Kampung Air

The Water Village

Graduation Presentation
Luuk Hofhuis
Tu Delft

Content

Why is this intervention needed?

Context
Inspiration & Research
Concept

How is it going to be realized?

Urban Plan
User & Typology
Construction
Aquaponics
Roof

What is future life in Melayu like?

User Focus

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User Focus

Context

Where is it?
How did this area develop?
What are its problems?

Location

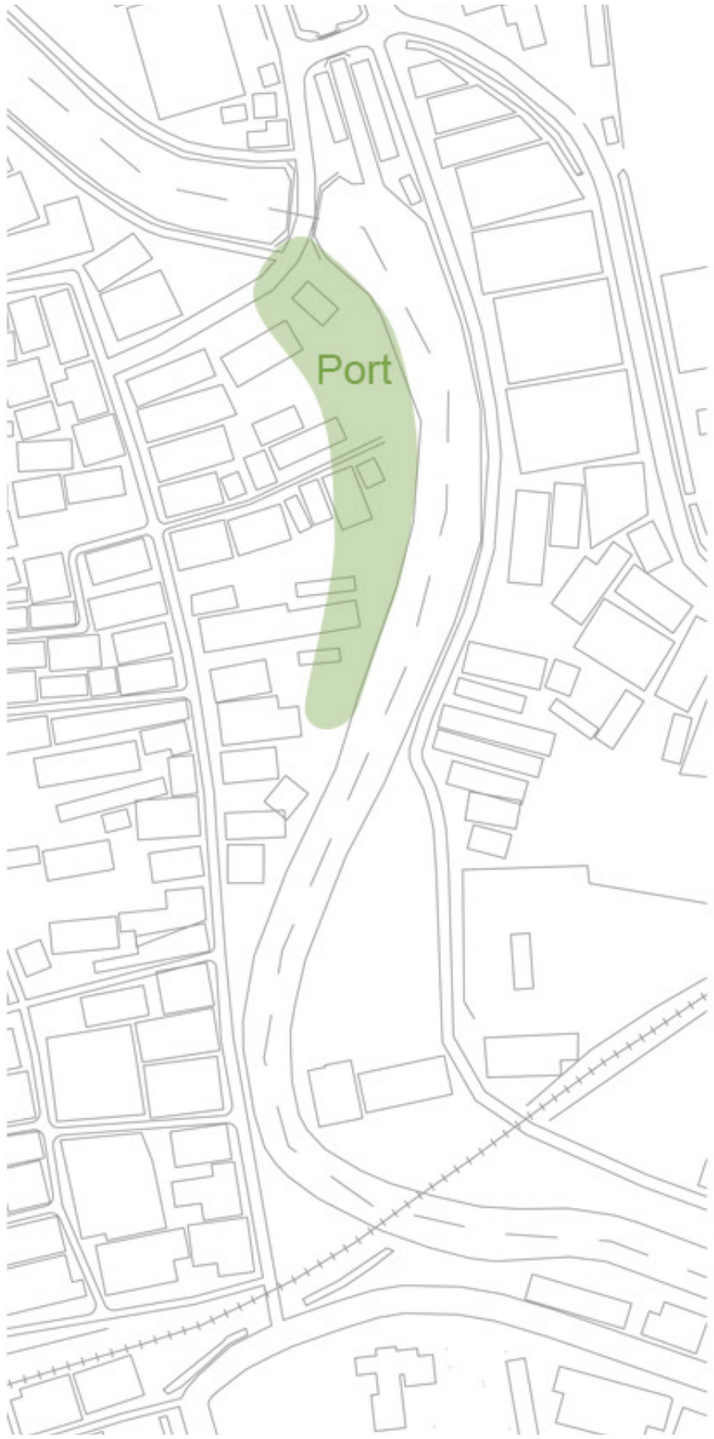
Location

Kampung
Melayu
Kota Lama
Kampung
Kauman
Pecinan
KEL. DADAP SARI
KEL. PURWODINATAN
KEC. SEMARANG TENGAH
KEL. REJOMULYO
KEL. MLATI BARU
KEL. PANGGUNG KIDUL
KEL. PLOMBOKAN
KEL. PURWOSARI
KEL. SEMARANG TIMUR
JL. PATIMURA

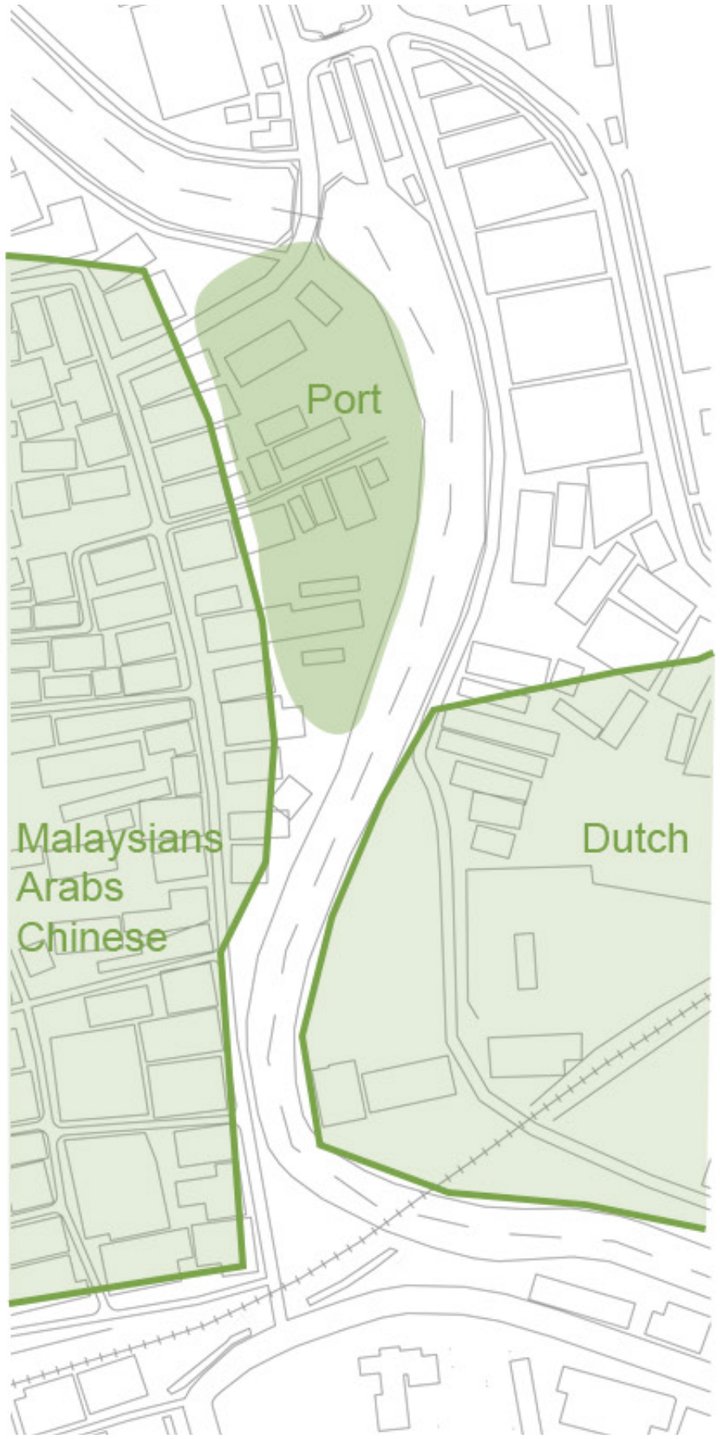
History

Pre 1500's - Coastal

1500+ - Port

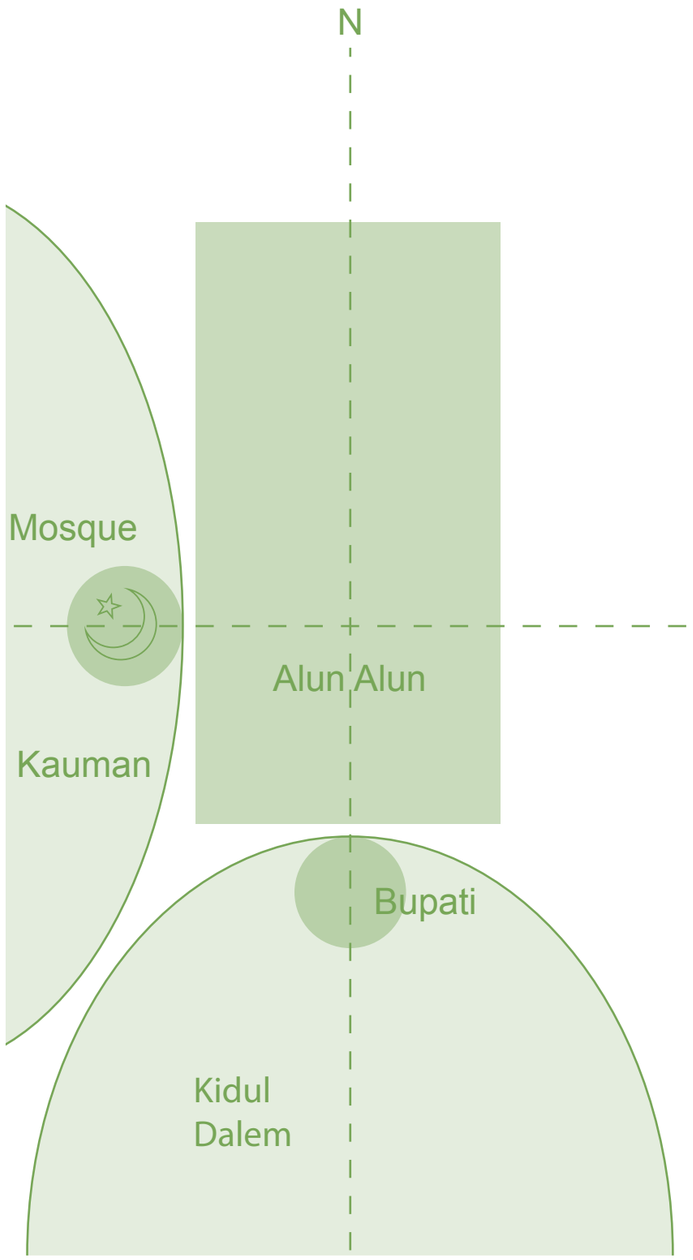


1600s+ - Foreign settlers



Traditional Javanese Urban Plan

Traditional Plan

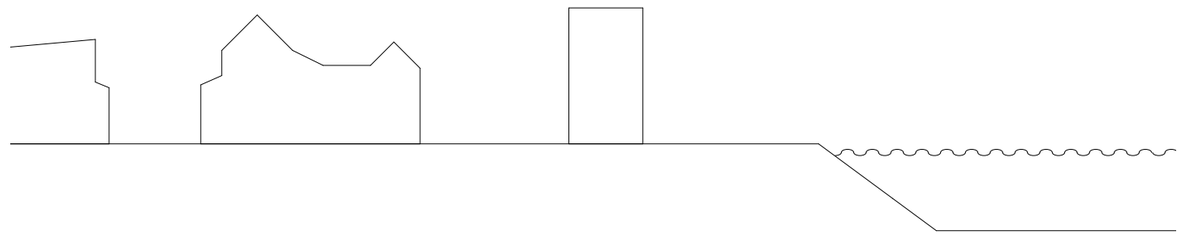


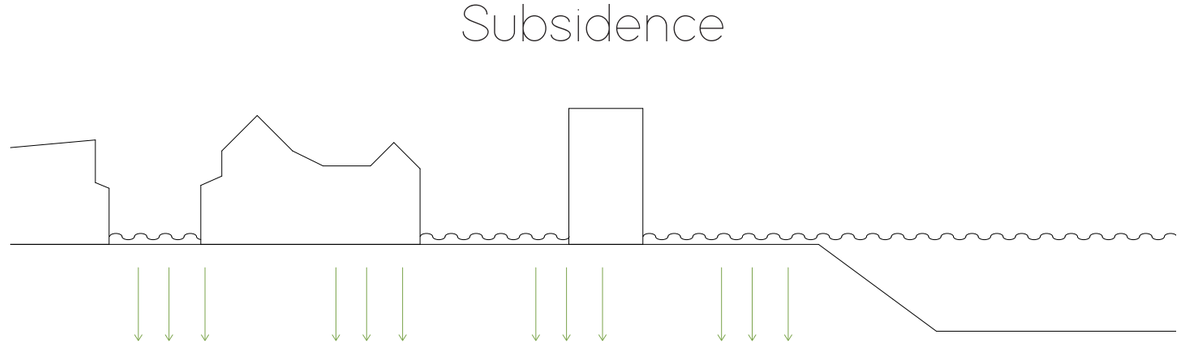
Semarang Pre 1800s

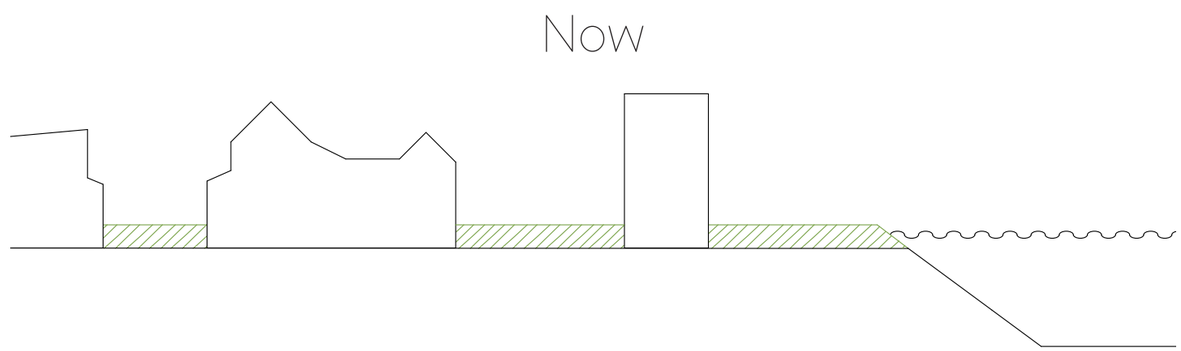
Semarang Now

Current Situation

Land Subsidence







Water Management

No sewage system

Supply through watervendor

Or through well - increasing subsidence

Urban Decay

Trash piling up
in open places

Houses starting
to fall apart

Social Structure

Mosque forms main social structure

Slums start to form

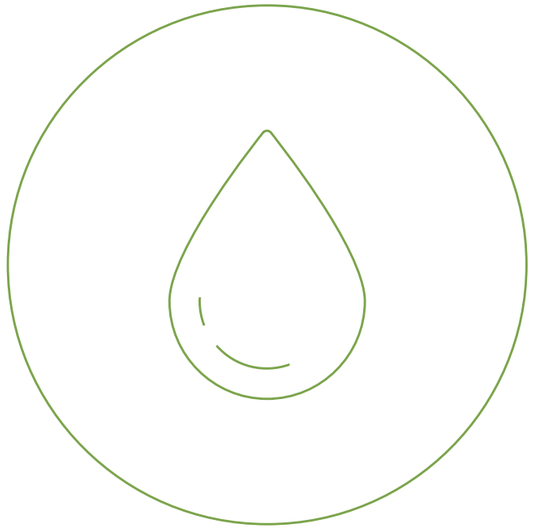
Economic Situation

People who
could afford mo-
ved out

Poorest people
stayed behind

Almost no
economic activity

Goal



Water Management

Supply
Sewage
Land Subsidence

Economic Impulse

Self Sufficient
Offer Perspective

Social Structure

Improve existing

Inspiration & Research

What might be a solution?

How can I improve this?

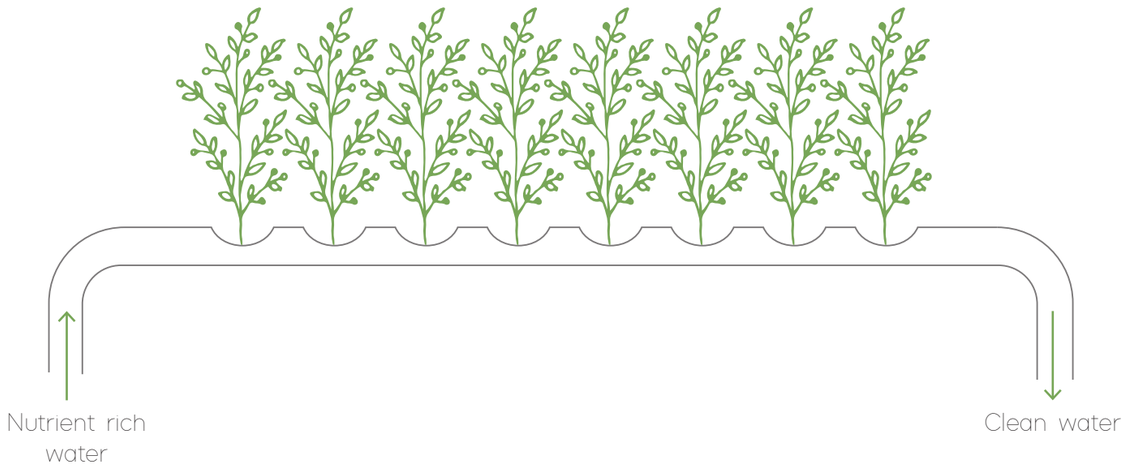
Kampung Kandri

Outskirts of Semarang

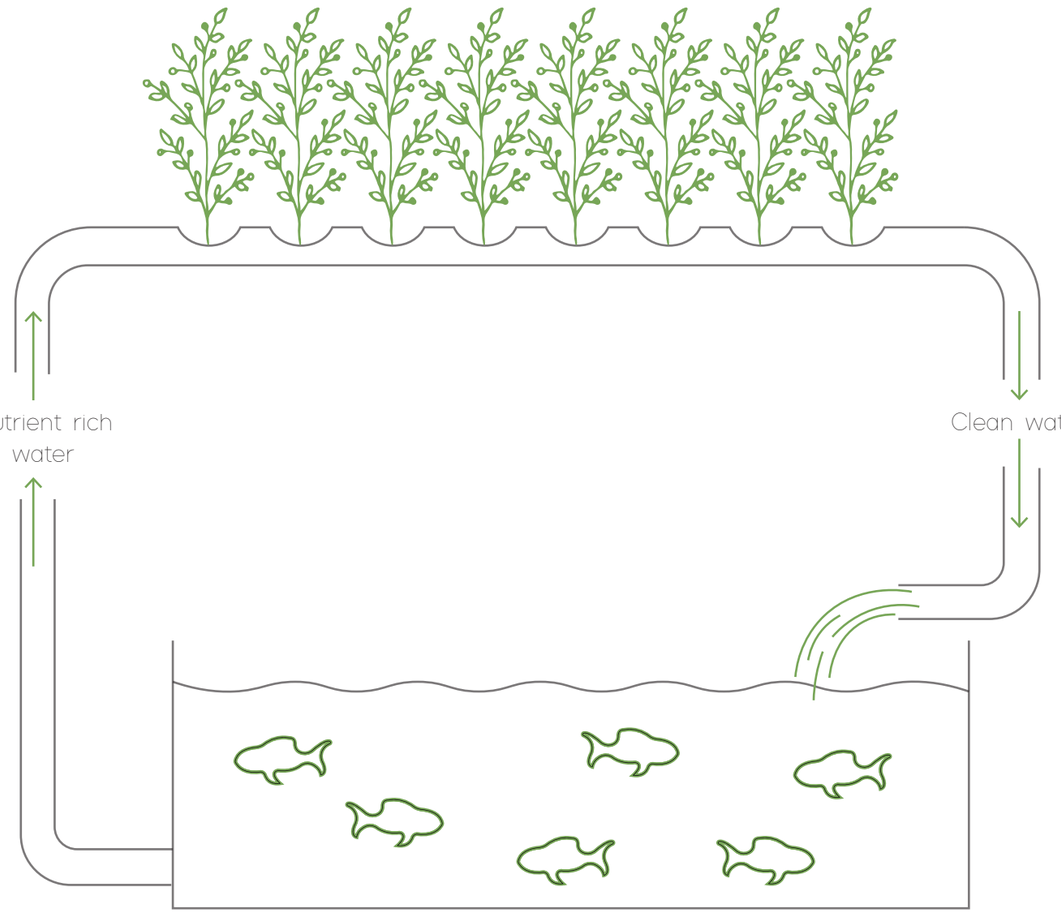
Small Kampung

Relatively dense

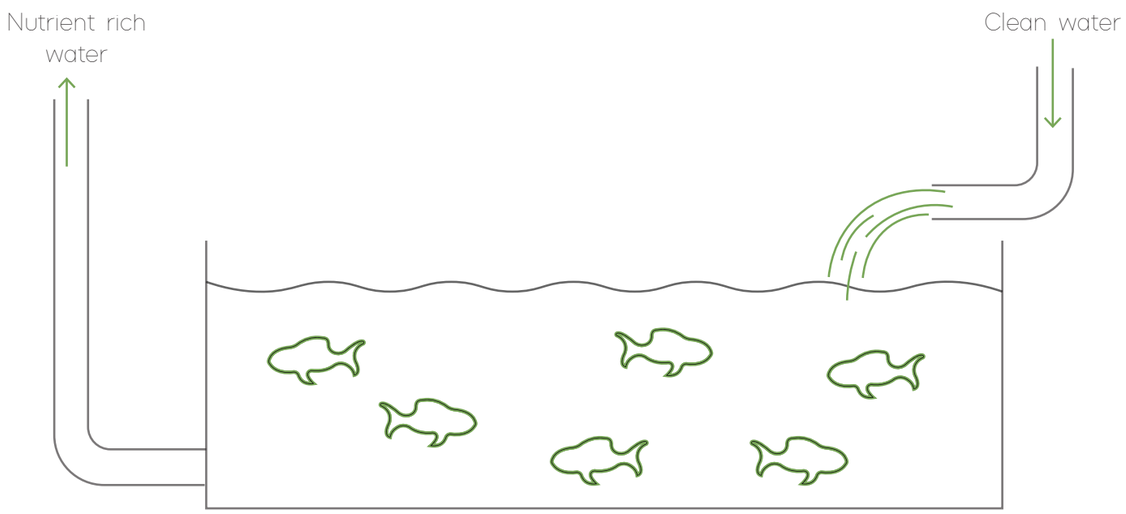
Aquaponics



Hydroponics



Aquaponics



Aquaculture

What it looks like

Plants on top

Small tanks on the bottom

Providing shade

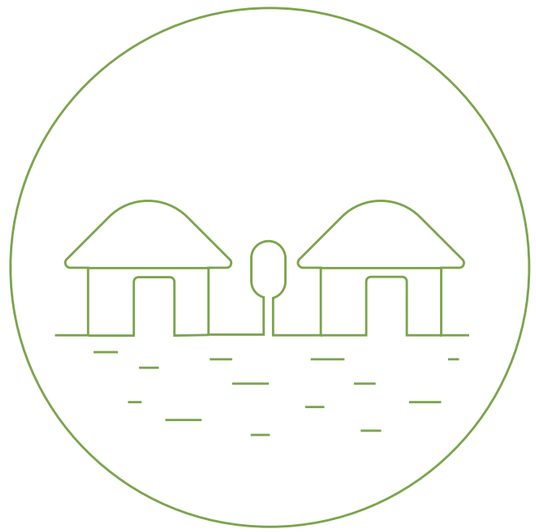
Benefits

Economic Impulse

Less reliance on store bought food

Social Structure

Tightly integrated with existing structure
More reliance on each other



Spatial & Climatic

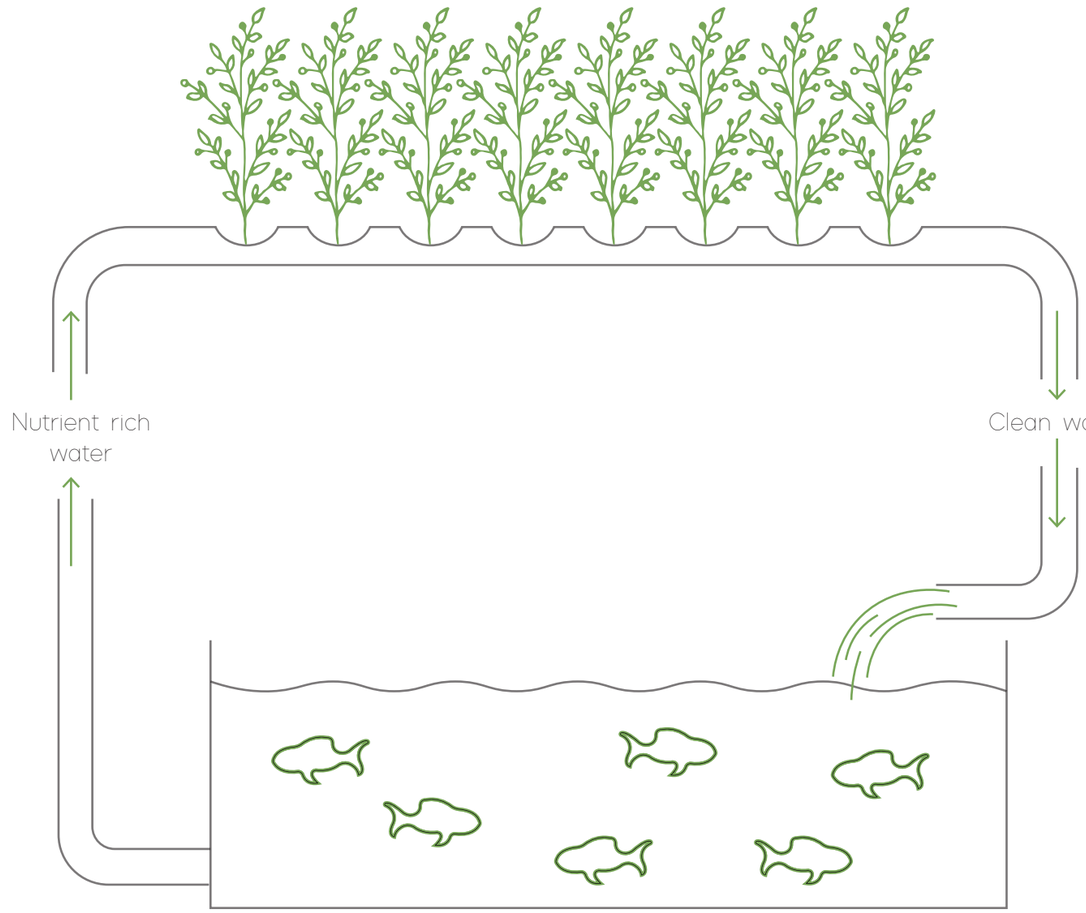
Creating greener environment
Mitigating urban heat island effect

Research Question

" How can an aquaponic system based on the one in Kampung Kandri be improved in a way that it fulfills the needs of of Kampung Melayu?"

" What are the consequences of these improvements?"

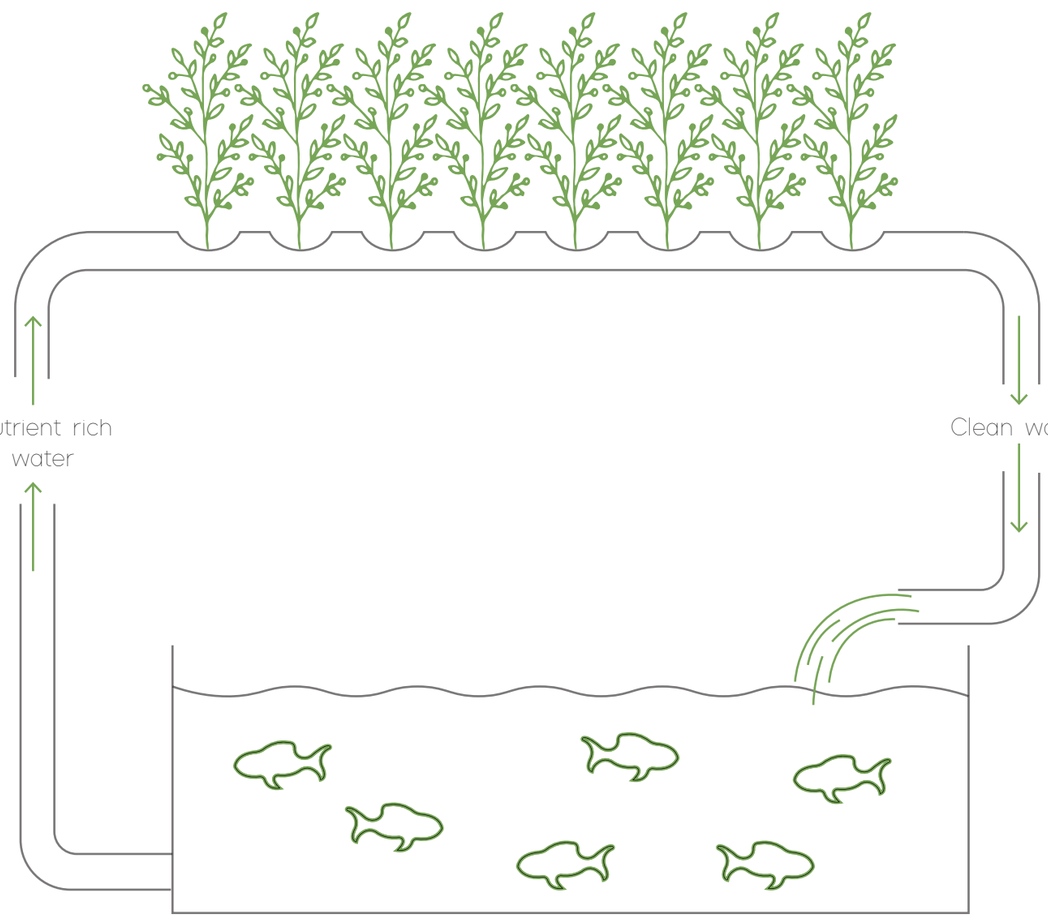
Principle



Improvements

Energy Demand for pumping

Create enough supply of water

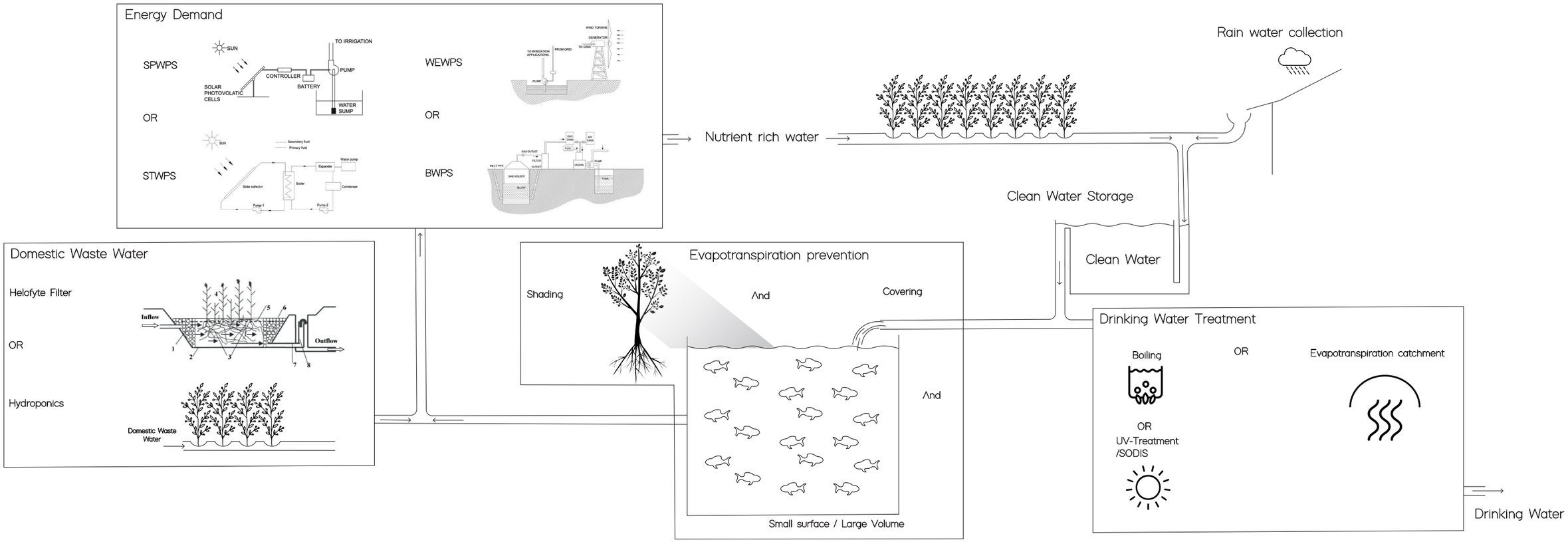


Prevent evapot-ranspiration to keep water

Treatment before use

Storage increase for the whole kampung

Conclusion



Schematic design guide

Based on necessary improvements

Multiple solutions available

Concept

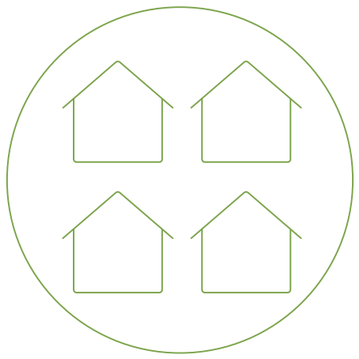
What is the goal?

Concept

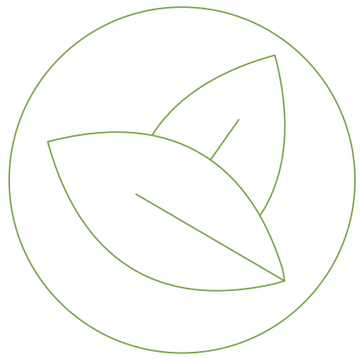
"Rebuilding Kampung Melayu by implementing an aquaponic system, using it as a means of water management, economic engine and social glue, while architecturally capitalizing on its spatial & climatic potential"

Project

"Rebuilding Kampung Melayu by implementing an aquaponic system, using it as a means of water management, economic engine and social glue, while architecturally capitalizing on its spatial & climatic potential"

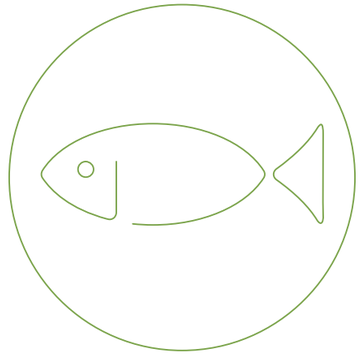


Housing



Hydroponics

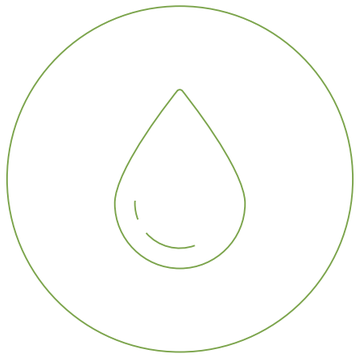
Shops



Aquaculture

Focus

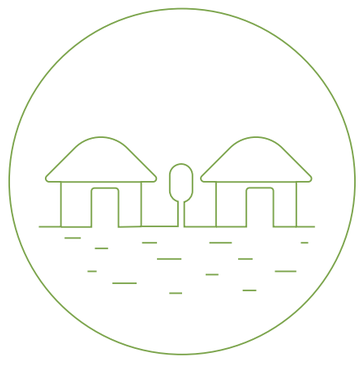
"Rebuilding Kampung Melayu by implementing an aquaponic system, using it as a means of water management, economic engine and social glue, while architecturally capitalizing on its spatial & climatic potential"



Water Management

Social Glue

Economic Engine



Spatial & Climatic

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Context

Urban Plan

How is this area going to transform?

How does this fit in a larger context?

Goal

A place for aquaponics

New appreciation for the river

Flood Protection

A futureproof identity for Melayu

Current Situation

Little room for
the river

Dense
neighbourhoods

Open spaces in
between

Maintain Road Structure

Use existing
structure of
roads

Demolish

Keep what is possible

Cherish the history

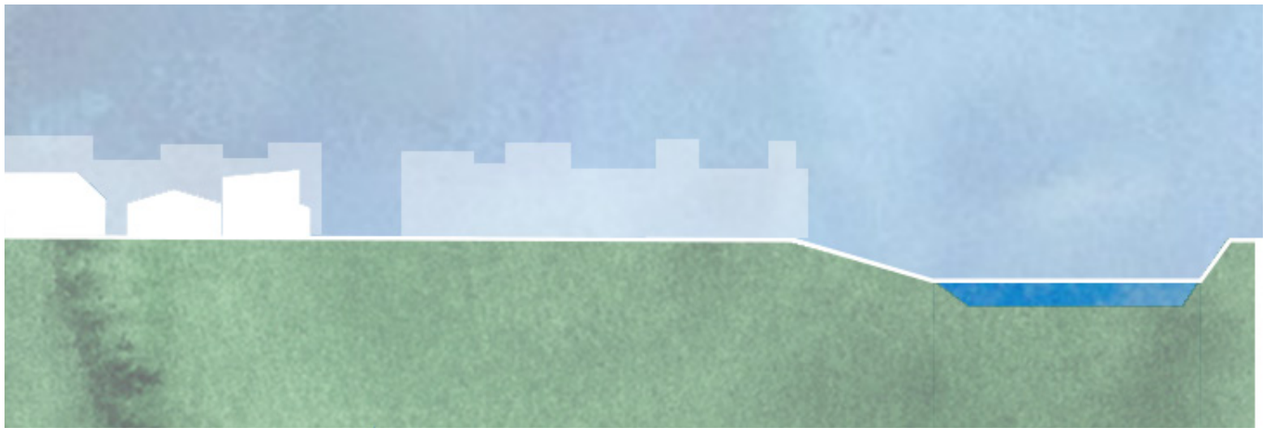
Remove the unsalvable

Room for River

Show the value
of the river

Mitigate river
flooding

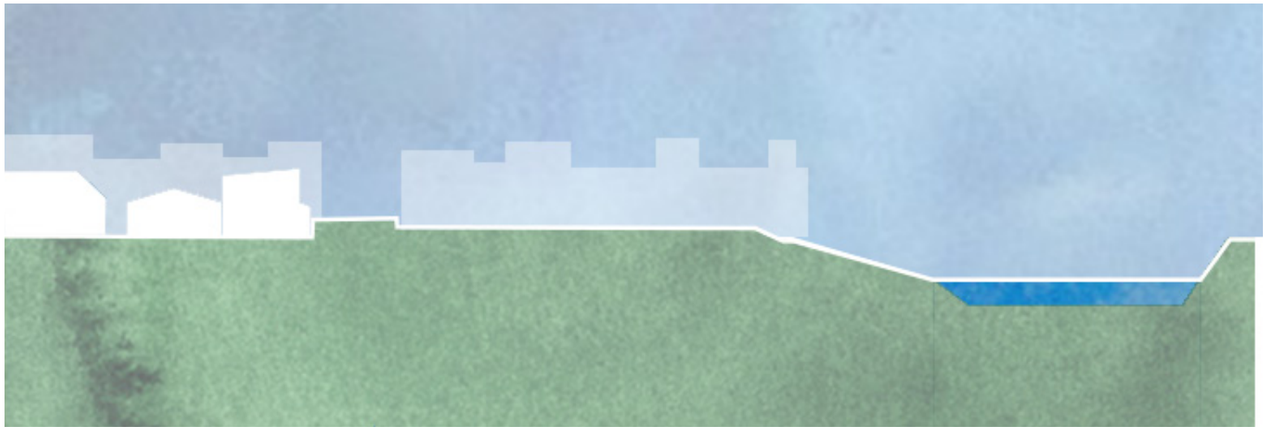
Integrate the
river



Flood Protection

Protection during
rainy season

Control extreme
situations

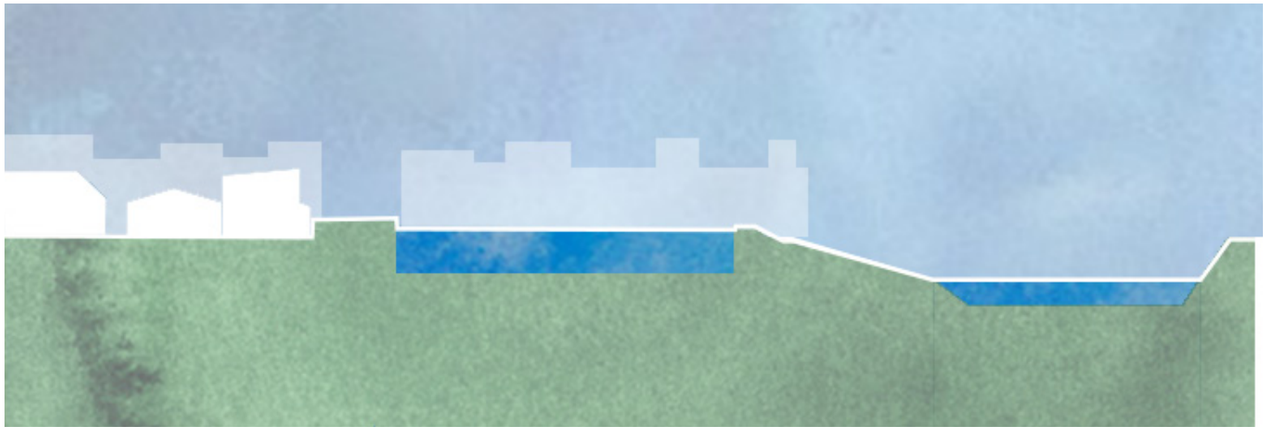


Create Basins

Escavate basins
and raise
surroundings

Aquaponics next
to the river

Aquaponics as
foundation of a
new Melayu

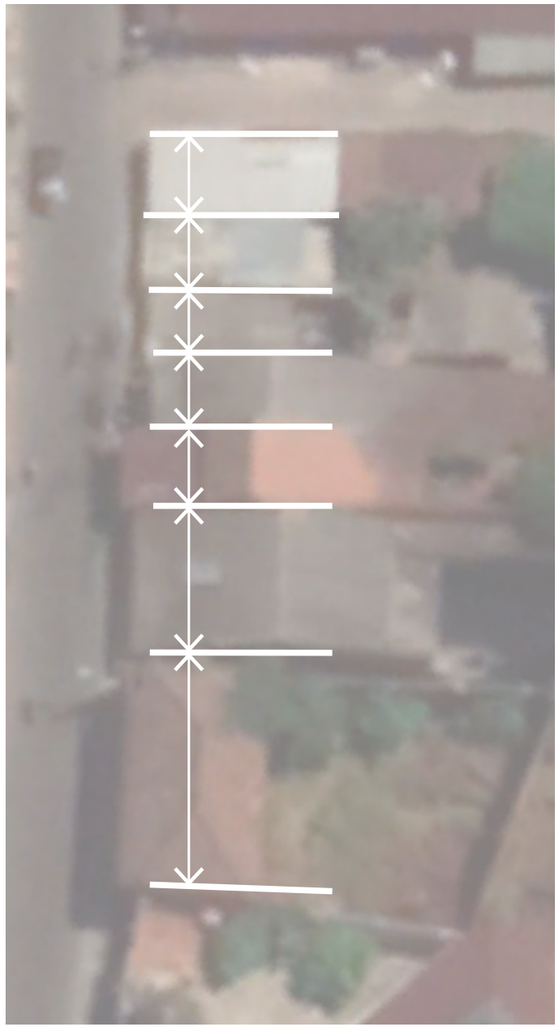


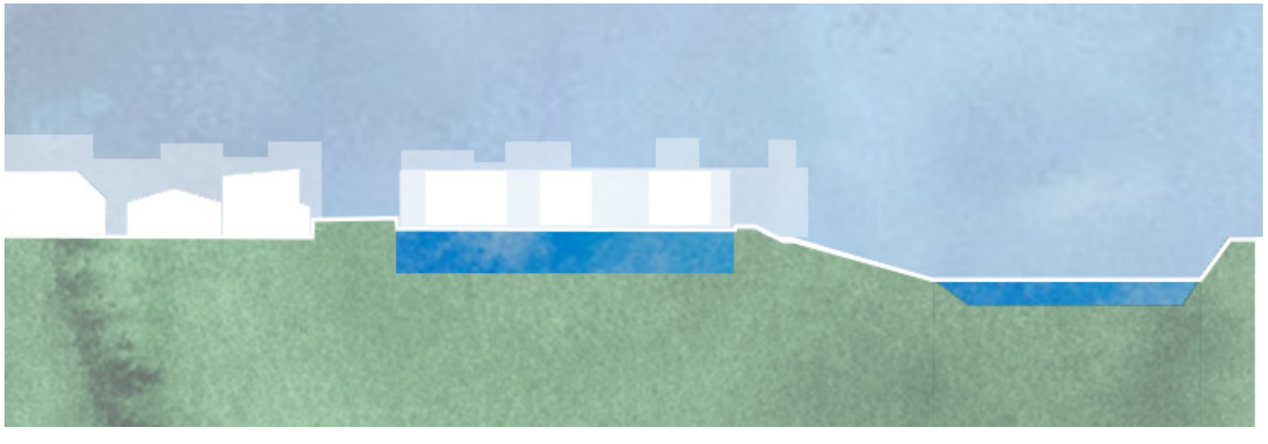
Housing Blocks on top

Create a direct connection with the water

Create shade for basin

Use Existing Structure





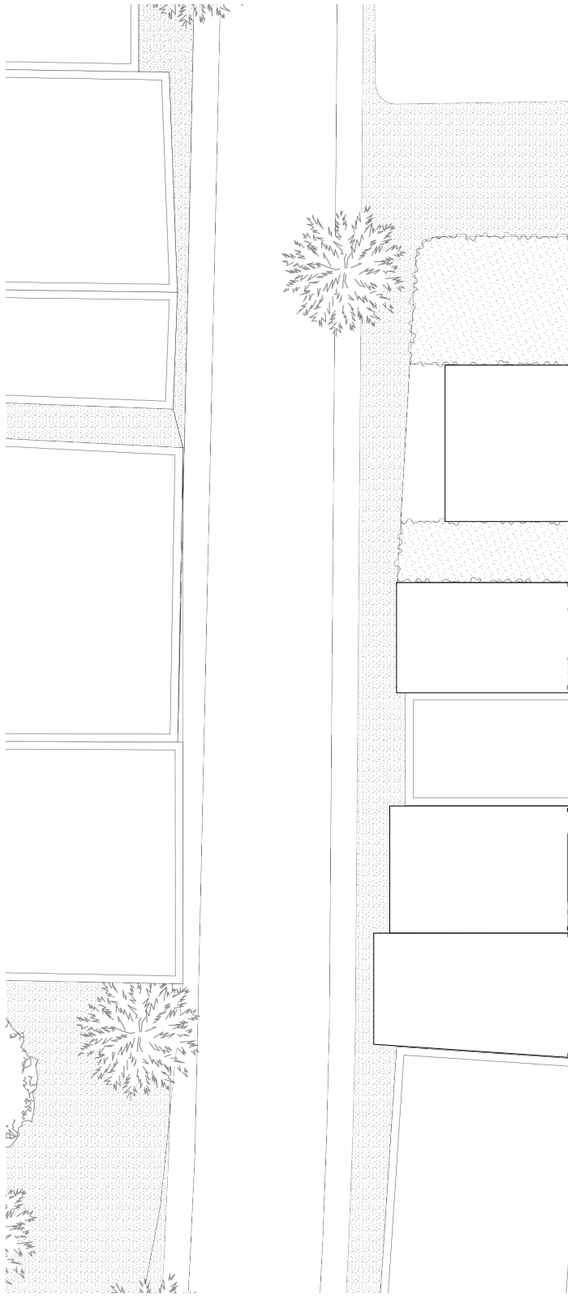
Zoning Plan

Historically

Future

Site Plan

Commerce



What to build

Housing

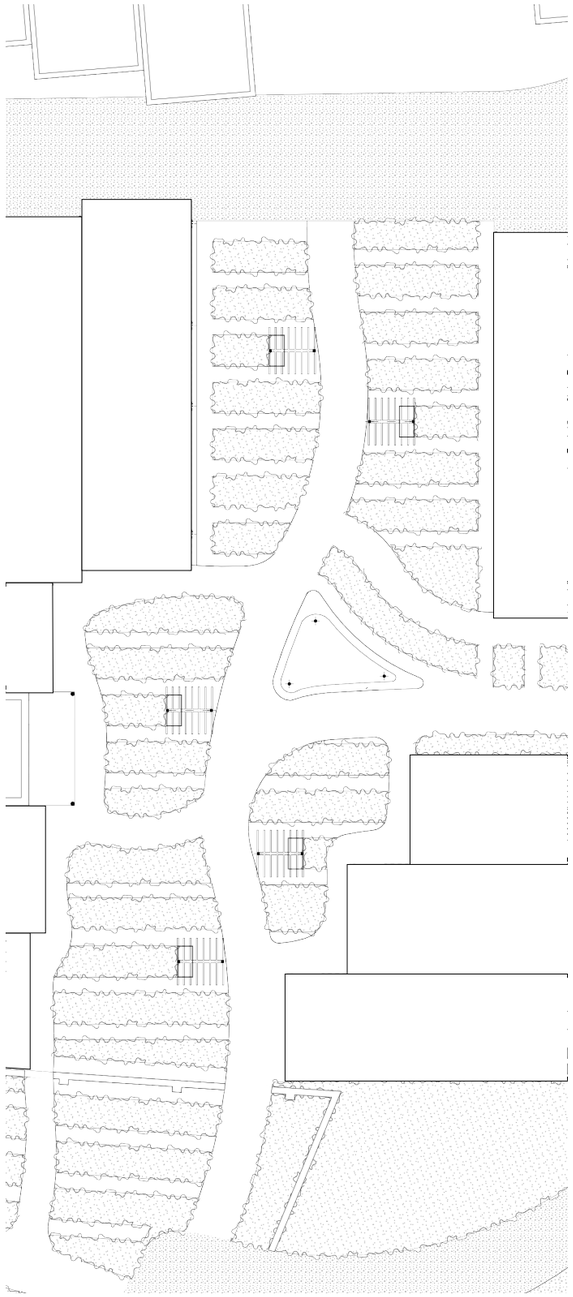
Shops

Focus

Economic Engine

Spatial & Climatic

Production



What to build

Housing

Hydroponics

Aquaculture

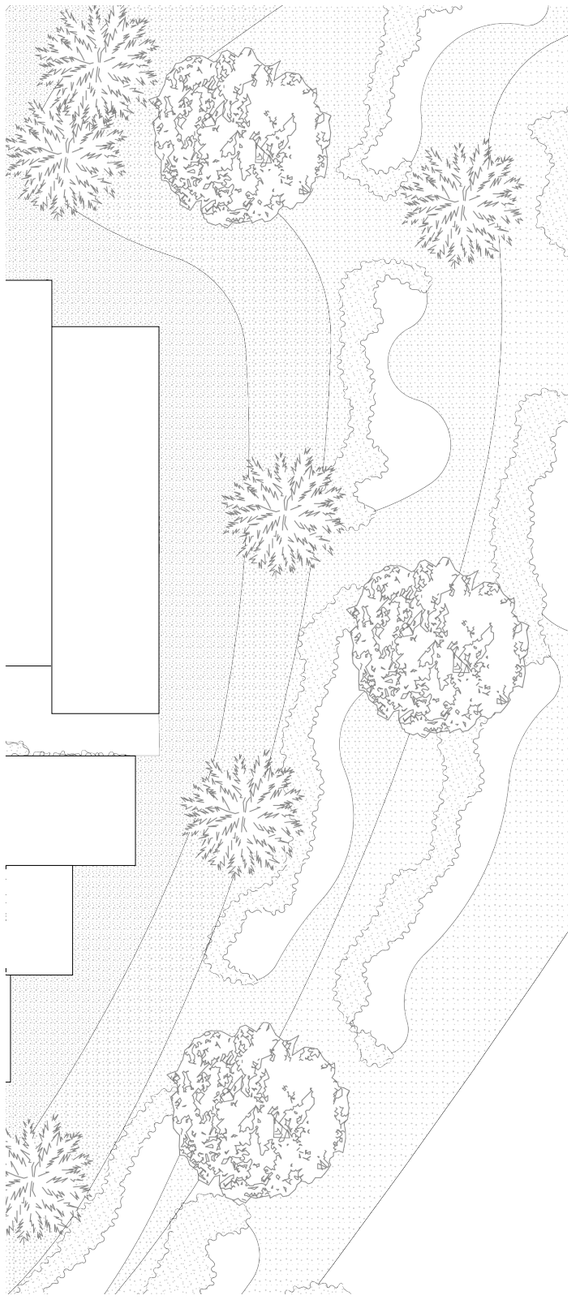
Focus

Social Glue

Spatial & Climatic

Water Management

Park



What to build

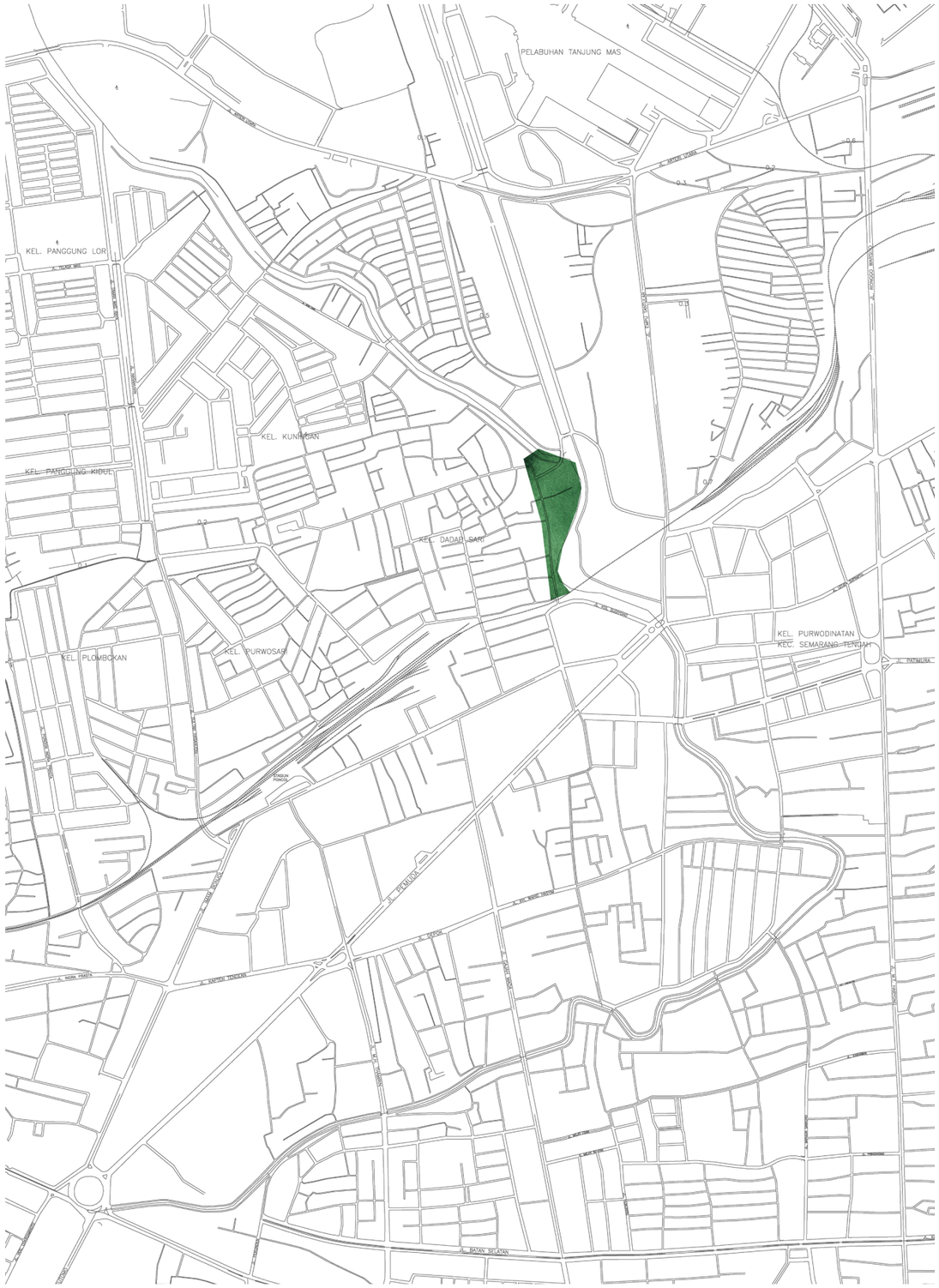
Housing

Focus

Spatial & Climatic

Water Management

Larger Context

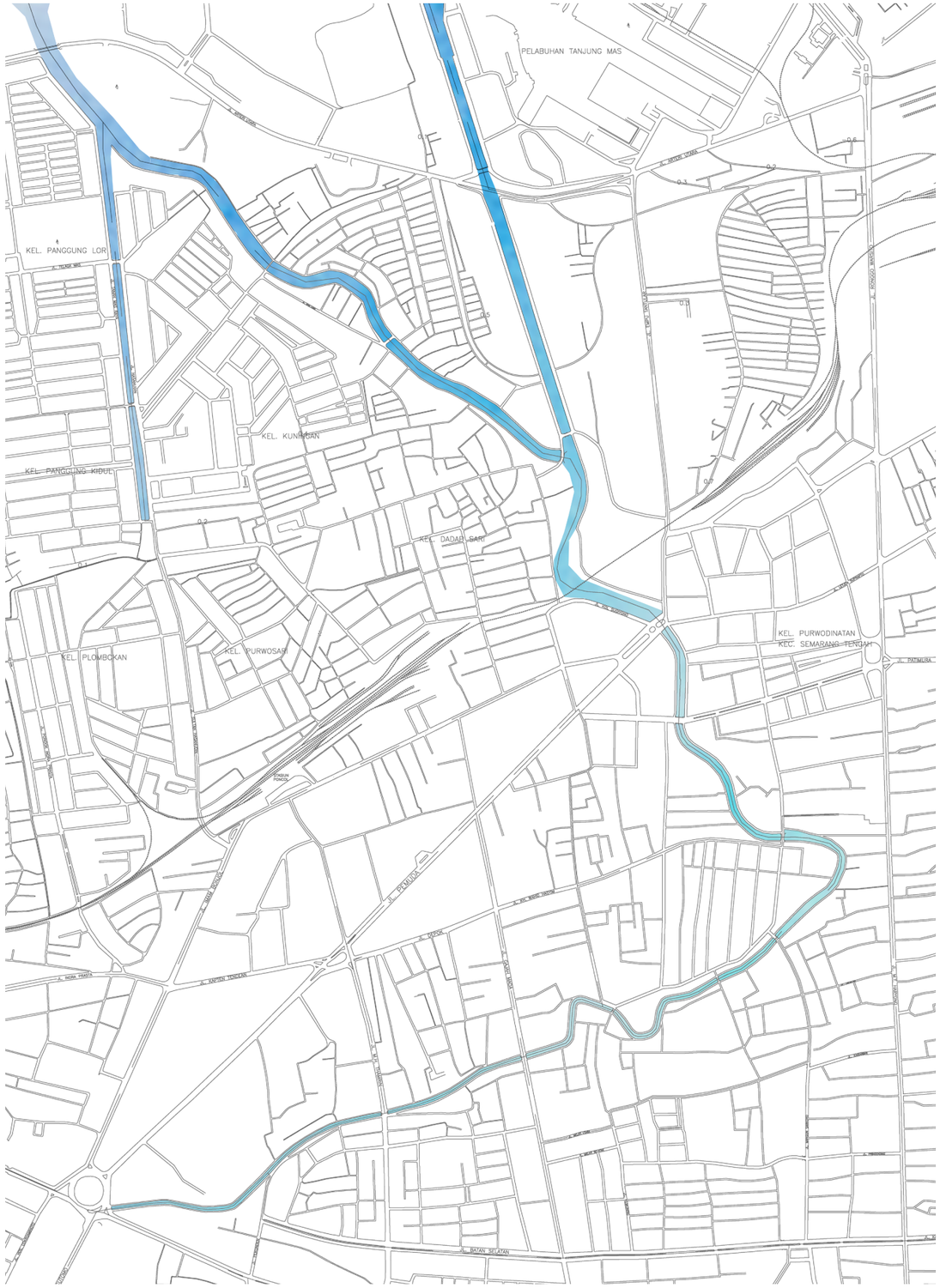


Water Management

Economic

Spatial & Climatic

Watermanagement



Create more
space for the
Kali Semarang
everywhere

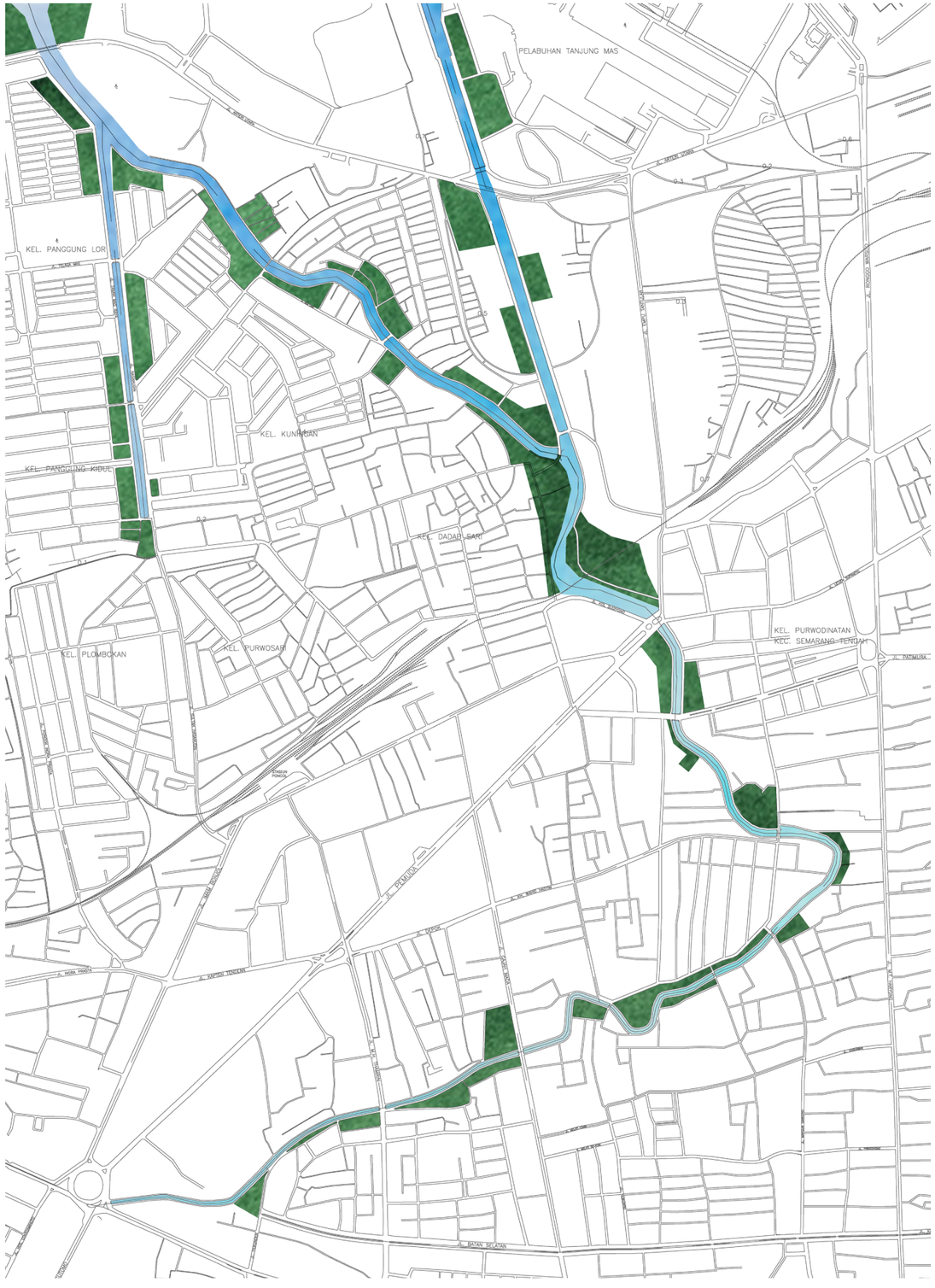
Economic

Produce food for other Kampungs areas such as Kota Lama

&

Become a hotspot for local cuisine

Spatial & Climatic



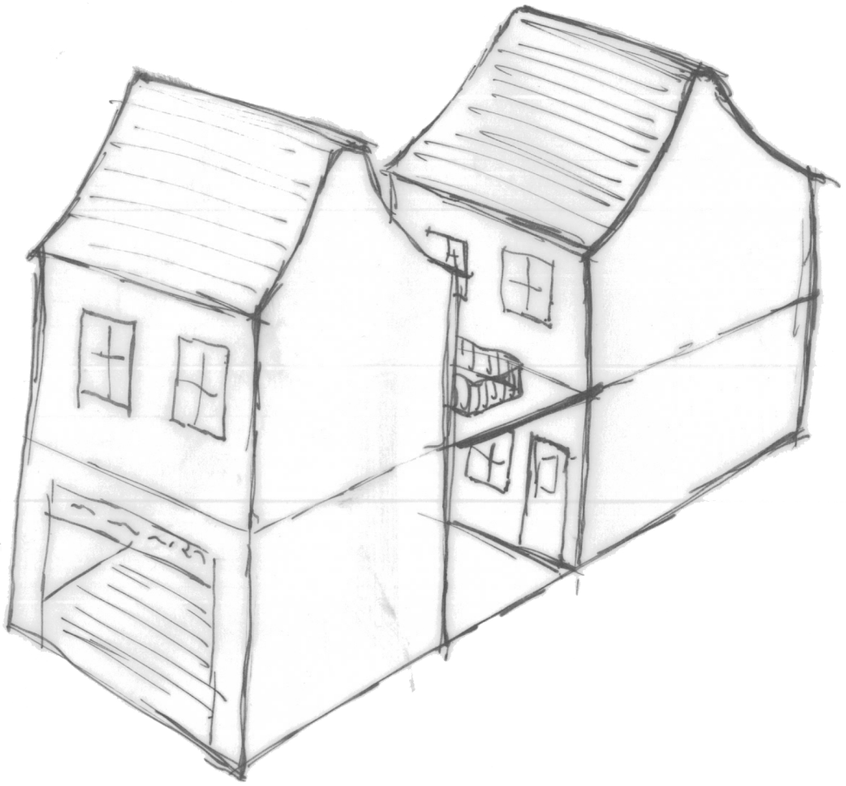
Turn the river into a cool breathable area in a hot and dense city

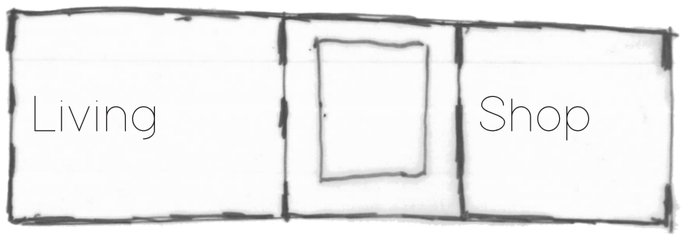
Users & Typology

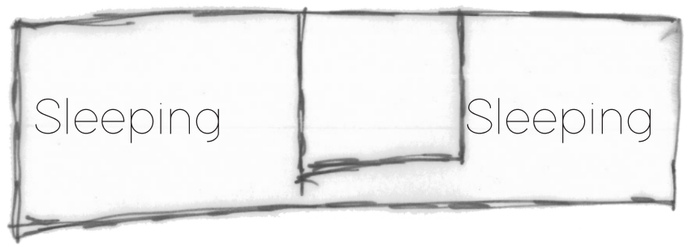
What are the houses going to be like?

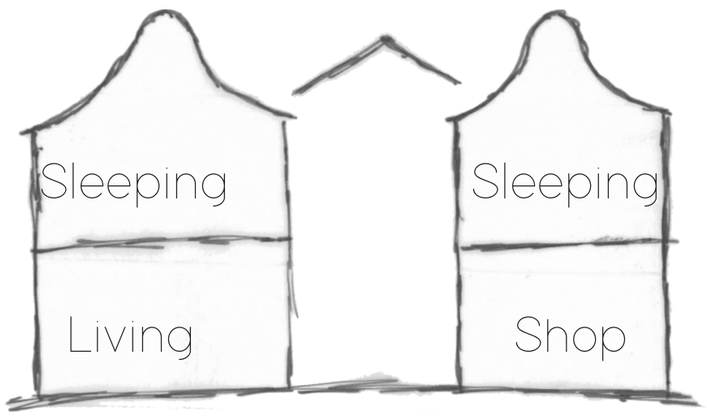
Who will be living there?

Shophouse



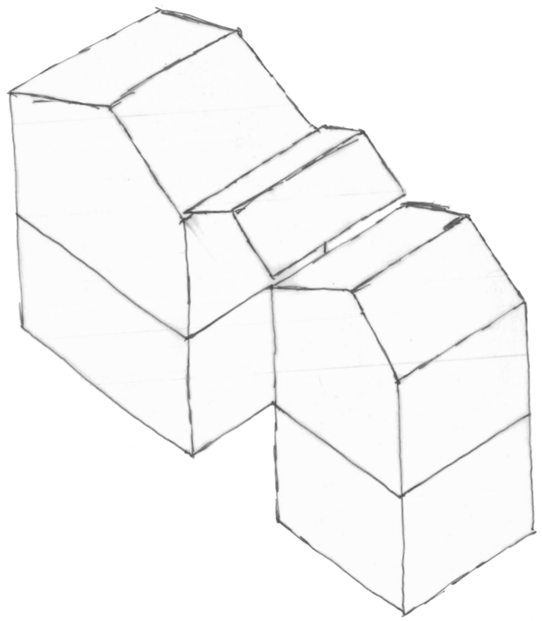

Living
Shop

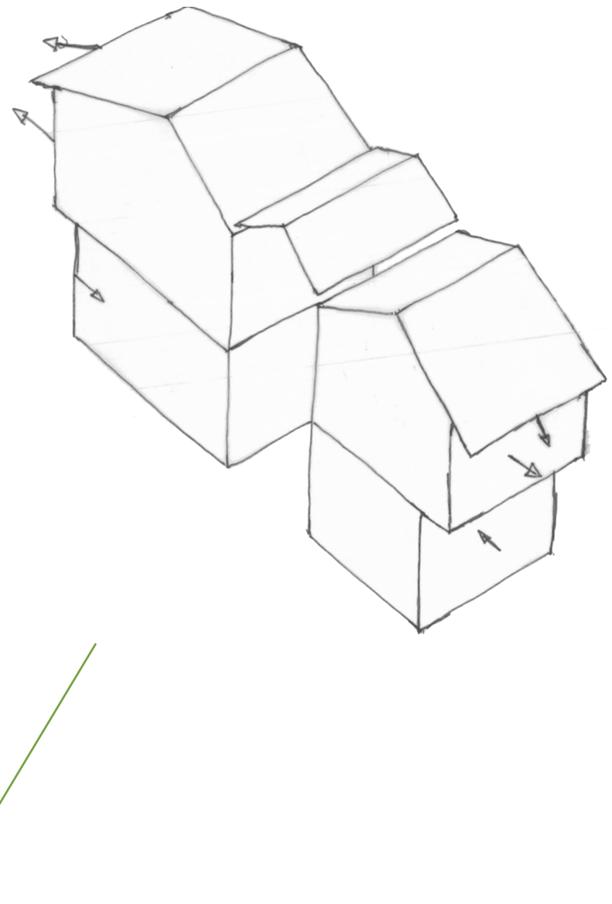

Sleeping
Sleeping

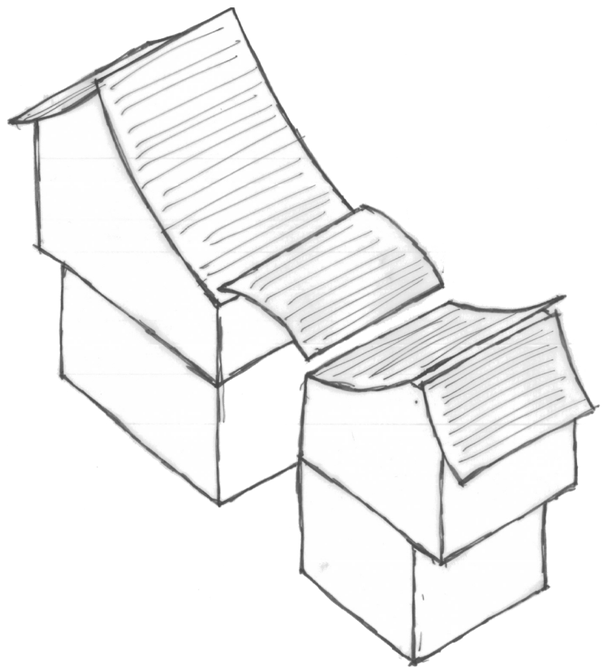

Sleeping
Sleeping
Living
Shop

Context

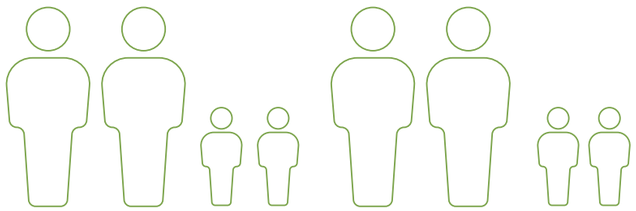
Shape







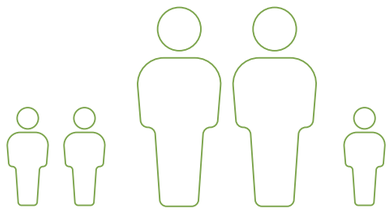
Users



Rumah 80

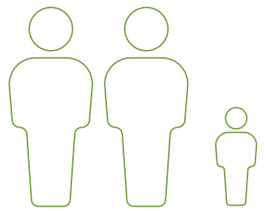
Augmentend nuclear family

Large nuclear family



Rumah 54

Nuclear family

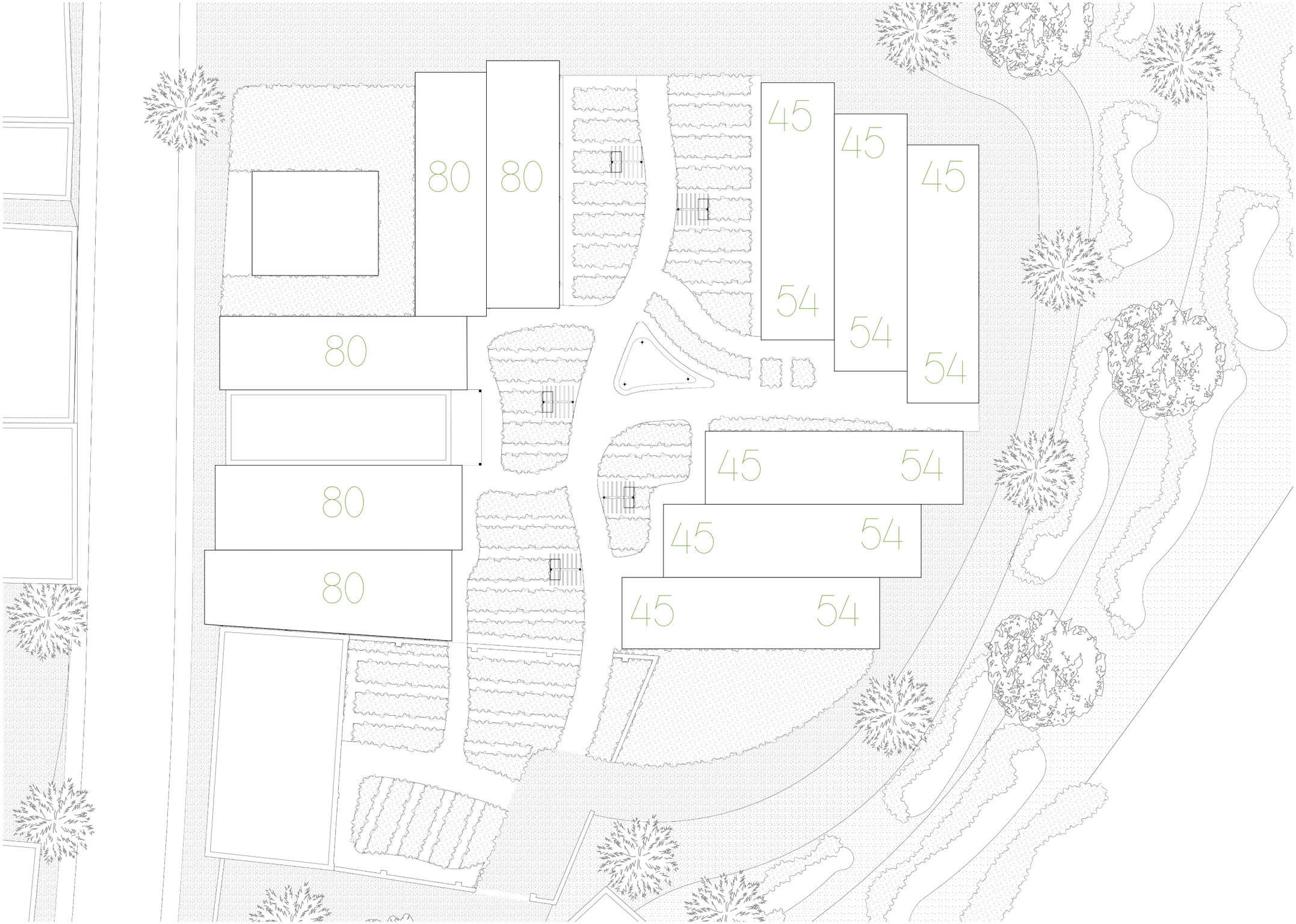


Rumah 45

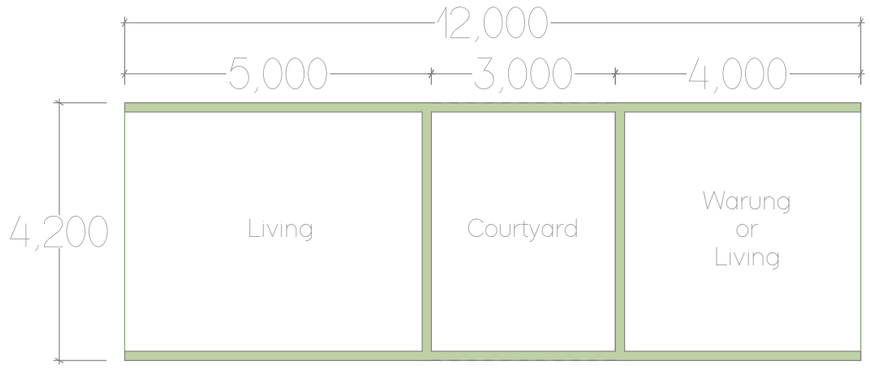
Starters

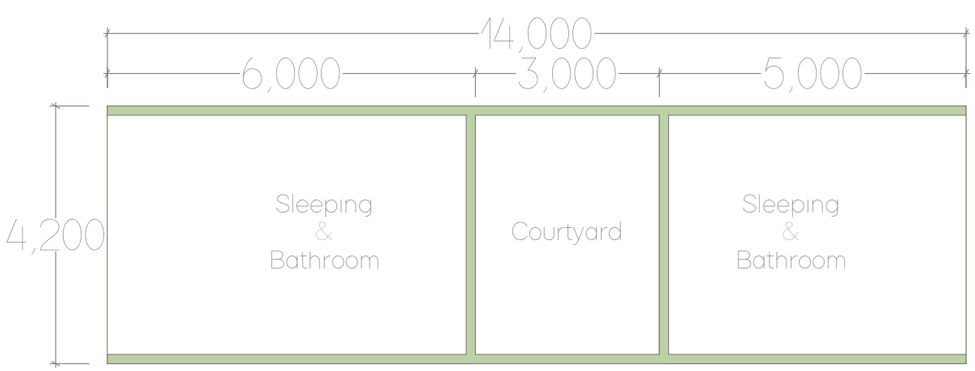
Small Nuclear family

Site Plan

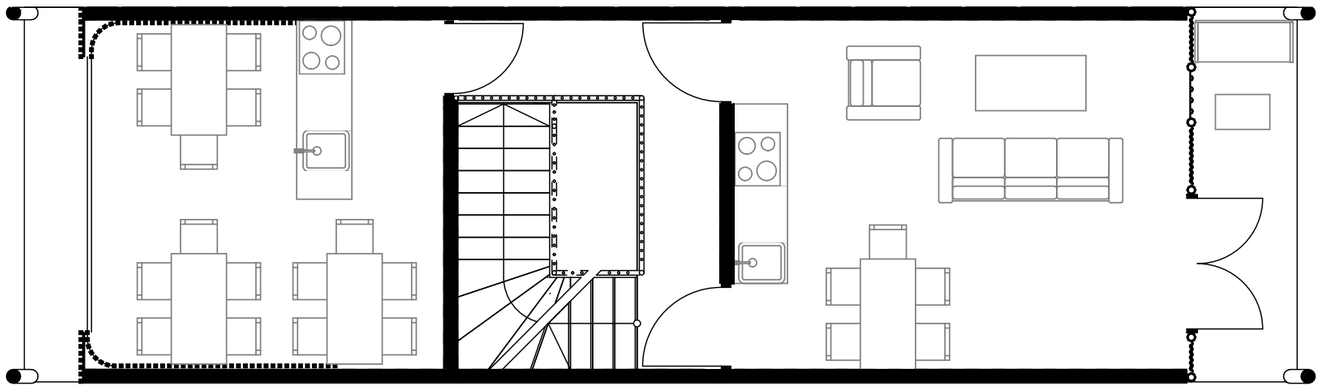


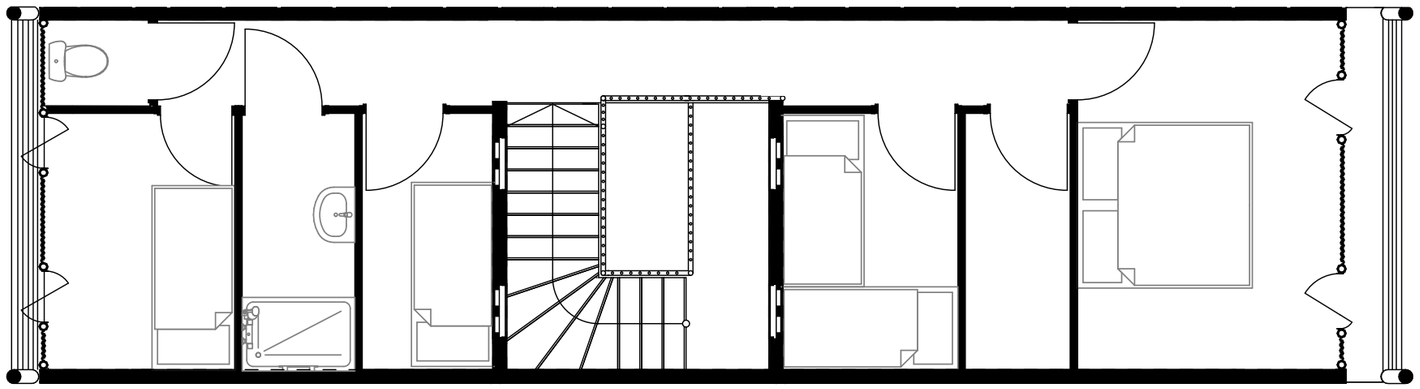
Measurements



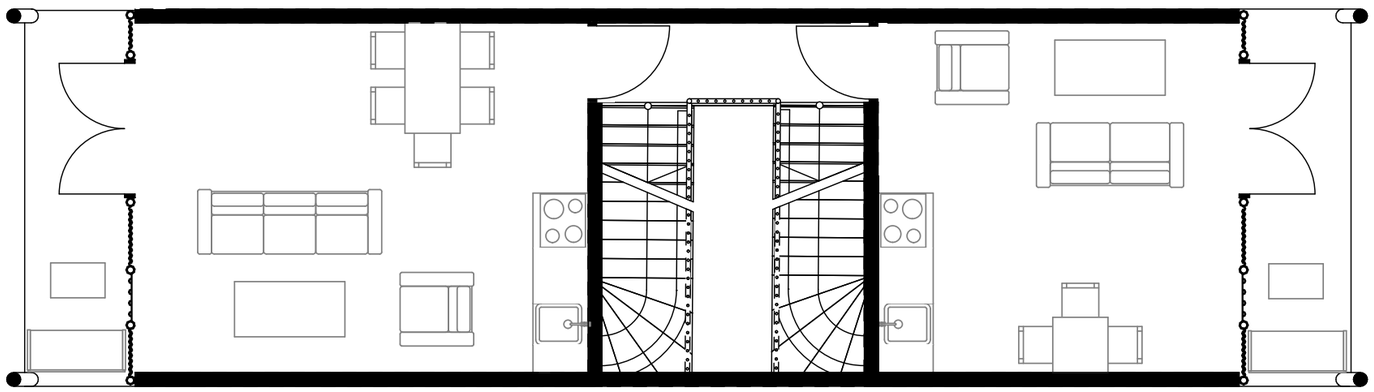


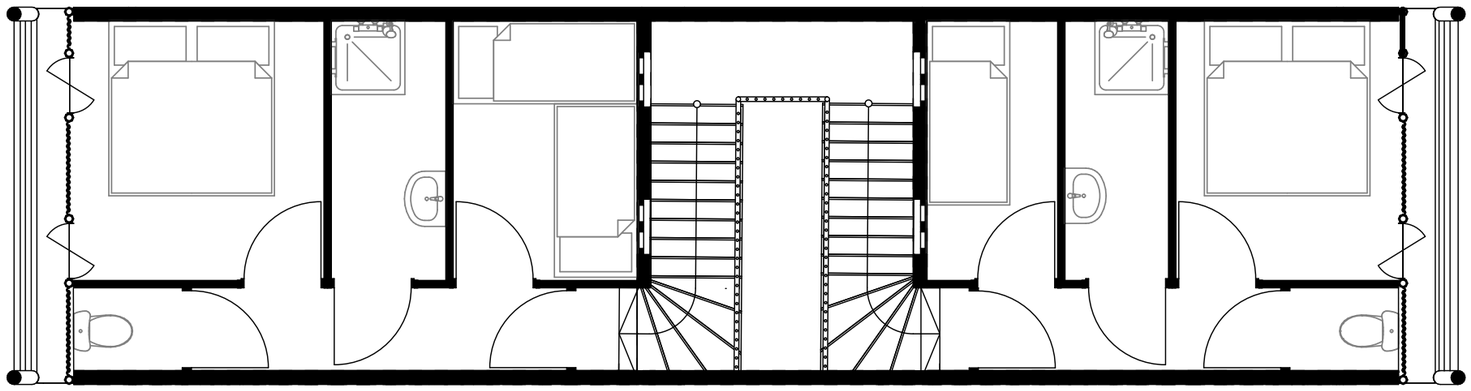
Rumah 80





Rumah 45 + 54





Site Plan

Construction

Who is going to build it?

How is it going to build?

Two Parts

Infrastructure

Flood protection

Basin

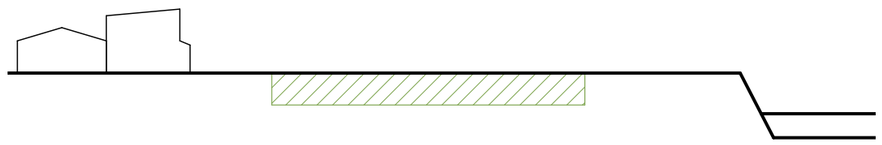
Living

Houses

Garden

Infrastructure

Current Situation



Government funded

Part of flood protection programme

Adjustment

Ground and materials reused

Dwelling

Government Loans

Loan backed by local government

For the lower income class

Buying in

Cooperative structure

Create responsibility

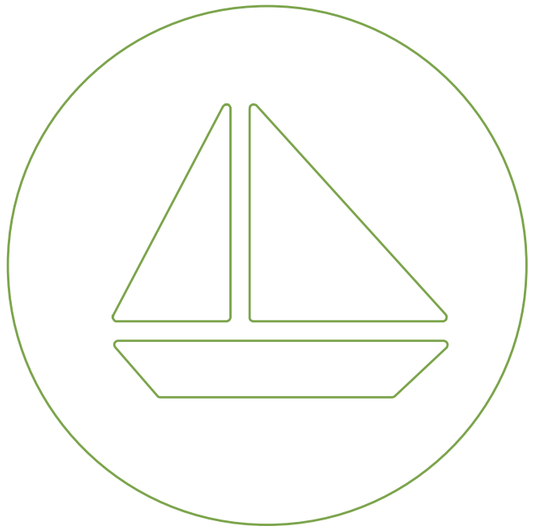
Getting a part

Structure of the house

Right to plot in the garden

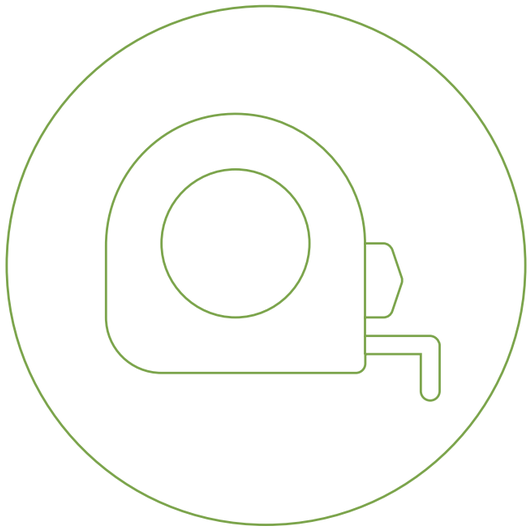
Shared responsibility of maintenance

Construction Principles



Floating

Coping with subsidence



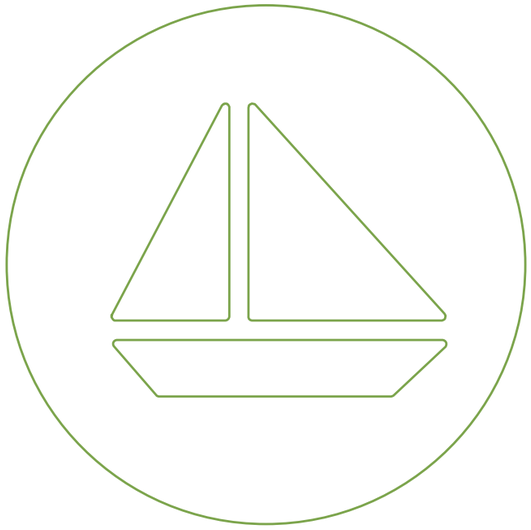
Easy Construction

Cheaper to build
Implementable elsewhere

Local Materials

Cheaper to build
Local economic impulse
Smaller climatic impact

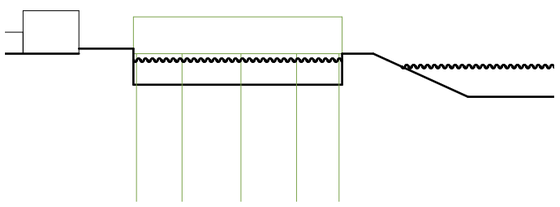
Floating



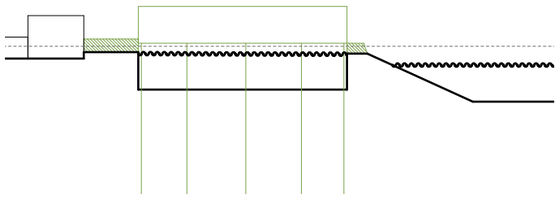
Floating

Piling

Now

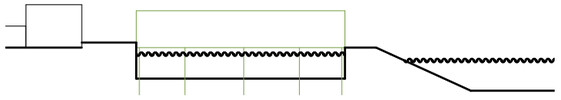


30 years later

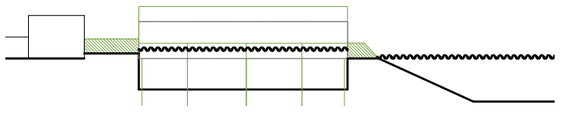


Rebuilding

Now

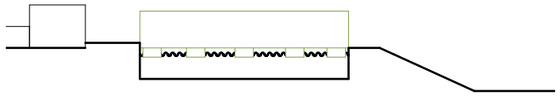


30 years later

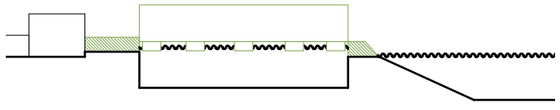


Floating

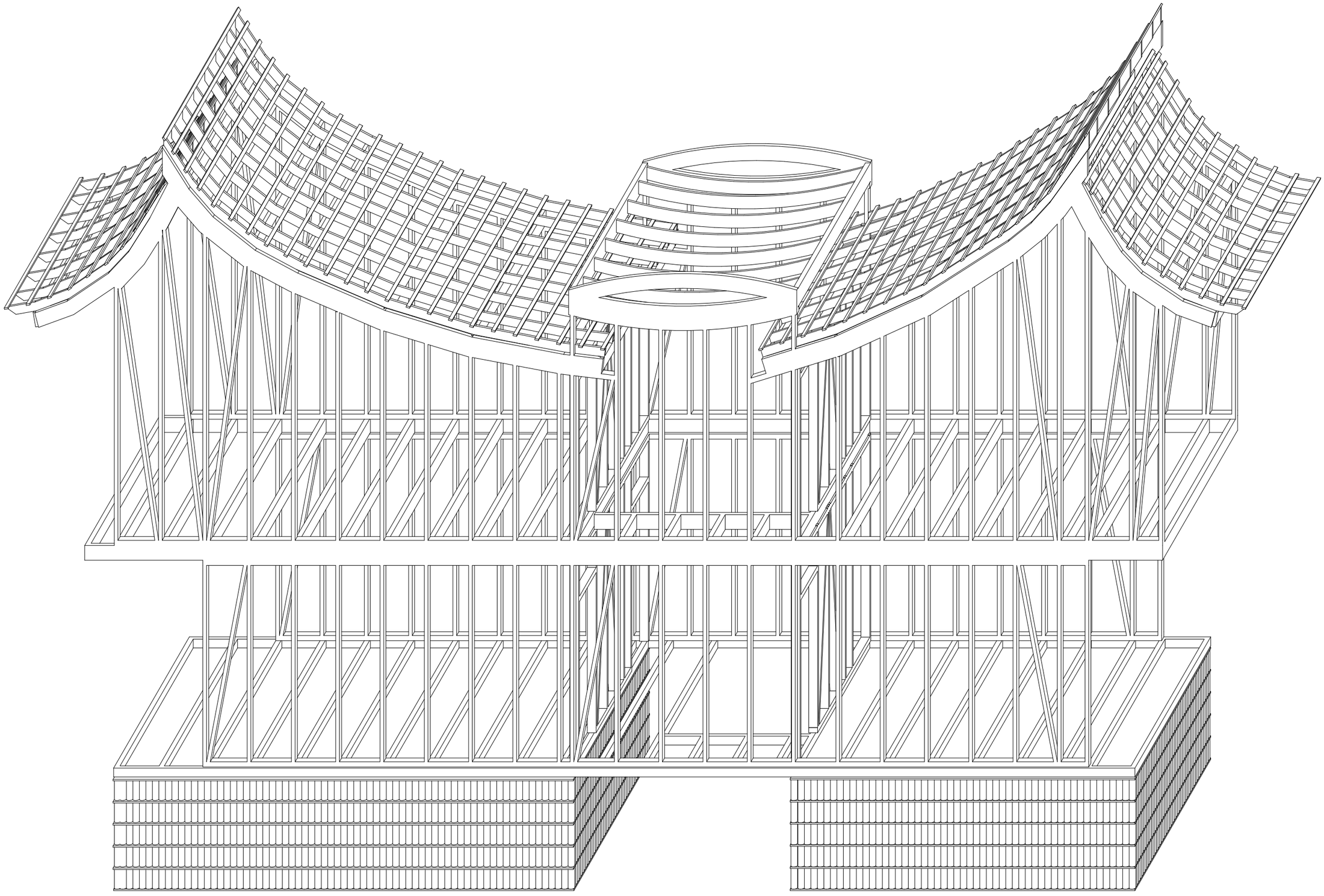
Now



30 years later



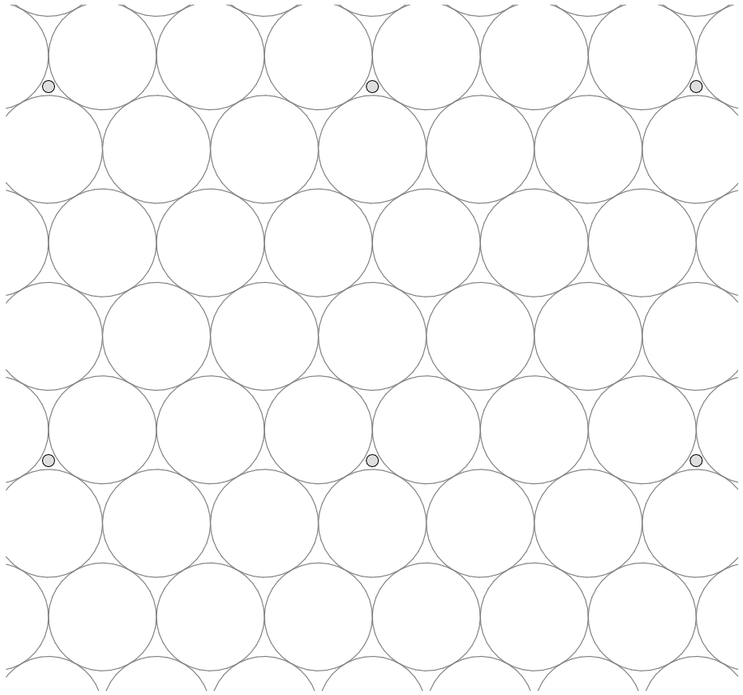
Building Process

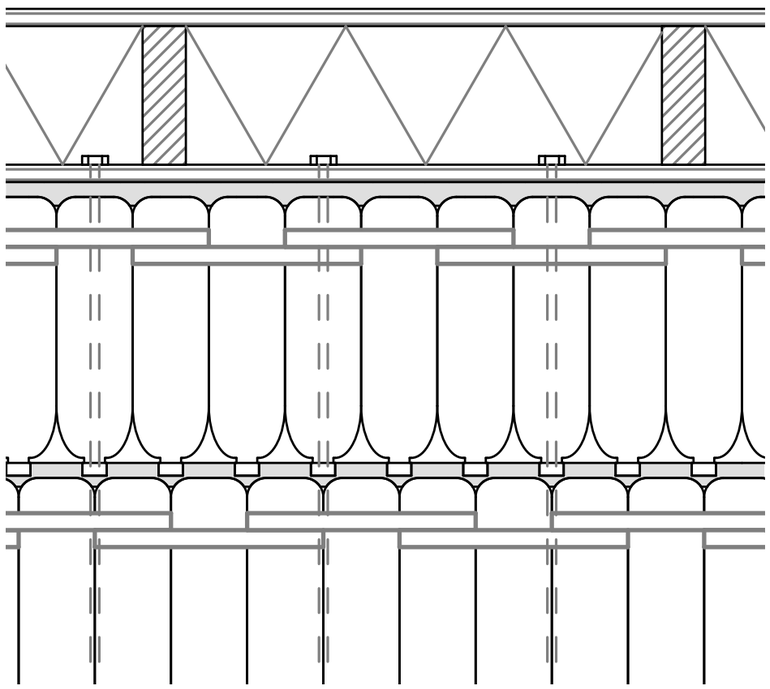


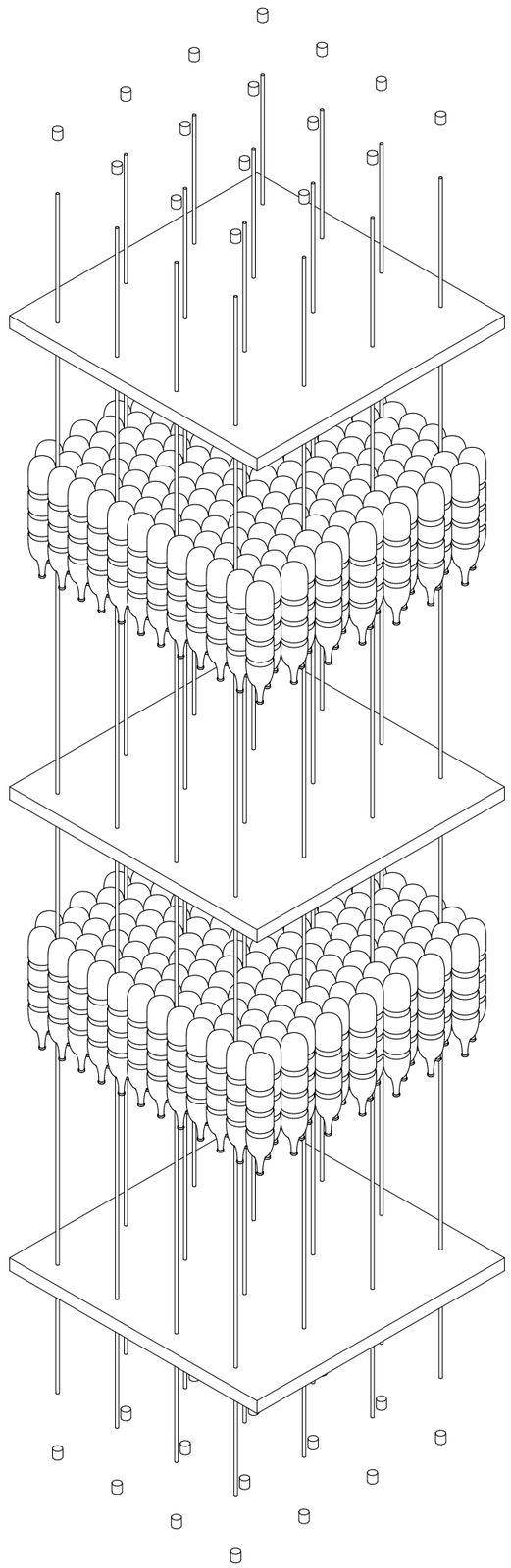
Float

Bottles

Fixation







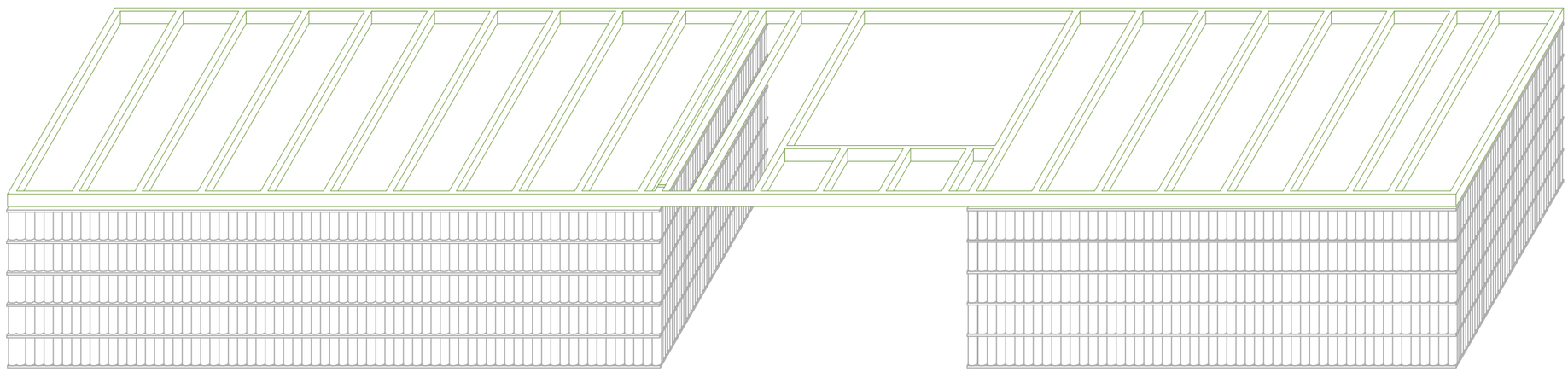
Bottles

Enough bottles can hold a house

Can be placed by the inhabitants

Next to Melayu they are collected

Ground Floor



Materials

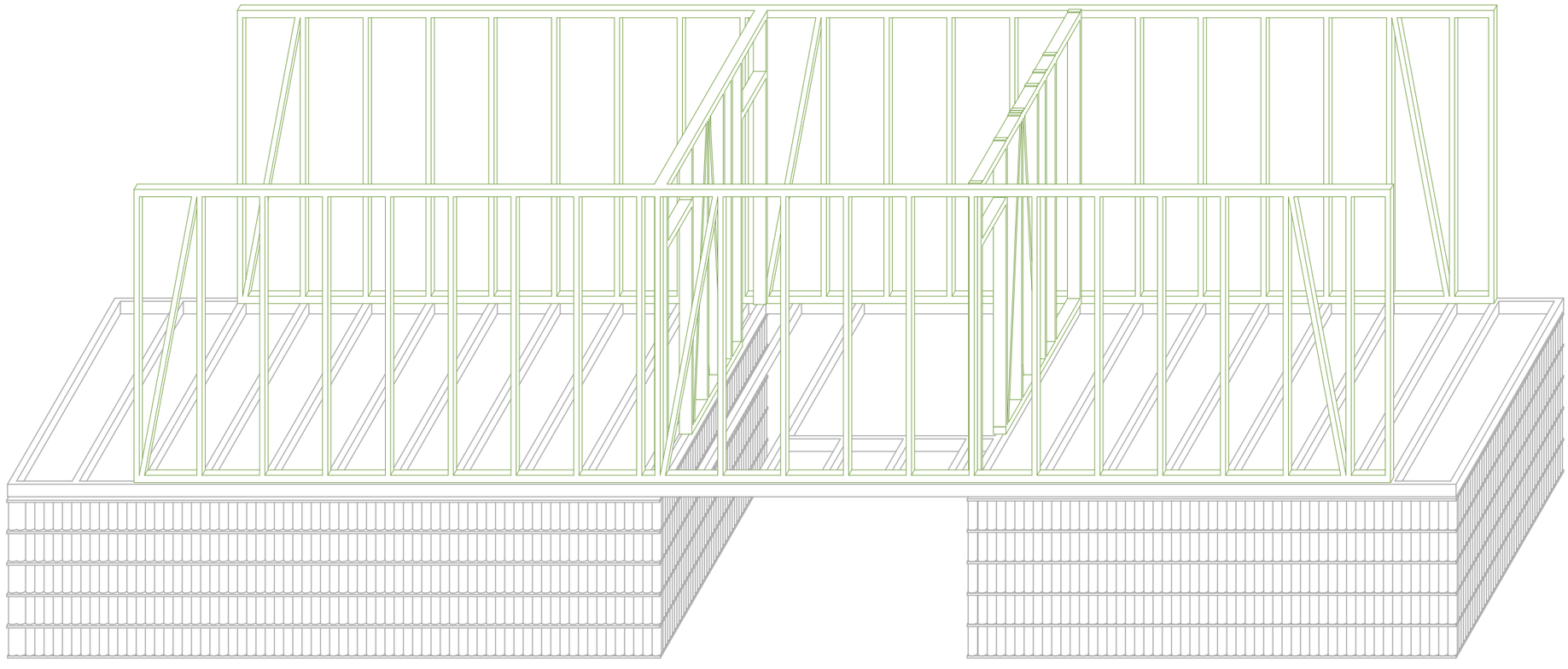
Bamboo Laminated Lumber

- Light weight and water proof
- Can be mounted together using screws and drill
- Multiple suppliers within Semarang

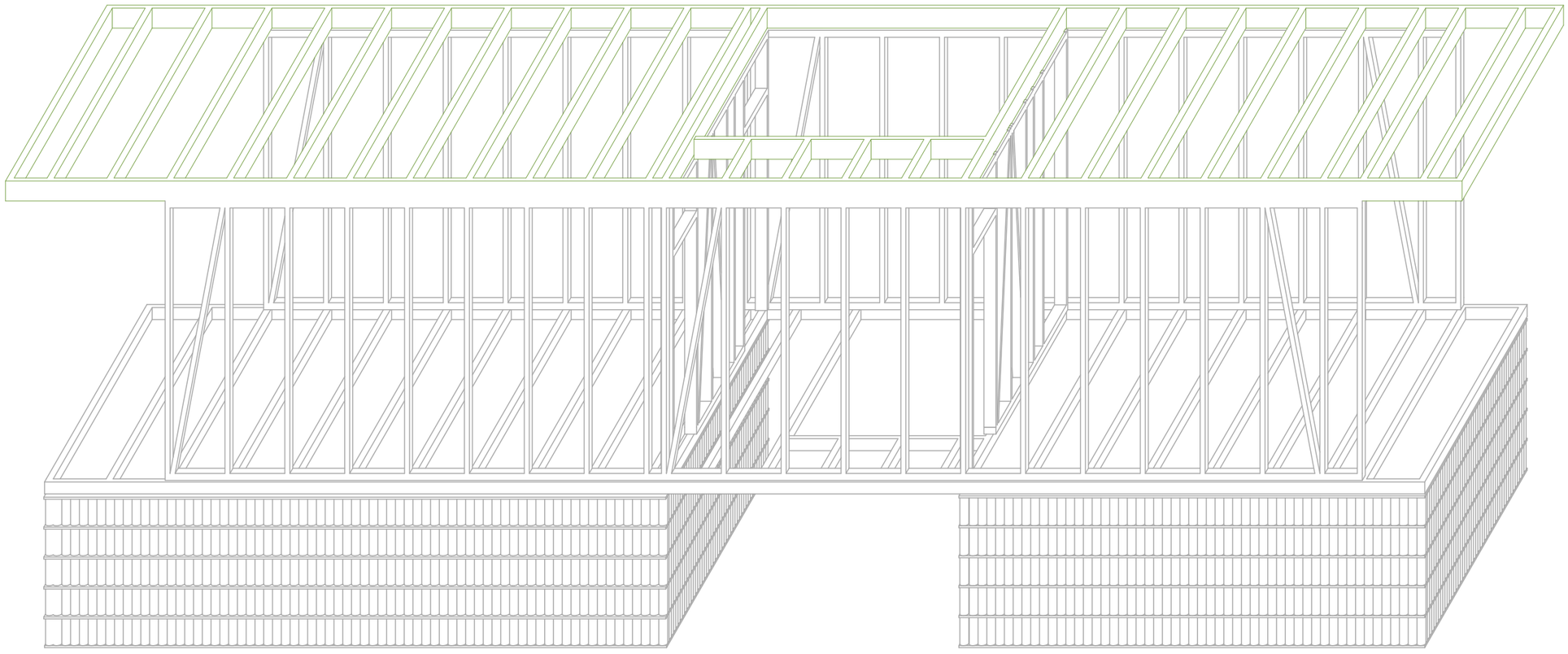
Banana fiber based Insulation

- Light weight
- No tools required to mount
  Knives needed to produce
- Can be self produced

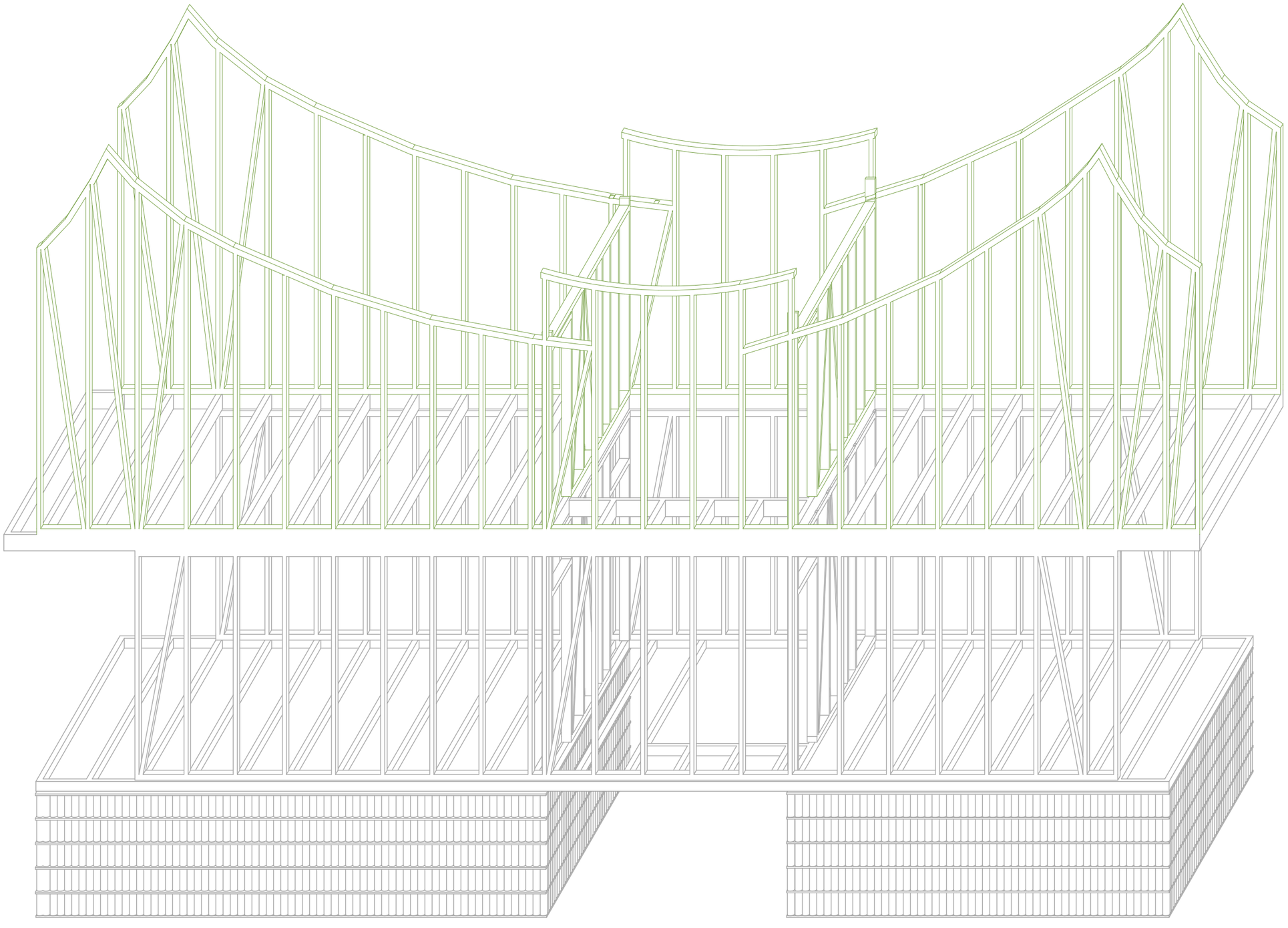
Walls



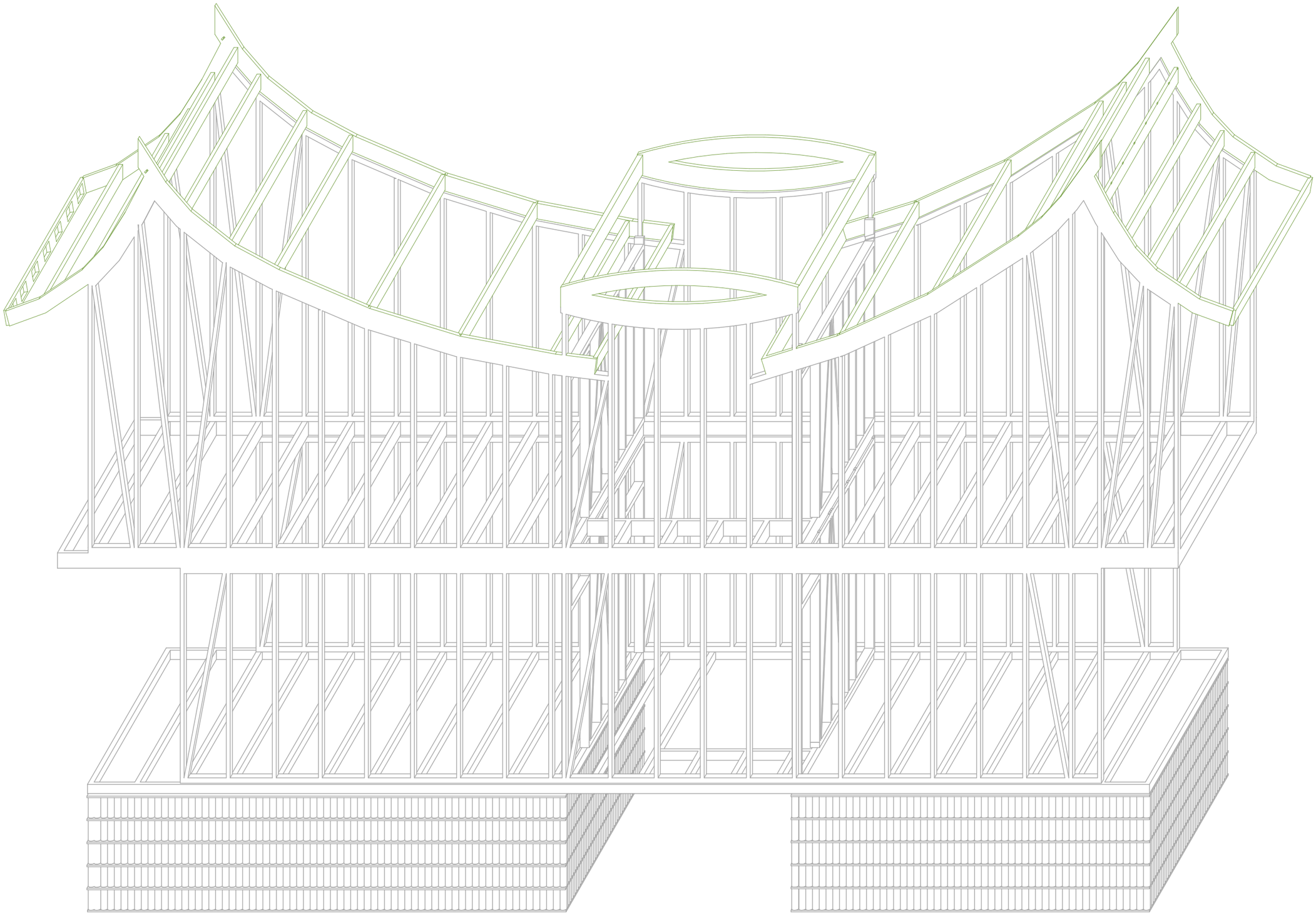
First Floor



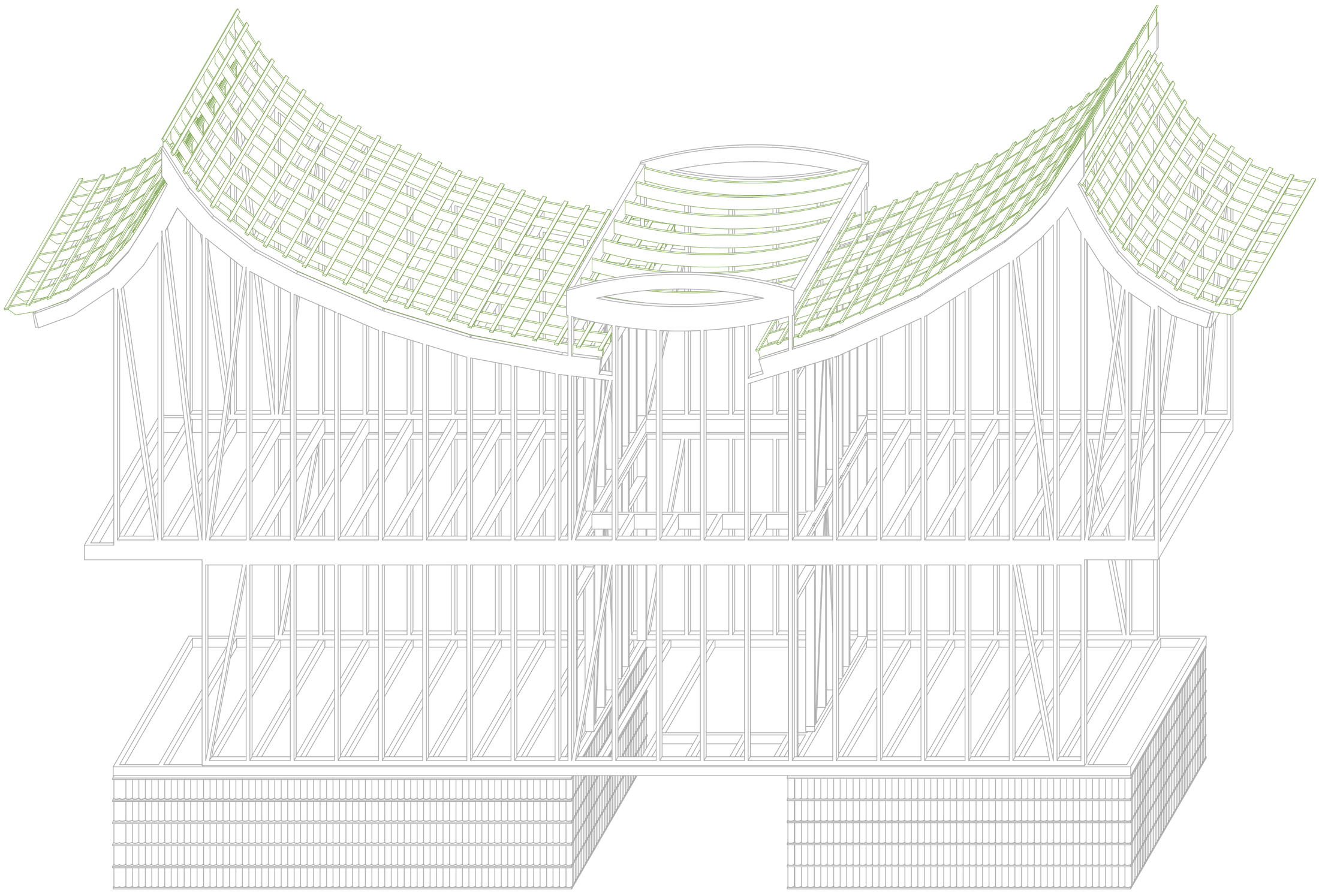
Walls



Roof



Roof Secondary Construction



Floating Principles

Floating

$$M_{Replaced\ Water} - M_{Float} = M_{Shophouse}$$

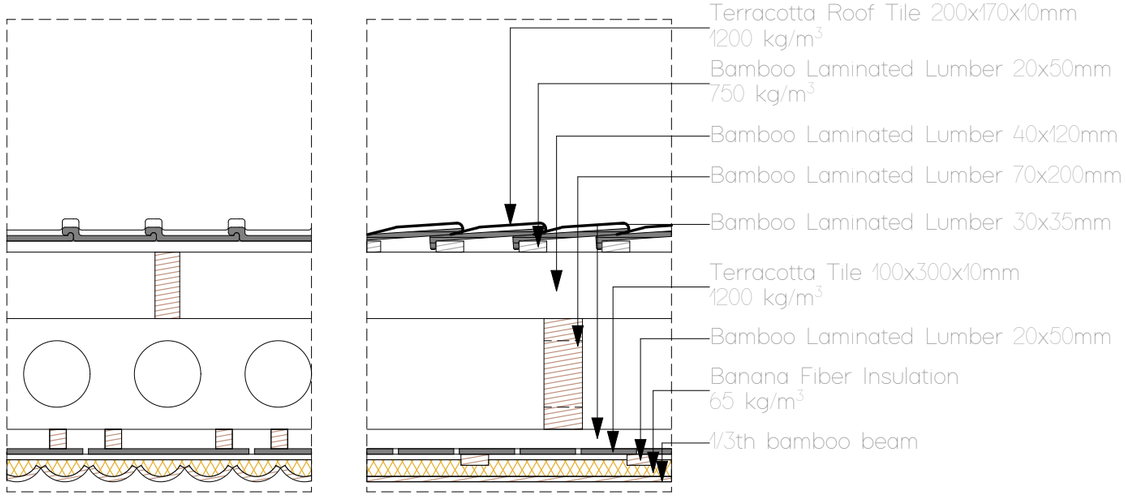
$M_{Replaced\ Water}$ = Mass of water Replaced by float (kg)
M_{Float} = Mass of the float (kg)
$M_{Shophouse}$ = Mass of the shophouse (kg)

Draught

$$D = M_x / B_{Wpmm}$$

D = Draught (mm)
B_{Wpmm} = Amount of replaced water per mm height (kg/mm)
M_x = Mass of object x (kg)

Calculations



Material	Density	Volume	Weight
T Roof tile	1200 kg/m^3	0,909 m^3	1.091 kg
BL Lumber	750 kg/m^3	3,107 m^3	2.330 kg
Terracotta Tile	1200 kg/m^3	0,595 m^3	714 kg
BF Insulation	65 kg/m^3	1,354 m^3	88 kg
Bamboo Beam	660 kg/m^3	0,674 m^3	445 kg
Total			4.668 kg

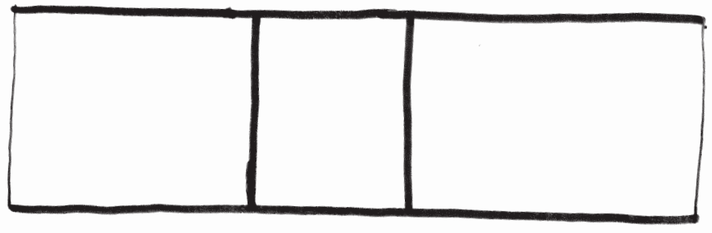
Draught

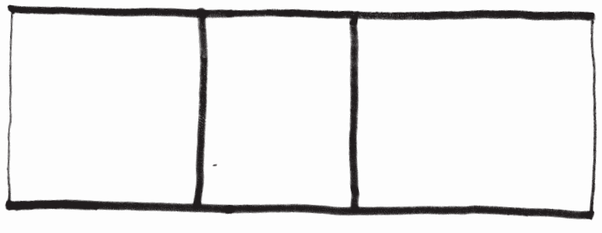
Total weight = 4668 kg

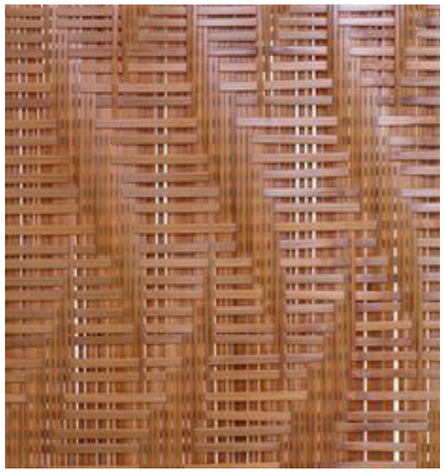
Draught = 141,5 mm

Result Possibility of increasing weight of terracotta tiles

Personal Influence

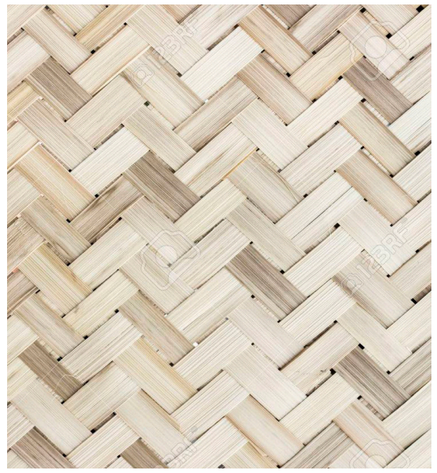






Modernly Woven Bamboo

Ventilation



Traditionally Woven Bamboo

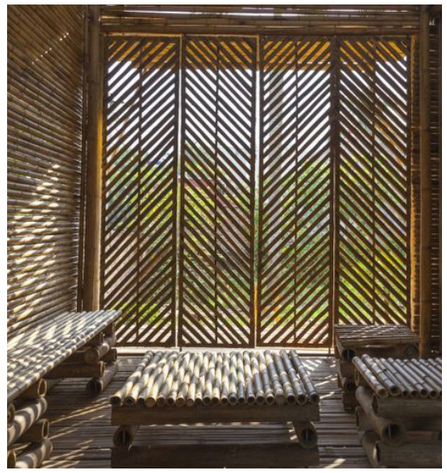
Ventilation

Softwood or Bamboo Board

Closed Wall

Bamboo beam constructed Wall

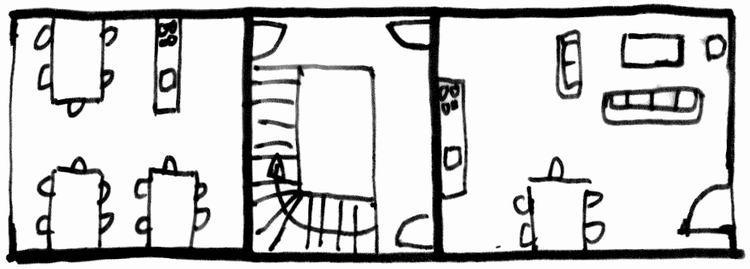
Closed Wall



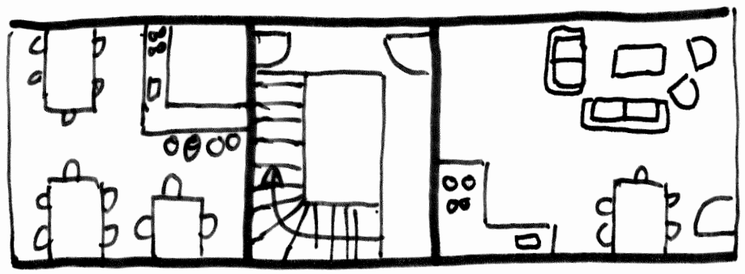
Revolting Bamboo Door

Opening

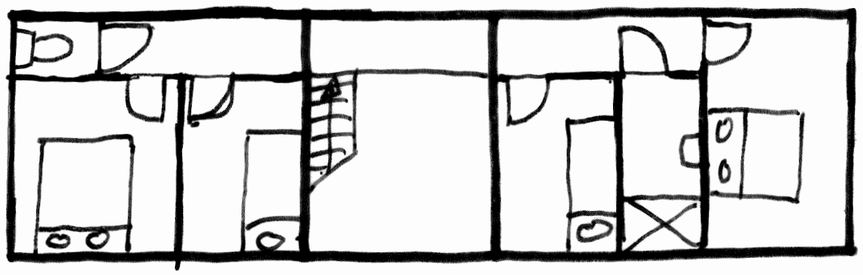
Floor Plans



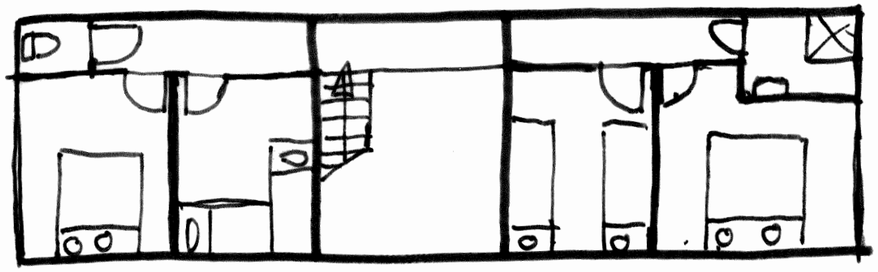
Ground Floor



Ground Floor



First Floor



First Floor

Aquaponics

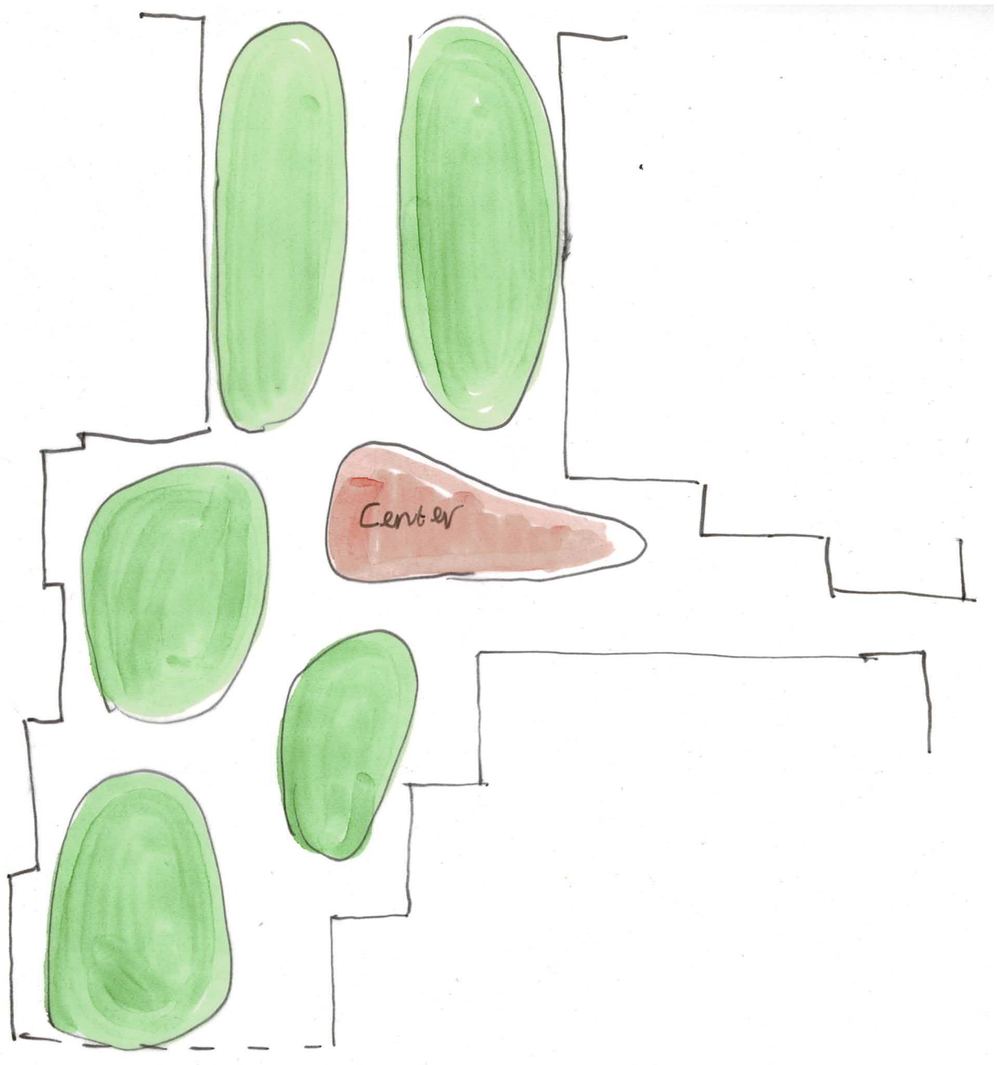
How is the garden designed?

How is it integrated in the houses?

Overview

Floor Plan

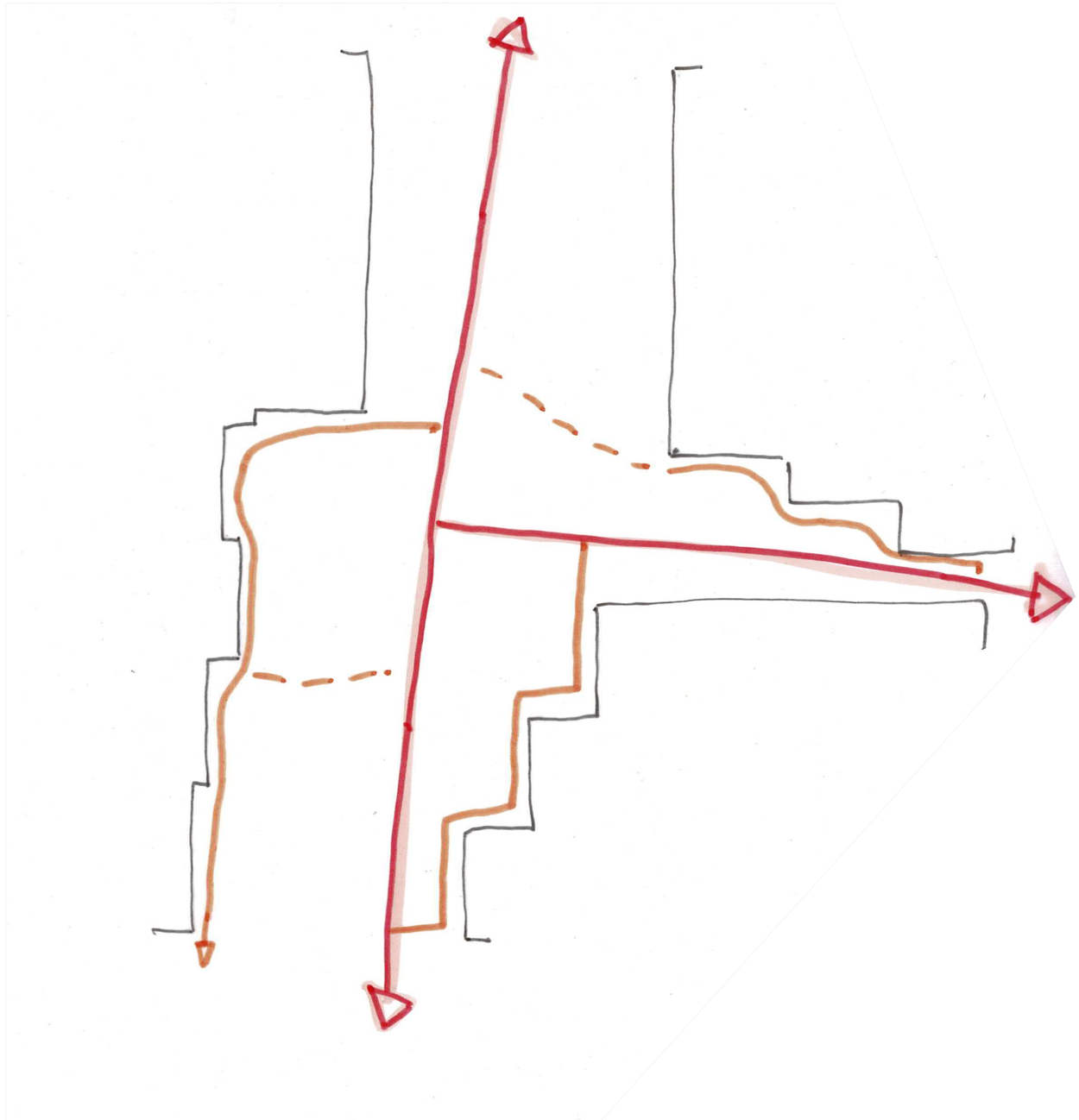
Clusters



5 Production based Clusters

1 Social Cluster

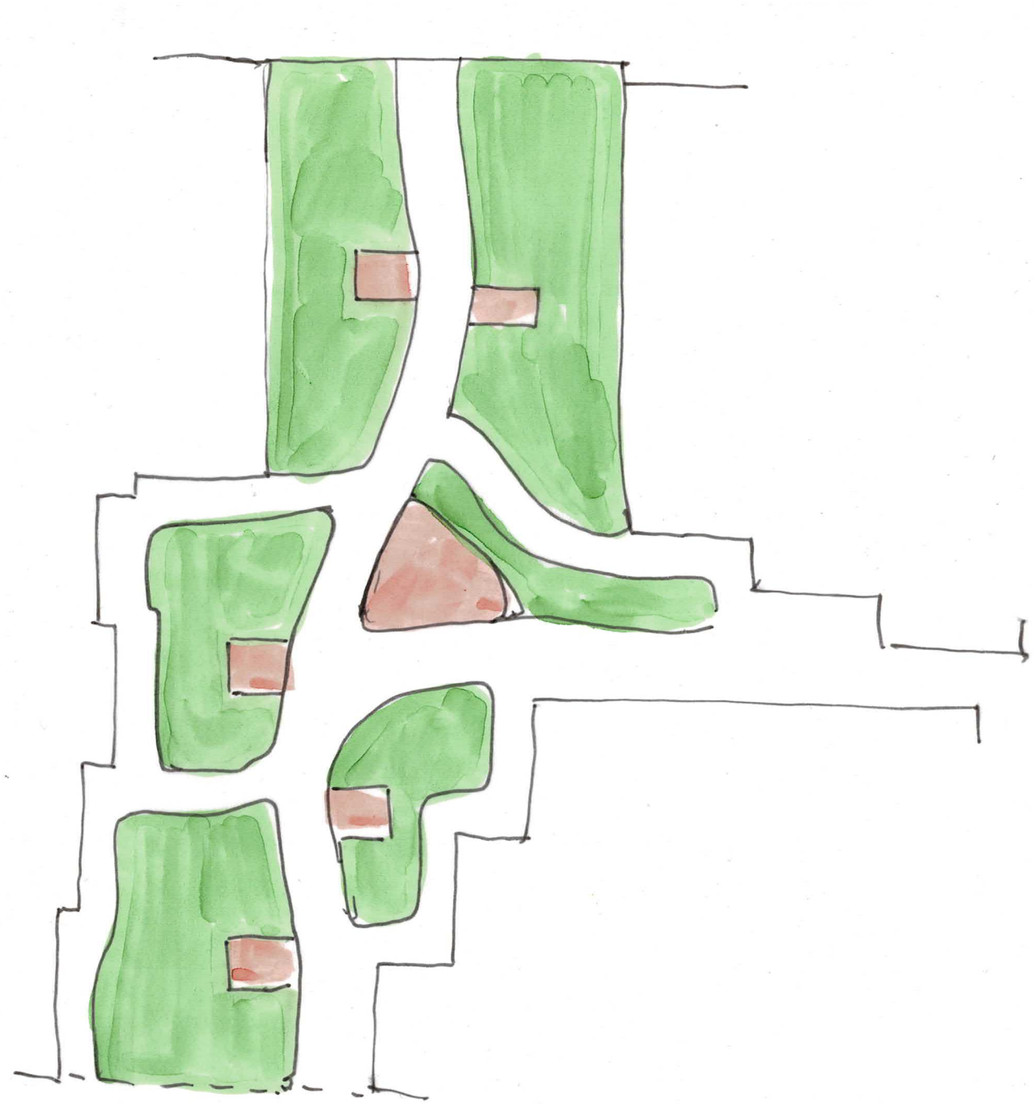
Acces



Main Pathway to connect
to outside block

Sub Pathways to connect
to houses

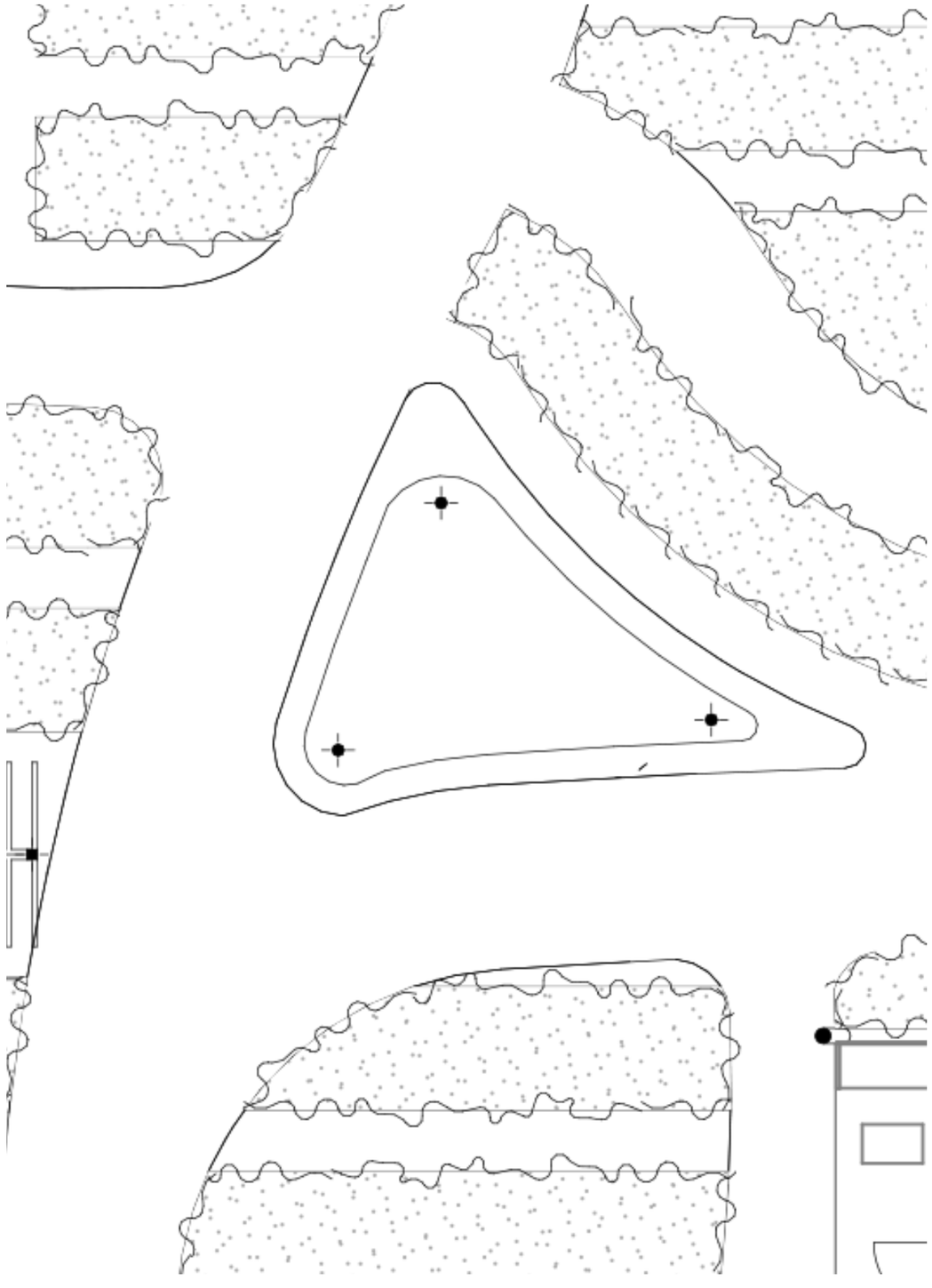
Design

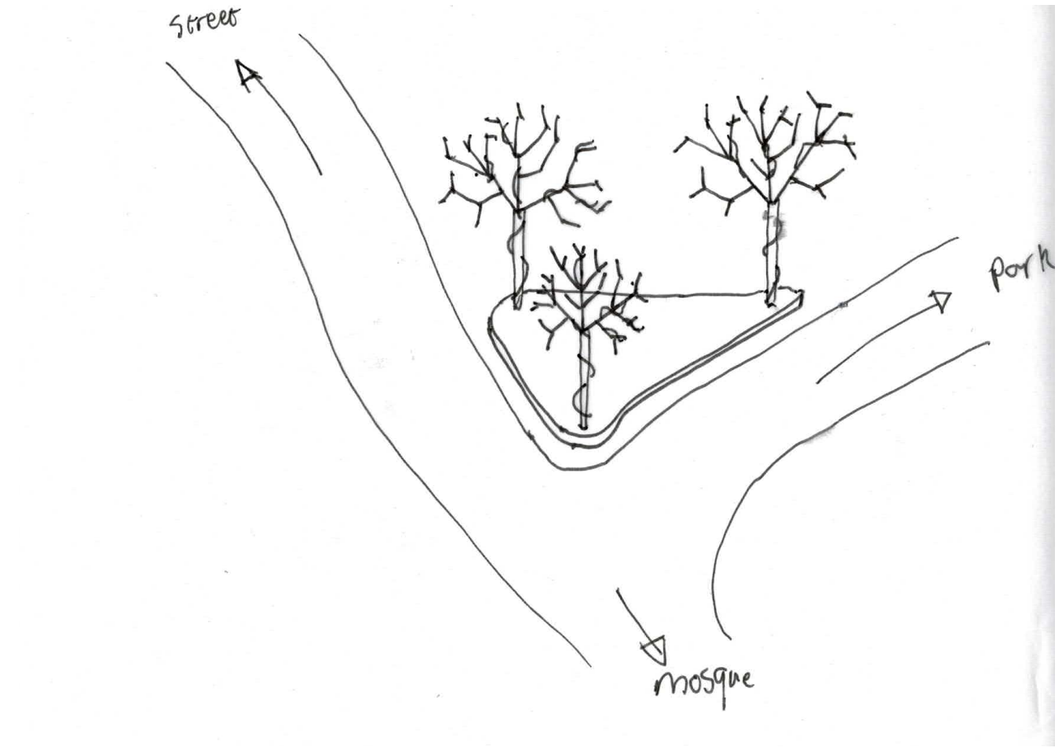


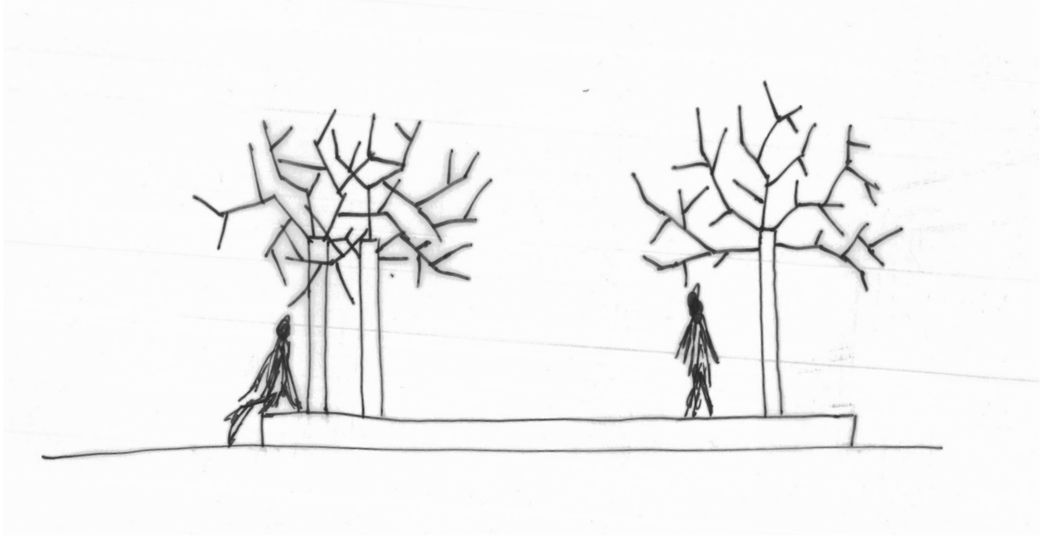
Clear structure of accessibi-
lity

Lot of place for production
and activities

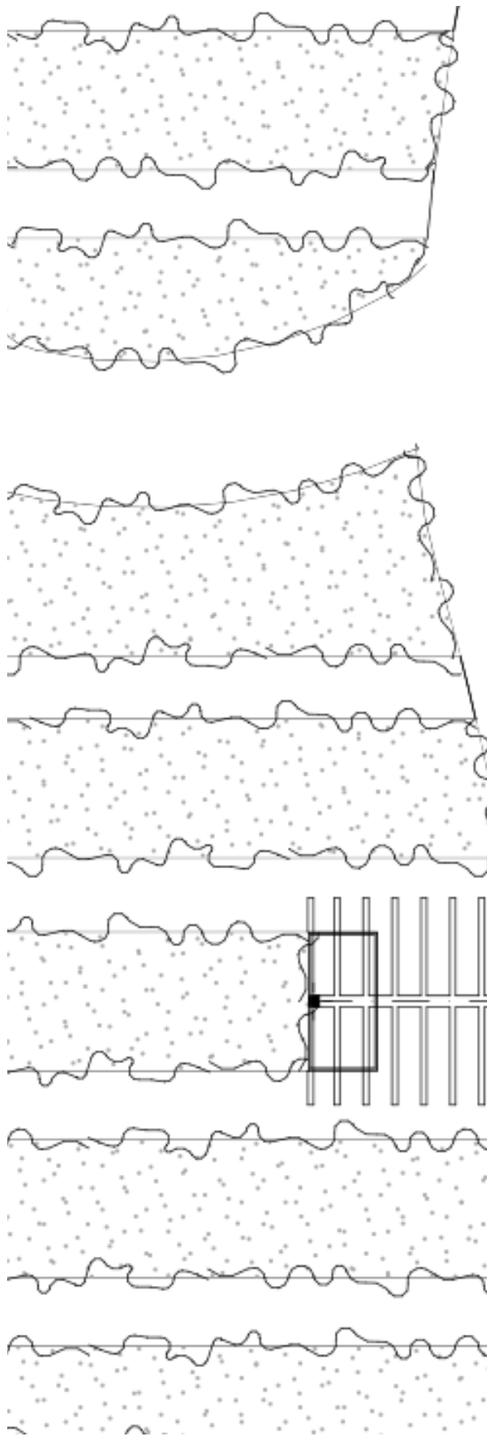
Social Cluster

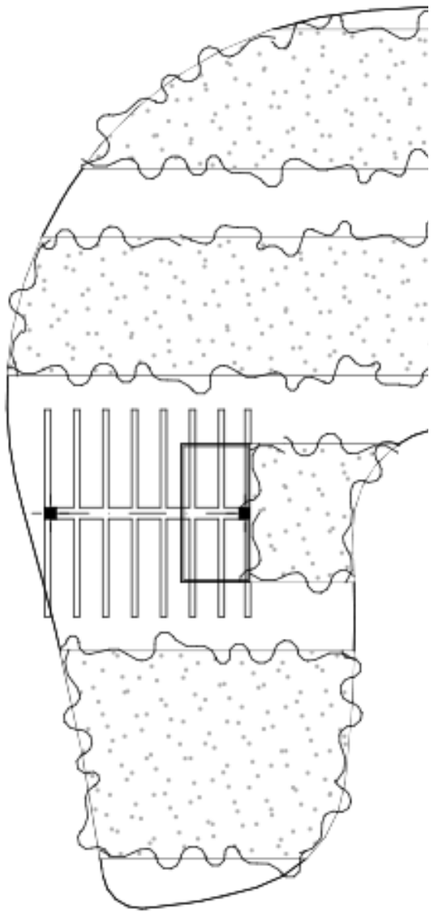


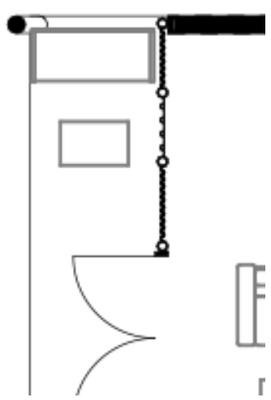


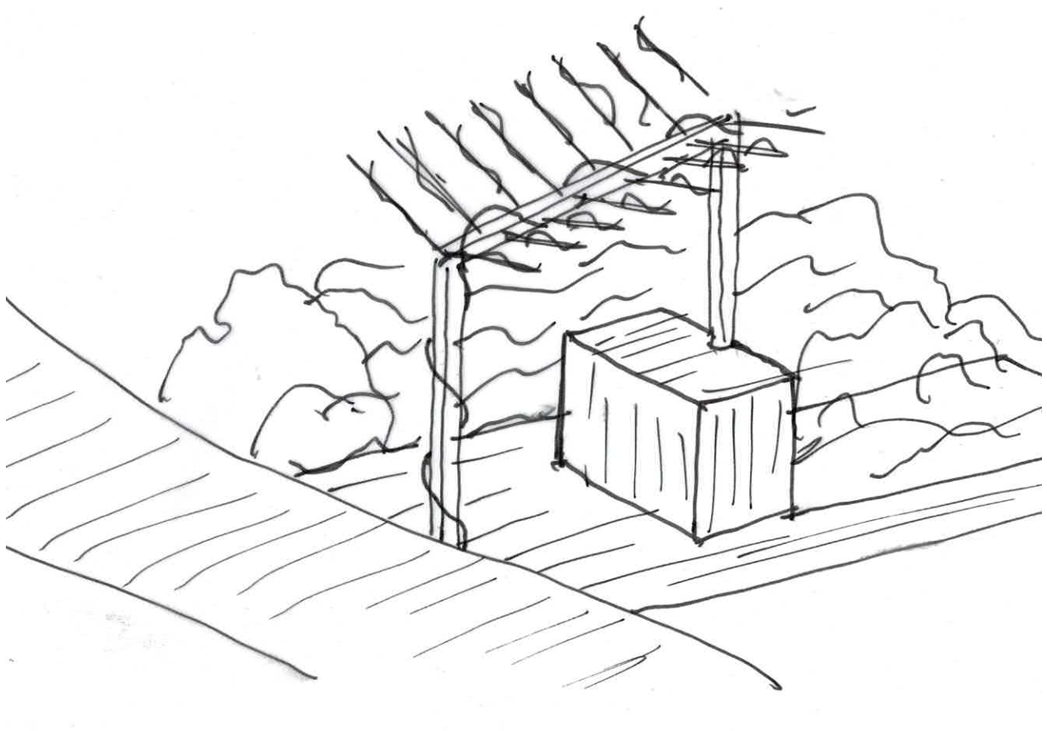


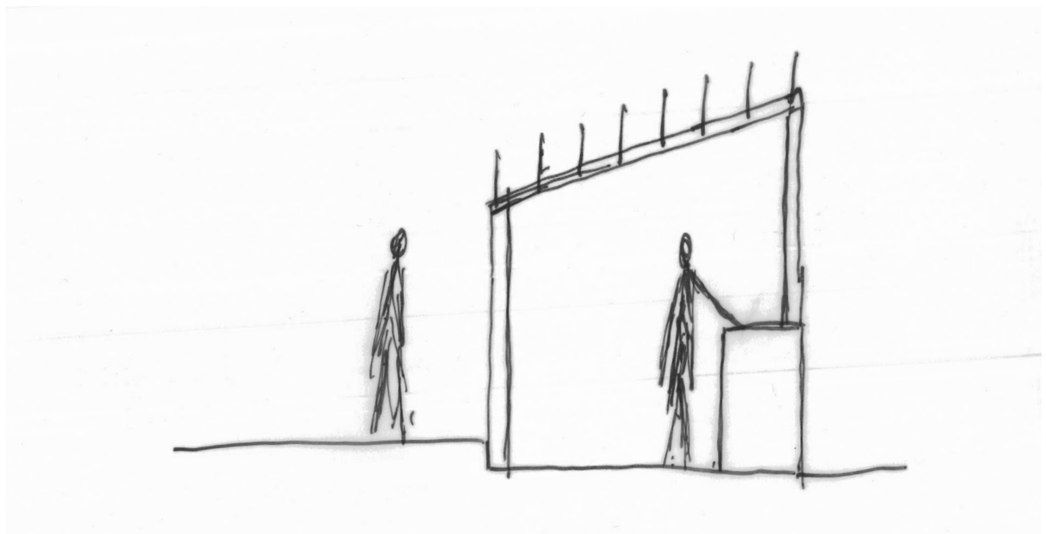
Production Cluster





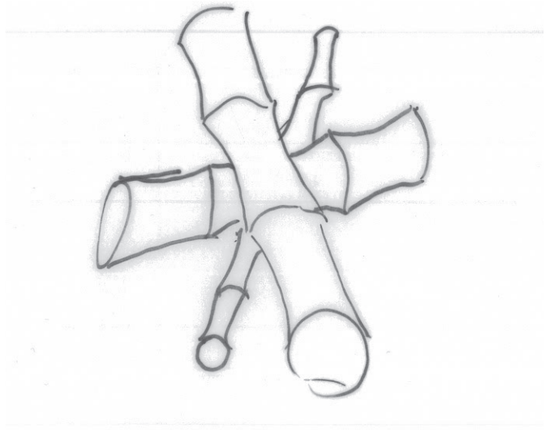






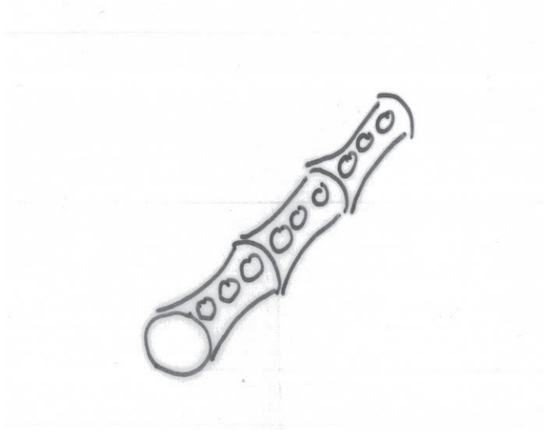
Garden Construction

Parts



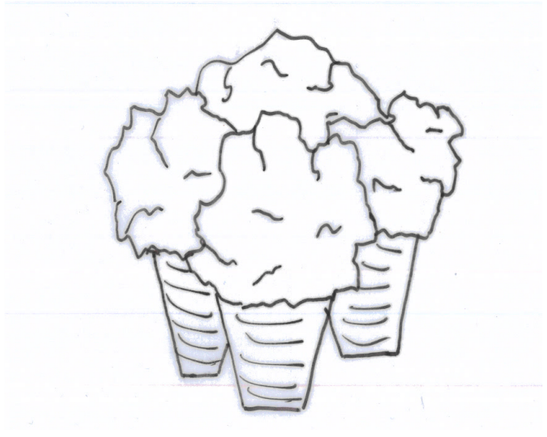
Bamboo Shafts

d = 100 mm
d = 70 mm
d = 40 mm



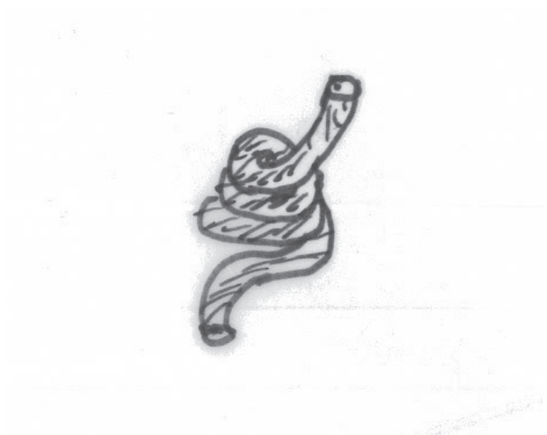
Hollow Bamboo Shaft

d = 100 mm
Holes d = 60 mm



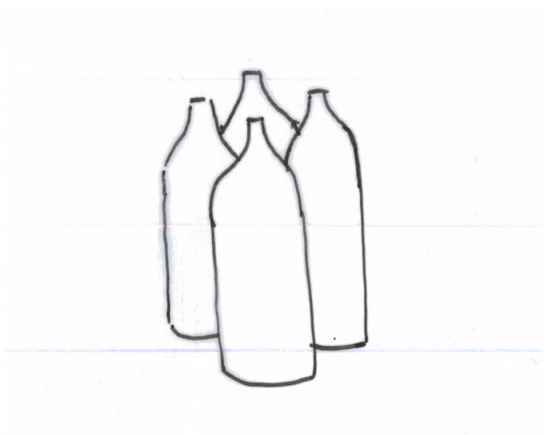
Cups with plants

Holes in it
Filled with aquaponics stones



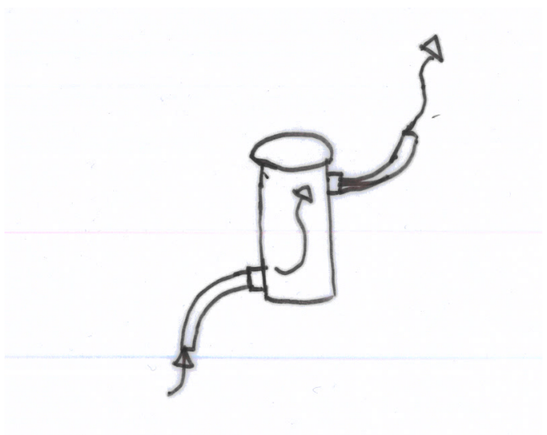
Rope and thread

For binding the shafts



Bottles

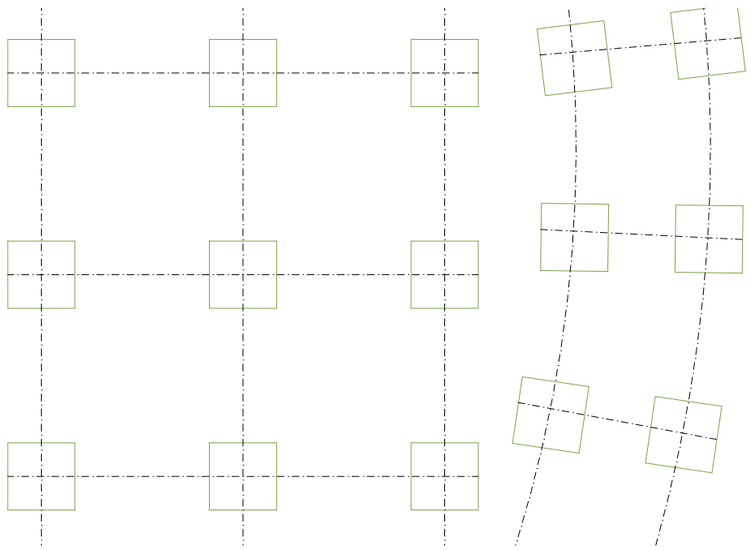
For floating device



Pump

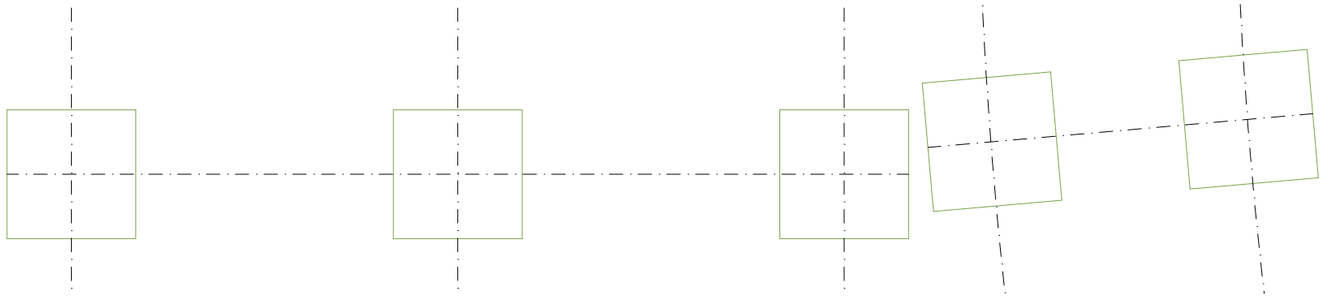
Electrical
For pumping water

Step 1



Floats based on bottles

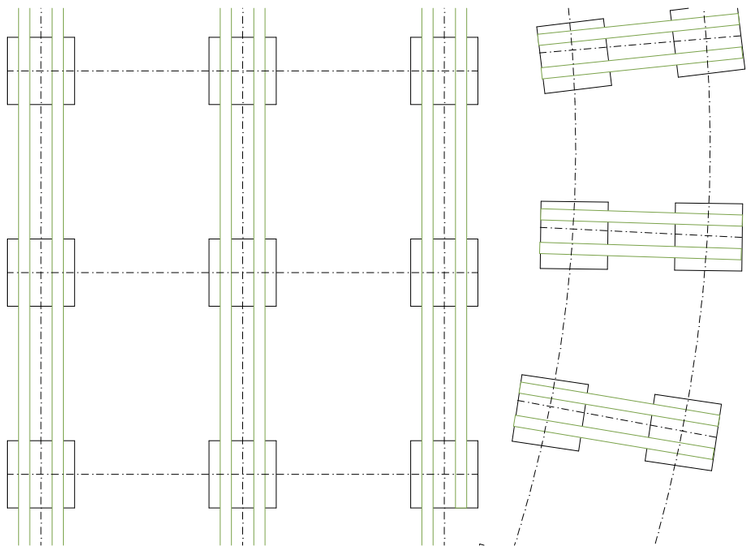
60 x 60 cm float



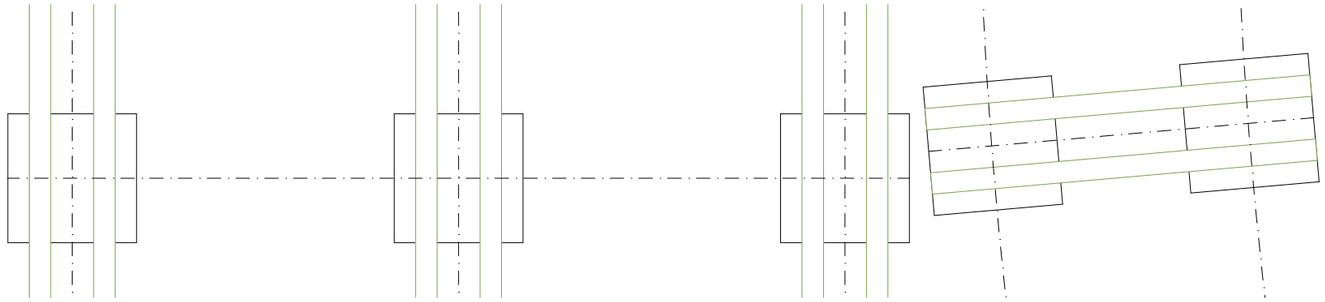
2 Levels of bottles

Grid of 180 cm

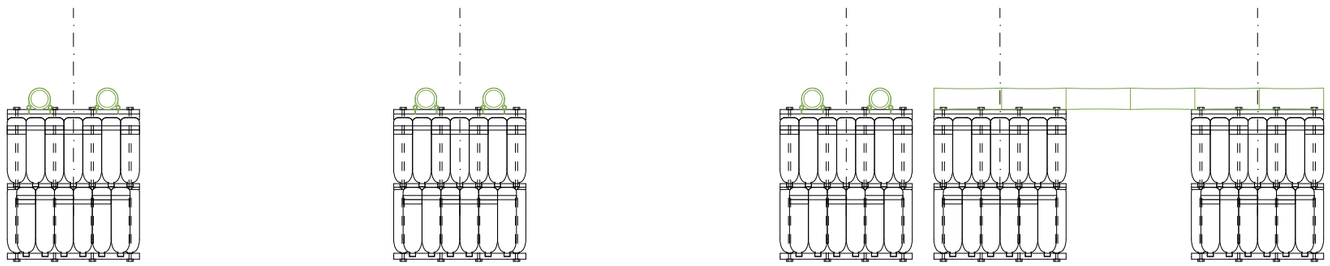
Step 2



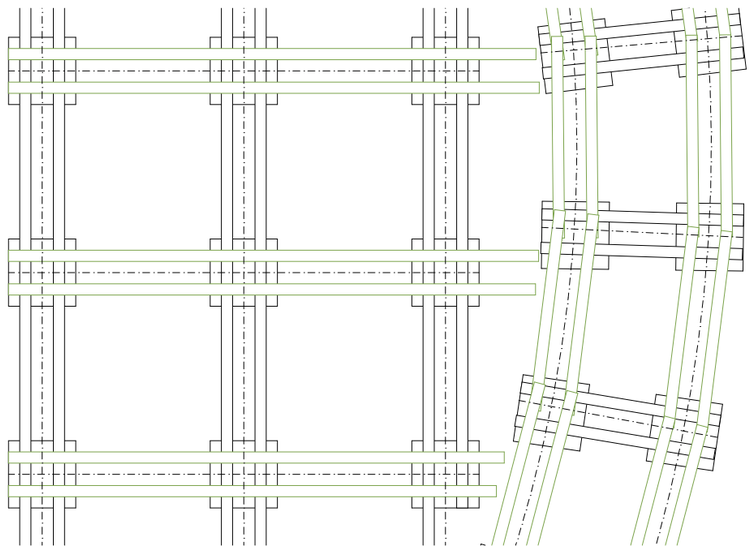
Bamboo beams per-
pendicular to path



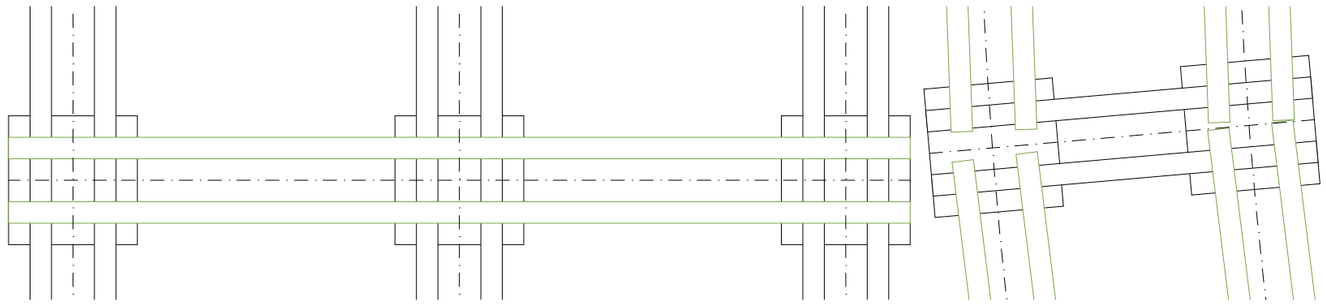
Binded to the Floats



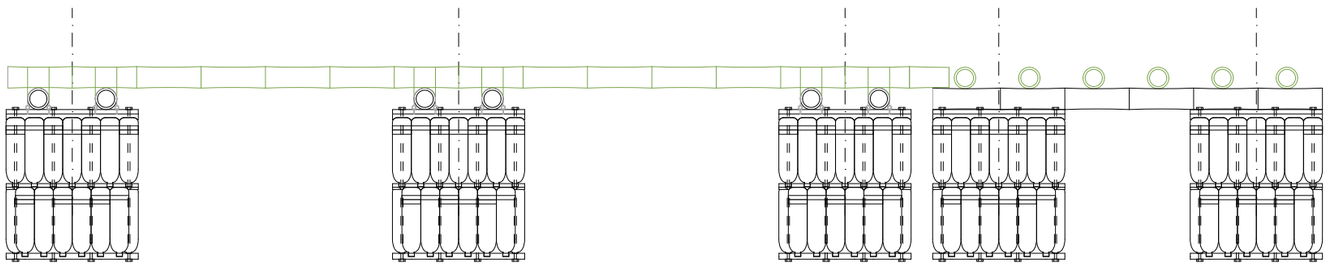
Step 3



Bamboo beams in other direction

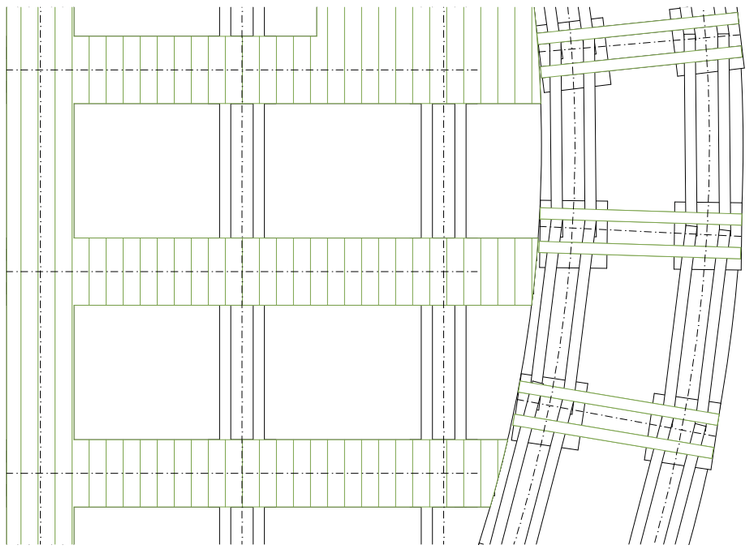


Forming one rigid whole

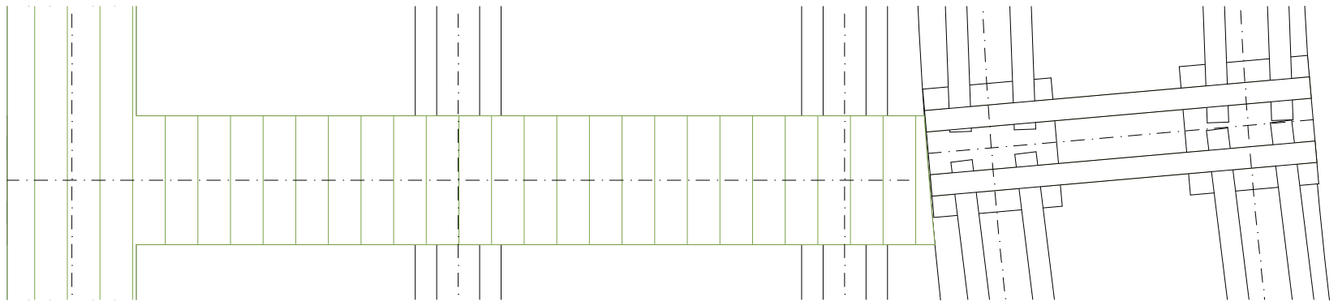


Binded to the other beams

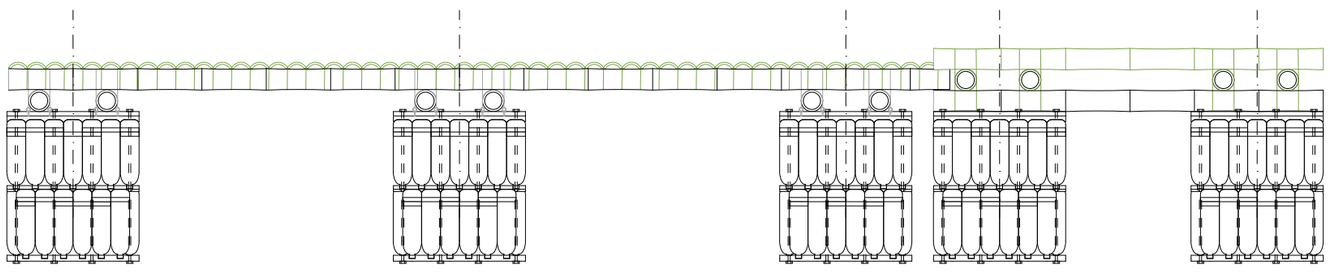
Step 4



Finishing layer on the service paths

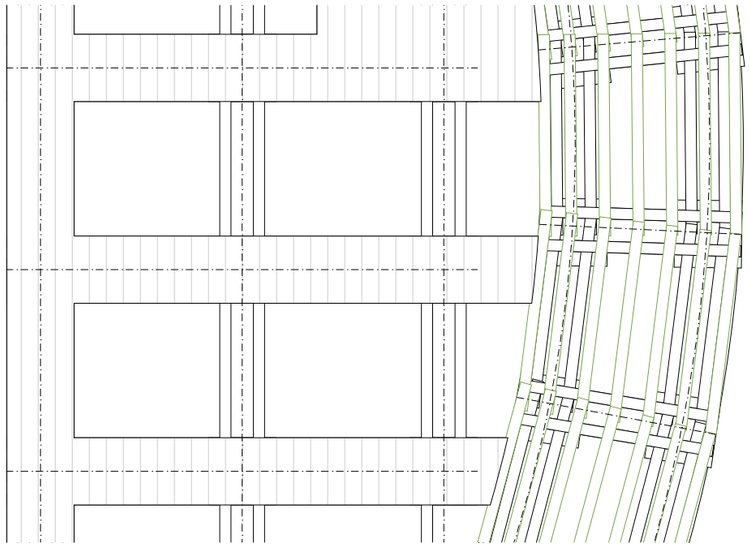


1/3th splitted bamboo cover

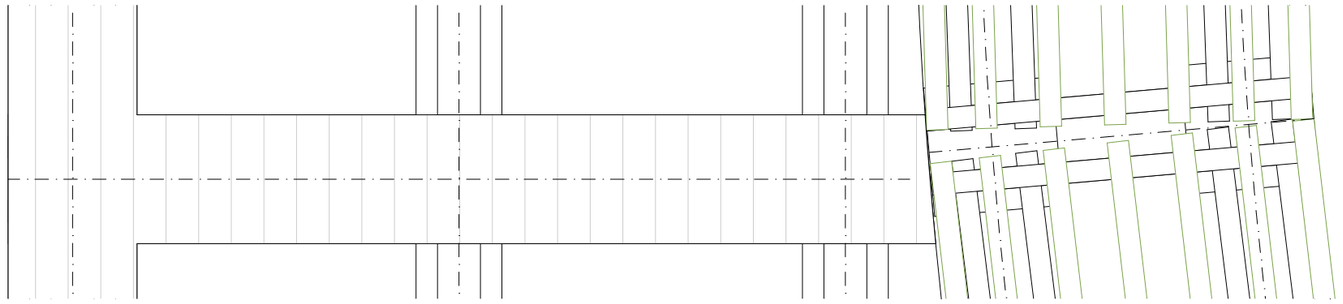


New layer of bamboo beams on main path

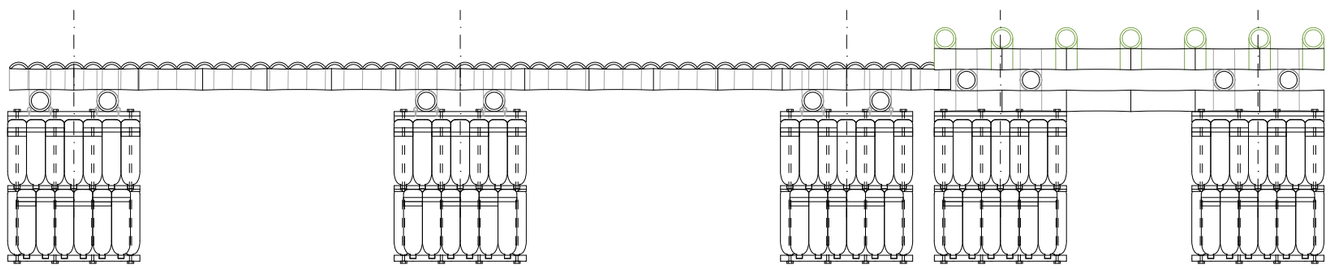
Step 5



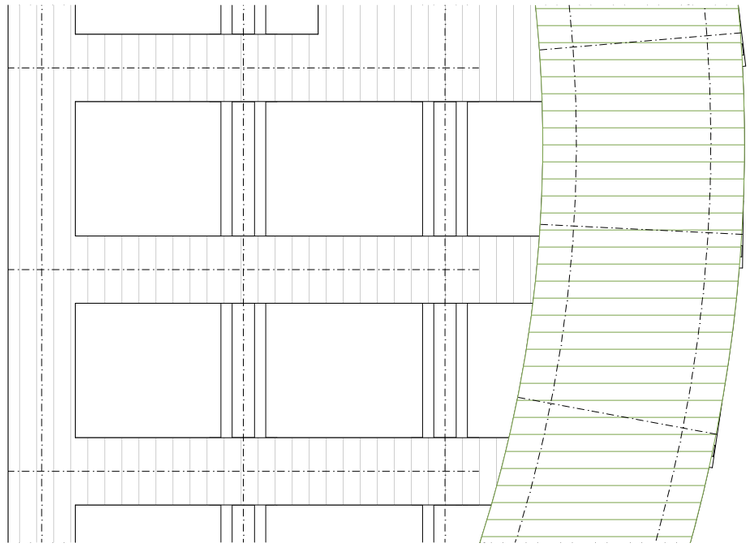
Bamboo beams on main path

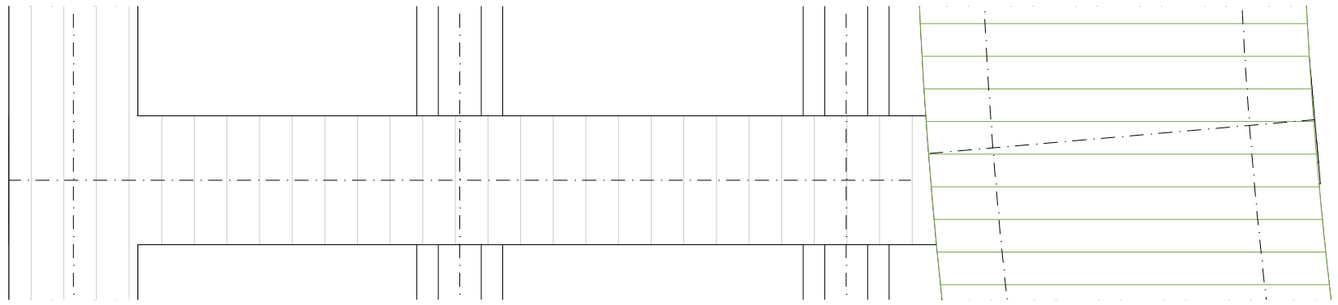


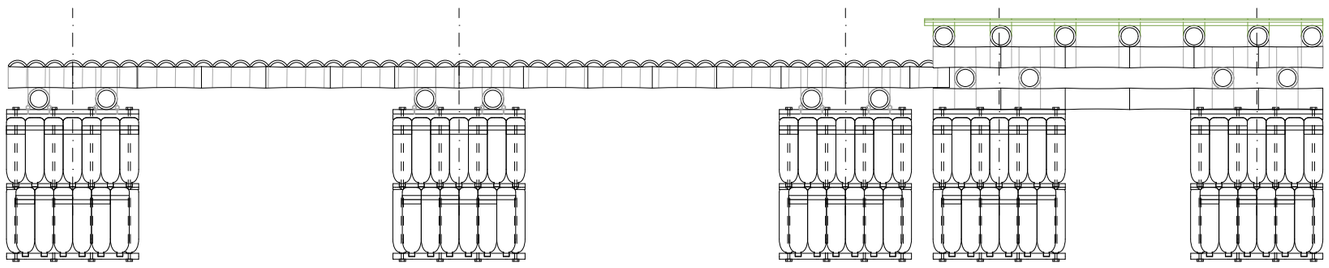
Every 30 cm



Step 6

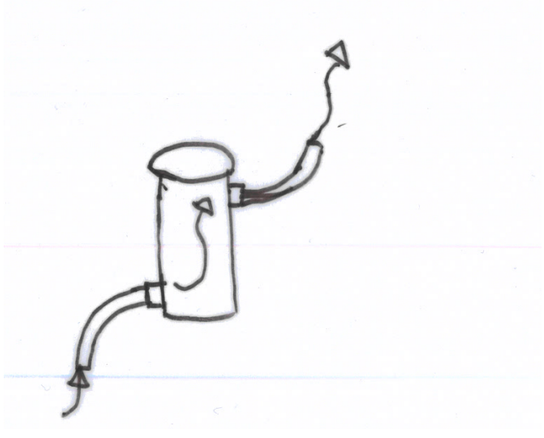






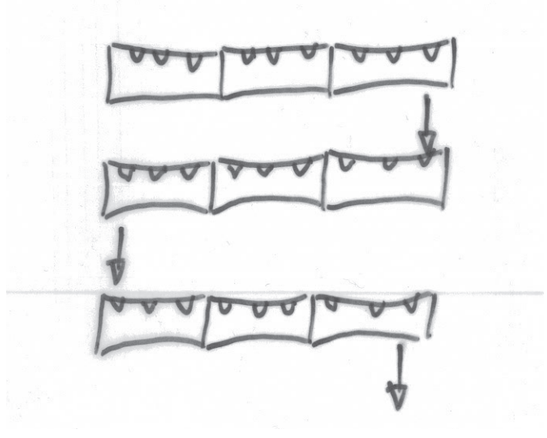
Main path covered with finish layer of bamboo

Aquaponic Principles



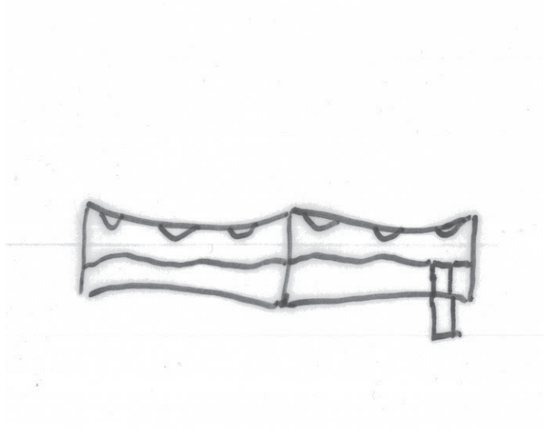
Pumping up water

d = 100 mm
d = 70 mm
d = 40 mm

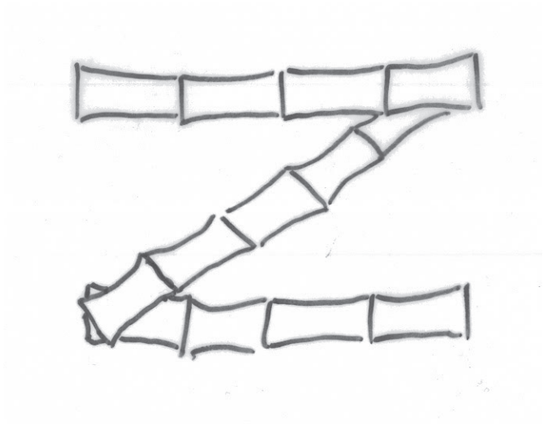


Flowing down

Step by step

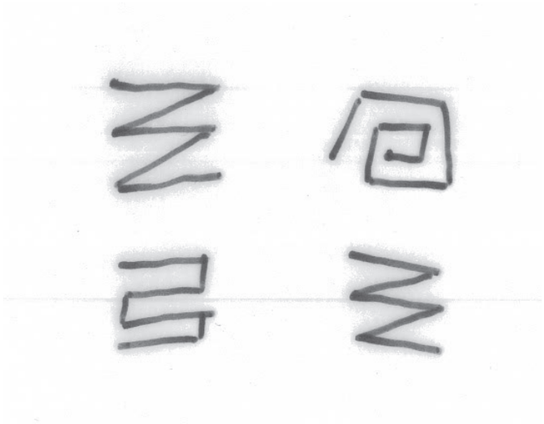


Water kept on level



Overlapping shafts

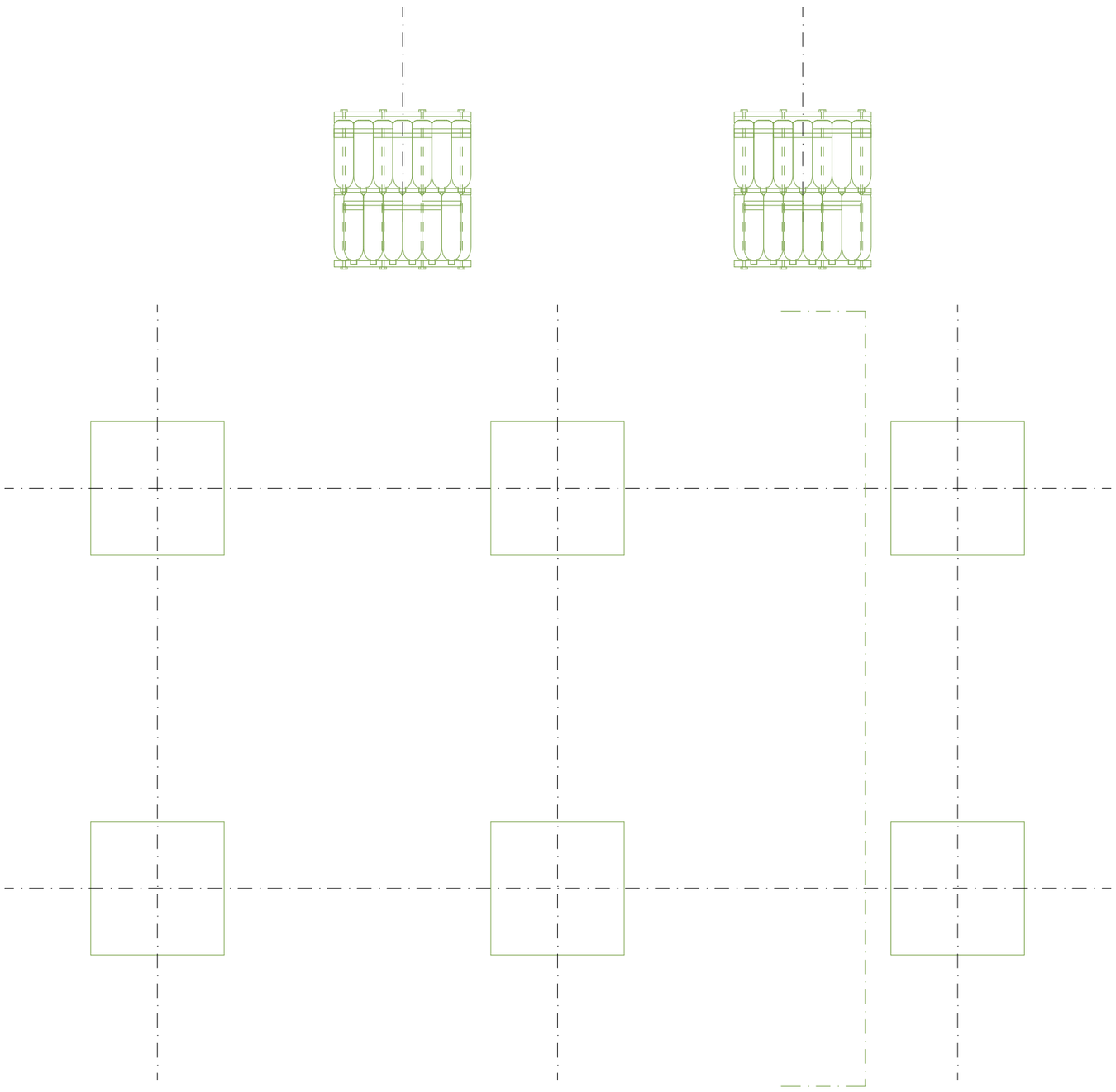
Connecting them



Freedom in forming

Personal Preference
Based on plant size

Step 1



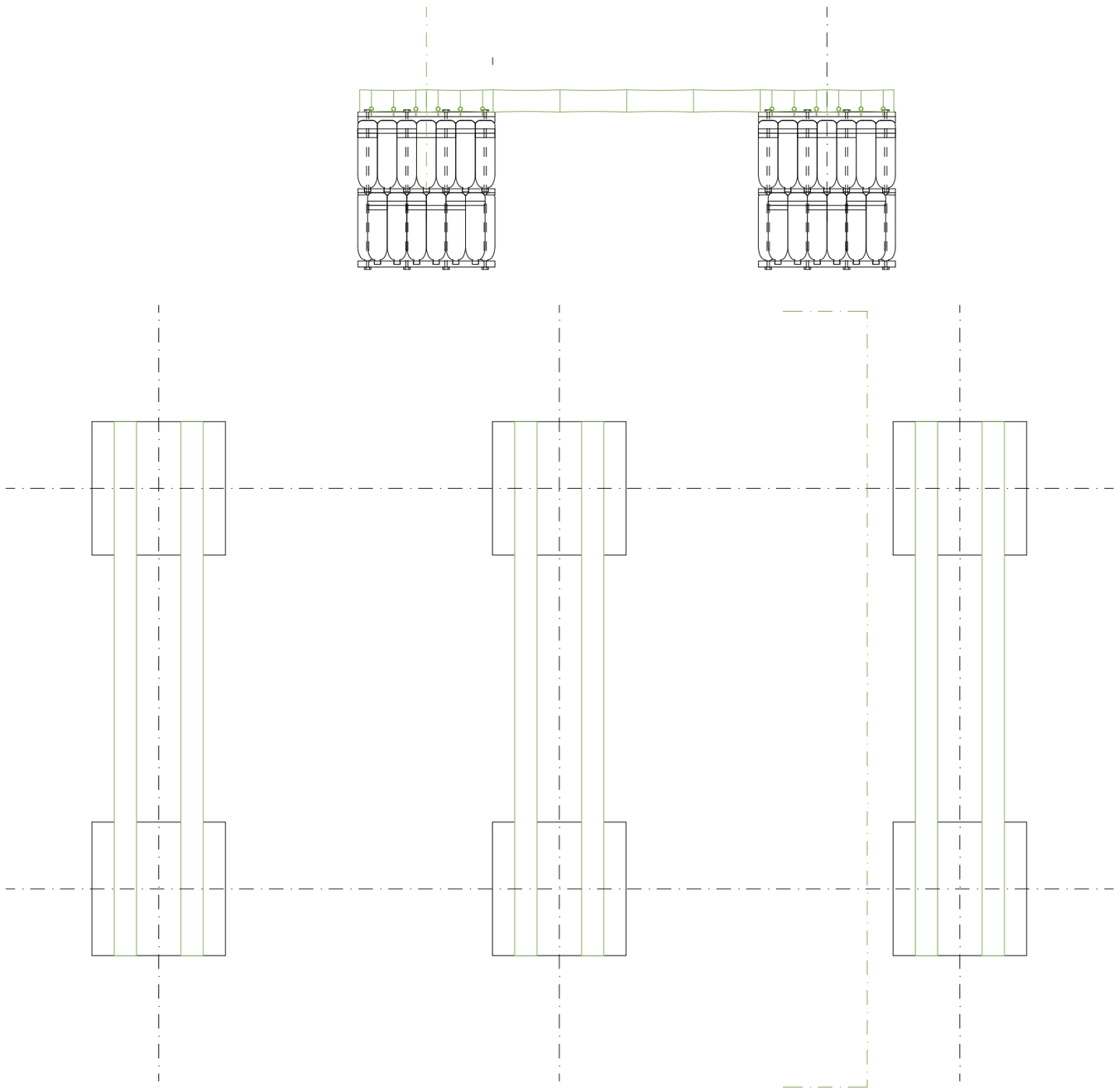
Floats based on bottles

60 x 60 cm float

2 Levels of bottles

Grid of 180 cm

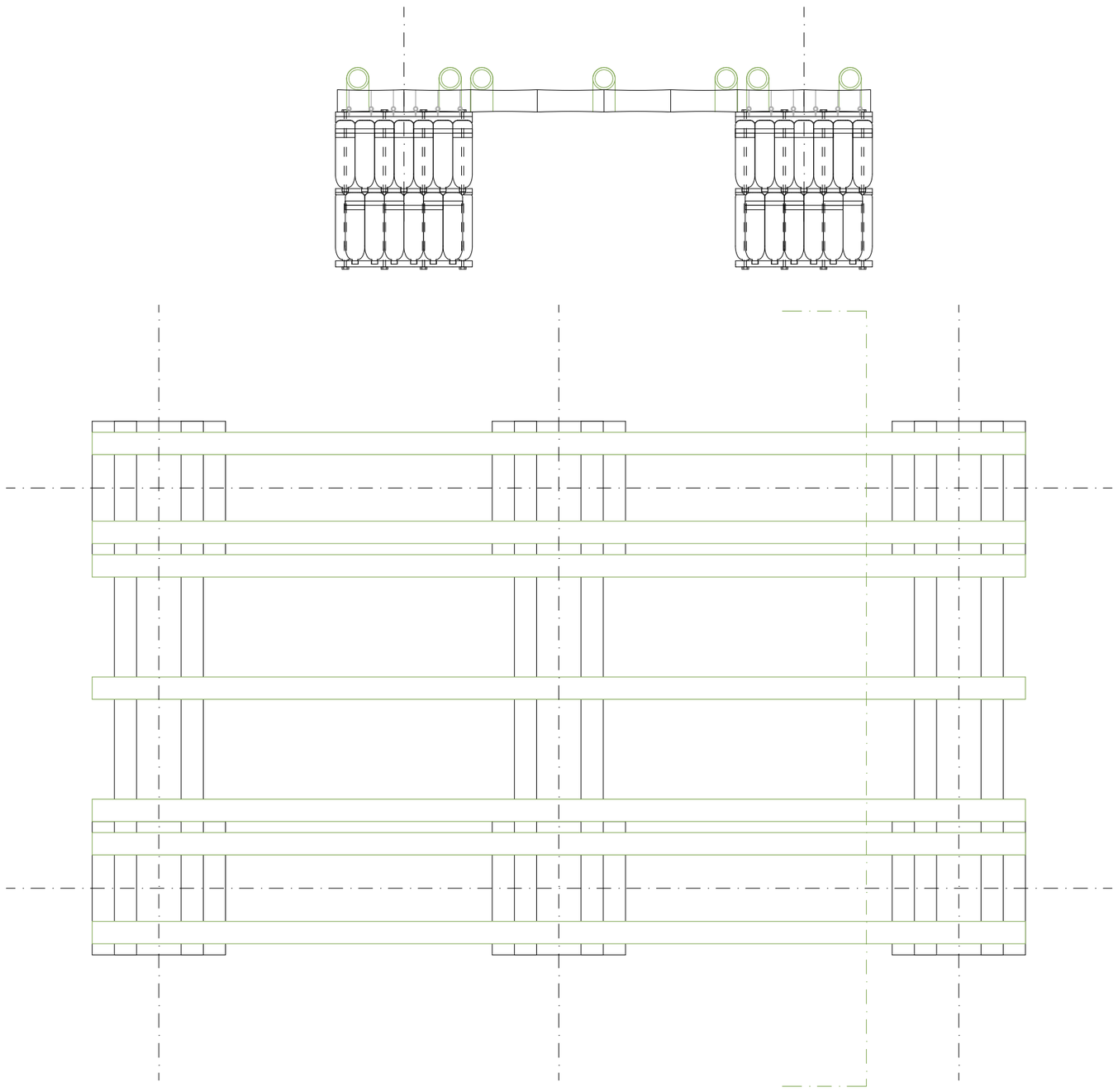
Step 2



Bamboo beams per-
pendicular to path

Binded to the Floats

Step 3

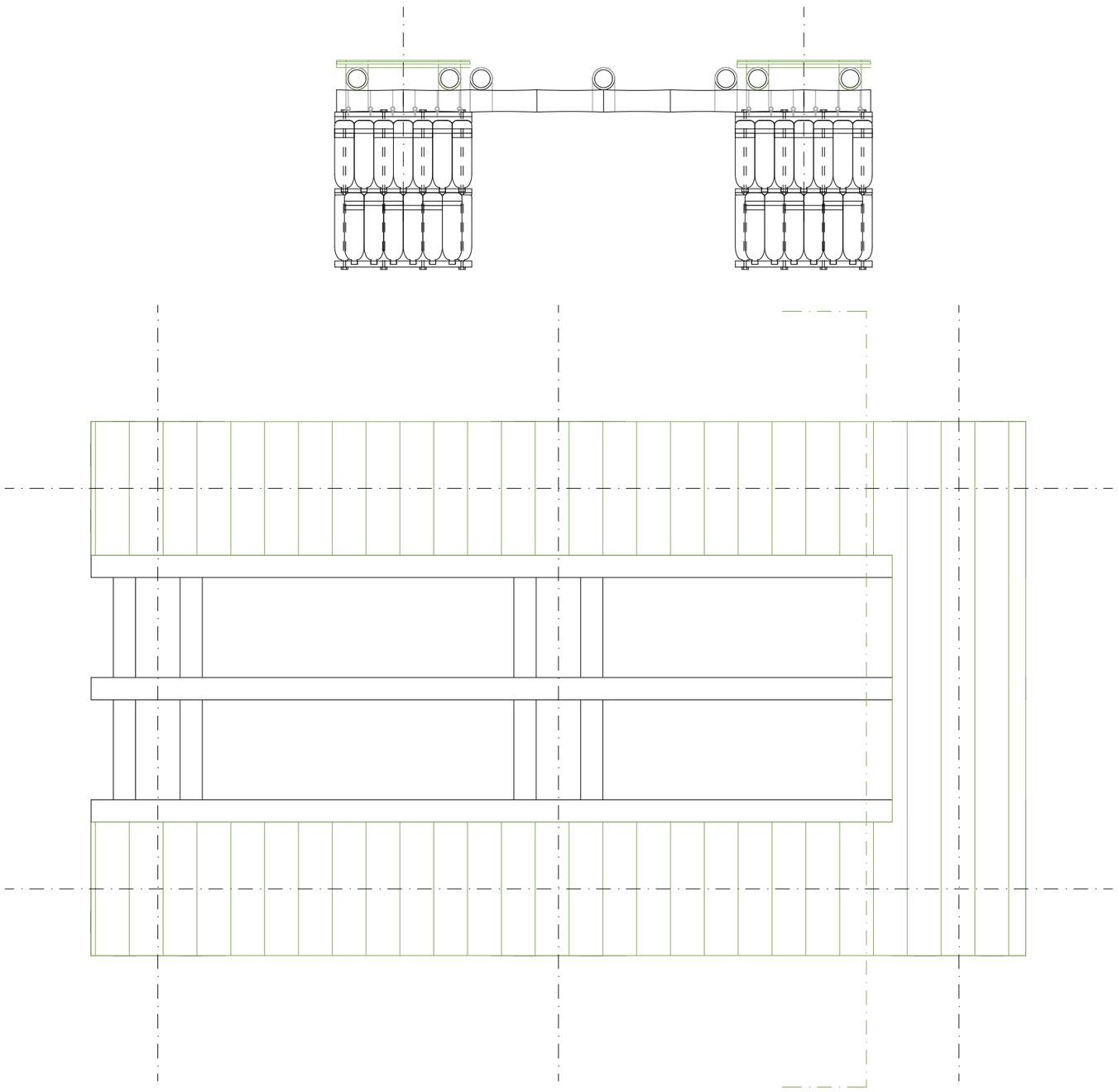


Bamboo beams in other direction

Forming one rigid whole

Binded to the other beams

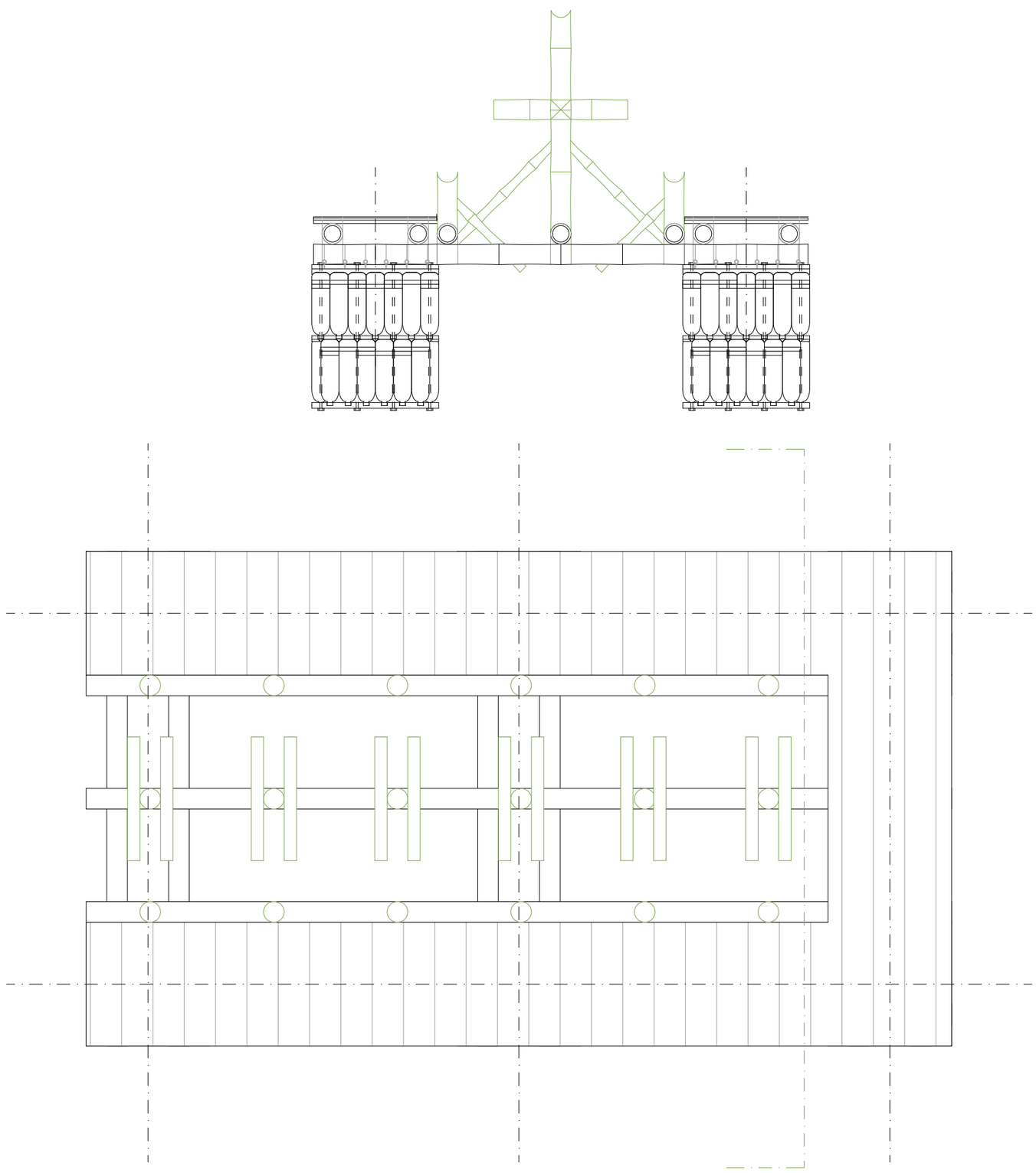
Step 4



Finishing layer on the service paths

1/3th splitted bamboo cover

Step 5

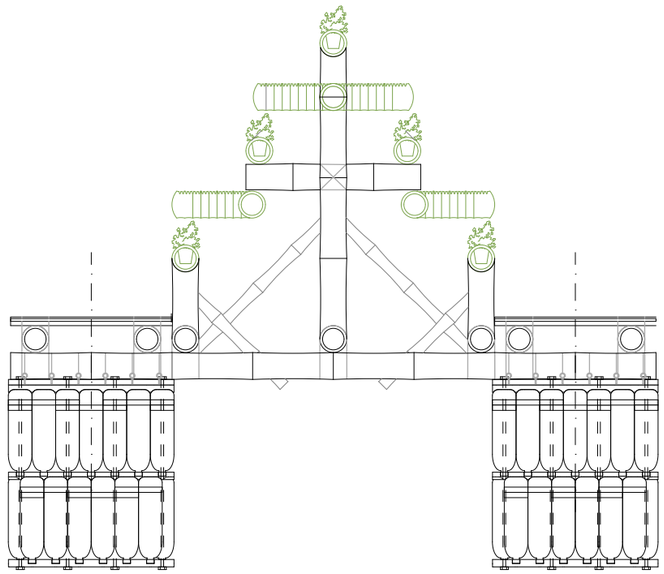


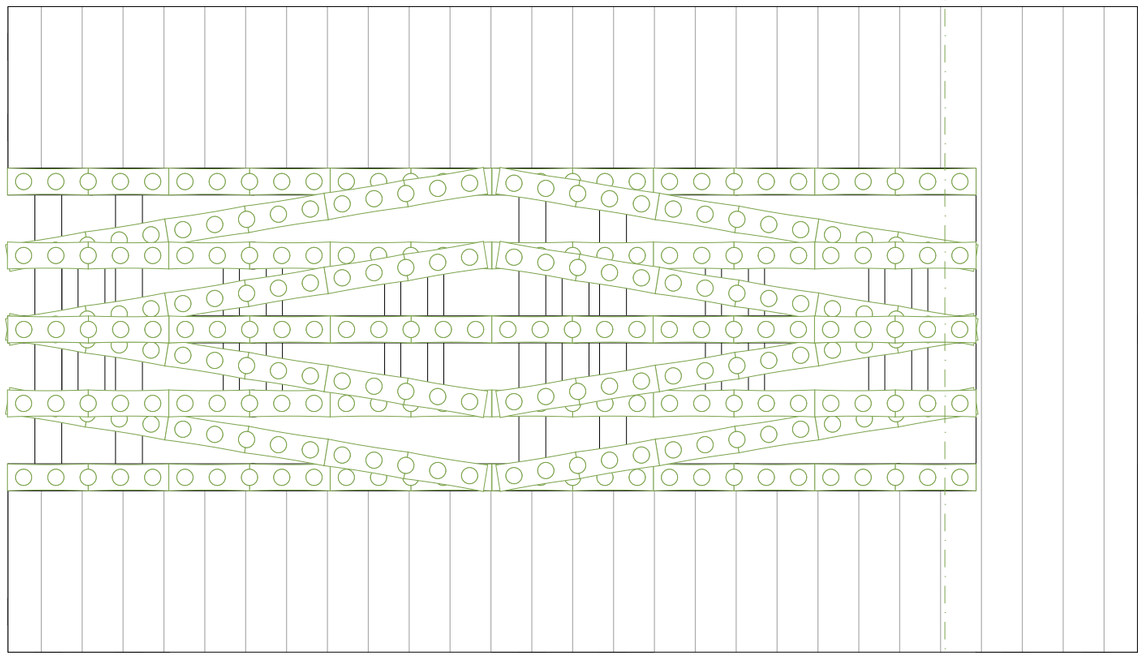
Building construction
with bamboo shafts

Securing them with
shafts under an angle

Binding it together with
rope

Step 6





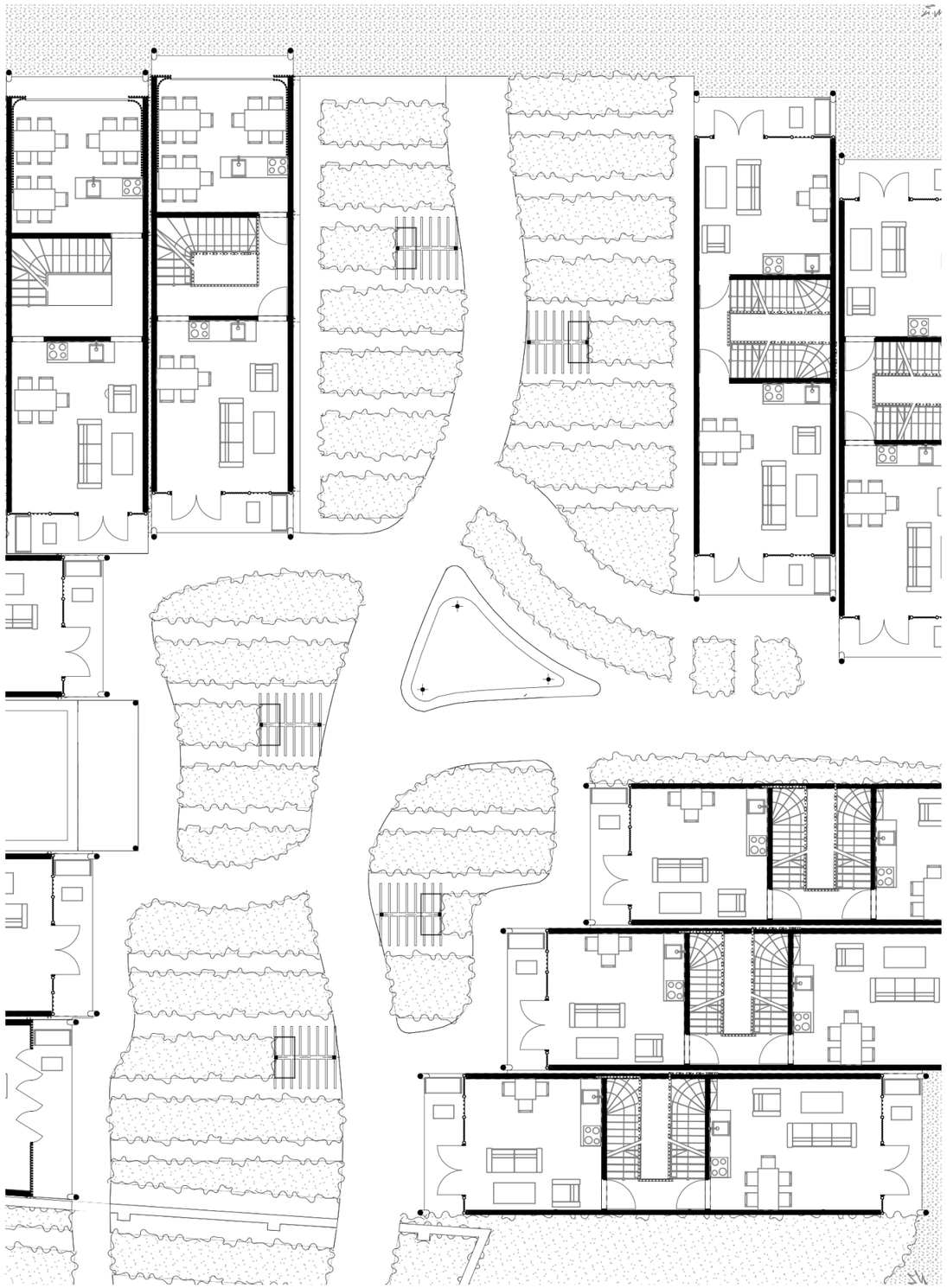
Adding bamboo shafts and tubes

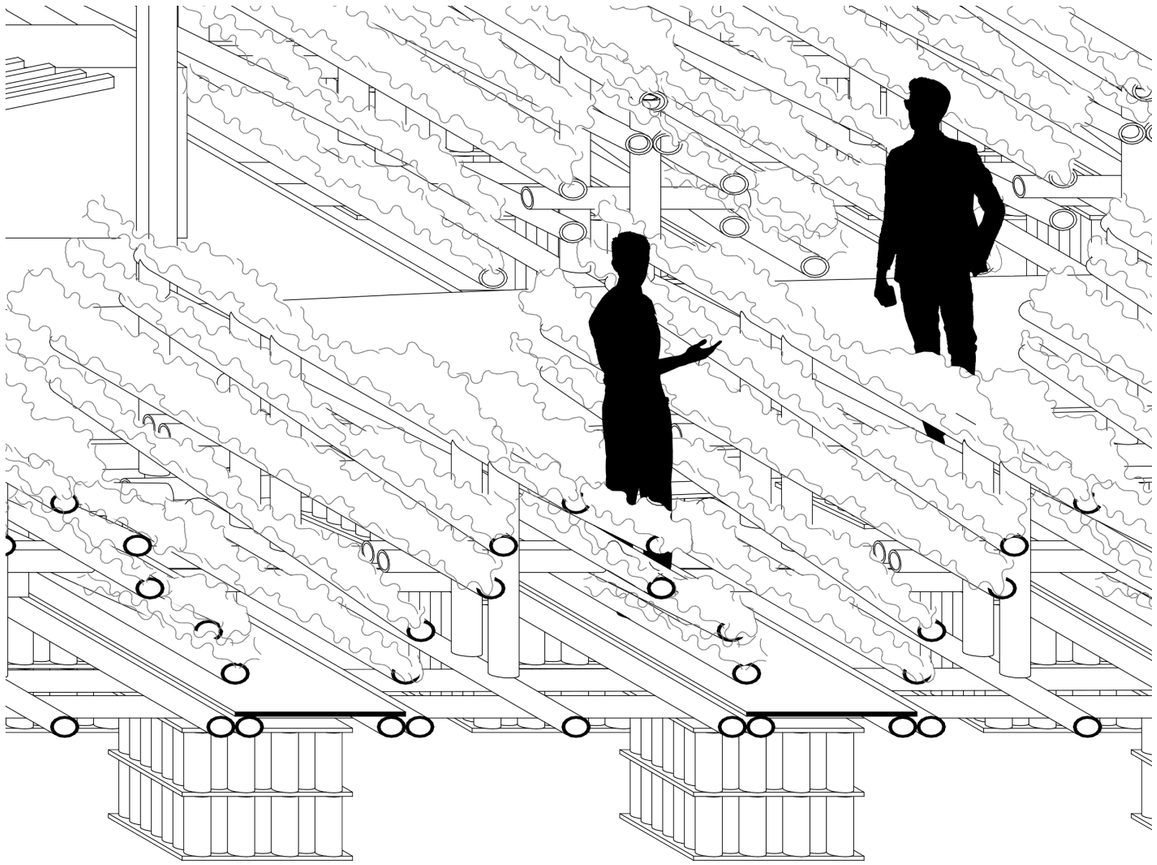
Adding pump

Placing plants

Turn it on

Overview

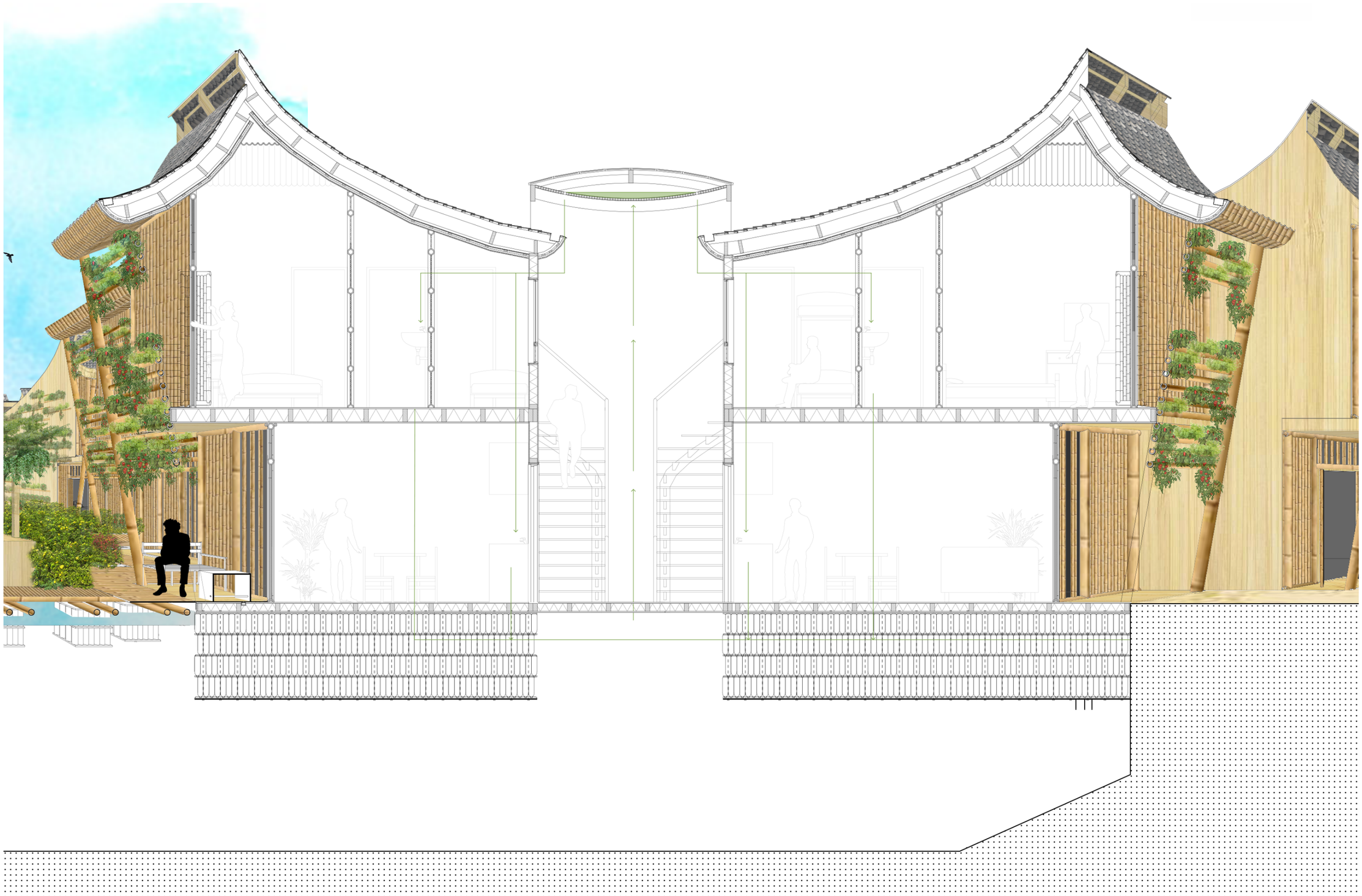




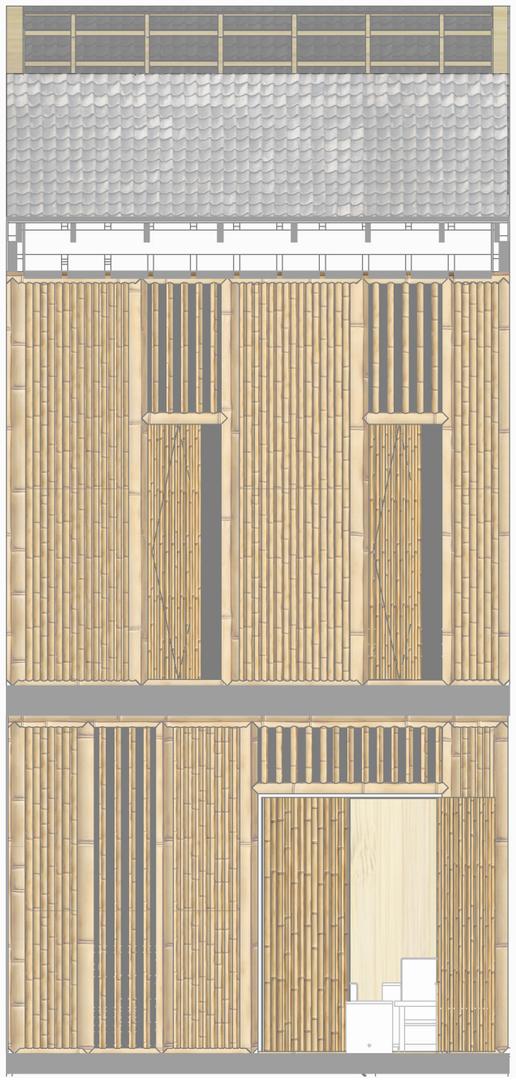
Garden

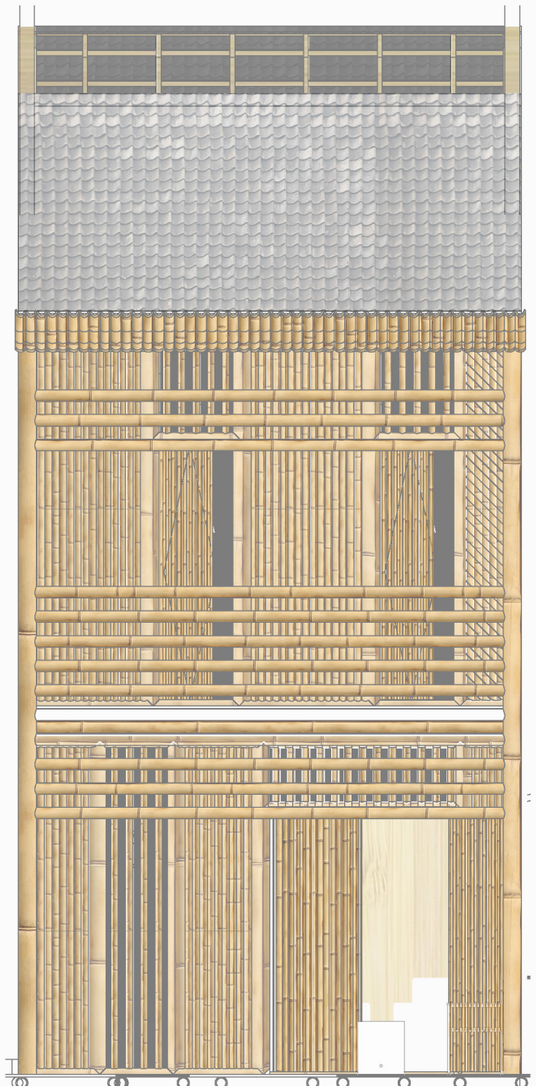
Facades

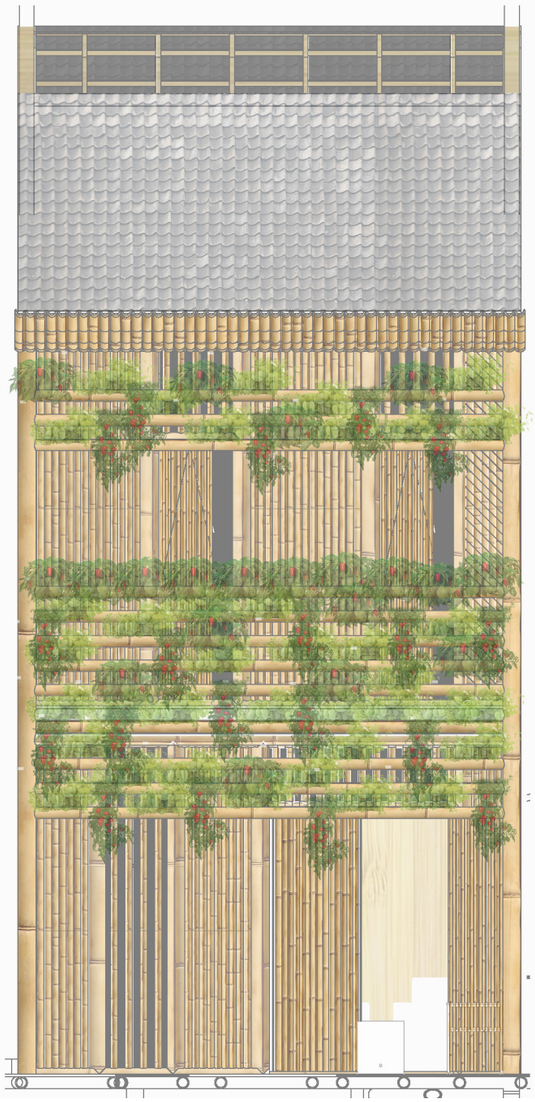
Waterflow



Garden & Park

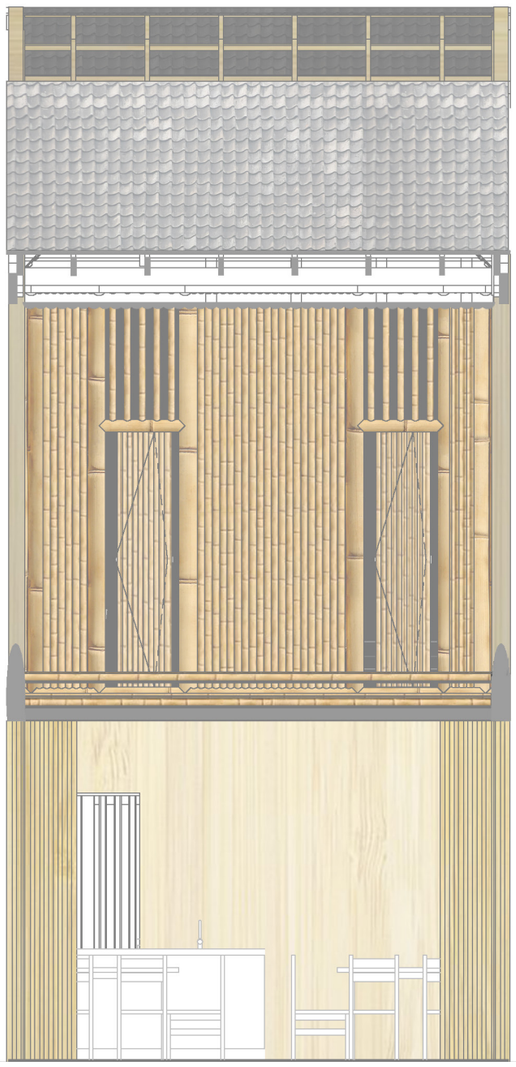


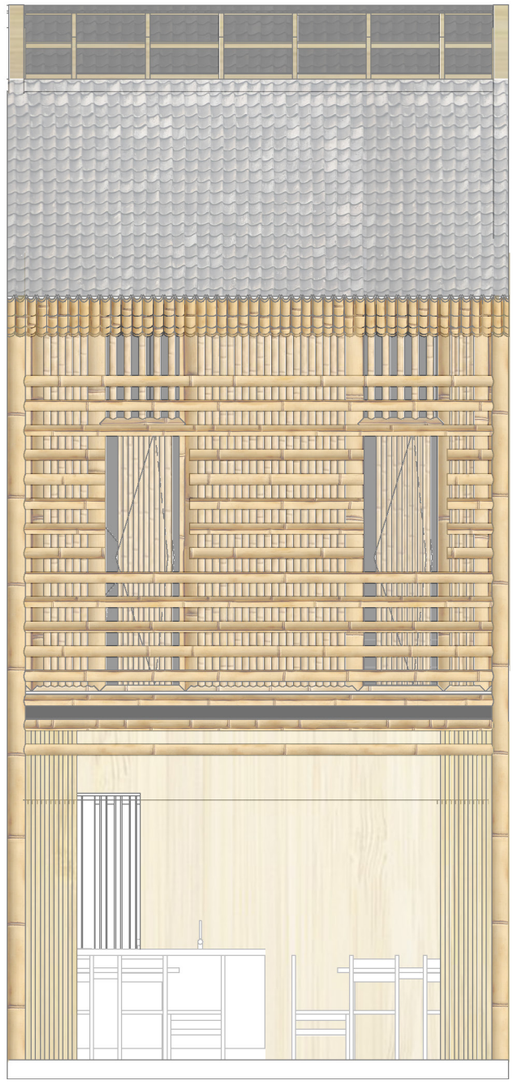


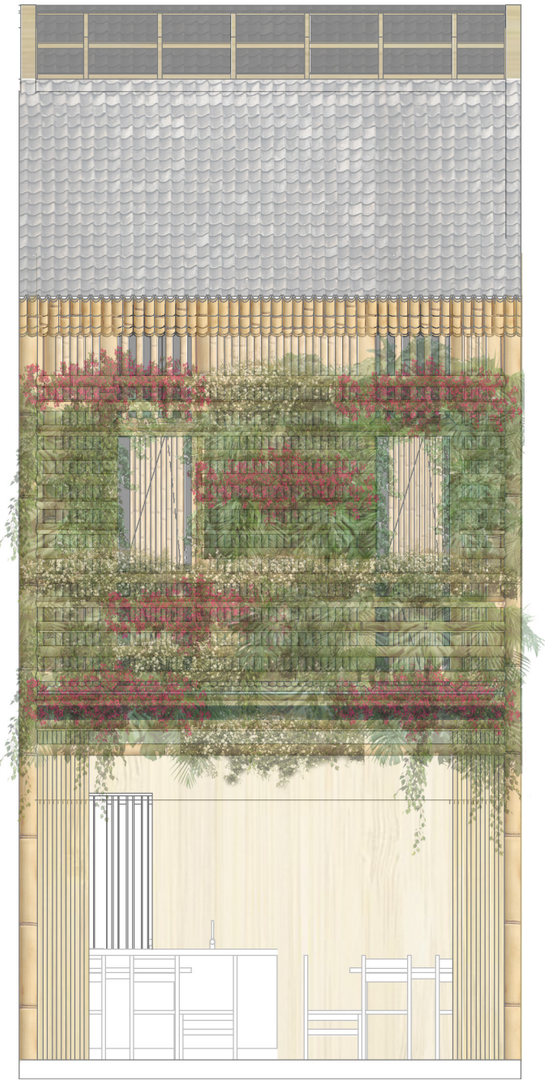


Zoom-In

Street







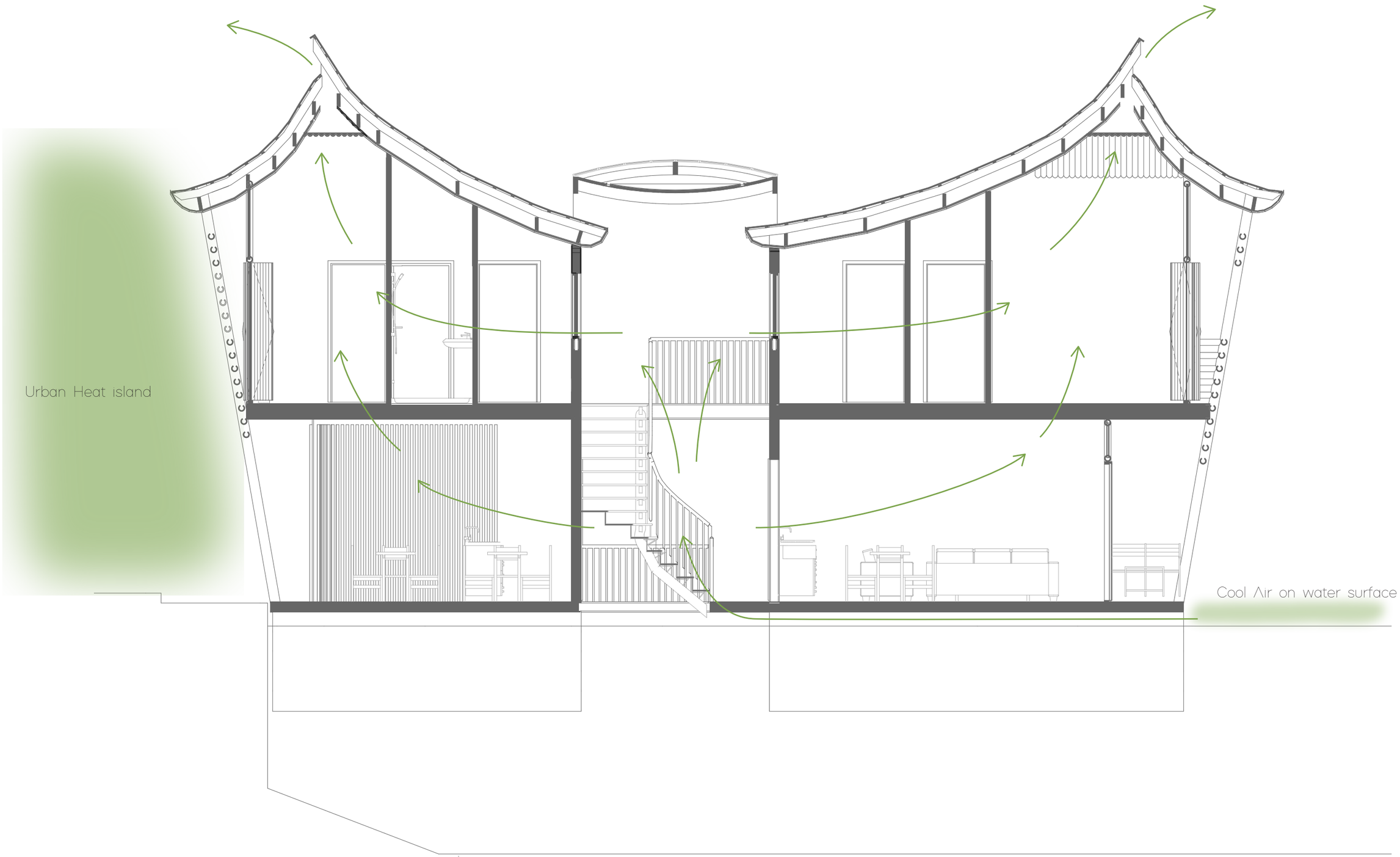
Zoom-In

Overview

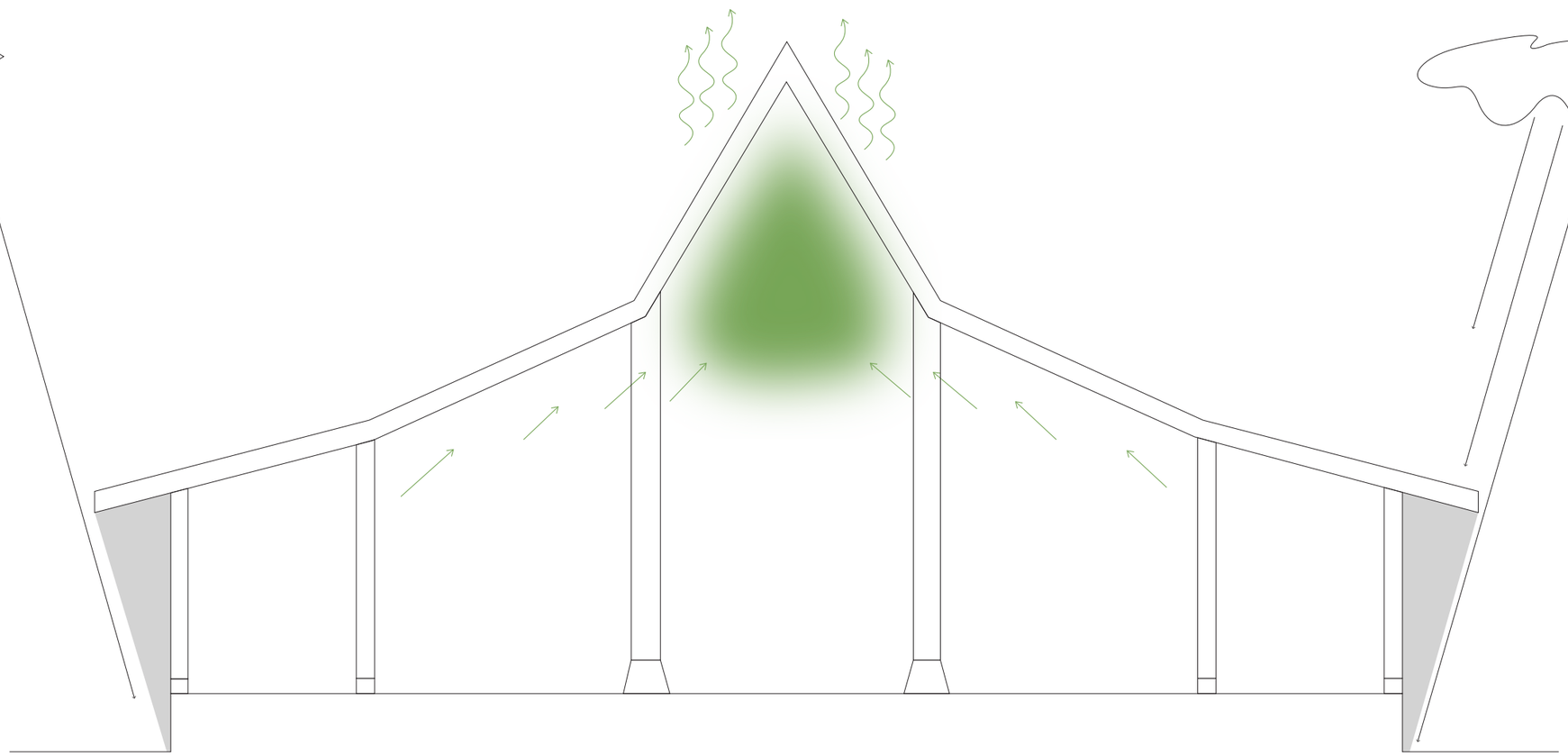
Roof

Temperature

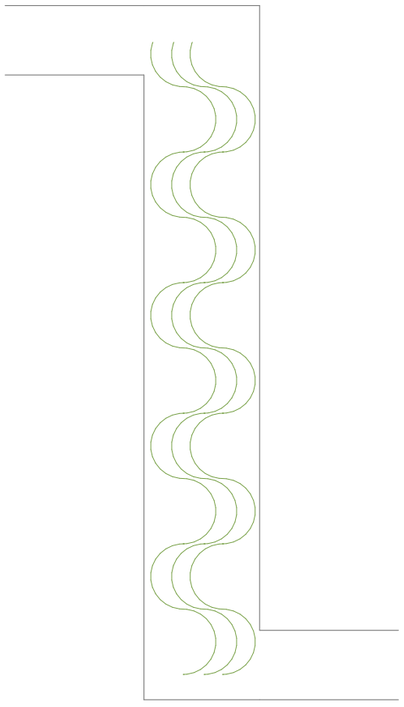
Prefered Air Flow



Inspiration

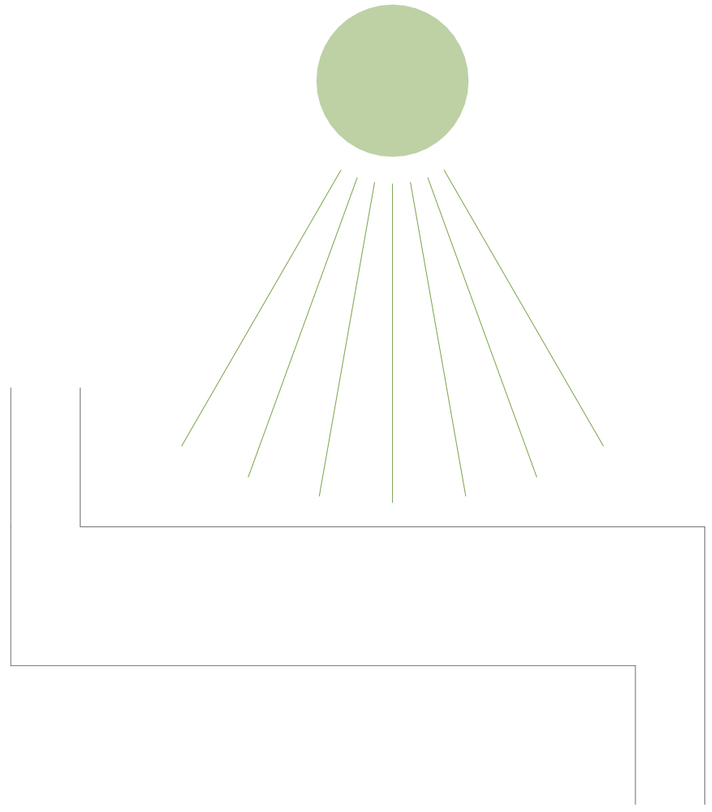


Principles



Maximizing Height

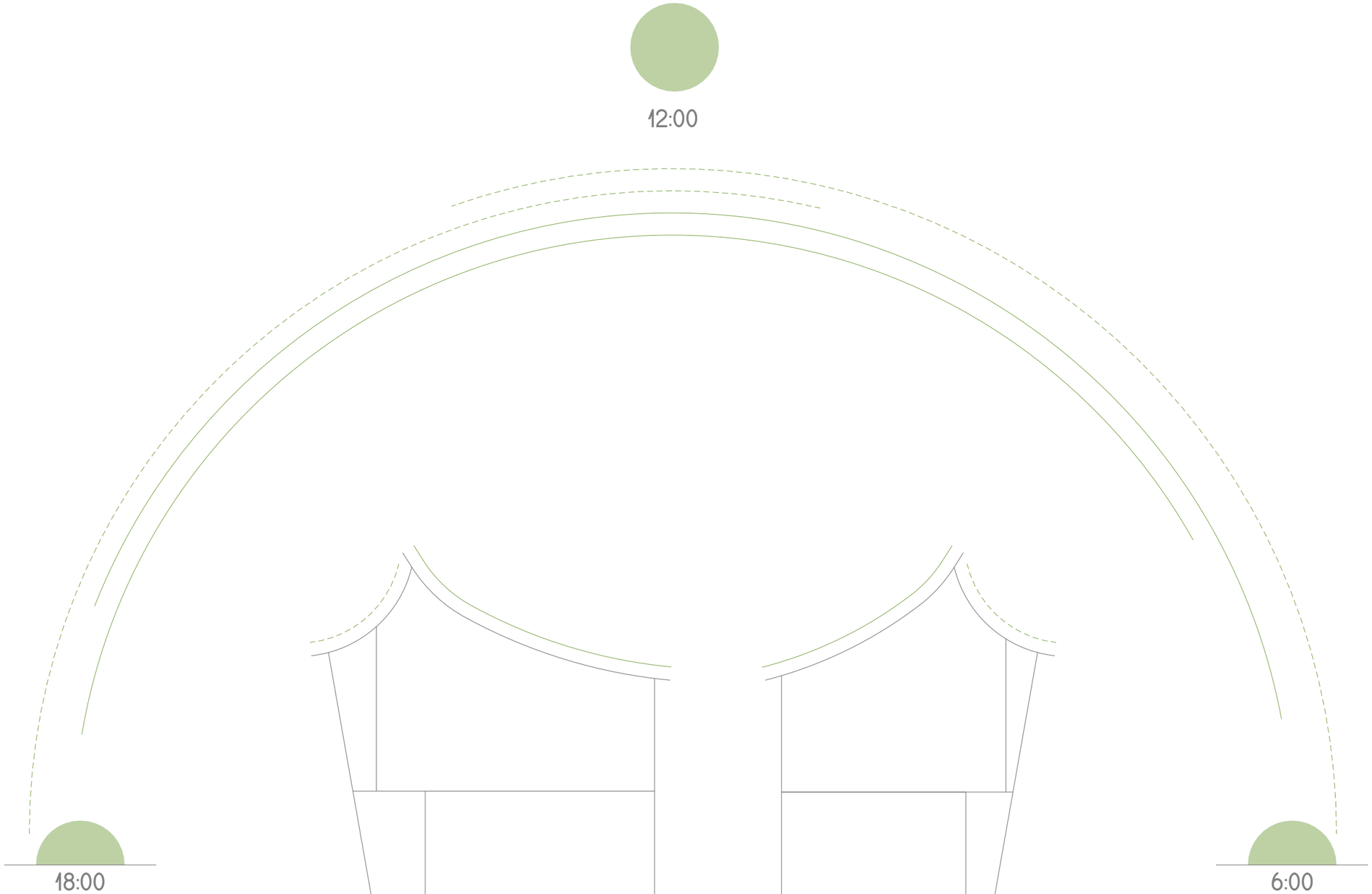
Enlargening the stack effect



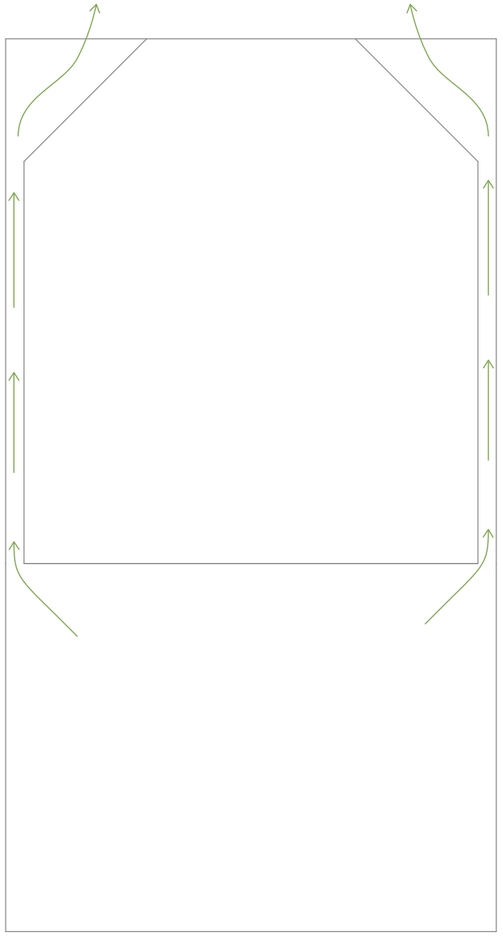
Maximizing Radiance

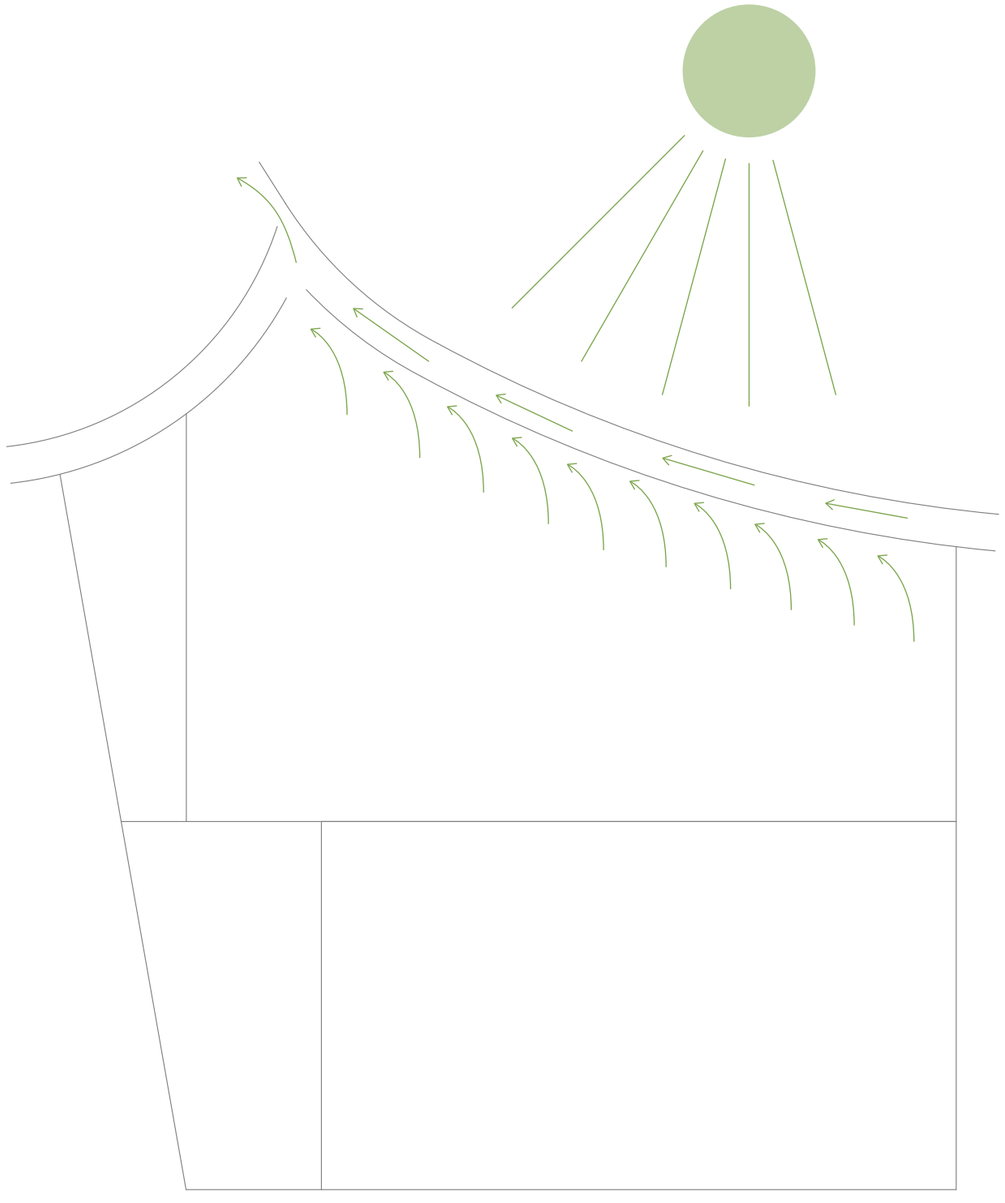
Creating a higher air temperature

Shape

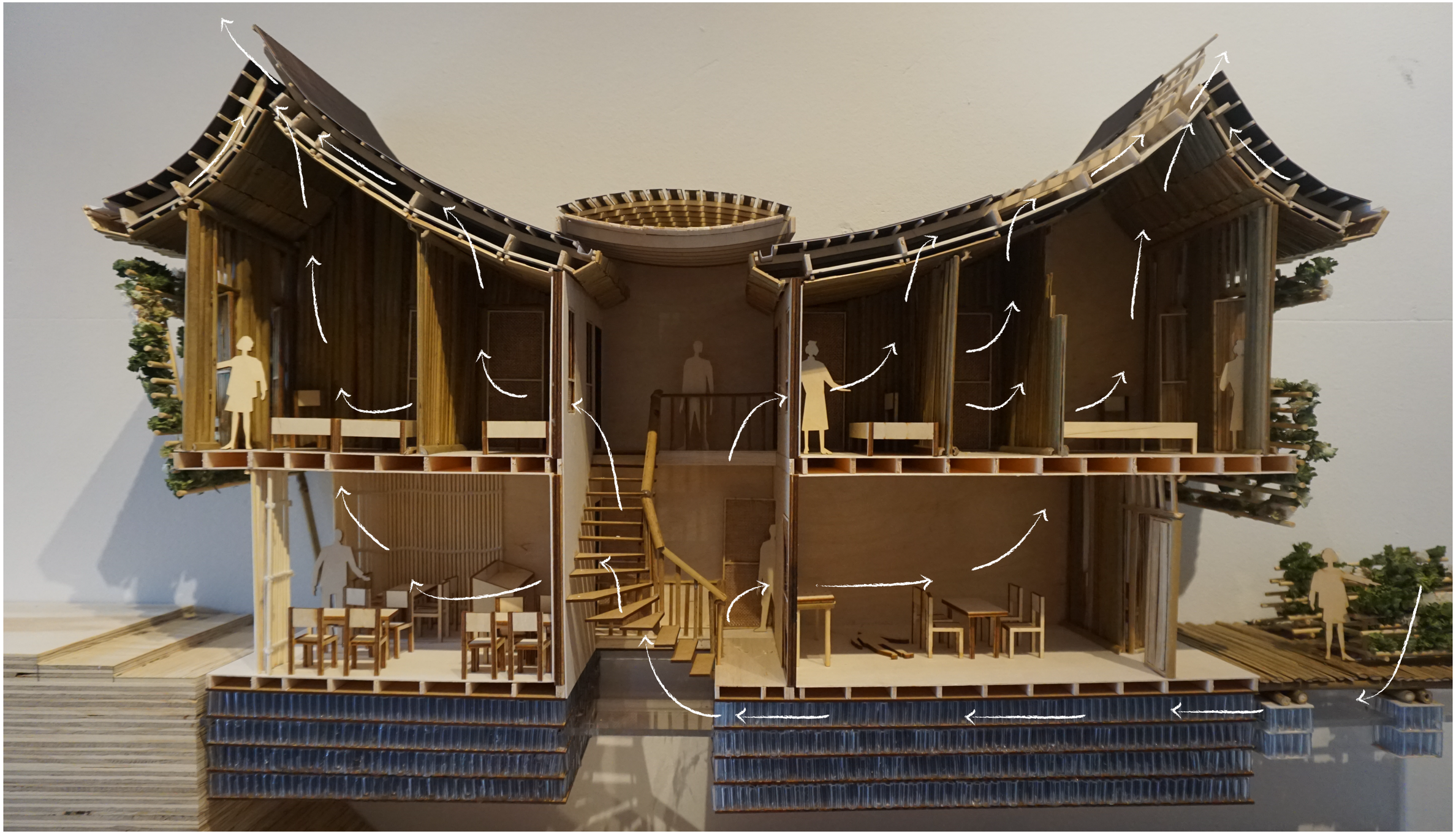


Airflow

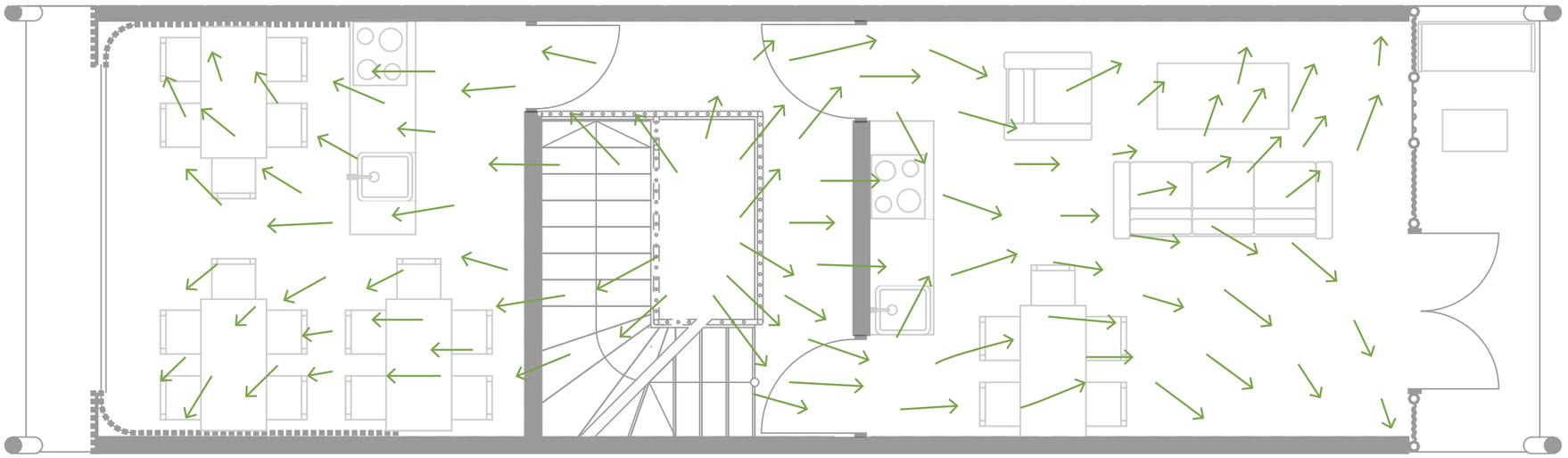


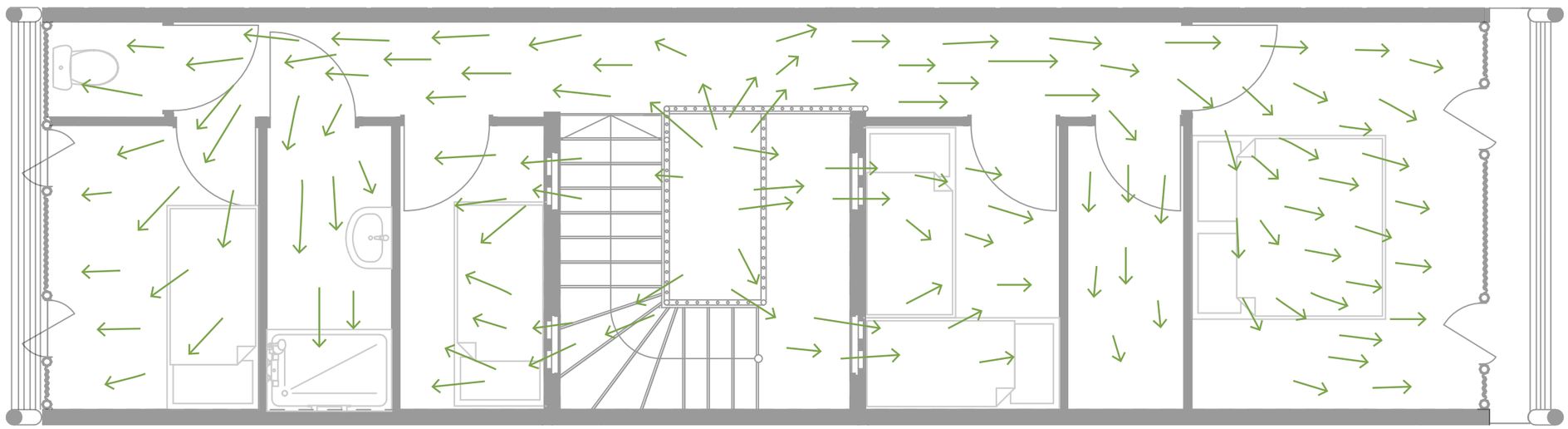


Flow - 3D

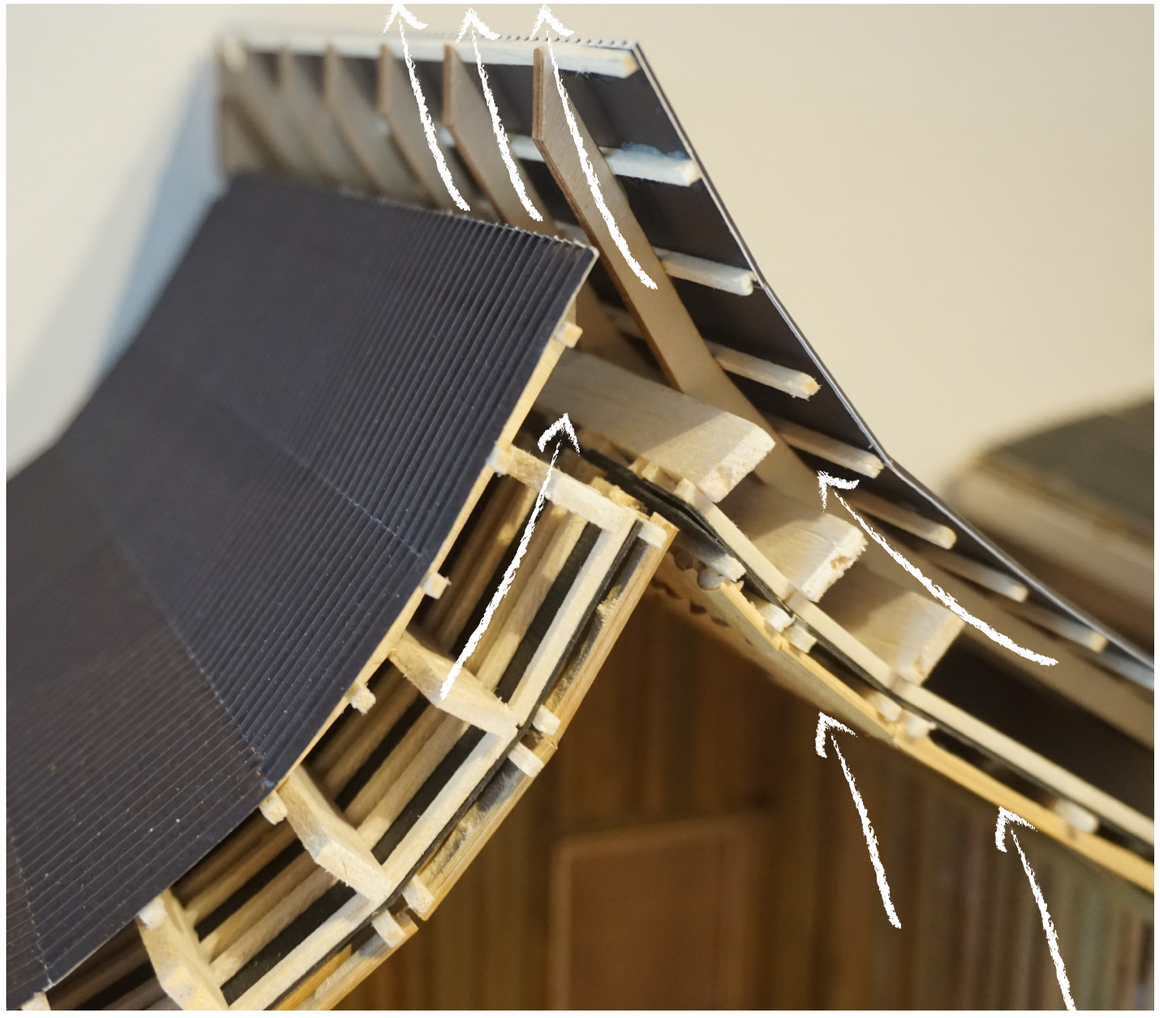


Flow - Floor Plan





Flow - Detailing



Content

Why is this intervention needed?

Context
Inspiration & Research
Concept

How is it going to be realized?

Urban Plan
User & Typology
Construction
Aquaponics
Roof

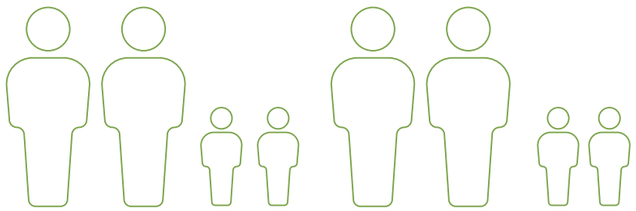
What is future life in Melayu like?

User Focus

User Focus

How is family life in Melayu?

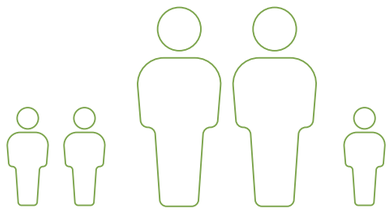
Users



Rumah 80

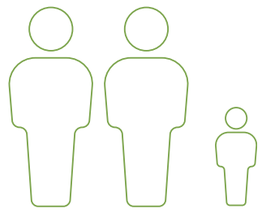
Augmentend nuclear family

Large nuclear family



Rumah 54

Nuclear family

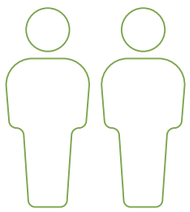


Rumah 45

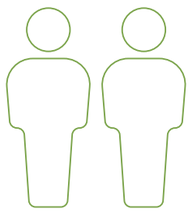
Starters

Small Nuclear family

Rumah 80



Grandparents



Parents

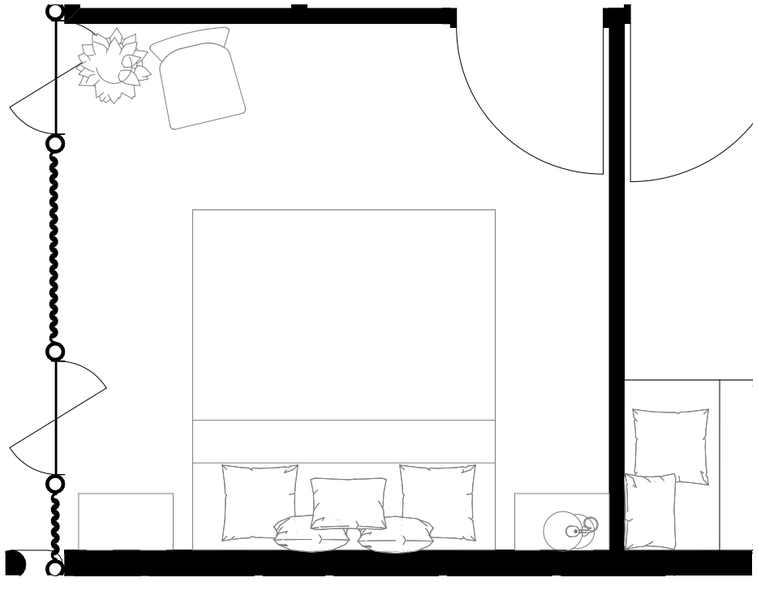
Kids

Grand Parents

Living with their child

Helping with the kids

Helping with the garden



4.30	
5.30	Waking Up & Praying
	Breakfast
6.30	
7.30	Harvesting Vegetables
8.30	
9.30	
10.30	Preparing Vegetables
11.30	
12.30	Helping around
13.30	
14.30	Preparing Vegetables
	Taking care of the kids
15.30	
16.30	
17.30	Preparing Vegetables
	Preparing dinner
18.30	
	Dinner
19.30	Taking care of the kids
20.30	
21.30	Evening Prayer

Routing

Prayer at the mosque

Harvesting Vegetables

Helping in the warung

Gossiping with the neighbours in the garden

Relaxing in the shadow

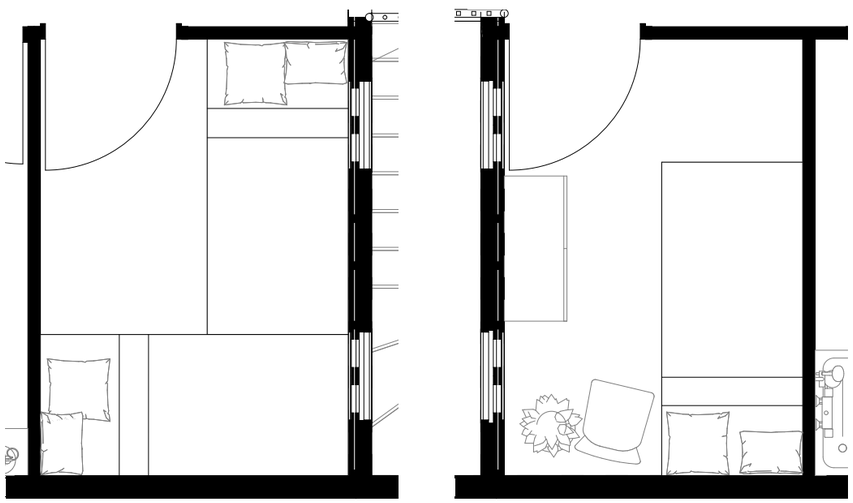
Diner with the family

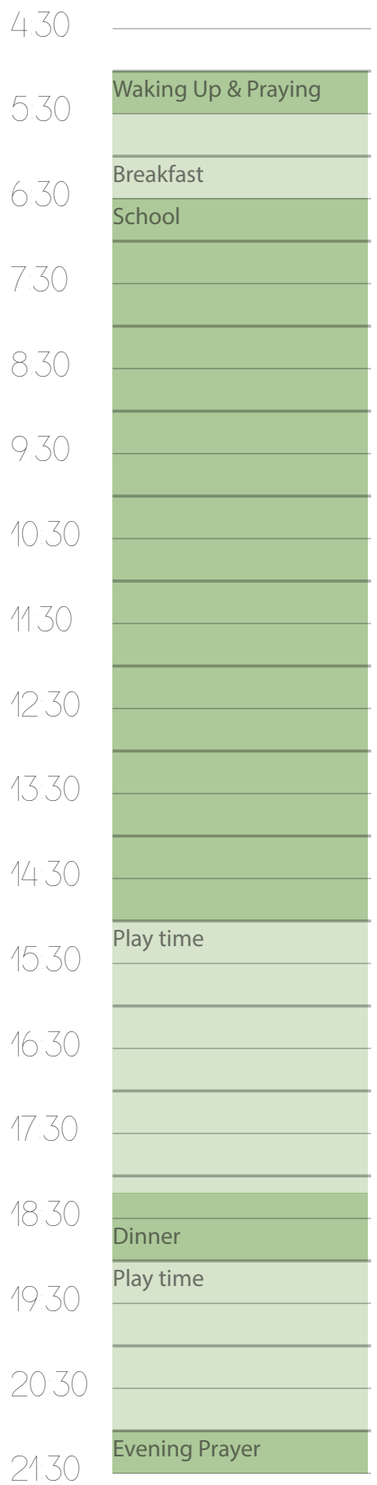
Children

Going to school

Playing in the park and garden

Helping in the Warung



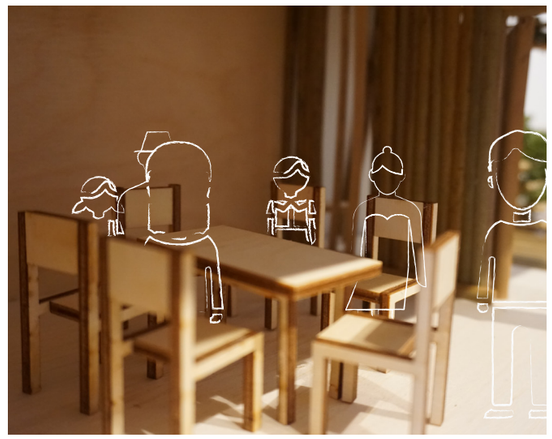


Routing

Praying at the mosque

Playing in the park

Playing on the porch



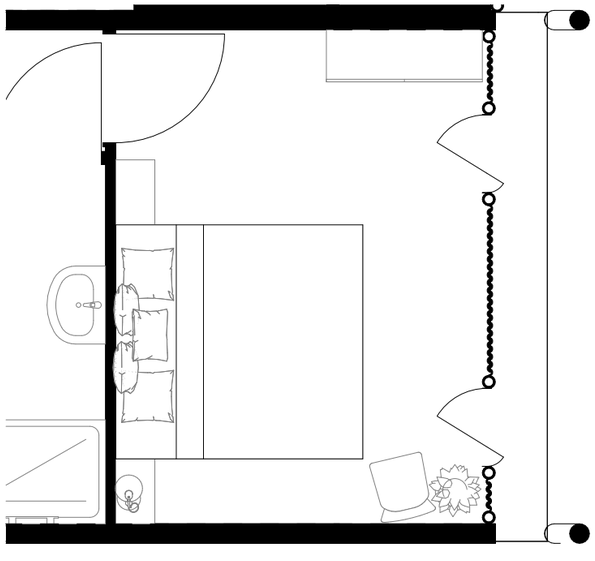
Diner with the family

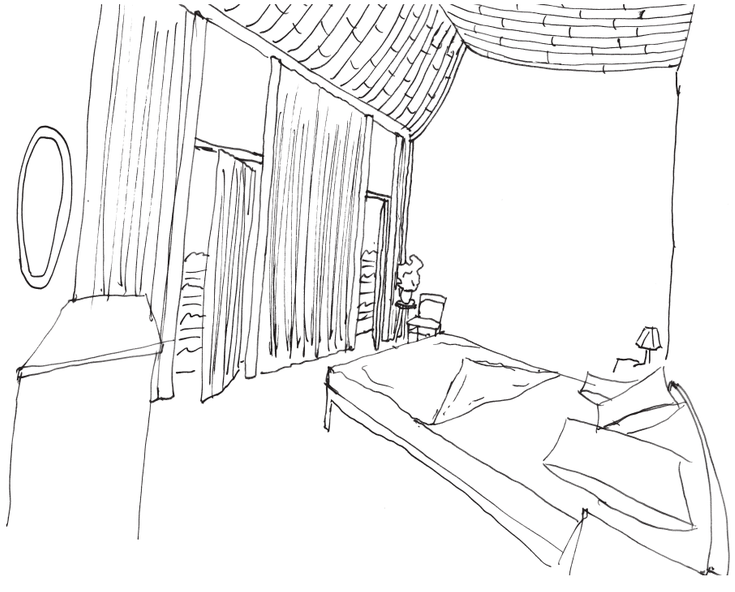
Parents

Working during the day

Spending time in the garden

Going to the market





4.30			
5.30	Waking Up & Praying		
6.30	Breakfast		
7.30	Market: Buying meat, rice & spices	Harvesting fish & feeding fish	Checking system
8.30			
9.30			
10.30	Preparing warung for opening		
11.30	Working in the Warung		
12.30			
13.30		Harvesting & checking	
14.30			
15.30			
16.30	Harvesting & checking		
17.30			
18.30	Dinner		
19.30	Working in the Warung		
20.30	Closing Warung		
21.30	Evening Prayer		

Routing

Praying at the mosque

Buying goods at the market

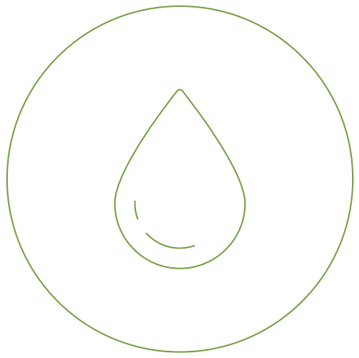
Harvesting in the garden

Working at the warung

Diner with the family

Concept

"Rebuilding Kampung Melayu by implementing an aquaponic system, using it as a means of water management, economic engine and social glue, while architecturally capitalizing on its spatial & climatic potential"



Water Management

Social Glue

Economic Engine

Spatial & Climatic

Water Management

Room for the River

Flood Protection

Using and reusing the water in the basin

Economic Engine

Providing a place for production

Providing a place for selling

Social Glue

Cooperative structure

Places in the garden reserved for social interaction

Spatial & Climatic

MItigating urban heat island effect

Using the potentials of the basin to create a cool enviranment

Creating more green space

Combining a production process with design

Thank you