180 Fawcett Street

Green Building Report

180 Fawcett Street is a new construction lab and office building located in the Alewife neighborhood of Cambridge, MA. It consists of four above grade levels with 21,400 GFA per level for approximately 62,050 GFA of flexible lab and office space. Fifty-five parking spaces are located below grade, a portion of which will include electric vehicle charging stations. The project is pursuing LEED v4 Gold certification. Based on the preliminary energy model, the building is projected to consume 13.51% less energy than an ASHRAE 90.1-2013 Appendix G Baseline, which is compliant with Massachusetts Stretch Energy Code.

1. Rating System Narrative

1.1 Introduction

In compliance with Article 22, the following narrative details the LEED certification goal for the Project and strategies implemented to meet the required and targeted credits based on the current stage of design. The Project is applying LEED BD+C for Core & Shell v4 rating system, with specific v4.1 credit substitution as noted, to demonstrate compliance with Article 22 of the Zoning Code. LEED v4 BD+C rating system tracks the sustainable features of the Project by assigning points in the following categories: Integrative Process (IP), Location and Transportation (LT); Sustainable Sites (SS); Water Efficiency (WE); Energy & Atmosphere (EA); Materials and Resources (MR); Indoor Environmental Quality (IEQ); Innovation (IN); and Regional Priority (RP). An evaluation of the Project's current design has identified 60 anticipated points, which meets Gold certification level, as referenced in the accompanying LEED checklist. As the Project design advances, all anticipated credits will continue to be evaluated and documented in LEED Online. As noted in the checklist, design credits will be confirmed by the end of 100% Design Development and construction credits by 100% Construction Documentation. Credits are indicated in the checklist with a D or C, respectively.

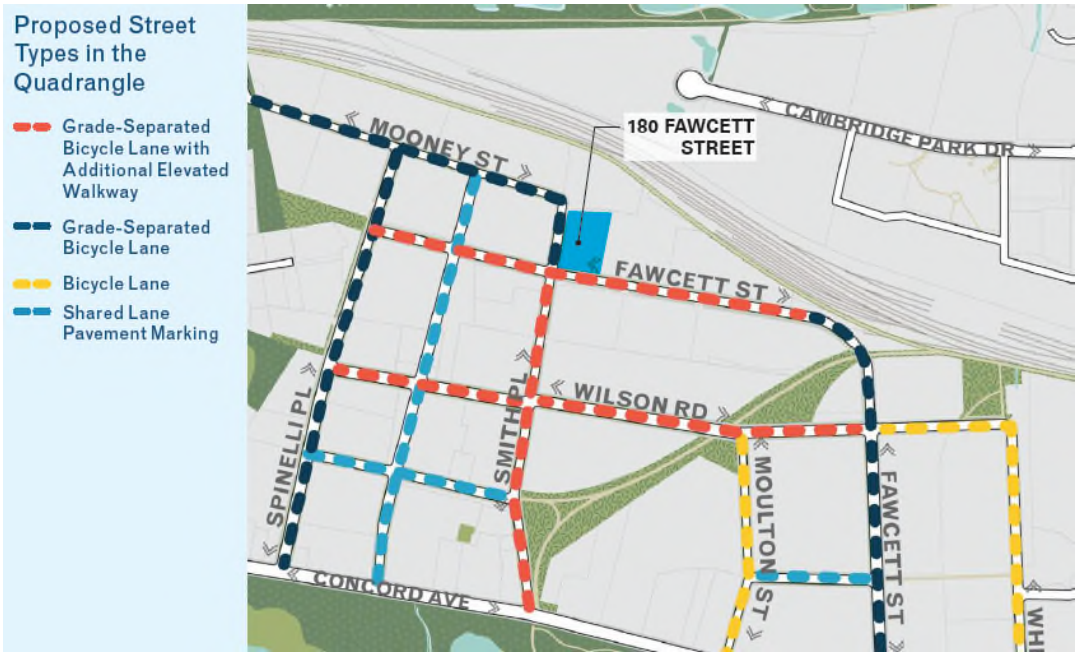
1.2 Article 22 Conformance

1.2.1 Integrative Process (IP)

Integrative Process – (1 point)
As part of the Concept phase, the Project team conducted a multidisciplinary team meeting to identify the Project's sustainability goals and synergies across disciplines that would support these goals. Prior to completion of the Schematic Design phase, the Project team will perform a preliminary energy modeling analysis to assess building configuration, orientation, and early ideas around building systems and how to reduce energy loads. The Project will also produce a preliminary water budget that identifies non-potable water supply sources and explores how to reduce potable water loads in the building. This assessment will provide guidance to the team and inform the Project's Owner's Project Requirements (OPR) and Basis of Design (BOD) documents.

1.2.2 Location and Transportation (LT)

The Project will pursue twelve points within Location and Transportation. These credits will be achieved based on the project's location in an urban area with access to numerous services and amenities. The Project will also provide bicycle facilities and amenities on site as well as below-grade parking. The approach to achieving the credit requirements is detailed below.



Sensitive Land Protection – Option 1. (2 points)

The site selected for the Project is a previously developed property and therefore, the Project is minimizing the impact of its physical footprint.

High Priority Site – Option 3. (3 points)

The site is located on a former landfill and it is anticipated that site investigation will reveal soil contamination. If contamination is found, remediation will be performed.

Surrounding Density and Diverse Uses – Options 1 & 2. (4 points)

The Project Site is located within a ½ mile walk of eight or more basic services, including restaurants, medical services, financial services, and places of worship.

Bicycle Facilities (LEED v4.1) – Case 1. (1 point)

The Project will provide 21 secured and covered long term bike storage spaces and nine short term bike storage spaces, exceeding the LEED v4.1 credit criteria of bike storage for at least 5% of regular occupants and for 2.5% of peak visitors. Two male and two female showers will be provided for the use of all occupants. The Project entrance is located in proximity of a bike network that connects to diverse services within three miles of the Project Site.

Reduced Parking Footprint (LEED v4.1) – Case 1. (1 point)

The Project will provide 55 parking spaces which is below the 30% reduction of the Institute of Transportation Engineers (ITE) baseline. Exemplary Performance of 60% below baseline will be met.

<u>Green Vehicles</u> – Option 1. (1 point)
The Project will provide Electric Vehicle Charging Stations in 2% of all parking spaces. Based on 55 parking spaces, at least 2 charging stations will be provided.

1.2.3 Sustainable Sites (SS)

The Project will pursue seven points within Sustainable Sites by targeting credits related to the redevelopment of the Project Site from a mostly impervious, paved condition, to a condition with more permeability and landscaping. Design features will consider the environment surrounding the building and aim to minimize effects on microclimates and existing habitats. The descriptions below outline the Project's approach to achieving the credit requirements.

Construction Activity Pollution Prevention (Prerequisite)
Contractor will establish and implement an Erosion and Sedimentation Control Plan in compliance with the EPA 2012 Construction General Permit for demolition and construction activities to be undertaken for the Project as detailed in the Division 1 Sustainable Design Requirements specifications.

Site Assessment – (1 point)
As part of Design Development, the Project team will complete a comprehensive site survey including a study of the topography, hydrology, climate, vegetation, soils, human use, and human health effects.

Site Development- Protect or Restore Habitat – Option 2. (1 point)
The Project will make a one-time donation to a land trust organization in the amount of $0.40/SF of site area. Based on the site area, this donation is estimated to be $13,372.

Open Space (LEED v4.1) – (1 point)
Over 30% of the Project site will be physically accessible outdoor space and at least 25% of the outdoor space will be vegetated. There will be an accessible green roof located at level four and the ground level will include open space as well as landscaping.

Heat Island Reduction (LEED v4.1) – Options 1 & 2. (2 points)
The Project will utilize high albedo materials for all hardscapes, including both non-roof and roof installations. All installed materials will meet LEED requirements for either initial or three-year Solar Reflectance Index values. Heat island effect will be mitigated through the installation of the level four green roof. In addition, 100% of parking spaces are located under the building. Exemplary Performance is met by achieving both credit options.

Light Pollution Reduction – (1 point)
Exterior lighting will comply with Illuminating Engineering Society (IES) levels for backlight, uplight, and glare to address light trespass and minimize uplighting. The Project does not anticipate utilization of uplighting in the landscape lighting design.

Tenant Design and Construction Guidelines – (1 point)
The Project will provide tenants with Tenant Design and Construction Guidelines to educate occupants about the sustainable features of the building.

1.2.4 Water Efficiency (WE)

The Project team will target nine points in Water Efficiency through the use of water efficient plumbing fixtures and reduced potable water for irrigation for landscaping. The Project anticipates meeting additional water metering requirements beyond the Prerequisite. The descriptions below detail the Project's approach to achieving the credit requirements.

Outdoor Water Use Reduction (Prerequisite) – Option 2.
The Project will use native and adaptive vegetation in the areas of new landscaping and on the green roof area to enable the reduction of potable water used for irrigation by over 30%.

Indoor Water Use Reduction (Prerequisite)
The Project will specify and install high efficiency plumbing fixtures to reduce annual indoor potable water consumption by over 20%. Toilets, urinals, lavatory faucets, and showerheads will have a WaterSense label. The Project will also meet process and appliance requirements. No once-through cooling with potable water will be used for any equipment that rejects heat and cooling towers will be supplied with makeup water meters, conductivity controllers and drift eliminators.

Building-Level Water Metering (Prerequisite)
The Project will include a permanent whole building water meter and share usage data with the USGBC for a period of five years post occupancy.

Outdoor Water Use Reduction (LEED v4.1) – Option 2. (2 points)
The Project will use regionally appropriate and low water plantings. The irrigation system is designed to reduce potable water usage by 75% through native and adaptive plantings.

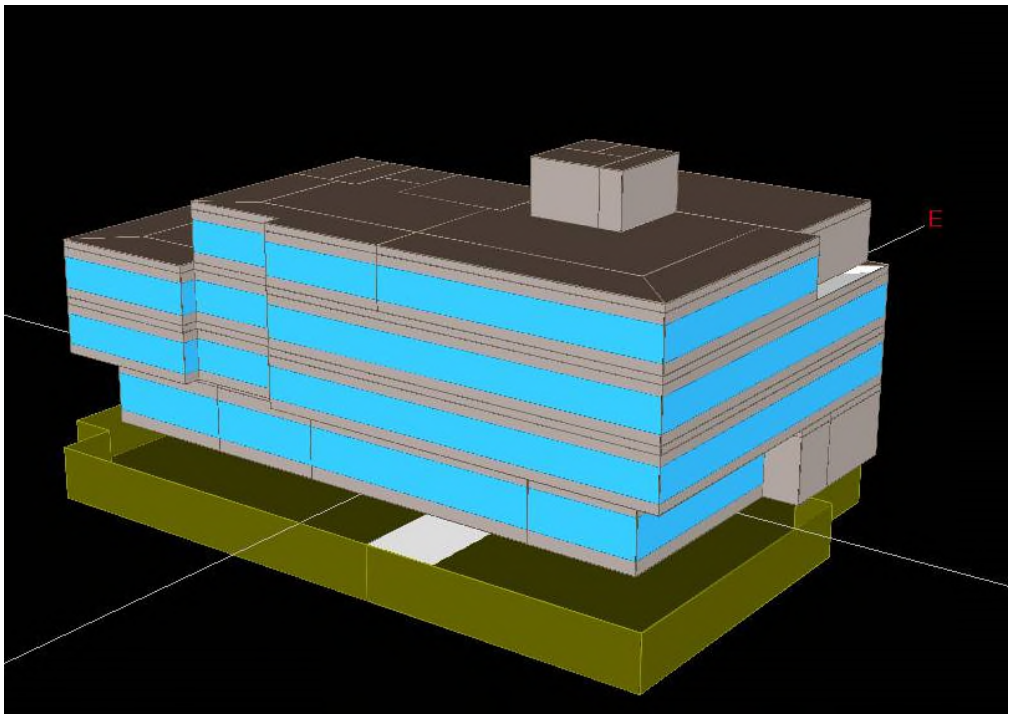
Indoor Water Use Reduction – (4 points)
The Project will specify and install high efficiency plumbing fixtures to reduce the annual demand for potable water over the LEED baseline. The following flow rates are targeted to meet a 40% reduction Toilets: 1.1 gpf, Urinals: 0.125 gpf, Showers: 1.5 gpm, Lavatory Faucets: 0.35 gpm, Pantry Faucets: 1.5 gpm.

Optimize Process Water Use (LEED v4.1) – Option 1. (2 points)
The cooling tower subcontractor will perform a one-time potable water analysis and design the cooling tower to maximize the number of cycles and water treatment without exceeding water parameters.

Water Metering – (1 point)
In addition to a whole building water meter, the Project will install permanent water meters for irrigation and domestic hot water.

1.2.5 Energy and Atmosphere (EA)

The Project will target 14 points for the Energy and Atmosphere category through the implementation of energy-saving strategies such as high-efficiency building envelope systems and components, high efficiency HVAC systems, and energy recovery units. Enhanced commissioning will be implemented in addition to the Fundamental commissioning required for the Prerequisite. Strategies for achieving credit requirements are detailed below.



Fundamental Commissioning and Verification (Prerequisite)
The Owner will engage a Commissioning Agent to provide Fundamental Commissioning Services including document review and verification that the building systems are installed and perform as designed and intended. Building systems include HVAC, lighting and daylight controls, and domestic hot water. The Owner will develop an Owner's Project Requirements (OPR) document detailing the building energy system goals and targets. The MEP Engineer and Architect will develop a Basis of Design (BOD) document describing the design of energy systems meeting these goals. The OPR and BOD documents will include the building envelope.

Minimum Energy Performance (Prerequisite) – Option 1.
The Project will be designed to meet the mandatory provisions of ASHRAE 90.1-2010. The team's Energy Analyst will perform a whole building energy analysis to demonstrate an annual energy cost reduction of over 5% compared to an ASHRAE 90.1-2010 Appendix G baseline.

Building-Level Energy Metering (Prerequisite)
The Project will include new whole building level gas and electric energy meters that measure total building energy consumption and commit to sharing the data with the USGBC for a period of five years post occupancy.

Fundamental Refrigerant Management (Prerequisite)
The Project design documents will specify refrigerants that are chlorofluorocarbon (CFC) free. Federal law also prohibits these refrigerants.

Enhanced Commissioning – Option 1, Path 2. (4 points)
The owner will engage a Commissioning Agent to provide Enhanced and Monitoring Based Commissioning Services for mechanical, electrical, and plumbing systems and assemblies. Advanced commissioning of building systems will include a review of progress construction documents, creation of an ongoing commissioning plan and a return to the building to evaluate systems ten months after occupancy.

Optimize Energy Performance – Option 1. (5 points)
The Project is designed to be a high performance and low energy building. To achieve this goal, the Project team is applying an integrated systems approach to determine building performance throughout design. The building systems include energy conservation measures such as high-performance building envelope, high efficiency mechanical and ventilation equipment, energy recovery units, low flow plumbing fixtures and reduced lighting power density to reduce building loads. Based on the preliminary energy model, the building is projected to achieve 11.5% energy cost savings compared to ASHRAE 90.1-2010, Appendix G. Iterative energy modeling analysis will inform the design and confirm progress toward the targeted reductions.

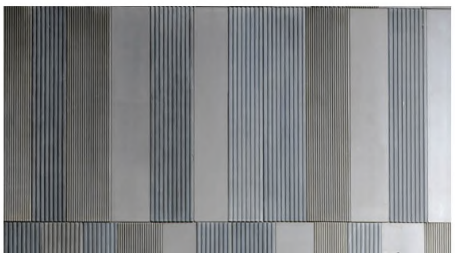
Advanced Energy Metering – (1 point)
The Project will provide advanced meters on all base building energy uses and sub-meters to enable tenant spaces to meter energy consumption of all systems dedicated to their space, with a minimum of one meter per energy source per floor. The basis of design includes floor by floor electrical metering.

Enhanced Refrigerant Management – Option 2. (1 point)
HVAC&R systems will utilize refrigerants with Low Ozone Depleting Potential and Global Warming Potential; fire suppression systems will not contain CFCs, Hydrochlorofluorocarbons (HCFCs), or halons. The Project engineer will design the chilled water and fan coil unit design to meet the credit requirements.

Green Power and Carbon Offsets – (2 points)
The Project will engage in a one-time green power purchase to offset the carbon impact equivalent of 100% of the building's energy demand over a five-year period.

1.2.6 Materials and Resources (MR)

The Project will target three points in the Materials and Resources category by carefully selecting materials that support a life-cycle approach that improves performance and promotes resource efficiency and human health. A construction waste management plan will be implemented to establish protocol for how the waste management provider collects and manages site-generated waste. The descriptions below detail the Project's approach to achieving the credit requirements.



Storage and Collection of Recyclables (Prerequisite)
The Project will provide easily accessible, centrally located areas in the building for the storage of collected glass, plastic, paper/cardboard, and metal recyclables for residents. In addition, the Project will commit to recycling e-waste and batteries.

Construction and Demolition Waste Management Planning (Prerequisite)
Contractor will develop and implement a Construction Waste Management Plan in order to track demolition and construction waste removed from the Project. The Plan will include a minimum of five materials targeted for recycling and the process for sorting and preparing materials on site.

Environmental Product Declarations (LEED v4.1) – Option 1. (1 point)
The Project design documents will specify the installation of at least 10 products sourced from three different manufacturers that have environmentally, economically, and socially preferable life-cycle impacts. Products with life-cycle assessments or industry-wide or product- specific Environmental Product Declarations are valued for this credit.

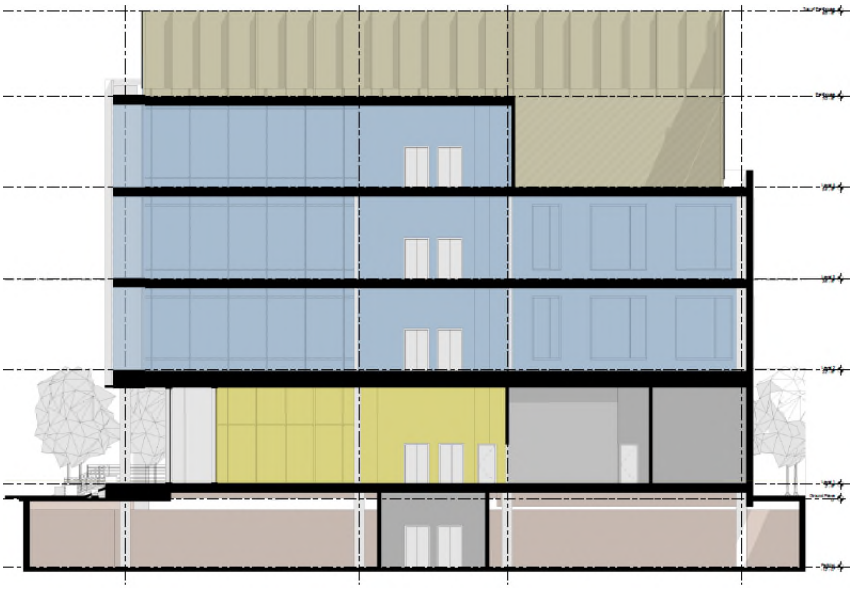
Material Ingredients (LEED v4.1) – Option 1. (1 point)
The Project design documents will specify the use of at least 10 products sourced from three different manufacturers that demonstrate the chemical inventory of the products, including: Health Product Declarations, Cradle to Cradle certification, Declare label, or American National Standards Institute (ANSI).

Construction and Demolition Waste Management – Option 1, Path 1. (1 point)
The Project will track construction and demolition waste removed over the course of construction with the goal of diverting a minimum of 50% of the demolition and construction waste from landfill disposal. At least three material streams will be diverted separately, such as metal, concrete, or commingled

waste. Materials utilized for Alternative Daily Cover will be considered waste material in the diversion calculations.

1.2.7 Indoor Environmental Quality (IEQ)

The Project will pursue seven points related to the implementation of indoor air quality measures, including but not limited to: monitoring outdoor air delivery to interior spaces to counter high concentrations of indoor air pollutants, increasing ventilation rates to spaces throughout the building, and managing indoor air quality during construction for the construction team as well as future occupants. The Project will seek to further provide a high-quality indoor environment through quality views for occupants. The descriptions below detail the Project's approach to achieving the credit requirements.



Minimum Indoor Air Quality Performance (Prerequisite) – Option 1.
The Project team will ensure all ventilation systems meet the minimum requirements of Sections four through seven of the ASHRAE 62.1-2010 Standard for Acceptable Indoor Air Quality. The Project will install air flow monitors as required to satisfy the monitoring requirements.

Environmental Tobacco Smoke Control (Prerequisite, LEED v4.1) – Option 1.
Smoking of tobacco, e-cigarette and controlled substances will be prohibited inside the building and within 25 feet of all entries, outdoor air intakes, and operable windows. Signage will be posted at regularly used entrances to communicate the policy.

Enhanced Indoor Air Quality Strategies – Options 1 & 2. (2 points)
The Project will include permanent entryway systems at least 10 feet long in the primary direction of travel, direct exhaust of all chemical storage areas, and MERV 13 filtration on all ventilation systems. Chemical storage areas will be provided with self-closing doors and deck-to-deck partitions or hard-lid ceilings.

Low-Emitting Materials (LEED v4.1) – (3 points)
The Project team will specify low-VOC paints, coatings, flooring, composite wood, ceiling tile, and insulation that comply with the appropriate testing and/or emissions requirements.

Construction Indoor Air Quality Management Plan – (1 point)
The Contractor will provide and implement a Construction Indoor Air Quality (IAQ) Management Plan that addresses HVAC protection, pathway interruption, housekeeping and scheduling measures that will maintain air quality during construction. Absorptive materials will be protected from moisture prior to installation. This Plan will be verified by site inspections.

Quality Views – (1 point)
The Project will provide direct views to the exterior that meet at least two of the LEED requirements for quality views for 75% or more of the regularly occupied spaces.

1.2.8 Innovation (IN)

Innovation – (5 points)
The Project team will seek to achieve at least five innovation points; potential credits include: Exemplary Performance for Reduced Parking, Exemplary Performance for Heat Island Reduction, Innovation: Project Walkable Site, and Innovation: Green Building Education. The Project team will continue to evaluate pilot credits to determine feasibility.

LEED Accredited Professional – (1 point)
At least one LEED AP BD+C professional is part of the Project team.

1.2.9 Regional Priority (RP)

Regional Priority Credits (RPCs) are established LEED credits designated by the USGBC as having priority for a particular location. When a project team achieves one of the designated RPCs, an additional point is awarded to the project. The four points available in this category are contingent upon meeting certain thresholds for credits in other categories. RPCs applicable to the Project Site in Cambridge include High Priority Site, Indoor Water Use Reduction, Optimize Energy Performance, Building Life-Cycle Impact Reduction, Rainwater Management, and Renewable Energy Production. The Project is currently targeting High Priority Site and Indoor Water Use Reduction in this category and will evaluate the potential to achieve additional credits as the design advances.

LEED v4 for BD+C: Core and Shell

Project Checklist

Project Name: 180 Fawcett St
Date: 8/5/2021

Y	?	N				
1			Credit	D	Integrative Process	1

12	2	6	**Location and Transportation**			20
			Credit	D	LEED for Neighborhood Development Location	20
2			Credit	D	Sensitive Land Protection	2
3			Credit	D	High Priority Site	3
4		2	Credit	D	Surrounding Density and Diverse Uses	6
	2	4	Credit	D	Access to Quality Transit	6
1			Credit	D	Bicycle Facilities **(LEED v4.1 substitution)**	1
1			Credit	D	Reduced Parking Footprint **(LEED v4.1 substitution)**	1
1			Credit	D	Green Vehicles	1

7	4	0	**Sustainable Sites**			11
Y			Prereq	C	Construction Activity Pollution Prevention	Required
1			Credit	D	Site Assessment	1
1	1		Credit	D	Site Development - Protect or Restore Habitat	2
1			Credit	D	Open Space **(LEED v4.1 substitution)**	1
	3		Credit	D	Rainwater Management **(LEED v4.1 substitution)**	3
2			Credit	D	Heat Island Reduction **(LEED v4.1 substitution)**	2
1			Credit	D	Light Pollution Reduction	1
1			Credit	D	Tenant Design and Construction Guidelines	1

9	1	1	**Water Efficiency**			11
Y			Prereq	D	Outdoor Water Use Reduction	Required
Y			Prereq	D	Indoor Water Use Reduction	Required
Y			Prereq	D	Building-Level Water Metering	Required
2	1		Credit	D	Outdoor Water Use Reduction **(LEED v4.1 substitution)**	3
4		1	Credit	D	Indoor Water Use Reduction	5
2			Credit	C	Optimize Process Water Use **(LEED v4.1 substitution)**	2
1			Credit	D	Water Metering	1

13	3	17	**Energy and Atmosphere**			33
Y			Prereq	C	Fundamental Commissioning and Verification	Required
Y			Prereq	D	Minimum Energy Performance	Required
Y			Prereq	D	Building-Level Energy Metering	Required
Y			Prereq	D	Fundamental Refrigerant Management	Required
4		2	Credit	C	Enhanced Commissioning	6
5	2	11	Credit	D	Optimize Energy Performance	18
1			Credit	D	Advanced Energy Metering	1
		2	Credit	C	Demand Response	2
	1	2	Credit	D	Renewable Energy Production	3
1			Credit	D	Enhanced Refrigerant Management	1
2			Credit	C	Green Power and Carbon Offsets	2

3	2	9	**Materials and Resources**			14
Y			Prereq	D	Storage and Collection of Recyclables	Required
Y			Prereq	C	Construction and Demolition Waste Management Planning	Required
		6	Credit	D	Building Life-Cycle Impact Reduction	6
1		1	Credit	C	Environmental Product Declarations **(LEED v4.1 substitution)**	2
	1	1	Credit	C	Sourcing of Raw Materials **(LEED v4.1 substitution)**	2
1		1	Credit	C	Material Ingredients **(LEED v4.1 substitution)**	2
1	1		Credit	C	Construction and Demolition Waste Management	2

7	3	0	**Indoor Environmental Quality**			10
Y			Prereq	D	Minimum Indoor Air Quality Performance	Required
Y			Prereq	D	Environmental Tobacco Smoke Control	Required
2			Credit	D	Enhanced Indoor Air Quality Strategies	2
3			Credit	C	Low-Emitting Materials **(LEED v4.1 substitution)**	3
1			Credit	C	Construction Indoor Air Quality Management Plan	1
	3		Credit	D	Daylight	3
1			Credit	D	Quality Views	1

6	0	0	**Innovation**			6
5			Credit	D	Innovation	5
1			Credit	C	LEED Accredited Professional	1

2	2	0	**Regional Priority**			4
1			Credit	C	Regional Priority: High Priority Site (2 pts)	1
	1		Credit	C	Regional Priority: Optimize Energy Performance (8 pts)	1
1			Credit	C	Regional Priority: Indoor Water Use Reduction (4 pts)	1
	1		Credit	C	Regional Priority: Building Life-Cycle Impact Reduction (6 pts), Renewable Energy Production (2 pts), Rainwater Management (3pts)	1

60	17	33	**TOTALS**	Possible Points:	110

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

2. Net Zero Narrative

2.1 Introduction

In compliance with Article 22, the following narrative details the design strategies that are being studied to improve energy performance of 180 Fawcett Street which is a core and shell life science development. An energy model has been developed during Schematic Design according to ASHRAE 90.1-2013 Appendix G parameters, with Massachusetts amendments, to study design decisions based on first cost and operational savings. The project team is evaluating thermal envelope performance including roof, foundation, walls, and glazing assemblies in addition to the window-to-wall ratio. Mechanical systems serving the base building have also been analyzed.

Key performance indicators for goal setting are as follows:

Site Energy Use Intensity (Site EUI)
Source Energy Use Intensity (Source EUI)
Greenhouse Gas Emissions (GHG)

These values will be tracked throughout the design process. The project team is dedicated to studying both high performance thermal envelope and mechanical systems to reduce the building's operational GHG emissions and EUI.

Project Name: 180 Fawcett Street
Project Address: 180 Fawcett Street
Submitted By: Matt D'Amico – Project Manager – CCF Fawcett Street Property Company, LLC
Date of Submission August 6th, 2021

Development Characteristics

Lot Area (sq. ft.):	33,432 (sq. ft.)
Existing Land Use(s) and Gross Floor Area (sq. ft.) by Use:	Industrial (38,028 sq. ft.)
Proposed Land Use(s) and Gross Floor Area (sq. ft.), by Use:	Technical office for research and development, Laboratory (62,050 gfa)
Proposed Building Height(s) (ft. and stories):	70' / 4 Stories w/penthouse
Proposed Parking Spaces:	25 (standard), 27 (compact): 55 (total)
Proposed Bicycle Parking Spaces (Long-Term and Short-Term):	16 (long-term), 7 (short-term): 25 (total)

Green Building Rating System

LEED – Leadership in Energy & Environmental Design (U.S. Green Building Council)			
Rating System & Version:	LEED v4 BD+C Core & Shell	Seeking Certification?	YES
Rating Level:	Gold	# of points	60 preliminary

2.2 Proposed Project Design

2.2.1 Thermal Envelope

Building Envelope		
Roofs	U-0.025	R-50 continuous roof insulation
Above Grade Walls	U-0.0464	Stud walls with 4" mineral wool outboard of air + vapor barrier
Below Grade Walls	U-0.092	R-10 continuous insulation at conditioned spaces below grade
Curtain Wall Vision U-Value	U-0.31	Sunguard SN-68
Curtain Wall Vision SHGC	0.40	Sunguard SN-68
Curtain Wall Spandrel U-Value	U-0.155	Kawneer Clearwall 2 Sided Horizontal SSG with Knife Plate Connections. Mineral Wool is Integral to Panelized System
Doors	U-0.70	Aluminum storefront
Window-to-Wall Ratio (WWR)	44%	Per Design Drawings

	Proposed		Baseline	
	Area (sf)	U-value	Area (sf)	U-value
Window	21,288	0.31	19,352	0.42
Wall	27,093	0.073	29,029	0.055
Roof	20,478	0.025	20,478	0.032
Below Grade Wall	8,937	0.092	8,937	0.119

Envelope Commissioning Process

The envelope will be constructed to ensure an airtight enclosure is maintained though taping and sealing of all joints, penetrations, and transitions. These include joints around fenestration, door frames, walls and floors, walls at building corners, walls and roofs, and walls and ceilings. Mechanical penetrations including ducts and plenums will be sealed. Any other changes in materials will be sealed, caulked, gasketed, or taped in an approved manner. Infiltration rates set by ASHRAE 90.1-2013 will be specified for the project. To ensure constructability, the air barrier components and boundary will be noted on the Construction Documents. The mechanical system will also be designed to resist positive and negative pressures.

2.2.2 Building Mechanical Systems

The office and life science heating and cooling system is designed to accommodate the lab ventilation requirements, which include significantly higher exhaust rates than seen in a conventional office building (2 CFM/SF versus 0.1 CFM/SF). As such, an all-air system is implemented that can provide both supply and exhaust air to laboratory fume hoods as well as ventilation air to office spaces. Once ventilation is provided to office tenants, terminal units can be utilized to provide additional heating and cooling.

The all-air system is conditioned through a four-pipe chilled and hot water system. Electric centrifugal chillers and natural gas fired condensing boilers provide cooling and heating to the rooftop air handling units. Chilled and hot water will also be distributed to the terminal units in tenant spaces – in this case four-pipe fan coils.

Laboratory exhaust systems cannot mix supply and exhaust air streams due to the health and safety risk to tenants – as such a glycol system is utilized to recover heat from the exhaust air stream to preheat or precool the supply airstream. The glycol system ensures there is no mixing of airstreams. The supply air handlers served by the heat recovery system are 100% outside air capable of full airside economizer. Free cooling plate and frame heat exchangers are also provided on the waterside for additional economizer capability.

System Descriptions	
Space Heating	Natural Gas Fired Condensing Boilers
Space Cooling	Electric Variable Speed Chillers with Waterside Free Cooling
Heat Rejection	Rooftop Open Circuit Cooling Tower
Circulation Pumps	Variable Speed Chilled, Hot, and Condenser Water Pumps
Ventilation (Fan Energy Only in Result Tables)	Rooftop AHUs with Variable Speed Drives and Heat Recovery
Domestic Hot Water/Non-potable Hot Water	Local Electric Tank Heaters
Interior Lighting	LED with Automated Controls per Energy Code
Exterior Lighting	LED with Photocell Controls per Energy Code

2.2.3 Lighting Systems

Common area lighting in the base building is limited to the lobby, elevator lobbies, stairwells, and back-of-house spaces. All lighting fixtures in the design package will be high-efficacy LED type with all required controls per ASHRAE 90.1-2013. This includes bi-level and vacancy sensors.

2.2.4 Commissioning

The Owner will engage a Commissioning Agent to provide Fundamental Commissioning Services including document review and verification that the building systems are installed and perform as designed and intended. Building systems include HVAC, lighting and daylight controls, and domestic hot water. The Owner will develop an Owner's Project Requirements (OPR) document detailing the building energy system goals and targets. The MEP Engineer and Architect will develop a Basis of Design (BOD) document describing the design of energy systems meeting these goals. The OPR and BOD documents will include the building envelope.

2.3 Building Energy Performance Measures

Overview	
Land Uses	New construction lab and office building located in an urban area with access to numerous services and amenities. Site is in proximity to a bike network and has onsite covered bike parking to encourage use of non-vehicular transportation. Ground level and level four have occupant accessible green roofs and open space to encourage interaction with the environment.
Building Orientation and Massing	Electric Variable Speed Chillers with Waterside Free Cooling
Envelope Systems	High performance double pane glazing with low U-value, higher insulation levels for vertical walls and roofs, green roofs
Mechanical Systems	Variable speed drives for electric chillers, pumps, and fans. Heat recovery and full airside economizer for ventilation air. Waterside economizer
Renewable Energy Systems	Competing rooftop needs limit available space for PV and there is limited site area for geothermal
District Wide Energy Systems	None
Other Systems	EV charging stations will be considered as the team develops the design

2.3.1 Integrative Design Process

The project team includes sustainability consultants that have been integral to the process since the start of the Entitlements Phase. The initial LEED-focused design charrette took place on April 14, 2021 and was attended by ownership, architect, landscape architect, civil engineer, and MEP engineer. Since then many independent meetings have occurred to analyze sustainability strategies and evaluate the feasibility of various LEED credits.

In addition, the consultants have identified and studied the following: feasibility of electric based heating and domestic hot water systems, laboratory exhaust energy recovery, availability of solar roof space, and enhancements to the thermal envelope.

Owner's Project Requirements and Basis of Design will be determined in part by the analysis conducted early in the design process. Information will be gathered during early research and discovery to inform the project requirements and basis of design. Based on this analysis, ownership will establish priorities and project goals.

Collaboration between consultants will continue as the design progresses and throughout construction.

2.3.1 Green Building Incentive Program Assistance

Mass Save is composed of local electric and natural gas utilities and energy efficiency service providers who work with building owners to identify energy saving opportunities. Incentives and rebates are available for energy efficiency measures that reduce electric and natural gas usage as demonstrated

through whole building energy modeling. The energy model is a comparative tool that is similar to the energy study described herein.

The project team will reach out to Mass Save to coordinate regarding technical support and potential incentives. The project team intends to engage with Mass Save to help ensure the thermal envelope, mechanical equipment, appliances and fixtures are assessed for water, energy and material efficiency.

2.4 Net Zero Scenario Transition

Studies are underway to identify feasible opportunities that transition the building away from natural gas to Net Zero ready. A non-exhaustive list of these strategies includes:

	Net Zero Condition	Transition Process
Thermal Envelope	Glazing – Replace IGU with triple glazing	As tenancies expire, the glazing can be replaced beginning with the ground floor assemblies. In lieu of IGUs, a triple pane system will be utilized
HVAC System	Chiller and Boiler Plant – replace central plant equipment with air source equipment	Two immediate solutions could be utilized to transition from natural gas boilers – these include electric resistance boilers and VRF. VRF can be considered for office space conditioning but it does not provide the requisite capacity for the lab ventilation load. Electric resistance is not ideal since it has the highest operating cost and highest greenhouse gas emissions based on current factors. As air source heat pump technology develops, it may be possible to replace the chillers and boilers with air source equipment that can extract or reject heat to the atmosphere. Space constraints will need to be studied as these types of heat pumps are limited by their heat exchange area, and overall footprint, balanced against the ventilation air loads. The ventilation loads in a life science building are significant while the roof area is limited.
Domestic Hot Water	Electric Tank Heaters – Replace with air source type	Electric tank water heaters can be replaced with air source heat pump units
Lighting	High efficacy LED	High efficacy LED or POE lighting can be utilized
Renewable Energy	Renewable Energy Credits	Offsite credits can be pursued in lieu of on-site production. These investments can impact the electric grid at the generation level to ensure renewable sources are prioritized over fossil fuel generation.

2.5 Energy Systems Comparison

Early design studies were conducted to identify feasible opportunities that transition the building away from natural gas to Net Zero ready. Relative to the HVAC systems, there are a few primary system types available as alternates to natural gas boiler systems. These are:

1) Electric Resistance Boilers
2) Variable Refrigerant Flow (VRF)
3) Air source heat pump chiller/heaters

Electric resistance boilers, although they provide an immediate option to transition to electric based heating, incur the highest greenhouse gas emissions and operating cost.

The team studied implementing VRF technology in lieu of four-pipe fan coils for only the portion of the floorplate that will be open office. VRF would not be able to integrate with the lab fume hood systems or condition the outside air at the laboratory spaces. At these select office locations, the interior fan coils and piping would be similar to the projected building design. However at the rooftop, there would be duplicate systems in addition to the chiller and boiler necessary for lab ventilation conditioning. The duplication of the HVAC systems renders the VRF option unfeasible from a space perspective.

Air source heat pumps could be implemented on a whole building basis, but the size of the condensing units are too large to maintain space for future tenant equipment on the rooftop and the required green roof area. For this reason they are not considered at this time, however the chilled and hot water distribution system can be retrofitted at a later date when the technology is more robust. Air source heat pump chiller/heaters are studied as the 'Non-Carbon' alternate.

In addition to the systems mentioned above, the team has also studied enhanced energy recovery systems (Konvekta or similar), lab fume hood controls (would be installed by tenants based on their individual needs), and triple glazing. Results for the projected building design with each energy conservation measure are presented at the end of this report.

	Included in analysis?		Describe the systems for which this was analyzed or explain why it was not included in the analysis
	Yes	No	
Solar Photovoltaics		No	Competing rooftop needs prioritized the following before PV: HVAC systems to condition ventilation air, space for future tenant supplemental systems, green roof area
Solar Hot Water		No	A central hot water system is not efficient for a building of this type. The standby losses and central domestic hot water piping system is more suitable for residential program
Ground-Source Heat Pumps (Geothermal)		No	There is limited site area available, and placing wells below poured concrete presents maintenance and repair challenges

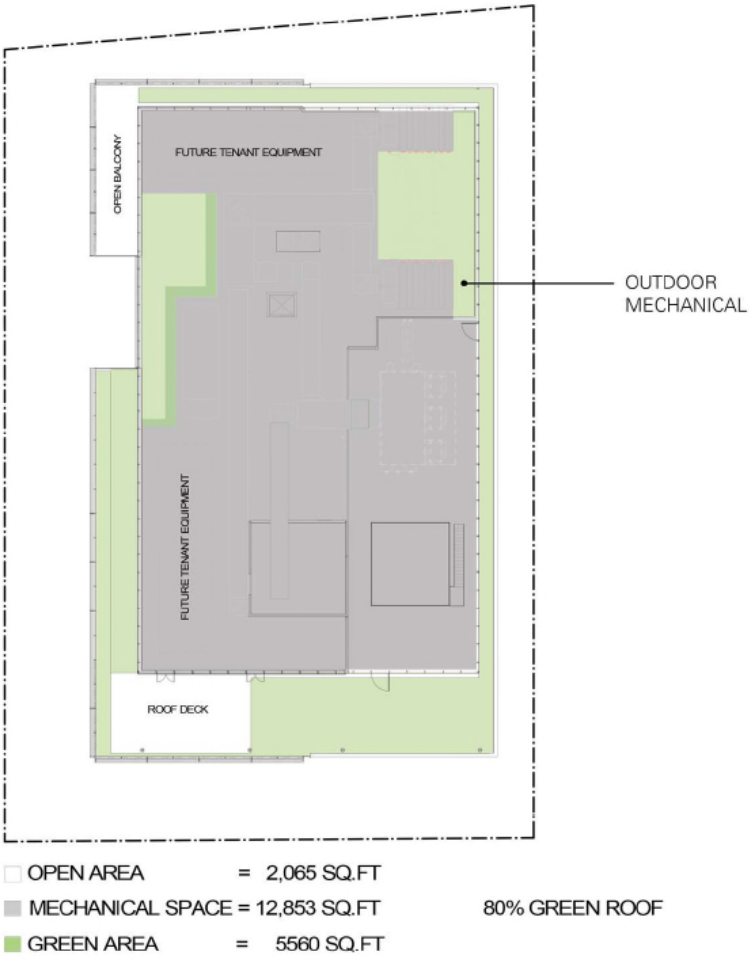
Water-Source Heat Pumps		No	Fan coils have been considered
Air-Source Heat Pumps	Yes		Large central system heat pumps were considered in concept but not studied since the available roof area is limited. This can be re-visited for future retrofit
Non-Carbon-Fuel District Energy		No	No district level energy systems are available
Other Non-Carbon-Fuel Systems		No	EV charging will be considered

2.5.1 Non-Carbon Fuel Scenario

Air source heat pumps could be implemented on a whole building basis, but the size of the condensing units are too large to maintain space for future tenant equipment on the rooftop and the required green roof area. For this reason they are not considered as a viable option at this time, however the chilled and hot water distribution system can be retrofitted at a later date when the technology is more robust. Air source heat pump chiller/heaters are studied as the 'Non-Carbon' alternate.

2.5.2 Solar-Ready Roof Assessment

Due to competing roof space requirements for the laboratory ventilation systems, and future tenant standby power, there is no additional space directly on the rooftop available for on-site photovoltaic (PV) arrays. Renewable energy credits (RECs) will be studied in place of direct roof mounted PV. The remaining open space, as shown in the diagram below, is utilized for Green Roof in addition to roof deck and balconies. We have provided a scenario where the green roof area is substituted for PV as a comparison.



Example Assuming Green Roof is replaced with Solar Array	
Total Roof Area (sf)	20,478
Unshaded Roof Area (sf)	7,625
Structural Support	Included in other
Electrical Infrastructure	Included in other
Other Roof Appurtenances	12,853
Solar-Ready Roof Area (sf)	4,956 (estimated as 65% of unshaded area)
Capacity of Solar Array	70 kW (installed cost of $280,000
Financial Incentives (SMART Solar Incentive)	$13,500 - $1,600 maintenance = $11,900
Annual Production (kwh/$)	91,243 kWh or $15,967
Cost Feasibility	NPV of 11 years at 8% discount rate

2.5.3 Results

Given the early design phase, relative capital costs are unknown at this time. However, based on cost estimating from comparable projects, the estimated incremental cost for air-source heat pump chiller-heaters has been accounted for. The maintenance costs for the systems are estimated to be comparable as cooling tower maintenance would be interchangeable with maintaining the outdoor condensers of an air source heat pump plant. Financial incentives are unknown at this time.

	Proposed Design		Non-Carbon Fuel Scenario	
	Installation Cost	Maintenance Cost	Installation Cost	Maintenance Cost
Space Heating	Baseline	TBD	$2,500,000 est.	TBD
Space Cooling	Baseline	TBD	Included above	TBD
Heat Rejection	Baseline	TBD	Included above	TBD
Pumps & Aux.	Baseline	TBD	Included above	TBD
Ventilation	Baseline	TBD	Included above	TBD
Domestic Hot Water	Baseline	TBD	Included above	TBD
Financial Incentives	TBD	TBD	Included above	TBD
Total Building Energy System Cost	TBD	TBD	$2,500,000	TBD

2.6 Anticipated Energy Loads and Greenhouse Gas Emissions

The City of Cambridge has adopted the Massachusetts Stretch Energy Code requiring new laboratory buildings over 40,000 SF to demonstrate a minimum 10% site or source energy reduction when compared to an ASHRAE 90.1 2013 Appendix G baseline. Below is the preliminary energy usage compared to the ASHRAE baseline, which surpasses the 10% requirement as shown in the 'Total Savings' Column. The first table includes energy usage, EUI, and GHG emissions, while the second table includes energy cost.

Site Energy - MMBTU	Lights	Misc.	Heating	Cooling	Heat Rej.	Fans	Pumps	DHW	Total	Inc. Svgs.	Tot. Svgs.	Site EUI [kBTU/SF]	Source EUI [kBTU/SF]	GHG [MeT]
ASHRAE 90.1-2013 Baseline	937	2,115	15,605	1,527	-	1,902	292	563	22,941	N/A	N/A	235.8	386.6	1,472
Design Envelope	937	2,115	15,403	1,546	-	1,918	292	563	22,774	0.73%	0.73%	234.1	385.6	1,464
Design HVAC	937	2,115	12,665	984	31	2,118	543	563	19,956	12.28%	13.01%	205.1	355.0	1,314
Lighting Assumption 30% Reduction	686	2,115	12,812	979	31	2,113	543	563	19,843	0.50%	13.51%	203.9	348.5	1,298

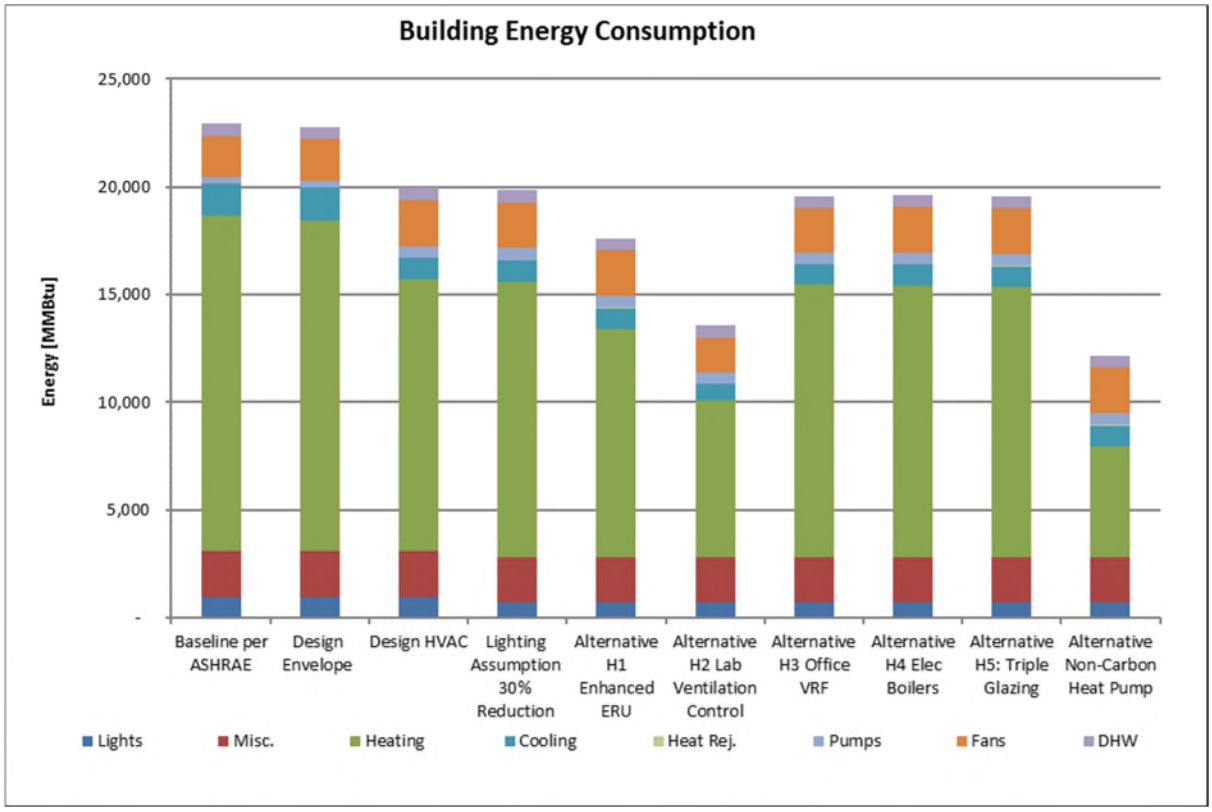
Energy Cost - $ USD	Lights	Misc.	Heating	Cooling	Heat Rej.	Fans	Pumps	DHW	Total	Inc. Svgs.	Tot. Svgs.
ASHRAE 90.1-2013 Baseline	$ 48,067	$ 108,447	$ 171,651	$ 78,316	$ -	$ 97,517	$ 14,970	$ 6,194	$ 525,161	N/A	N/A
Design Envelope	$ 48,059	$ 108,447	$ 169,433	$ 79,258	$ -	$ 98,335	$ 14,978	$ 6,194	$ 524,703	0.09%	0.09%
Design HVAC	$ 48,059	$ 108,447	$ 141,073	$ 50,442	$ 1,594	$ 108,608	$ 27,851	$ 6,194	$ 492,268	6.18%	6.26%
Lighting Assumption 30% Reduction	$ 35,189	$ 108,447	$ 142,706	$ 50,202	$ 1,581	$ 108,341	$ 27,856	$ 6,194	$ 480,516	2.24%	8.50%

2.6.1 Energy Use Intensity

Based on the preliminary energy model, the building is projected to consume 203.9 kBTU/SF, which is compliant with Massachusetts Stretch Energy Code and LEED v4. This represents a 13.51% reduction from the baseline site EUI of 235.8 kBTU/SF. The site EUI for a laboratory building is significantly higher than a traditional office due to the ventilation air conditioning loads.

It is clear from the studies that the building performance is predominantly influenced by the laboratory ventilation systems – in particular the energy required to condition the ventilation air. As such improved energy recovery and tenant variable flow fume hoods were both studied, with their respective impact shown below. In addition, variable refrigerant flow (VRF) technology and electric boilers were studied for their relative impact and potential for GHG reductions. Heat pump technology that can provide the heating requirements and fit within the available roof space is not yet available, but the team will continue to study other no or low-carbon alternatives.

Site Energy - MMBTU	Lights	Misc.	Heating	Cooling	Heat Rej.	Fans	Pumps	DHW	Total	Inc. Svgs.	Tot. Svgs.	Site EUI [kBTU/SF]	Source EUI [kBTU/SF]	GHG [MeT]
ASHRAE 90.1-2013 Baseline	937	2,115	15,605	1,527	-	1,902	292	563	22,941	N/A	N/A	235.8	386.6	1,472
Design Envelope	937	2,115	15,403	1,546	-	1,918	292	563	22,774	0.73%	0.73%	234.1	385.6	1,464
Design HVAC	937	2,115	12,665	984	31	2,118	543	563	19,956	12.28%	13.01%	205.1	355.0	1,314
Lighting Assumption 30% Reduction	686	2,115	12,812	979	31	2,113	543	563	19,843	0.50%	13.51%	203.9	348.5	1,298
Alternative H1 Enhanced ERU	686	2,115	10,593	978	31	2,113	543	563	17,622	9.68%	23.19%	181.1	325.6	1,286
Alternative H2 Lab Ventilation Control	686	2,115	7,304	744	21	1,603	531	563	13,568	27.35%	40.86%	139.5	268.2	935
Alternative H3 Office VRF	686	2,115	12,664	952	29	2,052	529	563	19,591	1.10%	14.61%	201.4	343.7	1,281
Alternative H4 Elec Boilers	686	2,115	12,621	979	31	2,113	541	563	19,649	0.84%	14.35%	202.0	346.4	1,760
Alternatetive H5: Triple Glazing	686	2,115	12,546	984	31	2,106	543	563	19,575	0.32%	14.67%	51.2	345.7	1,283



2.6.2 Annual Projected Energy Consumption and Greenhouse Gas (GHG) Emissions

Tables with energy and GHG results are included for the following scenarios that were simulated in the energy model:

Baseline – Stretch Code compliant per ASHRAE 90.1-2013 Appendix G. This is an air cooled VAV system based on the size and type of the building.

Proposed Design – aka 'Lighting Assumption with 30% Reduction.' This run includes the design envelope and design HVAC

Alternative H1 – this run is simulated on top of the Proposed Design and includes the impact of a Konvekta system

Alternative H2 – this run is simulated on top of the Proposed Design and includes the impact of tenant installed laboratory ventilation controls

Alternative H3 – this run is simulated on top of the Proposed Design and includes the impact of VRF for the office space only (approximately 40% of a typical floor plate)

Alternative H4 – this run is simulated on top of the Proposed Design and includes the impact of electric resistance boilers

Alternative H5 – this run is simulated on top of the Proposed Design and includes the impact of triple glazing

Alternative Non-Carbon Fuel – this run is simulated on top of the Proposed Design and includes the impact of air source heat pump chiller-heaters. This scenario is not feasible at this time for reasons previously discussed, but is included for comparison

Proposed Building Design	Baseline Building		Proposed Design		Future Net Zero Scenario		Non-Carbon Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating	156,046 therms	68%	127,621 therms	64.60%	see following charts		1,509,318 kWh	41.50%
Space Cooling	447,520 kWh	6.70%	286,868 kWh	4.90%			344,242 kWh	9.50%
Heat Rejection	0 kWh	0%	9,033 kWh	0.20%			9,033 kWh	0.20%
Pumps & Aux.	85,544 kWh	1.30%	159,179 kWh	2.70%			159,179 kWh	4.40%
Ventilation (Fan Energy Only)	557,238 kWh	8.30%	619,093 kWh	10.60%			619,093 kWh	17.10%
Domestic Hot Water	5,631 therms	2.50%	5,631 therms	2.80%			65,995 kWh	4.60%
Interior Lighting	274,669 kWh	4.10%	201,080 kWh	3.50%			201,080 kWh	5.60%
Exterior Lighting	0 kWh	0%	0 kWh	0%			0 kWh	0.00%
Misc. Equipment (Plug Loads)	619,696 kWh	9.20%	619,696 kWh	10.70%			619,696 kWh	17.10%
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI	235.8 kBTU/SF		203.9 kBTU/SF	13.51%	see following charts		127.0 kBTU/SF	46.16%
Source EUI	386.6 kBTU/SF		348.5 kBTU/SF	9.90%			275.5 kBTU/SF	28.70%
Total Energy Use	22,941 MMBTU		19,843 MMBTU	13.51%			12,351 MMBTU	46.16%
Total Energy Cost	$ 525,161		$ 480,516	8.50%			$ 609,724	-16.10%
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
On-Site Renewable Energy Generation	0	0	0	0	see following charts		0	0
Off-Site Renewable Energy Generation	0	0	0	0			0	0
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline				
GHG Emissions	1472		1298	11.80%				
GHG Emissions per SF	0.015		0.013	11.80%				

Alternate H1: Enhanced ERU	Baseline Building		Proposed Design		Future Net Zero Scenario		Non-Carbon Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating	156,046 therms	0.68	127,621 therms	64.60%	125,498 therms	64.18%	1,509,318 kWh	41.50%
Space Cooling	447,520 kWh	0.067	286,868 kWh	4.90%	286,477 kWh	4.98%	344,242 kWh	9.50%
Heat Rejection	0 kWh	0	9,033 kWh	0.20%	9,022 kWh	0.20%	9,033 kWh	0.20%
Pumps & Aux.	85,544 kWh	0.013	159,179 kWh	2.70%	159,085 kWh	2.77%	159,179 kWh	4.40%
Ventilation (Fan Energy Only)	557,238 kWh	0.083	619,093 kWh	10.60%	619,092 kWh	10.77%	619,093 kWh	17.10%
Domestic Hot Water	5,631 therms	0.025	5,631 therms	2.80%	5,631 therms	2.90%	65,995 kWh	4.60%
Interior Lighting	274,669 kWh	0.041	201,080 kWh	3.50%	201,080 kWh	3.50%	201,080 kWh	5.60%
Exterior Lighting	0 kWh	0	0 kWh	0.00%	0 kWh	0.00%	0 kWh	0.00%
Misc. Equipment (Plug Loads)	619,696 kWh	0.092	619,696 kWh	10.70%	619,696 kWh	10.80%	619,696 kWh	17.10%
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI	235.8 kBTU/SF		203.9 kBTU/SF	13.51%	201.7 kBTU/SF	14.47%	127.0 kBTU/SF	46.16%
Source EUI	386.6 kBTU/SF		348.5 kBTU/SF	9.90%	346.2 kBTU/SF	10.10%	275.5 kBTU/SF	28.70%
Total Energy Use	22,941 MMBTU		19,843 MMBTU	13.51%	19,622 MMBTU	14.47%	12,351 MMBTU	46.16%
Total Energy Cost	$ 525,161		$ 480,516	8.50%	$ 477,977	8.98%	$ 609,724	-16.10%
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
On-Site Renewable Energy Generation	0	0	0	0			0	0
Off-Site Renewable Energy Generation	0	0	0	0			0	0
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline				
GHG Emissions	1472		1298	11.80%	1286	12.64%	1216	17.39%
GHG Emissions per SF	0.015		0.013	11.80%	0.013		0.012	

Alternate H2: Lab Vent. Controls	Baseline Building		Proposed Design		Future Net Zero Scenario		Non-Carbon Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating	156,046 therms	0.68	127,621 therms	64.60%	72,709 therms	53.83%	1,509,318 kWh	41.50%
Space Cooling	447,520 kWh	0.067	286,868 kWh	4.90%	217,911 kWh	5.48%	344,242 kWh	9.50%
Heat Rejection	0 kWh	0	9,033 kWh	0.20%	6,281 kWh	0.20%	9,033 kWh	0.20%
Pumps & Aux.	85,544 kWh	0.013	159,179 kWh	2.70%	155,636 kWh	3.92%	159,179 kWh	4.40%
Ventilation (Fan Energy Only)	557,238 kWh	0.083	619,093 kWh	10.60%	469,707 kWh	11.82%	619,093 kWh	17.10%
Domestic Hot Water	5,631 therms	0.025	5,631 therms	2.80%	5,631 therms	4.15%	65,995 kWh	4.60%
Interior Lighting	274,669 kWh	0.041	201,080 kWh	3.50%	201,080 kWh	5.06%	201,080 kWh	5.60%
Exterior Lighting	0 kWh	0	0 kWh	0.00%	0 kWh	0.00%	0 kWh	0.00%
Misc. Equipment (Plug Loads)	619,696 kWh	0.092	619,696 kWh	10.70%	619,696 kWh	15.60%	619,696 kWh	17.10%
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI	235.8 kBTU/SF		203.9 kBTU/SF	13.51%	139.5 kBTU/SF	40.86%	127.0 kBTU/SF	46.16%
Source EUI	386.6 kBTU/SF		348.5 kBTU/SF	9.90%	268.2 kBTU/SF	30.60%	275.5 kBTU/SF	28.70%
Total Energy Use	22,941 MMBTU		19,843 MMBTU	13.51%	13,568 MMBTU	40.86%	12,351 MMBTU	46.16%
Total Energy Cost			$ 480,516	8.50%	$ 380,174	27.61%	$ 609,724	-16.10%
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
On-Site Renewable Energy Generation	0	0	0	0			0	0
Off-Site Renewable Energy Generation	0	0	0	0			0	0
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline				
GHG Emissions	1472		1298	11.80%	935	36.48%	1216	17.39%
GHG Emissions per SF	0.015		0.013	11.80%	0.010		0.012	

Alternate H3: Office VRF	Baseline Building		Proposed Design		Future Net Zero Scenario		Non-Carbon Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating	156,046 therms	0.68	127,621 therms	64.60%	126,029 therms	64.60%	1,509,318 kWh	41.50%
Space Cooling	447,520 kWh	0.067	286,868 kWh	4.90%	278,8588 kWh	4.90%	344,242 kWh	9.50%
Heat Rejection	0 kWh	0	9,033 kWh	0.20%	8,545 kWh	0.20%	9,033 kWh	0.20%
Pumps & Aux.	85,544 kWh	0.013	159,179 kWh	2.70%	154,940 kWh	2.70%	159,179 kWh	4.40%
Ventilation (Fan Energy Only)	557,238 kWh	0.083	619,093 kWh	10.60%	601,183 kWh	10.60%	619,093 kWh	17.10%
Domestic Hot Water	5,631 therms	0.025	5,631 therms	2.80%	5,631 therms	2.80%	65,995 kWh	4.60%
Interior Lighting	274,669 kWh	0.041	201,080 kWh	3.50%	201,080 kWh	3.50%	201,080 kWh	5.60%
Exterior Lighting	0 kWh	0	0 kWh	0.00%	0 kWh	0.00%	0 kWh	0.00%
Misc. Equipment (Plug Loads)	619,696 kWh	0.092	619,696 kWh	10.70%	619,696 kWh	10.70%	619,696 kWh	17.10%
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI	235.8 kBTU/SF		203.9 kBTU/SF	13.51%	201.4 kBTU/SF	14.61%	127.0 kBTU/SF	46.16%
Source EUI	386.6 kBTU/SF		348.5 kBTU/SF	9.90%	343.7 kBTU/SF	11.10%	275.5 kBTU/SF	28.70%
Total Energy Use	22,941 MMBTU		19,843 MMBTU	13.51%	19,591 MMBTU	14.61%	12,351 MMBTU	46.16%
Total Energy Cost			$ 480,516	8.50%	$ 474,244	9.70%	$ 609,724	-16.10%
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
On-Site Renewable Energy Generation	0	0	0	0			0	0
Off-Site Renewable Energy Generation	0	0	0	0			0	0
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline				
GHG Emissions	1472		1298	11.80%	1281	12.98%	1216	17.39%
GHG Emissions per SF	0.015		0.013	11.80%	0.013		0.012	

Alternate H4: Electric Boiler	Baseline Building		Proposed Design		Future Net Zero Scenario		Non-Carbon Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating	156,046 therms	0.68	127,621 therms	64.60%	3,697,792 kWh	64.20%	1,509,318 kWh	41.50%
Space Cooling	447,520 kWh	0.067	286,868 kWh	4.90%	286,868 kWh	5%	344,242 kWh	9.50%
Heat Rejection	0 kWh	0	9,033 kWh	0.20%	9,033 kWh	0.20%	9,033 kWh	0.20%
Pumps & Aux.	85,544 kWh	0.013	159,179 kWh	2.70%	159,179 kWh	2.70%	159,179 kWh	4.40%
Ventilation (Fan Energy Only)	557,238 kWh	0.083	619,093 kWh	10.60%	619,093 kWh	10.60%	619,093 kWh	17.10%
Domestic Hot Water	5,631 therms	0.025	5,631 therms	2.80%	5,631 therms	2.80%	65,995 kWh	4.60%
Interior Lighting	274,669 kWh	0.041	201,080 kWh	3.50%	201,080 kWh	3.50%	201,080 kWh	5.60%
Exterior Lighting	0 kWh	0	0 kWh	0.00%	0 kWh	0.00%	0 kWh	0.00%
Misc. Equipment (Plug Loads)	619,696 kWh	0.092	619,696 kWh	10.70%	619,696 kWh	10.70%	619,696 kWh	17.10%
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI	235.8 kBTU/SF		203.9 kBTU/SF	13.51%	202 kBTU/SF	14.35%	127.0 kBTU/SF	46.16%
Source EUI	386.6 kBTU/SF		348.5 kBTU/SF	9.90%	346.4 kBTU/SF	10.40%	275.5 kBTU/SF	28.70%
Total Energy Use	22,941 MMBTU		19,843 MMBTU	13.51%	19,649 MMBTU	14.35%	12,351 MMBTU	46.16%
Total Energy Cost			$ 480,516	8.50%	$ 984,813	-87.53%	$ 609,724	-16.10%
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
On-Site Renewable Energy Generation	0	0	0	0			0	0
Off-Site Renewable Energy Generation	0	0	0	0			0	0
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline				
GHG Emissions	1472		1298	11.80%	1760	-19.57%	1216	17.39%
GHG Emissions per SF	0.015		0.013	11.80%	0.018		0.012	

Alternate H5: Triple Glazing	Baseline Building		Proposed Design		Future Net Zero Scenario		Non-Carbon Fuel Scenario	
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
Space Heating	156,046 therms	0.68	127,621 therms	64.60%	125,024 therms	64.20%	1,509,318 kWh	41.50%
Space Cooling	447,520 kWh	0.067	286,868 kWh	4.90%	288,393 kWh	5.00%	344,242 kWh	9.50%
Heat Rejection	0 kWh	0	9,033 kWh	0.20%	9,127 kWh	0.20%	9,033 kWh	0.20%
Pumps & Aux.	85,544 kWh	0.013	159,179 kWh	2.70%	159,127 kWh	2.70%	159,179 kWh	4.40%
Ventilation (Fan Energy Only)	557,238 kWh	0.083	619,093 kWh	10.60%	617,018 kWh	10.80%	619,093 kWh	17.10%
Domestic Hot Water	5,631 therms	0.025	5,631 therms	2.80%	5,631 therms	2.90%	65,995 kWh	4.60%
Interior Lighting	274,669 kWh	0.041	201,080 kWh	3.50%	201,080 kWh	3.50%	201,080 kWh	5.60%
Exterior Lighting	0 kWh	0	0 kWh	0.00%	0 kWh	0.00%	0 kWh	0.00%
Misc. Equipment (Plug Loads)	619,696 kWh	0.092	619,696 kWh	10.70%	619,696 kWh	10.80%	619,696 kWh	17.10%
	$US, kBTU, kBTU/SF		$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline	$US, kBTU, kBTU/SF	% Reduction from Baseline
Site EUI	235.8 kBTU/SF		203.9 kBTU/SF	13.51%	201.2 kBTU/SF	14.67%	127.0 kBTU/SF	46.16%
Source EUI	386.6 kBTU/SF		348.5 kBTU/SF	9.90%	345.7 kBTU/SF	10.60%	275.5 kBTU/SF	28.70%
Total Energy Use	22,941 MMBTU		19,843 MMBTU	13.51%	19,575 MMBTU	14.67%	12,351 MMBTU	46.16%
Total Energy Cost			$ 480,516	8.50%	$ 477,490	9.08%	$ 609,724	-16.10%
	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total	kWh or Therms	% of Total
On-Site Renewable Energy Generation	0	0	0	0			0	0
Off-Site Renewable Energy Generation	0	0	0	0			0	0
	Tons CO2 [/SF]		Tons CO2 [/SF]	% Reduction from Baseline				
GHG Emissions	1472		1298	11.80%	1283	12.84%	1216	17.39%
GHG Emissions per SF	0.015		0.013	11.80%	0.013		0.012	

Green Building Project Checklist

Green Building Project Location: Cambridge, MA

Applicant

Name: 180 Fawcett St

Address: 180 Fawcett St, Cambridge, MA 02138

Contact Information

Email Address: mpassalacqua@cosentini.com

Telephone #: 212-615-3807

Project Information (select all that apply):

- ☒ New Construction – GFA: 62,050
- ☐ 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: 4
  - ☒ Building Design + Construction (BD+C) – Subcategory: Core & 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)

Project Phase

☐ **BUILDING PERMIT**

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

Required Submissions

All rating programs:

- ☐ Rating system checklist – updated from any prior version
- ☐ Rating system narrative – updated from any prior version with additional supporting information from construction documents
- ☐ Net zero narrative – updated from any prior version (see example template for guidance)
- ☐ Energy Simulation Tool results demonstrating compliance with selected rating system. *[Note: For Passive House rating program, must use WUFI Passive, Passive House Planning Package (PHPP), or comparable software tool authorized by Passive House.]*
- ☐ Credentials of Green Commissioning Authority (or copy of contract between developer and Commissioning Authority if an independent consultant or subcontractor), including documentation of Green Commissioning process experience on at least two building projects with a scope of work similar to the proposed project extending from early design phase through at least ten (10) months of occupancy
- ☐ Affidavit signed by Green Building Professional with attached credentials – use City form provided (Building Permit)

Passive House rating program only:

- ☐ Letter of intent from Passive House rater/verifier hired for on-site verification, with credentials of rater/verifier
- ☐ Credentials of Certified Passive House Consultant who has provided design, planning, or consulting services (if different from the Green Building Professional for the project)
- ☐ Construction drawings and specifications

Project Phase

☐ **CERTIFICATE OF OCCUPANCY**

Before applying for a certificate of occupancy, submit this documentation to CDD for review and approval.

Required Submissions

All rating programs:

- ☐ Rating system checklist – updated from any prior version
- ☐ Rating system narrative – updated from any prior version with additional supporting information from as-built conditions
- ☐ Net zero narrative – updated from any prior version (see example template for guidance)
- ☐ Energy Simulation Tool results demonstrating compliance with selected rating system, updated to as-built conditions. *[Note: For Passive House rating program, must use WUFI Passive, Passive House Planning Package (PHPP), or comparable software tool authorized by Passive House.]*
- ☐ Affidavit with schedule of commissioning requirements signed by Green Commissioning Authority, with attached credentials – use City form provided (Certificate of Occupancy)
- ☐ Affidavit signed by Green Building Professional with attached credentials – use City form provided (Certificate of Occupancy)

Passive House rating program only:

- ☐ Pressure Test Verification
- ☐ Ventilation Commissioning
- ☐ Quality Assurance Workbook
- ☐ Final testing and verification report from rater/verifier

Affidavit Form for Green Building Professional
Special Permit

Green Building
Project Location: 180 Fawcett St, Cambridge, MA 02138

Green Building Professional

Name: Robert Leber

☐ Architect

☒ Engineer

License Number: MA PE #36457

Company: Cosentini Associates

Address: 101 Federal Street – Suite 600, Boston, MA 02110

Contact Information

Email Address: rleber@cosentini.com

Telephone Number: 617-748-7800

I, Robert Leber, 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.

8/03/21

(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.

The U. S. Green Building Council

hereby certifies that

Robert Leber

has successfully demonstrated knowledge of the
green building design and construction industry and the
Leadership in Energy and Environmental Design (LEED™) 2.0
Green Building Rating System, Resources, and Process required
to be awarded with the title of

LEED™ 2.0 Accredited Professional

LEED
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

Steven Winter, Chairman

Christine Ervin, President & CEO