# PORTFOLIO

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01

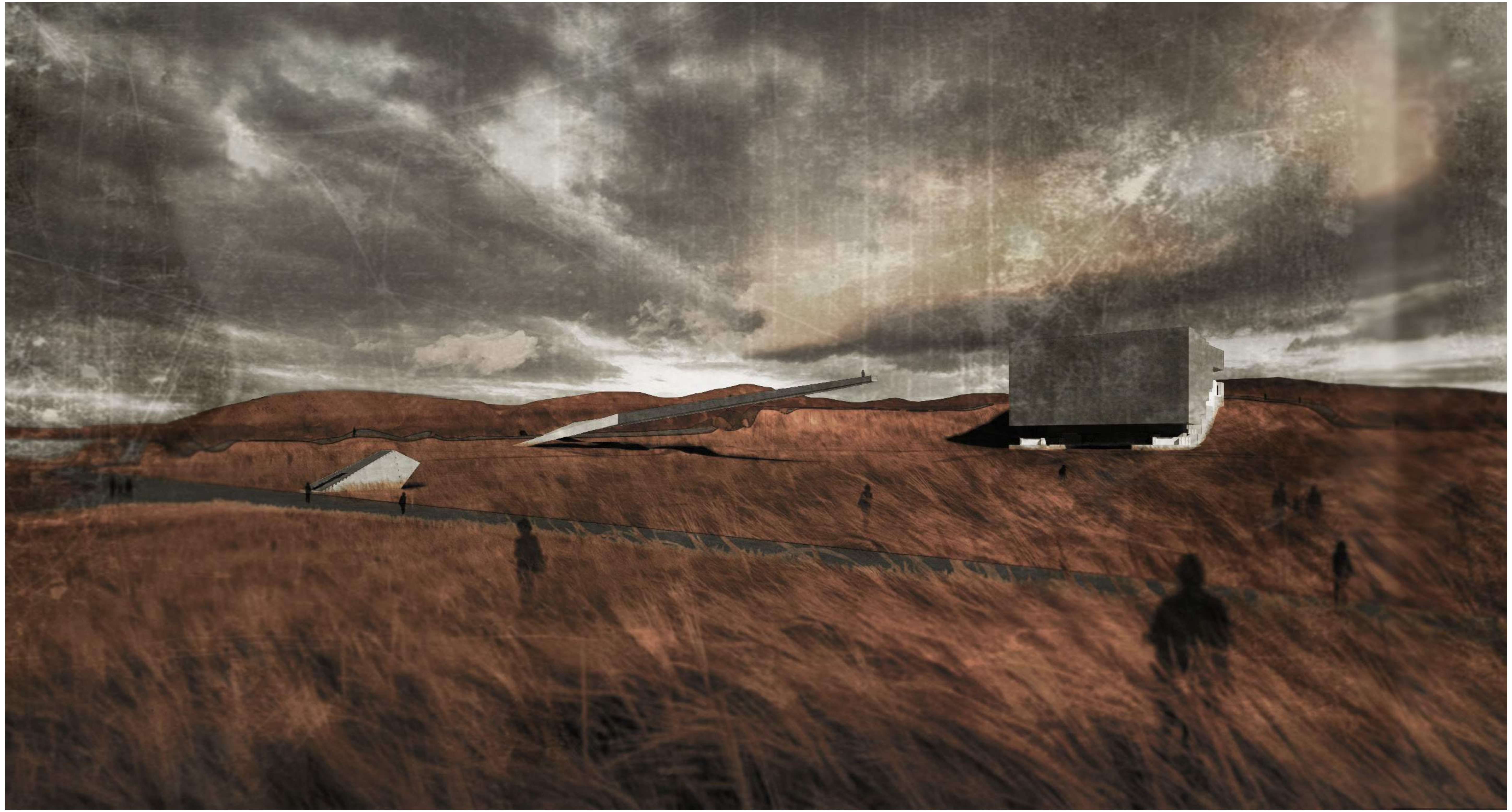
# DECOLONIZING HAWAII

Seven Star Houses / Lady Columbia / Landscsape
Year: 2021
Location: Hawaii
Type: Academic Project (Group)
Collaborators: Nanjia Jiang and Iris Hong
Instructors: Prof. Dominic Leong and Prof. Sean Connelly

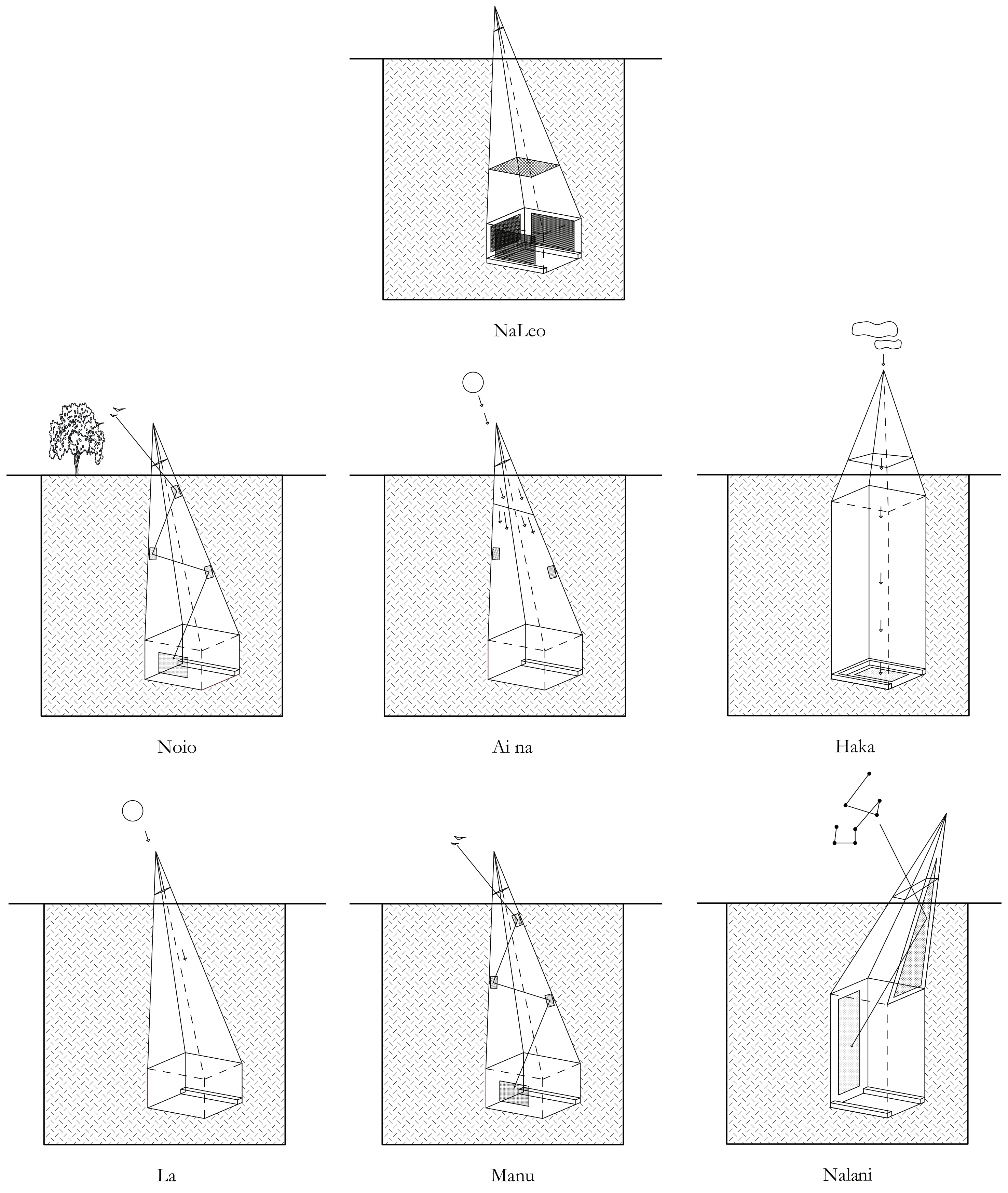
The Puowaina volcanic crater rises 461 feet above sea level and offers views of most of the Oahu island. As an isolated space overlooking the city, Puowaina was considered a sacred burial site to its indigenous people. The US military chose the Puowaina crater for its unique cultural and historical background as the perfect site for the National Memorial Cemetery of the Pacific which opened in 1949 and in which more than 13,000 american soldiers were buried.

After many years of debates over the construction of the cemetery for the soldiers who died in the numerous wars in the Pacific, the National Memorial Cemetery of the Pacific was opened to the public in 1949. Before the US Congress approved the construction of the cemetery in Honolulu, many locals were against the idea of building a city of the dead over the city of the living. However, once Congress gave the authorization, the governor of Hawaii donated Puowaina as the site for the new cemetery. During the second world war, a tunnel was dug out underneath the peak for the placement of the batteries to protect the shore. Also at the peak of the crater, the earth mound was removed to construct the viewing platform where tourists could see the panoramic view of the city and the sea.

In our attempt to decolonize the site we looked back at native practices and ancestral knowlege. Ho'oponopono was a healing ceremony that was practiced in Hawaii to set things right with each other and God and to restore and maintain good relationships among family through prayer, discussion, confession, repentance, and mutual restitution and forgiveness followed by closing prayers and periods of silence. Hooponopono is about conflict resolution. We look at healing as an opportunity to give back to a community that has long suffered from US colonialism. Our project aims to decolonize Hawaii is by restoring and strengthening the independence of the people and the land through healing practices. Thus we approach the concept of healing in a twofold manner: Healing of the land and healing of the people.

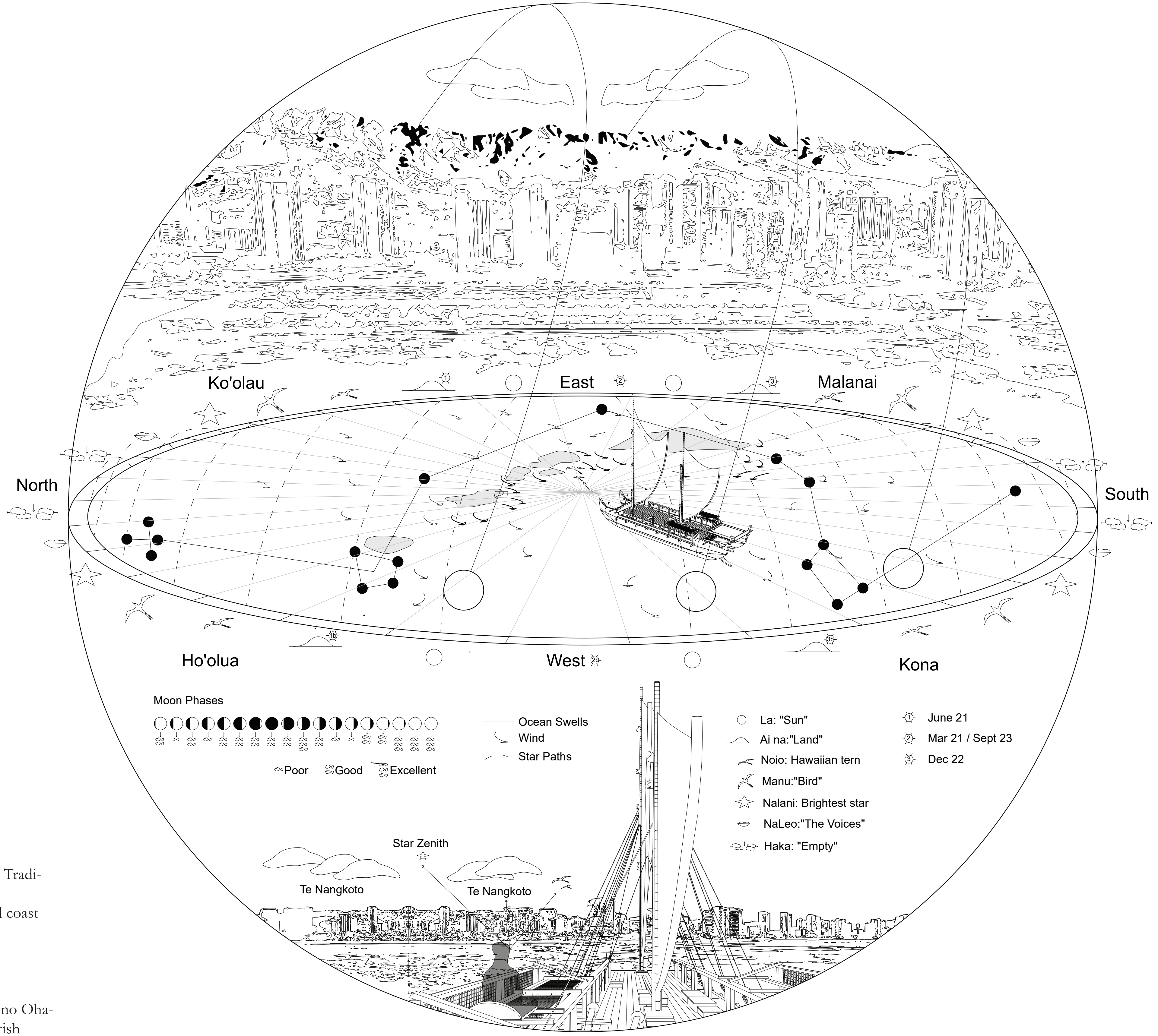


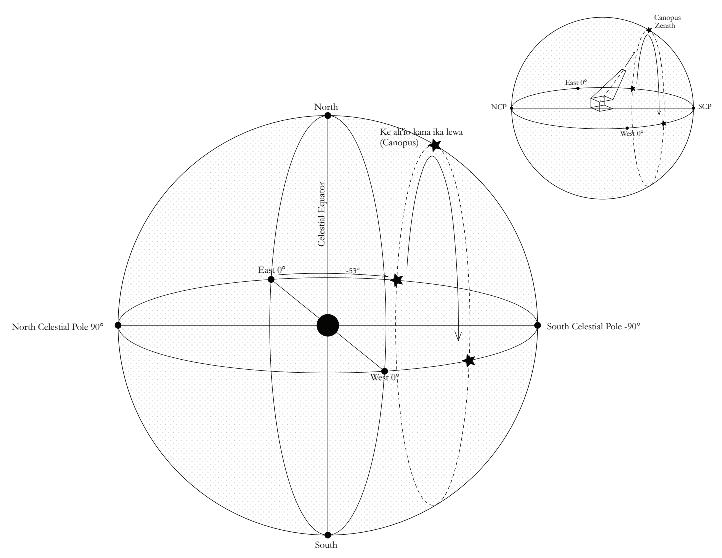
The Seven Star Houses

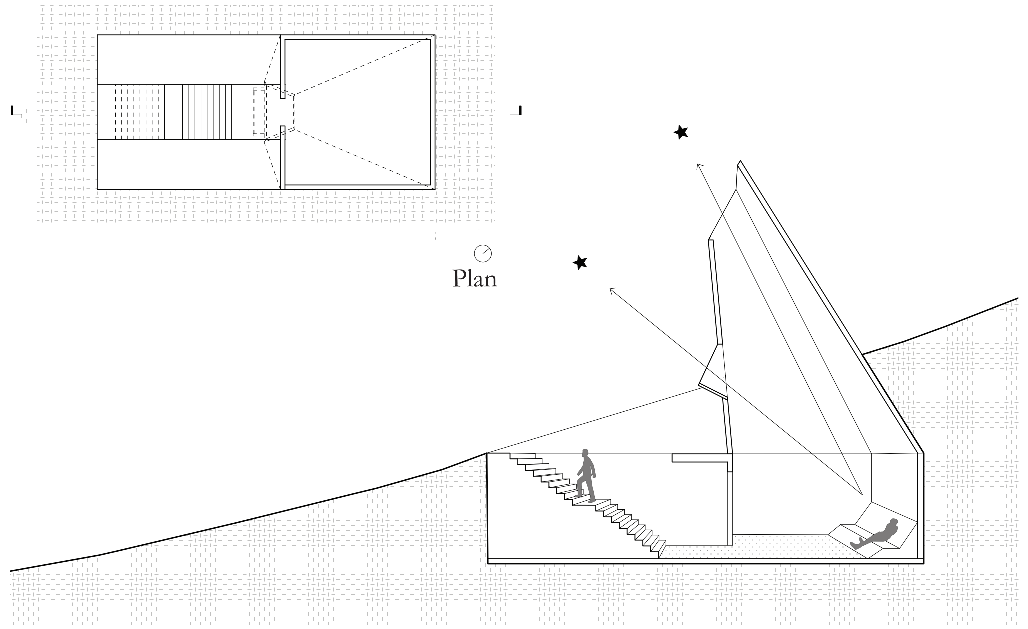



We looked back at navigation practices when thinking about healing the natives from colonization, as navigation enabled them to restore their faith in the importance and value of their ancestral knowledge. This demonstration of indigenous knowledge and technology led to a revitalization of voyaging. The star compass used by navigators was based on seven houses that were defined by elements of nature such as the sun (La), the stars (Nalani), the birds, the clouds… and through refocusing attention on these elements we aim to restore indigenous knowledge. Towards that objective, we developed a series of silent rooms for prayer and contemplation, that redirect/reorient the visitor from the pre-existing axis created by the cemetery to the natural elements that were used by Hawaiian navigators to orient themselves.

References:
'On Wayfinding' (Thompson, Nainoa), Hawaiian Voyaging Traditions https://archive.holulea.com
'Hawaiian Moon Phases', Spawning Guide for the Leeward coast of Hawaii Island - The Kohala Center https://kohalacenter.org/
A global map of wind, weather, and ocean conditions https://earth.nullschool.net/
'Hawaiian Star Compass', Kamehameha Schools - Kealapono Ohana Engagement Ohana - Resources to help the ohana flourish

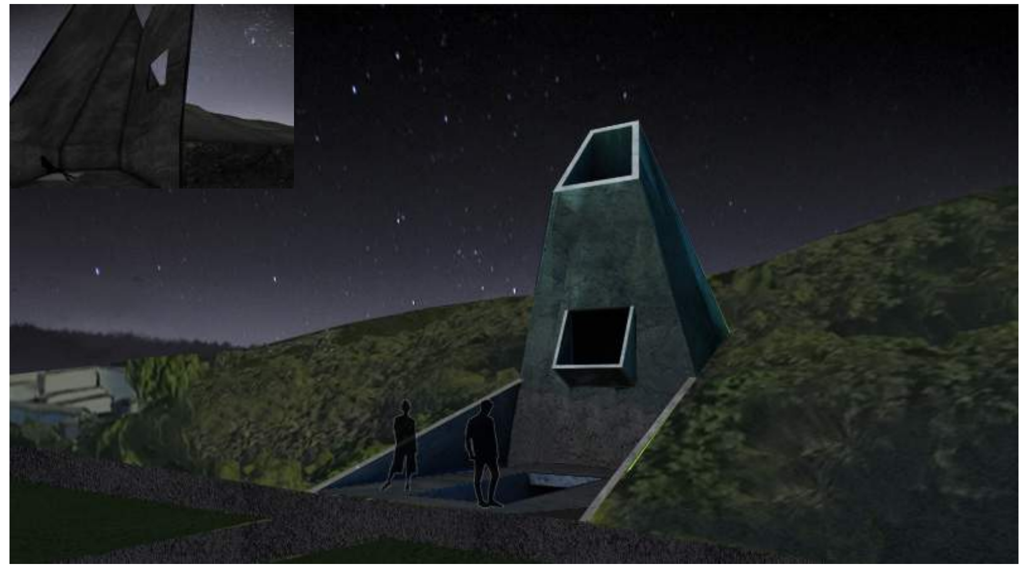




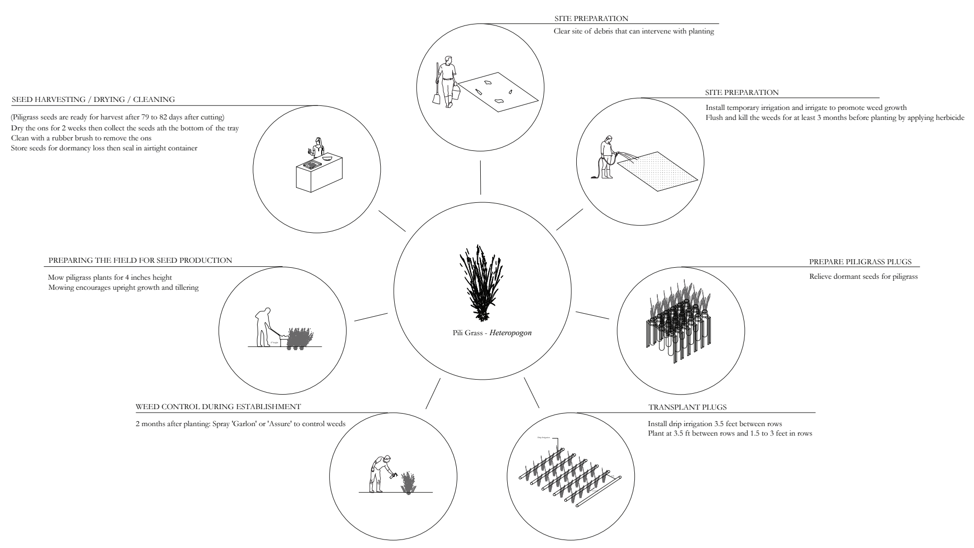


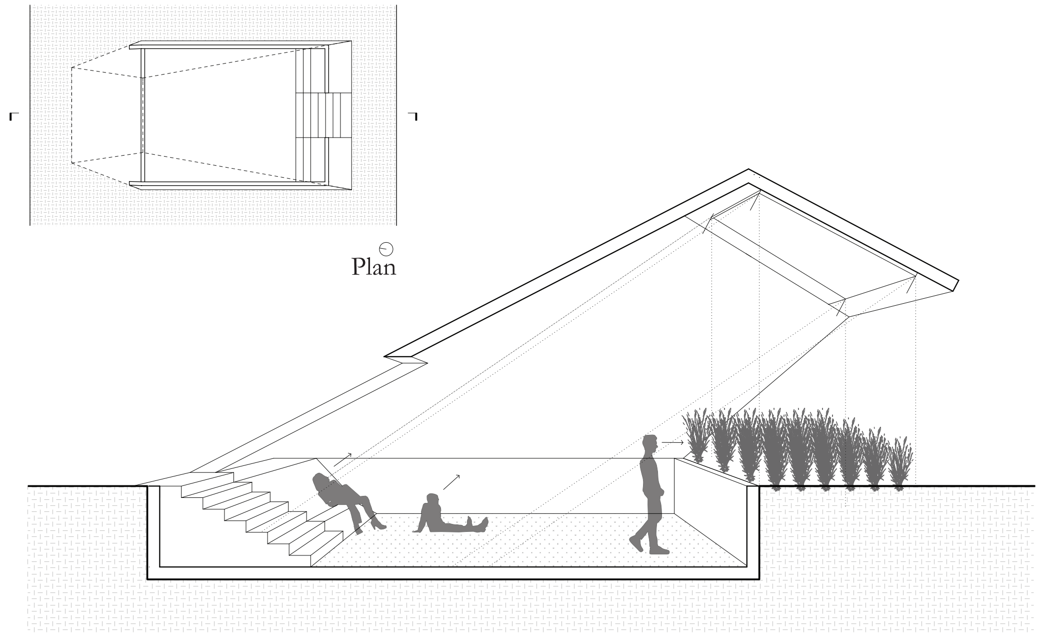
Plan

Section AA



NALANI

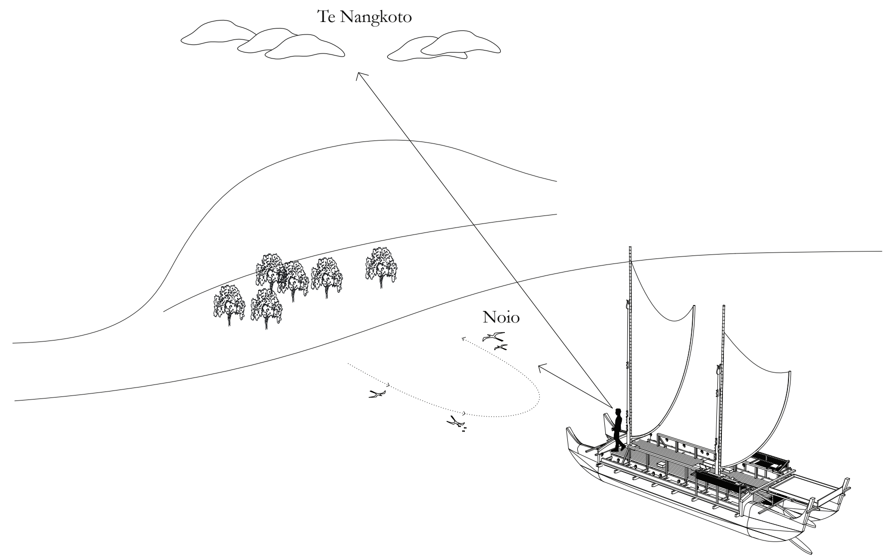


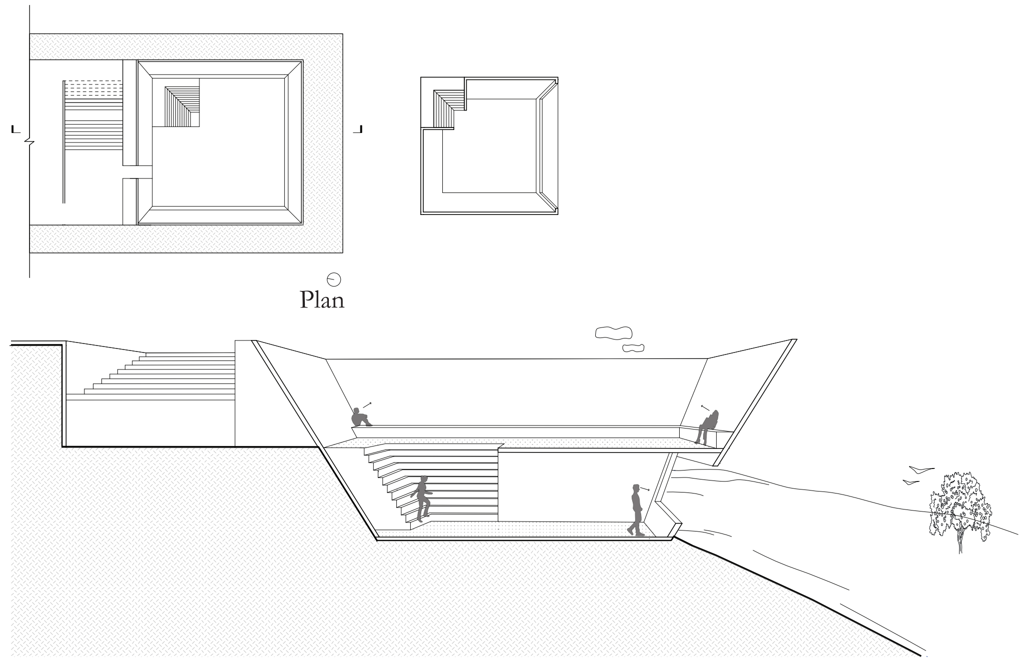


Plan

Section BB

AINA

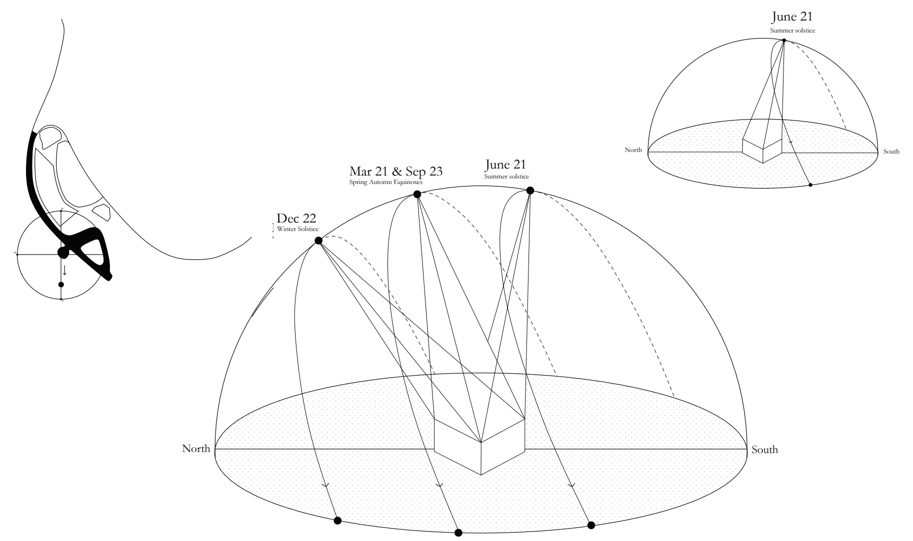


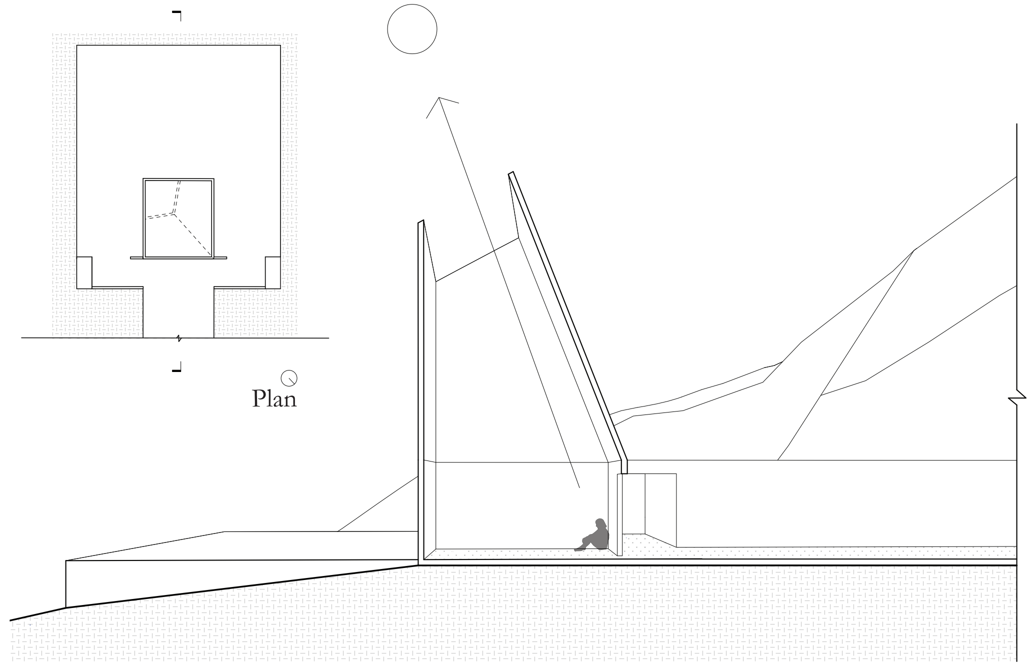



Plan

Section CC

NOIO / HAKA

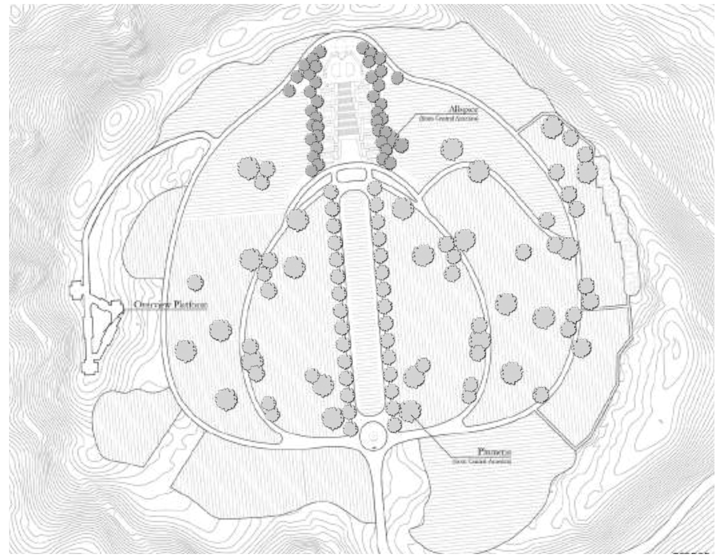


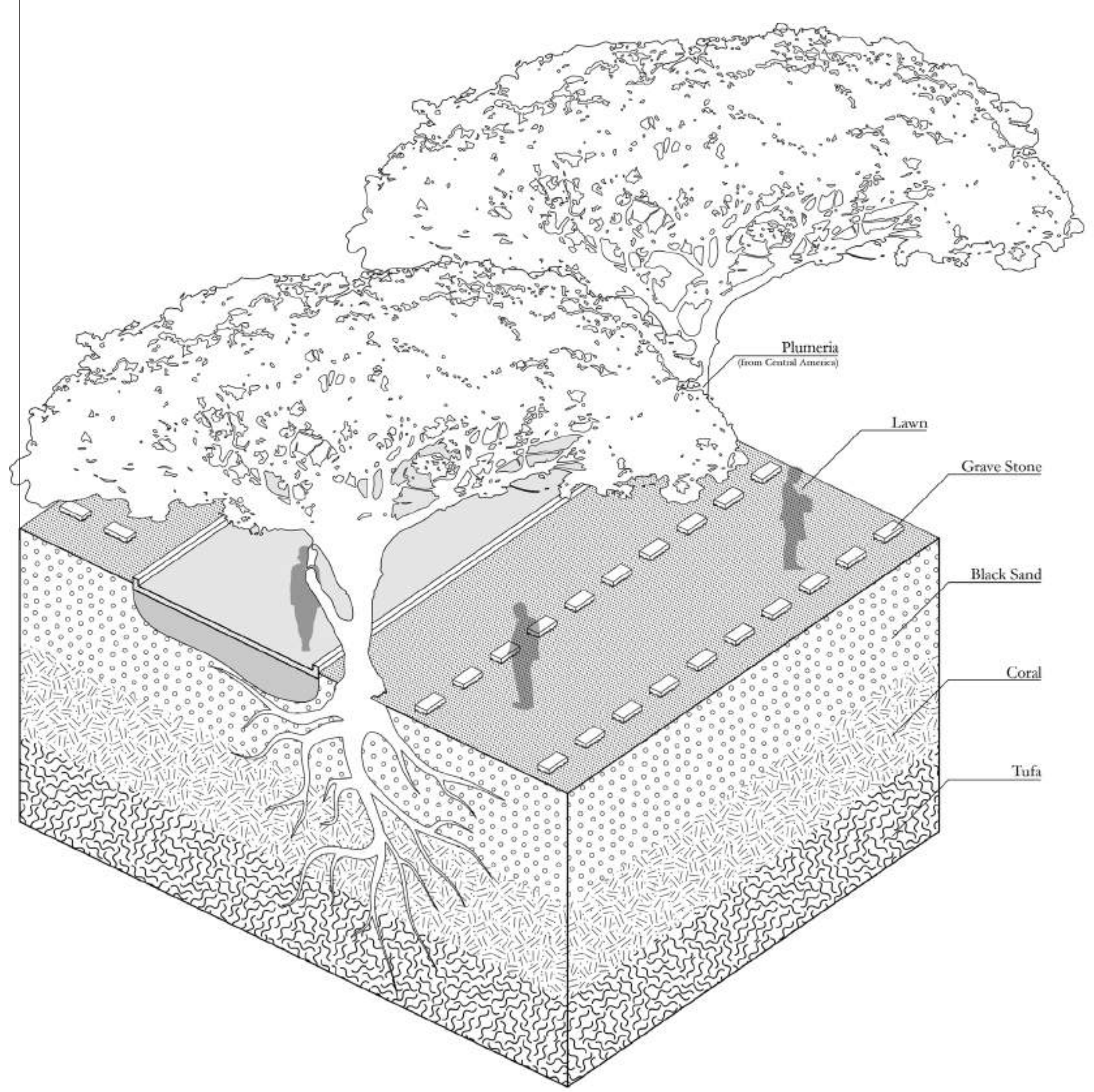
Plan

Section DD

LA



Before

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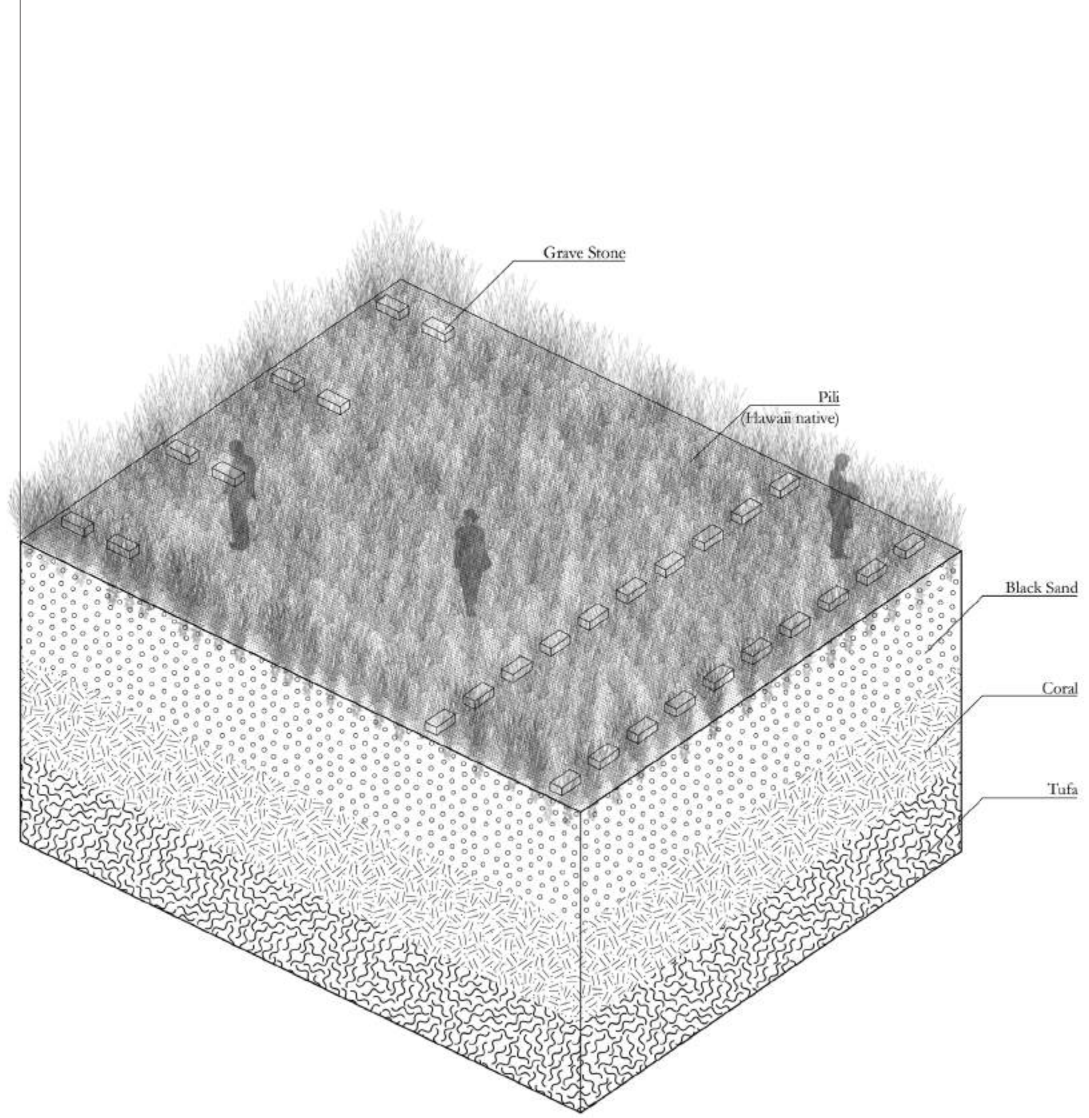
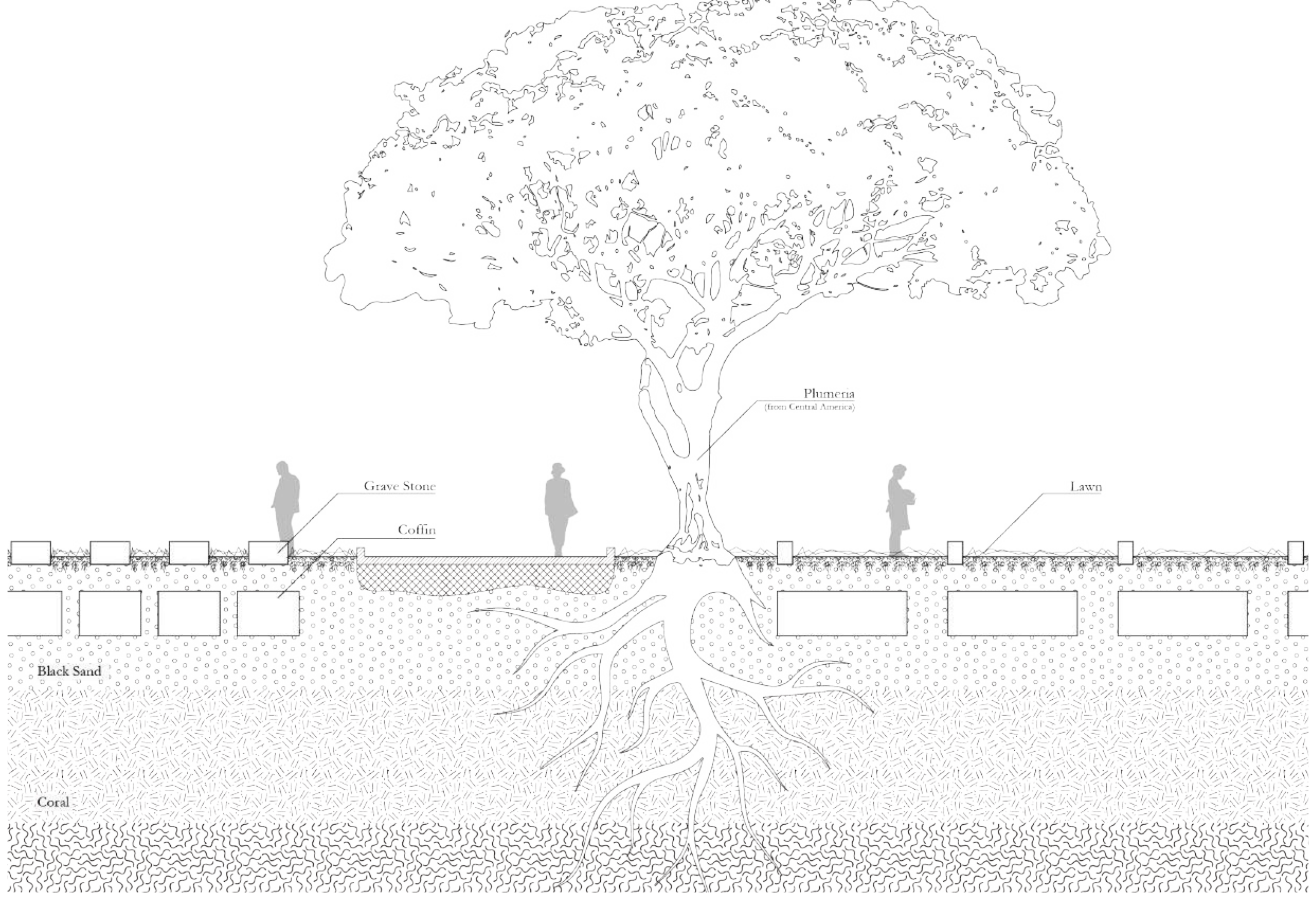
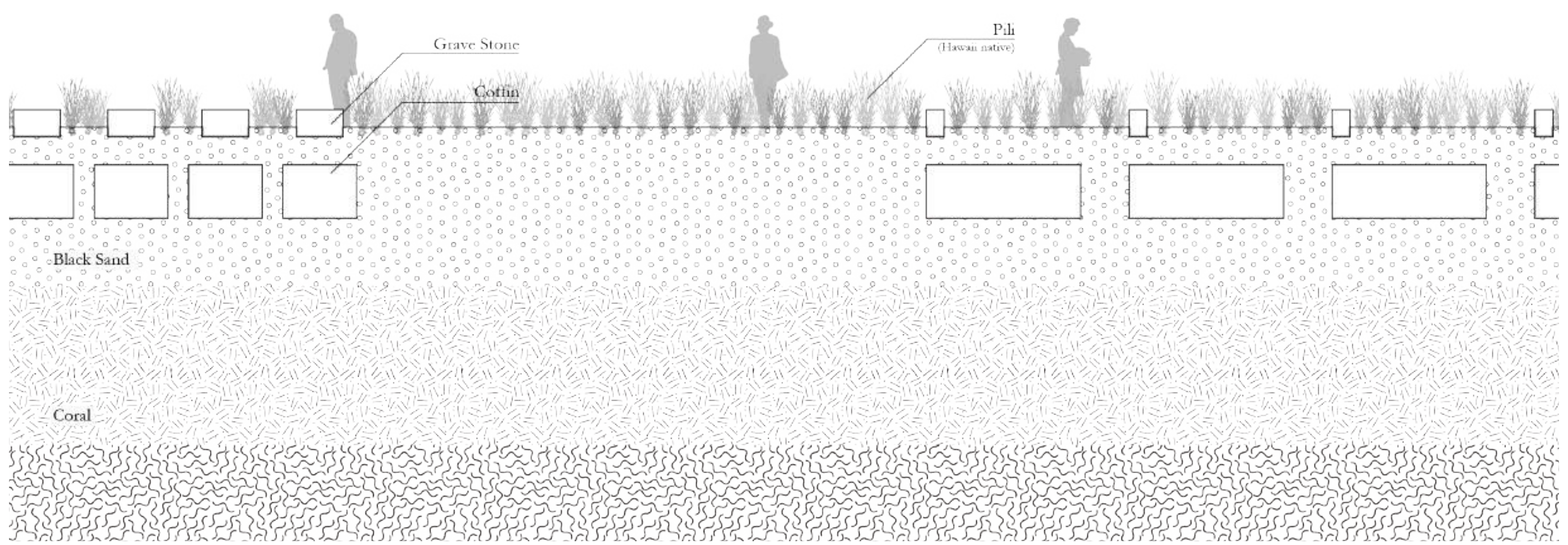



## Healing of the Land

In the cemetery the trees which are 60 yrs old are invasive to this experience of space which used to be a field. Through the removal of the trees and by planting a field of piligrass (Scientifically Heteropogon), an indigenous plant native to Hawaii, we aim to restore the native ecology. Piligrass is unfortunately now only found on 27 out of 41 sites. Pili means "to stick together", it is a symbol of connectivity, one that we hope to restore on Puowaina. Moreover, at the peak of the crater we removed the existing viewing platform and re-created the land that used to be there, thus restoring the original landscape.




Before

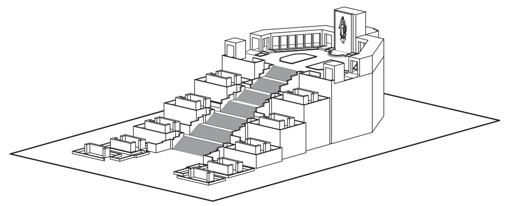



After

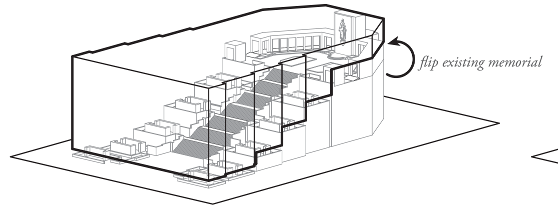
## Lady Columbia Intervention

Lady Columbia is the personification of the United States. The settlers wanted a figure representing themselves not the Native Americans. The name “Columbia” was used for the New World (America) in 1967. At the National Cemetery of the Pacific she represented a grieving mother figure overseeing the deceased. One of the ways in which our project aims to decolonize Hawaii and restore the independence of the people is through reversing the hierarchy, flipping the memorial thus creating a concrete structure that also covers part of Lady Columbia and represents an opposition to colonization.

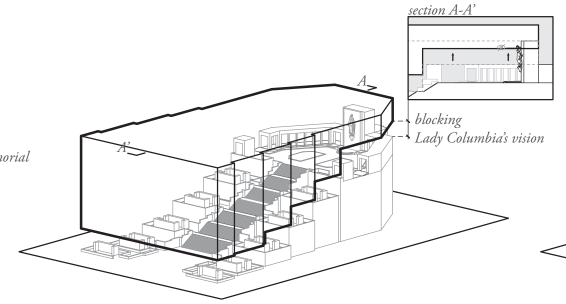
### Design Process



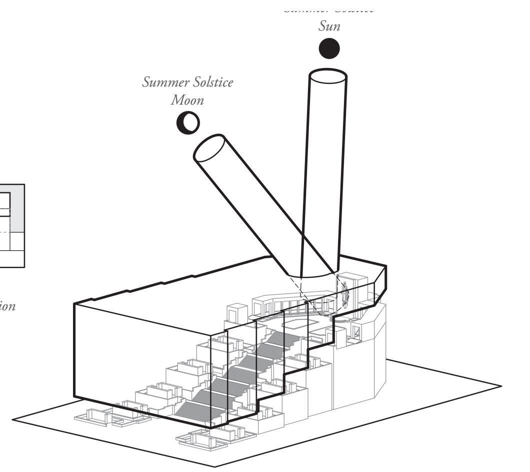
Existing Memorial



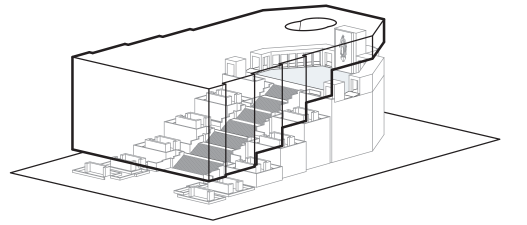

01: Flipping Memorial



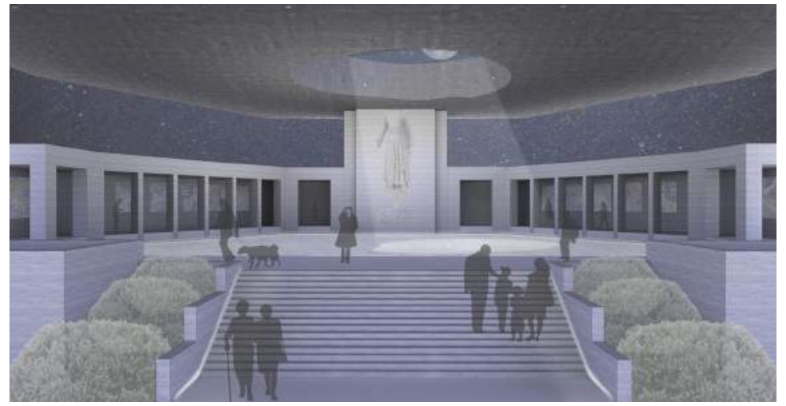

02: Lifting Up

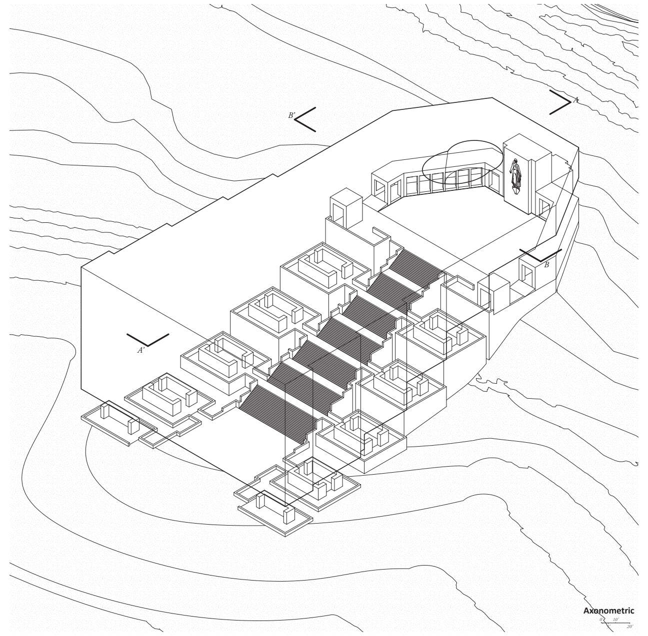


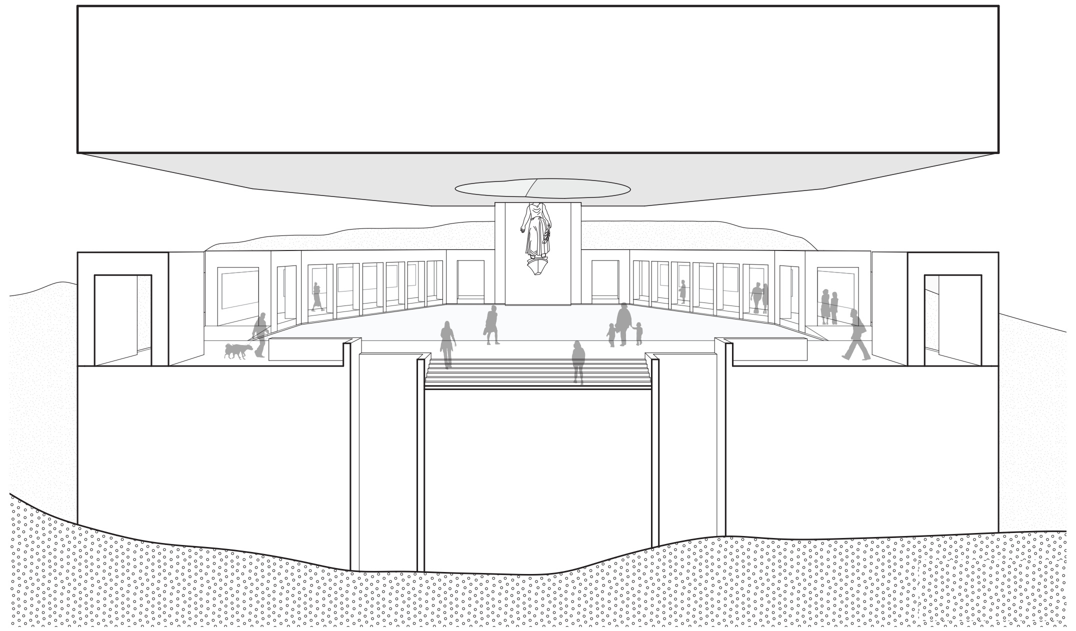

03: Introducing Sun and Moon Light Channel



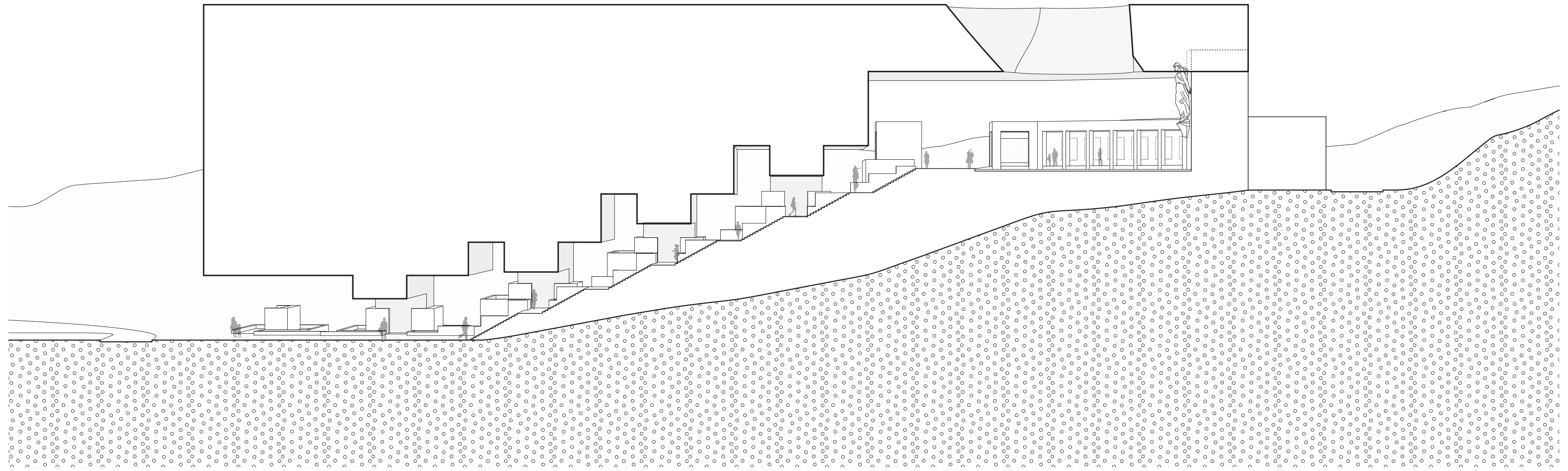
New Memorial





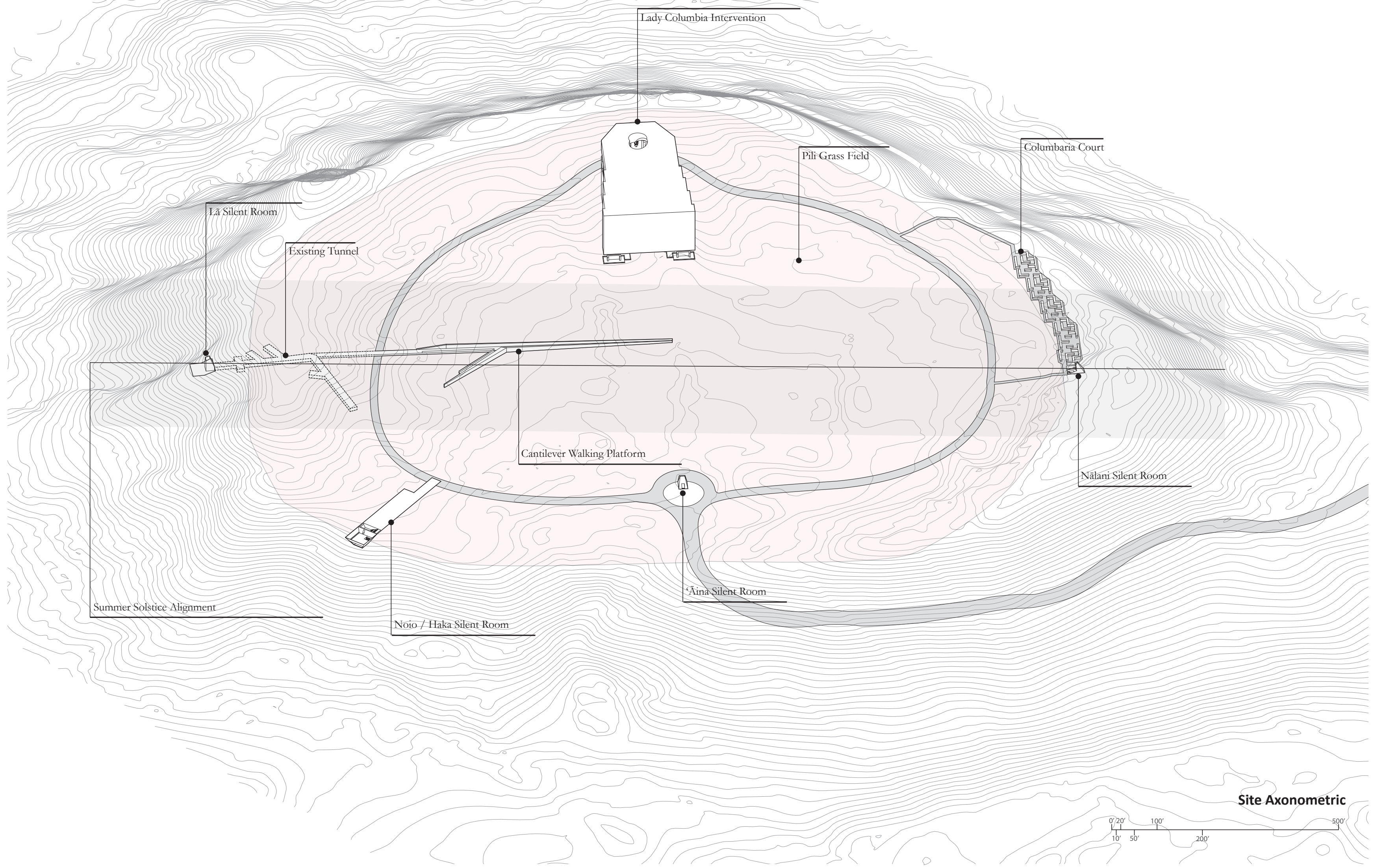



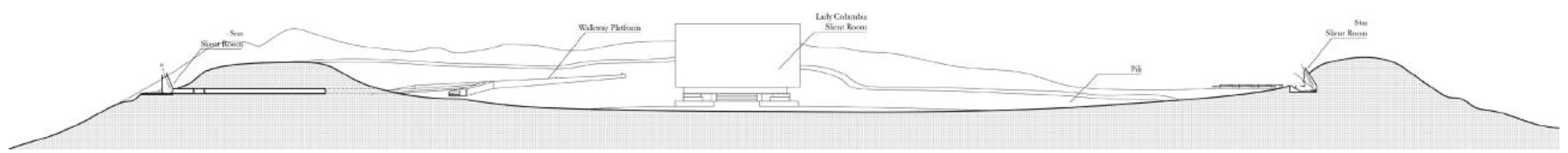
Section BB



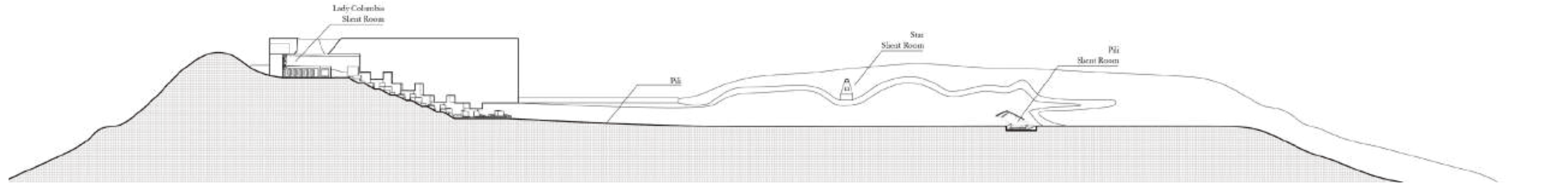
Section AA

Aligning with summer Solstice, the Hawaii burial axis started from Honolulu Harbor, passing by the ancient heiau site where located the Iolani Palace, the Sacred Mound, and the Hawaii State Capitol, finally reaching the altar at the peak of Puowaina. Here, Hawaiians used the sacred peak for offering humans as sacrifices for the punishment of violators of taboos to appease pagan gods. Our intervention emphasizes that axis as opposed to the one created by the national cemetery.



Section Cutting Summer Solstice



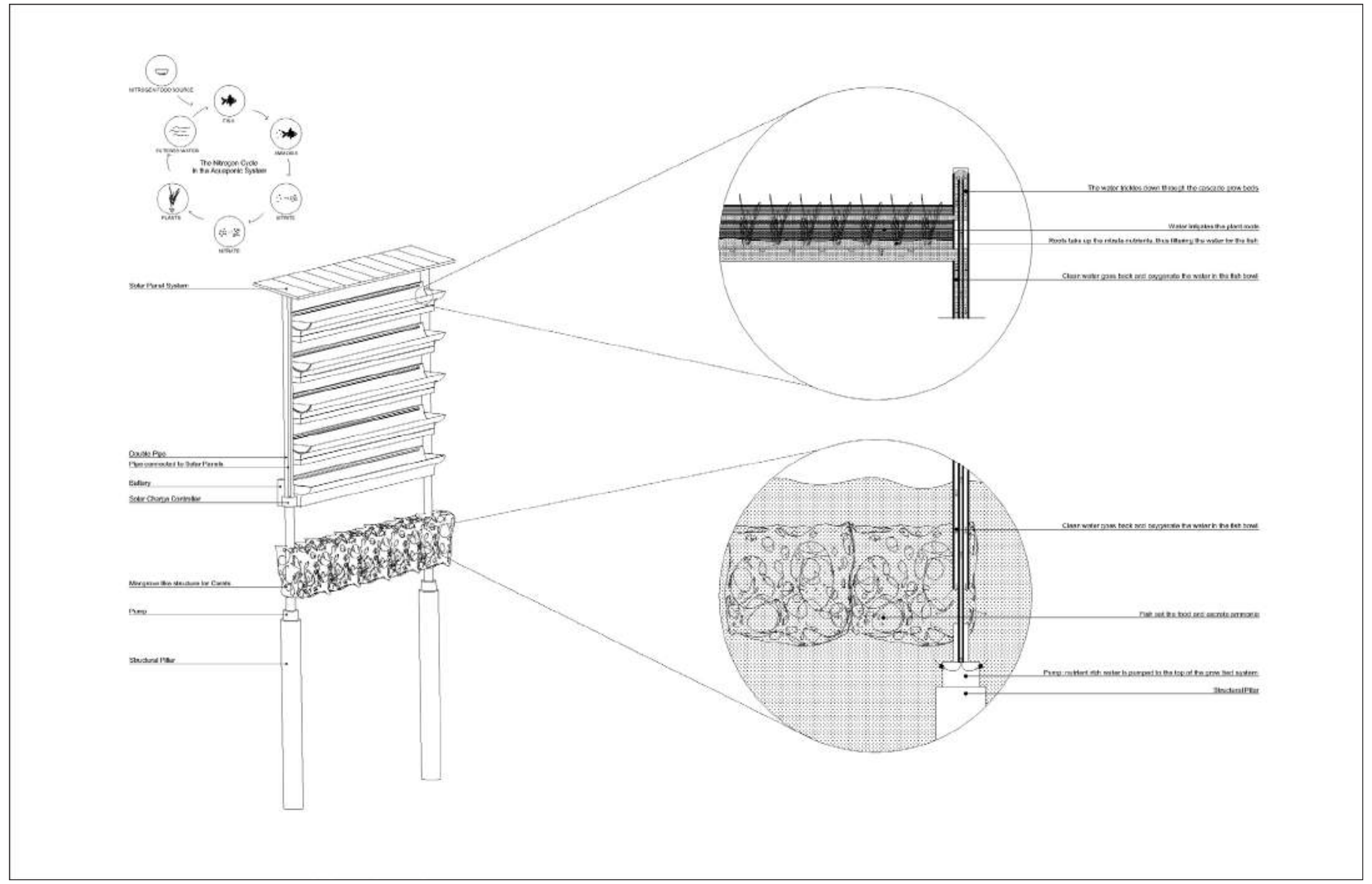
Section Cutting Lady Columbia and Pili Silent Room

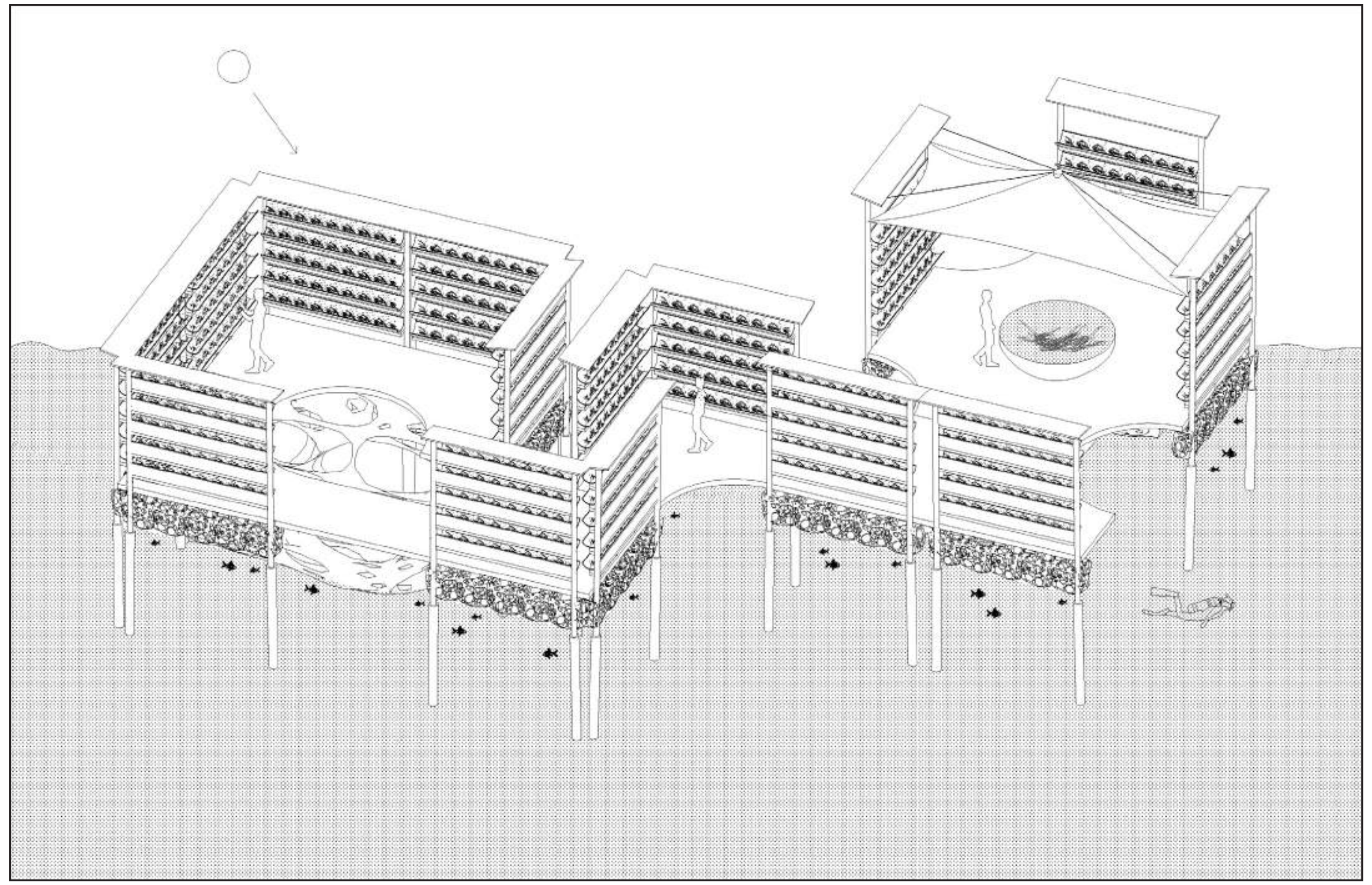
02

# JAMAICAN ECOLOGIES

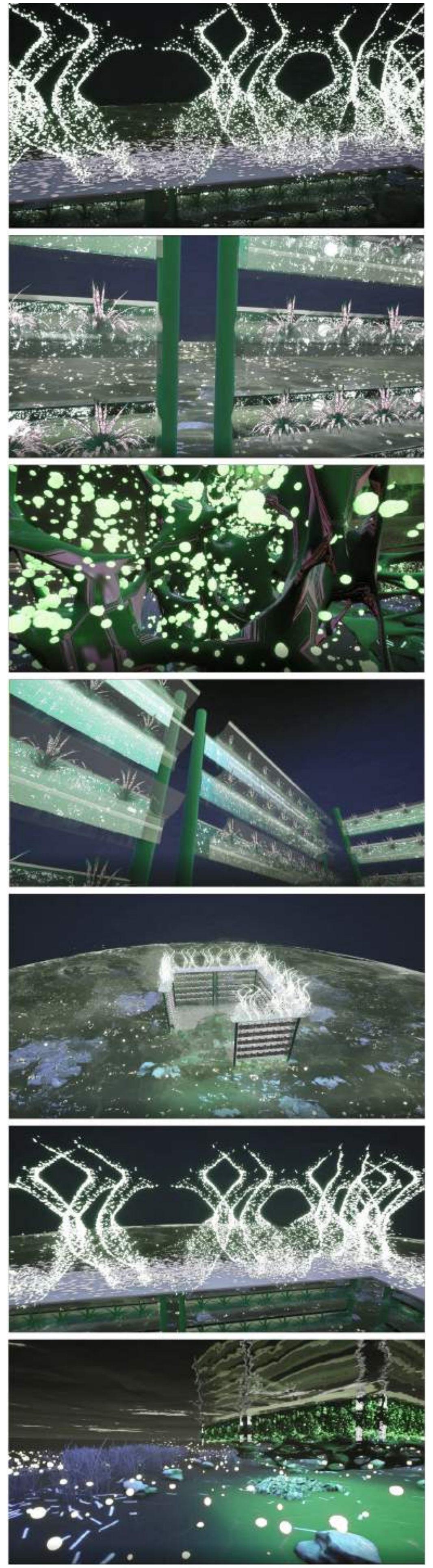
Aquaponic Center / Eco-Lodge / Market
Year: 2021
Location: Jamaica
Type: Academic Project (Group)
Collaborators: Aahana Banker and Anthea Viloria
Instructor: Prof. Vanessa Keith

As Jamaica is increasingly experiencing the severe impacts of climate change and food insecurity, people have turned towards more environmentally and financially sustainable farming practices such as aquaponics, a system in which the waste produced by farmed fish supplies nutrients for plants grown hydroponically: Fish eat food and excrete ammonia, nutrient rich water is then pumped to the top of the grow bed system, the water trickles down through the cascade grow beds, irrigates the plant roots, roots take up the nutrients thus filtering the water for the fish. Clean water goes back and oxygenates the water in the fish bowl.
Initially, we developed a device for vertical farming based on aquaponics, which could be deployed on water. The device helps revive fisheries, lower sea water temperatures thus promoting marine life; acts as a flood and erosion barrier and offers training and education opportunities.
We experimented with VR to show the invisible forces in play such as the way water and air particles are affected by our device and the positive effects of plants and coral reefs on the environment.
Thinking of how this system could be applied at a larger scale and in different contexts such as along a river, we developed a series of collages that capture the type of environment we intend to create: An intricate yet inclusive complex of that benefits from the aquaponic system, that comprises a learning center, visitor center and crocodile sanctuary, research center, communal facilities and living arrangements.
We developed by Holland Bay along the Canal that stems from the plantain garden river, a complex of architecture and landscape that comprises multiple complementary programs that coexist in a symbiotic relationship revolving around the system of aquaponics. The Eco-lodge houses student researchers from the University of the West Indies and their international partners. The complex comprises 12 units each with a housing capacity of up to 4 people, so a total housing capacity of 48 people, and is elevated above ground level to protect it from flooding. It is connected through elevated and ground-level pathways to all other facilities in the complex.

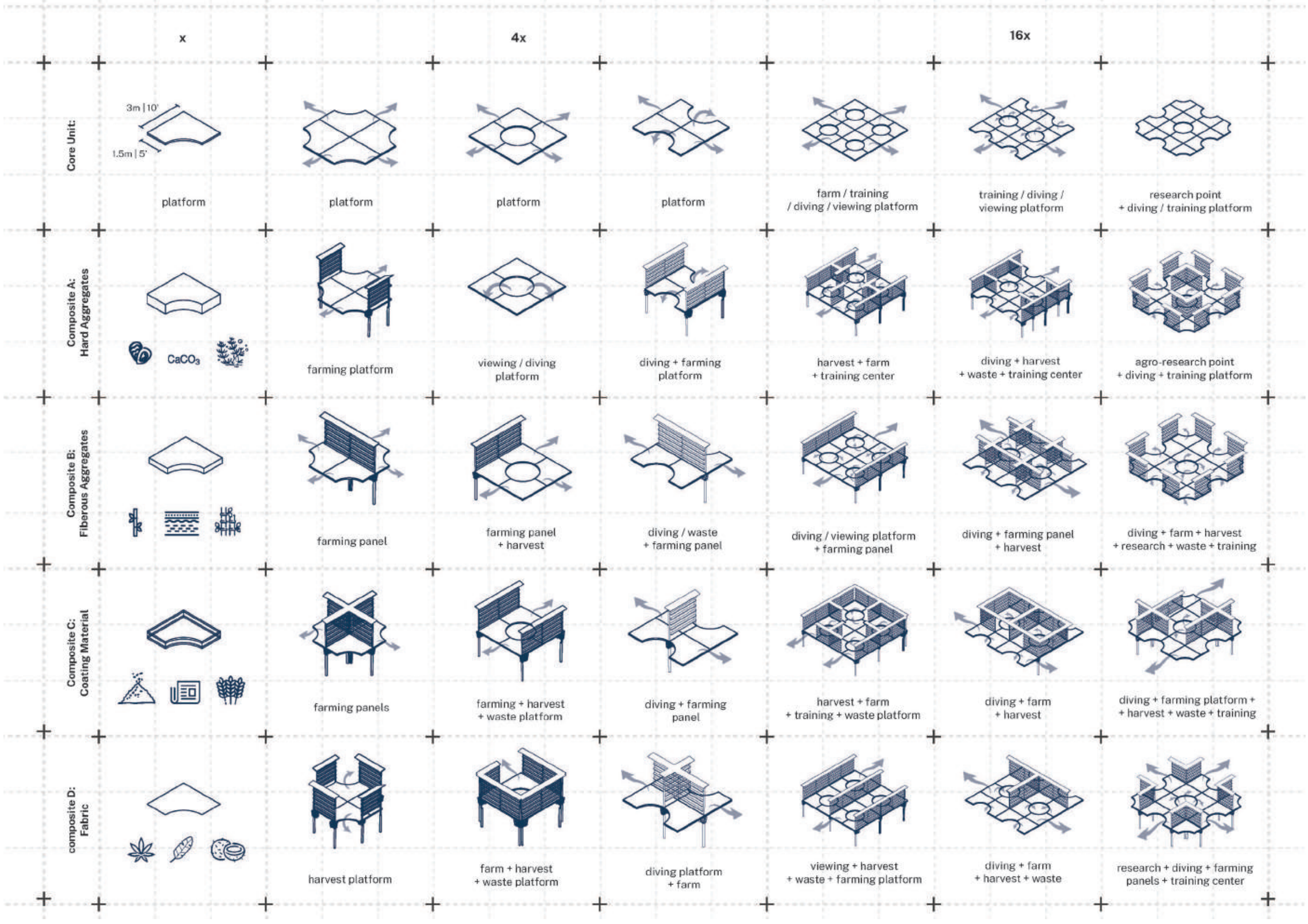




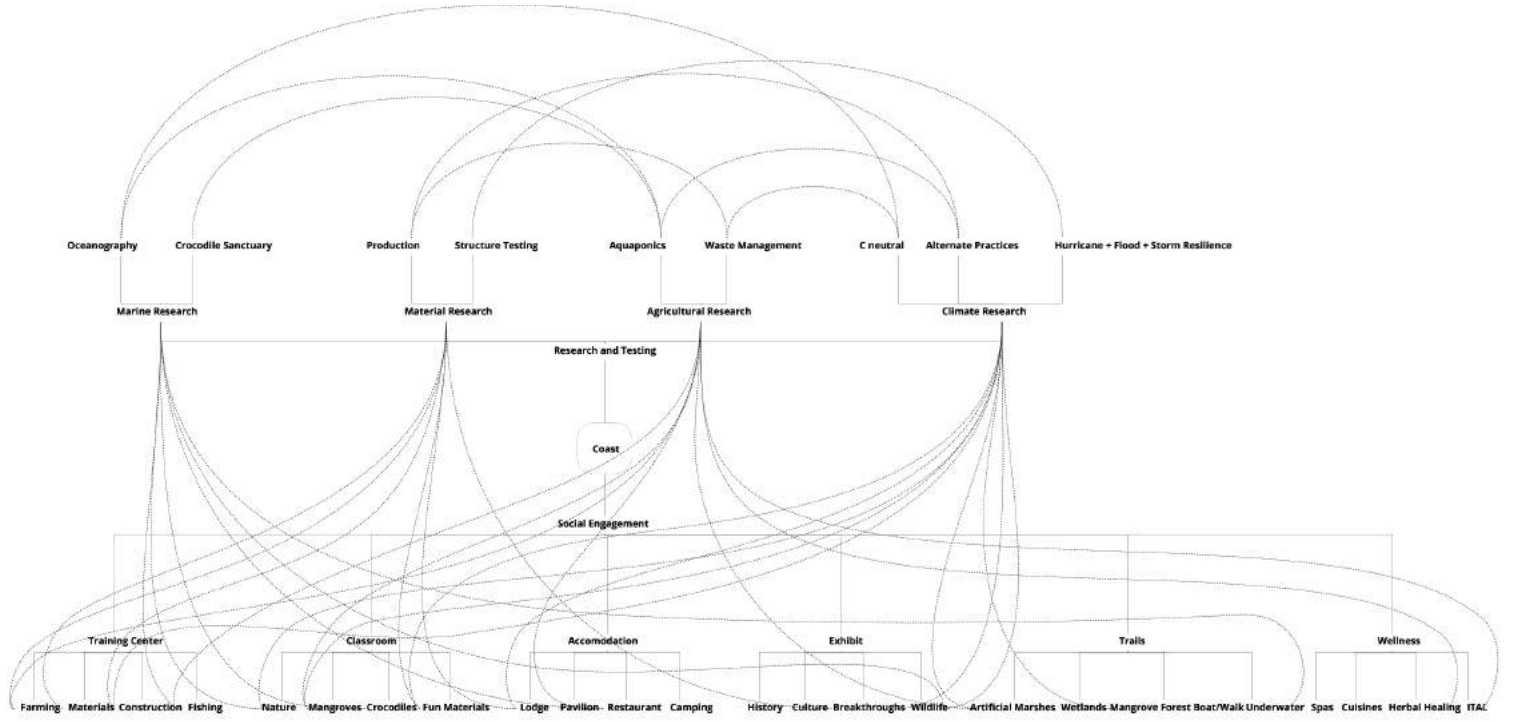
Revival + fisheries
Lower sea water temperatures promotes marine life
training and education
Fresh water harvesting
Flood and erosion barrier
Basil cultivation time: 6 weeks
One panel
1.8 - 2.75 kg/week
7.2 - 11 kg/month | 1 farm (as shown): 50 - 75 kg/month
>10C | Ideal temperature: 21C
6 - 8 Hours of sunlight, light shade
Moist, well drained soil
Planting tomatoes alongside can be profitable
Cultivation time: 60 - 100 days
Sunlight: 6 - 8 hours
On the roots
Soft mud below
Below the waterline
Lower roots

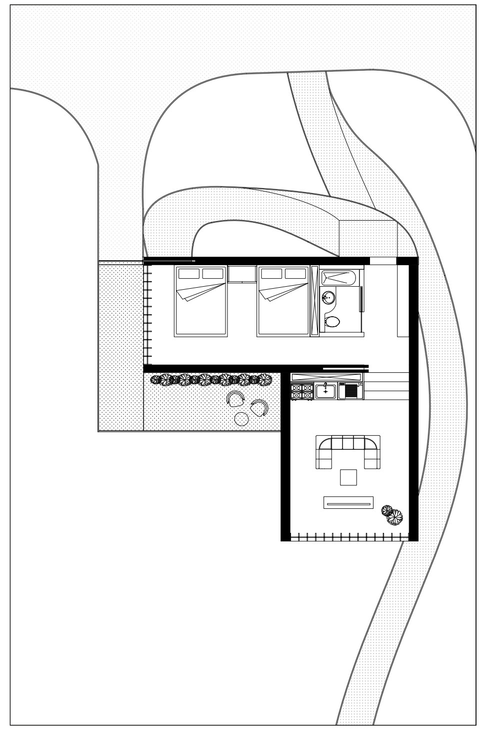
Site Maps



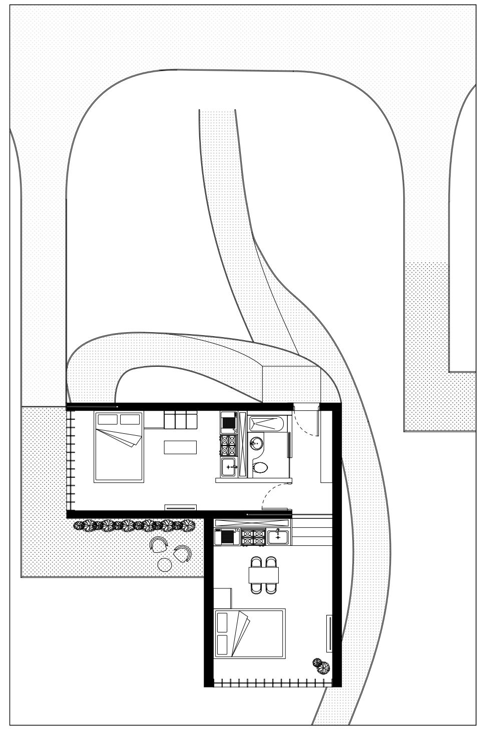

Aquaponic System Diagram



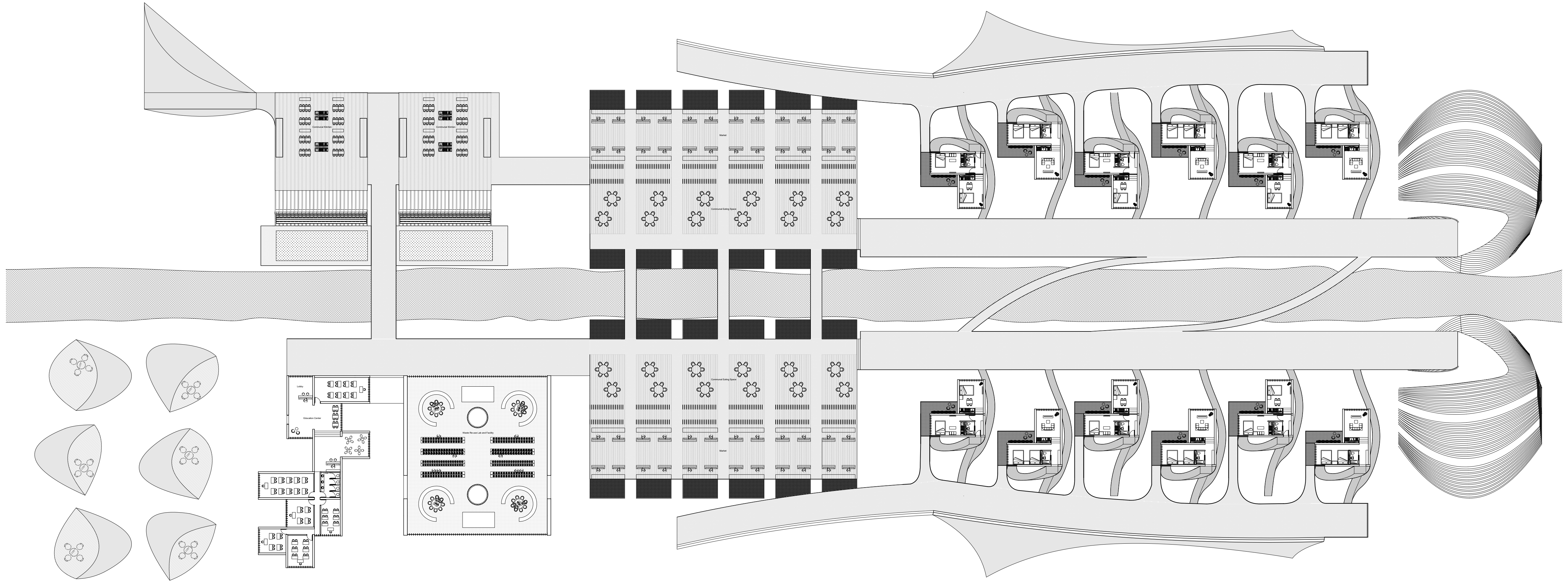

Programmatic Diagram



Unit Typology // 01



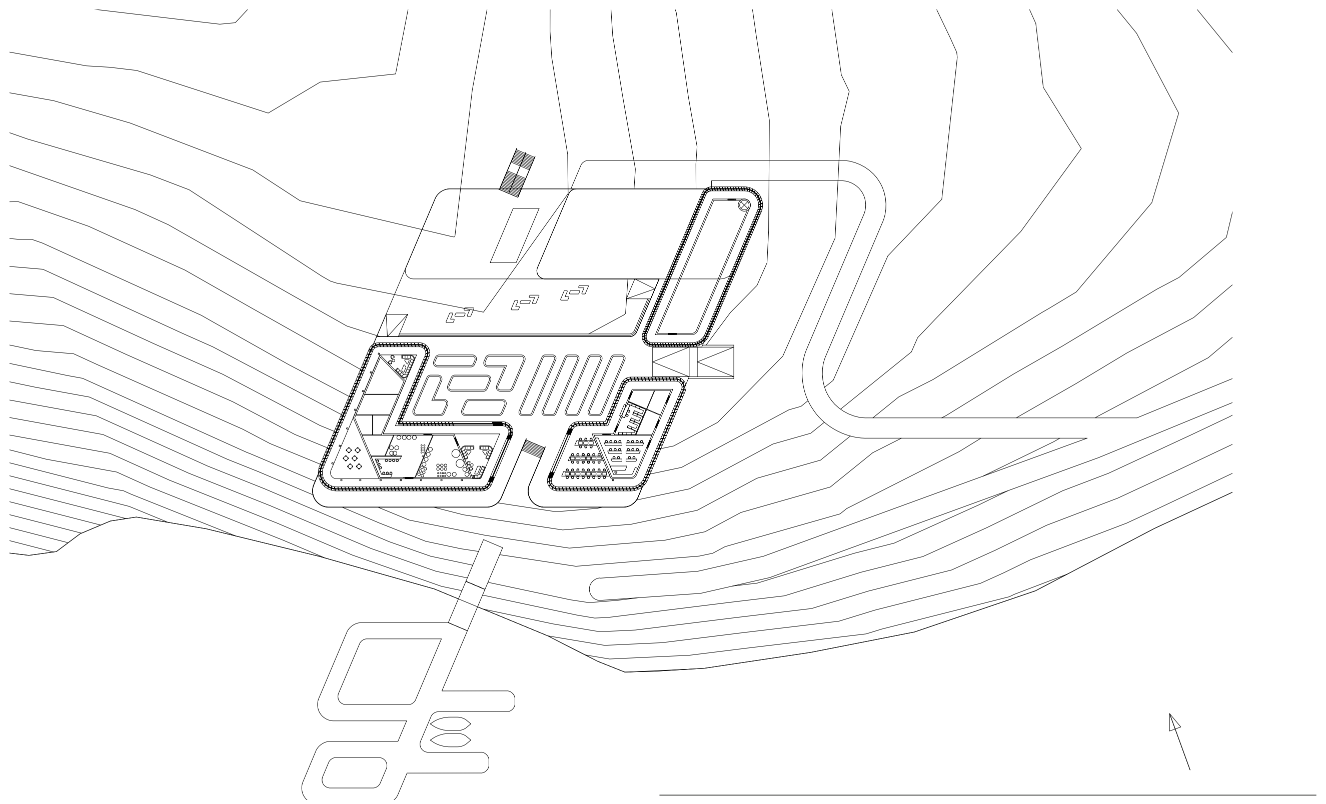
Unit Typology // 02



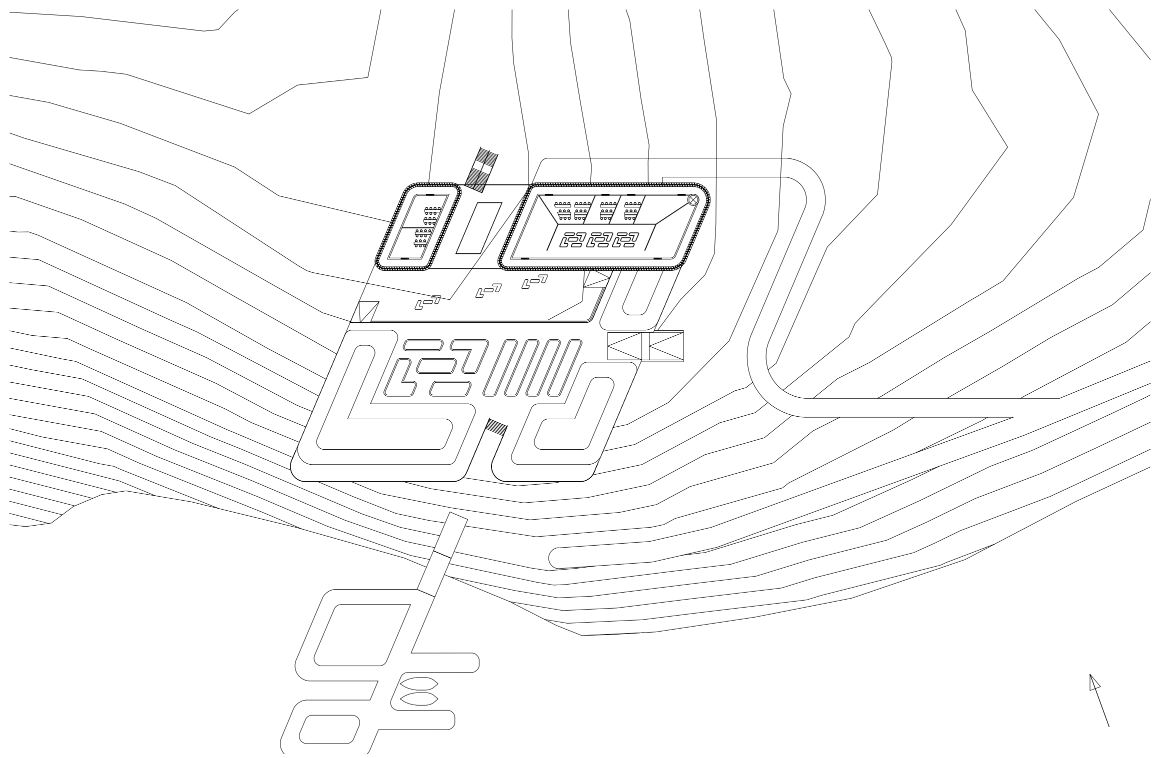
This overall site plan shows the multiple programs coming together: The aquaponic center which will grow a variety of products such as basil, hemp, and greens such as Lettuce, spinach, kale, tomatoes, cucumbers, green beans and more; connected to a fish tank, a communal kitchen, communal eating space, covered outdoor spaces for gathering, a market, and finally eco-lodge housing units.

Detailed Plan

Set in VR



Ground Floor Plan

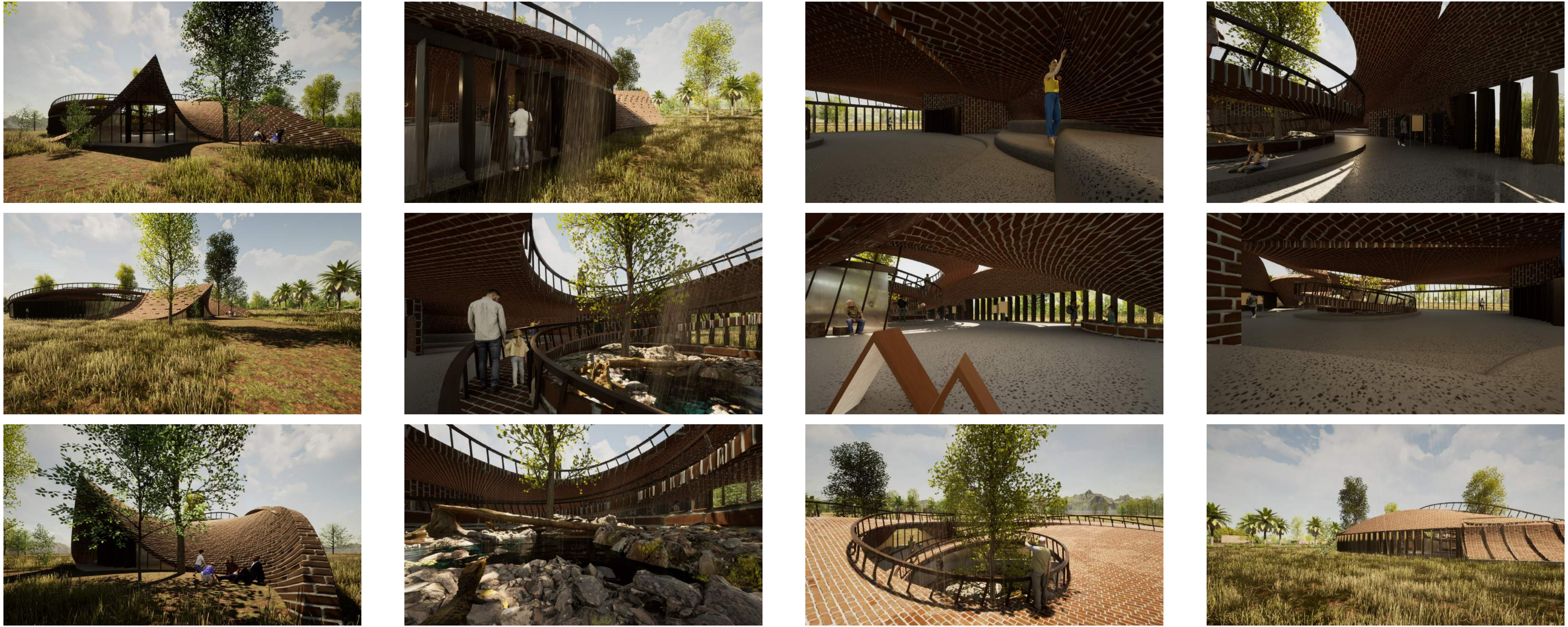


Upper Floor Plan

Closed Louvers

Open Louvers (semi-enclosed)

Open Louvers



03

## ARTPLANT #2800

Adaptive Re-Use of CocaCola Bottling Plant into Art Incubator
Year: 2022
Location: Houston, Texas
Type: Academic Project (Group)
Collaborator: Vasco Li
Instructor: Prof. Wonne Ickx

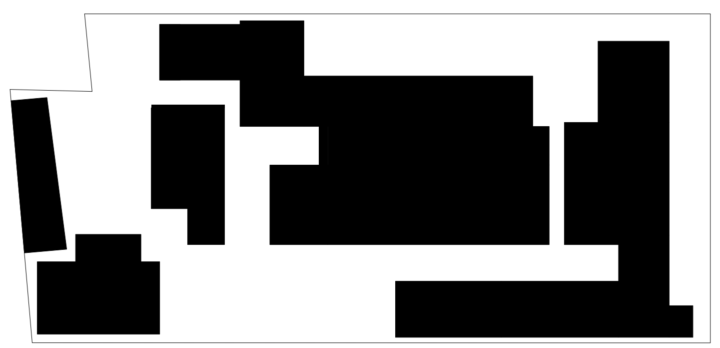
ARTPLANT #2800 situated on the site of the former Coca Cola bottling plant in Houston, considered a suburban site back in 1950, is now part of an enviable neighborhood and employment center. Houston is not densely populated, and its built environments are often spread-out, due to lack of zoning, urban planning and building rules. However, there are a few pockets of density in Houston that complicate the conception of the region as the capital of sprawl and Houston is experiencing a rapid urbanization. Through a grid organization we aim to densify the block. We organized street fronts and boundaries in well packed sequences in a way that helps maximize land use. Moreover, the original building footprint is laid out in a sort of randomized manner with a lot of open space, through the grid, we aim to adds clarity and order to the layout, facilitates navigation on the site and increases efficiency. We organized the streets as extensions of preexisting ones to facilitate access. We introduced courtyards within the existing long and dark factory buildings, to allow more natural light in the gallery, artist workshops and office spaces. The factory is an industrial landmark. When implementing our arts and design incubator, following the concept of a circular building economy, we intend to repurpose the existing facilities and intervene in a complementary manner. We created contrast however, between the old and the new through materiality: the lightness of the existing metal cladding contrasts with the new adobe brick. To emphasize the boundaries between the inner blocks and internal streets, the blocks are demarcated either by a change in the flooring materiality, or by adding brick walls of varying heights. These variations create unique spatial moments between one block and another, and between the block and the street. We envision the site as a permeable city block, one of walking urbanism where after defining a grid system the spaces left open provide many programmatic opportunities.



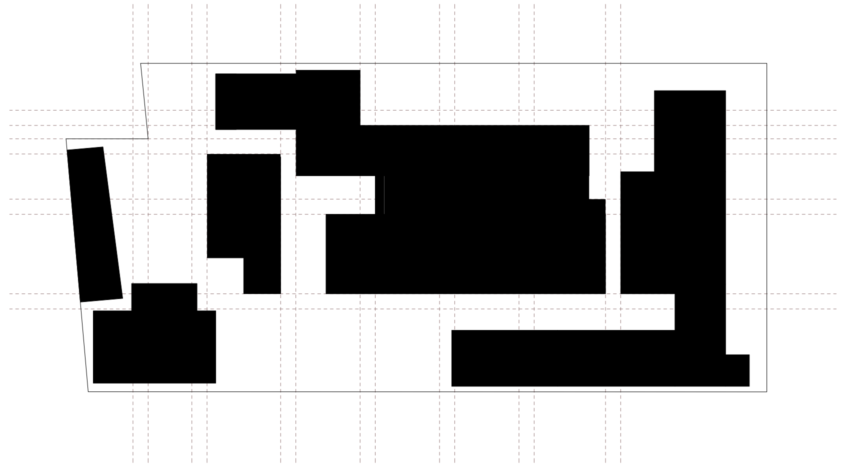






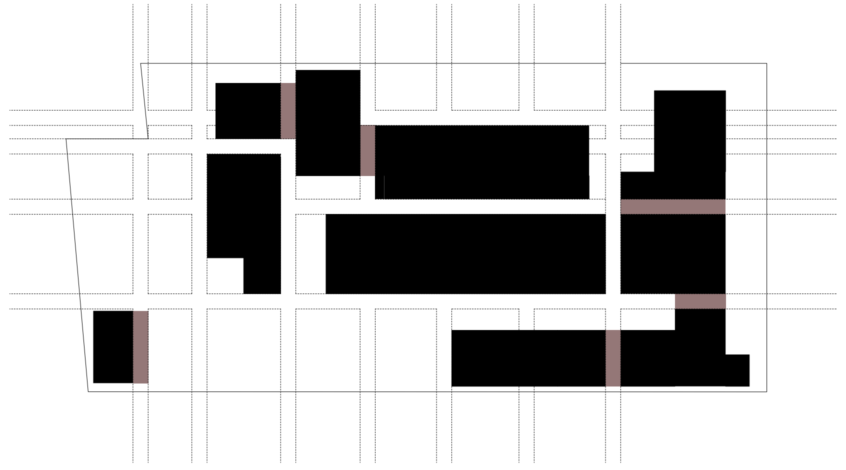


01 **Original Building Footprint**



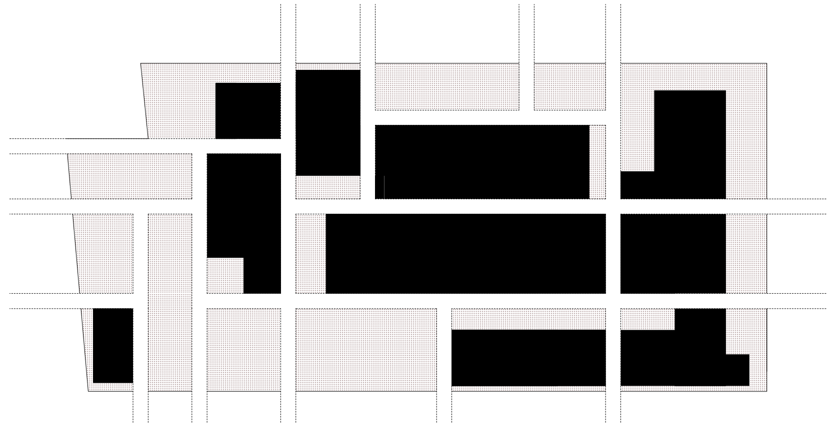
02 **Grid System Overlay**

Streets are 15' wide, and follow the existing streets on site as well as the surrounding ones to facilitate access to the site.



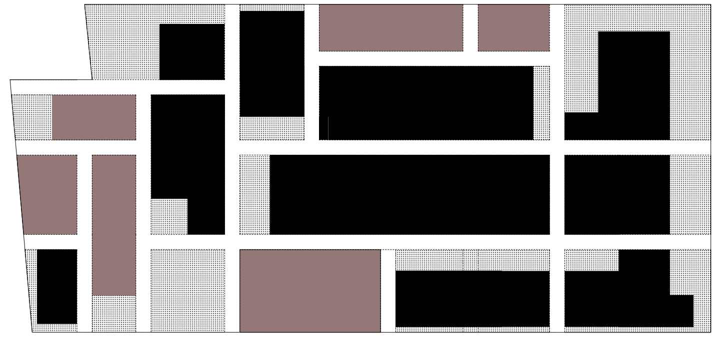
03 **Cutting Existing Buildings**

Where the existing buildings and the newly created system of roads overlap, we propose cutting an opening through the buildings.



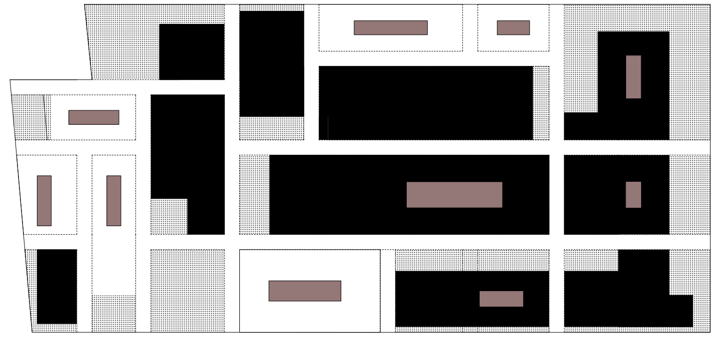
04 **Define the Inner Blocks**

Through the grid system we propose to maximize land use by clearly defining programs, landscape and boundaries between the inner blocks and internal streets.



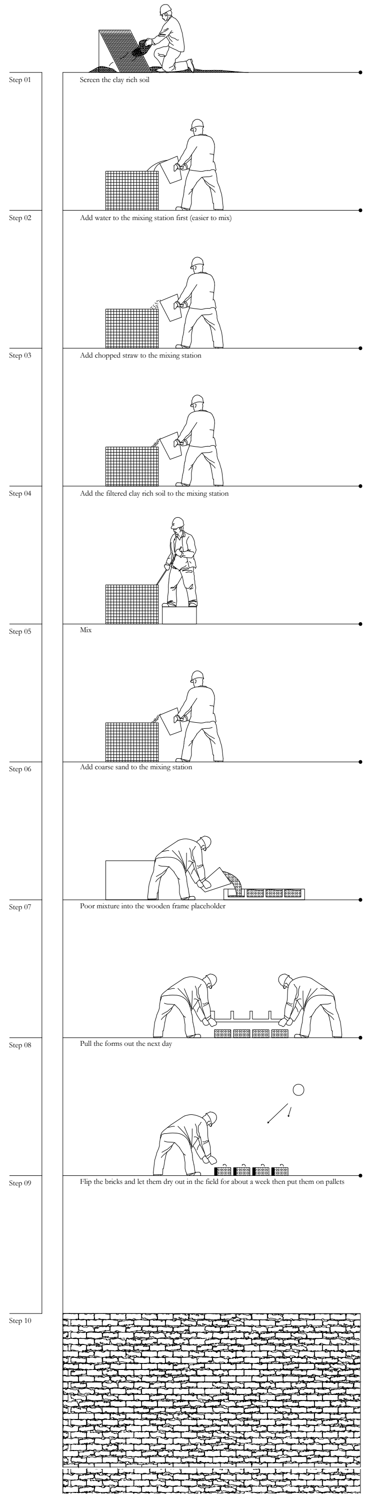
05 **Densify / Additional Buildings**

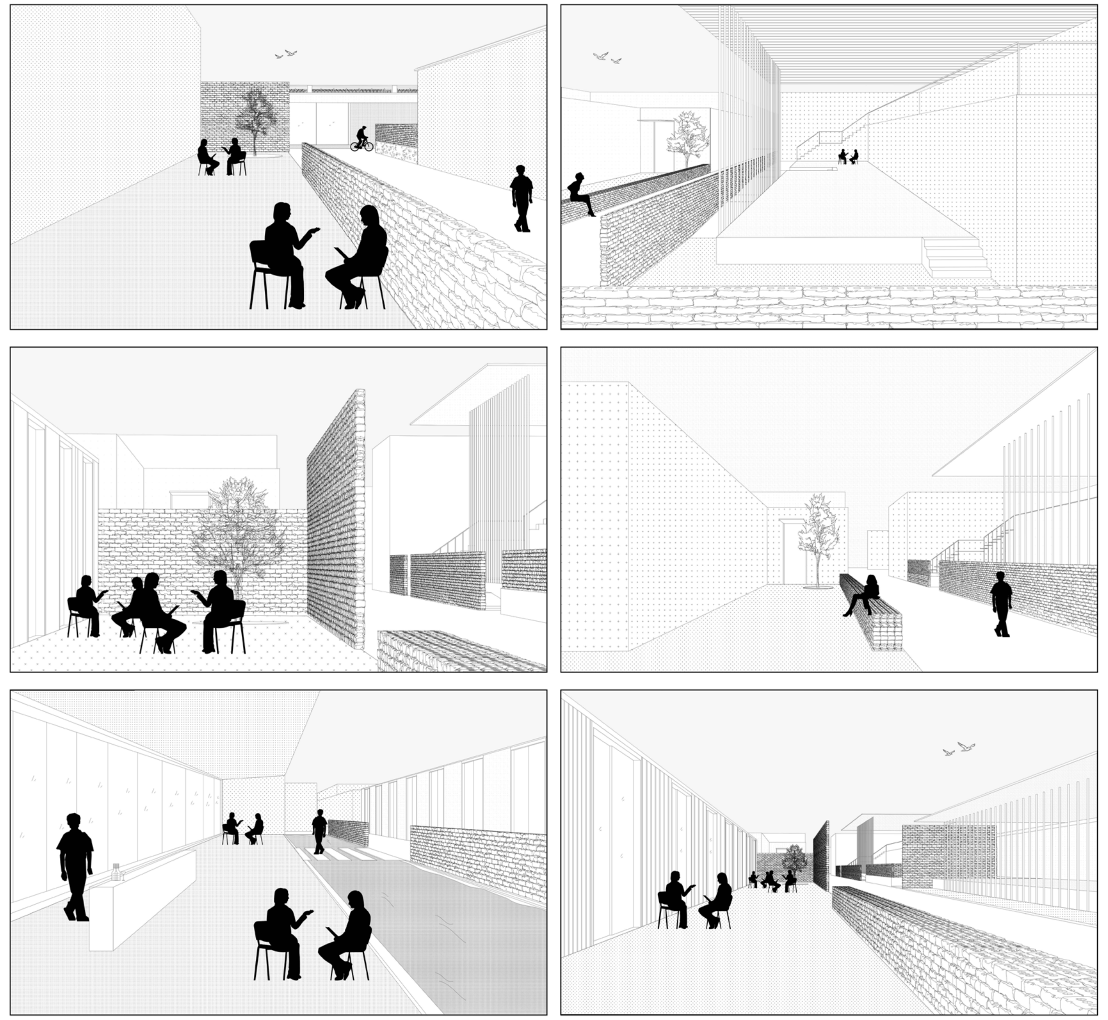
On some of the empty lots we implemented new buildings to accomodate programs and densify the block.



06 **Create Interior Courtyards**

To bring in natural light into the long industrial buildings.

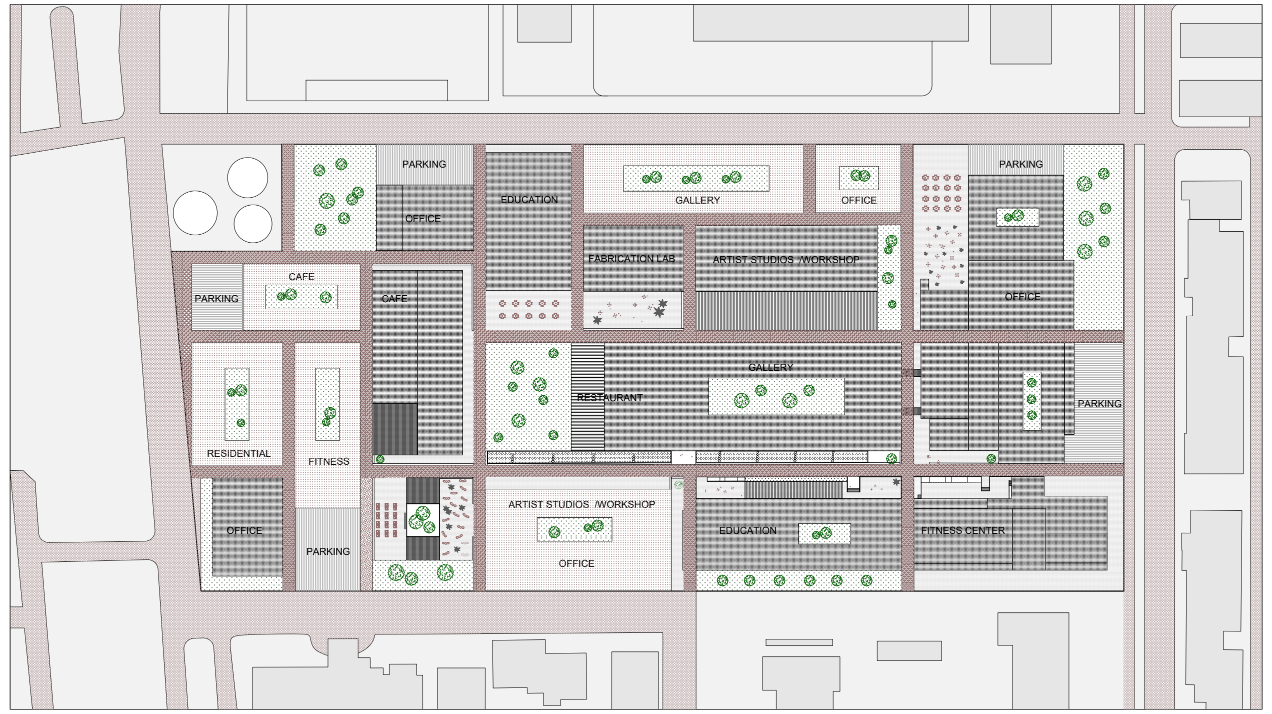




Initial Vignettes

Contrast is created between the existing metal cladding, existing washed out brick and the newly introduced adobe brick. We looked at adobe brick walls as a typology to enclose the internal blocks and define the grid more clearly. Adobe bricks (mud bricks) are made of earth, clay, sand and straw, using local construction techniques. The earth mix is cast in open moulds onto the ground and left to dry out. When used for construction the bricks are laid up into a wall using an earth mortar. The raw, almost industrial feel of the adobe brick is reminiscent of the previous use of the site as a plant.

To define the streets clearly, the blocks are demarcated and differentiated from the streets either by a change in the flooring materiality, or by adding brick walls of varying heights that in some cases become brick benches. These variations create unique spatial moments between one block and another, and between the block and the street.

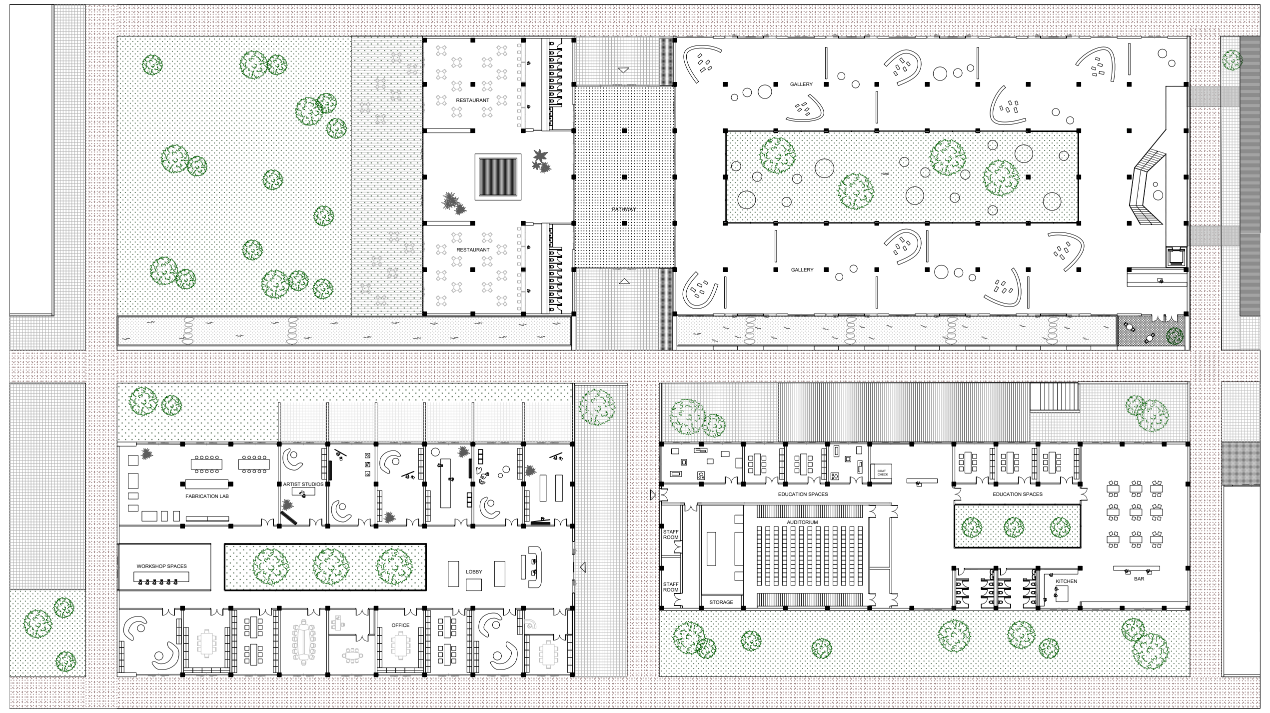



Existing Buildings
New Buildings

Masterplan

Covered Areas

Large works spaces: 2000 m2
Small work spaces: 2000 m2
Communal work spaces: 400 m2
Retail and rest: 800m2
Gallery: 2000m2
Education & Communication: 1000m2
Cafe + Retail: 2000m2
Cafe:1000m2
Fitness: 2000 m2
Core Program



Detailed Plan

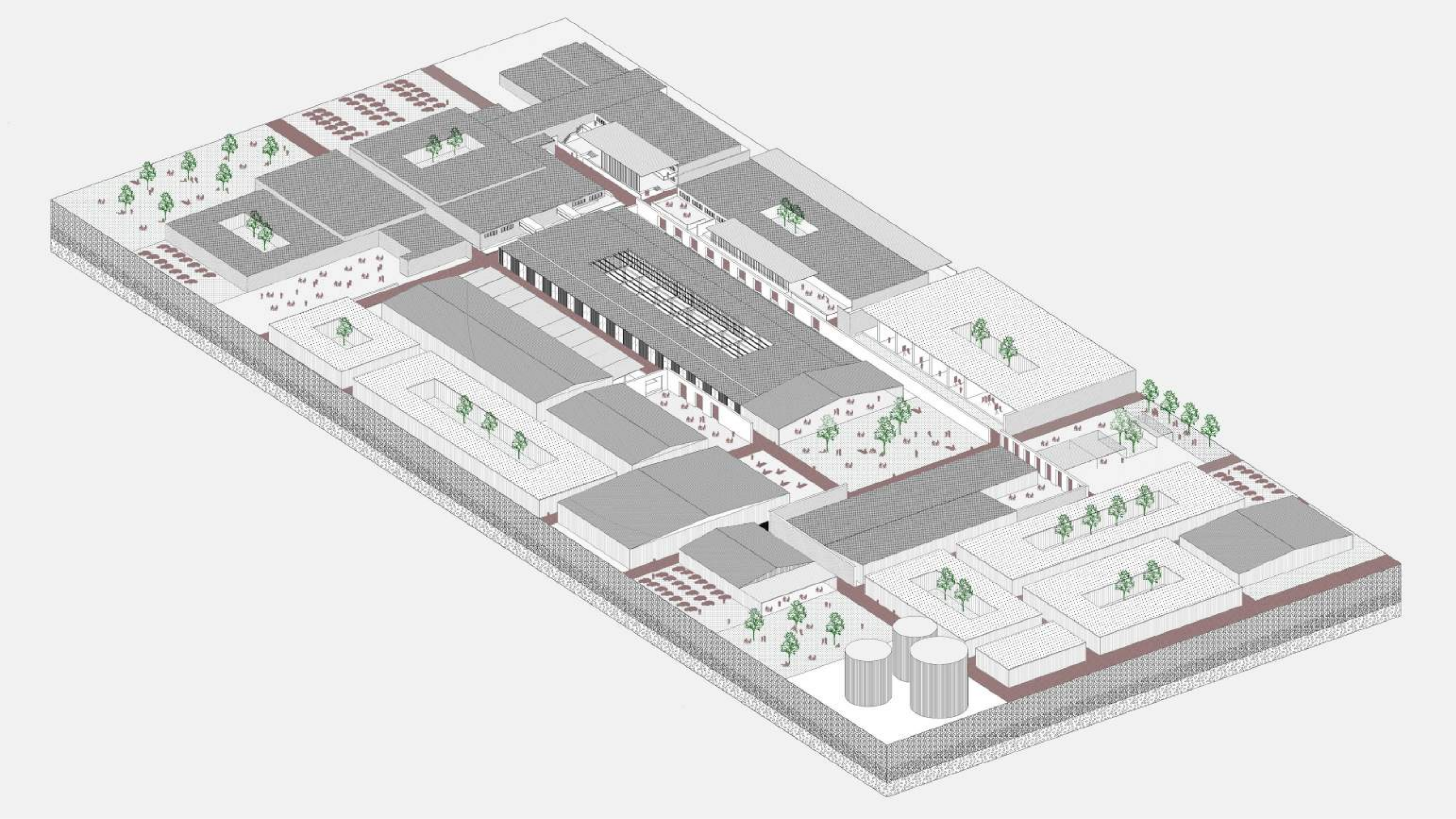
Spatiality

The existing buildings from the Coca-Cola factory similarly to many other industrial buildings are long spaces with little natural light entering the building. We created courtyards within the existing buildings to allow more natural light into the gallery, artist workshop and office spaces.

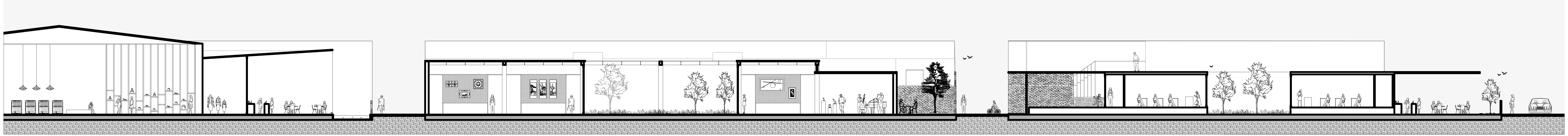
Scale 1'=1/32"

Scale 1'=1/16"

Scale 1'=1/4"



Through a grid organization we aim to densify the block, maximize land use, add clarity and order to the layout, facilitates navigation on the site and increases efficiency.














04

## THE WATERFALLS - 459 SMITH GOWANUS
DESIGN BY DEVELOPMENT

Multi-Use Center
Year: 2021
Location: Gowanus - New York
Type: Academic Project (Group)
Collaborators: Rita Gonzalez, Preet Aneja, Sanjana Gupta, Mollye Zijia Liu, Kass Abol-Melle
Instructors: Prof. Eran Chen

**Challenge:**
Complex Site & Zoning
“Toxic” Neighborhood Reputation
Ripple Effect along the Canal

**Goals:**
Calmness
Tranquility
Greenery

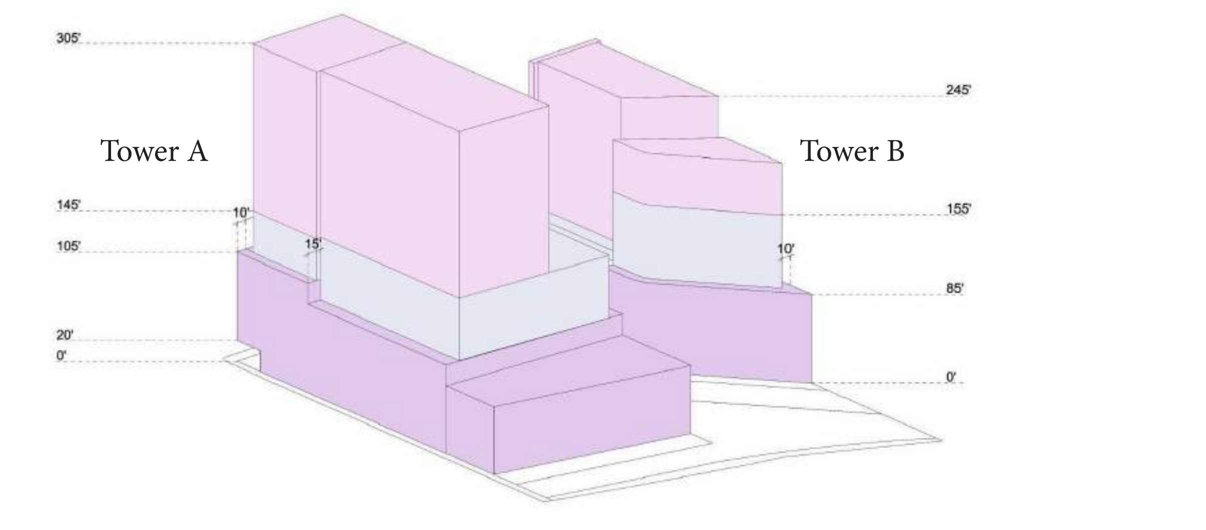
**Response:**
Attraction: Iconic Design
Activation: Seamless Densification
Animation: Green Space

**To Integrate Community needs:**
Green space and infrastructure with waterfront
Commercial and Office Space
Luxury with affordable housing
Recreational facilities

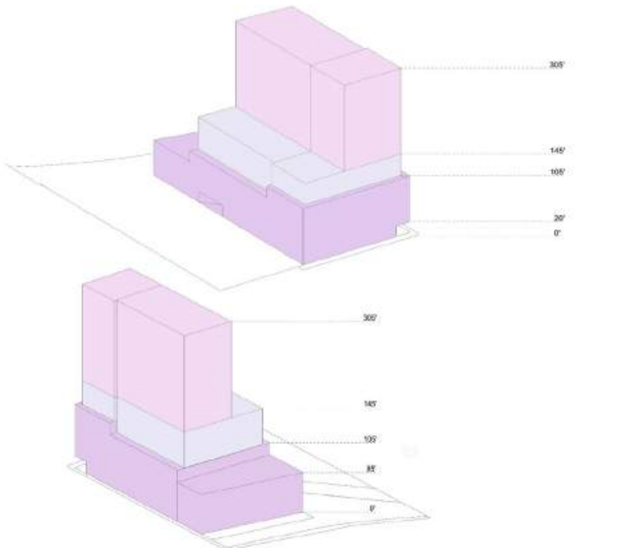
Public Green Space

Green Terraces

Architectural Waterfall



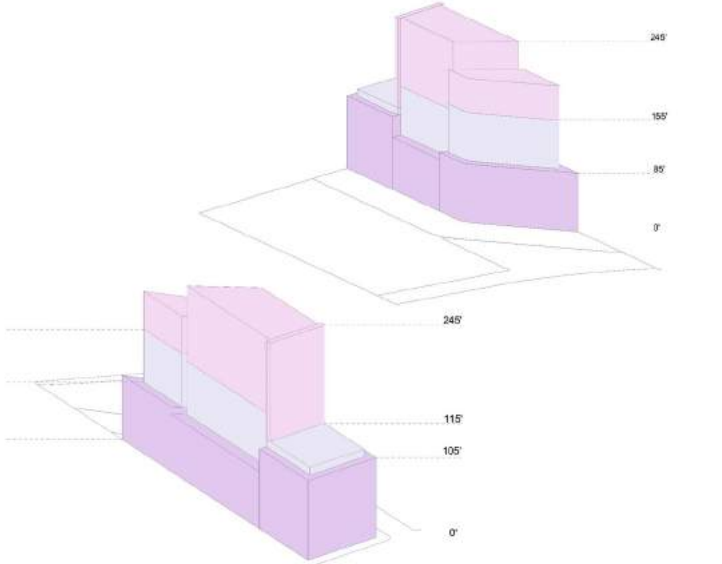

## Zoning Envelope



## Zoning Envelope D6

**Tower A**

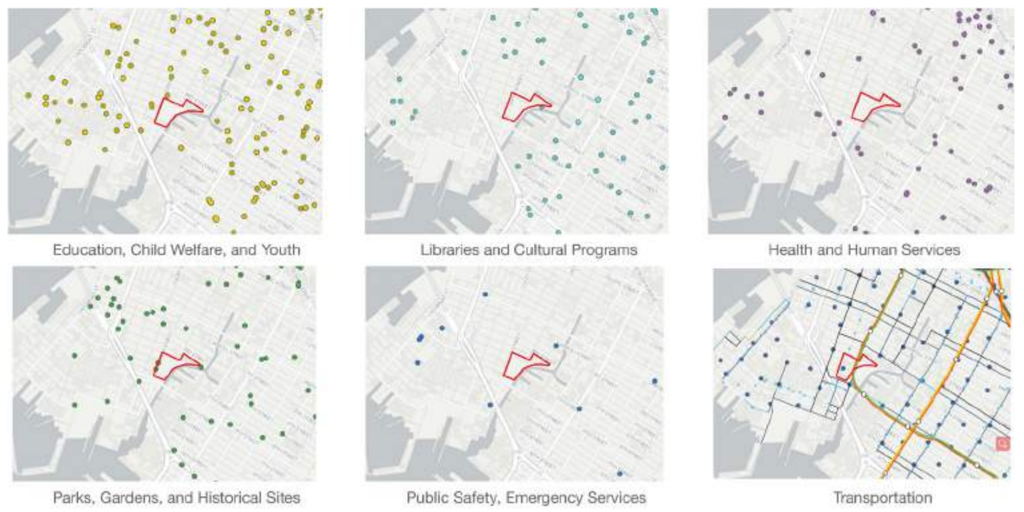
**Max Heights:**
305' from Huntington St
**Shoreline:**
40' step back from the canal on wide lots
**Base Height:**
65' along the canal for 100'
105' from the street for 100'
85' for 200' in between



## Zoning Envelope D5

**Tower B**

**Max Heights:**
245' from Huntington St
**Easement:**
60' street cutting through the site to connect Nelson St to Hoyt St
**Base Height:**
85' along the canal for 100'
95' from the street for 100'
75' for 200' in between




## Facilities Accessibility


## Target Market

## Population

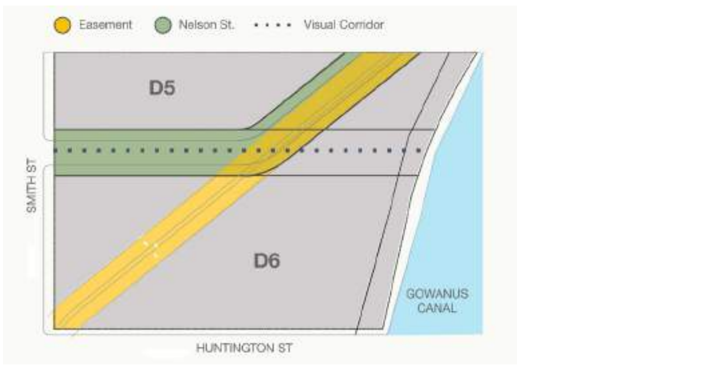
## Income/Employment

**Focus**
-Biggest goal under the new zoning proposal is to foster a more diverse and less segregated neighborhood that matches the racial demographics of the rest of New York City
-Look to drive in young working professionals while housing low-income families who have historically lived in the neighborhood for generations

**Plan Under New Zoning Proposal**
-Diversity will be measured through a"dissimilarity index"
-Affordable housing targets to accommodate 60% AMI income units
-Developers behind Gowanus Green plan to initiate a further remediation to appeal to more affluent target market with green, sustainable building plans and high-end amenities.

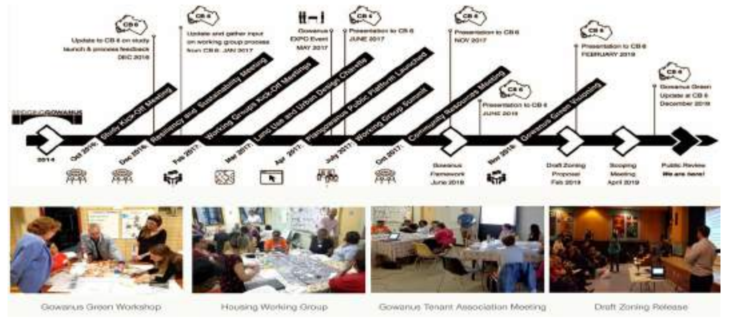
## Canal Corridor Zoning Proposal

**Vision**
Gowanus as a Sustainable and Resilient Neighborhood
**Key Aspects**
Remediation of Brownfield Sites
Elevation of the Shoreline
Standards for Climate Resilient Development
Canal Corridor
Enhanced Industrial & Commercial
Enhanced Mixed Use




## Site Information

-Zoning M1(4) / R7-2 Special Gowanus Zoning
-Smith Lot Frontage 353'
-Huntington Lot Frontage 420'
-Lot Area 168,865 sqft
-Lot Type Corner
-Mixed Use FAR 5 (4.4+0.3+0.3)
-Max Residential 4.4 (743,006sqft)
-Community Facilities 4.0 (675,460)
-Commercial 3.0 (506.595 sqft)
-Manufacturing 3.0
-Bonus Area
-Light Industrial, Arts Related, Cultural, Civic Services FAR 0.3
-All Non-Residential Uses FAR 0.3
-Developable ZFA 844,325 sqft




## Community Engagement

The community and city agencies have been engaged in building the Gowanus Neighborhood Plan together through a series of public events, meetings, and online engagement.
Non-zoning community priorities
Sustainability and Resiliency
Community and Cultural Resources
Housing
Economic and Job Development
Transportation / Waterfront and Open Space


## Gowanus Neighborhood

"South Brooklyn"
Well Connected transit
Superfund site in 2010, allocated $506MM for the cleanup.

| | | Required FAR | Required ZFA | Proposed FAR | Proposed ZFA |
|---|---|---|---|---|---|
| Max | **Residential** | 4.4 | 743,006 | **3.3** | 552,440 |
| | **Non Residential** | | | **1.7** | 290,800 |
| Max | Community Facility | 4 | 675,460 | **0.1** | 15,000 |
| Max | Commercial | 3 | 506,595 | **1.2** | 198,400 |
| Min | Light Industrial Flex | 0.3 | 50,660 | **0.5** | 77,400 |
| Max | Total | 5 | 844,325 | **5.0** | **843,240** |

| | Area | Percentage |
|---|---|---|
| Lot Area | 168,865 | 100% |
| Yard | 47,750 | 28% |
| Easement | 23,500 | 14% |
| Nelson St | 26,200 | 16% |
| Total Lot Coverage | 71,415 | 42% |

## Floor Area Breakout

| | |
|---|---|
| Land Acquisition ($12.5M / acre) | $48,457,587 |
| Hard Costs (PSF) | |
| Residential - MKT | $600 |
| Residential - MIH | $600 |
| Community Facility | $480 |
| Commercial | $470 |
| Light Industrial Flex and Life Labs | $420 |
| Soft Costs (PSF) (25% of HC) | |
| Residential - MKT | $150 |
| Residential - MIH | $150 |
| Community Facility | $120 |
| Commercial | $118 |
| Light Industrial Flex and Life Labs | $105 |

| | |
|---|---|
| Rental Rates (PSF) - Blended $55.95 | |
| Residential - MKT | $75.00 |
| Residential - MIH | $23.33 |
| Community Facility | $25.00 |
| Commercial | $50.00 |
| Light Industrial Flex and Life Labs | $40.00 |
| Cap Rate - Blended 4.47% | |
| Residential - MKT | 4.25% |
| Residential - MIH | 4.25% |
| Community Facility | 5.00% |
| Commercial | 5.00% |
| Light Industrial Flex and Life Labs | 4.25% |

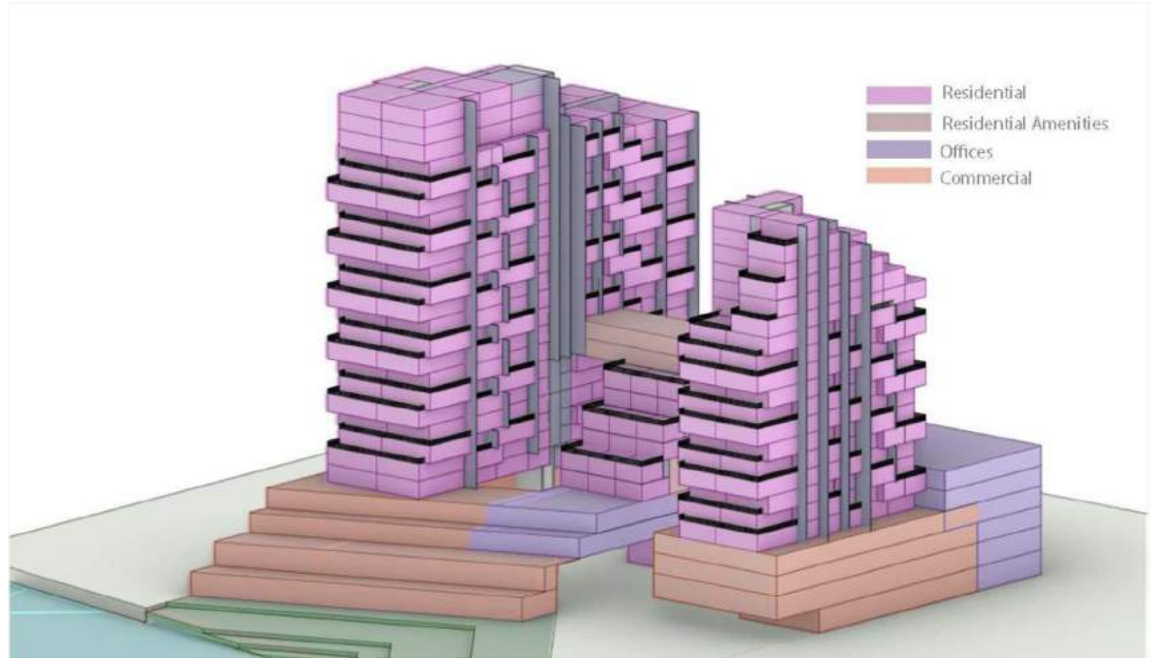
## BOE - Assumptions

| Sources | |
|---|---|
| Equity | 231,332,513 |
| Debt | 496,092,515 |
| **Total Sources** | **$727,425,028** |

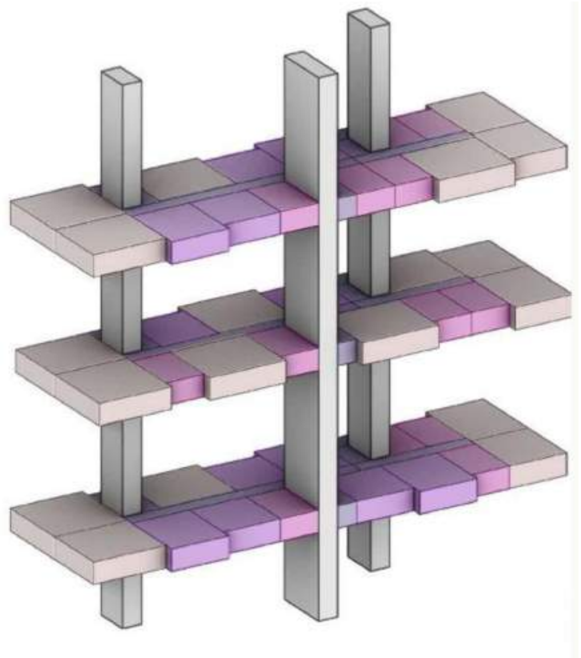
| Uses | |
|---|---|
| Hard Costs | 464,420,000 |
| Soft Costs | 116,105,000 |
| Land Acquisition | 48,457,587 |
| Other Costs | 69,416,191 |
| Contingency | 29,026,250 |
| **Total Uses** | **$727,425,028** |

| | |
|---|---|
| Yield on Cost | 5.4% |
| **Equity Multiple** | **2.7 x** |
| Unlevered IRR | 9.5% |
| Levered IRR | 15.5% |

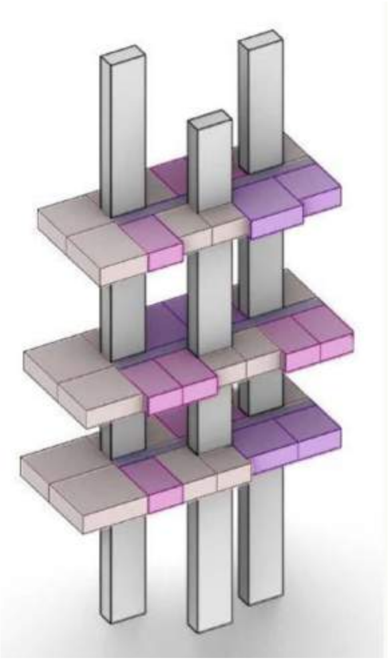
## BOE - Capital and Returns



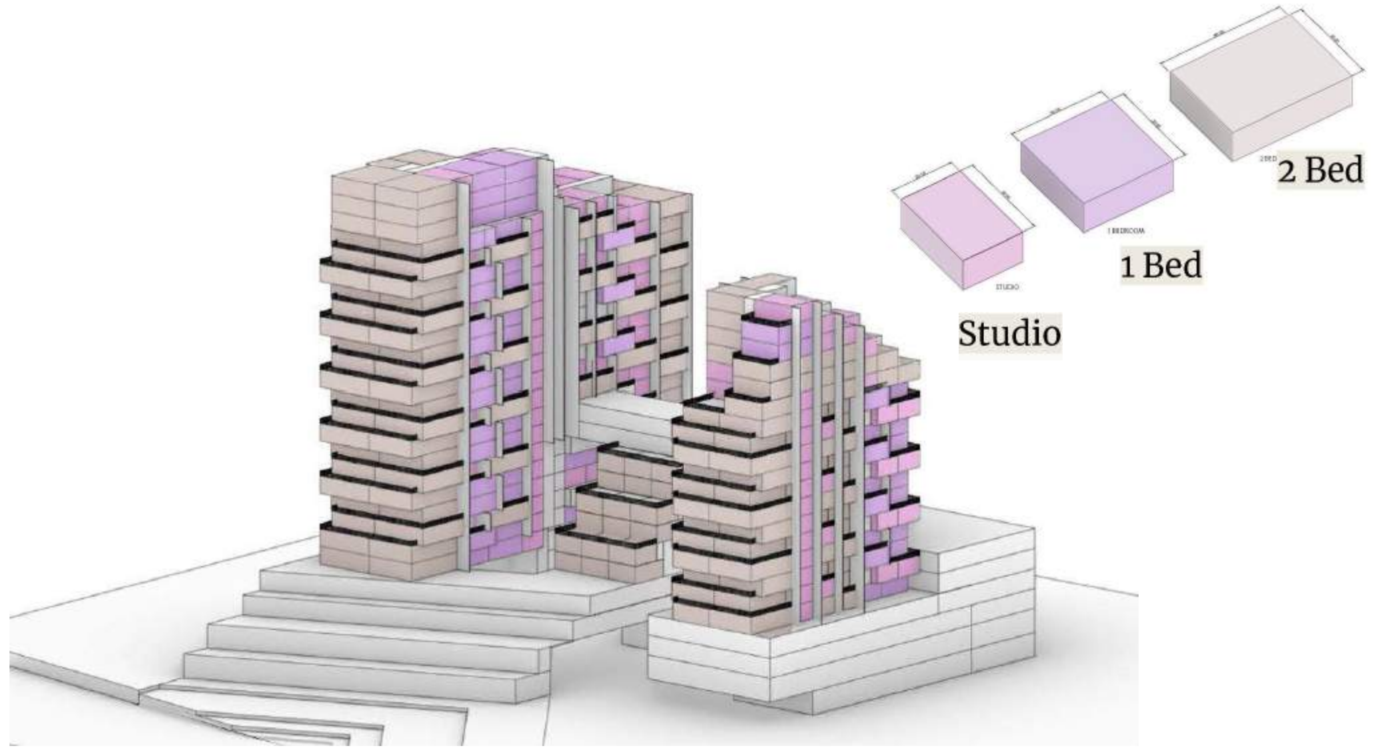

Proposed Building Massing



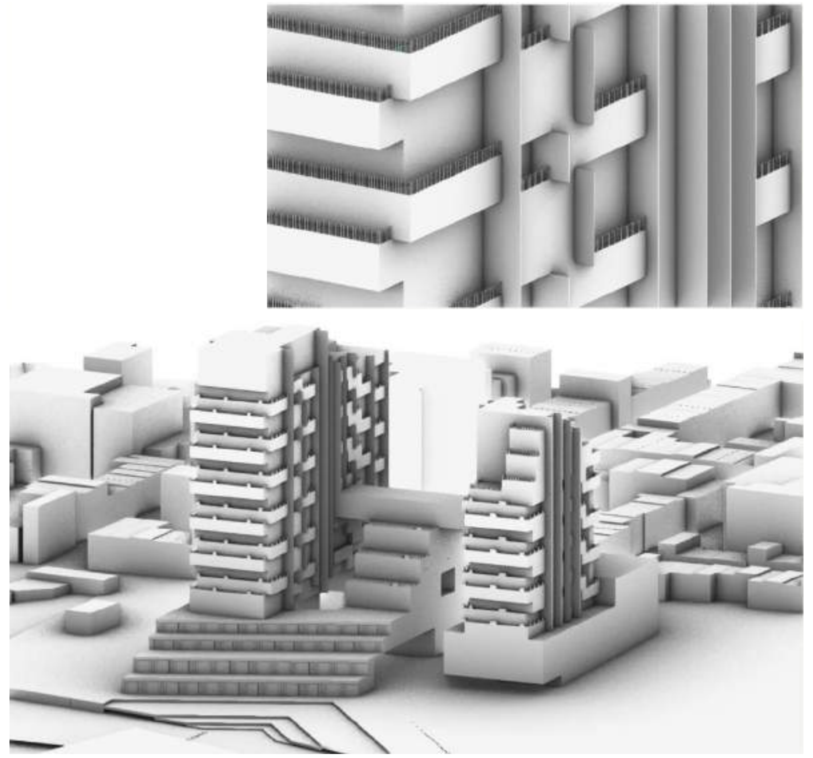
D6 Tower A



D5 Tower B




Residential Unit Mix



Outdoor Spaces


Ground Floor Plan


2nd Level Floor Plan


3rd  Level Floor Plan


Residential Floor Plan

05

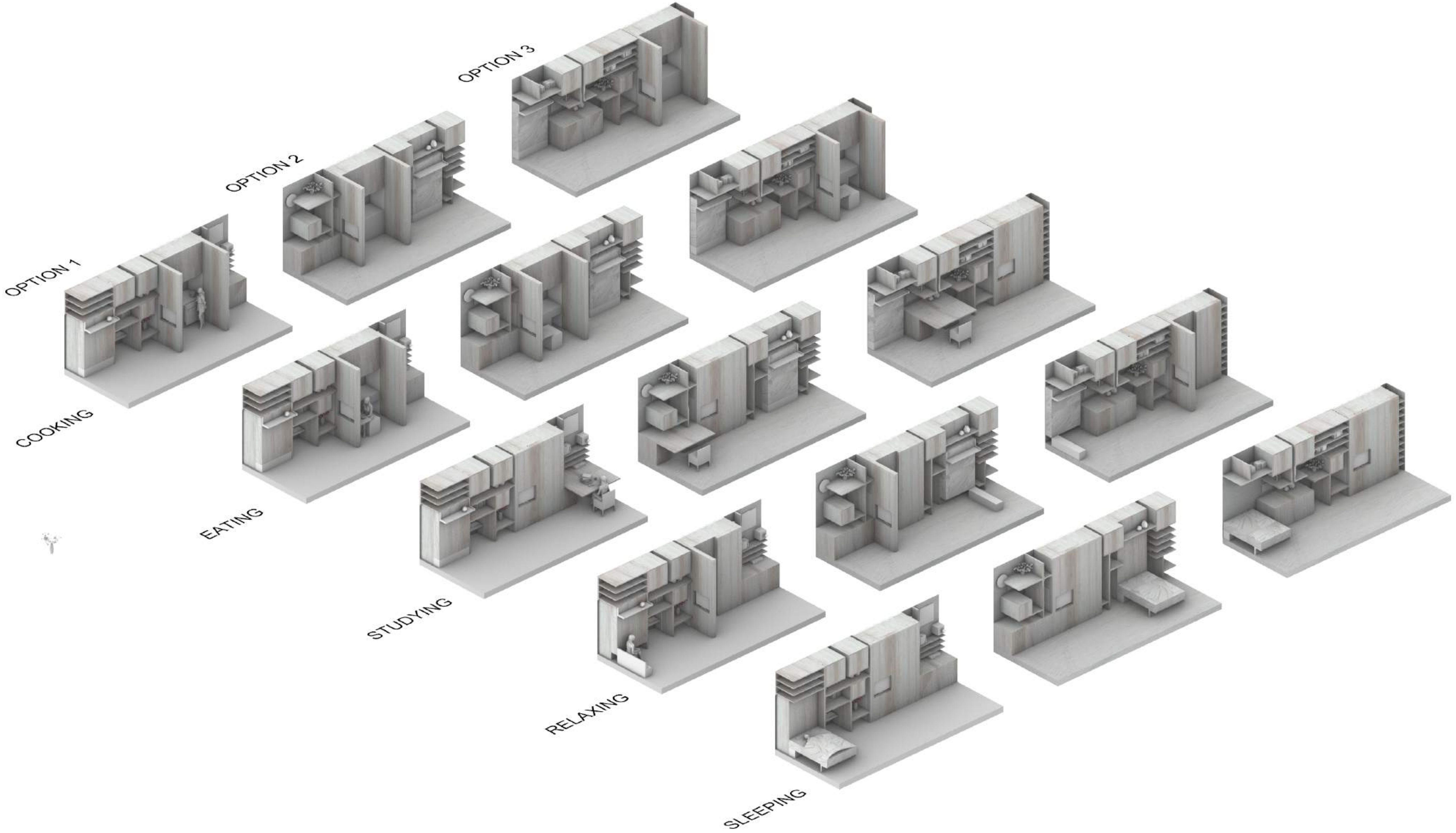
# MY MICROHOME
GENERATIVE DESIGN

Optimized Living
Year: 2021
Location: N/A
Type: Academic Project (Group)
Collaborators: Adrianna Fransz, Anoushaé Eirabie, Hyosil Yang,
Leo Di Wan
Instructors: Prof. Danil Nagy

The topic of a living and working space has enjoyed a spotlight in recent years as the value of space in major cities increases, and as the global community searches for ways to redefine productive, healthy environments that promote holistic lifestyles. Just over the last year and a half, as COVID-19 altered our typical daily lifestyle, quarantines and large periods of 'work from home' forever changed the ways in which we use our personal spaces. Never before have our living rooms and kitchens enjoyed such a critical analysis than during the pandemic. How a home, office or other living space is arranged to facilitate a routine can have a conscious or subconscious long-term impact on productivity and comfort. As a response to these recent changes in ways of living, this investigation proposes a solution that relies on user preferences to generate designs tied to lifestyle choices.

My Microhome optimizes the use of a wall in a typical micro-home by maximizing the distribution of activities across it. We chose specifically to use a micro home as a precedent for the design space because compared to typical apartments which are usually designed for efficiency in plan, a micro home forces our attention on any available space in the unit, including walls, ceilings and floors. For the purpose of this optimization we isolate a wall in the micro home and designate certain furniture that can fold out and back into the wall to allow for the best use of space elsewhere in the apartment and create a multi-purpose room. To generate a Microhome wall, the user inputs their lifestyle, sets a routine for the wall to follow, and then selects a single design option that best suits their needs.

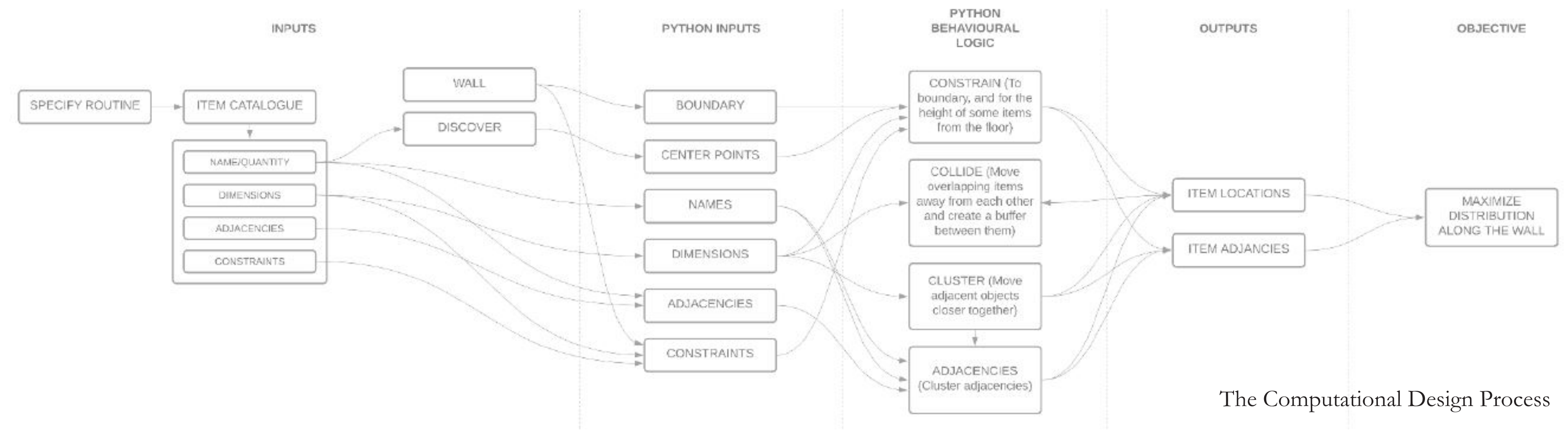
The process to accomplish this design task without optimization, while not impossible, would be difficult to maintain consistently. By deploying design through generation, multiple solutions based on the user's preferences can be created quickly and a large number of options can be developed through the 'Discover' process which generates optimal solutions for placement and operation.



COMPARISON

Our team was interested in and referenced the article from the site Code InComplete: "Binary Tree Bin Packing Algorithm" by Jack Gordon.
In it, Gordon tackles the challenge of developing a bin packing algorithm to pack rectangular blocks with specific dimensions into a single, fixed rectangle. The article helpfully outlines the goals Gordon aimed to achieve as well as the challenges and options he discovered, and details the solutions he created as well as the reason behind his decisions. We acknowledged 'bin packing' as one way to pack a space full of objects using subdivision, but we wondered how the notion of 'efficiency' might look different when it comes to an individual's living space, where unique design, preference, the ability to feel emotionally connected to a space might trump packing the space with as many pieces as possible. We therefore took an object-oriented approach, specifically objects reacting to each other based on some predefined behavioural preference.

METHODOLOGY



The Computational Design Process

INPUTS

The project begins by allowing a user to define a specific routine. In doing so, a series of suggested items/furniture populate a catalogue. We used to a JSON text file to define each item's name; dimensions, in this case width and height (all typical furniture sizes); constraints on location, some items when placed on a wall have to be a certain distance from the ground in order to remain functional (i.e. the surface of a table should be no higher than 2.5 feet); and adjacency, meaning other items that would sit in proximity to said item in order to establish a pattern of use.

This data list was then converted into point locations randomly generated using Discover: Continuous input parameters that were constrained in range only by a specified "wall" boundary. These point locations were then passed through another python script to receive a series of behavioural treatments in order to determine their final locations for evaluation. The python behaviours are defined as follows:

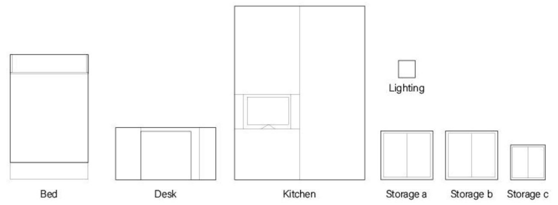
a) Constrain: Keeping the newly generated locations within the same bounding box they were generated in. Also implementing the 'height constraint' input specified in their JSON profile by raising the center points to a specific 'y' value.

b) Collide: Evaluating whether or not the 'widths' and 'heights' of the rectangles surrounding the center points overlap, and if so, moving them in the 'x' and 'y' directions so that their collective dimensions are no longer overlapping.

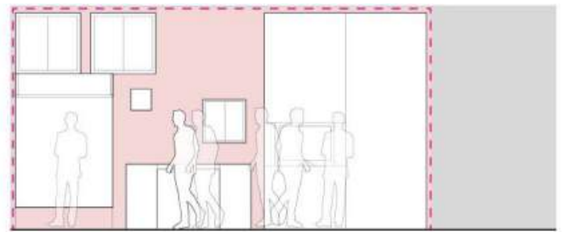
c) Cluster Adjacencies: Pulling items designated 'adjacent' in their JSON profiles closer together by applying a clustering logic: if the distance between 'adjacent' objects is greater than their combined widths and heights, move them closer together.

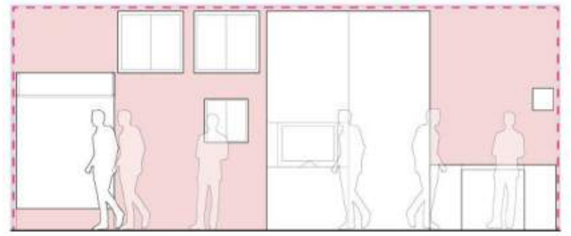
OUTPUTS
Generated outputs include the new item locations (based on a new center point) and number of adjacencies established. We associated the original dimensions of the items to the newly generated center points and produced a bounding area. We then multiplied this new bounding area by the established quantity of adjacencies and in doing so aimed to maximize the potential area these items can occupy inside the wall boundary while increasing their adjacency.


Limited Wall Space



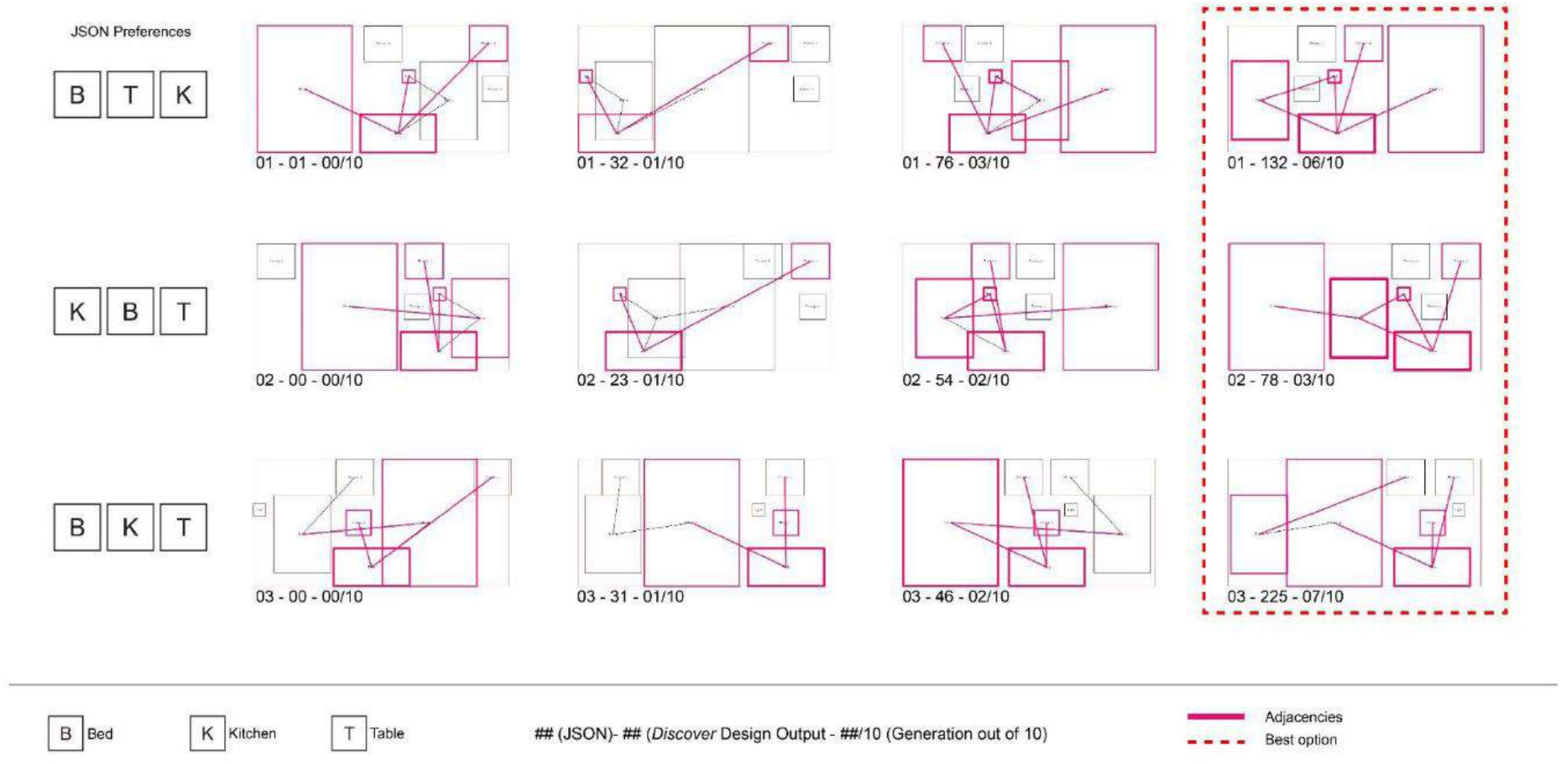
Foldable Furniture


Minimized Furniture Bounding Box Area
Less spaces between functions, more packed, more dead space


Maximized Furniture Bounding Box Area
More spaces between functions, less packed, maximize space use

RESULTS

The model was able to generate ideal options based on JSON preferences. The image below demonstrates that it did take a certain number of generations for the model to recognize and eliminate overlap, and move the items to their optimal positions based on adjacency. The Discover plot was set up to output 20 designs per generation over 10 generations at a mutation rate of 0.05.
Having Discover do the work of finding an optimal location for key items in a wall allows designers to focus on how to infill the space between these items, and create actual "homes" out of the generated spaces.



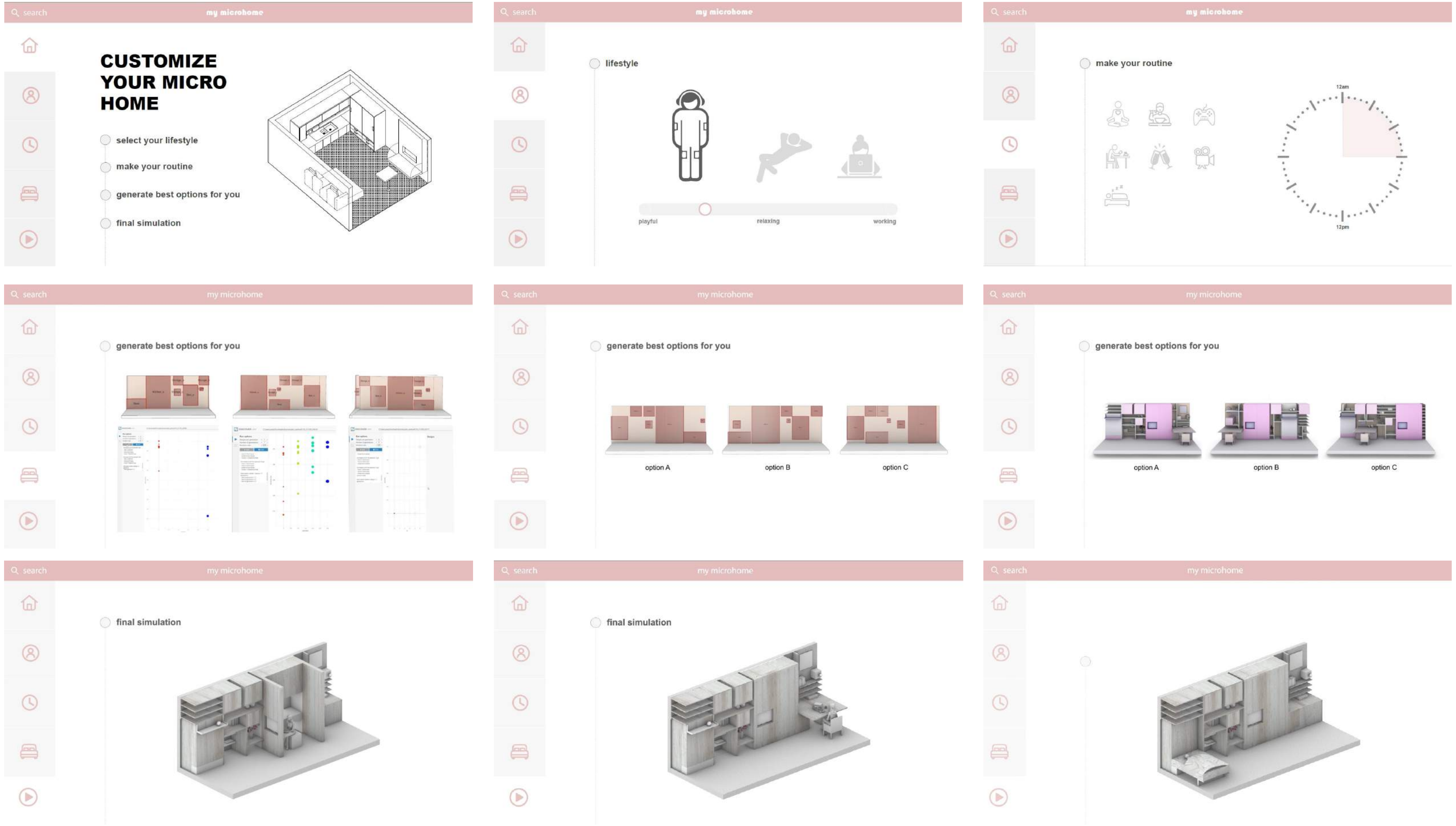
Optimal outputs generated through Discover

CONCLUSIONS

The model developed here is simple and at times predictable. There is room to introduce a wider variety of items and integrate a broader hierarchy in order to attain objectives that generate a more searchable model. There are also opportunities to introduce different types of the same functions generating ever more possibilities for the user.
There is, however, an excitement surrounding the possibility of extending the hand of the designer to the user directly through the kind of methodology My Microhome attempts to define. The notion that a user can design a space based on parameters that they are most familiar with, like their own routines, is a novel approach to architectural and interior design. My Microhome expands and facilitates the role of the architect/designer in the sense that it helps provide optimal design solutions. Direct user and designer exchanges see the generative model become a catalyst for collaborative and participatory design.

Spaces Completed by Designer


My Micro-home




https://medium.com/@hy2708/my-micro-home-90352fd63586

06

## DREAMSCAPES

Surreal Landscsape
Year: 2021
Location: Ultrareal
Type: Academic Project (Group)
Collaborators: Omar Badriek, Aahana Banker, Anthea Viloria
Instructors: Prof. Philip Crupi and Prof. Joe Brennan

*"As the dreamscape around me grows clearer, I slip further away from it. The mind is a magical thing, I'm discovering. A dreamscape is made of thought and is wider than the sky, able to grow large enough to fit not just our own world, but every possibility and impossibility beyond it." - Beth Revis*

Looking at rendering not simply as a means of representation but as a 'tool for design', this project experiments with the use of 3DS Max as a design instrument that enables unexpected results and fantastic imagery. The project exhibits an illogical, irrational juxtaposition of familiar architectural elements belonging to different movements (such as classical columns in contrast with pure modernist walls) and is set in the realm of surrealism with elements such as arches distorted or stretched beyond the familiar and the use of natural elements such as water in unusual ways, thus creating dream-like scenes through bizarre assemblages. By drifting away from the laws of physics and the boundaries of realistic feasability, the dreamscape is a manipulation of the mind, and an expression of impossibility.

07

# FLOORING
HEALTHY BUILDING MATERIALS

Material Research
Year: 2022
Location: Houston, Texas
Type: Academic Project (Individual)
Instructors: Prof. Catherine Murphy

**Product Category**
Flooring

**Project Description**
Adaptive Re-Use Project, Houston, TX. 10,000 sqm.

**Selection Criteria**
Strong and dependable surface, can withstand movement, non porous
Avoidance of certain chemical classes of concern

**Specific Area** (Where the material/product will be installed)
Artist Studios and Office spaces

**Programs / Populations of Concern** (mostly mid 20's -mid 30's)
Art Studios / Workshop Spaces / Fabrication Lab: Artists and Designers
Small and Large Office Spaces: Office Employees
Art Gallery / Cafes / Restaurants : Visitors
Education Center: Students
+The construction team working on installation.

I have chosen to relate my material research to my current studio project which is the adaptive re-use of the former Coca Cola Bottling Plant in Houston, Tx. After investigating the existing structures we are trying to incorporate a 10,000 m2 'Incubator for Arts and Design'.
To select the healthiest products, I have chosen to focus on the additional studio and workshop spaces in the new buildings that we're implementing on site as this is where artists will spend the majority of their time, thus they are the spaces with the highest potential for exposure. For the flooring material I am looking for a strong and dependable surface that can withstand movement and is non porous, and intend to avoid certain chemical classes of concern.
The existing seamless monolithic concrete floors (made from a mixture of Portland cement, expanding additives, gravel and sand) are better then regular monolithic conctrete when it comes to strength, durability and corrosion. They would work well as the flooring in the larger fabrication labs in the existing buildings. However, in the newly implemented buildings that will serve smaller artist studios and workshop spaces, where the risk of spilling and corrosion is higher, here are some other material alternatives: Linoleum, natural rubber and engineered wood.

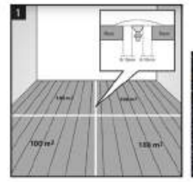

*"Coca-Cola requires industrial floors that can withstand the incredibly high volume of product that moves throughout their warehouses on a daily basis and requires an industrial flooring that is easy to clean...The reason for the preference for monolithic coatings is the nature of the operational loads on the floors in such buildings. Shock loads arising from the fall of various objects, the movement of goods and the intense movement of people and vehicles quickly cause damage to the floor at the joints of the coating elements. Another reason for choosing seamless floor coverings is the low risk of injury and high hygiene"*
- KALMAN Floor Company

| | RECOMMENDATION | | |
|---|---|---|---|
| |  |  |  |
| | LINOLEUM<br>ACCESSORY MATERIAL(S) | NATURAL RUBBER<br>ACCESSORY MATERIAL(S) | ENGINEERED WOOD<br>ACCESSORY MATERIAL(S) |
| HUMAN HEALTH<br>Rating | ★★★★★ | ★★★★☆ | ★★★★☆ |
| INDOOR CLIMATE<br>Rating | ★★★★☆ | ★★★★★ | ★★★★★ |
| ENVIRONMENT - ENERGY<br>Rating | ★★★★☆ | ★★★★☆ | ★★★★☆ |
| ENVIRONMENT - CARBON<br>Rating | ★★★★★ | ★★★☆☆ | ★★★★★ |
| AFFORDABILITY<br>Rating | ★★★★☆ | ★★☆☆☆ | ★★★☆☆ |
| MAINTENANCE<br>Rating | ★★★★☆ | ★★★☆☆ | ★★★★☆ |
| DISASSEMBLY/RECYCLING<br>Rating | ★★★★★ | ★★★☆☆ | ★★★☆☆ |

## LINOLEUM

Linoleum is a performance bio-based material made from renewable resources like linseed oil, tree resins, recycled wood flour and cork, and is considered one of the greenest, most resilient flooring options.
The product that I chose to look at which contains Linoleum is Marmoleum.
A resilient Floor Covering made from natural raw materials making it a preferable ecological floor covering with a low carbon footprint. It is built in three layers that form one homogenous product.

Click Panel Dimensions - 12" x 36" approx. (300mm x 900mm)
Click Square Dimensions -12" x 12" approx. (300mm x 300mm)
Structure:
Total Thickness - 9.8mm
Surface - 1mm Marmoleum®
Base Material - [illegible] HDF
Backing - 1mm cork
Carton Contents




| | |
|---|---|
| Linoleum | linseed oil (flaxseed oil)<br>resin<br>ground cork<br>wood flour |
| Marmoleum Modular | Linseed Oil 20%, Gum Rosin 2%, Tall Oil 6%, Wood Flour 31%, Calcium Carbonate 8%, Reused Marmoleum 23 %, Titanium Dioxide 3%, Various other pigments 1%, Polyester 5%, Lacquer 1% |

| | |
|---|---|
| Additives | Marmoleum Sheet –glued by professionals over a perfect subfloor. (Linoleum sheets are attached to the backing material by laying down flooring adhesive to the subfloor with a notched trowel).<br>Marmoleum Modular Tile—glued by professionals or DIY over a perfect subfloor<br>Marmoleum Click—floated by professional or DIY over moderately perfect subfloor (Doesn't require any glue): 'floated over most subfloors such as concrete or plywood without any glue. They require no underlayment because 1/16" cork is already built into the backing' (greenbuildingsupply) |

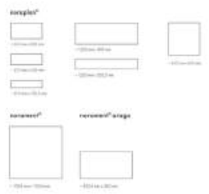
| | |
|---|---|
| Advantages | -Highly Durable<br>-Economical<br>-Sustainable solution for high-traffic areas: Linoleum rolls are made with a commercial grade layer that prevents the floor from being worn through quickly<br>-Linoleum can be embossed with patterns, painted with colors, or printed with a hardwood grain.<br>-Pigment can also be added into linoleum in the liquid stage. It comes in roll or tile format depending on the application.<br>-Bio-based / Non-toxic / Anti-microbial<br>-Linoleum flooring patterns are designed for both functionality and aesthetic value<br>-It also is more comfortable than most floors because of a slight padded feeling that makes prolonged standing or walking on a more pleasant experience.<br>-Homogeneous material and cohesive coloring throughout – meaning, you can easily buff out damaged, stained or scratched floors and refinish for a brand-new look<br>-Easy to maintain/ Clean and easy to install |
| Disadvantages | -Upon installation, linoleum flooring gives off linseed fumes for about a week to a month. These odors won't cause any harm, but they may frustrate some people.<br>-Requires professional installation<br>-Susceptible to moisture<br>-Flammable |

| | |
|---|---|
| Human Health | No particular hazard for people and the environment |
| Indoor climate | Odors during installation |
| Environment-Energy | Consumes electricity for maintenance |
| Environment-Carbon | Made from natural, raw materials making it an ecological floor<br>Marmoleum has a low carbon footprint |
| Affordability | linoleum is a bargain compared to wood, ceramic tile, and natural stone |
| Maintenance | -Wet Cleaning (Damp mopping) once a week<br>-Dry Cleaning (Vacuuming) twice a week<br>-In high traffic areas – more frequent cleaning |
| Disassembly - Recycling | -Product is biodegradable and can be composted<br>-Lasts 20 to 40 years |

| | |
|---|---|
| Certifications<br>Marmoleum Modular | Link to HPD<br>https://prod-hml.s3.amazonaws.com/HPD_Marmoleum_Modular_Exp_2024_10_08_2022-01-14-022248_ecqc.pdf<br><br>Link to EPD<br>https://prod-hml.s3.amazonaws.com/Forbo_Marmoleum_Modular_Tile_2.02.5mm_EPD_Exp_2023_01_05_2022-01-14-022216_usyd.pdf<br><br>Link to SDS<br>https://prod-hml.s3.amazonaws.com/SDS-Marmoleum_FORBO.pdf<br>Declare (Transparency Platform) |

## NATURAL FIBER

Natural Rubber is Made of latex: a sap found in para rubber trees, also known as Hevea brasiliensis
Norament tiles are made by pressing rubber under high pressure, which creates a surface that is resistant to wear and supports fast and easy cleaning.



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|---|---|
| Natural Rubber | Made of latex: a sap found in para rubber trees, also known as Hevea brasiliensis |
| Norament Tiles | Polymers (Synthetic Rubber) 39%, Minerals 46%, Titanium Dioxide 8%, Auxiliary Substances and Vulcanization System 7% |

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| Additives | These tiles are easy to install. They have interlocking edges for a secure fit. Installers do not need adhesives or glue when working with interlocking tiles. |

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| Advantages | -One of the number one eco-friendly resources being used today<br>-Long-lasting<br>-Effective<br>-Less harmful for the environment<br>-Ideal industrial floor covering<br>-Easy to wash down<br>-Good insulation on concrete floors<br>-Good weather resistance<br>-Easy to cut lengths from the roll<br>-Suitable for wooden deck covering and workshops<br>-Resistant to water exposure<br>-Good elastic properties, resilience, and damping |
| Disadvantages | -One of the biggest limitations of natural rubber is its poor resistance to hydrocarbons, fats, oils, and greases. Contact with these substances can cause swelling, softening, or complete dissolution of the rubber part resulting in partial or complete failure.<br>-Poor chemical resistance and processibility |

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| Human Health | No particular hazard for people and the environment |
| Indoor climate | Natural rubber flooring does not contain PVC, phthalates or chlorine, contributing to improved indoor air quality |
| Environment-Energy | Requires way less energy to produce than synthetic rubber |
| Environment-Carbon | $CO_2$ neutral (Carbon neutral rubber flooring)<br>Hevea tree – efficient carbon sequestration |
| Affordability | Premium rubber flooring can be quite expensive.<br>12 to 15 Doll per sqf |
| Maintenance | -Sealed surface is resistant to wear and supports fast and easy cleaning<br>-Low-maintenance, so it's not that hard to take care of. |
| Disassembly - Recycling | -Can be recycled by specialty firms<br>-Low aging resistance of Natural Rubber is due to its poor stability towards ozone and oxygen<br>-Lasts up to 20 years |

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| Certifications<br>Norament Tiles | Link To EPD<br>https://prod-hml.s3.amazonaws.com/epd-norament-standard_s20.pdf<br><br>Link to SDS<br>https://prod-hml.s3.amazonaws.com/sds_finished_goods_noraplan_norament_norament_stair-treads_0419.pdf |

## ENGINEERED WOOD

Engineered Wood is 'made by binding pieces of real wood, scrap wood, shredded wood fibers and/or sawdust with adhesives to create products that look and act like wood but are designed to be stronger and more durable'
'Engineered wood boards are generally made from the same hardwoods and softwoods used to manufacture lumber, but mixed with additives like adhesives. This type of wood often utilizes waste wood from sawmills, and are treated through chemical or heat processes to produce wood that meets size requirements that are hard to find in nature' - micropalned
Natural wood flooring is designed for human health because it is not altered from its natural state. This product should be used in heavy traffic areas and most importantly in areas where people live and work.

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|---|---|
| Engineered wood | Made by binding pieces of real wood, scrap wood, shredded wood fibers and/or sawdust with adhesives |
| Natural Wooden Flooring | Wood 99.9%, Polyvinyl Acetate Adhesive 0.05%, Natural Oils 0.05% |

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| Additives | When it comes to engineered wood floors, the floating floor method is often used. The process involves inserting the tongue of one plank into the groove of another and locking them together.<br>Adding glue can add more stability. |

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| Advantages | -Doesn't expand and contract to the same extent as solid wood<br>-Extremely durable<br>-Can be sanded - can be renewed when worn out / can be refinished<br>-Comes in a whole range of species, grades and finishes<br>-Easy/faster to install<br>-Less costly than solid hardwood flooring<br>-More resistant to fluctuations in temperature and humidity than solid wood flooring<br>-Less prone to moisture damage<br>-Good for heavy traffic areas |
| Disadvantages | -Can be Scratched and Dented<br>-Is not waterproof |

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| Human Health | Product good for human health because it remains unaltered from its natural state |
| Indoor climate | When it comes to indoor air quality, engineered hardwood floors are among the healthiest choices |
| Environment-Energy | Energy efficient |
| Environment-Carbon | Engineered wood lowers carbon emissions |
| Affordability | Professional installation of engineered wood is usually cheaper than it is for solid wood.<br>But still expensive |
| Maintenance | -Engineered hardwood offers easy care and maintenance.<br>-Floors are mopped once a month with warm water and wood floor soap |
| Disassembly - Recycling | -Lasts 20 to 80 y<br>-process waste is re-used to produce other wooden products<br>-50% is recycled, 37%landfilled, 13%incinerated |

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| Certifications<br>Natural Wooden Flooring | Link To EPD<br>https://prod-hml.s3.amazonaws.com/EPD-Product-Specific-3-1.pdf<br><br>Link to HPD<br>https://prod-hml.s3.amazonaws.com/772_mafi_wood_surfaces_2020-12-11-182131.pdf<br><br>Declare (Transparency Platform) |

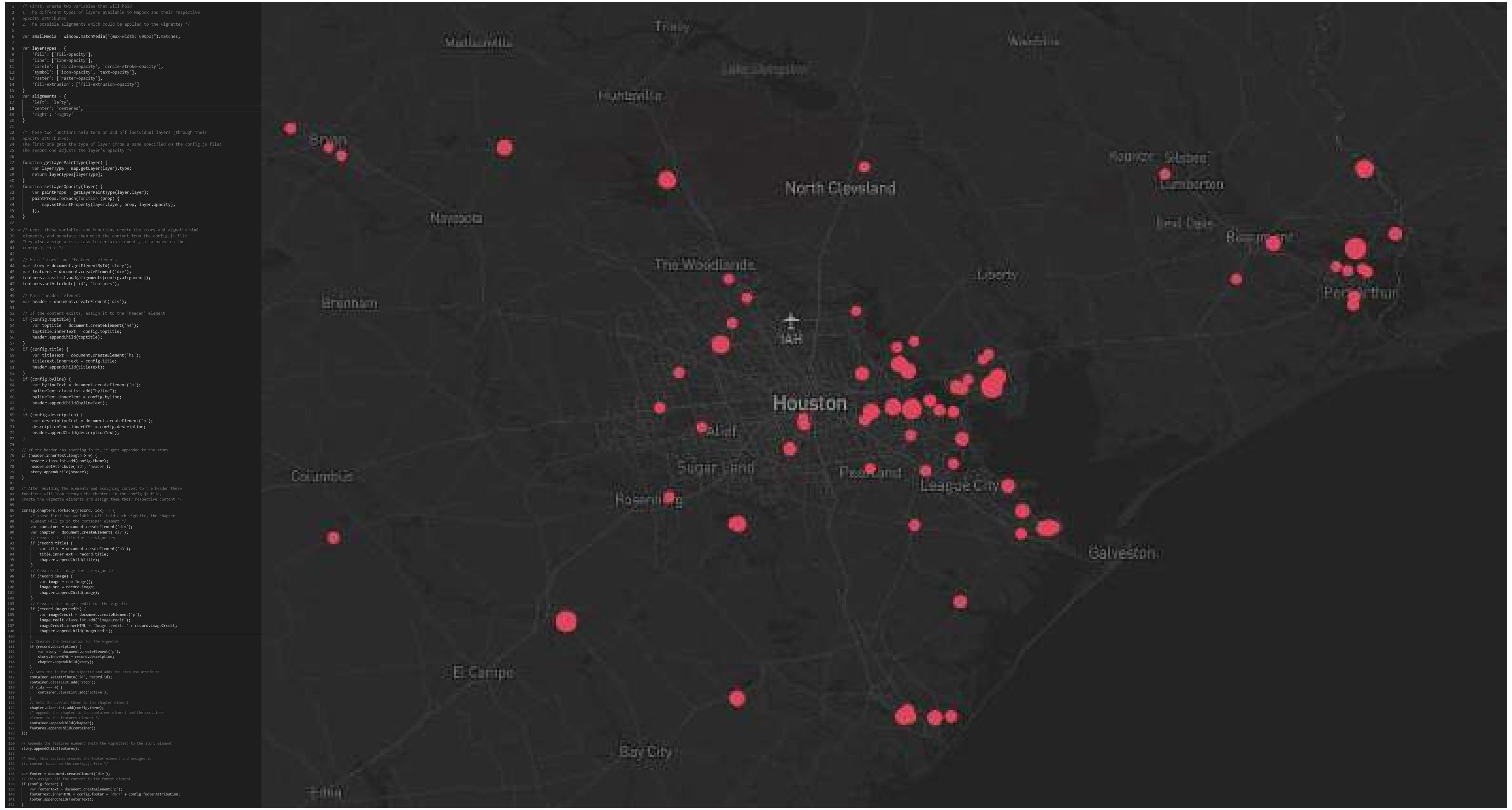
08

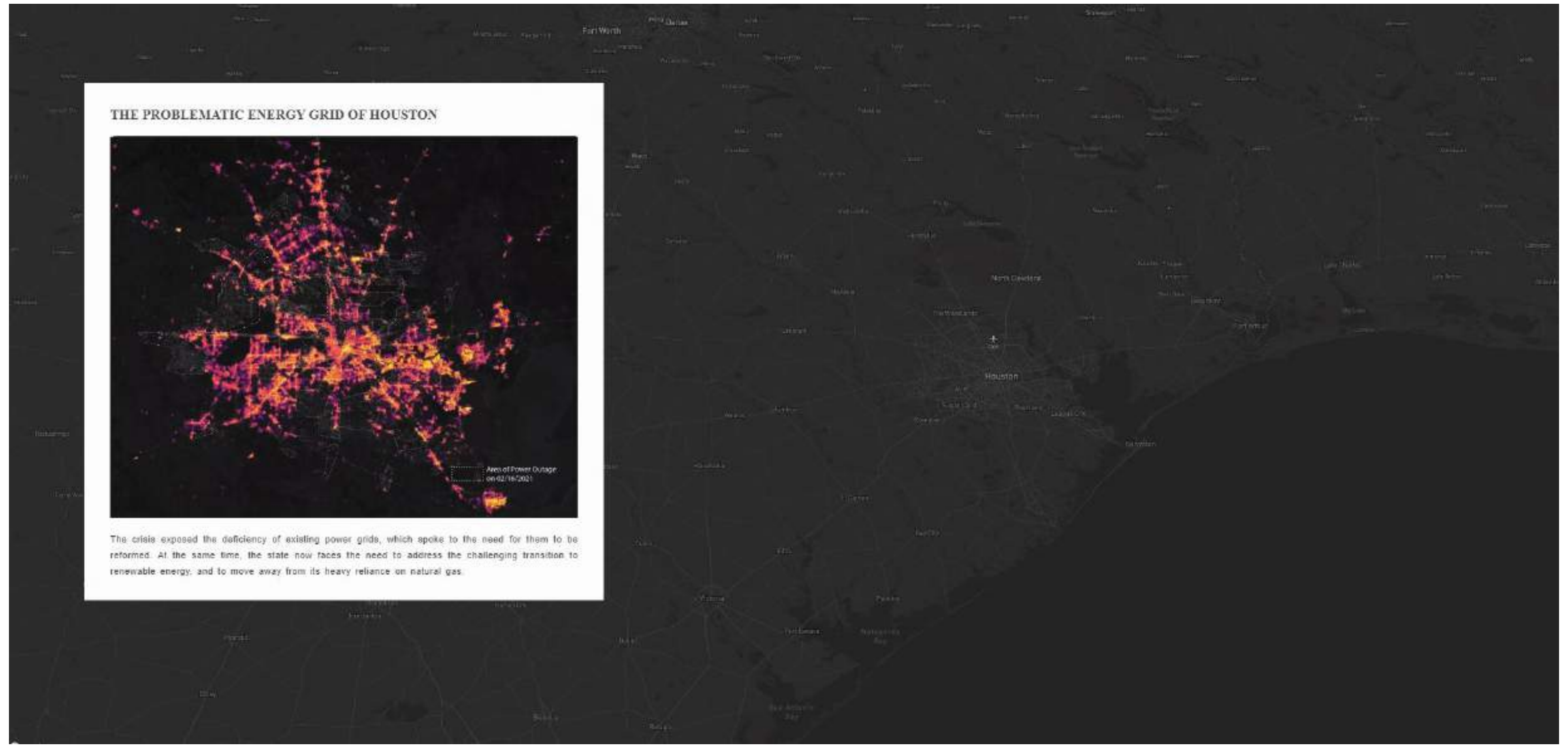
# RENEWABLE ENERGY : PATHWAY TO TEXAS'S ENERGY RESILIENCY

(POINTS UNKNOWN)

Scrolling Map - Visual Studio Code / Mapbox
Year: 2022
Location: Houston, Texas
Type: Academic Project (Group)
Collaborators: Rotina Tian and Mingxun Zou
Instructors: Prof. Juan Saldarriaga and Prof. Michael Krisch

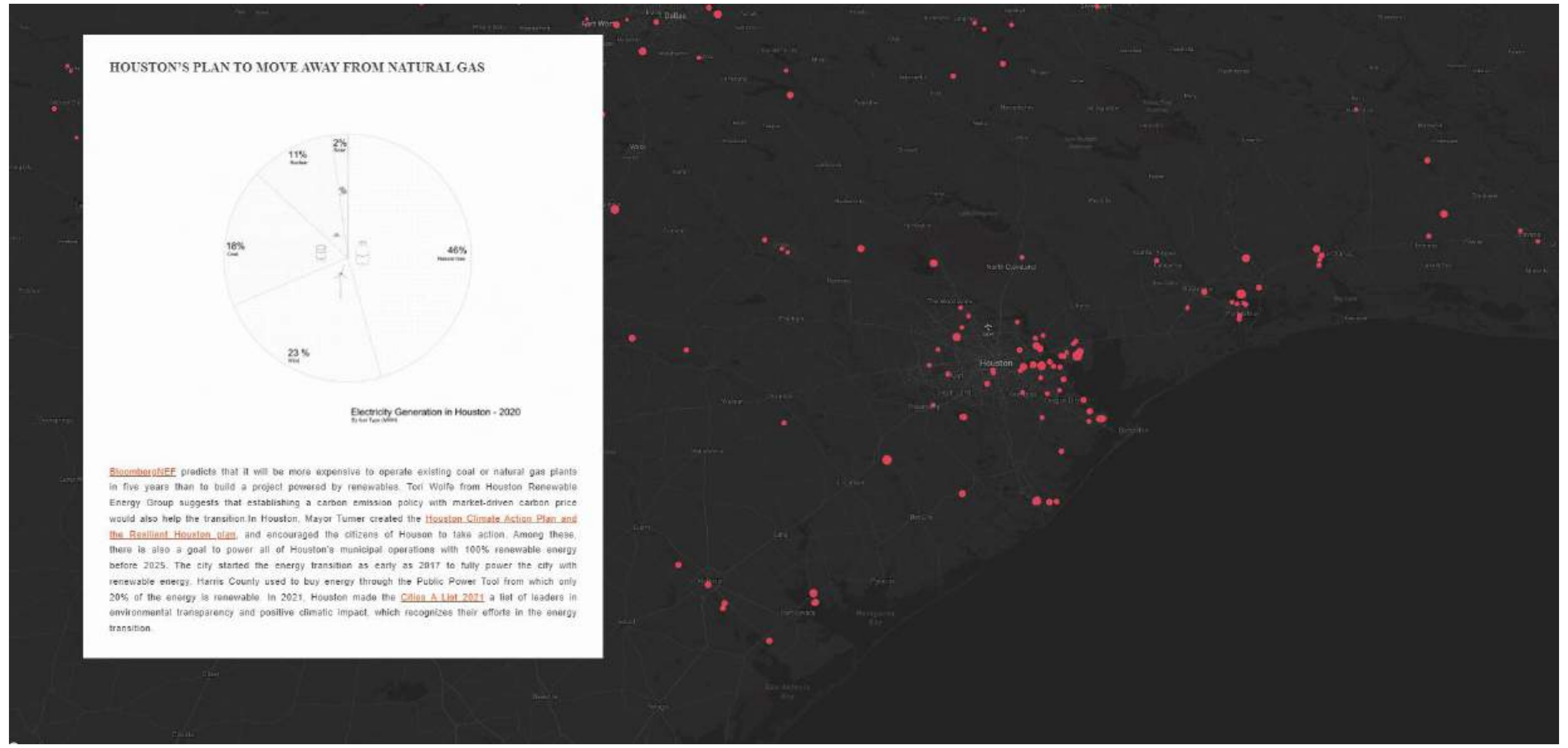
Texas has long been considered the energy capital of the world with abundant resources of natural gas and petroleum. However, during winter storm Uri in 2021, the state's natural gas supply was disrupted, un-winterized power plants were unable to perform, and Texas experienced one of the worst power outages. The energy crisis of 2021 brought up the question of whether the current independent energy grid in Texas is reliable or not, and led to a signigficant shift towards the ongoing renewable energy transition. UN climate summits and Biden's Climate Plan have pushed renewable energy to a new level of significance. Energy resiliency is especially relevant in today's context with the Russia-Ukraine war, when countries that used to depend on Russia for energy now have to look for resources elsewhere.






## Map 1 - The Effects of the 2021 Energy Crisis

Zooming in to Houston, the map below shows the areas that suffered from power outages during the 2021 winter storm.
The crisis exposed the deficiency of existing power grids, which spoke to the need for them to be reformed. At the same time, the state now faces the need to address the challenging transition to renewable energy, and to move away from its heavy reliance on natural gas.

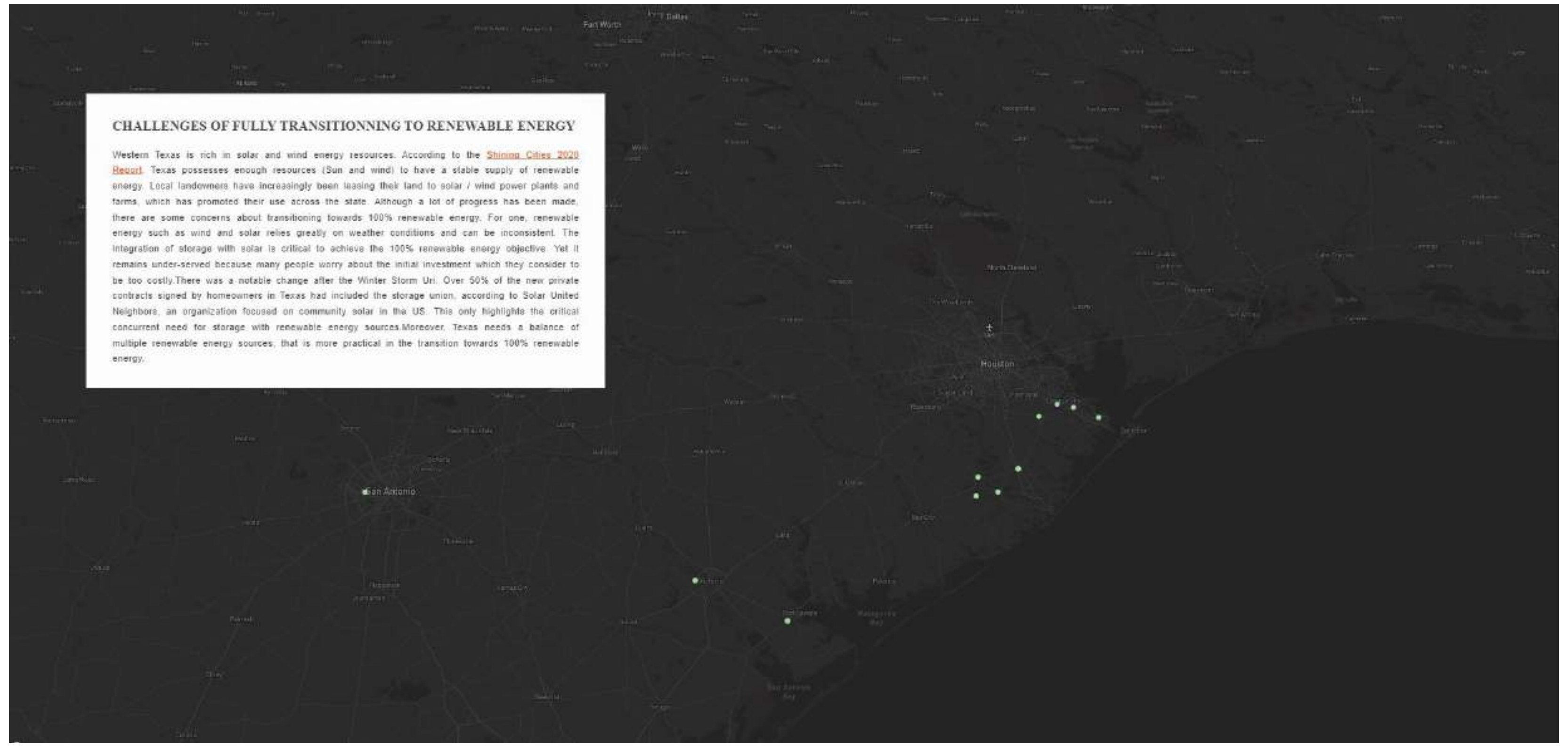




## Map 2 - Natural Gas Power Plants

The diagram shows that as of 2020 natural gas was the main energy resource used in Houston; and the map shows the current location of natural gas power plants in Houston.

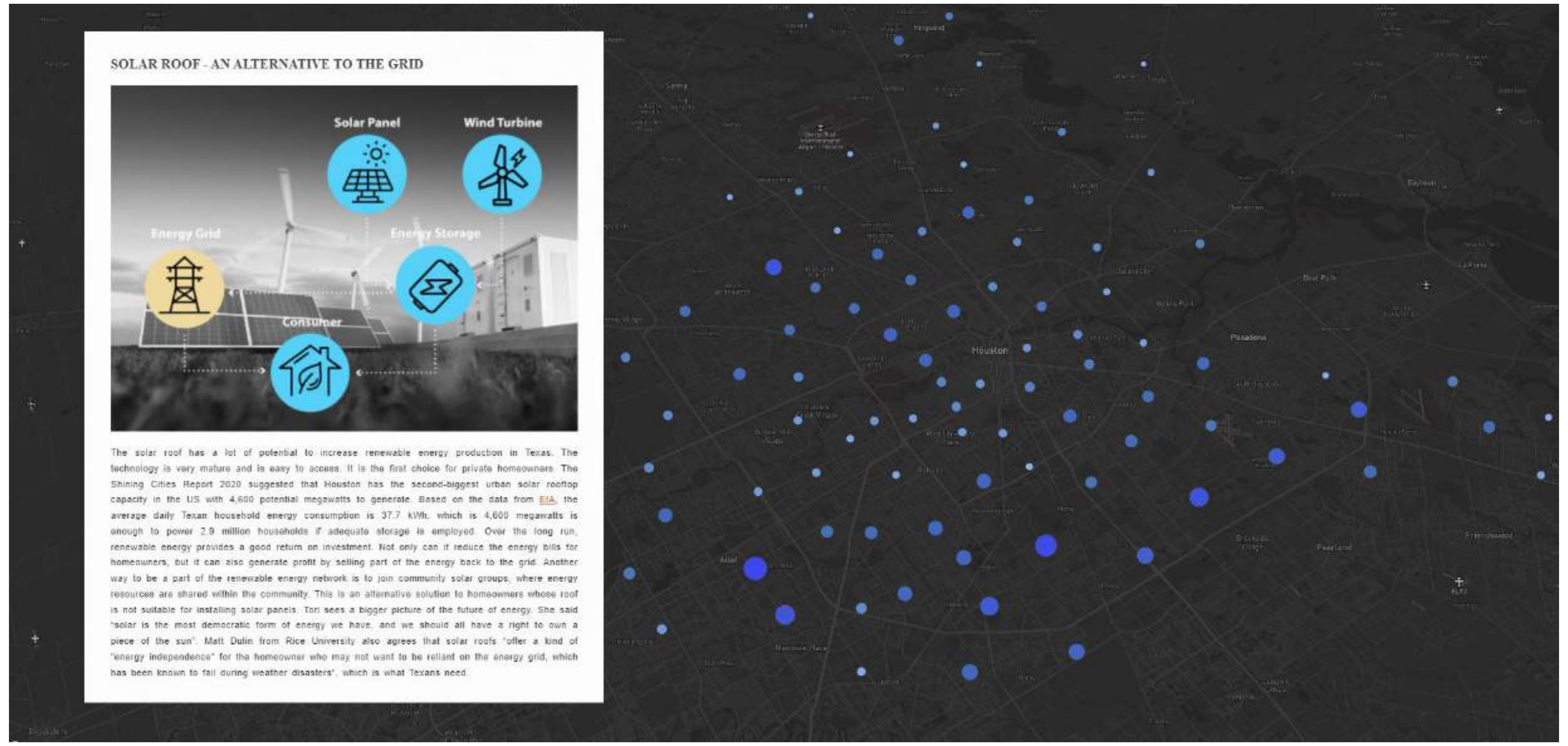
HOUSTON'S PLAN TO MOVE AWAY FROM NATURAL GAS:

BloombergNEF (link: https://about.bnef.com/new-energy-outloo) predicts that it will be more expensive to operate existing coal or natural gas plants in five years than to build a project powered by renewables. Tori Wolfe from the Houston Renewable Energy Group suggests that establishing a carbon emission policy with market-driven carbon price would also help the transition.
In Houston, Mayor Turner created the Houston Climate Action Plan and the Resilient Houston Plan (link: https://resilience.rice.edu/climate-resilience-metrics#resilience), and encouraged the citizens of Houson to take action. The objective is to power all of Houston's municipal operations with 100% renewable energy before 2025.
The city started the energy transition as early as 2017 to fully power the city with renewable energy. In 2021, Houston made the 'Cities A List 2021' (link: https://www.cdp.net/en/cities/cities-scores), a list of leaders in environmental transparency and positive climatic impact, which recognizes their efforts in the energy transition.




## Map 3 - Battery Storage

This map shows the locations of energy storage, one of the challenges to the full transition to renewable energy.
Western Texas is rich in solar and wind energy resources. According to the Shining Cities 2020 Report (link: https://environmentamerica.org/sites/environment/files/reports/Shining-Cities-2020/EA_Shining_Cities_scrn.pdf), Texas possesses enough resources (Sun and wind) to have a stable supply of renewable energy. Local landowners have increasingly been leasing their land to solar / wind power plants and farms, which has promoted their use across the state.
Although a lot of progress has been made, there are some concerns about transitioning towards 100% renewable energy. For one, renewable energy such as wind and solar relies greatly on weather conditions which can be inconsistent. The integration of storage with solar is thus critical to achieve the 100% renewable energy objective. Yet it remains under-served because many people worry about the initial investment which they consider to be too costly.
There was however, a notable change after Winter Storm Uri. Over 50% of the new private contracts signed by homeowners in Texas had included the storage unit, according to Solar United Neighbors, an organization focused on community solar in the US. This only highlights the critical and concurrent need for storage with renewable energy sources.
Moreover, Texas needs a balance of multiple renewable energy sources, to succeed in the transition towards 100% renewable energy.




## Map 4 - Solar Roof, an Alternative to the Grid

Solar roofs have a lot of potential to increase the renewable energy production in Texas. The 'Shining Cities Report 2020' suggested that Houston has the second-biggest urban solar rooftop capacity in the US with 4,600 potential megawatts to generate, which is enough to power 2.9 million households if adequate storage is employed.
( The Shining Cities Report 2020 suggested that Houston has the second-biggest urban solar rooftop capacity in the US with 4,600 potential megawatts to generate. Based on the data from EIA (link:https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf), the average daily Texan household energy consumption is 37.7 kWh, which can be rounded to 1.57 kw. 4,600 megawatts is enough to power 2.9 million households with adequate storage).
The technology is very mature and is easy to access. It is the first choice for private homeowners in terms of renewable energy. Over the long run, renewable energy provides a good return on investment. Not only can it reduce the energy bills for homeowners, but it can also generate profit by selling part of the energy back to the grid. Currently, there are multiple incentives, including a 26% tax benefit for installing solar panels.
Another way to be a part of the renewable energy network is to join community solar groups, where energy resources are shared within the community. This is an alternative solution for homeowners whose roof is not suitable for installing solar panels.
Tori sees a bigger picture for the future of energy. She said "solar is the most democratic form of energy we have, and we should all have a right to own a piece of the sun". Matt Dulin from Rice University also agrees that solar roofs "offer a kind of "energy independence" for the homeowner who may not want to be reliant on the energy grid, which has been known to fail during weather disasters", which is what Texans need at the moment.

09

## SELECTED COMMENTARIES
(TRANSCALARITIES)

Reading Responses
Year: 2021
Location: N/A
Type: Academic Essays (Individual)
Instructors: Andrés Jaques

**'Human and More-Than-Human Alliances'**

Primary Readings:

- 'A Cyborg Manifesto' - Donna Harraway
- 'Pipeless Dreams' - Mark Wigley

Response:

Mark Wigley in 'Pipeless Dreams' describes how architecture pursues simplicity through mechanisms of invisibility: "No building form is as complex as the systems that service it or the activities it services. Architecture is an act of simplification or of veiling complexity". He argues that architecture is about the skin: the art of creating thin seamless surfaces that hide all of the elements that make it functional: the pipes, the wires… in the pursuit of simplicity. The architect is aware of all the pipes seen as he's trying to hide them, but the act of hiding itself is not represented as an 'art form': "the world of pipes is a world of silence… the veiling itself is veiled". Even if a few architects embrace the pipes and decide to expose them, "the very allure of a few exposed pipes reinforces the default need to bury them", to return to a 'simple' and 'clean' design.

That desire to achieve simplicity through veiling mechanisms is also applicable to the realm of technology. As explained by Donna Harraway in 'A Cyborg Manifesto', technology has strengthened the realization of invisibility through miniaturization. "Modern machines are quintessentially microelectronic devices: they are everywhere and they are invisible… miniaturization has changed our experience of mechanism… Our best machines are made of sunshine; they are all light and clean because they are nothing but signals, electromagnetic waves, a section of a spectrum and these machines are eminently portable, mobile".

Buckminster Fuller advocated for mobility in architecture. Relating to the notion of the boundary of the physical and non-physical, he believed that the real problem with pipes is that they are fixed and constrain movement. He argued that a building should be self-supporting, detached, unrestrained by plumbing lines, electric cables, water lines, sewers and communication systems: "They must be transcended by systems that support movement in any direction at any time… to free buildings and their occupants to navigate within flow itself".

Complex mechanisms of veiling enabled by technological advancements have been used to achieve simplicity; when it would be a simple process to leave the pipes and elements that make a building functional exposed and find simplicity in their inherent aesthetic qualities.

**'Climate Divides'**

Primary Readings:

- 'Slow Violence, Neoliberalism, and the Environmental Picaresque' - Rob Nixon
- 'Inviting Atmospheres to the Architecture Table' - Calvillo

Response:

'Animal People' by Indra Sinha exposes the "dehumanizing chasm that divides those who can act with impunity and those who have no choice but to inhabit, over the long term, the physical and environmental fallout of actions undertaken by distant, shadowy economic overlords". Chernobyl received far more attention in the Western media than Bhopal because it was perceived as a threat to the West due to its proximity, and it could be assimilated with the threat that communism posed against free market double standards "that allow Western companies to operate with violent fatal impunity". 'Animal People' exposes these neoliberal double standards and calls out the chemical industry for its destructive effect on people's health and the environment. The Soviet authorities were too slow to respond to the catastrophe of Chernobyl and as a result an epidemic of thyroid cancers followed: "The stratified slow violence of the fallout was compounded by the tardiness of the Soviet authorities". Sinha exposes the "unfolding of slow violence across environmental time" and calls out the way the catastrophe was managed by those responsible who used distancing strategies (political bribery, back-room deals…) to evade taking the blame and taking their responsibilities: "It is corporate amnesia emboldened by a neoliberal regime of deregulation…Transnational companies internalise profits and externalise risks, particularly in impoverished regions of the global South". This phenomenon of 'corporate amnesia' happens to this day, is experienced at all scales and is embodied by distancing strategies, employed by those who seek to avoid taking responsibility for their actions.

**'Material Cyclabilities'**

Primary Readings:

- 'Deconstructing Research. A Reverse-Engineering Methodology and Practice'- Alison Creba and Lionel Devlieger
- 'Who Builds Your Architecture'

Response:

The art collective Rotor advocates for "physical immersion in a site through observation of and interaction with its users". Rotor highlights the importance of engaging with a project by being directly involved in it.
Architects have a responsibility to care about the living conditions of the construction workers employed to build their design, who work on the construction sites of their projects: "Architects must capitalize on their key role in the building process to ensure human rights and stop labor abuse" (WBYA). Architects have the opportunity to push the authorities to raise the labor standards. There are many elements to take into consideration. First, housing is not an 'offsite' problem but an integral part of any construction project: I absolutely agree with WBYA's claim that "migrant worker housing should be a design consideration when dealing with the administration of a project and site". A collective effort must be made between the architect, the construction manager, the contractor... to improve the worker's living conditions and provide well maintained accommodations that maximize spaces for rest and socializing. Second, it is important to reconsider the location of their living accommodations. Presently 'workers' camps' are located outside of the city, far from the amenities and social activities of the city centers. But social segregation only leads to further alienation and forces the workers to rely on the schedule of buses as primary modes of transportation to go anywhere, and thus binds them to an schedule imposed by the construction company; in that sense even their movements are being controlled. The architect should advocate for better placements of the worker's living accommodations to help integrate them into the social and cultural aspect of the host country. Although they may want to, many are reluctant to protest against such unfair living conditions and labor practices for fear of having their contracts terminated and be deported. There is a lot at stake for them should they speak up, which is why it is our responsibility as architects, as well as that of construction managers, contractors and consultants, to push forward their demands and to take every opportunity to better their living conditions (Proper accommodation, with proper amenities for food preparation, proper temperature, proper hygiene…) and to make sure that humane working conditions are maintained.

**'Decolonizing Design'**

Primary Readings:

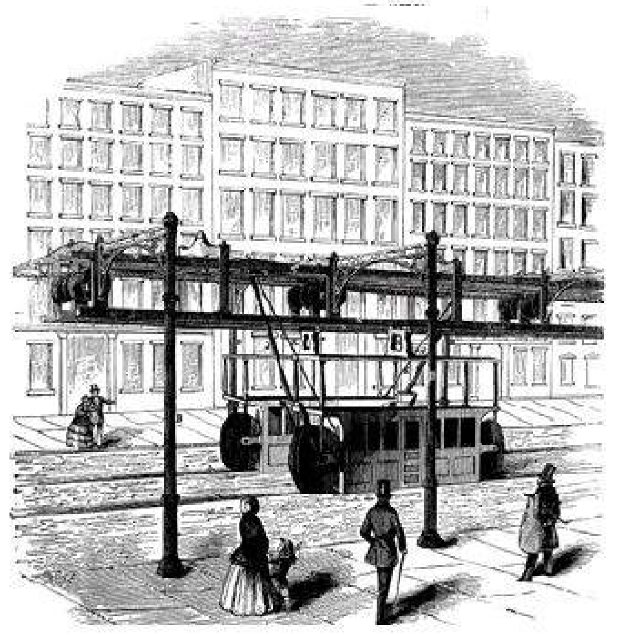
- 'The University and the Camp' - Anooradha Iyer Siddiqi
- 'Race Reason and the Architecture of Jefferson's Virginia Statehouse' - Mabel O. Wilson

Response:

In her essay 'The University and the Camp", Anooradha Iyer Siddiqi emphasizes the importance of understanding that coloniality outlives colonialism. She defines coloniality as the "long-standing patterns of power that emerged as a result of colonialism, but that define culture, labour, intersubjectivity relations and knowledge production well beyond the strict limits of colonial administrations" and argues that decoloniality is about understanding colonialism as a "force that rationalizes, erases, and denigrates people". She looked at the refugee camps for sources of knowledge with the intent to decolonize the mind; and explained that camps were and still are 'sites for empiricism'. She then explained the aim of the 'Decolonial theory', which "is intended to be reparative, restorative, and liberatory. It seeks to reverse larger forms of colonial violence, which are ongoing. It aspires to acknowledge, validate, and elevate the life and work of formerly and presently colonized people".

She argues that "Columbia University embodies a contradictory entanglement of liberal and oppressive traditions, particular to the history of the United states", and that the first step to a decolonial approach to architecture is to understand its 'entanglements with the colonial' but that it's important not to look at these entanglements as systemic. She told the stories of the multiple rallies and marches that were held on campus in opposition to the embedded colonial practices that the university engaged in. She gave the example of the story around the gymnasium that was intended to be built for Columbia College to portray the way architecture comes into play in relation to colonial practices and as an attempt to explain the opposition that rose against Columbia University's land use practices. The gymnasium's design was criticised for it allocation of the spaces (the basement space meant to be used by the Harlem community whilst the top level state of the art gym would be exclusive to Columbia students) which was perceived as inconsiderate to the Harlem community. She also tells the stories that happened at other universities such as the "poo protest" at the University of Cape town and the "Rhodes must fall" movement to highlight their aim which was to "bring out into the open institutional racism in university life in South Africa and Britain and to decolonize education" (Chaudhuri).

Mabel O Wilson's essay 'Race, Reason, and the architecture of Jefferson's Virginia Satehouse' looks at the racism sparked by colonialism, at the way nonwhite people were looked at as "primitive and uncivilized" and pays attention to the fact that many of the nation's important civic buildings, such as the White House, the US Capitol… were built by "enslaved black people, humans classified as property" and that it is important to acknowledge them. She also further elaborates on the way colonizers justified their exploitation of a community that they considered to be of an 'inferior race', 'primitive and uncivilized', and how they rationalized the 'expropriation of their land and labor' and the violent enslaving of others for personal gains, in a nation that ironically claimed to be all about the "unalienable rights to Life, Liberty and the pursuit of Happiness".



10

# MASS TRANSIT SYSTEMS: SHORT LIVED OR TIMELESS?

(NEW YORK RISING: HOW REAL ESTATE SHAPES A CITY)

Essay
Year: 2021
Location: New York
Type: Academic Essays (Individual)
Instructors: Thomas Mellins and Kate Ascher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*"The most foolish thing ever heard of. New York people will never go into a hole in the ground to ride"* – Russel Sage.

It is difficult to picture a time when the idea of subterranean travel seemed so nonviable and unthinkable. Historically, different types of transit systems, some of them still operating to this day, have served the city of New York, from omnibuses, to streetcars, trolleys, elevated rapid transit… all of which have contributed to the transportation system currently in place: the subway. As the population kept increasing in New York, the need for a rapid, efficient transit system became increasingly pressing. Many proposals ensued, some of them short-lived, others unbuilt due to lack of funding, technical failures, community or political opposition, or unresolved agency conflicts among other reasons. Nevertheless, these experimental proposals were quite enlightening, and one after the other, through trial and error, they led to the development of the current transportation system in New York. In what way did the shortlived transit inventions and experiments pave the way for the current subway system in Manhattan?

The rapid mass transit systems that developed over time presented many advantages, and the subway system more so than others. The expansion of transit facilities attracted more people to New York and facilitated new developments which in turn created an increased demand for rapid transportation systems:"Both the elevated lines and the subways spurred the population growth that city officials had anticipated and promoted. The number of people living in New York City's five boroughs rose from 1.5 million in 1870 to 3.4 million in 1900, and to nearly 7 million in 1930" (Plotch, 13). Mass transit systems created a more sustainable alternative for transportation; people would travel in bulk, thus reducing the number of single occupancy vehicles, which in turn reduced the carbon footprint. "Since mass transit's early years of horse drawn carriages on rails and coal burning steam locomotives, urban public train and bus operations, from its beginning, has had to operate within the natural and built environment, providing mitigating measures to thwart environmental impacts while operating" (Abdallah, 142).
Moreover, mass transit service presents many economic benefits, it has "always helped spur economic development to revitalize cities, both in the United States and around the world. Public transportation attracts people that want to live in thriving cities, helps to stimulate the economic growth that comes with more people settling in cities, and people who live in cities are generally more sustainable" (Abdallah, 142). It reduces the cost of travel, which also makes it easier to travel around the city. Furthermore, it improves mobility, connects the different neighborhoods within a city, allows people to be more productive during their commute and saves them a lot of time which leads to more enjoyable lifestyles: "Mass transit, which provides mobility options to millions of people in cities to go to work, school, or to recreational activities, exemplifies the three common pillars of sustainability: environmental, social, and economic" (Abdallah, 142). In the 1870s, the elevated railroads (Els) helped the population spread out of Lower Manhattan. The Els presented many advantages, they greatly increased the speed of travel, New Yorkers traveled "twice as fast as horse-drawn streetcars" and could "commute from much greater distances to Lower Manhattan's factories, warehouses, offices, and shops… As a result, after the Els were built, semirural parts of northern Manhattan were transformed into new residential neighborhoods. By the early twentieth century, the Els carried about seven hundred thousand daily riders every day, and over 80 percent of the city's inhabitants lived within walking distance of the stations". (Plotch, 12). The subway system holds most of the advantages listed above, and more. Being located underground, it is less disrupting to its context: produces less noise, does not obstruct the street, and does not invade privacy.

Moreover, technological advances have constantly induced the improvement of transit services in terms of energy consumption and development. For instance, electrification enabled the transformation from horse street cars to trolleys. In 1867, Charles Harvey's elevated rapid transit service, the El, was powered by steam-driven cables: "When it reopened in 1871, it was powered by steam engines. The 6th, 3rd, and 2nd Avenue Els soon followed. The Els were electrified in Brooklyn starting in 1898, and in Manhattan in 1902" (Roess, Sansone; 3). Whether for health, economic or political reasons, people grew increasingly concerned of elevated railways. "There was much discussion of the general safety and practicality of elevated structures. Most plans involved one of three options for motive power: Small Steam Engines: Technically, steam was the most practical system, as it had already been demonstrated on intercity railroads. It, however, involved known environmental problems related to the release of hot steam into the immediate surroundings. Cable Systems: Railcars would be propelled by a continuous moving cable (or rope). The cable or rope would be propelled by stationary steam engines at periodic locations. Some form of grip was used to detach the car from the cable to stop, and to reattach to the cable to start. Atmospheric or Pneumatic Power: Railcars would be "pushed" by forced air pressure and "pulled" by creation of a vacuum". (Roess, Sansone; 93). When the idea of having an underground system grew, "there was always the question of motive power for an underground railroad. Until nearly the end of the century, the steam engine was the only workable choice available… but the steam engine with all the smoke, gases, steam, and heat that it produced, was a hardly desirable choice for operation in a confined space" (Middleton, 57). Alfred Ely Beach proposed one of the earliest schemes for rapid transit, a subway for New York, in an editorial in the magazine that he worked on as an editor and proprietor: "The plan is to tunnel Broadway through the whole length, with openings and stairways at every corner" (Beach, Scientific American). "Beach believed that pneumatic (or atmospheric) power was the answer to an environmentally viable subway. He was not the first person to propose and build a pneumatic railway. Beginning in the 1830s, several had already been developed and demonstrated in Europe. Such railways were also referred to as "atmospheric" railways because they made use of air pressure for propulsion". (Roess, Sansone; 141). While the first subway in New York built by Beach in 1870 was powered by pneumatic pressure or atmospheric pressure; others thought of cable propulsion systems. Following Beach's Broadway subway plan proposal, several proposals ensued, mostly of elevated railways. However, it wasn't until the mid- 1890's with the development of electric traction that there was a viable alternative. As the population kept growing, the city built underground "electric-powered rail lines that would travel faster and further and would accommodate even more people than the Els.... Thus, the City of New York paid the construction costs for its first subway and in 1900 entered into a long-term lease with the Interborough Rapid Transit Company (IRT) to build and operate it" (Plotch, 12). The IRT was a "technological triumph, providing a system of unprecedented performance and capacity" (Middleton, 76). Thus, the advancement in technology played a vital role in enabling the development of subways.

There was no shortage of proposals for mass transit in NYC, but many of the proposed transportation systems presented several issues, and it is in trying to solve these issues that new proposals came about, and eventually led to the development of the subway system that we know today. For instance, in the 1850's the street railway industry did not properly meet the need for public transportation in New York City which was at the time developed all the way up to 42nd street; and had begun experiencing severe congestion as its population had reached half a million "The long narrow shape of Manhattan Island compounded New York's congestion problems, and the city's limited north south thoroughfares were jammed with drays, cabs, omnibuses, and horse cars" (Middleton, 2). Omnibuses caused almost 40% of the traffic on Broadway. They were time consuming, constituted a health risk and increased street congestion: "Travel by horse-drawn vehicle between downtown business areas and the uptown residential districts had already become so time consuming that growing numbers of New Yorkers were fleeing across the Hudson and East rivers to the New Jersey suburbs and Brooklyn" (Middleton, 2). Over time the omnibus and horse car services became increasingly inadequate and insufficient to satisfy the demand for public transit and created even more congestion. "New York's problems worsened over the next two decades. By 1860 the city's population had passed to 800,000 and annual traffic on the omnibuses and street railways exceeded 36 million passengers… What clearly seemed to be needed was some new form of transportation that could accommodate New York's enormous traffic volume quickly, free from the restrictions imposed by the city's clogged streets" (Middleton, 3). Moreover, many were worried about the health repercussions of having that many horses navigating the streets daily "The use of horse-drawn vehicles was a major health concern in its own right. At their peak, omnibus and streetcar operators used over 11,000 horses. On average, a horse would discharge 10 lbs of fecal material each day, much of it directly on the city's streets. They also literally drenched the streets with urine. City streets produced horrid odors, and carried the potential for transmittal of serious disease, including cholera and tetanus, which were, at the time, almost always fatal" (Roess, Sansone; 90). Furthermore, the travel conditions on omnibuses and streetcars were extremely uncomfortable "Conditions on streetcars and omnibuses were poor at best, and the problem received much attention from newspapers. Overcrowding, discomfort, and extremely slow progress made most public transportation trips an unpleasant experience" (Roess, Sansone; 90). Horse-powered transit also wasn't viable economically: "The cost of a carthorse was about $150.00. Such a horse could be kept in service for only about four years before being sold for less strenuous service. Because most streetcars required two horses, and because horses had to be changed frequently, most companies owned 4 to 10 horses per cart owned. Horses were the single most expensive investment for a streetcar company, and, as an asset, they depreciated quickly, and were subject to total loss from disease" (Roess, Sansone; 90). All these problems eventually led to new mass transit proposals in which the transportation system would be elevated so as to alleviate the congestion on the street and improve the travelling experience. Many proposals of elevated railways ensued, some of which remained conceptual, others built. "The story of New York's elevated rail rapid transit system is a critical juncture in the history of the city. Surrounded by water on a long, narrow island, the city needed to expand, and it needed a transportation system to enable it to do so. The elevated railway would provide the only answer for the thirty-four-year period between 1870 and 1904, when the first subway was opened" (Roess, Sansone; 89). At the end of the civil war, the immediate need for a rapid transit system became evident and was seriously contemplated. Many of the proposals were published in Alfred Ely Beach's magazine 'scientific American'. Beach himself played an important role in the development of rapid transit systems. "By 1850, ongoing debates were not concerned with the need for or inevitability of some form of transit system, but the details, namely, should the railway be located below the street, on the street, or above the street; if above, should it be above the sidewalk, or over the street itself; how should intersection crossings be handled; etc" (Roess, Sansone; 94). There were many environmental and health concerns related to steam engines. "The environmental and health concerns related to steam engines running on or over city streets were feared… Nevertheless, by mid-century, most New Yorker's had begun to think about a system of elevated railroads, perhaps using small steam engines for power …While the first elevated railway in New York would not appear until 1868, ideas for urban rapid transit were developing for decades" (Roess, Sansone; 92). In 1853 for instance, James Swett proposed an elevated railway along Broadway, with a suspended car below the rails and a steam engine above the rails.

"Although there was never any question of the efficiency of urban elevated railroads, in modern New York their disadvantages, which included the obstructive effect of their supporting pillars on motor traffic and the din of many trains passing over steel structures, outweighed their advantages. Consequently, they were progressively removed as the subway system developed" (Howson, 133). The elevated railroads had a negative impact on the public realm, they were noisy, dirty, shadowy, which in turn affected the adjacent private properties and real estate market. "New Yorkers complained about the deafening noise from the trains and the dark tunnels under the structures. Until the lines were electrified in the 1890s, people also had to deal with the stench from the passing locomotives and the hot ashes that dripped onto the sidewalks below" (Plotch, 12). "Residents along the line complained about the noise of the cars and the continual clatter that came from the moving cable" (Middleton, 9). Moreover, they impacted the privacy of the people living in the surrounding buildings, as passengers could peer directly into the homes located on the second floor. The elevated lines were called "old, unsightly and noisy". "Property owners flooded the mayor's mailbox urging him to support state legislation that would allow the city to remove the El. They said it would increase real estate values, promote slum clearance, increase light and air, reduce noise, and increase city revenue. Improving traffic was a key motivator… they wanted to remove the noisy eyesore because it would increase their real estate values" (Plotch, 22). All these problems caused by the elevated railroads led to the idea of moving the transportation system underground, so the adjacent properties won't be bothered by the noise, cast shadows, invasion of privacy; and the street would get more light and air. In trying to solve the problems caused by the elevated systems, the idea of an underground system grew more popular.
Real estate property owners benefit from an effective transportation system (because that would facilitate new developments) "Real estate interests were among the city's most powerful players. Politicians coveted new development because it created jobs and homes. New buildings also allowed elected officials to expand municipal services and borrow more money, since the city's budget relied on property taxes" (Plotch, 22). However sometimes, as previously mentioned in the case of the elevated railways, it can negatively affect their properties. Having the subway underground might be more profitable to these property owners. The unresolved environmental issues and negative impacts on adjacent properties and affected streets hastened the transformation from the use of elevated transit systems to underground ones. "The elevateds survived well into the 20th century, and indeed many continue to operate today. The age of subways, however, was about to begin as the century turned. Unresolved environmental issues, and the building of the subway system caused most of the Manhattan elevateds to be removed in the 1930s and 1940s" (Roess, Sansone; 133). Some of the elevated railroads started being replaced by subways "In Manhattan, the 9th Avenue El was replaced by the 8th Avenue Subway, and the 6th Avenue El was replaced by the 6th Avenue Subway" (Roess, Sansone; 133).

Understanding the reason why some of the proposals were never built or didn't last long was informative in the development of the subway systems. Many of the proposals didn't work because they failed to address the existing problems that they were supposed to solve. For instance, William Deitz's proposal of four feet wide cars running on individual rails, stabilized by an elevated track, and powered by a rope-cable system did not work because the cars were situated at ground level, thus ignoring the congestion problem on Broadway. Another example of a failure to address the existing problems is J.B. Wickersham's 1854 elevated terrace along Broadway proposal, which consisted of having an outward horse-railway and an inward pedestrian promenade. Although it presented some advantages like creating a 'protective canopy' above the sidewalk that wouldn't obstruct sunlight from reaching the middle of the street, it wasn't considered a good solution as it ignored the problems caused by horse-drawn transport mentioned previously such as the need for greater speed, comfort, the health concerns, the economic issues…. Moreover, it would be a health hazard to have a steam railway right next to a pedestrian walkway. "In 1867, a grand plan called the Arcade Railway (14) was introduced for Broadway. Designed by civil engineer B.B. Nowlan, the plan was supported by many of New York's leading entrepreneurs" (Roess, Sansone; 96). But it was never built because it lacked the 'specificity on the mode of power to be used', written plans didn't specify any particular source of power. All these trial-and-error situations were informative and important to the development of the subway system.

Moreover, many of the proposals never saw the light of day because they faced some kind of political opposition. "There was no lack of ideas or proposals in the period between 1825 and the 1870s, only the lack of political and financial will to make rapid transit in New York a reality. Some schemes were quite innovative and some completely impractical. Reality, however, began to set in during the 1860s. The need for a transit system of some kind became clearer and clearer as the problems of congestion became worse and worse". (Roess, Sansone; 98). Individual interests often came into play and held up the new proposals:"Rapid transit proponents had a number of major political adversaries. Boss Tweed and his cronies were becoming wealthy on the graft extorted from streetcar and omnibus operators. They vigorously fought any proposal for alternative forms of public transportation for decades. Property owners along proposed routes were generally opposed to elevated systems, fearing that the environmental conditions they would create would significantly reduce the value of their real estate. The merchants along Broadway were particularly vocal in their opposition. Property owners would have been perfectly happy to own land one block away from an elevated system, but no one wanted to own property right next to one. Businesses that catered to and serviced the omnibus/streetcar system were also opposed. Stable operators, veterinarians, feed sellers, etc., all stood to see their livelihoods seriously disadvantaged by new systems that did not employ literal horsepower…Eventually, need would win out over political resistance. In the end, two great pioneers, Charles T. Harvey and Dr. Rufus Gilbert would initiate elevated rail rapid transit in New York" (Roess, Sansone; 98). But their construction was still hindered by individual interests. Charles T. Harvey developed a cable-powered elevated railway from Battery Place to Greenwich Street, a single track 30 feet above the street, that was supported by a single row of columns and accessed by staircases. But his invention didn't please everyone: "The competing street railway companies and property owners, fearful of the intrusion of the elevated, filed suits to block construction of the road, and it was not until Feb 14 1870, that the line began operating to a new station at 29th street" (Middleton, 9). His system wasn't without fault, it had several operating problems, encountered many accidents, caused a lot of noise; but it also shows the many actors and factors that come into play when a proposal of this magnitude is executed. In Gilbert's case (he had proposed gothic cast-iron arches that would support tubes propelled by atmospheric power) it was the prospective cost of the elaborate structure of cast iron arches and the 'unproven nature' of his pneumatic atmospheric power scheme that scared away potential investors. Horse car companies and property owners who had the most to lose tried to stop the construction of the Gilbert and New York elevated line in 1876. These proposals, even though short lived or unbuilt, informed future rapid transit solutions: "Although Charles Harvey's cable-powered elevated proved a failure and Rufus Gilbert's proposed atmospheric tube elevated system never even reached the construction stage, the two projects did lay the foundation for the development of an elevated railway system for New York" (Middleton, 19). In 1870, Alfred Ely Beach bent the rules to realize his vision of the subway and laid the ground for the system in place today "Beach did not believe that a bill for passenger rail service could be practically achieved. Instead, Beach submitted a bill to allow construction of small pneumatic tubes for carrying mail and parcels across the North (Harlem) and East Rivers. The bill passed under the radar of the politicians…Under the auspices of this act, the Beach Pneumatic Subway Transit Company was incorporated on August 28, 1868." (Roess, Sansone; 144). The construction of the subway as we know it today didn't occur overnight and encountered many problems along the way. "Private companies paid for the construction and operation of the elevated lines, but no firm could finance an underground rail line because it was about four times as expensive per mile to build. The City of New York paid the construction costs for its first subway and in 1900 entered into a long-term lease with the Interborough Rapid Transit Company (IRT) to build and operate it" (Plotch, 12).

Whether unrealized or short lived, the numerous mass transit proposals that unfolded over time played an important role in hastening the construction of underground transit systems in Manhattan. Many of the mass transit proposals in NYC were enabled by the advancements in technology and fueled by the increasing societal need for efficient urban transportation systems. Moreover, the problems caused and encountered by certain systems informed and hastened the development of future systems which led to the development of the subway. The subway system eventually became the preferred solution to the city's urgent need for rapid mass transit: It solved many of the problems associated with the elevated railways, and was thus the logical, adequate solution to the problem of efficient transit.

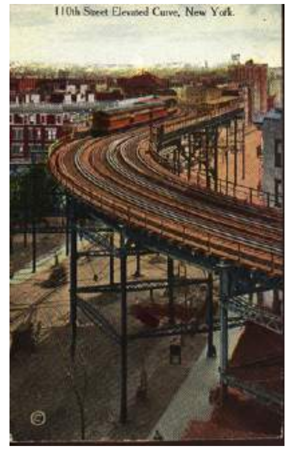

Fig 1 110th Street Elevated Curve, New York

(Source: Avery Classics Collection, Seymour B. Durst Old York Library Collection, Box no. 35, Item no. 371)


Fig 3 8th Ave., 116th Street North, N.Y. City

(Avery Classics Collection, Seymour B. Durst Old York Library Collection, Box no. 35, Item no. 391)


Fig 4 Charles T. Harvey Operating Car by Cable Power on First Elevated Railroad in Greenwich Street, in 1867

(Source: nycsubway.org)

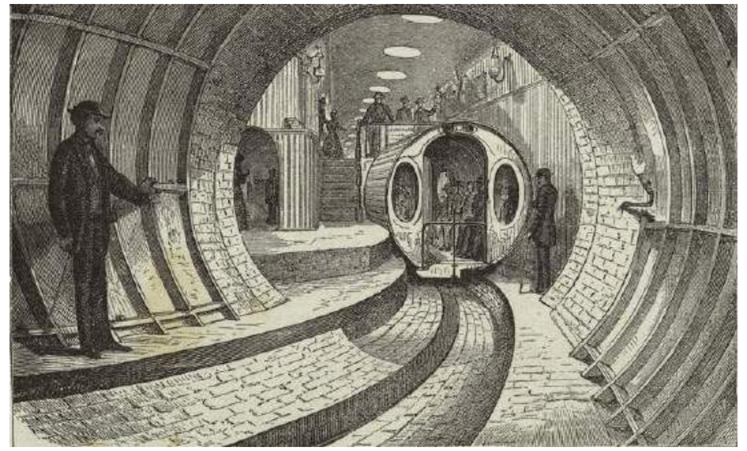

Fig 5 The Broadway Pneumatic Underground Railway - View of car in motion.

(Source: nycsubway.org)

Fig 3 8th Ave., 116th Street North, N.Y. City

(Avery Classics Collection, Seymour B. Durst Old York Library Collection, Box no. 35, Item no. 391)

Fig 6 Swett's elevated railway proposal for Broadway

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Fig. 8 The Arcade Railway

(Source: The Wheels that Drove New York: A History of the New York City Transit system)

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