



The Garage Cambridge, MA

Special Permit Application
Volume 3 – Appendices

December 6 , 2021

Trinity Property Management
Bruner/Cott Architects

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SOLAR STUDIES

■ Existing shadows ■ Proposed Building Shadows



Spring Equinox 9 am



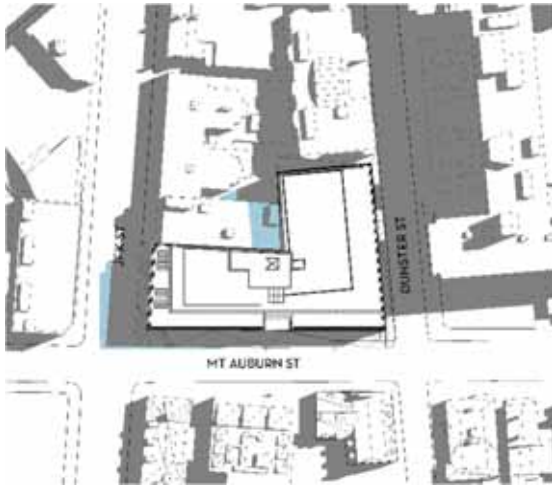
Spring Equinox 12 pm



Spring Equinox 3pm

SOLAR STUDIES

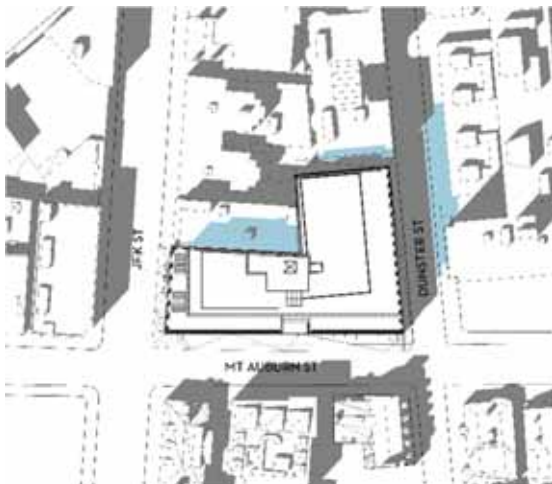
■ Existing shadows ■ Proposed Building Shadows



Summer Solstice 9 am



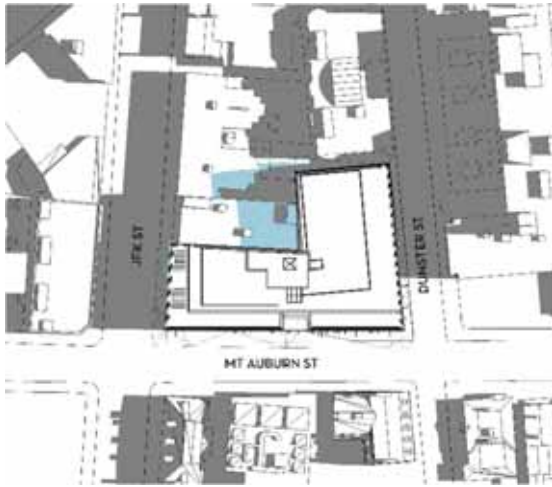
Summer Solstice 12 pm



Summer Solstice 3pm

SOLAR STUDIES

■ Existing shadows ■ Proposed Building Shadows



Fall Equinox 9 am



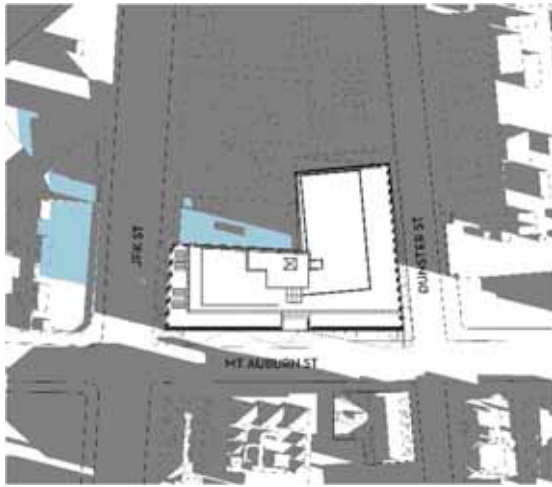
Fall Equinox 12 pm



Fall Equinox 3pm

SOLAR STUDIES

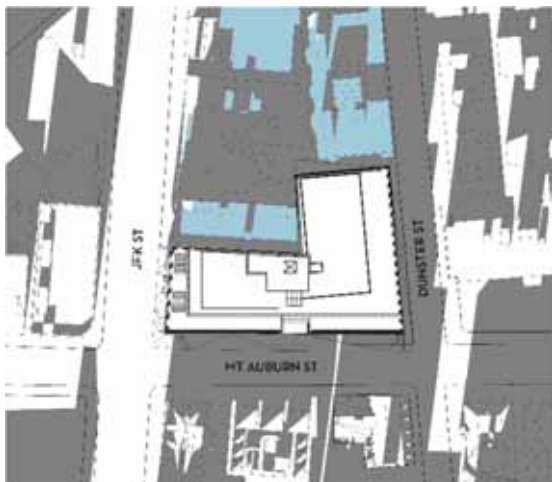
■ Existing shadows ■ Proposed Building Shadows



Winter Solstice 9 am



Winter Solstice 12 pm



Winter Solstice 3pm

GREEN BUILDING INTRODUCTION

Trinity Property Management, Inc.

The Garage

**Article 22 Special Permit
Submission**

ISSUE | September 23, 2021

Arup USA, Inc
60 State Street
Boston MA 02109
United States of America
www.arup.com

ARUP

Contents

- 1 Project Introduction**
 - 1.1 Project team
- 2 Green Building Checklist**
- 3 Green Building Professional Affidavit**
- 4 Green Building Report**
- 5 Net Zero Narrative**

Green Building Project Checklist

Green Building
 Project Location: 36 JFK Street, 81 Mt. Auburn Street, 33 Dunster Street, Cambridge, MA 02138

Applicant

Name: Trinity Property Management, Inc
 Address: Post Office Box 380212, Cambridge MA 02238
 Contact Information
 Email Address: JDiGiovanni@TrinityProperty.com
 Telephone #: (617)-354-0835

Project Information (select all that apply):

- New Construction – GFA: 99,814 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: 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)

Affidavit Form for Green Building Professional Special Permit

Green Building

Project Location: 36 JFK Street, 81 Mt. Auburn Street, 33 Dunster Street, Cambridge, MA 02138

Green Building Professional

Name: Hilary Williams PE LEED AP BD+C

Architect

Engineer

Mass. License Number: 55379

Company: Arup USA Inc.

Address: 60 State Street, Boston MA 02109

Contact Information

Email Address: Hilary.Williams@arup

Telephone Number: 617 864 2987

I, Hilary Williams PE LEED AP BD+C, 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.



7/15/2021

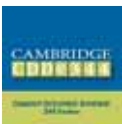
(Signature)

(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.





GREEN BUSINESS CERTIFICATION INC. CERTIFIES THAT

Hilary Williams

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.

10658894-AP-BD+C

CREDENTIAL ID

01 DEC 2011

ISSUED

28 NOV 2021

VALID THROUGH

A handwritten signature in black ink that reads "Mahesh Ramanujan".

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

Project Introduction

The Garage will be a mixed-use core & shell building containing office, retail, restaurant, and venue spaces. In total, the building will comprise approximately 99,814 Gross Floor Area (GFA) distributed over six (6) above-grade floors and one (1) basement level. The venue space is located in the basement, commercial and retail spaces are located on floors 1 and 2, and office tenant spaces are located on floors 2-6.



Project Rendering: View from Winthrop Park

image: Bruner/Cott

Table 1. Summary of building development characteristics

Site area:	17,608 SF lot area
Existing land use(s) and gross floor area, by use:	OFFICE GFA: 15,600 RETAIL GFA: 23,000 RESTAURANT GFA: 36,200 TOTAL GFA: 78,300
Proposed land use(s) and gross floor area, by use:	OFFICE GFA: 72,446 RETAIL GFA: 7,048 RESTAURANT GFA: 20,320 TOTAL GFA: 99,814
Proposed building height(s):	80 ft maximum, 7 stories (single level basement plus 6 above grade)
Proposed parking spaces:	0 off street
Proposed bicycle parking spaces (Long-term and short-term):	27 long-term inside the building 29 short-term – not provided in project

Project team

Owner: Trinity Realty I, LLC

The Garage design team includes:

- Architect: Bruner/Cott Architects
- MEP/FP & Structural Engineering: Arup
- Civil Engineering: Nitsch Engineering
- Landscape Architect: Klopfer Martin Design Group
- Cost Estimating: A.M. Fogarty
- Lighting Design: Lam Partners
- Sustainability Consulting: Arup
- Acoustics Consulting: Arup
- Code Consulting: Code Red
- Vertical Transportation: Syska
- Specifications: Kalin Associates

LEED Narrative and Checklist

Trinity Property Management, Inc.

The Garage

Article 22 Special Permit Submission:
Green Building Narrative

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 276639-00

ARUP

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- 2.2 Location and Transportation
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- 2.6 Materials and Resources Credits
- 2.7 Indoor Environmental Quality Credits
- 2.8 Innovation Credits
- 2.9 Regional Priority Credits

Appendices

Appendix A

LEED Checklist

1 LEED-CS v4 Scorecard Summary

The table below summarizes the LEED for Core & Shell Development (LEED-CS) credit summary for the proposed building design utilizing version 4 and selected opt-in version 4.1 credit requirements. The project is pursuing points to achieve LEED Gold certification. Gold certification requires achievement of at least 60 points, with the full range from 60-79 points. The project is targeting 69 points. A full LEED checklist can be found in Appendix A.

Table 2. LEED-CS points planned for Gold certification

Category	Points planned (YES)	Maybe Points
IP: Integrative Process	1	-
LT: Location and Transportation	18	-
SS: Sustainable Sites	5	-
WE: Water Efficiency	7	1
EA: Energy and Atmosphere	17	7
MR: Materials and Resources	6	4
EQ: Indoor Environmental Quality	6	1
ID: Innovation in Design	6	-
RP: Regional Priority	2	2
Total	68	15

A detailed credit by credit narrative is included in the following narrative.

2 LEED Credit Narrative

This section provides a detailed narrative for each LEED credit being pursued, with some credits being indicated as “maybe” for evaluation for their cost benefit using life cycle cost analysis.

The project will meet all three (3) minimum program requirements to (1) be in a permanent location on existing land, (2) use a reasonable LEED boundary and (3) comply with size requirements of at least 1,000 square feet of gross floor area.

Additionally, the project will achieve each of the twelve (12) prerequisites which are discussed under each credit category below.

2.1 Integrative Process

Integrative Process

1 point

The project is pursuing 1 point from this credit with the intention of supporting high-performance, cost-effective project outcomes through an early analysis of the interrelationships among systems. Early analyses for energy-related systems and water-related systems were completed and have been used to inform the basis of design (BOD), design documents, and construction documents. Early phase energy modeling was performed at the beginning of the project to evaluate the importance of building envelope attributes including triple glazed façade systems, and assessment of different HVAC alternatives. Water consumption calculations were performed to estimate the project’s indoor and outdoor water demand and set reduction targets. A series of sustainability focused charrettes have been held to define project goals, set targets for energy and water use reduction and review analysis of energy and water related reduction strategies.

2.2 Location and Transportation

LTc2 Sensitive Land Protection

2 points

The project will achieve this credit by being located on land that has been previously developed.

LTc3 High Priority Site

2 points

The project will achieve 2 points by being located on an infill location in the Harvard Square Historic District.

LTc4 Surrounding Density and Diverse Uses

6 points

The project will achieve the full 4 available points under the Surrounding Density criteria, and an additional 2 points for Diverse Uses criteria, for a total of 6 points. The table below includes a calculation of surrounding density, demonstrating exceedance of the LEED threshold of 35,000 square feet per acre of buildable land. The calculations have accounted for the full ¼ mile radius of surrounding area and shows the minimum density threshold is comfortably exceeded.

Table 3. Surrounding density calculations.

Total building area:	4,635,382 ft ²
Total radius area (including non-buildable land):	0.20 mi ²
	5,473,833 ft ²
	125.7 acres
Combined density:	51,300 ft ² /acre
Non-residential density:	1.25 FAR
Residential density:	5.6 dwelling unit/acre

The project targets an additional 2 points for Diverse Uses, having a main entrance within a ½ mile walking distance of the main entrance for eight (8) or more existing and publicly available diverse uses, as summarized below.

Table 4. Diverse uses by category and use type within 0.5 miles walking distance of project site

Location name	Category	Use type	Distance to site (miles)
Sweetgreen	Services	Restaurant	0.05
Petali Flowers	Community-serving retail	Other Retail	0.05
Harvard University Pharmacy	Community-serving retail	Pharmacy	0.1
Cambridge Trust	Services	Bank	0.1
La Flamme Barber Shop	Services	Hair Care	0.1
The Ethelbert Cooper Gallery of African & African American Art	Civic and community facilities	Cultural arts facility	0.05
Mike's Pastry	Services	Cafe	0.1
TIAA Financial Services	Services	Bank	0.03

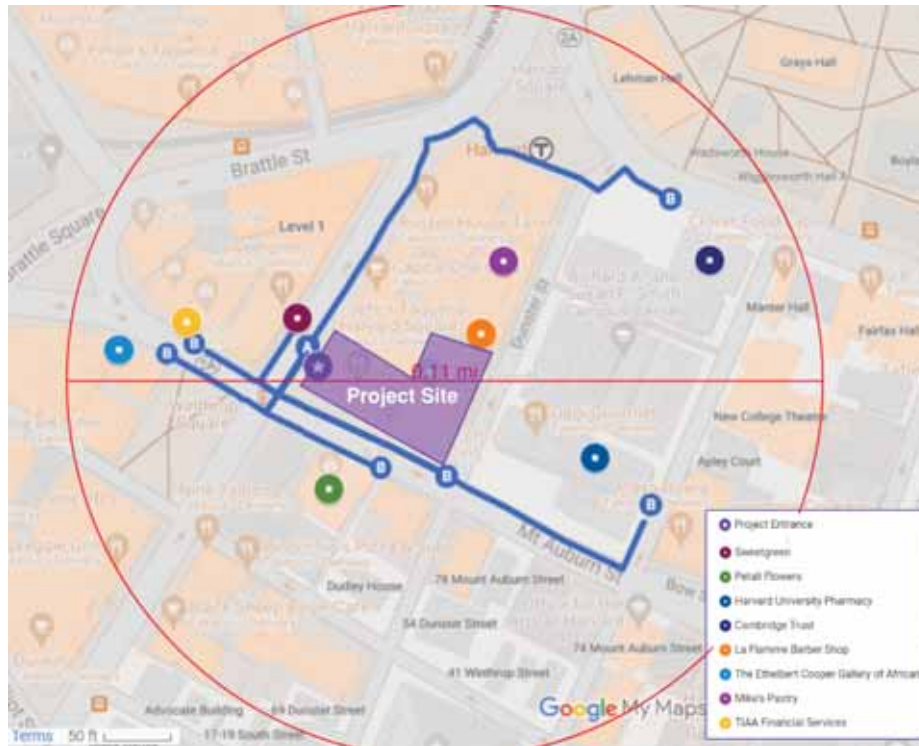


Figure 1. Map of Diverse Uses located within 0.5 miles walking distance of project site.

LTc5 Access to Quality Transit (v4.1)

6 points

The project will achieve 6 points for LTc5 Access to Quality Transit by having a functional entry for the project within a ¼-mile walking distance of existing bus stops and a ½-mile walking distance from the MBTA “T” system. A calculation of frequency of service that fulfill the credit criteria are included in the table below.

Table 5. Transit options in fulfillment of Quality Transit credit

Route	Stop	Distance to site (miles)	Weekday trips	Weekend trips
MBTA Red Line	Harvard	0.1	200	157
MBTA 1 Bus	Massachusetts Ave Stop ID: 110	0.2	127	100
MBTA 74 Bus	Harvard	0.1	43	26
MBTA 75 Bus	Harvard	0.1	33	37
Total:			403	320
LEED 6-point threshold:			360	216

Table 6. Bicycle parking and showers/changing rooms counts

	Short-term		Long-term		Showers / Changing Rooms	
	Criteria	Result	Criteria	Result	Criteria	Result
Cambridge Article 6.100	office: 0.06 spaces per 1,000 SF retail: 0.6 spaces per 1,000 SF restaurant: 1 space per 1,000 SF	29	office: 0.3 spaces per 1,000 SF retail: 0.1 spaces per 1,000 SF restaurant: .2 space per 1,000 SF	27	n/a	n/a
LEED LTc6	2.5% of peak visitors	7	5% of FTE	17	1 for first 100 FTE +1 for each 150 after	3

The project site is connected to a bicycle network that extends from Cambridge into Boston and connects to at least 10 diverse uses per LEED requirements.

LTc7 Reduced Parking Footprint (v4.1)

1 point

The project achieves 1 point for this credit under LEED v4.1 criteria, Option 1, by including no off-street parking.

2.3 Sustainable Sites

SS Prerequisite 1: Construction Activity Pollution Prevention

The project will meet this prerequisite by creating and implementing an erosion and sedimentation control plan for all construction activities associated with the project. The plan will conform to the municipal erosion and sedimentation requirements for the City of Cambridge.

SSc1 Site Assessment

1 point

The design team will conduct a site assessment per LEED criteria, to address topography, hydrology, climate, vegetation, species, soils, human use, and human health effects

SSc5 Heat Island Reduction

2 points

The project has targeted 2 points for achievement under SSc5 Option 1 (Nonroof and Roof). The Non roof measures are focused on light colored hardscape materials due to the very limited area for landscape at this existing urban site. The hardscape materials will incorporate light-colored granite and pre-cast concrete. The project will use a white roof to meet the minimum SRI value of 82.

SSc6 Light Pollution Reduction

1 point

The project will pursue 1 point under this credit using Option 1: BUG Rating Method. Exterior lighting priorities include providing a safe nighttime lighting environment that meets LEED criteria per BUG methodology and to minimize light spill from the building to adjacent streets. Per the Illuminating Engineering Society Model Lighting Ordinance, the project lies in a Lighting Zone 3 (LZ-3) corresponding to a moderately high lighting level in commercial mixed-use areas.

SSc7 Tenant Design and Construction Guidelines 1 point

The design team and owner will develop a document to establish sustainability requirements for tenants and to provide information from the base building to encourage tenants to pursue LEED ID+C certifications for their spaces.

2.4 Water Efficiency Credits

WE Prerequisite 1: Outdoor Water Use Reduction

The project will fulfill this prerequisite by not providing a permanent irrigation system.

WE Prerequisite 2: Indoor Water Use Reduction

The project will fulfill this prerequisite by installing fittings and fixtures that reduce aggregate water consumption by at least 20% from the baseline as specified in the LEED v4 Reference Guide and will be Water Sense labelled. Applicable water fixtures include toilets, lavatory faucets, kitchen faucets, and showerheads. In addition, appliances such as dishwashers and ice machines will meet the ENERGY STAR or equivalent performance.

WE Prerequisite 3: Building-Level Water Metering

The project will fulfill this prerequisite by installing a whole building water meter to measure the total potable water use for the building and associated grounds, compiled into monthly and annual summaries. The project commits to sharing with USGBC the resulting whole-project water usage data for a five-year period beginning on the date the project accepts LEED certification or typical occupancy, whichever comes first.

WEc1 Outdoor Water Use Reduction

2 points

This project does not plan on installing permanent irrigation and will therefore earn all of the available points for this credit.

WEc2 Indoor Water Use Reduction

**2 of 6 points
(+ 1 maybe)**

The project is targeting a 30% reduction in potable water use (2 points). Rainwater recycling for flushing is being assessed for its feasibility and cost effectiveness. Initial analysis shows rainwater recycling could account for only an estimated 22% of the annual flushing demand which would increase overall potable water savings to 37% and one additional LEED point. This additional point has been indicated as a maybe point.

Water fixture flow rates have been defined as follows and will be water sense labelled per LEED requirements:

	Design flow rate	Max. Allowable Flow Rate
• Toilets:	1.0 gpf	1.6 gpf
• Lavatories:	0.35 gpm	0.5 gpm
• Showers:	1.5 gpm	2.5 gpm
• Kitchen sinks:	0.5 gpm	2.0 gpm

WEc3 Cooling Tower Water Use

2 points

The project will meet the credit requirements by not providing a cooling tower and is classified as a system 7 in ASHRAE 90.1 Appendix G methodology.

WEc4 Water Metering

1 point

Water sub-metering will be implemented on the project to sub-meter water use for two (2) end uses, (1) domestic hot water and (2) the restaurant/kitchen space.

2.5 Energy and Atmosphere Credits

EA Prerequisite 1: Fundamental Commissioning and Verification

In fulfillment of this prerequisite, the project will engage commissioning (Cx) agents for mechanical, electrical, plumbing, and renewable energy systems and assemblies in accordance with ASHRAE Guideline O-2005 and ASHRAE Guideline 1.1-2007 for HVAC&R Systems, as they relate to energy, water, indoor environmental quality, and durability. In addition, a building enclosure commissioning (BECx) agent will be engaged for the project. The Cx and BECx agents will complete all steps outlined in LEED v4 Reference Guide.

EA Prerequisite 2: Minimum Energy Performance

In fulfillment of this prerequisite, the project will follow Option 1: Whole Building Energy Simulation to demonstrate an improvement of at least 5% in the proposed building performance rating compared with an ASHRAE 90.1-2010 Appendix G baseline building. Refer to the description of credit EAc2: Optimize Energy Performance below for detailed energy model results.

EA Prerequisite 3: Building-Level Energy Metering

In fulfillment of this prerequisite, the project will install building-level energy meters and submeters that can be aggregated to provide building-level data representing total building energy consumption. The project commits to sharing with USGBC the resulting energy consumption data for a five-year period beginning on the date the project accepts LEED certification. At a minimum, energy consumption must be tracked at one-month intervals.

EA Prerequisite 4: Fundamental Refrigerant Management

In fulfillment of this prerequisite, the project commits to not using chlorofluorocarbon (CFC)-based refrigerants throughout major HVAC&R systems.

EAc1 Enhanced Commissioning

**5 points
(+ 1 maybe)**

The project will pursue 5 points by meeting the requirements for Enhanced Commissioning and Building Envelope Commissioning scopes of work. The process will exceed the Article 22 Green Commissioning requirements, which require the engagement of a Green Commissioning Authority as defined in Article 2.000 who completes the activities outlined in Section 22.24.2. A commissioning agent will be engaged prior to the end of design development phase with a scope of work aligned with LEED criteria. The Proponent is assessing pursuit of monitoring-based commissioning in operation for 1 additional point which is identified as a 'maybe' point.

EAc2 Optimize Energy Performance

**11 points
(+ 1 maybe)**

The project target is an additional 20% energy reduction beyond the Stretch energy code requirement for a 10% reduction (i.e. ASHRAE 90.1-2013 with MA Amendments). Accordingly, this translates to achievement of 11 points under EA Credit 2 Optimize Energy Performance (23% energy cost savings from ASHRAE 90.1-2010). One (1) points are carried as "Maybe" for further development in the energy model as the design advances.

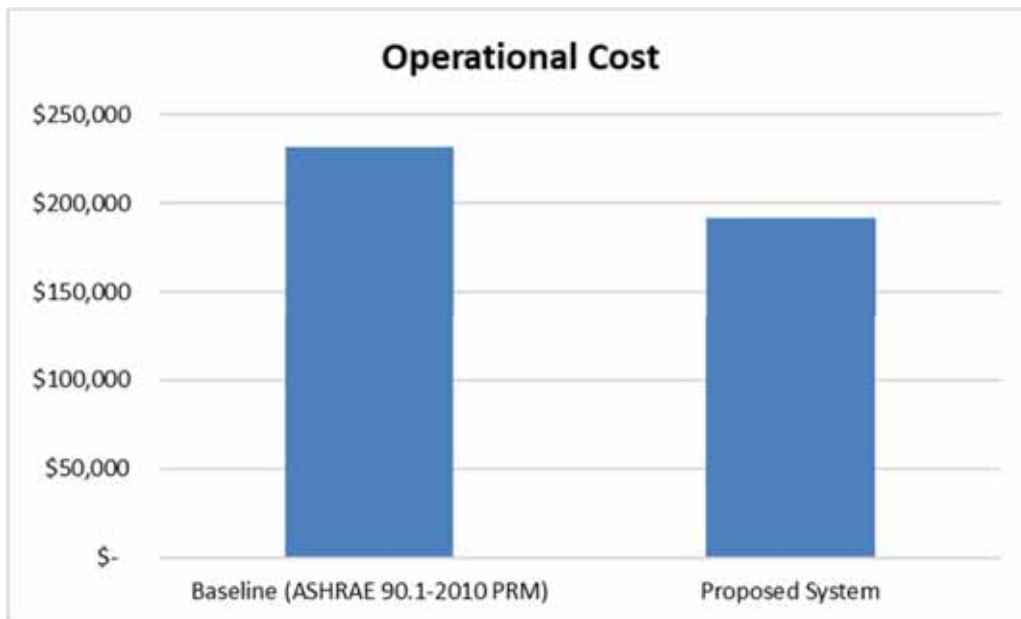


Figure 3. Energy cost of the LEED baseline and proposed design (heat pump system)

Table 7. Summary of Proposed design and LEED baseline results

	Energy Cost (\$/year)	LEED points
LEED v4 Baseline	\$231,786	-
Proposed Design	\$191.377	11

EAc3 Advanced Energy Metering

1 point

The project is pursuing 1 point under this credit by submetering future tenant spaces energy consumption. The metering will meet the prescribed characteristics listed in the LEED v4 Reference Guide for this credit, including having meters that are permanently installed, record both consumption and demand at intervals of one hour or less (and capable of reporting hourly, daily, monthly, and annual energy use), transmit data to a remote location that is remotely accessible. The metering system will be capable of storing all meter data for at least 36 months.

EAc5 Renewable Energy (v4.1)

5 points (maybe)

The project will assess purchasing off-site renewable energy credits (RECs) that meet LEED and City of Cambridge requirements to achieve project goals for energy and emissions reductions. All five (5) points have been identified as maybe points.

2.6 Materials and Resources Credits

MR Prerequisite 1: Storage and Collection of Recyclables

In fulfillment of this prerequisite, the project will provide dedicated areas accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building. Materials to be collected include mixed paper, corrugated cardboard, glass, plastics, and metals, with appropriate measures being taken for the safe collection of batteries, mercury-containing lamps, and electronic waste.

MR Prerequisite 2: Construction and Demolition Waste Management Planning

In fulfillment of this prerequisite, the project will develop and implement a construction and demolition waste management plan adhering to LEED v4 Reference Guide criteria. Requirements will be integrated into section 017419 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT AND DISPOSAL.

MRc1 Building Life-Cycle Impact Reduction 1 of 6 points

(+ 3 points maybe)

The project will pursue Option 4: Whole Building Life Cycle Assessment (LCA) for 1 point. In addition to conducting an LCA, the project is considering a mass timber structure which would reflect a reduction in embodied carbon which can earn the full 3 points, i.e. a 20% reduction. The additional points are included as 'maybe' since the embodied carbon calculation (LCA) has not been completed to date to confirm the reduction percentage.

MRc2 Building Product Disclosure and Optimization (BPDO) Environmental Product Declarations (v4.1) 1 of 2 points

The project will achieve Option 1: Environmental Product Declaration (EPD) for achievement of 1 point under version 4.1 by specifying at least 10 different permanently installed products sourced from at least three different manufacturers that have compliant EPDs. An emphasis will be placed on product specific EPDs and will support achievement of MRc1 and conducting the LCA. Requirements will be integrated into section 018113 SUSTAINABLE DESIGN REQUIREMENTS and coordinated with technical specification sections.

MRc3: BPDO: Sourcing of Raw Materials (v4.1) 1 of 2 points

The project has targeted achievement of 1 point using LEED v4.1 by specifying materials on the project will be FSC certified wood for permanently installed wood products, have

recycled content and be regionally sourced defined as within 100 miles of the project site to meet at least 15% total materials by cost.

MRc4 BPDO: Material Ingredients (v4.1)

1 of 2 points

(+ 1 point maybe)

The project is pursuing this credit under Option 1: Material Ingredient Reporting, specifying at least 10 building products from three (3) different manufacturers that have a Health Product Declaration (HPD), declare label or equivalent transparency declaration documenting the chemical inventory of the product to at least 0.1% (1,000 ppm).

Option 2 (Material Ingredient Optimization) is being assessed for its feasibility for 1 additional point. Under this strategy, project material selection would specify at least 5 building products from three (3) different manufacturers that have third-party verified Red List Free or Cradle to Cradle bronze certification.

The overall approach to interior material selection will place an emphasis on specifying Red List Free products as available to reduce chemicals of concern in the interior environment and improve indoor air quality. Requirements will be integrated into section 018113 SUSTAINABLE DESIGN REQUIREMENTS and coordinated with technical specification sections.

MRc5

Construction and Demolition Waste Management

2 points

The project has targeted 2 points for achievement using Option 1: Diversion which requires at least a 75% diversion rate and 4 material streams to be tracked. Requirements will be integrated into section 017419 CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT AND DISPOSAL.

2.7 Indoor Environmental Quality Credits

EQ Prerequisite 1: Minimum Indoor Air Quality Performance

In fulfillment of this prerequisite, the project will meet ventilation requirements by providing minimum outdoor air in accordance with ASHRAE Standard 62.1-2010.

EQ Prerequisite 2: Environmental Tobacco Smoke Control

In fulfillment of this prerequisite, the project will prohibit smoking inside the building, outside the building except in designated areas located at least 25 feet from all entries, outdoor air intakes, and operable windows.

EQc1 Enhanced Indoor Air Quality Strategies

2 points

The project will achieve 2 points under Option 1 Enhanced IAQ Strategies and Option 2 Additional enhanced IAQ Strategies. For Option 1, strategies A and C will be achieved by installing permanent entryway systems at least 10 feet long in the primary direction of travel to capture dirt and particulates and will install MERV 14 filters in AHUs prior to occupancy. For Option 2, Option C will be achieved by designing the ventilation system for CO2 monitoring in densely occupied spaces.

EQc2 Low-Emitting Materials (v4.1)

2 of 3 points

(+ 1 point maybe)

The project will pursue 2 points under this credit by specifying three (3) product categories that meet the low-emitting criteria for VOC content and general emissions evaluation. Flooring, Paints and Coatings, and Walls have been initially identified for compliance. An additional 1 point has been identified as maybe point if a fourth product category is achieved. Composite wood has been initially identified for achievement. Requirements will be integrated into section 018113 SUSTAINABLE DESIGN REQUIREMENTS and coordinated with technical specification sections.

EQc3 Construction IAQ Management Plan

1 point

The project will achieve 1 point by requiring the Contractor to develop and implement an indoor air quality (IAQ) management plan for the construction. The plan will meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3. Additional measures will be implemented to protect absorptive materials stored on-site and installed from moisture damage. Requirements will be integrated into section 018120 CONSTRUCTION INDOOR AIR QUALITY MANAGEMENT.

EQc5 Quality Views

1 point

The project is pursuing 1 point under this credit by establishing a direct line of sight to the outdoors via vision glazing for 75% of all regularly occupied floor area, and at least 75% of all regularly occupied floor area having at least two of the four kinds of views listed under this credit description in the LEED v4 Reference Guide. The project layout offers favorable conditions to achieve multiple requirements under the quality views credit. .

2.8 Innovation Credits

IDc1 Innovation – Active Design

1 point

The project is pursuing 1 point from this Innovation credit, meeting the criteria outlined in the LEED v4 Innovation Catalog with the intention of improving the health of occupants through physical activity while reducing environmental impacts. The building has a primary main stair accessed from lobby that enables occupants to travel between the building entrance floor, occupants' destination floors, and common use floors. In addition, the project will include 7 or more of the 11 features outlined in the LEED v4 Innovation Catalog for this credit.

IDc2 Innovation – O+M Starter Kit

1 point

The project is pursuing 1 point by establishing operational plans for Green Cleaning and Integrated Pest Management to ensure environmentally friendly cleaning products and pesticides are used and to provide good indoor air quality.

IDc3 Innovation – Purchasing (Lamps)

1 point

The project will pursue 1 point from this credit by specifying primarily an all-LED lighting design. The only non-LED lighting may be in select specialty lighting. Any non-LED lighting installed will be energy efficient and meet the mercury limits established in the LEED credit of an overall building average of 70 picograms of mercury per lumen-hour or less.

IDc4 Pilot Credit: Comprehensive Composting

1 point

The project is pursuing 1 point from this credit using Option 1: Regular compost collection and offsite processing. The design will integrate organic waste receptacles and regular organic waste collection in accordance with the LEED v4 Pilot credit criteria. The current facility already collects organic waste, and this will continue with the new facility.

IDc5 Innovation – Integrative Analysis of Building Materials

1 point

The project is pursuing 1 point from this Innovation credit, meeting the criteria outlined in the LEED v4 Innovation Catalog with by specifying at least 3 products that have a documented qualitative analysis of the potential health, safety and environmental impacts of the product in five stages of the product's life cycle (product assembly/manufacturing, building product installation, product use product maintenance, end of product life/reuse).

IDc6 LEED Accredited Professional

1 point

The project will achieve 1 point by having numerous members of the project team who are current LEED Accredited Professionals (APs) with a Building Design and Construction (BD+C) specialty. The Green Building Design Professional is the sustainability and LEED consultant on the project, Rebecca Hatchadorian of Arup, LEED BD+C credential ID #0010055526.

2.9 Regional Priority Credits

RP Credit – Energy Performance

1 point

The project is pursuing 1 Regional Priority Credit for exceeding the 8-point threshold for EA Credit 2: Optimize Energy Performance.

RP Credit – Building life-cycle impact reduction 1 point (maybe)

The project is tentatively pursuing 1 Regional Priority Credit for exceeding the 2-point threshold for MR Credit 1: Building life-cycle impact reduction.

RP Credit – High Priority Site

1 point

The project is pursuing 1 Regional Priority Credit for exceeding the 2-point threshold for LT Credit 3: High Priority Site.

RP Credit – Renewable Energy

1 point (maybe)

The project is tentatively pursuing 1 Regional Priority Credit for exceeding the 2-point threshold for EA Credit 5: Renewable Energy.

Appendix A

LEED Checklist



LEED v4 for BD+C: Core and Shell Project Checklist

Y ? N

1			D	Credit	Integrative Process	1
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Y ? N 'D' refers to design submission and 'C' to the construction submission

18	0	2		Location and Transportation		20
			D	Credit 1	LEED for Neighborhood Development Location	20
			D	Credit 2	Sensitive Land Protection Option 1: Previously Developed Land	2
		1	D	Credit 3	High Priority Site (Harvard Square Historic District)	3
			D	Credit 4	Surrounding Density and Diverse Uses	6
			D	Credit 5	Access to Quality Transit	6
			D	Credit 6	Bicycle Facilities	1
			D	Credit 7	Reduced Parking Footprint	1
		1	D	Credit 8	Green Vehicles	1

Y ? N

5	0	6		Sustainable Sites		11
			C	Prereq	Construction Activity Pollution Prevention	Required
			D	Credit 1	Site Assessment	1
		2	D	Credit 2	Site Development - Protect or Restore Habitat	2
		1	D	Credit 3	Open Space (30% Site Area incl. Bldg Footprint)	1
		3	D	Credit 4	v4.1 Rainwater Management (75% Rainfall Event for Zero Lot Line)	3
			C	Credit 5	Heat Island Reduction (Roof + Non-Roof)	2
			D	Credit 6	Light Pollution Reduction	1
			D	Credit 7	Tenant Design and Construction Guidelines	1

Y ? N

7	1	3		Water Efficiency		11
			D	Prereq	Outdoor Water Use Reduction	Required
			D	Prereq	Indoor Water Use Reduction	Required
			D	Prereq	Building-Level Water Metering	Required
			D	Credit 1	Outdoor Water Use Reduction (No installed irrigation)	2
		3	D	Credit 2	Indoor Water Use Reduction (2 pts = 30% reduction + recycling system)	6
			D	Credit 3	Cooling Tower Water Use (No Cooling Tower, baseline 7)	2
			D	Credit 4	Water Metering (2 end uses)	1

Y ? N

17	7	8		Energy and Atmosphere		33
			C	Prereq	Fundamental Commissioning and Verification	Required
			D	Prereq	Minimum Energy Performance	Required
			D	Prereq	Building-Level Energy Metering	Required
			D	Prereq	Fundamental Refrigerant Management	Required
		1	C	Credit 1	Enhanced Commissioning +BECx (MBCx Platinum)	6
		5	D	Credit 2	Optimize Energy Performance (23% = 11pts, 29% = 13pts)	18
			D	Credit 3	Advanced Energy Metering	1
		2	D	Credit 4	Demand Response	2
		5	D	Credit 5	v4.1 Renewable Energy	5
			D	Credit 6	Enhanced Refrigerant Management	1
			C	Credit 7	Green Power and Carbon Offsets	2

Project Name: Trolley House
Article 22
September 27, 2021

Y ? N 'D' refers to design submission and 'C' to the construction submission

6	4	4		Materials and Resources		14
			D	Prereq	Storage and Collection of Recyclables	Required
			C	Prereq	Construction and Demolition Waste Management Planning	Required
		2	C	Credit 1	Building Life-Cycle Impact Reduction (Whole-building LCA)	6
		1	C	Credit 2	v4.1 BPDO - Environmental Product Declarations (Option 1)	2
		1	C	Credit 3	v4.1 BPDO - Sourcing of Raw Materials (15%)	2
		1	C	Credit 4	v4.1 BPDO - Material Ingredients (Options 1 + 2)	2
		2	C	Credit 5	Construction and Demolition Waste Management (Option 1)	2

Y ? N

6	1	3		Indoor Environmental Quality		10
			D	Prereq	Minimum Indoor Air Quality Performance	Required
			D	Prereq	Environmental Tobacco Smoke Control	Required
			D	Credit 1	Enhanced Indoor Air Quality Strategies	2
		1	C	Credit 2	v4.1 Low-Emitting Materials (3 product categories)	3
			C	Credit 3	Construction Indoor Air Quality Management Plan	1
		3	D	Credit 4	Daylight	3
			D	Credit 5	Quality Views	1

Y ? N

6	0	0		Innovation		6
			D	Credit 1	Innovation - Active Design	1
			C	Credit 2	Innovation - O+M Starter Kit: Green Cleaning Policy + IPM	1
			D	Credit 3	Innovation - Purchasing - lamps	1
			D	Credit 4	Pilot - Comprehensive Composting	1
			C	Credit 5	Pilot - Integrative Analysis of Building Materials	1
			D	Credit 6	LEED Accredited Professional	1

Y ? N

2	2	0		Regional Priority		4
			D	Credit 1	Regional Priority: Energy Performance (8 pts = 17%)	1
			C	Credit 2	Regional Priority: Building life-cycle impact reduction (2 pts)	1
		1	D	Credit 3	Regional Priority: High Priority Site (2pts)	1
		1	D	Credit 4	Regional Priority: Renewable Energy (2 pts)	1

Y ? N

68	15	26		TOTALS	Possible Points:	110
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Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110

Net Zero Narrative

Trinity Property Management, Inc.

The Garage

Article 22 Special Permit

Submission: Net Zero Narrative

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 276639-00

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ARUP

Contents

- 1 Project Profile
 - 1.1 Development Characteristics
 - 1.2 Green Building Rating System
- 2 Proposed Design Characteristic
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 - 2.2 Building Systems
 - 2.3 Building Systems Commissioning Process
- 3 Anticipated Energy Loads and Greenhouse Gas Emissions
 - 3.1 Assumptions
 - 3.2 Annual Projected Energy Consumption and GHG Emissions
- 4 Building Energy Performance Measures
 - 4.1 Overview
 - 4.2 Integrative Design Process
 - 4.3 Solar-Ready Roof Assessment
- 5 Net Zero Scenario Transition

Appendices

Appendix A

Building Envelope Commissioning Plan

Appendix B

HVAC Systems Commissioning Plan

Appendix C

Energy Model Detailed Assumptions and Results

1 Project Profile

1.1 Development Characteristics

Table 8. Summary of building development characteristics

Site area:	17,608 SF lot area
Existing land use(s) and gross floor area, by use:	OFFICE GFA: 15,600 RETAIL GFA: 23,000 RESTAURANT GFA: 36,200 TOTAL GFA: 78,300
Proposed land use(s) and gross floor area, by use:	OFFICE GFA: 72,446 RETAIL GFA: 7,048 RESTAURANT GFA: 20,320 TOTAL GFA: 99,814
Proposed building height(s):	80 ft / 7 stories (single level basement plus 6 above grade)
Proposed parking spaces:	0 off street
Proposed bicycle parking spaces (Long and short-term):	29 short-term & 27 long-term

1.2 Green Building Rating System

Table 9. LEED rating system details

Rating system and version:	LEED for Core and Shell rating system LEED-CS v4
Seeking certification?	YES
Rating level:	Gold (60-79 points)
Points targeted:	68

Refer to the Green Building Narrative for full details on LEED certification approach.

2 Proposed Design Characteristic

2.1 Building Envelope

2.1.1 Description

Table 10. Envelope assembly descriptions

Roof:	TPO on rigid wool insulation
Exterior walls/glazing:	<p>Ground Floor West and South West: New brick cavity wall with continuous insulation and triple glazed window wall system at openings</p> <p>Ground Floor North, East, South East, and west at inner block: Existing brick (repointed and insulated) with triple glazed window wall system at openings</p> <p>Upper Floors West, South, East: Terracotta tile on thermally broken rail and clip system with continuous mineral insulation and steel/window wall back up. Triple Glazed window wall system.</p> <p>Upper Floors North and West at inner Block: Above adjoining property walls, Aluminum Panel on Thermally broken rail and clips and continuous insulation. At adjoining property walls, continuous insulation only.</p> <p>Typical condition: Off the shelf high-performance window wall system modified to receive high-performance triple glazing.</p>
Below-grade walls	Reinforced concrete with vapor barrier and rigid insulation.
Below-grade floor:	Concrete slab on grade with vapor barrier and rigid insulation
Window-to-Wall ratio:	<p>North façade – 4 %</p> <p>North party wall – 0 %</p> <p>East façade – 57 %</p> <p>South façade – 54 %</p> <p>West façade – 54 %</p> <p>West party wall – 0%</p> <p>Whole building – 35%</p>

2.1.2 Thermal Performance

Estimates of the thermal transmittance (U-value) for the building envelope compared to the Massachusetts Stretch Energy Code 780 CMR Chapter 13 amended February 7, 2020 are summarized in the table below. Note that these values represent the performance-based pathway baseline per the results presented later in this report.

The building envelope is a high-performance design that in aggregate exceeds the prescriptive performance of a code compliant baseline. The largest contributors are a window to wall ratio and high-performance with low-U-values in excess of code minimums.

Table 11. Envelope thermal performance, Proposed Design vs. Prescriptive Code

	Proposed			Baseline ¹		
	Description (per table above)	Area (ft ²)	U-value	Description	Area (ft ²)	U-value
Glazing	Exterior glazing	12,900	U-0.25	Non-operable glazing	10,710	U-0.42
Roof	Roof	12,280	U-0.032	Roof	12,280	U-0.032
Wall	Above-grade wall	43,140	Metal Framed Wall: U-0.064 Mass Wall: U-0.09	Above-grade wall	43,140	U-0.055
	Below-grade wall	11,550	C-0.09	Below-grade wall	11,550	C-0.0297

¹ baseline values are per ASHRAE 90.1-2013 per the energy modeling results later in this report.

2.1.3 Envelope Commissioning Process

Trinity Property Management, Inc. will engage a building envelope commissioning agent before the end of design development phase. The building envelope commissioning agent will conduct testing and commissioning of the envelope components and report the results in alignment with LEED v4 criteria for credit EA c1 Enhanced Commissioning Option 2. Details on the BECx process are described in Appendix A.

2.2 Building Systems

The proposed design mechanical and electrical systems are summarized in the table below.

Table 12. Mechanical and electrical system descriptions

Space heating/cooling:	<ul style="list-style-type: none"> • Building cooling and heating will be provided by an all-electric VRF heat pump system. Simultaneous heating and cooling with heat recovery are provided by the VRF system. • Electrical and IT room cooling is provided from split-type DX computer room air-conditioning (CRAC) units with roof mounted air-cooled condensing units.
Heat rejection:	<ul style="list-style-type: none"> • No cooling towers will be installed at the building.
Pumps & auxiliary:	<ul style="list-style-type: none"> • Domestic booster pumps will be necessary and be located in the service entry room in the basement level.
Ventilation:	<ul style="list-style-type: none"> • Two 7,500 CFM DOAS Air Handling Units will provide ventilation to all spaces. • Recirculation of return air is not anticipated, so bathrooms, showers, janitor’s closet, and trash room will be exhausted via DOAS units.
Domestic Hot Water:	<ul style="list-style-type: none"> • Domestic hot water will be generated by storage type heat pump water heaters. These heaters will generate water to 140°F.
Interior lighting:	<ul style="list-style-type: none"> • Lighting designed to meet or exceed the efficiency requirements prescribed by Massachusetts Stretch Energy Code 780 CMR Chapter 13 and additional ECMs per IECC C406.3 Reduced Lighting Power. • External lighting, Internal lighting, and plug loads will be individually monitored, and trended at the Building Automation System (BAS)
Exterior lighting:	<ul style="list-style-type: none"> • Priority to provide safe nighttime lighting environment that meets LEED criteria per BUG methodology. The exterior lighting design will be designed within the thresholds for Uplight and Light Trespass determined by the MLO Lighting Zone
Other equipment:	<ul style="list-style-type: none"> • Elevator shaft serving high-rise floors (more than 70 ft above grade plane) will be pressurized per 524 CMR 909.21 by the shaft pressurization fan (SPF-1)

2.3 Building Systems Commissioning Process

The project is pursuing LEED EA c1 Enhanced Commissioning Option 1 Path 2 and will engage a Commissioning agent in design development phase. Additionally, to track performance of the building, and ensure optimal efficiency, the Proponent is exploring use of a 3rd party monitoring based commissioning (MBCx) platform. The platform allows analyzing data pulled directly from the BAS to automatically detect sub-optimal performance and provide recommended actions to improve performance.

3 Anticipated Energy Loads and Greenhouse Gas Emissions

3.1 Assumptions

Early phase energy modeling was performed for the proposed design, as well as a baseline building prescribed by the Massachusetts Stretch Energy Code, 780 CMR Chapter 13 amended February 7, 2020. Modeling was performed using the DOE-approved Integrated Environmental Solutions Virtual Environment (IES-VE) software, version 2019. Energy modeling outcomes for both the baseline model and proposed design are subject to change as the architectural and mechanical design and input assumptions and schedules are refined in the subsequent design phases. Additionally, energy modeling is not exact and is used to compare relative performance between alternatives rather than predicting precise energy consumption, cost, and GHG emissions.

A summary of energy model inputs and more detailed results are provided in Appendix C.

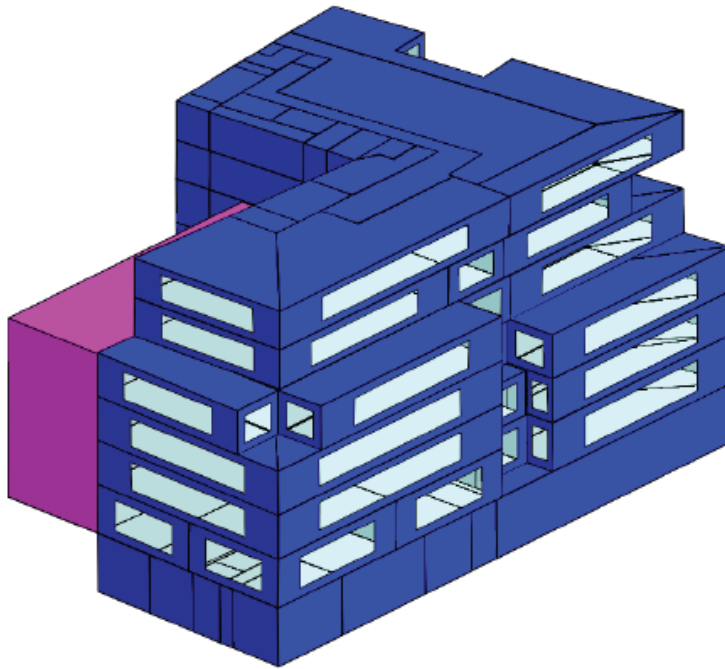


Figure 4. Image of the multizone whole-building energy model in IES-VE software

3.2 Annual Projected Energy Consumption and GHG Emissions

Preliminary energy modelling was completed to determine the proposed design performance against the Stretch Energy Code, 780 CMR, Ninth Edition, Chapter 13: Energy Efficiency Amendments as of 8/7/2020 . In accordance with the requirements, the baseline building incorporates the following three (3) energy conservation measures (ECMs):

1. More efficient HVAC performance in accordance with section C406.2
2. Reduced lighting power density system in accordance with section C406.3
3. Enhanced lighting controls in accordance with section C406.4

The energy model results for annual energy use intensity (EUI) and emissions comparing the baseline and proposed design (BOD) are summarized below.

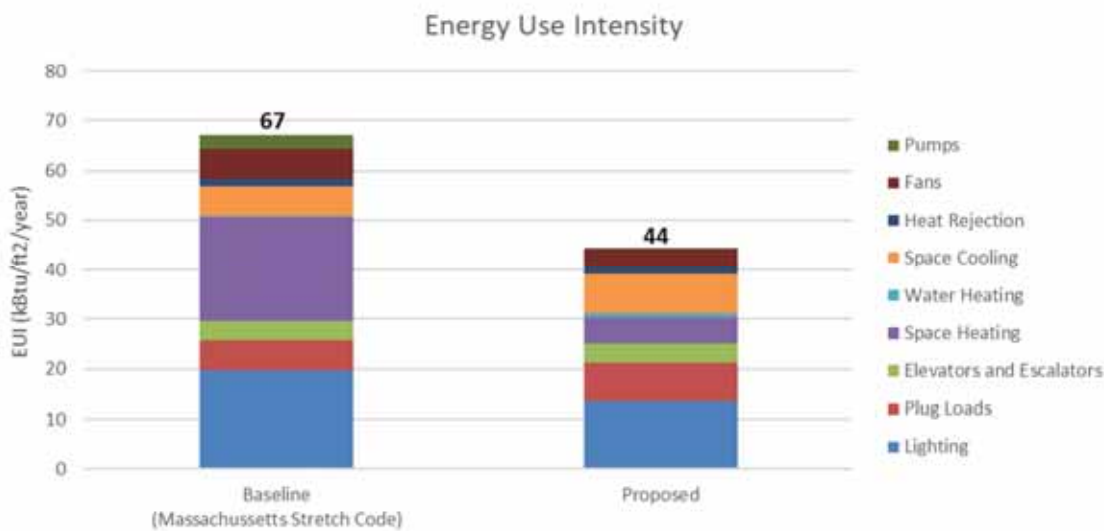


Figure 5. Energy Use Intensity (kBTU/sf/year) of Stretch code baseline and proposed design.

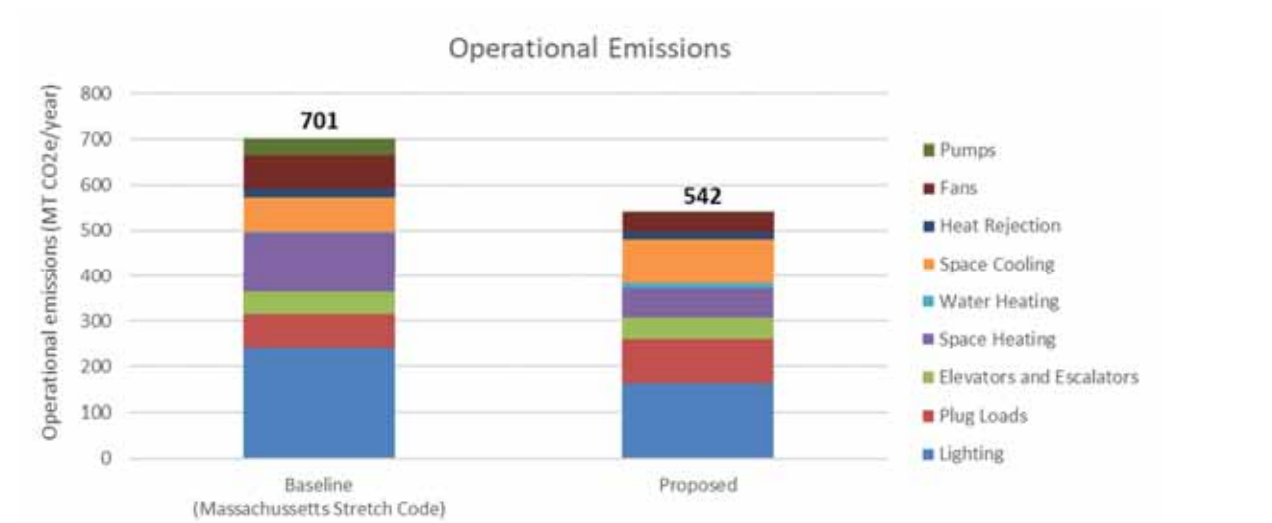


Figure 6. GHG emissions of Stretch energy code baseline and proposed design .

In comparison to the Stretch Energy Code baseline, the proposed design achieves a 34% reduction in energy and a 23% reduction in operational GHG emissions using the current electricity emissions factor. The 34% energy reduction far exceeds the minimum Stretch Energy Code requirement for a 10% reduction.

Table 13. Energy model energy and emissions summary

	Baseline		Proposed	
	Energy (MWh)	% of total	Energy (MWh)	% of total
Space Heating	730	31%	182	12%
Space Cooling	210	9%	281	18%
Heat Rejection	54	2%	44	3%
Pumps & Aux	101	4%	3	0%
Ventilation	210	9%	123	8%
Domestic HW	6	0%	32	2%
Int. Lighting	644	29%	437	28%
Ext. Lighting	42	2%	28	2%
Misc. Equipment	345	15%	407	26%
	\$US, kBTU, kBtu/SF		\$US, kBTU, kBtu/SF	% reduction from baseline
Total energy cost (\$ US)	\$231,786		\$191,377	17%
Total energy use (kBtu)	7,991,014		5,243,514	34%
Site EUI (kBtu/SF)	67		44	34%
	MWH	% total energy	MWH	% total energy
On-site renewable energy (MWh)	0	0	0	0
Off-site renewable energy (MWh)	0	0	0	0
	Metric tons CO ₂ [/SF]		Metric tons CO ₂ [/SF]	%reduction from baseline
GHG emissions (mtCO ₂ e)	701		542	23%
GHG emissions (mtCO ₂ e/SF)	0.0059		0.0046	23%

The improvement of the proposed design over the Stretch Code baseline is derived from significant heating and cooling energy savings. These savings are a result of the highly efficient, all-electric VRF heat pump system, the energy recovery wheel (up to 80% efficient), and the central DOAS system designed for demand control ventilation.

The proposed building design is proposed without natural gas consumption for space heating and domestic hot water. A comparable proposed building with natural gas condensing boilers is estimated to use 1,403 MMBtu/year at a cost of \$17,775.

4 Building Energy Performance Measures

4.1 Overview

The table below summarizes the ways in which building energy performance has been integrated throughout aspects of the project’s planning and design, engineering, and commissioning.

Table 14. Energy performance measures incorporated throughout design

Land uses:	<ul style="list-style-type: none"> • Adjacency to bicycle paths which connect to the existing Cambridge bicycle network, including 14 short-term and 20 long-term bicycle parking spaces meeting both City of Cambridge and LEED requirements. • Surrounding mixed use density including academic, commercial, and residential space (see LEED LT c3 Surrounding Density and Diverse Uses credit narrative) • Walking distance of public transit options (see LEED LT c4 Access to quality transit credit narrative) • Reduction in impervious surfaces from the existing condition
Building orientation and massing:	<ul style="list-style-type: none"> • The building massing and orientation is driven primarily by existing conditions. The project is located on an urban infill site and will preserve a portion of the existing building due to its historical importance to the site. • Regularly occupied spaces and convening spaces have been primarily programmed at the building perimeter for maximum daylighting and quality views for occupants. • The façade window-to-wall ratio is 35% overall.
Envelope systems:	<ul style="list-style-type: none"> • Triple glazing, and high performance window-wall frames for enhanced thermal performance and thermal comfort of occupants. • Opaque wall is highly insulated, all insulation is provided as continuous insulation outside of the vapor barrier. • Facade connection points are optimized and thermally broken • Concept Phase façade analysis identified sensitivities and drivers of energy performance through different design options. • Building envelope commissioning to be completed.
Mechanical systems:	<ul style="list-style-type: none"> • High-efficiency DOAS system with demand-controlled ventilation. • High-efficiency energy recovery system on exhaust air to minimize heating and cooling energy consumption.

Table 8 (continued)

Renewable energy systems:	<ul style="list-style-type: none"> • Due to rooftop equipment and available square footage, on-site PV will not be pursued. • The proponent will look into procuring off-site renewable energy as an option to further reduce GHG emissions.
District-wide energy systems:	<ul style="list-style-type: none"> • Not Applicable

4.2 Integrative Design Process

A series of two (2) sustainability focused workshops were held in schematic design phase, to collectively refine and review the analysis to support the sustainability and resilience goals and priorities initially defined at project inception to support a healthy, low carbon building design. Arup has worked collaboratively with Trinity Property Management and Bruner/Cott to progress and provide analysis on a range of sustainability strategies so informed decisions could be made.

Through these workshops, the sustainability goals and priorities of project were defined and refined. Per the sustainability workshops, the following goals and stretch goals have been established:

- LEED Core & Shell Development (LEED-CS) v4 GOLD certification
- Fitwel Multi-Tenant Base Building certification 1-Star to certify the health and wellness strategies for the project focused on indoor air quality material health, acoustics, stress management, and active design.
- WELL Building Standard-ready for future tenants

4.3 Solar-Ready Roof Assessment

A solar PV system is not incorporated in the proposed project design due to highly limited square footage available on the roof due to base building and future-tenant mechanical systems (see roof plan below). The Project is reviewing compliance with the recently passed Cambridge Green Roof Ordinance by studying options for vegetated green roof.



Details related to the project’s roof area are summarized in the table below.

Table 15. Solar-ready roof details

Total Roof Area:	13,492 ft ² total roof area
Modeled Roof Area for PV array:	N/A
Structural support:	In CD, team will explore for the Roof to be rated for between 10 – 40 psf with consideration for future PV installations
Electrical infrastructure:	Conduit and interconnection breakers to be provided in main electrical switchgear.
Capacity of solar array:	N/A
Financial incentives:	Federal Tax Incentive. The SMART program is available but requires the Owner does not retain the RECs so the GHG reduction would not be claimed by the building.

5 Net Zero Scenario Transition

The table below summarizes the technical framework by which the proposed project can be transitioned to net zero greenhouse gas emissions in the future.

Table 16. Details for net-zero scenario transition

	Net zero condition	Transition process
Building envelope:	The proposed design incorporates a high-performance façade that exceeds prescriptive code compliance to minimize thermal loads and reduce the demands for heating and cooling systems. A 35% window to wall ratio, shading fins, triple glazing, and high performance window-wall frames contribute to the high-performance enclosure.	The building is being designed with a high-performance envelope that will be maintained throughout its useful life. It is not anticipated that the building envelope will play a further role in transitioning to Net Zero.
HVAC systems:	The project has focused on demand reduction and as demonstrated above is a highly energy efficient building design, exceeding the new Stretch Energy Code by 24% (i.e. 34% total energy reduction). Building cooling and heating will be provided by an all-electric VRF heat pump system.	HVAC systems have been planned to be all electric. No further transition is required and GHG emission will decline as the MA electricity grid continues to decarbonize.
Kitchen appliances:	All electric kitchens, including electric stoves, for all restaurant and venue spaces.	The proposed design of the building includes gas cooking equipment. To transition to net zero the kitchen for restaurant and venue spaces will install all-electric cooking and process equipment.
Domestic hot water:	Domestic hot water (DHW) will be generated by storage type heat pump water heaters.	DHW systems have been planned to be all electric. No further transition is required and GHG emission will decline as the MA electricity grid continues to decarbonize.
Lighting:	High-efficiency lighting with occupant controls. Lighting will utilize LED and low lighting power densities by space type.	It is not anticipated that significant additional energy savings will be realized through lighting.

Renewable energy systems:	Off-site renewable energy procurement.	<p>Trinity will assess off-site renewable energy procurement to transition to Net Zero earlier than the MA electricity grid. Most importantly, the building has already included all-electric heating and domestic hot water systems, significantly reducing on-site combustion.</p> <p>Without significant available square footage on the site or roof, on-site solar PV not significantly contribute to reducing energy and emissions. As such, the project will rely on off-site renewable energy to achieve Net Zero.</p>
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Appendix A

Building Envelope Commissioning Plan

A1 Building Envelope Commissioning

The BECx process is summarized below. The components to be tested and the corresponding test criteria include:

- Waterproofing of below-grade construction including foundations, basements, and slab-on-grade that functions as part of the exterior enclosure system.
- Superstructure floor and roof construction that functions as part of the exterior enclosure system.
- Exterior enclosure construction, above grade, including exterior opaque walls, windows, and doors including sheathing, framing, and insulation, and interior finish materials attached to the exterior wall.
- Roofing, including roofing system, roofing insulation, and skylights, hatches, and other roof openings.

A CxA will be engaged in design development phase for a scope of work that meets LEED v4 EAc1 Enhanced Commissioning requirements.

Table 17. Envelope components and BECx test criteria

Component	Test Criteria
Fenestration & Curtain Wall	Any significant leakage identified will be assessed to determine if a specific cause can be identified and addressed to prevent during full-scale installation.
	Maximum air leakage of 0.10 cfm/ft at an air pressure differential of 6.24 psf.
	No uncontrolled water leakage when tested under a pressure difference of 8.0 lbf/sq. ft.
Air Barrier Assemblies	No major air leaks. A major leak is defined as air and smoke are visible and easily detectable by hand within one inch of the leak location(s). Pass/fail criteria shall be no bubbles observed in the leak detection liquid at 1.57 psf.
Sealant	Sealant pull testing shall be performed on sealant joints installed through the building enclosure. Pass/fail criteria shall require all sealants fail cohesively within themselves at or above the minimum manufacturer’s anticipated elongation percentage.
Dynamic Water	575 Pa (12.0 psf). Failure Criteria will need to be determined prior to testing.
Dynamic Water	Water infiltration
Whole Building Performance	LEED Homes Mid Rise Testing

Appendix B

HVAC Systems Commissioning Plan

B1 HVAC Systems Commissioning Plan

The HVAC commissioning process will cover the following components and phases, with all pre-functional testing, functional testing, and reporting to be carried out by a dedicated commissioning agent (CxA).

A CxA will be engaged in design development phase for a scope of work that meets LEED v4 EAc1 Enhanced Commissioning requirements.

Table 18. Building systems commissioning scope of work

Component / Phase	Scope
Recirculating air handling units	<ul style="list-style-type: none"> Chilled water system Controls Associated supply, transfer, return and exhaust fans Terminal units
100% outside air and exhaust air handling units	<ul style="list-style-type: none"> Chilled water system Steam system Associated supply and exhaust fan systems Supply and exhaust terminal units Controls
Supply and exhaust fans	<ul style="list-style-type: none"> Controls Terminal equipment
Terminal units	<ul style="list-style-type: none"> Constant volume and VAV boxes w/and w/o reheat coils (supply and exhaust) Laboratory supply and exhaust flow controls Fan coil units (FCU, FCW, FCH, FCA) Radiation (FTR) Chilled Beams Unit heaters (UH, CUH, RR, PR) In duct heating coils (RHC) Return air systems Heat Exchanger and Pumps (HW)
Chilled water systems	<ul style="list-style-type: none"> Chilled water Chilled Beam active and passive systems Chilled Beam water/pumps Distribution Equipment (AHU, AC, FCU, FCW, FCH, FCA)

Hot water systems	<ul style="list-style-type: none"> • Lab heating • Radiation heating • Heat exchangers • Pumps, AD, ET • VFD • Distribution Equipment (UH, CUH, RR, PR, RHC)
Fuel oil system	<ul style="list-style-type: none"> • Emergency generator fuel oil day tank transfer systems. • Storage tank and FOP 1&2 pumping transfer systems
Control systems	<ul style="list-style-type: none"> • Building automation system (BAS) • Fume hood control & laboratory control • HVAC and Exhaust systems • Atrium smoke management • Pneumatic air system • AHU and conference room CO2 sensing and control • Energy meters • Spectroscopy complete lab control sequences
Testing and balancing (TAB) phase	<ul style="list-style-type: none"> • TAB water-side • TAB air-side • TAB equipment and systems • TAB electrical

Appendix C

Energy Model Detailed Assumptions and Results

Input	
Calculation	

Space Conditioning & Ventilation

Trolley House
276639-00

Zone Types												
Revit Spaces	BOD Space Type Name	IES Template Name	Conditioned (Y/N)	Thermostat Schedule	Heating Setback (°F)	Heating Setpoint (°F)	Cooling Setpoint (°F)	Cooling Setback (°F)	Max Relative Humidity (%)	DHW Demand (gal/person/hour)	Occupant-Based Ventilation (cfm/person)	Area-Based Ventilation (cfm/ft²)
Venue	Auditorium seating area	Audience / Seating area - Auditorium	Y	Occupied, 12pm-12am	50	50	75	80	50	0	5	0.06
Flex Space	Conference/meeting	Conference/Meeting/Multipurpose	Y	Occupied, M-F 6am-6pm	65	70	75	80	50	0	5	0.06
Office - Tenant	Office Space	Office - Open plan	Y	Occupied, M-F 6am-6pm	65	70	75	80	50	0	5	0.06
Lobby Venue Lobby	Lobbies	Lobby	Y	Occupied, M-F 6am-6pm	65	70	75	80	50	0	7.5	0.06
Retail -Tenant	Sales (Retail)	Retail - Sales area	Y	Occupied, M-F 6am-6pm	65	70	75	80	50	0	7.5	0.06
Restaurant - Tenant	Sales (Retail)	Dining area	Y	Occupied, 12pm-12am	65	70	75	80	50	0	7.5	0.06
Stair Corridor Vestibule	Circulation Space	Corridor / Transition	Y	Unoccupied, continuous	65	70	75	80	50	0	ASHRAE 62.1	
Trash Custodial BOH Bike	Circulation Space	Storage	Y	Unoccupied, continuous	65	70	75	80	-	0	ASHRAE 62.2	
Restroom/WC Shower	Bathrooms	Restrooms	Y	Unoccupied, continuous	60	68	78	85	-	2	ASHRAE 62.1	
Kitchen	Kitchen	Food preparation	Y	Occupied, 12pm-12am	65	70	80	85	-	1	ASHRAE 62.1	
IT MEP	Mechanical & Electrical Rooms	Electrical / Mechanical	Y	Unoccupied, continuous	45	50	85	90	-	0	ASHRAE 62.1	
Elevator control	Elevator Machine Room	Elevators - Equipment	Y	Unoccupied, continuous	45	50	85	90	-	0	ASHRAE 62.1	

Internal Gains

Zone Types									
Template Name	Occupancy				Process Equipment	Lighting Power Density (Baseline/Reference)			Infiltration
	Peak Density <i>(people/1000 ft²)</i>	Peak Density <i>(ft²/person)</i>	Sensible Gain <i>(Btu/h/person)</i>	Latent Gain <i>(Btu/h/person)</i>	Equipment Power Density <i>(W/ft²)</i>	Lighting Power Density (Baseline/Reference) <i>(W/ft²)</i>	Lighting Power Density (Baseline/Reference) <i>(W/ft²)</i>	Lighting Power Density (Proposed/Design) <i>(W/ft²)</i>	Infiltration <i>(cfm/ft² facade)</i>
Audience / Seating area - Auditorium	-	500 people	305	545	0.5	0.567	0.79	0.9	0.043
Conference/Meeting/Multipurpose	50	20	250	200	0.75	1.107	1.23	1.2	0.043
Office - Open plan	-	100	250	200	0.75	0.882	0.98	1.1	0.043
Lobby	40	25	250	200	0.5	1.8	2	1.3	0.043
Retail - Sales area	-	60	275	275	0.75	1.296 + additional lighting allowances per 'Calcs' tab	1.68	1.7	0.043
Dining Area	-	12	275	275	0.75	0.585	0.65	1.7	0.043
Corridor / Transition	0	-	-	-	TBD - assumed 0.2 for DD	0.594	0.66	0.9	0.043
Storage	0	-	-	-	TBD - assumed 0.2 for DD	0.567	0.63	0.9	0.043
Restrooms	0	-	-	-	TBD - assumed 0.2 for DD	0.882	0.98	0.9	0.043
Food preparation	-	200	-	-	TBD - assumed 1.5 for DD	1.089	0.99	0.99	0.043
Electrical / Mechanical	0	-	-	-	TBD - assumed 1.0 for DD	0.378	0.95	0.95	0.043
Elevators - Equipment	0	-	-	-	TBD - assumed 1.0 for DD	0.378	0.95	0.95	0.043

Input
Calculation
Notes

Envelope

Opaque Envelope			Source / Comments
	Thermal Conductivity	Units	
Exterior Wall			
Metal-Framed Wall	0.064	Btu/hr-ft ² -F (U-Value)	Timber Structure Values from facades consultant 12/21/20 U-value includes thermal bridging
Mass Wall	0.09	Btu/hr-ft ² -F (U-Value)	Assuming Reinforced Concrete Core, Code baseline insulation Values from facades consultant 12/21/20
Stretch Code Baseline Above-Grade Wall (Steel framed)	0.055	Btu/hr-ft ² -F (U-Value)	ASHRAE 90.1-2013
Stretch Code Baseline Below-Grade Wall	0.0297	Btu/hr-ft ² -F (U-Value)	ASHRAE 90.1-2013, C=0.119
Roof			
Roof, insulation entirely above deck	0.032	Btu/hr-ft ² -F (U-Value)	Assuming ASHRAE 90.1-2013 code baseline until more information is provided
Stretch Code Baseline Roof (Insulation entirely above roof deck)	0.032	Btu/hr-ft ² -F (U-Value)	ASHRAE 90.1-2013
		Btu/hr-ft ² -F (U-Value)	
Floor			
Basement floor	0.0155	Btu/hr-ft ² -F (U-Value)	Assuming ASHRAE 90.1-2013 code baseline until more information is provided with U-value correction layer added for ground-contact
Exposed floor	0.057	Btu/hr-ft ² -F (U-Value)	Assuming ASHRAE 90.1-2013 code baseline until more information is provided
Stretch Code Baseline floor (Steel Joist)	0.038	Btu/hr-ft ² -F (U-Value)	ASHRAE 90.1-2013
Stretch Code Baseline exposed floor (unheated slab)	0.02	Btu/hr-ft ² -F (U-Value)	ASHRAE 90.1-2013, F=0.52
Internal Partition			
Example: Steel-Framed Wall	Example: 0.05	Btu/hr-ft ² -F (U-Value)	Not included for SD
		Btu/hr-ft ² -F (U-Value)	
		Btu/hr-ft ² -F (U-Value)	
Internal Floor / Ceiling			
Example: Concrete Floor	Example: 0.05	Btu/hr-ft ² -F (U-Value)	Not included for SD
		Btu/hr-ft ² -F (U-Value)	
		Btu/hr-ft ² -F (U-Value)	

Input
Calculation
Notes

Envelope (Continued)

Glazing							Source / Comments
	Thermal Conductivity	Units	Solar Heat Transmittance	Units	Light Transmittance	Units	
Vertical (Windows)							
DGU Single Lami Assembly (Double glazing option)	0.32	Btu/hr-ft ² -F (U-Value)	0.26	SHGC	57 %		50% glazing SHGC 0.26 from facade consultant, increased to 0.32 medium SHGC for SD comparison. Values from facades consultant 12/21/20 U-value is an estimate of assembly value, not COG
TGU Single Lami Assembly (Triple glazing option)	0.25	Btu/hr-ft ² -F (U-Value)	0.25	SHGC	50 %		30-40% glazing (40 modeled) Values from facades consultant 12/21/20, updated glazing %, VLT, & SHGC on 3/11/21 U-value is an estimate of assembly value, not COG, includes thermal bridging 50.60% VLT (50 modeled)
Stretch Code Baseline (Metal-framing, fixed)	0.42	Btu/hr-ft ² -F (U-Value)	0.4	SHGC	44 %		30% glazing, ASHRAE 90.1-2013, VLT = 1.1*SHGC
Horizontal (Skylights)							
Example: Typical DGU	Example: 0.05	Btu/hr-ft ² -F (U-Value)	Example: 0.05	SHGC	Example: 0.05	%	None Specified
		Btu/hr-ft ² -F (U-Value)		SHGC		%	
		Btu/hr-ft ² -F (U-Value)		SHGC		%	

Input
Calculation
Notes

Detailed HVAC Information

Trolley House
276639-00

		Units	Stretch Code Baseline - VAV with Reheat	Option 2 - DOAS & VRF	Source/Comments
HVAC Airside					
	System Type		07 Vav with reheat, system 03 PSZ-AC used for differing schedules	DOAS (DX Cooling, electric preheat) with VRF	BOD Draft 12/15/20
	Total Cooling Capacity	kBtu/h			
	Total Heating Capacity	kBtu/h			
	Supply Airflow	cfm			BOD Draft 12/15/20
	Outdoor Airflow	cfm			BOD Draft 12/15/20
	Demand Controlled Ventilation	(Y/N)		Y on DOAS-1, N on rest	Per CMH email on 4/14/21
	Economizer High Limit Shutoff	(°F)	75	75	Proposed = ASHRAE 90.1 2013 Baseline
	Supply Air Temperature Reset	(°F)			
	Energy Recovery	(Y/N)	N	Y	BOD Draft 12/15/20
	Type			Total energy recovery wheel	BOD Draft 12/15/20
	Energy Recovery Effectiveness	%		72	Baseline: ASHRAE 90.1-2013 Proposed: Estimate for SD
	Supply fan power	kW			
	Return or relief fan power	kW			
	Exhaust fan power	kW			
	Pressure Drop Adjustments				
	System Minimum Turndown	%			

Input
Calculation
Notes

Detailed HVAC Information

		Stretch Code Baseline	Option 2 - VRF	
Cooling System Parameters				Source/Comments
	Cooling Type	CHW	VRF - all-electric	BOD Draft 12/15/20
Number and type of chillers (and capacity per chiller if more than one type or size of chiller)		2 electric water-cooled chillers	12 outdoor units	Baseline: 300<x<600 2 water-cooled screw chillers sized equally
Purchased chilled water rate (cost per unit energy)				
Total chiller capacity	kBtu/h	5590	240 ton	BOD Draft 12/15/20
Chiller efficiency - full load		COP 7.44		Proposed: SD estimate Baseline: ASHRAE 90.1-2013 150<x<300 tons assumption for now + increased by 10%
Chiller efficiency - part load		COP 8.58		
Chilled water (CHW) supply temp	(°F)	44		
CHW ΔT	(°F)	12		
CHW supply temp reset parameters				
CHW loop configuration				
Number of primary or District Energy System (DES) plant CHW pumps		1		BOD Draft 12/15/20
Primary or DES plant CHW pump power	kW			BOD Draft 12/15/20
Primary or DES plant CHW pump flow	gpm			BOD Draft 12/15/20
Primary or DES plant CHW pump power	W/gpm	22		BOD Draft 12/15/21
Primary or DES plant CHW pump control		Constant		BOD Draft 12/15/21
Number of secondary or building booster CHW pumps		1		BOD Draft 12/15/22
Secondary or building booster CHW pump power	kW			BOD Draft 12/15/23
Secondary or building booster CHW pump flow	gpm			BOD Draft 12/15/24
Secondary or building booster CHW pump power	W/gpm	22		
Secondary or building booster CHW pump control		VFD		BOD Draft 12/15/25
Water-side economizer				
Water-side energy recovery				
Distribution Heat Loss (if applicable)				

Heat Rejection Equipment				Source/Comments
Number of cooling towers or fluid coolers			Axial fan open circuit cooling tower	
Cooling tower fan power	kW			
Cooling tower fan control			Variable speed	
Condenser water (CW) leaving temp	(°F)			
CW ΔT	(°F)			
Performance	gpm/hp	40.2		
CW loop temp reset parameters				
Number of CW pumps				
CW pump power	W/gpm	19		
CW pump flow	gpm			
CW pump control				

Input
Calculation
Notes

Detailed HVAC Information

Heating System Parameters				Source/Comments
Number and type of boilers		2 Nat draft boilers	VRF - all electric	BOD Draft 12/15/20
Purchased heating rate (cost per unit energy)				
Total boiler capacity	kBtu/h			BOD Draft 12/15/20
Boiler efficiency	%	91		ASHRAE 90.12013 Stretch Code Baseline +10%
Hot water or steam (HHW) supply temp	(°F)	180		
HHW ΔT	(°F)	50		
HHW temp reset parameters				
HHW loop configuration				
Number of primary or DES plant HHW pumps				BOD Draft 12/15/20
Primary or DES plant HHW pump power	kW			BOD Draft 12/15/20
Primary or DES plant HHW pump flow	gpm			BOD Draft 12/15/20
Primary or DES plant HHW pump power	W/gpm	19		
Primary or DES plant HHW pump control				BOD Draft 12/15/20
Number of secondary or building booster HHW pumps				BOD Draft 12/15/20
Secondary or building booster HHW pump power	kW			
Secondary or building booster HHW pump flow	gpm			
Secondary or building booster HHW pump power	W/gpm			
Secondary or building booster HHW pump control				
Distribution Heat Loss (if applicable)				

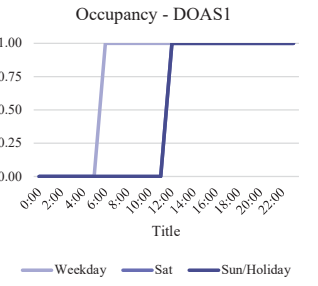
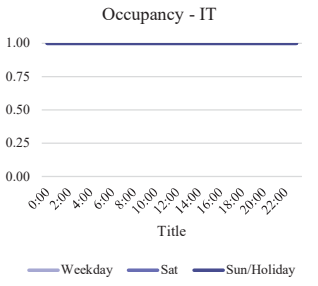
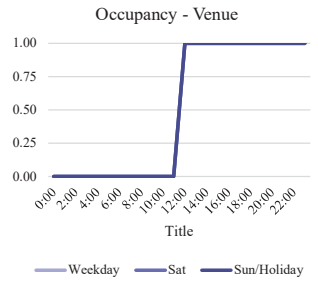
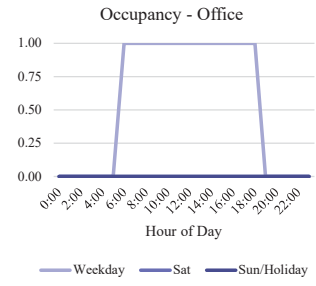
Domestic/Service Water Heating				Source/Comments
System type and fuel		Electric		
Input rating	kBtu/h			
Domestic water (DHW) supply temp	(°F)	140	140	Assumptions for SD
DHW ΔT	(°F)	100	100	
Efficiency	%			
Storage volume	gal			
Storage temperature	(°F)			
Peak hot water demand	gpm			
Condenser heat recovery				
Number of pumps				
Total pump power	kW			
Type of pump				
Distribution Heat Loss (if applicable)				

Input
Calculation
Notes

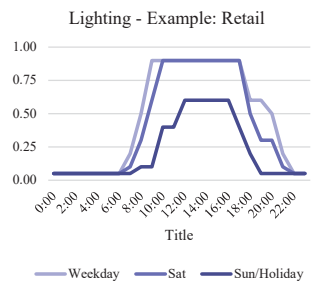
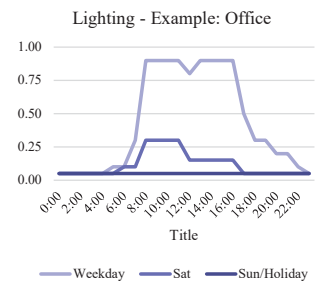
Schedules

Trolley House
276639-00

Occupancy		Source/Comments																									
Schedule	Day of Week	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00		
Occupancy - Office	Office	Weekday	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	Lead Mech Engineer
	Sat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	Sun/Holiday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Occupancy - Venue	Venue	Weekday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Lead Mech Engineer	
	Sat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
	Sun/Holiday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Occupancy - IT	IT	Weekday	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	Lead Mech Engineer	
	Sat	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
	Sun/Holiday	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
Occupancy - DOAS1	DOAS1	Weekday	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			
	Sat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				
	Sun/Holiday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00				

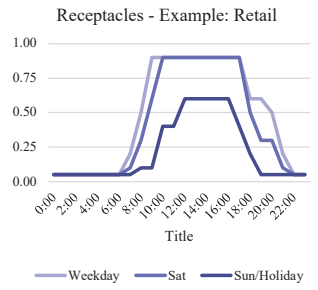
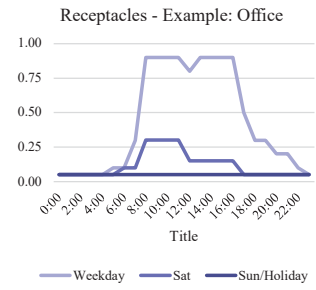


Lighting		Source/Comments																									
Schedule	Day of Week	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00		
Lighting - Example: Office	Example: Office	Weekday	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.90	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.20	0.20	0.10	0.05	Example: ASHRAE 90.1-2007 User's Manual
	Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
	Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
Lighting - Example: Retail	Example: Retail	Weekday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.60	0.60	0.50	0.20	0.05	0.05	Example: ASHRAE 90.1-2007 User's Manual	
	Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.30	0.60	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.10	0.05	0.05			
	Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.40	0.40	0.60	0.60	0.60	0.60	0.60	0.40	0.20	0.05	0.05	0.05	0.05	0.05		



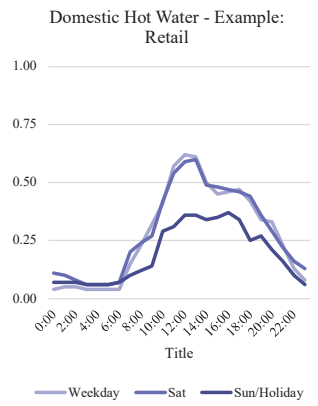
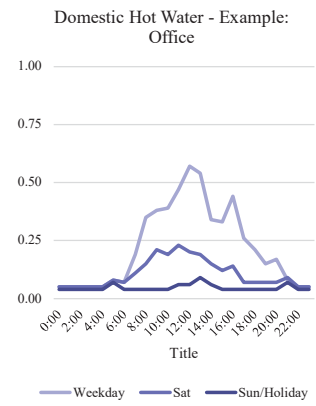
Receptacles Source/Comments

Schedule	Day of Week	0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00																								Source/Comments	
		0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00		
Receptacles - Example: Office	Example: Office	Weekday	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.90	0.90	0.90	0.90	0.80	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.20	0.20	0.10	0.05	Example: ASHRAE 90.1-2007 User's Manual
	Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
	Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
Receptacles - Example: Retail	Example: Retail	Weekday	0.05	0.05	0.05	0.05	0.05	0.05	0.20	0.50	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.60	0.60	0.50	0.20	0.05	0.05	Example: ASHRAE 90.1-2007 User's Manual	
	Sat	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.30	0.60	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.50	0.30	0.30	0.10	0.05	0.05			
	Sun/Holiday	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.10	0.10	0.40	0.40	0.60	0.60	0.60	0.60	0.60	0.40	0.20	0.05	0.05	0.05	0.05	0.05			



Domestic Hot Water Source/Comments

Schedule	Day of Week	0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00																								Source/Comments	
		0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00		
Domestic Hot Water - Example: Office	Example: Office	Weekday	0.05	0.05	0.05	0.05	0.05	0.08	0.07	0.19	0.35	0.38	0.39	0.47	0.57	0.54	0.34	0.33	0.44	0.26	0.21	0.15	0.17	0.08	0.05	0.05	Example: ASHRAE 90.1-2007 User's Manual
	Sat	0.05	0.05	0.05	0.05	0.05	0.08	0.07	0.11	0.15	0.21	0.19	0.23	0.20	0.19	0.15	0.12	0.14	0.07	0.07	0.07	0.07	0.09	0.05	0.05		
	Sun/Holiday	0.04	0.04	0.04	0.04	0.04	0.07	0.04	0.04	0.04	0.04	0.04	0.06	0.06	0.09	0.06	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.07	0.04	0.04	
Domestic Hot Water - Example: Retail	Example: Retail	Weekday	0.04	0.05	0.05	0.04	0.04	0.04	0.04	0.15	0.23	0.32	0.41	0.57	0.62	0.61	0.50	0.45	0.46	0.47	0.42	0.34	0.33	0.23	0.13	0.08	Example: ASHRAE 90.1-2007 User's Manual
	Sat	0.11	0.10	0.08	0.06	0.06	0.06	0.07	0.20	0.24	0.27	0.42	0.54	0.59	0.60	0.49	0.48	0.47	0.46	0.44	0.36	0.29	0.22	0.16	0.13		
	Sun/Holiday	0.07	0.07	0.07	0.06	0.06	0.06	0.07	0.10	0.12	0.14	0.29	0.31	0.36	0.36	0.34	0.35	0.37	0.34	0.25	0.27	0.21	0.16	0.10	0.06		



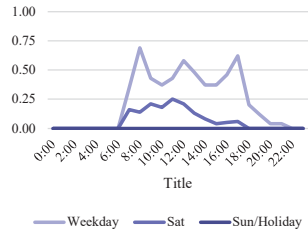
Process Loads

Source/Comments

Schedule	Day of Week	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
		Process Loads - Example: Elevator	Example: Elevator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.69	0.43	0.37	0.43	0.58	0.48	0.37	0.37	0.46	0.62	0.20	0.12	0.04	0.04
	Sat	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.14	0.21	0.18	0.25	0.21	0.13	0.08	0.04	0.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00
	Sun/Holiday	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Example: ASHRAE 90.1-2007 User's Manual

Process Loads - Example: Elevator



Results Baseline

Monthly Energy Use (kBtu)														
	Pumps - Meter 1 (kBtu/h)	Exhaust Fans - Meter 1 (kBtu/h)	Interior Central Fans - Meter 1 (kBtu/h)	Heat Rejection - Meter 1 (kBtu/h)	Space Cooling - Electricity: Meter 1 (kBtu/h)	Service Water Heating - DHW Electricity: Meter 1 (kBtu/h)	Service Water Heating - Electricity: Meter 1 (kBtu/h)	Service Water Heating - Natural Gas: Meter 1 (kBtu/h)	Space Heating - Electricity: Meter 1 (kBtu/h)	Space Heating - Natural Gas: Meter 1 (kBtu/h)	Elevators & Escalators - Meter 1 (kBtu/h)	Receptacle Equipment - Electricity: Meter 1 (kBtu/h)	Exterior Lighting - Meter 1 (kBtu/h)	Interior Lighting - Meter 1 (kBtu/h)
January	33,147	-	55,794	13,698	10,587	-	1,674	-	-	425,936	39,477	59,911	14,311	185,453
February	28,174	-	50,944	11,470	8,882	-	1,521	-	-	328,850	35,656	54,336	11,734	167,752
March	27,626	-	56,704	10,817	9,032	-	1,692	-	-	290,689	39,477	60,349	12,166	185,710
April	23,661	-	54,678	9,697	19,753	-	1,714	-	-	168,169	38,203	60,803	10,853	185,658
May	25,205	-	60,689	13,995	67,704	-	1,692	-	-	112,203	39,477	60,349	10,368	186,218
June	29,386	-	64,560	20,095	120,399	-	1,659	-	-	126,678	38,203	59,153	9,369	181,456
July	35,211	-	72,905	27,136	172,121	-	1,728	-	-	136,558	39,477	61,561	9,924	189,148
August	32,280	-	70,837	23,941	145,407	-	1,692	-	-	123,133	39,477	60,349	10,405	185,710
September	26,664	-	64,986	17,194	95,734	-	1,659	-	-	108,980	38,203	59,153	11,049	181,963
October	22,768	-	60,342	10,587	39,524	-	1,728	-	-	108,261	39,477	61,561	12,574	189,148
November	27,509	-	50,259	11,379	14,807	-	1,514	-	-	207,503	38,203	54,639	13,948	171,372
December	32,047	-	55,431	13,406	13,660	-	1,728	-	-	352,305	39,477	61,561	14,947	189,148
TOTALS	343,678	-	718,130	183,414	717,611	-	20,001	-	-	2,489,264	464,806	713,724	141,649	2,198,737

Results Proposed

Monthly Energy Use (kBtu)																
	Interior Lighting - Meter 1 (kBtu/h)	Exterior Lighting - Meter 1 (kBtu/h)	Receptacle Equipment - Electricity: Meter 1 (kBtu/h)	Elevators & Escalators - Meter 1 (kBtu/h)	Space Heating - Natural Gas: Meter 1 (kBtu/h)	Space Heating - Electricity: Meter 1 (kBtu/h)	Space Heating - DHW Electricity: Meter 1 (kBtu/h)	Service Water Heating - Natural Gas: Meter 1 (kBtu/h)	Service Water Heating - Electricity: Meter 1 (kBtu/h)	Service Water Heating - DHW Electricity: Meter 1 (kBtu/h)	Space Cooling - Electricity: Meter 1 (kBtu/h)	Heat Rejection - Meter 1 (kBtu/h)	Interior Fans - Meter 1 (kBtu/h)	Interior Local Fans - Meter 1 (kBtu/h)	Exhaust Fans - Meter 1 (kBtu/h)	Pumps - Meter 1 (kBtu/h)
January	124,993	9,921	77,554	39,477	-	150,585	-	-	-	9,079	20,552	16,267	27,189	10,504	1,633	1,485
February	113,418	8,221	70,290	35,656	-	118,711	-	-	-	8,260	26,932	12,914	24,509	9,059	1,477	1,345
March	126,058	8,418	78,010	39,477	-	97,441	-	-	-	9,222	41,090	13,454	26,754	8,796	1,633	1,432
April	126,751	7,334	78,492	38,203	-	37,271	-	-	-	9,023	62,312	11,540	26,112	7,956	1,685	1,340
May	126,058	6,923	78,010	39,477	-	10,158	-	-	-	9,222	101,122	10,770	22,847	8,238	1,633	603
June	123,381	6,192	76,476	38,203	-	3,462	-	-	-	8,893	128,380	11,760	22,313	8,868	1,623	447
July	128,363	6,679	79,569	39,477	-	2,010	-	-	-	9,209	156,372	13,437	23,860	9,918	1,696	652
August	126,058	7,163	78,010	39,477	-	2,755	-	-	-	9,222	140,619	13,393	23,057	9,482	1,633	589
September	123,381	7,734	76,476	38,203	-	5,128	-	-	-	8,893	117,119	11,631	21,427	8,634	1,623	252
October	128,363	8,852	79,569	39,477	-	14,751	-	-	-	9,209	87,837	10,305	23,510	8,238	1,696	667
November	114,337	9,480	70,887	38,203	-	63,650	-	-	-	8,646	43,037	12,705	24,277	7,559	1,434	1,291
December	128,363	10,181	79,569	39,477	-	114,518	-	-	-	9,209	32,277	13,576	27,306	9,819	1,696	1,449
TOTALS	1,489,523	97,099	922,914	464,806	-	620,440	-	-	-	108,087	957,650	151,752	293,161	107,070	19,460	11,552

Water Service Infrastructure Narrative

Report detailing the anticipated impact of the project on the city's water delivery infrastructure and supply. The requirements are set forth in Section 19.24 Paragraph {6}.

Water Service Infrastructure Narrative. The application shall include a report by the applicant detailing the anticipated impact of the project on the city's water delivery infrastructure and supply. It shall indicate the likely improvements to infrastructure necessary to accommodate the identified impacts. Where such determinations cannot be made at the time of application, the report shall indicate what investigations must be undertaken by the applicant to make such determination, their anticipated costs, and the schedule for their completion. The applicant shall provide certification that this report has been submitted to the Water Department.

Domestic water for the proposed building will be provided by a single new connection to the existing 24-inch municipal water system in Mt. Auburn Street. Refer to the memorandum provided by the plumbing engineer for anticipated domestic water demand for the building. Fire water service for the proposed building will be provided by a single connection to the existing 24-inch municipal water system in Mt. Auburn Street.

The following strategies and technologies will be employed in the plumbing design, which aid in water conservation and limiting water demands from the proposed building:

- Low-flow plumbing fixtures in restrooms
- Rainwater re-use to supplement toilet flushing demand.

Based on conversation with the Cambridge Water Department, there are currently no water capacity issues in the vicinity of the project site. Hydrant flow tests will be performed to determine the capacity of the water main in Vassar Street. Should it be determined that there is inadequate pressure and volume available a booster pump will be provided as part of the project to handle the deficiency. It is not anticipated that any improvements to the City owned infrastructure will be required for this project.

Sewer Service Infrastructure Narrative

Report detailing the anticipated impact of the project on the city's sanitary, stormwater, and combined sewer infrastructure. The requirements are set forth in Section 19.24{5}.

Sewer Service Infrastructure Narrative. The application shall include a report by the applicant detailing the anticipated impact of the project on the city's sanitary, stormwater, and combined sewer infrastructure. It shall indicate the adequacy of the preliminary site plan in meeting city, state, and federal requirements or established standards for implementation of best management practices for stormwater management and the likely improvements to infrastructure necessary to accommodate the impacts of the proposed project. Where such determinations cannot be made at the time of application, the report shall indicate what investigations must be undertaken by the applicant to make such determination, their anticipated costs, and the schedule for their completion. The applicant shall provide certification that this report has been submitted to the Department of Public Works.

SANITARY SEWER

Sewer flows from the proposed renovated building will be directed to the existing 8-inch City of Cambridge sewer infrastructure in JFK Street. The proposed project will generate approximately 39,900 gallons per day of wastewater flow. This calculation is based upon Title V flow assumptions. The existing site generates approximately 34,310 gallons per day of wastewater flow. Therefore, it is not anticipated that the project will trigger the Infiltration/Inflow mitigation threshold as it will not be adding more than 15,000 gallons per day of new sewer flow. Sewer Calculations will be forwarded to the DPW for review and approval.

Additionally, the project plans to implement the following strategies and technologies as part of the plumbing design, which will aid in water conservation thereby limiting sanitary sewer flows from the proposed buildings:

- Low-flow plumbing fixtures in bathrooms
- Rainwater re-use to supplement toilet flushing demands

STORMWATER

The project site is currently, and will remain, zero lot line, with building structure all the way to the property lines and therefore the project stormwater system will be contained entirely within the building infrastructure. As such, stormwater mitigation for this project will be provided to the maximum extent practicable and will include green roof installation where feasible and potential collection of rainwater from the building roof to be re-used for toilet flushing within the building. These stormwater management strategies for the proposed building improvements will provide mitigation of stormwater runoff as required by the City of Cambridge standards (25-2 rate deduction and phosphorous removal) to the maximum extent practicable.

The stormwater system from the building (site) will connect to the existing City of Cambridge drainage infrastructure in JFK street.

The project will be required to submit a Stormwater Permit to the Cambridge DPW for approval of all the above discussed

The capacity and condition of drinking water and wastewater infrastructure systems are shown to be adequate, or the steps necessary to bring them up to an acceptable level are identified.

The project sewerage services will connect to the City of Cambridge municipal sanitary sewer system in JFK Street. Refer to the memorandum provided by the plumbing engineer for anticipated sewer flow makeup from the proposed building. Based on discussions with the City of Cambridge DPW, the capacity and condition of the sewer mains in JFK Street are known to be adequate and in good condition.

Storm sewer flows (roof drain connections) from the site will be connected to the municipal storm system located in JFK Street. Stormwater flow rates from the proposed project site will be mitigated to the maximum extent practicable under final conditions as required by the City of Cambridge Stormwater Regulations. Based on discussions with the City of Cambridge DPW, the capacity and condition of the storm sewer mains in JFK Street are known to be adequate and in good condition. In addition, the project will comply with the City of Cambridge Green Roof Ordinance to the maximum extent practicable.

It is not anticipated that upgrades to the existing municipal infrastructure (sewer or storm sewer) will be required. Additionally, the locations of the proposed sewer and storm drain service connections to the municipal systems will continue to be discussed and reviewed with the City of Cambridge DPW as the project moves further into design.