Anthro(post)scene

MS ARCH 2021-2022

DHVANI SHAH

ANTHRO(POST)SCENE

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by

Dhvani Shah

A thesis
submitted in partial fulfillment
of the requirements for
the degree of Master of Science, Architecture
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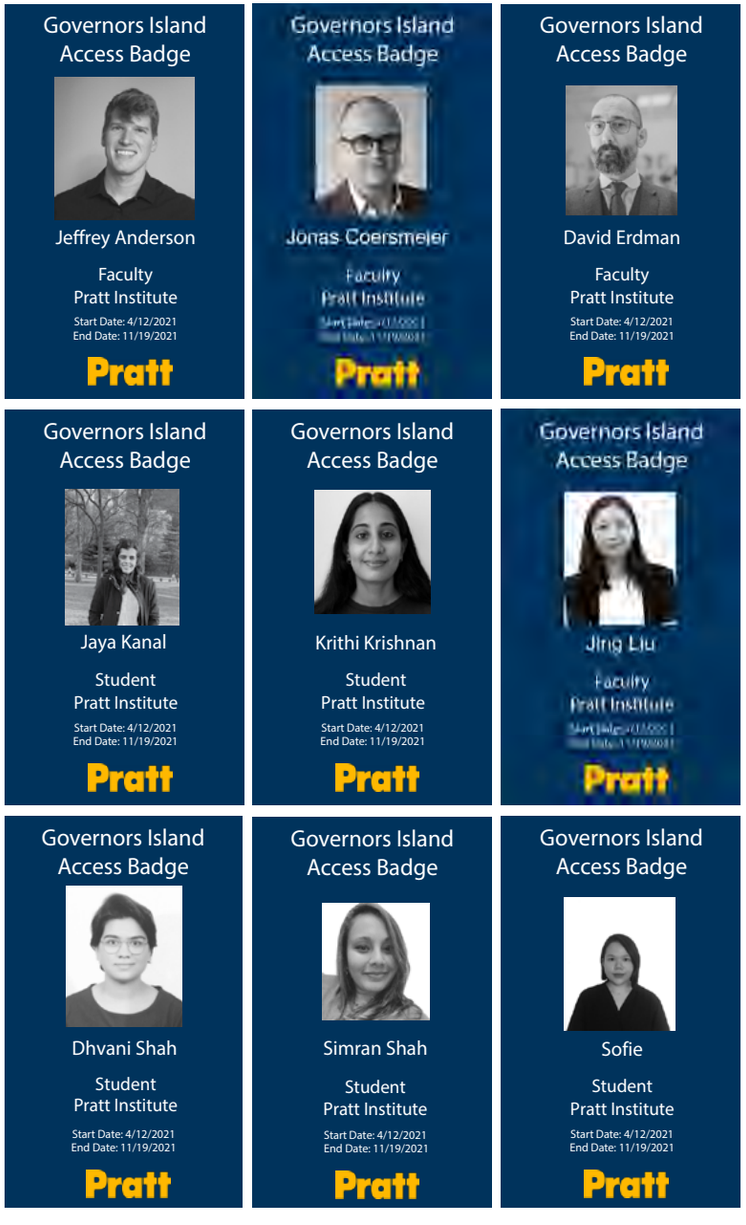
Governors Island, building 14, 2021

MS Programs Introduction

We began the 2021-2022 MS program year musing on the Anthropocene, the geological period marking the undeniable impacts of human activity on the planet; and we undertook our research on Governors Island in entirely new learning conditions that, on some level, usher in the "post-Anthropocene." With the increase of face-to-face learning and field studies this spring and summer, we encounter the smoke from California wildfires and record hot temperatures, reminding us of the urgency for design to engage climate crisis. With the culminating research in the winter of 2021-22 we find new virus variants, returning us to a now familiar state of isolation, concern and quarantine, as varied authors link the pandemic to the post-Anthropocene.

What does it mean to be post-Anthropocene? The term "post" yokes us to our environmental condition: it means that we wrestle with our anthropocentric exploitation of the planet; that we examine and acknowledge the inextricable relationship between racism and environmental degradation; and that we look at the manner in which social inequity is inscribed in the built environment.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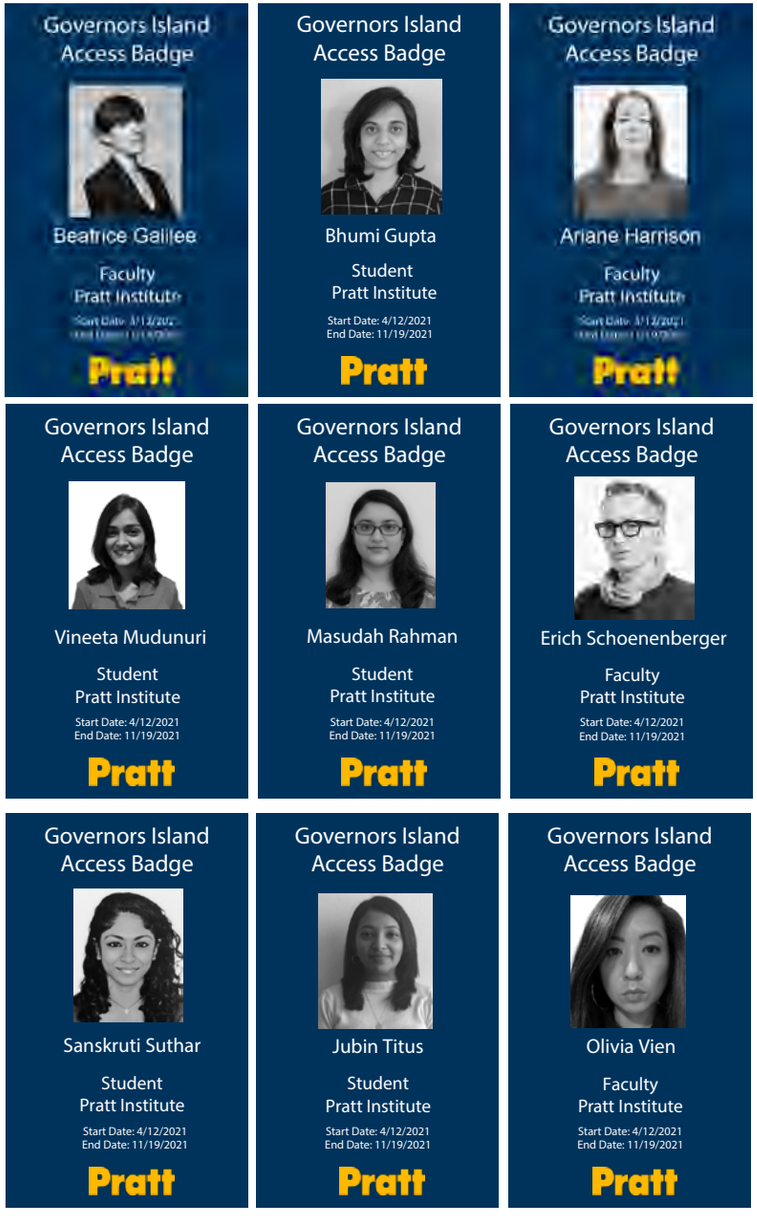
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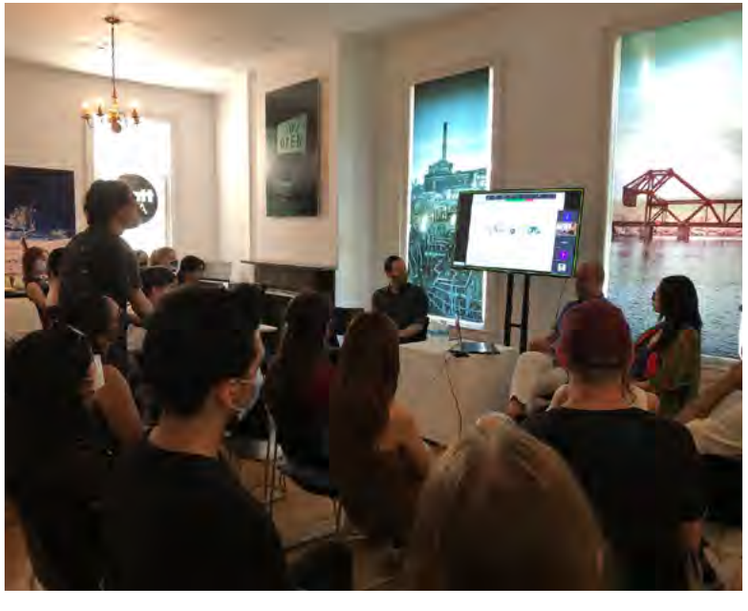
Pandemic brought us into new dialogues with the effects of the Anthropocene. Infection is not limited to animals and humans, but describes, as well, a structure of interactions that are reconfiguring around pandemic, racism, isolation, and environmental catastrophe. The conventional physical aggregation of non-diverse academic bodies makes way to zoomed discussions across time-zones and perspectives; studio reviews, the province of top down expert monologues makes way for new platforms of committed listening, engaged looking and real dialogue. Simultaneously, forays into in-person fabrication accomodated making immersive interiors, replete with an uncanny domesticity for repurposed historical houses.

Any "nature" left in the city is highly unnatural: it is constructed, cultivated and maintained by man and machine. It has few if any provisions for non-human species. The domestic interior, in a period of quarantine, must contain a world within its walls: wildness, energy, heating and cooling, water and fresh air. The MS programs in Architecture and Urban Design worked closely together in taking these constraints as cues, with intensive explorations of water, moss, biochar and biogel surfaces as new material for building interiors, seeking to bring the palette of nature into new public spaces. Artificial islands, archipelagos, tides and currents flowed into urban designs that embraced the flows of New York Harbor.

We suggested that it may be timely to bring nature's "wilderness" inside. The problem posed in the program asks whether architecture can re-imagine biophilic interiors as interiorized wildernesses – we see that the densely programmed interior cores that you designed anticipate and relieve the pressure of quarantined living. Your proposals explored the architectural reconfiguration of the domestic interior in integrating a constructed wilderness as well as a feral water, energy and waste services. The definition of "service core" as a space for plumbing, circulation and power was radically redefined to embrace ecological services: plant-life generators, algae-producing units, carbon sequestering media, desalization platforms and stormwater retention give new dynamics to the domestic core. These proposals explored environmental affects as well, in producing spaces that integrate nonhuman presence, that manifest actors outside of human perception. Volumetric interior landscapes created new outputs, from oxygen-rich air to biodiverse vertical surfaces to lighting that unfolds new potentials for domestic space under the confines of quarantine. Architecture proposals focused on ecological service cores that channel and filter stormwater, that nurture plant, algae and other animal life, that produce new lighting systems, and that condition air in novel ways. Urban design created new islands reaching into the Buttermilk Channel, connecting historical and ecological concerns.

The MS Architecture and Urban Design projects worked across several different scales, starting with an interrogation of the soils, histories and legacies of Governors Island. Soil studies contended with Lenape archaeology, brackish water-tables and lead contaminants on this urban island park whose checkered history is writ across its geological strata. Research posed questions of pressing concern: how can a park serve as a outdoor school? how can we create potable water for an island tethered to the mainland? how do we address geological racism in this island's colonial heritage? Studio faculty (Jonas Coersmeier, Ariane Lourie Harrison, Erich Schoenenberger, Olivia Vien, Jing Lui and Ray Rui Wu) and Mediums instructors (Jeffrey Anderson, Mia Landsbergis) worked through the "rewilded" interior at multiple scales. Electives in fabrication, exhibitions and urban adaptations tested concepts from Governors Island in new material and geographic contexts. And pro-seminars (Cynthia Davidson, Sanford Kwinter and Beatrice Galilee) developed theoretical and cultural frameworks for architectural interventions on Governors Island.

The culminating project site on Governors Island afforded a unique and relevant locus of exploration. In the early 20th century, the Army Corps of Engineers doubled the island, adding millions of cubic yards of fill to



the south side. West 8's masterplan brought artificial mounds to the island. Governors Island was a constructed nature. In 2016 on Governors Island, the British artist Rachel Whiteread furnished one of the island paths with a concrete cast of a small home titled *Cabin*. The domestic inscribes the island. Governors Island opened its thirty-odd Victorian homes for cultural, environmental and educational residencies. Pratt GAUD has occupied Building 14 in one of these residencies, with The Climate Museum, the NYC Audubon and the Urban Soils Institute as neighbors. This set of resources, along with recreation and arts programming, brings nearly one million visitors each summer.

The MS Architecture and Urban Design projects adapted the historic structures of Building 14, the Eastern Development Zone Shoreline and Building 3 with cores that, in addition to providing water, energy and air climatization, bring new formulations of wilderness into the interior. This work will become the subject of Pratt GAUD's "Re-Coring" exhibition in the Summer of 2022, along with an ongoing "Pratt Climate Provocations" exhibition for Fall of 2022.

The project team working with the Guerilla Science's "Communicating Climate Science Through the Arts" workshop drew heavily upon on the contributions and vision of MS students Dhvani Shah, Simran Shah, Vineeta Mudunuri and Jubin Titus. The contributions of MS students to this climate literacy effort has established a platform upon which Pratt SoA seeks to build an annual and ongoing program of workshops and exhibitions.

It is important to recognize the degree to which MS Architecture program work has received recognition for its curricular focus on Governors Island. Directed Research has been published in architectural journals, included in the 2021 Italian Virtual Pavilion at the Venice Biennale and related Pratt microsite, and featured in Dean's and Chair's talks on post-pandemic education. And the MS effort of Governors Island figured in the January 2022 award to Pratt of a three-year residency on Governors Island beginning in Summer 2022. Also, the MS cohort held an active role in the Pratt SoA, with Vineeta Mudunuri developing graphics and communication for the Dean's office, with Graduate Student Council representation by Jubin Titus, and with varied Graduate Assistant positions held by all members of the 2021-22 MS cohort.

It is a testament to your resiliency, your commitment to your education and your understanding of the significance of this period – one of pandemic and climate emergency – will mark a significant change for architecture and urban design. We are different now. Your culminating projects suggest that we have already ushered in the post-Anthropocene: that, in acknowledging the blinkered perspectives of the Anthropocene period, architects and urban designers will now envision, fabricate, and script more inclusive engagement in a global environment circumscribed by pandemic, climate change and inequitable socio-economic policies.

Ariane Lourie Harrison
MS Architecture and Urban Design Programs Coordinator

The carbon cycle plays two fundamental roles in the emergence and development of the Anthropocene. The first, familiar role is associated with climate change, a major vulnerability faced by humankind as a result of current changes in the earth system. The second and much deeper role is that carbon is central to the emergence of the Anthropocene as a planetary phenomenon, because the exploitation of energy from detrital carbon provided an essential evolutionary trigger for the Anthropocene.

Short film expressing the distress for future: https://www.youtube.com/watch?v=tZdEW5mVOMo

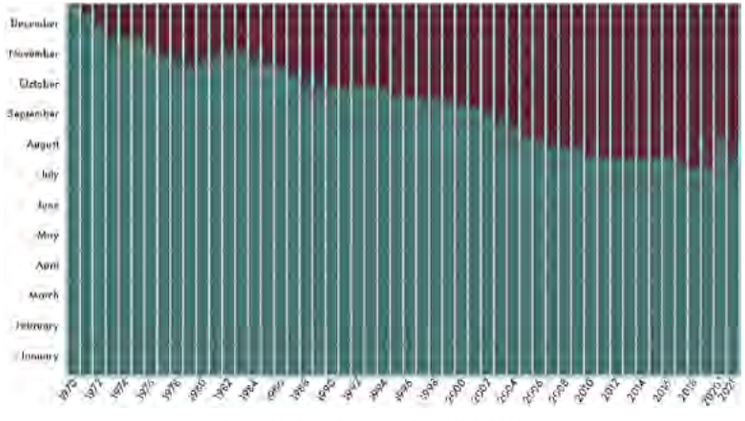


Figure 01: Earth Overshoot Day 1970-2021

* *The calculation of Earth Overshoot Day 2020 reflects the initial drop in resource use in the first half of the year due to pandemic-induced lockdowns. All other years assume a consistent rate of resource use throughout the year. We can conclude how environmental impacts are directly proportional to human activities. There is still hope if we reverse our actions and respect nature's budget for humankind.*

Prologue

2050, 30 Years Now

"**Earth Overshoot Day** marks the date when humanity's demand for ecological resources and services in a given year exceeds what Earth can regenerate in that year."[1] In 2021, it fell on July 29. Casually scrolling through my Instagram, I read this post while drinking coffee from a venti plastic Starbucks when my flight was about to take off emitting two hundred kilos of carbon dioxide. The idea that we have exhausted nature's budget for the year and we'll be living on borrowed time for the remaining five months was extremely unsettling. "From now on, everything we consume will be taken from the future", phrased the Earthrise Studio.

While imagining this sacrificed future, I leaned towards speculating possible scenarios in the year 2050, and the steps we should initiate in the next three decades in order to have a holistic life as an aware and responsible generation on a breathable planet. My design interventions speak of mines, memorials, and a marketplace where CO2 impacted environmental losses are mourned while promoting carbon as the new age commodity.

The increase in atmospheric carbon dioxide is central to global warming and climate crisis. Yet could the element of this compound; sequestered, contained, and transformed, produce new mediums for climate resilience?

This book is about my talk with three people whose work has been significant in studying carbon dioxide emissions and taking actions to combat climate change. Together, we visit these architectural interventions at Governors Island, New York to extend this dialogue. Dr. Haibo Zhai, research professor at Carnegie Mellon University, Ar. Edward Mazria, an internationally recognized architect, author, researcher, and educator, and Mr. Christian Müller, Head of Product Development Plant Engineering at Climeworks join me on this trip to share their wisdom.

[1] See Definition by Earth Overshoot Day, https://www.overshootday.org/about

Chapter 01

A Memorial

Defining a Memory

Recording a Time

Figure 02: Perspective Section Through Building 14 & Outdoor Element

It is the year 2050 and we are still alive. The past 3 decades have seen dramatic changes to atmospheric carbon, once that have set the course to the post Anthropocene, an end to an epoch.

Carbon Cycle

The carbon cycle is nature's way of recycling carbon atoms. The carbon cycle describes the process in which carbon atoms continually travel from the atmosphere to the Earth and then back into the atmosphere. Since our planet and its atmosphere form a closed environment, the amount of carbon in this system does not change.

Carbon is the foundation for all life on Earth. It can be stored in a variety of reservoirs, including plants and animals, which is why they are considered carbon life forms. About 18% of our body and 50% of plants are composed of carbon, the fourth most abundant chemical element. Carbon helps to regulate the Earth's temperature, makes all life possible, is a key ingredient in the food that sustains us, and provides a major source of the energy to fuel our global economy.

Carbon sinks are large deposits of carbon on earth that sequester more atmospheric carbon than they emit. The key active carbon sinks are organisms (both living and dead), soil, the oceans and the atmosphere. Together these are able to absorb around half of all human-induced carbon emissions. Past carbon sinks that no longer actively sequester carbon include fossil-fuel reserves and sedimentary calcium carbonate deposits such as limestone and chalk. On Earth, most carbon is stored in rocks and sediments, while the rest is located in the ocean, atmosphere, and in living organisms. These are the reservoirs, or sinks, through which carbon cycles.

In total, buildings account for about 40% of annual fossil fuel carbon-dioxide emissions, leading to increase in floods, fires, hurricanes, and billions of dollars in annual damage. My design interventions, described in this book, proposes a prototype for sequestering carbon at it's source, builds mines as carbon sinks which literally stores the captured carbon, and practices using renewable sources of energy to reduce carbon footprint. Carbon, anthropocene, capitalism, capitalocene, understanding these terms in my curatorial project helped me define carbon as the new age commodity and advocate for a carbon neutral environment.

Figure 03 (LHS): Photograph Of A Concrete Model With Graphite Shavings

Brooklyn Battery Tunnel

The Brooklyn–Battery Tunnel connects Red Hook in Brooklyn with Battery Park in Manhattan, and it passes offshore of Governors Island. The tunnel consists of twin tubes that each carry two traffic lanes under the mouth of the East River. With a length of 9,117 feet (2,779 m), it is the longest continuous underwater vehicular tunnel in North America. The tunnel is constantly sucking fumes out and bringing in fresh air from the surface. This is all because of the four ventilation chambers in Manhattan, Brooklyn, and Governors Island that are so powerful that they can completely replenish the entire tunnel with fresh air every 90 seconds.

As of 2016, the tunnel is used by 54,076 vehicles on an average weekday. The tunnel carries 28 express bus routes that connect Manhattan with Brooklyn or Staten Island. 38.36 metric tonnes of CO2 emitted per day, only through the tunnel. During construction, tunnel engineers touted the ventilation system as being so efficient that the ventilation towers could blow 25,000 tons of clean air into the tunnel every hour. The system consists of 53 fans that each had a diameter of 8 feet (2.4 m). The Brooklyn–Battery Tunnel is part of the Interstate Highway System, which is a 50,000-mile (80,000 km) system, consisting of five east–west routes and 10 north–south routes. IHS is approximately 28,800 times of Brooklyn-Battery Tunnel.

Brooklyn Battery Tunnel's ventilation building, continuously running fans on the building[1], East River's salinity, and Governors Island's support for research, development and demonstration of equitable climate solutions for New York City[2], together proves ideal to site the carbon capture mechanism. If the prototype at the Governor's Island can tackle 14,000 tonnes of CO2 every year along the 9,117 feet tunnel, could it also not tackle 0.4 Gigatonnes across the length of the entire Interstate Highway System?

[1] Inferred from Climesworks' air capture technology; https://climeworks.com/co2-removal.

[2] See Climate Solutions described on Governors Island's Website, 2020, https://www.govisland.com/about/climate-solutions.

Figure 04 (LHS): Illustrated Map of Huge L. Carey Tunnel Connecting Battery Park, Red Hook & Governors Island

Figure 05: An Illustration of Carbon Emissions from the Ventilation Tower over Huge L. Carey Tunnel, Imagined To Be Spreading And Merging With Surrounding Atmosphere And Flowing River Water.

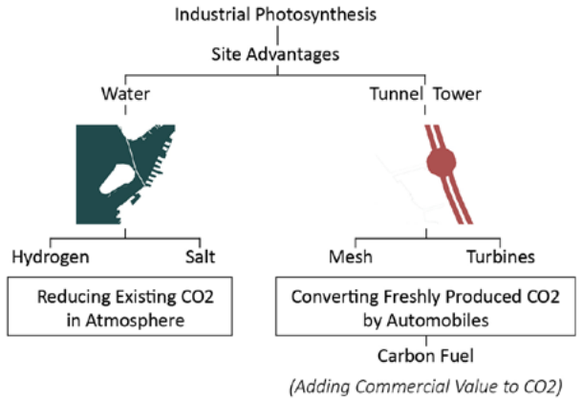


Figure 06: Electro Chemical Processes [E-Vent]

The aim of the Memorial is to shed light upon the rising global temperature, discuss the role of CO2 in it, and urge people to allow carbon to help keep the warming below 1.5 degree Celcius. The project also stresses the critical importance of a 2030 milestone-65% of CO2 reduction-to possibly achieve a carbon neutral environment by 2050, our only chance before climate change becomes irreversible. As architects, eliminating the embodied carbon of building structure, substructure, and enclosures which accounts for 11% of global GHG emissions is of paramount importance. The book studies the need of different architectural interventions at the end of each decade. Sequestering carbon at its source from automobile emissions, the project first memorialises, in 2050, the environmental losses incurred due to human interventions.

Figure 07: Brooklyn Battery Tunnel ventilation Tower, 2020

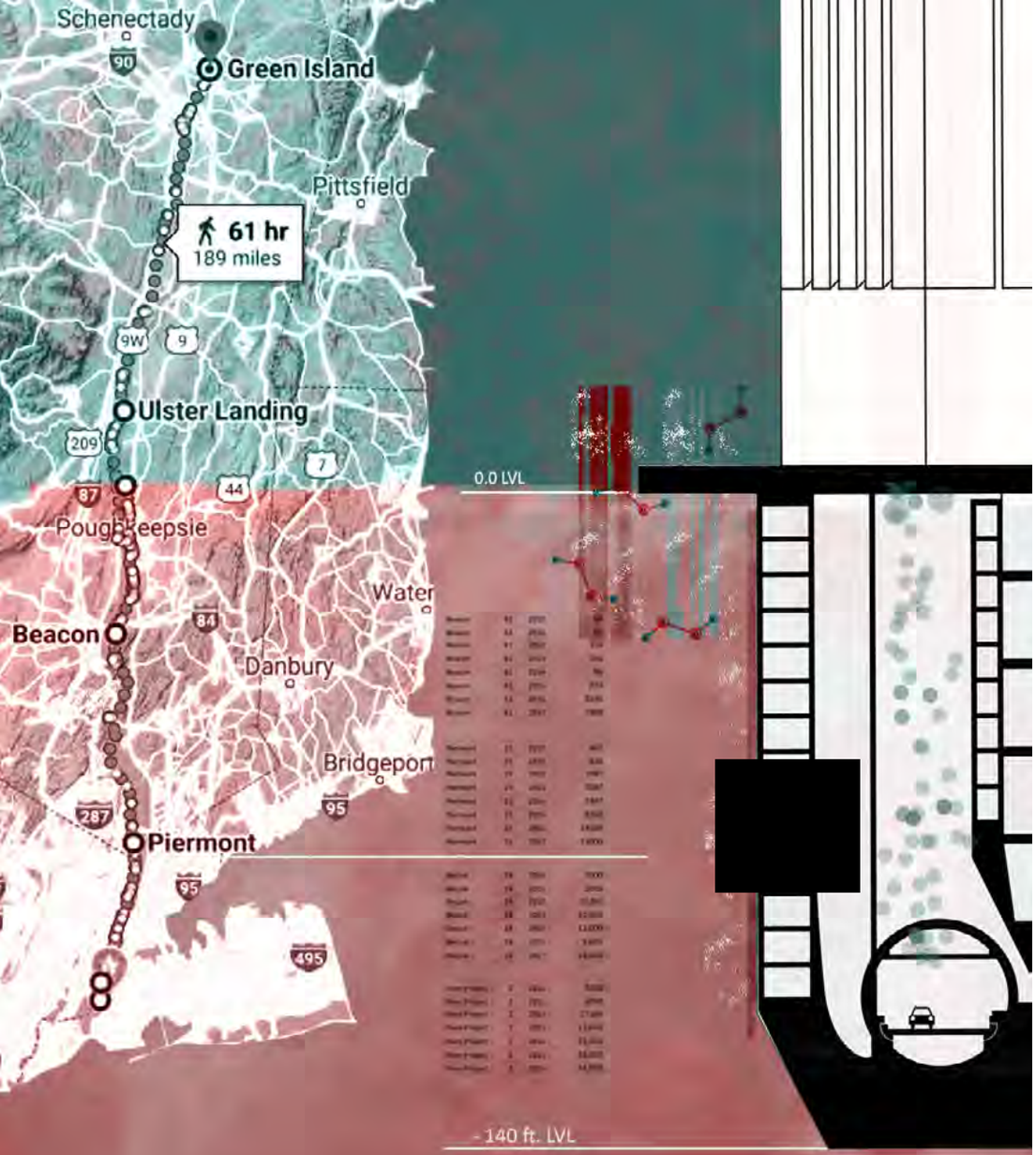


Figure 08: Deep Section Through Ventilation Building Showing Electro-Chemical Process in the East River

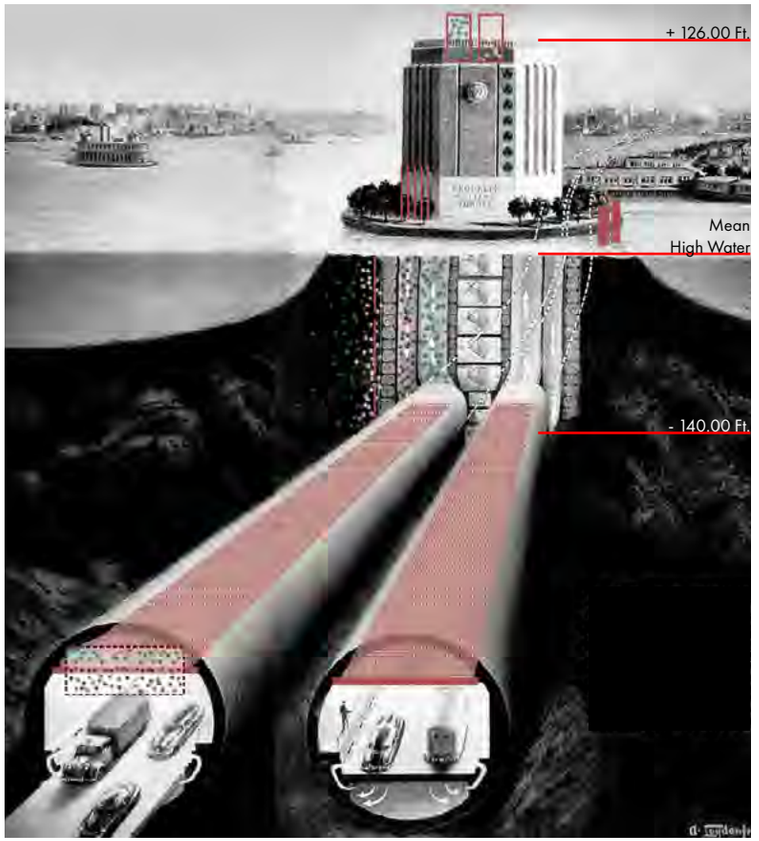


Figure 09: Visualisation of Breaking the CO2 , Capturing Carbon & Releasing Pure Gas in the Atmosphere [Base Image Source: Reddit; Leydenfrost, Alexander, editor. Brooklyn-Battery Tunnel. Brooklyn, 1950.]

We captured the carbon at the ventilation tower on Governors island and transformed the captured carbon into a new self-decomposing material[3]. The film installed in the tunnels act as an electric filter to seperate the elements of CO2, captures (red) carbon and releases only (green) oxygen. With the help of electrochemical process in the East River between H2O and NaCl, Hydrogen elements acquired assists in converting previously released CO2 in the atmosphere.

[3]Chandler, David. "MIT Engineers Develop a New Way to Remove Carbon Dioxide from Air." MIT News, 24 Oct. 2019, https://news.mit.edu/2019/mit-engineers-develop-new-way-remove-carbon-dioxide-air-1025.

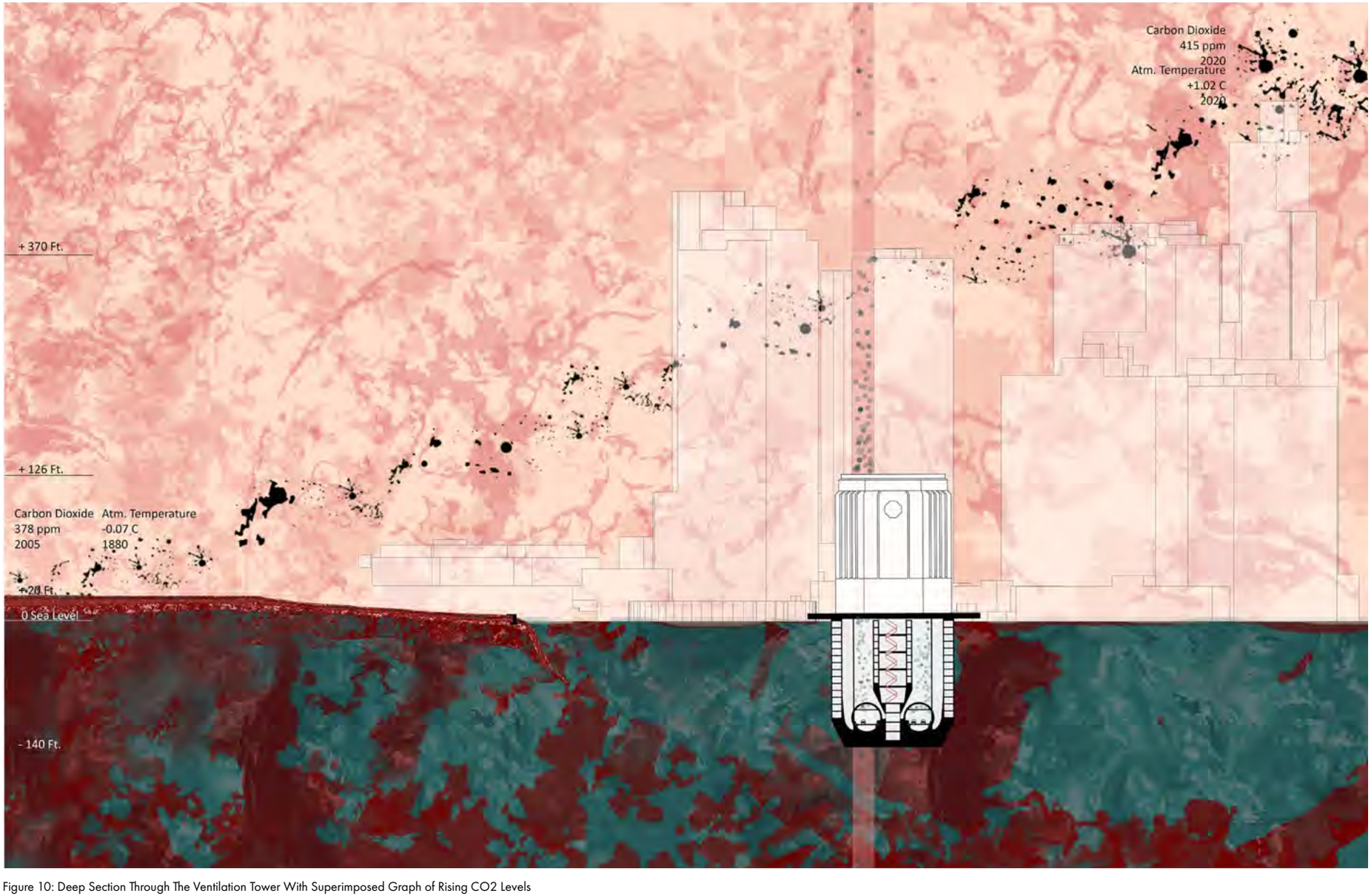


Figure 10: Deep Section Through The Ventilation Tower With Superimposed Graph of Rising CO2 Levels
[Graph Source: "Global Atmospheric CO2 and Surface Temperature(1880-2020)." NOAAclimate.gov, 23 Nov. 2021, https://www.climate.gov/media/13840. Accessed 10 Feb. 2021.]

Figure 11: Illustrated section through Building 14 on Nolan Park

In the year 2050, Governors Island serves as a landmark of past carbon use, and its ventilation tower is where the story of the carbon began. Rather than to forget that we have resolved carbon concentration in the atmosphere, the project proposed a memorial on Governors Island. The Building 14 at Nolan park is compared to the vertical monumentality of this unacknowledged edifice.

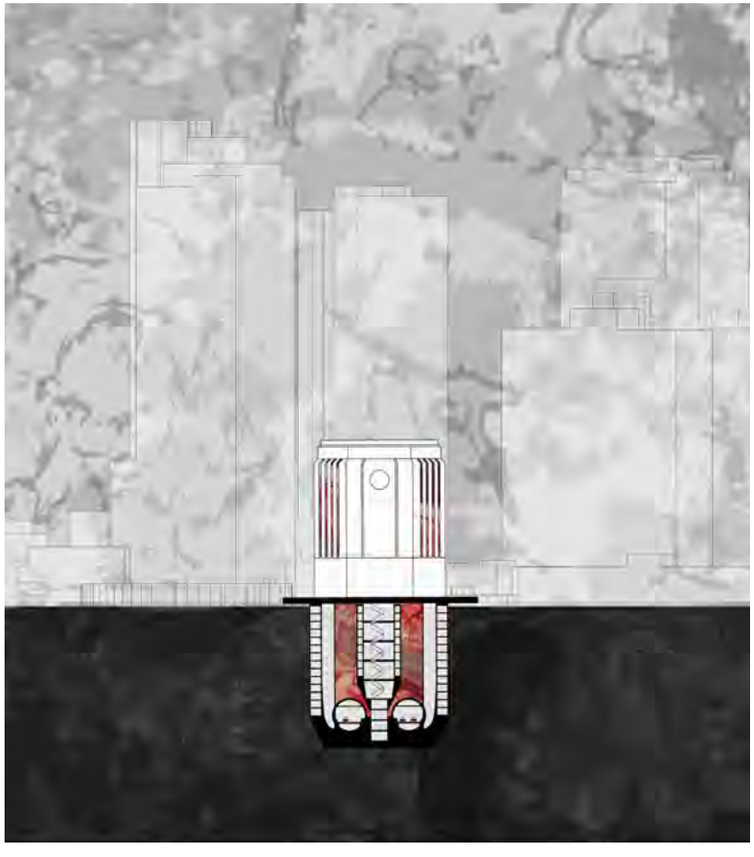
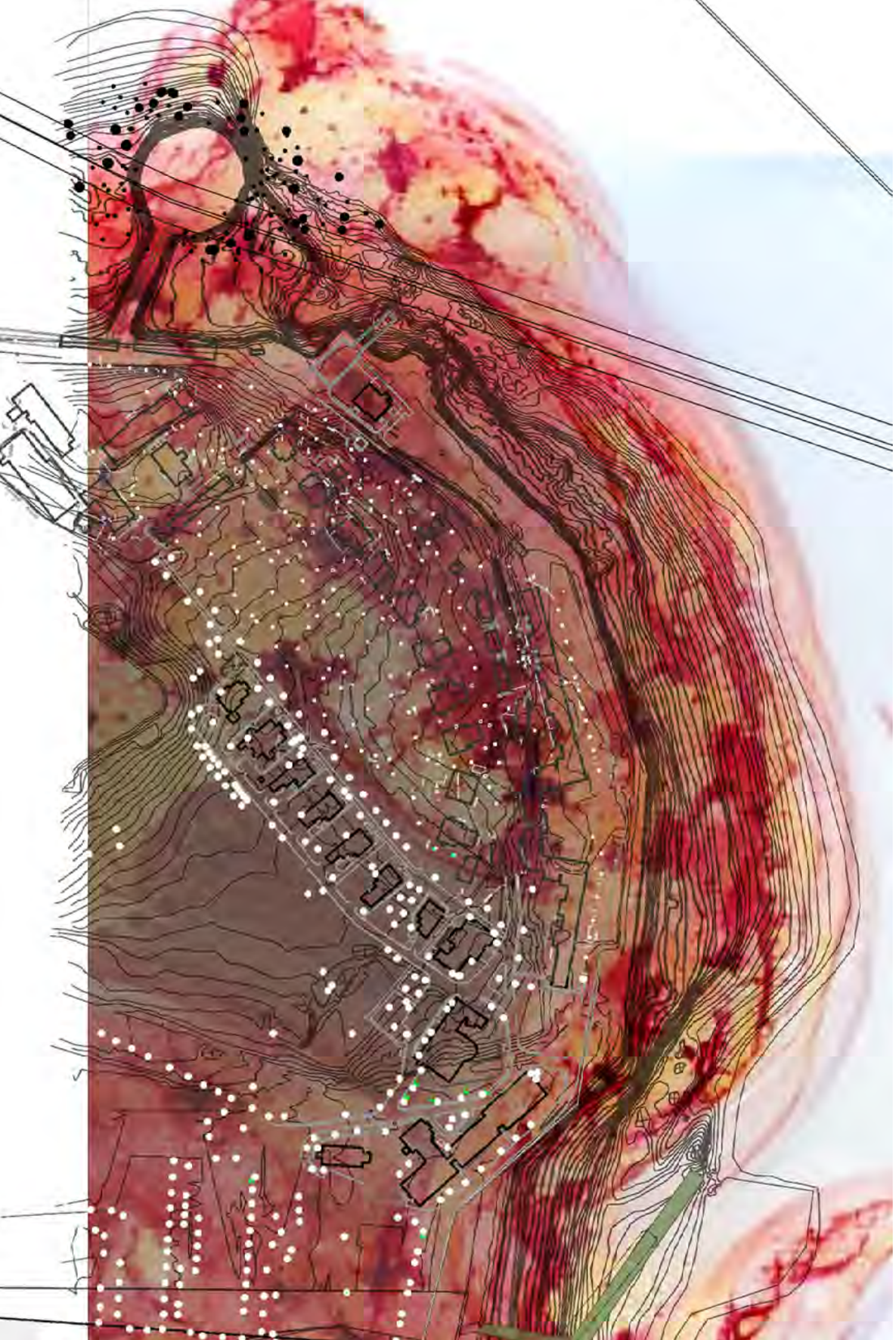


Figure 12: Illustrated section through the Ventilation Building

The project is a memorial for the impact of carbon dioxide emissions, the loss we never accounted for or acknowledged in the past. We converted this ephemeral gas into solid carbon, to grieve for this loss, and to avoid further demise. In this moment in future, are we responsible for remembering the kind of ecological issues our prior modes of development had created? The project has a Janus faced quality, like Governors Island itself. We may ask on this basis, does the memorial look back at the problem and does it point to a different type of ecological future?



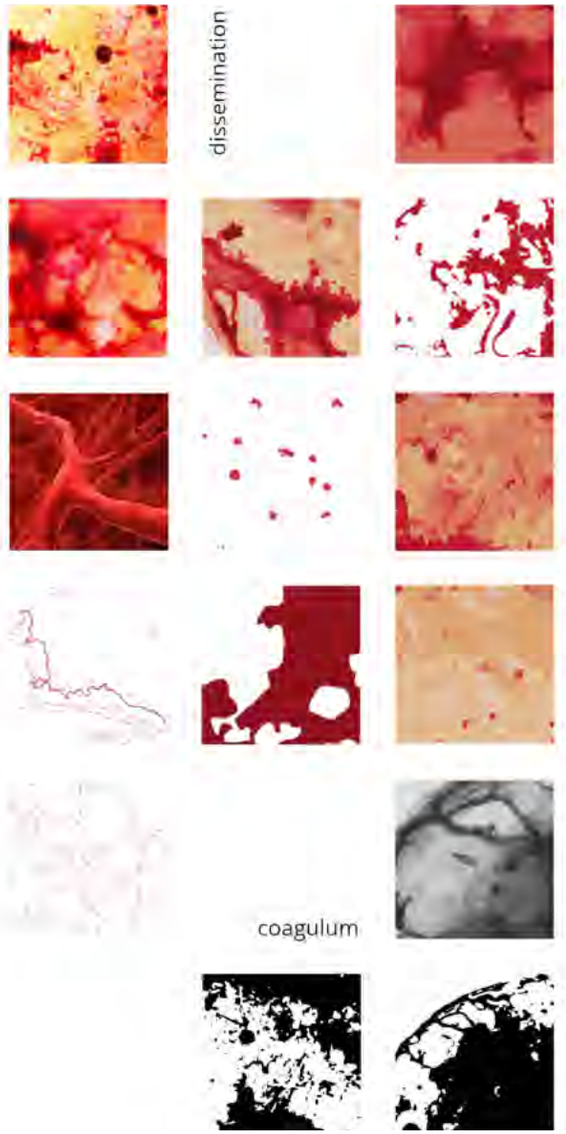


Figure 13: Derivation of Geometry from a Wax-Resin-Pigment Material Recipe
Figure 14(LHS): Superimposed Images of Material Experiments with Site Conditions

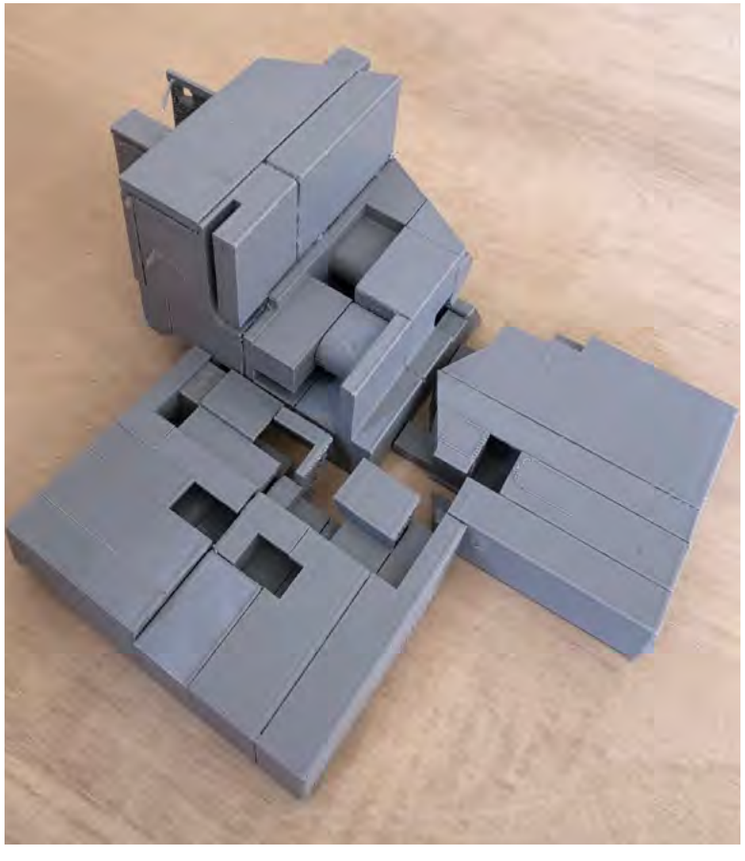


Figure 15: Rearranged Building 14 Chunk Model

The geometries derived from casting experiments is translated into 3-Dimensional model, later 3D printed as chunks. These chunks of Building 14 is reassembled in a way to define spaces over the narrative of monuments and memorials.

Figure 16: Casted Chunk Model in a Rockite-Resin-Pigment Recipe

While studying the monumental structures, the experiments with casting materials of extreme opacities, densities and properties revealed the beauty of seams, coagulation, traces of pigments, and power of depth and darkness.

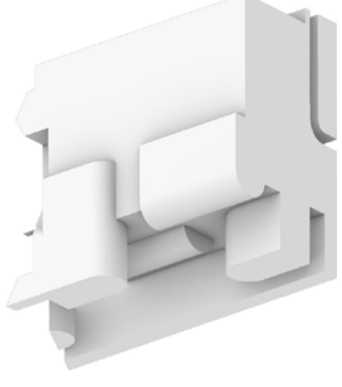


Figure 17: Illustrated section through Building 14 on Nolan Park
Figure 18: Establishing Solid Mass and Void Space Relationship

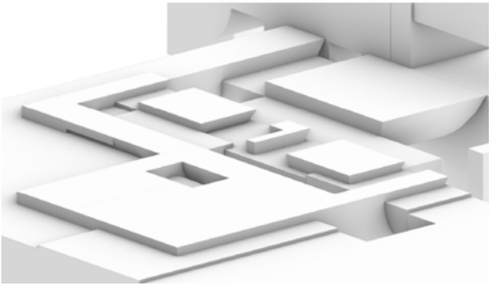


Figure 19: Interpreting Filleted Corners and Arched Spaces from Model Arrangement
Figure 20: Questioning Thickness of Floorplates and Defining Outdoor Landscape Elements
Figure 21: Connecting Level Differences with Heavy Staircases

Figure 22-24: Cut Plans at 2.4Ft., -5.6Ft., -10.6Ft.

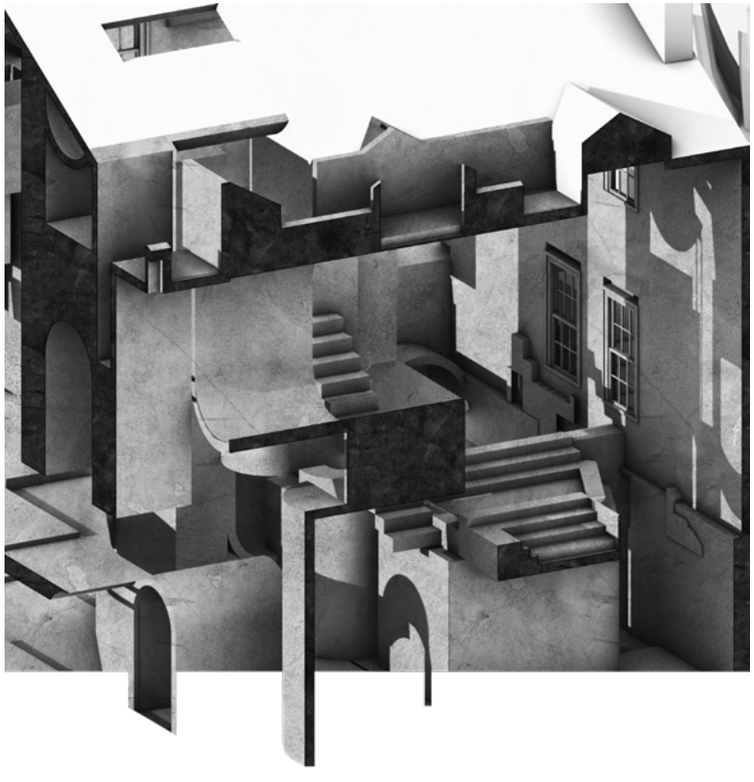
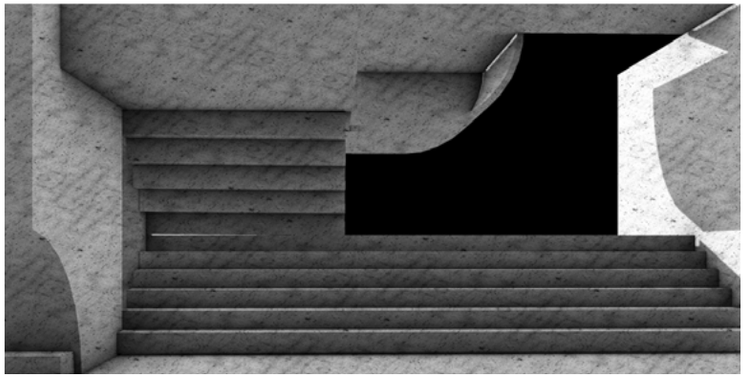
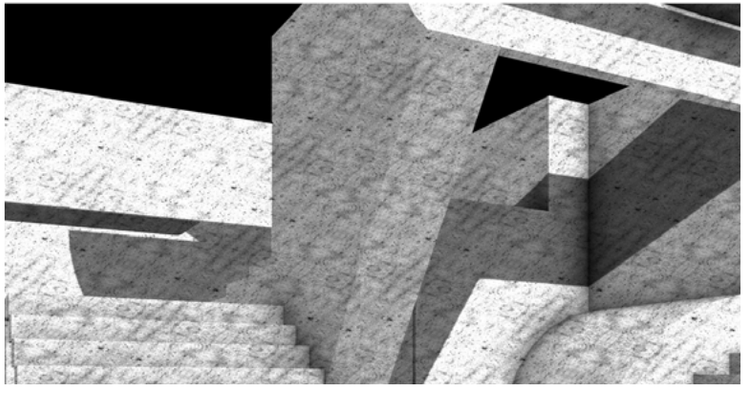
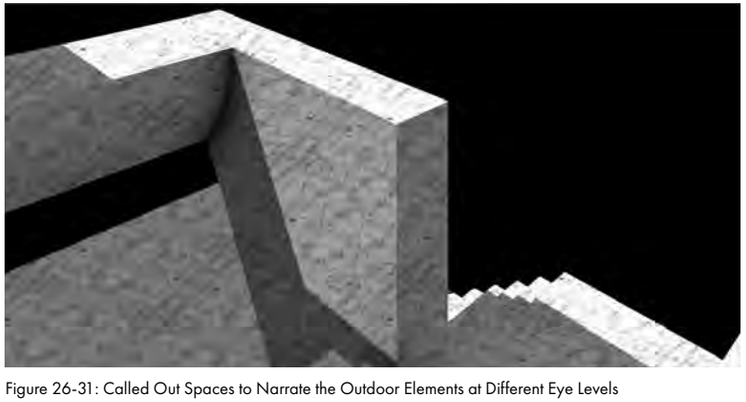


Figure 25: Perspective section through Building 14 on Nolan Park

The study of the smaller components appear together in this first visualization. These design elements begin to restore the existing conditions of the structure, giving significance to the need for replacement. The visitors on Governors Island proceed through outdoor landscape design into Building 14, (ref. Figure 22) its a procession and a remembering. A ceremonial route that carves the ground, marking its locus as a source by following the same path through the outdoor carvings underground into a dark dungeon. While some areas need people to budge beneath the beams and move between the seams of the memorial, others are open to the sky. There would be spaces with stark light when the sun is overhead, coupled with dark corners.







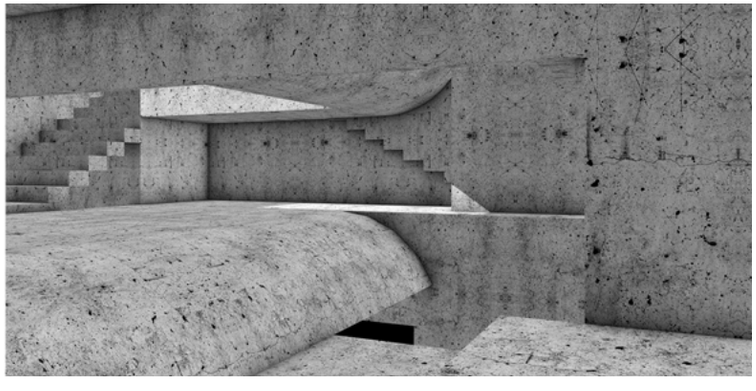


Figure 26-31: Called Out Spaces to Narrate the Outdoor Elements at Different Eye Levels

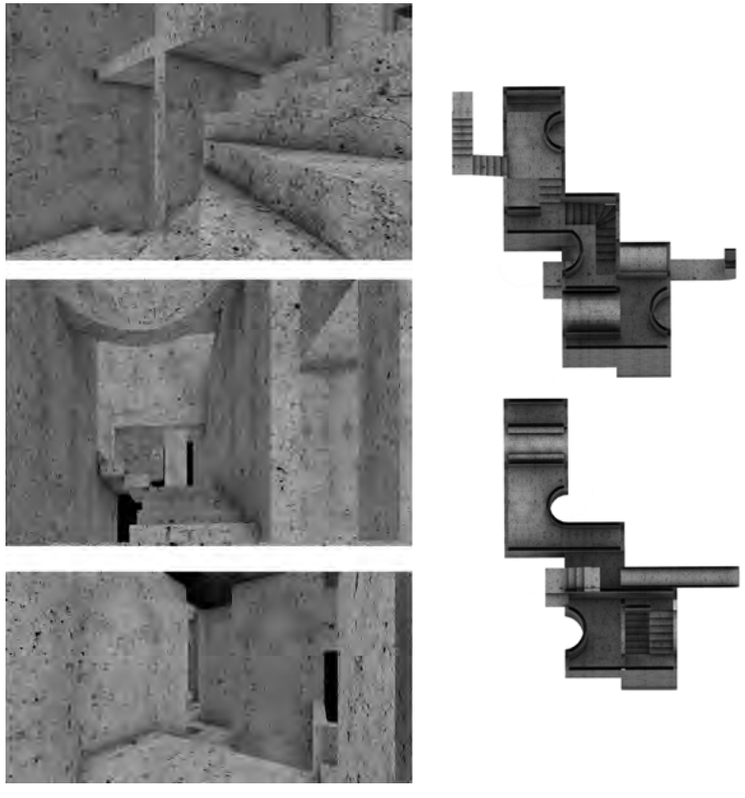


Figure 32: Staircase Connecting Outdoor and Underground Spaces

Figure 33: Carbon Concrete and Graphene [Image Source: Internet]

To further enhance the idea of this vent and soil, moments have been created where the ground can be touched from within. It allows us to fully appreciate depth of the intervention.

Carbon Concrete and Graphene

Carbon concrete is understood to mean a compound of concrete and carbon fibres.[4] Grid-like Carbon Fibre mats made of carbon fibres are placed between fine concrete layers. In the injector process devised by researchers at the University of Augsburg, the fibres are sprayed systematically into the concrete. This produces a building material with extreme tensile strength. There are plenty of good reasons to do so: in order to protect the steel from corrosion, thick concrete layers are necessary. However, the manufacture of cement not only consumes vast quantities of scare raw material sand but is also linked to high CO2 emissions. Carbon on the other hand does not corrode. The building material can be produced form any other material that contains carbon. In current projects the Ausburg researchers use something called lignin for example, a waste product, which is produced in timber production.

Graphene is considered to be the world's thinnest, strongest and most conductive material - of both electricity and heat.[5] Graphene has the potential to revolutionize entire industries - in the fields of electricity, conductivity, energy generation, batteries, sensors and more. Carbon that is 5% of steel's density but 200 times Its strength. As graphene is also strong and light, it means that it is a great material for making heat-spreading solutions, such as heat sinks or heat dissipation films. This could be useful in microelectronics (for example to make LED lighting more efficient and longer lasting) Graphene is also extremely high surface-area to volume ratio. This makes graphene a very promising material for use in batteries and supercapacitors. Graphene may enable batteries and supercapacitors (and even fuel-cells) that can store more energy - and charge faster, too. Graphene has a lot of promise for additional applications: anti-corrosion coatings and paints, efficient and precise sensors, faster and efficient electronics, flexible displays, efficient solar panels, faster DNA sequencing, drug delivery, and more.

[4] "A Hard Bone: Carbon Concrete from Augsburg." IDW, Klaus P. Prem Press - Public Relations - Information, 10 Nov. 2016, https://idw-online.de/en/news660731. Accessed 11 Feb. 2021.

[5] "Graphene Applications: What Is Graphene Used for?" Graphene, 12 July 2020, https://www.graphene-info.com/graphene-applications.

Figure 34: Robust Interior View of the Memorial

Figure 35: Space Below Ground Level Exhibiting the Building Material and the Memorial Seams

Figure 36: Entrance of the Memorial - The Procession

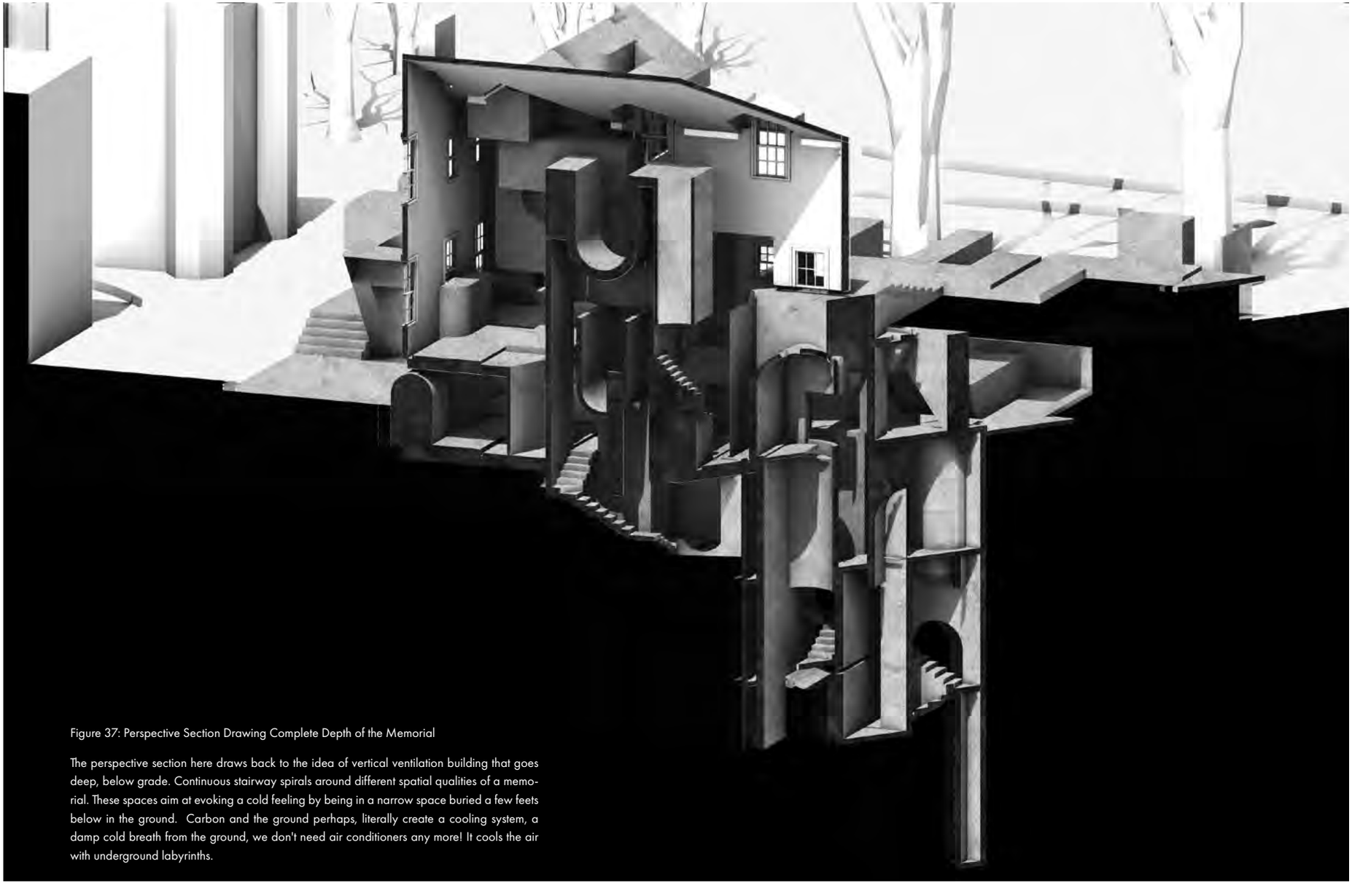
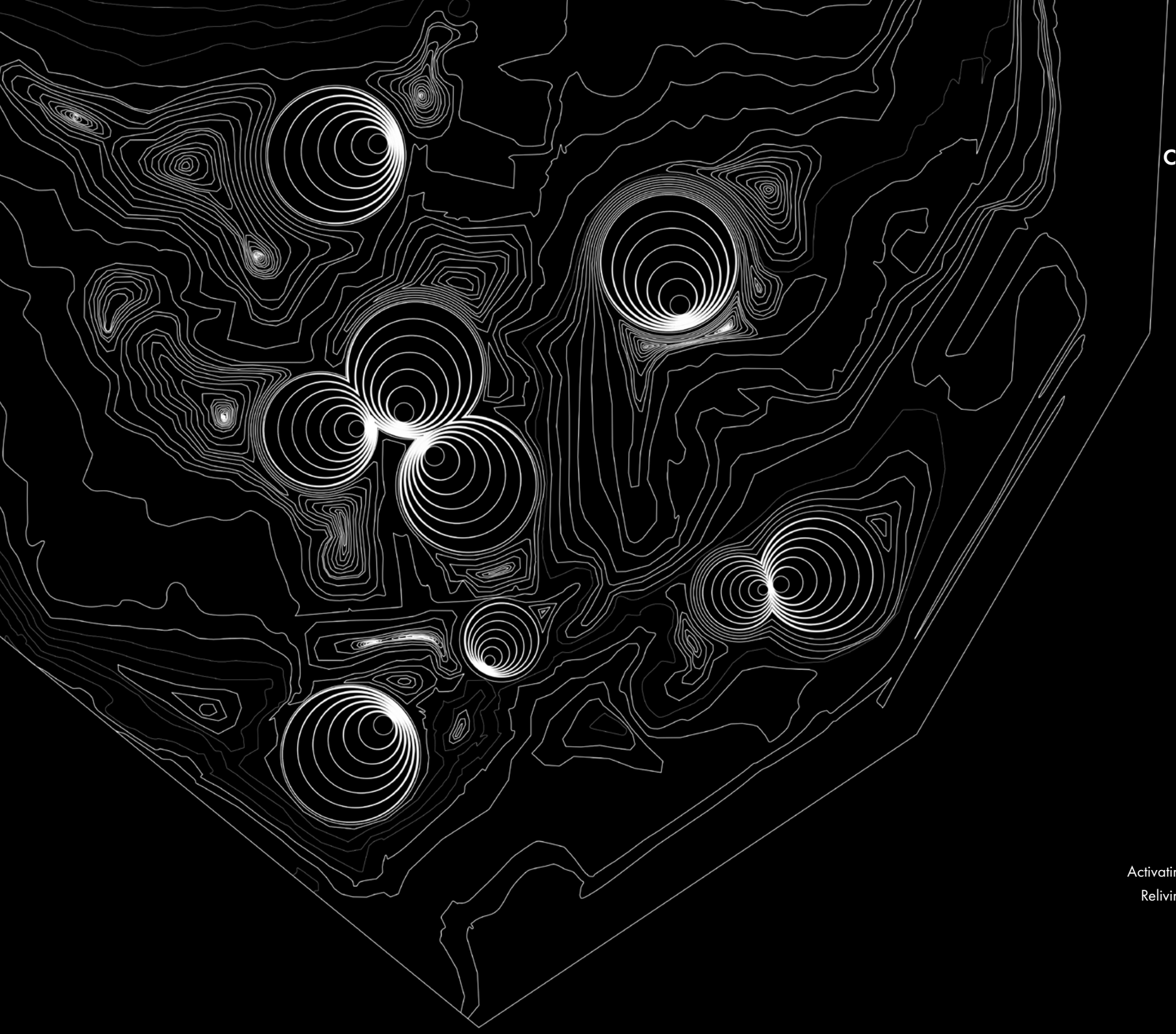


Figure 37: Perspective Section Drawing Complete Depth of the Memorial

The perspective section here draws back to the idea of vertical ventilation building that goes deep, below grade. Continuous stairway spirals around different spatial qualities of a memorial. These spaces aim at evoking a cold feeling by being in a narrow space buried a few feets below in the ground. Carbon and the ground perhaps, literally create a cooling system, a damp cold breath from the ground, we don't need air conditioners any more! It cools the air with underground labyrinths.



Chapter 02

A Mine

Activating The Memory

Reliving The Memory

Figure 38: Physical Model of the Crater Intervention

Figure 39: Depiction Of Striations With Photographs Of Material Experiments

Figure 40: Energy Diagram Over Section of the Crater

The aim of this project is to excavate stored carbon sequestered from the ventilation tower over the span of 30 years, and propose habitation in these carved spaces while the carbon is transformed into new building materials. Creating experiences within varied time frames is what the crater offers. Visitors experience living in the crater for a year, produce their own food and energy, and utilise the space as their laboratory to explore the properties of carbon. When the island isn't open for public access for 6 months, visitors would rely on the goods and electricity produced in the other half of the year. The crater lives on the principles of a retreat where carbon is your energy, pick your timeline and be part of the process. The journey begins from crater being an exhibit in itself with it functionally being a machine, a micro climate.

Deposition forms layers and thus creates textures. Conducted material study observes sedimentation and settling down of the substance. As a result patterns of striations and porous accumulation at places can be observed. Change in the texture of carbon over the years would speak about positive changes in atmosphere and thus about reduction of CO2 levels.

Figure 41-46: Called Out Spaces From Physical Crater Model

Figure 47: Cut Plans of the Crater Prototype

The crater addresses the thought of independent living where the systems of the house could be powered by it's own building materials. In order to make this functional, a mixed use aspect is associated with the scheme, where the public and the private sectors intervene in an indoor setting. Excavation of the crater forms circular rings where the layers of the carbon material are evident. In this process of excavation, mounds were developed to aid the temperature control for habitation beneath, used for community farming and define new circulation on the site. Mounds also are opportunities to connect energy generating functions around the crater visually and by circulation as well. Using the carbon as regenerative material and a host to energy, the sustainable structure provides for the visitors and takes care of itself by becoming a powerhouse. Simply, movement too, with the concept of piezoelectricity, would contribute as a resource.[1]

[1] MIT engineers have discovered a new way of generating electricity using tiny carbon particles that can create a current simply by interacting with liquid surrounding them. Read more about carbon properties and particle power on phys.org., https://phys.org/news/2021-06-material-carbon-nanotubes-electricity-scavenging.html

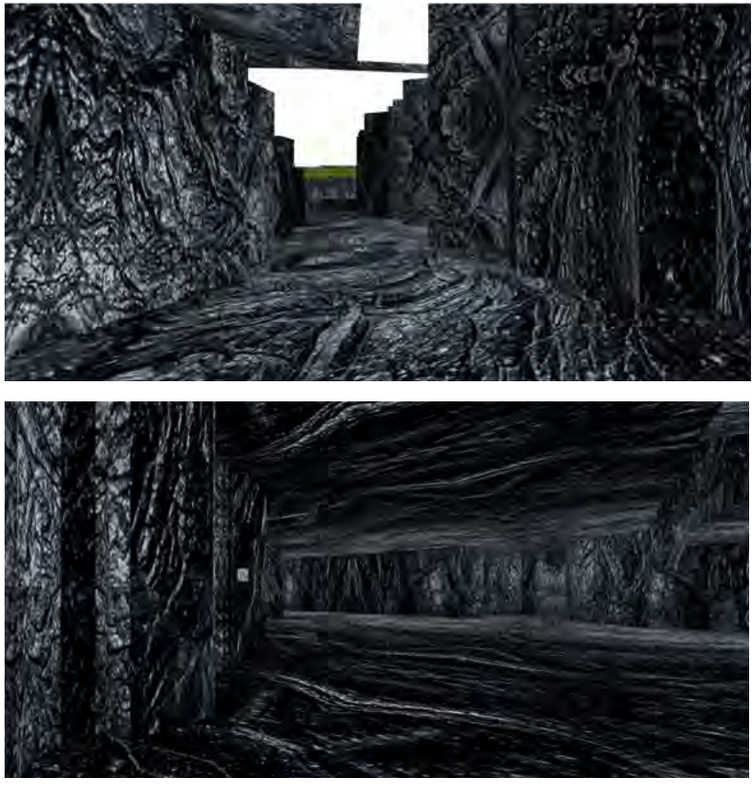


Figure 48: Excavated Spaces from Carbon Mines

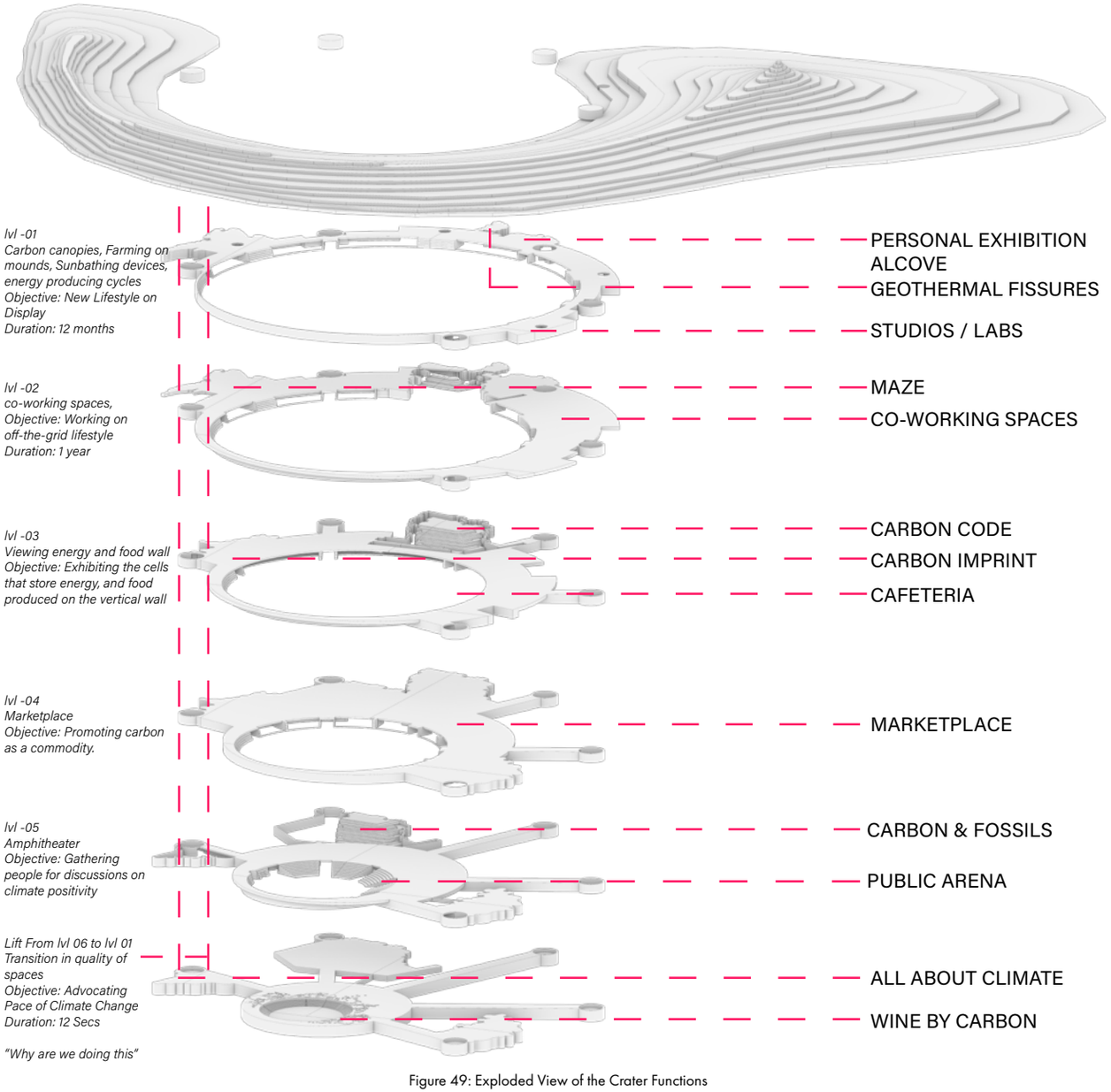


Figure 49: Exploded View of the Crater Functions

Over the years, the sediments formed by accumulation of captured carbon can be seen in multiple layers of carbon material. The island is a block of carbon material, a platform for innovation in the way we construct and design habitats. All this has led to a ruined state of material being used for futuristic living. The visitor experiences these spaces in a vertical spatial procession so that the desired ambiance of mystery is achieved. Part of the crater has steep slopes to put the new carbon material on display as in an exhibition. By defining a circle of sustainability between the house and environment, between visitors and residents, architecture happens in between the seams and folds of these multiple facades and systems where carbon material plays the role of a binder. The Craters envision communal life, where people have the opportunity to communicate amidst their centrally facing green spaces and gather at the core for communal activities. South facing elevations are covered with solar panels which suffices the energy need of te Crater all round the year. Facades and mounds produces food[2] for the year and outgrows the monotonous carbon material. The property of carbon porosity will allow the ground water to gather and form a pool in the basin of the crater, which is used as a landscape asset and embraces the reflective quality of water. By defining a circle of sustainability between the house and environment, between visitors and residents, architecture happens in between the seams and folds of these multiple facades and systems where carbon material plays the role of a binder. The Crater further integrates geo-thermally powered underground coil systems for water supply, electricity and communication systems. These are systems that make this house a city of its own, thus making it off-the-grid and sustainable.

[2] Plants take in carbon dioxide and convert it to energy for growth. See, Role of Carbon in plants, https://www.gardeningknowhow.com/garden-how-to/soil-fertilizers/role-of-carbon-in-plants.htm

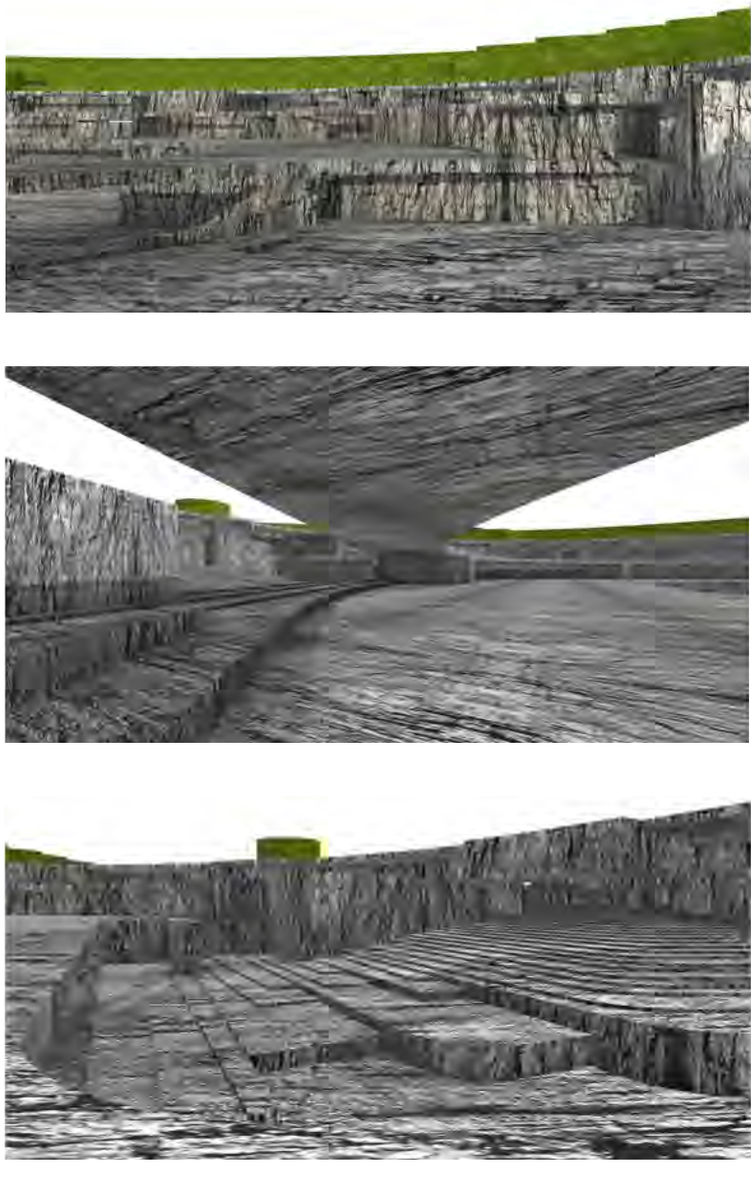


Figure 50: Called Out Spaces of the Crater

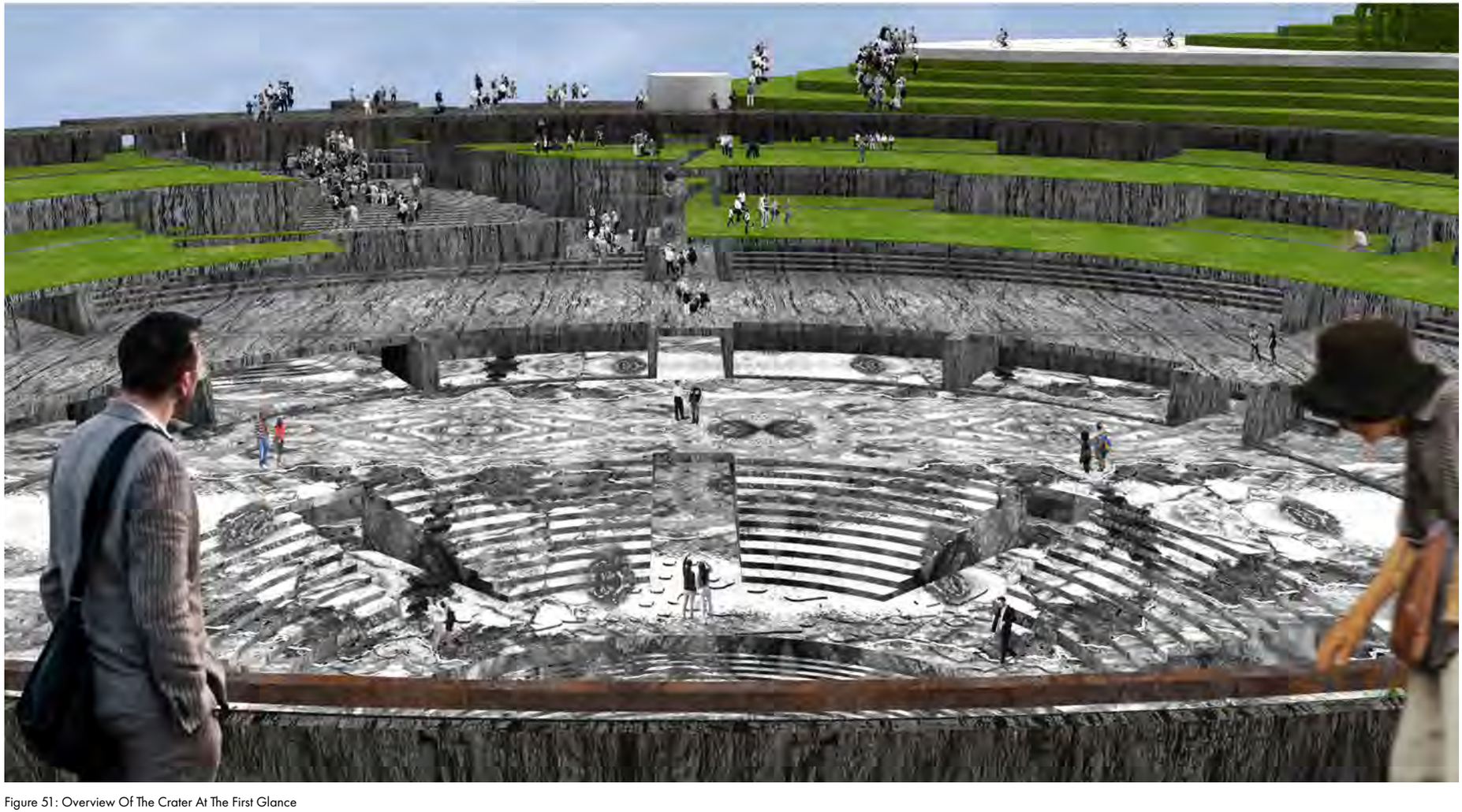


Figure 51: Overview Of The Crater At The First Glance

Figure 52: Vertical Plantations Outgrowing the Carbon Material

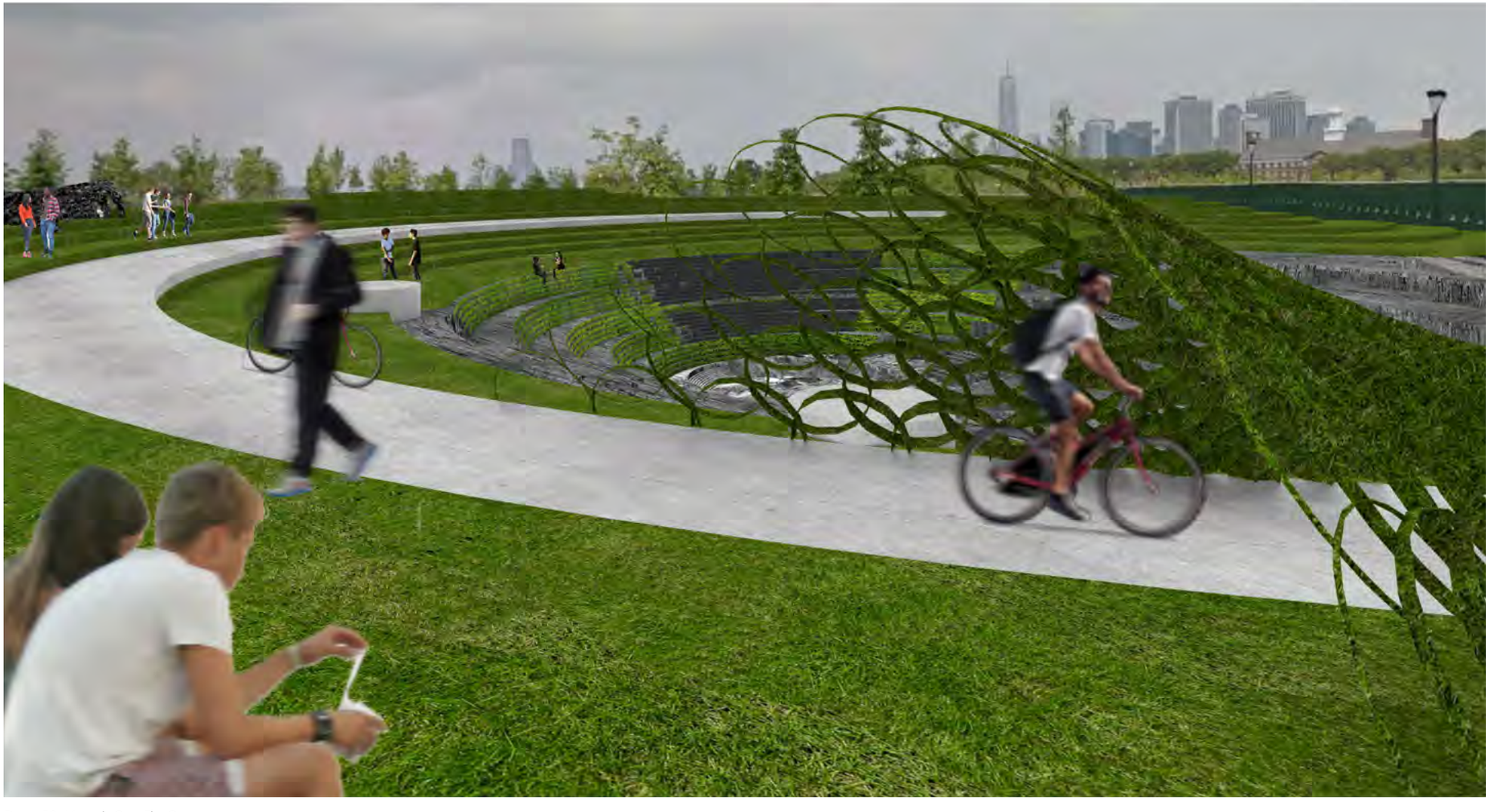


Figure 53: Mounds Over The Crater

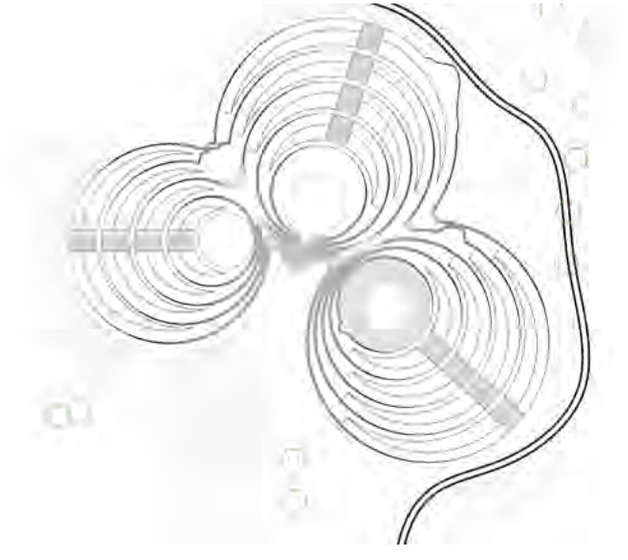


Figure 54: Layout For Three Craters Coming Together

Figure 55: Anticipated Governors Island Layout

Chapter 03

A Marketplace

Receding Taken Steps

Buying More Time

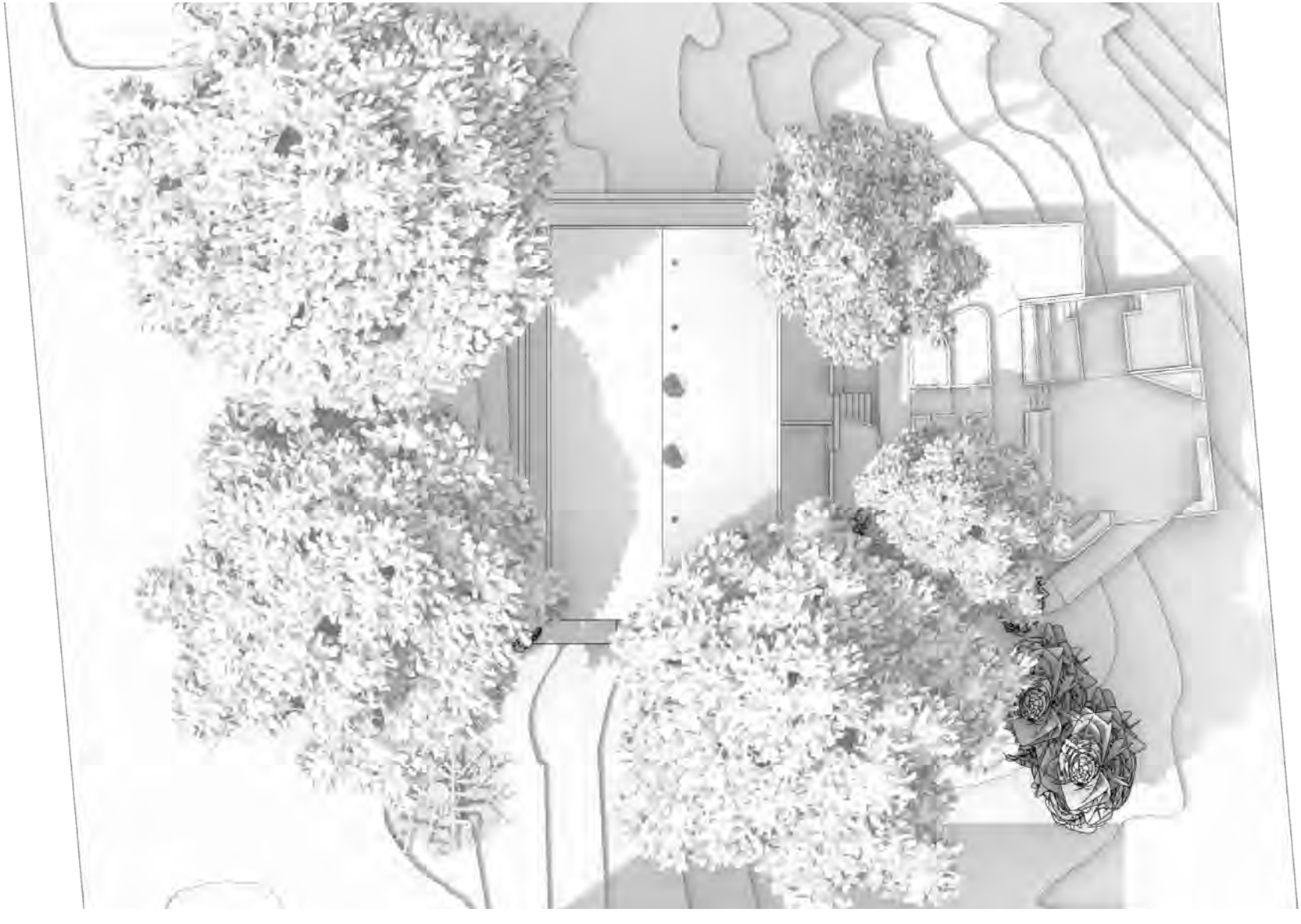


Figure 56: Building 03and Context Layout, Nolan Park

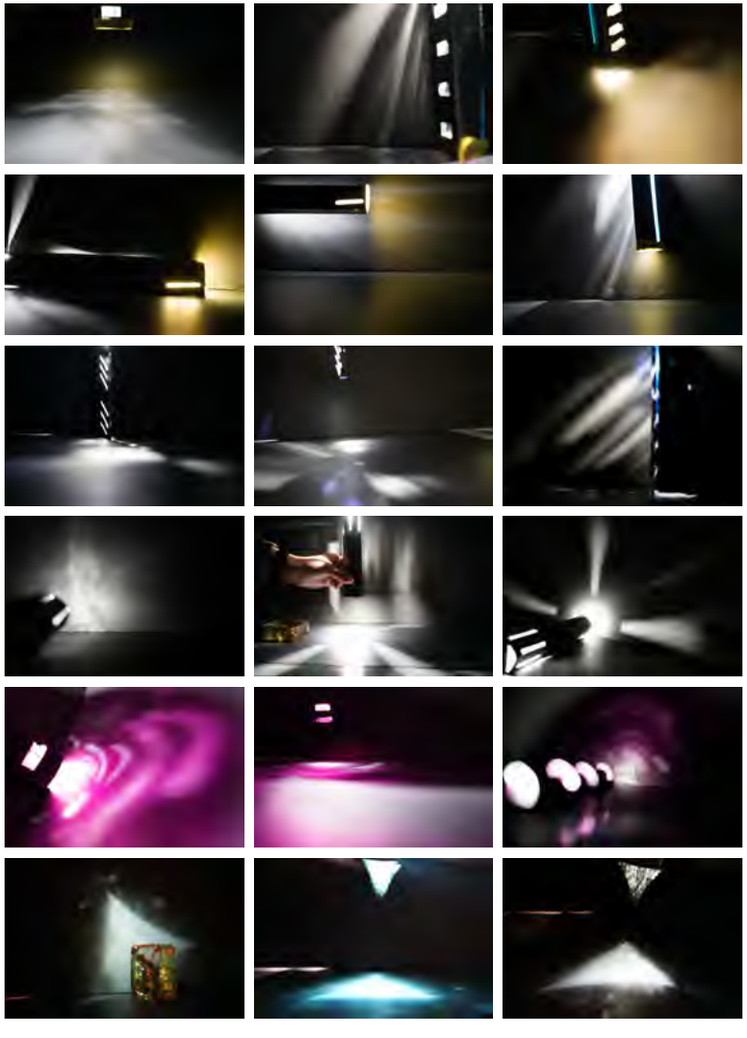


Figure 57: Light Testing Models With Different Openings & Colors To Understand Warmth And Darkness.

Upon studying the Building 03 site context and sun movement, we can conclude that the interior spaces are sparsely lit with the need for artificial lighting almost throughout the day. The aim of this project is to generate a source of renewable energy, study the psychology behind lighting, and minimize the number of light fixtures required by amplifying the source of natural light. The Light Shaft drastically reduces the lighting fixtures and the electricity load. It is an indirect source of natural light that illuminates the space with the help of reflection and refraction. The opening are designed as per the required light intensity and effects in a particular space based on it's function and lux requirements.

This is a 'Green Core' collaborative project amongst students leading topics of Electricity, Geothermal, Water, Waste and Material Fabrication; to device a self sustaining house, which perhaps aid to the entire Nolan Park on Governors Island and is an acting prototype for architectural designs.

Figure 57: Diagram for Energy Requirements Calculated for Nolan Park

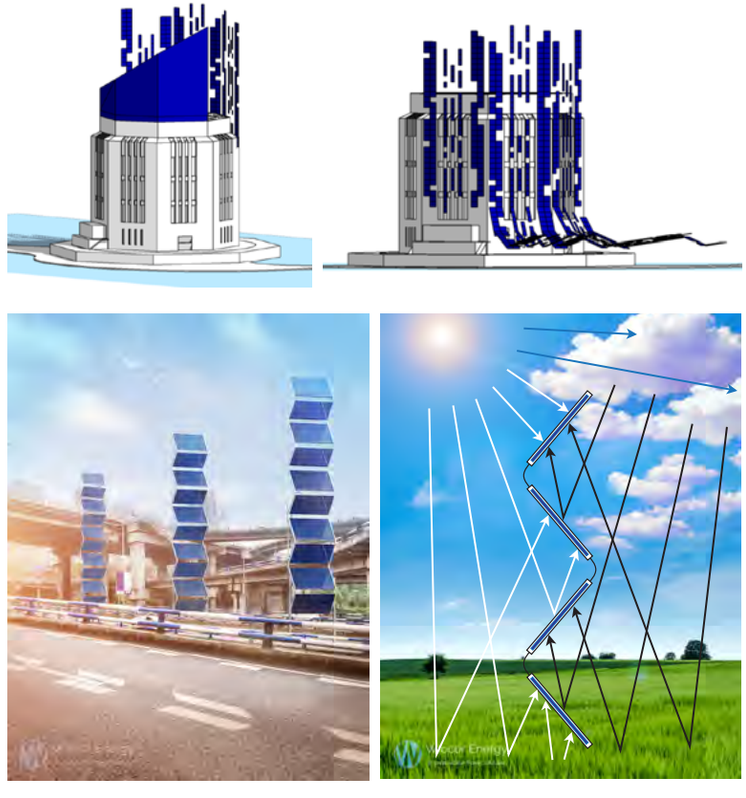


Figure 58: Bi-facial solar panels as an installation on the Ventilation Tower, Governors Island

Figure 59: Bi-Facial Solar Panel Technology and Installation

[Solar Power Technology is sourced from "WIOCOR Energy.", https://wioenergy.com/solar-towers.html.]

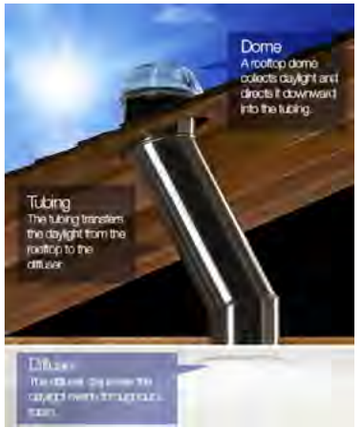


Figure 60: Diagram For Different Light Shaft Positions
Figure 61: Solar Tube Lighting [Solar Tube Lighting System is sourced from "Solatube", https://solatube.com/residential/tubular-skylights/.]

One elevaction of the elevator lit from behind

Capturing natural light from SW direction

Floor and back lit upto 3' in restrooms

Light directed through slits on kitchen counter

Figure 62: Concept Diagrams For Light Requirement in Different Spaces

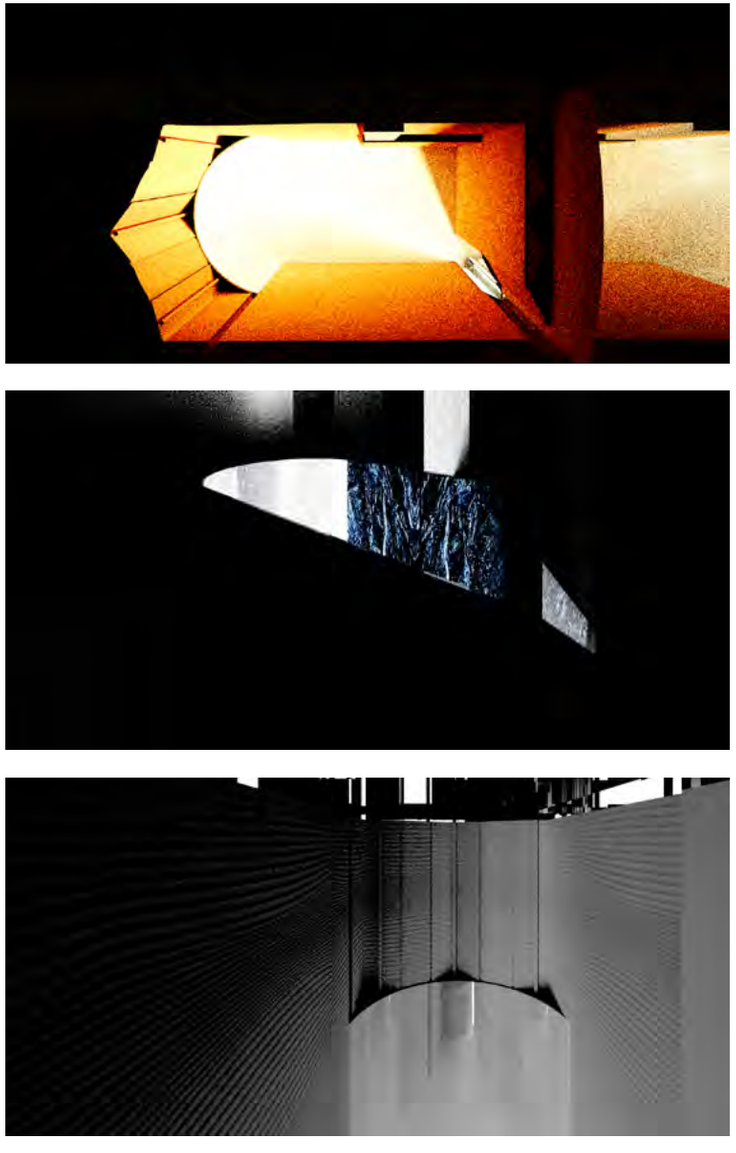


Figure 63: Testing Quality of Light, Reflectivity and Material Tactility within the Same Space

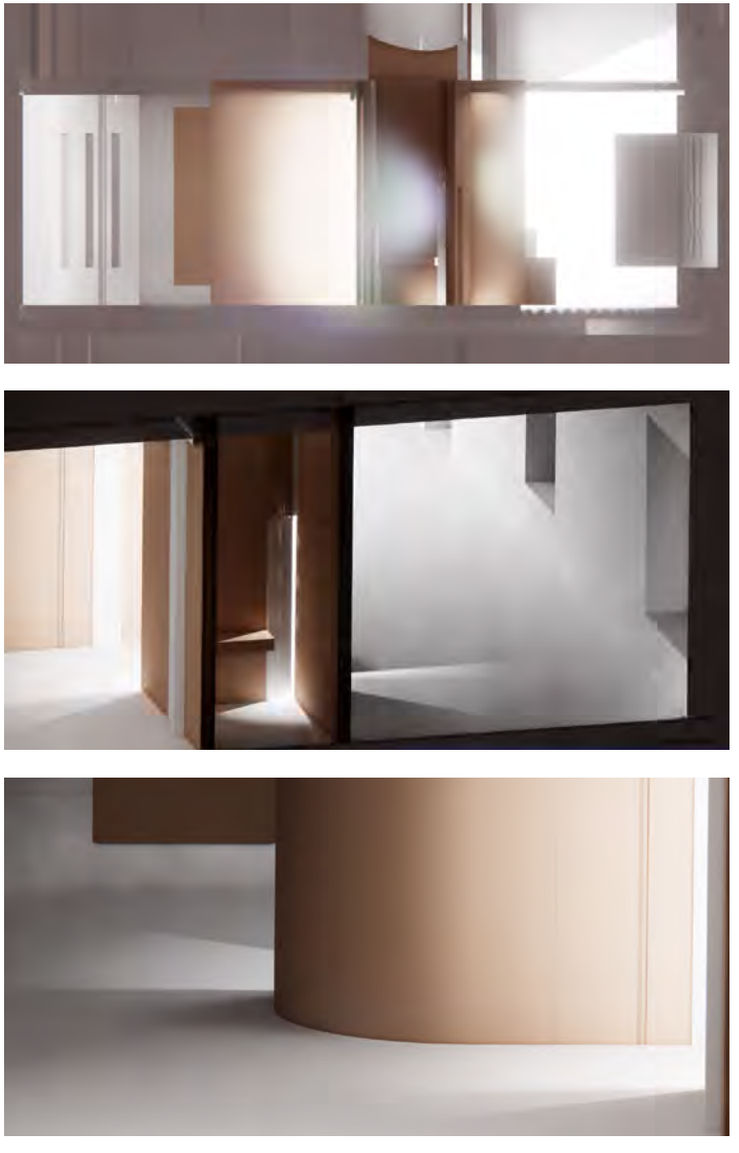


Figure 64: Testing Light Intensity Reflected Within The Shafts & Made To Travel In The House On Enscape

Figure 65: Light Shafts Installed within the Green Core

Figure 66: Building Section Explaining The Reflection Within Light Shaft And Openings Created As Per The Lux Requirement Of The Space

Figure 67: Axonometric View of the First Level

The 1st Floor is a workspace and has all the utilities- Lobby, Restrooms, Kitchenette. Here, the periphery is brighter than the center because the windows are used as a source of light too. The light shafts open up in the center which is deficient of natural light, and occupies the rooms because of the reflective surfaces.

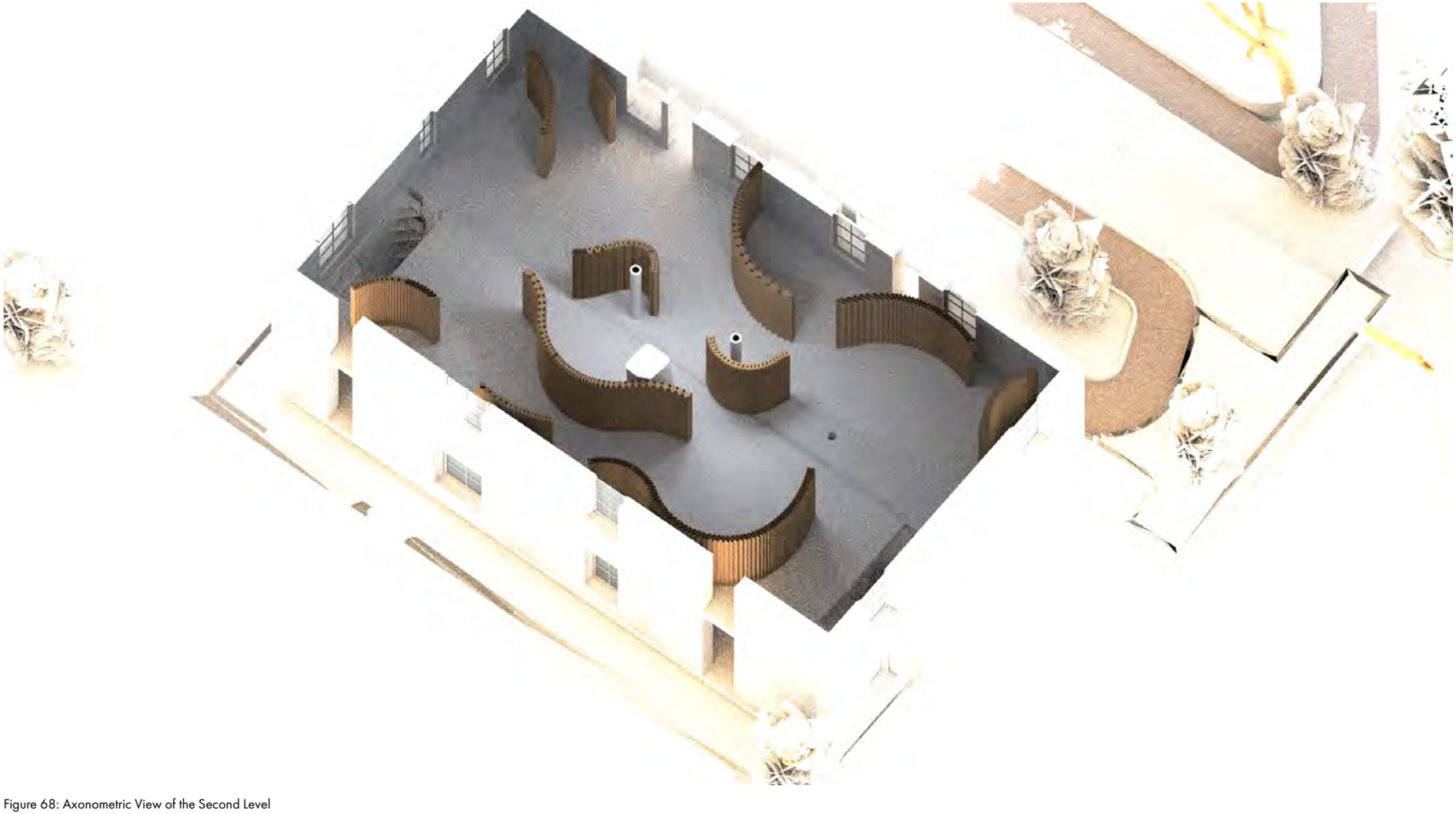


Figure 68: Axonometric View of the Second Level

The 2nd Floor is a dedicated exhibition space. Geothermal collapsible walls are used to act as reflective panels that can be adjusted as per the sun movement. Here, the periphery remains dark, to feel the drop in temperature important for Geothermal designer; the center is bright with the help of reflecting roof soffits and light shaft.

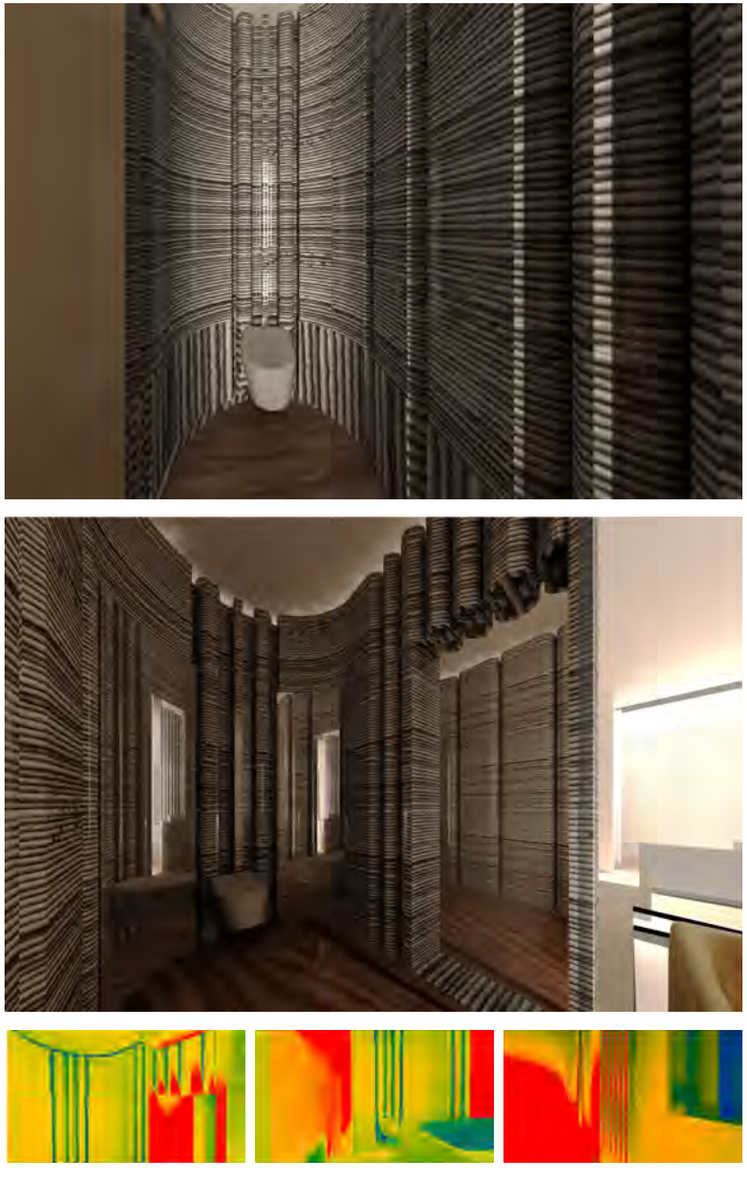


Figure 69: Rendered View of the Restroom Interiors with Light Diagrams to Understand the Shaft's Intensity

Figure 70: Rendered View of the Elevator and Lobby with Light Diagrams to Understand the Shaft's Intensity

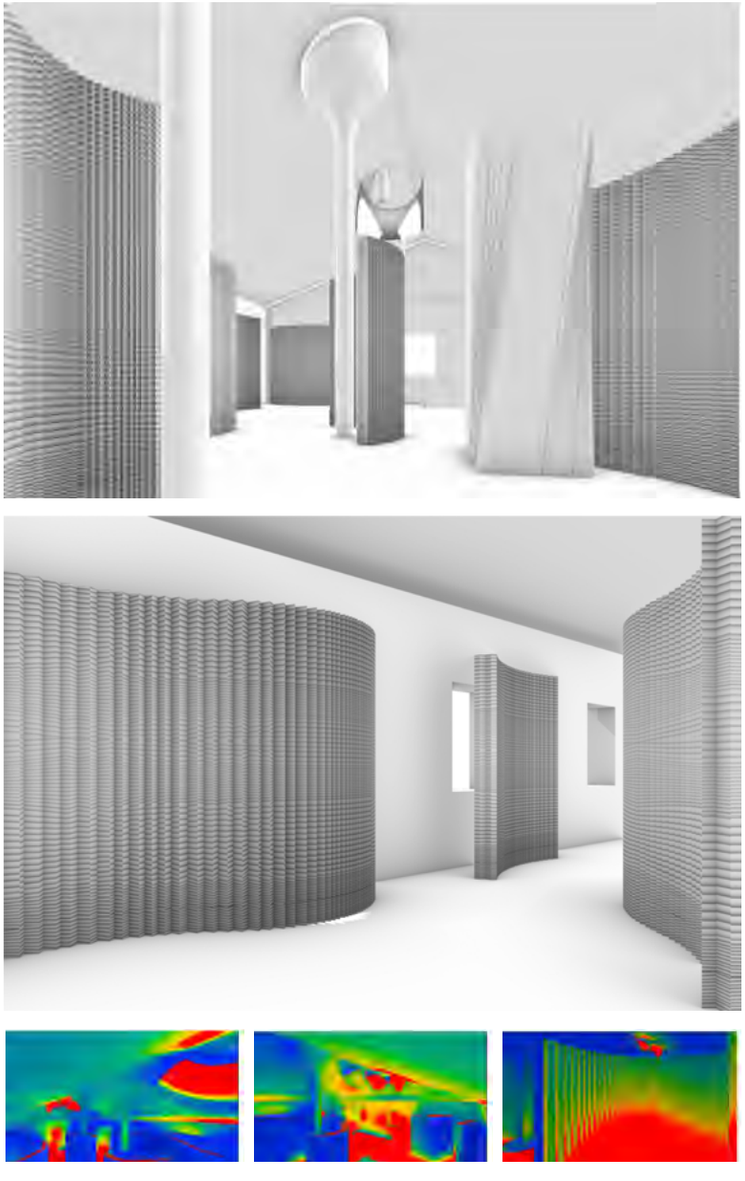


Figure 71: Rendered View of the Partitions with Light Diagrams to Understand the Shaft's Intensity

Figure 72: Rendered View of the Workspace with Light Diagrams to Understand the Shaft's Intensity

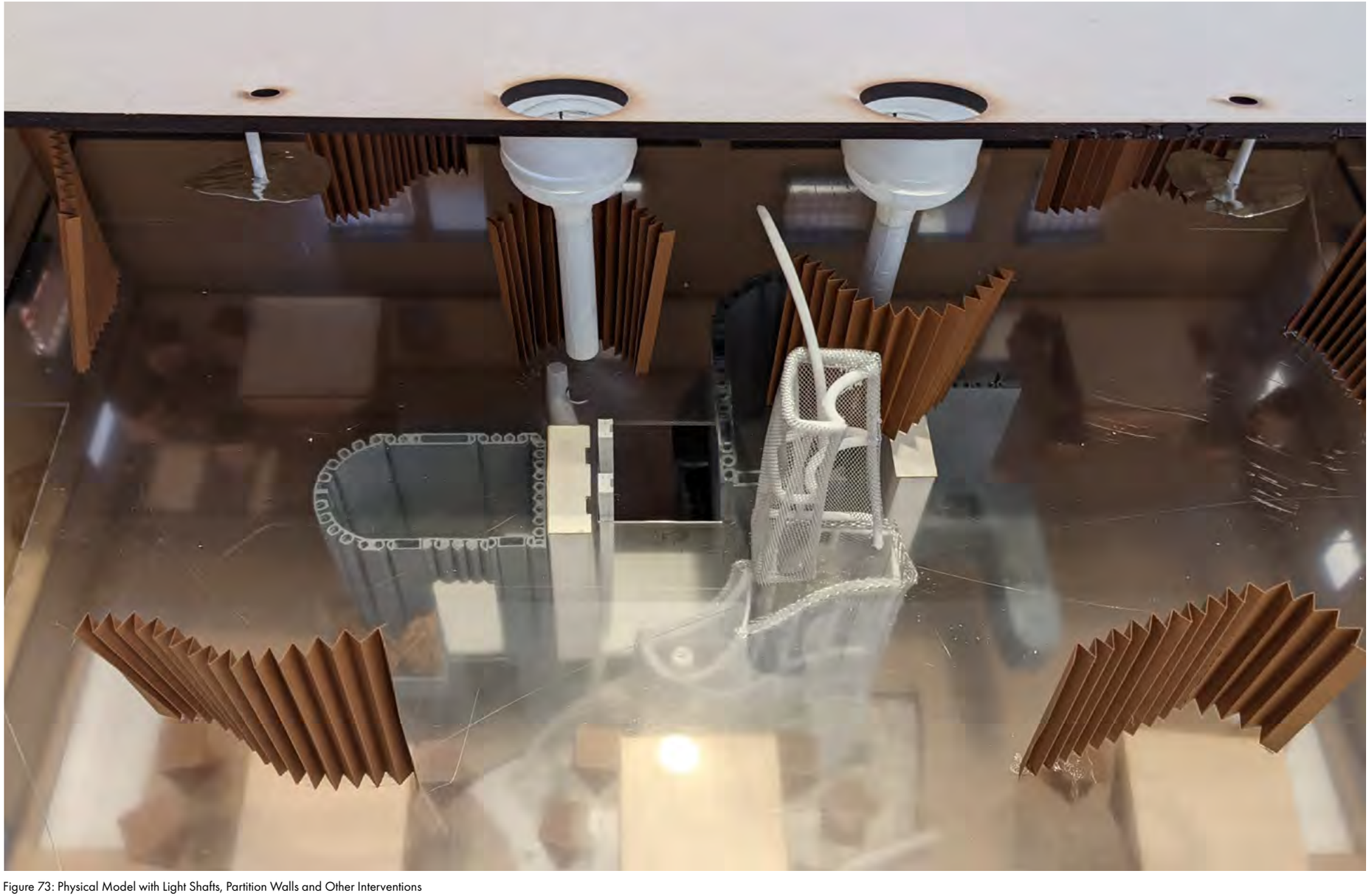


Figure 73: Physical Model with Light Shafts, Partition Walls and Other Interventions

Chapter 04

Communicating Climate Science Through The Arts

Climate Literacy Workshop on Governors Island

Communicating Climate Science Through The Arts

Guerilla Science x Pratt 2021

Our Approach

Following a year of sustained global stress caused by the COVID19 pandemic, 2021 saw new levels of climate change induced disaster. Widespread flooding across the world, devastating wildfires across the Pacific Northwest, and Hurricane Ida battering the Northeastern corridor are just some of the few challenges we've faced in this year alone. Humanity's future is now one in which climate disaster is, sadly, an existential threat. Fortunately, it is also largely within our power to stop it.

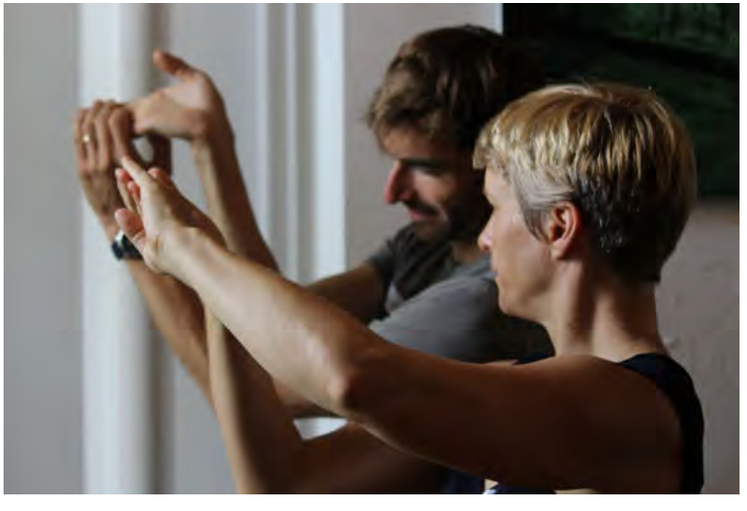
To do so is to take a complex and ever-changing problem and combat it with a novel, multidisciplinary approach involving strong scientific and political leadership. It requires social systems and communities to adapt and change and scientists, citizens, and creators to work together to develop new solutions to even newer problems. As such, we could think of no better focus under which to bring together our nascent community of scientists, architects, designers, and artists for the latest Communicating Climate Science through the Arts workshop.

"The Communicating Climate Science through the Art program was a fantastic way for our young people to engage with cutting edge research and meet real scientists. The team's interdisciplinary and equity-focused approach really resonated with what we aim to achieve at the BEAM Center, and we look forward to working with them again."

- Brian Cohen, Executive Director, Beam Center

The active learning modules included creating engaging events, rationales for public engagement with science, audience profiling, and planning for access and inclusion.

Participants chose to join one of three different co-design sessions, each led by a practicing scientist or STEM professional working in climate resilience who shared their latest research as inspiration, and helped facilitate the development of the group's activity.



Many people who believe that science is "not for them", have only ever encountered it via formal, largely passive, classroom experiences. The conference is designed for individuals interested in creating experiences that mix science with installation art, theatre, and play, to introduce new audiences to the excitement of scientific discovery and social relevance of climate science.

Putting talented and enthusiastic individuals together in the same room is only the first step in forming a Community of Practice. To support our community to create and develop their own public engagement activities we structured a multi-tiered process consisting of a series of team building activities, active learning modules, and co-design sessions in which participants created their own climate-themed public engagement.

Pollinator's Pavilion - Reimagining Pollination

One out of every three bites of food Americans consume comes from a plant pollinated by honeybees or other pollinators. Yet 90% of pollinating bees are not honeybees: native bees live in dirt, reeds, cracks in rock and other unobtrusive spaces. We know relatively little about their nesting habitats except that their natural habitats are greatly diminished and under constant threat by development. Which in turn threatens the pollination of 75% of global non-agricultural environments. How can we build habitat for the species that are foundational to our food production? How can we introduce the idea of native bees to inform people's understanding of critical and overlooked participants in their gardens and green spaces? [1]

The Pollinators Pavilion is a constructed or artificial habitat for native bees. Its rounded spiky form is shaped like a bee's bristling compound eye and a grain of pollen. These "spines" serve as canopies to protect bee nesting tubes from rain while housing a solar-powered monitoring system (camera and microprocessor). The monitoring system inside the Pollinators Pavilion's panels harvests images of the solitary bees, which relay to a database and AI model to automate insect identification, and help fill data gaps on these pollinators. Much remains unknown about the 4,000 species of solitary bees in America. Playing on the form of the bee's compound eye, our Pollinators Pavilions produces new habitat for solitary bee species at the Old Mud Creek Farm, a 2,500 acre model of regenerative organic agriculture in New York's Hudson Valley. The pavilion's innovative paneling system houses hundreds of nesting tubes for solitary bees and a solar-powered electronic monitoring platform. The diverse micro-conditions that we develop with our pavilion's novel paneling system provide artificial nesting structures for solitary bees and models environmental stewardship in our Anthropocene age.[2]

[1] Harrison, Ariane. Pollinators Pavilion Training Brief, Communicating Climate Sciene Through The Arts. Page 02.

[2] Ibid. Page 03.

Blueblocks - Reimagining Land/Water Divide

We are woefully unprepared for the sea level rise and stronger storms that come with a changing climate. But it's important to recognize that the climate mitigation and adaptation solutions we need are already here. These include renewable energy, replanting ecosystems, regenerative farming, retrofitting buildings, electrifying transportation and reducing waste.[3] How can we as designers support conversations about positive human and non-human co-habitation of the urban environment to create more diverse urban coastal habitats? Could we imagine invisible habitats, and make them visible and comprehensible to the public at large? [4]

A living prototype, exploring how plants and biophilic structures can improve the waterways of the Hudson River Estuary, BlueBlocks is a collaboration between thread collective and the RETI Center. BlueBlock Gardens create small salt marsh archipelagos that provide a range of ecological benefits for humans and other species: they increase habitat for a broad range of marine life, introduce plant ecologies at engineered urban edges, improve water quality, and serve as platforms for hands-on high school science. The constructed landscapes are designed specifically for urban coastal conditions and communities, linking positive ecological impacts and sustainable production practices, jobs, and education. We are in the process of building and installing a series of prototypes, following our first successful floating pilot in March of this year. [5]

[3] Maltby, Elliott. BlueBlocks Training Brief, Communicating Climate Sciene Through The Arts. Page 05.

[4] Ibid. Page 13.

[5] Ibid. Page 06.

Biogels - Reimagining Backyard Waste

Urban manicured lawns are ecologically unsustainable, require extensive resources, water, fertilizer, soil, maintenance and care. Yet these grasses have psychological associations to social order and safety. A well kept lawn affords visibility and surveillance over shared public space. In our suburbs, lawns are a symbol of wealth, beauty, home ownership, and the American dream. How might we as designers engage with wider audiences to rethink our shared relationships with urban grasses, nature, and our own diverse bodies? How might we engage with our shared biases around safety, beauty, aging, and time? [6] Field is a bio-arts laboratory and research space that creates new discourse around our relationships with nature, time and the body. Field prompts audiences to reflect on their own relationships to manicured public lawns and engage within their cities to rethink the homogeneity, order, and control present within the built environment. Ultimately, Field asks us to reflect on our own biases, assumptions, and desires while navigating shared space.[7]

Field is a critique of the urban typology of the manicured civic park, replicated within cities the world over, and the billion-dollar industry it advances. It is estimated that lawns comprise more than 3 times the acreage of agricultural corn production in the US, making them the single largest irrigated crop—covering about 128,000 sq.km. of public and private land[8]. In recent years, movements such as "no-mow" lawns are being popularized in order to rethink our relationships with these grasses. Field seeks to shift our ecological and aesthetic understandings of these grasses, and to rethink the current policies embedded within contemporary urban development programs that perpetuate their use. The project is a means to engage city workers, planners, and architects to generate discourse around power, space, and expanded ecology. The resulting landscape interventions engage urban dwellers from all walks of life. They are affective and embodied experiences of the urban 'wild' for adults and children alike.[9]

[6] Aggarwal, Mrinalini. Field Training Brief, Communicating Climate Sciene Through The Arts. Page 05.

[7] Ibid. Page 06.

[8] Cristins, Milesi. A Strategy for Mapping and Modeling the Ecological Effects of US Lawns. Page 01.

[9] Aggarwal, Mrinalini. Field Training Brief, Communicating Climate Sciene Through The Arts. Page 09.

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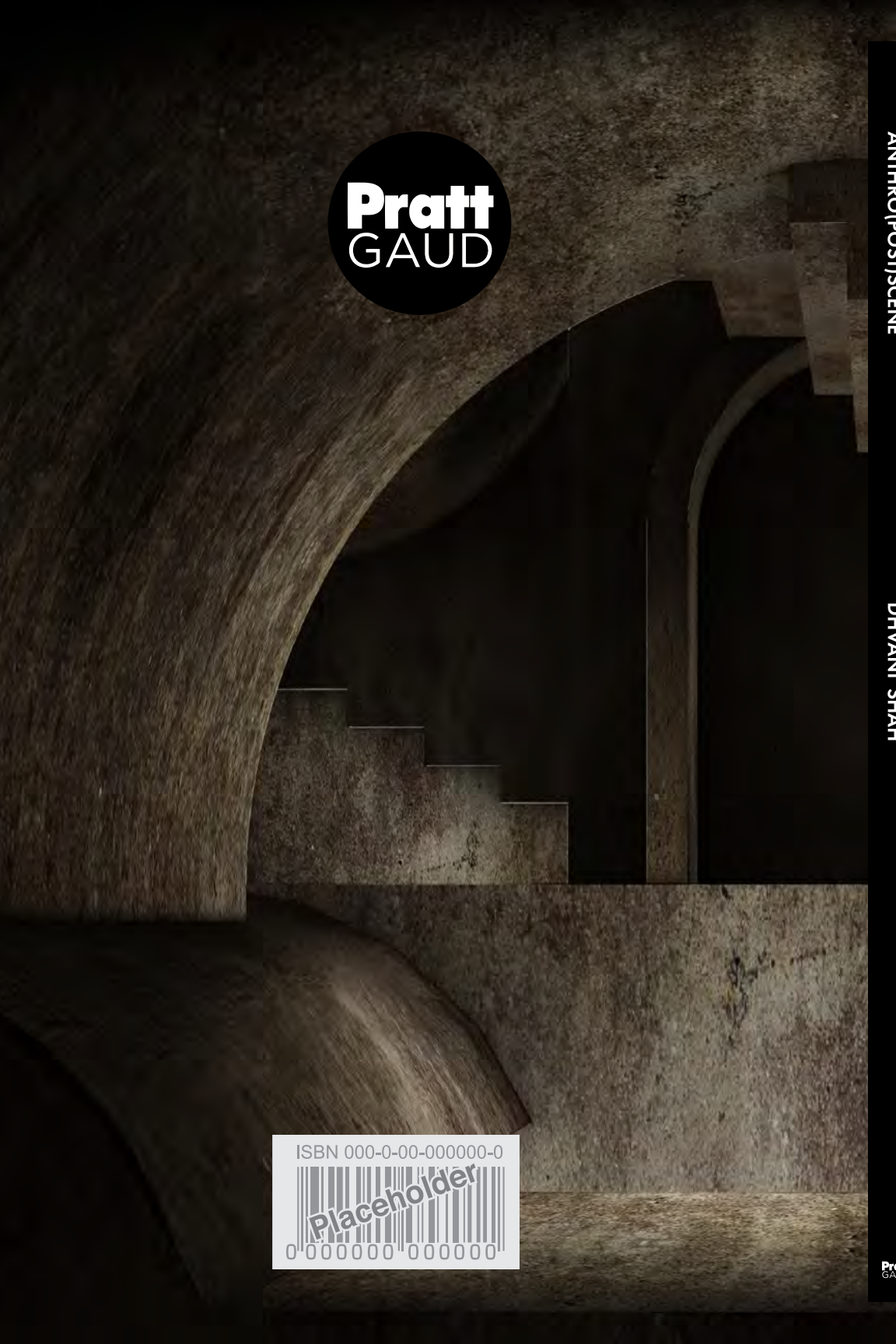

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