Notice of Project Change
EEA No. 1891

# Kendall Square Urban Renewal Project (KSURP) Amendment No. 10

## Cambridge, Massachusetts

SUBMITTED TO Executive Office of Energy and Environmental Affairs
Massachusetts Enviromental Policy Act Office

PROPONENT Cambridge Redevelopment Authority

PREPARED BY vhb

IN ASSOCIATION WITH:

Boston Properties
Sasaki Associates
Foley and Hoag
AHA Consulting Engineers
Haley & Aldrich

**June 2016**

June 30, 2016

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs
Attention: Deidre Buckley, Director of the MEPA Office
100 Cambridge Street, 9th Floor
Boston, MA 02114

Re: **Notice of Project Change**
**Kendall Square Urban Renewal Project (KSURP) Amendment No. 10**
**Cambridge, MA**
**EEA No. 1891**

Dear Secretary Beaton and Director Buckley:

On behalf of the Cambridge Redevelopment Authority (the "Proponent") and Boston Properties (the "Redeveloper"), Vanasse Hangen Brustlin, Inc. (VHB) is submitting a Notice of Project Change (NPC) for submission of the draft Memorandum of Understanding (MOU) for public review for the amendment to the Kendall Square Urban Renewal Plan (KSURP Amendment No. 10) within the Kendall Square neighborhood of the City of Cambridge (the "Project Change" or "Project"), as required by the Certificate issued on the Single Environmental Impact Report (SEIR) for the most recent previously reviewed project. This NPC also reports on the modifications to the proposed commercial and residential infill development, in compliance with the final approved zoning amendment, which was responsive to the City's public process in fall/winter 2015 and, ultimately, approved by Cambridge City Council on December 21, 2015.

The preliminary development program and building massing scheme presented in the SEIR were refined to respond to the City's desire to increase publicly beneficial land uses, including additional affordable housing, the inclusion of middle-income housing, the inclusion of three-bedroom units, and more Innovation Space consistent with the K2 Plan. As demonstrated herein, the program changes will result in a higher amount of public benefits and improvements than previously contemplated.

No new MEPA review thresholds are triggered as a result of the Project Change. The Project Change does not result in any new significant environmental impacts (that have not been or are not addressed with mitigation) beyond those documented and analyzed in the most recently previously reviewed MEPA filing. The Proponent requests a finding that the Project Change as proposed incorporates appropriate measures that adequately address environmental impacts such that no further review is required.

As presented in the SEIR, the Proponent and the Redeveloper remain focused on enhancing the favorable transportation mode split in Kendall Square that has played such an important role in the successful redevelopment of the area. It is acknowledged and well documented that an estimated 70 percent of trips

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travelled to Kendall Square utilize transit, walking, biking, shuttle and/or carpooling. The importance of maintaining and improving this mode split cannot be overstated, and is central to the Proponent's plans for the Project, as demonstrated by the enclosed draft MOU.

We look forward to working with you and your staff, other state agencies as well as members of the community to develop the best redevelopment plan for this location. We anticipate that the NPC will be noticed in the next edition of your *Environmental Monitor*. Requests for copies of the NPC should be directed to me at 617-607-0091 or via e-mail at ldevoe@vhb.com.

Very truly yours,

VANASSE HANGEN BRUSTLIN, INC.

Lauren DeVoe, AICP, LEED AP BD+C
Senior Environmental Planner

Enclosure

cc: Tom Evans, Cambridge Redevelopment Authority
Michael Tilford, Boston Properties
Douglas McGarrah, Foley and Hoag
Sean Manning, VHB

# Kendall Square Urban Renewal Project (KSURP) Amendment No. 10

## Cambridge, Massachusetts

SUBMITTED TO **Executive Office of Energy and Environmental Affairs**
Massachusetts Environmental Policy Act Office
100 Cambridge Street, Suite 900 (9th Floor)
Boston, MA 02114

PROPONENT **Cambridge Redevelopment Authority**
255 Main Street, 4th Floor
Cambridge, MA 02142

PREPARED BY **VHB**
99 High Street, 10th Floor
Boston, MA 02110

*In association with:*
Boston Properties
Sasaki Associates
Foley and Hoag
AHA Consulting Engineers
Haley & Aldrich

June 2016

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# *Commonwealth of Massachusetts*

***Executive Office of Energy and Environmental Affairs ■ MEPA Office***

| *For Office Use Only*<br>*Executive Office of Environmental Affairs* |
|---|
| MEPA Analyst: |
| Phone: 617-626- |

# Notice of Project Change

**The information requested on this form must be completed to begin MEPA Review of a NPC in accordance with the provisions of the Massachusetts Environmental Policy Act and its implementing regulations (see 301 CMR 11.10(1)).**

| | | |
|---|---|---|
| EEA # **1891** | | |
| Project Name: **Kendall Square Urban Renewal Project (KSURP) Amendment No. 10** | | |
| Street Address: **Cambridge Center** | | |
| Municipality: **Cambridge** | Watershed: **Boston Harbor (Charles River)** | |
| Universal Transverse Mercator Coordinates: **UTM 19, 46 60 991 N, 3 11 269 E** | Latitude: **42° 04′ 49″ N**<br>Longitude: **71° 16′ 52″ W** | |
| Estimated commencement date: **2016** | Estimated completion date: **2024** | |
| Project Type: **Mixed Use** | Status of project design**: Conceptual/Master Plan** | |
| Proponent: **Cambridge Redevelopment Authority** | | |
| Street Address: **255 Main Street, 4th Floor** | | |
| Municipality: **Cambridge** | State: **MA** | Zip Code: **02142** |
| Name of Contact Person: **Thomas L. Evans** | | |
| Firm/Agency: **Cambridge Redevelopment Authority (CRA)** | Street Address: **255 Main Street, 4th Floor** | |
| Municipality: **Cambridge** | State: **MA** | Zip Code: **02142** |
| Phone: **617-492-6800** | Fax: **617-492-6804** | E-mail: **tevans@cambridgeredevelopment.org** |

With this Notice of Project Change, are you requesting:

a Single EIR? (see 301 CMR 11.06(8)) ☐Yes ☒**No**
a Special Review Procedure? (see 301CMR 11.09) ☐Yes ☒**No**
a Waiver of mandatory EIR? (see 301 CMR 11.11) ☐Yes ☒**No**
a Phase I Waiver? (see 301 CMR 11.11) ☐Yes ☒**No**

Which MEPA review threshold(s) does the project meet or exceed (see 301 CMR 11.03)?

**The proposed project changes do not result in any new MEPA review thresholds compared to those contemplated in the previous filing (Single EIR filed October 15, 2015):**

**--301 CMR 11.03(1)(b)(7): Approval in accordance with M.G.L. c. 121B of a New urban renewal plan or a major modification of an existing urban renewal plan.**
**--301 CMR 11.03(5)(b)(4)(a): New discharge or expansion in discharge to a sewer system of 100,000 or more gallons per day of sewage, industrial wastewater, or untreated stormwater.**
**--301 CMR 11.03(6)(a)(6): Generation of 3,000 or more New adt (unadjusted) on roadways providing access to a single location.**
**--301 CMR 11.03(6)(b)(15): Construction of 300 or more New parking spaces at a single location.**

Which State Agency Permits will the project require?

**The proposed project changes do not require any new or modified State Agency Permits.**

Identify any financial assistance or land transfer from an Agency of the Commonwealth, including the Agency name and the amount of funding or land area in acres:

**The proposed project changes do not require any Financial Assistance or Land Transfer from the Commonwealth.**

## PROJECT INFORMATION

In 25 words or less, what is the project change?

**The proposed project changes provides the draft MOU for public review and describes the infill development program modifications to conform to the final rezoning approved by Cambridge City Council on December 21, 2015.**

See full project change description beginning on page 3.

Date of publication of availability of the ENF in the Environmental Monitor: (Date: **06/09/1975**)

Was an EIR required? ☒Yes ☐No; if yes,
was a Draft EIR filed? ☒Yes ☐No
was a Final EIR filed? ☒Yes (Date: **3/15/1977**) ☐No
was a Single EIR filed? ☒Yes (Date: **10/15/2015**) ☐No

Have other NPCs been filed? ☒Yes (Date(s): **07/23/92; 08/10/93; 06/24/97; 08/08/01; 01/28/05; 06/15/10; 04/15/15**) ☐No

If this is a NPC solely for lapse of time (see 301 CMR 11.10(2)) proceed directly to **ATTACHMENTS & SIGNATURES**.

## PERMITS / FINANCIAL ASSISTANCE / LAND TRANSFER

List or describe all new or modified state permits, financial assistance, or land transfers not previously reviewed: **dd w/ list of State Agency Actions (e.g., Agency Project, Financial Assistance, Land Transfer, List of Permits)**

**The proposed project changes do not require any new or modified State Agency Actions or Financial Assistance or Land Transfer from the Commonwealth. Refer to Table 1-2 of Chapter 1, *Project Change Description* for a list of anticipated permits and approvals.**

Are you requesting a finding that this project change is insignificant? A change in a Project is ordinarily insignificant if it results solely in an increase in square footage, linear footage, height, depth or other relevant measures of the physical dimensions of the Project of less than 10% over estimates previously reviewed, provided the increase does not meet or exceed any review thresholds. A change in a Project is also ordinarily insignificant if it

results solely in an increase in impacts of less than 25% of the level specified in any review threshold, provided that cumulative impacts of the Project do not meet or exceed any review thresholds that were not previously met or exceeded. (see 301 CMR 11.10(6))
☐**Yes** ☒**No; if yes, provide an explanation of this request in the Project Change Description below.**

**The Proponent requests that the Secretary of Energy and Environmental Affairs (EEA) make a finding that the Project Change, as described herein, incorporates measures that adequately minimize or mitigate environmental impacts such that no further MEPA review is required.**

**FOR PROJECTS SUBJECT TO AN EIR**

If the project requires the submission of an EIR, are you requesting that a Scope in a previously issued Certificate be rescinded?
☐**Yes** ☒ **No; if yes, provide an explanation of this request_____.**

If the project requires the submission of an EIR, are you requesting a change to a Scope in a previously issued Certificate?
☐**Yes** ☒**No; if yes, provide an explanation of this request_____.**

**SUMMARY OF PROJECT CHANGE PARAMETERS AND IMPACTS**

| Summary of Project Size & Environmental Impacts | Previously reviewed | Net Change | Currently Proposed |
|---|---|---|---|
| **LAND** | | | |
| Total site acreage | **24 ac.** | **-0-** | **24 ac.** |
| Acres of land altered | **24 ac.** | **-0-** | **24 ac.** |
| Acres of impervious area | **19.78 ac.** | **-0-**[1] | **19.78 ac.** |
| Square feet of bordering vegetated wetlands alteration | **-0-** | **-0-** | **-0-** |
| Square feet of other wetland alteration | **-0-** | **-0-** | **-0-** |
| Acres of non-water dependent use of tidelands or waterways | **-0-** | **-0-** | **-0-** |
| **STRUCTURES** | | | |
| Gross square footage | **4,336,700 GSF** | **±90,600 GSF**[2] | **4,427,300 GSF** |
| Number of housing units | **Up to 560 units** | **±0 units** | **Up to 560 units** |
| Maximum height (in feet) | **Up to 350 feet**[3] | **-0-** | **Up to 350 feet** |
| **TRANSPORTATION** | | | |
| Vehicle trips per day (unadjusted)[4] | **37,357** | **±238** | **37,595** |
| Vehicle trips per day (adjusted)[5] | **17,352** | **±82** | **17,434** |
| Parking spaces | **±3,813** | **±69 spaces**[6] | **±3,882** |
| **WATER/WASTEWATER** | | | |
| Gallons/day (GPD) of water use | **±1.39 mgd**[7] | **±11,917 gpd** | **±1.40 mgd** |

| | | | |
|---|---|---|---|
| GPD water withdrawal | **NA** | **NA** | **NA** |
| GPD wastewater generation/ treatment | **±1.06 mgd[7]** | **±10,834 gpd** | **±1.07 mgd** |
| Length of water/sewer mains (in miles) | **NA** | **NA** | **NA** |

mgd million gallons daily

1 The Project is expected to result in a de minimis change in impervious area throughout the KSURP area. Efforts to incorporate landscaping and other pervious areas, such as roof gardens and/or pervious pavers into the site design of the Project Components (in accordance with Plan Amendment open space requirements) are expected to reduce impervious area throughout the KSURP area.

2 Increase due to a shift in sites for infill office development (3 CC to 14 CC), which resulted in a smaller amount of existing office space demolition, an increase in Office bonus for additional Innovation Space, and modification to housing requirements (additional affordable housing and larger units). The Project Change will result in a higher amount of public benefits and improvements than previously contemplated, including affordable and middle income housing as well as the creation of Innovation Space.

3 Corrected from the SEIR NPC Form (Appendix G). Building heights up to 300 to 350 feet are allowed for residential buildings, as per Plan Amendment No. 10.

4 Estimated Unadjusted vehicle trips based on ITE vehicle trip generation rates largely overstate traffic impacts associated with KSURP infill development. Adjusted trips have been used historically in past MEPA filings because the Unadjusted number grossly overstates, as demonstrated by the FST reporting over the last decade (as illustrated in Figure 2.1 of the SEIR).

5 Accounts for mode splits and vehicle occupancy rates that drive down the actual number of vehicle trips generated by the Project based on FST annual reporting projections. The approach to traffic adjustments was based on direction from Cambridge Traffic, Parking & Transportation Department and approved by the Massachusetts Department of Transportation according to their Transportation Scoping Letter (TSL) issued December 4, 2014. A copy of the TSL was included in Appendix C of the SEIR.

6 This minimal increase in parking is a result of development program changes as described in footnote 2 above.

7 The estimated water demand and wastewater generation have been updated to more accurately reflect the residential uses (using estimated bedroom counts).

Does the project change involve any new or modified:

1. conversion of public parkland or other Article 97 public natural resources to any purpose not in accordance with Article 97? ☐**Yes** ☒**No**

2. release of any conservation restriction, preservation restriction, agricultural preservation restriction, or watershed preservation restriction? ☐**Yes** ☒**No**

3. impacts on Rare Species**?** ☐**Yes** ☒**No**

4. demolition of all or part of any structure, site or district listed in the State Register of Historic Place or the inventory of Historic and Archaeological Assets of the Commonwealth? ☐**Yes** ☒**No**

5. impact upon an Area of Critical Environmental Concern? ☐**Yes** ☒**No**

If you answered 'Yes' to any of these 5 questions, explain below:

**PROJECT CHANGE DESCRIPTION** (attach additional pages as necessary). The project change description should include:

(a) a brief description of the project as most recently reviewed

(b) a description of material changes to the project as previously reviewed,

(c) if applicable, the significance of the proposed changes, with specific reference to the factors listed 301 CMR 11.10(6), and

(d) measures that the project is taking to avoid damage to the environment or to minimize and mitigate unavoidable environmental impacts. If the change will involve modification of any

previously issued Section 61 Finding, include a draft of the modified Section 61 Finding (or it will be required in a Supplemental EIR).

**Refer to the *Notice of Project Change Form Narrative/Project Summary* section attached.**

## ATTACHMENTS & SIGNATURES

Attachments:

1. Secretary's most recent Certificate on this project **Refer to Appendix B.**
2. Plan showing most recent previously-reviewed proposed build condition **Refer to Figure S.4.**
3. Plan showing currently proposed build condition **Refer to Figures S.5, 1.3a through 1.3e.**
4. Original U.S.G.S. map or good quality color copy (8-1/2 x 11 inches or larger) indicating the project location and boundaries **Refer to Figure S.1.**
5. List of all agencies and persons to whom the proponent circulated the NPC, in accordance with 301 CMR 11.10(7) **Refer to Appendix A.**

Signatures:

| | | | |
|---|---|---|---|
| 6/29/16 | | 6/29/16 | |
| Date | Signature of Responsible Officer or Proponent | Date | Signature of person preparing NPC (if different from above) |
| **Tom L. Evans, Executive Director** | | **Lauren DeVoe, Senior Environmental Planner** | |
| Name (print or type) | | Name (print or type) | |
| **Cambridge Redevelopment Authority** | | **VHB, Inc.** | |
| Firm/Agency | | Firm/Agency | |
| **255 Main Street, 4th Floor** | | **99 High Street, 10th Floor** | |
| Street | | Street | |
| **Cambridge, MA 02142** | | **Boston, MA 02110** | |
| Municipality/State/Zip | | Municipality/State/Zip | |
| **617-492-6800** | | **617-607-0091** | |
| Phone | | Phone | |

# Notice of Project Change Form Narrative/Project Summary

Pursuant to the Massachusetts Environmental Policy Act (MEPA) and its implementing regulations, the Cambridge Redevelopment Authority (CRA, or the "Proponent") in conjunction with Boston Properties (the "Redeveloper") is submitting a Notice of Project Change (NPC) for modifications to commercial and residential infill development allowed by the amendment (Amendment No. 10) to the Kendall Square Urban Renewal Plan (KSURP) within the Kendall Square neighborhood of the City of Cambridge (the "Project"). Refer to Figure S.1 for a site location map. On November 25, 2015, the Secretary of Energy and Environmental Affairs (EEA) issued a Certificate determining the Single Environmental Impact Report (SEIR) submitted on the previously most recently reviewed project adequately and property complied with MEPA and its implementing regulations. This Certificate included a condition that a NPC is required to be filed for public review and comment that reports on mitigation commitments related to the Memorandum of Understanding (MOU) proposed to be developed by key project stakeholders to address transit impacts.

The purpose of the NPC filing is two-fold:

- To document the more fully developed proposed project mitigation related to public transit for public review and comment (in the form of the Memorandum of Understanding between the Massachusetts Department of Transportation (MassDOT)/Massachusetts Bay Transportation Authority (MBTA), City of Cambridge, and Boston Properties), in accordance with the SEIR Certificate (the "draft MOU"); and
- To document the key differences between the preliminary development program and building massing scheme previously presented in the SEIR and the currently proposed plan (the "Project Change"). The current development program and building massing scheme represents adaptations that comply with the final amendments to Article 14 of the Cambridge Zoning Ordinance approved by Cambridge City Council on December 21, 2015 (the "Current Project"). The program changes are intended to result in additional public beneficial uses based on public process in fall/winter 2015.

Key program changes since the SEIR include greater Innovation Space bonuses, height bonus for residential uses to allow for additional affordable housing units, home ownership, and 3-bedroom units. This resulted in the removal of the previously proposed Three Cambridge Center Mixed Use Building component for the addition of Fourteen Cambridge Center site.

The following section provides a brief overview of the history/background of the KSURP and the more recent MEPA review and approval process for the Project, a summary of the project changes since the SEIR, and an analysis of the relevant MEPA project change factors. Refer to the *Notice of Project Change Summary/Narrative* section of the SEIR for a more detailed description of KSURP history and background, including MEPA review history of previous Amendments No. 2 through No. 9.

# Project History, Background, and Status

## Kendall Square Urban Renewal Plan Overview

The adoption of the KSURP in 1965 and the first Major Plan Amendment in 1977, allowed the CRA to carry out the acquisition of 70 parcels of land, relocation of over 100 businesses, demolition of about 100 buildings and clearance of 43 acres of land. The original Kendall Square Urban Renewal Area included land between Main, Third, and Binney Streets as well as the Grand Junction Railroad. Figure S.2 shows the 1976 KSURP area boundary and property acquisition areas.

In the late 1970s, the CRA and Cambridge City Council engaged the public in a re-planning effort. In 1977, the plan was amended to create the Cambridge Center MX District (the "District") to attract mixed-use development to the area north of the MBTA Kendall/MIT Red Line station. The MXD boundary, as shown in Figure S.3, represents the zoning district that was established in the 1970s to help complete the development within the Urban Renewal Area for all of the non-federally owned land. The CRA selected Boston Properties as the master developer of the Cambridge Center Master Plan (described in detail in the SEIR).

Over the last 30 years, the Kendall Square area has become a center of innovation, creativity and technology; exceeding the expectation of the planners, designers, and developers in 1960's and 70's. The proposed KSURP Amendment No. 10 will advance the City of Cambridge's (the "City") planning goals for the KSURP (consistent with the recommendations from the 2013 K2C2 Planning Study for the KSURP area) through more efficient and improved use of the Kendall Square area and existing infrastructure. The KSURP will be updated to not only facilitate the job growth and housing opportunities, including affordable housing in Kendall Square, but the broader goal of creating a sustainable, inviting, and inclusive neighborhood.

The building construction limit of the KSURP, which has nearly been reached, is proposed to be increased to meet the continued demand for additional housing, office and biotechnology manufacturing space as well as to bring supporting retail to the KSURP area, while also enhancing open space opportunities. New provisions of Amendment No. 10 assists the CRA in linking transit investment to development to ensure that the KSURP area's transit assets grow along with it. Requirements for innovation space, affordable housing, and ground floor retail are included so that Kendall Square remains not only a destination for the great thinkers of today, but

also a laboratory for the great ideas of tomorrow and a great urban neighborhood for Cambridge.

## MEPA Review History

Adopted in 1965, the KSURP has been updated/amended a number of times since it was originally reviewed and approved under MEPA in 1977 (EEA No. 1891). As part of these updates (Plan Amendments No. 2 through No. 9), the Proponent regularly consulted with and updated the MEPA office, specifically on changes to traffic as a result of development program changes.

This section provides a summary of the review and approval history for the most recent previously-reviewed proposed build condition, Plan Amendment No. 10. Refer to the SEIR filed on October 15, 2015 for a detailed summary of the original KSURP MEPA filing and Plan Amendments No. 2 through No. 9.

### Most Recent Previously-Reviewed Proposed Build Condition - Amendment No. 10

On April 15, 2015, the Proponent filed an "expanded" NPC with a request for an SEIR for a Major Plan Amendment to the KSURP (Amendment No. 10) to allow for up to 1,034,000 gross square feet of additional commercial and residential development (the "Previously Reviewed Project"). As shown in Figure S.4, the key components of the Previously Reviewed Project included:

- Cambridge Center North Garage Office Buildings, including approximately 590,000 square feet of net new office, innovation, and retail space;
- Eleven Cambridge Center Residential Building, including 295 residential units and approximately 25,000 square feet of ground floor retail;
- Three Cambridge Center Mixed Use Building, including replacement office space (approximately 1,100 square feet net new), and the addition of 266 residential units and approximately 20,000 square feet of ground floor retail; and
- Approximately 75,100 square feet of new office space to be undertaken by other parties separate from the Redeveloper (referred to herein as "Other Developers"), including:
  - An approximately 60,000-square foot office expansion at the existing Whitehead Institute building at Nine Cambridge Center (the "Whitehead Institute Addition"); and
  - Conversion of approximately 15,100 square feet of mechanical space to commercial office space at the existing Broad Institute building at 75 Ames Street (the "Broad Institute Office Conversion").

The submission to MEPA for this Plan Amendment included a FST traffic analysis, which projected that a maximum build out under Plan Amendment No. 10 would have generated 14,457 ADVT.

On May 29, 2015, the Secretary of EEA issued a Certificate requiring a SEIR, which was filed on April 15, 2015. The SEIR addressed the Scope presented in the NPC Certificate and, at the request of City of Cambridge reviewers, represented a final complete document for the Project rather than providing a document that solely responds to the MEPA Scope. On November 25, 2015 the Secretary issued a Certificate on the SEIR that determined the Project adequately and properly complied with MEPA and its implementing regulations. The Certificate required the Proponent to file a NPC that included updated mitigation commitments for public review and comment. Following MEPA review, Plan Amendment No. 10 was approved by the Cambridge City Council on December 21, 2015.

## Site Context

Cambridge Center is a major urban mixed-use project set within a 24-acre area within the 43-acre KSURP area that has been and continues to be developed by the Redeveloper. The Cambridge Center Master Plan provides for over 3 million square feet of new development. All individual buildings and open space development are subject to a design review process conducted by the CRA.

Cambridge Center has been designed to accommodate a wide range of complementary uses. First-class office space and biotechnology laboratory space, hotel and retail space, and future residential space set in high-rise and mid-rise buildings is concentrated in the portion of the KSURP area between Main and Broadway (Parcel 4, or the - East Parcel) and on the western side (Parcel 3, or the West Parcel). Mid-rise and low-rise, two to seven-story buildings on the ten-acre section north of Broadway (Parcel 2, or the North Parcel) provide space for uses, such as biotechnology research and development and laboratory functions, biotechnology office and manufacturing uses as well as first-class office space.

The KSURP area includes over 150,000 square feet of public open space, parks, and plazas.

Please refer to the SEIR for a complete, chronological summary of Cambridge Center's development completed to date.

### Gross Floor Area of Development

Table S-1 below compares the currently allowed maximum permitted development (Gross Floor Area, or GFA, and housing units, parking spaces) to the as-built development and Current Project, as described herein. Associated estimated impacts (vehicle trips, water/wastewater) are also presented.

**Table S-1 Maximum Development Allowed and As-Built Development in the KSURP Area**

| | Maximum Development Allowed (Previously Reviewed) | Existing/As-Built Development | Approved Maximum Development Allowed (Amendment No. 10)[1] |
|---|---|---|---|
| Gross Floor Area (GFA)[2] | 3,302,100 GFA | 3,302,100 GFA | 4,273,000 GFA[3] |
| Gross Square Footage (GSF)[4] | 3,302,100 GSF | 3,292,900 GSF[5] | **5,218,500 GSF**[6] |
| Housing GSF | 200,000 GSF | 200,000 GSF | **641,000 GSF**[7] |
| Housing Units | Up to 185 units | 280 units[8] | 840 units[9] |
| Daily Vehicle Trips (Unadjusted) | 26,845 | 10,512 | **37,595** |
| Daily Vehicle Trips (Adjusted) | 13,714 | 3,638[10] | **17,434** |
| Off-Street Parking Spaces | 3,545 spaces | 2,667 spaces | 3,545 spaces[11] |
| Water Use[12] | ±1.24 million GPD | ±118,740 GPD | **±1.40 million GPD** |
| Wastewater Generation[12] | ±0.93 million GPD | ±107,945 GPD | **±1.07 million GPD** |

**Bold** = changed from SEIR Table S-2 due to Project Change, as presented herein.
GPD = Gallons per Day

1 Final approved by Cambridge City Council December 21, 2015.
2 Represents the total development allowance, but does not account for bonuses associated with Innovation and Retail spaces.
3 Represents a difference of 29,100 square feet from the NPC (4,302,100 GFA) to account for a variance received for Broad Institute under Amendment No. 6.
4 Represents total square footage, including building area associated with bonus uses.
5 Includes the planned Ames Street Residences approximately 200,000-square foot residential building.
6 Represents the GFA cap plus bonus uses (Innovation space and affordable/middle-income housing). Increase from SEIR is due to additional publicly beneficial land uses, including additional affordable housing, the inclusion of middle-income housing, the inclusion of 3-bedroom units and partially subsidized Innovation Space in response to the public process.
7 Required to be housing; could build more housing as a substitute for commercial.
8 Represents the planned Ames Street Residences. Smaller unit sizes allowed for 95 additional housing units from the Previously Reviewed Maximum of 185 units.
9 Existing/as-built units plus the proposed 560 units.
10 Actual vehicle trips based on FST reporting.
11 Represents maximum off-street parking allowed within the KSURP area. Approximately 809 new off-street parking spaces are proposed to support the Current Project would result in a total of 3,476 spaces, which is within the maximum allowed.
12 Estimated based on Title V generation rates, which do not account for the use of more efficient plumbing fixtures and other water conservation measures.

## Project Changes Since the SEIR

The preliminary development program and building massing scheme presented in the SEIR was refined to adapt to the final Article 14 amendment approved on December 21, 2015, which was responsive to the public process in fall/winter 2015. The Current Project intends to address the City's desire for more affordable and middle income housing as well as the creation of Innovation Space consistent with the K2 Plan. As demonstrated herein, the Current Project will result in a higher amount of public benefits and improvements than previously contemplated. While

public benefits, such as public open space, upgraded stormwater management facilities, streetscape improvements and bicycle accommodations are still proposed as part of the Current Project, the final Article 14 amendment obligated the Redeveloper to increase the publicly beneficial land uses, including additional affordable housing, the inclusion of middle-income housing, the inclusion of three (3) bedroom units and partially subsidized Innovation Space. In summary, the final zoning amendment resulted in the following program changes:

1. Modification of the housing program to provide specific housing types (i.e., home ownership and larger units) in response to the increased Affordable Housing requirement to at least 20% of the floor area of all housing units and allowing a Middle Income Housing zoning exemption of at least 5% of total housing requiring a minimum of 5% three-bedroom units in new housing. The same number of affordable units are being proposed, but all home ownership and three-bedroom units will be realized in the first phase—a more desirable residential development solution for the neighborhood.
2. Increase in Innovation Space (from 39,000 to 105,200 GFA) by increasing the zoning exemption of a minimum 5% of office and biotechnology manufacturing space to a maximum zoning exemption of 20% resulting in the allowance of additional net new office space within the new buildings. The full amount of Innovation Space would not fit within the allowed infill commercial building area; therefore, all of the Innovation Space is now proposed to replace existing office space at 255 Main Street (previously referred to as One Cambridge Center), which provides for a more visible and centralized location.
3. Reduction in overall retail space (from 50,000 to 30,000 GFA).
4. Increase in the overall vehicle parking capacity (from 740 spaces to 809 spaces) due to program modifications, the removal of the minimum parking requirements for commercial development, the decrease in the minimum residential parking requirement (to 0.4 space per dwelling unit), and establishing maximum parking limits for all uses.

These requirements merited a reconfiguration of the location and massing of components of the Project. As shown in Figure S.5, the key elements of the Project Change include:

- Submission of the draft MOU for public review.
- Replacement of Eleven Cambridge Center Residential Building with Office Building A (site location now referred to as 145 Broadway).
- Replacement of the Cambridge Center North Garage Office Buildings with two residential buildings;
- Elimination of the Three Cambridge Center Mixed Use Building component.
- Addition of Fourteen Cambridge Center site for construction of Office Building B (site location now referred to as 250 Binney Street).
- Creation of Innovation Space within an existing office building at 255 Main Street (previously referred to as One Cambridge Center).

› A slight reduction in the Broad Institute Office Conversion (from approximately 15,100 square feet to 14,000 square feet) due to more refined plan by the Other Developers.

The Whitehead Institute Addition and Broad Institute Office Conversion continue to be included as part of the overall KSURP Amendment No. 10 because they involve changes to previously reviewed and approved uses.

Table S-2 presents a program summary comparison of the Previously Reviewed Project and Current Project.

**Table S-2 Program Summary Comparison[1]**

| Infill Development | Previously Reviewed Project (SEIR) | Current Project | Project Change |
|---|---|---|---|
| Office | 584,600 GSF | 675,200 GSF | 90,600 GSF[2] |
| Retail | 50,000 GSF | 30,000 GSF | (-20,000 GSF) |
| Residential | 400,000 GSF | 420,000 GSF | 20,000 GSF[3] |
| **Total** | **1,034,600 GSF** | **1,125,200 GSF** | **90,600 GSF** |
| Residential Units | Up to 560 units | Up to 560 units | No Change |
| Parking | 740 spaces | 809 spaces | **69 spaces** |

1 Represents total net new building area in Gross Square Feet (GSF) GFA (Gross Floor Area) excluding accessory and support spaces, such as vertical transportation core and mechanical space, as defined in Article 2 if the Cambridge Zoning Ordinance.

2 Increase in office space due to a smaller amount of existing office space demolition (approximately 42,525 GSF less) because of the shift in sites for infill office development to Fourteen Cambridge Center from Three Cambridge Center and an increase in Office bonus for additional Innovation Space.

3 Increase due changes to housing requirements to create additional affordable housing and larger units.

Refer to Chapter 1, *Project Change Description* for additional details on the currently proposed development program as a result of the final and approved Plan Amendment No. 10, or the Current Project.

## Analysis of Relevant MEPA Project Change Factors

The Project Change consists of the draft MOU for public review and development program and building massing adaptations based on the final approved Article 14 amendment. The technical analyses and support documentation accompanying this NPC demonstrate that the Project Change does not result in any new significant environmental impacts (that have not been or are not addressed with mitigation) beyond those documented and analyzed in the SEIR. While the Proponent is not requesting a finding that the Project Change is "insignificant" pursuant to the relevant MEPA regulatory provisions (301 CMR 11.10), the Proponent requests a finding that the Project Change incorporates measures that adequately addresses environmental impacts such that no further MEPA review is required.

No new MEPA review thresholds or Mandatory Environmental Impact Report (EIR) review thresholds are triggered as a result of the Project Change. The following sections provide an evaluation of the significance of the Project Change under the

relevant factors/considerations set forth in the MEPA regulations under 301 CMR 11.10(6).

## Expansion of the Project

The Project Change will result in approximately 90,600 gross square feet of additional infill commercial and residential development (Table S-2). This represents an approximately 8.75 percent increase compared to the Previously Reviewed Project.

## Generation of Further Impact

No new MEPA review thresholds are triggered as a result of the Project Change. As with the Previously Reviewed Project, the only Mandatory Environmental Impact Report (EIR) review thresholds that are met or exceeded are the Transportation thresholds for new daily traffic and parking spaces, and the Wastewater threshold for generation of sanitary sewage. As demonstrated by Table S-3, no impact category has increased by 25 percent or more as a result of the Project Change. Please refer to Chapter 2, *Assessment of Project Change Impacts* for an evaluation of project change impacts.

**Table S-3 Generation of Further Impact Summary**

| Impact Category | Previously Reviewed Project (SEIR) | Current Project | Project Change | Percent Change |
|---|---|---|---|---|
| Traffic (Unadjusted) | 10,512 adt | 10,750 adt | +238 adt | 2.3% |
| Traffic (Adjusted) | 3,638 adt | 3,720 adt | +82 adt | 2.3% |
| Parking | 740 spaces | 809 spaces | +69 spaces | 9.3% |
| Wastewater | 132,585 gpd | 143,419 | +10,834 gpd | 8.2% |
| Total Area within Tidelands | 176,707 sf | 176,707 sf | No Change | 0% |

adt = average daily trips
gpd = gallons per day
sf = square feet

## Change in Schedule

As defined in the SEIR, the Current Project will still be constructed in two key phases with commercial office building space as an initial phase with residential closely following, as required by Article 14. Phase 1A will include demolition of the existing Eleven Cambridge Center commercial office building and construction of Office Building A—an approximately 394,236-gross square foot, 20-story commercial office building with ground-floor active use space. Phase 1B will include construction of a new up to 464-unit residential building on top of the North Garage along Broadway.

The previously proposed Phase 2 (Three Cambridge Center Mixed Use Development) has been broken into the following sub-phases: Office Building B; and Residential Building North. Phase 2A will include demolition of the existing Fourteen Cambridge

Center commercial office building and construction of Office Building B—an approximately 378,200-gross square foot, 15-story commercial office building with ground floor active use space. Phase 2B will include redevelopment of the North Garage along Binney Street into new up to 96-unit residential building. The Innovation Space conversion will be redeveloped concurrently with the proposed commercial space, per zoning requirements.

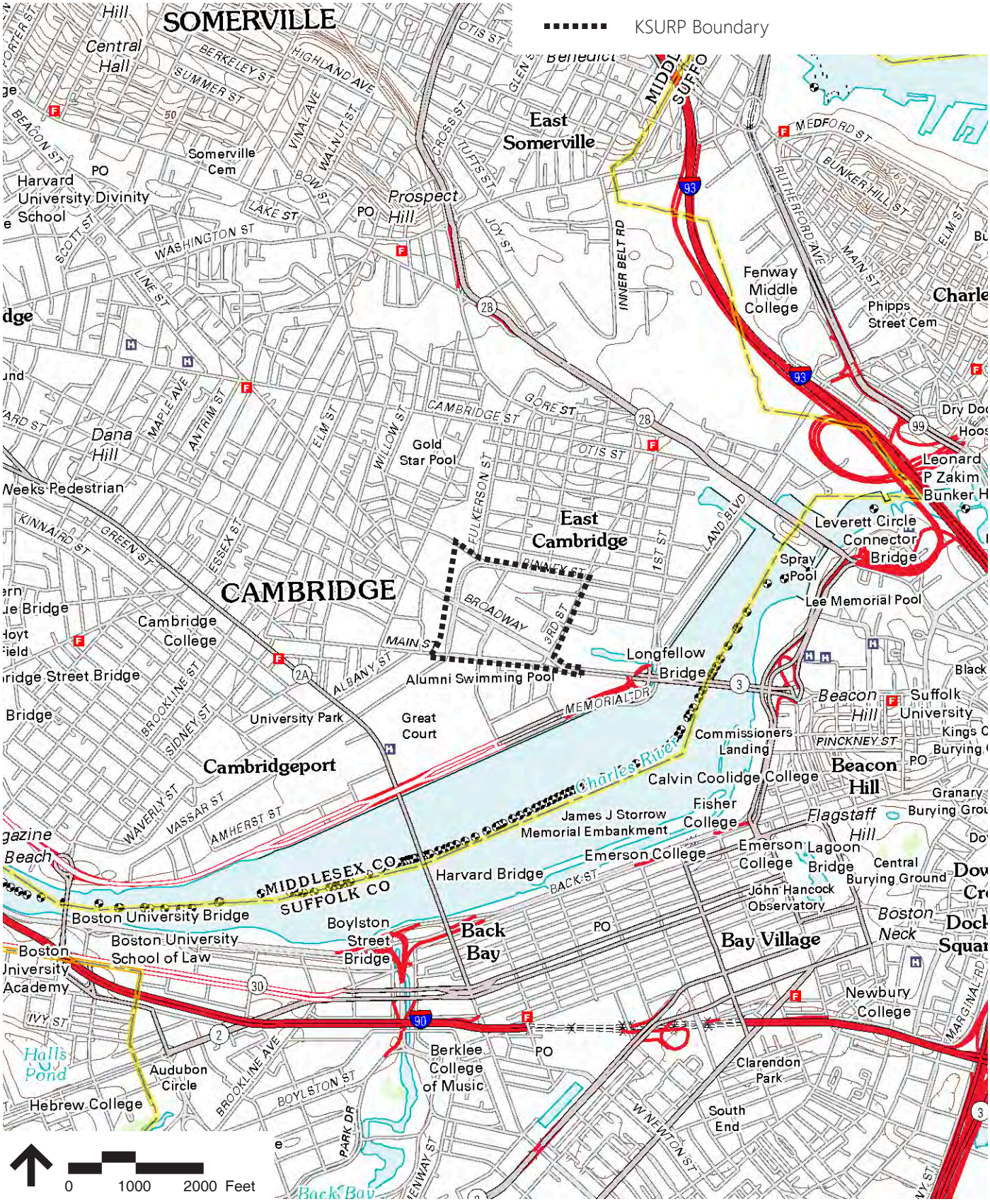
The Broad Institute Office Conversion and Whitehead Institute Addition are under the control of the Other Developers and will happen on independent timelines with the Broad Institute Office Conversion likely happening earlier.

## Change in the Project Site

The Project Change does not result in a change in the KSURP area as the subject parcels fall within the previously reviewed and approved KSURP area. The Three Cambridge Center site has been removed from the Project and 250 Binney Street (previously referred to as Fourteen Cambridge Center) has been added. The Innovation Space is now being proposed within the existing office building at 255 Main Street (previously referred to as One Cambridge Center). Refer to Figures S.4 and S.5 for a comparison of the previously reviewed and currently proposed infill development sites.

## Need for New Permits

No new or amended state permits are required for the Project Change.




**CRA**

Figure S.1
Site Location Map

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA

Source: City of Cambridge GIS, MassGIS

URBAN RENEWAL AREA BOUNDARY

ACQUIRED BY CRA

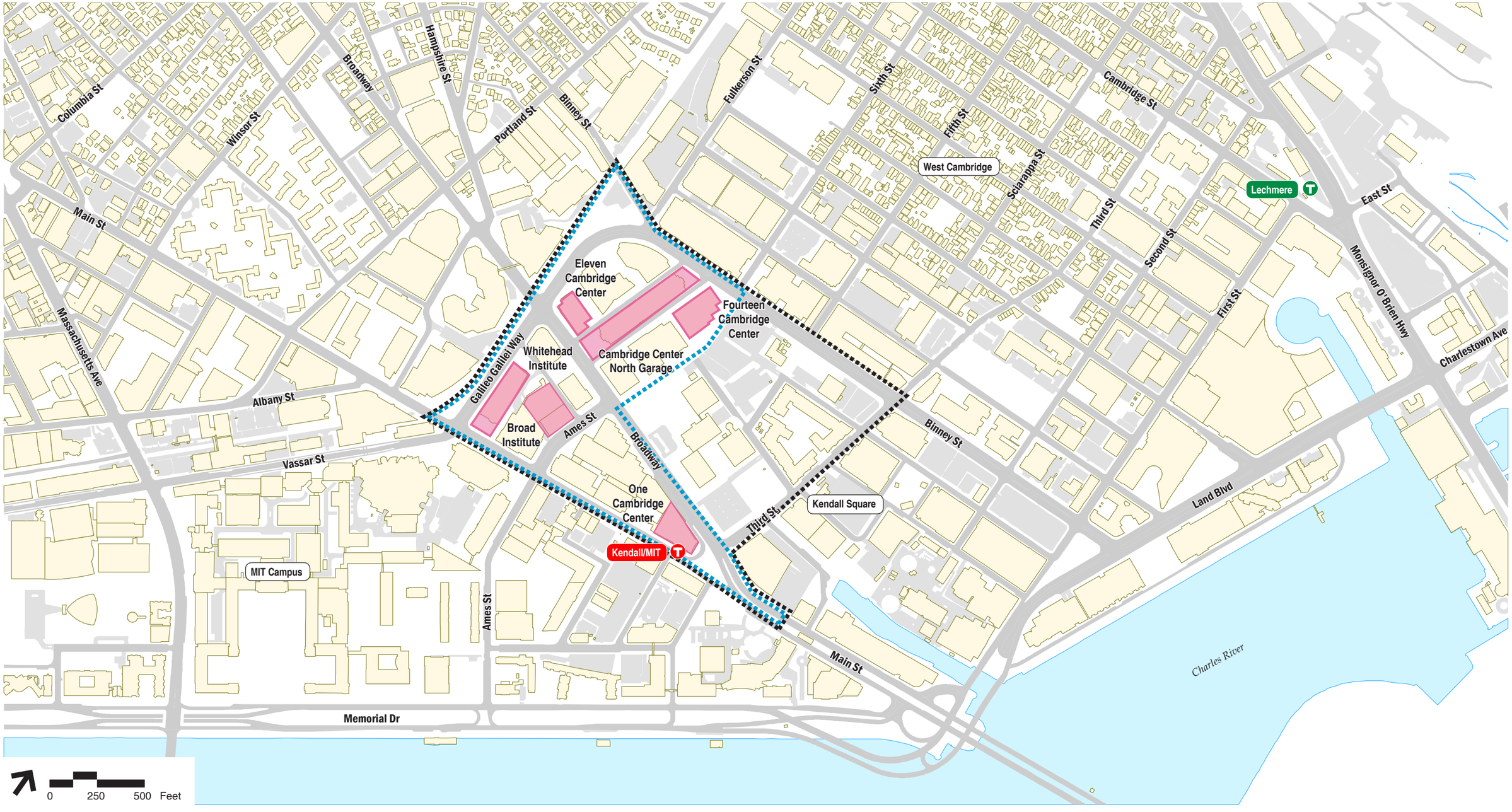
TO BE ACQUIRED BY CRA


**CRA**

Figure S.2
1976 KSURP Boundary and Property Acquisition Areas

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA

Source: Cambridge Redevelopment Authority



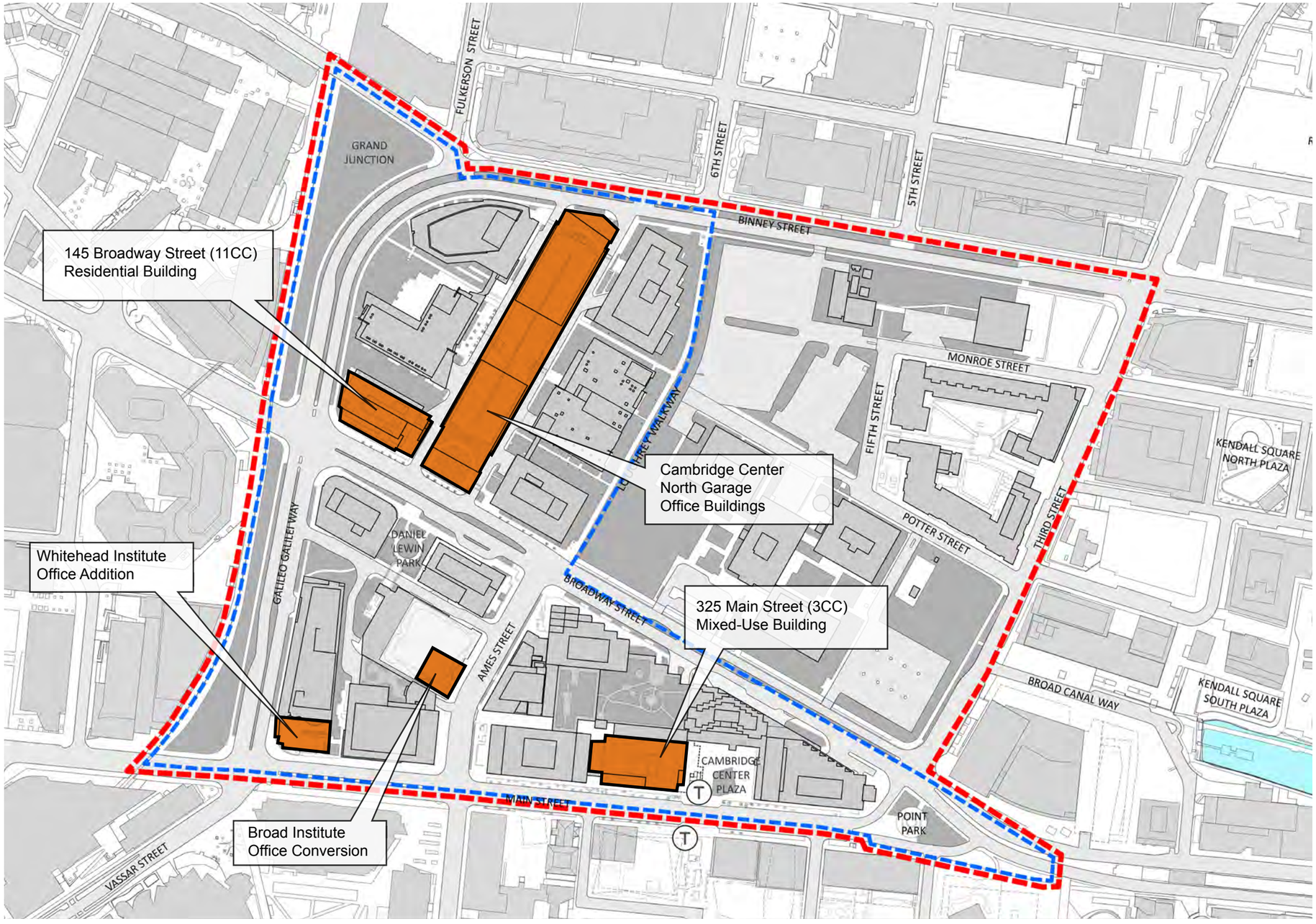

Source: City of Cambridge GIS

## CRA

Figure S.3

Project Area Context

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA




**LEGEND**

- KSURP Boundary
- MXD Boundary
- Project Most Recently Previously Reviewed KSURP (Amendment No.10)

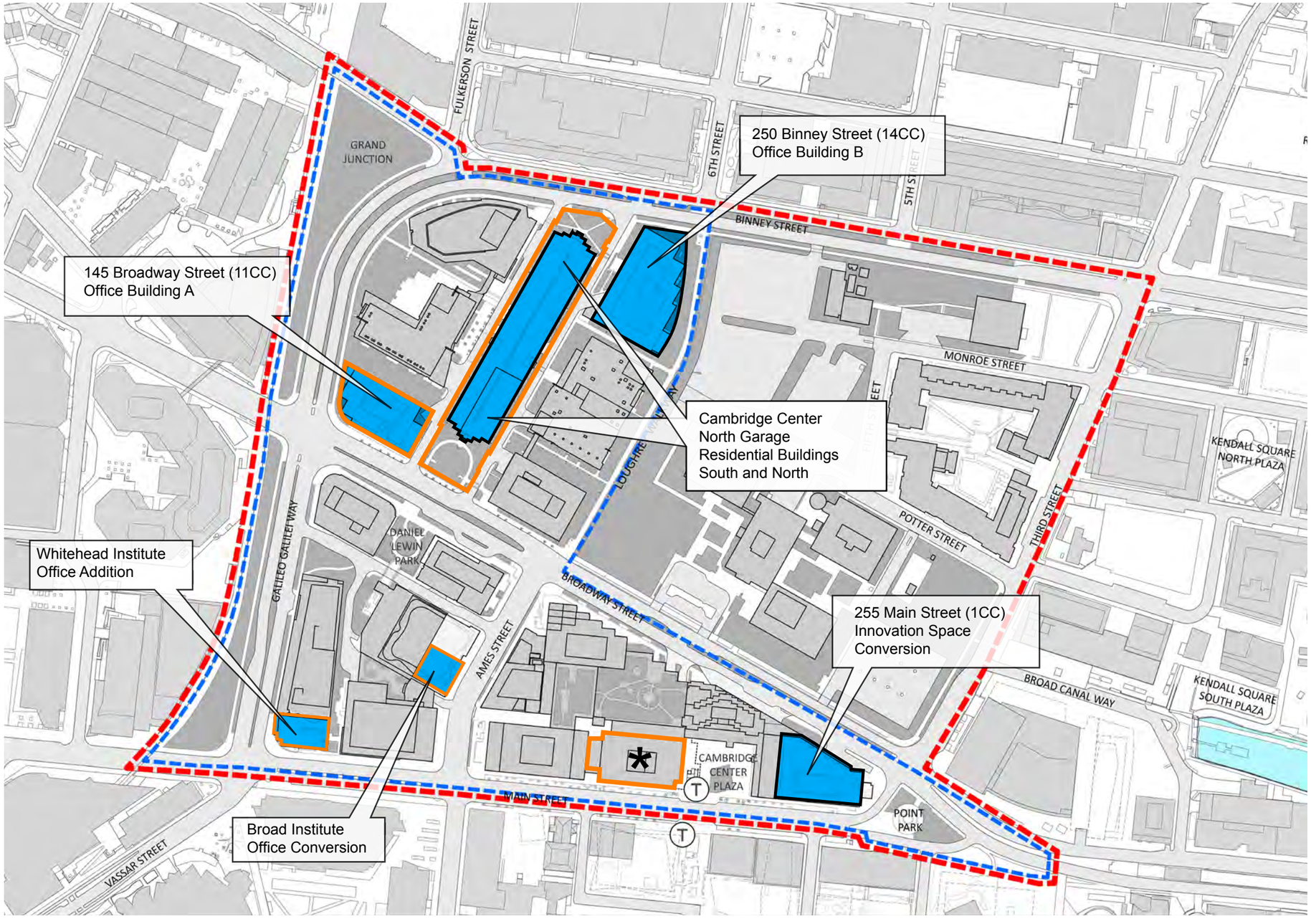
0 100 200 Feet

**CRA**

Source: Sasaki Associates

Figure S.4
Previously Reviewed Project

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA




**LEGEND**

- KSURP Boundary
- MXD Boundary
- Project Change (referred to herein as the Project Components)
- Project Most Recently Previously Reviewed KSURP (Amendment No.10)
- * Site no longer considered

0 100 200 Feet

**CRA**

Source: Sasaki Associates

Figure S.5
Proposed Project Change

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA

# 1

# Project Change Description

This chapter describes the existing site conditions and proposed modifications to the KSURP Amendment No. 10 as a result of the final approved amendments to Article 14 approved by the Cambridge City Council on December 21, 2015. Key program changes were a result of since the SEIR include greater Innovation Space bonuses, and greater requirements for affordable housing, home ownership, and 3-bedroom units.

## 1.1 Existing Site Conditions

The specific parcels subject of the Project include four parcels within the existing Cambridge Center complex:

- 145 Broadway (previously referred to as Eleven Cambridge Center);
- Cambridge Center North Garage fronting Broadway and Binney Street;
- 250 Binney Street (previously referred to as Fourteen Cambridge Center); and
- 255 Main Street (previously referred to as One Cambridge Center Street.

The Project Change includes removal of the Three Cambridge Center Mixed Use Building and addition of Office Building B at 145 Broadway.

The existing Whitehead Institute building at Nine Cambridge Center and the Broad Institute at 75 Ames Street continue to be included as part of the Project for the purposes of MEPA review because they involve changes to previously reviewed and approved uses, as previously described in the SEIR. Refer to Refer to Figure 1.1 for a Cambridge Center Properties Map and Figures 1.2a-d for existing site conditions. The existing conditions for each subject parcel or building are described in the following sections.

### 1.1.1 145 Broadway

The 145 Broadway site consists of approximately 37,862 square feet of land with an approximately 76,600-square foot commercial office building located at the corner of Broadway and Galileo Galilei Way. Refer to Figure 1.2a for the existing conditions for 145 Broadway. The site is bordered by a tree lined landscaped area and Fifteen Cambridge Center to the north, the North Garage to the east, Broadway to the south and Galileo Galilei Way to the west. A large diameter drainage culvert exists parallel to Broadway below the sidewalk. The culvert leads directly to the Charles River located approximately 0.4 mile to the east. The drainage culvert also served historically as an aqueduct connecting the former industrial complex at One Kendall Square to the Charles River supplying cooling water to the facility.

### 1.1.2 Cambridge Center North Garage

The Cambridge Center North Garage is a six-story approximately 92,000-square foot parking facility located at 135 Broadway and 280 Binney Street. The garage is surrounded on all sides by commercial office and biotech lab space. Refer to Figure 1.2a for the existing conditions for the North Garage. Access to the garage is through roadways on either side of the garage that connect to Binney Street to the north and Broadway to the south. The land at the north and south ends of the garage is improved with landscaped areas, benches, and walkways. A large steam line runs through the garage property below the ground floor slab contained within a 30-foot wide utility easement.

### 1.1.3 250 Binney Street

The 250 Binney Street site consists of 53,996 square feet of land with an existing 62,576 square foot manufacturing/lab building. Refer to Figure 1.2b for the existing conditions for 250 Binney Street. The site is bordered by a tree lined landscaped path called the Loughrey Walkway to the east and Twelve Cambridge Center to the South, the North Garage to the west, and Binney Street to the north.

### 1.1.4 255 Main Street

The 255 Main Street site consists of approximately 224,538 square foot of commercial office space located at the corner of Broadway and Main Street. Refer to Figure 1.2c for the existing conditions for 255 Main Street. The site is bordered by Broadway Street to the North, Point Park to the east, Main Street to the south and a plaza to the west.

### 1.1.5 Whitehead Institute and Broad Institute

Figure 1.2d shows the existing site conditions of the Whitehead Institute and Broad Institute sites. The Whitehead Institute is an approximately 200,000-square foot existing commercial building with research and development/laboratory uses located at Nine Cambridge Center at the corner of Main Street and Galileo Galilei Way. Constructed in 2006, the approximately 246,000 square feet Broad Institute building located at 75 Ames Street was the subject of Plan Amendment No. 8.
Project Change Description

## 1.2 Project Change Description

The Project Change consists of modifications to the preliminary development program and building massing scheme previously presented in the SEIR. The proposed adaptations are intended to comply with the final amendments to Article 14 of the Cambridge Zoning Ordinance in response to public process in fall/winter 2015 and approved by Cambridge City Council on December 21, 2015—both of which followed the conclusion of the most recent MEPA review process. Overall, the

development program and building massing modifications result in up to an additional 90,600 gross square feet of net new development.

The currently proposed infill development program intends to address the City's desire for affordable and middle income housing as well as the creation of innovation space consistent with the K2 Plan. And, as demonstrated herein, the Current Project would result in a greater level of public benefits and improvements previously contemplated, including public open space, upgraded stormwater management facilities, streetscape improvements and bicycle accommodations.

As shown in Figure S.5, the Project aims to encourage new development in the form of the following Project Components:

- Office Building A located at 145 Broadway;
- Residential Building North located atop the Cambridge Center North Garage fronting Broadway;
- Office Building B located at 250 Binney Street;
- Residential Building South located atop the Cambridge Center North Garage fronting Binney Street; and
- Innovation Space Conversion located at 255 Main Street.

The existing Whitehead Institute building at Nine Cambridge Center and Broad Institute at 75 Ames Street are also included in this MEPA review because they involve changes to the build-out under the KSURP.

Table 1-1 below presents the proposed development program.

**Table 1-1 Proposed Development Program**

| Project Component | Size (GSF[1]) | Building Height |
|---|---|---|
| **Phase 1A – Office Building A** | | |
| Existing Commercial Office at 145 Broadway (previously referred to as Eleven Cambridge Center) to be demolished | (78,636) | +48 feet (4 stories) |
| Commercial Office | 384,236 | +249 feet |
| Retail[2] | 10,000 | (20 stories) |
| *NET NEW:* | *315,600* | |
| **Phase 1B – Residential Building South** | | |
| Residential (along Broadway; previously referred to as Cambridge Center North Garage) | 350,000 (464 Units) | +350 feet[3] (33-stories) |
| *NET NEW:* | *350,000* | |
| **Phase 2A – Office Building B** | | |
| Existing Commercial Office at 250 Binney Street (previously referred to as Fourteen Cambridge Center) to be demolished | (62,576) | +32 feet (2 stories) |
| Commercial Office | 358,176 | +200 feet (15 stories) |
| Retail[2] | 20,000 | |
| *NET NEW:* | *315,600* | |
| **Phase 2B – Residential Building North** | | |
| Residential (along Binney Street; previously referred to as Cambridge Center North Garage) | 70,000 (96 Units) | +173'9" feet[3] (12 stories) |
| *NET NEW:* | *70,000* | |
| **Innovation Space Conversion** | | |
| Existing Commercial Office at 255 Main Street (previously referred to as One Cambridge Center) to be converted | 105,200 | NA (+180 feet, 12 stories) |
| Whitehead Institute Addition[4] | 60,000 | No change from existing (+84 feet, 6 stories) |
| Broad Institute Office Conversion (mechanical to be converted)[5] | 14,000 | NA |
| *NET NEW:* | *74,000* | |
| **TOTAL (NET NEW)** | **1,125,200[6]** | |
| Office | 675,200 | |
| Retail | 30,000[7] | |
| Residential | 420,000 | |
| Residential Units | 560[8] | |
| Parking Spaces | 809 | |

1 GSF (Gross Square Feet) excluding accessory and support spaces, such as vertical transportation core and mechanical space, as defined in Article 2 if the Cambridge Zoning Ordinance.

2 Retail uses can include Active Ground Floor Uses, such as active public gathering space, per Article 14 of the Cambridge Zoning Ordinance.

3 Allowable height up to 300 to 350 feet for residential buildings, as currently proposed in the Plan Amendment No. 10.

4 Office building addition to the existing facility at Nine Cambridge Center.

5 Accounts for the conversion of existing mechanical space to be re-purposed/fit-out into leasable commercial office space at the Broad Institute's 75 Ames Street location.

6 Does not include Innovation Space Conversion.
7 Assumes some restaurant space with approximately 106 seats.
8 Equates to approximately 840 bedrooms.

The KSURP regulates the level of development through a cap on aggregate Gross Floor Area (GFA) of all land uses in the KSURP area. The level of development is further restricted through use limitation of land use groups and Floor Area Ratio (FAR) controls by land use. These three tiers of regulations are designed to provide flexibility in the distribution of development throughout the KSURP area while maintaining a balance of land use in the KSURP area. These regulations are repeated in the Cambridge Center Mixed Use District (MXD) of the Zoning Ordinance.

The proposed amendment to the KSURP includes a few exemptions to the GFA caps namely:

› 50 percent of the Innovation Office Space;
› Ground floor retail that is sub-divided into establishments of 5,000 square feet or less (but allows exceptions for larger format retail, such as pharmacies or grocery stores); and
› Housing units that are permanently restricted to Middle Income households.

Thus, the total GFA allowance in Plan Amendment No. 10 provides approximately 675,200 square feet of net new commercial development and 420,000 square feet of residential development. The analysis of environmental impacts provided herein includes anticipated square footage beyond these GFA caps that would take advantage of the proposed exemptions; 52,600 square feet of Innovation Space and 30,000 square feet of ground floor retail space.

### 1.2.1 Project Components

The following sections describe each Project Component in further detail. Figures 1.3a-e present the proposed site conditions. Figure 1.4 demonstrates how the Current Project aims to be more consistent with the City's K2 Plan.

#### Office Building A

Figure 1.3a presents the proposed Office Building A massing. The redevelopment of Eleven Cambridge Center lot (Phase 1A) consists of new 20-story commercial office tower with ground-floor active use space totaling approximately 394,236 gross square feet. The new building is to be constructed in place of the existing four-story commercial office building. A public plaza provides direct and open access to the lobby and active use spaces, which extends along Broadway and wraps the corner of Galileo Galilei Way.

#### Residential Buildings North and South

Figure 1.3b presents the proposed Residential Buildings North and South massing and project rendering based on an early design concept. The Residential Building South (Phase 1B) consists of a newly constructed 33-story residential building that

will stand above the south portion of the Cambridge Center North Garage and will accommodate up to 464 units, totaling approximately 350,000 square feet of new development.

The proposed Residential Building North (Phase 2B) consists of a newly constructed 12-story residential building that will stand above the north portion of the Cambridge Center North Garage and will accommodate up to 96 units, totaling approximately 70,000 gross square feet of net new development.

**Office Building B**

Figure 1.3c presents the proposed Office Building B massing. The redevelopment of Fourteen Cambridge Center (Phase 2A) consists of a new 15–story commercial building totaling approximately 378,176 gross square feet. Office Building B will be constructed in place of the existing two-story commercial office building. Ground Floor uses will include active space along the Sixth Street Connector, an engaging lobby entrance along Binney Street and access to the below grade parking structure from the existing internal access road. Early design concepts have studied methods for terracing the building volume to address its site and provide an appropriate scale for both the Sixth Street connector and the Binney Street corner.

**Innovation Space Conversion**

The proposed renovations to One Cambridge Center will provide for approximately 105,200 sf of Innovation Space in the MXD district. These renovations will be distributed across several floors of the existing building, and constructed to accommodate smaller scale and start up type companies, consistent with the identity of Kendall Square. The main entry to the Innovation Space will be immediately off Point Park, at the intersection of Broadway and Main Street, with high visibility from the intersection, park, and Longfellow Bridge. Figure 1.3d presents the location of the proposed Innovation Space Conversion.

**Whitehead Institute Office Addition and Broad Institute Office Conversion**

The Whitehead Institute consists of an expansion of an existing use (an approximately 60,000-square foot commercial office/lab addition) and the Broad Institute proposes a change in use to their existing facility (conversion of approximately 14,000 square feet of mechanical space to commercial office space) to be undertaken. Since the SEIR the Broad Institute Office Conversion has been refined and has been reduced from 15,100 to 14,000 square feet due based on updated design information provided by that proponent. Figure 1.3e presents the Whitehead Institute Addition massing, as previously shown in the SEIR.

## 1.3 List of Regulatory Controls, Permits and Approvals

Table 1-2 below presents an updated list of anticipated permits and approvals required for the Project. It is possible that not all of these permits or actions will be required, or that additional permits or actions may be needed.

**Table 1-2 List of Anticipated Permits and Approvals**

| Agency/Department | Permit/Approval/Action | Status |
|---|---|---|
| **Commonwealth of Massachusetts[1]** | | |
| Massachusetts Department of Housing & Community Development | Urban Renewal Plan Amendment Approval | Approved April 26, 2016 |
| Executive Office of Energy and Environmental Affairs | Certificate Evidencing Completion of MEPA Review | Notice of Project Change submitted April 15, 2015<br>Single Environmental Impact Report submitted October 15, 2015<br>SEIR Certificate November 25, 2015<br>Public Benefits Determination December 23, 2015<br>Notice of Project Change submitted herein |
| Massachusetts Department of Transportation | Approval of Transportation Impact Study Scope Letter | December 4, 2014 |
| Massachusetts Department of Environmental Protection, Division of Air Quality Control | Air Quality Permit (under 310 CMR 7.00) for heating boilers and emergency generators | To be obtained (if required) |
| Massachusetts Department of Environmental Protection | Compliance with Massachusetts Contingency Plan | To be completed |
| Massachusetts Water Resources Authority Toxic Reduction and Control Group | Sewer Use Discharge Permit | To be obtained (if required) |
| **City of Cambridge** | | |
| Cambridge Redevelopment Authority | Urban Renewal Plan Amendment Approval | Approved July 15, 2015 |
| Cambridge City Council | Urban Renewal Plan Amendment Approval | Approved December 21, 2015 |
| | MXD Zoning Petition | Approved December 21, 2015 |
| Cambridge Planning Board | Recommendation on Urban Renewal Plan Amendment Approval | Adopted, November 10, 2015 |
| | Recommendation on MXD Zoning Petition | Adopted, November 10, 2015 |
| | Approval of Infill Development Concept Plan & Special Permit | To be obtained |

The Project will be designed to meet all applicable statutory and regulatory standard and requirements, as described more fully in the following sections. Chapter 3, *Summary of Proposed Mitigation and Draft Section 61 Findings* presents a comprehensive description of the proposed measures that aim to avoid, minimize, and/or mitigate environmental impacts as well as other beneficial measures associated with the Project.

## 1.4 Agency Coordination and Public Outreach

This section summarizes state and city outreach completed prior to this filing.

### 1.4.1 Massachusetts Department of Transportation

The Proponent and Redeveloper remain committed to developing an expanded program of transportation mitigation and enhancements designed to both preserve the favorable non-single occupant vehicle mode share balance in Kendall Square and provide additional improvements to mitigate the trip generation projected from the Project. The Proponent has engaged in extensive discussions with the Massachusetts Department of Transportation (MassDOT) and Massachusetts Bay Transportation Authority (MBTA) to identify potential transportation mitigation and enhancements in the Kendall Square area and to create a process for deciding on which measures would be recommended for funding. As described in Chapter 2, *Assessment of Project Change Impacts*, a Working Group will be established to develop recommendations in conjunction with the many stakeholders engaged in transportation planning and operations in Kendall Square. The proposed KSTEP to be established under the MOU between the Proponent and Redeveloper, with MassDOT, the MBTA, and the City, would supplement the transportation mitigation measures outlined herein. The KSTEP would be designed to enhance transit access to and mobility around Kendall Square, which the Proponent believes is critical to the long-term economic success of the area. Over the coming months, the Proponent will work closely with the City, the MBTA, and MassDOT to refine the KSTEP proposal and execute the MOU.

### 1.4.2 Massachusetts Environmental Policy Act Office

On June 8, 2016, the Proponent and Redeveloper held a pre-filing meeting with MEPA staff to present the Project Change, as presented herein, and confirm the filing approach. Additionally, an update on ongoing coordination efforts with MassDOT and the City, and on the status and overall intent of the draft MOU was provided.

### 1.4.3 City of Cambridge

The Cambridge Planning Board made recommendations on both the Kendall Square Urban Renewal Plan Amendment and the accompanying MXD Zoning petition on November. On December 21, 2015 the City Council approved the Plan Amendment and the zoning petition.

Together the Amendment and zoning create a unique planning and design review process for the Project requiring that new infill development be approved with an Infill Development Concept Plan. This Special Permit process requests many of the same elements as a Planned Unit Development but does so over a highly built out area undergoing further redevelopment with infill buildings. The Concept Plan requires proposals to provide details regarding the full plan area context, the

phasing of new GFA, proposed massing, details on the provision of housing and innovation space, an open space plan, a retail program, an infrastructure plan and a sustainability strategy. The Concept Plan must be approved by both the CRA Board and the Planning Board, and the project will undergo joint staff review.

The Project engineering team has held meetings with the City's Department of Public Works to discuss stormwater measures pursuing onsite and neighborhood solutions. Since the publication of the SEIR, the Proponent has held multiple sessions with the Department of Transportation, Parking, and Traffic to scope out the future TIS study along with bike parking and loading design. The Proponent and Developer have met on several occasions with the Community Planning Division regarding the overall Project plan, the community outreach program, and the co-design review process. Additionally initial design review session have taken place to evaluation building massing and initial building design.

### 1.4.4 Public Outreach

In 2015, The CRA conducted a significant amount outreach and community engagement to refine the language for the KSURP Amendment and MXD zoning. This included monthly public meetings of the CRA Board, multiple hearings with the Planning Board, a focused community workshop, meetings with various community groups and the utilizations of an online website forum in coUrbanize, which has 264 followers. The Proponent has utilized other innovation outreach methodologies such as a poster text survey initiative around the project site, and a Parking Day pop-up office to gather feedback.

A detailed list of meetings up to the time of the EIR filing in October was provided in the EIR. Below is a list of meetings held since that filing, as well as meetings plan in the near future related to the review of the Project and the Infill Development Concept Plan.

- October 13, 2015 Presentations to Planning Board and the Kendall Square Association
- November 5, 2015 CRA Board adopts revisions to KSURP (v2))
- November 10, 2015 Planning Board makes recommendations to City Council
- November 19, 2015 Public hearing of the City Council Ordinance Committee
- December 01, 2015 CRA Board makes additional revisions based on Ordinance Committee hearing (v3)
- December 3, 2015 Continued public hearing of the City Council Ordinance Committee – forwarded to the full council
- December 7, 2015 Full City Council Meeting
- December 16, 2015 CRA Board makes final set of revisions based on full City Council meeting (v4)
- December 21, 2015 City Council adopts KSURP Amendment and MXD Zoning
- March 16, 2016 CRA Board Meeting on Open Space Plan

- April 13, 2016 East Cambridge Planning Team (ECPT) – Open Space
- April 27, 2016 CRA Design Review Committee presentation on Massing and Program
- May 18, 2016 CRA Board – Sustainability Strategy Discussion
- June 9, 2016 ECPT – Massing and Sustainability Presentation
- June 15, 2016 – CRA Board – Presentation on circulation, streetscape, and parking
- June 23, 2015 – Bicycle Committee Meeting
- June 29, 2016 – Planning Board – Project Overview

Currently scheduled meetings – additional TBD:

- July 19, 2026 – Public Open House and Workshop on Concept Plan
- July 20, 2016 – CRA Board Meeting – Urban Design and Concept Plan Overview

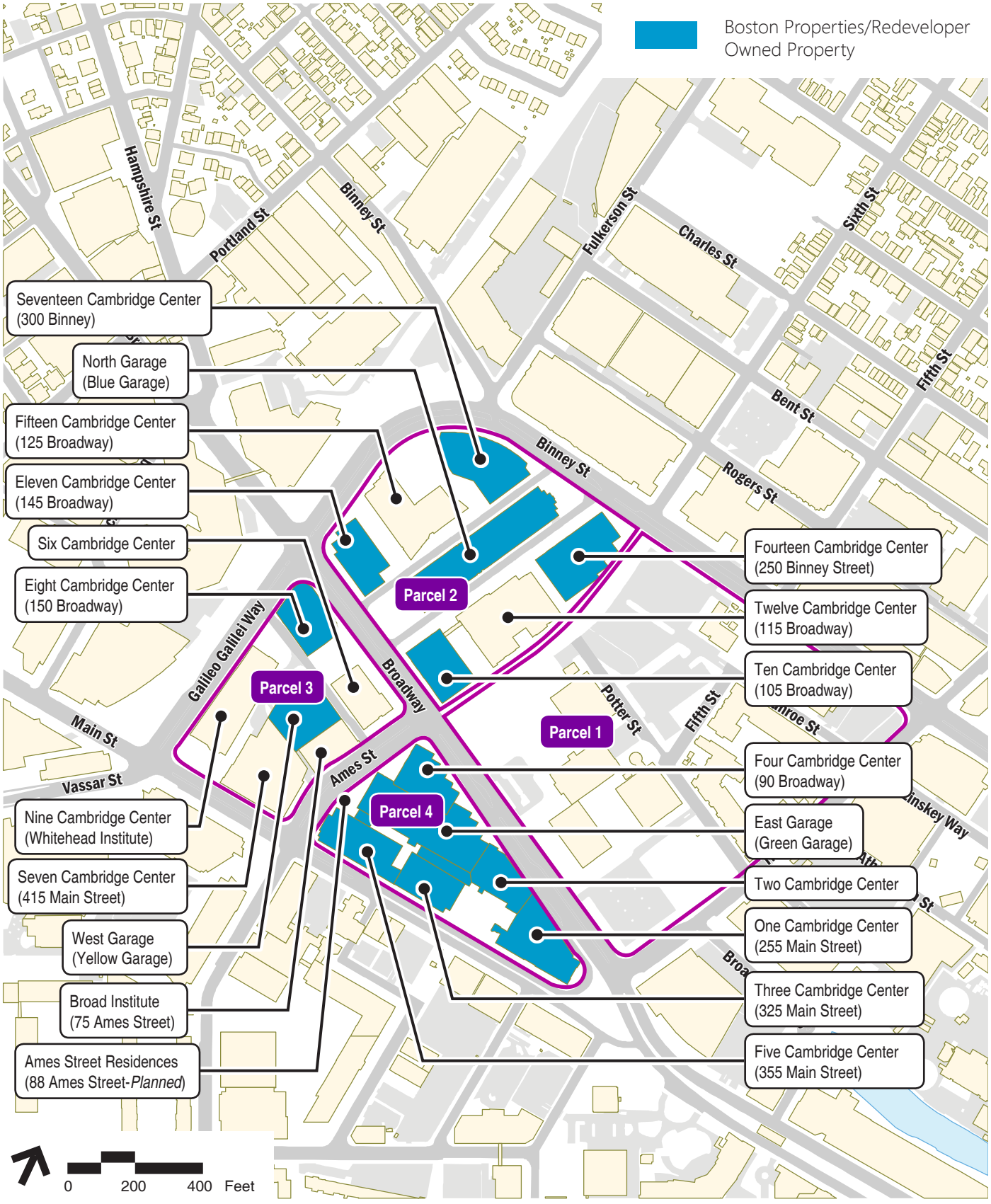
The Proponent has continued to utilize the coUrbanize[1] website, and exploring other methods of outreach such as on-site community intercept engagements, tabling at area markets, and online surveys.

## 1.5 Project Consistency

As described in the SEIR, the Project remains consistent with local, regional and/or state plans or policies. Please refer to the SEIR for a summary of the Projects consistency with the following specific plans/policies:

- Kendall Square Urban Renewal Plan
- K2 Plan
- Cambridge Growth Policy;
- Metropolitan Area Planning Council
- Governor's Clean Energy and Climate Plan
- Executive Order 385 – Planning for Growth
- Commonwealth's Sustainable Development Principles

[1] http://courbanize.com/kendall-sq-urban-renewal/




**CRA**

Figure 1.1
Cambridge Center Properties Key Map

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA

Source: City of Cambridge GIS, MassGIS


**CRA**

Figure 1.2a
Existing Conditions - North Garage & Eleven Cambridge Center

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA


**CRA**

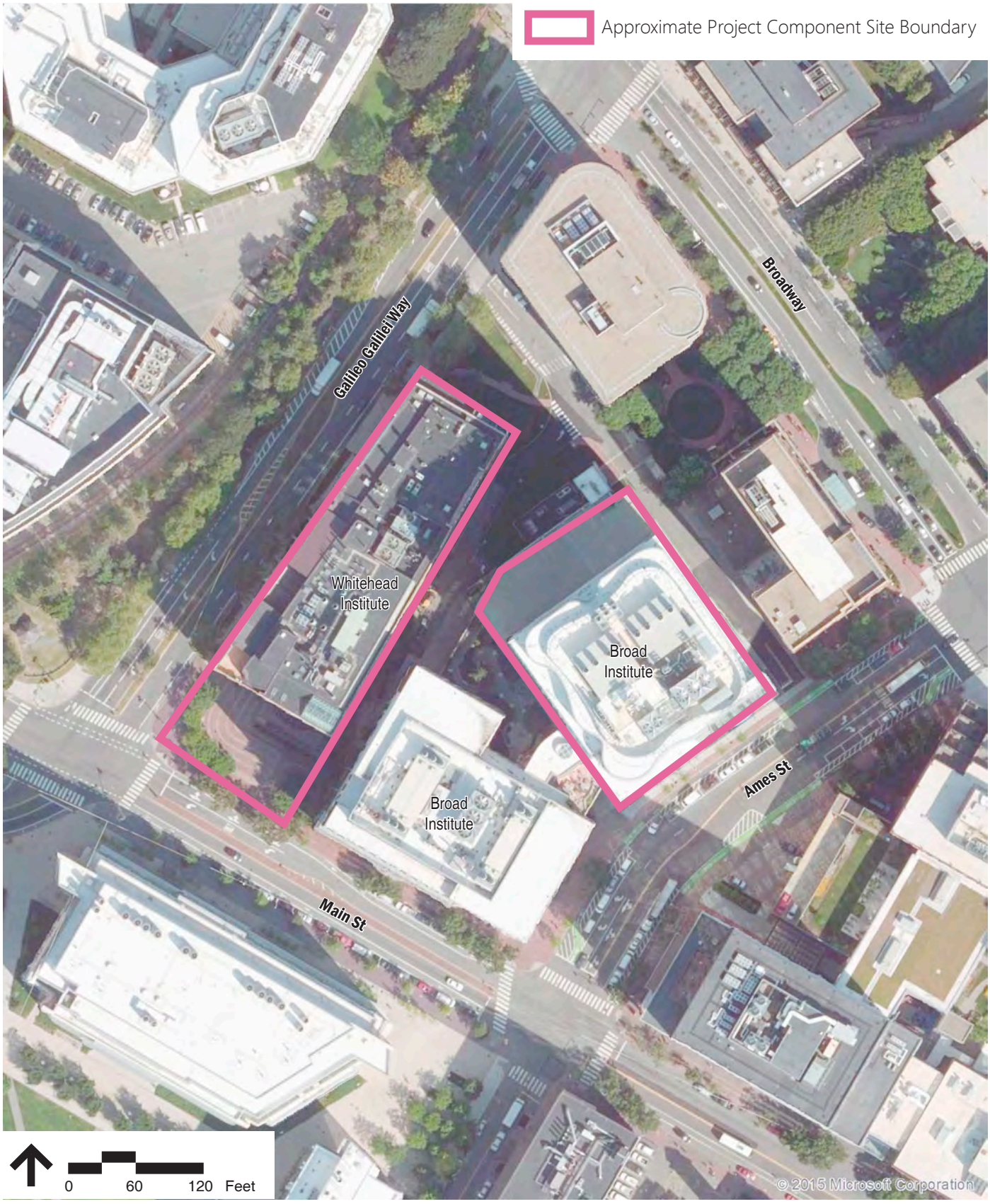
Figure 1.2b
Existing Conditions - Fourteen Cambridge Center

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA


**CRA**

Figure 1.2c
Existing Conditions - One Cambridge Center

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA




**CRA**

Figure 1.2d
Existing Conditions - Whitehead & Broad Institute Buildings

Kendall Square Urban Renewal Project Amendment No. 10
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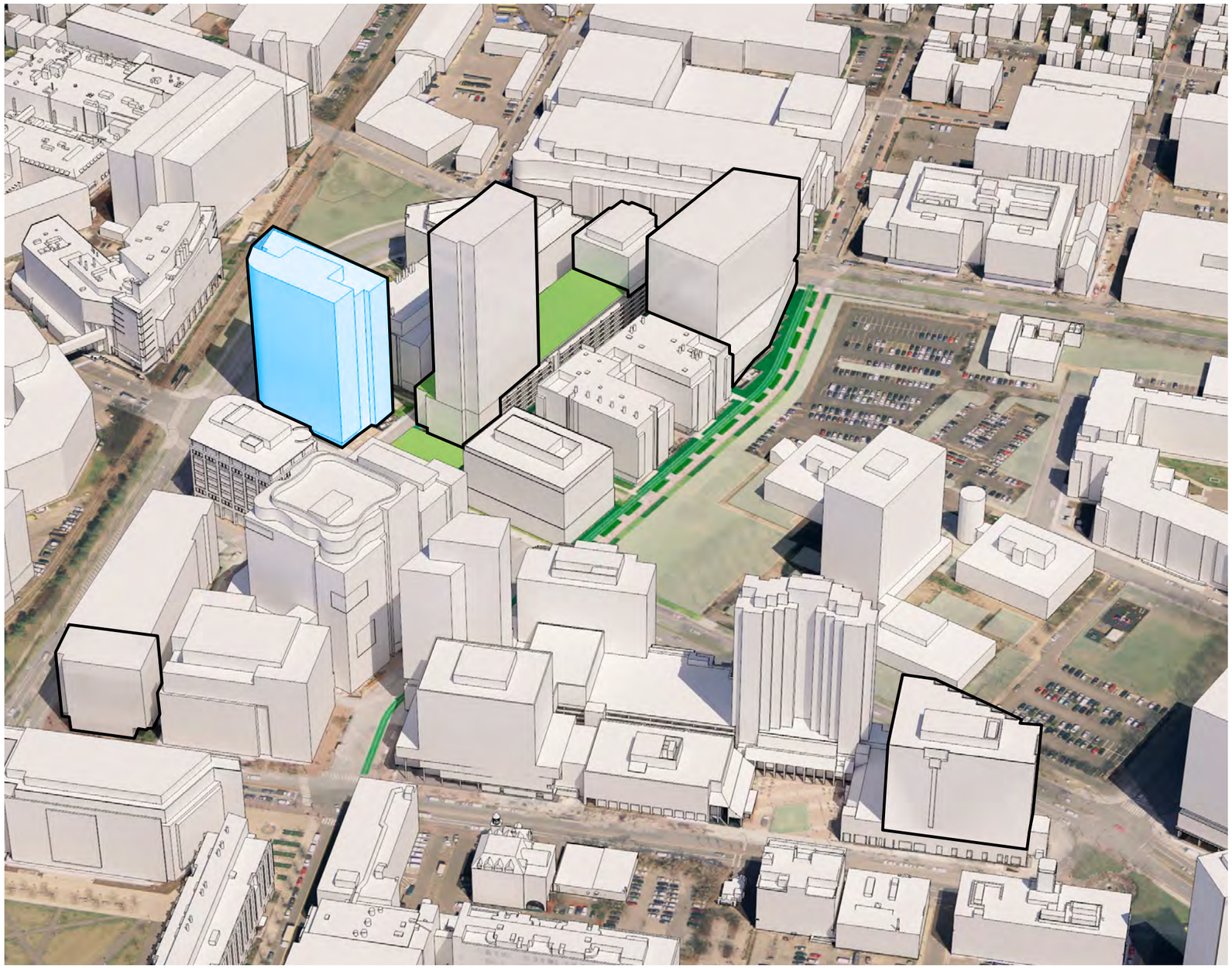
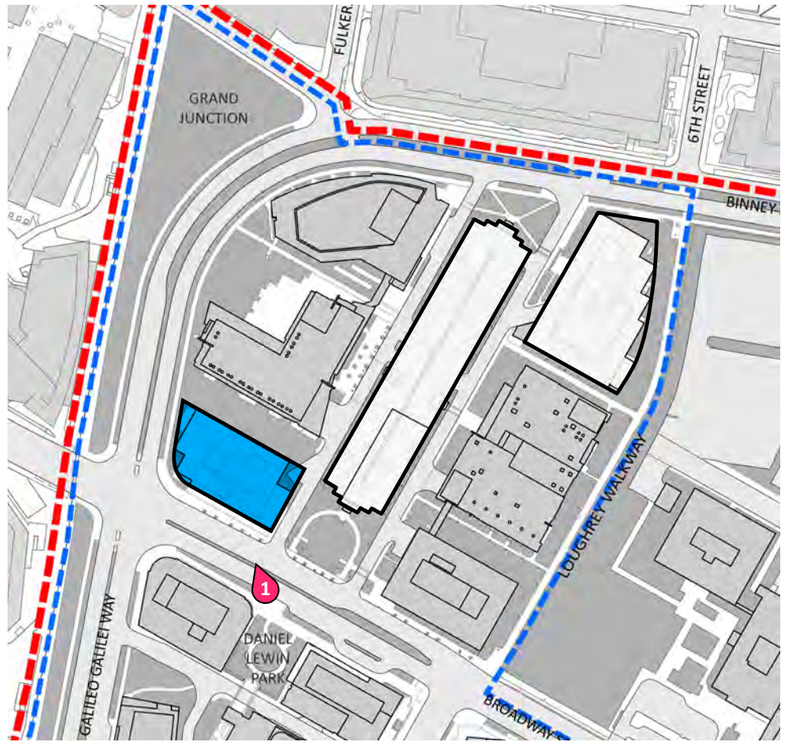


145 Broadway Street (11CC) Office Building A




1. Existing Site Photo

**CRA**

Sasaki Associates

Figure 1.3a
Proposed Conditions:
145 Broadway Street (11CC) Office Building A

Kendall Square Urban Renewal Project Amendment No. 10
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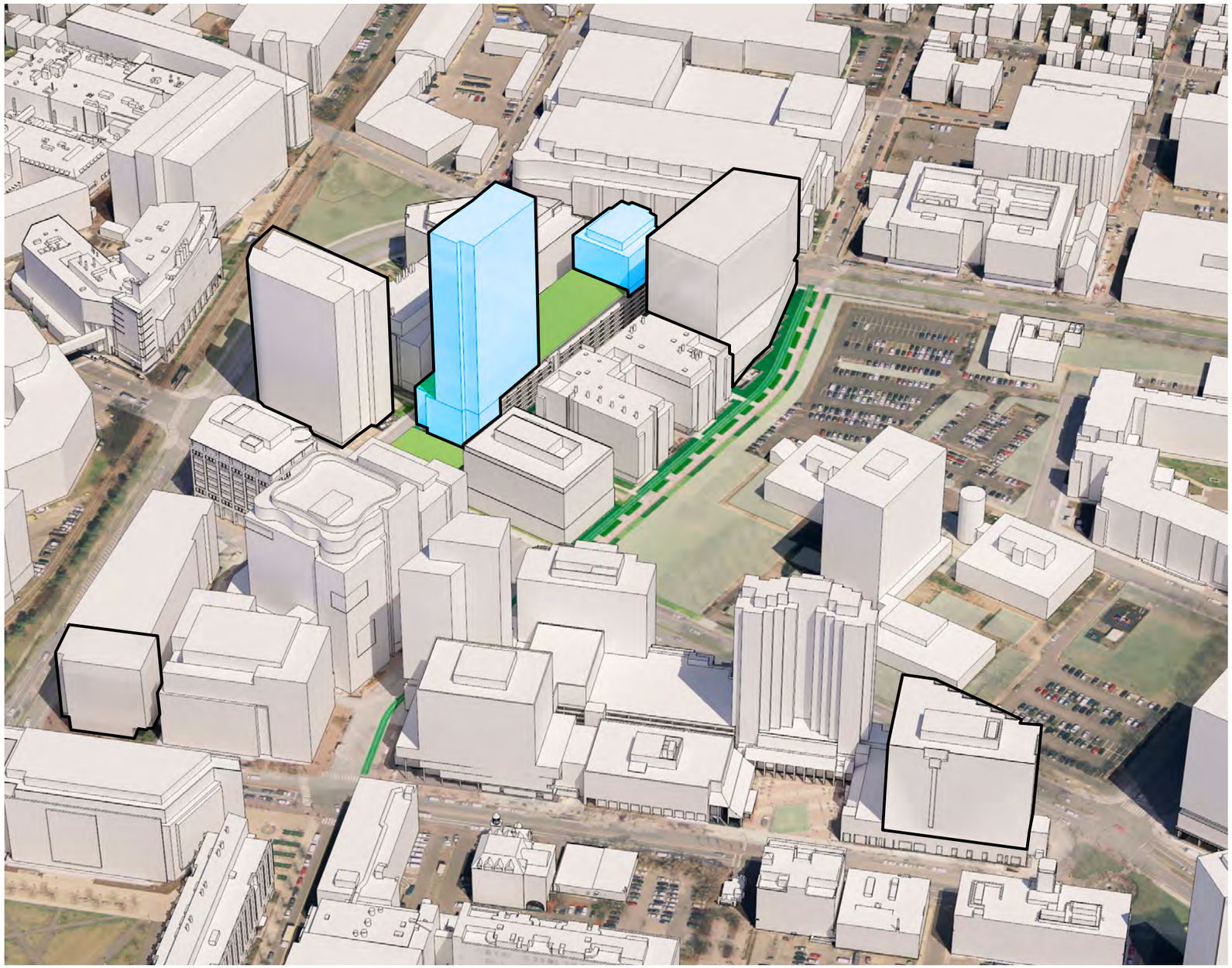
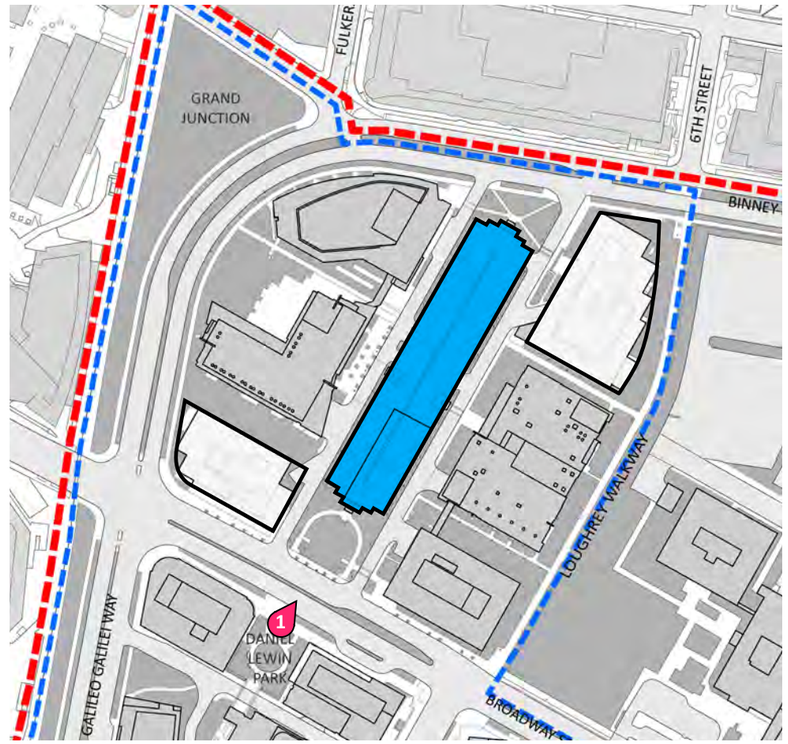


Cambridge Center North Garage Residential Buildings South and North




1. Existing Site Photo

**CRA**

Sasaki Associates

Figure 1.3b
Proposed Conditions:
Cambridge Center North Garage Residential Buildings

Kendall Square Urban Renewal Project Amendment No. 10
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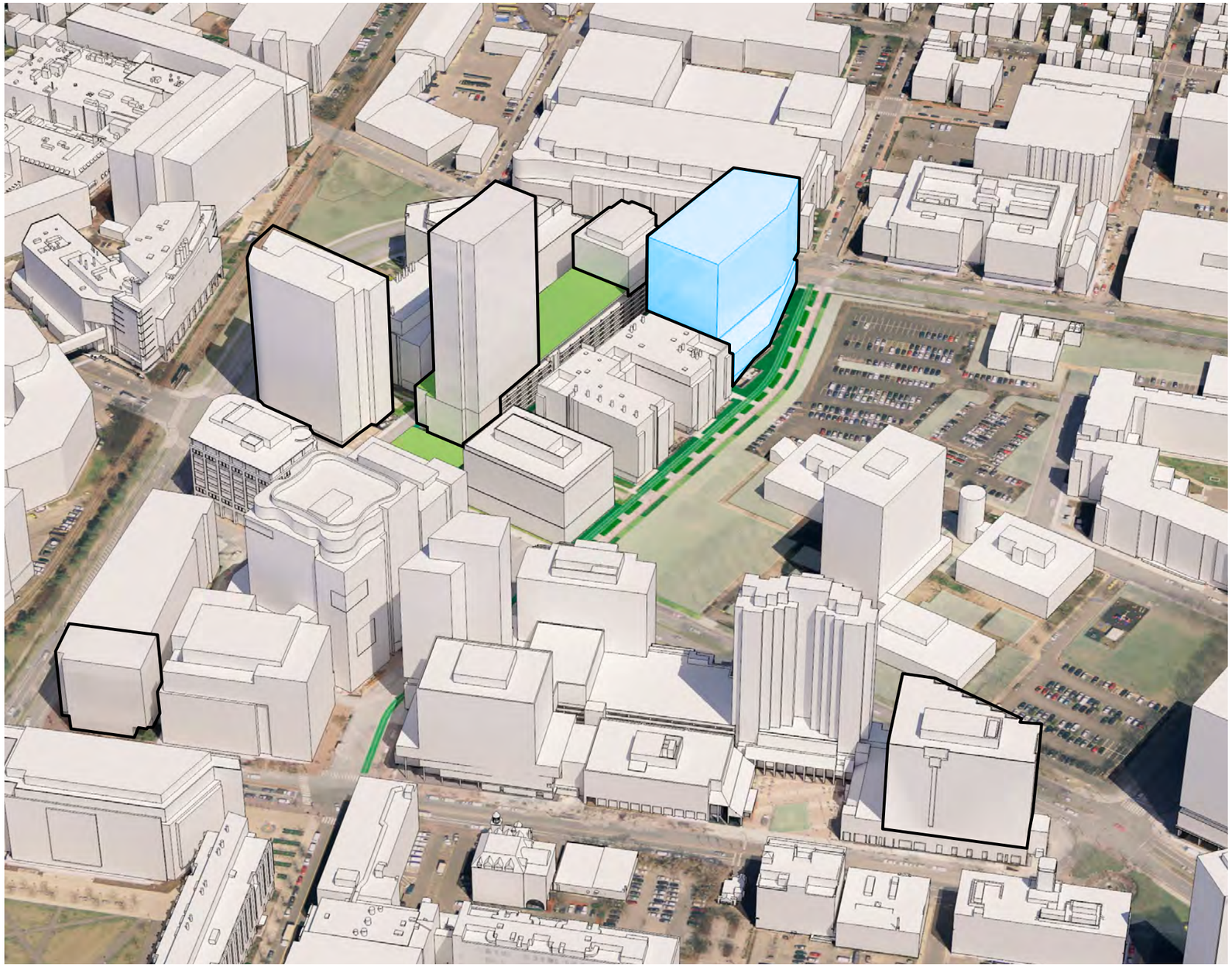
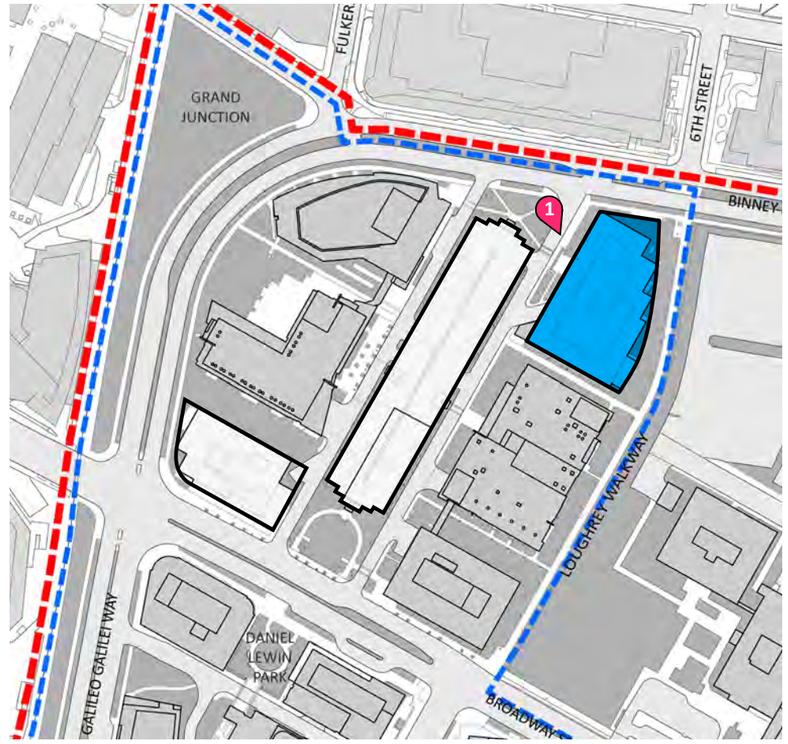


250 Binney Street (14CC) Office Building B




1. Existing Site Photo

**CRA**
Sasaki Associates

Figure 1.3c
Proposed Conditions:
250 Binney Street (14CC) Office Building B

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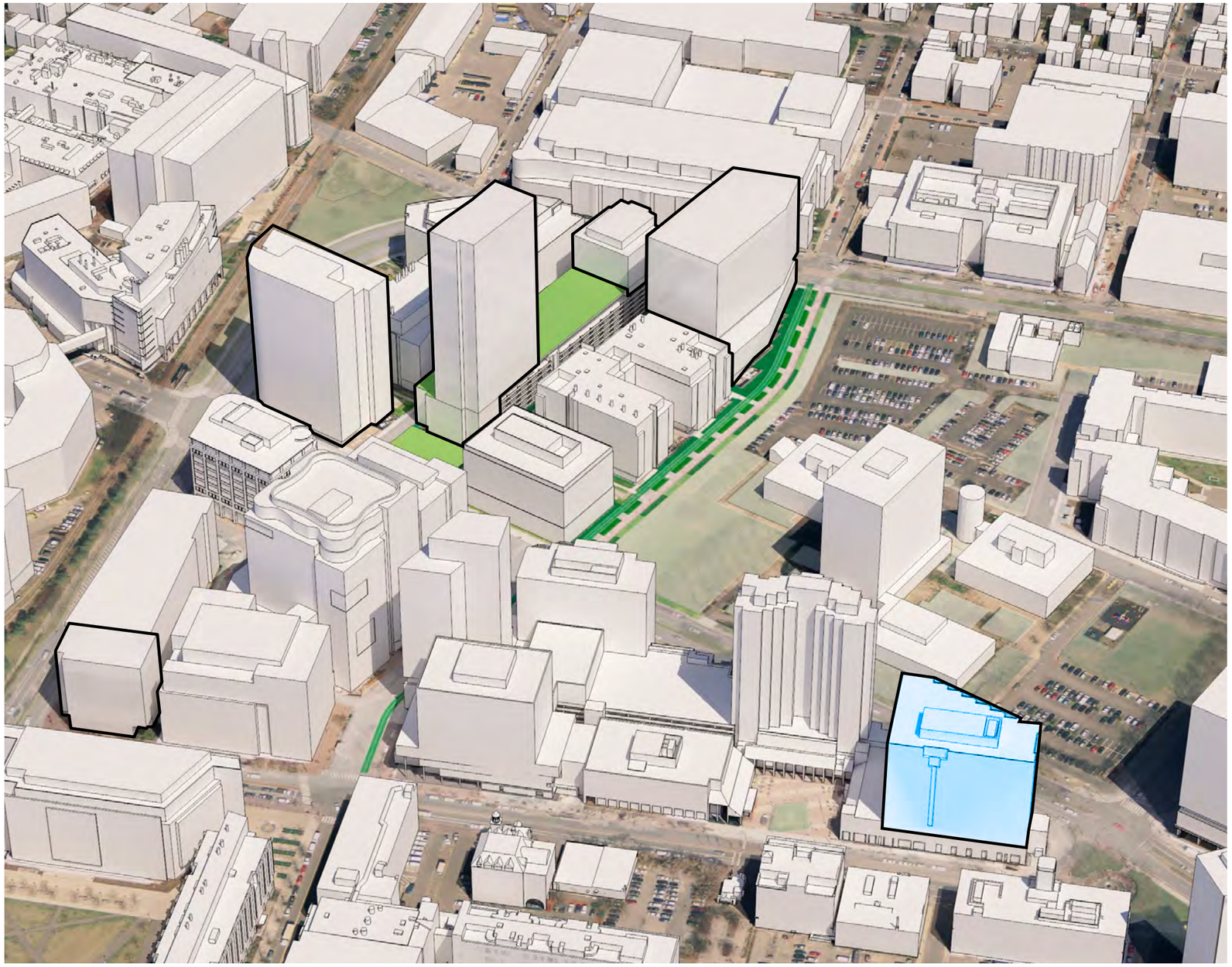
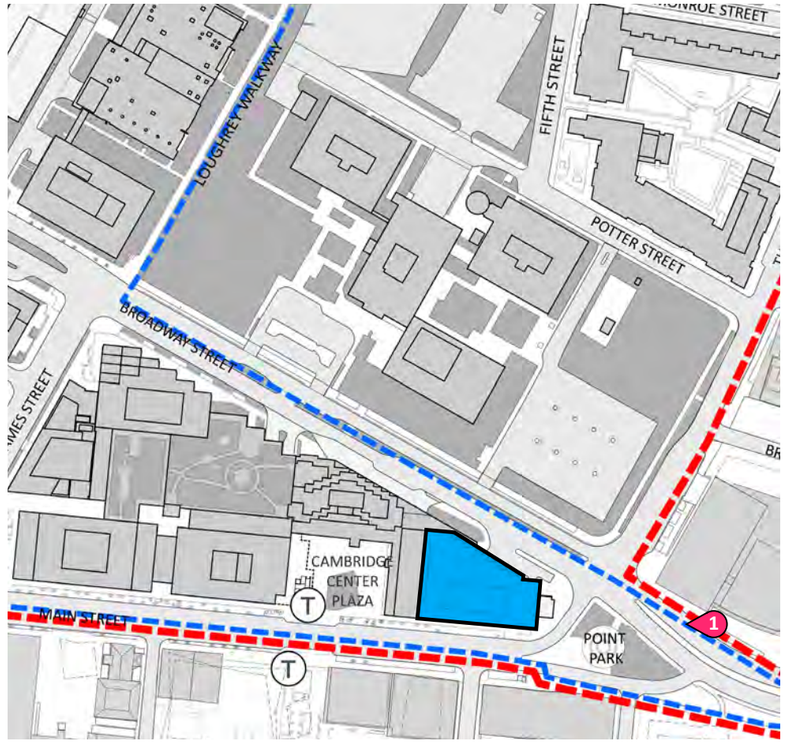


255 Main Street (1CC) Innovation Space Conversion *
(existing office space to be converted into New Innovation Space)

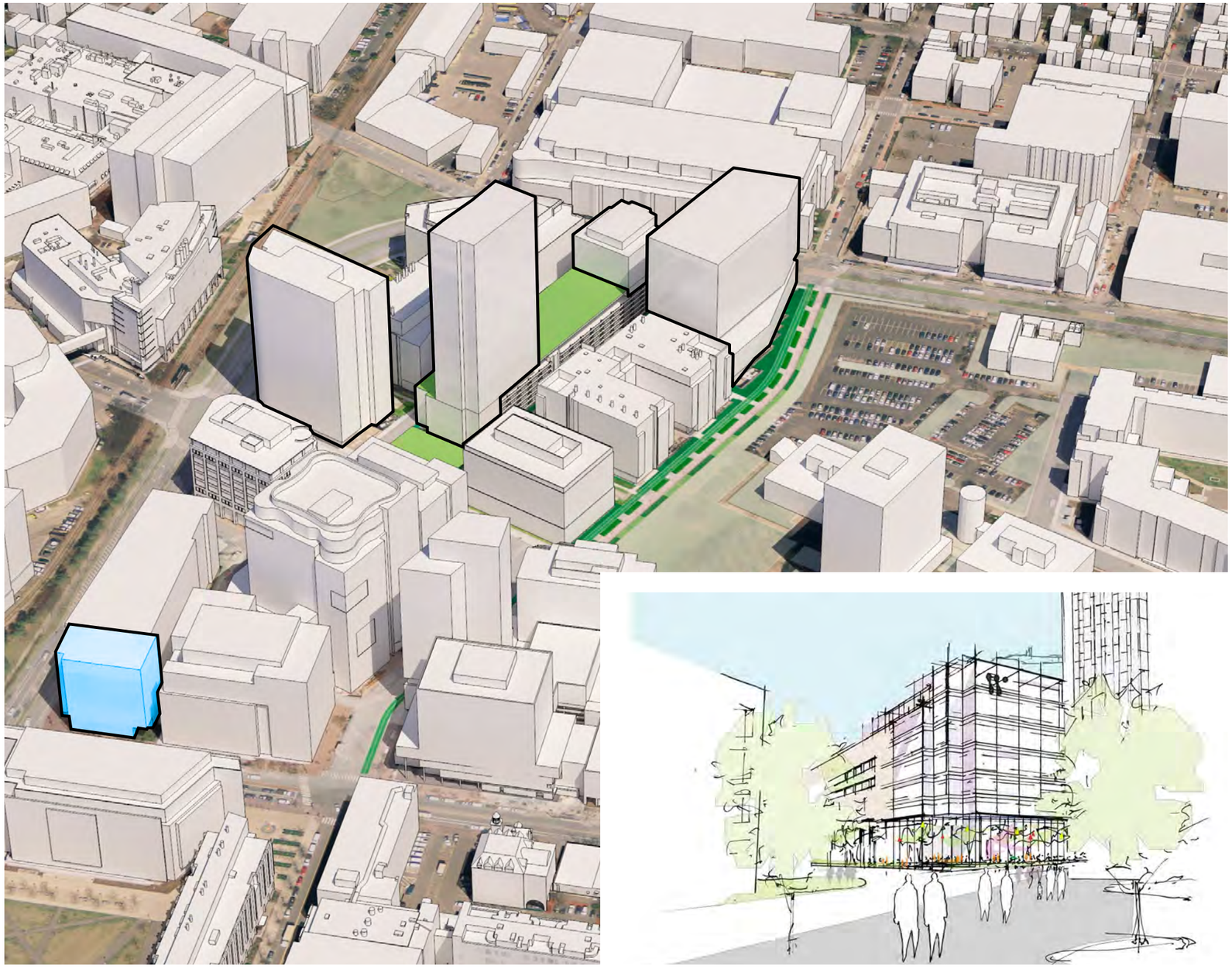



1. Existing Site Photo

**CRA**
Sasaki Associates

Figure 1.3d
Proposed Conditions:
255 Main Street (1CC) Innovation Space Conversion

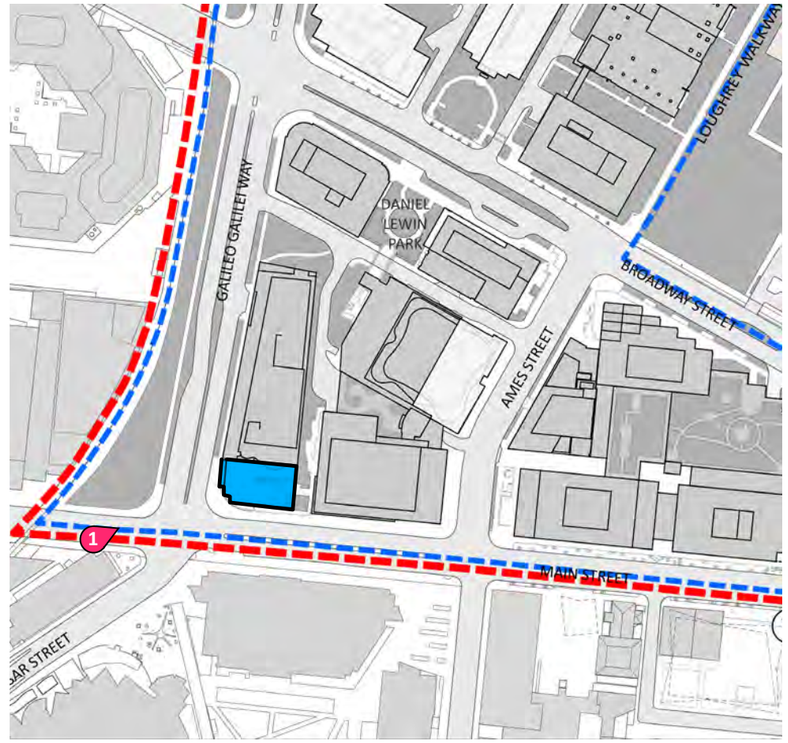
Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA



Whitehead Institute Office Addition



* Perspective View from Main Street



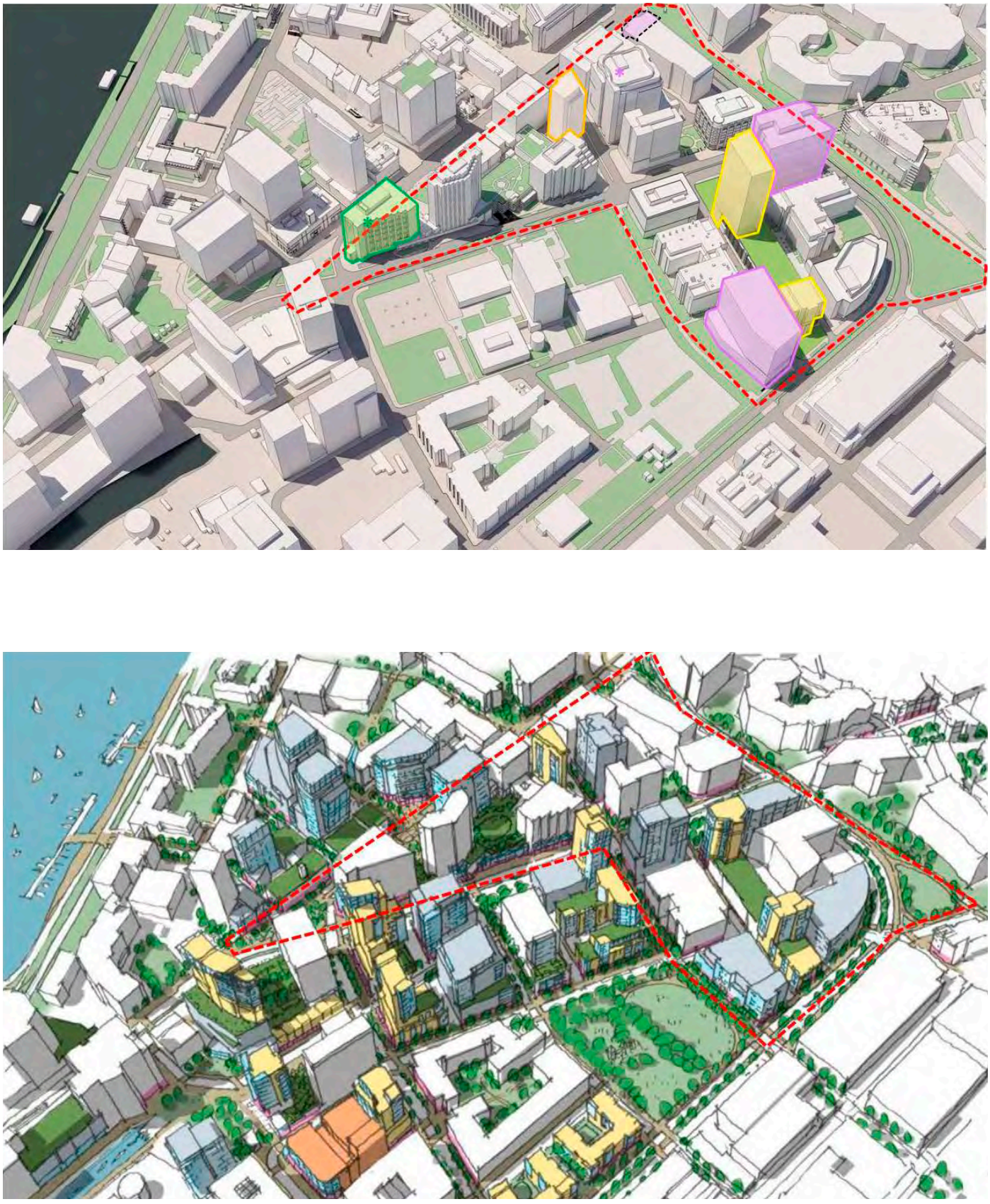

1. Existing Site Photo

**CRA**

Sasaki Associates *Tsoi / Kobus & Associates

Figure 1.3e
Proposed Conditions
Whitehead Institute Office Addition

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA



**CRA**

Figure 1.4
Building Massing Comparison to K2 Study

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA

Source: City of Cambridge GIS, MassGIS

# 2

# Assessment of Project Change Impacts

As described in greater detail in Chapter 1, *Project Description*, the development program proposed in connection with this Project Change represents an overall increase of approximately 90,600 net new gross square feet as compared to the Previously Reviewed Project and the mix of uses proposed have changed. The Project Change contemplates a reduction in retail use, an increase in commercial office use due to greater Innovation Space bonuses, and a small increase in residential square footage for additional affordable and 3-bedroom units.

This chapter provides an assessment of changes in potential environmental impacts associated with the Project Change. The following impact areas are including in this assessment:

- Transportation and Parking
- Air Quality
- Greenhouse Gas Emissions
- Climate Change Adaptation
- Chapter 91 Resources
- Stormwater Management
- Water and Wastewater
- Hazardous Materials
- Construction
- Open Space & Public Realm
- Social and Economic

## 2.1 Transportation and Parking

### 2.1.1 Vehicle Trip Generation

#### Unadjusted

Table 2-1 presents a comparison of the total unadjusted vehicle trip generation estimates for the Current Project and the Previously Reviewed Project. While the building program has increased by approximately 90,600 square feet, the overall unadjusted vehicle trip generation has remained relatively constant. For an average weekday, the Project Change is estimated to generate about 238 additional

unadjusted daily trips than the Previously Reviewed Project (less than a 2.3 percent increase). While during the morning peak hour, the Project Change is expected to generate 40 additional unadjusted trips than the Previously Reviewed Project, the number of evening peak trips are reduced slightly (by an estimated 17 unadjusted vehicle trips).

**Table 2-1 Comparative Trip Generation (Unadjusted Vehicle Trips)**

| Time Period/Direction | Previously Reviewed Project (SEIR) | Current Project | Project Change |
|---|---|---|---|
| **Daily** | | | |
| Entering | 5,256 | 5,375 | 119 |
| Exiting | 5,256 | 5,375 | 119 |
| **Total** | **10,512** | **10,750** | **238** |
| **AM Peak Hour** | | | |
| Entering | 842 | 878 | 36 |
| Exiting | 342 | 346 | 4 |
| **Total** | **1,184** | **1,224** | **40** |
| **PM Peak Hour** | | | |
| Entering | 419 | 418 | (-1) |
| Exiting | 887 | 871 | (-16) |
| **Total** | **1,306** | **1,289** | **(-17)** |

### Adjusted Traffic Generation

Table 2-2 presents a comparison of the adjusted vehicle trip generation estimates for the Current Project and the Previously Reviewed Project. For an average weekday, the Project Change is estimated to generate about 82 additional adjusted daily trips than the Previously Reviewed Project (less than a 2.3 percent increase). While during the morning peak hour, the Project Change is estimated to generate 11 additional adjusted trips than the Previously Reviewed Project, the number of evening peak trips are reduced slightly (by an estimated 5 adjusted vehicle trips).

**Table 2-2 Comparative Trip Generation (Adjusted Vehicle Trips)**

| Time Period/Direction | Previously Reviewed Project (SEIR) | Current Project | Project Change |
|---|---|---|---|
| **Daily** | | | |
| Entering | 1,819 | 1,860 | 41 |
| Exiting | 1,819 | 1,860 | 41 |
| **Total** | **3,638** | **3,720** | **82** |
| **AM Peak Hour** | | | |
| Entering | 276 | 286 | 10 |
| Exiting | 114 | 115 | 1 |
| **Total** | **390** | **401** | **11** |
| **PM Peak Hour** | | | |
| Entering | 146 | 146 | 0 |
| Exiting | 298 | 293 | (-5) |
| **Total** | **444** | **439** | **(-5)** |

Refer to Appendix C for information on how the adjusted vehicle trips were estimated based on mode split and the estimated unadjusted vehicle trips for the Current Project based on the *ITE Trip Generation Handbook* land use codes.

### 2.1.2 Parking

The Project Change includes construction of approximately 69 additional parking spaces than previously proposed (809 parking spaces compared to the approximately 740 spaces proposed for the Previously Reviewed Project). All new parking will be structured parking, as previously proposed. As discussed in the SEIR, collectively, with the approximately 2,708 existing off-street parking spaces and the Current Project parking supply, the KSURP area parking capacity falls within the maximum off-street parking supply previously approved under Plan Amendment No. 3 (3,545 spaces).

As presented in Appendix C, the parking capacity for the Current Project has been analyzed using the same shared parking approach as presented in the SEIR. The proposed parking configuration, which includes an approximately 374-space garage under Office Building A at 145 Broadway, an approximately 650-space garage under Office Building B at 250 Binney Street, and a net reduction of approximately 215 spaces in the North Garage (required to support the construction and retrofit of the residential towers) is adequate to meet the demands of the Current Project. As in the SEIR, no additional parking is proposed for the Whitehead Institute or Broad Institute components.

### 2.1.3 Transportation Impact Assessment

The transportation study that was prepared and submitted as part of the SEIR in support of the Previously Reviewed Project included a comprehensive and thorough analysis of the transportation impacts, as required by MassDOT and MEPA, with input from the City of Cambridge Traffic, Parking and Transportation Department (TP&T). That study clearly articulated the transportation impacts of the Previously Reviewed Project and delineated transportation mitigation and improvement actions to lessen the transportation effects of the Project and to provide improvements to the future transportation infrastructure in Kendall Square.

As shown in Tables 2-1 and 2-2, the impact characteristics of the Project Change are nearly identical, or in some cases modestly lower than the Previously Reviewed Project during peak hour study periods, which was comprehensively studied. Further, the access characteristics of the Project are nearly identical to the Previously Reviewed Project. The Project's access points to parking and loading are very similar to the Previously Reviewed Project, with access via Broadway and Binney Street. Most importantly, the Proponent and Redeveloper will continue to honor the wide array of transportation mitigation and improvement actions that were committed to under the Previously Reviewed Project, including those transit-related improvements that will be codified within a MOU (a draft of which is provided in Appendix D). Consequently, the impact analysis that was prepared and submitted in connection with the Previously Reviewed Project continues to provide an accurate assessment of the potential transportation-related impacts that can be expected with the future construction of the Current Project, as described within this NPC. A more detailed and complete description of transportation mitigation and improvement actions as described in Chapter 3, *Summary of Mitigation Draft Section 61 Findings*.

## 2.2 Air Quality and Mobile Source Greenhouse Gas Emissions

As demonstrated in Section 2.1, the Project Change will result in a de minimus change in traffic generation, which, in turn, does not significantly change air quality impacts or mobile source GHG emissions previously reported in the SEIR. Air quality and mobile source GHG emissions benefits continue to be anticipated through the implementation of the traffic mitigation measures, including a robust Transportation Demand Management (TDM) plan.

## 2.3 Stationary Source Greenhouse Gas Emissions

The Previously Reviewed Project required a GHG assessment, which was presented in Chapter 4, *Sustainability and Greenhouse Gas Emissions Assessment* of the SEIR. Due to the changes in development program and building massing, the stationary source

GHG assessment has been updated to reflect the Project Change. The updated stationary source GHG assessment is provided in Appendix E.

Through the implementation of a comprehensive design strategy, including responsive mitigated design and operational commitments, the Project is expected to result reductions in GHG emissions consistent with the MEPA GHG Policy. The Project consists of urban infill with dense, high-efficient buildings, a building reuse component (the North Garage Office Buildings) and reduced single-occupancy vehicle trips through alternative modes of transportation—all of which result in significantly less GHG emissions compared to a suburban "greenfield" development.

All Project Components will meet the current Stretch Energy Code requirements, where applicable (i.e., achieve at least a 20 percent overall reduction in annual energy use compared to a baseline using requirements of ASHRAE 90.1-2007). The Proponent has considered additional energy efficiencies that may be required to meet the potential Stretch Energy Code (i.e., approximately 15 percent more efficient than the IECC2012 and ASHRAE standard 90.1-2010—the new/updated statewide Base Energy Code). Table 2-3 presents a comparison of the Previously Reviewed Project's overall energy savings and associated stationary source GHG emissions to the Current Project.

**Table 2-3 Comparison of Prior Project and Project Change Energy Savings and Stationary Source $CO_2$ Emissions (Full Build)**

| | Energy Consumption (MWh/yr) | | | $CO_2$ Emissions (tons/yr)[1] | | |
|---|---|---|---|---|---|---|
| | Base Case | Design Case | Percent Savings | Base Case | Design Case[2] | Percent Reduction |
| Previously Reviewed Project | 102,337.9 | 72,170.4 | **29.5%** | 8,321.6 | 6,395.0 | **23.2%** |
| Current Project | 85,646 | 62,963 | **26.5%** | 7,106.8 | 5,658.7 | **20.4%** |
| Project Change | (-16,691.9) | (-9,207.4) | **(-3%)** | (-1,214.8) | (-736.3) | **(-2.8%)** |

MWh/yr = million kilowatt-hour per year
tons/yr = short tons per year

As demonstrated by the stationary source GHG assessment, overall the Current Project will achieve an estimated 20.4 percent reduction in stationary source $CO_2$ emissions by reducing overall energy consumption by approximately 26.5 percent through the implementation of energy optimizing building design and systems. (Note, the percentages of energy use are different from emission reductions due to emissions conversion factors.) While the overall energy savings and stationary source $CO_2$ emissions are slightly less compared to the Previously Reviewed Project, the overall estimated energy consumption and $CO_2$ emissions are estimated to be lower for both the Base and Design Cases. The reason for the lower energy savings and stationary source $CO_2$ emissions reductions is due to a change in model assumption for the parking garage fans. In the SEIR GHG assessment, these were modeled as constant in the baseline case and variable in the design case for which

energy savings was claimed for the CO control on the parking garage fans. Since the SEIR, the modeling of CO controls is required by new code (the 9th edition), which is expected to be adopted prior to the construction of the Project. Therefore, while CO controls are still considered an ECM any energy savings were eliminated from the updated models for Office Building A and the North Garage Residential Buildings. The additional energy savings associated with CO controls is estimated to be just over 4 percent.

A key GHG beneficial measure associated with the Project Change is that the co-generation facility located at Fourteen Cambridge Center will be utilized as an energy source for the Office Building B. This is expected to result in an additional 63.5 percent reduction in source energy and 1,636 tons reduction in annual stationary source $CO_2$ emissions. With this measure, the Current Project would result in greater stationary source GHG emissions reductions compared to the Previously Reviewed Project.

## 2.4 Mobile Source Greenhouse Gas Emissions

Because of the de minimus change in traffic generation for the Project Change, as demonstrated in Section 2.1, the mobile source GHG emissions assessment was not revisited as part of this NPC. The Project is anticipated to continue to result in a reduction of 105 tons per year in mobile source GHG emissions through the implementation of the traffic mitigation measures, including a robust Transportation Demand Management (TDM) plan.

## 2.5 Climate Change Adaptation

The Project changes associated with this NPC are intended to be consistent with the Previously Reviewed Project, as the Proponent is committed to identifying and adapting to the deleterious impacts of human-induced climate change. An in-depth discussion of this can be found in Section 3.8.2, Potential Climate Change Adaptation and Resiliency Measures. While resiliency and sustainability measures within the Project buildings and sites are consistent with the previous submission, some changes have been made due to the change in Project location.

The Project Change includes removing the redevelopment of the Three Cambridge Center building. As part of the previously reviewed submission, the Proponent committed to aiding the MBTA improve the resiliency of the MBTA Kendall Square Station. The Project is no longer impacting areas adjacent to the Kendall Square Station, reducing the need for the Proponent's contribution to MBTA resiliency measures. The Proponent is still committed to developing a sustainable Project, which includes promoting transit improvements and encouraging the use of mass transit as part of the KSTEP.

The City of Cambridge has been finalizing its Climate Change Vulnerability Assessment since the submission of the Previously Reviewed Project. At the time of filing, the City had yet to determine the likelihood of sea level rise induced flooding in East Cambridge for the year 2070. The City was able to confirm for the filing that there was less than a 0.1 percent chance of flooding in Eastern Cambridge due to sea level rise. The City has since evaluated the 2070 results of MassDOT's Advanced Circulation (ADCIRC) model of the Boston metro area, specifically for East Cambridge. In the 2070 high emissions scenario and the 2070 intermediate emissions scenario, the KSURP area has a 0.2 -0.5 percent chance of experiencing flooding due to sea level rise, with an estimated sea level rise value of 3.2 feet. Given that the exceedance probability is less than 1 percent, and the model results are at the end of the Project's 50-year design life, the Proponent is confident that the Project is resilient to sea level rise induced flooding. This Project is still prone to inland flooding, especially in concert with Sea Level Rise, which is discussed further in Section 3.4 of Chapter 3, *Summary of Mitigation Measures and Draft Section 61 Findings*.

## 2.6 Chapter 91 Resources

As described in the SEIR, a portion of the Project will occur within landlocked tidelands as defined by (310 CMR 9.00) and is subject to the Public Benefits Determination regulations (301 CMR 13.00). The SEIR provided a public benefits analysis of the Project consistent with the provisions of *An Act Relative to Licensing Requirements for Certain Tidelands* (2007 Mass. Acts ch. 168) (the Act). A Public Benefits review was conducted and Public Benefits Determination was issued on December 23, 2015. Consistent with the Act, the Project was determined to have a public-benefit. While the Project has adjusted the permitted mix of uses, there is no change to the public benefits commitments documented in the SEIR.

### Project Landlocked Tidelands

Table 2-4 below summarizes the total area and describes the nature of work proposed to occur within the tidelands. The proposed Office Building B and the Innovation Space Conversion are not located on filled tidelands, as shown in Figure 2.1. The amount of area within landlocked tidelands has not changed from the SEIR; however, the Project Change has adjusted the proposed nature of work within the landlocked tidelands for 11 CC and North Garage sites, as described in Table 2-4.

**Table 2-4 Project Landlocked Tidelands[1]**

| Project Component | Total Area within Tidelands (square feet) | Nature of Work within Tidelands |
|---|---|---|
| Office Building A (11 CC) | 28,600 sf | Redevelopment into an office building with ground-floor retail |
| Residential Buildings North and South (North Garage) | 60,288 sf | Construction of two residential buildings atop the existing North Garage and outdoor public open space improvements.[2] |
| Whitehead Institute Addition | 23,589 sf | No work within tidelands, as previously contemplated in the SEIR.[3] |
| Broad Institute Office Conversion | 64,230 sf | Change in use to existing facility (conversion of approximately 14,000 square feet of mechanical space to commercial office space). No change from the SEIR. |

1 Refer to Figure 2.1 for the project landlocked tidelands.
2 As illustrated in Figure 1.3b
3 The building addition is proposed for the portion of the building fronting Main Street, as illustrated in Figure 1.3e

The Project Change would not result in changes to the previously proposed public benefits with the exception of the Winter Garden, which was proposed to replace the existing public park located along Broadway as part of the Cambridge Center North Garage Office Buildings. The Current Project proposes to maintain and improve the existing public open space as part of the North Garage Residential Building North. Additionally, this component will provide for additional public open space on the roof of the North Garage. With this additional public benefit, the Public Benefit Determination issued by the Secretary on December 23, 2015 remains applicable to the Project as updated.

## 2.7 Stormwater Management

Similar to the Previously Reviewed Project, the existing Cambridge Center North Garage site remains impervious. This site consists of dense buildings and access roads, with limited peripheral landscaped areas. As part of this Project, the Redeveloper will develop the stormwater management practices required to meet local and state regulations. Specifically, the Project will comply with the MassDEP Stormwater Management Policy, as well as reduce the peak rate and total volume of runoff for the 25-year design storm in the post-development condition to meet the two-year predevelopment condition, as required by Cambridge Department of Public Works (CDPW). The Project will also improve the quality of stormwater runoff

from the Project area, which discharges to the Lower Charles River Basins, which has a Total Phosphorus Total Maximum Daily Load (TMDL) in place.

The Project will meet water quality improvement requirements by increasing the net pervious area, pretreating surface runoff for pollutants, maximizing the amount of runoff infiltrated to groundwater and supplementing with structural water quality units as required. One key goal of the Project is to develop a district level stormwater management approach. This is an improvement over the Previously Reviewed Project, as it allows the Project Components to implement an integrated stormwater management approach. The District-level stormwater management plan will include the redevelopment of the 6th Street Connector to improve the hydrologic condition of the entire Project Site area.

As previously proposed, this Project will greatly reduce the rate and total volume of stormwater runoff, while improving the water quality of the runoff and support the local groundwater levels. The Project's stormwater management practices will help to reduce the inland flooding expected with extreme precipitation events, which will be worsened by climate change. Refer to Section 3.5 of Chapter 3, *Summary of Mitigation Measures and Draft Section 61 Findings* for an in-depth evaluation of the proposed stormwater mitigation measures.

## 2.8 Water and Wastewater

The estimated water demand and wastewater generation have been updated to reflect the Current Project and to more accurately reflect the residential uses (using bedrooms). Table 2-5 below compares the estimated wastewater generation for the Current Project to the Previously Reviewed Project, based on the DEP Sewer Connection and Extension Regulations, 310 CMR 15.203.f by building use.

**Table 2-5 Comparison of Previously Reviewed Project and Current Project Water Demand and Wastewater Generation (Full Build)**

| | Previously Reviewed Project (SEIR) | Current Project | Project Change |
|---|---|---|---|
| Wastewater Generation[1] | 132,585 gpd | 143,419 gpd | +10,834 gpd |
| Water Demand | 145,844 gpd | 157,761 gpd | +11,917 gpd |

gpd = gallons per day

1 Updated to reflect residential bedrooms.

The Project Change is estimated to generate approximately 10,834 gallons per day of additional net new wastewater compared to the Previously Reviewed Project. As required by the Cambridge Department of Public Works (CDPW), each Project Component will include a sanitary holding tank capable of storing 8-hours of peak sanitary flow with a 1.5 factor of safety during times of surcharging sanitary sewer infrastructure.

Water demand is estimated by applying a 10% consumption factor to the estimated wastewater generation. Based on the updated wastewater generation, the Project Change will require approximately 11,917 gallons per day of water more than the Previously Reviewed Project. The water demand estimates do not include the water conservation techniques that the Proponent will employ to increase the sustainability of the Project (refer to Section 3.6 of Chapter 3). All connections to Cambridge Water Department (CWD) and CDPW infrastructure will be in accordance with each departments' requirements and will be coordinated further as the designs progress.

## 2.9 Hazardous Materials

As part of the Project Change, two new residential buildings will be constructed on the site of the Existing Cambridge North Garage in place of the two office buildings. Under the Current Project, Office Building A will be constructed on the existing 11 Cambridge Center site and Office building B will be constructed on the existing 14 Cambridge Center site that has been added. Three Cambridge Center has been removed from the Project.

From a hazardous materials perspective, there are no key changes to report as the Project Change consists of potential new development associated with rezoning the KSURP area. Appendix G provides updated descriptions of the historic and existing site conditions as well as the potential measures proposed to handle or mitigate conditions to the hazardous materials conditions for each Project Component based on the Current Project.

As each Project Component moves forward, it will be required to adhere to applicable hazardous materials regulations. For additional details on proposed mitigation measures including a description of the proposed vapor intrusion system please refer to Chapter 3, *Summary of Mitigation Measures and Draft Section 61 Findings*.

## 2.10 Construction

The following section summarizes the proposed Project phasing, potential construction-related impacts and proposed mitigation measures. As described in Section 1.x, the Current Project will be constructed in two key phases.

Any temporary construction impacts associated with the Project Change are expected to be consistent with the previously reviewed Project. The Proponent is committed to minimizing disruption of the surrounding neighborhood by identifying and mitigating temporary construction period impacts that include but not limited to stormwater runoff, truck traffic, air quality (dust), noise and

construction waste. Refer to SEIR Chapter 8, *Construction*, for a detailed analysis of temporary construction-period impacts.

Temporary construction-period impacts will be managed to minimize disruption to the surrounding neighborhood. Construction Management Plans (CMPs) will be prepared for each Project Component to address numerous temporary construction-related impacts, such as mitigation measures, road closures, detours, and staging. The TP&T will review and approve each CMP. The Redeveloper will work closely with the City throughout the construction of each Project Component. Chapter 3, *Summary of Mitigation Measures and Draft Section 61 Findings* provides additional details on the CMPs.

## 2.11 Open Space & Public Realm

The Project will:

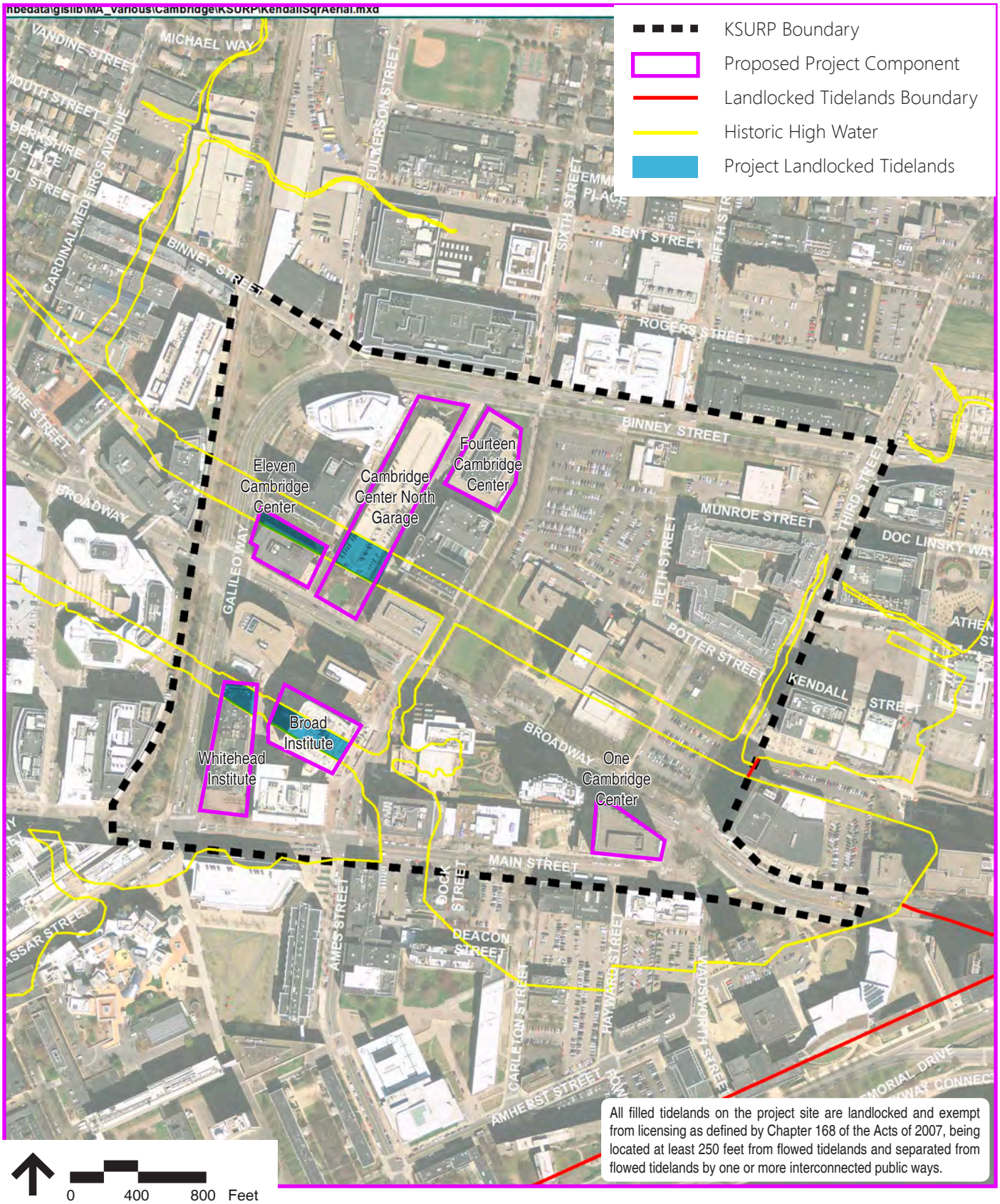
- Facilitate the creation of the Grand Junction Multi-Use Path within the MXD District, and beyond.
- Expand activity in the KSURP area beyond the typical business day (i.e., past 7PM) by introducing new residents and ground-floor retail uses.
- Enhance existing and create new ground level open spaces with multiple outdoor connections to buildings within the KSURP area.
- Create new urban open space opportunities on building rooftops while aiming to improve water quality and reduce heat island effect through green roofs and roof gardens for use by tenants.
- Implement and/or facilitate streetscape improvements along Broadway and Main Street between Ames Street to Galileo Galilei Way, the Sixth Street Connector, Point Park and Galileo Galilei Way between Ames and Binney Streets.

## 2.12 Social and Economic

The Project will:

- Expand the capacity of one of the top drivers of economic growth for the state and region, which is currently constrained by space.
- Support the economic development goals originally set forth by the KSURP by allowing new development and uses, which will bring new residents, customers, and employees.
- Continue to foster the economic activity in Kendall Square through the creation of commercial and innovation space targeted to a mix of tenants from the bio-tech, information technology, and/or health care industries.
- Provide opportunity for new ground floor retail that supports commercial and residential uses, such as food market or drug store.

- Provide up to 560 new housing units, 20 percent of which to be provided at an affordable rate to low- and moderate-income households and 5 percent of which will be made available to middle-income households.
- Create an estimated 2,650 construction jobs in all trades and over 2,600 permanent jobs.
- Create a total of approximately $6.7 million in new annual local tax revenue.




**CRA**

Figure 2.1
Chapter 91 Resources

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA

Source: City of Cambridge GIS, MassGIS

# 3

# Summary of Mitigation Measures and Draft Section 61 Findings

The following chapter presents an updated summary of proposed mitigation measures and the other components that will benefit the environment and/or community for the Current Project. As demonstrated in the SEIR, the Current Project will avoid, minimize, or mitigate damage to the environment to the maximum extent practicable, per the MEPA regulations.

As described in the Chapter 2, *Assessment of Project Change Impacts*, the Proponent will continue to monitor traffic within Kendall Square on an annual basis to determine the effectiveness of TDM initiatives and/or traffic improvements in compliance with the 1994 Section 61 Findings. Additionally, in accordance with the MEPA GHG Policy, the Redeveloper will submit a self-certification to the MEPA Office following construction of each Project Component to demonstrate that GHG emissions mitigation measures have been implemented. See the draft Letter of Commitment provided at the end of this chapter.

As demonstrated herein, the Project includes measures that fully and adequately address any actual or potential environmental impacts from the Project. Key public benefits from the Project include significant urban design and public realm improvements, increased housing opportunities, expanded retail options in Kendall Square, job creation and additional state and local tax revenues. The Project will result in sustainable, smart growth by favoring development in an urban area well-served by public transit over suburban, sprawling development.

Detailed descriptions of the proposed mitigation and other beneficial measures are set forth below. In addition to the public benefits and physical mitigation and other beneficial measures, the Proponent and Redeveloper as well as other stakeholders in the KSURP area, including MassDOT, MBTA, the City and Task Force, recognize that preserving and enhancing the public transit that serves Kendall Square is central not only to the success of the Project, but is required to support other planned development in the area. Therefore, through the creation of the KSTEP (a program of transit enhancements), the Proponent has developed an MOU with MassDOT and the MBTA, together with the Cambridge Redevelopment Authority and the City, as a mechanism to identify and implement appropriate transit improvements consistent with the KSTEP. A Summary of the MOU is included in Section 3.1.4 below and the draft MOU is included in Appendix D.

## 3.1 Transportation and Parking/Air Quality

The proposed transportation mitigation is aimed at addressing the Project-related impacts associated with additional vehicle trips. Proposed traffic operations mitigation measures include local intersection improvements, such as signal timing adjustments and roadway geometric changes which are to be coordinated and confirmed by the City through the future local review process for each Project Component.

As documented by the FST analysis, the KSURP area has consistently shown that actual vehicle trip generation in Kendall Square is significantly lower than the accepted methodology for projecting increases in traffic. The Proponent and Redeveloper are committed to continuing to implement a robust TDM plan targeted at reducing single-occupancy vehicle trips associated with the Project to preserve the favorable mode share balance in Kendall Square. In addition, the Proponent will continue to conduct annual traffic analysis of Kendall Square in compliance with the 1994 Section 61 Findings. The Proponent proposes to update the scope of the monitoring program to reflect the evolution of Cambridge's transportation priorities in a complex multi-modal urban environment such as Kendall Square.

### 3.1.1 Proposed Vehicular Access and Circulation Improvements

All traffic operations mitigation proposed at local intersection improvements will be coordinated and confirmed by the City through the future local review process for each Project Component. The LOS analysis performed at the study area intersections indicate that there are intersections where improvements can be made to reduce vehicle delay and enhance the overall intersection operations. These intersections have been studied from a vehicular operations standpoint and possible improvements have been suggested below. These suggested improvements will be discussed in detail with all stakeholders in the broader context of other proposed improvements. The final design and implementation of any vehicular access and circulation improvements associated with the Project will be agreed upon by all involved parties.

The Proponent understands that other users including pedestrian and bicyclist use these intersections and any improvements made need to consider the safety of all users. Therefore, additional studies may need to be done to ensure improvements at study area intersections have considered all user groups and maintained or improved safety and operations for all. The intersections studied for the purposes of this mitigation analysis are summarized below:

- Cambridge Street/Third Street – PM signal optimization;
- Broadway/Galileo Galilei Way – Signal optimization with permitted left turns;
- Main Street/Vassar Street/Galileo Galilei Way – Protected east/west left turn phase and signal optimization;
- Memorial Drive/Route 3/Ames Street – Additional right-turn only lane on Ames Street; and

› Massachusetts Avenue/Memorial Drive Off-Ramps – Signal optimization with right-turn on red.

The proposed mitigation at each of the intersections is documented. Refer to SEIR Chapter 2, *Transportation and Parking* for the 2024 Build Mitigated LOS analysis was performed to quantify the improved traffic operations at these intersections. The proposed vehicular improvements to particular intersection timings and phasing will maintain current cycle times as to not greatly impact pedestrian wait times at these intersections. All intersections with proposed mitigation will continue to provide adequate walk time for pedestrians of all abilities to safely cross the intersection.

The Proponent will work with the City to determine the specific vehicular access and circulation improvements to be made within the study area.

### 3.1.2 Proposed Transportation Demand Management Measures

The proposed TDM measures aim to reduce drive-alone trips, or single occupancy vehicles (SOVs), by encouraging employees, residents and visitors to use alternative modes of transportation. The proposed TDM plan for the Project includes consideration of enhanced TDM measures outlined in the K2 Final Report 2013, where applicable and feasible as well as Project-specific measures. Overall, the goal of the proposed TDM Plan is to reduce the use SOVs by encouraging carpooling and vanpooling, bicycle commuting and walking, and increased use of the Kendall Square public transportation system by employees and residents. The following TDM measures will be implemented as part of the Project:

› Encourage employers and tenants to provide transportation benefits paid to all employees for commuter expenses regardless of mode, or 100 percent transit subsidy.

› Offer new residents a transit subsidy (exact terms to be based on City coordination).

› Provide free access to EZRide shuttle to Lechmere and North Station.

› Encourage employers and tenants to provide private employee shuttles.

› Provide adequate bicycle parking and benefits including Hubway availability and possible membership subsidy.

› Maintain eight (8) parking spaces for ZipCar® car share parking currently in East Garage and determine the feasibility of implementing or sponsoring additional car-sharing program.

› Provide designated car-share parking spaces within and/or nearby Cambridge Center parking garages to the car-share business, if deemed feasible.

› Provide preferential parking to carpool and vanpool participants.

› Provide additional electric vehicle (EV) charging stations and preferential parking to alternative fuel vehicles, as dictated by market.

› Designate a Transportation Coordinator to oversee all transportation-related operational matters at each Project Component site, including vehicular

operations, servicing and loading, parking and implementation of the TDM Plan. The Transportation Coordinator will act as the contact and liaison for the City, local Transportation Management Association (TMA) and tenants of the Project.

- Post and make available transit maps, schedules and other information relevant to commuting options in the office and residential building lobbies.
- Provide real-time transportation information in all new and "significantly" renovated/improved lobbies within the Project Components using Transit Screen or other similar products including online platforms.
- Display real-time transit information in the public plaza framed by the Marriott Hotel at Two Cambridge Center, and One Cambridge Center on Parcel 4.
- Continue to participate in the Charles River TMA who's membership includes, but not limited to:
  - Emergency Ride Home,
  - NuRide – Ridematching system from MassRIDES, and
  - Carpool and vanpool matching.
- Implement shared parking strategies to reduce the number of new parking spaces needed to support the Project.
- Implement new parking pricing strategies to discourage parking in the area and reduce vehicle trips to the area.
- Monitor mode share goals identified as part of the K2 planning process though the proposed Traffic Monitoring Program (described further in the next section).
- Encourage employers to allow employee flex-time and provide employee shuttles to help manage and potentially reduce peak period congestion.

### 3.1.3 Proposed Traffic Monitoring Program

The Proponent will continue to conduct the annual traffic study and analysis of Kendall Square based on the 20 years of vehicle traffic data collected in compliance with the 1994 Section 61 Findings. The Proponent plans to update the scope of the monitoring program to reflect the evolution of Cambridge's transportation priorities in a complex multi-modal urban environment such as Kendall Square. The improved study shall utilize the most up to date development square footage and traffic projections as well as more holistically consider additional data on bicycles, pedestrians, travel behavior and transit service, as it becomes available.

Changes that may be considered in a new scope of work to be developed by the Proponent in the near future may include, but not limited to, the following:

- Obtain and utilize basic data on ridership at the MBTA Kendall Square/MIT station for both subway and bus services.
- Include boarding information from EZRide shuttle and other bus services in the area, as data becomes available.

- Update the tenant questionnaire to be more specific on the mode split – differentiating the type of bus (MBTA, EZRide) or new systems, such as Bridj™ and Uber.
- Differentiate between transient and monthly parkers in the garage data collection process.
- Evaluate new bicycle count locations in response to installation of new bicycle facilities.
- Evaluate the annual traffic data collected by other parties and investigate collaborative reporting over a broader geographic scope.
- Utilize emerging pedestrian, bicycle, and traffic counting technologies as they become feasible and fully comparable to existing dataset.

### 3.1.4 Proposed Public Transit Improvements

Due to insignificant changes to the proposed program, impacts to Red Line capacity for the Current Project are expected to be similar compared to what was reported in the SEIR. The SEIR analysis assumed that if the Red Line operates according to the published schedule, it can accommodate projected future ridership with and without the Project with one service segment projected to operate at overcapacity with or without the Project.

In recognition of the critically important role transit access and mobility play to the successful redevelopment and expansion in the MXD District and the Kendall Square area, the Proponent and Redeveloper have continued to meet and discuss a more comprehensive approach to address potential future public transit capacity issues through development of a fund to implement transit improvements in the Kendall Square area, following the completion of certain public review processes described below.

#### Proposed Kendall Square Transit Enhancement Program (KSTEP)

The Proponent and the Redeveloper remain focused, as they have throughout the development of Cambridge Center, on preserving and enhancing the favorable transportation mode split in Kendall Square that has played such an important role in the successful redevelopment of the area. It is acknowledged and well documented that approximately 70 percent of trip making in Kendall Square utilizes transit, walking, biking, shuttle and carpool. This remarkable factor is at the core of the opportunity for the Project. The importance of preserving and enhancing this condition cannot be overstated and is central to the Proponent's plans for expansion of the KSURP.

The Proponent and Redeveloper are committed to developing an expanded program of transportation enhancements designed to both preserve the favorable mode share balance in Kendall Square and provide additional improvements to support local efforts to further reduce the vehicle trips generated as a result of the Project and the broader Kendall Square area. The KSTEP will be developed in

conjunction with the many stakeholders engaged in transportation planning and operations in Kendall Square. The KSTEP would supplement the proposed transportation-related mitigation and other beneficial measures described herein.

The Proponent and Redeveloper have engaged in multiple discussions with MassDOT and the MBTA to review plans for the Project, its impacts, and potential transportation mitigation and enhancement measures in the Kendall Square area. A range of issues and opportunities have been identified and potential improvement measures to be considered for inclusion in the KSTEP program. The KSTEP would be designed to enhance access to and mobility around Kendall Square, which the Proponent believes is critical to the long-term economic success of the area. It is expected that the KSTEP will be focused on a range of short term and long-term transportation initiatives that will improve transit options and services in Kendall Square. They will include a range of projects, programs, and services directed at improving and enhancing transit and related options for people working, living, and visiting the Kendall Square area. Transit and transit-related improvement options to be considered would include both capital and operational investments that would result in service level improvements and capacity expansion in Kendall Square.

The Proponent recognizes that the development of the KSTEP will require detailed consideration and analysis of the enhancement alternatives as well as careful coordination with the stakeholders and service providers. The Proponent believes that this analysis can be undertaken in conjunction with the various existing transit focused interest and will for a public advisory body (the "Working Group") to coordinate with the City's Transit Strategic Plan, which is focused on improving transit capacity and quality throughout the City. The Proponent, in coordination with the City, will work with Mass DOT and the MBTA to develop the elements of the KSTEP, which can be refined over time.

The KSTEP would be supported by immediate and long-term funding commitments facilitated by the Proponent and Redeveloper in connection with the approvals for the Project. The Proponent has continued consultations with the MBTA, MassDOT, the Redeveloper and the City to develop a memorandum of understanding (the "MOU") as a mechanism to identify and implement appropriate transit improvements consistent with the KSTEP. The MOU, a draft of which is included with this NPC in Appendix D, will provide a vehicle to identify appropriate transit improvements in the KSURP area. The Proponent, in coordination with the City and the other parties to the MOU, will establish and maintain the KSETF for the purpose of establishing funding priorities and allocations for identified transit improvement projects.

Over the coming months, the key stakeholders will continue to work closely to refine the MOU, including potential additional details on the process for allocation of funds and the range of transit enhancement projects and program options for consideration. As provided in the MOU, the funding for the KSTEP Fund will be provided through an Initial Payment in the sum of six million dollars ($6,000,000). The Initial Payment will be made upon the issuance of any building permit for new commercial development associated with the Project. The Working Group shall meet to decide on recommendations for initial funding allocations, as set forth in the

MOU. Within a year of the Initial Payment to the KSTEP Fund the Working Group shall recommend longer term funding allocations for enhanced transit services in Kendall Square, potentially leveraging additional resources from an expanding KSTEP Fund or from other sources for more significant service enhancements in the future

## Proposed MBTA Bus and EZRide Shuttle Improvements

The Proponent understands the importance of the bus system within the Kendall Square area, both the MBTA routes and the EZRide Shuttle. As indicated in the analysis, bus operations will be affected by Project-generated traffic, particularly the EZRide Shuttle. The Proponent will work with the MBTA, City, and Charles River TMA to evaluate potential bus operations improvements in the KSURP area, including:

Studying and partially funding the increase in EZRide service. The Proponent will work with the Charles River TMA to devise a plan as to how EZRide can best serve the community in the future and provide support to the expansion of EZRide service including, but not limited to:

- Decreasing headways
- Increasing bus fleet
- Optimizing bus routes

Implement the proposed local roadway intersection signal improvements, discussed and analyzed (refer to the 'Proposed Vehicular Access and Circulation Improvements' section above), which will decrease delay at specific intersections that MBTA buses pass through. The bus routes anticipated to experience reductions in delay include Routes 64, 68, 85 and EZRide at the intersections of Broadway at Galileo Galilei Way and Main Street at Galileo Galilei Way/Vassar Street, respectively.

The Proponent will discuss with the City, MBTA and MassDOT as part of the MOU process, the study and possible implementation of the following bus mitigation measures along the bus routes serving the area:

- Bus Priority Signals
- Bus Lanes
- Bus Shelter Improvements
- Implementing the extension of bus routes from Central Square to Kendall Square.

The August 25, 2014 draft report, Central Square Access and Circulation Study Existing conditions Analysis (Task 1) presents a story that there is a potential need for a bus connection between Central Square and Kendall Square. Many passengers riding buses that terminate at Central Square use the Red Line to make their last connection to Kendall Square. With the extension of MBTA bus route(s) to Kendall Square demand could be shifted away from the Red Line and a vital second connection would be made between Central Square and Kendall Square. This study is still ongoing as there are three more tasks to be completed with the anticipation that the study will result is recommendations directed at the topic of extending

MBTA bus routes to Kendall Square. The Proponent is eager to learn of these recommendations and is committed to helping implement any recommendations directed at this topic. Due to the timeframe of this study and the proposed Project schedule, the Proponent will revisit this topic when the final recommendations by the Working Group are published and will work with the City and other stakeholders as to how these recommendations can be implemented.

### 3.1.5 Proposed Pedestrian Access, Safety, and Streetscape Improvements

As discussed previously, the KSURP area provides excellent pedestrian accommodations, including sidewalks on all study area roadways and crosswalks at all study area intersections. The City is ahead of many other communities in utilizing pedestrian countdown timers with LPI programming and many of the signalized intersections within the KSURP area have pedestrian countdown timers with such technology.

Both the Proponent and Redeveloper are committed to creating a cohesive integrated network of open spaces and connecting pathways while improving pedestrian safety, access and circulation within the KSURP area. The Proponent, in conjunction with the Redeveloper, will work with the City to identify areas of improvement. Measures could include the following:

- Provide additional pedestrian countdown timers at study area intersections.
- Implement LPI programming at study area intersection.
- Incorporate a new mid-block pedestrian crossing on Broadway between the proposed Cambridge Center North Garage Office Buildings and Danny Lewin Park on the south side of Broadway.
- Improve the Sixth Street Connector by increasing driver awareness of the pedestrian crossing with advanced warning signs. In addition, this connection should be studied for the implementation of a HAWK system.
- Review all pedestrian crossings within the KSURP boundaries to assess their potential for bulb-outs, raised crossings, pedestrian refuge islands, Rectangular Rapid Flashing Beacons (RRFB's), re-aligned non-apex ramps and/or other treatments to enhance the comfort and visibility of crosswalks.
- Enhance the Main Street streetscape between Ames Street and Galileo Galilei Way.
- Enhance the Broadway streetscape from Ames Street to Galileo Galilei Way.
- Enhance the Binney Street and Galileo Galilei Way streetscape from Sixth Street to Broadway.
- Improve pedestrian safety by enhancing lighting along sidewalks and pathways for safer pedestrian accommodations.
- Enhance open spaces with multiple outdoor connection to buildings within the KSURP area.

### 3.1.6 Proposed Bicycle Facilities

As discussed previously, the KSURP area is well serviced by bicycle facilities, including on-street bike lanes, cycle tracks, and multi-use pathways. The City and other improvement projects will further add to the bicycle infrastructure in the area.

Both the Proponent and Redeveloper are committed to enhancing bicycle infrastructure at/around each Project Component and within the KSURP area by connecting this infrastructure with other area-wide improvements. The Proponent will discuss with the City the possibility of contributing to the proposed infrastructure improvements within the area, including the cycle track along Galileo Galilei Way and the Grand Junction Multi-Use Path. Additionally, in close coordination with the City, the Redeveloper, and Other Developers, the Proponent will also explore opportunities to create a full service bike station within the area.

Based on the comprehensive evaluation of the existing KSRUP bicycle parking, the current number of supplied spaces complies with the original 1981 Bicycle Parking Requirements, while retrofitting the KSURP area to meet the 2013 Bicycle Parking Ordinance is not required by zoning. However, the Redeveloper is committed to supporting and expanding bicycle ridership within the district through current and future efforts in a variety of ways. The Redeveloper has donated sites for two Hubway stations located at Office Building B and Innovation Space Conversion. A third Hubway station will be installed at 88 Ames St in 2018. In addition to these infrastructure commitments, the Redeveloper sponsors a breakfast during the annual "Bike to Work Week" in May as well as provides free bike tune-up and safety checks twice a year (in the Spring and Fall).

In accordance with the City's Bicycle Parking Guidelines, the Project will include approximately 780 long-term bicycle spaces and 125 short-term bicycle spaces. Long-term secure bicycle spaces will be distributed between the Cambridge Center North, West, and East Garages and the proposed Office Building A garage. Outdoor short-term bicycle parking spaces will be distributed around the District, focusing on areas around the Project Component sites and other high demand areas observed as part of the existing conditions occupancy study. In addition, the Other Developer will also be required to provide bicycle parking that meets the City's guidelines for the Whitehead Institute Addition.

## 3.2 Sustainability

As with the Previously Reviewed Project, sustainability is integrated in to the Project' concept and design. A sustainable approach to a project can include repurposing previously developed land rather than building on untouched land, as well as locating new development within high-density areas and areas with highly accessible public transportation access. By constructing new commercial and residential spaces on previously developed sites a portion of which will be constructed above a reused portion of an existing building (the Cambridge Center

North Garage), the Project is being designed to achieve energy savings associated with construction and associated GHG emissions.

As a Transit Oriented Development (TOD), the Project will utilize the existing public transportation and mode share infrastructure to further reduce traffic and indirect air emissions, including mobile source GHG emissions. TOD is environmentally, economically, and socially sustainable; it promotes greater mobility, walking and biking, healthy lifestyles; value for property owners, businesses, local governments, transit authorities and residents. A recent study by the Center for Transit-Oriented Development shows that TOD produces approximately 43 percent less emissions than conventional suburban development.

The Project design will prioritize sustainability as a core strategic imperative and will implement state-of-the-art high performance green building technologies, construction, and operating procedures. This will establish a pathway to Gold-level certification under the Core & Shell Leadership in Energy and Environmental Design (LEED®) Green Building Rating System and superior energy use intensity performance, consistent with the K2 Plan. The Project design team will use iterative energy modeling and life cycle analysis that considers the long-term value of sustainable property investment decisions.

Refer to Appendix E for the specific sustainable measures proposed for the Project.

## 3.3 Greenhouse Gas Emissions

The GHG emissions assessment provided in Appendix E demonstrates that the Project meets the intent and requirements of the MEPA GHG Policy because it estimates potential Project-related GHG emissions and evaluates and incorporates measures to reduce the GHG emissions to the extent practical and feasible. The GHG emissions assessment is based upon the best information available at the current planning phase. The Project has been designed to meet the current Stretch Energy Code (i.e., a minimum 20 percent energy savings over ASHRAE 90.1-2007 standards).

Based on the updated building energy models, overall the Project, as currently designed, is projected to result in an energy savings of approximately 26.5 percent compared to the Base Energy Code requirements. This energy savings equates to an estimated 20.4 percent reduction in stationary source $CO_2$ emissions. Furthermore, the GHG assessment demonstrates the additional building improvements required to meet the future potential Stretch Energy Code requirements currently under consideration. Refer to Appendix E for further detail on the building improvements assumed to quantify the energy savings and associated stationary source GHG emissions reductions.

Section 3.10 below presents a self-certification, signed by an appropriate professional, to the MEPA Office that identifies the as-built energy conservation measures and documents the stationary source GHG emissions reductions from the baseline case for each Project Component post-construction, as required by the MEPA GHG Policy.

As a result of transportation-related mitigation, including site access and local roadway improvements as well as a robust TDM plan (described above), the Project is projected to reduced mobile source $CO_2$ emissions by an estimated 105 tons per year. This reduction also accounts for the mobile source GHG emissions benefits associated with the Project's urban location (i.e., walkability), existing bicycle facilities, and direct access to an extensive network of public transportation (i.e., the MBTA Red Line at Kendall Square/MIT station).

## 3.4 Climate Change Adaptation and Resiliency

### 3.4.1 Potential Site Design Measures

The Proponent and/or Redeveloper continue to plan to implement a comprehensive set of site design measures aimed at making each Project Component less vulnerable to climate change. These measures will work in combination with building design measures to increase the building's resiliency, as discussed further below under 'Potential Building Design Measures.'

As part of the sanitary sewer connection requirements discussed in the SEIR Chapter 6, *Water and Wastewater*, each Project Component will be required to store 24 hours' worth of wastewater flow on-site, protecting the newly constructed buildings from backups, which are a symptom of the limited capacity in the combined sewer system which services Cambridge. In addition, the Project will be infiltrating stormwater as part of the Cambridge stormwater requirements to be discussed in Section 3.5 below. Improving the hydrologic condition on-site will make the site more resilient to flooding, as stormwater is slowed and diverted from interfering with building operations through landscaped areas and infiltration systems. Both the sanitary storage and stormwater improvement features insulate the Project Components from potential issues due to climate change, while simultaneously improving the Cambridge infrastructure's ability to cope with extreme weather events. Backflow preventers will also be installed on sanitary and stormwater laterals connecting to vulnerable collection systems in the public way, thereby ensuring one-directional flow offsite in the event of extreme wet weather flows. To cope with increasing intensity in precipitation, stormwater infrastructure will be evaluated for capacities to handle short-duration, high intensity rain events, including inlet and piping capacities.

Additional site design measures are being considered to reduce the effects of a warmer climate with longer dry spells. Increased pervious/green area at the ground level and installing green roofs are two ways the Project anticipates reducing area-wide elevated temperatures associated with Urban Heat Island Effect. Additionally, landscaping could be designed to create a positive and comfortable microclimate by segregating large areas of impervious, heat trapping materials, providing tree canopy cover for pedestrians and low level plants, and encouraging evaporative cooling with dense greenery and water features where practical. To increase resiliency to heat and drought and minimize irrigation requirements vegetation will

predominantly be native species and efficient irrigation systems will be installed. Maximizing pervious and green space will simultaneously increase resiliency and aid the stormwater mitigation strategy on-site. Similarly, green roofs will be further increase the Project's resiliency by reducing the heat island effect, as well as mitigate stormwater runoff rates and volumes. The practicality of rainwater harvesting for irrigation, xeriscaping (landscaping without irrigation), and incorporating green roofs will be explored as designs progress.

If required, the Proponent and/or Redeveloper could consider the use of portable flood protection systems as a final defense between excessive flooding on-site and the building. Technologies, such as the Flood Log, Portadam, and the Aquafence Flood Barrier System can be stored in the building and deployed on-site when extreme flooding events are predicted. These systems effectively raise the flood level required to impact the building internally. They can be installed around the entirety of a site or limited to protecting vulnerable building elements, such as doors, low windows, and areaways. While these systems have been successfully installed in coastal cities for building owners conscious to make their buildings more resilient to current and potential future flooding, additional data on the potential for excessive flooding in the future once the Project Components come online is required before the Proponent and/or Redeveloper can commit to implementing such measures.

### 3.4.2 Potential Building Design Measures

Both the Proponent and Redeveloper are aware of precipitation-based inland flooding events. Potential building design resiliency measures include locating critical infrastructure above the first floor level (i.e., transformers, switchgear rooms, and mechanical rooms), limiting basement areas, and evaluating raised finish floor elevations and other improvements that may mitigate potential flooding.

Building finish floor elevations and necessary building utilities for all Project Components will be raised to the greatest practical extent to reduce the risk of internal flooding. Additionally, flood-resilient materials will be specified for first floor uses, where practicable. The Cambridge Center North Garage Residential Buildings are proposed to be constructed over an existing garage structure minimizing the ground floor exposure to the effects of extreme weather events, such as flooding. Other flood prevention techniques could include: sealed wall penetrations for cable and electrical lines; watertight door barriers; septic line backflow prevention valves, sump pumps, and discharge pumps—all of which could be connected to auxiliary external generator connections or resilient backup power. In addition, the Project is anticipated to include green roofs/roof gardens and roofing membranes with high Solar Reflectance Index (SRI) to reduce the volume of stormwater runoff and reduce solar heat gain/minimize air conditioning loads, respectively. Additionally, high-performance curtain wall is being considered to maximize views and daylighting of interior spaces, thus reducing overall lighting loads and associated internal heat gains, which has a direct impact on the space cooling load. As the climate change analysis shows, the rising temperature increases the space cooling demand in the

Cambridge climate; therefore, any strategy that can reduce the space cooling demand is considered an adaptive strategy for climate change.

The Project's climate change mitigation includes the incorporation of several ECMs to reduce GHG emissions associated with energy use beyond what is required by Code. (Refer to Appendix E for further details on such measures.) Some of these measures can also be considered adaptive design approaches to mitigate the potential impacts of climate change on the Project. These GHG emissions mitigation and climate change adaptation measures are considered mutually re-enforcing and, therefore, cannot be considered in isolation. As an example, the design team was conscious about reducing the window area in the residential setting as creating natural ventilation and mixed-mode design is an adaptive strategy in response to increases in temperature. Therefore, the window area was maintained at a ratio that can help in energy use reduction while it's still providing enough daylight and opening area for natural ventilation. Other climate change adaptive strategies considered in the conceptual design include improved envelope insulation and high performance glazing in response to increasing temperatures. The design team also investigated the deployment of several renewable energy sources and highly energy-efficient technologies, such as solar PV, wind, and co-generation plant. The design team is also aware that extreme climate change is not only limited to temperature rise, but also may include flooding, intensified downpours, and/or hail evets. Therefore, the design team will continue to consider whether the design and architectural elements selected for the Project Components can reduce the vulnerability to these extreme events.

**Other Potential Resiliency Measures**

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

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

In most cases, the proposed commercial buildings will shut down and send occupants home in storm-related power failure scenarios. Any generators provided will most likely be optional standby generators that are sized to maintain server room or process operations only. In the case of the residential components, the generators provided will be for life-safety uses only (stairway pressurization, egress

elevators, fire pump, etc.) and cannot by Code be used for ordinary ongoing operations in a building. The capacity provided by solar PV, even if the available space is maximized, will not be more than 10 percent of the power needed by the building, and cannot provide all power needed for normal operations. A CHP system could be used to provide limited ongoing operation, but the economics of such a system when compared to the likelihood of repeated power outages in the Kendall Square area would not be favorable. Storm response actions and resiliency measures will be incorporated into leasing agreements or tenant guidelines, including guidance related to tenant fit-out of commercial space, particularly those located on the lower floors.

## 3.5 Stormwater Management/Water Quality

As discussed earlier in Chapter 2, *Assessment of Project Change Impacts*, the Project will meet both local and state regulations regarding stormwater management. The MassDEP Stormwater Management Policy standards will still be met by this Project. Additionally, the stormwater runoff peak rate and volume will be reduced, as required by CDPW, such that the 25-year post-development hydrologic condition, meets that of the two-year pre-development condition. Runoff water quality will also be improved to meet the Charles River TMDL and maximize infiltration to the local groundwater. Refer to Tables F-1 and F-2 Appendix F for a summary of the existing and proposed site hydrology using a HydroCAD model.

### 3.5.1 District-level Stormwater Management Approach

The Previously Reviewed Project evaluated a hypothetical post-development stormwater management condition that employed 50 percent green roof coverage, maximizing green space at grade, and extensive stormwater infiltration to meet stormwater management regulations. In addition to those techniques, the Proponent has also explored a District-level stormwater management approach. The Project site has been condensed, which better supports integrated stormwater management practices. The Proponent is exploring the feasibility of constructing permeable pavement over the previously impervious roadway and pedestrian areas that service the Project Site to create a stormwater management system that assimilates the various Project Components. Infiltration systems have been designed to drain within 72-hours of each precipitation event as required by the CDPW's stormwater management guidance.

Office Building A does not include any green roof space, while the Residential Buildings North and South continue to include approximately 50 percent green roof area on the roof of the existing North Garage. Office Building B includes approximately 10,000 square feet of green roof space. Additionally, the Sixth Street Connector is proposed to be reconstructed with a cross section designed to maximize vegetation, stormwater storage, and infiltrative capacity. The Sixth Street connector will integrate off-site stormwater management with that of the Project to enhance the District-level stormwater approach.

### 3.5.2 Phosphorus Removal

Overall, the Project now proposes proportionally greater volumes of infiltrative capacity, equivalent to almost two inches of runoff over the entirety of the Project Site. Phosphorus removal rates in the Previously Reviewed Project approached 100 percent with less capacity for removal in the infiltration systems. The Current Project, including a District-level stormwater approach will remove Phosphorus at levels that greatly exceed the Previously Reviewed Project, and the required 65 percent threshold set by the Lower Charles Basin TMDL.

### 3.5.3 Inland Flooding

During extreme precipitation events the Project is still vulnerable to inland flooding, with the predicted changes in extreme precipitation patterns driven by climate change. The 10-year, 24-hour design storm does not present any inland flooding adjacent to the Project through the 2070-precipitation projection. Minor to moderate inland flooding is predicted for the 100-year, 24-hour design storm in the existing condition, through the 2070-precipitation projection. In addition, the City of Cambridge evaluated flooding due to sea level rise and storm surge propagation through stormwater infrastructure, thereby increasing the depth of inland flooding. The depth of flooding due to the 1 percent probability flood event in 2070 propagating into stormwater infrastructure, ranges from 0.5-to-2.0 feet on Broadway adjacent to the Project. Building and site design measures for mitigating the risks from the latest flooding information are discussed in Section 3.4. In general, the Project will serve to reduce the KSURP area's susceptibility to flooding during extreme precipitation events, given that each Project component will reduce the stormwater runoff for the 25-year design storm post-development condition to meet that of the 2-year design storm pre-development condition. This will reduce the frequency of surcharging in the local stormwater infrastructure. Stormwater infrastructure will also be designed to handle short-duration, high intensity precipitation events, which requires increased inlet and conveyance capacity. The Proponent will continue to coordinate with the CDPW to evaluate the appropriate means to address inland flooding in the KSURP area, which may include the improvement of stormwater infrastructure adjacent to the Project Site.

## 3.6 Water and Wastewater

### 3.6.1 Proposed Inflow/Infiltration Removal

As discussed in the previously reviewed submission, the Project is responsible for removing Infiltration/Inflow (I/I) to the sanitary sewer infrastructure in the KSURP area. I/I must be removed at a ratio of 4:1 relative to the updated wastewater generation estimates. Based on the Project's updated wastewater generation, the Proponent will be responsible for mitigating approximately 573,676 gallons of I/I based on the current program of uses, which is approximately 43,336 GPD more

than the previously reviewed value. Table F-4 of Appendix F provides the I/I removal requirement for each Project Component for the Current Project.

The Proponent met with CDPW on July 21 and November 11, 2015 to discuss I/I mitigation for this Project, as well as Ames Street Residential. The CDPW provided several potential I/I mitigation projects in East Cambridge, based on the sanitary sewer modelling program the City has recently completed. The Proponent has been evaluating the suggested projects to meet the I/I mitigation requirement for this Project. The sewer separation projects that have been suggested will mitigate the required volume of I/I for this Project. The Proponent will continue to coordinate with the CDPW on the mitigation of the required I/I as the Project Components progress and is committed to mitigating the required I/I before building occupation.

### 3.6.2 Proposed Water Conservation Measures

The Proponent is still committed to a sustainable project, which minimizes the demand for water and wastewater generation. Upon completion, the Project's water demand and wastewater generation will be significantly less than the estimates presented in Section 2.8 of Chapter 2, *Assessment of Project Change Impacts*. The Project will attempt to conserve water through several methods including low-flow plumbing fixtures (to design plumbing systems to be at least 20 percent efficient) and efficient air conditioning systems. Additionally, water conserving landscape irrigation practices will be implemented, such as the use of native vegetation and minimal/efficient irrigation systems. The Proponent and Redeveloper will also continue to consider the viability of alternate water sources, such as water reuse systems or rainwater harvesting as well as the practicality of xeriscaping, which is landscaping that does not require irrigation. Furthermore, the Proponent will continue to coordinate with the Cambridge Water Department to supply the Project with water and fire protection services. Similarly, the Proponent will coordinate further with the CDPW, on conveying wastewater to the appropriate infrastructure.

## 3.7 Hazardous Materials

### 3.7.1 Compliance with Massachusetts Contingency Plan

The Project will require pre-characterization of the soil and groundwater conditions for management of contaminated soil in advance of the proposed construction and to evaluate potential exposures for workers and the future building occupants and prepared the required regulatory submittals under the MCP, 310 CMR 40.0000. It is assumed that testing of soil and groundwater at the Residential Buildings North and South, and Office Building A sites will result in a new reporting condition to MassDEP and that activities at the properties would be subject to the requirements of the MCP. It is anticipated that conditions in the area outside Office Building B will encounter similar contaminant levels in soil as those encountered during the 2007 expansion activities therefore, it is likely that new activities can proceed under the

existing RTN; however, testing of groundwater may result in a new reporting condition.

Management of contaminated soil and groundwater and implementation of measures to reduce the risk of exposure to contaminants at these properties will be conducted under a Release Abatement Measure (RAM) Plan prepared by a Licensed Site Professional (LSP). The RAM Plan will address items pertaining to construction of new buildings in contaminated areas per 310 CMR 40.0042(3) within the area within and adjacent to the footprint of the proposed structure. The RAM plan will also include requirements for environmental monitoring for dust, vapors and odors resulting from disturbance of contaminated soils. Threshold criteria for fence line exposures to the nearby public will be established in the RAM Plan based on the construction timeframe for the specific contaminants of concern and worker exposures will be established in a site-specific Health & Safety Plan prepared by a qualified person on behalf of the Contractor conducting the work. To the extent feasible vapors and dust levels will be measured in real-time using portable instruments. Stationary and mobile units will be deployed at the perimeter of the site. The RAM Plan will also include measures to be undertaken for suppression of dust and for control of vapors and odors if exposure criteria is exceeded. Oversight of the RAM activities will be conducted by the LSP and their qualified representatives who will monitor and document the remedial activities in the field. Below-grade construction will require temporary construction dewatering. Treatment of groundwater dewatering effluent is anticipated to be a RAM activity. Discharge to the storm drains will be conducted under a NPDES Remedial General Permit (RGP).

Utility upgrades conducted in the public way or on private property will be conducted under a Utility-Related Abatement Measure (URAM). Soils will be pre-characterized within the proposed utility corridors prior to off-site removal or temporary storage. Contaminated soils removed from the utility trench will be replaced with "clean" soils reducing the risk of exposure to future utility workers conducting repairs or replacement. Utility trench backfill will be interrupted prior to connection with buildings with a segment of impervious flowable fill or lean concrete to prevent preferential pathways for vapor intrusion into buildings.

It is anticipated that the measures undertaken under the RAM will result in achieving a Permanent Solution for each property redevelopment.

Given the construction period of the buildings (1982 to 1990) the presence of asbestos containing material (ACM) is not anticipated. If ACM is encountered during demolition it will be handled appropriately in accordance with state and local regulations. A summary of the anticipated assessment and remedial activities for each property is summarized below.

**Residential Buildings A and B (Parcel 2)**

As previously mentioned, no below-grade space exists under the garage. The new residential buildings are planned on top of the existing garage. No new parking above or below grade is planned. New foundations will be required to support loads

imposed by the new residential buildings. It is anticipated that a majority of the historic fill and underlying soils will be significantly impacted with petroleum oils and hazardous materials and, therefore, characterization of soil materials in-place prior to excavation is planned as part of the Project. It is anticipated that contaminated groundwater will also be encountered and that treatment of construction dewatering effluent will be required. A vapor mitigation system will be incorporated into the design to eliminate the vapor intrusion pathway into the residential buildings.

**Commercial Building A (Parcel 2)**

As previously mentioned, it is possible that shallow groundwater at Eleven Cambridge Center could be impacted. No basement exists below the ground floor of Eleven Cambridge Center. Construction of below-grade parking will require removal of the existing fill and the garage will act to eliminate the vapor intrusion pathway. It is anticipated that a small volume of contaminated soil will be encountered during excavation and, therefore, characterization of soil materials in-place prior to excavation is planned as part of the Project. The initial phase of the characterization program would take place prior to building demolition at the exterior of the existing building. A second characterization phase would occur following building demolition and removal of the existing footing foundations. If Reportable Concentrations of contaminants in soil or groundwater are encountered, notification will be made to MassDEP and management of contaminated soil and groundwater would be conducted under a RAM Plan. Treatment of groundwater should be anticipated during construction during temporary construction dewatering. It is anticipated that post-construction conditions at the site will likely not require and Activity and Use Limitation (AUL).

**Commercial Building B (Parcel 2)**

Although a majority of contaminated soil was removed from the site during construction of the existing building 1982/1983, it is anticipated that heavily contaminated soil will be encountered within the limits of this property outside the existing building footprint. It is likely that the contamination will extend beyond the limits of the property below the adjacent access road especially near the existing loading dock. An initial phase of characterization is planned prior to building demolition at the exterior of the building. A second characterization phase would occur following building demolition and footing removal within the footprint of the proposed new basement to characterize soil for off-site removal to be excavated for construction of the basement. The presence of the below grade parking will eliminate the vapor intrusion pathway. Post construction treatment of underslab drainage water may be required for basement depths below two levels because of a release of 1,2 DCA from a cross-gradient property at 225 Binney Street, RTN 3-30331 that has impacted the deep groundwater regime.

It is anticipated that management of contaminated soil and groundwater would be conducted under a RAM Plan. Treatment of groundwater should be anticipated

during construction during temporary construction dewatering. It is anticipated that post-construction conditions at the site will likely require and Activity and Use Limitation (AUL). A new Permanent Solution filing would also prepared as the basis for the AUL.

**Innovation Space Conversion (Parcel 4)**

It is anticipated that only small amounts or no amount of soil will need to be managed during proposed renovations to the existing building. Additionally, while groundwater contamination has not been encountered historically, low levels of VOCs maybe present. Levels of contaminants that exceed the applicable Reportable Concentrations in groundwater will require new reporting under the MCP and the potential for vapor intrusion will need to be evaluated as part of the proposed building renovation under this new RTN.

**Whitehead Institute Office Addition (Parcel 3)**

Assessment of the Whitehead Institute Office Addition site has not been conducted since its construction in 1983. Historical data indicate the presence of metals and VOCs in soil and groundwater. New data required for the planned addition will likely encounter levels of VOCs and other contaminants at levels that will require remediation to achieve a condition of No Significant Risk under the current MCP. The potential for vapor intrusion is considered likely at this site.

### 3.7.2 Vapor Intrusion Evaluation and Assessment

The potential for vapor intrusion (VI) into the new buildings will be evaluated and assessed early in the building design phase to identify site conditions that may indicate when a VI pathway is probable. MassDEP Vapor Intrusion Guidance WSC #14-434 will be used as the basis for evaluation of the potential for vapor intrusion potential at sites where VOCs have been released into the environment. We have assumed that some level of VOCs are present in subsurface media within the limits of the KSURP area based on historical site usage. The VI assessment will consist of developing a Conceptual Site Model based on multiple lines of evidence including soil, groundwater and soil gas data, the presence of non-aqueous phase liquid (NAPL) in/on groundwater and the presence of preferential pathways through existing or future utility corridors will be considered. If a VI pathway is potentially complete based on the data collected a vapor mitigation system will be designed and incorporated into the new building design. The presence and use of planned below grade space will also be considered in the VI evaluation.

MassDEP has issued toxicity information and guidance for trichloroethylene (TCE) a chlorinated VOC which can result in significant risk at relatively low levels and Critical Exposure Pathways (CEP) for residential buildings. Although detection of TCE is not common in the KSURP area where additional residential use is planned under this NPC, soil and groundwater testing will include VOC analyses for this and other chlorinated VOCs. Detection of these highly toxic compounds could result in design changes to eliminate the vapor intrusion pathway for proposed residential usage.

These design changes would include commercial usage of ground floor or construction of a below grade parking garage below the residences.

### 3.7.3 Proposed Mitigation Measures

**Protective Barriers**

Contaminants in soil at the site which are typical in urban areas are anticipated to include heavy metals, PAHs and petroleum hydrocarbons at levels which could pose risk under the MCP for direct contact, ingestion and/or inhalation. It is planned to incorporate "protective barriers" into the new building design to mitigate risk of direct contact with contaminated soils. The protective barriers are anticipated to include the following:

- Landscaped Areas – Excavation and off-site removal of contaminated soil to a depth of 3 feet below final design grades and placement of a marker fabric and clean soil to the new grades.
- Exterior Hardscape Areas – placement of engineered pavement sections, concrete sidewalks or patios, landscape pavers or other systems which block exposure to underlying contaminated soil at the ground surface.

**Vapor Mitigation Systems**

New buildings constructed above contaminated soil or groundwater will be constructed with the elements of a vapor mitigation system below the ground floor slab to mitigate the source of vapor intrusion from the environmental media that could potentially contribute contaminants to indoor air. The vapor mitigation will consist of the following elements; ventilation layer, ventilation pipes or depressurization points and a vapor liner. The design of the vapor mitigation system (passive or active), liner thickness and type will depend on the type, level and toxicity of the contaminants detected. The effectiveness of the vapor mitigation will be evaluated post-construction by sampling and testing of sub-slab and indoor air.

## 3.8 Temporary Construction

As discussed in Chapter 2, *Assessment of Project Change Impacts*, the Proponent will develop a CMP for each Project Component. The purpose of the CMP is to develop a proactive approach to identify and address the potential impacts on the community that may arise during construction and to minimize these impacts where possible. The CMP will aim to address impacts of the Project-related construction activities on the City, the public ways/spaces, and the on-site MBTA facilities, where applicable. The Cambridge Traffic, Parking & Transportation Department will review and approve each CMP. The Redeveloper will work closely with the City throughout the construction of each Project Component.

The Redeveloper is committed to minimizing impacts to service at and access to the Kendall Square/MIT subway station throughout construction of the Project.

Furthermore, a key goal of the Project is to not close any sidewalks and/or bike lanes during construction activities. All pedestrian and bike accommodations will be relocated, if needed, and/or protected. Any temporary facilities will be maintained as a normal sidewalks and bike lanes with regards to winter weather operations (clearing of snow and ice) and extreme rain events (prevent/resolve large puddles), to the extent feasible.

Over the duration of the Project, there are likely to be other development projects in the areas adjacent to each Project Component. In order to help minimize disruption to local residents and businesses, the Redeveloper is committed to participating in coordinated construction management planning efforts that may be sponsored by the City and/or local community groups. Coordinated construction communication and logistical planning (i.e., signage programs, selective truck routes, etc.) can help mitigate local temporary transportation issues associated with concurrent construction projects.

## 3.9 Proposed Mitigation Implementation plan

Table 3-1 below presents the proposed mitigation implementation plan associated with anticipated implementation schedule and milestones as well as parties responsible for implementation.

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**Table 3-1 Proposed Mitigation and Other Beneficial Measures Implementation Plan**

| Measure | Responsible Party[1] | Whitehead Institute | Phase 1A 11CC | Phase 1B Res N. | Phase 2A 14CC | Phase 2B Res S. |
|---|---|---|---|---|---|---|
| **Transportation & Air Quality[2]** | | | | | | |
| ***Vehicular Access and Circulation Improvements*** | | | | | | |
| Analyze and propose adjustments to signal timing and phasing for study area local intersections, as appropriate, in coordination with the City. | Redeveloper | | X | X | X | X |
| ***Transportation Demand Management Plan[2]*** | Redeveloper/Future Employers | | X | X | X | X |
| ***Transportation Monitoring Program[2]*** | Proponent | X | X | X | X | X |
| ***Public Transit Enhancements*** | | | | | | |
| Establish the Kendal Square Transit Enhancement Program (KSTEP) in coordination with MassDOT, MBTA, and the City through the establishment of a Memorandum of Understanding (MOU). | Proponent & Redeveloper | | X | | | |
| Implement the Project-related improvement projects, program, and/or service improvements identified as part of the KSTEP, in coordination with MassDOT, MBTA, and the City and consistent with the MOU. | Proponent & Redeveloper | | X | X | X | X |
| ***Pedestrian Access, Safety & Streetscape Improvements*** | | | | | | |
| Improve study area intersections to accommodate pedestrians (countdown timers, LPI programming). | Redeveloper/Other Developers | X | X | X | X | X |
| Incorporate a new mid-block pedestrian connection on Broadway between the Cambridge Center North Garage Office Buildings and Danny Lewin Park. | Redeveloper | | | X | | |
| Improve the Sixth Street Connector. | Proponent & Redeveloper | | | X | | |
| Review all pedestrian crossings to assess their potential for bulb-outs, raised crossings, pedestrian refuge islands, Rectangular Rapid Flashing Beacons (RRFB's), realigned non-apex ramps and/or other treatments to enhance the comfort and visibility of crosswalks. | Proponent & Redeveloper | X | X | X | X | X |

**Table 3-1 Proposed Mitigation and Other Beneficial Measures Implementation Plan (continued)**

| Measure | Responsible Party[1] | Whitehead Institute | Phase 1A 11CC | Phase 1B Res N. | Phase 2A 14CC | Phase 2B Res S. |
|---|---|---|---|---|---|---|
| Enhance the Main Street streetscape between Ames Street and Galileo Galilei Way. | Proponent/Redeveloper/ Other Developers | X | | | | |
| ***Pedestrian Access, Safety & Streetscape Improvements (Continued)*** | | | | | | |
| Enhance the Broadway streetscape from Ames Street to Galileo Galilei Way. | Proponent & Redeveloper | | X | X | | |
| Enhance the Binney Street and Galileo Galilei Way streetscape from Sixth Street to Broadway. | Proponent & Redeveloper | | | | X | X |
| Improve pedestrian safety by enhancing lighting along sidewalks and pathways for safer pedestrian accommodations. | Proponent/Redeveloper/ Other Developers | X | X | X | X | X |
| Enhance open spaces with multiple outdoor connection to buildings within the KSURP area. | Redeveloper | | X | X | X | X |
| ***Bicycle Facilities*** | | | | | | |
| Enhance bicycle infrastructure at each Project Component and within the KSURP area by connecting this infrastructure with other area-wide improvements, in coordination with the City | Proponent | | X | X | X | X |
| Provide approximately 800 long-term bicycle storage for tenants/residents and approximately 142 short-term bicycle exterior parking for visitors. | Redeveloper | X | X | X | X | X |
| Explore opportunities to create a full service bike station within the area. | Proponent | | X | X | | |
| ***Greenhouse Gas Emissions*** | | | | | | |
| Incorporate key elements of sustainable and high performance building design to increase energy efficiency and reduce stationary source GHG emissions. | Redeveloper/Other Developers | X | X | X | X | X |

**Table 3-1 Proposed Mitigation and Other Beneficial Measures Implementation Plan (continued)**

| Measure | Responsible Party[1] | Whitehead Institute | Phase 1A 11CC | Phase 1B Res N. | Phase 2A 14CC | Phase 2B Res S. |
|---|---|---|---|---|---|---|
| Design, construct, and operate all Project Components in a sustainable manner; utilize LEED Green Building Rating Systems for incorporating sustainable elements. | Redeveloper/Other Developers | X | X | X | X | X |
| Provide Tenant Design and Construction Guidelines to potential office and retail tenants as a guide to use when fitting out their spaces to further ensure a sustainable development. | Redeveloper/Other Developers | X | X | X | X | X |
| Reduction in air emissions (VOCs and NOx) and mobile source GHG emissions associated with vehicular traffic through the implementation of the above-referenced transportation-related mitigation measures, including site access and local roadway improvements, and implementation of a robust TDM Plan. | Redeveloper/Other Developers | X | X | X | X | X |
| **Climate Change Resiliency** | | | | | | |
| Consider climate change impacts (i.e., potential sea level rise, extreme weather events) in site and building design, where applicable and feasible. | Redeveloper | | X | X | X | X |
| **Infrastructure** | | | | | | |
| ***Stormwater Management*** | | | | | | |
| Install on-site stormwater management and treatment systems that will improve water quality, reduce runoff volume, and control peak rates of runoff in comparison to existing conditions, in compliance with current City requirements and MassDEP stormwater management standards. | Redeveloper/Other Developers | X | X | X | X | X |
| Coordinate with DPW to determine if support can be given to neighborhood-scale stormwater projects in lieu of some on-site stormwater mitigation infrastructure. | Proponent/Redeveloper | | X | X | X | X |

**Table 3-1 Proposed Mitigation and Other Beneficial Measures Implementation Plan (continued)**

| Measure | Responsible Party[1] | Whitehead Institute | Phase 1A 11CC | Phase 1B Res N. | Phase 2A 14CC | Phase 2B Res S. |
|---|---|---|---|---|---|---|
| ***Water/Wastewater*** | | | | | | |
| Implement 4:1 I/I removal through contribution to City's I/I mitigation fund. | Redeveloper | | X | X | X | X |
| Install low-flow and low-consumption plumbing fixtures to reduce overall water consumption by at least 20 percent. | Redeveloper/Other Developers | X | X | X | X | X |
| **Hazardous Materials** | | | | | | |
| Develop a RAM Plan to manage contaminated soil and/ groundwater (if encountered) and implement measures as required to reduce the risk of exposure of contaminates at each Project Component. | Redeveloper | | X | X | X | X |
| **Construction Management** | | | | | | |
| Develop and implement a comprehensive Construction Management Plan (CMP) to mitigate temporary construction-related impacts | Construction Manager | X | X | X | X | X |
| Coordinate with other nearby private & public construction projects | Construction Manager | X | X | X | X | X |

1 The Proponent is the CRA and the Redeveloper is Boston Properties. Other Developers represents the developers for the Whitehead Institute and Broad Institute Project Components.

2 Refer to Chapter 3, *Summary of Mitigation Measures and Draft Section 61 Findings* for additional details.

## 3.10 GHG Self-Certification Statement

As required by the MEPA Scope in the NPC Certificate, this section in the form of a draft letter of commitment.

**D R A F T O N L Y**

September 15, 2015

Secretary Matthew A. Beaton
Executive Office of Energy & Environmental Affairs
100 Cambridge Street, Suite 900
Boston MA 02114

ATTN: Deirdre Buckley, Director, MEPA Office

**Re: Letter of Commitment for Stationary Source Greenhouse Gas Emissions Self-Certification**
**Kendall Square Urban Renewal Project (KSURP) Amendment No. 10**
**Cambridge, MA (EEA No. 15169)**

Dear Secretary Beaton and Director Buckley:

On behalf of the Cambridge Redevelopment Authority (the "CRA", or "Proponent") and Boston Properties (the "Redeveloper"), VHB has prepared a summary of the estimated reduction in overall energy use and stationary source Greenhouse Gas (GHG) emissions for Kendall Square Urban Renewal Project (KSURP) Amendment No. 10 in Cambridge (the "Project").

In accordance with the current the MEPA Greenhouse Gas Emissions Policy and Protocol (the "GHG Policy") dated May 2010, the stationary source GHG assessment was provided to the MEPA Office as part of the Notice of Project Change (the "NPC") filed on June 30, 2016. The Project has been designed to meet the requirements of the current Stretch Energy Code requirements for GHG emissions (compared to a base design compliant with ASHRAE 80.1-2007).[1] The design case assumed building design and system improvements that would result in energy reductions, in accordance with the GHG Policy. At the request of MEPA, the ASHRAE 90.1-2010 building improvement requirements are also presented to demonstrate how the Project would meet the future potential Stretch Energy Code. On *XXX*, a Certificate stating that the Project's NPC, dated *XXX*, adequately and properly complied with the Massachusetts Environmental Policy Act and its implementing regulations was issued by the Secretary of Energy and Environmental Affairs.

The energy conservation measures proposed for the full build-out of the Project are estimated to reduce the overall energy use by 26.5 percent resulting in a 20.4 percent reduction in stationary source $CO_2$ emissions when compared to the baseline case. The following table presents the estimated energy savings and $CO_2$ emissions reductions for each Project Component.

[1] Effective July 2010, the City adopted the Stretch Energy Code.

| Project Component | Energy Consumption (MBtu/yr) | | | $CO_2$ Emissions (tons/yr) | | |
|---|---|---|---|---|---|---|
| | Base Case | Design Case | Percent Savings | Base Case | Design Case | Percent Reduction |
| Office Building A - 145 Broadway | 21,977 | 15,812 | 28.1% | 1,909.4 | 1,462.6 | 23.4% |
| Residential Buildings (North and South)– 135 Broadway Street | 25,883 | 19,643 | 24.1% | 2,053.6 | 1,734.5 | 15.5% |
| Office Building B - 250 Binney Street | 22,140 | 16,167 | 27.0% | 1,984.4 | 1,566.9 | 21.0% |
| Whitehead Institute Addition | 15,646 | 11,341 | 27.5% | 1,159.4 | 894.7 | 22.8% |
| **Total** | 85,646 | 62,963 | **26.5%** | 7,106.8 | 5,658.7 | **20.4%** |

tons/yr = short tons per year

The building energy model results/energy savings and resulted stationary source GHG emissions reductions are preliminary as none of the proposed buildings have progressed past a conceptual level of design. Following completion of construction of each element, the Proponent will submit a self-certification to the MEPA Office, signed by an appropriate professional, which identifies the as-built energy conservation measures and documents the stationary source GHG emissions reductions from the baseline case.

If you have any questions, please contact me at (617) 924-1770 or via e mail at ldevoe@vhb.com.

Very truly yours,

VANASSE HANGEN BRUSTLIN, INC.

Lauren DeVoe, AICP, LEED AP BD+C
Senior Environmental Planner

cc: Tom Evans, Cambridge Redevelopment Authority
Mike Tilford, Boston Properties
Douglas McGarrah, Foley and Hoag

# Appendix A
# Distribution List

# NPC Distribution List

In accordance with Section 11.10(7) and 11.16(b) of the MEPA regulations, the Proponent has distributed copies of the Notice of Project Change (NPC) to the following state and local agencies as well as other interested parties. Additionally, per the SEIR Certificate, a copy has also been made available to the local library for public review.

It is anticipated that this NPC will be noticed in the next edition of the Environmental Monitor published on or about July 6, 2016 commencing the 30-day public review period, in accordance with Section 11.06(3) of the MEPA regulations. Thus, comments on this NPC are due to the MEPA Office no later than July 26, 2016. Comments on this NPC can be submitted to the MEPA Office at the following address:

Secretary Matthew A. Beaton
Executive Office of Energy and Environmental Affairs
Attention: MEPA Office re: EEA No. 1891
100 Cambridge Street, Suite 900
Boston, MA 02114

To request an additional copy of this document, please contact Lauren DeVoe at (617) 607-0091 or email at ldevoe@vhb.com.

**State Agencies**

Secretary Matthew A. Beaton (submitted herein)
Executive Office of Energy and Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114

Department of Environmental Protection
Commissioner's Office
One Winter Street
Boston, MA 02108

DEP/Northeast Regional Office
Attn: MEPA Coordinator
205B Lowell Street
Wilmington, MA 01887

Massachusetts Department of Transportation
Public/Private Development Unit
Attn: Lionel Lucian
10 Park Plaza
Boston, MA 02116

Massachusetts Department of Transportation - District #6
Attn: MEPA Coordinator
185 Kneeland Street
Boston, MA 02111

Massachusetts Historical Commission
The MA Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Metropolitan Area Planning Commission
60 Temple Place, 6th Floor
Boston, MA 02111

Massachusetts Department of Housing & Community Development
Attn: Carol Wolfe, Community Revitalization Coordinator
100 Cambridge Street, Suite 300
Boston, MA 02114

Massachusetts Water Resource Authority
Attn: Marianne Connolly
Charlestown Navy Yard
100 First Avenue, Building 39
Boston, MA 02129

Massachusetts Department of Energy Resources
Attn: MEPA Coordinator
100 Cambridge Street, 10th Floor
Boston, MA 02114

Massachusetts Bay Transit Authority
Attn: Andrew Bennan
10 Park Plaza, 6th Fl.
Boston, MA 02116-3966

Massachusetts Department of Conservation and Recreation
Attn: MEPA Coordinator
251 Causeway St. Suite 600
Boston MA 02114

**City of Cambridge**

City of Cambridge
Cambridge City Council
Attn: City Clerk
795 Massachusetts Ave
Cambridge MA 02139

Cambridge Community Development Department
Attn: Iram Farooq, Acting Assistant City Manager
344 Broadway
Cambridge, MA 02139

Cambridge Conservation Commission
Attn: Jennifer Letourneau, Director
344 Broadway
Cambridge, MA 02139

Cambridge Public Health Department
119 Windsor Street, Ground Level
Cambridge, MA 02139

Richard C. Rossi, City Manager
City Manager's Office
Cambridge City Hall
795 Massachusetts Avenue
Cambridge, MA 02139

Cambridge Traffic, Parking & Transportation Department
Attn: Joe Barr, Director
344 Broadway
Cambridge MA 02139

Cambridge Community Development Department
Environmental and Transportation Planning Division
Attn: Susanne Rasmussen
344 Broadway
Cambridge, MA 02139

Cambridge Public Works Department
Attn: Owen O'Riordan, Commissioner
147 Hampshire St
Cambridge MA 02139

Cambridge Water Department
Attn: Sam Corda, Managing Director
250 Fresh Pond Parkway
Cambridge MA 02138

Cambridge Redevelopment Authority
Attn: Kathleen Born, Chair of CRA Board
255 Main Street, 4th floor,
Cambridge, MA 02142

Cambridge Public Library
Main Library
449 Broadway
Cambridge, MA 02138

**Other Reviewers**

Congressman Michael E. Capuano
110 First Street
Cambridge, MA 02141

Central Transportation Planning/ Boston Region Metropolitan Planning Organization
State Transportation Building
10 Park Plaza, Suite 2150
Boston, MA 02116

Whitehead Institute
Attn: Martin Mullins, Vice President
Nine Cambridge Center
Cambridge, MA 02142

Broad Institute
Attn: Alan Fein, Executive Vice President
77 Ames Street
Cambridge, MA 02142

Biogen
Attn: Ed Dondero, Director of Facilities
14 Cambridge Center
Cambridge, MA 02142

Robert Johns, Director
Volpe, The National Transportation Systems Center
55 Broadway
Cambridge, MA 02142

Xenia Hotels
Attn: John Wilmoth, General Manager
120 Broadway
Cambridge, MA 02142

Brian Dacey
Cambridge Innovation Center
1 Broadway, 14th Floor
Cambridge, MA 02142

Stephen Kaiser
191 Hamilton Street
Cambridge, MA 02139
Charles River Watershed Association
190 Park Road
Weston, MA 02493

# Appendix B
# Most Recent Previous MEPA Certificate

*The Commonwealth of Massachusetts*
*Executive Office of Energy and Environmental Affairs*
*100 Cambridge Street, Suite 900*
*Boston, MA 02114*

Charles D. Baker
GOVERNOR

Karyn E. Polito
LIEUTENANT GOVERNOR

Matthew A. Beaton
SECRETARY

Tel: (617) 626-1000
Fax: (617) 626-1181
http://www.mass.gov/envir

November 25, 2015

CERTIFICATE OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS
ON THE
SINGLE ENVIRONMENTAL IMPACT REPORT

| | |
|---|---|
| PROJECT NAME | : Kendall Square Urban Renewal Project (KSURP) - Amendment #10 |
| PROJECT MUNICIPALITY | : Cambridge (Kendall Square) |
| PROJECT WATERSHED | : Boston Harbor (Charles River) |
| EEA NUMBER | : 1891 |
| PROJECT PROPONENT | : Cambridge Redevelopment Authority |
| DATE NOTICED IN MONITOR | : October 19, 2015 |

Pursuant to the Massachusetts Environmental Policy Act (MEPA; M.G. L. c. 30, ss. 61-62I) and Section 11.08 of the MEPA regulations (301 CMR 11.00), I have reviewed the Single Environmental Impact Report (SEIR) and hereby determine that it **adequately and properly complies** with MEPA and its implementing regulations. The Department of Housing and Community Development (DHCD) may act on the Proponent's request for a Major Amendment to its Urban Renewal Plan (URP) pursuant to 301 CMR 11.12 (4). The MEPA regulations indicate that an EIR can be found adequate even if certain aspects or issues require additional review and consideration, as long as these issues and aspects have been adequately described during MEPA review and subsequent permitting and review processes provide opportunities for additional public review and comment. The Proponent has thoroughly addressed the project's potential environmental impacts, considered alternatives and identified mitigation measures to avoid, minimize and mitigate these impacts. To provide additional public review of final mitigation commitments, the Proponent is required to file a Notice of Project Change (NPC) with

the MEPA Office that will include revised mitigation commitments and revised draft Section 61 Findings for review and comment.

The project consists of significant redevelopment, comprised of a mix of residential, office and retail uses, in a dense urban area in proximity to transit. As a transit-oriented-development (TOD), environmental impacts such as new traffic generation, land alteration, creation of impervious areas, will be minimized compared to greenfield development or projects with reduced density. The SEIR, submitted by the Cambridge Redevelopment Authority (CRA, "the Proponent") in consultation with Boston Properties (the "Redeveloper"), included a revised transit analysis, provided an update on consultations with State Agencies and other stakeholders, and identified potential mitigation measures to address project impacts. The SEIR demonstrates that environmental impacts associated with the project change are within the envelope of impacts identified and analyzed in previous MEPA filings.

Because the project is at a conceptual level of design, mitigation measures are not detailed to the extent typical of Final MEPA review, particularly in regards to measures to avoid impacts to the transit system and improvements to transit infrastructure and operations. The roadway system in the project area, which consists primarily of streets and intersections under the jurisdiction of the City of Cambridge, is constrained and the majority of intersections operate at degraded conditions during peak periods. The traffic and transit analysis provided in the SEIR is predicated on high mode shares for walking, bicycling and transit use, consistent with documented uses in the Kendall Square Area. These high mode shares reduce the project's generation of vehicle trips and, therefore, limit emissions of air pollutants, Greenhouse Gas (GHG) emissions, and potential impacts on traffic operations. The project will generate a significant level of additional transit users. The SEIR documents and acknowledges that the project will impact Massachusetts Bay Transportation Authority (MBTA) assets, including the Red Line and bus service, and degrade capacity during certain periods, particularly during the morning peak period. To the extent that the increase in transit users cannot be absorbed by the system and identified mode shares are not obtained, the project would have a greater impact on roadway operations and result in higher levels of air pollutants and GHG emissions.

The Proponent and Redeveloper have proposed a unique transit mitigation strategy that seeks to provide a sustainable source of funding to ensure that the transit infrastructure and assets in the Kendall Square Urban Renewal Plan (KSURP) area can continue to accommodate additional growth. The strategy may be guided through development of a Memorandum of Understanding (MOU) between the Massachusetts Department of Transportation (MassDOT), the MBTA, the Proponent, the Redeveloper, and the City. In addition, the Proponent, MassDOT, and MBTA indicate that a Kendall Square Transit Enhancement Fund (KSTEF) will be established. The Proponent and Redeveloper have committed to providing an initial contribution of $6 million dollars to the KSTEF.

I applaud the Proponent's commitment to achieve high rates of transit use, walking and bicycling and appreciate its support for addressing impacts to the transit system. I am proud to partner with Secretary Pollack and MassDOT to facilitate this innovative mitigation mechanism. I note that the analysis provided regarding impacts to transit assets and identification of mitigation is consistent with MEPA review of other TOD projects. The Boston Garden (EEA#

15052) and the Government Center Garage (EEA# 14383) projects included high transit mode shares and evaluated the impacts on the transit system. Both of these projects provided significant and meaningful mitigation to address potential impacts and improve MBTA infrastructure. These included improvements to busways and headhouses, creation of and improvements to pedestrian connections, and lighting and security-related amenities. Wynn Everett (EEA # 15060) has also committed to provide an annual operating subsidy to the MBTA to preserve the service and capacity improvements associated with the addition of new Orange Line trains and mitigate the impacts of its project on operations. We have worked collaboratively with MassDOT, the MBTA and project proponents in the development of appropriate mitigation for mode share that involves public transit.

Comment letters from MassDOT and the City of Cambridge acknowledge constructive consultation with the Proponent and indicate that clarity is necessary regarding the funding mechanism (such as a state Fund), amount of funding and, ultimately, final mitigation performed. The SEIR indicates support for this approach and establishment of the KSTEF. It is critical that any contributions made in lieu of specific mitigation, are developed, managed and expended with the utmost transparency and accountability. Subsequent coordination must provide certainty regarding: how funding allocations are determined commensurate with the scope and scale of the proposed project and associated impacts; the vehicle and entity responsible for managing funds; and, how funding will be prioritized and expended.

The SEIR and MassDOT comments indicate that an MOU will be developed by July, 2016. I expect that by that time more detailed mitigation will also be developed through consultation with the City of Cambridge through its permitting process. The NPC should include revised mitigation measures, revised Section 61 Findings and provide the information described above concerning funding, funding management and expenditure, including but not limited to development of an MOU or similar document.

Original Project Description and MEPA Procedural History

The Kendall Square Urban Renewal Project (KSURP) was created by the Proponent in 1965. The KSURP regulates the level of development through a cap on aggregate Gross Floor Area (GFA) of all land uses in the KSURP area. The level of development is further restricted through land use controls, including identification of Floor Area Ratios (FARs). The KSURP initially consisted of construction of up to 14 buildings totaling approximately 2.77 million gross square feet (GSF), three parking garages, open space, and other public improvements. The project was the subject of previous review under MEPA beginning with an Environmental Notification Form (ENF) in 1975, and followed by Draft and Final EIRs in 1977 and 1978 respectively, both of which were found to be adequate. Five NPCs were filed since 1978. The NPCs adjusted the permitted mix of uses within the area, increased the maximum allowed GFA within the area, and extended the term of the KSURP. None of the NPCs required further MEPA review.

A NPC for this project (KSURP Amendment No. 10) was submitted to the MEPA Office in April 2015. The extensive and detailed NPC included a request that I allow submission of a SEIR, and in a Certificate issued May 29, 2015, I granted the request for a SEIR. The Scope for

the SEIR requested further information on specific mitigation to address impacts on transit service and capacity. The Certificate noted that I may require the Proponent to file a Final EIR if the SEIR does not adequately address the Scope and substantive issues that remained to be addressed. The Proponent filed an SEIR for the project on October 15, 2015.

Project Description

The SEIR identifies redevelopment within 24 acres of the 43-acre KSURP area. The 24-acre project site is coincident with the boundaries of the Cambridge Center Mixed-Use Development (MXD) Zoning District. The project consists of the addition of 1,034,000 sf of net new commercial and residential development to the KSURP area. The proposed amendment to the KSURP includes exemptions to the GFA cap intended to incentivize ground floor retail, require innovation space, and balance commercial and residential uses. According to the NPC and SEIR, the analysis of environmental impacts is based on a total of 4,341,600 sf of development and includes increases in development beyond the GFA cap[1] that would be allowed based on proposed exemptions. As such, the analysis of environmental impacts is presented based on the maximum amount of development that could be permitted in the KSURP area under the GFA cap. The NPC and SEIR also extend the completion date for the full build-out of the KSURP from 2020 to 2030.

Specifically, the project consists of the following project components:

- **Phase 1A - Cambridge Center North Garage:** Proposed commercial office (546,000 sf), innovation space (39,000 sf ) and retail space (5,000 sf) over the existing Cambridge Center North [Parking] Garage.
- **Phase 1B - Eleven Cambridge Center:** Demolition of existing structure. Proposed 22-story residential building (210,000 sf and up to 294 units) and ground floor retail space (25,000 sf).
- **Phase 2 - Three Cambridge Center**: Demolition of existing structure. Proposed mixed-use building consisting of a 19-story building with commercial office space (106,200 sf) on the lower floors, up to 266 residential units (190,000 sf) on the upper floors, and approximately 20,000 sf of ground-floor retail.

The project also includes a 60,000 sf commercial office addition at the existing Whitehead Institute building at Nine Cambridge Center and the conversion of 15,100 sf of mechanical space into commercial office space at the Broad Institute at 75 Ames Street.

The project is proposed in two phases. Phase 1 will include two sub-phases (Phase 1A and 1B). Phase 1A will consist of the redevelopment of the Cambridge Center North Garage and Phase 1B will include demolition of the existing Eleven Cambridge Center building and construction of the new residential building with ground-floor retail space and below-grade parking. Phase 2 will include demolition of the Three Cambridge Center commercial office

[1] The proposed GFA cap associated with this NPC is 4,302,100 square feet of development. This excludes the exempted 19,500 sf of Innovation Space and 20,000 sf of ground floor retail space; however, this development is included in the analysis of environmental impact presented in the NPC.

building and construction of a new mixed-use building with commercial office space, ground-floor retail space, and residential units.

Permitting and Jurisdiction

The project as previously reviewed was subject to a mandatory EIR pursuant to Sections 11.03(l)(a)(2) and 11.03(6)(a)(6) of the MEPA regulations because it required State Agency Action(s), and was expected to create more than 10 acres of new impervious surface, and generate more than 3,000 new average daily vehicle trips.

The project, as currently proposed and described in the SEIR, is subject to a mandatory EIR as a stand-alone project pursuant to Section 11.03(6)(a)(6) of the MEPA regulations because it requires a State Agency Action and, on its own, will generate greater than 3,000 new average daily trips (adt) on roadways providing access to a single location. Traffic generation will exceed the EIR threshold even when adjusted to account for mode share. The project requires an approval of an Urban Renewal Plan Amendment from the Massachusetts Department of Housing and Community Development (DHCD). The project may also require an Air Quality Permit from the Massachusetts Department of Environmental Protection (MassDEP). The Urban Renewal Plan Amendment also requires approval by the CRA and Cambridge City Council. Components of the project will also require review and Infill Development Concept Plan approval as a Special Permit by the Cambridge Planning Board. The project is subject to review under the May 2010 MEPA GHG Emissions Policy and Protocol ("the Policy").

Because the project is not seeking Financial Assistance from the Commonwealth, MEPA jurisdiction is limited to those aspects of the project that are within the subject matter of required, or potentially required, State Agency Actions and that may cause Damage to the Environment as defined in the MEPA regulations. However, the subject matter of the Urban Renewal Plan approval and associated regulations (760 CMR 12.00) is sufficiently broad to confer the equivalent of broad scope jurisdiction over the potential environmental impacts of the project. Therefore, MEPA jurisdiction is broad in scope and extends to all aspects of a project that are likely, directly or indirectly, to cause Damage to the Environment, as defined in the MEPA regulations.

Review of the SEIR

The SEIR included a detailed description of existing and proposed conditions, project plans, and identified applicable statutory and regulatory standards and requirements and described how the project will meet those standards. The SEIR included responses to comments submitted on the NPC and indicated that no significant changes have been made to the project since the NPC filing. The SEIR provided an updated GHG analysis and Traffic and Transit Impact Assessment. It described the planning process and proposed revisions to zoning that provides context for the proposed amendments to the KSURP. The planning process has included analysis of alternative development scenarios. The project is consistent with the Commonwealth's Sustainable Development Principles. I have received comments from MassDOT, MassDEP, MAPC, and the City that support the Proponent and Redeveloper's efforts

to establish a comprehensive and creative solution that will identify and fund transit improvements within the KSURP area.

*Traffic and Transportation*

The SEIR includes an updated Transportation Study prepared in accordance with the *EEA/MassDOT Guidelines for Transportation Impact Assessments* (TIA). The Transportation Study included a comprehensive assessment of the transportation conditions in the KSURP study area based on a thorough analysis of existing and future conditions. The SEIR updated the transit analysis to incorporate appropriate MBTA data and statistics in the evaluation of the project's transit impacts. MassDOT comments note that this updated evaluation provides a better understanding of the potential impacts of the KSURP on the transit system over the next ten years.

*Kendall Square Transit Enhancement Program (KSTEP)*

In recognition of the importance of improved transit system and Red Line reliability, capacity, and overall enhanced public transit services to maintain a favorable mode share in the KSURP area, the Proponent and Redeveloper have advanced a Kendall Square Transit Enhancement Program (KSTEP). The KSTEP is a public-private partnership that will address these transit issues through coordination with MassDOT, the MBTA, the City, and other stakeholders. Designed to enhance mobility around the KSURP area, the KSTEP will include major transportation initiatives identified by the Kendall Square Mobility Task Force (Task Force) that will improve transit operations and services. Both the Proponent and Redeveloper are active members of the Task Force. The Task Force is led by MassDOT and will identify feasible initiatives, based on technical and cost issues, to be implemented over the short, medium, and long-term planning horizons. The Task Force's study is anticipated to be completed in February 2016.

According to the SEIR, transit mitigation projects and programs under consideration include the following:

- **MBTA Red Line Kendall Station Improvements** – Immediate operating and capital improvements to the existing transit infrastructure at Kendall Station, including station capacity and egress, Kendall Square transit information, communications and way-finding, Red Line ticketing, climate change adaptation and resiliency, bus and bicycle connectivity, and overall station functionality and appearance.
- **Kendall Station/Kendall Square Connection Enhancements** – Capital support for improving existing or new ground transportation via non-MBTA shuttles and/or MBTA buses or Bus Rapid Transit (BRT) aimed at facilitating access to and from Kendall Square.
- **MBTA Red Line Service Modernization and Improvements** – Signal, track, and other technology improvements designed to increase capacity and reliability especially at peak-of-the peak including enhancing headways and other improvements.

- **Long-Range Feasibility Investigations** – Planning for and potential capital investment toward new public transit services.

I refer the Proponent to comments from the City which request the Proponent expand the KSTEP to increase the bicycle share of the mode split and identify measures that can be implemented to expand bicycle infrastructure and use.

The Proponent and Redeveloper have proposed to enter into a MOU with MassDOT, MBTA, and the City, as a mechanism to implement the KSTEP. The SEIR included a commitment to file a draft MOU with MEPA for review by July 1, 2016. The Proponent, in coordination with the City and other parties to the MOU intend to establish and maintain a transit fund to implement transit improvement projects in the Kendall Square area. The KSETF may receive additional funding from other developments. The SEIR indicates that an initial contribution, of not less than $6 million dollars, will be provided to a transit fund to mitigate the project's impacts to transit.

The SEIR did not include a draft MOU or identify the subsequent process for addressing outstanding transit issues, including identification of specific mitigation to address impacts on transit service and capacity. MassDOT and the City have indicated that they will continue to work with the Proponent and Redeveloper to establish a process to guide the development of a mitigation plan and infrastructure improvements and its implementation.

*Transit System*

In response to comments from MassDOT and MBTA, the SEIR provided an updated transit analysis for the 2024 No-Build and Future Build conditions based on the most recent ridership and operational statistics for the Red Line segment between the Charles/MGH and the Kendall-MIT stations. Specifically, the analysis was expanded to include an evaluation based on the On-Time Performance (OTP) statistic (86 percent) that affects the headways and hourly capacity of the Red Line.

Based on this analysis, future conditions in this MBTA segment are expected to operate below service standards during some peak hours (Kendall Square Inbound entering and exiting trains in the morning peak hour and Kendall Square outbound exiting trains in the evening peak hour). Based on identified mode shares, the project will generate a significant number of new riders. The Proponent asserts that the percentage of increase contributed by the project is not significant compared to overall ridership; however, the 2024 Build condition demonstrates that additional transit riders associated with this project would further degrade peak hour utilization of this segment that is over capacity in the 2024 No-Build condition. Use of the Standard Capacity Methodology to evaluate performance indicates that the MBTA will operate over capacity with or without the project for one peak hour (Kendall Square Inbound entering trains in the morning peak hour). The SEIR also evaluated future conditions based on the platform loading capacity of the Kendall Square/MIT Station. Although operations will be further degraded, the evaluation indicates that there is sufficient capacity to accommodate transit riders while maintaining Level-Of-Service (LOS) D criteria, which is the MBTA Standard for transit stations in urban areas. The space requirements to maintain LOS C criteria will not be met in the morning Peak hour for either inbound or outbound platforms. As indicated above, the purpose of

the MOU and KSTEP is to provide a mechanism to identify, implement, and fund transit enhancement projects to support transit in Kendall Square.

The SEIR also provided an updated transit analysis that presents a more comprehensive representation of the project impacts and travel times for all bus lines (MBTA and EZRide) within the study area. Based on this analysis, some bus lines would experience various levels of delay as a result of increased density, bus dwelling times, bicycle and pedestrian intersections, or traffic delay at some intersections. The MBTA routes which currently operate close to capacity (64 Inbound-AM, 85 Inbound-AM, CT2 Outbound-AM and PM) will operate over capacity with the addition of the Project-generated transit trips (volume to capacity ratios of 1.15, 1.07, 1.01 and 1.07, respectively). In addition, based on an evaluation of total route delay, the EZRide Shuttle will experience total delays of approximately 60 seconds in the AM peak hour inbound and total delays of 281 and 46 seconds in the PM inbound and outbound routes (respectively). The CT2 outbound route will experience a 55 second total delay in the PM peak hour. A majority of the remaining bus routes will experience increased delays between 8 and 13 seconds. The Proponent has identified a number of mitigation measures to address the high volume to capacity ratios of some bus route peak hour utilization and the total route delay due to the project's traffic impacts. The SEIR did not provide a specific plan to mitigate these impacts but indicates that the mitigation studies and strategies will be discussed as part of the KSTEP and included in a draft MOU.

*Safety*

The SEIR included an updated safety analysis. It identified the following three intersections within the study area as having crash rates above the district average which are, therefore considered Highway Safety Improvement Program (HSIP) clusters subject to a Roadway Safety Audit (RSA):

- Main Street at Galileo Galilei Way/Vasser Street,
- Massachusetts Avenue at Vasser Street; and
- Massachusetts Avenue at Memorial Drive.

The Proponent has committed to preparing the RSAs for these locations and has indicated that timing of the RSAs will be phased with the project schedule. MassDOT has indicated it will continue to work with the Proponent and the City to ensure that the RSAs are completed and that appropriate safety improvements are identified and implemented.

*Trip Generation and Parking*

According to the NPC and SEIR, the proposed project change will generate approximately 10,512 unadjusted adt or 3,638 adjusted adt. The adjusted trip generation calculations reflect credits allowed for pass-by trips and mode share based on rates derived from the Proponent's existing traffic monitoring program. When the adjusted trips are added to the expected future traffic as projected in 2010 when the project was last reviewed under MEPA (Amendment No.8), traffic generation is estimated at 17,352 adt, which is less than the originally projected 19,300 vehicle trips.

The SEIR presented a vehicle capacity analysis for study area intersections in accordance with the 2000 Highway Capacity Manual (HCM). Based on this data, the following five intersections within the study area are expected to operate at or close to LOS F during the weekday morning and afternoon peak hours:

- Cambridge Street/ Third Street
- Broadway/Galileo Galilei Way
- Main Street/Vassar Street/Galileo Galilei Way
- Memorial Drive/Route 3/Ames Street; and
- Massachusetts Avenue/Memorial Drive Off-Ramps

In response to comments from the City, the SEIR also provided a Multimodal Level of Service (MMLOS) analysis performed in accordance with the 2010 HCM on the following intersections: Cambridge Street /Third Street, Binney Street/Third Street, and Main Street/Ames Street. THE MMLOS evaluates how intersection characteristics affect vehicle, pedestrian, bicycle, and transit users and is not focused on one individual user or transportation mode. The SEIR includes a comprehensive list of improvements related to each mode and has committed to work with the City to determine the specific access and circulation improvements to be made within the study area. The goal of the improvements will be to provide a balanced design and ensure that improvements are equitable for all users or modes of travel. I refer the Proponent to comments from the City which identifies concerns with impact of the proposed vehicular improvements on pedestrians and bicyclists. I expect that this issue will be addressed during the local review process.

The SEIR proposes a comprehensive Transportation Demand Management (TDM) Program to minimize new trip generation. In addition to its existing TDM Program, the Proponent has committed to incorporate additional TDM measures that could include: a car sharing program, MBTA transit pass subsidy, free rides on some existing shuttle routes, parking pricing, Hubway pass subsidy, transportation coordinator, and provision of "real-time" transportation information in all new and renovated lobbies and at select public plazas on the project site. In addition, the Proponent will continue to participate in the Charles River Transportation Management Association (TMA). Comments from the City support the Proponent's commitment to a robust TDM and traffic monitoring program.

The NPC and SEIR provided detailed parking calculations based on the proposed development program and described the methodology and assumptions used to estimate parking demand. Based on this information, the project will add 740 parking spaces to the area. When added to the existing 2,667 parking spaces that have been built, this results in a total of 3,407 parking spaces. This is below the total maximum off-street parking (3,545 parking spaces) reviewed during KSURP Amendment No. 3. All new parking will be located in parking structures and will be shared amongst all project components. I refer the Proponent to comments from the City which request the Proponent further reduce the parking supply. I note that the provision of reduced parking may minimize single occupant vehicle (SOV) use and encourage

the use of transit options, resulting in reduced GHG emissions. I encourage the Proponent to re-evaluate the proposed number of parking spaces during the local permitting process.

*Pedestrian/Bicyclist Accommodations*

The KSURP is located within an area that is well served by pedestrian accommodations, including sidewalks and crosswalks at all study area intersections. The SEIR provided a comprehensive inventory of all existing, planned, and proposed services, facilities, and routes for accessing the site on foot, and a detailed inventory of the bicycle network, including on-street bike lanes, cycle tracks, and multi-use pathways. The SEIR identified potential pedestrian access, safety, and streetscape improvements, including an improved Sixth Street connector, a potential mid-block pedestrian crossing on Broadway, and a commitment to work with the City to determine specific pedestrian and bicycle access and circulation improvements. I refer the Proponent to comments from the City which question the need for the proposed mid-block connection and identify bicycle and pedestrian improvements that warrant additional review.

*Water Supply and Wastewater*

According to the NPC and SEIR, the project will require approximately 118,740 gallons per day (gpd) of net new potable water demand. The SEIR includes a commitment to conserve water through the use of low-flow plumbing fixtures, efficient air conditioning systems, use of native vegetation and minimal irrigation systems. The Proponent will continue to explore the viability of alternate water sources such as water reuse systems, rainwater harvesting, and xeriscaping.

The City of Cambridge will require the removal of four gallons of infiltration and inflow (I/I) for each gallon of new wastewater flows generated by the project. The SEIR acknowledged the need to mitigate I/I into the sewer system at a rate of 4:1 (431,780 gpd total) to accommodate the approximately 107,945 gpd of wastewater flow that will be generated by the project. The SEIR indicates that these requirements will be addressed by coordinating with the City's Department of Public Works (DPW) to either correct I/I issues within the KSURP area or by funding other I/I reduction projects. According to the SEIR, the Proponent has been consulting with the City's DPW and will continue to work with the City as specific projects are identified.

The City also requires that the project provide on-site sanitary holding capacity equivalent to 24 hours of sanitary flows (approximately 107,945 gallons of storage) to address significant combined sewer capacity issues that arise during large storms. The SEIR indicates that this will be addressed by coordinating with the City and may include additional improvements to the sanitary sewer system in lieu of providing on-site storage capacity for sanitary flows. As the project is phased, I refer the Proponent to comments from CRWA and expect that the Proponent will implement identified I/I removal improvements to ensure that the increased project flow for each phase of the project does not contribute to combined sewer overflows into the Charles River.

The SEIR identifies the extent of wet weather sewer surcharging in the project area and identifies potential improvements to the sewer system in areas with pipe surcharge greater than

or equal to the two-foot manholes with a flood depths greater than or equal to 2.5-ft. I refer the Proponent to comments from the MWRA which request that the Proponent and the City share the results of their wastewater mitigation strategy evaluations. MWRA also suggests there may be benefit in considering I/I mitigation strategies beyond Kendall Square to further minimize discharges of untreated combined sewer overflows to the Charles River Basin during large storms.

*Stormwater*

The SEIR provided an expanded discussion of the existing stormwater infrastructure, conceptual drainage design, and an evaluation of the design in terms of stormwater peak rate, volume runoff, and pollutant loadings. According to the SEIR, stormwater management infrastructure will be designed in accordance with City and MassDEP Stormwater Management Standards (SMS) as design for each project component progresses. The SEIR indicates that all stormwater infrastructure serving the project site drains to the Charles River Basin at Broad Canal Way. Comments from MWRA note that stormwater from the project should not enter a City or MWRA sanitary or combined sewer outfall. MWRA comments also address the elimination of a potential connection between a storm drain in Galileo Way to a combined sewer in Broadway.

The project is located near and drains directly to the segment of the Charles River that is subject to a Lower Charles River Nutrient Total Maximum Daily Load (TMDL) and the Bacteria TMDL. The phosphorus TMDL requires a 62 percent reduction in phosphorous loading for this segment of the river. The SEIR identifies potential Low Impact Design (LID) and Best Management Practices (BMPs) that may be incorporated into the final design to treat stormwater runoff and achieve TMDL compliance. Comments from the Charles River Watershed Association (CRWA) and MassDEP indicate that these BMPS have the potential to meet regulatory requirements, though the limited information provided in the SEIR does not support an evaluation of the system's compliance with TMDL requirements. Comments from MassDEP and CRWA note that the Proponent should further consider how the incorporation of green roofs may affect phosphorous loading and consistency with TMDL requirements.

According to the SEIR, the Proponent will coordinate with the City to evaluate creative solutions to stormwater management to provide district-wide or neighborhood-wide benefits, including a potential connection to the Broad Canal. Comments from CRWA suggest retrofitting other open spaces (Point Plaza and Grand Junction Park) with green infrastructure and support the incorporation of green streets and other regional green infrastructure to meet water quality standards and provide flood storage on a regional level.

*Air Quality*

In accordance with the State Implementation Plan (SIP) for ozone attainment, the SEIR includes a mesoscale analysis for 2014 existing conditions, 2024 No-Build, and 2024 Build conditions. The analysis indicates that emissions of volatile organic compounds (VOCs) and nitrogen oxides ($NO_x$) for the 2024 Build scenario would be greater than the 2024 No-Build scenario. Because the project will increase emissions of VOCs, transportation mitigation is

required, including a TDM program. Under the 2024 No-Build condition, VOC emissions would be 7,507.71 kilograms per day (kg/day) and $NO_x$ emissions would be 9,257.12 kg/day. Under the 2024 Build condition, VOC emissions would be 7,507.82 kg/day and the $NO_x$ emissions would be approximately 9,257.75 kg/day. The project is estimated to generate 0.11 kg of VOC and 0.63 kg of $NO_x$ per day. The proposed mitigation, as previously described, will reduce VOCs by 0.04 kilograms per day (kg/day) and $NO_x$ emissions by 0.08 kg/day under the 2024 Build scenario.

The SEIR indicates that the project may require an Air Quality Permit (under 310 CMR 7.00) from MassDEP for heating boilers and emergency generators.

*Greenhouse Gas Emissions*

This project is subject to review under the May 2010 MEPA GHG Policy and it is subject to the Massachusetts Stretch Energy Code (Stretch Code) adopted by the City of Cambridge. The Stretch Code increases the energy efficiency code requirements for new construction (both residential and commercial) and for major residential renovations or additions in municipalities that adopt it. The Policy requires projects to quantify carbon dioxide ($CO_2$) emissions and identify measures to avoid, minimize or mitigate such emissions. The analysis quantifies the direct and indirect $CO_2$ emissions associated with the project's energy use (stationary sources) and transportation-related emissions (mobile sources). The GHG analysis evaluated $CO_2$ emissions for two alternatives as required by the Policy including 1) a Base Case and 2) a Preferred Alternative that includes additional energy saving measures and, at a minimum, complies with the Stretch Code. The analysis used the eQUEST, version 3.64, modeling software to perform the GHG analysis and included modeling assumptions and emissions rates.

At the time of the filing of the SEIR, the building code is the Massachusetts Building Code 8th Edition; however, the City has adopted the Stretch Code. The current Stretch Code requires energy efficiencies of 20 percent better than American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1-2007 and requires modeling of base and proposed cases based on the methodology as defined in ASHRAE 90.1-2007 (Appendix G). Based on this, ASHRAE 90.1-2007 was applied to define the Base Case. The SEIR also compared the proposed energy efficiency with the current Massachusetts Building Code, which is based on IECC 2012 and ASHRAE 90.1-2010. The Preferred Alternative is expected to meet the current Stretch Energy Code. Mobile GHG emissions were estimated using the standard methodology in the EEA/MassDOT Guidelines for EIR/EIS Traffic Impact Assessments and EPA's MOVES2014 emission factors. Potential project-related mobile GHG emissions were compared for the 2014 Existing Condition, the 2024 No-Build Condition, and the 2024 Build Condition (with physical and operational upgrades). The revised analysis indicates that the Base Case for the entire project will generate approximately 9,368 tons per year (tpy) of GHG emissions, consisting of 8,322 tpy of stationary source emissions and 1,046 tpy of mobile source emissions. The Preferred Alternative will reduce stationary source emissions by 1,927 tpy, an approximately 23 percent reduction, and will reduce mobile source emissions by 102 tpd, a 10 percent reduction. Overall emissions will be reduced by 2,029 tpy for an approximate 22 percent reduction

I commend the Proponent's commitment to creating a sustainable development and its efforts to address climate change impacts in coordination with the City and other stakeholder groups. Comments from the Department of Energy Resources (DOER) indicate the revised GHG analysis was very responsive to the scope and incorporated many suggested energy efficiency measures. The SEIR included a draft tenant manual that identifies specific strategies to encourage adoption of GHG reduction measures and an updated GHG analysis based on specific mitigation commitments. Although energy efficiency components for each building will vary, the SEIR summarizes the stationary source energy conservation measures. They include include high performance buildings with double pane curtainwalls and insulation, improved lighting power density (LPD), variable volume condensing and chilled hot water pumping, high efficiency centrifugal chillers, variable frequency drives (VFD) on cooling tower fans and higher efficiency cold water Delta T system, 96-percent efficiency condensing gas-fired hot water boilers, high efficiency water source heat pumps, high efficiency energy recovery ventilator, differential $CO_2$-based demand control ventilation for offices, and CO control and variable air volume (VAV) for underground garage fans. Based on comments from DOER, the project design and GHG analysis was revised to reduce window-to-wall ratios and to reduce LPD in the office and retail spaces by approximately 20 percent.

The GHG analysis assumed implementation of a number of local intersection operation improvements, bicycle and pedestrian enhancements, and the TDM Plan. I note that the Proponent has not committed to specific intersection improvements or bicycle and pedestrian enhancements. I expect that the Proponent's self-certification will confirm that these or equivalent reduction measures have been implemented to demonstrate a commensurate GHG reduction. I refer the Proponent to comments from MassDEP which encourage the installation of electric vehicle (EV) charging stations and request that one percent of the parking supply be set aside for this equipment as an additional measure to reduce GHG emissions.

According to the SEIR, an additional 605 tpy of $CO_2$ could be reduced by installing solar on the available rooftop space of the proposed buildings. The SEIR analyzed of the viability of a roof-mounted solar photovoltaic (PV) system for the buildings. The SEIR acknowledges that PV systems have been installed on other developments under the Redeveloper's control. In the SEIR, the commitment is limited to making the rooftops solar-ready. Comments from the City, DOER, and MassDEP encourage the Proponent to provide a commitment to add solar arrays to the project.

The SEIR also evaluated the purchase of energy from the Veolia (f/k/a Dalkia) Cambridge Combined Heat and Power (CHP) district steam network and included an expanded analysis that evaluated a connection to the Kendall CHP district plant for both heating and cooling energy using absorption chillers. These evaluations were completed in compliance with the draft *Guidance for the Application of the MEPA GHG Policy and Protocol to the Use of the Dalkia Cambridge CHP District Steam* document. According to this evaluation, use of steam from the Kendall CHP district plant for heating and cooling would reduce the total source energy used by the project by 90 percent. Use of steam to offset only natural gas used for heating would reduce the project's total source energy use by 62 percent. The SEIR identifies several challenges that make these options less financially attractive and note that additional analysis is needed. Comments from the City indicate that additional information will be required during

review of the Special Permit to assess the physical and financial feasibility of connecting to the Veolia district steam system. Given the significant GHG reductions associated with this potential measure, I expect the Proponent to continue evaluating use of the district steam system. In addition, I encourage the Proponent to work with DOER to consider how identified constraints may be addressed. Comments from CRWA identify other opportunities to integrate wastewater and energy reduction strategies into the project design.

*Climate Change Adaptation and Resiliency*

The SEIR noted the importance of planning for climate change impacts and resiliency resulting from sea level rise, increased storm frequency and duration, and extreme temperature events. The SEIR provided an update on the City's ongoing work with MassDOT to extend the scope of MassDOT's Advanced Circulation Model ("ADCIRC Model") for the Central Artery to the project area. Preliminary results from the ADCRIC Model indicate that there is a less than 0.1 percent chance of flooding due to climate driven sea level rise for the project site through 2030. I refer the Proponent to comments from the City which indicate that the storm surge may propagate through the piped infrastructure and cause flooding on a portion of Broadway. Comments from the City indicate that the project site is susceptible to flood risks from precipitation driven flooding via backups in the piped stormwater infrastructure. I anticipate that this will be evaluated and addressed during the local permitting process.

The SEIR included an assessment of sea level rise for the year 2075 which is calculated on a 50-year design life for the buildings. The assessment is based on the Office of Coastal Zone Management's (CZM) December 2013 report entitled *Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning* which presents estimates ranging from 0.60 ft to 3.92 ft. According to the evaluation, the adjacent roadway networks may be vulnerable to sea level rise; however this will be further evaluated once the final ADCIRC model results are available. Similarly, the MBTA Kendall Square Station may be vulnerable to flooding in the year 2075, which could affect accessibility to transit, an important consideration for the Redeveloper. The SEIR identified potential site elements that can be incorporated into project design to reduce the impact of sea level rise, extreme heat waves, and limit the potential impact of more frequent and intense precipitation.

*Hazardous Materials & Solid Waste*

According to the SEIR, the potential for vapor intrusion (VI) into new buildings will be evaluated in and assessed early in the building design phase to identify site conditions that may indicate when a VI pathway is probable in accordance with MassDEP Vapor Intrusion Guidance (WSC #14-434). The SEIR identified potential mitigation measures that may be implemented depending on the results of environmental investigations including protective barriers and vapor mitigation systems.

*Landlocked Tidelands*

A portion of the project will occur within landlocked tidelands as defined by the MassDEP's Waterways Regulations (310 CMR 9.00) and is subject to the Public Benefit Determination regulations (301 CMR 13.00). The SEIR provided a public benefits analysis of

the project consistent with the provisions of *An Act Relative to Licensing Requirements for Certain Tidelands* (2007 Mass. Acts ch. 168) (the Act). The area and type of activities proposed within the landlocked tidelands is summarized below.

| **Project Component** | **Total Area within Tidelands** | **Nature of Work** |
|---|---|---|
| Cambridge Center North Garage | 60,288 sf | Construction of commercial office space with innovation space, ground-floor retail, and indoor/outdoor public open space |
| Eleven Cambridge Center | 28,600 sf | Change in use from office to residential |
| Broad Institute Conversion | 64,230sf | Conversion of mechanical space to commercial office space |
| **Total** | **153,118 sf** | |

The benefits of the project identified in the SEIR include the redevelopment of the site to activate the area and facilitate residential development in the area. It will also provide pedestrian and bicycle improvements, public open space, and circulation improvements aimed at improving permeability throughout and around project components.

Consistent with Section 8 of the Act, I must conduct a Public Benefits Review as part of the EIR review of projects located on landlocked tidelands that entail new use or modification of an existing use. I will issue a Public Benefits Determination (PBD) within 30 days of the issuance of this Certificate.

*Construction Period Impacts*

The SEIR indentifies the construction period impacts of the project, including truck traffic, air quality (dust), noise, stormwater runoff, and construction waste. Mitigation measures identified in the SEIR include development of Construction Management Plans (CMP) for each project component to address numerous temporary construction-related impacts, including mitigation measures, road closures, detours, and staging. Mitigation measures to be included in the CMP include: erosion and sedimentation control, identification of designated truck routes, maintenance and protection of pedestrian and bicycle accommodations, dust suppression, covering trucks used for transportation of construction debris, daily cleaning of streets and sidewalks, and construction noise mitigation measures. The SEIR indicates that ultra-low-sulfur diesel fuel will be used for construction vehicles to mitigate construction-related air pollution and commits to meeting the requirements of the MassDEP State Revolving Fund (SRF) for diesel construction equipment. The SEIR also includes a commitment to divert at least 75 percent of construction and demolition waste from landfills.

Mitigation/Draft Section 61 Findings

The SEIR includes a summary of potential mitigation measures to avoid, minimize, and/or mitigate environmental impacts. I note identification of and commitment to implementing many of the identified potential mitigation measures remains to be determined based on consultation with the City and MassDOT. The Proponent and/or Redeveloper have committed to implement the following measures to avoid, minimize, and mitigate environmental impacts:

*Traffic/Transportation*

- Traffic Monitoring Program: The Proponent will continue to conduct annual traffic monitoring and employee survey program to evaluate the success of the TDM program and accuracy of trip and traffic projections, and adjust mitigation as necessary.

*Vehicular Access and Circulation Improvements*

- Analyze and propose adjustments to signal timing and phasing for study area local intersections, as appropriate, in coordination with the City

*Public Transit Improvements*

- Establish the KSTEP in coordination with MassDOT, the MBTA, and the City through the establishment of an MOU, or similar document
- Implement the project-related improvement projects, program, and/or service improvements identified in the KSTEP, in coordination with MassDOT, the MBTA, and the City

*Pedestrian and Bicycle Access and Circulation Improvements*

- Review all pedestrian crossings and study area intersections and evaluate potential improvements to accommodate pedestrians, in coordination with the City
- Improve the Sixth Street Connector
- Enhance the Main Street streetscape from Ames Street to Galileo Galilei Way
- Enhance the Broadway streetscape from Ames Street to Galileo Galilei Way
- Enhance the Binney Street and Galileo Galilei Way streetscape from Sixth Street to Broadway
- Enhance lighting along sidewalks and pathways
- Support roadway and streetscape improvements along Galileo Galilei Way between Binney and Main Streets
- Review and evaluate potential bicycle improvements to connect each project component to other area wide improvements, in coordination with the City
- Provide approximately 800 bicycle long-term storage spaces for residents/tenants and provide approximately 142 short-term bicycle exterior parking spaces
- Explore opportunities to create a full service bike station within the area

*GHG Emissions*

- Information on how to train/inform maintenance staff and employees on sustainable operation and design features.

- Implement TDM Program, including a car sharing program, MBTA transit pass subsidy, free rides on some existing shuttle routes, parking pricing, Hubway pass subsidy, transportation coordinator, and provision of "real-time" transportation information in all new and renovated lobbies and at select public plazas on the project site. The Proponent will continue to participate in the Charles River TMA.
- The project will be designed to meet the applicable version of the Stretch Code in effect at the time of construction.
- The Proponent will submit a post-construction self-certification document to the MEPA Office which will be signed by an appropriate professional (e.g., engineer, architect, transportation planner, general contractor) and indicate that all of the required mitigation measures, or their equivalent, have been completed for each project component. The certification should be supported by plans that clearly illustrate what type of GHG mitigation measures have been incorporated into the project. For those measures that are operational in nature (i.e. TDM, recycling, parking management), the Proponent should provide an updated plan identifying the measures, the schedule for implementation and how progress towards achieving the measures will be obtained.

*Water and Wastewater*

- Coordinate with the City to correct I/I issues in the vicinity of the Project or providing funding for projects that the City is performing to reduce I/I.
- The project will include water use reduction strategies to achieve a 20% reduction in water use. The reduction in water use will also reduce wastewater generation.

*Stormwater*

- The project will mitigate stormwater effluent from the post-development, 25-year design storm to the rates of the pre-development, 2-year design storm and reduce TSS by 80% from the pre-development condition.
- Proponent will work with the City to evaluate a district-wide stormwater management solution that will treat stormwater runoff beyond the scope of individual project components.
- Use of green roofs and continued evaluation of pervious pavers in project design.

*Climate Adaptation and Resiliency Measures*

- The Proponent and/or Redeveloper will continue to evaluate and implement (as appropriate) the following measures:
  - Potential Site Design Measures: increased pervious surfaces on the ground level, green roofs, increased tree plantings and landscaping, use of native vegetation to minimize irrigation requirements, implementation of efficient irrigation system, rainwater harvesting, xeriscaping, and use of portable flood protection systems.
  - Potential Kendall Square MBTA Station Resiliency measures: construction of trench drains with greater capacity than existing systems at entrance to the station

to redirect runoff away from staircases, use of mobile flood barriers at station entrances, ground level utility values, and adjacent to air intake/exhaust, elevation critical electrical infrastructure, and installing pumping equipment to minimize the effects of flooding.

- Potential Building Design Measures: Locating critical infrastructure above the first floor level, limiting basement areas, evaluating raised finish floor elevations, and potential use of flood-resistant building materials.

*Hazardous Waste*

- Develop a Release Abatement Measure (RAM) Plan to manage contaminated soil and/or groundwater (if encountered) and implement measures as required to reduce the risk of exposure of contaminates at each project component.
- Perform Vapor Intrusion (VI) evaluations in accordance with MassDEP guidelines and design and implement a vapor mitigation system (if required).
- Use of protective barriers in landscaped areas and exterior hardscape areas to mitigate risk of direct contact with contaminated soils.

*Construction Period*

- Development of a Construction Management Plan (CMP) for each project component including: erosion and sedimentation control, identification of designated truck routes, maintenance and protection of pedestrian and bicycle accommodations, dust suppression, covering trucks used for transportation of construction debris, daily cleaning of streets and sidewalks, and noise mitigation measures.
- Divert a minimum of 75 percent of construction and demolition waste from landfills.

Notice of Project Change

As noted above, the SEIR identified many potential mitigation measures and included a commitment to work with the City and MassDOT/MBTA to identify the specific measures that will be implemented. The purpose of the NPC is to document the proposed project mitigation when it has been more fully developed and submit it for public review and comment.

The NPC should include revised mitigation measures and revised Section 61 Findings. The NPC should contain clear commitments to implement these mitigation measures, estimate the individual costs of each proposed measure, identify the parties responsible for implementation (either funding design and construction or performing actual construction), and identify a schedule for implementation. The NPC should address, in particular, the process for identifying and funding transit enhancements, and include a MOU or similar document. It should address how funding allocations are determined commensurate with the scope and scale of the proposed project and associated impacts; the vehicle and entity responsible for managing funds; and, how funding will be prioritized and expended.

Circulation

In accordance with Section 11.10 of the MEPA Regulations and as modified by this Certificate, the Proponent should circulate a hard copy of the NPC to each Agency or Person who received the ENF or commented on the ENF, any EIR, or any prior NPC. Per 301 CMR 11.16(5), the Proponent may circulate copies of the NPC to these other parties in CD-ROM format or by directing commenters to a project website address. However, the Proponent should make available a reasonable number of hard copies to accommodate those without convenient access to a computer and distribute these upon request on a first-come, first-served basis. The Proponent should send correspondence accompanying the CD-ROM or website address indicating that hard copies are available upon request, noting relevant comment deadlines, and appropriate addresses for submission of comments. A CD-ROM copy of the filing should also be provided to the MEPA Office. A copy of the NPC should be made available for review at the Cambridge Public Library.

Conclusion

Based on a review of the SEIR, consultation with State Agencies, and review of public comments, I hereby determine that the SEIR adequately and properly complies with MEPA and its implementing regulations. DHCD may act on the Proponent's request for a Major Amendment to its Urban Renewal Plan (URP) pursuant to 301 CMR 11.12 (4).

November 25, 2015
Date

Matthew A. Beaton

Comments received:

| | |
|---|---|
| 11/18/2015 | Massachusetts Water Resources Authority |
| 11/18/2015 | Stephen H. Kaiser |
| 11/18/2015 | Charles River Watershed Association (CRWA) |
| 11/18/2015 | Massachusetts Department of Environmental Protection – Northeast Regional Office |
| 11/18/2015 | Massachusetts Department of Transportation (MassDOT) |
| 11/18/2015 | Metropolitan Area Planning Council (MAPC) |
| 11/19/2015 | Massachusetts Department of Energy Resources (DOER) |
| 11/20/2015 | City of Cambridge |

MAB/PC/pc

*The Commonwealth of Massachusetts*
*Executive Office of Energy and Environmental Affairs*
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Charles D. Baker
GOVERNOR

Karyn E. Polito
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December 23, 2015

PUBLIC BENEFIT DETERMINATION
OF THE SECRETARY OF ENERGY AND ENVIRONMENTAL AFFAIRS

| | |
|---|---|
| PROJECT NAME | : Kendall Square Urban Renewal Project (KSURP) - Amendment #10 |
| PROJECT MUNICIPALITY | : Cambridge (Kendall Square) |
| PROJECT WATERSHED | : Boston Harbor (Charles River) |
| EEA NUMBER | : 1891 |
| PROJECT PROPONENT | : Cambridge Redevelopment Authority |
| DATE NOTICED IN MONITOR | : October 19, 2015 |

Consistent with the provisions of *An Act Relative to Licensing Requirements for Certain Tidelands*, I hereby determine that the above-referenced project will have a public benefit. I issued a Certificate on the Single Environmental Impact Report (SEIR) for this Project on November 25, 2015.

Original Project Description and MEPA Procedural History

The Kendall Square Urban Renewal Project (KSURP) was created by the Proponent in 1965. The KSURP regulates the level of development through a cap on aggregate Gross Floor Area (GFA) of all land uses in the KSURP area. The level of development is further restricted through land use controls, including identification of Floor Area Ratios (FARs). The KSURP initially consisted of construction of up to 14 buildings totaling approximately 2.77 million gross square feet (GSF), three parking garages, open space, and other public improvements. The project was the subject of previous review under MEPA beginning with an Environmental Notification Form (ENF) in 1975, and followed by Draft and Final EIRs in 1977 and 1978 respectively, both of which were found to be adequate. Five Notices of Project Change (NPCs)

were filed since 1978. The NPCs adjusted the permitted mix of uses within the area, increased the maximum allowed GFA within the area, and extended the term of the KSURP. None of the NPCs required further MEPA review.

A NPC for this project (KSURP Amendment No. 10) was submitted to the MEPA Office in April 2015. The extensive and detailed NPC included a request that I allow submission of a SEIR, and in a Certificate issued May 29, 2015, I granted the request for a SEIR. The Scope for the SEIR requested further information on specific mitigation to address impacts on transit service and capacity. The Certificate noted that I may require the Proponent to file a Final EIR if the SEIR does not adequately address the Scope and substantive issues that remained to be addressed. The Proponent filed an SEIR for the project on October 15, 2015 and I issued a Certificate on November 25, 2015 that determined the project adequately and properly complies with MEPA and its implementing regulations and requires the Proponent to file a NPC with the MEPA Office that will include revised mitigation commitments and revised draft Section 61 Findings to provide additional public review and comment on final mitigation commitments.

Project Description

The SEIR identifies redevelopment within 24 acres of the 43-acre KSURP area. The 24-acre project site is coincident with the boundaries of the Cambridge Center Mixed-Use Development (MXD) Zoning District. The project consists of the addition of 1,034,000 square feet (sf) of net new commercial and residential development to the KSURP area. The proposed amendment to the KSURP includes exemptions to the Gross Floor Area (GFA) cap intended to incentivize ground floor retail, require innovation space, and balance commercial and residential uses. According to the NPC and SEIR, the analysis of environmental impacts is based on a total of 4,341,600 sf of development and includes increases in development beyond the GFA cap[1] that would be allowed based on proposed exemptions. As such, the analysis of environmental impacts is presented based on the maximum amount of development that could be permitted in the KSURP area under the GFA cap. The NPC and SEIR also extend the completion date for the full build-out of the KSURP from 2020 to 2030.

Specifically, the project consists of the following project components:

- **Phase 1A - Cambridge Center North Garage:** Proposed commercial office (546,000 sf), innovation space (39,000 sf) and retail space (5,000 sf) over the existing Cambridge Center North [Parking] Garage.
- **Phase 1B - Eleven Cambridge Center:** Demolition of existing structure. Proposed 22-story residential building (210,000 sf and up to 294 units) and ground floor retail space (25,000 sf).
- **Phase 2 - Three Cambridge Center**: Demolition of existing structure. Proposed mixed-use building consisting of a 19-story building with commercial office space (106,200 sf) on the lower floors, up to 266 residential units (190,000 sf) on the upper floors, and approximately 20,000 sf of ground-floor retail.

[1] The proposed GFA cap associated with this NPC is 4,302,100 square feet of development. This excludes the exempted 19,500 sf of Innovation Space and 20,000 sf of ground floor retail space; however, this development is included in the analysis of environmental impact presented in the NPC.

The project also includes a 60,000 sf commercial office addition at the existing Whitehead Institute building at Nine Cambridge Center and the conversion of 15,100 sf of mechanical space into commercial office space at the Broad Institute at 75 Ames Street.

The project is proposed in two phases. Phase 1 will include two sub-phases (Phase 1A and 1B). Phase 1A will consist of the redevelopment of the Cambridge Center North Garage and Phase 1B will include demolition of the existing Eleven Cambridge Center building and construction of the new residential building with ground-floor retail space and below-grade parking. Phase 2 will include demolition of the Three Cambridge Center commercial office building and construction of a new mixed-use building with commercial office space, ground-floor retail space, and residential units.

Permitting and Jurisdiction

The project as previously reviewed was subject to a mandatory EIR pursuant to Sections 11.03(l)(a)(2) and 11.03(6)(a)(6) of the MEPA regulations because it required State Agency Action(s), and was expected to create more than 10 acres of new impervious surface, and generate more than 3,000 new average daily vehicle trips.

The project, as currently proposed and described in the SEIR, is subject to a mandatory EIR as a stand-alone project pursuant to Section 11.03(6)(a)(6) of the MEPA regulations because it requires a State Agency Action and, on its own, will generate greater than 3,000 new average daily trips (adt) on roadways providing access to a single location. Traffic generation will exceed the EIR threshold even when adjusted to account for mode share. The project requires an approval of an Urban Renewal Plan Amendment from the Massachusetts Department of Housing and Community Development (DHCD). The project may also require an Air Quality Permit from the Massachusetts Department of Environmental Protection (MassDEP). The Urban Renewal Plan Amendment also requires approval by the CRA and Cambridge City Council. Components of the project will also require review and Infill Development Concept Plan approval as a Special Permit by the Cambridge Planning Board. The project is subject to review under the May 2010 MEPA GHG Emissions Policy and Protocol ("the Policy").

Because the project is not seeking Financial Assistance from the Commonwealth, MEPA jurisdiction is limited to those aspects of the project that are within the subject matter of required, or potentially required, State Agency Actions and that may cause Damage to the Environment as defined in the MEPA regulations. However, the subject matter of the Urban Renewal Plan approval and associated regulations (760 CMR 12.00) is sufficiently broad to confer the equivalent of broad scope jurisdiction over the potential environmental impacts of the project. Therefore, MEPA jurisdiction is broad in scope and extends to all aspects of a project that are likely, directly or indirectly, to cause Damage to the Environment, as defined in the MEPA regulations.

Landlocked Tidelands

A portion of the project will occur within landlocked tidelands as defined by the MassDEP's Waterways Regulations (310 CMR 9.00) and is subject to the Public Benefit

Determination regulations (301 CMR 13.00). Consistent with the provisions of *An Act Relative to Licensing Requirements for Certain Tidelands* (2007 Mass. Acts ch. 168, sec.8) (the Act), which was enacted on November 15, 2007, I *must* conduct a Public Benefits Review for projects in tidelands that are required to file an EIR.

The legislation states the following regarding the Public Benefits Determination:

"In making said public benefit determination, the secretary shall consider the purpose and effect of the development; the impact on abutters and the surrounding community; enhancement to the property; benefits to the public trust rights in tidelands or other associated rights, including, but not limited to, benefits provided through previously obtained municipal permits; community activities on the development site; environmental protection and preservation; public health and safety; and the general welfare; provided further, that the secretary shall also consider the differences between tidelands, landlocked tidelands and great pond lands when assessing the public benefit and shall consider the practical impact of the public benefit on the development."

The following addresses each of the considerations identified in the legislation.

1. *purpose and effect of the development*

This project consists of a transit-oriented redevelopment of the site with a mix of uses – residential, commercial office, and retail – that will enliven the area and complement existing uses. The project will create a prominent entrance to the Kendall Square area and, with continued planning and development, will improve transit access and associated infrastructure. Major benefits to the community include area-wide stormwater management infrastructure improvements and the provision of funding to implement transit system improvements.

2. *impact on abutters and the surrounding community*

The development is consistent with longstanding planning goals for this site. In line with the goals originally set forth by the KSURP in 1977, the project will attract new residents, employees, customers and visitors to the area. The project includes new incentives to encourage a broader array of ground-floor retail stores to encourage development of a livable, complete urban neighborhood. Up to 560 new housing units will be created, of which, 15 percent (84 total units) will be provided as low- and moderate-income housing.

Transit and transportation impacts were a significant focus of the environmental review process and will continue to be addressed through the local permitting process. The Proponent has identified a unique transit mitigation strategy that seeks to provide a sustainable source of funding to ensure that the transit infrastructure and assets in KSURP area can continue to accommodate additional growth. Traffic mitigation also includes a comprehensive Transportation Demand Management (TDM) plan and a robust monitoring and analysis program to assess effectiveness. The Proponent will work with the City of Cambridge to implement intersection improvements, including improvements for bicycle and

pedestrian access, and lighting improvements to enhance the experience of multimodal transit users.

*3. enhancement to the property*

The project will use land efficiently through infill development, including the re-use and vertical expansion of an above-ground parking structure with dense commercial development and the replacement of underutilized and outdated office buildings with a mix of uses that is responsive to the area's needs. The Cambridge Center North Garage will be enhanced by visually concealing the garage from public view and introducing new buildings on the north and south sides that include a new year-round public green space and winter garden. The ground level of the Eleven Cambridge Center and Three Cambridge Center properties will be activated with new retail uses. Other elements of the project will enhance the KSURP areas beyond the project component property boundaries by providing streetscape improvements, bicycle improvements, capacity improvements to the Sixth Street walkway, improved pedestrian access between buildings, and new bike paths and infrastructure upgrades. A new stormwater system will pre-treat runoff and the quality of water discharged into the surrounding waters of the Charles River.

4. *benefits to the public trust rights in tidelands or other associated rights*

Portions of the project site are located on landlocked tidelands. According to the SEIR, the traditional public trust rights in tidelands (i.e., the right to fish, fowl, and navigate) have long been precluded at the Project Site by the historic filling and development of the Broad Canal in the middle of the 20th century. The SEIR indicates that the project will benefit public rights through the provision of public open space and pedestrian enhancements through and around the project components.

*5. community activities on the development site*

The project enhances pedestrian access to public transportation facilities at Kendall Square/MIT Station and the Red Line. The project will create opportunities to improve community activities within and surrounding the project site by providing the following new and upgraded public spaces to connect buildings within the area:

- Replacement of the existing public park at Cambridge Center North Garage with a Winter Garden that will provide for a public and climate-controlled open space available for year-round use;
- Improvements to the Sixth Street Connector to accommodate the higher volume and mix of bikes and pedestrians, including new hardscapes, seating, and lighting;
- Improved pedestrian access between buildings by enhancing pathway qualities and features;
- Improvements to pedestrian walkways along service roads on both sides of the Cambridge Center North Garage to promote access; and

- Incorporation of bike paths, routes, and infrastructure throughout the KSURP area that are prioritized on the City's Bicycle Network Plan.

The project will also facilitate a more socially inclusive neighborhood by dedicating 15 percent of the housing units as inclusionary units for low- and moderate-income households, as well as a height bonus to incentivize construction of additional middle income units.

6. *environmental protection and preservation*

The project consists of redevelopment within a dense urban area with excellent access to transit. As a transit-oriented redevelopment, associated impacts, including traffic generation, land alteration, creation of impervious areas, are minimized compared to greenfield development or alternatives with reduced density. Impacts associated with the SEIR are within the envelope of impacts identified in the most recent MEPA filing. The project has been designed to avoid, minimize and mitigate potential environmental impacts including traffic generation, wastewater, water use, stormwater, tidelands, GHG emissions, air pollution, and impacts associated with climate change. Potential environmental impacts are associated with the development of 153,118 sf of filled landlocked tidelands; net new water demand of 118,740 gallons per day (gpd); and net new generation of 107,945 gpd of wastewater. The project will create approximately 740 new parking spaces and will generate approximately 10,512 new (unadjusted) average daily trips (adt) or 3,638 new adt when adjusted for mode share. The total number of parking spaces and traffic trips remain below the maximum limit as previously identified and reviewed by MEPA.

Measures to avoid, minimize and mitigate impacts are detailed in the Certificate on the SEIR and measures associated with tidelands are detailed in the section above. They include redevelopment within a dense urban area located in proximity to transit, provision of pedestrian and bicycle improvements, improved pedestrian access between buildings, incorporation of bike routes, development and implementation of a transit mitigation program in coordination with MassDOT, MBTA, the City, and other stakeholders; stormwater infrastructure upgrades, roadway improvements, and implementation of a TDM program.

In addition, the building will be designed to be certifiable by the US Green Building Council's Leadership in Environmental and Energy Design (LEED) at the Gold level. The project incorporates measures to improve energy efficiency including improved glazing properties; improved roof and exterior wall insulation; low-flow water fixtures; high-efficiency heating, ventilation, and air conditioning (HVAC) systems; variable frequency drive (VFD) on cooling tower fans, high-efficiency condensing hot water boilers, high-efficiency water source heat pumps, differential $CO_2$ based demand control ventilation for offices, and CO control and VFD for underground garage fans. In addition, it includes a commitment to construct all buildings to be "solar ready".

7. *public health and safety and general welfare*

The remediation of the site will be guided by the Massachusetts Contingency Plan (MCP) and will promote public health and safety by addressing contamination issues and removing or replacing obsolete structures. Neighborhood-wide stormwater infrastructure improvements will reduce surcharging events and will the quality of water discharged into the Charles River. The project will also incorporate site design features that will provide a safe and universally accessible facility, including on-site and off-site transportation improvements to increase pedestrian and bicycle safety and accessibility to the project site. The project will also include landscape, lighting, and streetscape improvements to provide a safe, well-lit environment for visitors and employees. In addition, the measures required to avoid, minimize and mitigate environmental impacts will also protect public health and safety, and the general welfare.

Enforcement of Public Benefits

In accordance with M.G.L. c. 30, s. 62I, the Proponent shall file a copy of the Certificate on the SEIR and this Public Benefit Determination with MassDEP within 30 days of today's date to notify the Department that work will be conducted within tidelands. MassDEP will then have the authority to enforce the conditions outlined herein and in the Public Benefit Determination pursuant to the statute.

I recognize that the public benefit commitments may be subject to certain revisions as the project proceeds. If the public benefits to be provided should change, the Proponent is instructed to submit a Request for Advisory Opinion to the MEPA Office for a determination as to whether the change is sufficiently material to require the submission of a Notice of Project Change (NPC) pursuant to 301 CMR 11.10. Otherwise, the Proponent may submit a NPC without requesting an Advisory Opinion if it is clear that the change(s) are material.

Conclusion

Based on the foregoing, I hereby determine that the project will have a positive public benefit. To meet the public publication requirements of the legislation, this Determination will be published in the Environmental Monitor on December 23, 2015.

December 23, 2015
Date

Matthew A. Beaton

MAB/PC/pc

# Appendix C
# Transportation Supporting Documentation

# Traffic Trip Generation Update

## Introduction

This technical appendix provides includes an analysis of estimated trip generation characteristics for the Current Project, and other important transportation mitigation and improvement actions that will continue to be provided in connection with the currently proposed program and building massing scheme, as described in Chapter 1, *Project Change Description*.

### Trip Generation Land Use Codes

To assess the impact of the Current Project, trip estimates were based on standard Institute of Transportation Engineers (ITE) trip rates published in ITE's Trip Generation manual (9th Edition). The appropriate ITE land use codes are shown below in Table C-1.

**Table C-1 Trip Generation Land Use Codes**

| Use Components | Building Size (GSF) | ITE Land Use Code (LUC) |
|---|---|---|
| Commercial Office | 675,200 SF | LUC 710 |
| Residential | 420,000 SF | LUC 220 |
| Retail | 30,000 SF | LUC 820 |
| **Total** | **1,125,200** | |

Source: ITE Trip Generation, 9th Edition

Table C-2 summarizes the total number of unadjusted, or raw ITE, vehicle trips to be generated for an average weekday and during commuter peak hours. These trip results do not account for alternative modes of transportation. The Current Project is anticipated to generate 10,750 daily-unadjusted vehicle trips, which is approximately 238 more than the Previously Reviewed Project. The Project Change is expected to generate 1,226 and 1,289 unadjusted vehicle trips, respectively, during the morning and evening peak hours.

**Table C-2 Project Change Trip Generation**

| | Unadjusted ITE Vehicle Trips | Adjusted ITE Vehicle Trips[1] |
|---|---|---|
| **Daily Total** | **10,750** | **3,720** |
| | | |
| AM Peak Hour | | |
| Entering | 878 | 286 |
| Exiting | 346 | 115 |
| **Total** | **1,224** | **401** |
| | | |
| PM Peak Hour | | |
| Entering | 418 | 146 |
| Exiting | 871 | 293 |
| **Total** | **1,289** | **439** |

1 Takes into account mode shares for the KUSRP area based on K2C2 and KSURP survey data

Table C-2 also presents the adjusted vehicle trips estimated for the Current Project based on area mode share adjustments discussed below. In total, the Current Project is expected to generate approximately 3,720 daily vehicle trips, with 401 trips occurring during the morning peak hour and 439 trips during the evening peak hour.

## KSURP Area Mode Splits

As discussed in the SEIR, the actual trip generation within the KSURP area has been observed and measured to be lower than the accepted trip generation methodology of the ITE Trip Generation Handbook. Over the past 10 years, the estimated (ITE) vehicle trip generation has been an average of 50 percent higher than observed trips. In 2010, FST updated its projection methodology to take into account historical traffic measurements and the excellent transit services and favorable mode split in Kendall Square. Specifically, FST assumed a 43 percent adjustment downward from ITE rates, consistent with values from the 1994-2010 data. FST noted the 43 percent adjustment was actually conservative, as count data suggested that actual trip generation was more than 50 percent below unadjusted ITE rates. This trend was documented in the SEIR Figure 2.1, which shows the original FEIR projected trips compared to the adjusted-estimated trip generation compared to the observed trip generation.

Identical to the analyses that were developed to support the Previously-Reviewed Project, residential mode split were based on the City's K2 Plan Study Enhanced TDM Mode Shares information presented at the Kendall Square Advisory Committee Meeting on January 26, 2012. Office and Retail mode splits were based on the FST *Kendal Square Urban Renewal Area 2014 Traffic Count Program and Trip Generation Analysis Report* from May 2013. Table C-3 restates the mode splits used.

**Table C-3 Project Mode Splits**

| Mode | Residential[1] | Office[2] | Retail[3] |
|---|---|---|---|
| Vehicle | 32% | 34% | 34% |
| Transit | 30% | 37% | 37% |
| Walk | 25% | 6% | 6% |
| Bike | 10% | 9% | 9% |
| Other | 3% | 14% | 14% |

Sources:
1-City of Cambridge K2 Plan Enhanced TDM Mode Shares
2-FST Kendall Square Urban Renewal Area Mode Shares
3-FST Kendall Square Urban Renewal Area Mode Shares

As described and utilized to support the Previously Reviewed Project, a local Average Vehicle Occupancy (AVO) for residential and office/retail was calculated from the 2006-2010 American Community Survey to be 1.11 for residential and 1.19 for employee/retail. More recent data does not provide accurate origin - destination flow data to calculate residential AVO separate from office/retail AVO. The local AVO was used to convert the person-trips to vehicle-trips for the vehicle trip estimate.

## Parking

The Project will add up to an additional 809 structured parking spaces to the KSURP area. As currently planned, the two proposed residential buildings will include the elimination of approximately 215 parking spaces within the Blue Garage, to support the construction of those facilities, including adequate lobbies and cores that can intercept the ground plane while maintaining existing adjacent open space. The net elimination of the 215 parking spaces consists of eliminating 276 existing parking spaces and adding a parking tier of approximately 61 spaces. The 145 Broadway building will include up to 374 below grade parking spaces and the 250 Binney building will include up to 650 below grade parking spaces. In total, the Project provides up to 809 new parking spaces to support planned changes in building program.

With the addition of the new Project vehicle parking there will be approximately 3,517 vehicle parking spaces within the KSURP area. Table C-4 summarizes the future parking supply in the area.

**Table C-4 Future Parking Supply in the KSURP Area**

| Project Component/Garage | Existing Parking (May 2016) | Proposed New Parking for Project | Future Parking |
|---|---|---|---|
| 135 Broadway Residences/Blue Garage | 1,170 | (-215) | 955 |
| Yellow Garage | 734 | 0 | 734 |
| Green Garage | 804 | 0 | 804 |
| 145 Broadway Office Building | 0 | 374 | 374 |
| 250 Binney Street Office Building | 0 | 650 | 650 |
| **Total** | **2,708** | **809** | **3,517** |

The CRA is obligated to collect tenant/employee travel mode data within the KSURP Area and summarize the results as part of the Kendall Square Urban Renewal Area Annual Traffic Update report. These surveys are distributed by BP to area firms and businesses and for the most recent year available, 2014, only 29 percent of respondents indicated that their primary mode was driving alone while 5 percent indicated they carpooled with two or more people. This data supports the low parking ratio for office and R&D components of the Project.

There is little information on residential car-ownership within the KSURP Area, as there are currently no residential buildings, but it is estimated, based on the American Community Survey (ACS) 5-year estimate (2009-2013) for the area, census tracts 3523 and 3524, approximately 40 percent of residents do not have access to a vehicle while less than 17 percent have access to more than two vehicles. It is expected that due to the residential locations of the Project, the vehicle ownership will be slightly lower than what the ACS data shows. The low car-ownership percentage estimated for the residential components provides the ability to provide additional parking for other users in the area.

## Summary of Transportation Mitigation

The proposed transportation mitigation continues to be aimed at addressing the Project-related impacts associated with additional vehicle trips. Mitigation elements to be committed to are identical to those described previously in support of the Previously Reviewed Project, as codified in the MEPA Certificate and Adequacy Determination issued on November 25, 2015, including the following key elements.

- Proposed traffic operations mitigation measures include local intersection improvements, such as signal timing adjustments and roadway geometric changes, which are to be coordinated and confirmed by the City through the future local review process for each Project component.
- Proposed TDM measures aim to reduce drive-alone trips, or single occupancy vehicles (SOVs), by encouraging employees, residents and visitors to use alternative modes of transportation. The proposed TDM Plan for the Project includes consideration of enhanced TDM measures outlined in the K2 Final

Report 2013, where applicable and feasible as well as Project-specific measures. Overall, the goal of the proposed TDM Plan is to reduce the use of SOVs by encouraging carpooling and vanpooling, bicycle commuting and walking, and increased use of the Kendall Square public transportation system by employees and residents.

- The Proponent will continue to conduct the annual traffic study and analysis of Kendall Square based on the 20 years of vehicle traffic data collected in compliance with the 1994 Section 61 Findings. The Proponent plans to update the scope of the monitoring program to reflect the evolution of Cambridge's transportation priorities in a complex multi modal urban environment such as Kendall Square. The improved study shall utilize the most up to date development square footage and traffic projections as well as more holistically consider additional data on bicycles, pedestrians, travel behavior and transit service, as it becomes available.

The Proponent is committed to developing a MOU with MassDOT and the MBTA, together with the Cambridge Redevelopment Authority and the City, as a mechanism to identify and implement appropriate transit improvements consistent with the KSTEP. (Refer to Section 3.1.4 of Chapter 3 for further information on the draft MOU.)

# Appendix D
# Draft Memorandum of Understanding (MOU)

# KENDALL SQUARE TRANSIT ENHANCEMENT PROGRAM

## MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding (the "MOU") is entered into by the Cambridge Redevelopment Authority (the "CRA"), the City of Cambridge (the "City"), the Massachusetts Department of Transportation ("MassDOT") and the Massachusetts Bay Transportation Authority ("MBTA"). Boston Properties Limited Partnership ("BP"), the designated redeveloper of the Mixed Use District (the "MXD District") under the Kendall Square Urban Renewal Plan (the "KSURP") is a concurring party to this MOU.

WHEREAS, since 1977, the CRA has undertaken the successful redevelopment of forty-three (43) acres within the MXD District which has resulted in the creation of an economic hub of 3.3 million gross square feet of office, retail, lab, innovation, hotel and residential development with road improvements, transit investment, parking garages, open spaces and other public amenities;

WHEREAS, in 1979 the CRA selected BP as the Master Developer for the Cambridge Center property in the MXD District of the KSURP, and BP remains the primary property owner in the MXD District;

WHEREAS, the success of the MXD District has been greatly enhanced by the favorable transportation mode split, with greater than seventy percent (70%) of trips to and from KSURP area utilizing transit, walking, biking, shuttles and car pools, the majority of which relies heavily on service provided by the MBTA's Red Line and the Kendall Square Red Line station;

WHEREAS, from 2011 through 2013, the City conducted an extensive planning process of the Kendall Square area as part of its Kendall Square Central Square Planning Study ("K2C2 Study") to develop a vision for the study area and formulated recommendations to achieve the vision, which included among other things; increased mixed use development opportunities and the provision of local transit improvements;

WHEREAS, in 2015, MassDOT formed the Kendall Square Mobility Task Force (the "Task Force") to study the transportation network and facilities servicing the Kendall Square area from throughout the region;

WHEREAS, the CRA wishes to enhance the transit-oriented environment in the KSURP area by piloting innovative programs to expand mobility through partnerships with both public and private parties, and MassDOT and the MBTA also wish to enter into such partnerships that can maximize alternative funding opportunities to support the MBTA's transit development and operations;

WHEREAS, in 2015 the CRA and the City amended the KSURP and the zoning for the MXD District, consistent with the K2C2 Study, to add approximately 600,000 square feet of gross floor area for commercial office, innovation and retail space and approximately 400,000

square feet of gross floor area for residential uses which expansion program is more fully described in KSURP Amendment No. 10 (the "Project");

WHEREAS, the CRA submitted a Single EIR for the Project for review under the Massachusetts Environmental Policy Act (MEPA) and on which the Secretary of Environmental Affairs issued a Certificate, dated November 25, 2015 (the "EIR"); and

WHEREAS, the EIR required the CRA to work with the MBTA, MassDOT, and the City to develop an MOU that outlines enforceable commitments to support the maintenance and improvement of the transit system servicing the KSURP area.

NOW, THEREFORE, in recognition of the critically important role access and mobility play to the successful redevelopment and expansion in the MXD District and the Kendall Square area, the parties to this MOU wish to set forth their understanding regarding certain commitments and the process to be undertaken that will lead to identification of the specific measures to be developed and implemented over the next 15 years that will preserve, enhance and expand transit access and mobility in the Kendall Square area through a Kendall Square Transit Enhancement Program ("KSTEP").

1. The parties to this MOU acknowledge and agree that all transit enhancement measures that are identified in this document for implementation under the terms of this MOU and the proposed KSTEP will be coordinated with planning efforts of MassDOT, the City, and other transportation programs identified by the parties.

2. The parties agree that funding to be provided under this MOU shall be focused on both short and long range transit enhancements that provide direct benefits to the KSURP area as well as to other properties and institutions located in and around Kendall Square. Accordingly, the parties agree to work together to establish a program that will contribute to transit funding in a manner that improves transit mobility in the MXD District and in the Kendall Square area.

3. The parties further agree that a KSTEP fund (the "KSTEP Fund") shall be established and maintained by the CRA, in coordination with the City and the other parties to this MOU. The CRA Board shall authorize disbursement of funds from the KSTEP Fund after concurring with and obtaining approval from the City Manager. As the geographic scope of the KSTEP is potentially expanded beyond the KSURP area, as discussed further in Section 10 below, it is anticipated that the KSTEP Fund may transition into or merge with a different governance structure, with the City playing a more central role in its administration.

4. The CRA shall convene a Working Group, which shall include the parties to this MOU, additional contributors to the KSTEP Fund and other stakeholders as may be designated, for the purpose of establishing funding priorities and allocations under the KSTEP Fund for consideration by the CRA Board and the City Manager. The Working Group, utilizing the recommendations of other relevant planning efforts, shall give consideration, at minimum, to projects with:

a. measurable improvement to transit service levels in the Kendall Square area (transit services that touch Kendall Square), including connections to and from transit service in the Kendall Square area;

b. the ability to leverage multiple layers of available public and private funds and remain long-term economically sustainable from a capital and operational perspective; and

c. a high level of utility from a broad mobility perspective.

5. Funding for the KSTEP Fund will be provided initially by Boston Properties, in conjunction with its addition of commercial GFA within the KSURP area as part of the Project, with the Initial Payment to be made to the KSTEP Fund upon the issuance of any building permit for new commercial development. The KSTEP funding shall be in a lump sum of six million dollars ($6,000,000).

6. Before the Initial Payment, the Working Group shall meet to decide on initial funding allocations for short-term transit enhancements and shall consider projects to be included in an immediate scope of transit investments for up to one-third (1/3) of the KSTEP funding commitment, which may include:

a. Capital investment for additional MBTA bus service to Kendall Square from under-served corridors and potentially including new routes that can be added relatively quickly;

b. Capital investment for additional EZ Ride bus service to address commuter peak periods in , additional routes to unserved corridors, and/or expansion of off peak service; or

c. Capital improvements to the existing transit infrastructure at Kendall Station, including increased station capacity by expanding passenger waiting areas, or similar enhancements, improved Kendall Square station transit information, resiliency measures, and/or improved bus connectivity.

7. Within a year from the Initial Payment, the Working Group shall meet to recommend longer term funding allocations for enhanced transit service in Kendall Square, potentially leveraging additional resources from an expanding KSTEP or other sources for more significant service enhancements in the future. The Working Group may consider the following projects as the scope for potential future transit funding.

a. Operating and capital support for new ground transportation via non-MBTA shuttles and/or MBTA buses or Bus Rapid Transit (BRT) aimed at facilitating access to and from Kendall Square to and from Central Square, Sullivan Square, Union Square, Longwood Medical Area, North Station, or other locations with a demonstrated clear need for access to or from Kendall Square;

b. Red Line service modernization and improvements, including signal, track, station, and other technology improvements designed to increase capacity and reliability especially at peak-of-the-peak, including enhancing headways (time between service) and other improvements that will positively impact the quality and capacity of transit service and the customer experience;

c. Other strategic investments that are consistent with the considerations listed above, and with the 2030 and 2040 transportation planning efforts, which all may also be considered for funding from the KSTEP Fund, including feasibility investigations and potential capital investments toward new transit service benefiting the Kendall Square area.

8. Prior to allocating funding from the KSTEP, the Working Group will obtain approval from the entity to which the funding is being allocated, confirming that entity is ready and willing to accept and expend those funds for the purpose intended by the Working Group.

9. The CRA may reserve up to two-thirds (2/3rds) of the Initial Payment to KSTEP Fund or otherwise place limits on the usage of funds for up to five (5) years from the date of the Initial Payment, in order to preserve a tangible link between the development investment in Kendall Square that generated the funds and the subsequent supporting investment in transit, especially related to the percentage of funds that may be used for capital expenditures, operational/maintenance expenditures or planning expenditures. The Parties will develop metrics of success to measure the success of the KSTEP within two years of the Initial Payment.

10. Additional ongoing funding for the KSTEP may also be provided by property owners and developers in the Kendall Square area under a transit enhancement funding program to be developed in cooperation with the parties to this MOU. The parties agree to use good faith efforts to expand the area and funding sources supporting the KSTEP and to advance efforts to implement a program of ongoing annual KSTEP Fund payments, or other financial contributions to transit improvements, by property owners and developers in the Kendall Square area.

11. This Agreement does not preclude the CRA or the City from seeking additional funding sources in the future for the KSTEP Fund or combining this fund with other transit funding programs, such as but not limited to the introduction of a special assessment district to Kendall Square. The parties further agree that the payments contemplated in paragraph 9, above, will require certain actions and approvals by the City and must be implemented in a non-discriminatory fashion consistent with the requirements of all applicable federal, state and local laws and regulations. Further, in connection with the payments to the KSTEP Fund, the parties acknowledge and agree that the transit funding required and to be required hereunder must take into consideration all other transportation mitigation payments required by state and municipal permits related to a particular development project, so as not to disproportionately or unfairly impact any single owner or property.

IN WITNESS WHEREOF, this Agreement is hereby duly executed by the parties on this __ day of _____, 2016.

# Exhibit A

**Kendall Square Transit Enhancement Program (KSTEP)**
*Funding Formula and Methodology*

## Formula Inputs

- Space/Square Footage: The square footage of development based on land use type (ie: office, retail, residential) is used in a standard trip generation calculation to predict the number of trips a future development project may generate through commonly accepted modeling by qualified transportation engineers and planners. Trip generation is calculated for all modes – auto, transit, bike and walk.
    - *The KSTEP uses only the commercial space square footage (600,000 GSF from the Project), in order to incentivize residential.*

- Daily Transit Trips Generated: The daily number of trips predicted to be generated by the proposed development is based upon the square footage of development in different land use categories and results in predicted daily vehicle, transit, walking and biking trips. Because the KSTEP is intended to benefit public transit it utilizes the transit trip generation number from the Project.
    - *The KSTEP uses only the adjusted daily office space transit trip generation to levy funding responsibility in order to not disincentive residential development. The KSTEP accepts the funding responsibility of50% of each transit trip as the presumed destination of the trip.*

- Timeframe: The Kendall Square Urban Renewal Plan, which provides the initial regulatory framework for the adoption of the KSTEP, expires in 2030 and therefore the KSTEP calculations are based on a 15 year development window. There are at least 260 weekdays in a calendar year, and in Massachusetts there are 11 legal holidays according to the Secretary of State's Office, leaving at least 249 working days in a year.
    - *The KSTEP is calculated using the number of weekdays in a year because the capacity burden on the T system from the proposed development is on weekdays.[1] In the case of the KSTEP funding calculation, 249 weekdays is multiplied by 15 years to equal 3,735 total days.*

- Fare Recovery Gap Per Trip: There are multiple methods to calculate the cost of a single MBTA trip. The CRA has concluded that the simplest and most effective way to calculate it using easily available data is to reverse calculate the fare recovery ratio presented in the Governor's Special Panel to Review the MBTA in spring 2015: *Back on Track – An Action Plan to Transform the MBTA*. That report states that the fare recovery ratio is 26% for bus, 48% for commuter rail, 55% for light rail/trolley, 61% for heavy rail/subway.

  Utilizing the 2015 standard subway fare ($2.10) a reverse calculation of the Fare Recovery Gap per MBTA Trip for subway service can be estimated. This number represents the cost gap that is not covered by each transit passenger fare. This gap is a significant financial burden on the MBTA and for each new trip on the system, this gap adds to that deficit. The MBTA lacks sufficient non-fare

[1] Alternatively, the capacity burden for other types of developments may be focused on weekend trips, such as a casino for example.

revenue, state aid, or federal aid to continue to close this accumulating gap, as new trips are continuously added through increased transit oriented development. For purposes of the KSTEP, the parties have determined that the subway fare gap per trip is $1.34.

- *The KSTEP calculation uses only the subway fare gap ($1.34/trip) as the multiplier because subway service is the primary MBTA service used by transit trips in and out of Kendall Square.*

**Application of the KSTEP Funding Formula to the Kendall Square Urban Renewal Project**

*DAILY TRANSIT TRIPS GENERATED BY THE PROJECT x .50 x TIMEFRAME (WEEKDAYS PER 15 YEARS)* ***x*** *FARE RECOVERY GAP PER TRIP = KSTEP Project Contribution*

**Product rounded up to $6,000,000**

# Appendix E
# Greenhouse Gas Assessment

# Greenhouse Gas Emissions Assessment

## Introduction

This technical appendix describes how the sustainable features of the Project and presents the updated stationary source Greenhouse Gas (GHG) emissions assessment, which has been prepared in accordance with the Executive Office of Energy and Environmental Affairs (EEA) MEPA Greenhouse Gas Policy and Protocol (the "MEPA GHG Policy"). The updated findings of the stationary source GHG emissions assessment are based on the currently proposed program and building massing scheme, as described in Chapter 1, *Project Change Description*.

Through the implementation of a comprehensive design strategy, including responsive mitigated design and operational commitments, the Project is expected to result reductions in GHG emissions consistent with the MEPA GHG Policy. The Project consists of urban infill with dense, high-efficient buildings, a building reuse component (the North Garage Office Buildings) and reduced single-occupancy vehicle trips through alternative modes of transportation—all of which result in significantly less GHG emissions compared to a suburban "greenfield" development.

All Project Components will meet the current Stretch Energy Code requirements, where applicable (i.e., achieve at least a 20 percent overall reduction in annual energy use compared to a baseline using requirements of ASHRAE 90.1-2007). The Proponent has considered additional energy efficiencies that may be required to meet the future potential Stretch Energy Code (i.e., approximately 15 percent more efficient than the IECC2012 and ASHRAE standard 90.1-2010—the new/updated state-wide Base Energy Code). As demonstrated by the stationary source GHG assessment, overall the Project will achieve an estimated 20.4 percent reduction in stationary source $CO_2$ emissions by reducing overall energy consumption by approximately 26.5 percent through the implementation of energy optimizing building design and systems. (Note, the percentages of energy use are different than emission reductions due to emissions conversion factors.)

## Regulatory Context

The following sections provides an overview of the state and local regulatory context related to energy efficiency and GHG emissions.

## Commonwealth of Massachusetts

### MEPA Greenhouse Gas Policy and Protocol

The Executive Office of Energy and Environmental Affairs (EEA) has developed the MEPA Greenhouse Gas Emissions Policy and Protocol (the "MEPA GHG Policy") – an initiative under the MEPA review process that requires project proponents to identify and describe the feasible measures to minimize both mobile and stationary source GHG emissions generated by their proposed project(s). Mobile sources consider vehicles traveling to and from a project. Stationary sources consider on-site boilers, heaters, and/or internal combustion engines (direct sources) as well as from the consumption of energy in the form of fossil fuels (indirect sources). Greenhouse gases include several air pollutants, such as carbon dioxide ($CO_2$), methane, hydrofluorocarbons, and perfluorocarbons. The MEPA GHG Policy calls for the evaluation of $CO_2$ emissions for a land development project because $CO_2$ is the predominant man made contributor to global warming. This evaluation makes use of the terms $CO_2$ and GHG interchangeably.

The MEPA GHG Policy states that all projects undergoing MEPA review requiring the submission of an Environmental Impact Report (EIR) must quantify the project's GHG emissions and identify measures to avoid, minimize, or mitigate such emissions. In addition to quantifying project-related GHG emissions, the MEPA GHG Policy requires proponents to quantify the effectiveness of proposed improvements in terms of energy savings, and therefore, potential emissions reductions. The goal of the MEPA GHG Policy is to identify and implement measures to minimize or reduce the total GHG emissions anticipated to be generated by that respective project.

### Massachusetts Stretch Energy Code

As part of the Green Communities Act of 2008, Massachusetts developed an optional building code that gives cities and towns the ability to choose stronger energy performance in buildings than the state building code (the "Stretch Energy Code"). Codified by the Board of Building Regulations and Standards as 780 CMR Appendix 115.AA of the 8th edition Massachusetts Building Code, the Stretch Energy Code is an appendix to the Massachusetts building code, based on further amendments to the International Energy Conservation Code (IECC). The Stretch Energy Code increases the energy efficiency code requirements for new construction (both residential and commercial) and for major residential renovations or additions in municipalities that adopt it.

The City was designated a Green Community under the Green Communities Designation and Grant Program, an initiative of the Department of Energy Resources (DOER). The goal of the grant program is for the municipality to use this grant money to help residents, businesses, and the municipality departments/facilities reduce

energy use or install renewable energy systems. In order to be designated a Green Community and, therefore, eligible for grant money available annually, the community is required to find ways to minimize life-cycle costs, such as adopting and implementing the Stretch Energy Code, which the City did in July 2010.

The current Stretch Energy Code requires the Project to achieve at least a 20 percent overall reduction in annual energy use compared to a baseline using requirements of ASHRAE 90.1-2007. For projects of this size and type, the Stretch Energy Code requires modeling of base and proposed cases based on the methodology as is defined in ASHRAE 90.1- Appendix G. On July 1, 2014, the IECC2009 and ASHRAE 90.1-2007 ceased to be a code option for non-stretch Code communities, and the IECC2012 and ASHRAE standard 90.1-2010 became the new/updated state-wide Base Energy Code. It is expected that an updated Stretch Energy Code, when enacted, will require additional energy reductions beyond these standards and that Green Communities, such as Cambridge will automatically adopt any updates to the Stretch Energy Code (unless they vote to change their bylaw to no longer be a stretch code community). At the time of this NPC filing, the updated Stretch Energy Code requirements remain unknown, however, the MEPA Office and DOER suggest new large projects target approximately 15 percent energy savings beyond the Base Energy Code requirements based on IECC2012 and ASHRAE 90.1-2010.[1]

Based on the history of the Project and through discussions with MEPA, a Base Energy Code using ASHRAE 90.1-2007 has been assumed. However, the ASHRAE 90.1-2010 building improvement requirements are also presented to demonstrate how the Project would meet the future potential Stretch Energy Code. Because the Project is in early stages of design, the assumptions on certain Project elements, such as interior fit-out and specific HVAC equipment efficiency ratings have been made to calculate the estimated GHG emissions reduction associated with the Project.

## Summary of City of Cambridge Initiatives

The following presents an update to the summary of City of Cambridge initiatives related to sustainability. The City has committed to a range of initiatives to support and encourage sustainable lifestyles and move the community toward greater resilience to climate change:

- In December 2013, the City created the "Getting to Net Zero Task Force" charged with advancing the goal of putting Cambridge on the trajectory towards becoming a "net zero community," with focus on GHG emissions from building operations. This includes reducing energy use of buildings and taking advantage of opportunities to harvest energy from renewable sources. In June 2015, the City Council unanimously voted to adopt the *Net Zero 25-Year Action Plan*.

[1] MA Commercial Building Energy Code Status for Projects Subject to the MEPA GHG emissions Policy and Protocol, with Building Related Stationary Sources, MA DOER, August 1, 2013.

- The Climate Protection Action Committee (CPAC) proposed new greenhouse gas emission reduction goals to the City Manager in spring 2014. These involve both community and municipal government actions toward greater sustainability.
- In early 2015, the City began to turn the information gathered through the Climate Change Vulnerability Assessment into a Climate Change Preparedness & Resilience Plan, relying heavily on community input to design an actionable plan.
- The City secured major grant funding to support the development of a Kendall Square EcoDistrict and initiate a study of district energy opportunities. The CRA and most major landowners and property managers in the KSURP are deeply involved in the formation of the EcoDistrict and related study of district energy. The study is scheduled to begin in late fall 2015 and is anticipated to be complete by fall 2016.
- In 2013, the City signed the Compact for a Sustainable Future, in partnership with Harvard University, MIT, and key business stakeholders. This Compact, which has since expanded to include the CRA and Boston Properties as signatories, creates a framework for collaboration on climate change mitigation and resiliency planning. The Compact is currently working in its Strategic Priorities.
- Through the CitySmart and Cambridge Energy Alliance programs, Cambridge is engaging closely with residents and businesses to educate and push for action through behavior change towards sustainable modes of transportation, residential and business energy efficiency measures, and use of renewable energy in local buildings.
- The City passed a Building Energy Use Disclosure Ordinance in 2014, and is considered a key step in efforts to reduce GHG emissions city-wide. By May 2016 all non-residential buildings 25,000 SF or greater and residential buildings of 50 or more units started reporting their energy and water use. The City's first Building Energy and Water Use report was published in May 2016 for data from the calendar year.
- Efforts to improve the energy performance of our building stock is hampered by the invisible nature of energy use. The ordinance is intended to address this problem by requiring owners of larger buildings to track and report annual energy use to the City and publicly disclose the data. Disclosure places the information in the marketplace, where various users such as potential property buyers, tenants, realtors, energy service providers, and others can use the data and to help create value for higher energy performing properties. The data will also aid the City and others in planning for higher energy performance in our building stock. The ordinance is a foundational strategy for various community sustainability initiatives including the Community Compact for a Sustainable Future, Kendall Square EcoDistrict, and efforts to move the community toward net zero emissions. Municipal buildings reported energy use for calendar year 2013, some non-municipal buildings will need to begin reporting energy use for the 2014 calendar year by May of 2015, with the remainder one year later.

- In January 2015, the Georgetown University Energy Prize announced the 50 semifinalist communities, which included Cambridge, who will be competing through 2016 to reduce their energy consumption. Ten finalists will be announced in January 2017. The winner of the Prize will be announced in June 2017.
- The Cambridge Bicycle Network Plan, published in fall 2015, identifies streets and paths, which provide direct connectivity between neighborhoods and key destinations within the City and adjacent jurisdictions. The plan aims to prioritize the funding, redesign, reconstruction, and maintenance of projects to promote the completion of a connected low-stress network that provides a bicycling option for people of all ages and abilities throughout the City. It is envisioned that over time all streets within the City will ultimately be designed to facilitate comfortable, low- stress bicycling, thereby influencing mode shift to bicycling and walking and resulting in further positive outcomes for GHG emissions.
- A Cambridge Transit Strategic Plan was published in late 2015 through the combined efforts of an Interdepartmental Staff Working Group that includes the CRA, as well as the Cambridge Transit Advisory Committee. Following a 2-year public transit strategic planning process that began in January 2013, the goal of this plan is to develop an action plan for how Cambridge will take a stronger leadership role to improve quality and expand capacity of our transit system to influence mode shift to transit and result in further positive outcomes for GHG emissions. The City is working to integrate prioritized objectives into the FY16 budget processes.
- The Eastern Cambridge/Kendall Square Open Space Study and design competition completed in 2015 explored ways to provide a network of well connected, managed, and programmed new and existing parks and open spaces that serve a variety of users, and provide a range of experiences and environments. These efforts resulted in the 2015 Kendall Square Open Space Framework Plan and several of the parks identified in that plan are currently under design and planned for construction in 2017.

## Approach to Sustainability

As with the Prior Project, sustainability is integrated in to the Project Change concept and design. A sustainable approach to a project can include repurposing previously developed land rather than building on untouched land, as well as locating new development within high density areas and areas with highly accessible public transportation access. By constructing new commercial and residential spaces on previously developed sites a portion of which will be constructed above a reused portion of an existing building (the Cambridge Center North Garage), the Project is being designed to achieve energy savings associated with construction and associated GHG emissions.

As a Transit Oriented Development (TOD), the Project will utilize the existing public transportation and mode share infrastructure to further reduce traffic and indirect air emissions, including mobile source GHG emissions. TOD is environmentally, economically, and socially sustainable; it promotes greater mobility, walking and biking, healthy lifestyles; value for property owners, businesses, local governments, transit authorities and residents. A recent study by the Center for Transit-Oriented Development shows that TOD produces approximately 43 percent less emissions than conventional suburban development.

The project design will prioritize sustainability as a core strategic imperative and will implement state-of-the-art high performance green building technologies, construction, and operating procedures. The project design team will use iterative energy modeling and life cycle analysis that considers the long-term value of sustainable property investment decisions.

Sustainability planning with an integrated design team during conceptual design will establish a pathway to Gold-level certification under the Core & Shell Leadership in Energy and Environmental Design (LEED®) Green Building Rating System and superior energy use intensity performance, consistent with the K2 Plan. The Project Change proposed all new building area to be concentrated in the northern portion of the KSURP area between Binney Street and Broadway, which is beneficial in implementing a more District-wide approach to sustainability in all stages of the Project (planning, design, construction and operations). Also, by having all new construction concentrated, the Project is a candidate for the Master Site LEED credit documentation approach. This approach accommodates the multiple buildings on a shared site and to streamline the documentation process where applicable prerequisites and credits are documented only one time under the Master Site project.

The following is a summary of key sustainable design goals for the Project:

### Site/Water

- Incorporation of LID measures District-wide, such as green roofs and/or pervious pavers as part of the open space improvements to assist in the reduction of the volume of stormwater runoff as well as heat island effect
- Light spill and noise pollution reduction
- Reduced potable water use through installation of low-flow plumbing fixtures
- Rainwater reuse for cooling tower make-up water
- Reduced irrigation through use of native/indigenous planting materials and/or rainwater harvesting

## Energy

- Design buildings and building systems to comply with the future more stringent requirements of the Stretch Energy Code compliance resulting in energy savings and associated GHG emissions reductions
- Energy Conservation Measures (ECMs) will continue to be considered/evaluated as design progresses, including:
  - High performance building envelope (i.e., improved roof, windows, and wall insulation)
  - Reduced window-to-wall ratio in residential buildings
  - Reduced lighting power densities in the office and retail spaces through the use of LED lighting technology
  - Building orientation and window locations shall be suited for improved energy efficiency
  - Consideration and evaluation of more innovative building systems, such as chilled beams technology and/or energy demand response/peak load reduction/smart grid compatible technologies
- Decreased Energy Use Intensity (EUI)
- Consideration and evaluation of on-site renewable/clean energy opportunities, including CHP, solar PV, and steam energy
- Thoughtful design to not preclude the integration of future technology, including the commitment to construct all new buildings to be solar-ready

## Materials/Occupant Comfort & Wellness

- Construction & Demolition Waste Diversion (require construction contractors to aim for a goal of 95 percent, as part of a Construction Waste Management Plan)
  - By keeping the Cambridge Center North Garage intact, a significant amount of construction waste associated with demolition and new construction to rebuild a garage structure is eliminated by the Project.
- Reduce operational waste through recycling/reuse programs in coordination with future tenants (as part of the Tenant Design and Construction Guidelines presented in SEIR Appendix E)
- Provide for operable windows and air quality monitoring in residential buildings to ensure fresh air and occupant comfort
- Ensure adequate level of natural light with glare controls within interior building spaces
- Implement a non-smoking policy

- Use of low-emitting interior building materials, such as finishes, paints, adhesives, and sealants.
- Work to develop an internal list of precautionary building materials, or a materials "red list", identifying those materials that negatively contribute to the health, wellness, and productivity of future building occupants and, therefore, are banned from being used in the Project.
- Evaluate and consider incorporation of WELL Building Standard® principles[2] to enhance the health and wellness of future occupants.

### Operations

- During the leasing process, the Redeveloper will provide Tenant Design and Construction Guidelines to potential office and retail tenants as a guide to use when fitting out their spaces. The guidelines will communicate the sustainable and resource-efficient features incorporated into the base building(s) and provide specific suggested sustainable strategies enabling tenants to coordinate their leased space design and construction with the rest of the building systems. Implement continued monitoring-based building commissioning to ensure optimal performance of building systems and to identify problem areas to drive smart future building renovation choices.
- The Redeveloper will track and report energy usage in order to identify inefficiencies and encourage building operators to reduce overall energy use.
- Incorporate building user-accessible energy and/or water real-time dashboards in visible areas of each Project Component to depict the building's energy usage (and generation) to educate building users.
- Consider utilizing the new LEED Dynamic Plaque for collection and evaluation of real-time building performance data.
- Implement green housekeeping and/or integrated pest management programs.

### Innovation/Emerging Technology

- Consider future incorporation of building technology as it becomes available further enhance overall sustainability over the life of the Project (i.e., work towards Net Zero Energy).
- Consider implementing District-wide sustainable initatives, such as local food production/farming and/or community gardens, and/or composting program.

[2] https://www.wellcertified.com/well

## Sustainable Site Features

The Project is inherently sustainable because it is within a dense urban area with access to public transit. The MBTA Red Line directly serves the KSURP area via Kendall Square/MIT subway station as well as four bus routes. This station is within a 5-minute walk from the Project Components (a 1-minute walk from Three Cambridge Center). The Project is a model for TOD since it reduces the need for single-occupancy vehicle use by proposing density in an area accessible by pedestrians and supported by an extensive public transit network. In compliance with the City's bike parking requirements, the Project will provide long-term (resident/employee) and short-term (visitor) bicycle spaces for the Project. Additionally, the Proponent will develop a robust program of TDM measures to reduce automobile trips generated by the Project.

The Proponent is planning to implement sustainable site features for the Project to mirror the sustainability strategies of the City, which will also serve to make the Project more resilient to climate change. These features are discussed further in the Climate Change Adaptation section. The Project will be required to implement Low Impact Development (LID) technologies to aid in the stormwater mitigation required by the City. These technologies are discussed in later sections, but include the implementation of subsurface infiltration, landscaped bioretention areas, nutrient reduction technologies, green roofs, efficient irrigation systems and rainwater harvesting. As the individual developments progress, sustainable site features will be researched and implemented to the greatest extent practicable given the high urban density of the Project as a whole.

## Sustainable Building Features

Green building strategies are integral to the project design. The Project will strive for the greatest achievable and economically-viable design and construction. For the commercial components, the facilities will be energy efficient with a long-term focus on maintenance to minimize long term impacts on the environment. The facilities will include a number of sustainable strategies, such as green roofs to mitigate the heat island effect, storm water detention, reduced water usage and solar photovoltaic (PV) panels.

## Resource Efficiency

The current Stretch Energy Code requires that the Project show at least 20 percent overall reduction in energy used as compared to the IECC2009/ASHRAE 90.1-2007 code compliant baseline model. Since the IECC 2012 and ASHRAE 90.1-2010 is more stringent than the current Stretch Energy Code baseline, the proposed HVAC and lighting systems and the ECMs were selected so that the overall energy savings fall within 24 and 30 percent better than 90.1-2007 and, therefore, also meet the potential

future Stretch Energy Code requirements. As presented in the stationary source GHG assessment below, the ECMs are estimated to result in just over 26 percent energy efficiency for the overall Project (all project components) based on building energy modeling for conceptual design.

For the commercial office components, a Dedicated OA system was proposed to provide fresh air to the office and amenity spaces, heating and cooling systems depending on the geometry of the building and energy efficiency factors were proposed to be a floor-by-floor water-cooled, DX system or a zone-by-zone Fan Coil Unit system. In the residential components, units will be naturally ventilated, and heating and cooling will be provided through high-efficiency Water Source Heat Pump system. A high-efficiency Energy Recovery Unit provides fresh air to the corridors while it recovers heat from the toilet exhaust. Finally, the laboratory space (60 percent lab and 40 percent office was assumed for the Whitehead Office Addition) will be ventilated, heated and cooled via a 100 percent outside air (OA) VAV Air Handling Unit equipped with energy recovery, using chilled water and hot water to condition to the supply air.

The proposed light fixtures will incorporate LED and CFL technology wherever possible, which will help in reducing the interior lighting power density in all spaces by at least 10 percent in residential corridors and 20 percent in the office and retail spaces as compared to the Base Energy Code.

The following is a summary of the proposed ECMs:

- Improved Glazing Properties
- Improved Roof Insulation
- Improved Exterior Wall Insulation
- Improved Interior Lighting Power Density
- Low-flow Water Fixtures and High-efficiency Domestic Water Heater
- Variable Volume Condensing and Chilled, and Hot Water Pumping
- High-Efficiency Centrifugal Chillers
- VFD on Cooling Tower Fans and Higher CW Delta T
- High-Efficiency Condensing Gas-fired Hot Water Boilers
- High-Efficiency Water Source Heat Pumps
- High-Efficiency Energy Recovery Ventilator
- Differential $CO_2$ Based Demand Control Ventilation for Offices
- CO Control and VFD for Underground Garage Fans

- Solar photovoltaics (to be investigated further as the design progresses)[3]

## Greenhouse Gas Emissions Assessment

This section presents the results of the GHG emissions assessment, in accordance with the MEPA GHG Policy. The Proponent is committed to incorporate many key aspects of sustainability and high performance building design, where applicable and feasible, as it is their intent to lease and operate the buildings in a sustainable manner.

The goal of the MEPA GHG Policy is to identify measures to reduce or minimize GHG emissions. As a way of quantifying project-related stationary source GHG emissions, the MEPA GHG Policy requires proponents to quantify the impact of proposed GHG reduction measures against a baseline to estimate energy usage savings. The Proponent is committed to incorporating many key aspects of sustainability and high performance building design as well as addressing climate change impacts and planning for resilience, where applicable and feasible, as it is their intent to lease and operate the buildings in a sustainable manner.

While GHG emissions include several gases, Carbon Dioxide ($CO_2$) was selected for evaluation because it is the most significant component of project-related GHG emissions. EPA has not set NAAQS for GHGs; however, they do encourage strategies to reduce emissions and save fuel.

Effective July 2010, the City adopted the Stretch Energy Code. The Project has been designed to meet the requirements of the current Stretch Energy Code requirements for GHG emissions (compared to a base design compliant with ASHRAE 80.1-2007). At the request of MEPA, the ASHRAE 90.1-2010 building improvement requirements are also presented to demonstrate how the Project would meet the future potential Stretch Energy Code. The Project will be evaluated with and incorporate sustainable design, including energy conservation measures throughout the design process in order to meet future requirements.

### Stationary Source Assessment Methodology

To provide for energy efficiency and reduced stationary source GHG emissions, the Proponent has evaluated the following key planning and design criteria:

1. Methods/strategies to reduce overall energy demand through appropriate design and sizing of building systems;

[3] At this early stage it is difficult to predict how much roof area will be available to support PV due to competing uses, including rooftop mechanical equipment and roof gardens/green rooftops. This GHG assessment includes preliminary order-of-magnitude calculations in order to demonstrate the possible PV capacity for the Project. This evaluation will continue to evolve through the design process.

2. Evaluation and incorporation, where feasible, of cost-effective energy-optimizing and high-performance systems; and
3. Consideration of the ability to supplement the required energy demand with self-generated energy (i.e., on-site clean and/or renewable energy source).

The Project was modeled with the proposed building geometry, HVAC system type, occupancy schedule, and ventilation rates as the baseline buildings.

Direct stationary source $CO_2$ emissions include those emissions from the facility itself, such as boilers, heaters, and internal combustion engines. Indirect stationary source $CO_2$ emissions are derived from the consumption of electricity, heat, or cooling from off-site sources, such as electrical utility or district heating and cooling systems. The direct and indirect stationary source $CO_2$ emissions from the proposed building sources are calculated using the computer-based eQUEST model[4] based on assumptions for the Project's building elements, such as (but not limited to) the specific type of use(s) and users of the buildings, building configuration and architecture type, building envelope (walls/windows), interior fit-out (where known), and HVAC system and equipment efficiency ratings.

The GHG mitigation measures can be divided into the buildings' construction materials, architecture, and the heating and cooling processes. The following presents the specific proposed building improvements (and their correlating eQUEST modeling parameters for reference, where applicable) that are assumed to be included as part of the Project for the purpose of this analysis. Since the design and future users of the Project Components are conceptual, the specific proposed improvements may be subject to design modifications, as necessary, where the stationary source GHG emissions reductions goals established by this assessment will be used to guide final building design.

## eQUEST Model and Analysis Conditions

The eQUEST model is used to estimate the amount of annual energy consumption by simulating a year of building operations based on typical yearly weather and user inputs. The model estimates the buildings' electricity and gas usage based on building design and system assumptions following the energy modeling protocol outlined in Appendix G of ASHRAE 90.1-2007.[5] The amount of consumed energy is then converted into the amount of $CO_2$ emitted using the standardized conversion factor.[6] The stationary source assessment calculated $CO_2$ emissions for the following build conditions:

▼

[4] eQUEST (the Quick Energy Simulation Tool), from James J. Hirsch, DBA James J. Hirsch & Associates, Camarillo, CA.

[5] American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., ASHRAE 90.1-2007-Energy Standard for Buildings Except Low-Rise Residential Buildings, Appendix G, 2007.

[6] 730 lb CO2/MWh was used to convert electricity consumption into the amount of CO2 emissions (2013 ISO-New England Marginal Emissions Report). 117.08 lb CO2/Mbtu was used to convert gas consumption into the amount of CO2 emissions (The Energy Information Administration Documentation for Emissions for GHG).

- **Build Condition with MA Building Code (the "Base Case"):** The Project assuming typical construction materials and building equipment/systems that meet the minimum requirements of the MA Building Code (8th Edition), or the base code. This baseline is established by the energy code as being defined by ASHRAE 90.1 – 2007.
- **Build Condition with Stretch Energy Code (the "Design Case"):** The Project assumes building design and system improvements in order to meet the current Stretch Energy Code (i.e., 20 percent over ASHRAE 90.1-2007).

## Stationary Source GHG Emissions Assessment

The stationary source GHG emissions assessment presented in this appendix has been updated to reflect the Project Change.

## Future Stationary Source $CO_2$ Emissions

The Project includes the construction of multiple buildings with various uses, including commercial office, innovation space, laboratory space, residential, retail and parking. The approach to and results of the building energy model for each Project Component is presented below. The Project was split into the following Project Components for building energy modeling purposes:

- Office Building A - 145 Broadway (Previously Eleven Cambridge Center);
- Residential Buildings (North and South)– 135 Broadway Street (on the Cambridge Center North Garage);
- Office Building B - 250 Binney Street (Previously Fourteen Cambridge Center); and
- Whitehead Institute Addition (no change from the SEIR).

The Broad Institute Office Conversion consisting of approximately 14,000 square feet of mechanical space into office space at the was not modeled given the de minimus energy usage and stationary source GHG emissions that would result from a small change in use.

The noteworthy improvements for the base building (or core and shell) of each Project Component are presented in the sections below. While these core and shell building design improvements are preliminary based on conceptual design, they will be mandated by the Redeveloper. While specific improvements may be subject to design modification as design progresses, the Redeveloper is committed to achieving the stationary source GHG emissions reductions estimated herein for the final building program and design.

Other beneficial improvements or measures that are expected to result in further reductions of stationary source GHG emissions, but were not accounted for in the building energy model are also discussed. These improvements/measures are generally operational in nature and, therefore, will be encouraged by the Proponent and/or Redeveloper. As presented in the draft Tenant Design and Construction Guidelines provided in SEIR Appendix E, the Redeveloper is committed to encouraging ECMs and other sustainable design, construction, and operation that will help achieve further GHG emissions reductions most of which cannot be quantified for the purposes of this GHG assessment. Two exceptions are plug load reductions and solid waste reduction/recycling, which are quantified in the following sections. The potential energy savings and associated stationary source $CO_2$ emissions associated with these operational measures has been estimated for the purposes of this stationary source GHG assessment.

### Office Building A - 145 Broadway Street

Table E-1 below presents a summary of the improvements that were included in the energy model for the new commercial office building located at 145 Broadway Street. Key energy savings features include improved glazing properties, improved roof and wall insulation, improved lighting power densities, variable volume condensing water pump, a high efficiency DW heater, and a high efficiency gas boiler.

**Table E-1 Office Building A - 145 Broadway Street Key Model Assumptions**

| Summary of Key Assumptions for Energy Model | Base Case | Design Case |
|---|---|---|
| Building Envelope (Construction Assemblies) | | |
| Walls | R-value: 13, with continuous insulation adding 7.5 R | R-value: 13, with continuous insulation adding 10 R |
| Roof | R-value: 20 | R-value: 25 |
| Fenestration and Shading | | |
| Fenestration Area | 40% | 48% |
| Metal Framing | U-value 0.45, SHGC 0.4 | Curtainwall Low-E Double Pane Glass |
| HVAC (Air-side) | | |
| Ventilation (Building) | Floor-by—Floor: ASHRAE 62.1 Fixed Rates | Dedicated OA System |
| Space Heating/Cooling | Package Rooftop, Chilled Water Cooling; VAV with Reheat with Minimum Volume set point of 40% | Water Cooled C; DX cooling; Perimeter FPT with Reheat and EC Motors |
| System Efficiency | Centrifugal Chiller > 300 tons 6.1 COP and 6.4 IPLV | VPAC- At least 13 EER |
| HVAC (Water-side) | | |
| Boiler Efficiency | 80% Efficient Natural Draft | 96% Efficiency Condensing |
| Lights | | |
| Interior Lighting | 1 W/SF Office<br>0.2 W/SF Garage | 0.8 W/SF Office<br>0.15 W/SF Garage |

The total estimated annual electricity use and natural gas consumption, and associated emissions for the office building is presented in Table E-2 below. Under the Base Case, the $CO_2$ emissions are estimated to be 1,909.4 tons per year. With the currently proposed building design and system improvements, the estimated energy use reduction for the building is approximately 28.1 percent, which equates to a 23.4 percent reduction (446.8 tons per year) in stationary source $CO_2$ emissions when compared to the Base Case. The stationary source $CO_2$ emissions percent reduction for the Office Building A under the Design condition was quantified as follows: 446.8/ 1,909.4 = 0.2340 x 100 = 23.4%.

$$\textit{Reduction \%} = \frac{\textit{Emissions Reductions Due to Project Improvements (End Use Savings)}}{\textit{Project-Generated Emissions (Base Case Emissions)}}$$

This methodology is applied consistently to the remaining buildings to determine the percent reduction of stationary source emissions.

**Table E-2 Office Building A - 145 Broadway Street Stationary Source $CO_2$ Emissions**

| | Energy Consumption | | | $CO_2$ Emissions | | |
|---|---|---|---|---|---|---|
| | Electricity (kWh/yr) | Natural Gas (MBtu/yr) | Total (MBtu/yr) | Electricity (tons/ yr)[1] | Natural Gas (tons/ yr) | Total (tons/ yr) |
| Base Case | 3,815,315 | 8,959 | 21,977 | 1,385.0 | 524.4 | 1,909.4 |
| Design Case | 3,289,018 | 4,589 | 15,812 | 1,193.9 | 268.7 | 1,462.6 |
| End-Use Savings | 526,297 | 4,370 | 6,165 | 191.1 | 255.7 | 446.8 |
| **Percent Savings** | | | **28.1%** | | | **23.4%** |

tons/yr = short tons per year

## Residential Buildings (North and South)
## 135 Broadway Street

Table E-3 below provides a summary of the proposed building improvements assumed for the residential towers to be constructed over the garage at 135 Broadway. Key energy savings features include improved glazing properties, improved roof and wall insulation, improved lighting power densities, high efficiency heat pumps, high efficiency ventilation systems, and a high efficiency gas boiler.

## Table E-3 Residential Buildings (North and South)/135 Broadway Street Key Model Assumptions

| Summary of Key Assumptions for Energy Model | Base Case | Design Case |
|---|---|---|
| Building Envelope (Construction Assemblies) | | |
| Walls | R-value: 13, with Continuous Insulation adding 7.5 R | R-value: 13, with Continuous Insulation adding 10 R |
| Roof | R-value: 20 | R-value: 25 |
| Fenestration and Shading | | |
| Fenestration Area | 40% | 59% |
| Metal Framing | Curtainwall-U: 0.45; SHGC: 0.4 | Kawneer 1600 Curtainwall-U: 0.26; SHGC: 0.37 |
| HVAC (Air-side) | | |
| Ventilation | Building: Floor-by-floor ASHRAE 62.1 Fixed Rates (Corridors and Retail) Natural Ventilation (Residential) | 100% OA, Energy Recovery Ventilator for Corridors and Toilet Exhaust (Corridors and Retail) Natural Ventilation (Residential) |
| Space Heating/Cooling (Residential) | Packaged Terminal AC; DX Cooling and Hot Water Heating | Water Source Heat Pump with EC Motors |
| System Efficiency (Residential | PTAC: 9.3<EER<11 | WSHP: Cooling EER-13 and Heating COP-5 |
| HVAC (Water-side) | | |
| Boiler Efficiency | 80% Efficient Natural Draft | 96% Efficient Condensing |
| Lights | | |
| Interior Lighting | 1.0 W/SF Residential 0.2 W/SF Garage | 1 W/SF Residential 0.15 W/SF Garage |

The total estimated annual electricity use and natural gas consumption, and associated emissions for the building are presented in Table E-4. Under the Base Case, the $CO_2$ emissions are estimated to be 2,053.6 tons per year. With the currently proposed building design and system improvements, the estimated energy use reduction for Residential Towers is 24.1 percent, which equates to a 15.5 percent reduction in stationary source $CO_2$ emissions when compared to the Base Case.

**Table E-4 Residential Buildings (North and South)/135 Broadway Street Stationary Source $CO_2$ Emissions**

| | Energy Consumption | | | $CO_2$ Emissions | | |
|---|---|---|---|---|---|---|
| | Electricity (kWh/yr) | Natural Gas (MBtu/yr) | Total (MBtu/yr) | Electricity (tons/ yr)[1] | Natural Gas (tons/ yr) | Total (tons/ yr) |
| Base Case | 3,297,820 | 14,630 | 25,883 | 1,197.1 | 856.5 | 2,053.6 |
| Design Case | 3,580,657 | 7,426 | 19,643 | 1,299.8 | 434.7 | 1,734.5 |
| End-Use Savings | -282,837 | 7,204 | 6,240 | -102.7 | 421.8 | 319.1 |
| **Percent Savings** | | | **24.1%** | | | **15.5%** |

tons/yr = short tons per year

### Office Building B 250 Binney Street

Table E-5 below presents a summary of the improvements that were included in the energy model for the new 250 Binney Street office building. Key energy savings features include improved glazing properties, improved roof and wall insulation, improved lighting power densities, variable volume condensing water pump, a high efficiency DW heater, and a high efficiency gas boiler.

**Table E-5 Office Building B -250 Binney Street Key Model Assumptions**

| Summary of Key Assumptions for Energy Model | Base Case | Design Case |
|---|---|---|
| Building Envelope (Construction Assemblies) | | |
| Walls | R-value: 13, with continuous insulation adding 7.5 R | R-value: 13, with continuous insulation adding 10 R |
| Roof | R-value: 20 | R-value: 25 |
| Fenestration and Shading | | |
| Fenestration Area | 40% | 48% |
| Metal Framing | U-value 0.45, SHGC 0.4 | Curtainwall Low-E Double Pane Glass |
| HVAC (Air-side) | | |
| Ventilation (Building) | Floor-by—Floor: ASHRAE 62.1 Fixed Rates | Dedicated OA System |
| Space Heating/Cooling | Package Rooftop, Chilled Water Cooling; VAV with Reheat with Min Volume set point of 40% | Water Cooled AC; VAV operation- 0.75 CFM/SF only 4 hrs/day and the rest 0.07 CFM/SF |
| System Efficiency | Centrifugal Chiller > 300 tons 6.1 COP and 6.4 IPLV | VPAC- At least 13 EER |
| HVAC (Water-side) | | |
| Boiler Efficiency | 80% Efficient Natural Draft | 96% Efficiency Condensing |
| Lights | | |
| Interior Lighting | 1 W/SF Office<br>0.2 W/SF Garage | 0.8 W/SF Office<br>0.15 W/SF Garage |

The total estimated annual electricity use and natural gas consumption, and associated emissions for the office building are presented in Table E-6 below. Under the Base Case, the $CO_2$ emissions are estimated to be 1,984.4 tons per year. With the currently proposed building design and system improvements, the estimated energy use reduction for the new office building is approximately 27.0 percent, which equates to a 21.0 percent (417.5 tons per year) reduction in stationary source $CO_2$ emissions when compared to the Base Case.

**Table E-6 Office Building B -250 Binney Street Stationary Source $CO_2$ Emissions**

| | Energy Consumption | | | $CO_2$ Emissions | | |
|---|---|---|---|---|---|---|
| | Electricity (kWh/yr) | Natural Gas (MBtu/yr) | Total (MBtu/yr) | Electricity (tons/ yr)[1] | Natural Gas (tons/ yr) | Total (tons/ yr) |
| Base Case | 4,216,206 | 7,754 | 22,140 | 1,530.5 | 453.9 | 1,984.4 |
| Design Case | 3,800,537 | 3,199 | 16,167 | 1,379.6 | 187.3 | 1,566.9 |
| End-Use Savings | 415,669 | 4,555 | 5,973 | 150.9 | 266.6 | 417.5 |
| **Percent Savings** | | | **27.0%** | | | **21.0%** |

tons/yr = short tons per year

### Innovation Space Conversion

By reusing the One Cambridge Center building instead of constructing a new structure, and by renovating the existing space to more energy efficient and healthier environment, the project has a greater impact on GHG emission reduction by preserving the embodied energy in the existing construction. Furthermore, the proponent will implement Energy Conservation Measures into design and renovation of this building, such as replacing existing lighting fixtures with high-efficiency, possibly LED fixtures, evaluating the existing ventilation and conditioning systems and replacing them with high-efficiency boilers and chillers, using variable volume fans and pumping systems if possible, and replacing the existing plumbing fixtures with low-flow and low-flush fixtures.

### Whitehead Institution Addition

Table E-7 below presents a summary of the improvements that were included in the eQUEST model for the proposed commercial office expansion of the Whitehead Institute. The modeling for this component has not changed from the SEIR submission. For the purposes of the energy model, the office expansion was a split into 60 percent lab space and 40 percent office space in order to account for anticipated energy needs for potential laboratory space. Key energy savings features include improved building envelope, high efficiency condensing boilers, and lower lighting power densities.

**Table E-7 Whitehead Office Addition: Key Model Assumptions**

| Summary of Key Assumptions for Energy Model | Base Case | Design Case |
|---|---|---|
| Building Envelope (Construction Assemblies) | | |
| Walls | R-value: 13, with continuous insulation adding 7.5 R | R-value: 13, with continuous insulation adding 13 R |
| Roof | R-value: 20 | R:value: 25 |
| Fenestration and Shading | | |
| Fenestration Area | 40% | 47% |
| Vertical Glazing | Curtainwall U: 0.45 | Curtainwall U: 0.41 |
| HVAC (Air-side) | | |
| HVAC System | Package Rooftop, Chilled Water Cooling; VAV with reheat | Lab: Packaged Rooftop With ERV, Chilled Water Cooling, and VAV with HW Reheat<br>Office: 4-pipe Fan Coil Units |
| CHW System | | |
| Chiller Type | Rotary Screw | Variable Speed Fans |
| Chiller Efficiency | 4.9 COP | 6.1 COP |
| CHW Pump Control | One Speed Pumps | Variable Speed Pumps |
| Service Hot Water | | |
| HW Boilers | 80% Efficient Natural Draft | 96% Efficient Condensing |
| HW Pump Control | One Speed Pumps | Variable Speed Pumps |
| Lights | | |
| Interior Lighting | Office: 1 W/SF<br>Lab: 1.4 W/SF<br>Retail: 1.7 W/SF | Office: 0.9 W/SF<br>Garage: 0.15 W/SF |

The total estimated annual electricity use and natural gas consumption, and associated emissions for the Whitehead Office Expansion are presented in Table E-8 below. Under the Base Case, the $CO_2$ emissions are estimated to be 1,159.4 tons per year. With the currently proposed building design and system improvements, the estimated energy use reduction for the expansion is approximately 27.5 percent, which equates to a 22.8 percent (264.7 short tons) reduction in stationary source $CO_2$ emissions when compared to the Base Case.

**Table E-8 Whitehead Office Addition Stationary Source $CO_2$ Emissions**

| | Energy Consumption | | | $CO_2$ Emissions | | |
|---|---|---|---|---|---|---|
| | Electricity (kWh/yr) | Natural Gas (MBtu/yr) | Total (MBtu/yr) | Electricity (tons/ yr)[1] | Natural Gas (tons/ yr) | Total (tons/ yr) |
| Base Case | 1,491,467 | 10,557 | 15,646 | 541.4 | 618.0 | 1,159.4 |
| Design Case | 1,413,934 | 6,516 | 11,341 | 513.3 | 381.5 | 894.7 |
| End-Use Savings | 77,533 | 4,041 | 4,305 | 28.1 | 236.5 | 264.7 |
| **Percent Savings** | | | **27.5%** | | | **22.8%** |

tons/yr = short tons per year Note: $CO_2$ emissions vary slightly from the SEIR submission as the GHG conversion factor for electricity has been updated.

## Overall Project Emissions (Full Build)

The total estimated annual electricity use and natural gas consumption, and associated emissions for the Project (all buildings combined, or full build out) are presented in Table E-9 below. Under the Base Case, the $CO_2$ emissions for the Project are estimated to be 7,106.8 tons per year. With the currently proposed building design and system improvements, the estimated $CO_2$ emissions are 5,658.7 tons per year which is a savings of 1,448.1 tons per year. The equivalent estimated energy use reduction for the Project is approximately 26.5 percent, which equates to an approximately 20.4 percent overall reduction in stationary source $CO_2$ emissions when compared to the Base Case. The reduction in stationary source energy is consistent with the Massachusetts Stretch Code.

### Table E-9 Stationary Source $CO_2$ Emissions for the Overall Project (Full Build)

| | Energy Consumption (MBtu/yr) | | | $CO_2$ Emissions (tons/yr) | | |
|---|---|---|---|---|---|---|
| **Project Component** | **Base Case** | **Design Case** | **Percent Savings** | **Base Case** | **Design Case** | **Percent Reduction** |
| Office Building A - 145 Broadway | 21,977 | 15,812 | 28.1% | 1,909.4 | 1,462.6 | 23.4% |
| Residential Buildings (North and South)– 135 Broadway Street | 25,883 | 19,643 | 24.1% | 2,053.6 | 1,734.5 | 15.5% |
| Office Building B - 250 Binney Street | 22,140 | 16,167 | 27.0% | 1,984.4 | 1,566.9 | 21.0% |
| Whitehead Institute Addition | 15,646 | 11,341 | 27.5% | 1,159.4 | 894.7 | 22.8% |
| **Total** | 85,646 | 62,963 | **26.5%** | 7,106.8 | 5,658.7 | **20.4%** |

tons/yr = short tons per year

## Energy Use Index

The Energy Use Index (EUI) is a tool used to provide a common basis of comparison for energy use for various building uses. It is the total amount of energy used at a project over a one-year period, divided by the square footage of that building and represents the energy consumed by a building relative to its size. Based on the most recent Commercial Building End-Use Consumption Survey (CBECS), the average office building is EUI 90 with a maximum of 35 recommended.[7] Table E-10 below provides the EUI for each of the Project Components under the Base and Design Cases. These EUI's are generally well below the averages presented in the CBECS however, the CBECS is based on older buildings where the EUI presented herein represent more aggressive state building codes as well as aggressive mitigation measures to reduce the energy use and greenhouse emissions.

▼

[7] Website link to article: http://greensource.construction.com/news/2012/04/120417-zero-energy-buildings-attainable-across-climates-researchers-say.asp

**Table E-10 Energy Use Index**

| Project Component | Energy Use Index (kBtu/sf-yr) Base Case | Design Case |
|---|---|---|
| Office Building A - 145 Broadway | 50 | 36 |
| Residential Buildings (North and South)– 135 Broadway Street | 57 | 43 |
| Office Building B - 250 Binney Street | 51 | 39 |
| Whitehead Institution Addition | 230 | 167 |

## Other Beneficial Stationary Source $CO_2$ Emissions Improvements

### Building Reuse

There are significant GHG emissions associated with energy expended for new building construction from the materials manufacturing processes and transportation of those building materials as well as from construction equipment. By redeveloping an urban site and reusing the Cambridge Center North Garage instead of constructing all new parking structures to support the proposed uses, the Project further reduces GHG emission and the impact on the climate by preserving the embodied energy and carbon in the existing materials. Reuse of the garage equates to over 257 million BTUs of energy (or over two million gallons of gasoline) and approximately 27 short tons/year of $CO_2$ emissions.[8]

Furthermore, the Redeveloper will make energy efficiency-related improvements, such as replacing inefficient lighting fixtures to the Cambridge Center North Garage in the future. Since these upgrades are not yet confirmed, they were not quantified as part of this stationary source GHG emissions assessment, but they can be assumed as beneficial measures to reducing $CO_2$ emissions under the future build condition.

### Water Efficiency/Wastewater Generation Reduction

Water efficiency is not only important for conserving potable water and reducing wastewater generation, but also for reducing energy. Nationally, about four (4) percent of electricity use can be attributed to the treatment of potable water and

[8] Source: http://thegreenestbuilding.org/

wastewater, excluding the energy use associated with water heating. Therefore, the Proponents' commitment to reducing water use and wastewater generation through the installation of low-flow fixtures not only supports the overall sustainability goals, but further mitigates the potential impacts from energy use on the climate.

As outlined in the current MEPA GHG Policy, projects that will consume greater than 300,000 gallons per day (gpd) of water or wastewater may be required to model GHG emissions associated with energy usage for water or wastewater treatment on a case-by-case basis. This project will require 161,490 gpd of potable water and will generate 146,809 gpd of wastewater. It is important to note that these values do not include the water conservation techniques that the Proponent will employ as part of the sustainability goals of the Project. However, since the combined total of 308,299 gpd of water and wastewater is above the screening threshold a GHG analysis is provided. Based on the MEPA GHG Policy, the 146,809 gallons per day of wastewater is equivalent to approximately 0.07 tons/year of $CO_2$ and the 161,490 gallons per day of potable water is equivalent to 0.01 tons/year of $CO_2$. The total $CO_2$ emissions for the treatment of the Project's water and wastewater use is equivalent to approximately 0.08 tons per year[9].

## Plug Loads

The Proponent commits to encouraging the use of ENERGY STAR appliances and equipment, where available and reasonably practicable. Additionally, it is anticipated that task lights will be installed with motion sensors and schedule systems in the commercial office spaces. The building energy model for the Design Case does not take credit for reduced plug loads because building users are not fully identified at this time and, therefore, it is not possible to accurately estimate the number and/or type of these appliances, which depend, in large part, on the nature of the ultimate building user types. However, the use of ENERGY STAR appliances and equipment has proven to result in a reduction in overall energy use and, therefore, a reduction in stationary source $CO_2$ emissions for the Project is anticipated.[10] To quantify this, a 10 percent reduction was applied to the total annual electrical output of the Miscellaneous[11] category derived from the eQUEST model for each Project Component to account for ENERGY STAR appliances and equipment. The total annual Miscellaneous electricity would be reduced from 3,502 MWh to 3,152 MWh, which equates to a reduction in 127 tons of stationary source $CO_2$ emissions. This results in an overall stationary source $CO_2$ emissions reduction of 22.2 percent for the Project and overall energy reduction of 27.9 percent.

▼

[9] Water/wastewater calculations are presented in the Appendix.

[10] Compared to standard office equipment and home appliances (non-ENERGY STAR- rated), ENERGY STAR-qualified products use 30 to 75 percent less electricity according to the ENERGY STAR website: http://www.energystar.gove/index.cfm?c=ofc

[11] The Miscellaneous category is one of the six categories eQUEST breaks electrical use into and the most applicable to plug-in loads.

### Building Commissioning, Energy Tracking, and Sub-Metering

The Proponent will consider the opportunity to conduct building commissioning. The intent of commissioning buildings is to improve the performance/efficiency of energy-related systems resulting in energy savings and GHG benefits. Enhanced commissioning, as defined by LEED, would be implemented for Office Buildings A and B, and Residential Buildings – North and South.

The use of building energy benchmarking data from tools, such as preliminary energy modeling and EPA's Target Finder during design allows the Redeveloper to establish achievable energy targets for the Project. Further, it is the intent of the Redeveloper to comply with the City's Building Energy Use Disclosure Ordinance, which aim at encouraging building operators to reduce overall energy use.

It is likely that commercial and residential tenants will be responsible for their own energy costs via lease agreements. By charging individual tenants for energy usage, the Redeveloper will have a better understanding of the energy profile, and can identify areas and specific systems for energy conservation measures and improvement. In addition, with direct payment and control of use, tenants leasing the building can encourage reduction in consumption of energy and water, and associated GHG emissions. The Proponent may explore and evaluate the costs associated with installing trackers or meters. The Proponent may also work with Eversource to design/employ high-efficiency equipment, where reasonable and feasible.

### Utility Incentives

Eversource and National Grid offer financial incentives to commercial and industrial customers who are building new structure or undergoing a major renovation. Incentives are available for high-efficiency equipment, systems and technologies that exceed the minimum Code requirements. Depending on the size of the building, number of Energy Conservation Measures and complexity of the project, the applicant can follow either the Prescriptive path or the Whole Building Approach. The Whole Building Approach or Custom incentives apply to more complex measures, which go beyond prescriptive guidelines, to reduce building electrical and thermal energy demand and consumption by implementing cost effective Energy Conservation Measures in the design process. KSURP buildings qualify for the Whole Building Approach and the developer plans to use this approach for the projects. The proponent will follow the Integrated Design path and during the schematic design of the project, the owner, utility representatives and the design team will participate in an Energy Efficiency Charrette for the purpose of generating, analyzing and comparing potential energy efficiency design features, to identify the best way to maximize energy savings and incentives for the projects. The owner, the design team and the rebate Technical Assistant will collaborate and host meetings during the design process to review the proposed ECMs and their environmental and financial

impacts at each stage of the design, at which time a consensus will be reached regarding which of the proposed ECMs will be considered for incorporation into the final building design.

### "Green" Tenant Leasing/Guidelines

During the leasing process, the Redeveloper will provide Tenant Design and Construction Guidelines to potential office and retail tenants as a guide to use when fitting out their spaces. Refer to SEIR Appendix E for the draft Tenant Design and Construction Guidelines. The intent of these guidelines is to educate future tenants about implementing sustainable design and construction features in their tenant improvement build-out as well as adopting green building practices that support the overall sustainability goals of the Project. The guidelines will also communicate the sustainable and resource-efficient features incorporated into the base building(s) and provide specific suggested sustainable strategies enabling tenants to coordinate their leased space design and construction with the rest of the building systems.

In summary, the lease guidelines may include the following information:

- Descriptions of sustainable design, construction and operations features of the proposed building(s), including resource conservation goals and features for tenant fit-out spaces (e.g., low-flow plumbing fixtures, sub-metered systems, lighting controls) as well as building certifications (i.e., LEED certification).
- Encourage tenant commitments for meeting various energy and water conservation goals.
- Descriptions of current regulatory requirements that pertain to leasable spaces.
- Possible strategies for energy efficiency, such as those for HVAC equipment recommendations, lighting/lighting controls, and low-flow/high-efficiency plumbing fixture recommendations may be included in the guidelines.
- Information on the various high performance building rating systems, such as EPA's ENERGY STAR, Green Globes, and LEED for Commercial Interiors (CI) as well as information on how the design case building(s) can contribute towards these certifications.
- Waste reduction goals and recycling facilities/programs.
- Information on Green Cleaning guidelines/policies.
- Information regarding Project-wide features that aim to encourage alternative transportation and TDM measures.
- Information on how to train/inform maintenance staff and employees on sustainable design/operation features.

## Solid/C&D Waste Reduction

Tenants have not been identified so it is difficult to predict how much recycled materials will be generated. However, in order to project the quantity of solid waste material generated for an office building, we have estimated the amount of generated waste based on a State of California study entitled "Waste Disposal and Diversion Findings for Selected Industry Groups." According to the study, large office buildings generate an average of 1,998 pounds of waste per 1,000 square feet per year. Therefore, it is estimated that the 675,200 square feet of net new office space in Office Buildings A and B, Whitehead Institute Addition, and Broad Institute Office Conversion, will generate approximately 1,349,050 pounds of waste annually. Based on the State of California study and Volume to Weight Data provided by the EPA, we estimate the volume of recycled materials generated for all office buildings to be 1,165,579 pounds, which includes both operational and Construction & Demolition (C&D) waste. The waste reduction calculations were only performed for office buildings in the original submission due to lack of access to any historic data for residential developments. During the NPC revisions, we came across a study done by the State of North Carolina for residential projects which generates a data set based on average pounds of recyclable material per household. Using the NC study, it is estimated that the up to 560-units residential development in North and South towers, will generate approximately 560,627 pounds of recyclable materials, including the Construction & Demolition (C&D) waste.

In order to achieve whole-building sustainability performance, the Redeveloper and Other Developers support and will follow the LEED Green Building Rating System guidelines. Therefore, it is anticipated that 100 percent of paper, corrugated cardboard, glass, plastic and metal would be recycled during operations and it is assumed that a minimum 75 percent of C&D waste will be diverted, as required by Massachusetts law. Following these assumptions, it is estimated that approximately 1,652,803 pounds of generated waste from both office and residential buildings will be diverted annually instead of being landfilled.

In order to estimate the potential GHG emissions reduction, two scenarios were established. The first scenario follows the survey results published in the California Study, which shows majority of recyclables in an average commercial buildings are disposed instead of being diverted. This scenario is presented as "Baseline Scenario." The second scenario, presented as "Alternative Scenario," follows the Redeveloper's sustainability goals and objectives described previously. Using the US EPA's GHG calculator, Waste Reduction Model (WARM), the "Alternative Scenario" shows a reduction of 1,588 metric tons of Carbon Dioxide in GHG emissions as compared to the "Baseline Scenario." The detailed WARM GHG Emission Analysis is attached for reference.

## Evaluation of Alternative Energy Sources

This section provides an updated rooftop solar photovoltaic (PV) evaluation based on the Current Project. Because the findings of the previous evaluations of alternative energy sources, including architectural wind, geothermal, and steam are not expected to be different based on the updated program and building massing scheme, these evaluations were not re-run. Refer to Chapter 4, *Sustainability and Greenhouse Gas Emissions Assessment* of the SEIR for the previous evaluations and findings.

### Rooftop Solar PV

The Proponent has conducted a preliminary evaluation of installing solar photovoltaic (PV) systems on the proposed building rooftops as the most practical and cost-effective application of on-site renewable energy for the Project. Table E-11 below presents a summary of the estimated solar power and associated stationary source GHG emissions reductions for the potential available rooftop area for the South Residential Tower at 135 Broadway Street, Office Building A-145 Broadway Street, Office Building B- 250 Binney Street, and the Whitehead Institute Addition. Note that PV was not feasible on the rooftop of the North Residential Tower at 135 Broadway Street as this roof is expected to be shaded most of the time by the southern tower. The suggested design will tie the solar panels on the roofs the South Residential Tower at 135 Broadway Street, Office Building A-145 Broadway Street, and Office Building B- 250 Binney Street to the grid. These three systems are analyzed as a whole. The calculations for the solar power emissions savings assuming a 90% inverter efficiency is provided in the attached supporting documentation.

**Table E-11 Estimated Photovoltaic (Solar) Power**

| Project Component | Available Roof Area (sf)[1] | Estimated Annual Output (kWh)[2] | Annual $CO_2$ Emissions Savings (tons per year) |
|---|---|---|---|
| South Residential Tower at 135 Broadway Street<br>Office Building A-145 Broadway Street<br>Office Building B- 250 Binney Street | 70,839 | 633,546 | 491 |
| Whitehead Institute Addition | 6,208 | 102,178 | 78 |
| **TOTAL** | **45,164** | **735,724** | **569** |

1 Roof area available for solar PV installation excluding competing space requirements for the building rooftop mechanical units and proposed vegetated roof.
2 Assumes no obstruction to sunlight.

The solar PV systems for the Project could produce an estimated average annual energy output of approximately 735,724 kWh. This equates to an additional reduction of approximately 569 tons per year of stationary source $CO_2$ emissions for the Project if PV system was installed on the respective buildings.

Solar PV availability will continue to be evaluated as the design progresses and as tenants and their needs are better identified. The Proponent understands the capacity of PV arrays continues to be roughly 10 watt/SF, which is an improvement over earlier versions of this equipment, but it is still lower than the average power draw of a multi-story office building (4-5 W/SF) or lab building (8-10 W/SF). The economics of installing solar PV continue to improve with tax credits available and the secondary renewable energy credits market available.

Given the estimated electricity generation, several federal and state tax incentives could be available to the Project, including, but not limited to, Business Energy Investment Tax Credit, and Massachusetts SREC-II, if it remains in effect. The Business Energy Investment Tax Credit is a Corporate Tax Credit available to commercial sectors for Solar, Geothermal, Wind, CHP, Fuel Cell, and Microturbine technologies. The incentive amount is 30 percent of expenditures for solar systems, such as PVs. Assuming the initial cost of $3.50 per Wdc, the estimated simple payback for installed PV on 4 buildings would be close to 12 years. Refer to Appendix D for the simple payback calculation.

While solar PV provides the advantage of supplying power while generating zero GHG emissions during operation, the capacity limitations of the equipment prevent obtaining all the building power from local Solar PV sources. Furthermore, the Proponent will have to consider the City's setback and screening requirements for rooftop equipment, which may have a significant impact on the available area for solar PV.

The Redeveloper cannot commit to installing solar PV systems on the rooftops of the proposed buildings at this time due to lack of final building design and understanding of competing rooftop space needs (for mechanical systems and green roofs/rooftop open space). The Proponent and Redeveloper need to further consider the opportunity costs and trade-offs for creating a livable high-density urban environment that depends on the creation of open space most likely on building rooftops. However, the Proponent is committed to constructing all new buildings to be "solar ready," including designing the roof structure to support the weight and wind loads associated with solar energy collectors as well as providing space to accommodate associated infrastructure, including conduit to the roof and space in the electrical room for an inverter should rooftop solar PV be a cost-effective ECM in the future.

### Co-Generation/Combined Heat and Power

A key GHG beneficial measure associated with the Project Change is that the co-generation facility located at Fourteen Cambridge Center will be utilized as an energy source for the Office Building B. This is expected to result in an additional 63.5 percent reduction in source energy and 1,636 tons reduction in annual stationary source CO2 emissions. With this measure, the Current Project would result in greater

stationary source GHG emissions reductions compared to the Previously Reviewed Project.

## Mobile Source Emissions Assessment

Mobile source GHG emissions are based upon the traffic volumes, the distance traveled and GHG emission rates. The mobile source emissions are calculated by performing a yearly mesoscale analysis to evaluate the changes in $CO_2$ emissions for the existing and future conditions within the traffic study area. The GHG mobile source analysis estimates the area-wide $CO_2$ emissions from vehicle traffic for a time period of one year. Mobile source emissions were calculated by performing an annual GHG emissions mesoscale analysis to evaluate the estimated change in $CO_2$ emissions for the existing and future conditions within the study area. The mobile source $CO_2$ assessment was conducted for the Existing, No-Build, Build and Build with Mitigation Conditions, as described below.

### Analysis Conditions

This NPC compares the future No-Build and Build conditions in order to identify the potential impact from the Project. Where applicable, the existing conditions are considered for comparison. In order to compare the effects of the proposed Project, the following analysis conditions were identified:

- **Existing Condition** represents the year 2014, the baseline analysis condition for comparison to future conditions;
- **No-Build Condition** represents the year 2024 and reflects existing traffic volumes increased to account for anticipated background traffic volume growth, and includes traffic related to specific development projects within the study area that are expected to be completed by 2024, and assumes no Project-related vehicle trips;
- **Build Condition** represents the year 2024 and includes the No-Build Condition traffic volumes plus the traffic associated with the Full-Build of the Project;
- **Build with Mitigation Condition** represents the 2024 Build Condition with the Project fully constructed and in operation with proposed transportation-related mitigation measures in place which includes all intersection improvements that results in reductions in delay (as presented in Chapter 2, *Transportation and Parking* and the 'Proposed Mitigation Measures' section below).

Future conditions were selected to reflect a ten-year traffic planning horizon. A comparison between the No-Build and Build Conditions of the same year show changes anticipated to occur as a result of the Project.

### Mobile Source Emission Rates

EPA's Office of Transportation and Air Quality (OTAQ) has developed the Motor Vehicle Emission Simulator (MOVES)[12]. MOVES2014 is U.S. Environmental Protection Agency's (EPA's) latest motor vehicle emissions model for state and local agencies to estimate greenhouse gases from cars, trucks, buses, and motorcycles.

All the vehicle emissions used in the mobile source GHG analysis were obtained using EPA's MOVES2014 emissions model. MOVES2014 calculates emission factors from motor vehicles in kilograms per vehicle-mile for existing and future conditions. The emissions calculated for this air quality assessment includes elements such as Tier 3 emission standards (which is an EPA program that sets new vehicle emissions standards, lowering the sulfur content of gasoline), heavy-duty engine and vehicle greenhouse gas regulations (2014-2018), and the second phase of light-duty vehicle GHG regulations (2017-2025). It also includes Massachusetts-specific conditions, such as the state vehicle registration age distribution and the statewide Inspection and Maintenance (I/M) Program.[13]

### Traffic Data

The air quality study used traffic data (volumes, delays, and speeds) developed for each analysis condition. The mesoscale analysis for $CO_2$ emissions used a yearly traffic volume for weekday and weekend periods. The vehicle miles traveled data used in the air quality analysis were developed based on the traffic data analyzed in this NPC. The mobile source GHG study area includes the entire Middlesex County.

### Existing Mobile Source $CO_2$ Emissions

Table E-12 presents $CO_2$ emissions from mobile sources under all conditions. The calculation of Existing Conditions mobile source emissions provides a base for which future years are evaluated. The mobile source analysis calculated the existing $CO_2$ emissions from the major roadways in the study area and represents Middlesex County. These emissions, estimated to be 5,745,642 tons per year, establish a baseline to which future emissions can be compared.

## Future Mobile Source $CO_2$ Emissions

Future Project-related mobile source $CO_2$ emissions calculations are based upon changes in traffic and emission factor data. The traffic data includes traffic volumes, vehicle miles traveled, roadway operations, and physical roadway improvements.

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[12] MOVES2014 (Motor Vehicles Emission Simulator), 2014, US EPA, Office of Mobile Sources, Ann Arbor, MI.

6 *The Stage II Vapor Recovery System* is the process of collecting gasoline vapors form vehicles as they are refueled. This requires the use of a special gasoline nozzle at the fuel pump.

The emission factor data included emission reduction programs and years of analysis. An updated trip generation was conducted for the proposed Project and the traffic will be very similar for this NPC project, therefore the mobile source analysis was not updated and has been restated below.

The mobile source analysis estimated the future study area $CO_2$ emissions due to the changes in traffic and emission data. Under the No-Build Condition, $CO_2$ emissions were estimated to be 5,542,707 tons per year. Under the Build Condition, the $CO_2$ emissions were estimated to be 5,543,753 tons per year.

The total Project-related mobile source GHG emissions are 1,046 tons per year, as presented in Table E-12 below. The 1,046 tons per year increase in $CO_2$ emission represents a 0.02 percent increase in $CO_2$ emissions for the Middlesex County area for future 2024 conditions.

**Table D-13 Mobile Source $CO_2$ Emissions Analysis Results (tons per year)**

| Pollutant | 2014 Existing Conditions | 2024 No-Build Conditions | 2024 Build Conditions | Project-Related $CO_2$ Emission[1] |
|---|---|---|---|---|
| Mobile Source GHG emissions ($CO_2$) | 5,745,642 | 5,542,707 | 5,543,753 | 1,046 |

GHG Greenhouse Gas
1 Represents the difference in $CO_2$ emissions between the Build and No-Build Conditions.

## Proposed Mitigation Measures

The mobile source GHG emissions assessment calculated the GHG emissions for the Project-related mobile sources. As discussed in Chapter 2, *Transportation and Parking* of this NPC, the Proponent will coordinate with the City to potentially implement intersection improvements to reduce delays and queuing as well as implement TDM measures in order to reduce single-occupant vehicle trips to the KSURP area and to minimize peak-period traffic demands in the KSURP area—all of which will provide for mobile source $CO_2$ emissions benefits. For the purposes of quantifying mobile source GHG emissions and projected reductions, this assessment assumed the local intersection operation improvements as described in Chapter 2.

Based on the new requirement to use MOVES2014 and the corresponding regional nature of the mesoscale analysis, the emissions related to Project-specific improvements, such as the intersection improvements and TDM program are minor reductions relative to the overall area (which are projected on a county-wide level).

The implementation of the TDM program is expected to improve air quality in the study area by promoting the use of alternative forms of transportation to the use of single-occupant motor vehicles as the principal travel mode to and from the KSURP area. Previous estimates of similar TDM programs have ranged on the order of two to

five percent reduction in vehicles miles traveled (VMT), which in turn will have a slight decrease in regional greenhouse gas emissions from the Build condition.

The proposed traffic mitigation (physical and operational upgrades at the intersections) is projected to reduce $CO_2$ emission by an estimated 102 tons per year, which results in a total Project-related $CO_2$ emissions of 941 tons per year. Table E-13 below presents a summary of the projected emissions reduction related to the traffic mitigation.

**Table E-13 Mobile Source $CO_2$ Emissions Mitigation Analysis Results (tons per year)**

| Pollutant | Project-Related $CO_2$ Emission[1] | Estimated Reductions Due to Traffic Mitigation[2] | Resulting Project-Related $CO_2$ Emissions |
|---|---|---|---|
| Greenhouse Gas ($CO_2$) Emissions | 1,046 | 105 | 941 |

1 Represents the difference in $CO_2$ emissions between the 2024 Build and No-Build Conditions
2 The traffic mitigation includes the physical and operations upgrades at the intersections and does not include TDM programs which would result in minor additional emissions reductions.

The Proponent and Redeveloper are committed to developing an expanded program of transportation mitigation and enhancements (the proposed KSTEP) designed to both preserve the favorable mode share balance in Kendall Square and provide additional improvements to mitigate the trip generation and associated mobile source GHG emissions projected to result from the Project. The KSTEP will be developed in conjunction with the many stakeholders engaged in transportation planning and operations in Kendall Square, including the Kendall Square Mobility Task Force, the MBTA, and MassDOT. The KSTEP would supplement the transportation mitigation and other beneficial measures outlined in Chapter 2, *Transportation and Parking*.

The traffic projections already took into account the aggressive transit mode share that is currently experienced and is projected to continue to be experienced in the future in the Kendall Square area. Because of the nature of TDM strategies quantification of specific measures is infeasible and is generally included in the mode share estimates for a project, as was done for the traffic and air quality studies.

The Proponent is current working with the Kendall Square (KS) Mobility Task Force, the City, MassDOT and the MBTA to develop a comprehensive effective plan for the transit enhancements for the Kendall Square area (the KSTEP). Details of the KSTEP are currently being developed and will include immediate, mid-range, and longer term Kendall Square access and transit and mobility improvements. Refer to the 'Proposed Public Transit Improvements' section of Chapter 3, *Summary of Mitigation* for additional information.

# Appendix E
# Greenhouse Gas Analysis Technical Supporting Documentation

**Energy Modeling (eQUEST) Assumptions and Results**

- REVISED (June 2016) Energy Modeling (eQUEST) Results for:
  - Residential Buildings (North and South)-135 Broadway Street;
  - Office Building A- 145 Broadway Street; and
  - Office Building B- 250 Binney Street
- March 2015 Energy Modeling (eQUEST) Results for Whitehead Institute Addition

**Energy and Emissions Model Summary**

**Energy Use Index (EUI) Comparison Tables**

**Combined Heat & Power (CHP) Supporting Documentation**

**Solid Waste Reduction Supporting Documentation**

**Solar Photovoltaic (PV) Systems Evaluation Supporting Documentation**

- On-Site Renewable Energy Generation for:
  - Residential Buildings (North and South)-135 Broadway Street;
  - Office Building A- 145 Broadway Street; and
  - Office Building B- 250 Binney Street
- March 2015 On-Site Renewable Energy Generation for Whitehead Institute Addition
- Solar PV Simple Payback Calculation

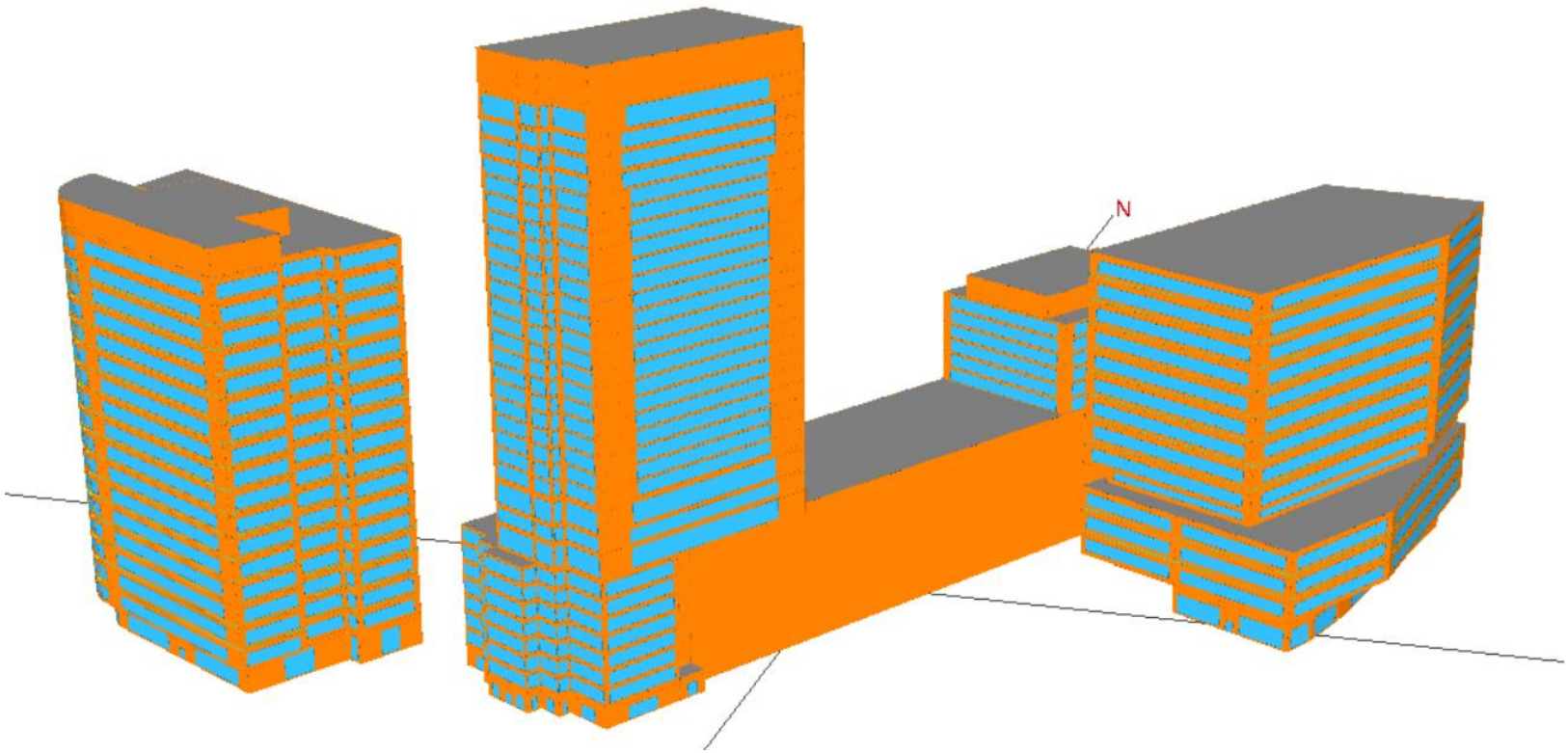
**Wastewater and Water GHG Analysis**

# Energy Modeling (eQUEST) Assumptions and Results

# Kendall Square Urban Renewal Plan – NPC

Boston Properties

June 15, 2016




AHA CONSULTING ENGINEERS

# 135 Broadway Street – Residential Towers on North Garage

## Energy Modeling Assumptions

| | | ASHRAE 90.1-2007 Baseline | ASHRAE 90.1-2010 | Proposed Design & ECMs (Energy Conservation Measures) |
|---|---|---|---|---|
| Envelope | Metal Framing Curtainwall | U-value 0.45; SHGC-0.4 | U-value 0.45; SHGC-0.4 | Kawneer 1600 Curtainwall System<br>Glass: U-0.26 & SHGC-0.37 - Overall inc. Frame: U-0.38; SHGC-0.38 |
| | Window-To-Wall Ratio | 40% | 40% | 59% |
| | Roof | R-20 c.i.; U-value of 0.048 | R-20 c.i.; U-value of 0.048 | R-25 c.i.; U-value of 0.039 |
| | Exterior Walls (steel-framed) | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-10 c.i.; U-0.055 |
| | | | | |
| Interior Loads | Occupancy | 500 SF/person on average | 500 SF/person on average | 500 SF/person on average |
| | Interior Lighting | 1 W/SF Residential Units<br>0.2 W/SF Parking Garage | 0.6 W/SF Residential Units<br>0.25 W/SF Parking Garage | 1 W/SF Residential Units<br>0.15 W/SF Parking Garage (25% Reduction) |
| | Office Plug Load | 0.3 W/SF | 0.3 W/SF | 0.3 W/SF |
| | Elevator Load | 8 cars (15 kW per car) | 8 cars (15 kW per car) | 8 cars (15 kW per car) |
| | | | | |
| DHW | Low-Flow Hot Water Fixtures | 2.2 GPM Lavatory Faucet | 2.2 GPM Lavatory Faucet | 1.5 GPM Residential Lavatory Faucet |
| | | 0.5 GPM Public Lavatory Faucet | 0.5 GPM Public Lavatory Faucet | 0.5 GPM (0.1 GPC) Retail Lavatory Faucet |
| | | 2.5 GPM Residential Showers | 2.5 GPM Residential Showers | 1.5 GPM Showers |
| | | 2.2 GPM Kitchen Faucet | 2.2 GPM Kitchen Faucet | 1.5 GPM Kitchen Faucet |
| | Gas-fired Water Heater | Efficiency: 80% | Efficiency: 80% | Efficiency: 90% |
| | | | | |
| CW System Non Residential | Cooling Tower Fan Control | Two-Speed Axial Fans | Two-Speed Axial Fans | N/A |
| | Cooling Tower Fan Power | 19.5 W/gpm | 19.5 W/gpm | N/A |
| | Condenser Water ΔT | 10˚ F | 10˚ F | N/A |
| | CW Pump Control | One Speed Pumps | One Speed Pumps | N/A |
| | | | | |
| HP Loop Residential | Cooling Tower Fan Control | N/A | N/A | Variable Speed Fans |
| | Boilers | N/A | N/A | 96% Efficient Condensing Boilers |
| | Pump Control | N/A | N/A | Variable Speed Pumps |
| | | | | |
| HW System Non-Res. | HW Boilers | 80% Efficient Natural Draft | 80% Efficient Natural Draft | N/A |
| | HW Pump Control | Variable Speed Pumps | Variable Speed Pumps | N/A |
| | HW Supply Temperature | 180˚ F | 180˚ F | N/A |
| | Hot Water ΔT | 50˚ F | 50˚ F | N/A |
| | | | | |
| Air-Side HVAC | Ventilation (Residential) | Natural Ventilation | Natural Ventilation | Natural Ventilation |
| | Ventilation (Corridors and Retail) | Floor-by-Floor: ASHRAE 62.1 Minimum Rates (fixed Rates) | Floor-by-Floor: ASHRAE 62.1 Minimum Rates (fixed Rates) | 100% OA, Energy Recovery Ventilator for corridors and toilet exhaust |
| | Space Heating/ Cooling (Residential) | Packaged Terminal AC; DX Cooling and Hot Water Heating | Packaged Terminal AC; DX Cooling and Hot Water Heating | Water Source Heat Pump (WSHP) with EC Motors |
| | Space Heating/ Cooling (Corridors) | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 40%. | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 30%. | Energy Recovery Ventilator:<br>Packaged Rooftop; DX Cooling and Gas Furnace |
| | System Efficiency (Residential) | PTAC: 9.3 < EER < 11 | PTAC: 9.3 < EER < 11.7 | WSHP: Cooling EER: 13 and Heating COP: 5 |
| | System Efficiency (Corridors) | Chilled Water Cooling;<br>4.90 COP and 5.60 IPLV | Chilled Water Cooling (Path B):<br>5.5 COP and 7.17 IPLV | At least 13 EER<br>(2007/2010 Code Requirements: 9.8 EER) |
| | Supply Fan Control | Residential: Constant Volume<br>Corridors: Variable Speed | Residential: Constant Volume<br>Corridors: Variable Speed | Residential: Cycling<br>Corridors: Constant Volume |
| | VAV Fan Part-Load Performance (Corridors) | ASHRAE 90.1 Part Load | ASHRAE 90.1 Part Load | Constant Volume Supply and Exhaust |

**Note 2** The Baseline Model is based on ASHRAE 90.1-2007 (Consistent with the current Stretch Energy Code); ASHRAE 90.1-2010 requirements have been added for comparison purposes.
The highlighted cells show the project-related differences between the two standards.

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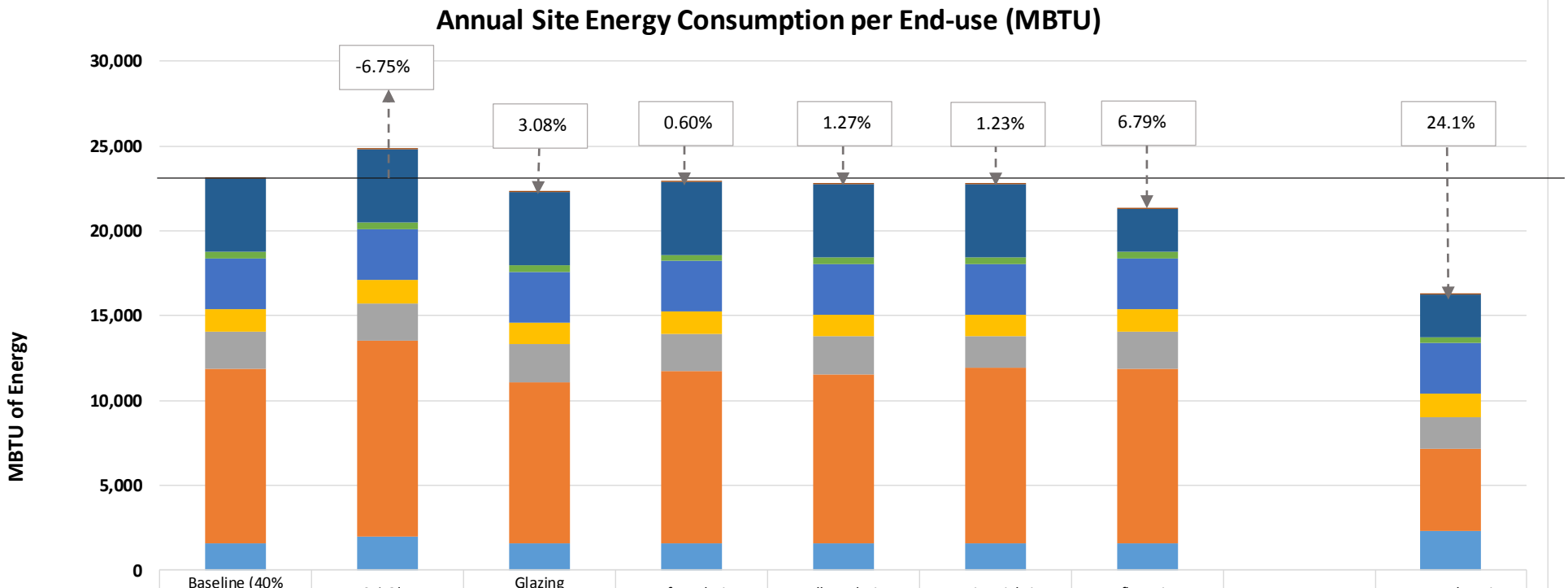
# 135 Broadway Street – Residential Towers on North Garage

## Site Energy Use Comparison




| | Baseline (40% Glass) | 59% Glass | Glazing Improvement | Roof Insulation | Wall Insulation | Interior Lighting | Low-flow Fixtures | | Proposed Design |
|---|---|---|---|---|---|---|---|---|---|
| Heat Rejection | 9 | 9 | 9 | 9 | 9 | 9 | 9 | | 17 |
| Domestic HW | 4,329 | 4,329 | 4,329 | 4,328 | 4,328 | 4,329 | 2,572 | | 2,571 |
| Pumps & Aux. | 372 | 399 | 360 | 372 | 370 | 372 | 372 | | 314 |
| Misc. Equipment | 2,971 | 2,971 | 2,971 | 2,971 | 2,971 | 2,971 | 2,971 | | 2,971 |
| Ventilation Fans | 1,315 | 1,385 | 1,300 | 1,311 | 1,308 | 1,315 | 1,315 | | 1,414 |
| Interior Lighting | 2,218 | 2,218 | 2,218 | 2,218 | 2,218 | 1,863 | 2,218 | | 1,863 |
| Space Heating | 10,302 | 11,557 | 9,550 | 10,148 | 9,972 | 10,339 | 10,302 | | 4,855 |
| Space Cooling | 1,563 | 1,958 | 1,544 | 1,566 | 1,573 | 1,563 | 1,563 | | 2,275 |

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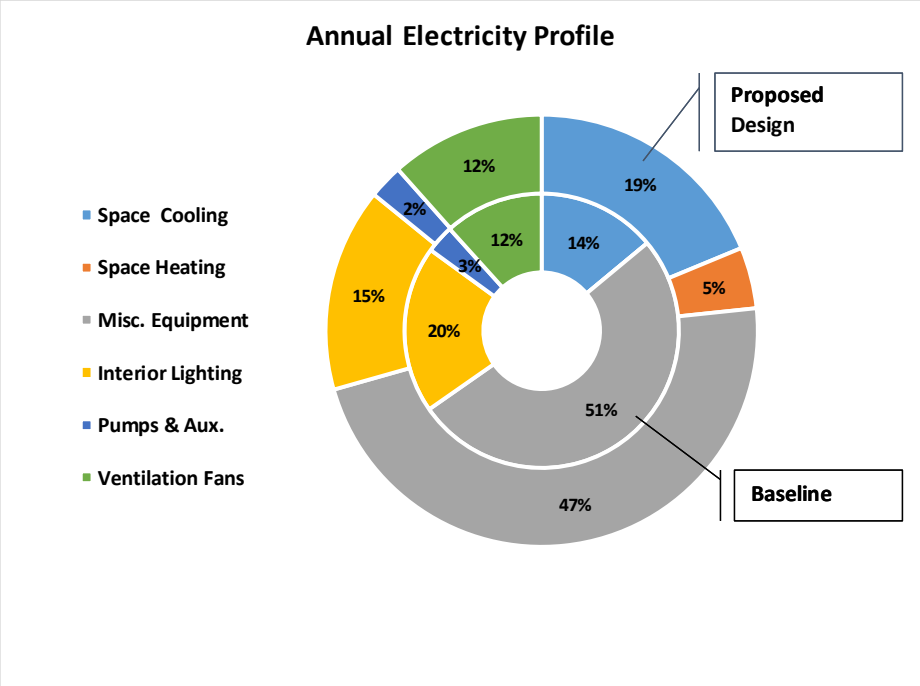
# 135 Broadway Street – Residential Towers on North Garage

## Cumulative Annual Energy Consumption

**Baseline and Proposed Design Comparison**

| | Interior Lighting | Elevator | Misc. Equipment | Space Heating | Space Cooling | Heat Rejection | Pumps & Aux. | Ventilation Fans | Exterior Lighting | | Space Heating | Domestic HW | | Total | Energy Savings Compared to Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | | *Therms* | *Therms* | | *MBTU* | *%* |
| **Baseline** | 650,153 | 822,047 | 870,641 | 0 | 458,004 | 2,713 | 108,851 | 385,411 | 0 | | 103,018 | 43,286 | | 25,883 | |
| **Proposed Design** | 546,111 | 822,047 | 870,641 | 164,107 | 666,510 | 4,881 | 91,935 | 414,425 | 0 | | 48,549 | 25,708 | | 19,643 | **24.11%** |




**Proposed Design Case includes following ECMs:**

- ECM 1: Improved Glazing Properties
- ECM 2: Improved Roof Insulation
- ECM 3: Improved Exterior Wall Insulation
- ECM 4: Improved Interior Lighting Power Density (Building and Garage)
- ECM 5: Low-Flow Water Fixtures and High-Efficiency DW Heater
- ECM 6: High-efficiency Water Source Heat Pumps for Residential Units
- ECM 7: High-efficiency ERU for Corridor Ventilation and Toilet Exhaust
- ECM 8: High-efficiency Condensing Gas-fired HW Boiler

# 145 Broadway Street – 11 Cambridge Center Office

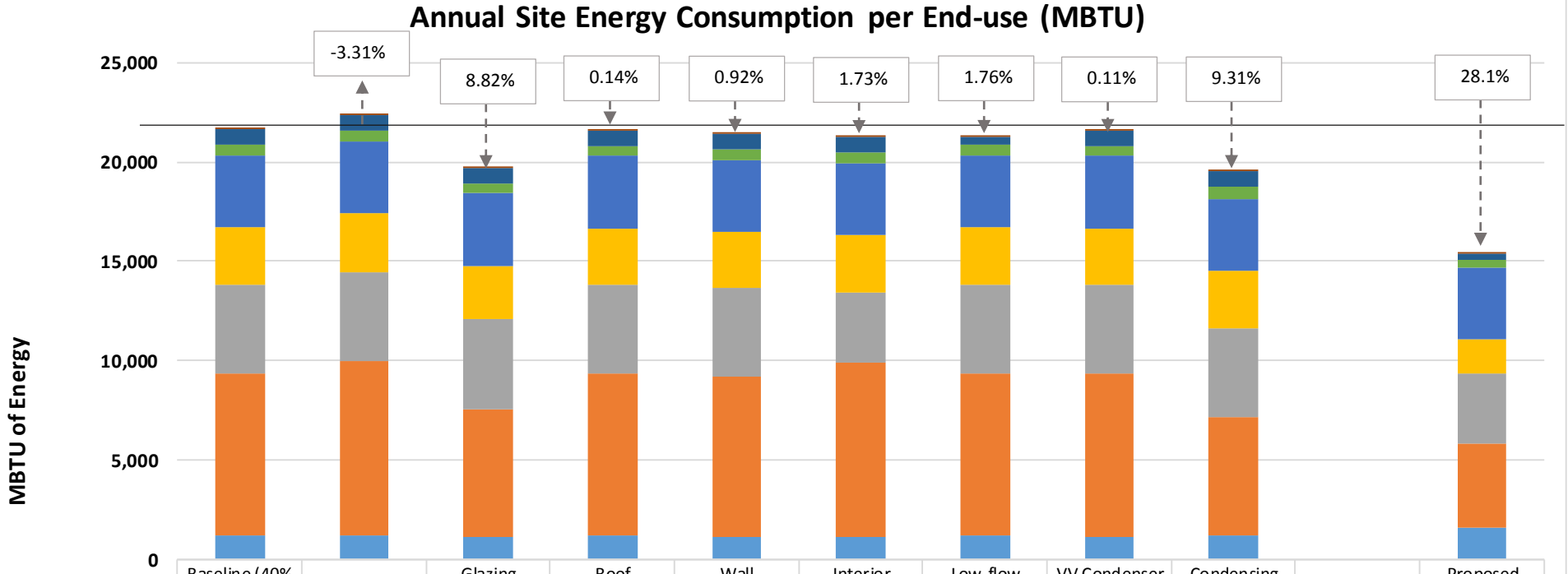
## Energy Modeling Assumptions

| | ASHRAE 90.1-2007 Baseline | | ASHRAE 90.1-2010 | Proposed Design & ECMs (Energy Conservation Measures) |
|---|---|---|---|---|
| Envelope | Metal Framing Curtainwall | U-value 0.45; SHGC-0.4 | U-value 0.45; SHGC-0.4 | Curtainwall with Low-E Double Pane Glass |
| | Window-To-Wall Ratio | 40% | 40% | 48% |
| | Roof | R-20 c.i.; U-value of 0.048 | R-20 c.i.; U-value of 0.048 | R-25 c.i.; U-value of 0.039 |
| | Exterior Walls (steel-framed) | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-10 c.i.; U-0.055 |
| | | | | |
| Interior Loads | Occupancy | 250 SF/ Person | 250 SF/ Person | 250 SF/ Person |
| | Interior Lighting | 1 W/SF Office (Building Area Method)<br>0.2 W/SF Parking Garage | 0.9 W/SF Office (Building Area Method)<br>0.25 W/SF Parking Garage | 0.8 W/SF Office (Overall 20% Reduction)<br>0.15 W/SF Parking Garage (25% Reduction) |
| | Office Plug Load | 0.75 W/SF | 0.75 W/SF | 0.75 W/SF |
| | Elevator Load | 4 cars (30 kW per car) | 4 cars (30 kW per car) | 4 cars (30 kW per car) |
| | | | | |
| DHW | Low-Flow Hot Water Fixtures | 0.5 GPM Lavatory Faucet | 0.5 GPM Lavatory Faucet | 0.5 GPM (0.1 GPC) Metering Lav Faucet |
| | | 2.5 GPM Showers | 2.5 GPM Showers | 1.5 GPM Showers |
| | | 2.2 GPM Kitchenette Faucet | 2.2 GPM Kitchenette Faucet | 1.5 GPM Kitchenette Faucet |
| | Gas-fired Water Heater | Efficiency: 80% | Efficiency: 80% | Efficiency: 96% |
| | | | | |
| CW System | Cooling Tower Fan Control | Two-Speed Axial Fans | Two-Speed Axial Fans | Variable Speed Fans |
| | Cooling Tower Fan Power | 19.5 W/gpm | 19.5 W/gpm | Less than 19.5 W/gpm |
| | Condenser Water ΔT | 10˚ F | 10˚ F | 15˚ F |
| | CW Pump Control | One Speed Pumps | One Speed Pumps | Variable Speed Pumps |
| | | | | |
| HW System | HW Boilers | 80% Efficient Natural Draft | 80% Efficient Natural Draft | 96% Efficient Condensing |
| | HW Pump Control | Variable Speed Pumps | Variable Speed Pumps | Variable Speed Pumps |
| | HW Supply Temperature | 180˚ F | 180˚ F | 150˚ F |
| | Hot Water ΔT | 50˚ F | 50˚ F | 30˚ F |
| | | | | |
| Air-Side HVAC | Ventilation (Building) | Floor-by-Floor: ASHRAE 62.1 Minimum Rates (fixed Rates) | Floor-by-Floor: ASHRAE 62.1 Minimum Rates (fixed Rates) | Dedicated OA System |
| | Ventilation (Garage) | CO Control as Designed | CO Control as Designed | CO Control: VAV operation - 0.75 CFM/SF only 4 hrs per day and 0.07 CFM/SF the rest. |
| | Space Heating/ Cooling | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 40%. | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 30%. | Water Cooled AC; DX Cooling; Perimeter FPT with Reheat and EC Motors |
| | System Efficiency | Centrifugal Chiller >300 tons<br>6.1 COP and 6.40 IPLV | Centrifugal Chiller >600 tons - Path B<br>5.95 COP and 8.78 IPLV | VPAC - Efficiency: At least 13 EER<br>(2007/2010 Code Requirements: 10.8 EER) |
| | Supply Fan Control | Variable Speed | Variable Speed | Variable Speed |
| | VAV Fan Part-Load Performance | ASHRAE 90.1 Part Load | ASHRAE 90.1 Part Load | Static Pressure Reset Control |

**Note 2** The Baseline Model is based on ASHRAE 90.1-2007 (Consistent with the current Stretch Energy Code); ASHRAE 90.1-2010 requirements have been added for comparison purposes.
The highlighted cells show the project-related differences between the two standards.

# 145 Broadway Street – 11 Cambridge Center Office

## Site Energy Use Comparison




| | Baseline (40% Glass) | 48% Glass | Glazing Improvement | Roof Insulation | Wall Insulation | Interior Lighting | Low-flow Fixtures | VV Condenser Water | Condensing Boilers | | Proposed Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heat Rejection | 12 | 12 | 12 | 12 | 12 | 11 | 12 | 14 | 12 | | 15 |
| Domestic HW | 776 | 777 | 776 | 776 | 776 | 777 | 390 | 776 | 776 | | 358 |
| Pumps & Aux. | 524 | 565 | 506 | 523 | 519 | 522 | 524 | 524 | 593 | | 350 |
| Misc. Equipment | 3,625 | 3,625 | 3,625 | 3,625 | 3,625 | 3,625 | 3,625 | 3,625 | 3,625 | | 3,625 |
| Ventilation Fans | 2,858 | 2,915 | 2,717 | 2,861 | 2,847 | 2,863 | 2,858 | 2,858 | 2,858 | | 1,691 |
| Interior Lighting | 4,488 | 4,488 | 4,488 | 4,488 | 4,488 | 3,574 | 4,488 | 4,488 | 4,488 | | 3,574 |
| Space Heating | 8,182 | 8,739 | 6,409 | 8,151 | 8,001 | 8,746 | 8,182 | 8,182 | 5,995 | | 4,232 |
| Space Cooling | 1,174 | 1,247 | 1,170 | 1,173 | 1,169 | 1,142 | 1,174 | 1,147 | 1,174 | | 1,576 |

Space Cooling | Space Heating | Interior Lighting | Ventilation Fans | Misc. Equipment | Pumps & Aux. | Domestic HW | Heat Rejection

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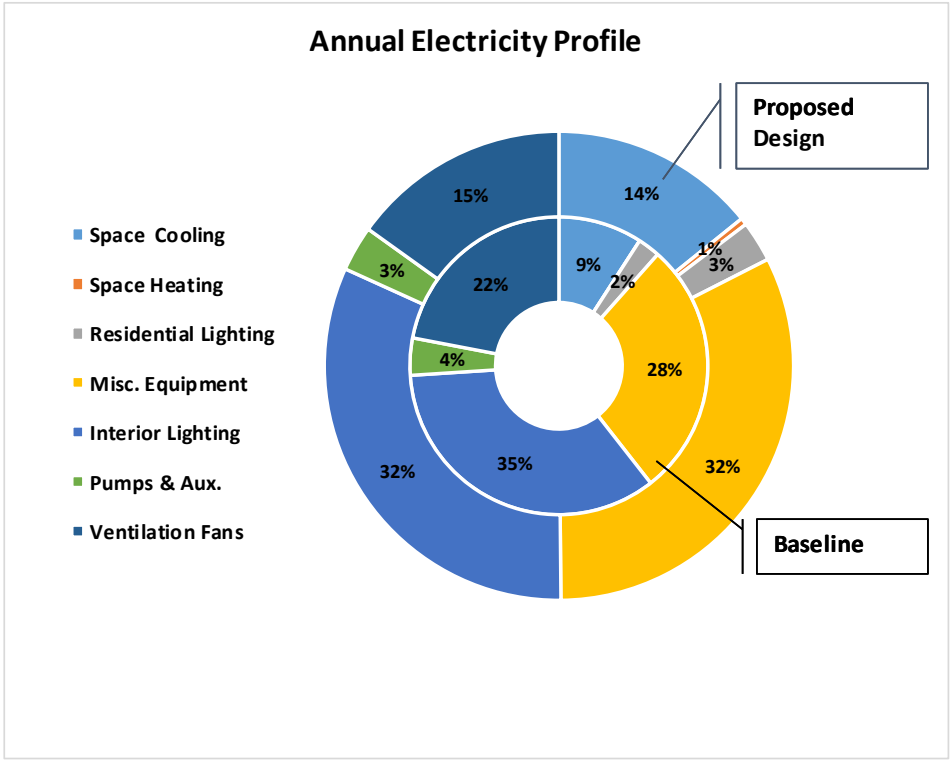
# 145 Broadway Street – 11 Cambridge Center Office

## Cumulative Annual Energy Consumption

### Baseline and Proposed Design Comparison

| | Interior Lighting | Residential Lighting | Misc. Equipment | Space Heating | Space Cooling | Heat Rejection | Pumps & Aux. | Ventilation Fans | Exterior Lighting | | Space Heating | Domestic HW | | Total | Energy Savings Compared to Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | | *Therms* | *Therms* | | *MBTU* | *%* |
| **Baseline** | 1,315,302 | 92,349 | 1,062,232 | 0 | 344,021 | 3,419 | 153,667 | 837,481 | 6,844 | | 81,823 | 7,763 | | 21,976 | |
| **Proposed Design** | 1,047,552 | 92,349 | 1,062,231 | 15,607 | 461,854 | 4,517 | 102,462 | 495,602 | 6,844 | | 42,318 | 3,576 | | 15,812 | **28.05%** |




**Proposed Design Case includes following ECMs:**

- ECM 1: Improved Glazing Properties
- ECM 2: Improved Roof Insulation
- ECM 3: Improved Exterior Wall Insulation
- ECM 4: Improved Interior Lighting Power Density (Building and Garage)
- ECM 5: Low-Flow Water Fixtures and High-Efficiency DW Heater
- ECM 6: Variable Volume Condensing Water Pumps
- ECM 7: VFD on Cooling Towers Fans and Higher CW delta T
- ECM 8: High-efficiency Condensing Gas-fired HW Boiler

# 250 Binney Street – 14 Cambridge Center Office

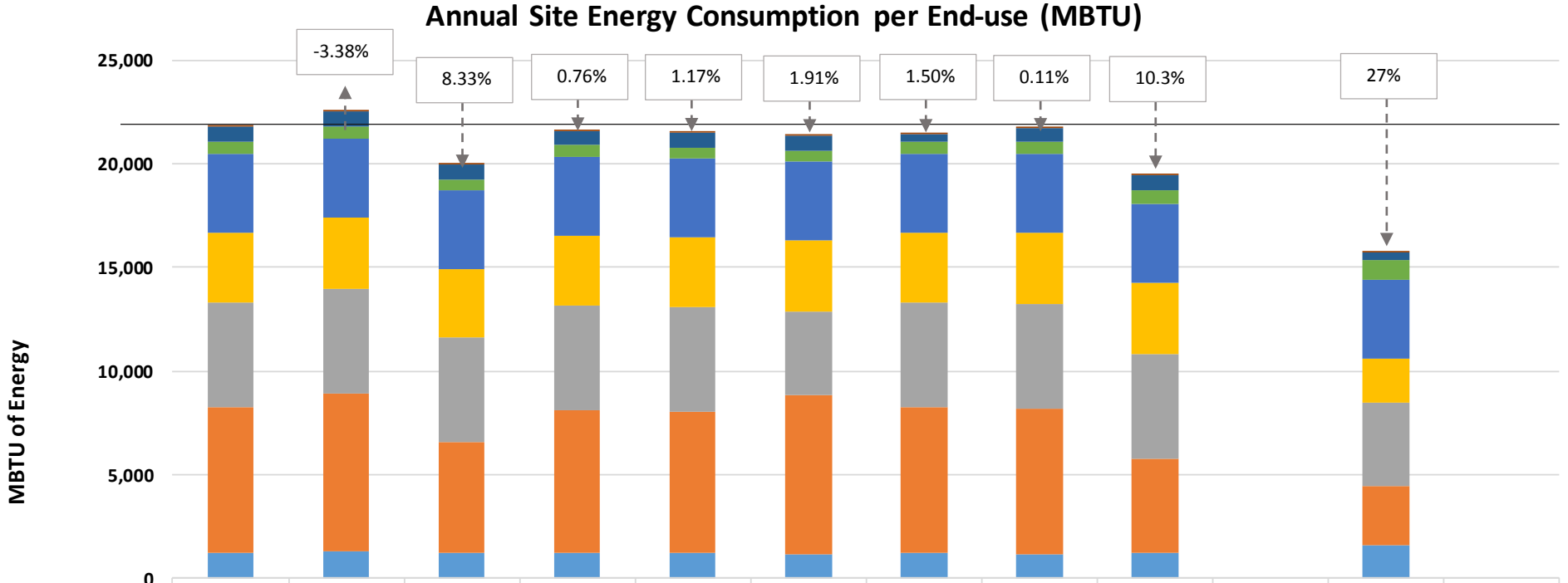
## Energy Modeling Assumptions

| | ASHRAE 90.1-2007 Baseline | | ASHRAE 90.1-2010 | Proposed Design & ECMs (Energy Conservation Measures) |
|---|---|---|---|---|
| Envelope | Metal Framing Curtainwall | U-value 0.45; SHGC-0.4 | U-value 0.45; SHGC-0.4 | Curtainwall with Low-E Double Pane Glass |
| | Window-To-Wall Ratio | 40% | 40% | 48% |
| | Roof | R-20 c.i.; U-value of 0.048 | R-20 c.i.; U-value of 0.048 | R-25 c.i.; U-value of 0.039 |
| | Exterior Walls (steel-framed) | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-10 c.i.; U-0.055 |
| | | | | |
| Interior Loads | Occupancy | 250 SF/ Person | 250 SF/ Person | 250 SF/ Person |
| | Interior Lighting | 1 W/SF Office (Building Area Method)<br>0.2 W/SF Parking Garage | 0.9 W/SF Office (Building Area Method)<br>0.25 W/SF Parking Garage | 0.8 W/SF Office (Overall 20% Reduction)<br>0.15 W/SF Parking Garage (25% Reduction) |
| | Office Plug Load | 0.75 W/SF | 0.75 W/SF | 0.75 W/SF |
| | Elevator Load | 4 cars (30 kW per car) | 4 cars (30 kW per car) | 4 cars (30 kW per car) |
| | | | | |
| DHW | Low-Flow Hot Water Fixtures | 0.5 GPM Lavatory Faucet | 0.5 GPM Lavatory Faucet | 0.5 GPM (0.1 GPC) Metering Lav Faucet |
| | | 2.5 GPM Showers | 2.5 GPM Showers | 1.5 GPM Showers |
| | | 2.2 GPM Kitchenette Faucet | 2.2 GPM Kitchenette Faucet | 1.5 GPM Kitchenette Faucet |
| | Gas-fired Water Heater | Efficiency: 80% | Efficiency: 80% | Efficiency: 96% |
| | | | | |
| CW System | Cooling Tower Fan Control | Two-Speed Axial Fans | Two-Speed Axial Fans | Variable Speed Fans |
| | Cooling Tower Fan Power | 19.5 W/gpm | 19.5 W/gpm | Less than 19.5 W/gpm |
| | Condenser Water ΔT | 10˚ F | 10˚ F | 15˚ F |
| | CW Pump Control | One Speed Pumps | One Speed Pumps | Variable Speed Pumps |
| | | | | |
| HW System | HW Boilers | 80% Efficient Natural Draft | 80% Efficient Natural Draft | 96% Efficient Condensing |
| | HW Pump Control | Variable Speed Pumps | Variable Speed Pumps | Variable Speed Pumps |
| | HW Supply Temperature | 180˚ F | 180˚ F | 150˚ F |
| | Hot Water ΔT | 50˚ F | 50˚ F | 30˚ F |
| | | | | |
| Air-Side HVAC | Ventilation (Building) | Floor-by-Floor: ASHRAE 62.1 Minimum Rates (fixed Rates) | Floor-by-Floor: ASHRAE 62.1 Minimum Rates (fixed Rates) | Dedicated OA System |
| | Ventilation (Garage) | CO Control as Designed | CO Control as Designed | CO Control: VAV operation - 0.75 CFM/SF only 4 hrs per day and 0.07 CFM/SF the rest. |
| | Space Heating/ Cooling | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 40%. | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 30%. | Water Cooled AC; DX Cooling; Perimeter FPT with Reheat and EC Motors |
| | System Efficiency | Centrifugal Chiller >300 tons<br>6.1 COP and 6.40 IPLV | Centrifugal Chiller >600 tons - Path B<br>5.95 COP and 8.78 IPLV | VPAC - Efficiency: At least 13 EER<br>(2007/2010 Code Requirements: 10.8 EER) |
| | Supply Fan Control | Variable Speed | Variable Speed | Variable Speed |
| | VAV Fan Part-Load Performance | ASHRAE 90.1 Part Load | ASHRAE 90.1 Part Load | Static Pressure Reset Control |

**Note 2** The Baseline Model is based on ASHRAE 90.1-2007 (Consistent with the current Stretch Energy Code); ASHRAE 90.1-2010 requirements have been added for comparison purposes.
The highlighted cells show the project-related differences between the two standards.

# 250 Binney Street – 14 Cambridge Center Office

## Site Energy Use Comparison




| | Baseline (40% Glass) | 48% Glass | Glazing Improvement | Roof Insulation | Wall Insulation | Interior Lighting | Low-flow Fixtures | VV Condenser Water | Condensing Boilers | | Proposed Design |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Heat Rejection | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 15 | 12 | | 16 |
| Domestic HW | 714 | 714 | 714 | 714 | 714 | 714 | 381 | 714 | 714 | | 381 |
| Pumps & Aux. | 551 | 590 | 536 | 551 | 550 | 551 | 551 | 551 | 643 | | 992 |
| Misc. Equipment | 3,809 | 3,809 | 3,809 | 3,809 | 3,809 | 3,809 | 3,809 | 3,809 | 3,809 | | 3,809 |
| Ventilation Fans | 3,416 | 3,474 | 3,254 | 3,402 | 3,382 | 3,423 | 3,416 | 3,416 | 3,416 | | 2,113 |
| Interior Lighting | 5,055 | 5,055 | 5,055 | 5,055 | 5,055 | 4,016 | 5,055 | 5,055 | 5,055 | | 4,016 |
| Space Heating | 7,040 | 7,621 | 5,379 | 6,888 | 6,817 | 7,683 | 7,040 | 7,040 | 4,588 | | 2,818 |
| Space Cooling | 1,199 | 1,269 | 1,194 | 1,199 | 1,199 | 1,165 | 1,199 | 1,172 | 1,199 | | 1,620 |

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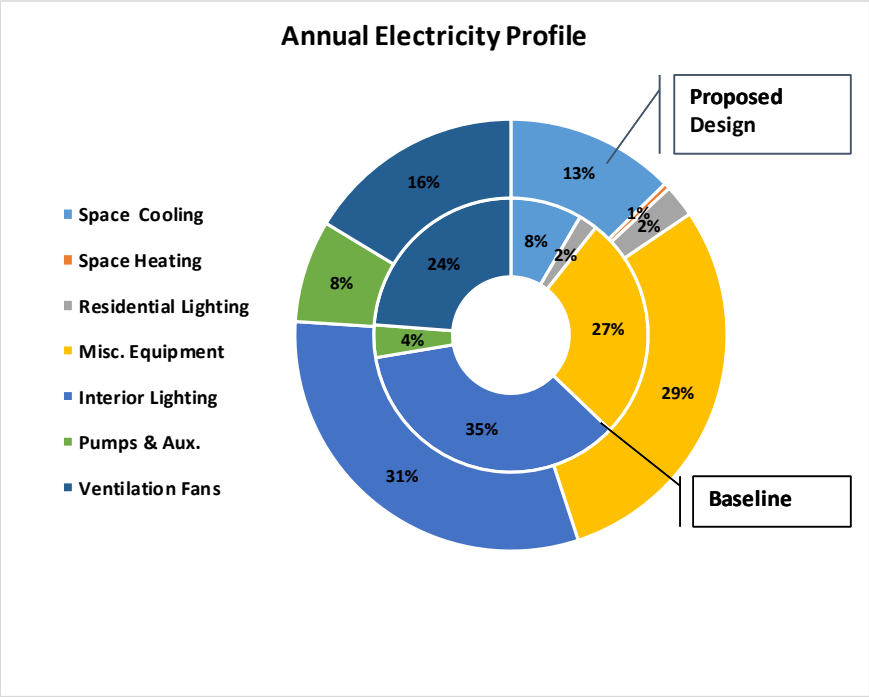
# 250 Binney Street – 14 Cambridge Center Office

## Cumulative Annual Energy Consumption

**Baseline and Proposed Design Comparison**

| | Interior Lighting | Residential Lighting | Misc. Equipment | Space Heating | Space Cooling | Heat Rejection | Pumps & Aux. | Ventilation Fans | Exterior Lighting | | Space Heating | Domestic HW | | Total | Energy Savings Compared to Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | | *Therms* | *Therms* | | *MBTU* | *%* |
| **Baseline** | 1,481,402 | 92,349 | 1,115,989 | 0 | 351,317 | 3,538 | 161,572 | 1,000,982 | 9,057 | | 70,396 | 7,140 | | 22,139 | |
| **Proposed Design** | 1,177,065 | 92,349 | 1,115,989 | 17,067 | 474,528 | 4,675 | 290,562 | 619,245 | 9,057 | | 28,182 | 3,806 | | 16,166 | **26.98%** |




**Proposed Design Case includes following ECMs:**

- ECM 1: Improved Glazing Properties
- ECM 2: Improved Roof Insulation
- ECM 3: Improved Exterior Wall Insulation
- ECM 4: Improved Interior Lighting Power Density (Building and Garage)
- ECM 5: Low-Flow Water Fixtures and High-Efficiency DW Heater
- ECM 6: Variable Volume Condensing Water Pumps
- ECM 7: VFD on Cooling Towers Fans and Higher CW delta T
- ECM 8: High-efficiency Condensing Gas-fired HW Boiler

# Kendall Square Urban Renewal Plan – Whitehead Commercial Office and Lab

Boston Properties

March 11, 2015

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# Whitehead Commercial Office and Lab

## Energy Modeling Assumptions

**Geometry**

| Building Geometry - Areas (SF) | | | | | | |
|---|---|---|---|---|---|---|
| **Floors** | **Retail** | **Lobby** | **Mezz.** | **Lab** | **Office** | **Mech. P** |
| ***Mechanical Penthouse*** | | | | | | 9,300 |
| ***7th Floor*** | | | | 5,580 | 3,720 | |
| ***6th Floor*** | | | | 5,580 | 3,720 | |
| ***5th Floor*** | | | | 5,580 | 3,720 | |
| ***4th Floor*** | | | | 5,580 | 3,720 | |
| ***3rd Floor*** | | | | 5,580 | 3,720 | |
| ***2nd Floor*** | | | 3,000 | | | |
| ***Ground Floor*** | 7,300 | 2,000 | | | | |

| **Total** | **Retail** | **Lobby** | **Mezz.** | **Lab** | **Office** | **Mech. P** |
|---|---|---|---|---|---|---|
| | 7,300 | 2,000 | 3,000 | 27,900 | 18,600 | 9,300 |
| | 68,100 | | | | | |

| **WWR Study** | **Wall Area** | **Window Area** | **Window-to-Wall Ratio** |
|---|---|---|---|
| **North** | 2,832 | 0 | 0% |
| **East** | 4,545 | 5,157 | 53% |
| **South** | 9,538 | 8,974 | 48% |
| **West** | 4,607 | 5,094 | 53% |
| **Total** | 21,522 | 19,225 | 47% |

| |
|---|
| Terracotta Rain Screen System and Curtainwall, 50%/50% |

# Whitehead Commercial Office and Lab

## Energy Modeling Assumptions

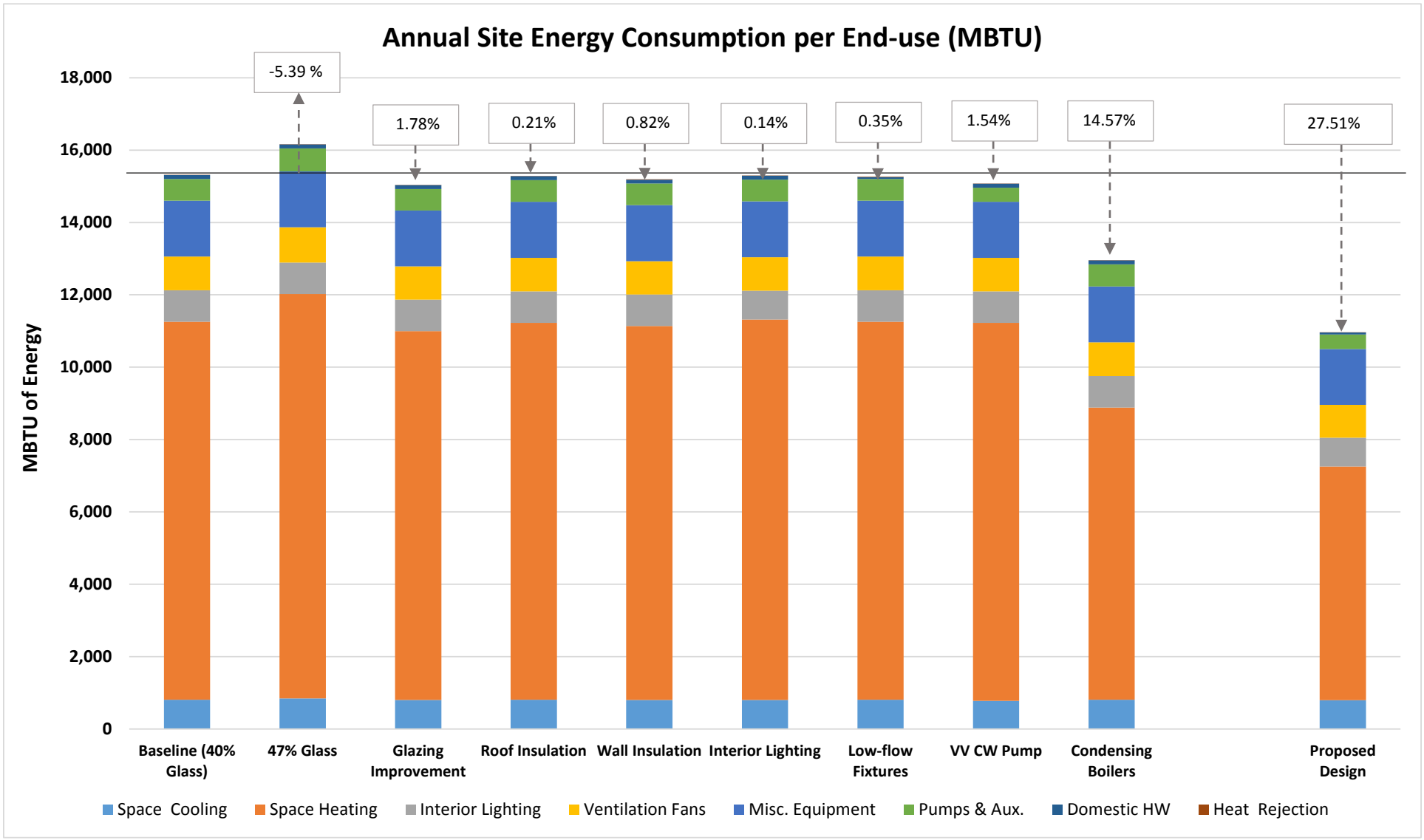
**Baseline and Proposed Design Inputs**

| | | ASHRAE 90.1-2007 Baseline | ASHRAE 90.1-2010 | Proposed Design and Suggested ECMs |
|---|---|---|---|---|
| Envelope | Metal Framing Curtainwall | U-value 0.45; SHGC-0.4 | U-value 0.45; SHGC-0.4 | Curtainwall with Low-E Double Pane Glass<br>Overall U-Value 0.41; SHGC-0.38 |
| | Window-To-Wall Ratio | 40% | 40% | 47% |
| | Roof | R-20 c.i.; U-value of 0.048 | R-20 c.i.; U-value of 0.048 | R-25 c.i.; U-value of 0.039 |
| | Exterior Walls (steel-framed) | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-7.5 c.i.; U-0.064 | R-13 + R-13 c.i.; U-0.055 |
| | | | | |
| Interior Loads | Occupancy | Office: 250 SF/ Person; Lab: 400 SF/ Person | Office: 250 SF/ Person; Lab: 400 SF/ Person | Office: 250 SF/ Person; Lab: 400 SF/ Person |
| | Interior Lighting | 1 W/SF Office; 1.4 W/SF Lab; 1.7 W/SF Retail | 0.98 W/SF Office; 1.81 W/SF Lab; 1.4 W/SF Retail | 0.9 W/SF Office (Overall 10% Reduction)<br>0.15 W/SF Parking Garage (25% Reduction) |
| | Office Plug Load | Office: 0.75 W/SF; Lab: 1.4 W/SF | Office: 0.75 W/SF; Lab: 1.4 W/SF | Office: 0.75 W/SF; Lab: 1.4 W/SF |
| | Elevator Load | 2 cars (30 kW per car) | 2 cars (30 kW per car) | 2 cars (30 kW per car) |
| | | | | |
| DHW | Low-Flow Hot Water Fixtures | 0.5 GPM Lavatory Faucet | 0.5 GPM Lavatory Faucet | 0.5 GPM (0.1 GPC) Metering Lav Faucet |
| | | 2.5 GPM Showers | 2.5 GPM Showers | 1.5 GPM Showers |
| | | 2.2 GPM Kitchenette Faucet | 2.2 GPM Kitchenette Faucet | 1.5 GPM Kitchenette Faucet |
| | Gas-fired Water Heater | Efficiency: 80% | Efficiency: 80% | Efficiency: 96% |
| | | | | |
| CW System | Cooling Tower Fan Control | Two-Speed Axial Fans | Two-Speed Axial Fans | Variable Speed Fans |
| | Cooling Tower Fan Power | 19.5 W/gpm | 19.5 W/gpm | Less than 19.5 W/gpm |
| | Condenser Water ΔT | 10˚ F | 10˚ F | 15˚ F |
| | CW Pump Control | One Speed Pumps | One Speed Pumps | Variable Speed Pumps |
| | | | | |
| CHW System | Chiller Type | Rotary Screw | Rotary Screw | Variable Speed Fans |
| | Chiller Efficiency | 4.9 COP | Path B: 4.9 COP and 6.5 IPLV | 6.1 COP |
| | Chilled Water ΔT | 12˚ F | 12˚ F | 12˚ F |
| | CHW Pump Control | One Speed Pumps | One Speed Pumps | Variable Speed Pumps |
| | | | | |
| HW System | HW Boilers | 80% Efficient Natural Draft | 80% Efficient Natural Draft | 96% Efficient Condensing |
| | HW Pump Control | One Speed Pumps | One Speed Pumps | Variable Speed Pumps |
| | HW Supply Temperature | 180˚ F | 180˚ F | 150˚ F |
| | Hot Water ΔT | 50˚ F | 50˚ F | 30˚ F |
| | | | | |
| Air-Side HVAC | Ventilation | Floor-by-Floor: 20% OA in Office and 100% OA in Lab | Floor-by-Floor: 20% OA in Office and 100% OA in Lab | 100% OA Unit serving lab spaces, and a 100% OA Dedicated OA System providing OA to office FCUs |
| | Space Heating/ Cooling | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 40%. | Packaged Rooftop, Chilled Water Cooling; VAV with Reheat with Min. Volume setpoint of 30%. | Lab: 100% Packaged Rooftop Unit with ERV, Chilled Water Cooling and VAV with Hot Water Reheat.<br>Office: 4-pipe Fan Coil Units |
| | Supply Fan Control | Variable Speed | Variable Speed | Lab: Variable Speed; Office: Constant Volume FCUs |
| | VAV Fan Part-Load Performance | ASHRAE 90.1 Part Load | ASHRAE 90.1 Part Load | Static Pressure Reset Control |

**Note 2** The Baseline Model is based on ASHRAE 90.1-2007 (Consistent with the current Stretch Energy Code); ASHRAE 90.1-2010 requirements have been added for comparison purposes.
The highlighted cells show the project-related differences between the two standards.

# Whitehead Commercial Office and Lab

## Site Energy Use Comparison

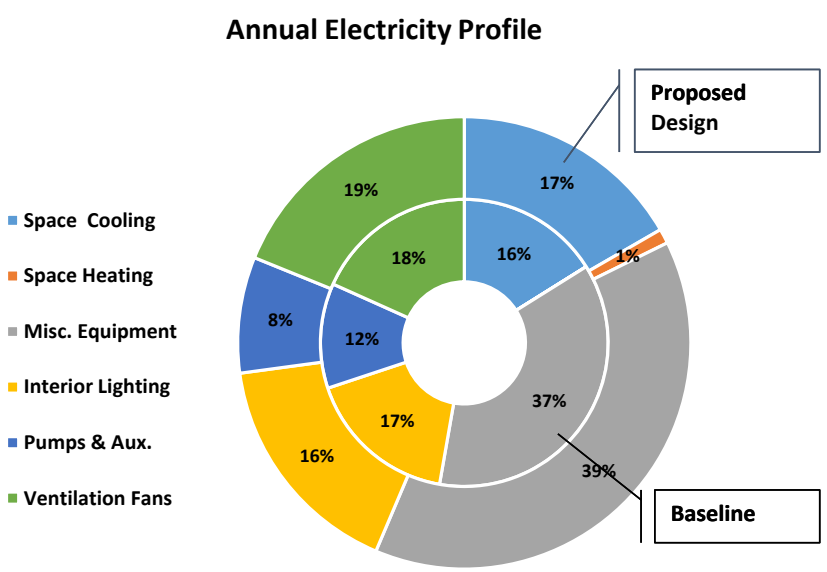


# Whitehead Commercial Office and Lab

## Cumulative Annual Energy Consumption

**Baseline and Proposed Design Comparison**

| | Interior Lighting | Elevator | Misc. Equipment | Space Heating | Space Cooling | Heat Rejection | Pumps & Aux. | Ventilation Fans | Exterior Lighting | | Space Heating | Domestic HW | | Total | Energy Savings Compared to Baseline |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | *kWh* | | *Therms* | *Therms* | | *MBTU* | *%* |
| **Baseline** | 255,096 | 92,664 | 453,058 | 0 | 237,106 | 2,455 | 176,021 | 272,107 | 2,960 | | 104,475 | 1,091 | | 15,645 | |
| **Proposed Design** | 232,503 | 92,664 | 453,058 | 14,761 | 233,253 | 1,741 | 117,064 | 265,930 | 2,960 | | 64,614 | 548 | | 11,342 | **27.51%** |




**Proposed Design Case includes following ECMs:**

- ECM 1: Improved Glazing Properties
- ECM 2: Improved Roof Insulation
- ECM 3: Improved Exterior Wall Insulation
- ECM 4: Improved Interior Lighting Power Density
- ECM 5: Low-Flow Water Fixtures and High-Efficiency DW Heater
- ECM 6: Variable Volume Condensing Water Pumps
- ECM 7: VFD on Cooling Towers Fans and Higher CW delta T
- ECM 8: High-efficiency Condensing Gas-fired HW Boiler
- ECM 9: High-efficiency Chillers
- ECM 10: Energy Recovery Unit for Labs

# Energy and Emissions Model Summary

# Stationary Source Greenhouse Gas Emissions Estimate

**Job number: 12959.00**
**Project: KSURP**

**135 Broadway Street (Residential Towers on North Garage)**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Elevator | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 458,004 | 2,713 | 0 | 103,018 | 43,286 | 385,411 | 108,851 | 822,047 | 870,641 | 650,153 | 0 | 3,297,820 | 14,630 | 25,883 |
| **DESIGN** | 666,510 | 4,881 | 164,107 | 48,549 | 25,708 | 414,425 | 91,935 | 822,047 | 870,641 | 546,111 | 0 | 3,580,657 | 7,426 | 19,643 |
| **END-USE SAVINGS** | -208,506 | -2,168 | -164,107 | 54,469 | 17,578 | -29,014 | 16,916 | 0 | 0 | 104,042 | 0 | -282,837 | 7,205 | 6,240 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 24.1% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Elevator | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 166.3 | 1.0 | 0.0 | 603.1 | 253.4 | 139.9 | 39.5 | 298.4 | 316.0 | 236.0 | 0.0 | 1,197.1 | 856.5 | 2,053.6 |
| **DESIGN** | 241.9 | 1.8 | 59.6 | 284.2 | 150.5 | 150.4 | 33.4 | 298.4 | 316.0 | 198.2 | 0.0 | 1,299.8 | 434.7 | 1,734.5 |
| **END-USE SAVINGS** | -75.7 | -0.8 | -59.6 | 318.9 | 102.9 | -10.5 | 6.1 | 0.0 | 0.0 | 37.8 | 0.0 | -102.7 | 421.8 | 319.1 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 15.5% |

**145 Broadway Street (11 Cambridge Center) Office**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 344,021 | 3,419 | 0 | 81,823 | 7,763 | 837,481 | 153,667 | 92,349 | 1,062,232 | 1,315,302 | 6,844 | 3,815,315 | 8,959 | 21,977 |
| **DESIGN** | 461,854 | 4,517 | 15,607 | 42,318 | 3,576 | 495,602 | 102,462 | 92,349 | 1,062,231 | 1,047,552 | 6,844 | 3,289,018 | 4,589 | 15,812 |
| **END-USE SAVINGS** | -117,833 | -1,098 | -15,607 | 39,505 | 4,187 | 341,879 | 51,205 | 0 | 1 | 267,750 | 0 | 526,297 | 4,369 | 6,165 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 28.1% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 124.9 | 1.2 | 0.0 | 479.0 | 45.4 | 304.0 | 55.8 | 33.5 | 385.6 | 477.5 | 2.5 | 1,385.0 | 524.4 | 1,909.4 |
| **DESIGN** | 167.7 | 1.6 | 5.7 | 247.7 | 20.9 | 179.9 | 37.2 | 33.5 | 385.6 | 380.3 | 2.5 | 1,193.9 | 268.7 | 1,462.6 |
| **END-USE SAVINGS** | -42.8 | -0.4 | -5.7 | 231.3 | 24.5 | 124.1 | 18.6 | 0.0 | 0.0 | 97.2 | 0.0 | 191.0 | 255.8 | 446.8 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 23.4% |

**250 Binney Street (14 Cambridge Center) Office**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 351,317 | 3,538 | 0 | 70,396 | 7,140 | 1,000,982 | 161,572 | 92,349 | 1,115,989 | 1,481,402 | 9,057 | 4,216,206 | 7,754 | 22,140 |
| **DESIGN** | 474,528 | 4,675 | 17,067 | 28,182 | 3,806 | 619,245 | 290,562 | 92,349 | 1,115,989 | 1,177,065 | 9,057 | 3,800,537 | 3,199 | 16,167 |
| **END-USE SAVINGS** | -123,211 | -1,137 | -17,067 | 42,214 | 3,334 | 381,737 | -128,990 | 0 | 0 | 304,337 | 0 | 415,669 | 4,555 | 5,973 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 27.0% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 127.5 | 1.3 | 0.0 | 412.1 | 41.8 | 363.4 | 58.7 | 33.5 | 405.1 | 537.7 | 3.3 | 1,530.5 | 453.9 | 1,984.4 |
| **DESIGN** | 172.3 | 1.7 | 6.2 | 165.0 | 22.3 | 224.8 | 105.5 | 33.5 | 405.1 | 427.3 | 3.3 | 1,379.6 | 187.3 | 1,566.9 |
| **END-USE SAVINGS** | -44.7 | -0.4 | -6.2 | 247.1 | 19.5 | 138.6 | -46.8 | 0.0 | 0.0 | 110.5 | 0.0 | 150.9 | 266.6 | 417.5 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 21.0% |

**Whitehead Office Expansion**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Elevator | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 237,106 | 2,455 | 0 | 104,475 | 1,091 | 272,107 | 176,021 | 92,664 | 453,058 | 255,096 | 2,960 | 1,491,467 | 10,557 | 15,646 |
| **DESIGN** | 233,253 | 1,741 | 14,761 | 64,614 | 548 | 265,930 | 117,064 | 92,664 | 453,058 | 232,503 | 2,960 | 1,413,934 | 6,516 | 11,341 |
| **END-USE SAVINGS** | 3,853 | 714 | -14,761 | 39,861 | 543 | 6,177 | 58,957 | 0 | 0 | 22,593 | 0 | 77,533 | 4,040 | 4,305 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 27.5% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Ext. Usage | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **BASELINE** | 86.1 | 0.9 | 0.0 | 611.6 | 6.4 | 98.8 | 63.9 | 33.6 | 164.5 | 92.6 | 1.1 | 541.4 | 618.0 | 1,159.4 |
| **DESIGN** | 84.7 | 0.6 | 5.4 | 378.3 | 3.2 | 96.5 | 42.5 | 33.6 | 164.5 | 84.4 | 1.1 | 513.3 | 381.5 | 894.7 |
| **END-USE SAVINGS** | 1.4 | 0.3 | -5.4 | 233.3 | 3.2 | 2.2 | 21.4 | 0.0 | 0.0 | 8.2 | 0.0 | 28.1 | 236.5 | 264.7 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 22.8% |

**PROJECT TOTAL**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Specialized Use | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 1,390,448 | 12,125 | 0 | 359,712 | 59,280 | 2,495,981 | 600,111 | 1,099,409 | 3,501,920 | 3,701,953 | 18,861 | 12,820,808 | 41,899 | 85,646 |
| **DESIGN** | 1,836,145 | 15,814 | 211,542 | 183,663 | 33,638 | 1,795,202 | 602,023 | 1,099,409 | 3,501,919 | 3,003,231 | 18,861 | 12,084,146 | 21,730 | 62,963 |
| **END-USE SAVINGS** | -445,697 | -3,689 | -211,542 | 176,049 | 25,642 | 700,779 | -1,912 | 0 | 1 | 698,722 | 0 | 736,662 | 20,169 | 22,683 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 26.5% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Specialized Use | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 504.7 | 4.4 | 0.0 | 2,105.8 | 347.0 | 906.0 | 217.8 | 399.1 | 1,271.2 | 1,343.8 | 6.8 | 4,654.0 | 2,452.8 | 7,106.7 |
| **DESIGN** | 666.5 | 5.7 | 76.8 | 1,075.2 | 196.9 | 651.7 | 218.5 | 399.1 | 1,271.2 | 1,090.2 | 6.8 | 4,386.5 | 1,272.1 | 5,658.6 |
| **END-USE SAVINGS** | -161.8 | -1.3 | -76.8 | 1,030.6 | 150.1 | 254.4 | -0.7 | 0.0 | 0.0 | 253.6 | 0.0 | 267.4 | 1,180.7 | 1,448.1 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 20.4% |

**CONVERSION TABLE**

| CONVERT | MULTIPLY BY |
|---|---|
| KWH TO MWH | 0.001 |
| MWH TO LBS[2] | 726 |
| THERMS TO MBTU | 0.1 |
| LBS TO SHORT TONS | 0.0005 |
| MBTU to KWH | 293.071 |
| MBTU to LBS[3] | 117.08 |

2 mwh to lbs of CO2 conversion factor from 2014 ISO New England Electric Generator Air Emissions Report
3 Mbtu to lbs of CO2 conversion factor from the EIA

## Stationary Source Greenhouse Gas Emissions Estimate with Energy Star Adjustment

**Job number: 12959.00**
**Project: KSURP**

**135 Broadway Street (Residential Towers on North Garage)**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Elevator | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 458,004 | 2,713 | 0 | 103,018 | 43,286 | 385,411 | 108,851 | 822,047 | 870,641 | 650,153 | 0 | 3,297,820 | 14,630 | 25,883 |
| **DESIGN** | 666,510 | 4,881 | 164,107 | 48,549 | 25,708 | 414,425 | 91,935 | 822,047 | 783,577 | 546,111 | 0 | 3,493,593 | 7,426 | 19,346 |
| **END-USE SAVINGS** | -208,506 | -2,168 | -164,107 | 54,469 | 17,578 | -29,014 | 16,916 | 0 | 87,064 | 104,042 | 0 | -195,773 | 7,205 | 6,537 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 25.3% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Elevator | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 166.3 | 1.0 | 0.0 | 603.1 | 253.4 | 139.9 | 39.5 | 298.4 | 316.0 | 236.0 | 0.0 | 1,197.1 | 856.5 | 2,053.6 |
| **DESIGN** | 241.9 | 1.8 | 59.6 | 284.2 | 150.5 | 150.4 | 33.4 | 298.4 | 284.4 | 198.2 | 0.0 | 1,268.2 | 434.7 | 1,702.9 |
| **END-USE SAVINGS** | -75.7 | -0.8 | -59.6 | 318.9 | 102.9 | -10.5 | 6.1 | 0.0 | 31.6 | 37.8 | 0.0 | -71.1 | 421.8 | 350.7 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 17.1% |

**145 Broadway Street (11 Cambridge Center) Office**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 344,021 | 3,419 | 0 | 81,823 | 7,763 | 837,481 | 153,667 | 92,349 | 1,062,232 | 1,315,302 | 6,844 | 3,815,315 | 8,959 | 21,977 |
| **DESIGN** | 461,854 | 4,517 | 15,607 | 42,318 | 3,576 | 495,602 | 102,462 | 92,349 | 956,009 | 1,047,552 | 6,844 | 3,182,796 | 4,589 | 15,450 |
| **END-USE SAVINGS** | -117,833 | -1,098 | -15,607 | 39,505 | 4,187 | 341,879 | 51,205 | 0 | 106,223 | 267,750 | 0 | 632,519 | 4,369 | 6,527 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 29.7% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 124.9 | 1.2 | 0.0 | 479.0 | 45.4 | 304.0 | 55.8 | 33.5 | 385.6 | 477.5 | 2.5 | 1,385.0 | 524.4 | 1,909.4 |
| **DESIGN** | 167.7 | 1.6 | 5.7 | 247.7 | 20.9 | 179.9 | 37.2 | 33.5 | 347.0 | 380.3 | 2.5 | 1,155.4 | 268.7 | 1,424.0 |
| **END-USE SAVINGS** | -42.8 | -0.4 | -5.7 | 231.3 | 24.5 | 124.1 | 18.6 | 0.0 | 38.6 | 97.2 | 0.0 | 229.6 | 255.8 | 485.4 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 25.4% |

**250 Binney Street (14 Cambridge Center) Office**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 351,317 | 3,538 | 0 | 70,396 | 7,140 | 1,000,982 | 161,572 | 92,349 | 1,115,989 | 1,481,402 | 9,057 | 4,216,206 | 7,754 | 22,140 |
| **DESIGN** | 474,528 | 4,675 | 17,067 | 28,182 | 3,806 | 619,245 | 290,562 | 92,349 | 1,004,390 | 1,177,065 | 9,057 | 3,688,938 | 3,199 | 15,786 |
| **END-USE SAVINGS** | -123,211 | -1,137 | -17,067 | 42,214 | 3,334 | 381,737 | -128,990 | 0 | 111,599 | 304,337 | 0 | 527,268 | 4,555 | 6,354 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 28.7% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Residential Lighting | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 127.5 | 1.3 | 0.0 | 412.1 | 41.8 | 363.4 | 58.7 | 33.5 | 405.1 | 537.7 | 3.3 | 1,530.5 | 453.9 | 1,984.4 |
| **DESIGN** | 172.3 | 1.7 | 6.2 | 165.0 | 22.3 | 224.8 | 105.5 | 33.5 | 364.6 | 427.3 | 3.3 | 1,339.1 | 187.3 | 1,526.3 |
| **END-USE SAVINGS** | -44.7 | -0.4 | -6.2 | 247.1 | 19.5 | 138.6 | -46.8 | 0.0 | 40.5 | 110.5 | 0.0 | 191.4 | 266.6 | 458.0 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 23.1% |

**Whitehead Office Expansion**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Ext. Usage | Misc. Equip.[1] | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (Therms) | (Therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 237,106 | 2,455 | 0 | 104,475 | 1,091 | 272,107 | 176,021 | 92,664 | 453,058 | 255,096 | 2,960 | 1,491,467 | 10,557 | 15,645 |
| **DESIGN** | 233,253 | 1,741 | 14,761 | 64,614 | 548 | 265,930 | 117,064 | 92,664 | 407,752 | 232,503 | 2,960 | 1,368,628 | 6,516 | 11,186 |
| **END-USE SAVINGS** | 3,853 | 714 | -14,761 | 39,861 | 543 | 6,177 | 58,957 | 0 | 45,306 | 22,593 | 0 | 122,839 | 4,040 | 4,460 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 28.5% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Ext. Usage | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 86.1 | 0.9 | 0.0 | 611.6 | 6.4 | 98.8 | 63.9 | 33.6 | 164.5 | 92.6 | 1.1 | 541.4 | 618.0 | 1,159.4 |
| **DESIGN** | 84.7 | 0.6 | 5.4 | 378.3 | 3.2 | 96.5 | 42.5 | 33.6 | 148.0 | 84.4 | 1.1 | 496.8 | 381.5 | 878.3 |
| **END-USE SAVINGS** | 1.4 | 0.3 | -5.4 | 233.3 | 3.2 | 2.2 | 21.4 | 0.0 | 16.4 | 8.2 | 0.0 | 44.6 | 236.5 | 281.1 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 24.2% |

**PROJECT TOTAL**

**ENERGY CONSUMPTION**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Specialized Use | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (kwh) | (kwh) | (kwh) | (therms) | (therms) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (kwh) | (MBtu) | (MBtu) |
| **BASELINE** | 1,390,448 | 12,125 | 0 | 359,712 | 59,280 | 2,495,981 | 600,111 | 1,099,409 | 3,501,920 | 3,701,953 | 18,861 | 12,820,808 | 41,899 | 85,645 |
| **DESIGN** | 1,836,145 | 15,814 | 211,542 | 183,663 | 33,638 | 1,795,202 | 602,023 | 1,099,409 | 3,151,728 | 3,003,231 | 18,861 | 11,733,955 | 21,730 | 61,768 |
| **END-USE SAVINGS** | -445,697 | -3,689 | -211,542 | 176,049 | 25,642 | 700,779 | -1,912 | 0 | 350,192 | 698,722 | 0 | 1,086,853 | 20,169 | 23,878 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 27.9% |

**GREENHOUSE GAS EMISSIONS**

| Scenario | Space Cool | Heat Rejection | Space Heating | Space Heating | Hot Water | Vent Fans | Pumps & Aux. | Specialized Use | Misc. Equip. | Interior Lighting | Exterior Lighting | Total Electricity | Total Gas | Total Energy |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) | (tons/yr) |
| **BASELINE** | 504.7 | 4.4 | 0.0 | 2,105.8 | 347.0 | 906.0 | 217.8 | 399.1 | 1,271.2 | 1,343.8 | 6.8 | 4,654.0 | 2,452.8 | 7,106.7 |
| **DESIGN** | 666.5 | 5.7 | 76.8 | 1,075.2 | 196.9 | 651.7 | 218.5 | 399.1 | 1,144.1 | 1,090.2 | 6.8 | 4,259.4 | 1,272.1 | 5,531.5 |
| **END-USE SAVINGS** | -161.8 | -1.3 | -76.8 | 1,030.6 | 150.1 | 254.4 | -0.7 | 0.0 | 127.1 | 253.6 | 0.0 | 394.5 | 1,180.7 | 1,575.2 |
| **PERCENT SAVINGS** | | | | | | | | | | | | | | 22.2% |

**CONVERSION TABLE**

| CONVERT | MULTIPLY BY |
|---|---|
| KWH TO MWH | 0.001 |
| MWH TO LBS[2] | 726 |
| THERMS TO MBTU | 0.1 |
| LBS TO SHORT TONS | 0.0005 |
| MBTU to KWH | 293.071 |
| MBTU to LBS[3] | 117.08 |

1 Plug-in loads accounted for by applying a 10% reduction of the Miscellaneous Equipment energy on all uses except residential (based on the discussions with MEPA/DOER).
2 mwh to lbs of CO2 conversion factor from 2014 ISO New England Electric Generator Air Emissions Report
3 Mbtu to lbs of CO2 conversion factor from the EIA

# Energy Use Index (EUI) Comparison Tables

# Site & Source Energy Use Intensity Comparison

## Site EUI

**Baseline and Proposed Design Comparison**

| 135 Broadway Residential Towers - North Garage | | | Residential | | |
|---|---|---|---|---|---|
| Area (all spaces) | 456,553 | | excluding parking garage | | |
| **Site Energy** | Electric | | Gas | Combined | EUI |
| | MWh/yr | kBtu/hr | kBtu/hr | kBtu/hr | kBtu/sf |
| **Baseline** | 3,298 | 11,252,162 | 14,630,400 | 25,882,562 | 57 |
| **Proposed** | 3,581 | 12,217,202 | 7,425,700 | 19,642,902 | 43 |
| ***% Proposed vs Baseline*** | | *-9%* | *49%* | *24%* | *24%* |

| 145 Broadway - 11 CC | | | Office | | |
|---|---|---|---|---|---|
| Area (all spaces) | 438,983 | | excluding parking garage | | |
| **Site Energy** | Electric | | Gas | Combined | EUI |
| | MWh/yr | kBtu/hr | kBtu/hr | kBtu/hr | kBtu/sf |
| **Baseline** | 3,815 | 13,017,855 | 8,958,600 | 21,976,455 | 50 |
| **Proposed** | 3,289 | 11,222,129 | 4,589,400 | 15,811,529 | 36 |
| ***% Proposed vs Baseline*** | | *14%* | *49%* | *28%* | *28%* |

| 250 Binney - 14 CC | | | Office | | |
|---|---|---|---|---|---|
| Area (all spaces) | 454,712 | | excluding parking garage | | |
| **Site Energy** | Electric | | Gas | Combined | EUI |
| | MWh/yr | kBtu/hr | kBtu/hr | kBtu/hr | kBtu/sf |
| **Baseline** | 4,216 | 14,385,695 | 8,958,600 | 23,344,295 | 51 |
| **Proposed** | 3,801 | 12,967,432 | 4,589,400 | 17,556,832 | 39 |
| ***% Proposed vs Baseline*** | | *10%* | *49%* | *25%* | *25%* |

# Site & Source Energy Use Intensity Comparison

Since the GHG emission factor for grid supplied electricity is more than twice as much as for natural gas, the design team implemented several energy conservation measures to lower the environmental impacts of buildings on a source-energy basis. As the following tables illustrate, the energy models show a 26.3 % reduction in energy use on a site-energy basis and 16.2% reduction in energy use on a source-energy basis.

| Site Energy | Baseline | | |
|---|---|---|---|
| | Site Electricity (kWh) | Site Gas (Therm) | Total Site Energy (MMBtu) |
| ***135 Broadway - Residential*** | 3,297,820 | 146,304 | 25,883 |
| ***145 Broadway - 11 CC Office*** | 3,815,315 | 89,586 | 21,976 |
| ***250 Binney - 14 CC Office*** | 4,216,206 | 77,536 | 22,139 |
| | 11,329,341 | 313,426 | 69,998 |

| Design | | |
|---|---|---|
| Site Electricity (kWh) | Site Gas (Therm) | Total Site Energy (MMBtu) |
| 3,580,657 | 74,257 | 19,643 |
| 3,289,018 | 45,894 | 15,812 |
| 3,800,537 | 31,988 | 16,166 |
| 10,670,212 | 152,139 | 51,621 |

| Percentage Savings | | |
|---|---|---|
| Electricity (%) | Site (%) | Total Energy (%) |
| -8.6% | 49.2% | **24.1%** |
| 13.8% | 48.8% | **28.1%** |
| 9.9% | 58.7% | **27.0%** |

| Reduction | | |
|---|---|---|
| | 18,378 | MMBtu |
| | **26.3%** | |

| Source Energy | Baseline | | |
|---|---|---|---|
| | Source Electricity (kWh) | Source Gas (Therm) | Total Source Energy (MMBtu) |
| ***North Garage and Office*** | 9,926,438 | 159,471 | 49,826 |
| ***11 Cambridge Center*** | 11,484,098 | 97,649 | 48,960 |
| ***3 Cambridge Center*** | 12,690,780 | 84,514 | 51,765 |
| | 34,101,316 | 341,634 | 150,551 |

| Design | | |
|---|---|---|
| Source Electricity (kWh) | Source Gas (Therm) | Total Source Energy (MMBtu) |
| 10,777,778 | 80,940 | 44,879 |
| 9,899,944 | 50,024 | 38,791 |
| 11,439,616 | 34,867 | 42,530 |
| 32,117,338 | 165,832 | 126,200 |

| Percentage Savings | | |
|---|---|---|
| Electricity (%) | Site (%) | Total Energy (%) |
| -8.6% | 49.2% | **9.9%** |
| 13.8% | 48.8% | **20.8%** |
| 9.9% | 58.7% | **17.8%** |

| Reduction | | |
|---|---|---|
| | 24,352 | MMBtu |
| | **16.2%** | |

# Combined Heat & Power (CHP) Supporting Documentation

## Combined Heat & Power Energy Impact Analysis

The potential connection to the local Kendall combined heat and power plant (Dalkia) was investigated following the site path energy modeling for cooling and heating energy. Detailed results are presented in the following table based on formula furnished by DOER "Guidance for the Application of the MEPA GHG Policy and Protocol to the use of the Dalkia CHP District Steam". The calculations show that if steam is used to offset natural gas used for heating, the total source energy associated with 3 buildings would be reduced by approximately 71% and the greenhouse gas emissions would be reduced significantly, again based on DOER formulas.

| Buildings | As-Proposed Energy Model | | | | Mitigated Without Optional Absorption Chillers Measure | | | | | | | Annual Savings | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | | D | E | F | G | H | I | | | |
| | | | | | B * 1.04 | | A - E | F * 3.01 | D * 1.59 | G + H | | | |
| | Site Electricity | Site Gas | Total Source Energy | Source Energy EUI | Note 1 | Elec. Cogenerated | Grid Electricity | SSFCF for Grid Elec. | SSFCF for CHP DS | Total Source Energy | Source Energy EUI | kWh of Electricity Savings | Annual CO2 Emissions Savings (Note 3) |
| | *MMBTU* | *MMBTU* | *MMBTU* | *kBtu/ SF* | *MMBTU* | *MMBTU* | *MMBTU* | *MMBTU* | *MMBTU* | *MMBTU* | *kBtu/SF* | *kWh* | *tons per year* |
| **135 Broadway - Residential** | 12,217 | 7,426 | 49,826 | **109** | 7,723 | 10,580 | 1,637 | 4,928 | 12,279 | 17,207 | **38** | 3,100,721 | 1,716 |
| **145 Broadway - 11 CC Office** | 11,222 | 4,589 | 97,649 | **222** | 4,773 | 6,539 | 4,683 | 14,096 | 7,589 | 21,685 | **49** | 1,916,378 | 1,061 |
| **250 Binney - 14 CC Office** | 12,967 | 4,589 | 84,514 | **186** | 4,773 | 6,539 | 6,428 | 19,350 | 7,589 | 26,939 | **59** | 1,916,378 | 1,061 |

Note (1): DS Losses = 12%; Assumed gas boiler efficiency = 93% therefore DS load = Site gas *.93* 1.12 = 1.04 Site gas.

Note (2): Annual non-baseload output emission rates for NPCC New England: 1,106.82 lb of CO2 per MWH reduction in electricity use; from eGrid 9th edition Version 1.0 Year 2010 GHG Annual Output Emission Rates

The analysis has been expanded so it considers the CHP for both heating and cooling, using absorption chillers. Assuming an installation of absorption chillers with COP of approximately 0.7, meaning that it takes 17,140 Btu of steam to produce one ton-hour of cooling, and following the MEPA guidance the calculations were performed for both cooling and heating. The analysis shows that if steam is used to both heat and cool the building, the total source energy associated with 4 buildings would be reduced by approximately 87.8%. The generated electricity exceeds the projects' need and it is equivalent to 800 homes' energy use for one year.

| Buildings | As-Proposed Energy Model | | | | Mitigated With Optional Absorption Chillers Measure | | | | | | | | | | | Annual Savings | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A | B | C | | D | E | F | G | H | I | J | K | L | I | | | |
| | | | | | B * 1.04 | | | A - E | F*12/1000+D | H * 1.37 | | J * 3.01 | H * 1.59 | G + H | | | |
| | Site Electricity | Site Gas | Total Source Energy | Source Energy EUI | Note 1 | Space Cooling | Steam for Space Cooling | Site Electricity w/O cooling | CHP DS (Note 2) | Elec. Cogenerated | Grid Electricity | SSFCF for Grid Elec. | SSFCF for CHP DS | Total Source Energy | Source Energy EUI | kWh of Electricity Savings | Annual CO2 Emissions Savings |
| | *MMBTU* | *MMBTU* | *MMBTU* | *kBtu/ SF* | *MMBTU* | *ton-hrs* | *kBtu* | *MMBTU* | *MMBTU* | *MMBTU* | *MMBTU* | *MBTU* | *MBTU* | *MBTU* | *kBtu/SF* | *kWh* | *tons per year* |
| **135 Broadway - Residential** | 12,217 | 7,426 | 49,826 | **109** | 7,723 | 189,567 | 3,249,171 | 9,942 | 11,362 | 15,566 | -5,623 | -16,926 | 18,065 | 1,139 | **2** | 4,561,829 | 2,525 |
| **145 Broadway - 11 CC Office** | 11,222 | 4,589 | 97,649 | **222** | 4,773 | 131,359 | 2,251,493 | 9,646 | 7,295 | 9,994 | -348 | -1,047 | 11,598 | 10,551 | **24** | 2,928,844 | 1,621 |
| **250 Binney - 14 CC Office** | 12,967 | 4,589 | 84,514 | **186** | 4,773 | 134,964 | 2,313,277 | 11,348 | 7,364 | 10,088 | 1,259 | 3,791 | 11,709 | 15,499 | **34** | 2,956,628 | 1,636 |
| | | | | | | | | | J * 1000 * 0.29307 | | | | | | | | |
| **Total** | 36,407 | 16,605 | 231,989 | | | | | | | | -4,712 | | | 27,190 | | 10,447,301 | 5,782 |

Note (1): DS Losses = 12% Ds distribution system losses.

Note (2): Negative numbers show that the CHP District can provide the total Site Electricity demanded by the project; so it's 100% savings.

Note (3): Annual non-baseload output emission rates for NPCC New England: 1,106.82 lb of CO2 per MWH reduction in electricity use; from eGrid 9th edition Version 1.0 Year 2010 GHG Annual Output Emission Rates

# Solid Waste Reduction Supporting Documentation

# Office Buildings

**Potential Greenhouse Gas emissions reduction associated with operational and construction and demolition waste reduction**

| Large Office | Annual Waste Generation | | | Baseline Scenario | | | | | Alternative Scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Weight [1] | | | Diverted | | | Disposed | | Diverted | | | Disposed | |
| | % | Pounds | Short Ton | % | Pounds | Short Ton | Pounds | Short Ton | % | Pounds | Short Ton | Pounds | Short Ton |
| *Aluminum Cans* | 0.3% | 4,047 | 2.0 | 0.0% | 0 | 0.0 | 4,047 | 2.0 | 100.0% | 4,047 | 2.0 | 0 | 0.0 |
| *Tin/ Steel Cans* | 0.3% | 4,047 | 2.0 | 0.1% | 4 | 0.0 | 4,043 | 2.0 | 100.0% | 4,047 | 2.0 | 0 | 0.0 |
| *Glass* | 1.6% | 21,585 | 10.8 | 0.0% | 0 | 0.0 | 21,585 | 10.8 | 100.0% | 21,585 | 10.8 | 0 | 0.0 |
| *HDPE & PET* | 1.3% | 17,538 | 8.8 | 0.0% | 0 | 0.0 | 17,538 | 8.8 | 100.0% | 17,538 | 8.8 | 0 | 0.0 |
| *Corrugated Cardboard* | 5.0% | 67,452 | 33.7 | 39.2% | 26,441 | 13.2 | 41,011 | 20.5 | 100.0% | 67,452 | 33.7 | 0 | 0.0 |
| *Newspaper* | 3.5% | 47,217 | 23.6 | 0.0% | 0 | 0.0 | 47,217 | 23.6 | 100.0% | 47,217 | 23.6 | 0 | 0.0 |
| *Office Paper* | 27.0% | 364,243 | 182.1 | 59.8% | 217,818 | 108.9 | 146,426 | 73.2 | 100.0% | 364,243 | 182.1 | 0 | 0.0 |
| *Phonebooks* | 0.2% | 2,698 | 1.3 | 0.0% | 0 | 0.0 | 2,698 | 1.3 | 100.0% | 2,698 | 1.3 | 0 | 0.0 |
| *Magazines* | 2.3% | 31,028 | 15.5 | 0.0% | 0 | 0.0 | 31,028 | 15.5 | 100.0% | 31,028 | 15.5 | 0 | 0.0 |
| *Lumber* | 4.0% | 53,962 | 27.0 | 1.0% | 540 | 0.3 | 53,422 | 26.7 | 75.0% | 40,471 | 20.2 | 13,490 | 6.7 |
| *Concrete & Drywall* | 4.0% | 53,962 | 27.0 | 0.0% | 0 | 0.0 | 53,962 | 27.0 | 75.0% | 40,471 | 20.2 | 13,490 | 6.7 |
| *Food Waste* | 17.1% | 230,687 | 115.3 | 4.5% | 10,381 | 5.2 | 220,307 | 110.2 | 100.0% | 230,687 | 115.3 | 0 | 0.0 |
| *Grass and Leaves* | 0.5% | 6,745 | 3.4 | 0.0% | 0 | 0.0 | 6,745 | 3.4 | 0.0% | 0 | 0.0 | 6,745 | 3.4 |
| *Mixed Paper* | 15.0% | 202,357 | 101.2 | 0.0% | 0 | 0.0 | 202,357 | 101.2 | 100.0% | 202,357 | 101.2 | 0 | 0.0 |
| *Mixed Metal* | 0.3% | 4,047 | 2.0 | 0.0% | 0 | 0.0 | 4,047 | 2.0 | 75.0% | 3,035 | 1.5 | 1,012 | 0.5 |
| *Carpet* | 4.0% | 53,962 | 27.0 | 0.0% | 0 | 0.0 | 53,962 | 27.0 | 75.0% | 40,471 | 20.2 | 13,490 | 6.7 |
| *Total* | | 1,165,579 | | | 255,184 | | 910,395 | | | 1,117,350 | | 48,229 | |

1. Per State of California study "Waste Disposal and Diversion Findings for Selected Industry Groups"
2. 1 short ton = 2,000 lbs.
3. Percentage Diverted in the Baseline Scenario is based on the survey results published in the California Study.

1. **Describe the baseline generation and management for the waste materials listed below. If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.**

2. **Describe the alternative management scenario for the waste materials generated in the baseline. Any decrease in generation should be entered in the Source Reduction column. Any increase in generation should be entered in the Source Reduction column as a negative value. Make sure that the total quantity generated equals the total quantity managed.**

| Material | Tons Recycled | Tons Landfilled | Tons Combusted | Tons Composted | Tons Anaerobically Digested | Tons Generated | Tons Source Reduced | Tons Recycled | Tons Landfilled | Tons Combusted | Tons Composted | Tons Anaerobically Digested |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum Cans | - | 2.0 | - | NA | NA | 2.0 | | 2.0 | - | | NA | NA |
| Aluminum Ingot | | | | NA | NA | 0.0 | | | | | NA | NA |
| Steel Cans | - | 2.0 | - | NA | NA | 2.0 | | 2.0 | - | | NA | NA |
| Copper Wire | | | | NA | NA | 0.0 | | | | | NA | NA |
| Glass | - | 10.8 | - | NA | NA | 10.8 | | 10.8 | - | | NA | NA |
| HDPE | - | 8.8 | - | NA | NA | 8.8 | | 8.8 | - | | NA | NA |
| LDPE | NA | | | NA | NA | 0.0 | | NA | | | NA | NA |
| PET | | | | NA | NA | 0.0 | | | | | NA | NA |
| LLDPE | NA | | | NA | NA | 0.0 | | NA | | | NA | NA |
| PP | NA | | | NA | NA | 0.0 | | NA | | | NA | NA |
| PS | NA | | | NA | NA | 0.0 | | NA | | | NA | NA |
| PVC | NA | | | NA | NA | 0.0 | | NA | | | NA | NA |
| PLA | NA | | | | NA | 0.0 | | NA | | | | NA |
| Corrugated Containers | 13.2 | 20.5 | - | NA | NA | 33.7 | | 33.7 | - | | NA | NA |
| Magazines/Third-class Mail | - | 15.5 | - | NA | NA | 15.5 | | 15.5 | - | | NA | NA |
| Newspaper | - | 23.6 | - | NA | NA | 23.6 | | 23.6 | - | | NA | NA |
| Office Paper | 108.9 | 73.2 | - | NA | NA | 182.1 | | 182.1 | - | | NA | NA |
| Phonebooks | - | 1.3 | - | NA | NA | 1.3 | | 1.3 | - | | NA | NA |
| Textbooks | | | | NA | NA | 0.0 | | | | | NA | NA |
| Dimensional Lumber | 0.3 | 26.7 | | NA | NA | 27.0 | | 20.2 | 6.8 | | NA | NA |
| Medium-density Fiberboard | | | | NA | NA | 0.0 | | | | | NA | NA |
| Food Waste (non-meat) | NA | | | | | 0.0 | | NA | | | | |
| Food Waste (meat only) | NA | | | | | 0.0 | | NA | | | | |
| Beef | NA | | | | | 0.0 | | NA | | | | |
| Poultry | NA | | | | | 0.0 | | NA | | | | |
| Grains | NA | | | | | 0.0 | | NA | | | | |
| Bread | NA | | | | | 0.0 | | NA | | | | |
| Fruits and Vegetables | NA | | | | | 0.0 | | NA | | | | |
| Dairy Products | NA | | | | | 0.0 | | NA | | | | |
| Yard Trimmings | NA | | | | | 0.0 | NA | NA | | | | |
| Grass | NA | - | 5.3 | | | 5.3 | NA | NA | | 5.3 | | |
| Leaves | NA | | | | | 0.0 | NA | NA | | | | |
| Branches | NA | | | | | 0.0 | NA | NA | | | | |
| Mixed Paper (general) | - | 101.2 | | NA | NA | 101.2 | | 101.2 | | | NA | NA |
| Mixed Paper (primarily residential) | | | | NA | NA | 0.0 | | | | | NA | NA |
| Mixed Paper (primarily from offices) | | | | NA | NA | 0.0 | | | | | NA | NA |
| Mixed Metals | - | 2.0 | | NA | NA | 2.0 | | 1.5 | 0.5 | | NA | NA |
| Mixed Plastics | | | | NA | NA | 0.0 | | | | | NA | NA |
| Mixed Recyclables | | | | NA | NA | 0.0 | NA | | | | NA | NA |
| Food Waste | NA | 174.1 | 8.2 | | | 182.3 | | NA | | 182.3 | | |
| Mixed Organics | NA | | | | | 0.0 | NA | NA | | | | |
| Mixed MSW | NA | | | NA | NA | 0.0 | NA | NA | | | NA | NA |
| Carpet | - | 27.0 | | NA | NA | 27.0 | | 20.2 | 6.8 | | NA | NA |
| Personal Computers | | | | NA | NA | 0.0 | | | | | NA | NA |
| Clay Bricks | NA | | NA | NA | NA | 0.0 | | NA | | NA | NA | NA |
| Concrete [1] | - | 10.0 | NA | NA | NA | 10.0 | NA | 10.0 | | NA | NA | NA |
| Fly Ash [2] | | | NA | NA | NA | 0.0 | NA | | | NA | NA | NA |
| Tires [3] | | | | NA | NA | 0.0 | | | | | NA | NA |
| Asphalt Concrete | | | NA | NA | NA | 0.0 | | | | NA | NA | NA |
| Asphalt Shingles | | | | NA | NA | 0.0 | | | | | NA | NA |
| Drywall | - | 17.0 | NA | NA | NA | 17.0 | | 17.0 | | NA | NA | NA |
| Fiberglass Insulation | NA | | NA | NA | NA | 0.0 | | NA | | NA | NA | NA |
| Vinyl Flooring | NA | | | NA | NA | 0.0 | | NA | | | NA | NA |
| Wood Flooring | NA | | | NA | NA | 0.0 | | NA | | | NA | NA |

Please enter data in short tons (1 short ton = 2,000 lbs.)
Please refer to the User's Guide if you need assistance completing this table.

[1] Recycled concrete used as aggregate in the production of new concrete.

[2] Recycled fly ash is utilized to displace portland cement in concrete production.

[3] Recycling tires is defined in this analysis as using tires for crumb rubber applications and tire-derived aggregate uses in civil engineering applications.

**Total Change in GHG Emissions ($MTCO_2E$): (1,051)**

| This is equivalent to... | | |
|---|---|---|
| annual emissions from | **221** | Passenger Vehicles |
| Conserving | **118,310** | Gallons of Gasoline |
| Conserving | **43,809** | Cylinders of Propane Used for Home Barbeques |
| Conserving | **6** | Railway Cars of Coal |
| | **0.00006%** | Annual $CO_2$ emissions from the U.S. transportation sector |
| | **0.00005%** | Annual $CO_2$ emissions from the U.S. electricity sector |

**$MTCO_2E$ = metric tons of carbon dioxide equivalent**

a) For explanation of methodology, see the EPA WARM Documentation:

Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks

-- available on the Internet at http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html

b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.

c) The GHG emissions results estimated in WARM indicate the full life-cycle benefits waste management alternatives. Due to the timing of the GHG emissions from the waste management pathways, (e.g., avoided landfilling and increased recycling), the actual GHG implications may accrue over the long-term. Therefore, one should not interpret the GHG emissions implications as occurring all in one year, but rather through time.

**Total Change in Energy Use (million BTU): (5,156)**

*Note: a negative value (i.e., a value in parentheses) indicates a reduction in energy consumption; a positive value indicates an increase.*

| This is equivalent to... | | |
|---|---|---|
| Conserving | **45** | Households' Annual Energy Consumption |
| Conserving | **887** | Barrels of Oil |
| Conserving | **41,497** | Gallons of Gasoline |

a) For explanation of methodology, see the EPA WARM Documentation:

Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks

-- available on the Internet at http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html

b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.

**Total Change in GHG Emissions (MTCE): (287)**

| This is equivalent to... | | |
|---|---|---|
| Removing annual emissions from | **221** | Passenger Vehicles |
| Conserving | **118,310** | Gallons of Gasoline |
| Conserving | **43,809** | Cylinders of Propane Used for Home Barbeques |
| Conserving | **6** | Railway Cars of Coal |
| | **0.00006%** | Annual $CO_2$ emissions from the U.S. transportation sector |
| | **0.00005%** | Annual CO2 emissions from the U.S. electricity sector |

**MTCE = metric tons of carbon equivalent**

AHA CONSULTING ENGINEERS

# Residential Towers

**Potential Greenhouse Gas emissions reduction associated with operational and construction and demolition waste reduction**

| Residential | Annual Waste Generation | | | Baseline Scenario | | | | | Alternative Scenario | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Weight [1] | | | Diverted | | | Disposed | | Diverted | | | Disposed | |
| | % | Pounds | Short Ton | % | Pounds | Short Ton | Pounds | Short Ton | % | Pounds | Short Ton | Pounds | Short Ton |
| *Aluminum Cans* | | 13,384 | 6.7 | 0.0% | 0 | 0.0 | 13,384 | 6.7 | 100.0% | 13,384 | 6.7 | 0 | 0.0 |
| *Tin/ Steel Cans* | | 30,240 | 15.1 | 0.1% | 30 | 0.0 | 30,210 | 15.1 | 100.0% | 30,240 | 15.1 | 0 | 0.0 |
| *Glass* | | 86,800 | 43.4 | 0.0% | 0 | 0.0 | 86,800 | 43.4 | 100.0% | 86,800 | 43.4 | 0 | 0.0 |
| *HDPE* | | 19,096 | 9.5 | 0.0% | 0 | 0.0 | 19,096 | 9.5 | 100.0% | 19,096 | 9.5 | 0 | 0.0 |
| *Corrugated Cardboard* | | 48,552 | 24.3 | 39.2% | 19,032 | 9.5 | 29,520 | 14.8 | 100.0% | 48,552 | 24.3 | 0 | 0.0 |
| *Newspaper* | | 57,680 | 28.8 | 0.0% | 0 | 0.0 | 57,680 | 28.8 | 100.0% | 57,680 | 28.8 | 0 | 0.0 |
| *Residential Paper* | | 130,704 | 65.4 | 59.8% | 78,161 | 39.1 | 52,543 | 26.3 | 100.0% | 130,704 | 65.4 | 0 | 0.0 |
| *PET* | | 30,016 | 15.0 | 0.0% | 0 | 0.0 | 30,016 | 15.0 | 100.0% | 30,016 | 15.0 | 0 | 0.0 |
| *Mixed Plastic* | | 43,456 | 21.7 | 0.0% | 0 | 0.0 | 43,456 | 21.7 | 100.0% | 43,456 | 21.7 | 0 | 0.0 |
| *Lumber* | 4.0% | 33,566 | 16.8 | 1.0% | 336 | 0.2 | 33,231 | 16.6 | 75.0% | 25,175 | 12.6 | 8,392 | 4.2 |
| *Concrete & Drywall* | 4.0% | 33,566 | 16.8 | 0.0% | 0 | 0.0 | 33,566 | 16.8 | 75.0% | 25,175 | 12.6 | 8,392 | 4.2 |
| *Carpet* | 4.0% | 33,566 | 16.8 | 0.0% | 0 | 0.0 | 33,566 | 16.8 | 75.0% | 25,175 | 12.6 | 8,392 | 4.2 |
| *Total* | | 560,627 | | | 97,559 | | 463,068 | | | 535,452 | | 25,175 | |

1. Per State of California study "Waste Disposal and Diversion Findings for Selected Industry Groups" and State of North Carolina Study for Residential Communities (http://www.resource-recycling.com/images/NCCallForDataHH.pdf)
2. 1 short ton = 2,000 lbs.
3. Percentage Diverted in

1. **Describe the baseline generation and management for the waste materials listed below. If the material is not generated in your community or you do not want to analyze it, leave it blank or enter 0. Make sure that the total quantity generated equals the total quantity managed.**

| Material | Tons Recycled | Tons Landfilled | Tons Combusted | Tons Composted | Tons Anaerobically Digested | Tons Generated |
|---|---|---|---|---|---|---|
| Aluminum Cans | - | 6.7 | - | NA | NA | 6.7 |
| Aluminum Ingot | | | | NA | NA | 0.0 |
| Steel Cans | - | 15.1 | - | NA | NA | 15.1 |
| Copper Wire | | | | NA | NA | 0.0 |
| Glass | - | 43.4 | - | NA | NA | 43.4 |
| HDPE | - | 9.5 | - | NA | NA | 9.5 |
| LDPE | NA | | | NA | NA | 0.0 |
| PET | | 15.0 | | NA | NA | 15.0 |
| LLDPE | NA | | | NA | NA | 0.0 |
| PP | NA | | | NA | NA | 0.0 |
| PS | NA | | | NA | NA | 0.0 |
| PVC | NA | | | NA | NA | 0.0 |
| PLA | NA | | | | NA | 0.0 |
| Corrugated Containers | 9.5 | 14.8 | - | NA | NA | 24.3 |
| Magazines/Third-class Mail | | | | NA | NA | 0.0 |
| Newspaper | - | 28.8 | - | NA | NA | 28.8 |
| Office Paper | | | | NA | NA | 0.0 |
| Phonebooks | | | | NA | NA | 0.0 |
| Textbooks | | | | NA | NA | 0.0 |
| Dimensional Lumber | 0.3 | 26.7 | | NA | NA | 27.0 |
| Medium-density Fiberboard | | | | NA | NA | 0.0 |
| Food Waste (non-meat) | NA | | | | | 0.0 |
| Food Waste (meat only) | NA | | | | | 0.0 |
| Beef | NA | | | | | 0.0 |
| Poultry | NA | | | | | 0.0 |
| Grains | NA | | | | | 0.0 |
| Bread | NA | | | | | 0.0 |
| Fruits and Vegetables | NA | | | | | 0.0 |
| Dairy Products | NA | | | | | 0.0 |
| Yard Trimmings | NA | | | | | 0.0 |
| Grass | NA | | | | | 0.0 |
| Leaves | NA | | | | | 0.0 |
| Branches | NA | | | | | 0.0 |
| Mixed Paper (general) | | | | NA | NA | 0.0 |
| Mixed Paper (primarily residential) | | 39.1 | 26.3 | NA | NA | 65.4 |
| Mixed Paper (primarily from offices) | | | | NA | NA | 0.0 |
| Mixed Metals | | | | NA | NA | 0.0 |
| Mixed Plastics | | 21.7 | | NA | NA | 21.7 |
| Mixed Recyclables | | | | NA | NA | 0.0 |
| Food Waste | NA | | | | | 0.0 |
| Mixed Organics | NA | | | | | 0.0 |
| Mixed MSW | NA | | | NA | NA | 0.0 |
| Carpet | - | 16.8 | | NA | NA | 16.8 |
| Personal Computers | | | | NA | NA | 0.0 |
| Clay Bricks | NA | | NA | NA | NA | 0.0 |
| Concrete [1] | - | 6.8 | NA | NA | NA | 6.8 |
| Fly Ash [2] | | | NA | NA | NA | 0.0 |
| Tires [3] | | | | NA | NA | 0.0 |
| Asphalt Concrete | | | NA | NA | NA | 0.0 |
| Asphalt Shingles | | | | NA | NA | 0.0 |
| Drywall | - | 10.0 | NA | NA | NA | 10.0 |
| Fiberglass Insulation | NA | | NA | NA | NA | 0.0 |
| Vinyl Flooring | NA | | | NA | NA | 0.0 |
| Wood Flooring | NA | | | NA | NA | 0.0 |

2. **Describe the alternative management scenario for the waste materials generated in the baseline. Any decrease in generation should be entered in the Source Reduction column. Any increase in generation should be entered in the Source Reduction column as a negative value. Make sure that the total quantity generated equals the total quantity managed.**

| Tons Source Reduced | Tons Recycled | Tons Landfilled | Tons Combusted | Tons Composted | Tons Anaerobically Digested |
|---|---|---|---|---|---|
| | 6.7 | - | | NA | NA |
| | | | | NA | NA |
| | 15.1 | - | | NA | NA |
| | | | | NA | NA |
| | 43.4 | - | | NA | NA |
| | 9.5 | - | | NA | NA |
| | NA | | | NA | NA |
| | 15.0 | | | NA | NA |
| | NA | | | NA | NA |
| | NA | | | NA | NA |
| | NA | | | NA | NA |
| | NA | | | NA | NA |
| | NA | | | NA | NA |
| | 24.3 | - | | NA | NA |
| | | | | NA | NA |
| | 28.8 | - | | NA | NA |
| | | | | NA | NA |
| | | | | NA | NA |
| | | | | NA | NA |
| | 20.2 | 6.8 | | NA | NA |
| | | | | NA | NA |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | NA | | | | |
| | | | | NA | NA |
| | 65.4 | | | NA | NA |
| | | | | NA | NA |
| | | | | NA | NA |
| | 21.7 | | | NA | NA |
| NA | | | | NA | NA |
| | NA | | | | |
| NA | NA | | | | |
| | | | | NA | NA |
| | 12.6 | 4.2 | | NA | NA |
| | | | | NA | NA |
| | NA | | NA | NA | NA |
| NA | 6.8 | | NA | NA | NA |
| NA | | | NA | NA | NA |
| | | | | NA | NA |
| | | | NA | NA | NA |
| | | | | NA | NA |
| | 10.0 | | NA | NA | NA |
| | NA | | NA | NA | NA |
| | NA | | | NA | NA |
| | NA | | | NA | NA |

Please enter data in short tons (1 short ton = 2,000 lbs.)
Please refer to the User's Guide if you need assistance completing this table.

[1] Recycled concrete used as aggregate in the production of new concrete.

[2] Recycled fly ash is utilized to displace portland cement in concrete production.

[3] Recycling tires is defined in this analysis as using tires for crumb rubber applications and tire-derived aggregate uses in civil engineering applications.

**Total Change in GHG Emissions ($MTCO_2E$):** **(537)**

| **This is equivalent to...** | | |
|---|---|---|
| annual emissions from | **113** | Passenger Vehicles |
| Conserving | **60,471** | Gallons of Gasoline |
| Conserving | **22,392** | Cylinders of Propane Used for Home Barbeques |
| Conserving | **3** | Railway Cars of Coal |
| | **0.00003%** | Annual $CO_2$ emissions from the U.S. transportation sector |
| | **0.00003%** | Annual $CO_2$ emissions from the U.S. electricity sector |

**$MTCO_2E$ = metric tons of carbon dioxide equivalent**

**Total Change in Energy Use (million BTU):** **(5,425)**

| **This is equivalent to...** | | |
|---|---|---|
| Conserving | **47** | Households' Annual Energy Consumption |
| Conserving | **934** | Barrels of Oil |
| Conserving | **43,670** | Gallons of Gasoline |

**Total Change in GHG Emissions (MTCE):** **(147)**

| **This is equivalent to...** | | |
|---|---|---|
| Removing annual emissions from | **113** | Passenger Vehicles |
| Conserving | **60,471** | Gallons of Gasoline |
| Conserving | **22,392** | Cylinders of Propane Used for Home Barbeques |
| Conserving | **3** | Railway Cars of Coal |
| | **0.00003%** | Annual $CO_2$ emissions from the U.S. transportation sector |
| | **0.00003%** | Annual CO2 emissions from the U.S. electricity sector |

**MTCE = metric tons of carbon equivalent**

c) For explanation of methodology, see the EPA WARM Documentation:

Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks

-- available on the Internet at http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html

d) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.

c) The GHG emissions results estimated in WARM indicate the full life-cycle benefits waste management alternatives. Due to the timing of the GHG emissions from the waste management pathways, (e.g., avoided landfilling and increased recycling), the actual GHG implications may accrue over the long-term. Therefore, one should not interpret the GHG emissions implications as occurring all in one year, but rather through time.

*Note: a negative value (i.e., a value in parentheses) indicates a reduction in energy consumption; a positive value indicates an increase.*

a) For explanation of methodology, see the EPA WARM Documentation:

Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks

-- available on the Internet at http://epa.gov/epawaste/conserve/tools/warm/SWMGHGreport.html

b) Emissions estimates provided by this model are intended to support voluntary GHG measurement and reporting initiatives.

# Estimating the impacts of climate change on Kendall Urban Renewal Buildings (Response to Comment 6.28)

Over the past decades, the Intergovernmental Panel on Climate Change (IPCC) has focused significantly to characterize the potential impacts of greenhouse gas emissions from human activities on the complex interactions of our global climate. IPCC generated General Circulation Models (GCM) which predict climate at a relatively high level of spatial resolution (5 x 5° latitude and longitude). The four major GCMs are HadCM3 (United Kingdom), CSIRO2 (Australia), CGCM2 (Canada), and PCM (USA), based on the 2001 report.[1] In the study, which was done by the US Department of Energy, a prototypical small office building was created in an energy modeling software and used to evaluate the impacts of climate change in 25 locations (20 climate regions). The research group developed a series of weather files, by modifying the existing meteorological weather files, to represent the climate change scenarios for 2100; then the typical building was simulated in different climates. This study shows that in cold climates, the net change to annual energy use due to climate change will be positive because of decrease in heating demand and less increase in cooling demand.

According to a research done by Hayhoe, Stoner and Gelca, the average temperature in Cambridge, MA is expected to increase by 2 - 3° F by the 2030s. By the 2070s, the annual temperature is predicted to increase by 4 - 5° F under the lower scenario and 7 - 8° F under the higher scenario.[2]

In the original submission, AHA ran a quantitative analysis to evaluate the impacts of climate change on the proposed four buildings, and performed energy modeling analysis for 2050 climate change scenario. In 2012, the University of Southampton, UK developed a spreadsheet tool which allows the users to generate climate change weather files for World-wide locations ready for use in building performance simulation programs. The Climate Change World Weather File Generator (CCWorldWeatherGen) uses IPCC Third Assessment Report model summary data of the HadCM3 A2 experiment ensemble, and its underlying weather file generation routines are based on the "morphing" methodology for climate change transformation of weather data, which was developed by Belcher, Hacker and Powell.[3] An screenshot of the weather file generator can be seen on the next page.

The EPW weather file (EnergyPlus Weather file) of Boston, MA was translated into a 2050s TMY2 weather file, using the "CCWorldWeatherGen" tool and then it was converted to a BIN file so that it can be used in eQuest. The weather file in all proposed models was replaced by the 2050 weather file and all four buildings, including residential and office towers and Whitehead laboratory, were simulated.

The analysis showed that the net change to annual energy use due to climate change will be positive for all office and residential buildings because the decrease in the space heating energy use is much larger than the increase in the space cooling energy use; However, comparing the annual energy cost showed that the operating cost for all buildings, increases even if the utility rates stay the same between 2016 and 2050. By implementing the utility rates fluctuations, the annual energy cost of each building in 2050 is almost double of the cost in 2016. Since the buildings under the current NPC application – 135 Broadway, 11 CC and 14 CC – consist of residential and office towers, we believe that the previous climate change analysis would be relevant to these projects, and the outcome can be implemented for the NPC application.

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[1] Crawley, Drury; "Estimating the impacts of climate change and urbanization on building performance", US Department of Energy, Washington, DC; October 2007.
[2] Hayhoe, K. Stoner, A. Gelca, R. "Climate Change Projections for the City of Cambridge"
[3] http://www.energy.soton.ac.uk/ccworldweathergen/

AHA CONSULTING ENGINEERS

# CCWorldWeatherGen climate change weather file generator V1.8

manual

For transforming EPW weather files into climate change TMY2/EPW files. (Acknowledgements & disclaimer of warranties below)

**Specify the HadCM3 data file path:** C:\CCWorldWeatherGen\HadCM3data

Summary of combined HadCM3 A2 ensemble climate change predictions for the selected weather site

**Selected scenario: A2 scenario ensemble for the 2050's**

| | | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | ANN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Daily mean temperature | **TEMP** | (°C) | 2.29 | 1.70 | 1.58 | 1.35 | 1.83 | 1.92 | 2.40 | 2.98 | 3.10 | 2.57 | 2.21 | 2.27 | 2.18 |
| Maximum temperature | **TMAX** | (°C) | 1.76 | 1.52 | 1.12 | 1.15 | 1.92 | 1.87 | 2.34 | 2.91 | 3.04 | 2.69 | 2.43 | 1.53 | 2.02 |
| Minimum temperature | **TMIN** | (°C) | 2.46 | 2.08 | 1.64 | 0.99 | 1.82 | 1.82 | 2.28 | 3.00 | 3.29 | 2.68 | 2.35 | 1.85 | 2.19 |
| Horizontal solar irradiation | **DSWF** | W/m² | -0.75 | -0.88 | -7.54 | 2.87 | 8.71 | 4.81 | 5.02 | 6.22 | 6.20 | 4.49 | -0.16 | -0.90 | 2.34 |
| Total cloud cover | **TCLW** | % points | -1.63 | -1.00 | 0.25 | -2.75 | -1.75 | -0.38 | -2.13 | -2.25 | -3.38 | -4.75 | -2.13 | -0.63 | -1.88 |
| Total precipitation rate | **PREC** | % | 2.65 | 7.45 | 21.62 | 4.78 | 4.33 | 9.63 | 19.13 | 5.44 | -0.43 | -2.51 | 3.64 | 10.72 | 7.20 |
| Relative humidity | **RHUM** | % points | -2.44 | -2.44 | -1.37 | -1.56 | -1.44 | -1.31 | -0.51 | -0.22 | -1.29 | -2.05 | -1.75 | -1.95 | -1.53 |
| Mean sea level pressure | **MSLP** | hpa | -1.37 | -1.14 | -2.96 | -0.40 | -0.09 | -1.23 | -1.08 | -1.38 | -1.29 | -0.31 | -0.56 | -0.86 | -1.05 |
| Wind speed* | **WIND** | % | -0.23 | 1.41 | 0.05 | -4.00 | -4.76 | -3.67 | 0.45 | -6.78 | -4.74 | -3.56 | -1.73 | -2.93 | -2.54 |

* Please note that wind speed resides on a 96x72 grid whilst all the other data is on a 96x73 grid

EPW weather file selection

**(1) Please specify the EPW file you want to transform**

Select EPW File for Morphing

**Current EPW baseline weather file for morphing:**

**BOSTON, USA**

| | |
|---|---|
| *Latitude:* | 42.37 N |
| *Longitude:* | -71.03 W |
| *Elevation:* | 5 m |

HadCM3 scenario timeframe selection

**(2) Please select a HadCM3 A2 scenario ensembe timeframe**

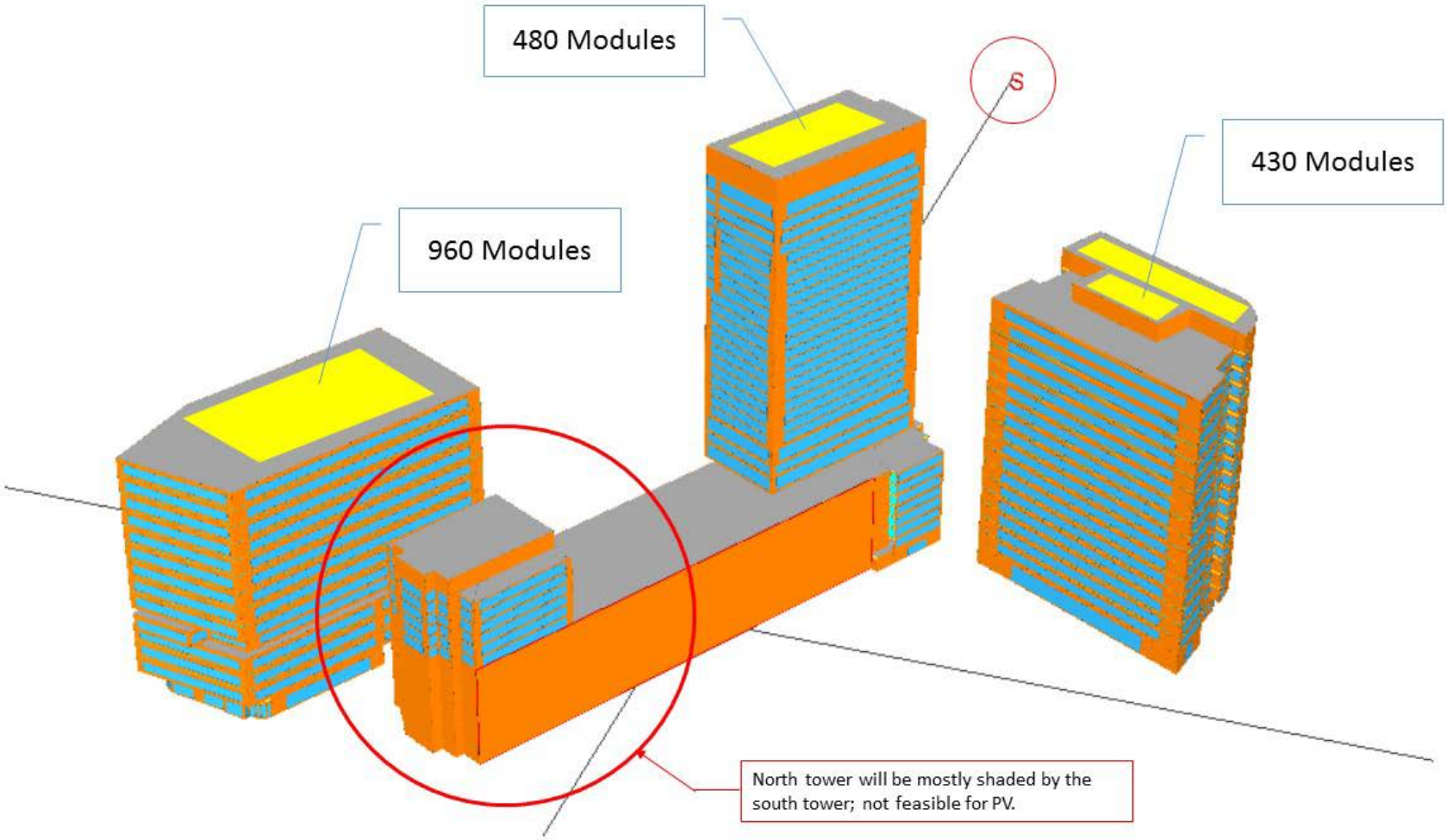
○ 2020's ◉ 2050's ○ 2080's Load Scenario

| Closest four HadCM3 96x73 grid points to BOSTON, USA | | *Latitude:* | *Longitude:* |
|---|---|---|---|
| | *A* | 42.50 N | -67.50 W |
| | *B* | 40.00 N | -71.25 W |
| | *C* | 45.00 N | -71.25 W |
| **A2 scenario for the 2050's** | *D* | 42.50 N | -71.25 W |

# Solar Photovoltaic (PV) Systems Evaluation Supporting Documentation

# On-Site Renewable Energy Generation

The suggested design is installation of a grid tied solar electric photovoltaic system on the roof of South residential tower, 14 CC and 11 CC, facing southeast.



# On-Site Renewable Energy Generation

**Photovoltaic Array – Option 1: 90% Efficient Inverter**

**System Data**

| | |
|---|---|
| Building Location: | Cambridge, MA |
| System DC Power: | 570 kW DC |
| Array Tilt Angle: | 10˚ Slope |
| Array Azimuth Angle: | 110˚ SE |
| Module Power: | 305 W Cell Polycrystal Line |
| Module Quantity: | 1,870 |
| Inverter Efficiency: | 90% |

**Annual Energy Savings Calculation:**

| | |
|---|---|
| Building Annual Electricity Use: | 10,670,212 kWh |
| Annual Electricity Generated from PV Array: | 633,546 kWh |
| Annual Percentage Energy Savings: | 5.9% |
| Green House Gas Emission Reduction: | 491 Tons of $CO_2$ |

**Photovoltaic Array – Option 2: 96% Efficient Inverter**

**System Data**

| | |
|---|---|
| Building Location: | Cambridge, MA |
| System DC Power: | 570 kW DC |
| Array Tilt Angle: | 10˚ Slope |
| Array Azimuth Angle: | 110˚ SE |
| Module Power: | 305 W Cell Polycrystal Line |
| Module Quantity: | 1,870 |
| Inverter Efficiency: | 96% |

**Annual Energy Savings Calculation:**

| | |
|---|---|
| Building Annual Electricity Use: | 10,670,212 kWh |
| Annual Electricity Generated from PV Array: | 676,393 kWh |
| Annual Percentage Energy Savings: | 6.3% |
| Green House Gas Emission Reduction: | 524 Tons of $CO_2$ |

# On-Site Renewable Energy Generation

**Option 1: 90% Efficient Inverter**

## RESULTS

Print Results

**633,546 kWh per Year ***

*System output may range from 608,077 to 656,607kWh per year near this location.*
*Click HERE for more information.*

| Month | Solar Radiation ( kWh / m² / day ) | AC Energy ( kWh ) | Energy Value ( $ ) |
|---|---|---|---|
| January | 2.01 | 27,774 | 3,844 |
| February | 2.94 | 37,303 | 5,163 |
| March | 3.93 | 54,687 | 7,569 |
| April | 4.66 | 62,042 | 8,587 |
| May | 5.62 | 74,830 | 10,356 |
| June | 6.03 | 76,018 | 10,521 |
| July | 6.09 | 78,883 | 10,917 |
| August | 5.50 | 71,490 | 9,894 |
| September | 4.40 | 55,980 | 7,748 |
| October | 3.33 | 44,593 | 6,172 |
| November | 2.01 | 26,476 | 3,664 |
| December | 1.72 | 23,469 | 3,248 |
| Annual | 4.02 | 633,545 | $ 87,683 |

**Option 2: 96% Efficient Inverter**

## RESULTS

Print Results

**676,393 kWh per Year ***

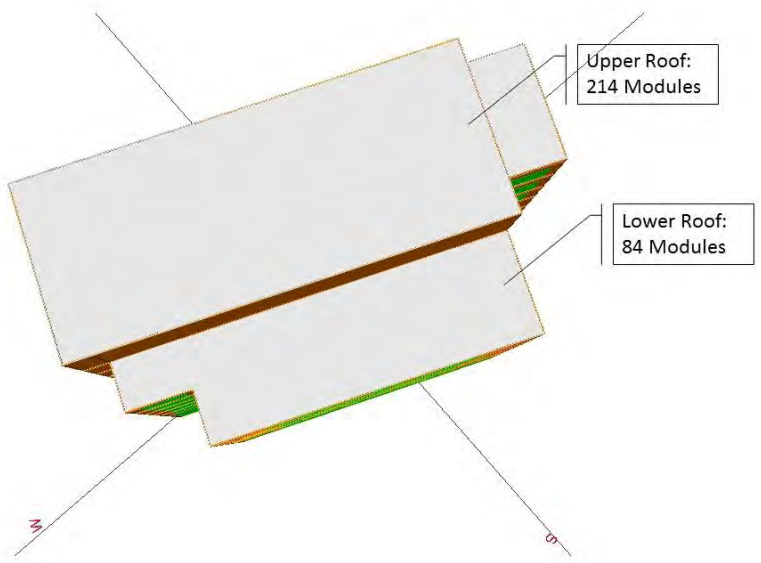
*System output may range from 649,202 to 701,013kWh per year near this location.*
*Click HERE for more information.*

| Month | Solar Radiation ( kWh / m² / day ) | AC Energy ( kWh ) | Energy Value ( $ ) |
|---|---|---|---|
| January | 2.01 | 29,681 | 4,108 |
| February | 2.94 | 39,837 | 5,513 |
| March | 3.93 | 58,382 | 8,080 |
| April | 4.66 | 66,228 | 9,166 |
| May | 5.62 | 79,869 | 11,054 |
| June | 6.03 | 81,136 | 11,229 |
| July | 6.09 | 84,191 | 11,652 |
| August | 5.50 | 76,306 | 10,561 |
| September | 4.40 | 59,763 | 8,271 |
| October | 3.33 | 47,619 | 6,590 |
| November | 2.01 | 28,294 | 3,916 |
| December | 1.72 | 25,086 | 3,472 |
| Annual | 4.02 | 676,392 | $ 93,612 |

# Whitehead Commercial Office and Lab

## On-Site Renewable Energy Generation

**Photovoltaic Array – Option 1: 90% Efficient Inverter**




| Month | Solar Radiation ( kWh / m² / day ) | AC Energy ( kWh ) | Energy Value ( $ ) |
|---|---|---|---|
| January | 2.08 | 4,681 | 749 |
| February | 3.02 | 6,210 | 994 |
| March | 4.00 | 8,966 | 1,435 |
| April | 4.71 | 10,048 | 1,608 |
| May | 5.65 | 11,929 | 1,909 |
| June | 6.05 | 11,985 | 1,918 |
| July | 6.11 | 12,420 | 1,987 |
| August | 5.55 | 11,328 | 1,812 |
| September | 4.46 | 8,977 | 1,436 |
| October | 3.41 | 7,284 | 1,165 |
| November | 2.08 | 4,404 | 705 |
| December | 1.79 | 3,946 | 631 |
| Annual | 4.08 | 102,178 | $ 16,349 |

Note - Average Cost of Electricity Purchased from Utility: $0.16/ kWh

**System Data**

| | |
|---|---|
| Building Location: | Cambridge, MA |
| System DC Power: | 90.89 kW DC |
| Array Tilt Angle: | 10˚ Slope |
| Array Azimuth Angle: | 120˚ SE |
| Module Power: | 305 W Cell Polycrystal Line |
| Module Quantity: | 298 |
| Inverter Efficiency: | 90% |

**Annual Energy Savings Calculation:**

| | |
|---|---|
| Building Annual Electricity Use: | 1,413,934 kWh |
| Annual Electricity Generated from PV Array: | 102,178 kWh |
| Annual Percentage Energy Savings: | 7.2% |
| Green House Gas Emission Reduction: | 77.7 Tons of $CO_2$ |

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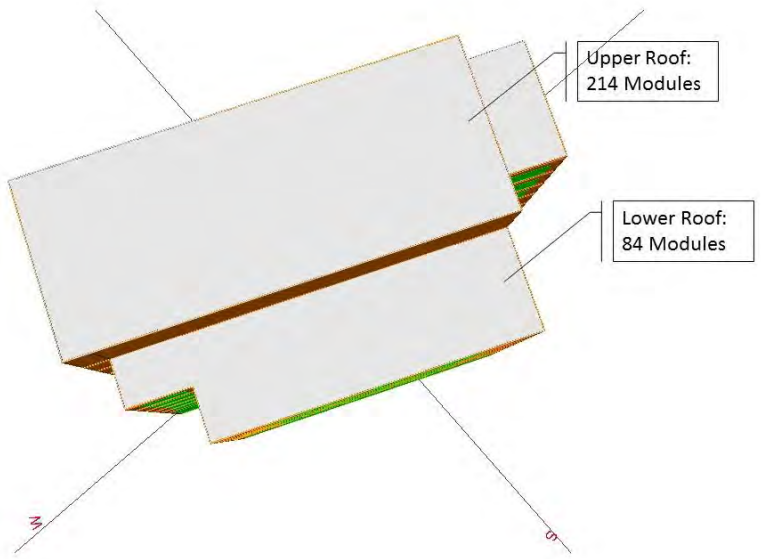
# Whitehead Commercial Office and Lab

## On-Site Renewable Energy Generation

**Photovoltaic Array – Option 2: 96% Efficient Inverter**




| Month | Solar Radiation ( kWh / m$^2$ / day ) | AC Energy ( kWh ) | Energy Value ( $ ) |
|---|---|---|---|
| January | 2.08 | 5,002 | 800 |
| February | 3.02 | 6,632 | 1,061 |
| March | 4.00 | 9,572 | 1,531 |
| April | 4.71 | 10,726 | 1,716 |
| May | 5.65 | 12,732 | 2,037 |
| June | 6.05 | 12,792 | 2,047 |
| July | 6.11 | 13,256 | 2,121 |
| August | 5.55 | 12,091 | 1,935 |
| September | 4.46 | 9,584 | 1,533 |
| October | 3.41 | 7,778 | 1,244 |
| November | 2.08 | 4,706 | 753 |
| December | 1.79 | 4,217 | 675 |
| Annual | 4.08 | 109,088 | $ 17,453 |

Note - Average Cost of Electricity Purchased from Utility: $0.16/ kWh

**System Data**

| | |
|---|---|
| Building Location: | Cambridge, MA |
| System DC Power: | 90.89 kW DC |
| Array Tilt Angle: | 10˚ Slope |
| Array Azimuth Angle: | 120˚ SE |
| Module Power: | 305 W Cell Polycrystal Line |
| Module Quantity: | 298 |
| Inverter Efficiency: | 96% |

**Annual Energy Savings Calculation:**

| | |
|---|---|
| Building Annual Electricity Use: | 1,413,934 kWh |
| Annual Electricity Generated from PV Array: | 109,088 kWh |
| Annual Percentage Energy Savings: | 7.77% |
| Green House Gas Emission Reduction: | 82.9 Tons of $CO_2$ |

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## Solar PV Simple Payback Calculation

| | | | |
|---|---|---|---|
| DC System Size | | 661 | kW DC |
| Annual Electricity Generation | | 735,724 | kWh |
| Average Cost of Electricity Purchased from Utility | $ | 0.16 | $/kWh |
| Average Initial Cost per Unit | $ | 3.50 | $/Wdc |
| Average Massachusetts (SREC-II) (MA2015-2016) | $ | 300.00 | $/MWh |
| | | | |
| Initial Cost | $ | 2,313,115.00 | |
| -Massachusetts SREC-II (MA2015-2016) | $ | 220,717.20 | |
| -Federal Tax Credit (30% of Expenditures) | $ | 693,934.50 | |
| Total Cost | $ | 1,398,463.30 | |
| | | | |
| Annual Generated Energy Value | $ | 117,715.84 | |
| | | | |
| Simple Payback=Total Cost/ Annual Generated Energy Value | | 12 | years |
| | Approximately | 8.4% | ROI |

# Wastewater and Water GHG Analysis

**GHG Emissions Calculations for Water and Wastewater Treatment**
**Based on MEPA GHG Policy Guidance**

**Project :** Kendal Square Urban Renewal Project : Notice of Project Change
**Date:** 6/23/2016

As outlined in the current GHG Policy, projects that will consume greater than 300,000 gallons per day (gpd) of water or wastewater may be required, on a case-by-case basis, to model GHG emissions associated with energy usage for water or wastewater treatment. Based upon current data supplied by the Massachusetts Department of Environmental Protection (MassDEP), project Proponents may use the following averages to estimate energy usage associated with water or wastewater treatment for the purposes of completing their GHG analysis.

For projects located within Massachusetts Water Resources Authority (MWRA) communities:
Wastewater Treatment average energy cost = 1.3kWh/1,000 gallons treated
Water Treatment average energy cost = 0.2 kWh/1,000 gallons treated
For projects located outside MWRA communities:
Wastewater Treatment average energy cost = 1.7 kWh/1,000 gallons treated
Water Treatment average energy cost = 1.1 kWh/1,000 gallons treated

Additionally, at the Proponent's discretion (and if applicable), the GHG analysis may use actual data from project community treatment plants in lieu of MassDEP's average data, so long as supporting documentation is included in the MEPA filing.

**Wastewater**

| | | |
|---|---|---|
| Estimated Project Waterwater = | 146,809 | gallons |
| Wastewater treatment average energy cost = | 1.3 | Kwh/1,000 gallons treated |
| Total Project Energy Cost for Watewater = | 190.85 | Kwh |
| Total Estimated GHG Emissions related to Wastewater = | 0.07 | tons/year |

**Water Use**

| | | |
|---|---|---|
| Estimated Project Water Use= | 161,490 | gallons |
| Water Treatment aver energy cost = | 0.2 | Kwh/1,000 gallons treated |
| Total Project Energy Cost for water = | 32.30 | Kwh |
| Total Estimated GHG Emissions related to Wastewater = | 0.01 | tons/year |

**CONVERSION TABLE**

| CONVERT | MULTIPLY BY | |
|---|---|---|
| MWH TO LBS | 726 | Conversion factor from 2014 ISO New England Electric Generator Air Emissions Report |
| LBS TO SHORT TONS | 0.0005 | |

# Appendix F
# Infrastructure Supporting Documentation

# Infrastructure Supporting Documentation

## Stormwater Management

Tables F-1 and F-2 provide existing and proposed site hydrology for the Current Project using a HydroCAD model. This analysis has been updated from the SEIR to reflect the removal of the Three Cambridge Center Mixed Use Building site and addition of Office Building B at 250 Binney Street (Fourteen Cambridge Center).

**Table F-1 Existing Site Hydrology**

| Project Component | Existing Site Impervious Area (SF) | Existing Site Pervious Area (SF) | Existing Site Runoff Rate 2-year, 24-hour Design Storm (CFS) | Existing Site Runoff Volume 2-year, 24-hour Design Storm (AF) |
|---|---|---|---|---|
| Phase 1A - Office Building A Net New | 27,707 | 10,155 | 2.09 | 0.164 |
| Phase 1B – Residential Building South Total | 38,630 | 5,974 | 2.68 | 0.217 |
| Phase 2A – Office Building B Net New | 51,223 | 9,398 | 3.55 | 0.284 |
| Phase 2B - Residential North Total | 37,406 | 9,840 | 2.69 | 0.213 |
| Whitehead Institute Addition | 14,500 | 500 | 0.94 | 0.078 |
| **TOTAL** | **169,466** | **35,867** | **11.95** | **0.956** |

**Table F-2 Proposed Site Hydrology**

| Project Component | Proposed Site Impervious Area (SF) | Proposed Site Pervious Area (SF)* | Proposed Permeable Paver Area (SF) | Infiltration System Capacity (CF)** | Proposed Site Runoff Rate 25-year, 24-hour Design Storm (CFS) | Proposed Site Runoff Volume 25-year, 24-hour Design Storm (AF) |
|---|---|---|---|---|---|---|
| Phase 1A - Office Building A Net New | 27,707 | 10,155 | 0 | 6,178 | 1.85 | 0.162 |
| Phase 1B – Residential Building South Total | 15,009 | 29,595 | 10,443 | 8,119 | 2.62 | 0.168 |
| Phase 2A – Office Building B Net New | 33,282 | 27,339 | 7,941 | 9,089 | 3.44 | 0.278 |
| Phase 2B - Residential North Total | 19,165 | 28,081 | 7,762 | 7,746 | 2.68 | 0.213 |
| Whitehead Institute Addition | 7,500 | 7,500 | 0 | 1,850 | 0.94 | 0.076 |
| **TOTAL** | **102,663** | **102,670** | **26,146** | **32,982** | **11.53** | **.897** |

*Permeable pavements and green roofs included in proposed site pervious area

**Permeable pavements included in infiltration system capacity, assumes 2-feet deep reservoir course with 30% voids

## Wastewater Generation

Table F-3 below presents the estimated wastewater generation for the Current Project by Project Component.

**Table F-3 Estimated Wastewater Generation for the Current Project**

| Project Component[1] | Use | Quantity | Flow Rate (gpd) | Sewage Generation (gpd) |
|---|---|---|---|---|
| **New Project-Related Sewage Generation** | | | | |
| Phase 1A – Office Building A | Office | 384,236 | 75/1,000 sf | 28,818 |
| | Retail | 2,000 | 50/1,000 sf | 100 |
| | Restaurant | 106* | 50/seat | 5,300 |
| *Office Building A Total* | | | | *34,218* |
| Phase 1B – Residential South | Residential | 650** | 110/bdrm | 71,500 |
| *Residential South Total* | | | | *71,500* |
| Phase 2A – Office Building B | Office | 358,176 | 75/1,000 sf | 26,863 |
| | Retail | 20,000 | 50/1,000 sf | 1,000 |
| Office Building B *Total* | | | | *27,863* |
| Phase 2B – Residential North | Residential | 134** | 110/bdrm | 14,740 |
| *Residential. North Total* | | | | *14,740* |
| Whitehead Institute | Commercial | 60,000 | 75/1,000 sf | 4,500 |
| *Whitehead Institute Total* | | | | *4,500* |
| Broad Institute Office Conversion | Office | 14,000 | 75/1,000 sf | 1,050 |
| *Broad Institute Total* | | | | *1,050* |
| **Total New Project-Related Sewage Generation** | | | | **153,871** |
| **Existing Sewage Generation to be Removed** | | | | |
| Eleven Cambridge Center | Commercial | 76,600 | (75/1,000sf) | (5,745) |
| Fourteen Cambridge Center | Commercial | 62,576 | (75/1,000sf) | (4,707) |
| **Total Existing to be Removed** | | | | **(10,452)** |
| **Net New Wastewater Generation** | | | | **143,419** |

gpd gallons per day
bdrm bedroom
*assumes 8,000 SF and 75 SF/seat
**assumes 1.4 bedrooms per unit
1 The Innovation Space Conversion component is not included because it will generate the same amount of wastewater as the existing office space.

Table F-4 summarizes the proposed Infiltration/Inflow (I/I) removal requirement for each Project Component for the Current Project.

**Table F-4 Current Project I/I Removal by Project Component**

| Project Component[1] | Net New Wastewater Generation (gpd) | I/I Removal Requirement (gallons) |
|---|---|---|
| Phase 1A - Office Building A Net New | 28,473 | 113,892 |
| Phase 1B – Residential Bldg. South Total | 71,500 | 286,000 |
| Phase 2A – Office Building B Net New | 23,156 | 92,624 |
| Broad Institute Office Conversion | 1,050 | 4,200 |
| Whitehead Institute | 4,500 | 18,000 |
| Phase 2B - Residential North Total | 14,740 | 58,960 |
| **Total I/I Removal** | **143,419** | **573,676** |

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

# Appendix G
# Hazardous Materials

# Hazardous Materials

This section provides an updated description of the historic and existing site conditions as well as the potential measures proposed to handle or mitigate conditions to the hazardous materials conditions for each Project Component based on the Project Change, as described in Chapter 1, *Project Change Description*. The Cambridge Center (CC) properties included as part of the Project are located on three separate parcels (Parcels 2, 3 and 4), as historically used to describe hazardous materials conditions.

## Summary of Project Change Impacts

As described in Chapter 2, *Project Change Description*, Office Building A and Office Building B will be constructed on the Parcel 2 lots following demolition of the existing structures located at 145 Broadway (previously referred to as 11 CC) and 250 Binney Street (previously referred to as 14 CC), respectively. The Office Buildings A and B will include below grade parking. The Residential Buildings – North and South will be constructed on the existing Cambridge Center North Garage for which no additional parking is planned below-grade. The proposed Innovation Space Conversion component consists of conversion of existing office space within the building located at 255 Main Street (previously referred to as 1 CC).

From a hazardous materials perspective, there are no key changes to report as the Project Change consists of potential new development associated with rezoning the KSURP area. As each Project Component moves forward, it will be required to adhere to applicable hazardous materials regulations, which were described in detail in Chapter 7, *Hazardous Materials* of the SEIR.

### Office Building A

As reported in the SEIR, no documented releases have occurred at 145 Broadway. The property was developed before the MCP regulations in 1988.

### Residential Buildings – North and South

As reported in the SEIR, response actions at the Cambridge Center North Garage were conducted under Phase IV of the 1988 Massachusetts Contingency Plan (MCP) as finalized in the Final Inspection Report submitted to MassDEP in 1990 under (RTN 3-00758). A long-term groundwater monitoring program was conducted from 1990 to 1994 to monitor groundwater quality in the remediated area. Low levels of

petroleum and VOCs were detected throughout the monitoring period. The Project Component site is currently pending a No Further Action determination.

**Office Building B**

The site at 250 Binney Street has been impacted by historical releases of petroleum hydrocarbons and tracked under RTN 3-3274. Interim Measures were performed at this site in 1990 to remove oil product (kerosene) from an on-site observation well. Based on site history it is likely that the contamination is from a release of kerosene from former above ground storage tanks, which were removed in the 1960's. The site is currently classified as Pending No Further Action following submission of a Consultant of Record Opinion dated 31 July 1997 which states that "no further remedial action is necessary. Contaminated soil was encountered during expansion of the building in 2007. Approximately 157 tons of contaminated soil was removed from the site during the building expansion activity.

**Innovation Space Conversion**

The site at 255 Main Street is not currently listed as a Disposal Site under the MCP. Recent soil testing conducted in 2012 performed on a shallow test pit sample for the new iconic entry indicated that on-site fill soils contain low but non-reportable levels of SVOCs, metals, PCBs, and TPH. Similar results could be expected for building improvements involving management of soil.

**Whitehead Institute Office Addition**

As reported in the SEIR, soil and groundwater contamination were encountered in investigations conducted prior to construction in 1983. Although the building was constructed prior to the 1988 MCP regulations contaminated soil and groundwater was managed with guidance and oversight from MassDEP (previously known as DEQE) under RTN 3-00273. This site is currently designated as No Further Action, as determination by MassDEP.

## Historical and Existing Site Conditions

As described in the *Notice of Project Change Form Narrative/Project Summary* section of this NPC, Cambridge Center emerged from approximately 24 acres of vacant land parcels previously occupied by low-rise manufacturing and industrial buildings, which were demolished beginning in 1968 as part of the approved KSURP. Cambridge Center had a number of industrial usages dating back to the late 1800's that have impacted subsurface environmental conditions. Available information indicates that the KSURP area was occupied by wetlands and marshland surrounding Leachmere's Point until the early 1800's. Originally, the general KSURP area was developed in 1805 as a port of delivery connected to the Charles River tidal basin. By 1850, the KSURP area had been filled. A network of canals, canal-oriented streets and building lots were subsequently established.

Chapter 1, *Project Change Description*, provides general descriptions of existing site conditions for each Project Component site. These sites are located in an urban environment, characterized by flat-lying topography dipping slightly to the south. The depth to groundwater ranges from 8 to 12 feet below existing ground surface. Groundwater flow direction is anticipated to be towards the southeast. Subsurface soil conditions consist of a surficial layer of miscellaneous fill (urban fill) overlying former marsh and marine deposits consisting of organic soil and peat, marine sand and marine clay. Glacial outwash and till soil strata are present below the marine clay at depths greater than 50 feet from ground surface.

**KSURP Parcel 2**

KSURP Parcel 2, currently occupied by the Cambridge Center North Garage, 145 Broadway (11 CC), and 250 Binney Street (14 CC) was occupied by a variety of industrial facilities, including an oil storage terminal, piano manufacturing, bus and truck body works, paint and varnish manufacturers, a plumbing supplies company, a liquid carbonic company, and a rubber stamp company. The area now occupied by 14 CC was used by Socony for vacuum oil packaging, a tar plant, sheet metal fabrication and paving machine manufacturing. The Broad Canal was constructed through the southern portion of the parcel in the early 1800's running parallel to Broadway, as shown on Figure G.1.

Figures G.2a-c present the historical maps for Parcel 2. By 1969, the former industrial buildings had been demolished and the canal filled. This parcel remained vacant until site development began in the early 1980's. The first buildings to be constructed included 14 CC (1983) and 11 CC (1984). The parcel is now completely occupied by low to high-rise commercial and biotech lab buildings and a parking garage constructed from 1983 to 2013. No vacant lots remain within this parcel.

The Cambridge Center North Garage constructed in 1990 is a 6-story precast concrete garage founded on end-bearing piles driven to glacial soils approximately 50 to 70 feet below-grade. No below-grade space exists below the garage.

The existing office/research building at 11 CC to be demolished as part of the Project is a four-story building founded on spread footing foundations following excavation of the fill and organic soils and backfilling to footing level with compacted structural fill. During construction and surrounding site improvements in 1983/1984 a majority of the historic fill was excavated and stockpiled. Visibly contaminated soil was not observed during excavation. Some stockpiled fill material was reused for backfill and clean fill was imported to the site to raise the footing grades. The remainder of the stockpiled fill soils were removed from the site. Although no chemical testing of soil or groundwater has been conducted at this property the potential for significant contamination to be present in soil is low. Testing of groundwater at the adjacent and upgradient property at Fifteen Cambridge Center indicates that groundwater has been impacted by VOCs (carbon tetrachloride and chloroform) contamination RTN 3-19217. Although 15 CC is updradient from 11 CC, it was historically separated from the subject property by the former Broad Canal. However, it is possible that groundwater at the subject property

could be impacted from historical site usage or more recent use as research and development.

The existing office research building at 14 CC (250 Binney Street) is a two story steel and masonry building. The north half of the building is founded on spread footing foundations following the complete removal of the fill and organic soils to the top of the naturally deposited sand stratum. The south half of the building is supported on spread footings bearing directly on the naturally deposited sand stratum. Fill and organic soils were removed at the individual footing locations but left-in-place between the footings in some areas. Individual footing excavations were backfilled with off-site granular fill up to slab level. Previous explorations indicated the presence of petroleum contamination in the fill and organic soils, therefore excavation at this site should anticipate the need to manage excavated soils in accordance with the MCP. Shallow groundwater is also impacted with petroleum which will require treatment during construction. Deep groundwater may also be impacted by a release of 1,2 DCA from a cross-gradient property at 225 Binney Street, RTN 3-30331. Consideration of this contamination would be limited to deep basement construction and management of permanent slab-underdrain water.

**KSURP Parcel 3**

KSURP Parcel 3 now occupied by Whitehead Institute located north of Main Street was occupied by UBS Chemical Corporation, which manufactured adhesives. Other historic uses of the parcel included an auto salvage and scrap yard, typesetters, a printed circuits company, an electrotype research building, a Gulf gasoline station (Main Street), a machine and tool company, an auto parts manufacturing company, residential houses, a diner, and the former South Canal. Whitehead Institute was the first building to occupy this parcel in 1983-84. KSURP Parcel 3 is currently occupied by the Marriott Residence Inn at 6 CC, a parking garage, The Broad Institute at 7 CC and a commercial office building at 8 CC all constructed during the late 1980 to 2005. The most recent construction to occupy this parcel was completed as an addition to the Broad Institute at 75 Ames Street in 2012/2013.

**KSURP Parcel 4**

KRURP Parcel 4 now occupied by high rise commercial buildings known as 1, 3, 4 and 5 CC, a hotel at 2 CC and a parking garage that were constructed during the period 1980 to 1990. 1 CC is located at the intersection of Main Street and Broadway (Figure 1.2c). Historical maps for Parcel 4, as shown on Figures G.3 a-c, indicate that the 1 CC area was occupied by carriage repair shop and additional buildings shown as stores and flats in 1900. The 1934 and 1950 plans indicate that the site was occupied by the Boston Elevated and the MBTA Traction power station. Other historical uses in this parcel included an electroplating facility, a bus yard and subway exit and auto repair and filling stations. 1 CC was constructed in 1987. Recent construction on this parcel included a connector between 3, 4, and 5 CC, and a renovated plaza area completed in 2013. Currently a high-rise residential building

is under construction at 88 Ames Street between 4 and 5 CC. This site is a DEP listed site with RTN 3-33330 for chlorinated solvents in soil and groundwater.

## Status of On-Site Releases

A summary table of the Release Tracking Numbers (RTNs) for the Cambridge Center parcels is provided in Table G-1 below. The on-site releases subject to the Project Change are summarized below. No documented releases have occurred at 1 or 11 CC.

### RTN 3-00758 (290 to 300 Binney Street - North Garage)

Remediation was conducted in 1989 in compliance with the MassDEP-approved Remedial Response Implementation Plan (RRIP). Oil contaminated soil and underground storage tanks were remediated prior to construction at the site. Remediation included excavation, stockpiling, and on-site treatment and subsequent removal of oil contaminated soils by asphalt batching, along with removal of USTs conducted during construction of the above-grade parking garage in 1990. Long-term groundwater monitoring program, conducted as part of RRIP from 1991 to 1994 indicate the presence low levels of VOCs and total petroleum hydrocarbons (TPH). A No Further Action determination was achieved in 1993.

### RTN 3-03274 (250 Binney Street - 14 CC)

Previous explorations indicated the presence of petroleum contamination in the fill and organic soils, therefore excavation at this site should anticipate the need to manage excavated soils in accordance with the MCP. Shallow groundwater is also impacted with petroleum which will require treatment during construction. Deep groundwater may also be impacted by a release of 1,2 DCA from a cross-gradient property at 225 Binney Street, RTN 3-30331. Consideration of this contamination would be limited to deep basement construction and management of permanent slab-underdrain water. RTN 3-03274 is currently classified as Pending No Further Action following submission of a Consultant of Record Opinion dated 31 July 1997 which states that "no further remedial action is necessary at this site. Contaminated soil was encountered during expansion of the building in 2007. Approximately 157 tons of contaminated soil was removed from the site during the building expansion activity.

### RTN 3-00273 (Whitehead Addition)

Soil and groundwater at the Whitehead Institute Addition site has been impacted by heavy metals and VOCs as a results of historical site use as a chemical manufacturing facility. A No Further Action determination was achieved in 1993.

## Table G-1 Summary of Other RTNs at Cambridge Center Properties

| Name/Address | RTN | Description of Release | Regulatory Status |
|---|---|---|---|
| Main Street (MIT Whitehead Institute, 9 CC) | 3-00273 | Volatile organic compounds (VOCs) were encountered in test pit excavations conducted in 1983 in preparation of building construction. Additional investigations determined that metals and VOCs are present in soil and groundwater at the site. The contamination was due to spills and releases from former underground storage tanks at the site. Polymers and adhesives were manufactured at the site in 1971 releasing chemicals associated with these processes in fill, natural soil, and groundwater. A risk assessment conducted by Environmental Research & Technology, Inc. in 1983 assigned a low risk of potential environmental/human health impairment from conditions at this site; however, the report cautioned that uncontrolled exposure or release of chemicals could occur during excavation of soil. | DEPNFA (No further action required) 1993 |
| 99 -109 Broadway (10 CC) | 3-00747 | Historical use of this property included soap manufacturer, building wrecker's yard and storage, metals storage, rubber goods manufacturer, carpenter, saw mill, piano/organ factory, lumber company, auto garage, and electrical fixtures. A 1987 Environmental Site Assessment (ESA) conducted at the site just prior to construction of the current building indicated that contaminants are present in soil including oil and grease, total metals arsenic, barium, cadmium, lead and mercury, and trace level toluene. Contaminants including oil and grease, Ploycyclic Aromatic Hydrocarbons (PAHs), Volatile Organic Compounds (VOCs) benzene, vinyl chloride, and trans-1,2 dichloroethene are present in groundwater. The risk assessment concluded negligible risk of cancer or pollutant-related health risks associated with development and use of site. A letter from MassDEP to the Cambridge Redevelopment Authority dated 21 July 1988 indicated that MassDEP concluded that the site is a "disposal site for which no further action is necessary." | PENNFA (pending no further action) 1988 |
| 115 Broadway 12 CC (Potter Parcel) | 3-01988 3-25774 | The site formerly known as the Potter Parcel on Parcel 2 of the Kendall Square Urban Renewal Area was occupied with an oil storage facility from 1886 to 1966. Environmental evaluation conducted in the 1987 and 1993 concluded that soil and groundwater at the site are contaminated with petroleum constituents consistent with former site usage. The source of contamination appears to be a tank farm that was formerly located on the property. The site was listed as location to be investigated in 1989 and was given RTN 3-1988 in 1993. RTN 3-25774 was assigned to address groundwater contamination following development of the site in 2006. In 2009 a Phase V Status Report to maintain a Remedy Operation Status monitoring this disposal site. A Remedy Implementation Plan was conducted in 2006 concurrently with the construction of Building 6A (office, lab, steam/power co- | RTN 3-01988 related to soil contamination achieved regulatory closure with a Class A-3 RAO and Activity Use Limit (AUL) in 2009<br><br>Remedial activities associated with underslab drainage effluent below Biogen Bldg 6A was completed in by the filing of a Phase V Completion Statement and Permanent Solution in |

**Table G-1 Summary of RTNs at Cambridge Center (Continued)**

| Name/Address | RTN | Description of Release | Regulatory Status |
|---|---|---|---|
| | | generation) and included removal and off-site disposal of petroleum source-area impacted soils and groundwater dewatering, treatment, and discharge. Quarterly groundwater sampling indicates declining trend in concentrations of petroleum related compounds (EPH, VPH, PAHs, and petroleum related VOCs). | February 2015 under RTN 3-25774 |
| 262 Binney Street (14 CC) | 3-03274 | This site, located at the northeast side of the North Garage was developed in 1983 with the current building. Petroleum contamination was noted during construction in 1982-83. Fill was removed in the northern portion of the building and replaced with clean soil. A limited site investigation was conducted at the property in 1990. Soil testing detected kerosene contamination. NAPL was measured in one monitoring well. Haley & Aldrich concluded in a Consultant of Record Statement dated 31 July 1997 that conditions at the site do not represent potential exposures to the building occupants based on the results of a health risk assessment conducted in 1992 and concluded that no further remedial action was necessary. MassDEP concluded in a letter dated 22 September 1992 that the conditions do not appear to present an immediate threat to public health, safety or the environment. | PENNFA (pending no further action) |
| 12 CC (Biogen 6A) (Potter Parcel) | 3-25774 | Concentrations of 1,2-dichloroethane, the primary contaminant, have been non-detect since 2012. Remedial activities associated with underslab drainage effluent below Biogen Bldg 6A was completed in by the filing of a Phase V Completion Statement and Permanent Solution in February 2015 | Permanent Solution No Conditions, February 2015 |
| 346 Binney Street (15 CC) | 3-01987 3-15370 | Site was originally listed as an MCP Disposal Site under RTN 3-1987. During an initial environment assessment on the Fulkerson Parcel, metals, semi-volatile organic compounds (SVOCs), and petroleum hydrocarbons were identified in soil and groundwater samples. A new RTN 3-15370 was issued in 1997. Remediation occurred concurrent with development. MCP Phase I and Tier Classification Report were written in 1998. RAM activities included management of contaminated soil and groundwater concurrently with the construction of the existing building in 1999-2001. A RAM completion report and Response Action Outcome (RAO) were submitted in 2002. | Class A-3 RAO with Activity Use Limit (AUL) 2002, AUL Amended in 2013. |
| 346 Binney Street (15 CC) | 3-19217, linked to 3-15370 (Primary RTN) | January 2000 groundwater samples associated with dewatering activities during construction reported carbon tetrachloride and chloroform in concentration above MCP RCGW-2. Immediate Response Action (IRA) activities were undertaken. | linked to Primary RTN 3-15370 with Class A-3 RAO |
| | | | |

**Table G-1 Summary of RTNs at Cambridge Center (Continued)**

| Name/Address | RTN | Description of Release | Regulatory Status |
|---|---|---|---|
| 346 Binney Street (15 CC) | 3-18804, linked to 3-15370 (Primary RTN) | Release from an abandoned UST was identified September 1999 during remedial actions for redevelopment of the site (RTN 1987). An Immediate Response Action (IRA) was implemented to mitigate release from UST. RTN was linked to the Class A-3 RAO Statement. The contents of the tank are unknown, though residual contents may be paint thinner. Tank capacity is ~3,000 gallons. IRA Completion Statement submitted February 2000. | linked to Primary RTN 3-15370 with Class A-3 RAO |
| 290- 300 Binney (North Garage) | 3-00758 | Remediation completed in compliance with the MassDEP-approved Remedial Response Implementation Plan (RRIP) in 1989. Oil contaminated soil and underground storage tanks were remediated prior to construction at site. Remediation included excavation, stockpiling, and on-site treatment and subsequent removal of oil contaminated soils by asphalt batching, along with removal of USTs conducted during construction of the above-grade parking garage in 1990. Long-term groundwater monitoring program, conducted as part of RRIP from 1991 to 1994 indicate the presence low levels of VOCs and total petroleum hydrocarbons (TPH). | PENNFA (pending no further action) 1993 |
| 3, 4 and 5 CC Connectors | 3- 31047 | Site assessment activities conducted in support of site development identified compounds in soil at concentrations exceeding MCP Reportable Concentrations, including VOCs (cis-1,2-DCE, TCE, and PCE), PAHs, cadmium, and lead, attributed to historical site filling and usage. RAM activities were conducted to manage Remediation Waste associated with below-grade foundation construction of two new building connectors and new utilities. | Class A-2 RAO 2013 |
| 88 Ames Street<br>Ames Street Residences | 3-33330 | Site assessment activities conducted in 2015 in support of new site development identified compounds in soil and groundwater at concentrations that exceeded the applicable Reportable Concentration including chlorinated solvents, lead and arsenic. RAM activities are currently underway for management and assessment of chlorinated solvents in soil and groundwater associated with site construction. | Release Notification submitted 23 December 2015 (unclassified), now under construction |
| 310-344 Binney (17 CC) | 3-01987<br>3-03437 | RTN 3-01987 was originally assigned to the Fulkerson Parcel located within the Kendall Square Urban Renewal Parcel 2. The Fulkerson Parcel was divided into two parcels and assigned different RTNs (one for 310 to 344 Binney Street and one for the remainder of the Fulkerson Parcel which eventually transitioned to 15 CC). RTN 3-03437 was assigned to 310 to 344 Binney Street in 1990 when an ESA identified metals, VOCs, SVOCs, PAHs, and petroleum hydrocarbons in soils samples, along with | PENNFA (pending no further action) 1997 RAM activities were conducted during 2012 and 2013 in conjunction with site development. A RAM Completion Report and Permanent |

**Table G-1 Summary of RTNs at Cambridge Center (Continued)**

| Name/Address | RTN | Description of Release | Regulatory Status |
|---|---|---|---|
| | | metals, petroleum hydrocarbons, and SVOCs in groundwater, likely due to numerous petroleum and solvent based USTs and ASTs. ESA concluded that development and use of the site posed no significant pollutant-related health risks and RTN 3-03437 achieved a No Further Action determination in 1997.<br>RAM Activities associated with construction of the currently existing building occurred in 2012 and 2013 as a Post Closure response activity. Three USTs were uncovered in 2012 during pre-excavation activities for construction, one of which was leaking and assigned RTN 3-30699. After UST removal disposal of impacted soil was addressed under the RAM Plan submitted under RTN 3-3437. A subslab vapor barrier and passive ventilation system was installed below the ground floor slab of the new building and the connector to 15 CC. Monitoring of indoor air was conducted following construction and occupancy of the building. A RAM Completion Report and Permanent Solution Statement was submitted in June 2015. An Activity and Use Limitation was recorded for the property. | Solution Statement with Conditions (AUL) was submitted in June 2015. |
| 415 Main Street<br>7 CC and<br>Broad Institute Expansion at 75 Ames Street | 3-01989 | This site is part of a larger site (Parcel 3) which is listed as a disposal site by MassDEP. Results of a 1989 Phase I Environmental Site Assessment detected petroleum hydrocarbons, heavy metals, volatile organic compounds and semi-volatile organic compounds in the soil and groundwater at the site. A Consultant-of-Record Statement under the 1993 Massachusetts Contingency Plan (MCP) was prepared for Parcel 3 and submitted to MassDEP on August 2, 1995. The Consultant-of-Record statement affirmed that based upon a review of existing information pertaining to the site, the conclusion contained in the 1989 assessments recommending the No Further Action determination was valid and complied with the 1988 MCP.<br>A RAM Plan was submitted in 2004 to manage contaminated soil associated with the construction of the current building at 7 CC. A Class A2 RAO was achieved on 5 December 2005 following completion of RAM activities.<br>Management of contaminated soil during the 2012/2013 construction of the current Broad Institute addition at 75 Ames Street was conducted as a Post-RAO response action. | No Further Action 1995 and<br>Class A-2 RAO 2005 |
| 120 Broadway<br>6 CC | 3-12210 | This site is also part of a larger site under RTN 3-01989, Kendall Square Urban Renewal Parcel 3. RTN 3-12210 was assigned to a historic release from a gasoline discovered during demolition of the former gasoline station and removal of two 8000 gallon gasoline USTs. | Class A-2 RAO 1996 |

| | | | |
|---|---|---|---|
| | | Response actions conducted as an Immediate Response Action (IRA) also included removal of contaminated soil and groundwater. | |

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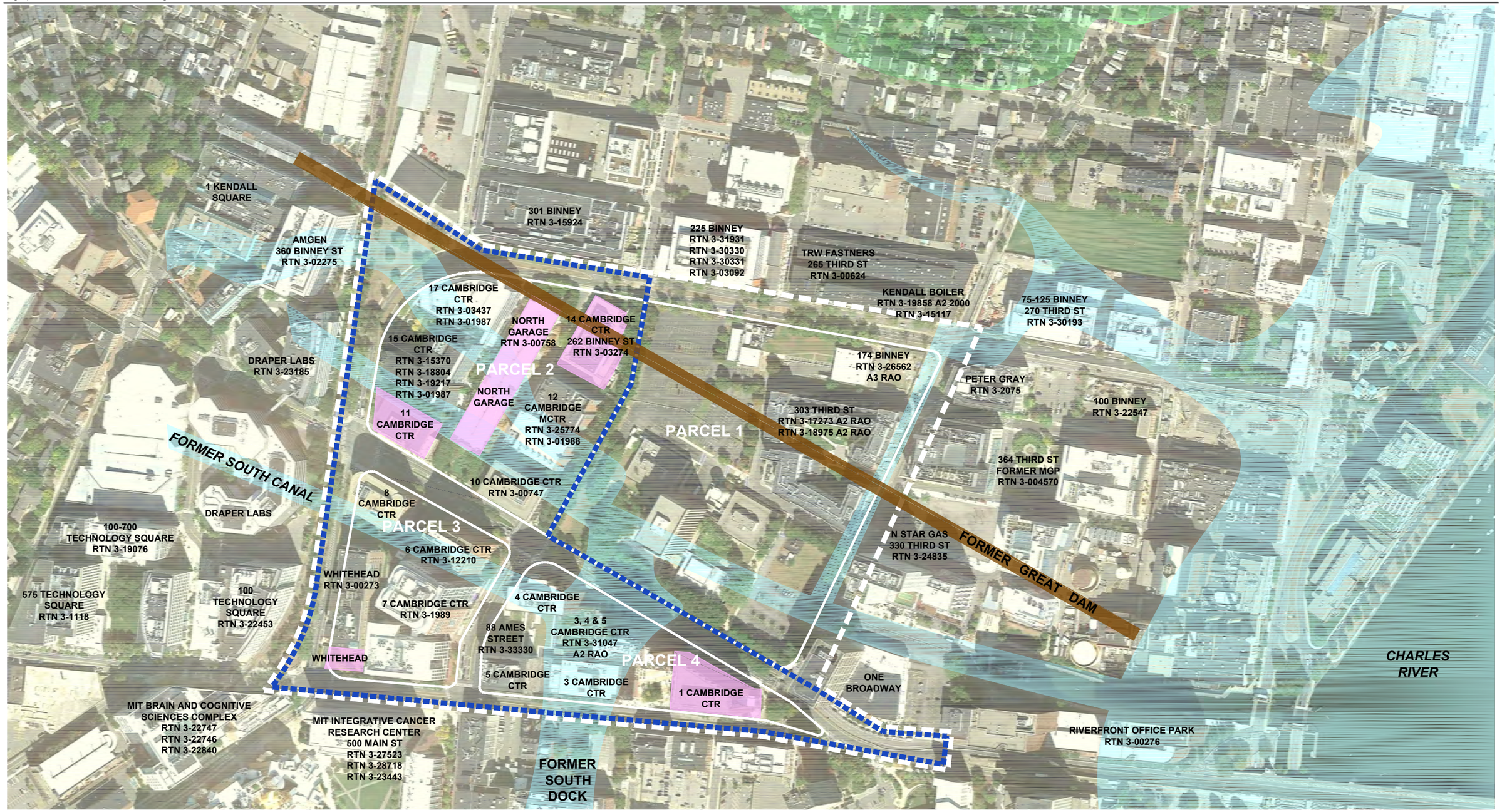



**LEGEND**

- FILLED TIDELAND
- LAND
- FORMER WATER WAY
- KSRUP BOUNDARY
- MXD DISTRICT

**NOTES**

1. IMAGE, DATED 27 SEPTEMBER 2014, TAKEN ELECTRONICALLY FROM GOOGLE EARTH PRO.
2. HISTORICAL 1777 LAND COVER INFORMATION DIGITIZED FROM A FIGURE TITLED " CAMBRIDGE: VICINITY IN REVOLUTIONALRY TIMES COMPILED TO SHOW THE PAROLE LIMITS OF BURGOYNE'S OFFICERS 1977" BY SAMUAL BATCHELDER DATED 1925 AND SHOULD BE CONSIDERED APPROXIMATE.
3. RTN LOCATIONS FROM MASS DEP DATABASE.

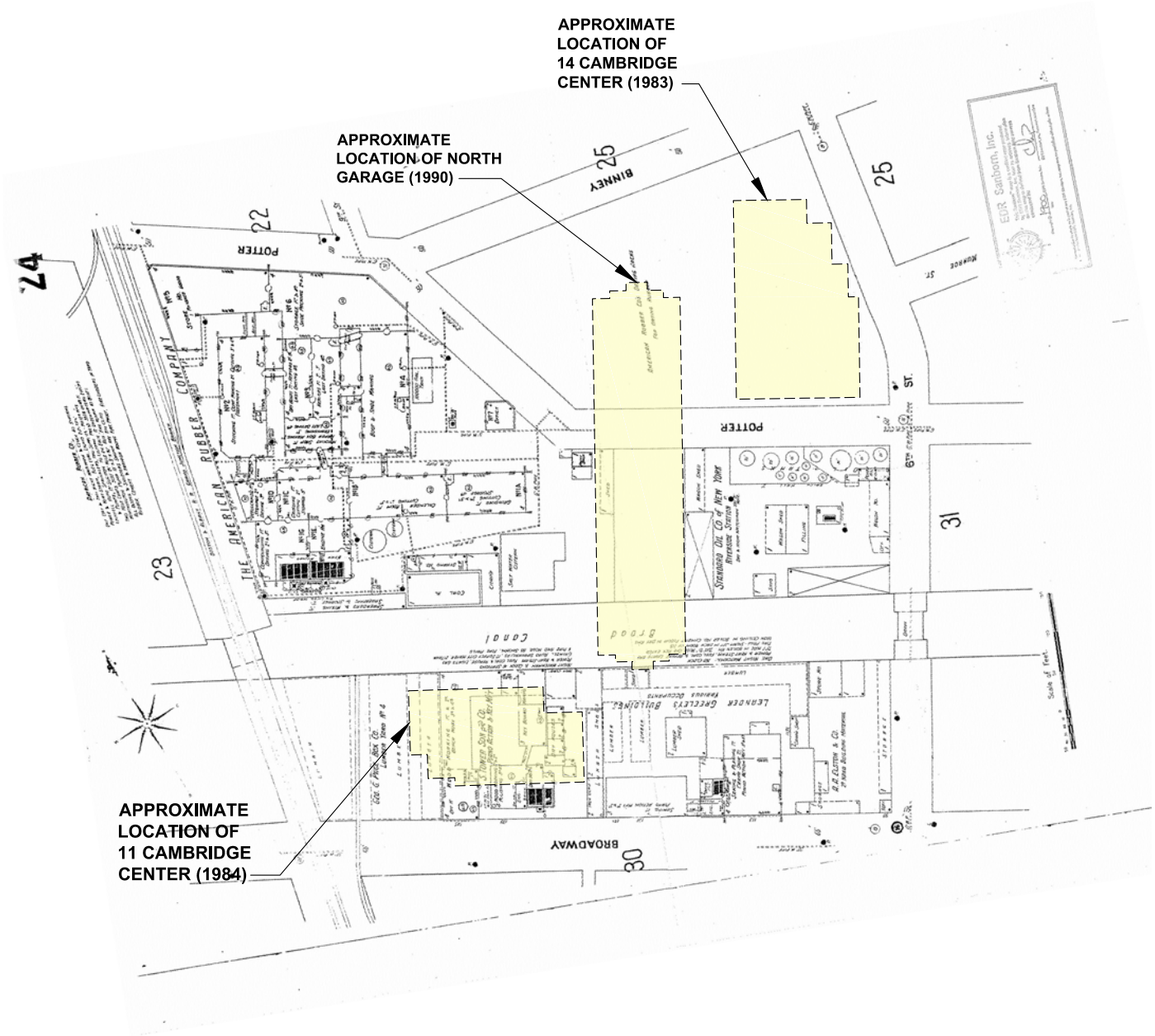
0 150 300 Feet (Approximate Scale)

**CRA**

Figure G.1

RTN LOCATIONS

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA



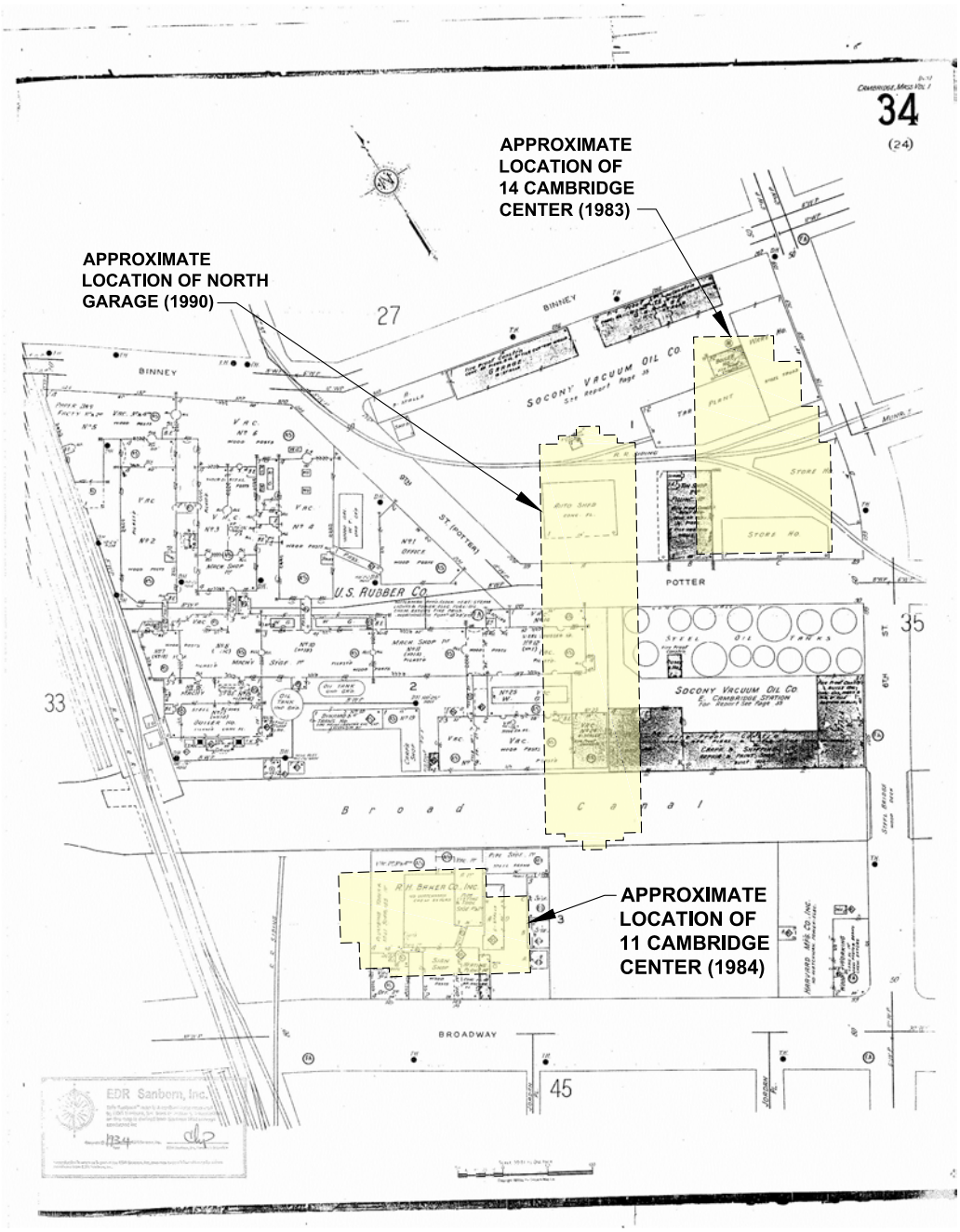

0 100 200 Feet (Approximate Scale)

**1900 CERTIFIED SANBORN MAP**

**CRA**

Figure G.2a
Historical Plan 1900 - KSURP Parcel 2

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA



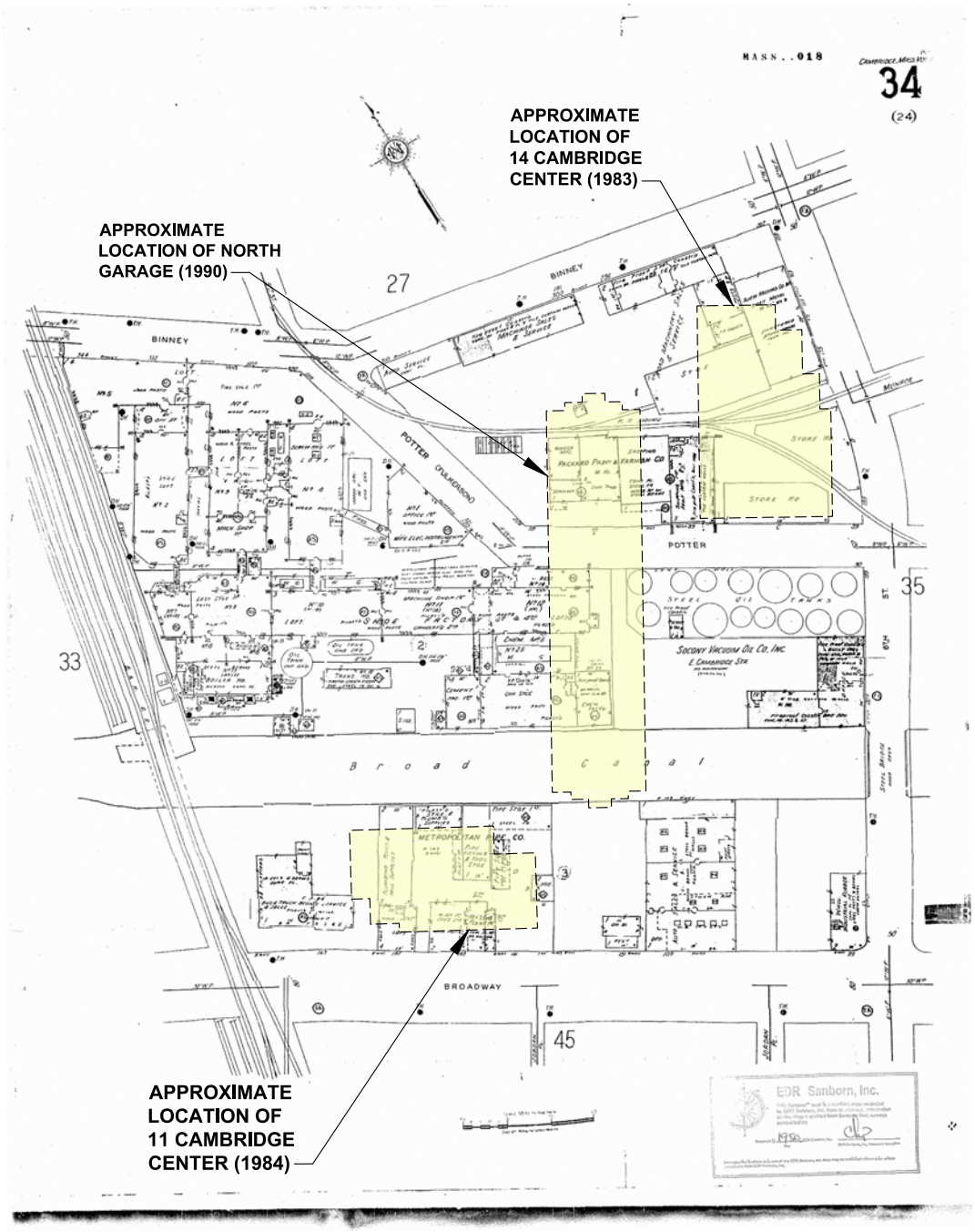

0 100 200 Feet (Approximate Scale)

**1934 CERTIFIED SANBORN MAP**

**CRA**

Figure G.2b
Historical Plan 1934 - KSURP Parcel 2

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA



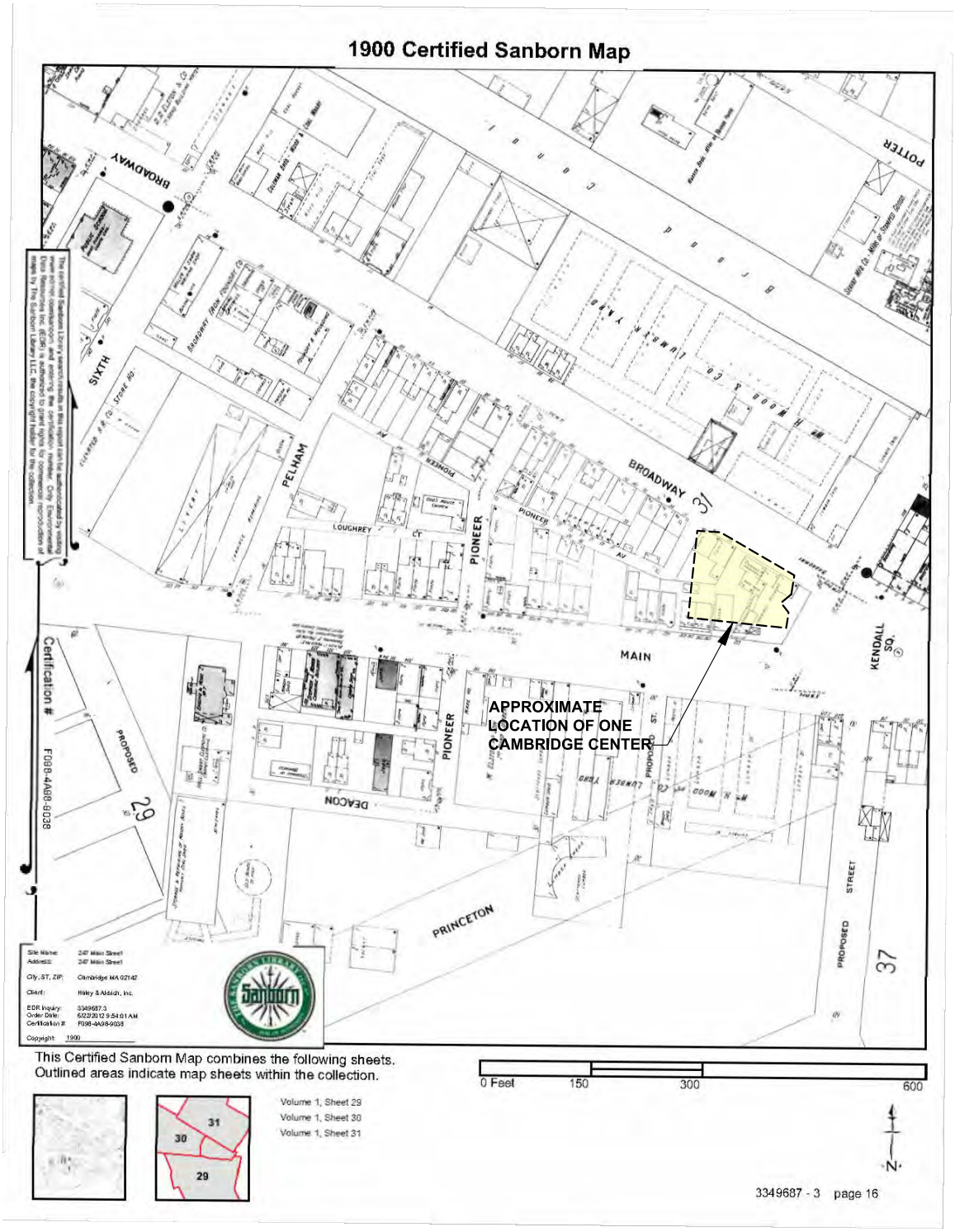

0 100 200 Feet (Approximate Scale)

**1950 CERTIFIED SANBORN MAP**

**CRA**

Figure G.2c
Historical Plan 1950 - KSURP Parcel 2

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA

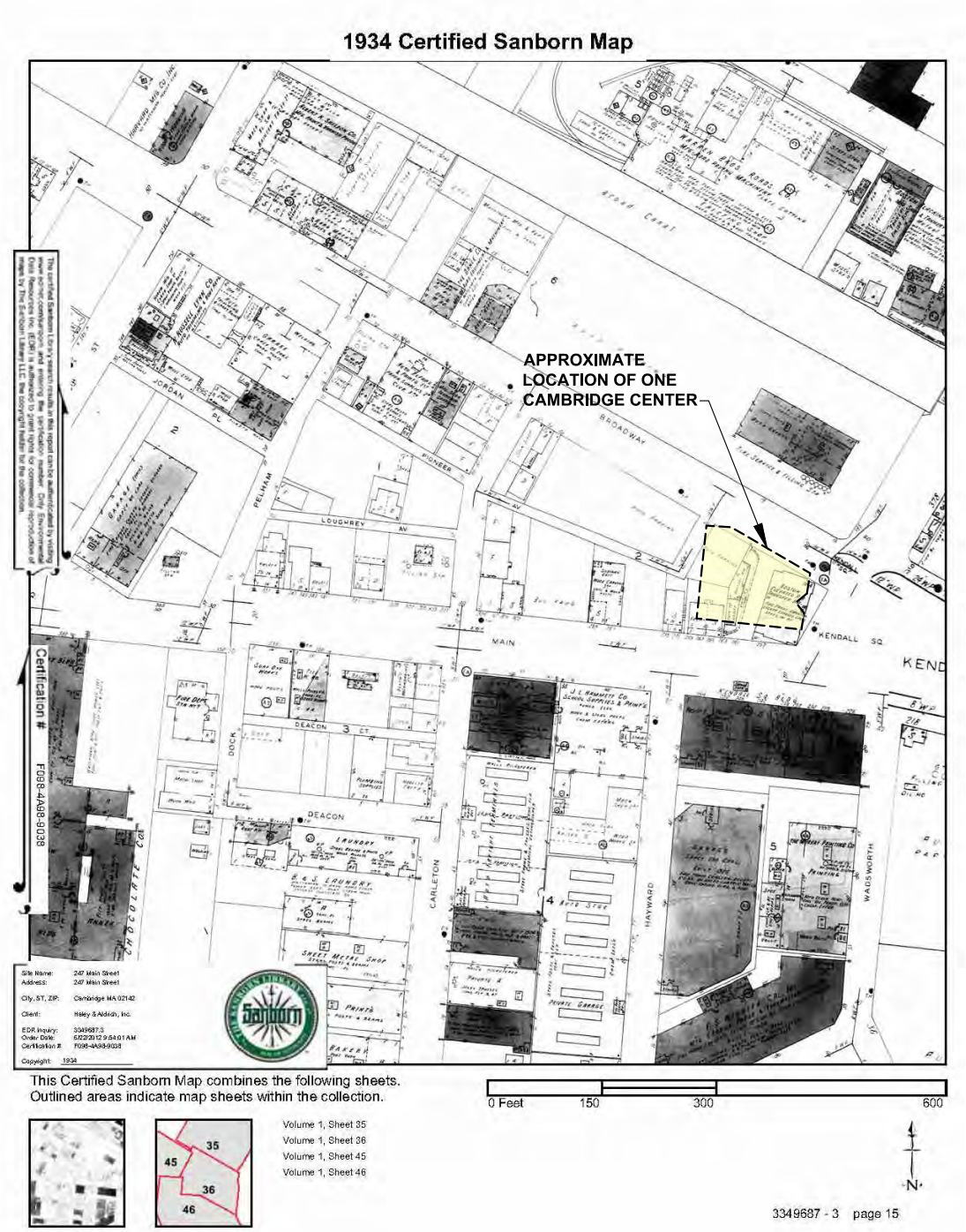



**CRA**

Source

Figure G.3a
Historical Plan 1900 - KSURP Parcel 4

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA



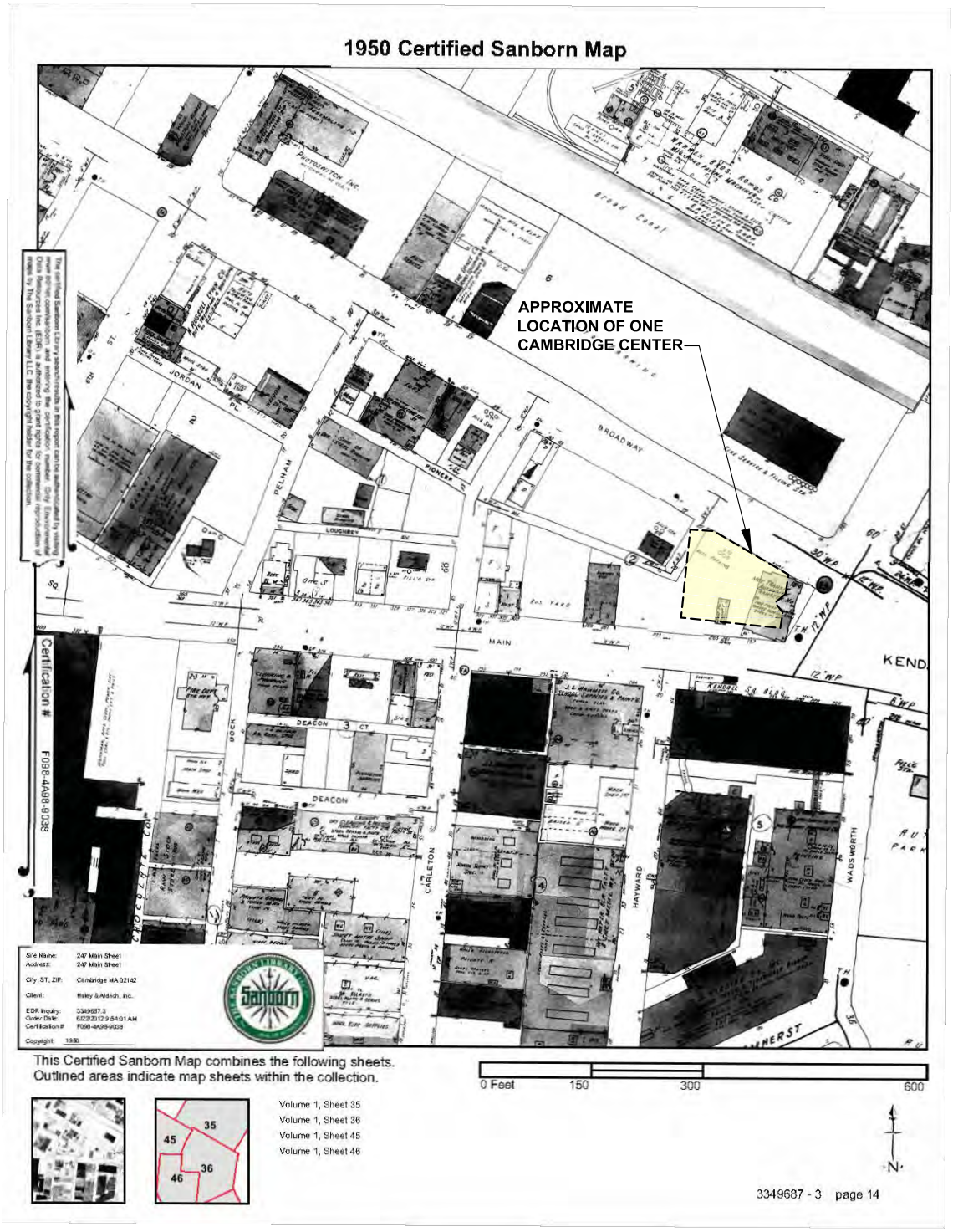

0 100 200 Feet

**CRA**

Source

Figure G.3b
Historical Plan 1934 - KSURP Parcel 4

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA




0 100 200 Feet

**CRA**

Source

Figure G.3c
Historical Plan 1950 - KSURP Parcel 4

Kendall Square Urban Renewal Project Amendment No. 10
Cambridge, MA