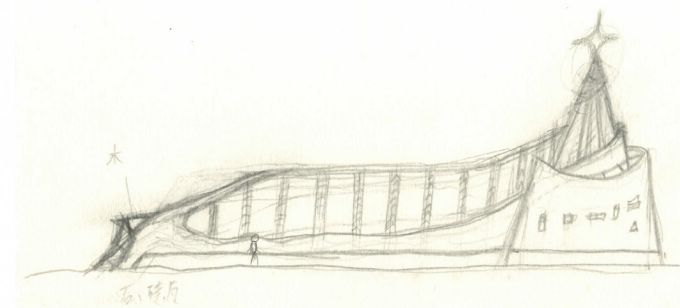




# Earthly Matters of Cosmic Awareness

A 2023 Thesis of Architecture



# **Earthly Matters of Cosmic Awareness: A 2023 Thesis of Architecture**

Henry L. Mitchell

Thesis submitted to the faculty of  
**Virginia Polytechnic Institute and State University**  
in partial fulfillment of the requirements for the degree of

**Master of Architecture**

**James Jones, Chair**

**Henri T.de Hahn**

**Kevin W. Jones**

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Blacksburg, Virginia

Keywords: Awareness, Passive Design, Off-grid, Greenhouse, Energy, Water, Food, Seed, Seed Library, Resilience, Education, Self-sufficiency, Sustainability, Cosmic, Space, Moon, Lunar Base, Earthship, Philosophy

# Earthly Matters of Cosmic Awareness: A 2023 Thesis of Architecture

Henry L. Mitchell

## Abstract

Architecture, as a discipline, has the potential to serve as a catalyst for cultivating an awareness of our intrinsic connection to the Earth and the broader universe. However, in the contemporary world, architectural practices frequently tend to alienate us from the natural environment, compelling many of us to inhabit indoor spaces reliant on centralized utility systems. This reliance, in turn, exerts significant stress on the Earth's ecosystems.

The essence of architecture should instead lie in its capacity to engage with the surrounding natural elements, including the sun, wind, earth, and rain, thereby prompting individuals to acknowledge their geographical and planetary context. By harnessing these natural forces at the local level, architectural structures could autonomously provide their occupants with essential resources such as energy, water, and sustenance throughout the year.

This thesis embarks on an exploration of the feasibility of integrating these principles of passive design into architectural structures, with the overarching goal of imparting experiential learning opportunities to the broader public. Through this endeavor, architecture can transcend its conventional role and emerge as a conduit for disseminating knowledge and awareness about sustainable living practices. Ultimately, this re-imagined role for architecture can play a pivotal part in catalyzing the ongoing human evolution towards enhanced health and resilience, both as individuals and as a species.

# Earthly Matters of Cosmic Awareness: A 2023 Thesis of Architecture

Henry L. Mitchell

## General Audience Abstract

Architecture should make us aware of how we are connected to the earth and by its extension, the universe. In today's world, it often closes us off from nature instead. Many of us are plugged in to an indoor culture that relies on centralized utility infrastructure to sustain, which often puts great strain on the natural environment.

By interacting with surrounding natural phenomenon such as the sun, wind, earth, and rain, our buildings should remind us of our geographical and planetary context. By gathering these natural forces locally, a building could supply its inhabitants with energy, water, and facilitate food production year round.

This thesis aims to explore how a building could demonstrate these principles of passive design to the general public by using architecture as a vessel for experiential learning.

This is the role Architecture can play in the process of human evolution towards becoming a healthier and more resilient species.

# Acknowledgments

This is a message of warm thanks to the people who has shown me unconditional kindness and support.

My deepest thanks goes to my committee, for investing their precious time and effort into me and my work, and for being so good at what they do:

James Jones for your interest, inspiration and guidance throughout this process.

Henri de Hahn for your character, wisdom and unrelenting help toward my defense.

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All the faculty and staff at Virginia Tech who assisted me as we crossed paths.

My mother, for everything you have ever done for me.

My uncle, for guiding me to this particular program, and for all the big helps you gave me along the way.

My dear friends and colleagues for being exactly the way you are.

Special thanks to the following individuals for their much appreciated help:

Noah,

Kenta,

Maria,

And to the people in my graduate life who supported me in the most unique and amazing ways, you know who you are.  
Yes. You.

Thank you for existing.

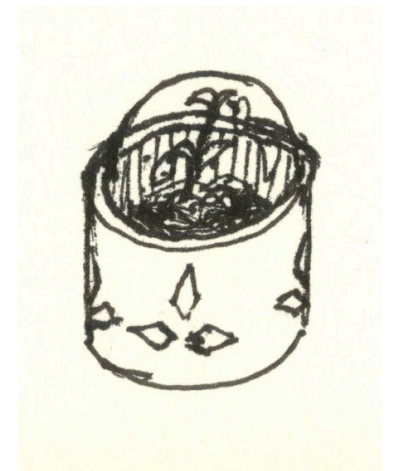
Love,  
Henry

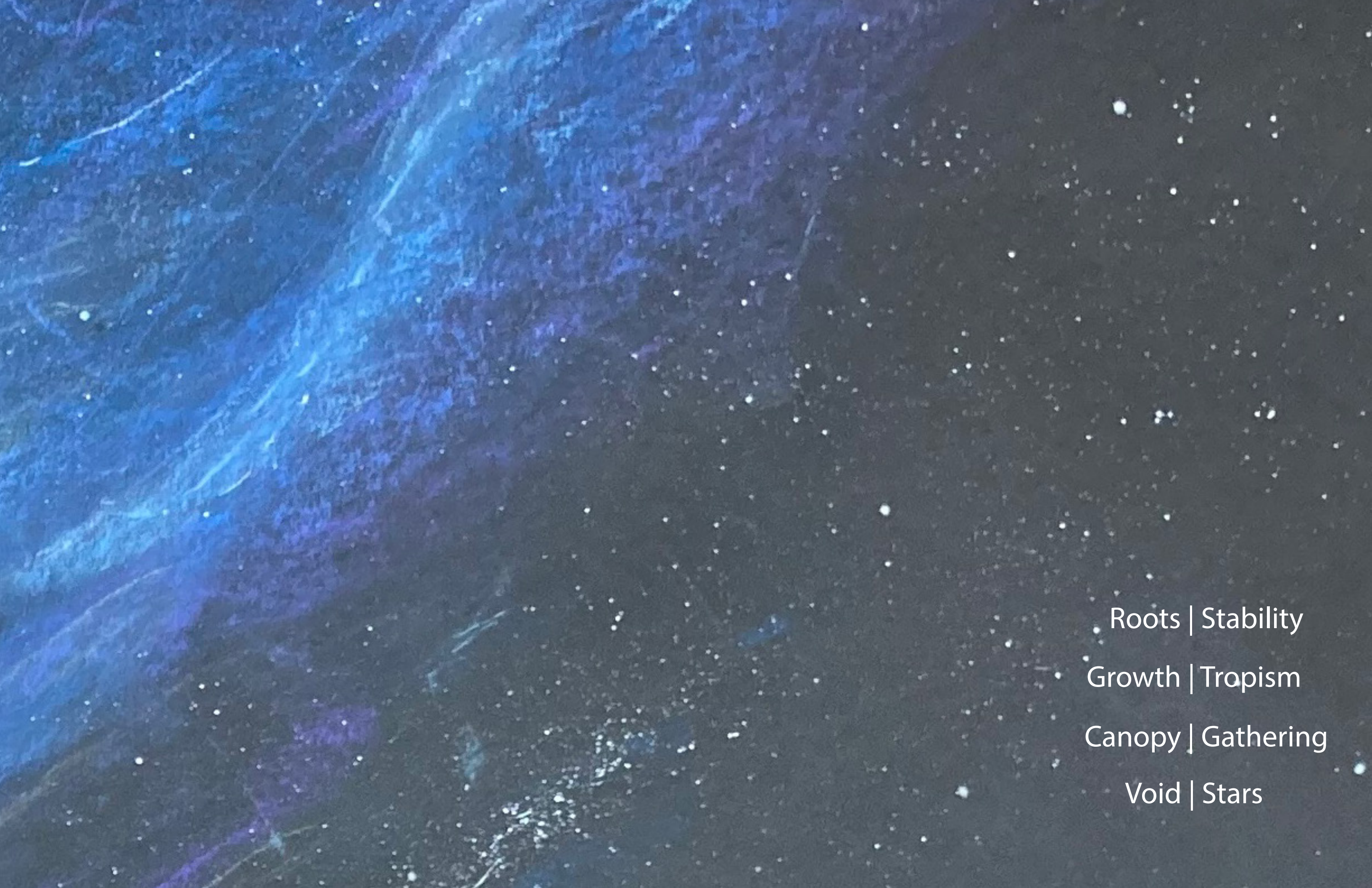
格物 | 致知

Earth | Site

Seed | Project

Enter / Imagine





Roots | Stability

Growth | Tropism

Canopy | Gathering

Void | Stars

# 格物 | 致知



格物 致知 诚意 正心 修身 齐家 治国 平天下

格物	Explore the nature of things
致知	Obtain and extended knowledge
诚意	Develop sincerity and honesty of intent
正心	Establish a pure and virtuous heart
修身	Cultivate the Self and body
齐家	Competence in familial affairs
治国	Govern the State
平天下	Bring Peace to All Under Heaven

征苍穹	Voyage the heavens
殖星海	Propagate the sea of stars

The phrase “格物 致知 诚意 正心 修身齐家 治国 平天下” is a key excerpt from the Chinese classic text “大学” (Dà Xué), which translates to “The Great Learning.” It is one of the Four Books, a collection of Confucian texts.

This phrase comprises eight important principles that are outlined in “大学” as essential steps for individual self-cultivation and the establishment of a harmonious society.

格物 (Gé Wù) - Investigation of Things: It refers to the act of observing and understanding the principles of the world, exploring the nature of things, and gaining knowledge through careful observation and study.

致知 (Zhì Zhī) - Extending Knowledge: Once one has investigated and gained knowledge, this principle encourages the application and extension of that knowledge to continuously seek wisdom and understanding.

诚意 (Chéng Yì) - Sincerity: It emphasizes the importance of sincerity, honesty, and genuine intentions in all actions and interactions with others.

正心 (Zhèng Xīn) - Cultivating the Heart-Mind: This principle focuses on cultivating a pure and virtuous heart-mind, maintaining inner integrity, and rectifying one's thoughts and intentions.

修身齐家 (Xiū Shēn Qí Jiā) - Cultivating the Self and Managing the Family: It advocates for self-improvement, fostering family harmony, and fulfilling one's responsibilities in the domestic sphere.

治国 (Zhì Guó) - Governing the State: This principle pertains to the proper governance of the state, promoting just and benevolent leadership to ensure the well-being of the people.

平天下 (Píng Tiān Xià) - Bringing Peace to All Under Heaven: It refers to achieving harmony and peace throughout society, where people can live in tranquility and prosperity.

Significance of “格物 致知 诚意 正心 修身齐家 治国 平天下”:

These eight principles from “大学” represent a comprehensive roadmap for personal and social development based on Confucian ethics and values. They serve as a guide for individuals to cultivate themselves morally, intellectually, and emotionally, thereby contributing to the overall betterment of society.

The significance of these principles lies in their emphasis on ethical behavior, self-improvement, and responsible governance. By aligning oneself with these values and acting upon them, individuals are encouraged to become virtuous and compassionate leaders capable of positively influencing their families and communities.

Furthermore, the principles of “格物 致知 诚意 正心 修身齐家 治国 平天下” have had a profound impact on Chinese culture and politics throughout history. They have been used as a foundation for educational systems and governmental policies, promoting a Confucian-inspired harmonious society based on benevolence, integrity, and mutual respect.

Architecture is what we make of things.

Author's response to the question: "Architecture is \_\_\_\_\_."  
Fall 2020



# 格物

Explore the nature of things

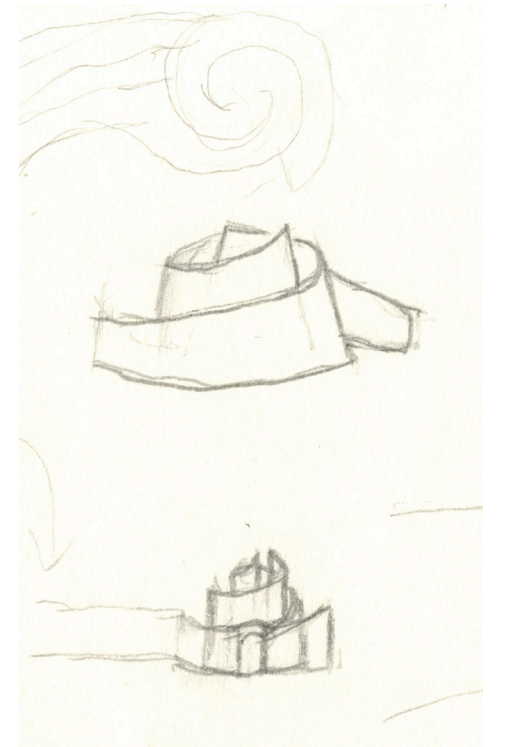
## What is a thing?

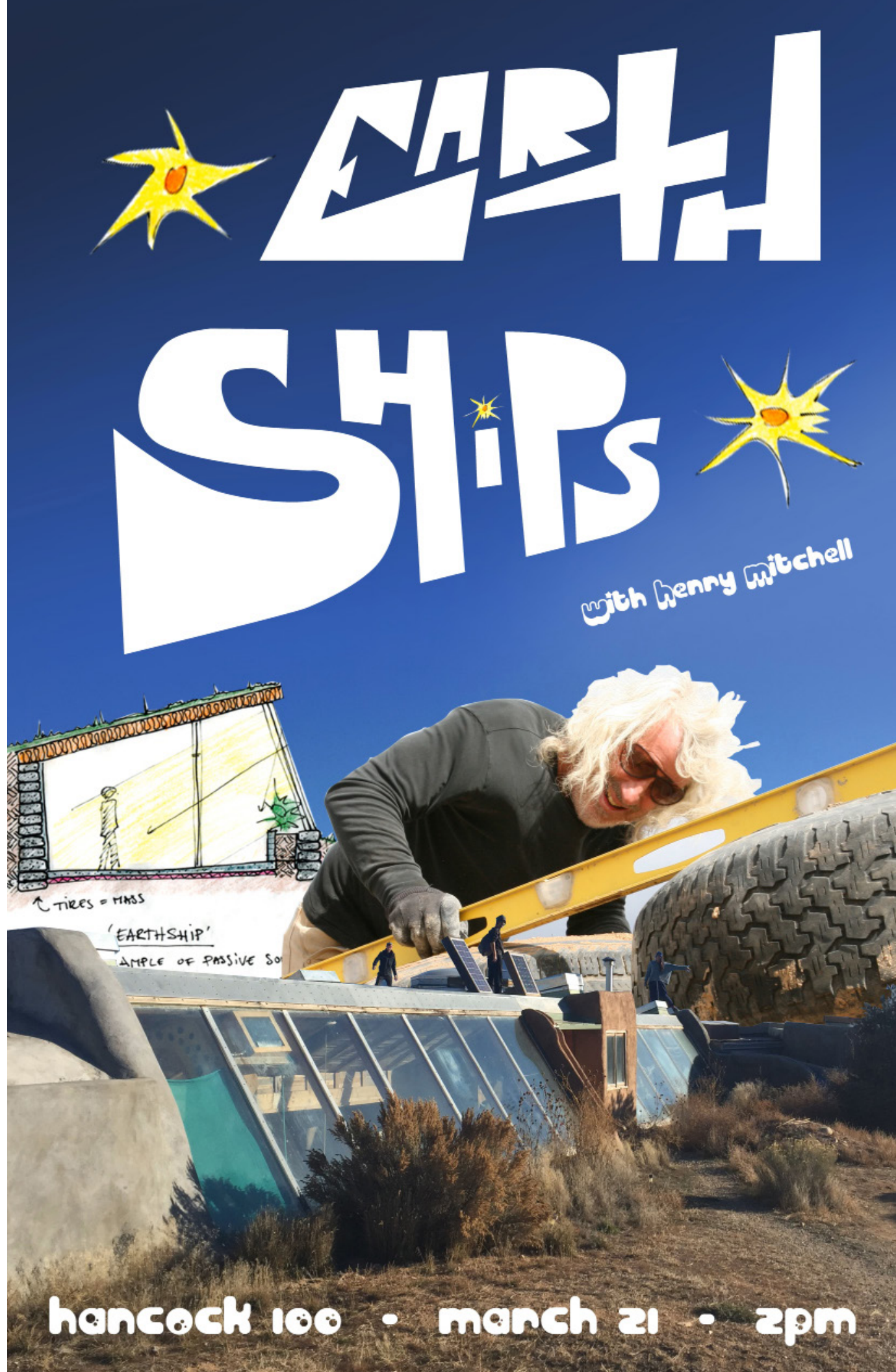
“We’ve learned to define ourselves as separate from it (the universe)... A basic problem we have to go through first, is to understand that **there are no such things as things.** That is to say, **separate things.**”

“**A thing is a noun... A noun isn’t a part of nature, its a part of speech.** There are no nouns in the physical world. There are no separate things in the world either. See, the physical world is wiggly. The clouds, mountains, trees, people, are all wiggly.”

“Only when **human beings** get working at things, they build buildings in **straight lines** and try to make out that the world isn’t really wiggly.”

Speech: “*No such Things as Things*” and “*Getting hold of the Wiggle*” from “*What is Reality?*”  
- a seminar recorded in Dallas, 1965 by *Alan Watts*





Prior to graduate study, the author built and learned alongside the crew of New Mexico Architect Michael E. Reynolds. The buildings designed by Michael, built by him and his company Earthship Biotecture, are known as Earthships.

These buildings make use of the earth's naturally occurring phenomena to achieve modern living standards off-grid.

The author has lectured on Earthships and his experiences building them during his time at Virginia Tech.

The work of Michael Reynolds and Earthships was a major contributor to the author's interest in Architecture, which grew into a decision to enroll in a graduate program.

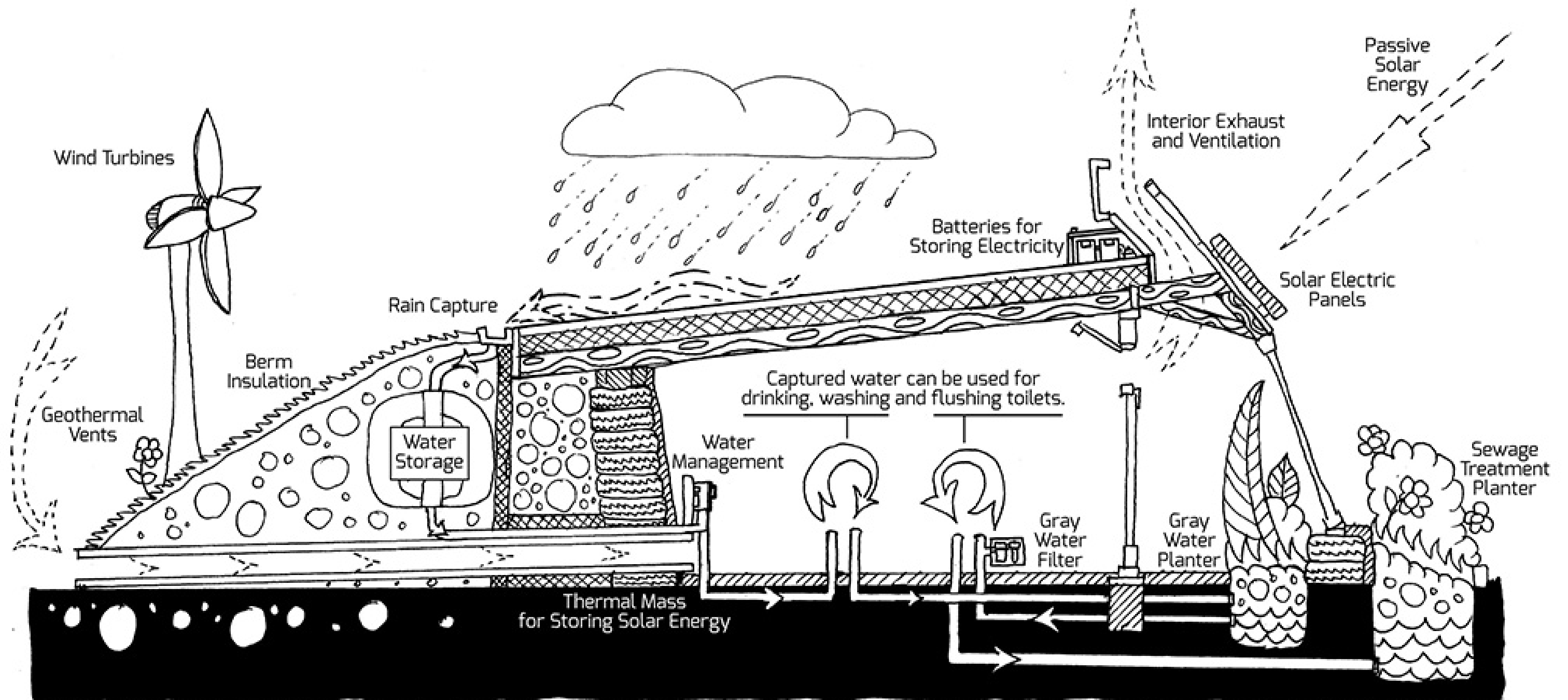
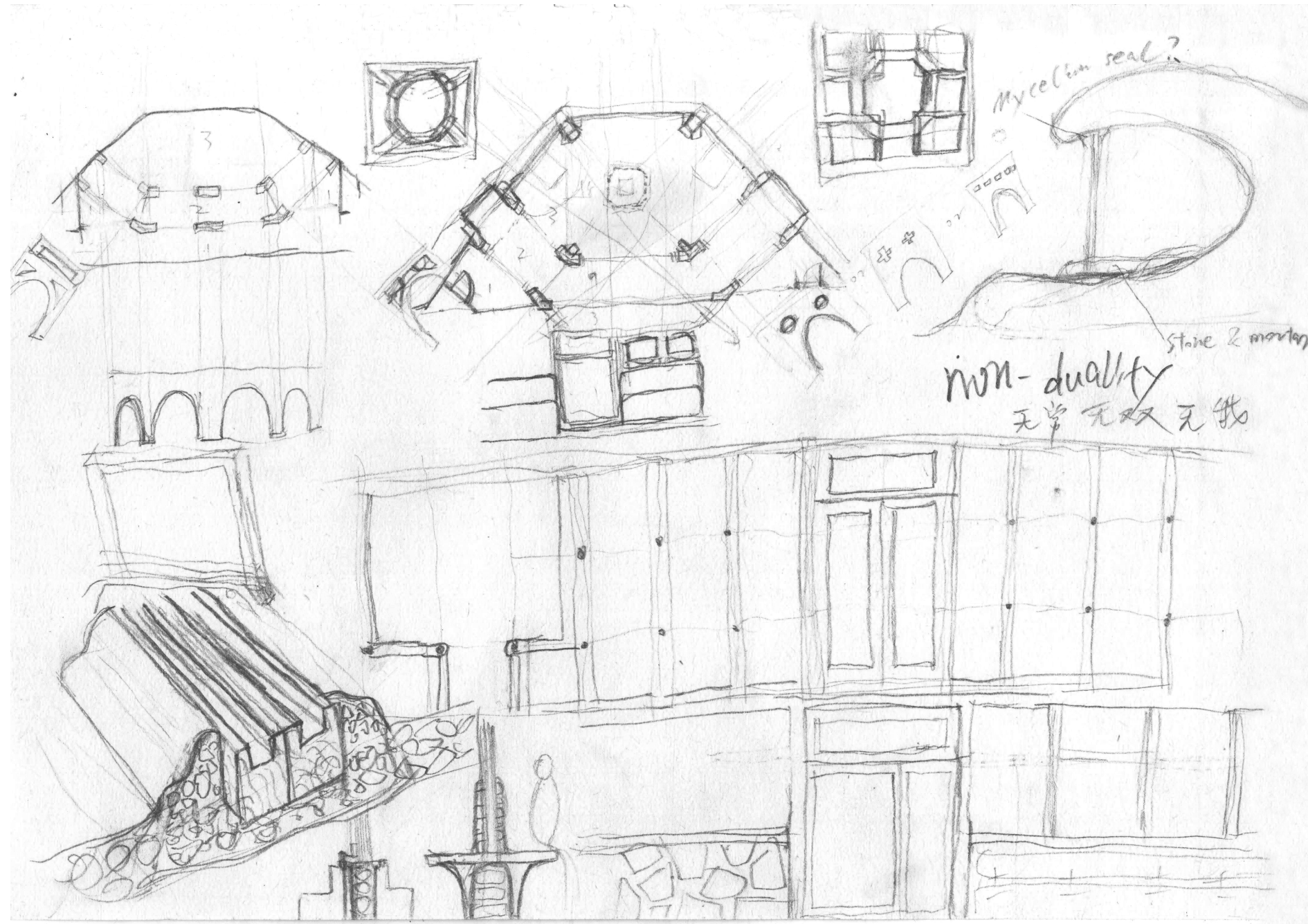


Image from Earthship Biotechure

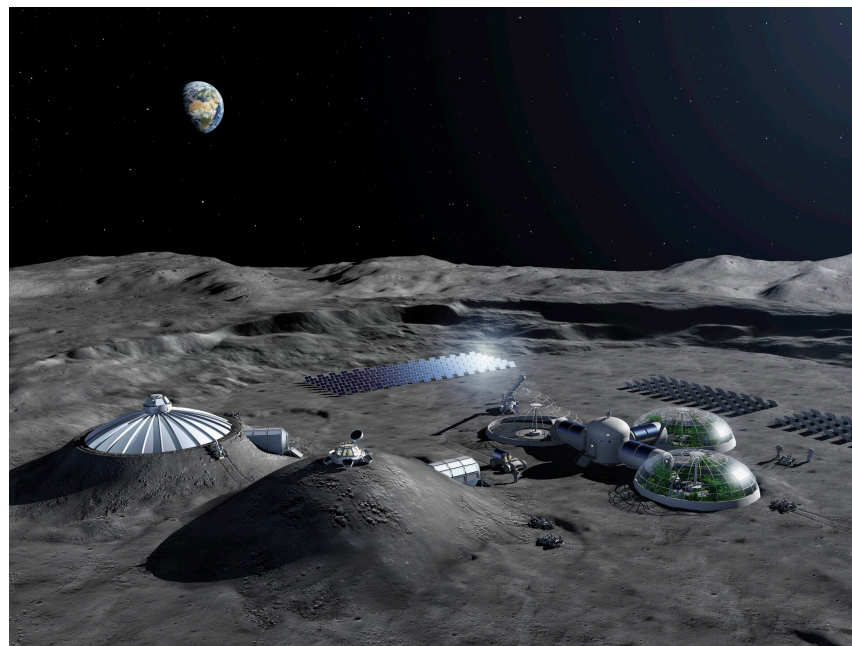


Sketch drawings of earth-sited, passive building inspired by Earthships

# Ship in Earth Ship in Space

Instead of severing us from the natural world, architecture should remind us of the cosmic, planetary nature of our existence.

By going into the earth, harnessing the sun, inviting the wind and gathering the rain, a building can provide us with our basic needs locally. This strategy of self-sufficiency through architecture by its cooperation with the naturally occurring phenomena, happens to be the same tactic favored when imagining human dwellings on the moon.

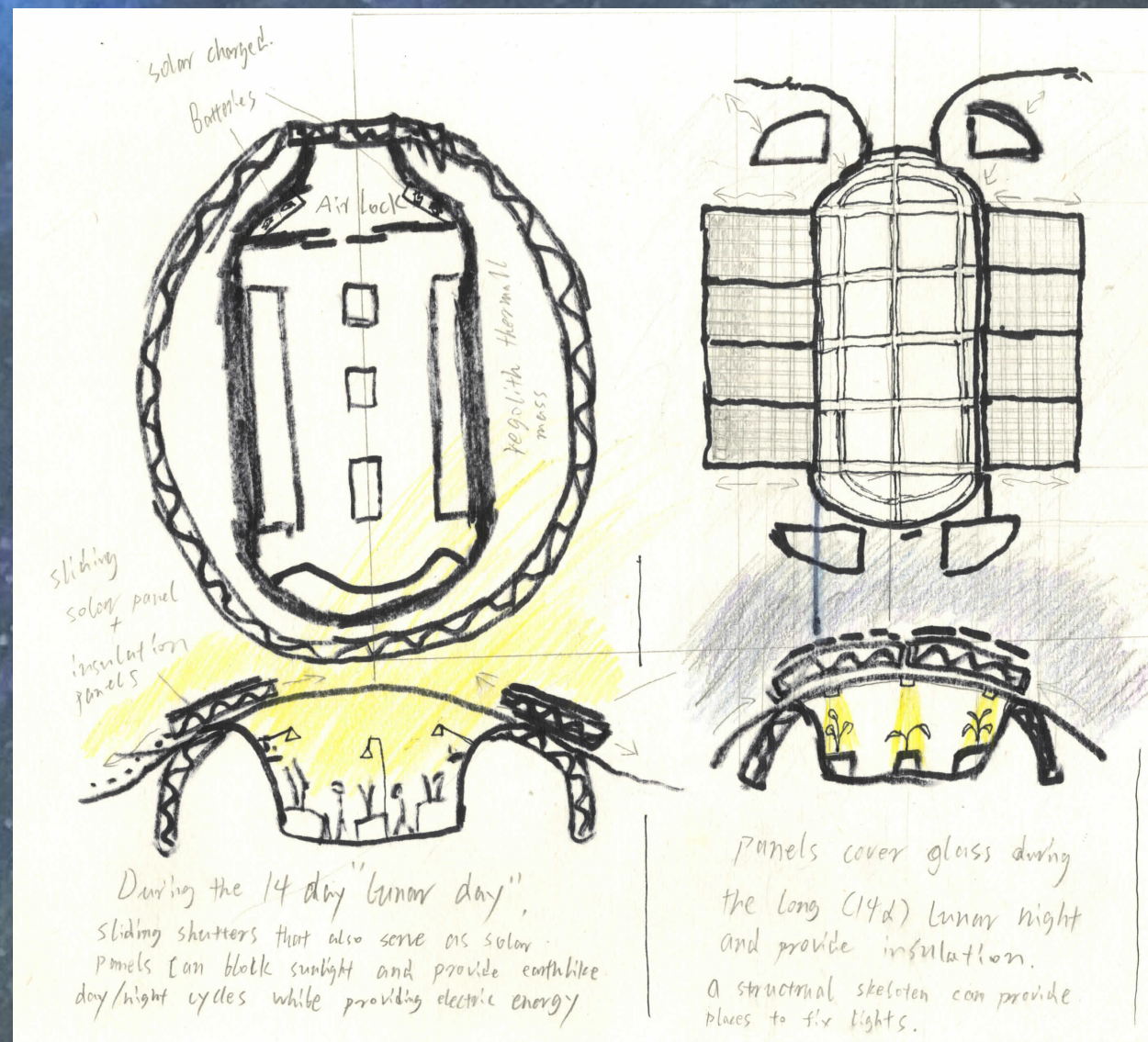


Artist impression of a Moon Base concept. Credit: ESA - P. Carril



Top left and right: Photos taken on site during construction at Earthship Mima, Tokushima prefecture, Japan. 2018

# 征苍穹 | 殖星海



	Lunar Night	Lunar Day
temperature	-162.7°C	116.6°C
equator	-201°F	242°F
polar	80K	140K
sub surface (50cm)	-315°F	-132.7°C
	250K (-9.67°F)	-23.15°C
		-207°F

Sketches of a imagined lunar greenhouse are made after discussions with aerospace engineering student and researching academic papers on the topic of settling the lunar environment.

These sketches highlight the importance of burrowing into the lunar surface material "regolith" in order to maintain stable temperatures despite extreme conditions.

The life cycle of a building is similar to that of a plant.

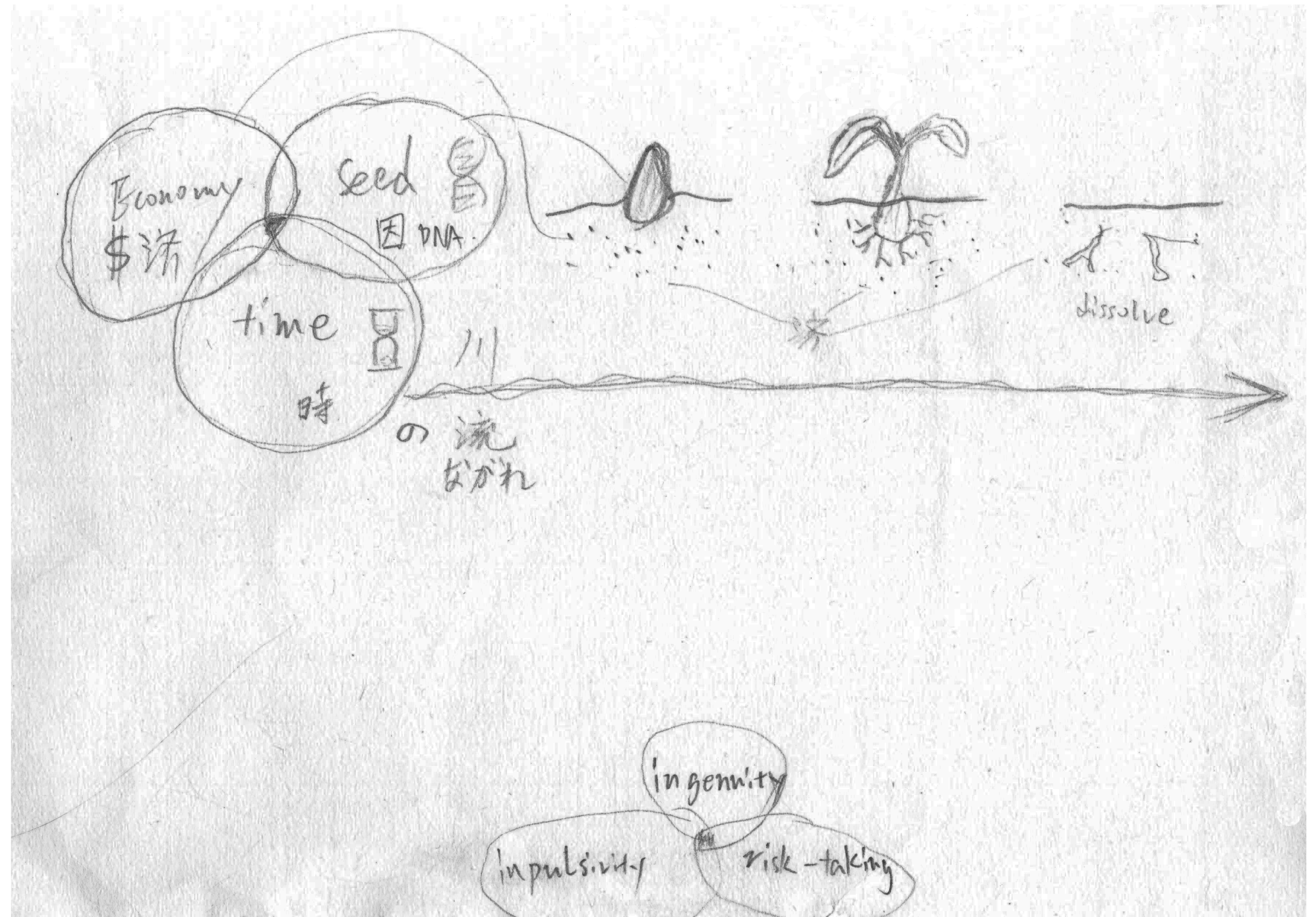
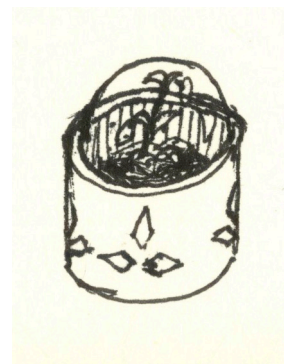
It starts with a seed, containing the idea, the blueprints of what to do.

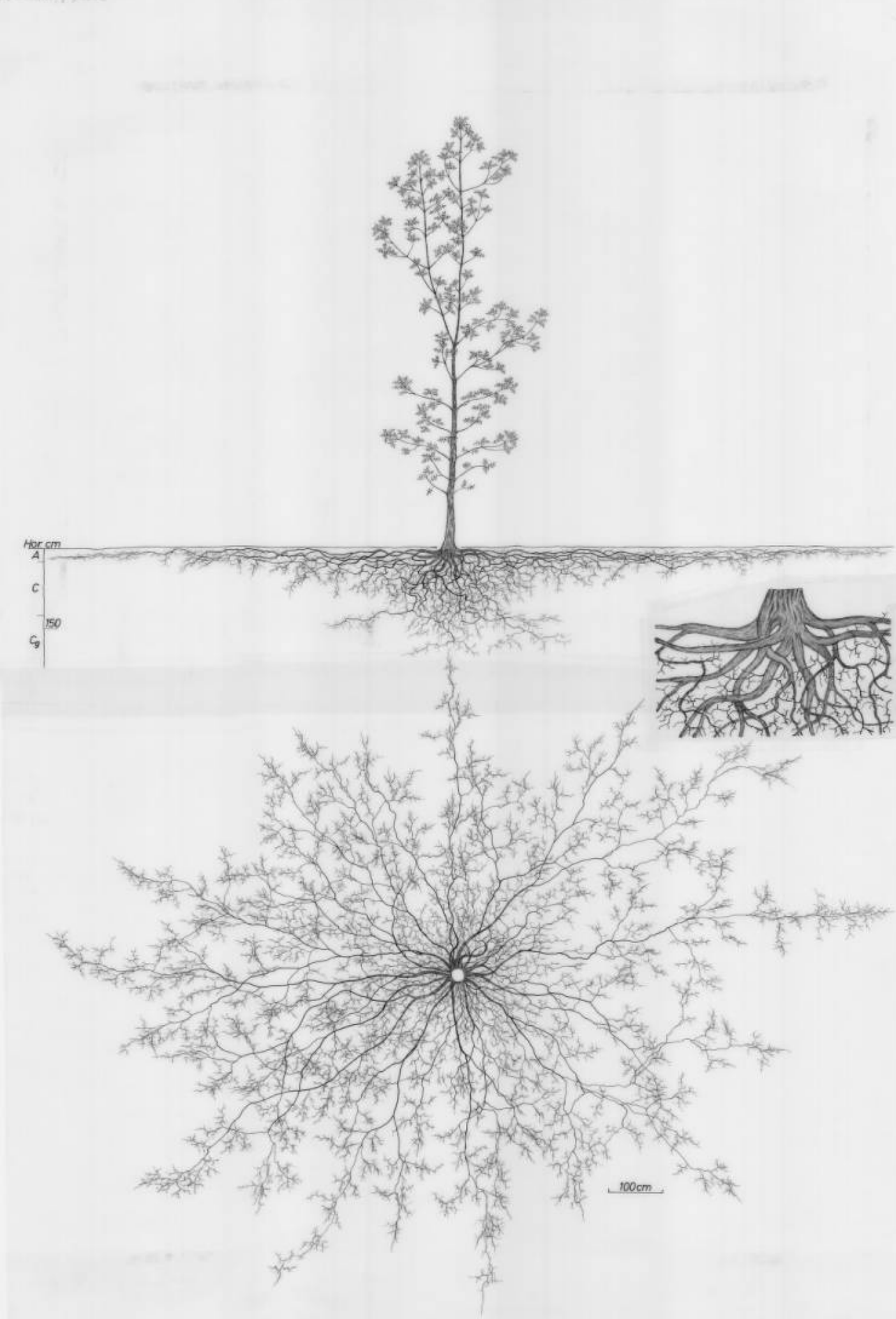
It's roots then reach out, studying the surrounding earth for the resources it needs and gathers them for its own construction.

The structure then grows upward towards the sky, interacting with the sun and rain.

It is now an entity with a role in its neighborhood, attracting those who wish to interact, spreading its own meaning into the world.

With time, it will eventually weather and decay. Its physical components returned to the earth.





Canopy

-

Roof

Stem

-

Structure

Roots

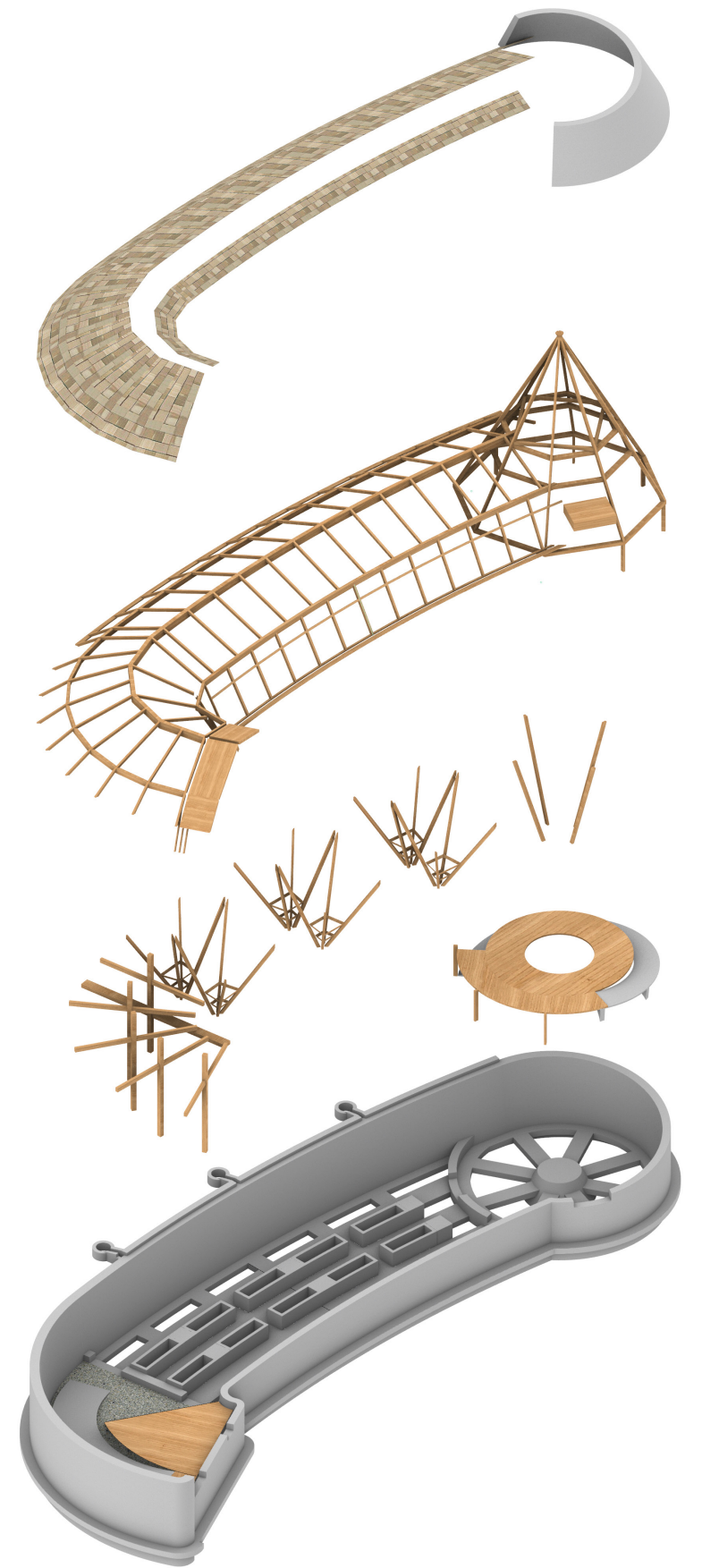
-

Foundation

Seed

-

Awareness



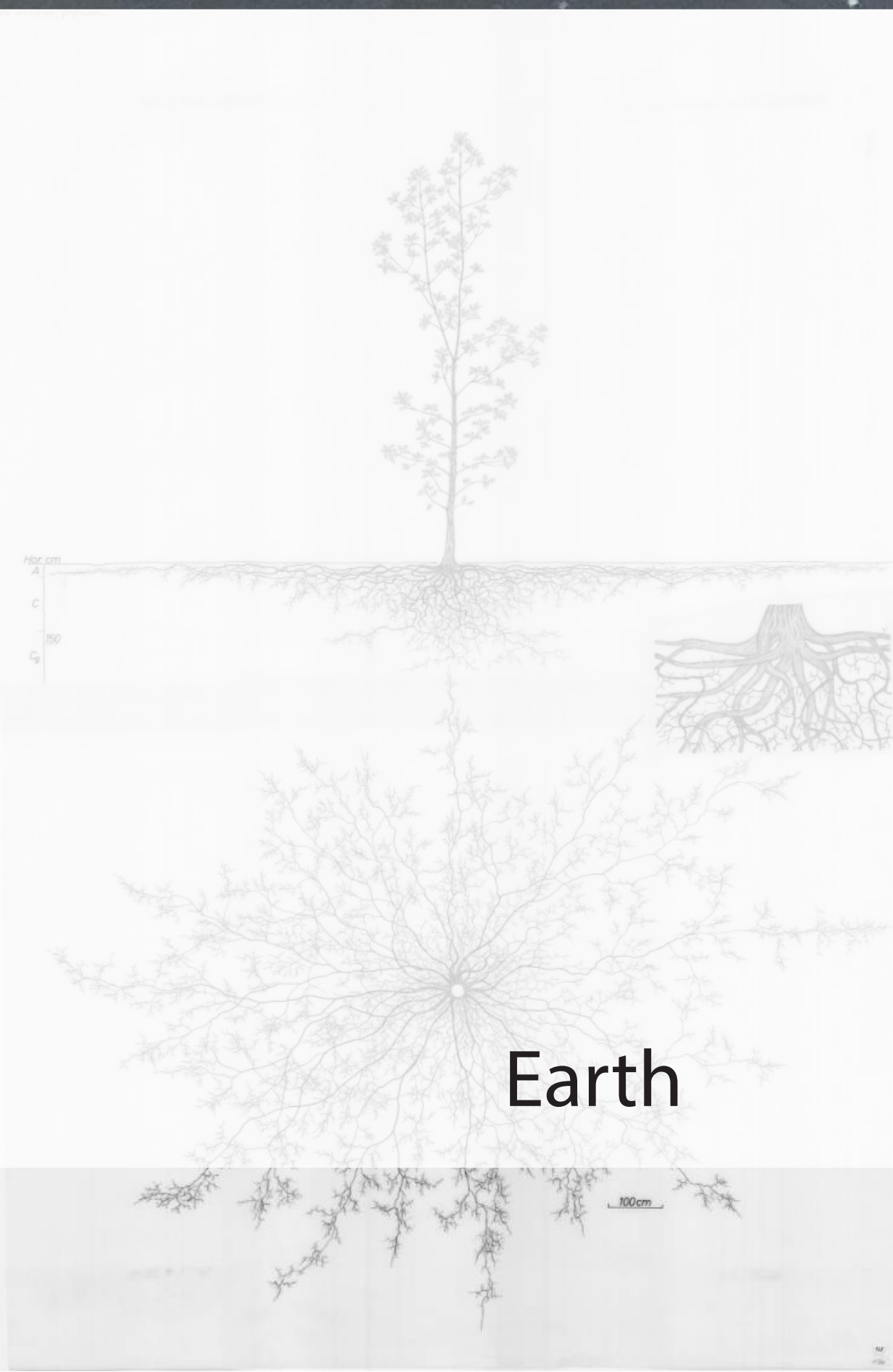


致知

Obtain and extended knowledge

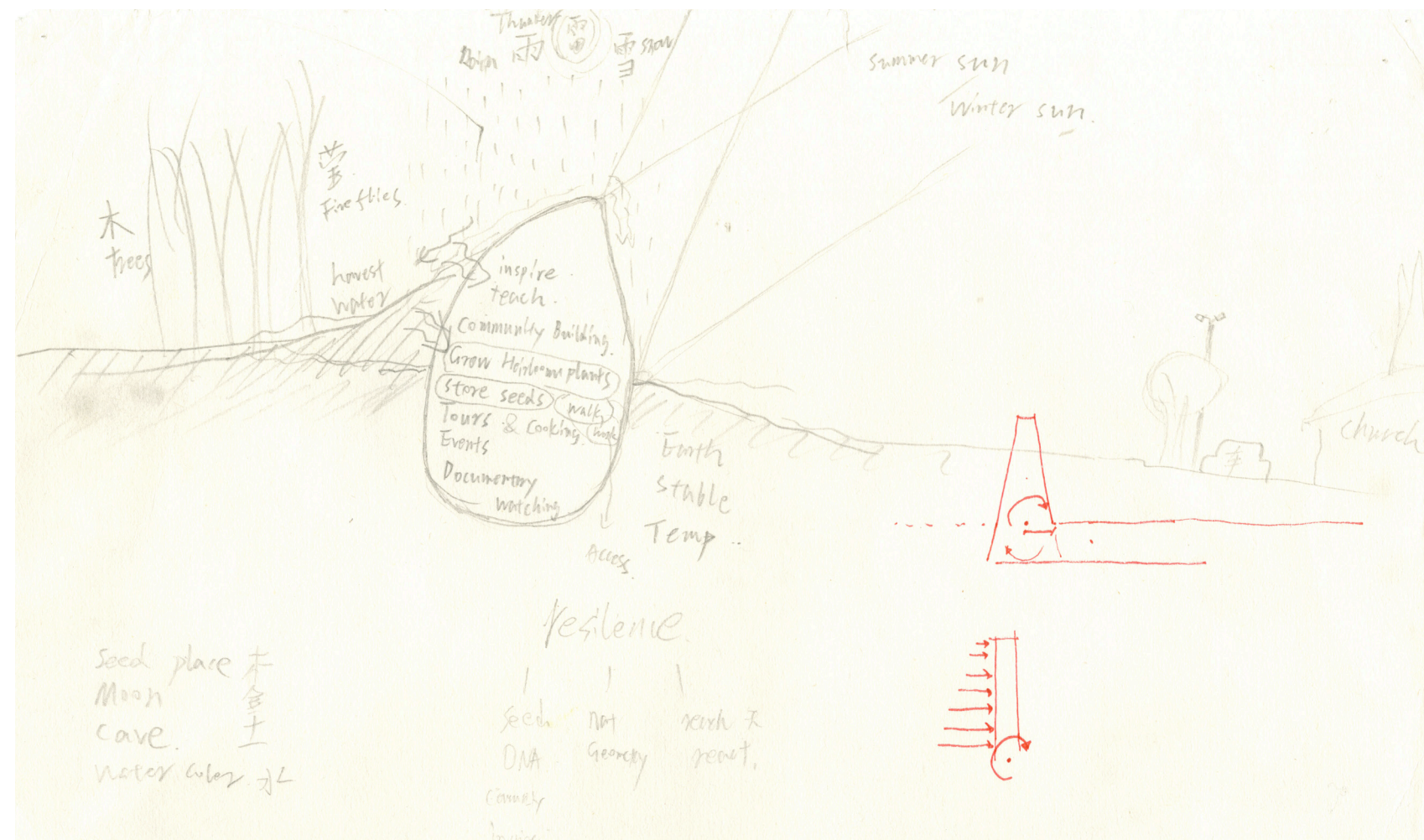


# Earth | Site



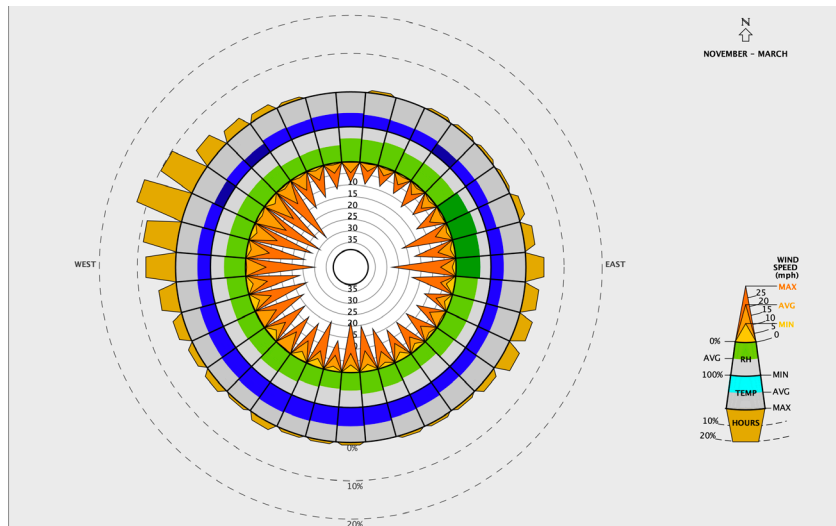
Earth

-



Site

Before the (Architecture) project comes the site

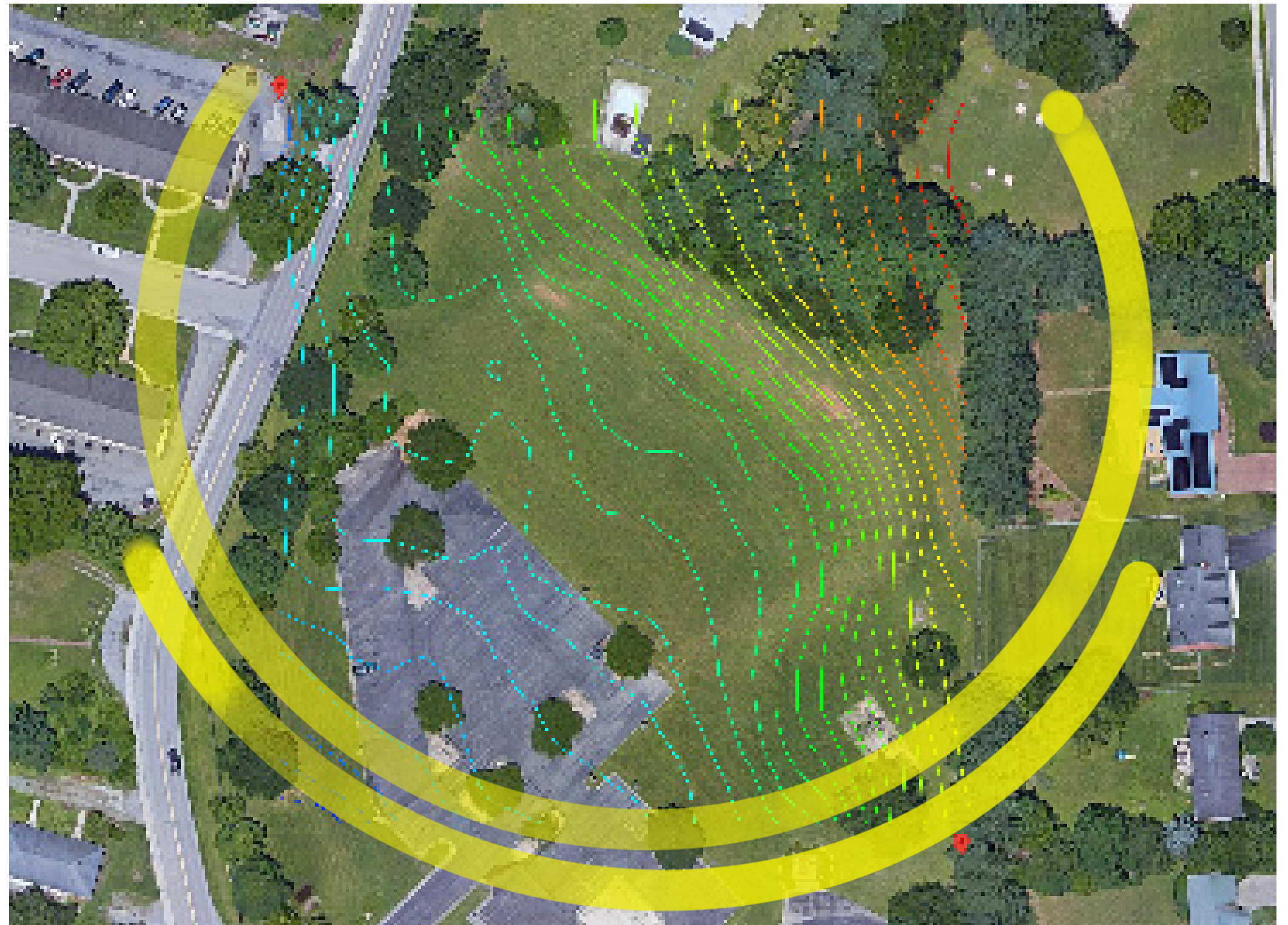


Wind wheel presenting patterns on site during colder months,  
Generated by Climate Consultant 6.0

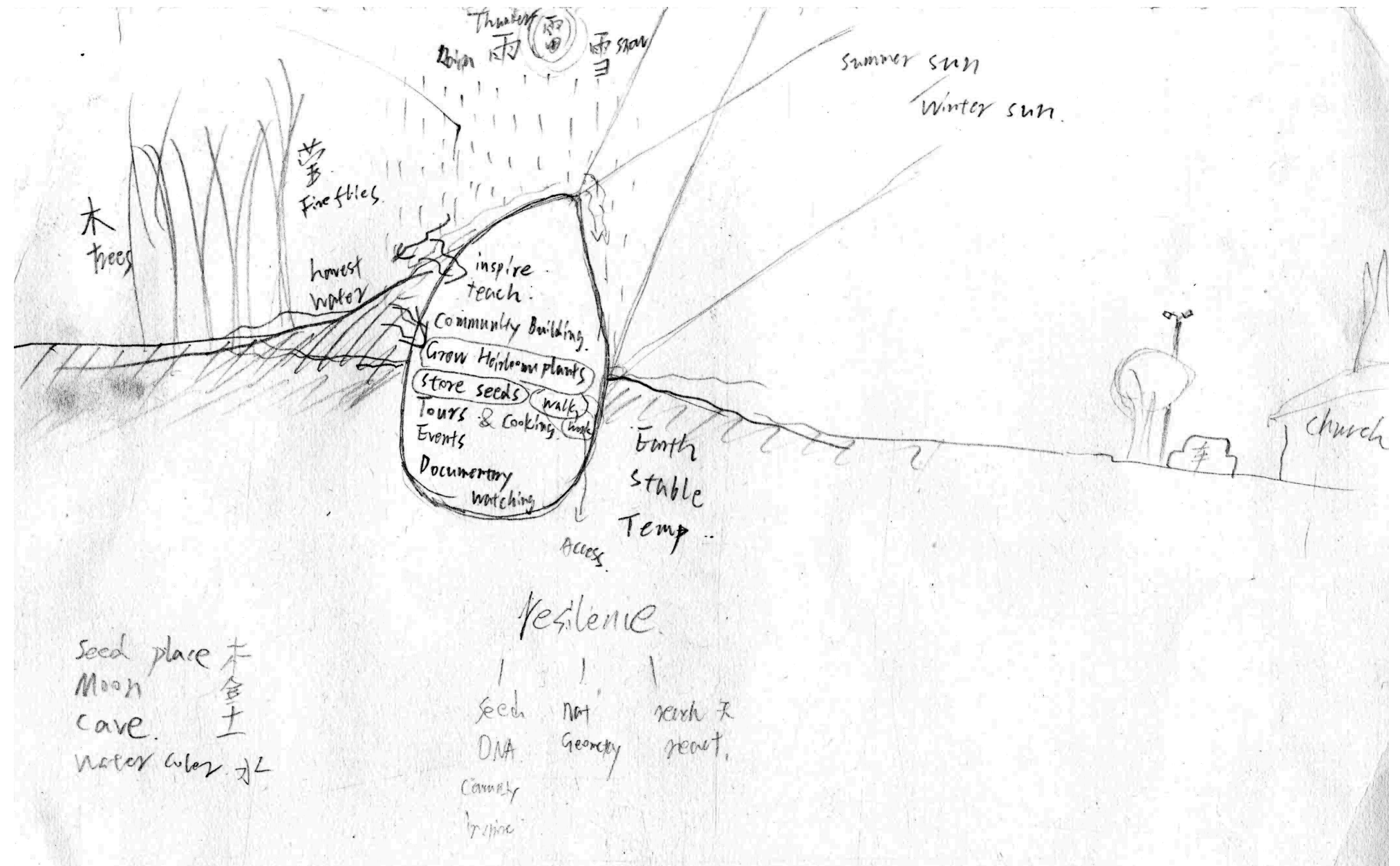
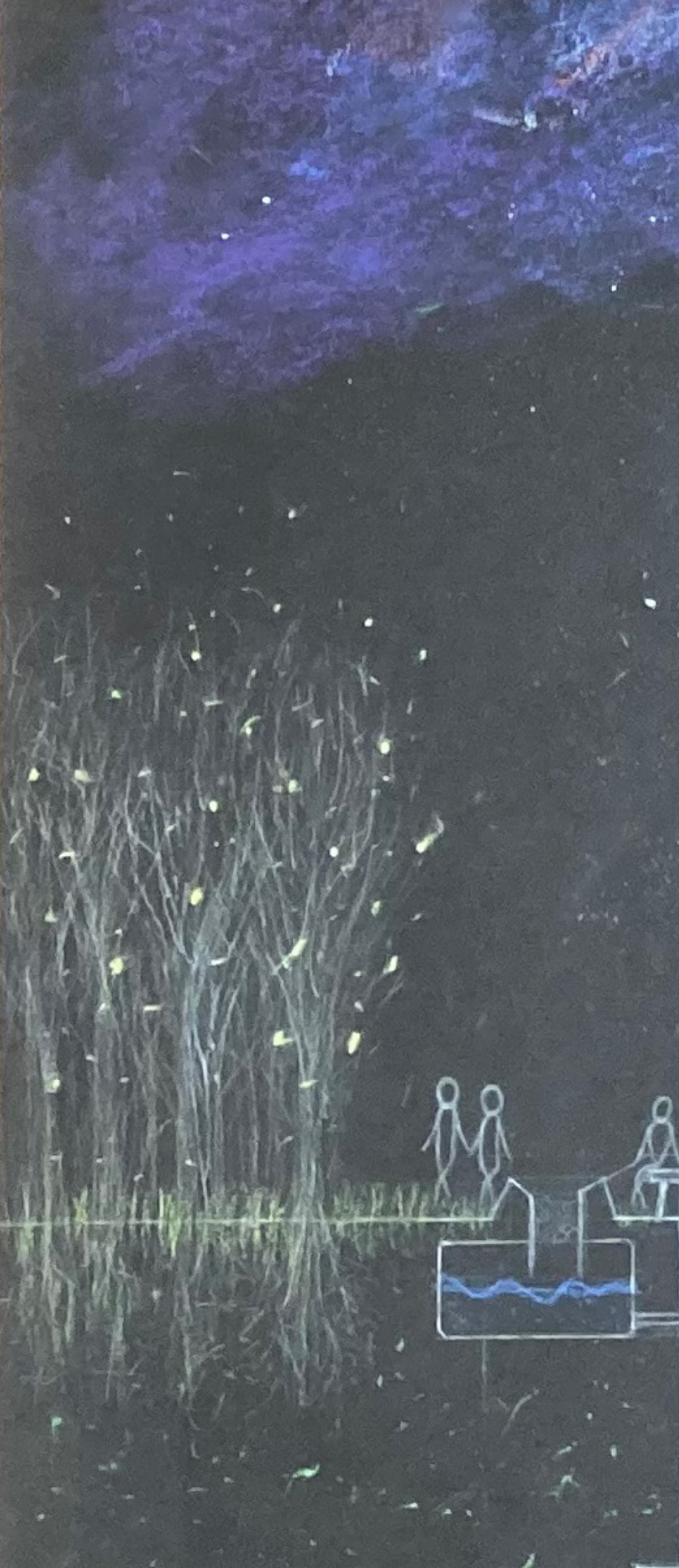
The site is a grassy lot by where the author has lived (been planted) for the entirety of his graduate education.

It features a shovel-like terrain that slopes down from the north into flat area leading to a church parking lot.

This makes it an ideal site for a building that is lodged into the hill, which will shield it from the cold winter winds coming from the north west, and expose it to direct sun coming from the south, especially during winter months.



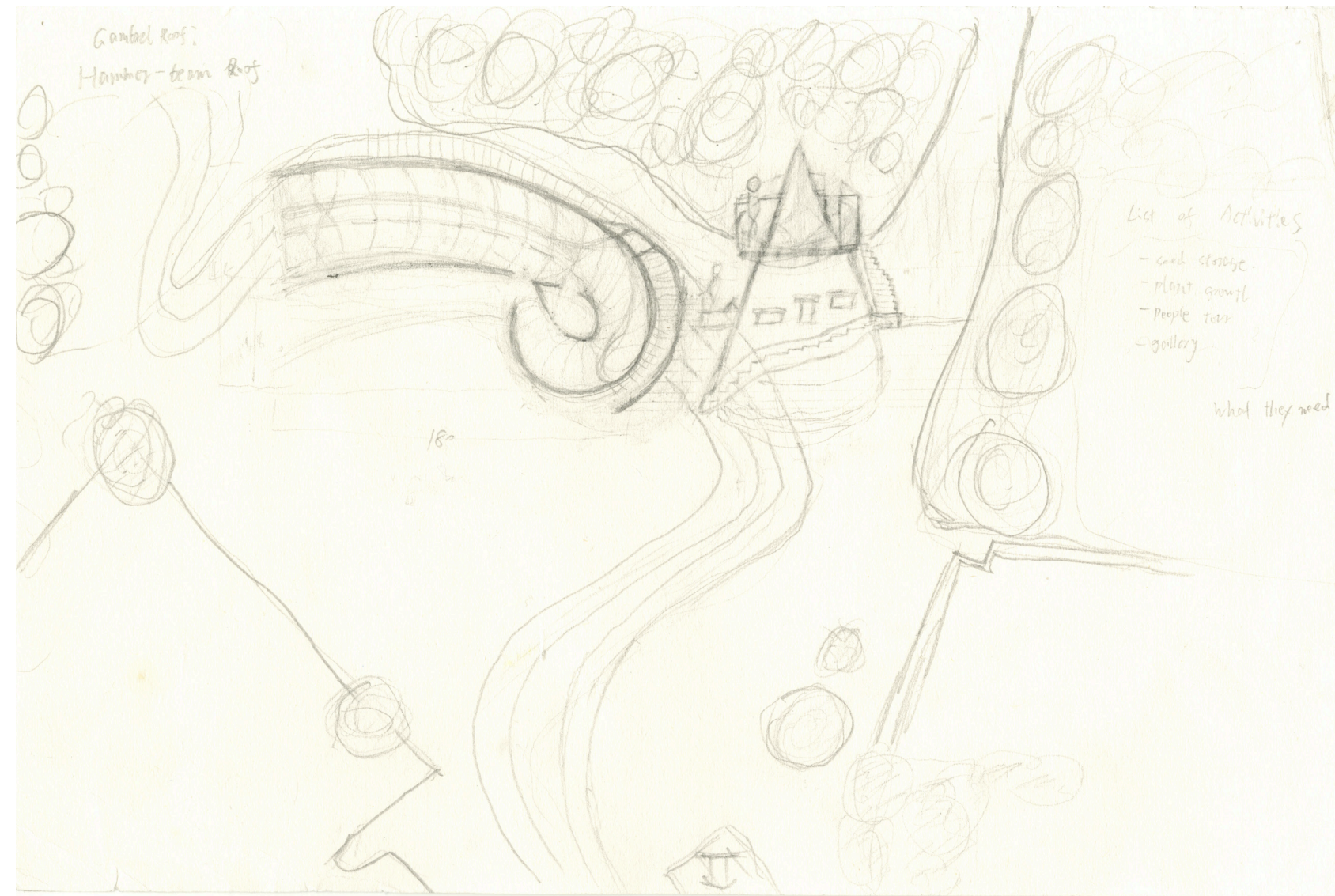
Site plan based on google earth image, accessed January 2023



By going into the earth, a building will also be able to utilize the relatively stable temperatures underground to stay cooler in the summers and warmer during winter. There is a berm to block the harsh northern wind. The trees growing there host fireflies on summer nights, during one of which distant storm clouds compete with 4th of July fireworks, lighting up the night sky.



Photos taken at annual firework gathering within 2 minute walking distance from the site



A building could be planted here as a seed for spreading awareness.

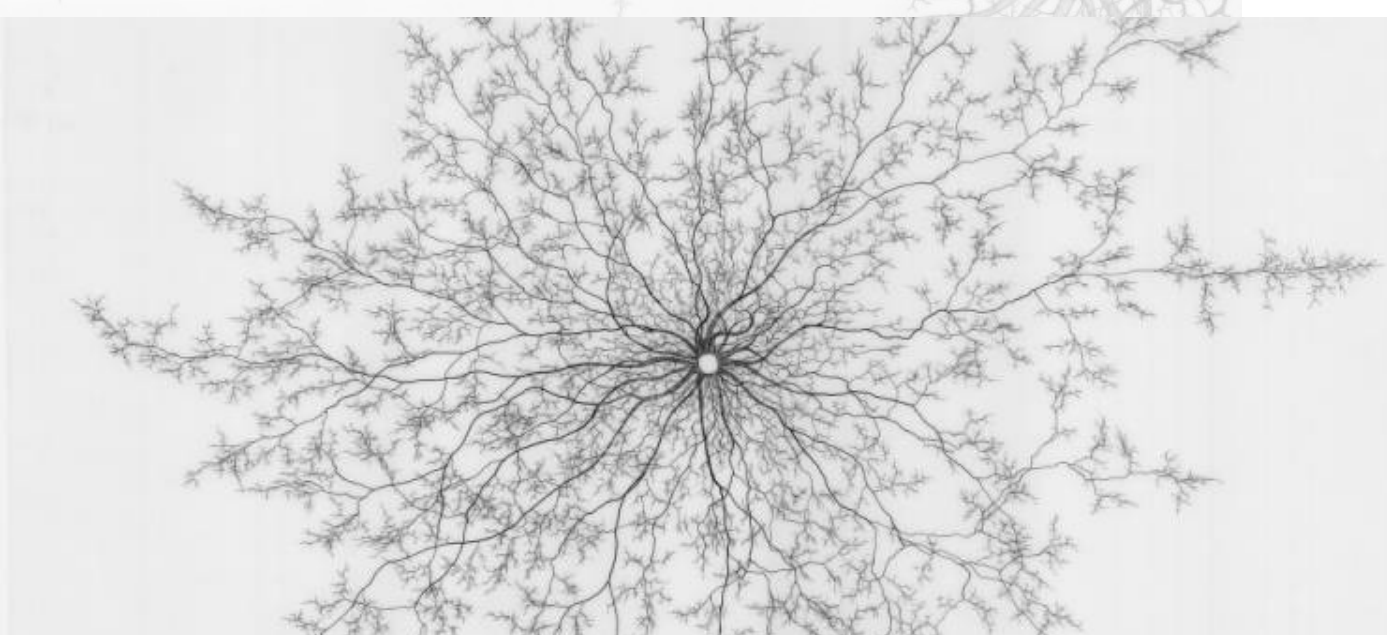
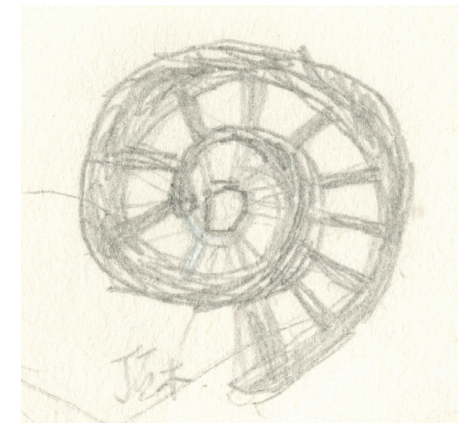
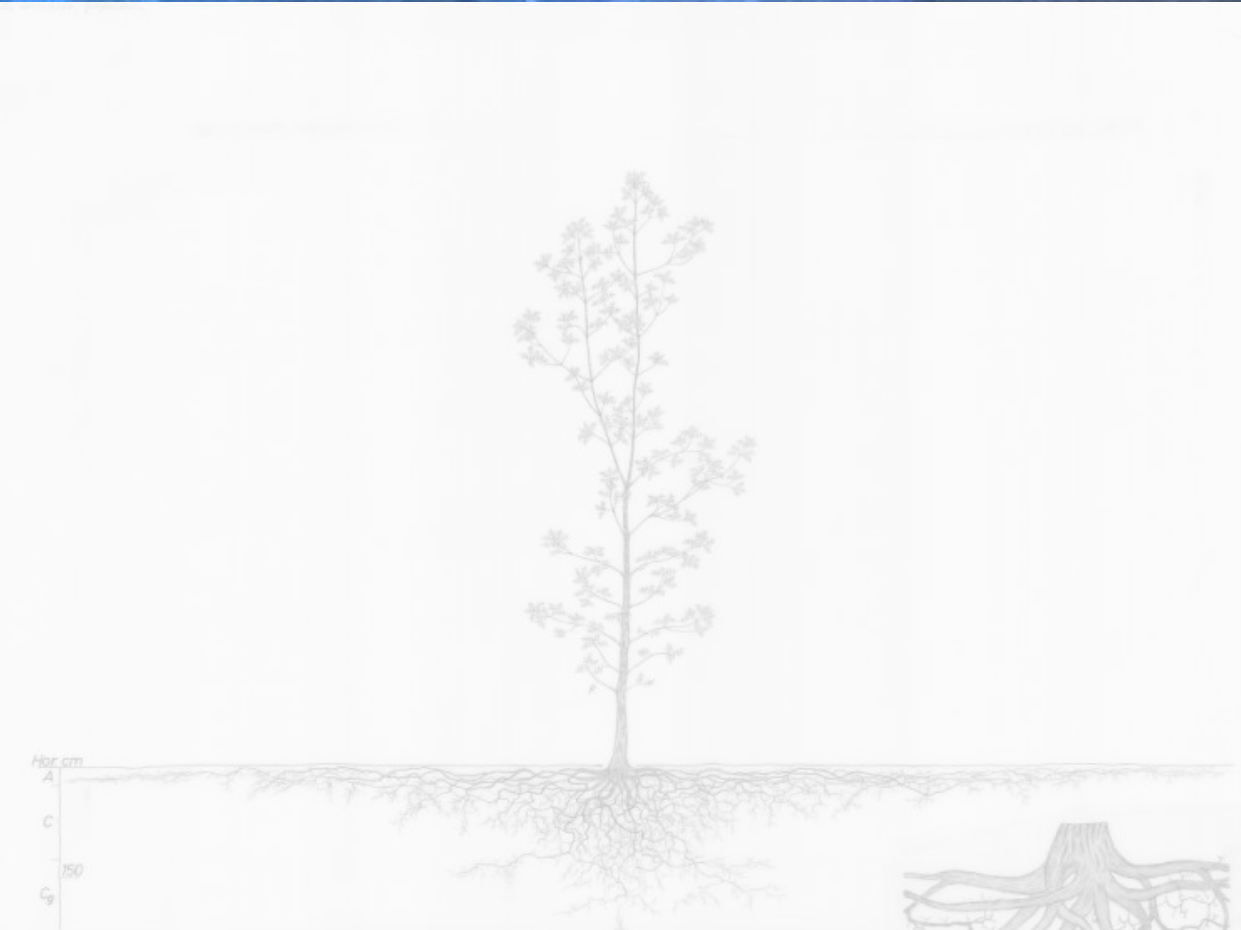
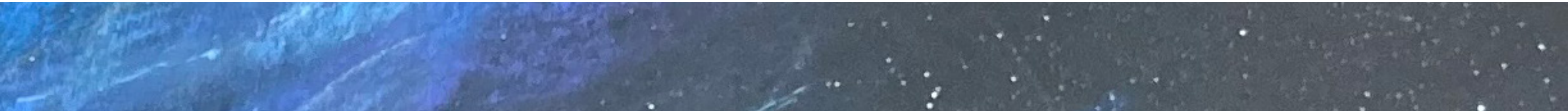


# 诚意

Develop sincerity and honesty of intent



# Seed | Project



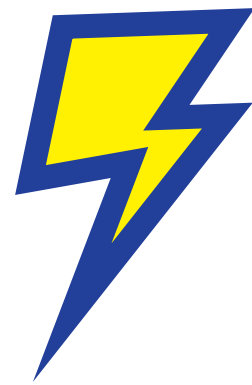
Seed

-

Project

The Architect is to a project what DNA is to a seed.

诚意 | 正心



Energy



Water

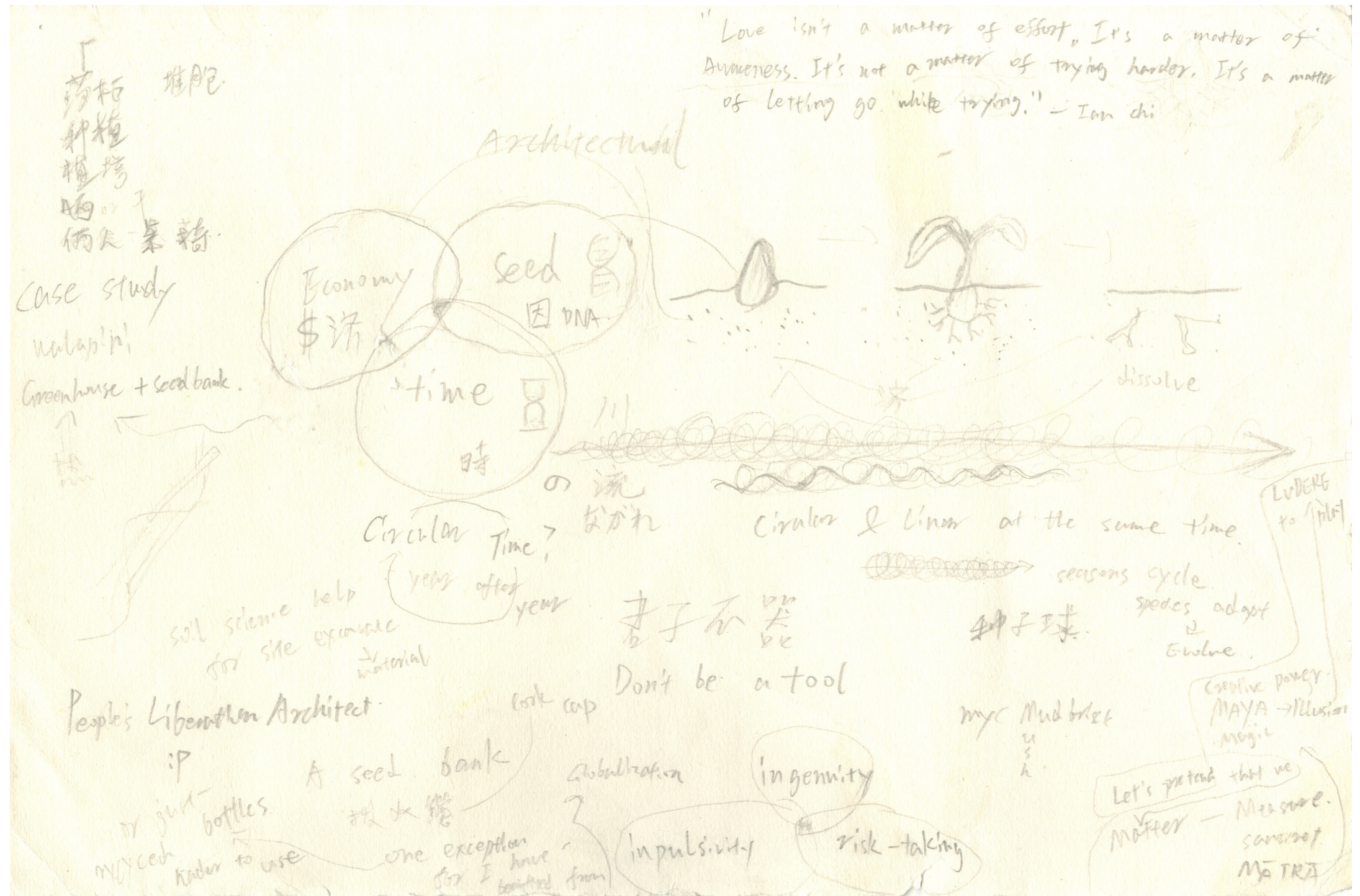


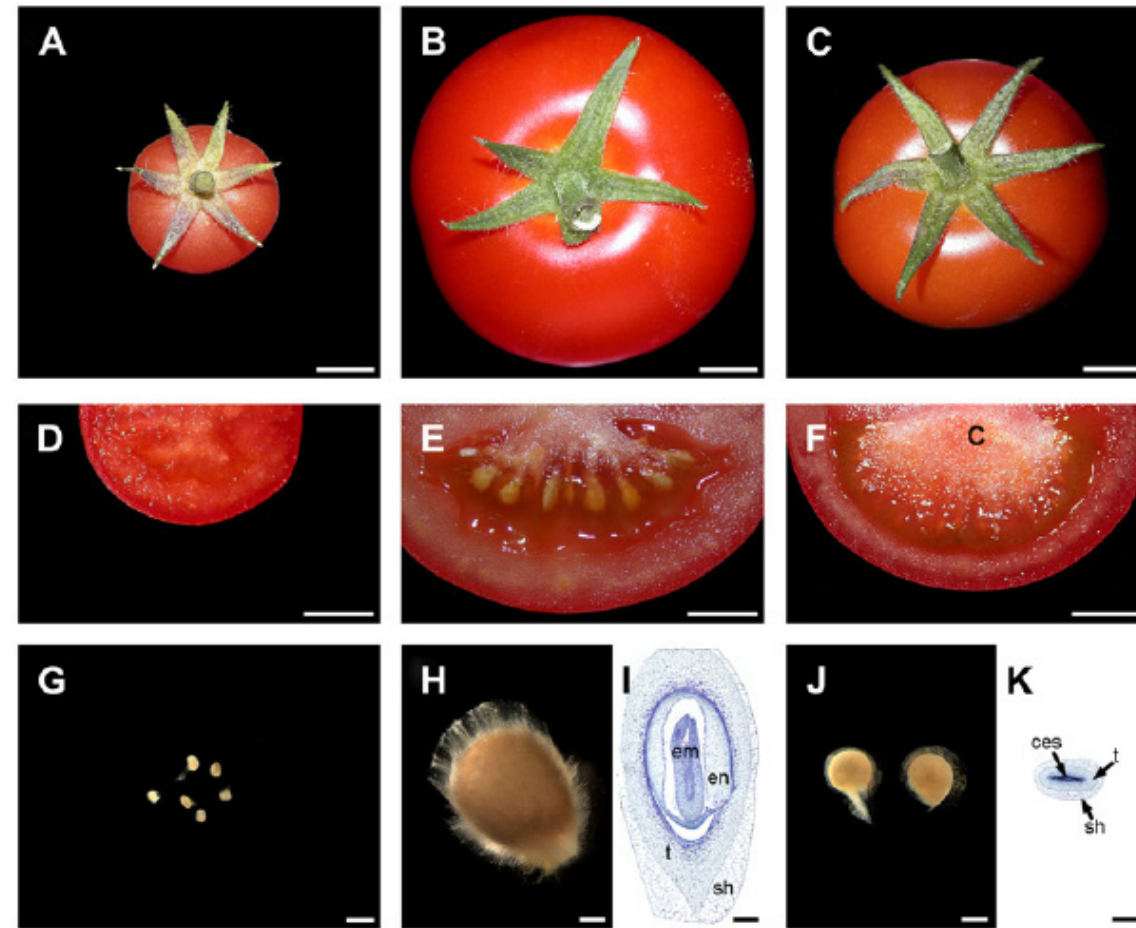
Food

The project should be a seed that will grow into a building that spreads awareness.

A building should make people aware of our connection to the natural world. It should do so by gathering natural forces and using them, therefore constantly reminding people of this connection.

The building will serve as a greenhouse and seed library for heirloom produce plants. This will give the community a place to gather and spread the knowledge and importance of seed and food security. All while demonstrating the passive, self-sufficient qualities of a passive building.





Expression of aberrant forms of AUXIN RESPONSE FACTOR8 stimulates parthenocarpy in arabidopsis and tomato - Scientific Figure on ResearchGate. Available from: [https://www.researchgate.net/figure/Fruits-and-seeds-of-wild-type-and-transgenic-tomato-plants-A-Typical-small\\_fig4\\_6074831](https://www.researchgate.net/figure/Fruits-and-seeds-of-wild-type-and-transgenic-tomato-plants-A-Typical-small_fig4_6074831) [accessed 1 Aug, 2023]

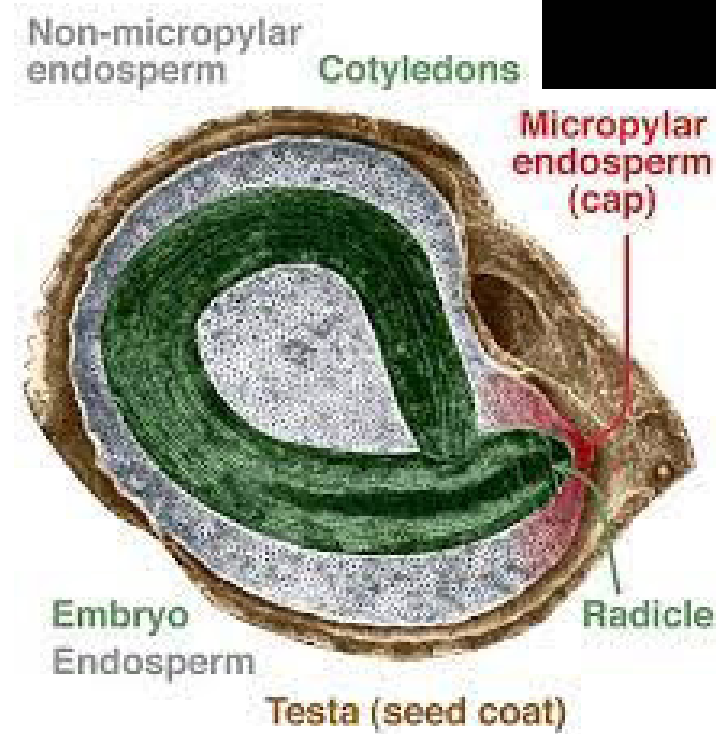
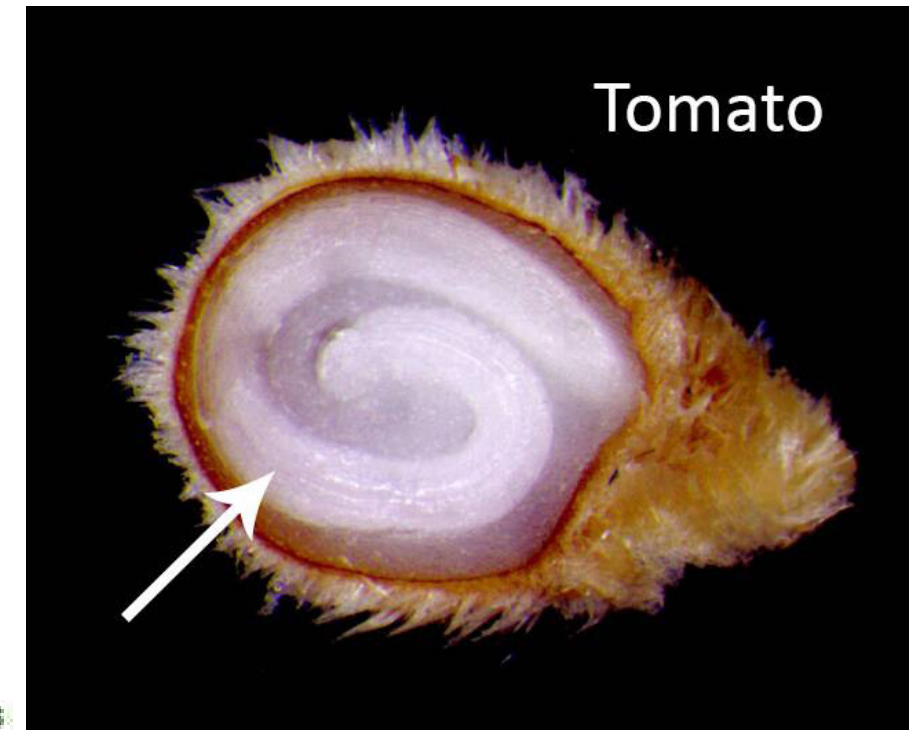
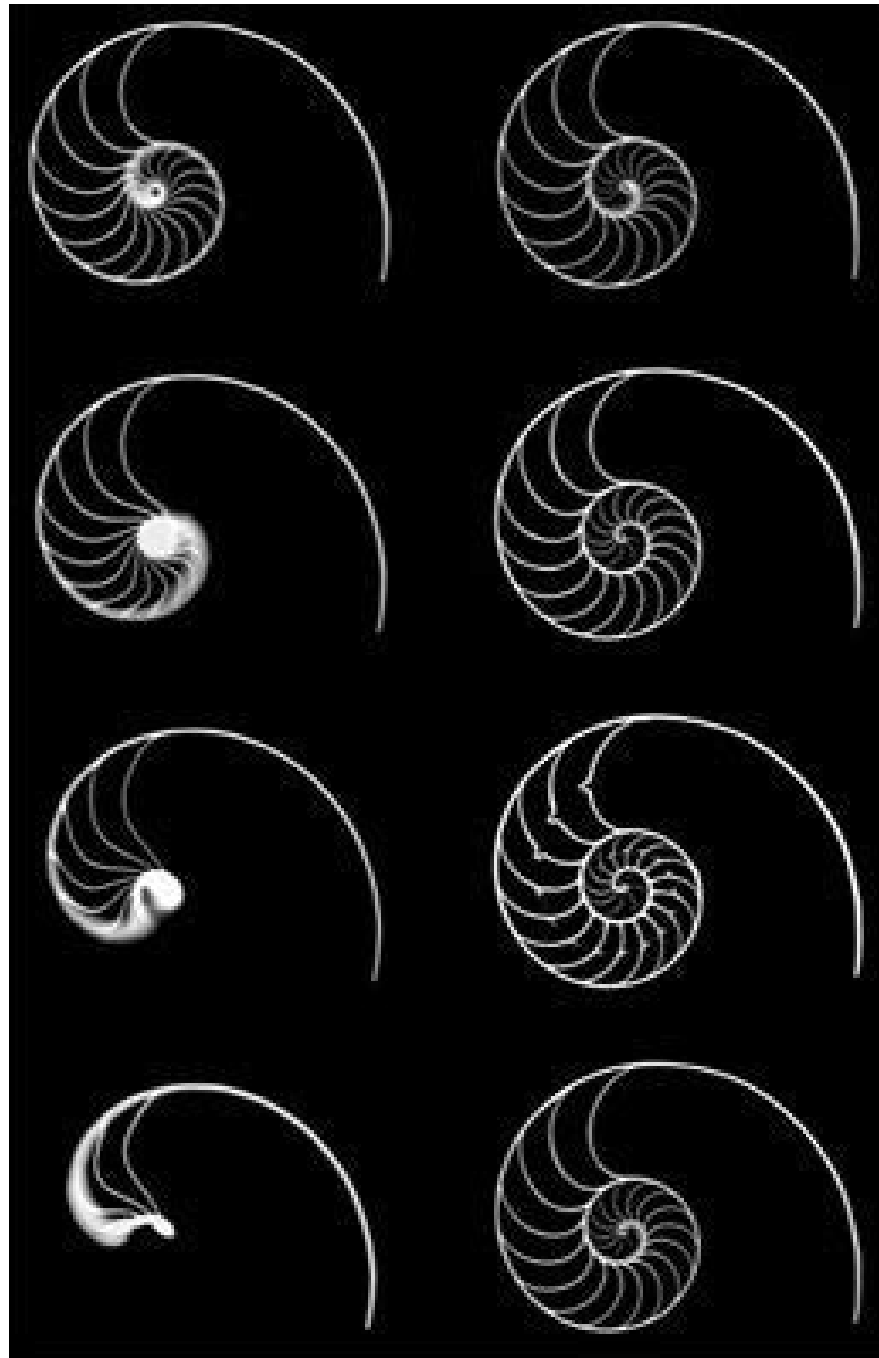
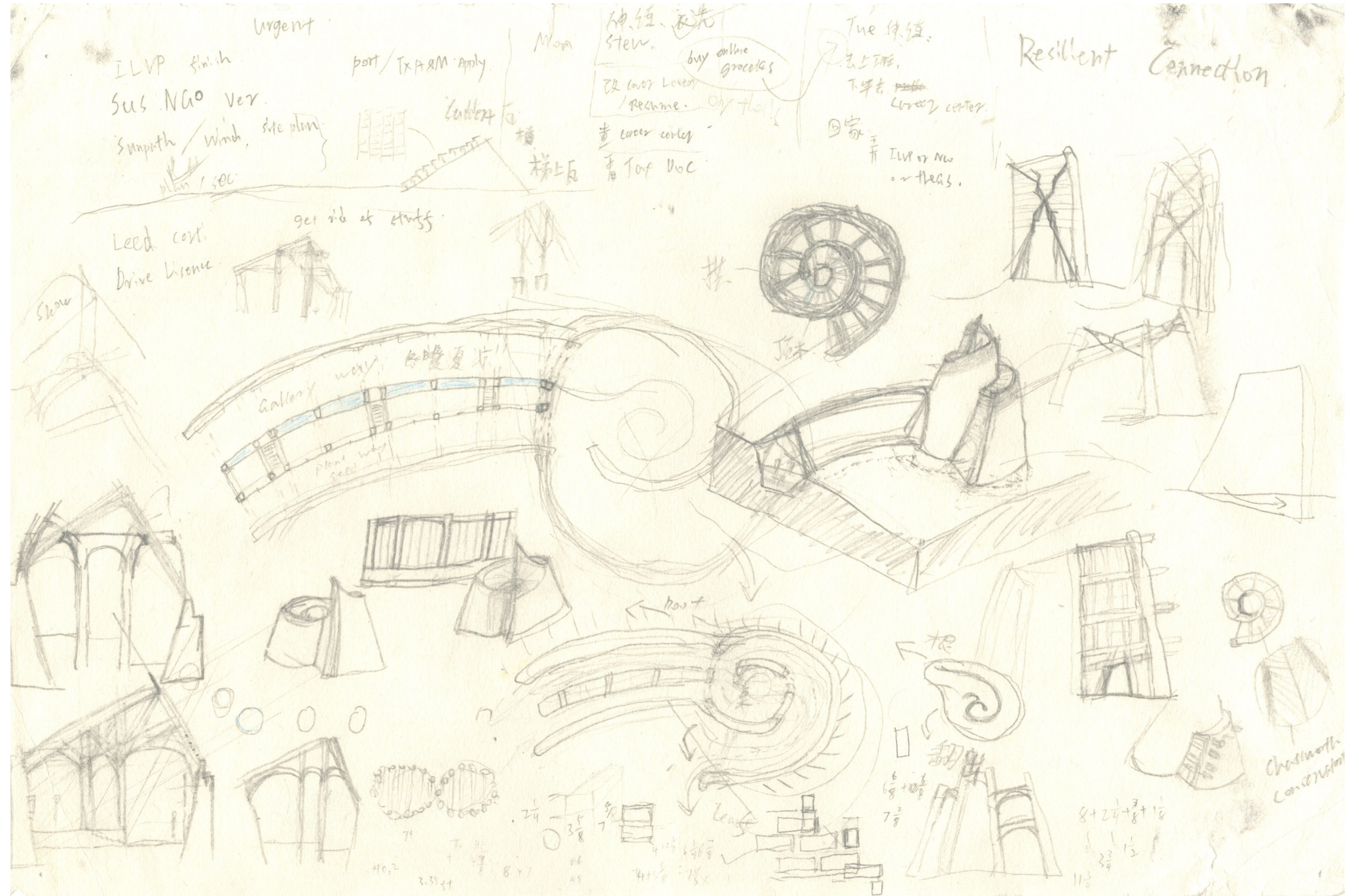


Image from PropG web glossary. Authors: Robert L. Geneve, Professor, University of Kentucky, Sandra B. Wilson, Professor, University of Florida, Fred T. Davies, Jr., Professor Emeritus, A&M Univeristy

Drawing showing a mature seed of *Capsicum annum* (Color image by Katrin Herrmann based on a EM image by Watkins and Cantliffe, *Plant Physiol* 72: 146-150, 1983). Color drawing published in Finch-Savage and Leubner-Metzger (2006).



Section cut of a nautilus shell - Florian Elias Rieser  
CC BY-SA 4.0



正心

Establish a pure and virtuous heart

# Enter / Imagine



Image generated by interaction with Midjourney AI

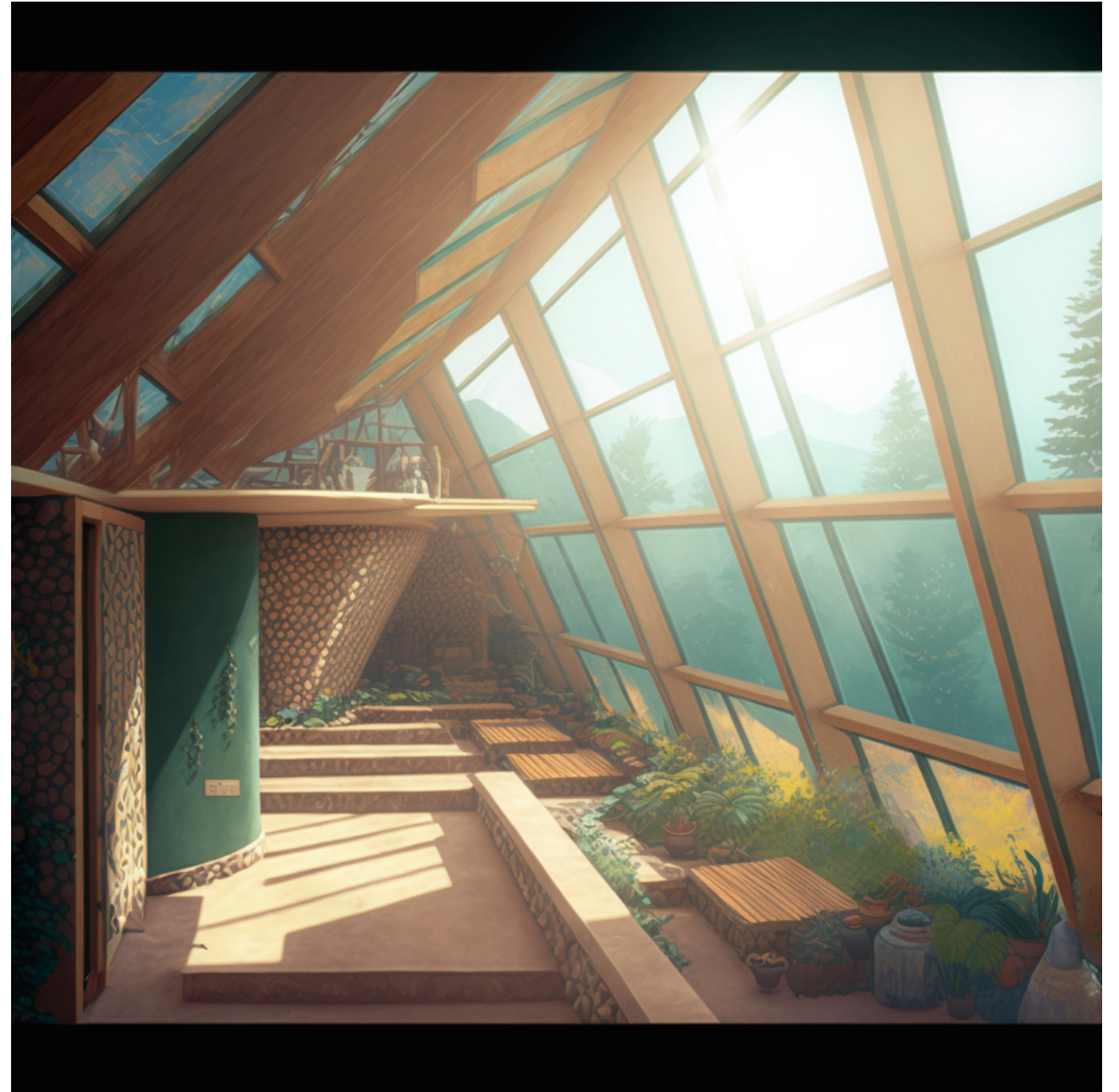
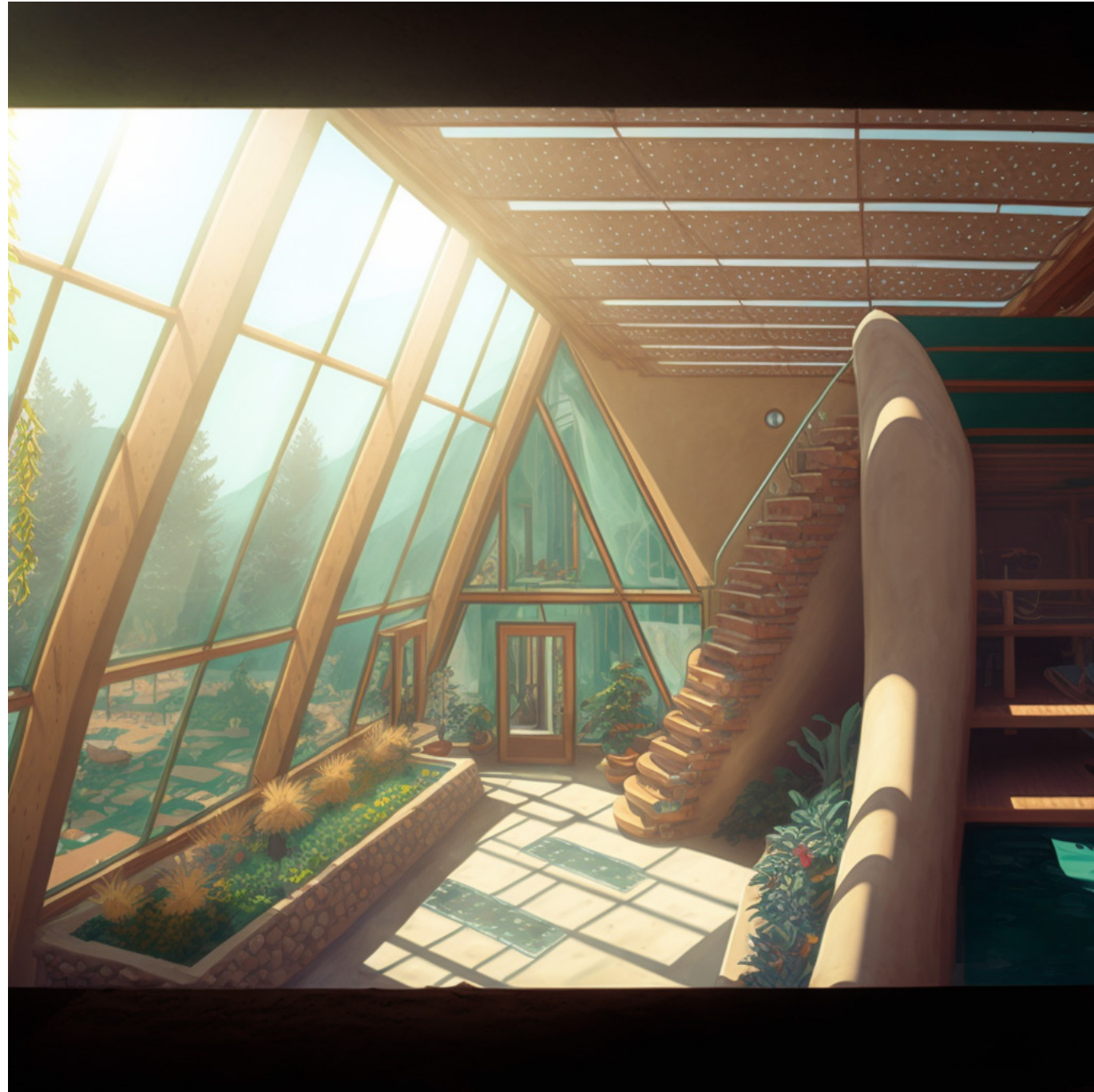
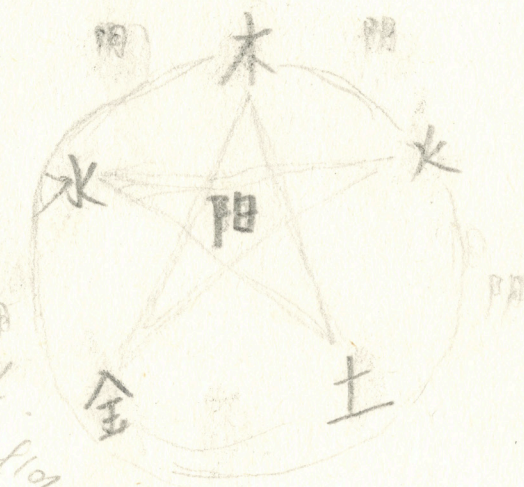
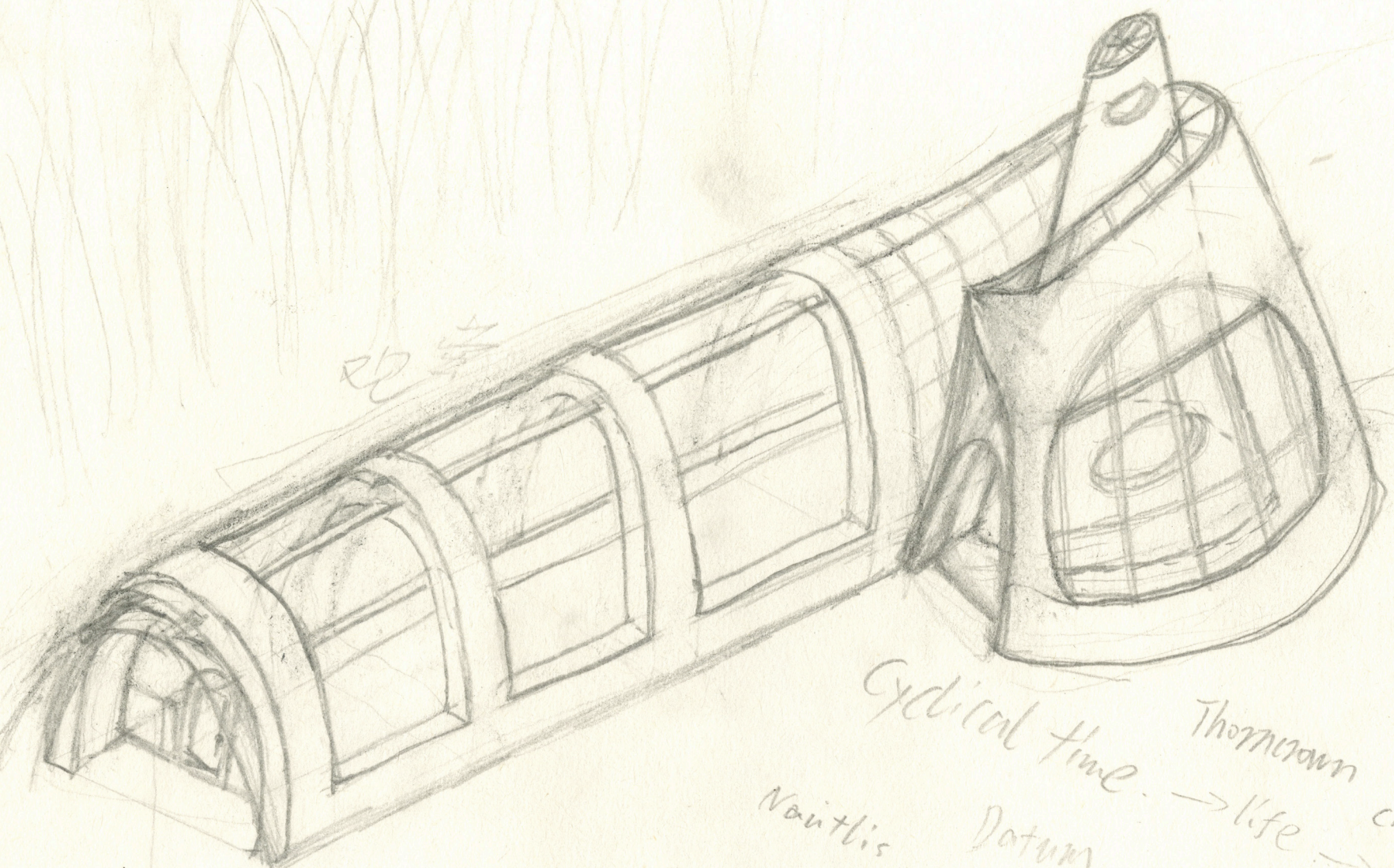


Image generated by interaction with Midjourney AI, the image from the previous page and photographs of the interiors of real Earthships were used as reference.



Image generated by interaction with Midjourney AI, the image from pages ago and photographs of the interiors of real Earthships were used as reference.

- Idea → 思想
- Performative → 行为
- place - how ppl live.
- how to build.

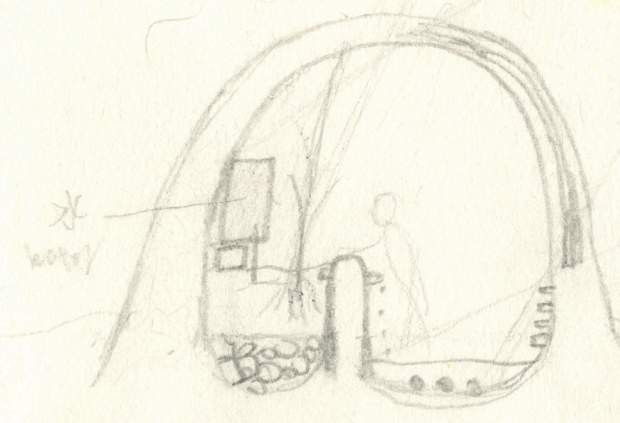


Cyclical time → life → evolution  
 Thomrown chapel  
 Datum → evolution

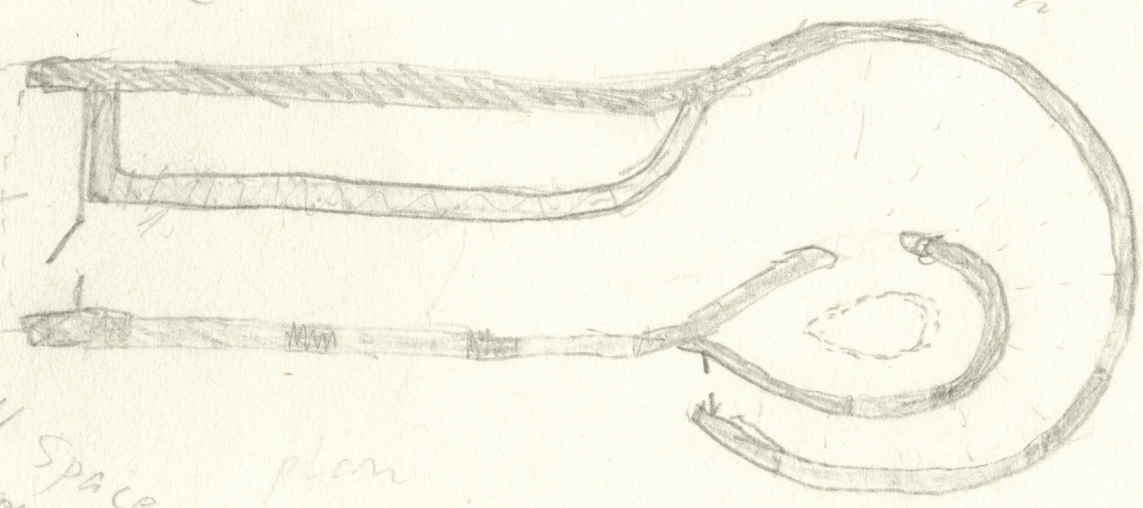
Nautlis

Jacob's house

Remo Pirano  
 Padre Pio



水  
 worry



Chill Space  
 Cafternoon

plan

负阴抱阳





修身

Cultivate the Self and body

# Roots | Stability

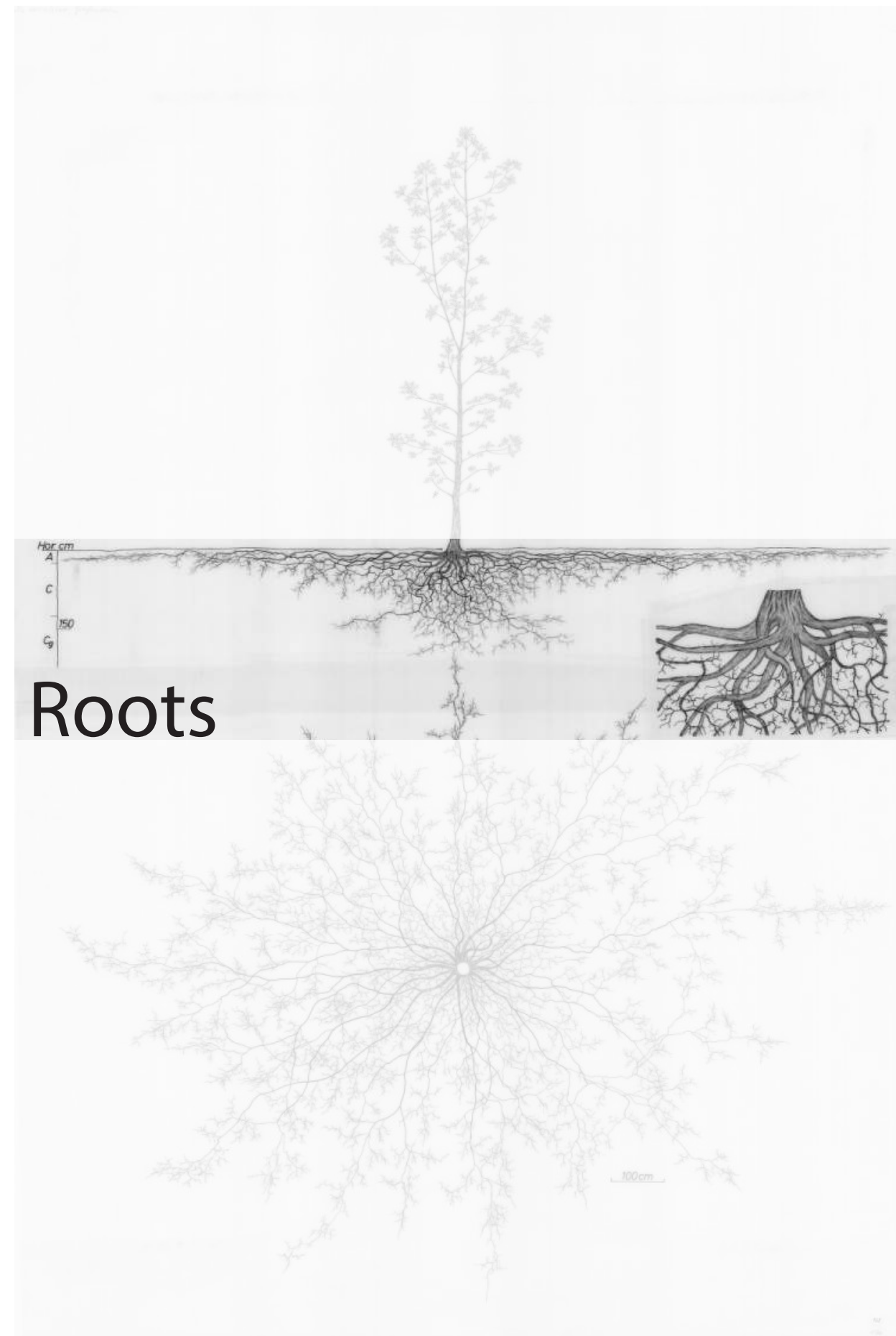




Stability

-

Roots



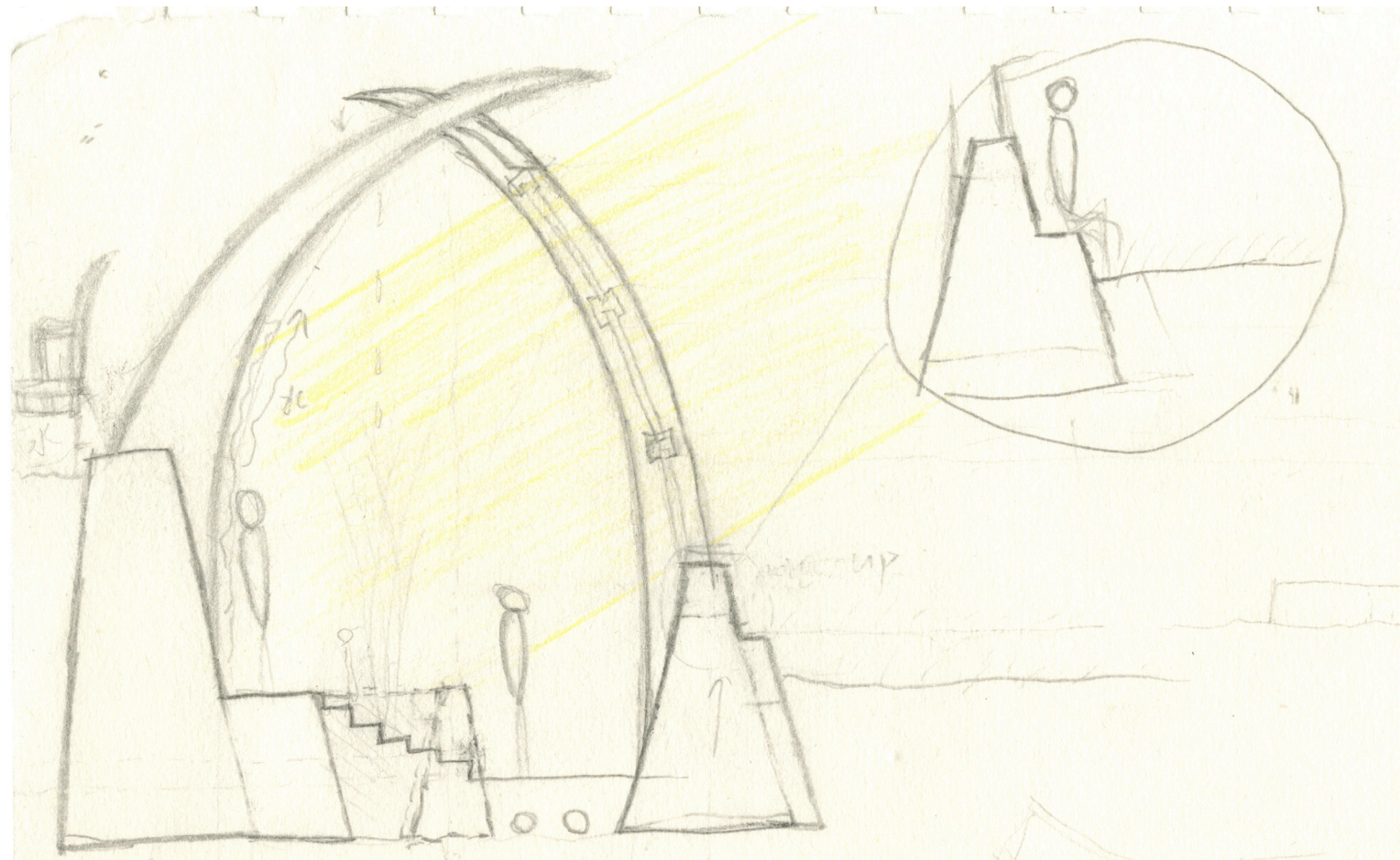
## What does it mean to go into the earth?

“The cave and the womb of mother earth, without fire the cave is a barren womb” just as without our star this pocket of the universe would be a lifeless party.

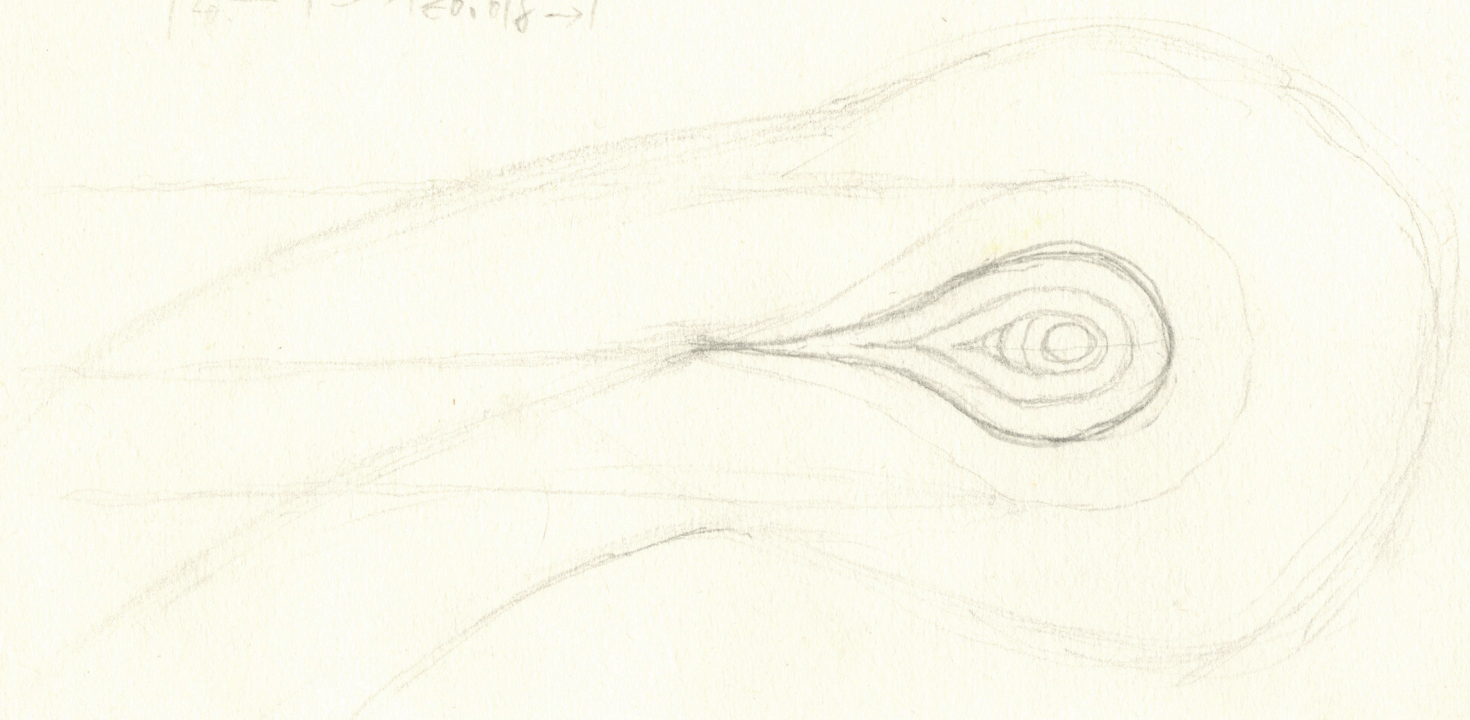
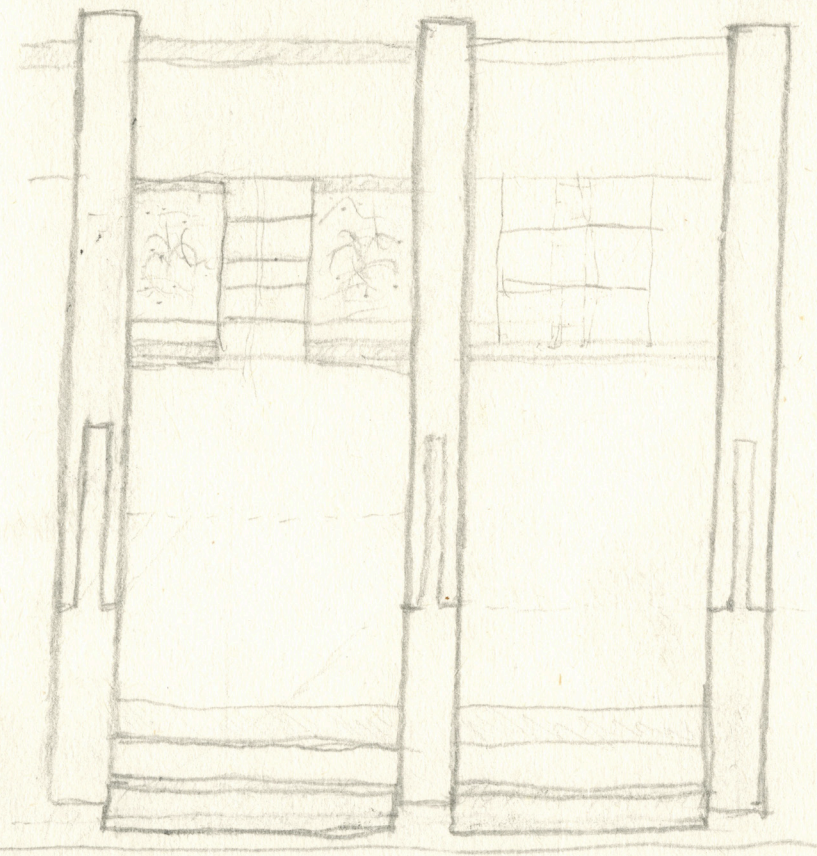
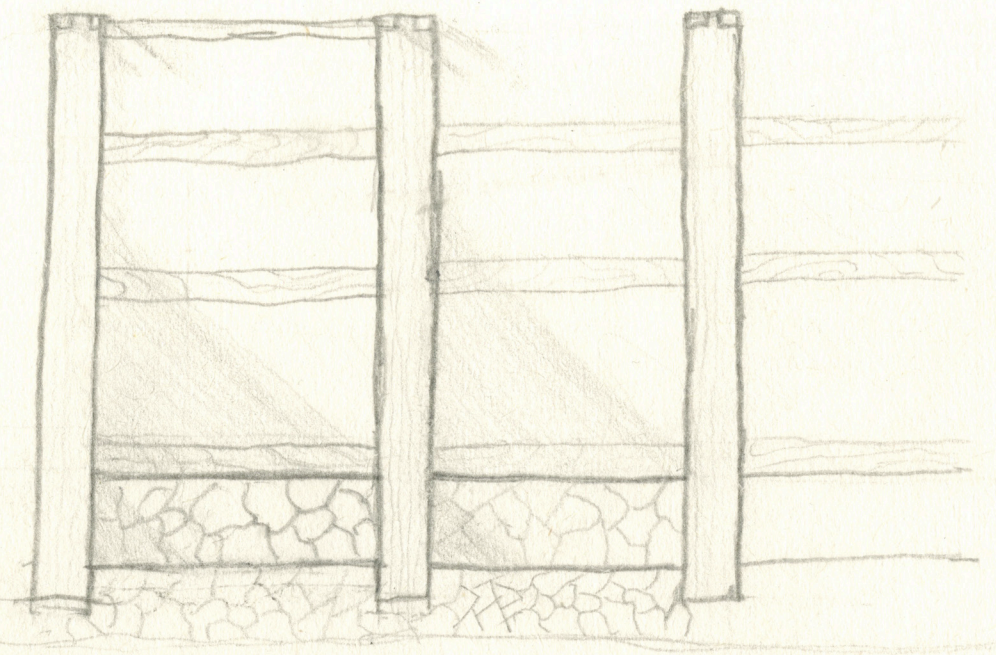
“The nostalgia of the primitive gesture of inhabitation is a tepid, round nostalgia for the womb and the nest. This is not a merely spatial sentiment; it is also--and above all-- a thermal sentiment.”

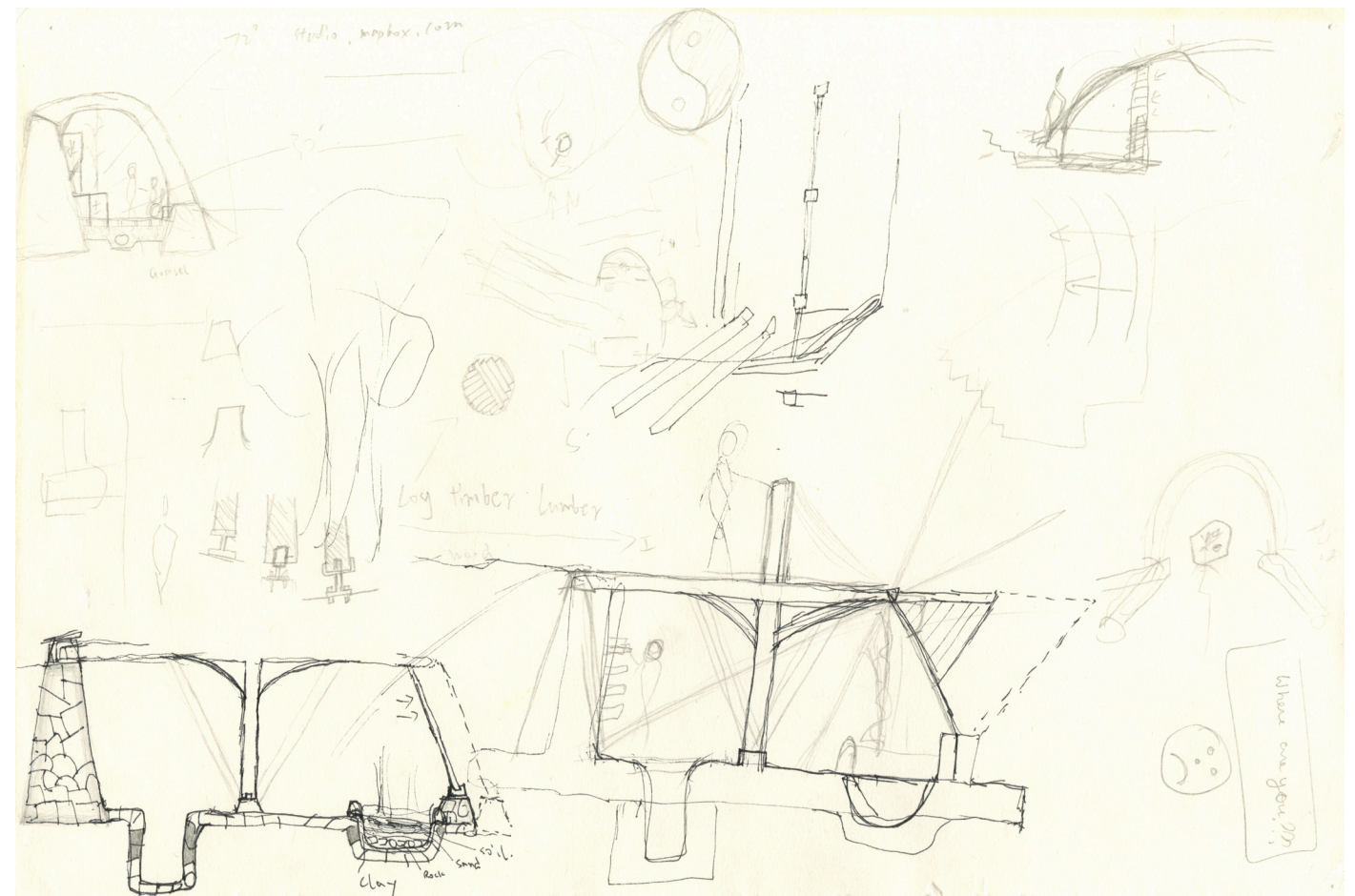
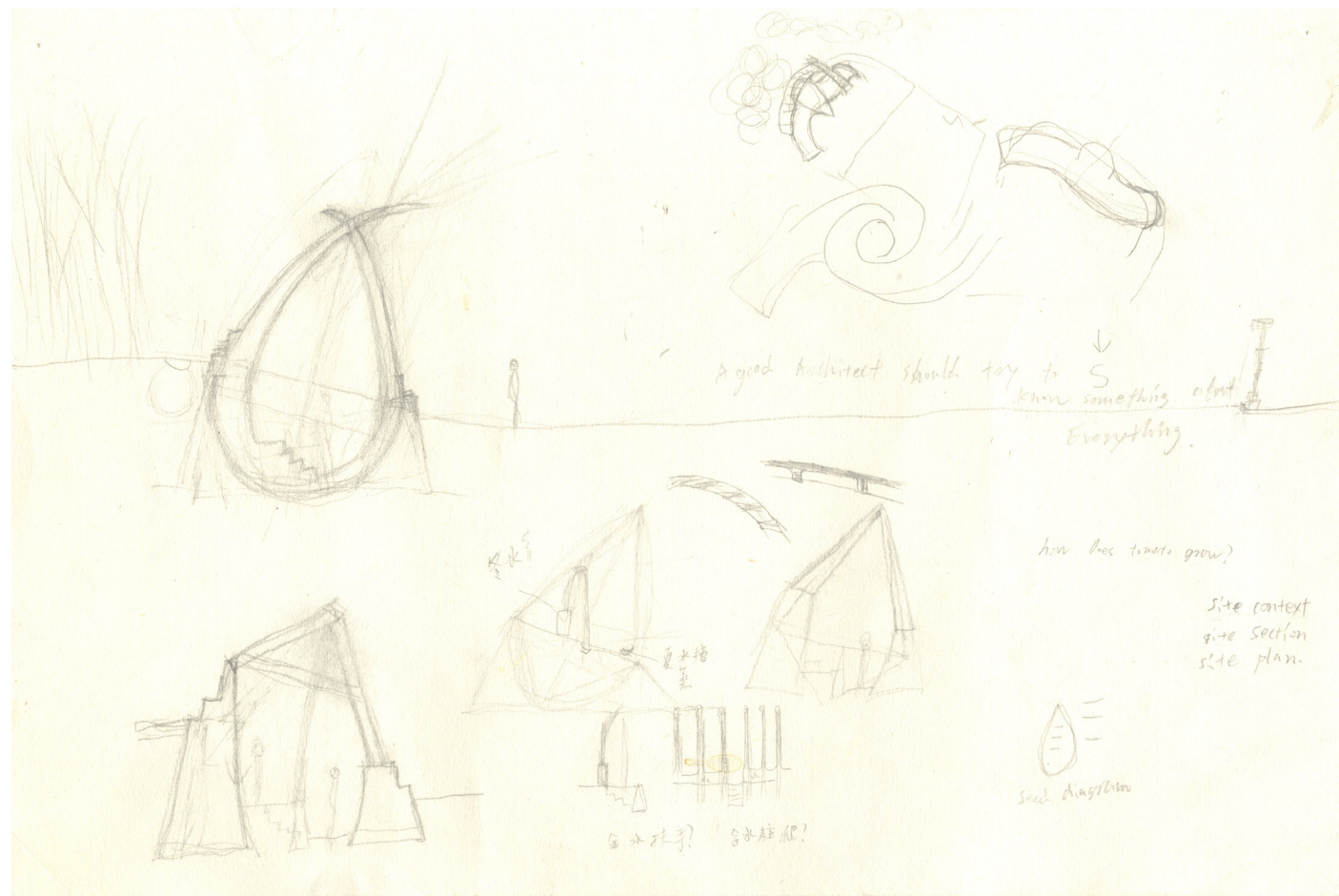
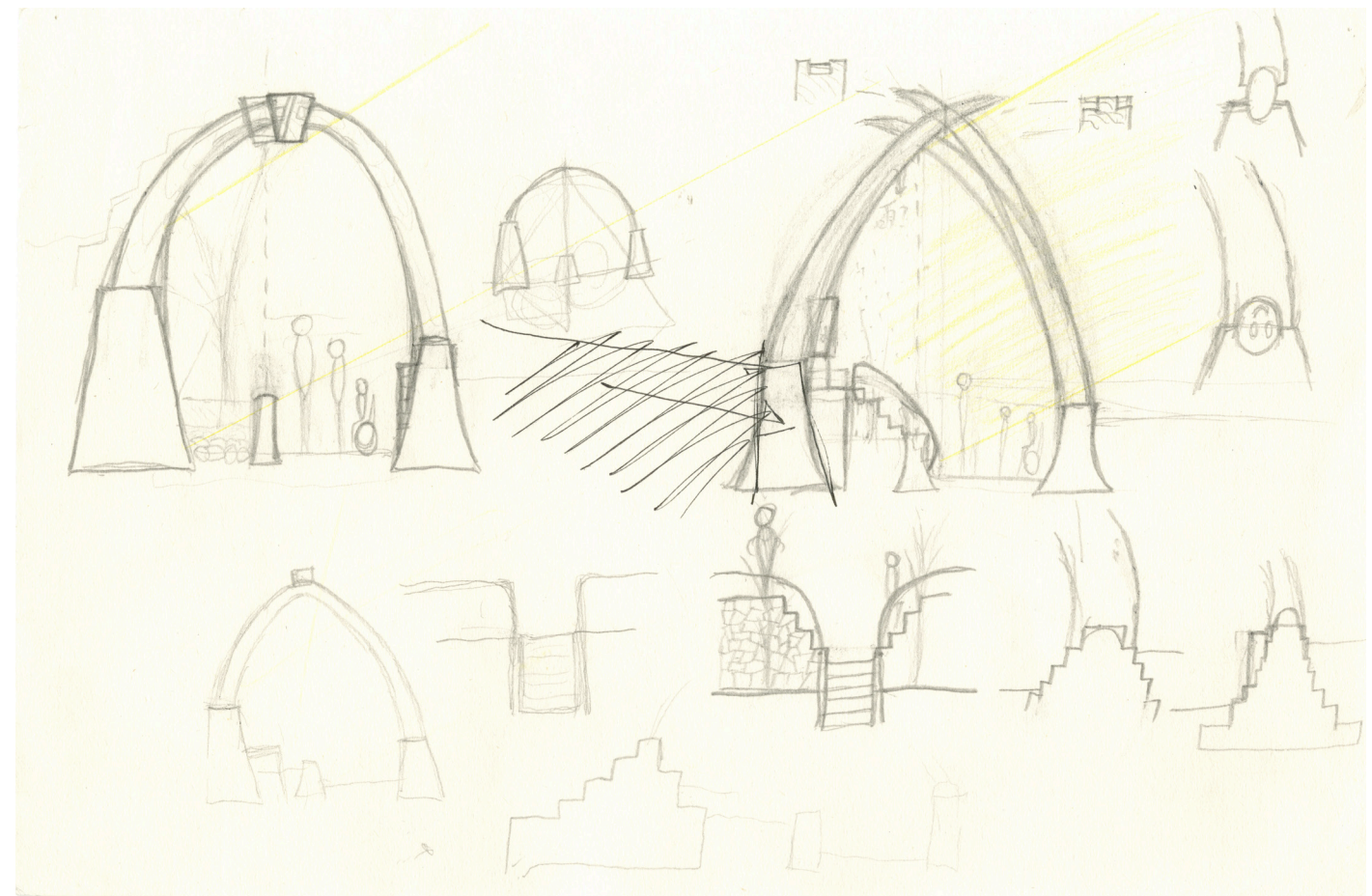
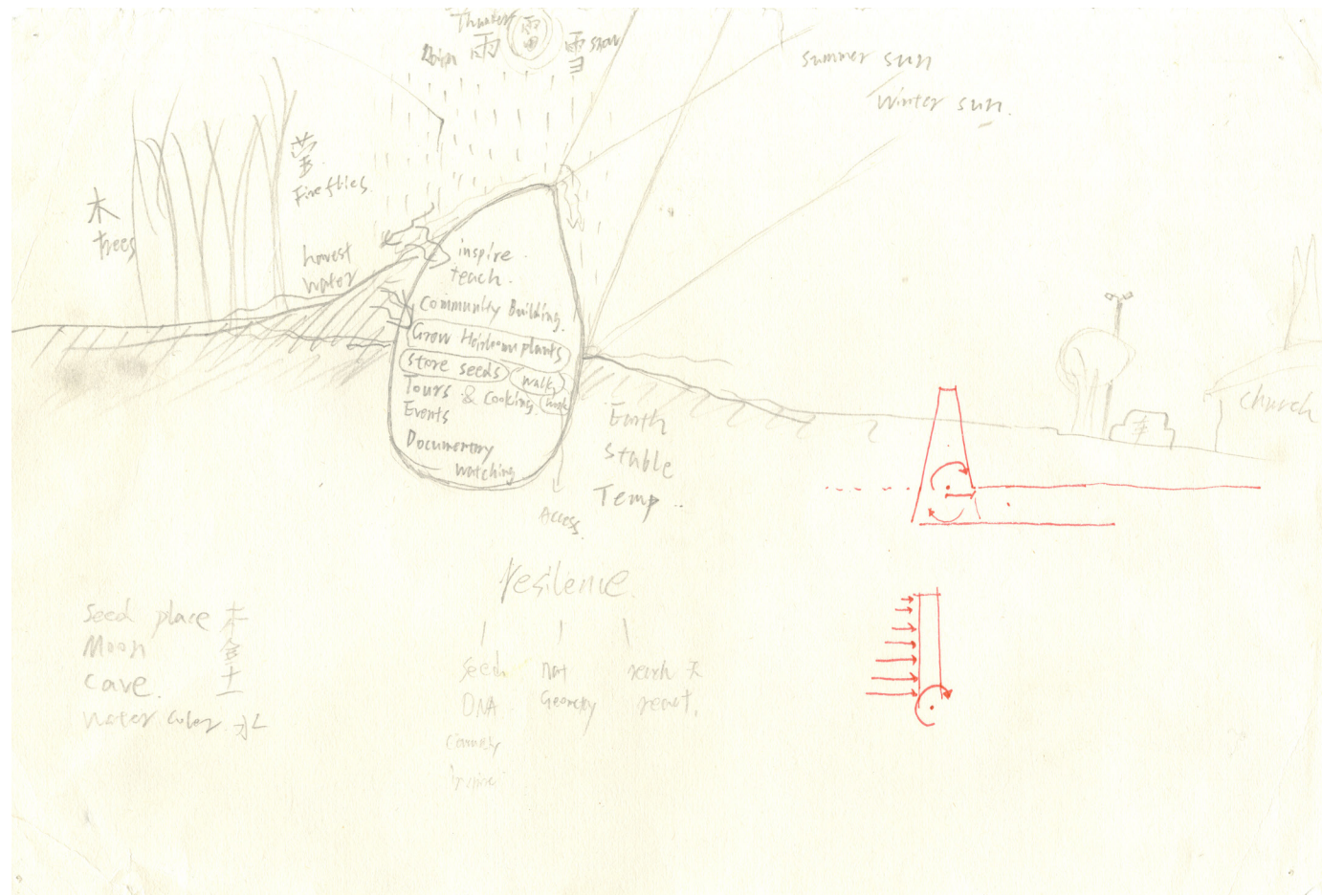
From *Fire and Memory, on architecture and energy*,  
by - Luis Fernández-Galiano P16

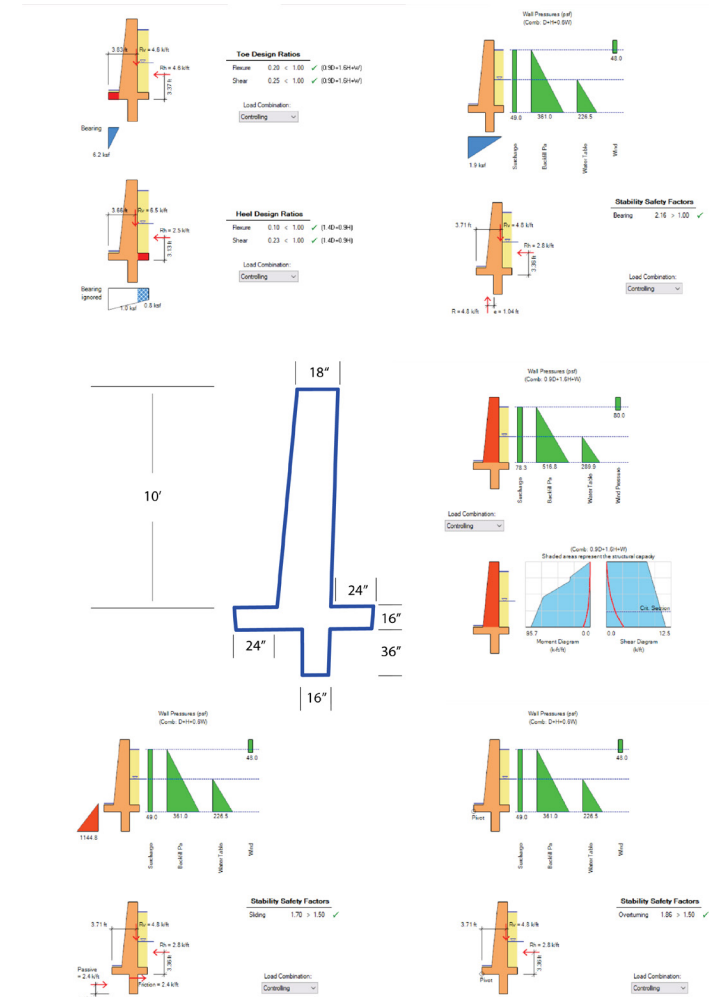
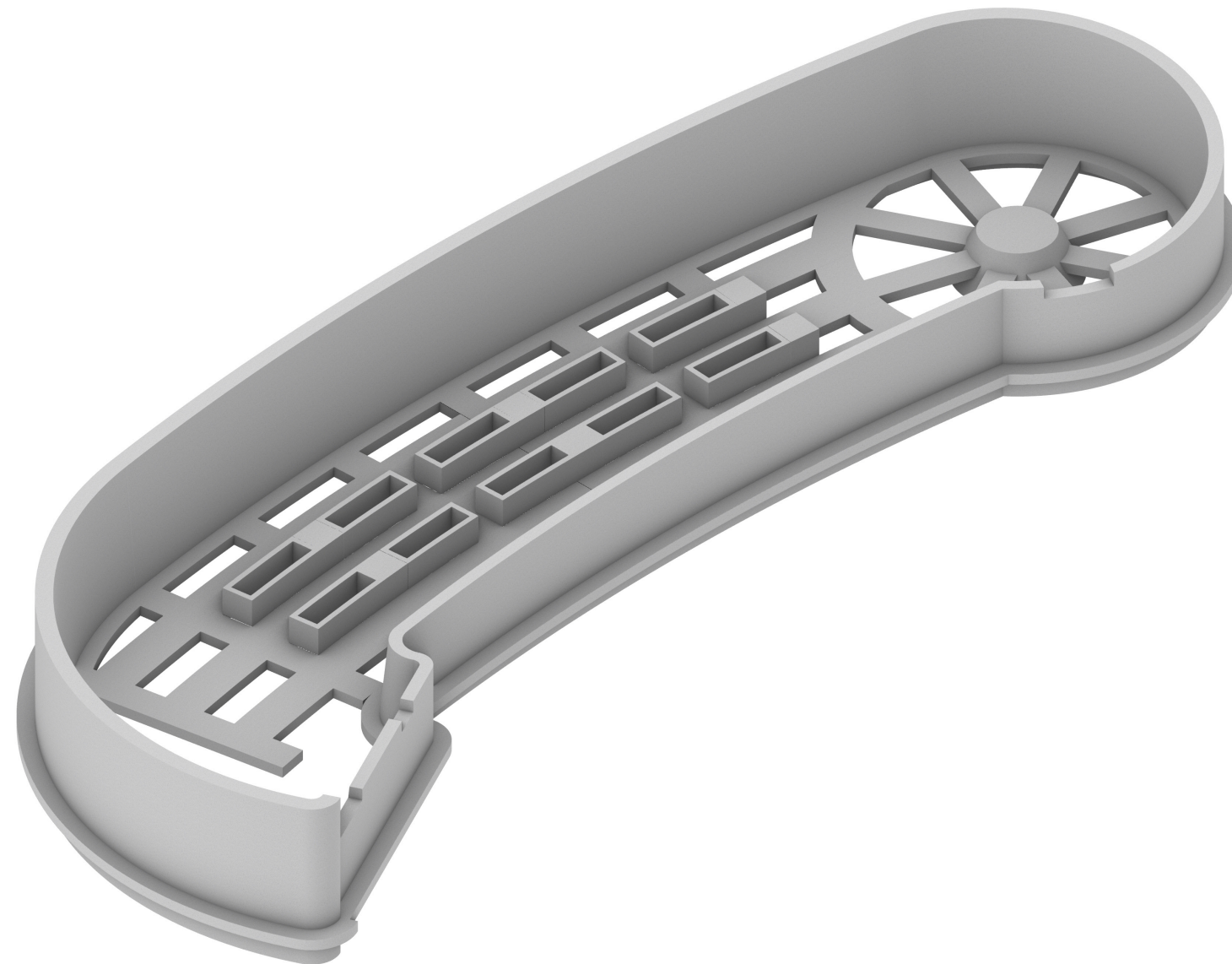
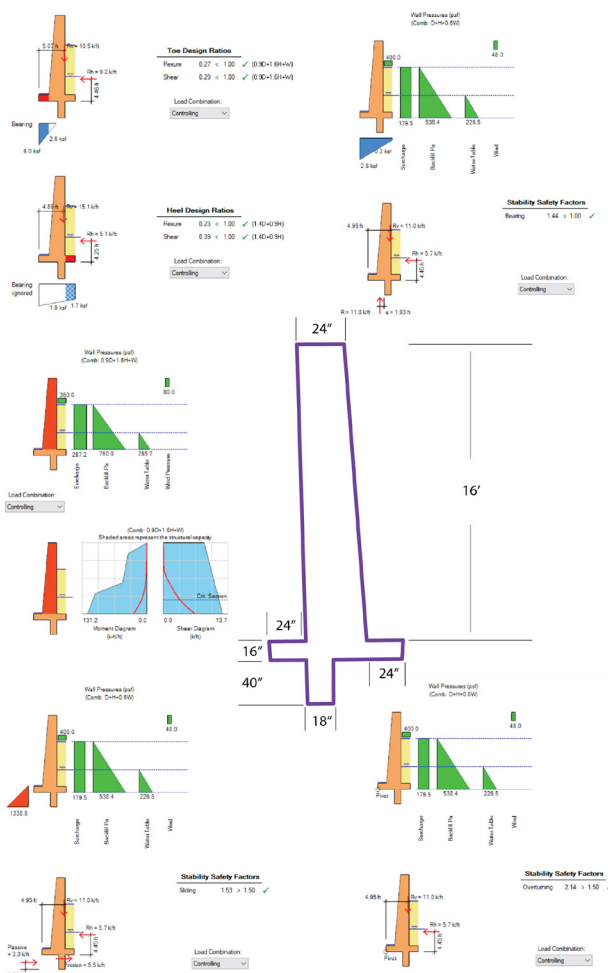




← 0.618 →  
← 0.618 →

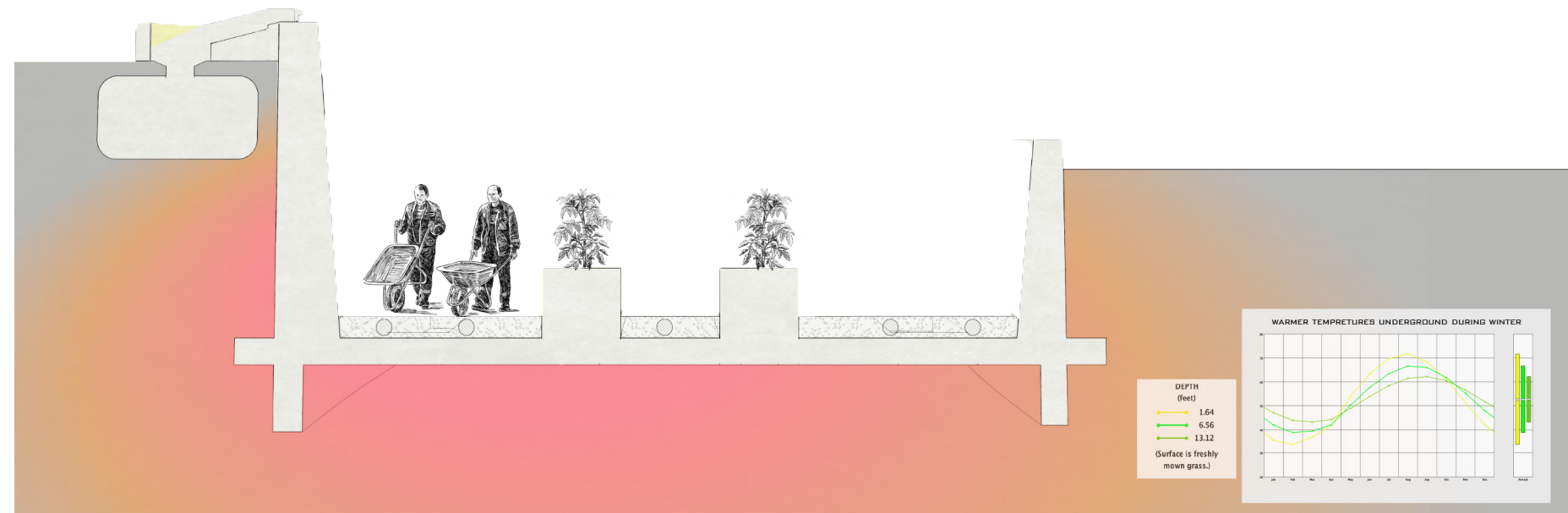






As shown on the left and right, dimensions and shape of north and south retaining walls are informed by running calculations using the free version of ASDIP RETAIN by ASDIP Structural Engineering Software.

Center: digital model of reinforced concrete foundation, with raised concrete planters



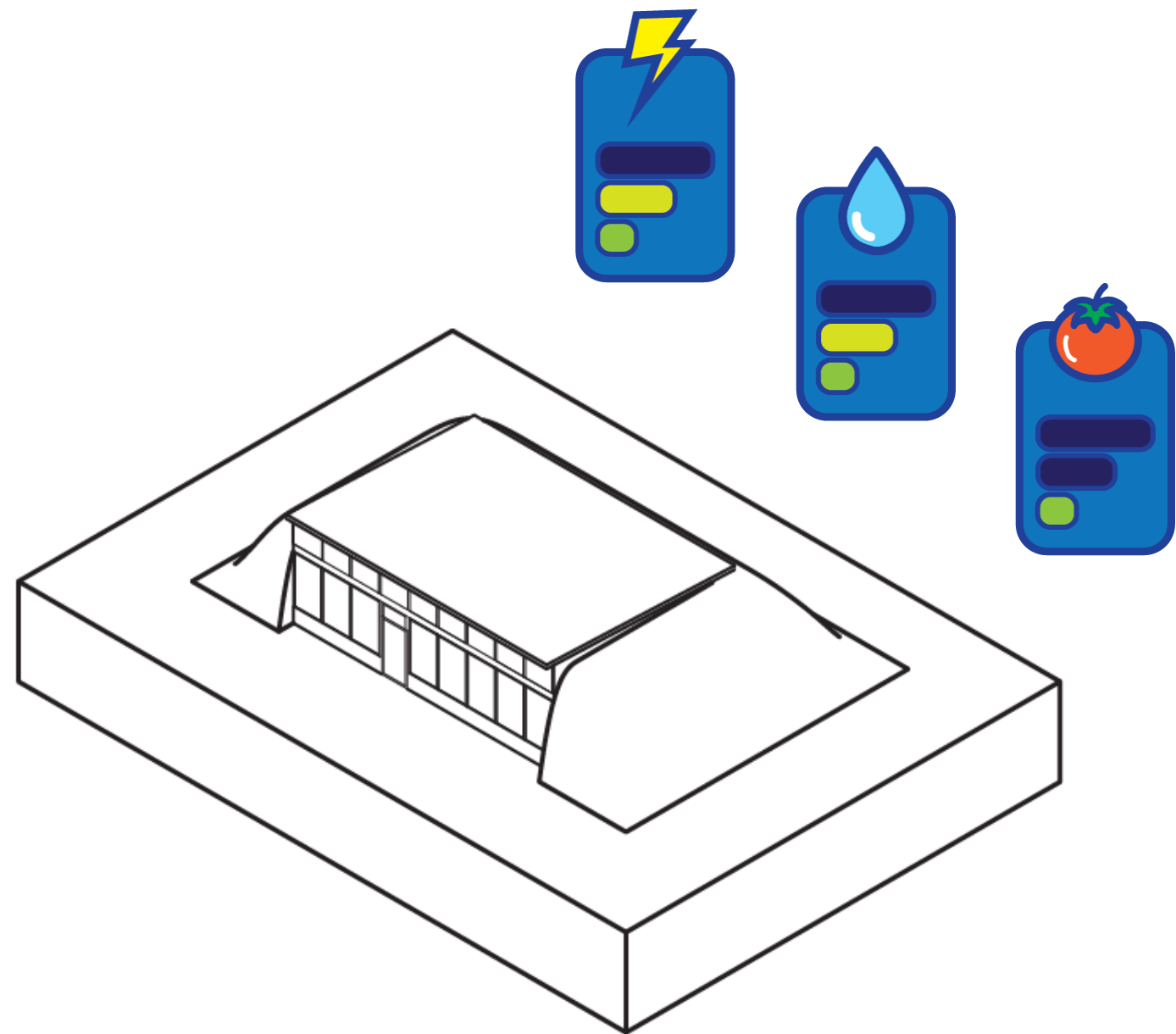
Digital model of light colored concrete wall. Section of concrete foundation in the earth, with a graph depicting how it utilizes the stable earth temperatures.



齐家

Competence in familial affairs

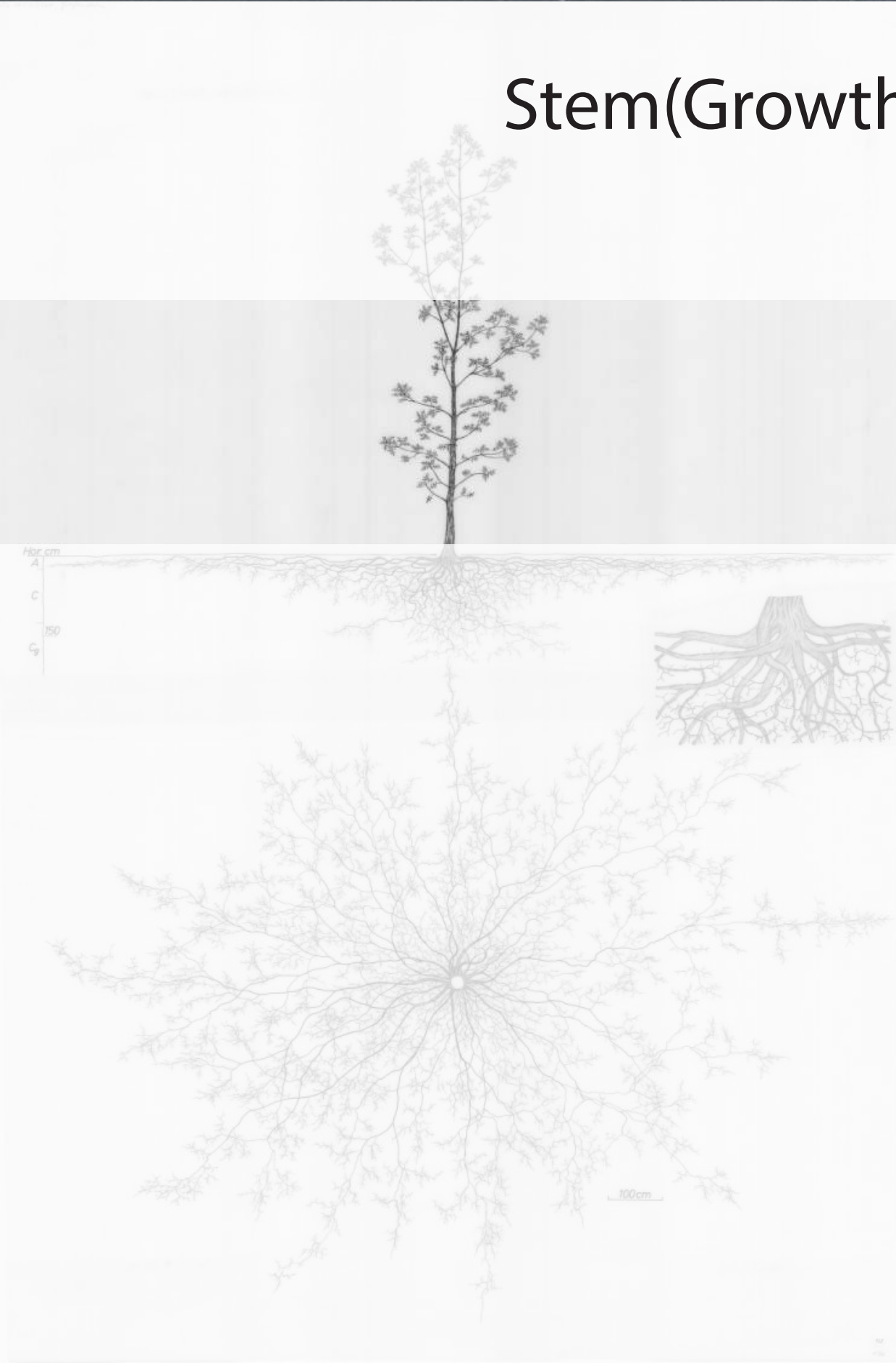
Being self-sufficient, or semi-self-sufficient, in basic resources like energy, water, and food through passive design and the use of solar energy, rainwater harvesting, and integrated greenhouses, will significantly decrease one's utility bills and reduce dependency on financial resources for mere existence. For this reason, living in a passive home that addresses basic human needs through the harnessing of naturally occurring phenomena could encourage more individuals to pursue careers or interests that are more fulfilling, ultimately leading to a healthier society.



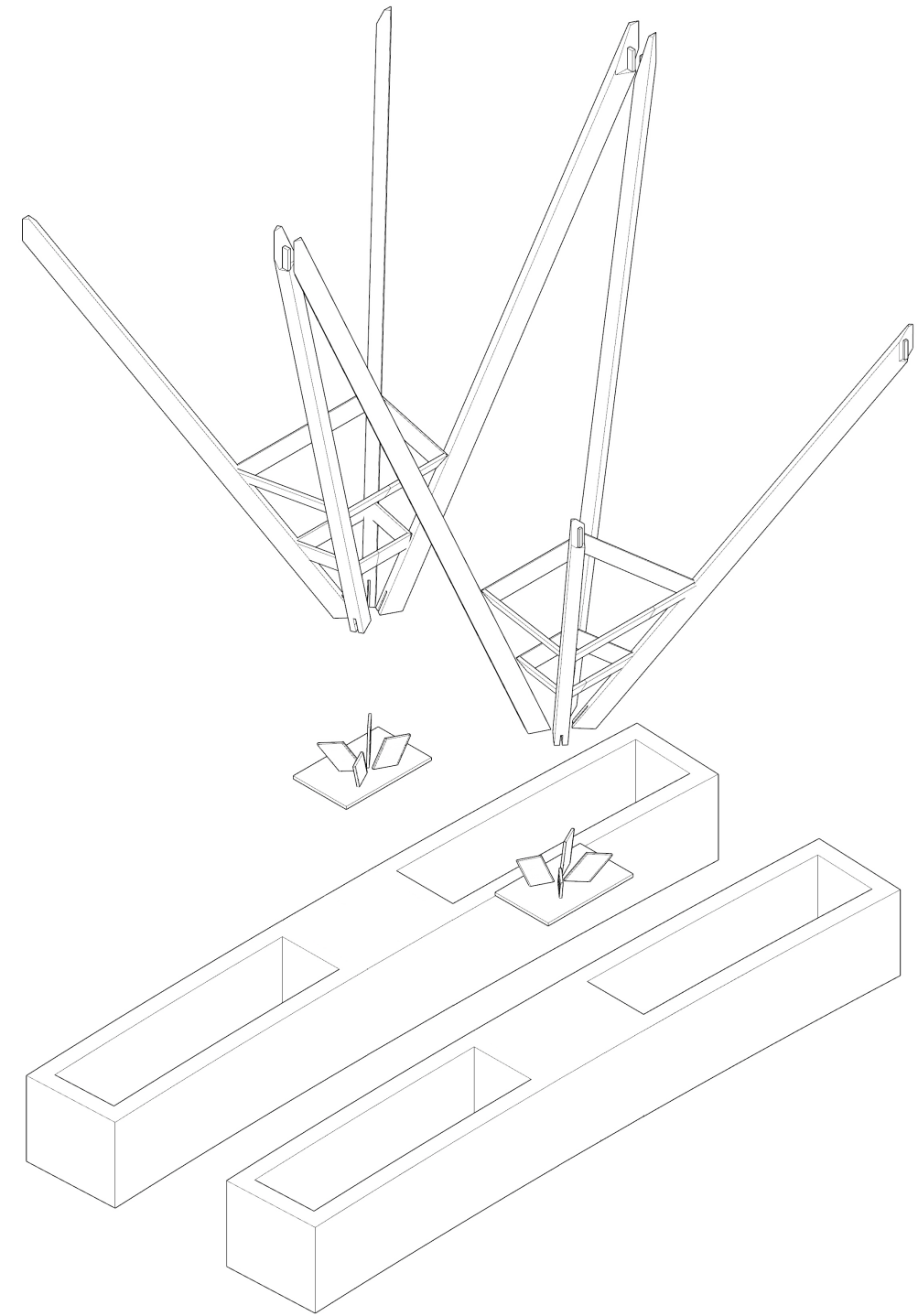


# Growth | Tropism

## Stem(Growth)



## - Structure(Tropism)



## Tropism

Tropism is a biological term that refers to the directional growth or movement of an organism in response to a specific external stimulus. This stimulus could be gravity, light, moisture, chemicals, or other environmental factors. The response to the stimulus results in the organism's growth or movement either toward or away from the source of the stimulus.

Photo tropism, specifically, is a type of tropism exhibited by plants in response to light. When a plant exhibits photo tropism, it shows a directional growth or movement towards or away from a light source.

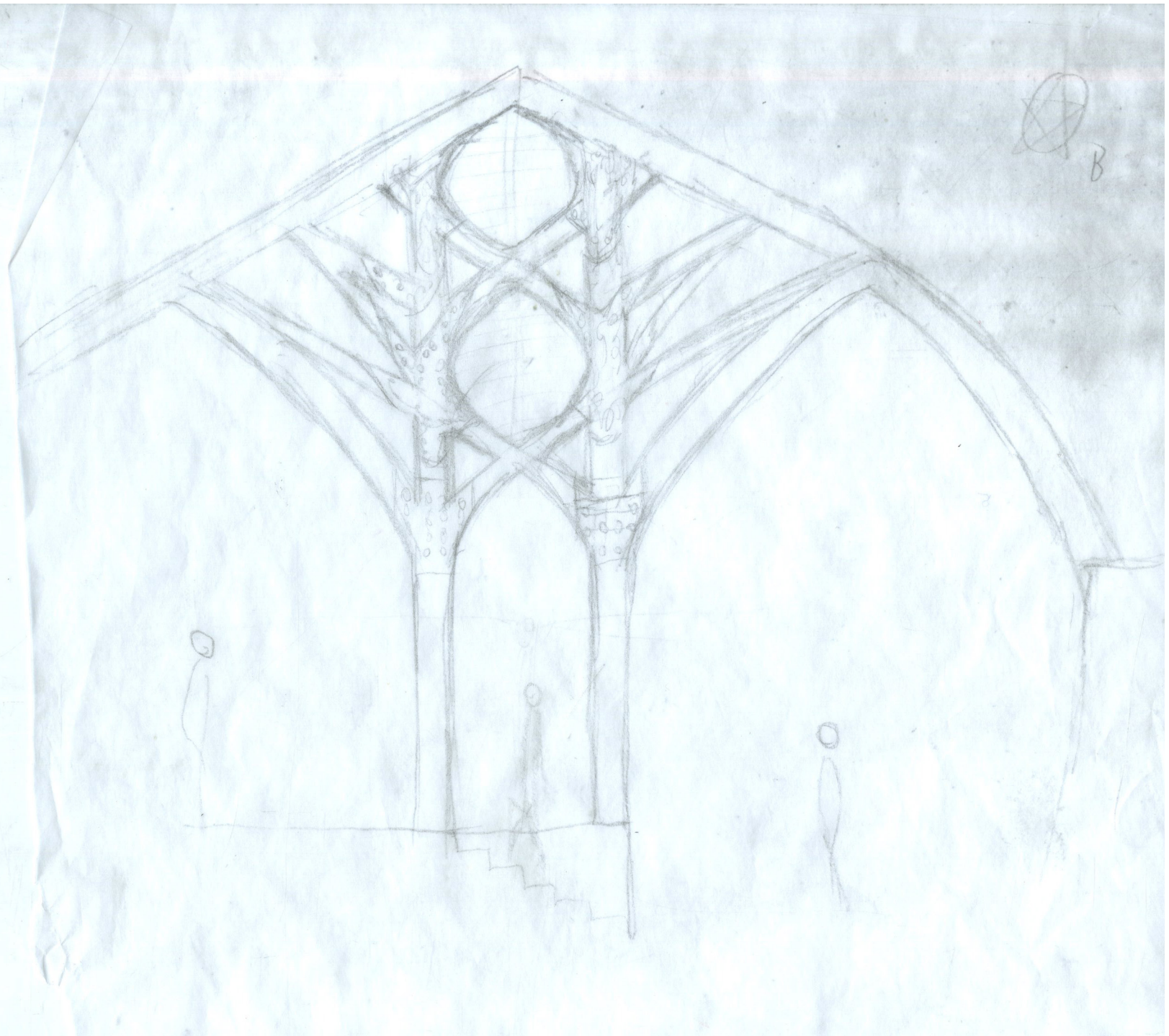
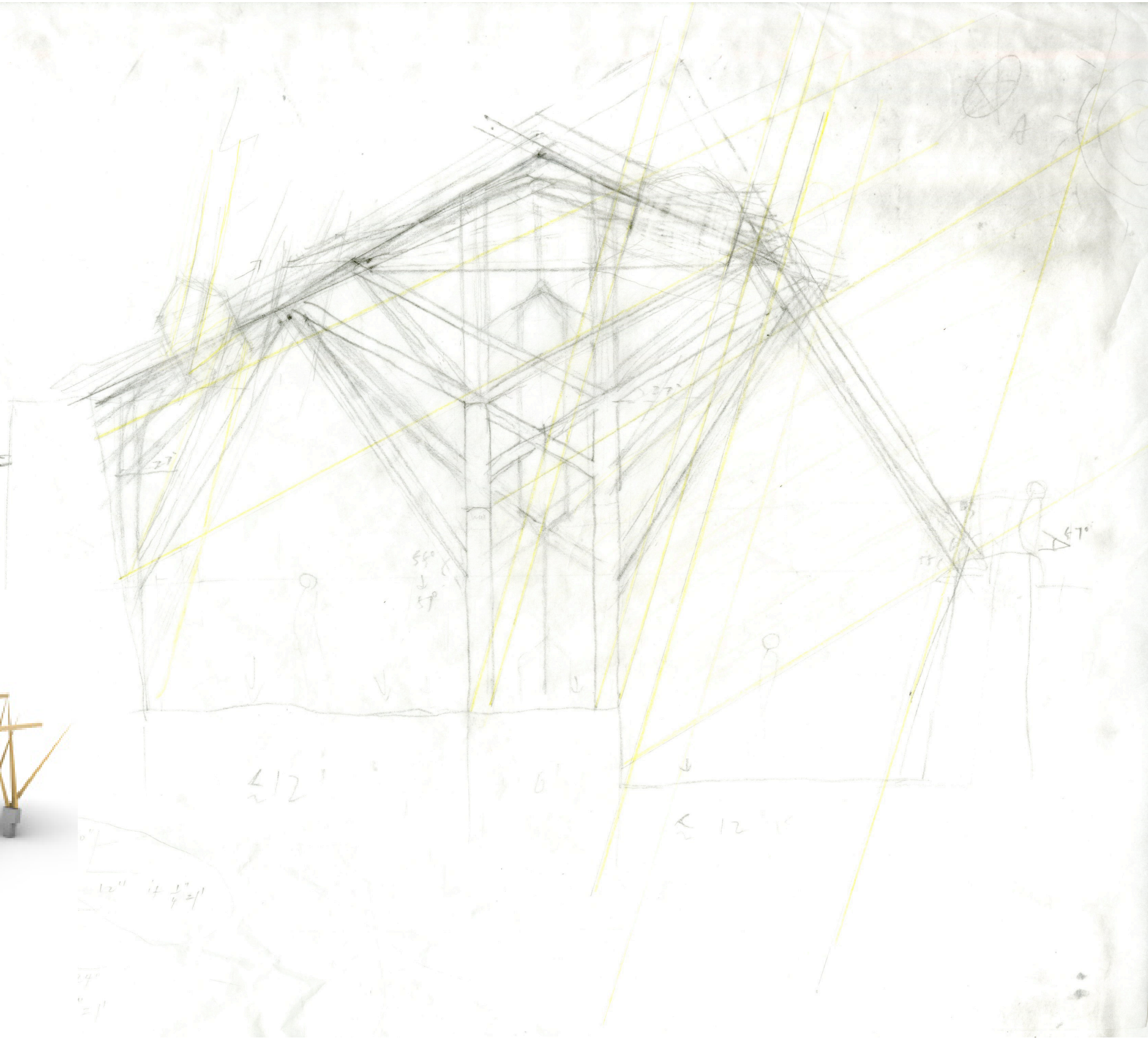
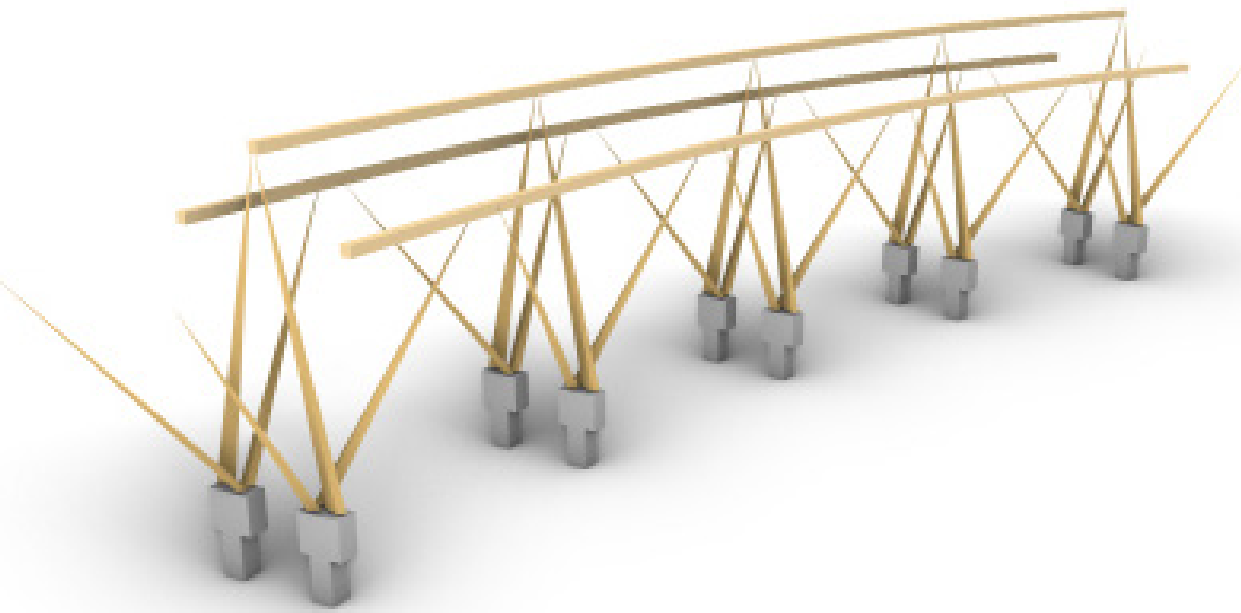
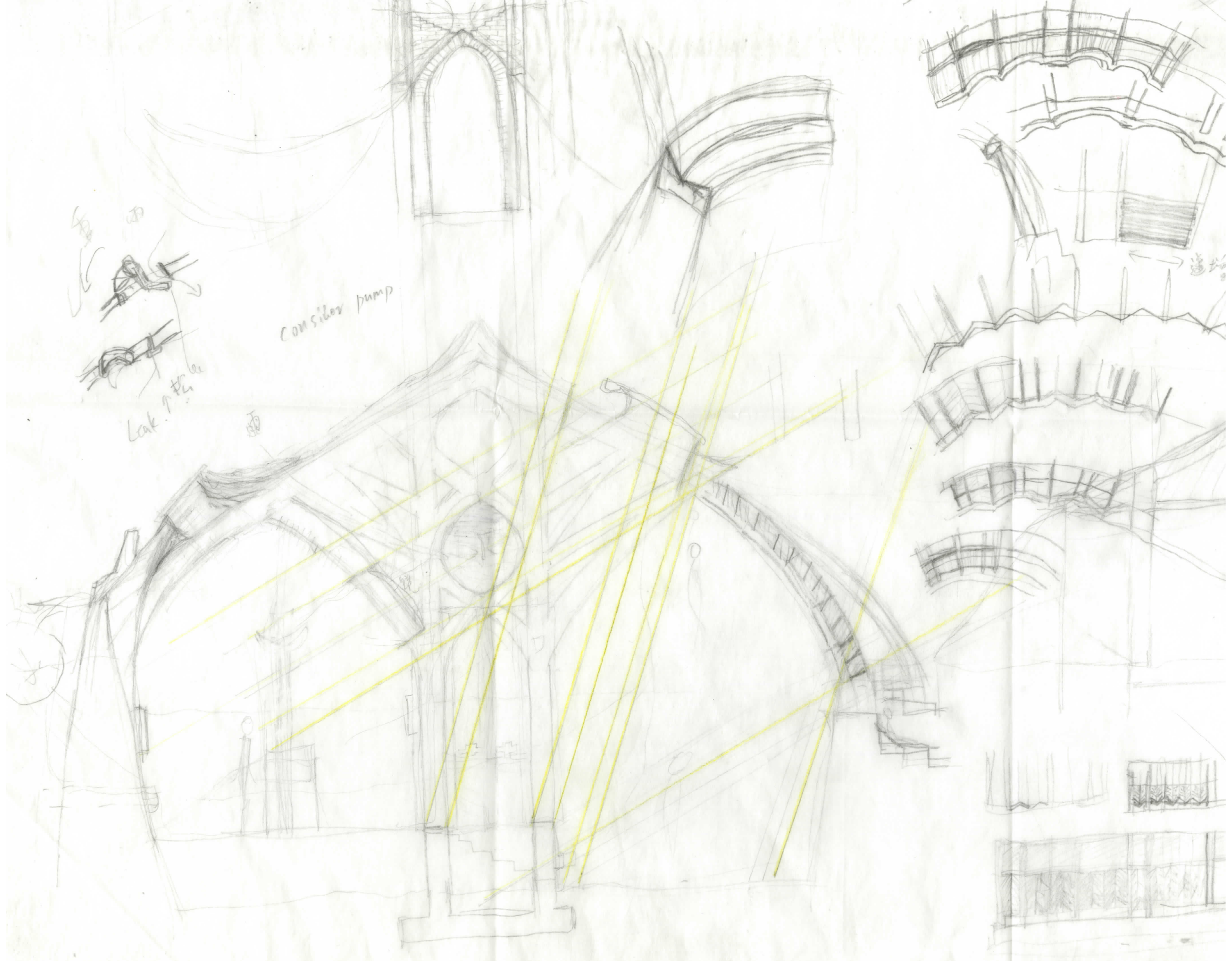




Photo of heirloom tomato plant commonly known as the Cherokee Purple, grown on the author's balcony in conjunction of the thesis project.

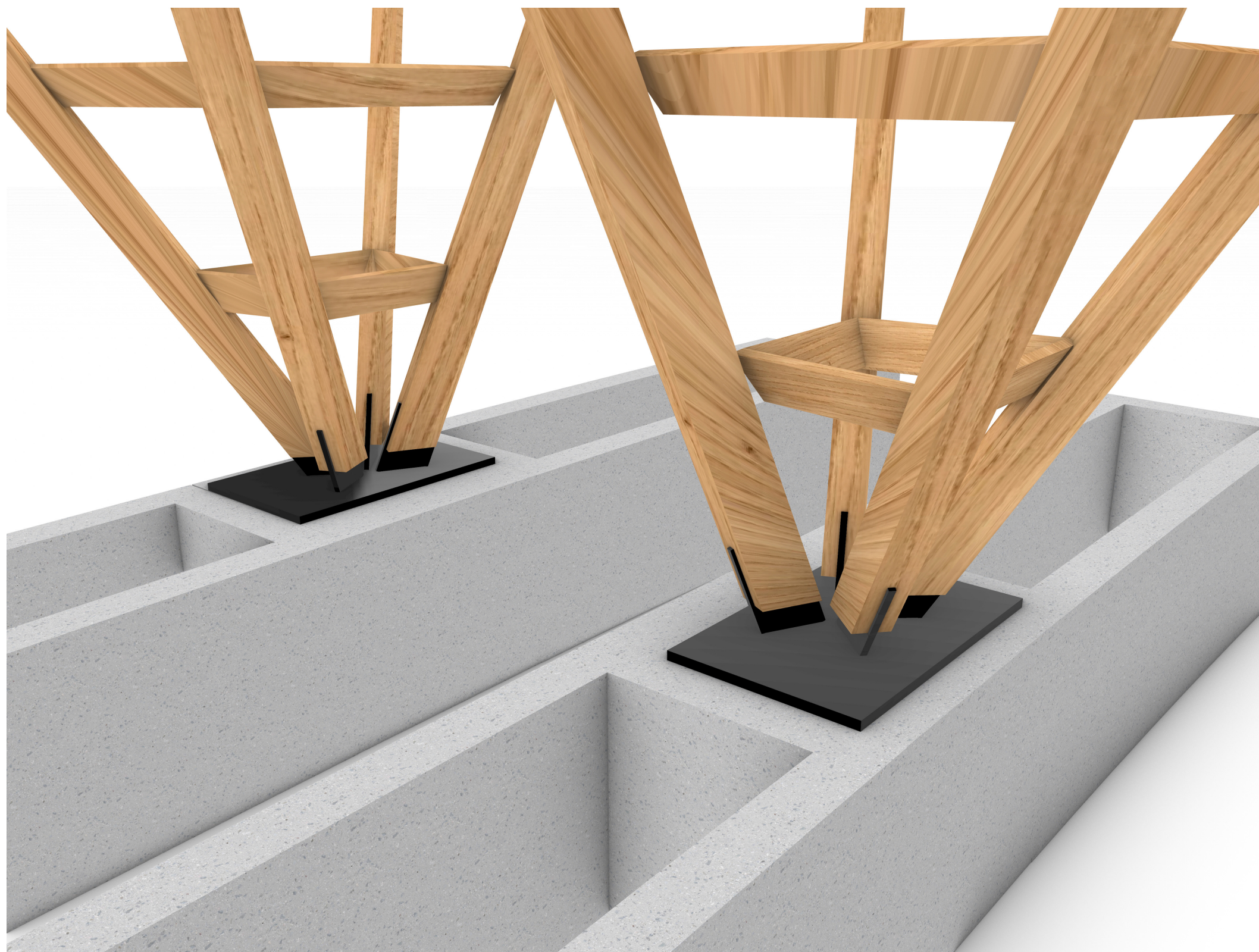




Consider pump

Leak

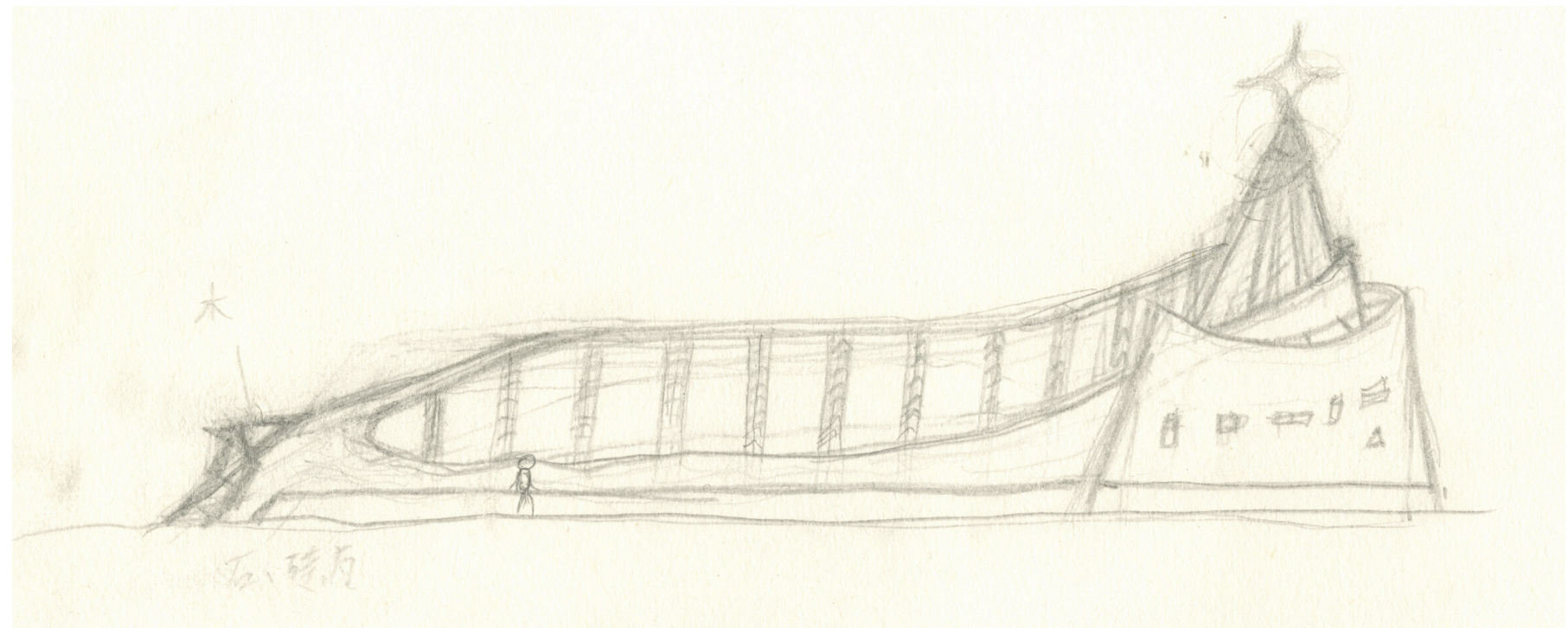
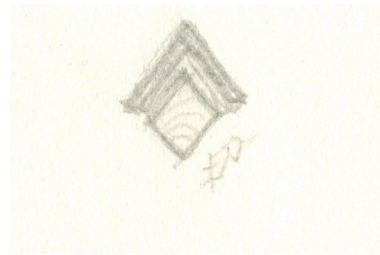
道地



The main structural support in the central greenhouse section of the building are organized in clusters of four 6 by 10 standard dimensional lumber without exceeding 25 ft for each piece.

The lumber is bolted to steel connectors which are bolted to the raised concrete extension of the foundation.

The main structure reaches upward towards the sky while spreading out diagonally as a plant would during its growth.

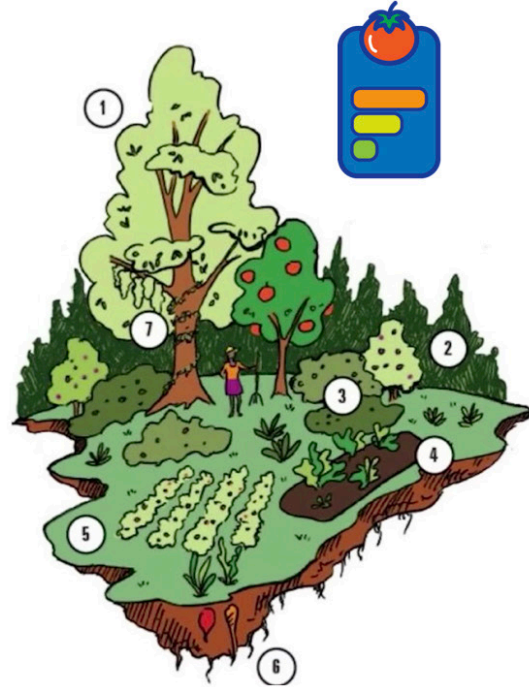


治国

Govern the State

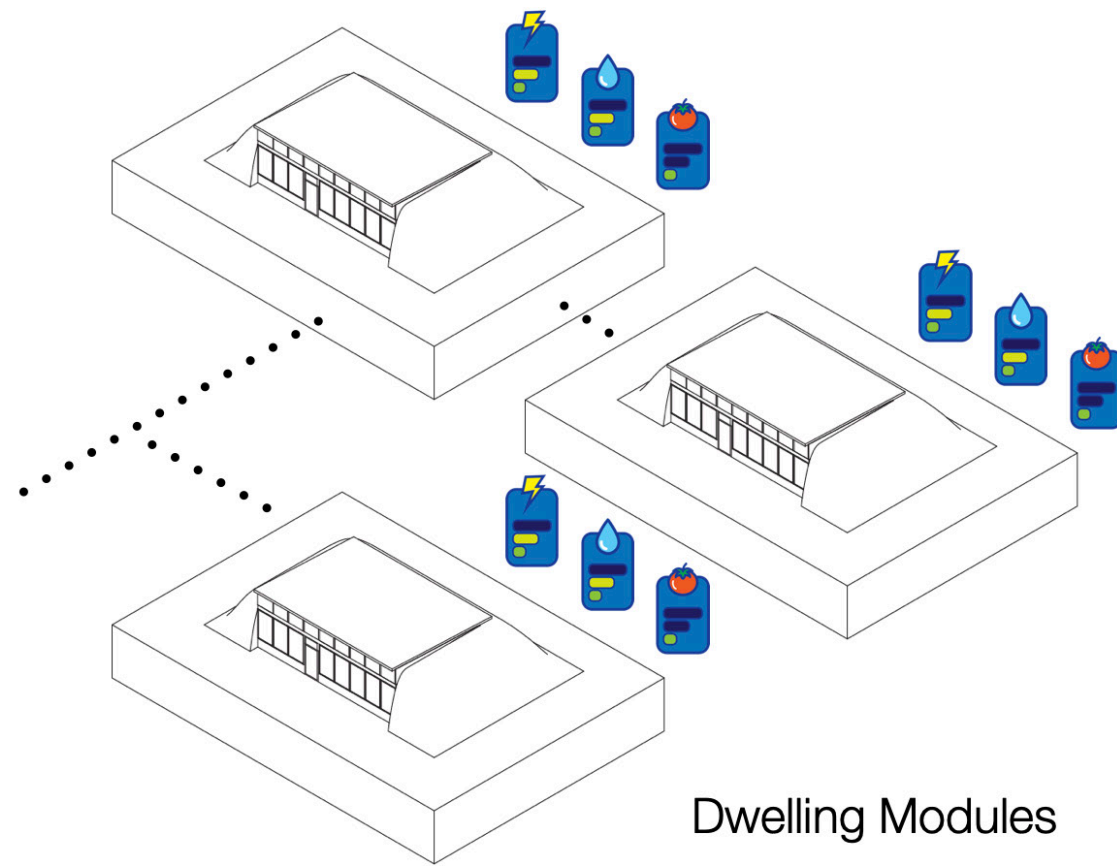
平天下

Bring Peace to All Under Heaven



Food Forest  
Module

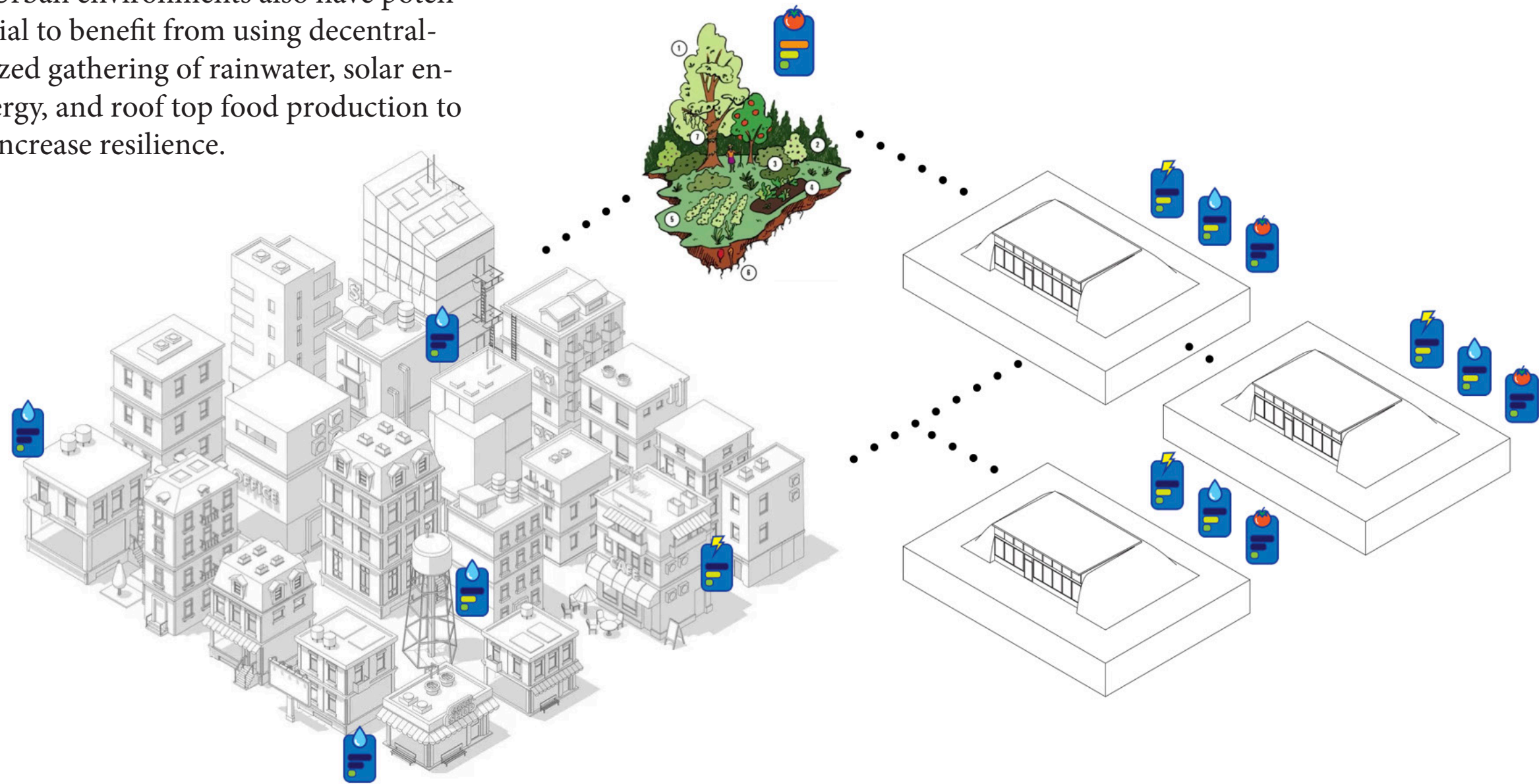
Stock image used for Food Forest Module



Dwelling Modules

Smart infrastructure networks comprised of self-sufficient modules that can independently provide its habitants with basic survival needs are more resilient than a centralized distribution system. Resources can be shared in the network, but when problems occur, unaffected modules can disconnect and be self-sufficient.

Urban environments also have potential to benefit from using decentralized gathering of rainwater, solar energy, and roof top food production to increase resilience.

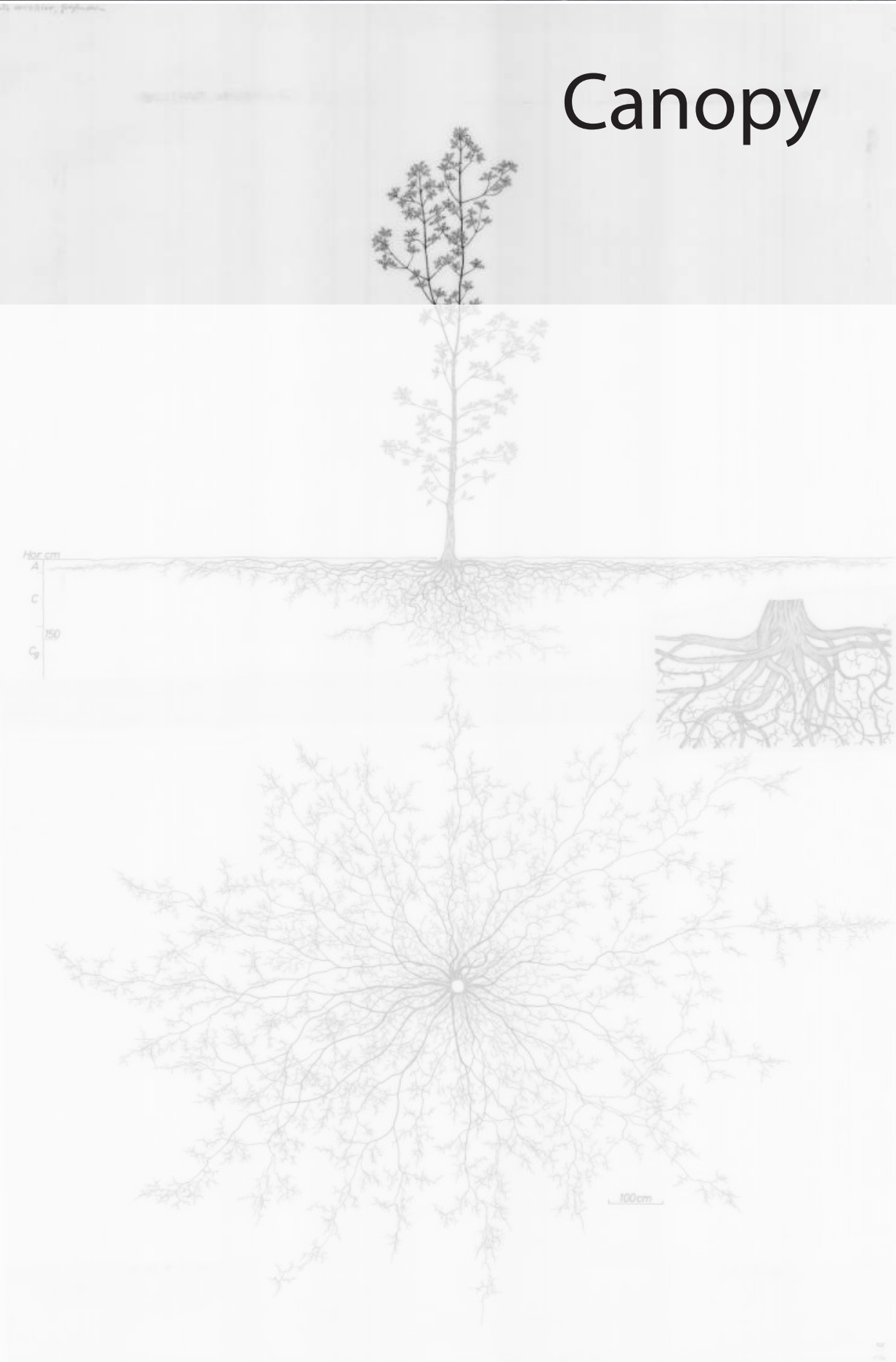


Stock image used for Food Forest Module and Urban module



# Canopy | Gathering

Canopy



- Roof

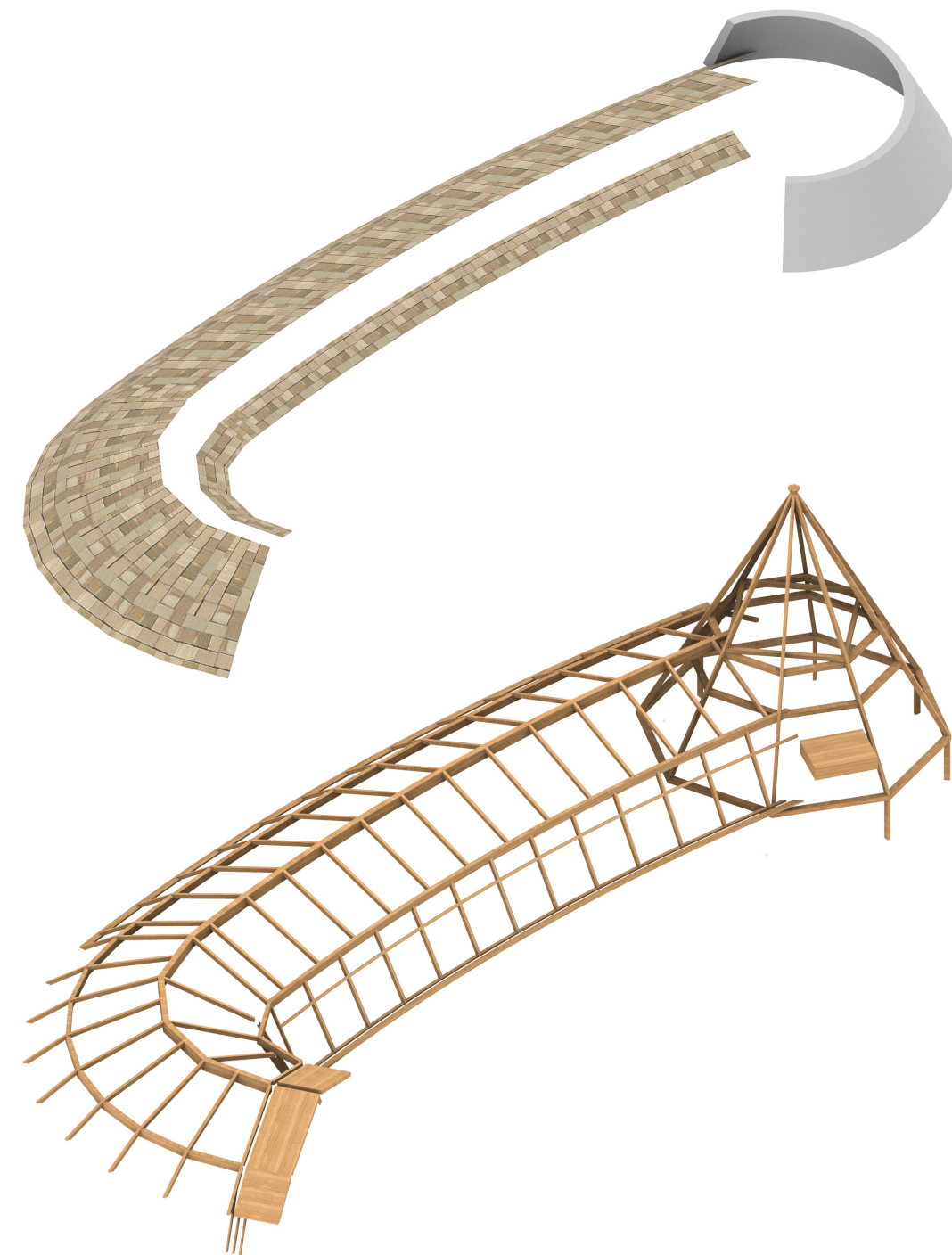
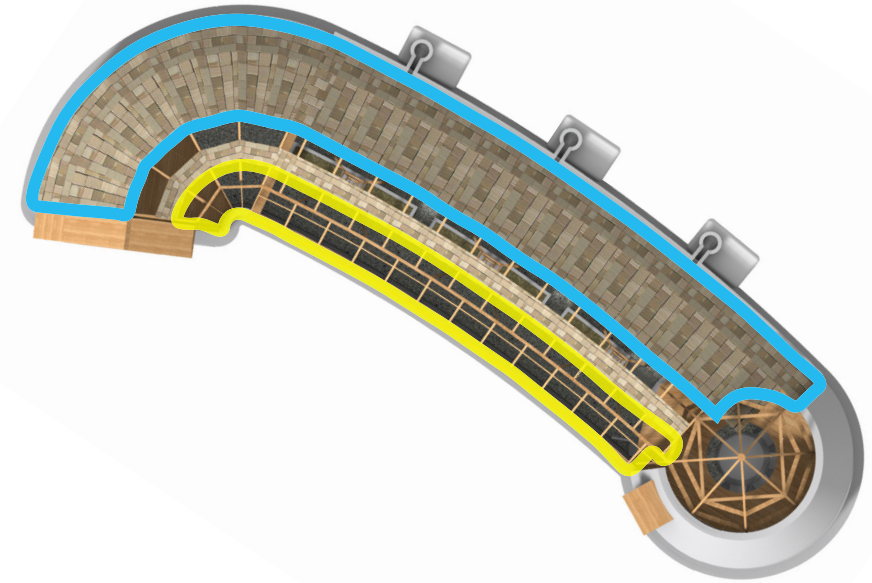


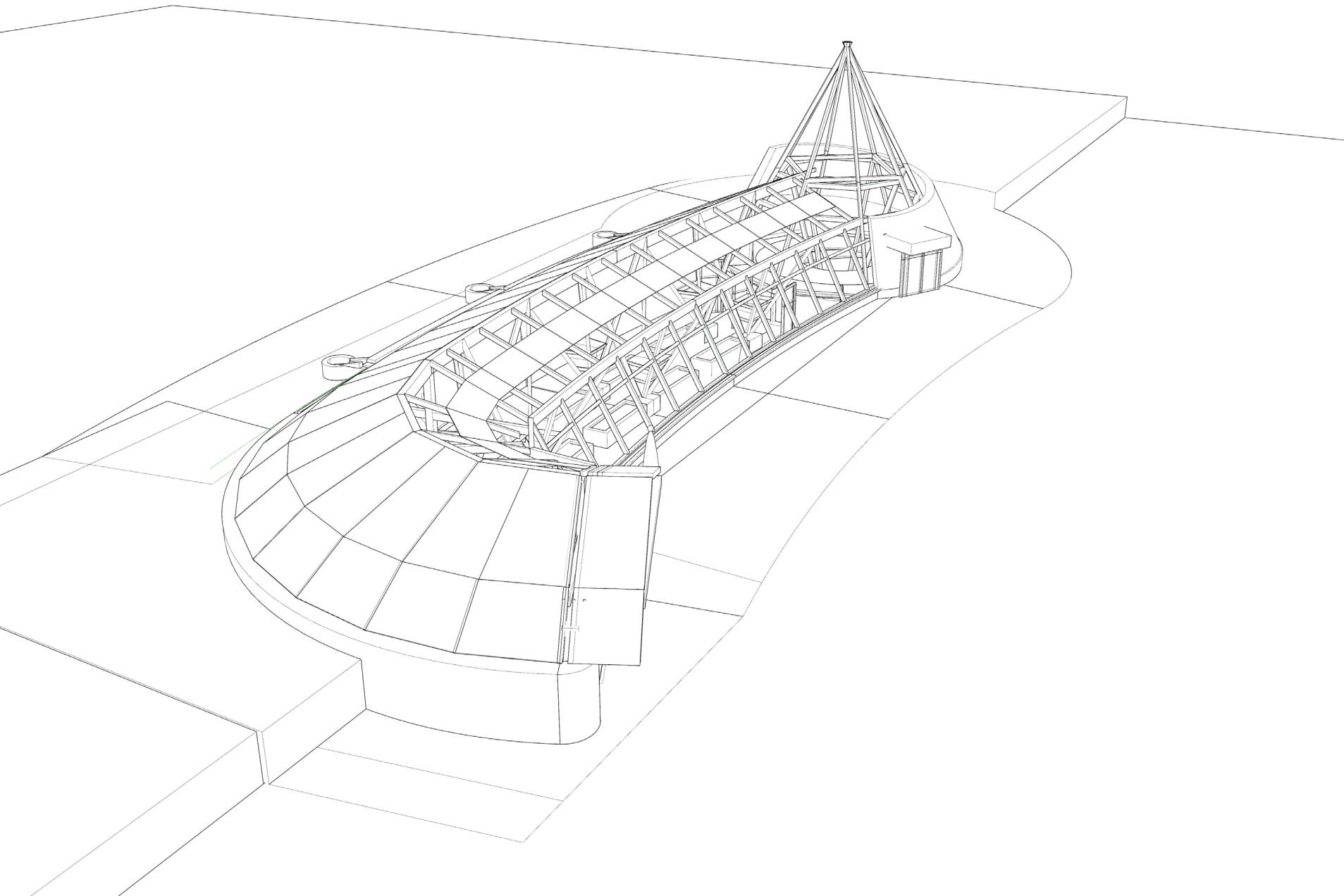


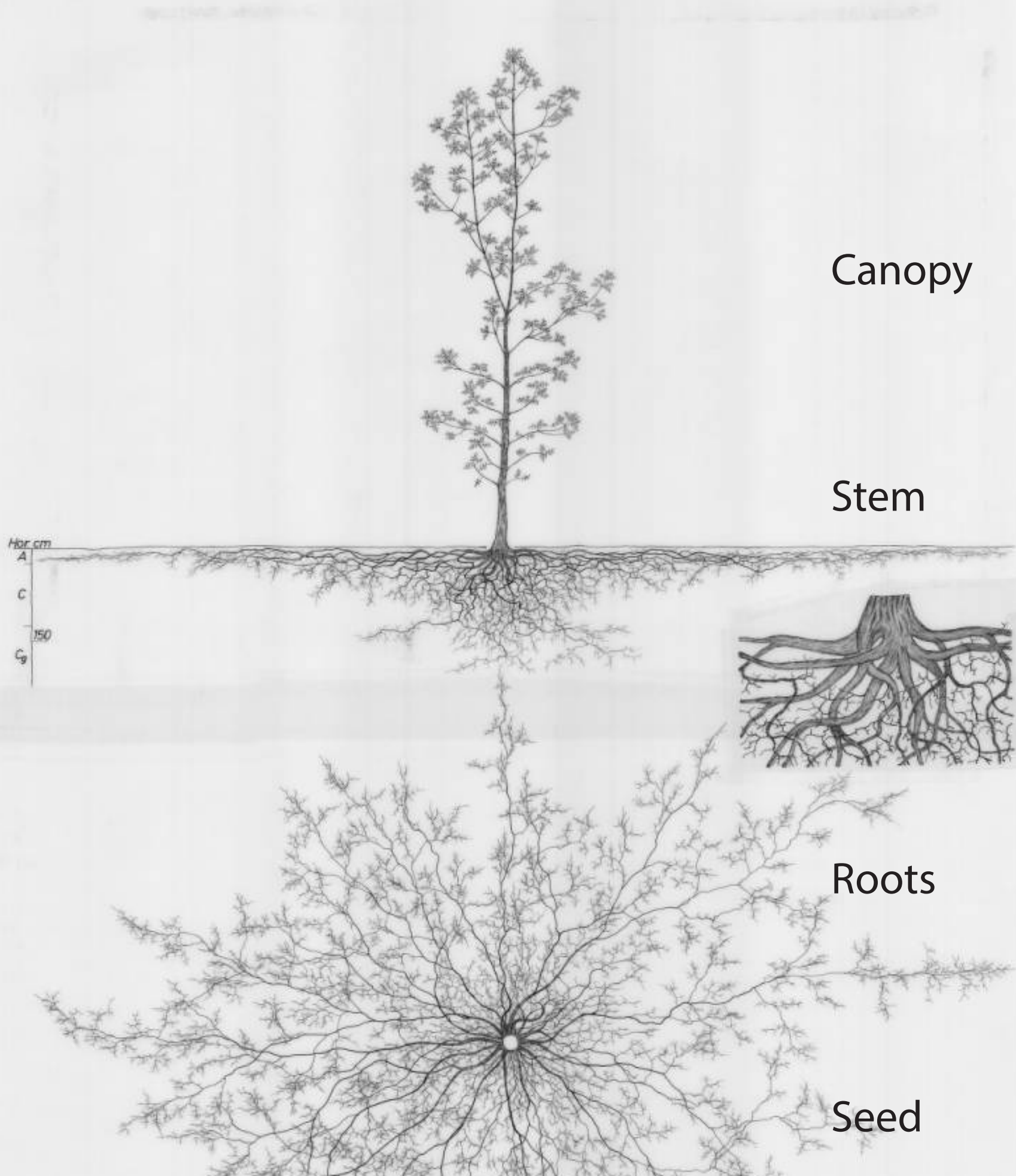
Image from Internet, copyright information not found

□ Rain water harvesting roof surface:  
Approx. 3000 sq-ft



□ South facing side glazed to receive  
winter solar gain





Canopy

Stem

Roots

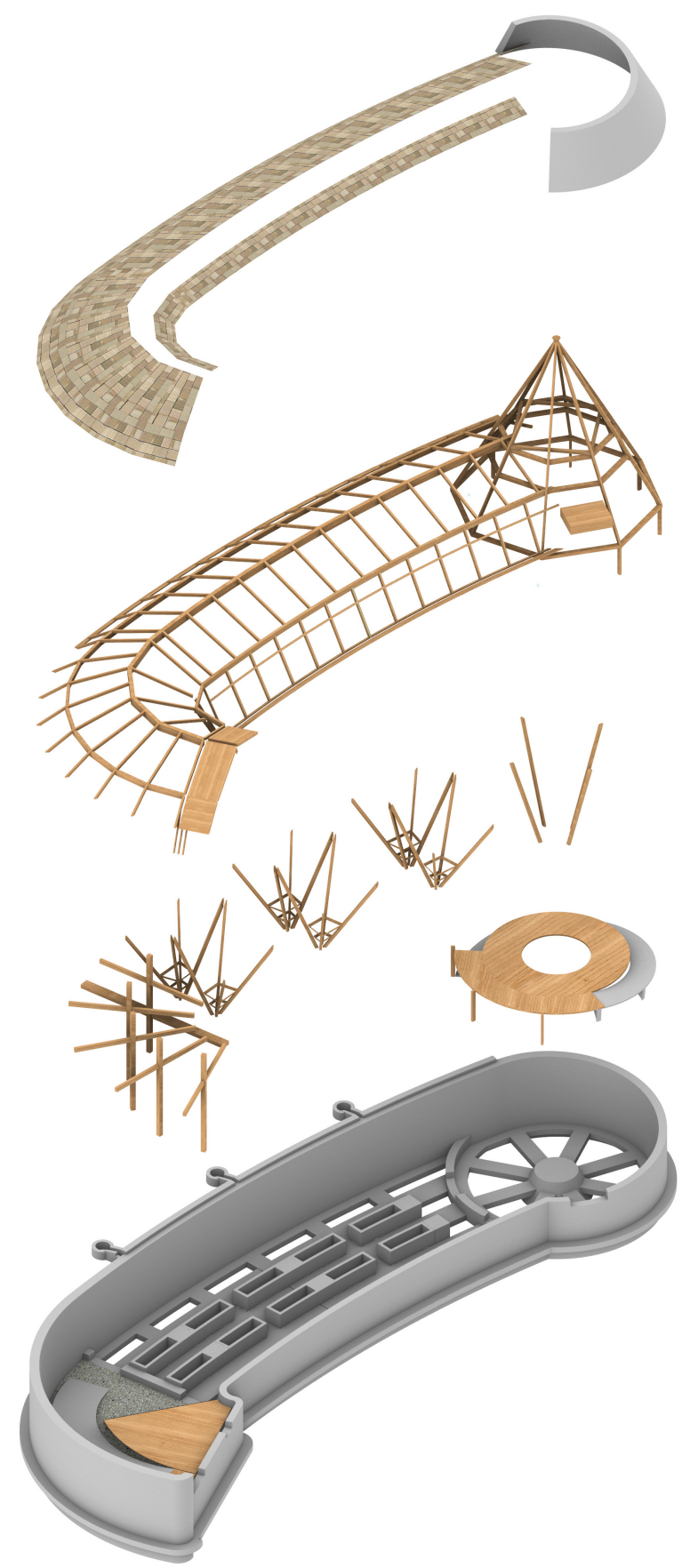
Seed

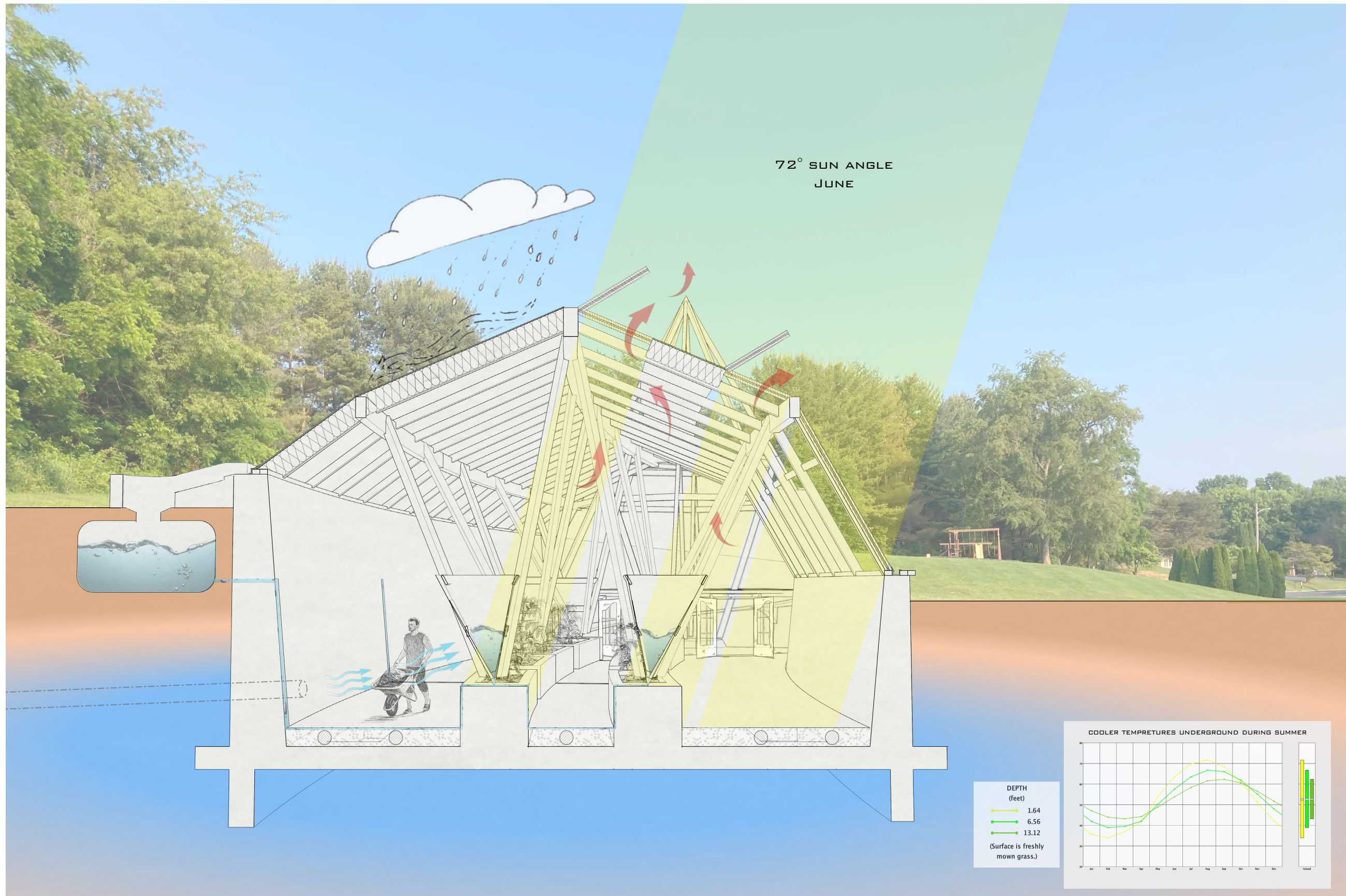
- Roof

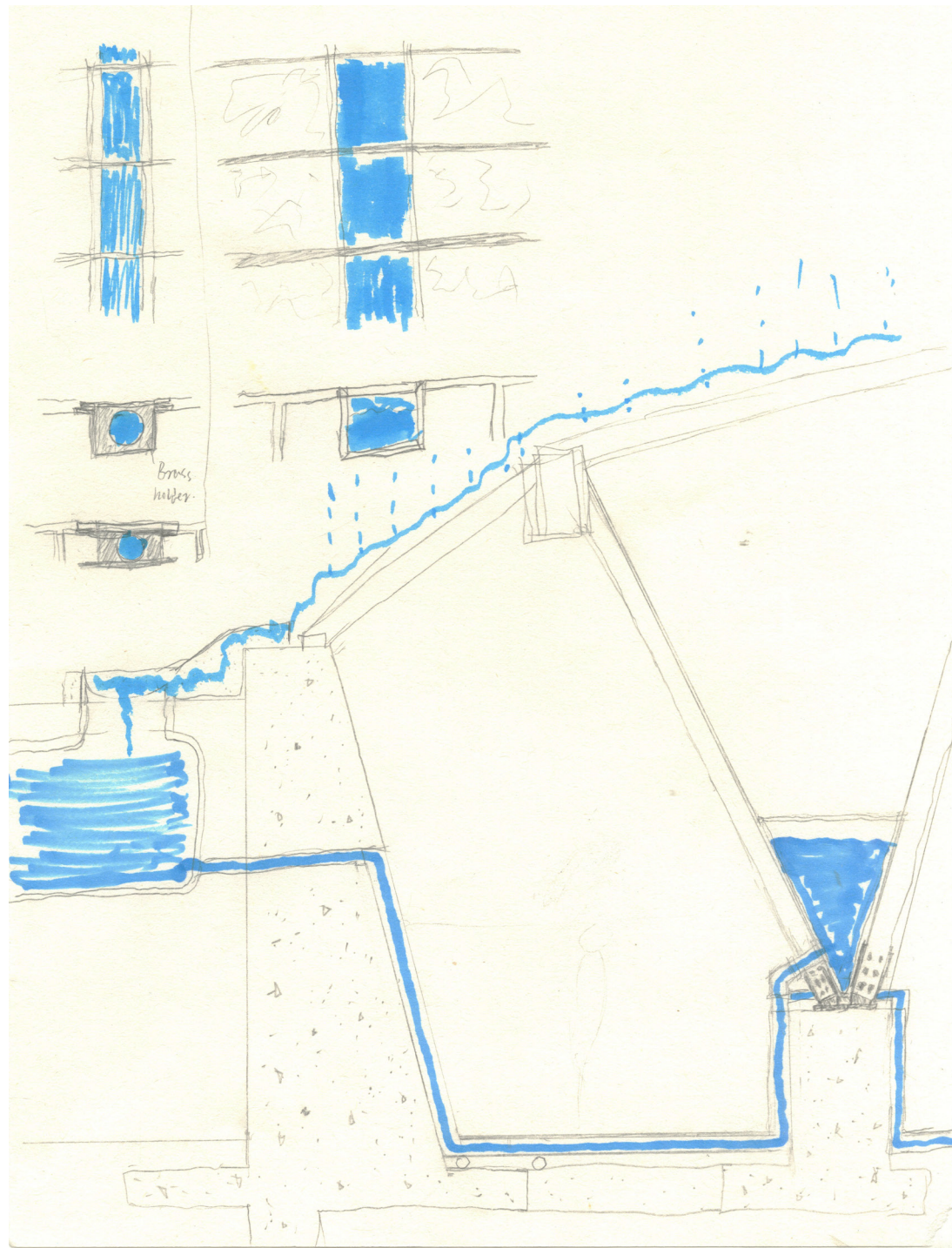
- Structure

- Foundation

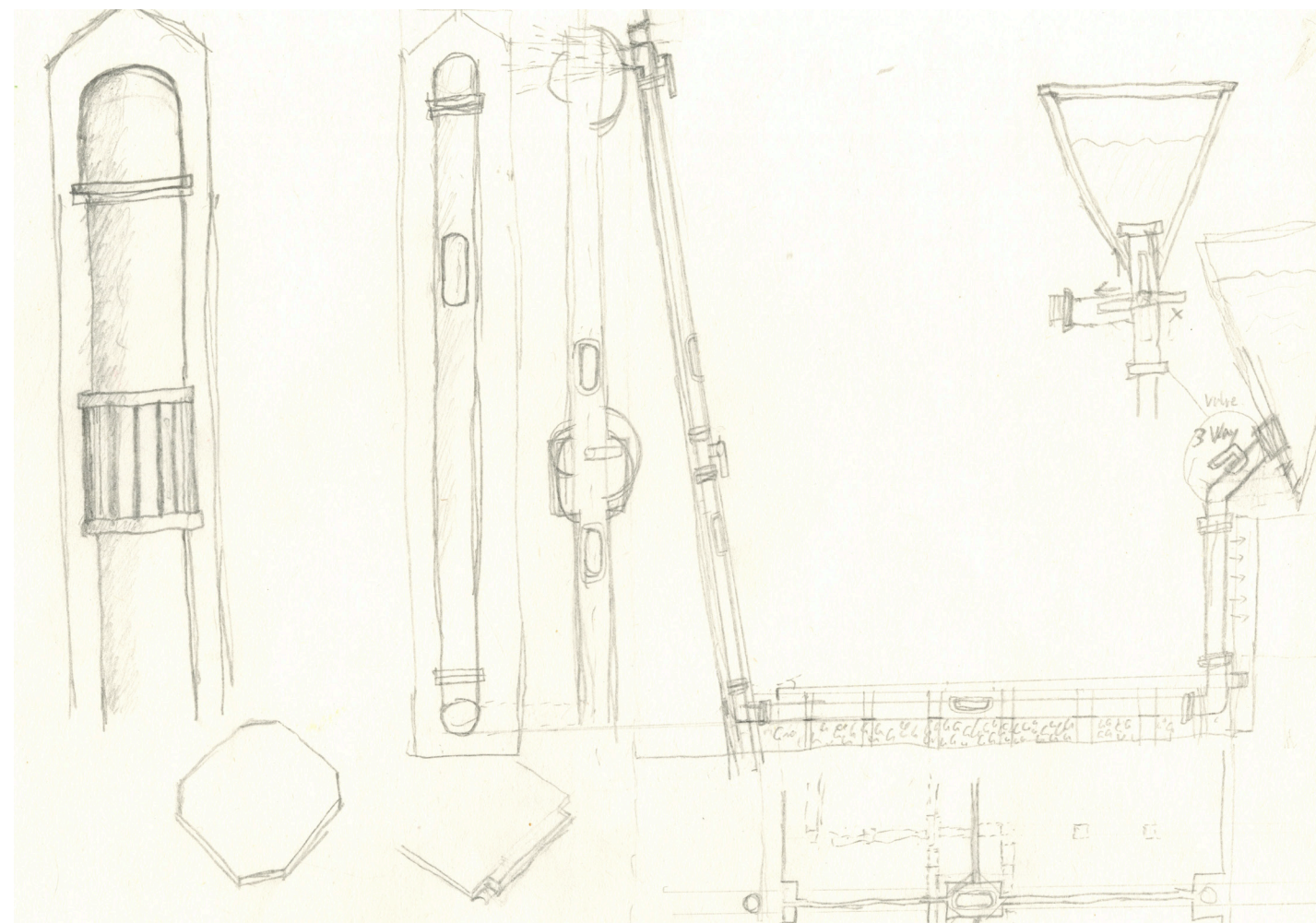
- Awareness







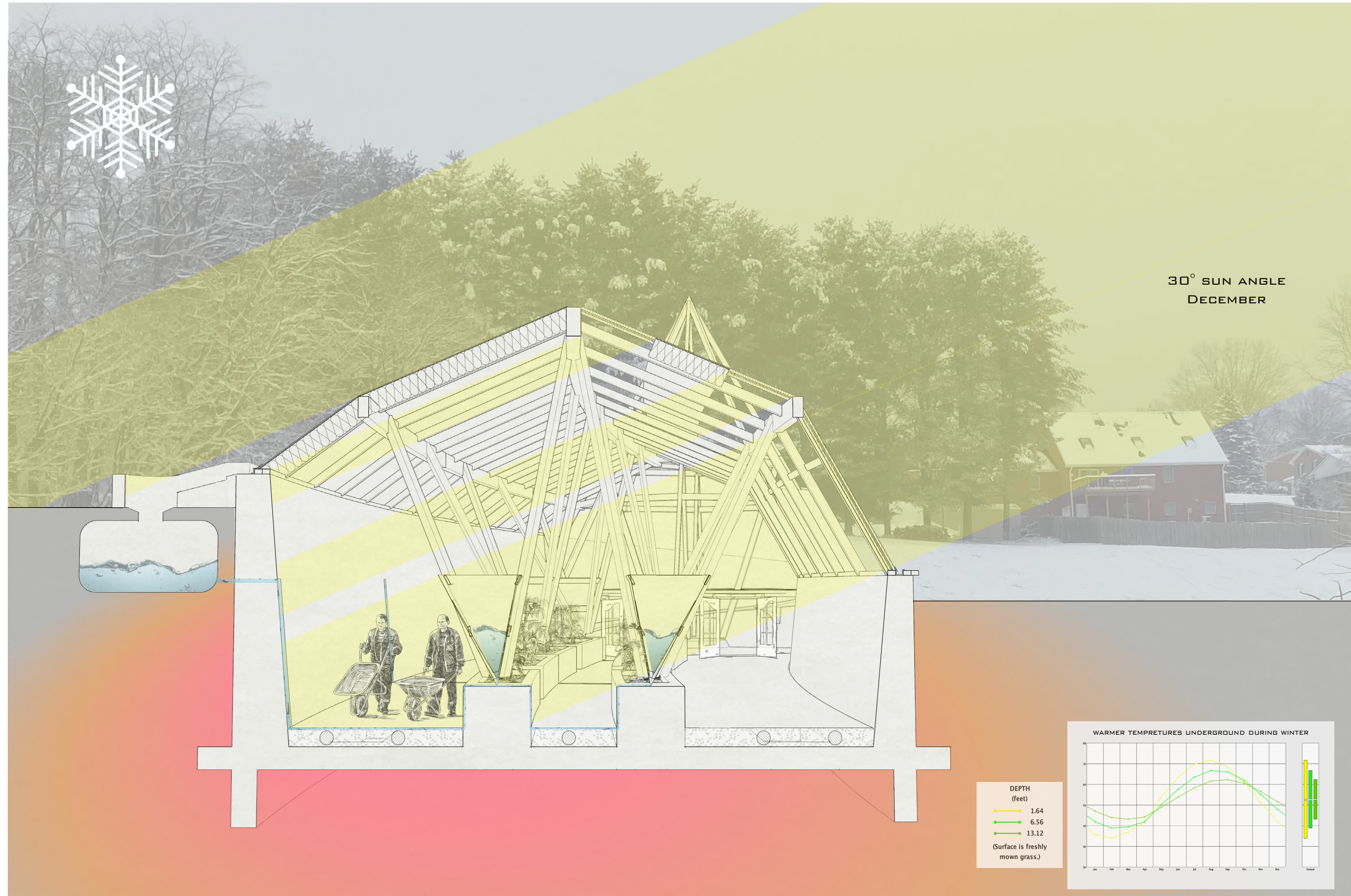
The off-grid rainwater system will allow for harvested rainwater to gravity feed into the indoor display tanks as needed. The system is hand operated by simple valves and requires no energy input due to the high difference between the cisterns buried uphill and the indoor tanks. If water is introduced indoors at correct times during the day depending on the season, it can contribute to the heating or cooling of the building.



Hand sketches of plumbing system that connects the water harvesting cisterns with the indoor water display tanks.



30° SUN ANGLE  
DECEMBER





Google Earth image of Blacksburg showing the site's relationship with schools in the area. Accessed January 2023.

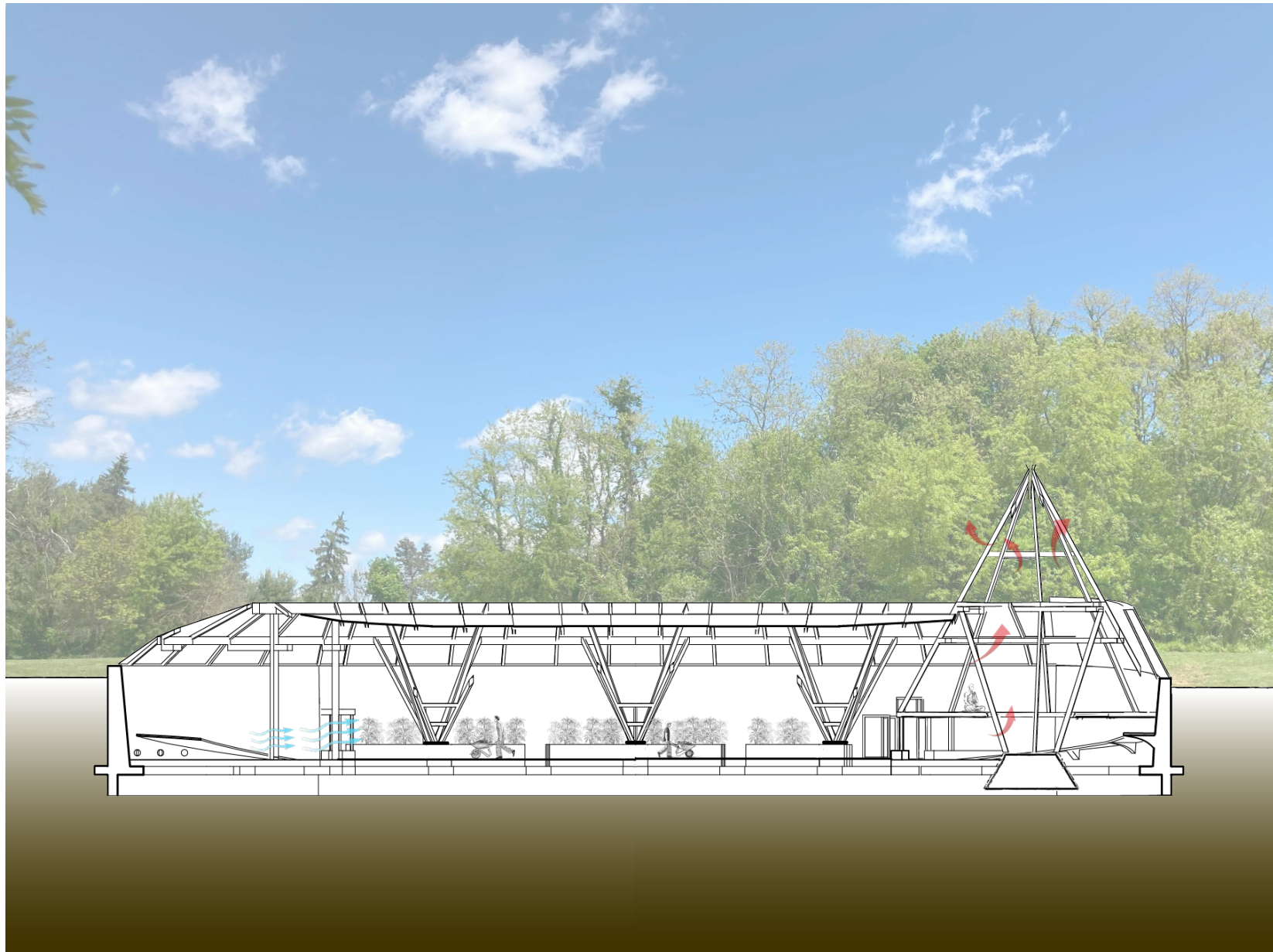
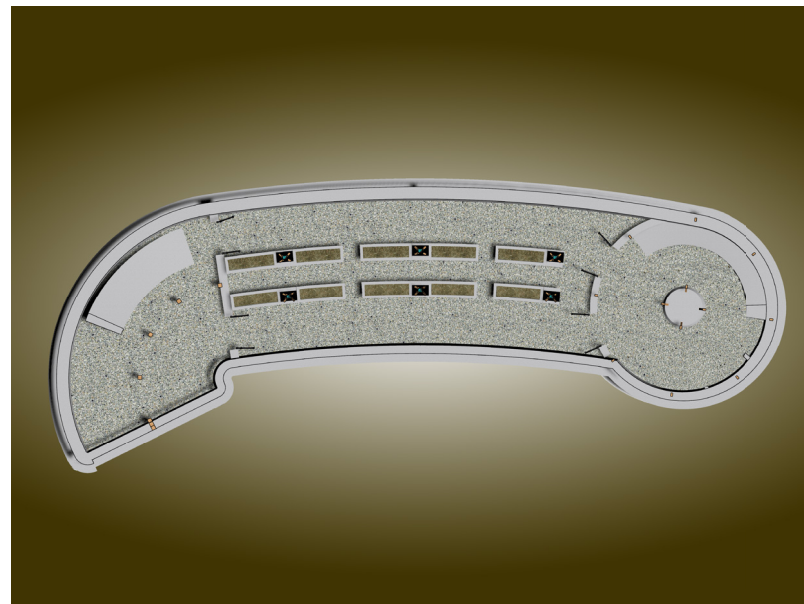
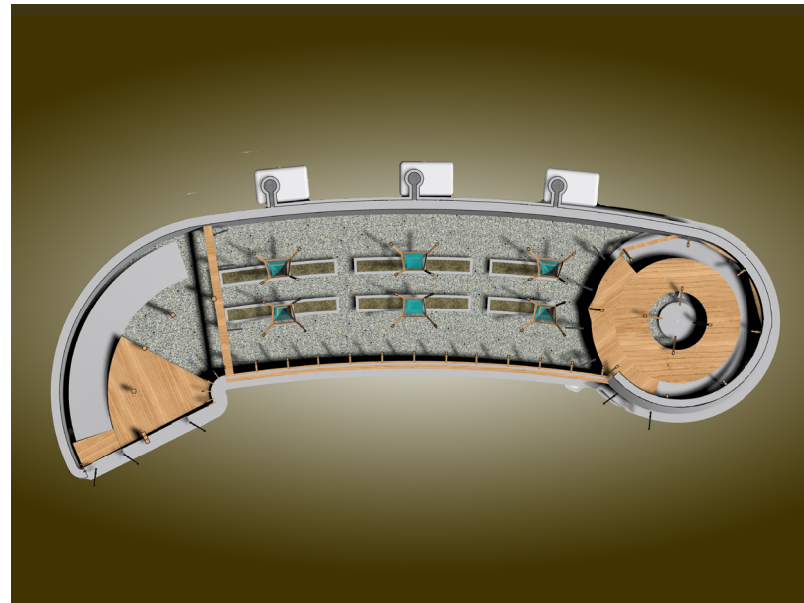
## The gathering of people

While gathering the forces of naturally occurring phenomena, the fundamental purpose of a building should be to gather and serve people.

Because of its context in Blacksburg, the site is ideal for a building that can receive student groups from the numerous schools in the area. The goal is for touring groups to experience the building and its passive systems and design first hand, and realize that this approach to our living environment could become the norm.

The building is to be a vessel for spreading the awareness that our buildings should fulfill human needs primarily through the interaction with its natural surroundings and gathering the naturally occurring phenomena nearby.

In addition to accommodating educational tours, the darker lower level of the east wing functions as a heirloom seed library for the local community. The bright, upper level of the east wing can facilitate spiritual activities such as yoga and meditation.



Top left : Surface level floor plan  
Bottom left: Lower level floor plan  
Right: Cross section with photograph of the site

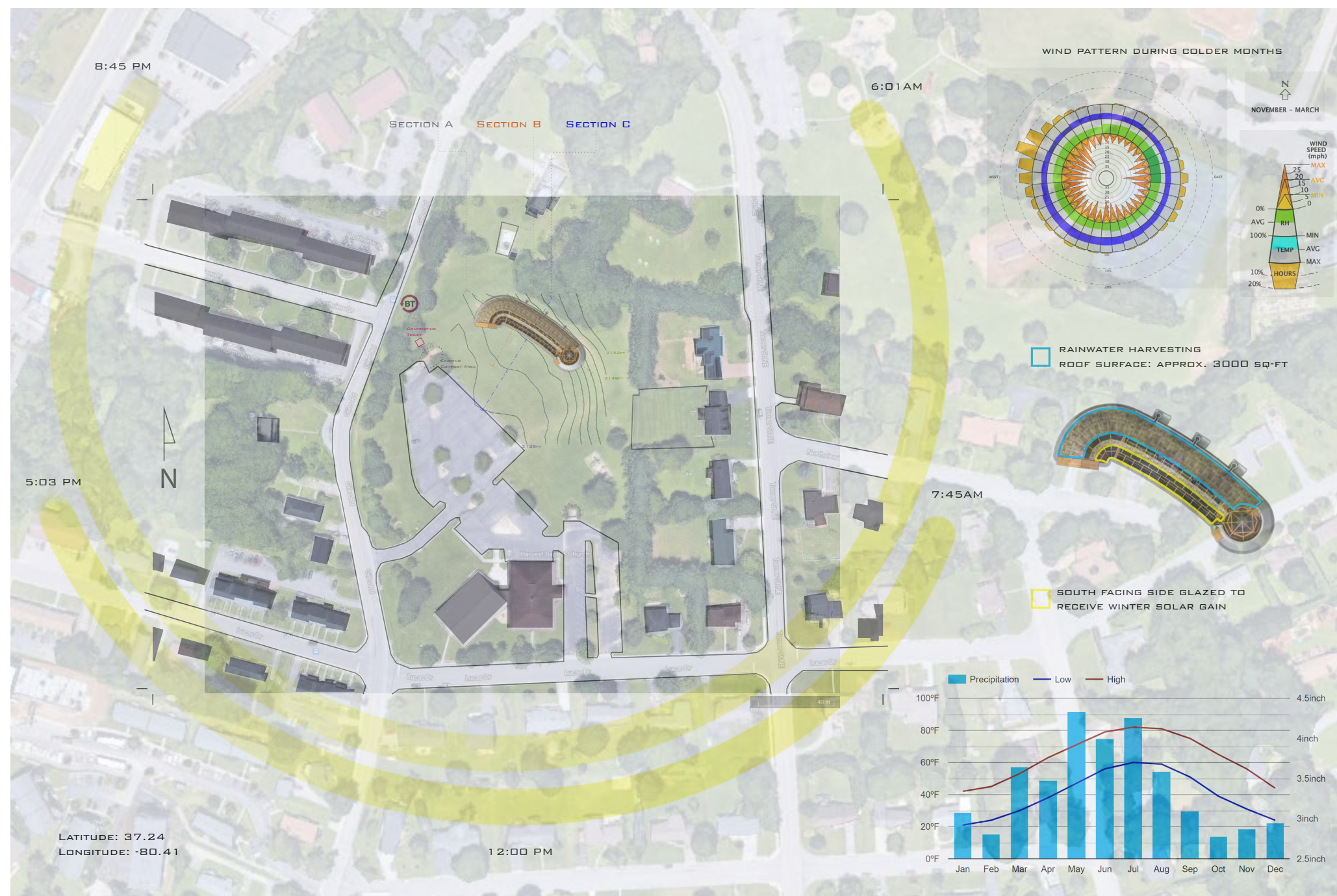
The building is designed to be accessible by wheelchair from both entrances per ADA guidelines.

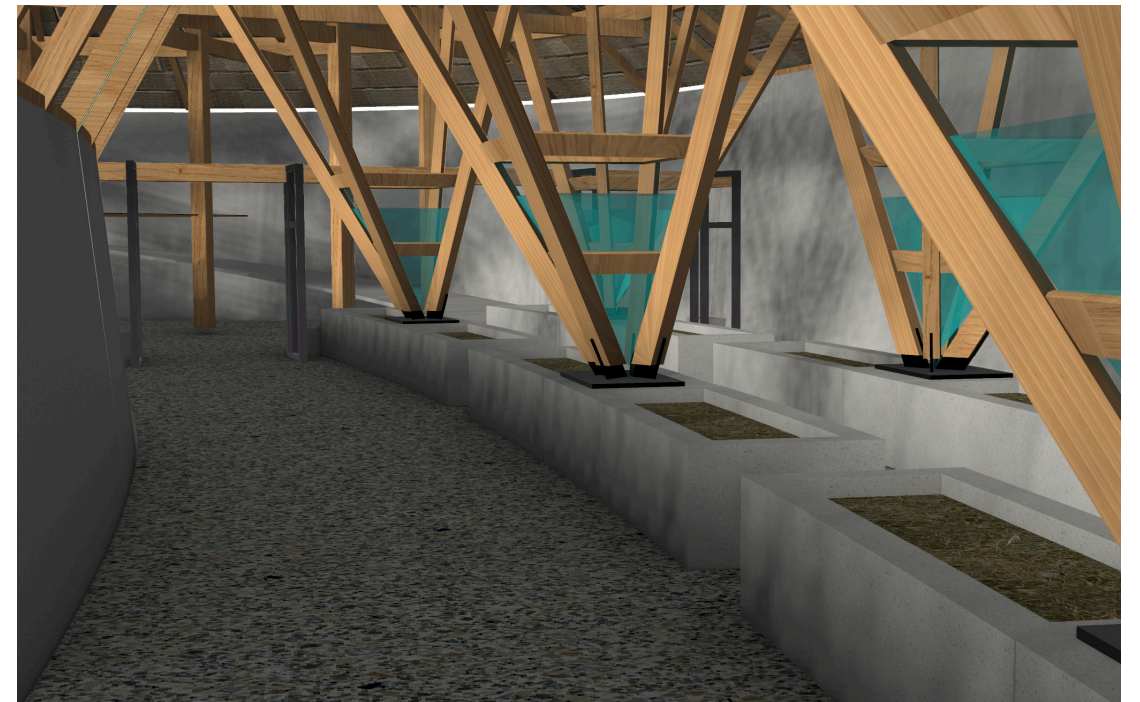
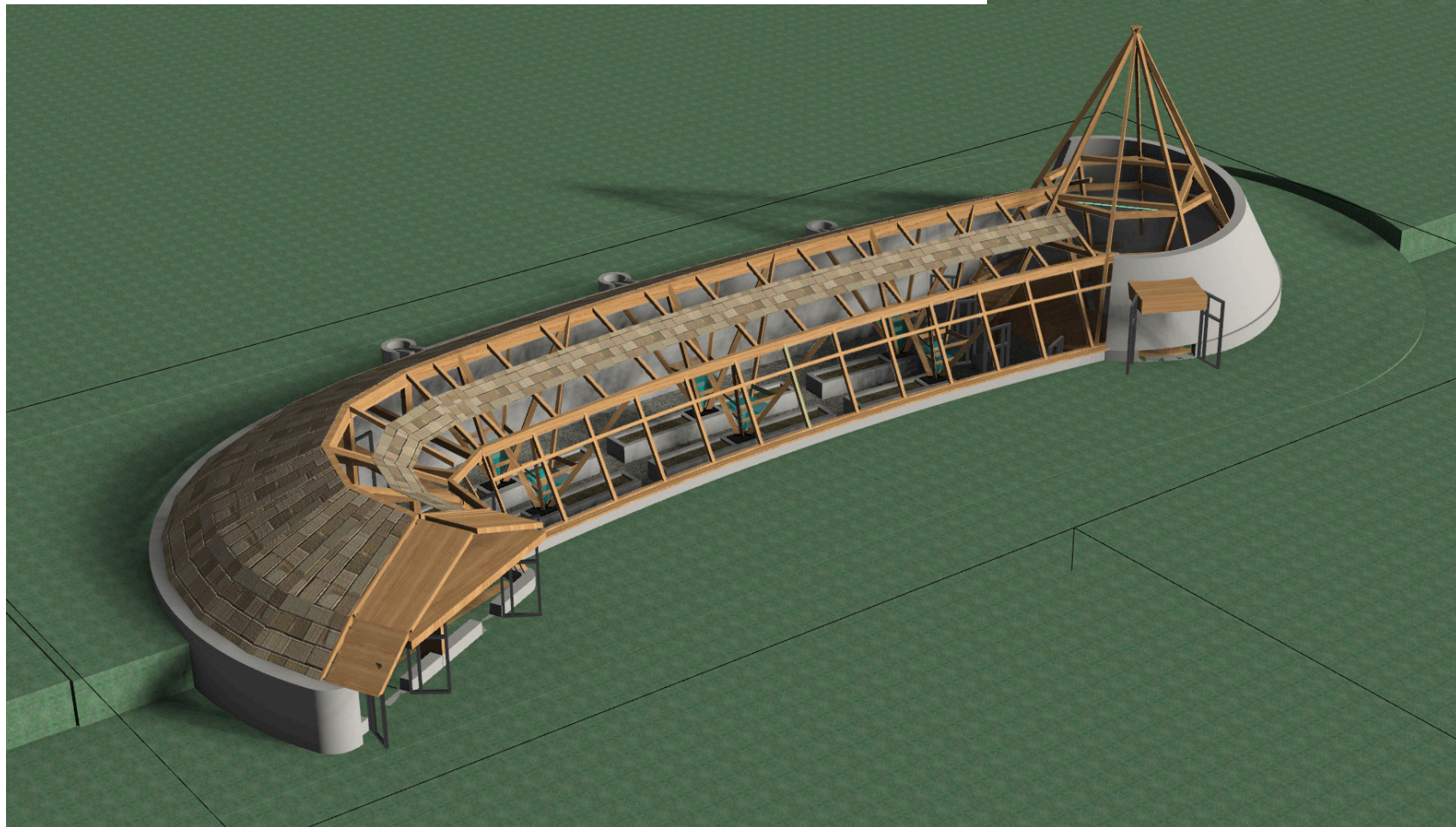
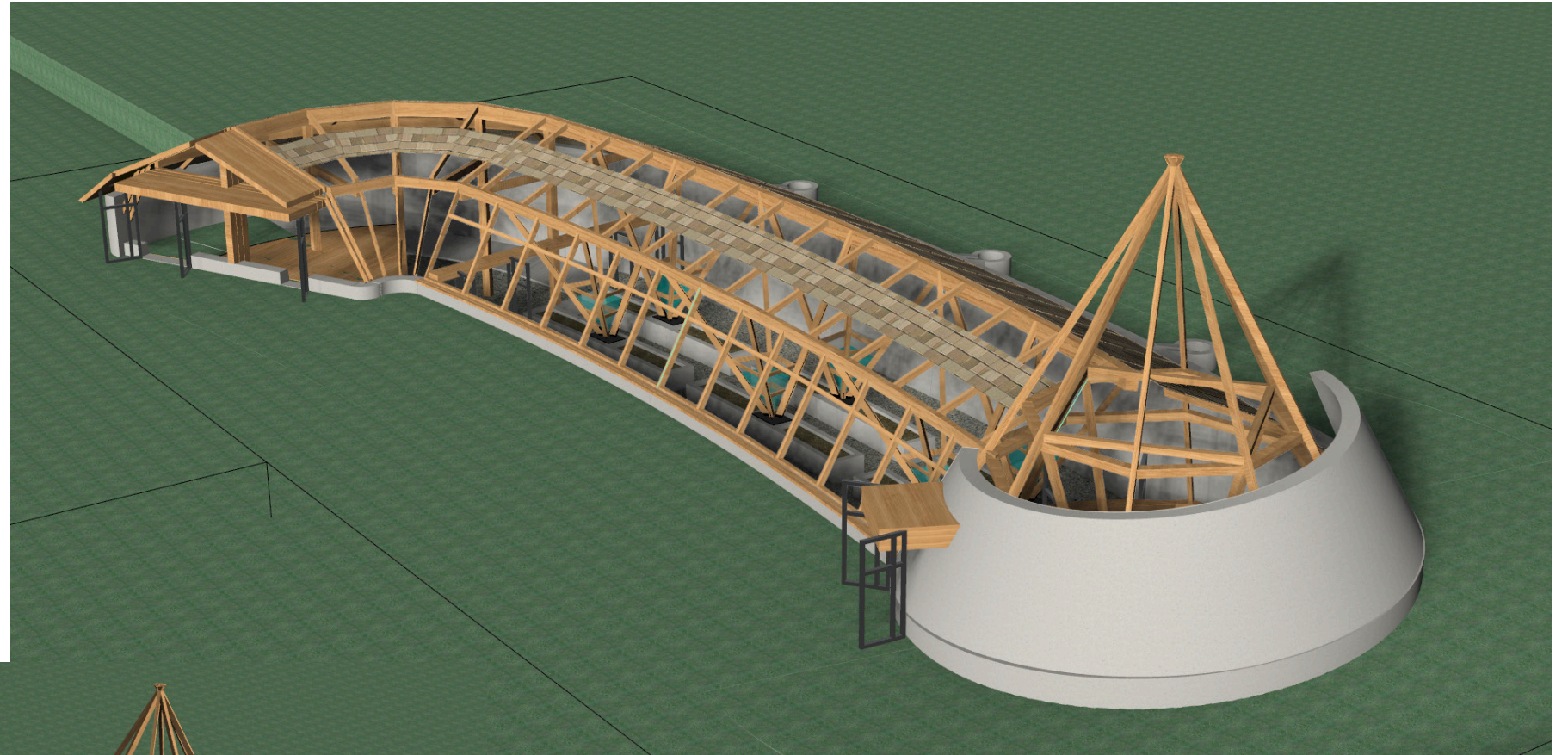
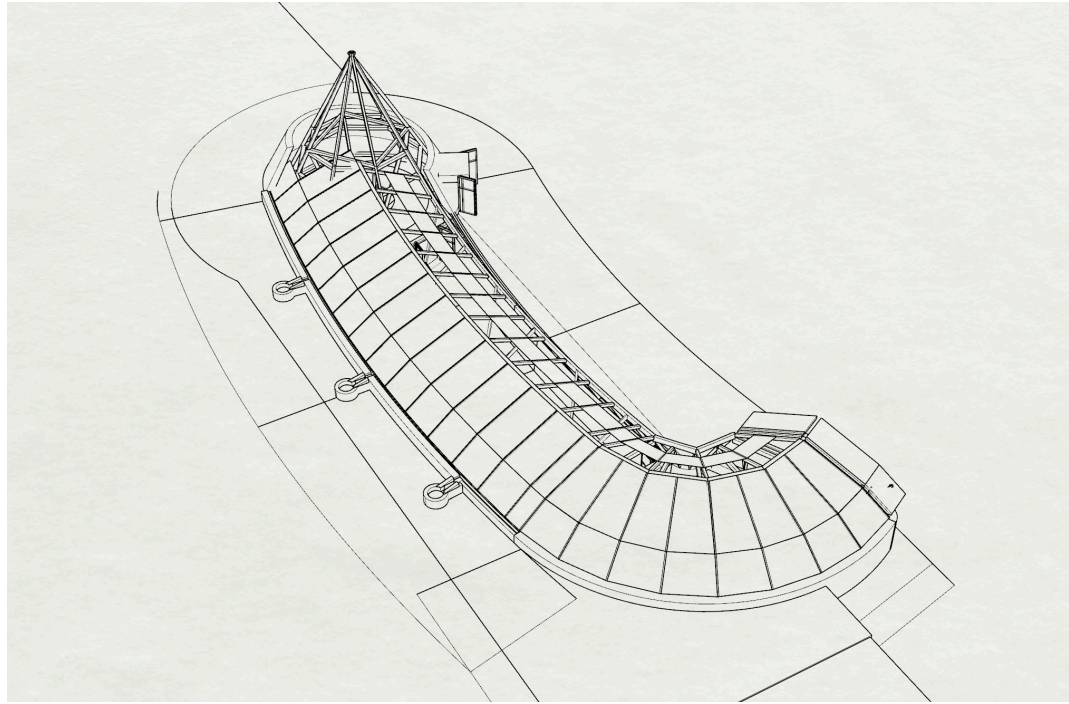



Top left : Photos of a compost toilet found near Middle Town, MD

Bottom left: Photo of preexisting compost pile on site

Right: Site plan with typographical, weather and solar information





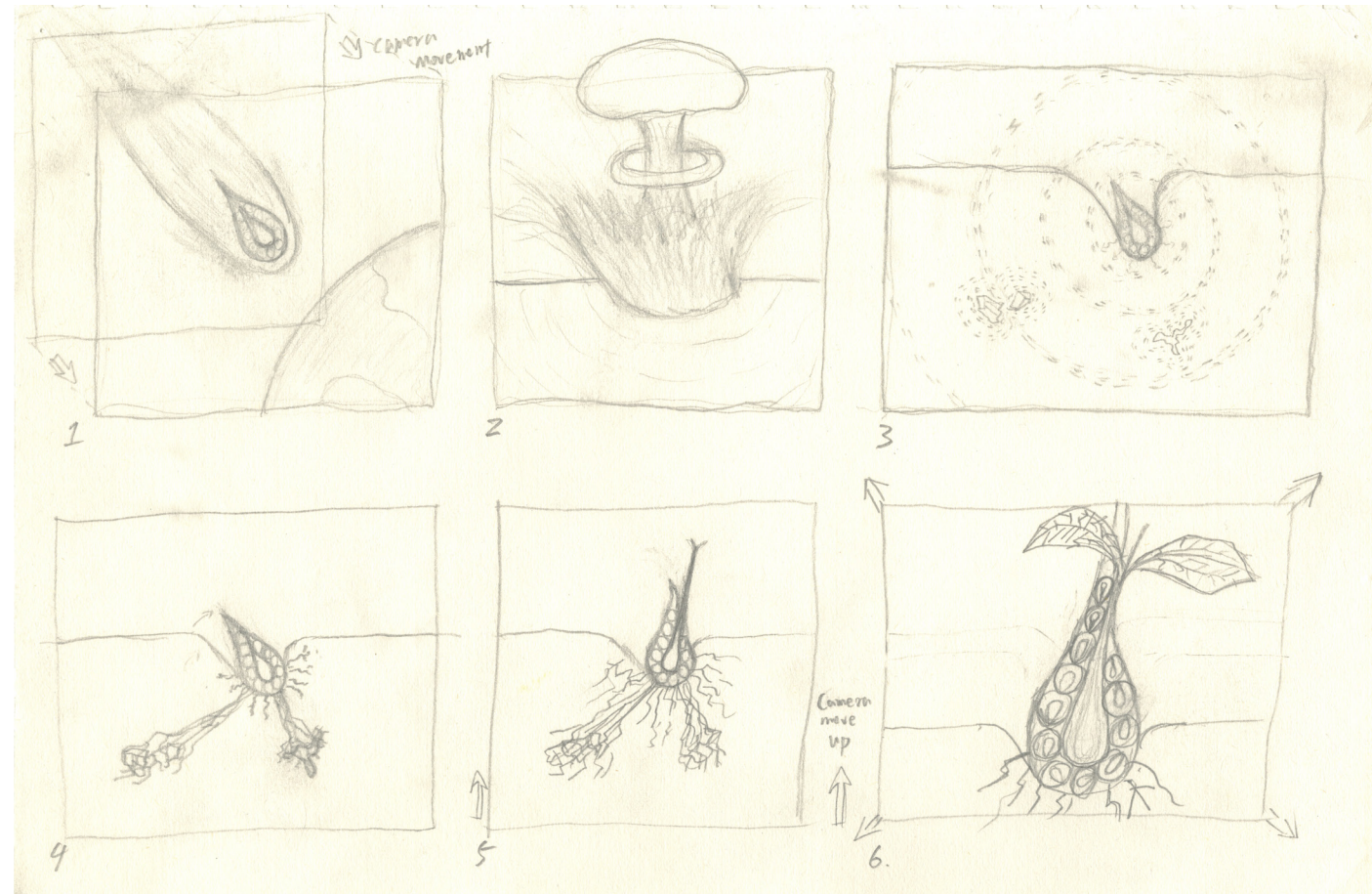


征苍穹

Voyage the heavens

殖星海

Propagate the sea of stars



Storyboards created for sci-fi themed film class





# Void | Stars

# The Void

Inside

By constructing a building, we tend to block out most natural elements and create a void within.

Spaces created by cosmically unaware Architecture is detached from our cosmic context, lost and orphaned, left to be defined narrowly by what goes on within.

It is year 2023. Visions of space colonization rekindled while we struggle to preserve our own habitat on earth. More and more of us find ourselves as atomized individuals: closed off, lonely, and disconnected despite the Internet. Plugged in to short lasting and shallow stimulations offered by corporations, we watch as satellites cruise the night sky like false stars.

Perhaps it is time our buildings reminded us to wiggle and vibrate as the miracles we truly are: living waves in a sea of stars.





White charcoal, pastels and acrylic on black paper.

It's not about the building. It's everything else.

## Extra Image Credit

All images used in this thesis document are for academic purposes only.  
All other images, drawings, photos and Illustrations contained in this document were produced by the author unless listed here or noted otherwise on the page in which it is used.

On pages 20, 30, 43, 53, 62, 64:  
Root system drawings, *Fraxinus excelsior*,  
Kutschera, L.; Lichtenegger, E., *Wurzelatlas mitteleuropäischer Waldbäume und Sträucher*. - Graz,  
Stuttgart : Leopold Stocker Verlag, 2002 (2. Aufl. 2013). - 604 p.

## References

Speech: “*No such Things as Things*” and “*Getting hold of the Wiggle*” from “*What is Reality?*”  
- a seminar recorded in Dallas, 1965 by *Alan Watts*

From *Fire and Memory, on architecture and energy*,  
by - *Luis Fernández-Galiano* P16