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MASSACHUSETTS CLEAN ENERGY CENTER®

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E-ICON ARCHITECTURE

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Senior Project Manager
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NEW ECOLOGY
Community-Based Sustainable Development

Passive House Momentum Builds

- MassCEC Passive House Design Challenge
- MassSave Passive House Incentives
- Higher Points in Low Income Tax Credit ranking for Passive projects

mass save®

Savings through energy efficiency

Passive House Incentives

- 100% of the feasibility study cost up to $5,000
- 75% of energy modeling cost up to $500 per unit (cap of $20,000)
- $3,000 per unit for certification

To apply and get more information, email details of proposed building to **multifhr@icf.com**

Cambridge Finch Incremental Cost

1.4% increase in cost from base design

- Upgrades to ventilation/ERV
- Higher cost for Passive House consultant
- Increased insulation/thermal bridge breaks
- Upgrade to triple glazed windows
- Increased cost for PH Rater

Baseline building: very good envelope and all heat pumps for heating and cooling; shading features

A Boston or Cambridge base building might be similar, but most stretch code community base buildings would see a higher incremental cost to move to Passive levels

Up Next!

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PASSIVE HOUSE: Building Inherent Value

ICON ARCHITECTURE

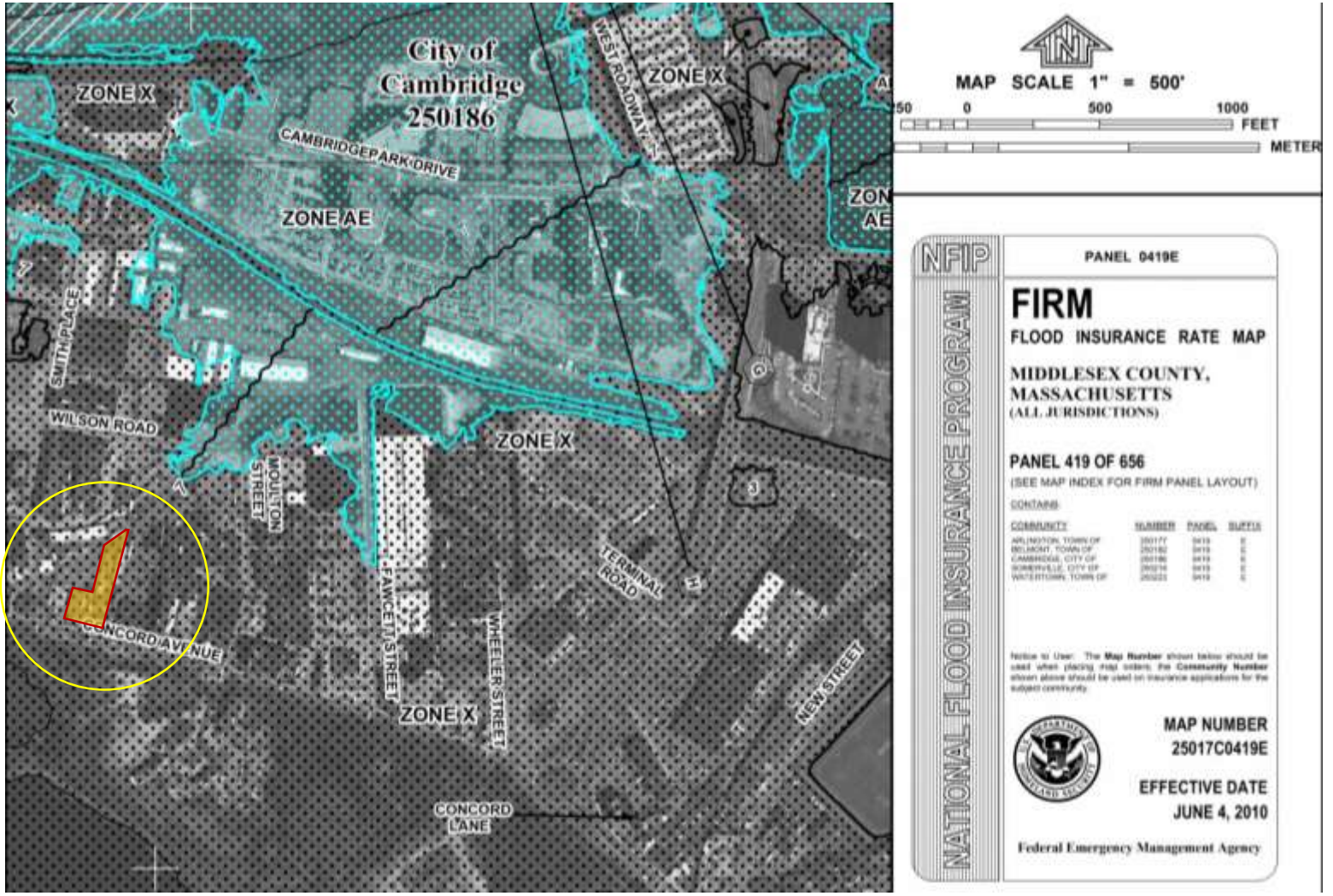
Fall 2018: Mass CEC Passive House Design Incentives

- 8 Passive House Affordable Projects (543 units)

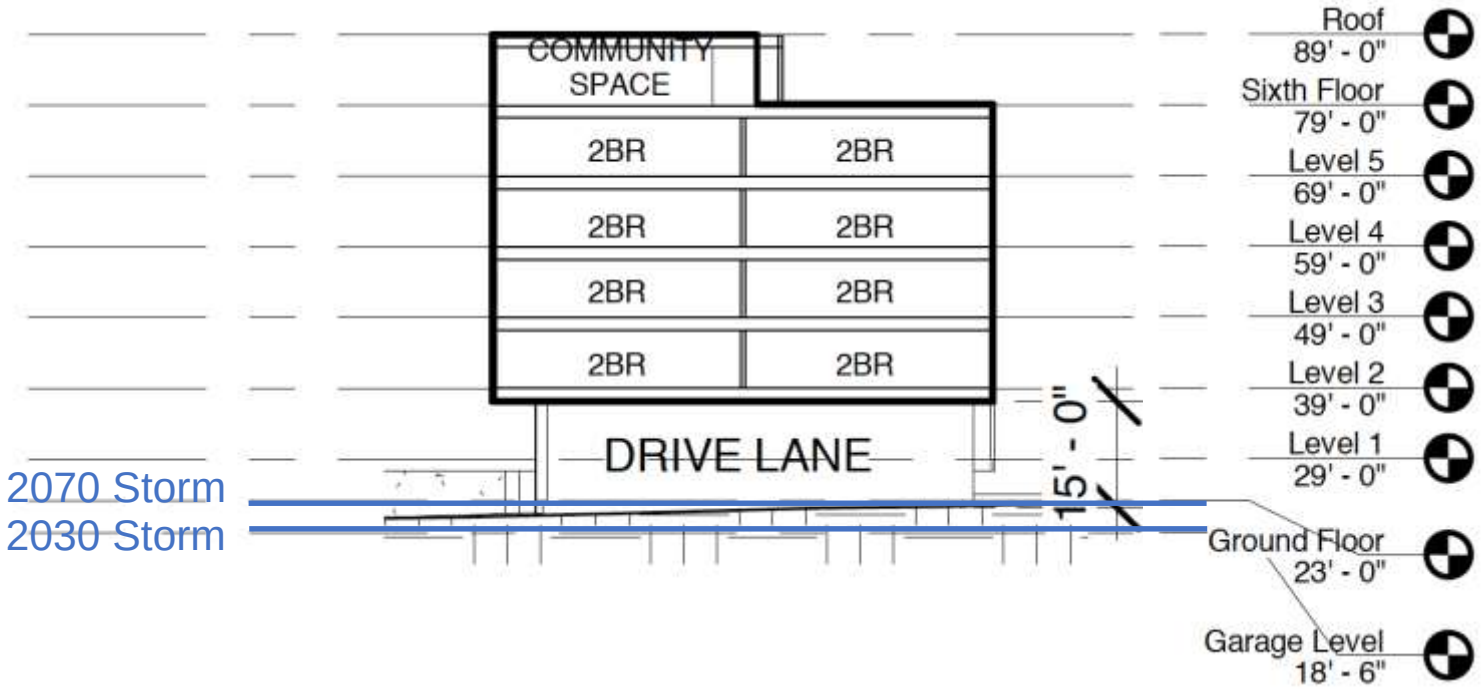
FINCH CAMBRIDGE

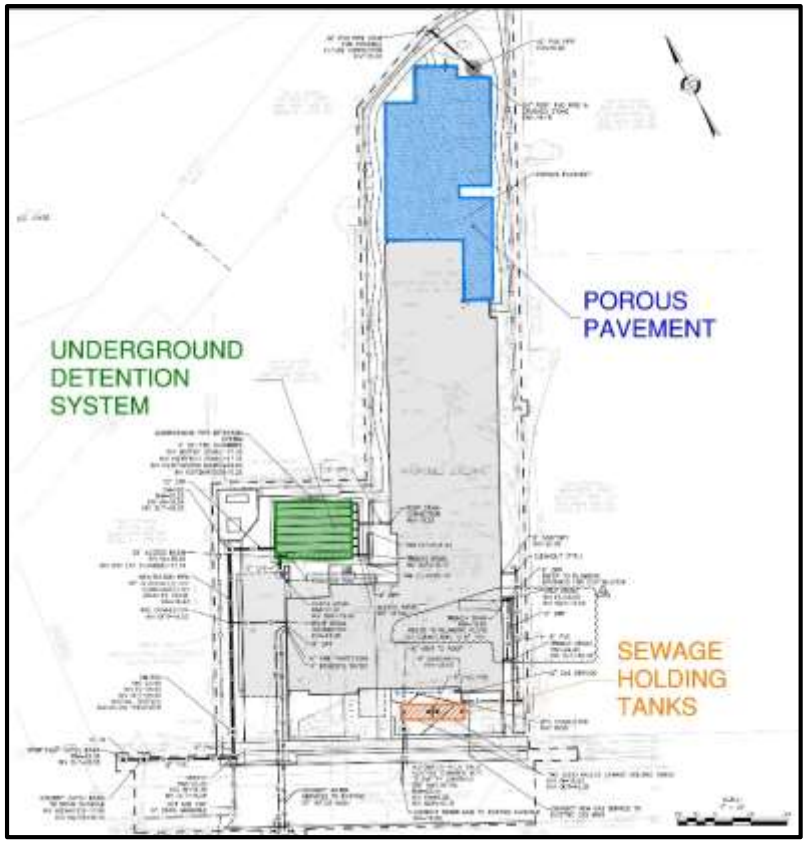
- Owner/Developer: Homeowners Rehab
- 98 affordable family units
- Opening July 2020

Flood Resilience

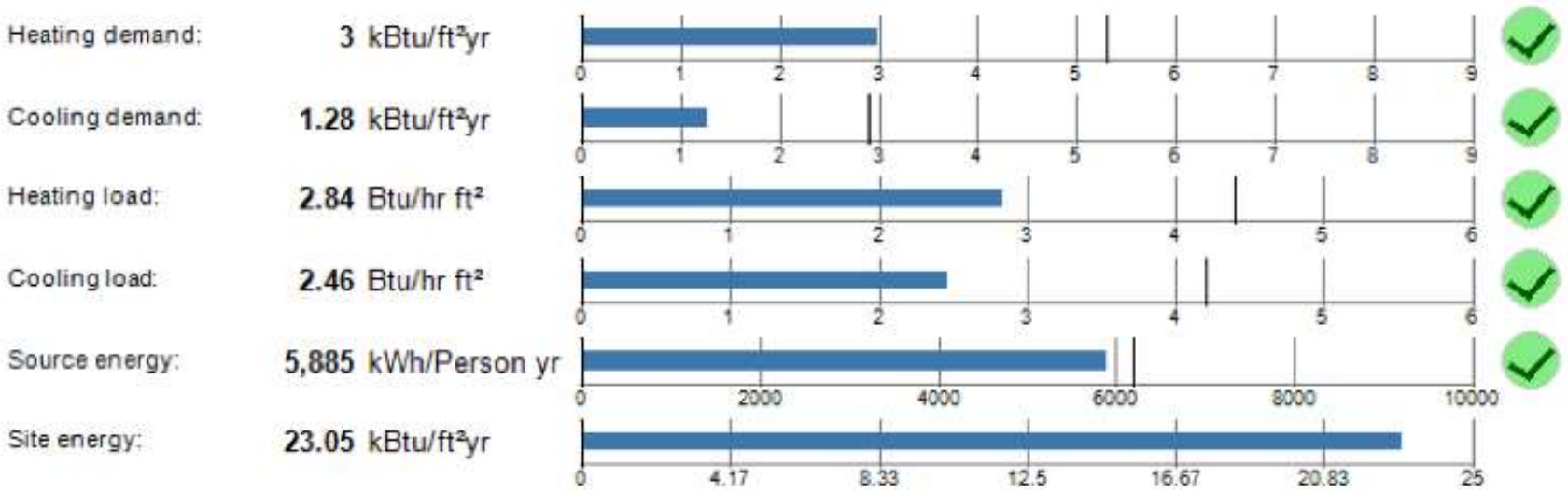


Flood Resilience





Passive House Performance



	National Median EUI for Multifamily Buildings* *(kBtu/ft2/yr)*	Finch Cambridge EUI (kBtu/ft2/yr)
Site EUI:	59.6	23.1
Source EUI:	118.1	56.2
EUI: (kBtu/ft2/yr)		

* Comparison EUI results came from the National Median EUI (Energy Use Intentsity) through the Energy Star Portfolio Manager: https://portfoliomanager.energystar.gov/pdf/reference/US%20National%20Median%20Table.pdf

What Does Successful Execution Require?

Builder as Partner:

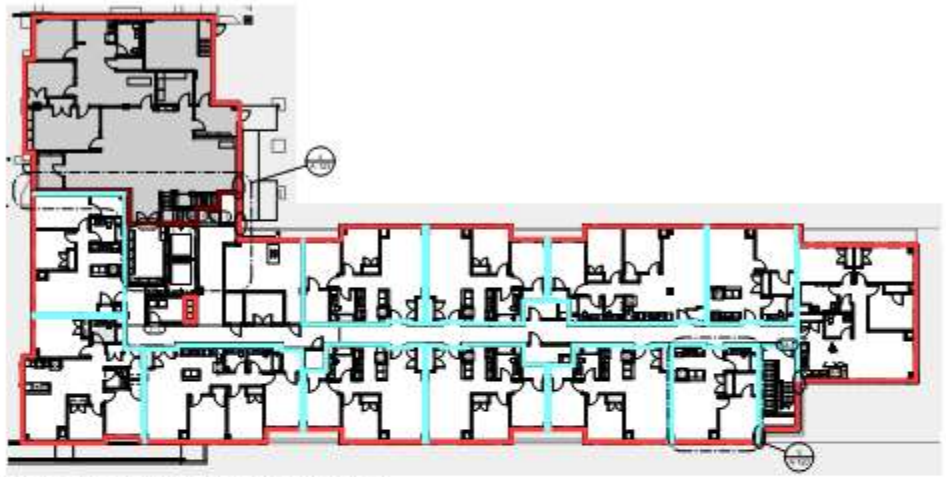
Attention to the CRAFT of building

COMMUNICATION
HUMILITY
APPRECIATION
MENTORSHIP

Communication/Collaboration

- Prominently post Airtight Building signs for duration of project
- Assign one person responsibility for maintaining the air barrier
- Discuss the air barrier with all subs prior to commencement of their work

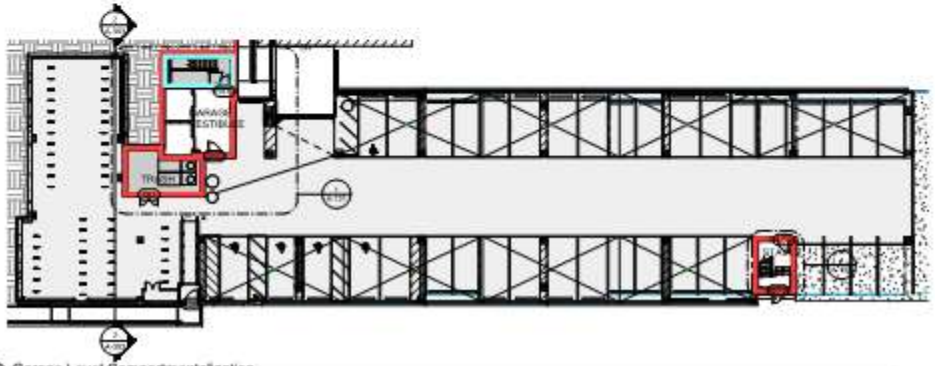
Graphic Communication



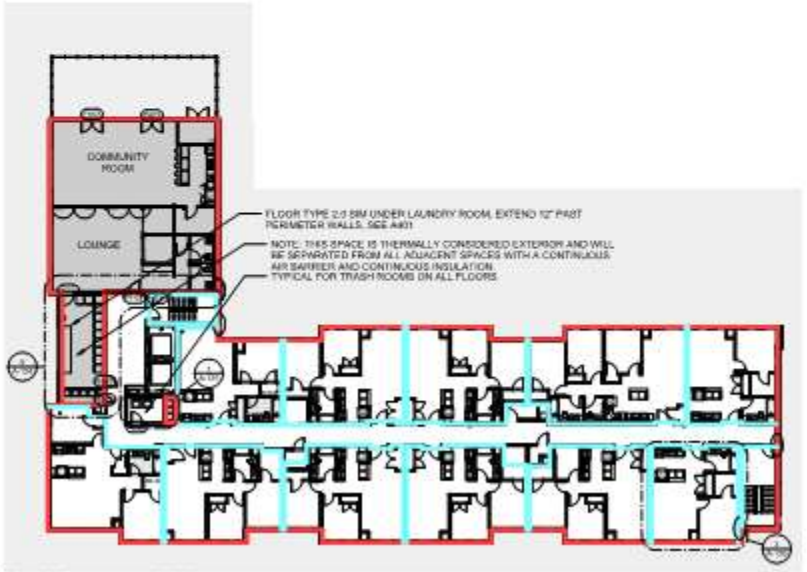
2 GROUND/ FIRST FLOOR COMPARTMENTALIZATION

3 TYPICAL UNIT COMPARTMENTALIZATION

TYPICAL AT EVERY UNIT ON ALL FLOORS

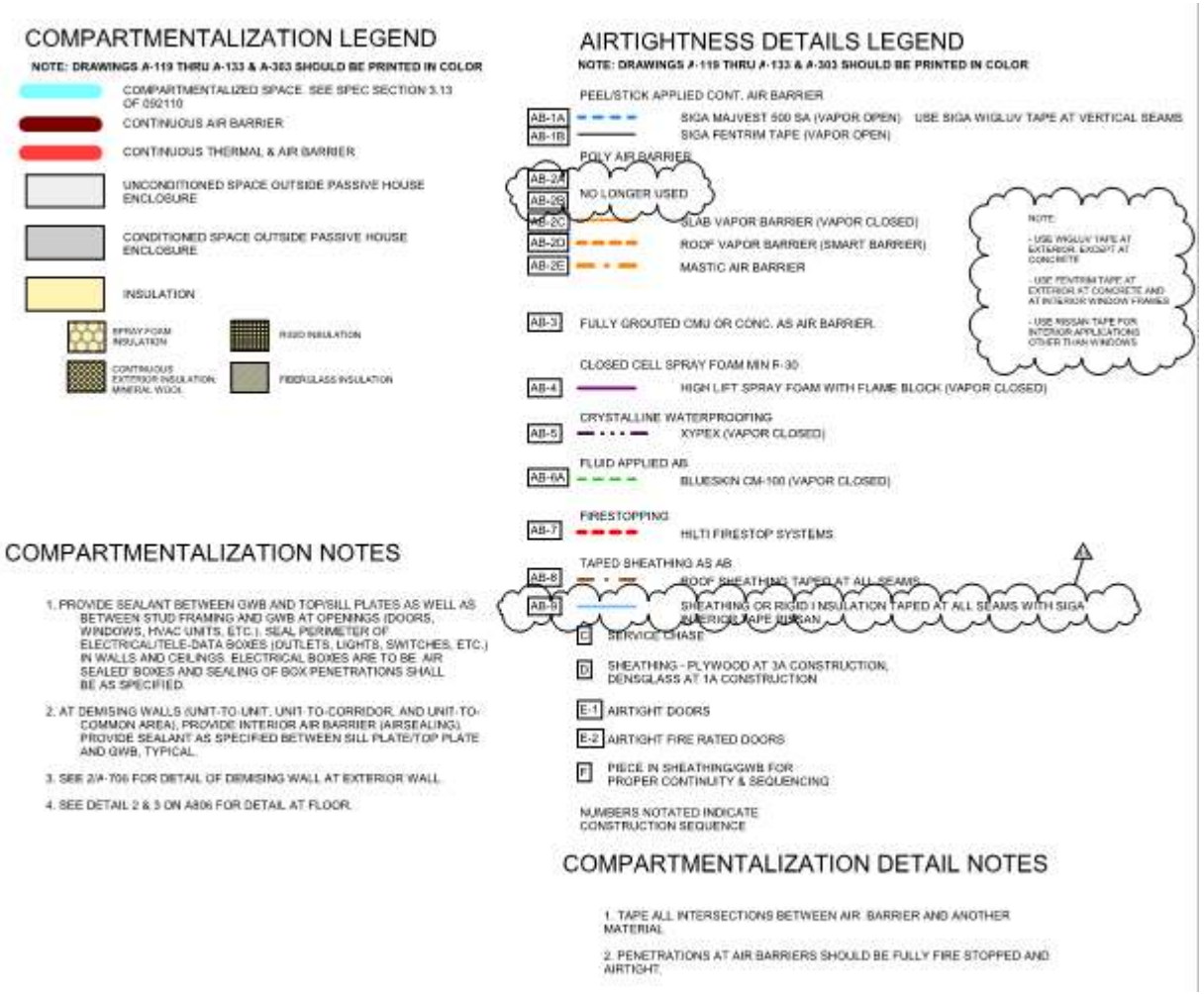


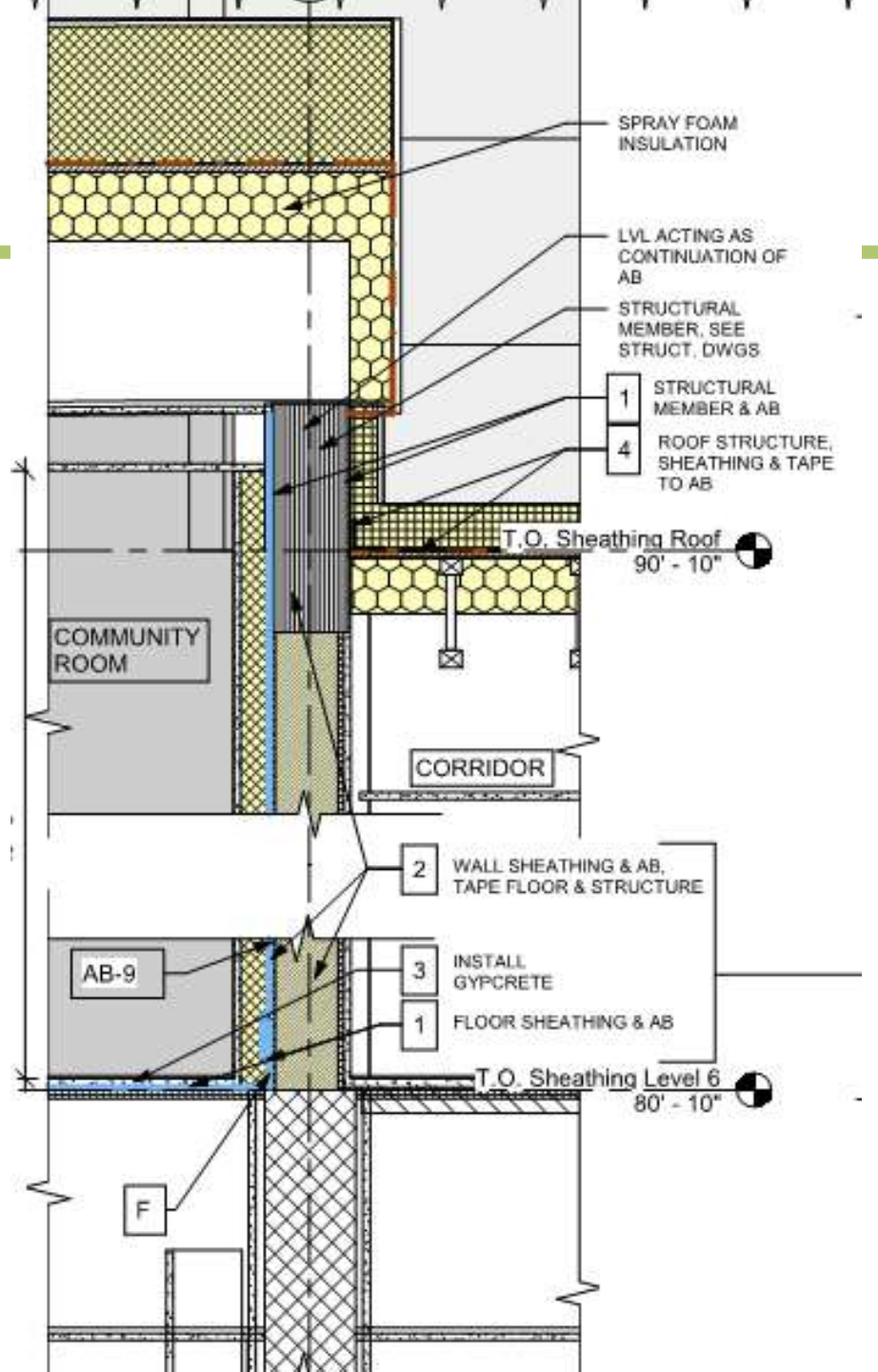
1 Garage Level Compartmentalization



4 Level 6 Compartmentalization

Graphic Communication

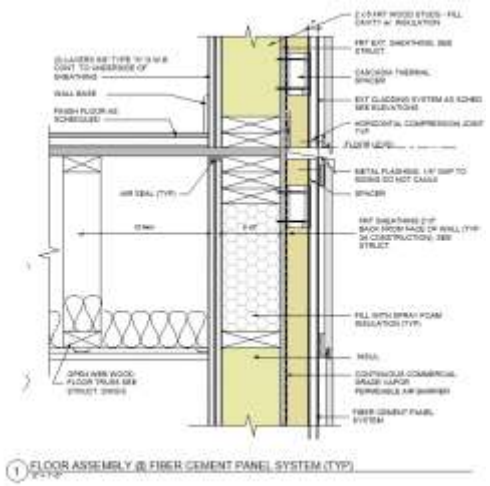




HOW DO YOU GET THERE?

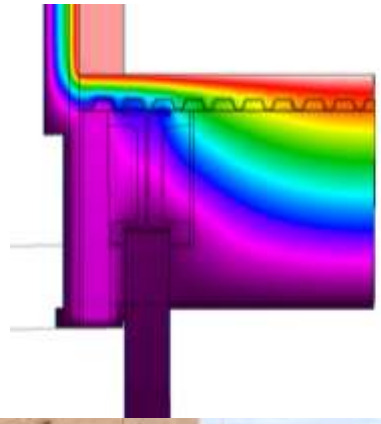
Avoid Thermal Bridging

CLADDING ATTACHMENT: CASCADIA CLIPS

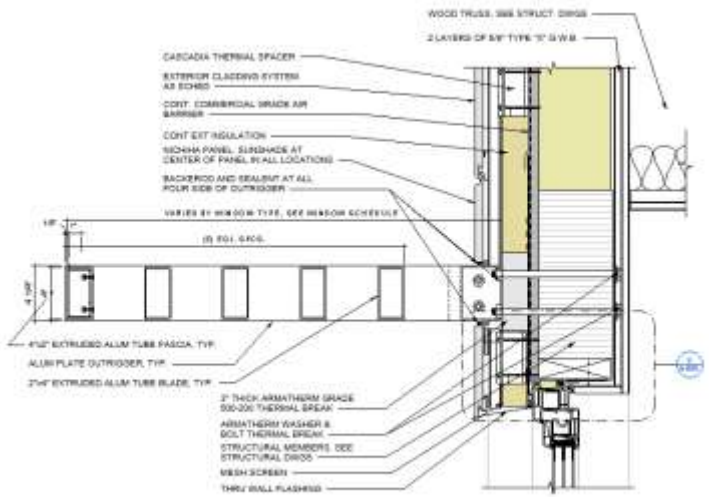


1 FLOOR ASSEMBLY @ FIBER CEMENT PANEL SYSTEM (TYP)

EXPOSED STEEL COLUMNS AT DRIVE LANE



SUN SHADE ATTACHMENT TO WINDOW HEADERS



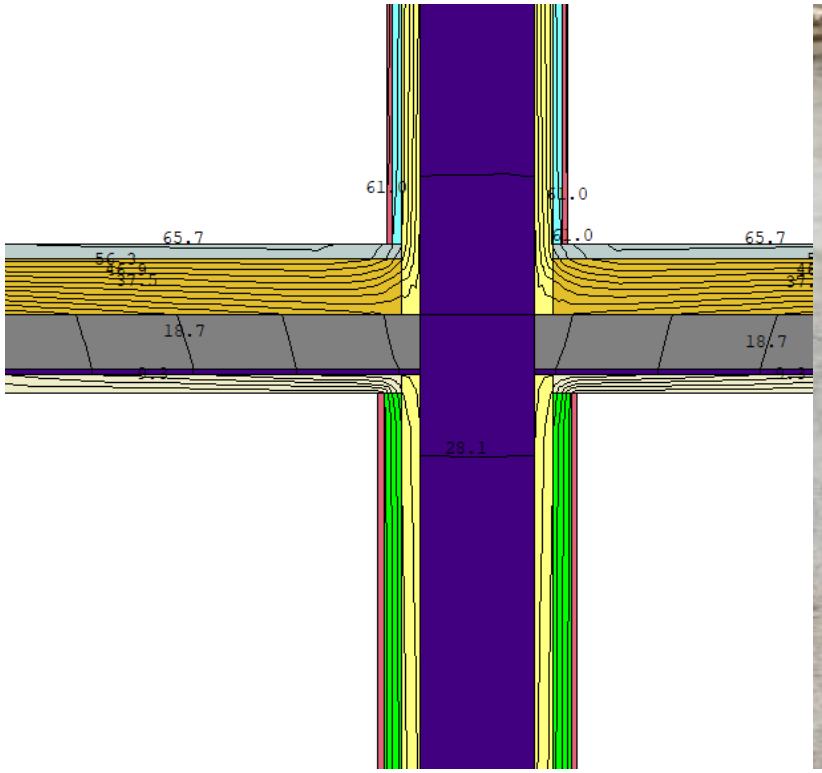
1 SOUTH SUN SHADE SECTION

HOW DO YOU GET THERE?

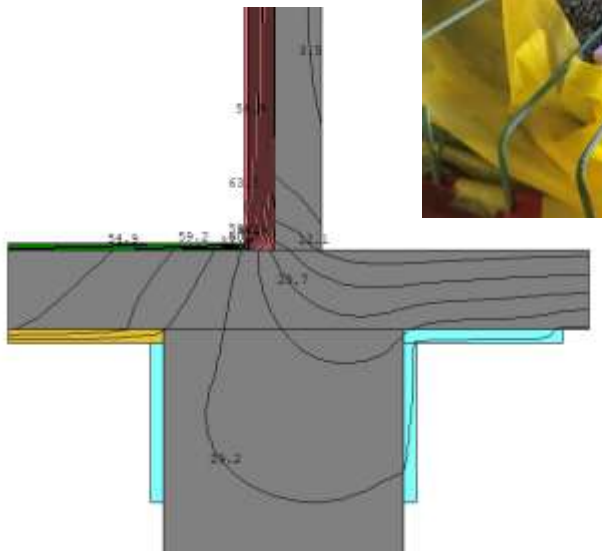
Thermal Bridging

THERM – a tool for cost-benefit analysis

COLUMN INTERFACE AT SLAB

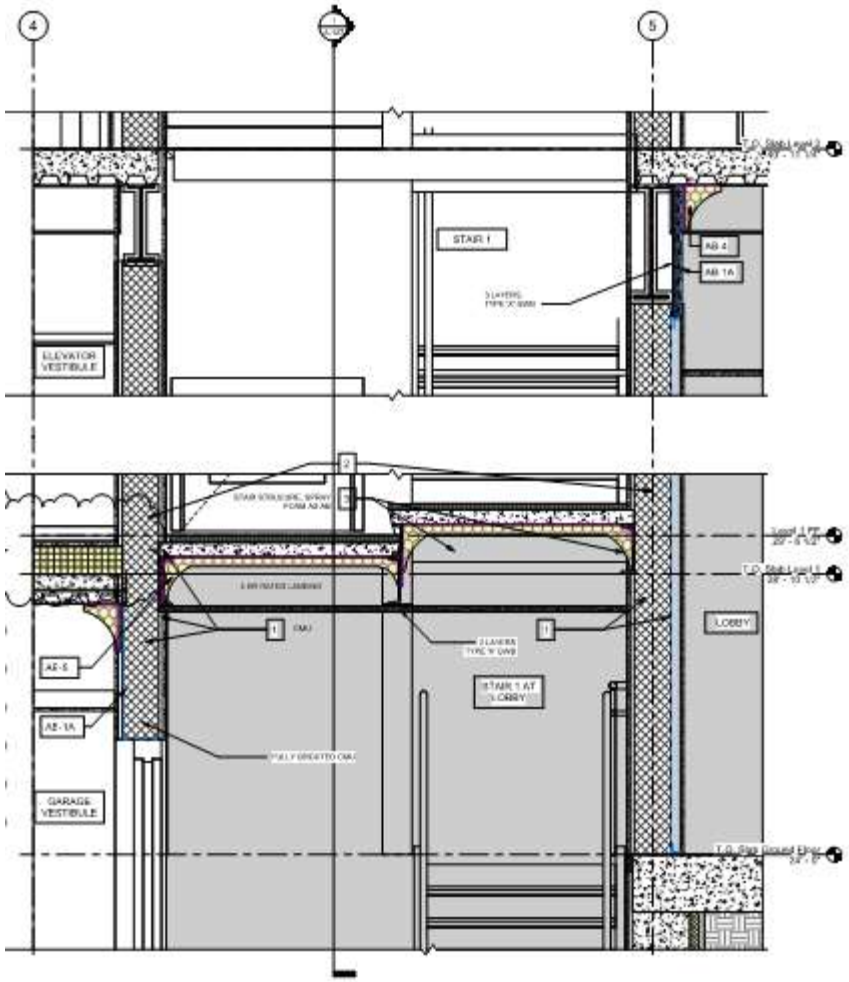


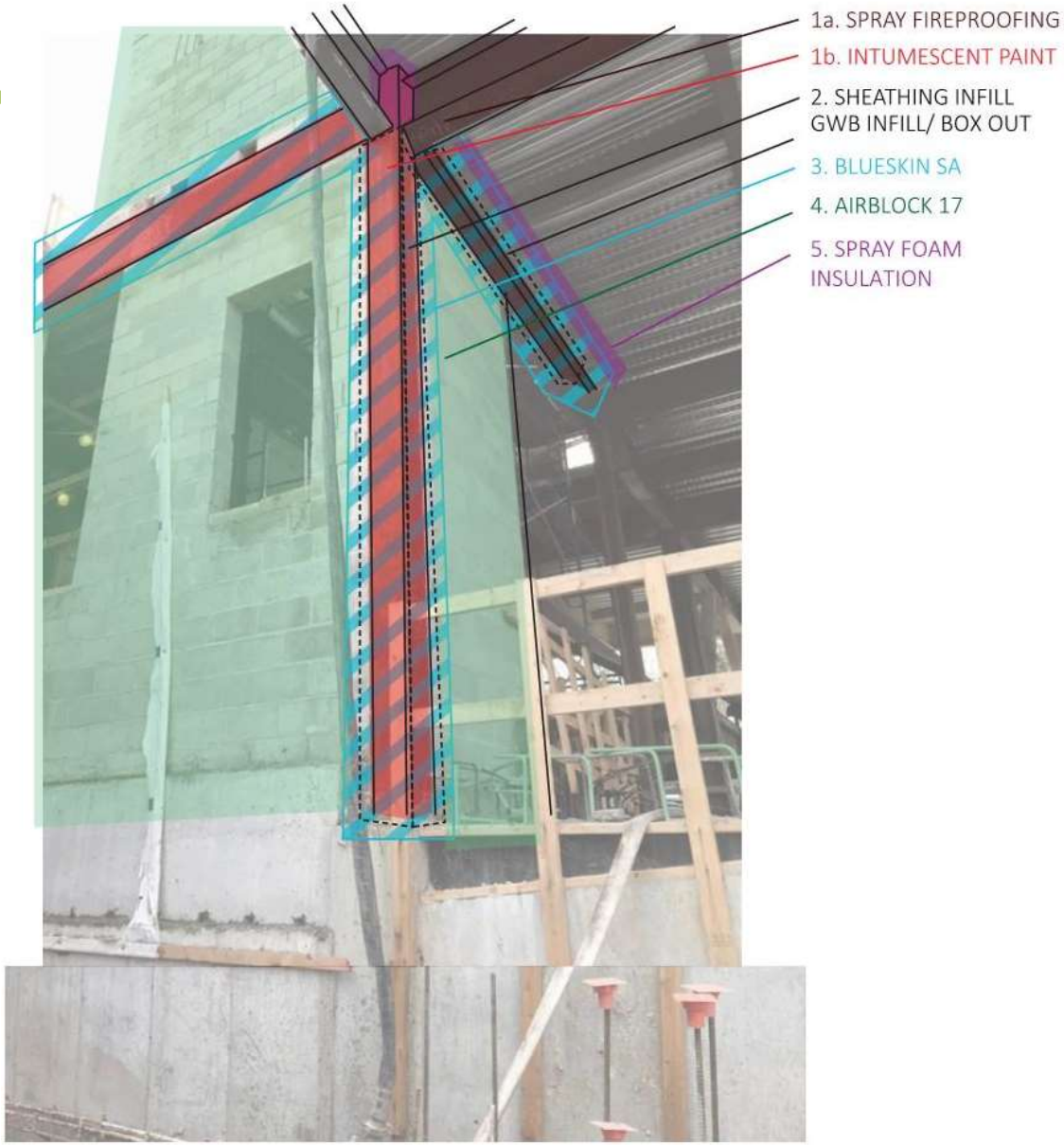
CONTINUOUS GARAGE SLAB



Field Communication

The right amount of information at the right time





Craft – Envelope Airtightness Continuity

Caio’s Team rocking the Air Barrier

Harbor Village

- Owner/Developer: North Shore CDC
- 30 affordable family units
- Started Construction, Jan 2020

3 Week Look Ahead Schedule

Job Number:	18-005001	**Date:**	4/13/2020
Project Name:	206 Main Street Gloucester	**Start Date:**	4/13/2020
		End Date:	5/3/2020
		Project Executive:	Dave Groom
Superintendent:	Keith Marescalchi	**Project Manager:**	Matt Robbins

Entering S, B or X will shade cell automatically

S	Scheduled	B	Behind Schedule	X	Will shade cell black

***Subcontractors must notify Groom Construction Project Manager or Superintendent within 24 hours of receiving this Three Week Look Ahead Schedule if not able to meet this schedule.

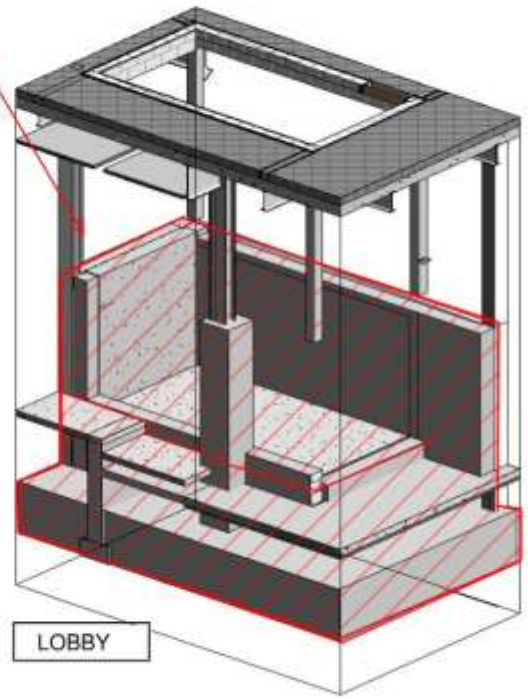
Item/Task	Subcontractor	Week #1							Week #2							Week #3							Remarks/Notes
		M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa	Su	
		4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	
BUILD ELECTRICAL INCLOSE FOR TEMP POWER	GROOM		S	S	S																		
FORM WALLS HH LINE	FORM UP	S	S	S																			MONDAY IS A RAIN OUT
FORM FOR PAD AT STAIR # 2	FORM UP	S	S	S																			
RECEIVE REBAR	GROOM	S																					
INSTALL DRAINAGE	LINSKEY	S	S	S	S	S			S	S													
FINISH DIGGING FOR FOOTING AT A LINE	LINSKEY		S																				
FORM FOOTING AT A LINE	FORM UP		S	S																			
POUR THE REST OF THE FOOTING ON A LINE	FORM UP			S																			
POUR PAD FOR STAIR # 2	FORM UP				S																		
REMOVE FORMS AT FOOTINGS AND PAD	FORM UP					S			S														
BACK FILL 1/2 OF THE WALL ON 7 LINE	LINSKEY										S	S											
FORM WALL ON A LINE	FORM UP								S	S	S												
POUR WALL ON A LINE	FORM UP											S											
START CMU STAIR # 2	VAZ											S	S			S	S	S	S	S			
FINISH DIGGING HH LINE FOR FOOTINGS , FORM AND POUR FOOTING HH LINE	LINSKEY AND FORMUP																	S	S				
POUR THE REST OF FOOTING ON HH LINE	FORM UP																			S			
HOPE FOR TEMP POWER	GROOM															S	S	S	S	S			

STAIR 2 SEQUENCE

1. FOUNDATION: WATERPROOFING

INSTALL LIQUID APPLIED WATERPROOFING AT OUTSIDE FACE OF ALL FOUNDATION WALLS AND FOOTINGS PART OF STAIR 2 STRUCTURE. IF STRUCTURE IS CONTINUOUS PAST STAIR 2, CONTINUE WATERPOOFING FOR 24"

MECH



LOBBY

PARKING

COMMERCIAL SPACE

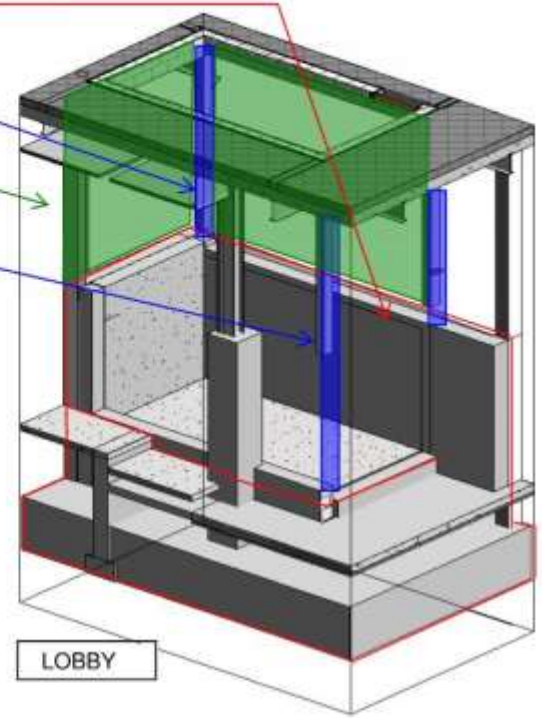
STAIR 2 SEQUENCE

1. FOUNDATION: WATERPROOFING

2. STEEL POSTS

3. CMU WALLS

4. **INTUMESCENT** PAINT ON STEEL AS AIR BARRIER



MECH

PARKING

LOBBY

COMMERCIAL SPACE

STAIR 2 SEQUENCE

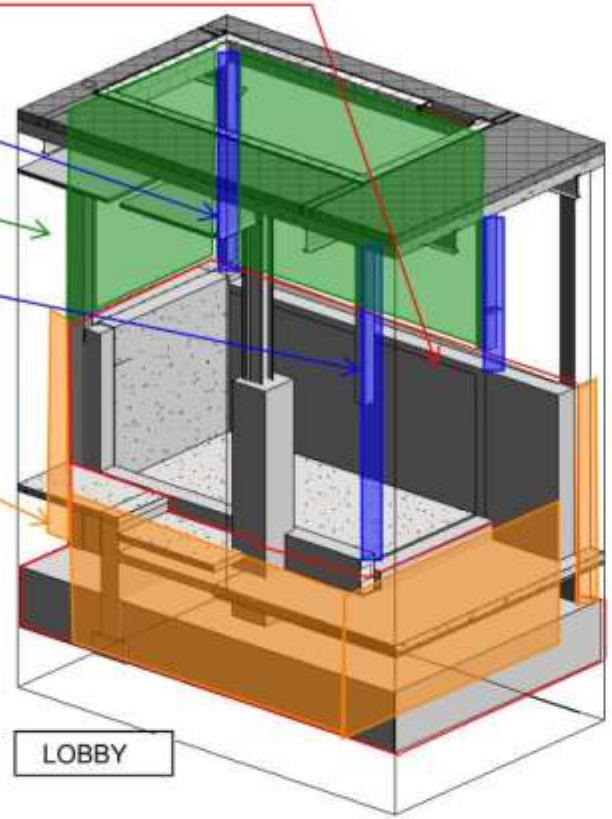
1. FOUNDATION: WATERPROOFING

2. STEEL POSTS

3. CMU WALLS

4. **INTUMESCENT** PAINT ON STEEL AS AIR BARRIER

5. SUB GRADE INSULATION MIN 48" BELOW GRADE



STAIR 2 SEQUENCE

1. FOUNDATION: WATERPROOFING

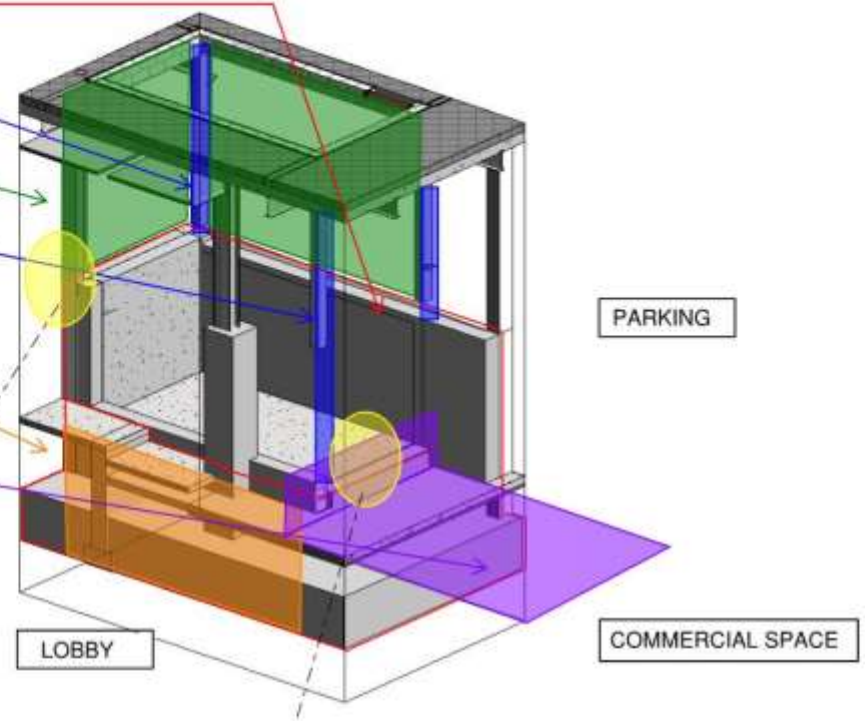
2. STEEL POSTS

3. CMU WALLS

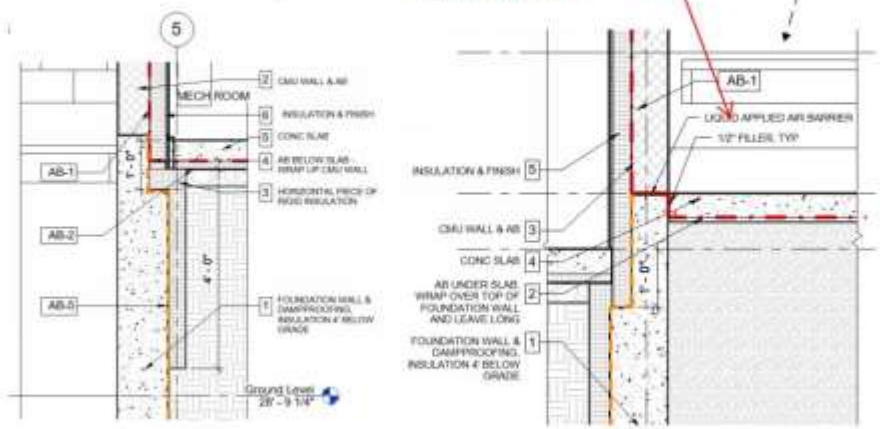
4. **INTUMESCENT** PAINT ON STEEL AS AIR BARRIER

5. SUB GRADE INSULATION MIN 48" BELOW GRADE

6. SUB SLAB INSULATION, VAPOR BARRIER, LAPS UP, SLAB POURED



DO WE NEED?



1/A116

1. FOUNDATION: WATERPROOFING

2. STEEL POSTS

3. CMU WALLS

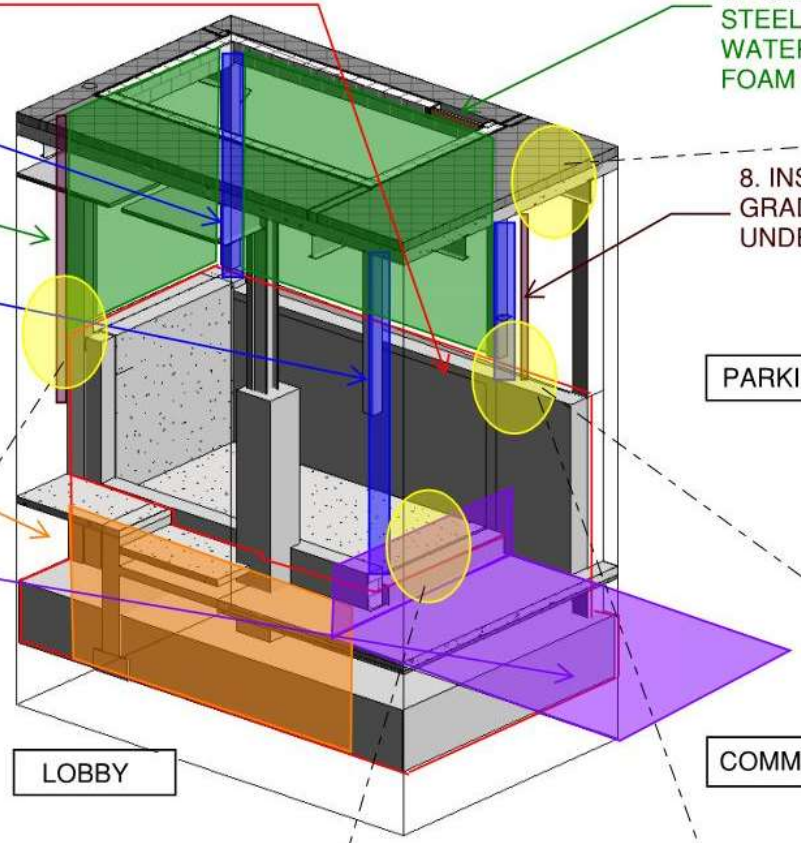
4. **INTUMESCENT** PAINT ON STEEL AS AIR BARRIER

5. SUB GRADE INSULATION MIN 48" BELOW GRADE

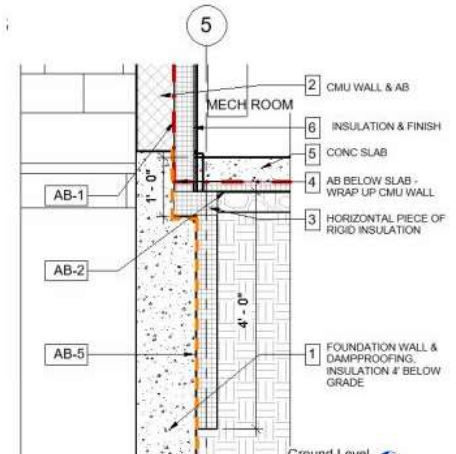
6. SUB SLAB INSULATION, VAPOR BARRIER, LAPS UP, SLAB POURED

7. **AIR BARRIER** ON CMU, LAP VAPOR BARRIER, INTUMESCENT PAINT ON STEEL & FOUNDATION WATERPROOFING & SPRAY FOAM UNDERSIDE OF DECK

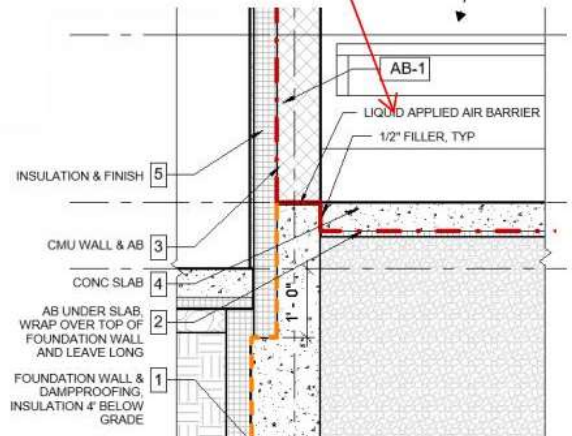
8. INSULATION ABOVE GRADE, & SPRAY FOAM UNDERSIDE OF DECK

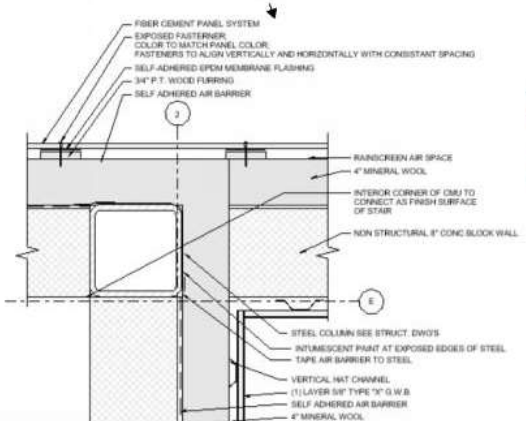


3/A116



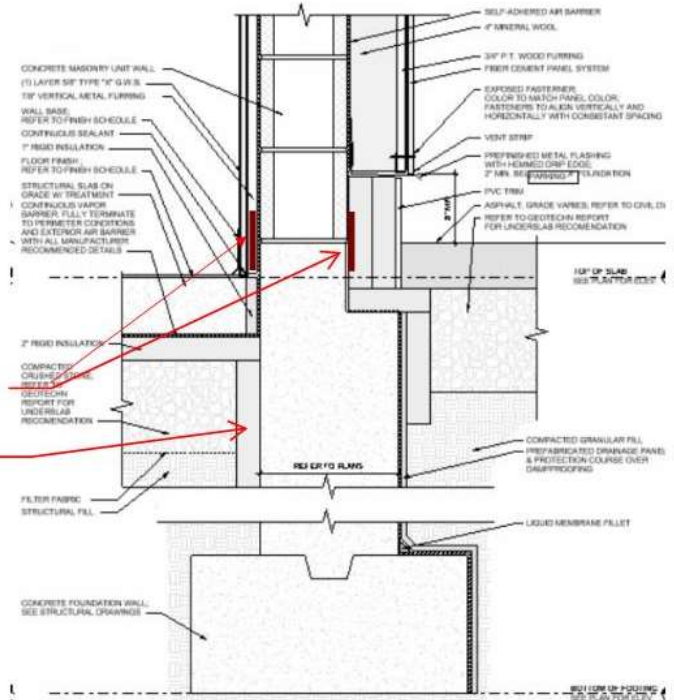
DO WE NEED?





TAPE TRANSITION

4' BELOW GRADE



2 LAUNDRY ROOM COMPARTMENTALIZATION
3/4" = 1'-0"

DETAILS LEGEND

A8-1	PEEL/STICK APPLIED CONT. AIR BARRIER
A8-2	10 MIL POLY AIR BARRIER
A8-3	FULLY GROUTED CMU OR CONC. AS AIR BARRIER
A8-4	CLOSED CELL HIGH LIFT SPRAY FOAM WITH FLAME BLOCK, MIN R-30
A8-5	CRYSTALLINE WATERPROOFING OR DAMPPROOFING
C	SERVICE CHASE
D	SHEATHING - PLYWOOD AT 3A CONSTRUCTION, DENSGLASS AT 1A CONSTRUCTION

COMPARTMENTALIZATION LEGEND

NOTE: THIS DRAWING SHOULD BE PRINTED IN COLOR

- COMPARTMENTALIZED SPACE. SEE SPEC SECTION 3.13 OF 092110
- APPLIED AIR BARRIER PRODUCT
- VAPOR BARRIER: DAMPPROOFING OR WATERPROOFING
- CONTINUOUS THERMAL & AIR BARRIER
- UNCONDITIONED SPACE OUTSIDE PASSIVE HOUSE ENCLOSURE
- CONDITIONED SPACE OUTSIDE PASSIVE HOUSE ENCLOSURE

206 Main Street,
Gloucester, MA

North Shore CDC

ARCHITECT

E-ICON ARCHITECTURE

101 SUMMER ST BOSTON MA 02110

CONSULTANT

KEY PLAN

STAMP

MARK	DATE	DESCRIPTION
	DEC 2019	CONFORMED SET
	NOV 2019	COORDINATION SET
	OCT 2019	PERMIT SET
	02/21/2019	ONE STOP SUBMISSION

PROJECT NUMBER: 216024
DRAWN BY:
CHECKED BY: MA

SHEET TITLE

TYPICAL FLOOR COMPARTMENTALIZATION

LOBBY SEQUENCE

1. FOUNDATION: WATERPROOFING

2. STEEL POSTS

3. STRUCTURAL CMU WALLS

4. INTUMESCENT PAINT & STRUCTURAL THERMAL BREAKS

5. STRUCTURAL THERMAL BREAKS

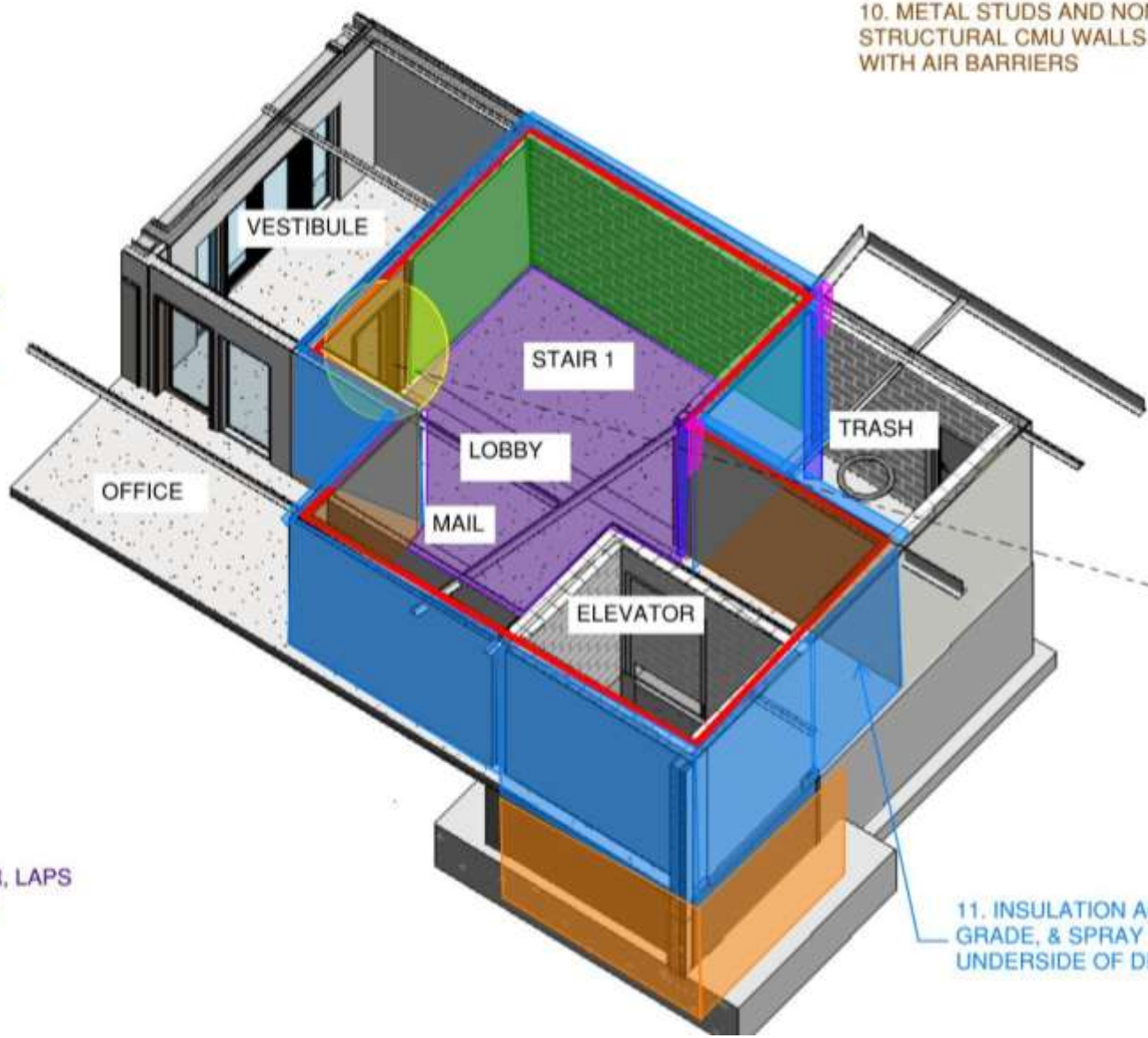
6. VERTICAL SUB GRADE

7. SUB SLAB INSULATION

8. VAPOR BARRIER, LAPS UP, SLAB POURED

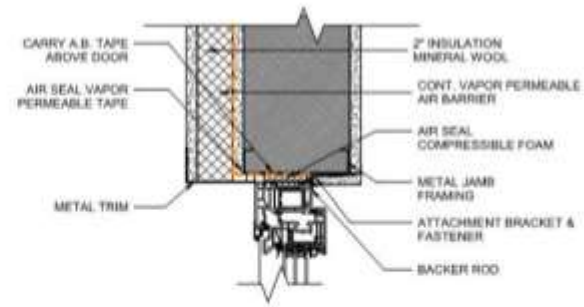
9. AIR BARRIER ON CMU

10. METAL STUDS AND NON STRUCTURAL CMU WALLS WITH AIR BARRIERS

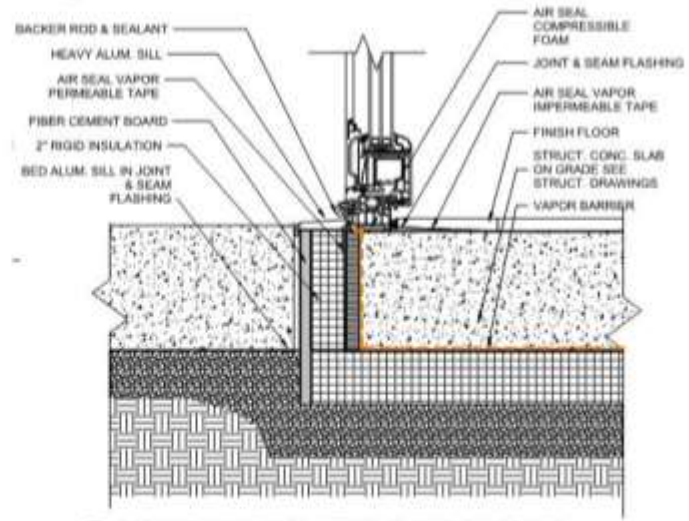


11. INSULATION ABOVE GRADE, & SPRAY FOAM UNDERSIDE OF DECK

DETAILS AT DOORS



2 PASSIVE HOUSE DOOR MTL JAMB DETAIL
3" = 1'-0"



1 PASSIVE HOUSE SILL DETAIL @ SLAB ON GRADE
3" = 1'-0"

LAUNDRY ROOM SEQUENCE

1. STRUCTURE IN PLACE.

2. NON STRUCTURAL WALL IN PLACE

3. AIR BARRIER APPLIED TO INSIDE FACE OF ALL 6 SIDES OF ROOM

- SELF AHDERED AIR BARRIER AT WALLS

- WATERPROOFING MEMBRANE AT FLOOR, TIE INTO FLOOR DRAIN

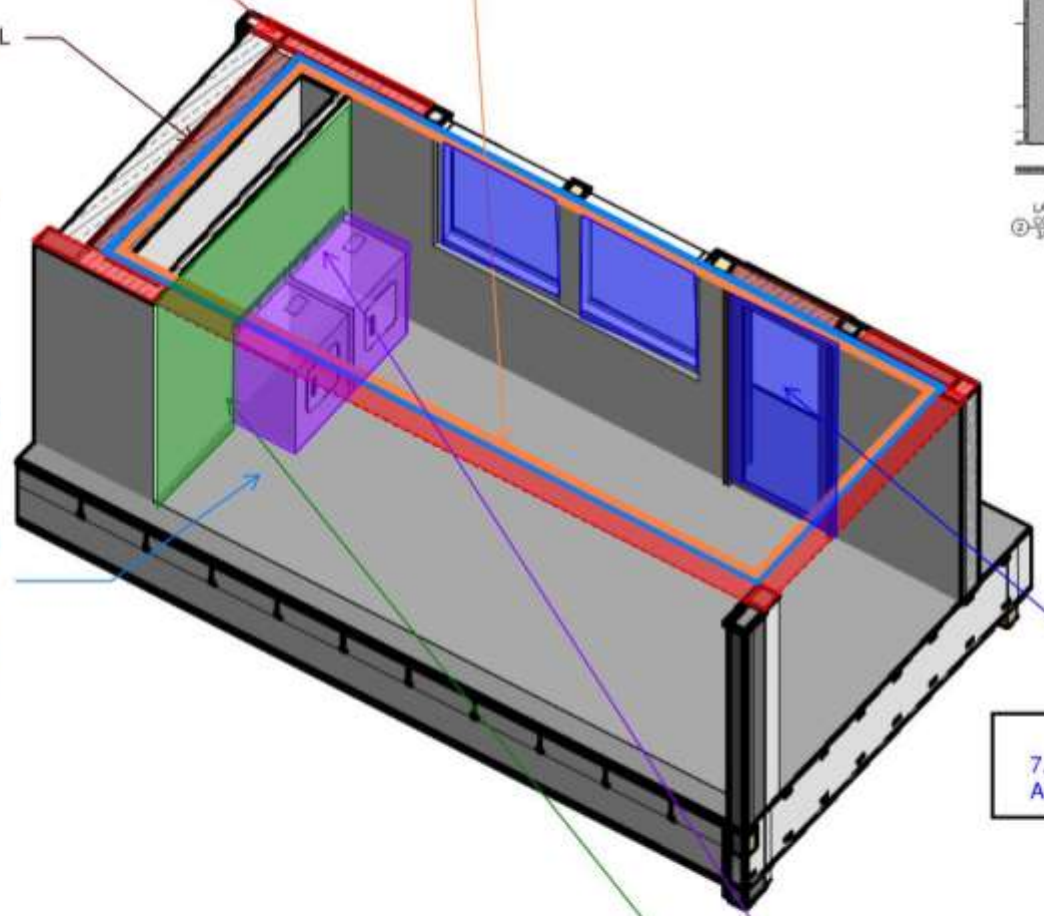
- TAPE TRANSITION BETWEEN WALL AND FLOOR

- SPRAY FOAM AT INTERSECTION IN CROSS SECTION

- WRAP INTO OPENINGS FOR DOORS AND WINDOWS

4. RIGID INSULATION AT WALLS

INULSATION BELOW LAUNDRY ROOM



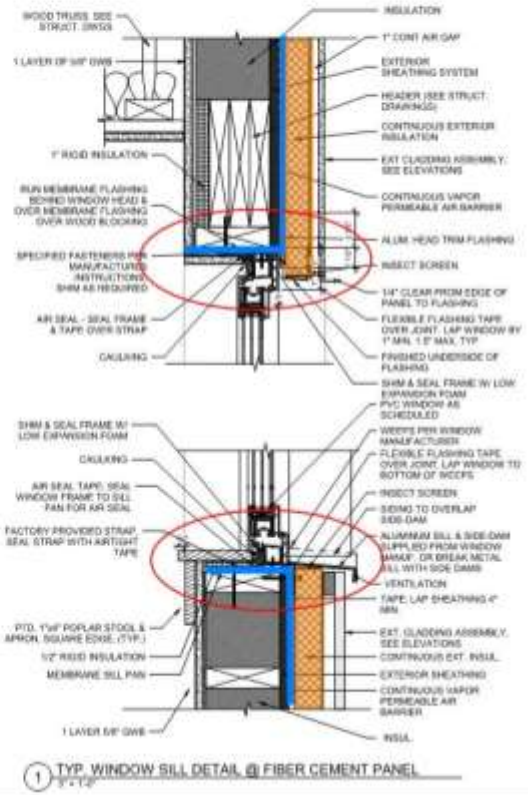
5. INSTALL MEP & DRYERS

6. INSTALL WALL TO SEPARATE MAKE UP AIR, GASKET DRYERS AT EDGES

7. INSTALL WINDOWS AND DOORS

LAUNDRY ROOM COMPARTMENTALIZATION
3/4" = 1'-0"

A-112



TYP. WINDOW SILL DETAIL @ FIBER CEMENT PANEL

3 Week Look Ahead Schedule

Job Number:	18-005001	**Date:**	4/20/2020
Project Name:	206 Main Street Gloucester	**Start Date:**	4/20/2020
		End Date:	5/10/2020
		Project Executive:	Dave Groom
Superintendent:	Keith Marescalchi	**Project Manager:**	Matt Robbins

Entering S, B or X will shade cell automatically

S	Scheduled	B	Behind Schedule	X	Will shade cell black

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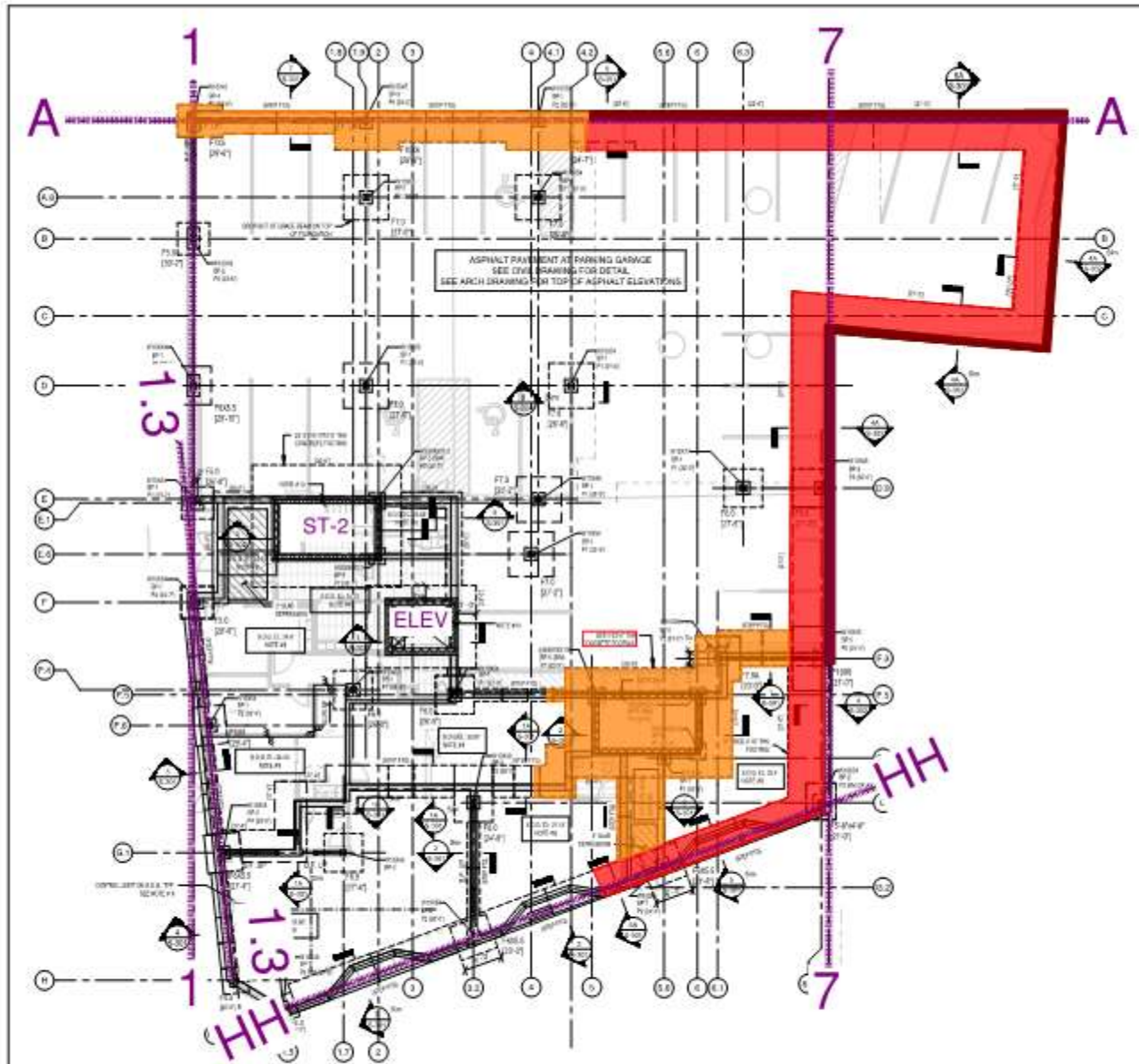
		4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	
dig the rest of HH line for footing	linskey	S																					
dig for footing along Elm street	linskey	S	S																				
finish forms and pour wall on A line	form up	S																					
tie rebar at stair # 2	form up	S	S																				
install forms at walls at stair # 2	form up		S	S	S																		
remove forms on wall at A line	form up			S																			
back fill wall at A line	linskey				S	S																	
Bring water lines into to site from main	linskey			S	S																		
pour walls at stairs # 2	form up					S																	
remove forms at stair # 2	form up								S	S													
form walls on HH line	form up								S	S	S												
start CMU at stair # 2	vaz											S	S			S	S	S	S				
pour walls at HH line	form up											S											
remove forms on wall on HH line	form up												S			S							
form footings and pad at elm st and stair # 1	form up															S	S	S	S	S			
water proof and back fill HH wall	linskey															S	S	S	S				
waterproof and passvive house work at stair # 2	waterproofing CO.															S	S						
Take video of work at stair # 2	groom																S						
back fill at stair # 2	linskey																		S	S			



1 Ground Level

Harbor Village

206 Main Street,
Gloucester, MA

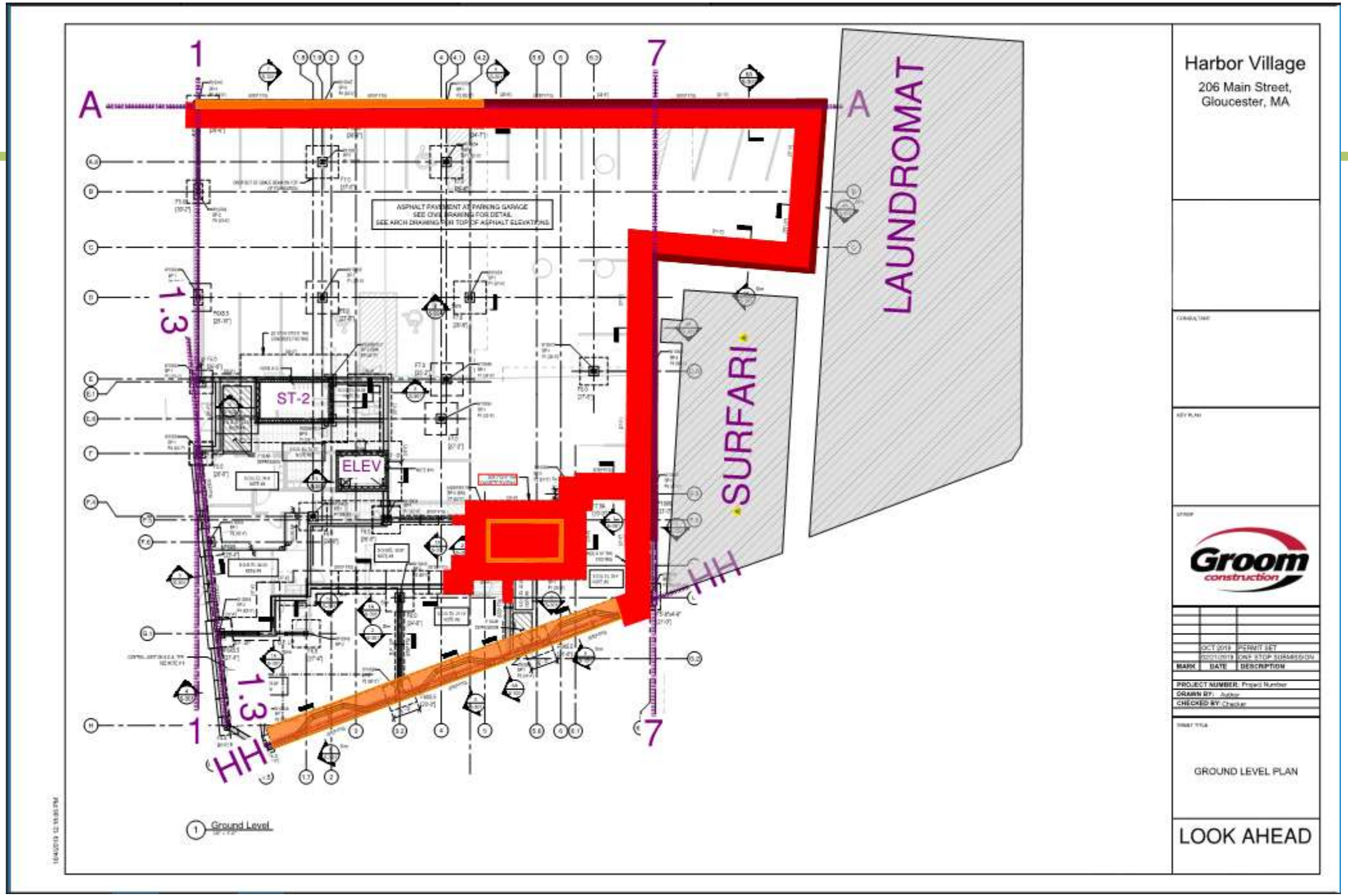
Groom construction

MARK	DATE	DESCRIPTION
	OCT 2019	PERMIT SET
	07/11/2019	ONE STOP SUBMISSION

PROJECT NUMBER: Project Number
DRAWN BY: Author
CHECKED BY: Checker

GROUND LEVEL PLAN

LOOK AHEAD



Harbor Village

206 Main Street,
Gloucester, MA

Groom construction

MARK	DATE	DESCRIPTION
	OCT 2019	PERMIT SET
	10/21/2019	DNP STOP SUBMISSION

PROJECT NUMBER: Project Number
DRAWN BY: Author
CHECKED BY: Checker

GROUND LEVEL PLAN

LOOK AHEAD

Harbor Village

206 Main Street,
Gloucester, MA

Groom construction

MARK	DATE	DESCRIPTION
	OCT 2019	PERMIT SET
	02/21/2019	CONF. & TOP SUBMISSION

PROJECT NUMBER: Project Number
DRAWN BY: Author
CHECKED BY: Checker

GROUND LEVEL PLAN

LOOK AHEAD

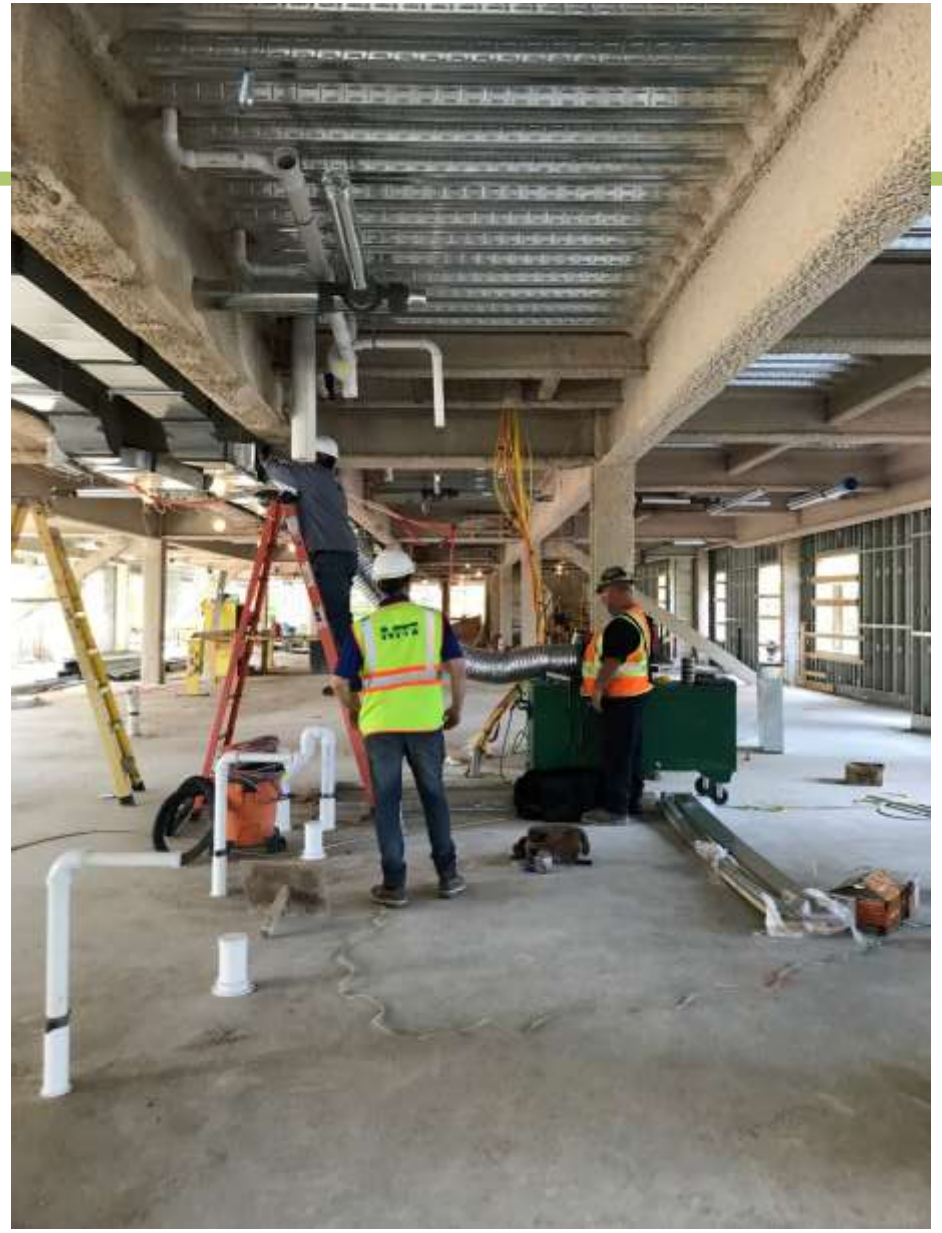
Craft: Pipe/Penetration Airtightness

First Try – Not Approved

Ian Russell - Plumber

Second Try –Approved

Testing/Verification

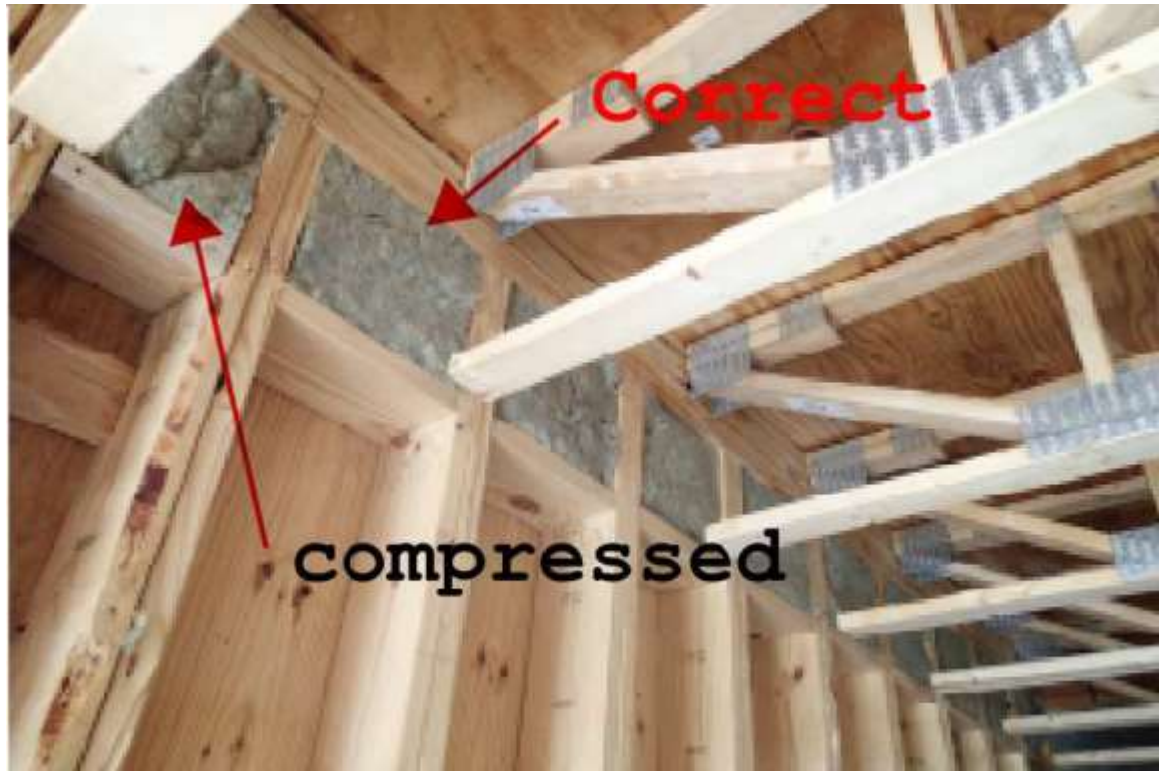


Craft – Envelope Airtightness Continuity

Not Approved

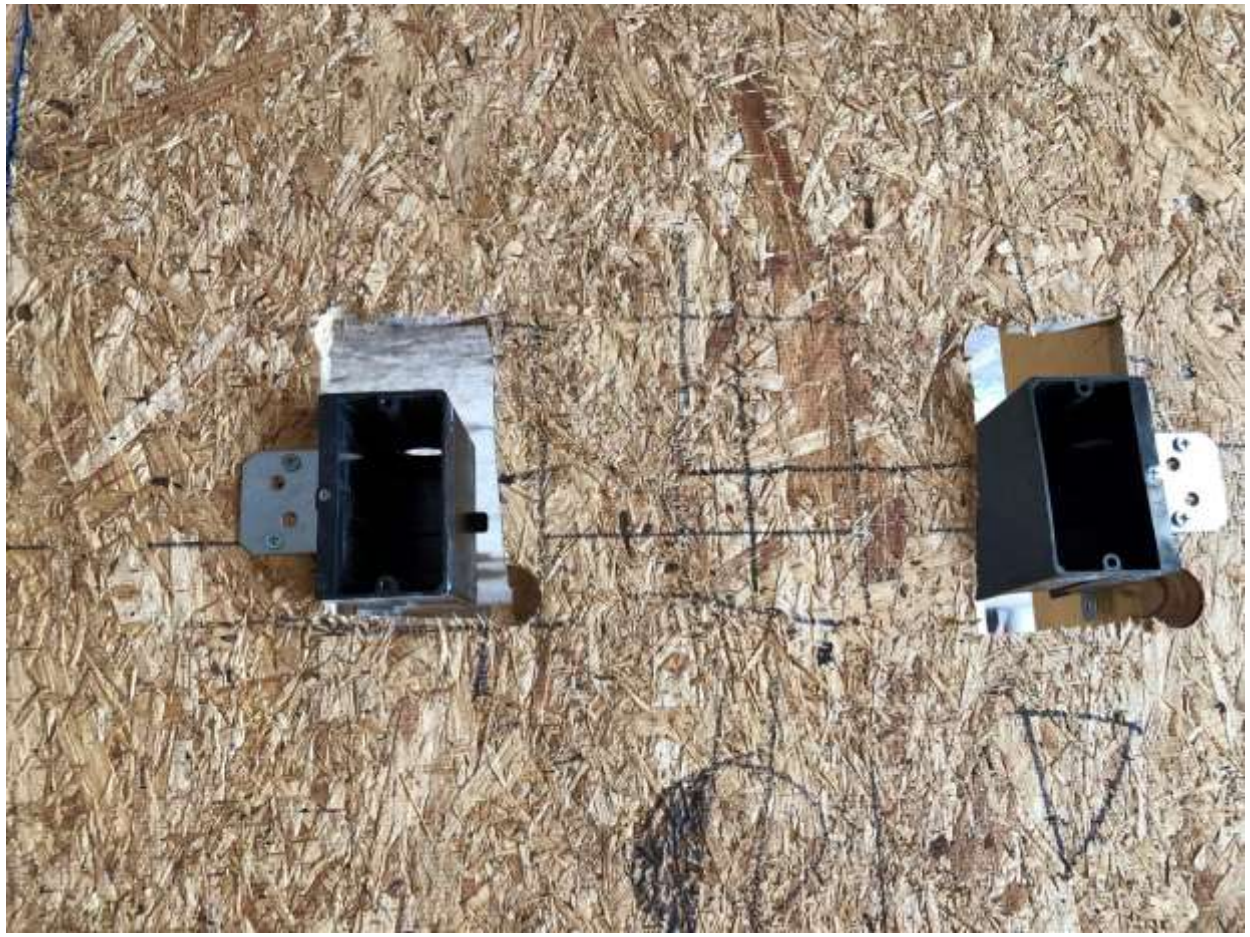
Approved

Craft – Envelope Thermal Continuity



Craft: Pipe/Penetration Insulation

Craft – Interior Compartmentalization



Not Approved

Approved

Commissioning/Monitoring

You are not alone – we are a team

Architect:	ICON Architecture
MEP/FP:	Petersen Engineering
GC:	NEI General Contracting – (CPHC added to team)
Energy Modeler & CPHC :	Linnean Solutions
PH Verifier:	JSR Adaptive Energy Solutions
Sustainability Consultant:	New Ecology
Envelope Consultant:	Building Enclosure Associates
Commissioning Agent:	Sustainable Engineering Solutions

Up Next!

James Petersen

PE

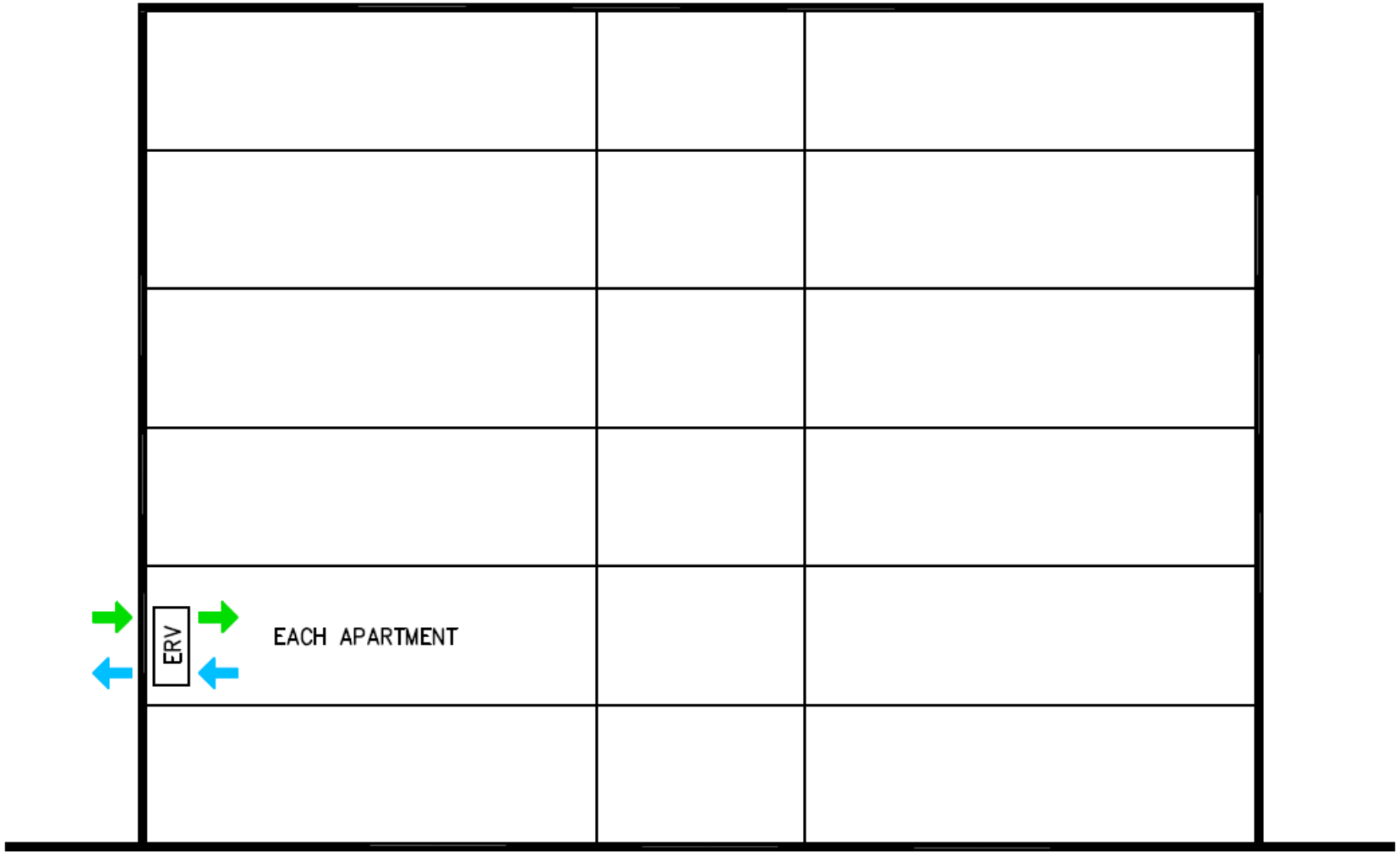
james@petersenengineering.com

603-436-4233 x111

Three Ventilation Approaches

- Local
- Floor-by-floor
- Central – Finch

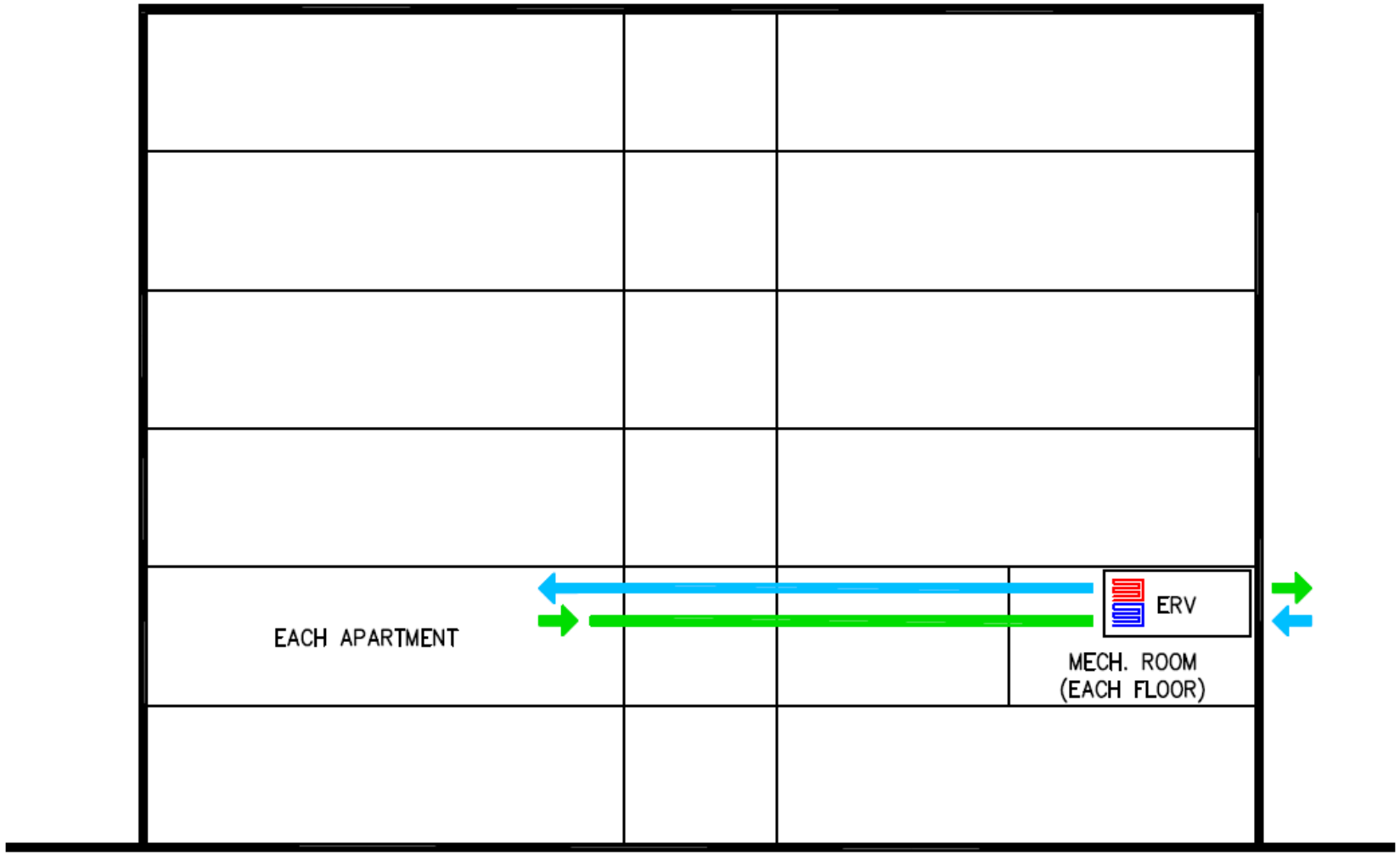
Local Ventilation - Schematic



Local Ventilation – Sample Equipment

23 in x 31 in x 34 in
60 CFM

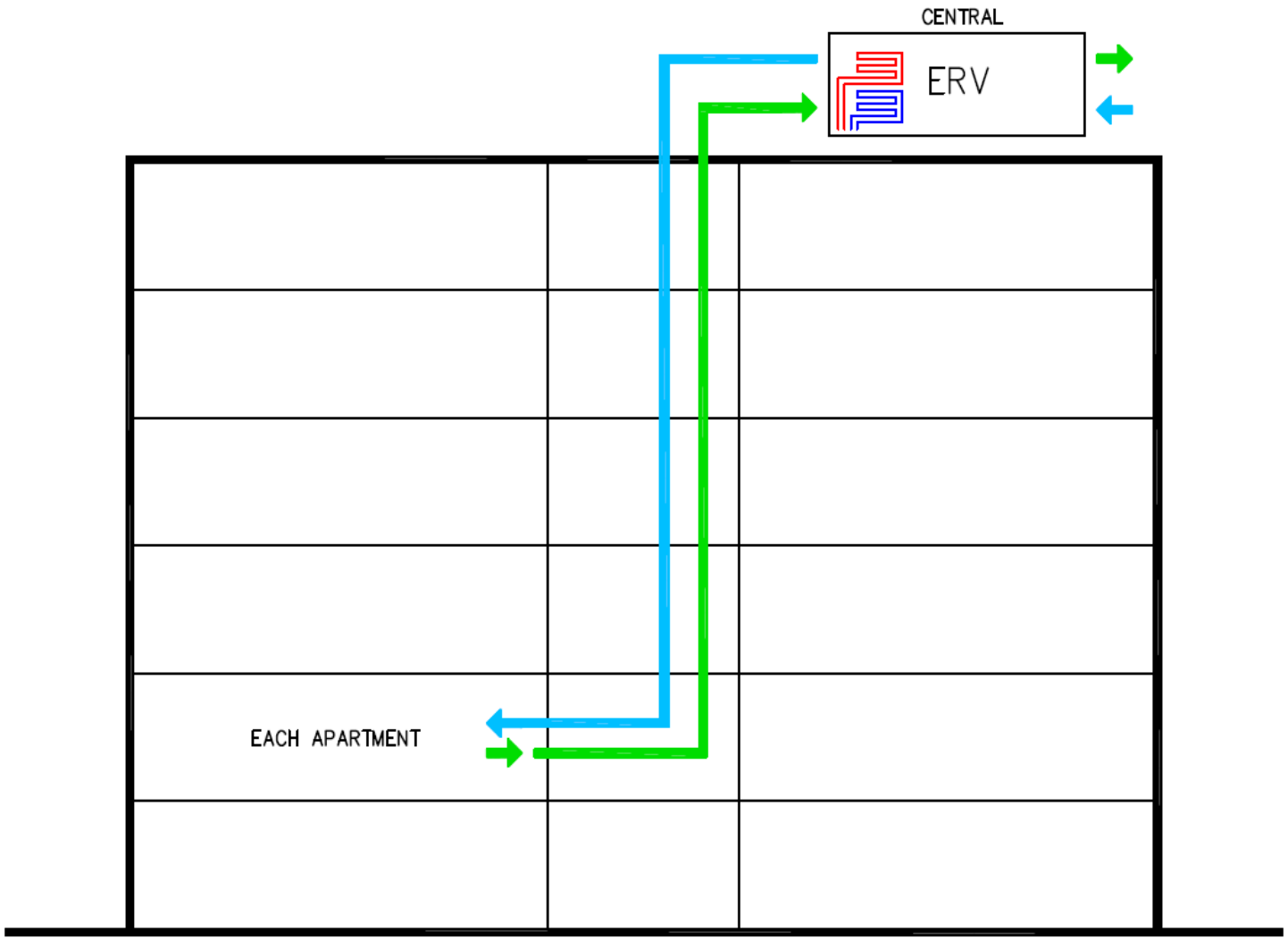
Floor-by-Floor Ventilation – Schematic



Floor-by-Floor Ventilation – Sample Equipment

55 in x 67 in x 16 in
700 CFM

Central Rooftop Ventilation - Schematic



Central Rooftop Ventilation – Sample Equipment

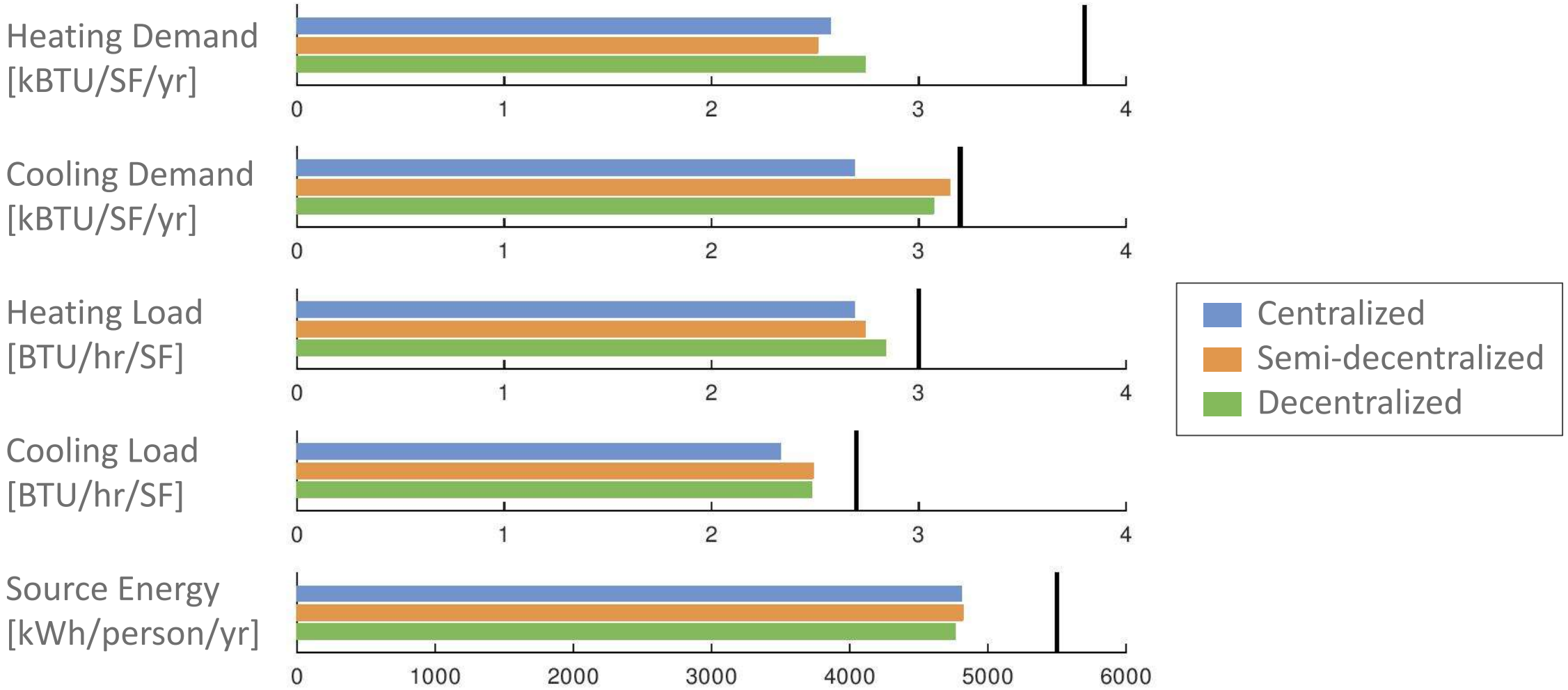
Central ERV

1000s CFM

Constant Airflow Regulator

What is an Air-to-Air Heat Exchanger?

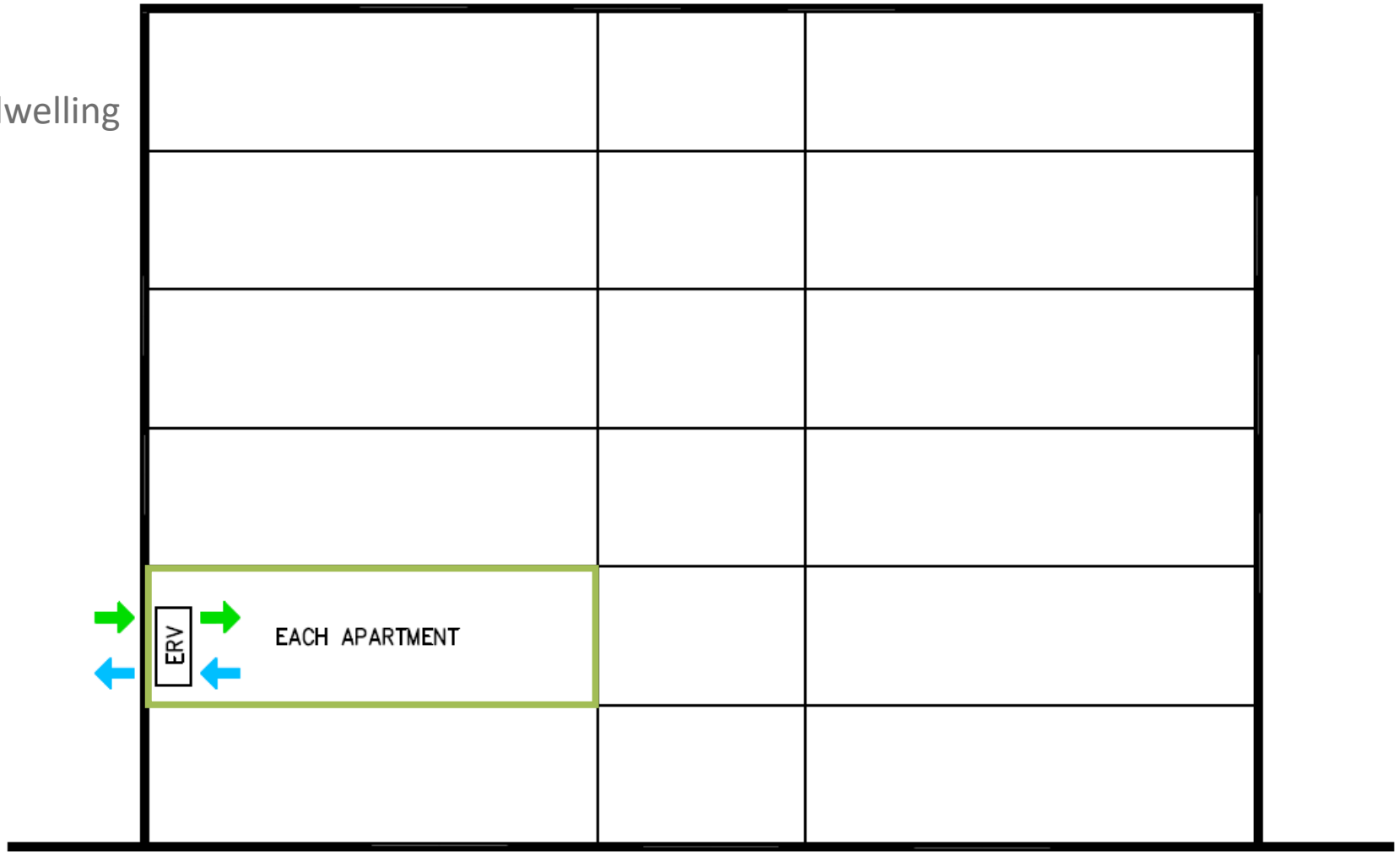
Representative System Comparison – WUFI



Assumptions: 80% sensible efficiency, 0.6 W/CFM (central and semi-decentralized) 0.5W/CFM (decentralized), includes duct heat transfer

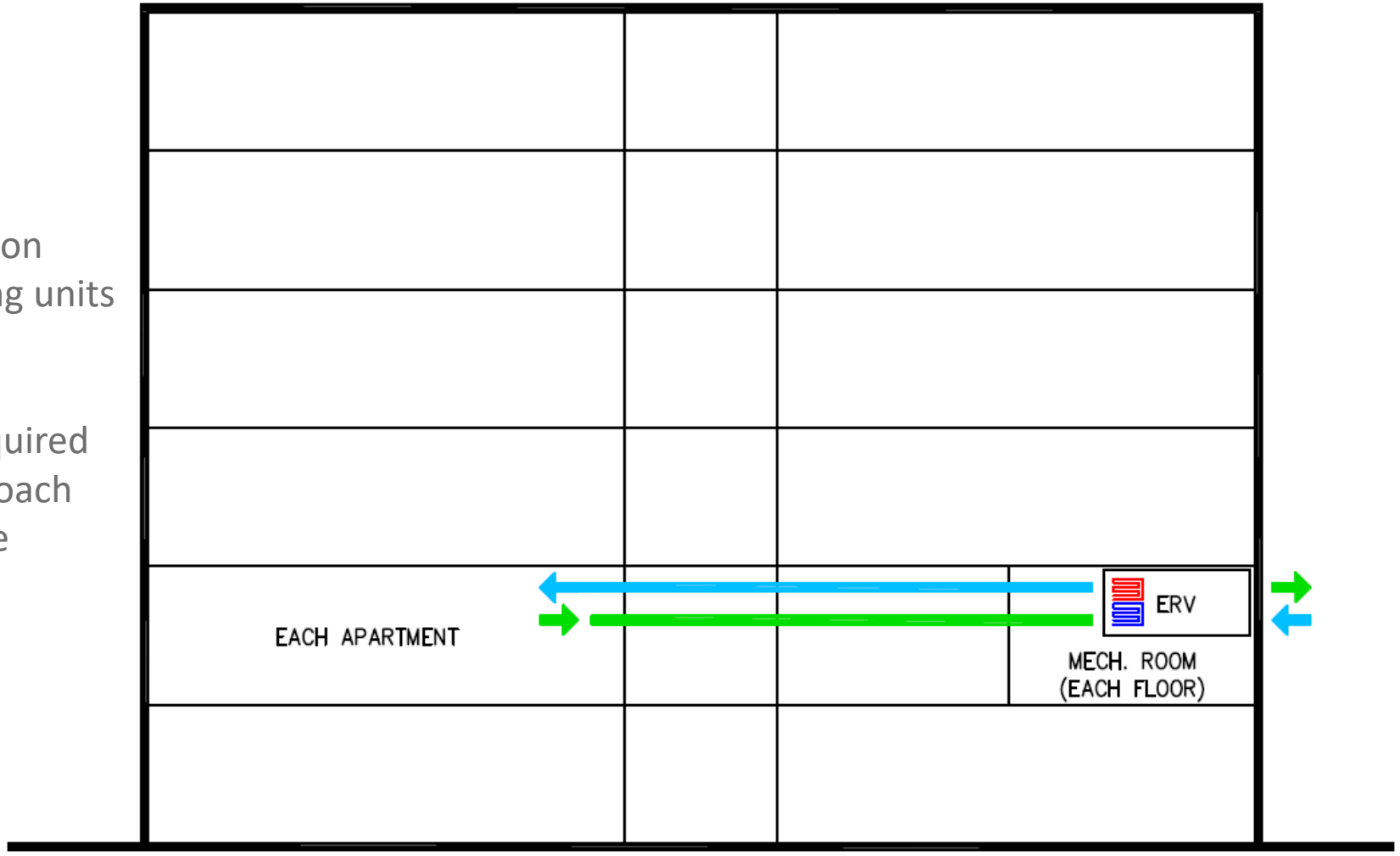
Local Ventilation - Considerations

- All equipment and ductwork within dwelling unit compartment – COVID-19 appeal
- Minimizes duct work
- Easy to balance
- No Fire/Smoke Dampers
- Tenant responsible for energy use
- Quarterly filter changes
- Sidewall exterior wall penetrations
- Floor space within dwelling unit
- More pieces of equipment
- Insufficient dehumidification
- Electric resistance pre-heat



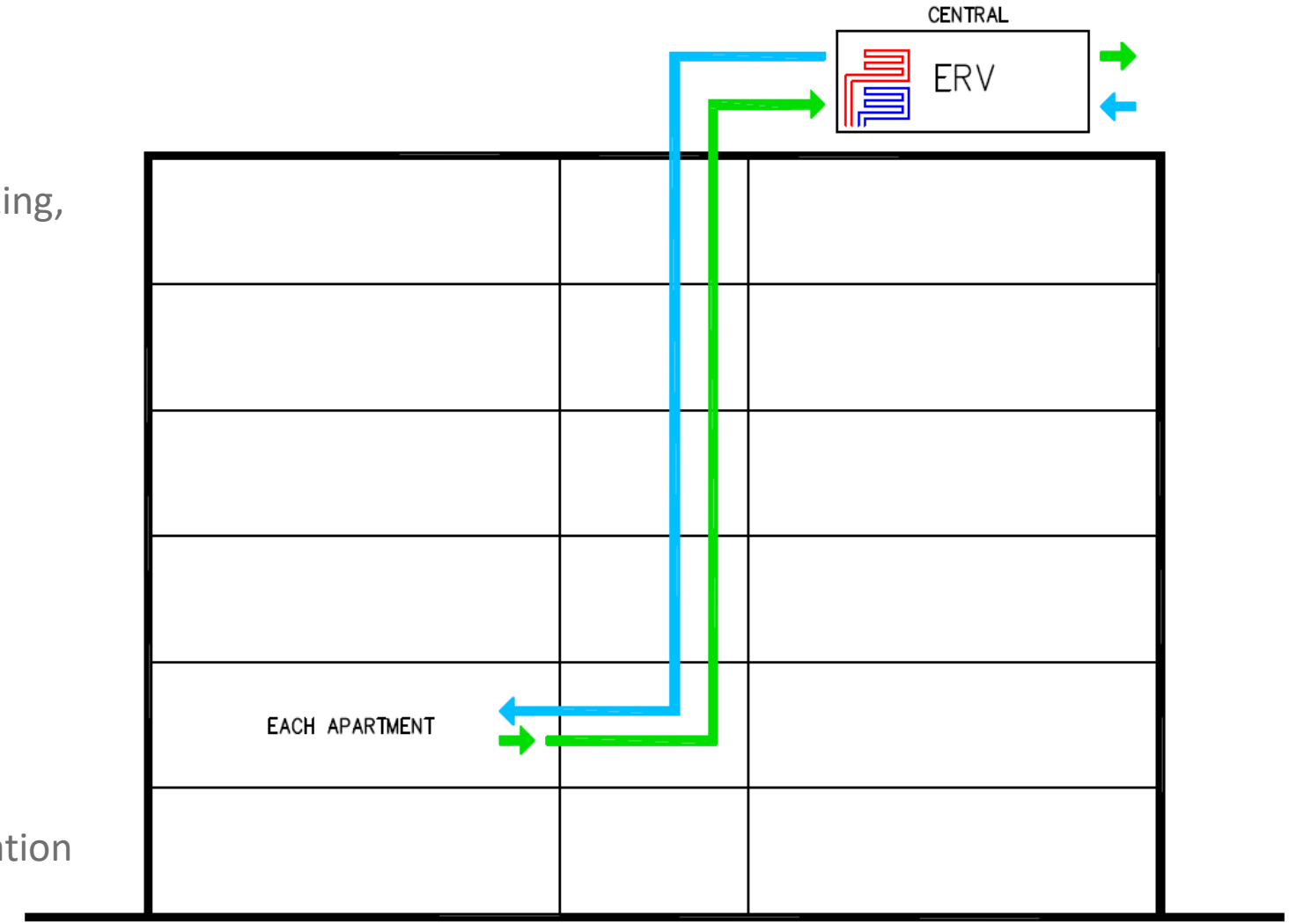
Floor-by-Floor Ventilation – Schematic

- No floor-to-floor shafts
- Bolt on cooling coil - dehumidification
- Accessible without entering dwelling units
- Relatively Simple Ductwork
- Floor-by-floor mechanical rooms
- Early design space coordination required
- More equipment than central approach
- Less manufacturer choices available
- Slight risk of virus spread by cross contamination – COVID-19



Central Rooftop Ventilation - Schematic

- Commercial grade equipment – lots of manufacturers, mature market
- Customizable (efficiency, filtering, economizing, tempering, dehumidification)
- True dedicated outdoor air system (DOAS)
- Fewer Pieces of equipment
- Selection software
- Complex duct system
  - Duct sealing critical
  - CAR dampers required for balancing
  - Critically reliant on good duct design
- Equipment outside of envelope
- Corridor ceiling space
- Fire/Smoke Dampers
- Slight risk of virus spread by cross contamination – COVID-19



Considerations- Summary

Local	Floor-by-Floor	Central
All equipment and ductwork within dwelling unit compartment – COVID-19	No floor-to-floor shafts	Commercial grade equipment – lots of manufacturers, mature market
Minimizes ductwork	Bolt on cooling coil - dehumidification	Customizable and additional features
Easy to balance	Accessible without entering units	Selection software
No Fire/Smoke Dampers	Relatively simple ductwork	True DOAS system
Tenant responsible for energy use		Fewer pieces of equipment
	Floor-by-floor mechanical rooms	Complex duct system
Quarterly filter changes	Early design space coordination	Duct sealing critical
Sidewall ext. wall penetrations	More equipment than central	CAR Dampers required for balancing
Floor space within dwelling unit	Less manufacturer choices available	Critically reliant on good duct design
More pieces of equipment	Slight risk of virus spread by cross-contamination – COVID-19	Fire/Smoke Dampers
Insufficient dehumidification		Corridor ceiling space
Electric resistance pre-heat		Equipment outside envelope
		Slight risk of virus spread by cross-contamination – COVID-19

Up Next!

Tom Chase

CPHC, LEED AP BD+C, Homes

Senior Project Manager

chase@newecology.org

617-557-1700 x7061

Commissioning/Testing & Verification

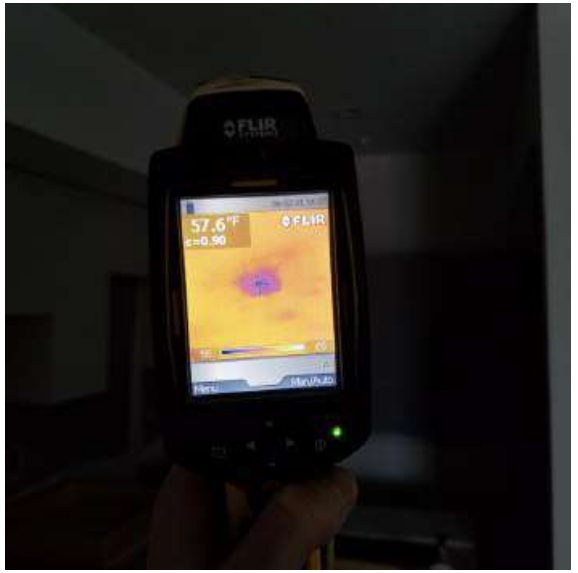
Architect:	ICON Architecture
MEP/FP:	Petersen Engineering
GC:	NEI General Contracting – (CPHC added to team)
Energy Modeler & CPHC :	Linnean Solutions
PH Verifier:	JSR Adaptive Energy Solutions
Sustainability Consultant:	New Ecology
Envelope Consultant:	Building Enclosure Associates
Commissioning Agent:	Sustainable Engineering Solutions

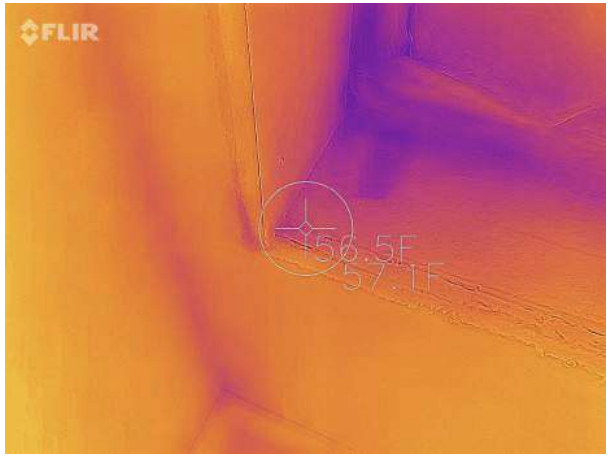
Compartmentalization

Compartmentalization Testing

Unit	**306**
Height (F)	10
Perimeter (LF)	125
Area (SF)	857
Enclosure (SF)	2,964
Volume (CF)	8,570
Threshold: 0.3 CFM50/SF of Enclosure	889
Test result (CFM)	638
Result CFM50/SF of Enclosure	0.22
ACH50	4.47

Compartmentalization Testing



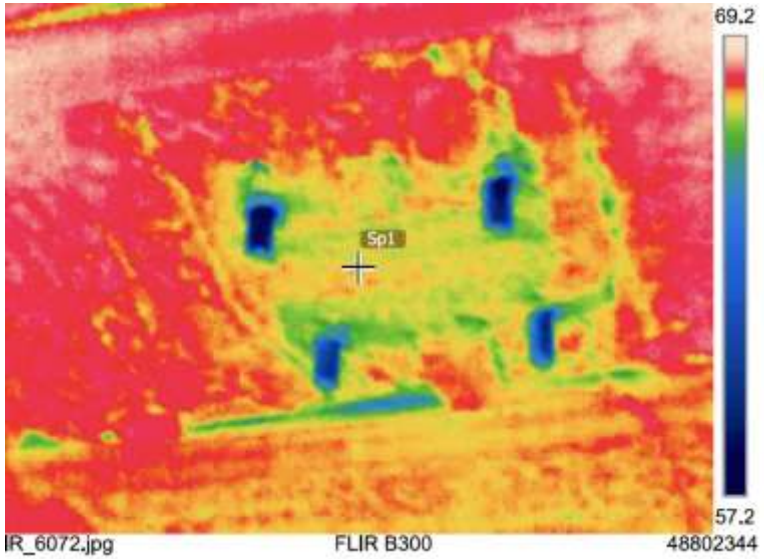


Thermal Imaging - Compartment

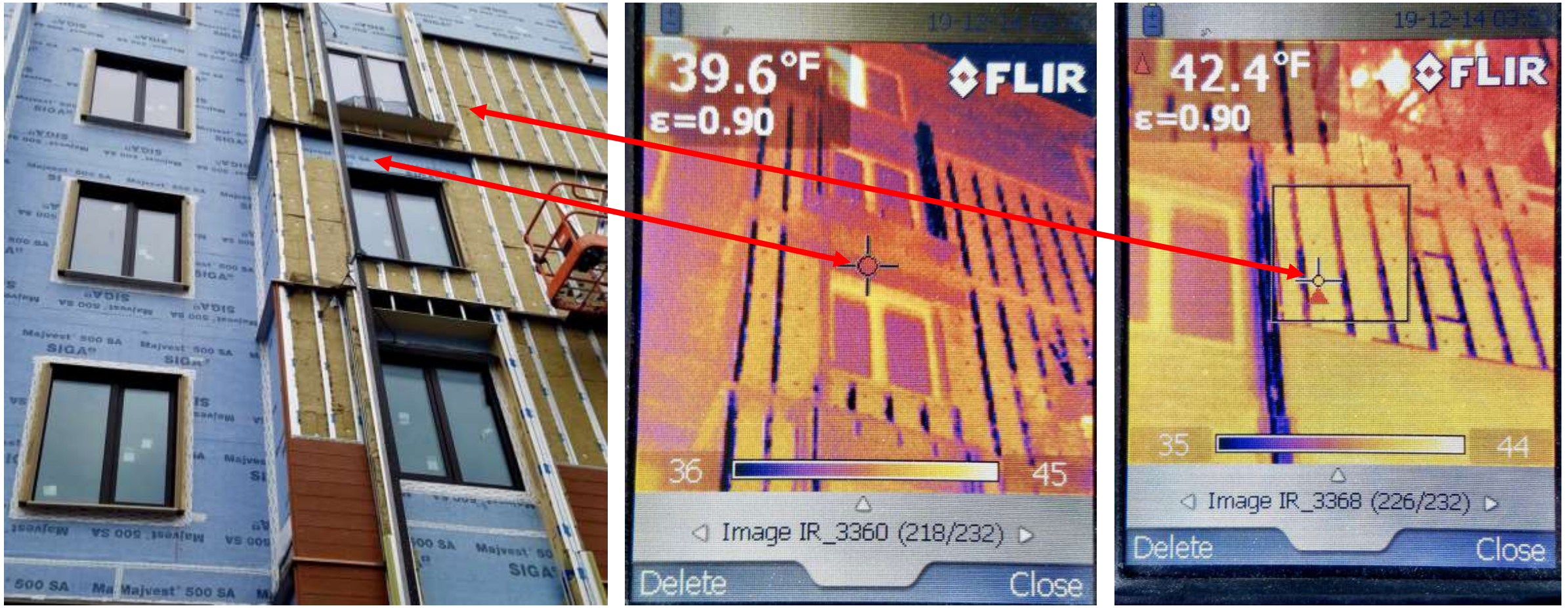
Duct Testing

Unit	Allowable Duct Leakage (CFM25)	Tested Duct Leakage (CFM25)
306	36	22
308	52	25
309	28	16
310	46	30
406	34	31
409	29	25

Thermal Imaging – Thermal Bridges

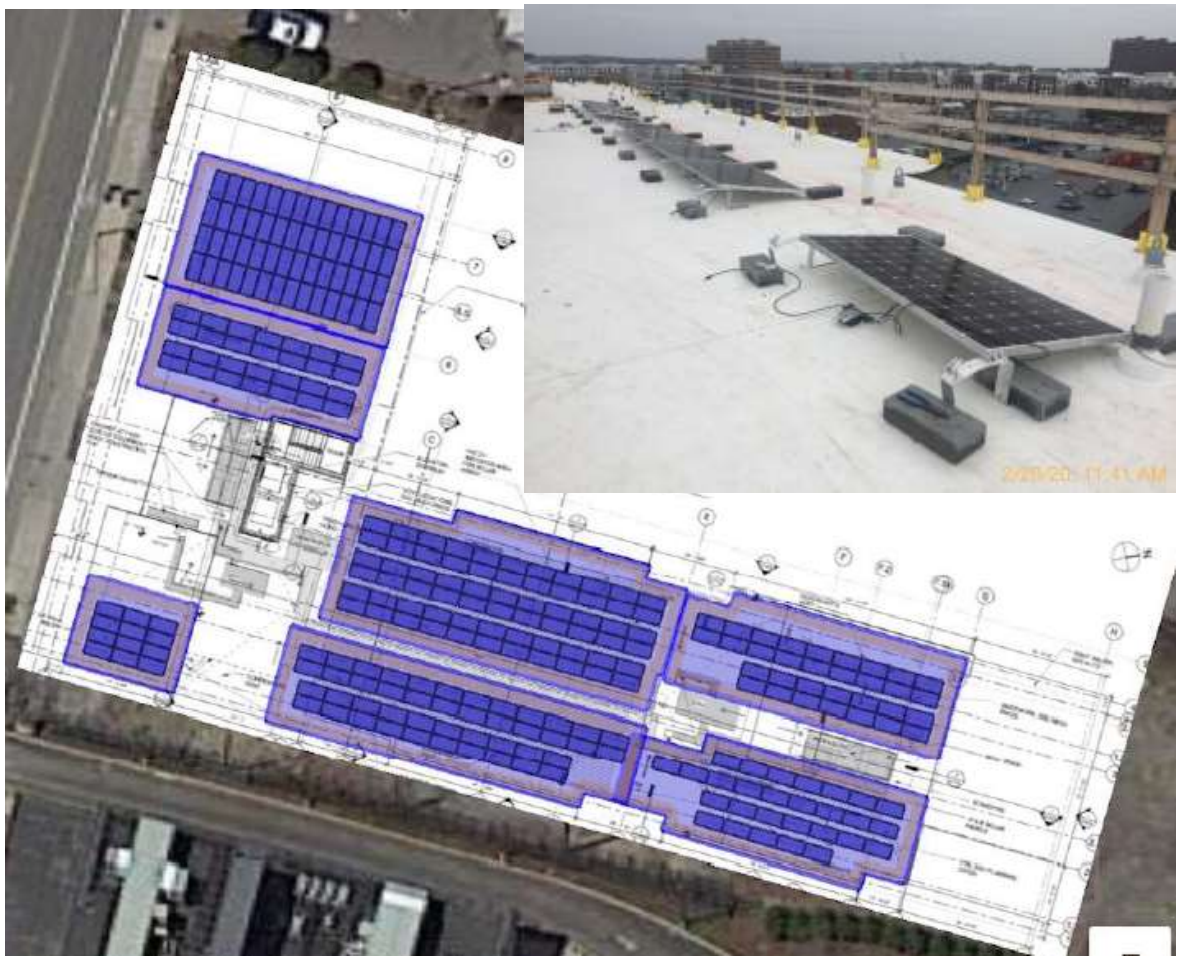


Thermal Imaging – Exterior



Thermal Imaging – Pre/Post C.I.

Solar PV



System Size: 105,070W DC
Estimated Annual Production: 116,628 kWh

Gross Price: $294,196
Price per Watt: $2.92
Federal Tax Credit: $0
Federal Depreciation: $0

Annual Electricity Value: $13,226
Annual SMART Incentive Value: $24,737

Simple Payback: 7.75 years

Monitoring and Optimization

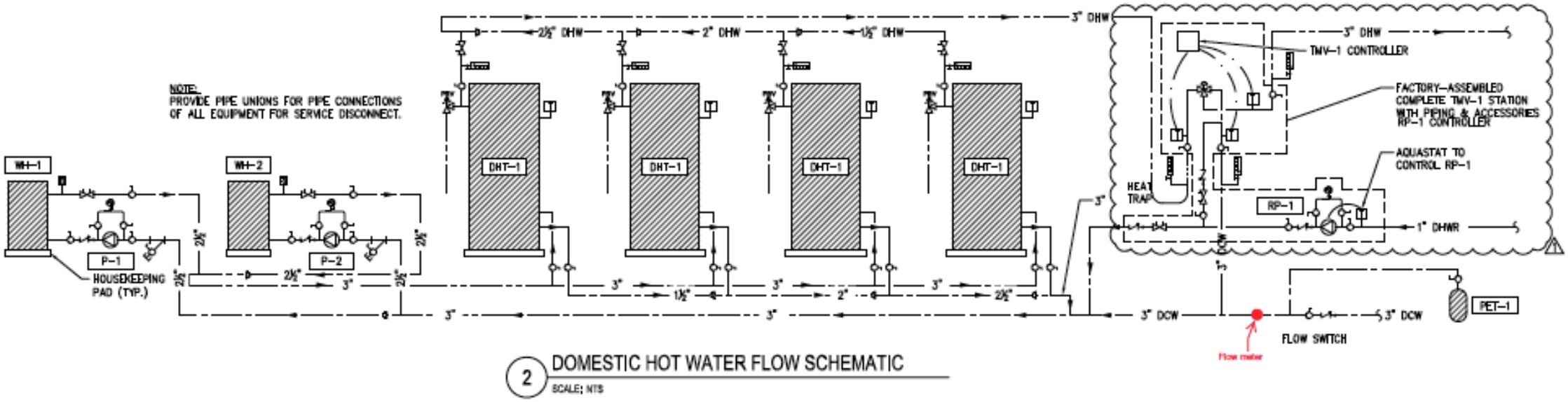
Systems Monitored through NEI ”Box” and Dashboard

- VRF, exterior units and in unit setpoints and temperatures – via API
- Central Water Meter (hourly)
- DHW Usage and Boiler and Pumps -
- Electronic Tempering Valve and DHW Recirculation Temp

Service Provided

- All sensors, cellular modem, and uninterruptible power supply
- Custom Dashboard
- Fault Detection
- Custom E-mail Alerts
- Historical Trend Logs
- Optimization Recommendations

Monitoring and Optimization



2 DOMESTIC HOT WATER FLOW SCHEMATIC

SCALE: NTS