SELECTED WORKS *2025/26*

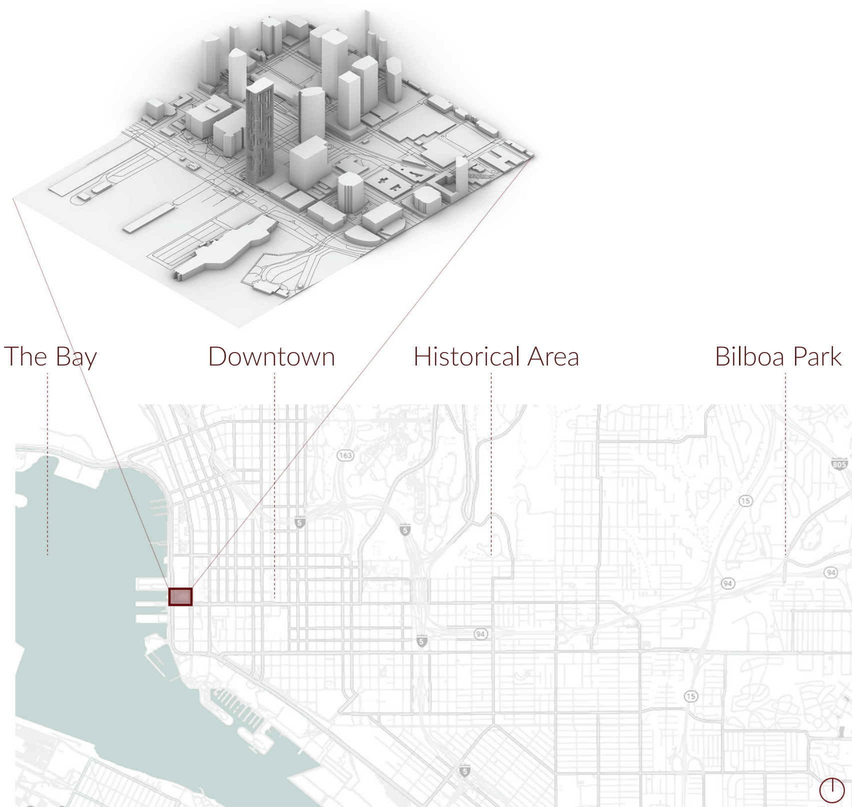
Isabelle Stratton

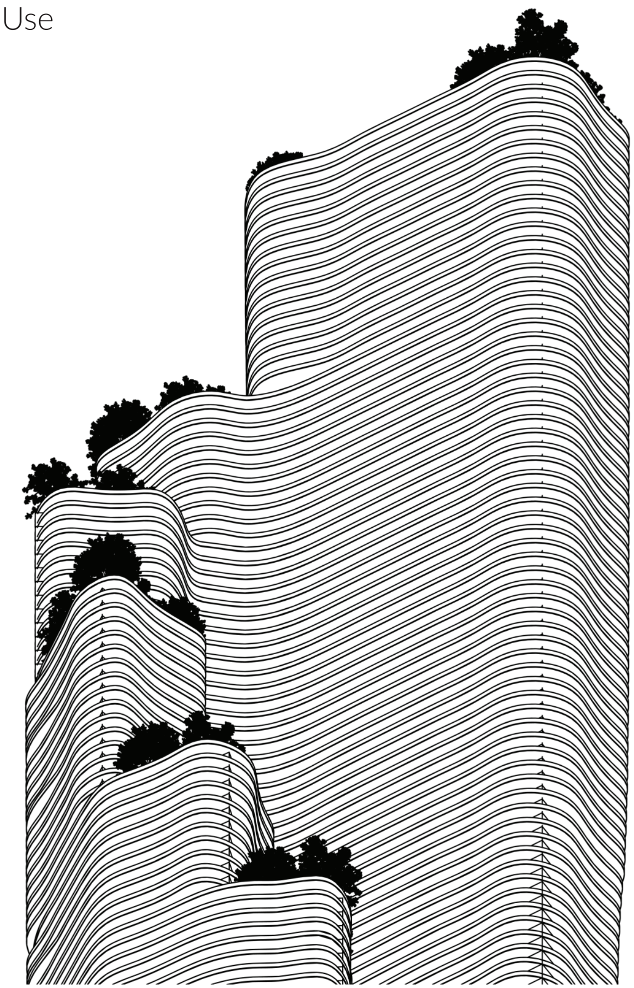
CONTENTS

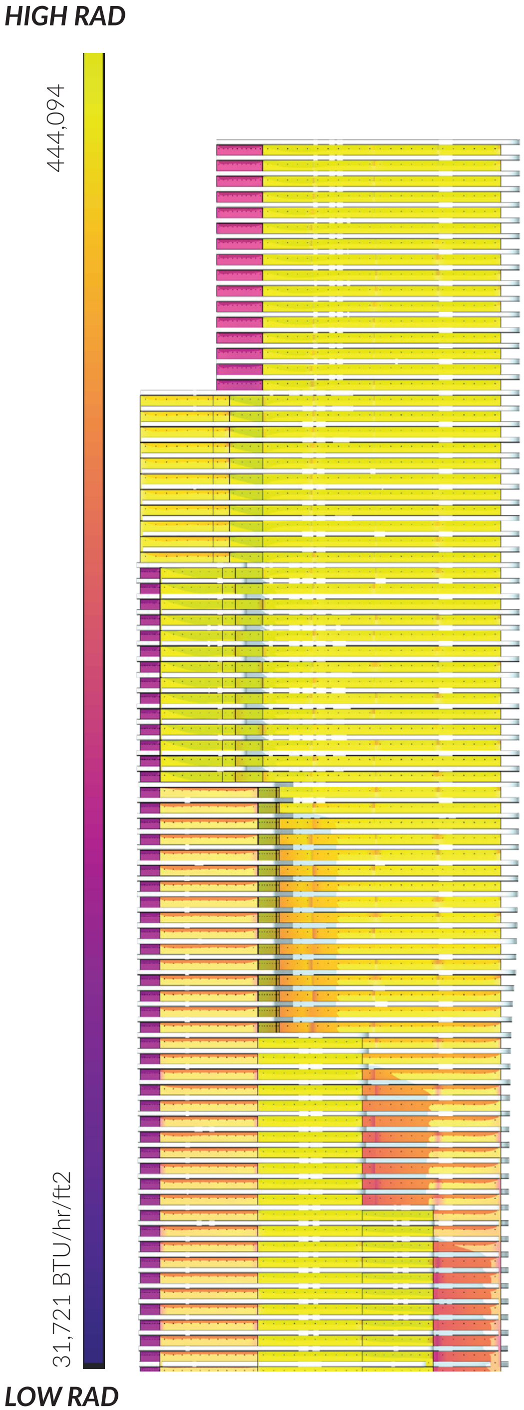
1. REIMAGINING AQUA TOWER

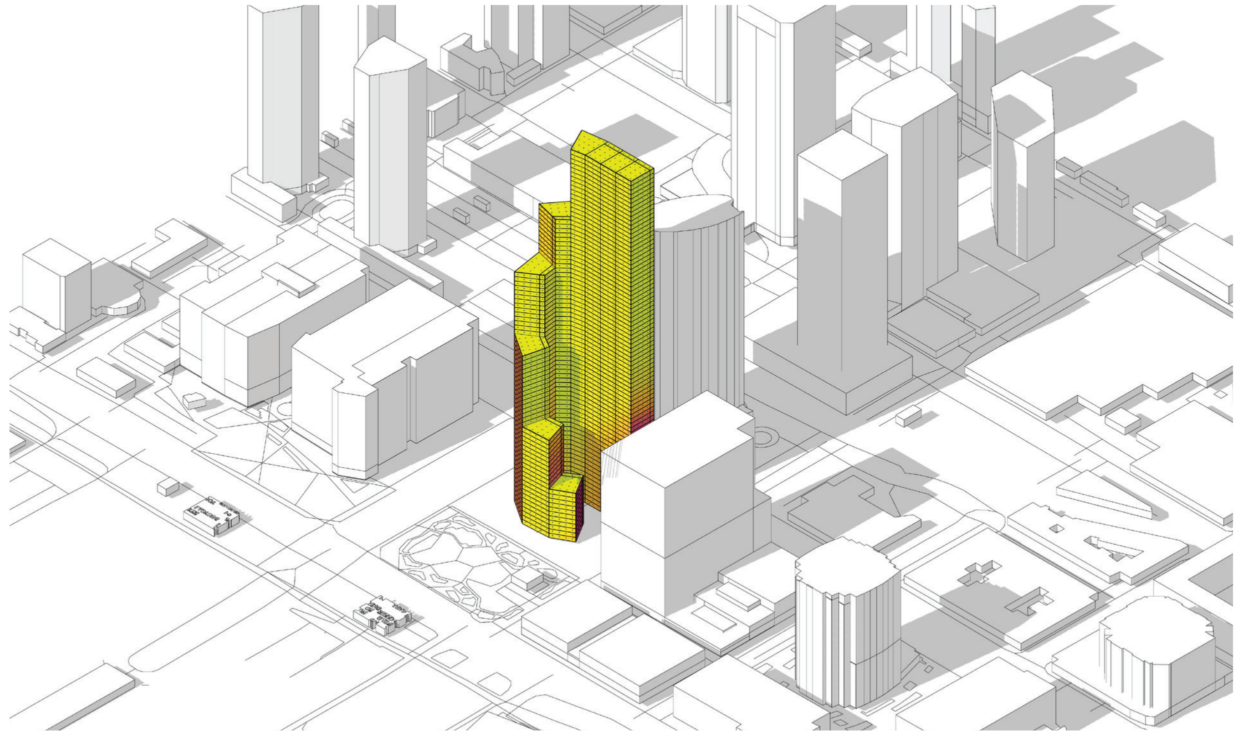
COLLABORATORS: Kruti Makwana, Aashritha Jaladi, Julia Twardzisz

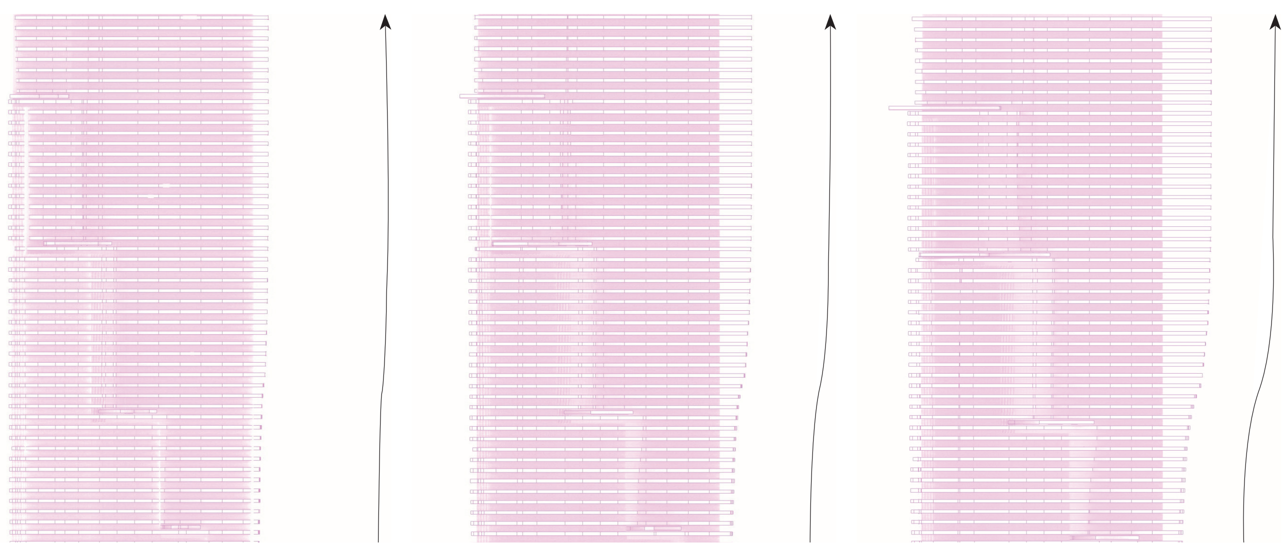
Reimagining Aqua Tower is a climate redesign project that translates the iconic Chicago skyscraper to a Pacific presence within San Diego's warm marine climate. Located in the Central Building District along the bay, the proposal prioritizes natural ventilation and cooling to mitigate thermal stress in climate zone 3B. The project introduces a staggering and cascading form modeled after waves and terrestrial contours, integrating green terraces and roof gardens that facilitate strong community connections. Individual units are strategically redesigned with parallel windows to maximize cross ventilation from prevailing western winds while capturing vistas of the Pacific Ocean and Balboa Park. These irregular balconies act as shading devices for the floors below, with their depths optimized through radiation simulations to reduce cooling demands and lower the Energy Use Intensity. By leveraging San Diego's pleasant diurnal temperature range, the design emphasizes a high tech approach to passive environmental performance for a vertical mixed use community.





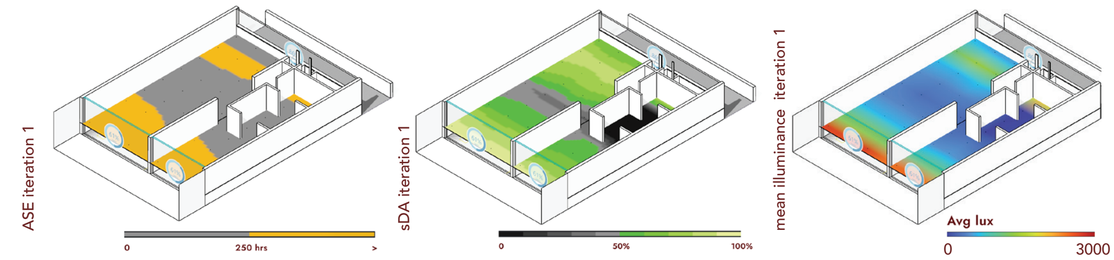


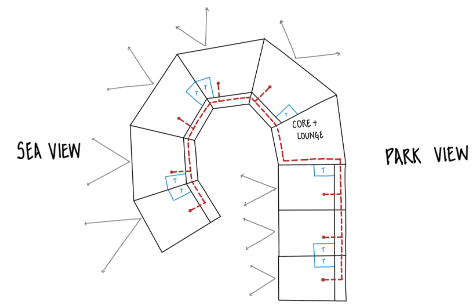




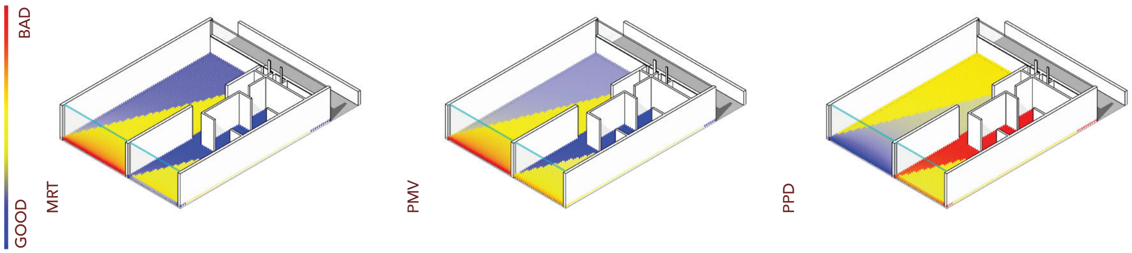
Higher solar radiation corresponds to increased overhang depth.
Max depth exaggerated for visual clarity.

DAYLIGHTING





SPATIAL THERMAL COMFORT JUNE 21ST 6PM



Energy Zones

Zone 1: Living room, Dining and Kitchen

Zone 2: Wash, Bathroom, Closet, Bedroom

Zoning

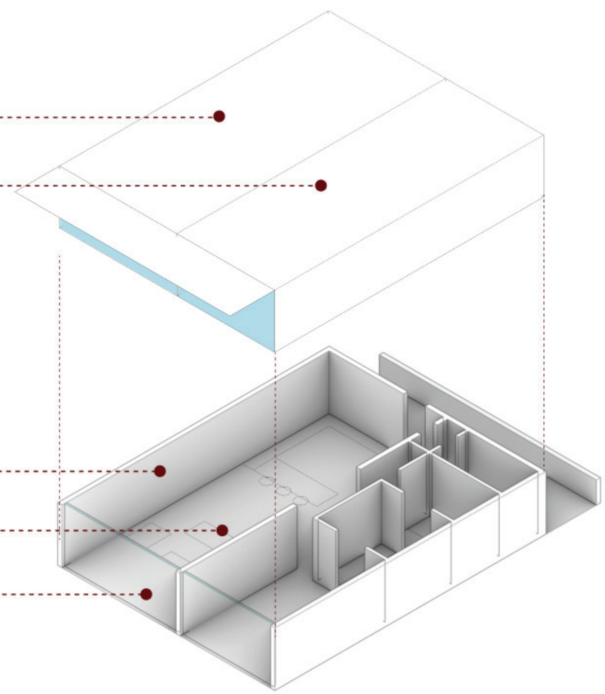
The zone is divided into 2 one is a more active zone of living room, kitchen and dining while the other is a zone of rest - bedroom, closet, washroom and the wash area of the kitchen

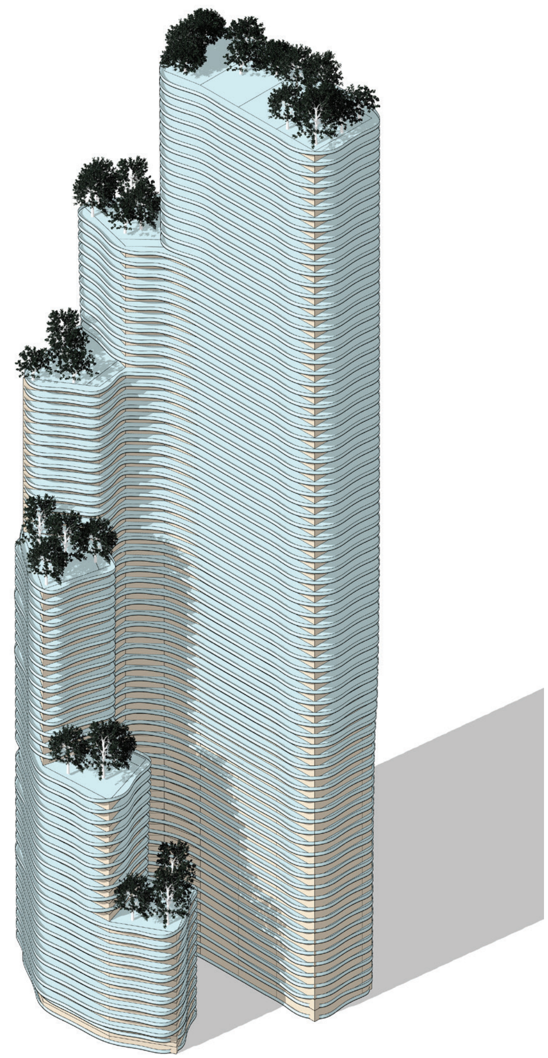
Materials

Masonry wall - CMU

Concrete Slab - Reinforced Cement Concrete

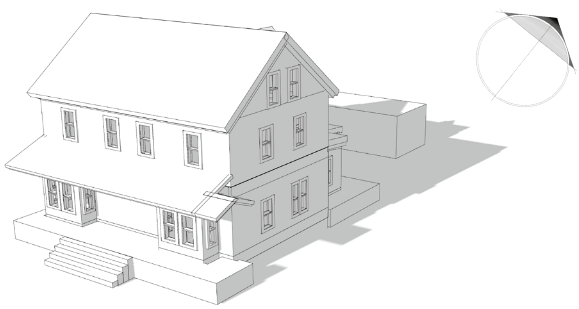
Glazing - Double glazed unit, VLT ↑ SHGC ↓

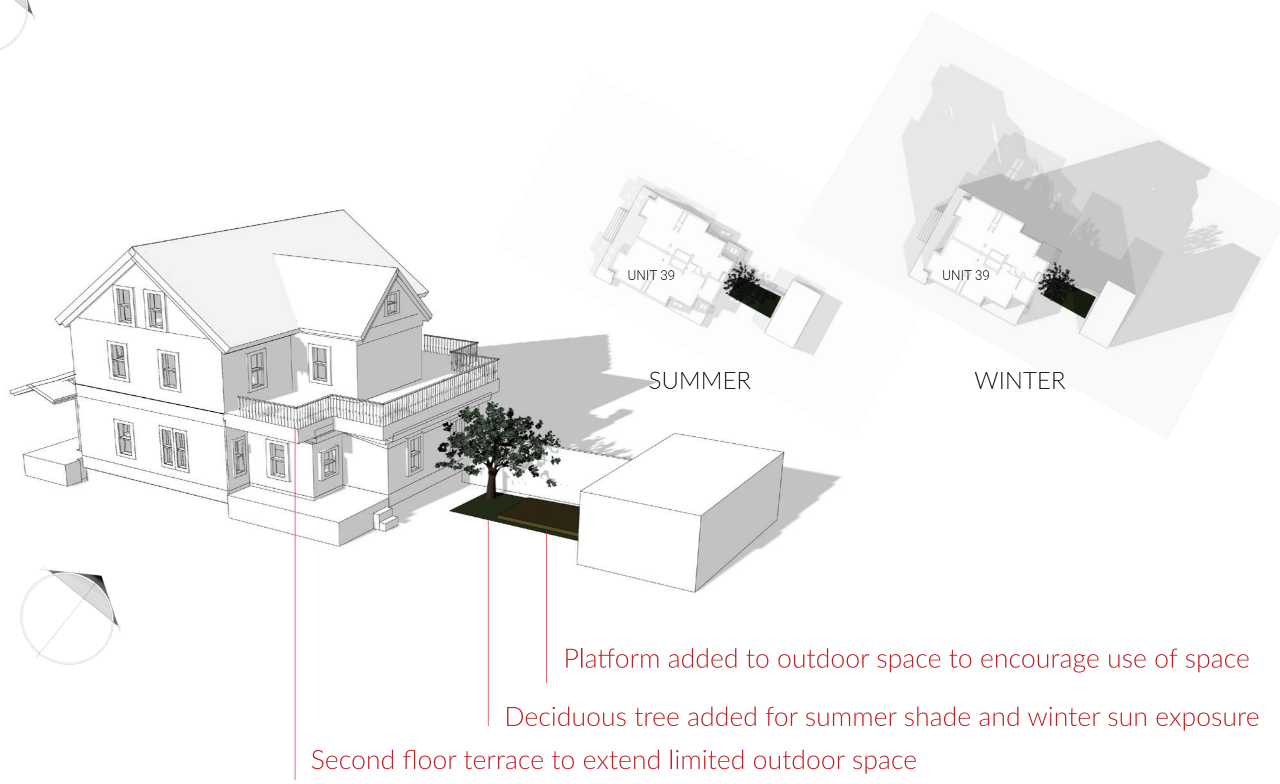




2. RESIDENTIAL RETROFIT AND REDESIGN

The energy performance assessment for 39 Beacon Street Gloucester, Massachusetts, explores two distinct paths for enhancing efficiency within its cold-dominant coastal climate. Located as part of a residential duplex, Unit 39 currently faces an orientation that provides some morning sun but limits direct solar gain in the afternoon due to the partitioning wall with the adjacent unit. To address this, the climate redesign serves as a theoretical reimagining of the home, proposing a 90-degree rotation of the building to a southern orientation to maximize winter solar gain. While this rotation represents an ideal environmental configuration, it is noted as a non-feasible structural change for the existing site.
In contrast, the designed sunspace is a feasible and highly recommended retrofit that utilizes the existing south porch structure. Unlike the theoretical redesign, the sunspace is a practical addition featuring a south-facing glass enclosure with operable windows and skylights that allow the area to open back up into a porch during the summer. This system passively captures solar radiation to warm interior surfaces and air, providing a supplementary heat source that reduces the home’s primary energy liability: space heating. By integrating night insulation shades and utilizing the common wall for heat distribution, the sunspace creates a resilient and adaptive interface between the home and its environment.





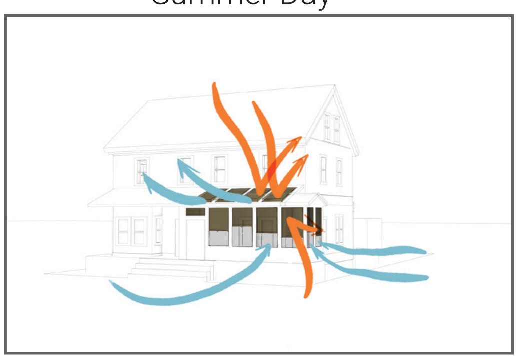
OPTIMIZED REDESIGN
(THEORETICAL)

RECOMMENDED SUNSPACE

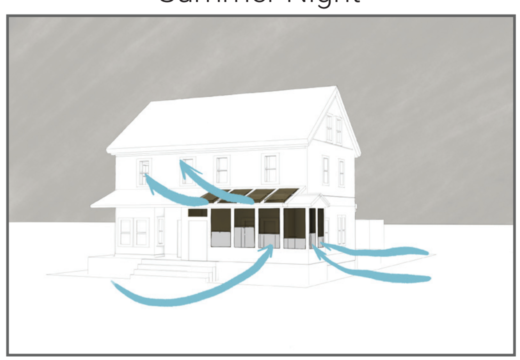
Winter Day

Winter Night

Summer Day



Summer Night



PASSIVE SOLAR HEATING — GLASS AREA CALCULATION

Isolated Sunspace (SSE2) – Massachusetts Climate

1. System Type & Specifications

System Type:
SSE2 — Semi-enclosed 90/30 sunspace with insulated common wall and night insulation

Location:
Boston, MA (cold climate)
Retrofit of existing south porch

Glazing:
- Vertical south: 5 windows (3'×5') = 75 ft²
- Roof skylights: 4 units (4'×3') = 48 ft²

Total: 123 ft²

- Double-pane low-E, argon (U=0.22, SHGC=0.45)

Thermal Controls:
- Common wall: R-13 to R-19
- Floor: R-19 insulated wood
- Night insulation shades
- Operable windows/skylights for summer ventilation

2. Heat Loss Calculation

```
Measured UA = 969.88 Btu/hr·°F
24UA = 24 × 969.88 = 23,277 Btu/day·°F
```

3. SSF/LCR Analysis

LCR	100	70	50	40	30	25	20	15
SSE2 SSF (%)	16	22	29	34	41	46	52	61

4. Target Performance (30% SSF)

```
Target SSF = 30% → LCR ≈ 50

Required glass area:
A = 24UA / LCR
A = 23,277 / 50
A ≈ 466 ft²
```

5. Actual Performance

```
Actual glass area = 123 ft²

Actual LCR:
LCR = 23,277 / 123
LCR ≈ 189
```

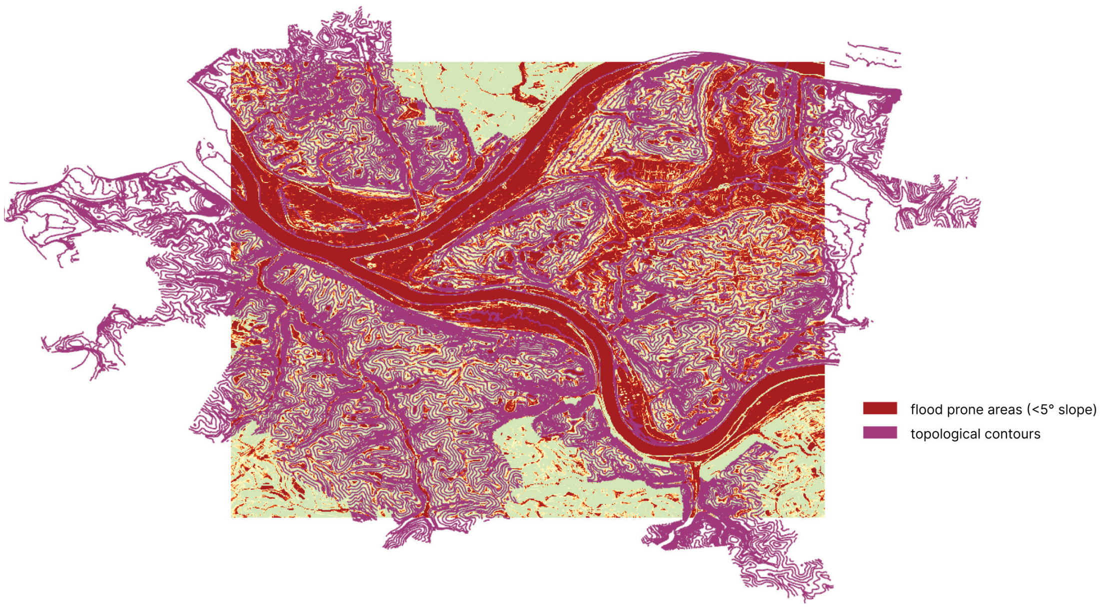
EXPECTED SOLAR SAVINGS FRACTION: 8-10%

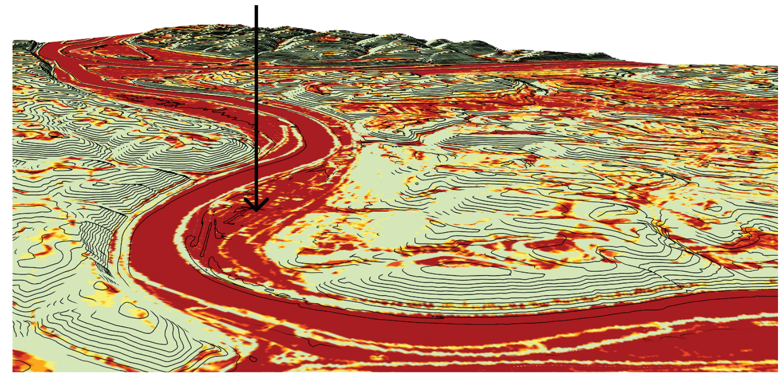
6. Design Commentary

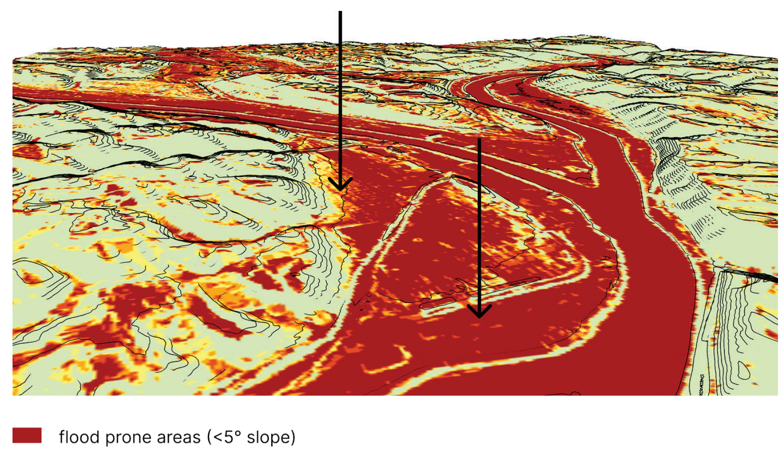
- **Glass Area:** 123 ft² limited by existing porch structure and budget. Provides useful daytime gains without overheating risk.
- **Thermal Mass:** Insulated porch floor and interior finishes moderate temperature swings; additional masonry not required at this LCR.

3. AGENTS OF BIODIVERSITY

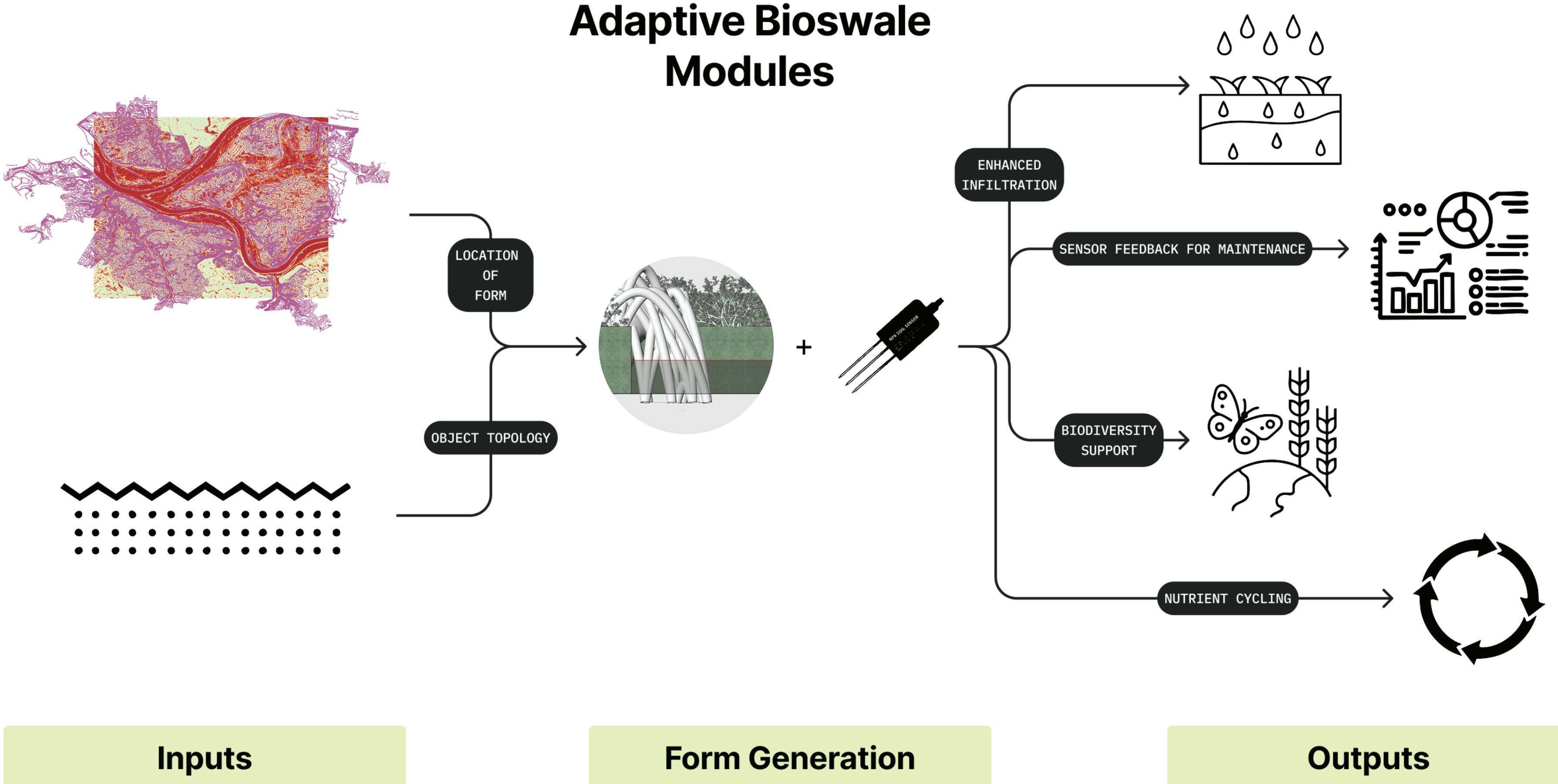
Agents of Biodiversity in Pittsburgh's Bioswales proposes the use of adaptive bio structures to mitigate flood risks caused by the city's steep topography, aging infrastructure, and intensifying storm events. As decentralized green infrastructure, bioswales improve soil infiltration and reduce runoff, yet they often face challenges such as ongoing maintenance demands and the need for consistent monitoring to ensure long term performance. To address these issues, the project introduces Adaptive Bioswale Modules crafted from ceramic or bio based composites that support biodiversity and nutrient cycling while enhancing infiltration. These modules use a sensor interface to track NPK and soil moisture levels, providing critical feedback for adaptive management. By integrating site specific factors like soil compaction and the degree of hill slope, this monitoring system optimizes maintenance schedules and helps reduce unnecessary spending to lengthen the life of the urban waterscape.







Adaptive Bioswale Modules

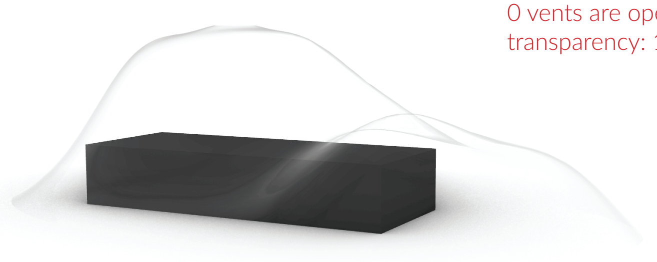


4. ENVIRONMENTALLY REACTIVE DOME

Environmentally Reactive Dome is procedurally generated in Grasshopper and GHPython using a subdivided panel system and responds in real time to ambient temperature through adaptive venting and electrochromic glazing. Below 45°F, all vents remain closed to create a greenhouse effect; within the thermal comfort range, vent opening increases according to a quadratic scaling function. When temperatures exceed the comfort zone, all vents open fully. Vents deploy outward along surface normals to prevent overlap, while glass transparency is temperature-driven and computed as (100 − temperature °F) + 20, producing a frosted appearance at higher temperatures (shown as black in the image for graphic clarity).

15°F / -9°C
temp < comfort zone:

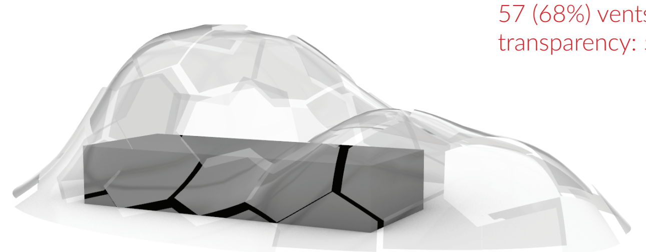
0 vents are open
transparency: 100%



COLD TEMPERATURES

60°F / 15°C
temp in comfort zone:

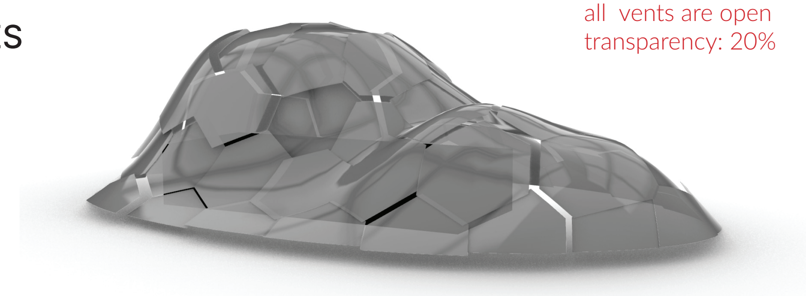
57 (68%) vents are open
transparency: 51%



MILD TEMPERATURES

90°F / 32°C
temp > comfort zone:

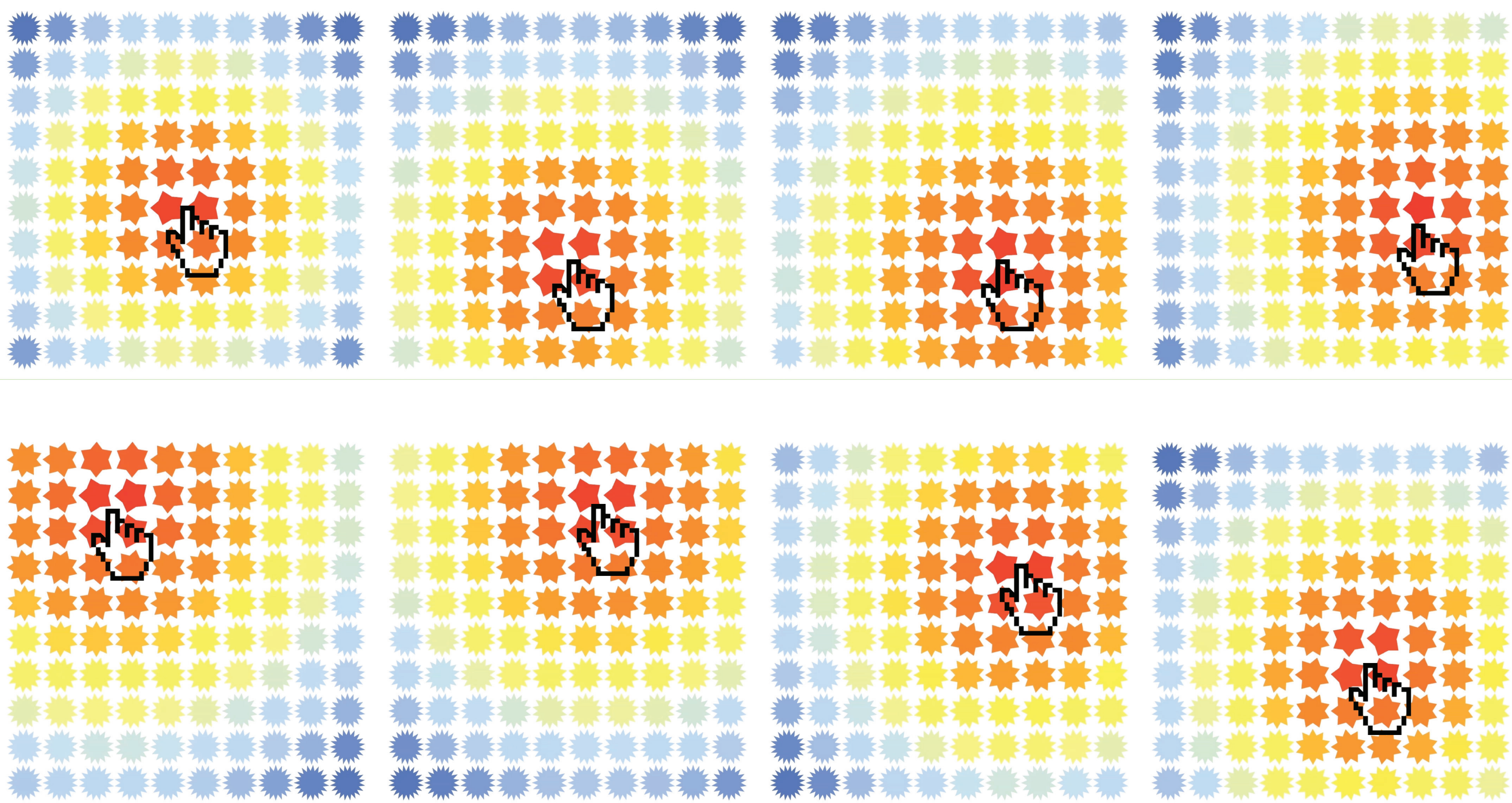
all vents are open
transparency: 20%



HOT TEMPERATURES

5. PARAMETRIC DRAWING

This parametric drawing creates a grid of radial shapes whose geometry is continuously influenced by the position of the cursor. Each shape measures its distance to the cursor and remaps that value to control the number of points used to construct the form. As the cursor moves closer, shapes reduce to fewer points and appear simpler; as it moves farther away, the shapes gain more points and become increasingly complex.
This distance-based control produces a gradual transition across the field, allowing a single point of interaction to generate a wide range of geometric variation while maintaining a coherent overall pattern.



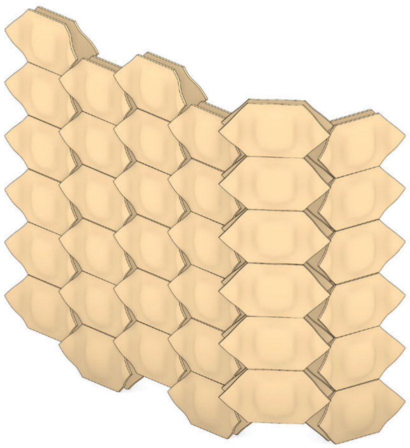
6. MYCO-BUBBLE WALL

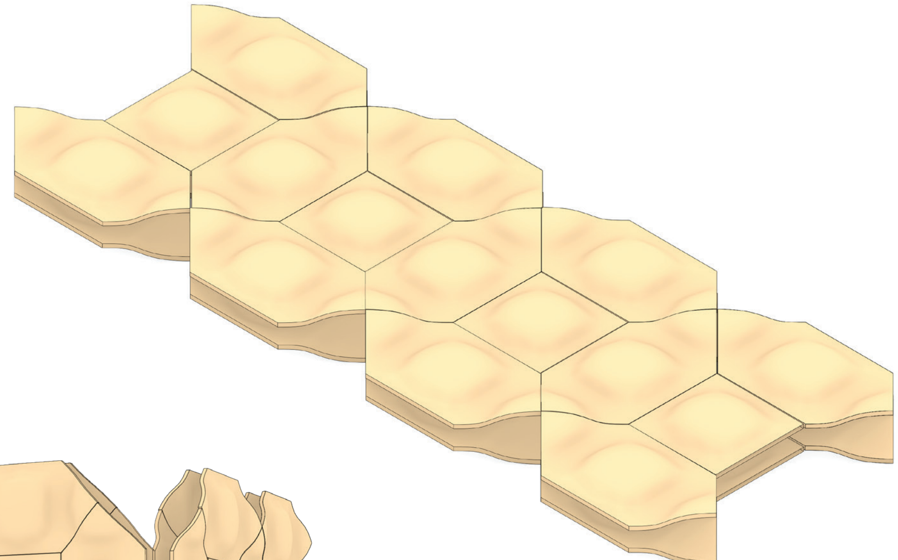
ON-GOING

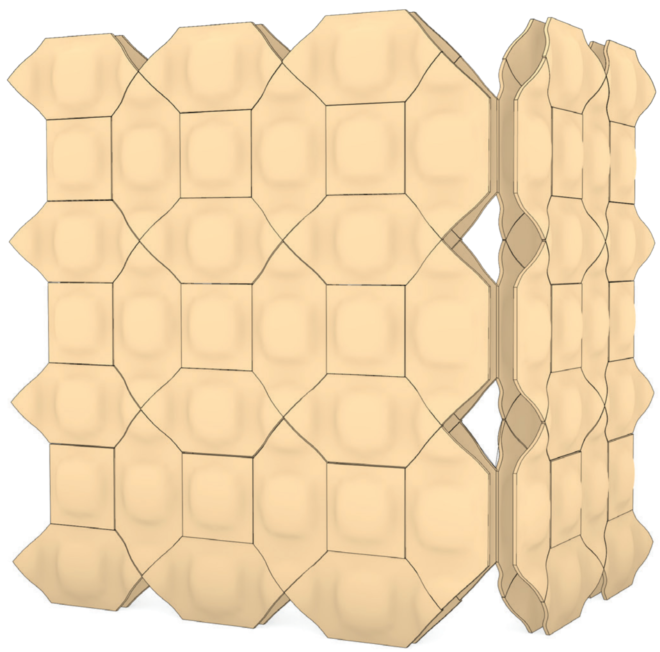
Myco-Bubble Wall is a non-planar, compressed mycelium panel system designed as a modular insulating wall.

CNC-milled molds and vacuum forming shape a 1-inch mycelium substrate, which is then compressed to increase strength while retaining air pockets for insulation. The resulting “bubble” modules tessellate into a double-layer wall assembly.

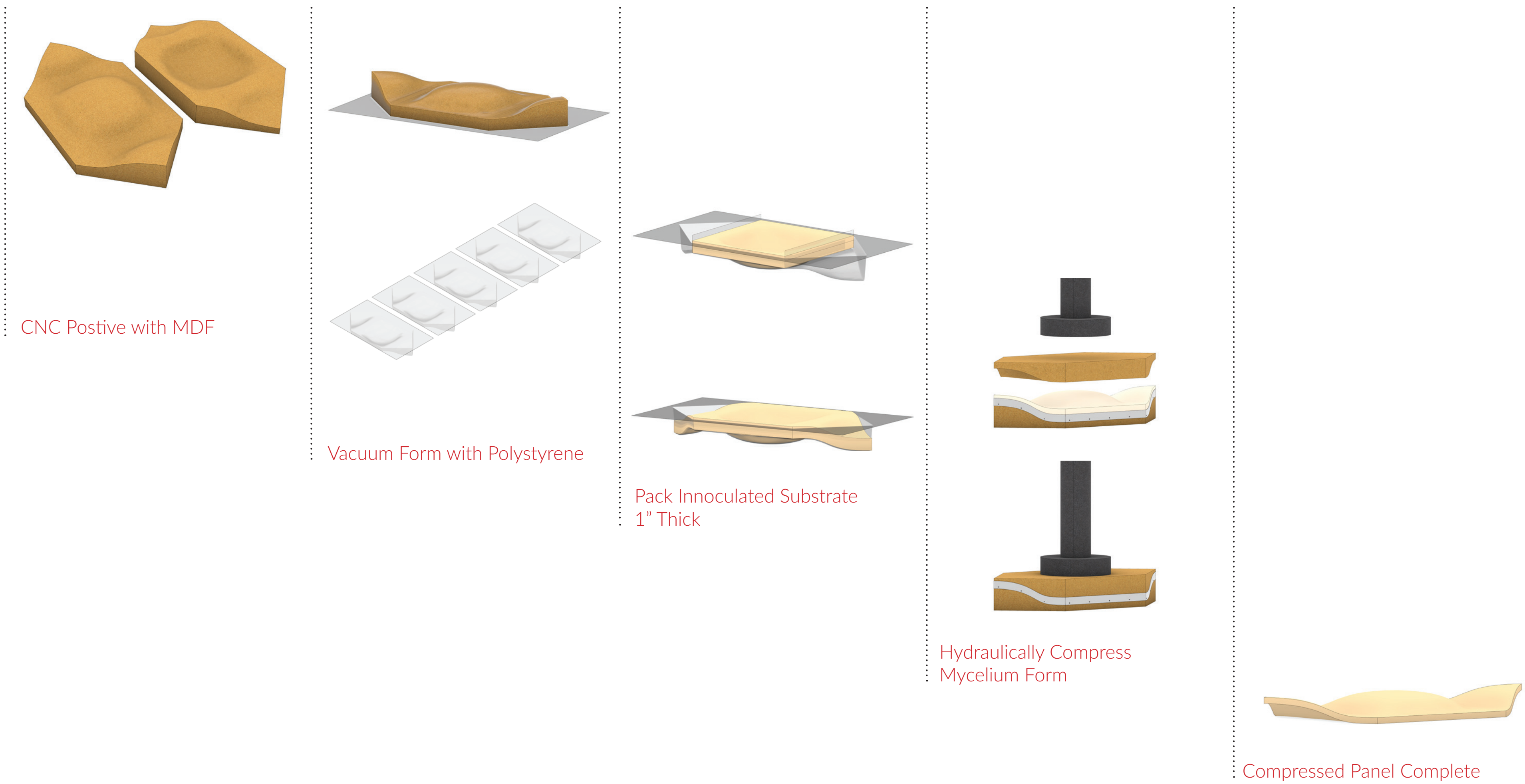
The project tests growth time, moisture, compression ratios, and post-mold knitting with loose mycelium foam to improve structural performance and continuity, positioning mycelium as both material and form generator.







MATERIAL TOOLING AND PROCESS DESIGN

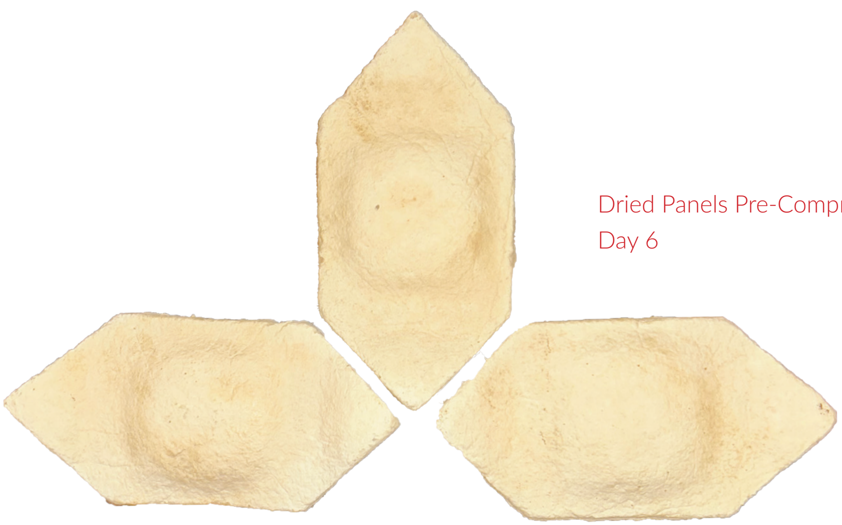


MYCELIUM GROWTH PROGRESS


Day 1

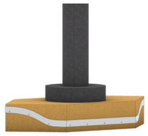

Day 2


Day 4


Dried Panels Pre-Compression
Day 6

Next Steps:

1. Compression



2. Substrate fill