Expanded Project Notification Form

Ruth Mulan Chu Chao Center at Harvard Business School

Submitted to:

BOSTON REDEVELOPMENT AUTHORITY
One City Hall Square
Boston, MA 02210

Submitted by:

HARVARD UNIVERSITY

November 5, 2013

Expanded Project Notification Form

Ruth Mulan Chu Chao Center
at Harvard Business School

Submitted to:

Boston Redevelopment Authority

Submitted by:

Harvard University

In conjunction with:

Epsilon Associates, Inc.
Goody Clancy
Atelier Ten
Goulston & Storrs
Haley & Aldrich
Nitsch Engineering
Reed Hilderbrand Associates
Skanska USA

November 5, 2013

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Chapter 1
General Information

1.0 GENERAL INFORMATION

1.1 Introduction

The President and Fellows of Harvard College ("Harvard" or "Harvard University"), on behalf of the Harvard Business School (HBS) (the "Proponent") propose the construction of the Ruth Mulan Chu Chao Center, an Executive Education building of approximately 75,000 gross square feet (GSF) (the "Project"). The Project will be located on the northeast corner of the HBS Allston campus, as shown in Figure 1-1, on a site that is currently occupied by Kresge Hall. The predominant use in the Project is a dining facility for HBS's Executive Education program. The building will also include classroom space, offices for staff, function rooms, and a kitchen. Improvements to outdoor space to support courtyard seating will also be included in the Project. There will be no new parking associated with the Project.

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.

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 administration services 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.

Source: Goody Clancy

Figure 1-1: Locus Map

1.3 Harvard Business School Executive Education Program

1.3.1 Background

HBS was the first business school to launch an Executive Education program; it did so in 1943 with an innovative 15-week "war retraining" program. Executive Education is a crucial component in the cycle of academic research and engagement with practice that has distinguished Harvard Business School since its founding. Ideas that are developed in the field are taught to and tested by participants who come to Executive Education programs; new ideas and oftentimes new academic case studies are developed as a result of this interaction; managers take the tools and learning they have gained in the programs back to their companies, thus reshaping businesses and communities around the world; and the programs enable new academic and curricular research efforts to be undertaken by faculty members, thereby enriching the overall academic interactions of the school. These programs lead to curricular innovations in the MBA and PhD programs, as well as the Executive Education programs, and to new approaches to, and substantive areas of, academic research.

There were approximately 10,000 participants in Executive Education programs in 2012, all "in residence." In addition, approximately 200 faculty members taught in the various programs. During this time, there were 115 Executive Education programs offered. Of these, 75 were Open Enrollment Programs (open to individuals sponsored by companies and focused on a wide range of business topics) and 40 were Custom Programs (targeted to companies that address their specific business needs).

Programs range from two days to 53 days, and approximately three quarters of the participants stay for one week or less.

Currently the Executive Education programs are located in several buildings, all of which are located in the northeast corner of the HBS campus. Baker Hall, Mellon Hall, and McArthur Hall each provide residential facilities for program participants. Tata Hall—currently under construction—will provide the fourth residential facility. McCollum Center and Hawes Hall provide classrooms, and Glass Hall is the administration building. Dining facilities for Executive Education participants are currently located in Kresge Hall.

1.3.2 Program Need

HBS's 1997 Campus Master Plan and subsequent Master Plans have identified the need for a major renovation or replacement of Kresge Hall to correct numerous deferred maintenance, code compliance, and accessibility problems, and to update its layout and spaces to meet the current program and functional needs of the evolving and expanding Executive Education program. Kresge Hall was designed in 1953 to serve as the dining facility for the HBS programs on the original McKim, Mead and White campus. As the campus population and programs grew, Kresge Hall became inadequate to meet dining needs for the whole of HBS, and the Spangler Center was opened in 2001 to provide dining, social, and meeting spaces for MBA and doctoral students, faculty and staff. Spangler was not designed to accommodate the Executive Education program as well. When Tata Hall, a 179-bed Executive Education residence, is occupied later this year, HBS will further expand its Executive Education population on campus, and Kresge Hall will be even less adequate to the task of delivering a dining and social experience appropriate for the growing Executive Education program.

Specifically, the architectural layout, acoustical design, and functionality of Kresge Hall are not sufficient to meet the current and future needs of the Executive Education program. The building does not provide space for the program's major tenets, including out-of-class discussion, debate, networking, socializing, small-group projects, and personal and professional growth. Its rooms are too small to accommodate typical Executive Education functions, are not acoustically isolated, and were not designed to accommodate speaker events. The building's mechanical systems are obsolete, which contributes to energy inefficiency and poor air quality throughout the building, an ongoing complaint from faculty, staff, and students. Service access conflicts with front-of-house circulation, and modifications have proven difficult and have compounded problems. HBS has concluded that Kresge Hall does not meet the Executive Education program's goals and objectives, and cannot be renovated or expanded to meet the programmatic needs which are optimally located on this site.

The spaces programmed for the Project will meet Executive Education and HBS's emerging and currently unmet needs. Construction of the Chao Center will support expansion of Executive Education while creating space for new initiatives and an enriched social experience. The Project will include flexible academic spaces that facilitate team-based exercises, as well as elegant and intimate spaces that promote discussion and learning in a relaxed environment across all of the school's constituencies. It will provide a superior dining experience with multiple options to support the scale of the Executive Education program.

The Project will support HBS's plans to enhance the Executive Education experience by providing a welcoming and orienting venue for Executive Education participants. The building will serve as a hub where Executive Education participants can dine, socialize, work, and interact with faculty, other participants of other programs, Executive Education staff, and MBA and doctoral students. These qualities will help define a cohesive Executive Education campus precinct.

The Project will capitalize on and enhance its important campus location as a natural focal point linking to the rich context of the McKim, Mead and White campus and landscape, particularly the Harvard Way axis, while relating to the contemporary design of the adjacent Tata Hall. The siting of the Project creates a larger and improved pedestrian connection on the north side of the building to the Executive Education Quad and the Weeks Bridge. It will serve as a connector building focused around a significant central atrium, with its first floor accessible on multiple sides, connecting the HBS community. Finally, the Project will provide a building designed to LEED Gold or better certification, improving energy efficiency and the indoor environment.

1.4 Project Team

Project Name:	Ruth Mulan Chu Chao Center 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, Associate Dean, 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 Reed Bergwall
Architect:	Goody Clancy 420 Boylston St. Boston, MA 02116 (617) 262-2760 Roger Goldstein Rob Chandler Todd Symonds
Landscape Architect:	Reed Hilderbrand Associates, Inc. Landscape Architecture 741 Mount Auburn Street Watertown, MA 02472 (617) 923-2422 Gary Hilderbrand Adrian Nial Brie Mendozza

Attorney:	Goulston & Storrs 400 Atlantic Avenue Boston, MA 02110 (617) 482-1776 Douglas Husid Matthew Kiefer
Permitting and Historic Resources Consultant:	Epsilon Associates, Inc. 3 Clock Tower Place, Suite 250 Maynard, MA 01754 (978) 897-7100 Geoff Starsiak Maureen Cavanaugh
Civil Engineer:	Nitsch Engineering 2 Center Plaza Suite 430 Boston, MA 02108 (617) 338-0063 Judith Nitsch John Schmid
Geotechnical and Hazardous Waste Consultant:	Haley & Aldrich, Inc. 465 Medford Street, Suite 2200 Boston, MA 02129 (617) 886-7400 Bryan Sweeney
Construction Consultant:	Skanska USA 253 Summer Street Boston, MA 02210 (617) 574-1498 Joe Breen
Sustainability Consultant:	Atelier Ten 45 East 29th Street, 4th Floor New York, NY 10003 (212) 254 4500 Nico Kienzl Shanta Tucker

Chapter 2
Project Description

2.0 PROJECT DESCRIPTION

2.1 Existing Site and Area Context

The site of the Project is in the northeast corner of the HBS campus, to the east of the original HBS campus designed by McKim, Mead and White in the late 1920s. In the 1970s, McCollum Center and Baker Hall were constructed to the north of the Project site. More recently, in 1998 McArthur Hall was built as an Executive Education housing facility also to the north of the Project site. As mentioned, Tata Hall, the fourth building providing residential space for the Executive Education Program, is currently under construction and is located immediately to the east of the Project site.

The Project site is currently occupied by Kresge Hall (see Figure 2-1). As described previously, due to numerous code and mechanical systems deficiencies, as well as functional and circulation challenges, the existing building is unable to efficiently serve its intended use as a core resource for the Executive Education program, it has been determined that the most effective course of action is a project that includes the replacement of the existing Kresge Hall with a new facility housing a dining facility, classroom space, offices for staff, function rooms, and a kitchen for the Executive Education program (see Section 2.2.2 below and Chapter 5 for more information). Therefore, Kresge Hall will be demolished and replaced as part of the Project.

2.2 Description and Program

2.2.1 Chao Center

The Chao Center will be a "Gateway" building to the Executive Education precinct with an improved connection to the Weeks Bridge to the north of the building and through the building. The Project is being proposed to meet the increasing demand for HBS Executive Education programs. In order to achieve the goals described in Section 1.3.2, including creating flexible academic spaces and superior dining options, within the space available on the Project site, the design team made numerous decisions affecting the character and layout of the design. These principles include the following:

- The design will allow for a larger, improved connection to the Executive Education Quad and the Weeks Bridge. Architectural elements including a glass façade and multi-level lobby, as well as a generous pathway to and through the building, will create a sense of openness in this connection.

- The massing of the building will be set back from East Drive to create welcoming outdoor space at the intersection of East Drive and Harvard Way, as well as create a gracious participant vehicular drop-off location to the south of Harvard Way;

- The ground floor will be the primary welcoming point for the Executive Education programs and academic program;

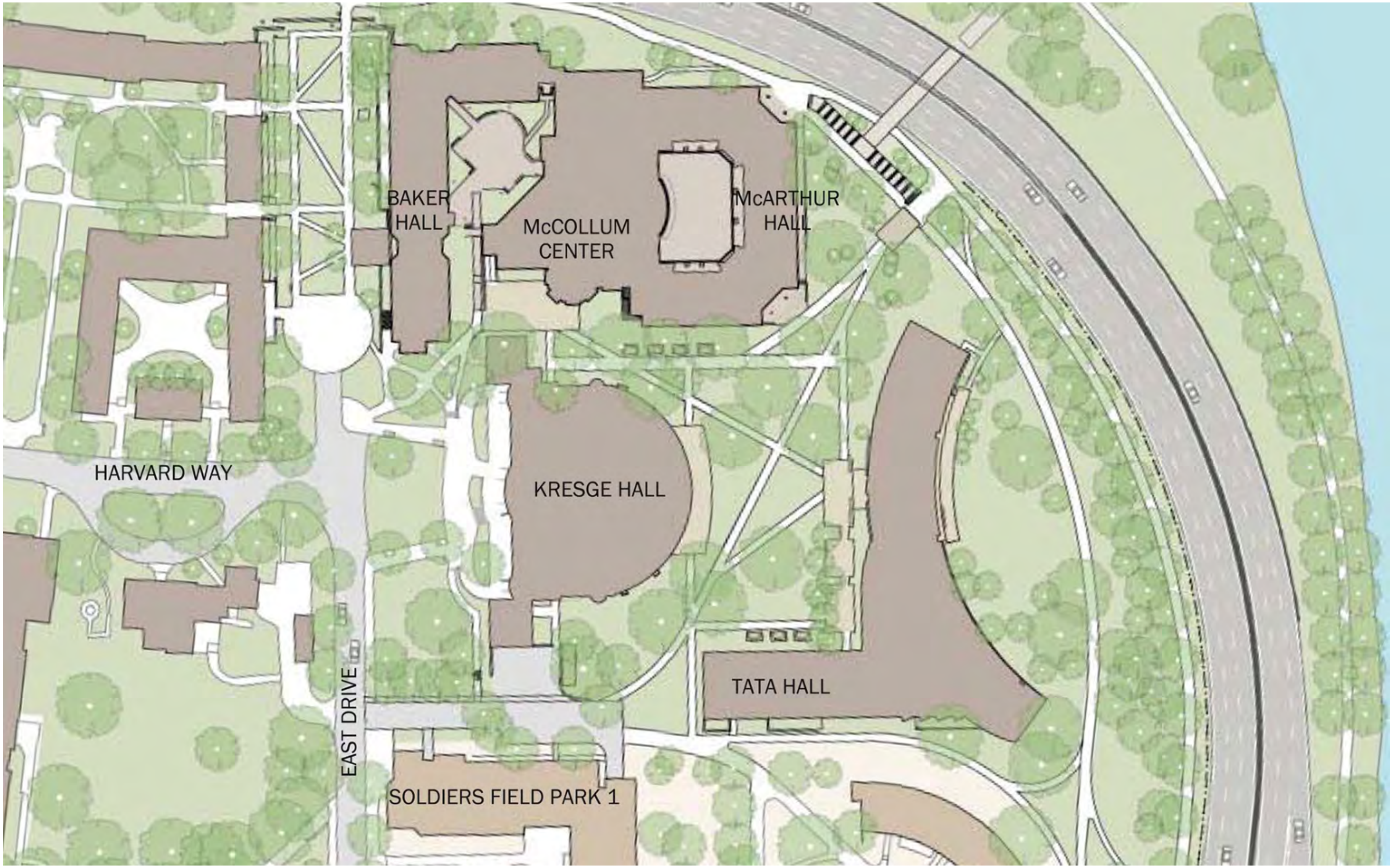

Figure 2-1: Existing Site

Source: Goody Clancy

- The second floor will be the primary dining floor;
- There should be a significant space located on the second floor to look back over Harvard Way;
- The building should be set back a comfortable distance from Baker and Tata Halls to allow for natural pedestrian site circulation;
- The loading dock will be accessed from the south;
- The building should have a public face and entrance on the south façade; and
- The kitchen will be located in the basement with a dedicated stair and elevator connection to the servery.

The resulting design for the Chao Center supports the specific needs of the Executive Education program and features state-of-the-art practices in technology and sustainability. Comprising approximately 75,000 GSF across three stories, the building delivers a central Hub for Executive Education participants and the larger Harvard community to arrive, collaborate, learn, dine together and build connections. The Project makes meaningful physical and symbolic connections to the historic HBS campus, completes the Executive Education Quad framed by Tata Hall to the east, and creates spaces that reflect the contemporary mission of the Executive Education programs and HBS. Figure 2-2 shows the Project footprint in the context of the existing Kresge Hall footprint. Figures 2-3 to 2-6 include floor plans.

At full build-out, the Project will consist of the building program shown in Table 2-1.

Table 2-1 Building Program

Use	Approximate Gross Square Footage*
Academic	10,900
Dining	25,400
Gathering	26,300
Office	4,100
Building Support	8,300
TOTAL	**75,000**

* Measured in accordance with the Boston Zoning Code.

Outdoor areas adjacent to the Chao Center will be landscaped and equipped to support courtyard seating and socializing. Because the great majority of Executive Education participants will arrive and depart in taxis, shuttle buses or other means of public transportation, there will be a dedicated drop-off/pick-up area and no new parking associated with the Project.

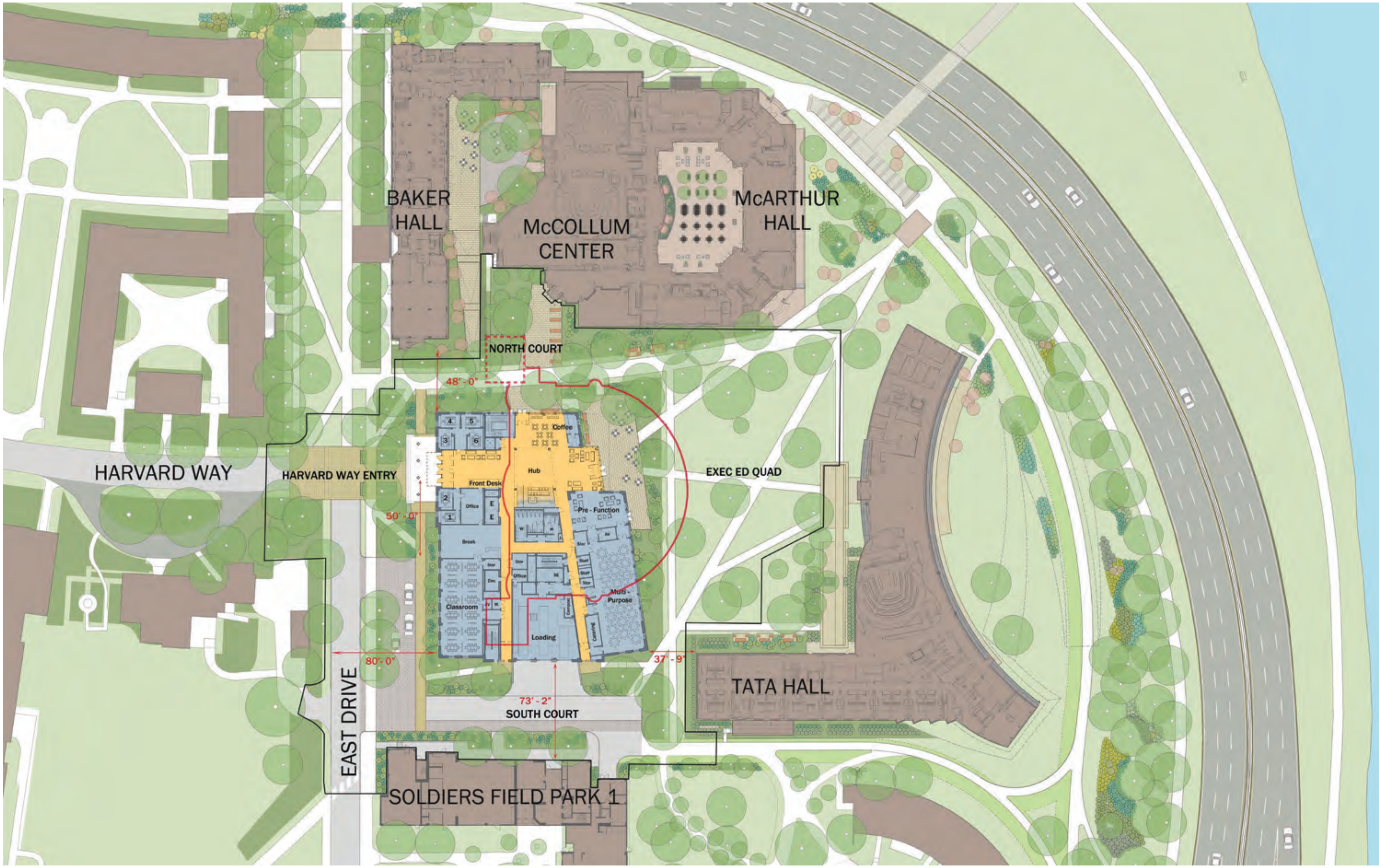

Figure 2-2: Site Plan
Expanded PNF

Source: Goody Clancy

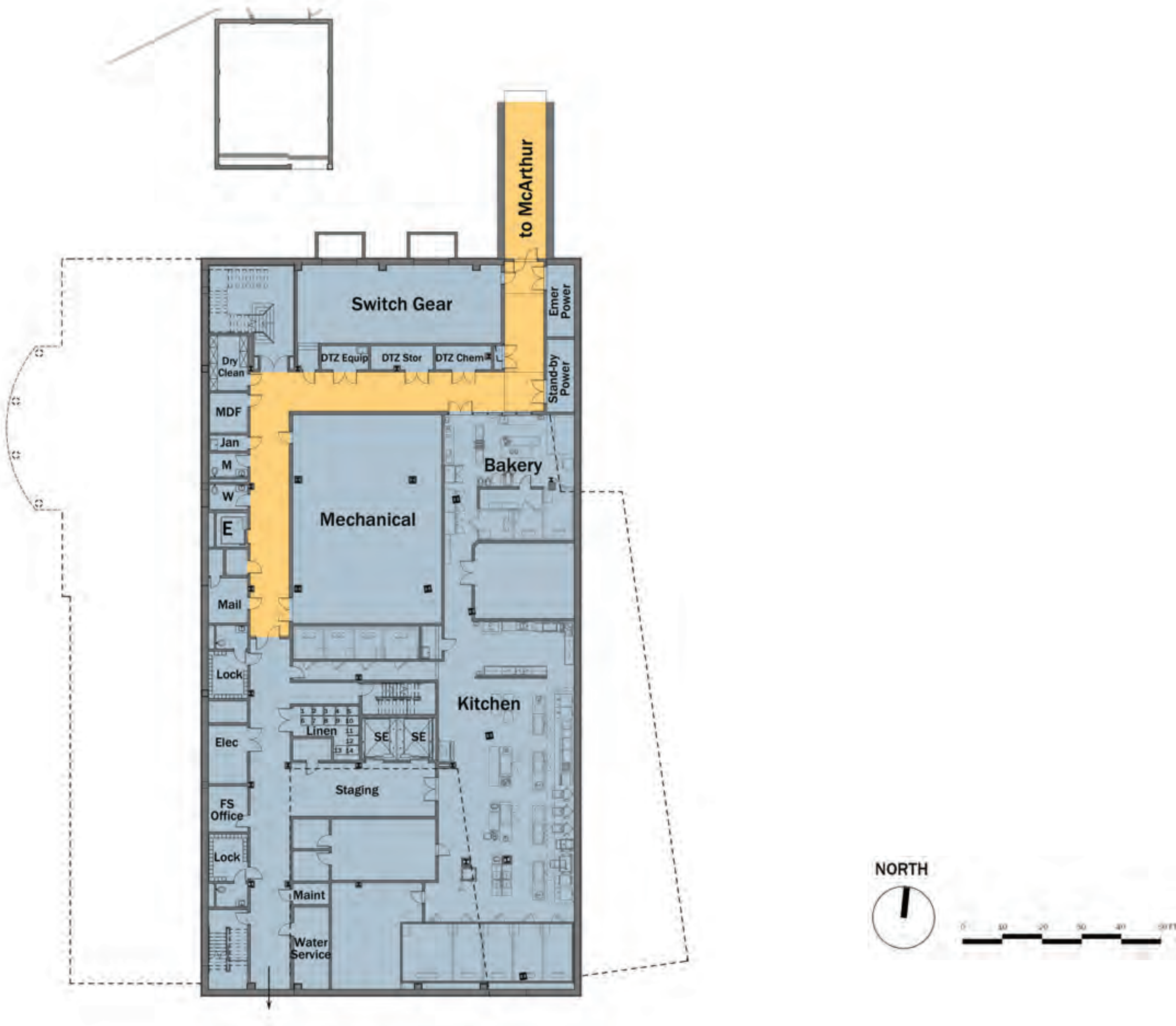

Figure 2-3: Basement Floor Plan

Source: Goody Clancy

Figure 2-4: First Floor Plan

Source: Goody Clancy

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RUTH MULAN CHU CHAO CENTER

Figure 2-5: Second Floor Plan
Expanded PNF

Source: Goody Clancy

Figure 2-6: Third Floor Plan

Expanded PNF

Source: Goody Clancy

2.2.2 Kresge Hall

Kresge Hall, designed by the architecture firm Perry, Shaw & Hepburn, Kehoe & Dean, was built in 1953 to serve as the dining facility for the expanding HBS programs, and was sited to the east of the original McKim, Mead and White campus. As the campus population and programs grew, Kresge Hall became an increasingly inadequate facility to meet dining needs for the whole of HBS. In 2001, HBS opened the Spangler Center to provide integrated dining, social and meeting spaces for MBA and doctoral students, faculty and staff.

Since it was constructed in 1953, Kresge Hall has undergone numerous minor alterations to adapt the building to meet changing functional requirements, but has not undergone a comprehensive renovation. Due to the building's physical constraints and outdated systems, the building cannot meet the programmatic requirements of the Executive Education program. Figure 2-7 shows the inefficient floor layout of Kresge Hall.

The use of the dining rooms is severely limited because of spatial, acoustic, and functional issues. The rooms are too small to accommodate typical Executive Education functions, are not acoustically isolated, and were not designed to accommodate speaker events.

The finishes throughout the building are notably out of date and are not consistent. The mechanical infrastructure is out of date, which contributes to the poor air quality throughout the building, an ongoing complaint from faculty, staff, and students.

Service access to Kresge Hall is not isolated from front-of-house circulation. Catering carts use the same entry door as participants. The service issues are compounded by the fact that Kresge Hall is not on the tunnel system that provides service connections between buildings of the Executive Education precinct and other HBS buildings. The busy and very visible exterior loading dock conflicts with nearby residential buildings and pedestrian connections between the HBS campus and the Executive Education precinct and Weeks Footbridge to the east.

Kresge Hall suffers from an inflexible and incoherent architectural layout. As discussed below, modifications have proven difficult and have not fully resolved inherent problems, and it is not feasible to expand the building vertically or horizontally to gain needed space and improve circulation. Specifically:

- The building cannot physically meet the changing HBS pedagogy, which requires flat-floor flexible classroom space. The style format is used for small group break-out sessions for interactive exercises that cannot be accomplished in the standard HBS case-method classrooms. This need cannot be addressed given the square footage limitations and current program within Kresge Hall.

- The front door does not present a welcoming face to Harvard Way and consequently is seldom used both due to the level changes and because it is not the best way to reach many of the interior functions.

- Circulation within the building is not straightforward due to the many level changes on each floor and multiple enclosed and unenclosed stairs.

- The many internal level changes present a significant challenge to providing universal accessibility throughout the building. HBS has provided several separated accessibility improvements over time, including a wheelchair lift and making special accommodations for participants whose wheelchairs cannot fit into the existing public elevator via the use of the service elevator off the basement kitchen.

- The eastward facing curved form of the building inhibits internal visual connections across the dining spaces in large group meetings.

- Because there is no one single circulation core for the building, large events cannot easily happen on multiple floors. Further, the building form does not provide a clear, accessible central hub that can be a recognizable destination, both from the exterior and the interior, to help orient participants.

- There are an insufficient number of restrooms, and they are not commonly located on each floor.

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, which includes the Chao Center, on July 26, 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 Chao Center was included as a Proposed Institutional Project as part of the approved July 2013 IMP filing. The next step in the process is for the IMP to go before the Boston Zoning Commission.

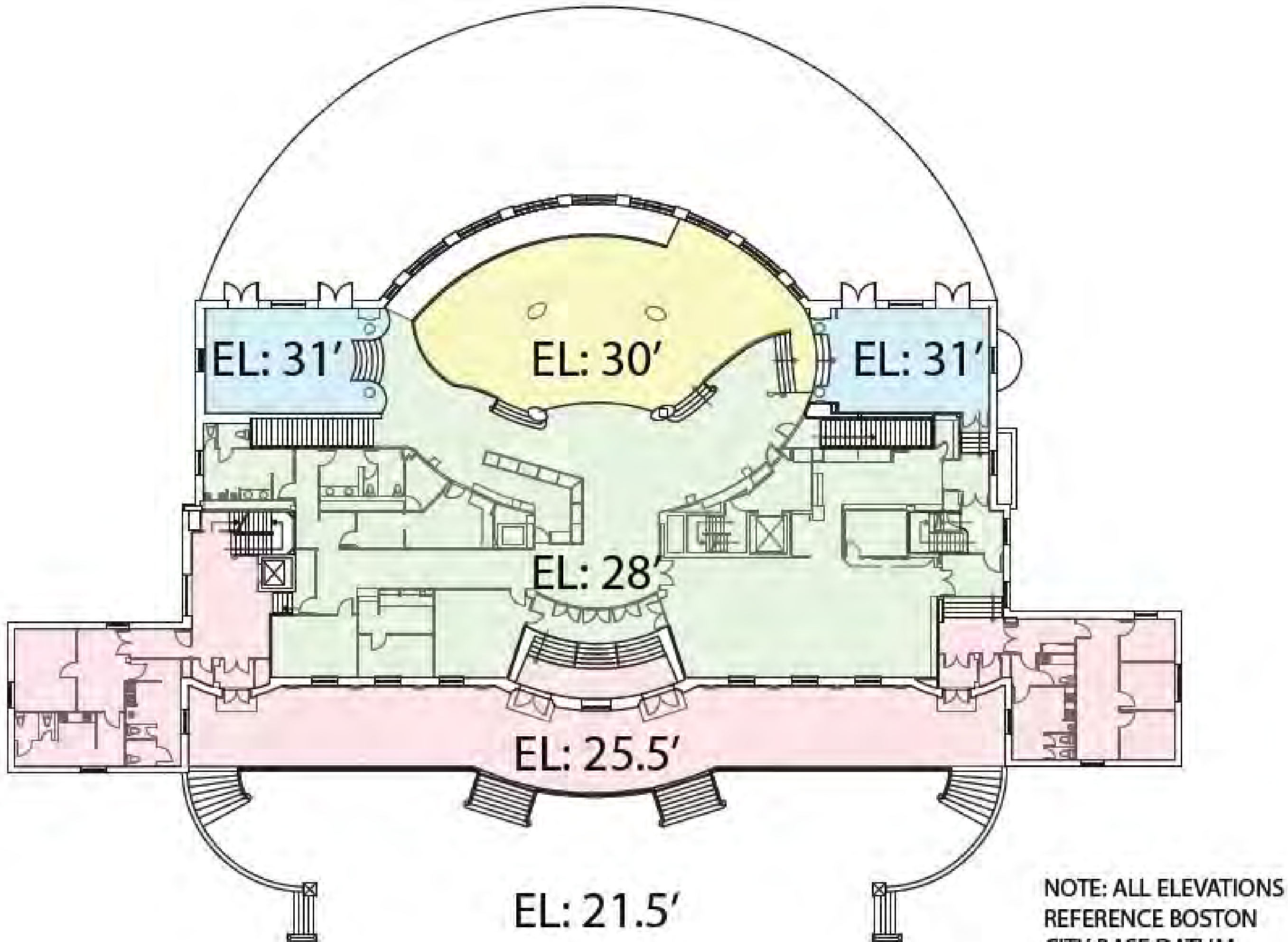


Diagram indicating stepped floor levels of Kresge Hall Level 1

2.5 Public Benefits

HBS has an extensive and long-standing track record of community benefits and programs targeted towards individuals and organizations in the City of Boston generally, and in Allston-Brighton specifically.

Going forward, community benefits for University projects in Allston will be part of a broader discussion of community benefits related to the University's IMP for its Allston campus. The University filed its new IMP on July 26, 2013 and, as part of the public review of that filing, Harvard has proposed a master plan for community benefits totaling $38.3 million, including an estimated $11 million in contributions to the Neighborhood Jobs Trust and the Neighborhood Housing Trust. The categories of benefits identified are:

- Education
- Economic and Workforce Development
- Open Space and Public Realm
- Housing

BRA staff continue to work with Harvard, the Task Force, and the broader community to further define the scope and content of a public benefits package, and the information presented here is intended as an update, not a final outcome of the discussions to date. It is expected that the public benefits package will be finalized in advance of the Boston Zoning Commission hearing on the Harvard IMP.

2.6 Regulatory Controls and Permits

2.6.1 Applicability of MEPA

Harvard's master plan, which includes the Chao Center, is currently undergoing MEPA review. A Notice of Project Change was submitted to MEPA on April 1, 2013. Harvard is currently preparing a Draft Environmental Impact Report for the master plan in response to the Secretary's Certificate issued on the NPC on May 10, 2013.

2.6.2 Permits and Approvals

Table 2-2 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 2-2 Preliminary List of Permits and Approvals

Agency	Approval
City	
Boston Redevelopment Authority	Article 80 IMP Approval Article 80 Large Project Review
Boston Zoning Commission	Article 80 IMP Approval
Boston Civic Design Commission	Design Review
Boston Landmarks Commission	Article 85 Demolition Delay 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 Review
Massachusetts Historical Commission	State Register Review
Department of Environmental Protection	Notice of Demolition/Construction/Fossil Fuel
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

The schedule calls for the permitting and design process to be complete by early 2014, with construction starting in the spring of 2014, and building completed by the spring of 2016.

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.

3.1 Transportation

Introduction and Overview

This section presents an assessment of potential long-term impacts of the proposed Chao Center building. The following summarizes the key findings of the transportation analysis for the Chao Center.

- Because the Project is a replacement for existing uses, the Chao Center 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.

- No additional parking spaces will be created to serve the Project because the Executive Education programs are residential in nature and participants rarely arrive by private automobile.

Assessment of Future Transportation Conditions

The Project is a replacement and consolidation of uses that currently exist on the HBS campus, mainly in the Kresge Hall building. With the exception of approximately 20 new staff positions created to service and maintain the building, the users of the Chao Center will be existing participants in HBS's Executive Education program. Existing participants will already be located on campus, and therefore are not associated with new impacts on the transportation system.

Approximately 20 new staff positions will be created to service and maintain the building, which will require increased operations and maintenance staff compared to Kresge Hall. Based on Boston Transportation Department (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, 12 people will drive, four will take transit, and four will walk or bike. This results in 24 new daily vehicle trips (12 arriving and 12 departing) with a vehicle occupancy rate of 1.1 persons per vehicle.

Executive Education Participants

The IMP Amendment/Draft Project Impact Report for the Tata Hall project (dated July 8, 2011) provided a detailed analysis of the travel characteristics of the participants in HBS's Executive Education program.

In summary, the participants in the Executive Education program have minimal impact on the local and regional roadway networks. Most participants use shuttle buses, taxicabs or limousine services to travel from Logan Airport or South Station to the HBS campus on either I-90 or Soldiers Field Road/Storrow Drive. Arrivals and departures are spaced throughout the week depending on the start and finish dates of each Executive Education program; approximately 75-80 percent of participants arrive on weekends, primarily on Sundays. The highest concentration of departure activity typically occurs on Fridays when approximately half of the programs end. Most of the departures occur in the afternoon between noon and 5:00 p.m., according to the airline schedule of the participants.

Participants have limited free time to leave the campus. The Executive Education programs are highly intensive and most days are filled with on-campus class time, workshops and social events that encourage interaction among participants. Participants walk to and from these activities. Most of the services required by program participants (e.g., athletic facilities, post office, bank, and dry cleaning services) are also found on campus and within convenient walking distance. Participants walk or use taxicabs, MBTA service or the Harvard University shuttle service to travel off campus when necessary. Participants also have the opportunity to bicycle by renting a shared bike from a new Hubway station in Soldiers Field Park or use one of the Zipcars that are parked in the Spangler Lot.

Loading

Loading will primarily occur within the building. The Project has three interior loading bays, two are for trucks, and one is a separate designated area for a dumpster. There is sufficient room for single-unit box trucks and tractor-trailers to enter and exit the loading docks. The Project will be connected to other HBS buildings 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, they tend to shelter one another. The Project, which is proposed at a maximum height of 52 feet to the top of the mechanical space, is similar in height to the existing Kresge Hall building and other buildings in the surrounding area, and therefore is 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, as well as the existing shadow, and illustrates the incremental impact of the Project. The analysis focuses on public 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 Kresge Hall which is similar in scale to the proposed Project. However, the footprints are different and the Project is located further westward, which results in some minor new shadow on the surrounding HBS campus and shadow within the area of the Kresge Hall footprint. The new shadow from the Project will be limited to the HBS campus and the immediate area surrounding the Project site. In addition to the pathways and green spaces on the HBS campus, other open spaces in the area include the Charles River Reservation and the Charles River. The Project will not cast new shadow on the Charles River Reservation, Charles River, Soldiers Field Road or any other nearby public open space 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 across the drop-off area, Harvard Way and East Drive. At 12:00 p.m., new shadow will be cast to the north across the existing Kresge Hall footprint, and the area just north and west of the Project. At 3:00 p.m., new shadow is cast to the northeast, with the majority of the new shadow being cast within the existing Kresge Hall footprint and small portions of the Executive Education Quad. No new shadow will be cast onto the Charles River, the Charles River Reservation, Soldiers Field Road or other off campus open spaces in the area.

New shadow created on the vernal equinox is illustrated in Figures 3-1 through 3-3.

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 across the drop-off area for the Project, and portions of Harvard Way and East Drive. At 12:00 p.m., new shadow is cast onto small areas immediately adjacent to the Project on the north and west sides. At 3:00 p.m., new shadow is cast to the northeast across small areas immediately adjacent to the Project, and mostly within the existing Kresge Hall footprint. At 6:00 p.m., new shadow is cast to the east across the area of the existing Kresge Hall footprint and a portion of the Executive Education Quad. No new shadow will be cast onto the Charles River, the Charles River Reservation, Soldiers Field Road or other off campus open spaces in the area.

New shadow created on the summer solstice is illustrated in Figures 3-4 to 3-7.

3.3.4 Autumnal Equinox (September 21)

During the autumnal equinox, new shadow will be limited to the HBS campus. At 9:00 a.m., new shadow will be cast to the west across the drop-off area, Harvard Way and East Drive. At 12:00 p.m., new shadow will be cast to the north across the existing Kresge Hall footprint, and the area just north of the Project, as well as a small area to the west. At 3:00 p.m., new shadow is cast to the northeast, with the majority of the new shadow being cast within the existing Kresge Hall footprint and limited portions of the Executive Education Quad. At 6:00 p.m., new shadow will be limited to a portion of the Executive Education Quad, as the existing shadow from Kresge Hall is cast across most of the Quad. No new shadow will be cast onto the Charles River, the Charles River Reservation, Soldiers Field Road or other off campus open spaces in the area.

New shadow created on the autumnal equinox is illustrated in Figures 3-8 through 3-11.

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 across a portion of the space southwest of Baker Hall, and within the area of the existing Kresge Hall footprint to the north. At 12:00 p.m., new shadow is cast to the north across a small area north of the Project and within the area of the existing Kresge Hall footprint. At 3:00 p.m., new shadow is cast to the northeast across the area of the existing Kresge Hall footprint, a small area of the Executive Education Quad, and a small area just north of the Project. No new shadow will be cast onto the Charles River, the Charles River Reservation, Soldiers Field Road or other off campus open spaces in the area.

New shadow created on the winter solstice is illustrated in Figures 3-12 through 3-14.

3.3.6 Conclusions

The Project site includes Kresge Hall which is similar in scale to the proposed Project, although located more to the west than the Project, which results in some new shadow on the surrounding campus and within the existing Kresge Hall footprint. As the new shadow will be limited to the HBS campus, the Charles River, the Charles River Reservation, Soldiers Field Road and other off campus open spaces in the area are not impacted by the Project.

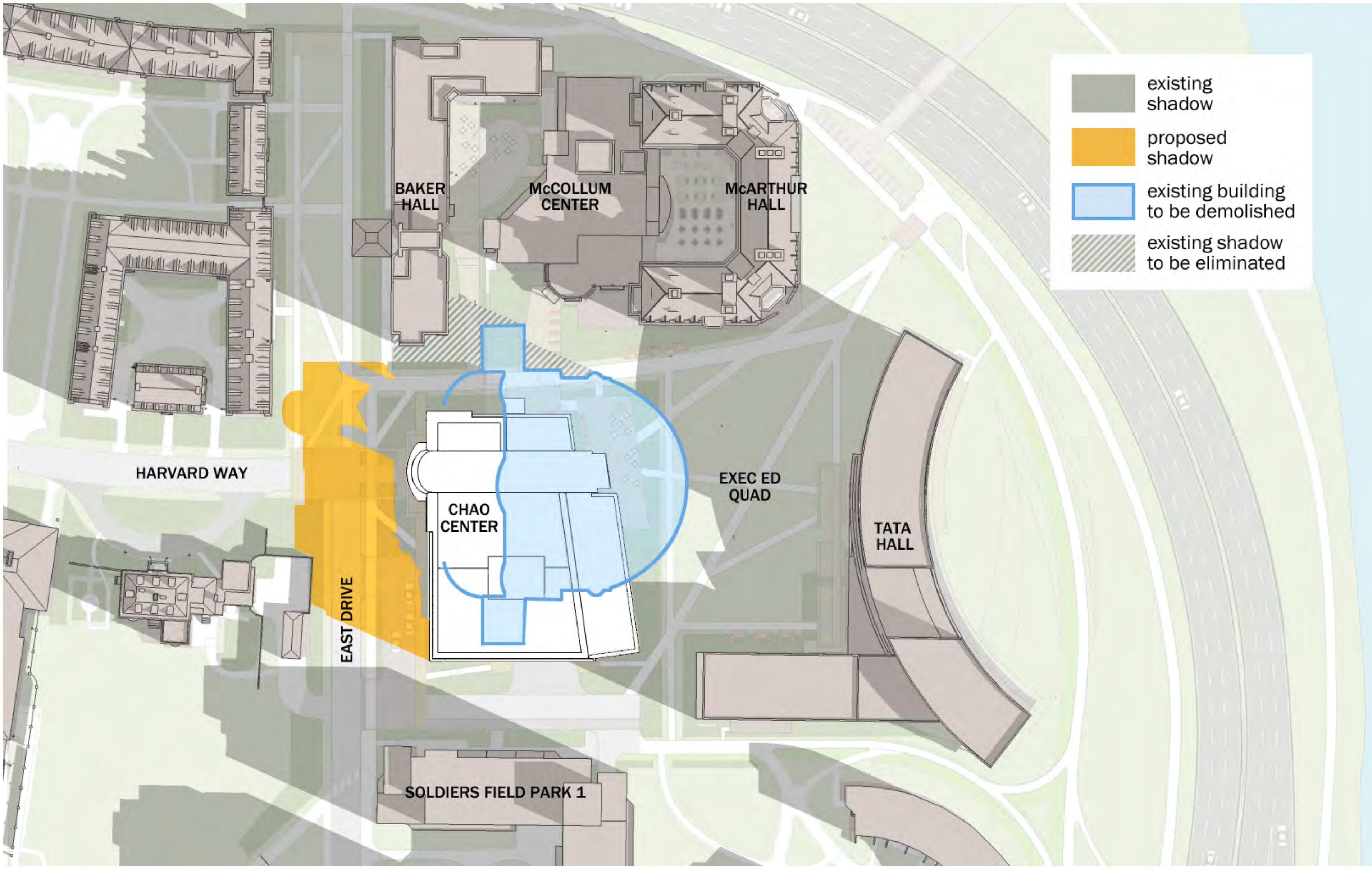


Figure 3-1: Shadow Study: March 21, 9:00 a.m.

Source: Goody Clancy

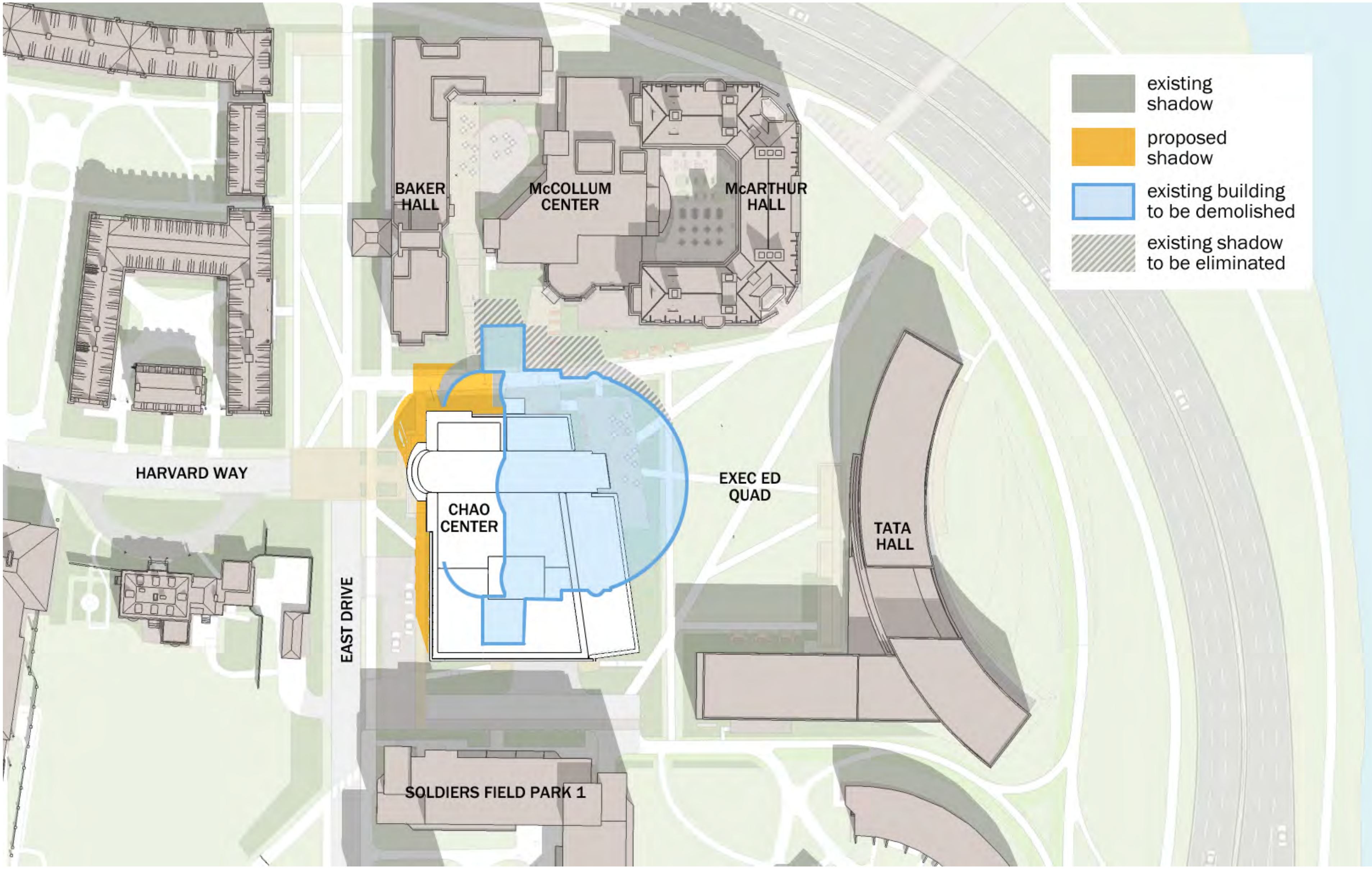


Figure 3-2: Shadow Study: March 21, 12:00 p.m.

Source: Goody Clancy

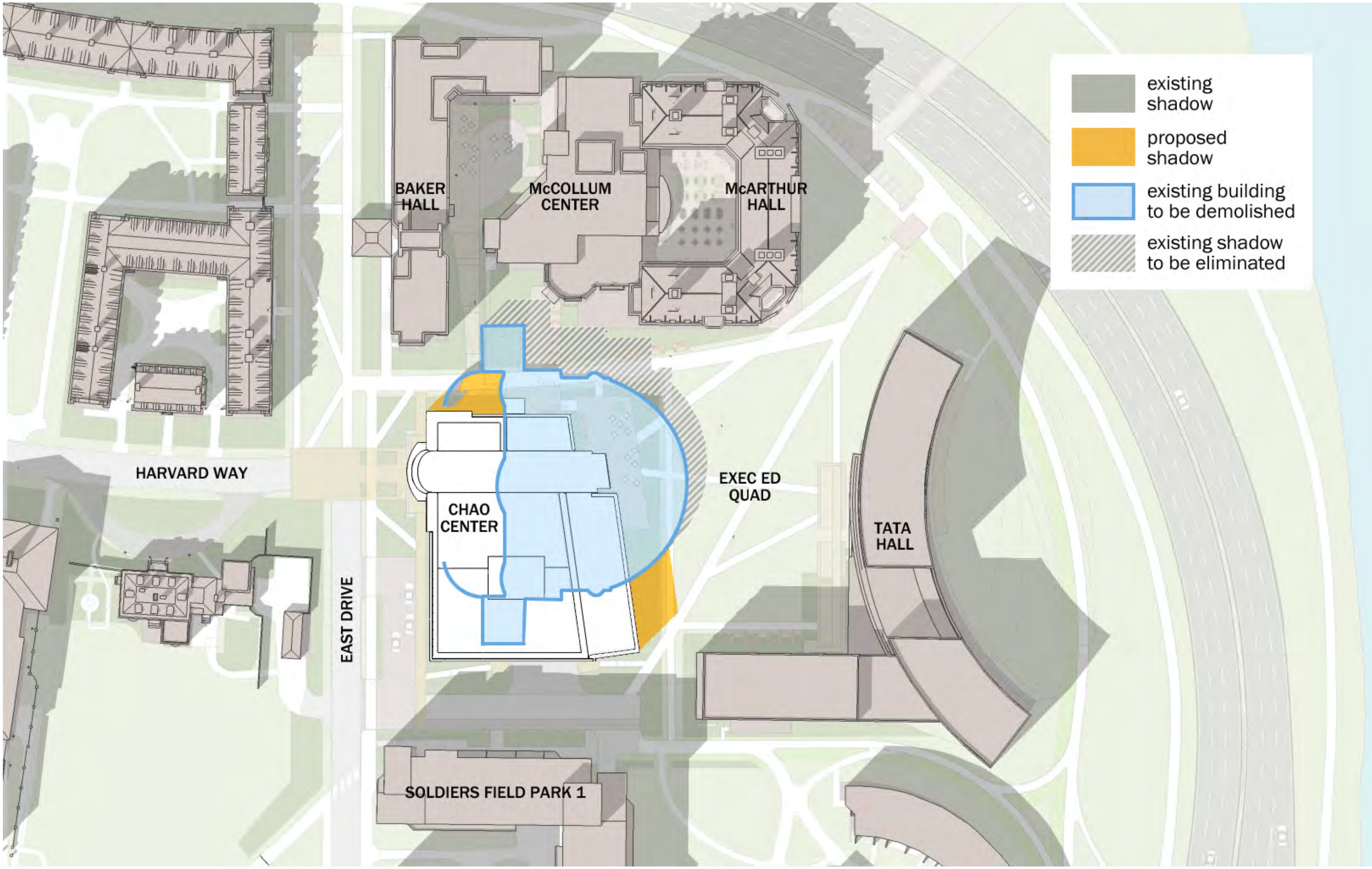


Figure 3-3: Shadow Study: March 21, 3:00 p.m.

Expanded PNF

Source: Goody Clancy

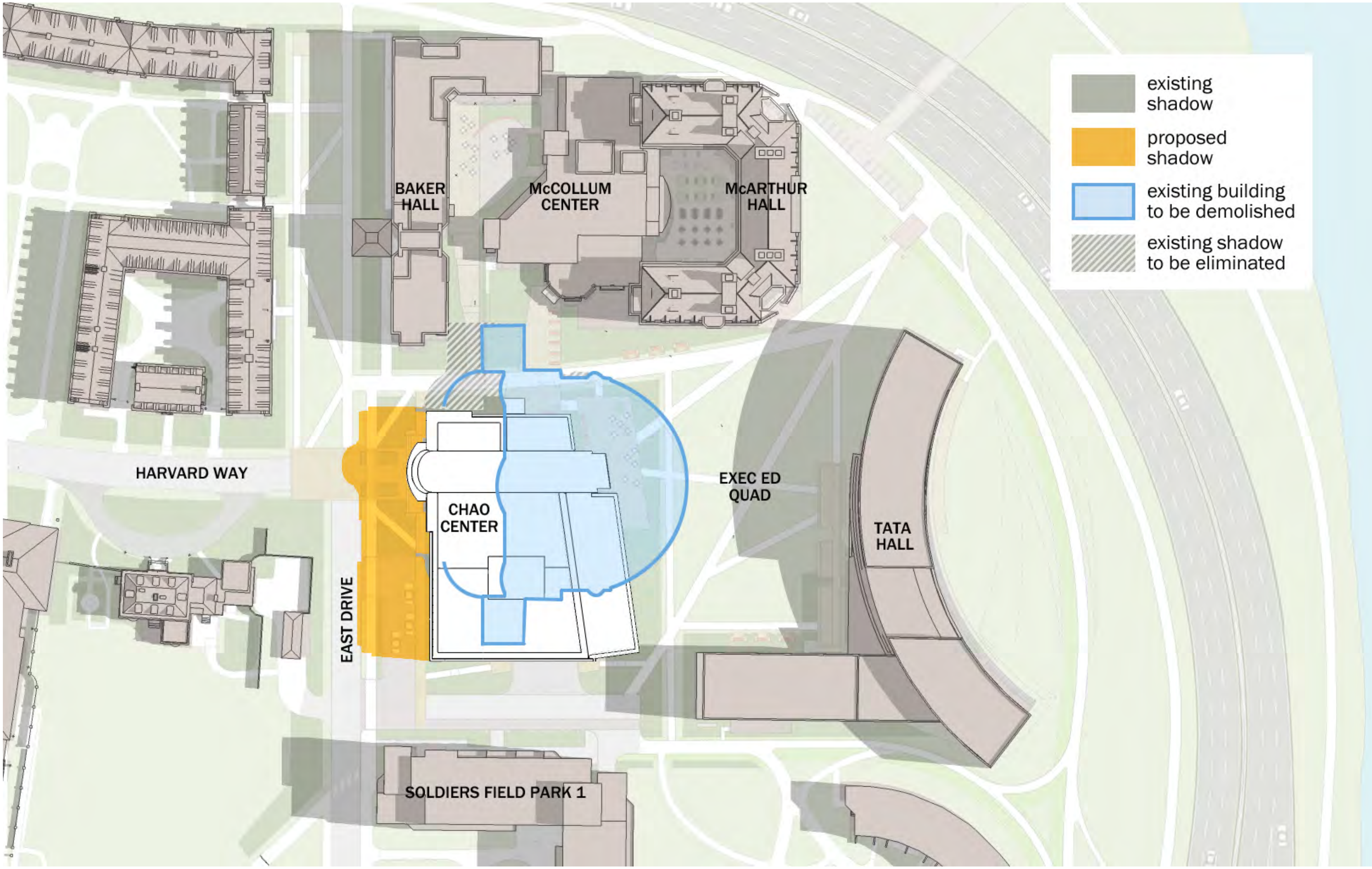


Figure 3-4: Shadow Study: June 21, 9:00 a.m.

Source: Goody Clancy

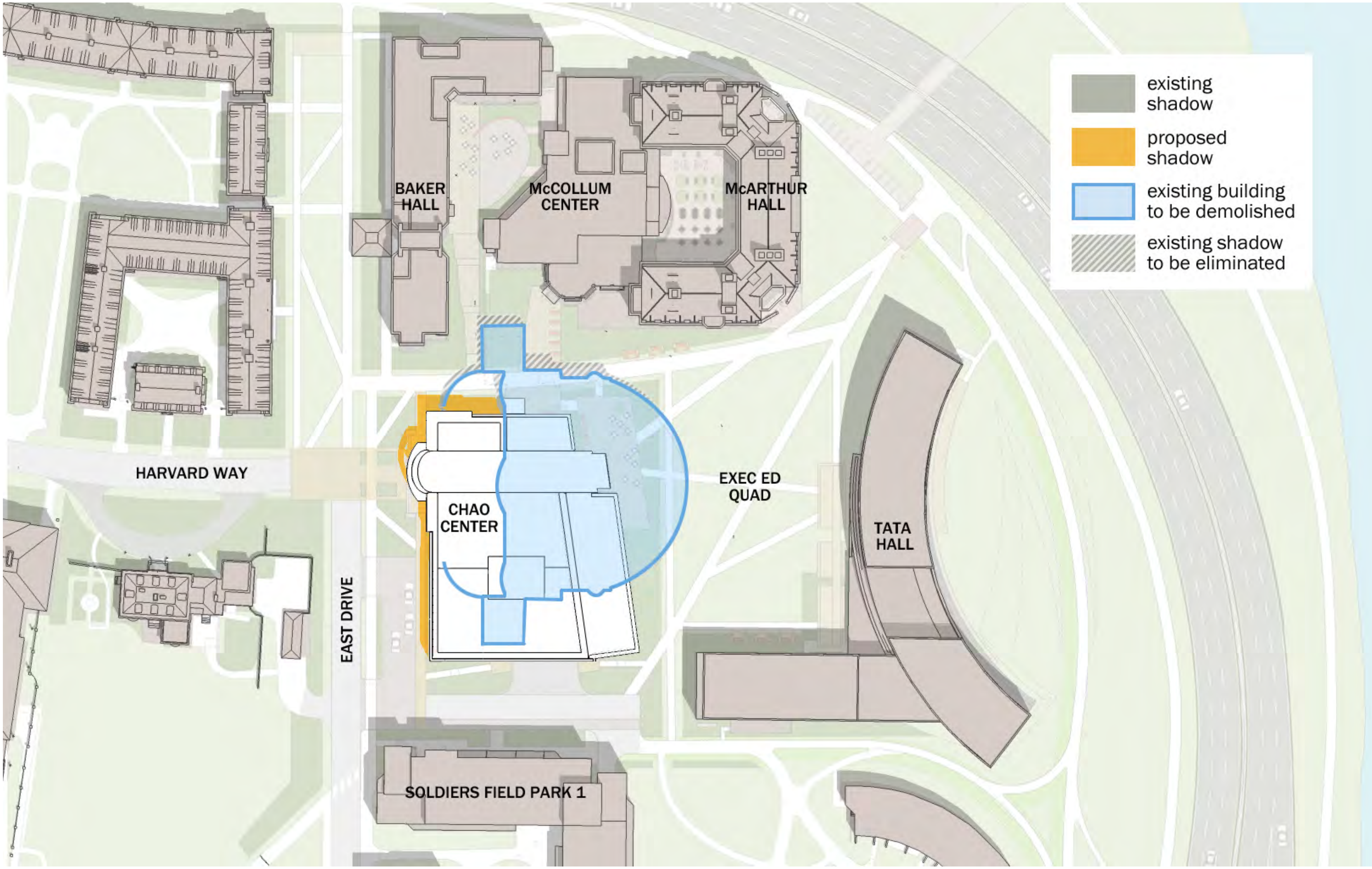


Figure 3-5: Shadow Study: June 21, 12:00 p.m.

Source: Goody Clancy

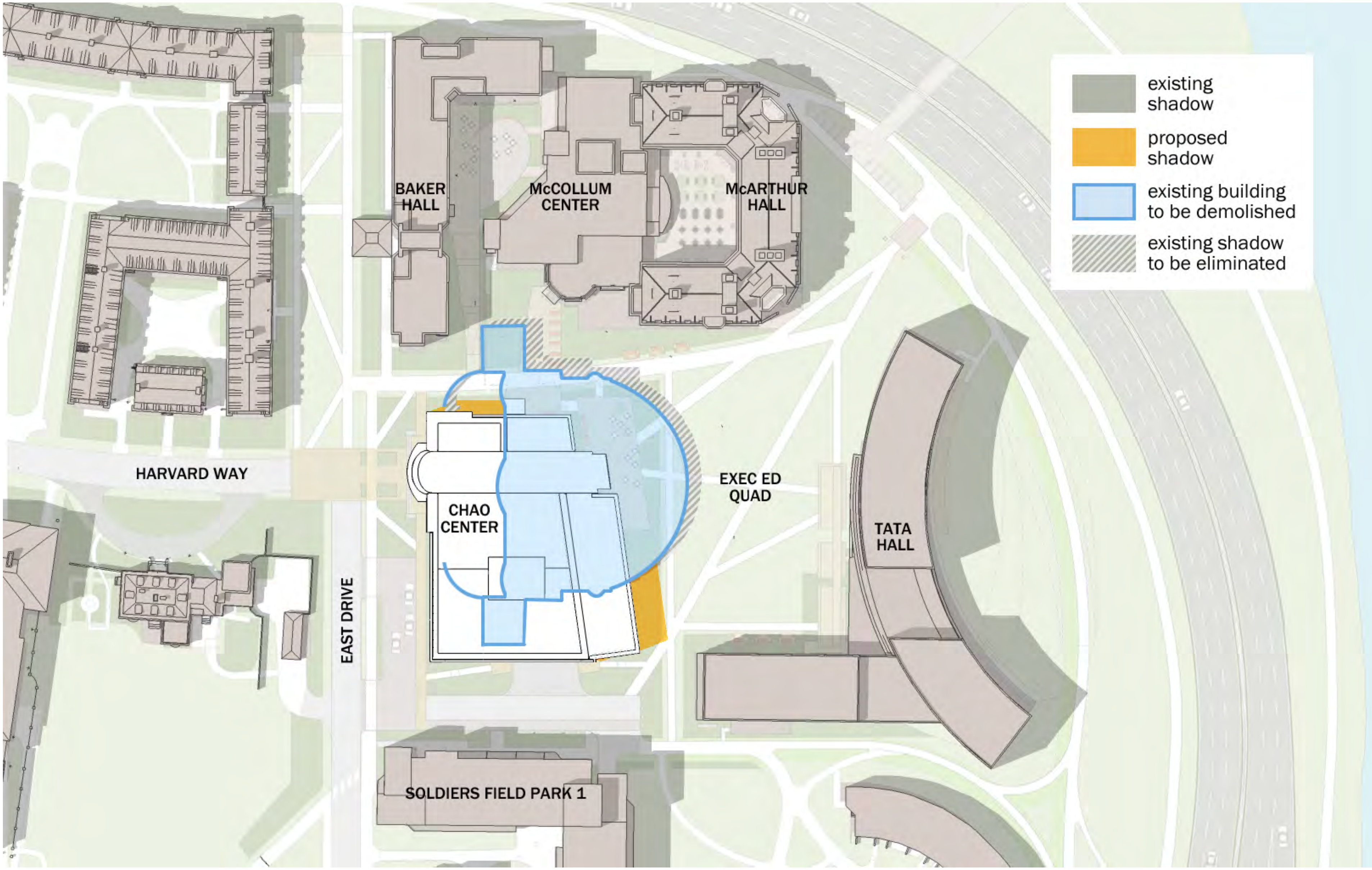


Figure 3-6: Shadow Study: June 21, 3:00 p.m.

Source: Goody Clancy

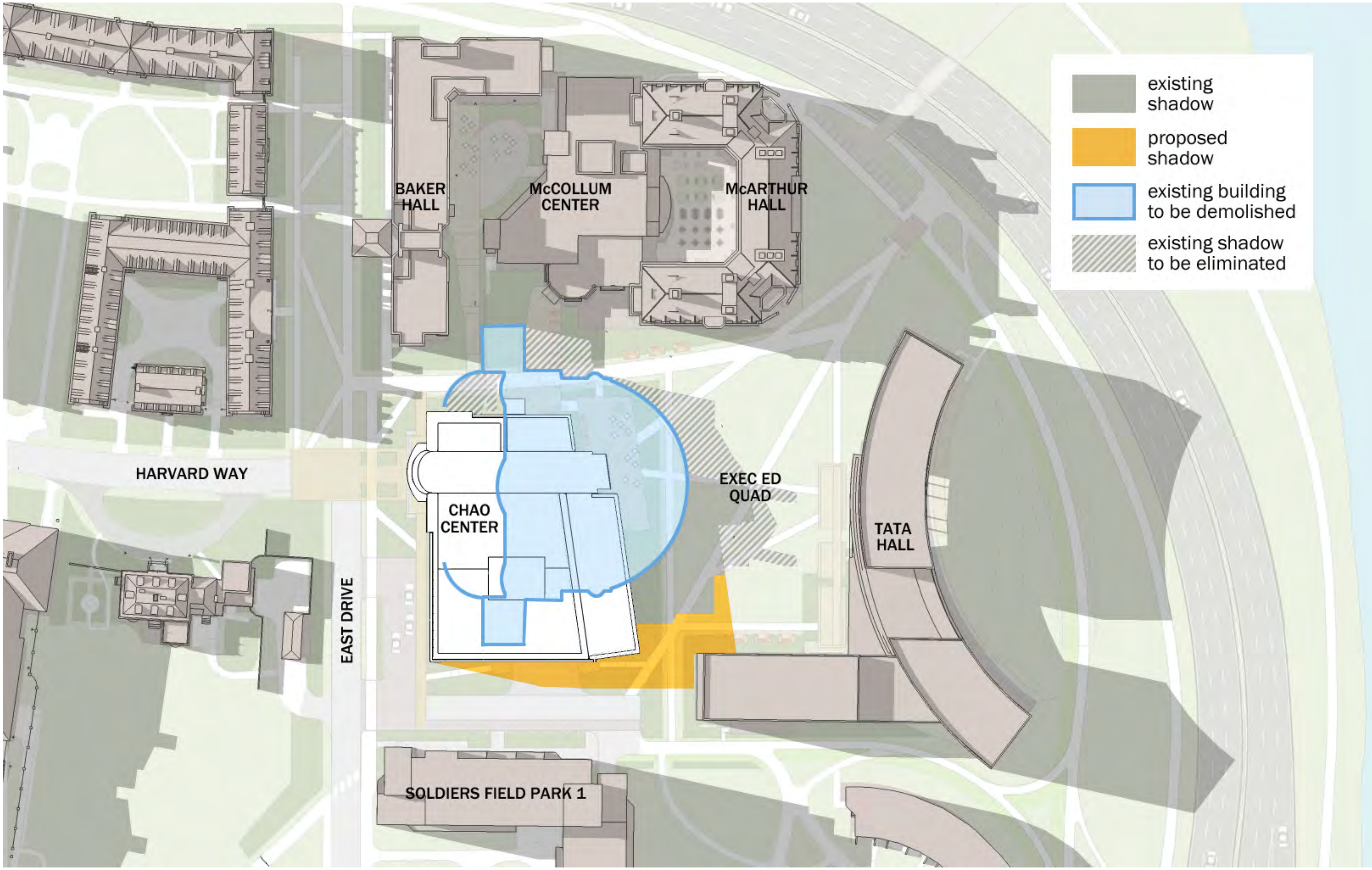


Figure 3-7: Shadow Study: June 21, 6:00 p.m.

Source: Goody Clancy

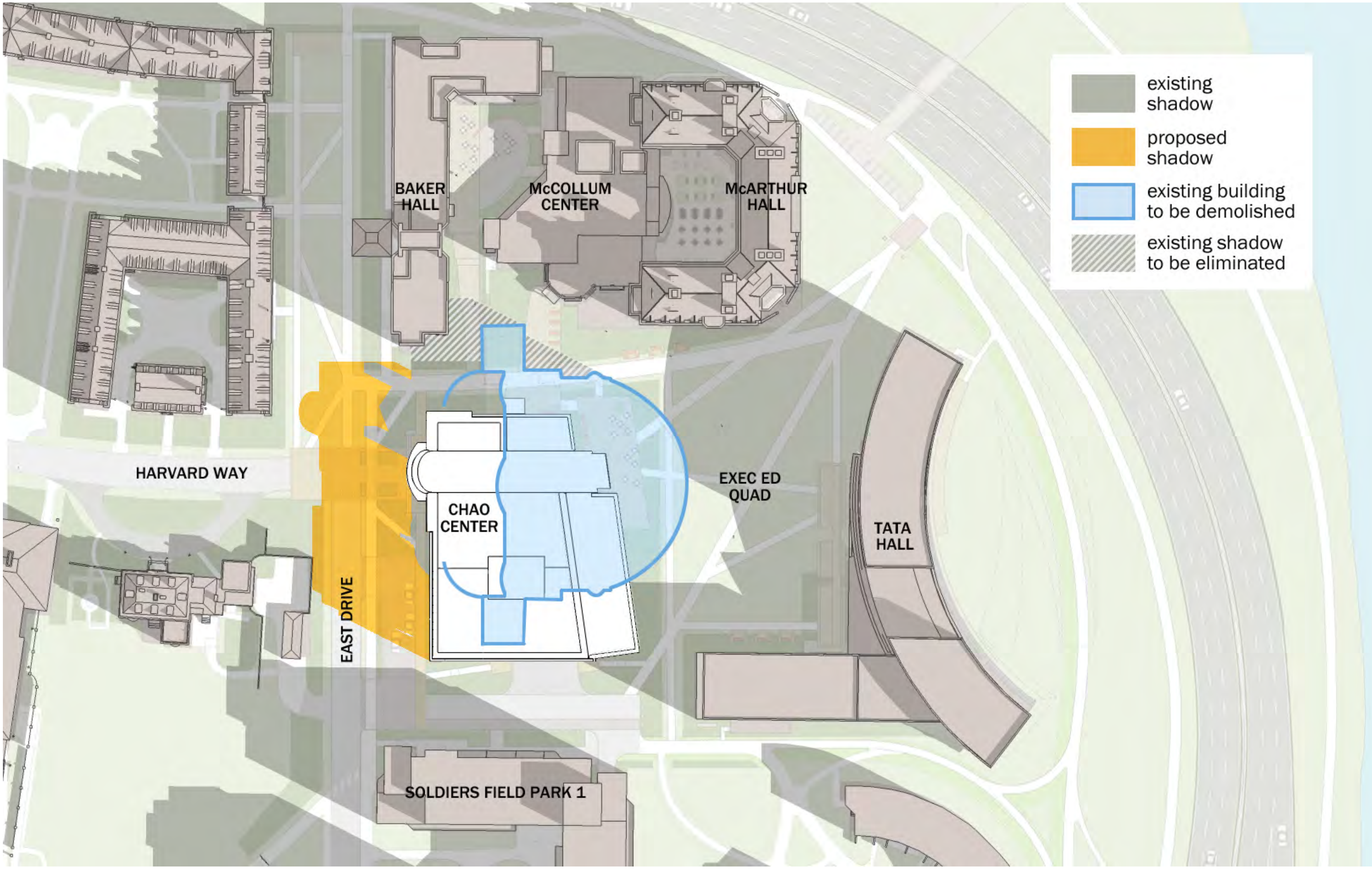


Figure 3-8: Shadow Study: September 21, 9:00 a.m.

Source: Goody Clancy

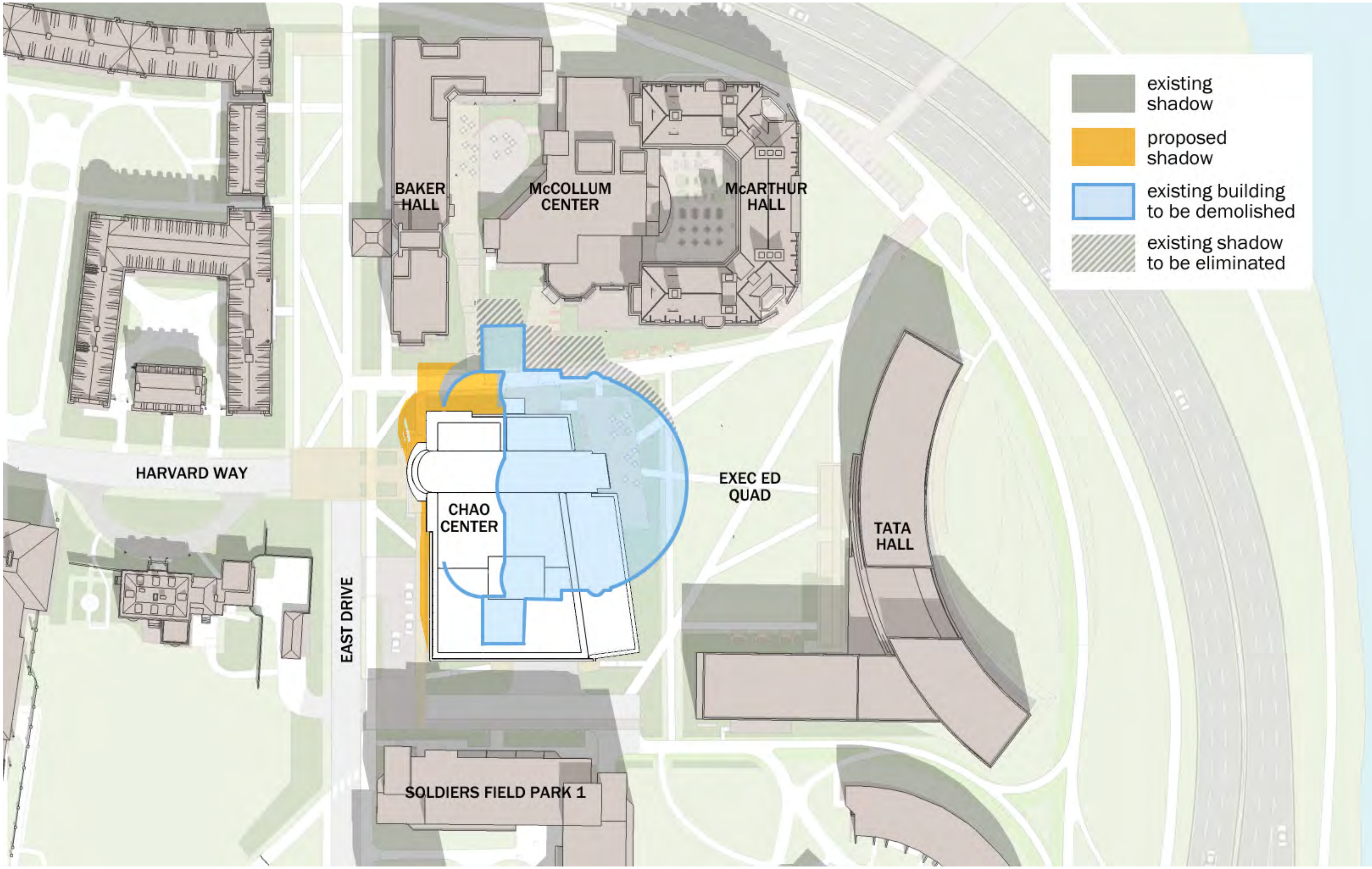


Figure 3-9: Shadow Study: September 21, 12:00 p.m.

Source: Goody Clancy

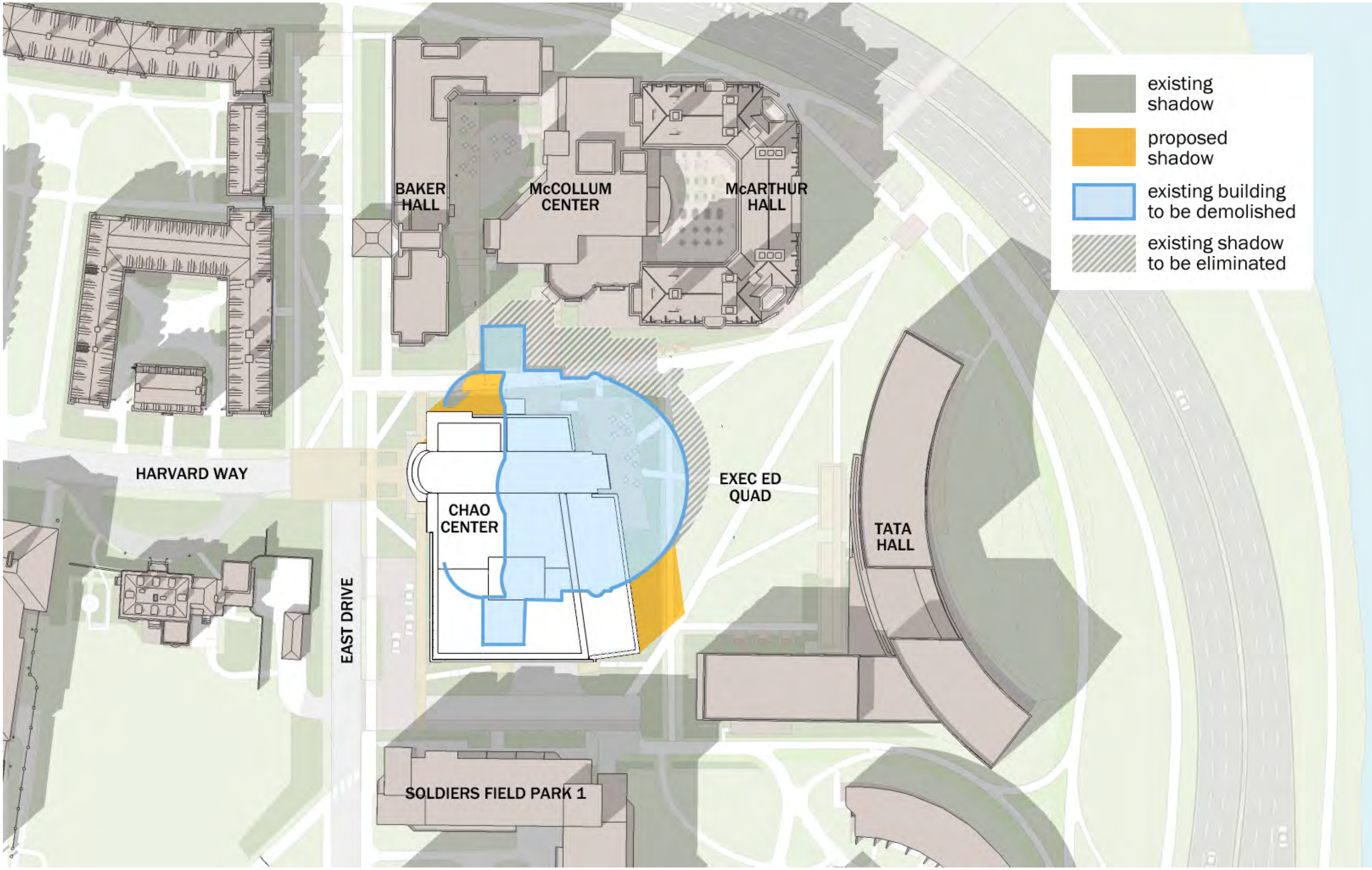


Figure 3-10: Shadow Study: September 21, 3:00 p.m.

Source: Goody Clancy

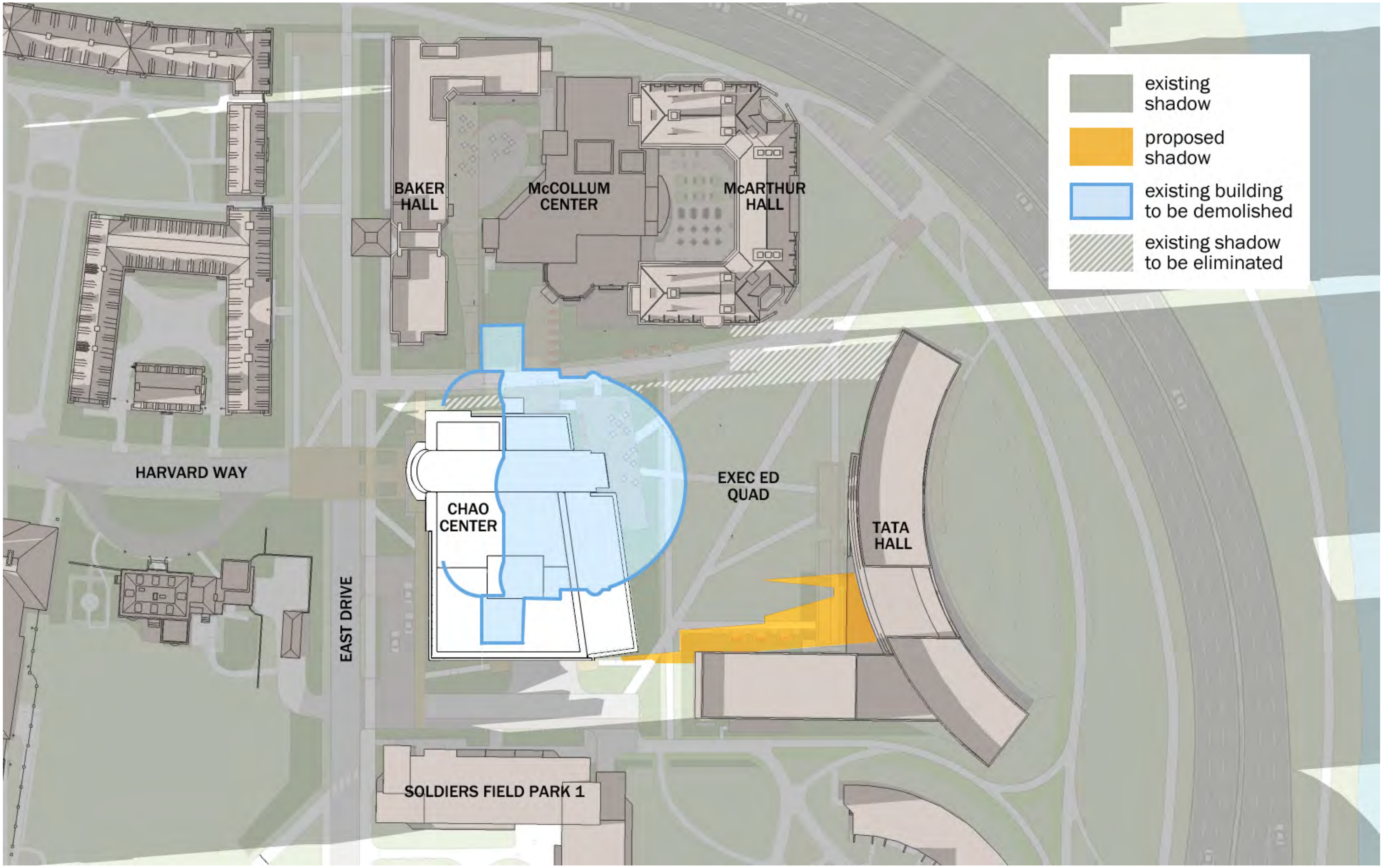


Figure 3-11: Shadow Study: September 21, 6:00 p.m.

Source: Goody Clancy

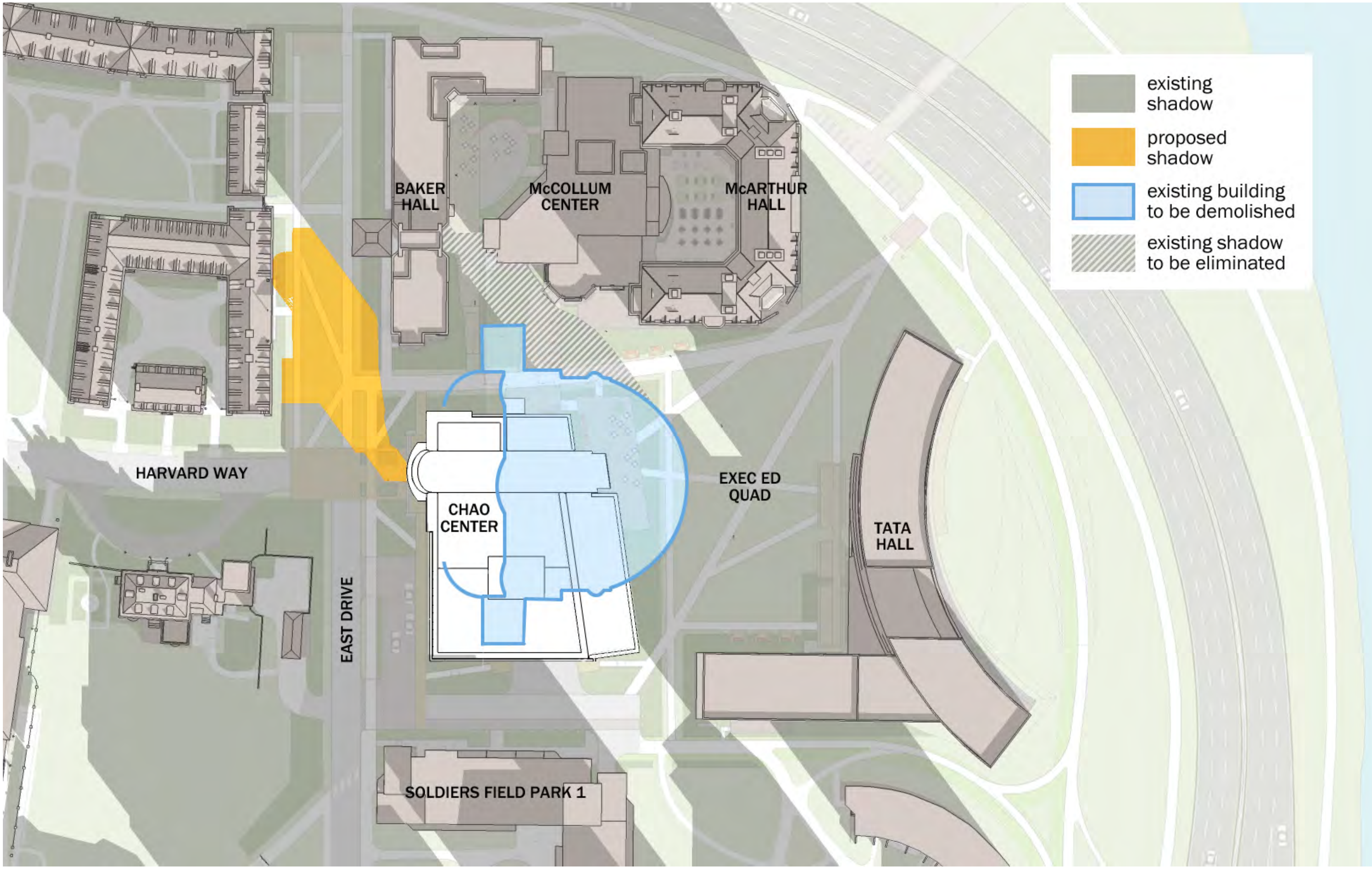


Figure 3-12: Shadow Study: December 21, 9:00 a.m.

Source: Goody Clancy

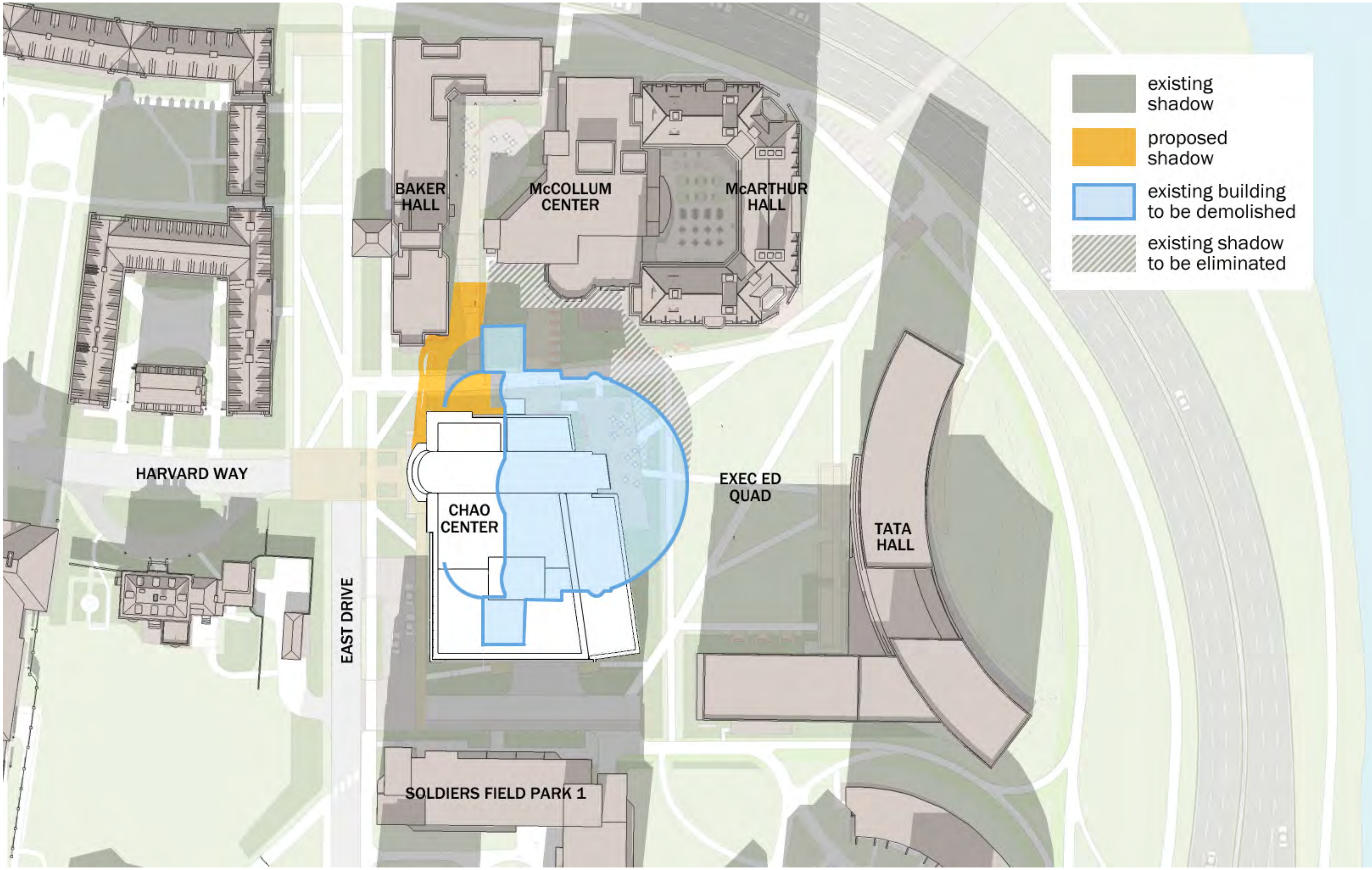


Figure 3-13: Shadow Study: December 21, 12:00 p.m.

Source: Goody Clancy

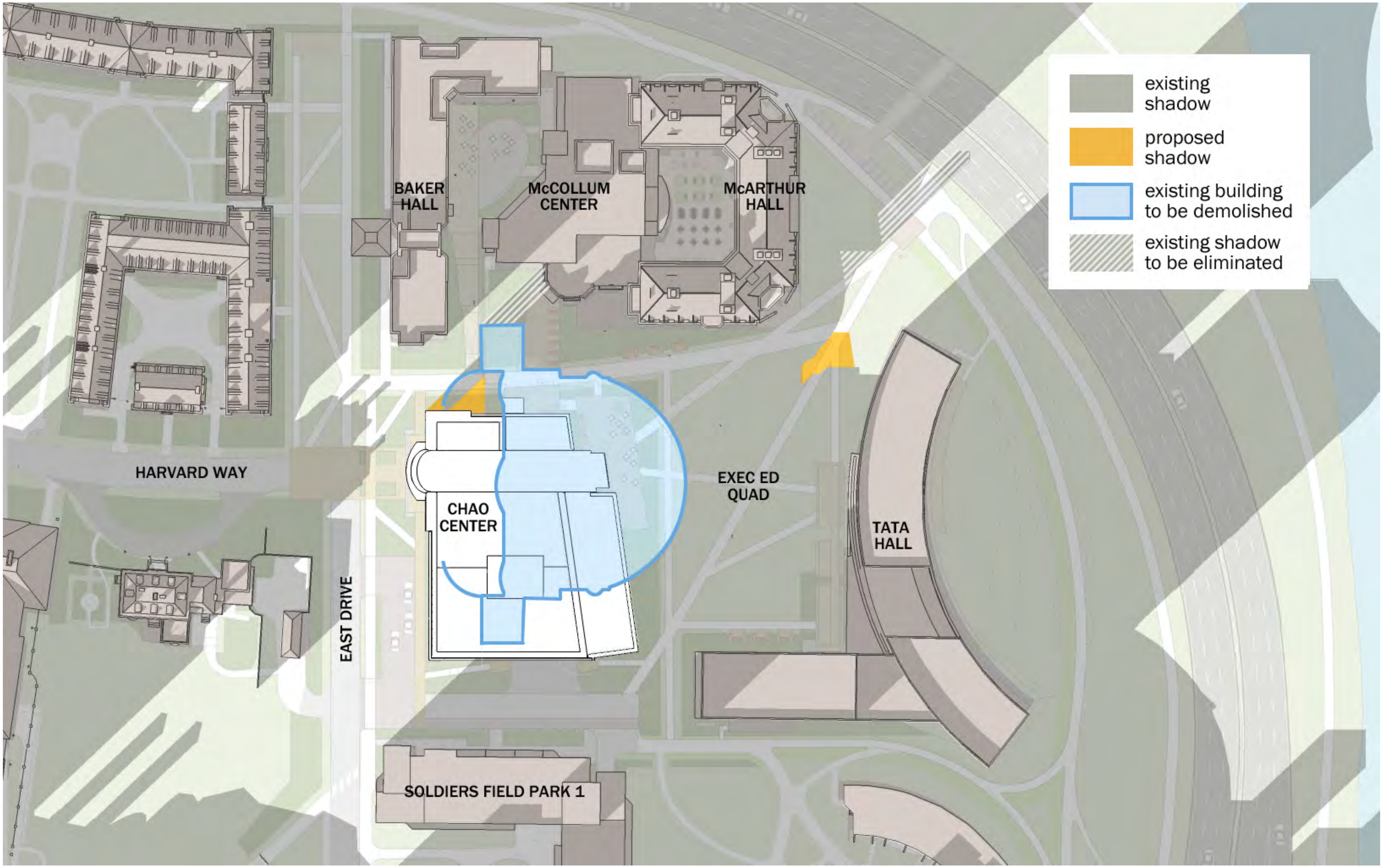


Figure 3-14: Shadow Study: December 21, 3:00 p.m.

Source: Goody Clancy

3.4 Daylight

3.4.1 Introduction

The purpose of the daylight analysis is to estimate the extent to which a proposed project will affect the amount of daylight reaching the public streets, sidewalks, and open areas in the immediate vicinity of a project site. The daylight analysis for the Project considers the existing and future daylight conditions from viewpoints on each side of the site. For the area context, two viewpoints were chosen looking from the Executive Education Quad and two viewpoints were chosen looking at Mellon Hall. The analysis shows that the proposed building will generally have similar or lower daylight obstruction values than the surrounding HBS campus.

3.4.2 Methodology

The daylight analysis was performed using the Boston Redevelopment Authority Daylight Analysis (BRADA) computer program. This program estimates the percentage of "sky dome" that will be obstructed by a project and is a useful tool in evaluating the percentage of obstruction from the proposed build condition.

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

The analysis treats the following elements as controls for data comparison:

- Existing Condition;
- Proposed Condition; and
- Area Context.

The daylight analysis examined daylight obstruction from four locations for the proposed building, as shown on Figure 3-15. Viewpoints considered for the analysis were from each side of the proposed building, looking east, north, and south toward the site (Viewpoints 1-3, respectively), and from the Executive Education Quad looking west (Viewpoint 4). The area context viewpoints looked at Tata Hall (currently under construction) from the Executive

Education Quad (AC1), McArthur Hall from the Executive Education Quad (AC2), Mellon Hall from the pathway on the south side of Soldiers Field Road (AC3), and Mellon Hall from the Quad on its south side (AC4).

3.4.3 Results of Daylight Analysis

The results for each viewpoint for the existing and proposed conditions, as well as for the area context viewpoints, are shown in Table 3-1. Figures 3-16 through 3-18 provide the BRADA results for each viewpoint.

Table 3-1 Daylight Analysis Results

Viewpoint Locations		**Existing Conditions**	**Proposed Conditions**
Viewpoint 1	Looking East Toward the Site	26.9%	32.0%
Viewpoint 2	Looking North Toward the Site	18.1%	33.6%
Viewpoint 3	Looking South Toward the Site	31.2%	32.4%
Viewpoint 4	Executive Education Quad Looking West Toward the Site	15.6%	28.5%
Area Context Viewpoints			
AC1	Executive Education Quad Looking East at Tata Hall	32.6%	
AC2	Executive Education Quad Looking North at McArthur Hall	31.1%	
AC3	Soldiers Field Road Pathway Looking South at Mellon Hall	39.5%	
AC4	Mellon Quad Looking North	43.3%	

3.4.3.1 Viewpoint 1

Viewpoint 1 was taken from the west side of the Project site. Under current conditions, Kresge Hall has a daylight obstruction value of 26.9 percent from this viewpoint. The Project will result in a daylight obstruction value of 32.0 percent. The Project will be located further to the west than the existing Kresge Hall. The daylight obstruction value will be similar to daylight obstruction values on other areas of the HBS campus.

3.4.3.2 Viewpoint 2

Viewpoint 2 was taken from the southern side of the Project site, to the north of the Soldier's Field Park Apartments, facing north. Under current conditions, Kresge Hall has a daylight obstruction value of 18.1 percent from this viewpoint. The Project will result in a daylight obstruction value of 33.6 percent. The daylight obstruction value will be similar to daylight obstruction values on other areas of the HBS campus.

G:\Projects2\MA\Allston\3504\PNF\daylight.mxd

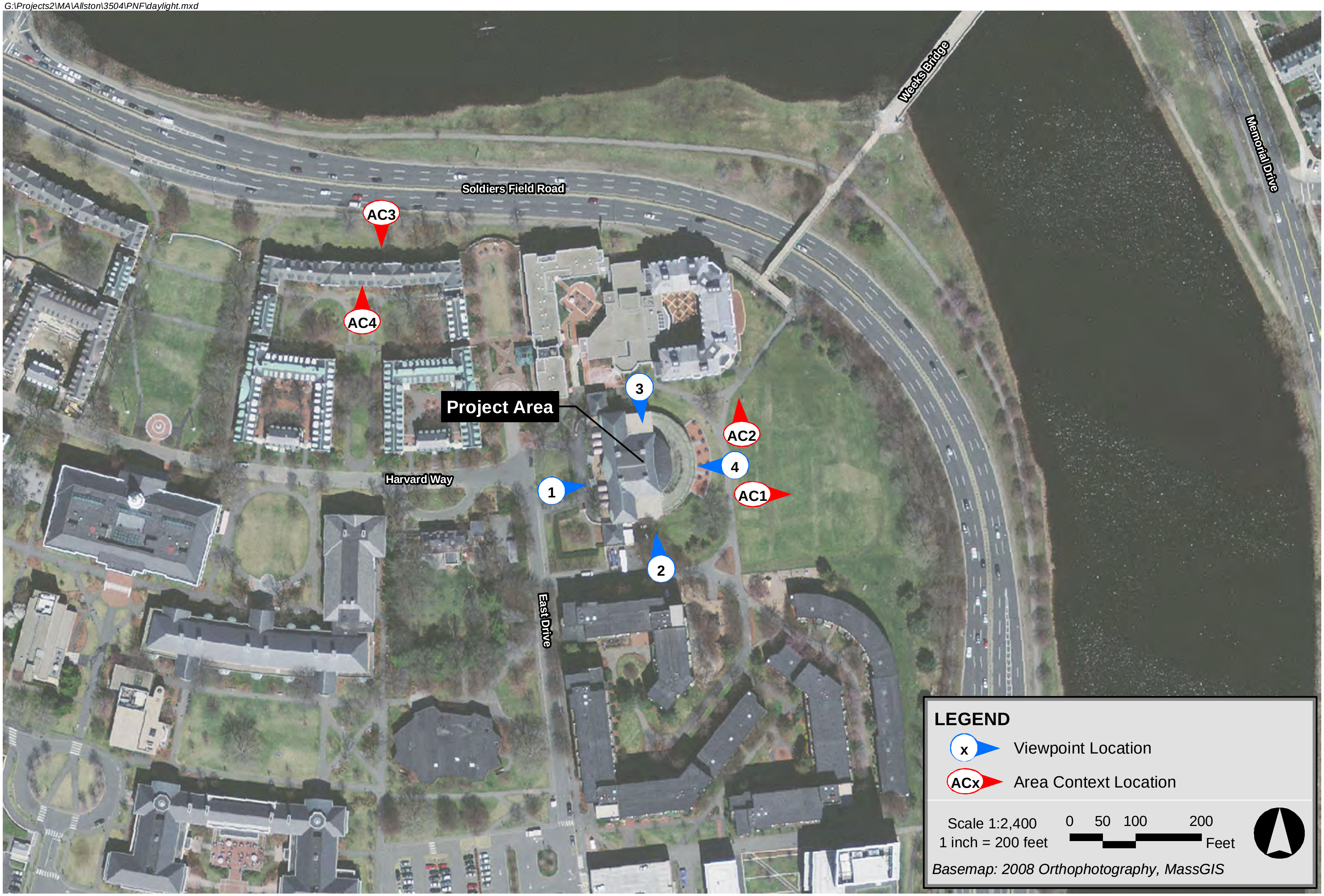
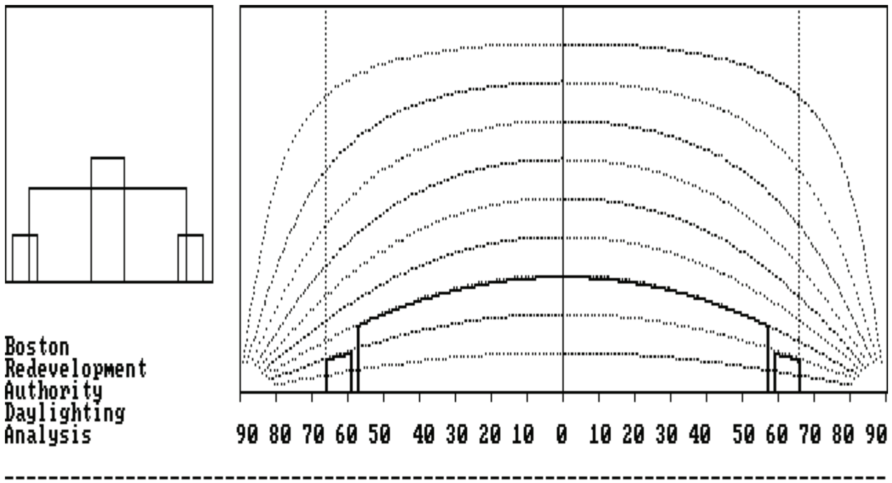


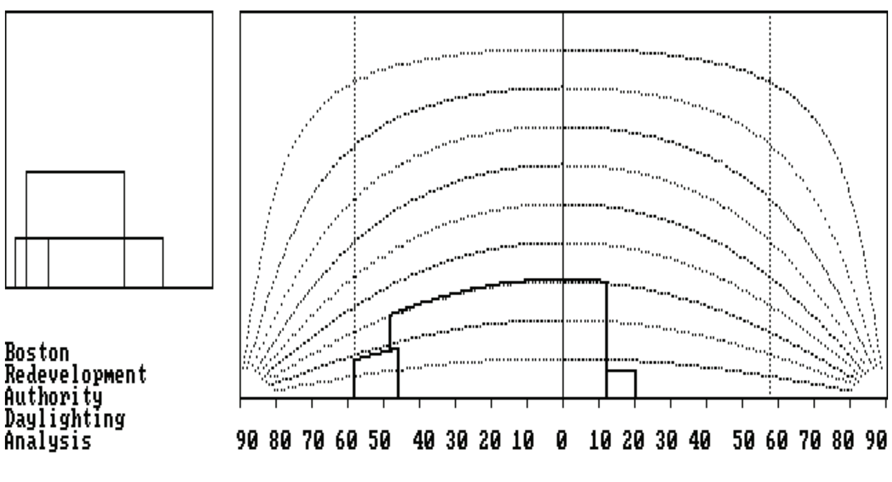
Figure 3-15: Daylight Analysis Viewpoints
Expanded PNF

Source: Epsilon Associates, Inc.



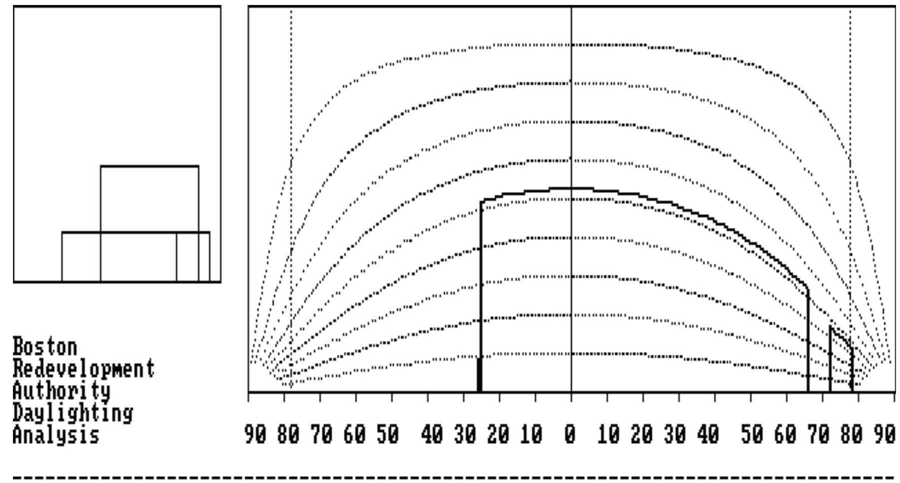
Obstruction of daylight by the building is 26.9 %

Existing Conditions - Viewpoint 1



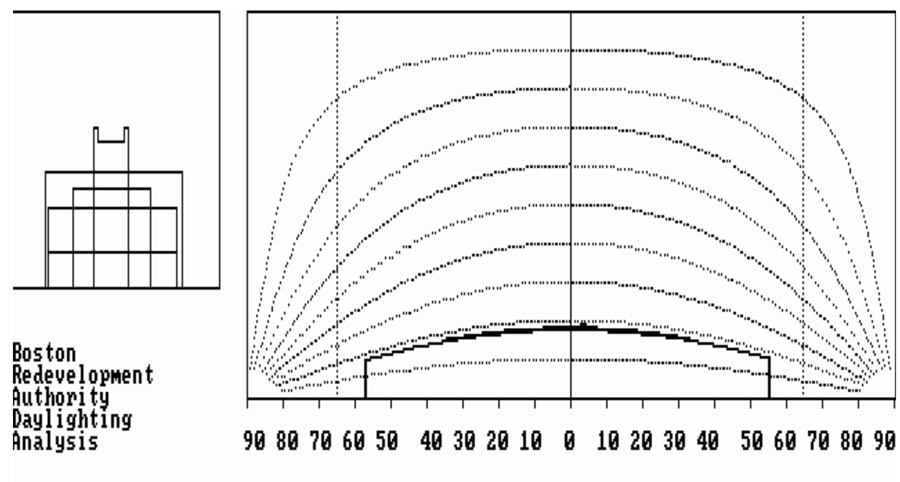
Obstruction of daylight by the building is 18.1 %

Existing Conditions - Viewpoint 2



Obstruction of daylight by the building is 31.2 %

Existing Conditions - Viewpoint 3

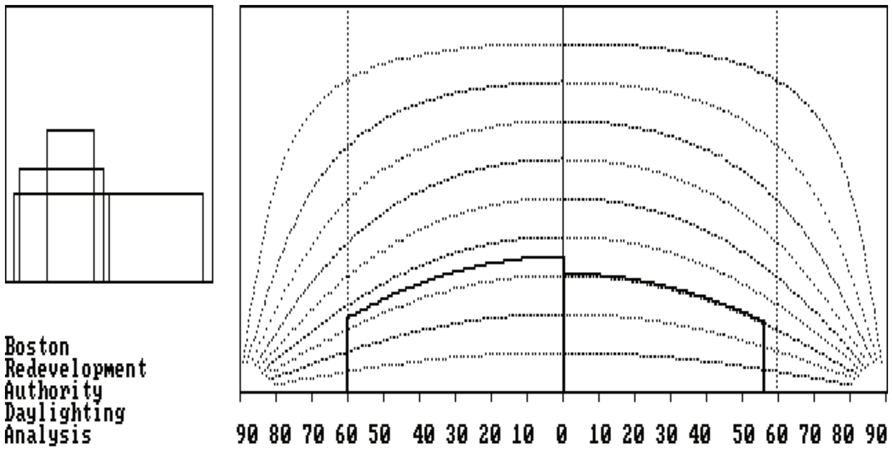


Obstruction of daylight by the building is 15.6 %

Existing Conditions - Viewpoint 4

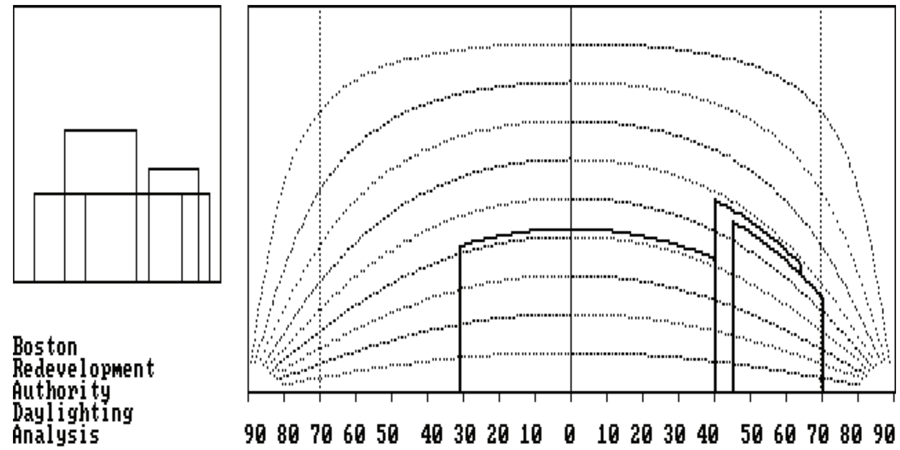
Figure 3-16: Daylight Analysis, Existing Conditions

Source: Epsilon Associates, Inc.



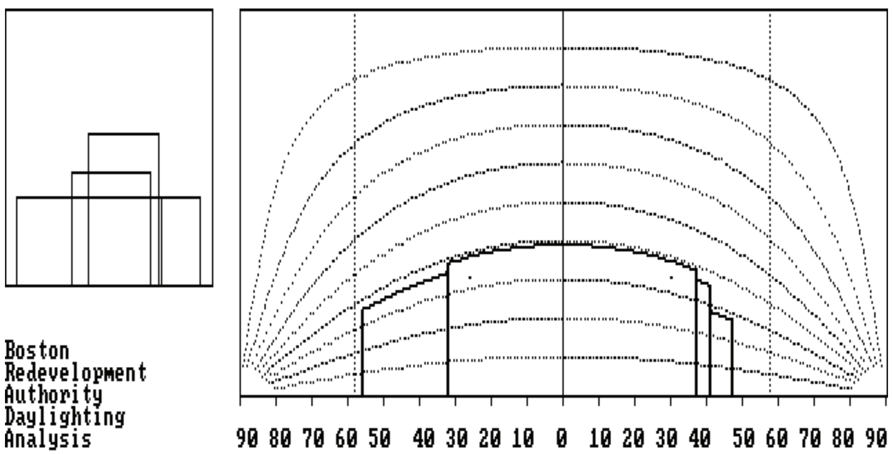
Obstruction of daylight by the building is 32.0 %

Proposed Project - Viewpoint 1



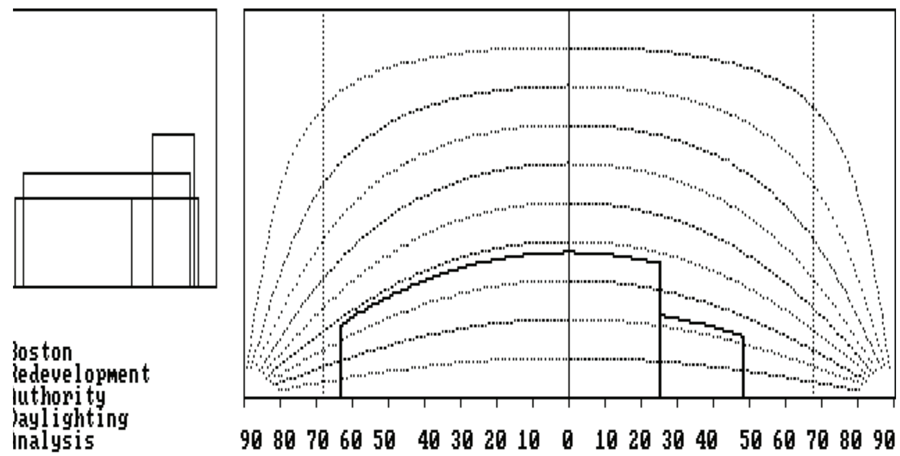
Obstruction of daylight by the building is 32.4 %

Proposed Project - Viewpoint 3



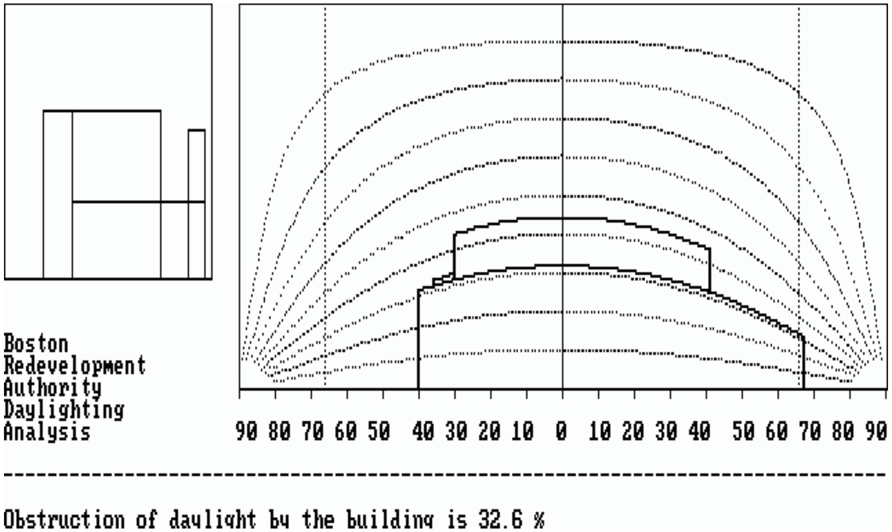
Obstruction of daylight by the building is 33.6 %

Proposed Project - Viewpoint 2

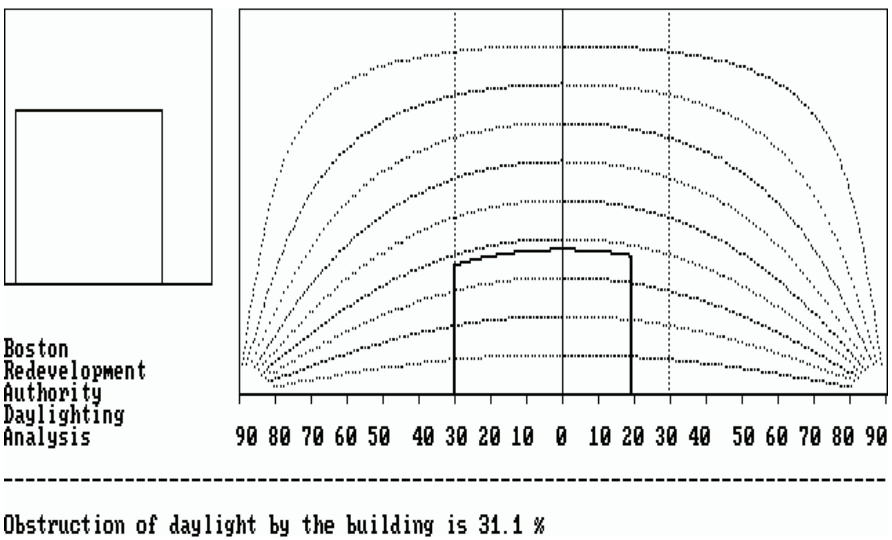


Obstruction of daylight by the building is 28.5 %

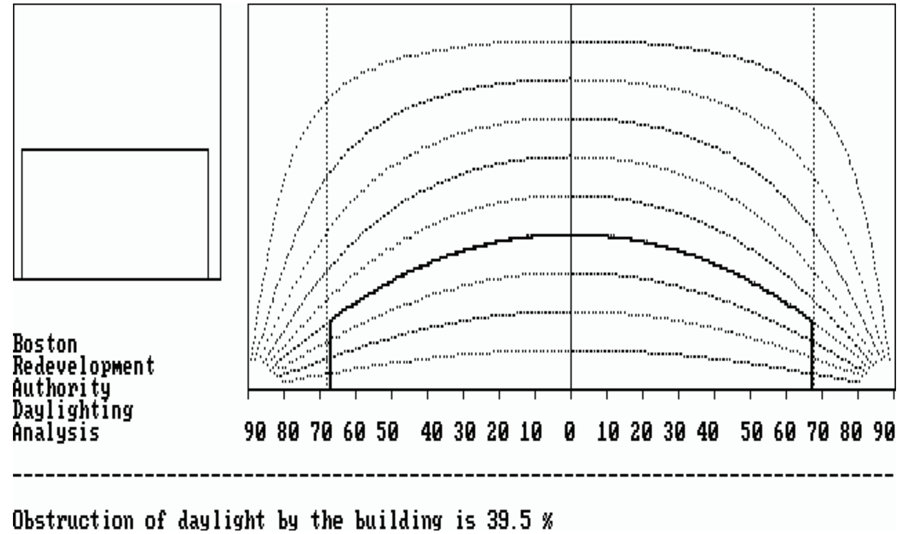
Proposed Project - Viewpoint 4



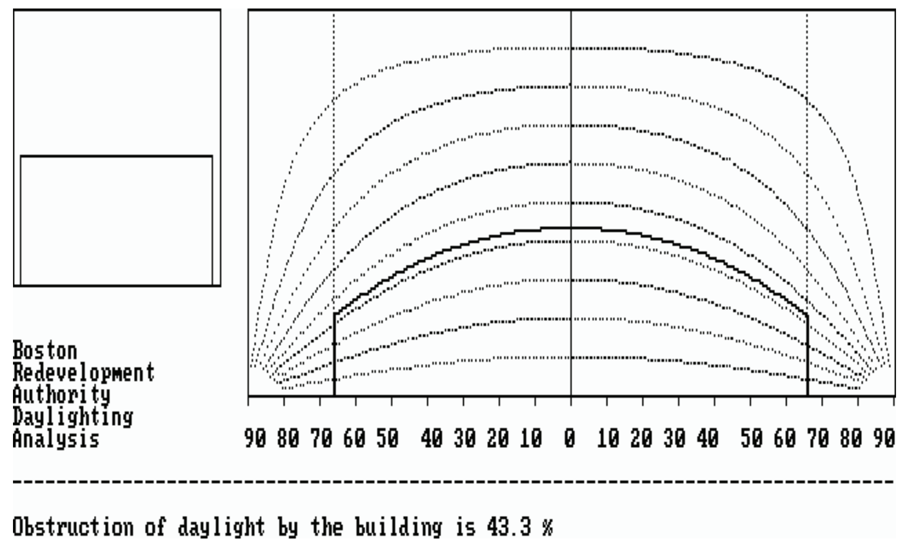
Area Context 1



Area Context 2



Area Context 3



Area Context 4

3.4.3.3 Viewpoint 3

Viewpoint 3 was taken from the northern side of the Project site, to the south of McCollum Center, facing south. The Project will be further south than the existing Kresge Hall. Under current conditions, Kresge Hall has a daylight obstruction value of 31.2 percent from this viewpoint. The Project will result in a daylight obstruction value of 32.4 percent. The daylight obstruction value will be similar to daylight obstruction values on other areas of the HBS campus.

3.4.3.4 Viewpoint 4

Viewpoint 4 was taken from the center of the future Executive Education Quad, facing west. Under current conditions, Kresge Hall has a daylight obstruction value of 15.6 percent from this viewpoint. The Project will result in a daylight obstruction value of 28.5 percent. The daylight obstruction value will be similar to daylight obstruction values on other areas of the HBS campus.

3.4.3.5 Area Context Viewpoints

The Area Context Viewpoints looked at Tata Hall and McArthur Hall from the Executive Education Quad and at Mellon Hall, a four-story HBS dormitory, from Soldiers Field Road and from its own quad. The daylight obstruction value of Tata Hall on the Executive Education Quad (AC1) will be 32.6 percent. McAthur Hall creates a daylight obstruction of 31.1 percent when viewed from the Executive Education Quad (AC2). Mellon Hall’s daylight obstruction values are 39.5 percent when viewed from the path on Soldiers Field Road (AC3) and 43.3 percent from within the Mellon Hall Quad (AC4).

3.4.4 Conclusions

The proposed Project is similar in scale and has similar surroundings as other locations within the HBS campus. The daylight obstruction values for the proposed Project will be slightly higher than the existing conditions, but similar to or lower than daylight obstruction values of existing areas on the HBS campus.

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 air handling units will vent to the rooftop, minimizing the potential for impacts to pedestrians in the surrounding area.

The existing mechanical equipment includes refrigeration units, pumps, air handling units, and air exhaust fans. A small electric heating unit is also included. Since there are no combustion sources (boilers, engines, etc.), there are no existing combustion pollutant emissions.

The Project will include a number of electrically-powered refrigeration units, pumps, air handling units, and air exhaust fans. Heating hot water will be provided by a new precinct hot water heating plant utilizing campus steam, to be located within the existing Kresge Hall utility mechanical room vault. The vault will contain three heat exchangers and a number of pumps, water tanks, and other related equipment. Since heating will be supplied from campus steam, no onsite boilers are required.

Everyday power will be supplied by Harvard's Engineering and Utility department. Emergency power will be supplied by an existing 600 kilowatt generator in the adjacent Tata Hall. Therefore no additional diesel emergency generators or ancillary equipment (fuel tanks) will be installed.

Since there are no combustion sources associated with the Project, there are no net emissions associated with the Project. Therefore, it can be expected that there will be no changes to air quality as a result of the proposed Project.

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. Mechanical equipment will be within the building and a mechanical penthouse on the rooftop. Currently, it is anticipated that there will be multiple large air handlers on the roof and additional mechanical equipment in the basement. The rooftop units will be shielded with noise protection to minimize increased noise in the surrounding area.

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 the building will also include the same internal noise protection for the building occupants as what is provided to protect the external environment.

The noise levels generated by the Project will 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	8 to 10
Organic Deposits	15 to 20
Fluvial Deposits (Sand)	0 to 5
Marine Deposits	65 to 75
Glacial Till	5 to 10

- **Fill –** The fill layer typically consists of medium dense to dense, poorly to well graded, coarse to fine, sand with varying amounts of gravel, silt, brick, and roots. This soil unit also contains layers of very soft to stiff organic silt and clay with organic fibers and varying amounts of gravel, sometimes with an organic odor.

- **Organic Deposits –** Organic Deposits are very soft to stiff, organic soil (generally organic silt), with varying amounts of sand and peat fibers.

- **Fluvial Deposits –** Fluvial Deposits typically consist of medium dense to very dense sand, with varying amounts of silt and gravel.

- **Marine Deposits –**Marine Deposits typically consist of silty clay. This unit is comparatively stiffer in the upper 5 to 10 feet. The samples collected at the top of the Marine Deposit are consistently hard or very stiff clay, with traces of silt, sand and gravel.

- **Glacial Till Deposits –** A very dense gray sandy silt with gravel (Glacial Till Deposits) was encountered below the Marine Deposits.

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 4 to 5 feet below grade (approximately El. 9 BCB). Groundwater levels are influenced by weather conditions, precipitation, the infiltration of surface water runoff, construction activities, leakage into or out of utility pipes, building/highway underdrain systems, localized water recharging, and other factors.

3.7.3 Foundation Support and Below-grade Construction

3.7.3.1 Foundation Support

The proposed building will be supported on structural slab that is supported by foundation piles that extend to glacial till or bedrock. The proposed building includes one below grade level. The foundation walls and lowest slab will extend below the groundwater level and these walls and slab will be waterproofed. The structure will not cause the groundwater level to raise, pond or be lowered in the surrounding area. The structure will be designed such that there is no long term groundwater pumping.

Perimeter walls will be waterproofed the full height of the basement level. All joints in the below-grade walls will have continuous waterstops.

3.7.3.2 Excavation Below Grade Construction

A temporary lateral earth support system will be required to complete the excavation for the basement. This lateral support system will be a relatively impermeable wall such as continuous interlocking steel sheet piles. The excavation will not 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. The permanent structure will be designed to resist hydrostatic uplift pressures so that no long term dewatering is required. A permit for temporary construction dewatering will be obtained for discharge of dewatering effluent. The temporary construction dewatering activities will not impact the adjacent buildings.

3.7.3.3 Geotechnical Instrumentation

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

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

3.7.4 Earthquake Impacts

The Project's design team has conducted soils investigation and analysis which include profiling properties and their predictive response to the Code Maximum Considered Earthquake. Additional site specific analysis has been performed in accordance with the code to assess the behavior of the soil profile and response of the building structure to the anticipated ground accelerations. As the design of the Project continues, the Project geotechnical consultant (Haley & Aldrich) and structural engineer (LeMessurier Consultants) will continue to coordinate to ensure that the Project meets all seismic code requirements.

3.8 Solid and Hazardous Wastes

3.8.1 Hazardous Wastes

3.8.1.1 Existing Building

Kresge Hall was constructed in 1953 when hazardous materials such as asbestos, lead, mercury, and polychlorinated biphenyls (PCBs) were commonly incorporated into building products. Isolated renovation projects and asbestos abatement have occurred throughout the building since then. Recently, a series of surveys of potential hazardous materials have been conducted to fully characterize the presence and extent of any remaining hazardous materials that would require abatement prior to demolishing the building. Asbestos containing materials (ACM) located within the building include radiator insulation, duct covering, elevator brakes, damp proofing, and window glazing. Among the hazardous materials observed in the building are fluorescent tubes and ballasts, mercury thermostats and switches, and Freon-containing devices.

Once the building is cleared of current occupants, furniture, and equipment, the building will be fully abated of hazardous materials by a licensed contractor in accordance with all applicable State and Federal requirements.

3.8.1.2 Soils

In the future, the Proponent plans to obtain site specific information regarding environmental conditions to evaluate for 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. 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 applicable appropriate Massachusetts Department of Environmental Protection (MassDEP) regulatory requirements.

3.8.1.3 Operation

With the exception of "household hazardous wastes" typical of residential and 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 potential reuse of existing materials from the existing Kresge Hall, use of recyclable materials, and an extensive program of managing the waste stream for recycling to maximize the diversion of construction waste from landfills.

Once the building is 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, will be collected and brought for removal to the new loading dock that will be constructed as part of the Project which will include a dual recycling/trash compactor. Both the recycling and solid waste procedures are consistent with the solid waste removal procedures for the existing buildings on campus.

3.8.3 Recycling

Harvard University is committed to a campus-wide recycling program. Harvard's recycling operations recover more tons of more types of recyclables than any urban campus in the United States. The University recovered over 7,721 tons of recyclables and compostables in fiscal year (FY) 2012 for a recovery rate of 53 percent, outstanding for an urban program. Here are a few of the recycling achievements that distinguish Harvard's programs from those of other urban institutions:

- Successful recycling in the city: No other urban campus has managed to recover over 7,700 tons for recycling and composting given city limitations of tight space, close proximity to neighbors, an active scavenging population, vigilant fire code enforcement, historic buildings without vehicle access, and noise restrictions.

- Building lasting sustainability into all levels of the University: Harvard's student-staffed Resource Efficiency Program diverted an additional 200 tons of refuse for recycling last year. In partnership with the Office for Sustainability, Harvard is expanding this program across the University to include graduate schools and Green Teams in many academic and administrative departments.

- Sharing surplus with neighbors: Harvard Recycling's partnership with Harvard Habitat for Humanity program has raised $616,000 through sales of recovered furniture, books, clothing and supplies. Harvard has also assisted over 200 other Boston-area and international charities with donations of surplus goods.

The Chao Center will be incorporated into these existing recycling programs. The Project will be set up for single stream recycling, a process where glass, plastic, paper and cardboard can be collected in the same receptacle. All classrooms will have built-in receptacles for recycling and each office will have its own dedicated bin for recycling. Gathering and dining areas will offer recycling with built-in bins and behind the scenes composting whenever food is served. The building will include a refrigerated room to hold compostable materials before they are removed for composting.

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.

In an effort to have clear, open and up-to-date communications with the neighborhood, the Project will develop a communications plan consistent with other Harvard projects in Allston. A 24-hour hotline will be established upon commencement of construction activity. In addition, when construction commences, a website will provide updates on construction as well as provide Harvard with feedback from the community. A mitigation staff and protocol will be established and be available to address all Project issues. Emergency contacts will be maintained for immediate follow-up on emergency situations. Additionally, Harvard will direct the construction manager to install community bulletin boards around the perimeter of the site. These bulletin boards will be maintained with current activity and schedule information.

The Proponent intends to follow the guidelines of the City of Boston and MassDEP, which direct the evaluation and mitigation of construction impacts.

3.10.2 Construction Methodology

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

As the design of the Project progresses, the Proponent will meet with BTD to discuss the specific location of barricades, need for lane closures, pedestrian walkways, and truck queuing areas. These will be incorporated into the CMP which will be submitted to BTD for approval prior to the commencement of construction work.

3.10.3 Construction Schedule

Site work is anticipated to commence in March 2014. It is anticipated that the Project will be completed in the spring of 2016.

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

3.10.4 Construction Staging/Public Safety/Access

Details on access to the site and construction staging areas will be provided in the CMP. Although specific construction and staging details have not been finalized, the Proponent and its construction management consultant will work to ensure that staging areas will be located to minimize impacts to pedestrian and vehicular flow on the campus. Generally, construction staging and material laydown will occur on-site. In addition, as part of the IMP process Harvard presented a plan for a centralized area south of Western Avenue for construction-related uses, including truck layover, materials storage, working parking, and temporary support structures. These will continue to be evaluated and presented in the CMP. Secure fencing and barricades will be used to isolate construction areas from pedestrian traffic adjacent to the site. Construction procedures will be designed to meet all Occupational Safety and Health Administration (OSHA) safety standards for specific site construction activities.

3.10.5 Construction Mitigation

The Proponent will follow City and MassDEP guidelines. As part of this process, the Proponent and construction team will evaluate the Commonwealth's Clean Air Construction Initiative.

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

"Don't Dump - Drains to Charles River" plaques will be installed at any new storm drains that are replaced or installed by the Proponent.

3.10.6 Construction Employment and Worker Transportation

The number of workers required during the construction period will vary. It is anticipated that approximately 150-200 construction jobs will be created during the peak period of construction. The Proponent will make reasonable good-faith efforts to designate at least 50 percent of the total employee work hours for Boston residents, at least 25 percent of total employee work hours for minorities and at least 10 percent of the total employee work hours for women. The Proponent will enter into a Boston Residents Construction Employment Plan with the City of Boston.

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 Proponent anticipates that the Soldiers Field Park Garage will be used to accommodate worker parking which will discourage parking on neighborhood streets. The general contractor will work aggressively to ensure that construction workers are well informed of the public- and Harvard-owned transportation options serving the area.

3.10.7 Construction Truck Routes and Deliveries

As currently proposed, construction trucks accessing the site will arrive via the Massachusetts Turnpike to the Soldiers Field Road access road to Western Avenue, and will depart using the same roadways. These trucks will be prohibited from using local neighborhood streets to arrive at or depart from the site. During bulk excavation, it is anticipated that approximately 25-30 trucks will arrive and depart at the site. Approximately 25-30 concrete trucks are anticipated during the larger pour periods. An average of 10-15 trucks will arrive and depart for miscellaneous daily deliveries once the structure is started. The construction team will manage deliveries to the site during morning and afternoon peak hours in a manner that minimizes disruption to traffic flow on adjacent streets. The construction team will provide subcontractors and vendors with Construction Vehicle & Delivery Truck Route Brochures in advance of construction activity. “No Idling” signs will be included at the loading, delivery, pick-up and drop-off areas.

3.10.8 Construction Air Quality

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

- ♦ Using wetting agents on areas of exposed soil on a scheduled basis;
- ♦ Using covered trucks;
- ♦ Minimizing spoils on the construction site;

- Monitoring of actual construction practices to ensure that unnecessary transfers and mechanical disturbances of loose materials are minimized;
- Minimizing storage of debris on the site; and
- Providing a wheel wash for vehicles leaving the Project site.

3.10.9 Construction Noise

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

Mitigation measures are expected to include:

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

3.10.10 Construction Vibration

Means and methods for performing work at the site will be evaluated for potential vibration impacts on nearby structures and utilities.

3.10.11 Construction Waste

The Proponent will take an active role with regard to the reprocessing and recycling of construction waste. The disposal contract will include specific requirements that will ensure that construction procedures allow for the necessary segregation, reprocessing, reuse and recycling of materials when possible. For those materials that cannot be recycled, solid waste will be transported in covered trucks to an approved solid waste facility, per MassDEP Regulations for Solid Waste Facilities, 310 CMR 16.00. This requirement will be specified in the disposal contract. Construction will be conducted so that materials that may be recycled are segregated from those materials not recyclable to enable disposal at an approved solid waste facility. HBS will consider donating excess building materials to the Building Materials Resource Center.

3.10.12 Protection of Utilities

Existing site drainage and private infrastructure located within or adjacent to the site will be protected during construction. Specific methods for constructing proposed utilities where they are near to, or connect with, existing water, sewer and drain facilities will be reviewed by BWSC as part of its site plan review process.

3.10.13 Rodent 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 extermination prior to work start-up will consist of treatment of areas throughout the site. During the construction process, regular service visits will be made.

3.10.14 Odor

There is a potential for odor from organic soils during excavation of the site. If odors from the organic soils on the site are noticed, Harvard will provide communication to the community and an odor inhibiting foam will be applied to the odor releasing material at the end of each day.

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

This chapter provides a discussion of the sustainability efforts the HBS will pursue related to the Project, as well as the measures the Proponent will undertake to ensure the building will be resilient to climate change.

4.1 Sustainable Design (LEED)

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

The 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 has been registered with the U.S. Green Building Council (USGBC) and is targeting several credits which span the seven categories and enable the Project to be LEED Certifiable in accordance with Article 37 as described below. The LEED NC v2009 checklist is included at the end of this chapter. Although the checklist currently shows 66 points, HBS is striving for the Chao Center to meet the Gold Certification level. *Credits that are still being studied are italicized.*

Sustainable Sites

The Project site is in a university campus close to several public transportation options, including bus and shuttle services. There is no new parking associated with the Project as the campus parking is located centrally, serving all campus buildings.

Prerequisite 1 Construction Activity Pollution Prevention

The construction manager will submit and implement an Erosion and Sedimentation Control (ESC) Plan for construction activities related to the construction of the new building specific to the Project. The ESC Plan will conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit.

Credit 1 Site Selection

The Project site is located on a previously developed urban site on the HBS campus. Kresge Hall will be demolished to make way for the new building.

Credit 2 Development Density and Community Connectivity

The Project site is on the HBS campus in Boston, MA. The surrounding community is replete with housing, restaurants, shops, grocery stores, educational and religious institutions, performance venues and other community amenities.

Credit 3 Brownfield Redevelopment

The Project site will be assessed for hazardous materials to determine if it is a Brownfield site. The demolition of Kresge Hall may surface waste materials that require special handling and disposal that would qualify for achieving this credit.

Credit 4.1 Alternative Transportation, Public Transportation Access

The proposed Project site is within one-quarter mile of multiple bus and shuttle stops.

Credit 4.2 Alternative Transportation, Bicycle Storage & Changing Rooms

Secure and covered bicycle racks may be located within 200 yards of the building entrance for at least 5 percent of the building occupants. Showers may be included within the building or located within 200 yards of the entrance for 0.5 percent of the building occupants.

Credit 4.3 Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles (FEV)

HBS's parking facilities will designate preferred parking for FEVs for 5 percent of the building's parking spaces. However, these spaces will only be designated once an occupant shows that they have a compliant FEV.

Credit 4.4 Alternate Transportation Parking Capacity

There is no new parking associated with the Project.

Credit 5.2 Site Development, Maximize Open Space

The footprint of the proposed building has been situated to maximize the area of the new Executive Education Quad, and to provide open spaces surrounding the new building.

Credit 6.1 Stormwater Design, Quantity Control

It is expected that runoff from vehicular surfaces and a portion of the proposed building roof will be directed to one infiltration system west of the proposed building. The remaining building roof and impervious pedestrian walkways/plazas will be directed to an infiltration system east of the proposed building. Additional Best Management Practices will be incorporated to manage stormwater across the remainder of the site. Porous pavement will be used to manage stormwater across a majority of the pedestrian walkways on-site, and high profile soil media will be used within landscaped areas to allow for sufficient infiltration.

Credit 6.2 Stormwater Design, Quality Control

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.

Credit 7.1 Heat Island Effect, Non-Roof

The Project team will study select paver materials that might meet the solar reflectance index (SRI) value limits. Trees will also shade the hardscape.

Credit 7.2 Heat Island Effect, Roof

The roof will have a high-albedo roof membrane with an SRI of 78 at minimum.

Water Efficiency

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

Prerequisite 1 Water Use Reduction, 20 Percent Reduction

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

Credits 1.1 Water Efficient Landscaping, Reduce by 50 Percent

The Project may have a permanent irrigation system for the site that will meet the 50 percent water use reduction.

Credit 3 Water Use Reduction

Specified fixtures include high efficiency toilets and urinals and low-flow lavatory and sink faucets. These fixtures will likely achieve at least a 30 percent savings in potable water use. The team is also investigating the use of water-efficient dishwashing equipment for the kitchen. In addition, the team is pursuing the implementation of a rain and process water harvesting gray-water system for toilet flushing at the major toilet rooms with a goal of achieving at least a 50 percent savings in potable water use. The team is also specifying water efficient dishwashing equipment for the kitchen.

Energy and Atmosphere

The building systems will be designed to optimize energy performance and will not use refrigerants that are harmful to the environment. The owner will engage a third-party

Commissioning Agent to confirm the building systems are installed and function as intended and designed.

Prerequisite 1 Fundamental Commissioning of the Building Energy Systems

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

Prerequisite 2 Minimum Energy Performance

The building performance rating will demonstrate a minimum 20 percent improvement in annual energy use, meeting the Stretch Energy Code requirement and exceeding the LEED prerequisite 10 percent annual energy cost improvement, compared to the baseline building performance calculated using the rating method in Appendix G of ANSI/ASHREA/IESNA Standard 90.1-2007. A whole building energy simulation will be used to demonstrate the projected energy savings for the Project.

Prerequisite 3 Fundamental Refrigerant Management

The specifications for refrigerants used in the building HVAC systems will not permit the use of chlorofluorocarbon (CFC) based refrigerants.

Credit 1 Optimize Energy Performance

The proposed building systems will strive for at least a 34 percent performance improvement over a baseline building performance rating. The team will develop a whole building energy model to demonstrate the expected performance rating of the designed building systems.

Credit 2 On-Site Renewable Energy

The Project team is studying renewable energy options for the Project site, in particular, solar domestic hot water.

Credit 3 Enhanced Commissioning

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

Credit 4 Enhanced Refrigerant Management

Long life, high-efficiency mechanical equipment will be specified for the HVAC systems, and the refrigerants specified for the systems will have low ozone-depletion and global warming potentials. The team is studying how to meet the credit requirements for the food service equipment since walk-in refrigerators and freezers often do not meet the credit threshold.

Credit 5 Measurement and Verification

HBS develops and implements measurement and verification plans for all buildings on its campus.

Credit 6 Green Power

HBS will consider purchasing green power via a two-year renewable energy contract to provide a minimum of 35 percent of the building's electricity from renewable sources.

Materials and Resources

Throughout the demolition and construction phase of the Project, the contractor plans to divert construction and demolition waste related to the Project from area landfills, and procure materials that have recycled content and/or are manufactured locally.

Prerequisite 1 Storage and Collection of Recyclables

Storage of collected recyclables will be accommodated throughout the building.

Credits 2.1 and 2.2 Construction Waste Management

Prior to the start of demolition, the Contractor will prepare a Construction Waste Management plan. The Contractor will divert as much demolition debris and construction waste from area landfills as possible with a goal of achieving 75 percent diversion.

Credits 4.1 and 4.2 Recycled Content 10 Percent/20 Percent (post-consumer & ½ pre-consumer)

The Project specifications will require materials to include pre- and/or post-consumer recycled content. During construction, material submittals will include a document indicating pre- and post-consumer recycled content percentages. The Contractor will track the recycled content for each material with a Project goal to achieve at least 10 percent recycled-content materials based on overall Project materials costs.

Credit 5.1 and 5.2 Regional Materials, 10 Percent/20 Percent Extracted, Processed and Manufactured Regionally

The Project specifications will indicate which materials are to be extracted, harvested, recovered and manufactured within a 500-mile radius of the Project site. The contractor will track the source location for each material with a Project target to achieve at least 10 percent regional materials based on overall Project materials costs.

Credit 6 Rapidly Renewable Materials

The team is exploring the applicability of rapidly renewable materials for the Project.

Credit 7 Certified Wood

The Project specifications will indicate that a minimum of 50 percent of purchased wood installed within the building envelope be FSC certified.

Indoor Environmental Quality

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

Prerequisite 1 Minimum IAQ Performance

The building mechanical systems will be designed to meet or exceed the requirements of ASHRAE Standard 62.1-2007 sections 4 through 7 and/or applicable building codes.

Prerequisite 2 Environmental Tobacco Smoke (ETS) Control

The building will be a non-smoking environment.

Credit 1 Outdoor Air Delivery Monitoring

The Project will incorporate permanent CO_2 sensors and measuring devices to provide feedback on the performance of the HVAC system. Devices will be programmed to generate an alarm when the conditions vary by 10 percent from a set point.

Credit 2 Increased Ventilation

The Project team is studying the option of increased ventilation rates that are 30 percent above ASHRAE 62.1-2007. This will be weighed against the anticipated energy penalty associated with increased conditioning needs for ventilation air by using the whole building energy model.

Credit 3.1 Construction IAQ Management Plan (during construction)

The contractor will develop an Indoor Air Quality Management Plan for the construction and pre-occupancy phases of the Project to meet/exceed the recommended Control Measures of the SMACNA IAQ Guidelines for Occupied buildings Under Construction 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).

Credit 3.2 Construction IAQ Management Plan (before occupancy)

The contractor will schedule a building flush-out after the completion of construction and prior to occupancy. HBS may decide to conduct baseline IAQ testing in place of flush-out to demonstrate that contaminant maximum concentrations are not exceeded.

Credits 4.1 Low-Emitting Materials, Adhesives & Sealants

The specifications will include requirements for adhesives and sealants to meet low volatile organic compounds (VOC) criteria for adhesives and sealants.

Credits 4.2 Low-Emitting Materials, Paints and Coatings

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

Credits 4.3 Low-Emitting Materials, Flooring Systems

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

Credit 4.4 Low Emitting Materials, Composite Wood and Agrifiber Products

The Project team plans to use composite wood and agrifiber products that contain no added urea-formaldehyde.

Credit 5 Indoor Chemical and Pollutant Source Control

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

Credit 6.1 Controllability of Systems, Lighting

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

Credit 7.1 Thermal Comfort Design

It is the intent of the design to meet ASHRAE 55-2004 Thermal Comfort Conditions for Human Occupancy.

Credit 7.2 Thermal Comfort Verification

HBS intends to develop a thermal comfort survey to be distributed after occupancy. A plan for corrective action will be developed if the survey indicates that more than 20 percent of occupants are dissatisfied with the thermal comfort in the building.

Innovation & Design Processes

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

Credit 1.1 Green Housekeeping

HBS has a campus green housekeeping plan that is implemented in all of its buildings. The plan meets all LEED for Existing Buildings: Operations & Maintenance (EB O&M) requirements for green cleaning.

Credit 1.2 Green Building Education

HBS requires all campus buildings to implement a green education program. Strategies that have been discussed include informational touchscreens, occupant outreach, and green building tours.

Credit 1.3 Exemplary Performance, Construction Waste Management

The Project team will study how to achieve exemplary credit for maximized diversion of construction waste.

Credit 1.4 and 1.5 Pilot Credits

The Project team will research LEED Pilot credits to be submitted as an ID credit. Possible strategies include low-mercury lighting or bicycle network and sharing programs.

Credit 2 LEED Accredited Professional

The team has several LEED accredited professionals working on the Project.

Regional Priority Credits

Regional Priority Credits (RPC) are established LEED credits designated by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs, an additional credit is awarded to the project. Up to four RPCs can be achieved on a project. The following RPCs are applicable to the Project area:

Credits Pursued

SSc2 Development Density and Community Connectivity

SSc6.1 Stormwater Design: Quantity Control

SSc7.1 Heat Island Effect: Non-Roof

SSc7.2 Heat Island Effect: Roof

Credits Not Pursued

MRc1.1 and 1.2 Building Reuse

SSc5.1 Site Development: Protect or Restore Habitat

SSc8 Light Pollution Reduction

EQc6.2 Controllability of Systems: Thermal Comfort

EQc8 Daylight and Views

As described above, HBS is committed to sustainable practices. HBS has committed to reducing its greenhouse gas emissions by 30 percent of 2006 levels by 2016. Currently, eight HBS buildings are LEED certified, and HBS has a goal of all new projects being LEED certified at the Gold Level, including the Chao Center.

4.2 Climate Change

4.2.1 Introduction

In an effort to minimize the Project's impact on climate change, the Project will maximize energy performance and use renewable resources, as described above. Measures include high-efficiency lighting and daylighting use, interior design encouraging use of stairs over elevators, Energy Star office and classroom equipment, and gas-based kitchen equipment. These measures will minimize the building's energy demand, and thus its contribution of climate changing pollutants. However, further measures will be required to ensure the building will be resilient as inevitable changes to the climate occur.

Like the City of Boston, Harvard University is especially interested in the adaptability of its campus and the city to long-term climate change. The City of Boston has manifested this interest through the Mayor's Executive Order Relative to Climate Change in Boston and the recent convening of the Mayor's Climate Action Leadership Committee. In April 2013, the BRA released a Climate Change Preparedness Questionnaire regarding project specific strategies and actions to make projects more resilient to the effects of climate change. The Questionnaire for this Project has been submitted electronically to the BRA and is included with this PNF in Appendix A. As presented in its recently filed IMP, Harvard University proposes to adopt climate change adaptation procedural guidelines and climate change resilience strategies for the development of the Allston campus, which includes the HBS campus. In implementing these guidelines and policies, Harvard plans to conduct an Allston campus-wide vulnerability assessment and adaptation plan, to ensure that all new development is resilient to the impacts of climate change.

Harvard University has reviewed the Massachusetts Climate Change Adaptation Report to assess the possible climate change impacts to the Allston campus. The Report identifies and summarizes the likely changes to the climate, climate impacts, vulnerabilities, and possible adaptation measures in Massachusetts. The Report, published in 2011 by the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) and the Climate Change Adaptation Advisory Committee, uses the most recent information and climate predictions available, including from the International Panel on Climate Change (IPCC) and other peer-reviewed scientific climate change projections.

For Harvard University's Allston campus, the most impactful changes will be in air and sea surface temperature, precipitation, and sea level rise. It is reasonable to assume that the areas which are currently at risk for flooding and hurricane surge in Allston today, will continue to be of concern in the future. The impacts from each of these changes that are of particular importance for the development of the Allston campus are outlined below.

4.2.2 Ambient Air Temperature

Increases in ambient temperature will result in more frequent days above 90˚F and 100˚F. The Report predicts 30-60 days over 90˚F by 2100 (up from 12 under current conditions), and between 3-28 days above 100˚F by 2100, depending on the emissions scenario. There will also be longer durations of heat waves. These conditions will place a high demand on the electric grid, risking more frequent power outages. There are also air quality implications leading to health concerns for building occupants. These conditions can be worse in urban areas, because of the heat-absorbing pavement and buildings.

In order to prepare for this, the roof will be constructed with high reflective materials and be partially vegetated, which can reduce energy use in addition to reducing the heat island effect. New shade trees around the new building will also reduce the local heat island effect. As described previously, the Project will involve no addition of parking spaces, thereby minimizing the amount of new impervious pavement. In fact, the proposed Project is expected to reduce impervious area onsite by approximately five percent, plus or minus, from the existing condition, including the proposed porous pavement area. The building will have a high performance envelope (walls, roof, glazing) that will help minimize heat gains and also minimize the energy required to provide a comfortable indoor environment. Ventilation systems will incorporate enthalpy energy recovery to cool and dehumidify outdoor air by using relief air. HBS's chilled water plant will provide cooled water to the Chao Center with improved efficiency over a building-only system.

4.2.3 Sea Surface Temperature

Increases in sea surface temperature may increase the frequency and intensity of severe ocean storms, which could cause flooding events on the Allston campus.

In order to mitigate this, the Project will include a stormwater retention/detention system to capture and recharge minimally one-inch of rainfall over the total site to mitigate the peak rate of runoff and result in a total runoff volume significantly below the existing levels. HBS is working to achieve a goal of capturing and recharging 1.5 inches of rainfall over the total site.

4.2.4 Sea Level Rise

Sea level rise is caused by local coastal subsidence, plus the expansion of water with increased temperatures and the melting of land ice in places such as Greenland and Antarctica. According to the IPCC, if sea level continues to rise at the current rate, the sea level in Massachusetts as a whole will rise by one foot by the year 2100.[1] However, using a high emissions scenario, sea level rise could reach six feet. As was described in the IMP, due to the Project's location on the Charles River behind the Charles River Dam, impacts from sea level rise are not currently anticipated in a 50-year scenario with a 5.5 foot coastal flood. However, in a 100-year scenario with a 7.5 foot coastal flood, the flood elevation would exceed the top of the dam and would result in widespread flooding within the Charles River Basin.

4.2.5 Precipitation

There are expected changes in precipitation patterns in Massachusetts that will affect the Allston campus. There will be an increase in overall precipitation. However, it is expected that the precipitation will fall more frequently in the winter and less so in the summer—leading to the extremes of both flooding and droughts. Winter precipitation may increase as much as 30% under the high emissions scenario, but due to the changes in air temperatures, it may fall more frequently in the form of rain and ice rather than snow. Ice storms have different implications for building safety and power reliability than snow and rain storms. Ice storms typically impact trees and above-ground utility infrastructure. Since the majority of the HBS campus utility infrastructure is underground, it is not anticipated to be impacted by ice events.

[1] IPCC (Intergovernmental Panel on Climate Change), 2007. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Avery, M. Tignor, and H. L. Miller (eds.)]. Cambridge University Press, Cambridge, UK, and New York, 996 pp.

Extreme precipitation events (those with greater than two inches of rainfall) are predicted to increase in frequency. The Allston campus is expected to experience a 100-year flood every two or three years by 2050, and every year to two years by 2100. Basement-level utilities will be mounted on concrete pads to be protected from flooding, and the majority of the building will be equipped with sump pumps. The Proponent is considering the use of submersible electrical switchgear.

As described above, the Project will include a stormwater retention/detention system to capture and recharge minimally one-inch of rainfall over the total site to mitigate the peak rate of runoff and total runoff volume significantly below the existing levels.

LEED 2009 for New Construction

Chao Center

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

Achievability rating: **Hi** = 90%, **Med** = 60%, **Low** = 10%, **NP** = not possible.

Achievability					
hi	med	low	NP		
66	10	10	24	66	**Projected Points for GOLD targeting**

hi	med	low	NP	Credit	Prerequisites	Standard
Y				SS Prereq 1	**Construction Activity Pollution Prevention**	Create and implement erosion control plan that meets the 2003 EPA Construction General Permit.
Y				WE Prereq 1	**Water Use Reduction:** 20%	Reduce water use by 20% over the baseline specified in LEED.
Y				EA Prereq 1	**Fundamental Commissioning of Building Energy Systems**	Engage commissioning agent, and develop and execute a commissioning plan.
Y				EA Prereq 2	**Minimum Energy Performance**	Reduce energy cost by 10%, compared to ASHRAE 90.1-2007, Appendix G
Y				EA Prereq 3	**Fundamental Refrigerant Management**	Eliminate CFCs in building HVAC&R.
Y				MR Prereq 1	**Storage & Collection of Recyclables**	Provide space 225 ft^2 for the collection and storage of paper, cardboard, glass, plastic, and metals.
Y				IEQ Prereq 1	**Minimum IAQ Performance**	Meet sections 4 through 7 of ASHRAE 62.1-2007.
Y				IEQ Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Prohibit smoking inside building, and locate exterior smoking areas at least 25 feet away from building.

hi	med	low	NP	Credit	Sustainable Sites	Standard
21	3	0	2			
1				SS Credit 1	**Site Selection**	Do not develop sites that are prime farmland, floodplains or wetlands, parkland, or key habitat.
5				SS Credit 2	**Development Density and Community Connectivity**	Locate project in dense areas or near key community services.
	1			SS Credit 3	**Brownfield Redevelopment**	Locate project on a remediated brownfield site.
6				SS Credit 4.1	**Alternative Transportation:** Public Transportation Access	Locate project within 1/2 mile of a rail station or 1/4 mile of two bus lines.
	1			SS Credit 4.2	**Alternative Transportation:** Bicycle Storage & Changing Rooms	Provide bicycle racks for 5% of builidng occupants and showers for 0.5% of FTE occupants.
3				SS Credit 4.3	**Alternative Transportation:** Low-Emitting and Fuel-Efficient Vehicles	Provide preferred parking for hybrid vehicles for 5% of the project's parking capacity.
2				SS Credit 4.4	**Alternative Transportation:** Parking Capacity	Do not exceed zoning parking requirements; provide preferred carpool parking for 5% of parking capacity.
			1	SS Credit 5.1	**Site Development:** Protect or Restore Habitat	Restore 50% of site open space or 20% of the total site, whichever is greater, for native /adapted vegetation.
1				SS Credit 5.2	**Site Development:** Maximize Open Space	Exceed zoning open space requirements by 25%.
1				SS Credit 6.1	**Stormwater Design:** Quantity Control	No net increase site runoff, OR, reduce over existing conditions by 25%.
1				SS Credit 6.2	**Stormwater Design:** Quality Control	Develop stormwater plan that meets local best management practice, and removes 80% TSS.
	1			SS Credit 7.1	**Heat Island Effect:** Non-Roof	Use open-grid paving, light-colored paving, or provide shade on 50% of all hardscape.
1				SS Credit 7.2	**Heat Island Effect:** Roof	Use light-colored membrane for 75% of roof or vegetated roof for 50% of roof.
			1	SS Credit 8	**Light Pollution Reduction**	No nighttime light trespass from building AND meet exterior lighting requirements of ASHRAE 90.1-2007.

hi	med	low	NP	Credit	Water Efficiency	Standard
4	0	2	4			
2				WE Credit 1	**Water Efficient Landscaping:** 50% Reduction	Reduce potable water used for irrigation by 50%
			2	WE Credit 1	**Water Efficient Landscaping:** No Potable Water	No potable water use for irrigation.
			2	WE Credit 2	**Innovative Wastewater Technologies**	Reduce water used for sewage conveyance by 50%.
2		2		WE Credit 3	**Water Use Reduction:** 30% / 35% / 40%	Reduce water use by 30%/35%/40% over the baseline specified in LEED.

hi	med	low	NP	Credit	Energy & Atmosphere	Standard
17	4	4	9			
3				EA Credit 1	**Optimize Energy Performance:** 12% / 14% / 16%	Reduce building energy cost by 12%/ 14%/ 16% compared to ASHRAE 90.1-2007, Appendix G.
3				EA Credit 1	**Optimize Energy Performance:** 18% / 20% / 22%	Reduce building energy cost by 18%/ 20%/ 22% compared to ASHRAE 90.1-2007, Appendix G.
3				EA Credit 1	**Optimize Energy Performance:** 24% / 26% / 28%	Reduce building energy cost by 24%/ 26%/ 28% compared to ASHRAE 90.1-2007, Appendix G.
3				EA Credit 1	**Optimize Energy Performance:** 30% / 32% / 34%	Reduce building energy cost by 30%/ 32%/ 34% compared to ASHRAE 90.1-2007, Appendix G.
	1	2		EA Credit 1	**Optimize Energy Performance:** 36% / 38% / 40%	Reduce building energy cost by 36%/ 38%/ 40% compared to ASHRAE 90.1-2007, Appendix G.
			4	EA Credit 1	**Optimize Energy Performance:** 42% / 44% / 46% /48%	Reduce building energy cost by 42%/ 44%/ 46%/ 48% compared to ASHRAE 90.1-2007, Appendix G.
	1		1	EA Credit 2	**On-Site Renewable Energy:** 1% / 3%	Produce renewable energy on-site for 1%/ 3% of building energy consumption, calculated by cost.
			2	EA Credit 2	**On-Site Renewable Energy:** 5% / 7%	Produce renewable energy on-site for 5%/ 7% of building energy consumption, calculated by cost.
			2	EA Credit 2	**On-Site Renewable Energy:** 9% / 11% / 13%	Produce renewable energy on-site for 9%/ 11%/ 13% of building energy consumption, calculated by cost.
2				EA Credit 3	**Enhanced Commissioning**	Design review, post occupancy review, recommissioning manual.
		2		EA Credit 4	**Enhanced Refrigerant Management**	Select refrigerants with low global warming potential and ozone depletion potential.
3				EA Credit 5	**Measurement & Verification**	Develop and implement an M&V plan that meets IPMVP, Options B or D.
	2			EA Credit 6	**Green Power**	Purchase Green-e certified electricity supply for 2 years, for 35% of building's electricity demand.

5	2	1	6	**Materials & Resources**		**Standard**
			3	MR Credit 1.1	**Building Reuse:** Maintain Existing Walls, Floors, & Roof, 55% / 75%/ 95%	Maintain existing structure and envelope for 55% / 75% / 95% of the existing building.
			1	MR Credit 1.2	**Building Reuse:** Maintain Existing Interior Nonstructural Elements, 50%	Use existing interior nonstructural elements in at least 50% of the completed building.
2				MR Credit 2	**Construction Waste Management:** 50% / 75%	Create a construction waste management plan and recycle and/or salvage construction waste.
			2	MR Credit 3	**Materials Reuse:** 5% / 10%	Use salvaged, refurbished, or reused materials for 5% / 10% of construction materials, calculated by cost.
1	1			MR Credit 4	**Recycled Content:** 10% / 20% (post-consumer + 1/2 pre-consumer)	Use materials or products with recycled content for 10% / 20% of construction materials, calculated by cost.
1	1			MR Credit 5	**Regional Materials:** 10% / 20%	Use materials extracted and manufactured within 500 miles for 10%/20% of construction materials, calculated by cost.
		1		MR Credit 6	**Rapidly Renewable Materials**	Use rapidly renewable materials for 2.5% of construction materials, calculated by cost.
1				MR Credit 7	**Certified Wood**	Use FSC-certified wood for 50% of wood-based materials, calculated by cost.

10	1	2	3	**Indoor Environmental Quality**		**Standard**
1				IEQ Credit 1	**Outdoor Air Delivery Monitoring**	Install monitoring of outdoor air on ventilation systems and monitor CO2 concentrations.
		2		IEQ Credit 2	**Increased Ventilation**	Increase ventilation rates by 30% above ASHRAE 62.1-2007.
1				IEQ Credit 3.1	**Construction IAQ Management Plan:** During Construction	Develop an IAQ plan that meets SMACNA IAQ Guidelines for Occupied Buildings Under Construction.
1				IEQ Credit 3.2	**Construction IAQ Management Plan:** Before Occupancy	Provide air quality testing or building flush-out prior to occupancy.
1				IEQ Credit 4.1	**Low-Emitting Materials:** Adhesives & Sealants	Use adhesives and sealants that comply with the SCAQMD Rule #1168
1				IEQ Credit 4.2	**Low-Emitting Materials:** Paints & Coatings	Use products with VOC levels specified in Green Seal Standard GS-11 and GC-03, and SCAQMD Rule 1113.
1				IEQ Credit 4.3	**Low-Emitting Materials**: Flooring Systems	Use carpet that meets the CRI Green Label requirements and FloorScore compliant hard surface flooring.
1				IEQ Credit 4.4	**Low-Emitting Materials:** Composite Wood & Agrifiber Products	Use materials with no added urea-formaldehyde resins or adhesives.
1				IEQ Credit 5	**Indoor Chemical & Pollutant Source Control**	Floor grates at doors, MERV 13 filters, and exhausts and hazardous liquid container in chemical use areas.
	1			IEQ Credit 6.1	**Controllability of Systems:** Lighting	Provide lighting controls for 90% of individuals AND 100% of group lighting controls.
			1	IEQ Credit 6.2	**Controllability of Systems:** Thermal Comfort	Provide comfort controls or operable windows for 50% of individuals AND 100% of group spaces.
1				IEQ Credit 7.1	**Thermal Comfort:** Design	Meet ASHRAE 55-2004, Thermal Comfort Conditions for Human Occupancy.
1				IEQ Credit 7.2	**Thermal Comfort:** Verification	Meet IEQc7.1, provide permanent monitoring system, and perform a thermal comfort survey after occupancy.
			1	IEQ Credit 8.1	**Daylight & Views:** Daylight	Meet prescriptive requirements, or achieve 25 footcandles, in 75% of regularly occupied spaces.
			1	IEQ Credit 8.2	**Daylight & Views:** Views	Provide direct views to the outside in 90% of regularly occupied spaces.

6	0	0	0	**Innovation in Design**		**Standard**
1				ID Credit 1.1	**Innovation in Design, Green Housekeeping**	Pending GBCI judgment.
1				ID Credit 1.2	**Innovation in Design, Green Building Education**	Pending GBCI judgment.
1				ID Credit 1.3	**Innovation in Design, Greatly Exceed CWM target**	Pending GBCI judgment.
1				ID Credit 1.4	**Innovation in Design, Low Mercury Lighting**	Pending GBCI judgment.
1				ID Credit 1.5	**Innovation in Design, tba**	Pending GBCI judgment.
1				ID Credit 2	**LEED™ Accredited Professional**	LEED Accredited Professional on design team.

3	0	1	0	**Regional Priority**		**Standard**
1				RP Credit 1.1	**Development Density and Community Connectivity**	Locate project in dense areas or near key community services.
1				RP Credit 1.2	**Stormwater Design: Quantity Control**	No net increase site runoff, OR, reduce over existing conditions by 25%.
		1		RP Credit 1.3	**Heat Island Effect: Non-Roof**	Use open-grid paving, light-colored paving, or provide shade on 50% of all hardscape.
1				RP Credit 1.4	**Heat Island Effect: Roof**	No nighttime light trespass from building AND meet exterior lighting requirements of ASHRAE 90.1-2007.

Chapter 5

Urban Design

5.0 URBAN DESIGN

The design team has conducted an extensive design exploration to arrive at the proposed scheme. During the initial steps of Concept Design, the design team tested many alternative siting and massing strategies to understand the Chao Center's relationships to the McKim, Mead and White portion of the HBS campus, the Executive Education precinct, and the culture of HBS.

5.1 Siting Context

The Project is located at an important place in the physical geometry of the HBS campus at the end of Harvard Way, and in the social geography of HBS, connecting Executive Education participants with others at the School. The building design team (Goody Clancy) collaborated with the Project's landscape architect (Reed Hilderbrand) to ensure the Chao Center establishes new pedestrian links while reinforcing existing pedestrian networks. The Project works within the larger campus landscape context to define a sequence of distinctive outdoor spaces, including the Executive Education Quadrangle that completes the outdoor space west of Tata Hall, the "North Court" between Chao Center and McCollum Center, and a pedestrian oriented space at the end of Harvard Way.

Pedestrian Circulation: The Project is sited to strengthen emerging larger scale circulation patterns across the HBS campus as the Allston campus is developed, linking Boston and Cambridge. In the IMP, East Drive is identified as one of the "ladder connecting streets" strengthening connections between Boston and Cambridge. Proposed changes to the landscape in the Executive Education Quad and along East Drive adjacent to the Project facilitate pedestrian movement and improve the quality of the open spaces pedestrians move through (see Figure 5-1).

By siting the Project well south of the existing Kresge Hall, the building creates space for the north spine, a broad path from Weeks Bridge (an important pedestrian link between Boston and Cambridge) to East Drive and Harvard Way. This plan is a change from the landscape plans for the Executive Education Quad proposed for Tata Hall. It establishes a clearer, shorter, safer campus and urban-scale connection through the Quad by connecting to Harvard Way through a more gracious landscape experience. The future renovation of Baker Hall and the creation of a shared mechanical space within the basement of the Project create further opportunities for added ground floor space within Baker Hall that will open to and animate the north spine.

New Outdoor Spaces: Together with Tata Hall, the Chao Center completes the emerging Executive Education Quad. It forms the western edge of this significant campus scale space in the center of the Executive Education precinct. Public spaces within the building (multi-purpose room, east lounge, and coffee bar) line the new Quad and open onto a terrace facing the Quad, animating the outdoor space. The east face of the Chao Center is shifted eight degrees to open the space away from Tata Hall and bring McArthur Hall and McCollum Center, a focus of academic activity, into the new Executive Education Quad. The eight degree shift aligns with the campus geometry, bringing the subtle dynamism of the historic open spaces there to the Executive Education precinct.

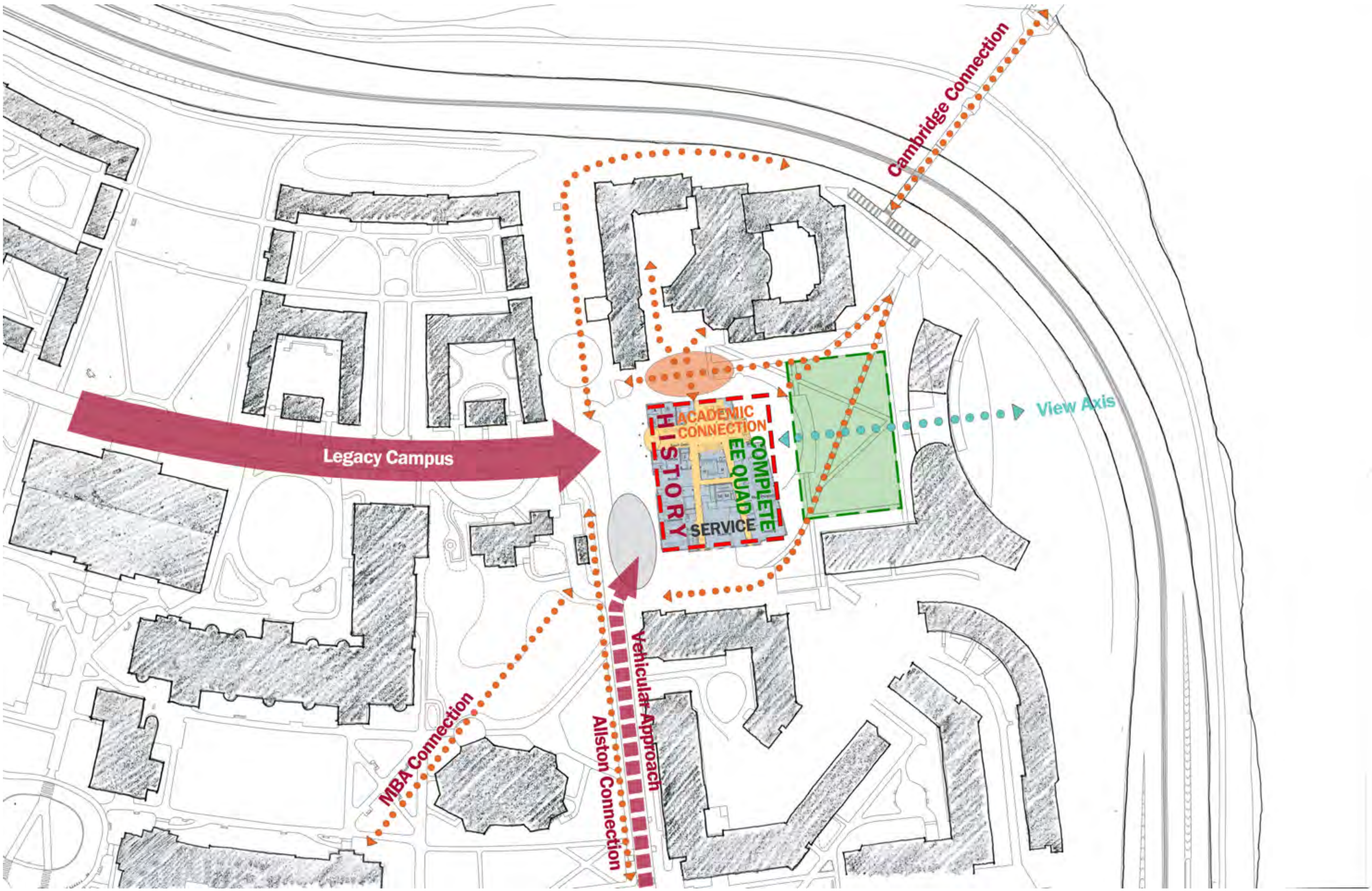


Figure 5-1: Site Context Showing Pedestrian Circulation

Source: Goody Clancy

The Project's calm, largely transparent north wall shapes the "North Court" and welcomes Executive Education participants from Baker, McArthur, and McCollum Halls. This newly found space on the campus is made possible by siting the Chao Center south of the footprint of Kresge Hall. It will be an active space animated by Executive Education participants moving from classes in McCollum Center to the Chao Center, and by the campus wide activity of pedestrians moving along the north spine.

The unified west entrance to the Project from Harvard Way, marked with a gracefully curved portico, marks an important new open space, and carries the landscape elements and character of Harvard Way across East Drive to the building. Limiting vehicular traffic on East Drive to the building's drop-off loop south of Harvard Way will allow East Drive north of this point, and the intersection with Harvard Way, to be landscaped as a space for pedestrians (with provision for emergency vehicles), with increased connectivity and amounts of green space along East Drive.

5.2 Massing

The Project is massed to achieve a gracious presence at the east end of Harvard Way, set back from East Drive to shape a dignified outdoor space at this important place on the campus. The Chao Center reflects the scale of the McKim, Mead and White buildings along Harvard Way. Like them, it is horizontal, with a two story brick body on a short granite base. Its west elevation, facing the McKim, Mead and White campus creates a broad face along East Drive, with a three story glazed volume behind a gracefully curved two-story portico marking the Harvard Way axis. An attic story at the top of the building reinforces the predominately horizontal massing of the building, and reflects the restrained tops of the academic buildings along Harvard Way. The east façade facing the Executive Education Quad and Tata Hall, and the north façade facing the north court, are calm, two-story brick and glass volumes, punctuated by the three-story glazed volume that contains the Chao Center's public spaces and aligns with Harvard Way.

5.3 Exterior Character

The exterior design of the Project is intended to resonate with the Georgian influences of the McKim, Mead and White campus, while responding in a more contemporary way to Tata Hall and the other Executive Education precinct buildings. Figures 5-2 through 5-7 compare existing exterior views of the Project site with the designs of the Project. The proposed masonry elevations reflect the key principles of Georgian architecture, including:

- Local symmetry;
- Primarily horizontal massing;
- Use of monumental elements in institutional buildings;
- Calm roof volumes above a distinct cornice;

Figure 5-2: Existing View from Harvard Way

Source: Goody Clancy

Figure 5-3: Proposed View from Harvard Way

Expanded PNF

Source: Goody Clancy

Figure 5-4: Existing View from the Weeks Bridge

Source: Goody Clancy

Figure 5-5: Proposed View from the Weeks Bridge

Source: Goody Clancy

Figure 5-6: Existing View from the Southwest

Source: Goody Clancy

Figure 5-7: Proposed View from the Southwest

Source: Goody Clancy

- ♦ Graphical secondary elements; and
- ♦ Consistently proportioned, vertically oriented glazing with a high wall to glass ratio.

The building's facades are designed to elegantly frame the new open spaces it shapes to its west, north, and east. The north and east sides of the building, facing McCollum Center and Tata Hall respectively, are made up of a broad series of vertically oriented glazed openings, proportioned to reflect the Georgian campus, but changing the ratio of wall to glass to connect with the more contemporary style of the emerging Executive Education precinct.

5.4 Interior

The interior is arranged around a central hub for Executive Education participants that serves as an orienting element on arrival day, and continues as a daily interaction space during the duration of their program. The hub extends the pedestrian circulation along Harvard Way, through the building, into the Executive Education Quad. This hub will create a nexus between the Executive Education participants and the larger HBS community, including MBA and Doctoral students. The building will be the central home for Executive Education staff as well. Active spaces on the ground floor—a coffee bar, the Hub, and the highly programmed multi-purpose room—will animate the Executive Education Quad.

The loading dock is located within an interior garage, allowing most functions to be closed off behind an overhead door. The central atrium/hub will be shaped and formed to allow presentations by a speaker, exhibits, and interaction among the HBS community. Classrooms are designed to provide flexibility, appropriate technology, scalability and appropriate intimacy for a given class size.

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 Kresge Hall, constructed in 1953. Buildings in the immediate vicinity of the Project site are all contemporary, including McArthur (ca. 1999), Esteves (formerly Baker) (ca. 1970), and McCollum (1970) Halls to the north, Tata Hall (2013) to the east, and the Soldiers Field Park Apartments (1976) to the south.

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

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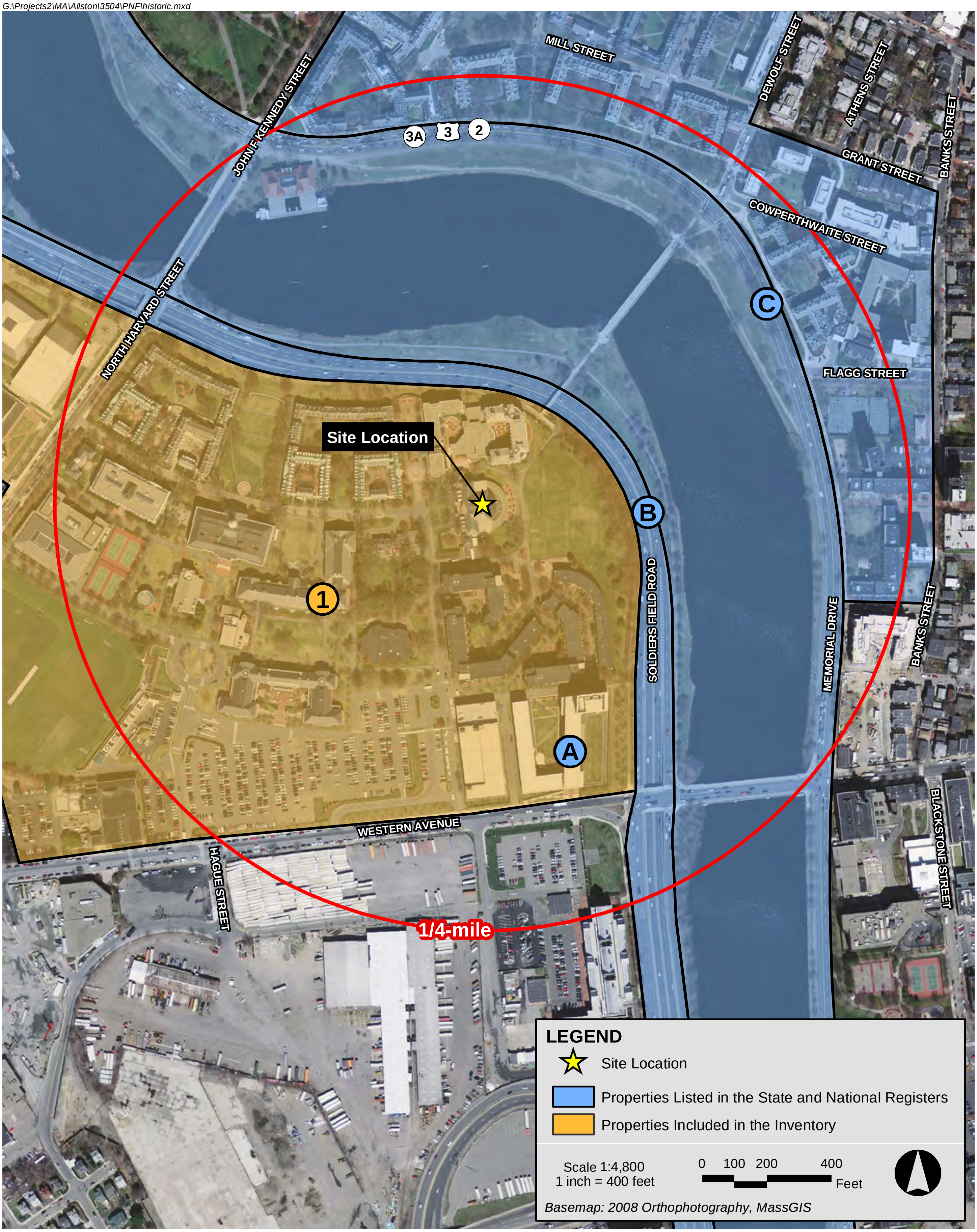

6.1.2 Archaeological Resources

The proposed Project site is located on previously disturbed and filled land. No previously identified archaeological resources are located within the Project site. No impacts to archaeological resources are anticipated.

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 Construction Impacts

The Project includes the demolition of Kresge Hall located within the Harvard Business School – Athletic Facilities Area, which is included in the Inventory. Kresge Hall is a Georgian Revival, three-story brick building, which was built in 1953 from designs by Perry, Shaw and Hepburn, Kehoe and Dean Architects. Following its original construction, two one-story additions were added in the 1970s, one on the northwest corner and one on the southwest corner of the building. Currently, these additions house offices, storage space, restrooms, and other back-of-house uses.

As described in Section 2.2.2, Harvard has been evaluating the long-term use of Kresge Hall for many years. After careful review, Harvard and HBS have concluded that Kresge Hall does not meet the Executive Education programs goals and objectives for a gateway center, and the building cannot be renovated or expanded to meet the programmatic needs of the Executive Education program which are optimally located on this site.

6.2.2 Visual Impacts

The new building has been sited and designed to be responsive to and harmonious with the historic McKim, Mead and White campus in terms of its height, scale, form, and materials. The building has been sited with the main entry and formal front on axis with Harvard Way to strengthen the experience of arrival, and to complement the historic site plan. The large outdoor reception and circulation area will create a direct link between the historic landscape features and buildings of Harvard Way, and the contemporary Executive Education Quad to the east.

The building has been designed to be similar in height and scale to the historic McKim, Mead and White academic buildings (Baker Library and Morgan Hall) and the residential buildings along Harvard Way. The glazed lantern of the Chao Center, on axis with Harvard Way, is 48 feet high, smaller than, but comparable to the Baker Hall portico (49 feet), reflecting each building’s relative place in the hierarchy of functional and symbolic significance on the HBS campus (see Figure 5-2). The brick and limestone base and body of the building is approximately 36 feet high, similar in scale to the adjacent McKim, Mead and White residential buildings.

The building massing, like Baker Hall and Morgan Hall, is horizontal. The two-story brick body of the building sits on a low granite base. The west elevation facing Harvard Way extends 185 feet to create a broad face along East Drive, punctuated by the three-story portico centered on

Harvard Way. An attic story at the third floor, largely clad in white painted metal, reinforces the horizontal massing and reflects the restrained "tops" (balustrades with receding, low pitched slate roofs) of the original HBS campus buildings.

The building will be made from a simple material palette of brick masonry, limited limestone elements, and white painted trim at windows, entrances, and cornices, to visually connect it to the historic campus. The tall proportions of openings, their spacing and repetitive pattern, and the ratio of wall-to-window openings are harmonious with the historic McKim, Mead and White campus without replicating it.

Located at the critical intersection of Harvard Way and East Drive, the new Chao Center will provide a prominent gateway to the central Executive Education functions and support spaces for participants that will reflect the design of the existing campus. This new building and its design are key to the continued growth and success of the Executive Education programs at HBS.

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 through 3-14.

The existing site includes Kresge 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 west, which results in some minor new shadow on the immediate surrounding HBS campus and within the area of the Kresge Hall footprint. Shadow impacts to surrounding HBS buildings are minimal. There will be new shadow cast on the east elevation of McCulloch Hall at 9:00 a.m. on December 21; on the south elevation of Baker Hall at 12:00 p.m. on December 21; and on the west elevations of Tata Hall at 6:00 p.m. on June 21 and September 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 will be implemented prior to and during construction, and will likely consist of settlement monitoring of adjacent buildings. The Project's geotechnical team will install settlement points on the surrounding buildings. The team will survey/monitor those points prior to, during, and post construction.

In addition, seismographs will record vibrations during sheet pile wall installation (excavation support wall) and foundation pile installation 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. A MHC Project Notification Form has been filed with the MHC to initiate the State Register Review process.

6.3.2 Boston Landmarks Commission

The proposed demolition of the existing building on the Project site, Kresge Hall, will be subject to review by the BLC under Article 85 of the Boston Zoning Code. An Article 85 Application for the property has been submitted to the BLC.

Chapter 7

Infrastructure Systems

7.0 INFRASTRUCTURE SYSTEMS

This section describes the infrastructure systems that will support the Project. 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.

The systems discussed below include those owned or managed by the Boston Water and Sewer Commission (BWSC), private utility companies, and on-site 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 Kresge Hall building along the west face and flow towards Harvard Way. Sewer generation flows west and south within HBS's campus through a series of 6- to 18-inch pipes to a 12-inch sewer main in North Harvard Street and possibly to a 24-inch reinforced concrete pipe sewer main in Western Avenue, respectively.

Sewage generated in the Project area is conveyed to the Massachusetts Water Resources Authority (MWRA) facility on Deer Island via the MWRA South Charles Relief Sewer and the Boston Main Drainage Tunnel.

7.1.2 Demand/Use

The existing building on the Project site generates approximately 18,640 gallons per day (gpd) of sanitary sewage, and the Project will generate approximately 23,720 gpd of sewage, representing an increase of approximately 5,080 gpd. Generation rates from the Massachusetts 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 wastewater generation is anticipated to be less than approximately 23,720 gpd.

7.1.3 Proposed Connection

The sewer service for the Project will tie into HBS's sanitary sewer system which discharges to BWSC mains located in Harvard Way, North Harvard Street and Western Avenue. Harvard will coordinate with the BWSC on the design and capacity of the proposed connection to the sewer system. In addition, the Proponent will submit a General Service Application and site plan for review as the Project progresses.

The Project anticipates an increase in wastewater flows exceeding 15,000 gpd; therefore, a Sewer Connection Permit (self-certification) from MassDEP may be required in connection with the

Project. However, based on anticipated changes in the school's food preparation program along with water conservation methods such as low-flow toilets, sewage demands are anticipated to be similar to existing demands.

Based on the projected 1,200 meals per day and criteria from Massachusetts State Plumbing Code 248 CMR, the exterior grease interceptor is anticipated to provide 6,000 gallons of effective capacity. The grease interceptor will be designed to meet all applicable code requirements.

An analysis was performed on the sanitary sewer lines that the Project may utilize. Information on the sewer lines in the loading dock and in East Drive was obtained for the analysis. Pipe diameters and inverts were taken from compiled information gathered from record drawings, an electronic survey provided by HBS, and field investigations. The flow capacity was analyzed using the Manning equation.

Results indicate that the minimum hydraulic capacity of the system is located along the 8-inch sewer line located in the Kresge Hall driveway. This pipe has a capacity of 0.96 million gallons per day (mgd). Based on the peak flow estimate, the Project will not significantly burden the existing sewage system. Calculations are presented in Table 7-1.

Table 7-1 Sewer Hydraulic Capacity Analysis

Street	Size (inch)	Slope (ft/ft)	Manning's 'n'	Exist. Capacity (mgd)	Exist. Capacity (gallons per minute, gpm)	Prop. Peak Flow to Main (gpm)
Kresge Hall Driveway	8	0.009	0.010	0.96	669	55.6
East Drive	18	0.021	0.010	12.79	8,881	164.7
East Drive	12	0.006	0.010	2.32	1,610	220.3

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 HBS's internal water system located in Harvard Way. Record drawings indicate that the water main in Harvard Way extends from a 12-inch ductile iron water main in Western Avenue, or a 12-inch water main in North Harvard Way. Chilled water lines extend through the campus utility tunnel and service the existing building at the utility vault.

Domestic water demand is based on estimated sewage generation with an added factor of 10 percent for consumption, system losses, and other use. Based upon sewage generation rates calculated previously, functioning at full capacity, the Project is anticipated to require approximately 26,092 gallons of water per day, representing an increase of 5,588 gpd from the existing site. However, based on anticipated changes in the school's food preparation program along with water conservation methods such as low-flow toilets, water demands are anticipated to be similar to the existing demands.

7.2.2 Proposed Connection

To maintain uninterrupted water services, separate domestic and fire protection services will be provided from a connection to HBS's internal water system in Harvard Way. Existing chilled water services will be protected and maintained.

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

The FMO Fire/Safety Group conducted hydrant flow tests on April 6, 2013. There appears to be adequate capacity within the vicinity. Hydrant flow data is presented in Table 7-2.

Table 7-2 Existing Hydrant Flow Data

Hydrant #	Static Pressure	Residual Pressure	Total Flow	Flow at 20 psi	Flow at 10 psi
HBS 9	80 psi	70 psi	1,010 gpm	2,658 gpm	2,889 gpm

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 that include retention/detention, infiltration, and reuse to mitigate the 1.5-inch storm event on-site and decrease phosphorus loads leaving the site. The mitigation measures may include directing stormwater to the landscape for natural mitigation, treatment through biological processes such as treatment swales and/or water features, and infiltration back to the natural soils.

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 future condition.

7.3.2 Existing Conditions

The Project site is serviced by on-campus drain lines. According to BWSC record information, this existing system includes connections to a 36-inch Department of Conservation and Recreation drain which flows easterly to a 42-inch drain to the Charles River.

The Project site currently consists of an existing building (Kresge Hall), paved walkways, and landscaped areas.

7.3.3 Proposed Conditions

The stormwater design will include stormwater best management practices (BMPs) and various stormwater retention/detention, infiltration, and reuse 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 significantly below the existing levels. It is expected that runoff from paved surfaces and potentially a portion of the proposed building roof will be directed to infiltration systems west of the proposed building. The remaining building roof and impervious pedestrian plazas will be directed to infiltration systems east of the proposed building. Additional BMPs will be incorporated to manage stormwater across the remainder of the site. Porous pavement will be used to manage stormwater across a majority of the pedestrian walkways on-site, and high profile soil media will be used within landscaped areas to allow for sufficient infiltration. Following required infiltration and treatment to remove sediments, stormwater from the site will be routed to the existing on-site storm drain system.

The proposed Project is expected to reduce impervious area onsite by approximately five percent, plus or minus, from the existing condition, including the new porous pavement 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 system proposed for the site 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 untreated stormwater will discharge into, or cause erosion to, wetlands or waters.

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

Compliance: In accordance with HBS's Stormwater Plan Goals, the proposed site will collect, store, and recharge minimally one inch over the impervious site.

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 system will remove 80 percent of the post-development site's average annual TSS load. Water quality inlets, as needed, will be sized to meet this requirement.

Standard #5: If the Site contains an area with Higher Potential Pollutant Loads (as prescribed by the Policy), BMPs must be used to prevent the recharge of untreated stormwater.

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

Standard #6: If the Site contains areas of Sensitive Resources (as prescribed by the Policy), such as rare/endangered wildlife habitats, Areas of Critical Environmental Concern (ACECs), etc., a larger volume of run-off from the "first flush" must be treated (one inch of run-off from impervious area).

Compliance: The Project 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 meet or exceed all standards.

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

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

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

Compliance: 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 system.

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

Compliance: No illicit discharges to the stormwater management system are proposed.

7.4 Electricity

New electrical switchgear supplied from the campus high voltage distribution system will be installed in the basement. The building standby power will be provided by a generator located in the adjacent Tata Hall basement. The electrical system will be distributed to panels and transformers in electrical closets on each floor. 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.

7.5 Heating and Cooling

New mechanical systems will be provided to serve the building. 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 existing Kresge Hall utility vault.

The building will be conditioned via central air handling units with heat recovery located in a mechanical room in the basement and on the roof behind a visual screen. Dedicated makeup air units will bring in outside makeup air for the kitchen exhaust hoods and also provide heating and cooling for the kitchen. Kitchen hoods will be served by an exhaust fan located on the roof.

7.6 Telecommunications

The Project will tie into the telecommunications infrastructure within the existing HBS campus.

Appendix A

Climate Change Questionnaire

Boston Climate Change Preparedness Questionnaire - New Construction

2. Project Information

1. Project Name and Location

Project Name : Ruth Mulan Chu Chao Center
Project Address : Harvard Business School Campus

2. Project Contact:

Name : Catherine Ferrara
Title : Staff Scientist
Company : Epsilon Associates, Inc.
Email Address : cferrara@epsilonassociates.com
Phone Number : 978-897-7100

3. Project Contact:

Name : Catherine Ferrara
Title : Staff Scientist
Company : Epsilon Associates, Inc.
Email Address : cferrara@epsilonassociates.com
Phone Number : 978-897-7100

4. Team Description:

Owner / Developer : President and Fellows of Harvard College, acting by and through Harvard Business School
Architect : Goody Clancy
Engineer (building systems) : Vanderweil Engineers
Sustainability / LEED : Alelier Ten
Permitting : Epsilon Associates
Construction Management : Skanska

3. New Page

5. Is this project a:

Single building

6. At what phase is this project?

PNF Submitted

4. Phased, multi-building project

Project Identification

5. Single building project

7. Project Identification:

Project Name : Ruth Mulan Chu Chao Center
Primary Project Address : Harvard Business School Campus
Additional Project Address : Allston, MA

6. Master Plan

Project Identification

7. Institutional Master Plan

Project Identification

8. Building Classification and Description

8. Building Uses - check all appropriate uses:

Education
Office
Institutional

9. Building First Floor Uses - list all:

Classrooms, Function, Loading, Lobby

10. Construction Type – select most appropriate type:

Steel Frame

11. Building Size: do not include commas

Site Area (Square Feet) : approx. 43,560
Building Area (Square Feet) : 75,000
Building Height (Feet) : 54
Number of Stories (Floors) : 3
First Floor Elevation (feet above sea level)(Boston City Base Elev.)(Ft.) : 7' 6"
Number of below grade levels : 1

9. Green Building

12. Which LEED Rating System(s) has or will your project use (by area for projects using multiple rating systems):

	Rating System
Primary Use	LEED 2009 for New Construction
Secondary Use	
Additional Uses	

13. What are the projected LEED Rating System Outcome(s):

	Rating System
Primary Use	Gold
Secondary Use	
Additional Uses	

14. Is or will the Project Register with the US Green Building Council

Yes

15. Is or will the Project Seek US Green Building Council Certification:

Yes

10. Higher Temperatures and Heat Waves - Analysis and General Strategies

16. Analysis Sources:

List Climate Change information sources : Massachusetts Climate Change Adaptation Report (2011)
Was there information you were unable to find : NA

17. What time span of Climate Change was considered:

50 Years

18. Analysis Conditions:

What Low Temperature will be used for project planning (degrees) : 10
What High Temperature will be used for project planning (degrees) : 90

19. What Extreme Heat Event characteristics will be used for project planning:

Peak High (degrees) : 95.8
Duration (days) : 20
Number of events per year : 1

20. What measures will the project employ to reduce urban heat-island effect:

Shade trees
High reflective roof materials
Vegetated roof materials

21. Will the project be able to manage hotter and more humid summers without increasing its electrical load; if so how?

If yes, describe strategies: High performance envelope; Ventilation system using enthalpy energy recovery; High efficiency equipment; Planned Demand Response Mode

22. Will the building remain operable without utility power for an extended period; if so for how long and by what strategies?

If Yes, for how long (days) and describe strategies: Roll-up generator with plug-in connection (at grade) provided during extended outage

11. High Temperatures and Heat Waves - Active and Passive Strategies

23. What will be the overall energy performance of the project or building (percentage above code)

25%

24. How will project energy performance be determined

Whole Building Energy Model

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

High performance lighting
Automatic lighting controls
Building day lighting
EnergyStar equipment / appliances
High performance HVAC equipment
Energy recovery ventilation
Describe any added measures: Hydronic based systems; VAV kitchen hoods; Stormwater harvesting; Low-flow plumbing

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

Describe any added measures: Stormwater harvesting and irrigation; Ventilation with enthalpy energy recovery; VAV air distribution; Variable speed fans and pumps; DDC controls for HVAC; EnergyStar

27. Will the project employ Smart Grid Infrastructure and / or Systems

Local distributed steam / heating / cooling system

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

External shading devices
High performance building envelop
Describe any additional measures: Window/wall ratio <40%; Insulation above code; High performance glazing; Low-flow plumbing

29. List the R values for building envelope elements:

Roof : 30
Walls : 14
Floors / Slab : 10
Foundation / Basement : 10
Windows : 0.25
Doors : 0.25

12. Sea-Level Rise and Storms – location analysis and description

30. Location Description:

Site Elevation - low point (feet above sea level)(Boston City Base Elev.)(Ft.) : 13
Site Elevation - high point (feet above sea level)(Boston City Base Elev.)(Ft.) : 14

31. Location Classification - is the site or building located in any of the following:

	Yes	No
Coastal Zone		X
Velocity Zone		X
Flood Zone		X
Area Prone to Flooding		X

32. Are updates in the floodplain delineation due to climate change likely to change the classification of the site or building location:

No

33. What is the project or building proximity to nearest Coastal, Velocity or Flood Zone or Area Prone to Flooding (horizontal distance in feet)

Approx. 500 feet

13. Sea-Level Rise and Storms – analysis and general strategies

Analysis Sources:

What time span of Climate Change and Rising Sea-Levels was considered:

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

14. Sea-Level Rise and Storms - Building Flood Proofing

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

Will the proposed ground floor be raised in response to Sea Level Rise:

Will the proposed ground floor be raised in response to Sea Level Rise:

Will lower building levels be constructed in a manner to prevent water penetration:

Describe measures and strategies intended to ensure the integrity of critical building systems during a flood or severe storm event:

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

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

Describe any additional Building Floor Proofing strategies?

15. Sea-Level Rise and Storms - Building Resiliency and Adaptability

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

Will the building include additional structural capacity and or building systems to accommodate future on-site renewable and or clean energy sources; if so what:

Can the site and building be reasonably modified to increase Building Flood Proofing; if so how:

Describe any additional Building Resiliency and Adaptability strategies: