

# Thinking Outside the Box(es): Resilient Modular Permanent Supportive Housing in Santa Cruz, CA

**PhiusCon**  
**October 15, 2021**



# Speakers



**Kurt Weninger**  
*PE (CA), CPHC*

Building Science Engineer  
RDH Building Science



**Sibley Simon**  
*Owner's representative*

President  
New Way Homes



**Will Bloomer**  
*AIA, LEED AP, CPHD*

Associate  
David Baker Architects



**Dustin Jolley**  
*PE, LEED AP*

Founder & Principal  
OurEnergy



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# Non-traditional Financing

## New Way Homes & Housing Matters



NEW WAY HOMES

New Way Homes is a new model for solving the under-production of affordable and workforce housing in California.

- Impact investment.
- Non-profit landowners.
- Modular construction and higher sustainability standards.
- Develops infill, below-market rate rental housing.



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# Site Constraints, Proposed Design

## DBA and OurEnergy



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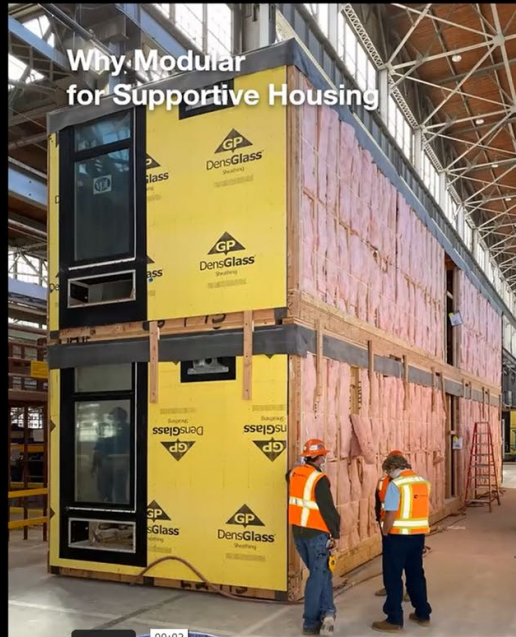


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# Modular DBA & RDH

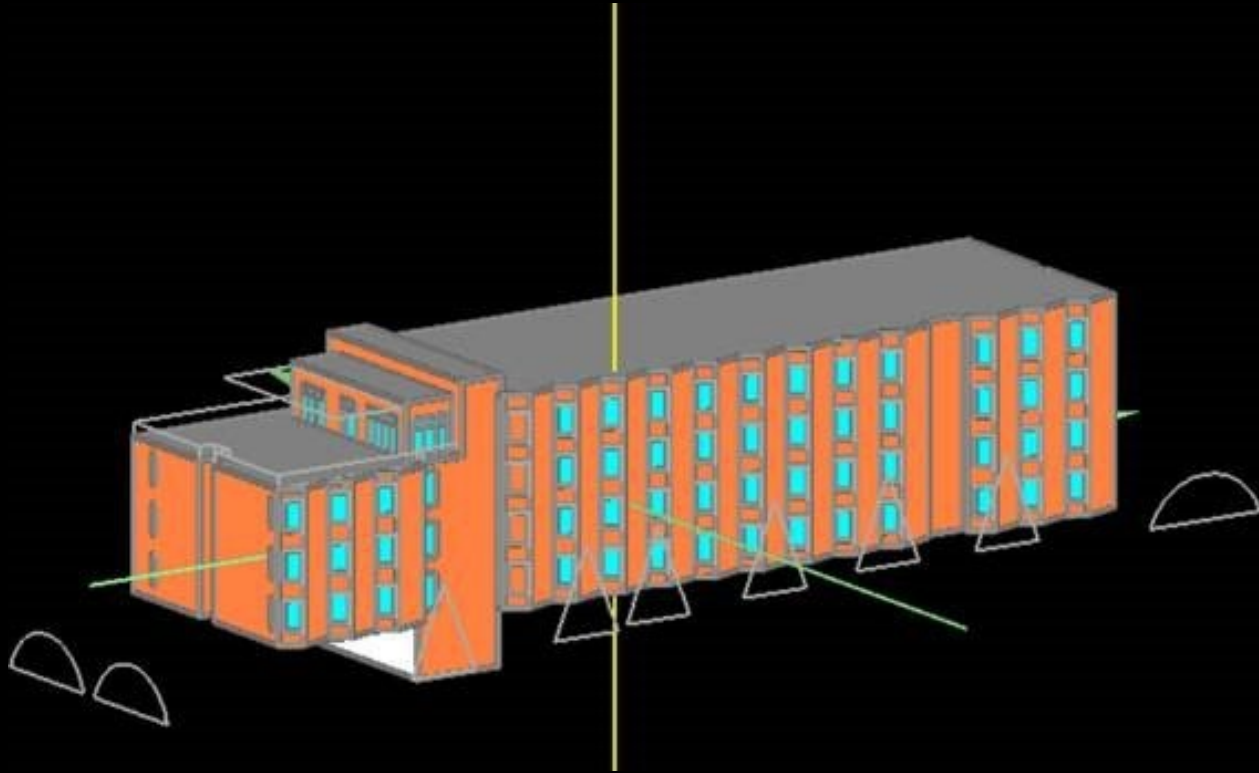


- **Studios** maximize space utilization, layout efficiency and stacking speed
- Modest (~5%) construction **cost savings** from off-site construction
- 25-30% construction delivery **schedule reduction**
- Corresponding savings from contractor overhead is typically larger than construction cost savings
- In addition, developers see the added benefit of leasing and move-ins occurring months earlier.





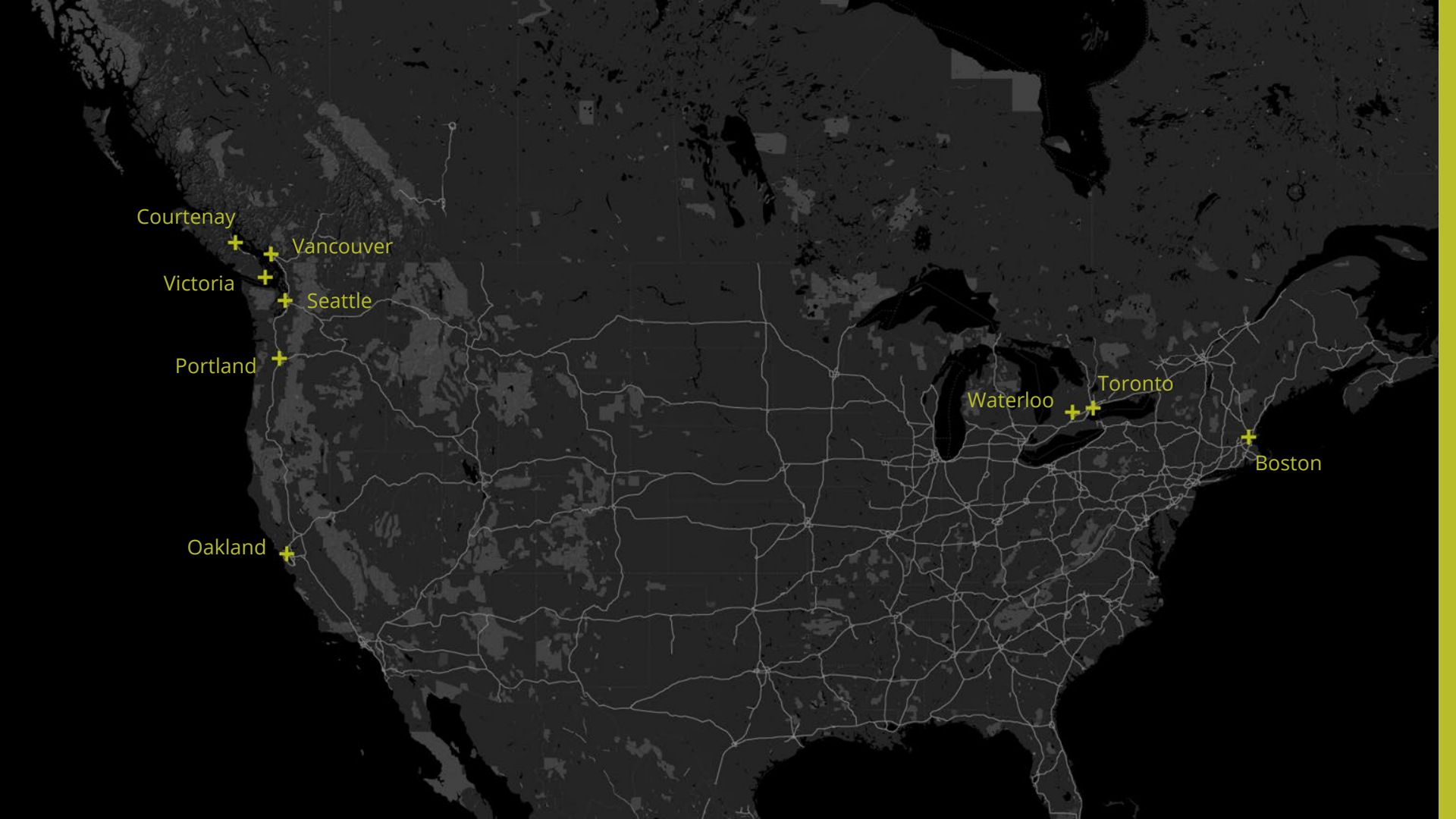
# Modular and Passive House RDH





**RDH**

THE RDH DIFFERENCE



Courtenay



Vancouver



Victoria



Seattle



Portland



Oakland



Waterloo



Toronto



Boston

# Modular Construction – 6 sided boxes



# Benefits of Modular Construction for Passive House

**1. Better quality in a controlled factory environment**

2. Integrated testing in factory

3. Less demand for highly trained field personnel

4. Less time on site



# Factory QA / QC is a Must!



# Site Curb Coordination with Modular Tolerances



What's  
wrong with  
this picture?

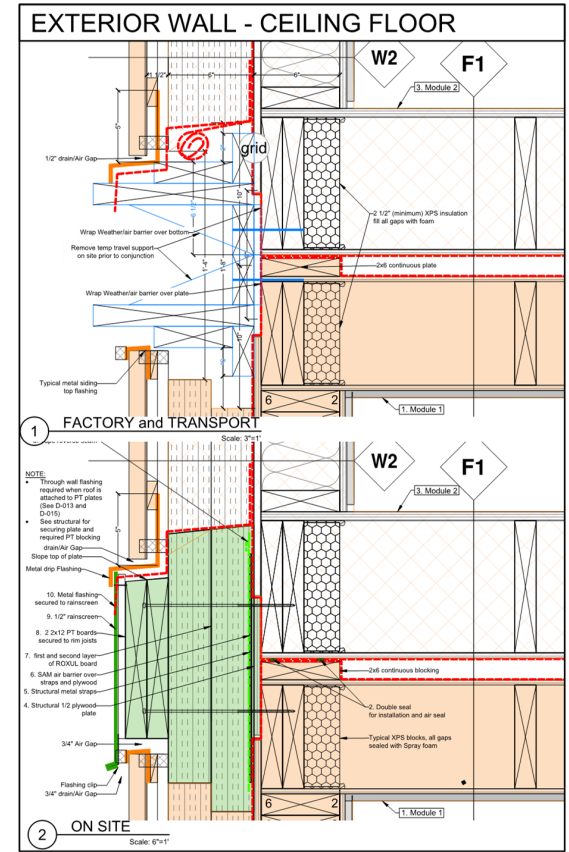




# What Enclosure Control Layers are Installed in Factory and On Site?

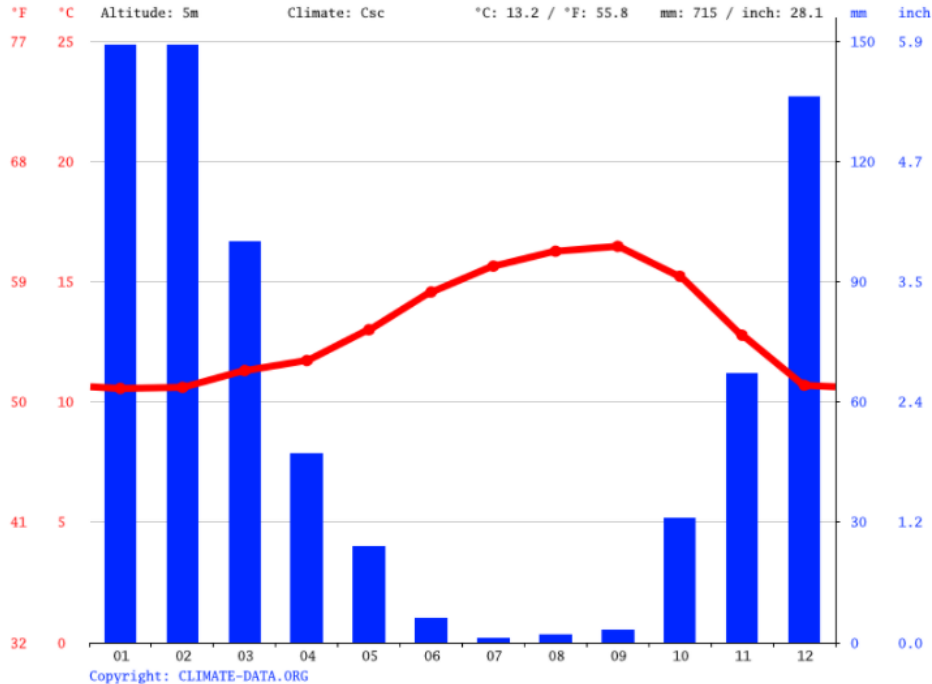
1. In Factory: Self-adhered WRB, windows, & temp roof in factory

2. On-Site: Joint detailing, exterior insulation, cladding, finished roof – Plan for laps!



# Santa Cruz Average Annual Climate

## Temperature Vs. Precipitation Annually



# How to Protect Modules from Rain before Air/Water Barrier is made Continuous?



# PHIUS+ Design Constraints

## 1. Mild Santa Cruz Climate

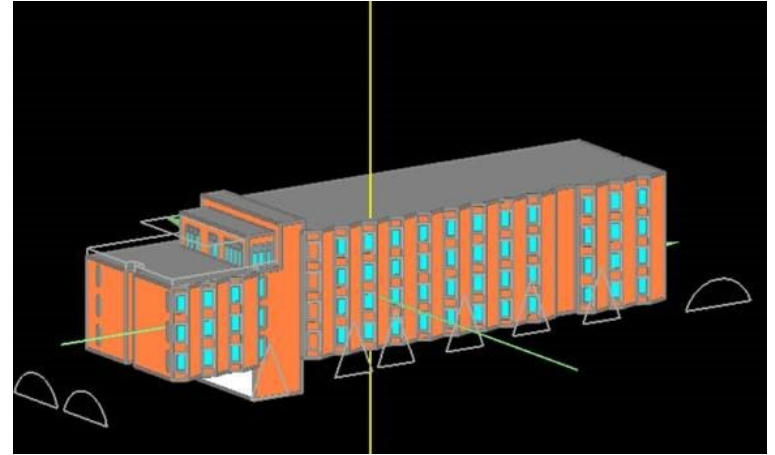
- Heating Degree Days = 1696
- Cooling Degree Days = 262
- Peak Heating Temperature = 38.7F
- Peak Cooling Temperature = 88.6F

## 2. 1 ACH for whole building

## 3. 121 total units with iCFA of 44,500 ft<sup>2</sup>

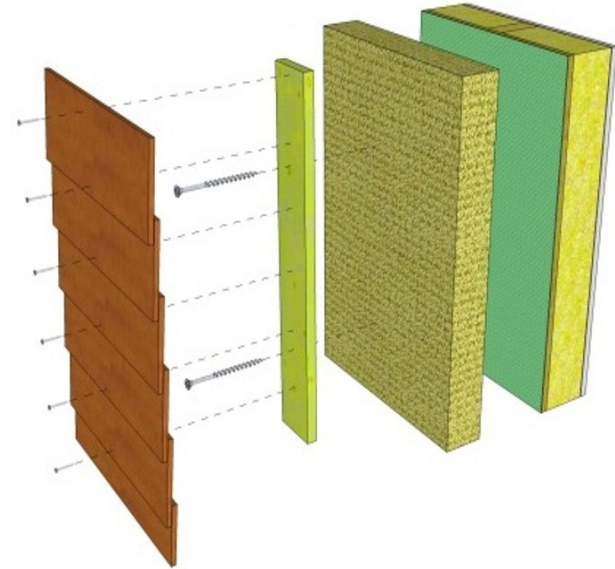
- iCFA/person = 368 ft<sup>2</sup>/person

## 4. Proximity to highway & likelihood of wildfires



# Summary of PHIUS+ Attributes - Enclosure

- 1. Form Factor:** 0.92 envelope/iCFA. 18% Window to -Wall Ratio (WWR)
- 2. Wall Assemblies:** Self-adhered WRB; R-17 effective walls
- 3. Window Performance:** Double-Glazed Vinyl Frames. Effective U-value 0.33 Btu/(hr-F-ft<sup>2</sup>); SHGC 0.27

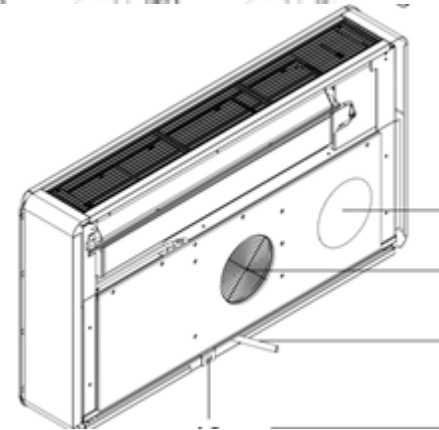


# Summary of PHIUS+ Attributes - Mechanical

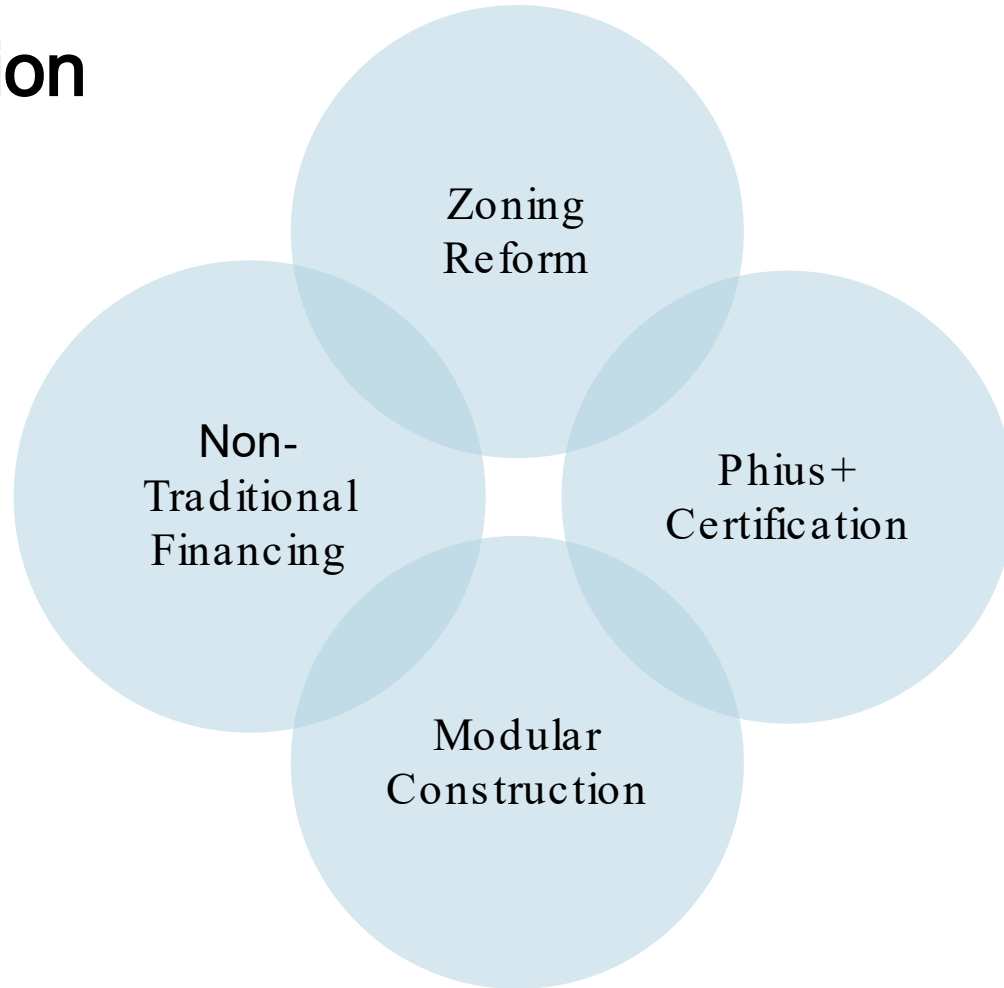
## 1. Heat Recovery Ventilation:

Floor-by-floor centralized HRV. 1.35 ACH per studio.

## 2. Space Conditioning: Ephoca HPAC 2.0 wall-mounted heat pump.



# Our Solution





Thank You!



David Baker  
Architects







**NEW WAY HOMES**

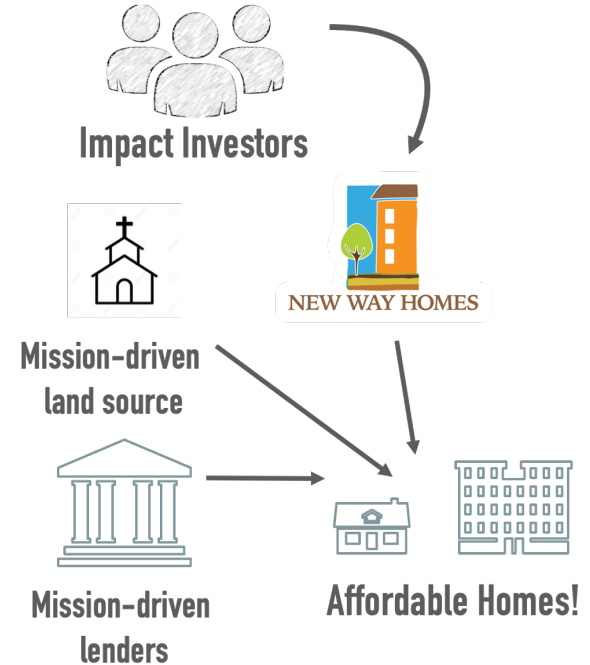
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# The Permanent Supportive Housing Problem

An aerial photograph of Santa Cruz, California, showing the city's grid layout and surrounding green hills. The city is situated in a valley, with the San Lorenzo River visible on the left. The surrounding hills are covered in dense green vegetation. The city's layout is a mix of residential and commercial areas, with a prominent highway running through the center.

## Santa Cruz

6 sq. mi. | over 150 houseless per 10,000 residents

- Santa Cruz has one of the highest rates of chronic homelessness in the nation
- California is millions of units short of having enough housing, and homelessness is rising



Resolving  
Homelessness  
Together

Housing Matters is the largest nonprofit in Santa Cruz County focused on resolving homelessness.

For over 30 years, one of its main assets has been a campus with a wide variety of co-located services.

[www.buildingwithpurpose.org](http://www.buildingwithpurpose.org)

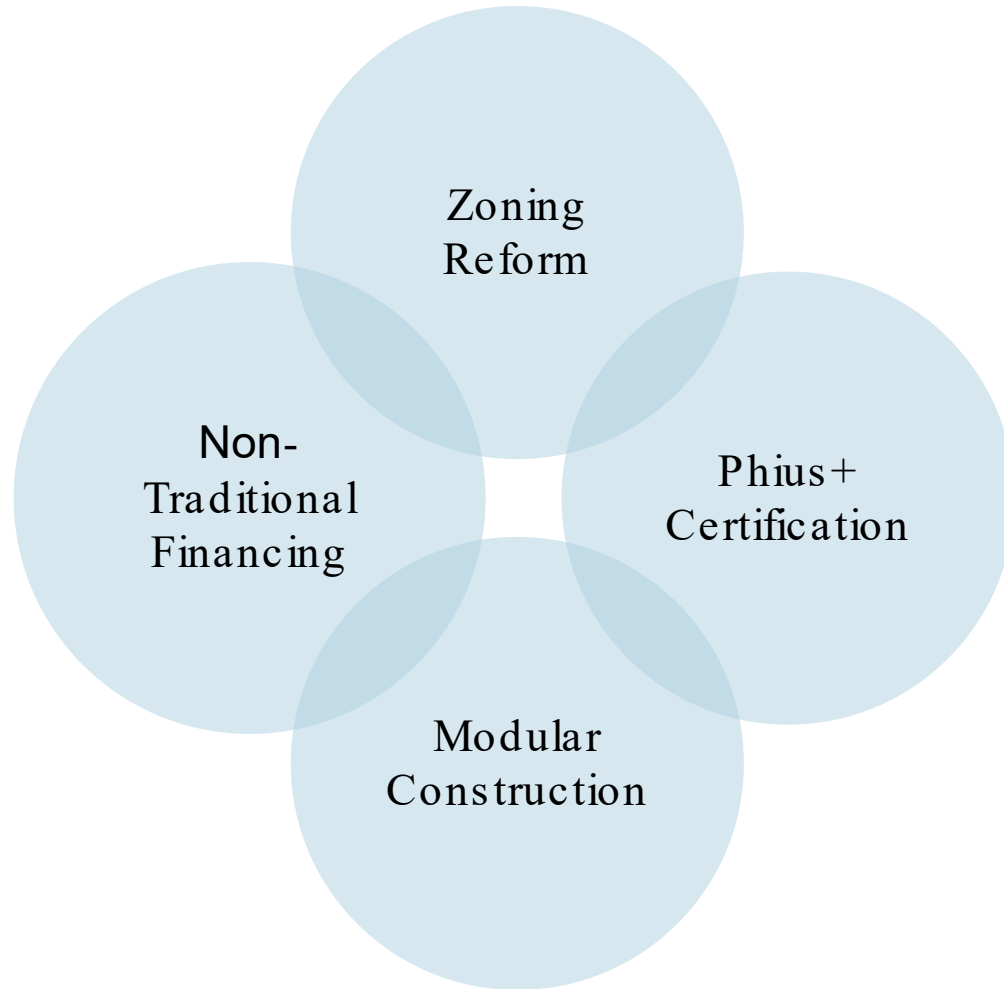


# Project Requirements

An aerial photograph of an urban area. A multi-lane highway runs diagonally from the bottom left towards the top right. To the left of the highway, there is a large, modern building with a prominent blue roof and a facade of vertical wooden slats. Further back, there are several residential houses, some with gabled roofs, and a few commercial buildings. The area is interspersed with green trees and grassy patches. In the bottom left corner, there is a small logo consisting of the Chinese characters '中外'.

- Co-located services
- Low maintenance costs
- Low energy use and resilience
- High air quality for health-impacted residents

## Our Solution





151

GOUGH

Gough

Fulton

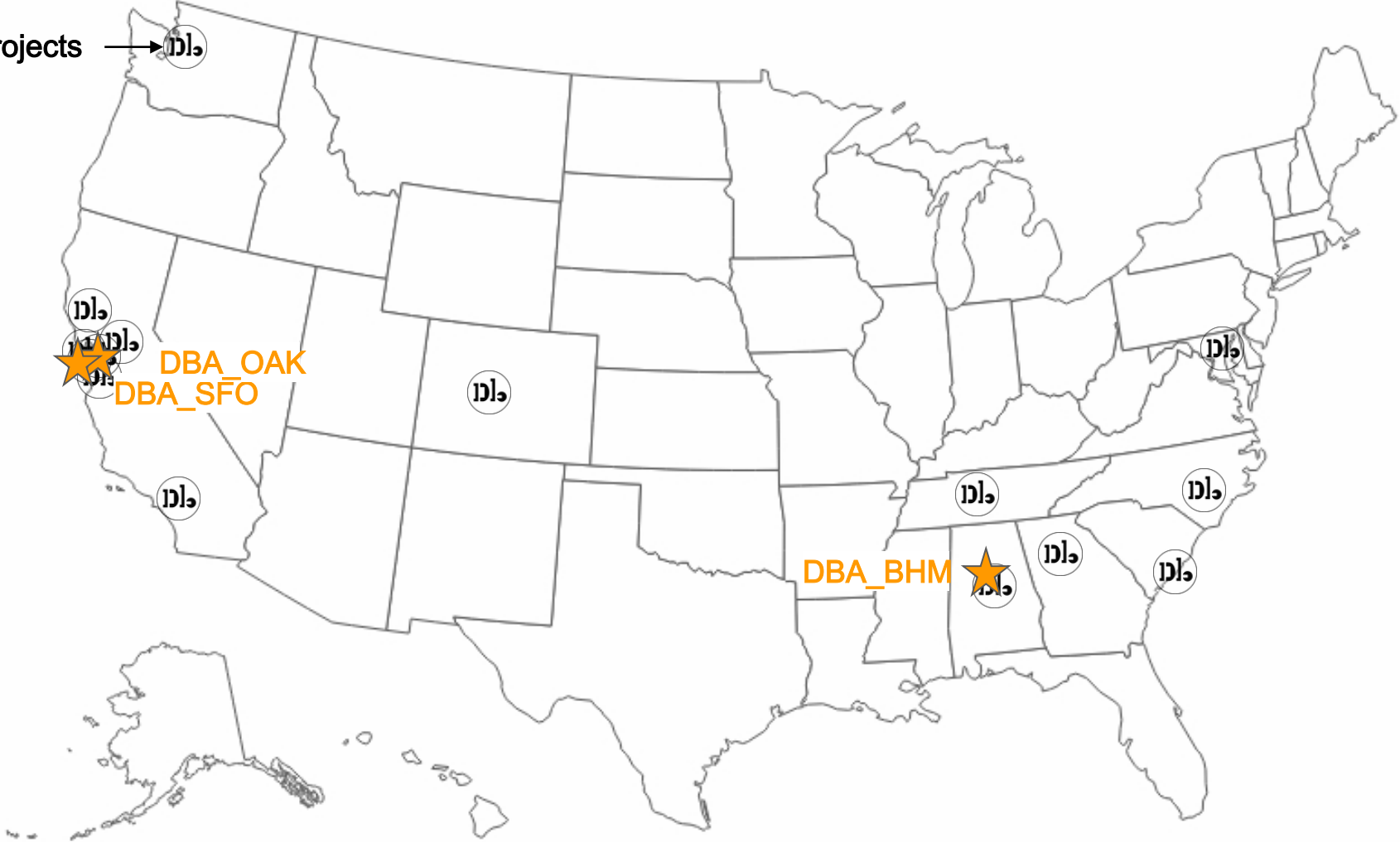
SFCM



39 years  
13,000+ homes  
400+ awards  
Multifamily Experts



Projects



DBA\_OAK  
DBA\_SFO



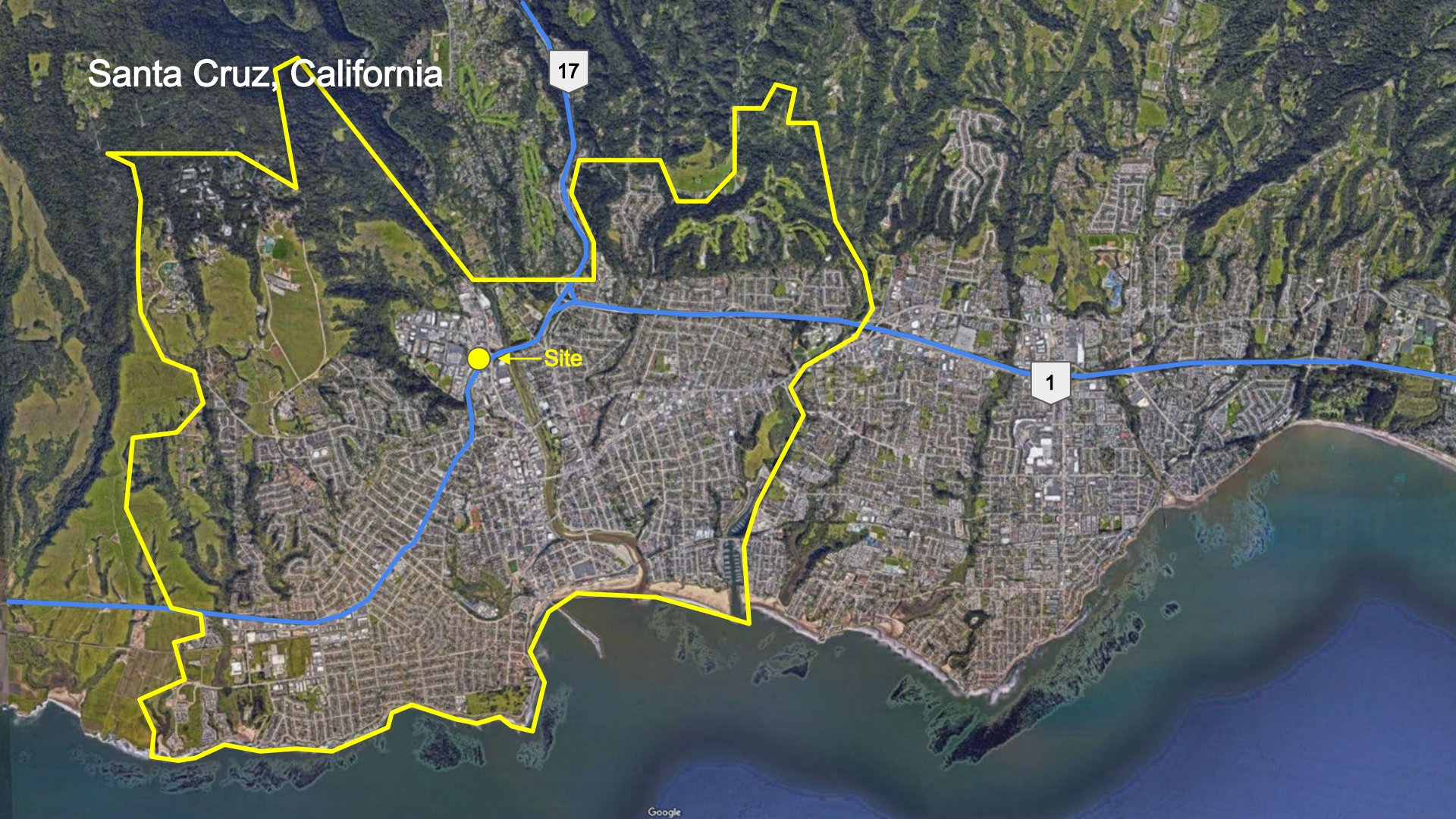
DBA\_BHM



# Santa Cruz, California



# Santa Cruz, California

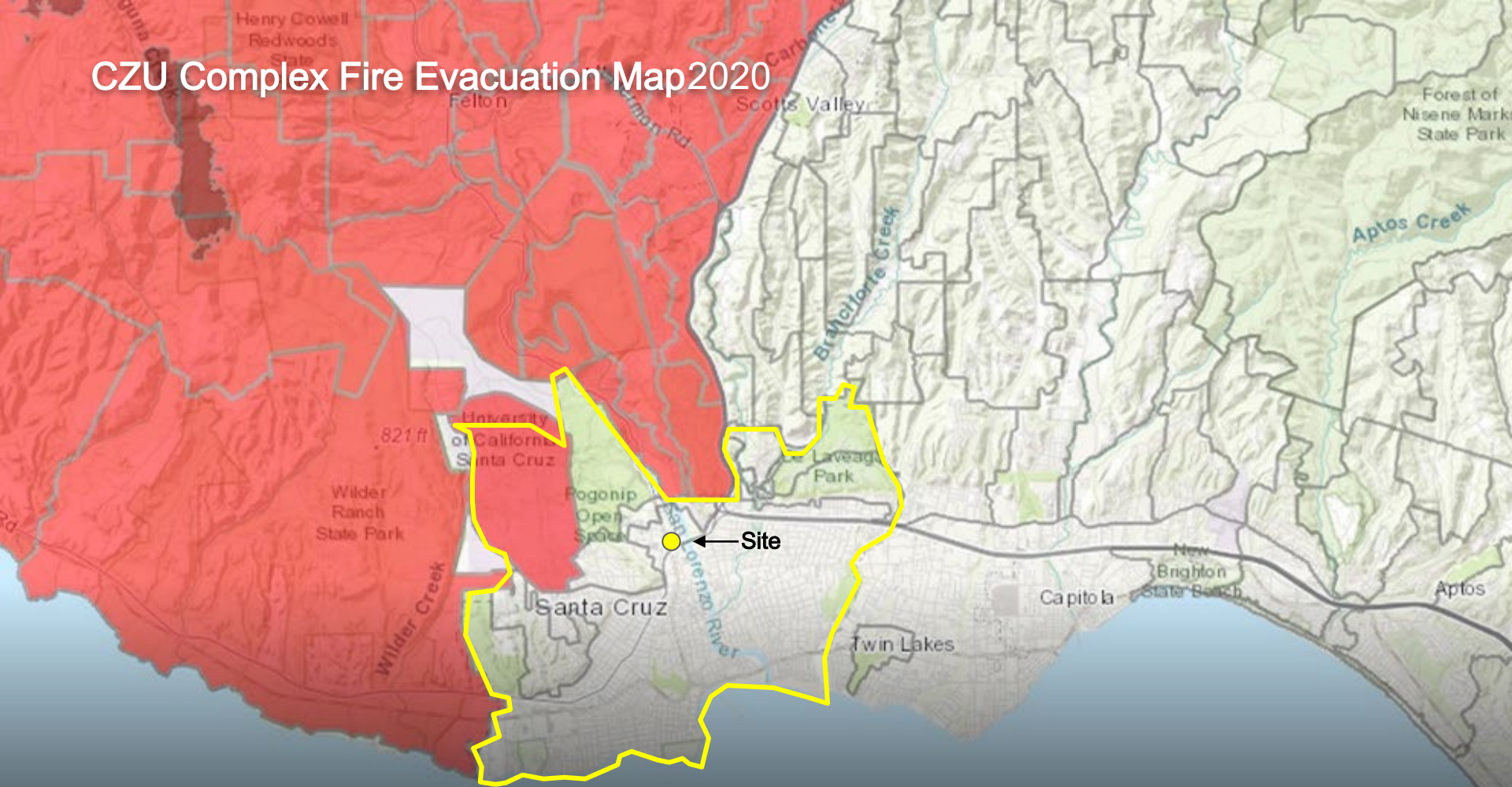


17

Site

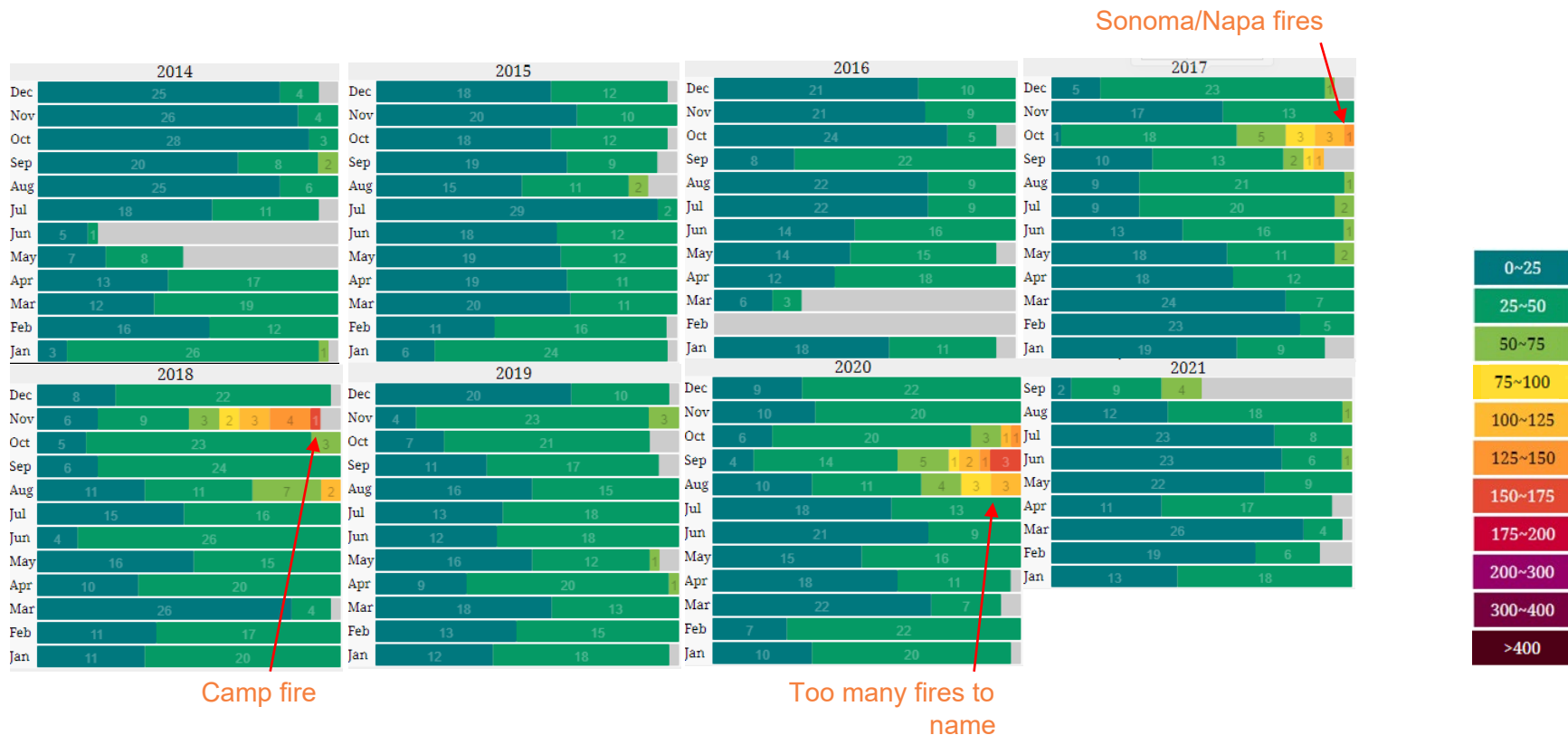
1

# CZU Complex Fire Evacuation Map 2020

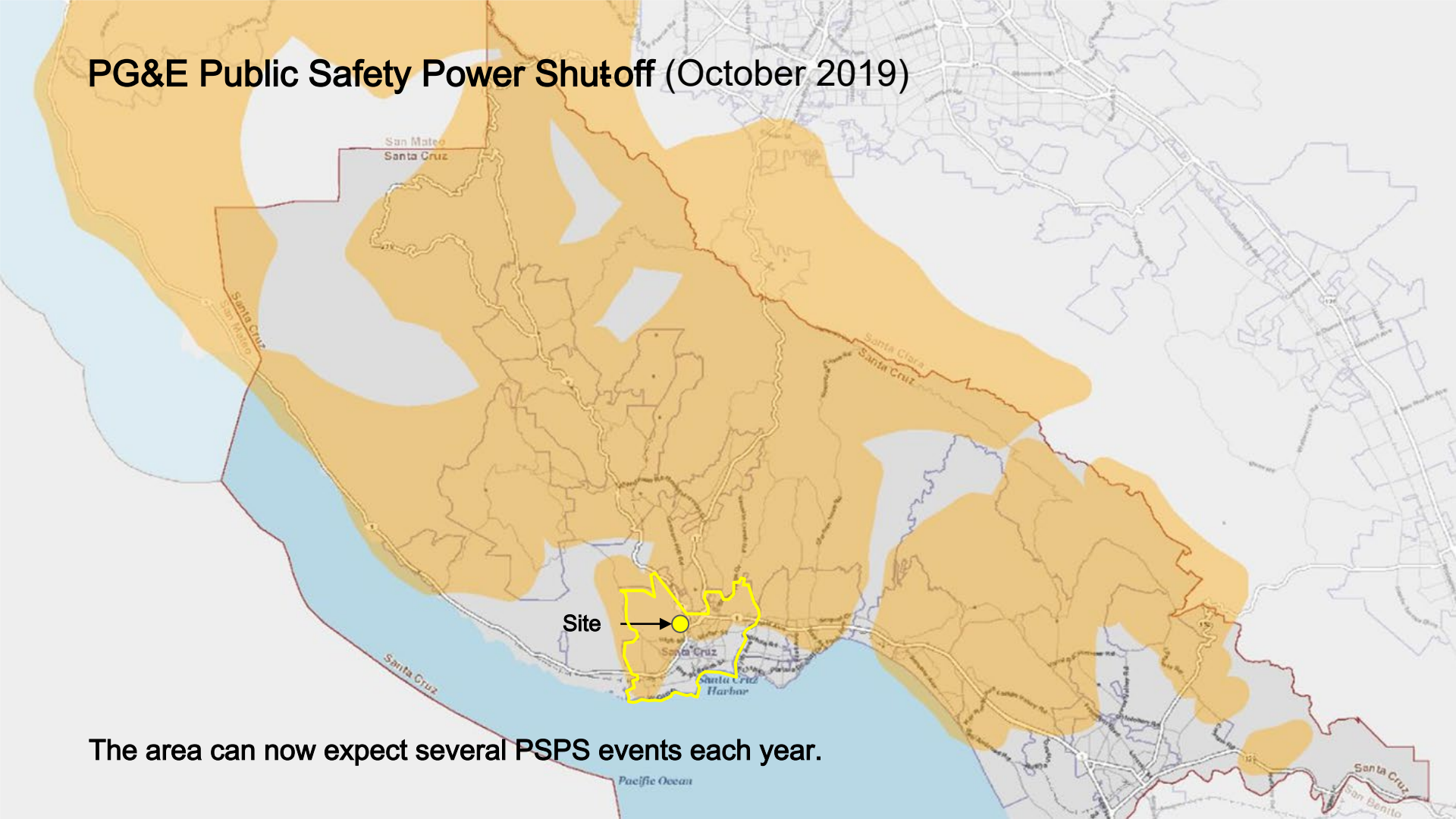


An overlook of the CZU August Lightning Complex fires (DARK RED) and evacuation zones (RED).

# Increase in 24-hour PM2.5 Averages for Santa Cruz, 2014-2021

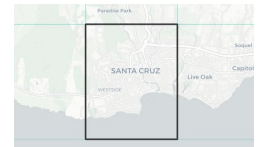
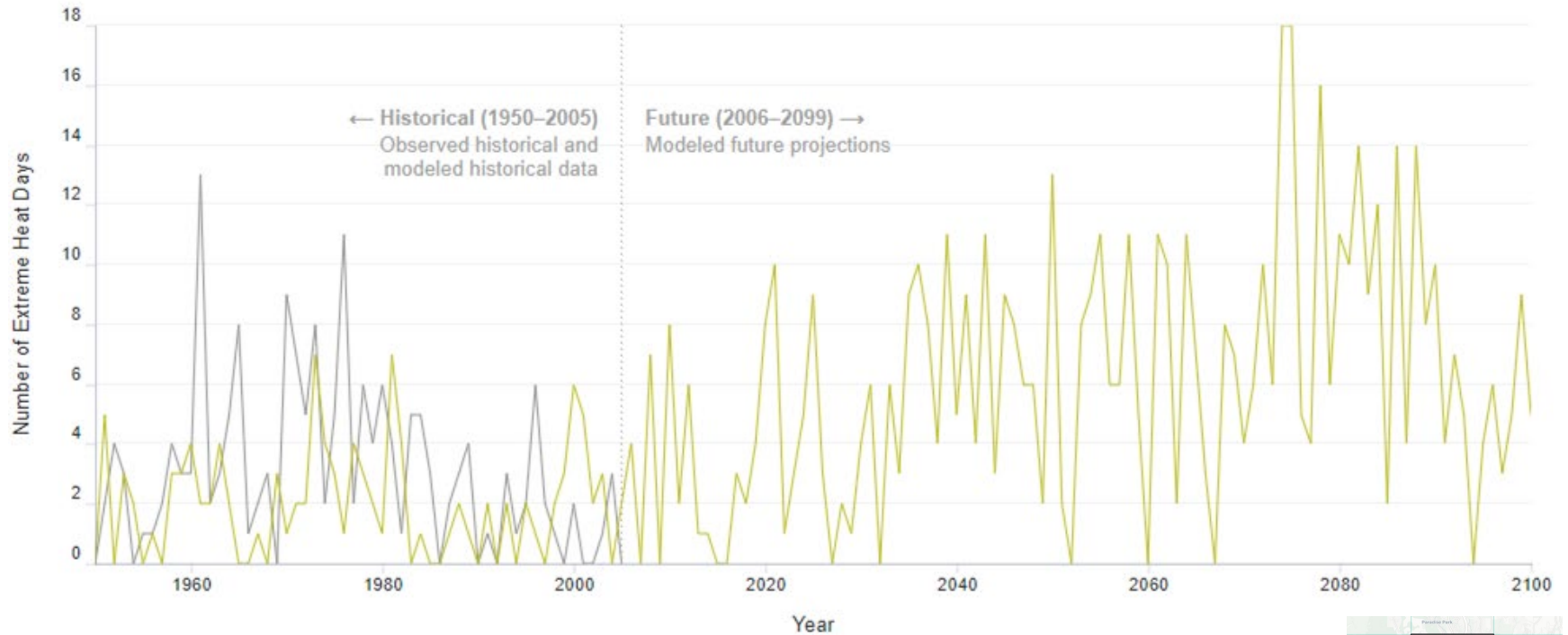


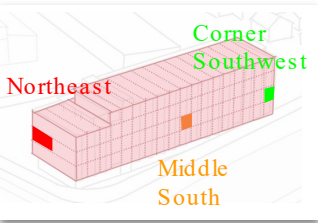
# PG&E Public Safety Power Shutoff (October 2019)



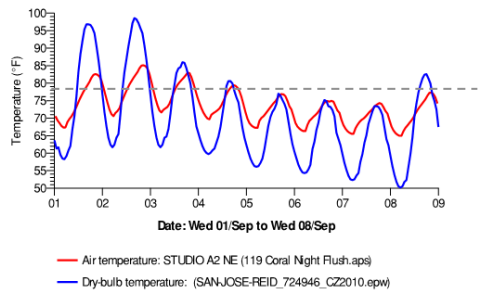
The area can now expect several PSPS events each year.

# Predicted annual number of extreme heat days, 1950-2100

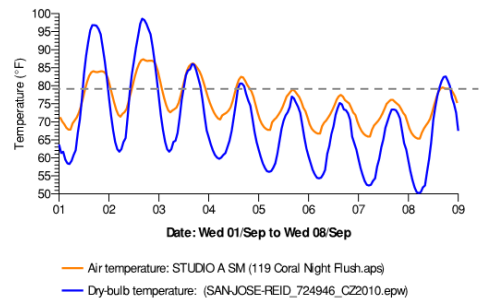




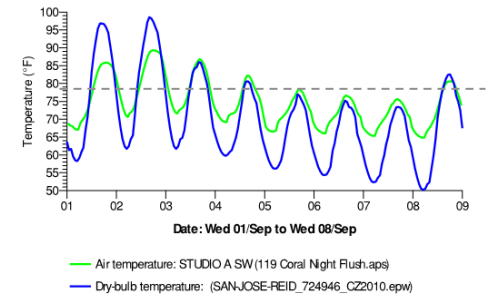
Northeast Unit Night Flush - Peak Week:



Middle South Unit Night Flush - Peak Week:

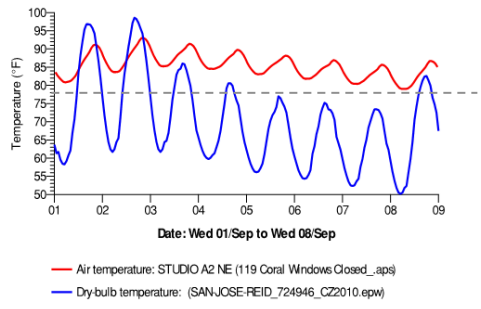


Corner Southwest Unit Night Flush - Peak Week:

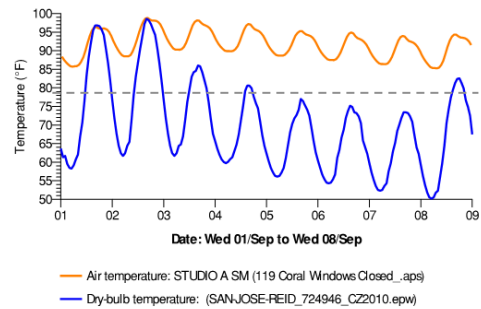


## Night Flush

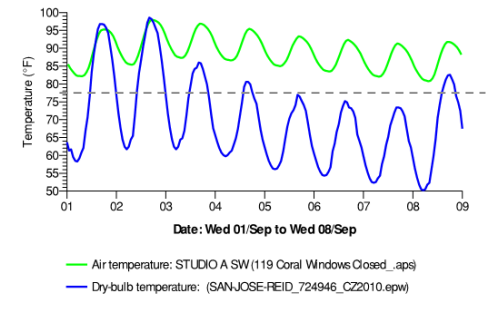
Northeast Unit Windows Closed - Peak Week:



Middle South Unit Windows Closed - Peak Week:

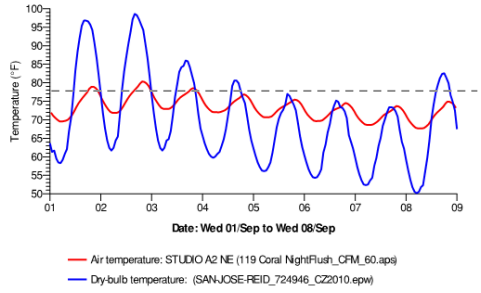


Corner Southwest Unit Windows Closed - Peak Week:

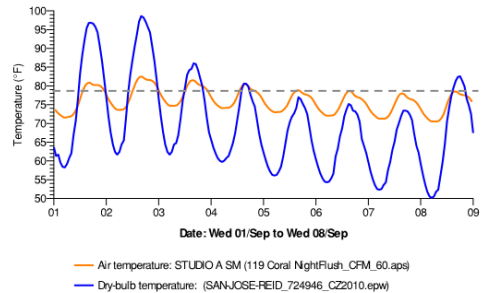


## Windows Closed

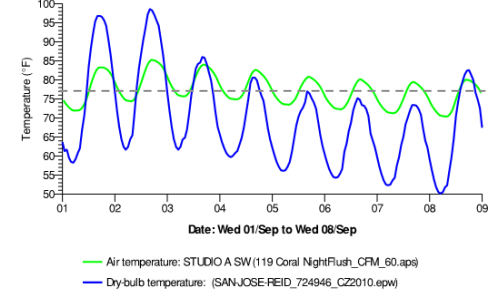
Northeast Unit Windows Closed w 50 CFM tempering air - Peak Week:



Middle South Unit Windows Closed w 50 CFM tempering air - Peak Week:



Corner Southwest Unit Windows Closed w 50 CFM tempering air - Peak Week:



## Tempered Ventilation

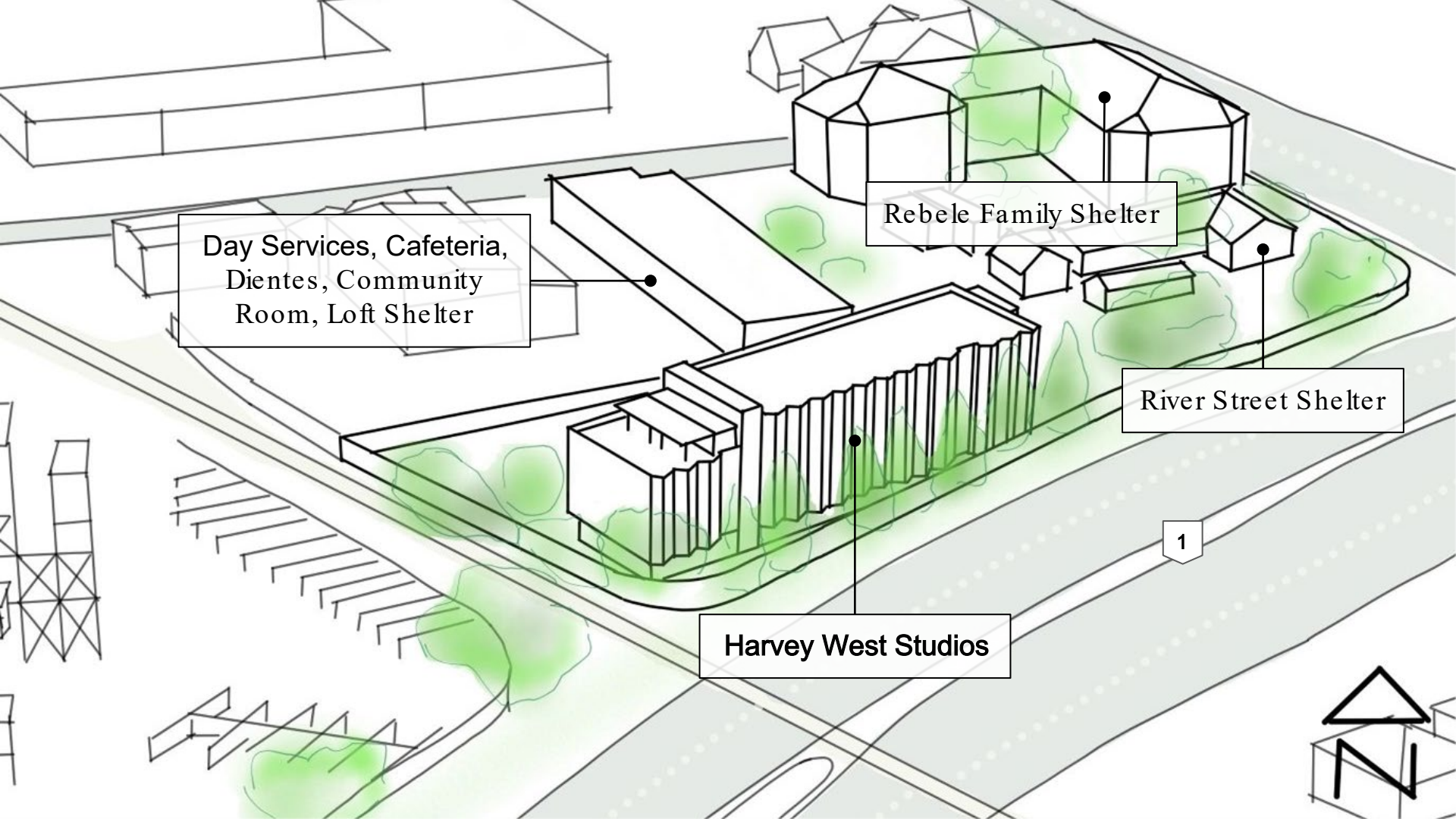






**Harvey West Studios**

1



Day Services, Cafeteria,  
Dientes, Community  
Room, Loft Shelter

Rebele Family Shelter

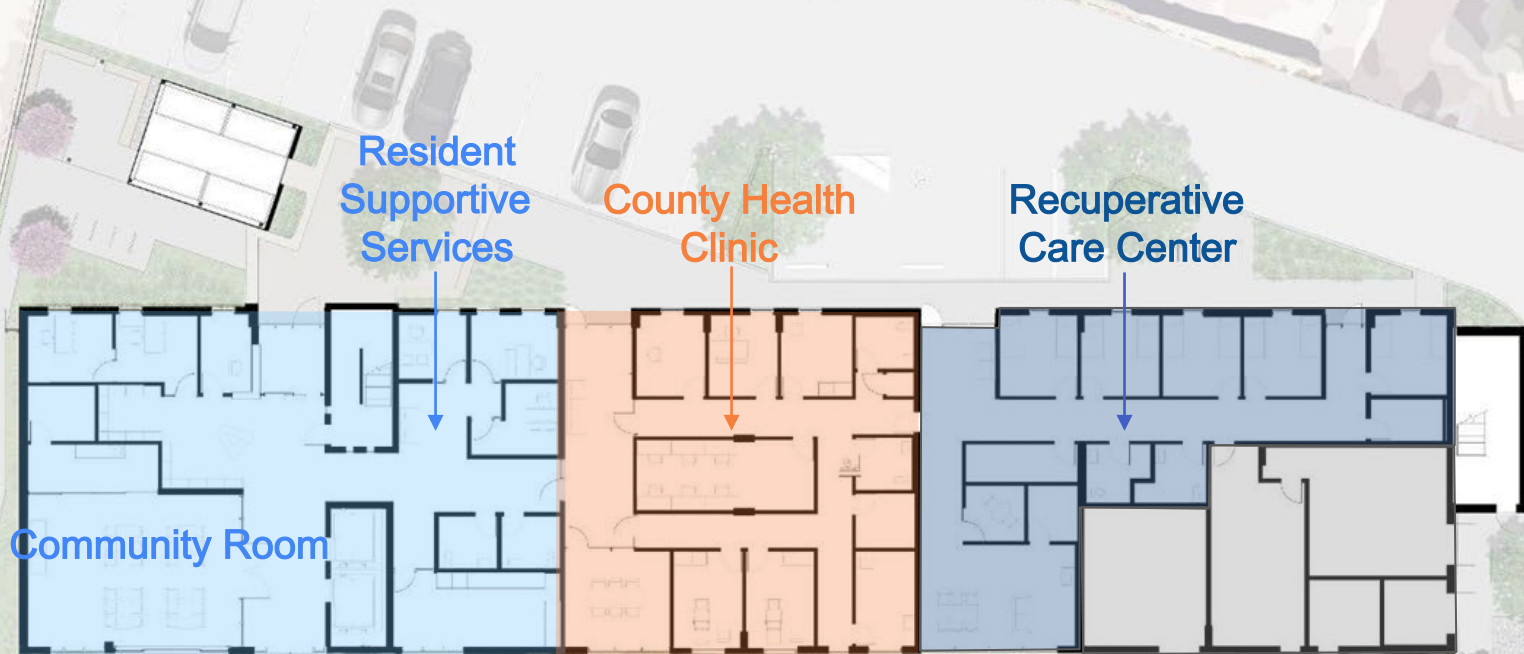
Harvey West Studios

River Street Shelter

1



# Ground Floor Program



Resident Supportive Services

County Health Clinic

Recuperative Care Center

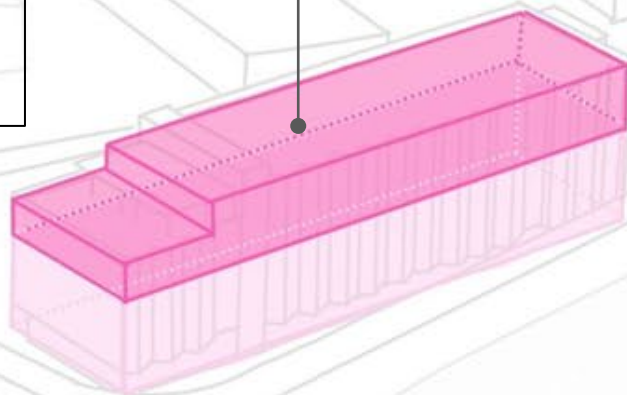
Community Room



## Density Bonus

80% Density Bonus for an  
100% Affordable Housing  
Development

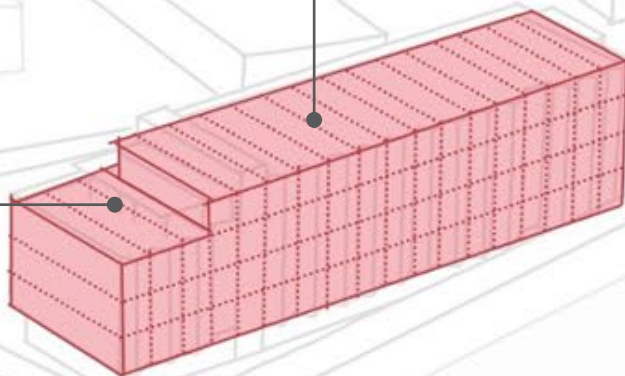
No Parking  
Minimums



# Modular

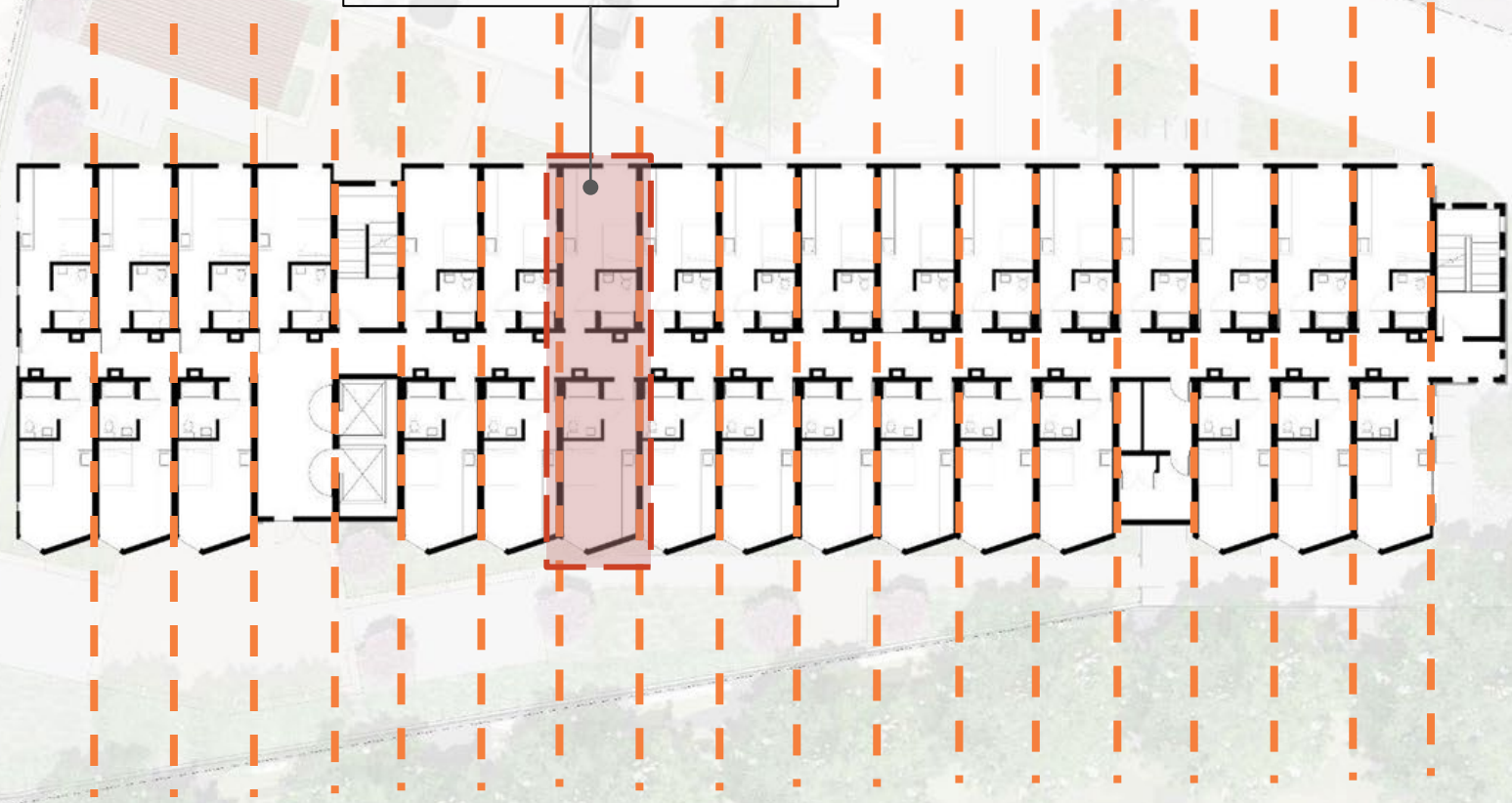
Plan Optimized for  
Modular Construction

Mods Removed for  
Roof Deck

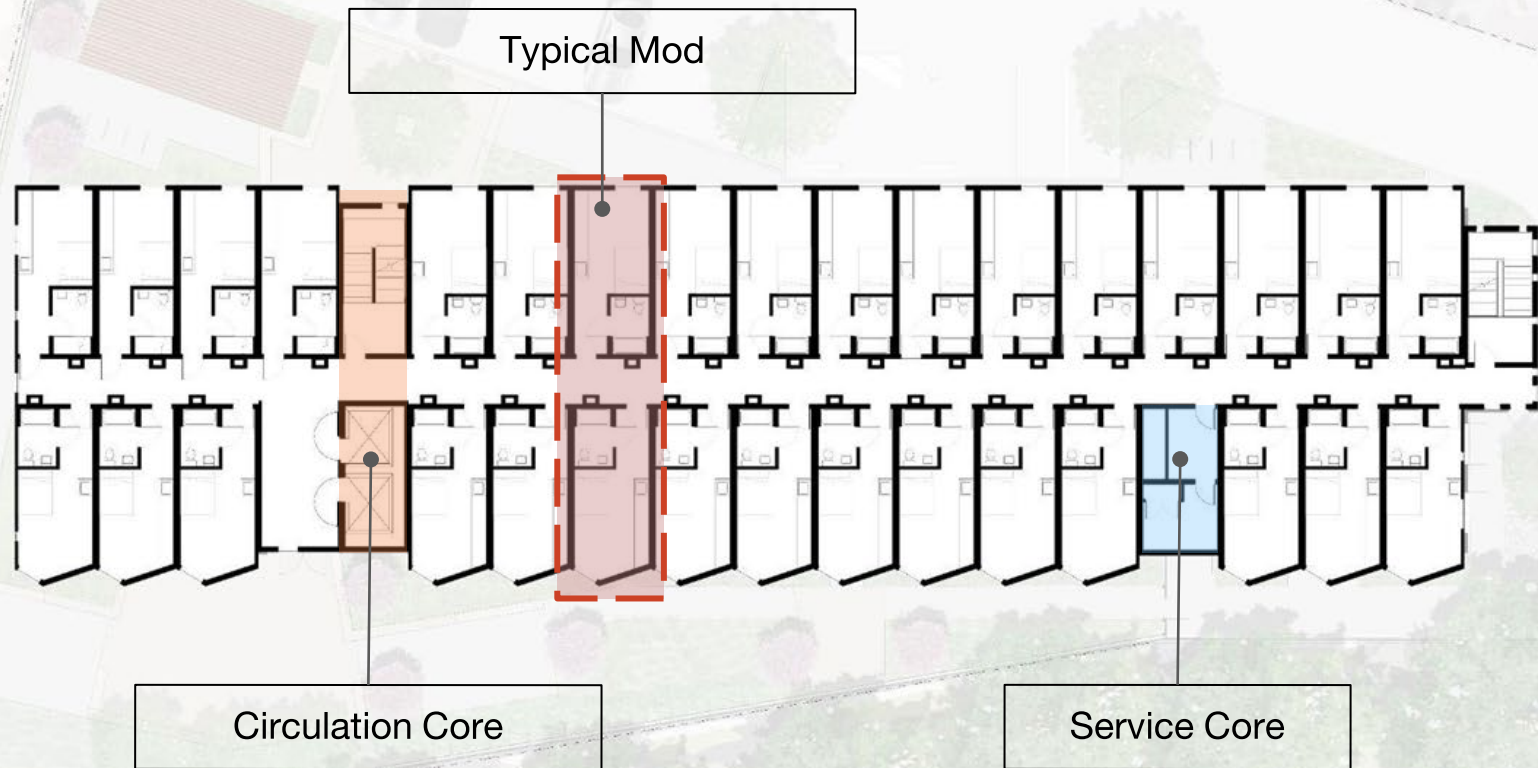


# Upper Floor Plan

Typical Mod

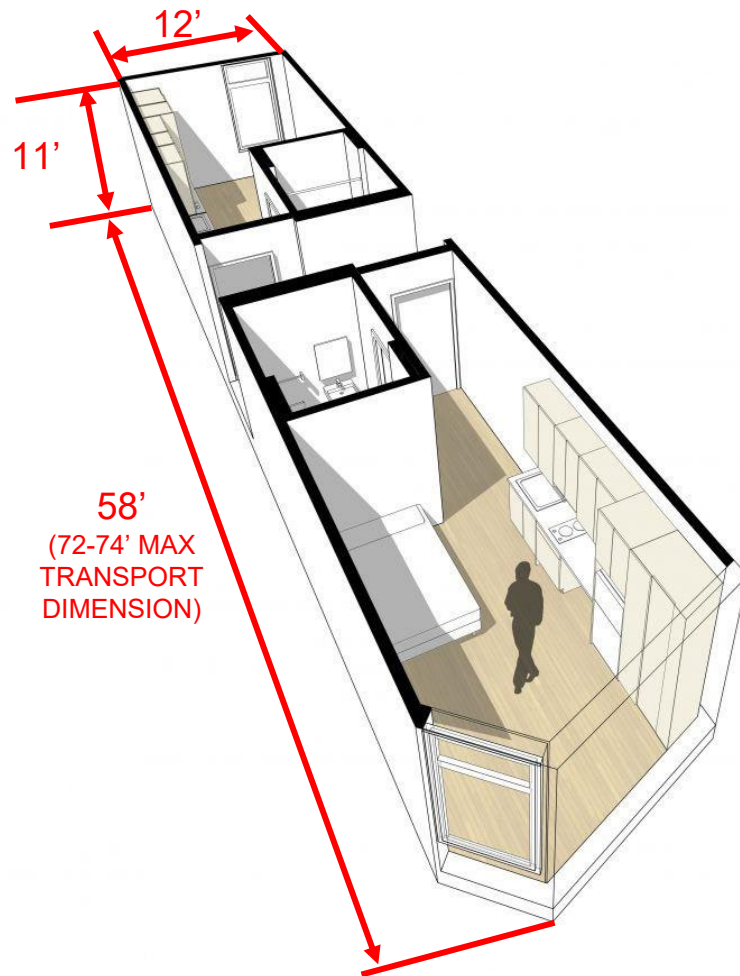


# Upper Floor Plan





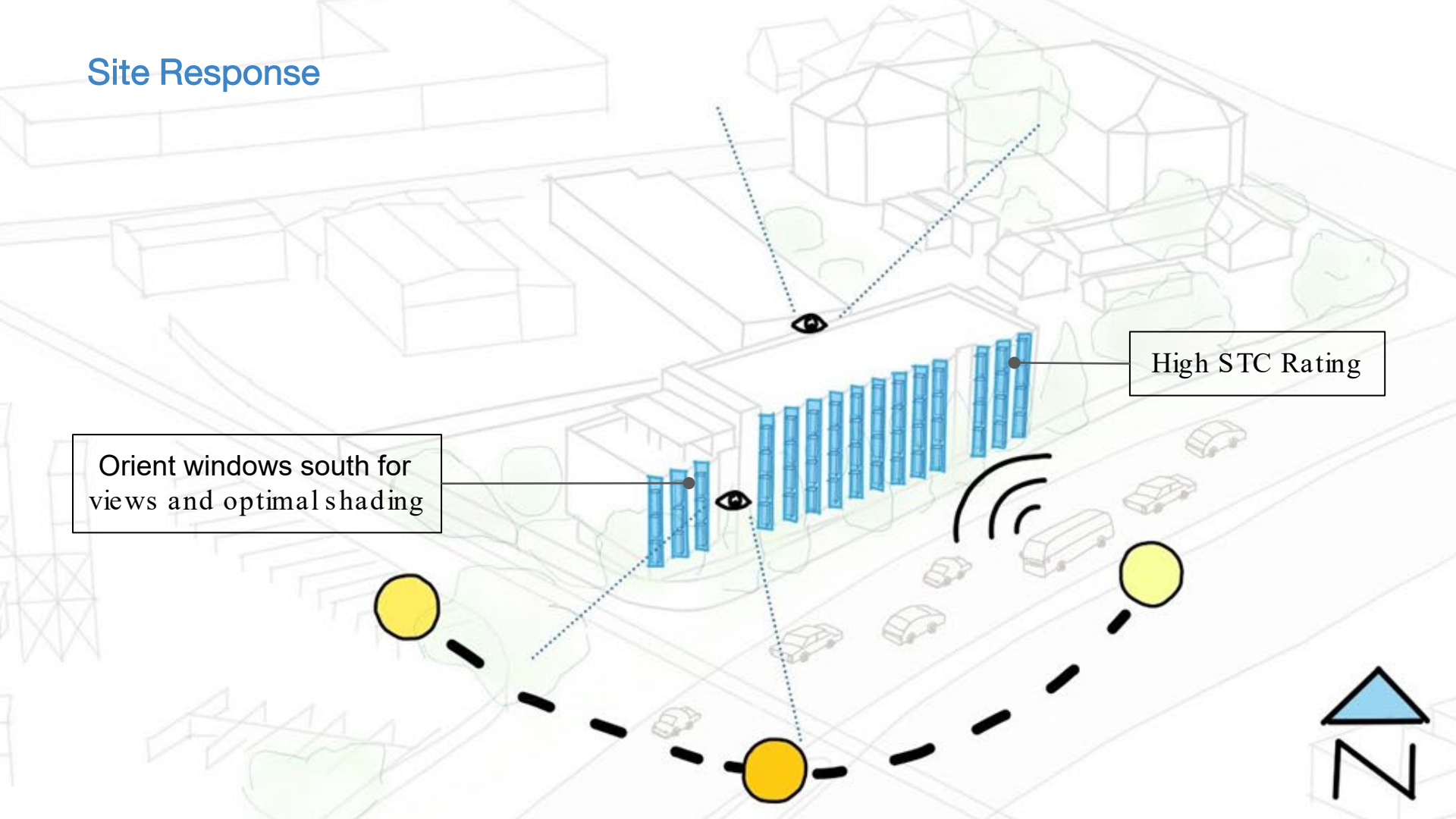
# Double-Loaded Module



# Site Response

Orient windows south for views and optimal shading

High STC Rating



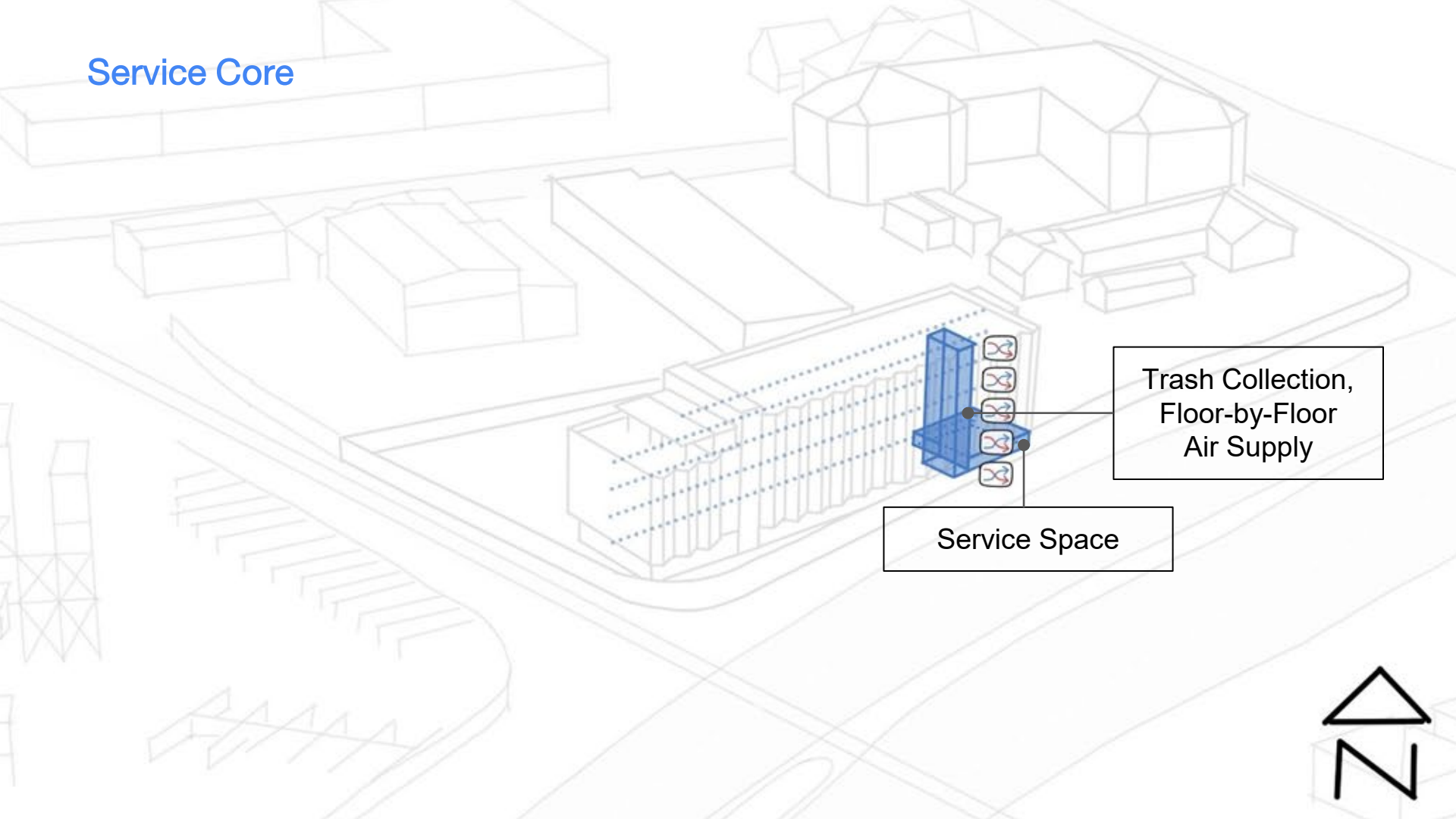
## Circulation Core

Shared Roof Deck

Continuous entry, lobby,  
offices, common area.  
Outdoor Patio & Roof Deck



Service Core

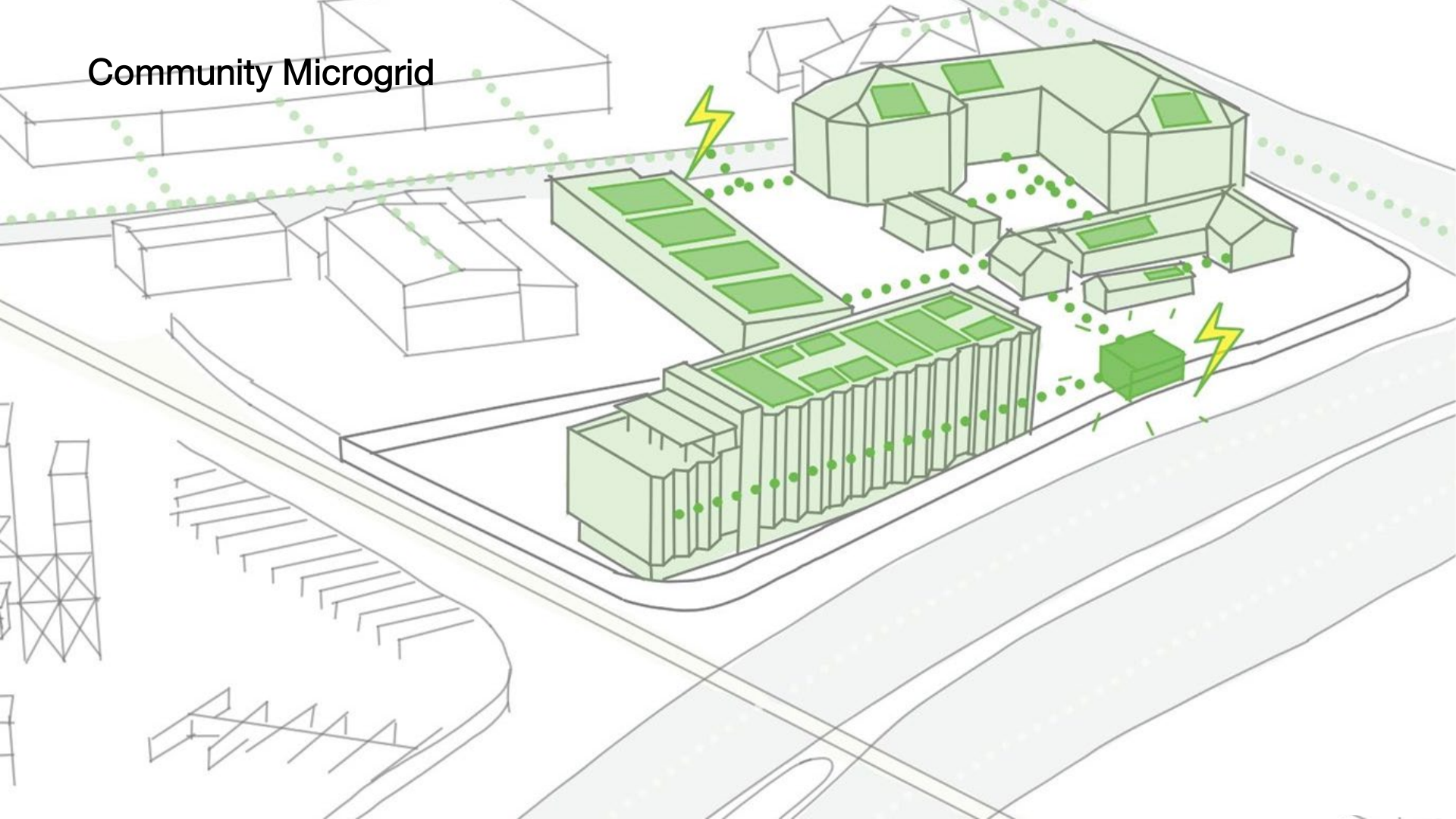


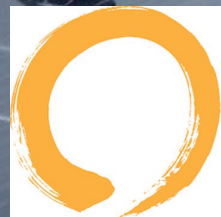
Trash Collection,  
Floor-by-Floor  
Air Supply

Service Space



# Community Microgrid



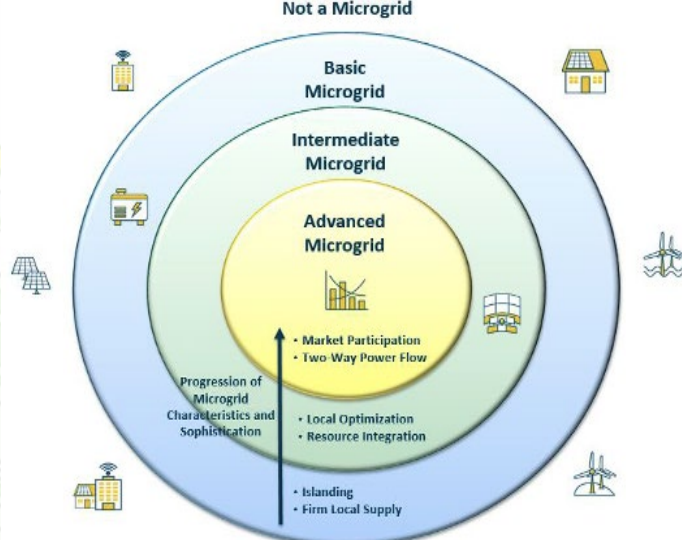


OURENERGY

# Community Microgrid

## What is a [community] microgrid?

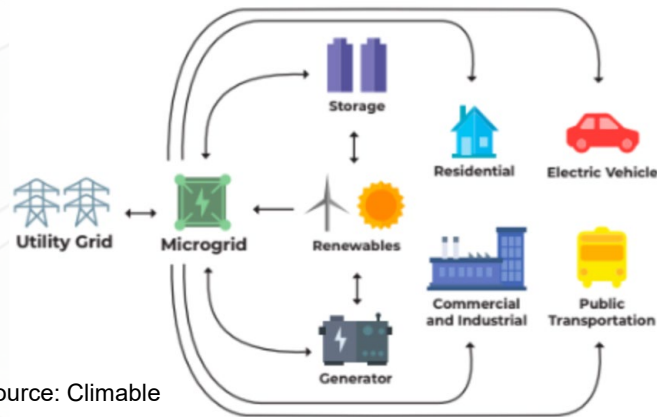
- Electrical network of distribution, metering and controls that connects
  - Utilities
  - Hybrid power generation - Solar PV + Standby
  - Energy Storage
  - Advanced controls - 24-7 control monitoring supply & demand
- Both grid-connected or island mode
- Provides Community Benefit
  - Serves more than one account / individual / business
  - Provides essential public services



Source: DOE

- Solar or Wind without Storage
- Demand Response

## Movement of Energy in a Microgrid



Source: Climable

## Campus Microgrid Current Condition

63.19 kW

56.8 kW

Current: 29 kW PV Array  
Future: 200 kW

- 150 kW solar systems installed across several legacy accounts
- PG&E connection, net metered with metering aggregation
- No standby resilient energy
- Adjacent facilities accessible for expansion



Future navigation center

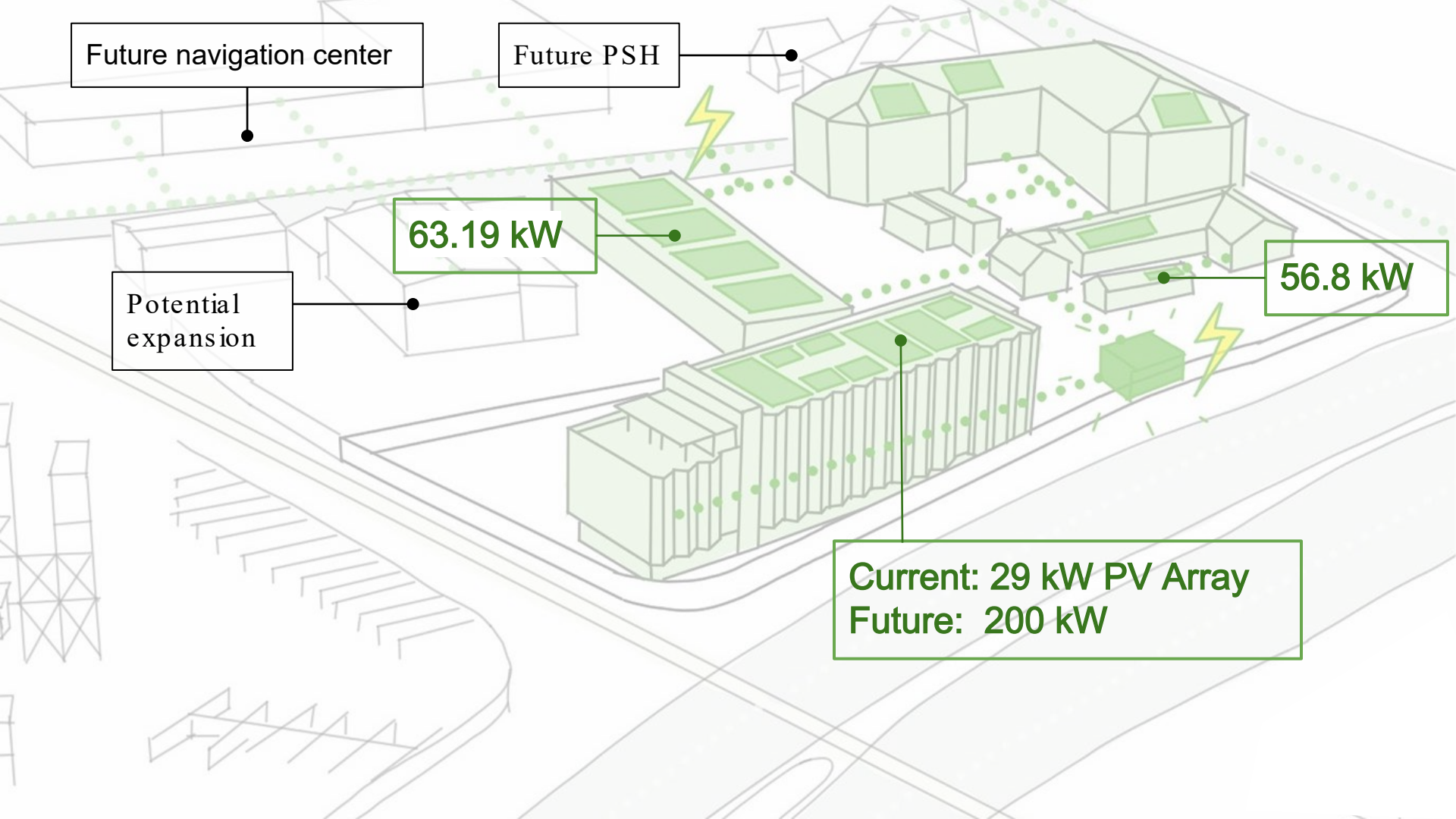
Future PSH

63.19 kW

Potential expansion

56.8 kW

Current: 29 kW PV Array  
Future: 200 kW



## Vision An Adaptive and Expandable Microgrid

- With the addition of HWS-PSH, 320 kW of solar PV will be installed across campus
- An estimated ~650kW of solar PV required to offset current campus load (after addition of new PSH at 119 Coral). ~50% of the generation needed to be ZNE
- Integration of electrical utilities to campus microgrid, and accommodate future modular expansion
- DERs including renewables, battery energy storage, standby power generation, advanced controls including integrated building loads management
- Retain PG&E connection
- Capable of islanding during grid outages

## Why Modular for Supportive Housing



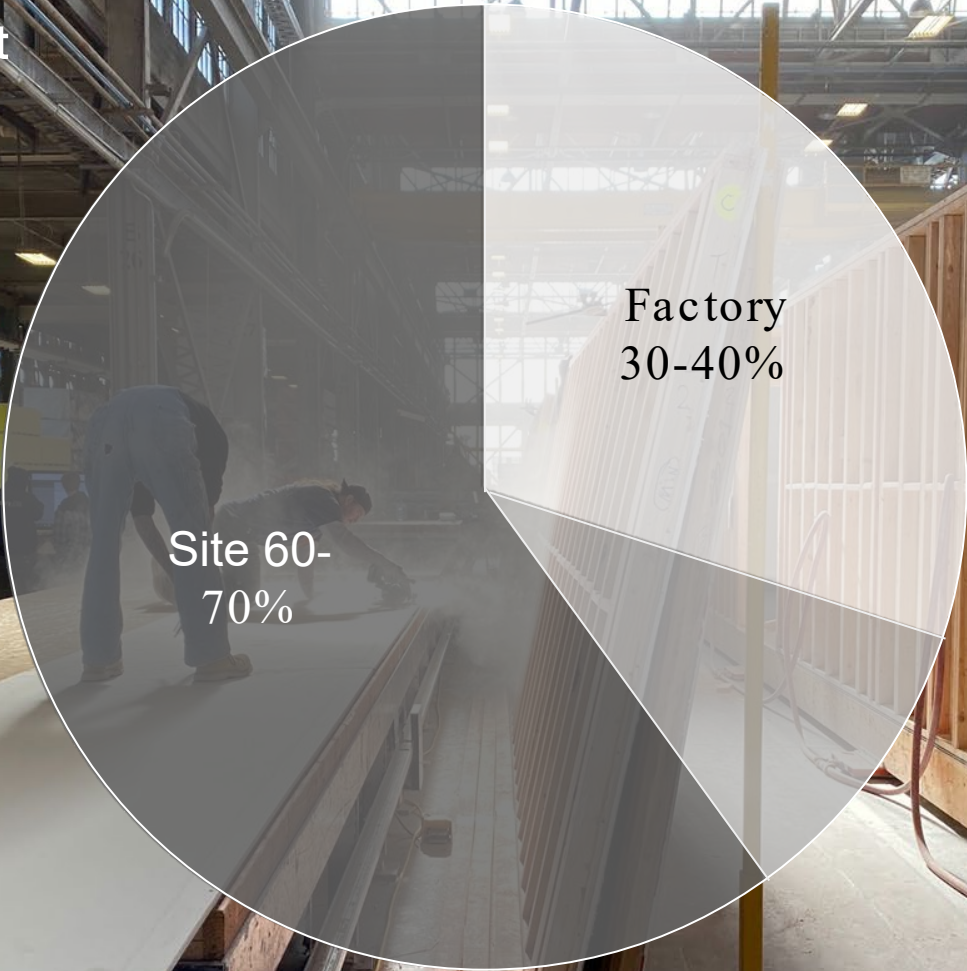
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- Modest (~5%) construction **cost savings** from off-site construction
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- Corresponding savings from contractor overhead is typically larger than construction cost savings
- In addition, developers see the added benefit of leasing and move-ins occurring months earlier.

# Why Modular for Supportive Housing



- Construction in **controlled environment** (ideally):
  - Better safety
  - Less construction waste
  - More quality control

# Construction Cost



## Mitigating Risks



- **Non-traditional financing**  
Pre-production work, early deposit and production scheduling are all incompatible with traditional tax credit financing
- **Construction bond**  
Mitigate catastrophic failures or major delays

## Mitigating Risks



- **Logistics at urban sites**  
Off-site or near-site staging can be a challenge -  
Try to use a local factory with storage yards or  
else identify staging logistics
- **Efficient work flow**  
Planning for separate state (modular) and local  
(site-build) building permits

The Union Oakland, Completed 2020  
110 Homes





Tahanan, San Francisco Finishing Construction  
145 PSH Homes

