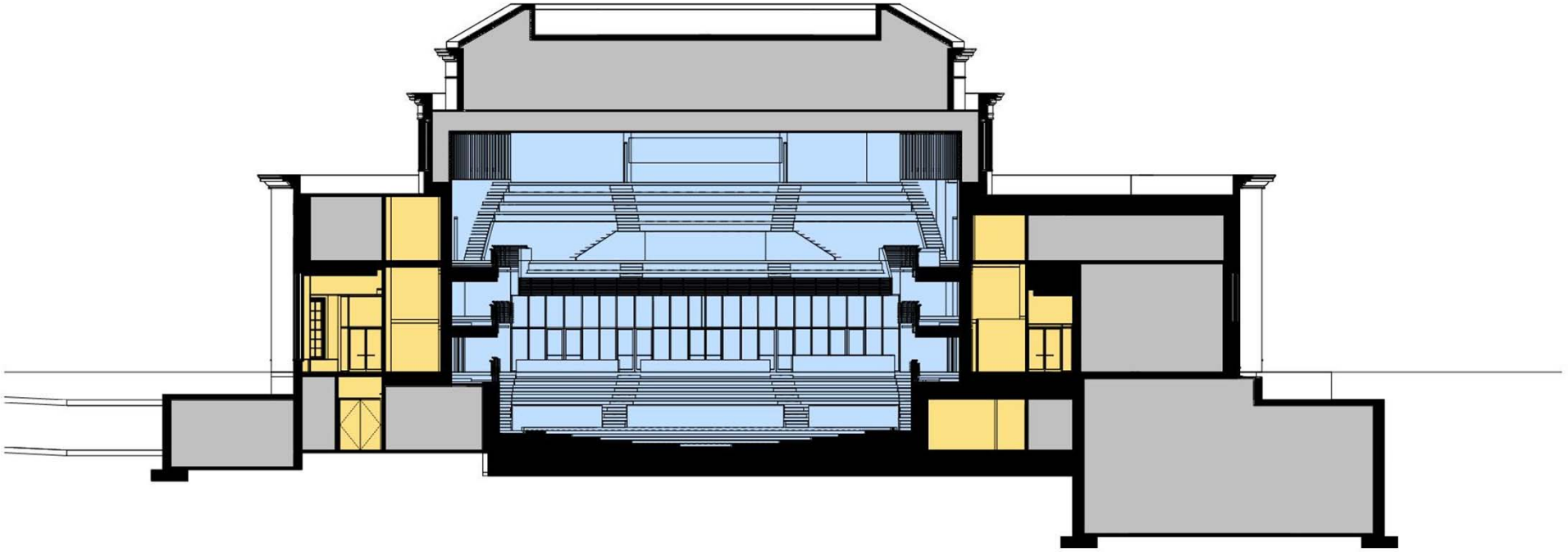


Figure 2-11: East – West Building Section

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

Figure 2-12: North Elevation
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

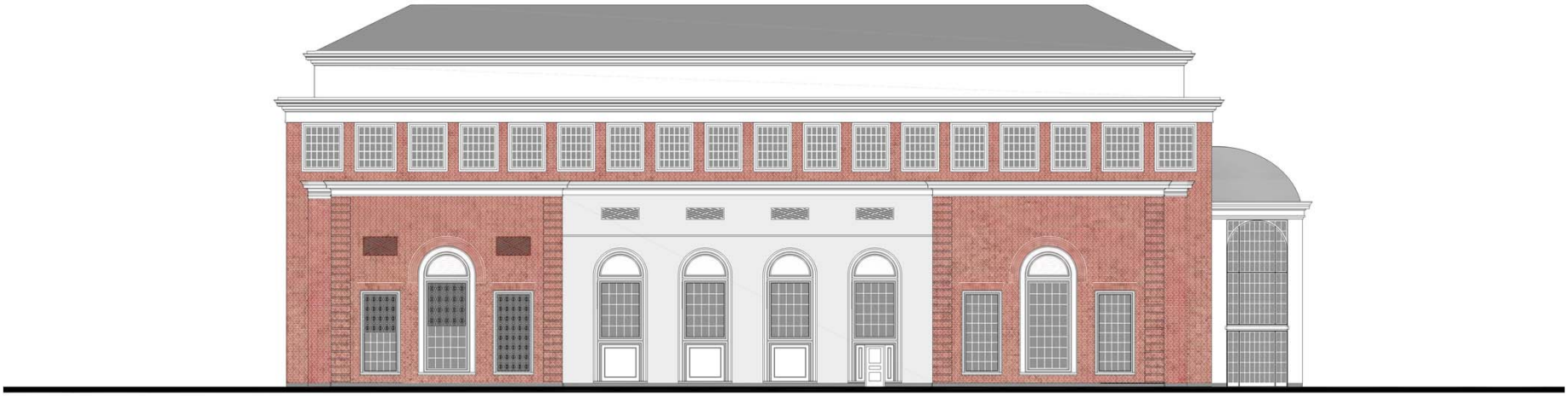


Figure 2-13: East Elevation
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

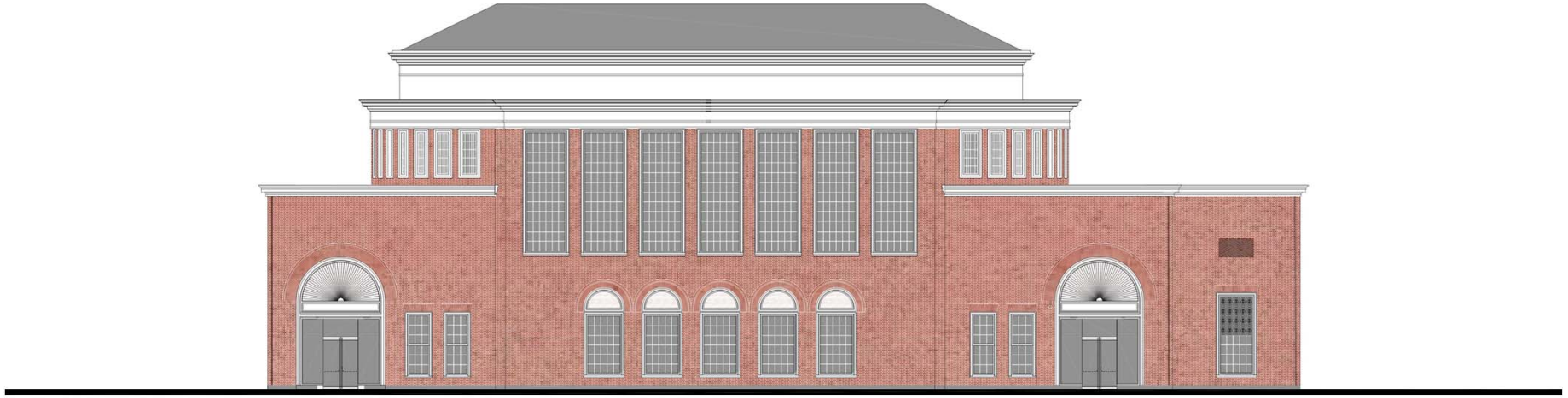


Figure 2-14: South Elevation

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

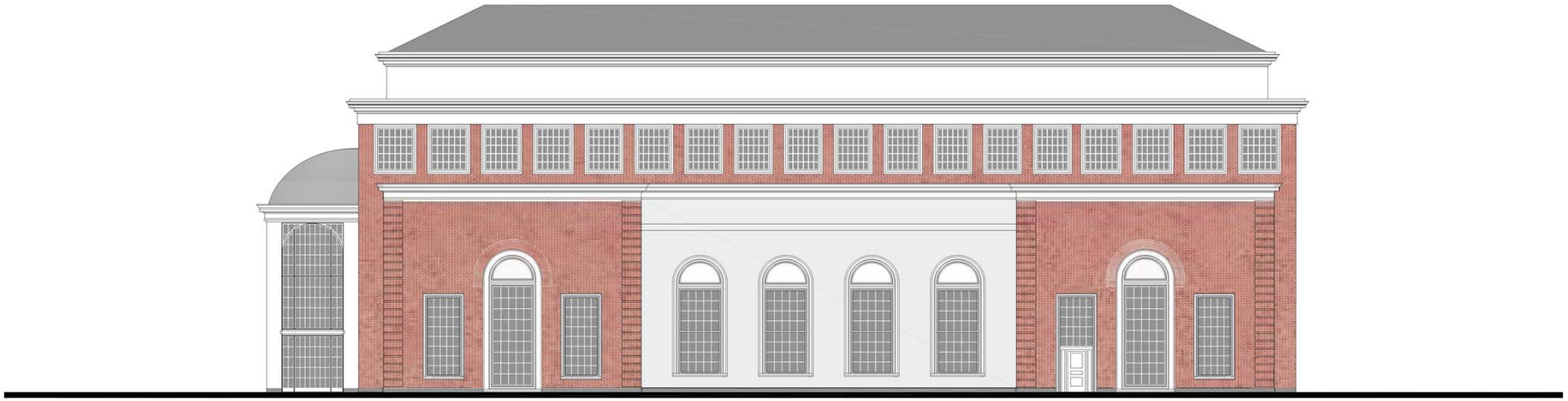


Figure 2-15: West Elevation
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

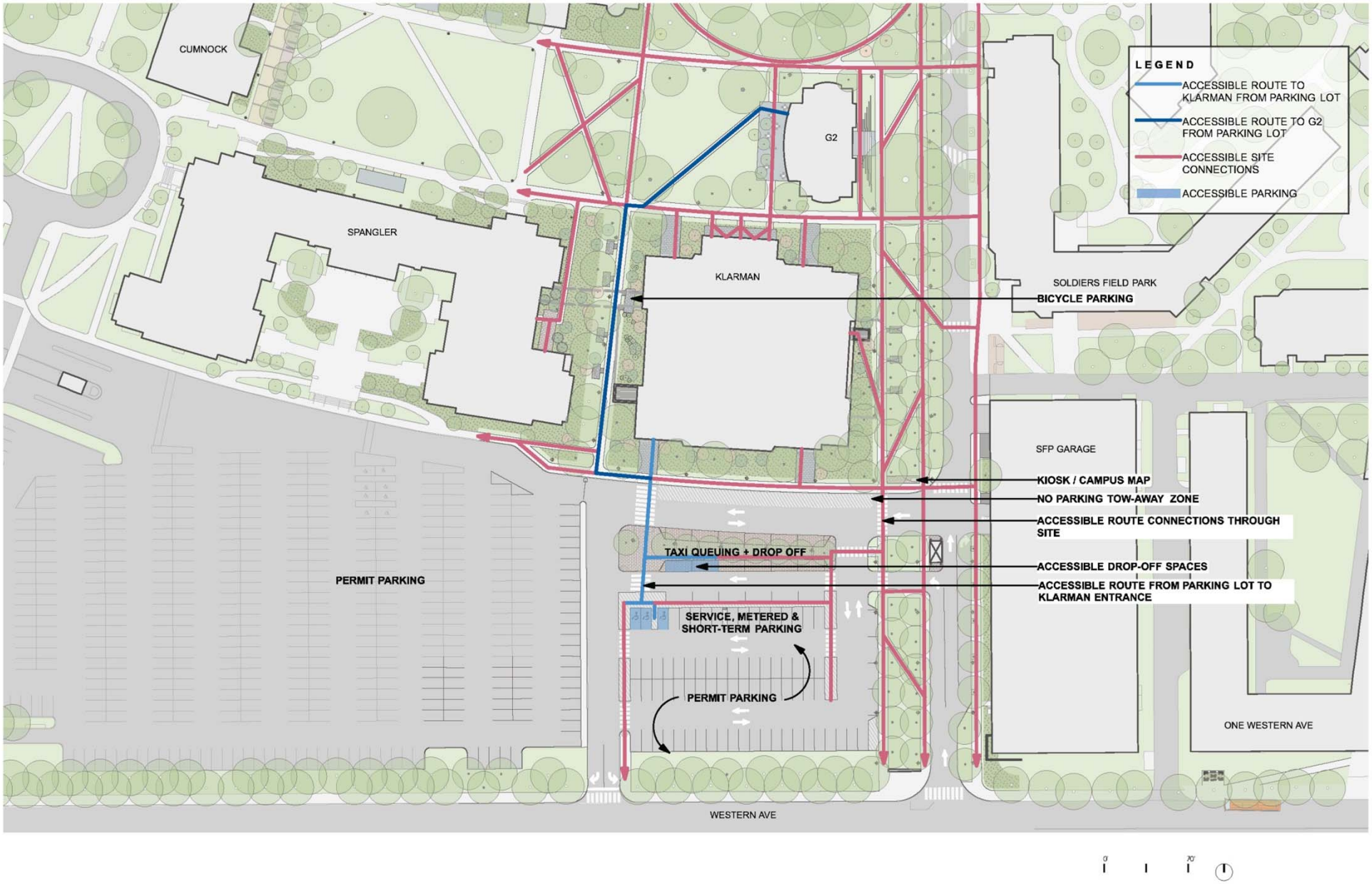


Figure 2-16: Pedestrian and Vehicular Circulation

Expanded PNF

Source: Reed Hilderbrand LLC

Chapter 3
Environmental Protection Component

3.0 ENVIRONMENTAL PROTECTION COMPONENT

This chapter describes the proposed Project's expected environmental impacts and the mitigation measures that will be undertaken to avoid and minimize those impacts to the greatest extent practicable. As a replacement project on the HBS campus, impacts beyond the campus boundaries are anticipated to be negligible.

3.1 Transportation

3.1.1 Introduction and Overview

This section presents an overview of existing transportation conditions and an assessment of potential long-term impacts of the proposed Klarman Hall/G2 Pavilion project. The following summarizes the key findings of the transportation analysis for Klarman Hall and the G2 Pavilion.

- Because both phases of the Project are replacements for existing uses, the Klarman Hall/G2 Pavilion project is not expected to have any noticeable effects on area traffic conditions and will not require changes or improvements to the adjacent public street system. It is anticipated that the reconfiguration of Kresge Way and the adjacent parking lot will have a positive effect on Western Avenue operations.

- No additional parking spaces will be created to serve the Project because the users of this facility will largely be on campus already.

3.1.2 Assessment of Future Transportation Conditions

The Klarman Hall/G2 Pavilion project is a replacement and consolidation of uses that currently exist on the HBS campus, mainly in the Burden Hall building. With the exception of approximately ten new staff positions created to service and maintain the building, the users of Klarman Hall and the G2 Pavilion do not represent new uses on the campus and, as such, will not generate new impacts on the transportation system.

The IMP for Harvard's Allston Campus (dated July 2013, Revised October 2013) provided a detailed analysis of the travel characteristics of the projects in the IMP.

As mentioned, approximately ten new staff positions will be created to service and maintain the building. Based on BTD mode shares for this section of the city, approximately 59 percent will drive, 18 percent will take transit and 23 percent will walk or bike. Based on these rates, six people will drive, two will take transit, and two will walk or bike. This will result in 12 new daily vehicle trips (6 arriving and 6 departing) with a vehicle occupancy rate of 1.1 persons per vehicle.

3.1.3 Parking

There will be no new parking associated with the Project. The development of this Project will result in the loss of approximately 70 parking spaces that exist in a surface lot that sits within the

footprint of the proposed Klarman Hall, and an additional 20 spaces will be lost in the Soldiers Field Park Garage to accommodate operational improvements to Kresge Way (formerly East Drive). These spaces are within the University's overall parking pool and will be reallocated in the future as warranted. The parking demand for these spaces will be accommodated within the existing institutional parking supply. The desire to create new paths to Western Avenue and the need to address existing operational issues was given priority over the loss of parking spaces.

3.1.4 Improvements to Kresge Way

The existing configuration of Kresge Way is dominated by vehicular circulation needs. Kresge Way provides vehicular access to the Soldiers Field Park Garage and its underground connection to the One Western Avenue garage, drop-off/pick-up locations for HBS and a nearby daycare center, and a shuttle bus stop on Harvard's Allston Express shuttle route. A gated entrance is located to the north of the Soldiers Field Park Garage to control vehicular access into the campus, as it is a campus way and not open to public travel. The existing configuration of Kresge Way is also constrained, and the amount of competing uses can impact campus and local street operations. For example, taxis will spill onto Western Avenue when the number of taxis exceeds the available space in the existing cabstand.

Separate from this Project, Kresge Way is being redesigned to include landscape and streetscape improvements which will improve the pedestrian and bicycle environment (see Figure 3-1). Landscape treatment along the Project site will be extended south to Western Avenue along Kresge Way to provide an additional green buffer and new paths for pedestrian and bicycles. A number of operational improvements will also be made to address existing vehicular traffic conditions. These include:

- Bringing the taxi queueing area further into the campus and away from the intersection of Kresge Way and Western Avenue in order to eliminate conflicts and reduce the potential spillover of taxis into Western Avenue during times of peak campus activities;

- Shifting the existing guard shack to the south along Kresge Way, and creating dedicated through and right turn (garage access) lanes entering the site from Western Avenue in order to provide clarity to drivers entering the campus;

- Relocating the shuttle bus stop on Kresge Way to Western Avenue (and combining it with the existing MBTA bus stop) in order to simplify operations on Kresge Way;

- Providing a clearly delineated short-term and pick-up/drop-off areas within the site; and

- Reconfiguring circulation in the Soldiers Field Park Garage to complement the Kresge Way circulation changes and create additional queue storage space within the garage.

These improvements will simplify and clarify circulation at a busy campus gateway, creating a more welcoming entrance to the HBS campus.

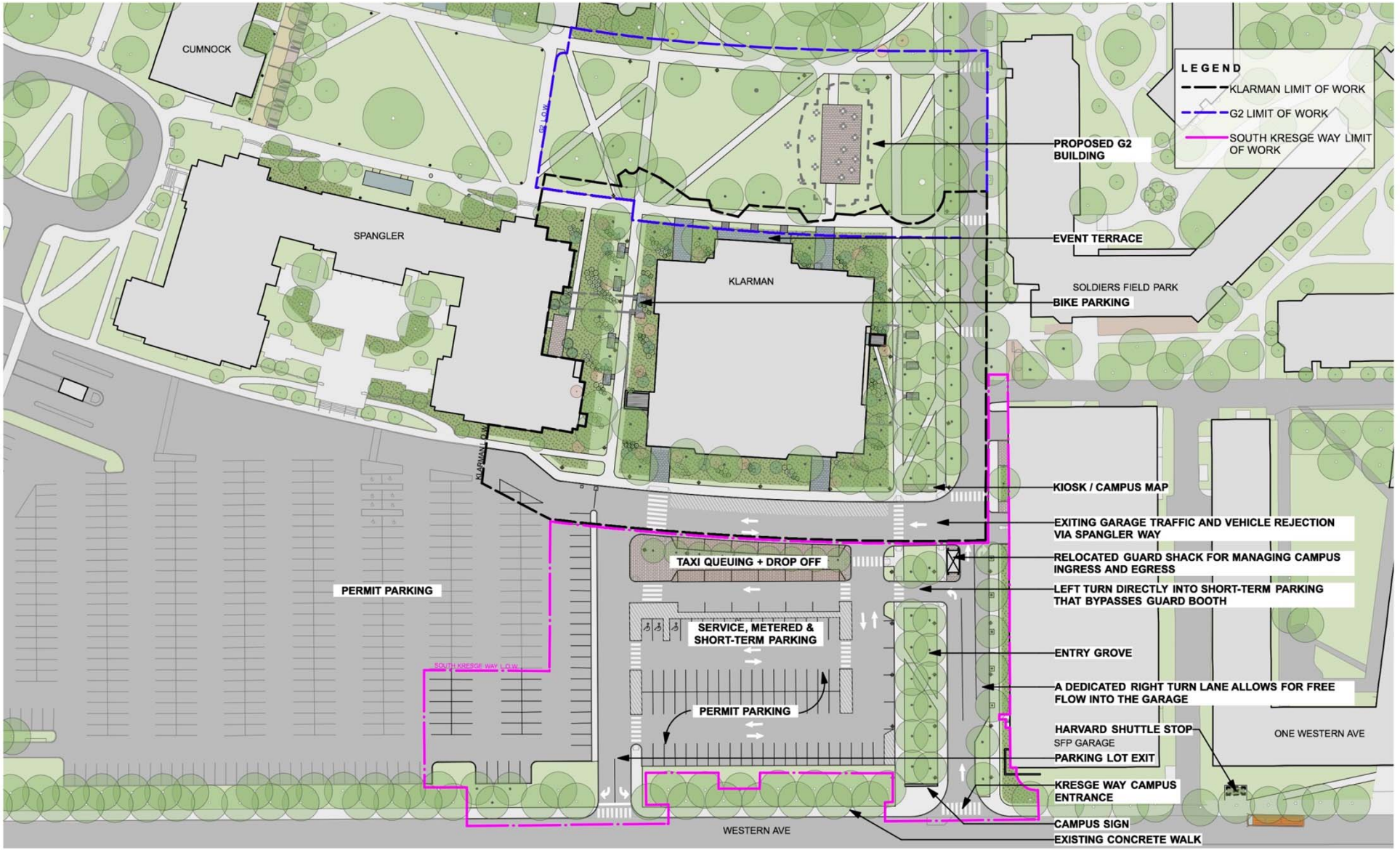


Figure 3-1: Kresge Way Plan

Expanded PNF

Source: Reed Hilderbrand LLC

3.1.5 Loading

The Project does not include any loading bays. Instead, the Project will be connected to HBS's Central Receiving Facility through the HBS tunnel system that will be extended to the Project site.

3.2 Wind

Wind impact analyses are typically completed for buildings that have the potential to bring upper level winds to the ground, such as buildings that are taller than the trees and buildings in the surrounding area. When there are many buildings of similar height in an area, as is the case on the HBS campus, they tend to shelter one another. Klarman Hall, which is proposed to be approximately 66 feet in height, will be similar in height, or lower, than the surrounding buildings, including Spangler Center, Aldrich Hall, Hawes Hall, and the Soldiers Field Park buildings. The G2 Pavilion is proposed to be only two stories tall, shorter than the surrounding buildings. Therefore, the proposed buildings are not expected to bring upper level winds to the ground. Therefore, the Project is not expected to have any significant impacts on pedestrian level winds.

3.3 Shadow

3.3.1 Introduction and Methodology

As typically required by the BRA, a shadow impact analysis was conducted to investigate shadow impacts from the Project during three time periods (9:00 a.m., 12:00 noon, and 3:00 p.m.) 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 p.m. time period during the summer solstice and autumnal equinox.

The shadow analysis presents net new shadow from the building, the existing shadow, and areas that are under existing shadow but will not be under shadow in the build condition, and illustrates the incremental impact of the Project. The analysis focuses on open spaces and major pedestrian areas in the vicinity of the Project site. Shadows have been determined using the applicable Altitude and Azimuth data for Boston.

The existing site includes Burden Hall and a surface parking lot. Klarman Hall will be similar in size to Burden Hall but located on the existing surface parking area, while the G2 Pavilion will be a smaller structure on the site of the existing Burden Hall. The new shadow from the Project will be limited to the HBS campus and the immediate area surrounding the Project site. Due to the Project's location within Harvard's Allston campus, new shadow impacts will be limited to the Allston campus. No new shadow will be cast on any public properties in the surrounding area during the time periods studied.

3.3.2 Vernal Equinox (March 21)

During the vernal equinox, new shadow will be limited to the HBS campus. At 9:00 a.m., new shadow will be cast to the west and northwest of Klarman Hall. At 12:00 p.m., new shadow will be cast to the north of Klarman Hall and onto a portion of the site currently occupied by Burden Hall. At 3:00 p.m., new shadow is cast to the north and northeast of Klarman Hall. During all three time periods, shadow from the G2 Pavilion will be mostly limited to the area currently occupied by Burden Hall and the area under existing shadow from Burden Hall, with slivers of new shadow on the area immediately adjacent to the northeastern corner of the G2 Pavilion. In addition, a large area that is under existing shadow or occupied by Burden Hall will be free from shadow in the build condition.

New shadow created on the vernal equinox is illustrated in Figure 3-2.

3.3.3 Summer Solstice (June 21)

During the summer solstice, new shadow will be limited to the HBS campus. At 9:00 a.m., new shadow is cast to the west of Klarman Hall. At 12:00 p.m., new shadow is cast onto small areas immediately adjacent to Klarman Hall on the north and west sides. At 3:00 p.m., new shadow is cast to the northeast across small areas immediately adjacent to Klarman Hall. At 6:00 p.m., new shadow is cast to the east of Klarman Hall and across Kresge Way. During all four time periods, shadow from the G2 Pavilion will be mostly limited to the area currently occupied by Burden Hall and the area under existing shadow from Burden Hall, with small areas of new shadow cast to the north and east immediately adjacent to the G2 Pavilion. In addition, a large area that is under existing shadow or occupied by Burden Hall will be free from shadow in the build condition.

New shadow created on the summer solstice is illustrated in Figure 3-3.

3.3.4 Autumnal Equinox (September 21)

During the vernal equinox, new shadow will be limited to the HBS campus. At 9:00 a.m., new shadow will be cast to the west and northwest of Klarman Hall. At 12:00 p.m., new shadow will be cast to the north of Klarman Hall and onto a portion of the site currently occupied by Burden Hall. At 3:00 p.m., new shadow is cast to the north and northeast of Klarman Hall. At 6:00 p.m., new shadow will be cast to the east of Klarman Hall and across Kresge Way. During all four time periods, shadow from the G2 Pavilion will be mostly limited to the area currently occupied by Burden Hall and the area under existing shadow from Burden Hall, with small areas of new shadow cast to the north immediately adjacent to the G2 Pavilion at 9:00 a.m. and 12:00 p.m. In addition, a large area that is under existing shadow or occupied by Burden Hall will be free from shadow in the build condition.

New shadow created on the autumnal equinox is illustrated in Figure 3-4.

3.3.5 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 to elongate and create considerable shadow in the area.

During the winter solstice, new shadow will be limited to the HBS campus. At 9:00 a.m., new shadow is cast to the northwest of Klarman Hall. At 12:00 p.m., new shadow is cast to the north of Klarman Hall. At 3:00 p.m., new shadow is cast to the northeast of Klarman Hall and across Kresge Way. During all three time periods, shadow from the G2 Pavilion will be limited to the area currently occupied by Burden Hall and the area under existing shadow from Burden Hall, with the exception of a small area at 12:00 p.m.. In addition, a large area that is under existing shadow or occupied by Burden Hall will be free from shadow in the build condition.

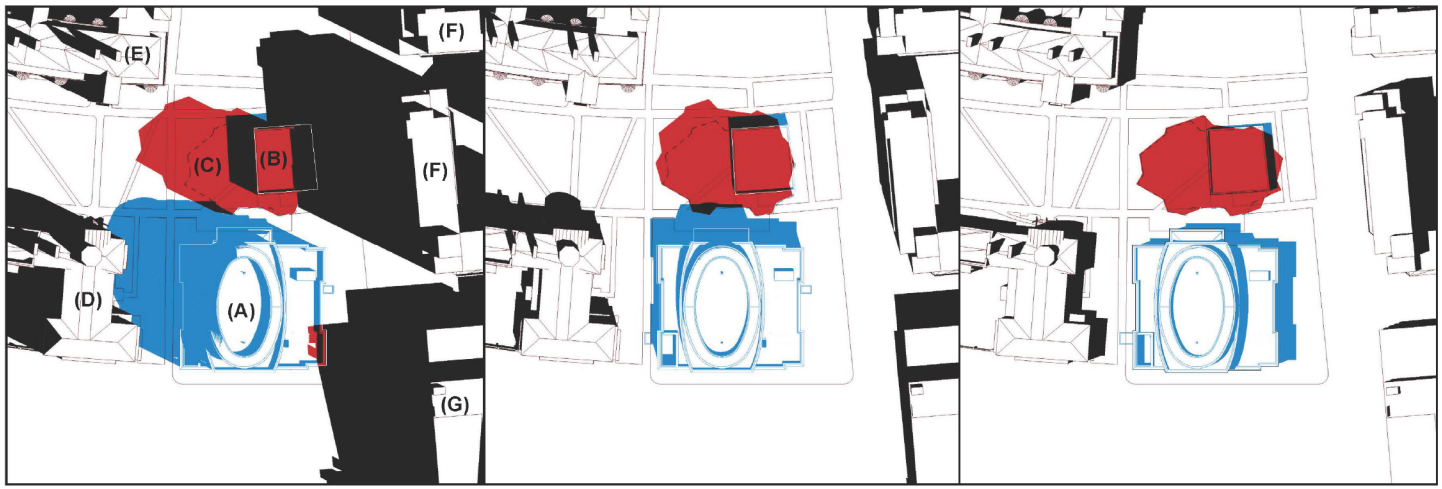
New shadow created on the winter solstice is illustrated in Figure 3-5.

3.3.6 Conclusions

The Project site includes a surface parking lot that is proposed to include Klarman Hall, a building similar in size to Burden Hall, and Burden Hall which will be demolished and replaced with open space and the G2 Pavilion which will be significantly smaller than Burden Hall. Although the buildings will create new shadow, new shadow will be limited to the HBS campus. In addition, a significant portion of the area currently occupied by Burden Hall and areas under shadow from Burden Hall will be free from shadow in the build condition. No new shadow will be cast onto nearby public spaces.

3.4 Daylight

As discussed in Section 3.2, Klarman Hall will be similar in height to the surrounding buildings, and the G2 Pavilion will be shorter than the surrounding buildings. With the large parking lot south of Klarman Hall and the HBS Central Green to the north of Klarman Hall and the west of the G2 Pavilion, there will be significant areas that allow for views of the sky. The development of the Project will be consistent with the development of the existing HBS campus, allowing for pedestrian ways, large greens and other open spaces between buildings. Therefore, daylight obstruction impacts from the Project are anticipated to be similar to daylight obstruction impacts on the existing campus.

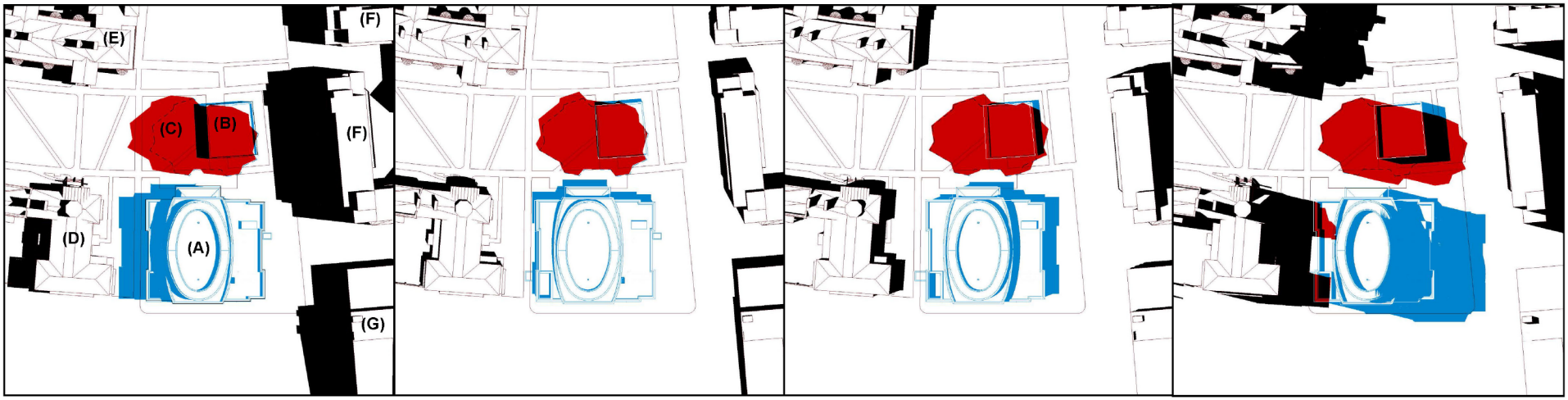


(A) KLARMAN HALL
(B) G2 BUILDING
(C) BURDEN HALL (TO BE DEMOLISHED)
(D) SPANGLER CENTER
(E) ALDRICH HALL
(F) SOLDIERS FIELD HOUSING
(G) SOLDIERS FIELD PARKING

EXISTING SHADOWS TO REMAIN
EXISTING SHADOWS TO BE DELETED
NEW BUILDING SHADOWS

Figure 3-2: Shadow Study, March
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

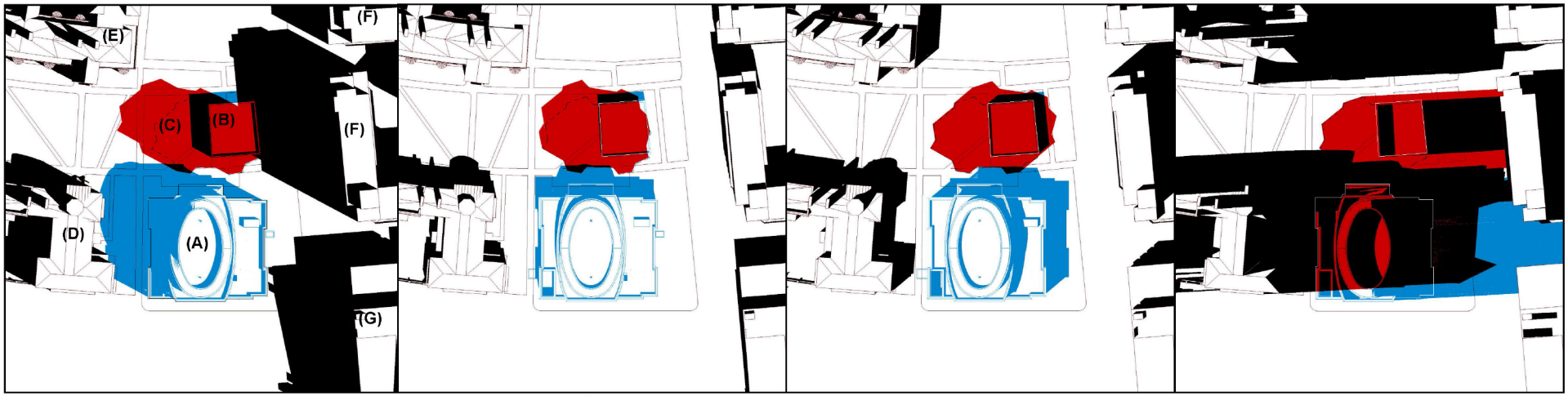


(A) KLARMAN HALL
(B) G2 BUILDING
(C) BURDEN HALL (TO BE DEMOLISHED)
(D) SPANGLER CENTER
(E) ALDRICH HALL
(F) SOLDIERS FIELD HOUSING
(G) SOLDIERS FIELD PARKING

EXISTING SHADOWS TO REMAIN
EXISTING SHADOWS TO BE DELETED
NEW BUILDING SHADOWS

Figure 3-3: Shadow Study, June
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

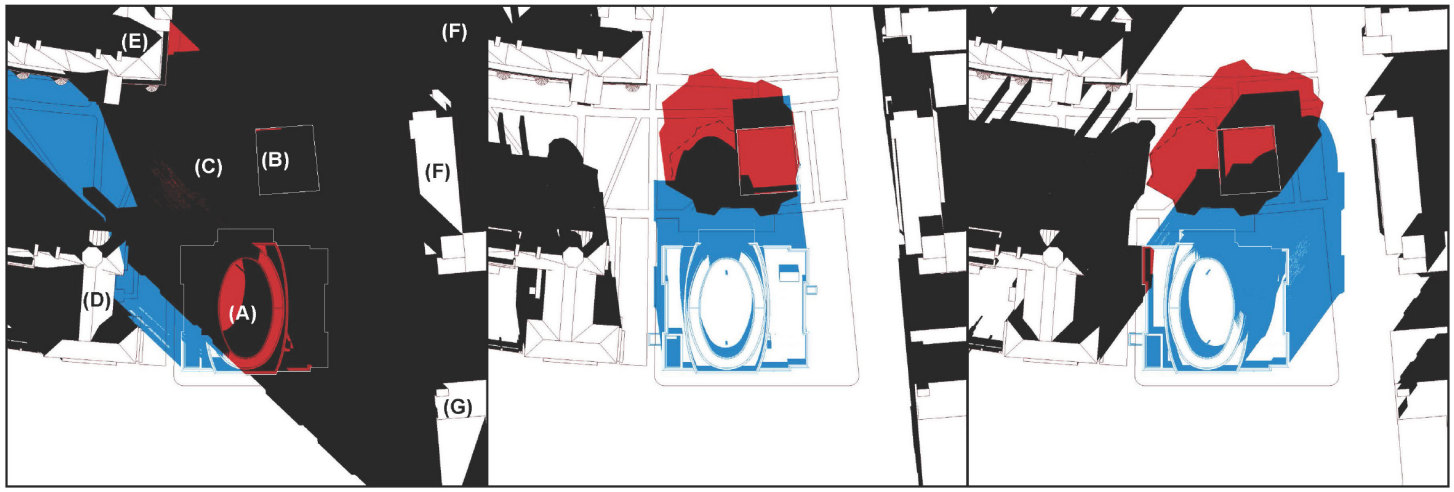


(A) KLARMAN HALL
(B) G2 BUILDING
(C) BURDEN HALL (TO BE DEMOLISHED)
(D) SPANGLER CENTER
(E) ALDRICH HALL
(F) SOLDIERS FIELD HOUSING
(G) SOLDIERS FIELD PARKING

EXISTING SHADOWS TO REMAIN
EXISTING SHADOWS TO BE DELETED
NEW BUILDING SHADOWS

Figure 3-4: Shadow Study, September
Expanded PNF

Source: William Rawn Associates, Architects, Inc.



(A) KLARMAN HALL
(B) G2 BUILDING
(C) BURDEN HALL (TO BE DEMOLISHED)
(D) SPANGLER CENTER
(E) ALDRICH HALL
(F) SOLDIERS FIELD HOUSING
(G) SOLDIERS FIELD PARKING

EXISTING SHADOWS TO REMAIN
EXISTING SHADOWS TO BE DELETED
NEW BUILDING SHADOWS

Figure 3-5: Shadow Study, December
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

3.5 Air Quality

As discussed in Section 3.1, the Project will result in a limited number of new vehicle trips. Therefore, air quality impacts from traffic related to the Project are anticipated to be negligible.

Air quality impacts from the Project's mechanical equipment are also anticipated to be minimal. The Project's mechanical equipment will include a number of electrically-powered refrigeration units, pumps, air handling units, and air exhaust fans. The air handling units will vent to the rooftop, minimizing the potential for impacts to pedestrians in the surrounding area.

Hot water will be provided by instantaneous electric on-demand water heaters. Since heating will be supplied from campus steam, no onsite boilers are required. Therefore, there will be no air quality impacts from heating or hot water generation.

Everyday power will be supplied by Harvard's Engineering and Utility department. Emergency power will be supplied by a new 350 kilowatt (electrical output) generator. According to the MassDEP Environmental Results Program, all standby and emergency generators over 37 kW must be registered within 60 days of startup. As long as the unit meets the requirements set forth in 310 CMR 7.26(42), the unit is presumed to comply with permitting requirements. Since the engine output power (546 horsepower) is not over the 1 megawatt (1340 horsepower) threshold, a formal air quality impact analysis is not required as part of the registration and no adverse air quality impacts are presumed. Given the infrequent operation of emergency generators, air quality impacts are typically negligible.

Therefore, it can be expected that there will be no changes to air quality as a result of the proposed Project.

The mechanical equipment for G2 Pavilion has not been determined. However, given the proposed program, no changes to air quality are anticipated.

3.6 Noise

The Project is located on the HBS campus away from residential areas in an area with high ambient noise due to the traffic on Soldiers Field Road. It is anticipated that the Project will have a minimal impact on ambient noise levels in the surrounding area. Klarman Hall's mechanical equipment will be within the building. Currently, it is anticipated that there will be several air exhaust points on the rooftop, a generator and air handling unit on the second level, and additional mechanical equipment in the basement. Mechanical and electrical equipment that are served by areaways will be acoustically protected using sound attenuators to muffle noise generated by the operation of such equipment, as necessary. Equipment housed inside Klarman Hall will also include the same internal noise protection for the building occupants as what is provided to protect the external environment.

The mechanical equipment has not yet been determined for the G2 Pavilion.

The noise levels generated by Klarman Hall and G2 Pavilion will be designed to comply with the City of Boston Zoning District Noise Standards.

3.7 Geotechnical Impacts/Groundwater

3.7.1 Geotechnical

Based on available test boring information obtained at the site, subsurface soil conditions underlying the proposed building are characterized by the following general soil profile:

Soil Deposit	Approximate Thickness of Layer (ft)
Fill	10 to 15
Organic Deposits	0 to 5
Fluvial Deposits (Sand)	2 to 5
Marine Deposits	65 to 75
Glacial Till	5 to 10

The top of rock is approximately 110 feet below grade.

3.7.2 Groundwater

The Project site is not located in the Groundwater Conservation Overlay District.

Several groundwater monitoring wells exist at and in the vicinity of the site. Data obtained from these wells indicate the groundwater level is approximately 7 to 8 feet below grade (approximately El. 8 BCB).

3.7.3 Foundation Support and Below-grade Construction

3.7.3.1 Foundation Support

The site has been evaluated with respect to the existing buildings in the area and the subsurface conditions. The foundation design proposed and the temporary lateral support proposed consider the site and surrounding buildings located on HBS's campus.

Klarman Hall will be supported on soil bearing spread footings, and the lowest basement slab will be a soil bearing slab-on-grade. The proposed building includes one below grade level. The lowest basement level will have an underslab drainage system below the slab to relieve hydrostatic uplift pressures. The foundation walls will extend below the groundwater level and these walls will be waterproofed and designed to resist lateral hydrostatic pressures. The foundation design for the G2 Pavilion will be determined at a later date when more information about the design is available.

3.7.3.2 Excavation Below Grade Construction

A temporary lateral earth support system will be required to complete the excavation for the basement of Klarman Hall. This lateral support system will consist of continuous interlocking steel sheet piles. The excavation is not expected to affect the existing buildings in the area.

Temporary construction dewatering will be required inside the limits of the excavation support wall to enable foundation construction. A permit for temporary construction dewatering will be obtained for discharge of dewatering effluent.

The need for below grade construction in relation to the construction of the G2 Pavilion has not been determined.

3.7.3.3 Geotechnical Instrumentation

A geotechnical monitoring program may be implemented prior to and during construction of Klarman Hall, and would likely consist of settlement monitoring of adjacent buildings. In addition, seismographs will record vibrations during sheetpile wall installation (excavation support wall) to monitor vibrations.

An engineer's representative will be on site during foundation excavation to observe the suitable subgrade is achieved, in accordance with the Building Code requirements.

The need for geotechnical instrumentation during the construction of the G2 Pavilion has not been determined.

3.8 Solid and Hazardous Wastes

3.8.1 Hazardous Wastes

3.8.1.1 Site Conditions

The environmental conditions of the site will be evaluated prior to construction to determine the presence of oil and hazardous materials. Foundation construction for the new building will generate soil requiring off site transport. Chemical testing of the material will be required by receiving facilities to identify chemical constituents and any contaminants present. Chemical testing of the material will be conducted prior to construction in accordance with facility requirements. There is no history of releases at the Project site.

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

3.8.1.2 Operation

With the exception of "household hazardous wastes" typical of academic uses (for example, cleaning fluids and paint), the Project will not generate hazardous waste during operation.

3.8.2 Solid Wastes

In accordance with current sustainable building practice and LEED guidelines, efforts will be made to minimize solid waste generated from construction activity. These efforts will include an extensive program of managing the waste stream for recycling to maximize the diversion of construction waste from landfills.

Once the buildings are occupied and operating, solid waste generated by the Project will be collected and disposed of off-site by a licensed contractor as part of HBS's existing campus-wide waste program. The solid waste generated by the building operations, including recycling and organic waste for composting, will be collected and brought to the campus loading dock for pickup. Both the recycling, composting and solid waste procedures are consistent with the solid waste removal procedures for the existing buildings on campus. HBS has achieved a 67% recycling rate and a 52% reduction in waste per capita since 2006.

3.8.3 Waste Reduction and Recycling

Harvard University is committed to a campus-wide recycling and waste reduction program. The Harvard University Sustainability Plan sets a 50% reduction in waste per capita by 2020 (as compared to a 2006 baseline). The University as a whole has achieved a 27% reduction as of (FY) 2014. The University recovered over 7,152 tons of recyclables and compostables in (FY) 2014 for a recovery rate of 51 percent. The University also collected 413 tons of materials for reuse or donation. Harvard's extensive waste reduction initiatives include freecycle events and donation stations, single-stream recycling, construction and demolition waste diversion, composting, and electronic waste collection areas. Here are a few of highlights of Harvard's programs that impact waste reduction:

- Food donation programs: Harvard University participates in a food donation program with local non-profits as part of its efforts to reduce food waste. The Harvard University Dining Services donates up to 2,500 pounds of food on a weekly basis to Food for Free from undergraduate dining halls.

- Building lasting sustainability into all levels of the University: Harvard focuses on educating students and staff on waste through peer education. Student peer-to-peer outreach programs are in place at Harvard College, Harvard Business School, Harvard Law School, and Harvard University Housing. There are more than 230 recognized Green Offices and dozens of green teams across Harvard's Schools and administrative departments that engage more than 4,000 employees.

- Reuse and Donation: Harvard Recycling's partnership with Harvard Habitat for Humanity program has raised $689,184 through sales of recovered furniture, books, clothing and supplies. Harvard has also donated surplus goods to the Cities of Cambridge and Boston, Partners in Health, Allston Brighton Area Planning Action Council, Les Oeuvres de la Divine Misericorde of Port-au-Prince, Haiti, and over 200 other Boston-area and international charities.

Klarman Hall and G2 Pavilion will be incorporated into these existing waste reduction and recycling/composting programs. Each office will have its own dedicated bin for recycling. Gathering areas will house built-in bins that will include a bin for single stream recycling, composting and waste.

3.9 Flood Hazard Zones/Wetlands

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map for this area (25025C0076G) shows that the FEMA Flood Zone Designation for the Project site is Zone X, "Areas determined to be outside the 0.2% annual chance floodplain."

The Project site does not contain wetlands.

3.10 Construction Impact

3.10.1 Introduction

A Construction Management Plan (CMP) in compliance with the City's Construction Management Program will be submitted to BTD once final plans are developed and the construction schedule is fixed. The construction contractor will be required to comply with the details and conditions of the approved CMP.

HBS has chosen Walsh Brothers Inc. (WBI) as the Construction Manager / General Contractor for the pre-construction associated with the Project. HBS and WBI will administer the CMP. WBI will have the authority to enforce the provisions of the CMP on all contractors, sub contractors, suppliers and vendors participating in the Project throughout the construction period. Compliance with this CMP will be monitored on a daily basis and will be in accordance with the Construction Mitigation Specification. The following CMP is for Klarman Hall; G2 Pavilion will have its own CMP with similar commitments.

3.10.2 Construction Phasing

The first phase of the Project will be to clear existing utilities including sewer, storm, electrical and water from the building site in March 2016. This will require installation of replacement utilities routed to the south of the new Klarman Hall through what is now surface parking, islands and walk paths. During this phase, the HBS exit from Kresge Way onto Western Ave will be altered. Fencing will be erected around the utility work areas and moved as the utility work progresses across the parking lot areas. WBI is planning to create a temporary curb cut on

Western Avenue that will allow construction vehicles to enter and exit directly into the construction site rather than using Kresge Way. This driveway will be used for construction vehicles only from 7:00 a.m. to 3:00 p.m. After 3:00 p.m., this driveway will be used as an exit for non-construction related vehicles exiting the HBS campus in lieu of the current West Lane exit. The entrance gate to the construction site will not be located directly on Western Avenue, it will be set back approximately 45 feet from the curb. There will also be some modifications to Kresge Way to alter traffic flow in and out of the campus during construction. The entrance and exit reconfiguration will be completed early in phase one. WBI intends to occupy one lane on the eastbound side of Western Avenue, adjacent to the HBS campus, during construction. This lane is currently being used for the Chao Center project.

The second phase of the project will run from June 2016 to Feb 2018. During this phase, the excavation, structural, façade, MEP and interiors work for Klarman Hall will be completed. The site entrance and exit will remain un-changed during this phase.

The third phase starts in March 2018 with the new sitework and landscaping in areas surrounding Klarman Hall. In June and July 2018, the existing Burden Hall building will be demolished. The construction of the G2 Pavilion will be after demolition of Burden Hall, although a specific start date has not yet been determined.

3.10.3 Construction Traffic Flow

Deliveries coming to the site will use the Cambridge/Allston exit from the Massachusetts Turnpike following signs headed for Cambridge, turn left onto the surface road along Soldiers Field Road, then left onto Western Avenue, and follow Western Avenue toward the site, turning into the site from a dedicated construction entrance past Kresge Way.

One lane on the eastbound side of Western Avenue will be used as a queuing area for trucks waiting to enter the site.

Trucks leaving the site will turn left onto Western Avenue heading east toward Soldiers Field Road. All trucks will then turn right onto Soldiers Field Road and follow the signs for the entrance to the Massachusetts Turnpike.

3.10.4 Site Construction Fencing and Pedestrian Access

The entire site will be enclosed by chain link fencing. The construction site entrance gate will be set back from the Western Avenue curb line by approximately 45 feet and will not interfere with pedestrians using the Western Avenue sidewalk.

3.10.5 Truck Staging

HBS and WBI will work to ensure that staging areas will be located on site to minimize impact to pedestrian and vehicular flow in the neighborhood, and that the staging areas are being coordinated with other construction activity in the immediate area.

3.10.6 Contractor Parking

To reduce vehicle trips to and from the construction site, construction workers will be encouraged to use non-auto modes. But recognizing that many workers will choose to drive to the site, the University will ensure that all trade workers have access to campus parking. Parking on neighborhood streets will be prohibited.

3.10.7 Work Hours

Consistent with City of Boston requirements the typical construction hours for the Project will be from 7:00 a.m. to 6:00 p.m. Monday through Friday. No substantial sound generating activity will occur before 7:00 a.m. If longer hours, additional shifts or weekend work is required, the construction manager will submit a work permit request to the City's Inspectional Services Department.

3.10.8 Communication and Neighborhood Outreach

In an effort to have clear, open and up-to-date communication with the neighborhood, the Project will participate in Harvard's communication plan for projects in Allston. WBI will provide an emergency contact list for 24-hour emergency response for any construction related issues. Project bulletin boards and a Project website with construction activity updates and community related topics will be utilized for information sharing. Emergency contact information will be indicated at both locations.

3.10.9 Police Details

The Project will require the use of police details to support heavy truck traffic and general site logistics. Police detail locations and quantities may vary between phases and certain activities. Depending on the location of the site and the activity, police details will be provided by the Harvard University Police Department, State Police or Boston Police.

3.10.10 Pest Control

A rodent extermination certificate will be filed with each 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 in compliance with the City's requirements. Rodent control prior to work startup will consist of documentation of existing conditions, treatment of areas throughout the site and a follow up walkthrough to determine if more treatment is necessary. During the construction process, regular service visits will be made. If there is an increase in rodent activity or if complaints are received, additional treatment and monitoring will be conducted.

3.10.11 Winter Weather and Extreme Weather Conditions

During periods of high winds or large amounts of snow, WBI will make sure that the site remains secure. Snow removal may be WBI's responsibility or may fall on Harvard's maintenance group

depending on the location on the property. The contractor is responsible for clearing the perimeter pathways around the Project. Off hours may be needed for snow clearing, ice melt and maintenance operations.

3.10.12 Noise, Dust and Vibration

WBI will adhere to the City's noise ordinance and the published guidelines for protecting air quality and preventing dust from construction. Repeated violations and/or complaints may result in the immediate temporary suspension of the construction activities that are causing the excessive noise or dust levels. Any activity that will cause excessive noise, dust or vibration will be carefully monitored and documented.

3.11 Wildlife Habitat

The site is within a fully developed urban area 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.

Chapter 4
Sustainability and Climate Change

4.0 SUSTAINABILITY AND CLIMATE CHANGE

4.1 Sustainable Design (LEED)

This section provides a discussion of the sustainability efforts the HBS will pursue related to the Project.

HBS is committed to developing buildings that are sustainably designed, energy efficient, environmentally conscious and healthy for faculty, staff and students. 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 will be registered with the U.S. Green Building Council (USGBC) and will target LEED Gold under LEED v4.

Atelier Ten has conducted a LEED for NC v4 assessment of Klarman Hall. The checklist at the end of this chapter provides a LEED appraisal, a tool for assessing a project's LEED status quickly and comprehensively. Each LEED credit is listed on the appraisal and is assigned a high, medium or low probability of achievement based on a credit review to date.

These probabilities are shown in the columns to the left of the credit titles. Points that are not possible for the Project are listed in the column marked NP. A final projected score is then compiled and shown at the top. To compile the score, it is assumed that 90% of all high probability points will be earned, 60% of medium probability points, and 10% of all low probability points.

Based on the current design, Klarman Hall is projected to earn 71 points with 56 points in the high category, which is in LEED Gold certification range. Moving into Design Development, the design team will focus on the LEED credit calculations and sustainable material selection.

Since the G2 Pavilion program and envelope have not been determined at this time, a LEED Checklist is not included for this building. It is anticipated that the G2 Pavilion will have a target of LEED Gold.

Integrative Process

IP Credit 1, Integrative Process: An early phase energy model and water balance have been completed.

Location and Transportation

LT Credit 2, Sensitive Land Protection: The Project is located on previously developed land.

LT Credit 4, Surrounding Density and Diverse Uses: The Project is located on a site whose surrounding existing development density is approximately 22,000 sf per acre and is within one-half mile of eight qualifying public amenities.

LT Credit 5, Access to Quality Transit: MBTA bus routes 66, 70, 70A and 86 have stops within one-quarter mile of the site, and provide 239 weekday and 128 weekend trips.

LT Credit 6, Bicycle Facilities: The site has access to an eligible bicycle network. Bicycle racks and a shower will be included.

LT Credit 7, Reduced Parking Footprint: The applicability of this credit will be analyzed during Design Development.

LT Credit 8, Green Vehicles: The applicability of this credit will be analyzed during Design Development.

Sustainable Sites

SS Prereq 1, Construction Activity Pollution Prevention: An erosion and sediment control plan will be prepared for the Project.

SS Credit 1, Site Assessment: HBS is studying the need for completed a site assessment beyond what has been completed for the Project.

SS Credit 2, Site Development: Protect or Restore Habitat: The Project team is evaluating whether new landscaping for the site will achieve this credit.

SS Credit 3, Open Space: The Project site will include open space for more than 30% of the site area, of which more than 25% will be vegetated.

SS Credit 4, Rainwater Management: The Project includes infiltration beds, and intends to manage runoff for at least the 95th percentile rainfall event.

SS Credit 5, Heat Island Reduction: The Project will include a high SRI roofing material and green roof. The achievability of this credit will be determined during Design Development (DD).

Water Efficiency

WE Prereq 1, Outdoor Water Use Reduction (30%): Efficient irrigation will reduce outdoor water use by at least 30%.

WE Prereq 2, Indoor Water Use Reduction (20%): The Project will include efficient fixtures and fittings to exceed a 20% water use reduction from the baseline.

WE Prereq 3, Building-Level Water Metering: The Project will include building-level water metering.

WE Credit 1, Outdoor Water Use Reduction: Efficient irrigation and stormwater reuse may allow the Project to achieve a reduction in potable water for irrigation by at least 50%.

WE Credit 2, Water Use Reduction: The Project will include efficient fixtures and fittings with a current anticipated water use reduction of 33% from the baseline.

WE Credit 4, Water Metering: The Project will include sub meters to measure the relevant water end uses.

Energy and Atmosphere

EA Prereq 1, Fundamental Commissioning and Verification: The Project will undergo commissioning consistent with this requirement.

EA Prereq 2, Minimum Energy Performance: The energy model, based on Schematic Design, shows the proposed design achieves a 17% cost savings compared to ASHRAE 90.1-2010, exceeding the 5% requirement.

EA Prereq 3, Building-Level Energy Metering: The Project will include building-level energy metering.

EA Prereq 4, Fundamental Refrigerant Management: The Project's HVAC&R will not include CFCs.

EA Credit 1, Enhanced Commissioning: Enhanced commissioning is standard practice at HBS and it will be pursed for the Project. HBS will determine if envelope commissioning will be pursued at a later date.

EA Credit 2, Optimize Energy Performance: The energy model, based on Schematic Design, shows the proposed design achieves a 17% cost savings compared to ASHRAE 90.1-2010. The Project team will study additional measures that may result in cost savings.

EA Credit 3, Advanced Energy Metering: The design includes meters for high pressure steam, steam condensate return, chilled water and electric substation. Distributed metering at distribution sub panels will segregate the receptacle, lighting and mechanical loads.

EA Credit 4, Demand Response: HBS participates in demand response programs.

EA Credit 5, Renewable Energy: The Project intends to include solar PV which would produce enough energy to achieve points towards this credit.

EA Credit 6, Enhanced Refrigerant Management: The refrigerants will comply with the credit requirements.

Materials and Resources

MR Prereq 1, Storage and Collection of Recyclables: A recycling area will be included in the building.

MR Prereq 2, Construction and Demolition Waste Management Planning: Construction waste management is standard at HBS.

MR Credit 1, Building Life-Cycle Impact Reduction: The Project team will evaluate this credit for achievability during Design Development.

MR Credit 2, Building Product Disclosure and Optimization: Environmental Product Declarations: The Project team will identify products with environmental product declarations during Design Development.

MR Credit 3, Building Product Disclosure and Optimization: Sourcing of Raw Materials: The Project team will identify compliant materials during Design Development.

MR Credit 4, Building Product Disclosure and Optimization: Materials Ingredients: The Project team will identify compliant materials during Design Development.

MR Credit 5, Construction and Demolition Waste Management: Construction waste management is standard at HBS, and the Project team will target diversion of 75% of the waste from at least four material streams.

Indoor Environmental Quality

IEQ Prereq 1, Minimum IAQ Performance: The design will meet sections 4 through 7 of ASHRAE 62.1-2010.

IEQ Prereq 2, Environmental Tobacco Smoke (ETS) Control: No smoking is standard at HBS.

IEQ Credit 1, Enhanced Air Quality Strategies: The building will include walk-off mats, as well as CO_2 sensors in densely occupied spaces.

IEQ Credit 2, Low-Emitting Materials: Low-emitting requirements will be included in the specifications for the Project.

IEQ Credit 3, Construction IAQ Management Plan: Indoor Air Quality Management is standard practice at HBS.

IEQ Credit 4, Indoor Air Quality Assessment: HBS will determine if a pre-occupancy flush-out will occur at a later date.

IEQ Credit 5, Thermal Comfort: The Project team will study if this credit can be achieved during design.

IEQ Credit 6, Interior Lighting: Lighting controls will be provided for individual workstations, and the lighting design will meet best practice requirements.

IEQ Credit 7, Daylight: The calculation to determine if this credit is achievable will be completed during Design Development.

IEQ Credit 9, Acoustic Performance: Credit compliance is anticipated given the Project program.

Innovation in Design

The Project may achieve ID credits related to green education and green cleaning. Additional ID credits will be studied during Design Development.

4.2 Renewable Energy

The Project intends to integrate a 70kW PV array on the roof. This size of PV array is expected to generate approximately 94,500 kWh annually and result in an approximately 4% utility cost reduction.

4.3 Climate Change

The design of Klarman Hall has addressed climate change and resiliency issues by integrating measures that reduce resource consumption and plan for future uncertainties. The building design is projected to be 36% more energy efficient than code requirements, and projected to reduce carbon emissions by up to 38%. The design of the G2 Pavilion is anticipated to include measures to reduce energy use.

Stormwater management has also been carefully considered given the Project site's proximity to the Charles River. The site includes multiple infiltration beds as well as a stormwater storage tank to efficiently deal with stormwater runoff on-site. The stormwater tank also allows non-potable water collection to be used for irrigation or other non-potable uses, therefore reducing the demand of potable water on the municipal infrastructure. The landscape design integrates native/adaptive vegetation that are drought tolerant when non-potable water is not available.

Klarman Hall's systems have been designed based on the building's proposed use as an auditorium with limited office and support spaces. The building's emergency systems will be used for short-term events; during larger emergency events, the building will be closed. The G2 Pavilion will also be closed in the event of a large emergency event.

The Climate Change Checklist for the Project is included as Appendix B.

LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name: Klarman Hall
Date: 25-Sep-15

Y	?	N			
1			Credit	Integrative Process	1

13	1	18	Location and Transportation		16
		16	Credit	LEED for Neighborhood Development Location	16
1			Credit	Sensitive Land Protection	1
2			Credit	High Priority Site	2
4		1	Credit	Surrounding Density and Diverse Uses	5
5			Credit	Access to Quality Transit	5
	1		Credit	Bicycle Facilities	1
1			Credit	Reduced Parking Footprint	1
		1	Credit	Green Vehicles	1

5	1	4	Sustainable Sites		10
Y			Prereq	Construction Activity Pollution Prevention	Required
	1		Credit	Site Assessment	1
		2	Credit	Site Development - Protect or Restore Habitat	2
1			Credit	Open Space	1
2		1	Credit	Rainwater Management	3
2			Credit	Heat Island Reduction	2
		1	Credit	Light Pollution Reduction	1

4	4	3	Water Efficiency		11
Y			Prereq	Outdoor Water Use Reduction	Required
Y			Prereq	Indoor Water Use Reduction	Required
Y			Prereq	Building-Level Water Metering	Required
1		1	Credit	Outdoor Water Use Reduction	2
2	4		Credit	Indoor Water Use Reduction	6
		2	Credit	Cooling Tower Water Use	2
1			Credit	Water Metering	1

27	3	3	Energy and Atmosphere		33
Y			Prereq	Fundamental Commissioning and Verification	Required
Y			Prereq	Minimum Energy Performance	Required
Y			Prereq	Building-Level Energy Metering	Required
Y			Prereq	Fundamental Refrigerant Management	Required
6			Credit	Enhanced Commissioning	6
14	3	1	Credit	Optimize Energy Performance	18
1			Credit	Advanced Energy Metering	1
2			Credit	Demand Response	2
3			Credit	Renewable Energy Production	3
1			Credit	Enhanced Refrigerant Management	1
		2	Credit	Green Power and Carbon Offsets	2

5	6	2	Materials and Resources		13
Y			Prereq	Storage and Collection of Recyclables	Required
Y			Prereq	Construction and Demolition Waste Management Planning	Required
	3	2	Credit	Building Life-Cycle Impact Reduction	5
1	1		Credit	Building Product Disclosure and Optimization - Environmental Product Declarations	2
1	1		Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
1	1		Credit	Building Product Disclosure and Optimization - Material Ingredients	2
2			Credit	Construction and Demolition Waste Management	2

7	5	4	Indoor Environmental Quality		16
Y			Prereq	Minimum Indoor Air Quality Performance	Required
Y			Prereq	Environmental Tobacco Smoke Control	Required
1	1		Credit	Enhanced Indoor Air Quality Strategies	2
2	1		Credit	Low-Emitting Materials	3
1			Credit	Construction Indoor Air Quality Management Plan	1
	2		Credit	Indoor Air Quality Assessment	2
1			Credit	Thermal Comfort	1
1	1		Credit	Interior Lighting	2
		3	Credit	Daylight	3
		1	Credit	Quality Views	1
1			Credit	Acoustic Performance	1

6	0	0	Innovation		6
5			Credit	Innovation	5
1			Credit	LEED Accredited Professional	1

3	1	0	Regional Priority		4
1			Credit	Regional Priority: LT High Priority Site	1
	1		Credit	Regional Priority: WE Indoor Water Use Reduction (40%)	1
1			Credit	Regional Priority: EA Optimize Energy Performance (20%)	1
1			Credit	Regional Priority: EA Renewable Energy Production (5%)	1

71	21	34	TOTALS	Possible Points:	110

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

Chapter 5
Urban Design

5.0 URBAN DESIGN

5.1 Project Context

The Project will be a central element of campus life for HBS, and will serve an important function as the large gathering space for major on-campus events. Located within the HBS campus, the Project's northern face will be towards the HBS Central Green. The eastern edge of the Project site abuts Kresge Way, one of two major vehicular entrances into the HBS campus; its southern edge abuts the main surface parking lot for campus and the south face of the building will be visible from Western Avenue across the parking lot.

5.2 Klarman Hall

5.2.1 Response to Campus Architecture

The Project will be clad in brick, with a level of pattern and detail consistent with many of the core campus buildings. While it is not immediately adjacent to the historic McKim, Mead & White campus buildings, it is responsive to the Georgian character of the founding campus and subsequent buildings that are located nearby—namely Spangler Center (to the west) and Aldrich Hall (to the north). The windows will be large to reflect the open and public character of the Project, but will utilize traditional materials and detailing consistent with the core HBS campus. The building will have a significant area of flat roof to take advantage of the opportunity for photovoltaic arrays (a key sustainable design goal). Above the hall, a curved roof element will feature a slate roof to match the adjacent roof at Spangler Center (see Figure 5-1). A lobby on the north side of the building, known as the Winter Garden, will be clad in steel windows that provide a unique architectural character to the building while still retaining a Georgian sensibility in the detailing and scale of elements (see Figures 5-2 and 5-3). Figure 5-3 includes a view of the G2 Pavilion; however, the design and scale of the building has not yet been determined.

5.2.2 Building Scale

The Project will house a 1,000 seat gathering space—a significant volume on a campus comprising buildings that typically contain smaller spaces. With a sensitivity to campus scale in mind, the building features several design elements that help to situate the Project within the scale of the campus:

- The support spaces and lobbies for the building will be two stories high, approximately matching the belt course line of Spangler Center (its closest neighbor on campus) between its first and second floors;

- The volume of the hall itself will project another fifteen feet, slightly above the eave line of Spangler Center, giving the building a sense of verticality and visual prominence. The projecting volume will be clad in windows on three sides, providing a sense of visual transparency and lightness while also bringing abundant daylight into the hall itself;

- Above the hall will be a curved form with a slate roof that will be smaller than the footprint of the hall itself; this element will rise to a height just above the roof level of Spangler Center.

The three datum lines of the Project provide a volumetric consistency with Spangler Center, while also generating a visual focus at the hall—the signature element of the Project and its primary program. The careful treatment of the architecture and architectural lighting (interior and exterior) will identify the Project as a special place on the HBS campus while retaining a strong sense of architectural connection to the campus.

5.2.3 Welcoming Character

The north face of the Project has two entrances along the Central Green and a large all-glass gathering space (the Winter Garden). The transparency of the entrances and the Winter Garden will serve to provide a direct visual connection between the interior of the building and the Central Green, and a clear visual indication of the character of the building as a shared space for the use of HBS (see Figure 5-4). By aligning the north face of the Project with the north face of Spangler Center, the building will also reinforce a strong southern edge to the Central Green (see Figure 2-4). The south face of the Project will have two entrances along Spangler Way, looking across the parking lot to Western Avenue, and ultimately to future development across Western Avenue (see Figure 5-5).

5.2.4 Relationship to Kresge Way

As part of the Project's evolution, the design team evaluated whether the east face of Klarman Hall should be "splayed" in order to make it parallel to Kresge Way.

For a number of reasons, the design team has chosen not to pursue that approach, mainly related to the recognition that the building as designed follows the patterns on the existing HBS Campus.

- Arced Pattern: HBS buildings are organized around a series of east/west arcs, where each building is perpendicular to its arc. Klarman Hall is aligned with this arced pattern, specifically with its north-south centerline perpendicular to the east-west arc that links Klarman and Spangler.

- Pattern of Orthogonal Buildings: HBS Buildings are typically orthogonal, not "splayed" (trapezoidal). For rectangular buildings like Baker, Bloomberg, Morgan and Hawes, the east and west side walls are perpendicular to the north-south facade. Klarman Hall follows this pattern. Only long thin linear buildings "bend" (but not "splay") to adjust to the radial arc (Spangler, Aldrich, McKim Residences).

In addition, the proposed west side of the Kresge Way landscape creates a "soft" edge in contrast to the existing "hard" building edge on the east side. The wide landscape zone from the Dean's house south to Western Avenue creates a significant buffer between the building and road edge.

On pragmatic terms, the HBS team has worked hard to regularize its structural system for structural and spatial efficiency—avoiding any irregular structural grids (such as "splaying") that would introduce unnecessary complexity and added cost to this already complex structure.

With that said, the design team is continuing to study this eastern edge of the building and Project site, particularly to: 1) activate the eastern edge of the building through the landscape; and 2) maximize visually transparency and the number of windows along this façade that glow at night.

5.3 G2 Pavilion

On its east side, the G2 Pavilion will be set back approximately 70 feet from a re-landscaped Kresge Way. This setback matches the setback of Klarman Hall from Kresge Way (see Figure 2-4). Together, this setback and the extension of landscaped walks to Western Avenue create a continuous tree-lined pedestrian corridor along Kresge Way from Western Avenue to the HBS Central Green. This new landscaped corridor will create a new pedestrian path and view corridor through the HBS campus, and connect the Western Avenue entrance to the legacy HBS campus. The setback also preserves one of the campus's best mature canopy trees, and allows for a gentle grade change that is easily walkable from the G2 Pavilion to Kresge Way.

The G2 Pavilion is sited at the east terminus of the HBS Central Green, and is centered on the Green's long axis, creating and iconic focal point and completing the enclosure of the Green as an academic quadrangle. The G2 Pavilion's west face is set back so that Klarman Hall's Winter Garden gathering space, and the G2 Pavilion's west entrance, will face a common lawn area that can be used for outdoor gatherings and also be tented for special events.

As the design of the G2 Pavilion develops, it will undergo additional design review by the BRA staff.

Figure 5-1: View Looking Northwest
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

Figure 5-2: View Looking South

Expanded PNF

Source: William Rawn Associates, Architects, Inc.

Figure 5-3: View Looking Southeast
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

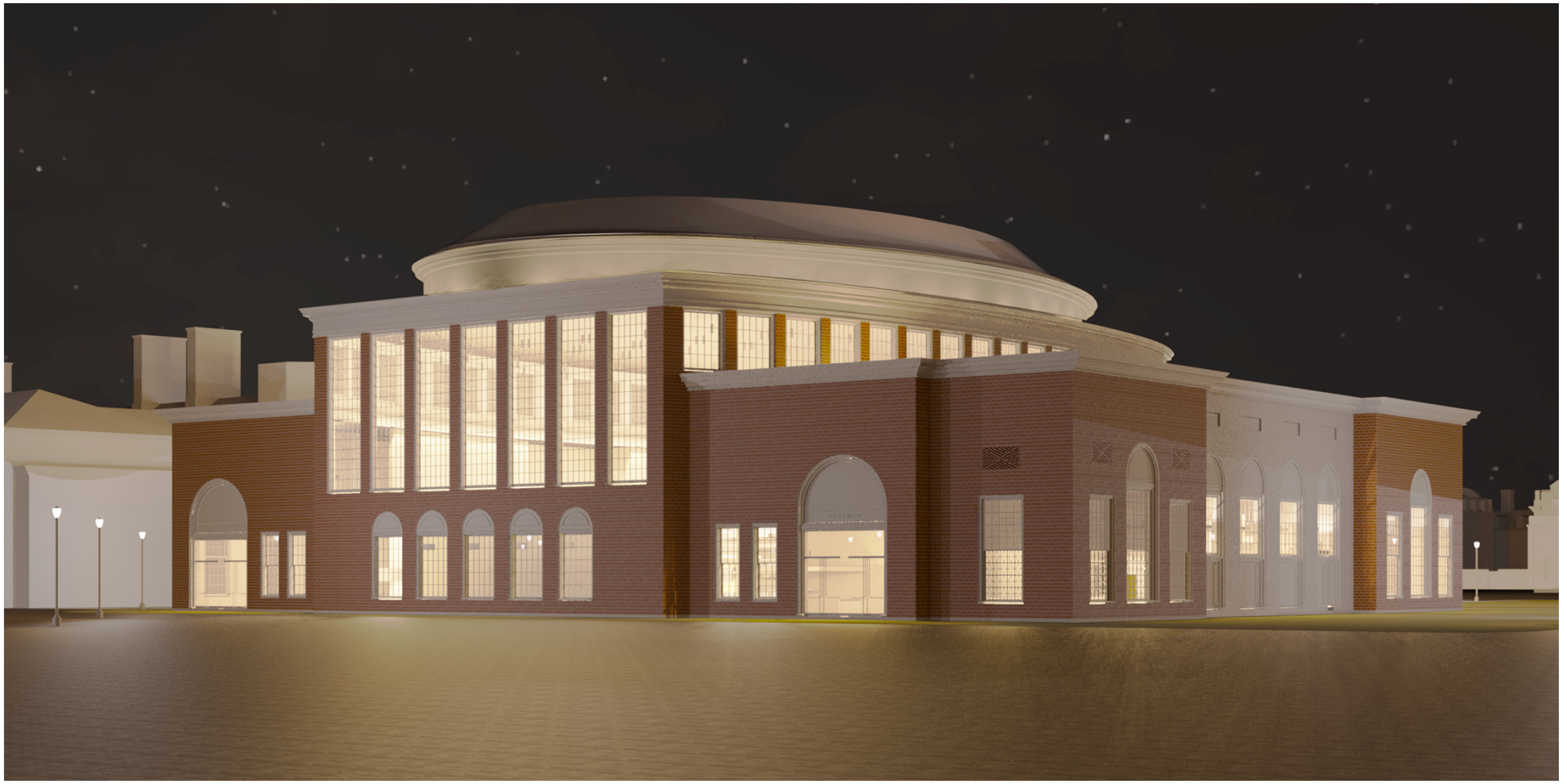


Figure 5-4: View Looking Northwest
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

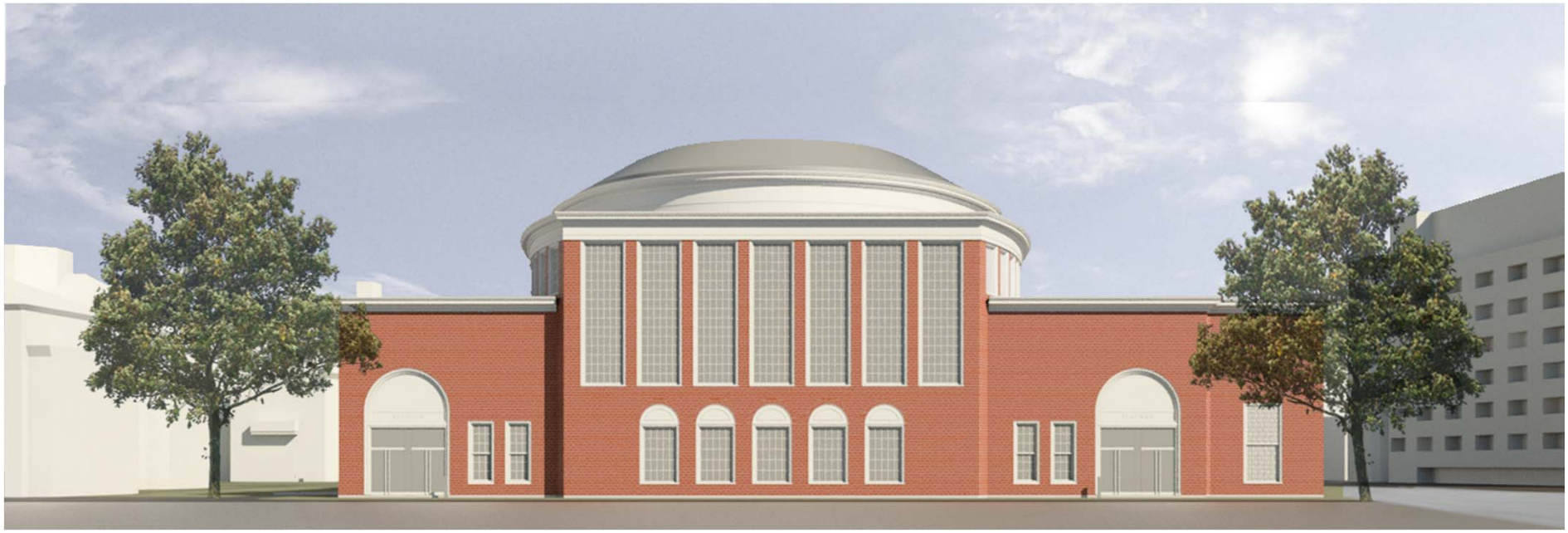


Figure 5-5: View Looking North
Expanded PNF

Source: William Rawn Associates, Architects, Inc.

Chapter 6
Historic and Archaeological Resources

6.0 HISTORIC AND ARCHAEOLOGICAL RESOURCES

6.1 Historic and Archaeological Resources

The following section describes historic resources within and in the vicinity of the Project site, and generally discusses potential impacts on historic resources from the proposed Project.

6.1.1 Historic Resources

The proposed Project site is located within and in the vicinity of properties listed in the State and National Registers of Historic Places and/or included in the Inventory of Historic and Archaeological Assets of the Commonwealth (Inventory). The Project site is located within the Harvard Business School – Athletic Facilities Area, an area included in the Inventory. The site encompasses Burden Hall, constructed in 1971 and designed by Phillip Johnson.

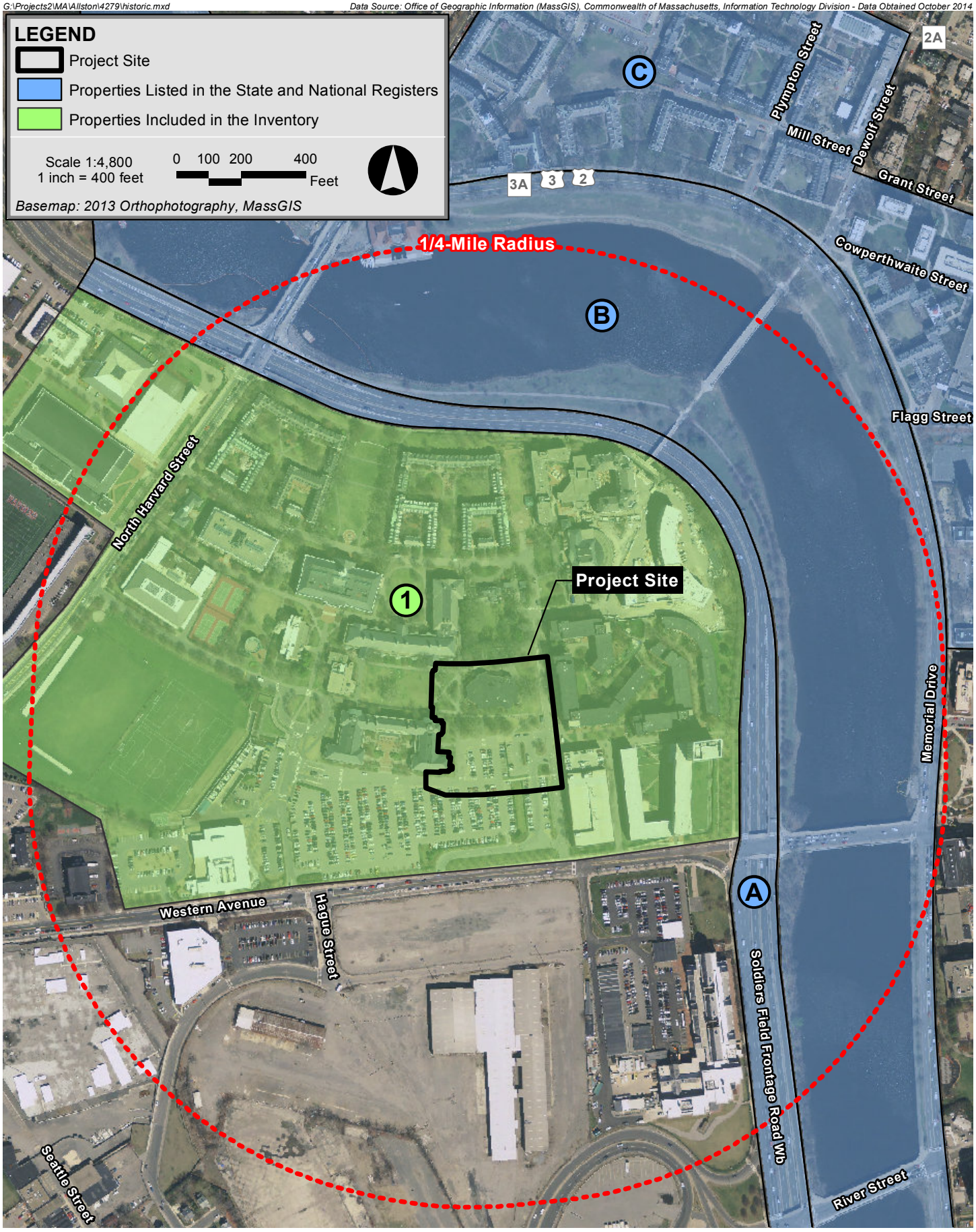
The Project site is in the vicinity of the Charles River Reservation – Soldiers Field Road Area and, beyond that, the Charles River Basin Historic District, both of which are listed in the State and National Registers of Historic Places.

The name and address of properties listed in the State and National Registers of Historic Places and properties included in the Inventory within one-quarter mile of the Project site are listed below in Table 6-1. Figure 6-1 depicts the locations of these properties.

Table 6-1 Historic Resources within One-Quarter Mile of the Project Site

Map No.	Name	Address
Properties Listed in the State and National Registers of Historic Places		
A	Charles River Reservation – Soldiers Field Road, Boston	Soldiers Field Road
B	Charles River Basin Historic District, Boston and Cambridge	Eliot Bridge to Charles River Dam including parkland and parkways in Boston and Cambridge
C	Harvard Houses District, Cambridge	Mt. Auburn, Grant, Cowperthwaite, Banks, Putnam, JFK Streets and Memorial Drive
Properties Included in the Inventory of Historic and Archaeological Assets of the Commonwealth		
1	Harvard Business School – Athletic Facilities Area	Soldiers Field Road, North Harvard Street

Data Source: Office of Geographic Information (MassGIS), Commonwealth of Massachusetts, Information Technology Division - Data Obtained October 2014



HARVARD | BUSINESS | SCHOOL
KLARMAN HALL / G2 PAVILION

Figure 6-1: Historic Resources
Expanded PNF

Source: Epsilon Associates, Inc.

6.1.2 Archaeological Resources

As part of the larger master plan project in 2007, Harvard Business School (HBS) retained the Public Archaeology Laboratory, Inc. (PAL) to undertake an archaeological sensitivity assessment for the project area that was under consideration at that time. The larger master plan was not advanced and the ensuing PAL survey was suspended. The Ten-Year Plan Draft Environmental Impact Report (DEIR) included a summary of the archaeological sensitivity assessments for the Project, as identified by PAL in their 2007 preliminary assessment.

As part of the current Ten-Year Master Plan, HBS filed an MHC PNF for the demolition of Kresge Hall to initiate consultation with the MHC in August 2013. Subsequently, the MHC and HBS entered into a Memorandum of Agreement (MOA), outlining measures to mitigate the adverse effect to historic resources. These included an agreement to advance an archaeological survey of all four projects included in the Ten-Year Plan that are located within the HBS campus, specifically Kresge Hall, Burden Hall, Baker Hall, and Ohiri Field.

An archaeological reconnaissance survey was conducted in 2014 for four HBS project areas, including the area that encompasses Burden Hall. The survey assigned moderate archaeological sensitivity for pre-contact Native American and post-contact (early Euro-American settlement) resources to the southern parking lot portion of the Project site. The 1971 construction of Burden Hall and the tunnel extension to the south likely disturbed intact natural organic subsoil strata below the generalized 8–10 feet of fill deposits in the northern portion of the Project site (the proposed location of the G2 Pavilion). Low archaeological sensitivity was assigned to this portion of the site.

The survey recommended that a qualified archaeologist review additional soil borings conducted for those areas of the Project site that were assigned moderate archaeological sensitivity, if proposed new construction would extend vertically into the identified sensitive archaeological strata.

A supplemental reconnaissance survey report was undertaken in 2015, which analyzed soil borings for the Klarman Hall site. The soil borings review confirmed the presence of organic (fibrous peat) deposits below the fill from about 10 to 21 feet below ground surface. Given the deeply buried vertical placement of the archaeologically sensitive soil stratum, conventional archaeological hand and machine-assisted subsurface testing in the Project area is not recommended. Rather, the survey recommends that a qualified archaeologist monitor below-grade excavations for the Klarman Hall building. The archaeological monitoring would be designed to identify, document, and record any significant precontact cultural deposits, which may be encountered from about 10–20 feet below ground surface.

As a result of the initial PNF filed with MHC in 2013, reconnaissance survey completed in April 2014, and subsequent supplemental reconnaissance survey detailing the results of the soil borings review completed in August 2015, MHC is aware of the continuing archaeological survey required at the Klarman Hall site. HBS is committed to having a qualified archaeologist monitor

construction excavations, as recommended by the supplemental reconnaissance survey. If required, an additional MHC PNF will be filed to advance the recommended archaeological monitoring at the site.

6.2 Impacts to Historic Resources

The proposed Project may have direct and indirect impacts on the visual, shadow, and geotechnical conditions in the vicinity of the Project site where historic resources are present.

6.2.1 Visual Impacts

As noted in Chapter 2, Burden Hall was not built as part of the McKim, Mead and White campus, and is a windowless building lacking a positive relationship with campus open spaces, pedestrian paths, and buildings. It is disconnected from other campus academic and student buildings, and does not contribute to a positive participant experience, or campus life. It constricts views and pedestrian connections between the HBS Central Green, the focus of the academic campus, and Kresge Way, an important pedestrian route.

The Project, while not immediately adjacent to the historic McKim, Mead and White campus, has been designed to be responsive to the Georgian character of the historic campus and later buildings that are located nearby, including Spangler Center to the west and Aldrich Hall to the north. The building will be clad in brick, with a level of pattern and detail consistent with many of the core campus buildings. The windows will be large to reflect the open and public character of the Project, but utilize traditional materials and detailing consistent with the core HBS campus. Above the hall, a curved roof element will feature a slate roof. The careful treatment of the architecture and architectural lighting (interior and exterior) will identify the Project as a special place within HBS, while retaining a strong sense of architectural connection to the historic campus.

The Project will not have any visual impacts on historic resources in the vicinity of the HBS campus, including the Charles River Reservation Parkway – Soldiers Field Road Area or the Charles River Basin Historic District. The Project site is not visually connected to these resources as it is blocked by intervening buildings.

6.2.3 Shadow Impacts

As described in Section 3.3, a shadow impact analysis has been prepared to demonstrate the anticipated impacts from the Project in comparison to the existing conditions. A shadow analysis was completed for March 21, June 21, September 21, and December 21 at 9:00 a.m., 12:00 p.m. and 3:00 p.m., as well as 6:00 p.m. for June 21 and September 21. The shadow analysis study is depicted in Figures 3-1 to 3-14.

The site includes Burden Hall, which is similar in scale to the proposed Project. However, the footprints of the two buildings are different and the Project is located further south, which results in some minor new shadow on the immediate surrounding HBS campus and within the area of the

Burden Hall footprint. Shadow impacts to surrounding HBS buildings are minimal. There will be new shadow cast on the east elevation of Spangler Center at 9:00 a.m. on March 2, September 21, and December 21.

The Project will not have any shadow impacts on historic resources in the vicinity of the HBS campus, including the Charles River Reservation Parkway – Soldiers Field Road Area or the Charles River Basin Historic District during the time periods studied.

6.2.4 Geotechnical Impacts

The Project site is not in the immediate vicinity of historic structures. No vibration impacts are anticipated for nearby historic and non-historic properties. A geotechnical monitoring program may be implemented prior to and during construction, and would likely consist of settlement monitoring of adjacent buildings. In addition, seismographs will record vibrations during sheetpile wall installation (excavation support wall) to monitor vibrations.

An engineer's representative will be on site full time during foundation pile installation to monitor these activities in accordance with the Building Code requirements.

6.3 Coordination

6.3.1 Massachusetts Historical Commission

The MHC has review authority over projects requiring state funding, licensing, permitting, and/or approvals that may have direct or indirect impacts to properties listed in the State Register of Historic Places. If it is determined that the Project will involve a state action, a MHC Project Notification Form will be filed with the MHC to initiate the State Register Review process.

The PCN, as described in Section 2.6.1, will be sent to the MHC.

6.3.2 Boston Landmarks Commission

The building was constructed in 1971 and therefore is not subject to review by the BLC under Article 85 of the Boston Zoning Code.

Chapter 7
Infrastructure Systems

7.0 INFRASTRUCTURE SYSTEMS

This section describes the infrastructure systems that will support the Project and surrounding area, discusses the Project's potential impacts on these utilities, and identifies mitigation measures to address potential impacts. Based on initial investigations, the existing infrastructure systems in the area appear to be able to accept the incremental increase in demand associated with the development and operation of the Project.

To ensure that the Project can be adequately serviced by existing and/or proposed new infrastructure, final engineering and design will be determined once the Project has received necessary approvals. During the design and construction of the Project, the Project team will coordinate with the appropriate agencies and utility owners.

As described in detail in Chapter 2, the Project site is located on the HBS campus and is bounded by Kresge Way to the east, Western Avenue to the south, Spangler Center to the west, and the Interim Dining facility/Dean's lawn to the north. The Project includes the construction of Klarman Hall, a new auditorium building, and G2 Pavilion, an academic building. Burden Hall, which is currently located on the site will be demolished.

The systems discussed below include those owned or managed by the Boston Water and Sewer Commission (BWSC), private utility companies, and campus infrastructure systems. There will be close coordination among these entities and with the Project team during subsequent reviews and the design process.

7.1 Wastewater

7.1.1 Existing Wastewater

Local sanitary sewer service in the City of Boston is provided by the BWSC. Record drawings indicate existing sanitary sewer connections exit the Burden Hall building along the east face and flow towards a private sewer main in Kresge Way. The Kresge Way private sewer main ties into a private sewer main that flows in a southwesterly direction across campus through the center of the existing parking lot within the Project site and connects to the 84" x 112" Massachusetts Water Resources Authority (MWRA) combined sewer (Charles Relief South Sewer). The Charles Relief South Sewer is ultimately conveyed to the MWRA facility on Deer Island via the Boston Main Drainage Tunnel.

7.1.2 Demand/Use

The existing Burden Hall generates approximately 2,325 gallons per day (gpd) of sanitary sewage, and the proposed Project will generate approximately 5,530 gpd of sewage for the overall building programs, representing an increase of approximately 3,205 gpd (see Table 7-1). Generation rates from the Massachusetts Department of Environmental Protection The State Environmental Code (Title 5) were used to support the development of these preliminary sewage generation estimates. This estimate is conservative, and with the use of low-flow fixtures and

other water conservation measures, the Title 5 calculated increased wastewater generation is anticipated to be less than approximately 3,205 gpd.

Table 7-1 Sanitary Flows

Proposed Use	Units/Size	Design Flow Rate (GPD/unit)	Proposed Sanitary Flows (GPD)
Klarman Hall (Phase 1: New Construction)			
Auditorium	1,000 seats	3/seat	3,000
Office	1,724 SF	75/1,000 SF	130
G2 (Phase 2: New Construction)			
Office	8,000 SF	75/1,000 SF	600
Conference/ Classroom	300 seats	3/seat	900
Function Hall	300 seats	3/seat	900
Phase 1+2 Total Proposed Sanitary Flow			5,530
Existing Use	**Units/Size**	**Design Flow Rate (GPD/unit)**	**Existing Sanitary Flows (GPD)**
Burden Hall (Phase 2: Demolition)			
Auditorium	775 seats	3/seat	2,325
Phase 2 Total Existing Sanitary Flow			2,325
Total Proposed Sanitary Flow Due to Project			5,530
Total Existing Sanitary Flow			2,325
Total Increase in Sanitary Flow Due to Project			3,205

7.1.3 Proposed Condition

The sewer services for the Project will tie into the private HBS sanitary sewer systems in Kresge Way and the parking lot. The Proponent will coordinate with the BWSC on the design and capacity of the proposed connections to the sewer system which will be reviewed as part of the BWSC's Site Plan Review Process.

Based on anticipated water conservation methods such as low flow toilets, sewage demands are anticipated to be similar to existing demands.

An analysis was performed on the private sanitary sewer mains that the Project may utilize. Pipe diameters and inverts were taken from an existing conditions survey provided by the Proponent. The flow capacity was analyzed using the Manning equation.

Results indicate that the minimum hydraulic capacity of the 12-inch sewer main located in Kresge Way is 1,090 GPM (gallons per minute). The G2 Pavilion is anticipated to tie in to the sewer main in Kresge Way. Results indicate that the minimum hydraulic capacity of the 18-inch sewer main located within the eastern portion of the existing parking lot is 2,465 GPM. Klarman Hall is anticipated to tie in to the sewer in the parking lot. Based on the peak flow estimate, the Project will not significantly burden the existing sewage system. Calculations are presented in Table 7-2.

Table 7-2 Sewer Hydraulic Capacity Analysis

Street	Size (inch)	Slope (ft/ft)	Manning's 'n'	Exist. Capacity (Million Gallons per Day, MGD)	Exist. Capacity (Gallons Per Minute, GPM)	Prop. Peak Flow to Main (GPM)
Existing Parking Lot (East)	18 RCP	0.004	0.015	3.55	2,465	2.17
Existing Parking Lot (West)	18 PVC	0.004	0.010	5.87	4,076	2.17
Kresge Way	12 RCP	0.006	0.015	1.57	1,090	1.67

7.2 Domestic Water and Fire Protection

7.2.1 Existing Water Supply System

The Project is located in the Northern Low service area of the BWSC public water supply service areas. The three streets abutting the HBS campus, Soldier's Field Road, North Harvard Street and Western Avenue, are served by 12-inch northern low service mains. The Project is expected to be fed by a connection to the private water main located in Kresge Way. Record drawings indicate that the private water main in Kresge Way connects to a 12-inch BWSC water main in Western Avenue, or a 12-inch BWSC water main in North Harvard Street.

Domestic water demand is based on estimated sewage generation with an added conservative factor of 1.1 (10%) to account for consumption, system losses, and other uses. Based upon sewage generation rates calculated previously, functioning at full capacity, the overall Project will require approximately 6,083 gallons of water per day, representing an increase of 3,526 gpd from the existing condition. However, based on anticipated changes in the school's water conservation

methods with the use of low-flow fixtures, water demands are anticipated to be similar to the existing demands.

7.2.2 Proposed Condition

To maintain uninterrupted water services, separate domestic and fire protection services will be provided to the proposed buildings from connections to the private water main in Kresge Way.

Domestic water service connections required by the Project will meet the requirements of the BWSC and applicable city and state codes and standards, including cross-connection and backflow prevention.

Compliance with the standards for the domestic water system service connections will be reviewed as part of BWSC's Site Plan Review process. The review includes, but is not limited to, sizing of domestic water and fire protection services, calculation of meter sizing, backflow prevention design, and location of hydrants and siamese connections to conform to BWSC and Boston Fire Department requirements.

7.3 Stormwater Management

7.3.1 General

The stormwater management controls will be established in compliance with BWSC standards and MassDEP's Stormwater Management Policy. In addition, as part of HBS's Stormwater Plan, the design team is investigating various innovative options for stormwater management that includes detention, infiltration, and reuse to strive to mitigate 1.5-inch of rainfall on-site and decrease phosphorus loads leaving the site. The mitigation measures may include directing stormwater to the landscaped areas for natural mitigation, treatment through biological processes such as treatment swales and/or water features, infiltration back to the natural soils, and structural treatment.

The Project is expected to improve runoff water quality through treatment and infiltration. The existing drainage pattern, which consists of closed pipe drainage discharging to the Charles River, will be matched in the proposed condition.

7.3.2 Existing Conditions

The Project site is serviced by private drain mains. According to BWSC record information, this existing system includes connections to a 36-inch private drain main that flows easterly through a series of 42-inch Department of Conservation and Recreation drain mains, ultimately discharging to the Charles River.

7.3.3 Proposed Conditions

The stormwater design will include stormwater best management practices (BMPs) and stormwater detention/infiltration systems to capture and recharge minimally one-inch of rainfall

over the total site to mitigate the peak rate of runoff and total runoff volume below the existing levels.

The Project will strive to infiltrate stormwater runoff from impervious areas into the ground to the greatest extent practicable. The proposed stormwater management system will include an upgraded site closed drainage system and building roof recharge systems.

The construction of Klarman Hall is expected to slightly increase impervious area onsite by less than 5 percent from the existing condition. The demolition of Burden Hall and construction of the G2 Pavilion is expected to decrease impervious area onsite by approximately 20 percent from the existing condition. Porous pavement walkways have been conservatively calculated as impervious areas.

Stormwater management controls will be established in compliance with BWSC standards, and the Project will not introduce any increased peak flows, pollutants, or sediments that would potentially impact the Charles River. In conjunction with the site plan and the General Service Application, the Proponent will submit a stormwater management plan to the BWSC. Compliance with the standards for the final site design will be reviewed as part of the BWSC Site Plan Review process.

The design objective for the stormwater management systems proposed for the Project is to meet the Massachusetts Stormwater Management Standards to the greatest extent practicable. These standards have been specifically addressed in the Project design in the following manner:

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

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

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 offsite for the 100-year design storm.

Compliance: The proposed design will comply with this Standard.

Standard #3: Loss of annual recharge to groundwater shall be eliminated or minimized through the use of infiltration measures including environmentally sensitive site design, low impact development techniques, stormwater best management practices, and good operation and maintenance. At a minimum, the annual recharge from the post-development site shall approximate the annual recharge from pre-development conditions based on soil type. This Standard is met when the stormwater management system is designed to infiltrate the required recharge volume as determined in accordance with the Massachusetts Stormwater Handbook.

Compliance: The Project will comply with this standard to the greatest extent practicable. In accordance with the Proponent's Stormwater Plan Goals, the proposed site will collect, store, and recharge at least one-inch over the impervious site to the greatest extent practicable.

Standard #4: For new development, the proposed stormwater management system must achieve an 80 percent removal rate for the Site's average annual load of total suspended solids (TSS).

Compliance: To the extent practicable, the Project's stormwater management systems will remove 80 percent of the post-development site's average annual TSS load. Within the Project's limit of work, there will be mostly roof, landscaping, paved pedestrian areas, and paved roadway. Runoff from paved areas that would contribute unwanted sediments or pollutants to the existing storm drain system will be collected by deep sump, hooded catch basins and conveyed through water quality units before ultimately discharging to the Charles River.

Standard #5: For land uses with higher potential pollutant loads, source control and pollution prevention shall be implemented in accordance with the Massachusetts Stormwater Handbook to eliminate or reduce the discharge of stormwater runoff from such land uses to the maximum extent practicable. If through source control and/or pollution prevention all land uses with higher potential pollutant loads cannot be completely protected from exposure to rain, snow, snow melt, and stormwater runoff, the proponent shall use the specific structural stormwater BMPs determined by the Department to be suitable for such uses as provided in the Massachusetts Stormwater Handbook. Stormwater discharges from land uses with higher potential pollutant loads shall also comply with the requirements of the Massachusetts Clean Waters Act, M.G.L. c. 21, §§ 26-53 and the regulations promulgated thereunder at 314 CMR 3.00, 314 CMR 4.00 and 314 CMR 5.00.

Compliance: The Project will comply with this standard. The Project site does not contain an area with Higher Potential Pollutant Loads.

Standard #6: Stormwater discharges within the Zone II or Interim Wellhead Protection Area of a public water supply, and stormwater discharges near or to any other critical area, require the use of the specific source control and pollution prevention measures and the specific structural stormwater best management practices determined by the Department to be suitable for managing discharges to such areas, as provided in the Massachusetts Stormwater Handbook. A discharge is near a critical area if there is a strong likelihood of a significant impact occurring to said area, taking into account site-specific factors. Stormwater discharges to Outstanding Resource Waters and Special Resource Waters shall be removed and set back from the receiving water or wetland and receive the highest and best practical method of treatment. A "storm water discharge" as defined in 314 CMR 3.04(2)(a)1 or (b) to an Outstanding Resource Water or Special Resource Water shall comply with 314 CMR 3.00 and 314 CMR 4.00. Stormwater discharges to a Zone I or Zone A are prohibited unless essential to the operation of a public water supply.

Compliance: The Project will comply with this standard. The Project is not within an outstanding resource area and will not discharge untreated stormwater to a sensitive area or any other area.

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

Compliance: The Project will comply with this standard.

Standard #8: A plan to control construction-related impacts including erosion, sedimentation and other pollutant sources during construction and land disturbance activities (construction period erosion, sedimentation, and pollution prevention plan) shall be developed and implemented. These controls must be designed into the project to minimize adverse environmental effects.

Compliance: The Project will comply with this standard. A plan to control temporary construction-related impacts during erosion, sedimentation and other pollutant sources during construction and land disturbing activities will be developed and implemented.

Standard #9: A long-term BMP operation and maintenance plan will be developed and implemented to ensure proper maintenance and functioning of the stormwater management system.

Compliance: The Project will comply with this standard. An Operations and Maintenance (O&M) Plan, including long-term BMP operation requirements, will be prepared and will ensure proper maintenance and functioning of the stormwater management system.

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

Compliance: The Project will comply with this standard. There will be no illicit connections associated with the Project. Temporary construction dewatering will be conducted in accordance with applicable BWSC and Massachusetts Water Resource Authority (MWRA) requirements, as necessary.

7.4 Electricity

New electrical switchgear supplied from the campus high voltage distribution system will be installed in the basement of Klarman Hall. Standby power for Klarman Hall will be provided by a generator located on the low roof of Klarman Hall. The electrical system will be distributed to panels and transformers in electrical closets on each floor of Klarman Hall. The building will be equipped with a lightning protection system to safeguard persons and property from hazards arising from exposure to lightning. The lighting system will use a combination of LED and fluorescent fixtures utilizing occupancy and daylight sensors to minimize energy usage. The G2 Pavilion will also tie into the campus electrical system.

7.5 Heating and Cooling

New mechanical systems will be provided to serve the buildings. Existing campus chilled water will be utilized for cooling. Heating hot water will be provided by a new precinct hot water heating plant utilizing campus steam, to be located within the basement mechanical room of Klarman Hall. Klarman Hall will be conditioned via central air handling units with heat recovery located in mechanical rooms in the basement and on the second floor. Toilet rooms, janitor closets, utility rooms, pantry and similar spaces will be exhausted via fans located on the roof. The G2 Pavilion is anticipate to have similar mechanical equipment for heating and cooling.

7.6 Telecommunications

The Project will connect to the campus telecommunications systems.

7.7 Utility Protection During Construction

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

Appendix A
Accessibility Checklist

Accessibility Checklist

(to be added to the BRA Development Review Guidelines)

In 2009, a nine-member Advisory Board was appointed to the Commission for Persons with Disabilities in an effort to reduce architectural, procedural, attitudinal, and communication barriers affecting persons with disabilities in the City of Boston. These efforts were instituted to work toward creating universal access in the built environment.

In line with these priorities, the Accessibility Checklist aims to support the inclusion of people with disabilities. In order to complete the Checklist, you must provide specific detail, including descriptions, diagrams and data, of the universal access elements that will ensure all individuals have an equal experience that includes full participation in the built environment throughout the proposed buildings and open space.

In conformance with this directive, all development projects subject to Boston Zoning Article 80 Small and Large Project Review, including all Institutional Master Plan modifications and updates, are to complete the following checklist and provide any necessary responses regarding the following:

- improvements for pedestrian and vehicular circulation and access;
- encourage new buildings and public spaces to be designed to enhance and preserve Boston's system of parks, squares, walkways, and active shopping streets;
- ensure that persons with disabilities have full access to buildings open to the public;
- afford such persons the educational, employment, and recreational opportunities available to all citizens; and
- preserve and increase the supply of living space accessible to persons with disabilities.

We would like to thank you in advance for your time and effort in advancing best practices and progressive approaches to expand accessibility throughout Boston's built environment.

Accessibility Analysis Information Sources:

1. Americans with Disabilities Act – 2010 ADA Standards for Accessible Design
    a. http://www.ada.gov/2010ADAstandards_index.htm
2. Massachusetts Architectural Access Board 521 CMR
    a. http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/aab/aab-rules-and-regulations-pdf.html
3. Boston Complete Street Guidelines
    a. http://bostoncompletestreets.org/
4. City of Boston Mayors Commission for Persons with Disabilities Advisory Board
    a. http://www.cityofboston.gov/Disability
5. City of Boston – Public Works Sidewalk Reconstruction Policy
    a. http://www.cityofboston.gov/images_documents/sidewalk%20policy%200114_tcm3-41668.pdf
6. Massachusetts Office On Disability Accessible Parking Requirements
    a. www.mass.gov/anf/docs/mod/hp-parking-regulations-mod.doc
7. MBTA Fixed Route Accessible Transit Stations
    a. http://www.mbta.com/about_the_mbta/accessibility/

Article 80 | ACCESSIBILTY CHECKLIST

Project Information

Project Name:	Klarman Hall
Project Address Primary:	Harvard Business School
Project Address Additional:	
Project Contact (name / Title / Company / email / phone):	Tom Koch, Project Manager, Harvard Business School, tkoch@hbs.edu, (617) 495-6189

Team Description

Owner / Developer:	Harvard Business School
Architect:	William Rawn Associates, Architects, Inc.
Engineer (building systems):	R. G. Vanderweil Engineers
Sustainability / LEED:	Atelier Ten
Permitting:	Epsilon Associates
Construction Management:	Walsh Brothers

Project Permitting and Phase

At what phase is the project – at time of this questionnaire?

PNF / Expanded PNF Submitted	Draft / Final Project Impact Report Submitted	BRA Board Approved
BRA Design Approved	Under Construction	Construction just completed:

Article 80 | ACCESSIBILTY CHECKLIST

Building Classification and Description

What are the principal Building Uses - select all appropriate uses?

	Residential – One to Three Unit	Residential - Multi-unit, Four +	Institutional	Education
	Commercial	Office	Retail	**Assembly**
	Laboratory / Medical	Manufacturing / Industrial	Mercantile	Storage, Utility and Other
First Floor Uses (List)	***Academic, assembly and associated support spaces***			

What is the Construction Type – select most appropriate type?

	Wood Frame	Masonry	**Steel Frame**	Concrete

Describe the building?

Site Area:	*SF*	Building Area:	***Klarman 81,100 sf*** ***G2 18,000-24,000 sf***
Building Height:	***Klarman 66 Ft.*** ***G2 TBD***	Number of Stories:	***Klarman 2 Flrs.*** ***G2 2 Flrs***
First Floor Elevation:	***19'-0" BCB Elev.***	Are there below grade spaces:	***Yes*** / *No*

Assessment of Existing Infrastructure for Accessibility:

This section explores the proximity to accessible transit lines and proximate institutions such as, but not limited to hospitals, elderly and disabled housing, and general neighborhood information. The proponent should identify how the area surrounding the development is accessible for people with mobility impairments and should analyze the existing condition of the accessible routes through sidewalk and pedestrian ramp reports.

Provide a description of the development neighborhood and identifying characteristics.	The Project is located in the heart of the Harvard Business School Campus
List the surrounding ADA compliant MBTA transit lines and the proximity to the development site: Commuter	Bus Lines 66, 70, 70A, 86

rail, subway, bus, etc.	
List the surrounding institutions: hospitals, public housing and elderly and disabled housing developments, educational facilities, etc.	Harvard University
Is the proposed development on a priority accessible route to a key public use facility? List the surrounding: government buildings, libraries, community centers and recreational facilities and other related facilities.	No

Surrounding Site Conditions – Existing:

This section identifies the current condition of the sidewalks and pedestrian ramps around the development site.

Are there sidewalks and pedestrian ramps existing at the development site?	Sidewalks
If yes above, list the existing sidewalk and pedestrian ramp materials and physical condition at the development site.	Bituminous sidewalks
Are the sidewalks and pedestrian ramps existing-to-remain? If yes, have the sidewalks and pedestrian ramps been verified as compliant? If yes, please provide surveyors report.	Existing sidewalks will be replaced with new construction
Is the development site within a historic district? If yes, please identify.	Yes, Harvard Business School – Athletic Facilities Area

Surrounding Site Conditions – Proposed

This section identifies the proposed condition of the walkways and pedestrian ramps in and around the development site. The width of the sidewalk contributes to the degree of comfort and enjoyment of walking

along a street. Narrow sidewalks do not support lively pedestrian activity, and may create dangerous conditions that force people to walk in the street. Typically, a five foot wide Pedestrian Zone supports two people walking side by side or two wheelchairs passing each other. An eight foot wide Pedestrian Zone allows two pairs of people to comfortable pass each other, and a ten foot or wider Pedestrian Zone can support high volumes of pedestrians.

Are the proposed sidewalks consistent with the Boston Complete Street Guidelines? See: www.bostoncompletestreets.org	No, we are matching existing conditions.
If yes above, choose which Street Type was applied: Downtown Commercial, Downtown Mixed-use, Neighborhood Main, Connector, Residential, Industrial, Shared Street, Parkway, Boulevard.	
What is the total width of the proposed sidewalk? List the widths of the proposed zones: Frontage, Pedestrian and Furnishing Zone.	8' wide sidewalks
List the proposed materials for each Zone. Will the proposed materials be on private property or will the proposed materials be on the City of Boston pedestrian right-of-way?	On Western Ave – Matching existing concrete Everywhere else – Porous Bituminous Asphalt
If the pedestrian right-of-way is on private property, will the proponent seek a pedestrian easement with the City of Boston Public Improvement Commission?	No
Will sidewalk cafes or other furnishings be programmed for the pedestrian right-of-way?	No all furnishings will be outside the right-of-way
If yes above, what are the proposed dimensions of the sidewalk café or furnishings and what will the right-of-way clearance be?	

Proposed Accessible Parking:

See Massachusetts Architectural Access Board Rules and Regulations 521 CMR Section 23.00 regarding accessible parking requirement counts and the Massachusetts Office of Disability Handicap Parking Regulations.

What is the total number of parking spaces provided at the development site parking lot or garage?	Parking is part of the University parking pool in Allston
What is the total number of accessible spaces provided at the development site?	4 spaces
Will any on street accessible parking spaces be required? **If yes,** has the proponent contacted the Commission for Persons with Disabilities and City of Boston Transportation Department regarding this need?	No
Where is accessible visitor parking located?	Directly south of building.
Has a drop-off area been identified? **If yes,** will it be accessible?	Yes and it will be accessible.
Include a diagram of the accessible routes to and from the accessible parking lot/garage and drop-off areas to the development entry locations. Please include route distances.	See diagram.

Article 80 | ACCESSIBILTY CHECKLIST

Circulation and Accessible Routes:

The primary objective in designing smooth and continuous paths of travel is to accommodate persons of all abilities that allow for universal access to entryways, common spaces and the visit-ability* of neighbors.

**Visit-ability – Neighbors ability to access and visit with neighbors without architectural barrier limitations*

Provide a diagram of the accessible route connections through the site.	See diagram.
Describe accessibility at each entryway: Flush Condition, Stairs, Ramp Elevator.	Flush condition at all four entry doors
Are the accessible entrance and the standard entrance integrated?	Yes
If no above, what is the reason?	
Will there be a roof deck or outdoor courtyard space? If yes, include diagram of the accessible route.	No
Has an accessible routes way-finding and signage package been developed? If yes, please describe.	No

Accessible Units: (If applicable)

In order to facilitate access to housing opportunities this section addresses the number of accessible units that are proposed for the development site that remove barriers to housing choice.

What is the total number of proposed units for the development?	n/a
How many units are for sale; how many are for rent? What is the market value vs. affordable breakdown?	n/a
How many accessible units are being proposed?	n/a

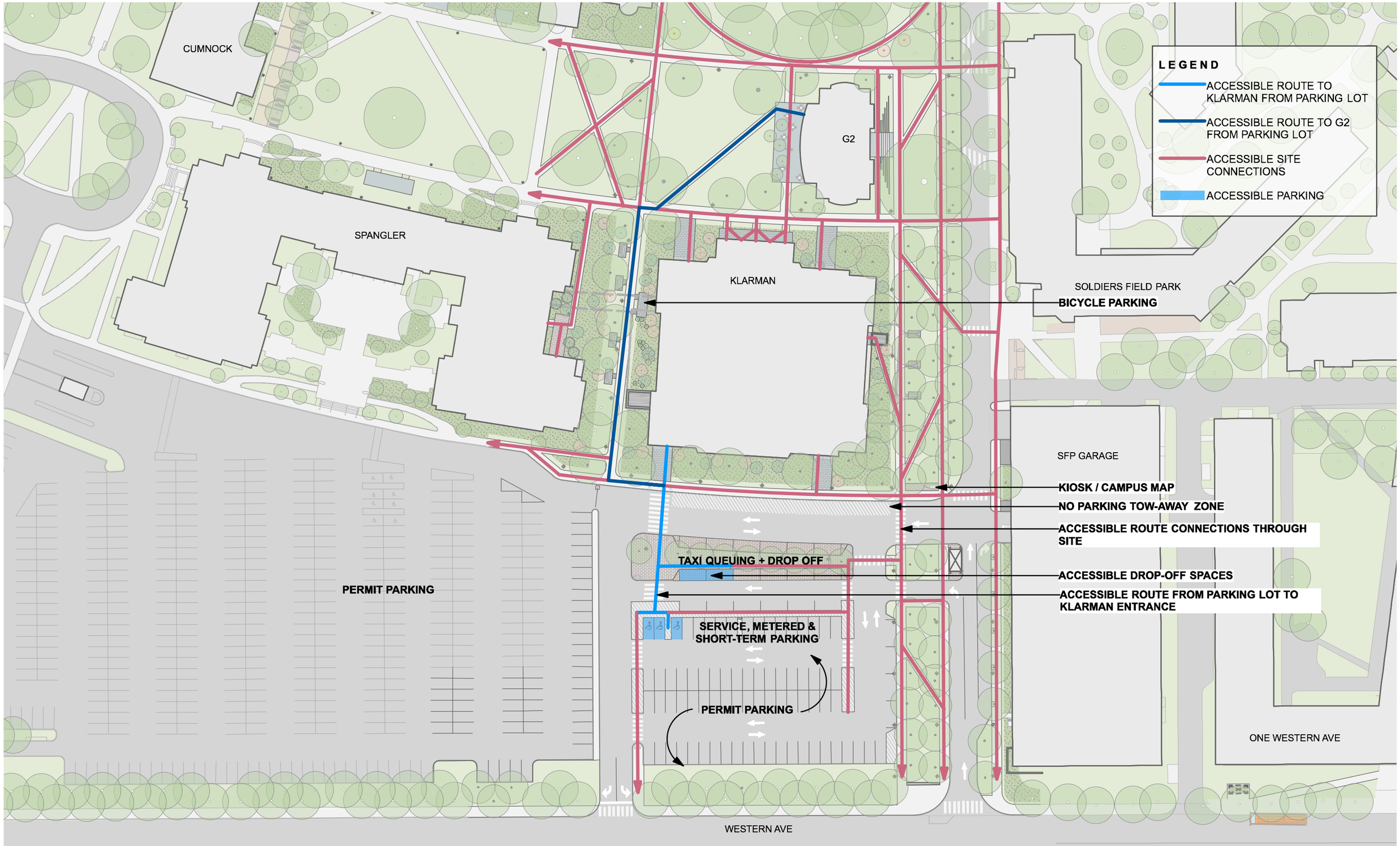
Article 80 | ACCESSIBILTY CHECKLIST

Please provide plan and diagram of the accessible units.	n/a
How many accessible units will also be affordable? If none, please describe reason.	n/a
Do standard units have architectural barriers that would prevent entry or use of common space for persons with mobility impairments? Example: stairs at entry or step to balcony. **If yes,** please provide reason.	n/a
Has the proponent reviewed or presented the proposed plan to the City of Boston Mayor's Commission for Persons with Disabilities Advisory Board?	n/a
Did the Advisory Board vote to support this project? **If no,** what recommendations did the Advisory Board give to make this project more accessible?	n/a

Thank you for completing the Accessibility Checklist!

For questions or comments about this checklist or accessibility practices, please contact:

kathryn.quigley@boston.gov | Mayors Commission for Persons with Disabilities



REED HILDERBRAND

HARVARD BUSINESS SCHOOL
BOSTON, MASSACHUSETTS

KLARMAN HALL
ACCESSIBLE ROUTES

0' 70'

OCTOBER 1, 2015

Appendix B
Climate Change Checklist

Climate Change Preparedness and Resiliency Checklist for New Construction

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

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

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

Climate Change Analysis and Information Sources:

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

Checklist

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

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

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

A.1 - Project Information

Project Name:	Klarman Hall
Project Address Primary:	Harvard Business School
Project Address Additional:	
Project Contact (name / Title / Company / email / phone):	Tom Koch, Project Manager, Harvard Business School, tkoch@hbs.edu, (617) 495-6189

A.2 - Team Description

Owner / Developer:	Harvard Business School
Architect:	William Rawn Associates
Engineer (building systems):	R.G. Vanderweil Engineers
Sustainability / LEED:	Atelier Ten
Permitting:	Epsilon Associates
Construction Management:	Walsh Brothers
Climate Change Expert:	

A.3 - Project Permitting and Phase

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

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

A.4 - Building Classification and Description

List the principal Building Uses:	Assembly for groups from 300-1,000, Academic
List the First Floor Uses:	Assembly and associated support spaces, Academic

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

Wood Frame	Masonry	Steel Frame	Concrete

Describe the building?

Site Area:	*SF*	Building Area:	*Klarman 81,100 SF G2 18k-24k sf*
Building Height:	*Klarman 66 Ft G2 TBD.*	Number of Stories:	*Klarman 2 Flrs G2 2 Flrs.*
First Floor Elevation (reference Boston City Base):	*19'-0" Elev.*	Are there below grade spaces/levels, if yes how many:	*Yes / 1 Level*

A.5 - Green Building

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

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

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

Registered:	***Yes***	Certified:	***No***
	LEED v4		

A.6 - Building Energy

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

Electric:	*802,711 (kW)*	Heating:	*1,364(MMBtu)*
What is the planned building Energy Use Intensity:	*55 (kBTU/SF-yr)*	Cooling:	*314 (MMBtu)*

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

Electric:	*254 (kW)*	Heating:	*1 (MMBtu/hr)*
		Cooling:	*N/A*

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

Electrical Generation:	*350 (kW)*		Fuel Source:	*Diesel*
System Type and Number of Units:	**Combustion Engine**	Gas Turbine	Combine Heat and Power	*1 (Units)*

B - Extreme Weather and Heat Events

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

B.1 - Analysis

What is the full expected life of the project?

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

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

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

What time span of future Climate Conditions was considered?

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

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

8/91	*Deg.*

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

95 Deg.	*5 Days*	*6 Events / yr.*

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

30-90 Days	*0.2 Events / yr.*

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

45 Inches / yr.	*4 Inches*	*0.5 Events / yr.*

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

105 Peak Wind	*10 Hours*	*0.25 Events / yr.*

B.2 - Mitigation Strategies

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

Building energy use below code:	*36%*
How is performance determined:	Whole Building Energy Model compared to ASHRAE 90.1-2010 Baseline Design

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

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

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

Roof:	*R = 31.7*	Walls / Curtain Wall Assembly:	*R = 27.8*
Foundation:	*R = 7.5*	Basement / Slab:	*F= 0.730*
Windows:	*U = 0.556*	Doors:	*R = / U =*

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

	~~On-site clean energy / CHP system(s)~~	~~Building-wide power dimming~~	Thermal energy storage systems	Ground source heat pump
	~~On-site Solar PV~~	On-site Solar Thermal	Wind power	None
Describe any added measures:				

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

Select all appropriate:	Connected to local distributed	~~Building will be Smart Grid ready~~	~~Connected to distributed steam,~~	Distributed thermal energy

electrical		~~hot, chilled water~~	ready

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

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

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

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

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

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

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

Select all appropriate:	~~On-site retention systems & ponds~~	~~Infiltration galleries & areas~~	vegetated water capture systems	~~Vegetated roofs~~
Describe other strategies:	Stormwater tanks are an additional alternative holding 10k or 20k gal, vegetated roof area TBD			

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

Select all appropriate:	Hardened building structure & elements	Buried utilities & hardened infrastructure	Hazard removal & protective landscapes	~~Soft & permeable surfaces (water infiltration)~~
Describe other strategies:				

C - Sea-Level Rise and Storms

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

C.1 - Location Description and Classification:

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

No

Describe site conditions?

Site Elevation – Low/High Points:	15'-21' EL. BCB
Building Proximity to Water:	840' +/-

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

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

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

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

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

670' +/-

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

C - Sea-Level Rise and Storms

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

C.2 - Analysis

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

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

C.3 - Building Flood Proofing

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

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

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

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

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

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

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

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

Yes / No

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

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

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

Yes / No	
If Yes, describe:	

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

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

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

C.4 - Building Resilience and Adaptability

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

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

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

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

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

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

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

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

For questions or comments about this checklist or Climate Change Resiliency and Preparedness best practices, please contact: John.Dalzell.BRA@cityofboston.gov