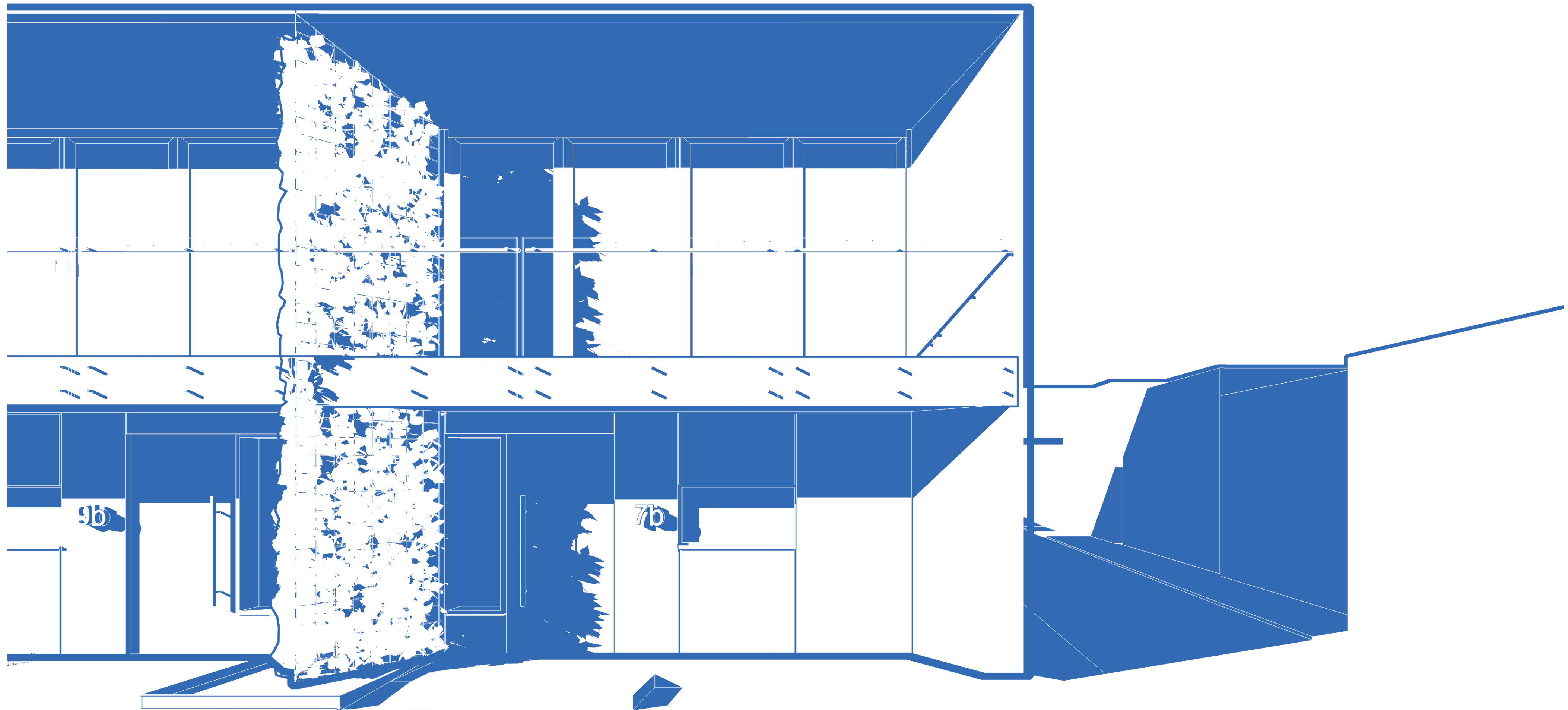


LANEZERO

The Future Cities Collective

2017 U.S. Department of Energy Race to Zero



SUPPORT AND PARTNERSHIPS



Vera Straka
(Faculty Advisor)



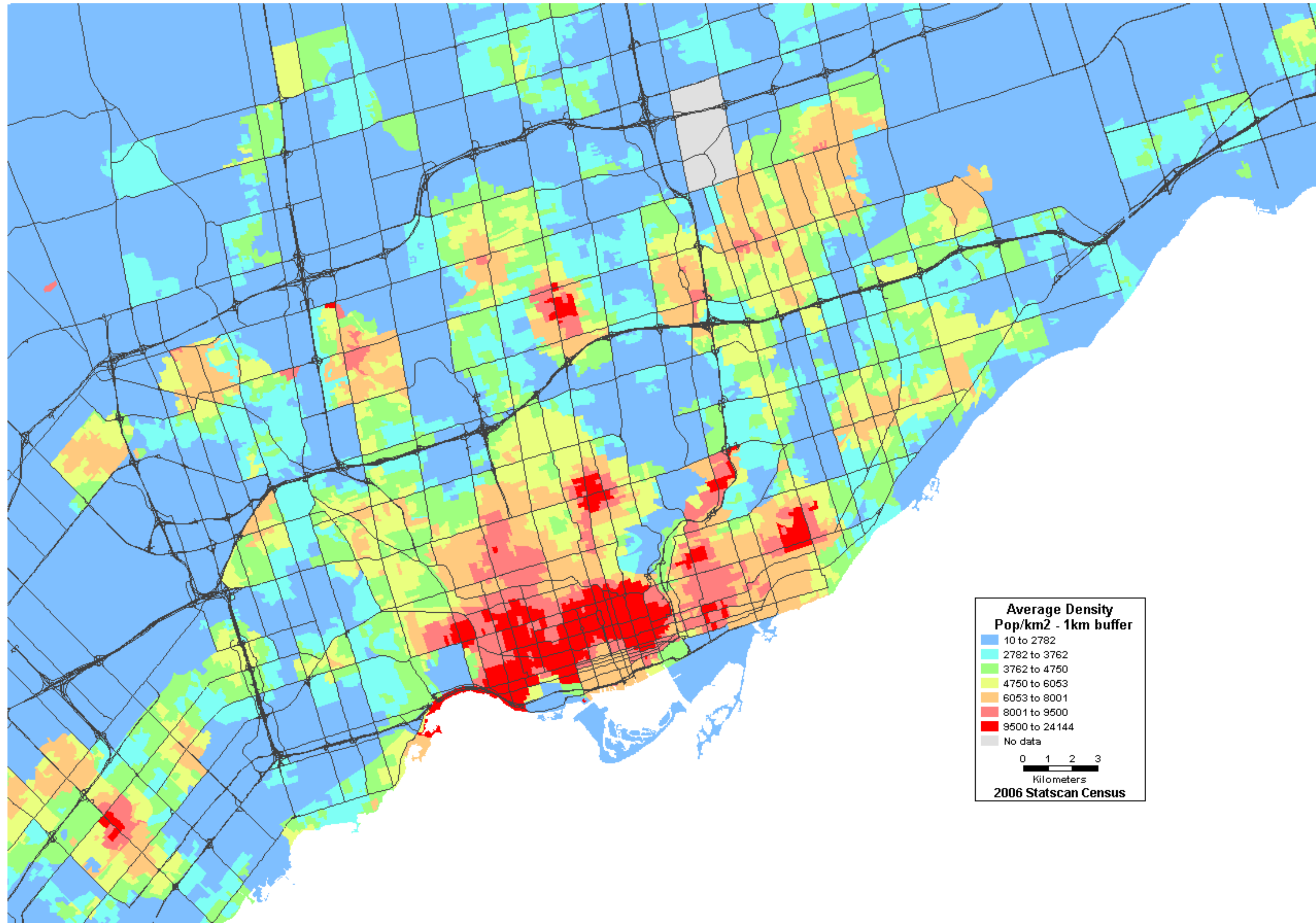
TORONTO



TORONTO



TORONTO



CHRISTIE PITS



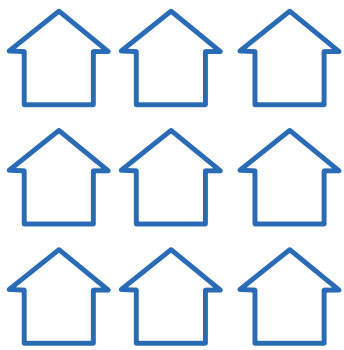
LANEWAYS



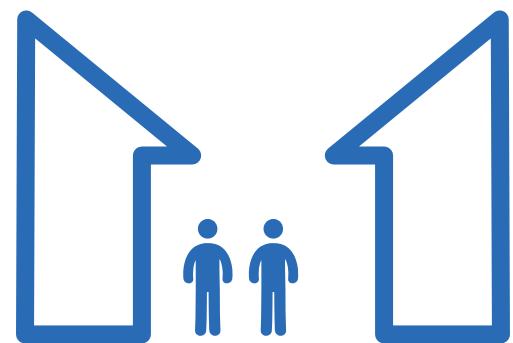
DESIGN GOALS



NON-DISRUPTIVE DENSIFICATION



SCALEABLE AND REPLICABLE DESIGN



ACTIVATE LANEWAYS



SPATIAL EFFICIENCY



LOVE WHERE YOU LIVE

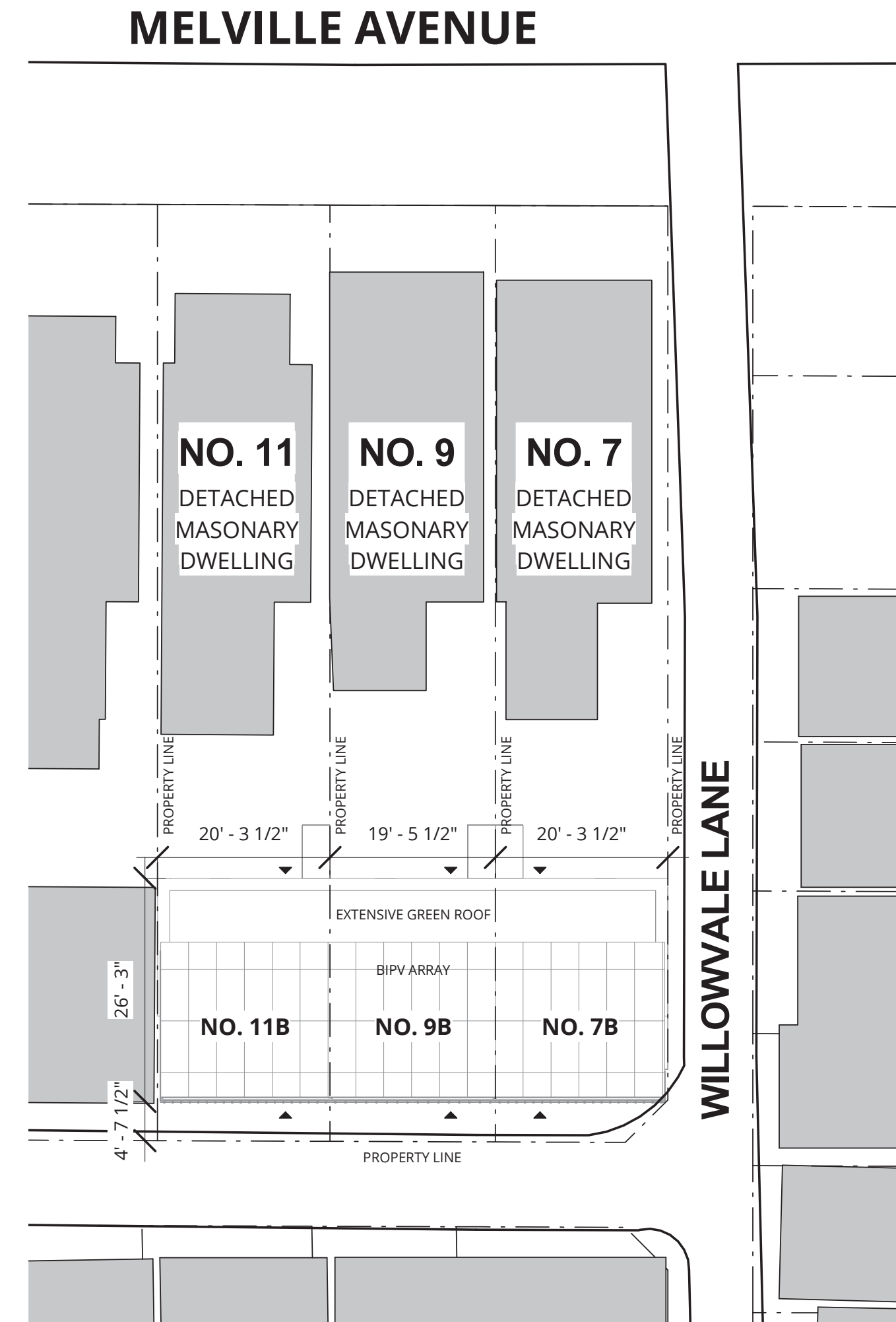
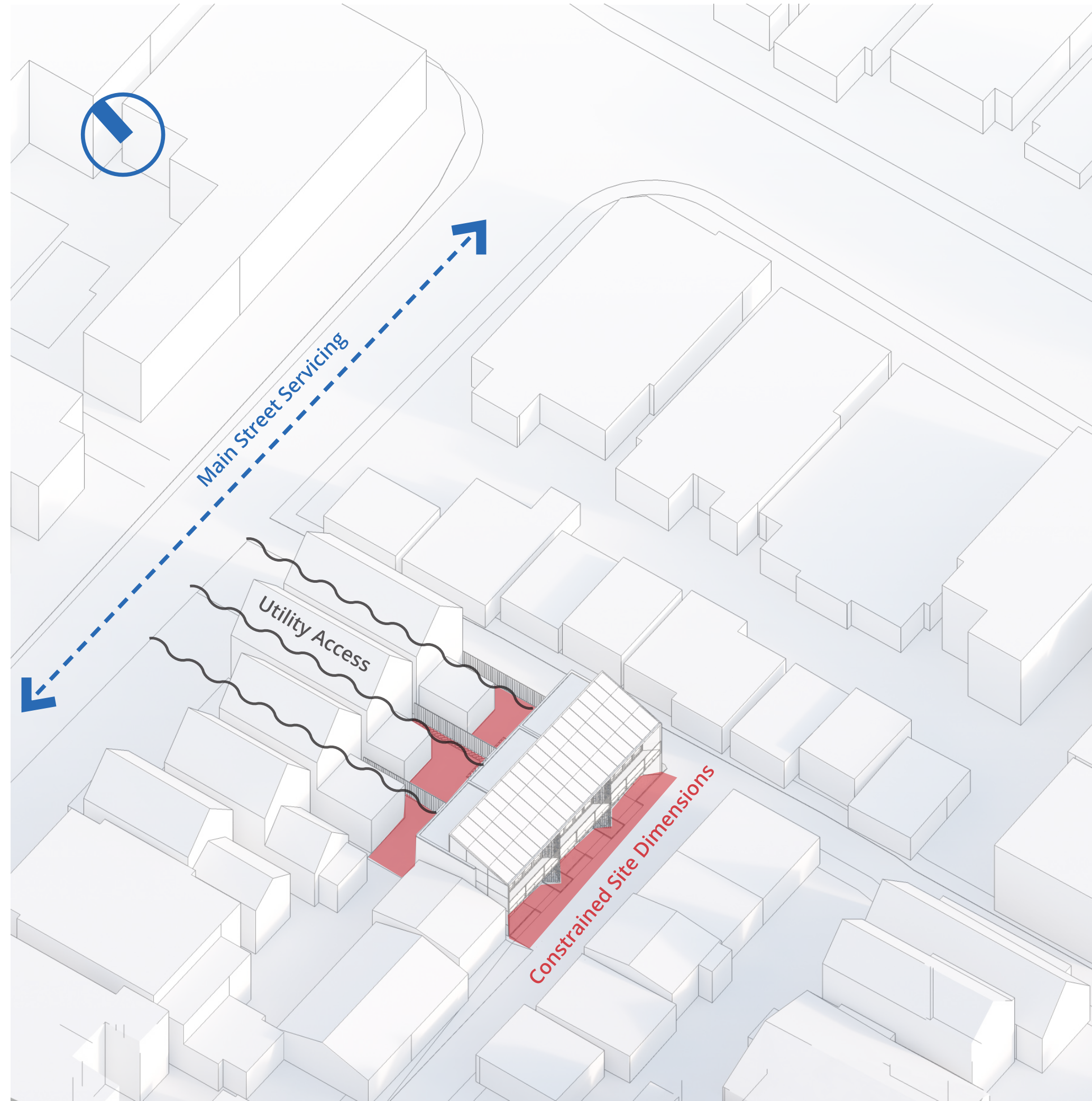


MEET MARKET DEMAND



NET-ZERO SITE ENERGY BUILDING

SITE CONDITIONS



LaneZero



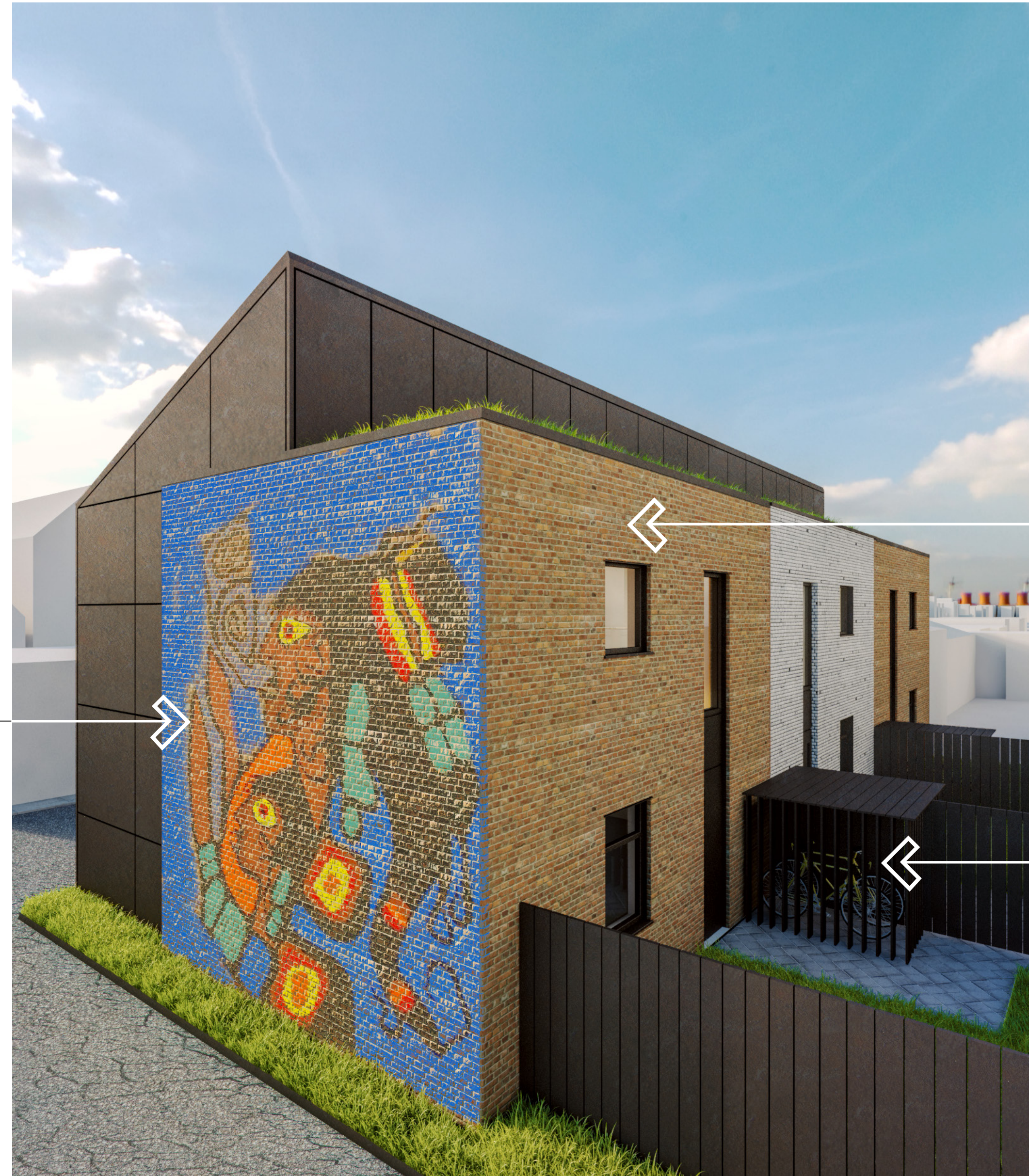
ACTIVATING THE LANEWAY



Vines and Planters Bring Life to the Laneway

Private Lane-Facing Balcony

Durable Street Facing Materials



Mural by Local Artist

Salvaged Brick from Existing Garage

Enabling Active Lifestyles

TARGET DEMOGRAPHICS



Loves: Biking to the park on Saturdays

Dislikes: Drivers who cut off bikers

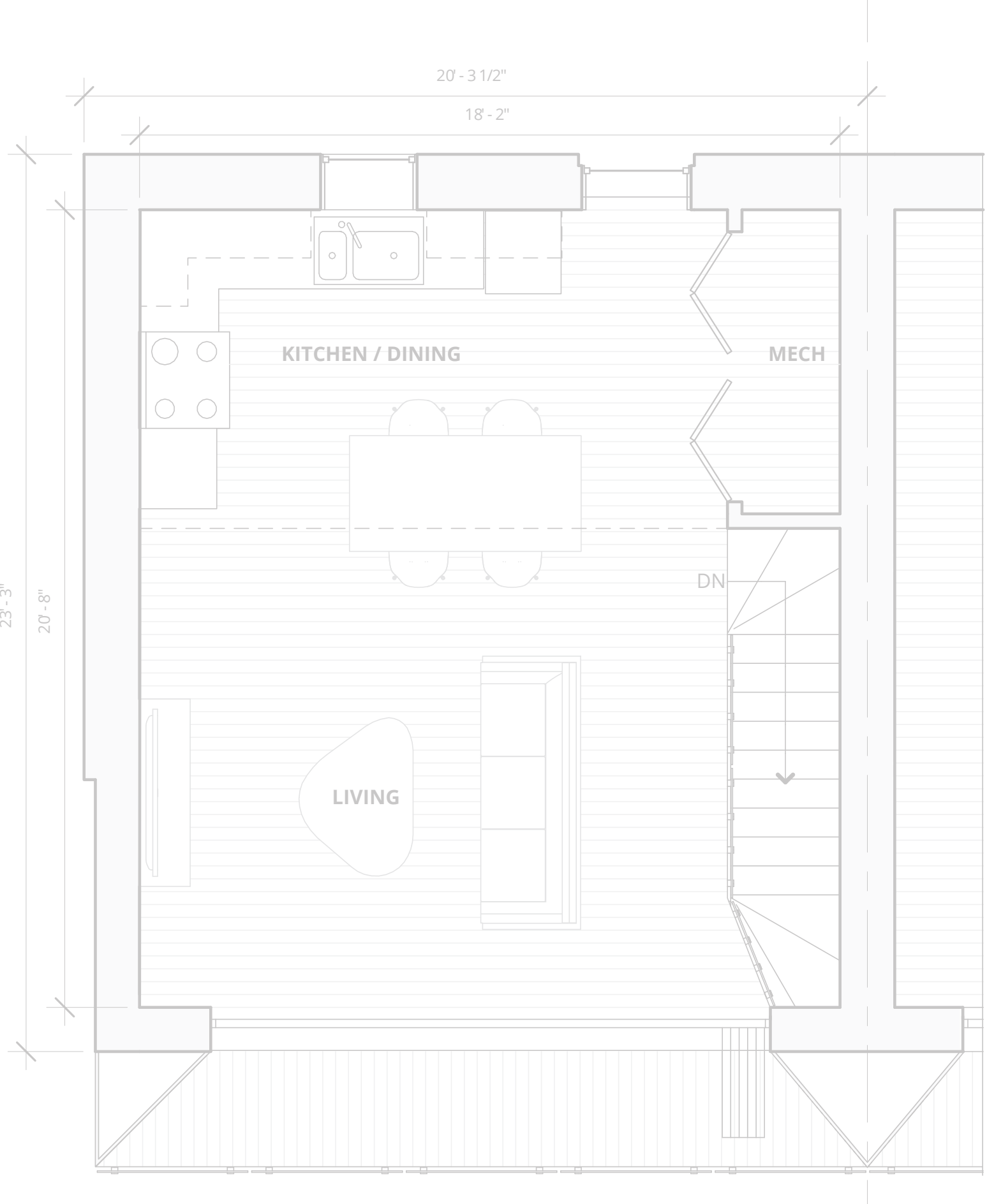
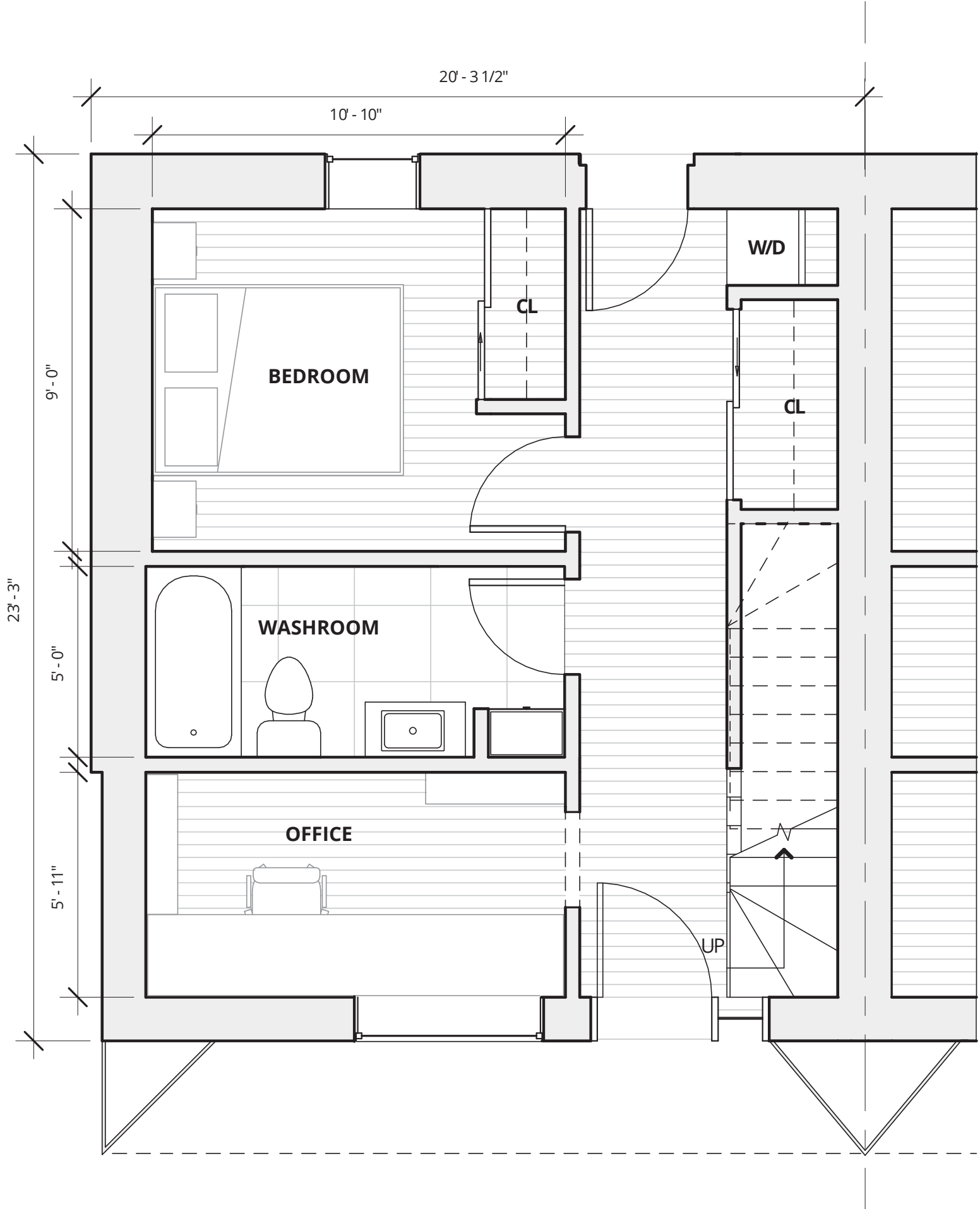
Loves: Weekend getaways to New Orleans

Dislikes: Anything with G.M.O.'s

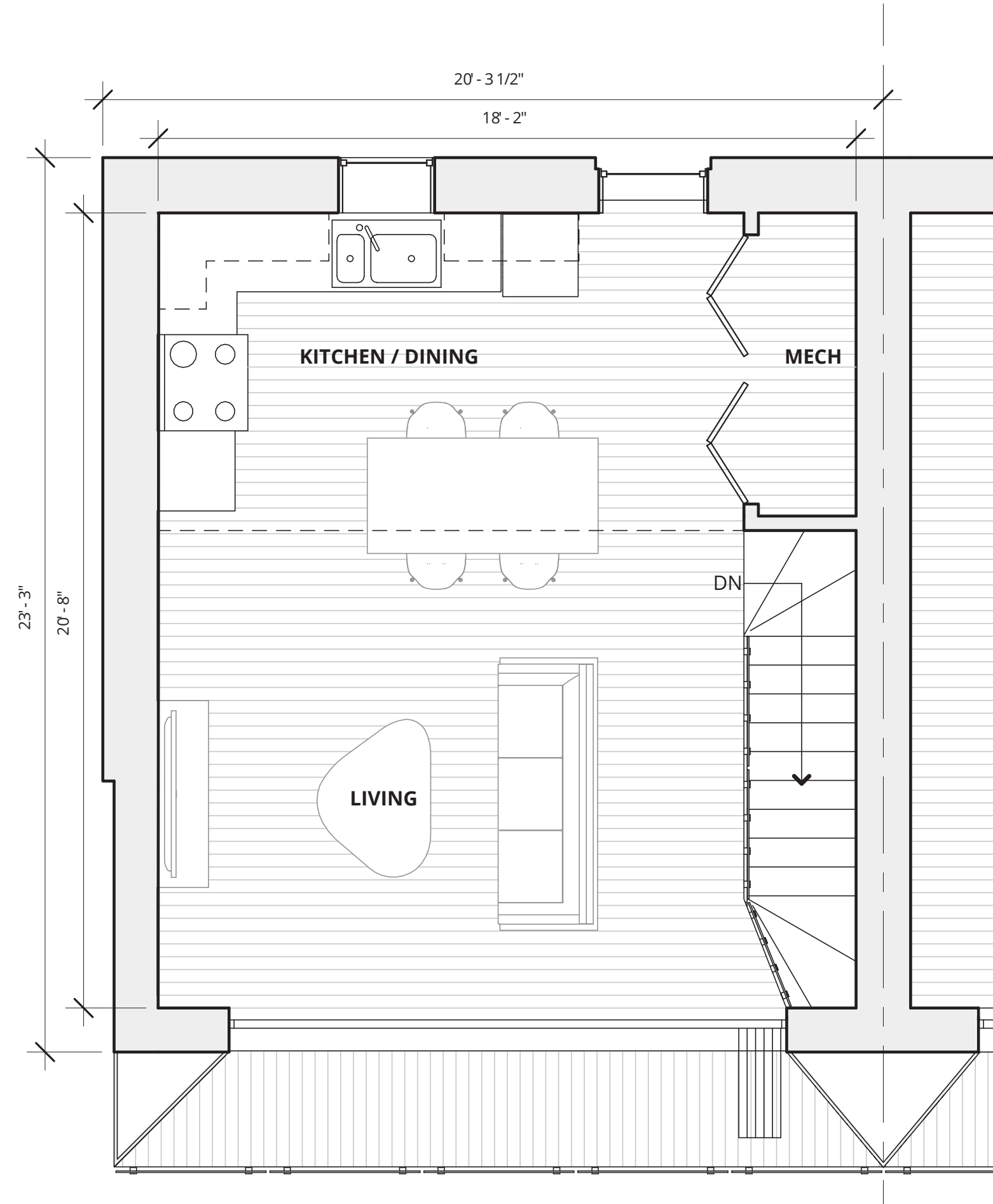
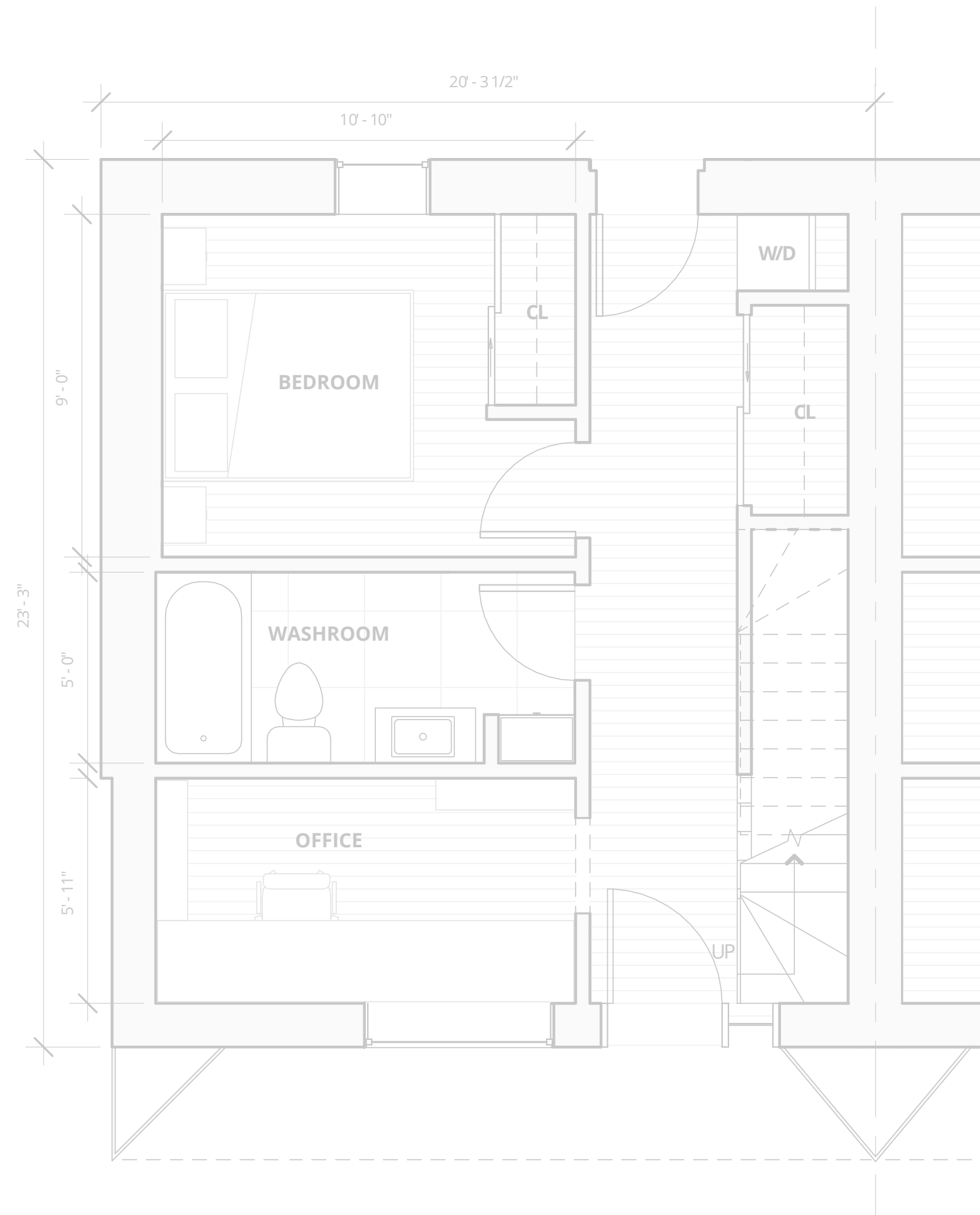
Loves: Craft Beer

Dislikes: Uber getting confused about their laneway address

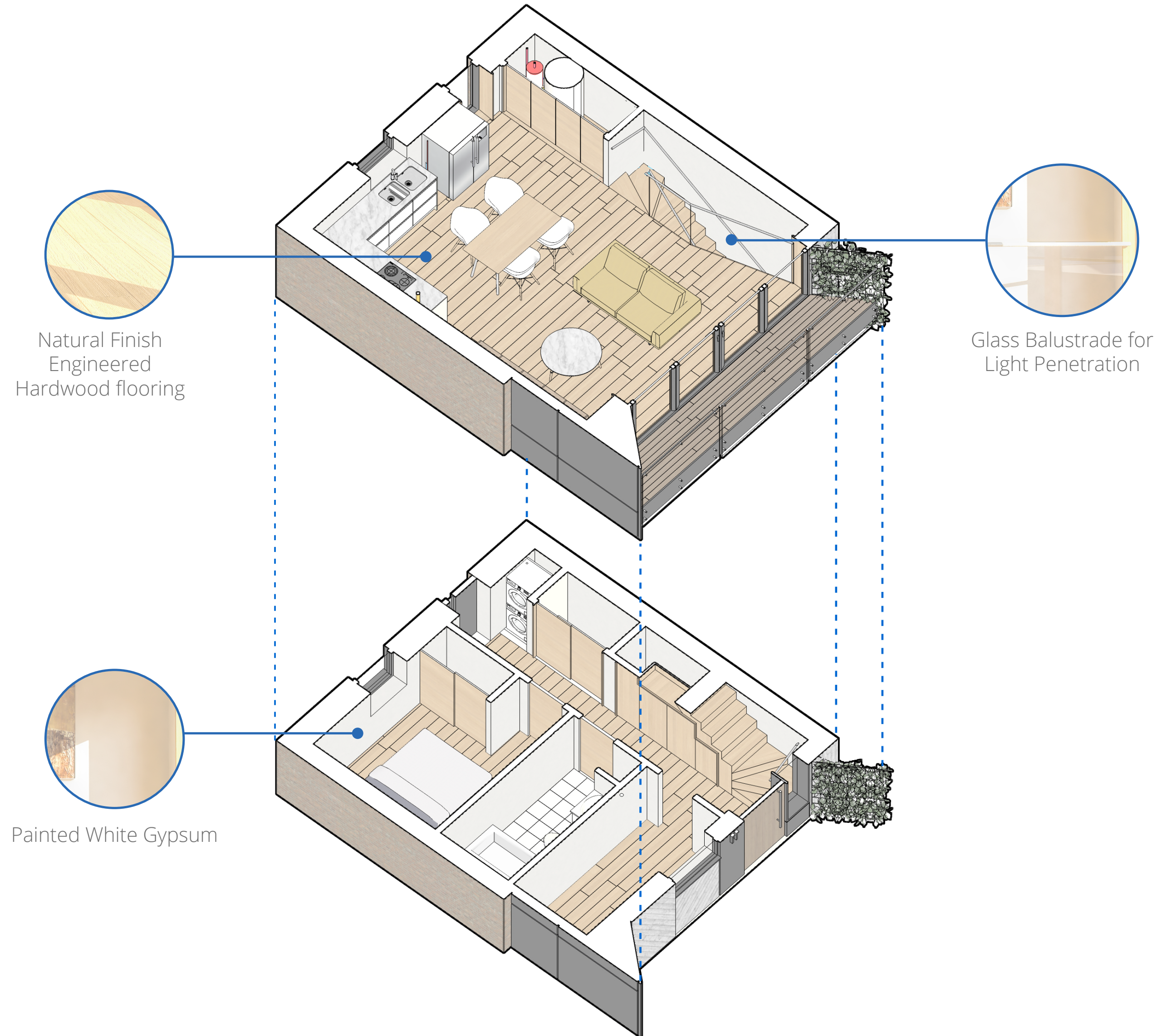
GROUND FLOOR PLAN



SECOND FLOOR PLAN



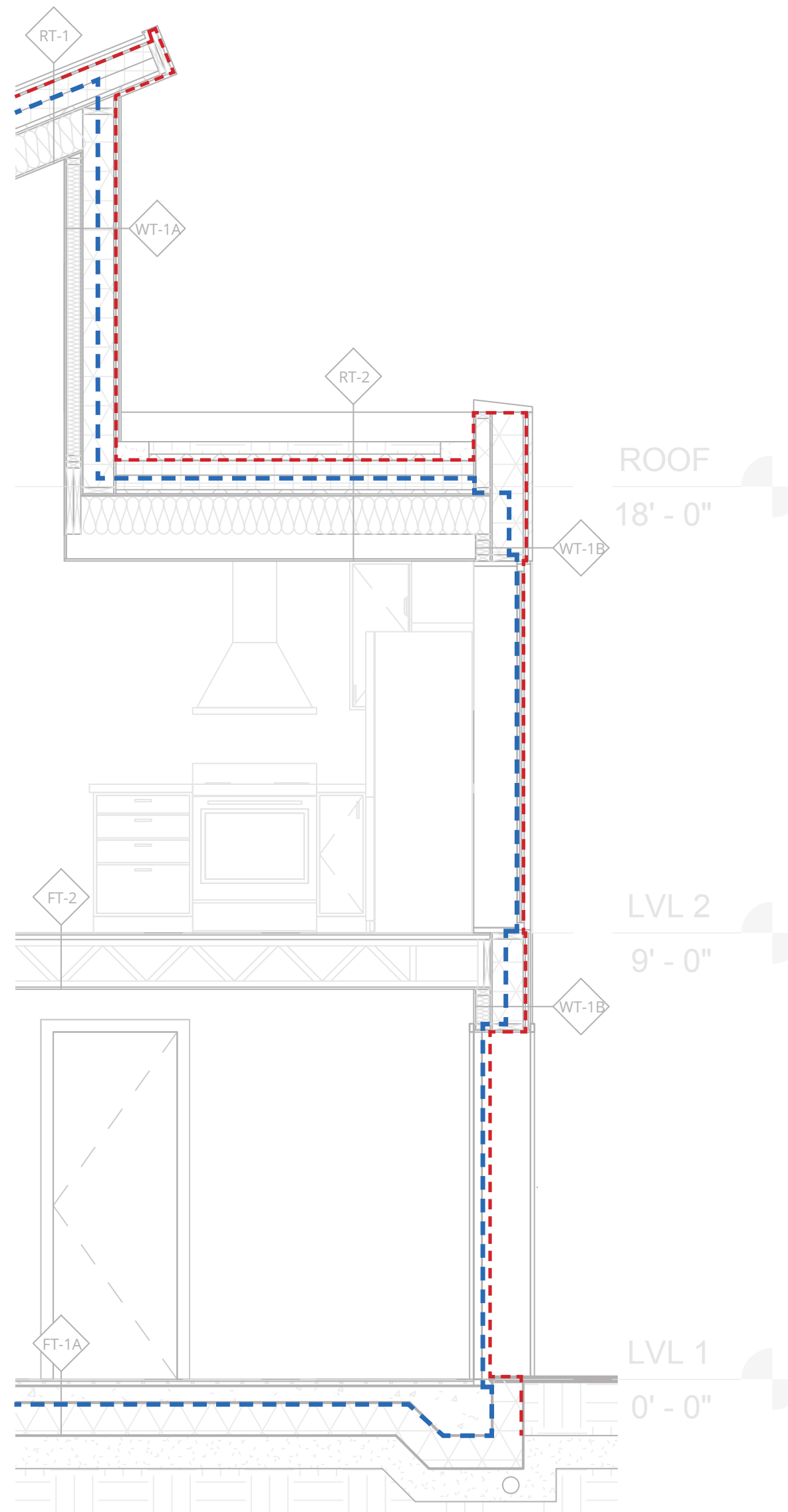
MATERIAL SELECTION



	R-Value (hr-ft ² *°F)/Btu
Slab	35
Exterior Wall	40
BIPV Roof	67
Green Roof*	67

* Planting and medium excluded

- - - - Vapour Control Layer
- - - - Air Control Layer



WT-1A

- 1/2" GWB
- 2x4 WOOD STUDS @ 16" O.C W DENSE PACK CELLULOSE
- 1/2" OSB
- 7.5" EPS FOAM
- 1/2" ZIP SHEATHING
- VENTED AIR SPACE
- ALUMINUM CLADDING

FT-1A

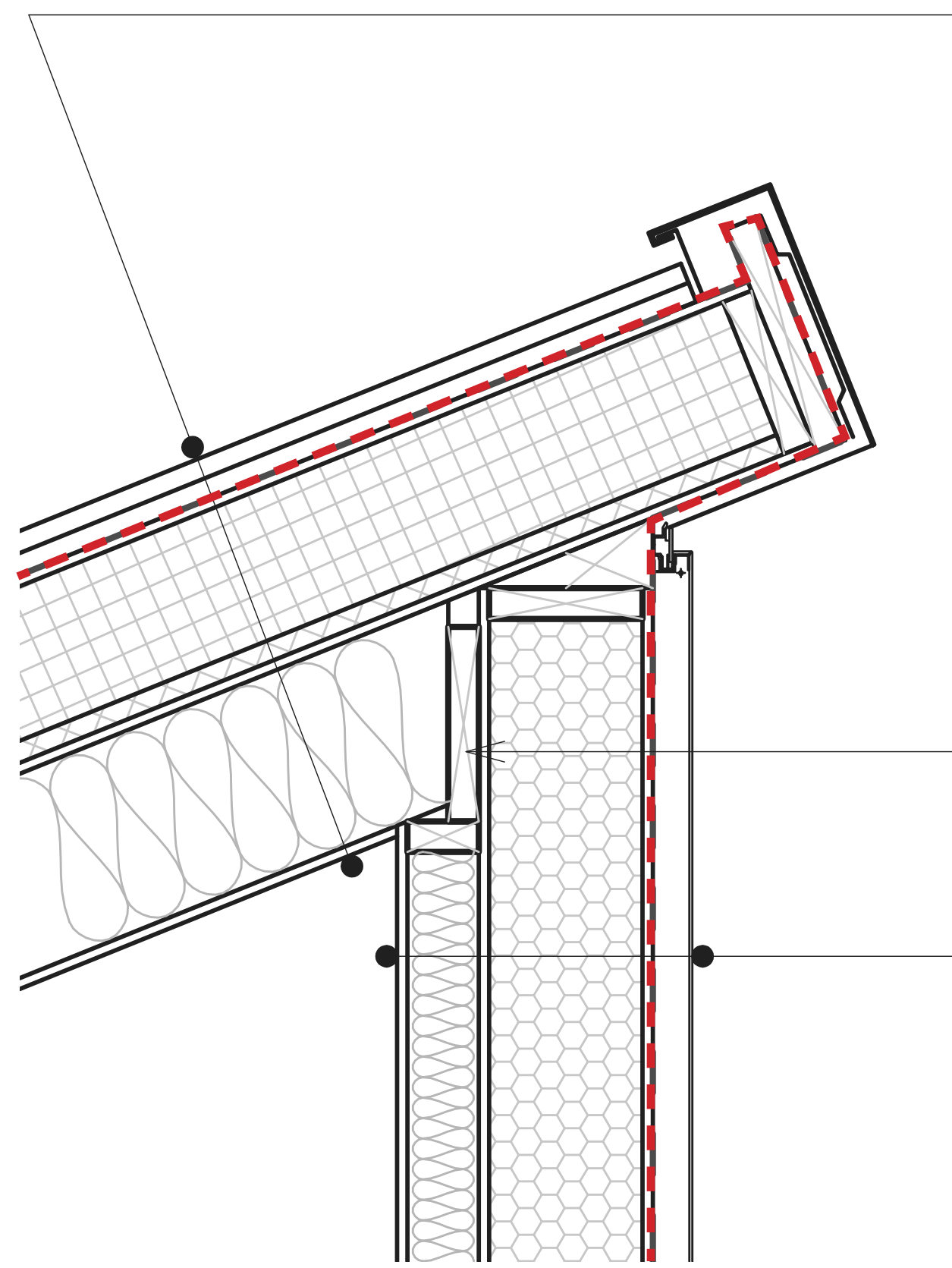
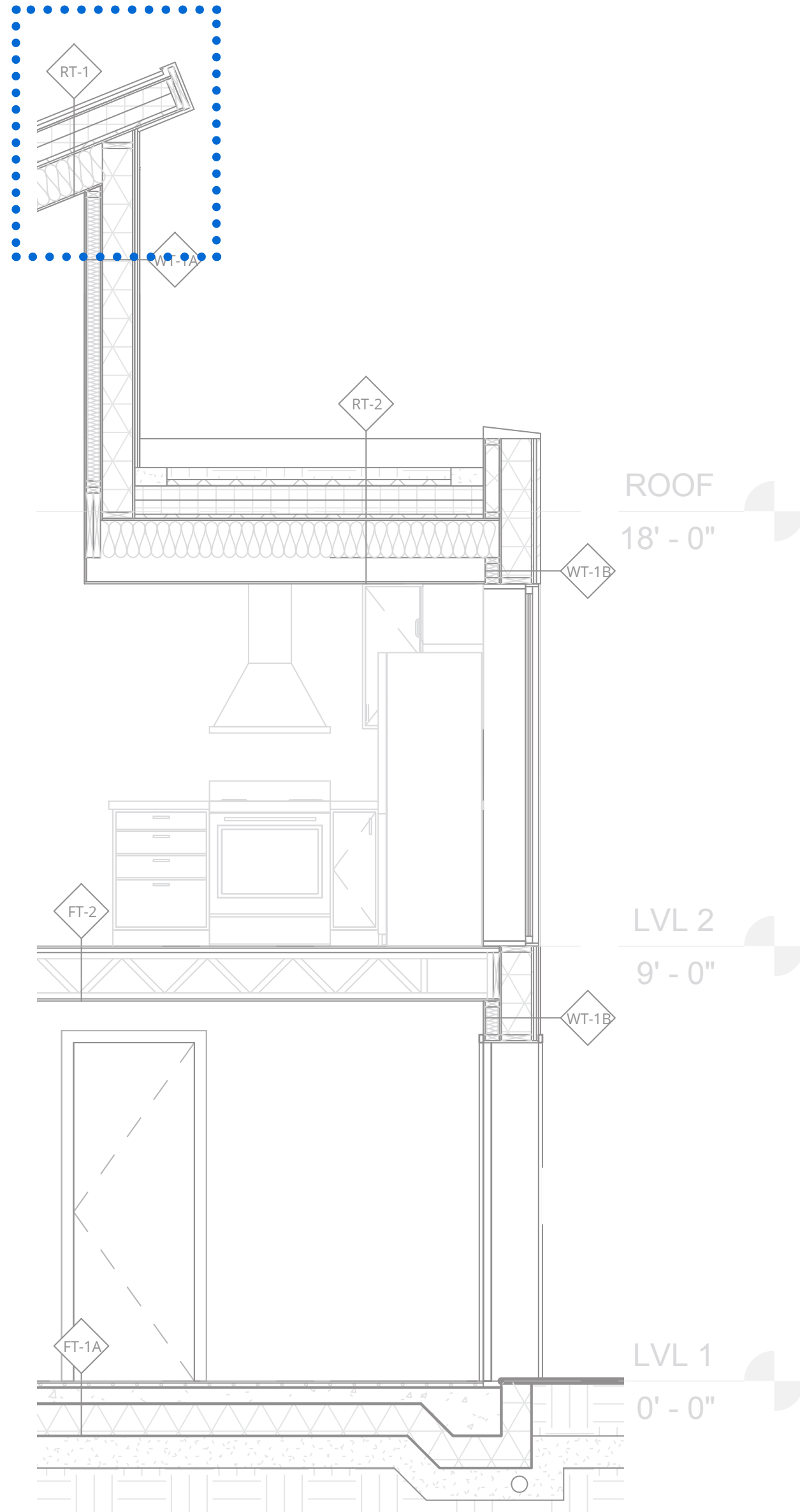
- 1/2" HARDWOOD FLOORING
- 1 1/8" WARMBOARD
- 1/2" VENT GRID MAT
- 4" CONCRETE
- POLY FILM
- 8" EPS INSULATION

RT-1

- PV PANELS
- MOUNTING GIRTS / VENTED AIR SPACE
- ASPHALT PAPER
- 1/2" OSB
- 2 x 3.5" XPS INSULATION
- 1" ROXUL TOPROCK
- 10 PERM VAPOUR RETARDER
- 1/2" OSB
- 2x10 WOOD RAFTERS @ 24" O.C W DENSE-PACK CELLULOSE INSULATION
- 1/2" GWB

RT-2

- 3" SUBSTRATE MEDIUM
- FILTER FABRIC
- 1 1/2" DRAINAGE BOARD
- 1/8" PROTECTION MAT
- ASPHALT PAPER
- 2 x 3.5" XPS INSULATION
- 1" ROXUL
- 10 PERM VAPOUR RETARDER
- 1/2" OSB
- 2x10 WOOD RAFTERS AT 24" O.C W DENSE-PACK CELLULOSE INSULATION
- 1/2" GYPSUM DROP CEILING (6" BELOW RAFTERS)



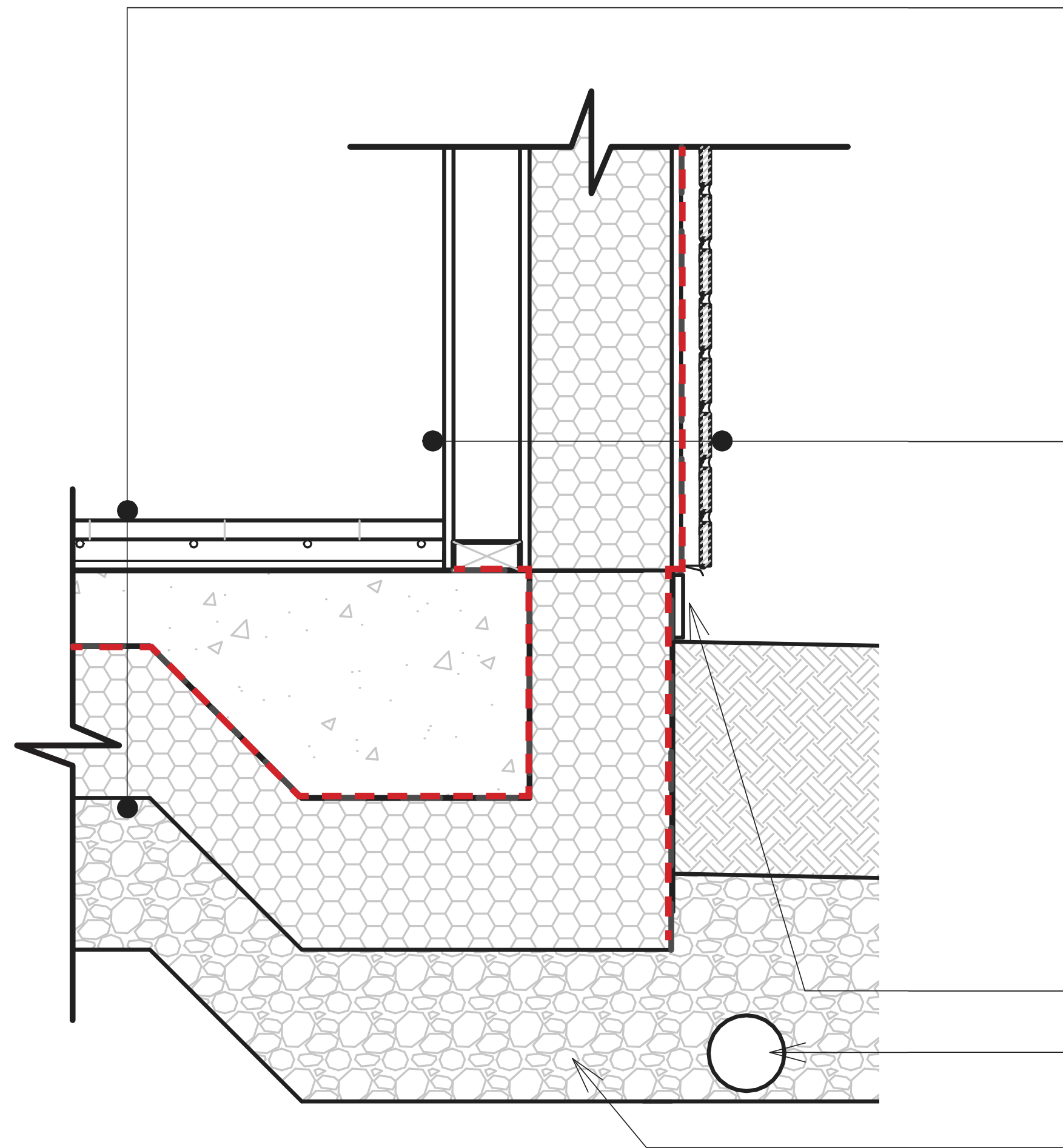
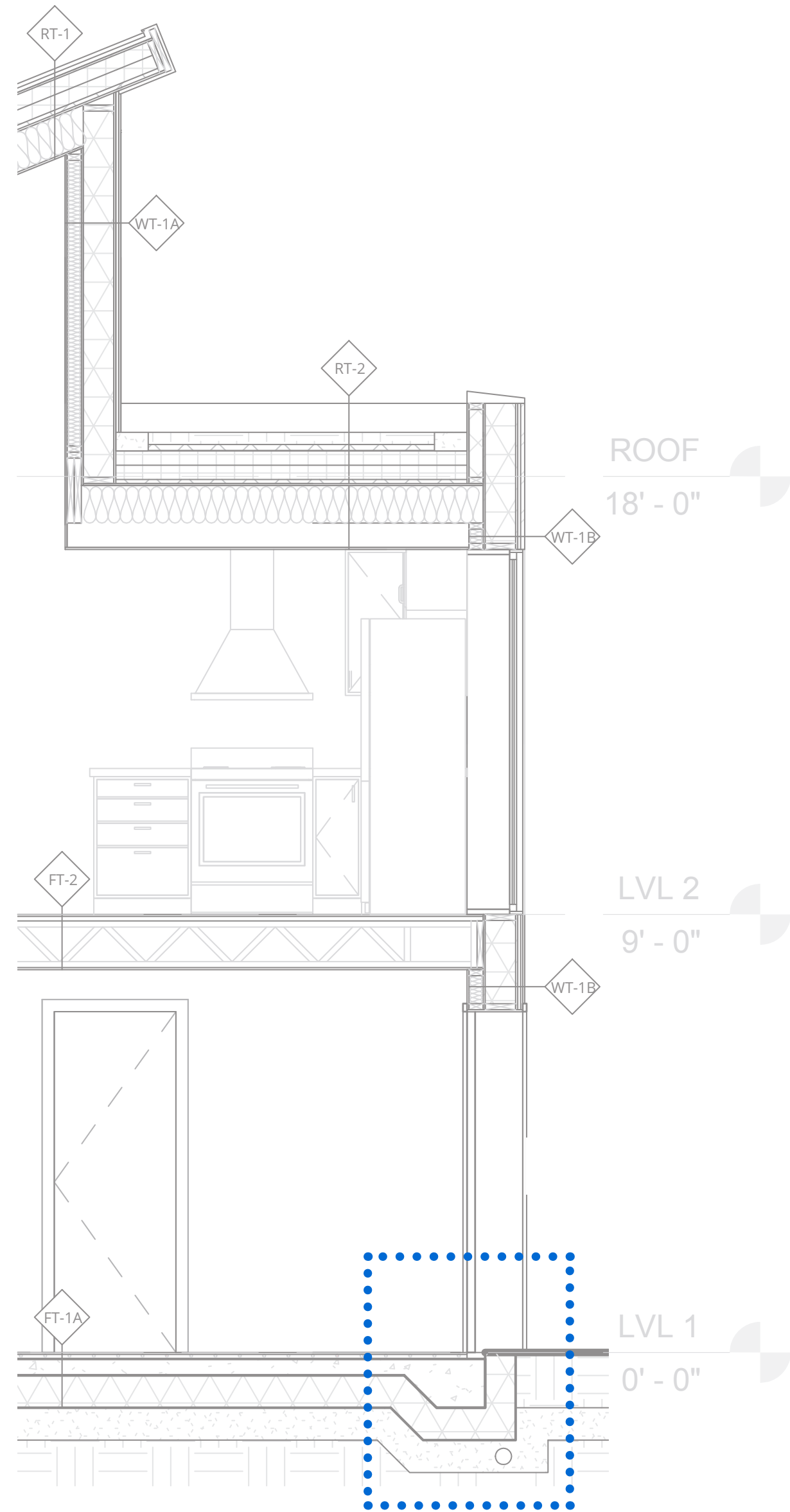
RT-1
PV PANELS
MOUNTING GIRTS / VENTED AIR SPACE
ASPHALT PAPER
1/2" OSB
2 x 3.5" XPS INSULATION
1" ROXUL TOPROCK
10 PERM VAPOUR RETARDER
1/2" OSB
2" x 10" WOOD RAFTERS @ 24" O.C W
DENSE-PACK CELLULOSE INSULATION
1/2" GWB

2x10 RIM BOARD

WT-1A
1/2" GWB
2x4 WOOD STUDS @ 16" O.C WITH DENSE PACK CELLULOSE
1/2" OSB
7.5" EPS FOAM (THERMAL AND VAPOUR BARRIER)
1/2" OSB
VENTED AIR SPACE
ALUMINUM CLADDING

--- Air Control Layer

BUILDING ENVELOPE



--- Air Control Layer

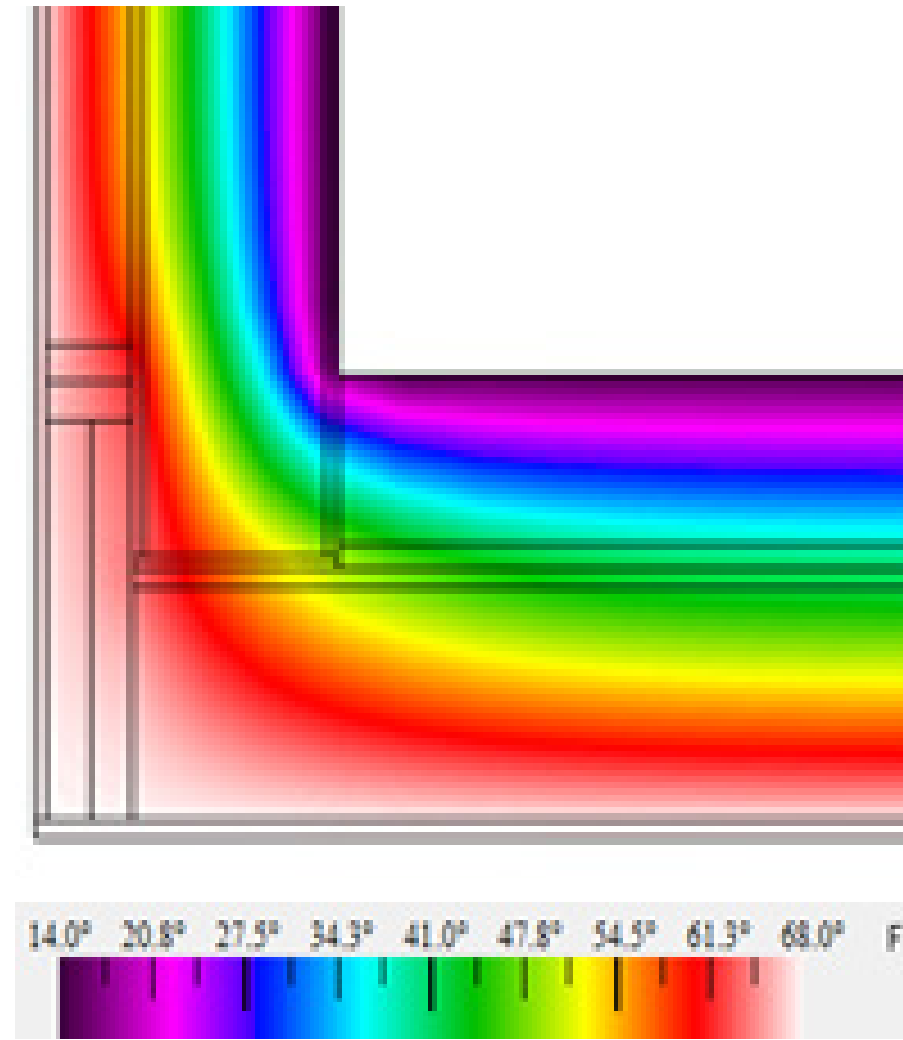
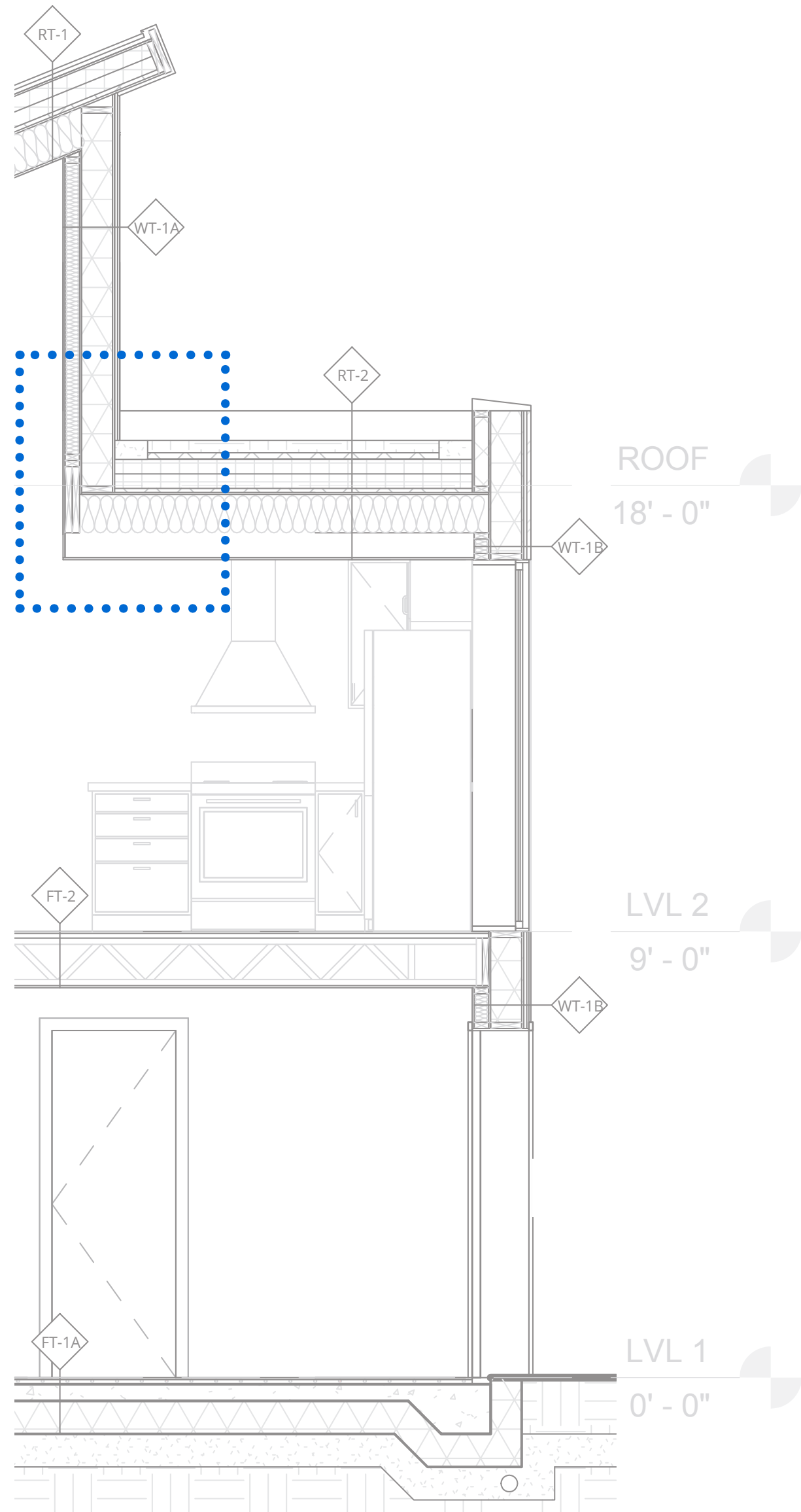
FT-1A

- 1/2" HARDWOOD FLOORING
- 1 1/8" WARMBOARD
- 1/2" VENT GRID MAT
- 4" CONCRETE
- POLY FILM
- 8" EPS INSULATION

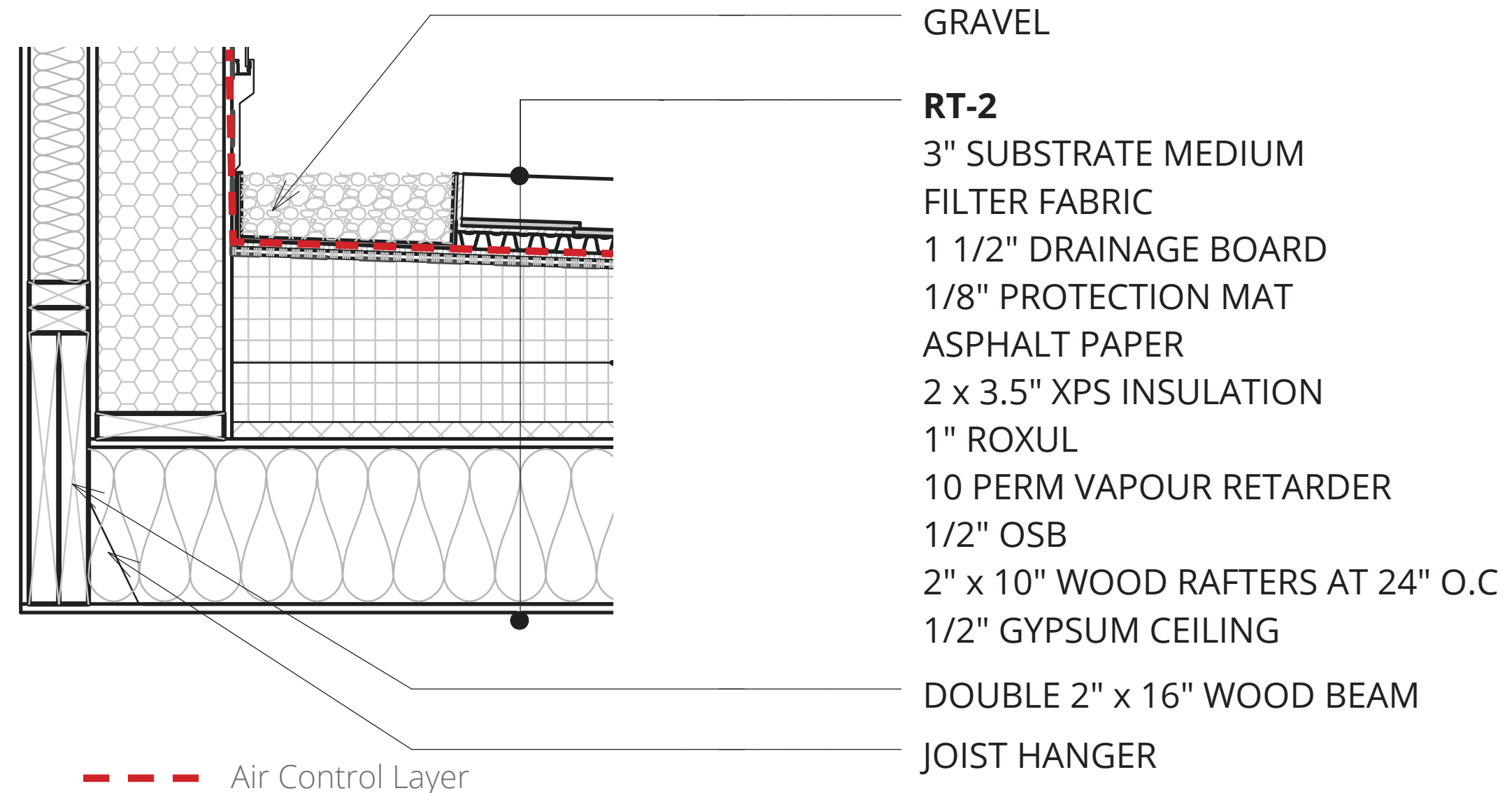
WT-1B

- 1/2" GWB
- 2x4 WOOD STUDS @ 16" O.C WITH DENSE PACK CELLULOSE
- 1/2" OSB
- 7.5" EPS FOAM (THERMAL AND VAPOUR BARRIER)
- 1/2" OSB
- VENTED AIR SPACE
- BRICK VENEER
- PROTECTION BOARD
- WEeping TILE
- GRAVEL

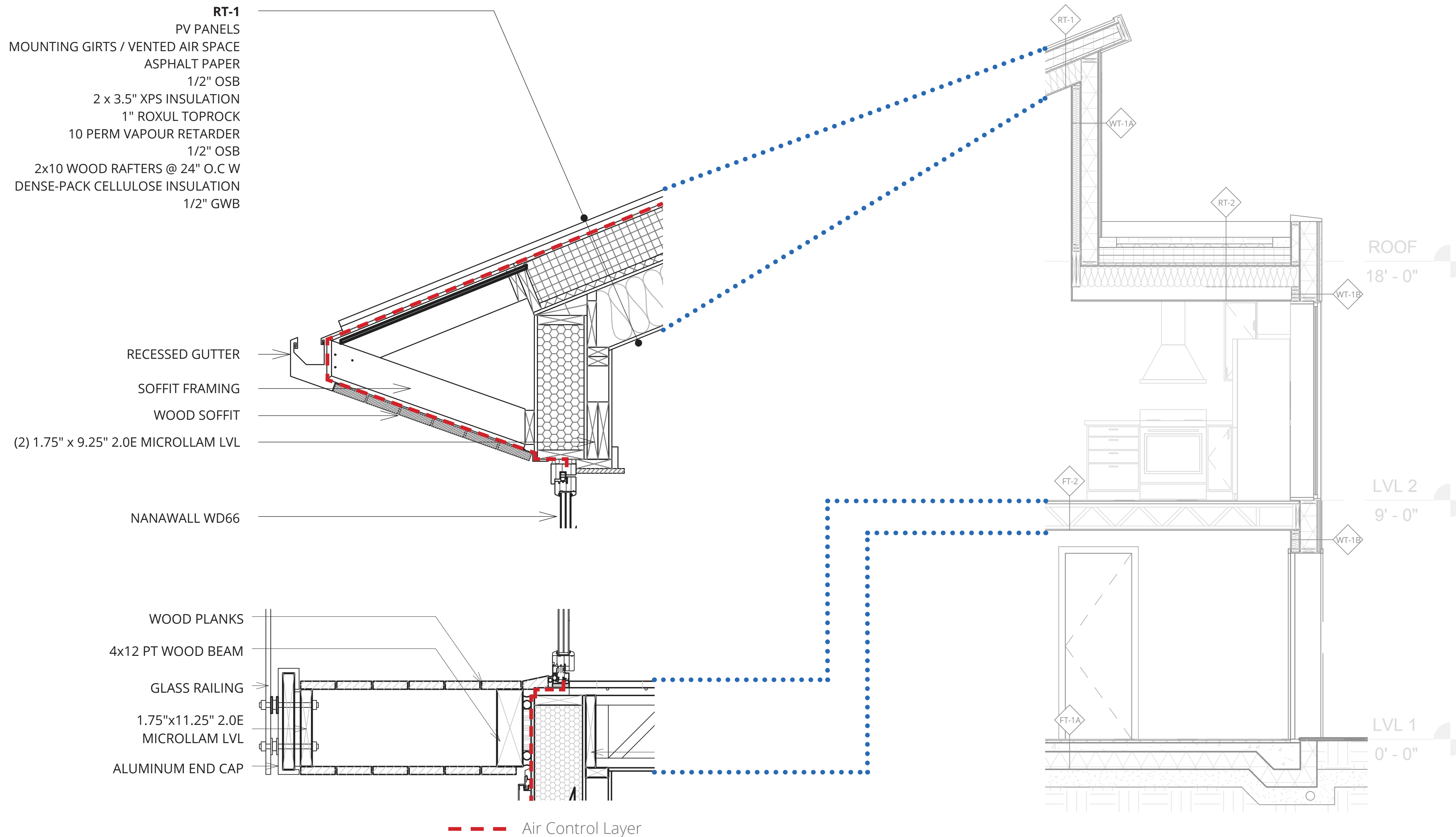
BUILDING ENVELOPE



Detail	Psi Value Btu/h ft °F
Exterior Wall to Partition Wall	-0.005
Exterior Wall to Exterior Wall	-0.062
Exterior Wall to Slab	-0.284
Exterior Wall to Floor East / West	-0.028
Exterior Wall to Floor North / South	-0.062
Exterior Wall to Green Roof	-0.036
Exterior Wall to BIPV Roof	-0.030
Clerestorey Wall to Green Roof	-0.048
Clerestorey Wall to BIPV Roof	-0.062

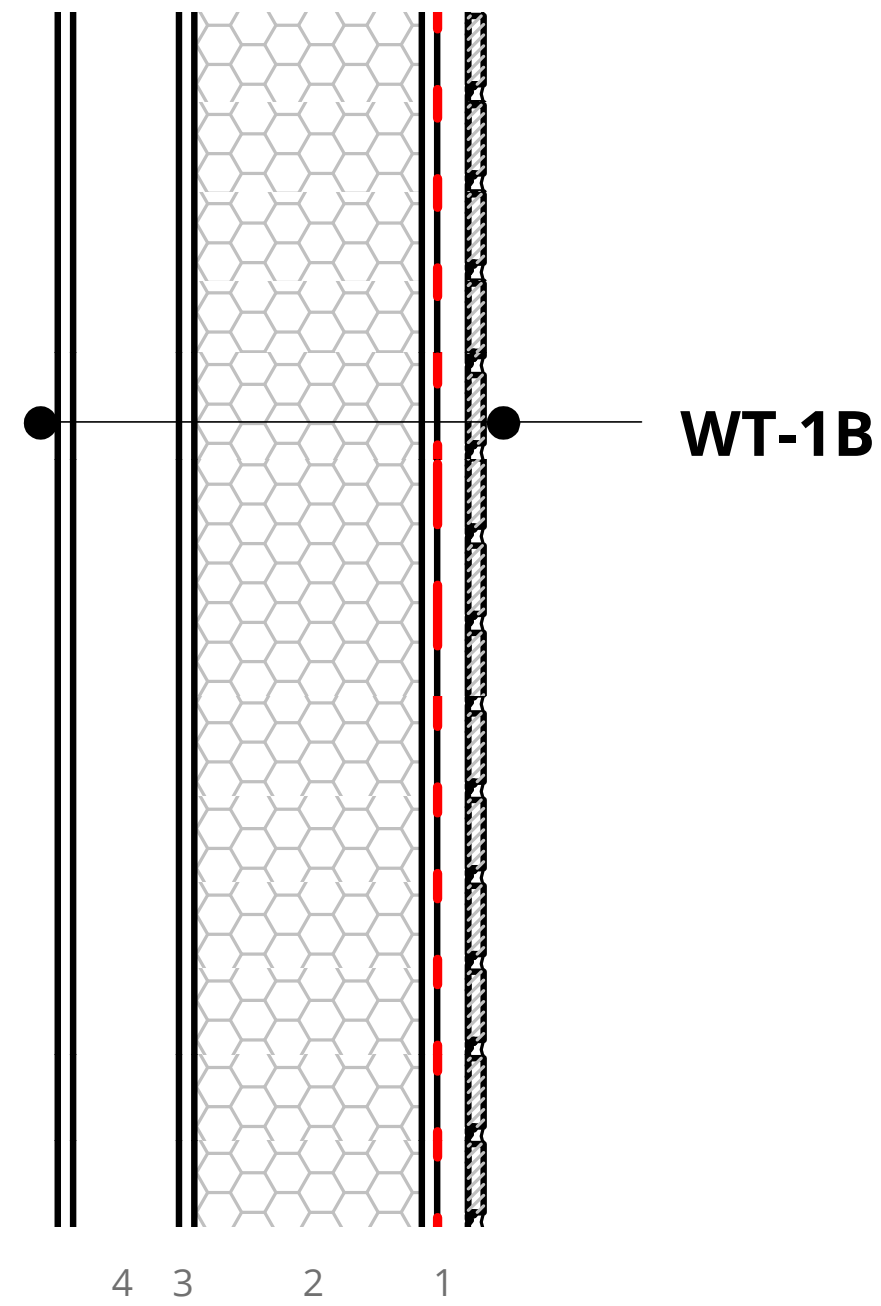


BUILDING ENVELOPE

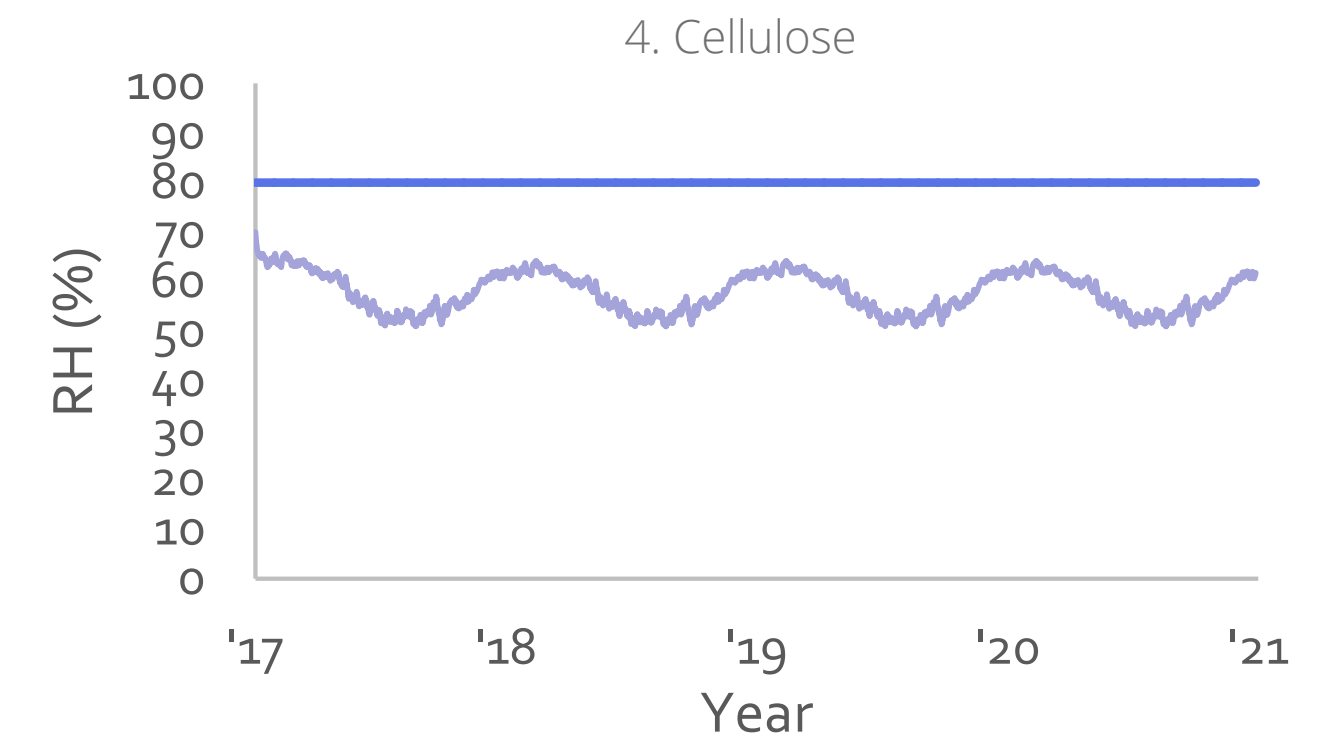
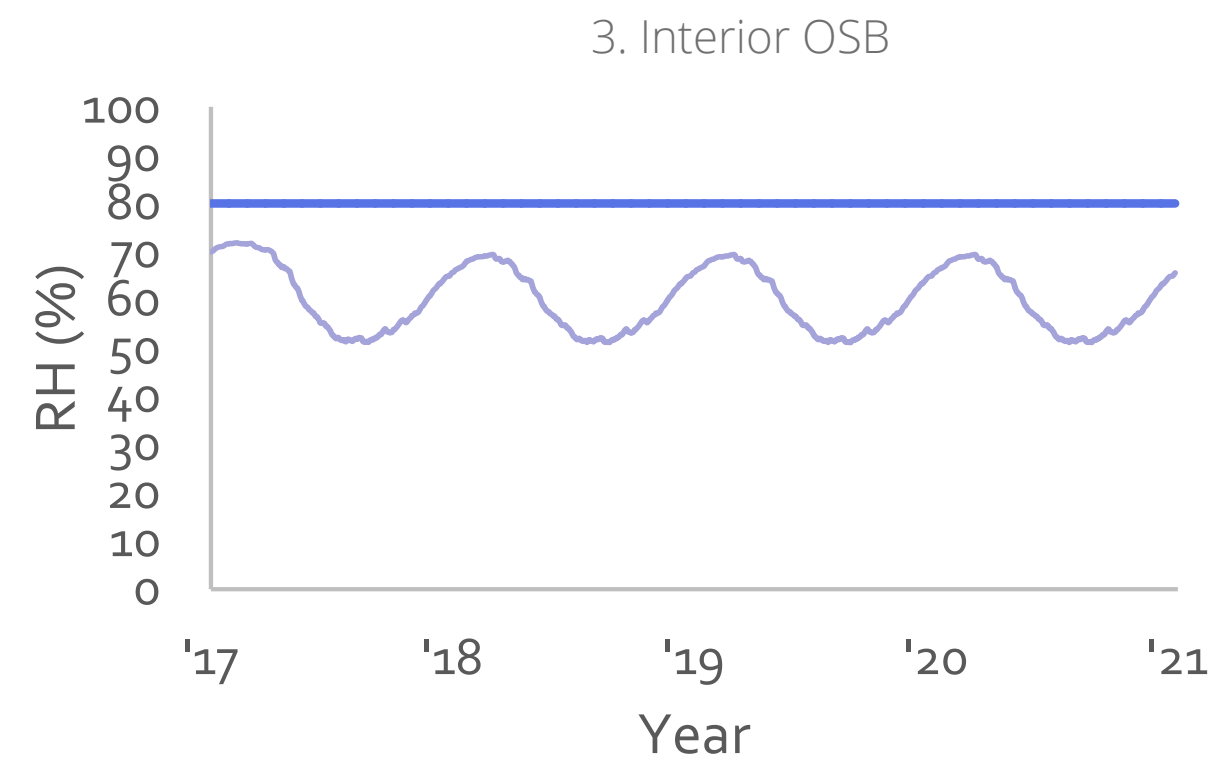
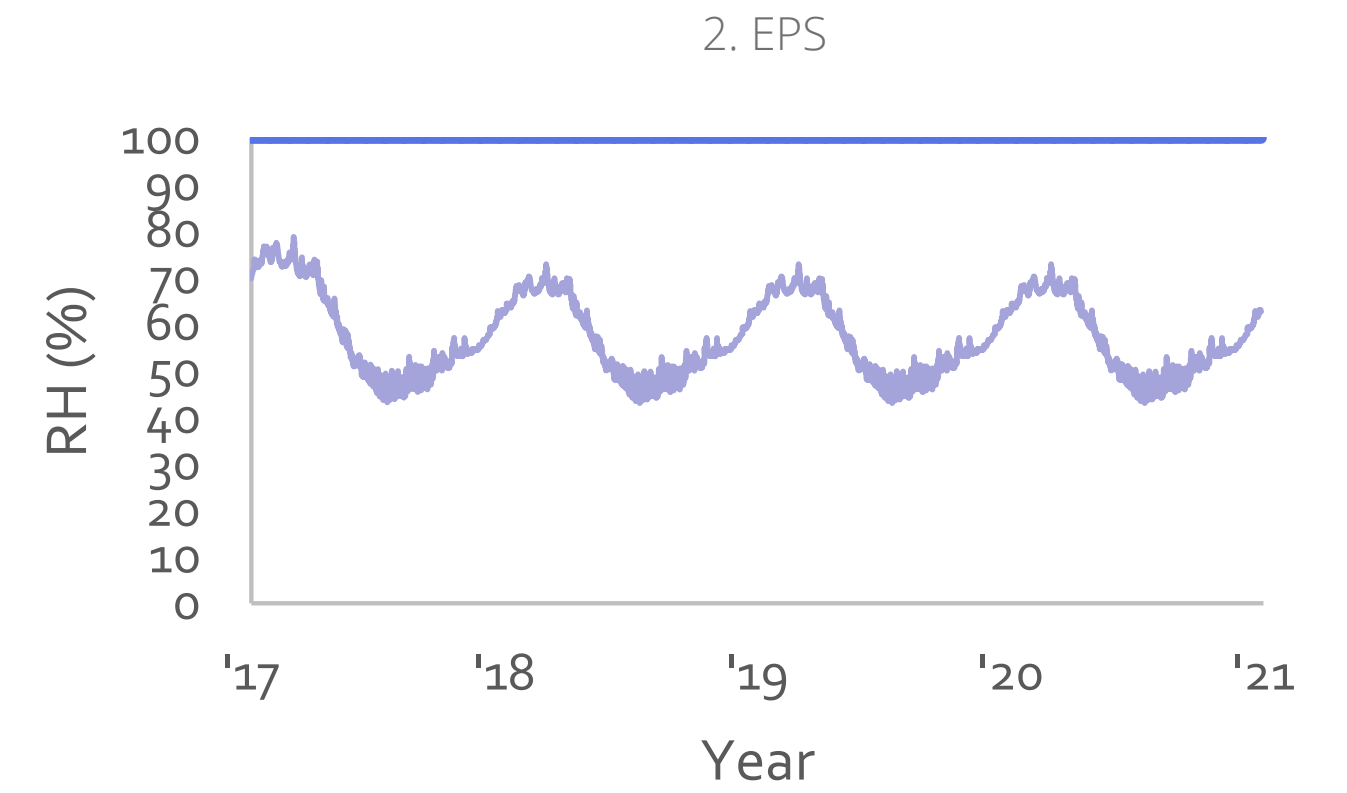
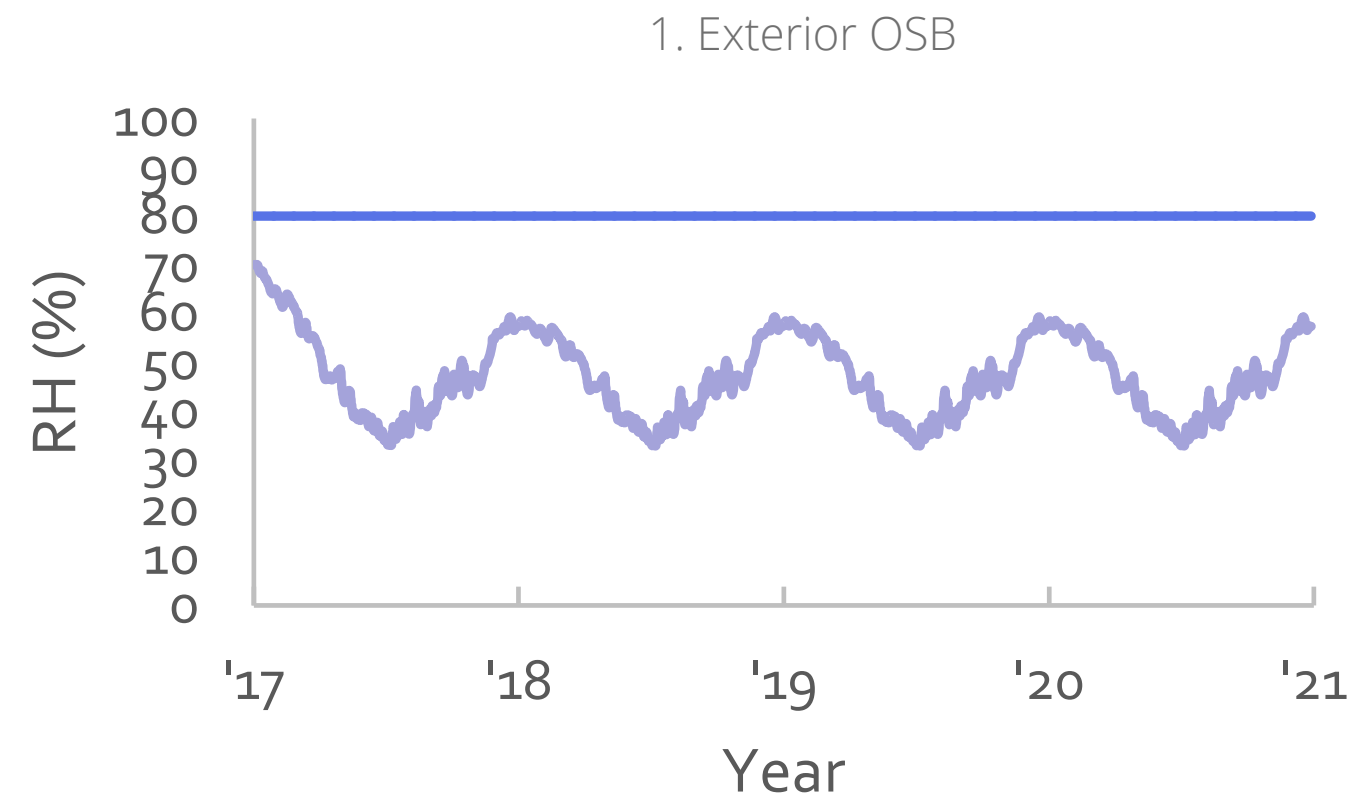


HYGROTHERMAL ANALYSIS

--- Air Control Layer

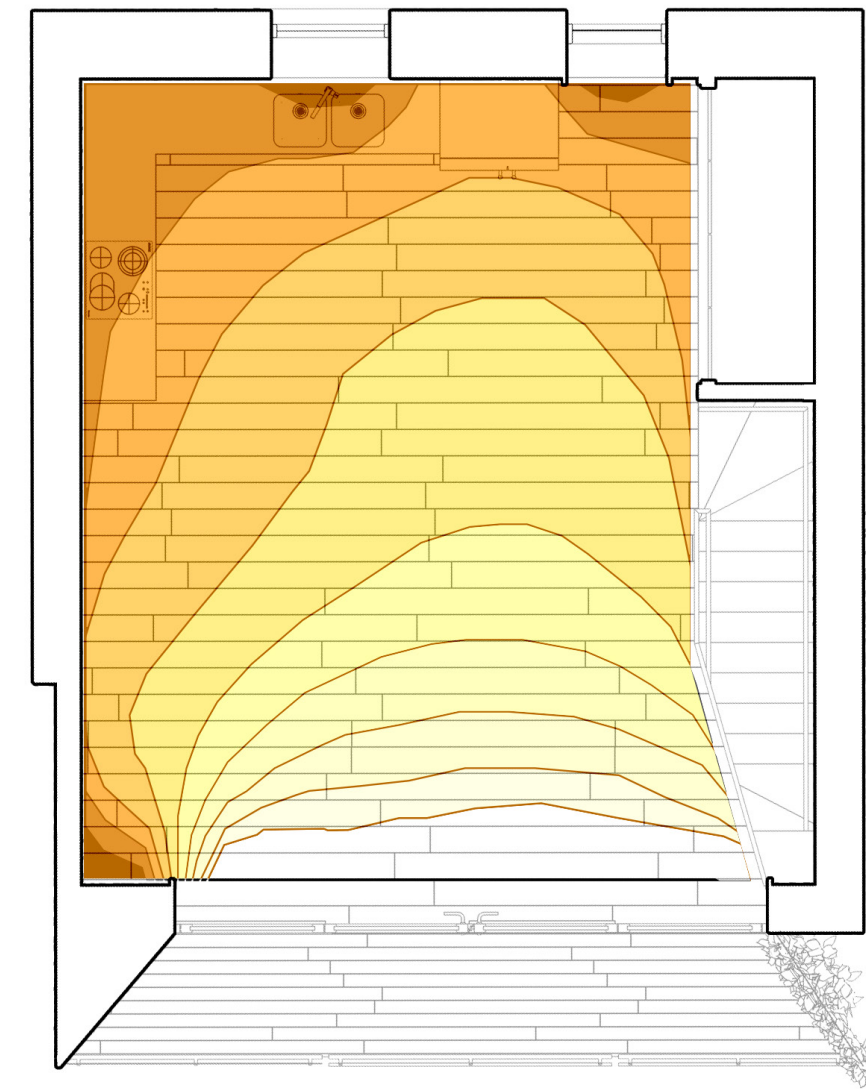


- **WT-1B**
- 1/2" GWB
- 2x4 WOOD STUDS @ 16" O.C WITH DENSE PACK CELLULOSE
- 1/2" OSB
- 7.5" EPS FOAM (THERMAL AND VAPOUR BARRIER)
- 1/2" OSB
- VENTED AIR SPACE
- BRICK VENEER

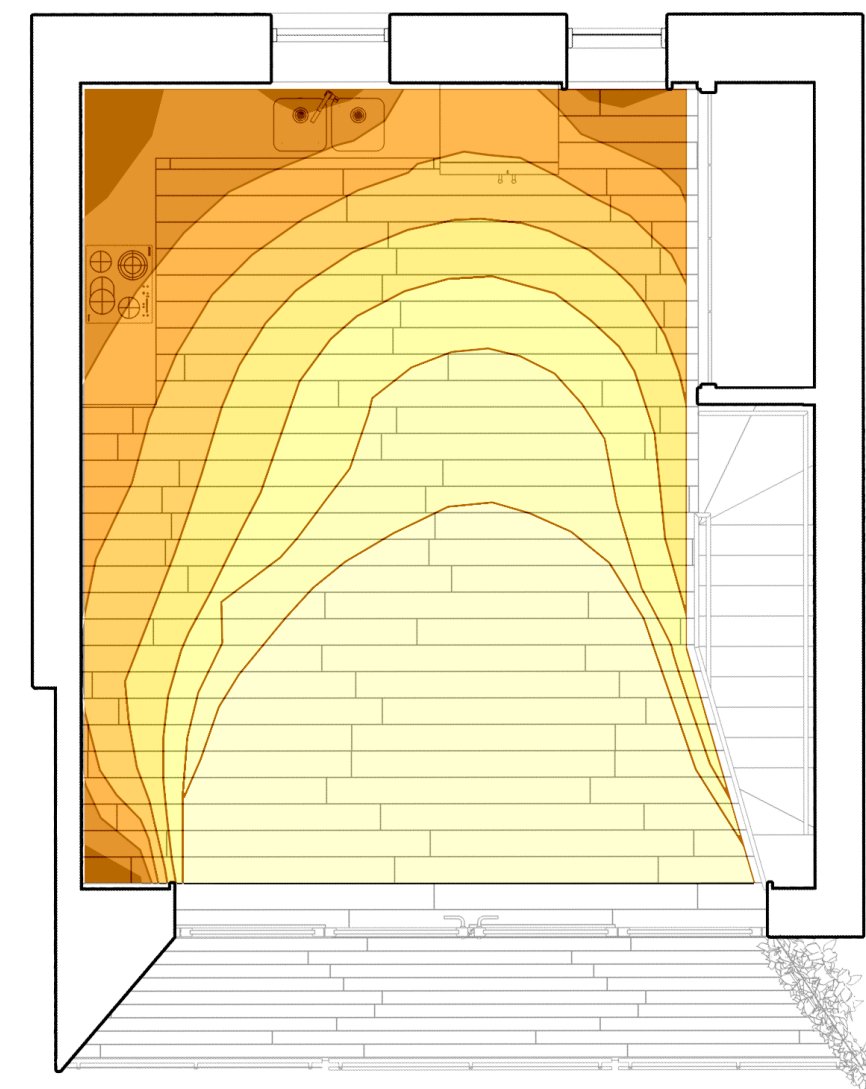
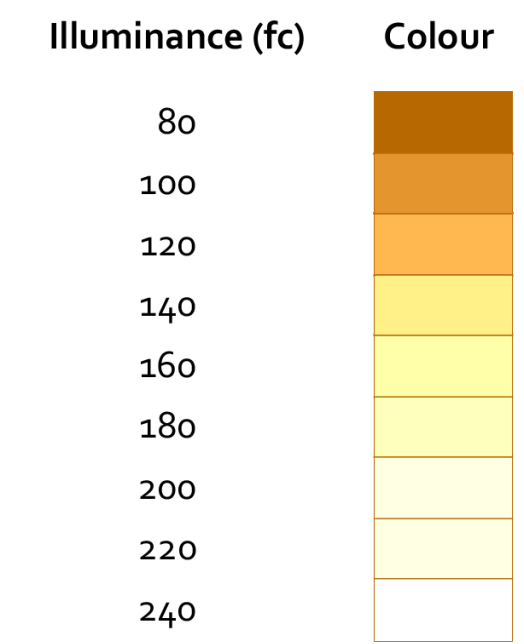




Living Room

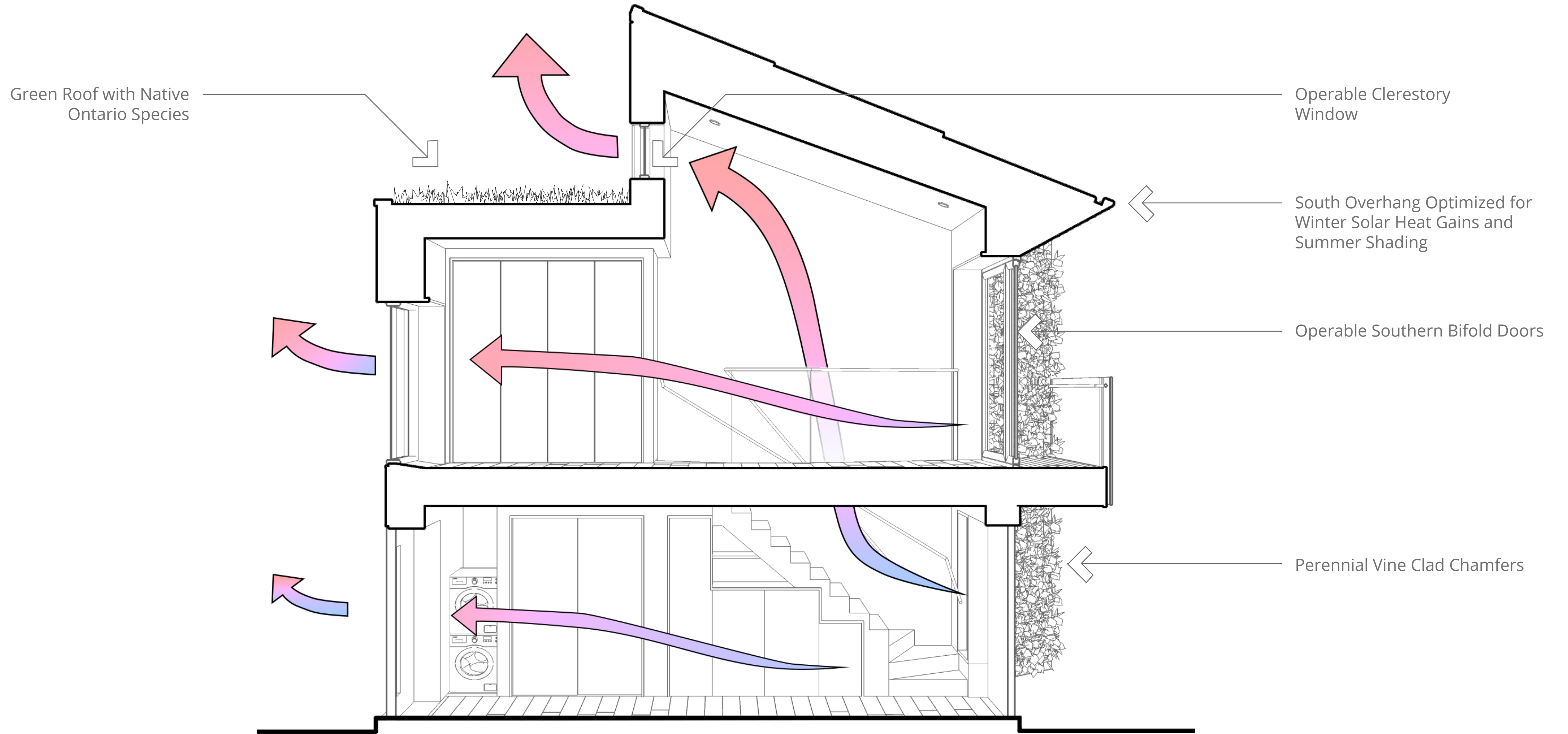


Summer Solstice (12:00PM)

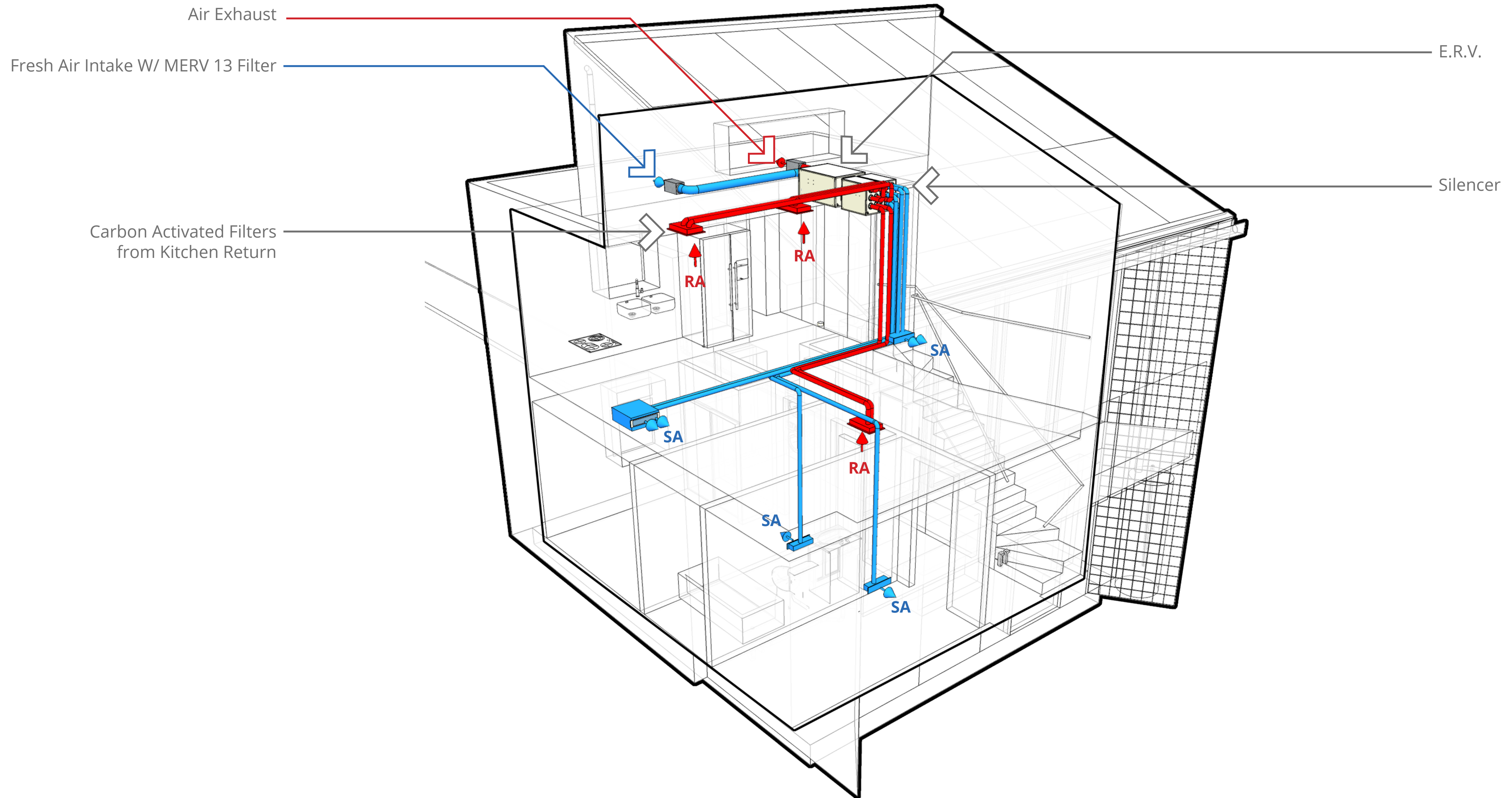


Winter Solstice (12:00PM)

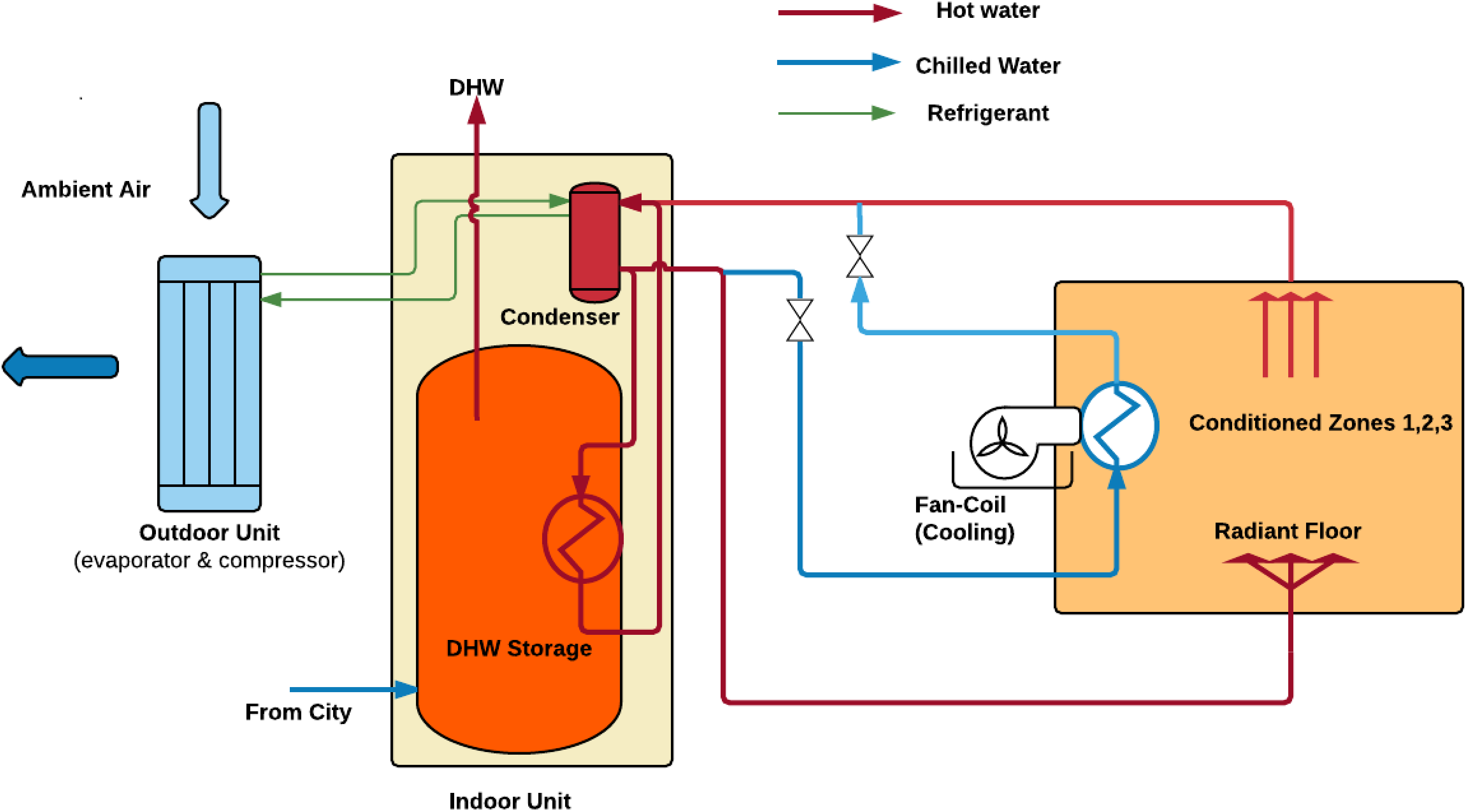
PASSIVE STRATEGIES

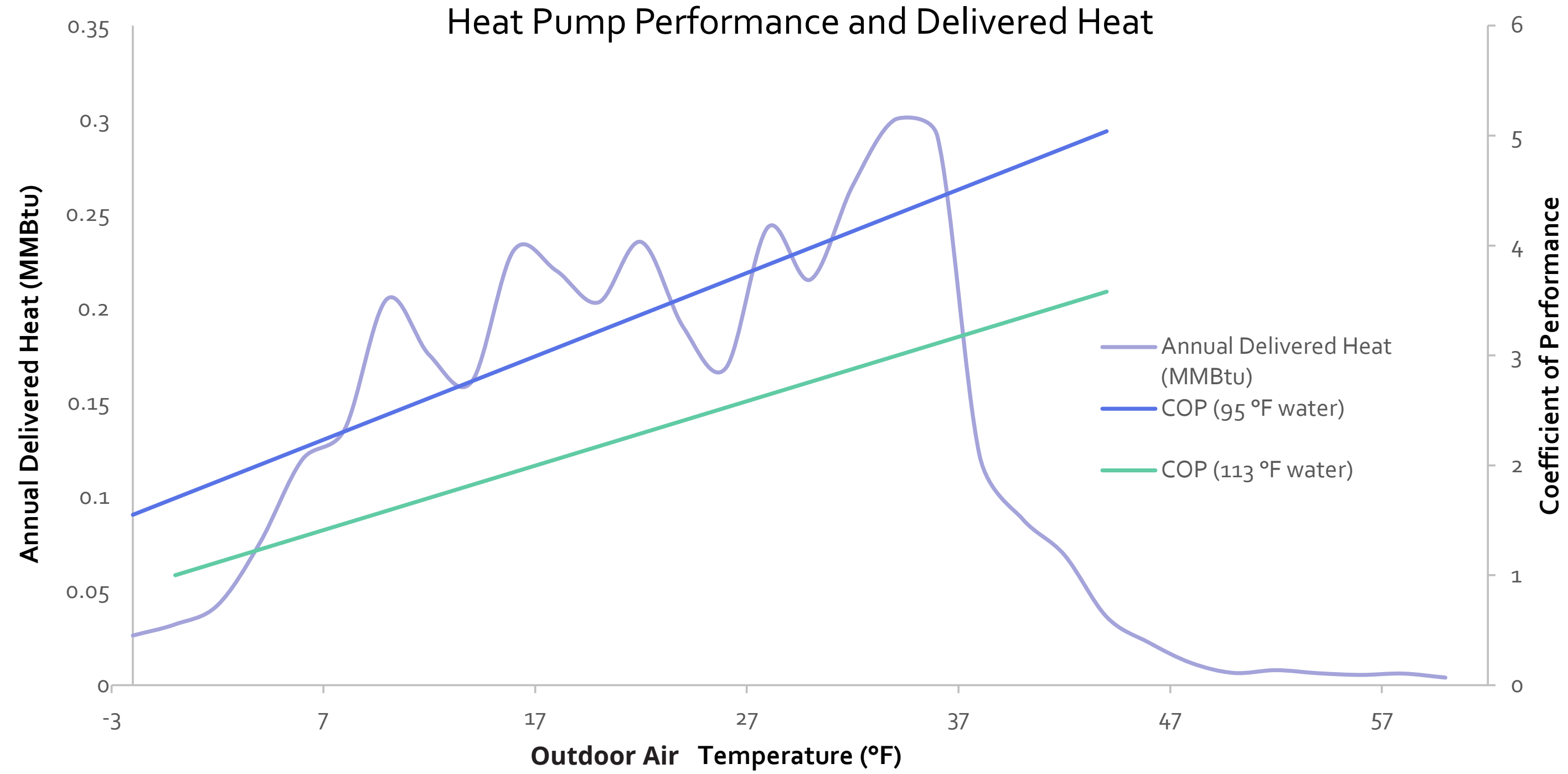


MECHANICAL VENTILATION










THERMAL SYSTEM

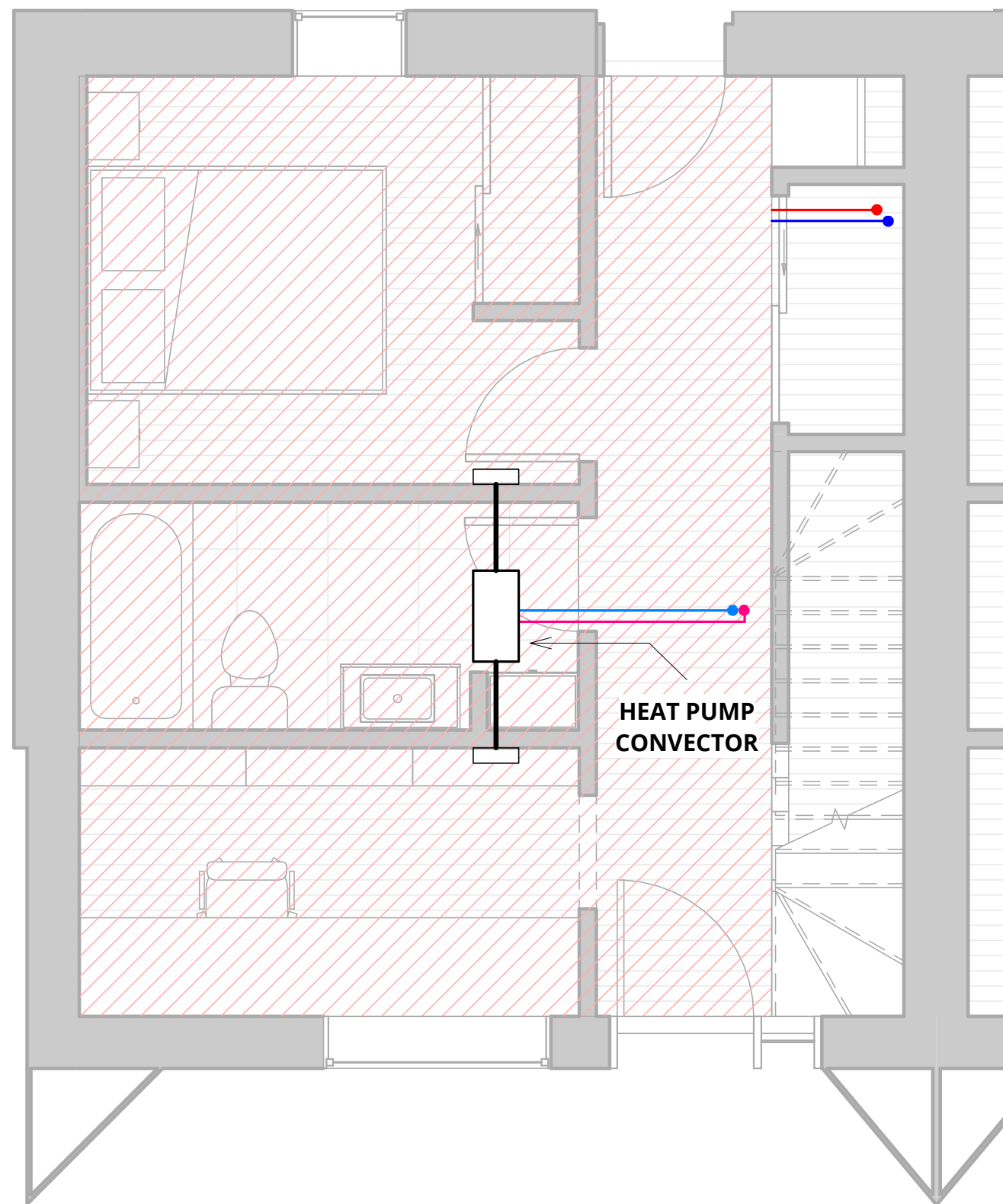




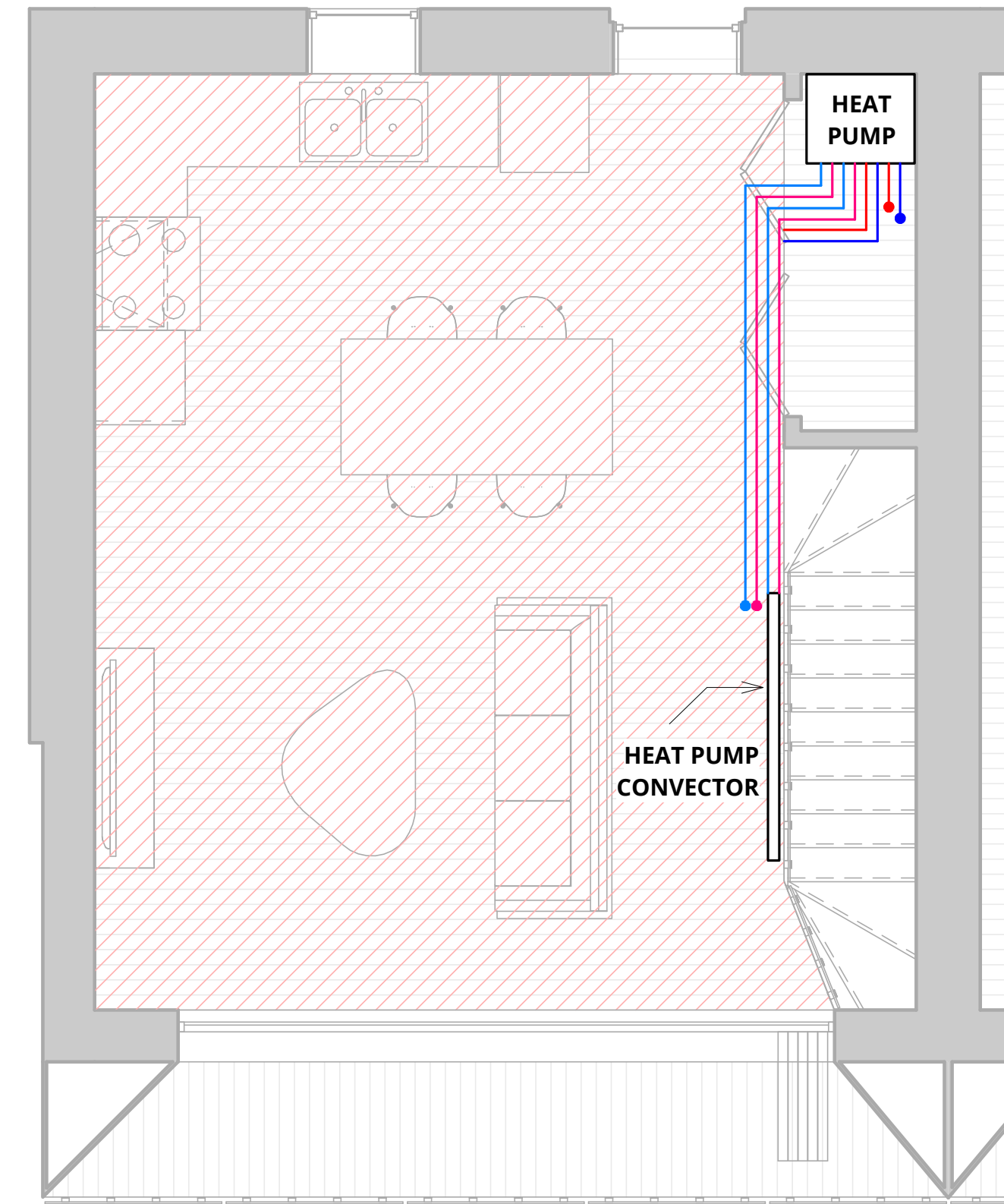
	Rated Efficiency	Seasonal Coefficient of Performance	LaneZero Design Load (Btu/hr)	Design Temperature (°F)
Space Heating	HSPF 11	2.33	6097	1.9 (99.6% DB)
Space Cooling	SEER 13	3.33	9860	84.2/69.8 (0.4% DB/WB)
DHW	EF 2.4	2.4	N/A	N/A

HEATING AND COOLING DELIVERY

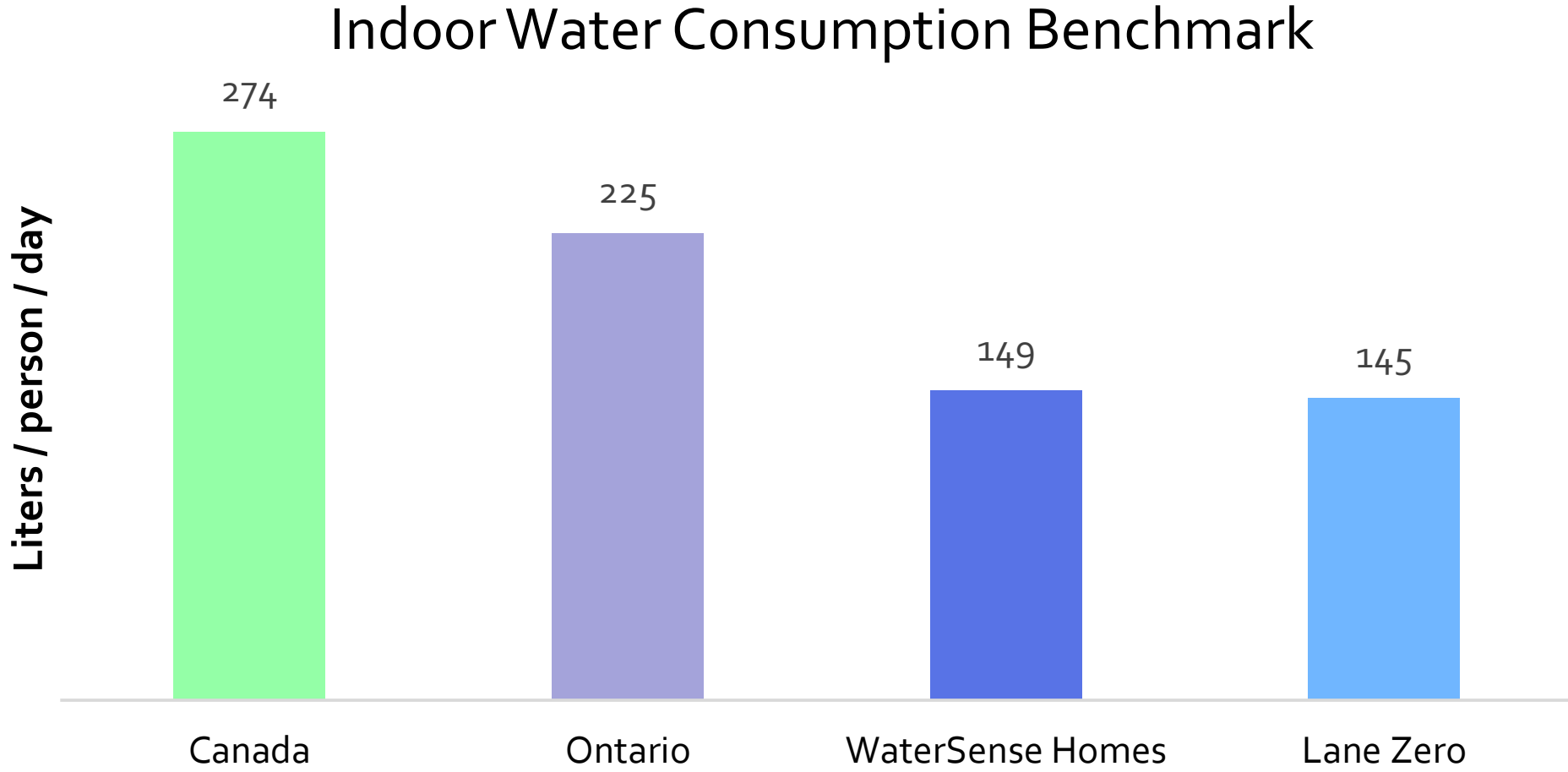
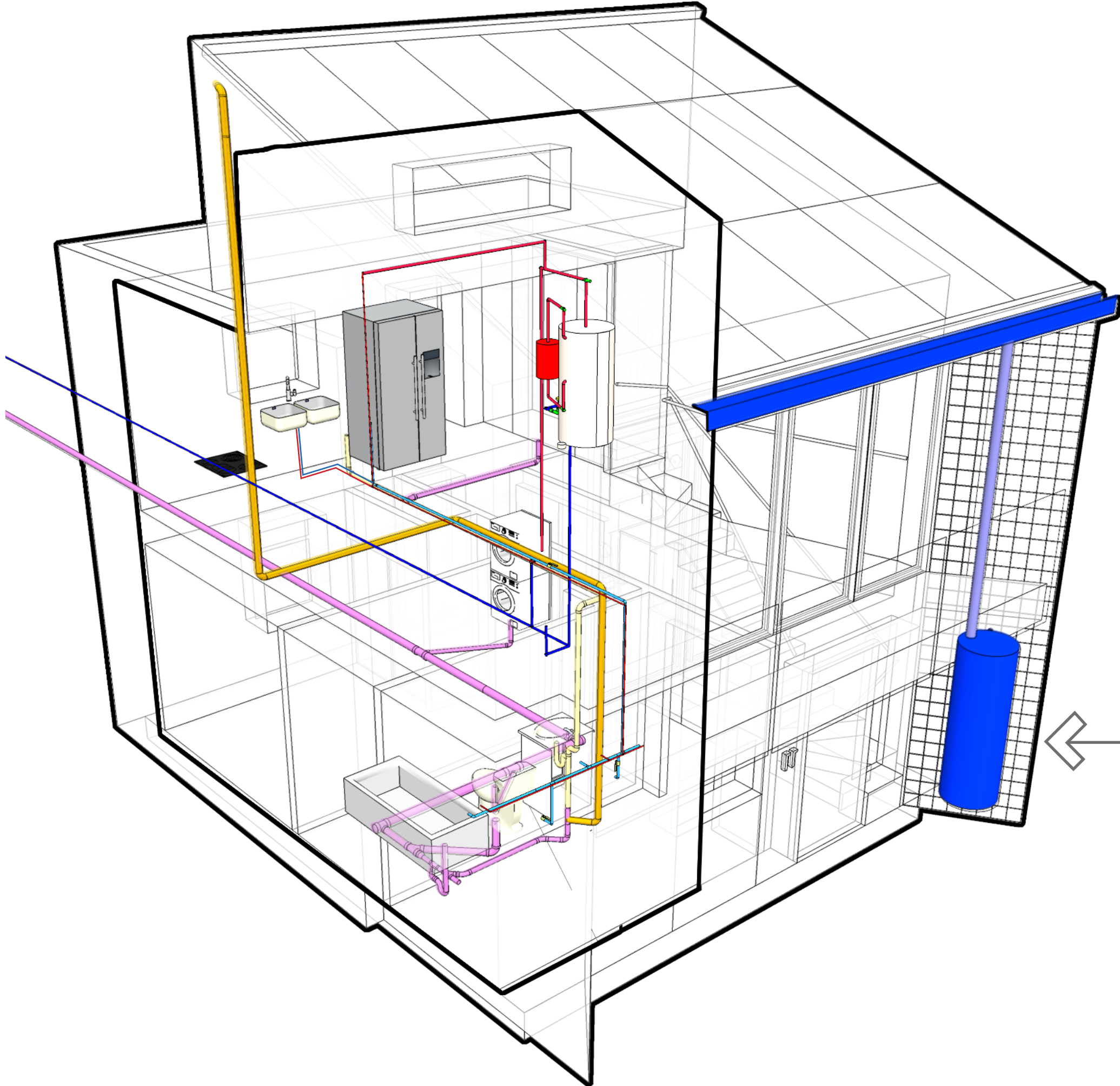
LEGEND	
	HOT WATER SUPPLY
	HOT WATER RETURN
	CHILLED WATER SUPPLY
	CHILLED WATER RETURN
	HEATED FLOOR
	DIFFUSER
	DUCT



GROUND FLOOR

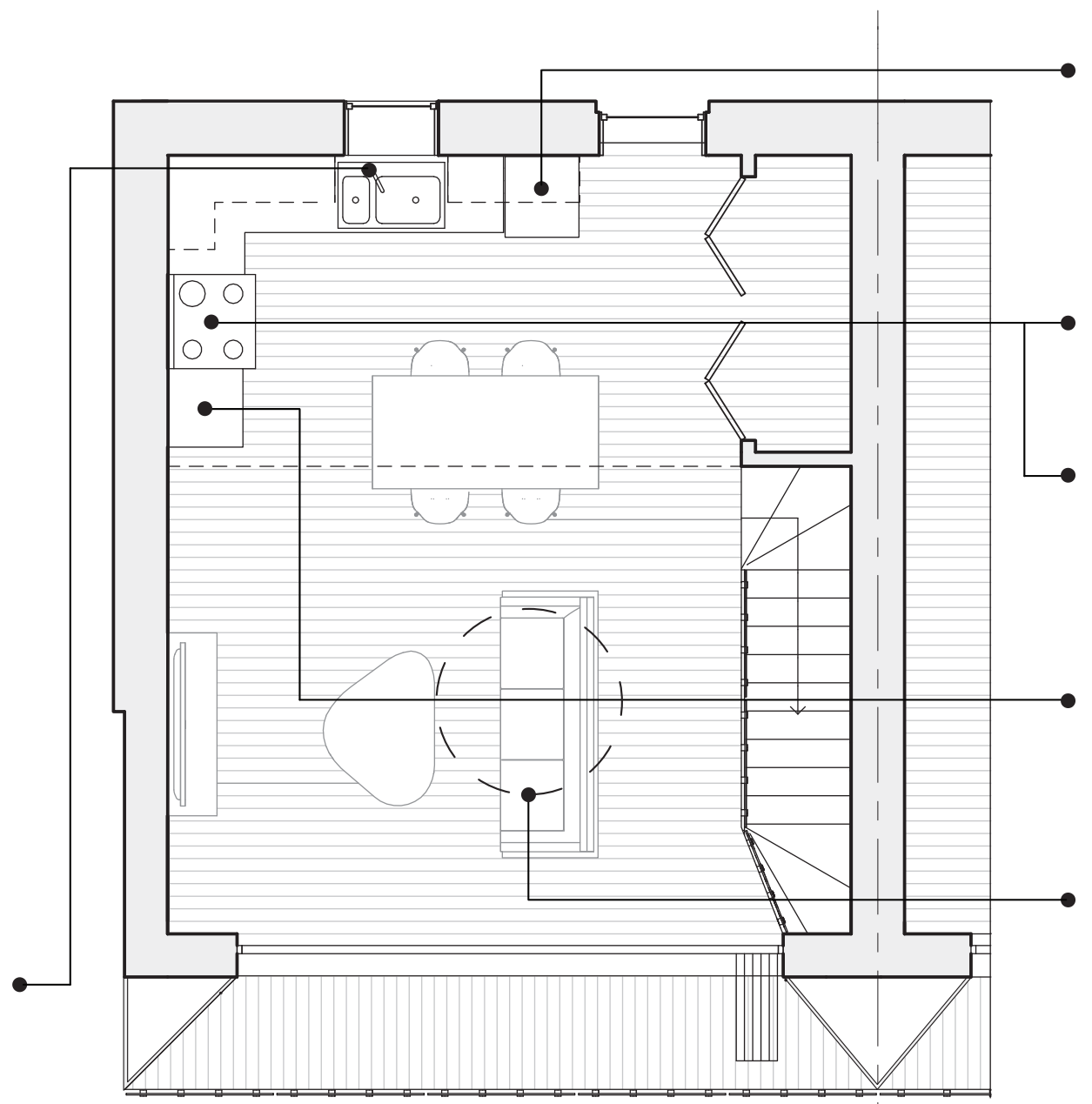


SECOND FLOOR

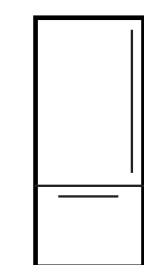


Rainwater Collection Cistern
174 Gallon Capacity

APPLIANCES



Kitchen Faucet
Moen - Essie
5.6 Liters per minute
EPA Approved



Refrigerator
Bosch 500 B11CB50SSS
Capacity: 11 cu. ft.
Consumption: 357 kWh/yr
Energy Star



Range Hood
Bosch 300 - HCP30E51UC
Energy Star



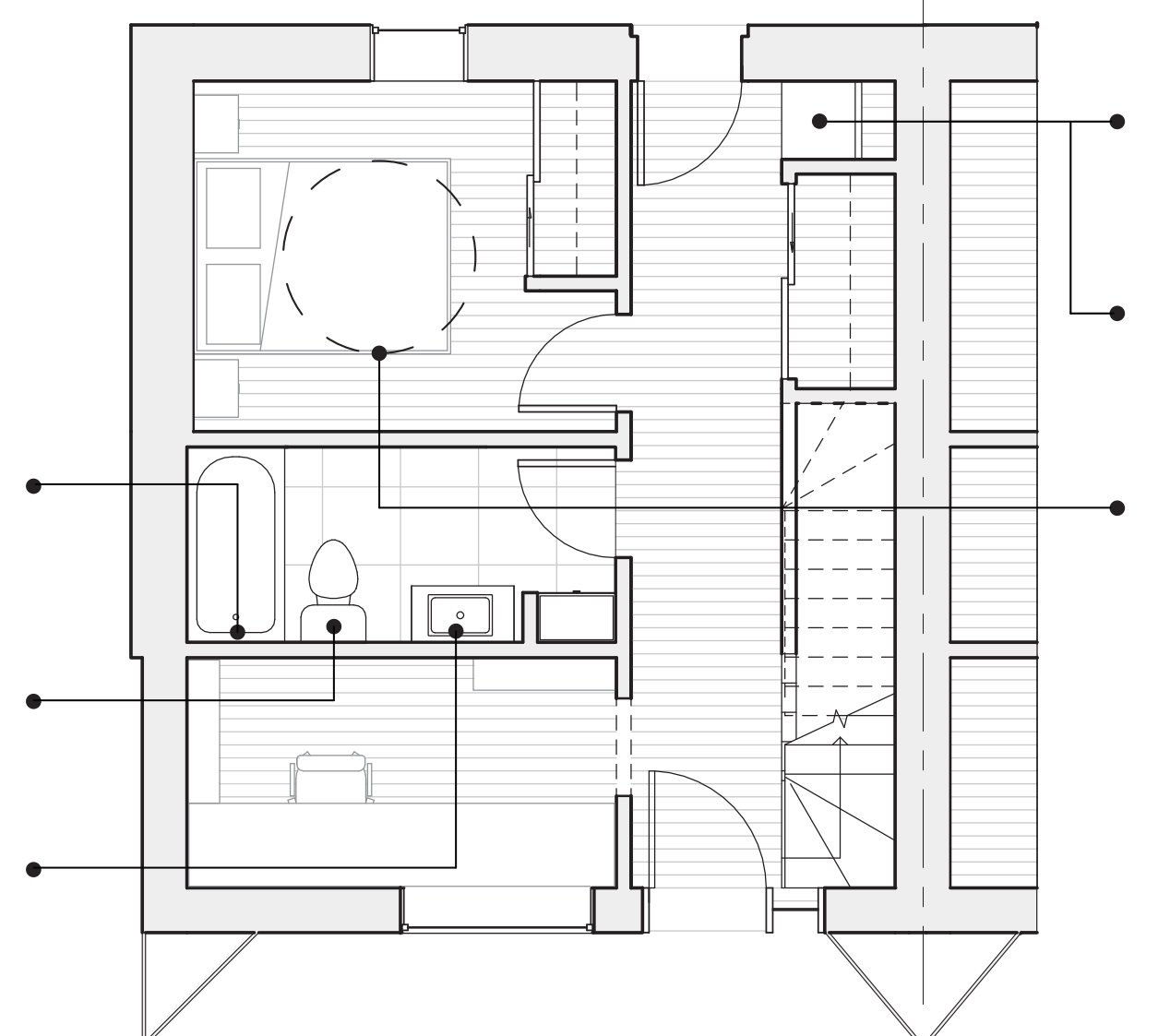
Electric Range
Bosch 800 - HEI8054C
Capacity: 4.6 cu. ft.
Convection oven: 2000 W
Induction cooktop:
100 W - 3000 W



Dishwasher
Bosch 300 - SPE53U55UC
Consumption: 259 kWh/yr
Water Consumption: 645g
Energy Star



Fan
Haiku L
Consumption: 2.5/17.7 W
Energy Star



Showerhead
Nebia
2.84 Liters per minute



Toilet
Water Matrix - N7717 DF
1.9 - 3.6 L per flush
WaterSense



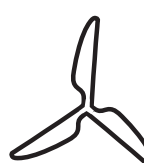
Bathroom Faucet
Kohler - Composed
4.5 L per minute
WaterSense



Condensing Dryer
Beko - HPD24412W
Capacity: 4.1 cu. ft.
Consumption: 190 kWh/yr
Energy Star



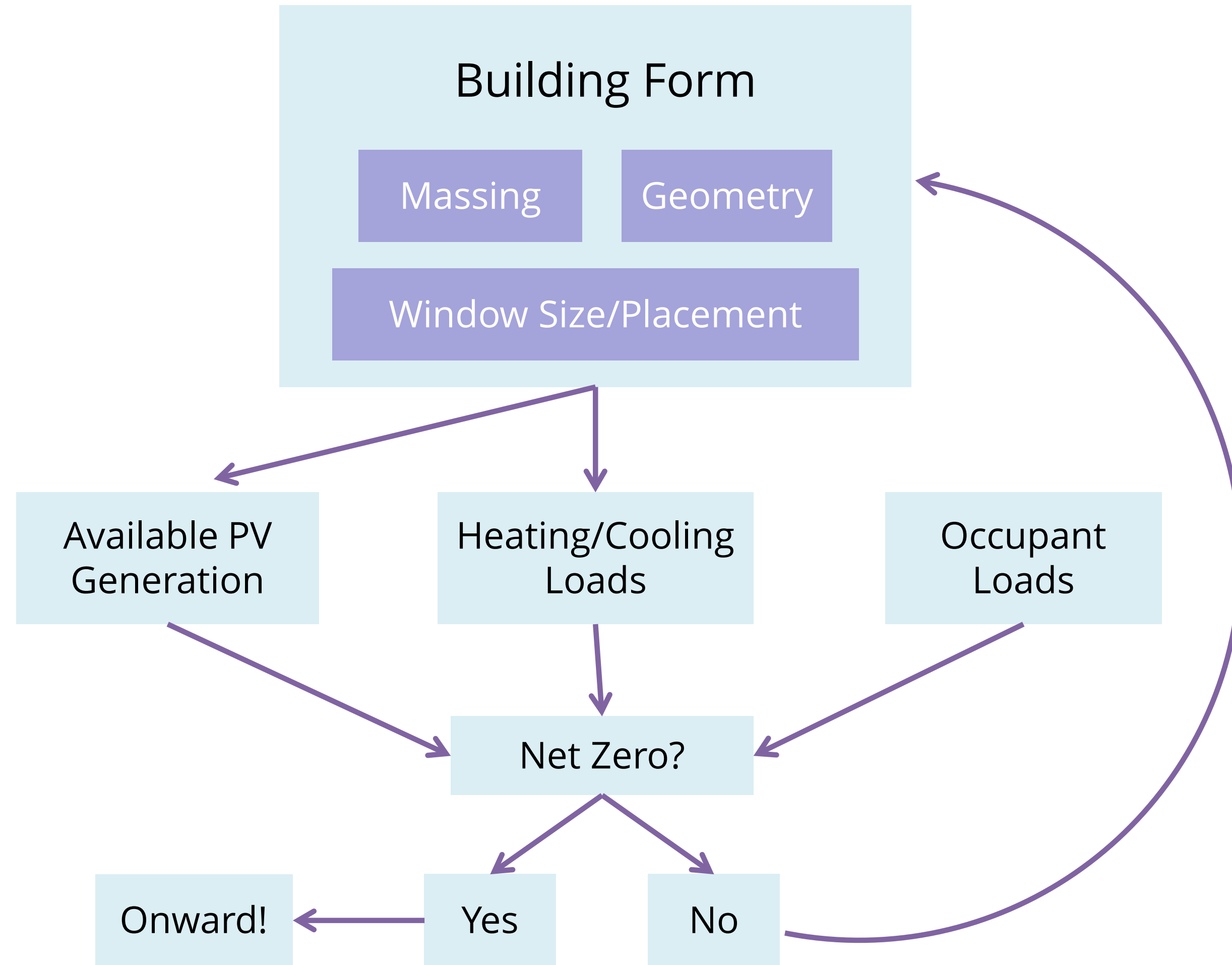
Washer
Beko - WMY10148W0
Capacity: 2.5 cu. ft.
Consumption: 86 kWh/yr
Energy Star

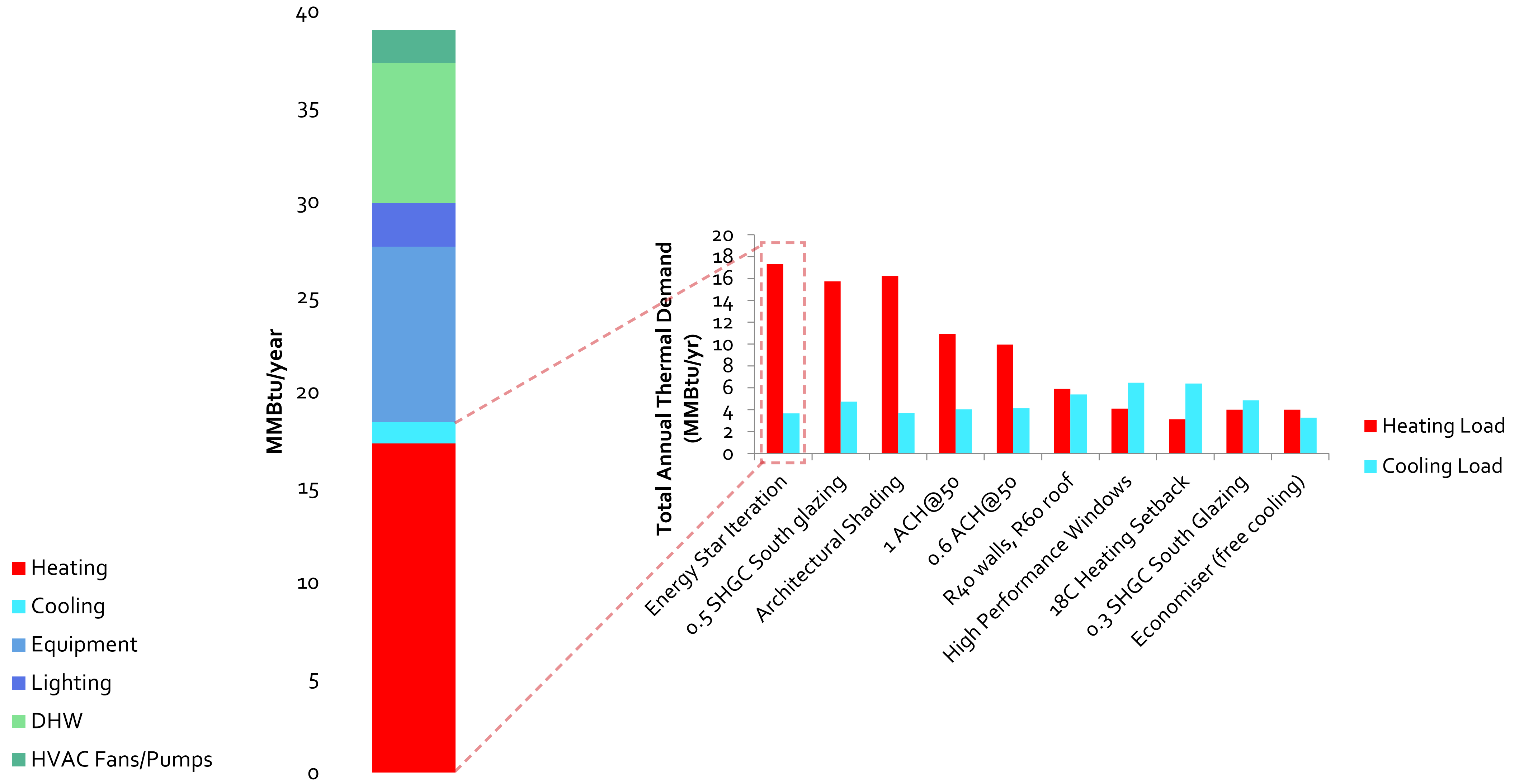


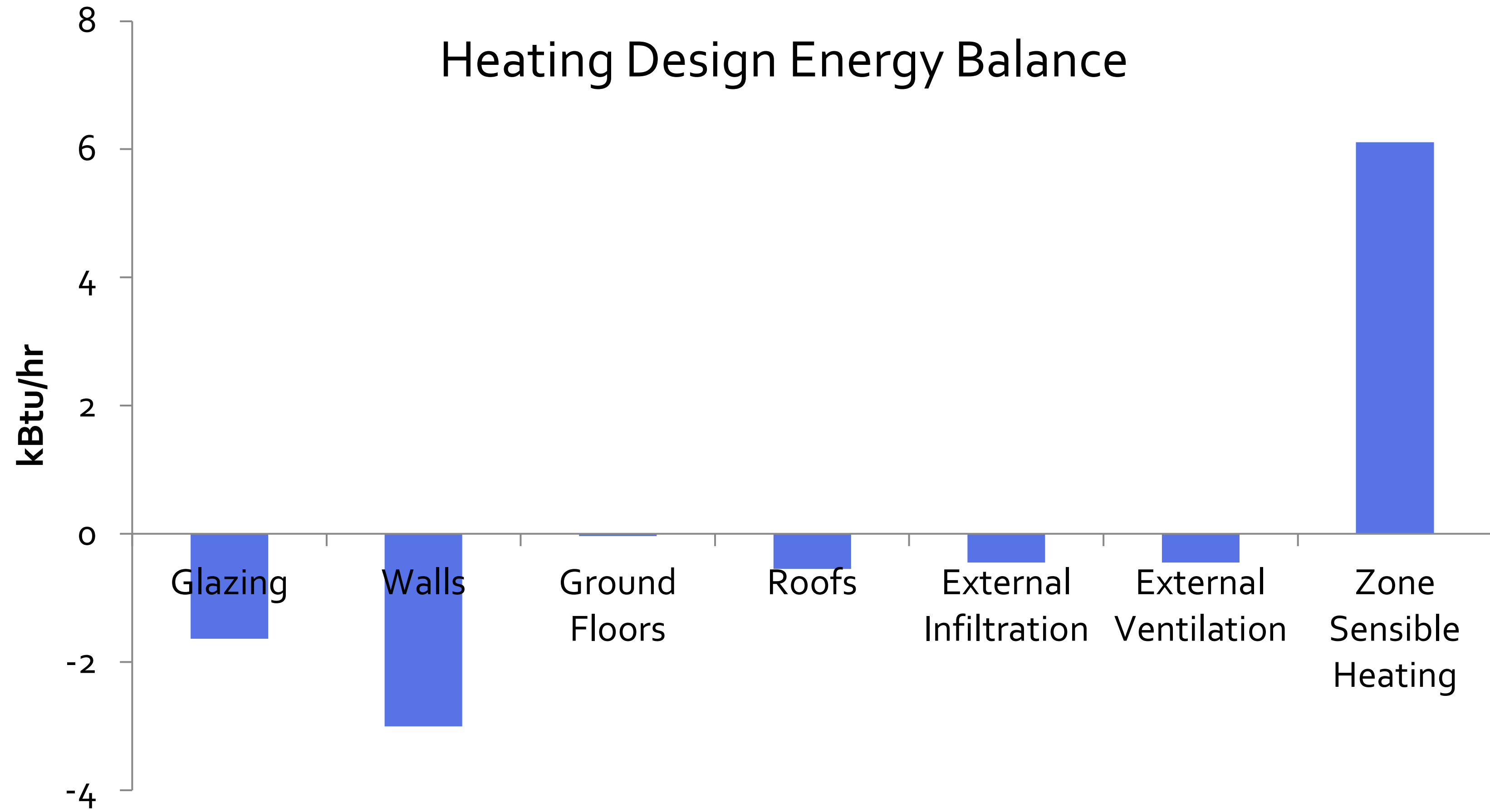
Fan
Haiku H
Consumption: 1.49/14.8 W
Energy Star

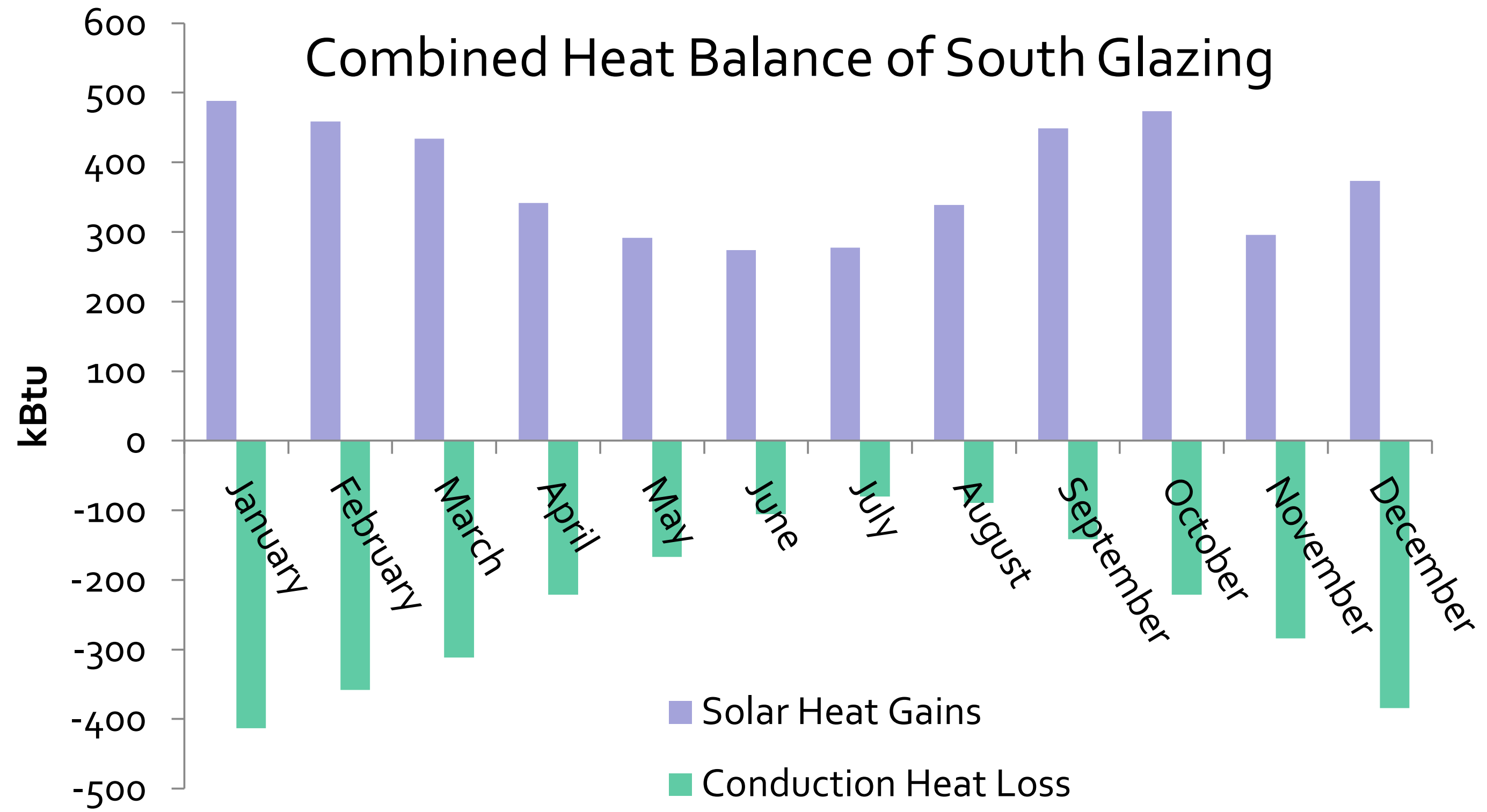
Smart Thermostat
Ecobee₃
Sensored thermostat management



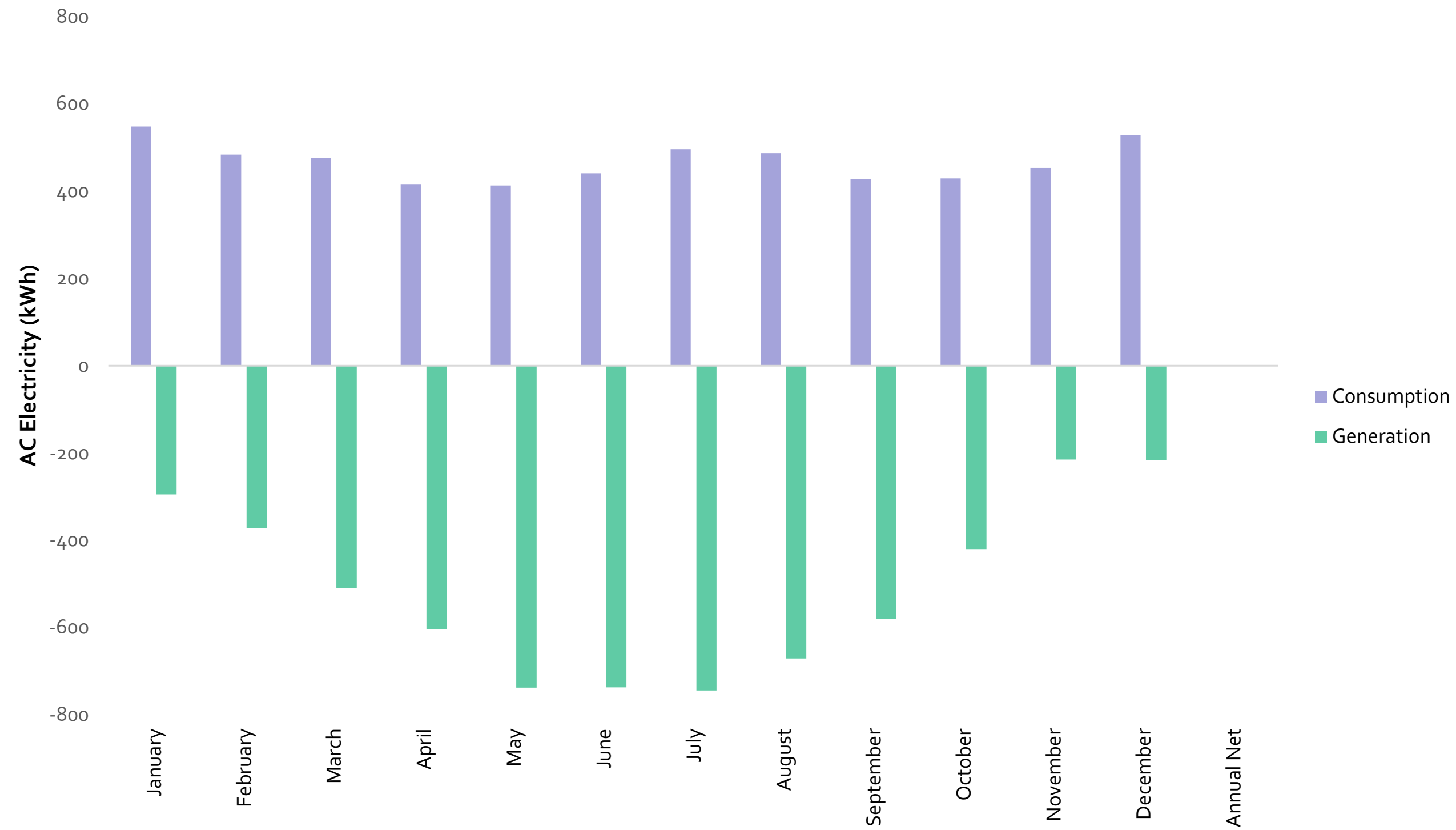






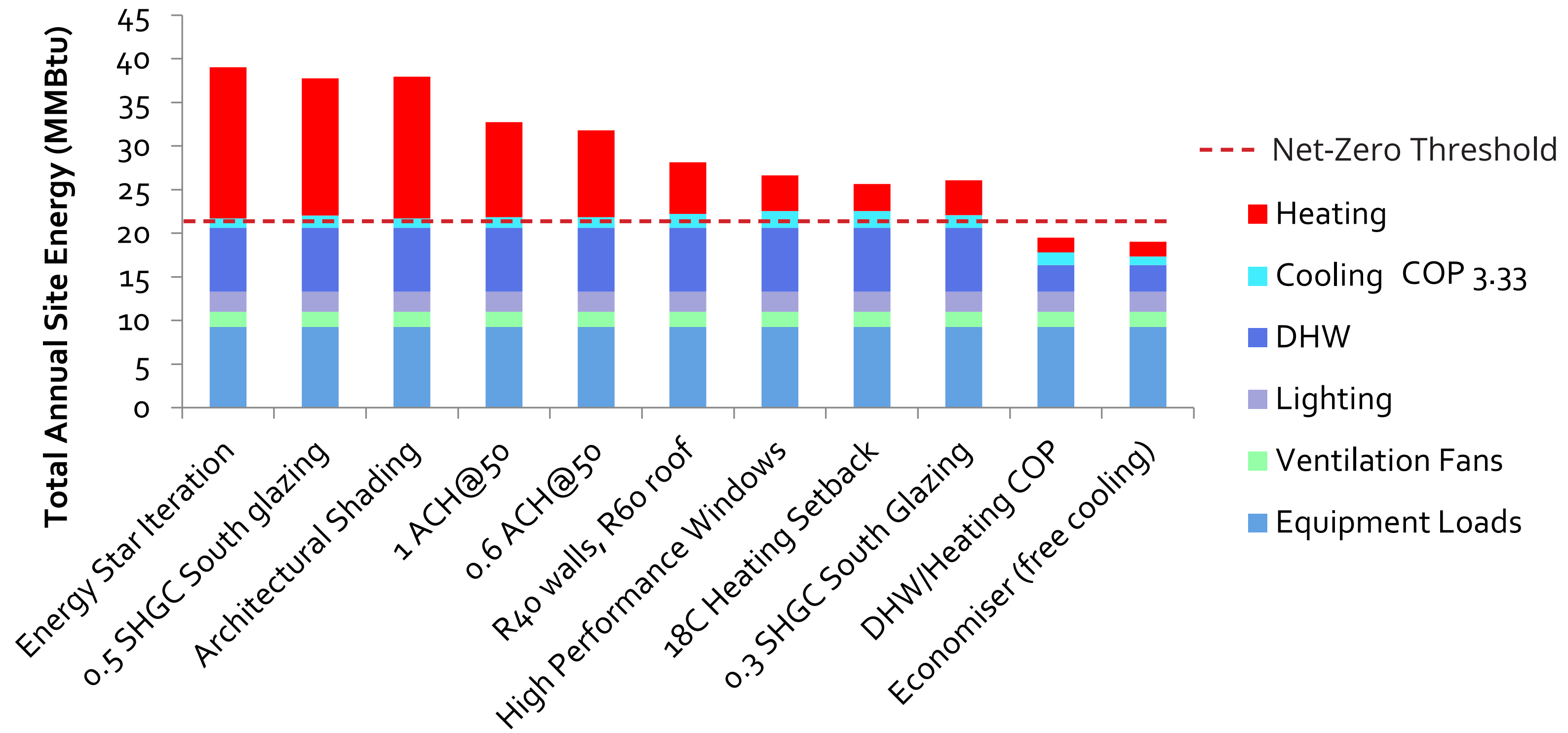


Monthly Predicted PV Production and Consumption of Electricity of the East Unit



Array (1 Unit)	
Area	320 ft ²
Latitude	43.67 N
Tilt	21.6°
Azimuth	164°
Panel Type	glass-glass 60 cell mono
Efficiency	17.33%
Nominal Max Power	5.13 kW
Miscellaneous Losses	14%
DC to AC Size Ratio	1.1
Inverter Efficiency	0.96

Iterative Envelope/HVAC Improvements Achieving Net-Zero Energy

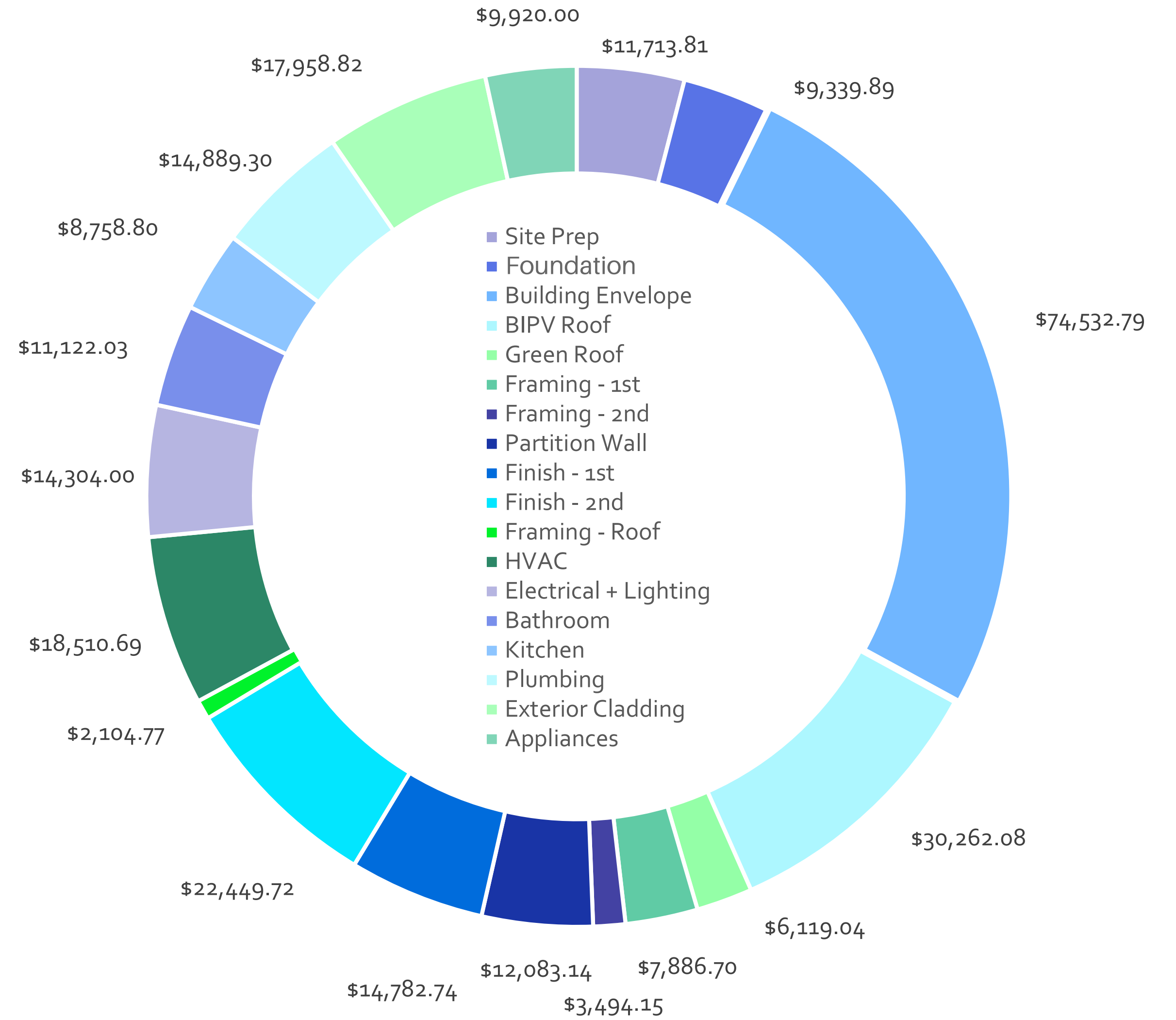


Construction Cost: \$310,000 /unit

Mortgage: \$1,110 /month
 20% Down Payment
 2.5% annual interest rate
 Does not include cost of land

Rental Rate: \$2,400 /month

Return on Investment: 8.5%



LANEZERO OCCUPANT DEBTS & INCOMES

	Item	Type	Monthly	Yearly
A	Income	Profit	\$7,053.00	\$85,000.00
B	Household Debt (6% Income/year)	Expense	\$425.00	\$5,100.00
C	Operation & Maintenance	Expense	\$50.00	\$600.00
D	Utility Cost	Profit*	\$50.00	\$600.00
E	Property Tax	Expense	\$850.00	\$10,200.00
F	Insurance	Expense	\$77.00	\$925.00
G	Mortgage	Expense	\$1,110.00	\$13,320.00
Debt	= B + C - D + E + F + G	Expense	\$2,462.00	\$29,550.00
Income	= A	Profit	\$7,053.00	\$85,000.00
Ratio	= \sum Debt / \sum Income		35%	

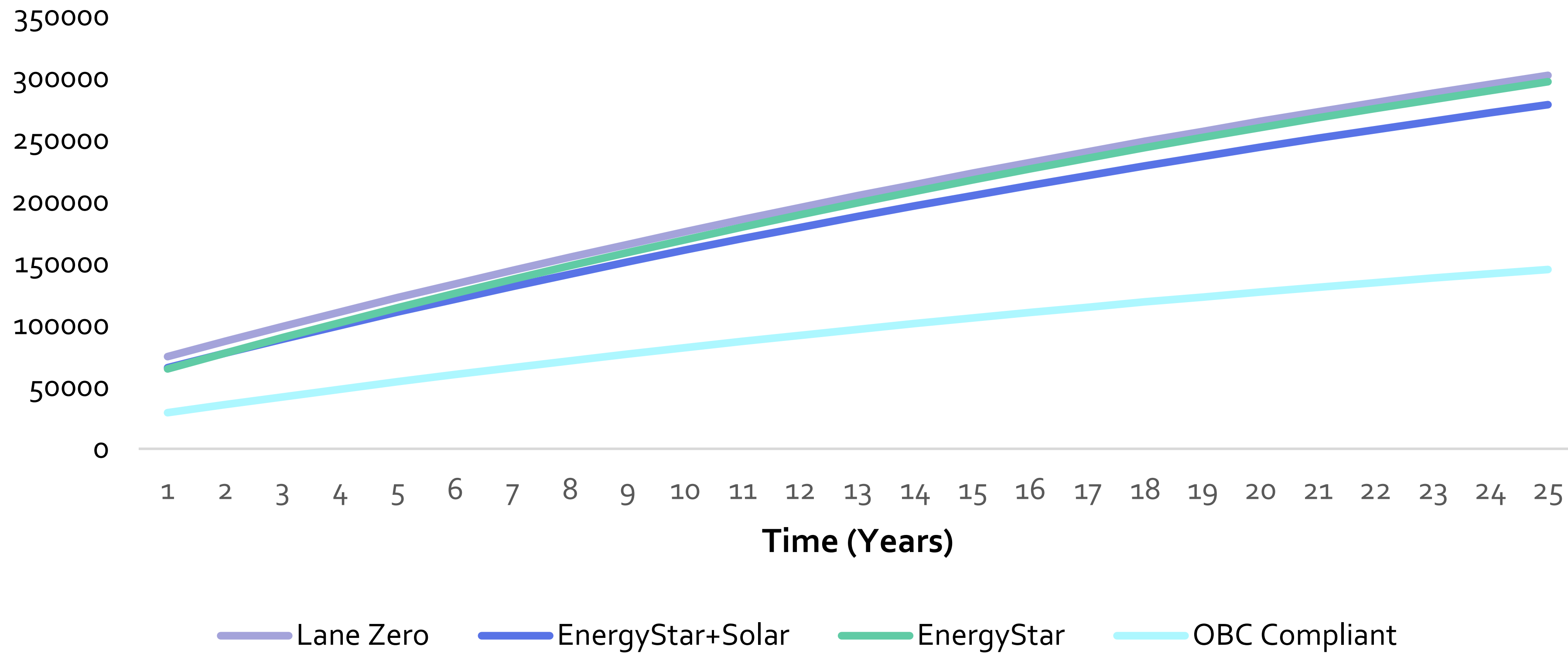
*Income generated from electricity generation > cost of remaining utilities

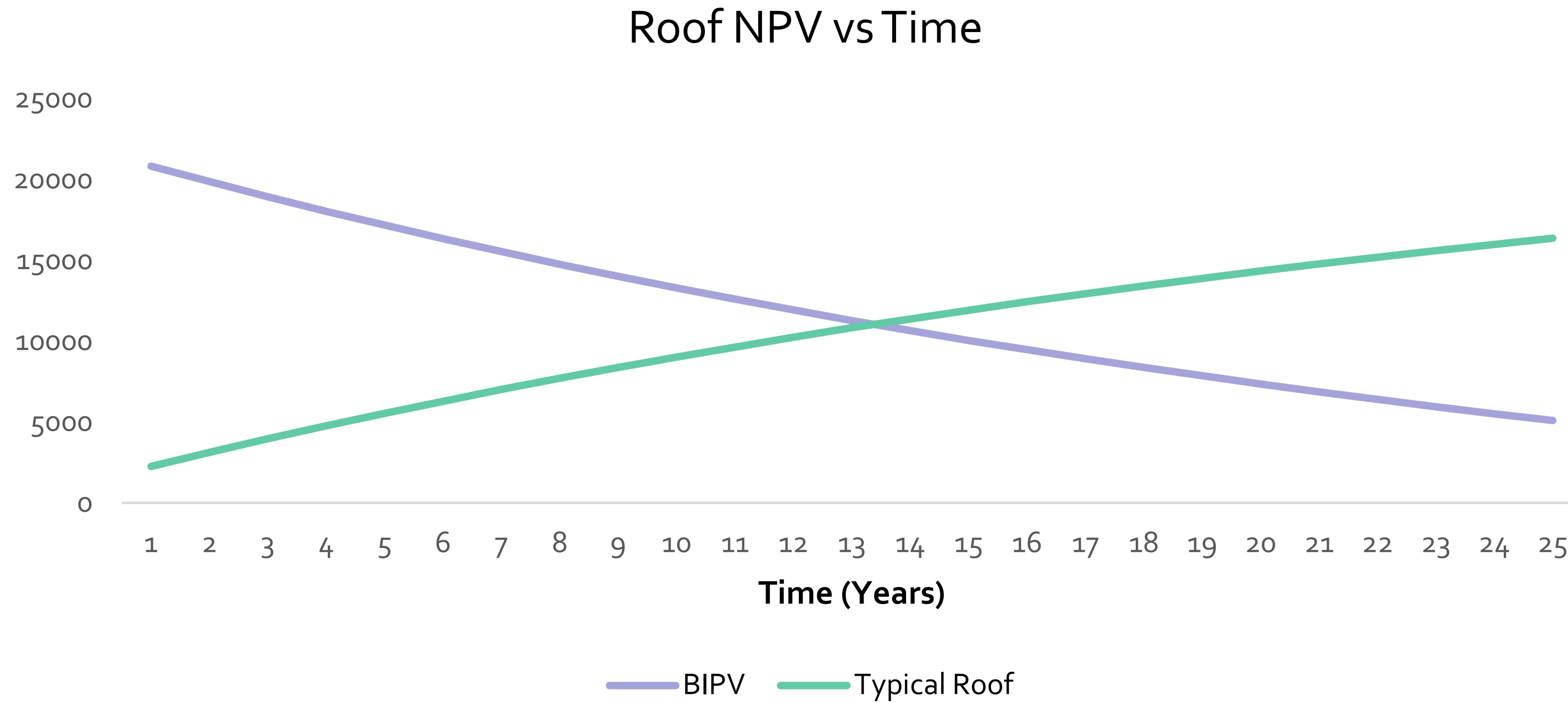
*All Values in CAD

UTILITY COST BREAKDOWN BY CONSTRUCTION

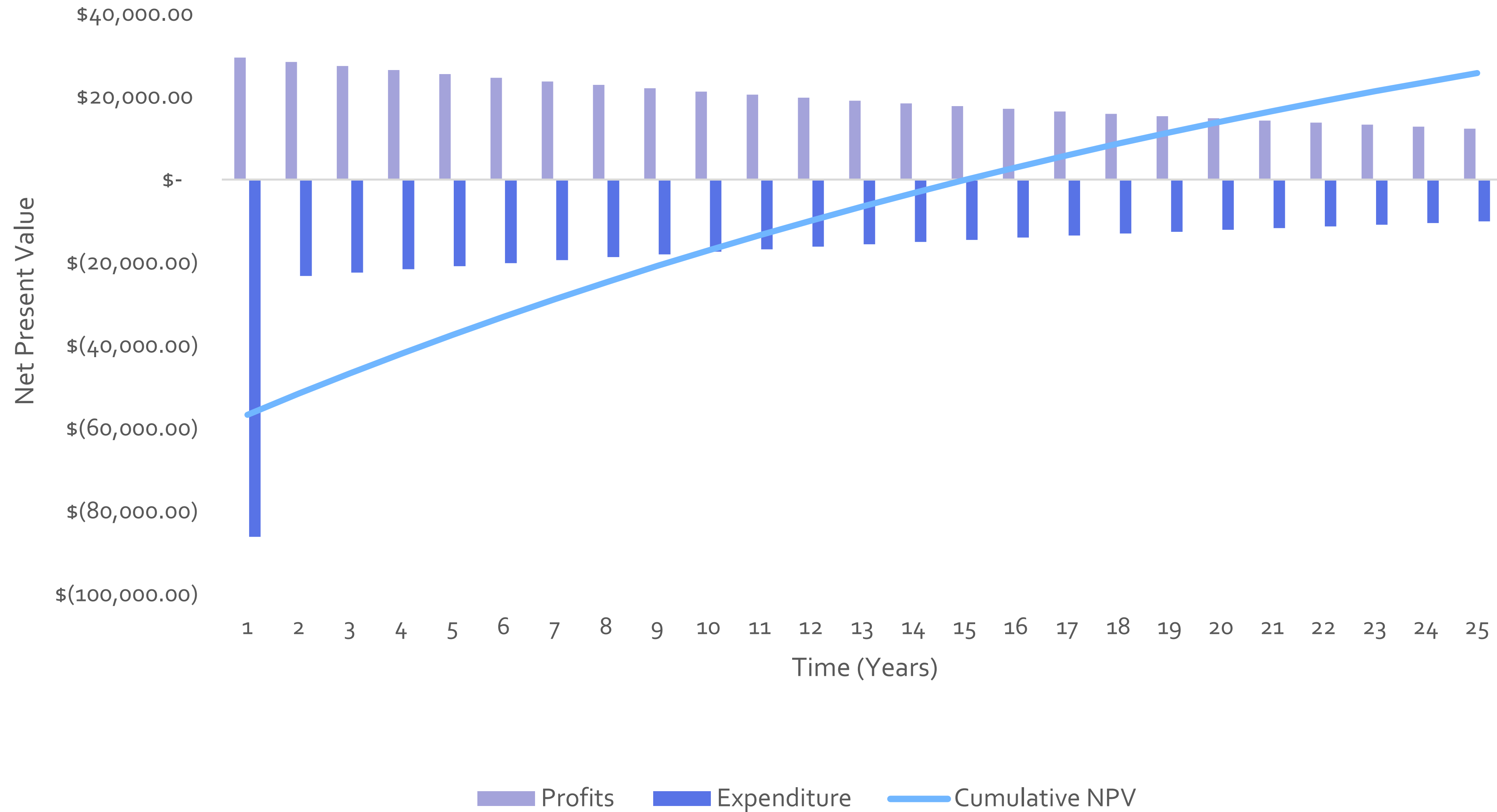
	LaneZero	Energy Star + Solar	Energy Star	OBC Compliant
<i>Utility Consumptions and Productions:</i>				
Electricity - Consumed	5575 kWh	10980 kWh	10980 kWh	5250 kWh
Electricity - Produced	6100 kWh	6100 kWh	0 kWh	0 kWh
Natural Gas	0 kWh	0 kWh	0 kWh	20395 kWh
Water	110 m ³	165 m ³	165 m ³	165 m ³
<i>Utility Costs:</i>				
Electricity - Consumed (\$0.15 / kWh)	\$856.65	\$1,687.19	\$1,687.19	\$806.72
Electricity - Produced (\$0.31 / kWh)	\$(1,897.10)	\$(1,897.10)	\$-	\$-
Natural Gas (\$0.03 / kWh)	\$-	\$-	\$-	\$517.18
Water (\$3.62 / m ³)	\$398.48	\$597.71	\$597.71	\$597.71
TOTAL	\$(641.97)	\$387.80	\$2,284.90	\$1,921.60

Cumulative Cost by Construction Type vs Time





ANNUAL PROFITS, EXPENDITURE & CUMULATIVE NPV







Hayley Cormick

Project Management
BASc, MBSc (Candidate)
Ryerson University



Brandon Wilbur

Mechanical
BSc, MEng (Candidate)
Ryerson University



Tamo Dembeck-Kereke

Energy Analysis
BSc, MASc (Candidate)
Ryerson University



Matthew Ferguson

Architectural Design
BArchSci, MArch (Candidate)
Ryerson University



Christopher Raghubar

Financial Analysis
BSc, MASc (Candidate)
Ryerson University



Matteo Calisesi

Acoustic Analysis
Arch/Constr. Eng. (Bachelor / Master)
University of Bologna



Jason Gray

Building Envelope
BEng, LEED AP, MASc (Candidate)
University of Toronto



Kevin Wu Almanzar

Building Envelope
BSc, MEng
University of Toronto



Xavier Mendieta

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BSc, MASc (Candidate)
Ryerson University



Ladan Arbabi

Energy Modelling
BArchSci, MBSc (Candidate)
Ryerson University



Ryan Fernandes

Architectural Design
BArchSci (Candidate)
Ryerson University



Greer Stanier

Architectural Design
BArchSci (Candidate)
Ryerson University



Phu Dinh

Architectural Design
BArchSci, MAMD, MArch (Candidate)
Ryerson University



Shivraj Sagar

Acoustic Analysis
BEng (Candidate)
Ryerson University



Roya Nosrati

Building Envelope
BArchSci, MASc (Candidate)
Ryerson University