

WALDEN SQUARE APARTMENTS

Cambridge, MA



WinnCompanies



Volume 3: Appendices



PCOA

Architecture
Interiors
+ Planning

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Green Building Requirements

102 Sherman Street Green Building Report – Comments on AHO Review Stage

Status: Pursuant to Section 22.25.1 of the Zoning Ordinance, the Community Development Department (CDD) received the Green Building Report (GBR) for the Special Permit stage of this project (also known as Walden Square Apartments) on 6/14/2021. CDD staff have reviewed the project's GBR and offer the following Determination, Summary of Compliance and Advisory Comments on the project's sustainability.

CDD Determination: The GBR documentation provided by the Applicant sufficiently demonstrates compliance with the Green Building Requirements of Section 22.24 at the AHO review stage of review. A revised submission with additional documentation will be required at the building permit stage.

Project Summary: This project is subject to the City's Green Building Requirements (Section 22.20, Zoning Ordinance). The project is currently meeting the minimum requirements for PHIUS+ Core rating system and pursuing Passive House certification. The Green Building Report for this project is complete and meets Article 22 requirements.

Rating System: PHIUS+ Core Residential (2018)

Summary of Compliance

Green Building Professional Certification

- Greg Smith of PCA Design has been identified as the Green Building Professional for the project. The affidavit states that this professional has reviewed all relevant documents for this project and confirm to the best of his/her 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.
- A copy of the professional's credential from Green Building Rating Program has been provided.

Rating System Checklist, Rating System Narrative and Net Zero Narrative

- The building is targeted to not exceed heating and cooling demands, heating and cooling loads and source energy consumption of the base design.
- The proposed site energy use intensity (EUI) is approximately 17.25 kBtu/sf-yr.
- The energy use reduction is approximately 56% relative to ASHRAE 90.1-2013 Baseline, which exceeds the 10% minimum requirement for Stretch Code.
- Proposed GHG emissions will be 57% reduction from baseline.
- Window to Wall Ratio at 18%.

Advisory Comments:

The City's goal is to promote environmentally sustainable and energy-efficient design and development practices in new construction and the renovation of existing buildings. For example, strategies that are relevant for this project include the rehab of existing buildings and reuse of materials, conservation of natural resources and reduction of toxins in building materials and construction methods, reduction in

energy use in construction and daily operations. To support the City's goal in sustainability, staff recommend the following as we move forward with the next phases:

- Use of non-emitting materials.
- Continue assessment information on embodied carbon.
- It would be helpful (though not required) to share comments provided by Passive House at future stages of design to confirm that the standards are on track to be met.

Staff appreciate the Project team in providing the requested information and would encourage continuing to pursue the highest level of sustainable and energy-efficient design possible as the project moves through design development.

The project will be subject to review prior to receiving Building Permit and Certificate of Occupancy. CDD Staff is available to work with the Applicant through continuing design review and looks forward to receiving updates including projected building performance, Annual Projected Energy Consumption, Greenhouse Gas (GHG) Emissions and information on building materials and resources.



City of Cambridge Community Development Department
344 Broadway
Cambridge, MA 02139

May 14, 2021

Subject: Walden Square Apartments Article 22 Initial Filing Green Building Report

Dear Cambridge Community Development Department:

The Walden Square Apartments project team is excited to share the attached documents, collectively the Article 22 Green Building Report, documenting the currently planned building sustainability features for this highly efficient 100% affordable multifamily development. Currently in schematic design, the project is targeting Passive House certification under the PHIUS+ 2018 Core rating system. Walden Square is designed for resilience and incorporates a number of sustainable features including all-electric heating and cooling systems and a rooftop-mounted solar photovoltaic system.

The following documents contained herein demonstrate that Walden Square Apartments is in compliance with Article 22 preliminary submission requirements:

- Green Building Checklist
- Net Zero Narrative
- Rating System Narrative
- Green Building Professional Affidavit

The project team expects Walden Square to earn full certification as a Passive House under the PHIUS+ Core (PHIUS+ 2018) rating system. The project team will continue to update the WUFI energy modeling as design progresses and the project seeks pre-certification with PHIUS, and will share an updated report with CDD in the forthcoming building permit Article 22 submission.

This project will be MA Stretch Energy Code compliant, following the commercial building requirements at 780 CMR Appendix AA103.2. The project will demonstrate compliance through either the PHIUS certification pathway or the exclusively R-use building exception by following the ERI pathway under AA103.1. As shown in the attached Net Zero Narrative, the project is currently estimated to exceed MA Stretch Energy Code performance requirements by approximately 56%.

As part of the PHIUS requirements, the project will also earn the EPA Indoor airPLUS certification and the ENERGY STAR Multifamily New Construction certifications. The EPA Indoor airPLUS certification program focuses on high quality indoor air and low or no emissions from building materials (low/no VOCs). The project will include MERV 13 filters to maintain indoor air quality. In addition to these certification requirements, this project will follow all Massachusetts Department of Housing and Community Development (DHCD) design requirements. As the building design progresses, the project team will continue to explore opportunities to reduce the environmental impact of the project including exploration of additional on-site solar PV capacity, potential green roof areas, zero VOC indoor finishes, and lower embodied carbon materials.



The resulting building will be an exceptionally high performance structure demonstrating a careful focus on energy and emissions performance and high quality indoor air. The project team looks forward to creating an affordable, resilient, and high-performing building and to sharing future updates on project progress with CDD.

Green Building Project Checklist

Green Building

Project Location: Walden Square Apartments

Applicant

Name: WinnDevelopment Company Limited Partnership

Address: One Washington Mall, Suite Boston, Boston MA 02108

Contact Information

Email Address: mrobayna@winnco.com

Telephone #: 617-532-2185

Project Information (select all that apply):

- New Construction – GFA: 163,099 sf
- 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: _____
- Building Design + Construction (BD+C) – Subcategory: _____
- Residential BD+C – Subcategory: _____
- Interior Design + Construction (ID+C) – Subcategory: _____
- Other: _____
- Passive House – Version: 2018
- 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)



WALDEN SQUARE APARTMENTS

Net Zero Narrative

Cambridge, MA
May 3, 2021



Submitted to
Cambridge Community Development Department
344 Broadway
Cambridge, MA 02139



Prepared by
New Ecology, Inc.
15 Court Square Suite 420
Boston, MA 02108

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Project Profile

Table 1: Development Characteristics	
Lot area (sf)	319,049 sf
Existing land use(s) and current GFA (sf) by use	Parking, GFA = 25,973 sf
Proposed land use(s) and total GFA (sf) by use	Residential, GFA = 163,099 sf
Proposed land use(s) and net new GFA (sf) by use	Residential, GFA = 163,099 sf
Proposed new building height(s) (ft and stories)	80'-0" & 7 stories
Proposed new dwelling units	103
Proposed open space (sf)	111,667 sf
Proposed parking spaces	48
Proposed bicycle parking (long- and short-term spaces)	110 long-term, 10 short-term

Table 2: Green Building Rating System			
Passive House Institute US (PHIUS) or Passivhaus Institut (PHI)			
Rating system & version	PHIUS+ 2018 CORE	Seeking certification?	<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> TBD

Proposed Project Design Characteristics

Table 3: Building Envelope Assembly Descriptions	
Roof	Assembly R-50
Foundation	Assembly R-40 (concrete slab-on-deck,)
Exterior walls	Steel-framed walls: R-14 (3" continuous mineral wool, no cavity insulation) Wood-framed walls: R-28 (2" continuous mineral wool, with cavity insulation)
Windows	Triple-pane windows: U-0.20, SHGC 0.30
Window-to-wall ratio	18%

Table 4: Building Envelope Performance		
	Baseline	Proposed
	U-value	U-value
Window	0.32	0.20
Wall	0.06	Steel-framed – 0.07, Wood-framed – 0.04
Roof	0.026	0.019

As of March 31, 2021, preliminary WUFI modeling is complete. The areas for windows, walls, and roof will be updated as design progresses and once PHIUS pre-certification modeling is complete.

Envelope Commissioning Process

The Project team will test and verify the envelope air barrier and air infiltration rates using bi-directional blower door testing both at construction midpoint and again after construction completion. Two (2) inspections will be performed after framing and air-sealing are complete but before insulation is installed, in order to identify any potential areas of thermal bridging and/or air infiltration. These inspections will be documented with site photos. Once installed, the air barrier will be tested with a bi-directional whole building blower door test conducted to PHIUS+ CORE standards. At the end of construction, the whole building blower door test will be repeated to confirm air-tightness, and 21 units will be blower door tested for air infiltration rates per RESNET sampling protocols. In addition, an inspection using a thermal imaging camera will be conducted to show compliance with thermal bridging and air sealing protocols.

Building Mechanical Systems

Table 5: Building Mechanical Systems Description	
Space heating	VRF air-source heat pump with in-unit fan coils.
Space cooling	VRF air-source heat pump with in-unit fan coils
Heat rejection	See above systems.
Pumps & auxiliary	See above space conditioning and below DHW systems.
Ventilation	Central ERV with air-source heat pump
Domestic hot water	<u>Proposed</u> : Central, gas-fired domestic hot water plant with recirculation loop. <u>Net Zero Scenario</u> : Central, air-source heat pump domestic hot water plant with recirculation loop.
Interior lighting	In-unit lighting will be all LED; common area lighting will be all LED with occupancy sensors
Exterior lighting	All exterior lighting will be LED with outdoor lighting controls.

Mechanical Systems Commissioning Process

The project will retain a licensed commissioning agent (CxA) who will develop a detailed commissioning plan based on the building specifications and systems. The CxA will develop a functional performance test sheet for each system to be commissioned, and will commission the following systems: mechanical systems and equipment including Energy Recovery Ventilation (ERV) systems, central VRF air-source heat pump systems, a sample of apartment fan coils, and all direct digital controls. For lighting systems, all common space lighting control systems including occupancy sensors will be commissioned and sampled at the appropriate rate. For plumbing systems, the domestic hot water heating system, including central boiler plant, storage tanks, circulating pumps, thermostatic mixing valves, and controls will be reviewed for compliance with sequence of operation and control setpoints per project specifications.

Building Energy Performance Measures

Table 6: Building Energy Performance Measures	
Land uses	Housing development promoting walking and bicycling, located close to multiple public transportation modes (bus, subway), close to groceries, schools, daycare, and other necessities, and close to parks. Bicycle storage and parking provided on site.
Building orientation and massing	Primary building axis is optimized as East-West, with all units provided with multiple operable windows to allow passive ventilation.
Envelope systems	Continuous insulation, high performance glazing, and, high SRI roofs.
Mechanical systems	Energy recovery ventilators will be provided for ventilation. VRF distribution system will be designed to minimize energy losses.
Renewable energy systems	A preliminary solar PV layout for a roof-mounted system is complete. The project team will continue to evaluate solar PV layout and capacity potential as design progresses.
District-wide energy systems	N/A

Integrative Design Process

As part of the integrative design process, the developer, architect, and mechanical engineer participated in an early-stage MEP- and envelope-focused Passive House charrette. During the kick-off meeting, the Project Team considered preliminary design concepts and began to define a comprehensive greening strategy that meets City of Cambridge Article 22, Stretch Energy Code, and PHIUS+ 2018 requirements. The Project Team, including builder and PHIUS verifier, will continue to hold integrative design meetings throughout design development to ensure a thoughtful approach to designing and constructing the Project in accordance with its high-performance goals.

Green Building Incentive Program Assistance

The project anticipates incremental project costs associated with certain high-performance systems and design features, including its energy efficient building envelope and electric heating and cooling system. The project will enroll in the MassSave Passive House incentive program to help offset a portion of the project's additional soft and hard costs associated with meeting the Passive House standards. The project team plans to fully certify the building in order to be eligible for the full incentive package offered by MassSave.

Net Zero Scenario Transition

Table 7: Net Zero Scenario Transition		
	Net Zero Condition	Transition Process
Building envelope	The building envelope will be built to PHIUS Passive House standards, making it an ideal structure to achieve Net Zero in the future with on and off-site renewables. The envelope will be well-insulated and have a low level of air infiltration which will be tested and verified at construction.	This system will be a zero (site) emissions system at installation.

HVAC Systems	<p>A VRF system is currently included in the proposed HVAC design for the building.</p> <p>Central energy recovery ventilation will be used to capture energy from the ventilation system and will be installed at construction.</p>	<p>VRF in current design will be a zero emissions system at installation.</p> <p>ERVs in current design will be a zero emissions system at installation.</p>
Domestic Hot Water	<p>A central gas-fired boiler plant will be included at construction. The plant will be located within a rooftop mechanical room sized and designed to accommodate the future space, structural and electrical requirements for an all-electric DHW system.</p> <p>The project is actively considering and modeling a central air-source domestic hot water plant.</p>	<p>At the end of the system lifetime, the project team expects the all-electric DHW system technology, availability, and service capacity to have advanced sufficiently to allow for conversion of this system to all-electric.</p>
Lighting	<p>The project will use LED lighting throughout at construction. The building energy model for this project, will factor in Lighting Power Density as a calculation in overall building energy consumption. Fixtures will be modeled and will be specified in project documents to meet or exceed the energy requirement of the WUFI model.</p>	<p>The building and management team will include updated technology as it is available and will update systems at the end of service life of the lighting systems.</p>
Renewable Energy Systems	<p>The project will be solar-ready at construction.</p>	<p>The project will be solar-ready and will include PV panels as necessary to meet PH requirements at time of construction.</p>
Other Strategies	<p>The project is actively considering and modeling the use of window reveals and glazing tuning to reduce building energy consumption during summer months, while also allowing solar thermal gains during winter months.</p>	

Energy Systems Comparison

The Project team evaluated the greenhouse gas emissions impacts and financial feasibility of two (2) design scenarios, “Proposed” and “NZ Scneario”, for the Walden Square Apartments project. Operational and performance costs were estimated using the results of the preliminary WUFI model conceptual construction pricing, and per-square-foot maintenance cost estimates provided by WinnCompanies.

Assumptions

Table 8 Energy Systems Included/Excluded in Analysis			
	Included in Analysis?		Describe systems analyzed or explain why it was excluded from analysis
	Yes	No	
Solar photovoltaics	X		PV is assumed to be included in design, but will likely be procure through a PPA. Exact amount of PV required to meet needs is to be determined via WUFI model results.
Solar hot water heater		X	In combination with potential PV solar panels, there is not enough space on the roofs to justify both technologies.
Ground-source heat pumps		X	Due to the limited space of the site, GSHP was determined to be cost-prohibitive at this time.
Water-source heat pumps		X	Focus was on the ASHP VRF as the most feasible option.
Air-source heat pumps	X		High-efficiency ASHP VRF
Non-carbon fuel district energy		X	Building energy loads are expected to be too low for district energy system application.
Other non-carbon fuel systems	X		Purchase of carbon offsets would be included for the NZ scenario should the City of Cambridge require them in the future.

Non-Carbon Fuel Scenario

One non-carbon, all-electric scenario was examined. The tables below provide descriptions of each scenario.

Table 9: LCCA Scenario Description by Key Components		
Scenario	Proposed	NZ Scenario
Heating & cooling	VRF ASHP, in-unit FCU	VRF ASHP, in-unit FCU
Ventilation	Central ERV	Central ERV
DHW	Central gas-fired	Central ASHP
Envelope	PH (as described in Table 3)	PH (as described in Table 3)
Window	PH (U-0.20)	PH (U-0.20)
Carbon offsets	No	Yes
Co-gen	No	No

The project team has researched and evaluated a central air-source heat pump system (ASHP) approach for generating domestic hot water (DHW) for the Walden Square project. There is emerging ASHP technology from several manufacturers that will be capable of meeting the DHW requirements for this building in the future, but the equipment has not yet been released and/or installed and proven in this region. Therefore, the DHW system for Walden Square will initially be gas-fired, but it will be designed with provisions such that it can be readily converted to ASHP technology in the future. These provisions

include an adjacent roof space for future ASHP units as well as potential space inside the building for the heat exchanger, storage tanks and pumps that are anticipated for a future ASHP system.

Solar-Ready Roof Assessment

The Project will be designed to be solar ready and will continue evaluating incorporating solar PV, which may be developed by a third party PPA provider. Results from the solar PV assessment presented below will be added to the future pre-certification WUFI model.

Table 10: Solar-Ready Roof Assessment	
Total roof area (sf)	26,172 sf
Unshaded roof area (sf)	7,000 sf
Structural support	Self-ballasted
Electrical infrastructure	(1) Trinergy Plus-60kW (400V) Inverter
Other roof appurtenances	Mechanical pads, stair and elevator overhangs. Designated mechanicals area located toward the North side of the roof structure.
Solar-ready roof area (sf)	5,800 sf
Capacity of solar array	61.2 kW
Financial incentives	TBD
Cost feasibility	TBD

Figure 1: PV Detailed Layout

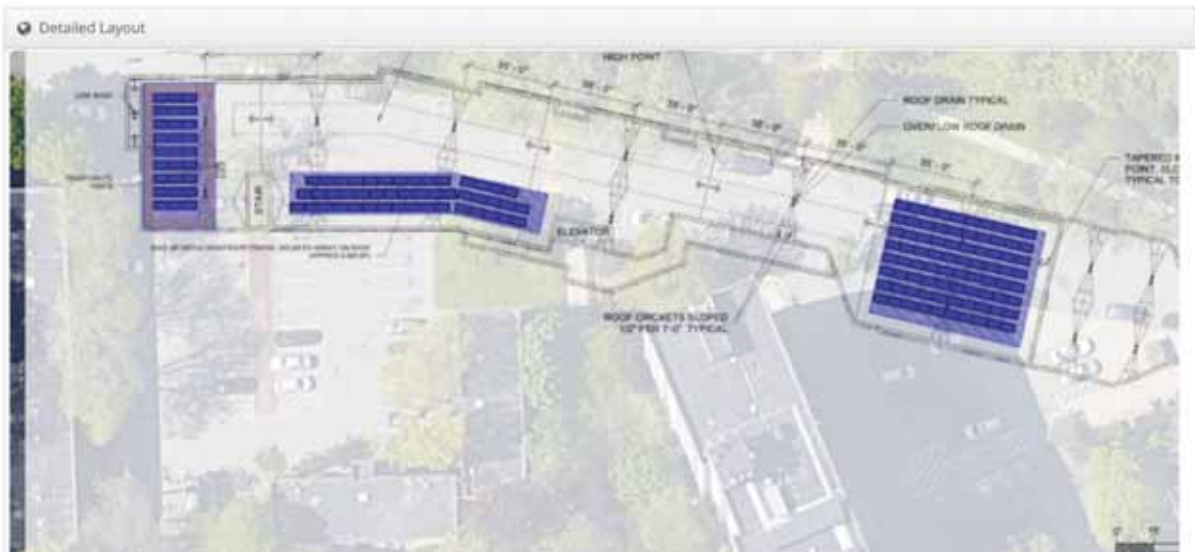


Figure 1 shows the detailed layout generated using the Helioscope PV system planning tool. PV arrays were designed to maximize available solar ready roof spaces.

Results

Preliminary cost estimates for both the proposed design and net zero scenario are presented below.

Table 11: Installation and Maintenance Cost Comparisons				
	Proposed Design		Non-Carbon-Fuel Scenario	
	<i>Installation cost</i>	<i>Maintenance</i>	<i>Installation cost</i>	<i>Maintenance</i>
Space heating	\$990,769.00	\$44.33	\$990,769.00	\$44.33
Space cooling	\$990,769.00	\$19.00	\$990,769.00	\$19.00
Heat rejection	N/A	N/A	N/A	N/A
Pump & auxiliary	\$139,829.00	\$44.33	\$139,829.00	\$44.33
Ventilation	\$1,004,847.00	\$44.33	\$1,004,847.00	\$44.33
Domestic hot water	\$215,122.00	\$35.00	\$650,000.00	\$45.00
(Financial incentives)	(\$309,000.00)	N/A	(\$309,000.00)	N/A
Total building energy system cost	\$3,032,336.00	\$187.00	\$3,467,214.00	\$197.00

Anticipated Energy Loads and GHG Emissions

Petersen Engineering completed preliminary WUFI modeling for the project and will continue to refine the modeling as design development progresses. Final modeling results for Article 22 compliance will be updated in future submissions as the project design progresses.

Assumptions

The project will pursue Passive House certification and utilize WUFI energy modeling to demonstrate energy loads and energy use. The anticipated baseline building (10% better than ASHRAE 90.1-2013) energy use is indicated in the table below. Building heating and cooling loads, hot water heating load, in unit and common space lighting, appliances and plug loads, as well as miscellaneous system loads were included in this preliminary energy model.

Annual Projected Energy Consumption

The below table summarizes the energy use for the baseline, proposed, and net zero scenarios based on preliminary WUFI modeling.

Table 12: Annual Anticipated Baseline and Proposed Building Energy Use					
	Baseline	Proposed		Non-Carbon-Fuel Scenario	
	Energy Use and Cost	Energy Use and Cost	% Reduction from Baseline	Energy Use and Cost	% Reduction from Baseline
Site EUI (kBtu/sf/yr)*	39.51	17.25	56.3%	14.20	64.1%
Source EUI (kBtu/sf/yr)*	62.05	26.61	57.1%	25.55	58.8%

Electricity (kWh)*	1,063,536	441,507	58.5%	535,858	49.6%
Gas (therms)	14,591	7,147	51.0%	0	100%
Total Site Energy Use (kBtu/yr)*	5,085,806	2,220,266	56.3%	1,827,276	64.1%
Total Energy Cost*	\$248,297	\$104,384	58.0%	\$116,281	53.2%

*Site EUI, Source EUI, Electricity, Total Site Energy Use, and Total Energy Cost are net of on-site solar PV energy production.

Table 13: Annual Projected Renewable Generation						
	Baseline		Proposed		Non-Carbon-Fuel Scenario	
	Energy Generation	% Total Energy	Energy Generation	% Total Energy	Energy Generation	% Total Energy
On-site Renewable Energy Generation (kWh)	0	0%	79,440	10.9%	79,440	12.9%
Off-site Renewable Energy Generation and Carbon Offsets (site kWh and/or therms)	1,063,536 kWh, 14,591 therms	100%	441,507 kWh, 7,147 therms	89.1%	535,858 kWh	87.1%

Annual Projected GHG Emissions

The annual expected CO₂ emissions for the proposed building based on the preliminary WUFI energy model are provided in the table below.

Table 14: Annual CO ₂ and CO ₂ e Emissions					
	Baseline	Proposed		Non-Carbon-Fuel Scenario	
	Emissions	Emissions	% Reduction from Baseline	Emissions	% Reduction from Baseline
Total GHG Emissions (mtCO ₂ and CO ₂ e/yr)	394.92	169.73	57.0%	159.93	59.6%
GHG Emissions per SF (mtCO ₂ and CO ₂ e/sf/yr)	3.07	1.32	57.0%	1.24	59.6%

Walden Square Apartments Rating System Narrative PHIUS+ CORE

Cambridge, MA
May 3, 2021



Submitted to
Community Development Department
City of Cambridge
344 Broadway
Cambridge, MA 02138



Prepared by
New Ecology, Inc.
15 Court Square Suite 420
Boston, MA 02108

Project Description

The Walden Square Apartments project (the Project) complies with the City of Cambridge Zoning Article 22: Sustainable Design and Development requirements. The Project will be designed and constructed under the guidelines of the Passive House Institute U.S. (PHIUS). The building will meet the design, construction, and testing requirements of the certification program and will be certified as a Passive House project. The building will be certified using PHIUS+ 2018 CORE.

The Project is comprised of one (1) multifamily residential building to be constructed above an existing parking lot of a previously developed site located in the Walden Square Apartments site.

Integral to PHIUS certification is compliance with ENERGY STAR Multifamily New Construction and EPA Indoor airPLUS requirements. In combination with third-party, RESNET-approved quality assurance and control testing, the building will exceed the Cambridge Green Building Requirements as outlined in Article 22.20. New Ecology will serve as the Project's PHIUS Verifier.

PHIUS+ 2018 Rating System Requirements

PHIUS+ CORE OVERVIEW

The Project team will pursue Passive House certification to the standards set by the Passive House Institute US (PHIUS) for their PHIUS+ 2018 CORE (PHIUS+ CORE) rating system as well as certifying through the ENERGY STAR and EPA Indoor airPLUS programs. The PHIUS+ CORE rating system includes stringent and verified building performance metrics as well as professional testing of the building envelope and air sealing at two stages during building construction. EPA Indoor airPLUS certification includes verification of indoor air quality (IAQ) quality control measures including but not limited to: moisture control, HVAC venting and sealing, and use of low VOC materials in construction. ENERGY STAR requires prescriptive performance and testing for a variety of mechanical and envelope systems. The project team believes that these three ratings systems will result in a highly efficient building which protects occupant health through excellent indoor air quality, as well as exceptional passive resilience to extreme heat events.

While there is no rating system checklist for PHIUS+ CORE, there is a PHIUS Verifier workbook that will be completed as part of the field verification process as well as multiple ENERGY STAR checklists and an EPA Indoor airPLUS checklist completed during construction. The metrics measured and inspected by the PHIUS Verifier include:

- Building Envelope Air Infiltration (whole building) & Compartmentalization (units)
- Ventilation Air Flow Rates
- Heating and Cooling Equipment & Air Filtration Verification
- Domestic Hot Water System Specification and Performance Verification
- Appliance Energy Consumption Verification
- Indoor Air Quality Verification using the EPA Indoor airPLUS Verification Checklist

The PHIUS+ CORE rating system includes feasibility modeling to reach specified building performance metrics early in design, which are presented below in table format. The PHIUS verification process for the building energy model includes review and comments by a model evaluator from the PHIUS organization during subsequent rounds of review. This upcoming review of the model will examine building assumptions for the envelope and mechanical systems, and is known to be a thorough and rigorous examination of building systems. The project team expects that the outcome of this modeling and review process, combined with envelope and air infiltration testing, will lead to a very high-performance building with greatly reduced heating and cooling needs as compared with a baseline building.

TECHNICAL AND DESIGN APPROACHES

The Project design will follow a performance pathway using WUFI Passive modeling software to guide the material, assemblies, and equipment selection, as required to meet the certification metrics. The information below is an accurate estimation of the design and assumptions made by the design team at this early stage of the process and may change based on further design development. Once complete, the success of the design, construction, and compliance with City of Cambridge Article 22 will be measured by:

- Results of the WUFI Passive energy model during design
- Registration with and precertification by PHIUS (acceptance of the design)
- Performance testing by a PHIUS verifier (New Ecology) and update to energy model based on results
- Certification by PHIUS (acceptance of design and construction)

The Project has implemented the following approaches to comply with Article 22 and PHIUS requirements:

Envelope

- The WUFI model currently considers two wall assemblies: Steel-framed wall with 3" continuous mineral wool and no cavity insulation with an estimated R-value of 14, and a wood framed wall with 2" continuous mineral wool and cavity insulation with an estimated R-value of 28.
- Sheet-applied weather resistive air barrier to help meet rigorous PHIUS infiltration criteria and to control bulk water and vapor drive. Current WUFI model utilizes "combustible" infiltration criteria of 0.06 CFM₅₀/ft². Applicable infiltration criteria to be determined by PHIUS at the time of pre-certification.
- Roof insulation will be above deck and is currently shown with an estimated R-value of 50
- Slab-on-deck will be fully-insulated and is currently shown with an estimated R-value of 40
- Windows will be high performance and are currently shown with an estimated U-value of 0.20, while SHGC, window reveals, and shading devices will be dictated by subsequent modeling iterations.
- The Project team will review opportunities to eliminate thermal bridging throughout.

Heating, Cooling, and Ventilation

- Heating will be designed to meet efficiency requirements dictated by the energy model and will be provided via a central high-efficiency, VRF air-source heat pump (ASHP).
- Cooling will be provided to the building through the central VRF ASHP.
- Domestic hot water will be generated via a central gas-fired system with a recirculation loop. System will be roof-mounted and the building will be designed with sufficient mechanical penthouse space, structural capacity, and electric service capacity to allow future conversion to a central air-to-water heat pump domestic hot water system.
- Ventilation will be provided using centralized energy recovery ventilators (ERVs) meeting ASHRAE 62.2-2016 and 62.1-2016 serving residential and common/commercial areas, respectively.

PHIUS+ CORE-CERTIFIED BUILDINGS REQUIREMENTS

PHIUS sets strict standards for building certification under its PHIUS+ CORE rating system. PHIUS+ CORE sets requirements for building metrics in five areas: heating demand, cooling demand, heating load, cooling load and source energy consumption based on the expected number of residents. These 5 metrics are modeled, measured and verified by PHIUS using WUFI Passive modeling. Ongoing design development will continue to integrate all PHIUS requirements, ensuring the Project satisfies each performance category described herein.

Field-Tested Air-Tightness Standard

A rigorous and field-tested air-tightness standard is also applied to buildings seeking certification. The building envelope is tested twice using whole building blower door testing. The first test is conducted after the installation of the air barrier, and the second at the completion of construction.

The PHIUS Passive House Air Tightness Standard is as follows:

- Residential Units air leakage: 0.30 CFM50 per sq. ft. of unit enclosure area, or less, demonstrated through blower door testing performed by the PHIUS+ Verifier following PHIUS sampling protocols.
- Whole Building air leakage: 0.06 CFM50 per sq. ft. of building enclosure area, or less, demonstrated through a blower door test performed by the PHIUS+ Verifier.

Field Inspections During Construction

A credentialed PHIUS+ Verifier will inspect, document and confirm the following features of the building envelope and building performance:

- Air Infiltration Testing: Blower door testing will be done at project mid-point for the whole building and at project completion for both the units (sampled per RESNET protocols) and the whole building in order to ensure compliance with the requirements outlined above.
- Thermal Bridging and Air Infiltration Inspection: The project will be inspected after framing, but before insulation installation to inspect construction and identify potential areas of thermal bridging and air infiltration.

- Thermal Bridging Inspection: Thermal imaging inspection with an infrared camera to review and show compliance with thermal bridging and air sealing protocols.
- EPA Indoor airPLUS Review: Review of compliance and documentation.
- ENERGY STAR HVAC Review: Review of the HVAC functional test checklist, and additional site visits to observe testing and balancing of the HVAC systems as required by PHIUS.

EPA INDOOR airPLUS-CERTIFIED BUILDINGS REQUIREMENTS

While most ENERGY STAR requirements are met and exceeded by PHIUS+ CORE requirements, the EPA Indoor airPLUS certification is an additional set of requirements intended to ensure healthy indoor environments for future building occupants. Indoor airPLUS is checklist-based and focuses on building techniques that improve indoor air quality both through the construction process and throughout the lifetime of the building. Requirements are mainly focused on using low VOC materials, using proper procedures when constructing ductwork and systems, and following building procedures to prevent future water damage and/or mold growth. The EPA Indoor airPLUS certification is integral to the PHIUS+ CORE certification, and it will be independently reviewed and verified by NEI and PHIUS.

The EPA Indoor airPLUS checklist requirements are assembled into the following categories: moisture control, radon, pests, HVAC systems, combustion pollutants, materials and final (inspection). The program requirements are outlined in the [EPA Indoor airPLUS Construction Specifications Version 1 \(Rev 04\)](#) and are summarized below. All requirements will be verified and confirmed by the qualified verifier and/or builder.

- Moisture Control
 - Drain or sump pump installed in basements and crawlspaces as applicable. In EPA Radon Zone 1, check valve also installed.
 - Layer of aggregate or sand (4 in.) with geotextile matting installed below slabs AND radon techniques used in EPA Radon Zone 1.
 - Basements/crawlspaces insulated, sealed and conditioned.
 - Protection from water splash damage if no gutters.
 - Supply piping in exterior walls insulated with pipe wrap, as applicable.
 - Hard-surface flooring in kitchens, baths, entry, laundry, and utility rooms
- Radon
 - Radon-resistant features installed in Radon Zone 1 homes in accordance with Construction Specification 2.1.
- Pests
 - Corrosion-proof rodent/bird screens installed at all openings that cannot be fully sealed. (Not required for clothes dryer vents.)
- HVAC Systems
 - Duct systems protected from construction debris AND no building cavities used as air supplies or returns.
 - No air-handling equipment or ductwork installed in garage.

- Clothes dryers vented to the outdoors or plumbed to a drain according to manufacturer's instructions.
- Central forced-air HVAC system(s) have minimum MERV 8 filter for in-unit heating and cooling equipment (fan coil units), MERV 13 filter for ventilation supply air systems AND no ozone generators in home. Temporary filter installed to protect unit from construction dust.
- Combustion Pollutants
 - Emissions standards met for fuel-burning and space-heating appliances.
 - CO alarms installed in each sleeping zone (e.g., common hallway) according to NFPA 720.
 - Multifamily buildings: Smoking restrictions implemented AND ETS transfer pathways minimized.
- Materials
 - All composite wood products certified low-emission.
 - Interior paints and finishes certified low-emission.
 - Carpet, carpet adhesives, and carpet cushion certified low-emission.
- Final (Inspection)
 - HVAC system and ductwork verified to be dry and clean AND new filter installed.
 - Equipment manuals, Indoor airPLUS label, and certificate provided for owner/occupant.

The Project team looks forward to the construction of a highly efficient building with a focus on reducing energy consumption and protecting resident health. The Project team is confident that the design of Walden Square Apartments, including its integration of PHIUS+ CORE, ENERGY STAR, and EPA Indoor airPLUS standards, will result in a high-quality community for years to come.

Affidavit Form for Green Building Professional Special Permit

Green Building

Project Location:

Walden Square

Green Building Professional

Name:

Greg Smith

Architect

Engineer

License Number:

AIA#: 30168856 MA#: 20534 CPHC#: 1370

Company:

PCA Design

Address:

221 Hampshire Street, Cambridge, MA 02139

Contact Information

Email Address:

gsmith@prellchill.com

Telephone Number:

617-547-8120

I, Greg Smith, 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.


(Signature)

4/6/2021
(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.





Passive House Institute US

CERTIFICATION OF COMPLETION

The Passive House Institute US Awards



The Designation of

CERTIFIED PASSIVE HOUSE CONSULTANT

To:

Greg Smith CPHC®

Executive Director

1/22/2012

Date Issued

1370

CPHC Number

7/15/2021

Valid Through

This certificate hereby attests to the Consultant's ability to skillfully balance energy and design of envelope, mechanical and other building systems to execute buildings that meet the criteria of the **Passive House Building Energy Standard** for North American climate zones.

Buildings designed, modeled and constructed to meet the Passive House Building Energy Standard are ultra-efficient and characterized by superior indoor air quality, thermal comfort and durability.

The minimized energy demands of Passive House buildings reduce building operating costs permanently, while also mitigating the impact of energy price increases over time.

Buildings successfully designed and quality assured to the Passive House Building Energy Standard can achieve carbon neutrality with the addition of a small renewable generation system, thereby putting owners and occupants firmly on the path to a carbon-neutral lifestyle.



To: City of Cambridge
Department of Public Works
147 Hampshire Street
Cambridge, MA 02139

Date: July 28, 2021

Project #: 15190.00

From: Jocelyn Gambone, P.E. - VHB

Re: Walden Square Apartments – Planning Board Filing
21 Walden Square Road

In support of the City of Cambridge Planning Board's review required under the Affordable Housing Overlay (AHO) requirements, this memorandum has been prepared to present the planned infrastructure improvements associated with the proposed residential building located at 21 Walden Square Road, in Cambridge, Massachusetts. The applicant, Winn Development, is seeking confirmation from the City of Cambridge Department of Public Works (DPW) that the proposed infrastructure improvements are in general alignment with the City's stormwater management, resiliency and other city-wide initiatives. The Applicant is aware that the Project will require further review with DPW and is subject to the City's Land Disturbance Regulations and Stormwater Control Requirements.

Site & Project Description

The Applicant, Winn Development, is proposing to construct approximately 95 affordable housing units (the Project) at their existing Walden Square Apartment complex. As proposed, the Project consists of a seven-story, 153,816± gsf residential building with approximately 50 parking spaces located at ground level, ancillary landscape improvements and utility improvements to support this use. The residential floors will be located above the parking area.

The Project site occupies approximately 1.9-acres (the Site) of the northeast corner of 7.3-acre Walden Square Apartment complex, adjacent to Raymond Street. The Site lies within the surface watershed of the Alewife Brook and is bounded by an industrial development and City land to the north, residences to the east and south and commercial/ residential uses to the west. See Figure 1, Site Locus Map.

Stormwater Management

The Project is currently designed to comply with DPW's Wastewater and Stormwater Management Guidance, including retention of the difference between the 2-year 24-hour pre-construction runoff hydrograph and the post-construction 25-year 24-hour runoff hydrograph. The Project proposes to achieve this goal with the use of subsurface infiltration chambers. Please refer to the attached Permit Plans for additional detail.

Rainfall volumes used for this analysis were based on the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Type III, 24-hour storm event for Cambridge. Runoff coefficients for the existing and proposed conditions were determined using NRCS Technical Release 55 (TR-55) methodology as provided in HydroCAD. The HydroCAD model is based on the NRCS Technical Release 20 (TR-20) Model for Project Formulation Hydrology. Results are summarized below in Tables 1 & 2.



Table 1
Peak Discharge Rates (cfs*)

<i>Design Point</i>	<i>2-year</i>	<i>10-year</i>	<i>25-year</i>	<i>100-year</i>
Design Point: Sherman Street Drainage				
Existing	5.6	9.4	11.8	15.4
Proposed	1.7	4.3	5.3	15.6

Table 2
Stormwater Volume Analysis (af)

<i>Design Point</i>	<i>2-year</i>	<i>10-year</i>	<i>25-year</i>	<i>100-year</i>
Design Point: Sherman Street Drainage				
Existing	0.4	0.7	0.9	1.2
Proposed	0.2	0.4	0.6	1.2

The results of the analysis indicate that there is no increase in peak discharge rates between the pre- and post-development conditions for the 2, 10- and 25-year storm events and provides a reduction in overall runoff volume for all storm events analyzed. Project increases pervious area over the existing condition, resulting in a reduced overall runoff volume. During the 100-year storm event there is a negligible increase of 0.2 cfs, resulting in isolated ponding on-site. The on-site drainage infrastructure will be designed to convey the 10-year storm event, taking into account that the City’s system is only able to convey the 2-year storm event.

The Project will achieve recommended removal rates of Phosphorous, Total Suspended Solids (TSS) and other pollutants. A minimum of 80% TSS removal will be achieved through the use subsurface infiltration chambers and 44% pre-treatment will be provided by deep sump hooded catchbasins and structural water quality units. It is anticipated that the Project will provide phosphorous removal, primarily through infiltration.

Flood Resiliency

In accordance with DPW requirements, the Project proposes to be resilient to the 2070 10-year storm event flooding elevation. According to the City of Cambridge’s Flood Viewer, the 2070 10-year storm event flooding elevation is 25.3 Cambridge City Base (CCB) for the Site and the 2070 100-year storm event flooding elevation is 27.2 CCB. Within the Project limits the Site’s topography varies between elevation 30 Cambridge City Base (CCB) at Raymond Street and slopes down in the westerly direction to elevation 23 CCB. Grades within the proposed parking area will generally match the existing surface. The building’s finished floor at ground level will vary slightly, however the lobby and utility equipment will be located at or above elevation 27 (CCB) and all residential units will be located above ground level, on floors 2-7. The proposed transformer is located on the western side of the building, also at or above elevation 27 CCB. The finished floor of the trash room will be elevated or designed to allow for future floodproofing to elevation 25.3 (CBC).

According to the effective FEMA flood map panel 25017C0419E, dated June 4, 2010, the Site is located in Zone X, “areas determined to be outside of the 0.2% annual chance floodplain”. Please see Figure 4.

Sanitary Sewer Generation and Water Demand

The Walden Square Apartment complex is currently comprised of six residential buildings, containing a total of 240 units. The proposed building program is anticipated to include 95 residential units, containing a total of 221 bedrooms



and 50 covered parking spaces within the ground level garage. The estimated wastewater generation of the proposed project is 24,360 gallons per day (GPD). The existing generation rate for the Project area is 0 GPD, because the Project is located over an existing parking lot. Sewer generation rates are calculated in accordance with consistent with Massachusetts Department of Environmental Protection 310 CMR 15.000 – Septic Systems (“Title V).

Table 3
Existing and Proposed Sewer Generation

<i>Existing Generation</i>	<i>Units</i>	<i>Generation Rate</i>	<i>Sewer Generation (GPD)</i>
Parking Lot	N/A	N/A	0
EXISTING TOTAL			0
<i>Proposed Generation</i>	<i>Units</i>	<i>Generation Rate</i>	<i>Sewer Generation (GPD)</i>
Residential	221 Bedrooms	110 gal/ bedroom	24,310
Covered Parking (Garage)	50 spaces	1 gal/space	50
PROPOSED TOTAL			24,360
NET NEW SEWER=			24,360

In accordance with the DPW’s Inflow and Infiltration (I&I) Policy, the Project will require I&I mitigation at a rate of 4:1. Based on the increase in sewer generation, the Applicant anticipates that the Project will be required to mitigate a volume of 97,440 gallons. During the 1-year, 6-hour storm event with a depth of 1.72” and peak intensity of 0.87 inch/ hour, the proposed subsurface infiltration system is anticipated to infiltrate approximately 57,000 gallons rainfall. The Applicant is in the process of working with DPW to evaluate the potential of sharing an off-site mitigation project with another developer to provide the remaining 40,440 gallons of required mitigation.

Domestic water demand is based on estimated sewer generation with an added factor of 10 percent for consumption, system losses and other uses. Based upon sewage generation rates outlined in the DEP State Environmental Code, Title 5, 310 CMR 15.000 and a factor of 1.1, the Project is anticipated to demand 26,796 gallons of water per day.

Figures:

- Figure 1 – Site Locus Map
- Figure 2 – FIRMETTE, Map Panel 25017C0419E



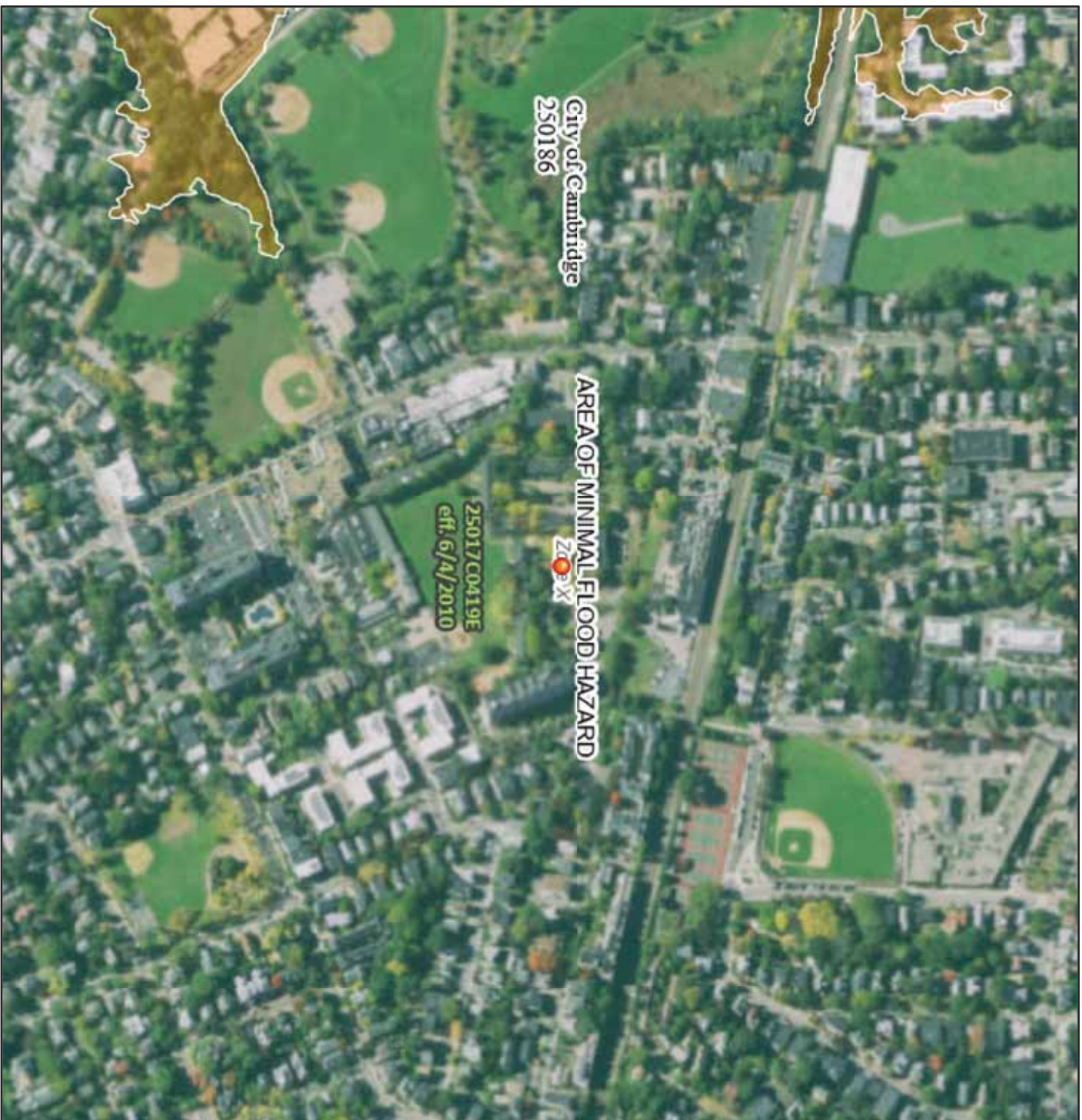
Locus Map
21 Walden Square Road
Cambridge, MA

Figure 1
April 2021

National Flood Hazard Layer FIRMette



71°9'9"W 42°23'34"N



Legend

SEE HIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) <small>Zone A, V, A99</small> With BFE or Depth <small>Zone AE, AO, AH, VE, AR</small> Regulatory Floodway
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OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <small>Zone X</small> Future Conditions 1% Annual Chance Flood Hazard <small>Zone X</small> Area with Reduced Flood Risk due to Levee. See Notes. <small>Zone X</small> Area with Flood Risk due to Levee <small>Zone D</small>
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OTHER AREAS GENERAL STRUCTURES	NO SCREEN Area of Minimal Flood Hazard <small>Zone X</small> Effective LOMIRs Area of Undetermined Flood Hazard <small>Zone D</small> Channel, Culvert, or Storm Sewer Levee, Dike, or Floodwall
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OTHER FEATURES	20.2 Cross Sections with 1% Annual Chance 17.5 Water Surface Elevation Coastal Transect Base Flood Elevation Line (BFE) Limit of Study Jurisdiction Boundary Coastal Transect Baseline Profile Baseline Hydrographic Feature
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MAP PANELS	Digital Data Available No Digital Data Available Unmapped
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The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **4/15/2021 at 4:25 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



Basemap: USGS National Map: Orthoimagery. Data refreshed October, 2020