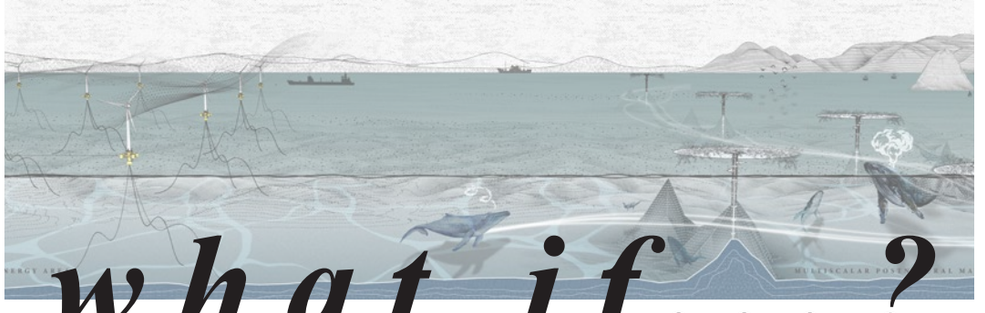


what if...?

a collection of work focused on
speculation & curiosity

Julie Kim

As an architecture student and designer, my work has always been rooted in speculation and curiosity. I am constantly questioning what if? What if 3D printing could be utilized to streamline the typical construction process of apartment building? What if a giant renewable energy infrastructure is constructed and damages an entire bio-community that's imperative for carbon capture? These are the types of questions that fuel my creativity and drive me to push the boundaries of what is possible. For me, architecture is not just about creating spaces; it is about imagining new possibilities and exploring the unknown. I believe that by asking these kinds of questions, we can start much needed conversations to spur radical solutions and problem solving.

what if...

...housing is 3D printed?
fall 2021
instructor : michael caton

...we can climb past inaccessible health care?
spring 2022
instructor : bryony roberts

...urban voids could foster intergenerational relationships?
fall 2020
instructor : alessandro orsini

...schools become post-carbon?
spring 2020
instructor : miku dixit

...walls were sculpted?
fall 2022
instructor : zach mulitauaopele

...pavilions could be inflated?
spring 2023
instructors : galia solomonoff and laurie hawkinson

...we built landscapes for whales?
spring 2023
instructors : mireia luzarraga and alejandro muino

...we democratize map-making?
fall 2022
instructors : leslie gill and khoi nguyen

what if...

...housing is 3D printed?

Instructor : Michael Caton
Partner : Joachym Joab
Columbia GSAPP
Fall 2021

The need for faster, cheaper, and better housing has put immense pressure on the construction industry. In this studio, students were challenged to address housing issues related to what is built, how it's built, and the structure of development.

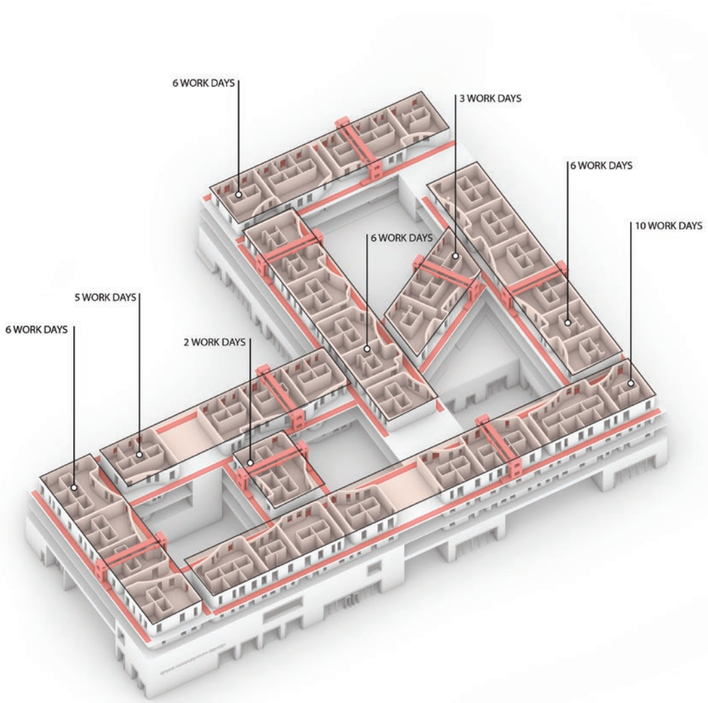
My partner, Joachym, and I focused on the "what" and "how" of building, proposing a new construction process that involves partnerships with three technology companies - ICON, Dusty Robotics, and Batiprint 3D.

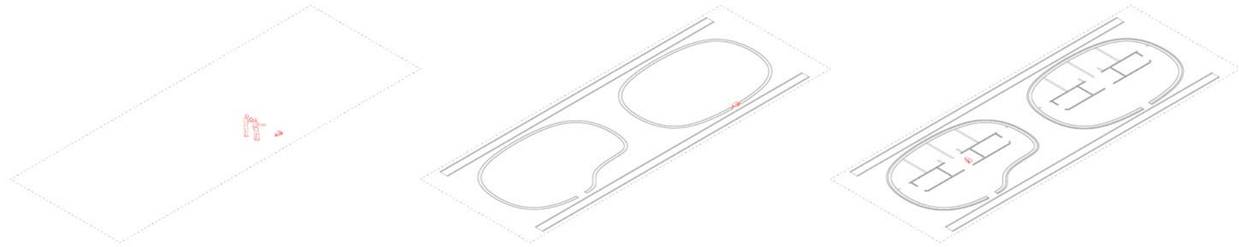
Our aim was to use 3D printing technology to reduce hard costs and revolutionize the typical building methodology, ultimately creating affordable housing in the Bronx.

left : render of street view of front facade

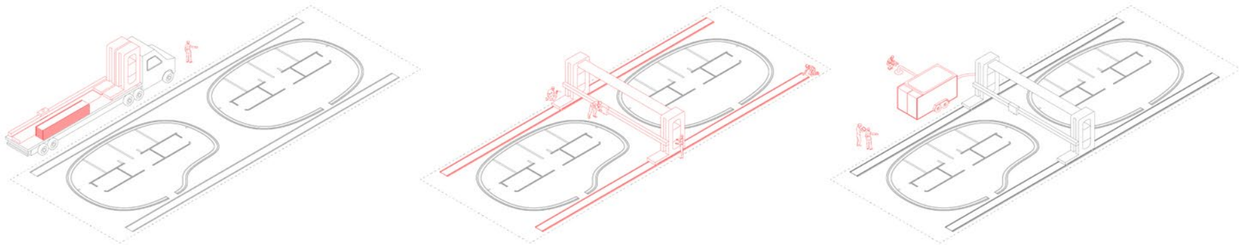
The Construction Process

To revolutionize traditional construction methods, we partnered with three technology companies: ICON, Dusty Robotics, and Batiprint 3D. ICON uses custom concrete mix and transportable printers to create homes, while Dusty Robotics utilizes a robot to print full-sized floor plans on-site. Batiprint 3D offers a transportable insulation printer that prints polyurethane insulation. By combining these technologies, we aimed to significantly reduce construction time. For example, a building with 20 units traditionally takes 68.8 weeks to complete, but with our methodology, it can be finished in just 12 weeks. The diagram below illustrates the placement and duration of printing times for different wings in the floorplan.

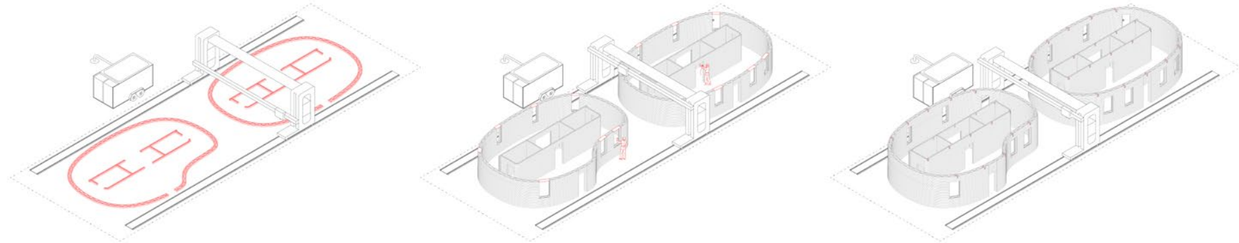




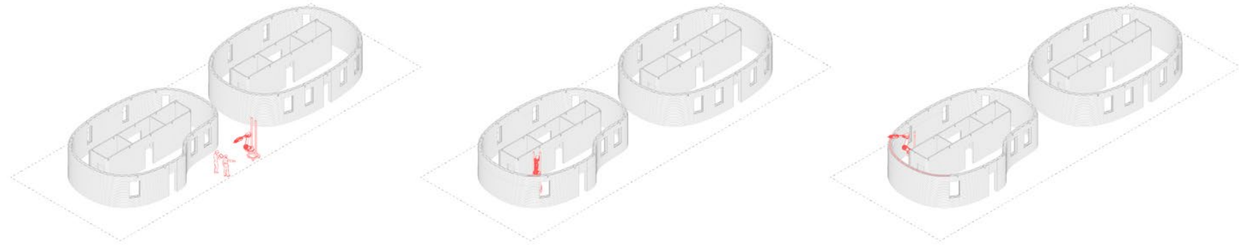
PHASE I : BIM printer layout



PHASE II : 3D concrete printer setup and deployment

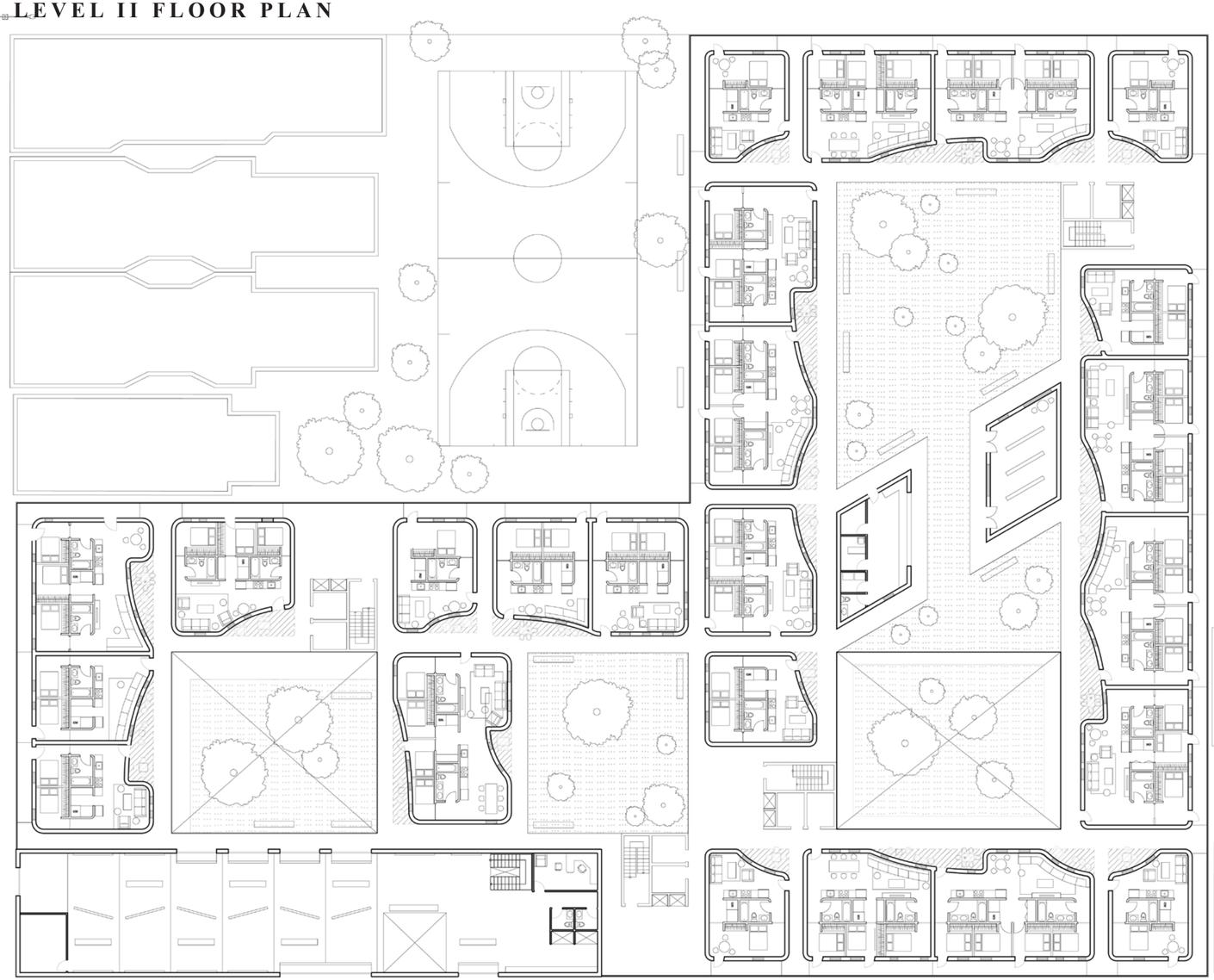


PHASE III : 3D concrete printing of units

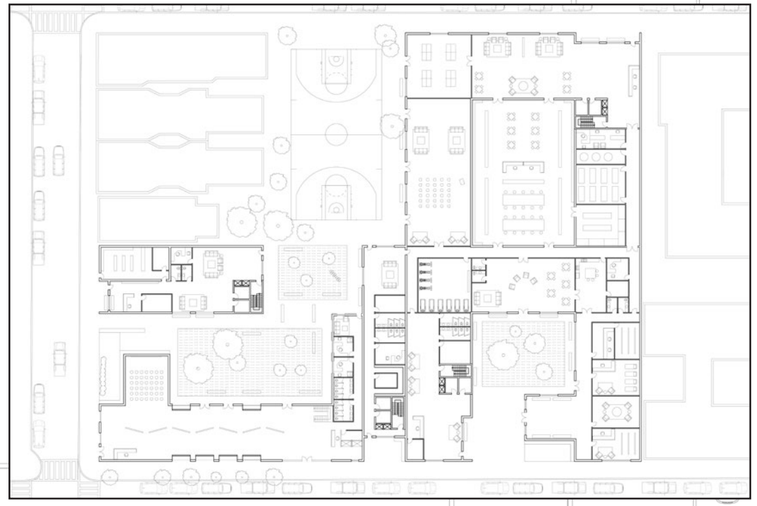


PHASE IV : Batiprint polyurethane insulation print process

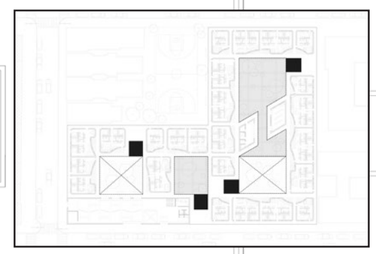
LEVEL II FLOOR PLAN



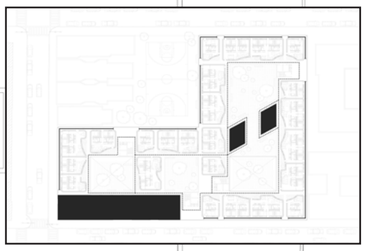
GROUND FLOOR PLAN

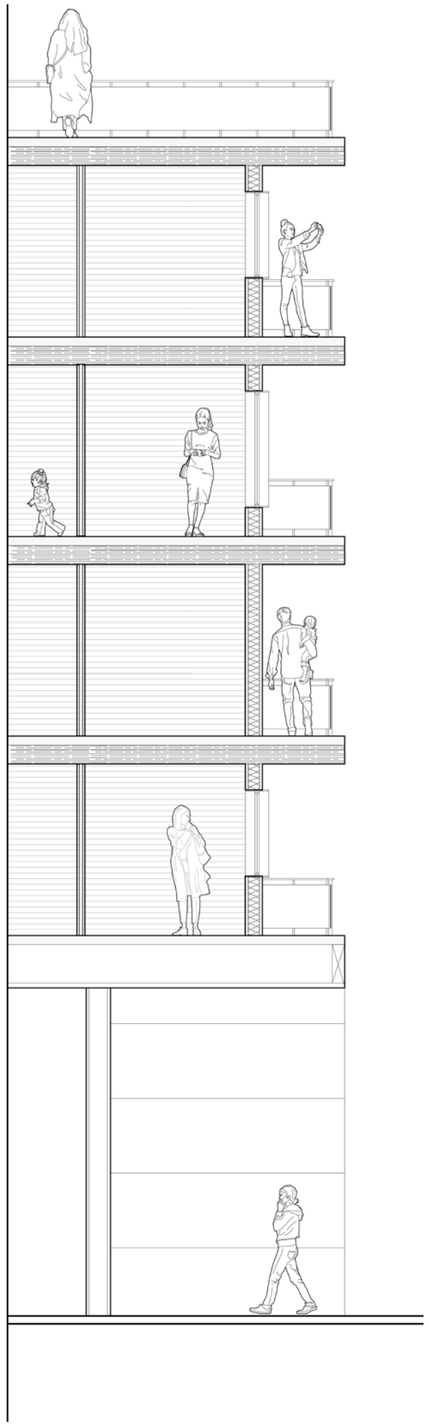


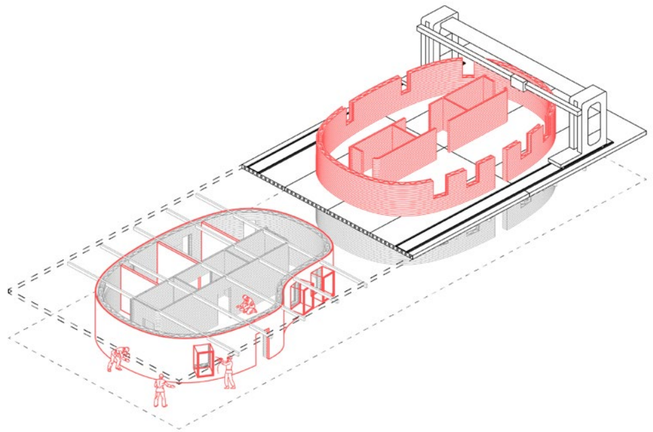
CORE LOCATIONS



CIRCULATIONS



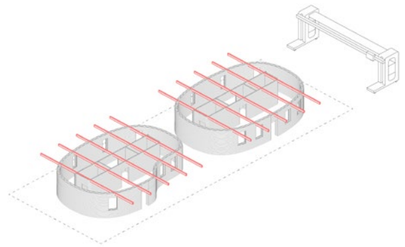




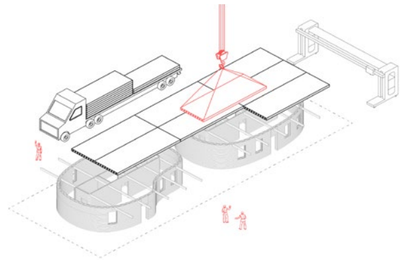
Vertical Build | Simultaneous Construction Ability

Towards the end of the printing process, the walls are printed with notches where wood beams are inserted. Next, CLT wood floor panels are transported and installed above the beams. The BIM setup and 3D printer are then laid out on the new floor to begin the construction process again. This process allows construction workers to simultaneously work on finishing units on the floor below.

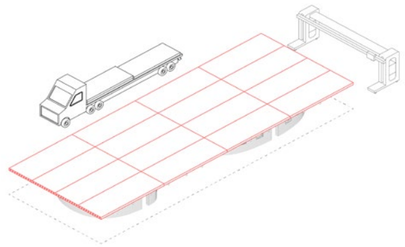
To provide flexibility in the 3D printed wall design, each unit has “wet” cores that house the bathroom, laundry room, and kitchen. The layout of furniture is easily customizable to meet the needs of residents.



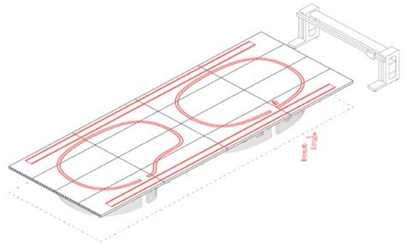
1. insertion of wood beams into notches



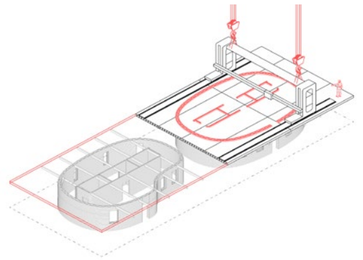
2. transport of CLT wood floor panels



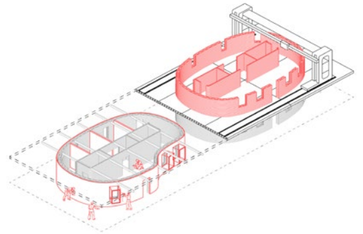
3. installation of CLT wood floor panels



4. bim process on second floor

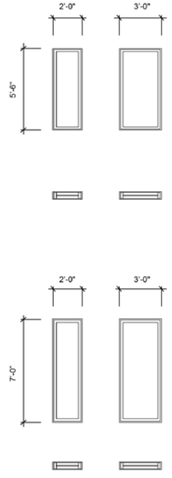


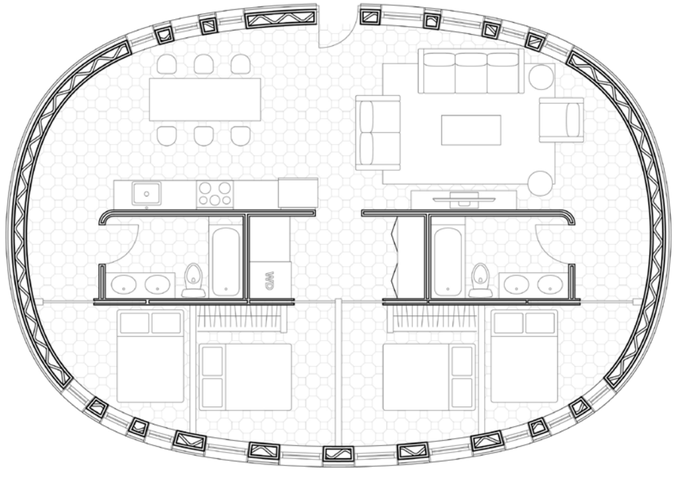
5. printing process starts again on second



6. installation of finishes of printed units

plan of typical four bedroom unit



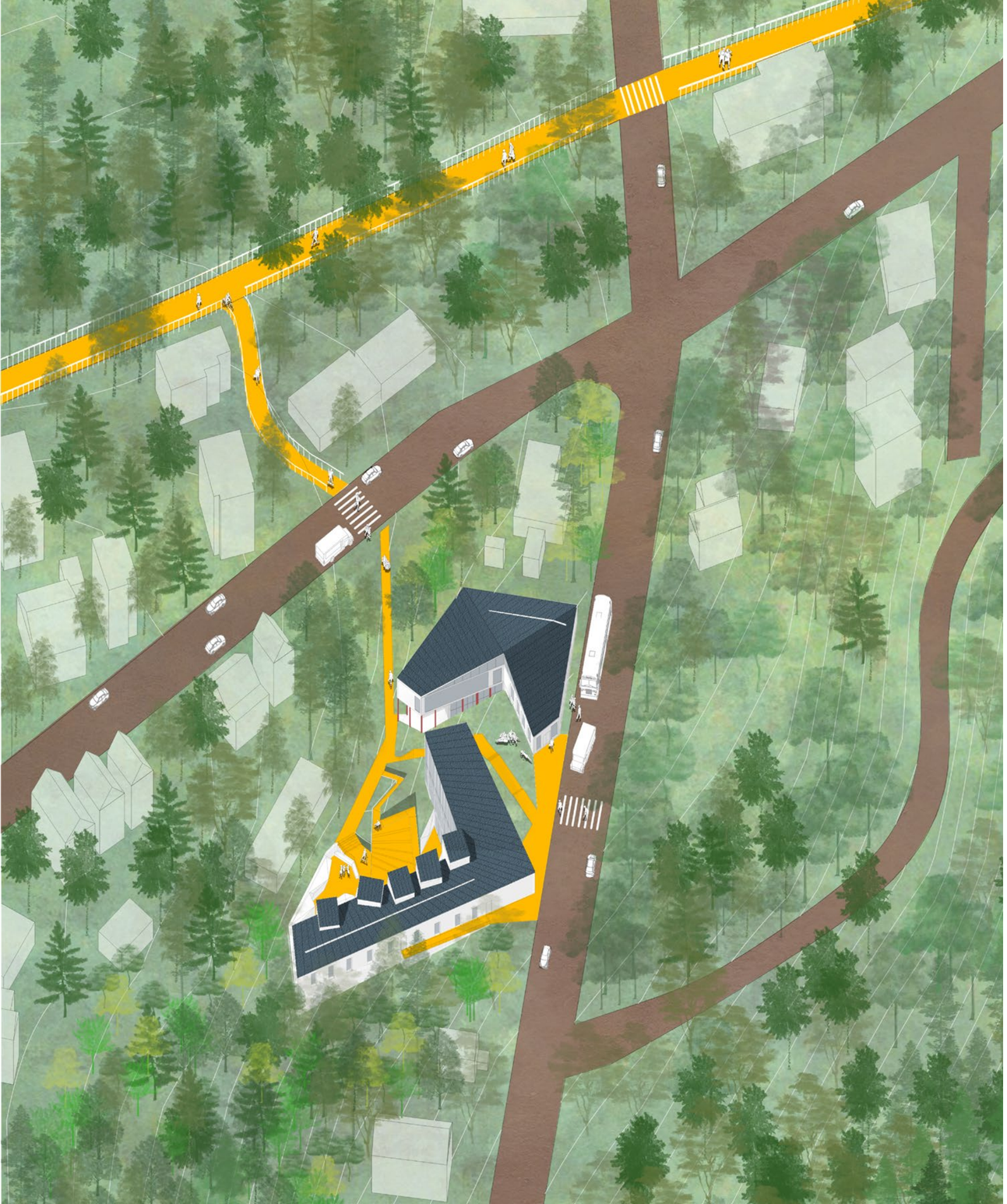


interior photograph of hand made model

renders of interior courtyards


WD


BRONX DOCUMENTARY CENTER



what if...

...we can climb past inaccessible health care?

Instructor : Bryony Roberts
Partner : Zoe Su
Columbia GSAPP
Spring 2022

CLIMB! is a community-based initiative that aims to address the economic and educational disparity in Poughkeepsie by providing a range of services centered around physical activity and mental health. By integrating a rock climbing and bouldering gym with a youth center, emergency housing, and a mental and physical health clinic, CLIMB! aims to create a supportive and empowering environment for young people in the area.

The use of rock climbing as the primary physical activity is a unique approach, as it not only promotes physical fitness but also requires mental focus, problem-solving skills, and teamwork. This can help to build confidence, resilience, and social skills among young people who may be facing challenges in their lives.

The use of a one visit, all services clinical model is also an innovative approach that can help to break down barriers to accessing healthcare. By providing a range of services in one location, including peer support, psychiatric lab, targeted case management, and primary health screening and monitoring, young people can receive holistic care that addresses both their physical and mental health needs. The focus on person-centered treatment, care coordination, and evidence-based practice is also important, as it ensures that care is tailored to the individual and is based on the latest research and best practices.

left : axon drawing showing neighborhood connectivity and integration to landscape

PHYSICAL

CLIMBING IS A **LOW IMPACT** AEROBIC WORKOUT

CLIMBING BUILDS CORE MUSCLES AND A STRONG **CARDIOVASCULAR** SYSTEM

ANTERIOR DELTOIDS & BICEPS

RHOMBOIDS & LATISSIMUS DORSI

GASTROCNEMIUS & SOLEUS

FOREARMS

MENTAL

"ALMOST THERE. MY GOAL FOR THE WEEK."

CLIMBING CAN BE CONSIDERED AS THERAPY IN DISGUISE DUE TO ITS STRESS RELIEVING CAPABILITIES AS WELL AS ITS NEED TO REQUIRE FULL CONCENTRATION AT ONCE

DISABILITY BENEFITS

CHILDREN AND ADULTS WITH CEREBRAL PALSY OFTEN HAVE MOVEMENT PROBLEMS THAT MAKE IT DIFFICULT TO WALK, LET ALONE EXERCISE. STUDIES HAVE SHOWN THAT WITHIN 3 MONTHS OF TRAINING, THEY SHOW IMPROVED AEROBIC CAPACITY AND AN IMPROVEMENT IN THEIR ABILITY TO STAND, WALK, JUMP, AND RUN.

BENEFITS FOR DISABLED CLIMBERS

ROCK CLIMBING IS VERY TACTILE, BOTH IN THE HOLDS AND IN THE TEXTURE OF THE WALLS. THE HOLDS ARE BRIGHTLY COLORED WITH DIFFERENT SHAPES AND CAN STIMULATE VISUALLY AND HOLD INTEREST.

ROCK CLIMBING ALLOWS FOR **ACTIVE** DECISION MAKING, PRE VISUALIZATION, AND GOAL SETTING.

"YOU CAN DO IT, ALMOST THERE. I BELIEVE IN YOU!"

SOCIAL

CLIMBERS GAIN MUTUAL **TRUST** AND A CHANCE TO BUILD COMMUNICATION AND LISTENING SKILLS.

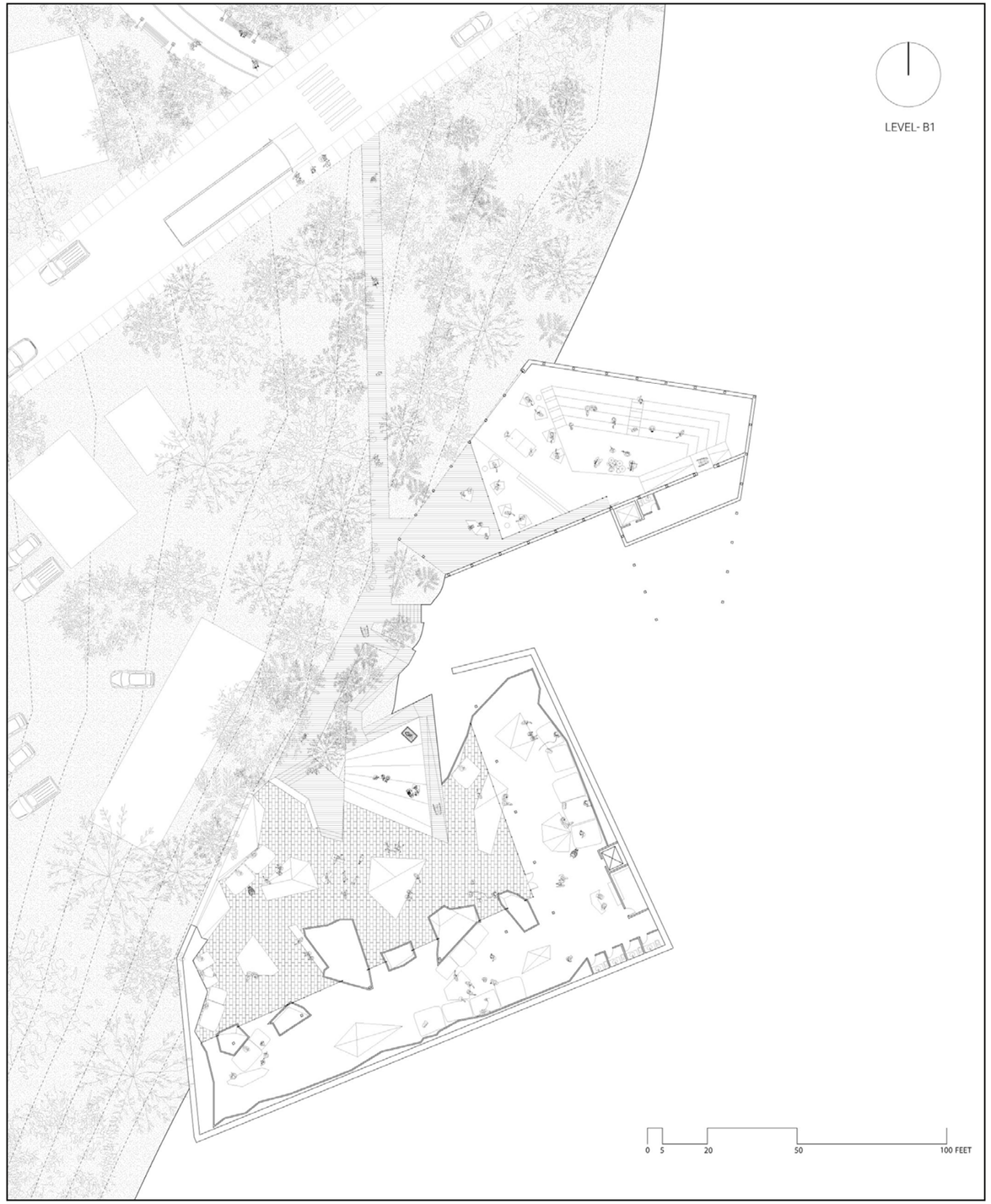
BENEFITS FOR BLIND CLIMBERS

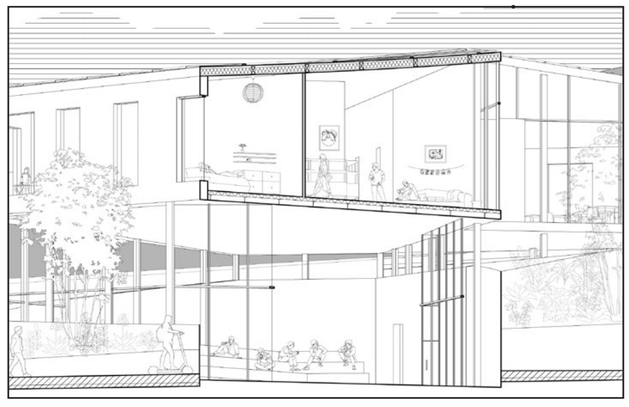
BLIND CLIMBERS RELY ON THE TOUCH OF THE WALL AND STRONG COMMUNICATION SKILLS WITH THEIR BUDDY.

"DON'T WORRY, I'M SPOTTING YOU. YOU'RE SAFE."

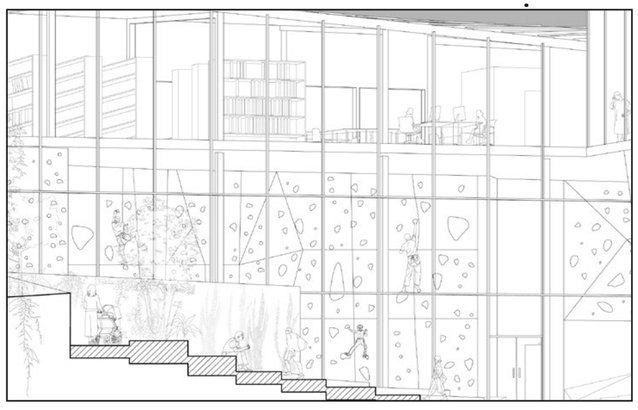
CLIMBERS FORGE FRIENDSHIPS AND LEARN TO NETWORK THROUGH THE BUDDY SYSTEM


LEVEL- GROUND
CLINTON ST.
0 5 20 50 100 FEET

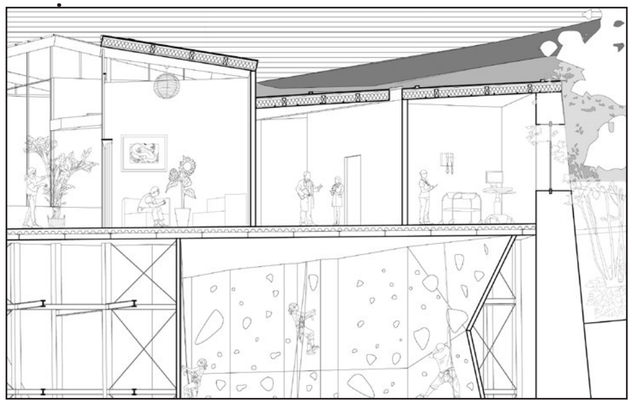

LEVEL- B1
0 5 20 50 100 FEET



EMERGENCY HOUSING



ROCKCLIMBING & BOULDERING



MENTAL & PHYSICAL HEALTH CLINIC

Climbing for Physical, Mental & Social Wellbeing

To ensure that the youth center is easily accessible, transportation services are thoughtfully coordinated with local schools. This collaborative effort between the schools and transportation services helps to remove transportation barriers and allows more youth to benefit from the programs and resources provided by the youth center.

Additionally, the clinic located in the same facility as the climbing facilities underscores the value of physical activity in promoting good mental and physical health. With the climbing facilities situated near the clinic, young people are encouraged to engage in physical activities that can help them to develop strength, agility, and resilience. Furthermore, climbing can serve as a therapeutic outlet, allowing young people to challenge themselves and build confidence while also improving their overall well-being.

what if...

...urban voids could foster intergenerational relationships?

Instructor : Alessandro Orsini
Columbia GSAPP
Fall 2020

Program: intergenerational community center
Site: W 125th St. and Broadway, NY, NY

The majority of individuals who reside in public housing developments owned by NYCHA are families with young children and elderly individuals who live independently. About 22% of the NYCHA population consists of individuals aged 62 years and older, while almost 30% of the population comprises children who are under the age of five. A significant number of these individuals, almost 60%, live below the federal poverty line. Furthermore, these residents face challenges such as inadequate access to childcare, unreliable heating and air conditioning, and insufficient communal spaces.

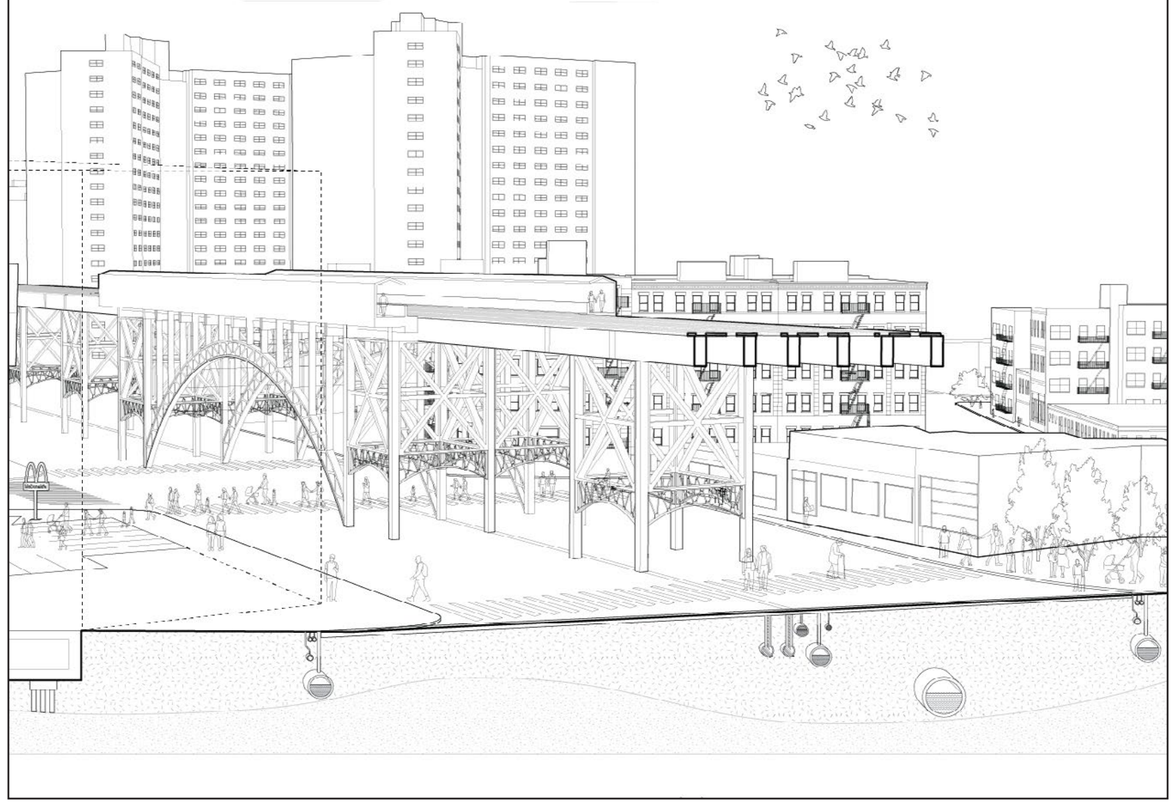
My project endeavors to transform an existing urban void into a vibrant and safe space that is accessible to all residents, fostering intergenerational connections and encouraging residents to support each other in the face of scarce resources. By creating inviting shared areas, dynamic play spaces, and versatile amenities, I hope to revitalize this space and provide a colorful oasis for the community.

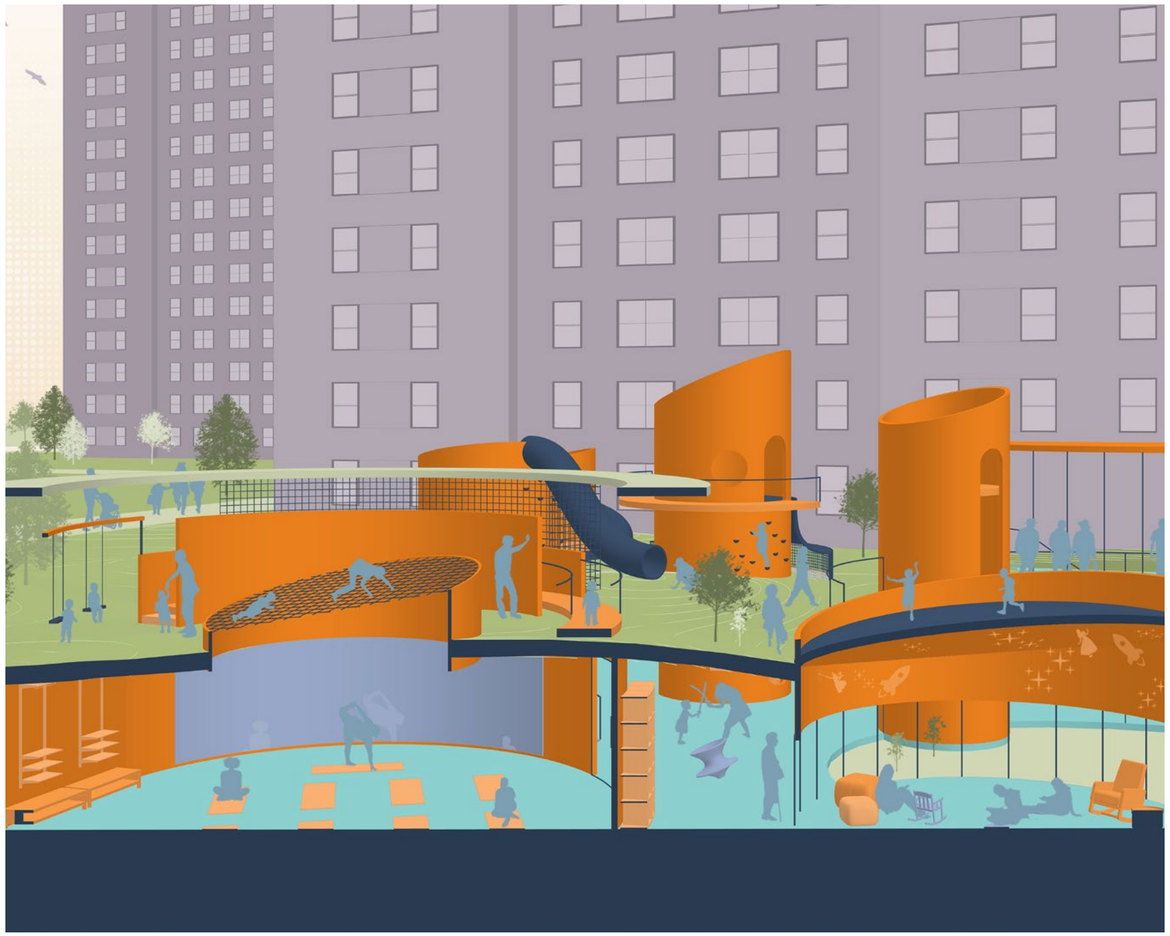
left : interior 'stage set' model made of paper

Urban Voids

Our studio conducted a comprehensive analysis of the urban voids present in our site, which spans from W 120th Street to W 152nd St. As depicted in the drawing on the left, I charted the various urban voids within our designated area, visualizing them as constituent parts of a larger network of interconnected spaces that also link to Broadway.

My particular focus was on an urban void located at the intersection of W 125th St. and Broadway. This urban void is situated between a row of shops and the Grant Houses, which were constructed by NYCHA in collaboration with Columbia University. The purpose of this project was to create a buffer zone between the university's Morningside Campus and the surrounding Harlem community. Unfortunately, this initiative resulted in the displacement of thousands of low-income families living in the vicinity of the school, who were moved further north beyond Morningside Gardens.



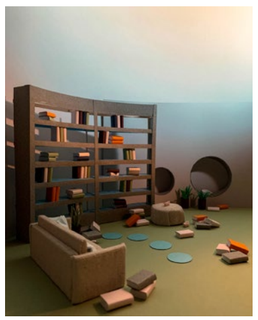


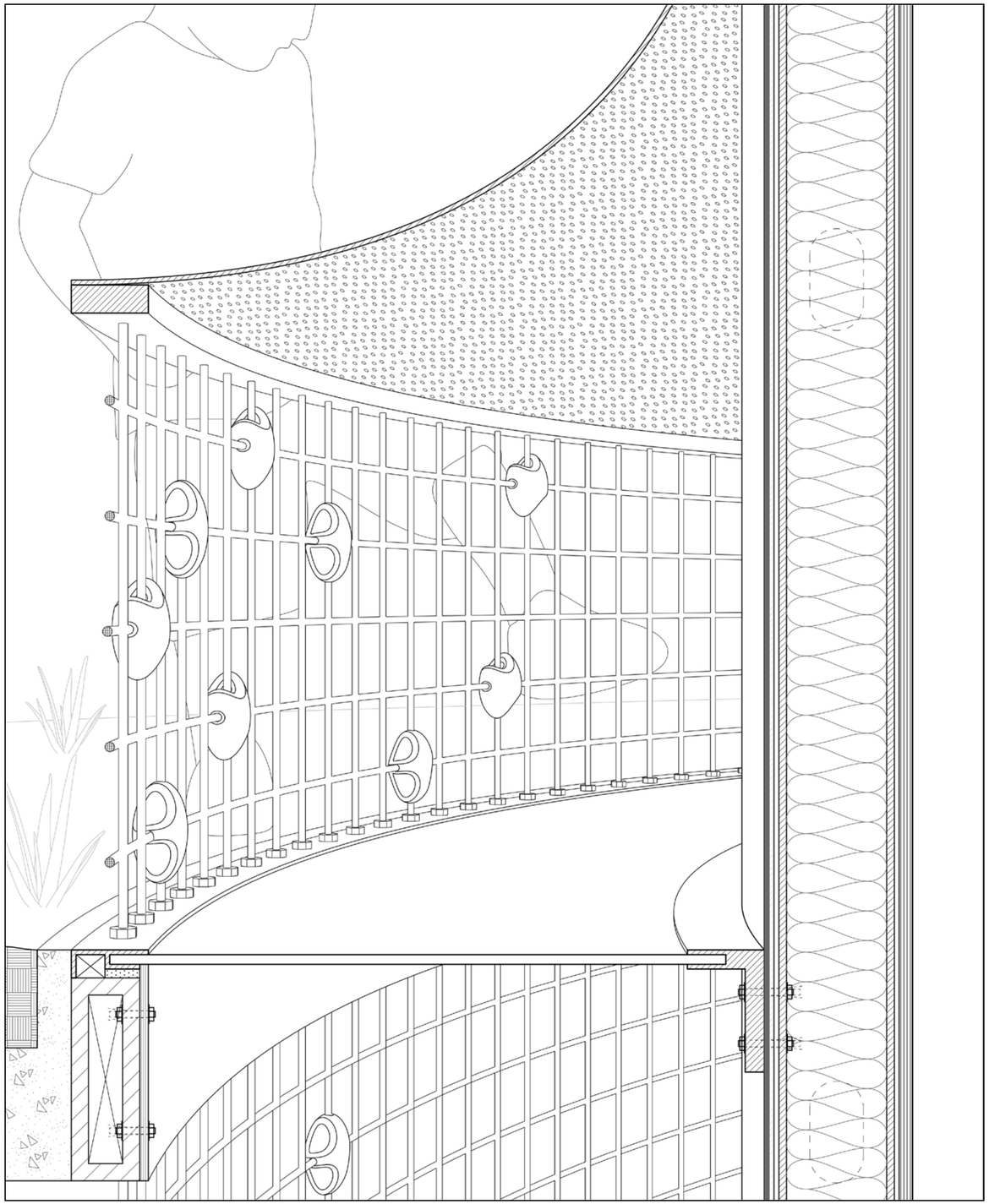
The Goal

My intergenerational program cultivates relationships between seniors and children, creating a mutually beneficial cycle of companionship and growth. Seniors serve as mentors for children navigating life's challenges, while children offer companionship and alleviate feelings of loneliness and loss of purpose in seniors. The program also provides safe and affordable childcare for NYCHA families.

Designed to promote intergenerational connections, the program features a playscape, libraries, classrooms, VR immersion and game pods, and a group fitness room. Accessible through four entry points, the primary spaces are located underground, while an unused health center on the first floor of the NYCHA building serves as an extension of the program. The design features playful elements such as curves and sculptural elements, creating a functional and visually appealing environment. The surrounding grounds offer a safe and welcoming space for play and community gatherings, with interventions scattered throughout the site to encourage interaction. An elevated platform connects Broadway to W 125th St.

interior "stage set" paper models





1:2 Scale Construction of Play

To enhance our design, we were assigned to construct a 1:2 scale model of a specific aspect of our project. I decided to focus on an interactive climbing wall and bench, using a painted wood frame, bungee cord, 3D printed tactile hand holds, and a perforated metal sheet to create the model.

Through this exercise, I gained a deeper understanding of how the main structure of the cylinders could integrate with the playscape, creating a more cohesive design.

left : construction drawing of one to two
below : physical model of one to two study


DAIRY

what if...

...schools become post-carbon?

Instructor : Miku Dixit
Columbia GSAPP
Spring 2021

The vacant P.S. 64 school in East Village has become the focus of an investigation into how the school environment can serve as a vital resource for a child's education, providing enrichment not only for individual students but also for the entire community.

In this project, low-carbon principles have been incorporated, and architectural valves have been used extensively to transform the traditional classroom environment. Valves refer to devices or natural objects that regulate, direct, or control the flow of a fluid by opening, closing, or partially obstructing various passageways. In this case, air is the primary fluid and an essential building material. By using structural cores and sleeves, customizable, passive, and isolated climates are created throughout the school.

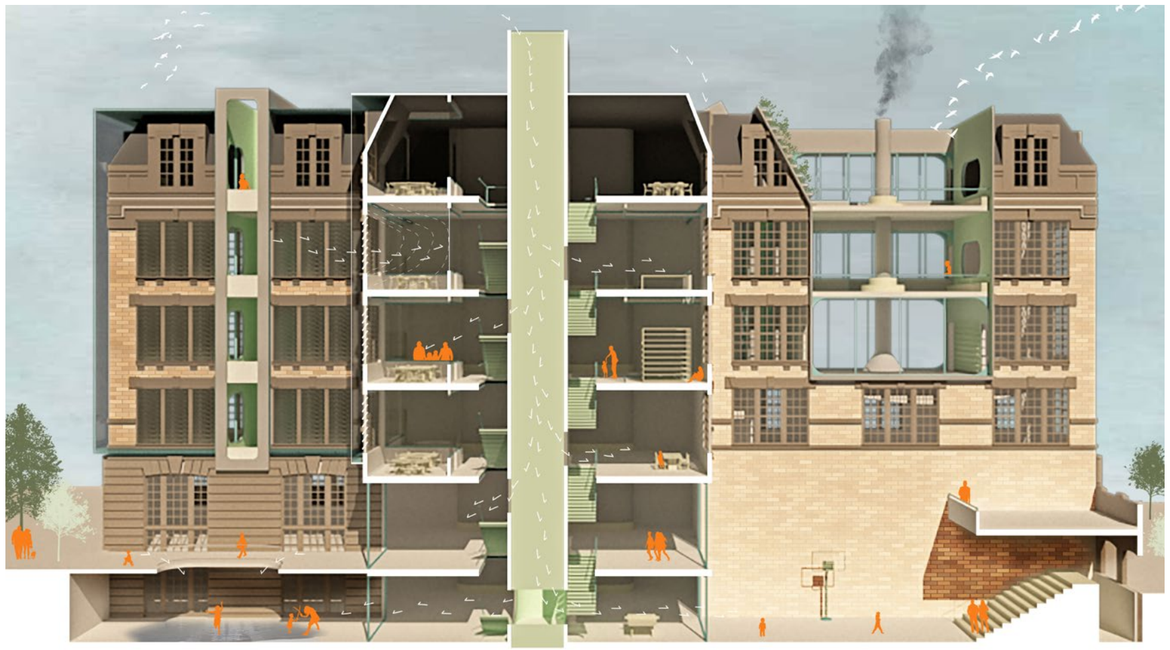
left : interior view from an operable core

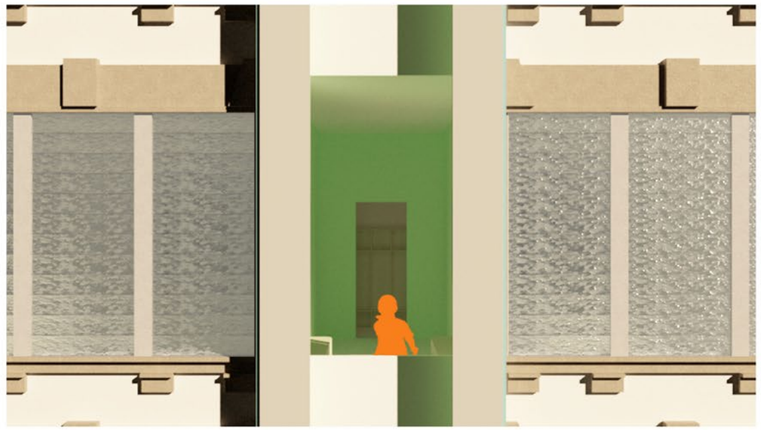
Passive Systems & Climatic Phenomena

Although primarily serving as thermal regulators, the structural cores and sleeves are transformed into immersive and interactive educational spaces. These infrastructural elements are designed to function in both hot and cold weather conditions, distributing energy throughout the school. By utilizing louvers, sliding glass doors, and other tactile elements, the cores can be opened or sealed, creating ideal learning and play environments in adjacent spaces.

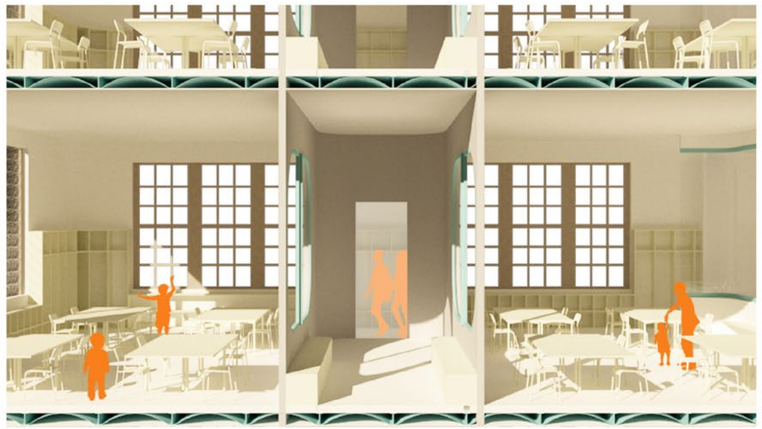
The school's design will expose students to both passive and active climatic systems, and they will be encouraged to engage in various modes of activity and learning as they move between the cores.

section drawing showing passive climatic systems



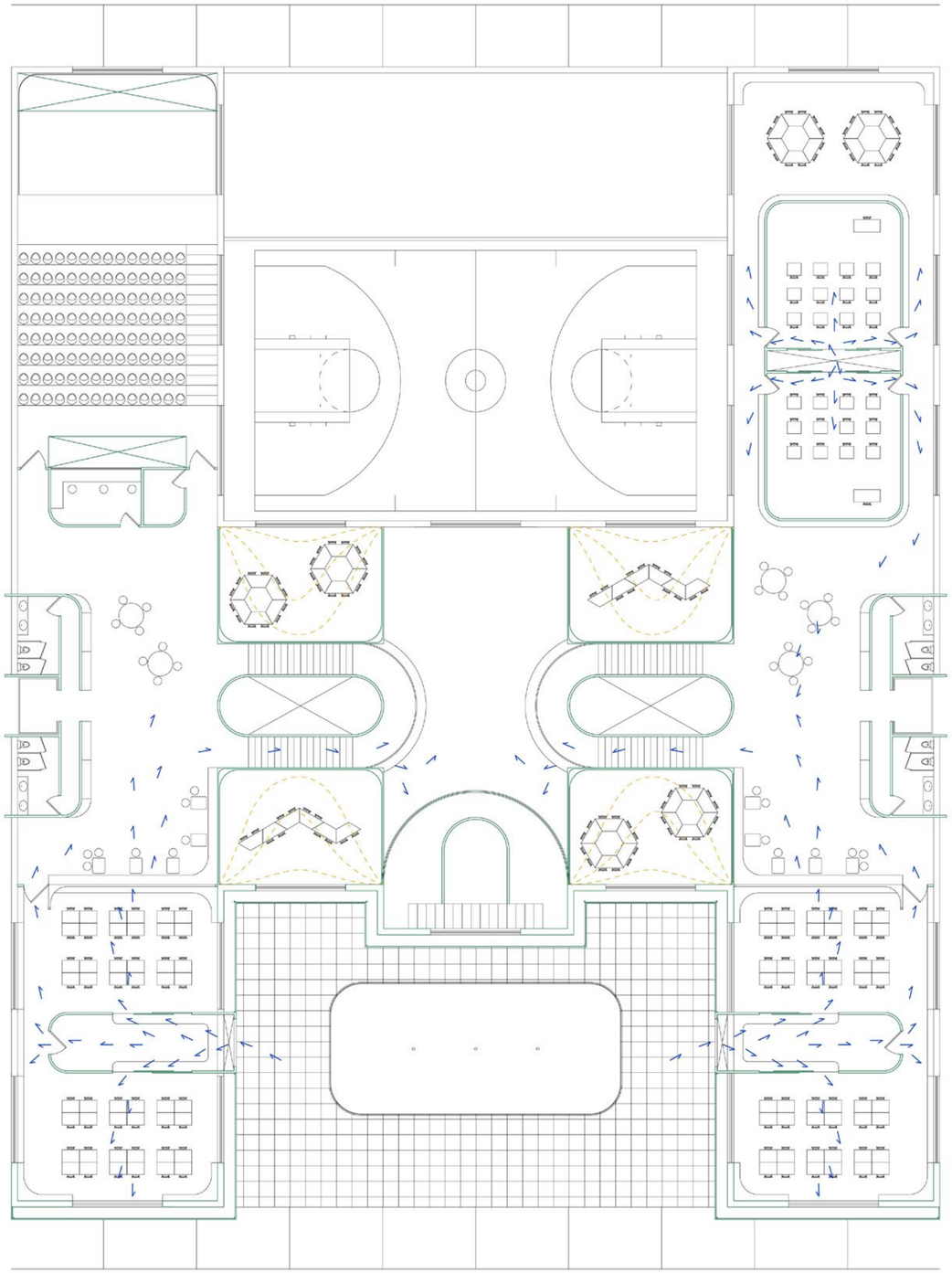


classroom core exterior



classroom core | valve closed

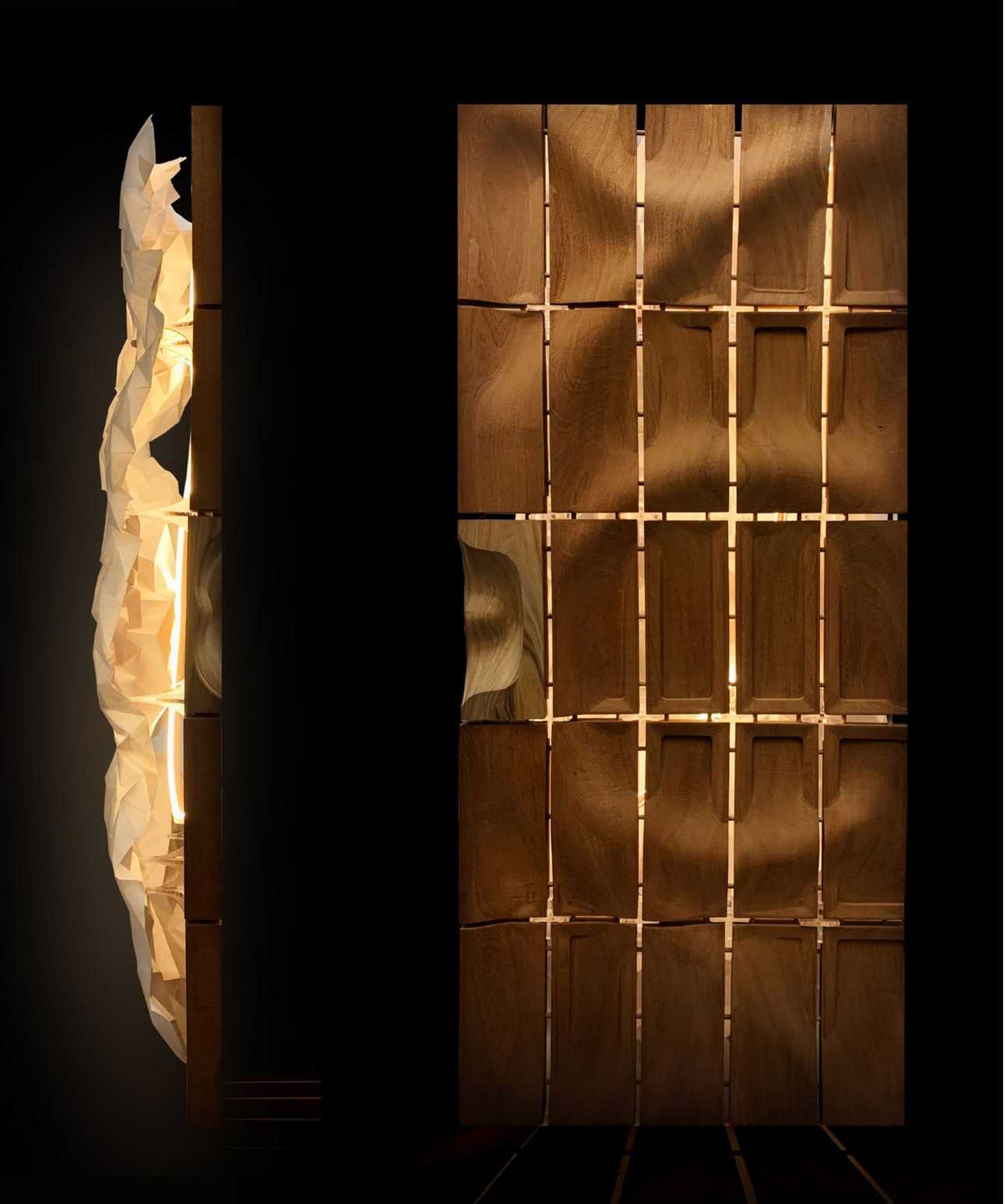
classroom core | valve open



floor plan of second floor

renders of classrooms


READING
HOMBRE NIÑO



what if...

...walls were sculpted?

Instructor : Zach Mulitauaopele
Partners : Daniel Chang and Cecile Kim
Columbia GSAPP
Fall 2022

As digital fabrication processes continue to advance, our comprehension and command of these construction methodologies are critical in capturing the full potential they offer to the built environment and how we design. In this studio, we focused on advanced detailing, fabrication, and assembly techniques. My partners and I challenged the conventional illustrative mode of architectural detailing by using 1:1 material exploration to facilitate design ideation and spatial speculation.

Through this process, we were able to refine our designs in a way that was not possible through traditional 2D drawing techniques alone. By physically testing and manipulating materials at full scale, we were able to identify opportunities for design innovation and uncover potential issues that would not have been apparent through illustration alone. This approach allowed us to better understand the limitations and possibilities of the materials and fabrication methods we were using, leading to more thoughtful and informed design decisions. Overall, our studio emphasized the importance of exploring new techniques and methods in order to expand our understanding of the built environment and create designs that are both functional and beautiful.

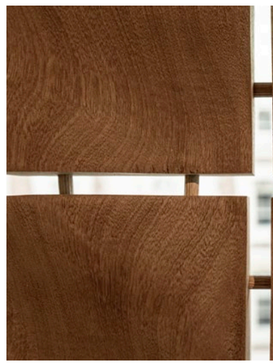
left : images of final wood wall typology

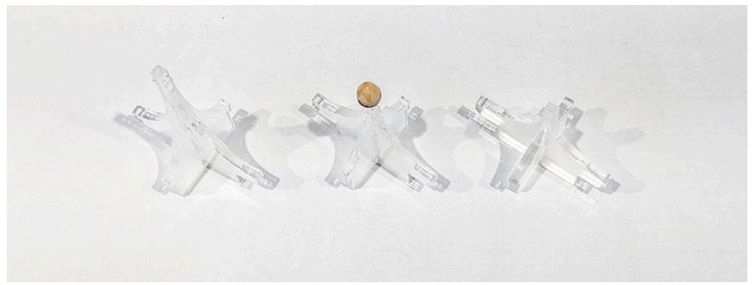
Process of Fabrication

The project began with the creation of a door handle, which we designed to fit comfortably in the hand using the CNC milling process. The handle was intentionally designed to appear as a normal rectangular piece of wood from the front, but upon gripping it, the user would discover the smooth and concave texture on the back.

Next, we turned our attention to designing a wall typology. Using the CNC, we created an undulating and tapering form on one side of the wall by cutting larger slabs of sapelle wood into their respective pieces. We then assembled the smaller blocks using wood dowels, resulting in a unique and visually striking pattern.

To complete the wall, we designed a skin or light that was attached to the wood using clear plexi anchor points placed at the intersections of the blocks. The skin was created from folded rice paper, which added an element of visual interest and texture to the design.





initial door handle

what if...

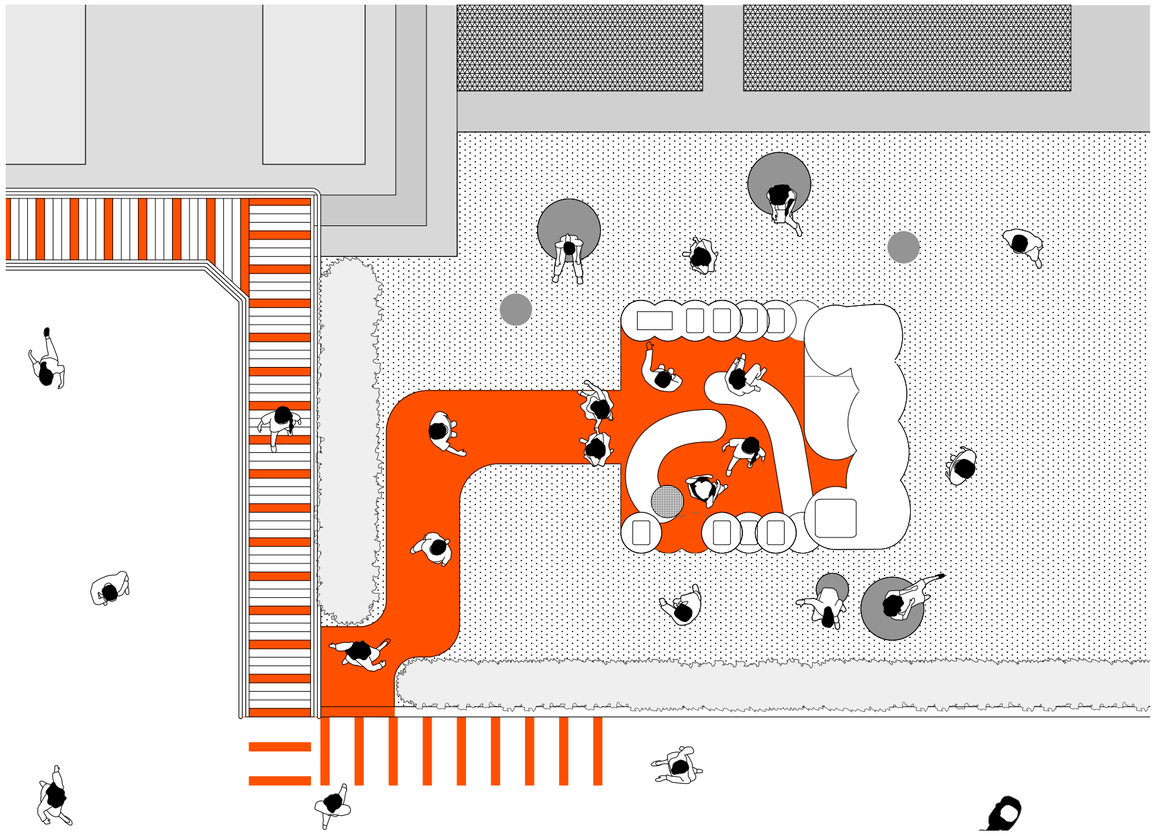
...pavilions could inflate?

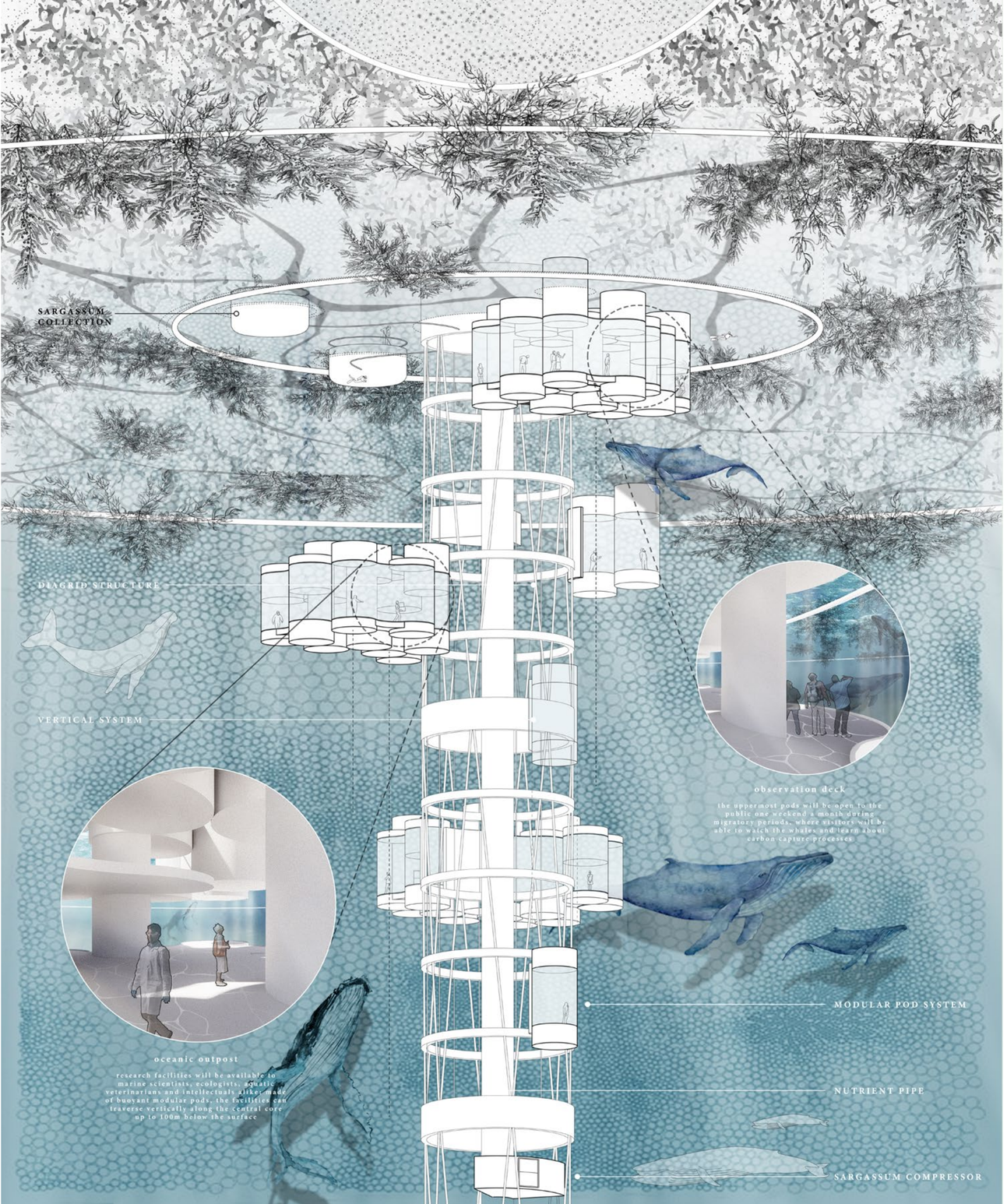
Instructors : Galia Solomonoff and Laurie Hawkinson
Partners : ChiChi Wakabayashi, Saba Ardesheri, Carley Pasqualotto, Maclane Regan, Angela Keele
Columbia GSAPP
Spring 2023

Inflatable pavilions offer a unique and innovative way of creating temporary structures. These lightweight and portable pavilions can be quickly assembled and dismantled. Inflatable pavilions are also incredibly versatile, as they can be made in a variety of shapes and sizes, and can even be illuminated from within. One of the key benefits of using inflatables for pavilions is their portability and ease of transport. They can be deflated and stored in a small space, making them ideal for events that require frequent set-up and take-down. The potential to make pavilions out of inflatables is exciting, as it offers endless possibilities for creating unique and striking temporary structures that are both functional and visually appealing.

The Hug pavilion features two PV panels to allow for sustainable charging of mobile devices during the spring 2023 graduation ceremonies. The pavilion also features mobile arms that visitors are free to move, hug, or lounge upon.

left : children playing with the pavilion arms





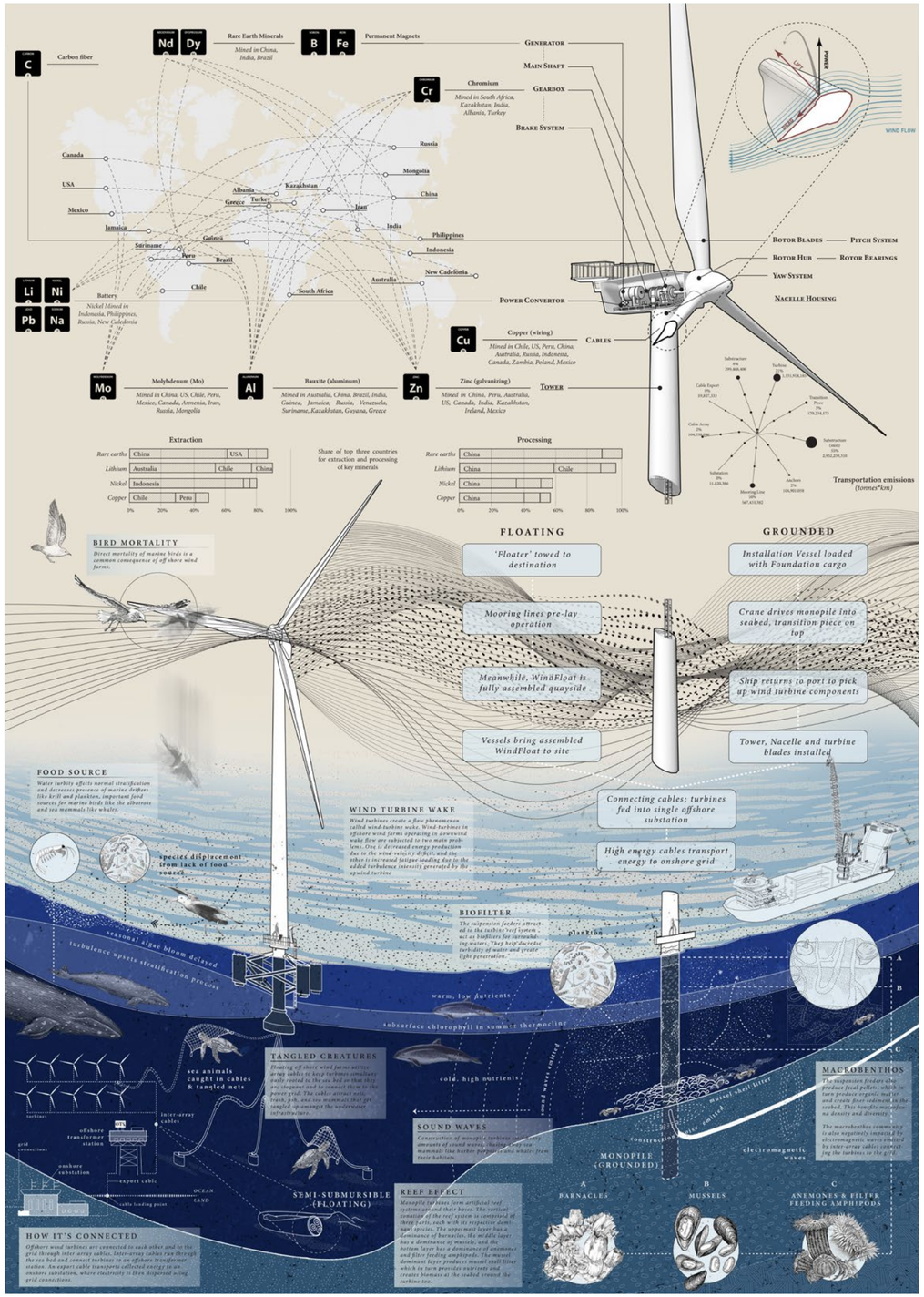
what if...

...we built landscapes for whales?

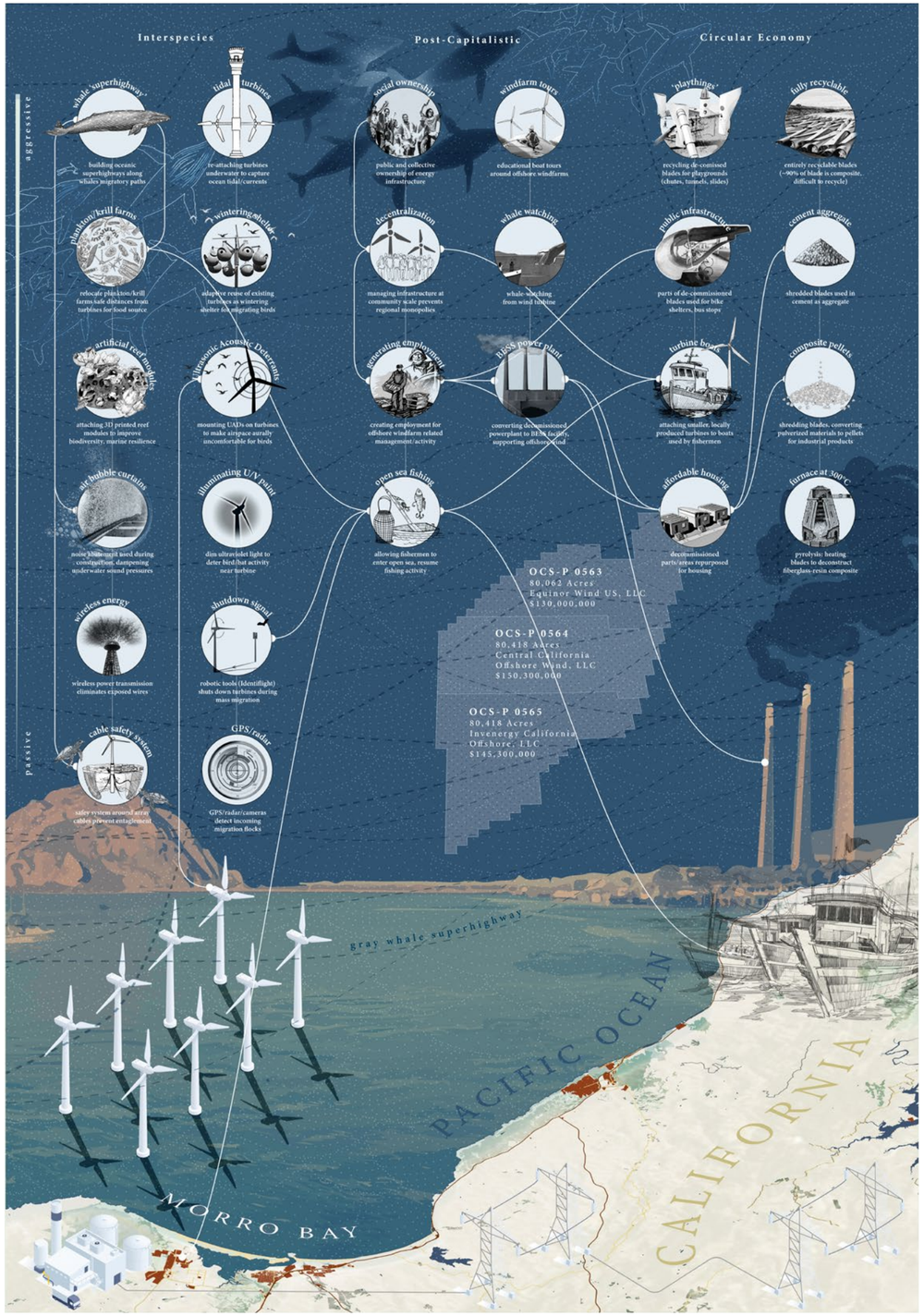
Instructors : Mireia Luzarraga and Alejandro Muino
Partner : Michael Lau
Columbia GSAPP
Spring 2023

The project challenges and pushes back on the oceanic ecological injustices of renewable offshore wind energy. The intervention focuses primarily on Morro Bay in the North Pacific Ocean, where 240 thousand acres of planned offshore wind farms would endanger migrating blue whales, which are critical to the ocean's natural carbon capture capacity. A proposed post-natural marine landscape of seamounts stacked over time with compressed sargassum protects endangered whales, gently altering whale migratory routes over time, while promoting oceanic biodiversity and enhancing the ocean's natural carbon capture capacity. The spectacle of the (infinitely) scalable, continuous marine landscape juxtaposes the immense scale of the wind farm - reclaiming agency of the ocean's natural environment and its ecosystems.

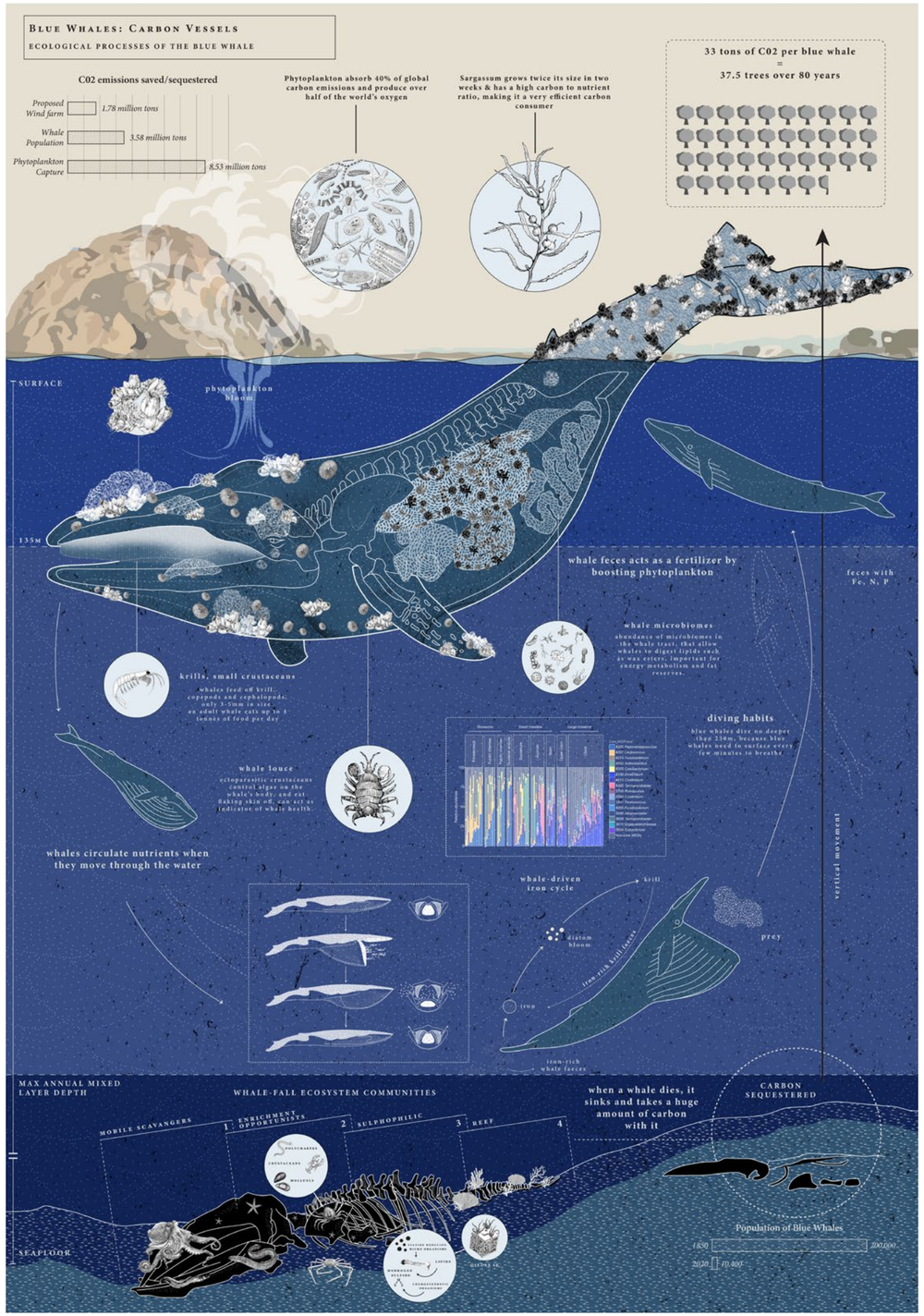
left : axonometric of pod module system



Cosmogram



Theatre of Operations



Study of a Whale

Whales : Carbon Capture Vessels

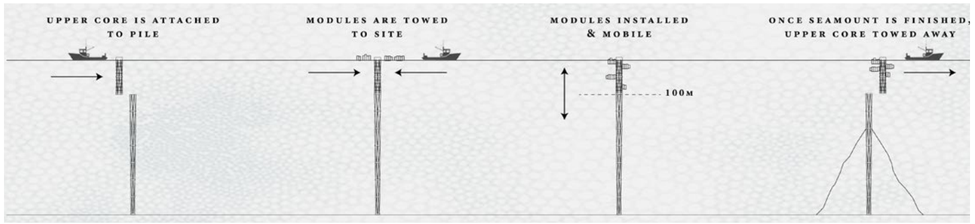
After extensive research, we identified whales as a key cog in the ocean's natural ecosystem; we propose a third nature marine landscape of seamounts to protect endangered whales, gently altering whale migratory routes over time. Whales have amazing carbon capture potential; both pertaining to itself, as well as the ecological processes it stimulates. hen whales die, they sink to the bottom of the ocean, each great whale sequestering 33 tons of C02 on average; equivalent to 3000 trees (48 pounds C02 a year)

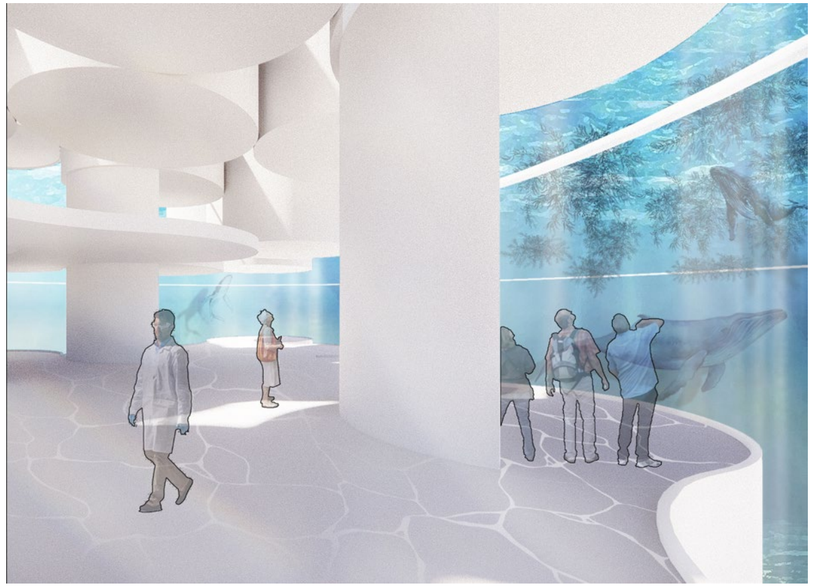
Seamounts

Seamounts, undersea mountains formed by volcanic activity, are a crucial part of the whales migratory navigation; due to the rich biodiversity it hosts, and their unique geomagnetic signatures. They serve as resting and feeding stops for whales. We propose the formation of a vast postnatural landscape of seamounts by the stacking of compressed sargassum. Regulated ranching of free floating sargassum is completely safe and productive; the sargassum absorbs C02 before being harvested, compressed and delivered down to the seabed, a form of organic carbon capture in itself. Nutrient pipes control the free-floating sargassum, while drawing nutrient rich water from the deep ocean.

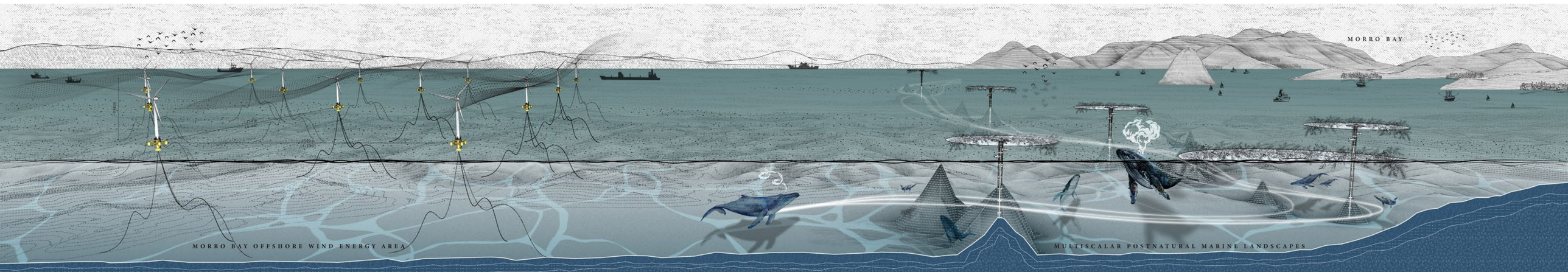
The intervention will initially be towed to site, from there on all processes are localized; a non-intrusive, lightweight core structure is extended to seabed, temporarily anchoring the station for the delivery and distribution of compressed sargassum. Air bubble curtains are deployed during the installation of micropiles structure, dampening the underwater sound pressures.

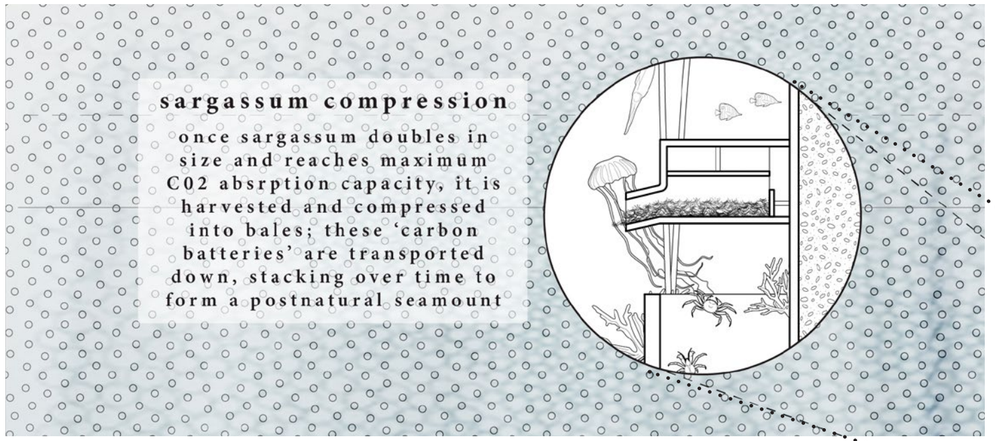
diagram showing localized construction of cores and seamounts



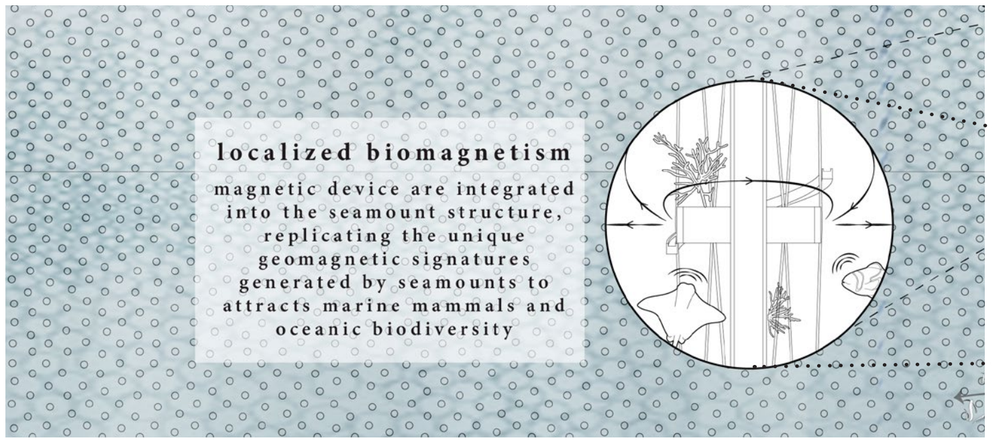


Here, we envision marine scientists and ecologists, aquatic veterinarians and intellectuals alike occupying the oceanic outpost. Research facilities, mechanical equipment and observation decks are made of buoyant modular pods that traverse vertically along the core, up to 100m below the surface of ocean water (epipelagic/sunlight zone). Local fishermen are also consulted, the up-close facility helping them determine no-fishing zones to preserve certain endangered species.

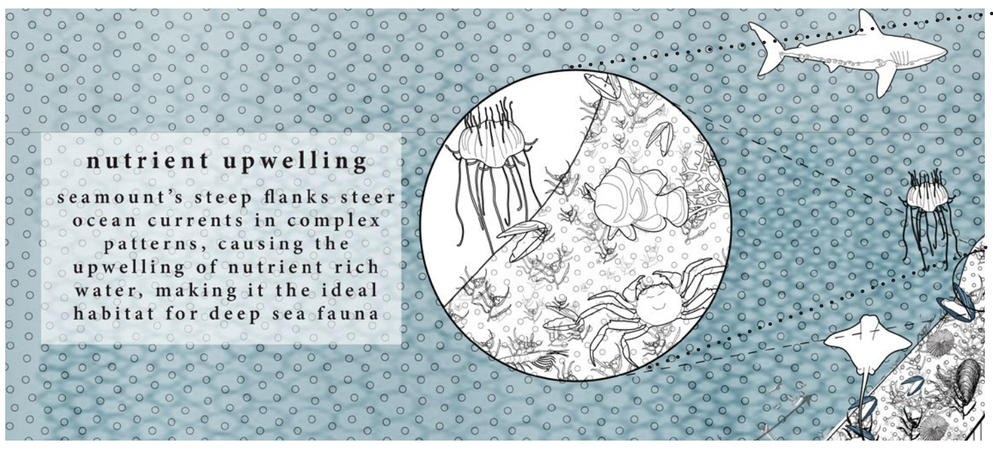



sargassum compression
once sargassum doubles in size and reaches maximum C02 absrption capacity, it is harvested and compressed into bales; these 'carbon batteries' are transported down, stacking over time to form a postnatural seamount

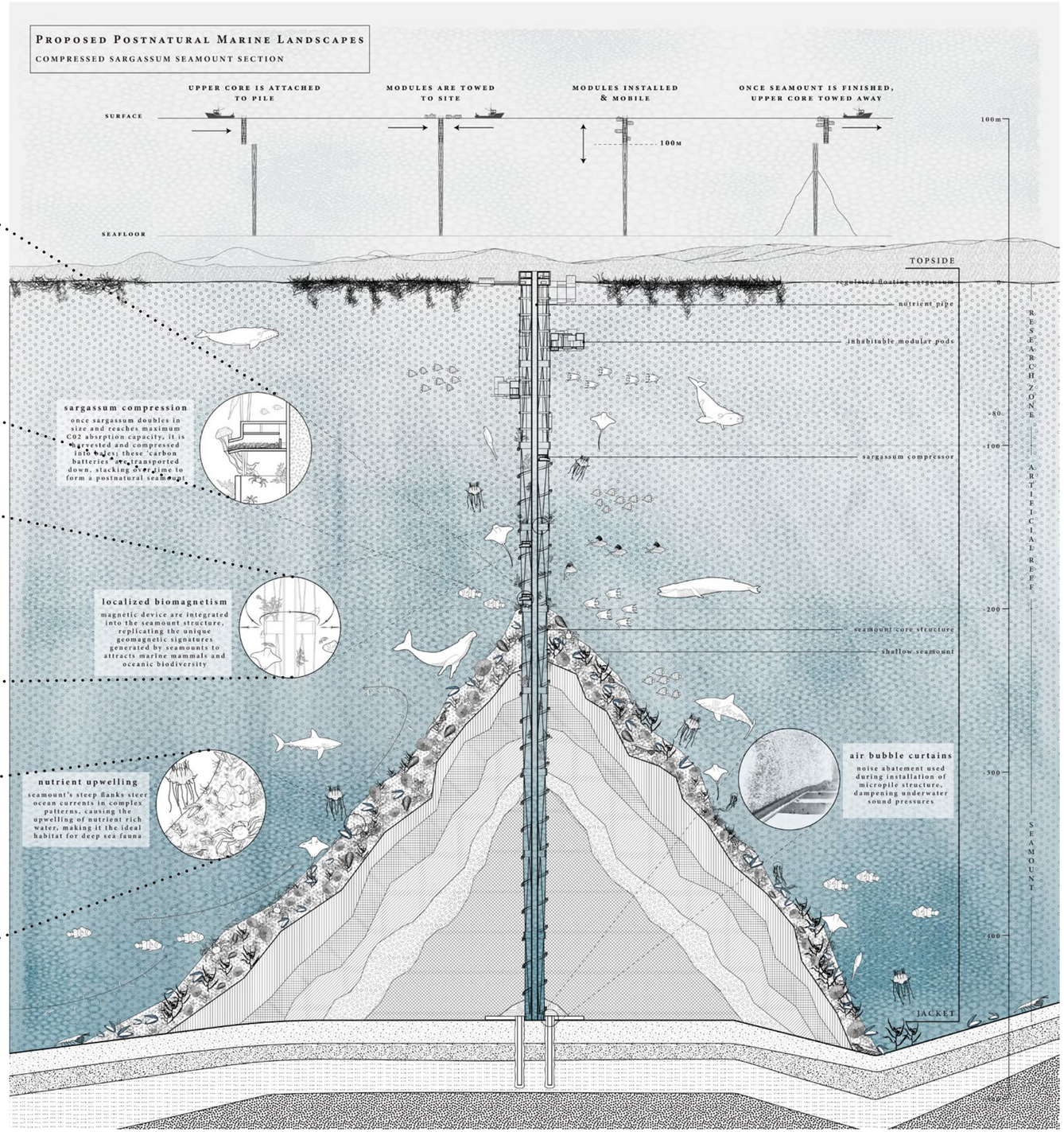
1

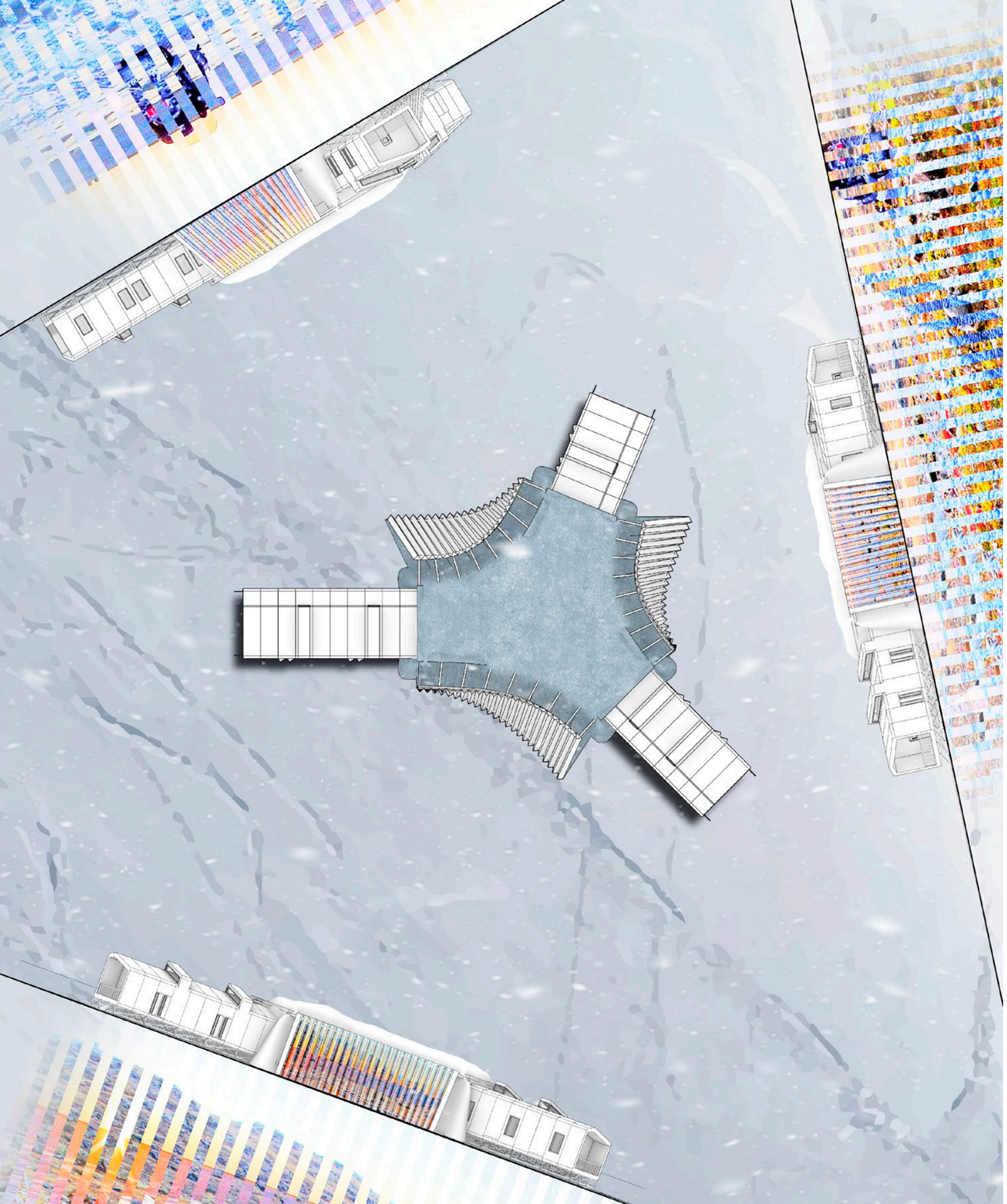

localized biomagnetism
magnetic device are integrated into the seamount structure, replicating the unique geomagnetic signatures generated by seamounts to attracts marine mammals and oceanic biodiversity

2


nutrient upwelling
seamount's steep flanks steer ocean currents in complex patterns, causing the upwelling of nutrient rich water, making it the ideal habitat for deep sea fauna

3


PROPOSED POSTNATURAL MARINE LANDSCAPES
COMPRESSED SARGASSUM SEAMOUNT SECTION
UPPER CORE IS ATTACHED TO PILE
MODULES ARE TOWED TO SITE
MODULES INSTALLED & MOBILE
ONCE SEAMOUNT IS FINISHED, UPPER CORE TOWED AWAY
SURFACE
SEAFLOOR
100M
TOPSIDE
regulated floating sargassum
nutrient pipe
inhabitable modular pods
sargassum compressor
seamount core structure
shallow seamount
JACKET
RESEARCH ZONE
ARTIFICIAL REEF
SEAMOUNT
0
80
100
200
300
400
500
sargassum compression
once sargassum doubles in size and reaches maximum C02 absrption capacity, it is harvested and compressed into bales; these 'carbon batteries' are transported down, stacking over time to form a postnatural seamount
localized biomagnetism
magnetic device are integrated into the seamount structure, replicating the unique geomagnetic signatures generated by seamounts to attracts marine mammals and oceanic biodiversity
nutrient upwelling
seamount's steep flanks steer ocean currents in complex patterns, causing the upwelling of nutrient rich water, making it the ideal habitat for deep sea fauna
air bubble curtains
noise abatement used during installation of micropile structure, dampening underwater sound pressures



what if...

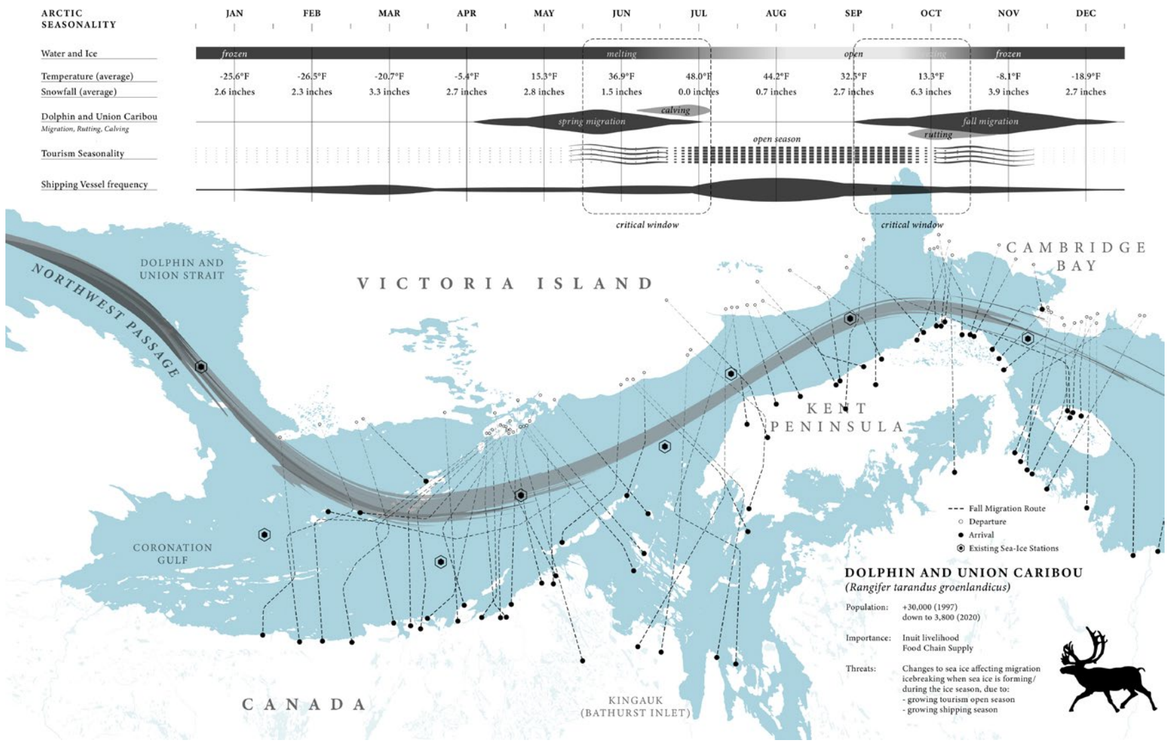
...we democratize map-making?

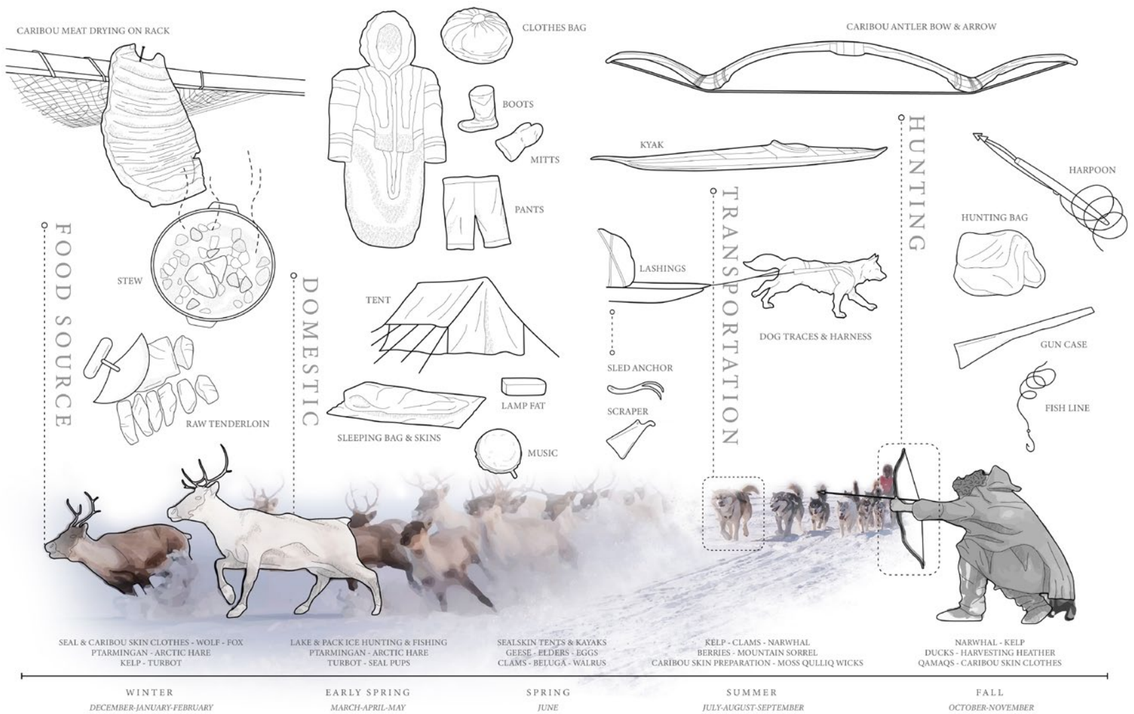
Instructors : Leslie Gill and Khoi Nguyen
Partner : Michael Lau
Columbia GSAPP
Fall 2022

We proposed a research outpost for map-making between under-represented entities of the Nunavut region in Canada - Caribou migrations and Inuit populations, utilizing a bottom-up approach to research and data collection.

The outpost will be established in Nunavut, Canada to facilitate map-making and data collection for caribou migrations and Inuit populations. The research center will have representatives from universities, local Inuits, and biologists from the Government of Nunavut. The research will cover three areas, including caribou monitoring and tagging, participatory mapping with Inuit hunters, and sea ice thickness measuring. Participatory mapping will involve semi-directed interviews and physical maps, which will be translated into digital pieces. Sea ice thickness will be measured using sea ice buoys deployed at existing sea ice stations and along Inuit trails, with the help of an existing program called Smart Ice.

left : plan of the outpost with collage of lenticular device

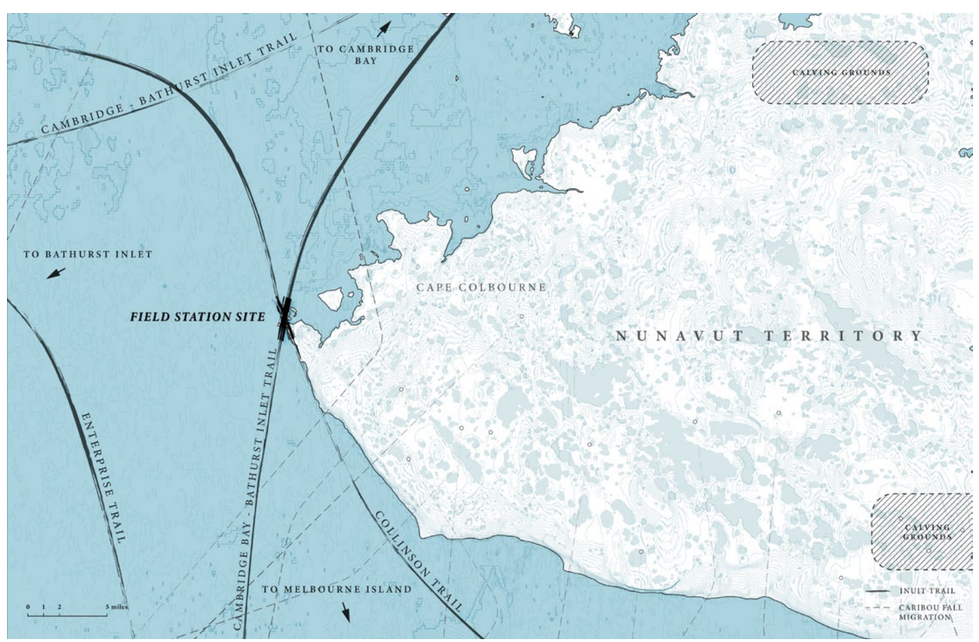




Dolphin Union Caribou in the Canadian Arctic

Icy harbors within the Canadian Arctic intersect in the Dolphin Union caribou grounds, necessitating the use of icebreakers for shipping and tourism boats. This affects the migratory routes commonly used by the Dolphin Union caribou, and often results in the premature deaths of these animals. The deaths of the animals in turn affect the native Inuit population living in the area too. Caribou are an important part of Inuit culture. They serve as a significant source of food, clothing, and tools for survival. Caribou hide is also noted for its unique thermal insulation properties, which make it ideal for warm winter clothing and sleeping mats.

below : map showing site of field station location in relation to migratory routes



NET GUNNING VIA HELICOPTOR

CARIBOU TAGGING

COLLAR

DIGITIZING PHYSICAL MAPS FROM WORKSHOPS

CHECK SEA ICE STRENGTH WITH HARPOON

MYLAR OVERLAY

BEWARE OF LEADS!

PAY ATTENTION TO DRAINAGE HOLES & WHIRL POOLS

INUIT PARTICIPATORY MAPPING

LOOK FOR ICE BRIDGES

SEA ICE BUOYS
PLACED AT EXISTING SEA ICE STATIONS
& INUIT TRAILS

CAMBRIDGE BAY

21 KM

31 KM

28 KM

52 KM

CANADA

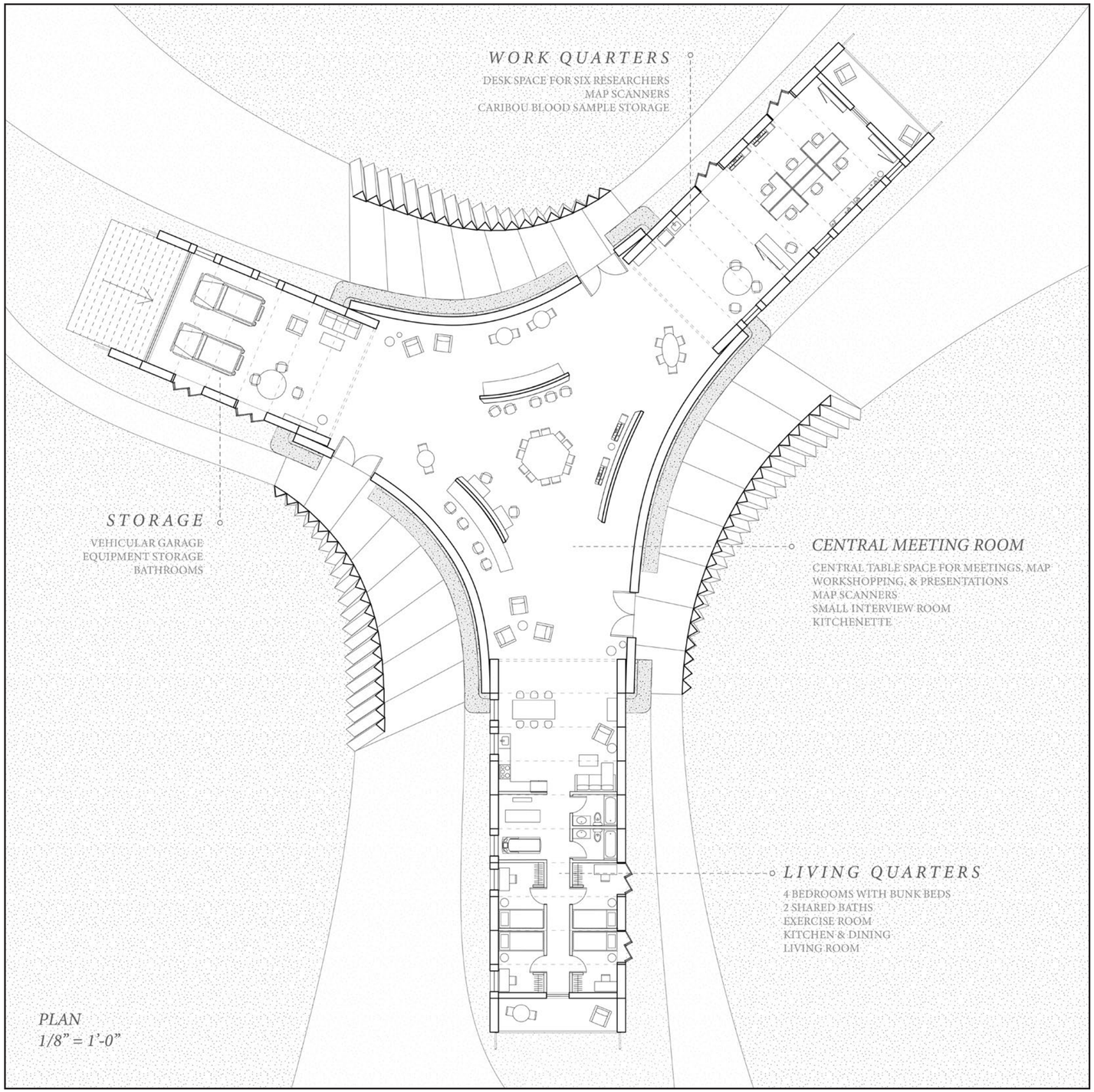
53 KM

49 KM

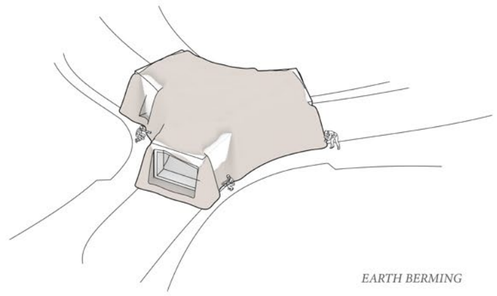
VICTORIA ISLAND

59 KM

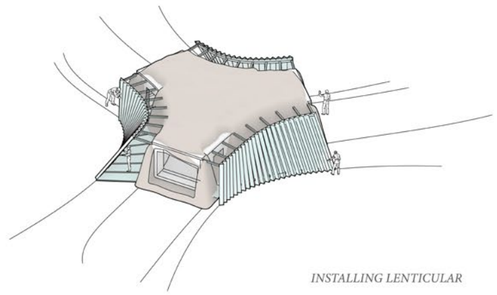
35 KM



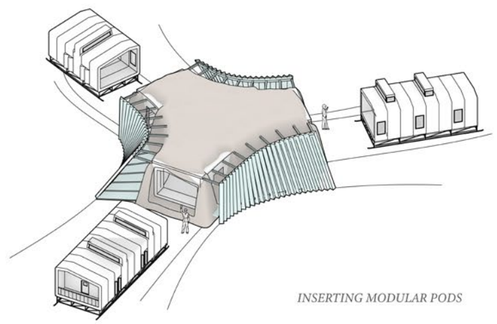
PLAN
1/8" = 1'-0"



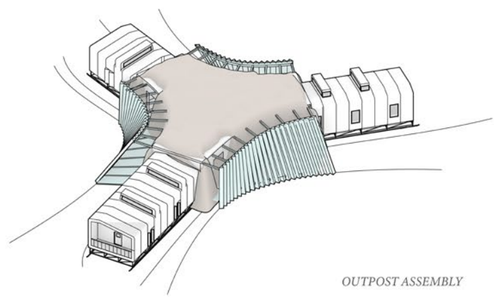
EARTH BERMING



INSTALLING LENTICULAR



INSERTING MODULAR PODS



OUTPOST ASSEMBLY