9 MARCH 2023

FORM: CRM (August 2022)
Discontinue Prior Editions

CITY OF SOMERVILLE

Inspectional Services • Planning Board • Zoning Board of Appeals

Stage 1

CERTIFICATION OF REQUIRED MATERIALS BY CITY OF SOMERVILLE DEPARTMENT OF SUSTAINABILITY & ENVIRONMENT

Development Site Address:	256-260 Elm Street (P&Z #21-039)
Applicant Name:	Ryan Kurlbaum, Project Designer Senior Associate, Perkins & Will

As required by the City of Somerville's Development Review Submittal Requirements, I certify that I have received and approved the following development review materials for the development proposal identified above:

- [x] Sustainable & Resilient Building Questionnaire
- [x] Low Load Buildings Energy Input Form
- [ ] Net-Zero Ready Building: PHIUS+ — N/A
  - Building Resilience & Sustainability Narrative
  - Copy of signed PHIUS+ Certification Contract
  - Copy of signed PHIUS+ Certification Fee Receipt
- [ ] Net-Zero Ready Building: Zero Carbon — N/A
  - Building Resilience & Sustainability Narrative
  - Evidence of ILFI Premium Membership
  - Evidence of ILFI New Zero Carbon Project Registration
- [x] LEED Certifiability — Platinum
  - LEED Gold or Platinum checklist
  - LEED Narrative
  - Signed affidavit by LEED accredited professional

Signature: Emily Sullivan (Digitally signed by Emily Sullivan
DN: cn=Emily Sullivan, o, ou, email=esullivan@somervillema.gov, c=US
Date: 2022.10.13 17:51:42 -04'00')
Sustainability & Environment Representative

Date: 10/13/2022

LEED CERTIFIABILITY SCORECARD

LEED v4 BD+C: Core and Shell
Project Checklist

<u>underline</u> - TGE recommends v4.1 for this credit

Project Name: **Davis Square Plaza Phase 2**

Address: Elm Street Somerville
Date: 6.14.22

Y	?+	?-	N		Integrative Process	1
1	0	0	0	Credit 1	Integrative Process	1

18	0	0	2		Location and Transportation	20
x	x	x	x	Credit 1	LEED for Neighborhood Development Location	20
2				Credit 2	Sensitive Land Protection	2
2			1	Credit 3	High Priority Site	3
6				Credit 4	Surrounding Density and Diverse Uses	6
6				Credit 5	<u>Access to Quality Transit</u>	6
1				Credit 6	<u>Bicycle Facilities</u>	1
1				Credit 7	Reduced Parking Footprint	1
			1	Credit 8	<u>Green Vehicles</u>	1

9	1	0	1		Sustainable Sites	11
Y				Prereq 1	Construction Activity Pollution Prevention	Required
1				Credit 1	Site Assessment	1
1			1	Credit 2	<u>Site Development - Protect or Restore Habitat</u>	2
	1			Credit 3	<u>Open Space</u>	1
3				Credit 4	<u>Rainwater Management</u>	3
2				Credit 5	Heat Island Reduction	2
1				Credit 6	Light Pollution Reduction	1
1				Credit 7	Tenant Design and Construction Guidelines	1

8	0	0	3		Water Efficiency	11
Y				Prereq 1	Outdoor Water Use Reduction	Required
Y				Prereq 2	Indoor Water Use Reduction	Required
Y				Prereq 3	Building-Level Water Metering	Required
3				Credit 1	Outdoor Water Use Reduction	3
4				Credit 2	Indoor Water Use Reduction	4
			3	Credit 3	Cooling Tower Water Use	3
1				Credit 4	Water Metering	1

20	2	2	9		Energy and Atmosphere	33
Y				Prereq 1	Fundamental Commissioning and Verification	Required
Y				Prereq 2	Minimum Energy Performance	Required
Y				Prereq 3	Building-Level Energy Metering	Required
Y				Prereq 4	Fundamental Refrigerant Management	Required
6				Credit 1	Enhanced Commissioning	6
10	2	2	4	Credit 2	Optimize Energy Performance	18
1				Credit 3	Advanced Energy Metering	1
			2	Credit 4	Grid Harmonization	2
			3	Credit 5	<u>Renewable Energy Production</u>	3
1				Credit 6	Enhanced Refrigerant Management	1
2				Credit 7	<u>Green Power and Carbon Offsets</u>	2

7	2	1	4		Materials and Resources	14
Y				Prereq 1	Storage and Collection of Recyclables	Required
Y				Prereq 2	Construction and Demolition Waste Management Planning	Required
2	1		3	Credit 1	<u>Building Life-Cycle Impact Reduction</u>	6
1		1		Credit 2	<u>Building Product Disclosure and Optimization - EPD</u>	2
	1		1	Credit 3	<u>Building Product Disclosure and Optimization - Sourcing of Raw Materials</u>	2
2				Credit 4	<u>Building Product Disclosure and Optimization - Material Ingredients</u>	2
2				Credit 5	<u>Construction and Demolition Waste Management</u>	2

9	1	0	0		Indoor Environmental Quality	10
Y				Prereq 1	Minimum Indoor Air Quality Performance	Required
Y				Prereq 2	Environmental Tobacco Smoke Control	Required
2				Credit 1	Enhanced Indoor Air Quality Strategies	2
3				Credit 2	<u>Low-Emitting Materials</u>	3
1				Credit 3	Construction Indoor Air Quality Management Plan	1
2	1			Credit 4	Daylight	3
1				Credit 5	Quality Views	1

5	1	0	0		Innovation	6
1				Credit 1	Exemplary Performance: EPDs	1
1				Credit 2	Exemplary Performance: HPDs	1
1				Credit 3	Innovation Credit: Low Mercury Lighting	1
	1			Credit 4	Innovation Credit: TBD	1
1				Credit 5	Pilot Credit: Integrative Analysis of Building Materials	1
1				Credit 6	LEED Accredited Professional	1

4	0	0	0		Regional Priority (earn up to 4 points)	4
1				Credit 1	EAc2 Optimize Energy Performance (17%/8 pts)	1
1				Credit 2	MRc1 Building Life-Cycle Impact Reduction (2pts)	1
1				Credit 3	LTc3 High Priority Site (2 points)	1
1				Credit 4	SSc4 Rainwater Management (2 pts)	1

81	7	3	19	TOTALS	Possible Points:	110

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

LOW LOAD ENERGY INPUT FORM

PRE-SUBMITTAL LOAD ASSESSMENT

Reducing heating loads is the single-most important step towards designing a cost-effective zero-carbon building in Somerville.
This calculator provides an easy way to assess and reduce your building's loads.

Instructions:

1 Fill in the blue cells with your project information: All user inputs in blue are required.
2 Review Pre-Submittal Dashboard tab.
3 Compare the Proposed heating load to the heating load of a MA Code Minimum design, and to a Low Load design.
4 For more details, review the 'Detailed Loads' tab. It provides a summary of the assumptions in the MA Code and Low Load options.
5 Consider strategies to cost-effectively reduce the heating load and heating capacity of the Proposed design.

Project Name	Davis Square Plaza
Project Address	256 - 260 Elm Street - Somerville, MA 02144
Submission date	9/30/2022
Filing	P&Z21-039
Individual responsible of submission	Raisa Saniat
Firm responsible for submission	Perkins&Will / RFS Engineering

Project team

Owner	Asana Partners
Architect	Perkins&Will
MEP Consultant	RFS Engineering
Energy Performance Consultant	RFS Engineering
Envelope Consultant	

Summary of submission

This Section includes an overview of the Davis Square Plaza Development approach to Sustainable Design. The project has established a goal to target LEED-CS v4 Gold Certification for Phase 1 [existing building] and is targeting LEED-CS v4 Platinum for Phase 2 [new construction] and demonstrate compliance with applicable portions of the Somerville Zoning Code. Additionally, the new construction, Phase 2 building project will meet the requirements of the new Massachusetts State Energy Code.

General Project Inputs			User Comments
Number of Stories Above Grade	4		
Total Building Gross Floor Area	100,763	GSF	
Total Building Net Occupiable Floor Area	73,589	NSF	
Total Building Vertical Façade Area	46,150	SF	
Roof Area	21,543	SF	includes terraces

Primary Building Type			User Comments
Primary Building Type	Office or Laboratory Building (>50,000 ft2)		
Gross Square Feet	100,763	GSF	
Vertical Façade Area	46,150	SF	
Window Area (SF)	10,787	SF	

Secondary Building Type			User Comments
Secondary Building Type			
Gross Square Feet		GSF	
Vertical Façade Area		SF	
Window Area (SF)		SF	

Tertiary Building Type			User Comments
Tertiary Building Type			
Gross Square Feet		GSF	
Vertical Façade Area		SF	
Window Area (SF)		SF	

Envelope Parameters			User Comments
Window Assembly U-value	0.35	Btu/h-F-sf	
Wall Assembly U-value	0.048	Btu/h-F-sf	
Roof Assembly U-value	0.029	Btu/h-F-sf	
Infiltration - Maximum at Blower Door Test	0.4	cfm/sf at 75pa	

HVAC Parameters			User Comments
Minimum Outdoor Airflow + Make-Up Rate	60,000	CFM	
Proposed Outdoor Airflow + Make-Up Rate	60,000	CFM	
IF LAB OR HEATHCARE Class 3 and 4 Exhaust (CFM)	27,500	CFM	
IF EXEMPT SPECIALTY EXHAUST OR COMMERCIAL KITCHENS INCLUDED Exempt Exhaust (CFM)		CFM	
IF MECHANICALLY HUMIDIFIED Humidification Load		MBH	
IF APPLICABLE Process Heating Load		MBH	
Ventilation Heating Sensible Recovery Effectiveness	70%	%	
Ventilation Cooling Total Enthalpy Recovery Effectiveness	65%	%	
Class 3 and 4 Exhaust Sensible Recovery Effectiveness	50%	%	
Electric Space Heating Plant Capacity (at 35°F ambient)	4,094	MBH	
Non-Electric Space Heating Plant Capacity		MBH	
Total (Non-Redundant) Space Heating Plant Capacity	4,094	MBH	
Will the building's heating system be 100% electric?	Yes		
Will the building's DHW be 100% electric?	Yes		
Cooling Plant Capacity	350	Tons	

Envelope Outputs			User Comments
Window-to-wall ratio	23%		
Average Envelope U-value (UxA / A) - Design	0.090	Btu/h-F-sf	
Average Envelope U-value (UxA / A) - Maximum per Code	0.104	Btu/h-F-sf	
Average Envelope U-value (UxA / A) - Aligns with Code?	Yes	Btu/h-F-sf	

Heating Capacity			User Comments
Low Load Building - Heating Plant Capacity	23.4	Btu/h-sf	
Proposed Building - Heating Plant Capacity	40.6	Btu/h-sf	
MA Code Minimum Building - Heating Plant Capacity	48.9	Btu/h-sf	

Heating Loads		
Low Load Building	18.7	Btu/h-sf
Proposed Building	24.3	Btu/h-sf
MA Code Minimum Building	39.1	Btu/h-sf

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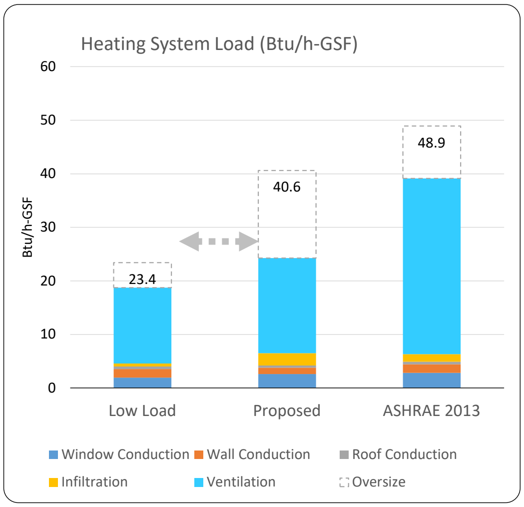
PRE-SUBMITTAL DASHBOARD

If the ***Proposed Heating Load*** *is equal to or less than the* ***Low Load Target*** *AND the* ***Proposed design is all electric*** *, then* ***you are done!*** *If not, then complete the Development Review section.*

For labs and healthcare only:

If the ***Proposed Heating Load*** *is equal to or less than the* ***Low Load Target*** *AND the* ***Proposed Electric Heat Pump Heating Capacity*** *is equal to or greater than the* ***35 °F Ambient Suggested Minimum Heat Pump Heating Capacity*** *, then* ***you are done!*** *If not, then complete the Development Review section.*

HEATING SYSTEM PROPOSED TO BE ELECTRIC
DHW SYSTEM PROPOSED TO BE ELECTRIC



LOAD EVALUATION

	Low Load	Proposed	ASHRAE 2013
Window-to-Wall Ratio (%)	23%	23%	23%
Window Assembly U-Value (Btu/h-F-sf)	0.26	0.35	0.38
Opaque Wall U-Value (Btu/h-F-sf)	0.06	0.05	0.06
Infiltration (cfm/sf at 75pa)	0.10	0.40	0.25
Roof Assembly R-Value (Btu/h-F-sf)	0.03	0.03	0.03
Ventilation Sensible Recovery (%)	69%	61%	27%
Building Heating Load (Btu/h-GSF)	19	24	39
Primary System Oversize (%)	25%	68%	25%

HEATING CAPACITY TO BE ELECTRIFIED

	Low Load	Proposed	ASHRAE 2013
Heating Load (Btu/h-GSF) to be Electrified	18.7	24.3	39.1
		HIGH LOAD	

LABS AND HEALTHCARE ONLY	Suggested Minimum (35°F Ambient)*	Proposed	
Electric Heat Pump Heating Capacity (Btu/h-GSF)	12.1	40.6	
Electric Heat Pump Heating Capacity (MBH)	1,222	4,094	PASS
Electric Heat Pump % of Total Proposed Heating Load	30%	100%	
Overall Pass/Fail for Labs and Healthcare (must pass both criteria)			FAIL

**The City of Somerville understands that it may not be practical to electrify 100% of the heating plant for high-ventilation facilities such as life sciences or healthcare buildings. Efficient systems and electrifying a portion of the heating plant equivalent to the load at 35 °F will reduce fossil fuel consumption by upwards of 90%. The addition of heat pumps to satisfy this load will largely decarbonize high-ventilation load facilities in operation while allowing for combustion-based fuel sources to address peak heating conditions.*

DEVELOPMENT REVIEW INFO

New buildings and extensive renovations should ideally be designed to achieve operational carbon neutrality and to minimize embodied carbon in construction materials.
This calculator provides an easy way to assess the operational emissions of your proposed design.

Instructions:
1. Fill in the blue cells with the required information: All user inputs in blue are required.
2. Review the Development Review Dashboard tab.
3. Compare the Proposed design to that of the MA Code Minimum design, and the 'Low Load' design.
4. Consider strategies to cost-effectively reduce the loads of the Proposed design to bring it closer in line to the Low Load building.

Energy Use Inputs	Site Annual Energy Consumption (MMBtu/yr)			Energy Use Intensity (kBtu/sf/yr)		
End Use Breakdown	Zero Carbon	Proposed	ASHRAE 2013	Low Load	Proposed	ASHRAE 2013
Lighting	not required	699	754	not required	6.9	7.5
Plug Loads		1,827	1,827		18.1	18.1
Fans		1,069	700		10.6	6.9
Pumps		203	44		2.0	0.4
Cooling		786	728		7.8	7.2
Heating - Non-Electric 1			6,638		-	65.9
Heating - Non-Electric 2					-	-
Heating - Electric		1,466			14.5	-
DHW - Non-Electric 1			100		-	1.0
DHW - Non-Electric 2					-	-
DHW - Electric		72			0.7	-
Process 1					-	-
Process 2					-	-
Process 3					-	-
Process 4					-	-
On-site Renewables (negative)					-	
Off-Site Renewables (negative)					-	
TOTAL without Renewable Energy		**6,122**	**10,791**		**60.8**	**107.1**
TOTAL with Renewable Energy		**6,122**	**10,791**		**60.8**	**107.1**

(if cogen is part of the proposed design, charge fuel consumption to Heating and credit e

Emissions Outputs	Energy Consumption by Fuel (MMBtu/yr)			Current Carbon Emissions (metric tons CO2e/yr)		
Fuel Type	Low Load	Proposed	ASHRAE 2013	Zero Carbon	Proposed	ASHRAE 2013
Renewable Electric Credit	not required	-	-	not required	-	-
Electric		14,620	12,726		327	284
Gas		-	7,075		-	358
Oil		-	-		-	-
Propane		-	-		-	-
Other District Heating		-	-		-	-
District Cooling		-	-		-	-
Other Fuel 1		-	-		-	-
Other Fuel 2		-	-		-	-
TOTAL without Renewable Energy	**-**	**14,620**	**19,801**	**0**	**327**	**642**
TOTAL with Renewable Energy	**-**	**14,620**	**19,801**	**0**	**327**	**642**
Energy Use Intensity (kBtu/sf/yr)		145.1	196.5			

Emissions Intensity Outputs	Carbon Emissions Intensity (lbCO2e/yr-sf)		
	Low Load	Proposed	ASHRAE 2013
TOTAL Without Renewable Energ	not required	7.1	14.0
Renewable Energy Credit		-	-
TOTAL with Renewable Energy	**-**	**7.1**	**14.0**

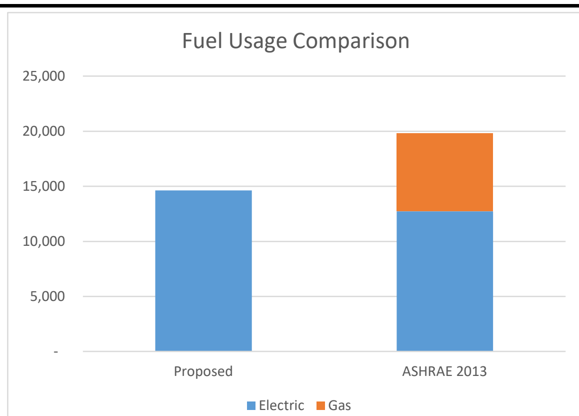
Carbon Emissions Factors for City of Somerville		
Fuel Type	lbCO2e/MMBtu	Value is based on:
Renewable Electric Credit	155	
Electric	155	*Portfolio Manager Region Emissions Inensity. Note: this value will not match MEPA/DO*
Electric 2035	115	
Gas	117	*US EIA value*
Oil	161	*US EIA value*
Propane	139	*US EIA value*
Other District Heating		*User to calculate and input custom value.*
District Cooling		*User to calculate and input custom value, based on the specific district chilled water syst*
Other Fuel 1		*User to calculate and input value for Other fuel type.*
Other Fuel 2		*User to calculate and input value for Other fuel type.*
		User to input description of Other Fuel type.

Footnotes:
1. Based on the latest ISO-NE Emissions Report. Should be updated as more recent ISO-NE Emissions Reports are available.

Fuel Type (drop-down menu)	Instructions
Electric	
Electric	
Electric	
Electric	
Electric	
Gas	
Gas	
Electric	
	Process loads may include: pool heating, sterilization, humidification, etc.
	Off-Site Renewable energy is limited to MA Class I RECs and minimum 15-year power purchase agreements for new renewable energy systems (installed within last 3 years) from grid regions with emissions factors at least as high as ISO-NE.

lectricity generation proportionally to all electric end uses)

2035 Carbon Emissions (metric tons CO2e/yr)	
Zero Carbon	Proposed
not required	
	243
	-
0	243
0	243



'R submissions, but it is used for LEED points.

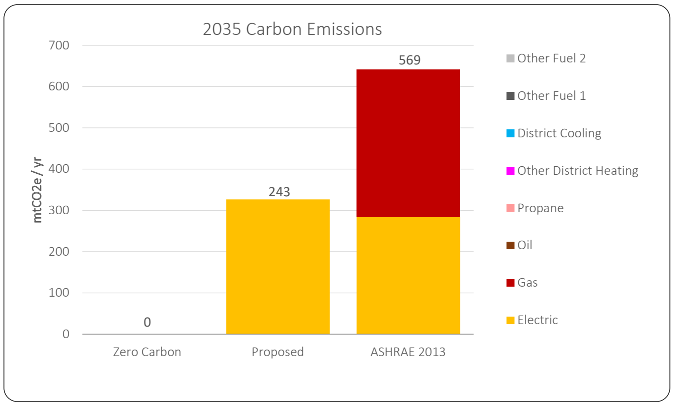
em.

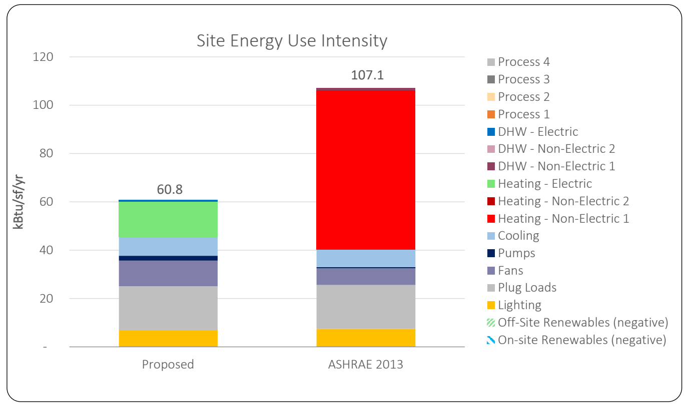
DEVELOPMENT REVIEW DASHBOARD

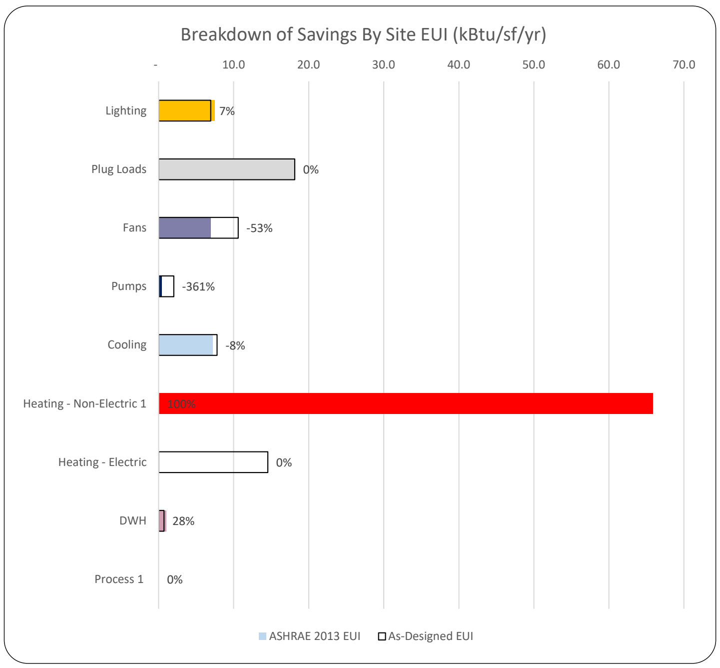
	Proposed	ASHRAE 2013	% Savings
Current Carbon Emissions Intensity (lbCO2e/yr-sf)	7.1	14.0	49.1%
Site Energy Use (kBtu/sf/yr)	60.8	107.1	43.3%
Source Energy Use (kBtu/sf/yr)	145.1	196.5	26.2%
Annual Carbon Offsets to achieve ZNC (metric tons CO2e/yr)	327	642	
2035 Carbon Emissions Intensity (lbCO2e/yr-sf)*	243	569	57.3%

LEED EAc1 Optimize Energy Performance Point Calculator**

Please Select Rating system	LEED NC CS	
Please Select Building Type	All Other	
Points earned	15	Min 10 pts***



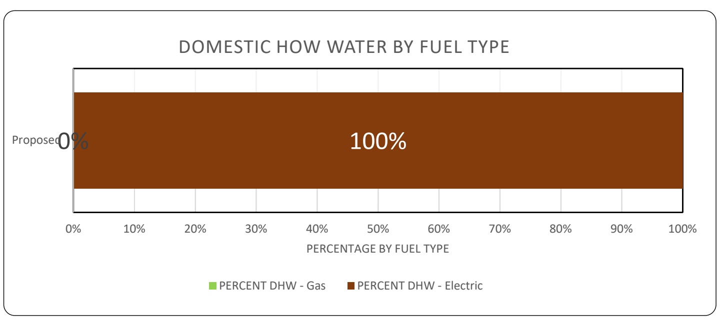


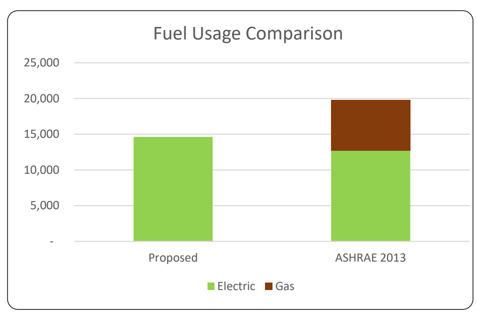


* A 40% savings CO2e emissions target (using 2035 emissions factors) has been established based on the findings of Built Environment Plus' "Massachusetts is Ready for Net Zero 2021 Report." The report surveyed over 7 Million GSF of Net-Zero buildings spanning a range of building types including K-12, Higher Education, Healthcare, Laboratory, Office, and Multifamily buildings in Massachusetts. The report findings indicate that a 40% savings in CO2e emissions, based on 2035 ISO-NE emissions rates, is a readily acheivable benchmark for high-performance buildings within the Greater Boston Area. The target represents the building-level operational carbon emissions reductions expected by the City of Somerville prior to the purchase of onsite or offsite renewable energy, or carbon offsets.

**The City of Somerville requires projects to use the Alterntative Energy Performance Metric Pilot Credit EApc95 (https://www.usgbc.org/credits/eapc95v4). This compliance path allows projects to document performance improvements using Option 1 Whole Building Simulation and leverage an average of source energy and carbon emissions as an indicator of performance. The City prefers this compliance path as the considerations for CO2e emissions aligns with the City's Net Zero Performance goals.

*** An EAc1 earning of at least 10 points is best poised to align with the City's CO2e and energy performance goas.





Per ASHRAE 90.1-2019 Appendix G with MA Amendments (780 CMR revised 9th edition, mandatory as of January 2021)

Building Area Types Baseline Building Gross Above-Grade % Glazing	%
Grocery store	7%
Healthcare (outpatient)	21%
Hospital	27%
Hotel/motel (≤75 rooms)	24%
Hotel/motel (>75 rooms)	34%
Office or Laboratory Building (≤5000 ft2)	19%
Office or Laboratory Building (5000 to 50,000 ft2)	31%
Office or Laboratory Building (>50,000 ft2)	40%
Restaurant (quick service)	34%
Restaurant (full service)	24%
Retail (stand alone)	11%
Retail (strip mall)	20%
School (primary)	22%
School (secondary and university)	22%
Warehouse (non-refrigerated)	6%
Multifamily	24%

Approximate value, based on technology available in 2020.

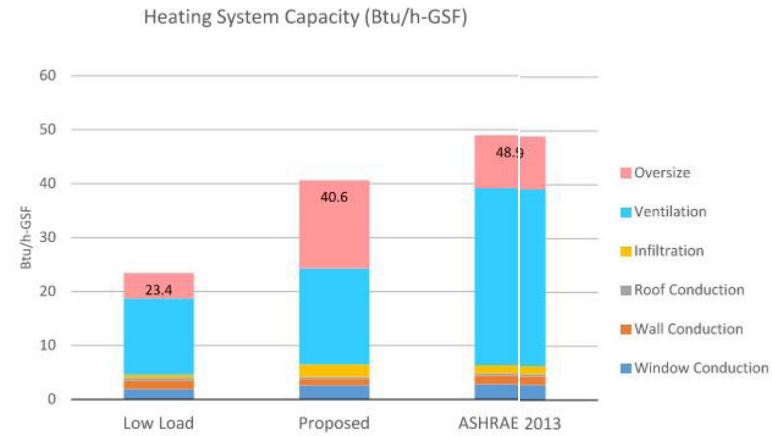
Heat Pump Electrical Infrastructure Design Demand Conversion Factor	COP
VRF	2.0
Air to Water	1.7
Exhaust-Source	1.9

LOAD CALCULATIONS

This tab automatically creates the 'ZNC' and 'MA Code' options.
It then calculates the heating load associated with each option.
It also calculates the ventilation cooling load credit for the ZNC option.

Instructions:

1 This tab must remain locked for submission to the City of Somerville



Heating Load Outputs (Btu/h-GSF)	Low Load	Proposed	ASHRAE 2013
Window Conduction	1.9	2.6	2.8
Wall Conduction	1.6	1.2	1.6
Roof Conduction	0.5	0.4	0.5
Infiltration	0.6	2.3	1.4
Ventilation	14.2	17.8	32.8
Oversize	4.7	16.4	9.8
Total Space Heating System Load	**23.4**	**40.6**	**48.9**
TOTAL Conduction	4.0	4.2	4.9
TOTAL Envelope	4.6	6.5	6.3
NON-Space-Heating Plant Load	3.3	3.3	3.3

Summary of Automatic Changes to Proposed Design	Low Load	Proposed	ASHRAE 2013
Total Building - Window to Wall Ratio	23%	23%	23%
Window Average Assembly U-value (Btu/h-ΔT-sf)	0.26	0.35	0.38
Wall Average Assembly U-value (Btu/h-ΔT-sf)	0.064	0.048	0.064
Roof Average Assembly U-value (Btu/h-ΔT-sf)	0.032	0.029	0.032
Infiltration - Maximum at Blower Door Test (cfm/sf at 75pa)	0.10	0.40	0.25
Proposed Outdoor Airflow Rate (CFM)	60,000	60,000	60,000
Ventilation Heating Sensible Recovery Efficiency	80%	70%	50%
Class 3 and 4 Exhaust Sensible Recovery Efficiency	55%	50%	0%
Electric Heating System Capacity (Btu/h-gsf)	0.0	40.6	0.0
Oversize Factor: Heating System Capacity / Heating Load (%)	125%	168%	125%

General Information	Low Load	Proposed	ASHRAE 2013
Number of Stories Above Grade	4	4	4
Total Building Gross Floor Area	100,763	100,763	100,763
Total Building Net Occupiable Floor Area	73,589	73,589	73,589
Daylight Area (per IECC 2018)	-	-	-
Total Building Vertical Façade Area	46,150	46,150	46,150
Roof Area	21,543	21,543	21,543

Primary Building Type	Low Load	Proposed	ASHRAE 2013
Primary Building Type	Office or Laboratory Building (>50,000 ft2)	Office or Laboratory Building (>50,000 ft2)	Office or Laboratory Building (>50,000 ft2)
Gross Square Feet	100,763	100,763	100,763
Vertical Façade Area	46,150	46,150	46,150
Window Area	n/a	10,787	n/a

Secondary Building Type	Low Load	Proposed	ASHRAE 2013
Secondary Building Type	-	-	-
Gross Square Feet	-	-	-
Vertical Façade Area	-	-	-
Window Area	n/a	-	n/a

Tertiary Building Type	Low Load	Proposed	ASHRAE 2013
Tertiary Building Type	-	-	-
Gross Square Feet	-	-	-
Vertical Façade Area	-	-	-
Window Area	n/a	-	n/a

Daylight Area	Low Load	Proposed	ASHRAE 2013
% Daylight Area	0%	0%	0%
Daylight Area >25%? (or >50% if building is <3 stories above grade)	No	No	No

Envelope	Low Load	Proposed	ASHRAE 2013
Total Vertical Façade Area	46,150	46,150	46,150
Primary Building - Window to Wall Ratio	23%	23%	n/a
Secondary Building - Window to Wall Ratio	0%	0%	n/a
Tertiary Building - Window to Wall Ratio	0%	0%	n/a
Total Building - Window to Wall Ratio	23%	23%	23%
Total Window Area	10,787	10,787	10,787
Window Average Assembly U-value (Btu/h-ΔT-sf)	0.26	0.35	0.38
Wall Area (SF)	35,363	35,363	35,363
Wall Average Assembly U-value (Btu/h-ΔT-sf)	0.064	0.048	0.064
Roof Area (SF)	21,543	21,543	21,543
Roof Average Assembly U-value (Btu/h-ΔT-sf)	0.032	0.028571429	0.032
Infiltration - Maximum at Blower Door Test (cfm/sf at 75pa)	0.1	0.4	0.25
Infiltration - Maximum at Blower Door Test (cfm at 75pa)	6,800	27,100	16,900
Infiltration - Design (cfm)	760	3,041	1,901
Average UxA Value[2]	0.085	0.090	0.104

Ventilation	Low Load	Proposed	ASHRAE 2013
Minimum Outdoor Airflow Rate (CFM)	60,000	60,000	60,000
Minimum Outdoor Airflow Rate (CFM/Net SF)	0.82	0.82	0.82
Proposed Outdoor Airflow Rate (CFM)	60,000	60,000	60,000
Proposed Outdoor Airflow Rate (CFM/Net SF)	n/a	0.82	n/a
Exhaust/Relief Air (not including Class 3 and 4 and Exempt Exhaust)	32,500	32,500	32,500
Ventilation Heating Sensible Recovery Efficiency	80%	70%	50%
Class 3 and 4 Exhaust (CFM)	27,500	27,500	27,500
Class 3 and 4 Exhaust Sensible Recovery Efficiency	55%	50%	0%
Exempt Exhaust (CFM)	-	-	-
Exempt Exhaust Heat Recovery Efficiency	0%	0%	0%
Average Exhaust Heat Recovery Efficiency	69%	61%	27%

Heating Load	Low Load	Proposed	ASHRAE 2013
Delta-T (˚F Outdoor - ˚F Indoor)	70	70	70
Window Conduction Heating Load (MBH)	196	264	287
Wall Conduction Heating Load (MBH)	158	118	158
Roof Conduction Heating Load (MBH)	48	43	48
Envelope Infiltration Heating Load (MBH)	57	230	144
Ventilation Heating Load (MBH)	1,427	1,789	3,308
Safety Factor (MBH)	472	1,650	986
TOTAL Space Heating System Load (MBH)	2,359	4,094	4,931
Total Envelope Conduction Heating Load (MBH)	403	425	494
Maximum Electric Heating System Capacity (Btu/h-gsf)	n/a	n/a	n/a
Electric Heating System Capacity (Btu/h-gsf)	-	40.6	-
Electric Heating System Capacity (MBH)	-	4,094	n/a
Other Heating System Capacity (MBH)	2,359	-	4,931
TOTAL Heating System Capacity (MBH)	n/a	4,094	n/a
Oversize Factor: Heating System Capacity / Heating Load (%)	125%	168%	125%
NON-Space-Heating Plant Capacity (MBH)	333	333	333

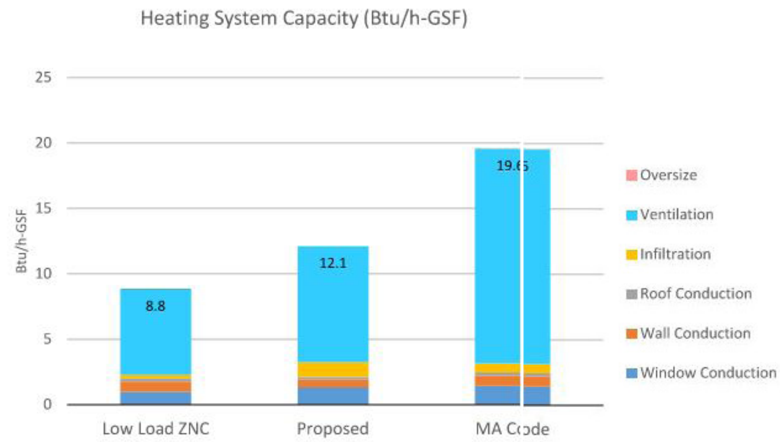
Ventilation Cooling Load	Low Load	Proposed	ASHRAE 2013
Outdoor Air - Temperature (F)	91	91	91
Outdoor Air - Wet Bulb (F)	73	73	73
Outdoor Air - Enthalpy (Btu/lb)	36.48	36.48	36.48
Indoor Air - Temperature (F)	75	75	75
Indoor Air - Relative Humidity (%)	55%	55%	55%
Indoor Air - Enthalpy (Btu/lb)	29.13	29.13	29.13
Ventilation Cooling Enthalpy Recovery Efficiency (%)	78%	65%	50%
Ventilation Air after Energy Recovery - Enthalpy (Btu/lb)	30.78	31.69	32.81
Ventilation Discharge Air Enthalpy (Btu/lb)	22.13	22.13	22.13
Ventilation Delta H (Btu/cfm)	8.65	9.56	10.68
Ventilation Cooling Load (Btu/cfm)	39	43	48
Ventilation Cooling Load (Tons)	475	524	585
Class 3 and 4 Exhaust Sensible Heat Recovery Efficiency (%)	55%	50%	0%
Class 3 and 4 Exhaust Make Up - Temperature after Energy Recovery (F)	82	83	91
Class 3 and 4 Exhaust Make-Up Load Reduction (Tons)	20.16666667	18.33333333	0
Total Load Reduction (Tons)	70	18	(61)

LOAD CALCULATIONS

This tab automatically creates the 'ZNC' and 'MA Code' options.
It then calculates the heating load associated with each option.
It also calculates the ventilation cooling load credit for the ZNC option.

Instructions:

1 This tab must remain locked for submission to the City of Somerville



Heating Load Outputs (Btu/h-GSF)	**Low Load ZNC**	**Proposed**	**MA Code**
Window Conduction	1.0	1.3	1.4
Wall Conduction	0.8	0.6	0.8
Roof Conduction	0.2	0.2	0.2
Infiltration	0.3	1.1	0.7
Ventilation	6.6	8.9	16.4
Oversize	0.0	0.0	0.0
Total Space Heating System Capacity	**8.8**	**12.1**	**19.6**
TOTAL Conduction	2.0	2.1	2.4
TOTAL Envelope	2.3	3.3	3.2
NON-Space-Heating Plant Capacity	3.3	3.3	3.3

Summary of Automatic Changes to Proposed Design	**Low Load ZNC**	**Proposed**	**MA Code**
Total Building - Window to Wall Ratio	23%	23%	23%
Window Average Assembly U-value (Btu/h-ΔT-sf)	0.26	0.35	0.38
Wall Average Assembly U-value (Btu/h-ΔT-sf)	0.064	0.048	0.064
Roof Average Assembly U-value (Btu/h-ΔT-sf)	0.032	0.029	0.032
Infiltration - Maximum at Blower Door Test (cfm/sf at 75pa)	0.10	0.40	0.25
Proposed Outdoor Airflow Rate (CFM)	60,000	60,000	60,000
Ventilation Heating Sensible Recovery Efficiency	80%	70%	50%
Class 4 Exhaust Sensible Recovery Efficiency	60%	50%	0%
Electric Heating System Capacity (Btu/h-gsf)	7.1	0.5	0.0
Oversize Factor: Heating System Capacity / Heating Load (%)	125%	125%	125%

General Information	**Low Load ZNC**	**Proposed**	**MA Code**
Number of Stories Above Grade	4	4	4
Total Building Gross Floor Area	100,763	100,763	100,763
Total Building Net Occupiable Floor Area	73,589	73,589	73,589
Daylight Area (per IECC 2018)	-	-	-
Total Building Vertical Façade Area	46,150	46,150	46,150
Roof Area	21,543	21,543	21,543

Primary Building Type	**Low Load ZNC**	**Proposed**	**MA Code**
Primary Building Type	Office or Laboratory Building (>50,000 ft2)	Office or Laboratory Building (>50,000 ft2)	Office or Laboratory Building (>50,000 ft2)
Gross Square Feet	100,763	100,763	100,763
Vertical Façade Area	46,150	46,150	46,150
Window Area	n/a	10,787	n/a

Secondary Building Type	**Low Load ZNC**	**Proposed**	**MA Code**
Secondary Building Type	-	-	-
Gross Square Feet	-	-	-
Vertical Façade Area	-	-	-
Window Area	n/a	-	n/a

Tertiary Building Type	**Low Load ZNC**	**Proposed**	**MA Code**
Tertiary Building Type	-	-	-
Gross Square Feet	-	-	-
Vertical Façade Area	-	-	-
Window Area	n/a	-	n/a

Daylight Area	**Low Load ZNC**	**Proposed**	**MA Code**
% Daylight Area	0%	0%	0%
Daylight Area >25%? (or >50% if building is <3 stories above grade)	No	No	No

Envelope	**Low Load ZNC**	**Proposed**	**MA Code**
Total Vertical Façade Area	46,150	46,150	46,150
Primary Building - Window to Wall Ratio	23%	23%	n/a
Secondary Building - Window to Wall Ratio	0%	0%	n/a
Tertiary Building - Window to Wall Ratio	0%	0%	n/a
Total Building - Window to Wall Ratio	23%	23%	23%
Total Window Area	10,787	10,787	10,787
Window Average Assembly U-value (Btu/h-ΔT-sf)	0.26	0.35	0.38
Wall Area (SF)	35,363	35,363	35,363
Wall Average Assembly U-value (Btu/h-ΔT-sf)	0.064	0.048	0.064
Roof Area (SF)	21,543	21,543	21,543
Roof Average Assembly U-value (Btu/h-ΔT-sf)	0.032	0.028571429	0.032
Infiltration - Maximum at Blower Door Test (cfm/sf at 75pa)	0.1	0.4	0.25
Infiltration - Maximum at Blower Door Test (cfm at 75pa)	6,800	27,100	16,900
Infiltration - Design (cfm)	760	3,041	1,901
Average UxA Value[2]	0.085	0.090	0.104

Ventilation	Low Load ZNC	Proposed	MA Code
Minimum Outdoor Airflow Rate (CFM)	60,000	60,000	60,000
Minimum Outdoor Airflow Rate (CFM/Net SF)	0.82	0.82	0.82
Proposed Outdoor Airflow Rate (CFM)	60,000	60,000	60,000
Proposed Outdoor Airflow Rate (CFM/Net SF)	n/a	0.82	n/a
Exhaust/Relief Air (not including Class 4 and Exempt Exhaust)	32,500	32,500	32,500
Ventilation Heating Sensible Recovery Efficiency	80%	70%	50%
Class 4 Exhaust (CFM)	27,500	27,500	27,500
Class 4 Exhaust Sensible Recovery Efficiency	60%	50%	0%
Exempt Exhaust (CFM)	-	-	-
Exempt Exhaust Heat Recovery Efficiency	0%	0%	0%
Average Exhaust Heat Recovery Efficiency	71%	61%	27%

Heating Load	Low Load ZNC	Proposed	MA Code
Delta-T (˚F Outdoor - ˚F Indoor)	35	35	35
Window Conduction Heating Load (MBH)	98	132	143
Wall Conduction Heating Load (MBH)	79	59	79
Roof Conduction Heating Load (MBH)	24	22	24
Envelope Infiltration Heating Load (MBH)	29	115	72
Ventilation Heating Load (MBH)	662	894	1,654
Safety Factor (MBH)	-	-	-
TOTAL Space Heating System Capacity (MBH)	892	1,222	1,972
Total Envelope Conduction Heating Load (MBH)	202	213	247
Maximum Electric Heating System Capacity (Btu/h-gsf)	10	n/a	n/a
Electric Heating System Capacity (Btu/h-gsf)	7.1	1	-
Electric Heating System Capacity (MBH)	713	4,094	n/a
Other Heating System Capacity (MBH)	178	-	1,972
TOTAL Heating System Capacity (MBH)	n/a	4,094	n/a
Oversize Factor: Heating System Capacity / Heating Load (%)	125%	125%	125%
NON-Space-Heating Plant Capacity (MBH)	333	333	333

Ventilation Cooling Load	Low Load ZNC	Proposed	MA Code
Outdoor Air - Temperature (F)	91	91	91
Outdoor Air - Wet Bulb (F)	73	73	73
Outdoor Air - Enthalpy (Btu/lb)	36.48	36.48	36.48
Indoor Air - Temperature (F)	75	75	75
Indoor Air - Relative Humidity (%)	55%	55%	55%
Indoor Air - Enthalpy (Btu/lb)	29.13	29.13	29.13
Ventilation Cooling Enthalpy Recovery Efficiency (%)	78%	65%	50%
Ventilation Air after Energy Recovery - Enthalpy (Btu/lb)	30.78	31.69	32.81
Ventilation Discharge Air Enthalpy (Btu/lb)	22.13	22.13	22.13
Ventilation Delta H (Btu/cfm)	8.65	9.56	10.68
Ventilation Cooling Load (Btu/cfm)	39	43	48
Ventilation Cooling Load (Tons)	475	524	585
Class 4 Exhaust Sensible Heat Recovery Efficiency (%)	60%	50%	0%
Class 4 Exhaust Make Up - Temperature after Energy Recovery (F)	81	83	91
Class 4 Exhaust Make-Up Load Reduction (Tons)	22	18.33333333	0
Total Load Reduction (Tons)	72	18	(61)

SustainaVille
creating a resilient & carbon neutral somerville

City of Somerville
Sustainable & Resilient
Buildings Questionnaire
Updated October 2019

INTRODUCTION

This document outlines Development Review Application requirements in relation to the long-term environmental sustainability and climate resilience of buildings within Somerville. Development proposals that require Site Plan Approval by the Somerville Zoning Ordinance must include a completed Sustainable & Resilient Buildings Questionnaire (Questionnaire) with the required Development Review Application. A Development Review Application is considered incomplete unless a completed questionnaire is submitted with the application. It is strongly recommended that the development team meets with staff from the Office of Sustainability and Environment prior to submitting the Development Review Application.

The purpose of this Questionnaire is to minimize the adverse environmental impacts in the design, construction, and occupancy of buildings in Somerville and to ensure that the impacts of future climate conditions are carefully evaluated.

Please review the following documents before completing the Questionnaire:

- **Somerville Climate Change Vulnerability Assessment**
- **Carbon Neutrality Pathway Assessment**
- **Somerville Climate Forward**

PROCEDURE:

A completed Sustainable & Resilient Buildings Questionnaire must be submitted with a Development Review Application for all development proposals that require Site Plan Approval. New construction or alterations to existing structures of 25,000 square feet or more must also submit an updated Questionnaire prior to the issuance of the first Building Permit and prior to the issuance of the first Certificate of Occupancy to identify any design changes made subsequent to Site Plan Approval or additional information determined as the development process unfolds.

BACKGROUND: CARBON NEUTRALITY

Understanding the global imperative to reduce greenhouse gas emissions in order to prevent extreme changes to the climate, Mayor Joseph A. Curtatone set a goal for Somerville to become carbon neutral by the year 2050. Carbon neutrality is defined as the net-zero release of carbon dioxide and other greenhouse gases (GHG) within Somerville's municipal boundary. Reducing greenhouse gas emissions is critical to avoiding the worst impacts of climate change and to protecting the health, safety, and welfare of current and future generations. In 2017, the Somerville Board of Aldermen passed a resolution reaffirming the city's carbon neutrality goal. And In 2018, Somerville released its first community-wide climate action plan, Somerville Climate Forward.

To achieve carbon neutrality by 2050 and to minimize adverse environmental impacts, Somerville will need to drastically reduce greenhouse gas emissions from electricity, buildings, transportation, and waste disposal. To meet these goals, all buildings within the city will need to pursue net zero emissions. New development should be designed to maximize envelope performance and energy efficiency, produce or procure renewable energy, and phase out fossil fuel use through electrification of building systems. The City of Somerville recognizes that as technology advances, incorporating design elements to mitigate carbon emissions and increase resilience may become more feasible. Applicants are asked to devise strategies that permit building systems to adapt and evolve over time to further reduce GHG emissions and to avoid path dependency that perpetuates reliance on fossil fuels.

BACKGROUND: CLIMATE CHANGE VULNERABILITY

Despite efforts to minimize greenhouse gas emissions, climate change is already impacting Somerville and changes to the climate will continue to intensify. The City of Somerville's Climate Change Vulnerability Assessment analyses vulnerabilities associated with Somerville's key climate stressors: increased precipitation, sea level rise and storm surge, and higher temperatures. The analysis recommends that new development consider these climate impacts and take appropriate measures to address the projected climatic conditions described in the assessment.

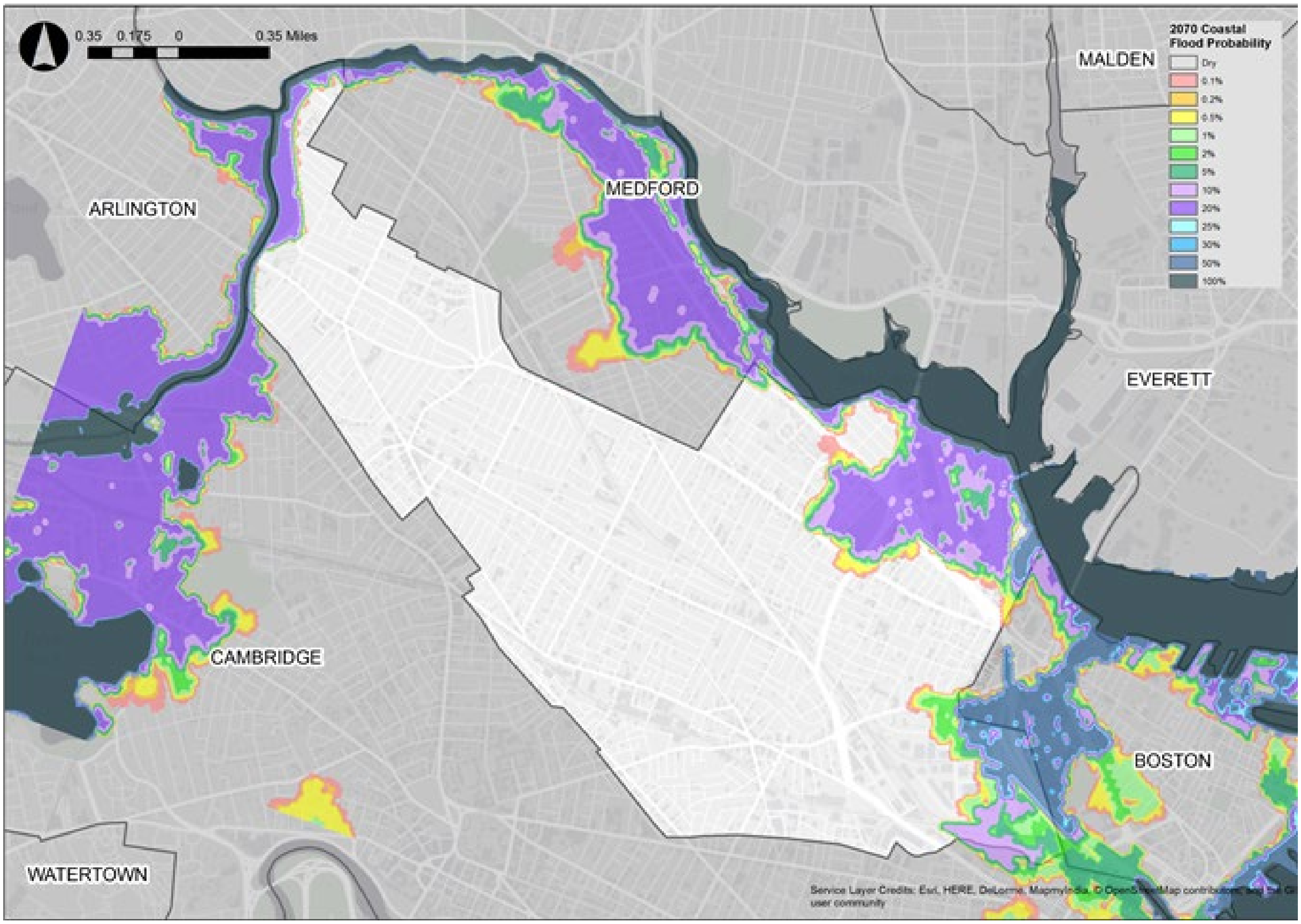
Several areas of Somerville are already prone to flooding from intense precipitation. With climate change, precipitation events will become more intense—meaning that a greater volume of rain will fall in a shorter period of time. Somerville is projected to experience more than a 30% increase in rainfall during a 100-year 24-hour event. This increase in precipitation will increase the risk of flooding in areas where the drainage system does not have sufficient capacity.

In addition to flooding from precipitation, sea level rise and storm surge are already potential concerns for areas of East Somerville and by 2035-2040 the Amelia Earhart Dam could be regularly flanked by storms, resulting in flooding for areas of Assembly Square, Ten Hills, and Winter Hill.

As the climate continues to change, average seasonal temperatures are also expected to increase and the number of days above 90 degrees Fahrenheit (historically about 10 a year) could rise to 40 days by 2030, a third of the summer, and 90 days by 2070, nearly the entire summer. In 2018 there were 23 days over 90 degrees.
As temperatures increase, Somerville will become more susceptible to the urban heat island effect which causes hotter temperatures due to paved surfaces and waste heat generated by energy use when compared to less developed areas. Increasing average temperatures can have wide-ranging impacts on human life, the built environment, and natural ecosystems. Rising temperatures and more intense heat waves present significant public health concerns and can contribute toward kidney, lung, and heart problems. Vulnerable populations are particularly susceptible to heat-induced illness and mortality. There will also be increasing demand for indoor cooling.

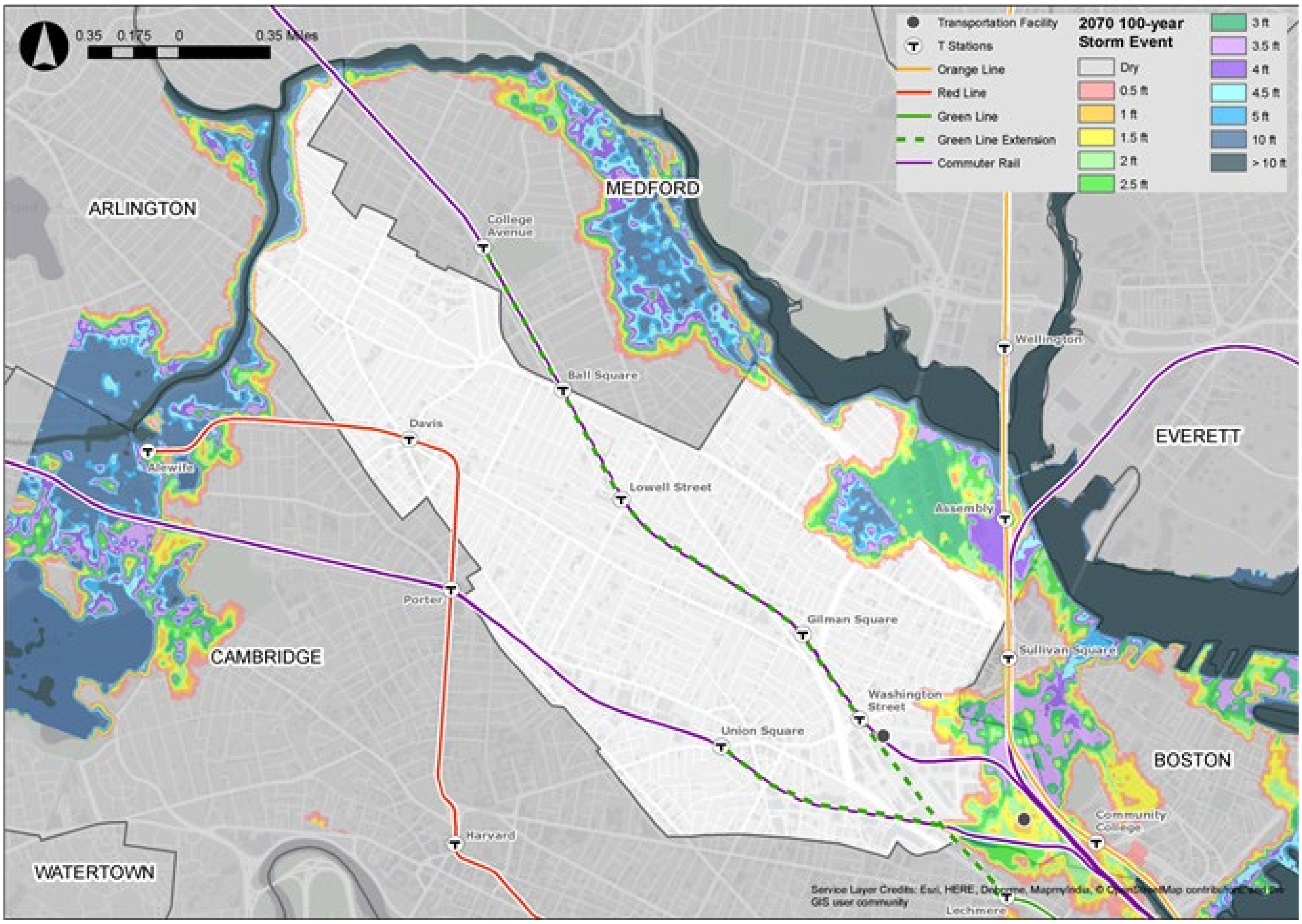
The following maps and figures provide an overview of projected climate exposure. Please review [the Climate Change Vulnerability Assessment] for more detailed analysis on Somerville's exposure, vulnerability, and risk to climate change. For higher resolution maps and GIS files, please contact Hannah Payne, Sustainability Coordinator, at hpayne@somervillema.gov.

2070 Coastal Flood Probability



This map shows the annual chance of flooding from coastal storm events and sea level rise in 2070. A 100% chance of flooding means that there is a nearly certain chance that the area will flood at least once in a given year, while a 50% chance means that there is an equal chance that it may or may not flood in a given year. A 1% chance of flooding corresponds with a 100-year event. A 0.1% chance corresponds with a 1000-year event. This map does not account for drainage (Somerville Climate Change Vulnerability Assessment, 2017)

2070 Coastal Flood Depth from 2070 100-year Storm Event



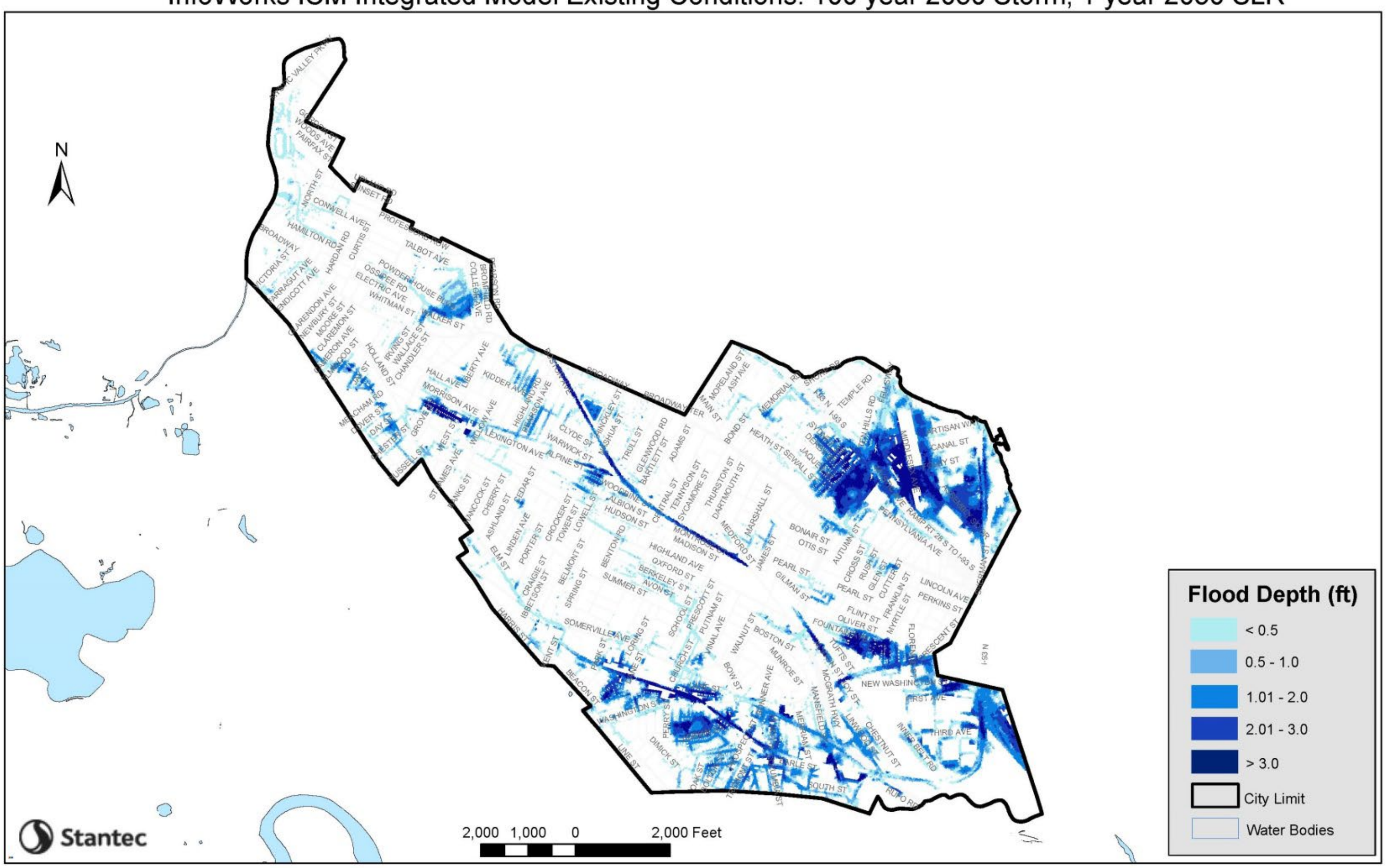
This map shows the projected flood depths of a 100-year coastal storm event in 2070 along with public transportation infrastructure assets. This map does not account for drainage (Somerville Climate Change Vulnerability Assessment, 2017)

Precipitation Projections

Precipitation-based flooding is projected to increase in Somerville and is currently more of an immediate and widespread threat than sea level rise and storm surge. The intensification of both the frequency and intensity of rainfall events is likely to cause increased risk of flooding during rain events.

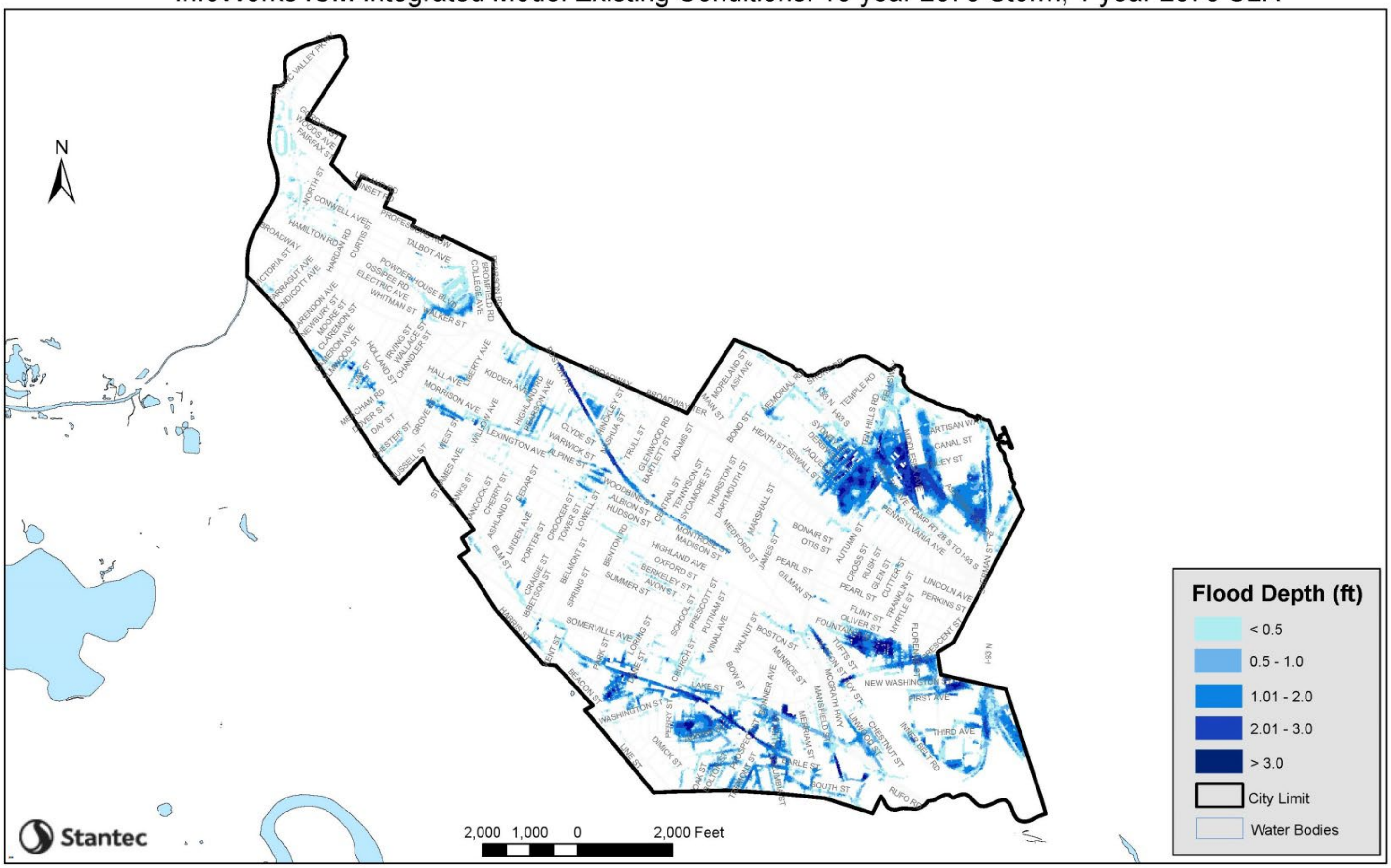
Storm Type	Present-day Rainfall	2030 Rainfall	2070 Rainfall
10-year (10% annual chance), 24-hour	4.9 in	5.6 in	6.4 in
100-year (1% annual chance), 24-hour	8.9 in	10.2 in	11.7 in

InfoWorks ICM Integrated Model Existing Conditions: 100 year 2030 Storm, 1 year 2030 SLR



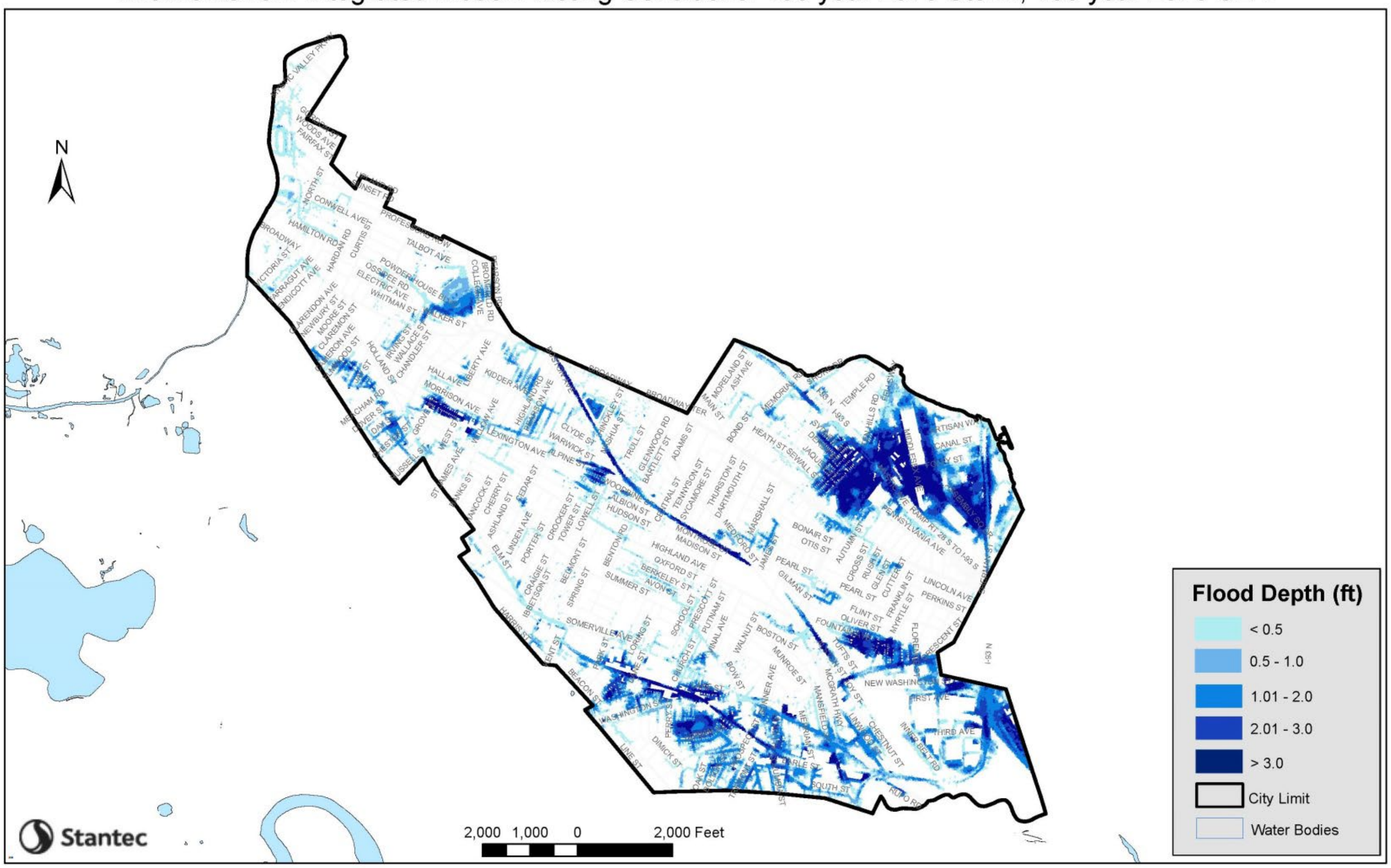
This map shows the impact of both precipitation-based flooding and sea level rise and storm surge. This map shows the modeled flood depths of a 100-year, 24-hour Design Storm with 1-year storm surge and sea level rise projections in 2030. Unlike the maps above, this includes modeling of the drainage system, which takes into account how water will be conveyed out of the city. The model is based on how the system is designed to function, so actual areas of flooding and depth of flooding could vary (Stantec, 2019).

InfoWorks ICM Integrated Model Existing Conditions: 10 year 2070 Storm, 1 year 2070 SLR



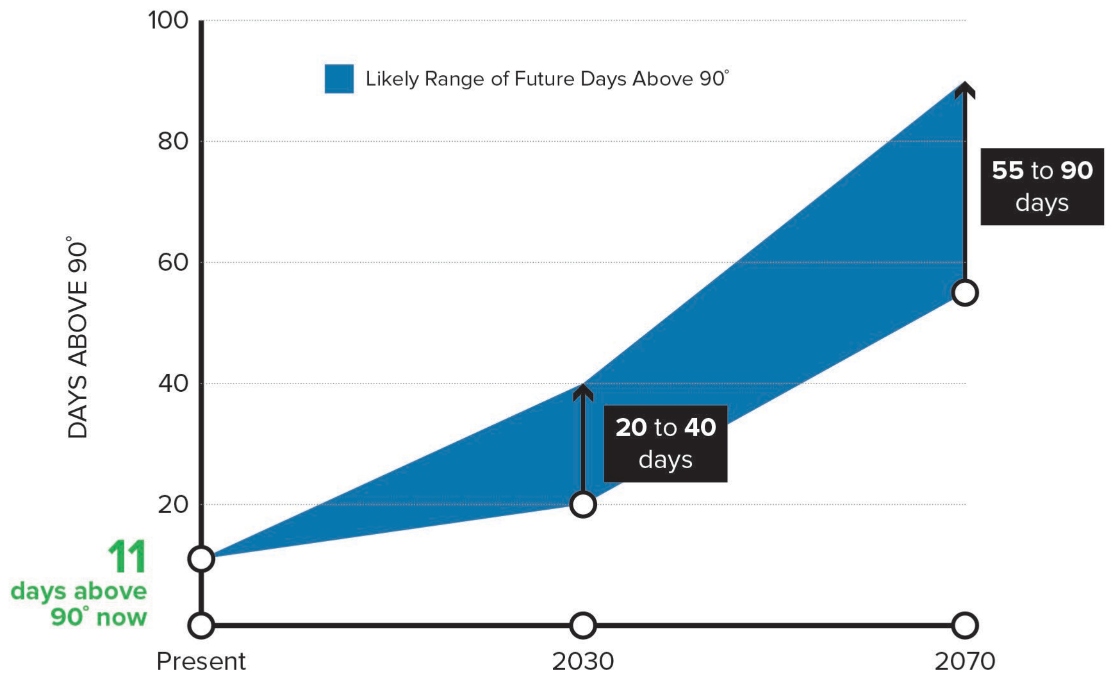
This map shows the impact of both precipitation-based flooding and sea level rise and storm surge. This map shows the modeled flood depths of the 10-year, 24-hour Design Storm with 1-year storm surge and sea level rise projections in 2070. This map includes modeling of the drainage system, which takes into account how water will be conveyed out of the city. The model is based on how the system is designed to function, so actual areas of flooding and depth of flooding could vary (Stantec, 2019).

InfoWorks ICM Integrated Model Existing Conditions: 100 year 2070 Storm, 100 year 2070 SLR



This map shows the impact of both precipitation-based flooding and sea level rise and storm surge. This map shows the modeled flood depths of 2070 100-year, 24-hour Design Storm with 100-year storm surge and sea level rise projections in 2070. This map includes modeling of the drainage system, which takes into account how water will be conveyed out of the city. The model is based on how the system is designed to function, so actual areas of flooding and depth of flooding could vary (Stantec, 2019).

Temperature Projections



(Somerville Climate Change Vulnerability Assessment 2017)

Temperature	1971-2000 (average)	2030 Avg. (low)	2030 Avg. (high)	2070 Avg. (low)	2070 Avg. (high)
Annual	50.0º F	53.3º F	53.5º F	55.8º F	58.7º F
Summer	70.6º F	74.5º F	74.8º F	77.4º F	80.6º F
Winter	29.8º F	32.2º F	33.0º F	34.6º F	38.0º F

RESOURCES:

For information on net-zero and resilient building and site design, please review the following resources:

- Passive House Principles
- Architecture 2030 Palette (Net-zero design tools)
- Building Resilience in Boston
- Enhancing Resilience in Boston
- A Better City's Resiliency Toolkit
- Ready to Respond: Strategies for Multifamily Building Resilience

For additional information visit www.somervillema.gov/sustainaville

SUSTAINABLE & RESILIENT BUILDINGS QUESTIONNAIRE

Section 1: Proposal Information

Proposal Name	Davis Square Plaza
Address	256-260 Elm Street
Developer	Asana Partners
Business Address	1616 Camden Road, Suite 210 Charlotte, NC 28203
Designated Contact	Welch Liles
Telephone Number	704.490.2528
Contact's Email Address	wliles@asanapartners.com
Date Submitted	10/5/2022
Filing Type (Development review application, Building Permit, or CoA)	Site Plan Review
Is this a revised Questionnaire?	NO
Is MEPA Approval Required?	NO

Section 2: Building & Site Details

2.1 Building Information

Building Uses	Retail (ground level only) and Laboratory / Office Tenant Space
Gross Floor Area	100,763
Expected Life of Building	50 years
Expected Life of Building Systems: HVAC, electrical, boilers, plumbing, telecom, lighting, energy management.	Mechanical Systems: 15 - 20 years for exterior equipment 30 years for interior equipment/distribution systems Plumbing Systems: 15-20 years for interior equipment 50 years for distribution systems Electrical Systems: 40 years for power equipment and distribution. Lighting Systems: 20 years for fixtures and controls Telecom Systems: 10 years for interior equipment/distribution systems
Type of Heating System(s)	Air to water heat pumps with supplemental electric boilers (hot water)
Type of Cooling System(s)	Air to water heat pumps (chilled water)

2.2. Green Building Green Building Professional(s): Name(s) and contact information	Sarah Michelman The Green Engineer, Inc. 23 Bradford Street Concord, MA 02174 sarah@greenengineer.com
Professional Credentials: Green Building Program Certification(s)	LEED AP B D+C
Building LEED Rating	LEED C+S v4 Platinum
Building LEED Point Score	81
Will you pursue LEED certification through the USGBC?	Yes
Are any other green building certifications being pursued? (Passive House, Enterprise Green Communities, etc.). Please describe.	No
2.3. Electric Vehicle Parking	The number of electric vehicles (EVs) in Somerville is expected to increase significantly over the next decade with more electric vehicles coming to market than ever before. Conservative estimates based on historical trends alone suggest 20% of personal vehicles in Somerville will be electric by 2040. Installing capacity for EV supply equipment (EVSE) has been shown to be more feasible and cost effective during construction than when retrofitting parking areas to support the installation of EVSE in the future[1]. Providing EVSE can increase the property value, become a future revenue source, and provide an amenity that more tenants and commuters will be looking for. It is recommended that parking facilities be designed to allow for the most flexibility to adapt to future needs of electric vehicles and changing mobility needs. The City of Somerville recommends 25% of spaces have installed charging access and up to 100% of spaces be "EV Ready" (everything but the station installed). Eversource currently has a program to pay the associated infrastructure costs of EV charging, including infrastructure needed to be "EV ready." Please consult with Eversource to determine if any installation costs could be covered through their Make Ready Program.

[1] http://evchargingpros.com/wp-content/uploads/2017/04/City-of-SF-PEV-Infrastructure-Cost-Effectiveness-Report-2016.pdf; https://www.richmond.ca/__shared/assets/Residential_EV_Charging_Local_Government_Guide51732.pdf

Total # of Parking Spaces	There is no new on-site parking being provided.
EVSE Plugs (number and voltage/ level of plugs)	n/a
EV Ready Spaces (everything but station is installed)	n/a
Please share any other information on your EV strategy. Have you spoken with Eversource? Are you talking with EVSE providers? Have you considered EVSE needs in conjunction with your parking and mobility management plans?	n/a

2.4 Key Building Efficiency Metrics
The following should be provided for each building type (office, retail, multifamily, hotel, restaurant, etc.).

Vertical Envelope Performance

Vertical Envelope	ASHRAE Reference Building			Proposed Building		
	Percent of Vertical Area	R value *(see note 1)*	U value *(see note 2)*	Percent of Vertical Area	R value *(see note 1)*	U value *(note 2)*
Framed, insulated Wall	77%		0.055	77%		0.048
Opaque glass, curtain wall, shadowbox, spandrel	NA – ASHRAE reference building has no spandrel					
Vision glass	23%		0.38	23%	-	0.30
	100%		***0.511***	***100%***		***0.439***

Notes:
1. Show in format of R+R c.i. where first R is amount of discontinuous insulation and second R is amount of continuous insulation.
2. U values shall be based on indicated R+R c.i. and shall conform to Appendix A of ASHRAE 90.1 2013.
3. U value includes frame, per NRFC standard methods.

4. Aggregate U is calculated as: ($U_1\%_1 + U_2\%_2 + U_3\%_3$) where U is the respective thermal transmittance values and $\%_1$ is the percent area of framed insulated wall; $\%_2$ is the percent area of opaque glass, curtain, or shadowbox; and $\%_3$ is the percent area of vision glass. Only areas adjacent to conditioned space are counted, areas adjacent to unconditioned spaces (e.g. parking garages, mechanical penthouses) are not counted. Aggregate R is the inverse of aggregate U. For percent areas for ASHRAE reference building, see Table G3.1.1-1 in ASHRAE 90.1 2013.

Other Performance Metrics

	ASHRAE Reference Building	**Proposed Building**
Air Infiltration (ACH 50)	0.4 cfm/sq.ft.	0.4 cfm/sq.ft.
Aggregate Vertical Envelope R	7.25	8.45
Roof R	31.25	31.25
Lowest level conditioned floor above unconditioned space (if any) R		
Cooling End Use (kBtu/sf-yr)	6.3	6.8
Heating End Use (kBtu/sf-yr)	57.7	12.7
Peak Heating (kBtu/hr-sf)	30.9	14.8
Peak Cooling (kBtu/hr-sf)	36.5	23.2
Site EUI (kBtu/hr-sf)	93.7	53.2

Section 3. Planning for Net Zero Emissions and Energy Resilience

3.1. How is the building currently designed to reduce energy usage? Please describe the key design features of the building including:

A) Building envelope performance (including roof, foundation, walls, and window assemblies)
B) How has the design team integrated energy performance into the building and site design and engineering (orientation, massing, mechanical systems, envelope, etc.)?
C) Efficiency of heating and cooling systems. Will these systems be electric? Provide reasoning for selection of heating and cooling systems.

This project is a demolition and replacement of an existing building. The siting of the building was limited due to the density of existing building. The existing plaza will remain and be upgraded for community use.

Envelope performance is intended to be optimized against the high tenant laboratory air change rates that are anticipated which has a tendency to reduce the effect of heat transfer through the envelope. High internal equipment loads are also considered as part of this analysis.

Mechanical systems are being designed as all-electric using air to water heat pumps that are capable of both hot water and chilled water production separately or simultaneously via heat recovery between fluid streams. The current ASHP selection is rated at 1.27 kW/ton at full load during cooling operation, 1.73

kW/ton at full load during heating operation and 0.70 kW/ton during simultaneous/heat recovery operation. Electric resistance boilers will be provided for redundancy when the air to water heat pumps approach their lower ambient temperature operating limit on heating design days.

3.2 Will the building be a net zero carbon building? A net zero carbon building is a highly energy efficient building that does not burn fossil fuels and either produces or procures enough carbon-free electricity to meet the building's total energy demand. If the building will not be a net zero carbon building, provide a technical description of how the building's systems will be transitioned over time to achieve net zero carbon emissions, including how and when systems can be transitioned in the future to carbon-free alternatives (provide timeline including 2030, 2040, and 2050 targets). Description must include whether any remaining emissions will be offset with on-site or off-site renewables and at what quantity. Changes could include, but are not limited to, addition of on-site renewable energy generation, energy storage, additional energy efficiency measures, building electrification, or other measures that would further reduce greenhouse gas emissions.

All building mechanical and plumbing systems will be electricity based and no on-site fossil fuel systems will be utilized. The building has the potential to be a net zero energy/carbon facility but will be highly dependent on tenant fit-outs and the actual energy use intensity. On-site renewable energy potential is severely limited so any electricity emission offsets would be achieved through the purchase of renewable energy certificates.

3.3 Describe any and all incentives, rebates, grants provided by utilities, government organizations, and other organizations being pursued to maximize building efficiency and to reduce emissions. Description must include any incentives that were considered but are not being pursued, including reasoning for each decision.

The project design team held a design charrette with a representative from Eversource to discuss and review incentive program options and identify the appropriate pathway for this project. It appears that Mass Save incentives for air source heat pump equipment is currently $2,500/ton although this will need to be confirmed based on the central air to water heat pumps being specified.

3.4 Evaluate feasibility of on-site renewable generation. Please describe your analysis and findings. Analysis should consider incentives available. Will any renewable energy generation be incorporated into the project? If so, please describe (system type and capacity). If no, could it be added in the future? And will any off-site renewable energy be purchased?

The building has a very compact footprint and limited roof area due to the laboratory mechanical equipment so on-site renewable energy potential is not practically feasible. The proponent will be considering the feasibility of purchasing renewable energy certificates.

3.5. Are any on-site energy storage systems planned? Please describe.

No on-site energy storage systems are being considered at this time

3.6 Does the electric utility's infrastructure have enough capacity to support the addition of your building's energy load? Please provide confirmation from utility.

The existing electrical infrastructure will be demolished and new utility infrastructure will be installed to fully support building design loads and it is assumed that Eversource has sufficient capacity available to support the overall increases in electricity load due to mechanical and plumbing system electrification.

3.7 Will the building's roof include any sustainability features? These may include, but are not limited to, high albedo roof materials, solar panels, or vegetation. Please describe what features could be added in the future (i.e. roof will be designed to support solar or green roof installation of X size).

The roof will include high albedo materials along with the appropriate levels of insulation.

Section 4: Climate Change Risk and Vulnerability

4.1 Climate Vulnerability Exposure (check all that apply)	☐ Sea Level Rise & Storm Surge ✓ Precipitation Induced Flooding ✓ Heat ☐ Other(s):

4.2 How is your site vulnerable to projected climate change impacts?

The site is vulnerable to the generalized increased risk of extreme weather events due to climate change, but is not projected to be subject to sea level rise or storm surge. The site location is vulnerable for future precipitation induced flooding.

The next two sections ask specific questions about how the project is designed to manage climate-related risks from heat, coastal and inland flooding.

Section 5: Managing Heat Risks

5.1 Describe all building features that will keep building occupants safe and comfortable during extreme heat, including mechanical systems and non-mechanical design elements to cool building (orientation, envelope, operable windows, etc.).

Glazing is being specified with a reduced solar heat gain coefficient (SHGC) of 0.28 which is a 30% reduction relative to the maximum prescriptive requirements of the 2018 IECC. Optimized wall and roof insulation values will also exceed the prescriptive requirements of the 2018 IECC by 15% as a design target. Roof materials will also be specified to meet the heat island reduction credit requirements for LEED v4.

Mechanical cooling will be provided for all regularly occupied retail and tenant areas and will be capable of operating to approximately 115 deg. F ambient dry bulb temperature at a 10-15% loss of rated capacity. Redundancy in the air source heat pump (ASHP) system configuration will result in additional installed capacity above the peak design cooling load itself. The ASHPs will also be capable of operating in heat recovery mode which will allow waste heat from cooling operation to be recovered within the heating hot water loop, further reducing the need for heat rejection to ambient conditions via the condenser. Air side energy recovery systems will also allow for active reductions in ventilation air conditioning loads.

5.2 How has increased demand for indoor cooling been factored into the building design and energy management strategy?

Sufficient cooling capacity will be required for all regularly occupied retail and tenant areas and upstream air and hydronic systems will have excess capacity to provide for flexibility in the design and ultimate operation of tenant areas.

5.3 List any indoor spaces without cooling and their uses.

Areas not being provided with mechanical cooling include stairwells and entrance vestibules, duct and elevator shafts, transformer and secondary electrical rooms, mechanical rooms, loading dock and the bike storage area. Passive cooling using ventilation air will be provided for mechanical rooms and the transformer room.

5.4 What design features will be implemented on site to minimize the site's contribution to the urban heat island effect? Please describe any and all design elements. Strategies could include, but are not be limited to, the following:

- High albedo pavement or roof materials
- Passive cooling or increased ventilation capacity
- Green roofs or walls
- Heat resistant trees and plants
- Additional landscaped areas

The pavement for the plaza renovation will be high albedo and will include permeable pavers. Additional landscaped areas within the civic plaza will remove from the total hardscaped surface area. A variety of trees and plants will also reduce the heat island effect.

Section 6: Managing Flood Risks

6.1 Is the site susceptible to flooding from sea level rise and storm surge and/or rain events now or during the building's expected lifetime? Please refer to the Somerville Climate Change Vulnerability Assessment and the updated stormwater flooding maps provided in the Background section of this Questionnaire. Additional maps and data are available by request (email hpayne@somervillema.gov)

The project site is not susceptible to flooding from sea level rise, storm surge, or rain events now or within the 10-year expected flood depth. The project site is more susceptible within the expected 100 year 2070 storm, falling into the 1.01 – 2.00-feet flood depth zone.

If you answered YES to the previous question, please complete the remainder of Section 6. Otherwise, you have completed the Questionnaire. Thank you.

6.2 Flooding Design Considerations

Proposed Site Elevation - Low	27.67 +/- (ft)	Proposed Site Elevation - High	30.60 +/- (ft)
Lowest elevation of life-safety systems	19.60 (ft)	Proposed First Floor Elevation	30.60 (ft)
Nearest flood elevation for the 2070 10-year storm	1.01-2 ft flood depth	Nearest flood elevation for the 2070 100-year storm	1.01-2 ft flood depth

6.3 What are the first floor uses of the building? Are there any below ground stories of the building? If so, what uses are located below ground?

First floor uses of the building include retail, lobby, and support core (loading, restrooms/showers, bike storage, etc.). The below ground level includes open space for possible storage, mechanical support, and PH neutralization, fitness, and conference center.

6.4 Are there any flood-sensitive assets, utilities, mechanical equipment, or life-safety systems located in areas of the building that are at risk of flooding? What measures will protect building systems during a flood or severe storm? These might include, but may not be limited to, the following:

- Elevation of utilities and mechanical systems
- Water tight utility conduits
- Waste water back flow prevention
- Storm water back flow prevention
- Systems located above the ground floor
- Securing objects at risk of becoming dislodged

The emergency generator and head end mechanical systems are located at the roof level.
The electric utility transformer is located above grade and within the building envelope.
Water and fire service entrances as well as the acid neutralization system that will serve the laboratory tenant areas are both located in the basement. Items at risk will be secured.

6.5. Residential and commercial buildings should be designed to maintain regular operations during a 10-year storm in 2070. **Describe how the site and building have been designed to maintain regular operations--meaning all systems will remain operational and all occupied spaces are protected from flooding--during the 2070 10-year storm.** Please refer to both the 2070 coastal flood probability map and the 2070 10-

year storm and 1-year sea level rise scenario (pages 3 and 6). Resilience measures might include, but may not be limited to, the following:

- Elevation of the site
- Structural elevation of the building
- Non-structural elevation of the ground floor
- Energy storage and backup generation
- Wet flood-proofing (allowing water to flow through building envelope)
- Dry flood-proofing (preventing water from entering building)

The building is located outside of the flood zone for both 10-year storm and 1-year sea level rise scenarios. The emergency generator provides power for both preservation heat and critical systems.

6.6 Residential buildings should be designed to allow occupants to shelter in place during a catastrophic storm (100-year event) today and in the future, this means all life-safety systems should be above the 2070 100-year flood elevation. **How will your site and building be impacted by the 2070 100-year, 24-hour storm and how will your site and building be designed to protect against those impacts?** Please evaluate impact based on both the 2070 coastal flood depth model for the 100-year storm and the 2070 100-year, 100-year sea level rise model (pages 4 and 7). Summarize anticipated pre- and post-event policies, strategies, and actions necessary to facilitate post-flood recovery.

NA - Project does not contain residential uses, only retail and lab/office.

6.7 Will hazardous or toxic material be stored on site? Where will it be stored? How will you protect hazardous or toxic material from flooding?

Mild hazardous materials of level BSL2 will be stored on site. These materials will be stored on Level 1 away from public access. The level of flood risk of these items will be minimal by locating them above the anticipated flood level.

6.8 Will the site be accessible by a typical vehicle during a 10-year event (up to 6 inches of water) and by emergency vehicles (up to 12 inches of water) during a 100-year event?

Given the 1-2 ft of flooding anticipated from the 2070 10-year event, a typical vehicle will not be able to access the site. Based on the 2070 100-yr event, an emergency vehicle may be able to access the site depending on the intensity of flooding (anticipated 1-2 ft).