## ALLIES FOR EFFICIENCY

# WESTMORELAND UNION MANOR

## SENIOR HOUSING ENERGY RENOVATION

# WUM - ULRA

- Union Labor Retirement Association was incorporated in 1962 as a non-profit with the intention of providing housing and related services for elderly persons
- In 1965, the ULRA purchased this piece of property from Fred Meyer, who had hoped to build a store here
- WUM is the largest affordable housing community for seniors in the state of Oregon
- In 1991, Manor Management Services took over the management contract for WUM and the other ULRA properties. MMS Inc. manages 21 properties and 1,686 affordable senior apartments in Oregon, Washington and Alaska
- Westmoreland's Union Manor has 301 apartments: 204 studios, 96 one-bedroom units, 1 two-bedroom manager's unit
- In 2016, the average move in age was 74. The unit turnover rate during construction was 11%

# Project Team

Development Consultant

Architect

Landscape Architect

Structural and Civil Engineers

MEP Engineers

General Contractor

# Agenda

- Brian Sweeney, HDC - Overview of project history, goals and funding
- Bill Lanning, MWA – Existing building physical state and design solutions
- Andrew Lasse, Interface – Building MEP analysis and systems replacement
- Howie Petker, Walsh – Construction and tenant interface
- Questions??

Chaucer Court

SW 10$^{th}$ and Salmon

Completed 2012

# Project Background

- The project was originally built with a federally-insured mortgage provided by the U.S. Department of Housing and Urban Development (HUD) due to be repaid in June 2015.

- WUM also received HUD Section 8 rental subsidies that covered 217 of the 300 units

- Through a HUD program known as SPRAC - Senior Preservation Rental Assistance Contract - WUM applied for and was awarded more rental subsidies for those units not currently included in the Section 8 contract (2014). This brought the total of number of subsidized units to 284.

- The additional subsidy allowed the owner to leverage $50M in equity and debt financing, contributing $25M towards rehabilitation and modernization of the building

- The Project Team was assembled in 2014 to facilitate the application and subsequently analyze the building’s needs and proceed with a design solution.

- Construction began June 2015 and will be complete by June 2017

Where do we start?

# Project Goals

## Renovate the building to insure another 50 years of safe and maintainable inhabitation thorough the following:

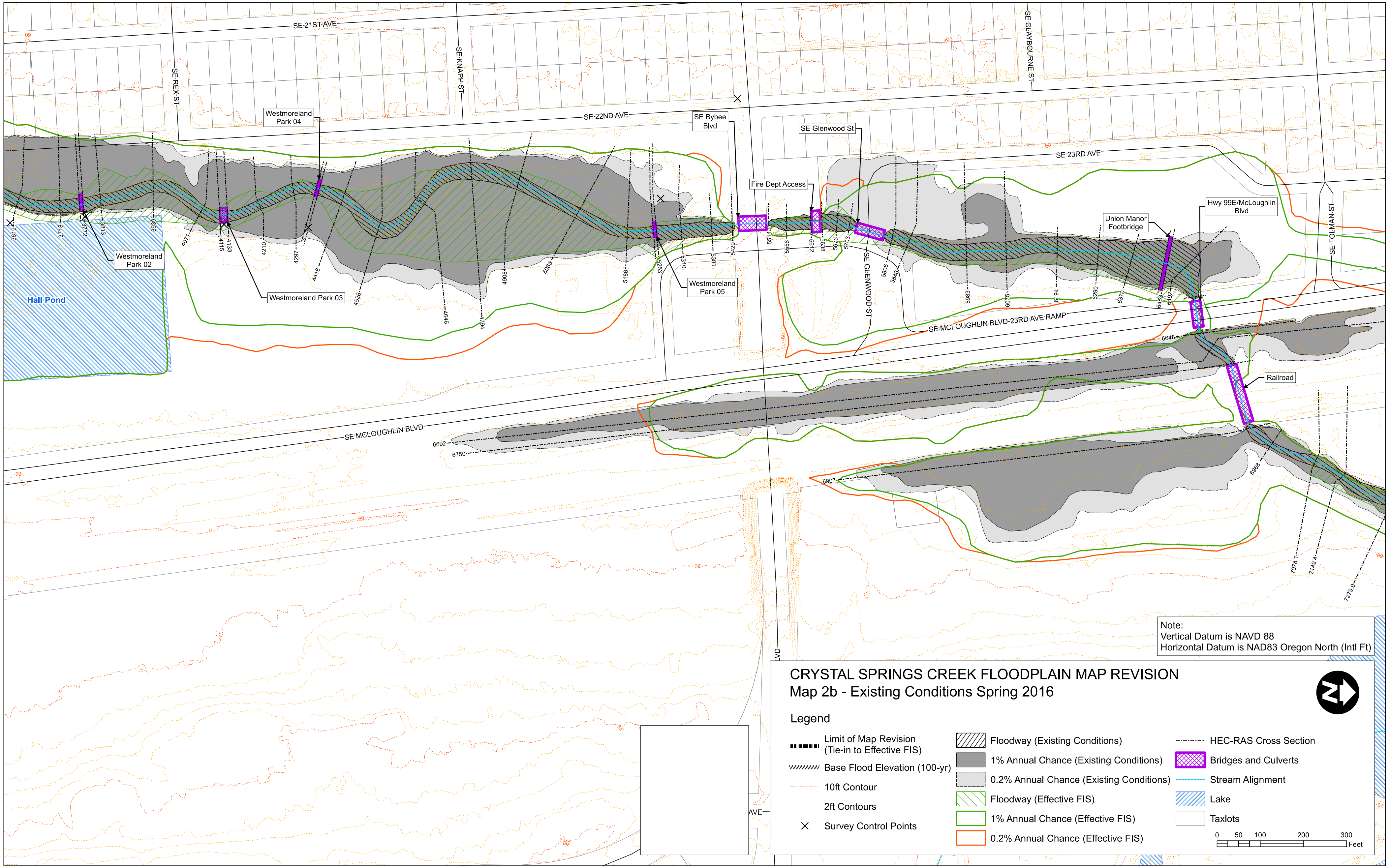
- Replace building envelope to improve energy efficiency and tenant comfort
- Bring the structural components into compliance with current codes
- Replace building systems – HVAC, plumbing, electrical, alarm and security
- Improve interior finishes and fixtures
- Provide code mandated accessibility at units and site
- Address existing challenges of occupied units, flood zone, hazardous materials and noise

Active folk
everywhere, all hours

Hazmat

asbestos @ plumbing

Crystal Springs Creek




Note:
Vertical Datum is NAVD 88
Horizontal Datum is NAD83 Oregon North (Intl Ft)

# CRYSTAL SPRINGS CREEK FLOODPLAIN MAP REVISION

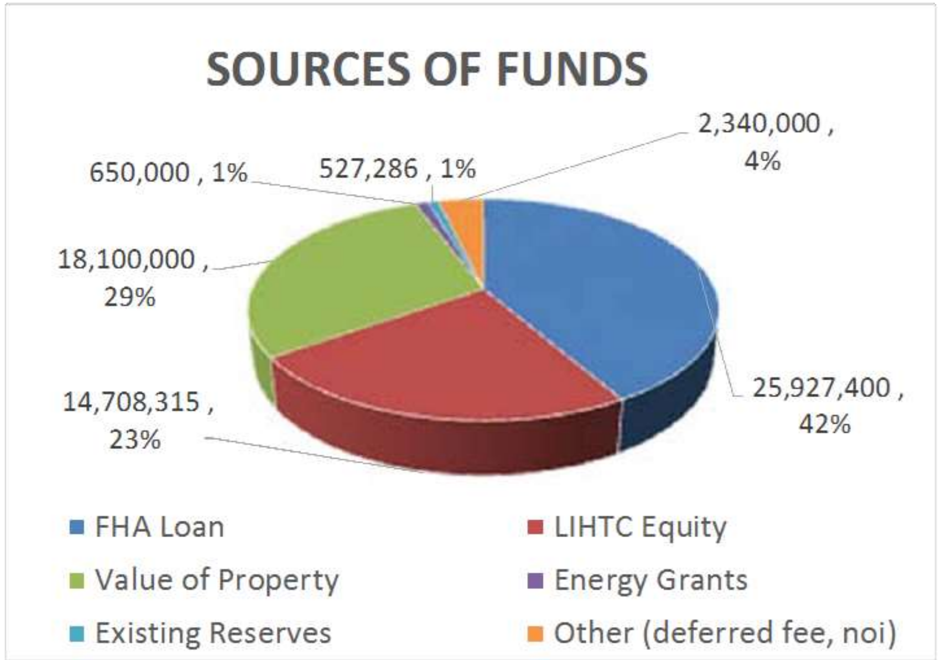
## Map 2b - Existing Conditions Spring 2016

Legend

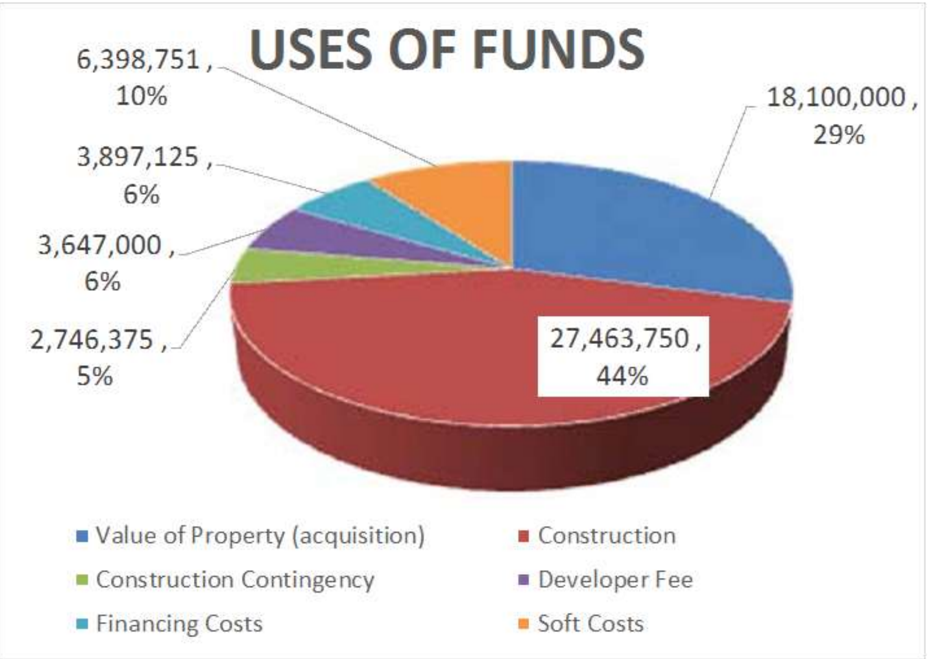
- Limit of Map Revision (Tie-in to Effective FIS)
- Base Flood Elevation (100-yr)
- 10ft Contour
- 2ft Contours
- Survey Control Points
- Floodway (Existing Conditions)
- 1% Annual Chance (Existing Conditions)
- 0.2% Annual Chance (Existing Conditions)
- Floodway (Effective FIS)
- 1% Annual Chance (Effective FIS)
- 0.2% Annual Chance (Effective FIS)
- HEC-RAS Cross Section
- Bridges and Culverts
- Stream Alignment
- Lake
- Taxlots

0 50 100 200 300 Feet

| SOURCES | TOTAL |
|---|---|
| FHA Loan | 25,927,400 |
| LIHTC Equity | 14,708,315 |
| Value of Property | 18,100,000 |
| Energy Grants | 650,000 |
| Existing Reserves | 527,286 |
| Other (deferred fee, noi) | 2,340,000 |
| **Total Sources** | **62,253,001** |




| USES | TOTAL |
|---|---|
| Value of Property (acquisition) | 18,100,000 |
| Construction | 27,463,750 |
| Construction Contingency | 2,746,375 |
| Developer Fee | 3,647,000 |
| Financing Costs | 3,897,125 |
| Soft Costs | 6,398,751 |
| Total Uses | 62,253,001 |



mwa architects

# Westmoreland Union Manor – Building Design

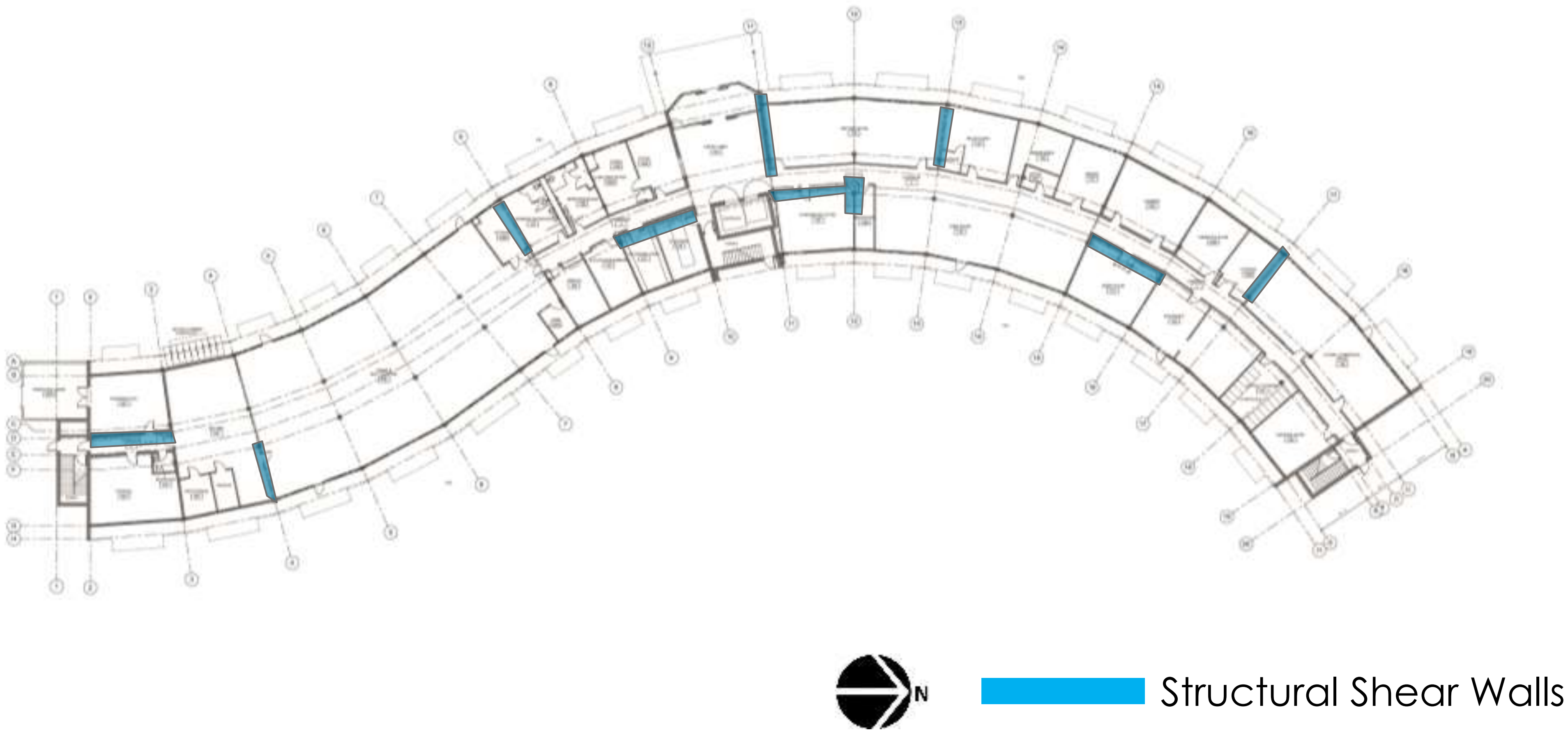
AFE Presentation – Feb 23, 2017

Project Team

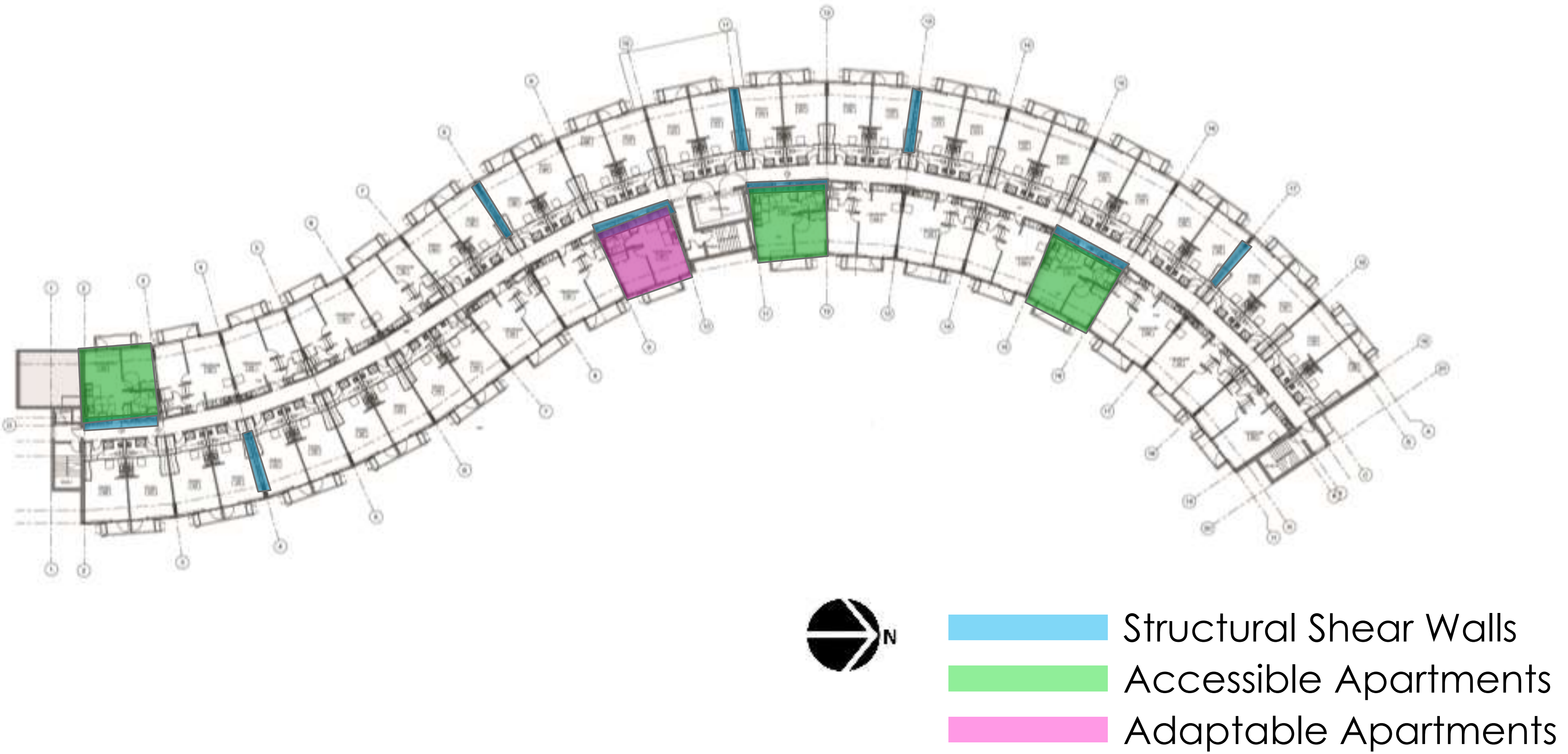
- Exterior Envelope – MWA Architects, Walsh Construction Company, KPFF Structural Engineering and RDH
- Mechanical Design – Interface Engineering
- Electrical Design/Build – Merit Electric and Interface Engineering
- Plumbing Design/Build – Peninsula Plumbing and Interface Engineering

# Integrated Design Delivery

# Analysis of Existing Building Conditions



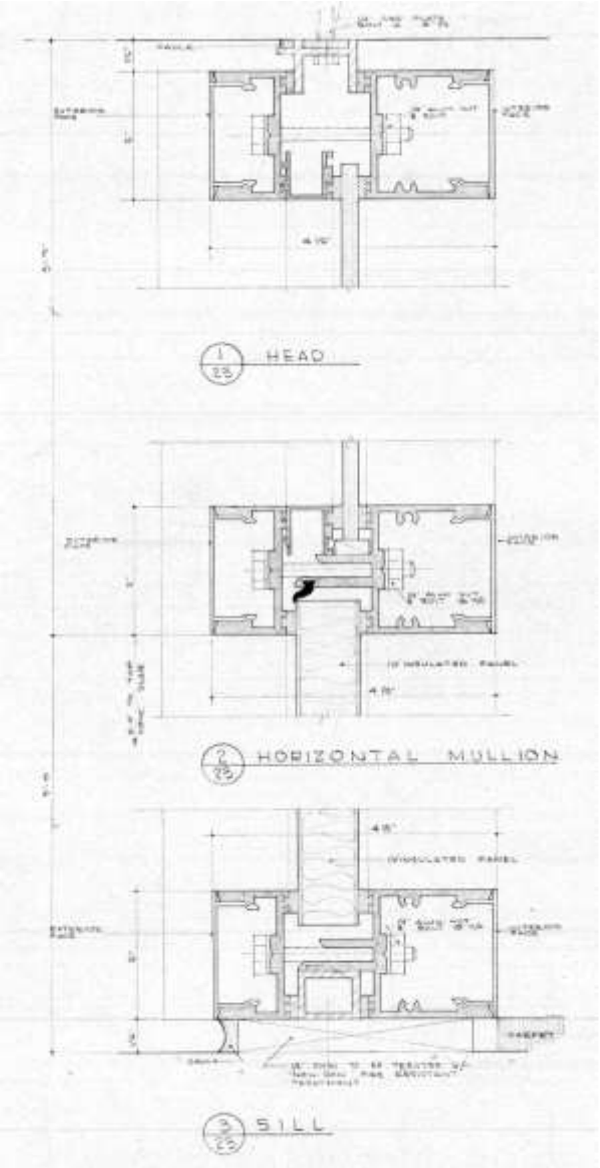

# Ground Floor Building Plan

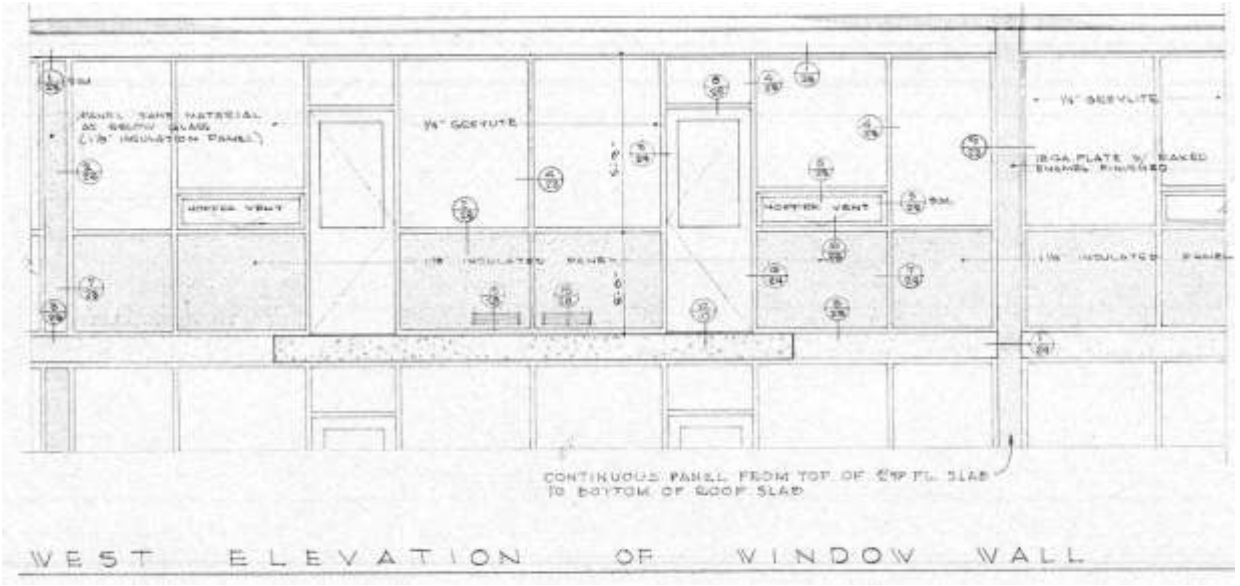



# $2^{nd}$-$7^{th}$ Floor Building Plan

- Slab on grade foundation system
- Concrete lift slab construction – 9" PT deck from second floor to roof.
- Steel columns support for PT deck
- Concrete exterior walls at ends of building with concrete elevator/stair core

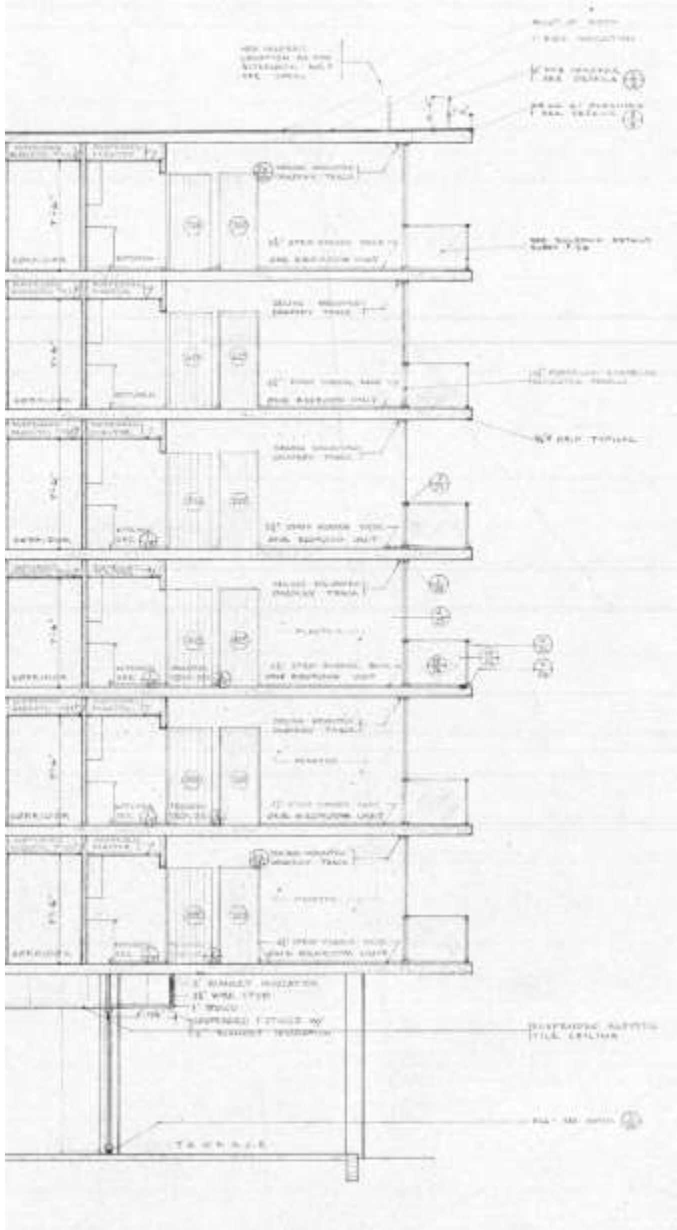
# Primary Structure




- Single glazed wall system with a 1-1/8" insulated aluminum panel.
- 57% glazing area at exterior wall.
- Approximately 85% of exterior wall envelope.

# Primary Exterior Envelope – System



Pro's

- In small senior apartments, every inch counts.  Existing wall system was limited to a 4" assembly depth
- Natural light and views.

Con's

- Wall system lacked thermal value
- In addition to window wall system, thermal breaks at exposed slab edge, balconies, roof and overhang at $1^{st}$/$2^{nd}$ floor transition
- Allowed for a tremendous amount of exterior noise to enter  from McLoughlin Blvd and the railroad tracks
- Indoor air quality suffered due to age and joints in wall system

# Primary Exterior Envelope – Qualities

Heating and Cooling

- 2 pipe system with roof top boilers and chiller
- Building limited to either heating or cooling mode
- Large radiators located in unit living room and bedroom

Electrical

- Single transformer located inside building

Plumbing

- Galvanized piping system, primary shut-off allowed for isolation of half of building at a time

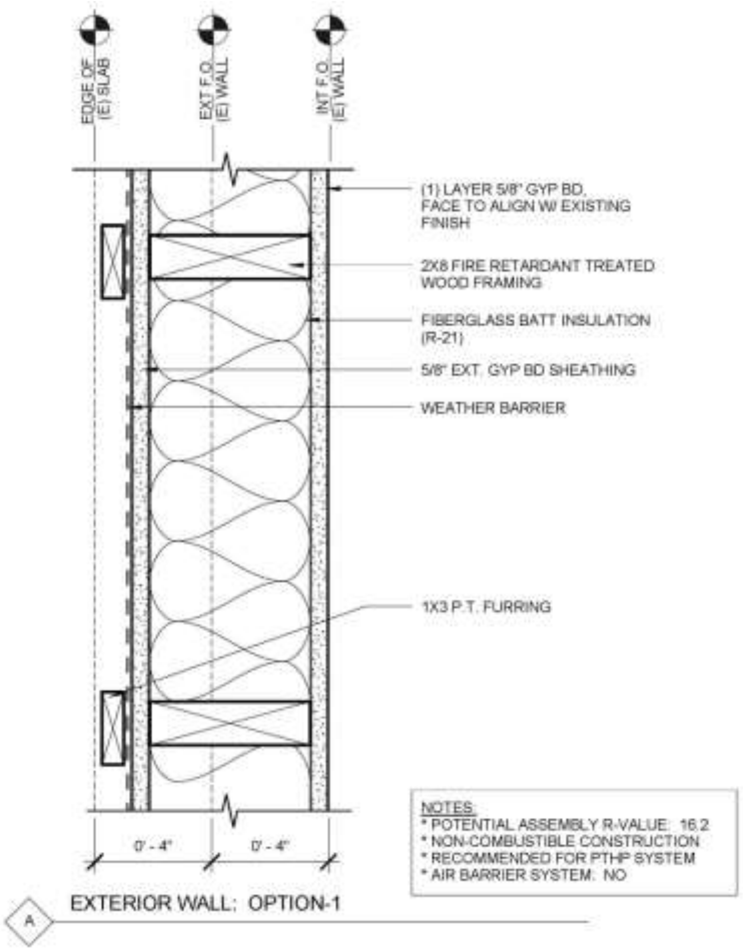
Pro's

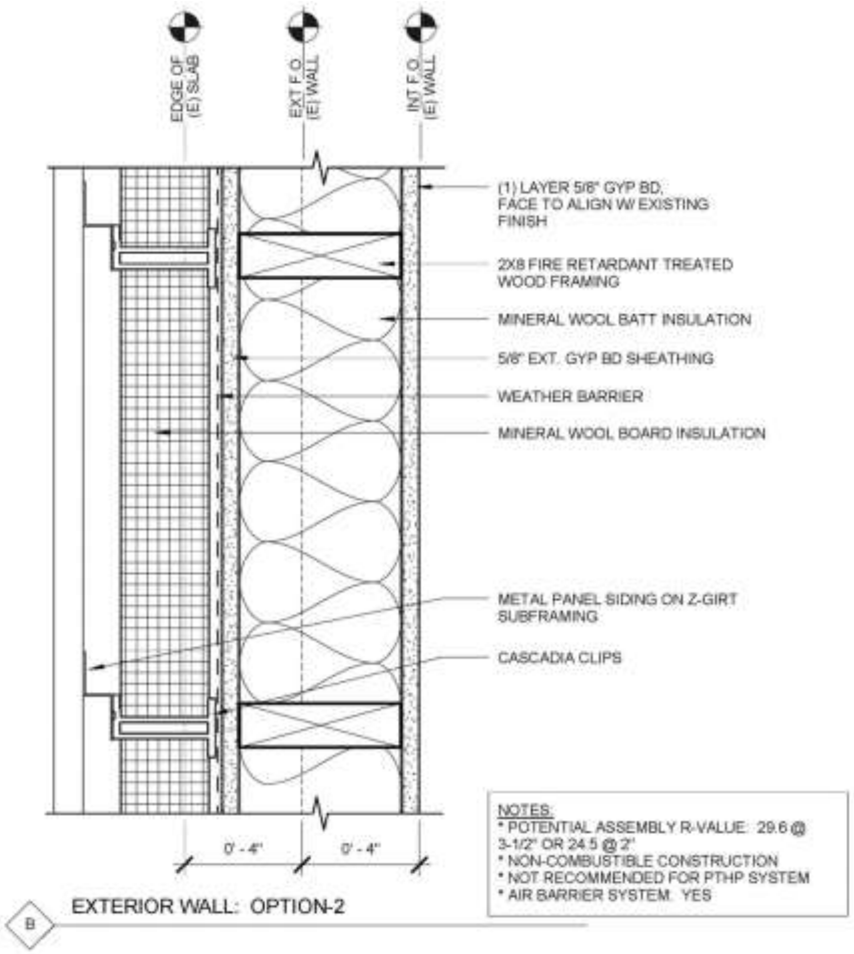
- Heating/cooling system easy to understand, either in heat cycle or cool cycle

Con's

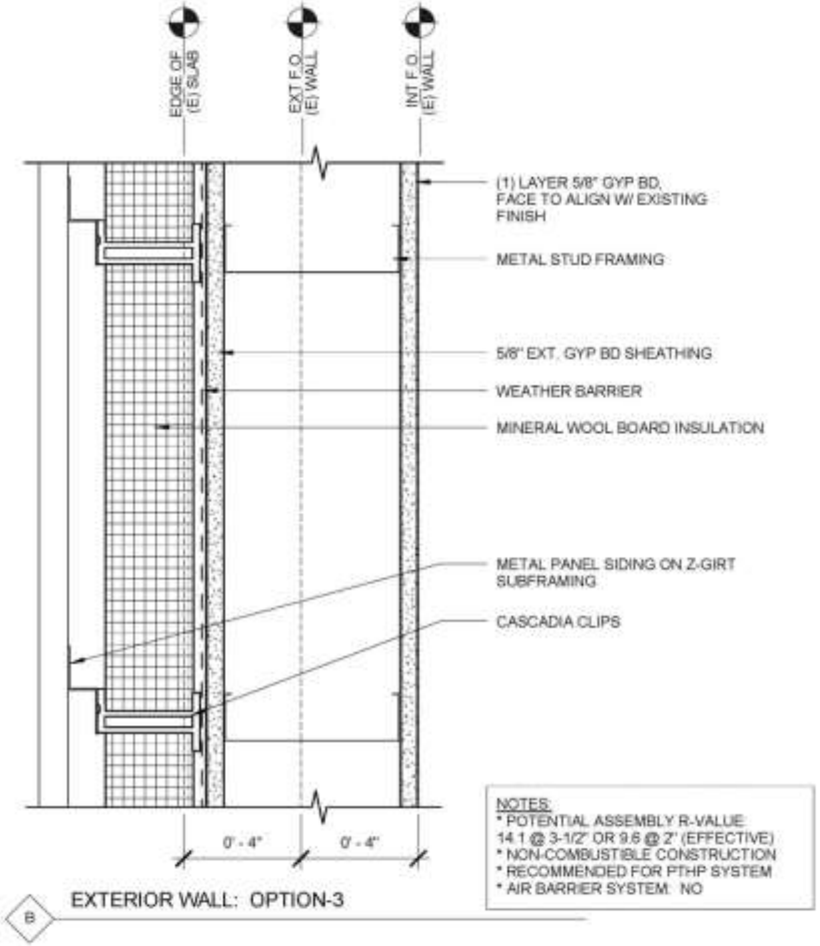
- Lack of control for residents over their individual environment
- Length of building and solar exposure cause one side of building to be hot and the other cold at the same time

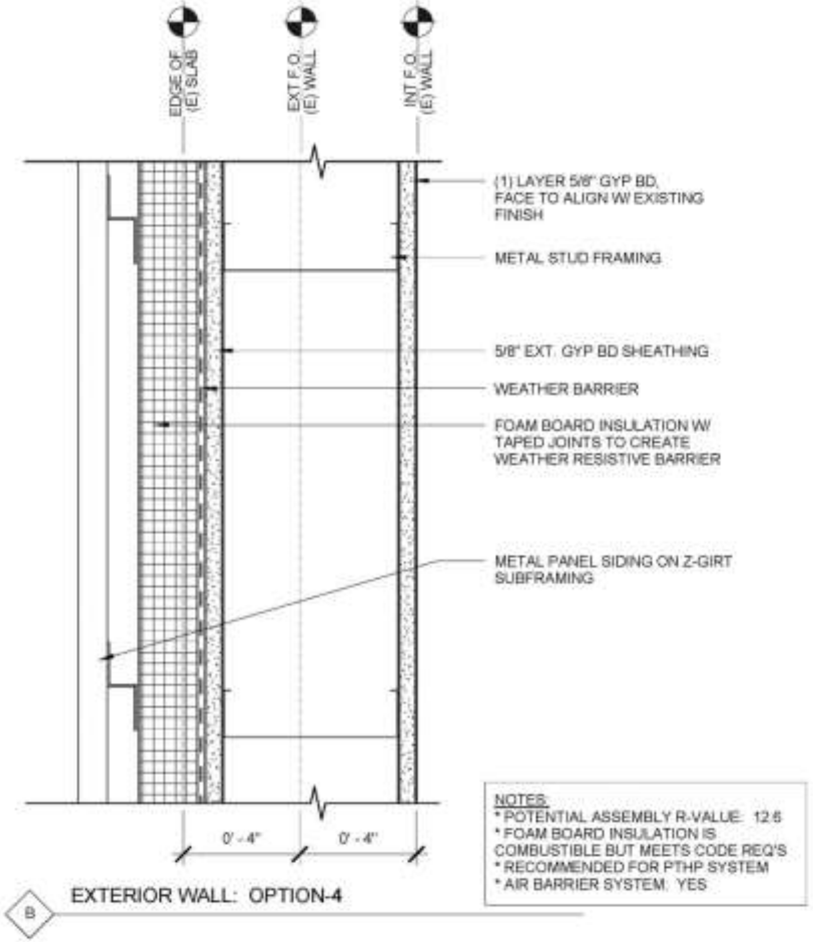
# Building M/E/P – Systems and Qualities



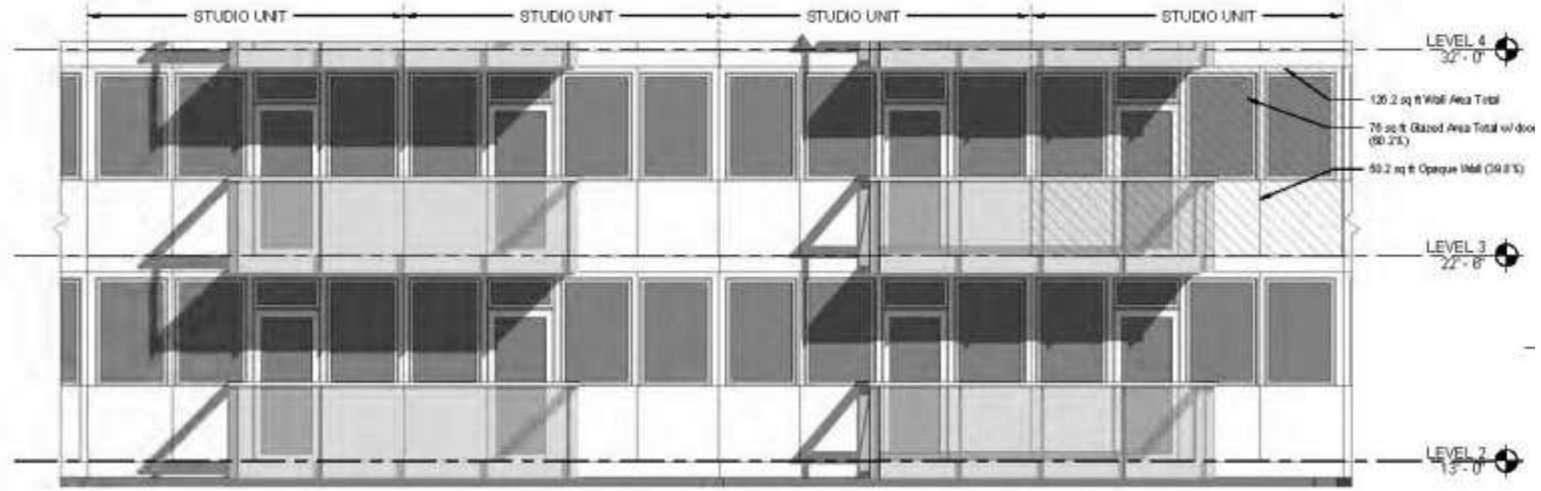




# Goals – Preliminary Wall Analysis



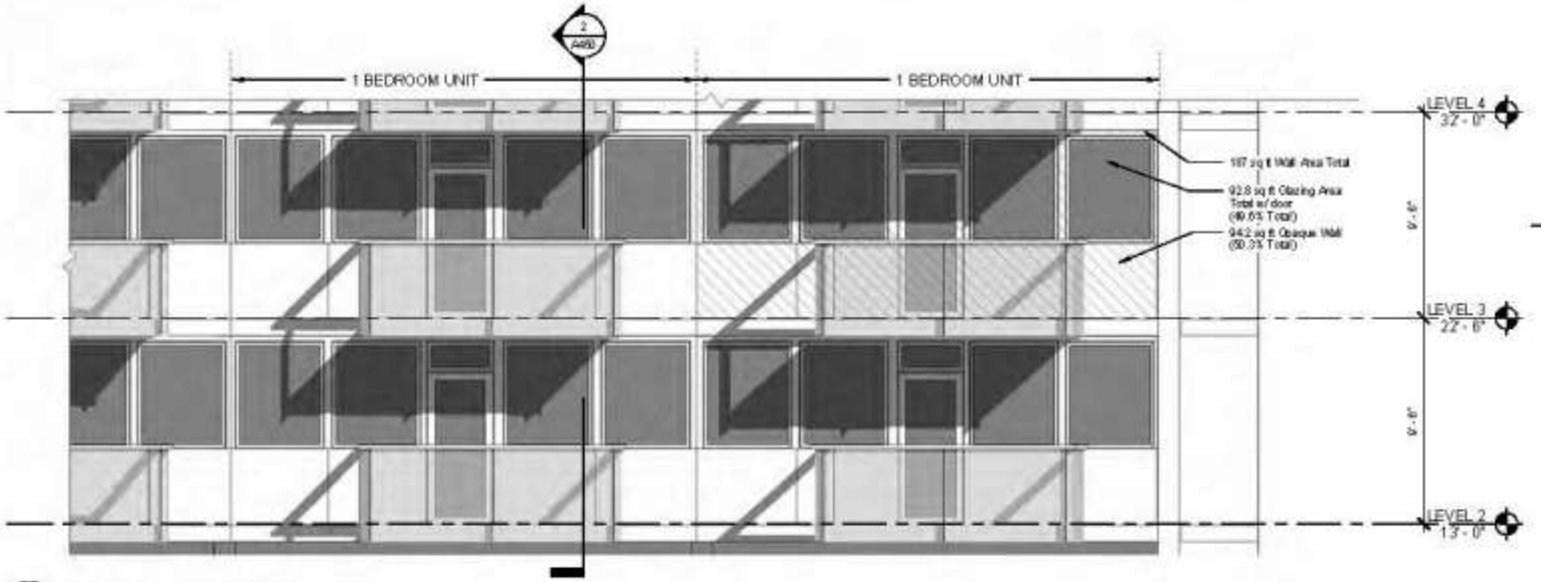




# Goals – Preliminary Wall Analysis




3 ENLARGED ELEVATION - EAST
SCALE: 1/4" = 1'-0"

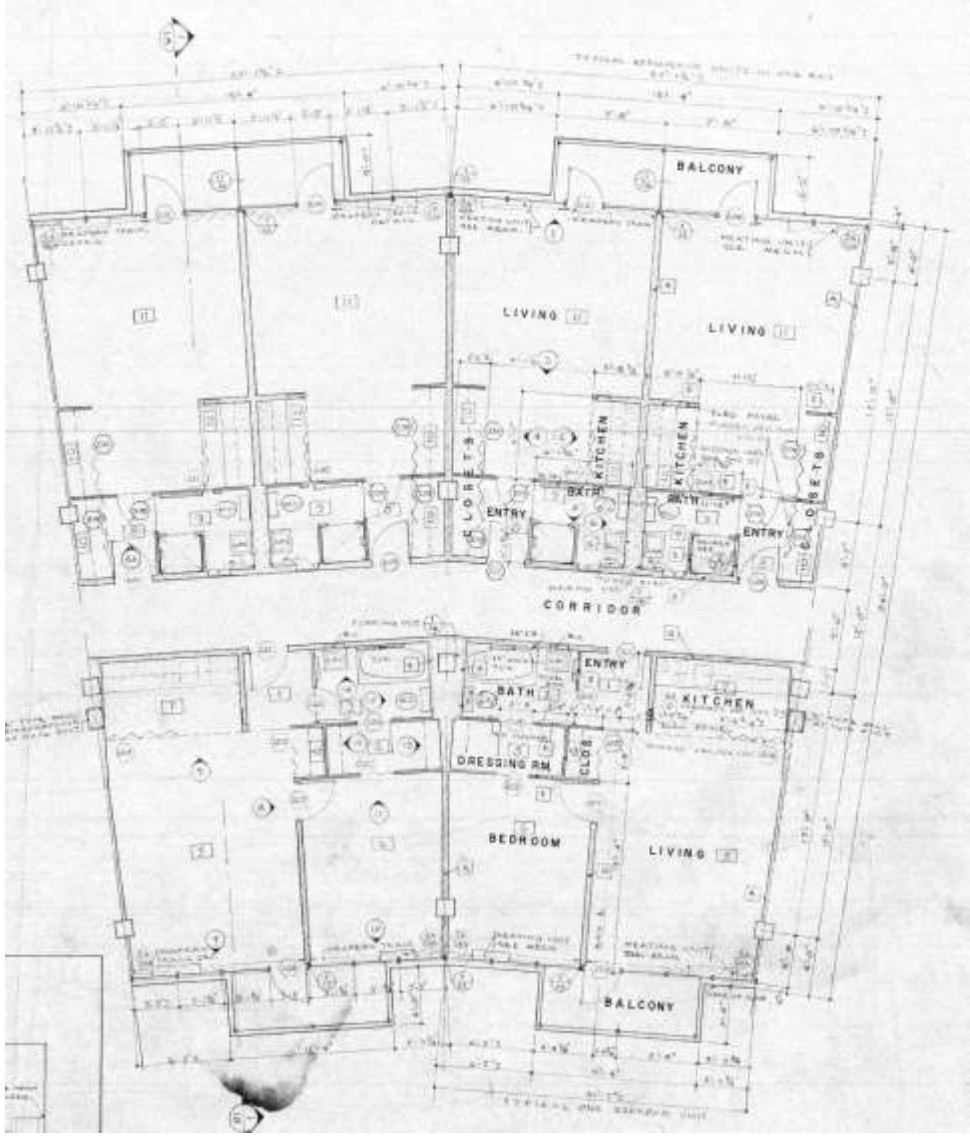
60% Glazing area at studio apartments




4 ENLARGED ELEVATION - WEST
SCALE: 1/4" = 1'-0"

50% Glazing area at one bedroom apartments

# Goals – Preliminary Glazing Analysis

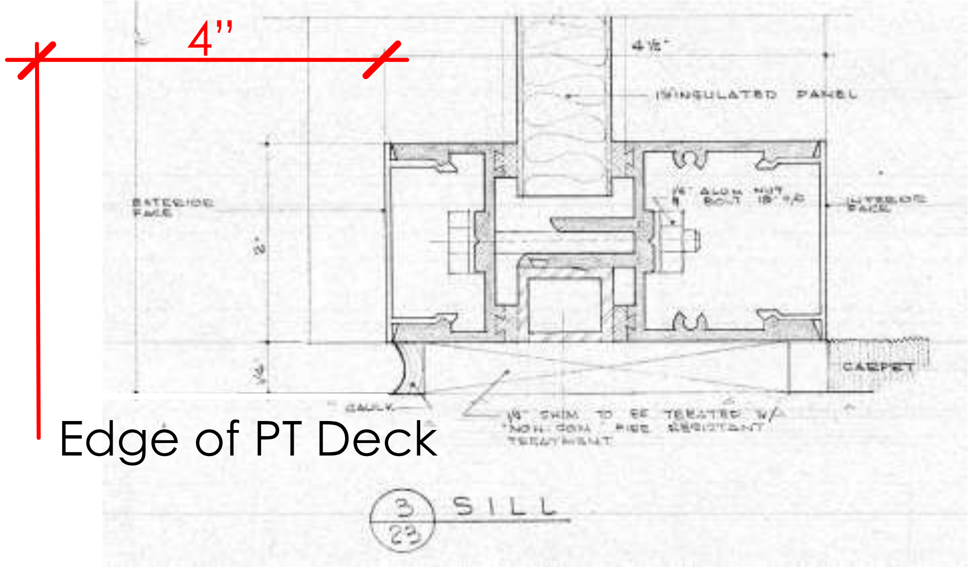


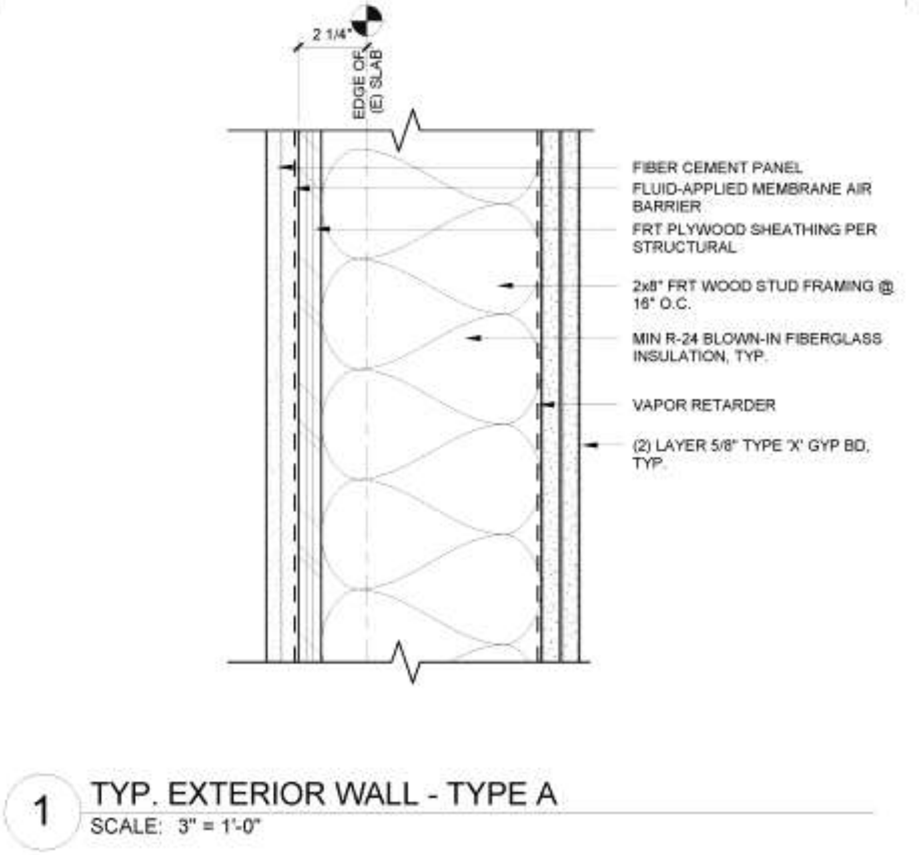

- Provide individual resident control
- Utilize systems that limit impact to residents in occupied apartments.

# Goals – HVAC Analysis (Residential Apartments)


- Project staging in an occupied building – 2 year construction duration
- Limiting impact of "open" wall areas during replacement
- Detailing of infill wall system to accommodate structural deflection
- Waterproofing of joints as renovation occurred in vertical stacks
- Addition of structural and accessibility upgrades which increased construction duration

# Challenges – Exterior Envelope



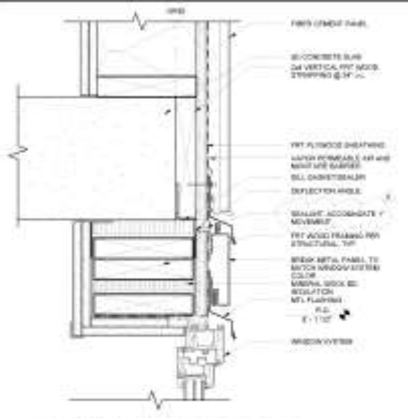




New wall system increased length of apartment by 1-3/4", Remember every bit counts

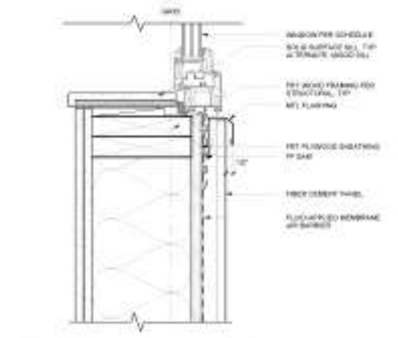
# Innovation – Exterior Envelope, Wall


- Prosoco Cat-5 liquid applied air/water barrier
- Prosoco Fast Flash
- Prosoco Joint and Seam Filler
- Prosoco AirDam
- ProtectoWrap foil faced SAM with BT primer

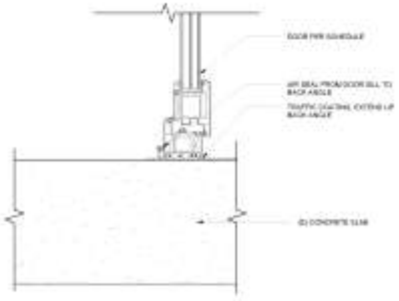
# Innovation – Exterior Envelope, Mock-Ups!



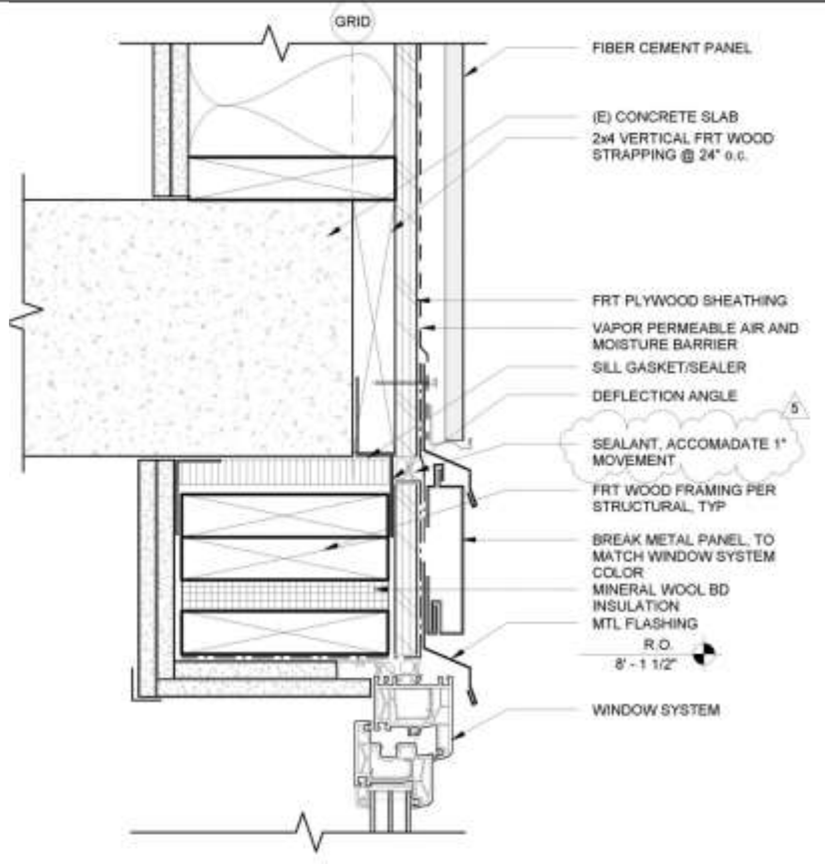
1 SECTION DETAIL - WINDOW HEAD



5 SECTION DETAIL - WINDOW SILL

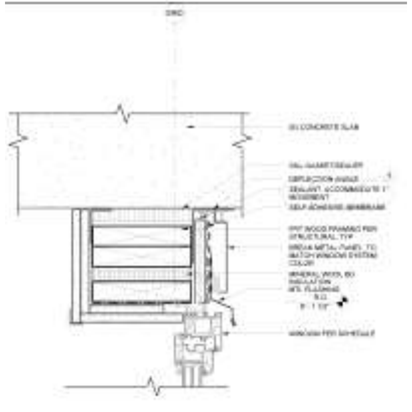


9 SECTION DETAIL - DOOR THRESHOLD

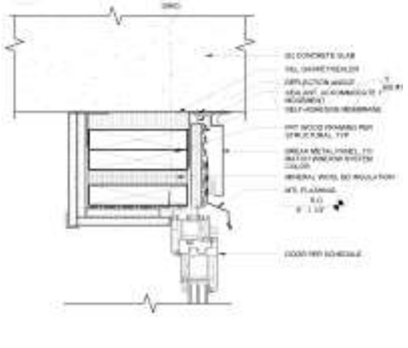



1 SECTION DETAIL - WINDOW HEAD
SCALE: 3" = 1'-0"

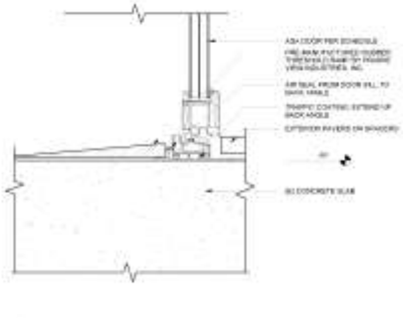
# Innovation – Exterior Envelope, Window Head



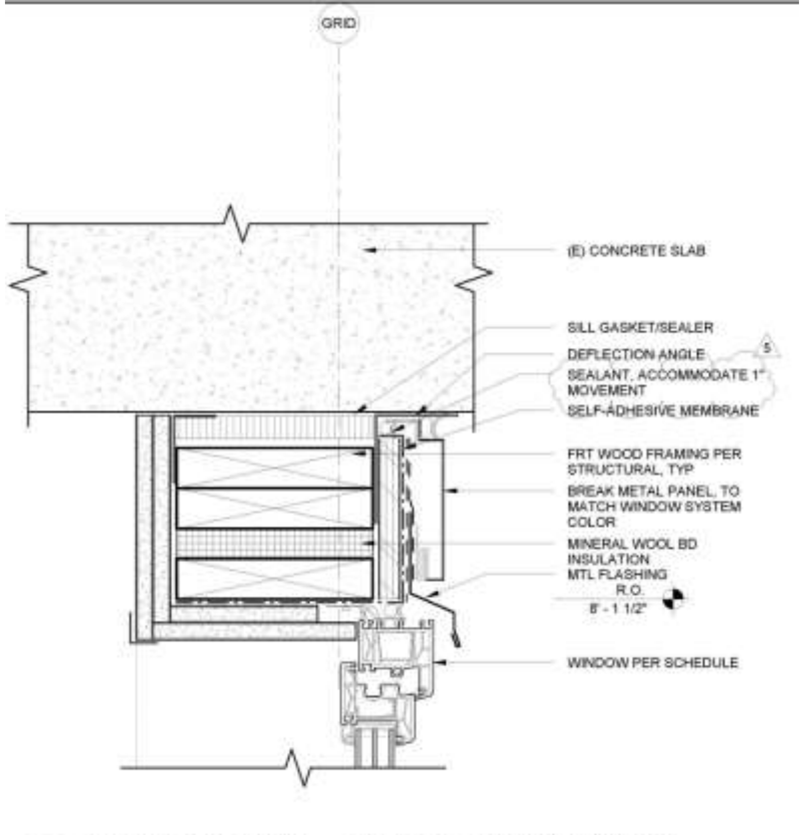
3 SECTION DETAIL - WINDOW HEAD AT DECK



7 SECTION DETAIL - DOOR HEAD



11 SECTION DETAIL - DOOR THRESHOLD AT ADA




3 SECTION DETAIL - WINDOW HEAD AT DECK
SCALE: 3" = 1'-0"

# Innovation – Exterior Envelope, Window Head

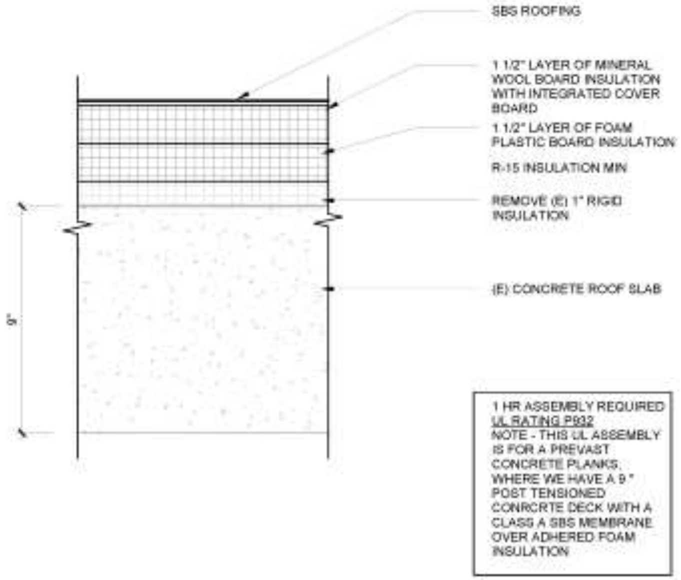
Existing One Bedroom unit - Bedroom

Existing One Bedroom unit – Living

Renovated One Bedroom unit - Bedroom

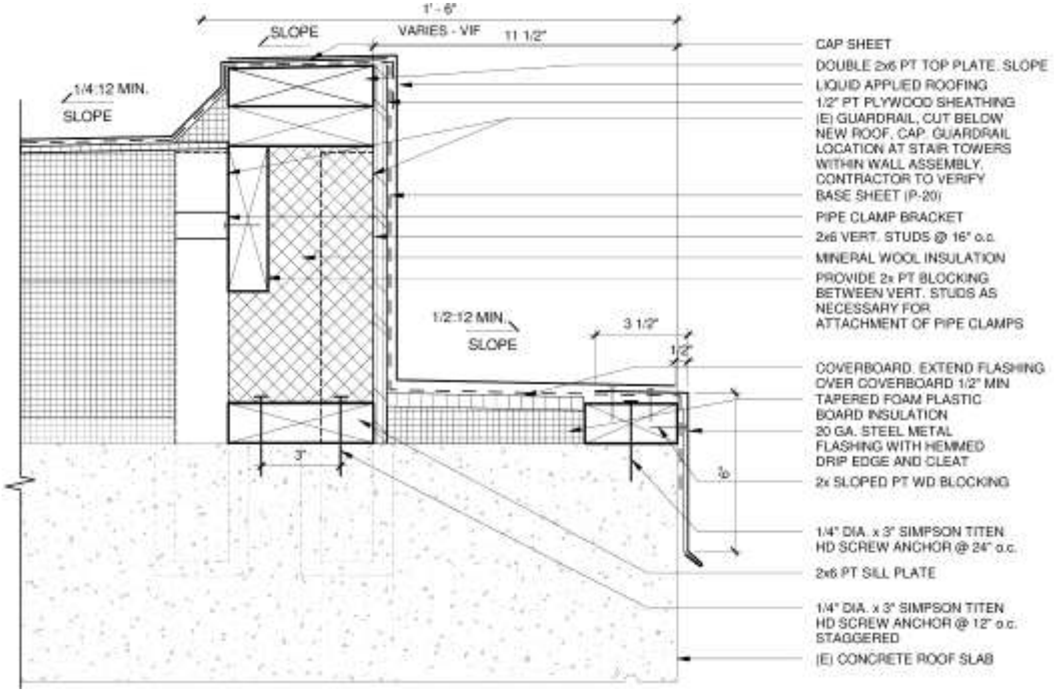
Renovated One Bedroom unit – Living

# Innovation – Exterior Envelope, Wall




1 TYP. ROOF ASSEMBLY

SCALE: 3" = 1'-0"

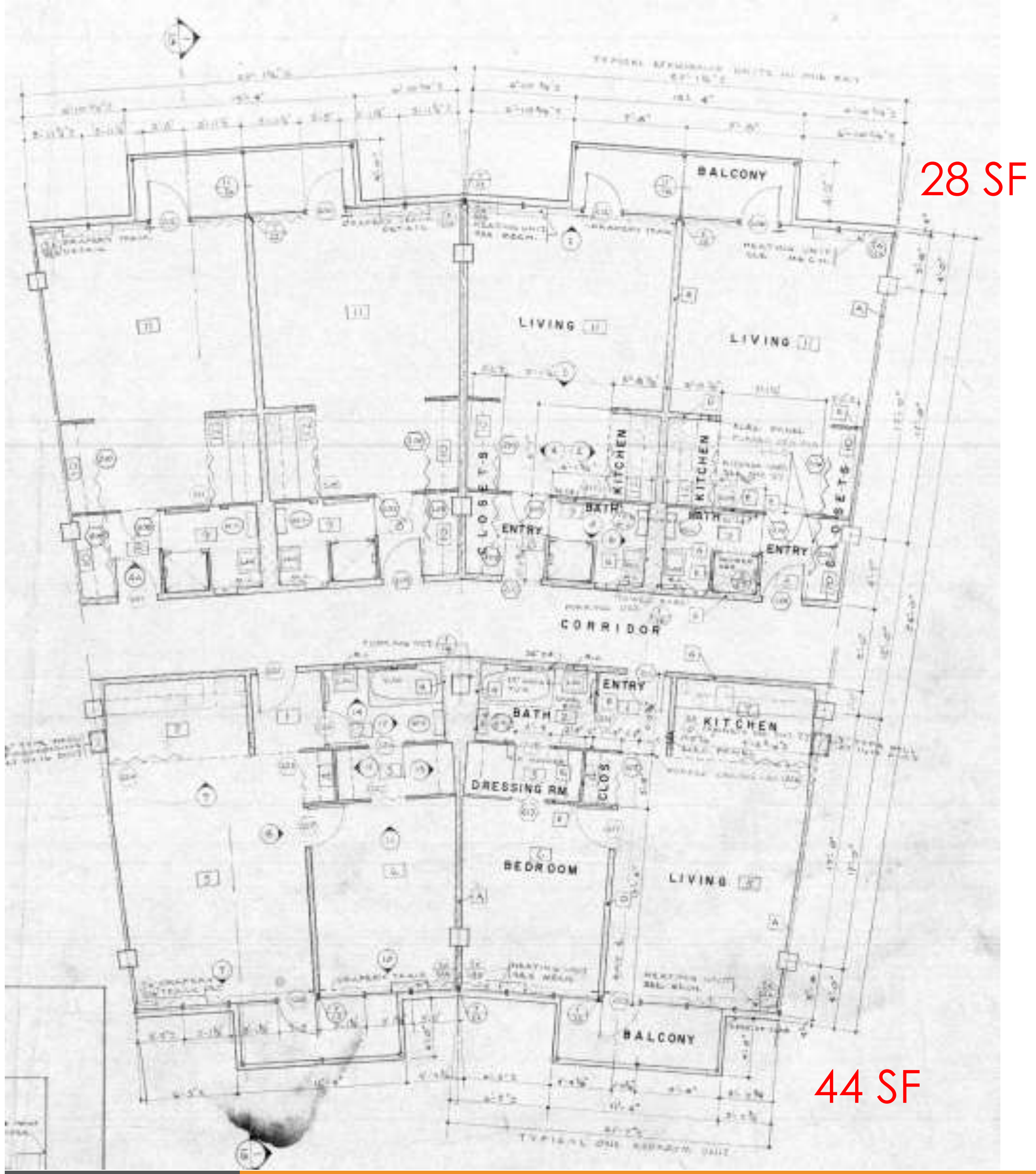


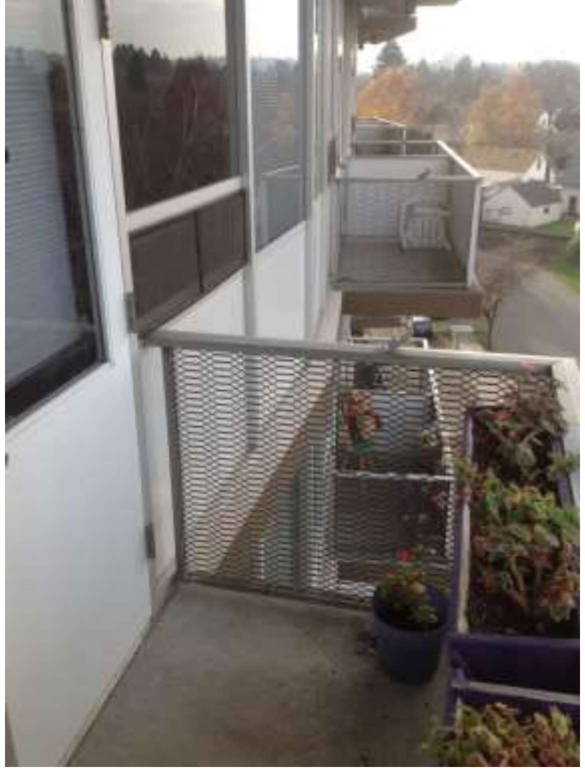

- Minimum of 3” of insulation at roof low point, drains to middle of building.
- +14” insulation at roof edge. Design maintains character of existing building with a thin fascia profile.
- Not able to provide full wrap at roof edge due to budget.

# Innovation – Exterior Envelope, Roof

- Insulation thickness allowed permanent utility services to be run below roof.
- Mother Nature’s test: Snow remained on section of new roof for 8+ days as it melted on the old system after 1 day

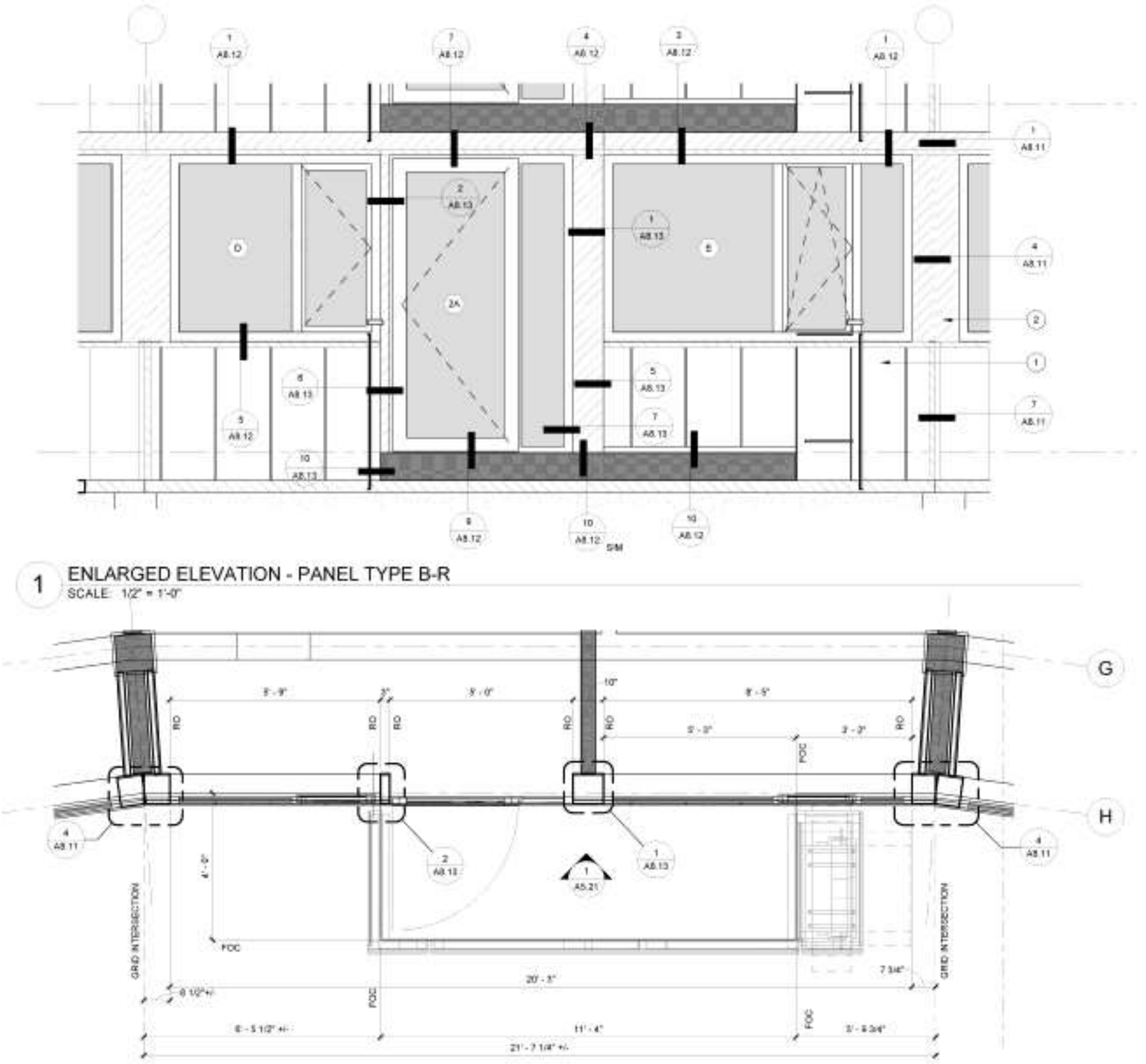
# Innovation – Exterior Envelope, Roof



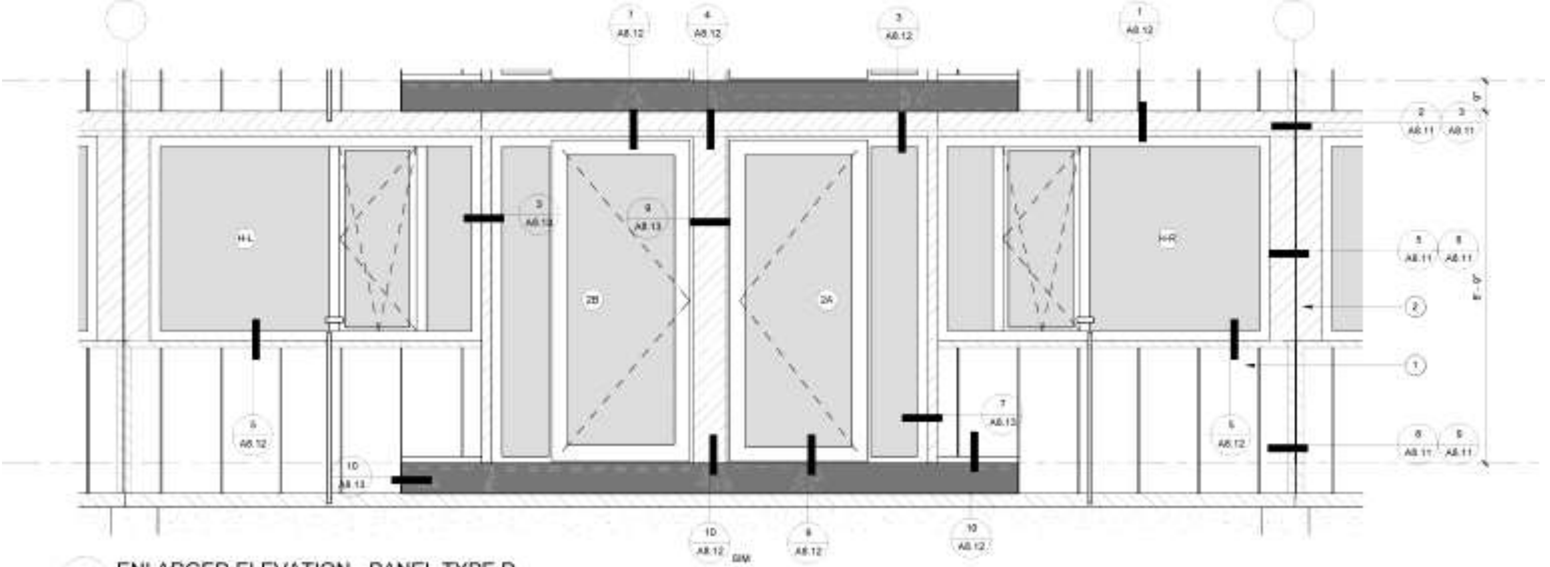
- Committed to approach of utilizing small independent systems to support resident heating and cooling needs.
- Needed to determine where to place exterior condenser units.
- Original thought was placing them on the existing decks.

# Challenges – Residential HVAC Equipment

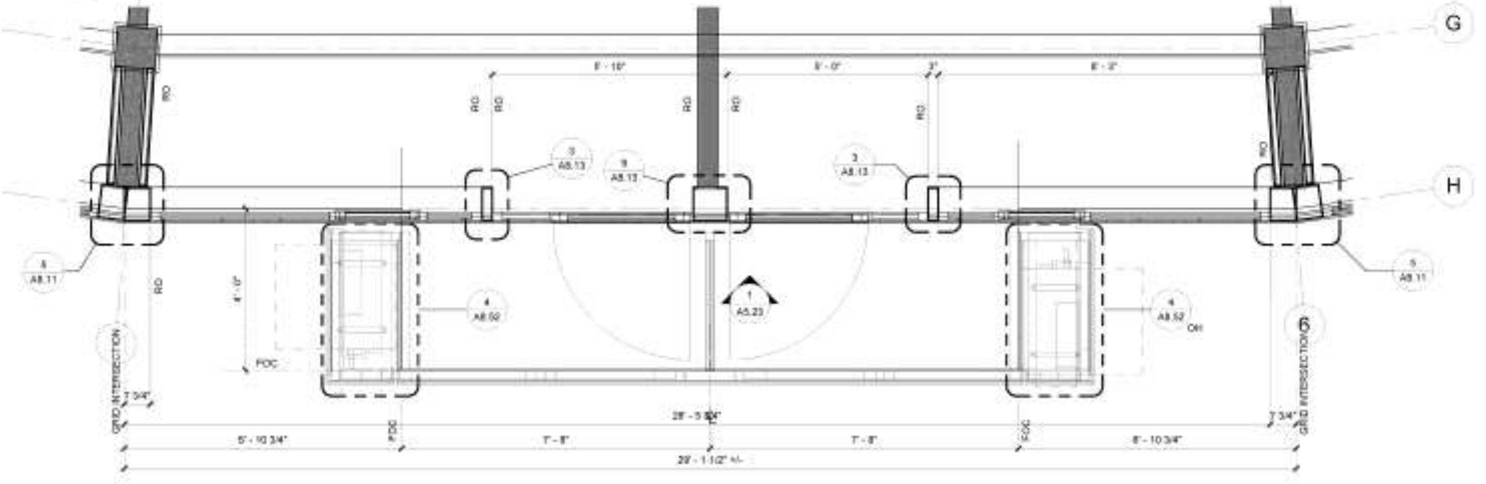



- Deck footprint was to small to locate condensing units
- ‘Saddlebagged ‘ them outside of existing footprint
- Created new deck rail configuration which allowed for more usable space.
- Utilized area over condenser for additional usable deck area
- Exterior wall replacement was opportunity to improve deck access and function

# Innovations – Residential HVAC Equipment @ One Bedroom Apartments



1 ENLARGED ELEVATION - PANEL TYPE D
SCALE: 1/2" = 1'-0"



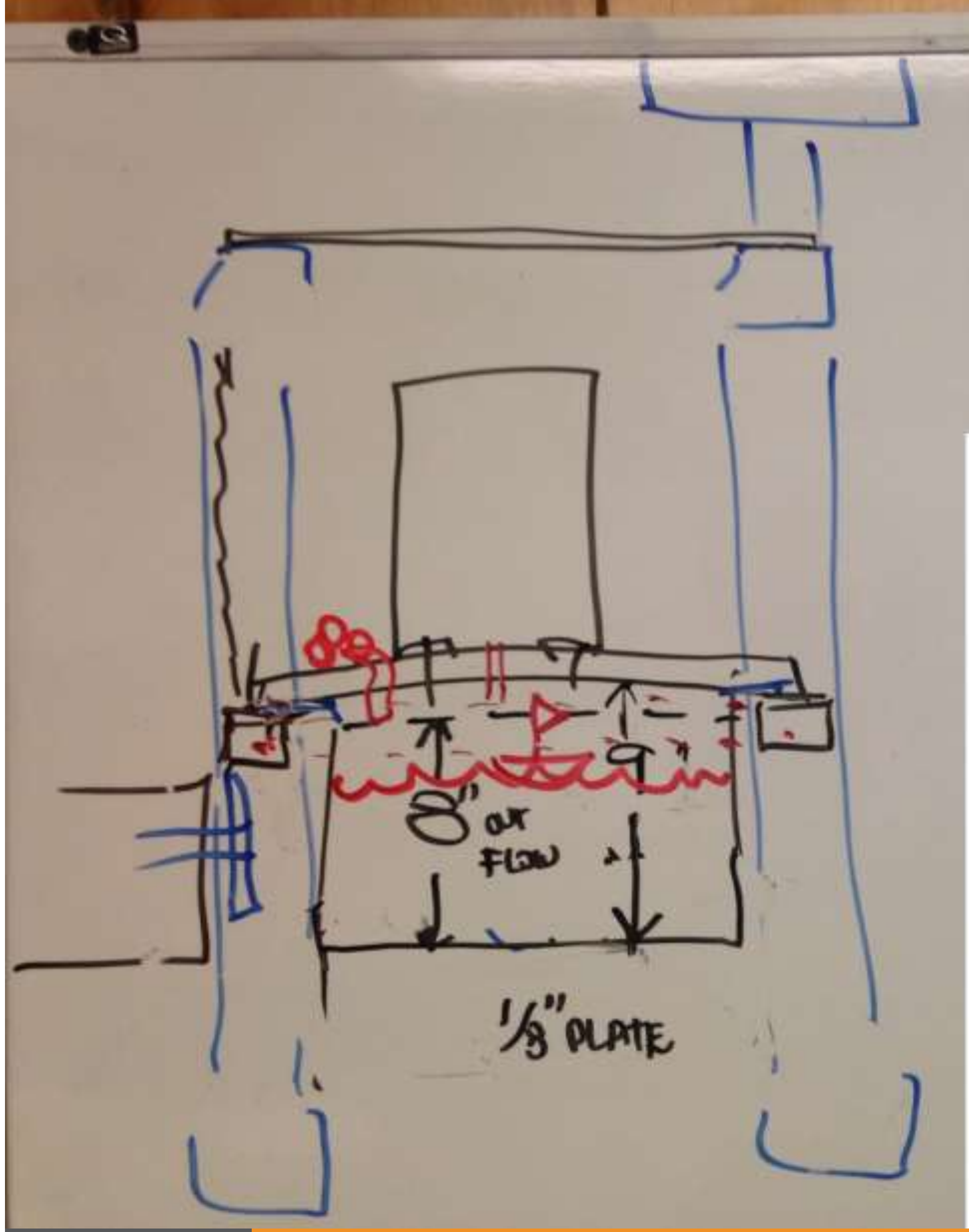
2 ENLARGED PLAN - PANEL TYPE D
SCALE: 1/2" = 1'-0"

# Innovations – Residential HVAC Equipment @ Studio Apartments

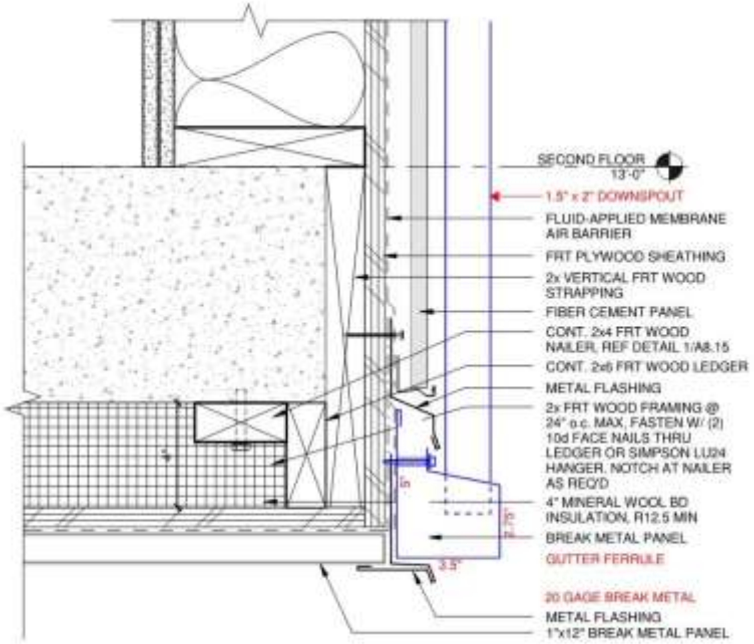
# Innovations – More Mock-Ups!

# Innovations – Exterior Expression

# Lessons Learned – Exterior Envelope (the small details)




# Lessons Learned – Condensate (where does it go?)




# Lessons Learned – Condensate (where does it go?)

WESTMORELAND UNION MANOR RENOVATION

# Mechanical Systems and Energy Modeling

**Andrew Lasse** PE, LEED AP
Principal, Sr. Mechanical Engineer

INTERFACE ENGINEERING

# Agenda

## 1: Existing Building Systems

- Central Mechanical Room
- Living Units
- Commons Areas

## 2: Mechanical Considerations

- Goals
- HVAC Options
- Decision Making

## 3: Energy Modeling

- Existing Building
- Objectives
- Results

# Scope + Process

Due Diligence

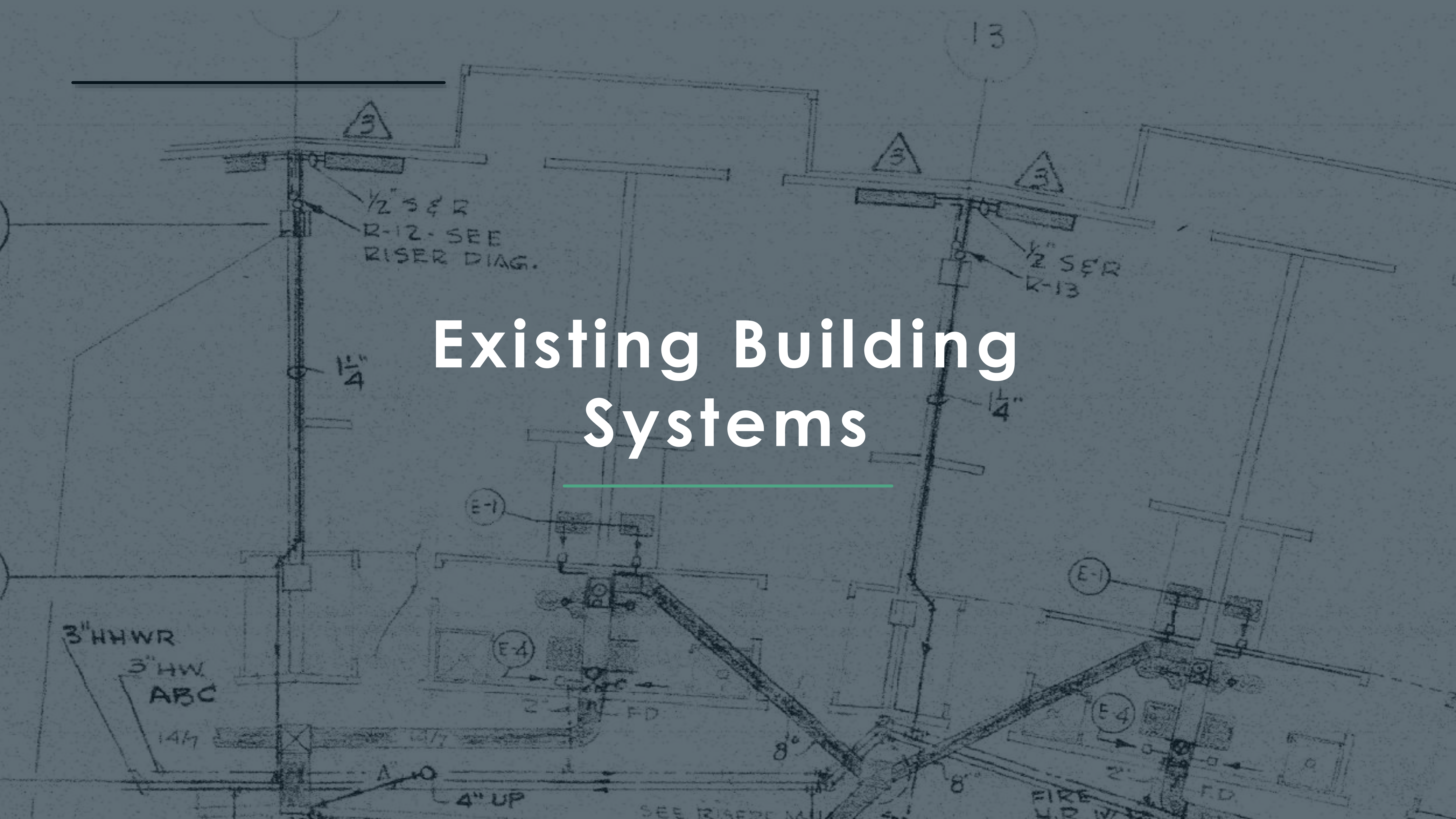
Determine Scope & Budget

Energy Modeling

Full Design for HVAC

Design Build for Plumbing & Electrical

# Existing Building Systems



# History

- Constructed in 1966
- 160,000 SF
- 7 stories
- 301 Living Units
- Studios & 1 Bedrooms
- 9'-6" Floor to Floor
- **Site Visit Feb 2014**

*Due Diligence Focus:*

1. *Determine Ways to Lower Energy Costs*
2. *Identify Aging Building Systems*
3. *Opportunities to Enhance the Quality of Interior Environment*

# Central Systems

*Originally heating only – chiller was installed years after the building was completed.*

- Rooftop Penthouse Mechanical Room
- Dual Cleaver Brooks, 4200 MBH Firetube boilers (original), 180 F
- Carrier Centrifugal Chiller, 300 tons, R-11
- Baltimore Aircoil Cooling Tower, 300 tons
- Two Pipe Change over system
- Pneumatic controls

# Central Systems

*Originally heating only – chiller was installe years after the building was completed.*

- Separate Domestic Hot Water Penthouse Enclosure
- Jarco 1400 MBH Domestic Hot Water Heaters
- Galvanized & Copper Piping
- 4,000 Gallon Hot Water Storage Tank
- Recirculation Pumps

# Living Units

*Unit Ventilators at the exterior with constant exhaust from kitchens and restrooms. Piping and ductwork distribution vertically.*

- McQuay Seasonmaker
- 3 way valves
- 180 F / 40 F distribution
- Greenheck downblast exhaust
- Sidewall Kitchen & Bath grilles
- Operable Windows


# Common Areas

*The first floor consists of various common area uses, served by a series of indoor air handling units utilizing the central heating & chilled water systems.*

- PACE Air Handling Equipment
- Multizone
- Original to Building
- Asbestos
- Hydronic Unit heaters
- Mitsubishi Split for Elevator

# Envelope

*The original building utilized single pane glazing, glass doors at each unit balcony, with minimum insulation at metal panel and roof.*

- Single Pane Glass
  - u = 1.18 Btu/ft^2*hr*degF
- Window to Wall Ratio: 57%
- Wall: Metal Panel and plywood
  - u = 0.25
- Roof: 9" concrete, 1" rigid
  - u=.128 total

# **Mechanical Systems:** Considerations

# Due Diligence Findings

*The due diligence phase allowed Interface to help identify systems in need of replacement, potential code improvements, and energy efficiency upgrades*

Findings:

- Original equipment beyond useful life
- Significant energy loss through façade
- Inefficient Heating Systems
- Occupant Comfort
- Phasing Considerations

# HVAC System Considerations

*Replacement of the existing HVAC systems was a priority, with respect to the following considerations:*

- Energy Efficiency
- Maintenance
- Occupant Comfort
- **Ability to Phase construction**
- Acoustical
- New Façade impacts
- First Cost and Payback


# HVAC System Options

*Various HVAC systems types were evaluated for the Living Units*

- Variable Refrigerant Flow (VRF)
- Split System Heat Pumps
- Packaged Terminal Heat Pumps

# Packaged Terminal Heat Pumps

*Pros:*

- Lowest First Cost, Installation Cost
- Works well for staged construction


*Cons:*

- Noisy
- Short life cycle
- Marginal Energy Efficiency
- Reduce envelop performance
- Need two units for 1 bedroom residences

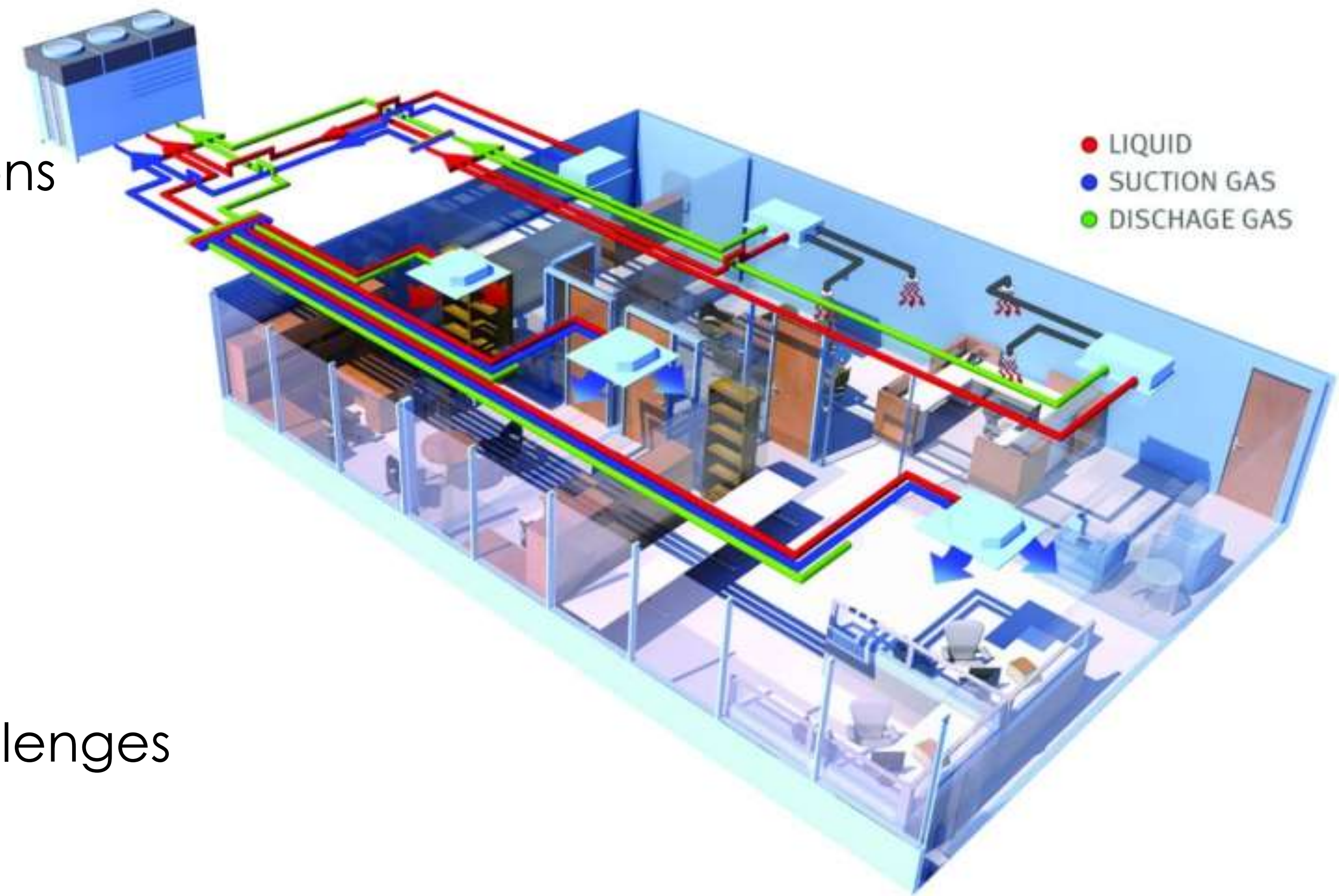
# Variable Refrigerant Flow (VRF)

*Pros:*

- Works for both Common areas and Living Units
- Many indoor fan coil options
- Energy recovery
- Higher efficiency
- Longer life cycle

*Cons:*

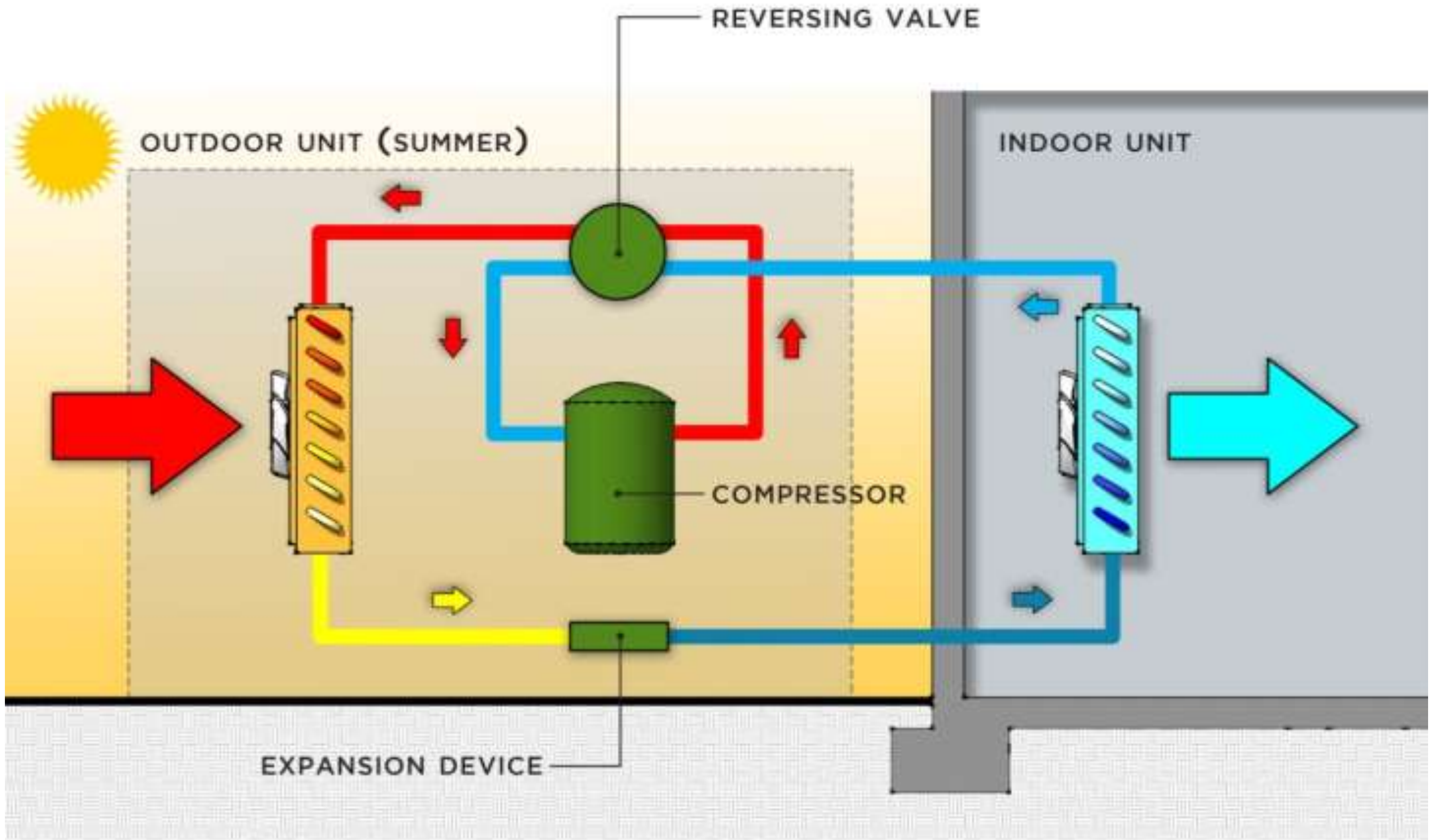
- Higher Installation cost
- Staged Construction challenges
- Proprietary



# Split System Heat Pumps

*Pros:*

- Energy Efficiency
- High Heating Coefficient of Performance
- Improved lifespan
- Staging construction
- Minimal impact to envelop




*Cons:*

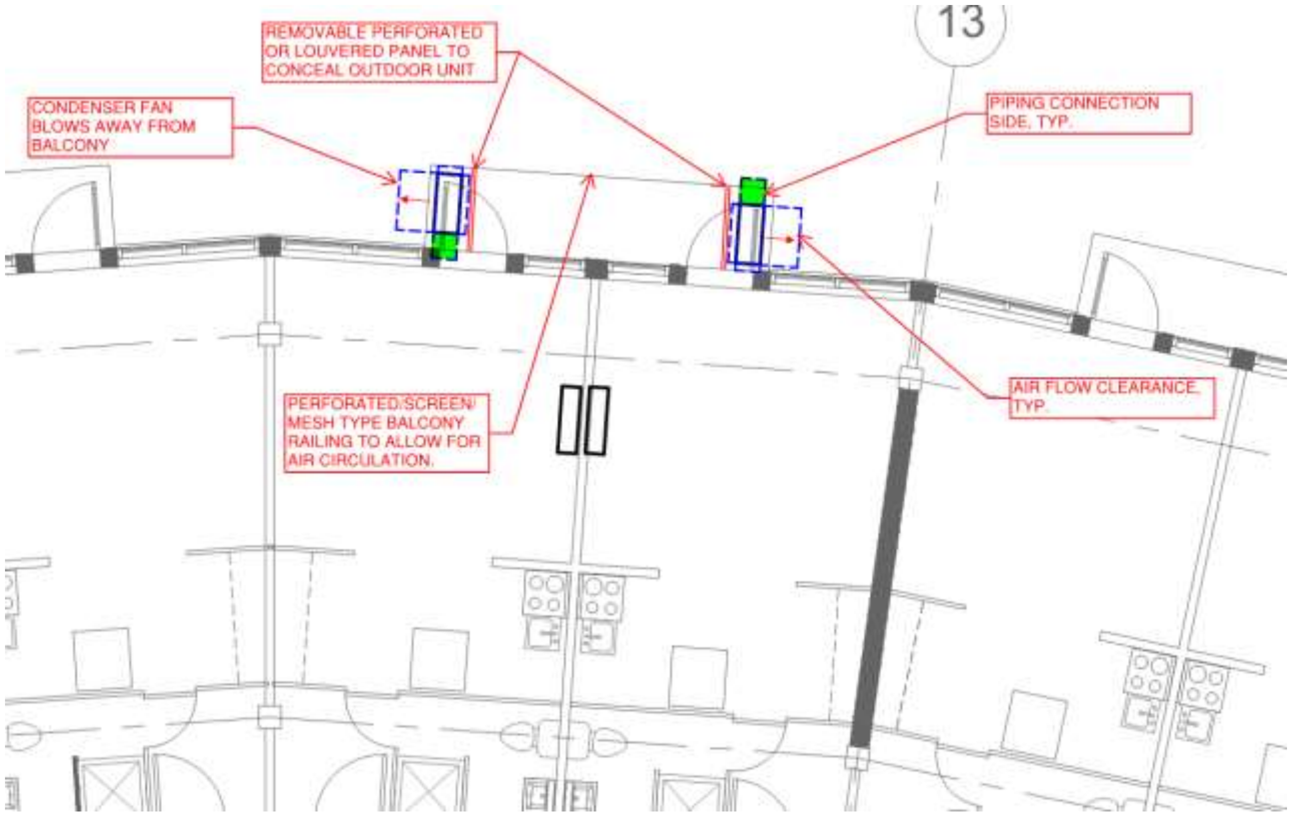
- 301 condensing units to find a home for

# Mechanical Systems: Determination

# Living Unit HVAC System

***Split System Heat Pumps** with programmable t-stats were chosen for the Living Units due to the following criteria:*

- Compared to PTHP:
  - More efficient, less noise, fits with façade, floor space, weatherization
- Compared to VRF:
  - Comparable efficiency, better phasing capabilities, lower first cost, comparable payback



# Living Unit HVAC System

***Split System Heat pumps** installation outside existing balconies*

- Challenge of Locating Units
- Clearances
- Access
- Visibility

# Living Unit HVAC System

*Controls upgraded to improve occupancy comfort and controllability*

- Programmable Thermostat Upgrade
- Accessibility
- Dual Heating and Cooling Setpoints
- Fan controls


# Common Areas HVAC Systems

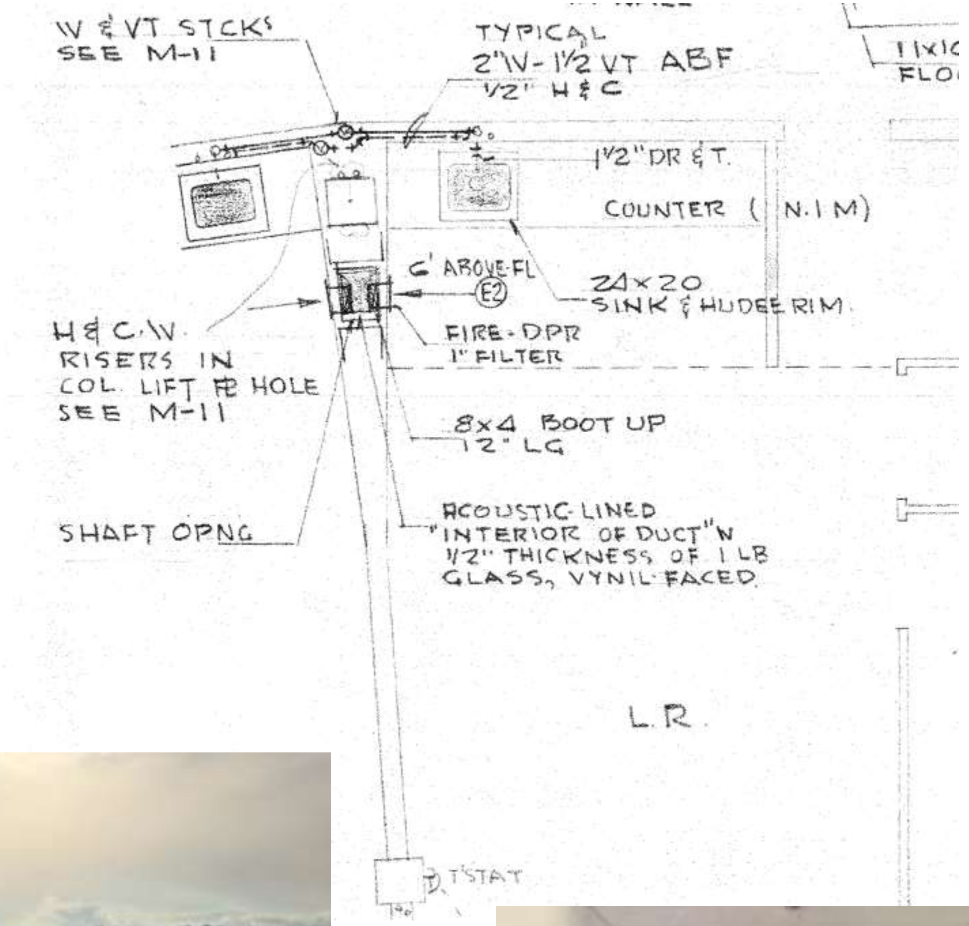
***Variable Refrigerant Flow (VRF) system***
*was chosen for the  first floor commons spaces.*

- Ideal zoning (14 zones)
- High Efficiency, Energy recovery
- Logistics and Routing
- Dedicated Outside Air

# Living Unit Exhaust System

*Modification to exhaust systems included primarily the central rooftop fans replacement*

- Constant volume exhaust
  - Kitchen = 60 CFM
  - Bathroom = 60 CFM
- Exhaust combined in shaft
- Sidewall & overhead grilles with OBDs
- Code minimum exhaust:
  - Kitchen = 25 CFM
  - Bathroom = 20 CFM



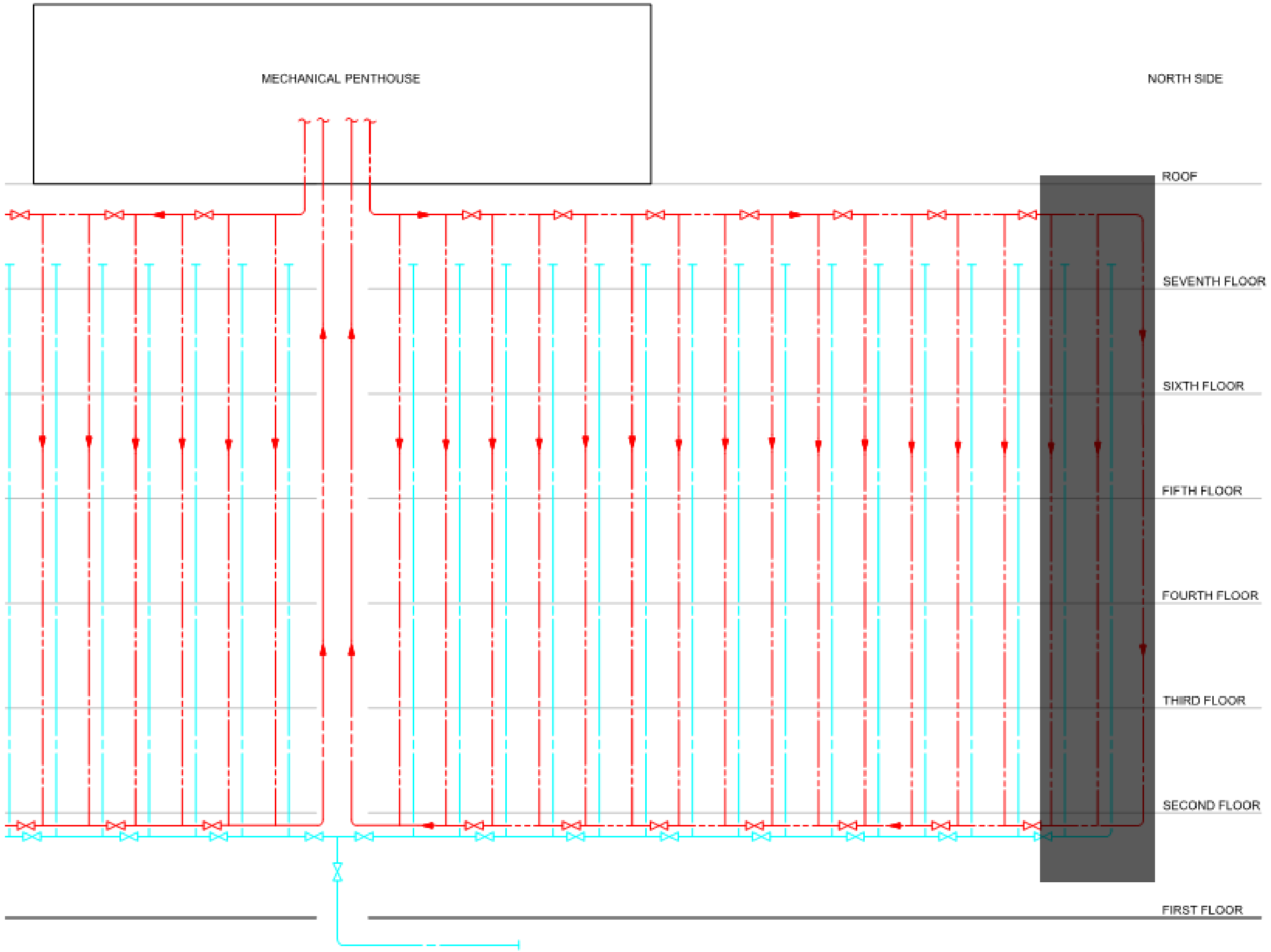

# Domestic Hot Water Systems

*DHW systems were upgraded early to serve mains ahead of phased construction*

- HW mains at 7th Floor Ceiling
- Vertical distribution
- Recirculation Collects at Level 1
- Phasing Considerations
- Shut offs during construction

EXISTING HOT WATER DESIGN

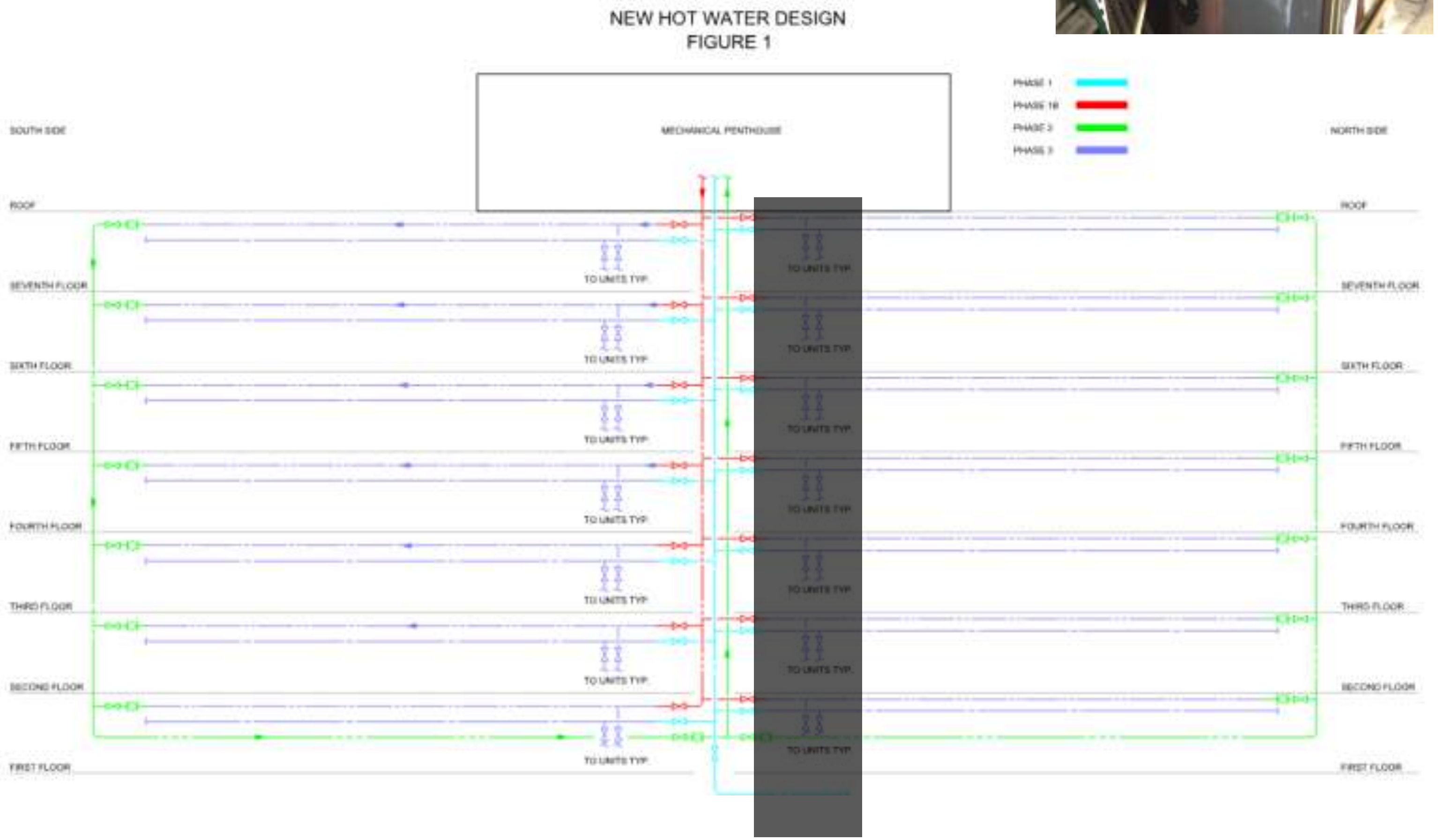
FIGURE 2



# Domestic Hot Water Systems

*Condensing Hot Water heaters coupled with a horizontal distribution system*

- Central Vertical Riser
- Horizontal Branches
- Tie in new units
- Maintain original vertical risers during construction



# Energy

Goals

Existing Utility Bills

Energy End Use Breakdown

Energy Conservation Measures

Energy Trust of Oregon Incentives

# Goals

*Identifying the purpose and corresponding targets for the Energy Modeling process*

- Primary Goal: Lower Energy Cost
- Determine most cost effective Energy Conservation Measures
- Obtain incentives from Energy Trust of Oregon
- Analyze paybacks using Energy Trust of Oregon criteria

# Energy Modeling Approach

*Interface used eQUEST energy modeling software for the purposes of analyzing building energy usage.*

- DOE-2 eQUEST software
- Baselines:
  - Existing Building
  - Code Minimum (Energy Trust)
- Envelope Analysis
- HVAC Analysis
- Energy Trust of Oregon Analysis

# Existing Utility Bills

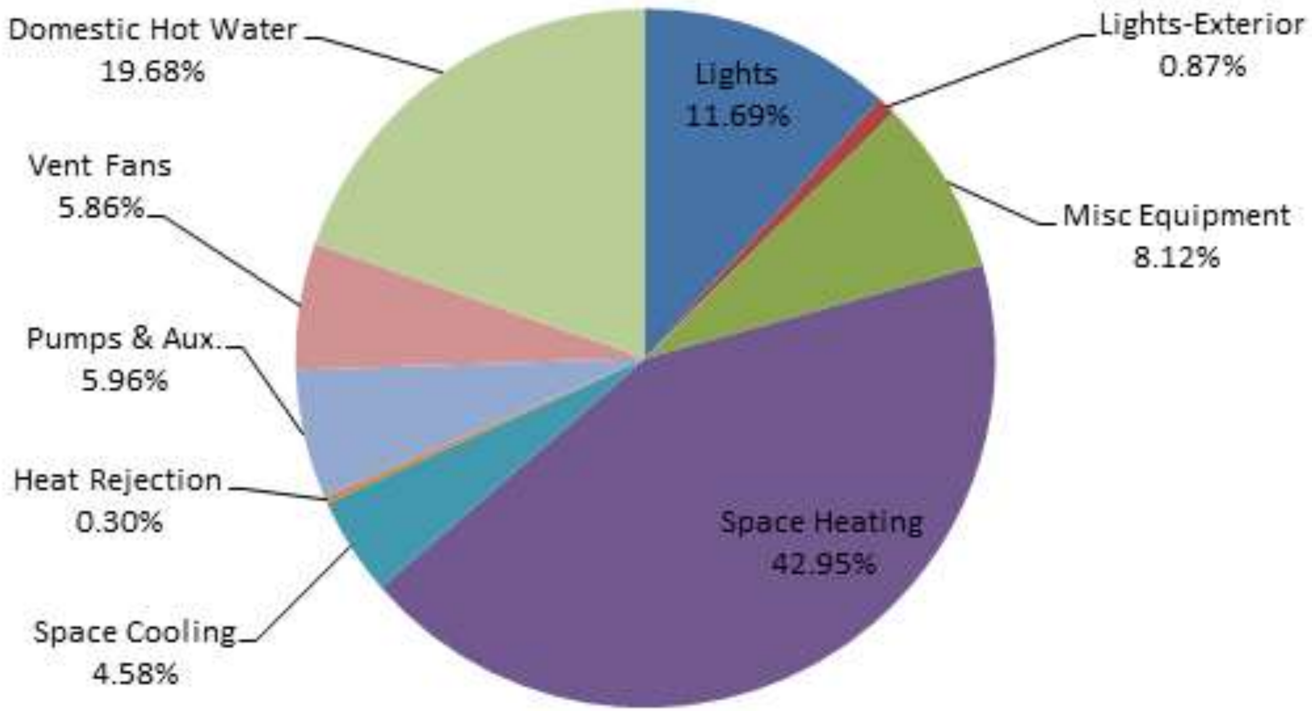
*Obtaining the existing building energy costs via utility bills allowed us to calibrate the existing building energy model baseline.*

- Yearly Energy Cost: $182,000
  - Gas: $86,000
  - Electricity: $96,000
- Energy Cost/SF/year: $1.14
- Existing EUI:
  - 100.5 kBtu/SF/year
- Target Finder Median:
  - 106.4 kBtu/SF/year

# Existing Building Energy End Use Breakdown

*This breakdown represents the existing building energy end use.*

- EUI: 100.5 kBtu/SF/year
- Major Energy Users:
  - Heating
  - Domestic Hot Water
  - Lighting

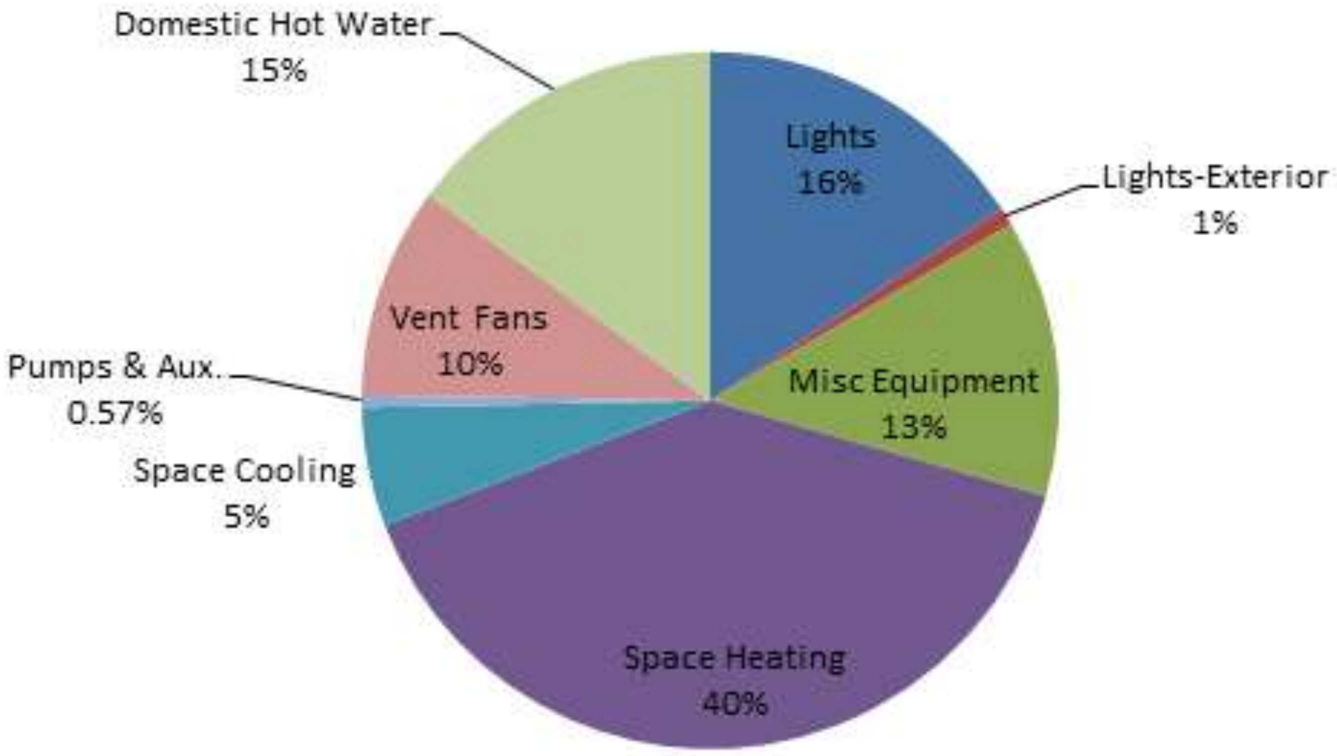



**Existing Building Energy End Uses**

# Code Minimum Building Energy End Use Breakdown

*This breakdown represents the Code Baseline energy end use for modeling to secure ETO incentives.*

- EUI: 50 kBtu/SF/year
- Major Differences:
  - Domestic Hot Water
  - Heating Efficiency
  - Lighting
- Major Energy Users:
  - Heating
  - Domestic Hot Water
  - Lighting

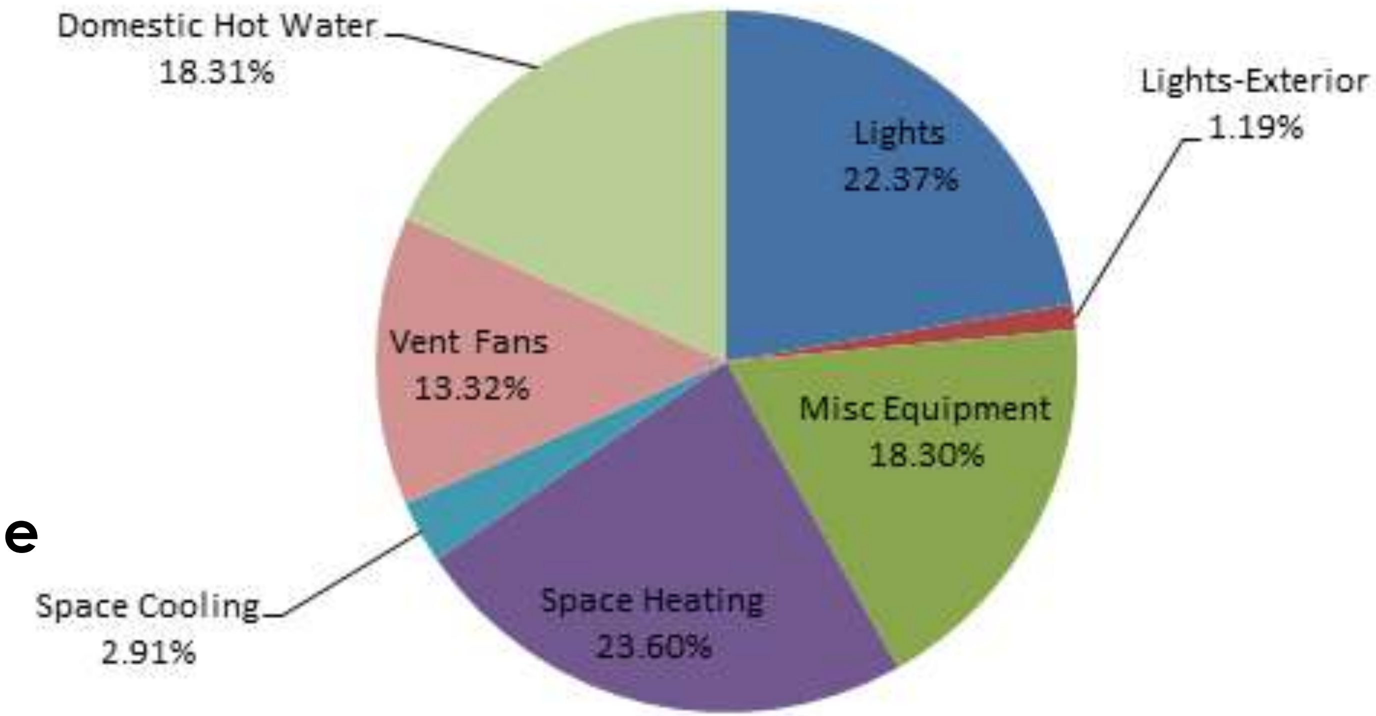



**Baseline Building Energy End Uses**
EUI: 50.0 Kbtu/sf-year

# As-Designed Building Energy End Use Breakdown

*This breakdown represents the Proposed Baseline energy end use, which includes the project ECMs.*

- EUI: 35.2 kBtu/SF/year
- Major Contributors:
  - Domestic HW
  - Heating COP
- Lighting not included
- **30% reduction over baseline energy use**
- **68% reduction over existing building energy use**




**Interactive Building Energy End Uses**

EUI: 35.2 Kbtu/sf-year

# Energy Conservation Measures

**TARGETS:**

**Envelope (Roof, Walls, Glass)**

**HVAC systems (Central and Residential)**

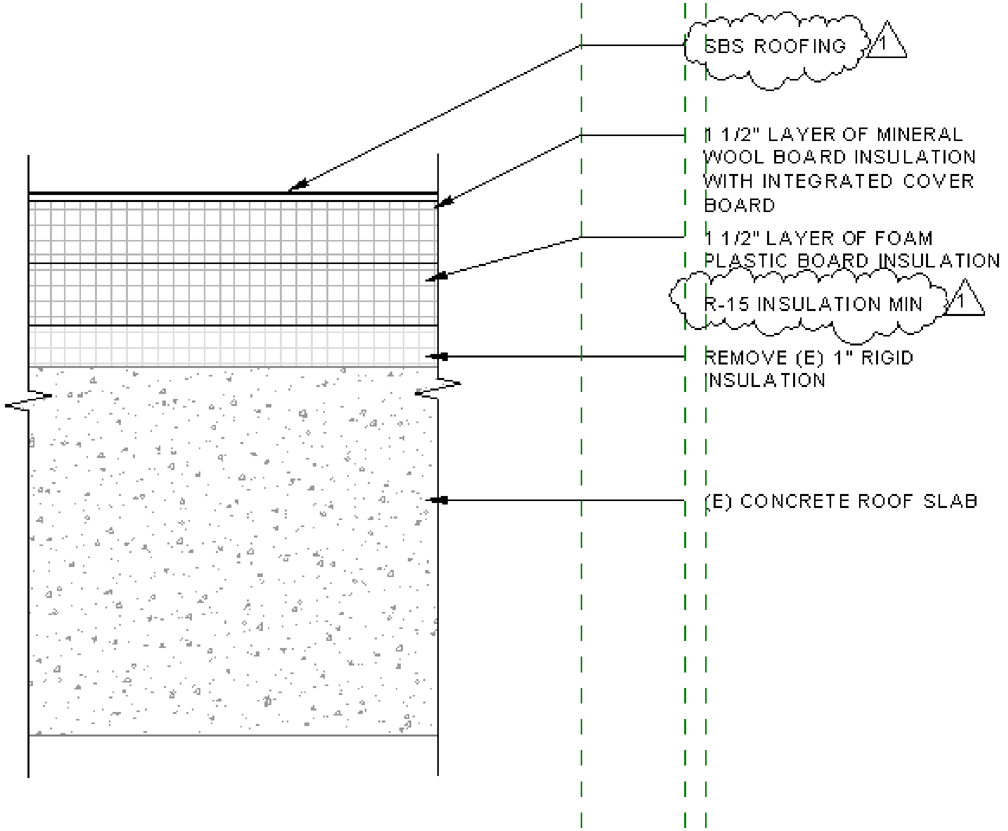
**Domestic Hot Water**

**Lighting (Separate Path)**

# ECM – Roof Performance

*Improve roof insulation – replace existing 1" rigid with 3" rigid insulation*

- Existing Assembly U Value: 0.128
- Designed Assembly U Value: 0.041
- Proposed roof will use two 1.5" layers of mineral wood board insulation.
- Existing 9" concrete roof remains below
- Area: 23,900 SF



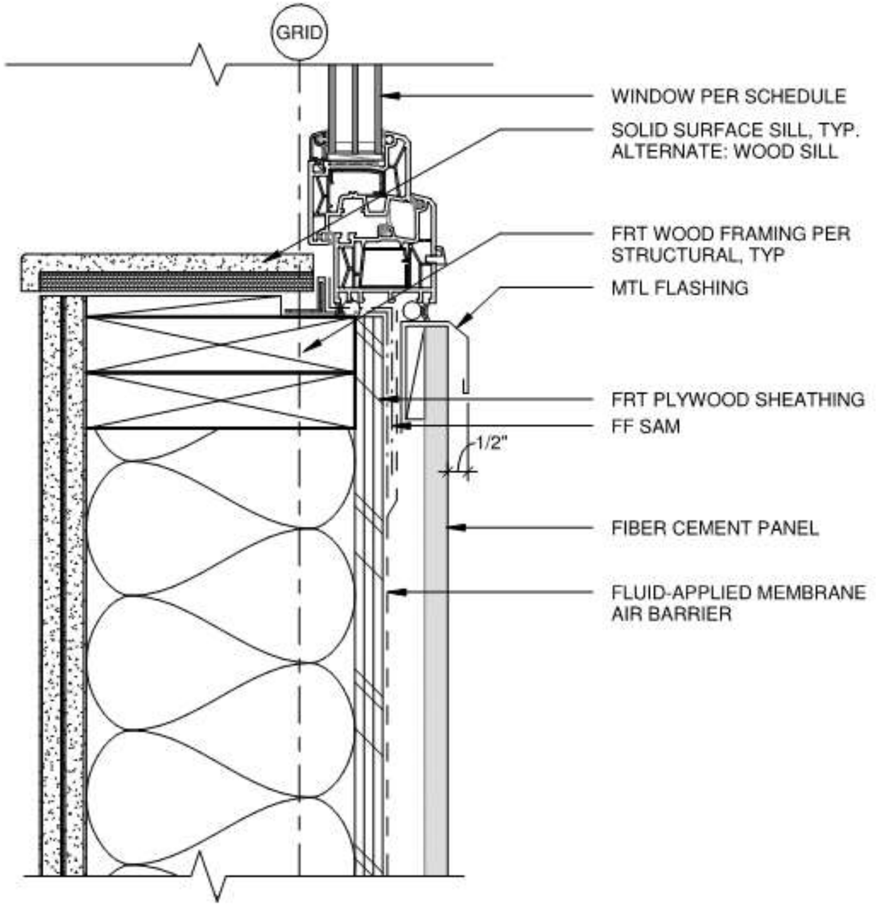

*Savings: $1,695/year compared to existing building*

# ECM – Wall Performance

*A parametric analysis was performed early in the design process to target the best, most cost effective wall assembly that saves the most energy for Westmoreland.*

- Existing Wall:
    - Aluminum Panel / plywood,
    - Existing assembly U value: 0.25
- Proposed Wall:
    - 2x8 wood framed with R-27 blown in fiberglass
    - Proposed assembly U value: 0.04

*Savings: $2,760/year compared to existing building*



# ECM – Glazing Performance

*High Performance Innotech argon filled triple pane windows as an upgrade to existing single pane glass.*

- Existing Building:
  - 57% glass, U value 1.18
- Code Baseline Building:
  - 30% glass, U value: 0.45
  - SHGC: 0.40
- Proposed Building:
  - 35% glass, U value: 0.19
  - SHGC: 0.24

*Savings: $3,704/year compared to existing building*

# ECM – Domestic Hot Water

*High Efficiency Domestic Hot Water Heater to replace aging existing equipment.*

- Gas water heaters in Penthouse
- Rheem High Efficiency Condensing Water Heaters
- Existing Efficiency: 73%
- Code Baseline Efficiency: 80%
- Proposed Efficiency: 93%

*Savings: $2,260/year compared to code baseline*


# ECM – HVAC Systems Living Units

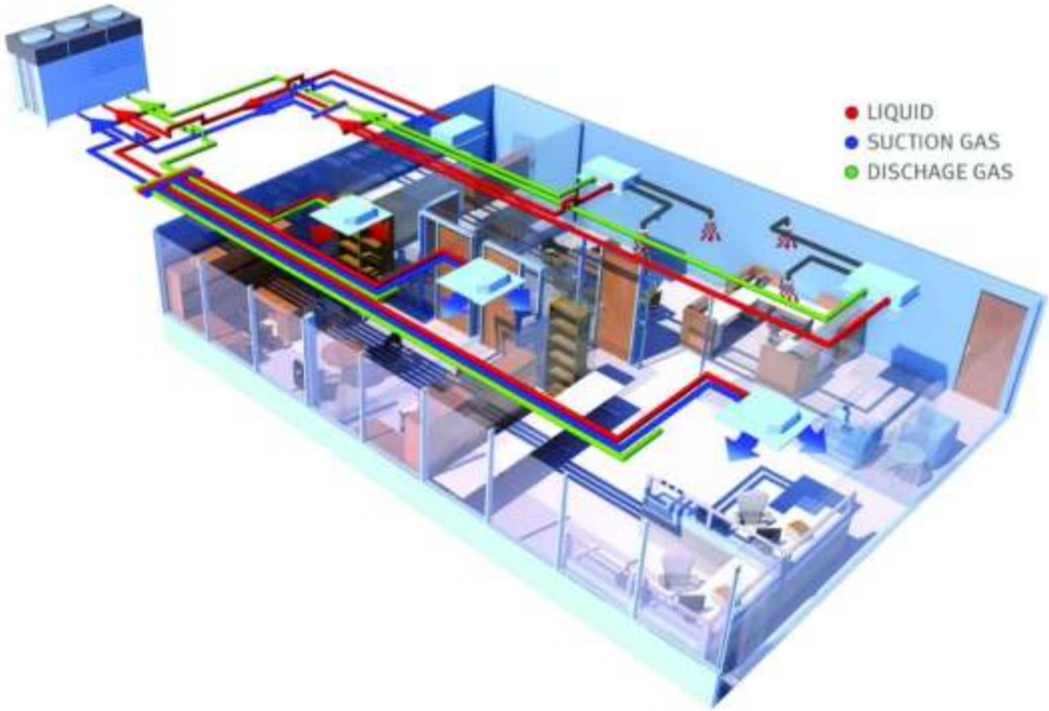
*Split system heat pumps for the residential areas and VRF with heat recovery ventilation for the level 1 commons.*

- Residential Units:
  - Indoor residential Fan Coils
  - Condensing Units on Balcony
- Code Baseline:
  - Packaged Terminal Heat Pump (System 2)
- *Total Energy Cost Savings: $36,100/year*
- *Total % savings: 26% overall*
  - *Compared to Code Baseline*

# ECM – HVAC Systems Common Areas

*Split system heat pumps for the residential areas and VRF with heat recovery ventilation for the level 1 commons.*


- Ground Floor:
  - Variable Refrigerant Flow (VRF)
  - Heat Recovery Ventilators
- Code Baseline:
  - Hybrid gas fired VAV (System 7)
- *Total Energy Cost Savings: $36,100/year*
- *Total % savings: 26% overall*
  - *Compared to Code Baseline*



# ECM – Lighting

*Existing compact fluorescent and incandescent fixtures were replaced with LEDs, as well as bringing areas up to code.*

- Residences:
  - Existing vanity, scones, ceiling fixtures
  - Replaced with LED fixtures
- Corridors and Commons areas:
  - 2x4 recessed troffers with T8 lamps
  - Code spacing and LED lamp replacement
  - 2x4 and downlight LEDs
- Separate path through Energy Trust of Oregon

# Energy Cost Savings

Existing Building Yearly Energy Cost: $181,935

Projected Building Yearly Energy Cost: **$94,561**

Total Energy Cost Savings: **$87,374 (48% savings)**

# Energy Trust Incentives

### Cost Effective Measures:

## Domestic Hot Water Upgrade

## High Efficiency HVAC System Upgrade

# Westmoreland Union Manor
# Renovation
## June 2015 through May 2017

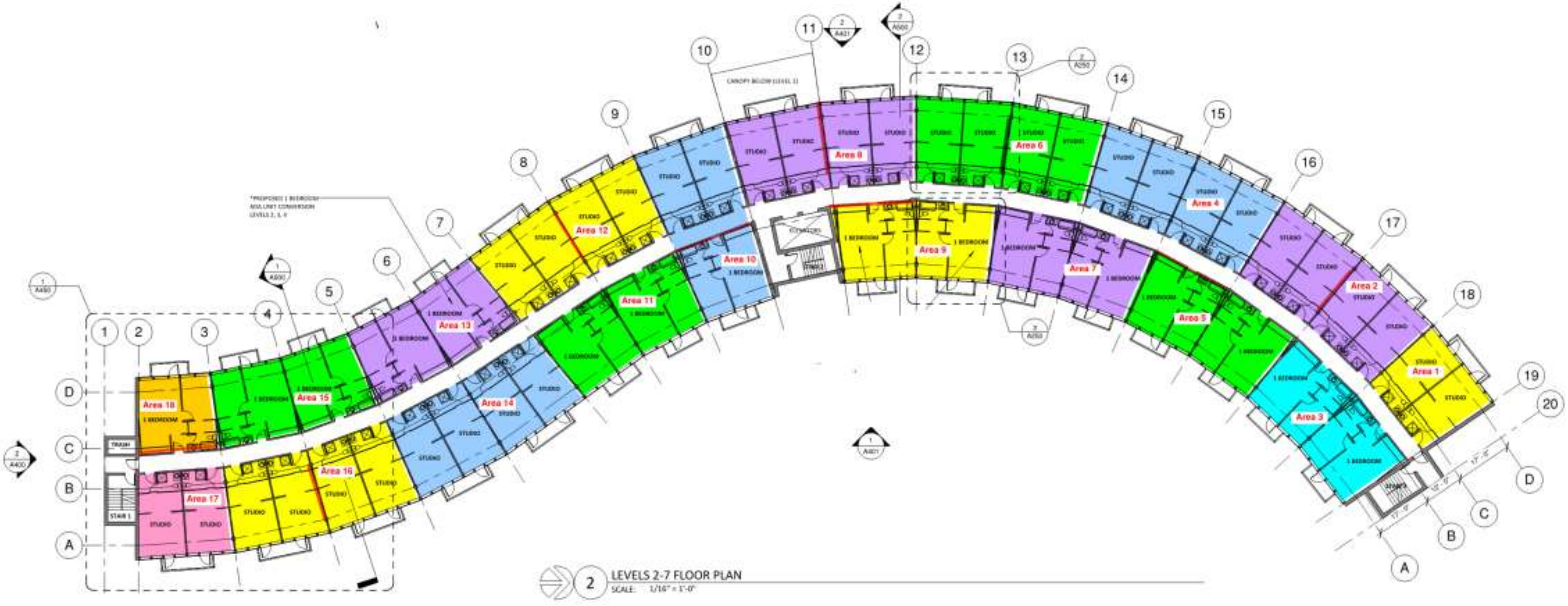
WALSH
CONSTRUCTION CO.

West
Elevation

Area 6 of 18
Complete

EAST ELEVATION
AREA 7 OF 18
IN-PROCESS

# Area Sequencing for Cycling 18 Zones



# SEQUENCE OF PRE-UNIT WORK :

- New Domestic Water to Building (Incl’g DCVA)
- New Boiler System Online (5 Gas Fired High-Efficiency Units)
- New Electrical Service to Building
- New IFS Distribution Gear (3 req’d)
- Distribution for Each System Prior to Initial Unit Stack Renovation

New Domestic Water Tap to Existing Combined Dom and Fire Lines

New Domestic Water Routing per PWB Requirements

New Dom Water DCVA (Double-Check) Vault Prep

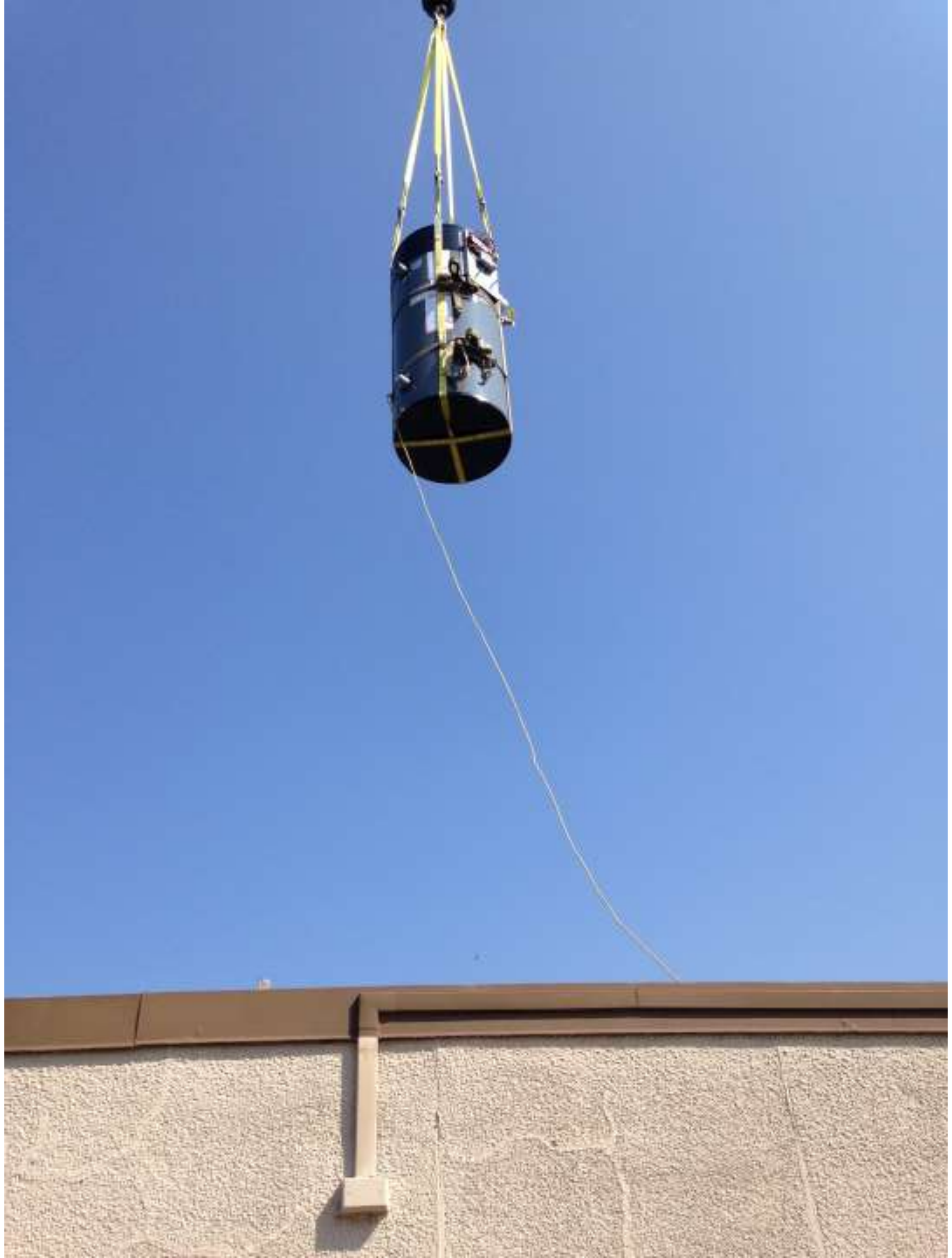
New Dom Water DCVA (Double-Check) Vault

Domestic water shut-off

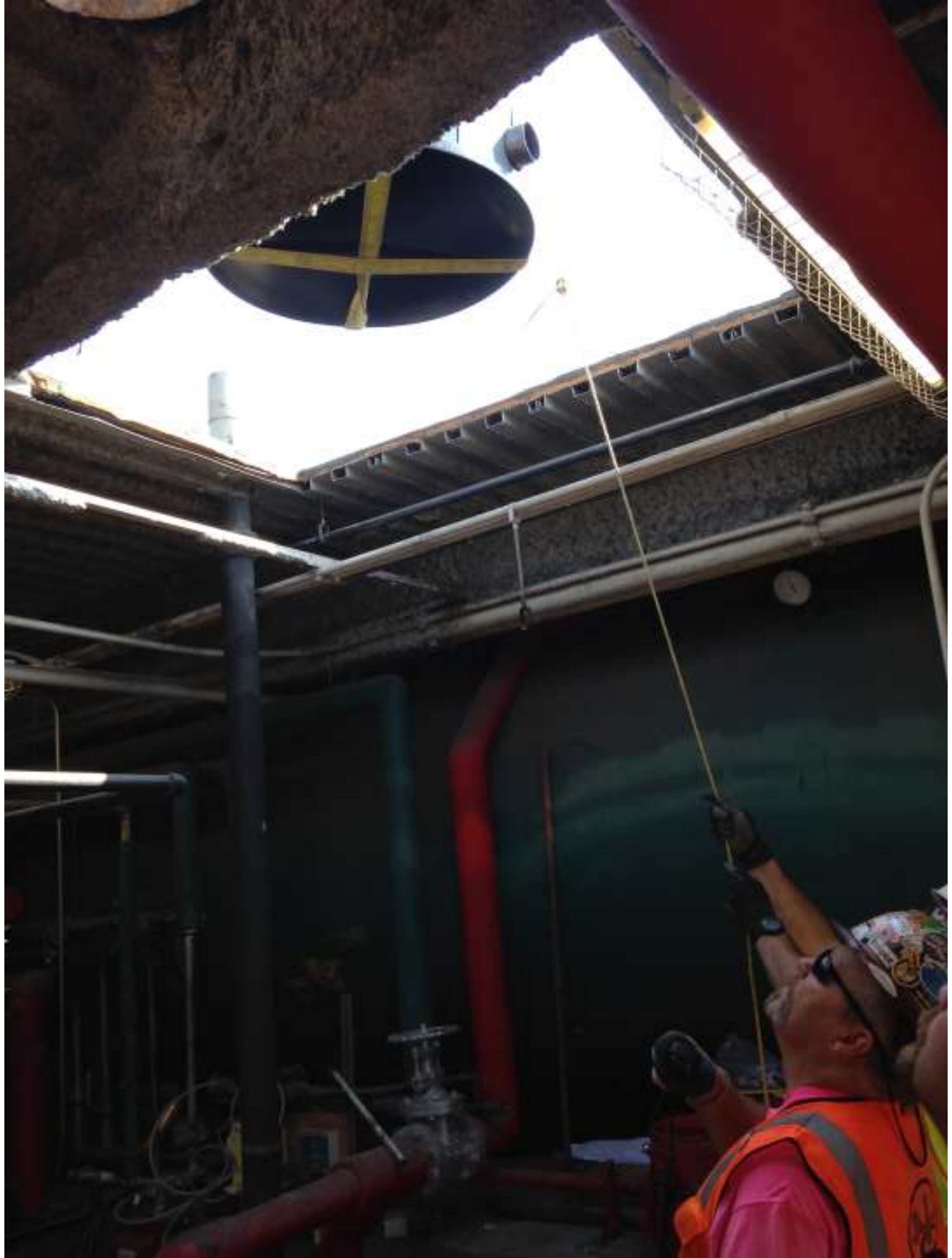
1 of 2 Original Gas-Fired Boilers
(Fed by 5inch Nat Gas Line @ 5 psf)

Initial Demolition to Remove First Boiler to Permit Installation of New Water-Heating Units

Crane positioned to fly in boilers to penthouse



1200 lb. boilers rigged for placement



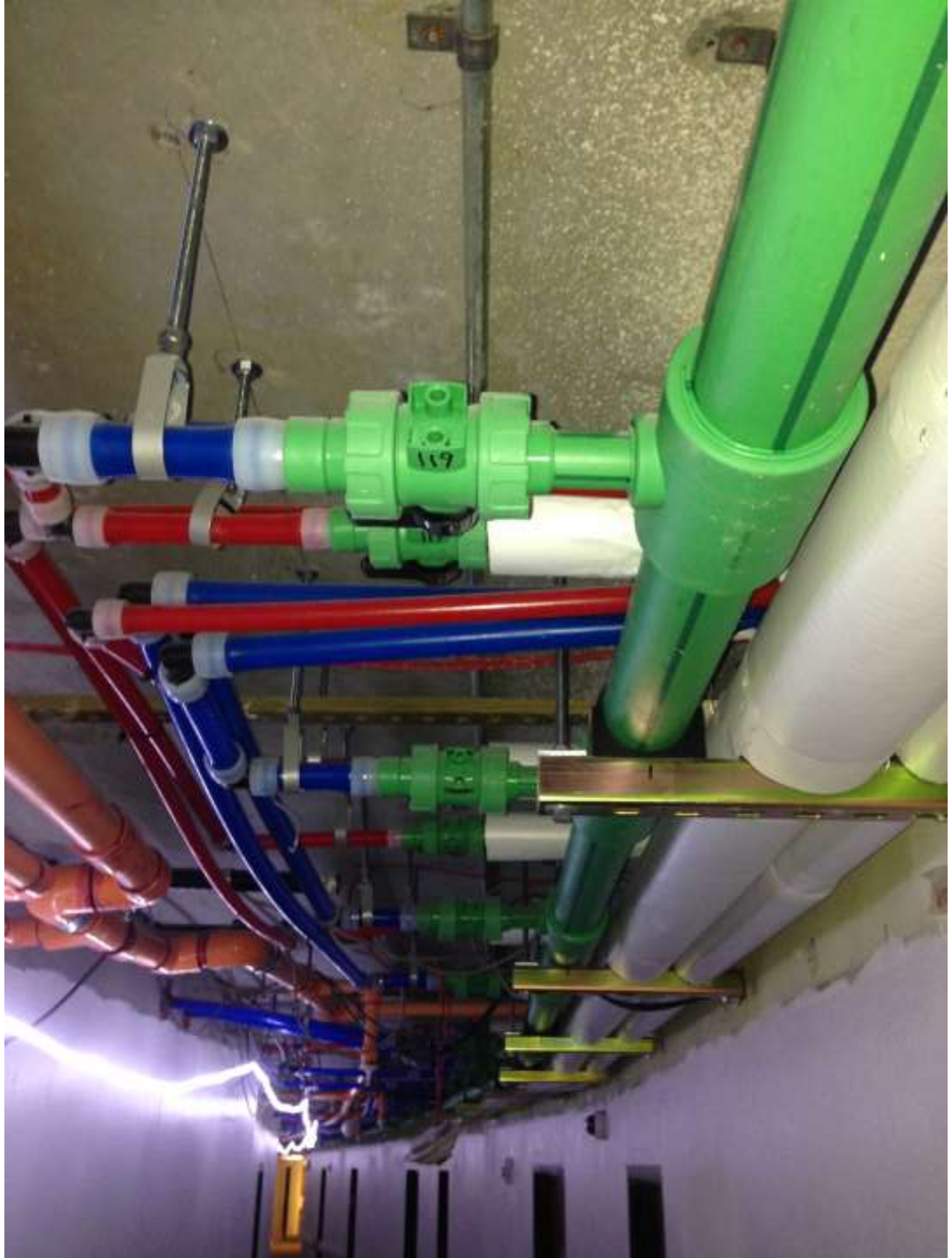
Structural deck removed for installation

Rigging and positioning

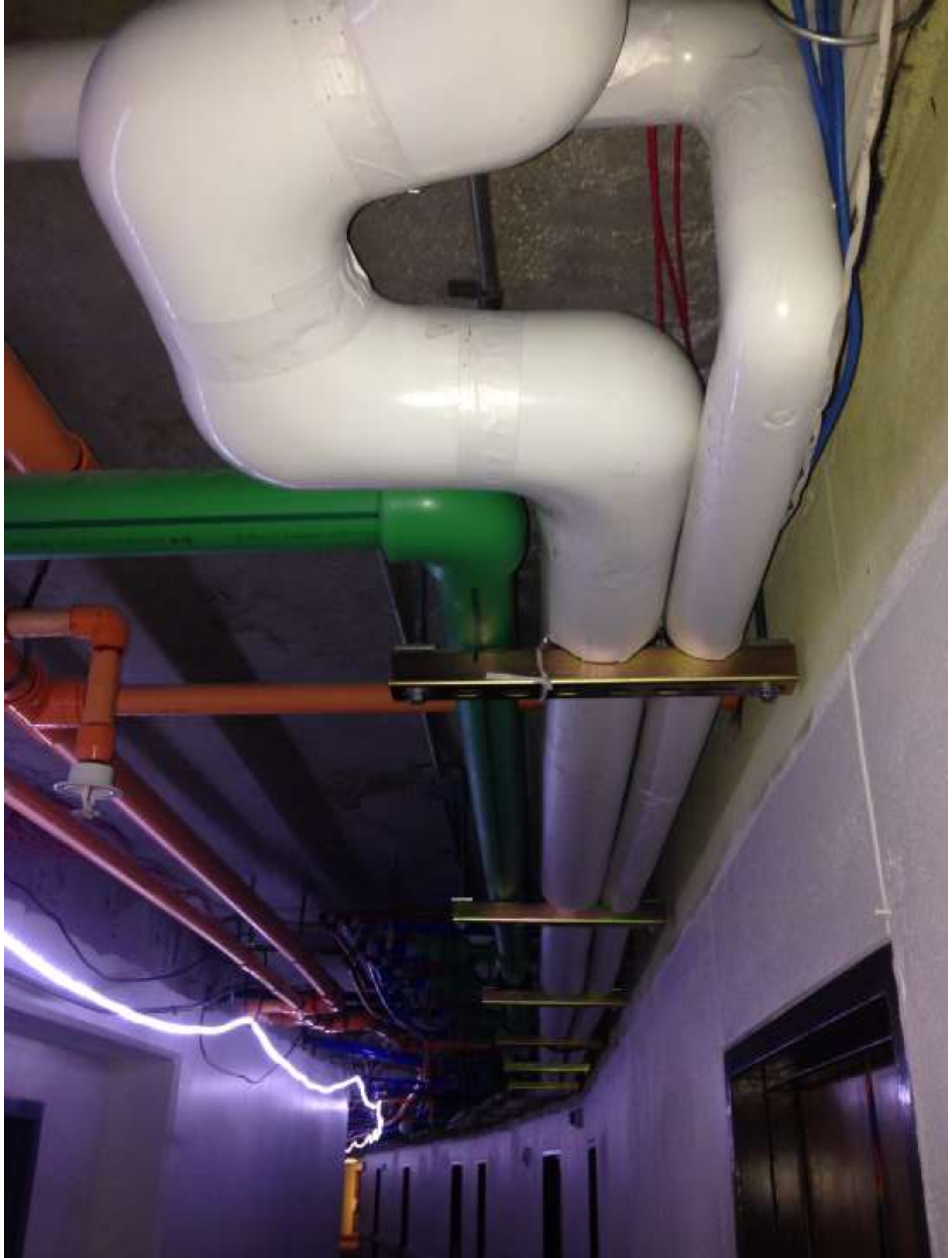
Boiler combustion/ exhaust ducting in place

Main Dom Boiler Header Assembly

Main Dom Boiler
Header
Assembly



Typical Corridor Routing of Water Dist System and Individual Unit Valves



Dom water routing, isolating north from south

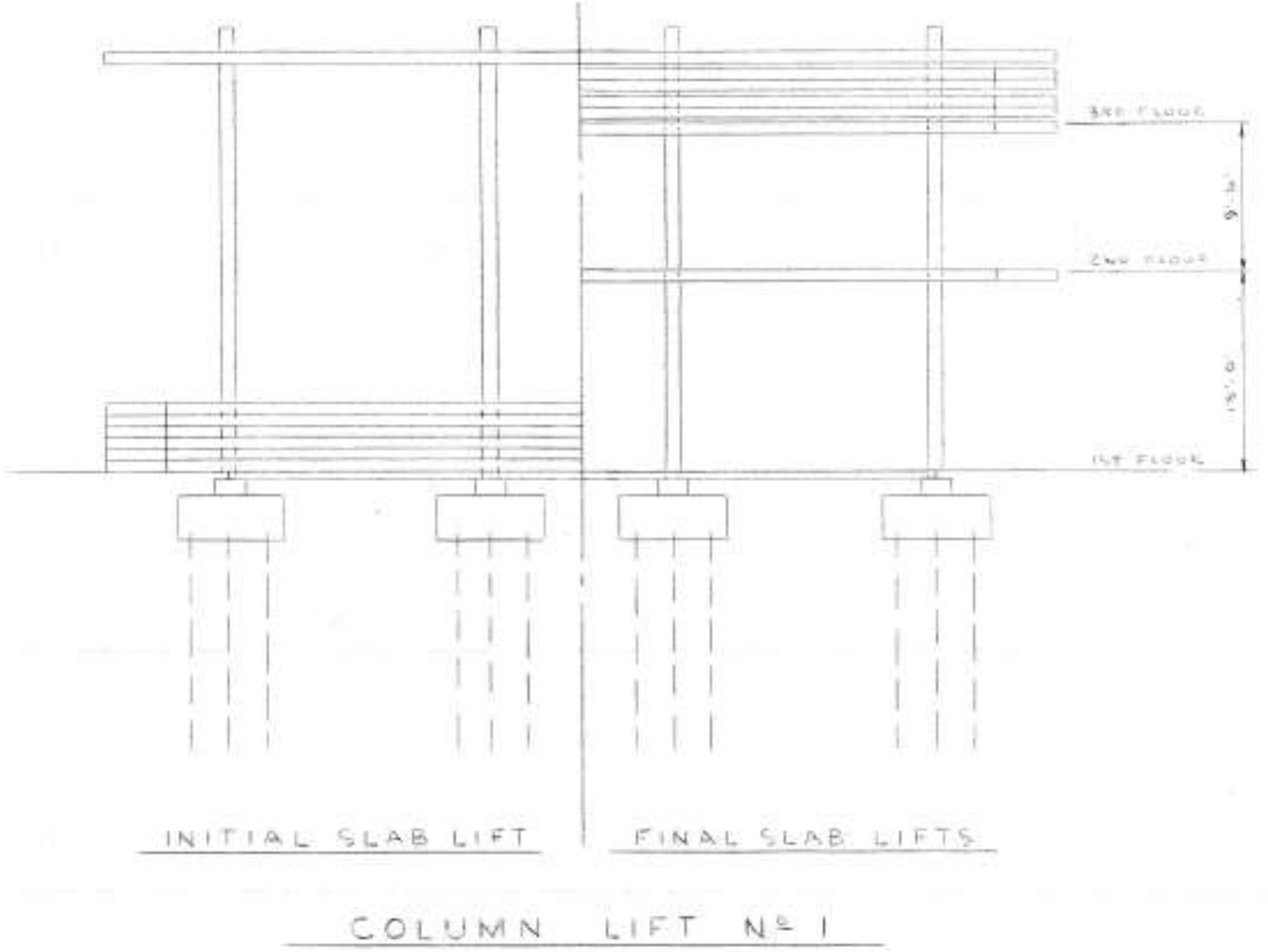
Dom water routing isolating north from south

New PGE Vaults (3) and Associated Duct for Expanded Electrical Service

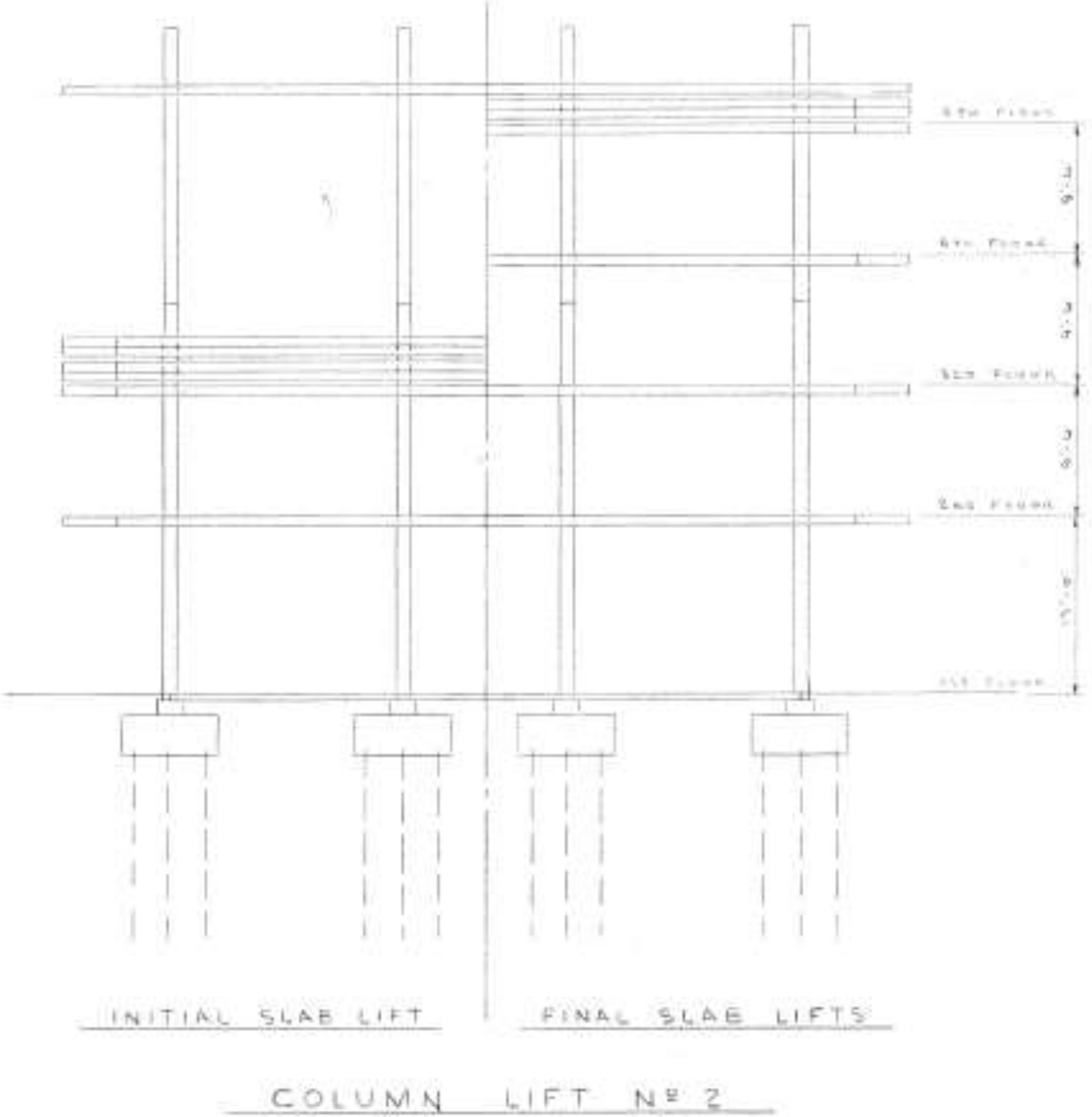
New 277/480vc Service
for new HVAC


IFS Distribution and Transformer Gear to Service Mini-Split Heat Pumps per Unit

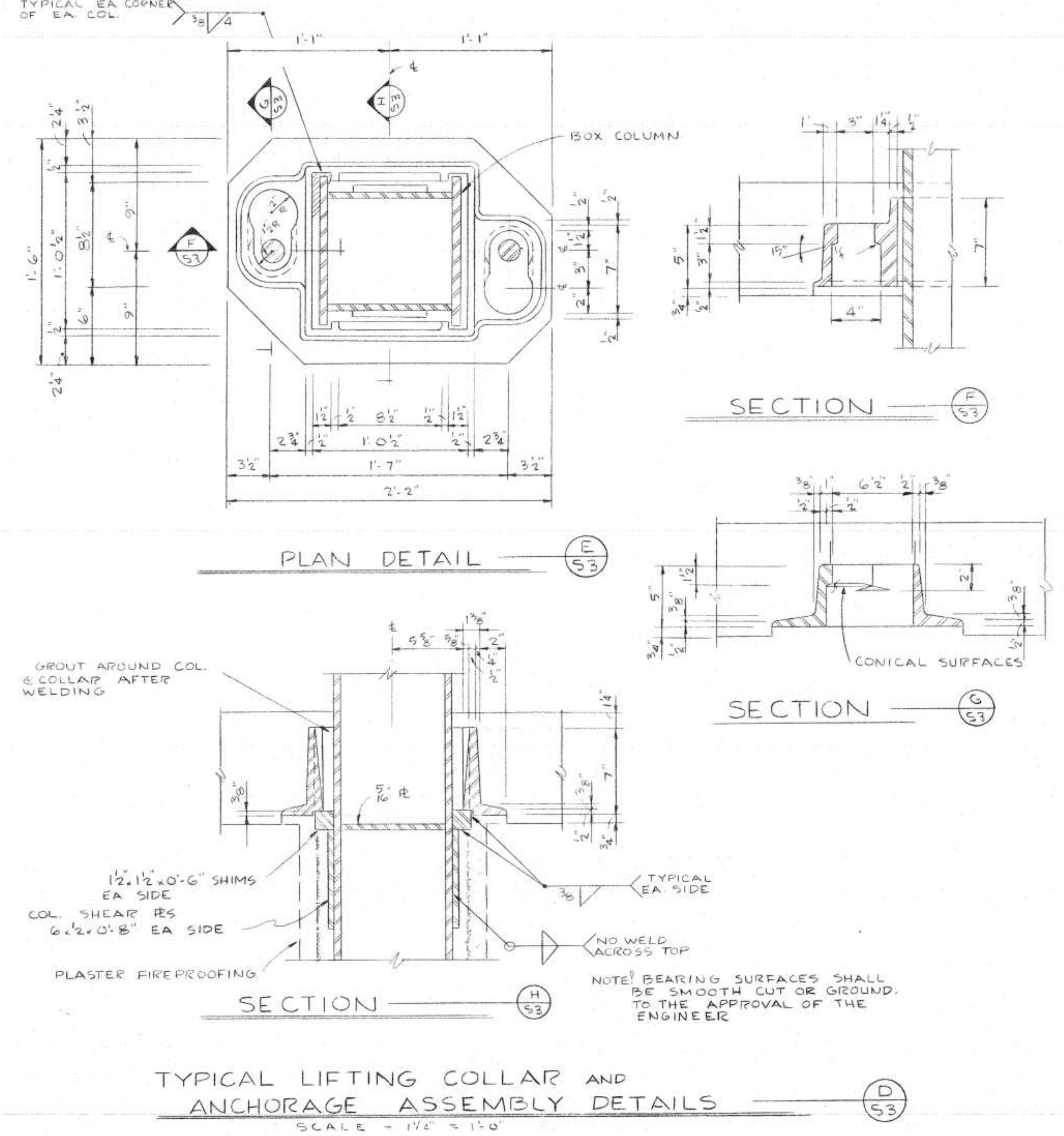

Existing Roof Congested with Cell Service Broadcast Gear (3 Carriers, Each Supporting Multiple Technologies)




Stack slab detail with initial hoisting sequence




Stack slab detail with subsequent hoisting sequence




# PT slab dogging embeds at columns

Wall Fabrication
And
Pre-Application of
WRB

Wall Inventory Ready for Installation

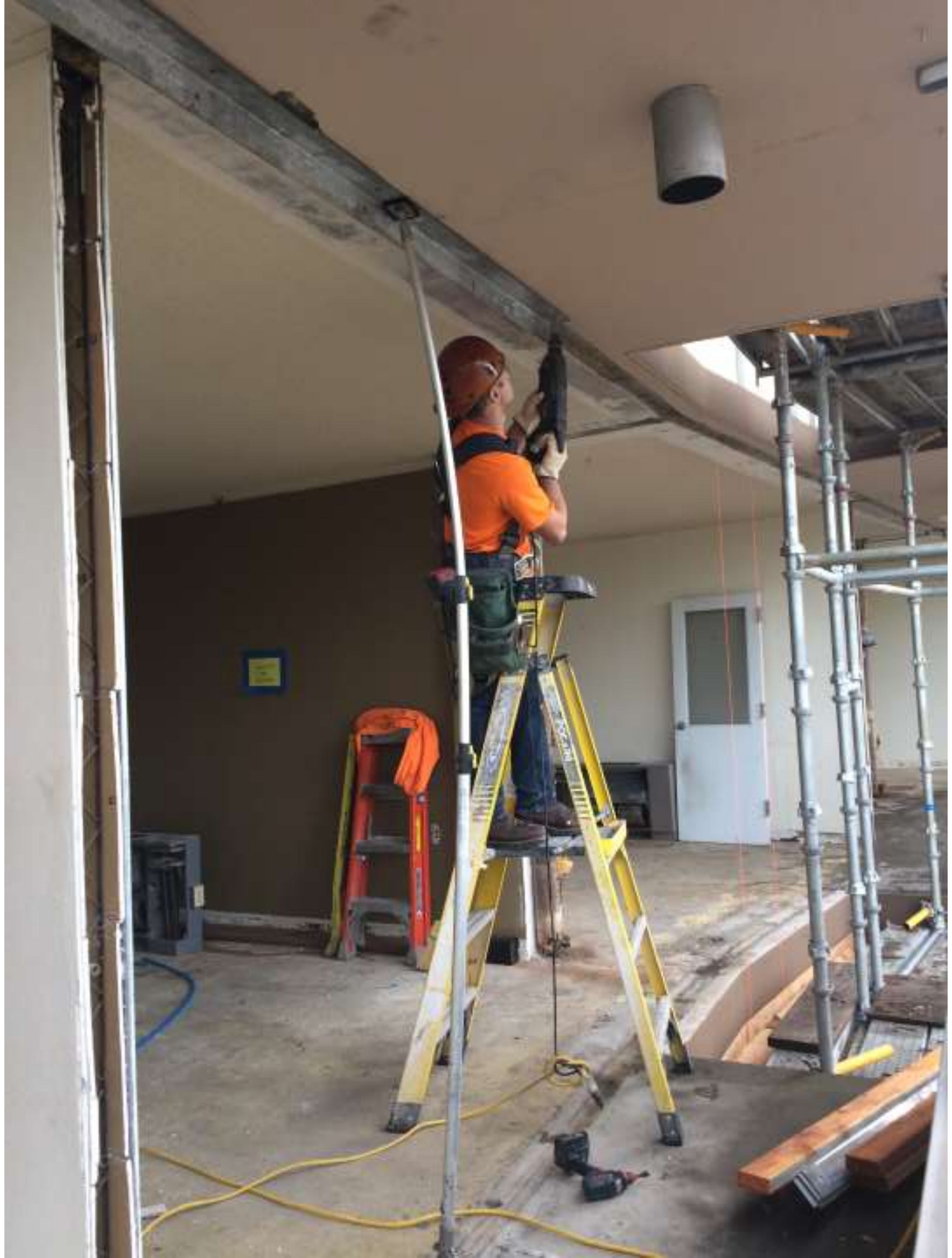
"Flying" Walls into Place as Demo Precedes per Floor


Wall Demo and Abatement of Existing Exterior Components

Installation of Seismic Gap Retaining Angle at Wall Head

Note:

Full Height Jack-Lines to Maintain Wall Plane and Eliminate Apex Drift



Installation of interior deflection head track

Walls Installed and Made Weather-Tight If Inclement Weather Anticipated

Temporary closure of doors & windows for weather

Water-
proofing at
Concrete Decks
Interfaced with
Wall Framing,
Sheathing, & Back
Dam
– 96 hr. Cure Time

Exterior Glazing and Doors Installed, Cladding & Metal Staged

Head-Wall
Seismic Gap
with Backer Rod
Installed Ready
for Caulking

# MEP Penetrations

MEP
Penetrations
Detailed -
Ready For
Rain-screen
Cladding
Cover

Initial horizontal flashings and clips installed

Ceraclad
alignment and
retaining clips

Finished deck coating and flashing interface

Final Product, Ready to Receive New Galv. Steel Railings

Transition Sealants Applied

Completed Installation of Deck Rails, Mini-Splits, And Perf Panel Screens to Finished Zone


Mobilization of Micro-Pile Drilling Equipment into Interior Shearwall Condition

Drilling of Pile No. 2 (of 4) in Building Interior –
Ground Water and Spoils Created Substantial Challenges to an Occupied Building

Typical shotcrete shearwall re-steel full height of building: Pile-cap to roof slab, fully welded to columns

# Questions/ Comments?