125CPD

125 CAMBRIDGEPARK DRIVE

APPLICATION FOR SPECIAL PERMIT: VOLUME 3
ARTICLE 22: GREEN BUILDING REPORT
PLANNING BOARD NUMBER: [TBD]

JULY 18, 2022

SUBMITTED TO: CITY OF CAMBRIDGE

SUBMITTED BY: LONGFELLOW REAL ESTATE PARTNERS

PREPARED BY: ELKUS MANFREDI ARCHITECTS

ELKUS | MANFREDI ARCHITECTS

LONGFELLOW

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REVIVAL
CAMBRIDGEPARK DRIVE
125

SECTION 8

Green Building Report

Green Building Project Checklist

Green Building Project Location: 125 Cambridge Park Drive

Applicant

Name: _____

Address: _____

Contact Information

Email Address: _____

Telephone #: _____

Project Information (select all that apply):

- ☐ New Construction – GFA: _____
- ☒ Addition – GFA of Addition: _____
- ☒ Rehabilitation of Existing Building – GFA of Rehabilitated Area: _____
  - ☐ Existing Use(s) of Rehabilitated Area: _____
  - ☐ Proposed Use(s) of Rehabilitated Area: _____
- ☒ Requires Planning Board Special Permit approval
- ☒ Subject to Section 19.50 Building and Site Plan Requirements
- ☐ Site was previously subject to Green Building Requirements

Green Building Rating Program/System:

- ☒ Leadership in Energy and Environmental Design (LEED) – Version: LEED-CS v4
  - ☒ Building Design + Construction (BD+C) – Subcategory: Core and Shell
  - ☐ Residential BD+C – Subcategory: _____
  - ☐ Interior Design + Construction (ID+C) – Subcategory: _____
  - ☐ Other: _____
- ☐ Passive House – Version: _____
  - ☐ PHIUS+
  - ☐ Passivhaus Institut (PHI)
  - ☐ Other: _____
- ☐ Enterprise Green Communities – Version: _____

Project Phase

☒ **SPECIAL PERMIT**

Before applying for a building permit, submit this documentation to CDD for review and approval.

Required Submissions

All rating programs:

- ☐ Rating system checklist
- ☐ Rating system narrative
- ☐ Net zero narrative (see example template for guidance)
- ☐ Affidavit signed by Green Building Professional with attached credentials – use City form provided (Special Permit)

8A. Sustainability Narrative

The Project at 125 CambridgePark Drive embraces a diverse range of sustainable concepts that form the foundation for this forward-looking Project, paramount of which is the re-use of the existing building. From a doubling of Open space, restoration of natural habitat and addition of trees, strong pedestrian connections, bicycle facilities, reduction of parking and provision of electric vehicles, on-site solar array, rainwater collection and resiliency measures and exemplary cool factor, high-efficiency mechanical systems, this Project strives to set the benchmark for sustainable design in the Alwefie Triangle. For additional project description see Volume 1.

The Project was reviewed for compliance using the USGBC's LEED for Core and Shell Development, (LEED-CS), version 4 rating system. The project plans to substitute LEEED v4.1 credit compliance pathways where applicable and as approved by the GBCI. The Project is targeting 64 out of a possible 110 credit points with an additional 15 credit points still undergoing evaluation to determine feasibility of achievement. The Project anticipates meeting the City of Cambridge requirement to be LEED v4 Gold 'certifiable'. In addition to the City of Cambridge requirements, the Project will be registered under the LEED-CS v4 rating system and will be pursuing formal certification with the USGBC.

The team will continue to evaluate design options against LEED requirements with the goal to design and construct a building which minimizes its impact on the environment, creates an engaging and healthy space for occupants and reduces operating costs. Several credits remain designated as 'Maybe' due to the uncertainty of future design decisions, which is common at this phase of the Project. The team will continue to evaluate LEED credits to pursue to ensure enough of a "point cushion" to ensure the LEED Gold requirement is met.

The USGBC recently released the beta version of the LEEDv4.1 rating system which is intended to serve as an update to (and improvement upon) LEEDv4. Recent guidance issued by the USGBC allows LEEDv4 projects to substitute any prerequisite or targeted credit for the LEEDv4.1 equivalent. Credits this Project intends to pursue using the LEED v4.1 criteria have been denoted with (LEEDv4.1) adjacent to the credit name within the scorecard below and ensuing credit narratives.

As detailed below, the Project meets the LEEDv4 Core and Shell Minimum Program Requirements and each of the required Prerequisites. Additionally, the following credits are being targeted:

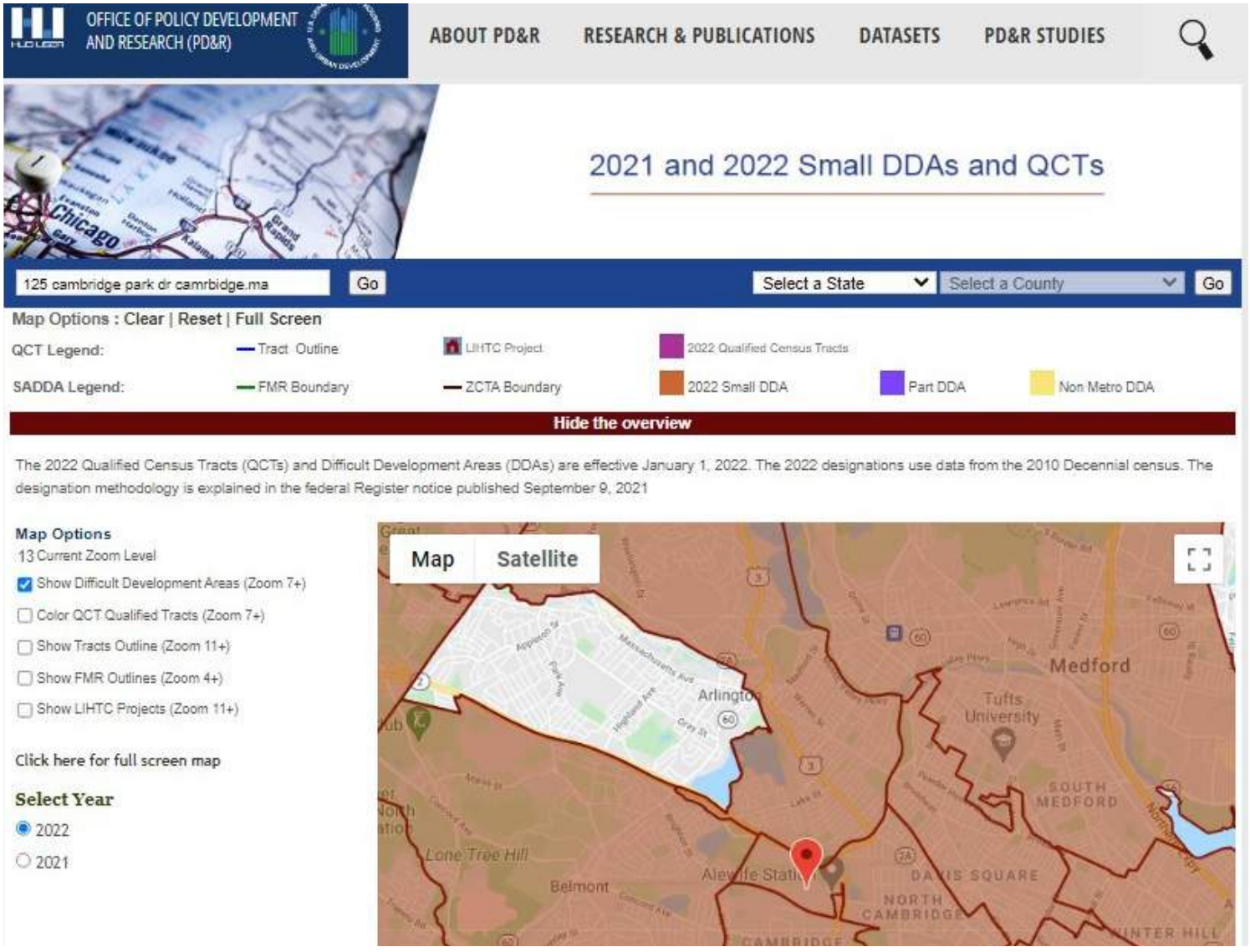
A. Location and Transportation (LT)

LT CREDIT 2 SENSITIVE LAND PROTECTION 2 CREDIT POINTS

The Project will meet the credit requirements by being located on land that has been previously developed. The project is the renovation of an existing building with a small multi-story addition.

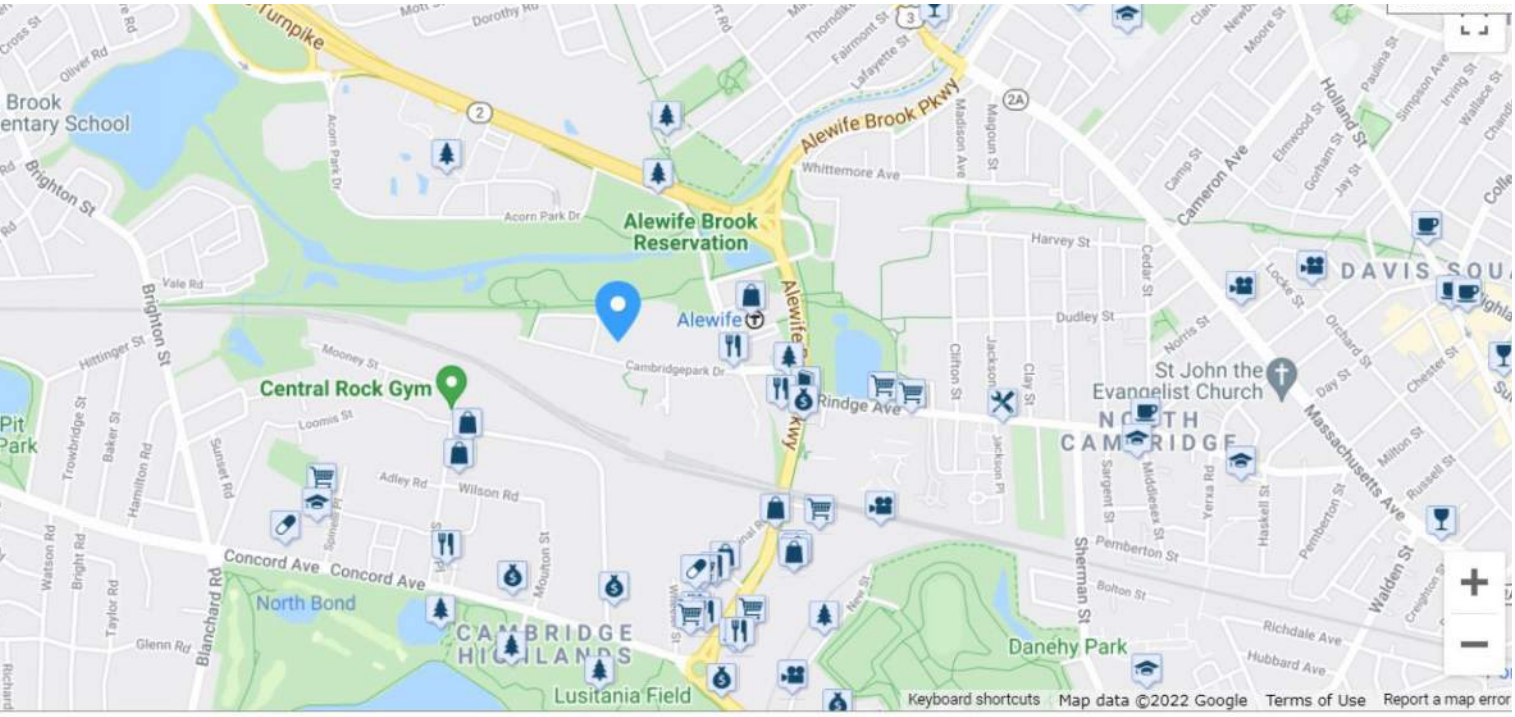
LT CREDIT 3 HIGH PRIORITY SITE 2 CREDIT POINTS

The Project will meet the credit requirements by being located on a site in a U.S. Department of Housing and Urban Development's Difficult Development Area as shown in the map below.



LT CREDIT 4 SURROUNDING DENSITY AND DIVERSE USES (LEEDV4.1) 6 CREDIT POINTS

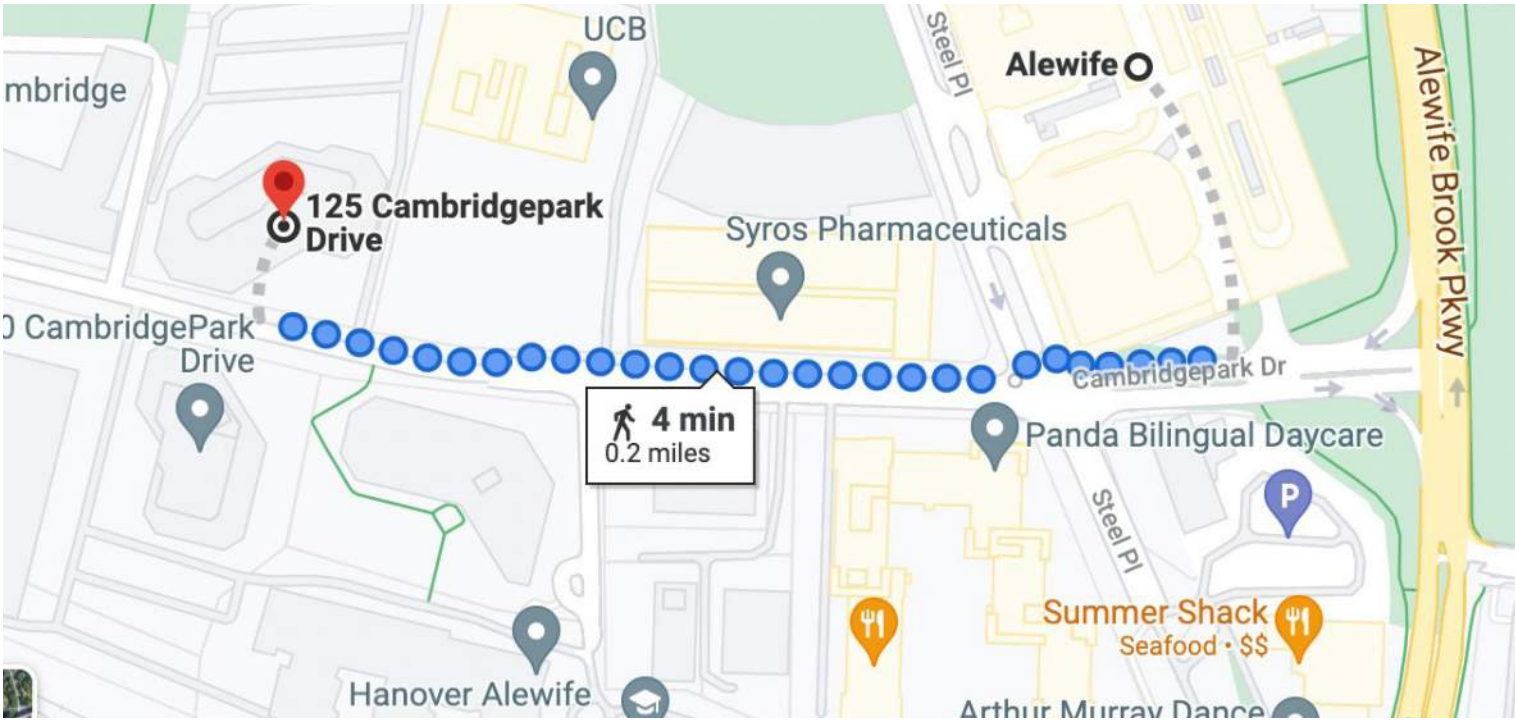
The Project will meet Option 1 for Surrounding Density by being located in an area with an average density greater than 35,000 sf/acre. The Project will meet Option 2 for Diverse Uses by being located within ½ mile walking distance of at least 9 publicly available diverse uses in at least three separate use categories.



Category	Use Type	No.	Business Name	Distance
Food retail	Restaurant	1	Summer Shack	0.3 mi
Community -serving retail	Convenience Store	2	Quick Bite	0.4 mi
	Pharmacy	3	CVS	0.3 mi
	Café	4	Revival Café + Kitchen	0.0 mi
Services	Exercise Studio	5	Arthur Murray Dance Studio of Cambridge	0.2 mi
	Restaurant	6	The Little Blue Bakery	0.2 mi
Civic and community facilities	Public Park	7	Alewife Brook Reservation	0.4 mi
	Place of Worship	8	Church in Cambridge	0.3 mi
	Childcare (licensed)	9	KinderCare Learning Center	0.1 mi

LT CREDIT 5 ACCESS TO QUALITY TRANSIT (LEEDV4.1) 3 CREDIT POINTS

LEEDv4.1: The Project is located within ½ mile walking distance of the Alewife train station. This transit station provides occupants with access to 370 weekday rides and 181 weekend rides.



LT CREDIT 6 BICYCLE FACILITIES (LEEDV4.1) 1 MAYBE CREDIT POINT

Project has approximately 13 bike spaces. To satisfy the credit requirements, locate within 200 yards of bicycle network and provide long-term bike storage for at least 5 percent of all regular building occupants and short-term storage for at least 2.5 percent of all peak visitors. (20 short term and 66 long term bike racks. The team is exploring additional bike racks and enough showers and changing rooms to comply with the credit requirements to provide one shower for the first 100 regular building occupants and one additional for every 150 thereafter.

LT CREDIT 7 REDUCED PARKING FOOTPRINT (LEEDV4.1) 1 CREDIT POINT

No new parking will be provided as a part of this Project.

LT CREDIT 8 ELECTRIC VEHICLES (LEEDV4.1) 1 CREDIT POINT

The project team will provide 20 EV ready spaces, exceeding the quantity required to meet the LEED credit.

B. Sustainable Sites (SS)

SS PREREQUISITE 1: CONSTRUCTION ACTIVITY POLLUTION PREVENTION **REQUIRED**

The construction manager will be required to submit and implement an appropriate SWPPP/Erosion and Sedimentation Control (ESC) Plan for construction activities related to the construction of the Project. The ESC Plan will conform to the erosion and sedimentation requirements of the applicable NPDES regulations and specific municipal requirements for the City of Cambridge. Additionally, the ESC Plan will address management and containment of dust and particulate matter generated by on site demolition and construction activities. Civil design drawings will include measures for the implementation of the ESC plan.

SS CREDIT 1: SITE ASSESSMENT **1 CREDIT POINT**

A comprehensive site assessment will be completed as part of the Project. The site assessment will include topography, hydrology, climate, vegetation, soils, human use, and human health effects and was used to inform the design.

SS CREDIT 2: SITE DEVELOPMENT- PROTECT AND RESTORE (LEEDV4.1) **1 MAYBE CREDIT POINT**

The Building Owner may elect to provide financial support equivalent to $0.30 per square foot for the total site area to a nationally or locally recognized land trust or conservation organization.

SS CREDIT 3: OPEN SPACE **1 CREDIT POINT**

Project outdoor space is greater or equal to 30 percent of total site area and includes at least 25 percent of vegetated space.

SS CREDIT 4: RAINWATER MANAGEMENT (LEEDV4.1) **1 MAYBE CREDIT POINT**

The 125 Cambridge Park Drive Project will meet the Cambridge DPW Stormwater Management Standards to the maximum extent practicable. Stormwater runoff is currently collected through roof drains which discharge to the municipal system. The project is targeting managing on-site runoff for the 80th percentile of local rainfall events using approved structural and LID and GI strategies.

SS CREDIT 5 HEAT ISLAND REDUCTION **1 CREDIT POINT**

The roof and non-roof hardscape materials of the Project will include light-colored surfaces to reduce the overall heat island effect impact on the Project site. The roof membrane will be ahigh albedo roof product with an initial SRI value of 82 minimum.

SS CREDIT 6 LIGHT POLLUTION REDUCTION — 1 CREDIT POINT

The project will meet the City of Cambridge lighting ordinance and is target meeting uplight and light trespass requirements by complying with the LEED v4 BUG Rating method. To meet credit requirements, the site lighting will not exceed the LEEDv4 allowable luminaire backlight, uplight and glare ratings for Lighting Zone 3.

SS CREDIT 7 TENANT DESIGN AND CONSTRUCTION GUIDELINES — 1 CREDIT POINT

Tenant Design and Construction Guidelines will be developed outlining the sustainable design and energy efficiency measures in the core and shell phases and providing detailed guidance for the office/lab tenants to design and build in alignment with the Project sustainability goals. Information will also be included to assist tenants in pursuing LEED certification for their spaces. The team will encourage tenants to pursue LEED and/or WELL certification as part of their build out.

C. Water Efficiency (WE)

WE PREREQUISITE 1 OUTDOOR WATER USE REDUCTION, 30% REQUIRED

The Project is investigating irrigation systems at this time. The potable water demand for irrigation use will target a 50%-75% reduction from the mid-summer day baseline and therefore meet the prerequisite requirement of a 30% potable water use reduction.

WE PREREQUISITE 2 INDOOR WATER USE REDUCTION, 20% REDUCTION REQUIRED

The project is planning to re-use the existing plumbing fixtures, The Project will meet the requirement to reduce potable water consumption by at least 20% over the baseline calculated for the building (not including irrigation) after meeting Energy Policy Act of 1992 fixture performance requirements.

WE PREREQUISITE 3 BUILDING LEVEL WATER METERING REQUIRED

The Project will meet the requirements of this prerequisite by installing permanent water meters that measure the total potable water use the building and associated grounds. In addition to installing the meters, the Project will commit to sharing water usage data with the USGBC for a five-year period beginning on the date the Project accepts LEED certification or typical occupancy, whichever comes first. It is understood that the building will be subject to the Building Energy Use Disclosure Ordinance and will annually report and disclose energy performance in terms of energy usage.

WE CREDIT 1 OUTDOOR WATER USE REDUCTION 1 CREDIT POINT, 1 MAYBE CREDIT POINTS

See narrative with WEp1 above.

WE CREDIT 2 INDOOR WATER USE REDUCTION 3 MAYBE POINTS

See narrative with WEp2 above.

WE CREDIT 3 COOLING TOWER WATER USE (LEEDV4.1) 1 CREDIT POINTS

The Project will conduct a one-time potable water analysis for the cooling tower water and calculate the cycles of concentration. Through increasing the level of treatment in the make-up and/or condenser water, the Project will achieve the calculated maximum number of cycles before any of the parameters analyzed exceed their maximum allowable levels of concentration. The control parameters that are required to be assessed are: Ca, total alkalinity, SiO2, Ci, and conductivity.

WE CREDIT 4 WATER METERING 1 CREDIT POINT

To support water management and identify opportunities for additional water savings, the Project will include permanent water meters for two of the following boilers, condenser water, chilled water, irrigation and domestic hot water.

D. Energy and Atmosphere (EA)

EA PREREQUISITE 1 FUNDAMENTAL COMMISSIONING AND VERIFICATION REQUIRED

The following systems are included in the Commissioning scope of work:

- Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems
- HVAC controls
- Lighting controls
- Electrical systems
- Domestic hot water systems
- Plumbing and pumps
- Building Automation System

EA PREREQUISITE 2 MINIMUM ENERGY PERFORMANCE REQUIRED

To meet the prerequisite, the Project's building performance will demonstrate a minimum of 2% improvement in energy use by cost when compared to a baseline building performance as calculated using the rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2010. The Project is also required to meet the MA Energy Code and MA Stretch Energy Code requirements.

Comprehensive, iterative energy modeling is being used to explore design options to meet all Code requirements and to provide substantiation for the LEED application. Energy performance goals were established during the Schematic Design for the Project phase.

EA PREREQUISITE 3 BUILDING LEVEL ENERGY METERING REQUIRED

To meet the requirements of this prerequisite, the Project will install whole building energy meters for gas and electricity. In addition to installing the meters, the Project will commit to sharing energy usage data with the USGBC for a five-year period beginning on the date each accepts LEED certification or typical occupancy, whichever comes first. It is understood that at a minimum, the Project will be subject to the Building Energy Use Disclosure Ordinance and will annually report and disclose energy performance in terms of energy usage.

EA PREREQUISITE 4 FUNDAMENTAL REFRIGERANT MANAGEMENT REQUIRED

CFC based refrigerants will not be used in the Project's HVAC & R systems.

EA CREDIT 1 ENHANCED COMMISSIONING **3 'YES' CREDIT POINTS, 2 'MAYBE' CREDITS POINTS**

In addition to EApr1 Fundamental Commissioning and Verification requirements, Option 1 Path 1 Enhanced Commissioning will be pursued by the Project. The Building Owner will engage a commissioning agent to review the proposed design and verify the building systems meet the Owner's expectations and requirements. Furthermore, BECx is being considered and maybe included in the Cx scope of work.

The following commissioning process activities in addition to those required under EA Prerequisite Fundamental Commissioning and Verification will be completed by the commissioning agent, in accordance with ASHRAE Guideline 0–2005 and ASHRAE Guideline 1.1–2007 for HVAC&R systems, as they relate to energy, water, indoor environmental quality, and durability:

- Review contractor submittals.
- Verify inclusion of systems manual requirements in construction documents.
- Verify inclusion of operator and occupant training requirements in construction documents.
- Verify systems manual updates and delivery.
- Verify operator and occupant training delivery and effectiveness.
- Verify seasonal testing.
- Review building operations 10 months after substantial completion.
- Develop an on-going commissioning plan.

Requirements for enhanced commissioning will be included in the OPR and BOD.

Building envelope commissioning will not be pursued. As mentioned above, the Project will be performing LEED EAp1 Fundamental Commissioning and Verification and EAc1 Enhanced Systems Commissioning. These activities will support the Owner's Project Requirements for energy performance. The Project will not utilize envelope commissioning because it has inherent redundancies and areas of conflict with the roles and scope of members of the Project's design team – waterproofing and glazing consultants. These consultants provide design guidance, set performance standards, write specifications, review submittals, and help to maintain quality control.

EA CREDIT 2 OPTIMIZE ENERGY PERFORMANCE **12 POINTS**

The Project is designed to meet IECC 2015/ASHRAE 90.1-2013 energy efficiency requirements to comply with the requirements of the Massachusetts Stretch Energy Code.

The team recognizes the importance of energy efficiency and will continue to evaluate opportunities reduce energy use and increase points within the Energy & Atmosphere category, specifically within the Optimize Energy Performance credit. The has implemented a whole building energy analysis approach, preliminary results estimate a 22.9% savings when applying the EApc95 Alternative compliance path.

EA CREDIT 5 RENEWABLE ENERGY PRODUCTION **1 CREDIT POINT**

Project team is investigating installing a PV array on the on-site parking garage and is targeting to offset one percent of the building's energy cost.

EA CREDIT 6 ENHANCED REFRIGERANT MANAGEMENT **1 MAYBE CREDIT POINT**

The HVAC equipment will install in the base building uses low-impact refrigerants that have low global warming and ozone depletion potential. Refer to snapshot of chiller schedules confirming that all refrigerants will be low impact:

EA CREDIT 7 GREEN POWER AND CARBON OFFSETS **2 CREDIT POINTS**

The Building Owner is exploring the option to purchase Green Power and Carbon Offsets through a 5-year contract to offset a minimum of 100% of the building's energy use with renewable sources.

E. Materials and Resources (MR)

MR PREREQUISITE 1 STORAGE AND COLLECTION OF RECYCLABLES

REQUIRED

Storage of collected recyclables will be accommodated in a designated recycling area within the loading dock area. Recyclable materials collected will include mixed paper, corrugated cardboard, glass, plastics, and metals, and the disposal of batteries and electronic waste. A contracted waste management company will collect the recyclables on a regular basis.

MR PREREQUISITE 2 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLANNING **REQUIRED**

The Project will meet the requirements of this prerequisite by including a Construction Waste Management section in Division 1 of the project manual. The specification will include direction for the construction manager to submit and implement a compliant waste management plan for the duration of construction. Waste diversion goals for the Project will include at least five materials targeted for diversion.

MR CREDIT 1 BUILDING LIFE-CYCLE IMPACT REDUCTION (LEEDV4.1)
4 CREDIT POINTS

The Project is an existing building and is pursuing option three Building and Material Reuse v4.1. It is anticipated approximately 50%-75% of the existing structure and enclosure will be re-used.

MR CREDIT 2 BUILDING PRODUCT DISCLOSURE **1 CREDIT POINT**
1 MAYBE POINT

& Optimization (BPDO): EPDs (LEEDv4.1)

The Project will provide EPDs for at least ten different permanently-installed products from five or more manufacturers. One additional point can be earned if the Project tracks Multi-Attribute Optimization.

MR CREDIT 3 BPDO: SOURCING OF RAW MATERIALS (LEEDV4.1)
1 MAYBE POINT

The Project will attempt this credit via Option 2. The technical specification will include information for applicable products and materials to meet one of the following extraction criteria (as applicable): Extended producer responsibility, Bio-Based materials, FSC wood, Materials reuse, Recycled Content, and/or regionally extracted and manufactured (within 100 miles of the site). Credit achievement cannot be determined until construction phase.

MR CREDIT 4 BPDO: MATERIAL INGREDIENTS (LEEDV4.1)
2 CREDIT POINTS

The Project will attempt this credit via Option 1. The project manual will include the information and direction for the construction manager and their sub-contractors to provide and submit materials and products documentation identifying the chemical make-up. The documentation may be Health Product Declarations, Cradle-to-Cradle or Declare certification. The team will work to provide documentation for 10 different permanently installed products sourced from at least 3 different manufacturers.

MR CREDIT 5 CONSTRUCTION & DEMOLITION WASTE MANAGEMENT (LEEDV4.1) **2 CREDIT POINTS**

The Project will meet the requirements of this credit by including a Construction Waste Management section in Division 1 of the project manual. The specification will include direction for the construction manager to attempt to divert a minimum of 50% of the demolition and construction waste generated on site from area landfills with a target of >75% diversion. The construction waste management plan will include tracking 5 waste streams. Diverted material reported will include at least four different material streams. Demolition waste will be separated on site as part of the strategy to meet this credit.

F. Indoor Environmental Quality (IEQ)

IEQ PREREQUISITE 1 MINIMUM IAQ PERFORMANCE

REQUIRED

The Project's mechanical systems are designed to exceed the requirements of ASHRAE Standard 62.1-2010 sections 4 through 7. The mechanical engineer will complete a ventilation rate procedure (VRP) calculator to verify compliance for the Project. Outdoor airflow monitors are included in the Project.

IEQ PREREQUISITE 2 ENVIRONMENTAL TOBACCO SMOKE CONTROL (LEEDV4.1)

REQUIRED

Smoking will be prohibited in the building and on the grounds within 25' of the building. Signage will be posted within 10' of all building entrances to indicate the interior and exterior no-smoking policy.

IEQ CREDIT 1 ENHANCED INDOOR AIR QUALITY STRATEGIES

1 CREDIT POINT, 1 MAYBE POINT

The Project is being designed to incorporate permanent entryway systems, properly enclosed and ventilated chemical use/storage areas, and compliant filtration media (MERV 13+).

Additionally, minimum ventilation rates required by ASHRAE 62.1-2010 are expected to be exceeded by at least 30%, however, the mechanical engineer needs to perform the calculations before this can be confirmed.

IEQ CREDIT 2 LOW EMITTING MATERIALS (LEEDV4.1)

3 CREDIT POINTS

The Project will attempt this credit through meeting the compliance criteria for the following compliant categories: interior paints and coatings, adhesives and sealants, flooring, ceilings, insulation and composite wood. Intending to achieve at least 6 categories for 3 points.

IEQ CREDIT 3 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT PLAN

1 CREDIT POINT

The project manuals for the Project will include direction for the construction manager to develop and implement an Indoor Air Quality Management plan in compliance with applicable control measures as stated in the SMACNA IAQ Guidelines for Occupied Buildings under construction 2nd Edition, 2007 ANSI/SMACNA 008-2008 Chapter 3. Additional measures will be implemented to ensure absorptive materials will be protected from moisture damage.

IEQ CREDIT 8 QUALITY VIEWS

1 CREDIT POINT

The Project will meet this credit by achieving a direct line of sigh to the outdoors via vision glazing for 75 percent of all regularly occupied floor area that meets at least two of the four kinds of views.

G. Innovation (IN)

INC1 EXEMPLARY PERFORMANCE: EPDS 1 CREDIT POINT

The Project will achieve Exemplary Performance for installing at least 20 products from five different manufacturers with compliant EPDs.

INC2 EXEMPLARY PERFORMANCE HPDS 1 CREDIT POINT

The Project team is exploring innovation strategies.

INC3 INNOVATION: PURCHASING - LAMPS 1 CREDIT POINT

The Project will achieve one innovation point by complying with LEED Innovation Credit: Purchasing – Lamps, which requires that the calculated average mercury content for the Project be below 35 picograms of Hg per lumen hour. The Project will be 100% LED.

INC4 INNOVATION: TBD 1 MAYBE CREDIT POINT

The Project team is exploring innovation strategies.

INC5 PILOT: INTEGRATIVE ANALYSIS OF BUILDING MATERIALS 1 CREDIT POINT

The Project will specify, purchase and install three different permanently installed products that have a documented qualitative analysis of potential health, safety, and environmental impacts of the product over its life cycle.

INC6 LEED ACCREDITED PROFESSIONAL 1 CREDIT POINT

Many members of the team are LEED Accredited Professionals (APs).

H. Regional Priority (RP)

Regional Priority Credits (RPCs) are established by the USGBC to have priority for a particular area of the country. When a project team achieves one of the designated RPCs, an additional credit is awarded to the project. LEEDv4 RPCs applicable to the Cambridge area include: LTc3 High Priority Site (2 points), SSc4 Rainwater Management (2 points), WEc2 Indoor Water Use Reduction (4 points), EAc2 Optimize Energy Performance (17%/8 points), EAc5 Renewable Energy Production (3%/2 points), and MRc1 Building Life-Cycle Impact Reduction (2 points).

The Project is currently tracking the following RPCs:

RPC1 EAC OPTIMIZE ENERGY PERFORMANCE (2 POINTS)	**1 CREDIT POINT**
RPC2 LTC HIGH PRIORITY SITE (2 POINTS)	**1 CREDIT POINT**
RPC3 SSC RAINWATER MANAGEMENT (2 POINTS)	**1 MAYBE POINT**
RPC4 MRC1 BUILDING LIFE-CYCLE IMPACT REDUCTION (2 POINTS)	**1 CREDIT POINT**

8B. LEED V4 Core Shell Scorecard

The Project was reviewed for compliance using the USGBC's LEED for Core and Shell Development, (LEED-CS), version 4 rating system. The project plans to substitute LEEED v4.1 credit compliance pathways where applicable and as approved by the GBCI. The Project is targeting 64 out of a possible 110 credit points with an additional 15 credit points still undergoing evaluation to determine feasibility of achievement. The Project anticipates meeting the City of Cambridge requirement to be LEED v4 Gold 'certifiable'. In addition to the City of Cambridge requirements, the Project will be registered under the LEED-CS v4 rating system and will be pursuing formal certification with the USGBC.

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Y	M	N			
0	0	1	**Integrative Process**		1
		1	Credit 1	Integrative Process	1

15	1	4	**Location and Transportation**		20
		N	Credit 1	LEED for Neighborhood Development Location	20
2			Credit 2	Sensitive Land Protection	2
2		1	Credit 3	High Priority Site	3
6			Credit 4	Surrounding Density and Diverse Uses	6
3		3	Credit 5 (LEEDv4.1)	Access to Quality Transit	6
	1		Credit 6 (LEEDv4.1)	Bicycle Facilities	1
1			Credit 7 (LEEDv4.1)	Reduced Parking Footprint	1
1			Credit 8 (LEEDv4.1)	Green Vehicles	1

5	2	4	**Sustainable Sites**		11
Y			Prereq 1	Construction Activity Pollution Prevention	Req
1			Credit 1	Site Assessment	1
	1	1	Credit 2 (LEEDv4.1)	Site Development - Protect or Restore Habitat	2
1			Credit 3	Open Space	1
	1	2	Credit 4	Rainwater Management	3
1		1	Credit 5	Heat Island Reduction	2
1			Credit 6	Light Pollution Reduction	1
1			Credit 7	Tenant Design and Construction Guidelines	1

3	4	4	**Water Efficiency**		11
Y			Prereq 1	Outdoor Water Use Reduction	Req
Y			Prereq 2	Indoor Water Use Reduction	Req
Y			Prereq 3	Building-Level Water Metering	Req
1	1	1	Credit 1 (LEEDv4.1)	Outdoor Water Use Reduction	3
	3	2	Credit 2	Indoor Water Use Reduction	5
1		1	Credit 3 (LEEDv4.1)	Cooling Tower Water Use	2
1			Credit 4	Water Metering	1

3	1	0	**Regional Priority**		4
1			Credit 1	RP Credit: EAc Optimize Energy Performance	1
1			Credit 2	RP Credit: LTc High Priority Site	1
	1		Credit 3	RP Credit: SSc Rainwater Management	1
1			Credit 4	RP Credit: MRc Building Life-Cycle Reduction	1

Y	M	N			
18	**3**	**12**	**Energy and Atmosphere**		**33**
Y			Prereq 1	Fundamental Commissioning and Verification	**Req**
Y			Prereq 2	Minimum Energy Performance	**Req**
Y			Prereq 3	Building-Level Energy Metering	**Req**
Y			Prereq 4	Fundamental Refrigerant Management	**Req**
3	**2**	**1**	Credit 1	Enhanced Commissioning	6
12		**6**	Credit 2	Optimize Energy Performance	18
		1	Credit 3	Advanced Energy Metering	1
		2	Credit 4	Demand Response	2
1		**2**	Credit 5	Renewable Energy Production	3
	1		Credit 6	Enhanced Refrigerant Management	1
2			Credit 7	Green Power and Carbon Offsets	2

9	**2**	**3**	**Materials and Resources**		**14**
Y			Prereq 1	Storage and Collection of Recyclables	**Req**
Y			Prereq 2	Construction /Demolition Waste Management Planning	**Req**
4		**2**	Credit 1 (LEEDv4.1)	Building Life-Cycle Impact Reduction	**6**
1	**1**		Credit 2 (LEEDv4.1)	BPDO – EPD	**2**
	1	**1**	Credit 3 (LEEDv4.1)	BPDO - Sourcing of Raw Materials	**2**
2			Credit 4 (LEEDv4.1)	BPDO – Material Ingredients	**2**
2			Credit 5 (LEEDv4.1)	Construction and Demolition Waste Management	**2**

6	**1**	**3**	**Indoor Environmental Quality**		**10**
Y			Prereq 1	Minimum Indoor Air Quality Performance	**Req**
Y			Prereq 2	Environmental Tobacco Smoke Control	**Req**
1	**1**		Credit 1	Enhanced Indoor Air Quality Strategies	**2**
3			Credit 2 (LEEDv4.1)	Low-Emitting Materials	**3**
1			Credit 3	Construction Indoor Air Quality Management Plan	**1**
		3	Credit 4	Daylight	**3**
1			Credit 5	Quality Views	**1**

5	**1**	**0**	**Innovation**		**6**
1			Credit 1	Exemplary Performance: EPDs	**1**
1			Credit 2	Exemplary Performance: HPDs	**1**
1			Credit 3	Innovation: Purchasing - Lamps	**1**
	1		Credit 4	Innovation: TBD	**1**
1			Credit 5	Pilot Credit: Integrative Analysis of Building Materials	**1**
1			Credit 6	LEED Accredited Professional	**1**

64	**15**	**31**	**TOTALS**	**110**

8C. LEED Credential

LEED AP BD+C

87211-AP-BD+C

CREDENTIAL ID

23 SEP 2010

ISSUED

21 SEP 2022

VALID THROUGH

GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

Sarah Michelman

HAS ATTAINED THE DESIGNATION OF

LEED AP® Building Design + Construction

by demonstrating the knowledge and understanding of green building practices and principles needed to support the use of the LEED® green building program.

Mahesh Ramanujam

MAHESH RAMANUJAM
PRESIDENT & CEO, U.S. GREEN BUILDING COUNCIL
PRESIDENT & CEO, GREEN BUSINESS CERTIFICATION INC.

8C. Affadavit

Affidavit Form for Green Building Professional Special Permit

Green Building
Project Location: 125 Cambridge Park Drive

Green Building Professional

Name: Sarah Michelman

☒ Architect

☐ Engineer

Mass. License Number: MA Lic No 10402

Company: The Green Engineer, Inc

Address: 23 Bradford Street Concord, MA 01742

Contact Information

Email Address: sarah@greenengineer.com

Telephone Number: 978.341.5462

I, Sarah Michelman , as the Green Building Professional for this Green Building Project, have reviewed all relevant documents for this project and confirm to the best of my knowledge that those documents indicate that the project is being designed to achieve the requirements of Section 22.24 under Article 22.20 of the Cambridge Zoning Ordinance.

April 8, 2022

(Signature) *(Date)*

Attach either:

☒ Credential from the applicable Green Building Rating Program indicating advanced knowledge and experience in environmentally sustainable development in general as well as the applicable Green Building Rating System for this Green Building Project.

☐ If the Green Building Rating Program does not offer such a credential, evidence of experience as a project architect or engineer, or as a consultant providing third-party review, on at least three (3) projects that have been certified using the applicable Green Building Rating Program.

8D. Net-Zero Narrative

Project Profile

Development Characteristics	
Lot Area:	126,612 SF
Existing Land Use(s) and Gross Floor Area :	Technical Office, 183,925 SF
Proposed Land Use(s) and Gross Floor Area:	Technical Office, 33,056 SF
Proposed Building Height(s):	6 stories, 78'-1"
Proposed Dwelling Units:	N/A
Proposed Open Space:	The project will provide upwards of 37,000 SF of Open Space, or 28.6% of the Lot Area
Proposed Parking Spaces:	The project does not propose any new Parking Spaces. The existing 179 Parking Spaces will be reduced to 84.
"Proposed Bicycle Parking Spaces (Long-Term and Short-Term):"	The project will provide 68 Long Term Bicycle Parking Spaces on the Interior of the Addition, and 40 Short Term Spaces outside near the entrances.

Green Building Rating System

LEED-Leadership in Energy & Environmental Design (U.S. Green Building Council)	
Rating System & Version:	LEED v4 Core and Shell
Rating Level	LEED Gold
Seeking Certification	YES
No. of Points	61
Enterprise Green Communities	
Rating System & Version:	N/A
Rating Level	N/A
Seeking Certification	NO
No. of Points	N/A
Passive House Institute US (PHIUS) or Passivhaus Institut (PHI)	
Rating System & Version:	N/A
Rating Level	N/A

Building Envelope

Development Characteristics	
Roof:	White Thermoplastic Polyolefin Roofing Membrane, Underlayment Board over Insulation, Extruded-Polystyrene Board Insulation R-30, Self-adhering Sheet Vapor Retarder Under Insulation, 4" Normal Concrete Metal Deck.
Foundation:	12-14" Cast-in-place Concrete foundation wall, self-adhered sheet waterproofing, drainage board, 3" Extruded Polystyrene Rigid Insulation R-15.
Exterior Walls:	6" metal stud with batt insulation and 4" Continuous Insulation R-23
Windows:	Solar Ban 60 with thermallly broken metal frame
Window-to-Wall Ratio:	35 % Window to Wall Ratio
Other Components:	
Proposed Parking Spaces:	The project does not propose any new Parking Spaces. The existing 179 Parking Spaces will be reduced to 79.
"Proposed Bicycle Parking Spaces (Long-Term and Short-Term):"	The project will provide 68 Long Term Bicycle Parking Spaces on the Interior of the Addition, and 40 Short Term Spaces outside near the entrances.

	Proposed		Baseline	
	Area (SF)	**U-Value**	**Area (SF)**	**U-Value**
Window Assembly	7,408 SF	0.032	7,408 SF	0.055
Wall	12,238 SF	0.032	12,238 SF	0.048
Roof	7,500 SF	0.043	7,500 SF	0.064

Envelope Commissioning Process

The majority of the project is an existing occupied building. For the addition, a building envelope commissioing agent will be engaged to commission the building envelope.

Building Mechanical Systems

System Descriptions	
Space Heating:	(3) 4800 mbh 96% efficienct Natural Gas fired Condensing Boilers feeding a hydronic hot water heating loop
Space Cooling:	(3) 465 ton High Efficiency VFD Centrifugal Chillers feeding a hydronic chilled water cooling loop
Heat Rejection:	(2) 465 ton Open Cell Cooling towers
Pumps & Auxiliary:	"3 primary chilled water VFD pumps 3 primary hot water VFD pumps 3 secondary hot water VFD pumps 3 condenser water VFD pumps"
Ventilation:	(2) 98,000 cfm Air Handling Units with glycol loop energy recovery
Domestic Hot Water:	Electric Hot water heater
Interior Lighting:	LED lighting
Exterior Lighting:	LED lighting
Other Equipment:	

System Commissioning Process

A commissioning agent has been engaged by the Building Owner for purposes of providing fundamental commissioning services for all building systems. In addition to EApr1 Fundamental Commissioning and Verification requirements, Option 1 Path 1 Enhanced Commissioning and Option 2 Building Envelope Commissioning may be pursued by the Project. In addition to the commissioning of mechanical and electrical systems, the Building Owner is considering engaging the commissioning agent to perform monitoring-based commissioning activities as they relate to the operations and maintenance of the building once it has been occupied. Requirements for enhanced and monitoring-based commissioning will be included in the OPR and BOD.

Building Energy Performance Measures Overview

System Descriptions	
Land Uses:	The project is sited on previously developed land, classified by U.S. Department of Housing and Urban Development's as a Difficult Development Area
Building Orientation and Massing:	The addition to the building will be located on the northeast corner of the building. Locating the addition on the north side, minimizes heat gain exposure.
Envelope Systems:	The addition will use high performance building envelope for all exterior walls and roofing. A highly reflective white TPO roof membrane will be installed. The existing balconies will be converted to green roofs, with up to 15% of the green roof area designated as building occupant outdoor open space.
Mechanical Systems:	High efficiency condensing boilers and high efficiency centrifugal chillers providing hot water and chilled water to VAV air handling units providing ventilation air to tenants. Supplemental air and cooling required in addition to the base building allowance will be provided through supplemental tenant systems. AHU's are outfitted with glycol energy recovery to recover energy that would otherwise be exhausted to precondition incoming air.
Renewable Energy Systems:	The project will incorporate a PV Solar Array over a portion of the parking lot to the north, while also introducing a solar array ontop of the adjacent parking garage at 140 Cambridgepark Drive.
District-Wide Energy Systems:	This project does not incorporate district-wide energy systems.
Electric Vehicle Systems:	The project will implement 20 EV charging stations equal to 25% of the total parking capacity for the project (79 Total Spaces).
Green Roofs:	The project will convert existing balconies to Green Roofs, with up to 15% dedicated to occupant open space.

The project is utilizing energy modeling to confirm that the basis of design is meeting the city's green building requirements. Within the limitations of the project, additional measures will be evaluated to determine their impact on project energy and cost goals.

Integrative Design Process

The project team has collaborated on a number of design solutions to identify a cost effective basis of design that significantly exceeds current energy code requirements. Sustainable design focused meetings have been conducted in early design to assist the team in establishing shared sustainable design and energy / water efficiency goals for the project. Early design phase energy modeling has been conducted to review systems synergies and assess areas where energy loads may be significantly reduced. The Project has conducted interdisciplinary early meetings focusing on sustainability. Early energy modeling was performed to provide real feedback on decision-making.

Green Building Incentive Program Assistance

The Project is planning to particiapte in the MassSave Large Building Incentives program through Eversource - the main utility provider for the project. As part of the program, the Project will schedule an energy charrette with Eversource to identify energy conservation measures that can be incorporated in the MassSave program's incentive study.

NetZero Scenario Transition

Opportunities for energy reduction on the project have been identified. Due to limitations of the existing building and the intended high energy intensity lab program, transition to a fully net zero scenario seem infeasible at this time.

System Descriptions	Net Zero Condition	Transition Process:
Building Envelope:	Possible options include potential for future air-sealing of the envelope and retro Cx of envelope.	The proposed envelope for the addition is considered high performance and exceeds minimum code requirements. No upgrades would be necessary to achieve ZNE.
HVAC Systems:	Future ZNE scenario assumes electrification of heat energy sources. An air source heat pump (ASHP) technology could be used and boilers/chillers would be supplemented with modular air-cooled heat pumps that could provide chilled and hot water to help offset natural gas consumption and rely on a more renewable electric grid.	IASHPs and/or heat shift chillers could be considered to supplement the existing system and help reduce heating loads from natural gas. It is likely that natural gas will still be required as ASHPs have insufficient capacity at lower outside air temperatures to meet the required loads of a laboratory space. The existing building infrastructure and space utilization make this transition unlikely at the whole building level.
"Domestic Hot Water:"	To lower energy use in the future, domestic hot water heating source can be a heat pump type water heater	At the end of life of the original equipment it is possible to easily convert the existing system to a high efficient heat pump system for domestic hot water system.
Lighting:	In a Core and Shell project, lighting design is driven by the tenant. Although beyond the Applicant's scope of work, it is assumed that the tenants will design their spaces to MA code allowable lighting power density (LPD).	It is important to acknowledge that the new Massachusetts Building Energy Code has stringent LPD thresholds and the Applicant will be engaging in dialogue with the tenants to go beyond the code thresholds. This LPD reduction in tenant spaces may be required through tenant lease and sale agreement.
Renewable Energy Systems:	The project will incorporate a PV Solar Array over a portion of the parking lot to the north, while also introducing a solar array ontop of the adjacent parking garage at 140 Cambridgepark Drive.	Due to high energy use intensities for laboratory type buildings, offsite renewable energy sources are likely required to balance site energy sources. A number of options exist, including solar, wind, purchase power agreements and green power purchases.

Energy Systems Comparison

OVERVIEW

The building was compared against an ASHRAE 90.1-2013 Appendix G baseline in order to provide an initial profile and understanding of building performance and end-uses which impact building energy the most. Additional energy conservation measures are under review and may be incorporated into the project as the design develops.

ASSUMPTIONS:

The anticipated energy loads assume a 50% Office/50% Laboratory split.

	Included in Analysis?		
	YES	No	Transition Process:
Solar Photovoltaics:	X		The project will incorporate a PV Solar Array over a portion of the parking lot to the north, while also introducing a solar array ontop of the adjacent parking garage at 140 Cambridgepark Drive.
Solar Hot Water:		X	There is limited available roof area on the project. Any available area has been evaluated for PVs rather than solar hot water due to the larger impact per available area.
Ground-Source Heat Pumps (Geothermal):		X	Historic soil contamination and the lack of available lot area makes GSHP wells not feasible
Water-Source Heat Pumps:		X	Water source heat pumps typically use a conventional boiler plant as the primary heat source. Furthermore, this system type is not typically used for laboratory applications. While the may be used in office applications, it would require additional base building equipment (e.g. cooling tower, condenser loop piping, etc.) that reduces cost feasibility. Additionally, air-source solutions tyically fare better due to the lack of boiler requirements.
Air-Source Heat Pumps:		X	The existing building infrastructure and space requirements did not lend itself to use of air source heat pumps at this time.
"Non-Carbon- Fuel District Energy:"		X	There is no existing feasible district steam connection (Vicinity) in close proximity to the site. No small-scale district energy solution is feasible given site soil conditions
Other Non- Carbon-Fuel Systems:		X	N/A

NON CARBON FUEL SCENARIO

Zero carbon laboratories in dense urban areas have low feasibility due to the lack of area available to accommodate associated air-source or ground source equipment infrastructure. An air-source system would likely take all available roof area, plus additional (otherwise leaseable) mid elevation floors to house the condensing units necessary to meet the capacities anticipated by laboratory processes. Similarly, ground source systems would take a correspondingly large amount of ground area that is not accessible on the site. As a result, the net zero option described below is considered feasible using readily available technology, without the uncertainties inherent to the zero carbon option.

Solar-Ready Roof Assessment	
Total Roof Area (sq. ft.):	7,500 SF
Unshaded Roof Area (sq. ft.):	1,000 SF
Structural Support:	The existing building cannot accept a PV array due to limits on the structural capacity of the existing building. The addition could structural support additional loads, however the available roof area does not provide a sufficiently large area to generate a meaningful amount of energy.
Electrical Infrastructure:	No Electrical infrastructure currently exists.
Other Roof Appurtenances:	The roof will need to accommodate (3) Cooling towers and a generator with addociated clearances. In addition Acoustic screen panels are required, which will generate shade.
Solar-Ready Roof Area (sq. ft.):	Zero. Due to the location of the addition on the north side of the existing building, and due to infrastructure and acoustic screenwall space requirements, rooftop solar is not feasibile.
Capacity of Solar Array:	The opportunity for the existing building and the addition to support Solar is not feasibile. In lieu of Rooftop Solar, the project will implement solar over a portion of the north parking lot, up to 10,000 SF - 225 kWh/Year. In addition, as part of the overall campus upgrades, a solar array will be introduced over the 140 Cambridgepark Drive garage, 27,000SF - 603 kWh/Year.
Financial Incentives:	Based on the anticipated Building Load of 2,965 kWh annually, the solar array can offset the Load by approximately 28%
Cost Feasibility:	Combined cost for Parking Lot solar and Garage Solar for a total system size of 650 kW is on the order of $1.75 Million

	Proposed Design		Net Zero Scenario	
	Installation Cost	Maintenance Cost	Installation Cost	Maintenance Cost
Envelope	$1,875,000	TBD	$2,500,000	TBD
HVAC Systems	$7,056,050	TBD	$9,300,000	TBD
Domestic Hot Water	$230,000	TBD	$400,000	TBD
Other (Solar PV)	$1,750,000	TBD	$4,500,000	TBD
(Financial Incentives)				
Total Building Energy System Cost	$10,911,050	TBD	$16,700,000	TBD

Anticipated Energy Loads and Greenhouse Gas Emissions

ASSUMPTIONS:

The anticipated energy loads assume a 50% Office/50% Laboratory split. The project incorporates early energy modeling for the renovated existing building with the addition. Analysis of the building afforded the opportunity to explore energy reduction on mechanical systems, improve energy efficiency, and reduce greenhouse gas emissions.

	Baseline Building		Proposed Design		Net Zero Scenario		Proposed Design	
	MMBTU	% of Total	MMBTU	% of Total	MMBTU	% of Total	MMBTU	% of Total
Lights	2,812	6%	1,957	6%	TBD	TBD	See Future Net Zero Option	
Misc. Equip	7,629	17%	7,629	24%	TBD	TBD		
Space Heating	27,287	61%	15,279	48%	TBD	TBD		
Space Cooling	2,432	5%	1,591	5%	TBD	TBD		
Heat Rejection	174	0%	200	1%	TBD	TBD		
Pumps & Aux	596	1%	643	2%	TBD	TBD		
Vent Fans	3,892	9%	4,380	14%	TBD	TBD		
DHW	89	0%	89	0%	TBD	TBD		
Ext Ltg								

	$US, kBTU, kBTU/SF	$US, kBTU, kBTU/SF	%	$US, kBTU, kBTU/SF	$US, kBTU, kBTU/SF
Site EUI	209	148	29%		See Future Net Zero Option
Source EUI	TBD	TBD	TBD		
Total Energy Use	44,910,496	31,768,211	29%		
Total Energy Cost	$1,369,519	$1,149,788	16%		

	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	%	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF
"On-Site Renewable Energy Generation"							See Future Net Zero Option
"Off-Site Renewable Energy Generation"							

	Tons CO2 [/SF]	Tons CO2 [/SF]	% Reduction
GHG Emissions	2681.9	1966.9	27%
GHG Emissions per SF	0.012	0.0085	27%

8E. Project Overview

ENERGY MODEL REPORT:
Special Permit Submission
Net Zero Energy Analysis

125 Cambridge Park Drive Phase 2 | Cambridge, MA

An Energy Evaluation by R. G. Vanderweil's Building Performance Group

07/05/2022

VANDERWEIL

PROJECT OVERVIEW

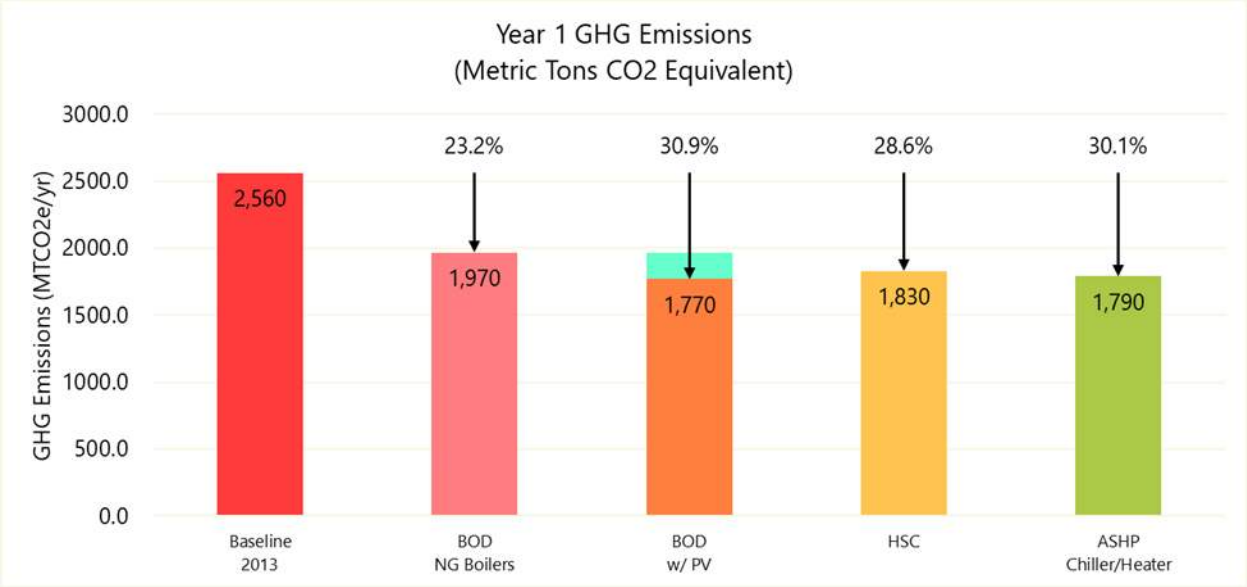
The project located at 125 Cambridge Park Drive is an existing six story 194,500 gross square feet (GSF) building with a proposed 36,000 GSF addition. The building renovation and new construction project is a core and shell building project designed for approximately 50% useable square feet (USF) office space and 50% USF laboratory space. This energy report has been developed in support of the City of Cambridge Article 22 Green Building Requirements and Net Zero Action Plan which seeks to neutralize Greenhouse Gas (GHG) emissions.

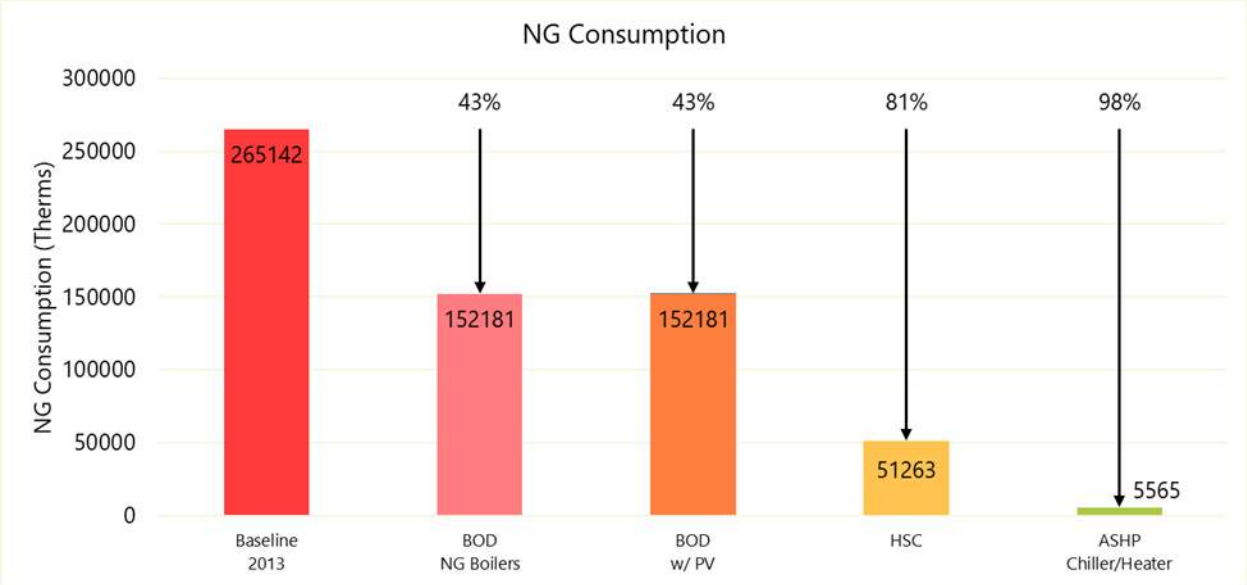
This report evaluates the energy performance of the **05/17/22 Phase 2 SD Design (new addition) with existing infrastructure/fitout per the 12/03/21 100% Construction Documents (Phase 1)** The purpose of this energy model is to evaluate anticipated energy, cost, and GHG emissions relative to an ASHRAE 90.1-2013 Baseline, not to predict actual energy use. **In addition to the SD Design, it evaluates three potential pathways for the building to transition to net zero emissions in the future, acknowledging that these options may have technical, practical, and economical impacts that may not be able to be implemented in the current project.**

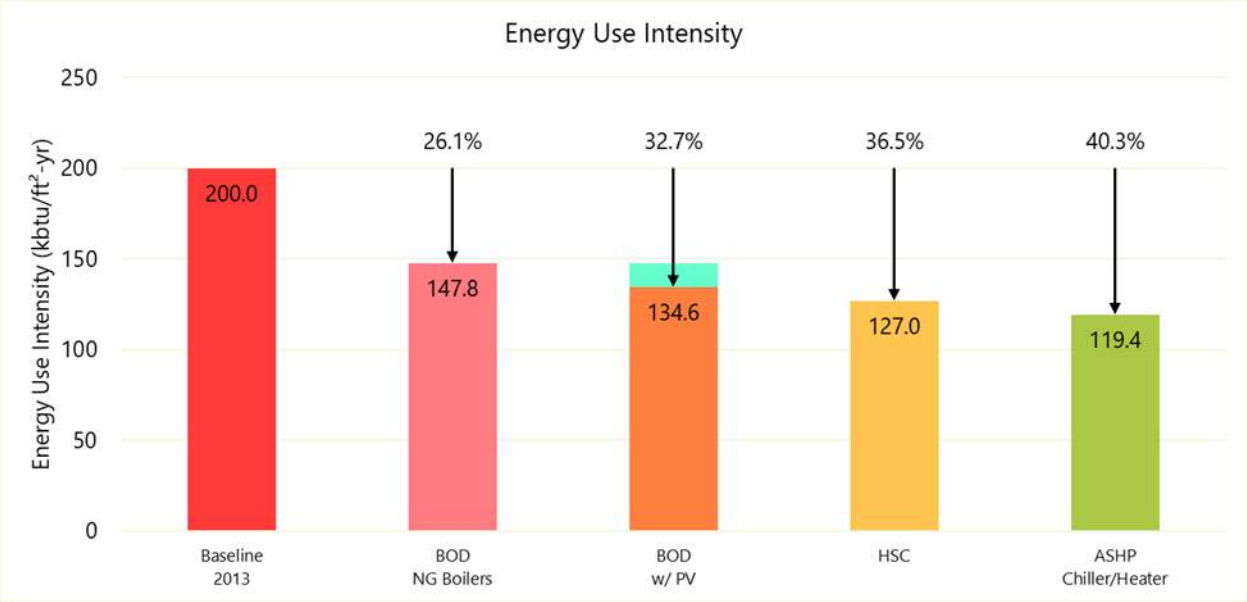
While the ASHP virtually eliminates natural gas consumption, the Heat Shift Chiller option is able to reduce natural gas consumption by 81% compared to the ASHRAE 90.1-2013 baseline. As the grid continues to become cleaner, greenhouse gas emissions from electricity will continue to reduce along with it while natural gas emissions will remain constant.

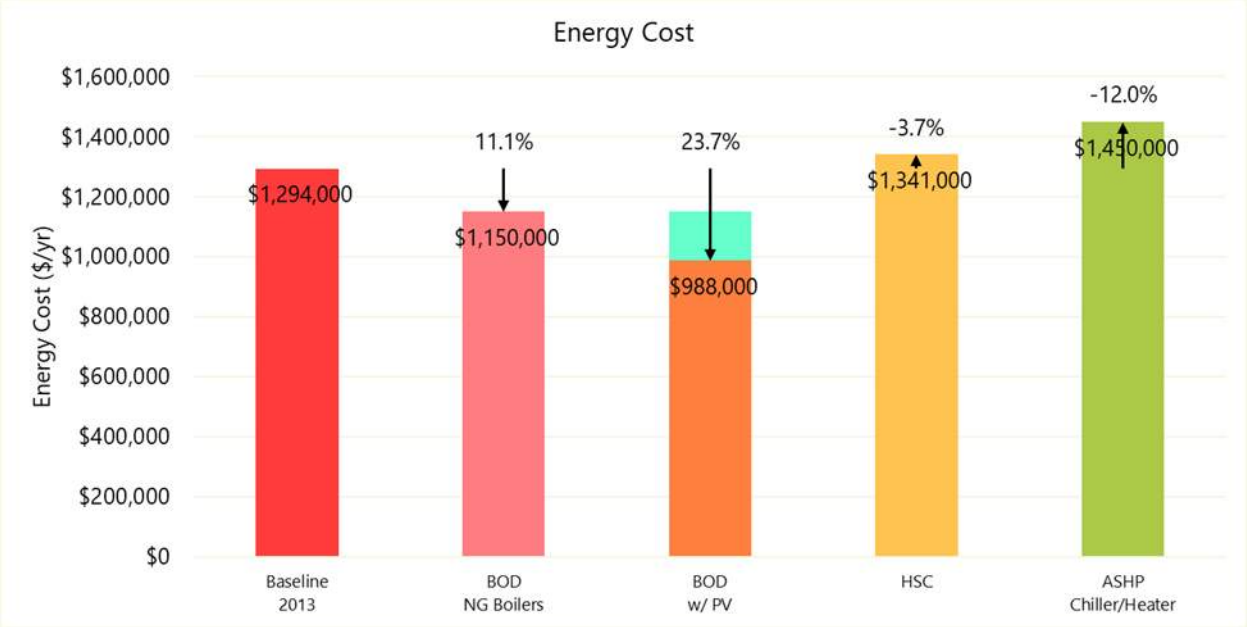
PROJECT PHASE	**Phase 2 SD Build-out**.
BUILDING TYPE	Existing Building Renovation (Phase 1) **New Construction (Phase 2)** Lab/Office
PROJECT AREA	**36,000 GSF (Phase 2 only)** 230,000 GSF (Total, Phase 1+2)
BASELINE	ASHRAE 90.1-2013 w/ MA amendments

Model	EUI (kBTU/sf-yr)	Energy Savings (%)	Yr 1 GHG Emissions (MTCO2e/yr)	Yr 1 GHG Savings (%)	Annual Cost ($)	Annual Cost Savings (%)
Baseline 2013	200.0	-	2561.0	-	$1,293,956	-
BOD NG Boilers	147.8	26.1%	1967.0	23.2%	$1,149,789	11.1%
BOD w/PV	134.6	32.7%	1768.9	30.9%	$ 987,599	23.7%
Heat Shift Chiller	127.0	36.5%	1827.3	28.6%	$1,341,303	-3.7%
ASHP Chiller/Heater	119.4	40.3%	1790.3	30.1%	$1,449,508	-12.0%


Year 1 GHG Emissions
(Metric Tons CO2 Equivalent)
GHG Emissions (MTCO2e/yr)
3000.0
2500.0
2000.0
1500.0
1000.0
500.0
0.0
23.2%
30.9%
28.6%
30.1%
2,560
1,970
1,770
1,830
1,790
Baseline 2013
BOD NG Boilers
BOD w/ PV
HSC
ASHP Chiller/Heater


NG Consumption
NG Consumption (Therms)
300000
250000
200000
150000
100000
50000
0
43%
43%
81%
98%
265142
152181
152181
51263
5565
Baseline 2013
BOD NG Boilers
BOD w/ PV
HSC
ASHP Chiller/Heater


Energy Use Intensity
Energy Use Intensity (kbtu/ft²-yr)
250
200
150
100
50
0
200.0
26.1%
147.8
32.7%
134.6
36.5%
127.0
40.3%
119.4
Baseline 2013
BOD NG Boilers
BOD w/ PV
HSC
ASHP Chiller/Heater


Energy Cost
Energy Cost ($/yr)
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
$1,294,000
11.1%
$1,150,000
23.7%
$988,000
-3.7%
$1,341,000
-12.0%
$1,450,000
Baseline 2013
BOD NG Boilers
BOD w/ PV
HSC
ASHP Chiller/Heater

BASELINE ENERGY MODEL

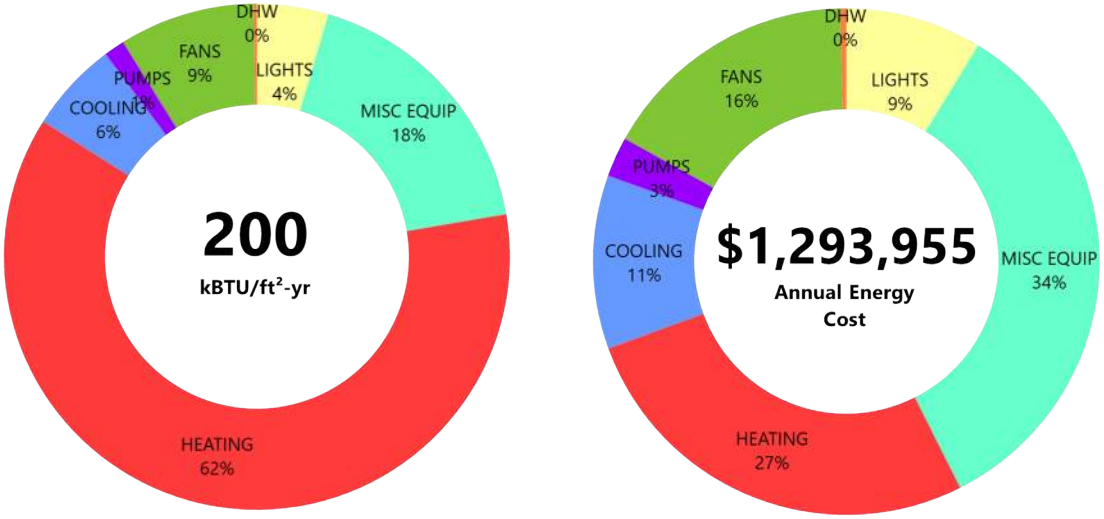
For this analysis, the Baseline energy model was developed based on ASHRAE 90.1-2013 Appendix G per the requirement of the Cambridge Net Zero Narrative.

Specific baseline building parameters are itemized in the Appendix. Highlights of the Baseline Model include:

90.1 BASELINE HVAC SYSTEM TYPE	System 7 VAV with Reheat (1 system per floor for Office; 1 for gen. lab)
90.1 BASELINE HVAC SYSTEM TYPE	Chilled water (Water-cooled Centrifugal Chillers)
90.1 BASELINE HEATING TYPE	Hot Water (Standard Efficiency Boilers)
90.1 BASELINE ENERGY RECOVERY	As required by ASHRAE 90.1 6.5.6.1
90.1 BASELINE WINDOW/WALL RATIO	35%

To further understand how the design decisions are impacting the energy performance of the building, it is useful to view the Baseline model's annual energy consumption (kBTU) broken down by major end-use components:

90.1 BASELINE
ENERGY / COST BY END USE



BASIS OF DESIGN ENERGY MODEL

The 125 Cambridge Park Drive energy model was created based on the **05/17/22 Phase 2 SD Design (new addition) with existing infrastructure/fitout per the 12/03/21 100% Construction Documents (Phase 1)**. This was done because phase 2 was designed to expand upon existing phase 1 infrastructure. Future equipment was included in the model per the Basis of Design and as specified in the Phase 1 Construction Documents.

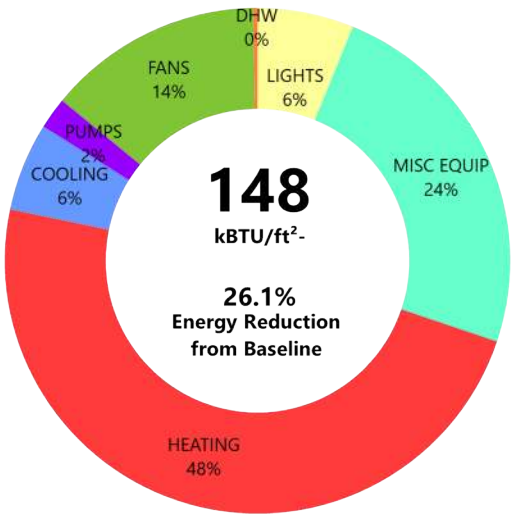
The Proposed Full Buildout Design has two all-air VAV systems that serve the office, general lab, and core areas. The restaurant/dining space on the first floor is not included as part of this project and will be considered in a separate project. Building air handlers were sized to provide an allowance for ventilation air for labs and offices. Any additional ventilation air or supplemental cooling required by the tenant fitouts will be installed at the time of the fitout.

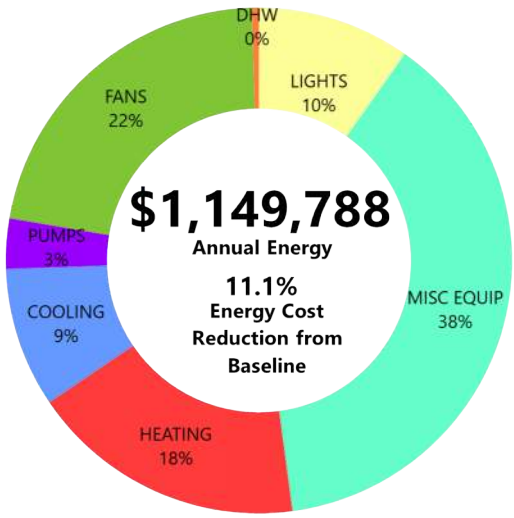
The AHU's have hydronic cooling and heating which are generated from the central plant located in another building (phase 1 existing building). **The phase 1 central plant is currently under construction and phase 2 intends to expand on the capacity of the plant in addition to the new construction in phase 2.** The fully designed chilled water system consists of 3 water-cooled centrifugal chillers, with a water-side economizer. The fully designed heating hot water system consists of three natural gas condensing boilers.

Specific building parameters and energy model inputs/outputs are itemized in the Appendix. Highlights of the Design Model include:

BOD HVAC SYSTEM TYPE	All Air VAV systems (Office, Lab, Core)
BOD COOLING TYPE	Chilled Water (WC Chillers)
BOD HEATING TYPE	Heating Hot Water (NG Condensing Boilers)
BOD ENERGY RECOVERY	Glycol Energy Recovery Coils on general exhaust
BOD WINDOW/WALL RATIO	35%

DESIGN MODEL
ENERGY / COST BY END USE





BOD ENERGY CONSERVATION MEASURES

Energy conservation measures (ECMs) associated with energy savings for this project currently include:

- **Improved Envelope:**
  Reduces the effect of outdoor conditions due to conduction of heat through the building envelope.
  - New and Existing Roof
    - R-30 insulation (assembly)
  - New Windows
    - Solarban 60 with thermally broken metal frame
    - COG U 0.28 btu/hr-sf (0.32 Assembly U value)
    - SHGC 0.3
  - Existing Windows to remain (Phase 1)
  - New walls
    - 6" metal stud with batt insulation and 4" continuous insulation
    - R-23 insulation (assembly)
  - Existing Walls to remain (Phase 1)
- **Sensible Energy Recovery:**
  Sensible Energy Recovery recovers sensible energy from general exhaust air streams and lab hood exhaust to precondition incoming outside air.
- **Condensing Boilers: (Existing Phase 1+ Expanded Phase 2)**
  Condensing boilers provide lower temperature water at higher efficiency than conventional boilers and save heating energy.

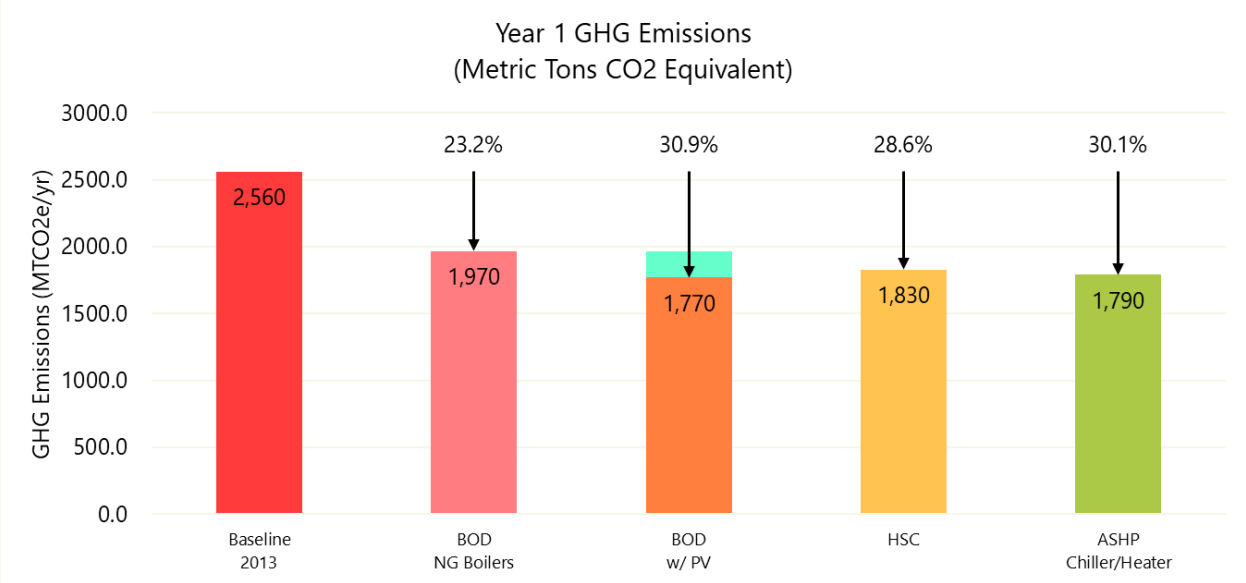
NET ZERO ENERGY CONSERVATION MEASURES FOR EVALUATION

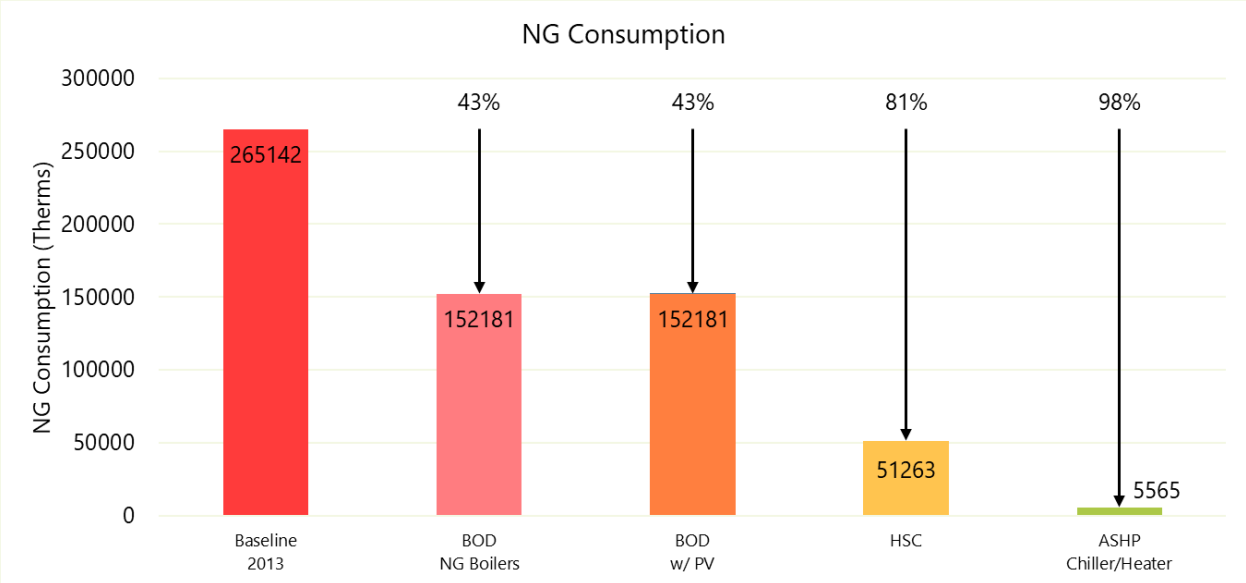
Energy conservation measures (ECMs) that are being evaluated in support of the city's net zero action plan include:

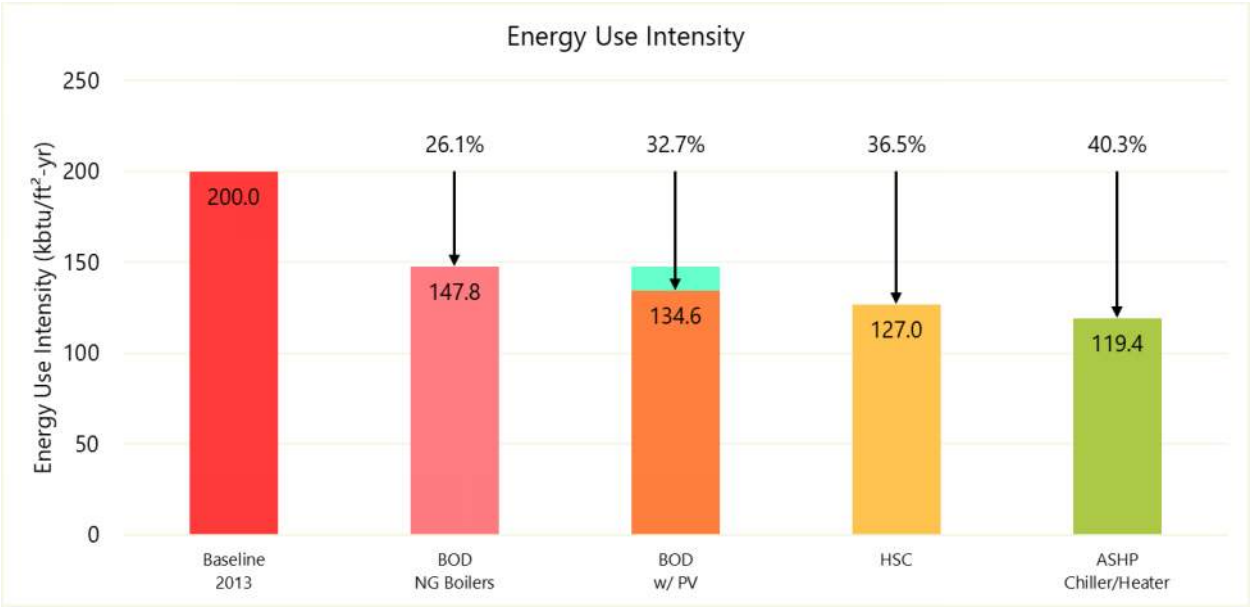
- **Photovoltaics**
  2 Large carport PV arrays are being considered, totaling 645 kW and generating an estimated 827,500 kwh annually, according to an early stage analysis by Blackbear Energy dated April 2022.
- **Heat Shift Chiller (Transitional Net Zero Emissions Option)**
  A 250 ton heat shift chiller would be installed in the existing central plant to simultaneously produce chilled water and hot water and significantly reduce heating energy produced with fossil fuels. The chiller would be sized to handle summer reheat loads as well provide baseload heating when heating loads exceed the capacity of the heat shift chiller. When heating exceeds the capacity of the Heat Shift Chiller, BOD natural gas condensing boilers provide supplemental heating to meet building heating loads.
- **Centralized Air Source Heat Pump Chiller/Heater (Full Net Zero Emissions Option)**
  Modular Air Source Heat Pump chiller/heater would be added that are reversible and capable of producing simultaneous heating hot water and chilled water. The ASHP Chiller/heaters would be sized to handle the full building heating and cooling loads. When air temperatures drop too low,

the capacities of the ASHP chiller heaters significantly decrease and BOD natural gas condensing boilers provide supplemental heating to meet building heating loads.

Note that these options are still in preliminary stages of feasibility. This analysis is aimed at informing the current BOD and providing a framework by which the project could potentially transition to net zero emissions. This analysis does not currently cover the financial or technical feasibility of incorporating these design options into the project.






Energy Use Intensity
Energy Use Intensity (kbtu/ft²-yr)
250
200
150
100
50
0
200.0
147.8
134.6
127.0
119.4
26.1%
32.7%
36.5%
40.3%
Baseline 2013
BOD NG Boilers
BOD w/ PV
HSC
ASHP Chiller/Heater


Energy Cost
Energy Cost ($/yr)
$1,600,000
$1,400,000
$1,200,000
$1,000,000
$800,000
$600,000
$400,000
$200,000
$0
$1,294,000
$1,150,000
$988,000
$1,341,000
$1,450,000
11.1%
23.7%
-3.7%
-12.0%
Baseline 2013
BOD NG Boilers
BOD w/ PV
HSC
ASHP Chiller/Heater

ENERGY PERFORMANCE MATRICES

Baseline (90.1-2013)						
End Use	ELEC (kWh)	NAT GAS (therms)	STEAM (MBTU)	CHW (MBTU)	Total Energy (kBTU)	% of Total
Lights	575,564				1,964,400	5%
Exterior Lights						0%
Misc. Equipment	2,235,397				7,629,410	18%
Space Heating		265,142			26,514,200	62%
Space Cooling	683,145				2,331,574	5%
Heat Rejection	48,749				166,380	0%
Pumps & Aux	168,707				575,797	1%
Ventilation & Fans	1,092,000				3,726,996	9%
Onsite Rewnables						0%
Domestic Hot Water	26,129				89,178	0%
Total Energy by Type	4,829,691	265,142	-	-	42,997,935	100%
Total Cost by Type	$ 946,619	$ 347,336	$ -	$ -		
Total Energy Cost	$					1,293,955
Site EUI (kBTU/SF)						200.0
Site Emissions (MTCO2e)						2,560.99

Design run						
End Use	ELEC (kWh)	NAT GAS (therms)	STEAM (MBTU)	CHW (MBTU)	Total Energy (kBTU)	% of Total
Lights	573,394				1,956,994	6%
Exterior Lights						0%
Misc. Equipment	2,235,397				7,629,410	24%
Space Heating	17,887	152,181			15,279,148	48%
Space Cooling	466,224				1,591,223	5%
Heat Rejection	58,474				199,572	1%
Pumps & Aux	188,278				642,593	2%
Ventilation & Fans	1,283,356				4,380,094	14%
Onsite Renewables						0%
Domestic Hot Water	26,129				89,178	0%
Total Energy by Type	4,849,139	152,181	-	-	31,768,211	100%
Total Cost by Type	$ 950,431	$ 199,357	$ -	$ -		
Total Energy Cost	$					1,149,788
Site EUI (kBTU/SF)						147.8
Site Emissions (MTCO2e)						1,966.95

Savings by Enduse						
	Energy			Energy Cost		
End Use	kBTU	Enduse Savings %	Enduse Energy Savings %	$	Enduse Savings %	Enduse Cost Savings %
Lights	7,406	0%	0.0%	$ 425	0%	0.0%
Exterior Lights			0.0%	$ -		0.0%
Misc. Equipment		0%	0.0%	$ -	0%	0.0%
Space Heating	11,235,052	42%	26.1%	$ 144,473	42%	11.2%
Space Cooling	740,351	32%	1.7%	$ 42,517	32%	3.3%
Heat Rejection	(33,191)	-20%	-0.1%	$ (1,906)	-20%	-0.1%
Pumps & Aux	(66,796)	-12%	-0.2%	$ (3,836)	-12%	-0.3%
Ventilation & Fans	(653,098)	-18%	-1.5%	$ (37,506)	-18%	-2.9%
Onsite Renewables			0.0%	$ -		0.0%
Domestic Hot Water		0%	0.0%	$ -	0%	0.0%
Total	11,229,724		26.1%	$ 144,167		11.1%
	Total Site Energy Savings 26.12%			Total Site Cost Savings 11.14%		
	Greenhouse Gas Reduction 23.20%					

BOD with PV						
End Use	ELEC (kWh)	NAT GAS (therms)	STEAM (MBTU)	CHW (MBTU)	Total Energy (kBTU)	% of Total
Lights	573,394				1,956,994	6%
Exterior Lights						0%
Misc. Equipment	2,235,397				7,629,410	24%
Space Heating	17,887	152,181			15,279,148	48%
Space Cooling	466,224				1,591,223	5%
Heat Rejection	58,474				199,572	1%
Pumps & Aux	188,278				642,593	2%
Ventilation & Fans	1,283,356				4,380,094	14%
On Site Renewables	(827,500)				(2,824,258)	-9%
Domestic Hot Water	26,129				89,178	0%
Total Energy by Type	4,021,639	152,181	-	-	28,943,954	91%
Total Cost by Type	$ 788,241	$ 199,357	$ -	$ -		
Total Energy Cost	$					987,598
Site EUI (kBTU/SF)						134.62

BOD with Heat Shift Chiller						
End Use	ELEC (kWh)	NAT GAS (therms)	STEAM (MBTU)	CHW (MBTU)	Total Energy (kBTU)	% of Total
Lights	573,394				1,956,994	6%
Exterior Lights						0%
Misc. Equipment	2,235,397				7,629,410	24%
Space Heating	793,272	51,263			7,833,737	25%
Space Cooling	1,252,201				4,273,762	13%
Heat Rejection	65,300				222,869	1%
Pumps & Aux	271,704				927,326	3%
Ventilation & Fans	1,283,356				4,380,094	14%
On Site Renewables						0%
Domestic Hot Water	26,129				89,178	0%
Total Energy by Type	6,500,753	51,263	-	-	27,313,370	86%
Total Cost by Type	$ 1,274,148	$ 67,155	$ -	$ -		
Total Energy Cost	$					1,341,302
Site EUI (kBTU/SF)						127.04

BOD with ASHP Chiller/Heater						
End Use	ELEC (kWh)	NAT GAS (therms)	STEAM (MBTU)	CHW (MBTU)	Total Energy (kBTU)	% of Total
Lights	573,394				1,956,994	6%
Exterior Lights						0%
Misc. Equipment	2,235,397				7,629,410	24%
Space Heating	1,677,376	5,565			6,281,384	20%
Space Cooling	1,470,281				5,018,069	16%
Heat Rejection						0%
Pumps & Aux	89,307				304,805	1%
Ventilation & Fans	1,286,369				4,390,377	14%
On Site Renewables						0%
Domestic Hot Water	26,129				89,178	0%
Total Energy by Type	7,358,253	5,565	-	-	25,670,217	81%
Total Cost by Type	$ 1,442,218	$ 7,290	$ -	$ -		
Total Energy Cost	$					1,449,508
Site EUI (kBTU/SF)						119.40

ENERGY MODEL INPUTS

INPUT PARAMETER	BASELINE ASHRAE 90.1-2013 App. G	PROPOSED DESIGN 05/17/22 SD Design	INPUT SOURCES
GENERAL INFORMATION			
CLIMATE ZONE	5A		ASHRAE 90.1-2016
WEATHER STATION	MA_Boston_Logan_Intl_Arp.bin		ASHRAE 90.1-2016
BUILDING ORIENTATION	True North		05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
OUTDOOR DESIGN CONDITIONS	Summer: 90.6°F DB, 72.6°F WB Winter: 8.5°F DB		05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
INDOOR DESIGN CONDITIONS	Office Spaces/BOH: Summer 75°F (60% RH) / Winter 70°F Laboratories: Summer 73°F (60% RH) / Winter 70°F		05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
PEAK OCCUPANT DENSITY	Offices: 150 ft^2/person Laboratory: Conference: 25 ft^2/person Back-of-house: 300 ft^2/person (assumption)		Diversified estimate
UTILITY RATES			
ELECTRICITY UTILITY RATE	$0.196/kWh		EIA 2022 commercial average for MA
NATURAL GAS UTILITY RATE	$1.31/therm		EIA 2022 commercial average for MA
SUMMARY OF CONSTRUCTION MATERIALS			
ROOF CONSTRUCTION	Existing: U-0.055 btu/hr-sf (R-18) New: Insulation Entirely above Deck U-0.032 btu/hr-sf	Insulation Entirely above Deck U-0.032 btu/hr-sf (R-30)	ASHRAE 90.1-2013 estimate existing conditions 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design

INPUT PARAMETER	BASELINE ASHRAE 90.1-2013 App. G	PROPOSED DESIGN 05/17/22 SD Design	INPUT SOURCES
WALL CONSTRUCTION	Existing : 6" steel framed with batt insulation: U-0.1 btu/hr-sf (R-10) New: Steel-framed U-0.055 btu/hr-sf	Existing : 6" steel framed with batt insulation: U-0.1 btu/hr-sf (R-10) New: 6" Steel-framed w/ 4" CI U-0.043 btu/sf-sf (R-23)	ASHRAE 90.1-2013 estimate existing conditions 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
SLAB CONSTRUCTION	Unheated F-0.73	Unheated F-0.73	ASHRAE 90.1-2013
INFILTRATION	0.03 cfm/sf	0.03 cfm/sf	Initial assumption
GLAZING DESCRIPTION (ASSEMBLY)	Existing: Unidentified double pane U-0.6 btu/hr-sf SHGC 0.59 New: Metal framing Assembly U-0.42 SHGC-0.40	Existing: Unidentified double pane U-0.6 btu/hr-sf SHGC 0.59 New: Solarban 60 COG U 0.28 Assembly U-0.32 SHGC-0.3	ASHRAE 90.1-2013 estimate existing conditions 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
WINDOW-TO-WALL RATIO	35%	35%	05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
PLUG LOADS & LIGHTING			
EQUIPMENT POWER DENSITY	Same as Design	Office: 1.5 W/sf Lab: 6 W/sf Lab Support 15 W/sf BOH: 0.25 W/sf	Diversified estimate based on 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
LIGHTING POWER DENSITY	Office: 0.61 W/sf Lab: 1.43 W/sf BOH: 0.41 W/sf	Office: 0.61 W/sf Lab: 1.33 W/sf BOH: 0.43 W/sf	ASHRAE 90.1-2013 Table 9.6.1 MA Energy Code
LIGHTING CONTROLS	Same as Design	Occupancy sensors for high occupancy spaces Daylighting controls	ASHRAE 90.1-2013 9.4.1.2 9.4.1.4
HVAC AIR SIDE SYSTEM SUMMARY			
HVAC SYSTEM	1 Lab VAV with reheat (system 7) 1 nonlab VAV with reheat per floor	(2) 98,000 CFM 100% OA VAV AHUs with HW reheat	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design

INPUT PARAMETER	BASELINE ASHRAE 90.1-2013 App. G	PROPOSED DESIGN 05/17/22 SD Design	INPUT SOURCES
DEMAND CONTROLLED VENTILATION	DCV where required	DCV where required	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
FAN CONTROL	Same as Design	VAV: Variable speed	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
MINIMUM FLOW	VAV: 30% of zone peak flow	VAV: 30% of zone peak flow	
AIR-SIDE ECONOMIZER	Temp OA > 70°F	Dual Enthalpy	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
ENERGY RECOVERY (TYPE AND EFFECTIVENESS)	As required by ASHRAE 90.1-2013 6.5.6.1	Glycol energy recovery (47% sensible effectiveness) on general exhaust	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
HVAC WATER SIDE SYSTEM SUMMARY			
COOLING TYPE	Chilled water	Chilled Water	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
CHILLER TYPE	(2) Water cooled Centrifugal 0.56 kw/ton	(3) 465 ton Water cooled centrifugal (6.0 COP_C) OPTION: Heat Shift Chiller 4.0 COP Cooling OPTION: ASHP Chiller/Heater 3.0 Cooling	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
CHILLED WATER (CHW) SUPPLY TEMP	44°F	42°F	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
CHW RETURN TEMP	56°F	56°F	

INPUT PARAMETER	BASELINE ASHRAE 90.1-2013 App. G	PROPOSED DESIGN 05/17/22 SD Design	INPUT SOURCES
DEMAND CONTROLLED VENTILATION	DCV where required	DCV where required	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
FAN CONTROL	Same as Design	VAV: Variable speed	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
MINIMUM FLOW	VAV: 30% of zone peak flow	VAV: 30% of zone peak flow	
AIR-SIDE ECONOMIZER	Temp OA > 70°F	Dual Enthalpy	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
ENERGY RECOVERY (TYPE AND EFFECTIVENESS)	As required by ASHRAE 90.1-2013 6.5.6.1	Glycol energy recovery (47% sensible effectiveness) on general exhaust	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
HVAC WATER SIDE SYSTEM SUMMARY			
COOLING TYPE	Chilled water	Chilled Water	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
CHILLER TYPE	(2) Water cooled Centrifugal 0.56 kw/ton	(3) 465 ton Water cooled centrifugal (6.0 COP_C) OPTION: Heat Shift Chiller 4.0 COP Cooling OPTION: ASHP Chiller/Heater 3.0 Cooling	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
CHILLED WATER (CHW) SUPPLY TEMP	44°F	42°F	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
CHW RETURN TEMP	56°F	56°F	

INPUT PARAMETER	BASELINE ASHRAE 90.1-2013 App. G	PROPOSED DESIGN 05/17/22 SD Design	INPUT SOURCES
PRIMARY HHW PUMP SPEED CONTROL	Variable primary	Variable primary	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
NUMBER OF HHW PUMPS	2 primary pumps	3 primary pumps	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
HHW PUMP POWER	19 w/gpm	24.5 W/gpm	ASHRAE 90.1-2013/ 05/17/2022 Phase 2 SD Design + 12/03/2021 100% Phase 1 CD Design
DOMESTIC HOT WATER	Same as Design	Electric DW Heater	12/03/2021 100% Phase 1 CD Design + 05/17/2022 Phase 2
RENEWABLES	None	None OPTION: 645 kW Carport Arrays	4/22 Black Bear Energy Design Memo

DATE	MODEL REPORT	SUMMARY OF CHANGES	DESIGN EUI	ENERGY SAVINGS	MODELER	CHECK
07/05/2022	Special Permit Model	Original run	147.8.0 kBtu/ft^2-yr	26.1%	DL	DL/PM

*Based on EApc95 savings against 90.1-2013 Appendix G baseline)

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METHODOLOGY

Vanderweil models energy performance using eQUEST 3.64, a software program that utilizes DOE-2.2 to simulate the hourly energy consumption and demand load shapes for a given building. To develop a model, a graphic representation of the building is created using floor plans, floor heights, and window configurations. Mechanical systems and building envelope are defined, and operating parameters such as lighting power density, airflow rates, and occupancy schedules are included. The simulation uses 30-year average hourly weather data to estimate the energy consumption of the building for each hour of the year.

LIMITATIONS

In order to estimate energy consumption profiles, Vanderweil utilizes traditional computer-based simulation programs such as Trane Trace®, DOE-2, and/or our own in-house calculations and/or programs based on industry standard methods. Vanderweil neither has control of nor assumes control of the actual building, occupant behavior, equipment operation/maintenance, or climatic conditions. Accordingly, Vanderweil does not expressly or implicitly warrant or represent that Vanderweil's energy and associated cost estimates of the building or equipment operation will be the actual operation energy and cost. Rather, the purpose of this energy model is only to compare design options against a baseline to inform design decisions.

8F. Cambridge Cool Factor

This document guides applicants in completing the Cool Factor Score Sheet. Below, each strategy that contributes to the score is defined, and any requirements for utilizing and counting the strategies are explained.

Application of each provision to the Project follows the provision in italics.

HOW TO FILL OUT THE SCORE SHEET

First, fill out the fields at the top of the Score Sheet, including the total lot area of the site in square feet and the open space requirement per the Zoning Ordinance. Then, for all strategies except those in category A, enter the number of square feet dedicated to the strategy (such as B3: Planting Area or C3: Green Roof). For strategies in category A, simply enter the number of trees; the corresponding square footage of tree canopy is automatically calculated by the Score Sheet. The Score Sheet distinguishes between strategies that are within 20 feet of the public right-of-way and those that are not. Note that a strategy can only be counted once.

HOW THE SCORE SHEET IS CALCULATED

For all strategies, the area of each strategy is automatically multiplied by a weighting factor, so strategies that provide a greater cooling benefit have a higher relative value. For example, preserving large canopy trees, which provide large areas of shade and significant cooling, has the highest value due to its high multiplication factor. Similarly, strategies that are within 20 feet of the public right-of-way have a higher multiplication factor than strategies that are outside of that area because they provide an additional public benefit. The Score Sheet automatically calculates the value of all strategies, then divides that sum by the total cooling area goal, which is simply the total lot area multiplied by the open space requirement. If the resulting figure is 1 or above, then the requirements of the Cool Factor have been met. If the score is below 1, revisit the initial site strategies and try to identify any opportunities to increase the use of strategies with higher multipliers and strategies within 20' of the public right of way. Also consider increasing the area of individual strategies.

Preservation of Existing Trees (A1-5)

Existing trees are trees that are preserved and protected onsite throughout the construction process. Because of their maturity, existing trees often provide more shade than young trees, which is why they receive a relatively high multiplier on the score sheet.

In order to receive credit, existing trees must be in good health. Existing tree size is defined by the canopy width at the time of score sheet submittal. The score sheet approximates the canopy width of understory trees at 150 square feet and the canopy width of canopy trees at 700 square feet.

DEFINITIONS

Understory Trees are defined as trees reaching a canopy spread of 8' to 15' at maturity. Examples include Serviceberry (Amelanchier Canadensis), Eastern Redbud (Cercis Canadensis), and Cornelian-cherry dogwood (Cornus mas).

Canopy Trees are defined as trees reaching a spread of 25' to 30' at maturity. Examples include Pine oak (Quercus palustris), Kentucky Coffeetree (Gymnocladus dioicus), and American Linden (Tilia Americana).

STRATEGIES

A1: Understory Tree, currently <10’ canopy spread

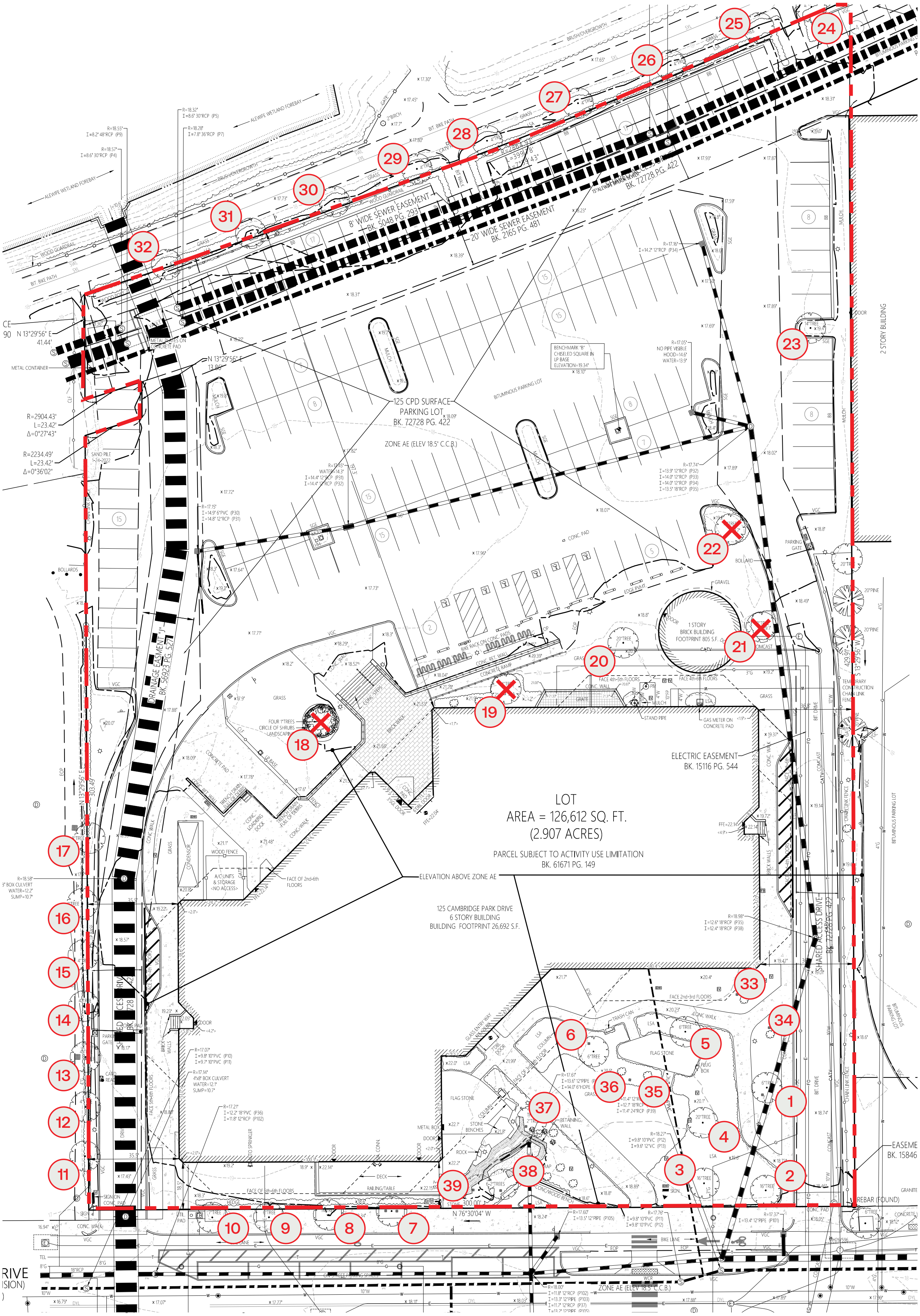
A2: Understory Tree, currently >10’ canopy spread

A3: Canopy Tree, currently <15’ canopy spread

A4: Canopy Tree, currently between 15’and 25’ canopy spread

A5: Canopy Tree, currently >25’ canopy spread

The Preservation of Existing Trees is a critical component of the overall site strategy to increase the amount of Open Space and green connections to the Alewife Reservation. A Tree Inventory (Volume 1) has been conducted and the Tree Study (Volume 2) increases the amount of trees on site. Though Several existing trees may require removal to enable the new Electrical Service, the Project is exploring ways to maintain the overwhelming majority of existing trees on site.


LOT
AREA = 126,612 SQ. FT.
(2.907 ACRES)
PARCEL SUBJECT TO ACTIVITY USE LIMITATION
BK. 61671 PG. 149
125 CAMBRIDGE PARK DRIVE
6 STORY BUILDING
BUILDING FOOTPRINT 26,692 S.F.
ELEVATION ABOVE ZONE AE
125 CPD SURFACE PARKING LOT
BK. 72728 PG. 422
ZONE AE (ELEV 18.5' C.C.B.)
ELECTRIC EASEMENT
BK. 15116 PG. 544
1 STORY BRICK BUILDING FOOTPRINT 805 S.F.
8' WIDE SEWER EASEMENT
BK. 5048 PG. 293
20' WIDE SEWER EASEMENT
BK. 2165 PG. 481
BITUMINOUS PARKING LOT
2 STORY BUILDING
N 76°30'04" W
300.00'
N 13°29'56" E
R=2904.43'
L=23.42'
Δ=0°27'43"
R=2234.49'
L=23.42'
Δ=0°36'02"
REBAR (FOUND)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
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37
38
39


EXISTING TREES ON THE NORTH SIDE OF THE PARKING TO REMAIN AND BE PROTECTED
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
125 CPD
EXISTING TREES ON THE SOUTH & EAST SIDE OF 125 CPD TO REMAIN AND BE PROTECTED

New and Transplanted Trees (A6-7)

The following strategies are for newly planted trees brought from off site as well as transplanted trees. These trees may take several years before they form a mature canopy and contribute to shading of the site, therefore, they receive a smaller multiplier than preserved existing trees. The score sheet approximates the canopy width of understory trees at 150 square feet and the canopy width of canopy trees at 700 square feet.

STRATEGIES

A6: New and Transplanted Understory Trees (at least 400 cubic feet of soil per tree required)

A7: New and Transplanted Canopy Trees (at least 700 cubic feet of soil per tree required)

The Project introduces at least (12) New Understory Trees and (5) New Canopy Trees.

Planting Areas (B1-3)

Planting areas may include lawn, perennials and groundcovers, or woody plants, such as shrubs. Planting areas are divided into categories based on the plants' mature height. Taller plants contribute more to temperature reduction, which is why plants taller at maturity receive a higher multiplier. Permanent above-grade planters may be counted for credit; movable planters may not be counted for credit.

DEFINITIONS

Herbaceous plants (i.e. plants without persistent woody stems) include Little Blue Stem (Schizachyrium scoparium), New England Aster (Aster novae-angliae), and Foamflower (Tiarella cordifolia). Woody plants (i.e. plants with hard stems) include Winterberry (Ilex verticillata), Summersweet (Clethra anifolia), and Oakleaf hydrangea (Hydrangea quercifolia).

STRATEGIES

B1: Lawn Area, sod or seeded tall grasses (minimum 8" soil depth is required)

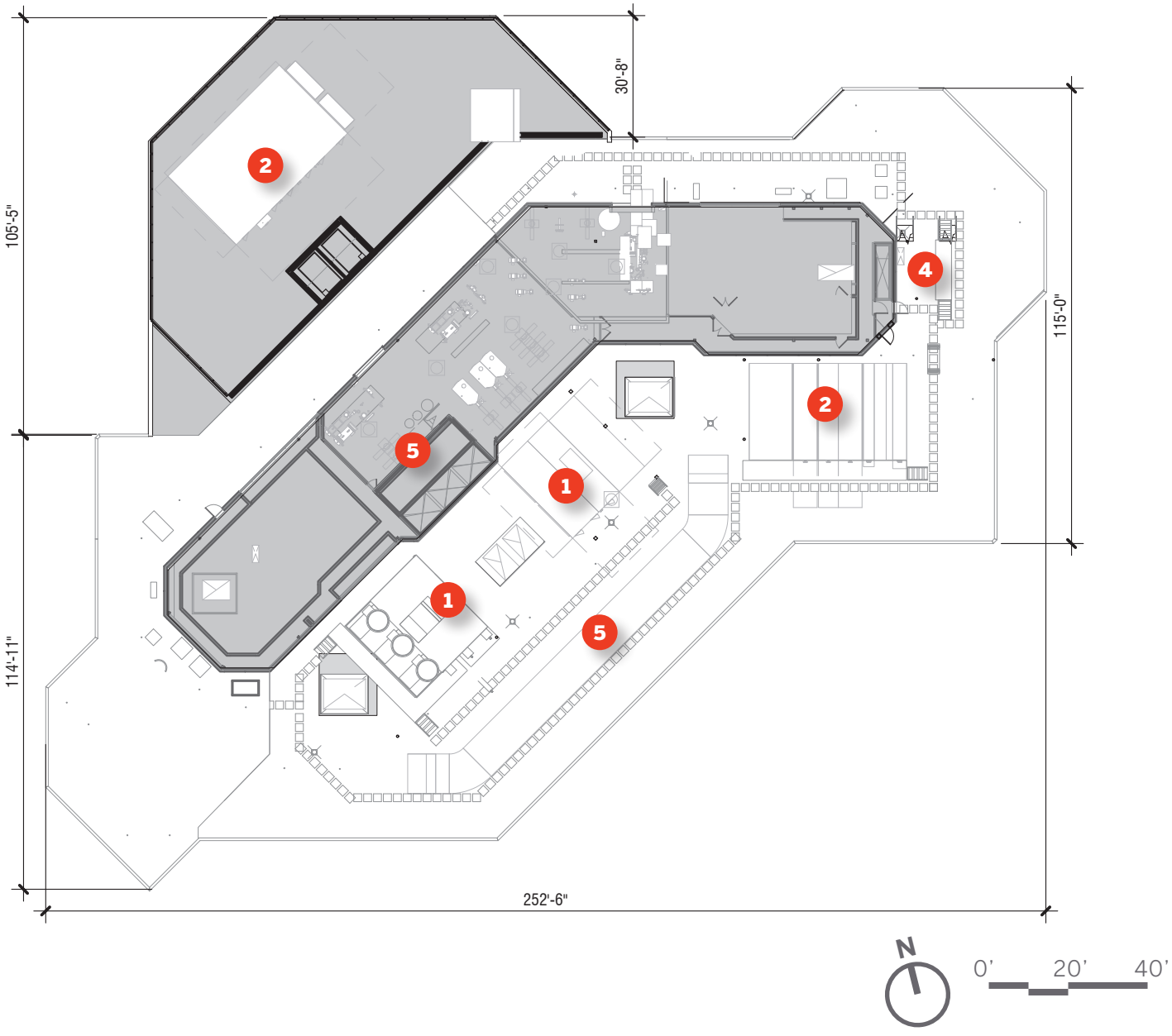
B2: Low Planting Area, herbaceous or woody plants less than 2' tall at maturity (minimum 12" soil depth is required)

B3: Planting Area, herbaceous or woody plants more than 2' tall at maturity (minimum 18" soil depth is required)

The Project doubles the amount of Open Spaces, with a range of Low Planting Areas and additional Planting areas that provide taller plants at maturity.

1 EXHAUST AIR HANDLER
2 SUPPLY AIR HANDLER
3 COOLING TOWER
4 EMERGENCY GENERATOR
5 DUCTWORK

PROPOSED ROOF PLAN



Green Facade and Living Wall (C1-2)

Green facades and living walls are living vertical systems that contain plant species and/or a planting medium.

DEFINITIONS

Green Façades are vertical surfaces covered with vines or climbing species that are planted in the ground and attach themselves to a lattice, cable, mesh, or wall surface. Some species need vertical support structures while others do not.

Living Walls are vertical surfaces comprised of plants that are planted directly in a suspended growing medium. These systems are usually more intensive to construct and maintain because they require special structures to hold the soil volume.

STRATEGIES

C1: Green Façade, requirements include:

• Provide a minimum 15' wide and 10' tall structure for vines that need a support system;

• Plant species based on their recommended spacing to cover at least a 15' wide portion of wall for vines that do not need support;

• Green facades can receive a maximum credit equivalent to the expected extent of coverage within 10 years or the total area of the support structure, whichever is smaller;

• Soil requirements: minimum 6 cubic feet per plant.

C2: Living Wall (an irrigation system is required to receive the credit)

The Project elected not to employ Green Facades and Living Walls due to the location of the Addition on the north side of the existing building, and limited opportunities on the south side.

Green Roofs (C3-5)

DEFINITIONS

Green Roof is defined as a planted area over a built structure with a "lightweight with a shallow layer of growing substrate of less than 8" deep, requiring minimal maintenance. They generally have lower water requirements and use small, low-growingplant species, particularly succulents." (Growing Green Guide) Intensive Green Roof is defined as a planted area over built structure that is "generally heavier, with a deeper layer of growing substrate, that supports a wider variety of plant types. Intensive green roofs need more irrigation and maintenance than extensive roofs, and are highly engineered landscapes, often built directly on structures with considerable weight load capacity." (Growing Green Guide)

STRATEGIES

C3: Green Roof, low soil volume planting such as succulents and grasses (minimum 4" soil depth)

C4: Short Intensive Green Roof, herbaceous and woody plants less than 2' tall at maturity (minimum 18" soil depth)

C5: Tall Intensive Green Roof, herbaceous and woody plants greater than 2' tall at maturity (minimum 24" soil depth, trees counted separately)

The Project converts the (10) existing Balconies to a be a able to support a combination of Short Intensive Green Roofs and Tall Intensive Green Roofs, while also introducing several new balconies which will also install a combination of Green Roofs with up to 15% Private Open Space providing outdoor space to tenants on the upper levels.

Paving and Shade Structures (D1-3)

"Solar reflective cool pavements stay cooler in the sun than traditional pavements. Pavement reflectance can be enhanced by using reflective aggregate, a reflective or clear binder, or a reflective surface coating" (Berkeley Lab, Heat Island Group). Note that all projects are required to have a high SRI roof, per the definition and strategies below.

DEFINITIONS

Solar Reflective Index (SRI): "The SRI is a composite score of solar reflectance and thermal emittance. Solar reflectance, or albedo, is the percentage of solar energy reflected by a surface." (Hui Li Ph.D., P.E., In Pavement Materials for Heat Island Mitigation, 2016). Thermal emittance characterizes the surface capability to reemit the previously absorbed heat away from itself (A.L. Pisello, in Eco-Efficient Materials for Mitigating Building Cooling Needs, 2015).

STRATEGIES

D1: High SRI Roof, low slope roofs (i.e. ≤ 2:12) must have a minimum SRI of 82 and steep slope roofs (i.e. > 2:12) must have a minimum SRI of 39

D2: High-SRI Paving must have an SRI of 39 or higher (LEED, V4)

D3: High-SRI Shade structures may include fabric or tensile shade structures as well as hard-material structures, the shade structure material must have an SRI of 39 or higher (LEED, V4)

The Project introduces a Solar Array over the electric vehicle parking spaces which also provide shade. In addition, thiis area will receive pervious pavement, and will use high SRI paving.

8F. Cambridge Cool Factor

City of Cambridge **Cool Factor Score Sheet** **7/8/2022**

Project Address	Special Permit Number	Total Lot Area (SF)	
125 CambridgePark Drive	PB-XXX	126612	
Applicant Name	Phone Number	Open Space Requirement (%)	
Longfellow Real Estate Partners	617-303-2900	15%	
Applicant Contact / Address	Email Address	Includes High SRI Roof	SRI Value
260 Franklin Street Suite 1920, Boston, MA	mlerner@lfrep.com	☑ Yes	90
Project Description		Result	
Addition to Existing Technical Office Building		**Pass**	

Enter minimum required open space ratio. If the ratio is less than 20%, enter 20 here.

Low slope roofs (i.e. ≤ 2:12) must have a minimum SRI of 82. Steep slope roofs (i.e. > 2:12) must have a minimum SRI of 39.

When entering strategies that are within 20' of the public right of way (column L), do not also enter them in column H.

			Outside 20' of PROW	Value Factor		Within 20' of PROW	Value Factor	Contributing Area
Trees		**Preserved Existing Trees**						
Enter the number of trees in each category. Count each tree only once on this form.	A1	Understory tree currently <10' canopy spread	0	0.80	+	0	1.60	-
	A2	Understory tree currently >10' canopy spread	5	1.00	+	2	2.00	1,350
	A3	Canopy tree currently <15' canopy spread	0	0.80	+	0	1.60	-
	A4	Canopy tree currently between 15' and 25' canopy spread	10	1.00	+	13	2.00	25,200
	A5	Canopy tree currently >25' canopy spread	3	1.20	+	2	2.40	5,880
		New or Transplanted Trees						
	A6	Understory tree	12	0.60	+	0	1.20	1,080
	A7	Canopy tree	5	0.70	+	0	1.40	2,450
Planting Areas	B1	Lawn	1300	0.30	+	0	0.60	390
Enter area in square feet of each component in the box provided	B2	Low Planting	4500	0.40	+	2500	0.80	3,800
	B3	Planting	5000	0.50	+	1000	1.00	3,500
Green Roofs & Facades	C1	Green Façade	0	0.10	+	0	0.20	-
For definitions, see reference document.	C2	Living Wall	0	0.30	+	0	0.60	-
	C3	Green Roof	3500	0.30	+	100	0.60	1,110
	C4	Short Intensive Green Roof	0	0.50	+	0	1.00	-
	C5	Intensive Green Roof	0	0.60	+	0	1.20	-
Paving & Structures	D1	High-SRI Roof	Required	N/A				
	D2	High-SRI Paving	32500	0.1				3,250
	D3	High-SRI Shade Structure	4300	0.2	+	100	0.40	900

High-SRI roofs are a prerequisite of the Cool Factor and therefore are not assigned a point value.

Project Summary

Portion of lot area utilizing green strategies	*35%*
Portion of score from green strategies	*92%*
Portion of score from trees	*74%*
Portion of score contributing to public realm cooling	*52%*

Total Contributing Area	**48,910**
Total Area Goal	**18,992**
COOL FACTOR SCORE	**2.58**

If your project scores 1 or above, you have successfully met the requirements of the Cool Factor.

By employing a comprehensive Sustainability Strategy, by keeping existing trees and planting many new ones, providing a range of planting areas, stormwater measures, Green Roofs, Solar Array Shade structures, High-SRI Roofing and Paving, the Project is able to achieve an exemplary Cool Factor Score of **2.58**.

Green Building Report Database

Date: 7/18/22		
Project name: 125 CambridgePark Drive		
Building use:	Non residential (type)	Technical Office (4.3.4.F)
Project Design Phase: Schematic Design	Program/Schematics/ DD or CD--% complete	SD - 100% Complete
Project phase @ CDD: Special Permit	Pre App; Special Permit; Building Permit, or C of O	SPECIAL PERMIT

Please fill out Green Building Report information items below:		
Item	**Metrics/Units**	**Project's GBR Information**
ASHRAE Version (Stretch Code standards)	Standard-Year	2016 for Code, 2010 for LEED (Stretch Code - N/A)
Improved energy performance of baseline standard used compared to ASHRAE standard 90.1-2013	%	29%
Energy Cost Savings (LEED project - compared to baseline reported in EA)	%	16%
Energy Use Savings (LEED project - reduction compared to baseline reported in EA)	%	29%
Total energy cost/year	$	$1,149,788
Site EUI (Stretch Code standards)	kBTU/SF-yr	148
Source EUI (Stretch Code standards)	kBTU/SF-yr	209
GHG intensity	kg CO2/sf	8.5
GHG emissions reduction proposed	%	27%
GHG emissions total	mtCO2e	1966.9
Solar Ready	YES or NO	YES
Solar Capacity	kW	828 kWh/Year
Solar (renewable energy cost) contribution	%	28% Load Offset
Solar Ready (Roof area)	SF	37,000 SF
Green Roof (Type:extensive or intensive)	YES or NO (SF)	YES: Intensive 3500 SF
Bio-Solar Roof (using green roof and solar)	YES or NO (SF)	N/A
Building Envelope commissioing	YES or NO	YES

Item	Metrics/Units	Project's GBR Information
District energy	YES or NO	NO
Fossil Fuel use	YES or NO	YES (Gas fueled Boilers)
Envelope Commissining used	YES or NO	YES
Window-to-wall	%	35%
Triple-glazing used	YES or NO	NO
U-Value of glazing used	U-Value	0.32
VLT for vertical glazing at ground level uses	%	35%
Water use reduction below LEED baseline (Indoor)	%	Existing to be re-used
Water use reduction below LEED baseline (outdoor)	%	50 % Min
Lighting design/plug load reduction	%	TBD
Number of EV ready spaces	% of total paking	25%
C & D waste diverted from landfill	%	
Building Certification Rating Used	Version	LEEDv4 Core/Shell
LEED Certification Level	Platinum, gold, or silver	GOLD
LEED Credit points (number pursued or verified)	Points	61
Life-cycle/embodied carbon assesement tools used	Yes/Not yet	Majority of project is a gut renovation with a small addition. Over 75% of the existing structure and enclosure are being reused
Expected Life time GHG emissions*	CO2/CO2e	TBD
Total square footage	SF	221,500 SF
# Residential units (if residential use included)	Units	N/A
Home Energy Rating System (HERS) (Residential Projects)	HERS Score	N/A

* For purpose of carbon accounting of building's carbon footprint, calculate total GHG emissions in MTCO2e. This is for both building operation and embodied carbon. Embodied carbon should be based on a building life cycle assessment (i.e., from design to demolition) using the appropriate LCA tools and methodology per LEED credit framework and guidance. LCA for building products/materials and construction from cradle to grave. Calculating building's carbon footprint should be, at a minimum, for foundation, structure, and enclosure elements with assumed 60-year service life, and life cycle stages A1-A5, B2-B5, and C1-C4). Stages B6 & B7 should be from operational energy & water use. GHG emissions estimate should also indicate total GHG emissions projected from building occupancy to year 2050.

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