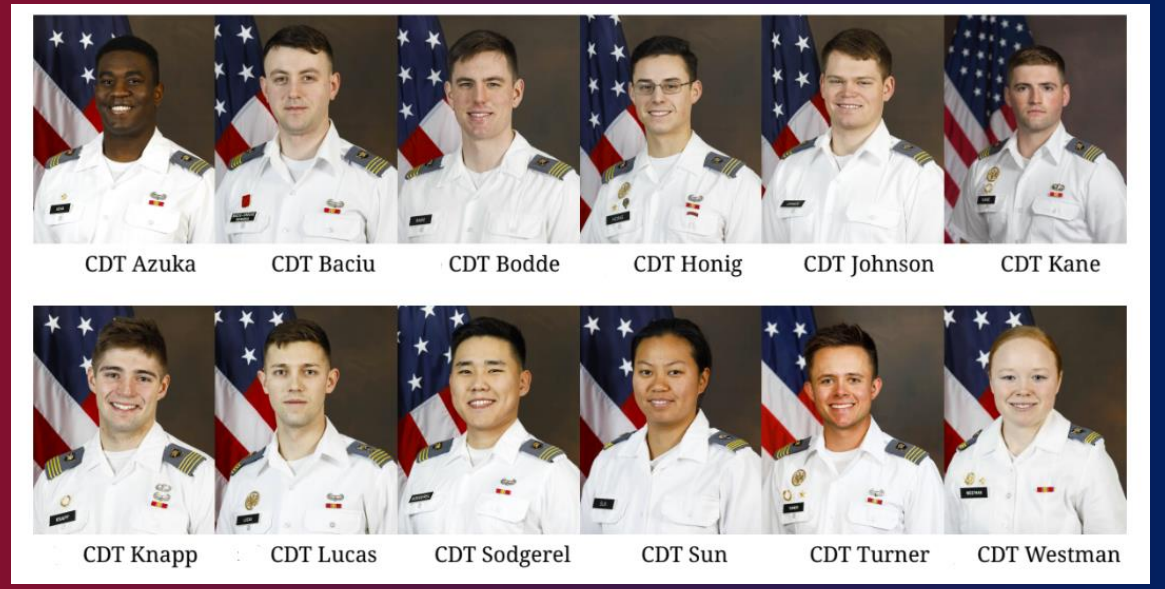
UNITED STATES MILITARY ACADEMY
WEST POINT

ALL AMERICAN ABODE

ALL AMERICAN ABODE
SOLAR DECATHLON
SUBURBAN SINGLE FAMILY
12 APRIL 2019

THE TEAM



12 undergraduate students
6 Academic Majors
12 different home states / countries
11 different follow on duty assignments

THE AMERICAN SOLDIER & FORT BRAGG

PROJECT GOALS

SFC Brown, Mrs. Brown, John and Sarah Brown:

- 10 years in the Army.
- 2 combat deployments.
- 3 family moves to Texas, Washington, and North Carolina.
- Looking to be in the Army for 10 more years.

THE PROBLEM

PROJECT GOALS

Top Army officials visit homes at Fort Bragg

Army reveals plans to improve military housing to Congress

By Sean Kimmons, Army News Service March 7, 2019

RELATED STORIES

MARCH 15, 2019

Garrison, community leaders gathe... Fort Campbell to discuss partnerships

BASE HOUSING

Army Secretary calls military housing problems 'unconscionable'

By Rachael Riley, The Fayetteville Observer | March 03, 2019 at 11:56 AM

NEWS

Fort Bragg officials on Wednesday said they estimate that 1 to 2 percent of the 6,150 homes in the installation's family housing program have "significant challenges" that need to be addressed.

BUY PHOTO

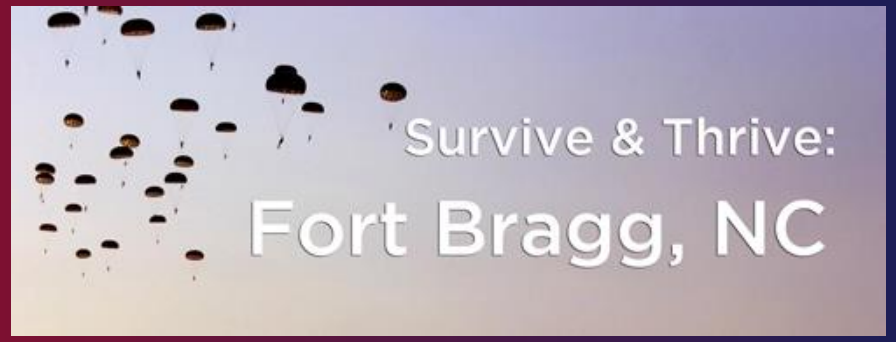
Pennalla Evans is a military spouse who said she has been dealing with housing issues, including mold, at Fort Bragg. [Melissa Sue Gerrits/The Fayetteville Observer]

HIDE CAPTION

Fort Bragg, Corvias officials provide update to housing issues

HOUSING MANAGEMENT

PROJECT GOALS



Bragg Dynamic:

- 70% live off post
- 6,100 homes
- 10 unique communities
- 7 pay-grade specific
- 2,770 built before 1978

Garrison Command:

- Oversight and quality and control
- Reimbursed by Corvias for utilities
- In charge of Department of Public Works
- Military authority for housing

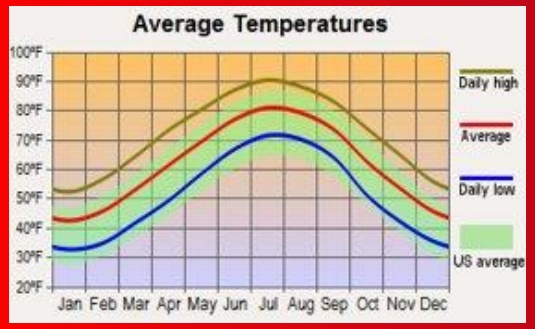
Privatized Housing:

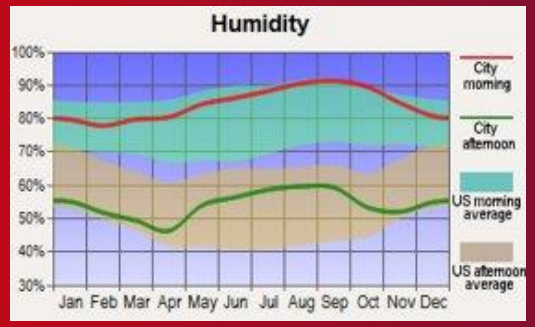
- 35-year renovation plan
- Desire green building, have funding
- Construction, O&M
- Subsidized by housing allowance / federal funding

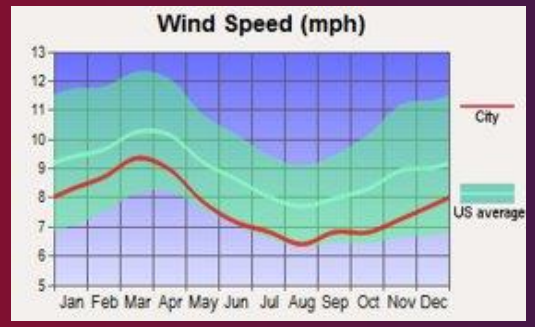
Corvias®

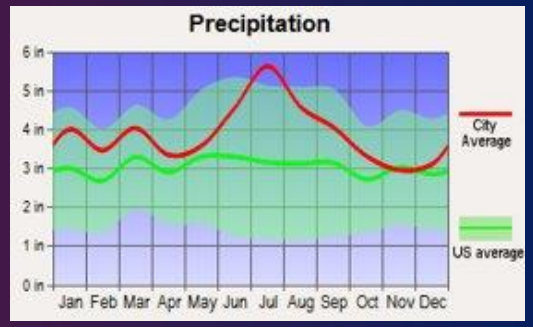
FORT BRAGG & ANZIO ACRES

PROJECT GOALS





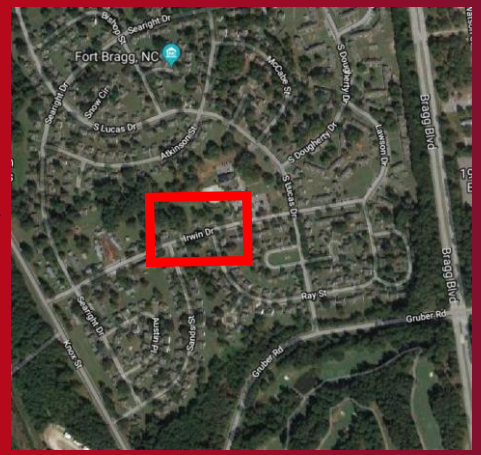




Founded: September 4th, 1918
Population: 39, 457

Total Area: 252 sq. Mi
Time Zone: EST
Cumberland County, NC

HDD: 2800
Latitude: 35.14 N
Sunny Days: 219



0.22 acre plot
2 adults, 2-3 kids

PROJECT GOALS & CONSTRAINTS

PROJECT GOALS

Race to Zero

Affordable
Energy Net-Zero
Market Ready

Army

Affordable
Net-Zero Initiative
Complies to UCF

Team Goals

Net-Zero Home
Easily Constructible
Affordable
Proactive Maintenance
Features Smart Tech
Commercial Products

Occupant Needs

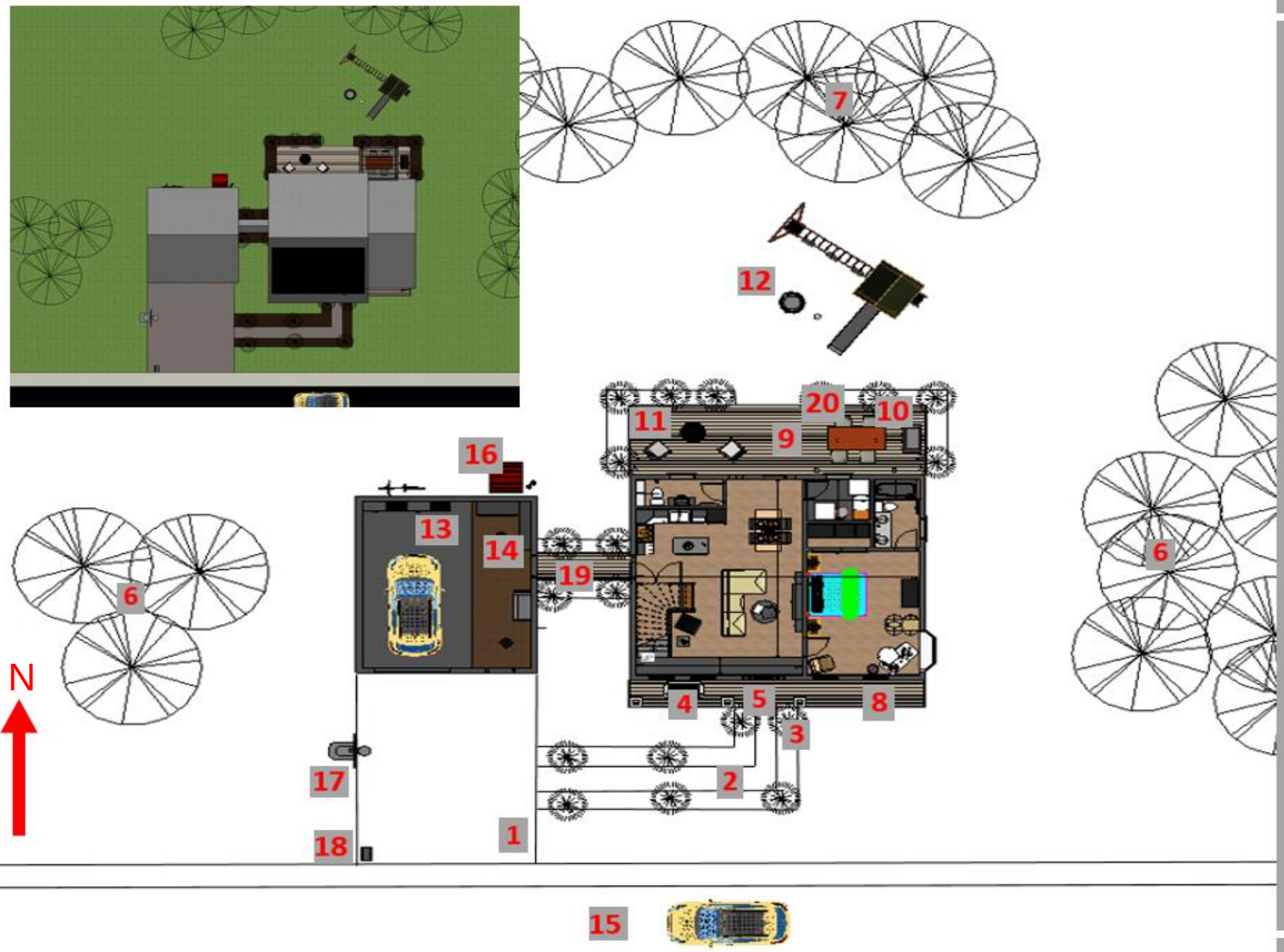
Quality of Life
Ease of Use
Aesthetics

Corvias Needs

Easy Maintenance
Low Upkeep Cost

SITE PLAN

PROJECT GOALS



LEGEND

1 Driveway
2 Walk-Way
3 Shrubs in Mulch
4 Porch Swing
5 Historic Architectural Features
6 Deciduous Trees
7 Evergreen Trees
8 Porch
9 Deck
10 Outdoor Eating
11 Fire Pit and Seating
12 Playground Space
13 Equipment Storage
14 Work Station
15 Irwin Drive
16 Doghouse
17 Basketball Hoop
18 Mailbox
19 Open Breezeway
20 Pergola

EXTERIOR DESIGN

PROJECT GOALS

OPTIMIZED VIEWS


COMMUNITY CONNECTION



SOLAR PERFORMANCE



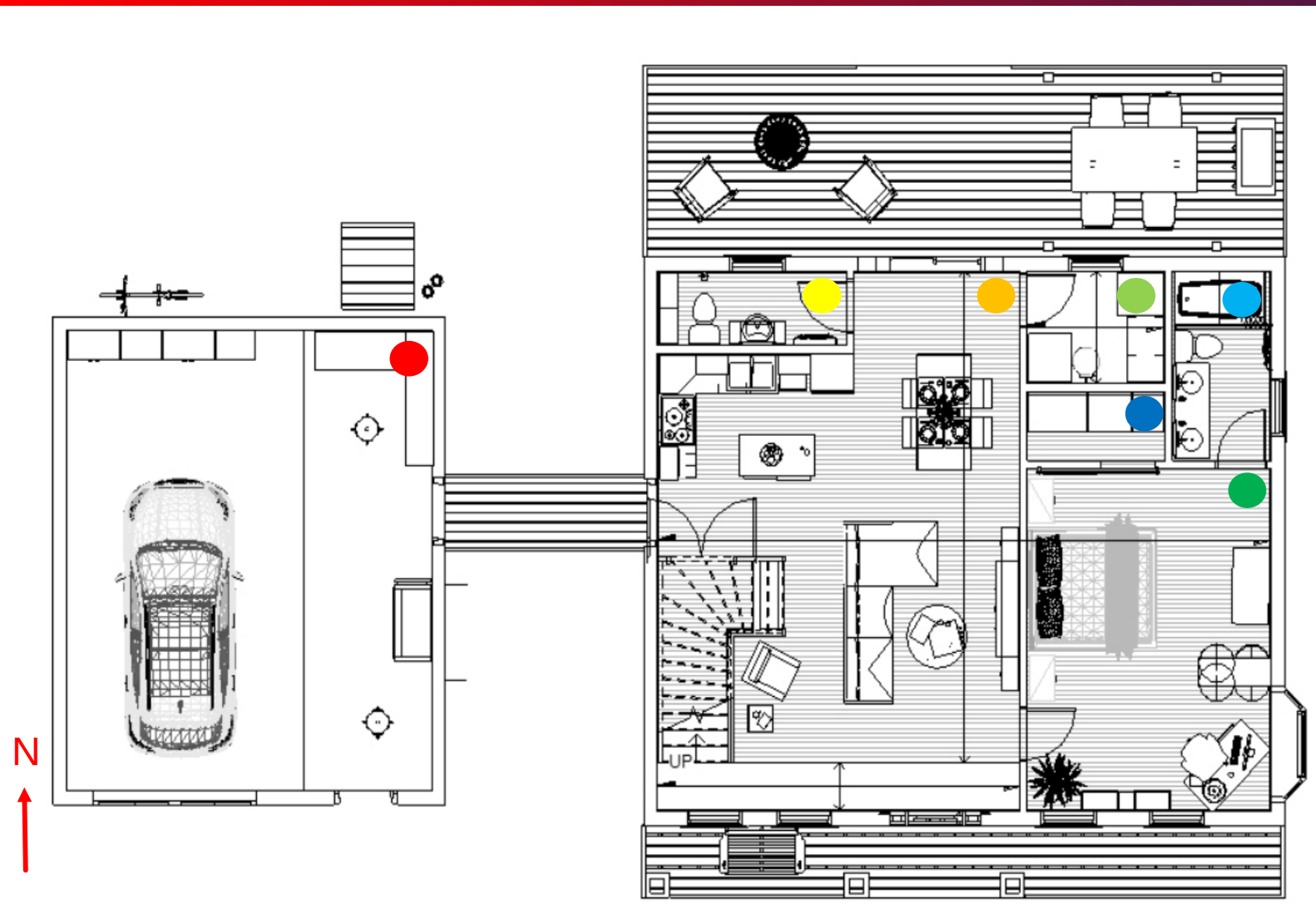


HEATING AND COOLING



FIRST FLOOR

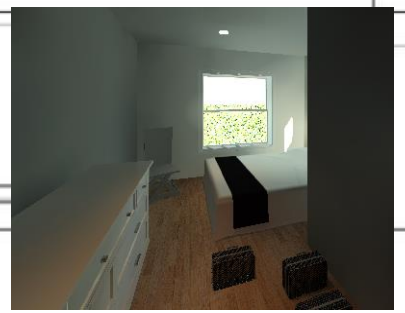
PROJECT GOALS



Square Footage		
Garage	481 SF	
Living, Dining, Kitchen	514 SF	
Half Bathroom	40 SF	
Laundry/Utility Room	45 SF	
Master Bedroom	240 SF	
Master Bathroom	54 SF	
Master Closet	27 SF	
First Floor	920 SF	

FUNCTIONALITY » EFFICIENCY » SIMPLICITY

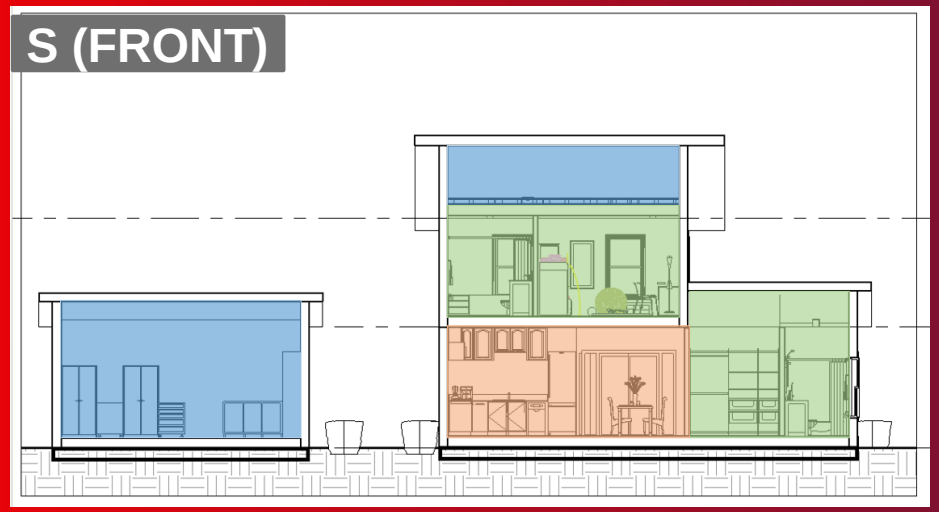
SECOND FLOOR

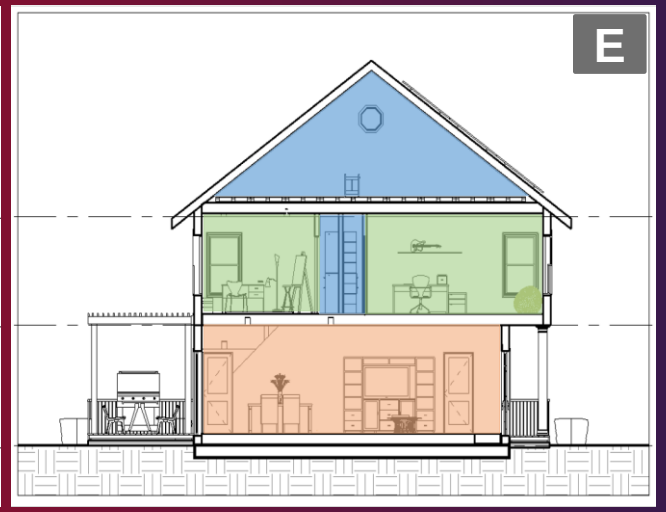


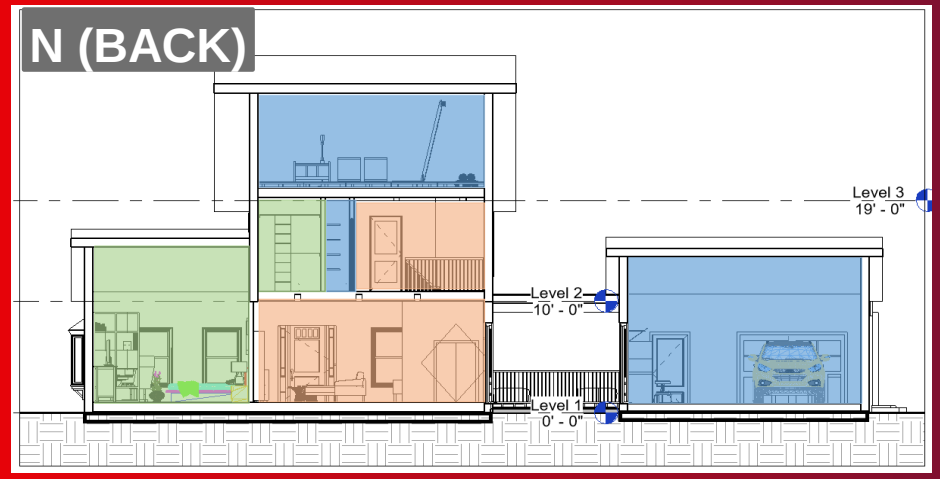
Square Footage		
Landing	60 SF	
Adaptable Room	115 SF	
Full Bathroom	76 SF	
Linen Closet	9 SF	
Bedroom Closet	10 SF	
Bedroom	126 SF	
Bedroom	130 SF	
Second Floor	536 SF	
Attic	624 SF	

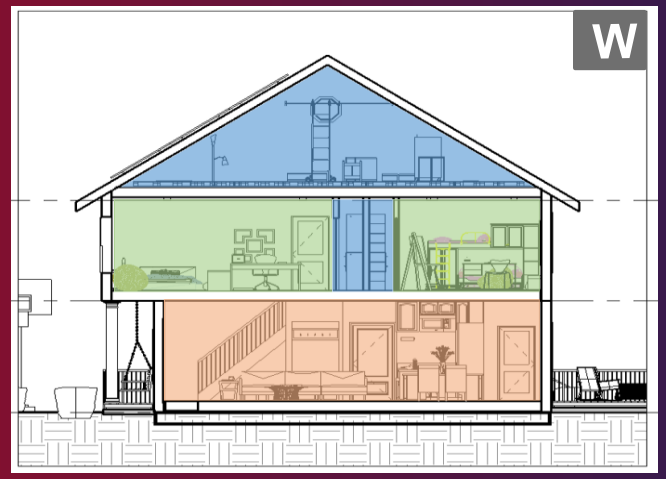
FUNCTIONALITY » EFFICIENCY » SIMPLICITY

HOME TOUR









STORAGE

PUBLIC

PRIVATE

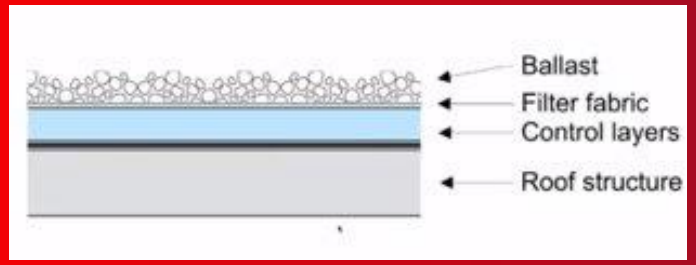
INTERIOR DESIGN

PROJECT GOALS

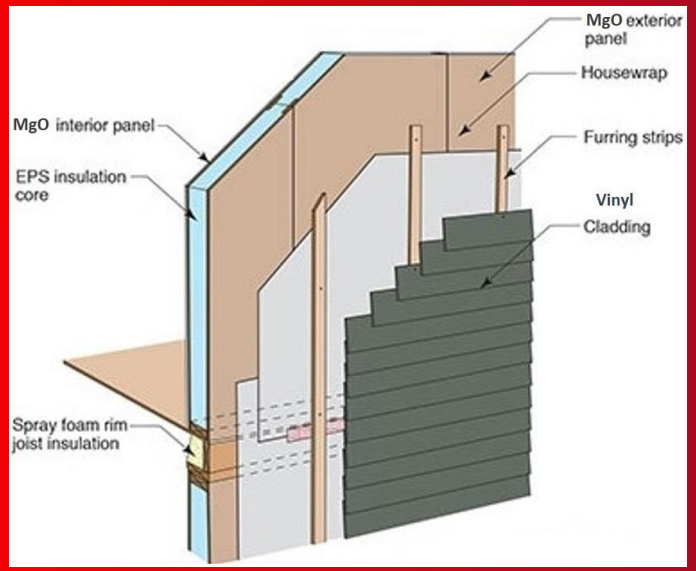
BUILDING SYSTEMS

PROJECT GOALS

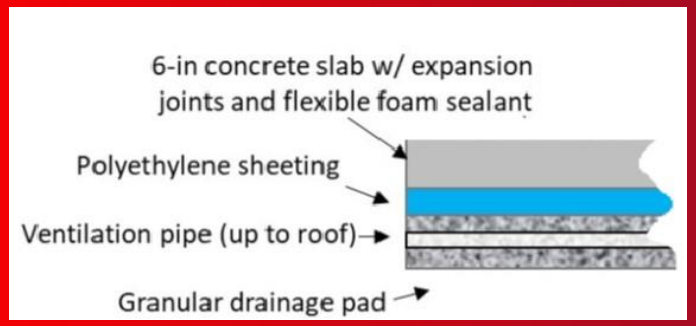
R-21

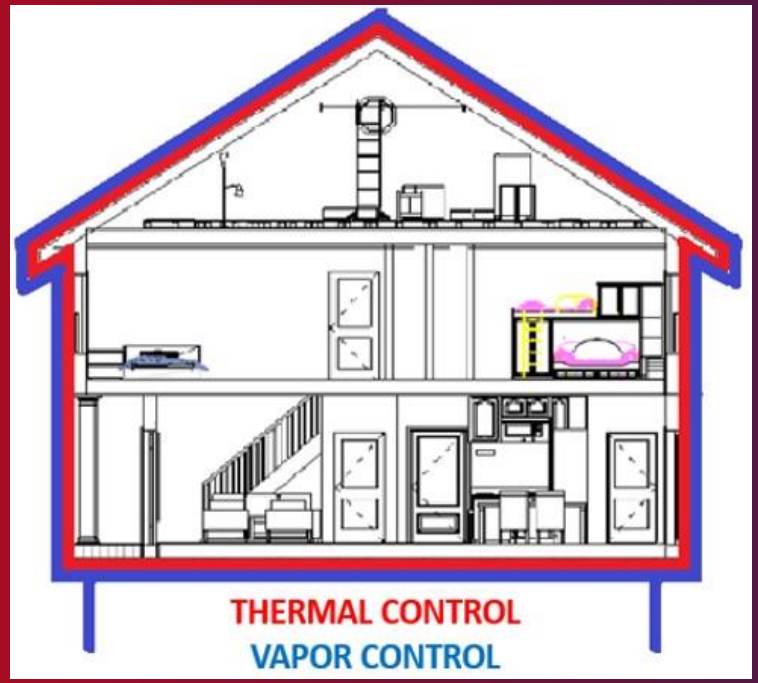


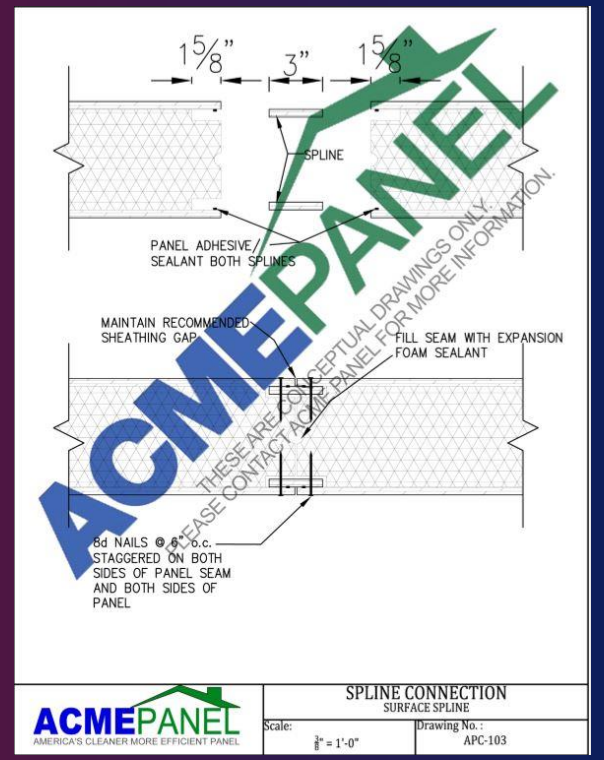
R-21



R-7







MECHANICAL SYSTEMS

Geothermal Heat Pump- WaterFurnace 5 Series 500A11-026

- COP 4.5
- EER 26
- Horizontal loop

A.O. Smith 50-Gal Electric Heat Pump Hot Water Heater

- 3.42 EF
- 10-year lifespan

Fantech ERV 2004N Series

- 225 cfm
- 75% effective at 0 degrees C
- 52% effective at 95 degrees F
- Humidity control

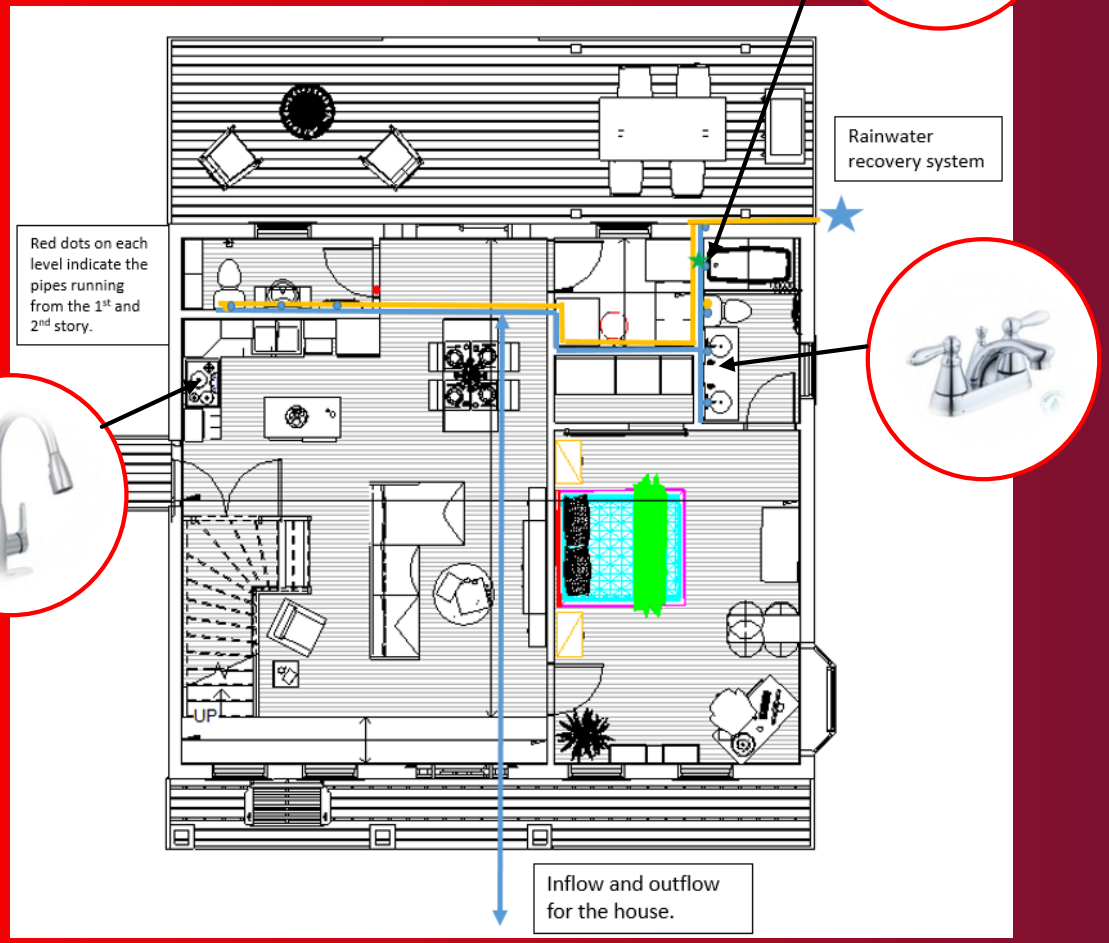
INDOOR AIR QUALITY

PROJECT GOALS

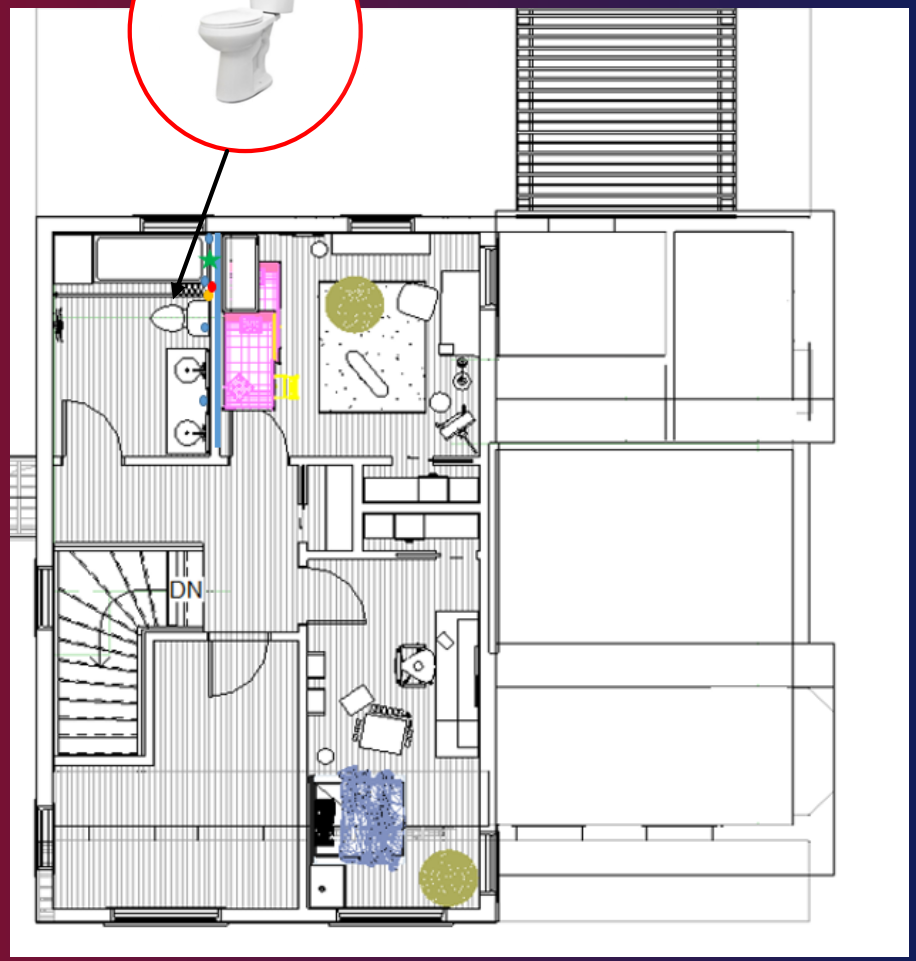
Pollutant	Outdoor Level (NAAQS)	Ventilation Threshold (For best health) (Vent at rate required for room)	Ventilation Threshold (0 occupants) (Vent at rate required for room)	Emergency Ventilation Threshold (Vent at max allowable rate)
Carbon Dioxide	350 ppm	800 ppm	>1000 ppm	> 2000 ppm
Carbon Monoxide	0-0.1 ppm	9 ppm	>70 ppm	>150 ppm
PM-2.5	0 -0.035 ppm	0.012 ppm	> 0.055 ppm	> 0.1 ppm
Radon	0.4 pCi/L	> 0.4 pCi/L	0.4 pCi/L -4 pCi/L	> 4pCi/L
Humidity		<30% - >60%	<30% - >60%	<30% - >60%
Temperature		62-74 F Winter 72-80 F Summer	N/A	N/A

- Based on researched standards for each pollutant.
- Automated maintenance of comfort levels throughout the home.
- Required ventilation provided while being as energy efficient as possible.

PLUMBING SYSTEM



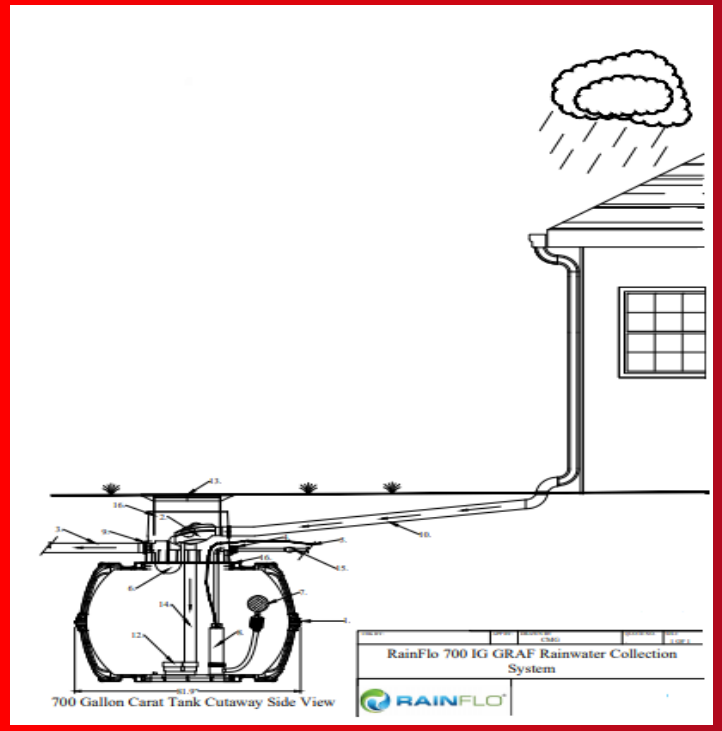
First Floor Plumbing Layout



Second Floor Plumbing Layout

WATER MANAGEMENT

PROJECT GOALS



Fixture	Flow Rate	Baseline
Toilet	1.1/1.6 gpf	3 gpf
Shower	1.8 gpm	2.1 gpm
Bathroom Faucet	1.2 gpm	2.2 gpm
Kitchen Faucet	1.5 gpm	2.2 gpm
Dishwasher	2.8 WF	3-5 WF

Rainwater Recovery:

- 6000+ Gallons per year recovered
- Use for clothes washing and toilet flushing.

Drain Water Heat Recovery:

- Up to 67.5% efficient system
- Placed on each shower fixture.
- 12.5 kW of heat recovery

Low Flow Plumbing Fixtures:

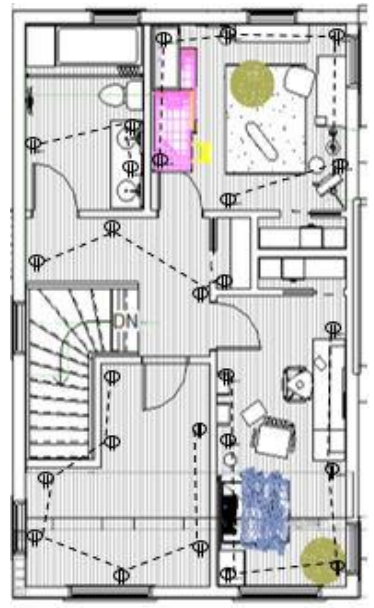
- 42% reduction from baseline
- EPA Water Sense Qualified

PLUG LOADS

Highlights:

- Energy Star Appliances
- Energy Monitoring
- Smart Plugs
- Electric Car Charging

First Floor



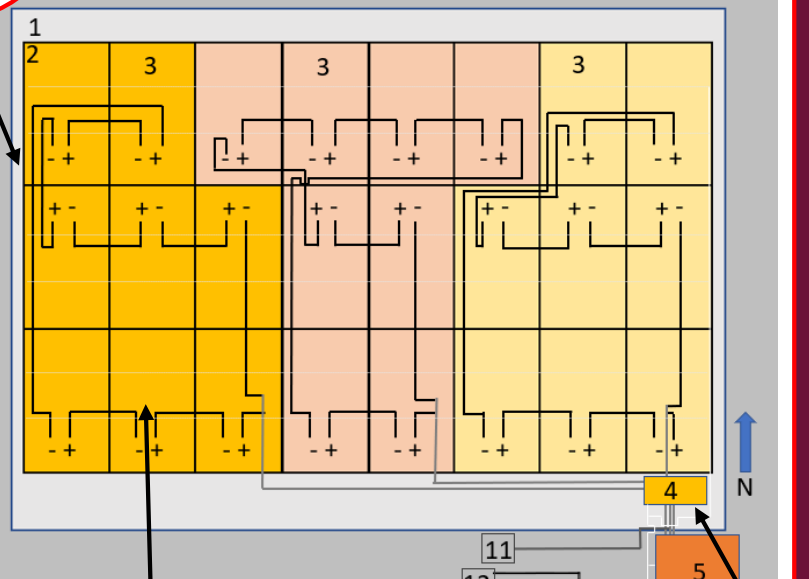
Second Floor

Note: Design meets NEC and was reviewed by certified electrician

PV ARRAY

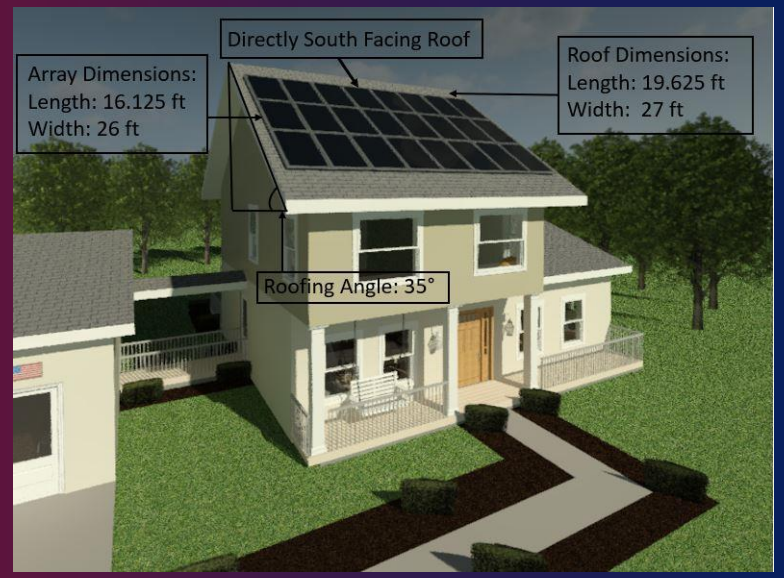
PV Array Key:
1) Roof
2) 7,440 Watt PV Array
3) 310 Watt Panel
   - String A:
   - String B:
   - String C:
4) Rapid Shutdown control
5) SMA Inverter (DC Disconnect)
6) AC Disconnect
7) AC Service panel with PV breakers
8) Sense Energy Monitor
9) Utility Meter
10) Connection to Utility Grid
11) Input to DC lighting
12) Emergency Outlet

Line Diagram:
- Polar DC Wire: —
- String DC Connection: —
- AC Connection: —
- Grounding Wire: —
- Mounting System: —
- DC input wire: —



Highlights:

- Direct Energy Sellback
- 10,279.2 kWh/yr
- $2.45/Watt
- Pending full UFC compliance*



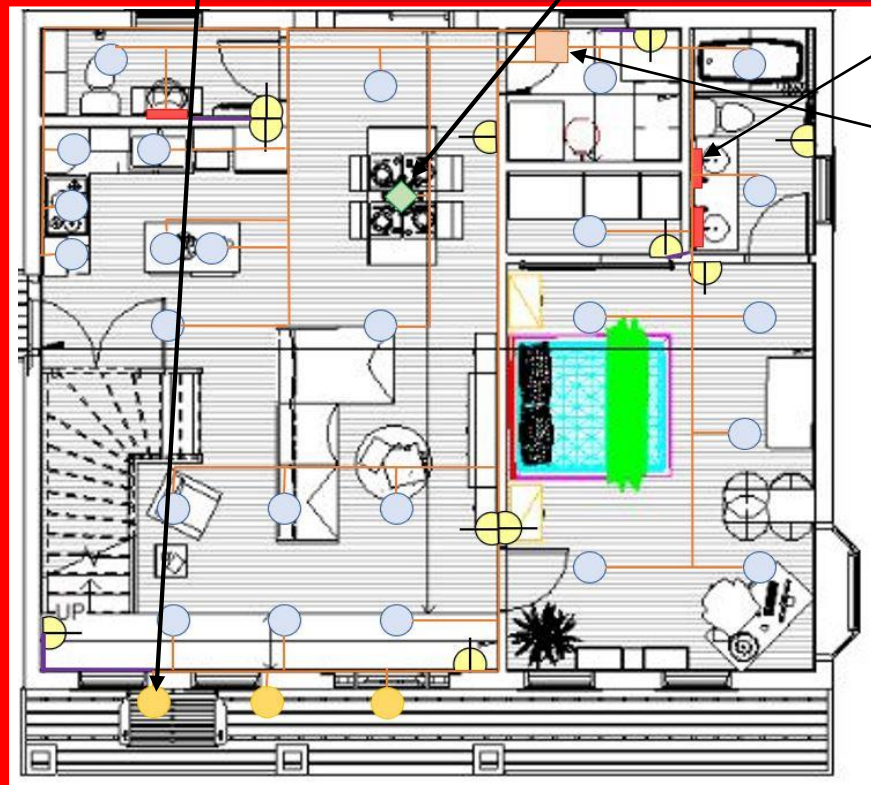
*Note: UFC takes precedent over NEC

LIGHTING

PROJECT GOALS

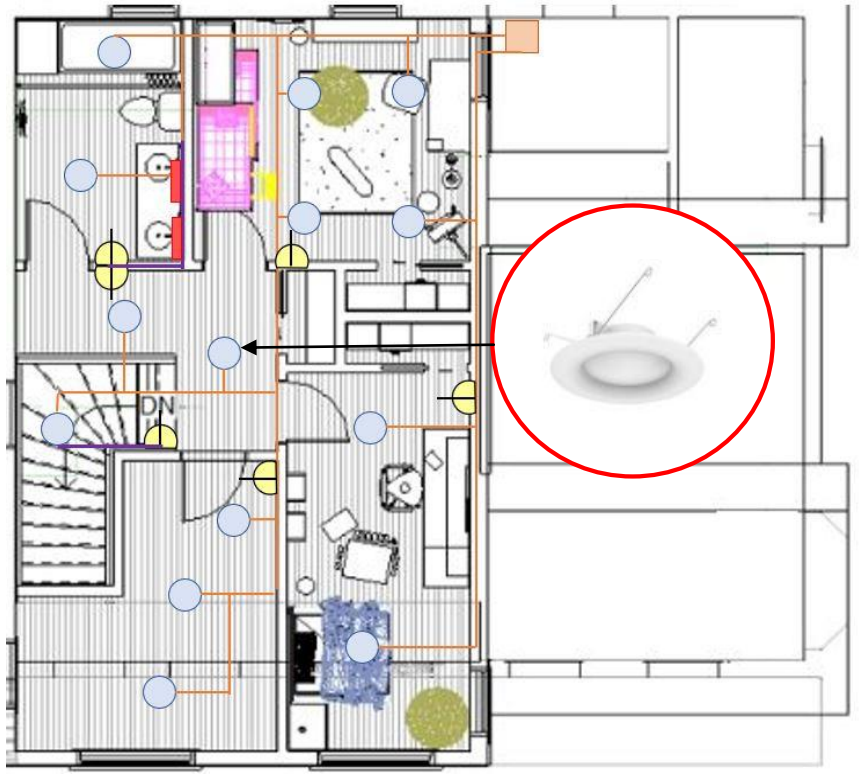
Highlights:

- DC LEDs – driver efficiency
- Energy Star Choices
- Smart dimming capability
- PV integration
- Seasonal Affectiveness Disorder



KEY

- Switch
- 16W Vanity Light
- 9W Outdoor Recessed Downlight
- 10W Recessed Downlight
- 14W Ceiling Diffuser
- IMA-1000W 48 V AC-DC Converter



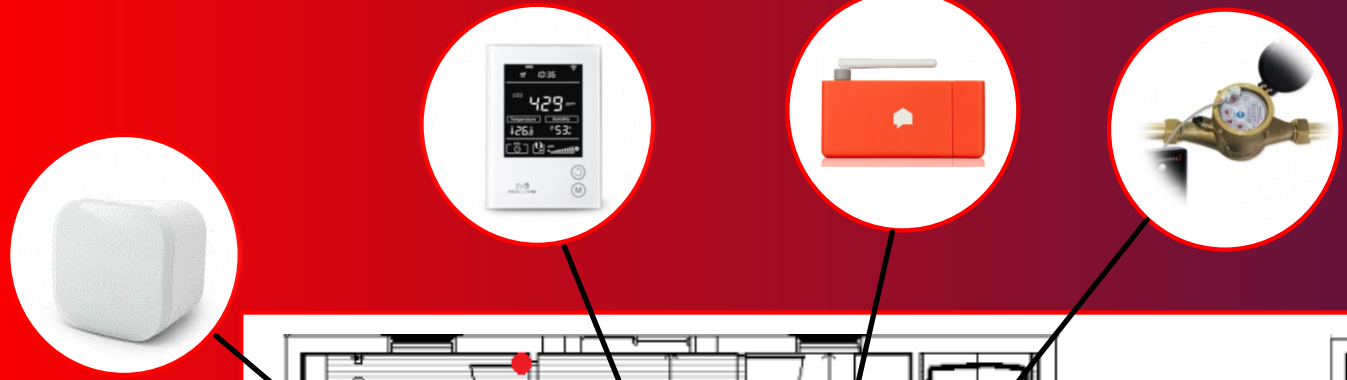
First Floor

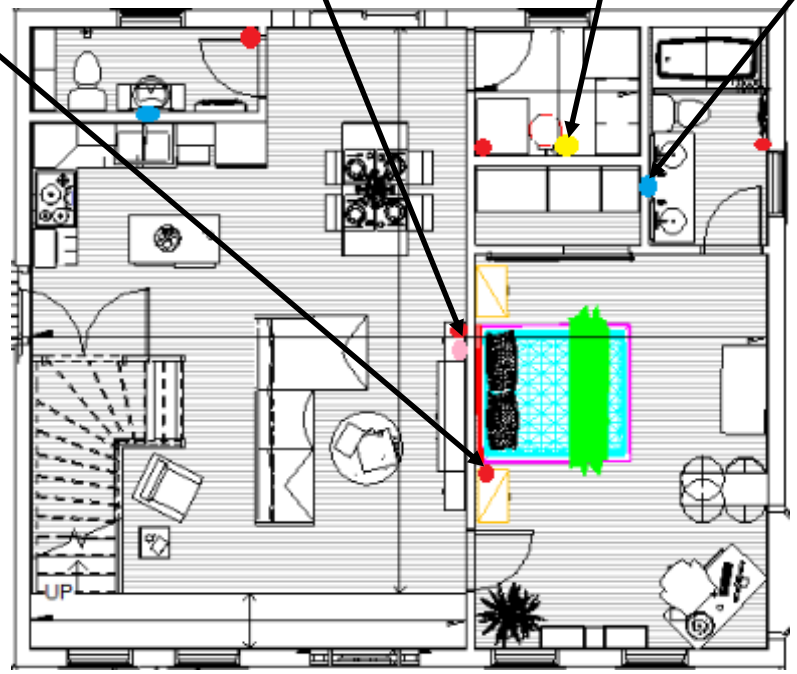
Second Floor

SMART CONTROL AND SHADING

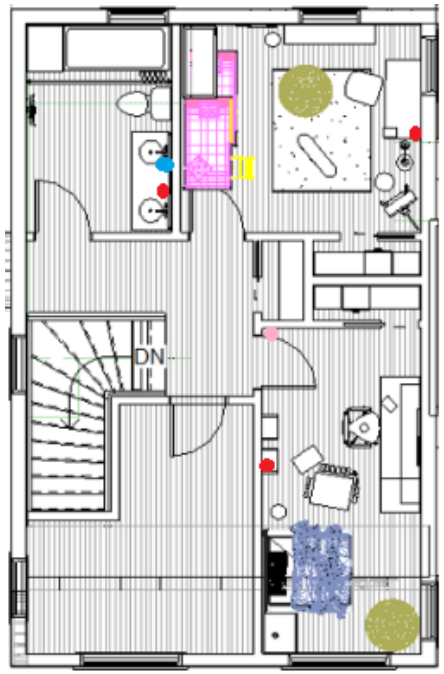
Highlights:

- Automated Control
- Z-wave implementation
- Sensing
- Energy Savings
- Improved Livability





First Floor



Second Floor

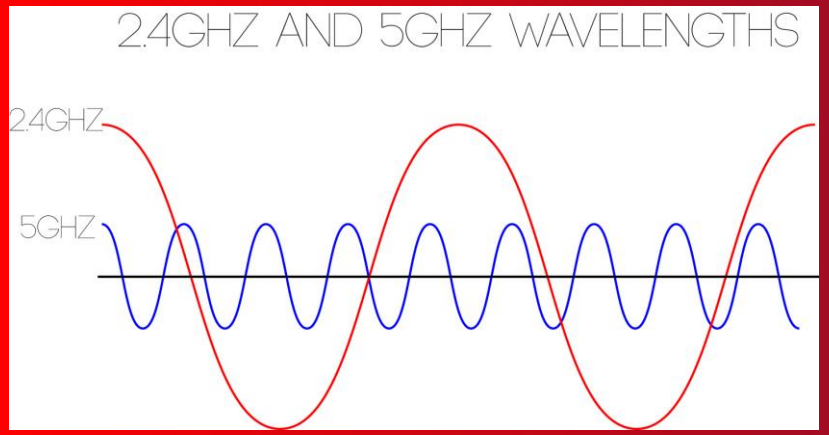
Water Use Sensor
Air Quality Sensor
Motion/Temp/Light Sensor
Current Sensor

NETWORK RESILIENCE

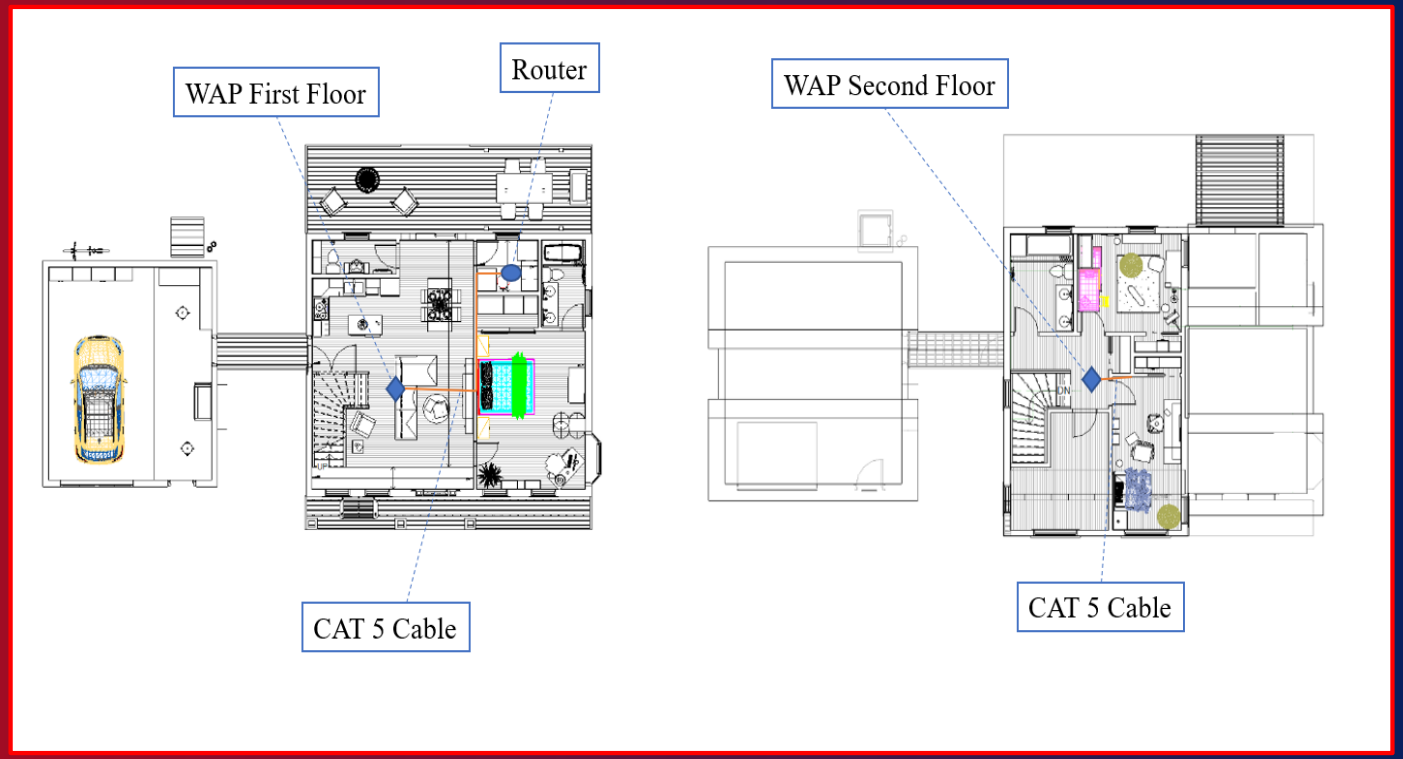
PROJECT GOALS

Highlights:

- Network & device segregation.
- Speed
- Security



Wavelength Comparison

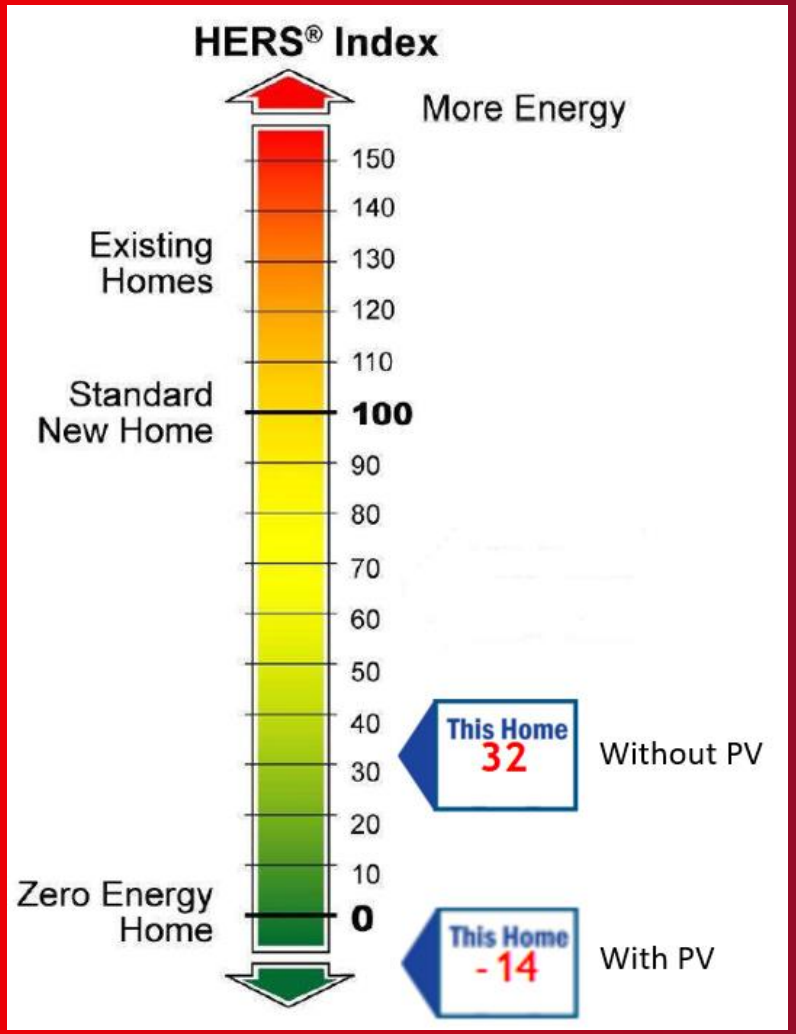


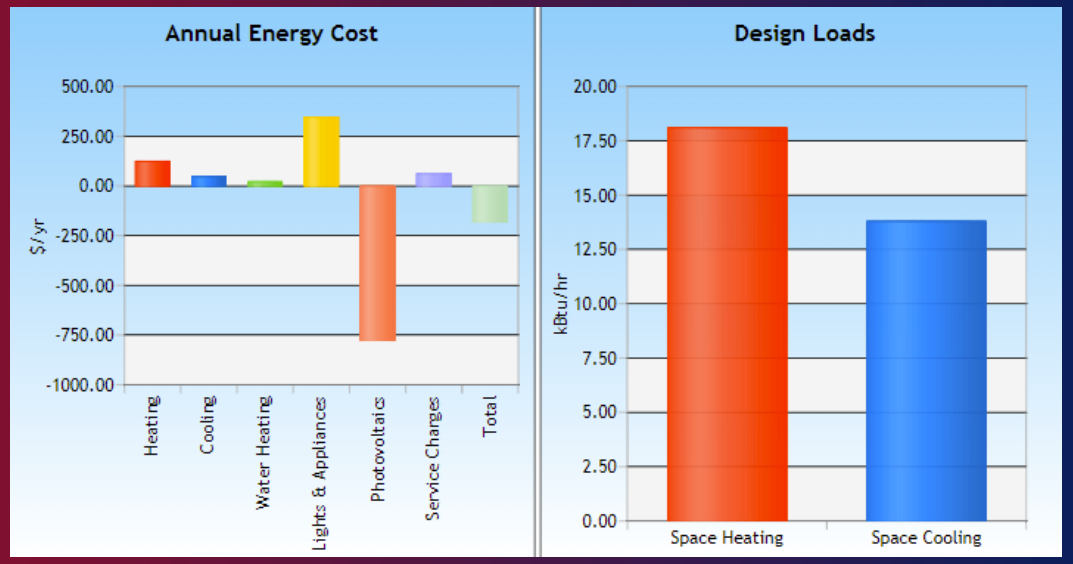
First Floor

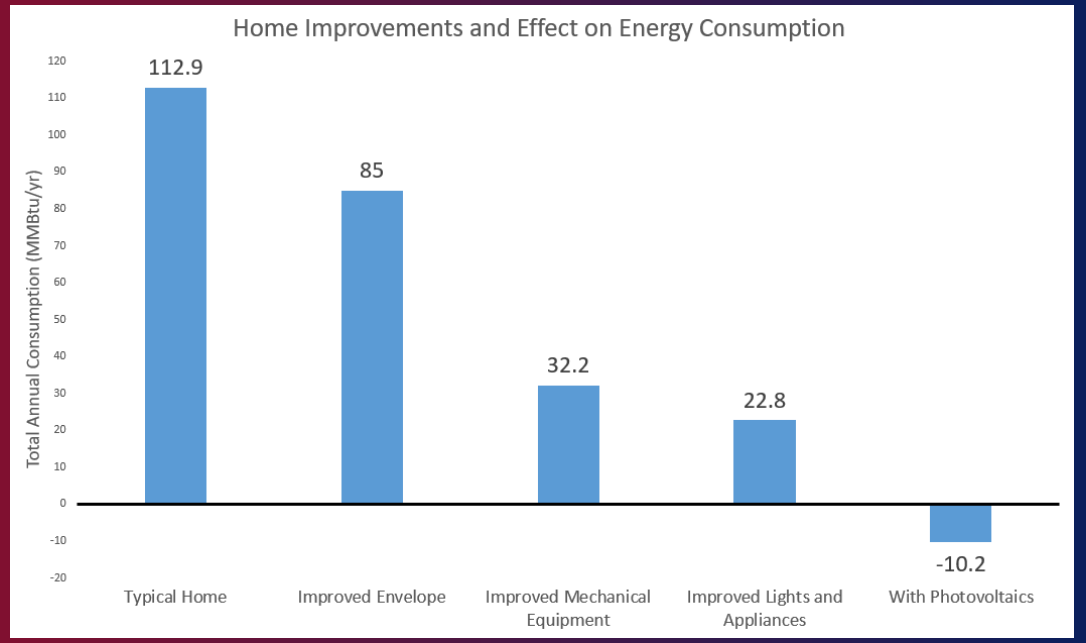
Second Floor

ENERGY PERFORMANCE

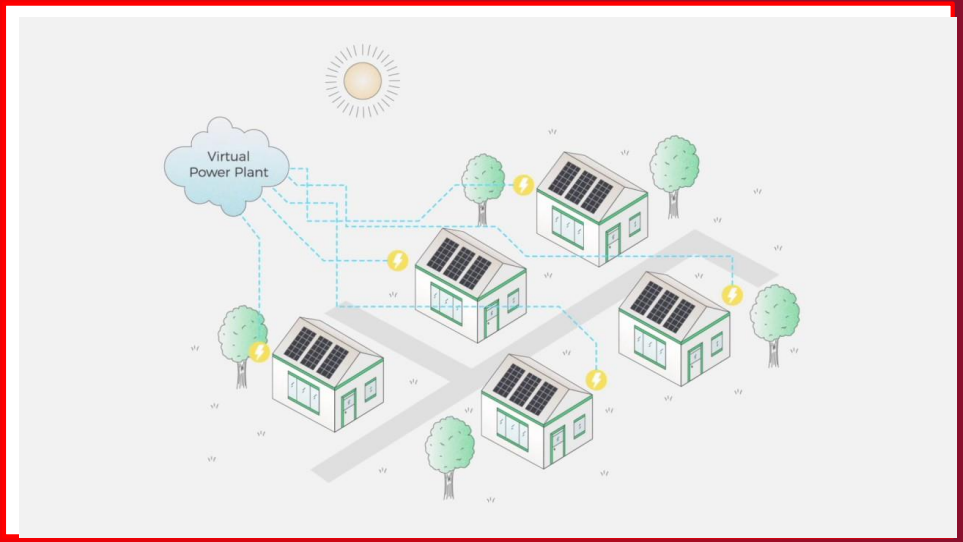
PROJECT GOALS







ENERGY



Energy Dynamic:

- Army Net-Zero initiative
- Smart Tech impact
- Overproducing Energy: 3000 kWh/yr
- Energy Storage
- Virtual Power Plant

SANDHILLS UTILITY SERVICES, LLC

FINANCIAL ANALYSIS

Realistic

- Tangible estimates through team members and industry experts, based on sound decisions

Affordable

- Within the housing allowance of the soldiers and families that live there

Feasible

- Able to easily replicate All-American Abode in construction and costs

Forecast

- Effectively determine the cost of All-American Abode for the next five years

REALISTIC CONSTRUCTION METRICS

Present Building Cost: $194,418

Sale Price: $264,911

Construction Time: 108 days

Corvias Profit: $37,237

Order Totals	
Taxable Subtotal	$9,763.11
Sales Tax @ 7%	$683.42
Non-taxable Subtotal	$0.00
Total	$10,446.53
Deposit Received	$0.00
Amount Due	**$10,446.53**

Walls								Weighted Scores				
Value Measure	Swing Weight	Global Weight	Stickbuilt	SIP	ICF	Xi Walls	Perfect Score	Stickbuilt	SIP	ICF	Xi Walls	Ideal Solution
Total Cost	8	0.286	36000	20000	40000	40000	20000	15.873	28.571	14.286	14.286	28.6
R-value	10	0.357	11	24	22	15	24	16.369	35.714	32.738	22.321	35.7
Thickness (in)	5	0.179	5	6.5	8	8	5	17.857	13.736	11.161	11.161	17.9
Installation Time (days)	5	0.179	22	2	3	2	2	1.623	17.857	11.905	17.857	17.857
Total Weight	28	1.000						51.723	95.879	70.089	65.625	100.0
			Scoring Function	"=((RawScore)/(PerfectScore))*GlobalWeight"								
			Decision	SIP (Structurally Insulated Panel) from ACME Panel								

FEASIBILITY AND AFFORDABILITY

Housing Allowance:

- Annual: $17,568
- Monthly: $1,464
- Average salary for a senior enlisted soldier: $57,000

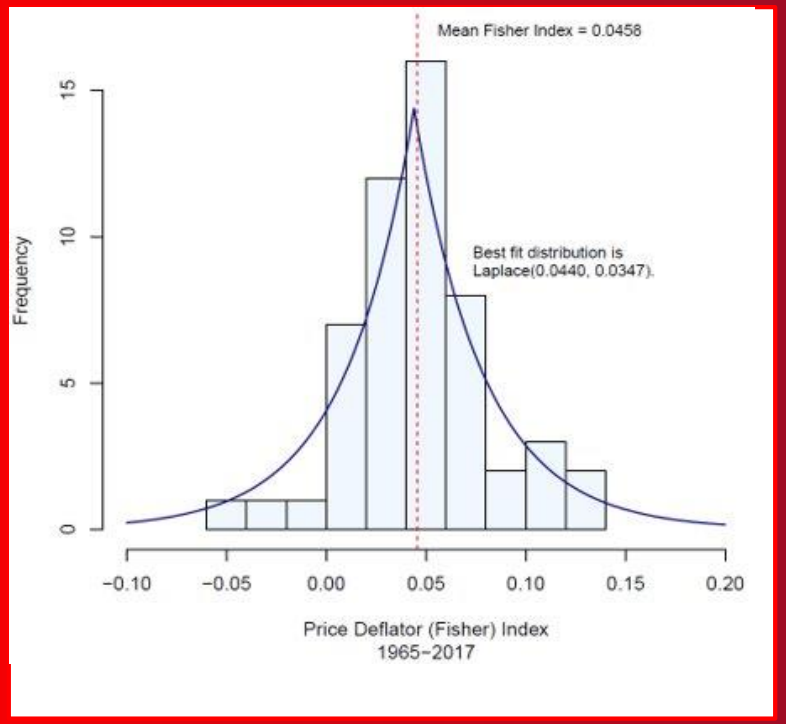
Monthly Payments:

- Mortgage: $1,316
- Payback on construction: $798

Competition:

- Median Fayetteville House Value, 3BR (Zillow): $139,200
- Building for a different market
  - Affordable for military, within housing allowance
  - Younger soldiers live in the barracks

TIMELINE AND FORECASTING



- Fisher Index to model inflation and OMB Circular discount rate to bring back to 2019 dollars.

- Build Year 0-1: $264,911
- Build Year 1-2: $276,556
- Build Year 2-3: $288,728
- Build Year 3-4: $301,444
- Build Year 4-5: $314,727

FINAL OVERVIEW

Relevant Project Data and Cost Estimates

- Structure: 1,456 S.F. home on 0.22 acres.
- HERS Score = -14, construction cost =$194,418 and $42 per month in utility costs.
- Excess photovoltaic energy produced offsets Fort Bragg's utility bill.

Project Technical Specifications

- Envelope: SIPs walls (R = 21) and roofing (R = 21), insulated slab-on-grade (R = 7).
- Glazing: Pella windows: U-0.28 (R-3.6) with sliding glass door of U-0.3 (R-3.3).
- Smart Features: Sensors and actuators to monitor and control water, air quality, etc., controlled via Mobile App.
- Energy Production: 7,440 Watt PV Array
- 42 percent reduction in water usage
- LEED Platinum

END OF STORY

- It is bigger than SFC Brown
- The military family
- Diversity of the occupant
- Balance: Needs vs People

THANK YOU!

QUESTIONS?