

FARMWORK

A FARM-INTEGRATED OFFICE IN
MARINETERREIN, AMSTERDAM



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STUDENT NUMBER: 4618327

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1. PROBLEM STATEMENT

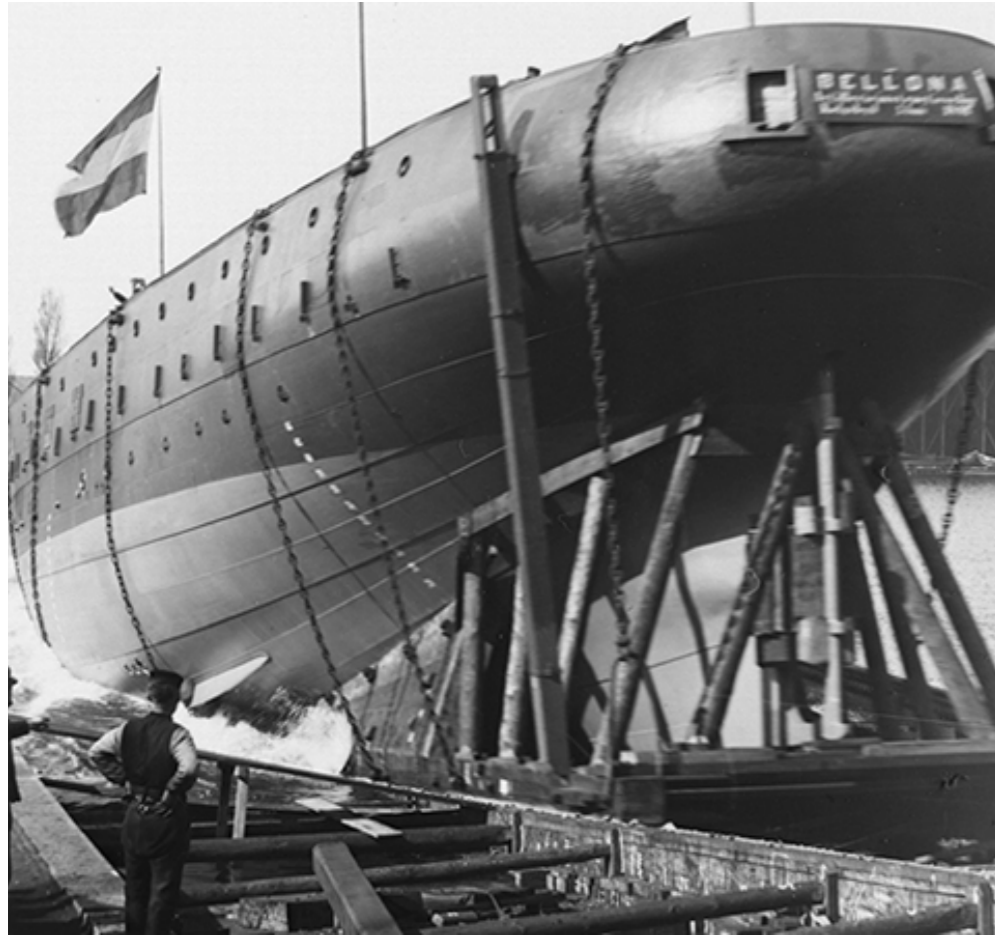
2. THEMATIC RESEARCH

3. CONCEPTUAL DESIGN

4. FINAL DESIGN

1. PROBLEM STATEMENT |

Marineterrein, Amsterdam



Before
Used as shipyard



Now
Military+semi public
function



Future
Sustainability and
innovation

Site Analysis

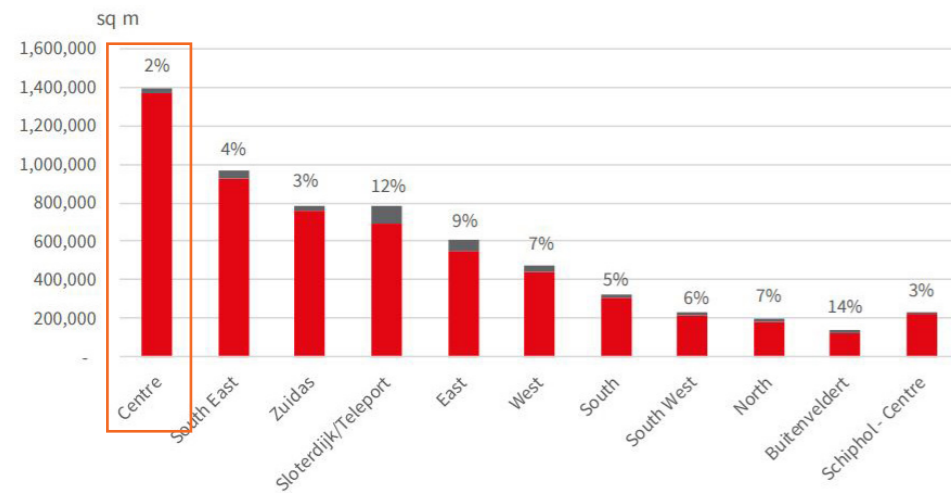
close to central station
convenient transportation
vacant spaces

closed, limited activities
limited connection with surrounding

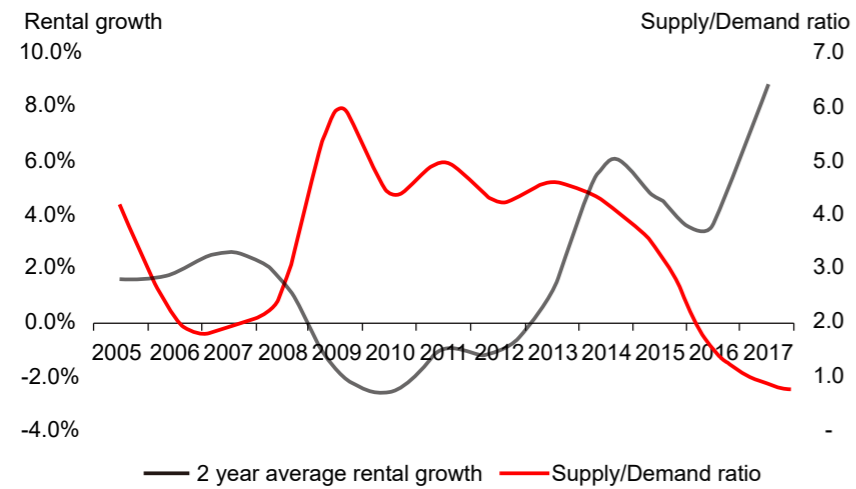


Office in Marineterrein, Amsterdam

increasing lack of space
in central area



Occupied stock and supply per sub location



supply/demand ration in Amsterdam until 2018

office spread in
Amsterdam



- 1.lack of vacant space for construction in central area
- 2.Marineterrein have potential for office

Office problem

health

limited activities
unfresh air

How buildings are killing you softly

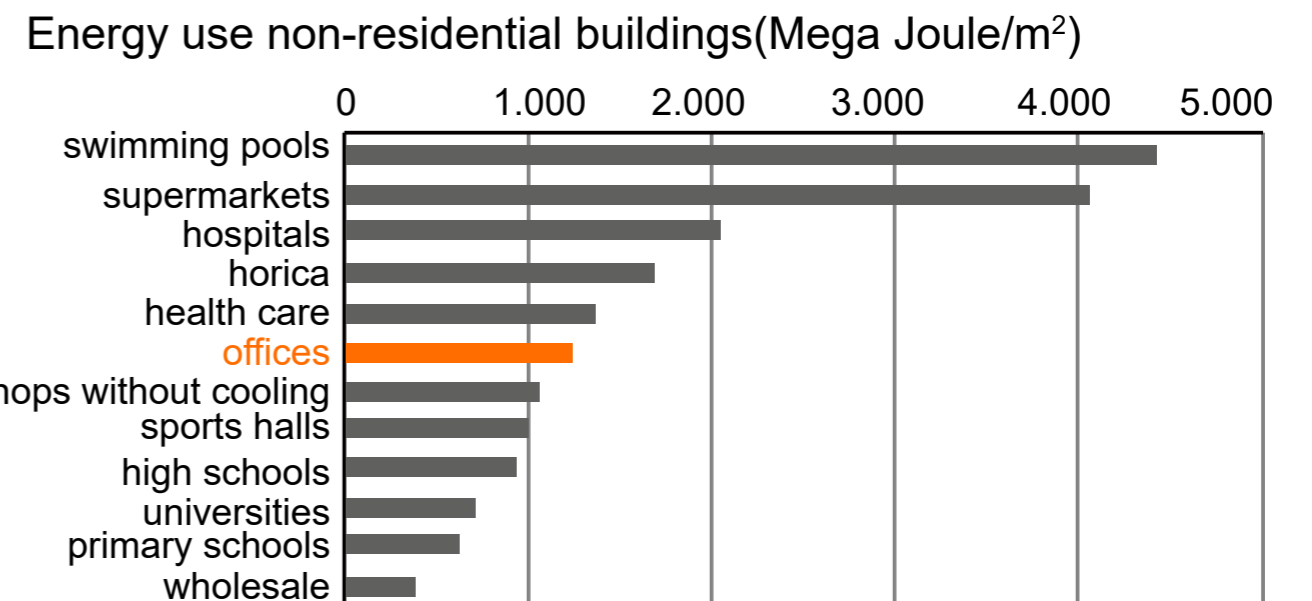
We are much more creative and smarter outdoors. Still we choose to spend 22 hours a day indoors.



For the optimized environment, we increased the amount of outdoor air brought in to the space (i.e., the ventilation rate), doubling what is required under the “acceptable indoor air” standard, a condition that most buildings can achieve. We also changed the level of volatile organic compounds (VOCs) in the space by controlling the number of common materials that emit these chemicals – e.g., surface cleaners, dry erase markers, dry cleaned clothing, and building materials. We exposed the workers to a typical and a low VOC concentration. Last, we tested three levels of carbon dioxide (CO₂) in the air: low levels (600 parts per million) that result from high ventilation rates, a typical level seen [in many offices](#) (950 ppm), and higher levels that are commonly encountered [in U.S. schools](#) (1400 ppm).

mass energy consumption

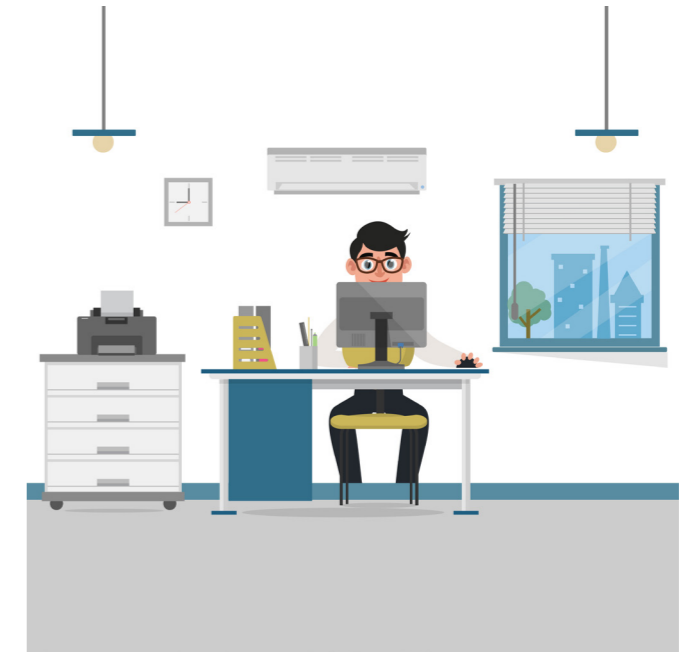
30% of energy consumption is related to offices in the Netherlands



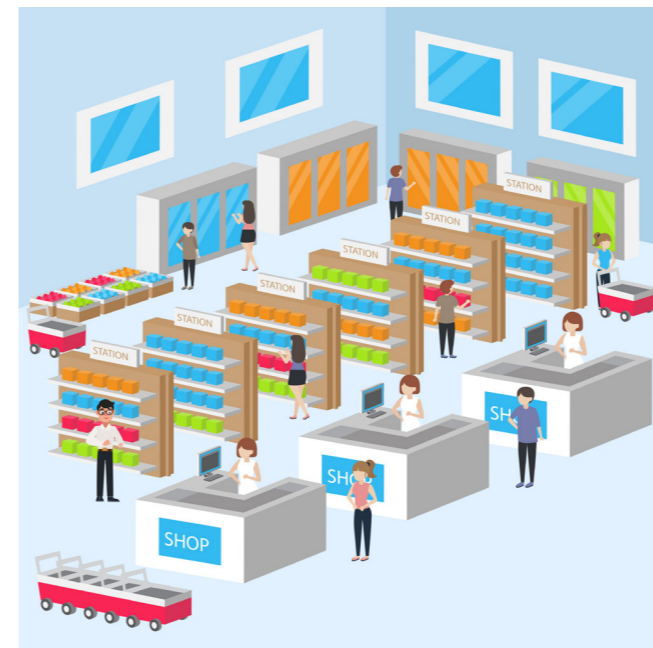
Current office scenario



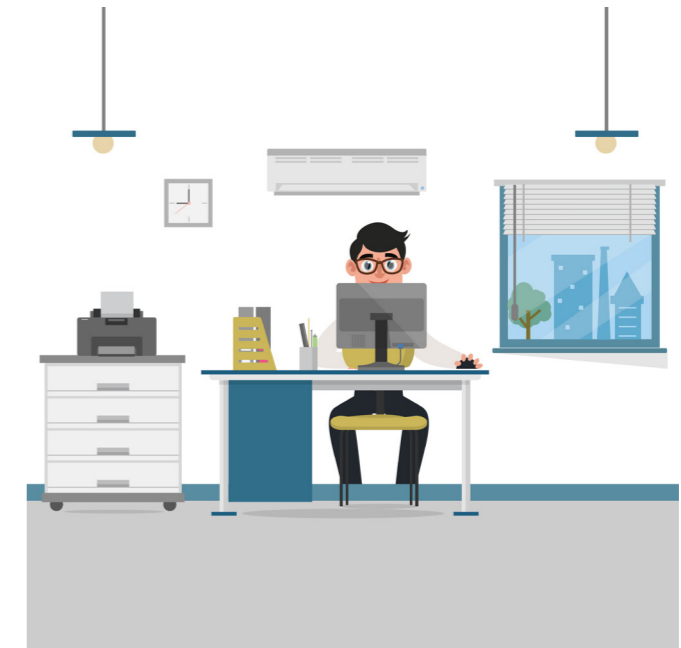
1



2



3



4

Marineterrein, Amsterdam---wish for the future

The organization at the Marineterrein focus on issues like **learning, water quality, health, and an increasing lack of space.**

*Liesbeth Jansen, Project Leader at Bureau Marineterrein Amsterdam
Thijs Meijer, Deputy Director of Bureau Marineterrein Amsterdam*

As more and more people live and work in the city, there is less space for green areas and more room is being taken up by buildings and streets. On Marineterrein, organizations are looking for ways to **introduce more greenery into the city...**

Bureau Marineterrein Amsterdam

Improvement of office

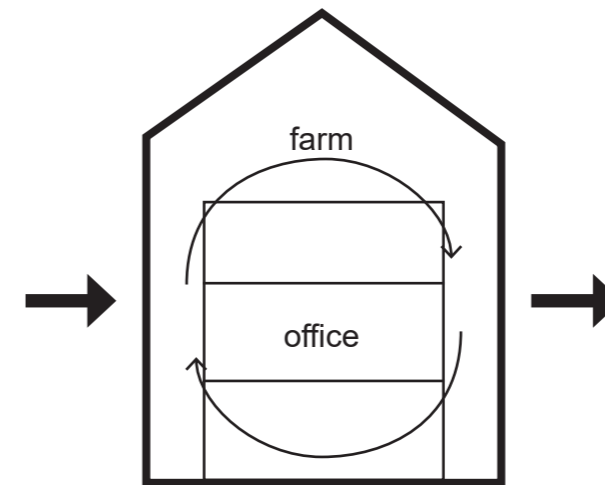
What if integrate farming into office?
The office will have:



Better air quality

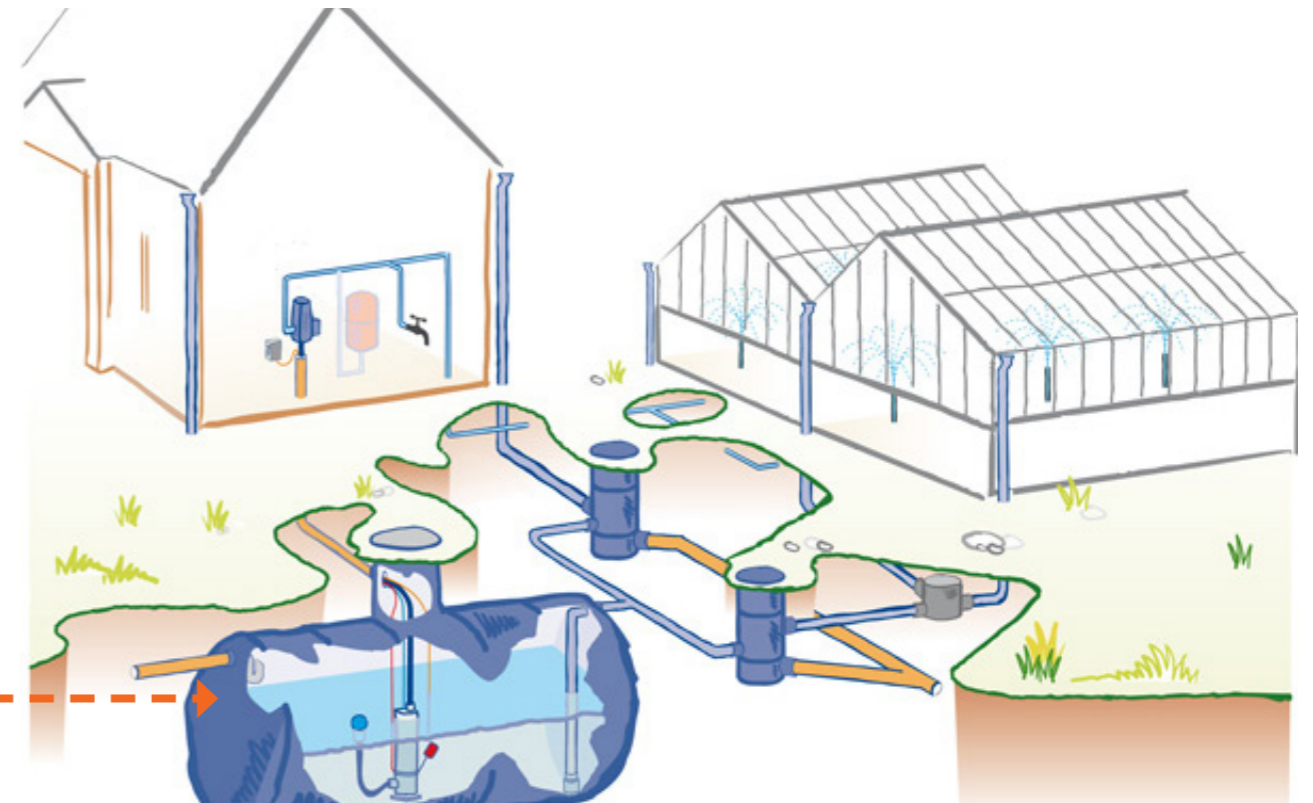
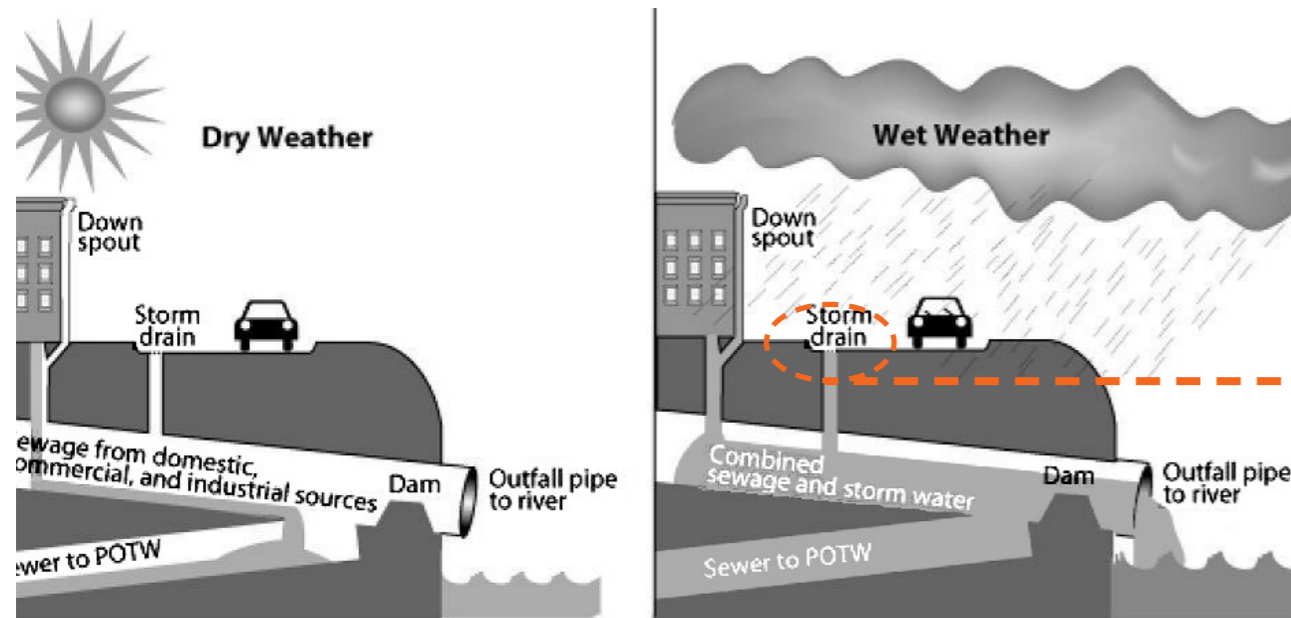


Fresh vegetable
Greenery space in office



Better energy efficiency

Improvement of surrounding environment



too much rain water lead to water pollution

irrigation with rain water
reduce water to outfall pipe to river

Irrigation with rain water
Cleaning with purified rain water

Reduce water spread to outfall pipe to river

Improvement of office

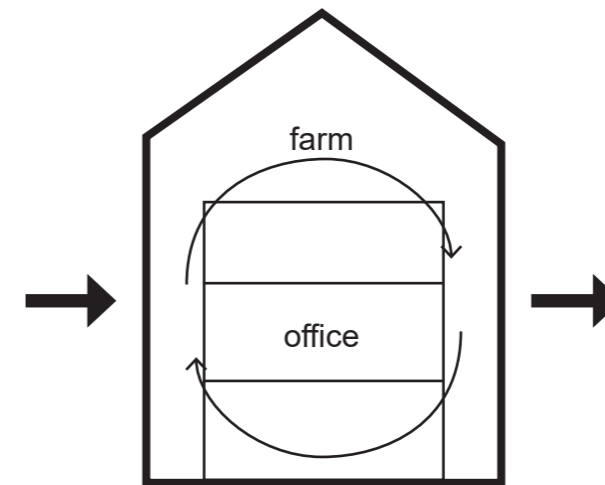
What if integrate farming into office?
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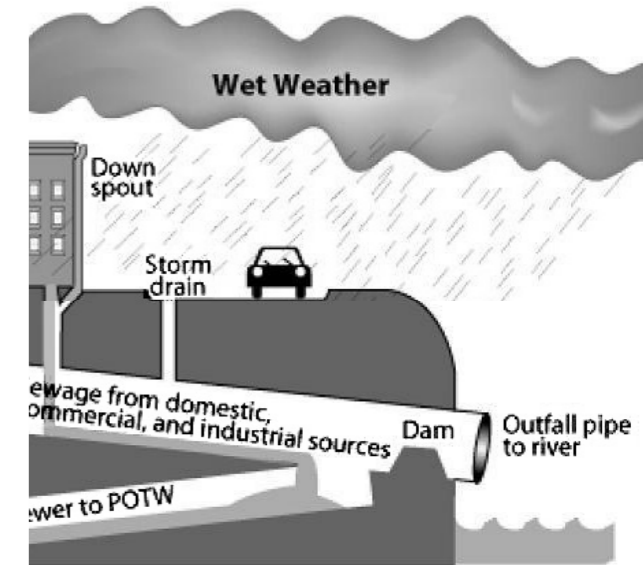
Better air quality



Fresh vegetable
Greenery space in office

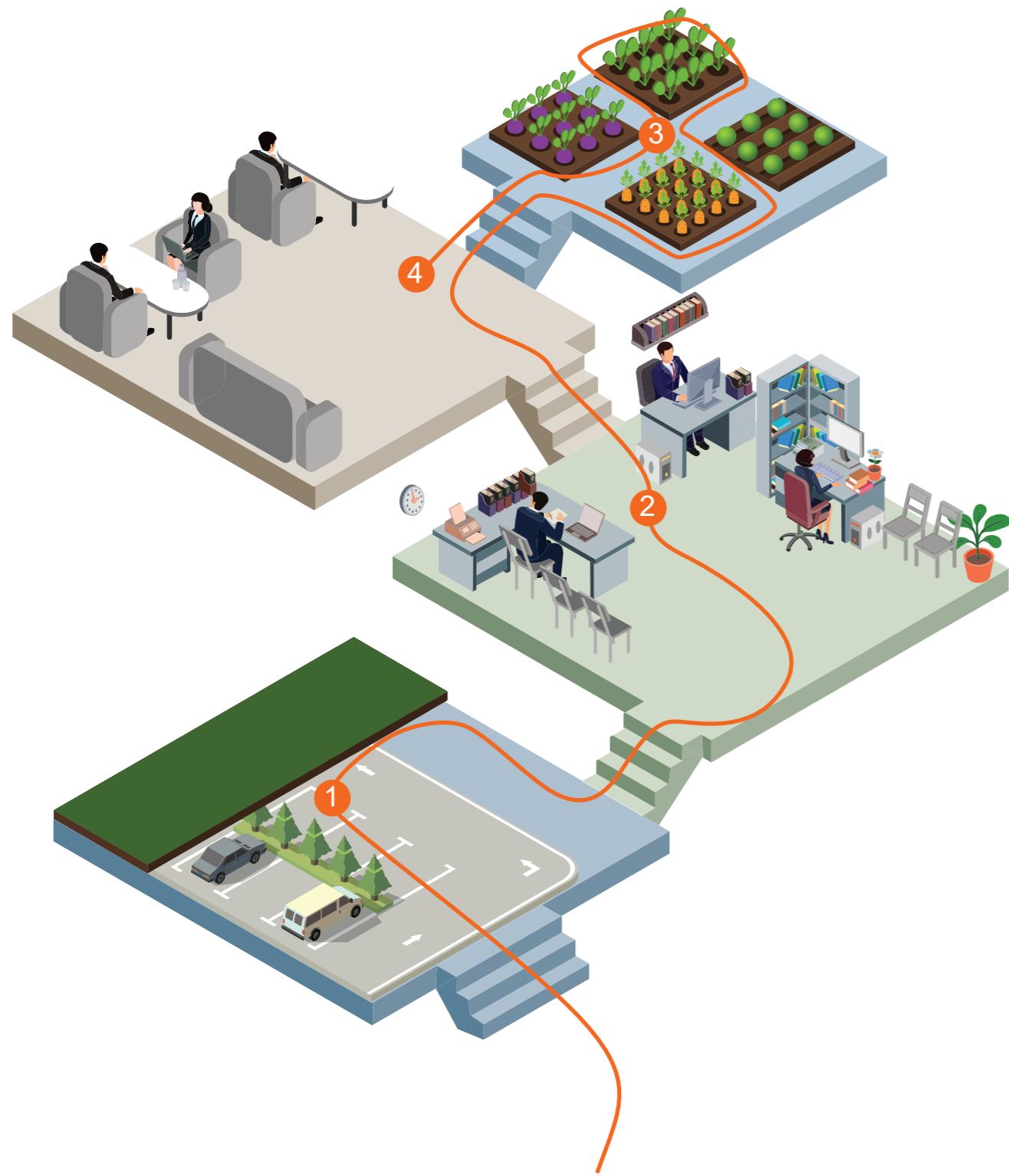


Better energy efficiency

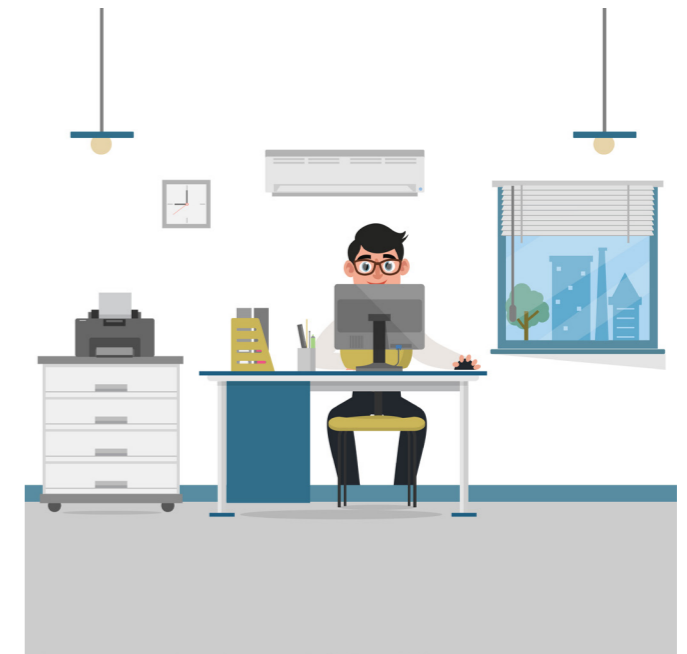


Reduce water pollution

Future office scenario



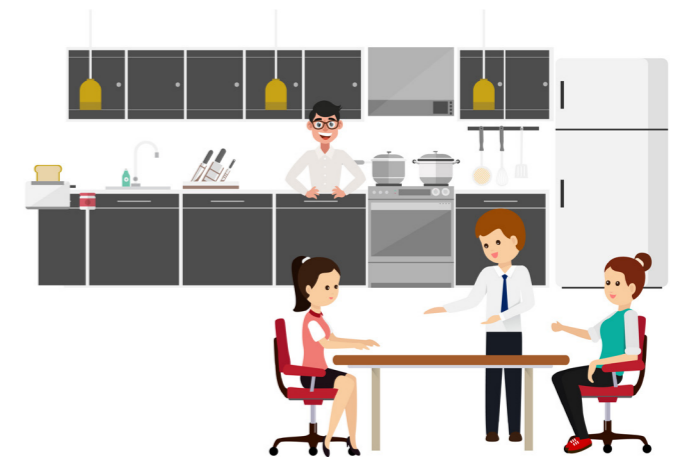
1



2



3



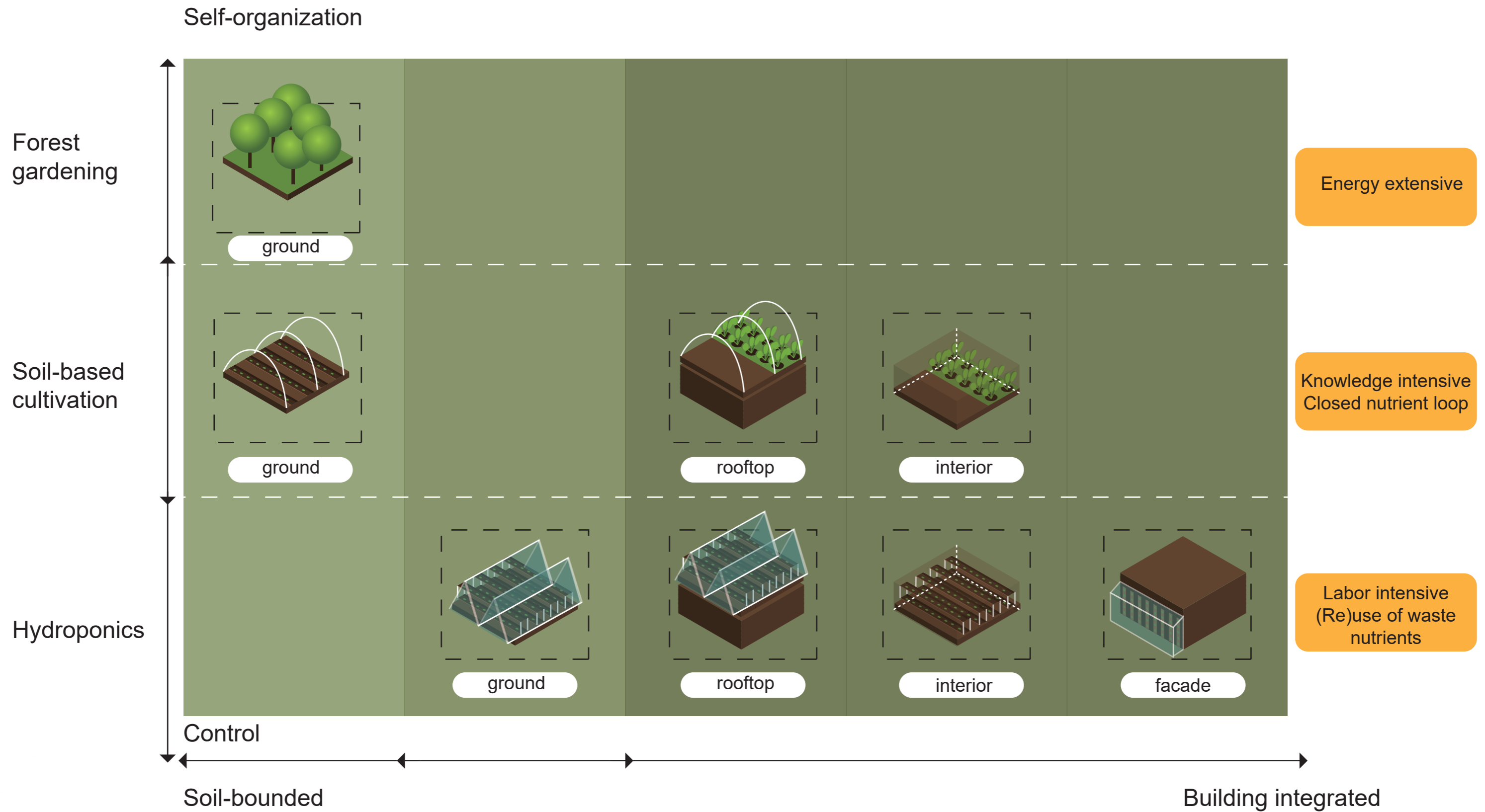
4

Main objective

Create a farm-integrated office
as a way to improve office environment
act as a part of sustainable and innovative Marineterrein

2. THEMATIC RESEARCH |

Classification for urban farming



Case studies



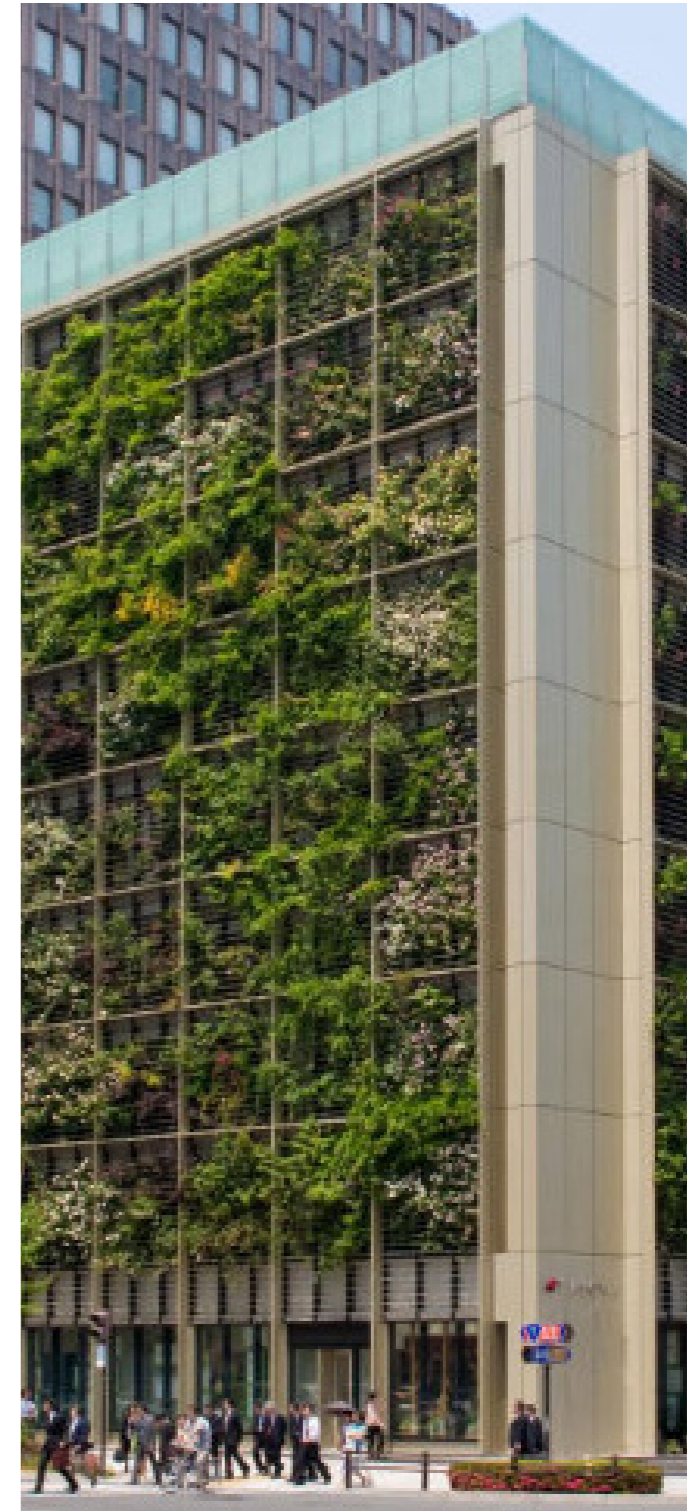
Lufa farms



Aeres hogeschool



VTN



Pasona

Case studies

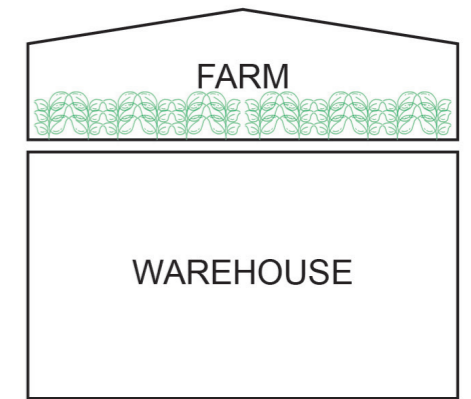
Lufa farms, Montreal, Canada

Area: 5800 m²

Structure: steel frame structure

Place for plant: roof garden

Design: 1. greenhouse add on top of an old warehouse



rooftop farming



Case studies

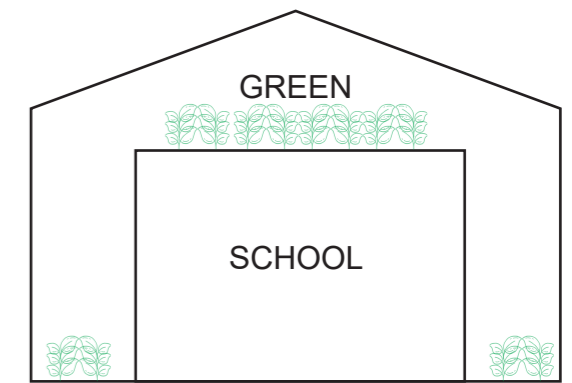
Aeres Hogeschool, Dronten, NL

Area: ?m²

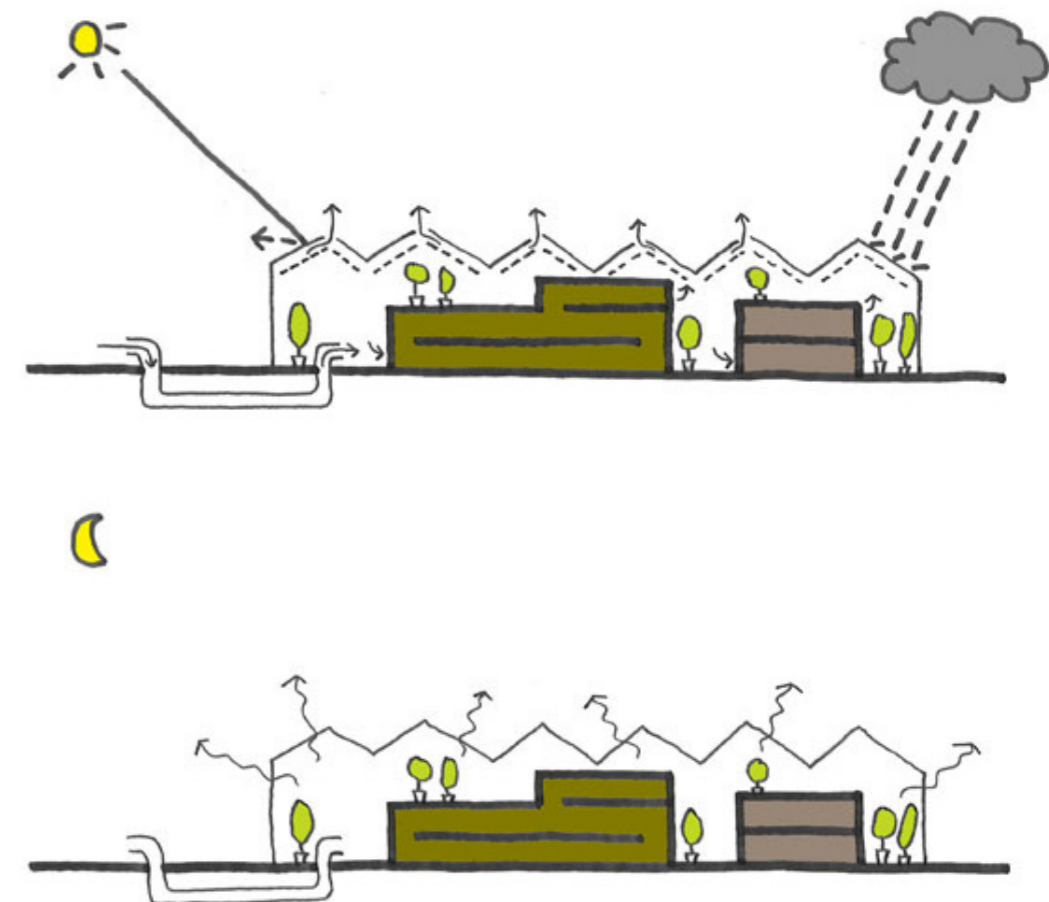
Structure: frame structure

Place for plant: ground+rooftop

Design: The use of sun protection fabrics from the horticulture sector and screen printing on part of the glass façade limits the need for active cooling in the summer.



envelope



Case studies

VTN, Ho Chi Minh City, Vietnam

Area: 1386m²

Structure: concrete + steel supporting

Place for plant: roof garden+ground+hanging box on facade

Design: 1.combined with glazing, vegetables filters direct sunlight and purifies the air

2.irrigated with stored rainwater

3. water evaporation cools the air

4.northern wall is solid for future extension, with openings to enhance cross ventilation

5. double-layered brick wall with air layer, enhance insulation

reduce AC use



facade farming



Case studies

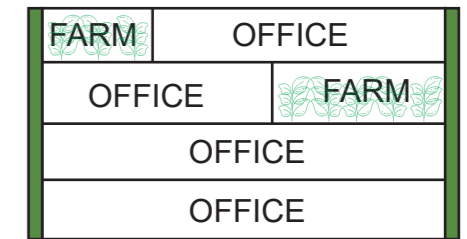
Pasona urban farm, Tokyo, Japan

Area:20000m²

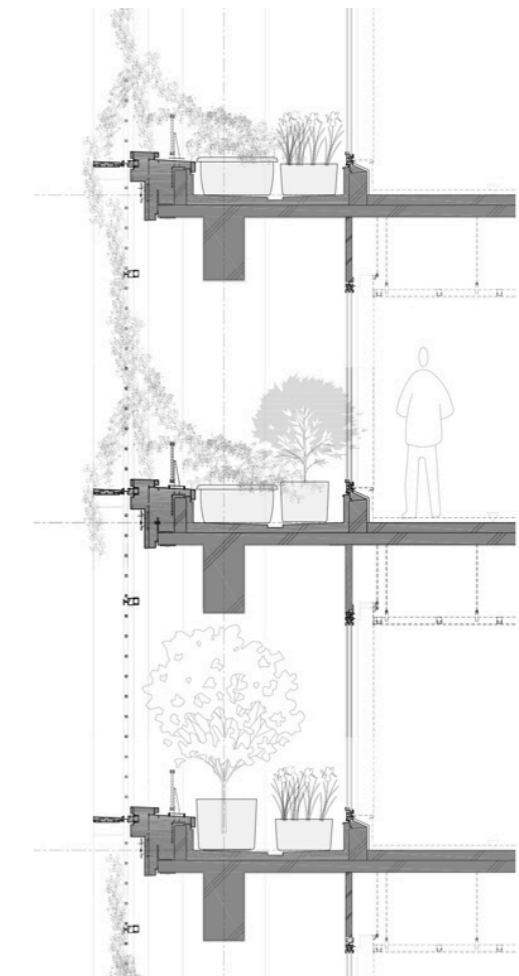
Structure: Reinforced Concrete + Steel [existing envelope and superstructure]

Place for plant: ground +ceiling + facade

- Design:
- 1.Preservation and renovation of existing building structure
 - 2.Green rooftop with leisure areas
 - 3.Green wall balconies with seasonal flowering climbing plants
 - 4.Indoor vegetation improvement on working environment
 - 5.User participation in the maintenance and harvesting of crops, and envelope control through operable windows

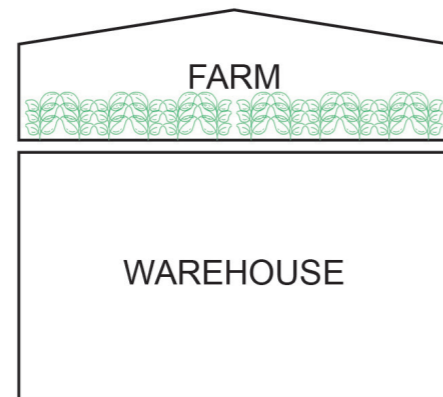


shared space

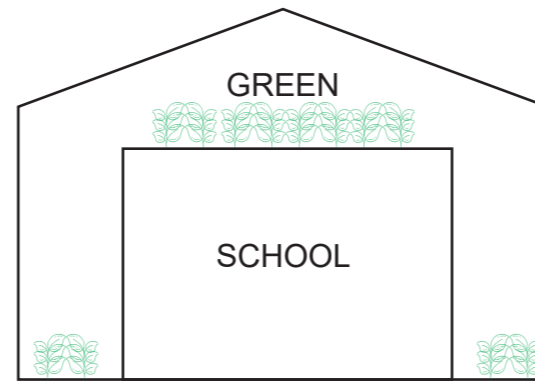


Case studies

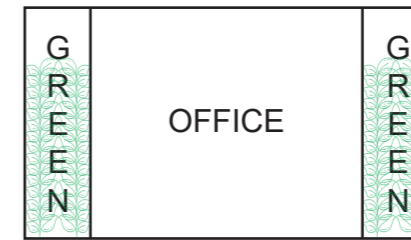
Typology conclusion



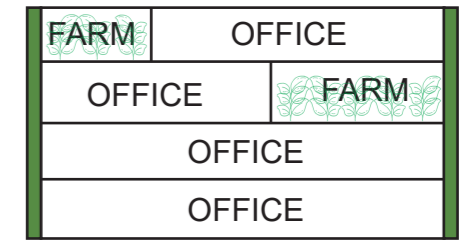
rooftop farming



envelope



facade farming



shared space

advantage

- independent, easy temperature and moisture control
- more available choice of crops
- sunlight for green

- energy saving
- better air quality
- better thermal performance
- sunlight for green
- easy temperature and humidity control

- better air quality
- limited maintenance interfere in two functions

- better air quality
- more available choice of crops
- totally integrated

disadvantage

- no energy saving
- no connect with warehouse


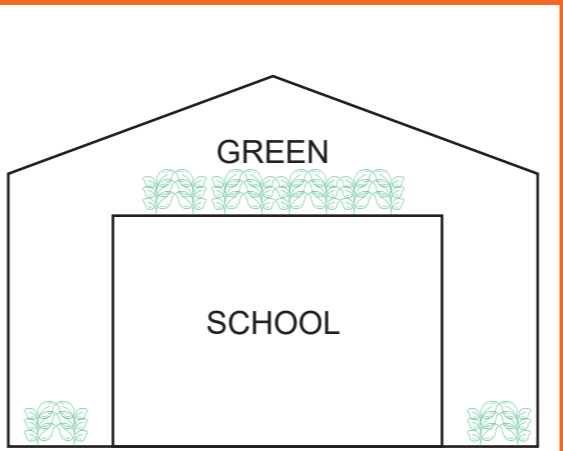
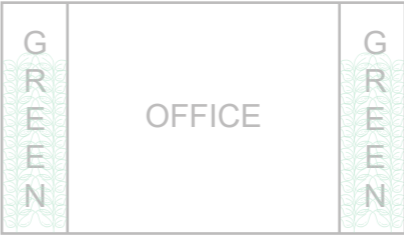
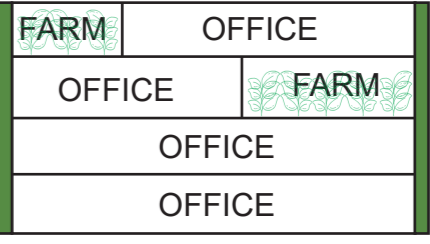
- limited choice of crops

- high maintenance costs in crops in winter
- no energy saving

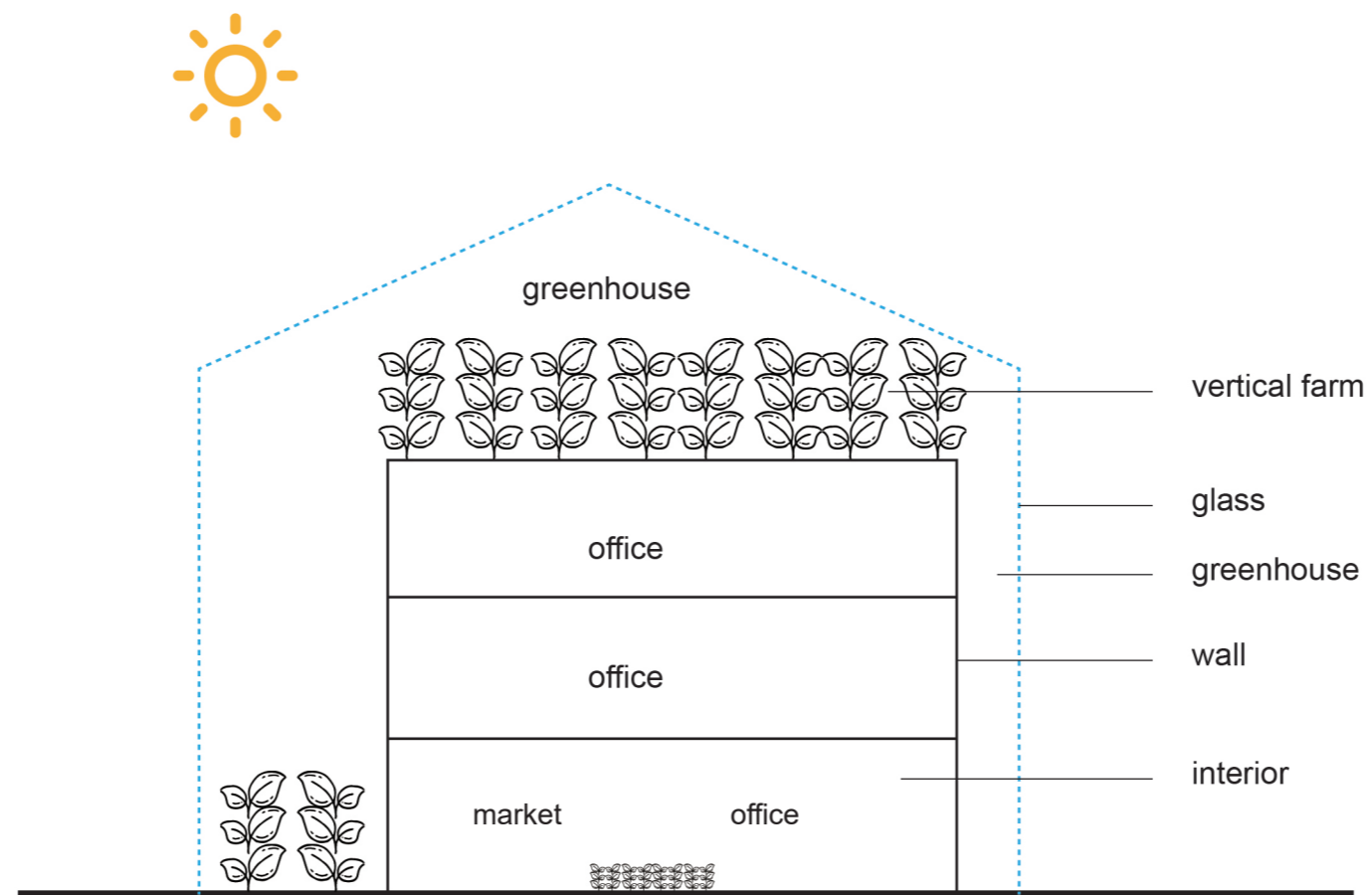
- hard temperature and humidity control

Case studies

Typology conclusion

	 <p>rooftop farming</p>	 <p>envelope</p>	 <p>facade farming</p>	 <p>shared space</p>
advantage	<ul style="list-style-type: none"> ● independent, easy temperature and moisture control ● more available choice of crops ● sunlight for green 	<ul style="list-style-type: none"> ● energy saving ● better air quality ● better thermal performance ● sunlight for green ● easy temperature and humidity control 	<ul style="list-style-type: none"> ● better air quality ● limited maintenance interfere in two functions 	<ul style="list-style-type: none"> ● better air quality ● more available choice of crops ● totally integrated
disadvantage	<ul style="list-style-type: none"> ● no energy saving ● no connect with warehouse 	<ul style="list-style-type: none"> ● limited choice of crops 	<ul style="list-style-type: none"> ● high maintenance costs in crops in winter ● no energy saving 	<ul style="list-style-type: none"> ● hard temperature and humidity control

My Design Draft



Farm-integrate office

the space



SPACE

WORKING



FARMING

Private office

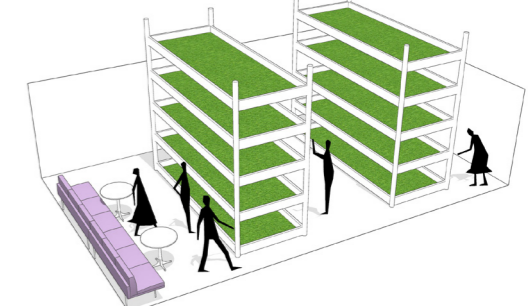
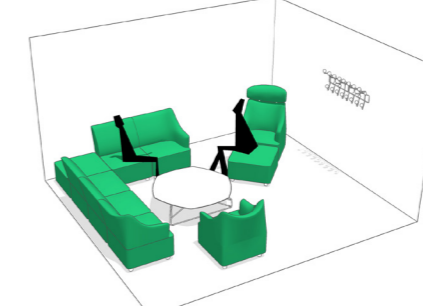
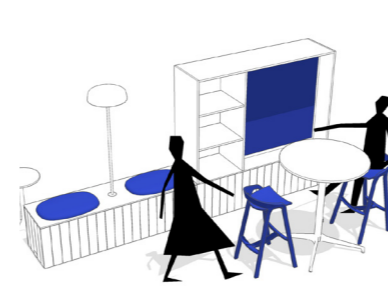
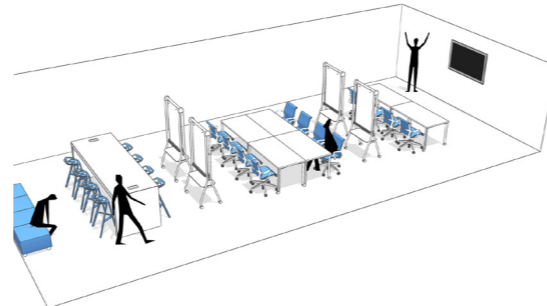
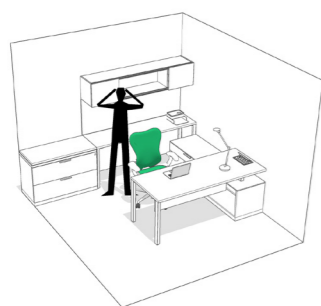
Meeting room

Hot desk

Restaurant

Visitor area

Growing space



office type



The European coworking markets are expected to grow at around 15% per year over the forecast horizon.

open office space

open, flexible, interact



traditional office space

private, quite, concentration



Farm-integrate office

ratio of function

RATIO

FUNCTION

	sample 1	sample 2	sample 3	sample 4	AVERAGE	
others	19%	22%	25%	17%	20.75%	walking/stay elevators w.c
office	12%	32%	25%	8%	19.25%	private office semi-public office
public	17%	18%	12%	36%	20.75%	service desk sofa to stay coffee room rest room
hot desk	48%	26%	32%	37%	35.75%	shared media space
meeting	4%	2%	6%	2%	3.5%	public working space meeting room

* sample 1--co working utopic_us conde de casal, US
 sample 2--Fosbury & sons co-work, Belgium
 sample 3--The work project coworking offices, HK
 sample 4--simplywork 6.0 co-working space, China

Farm-integrate office

ratio of function in Amsterdam

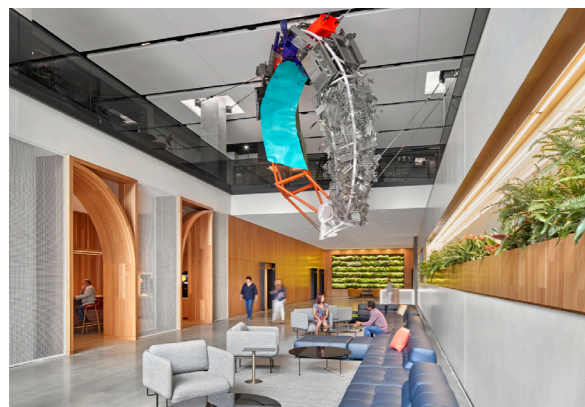
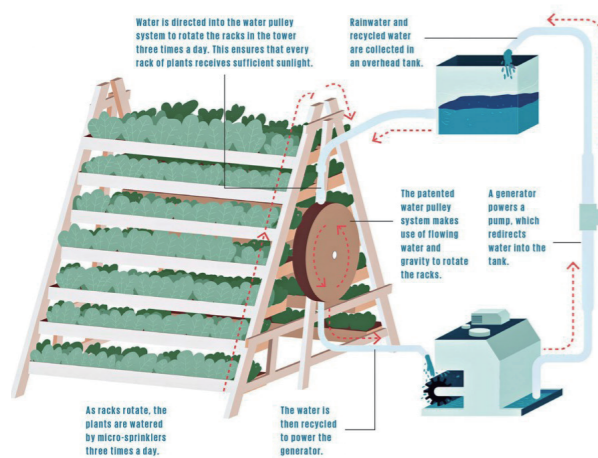
	TOTAL AREA	MEETING ROOM	BUSINESS CLUB (PUBLIC)
Zuidas	17500m ²	14 (around 300 m ²) 2%	2000m ² 11.5%
Amstel	3600m ²	7 (around 150 m ²) 4%	1000m ² 27.7%
Keizersgracht	3815m ²	5 (around 100 m ²) 3%	660m ² 17.3%
Vijzelstraat	10000m ²	10 (around 200 m ²) 2%	2000m ² 20%
Herengracht	6000m ²	7 (around 150 m ²) 2.5%	1200m ² 20%
Westerpark	7144m ²	10 (around 200 m ²) 3%	1261m ² 17.6%

Farm-integrate office

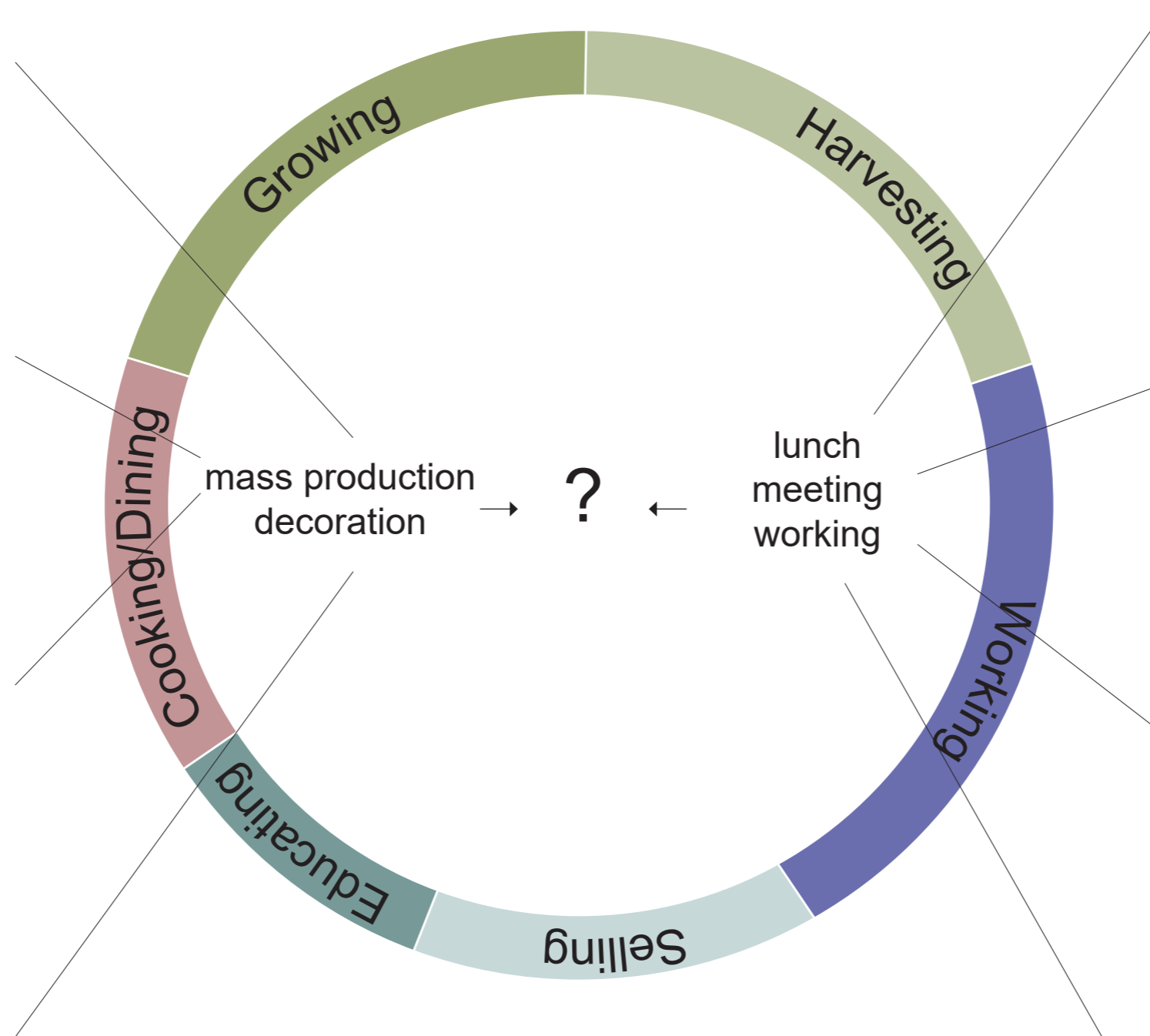
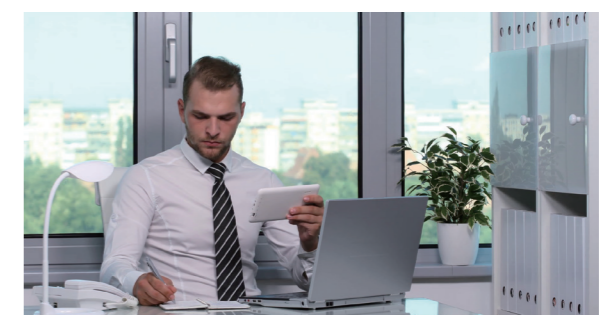
Typologies of farming



HOW SKY GREENS' A-GO-GRO TOWER WORKS



Activities in offices



Farm-integrate office

TYPE 1



soil-based
decoration



TYPE 2



hydroponic
decoration, production
LED supplement



TYPE 3



hydroponic
mass production

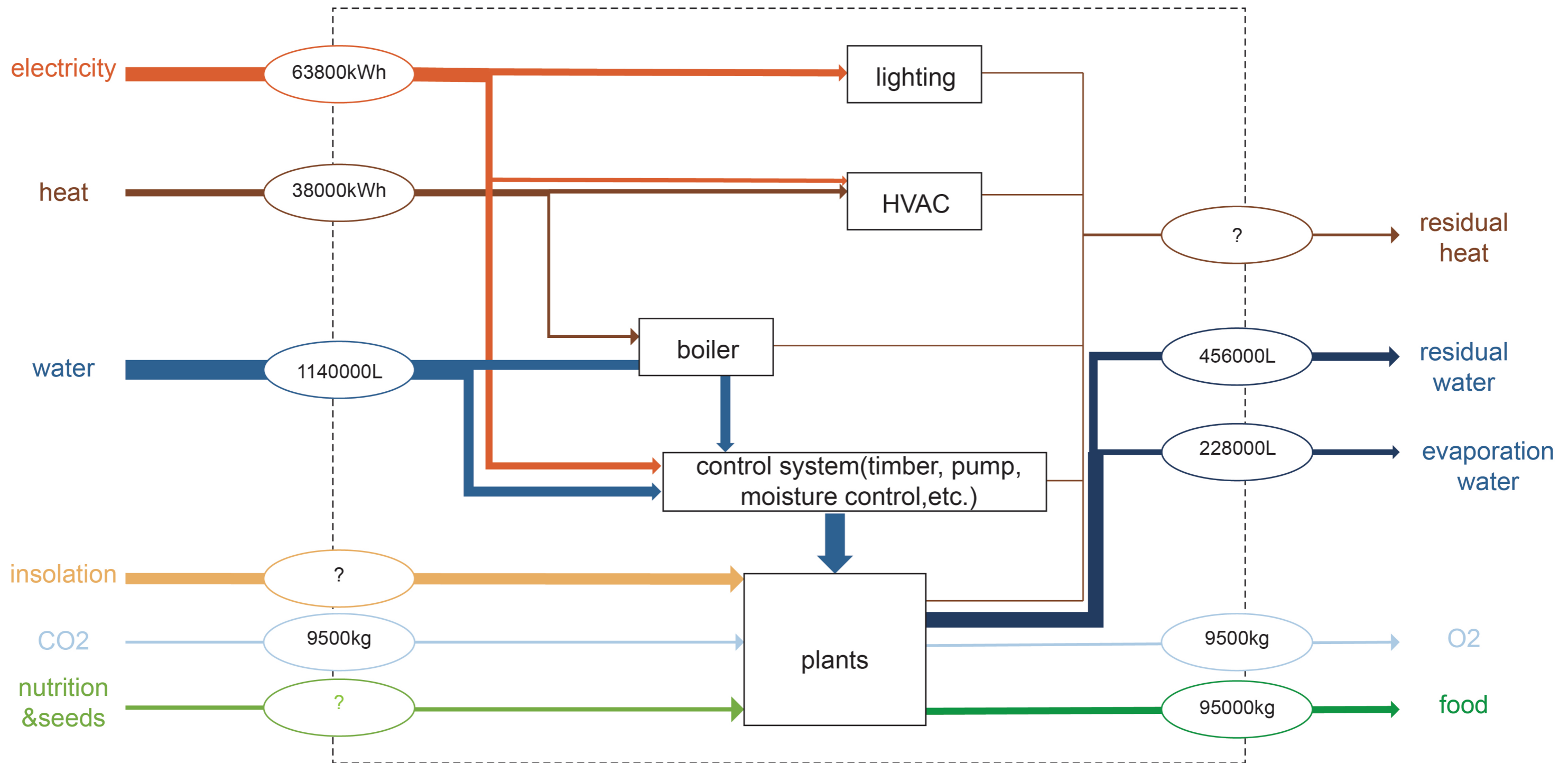


Architecture requirement

- Height of office: $\geq 4.2\text{m}$
- Height of roof: $\geq 5\text{m}$
- South facing
- Flexibility
- Adequate public space
- Not site specific
- Easy construction
- Material environmental friendly
- Cheap

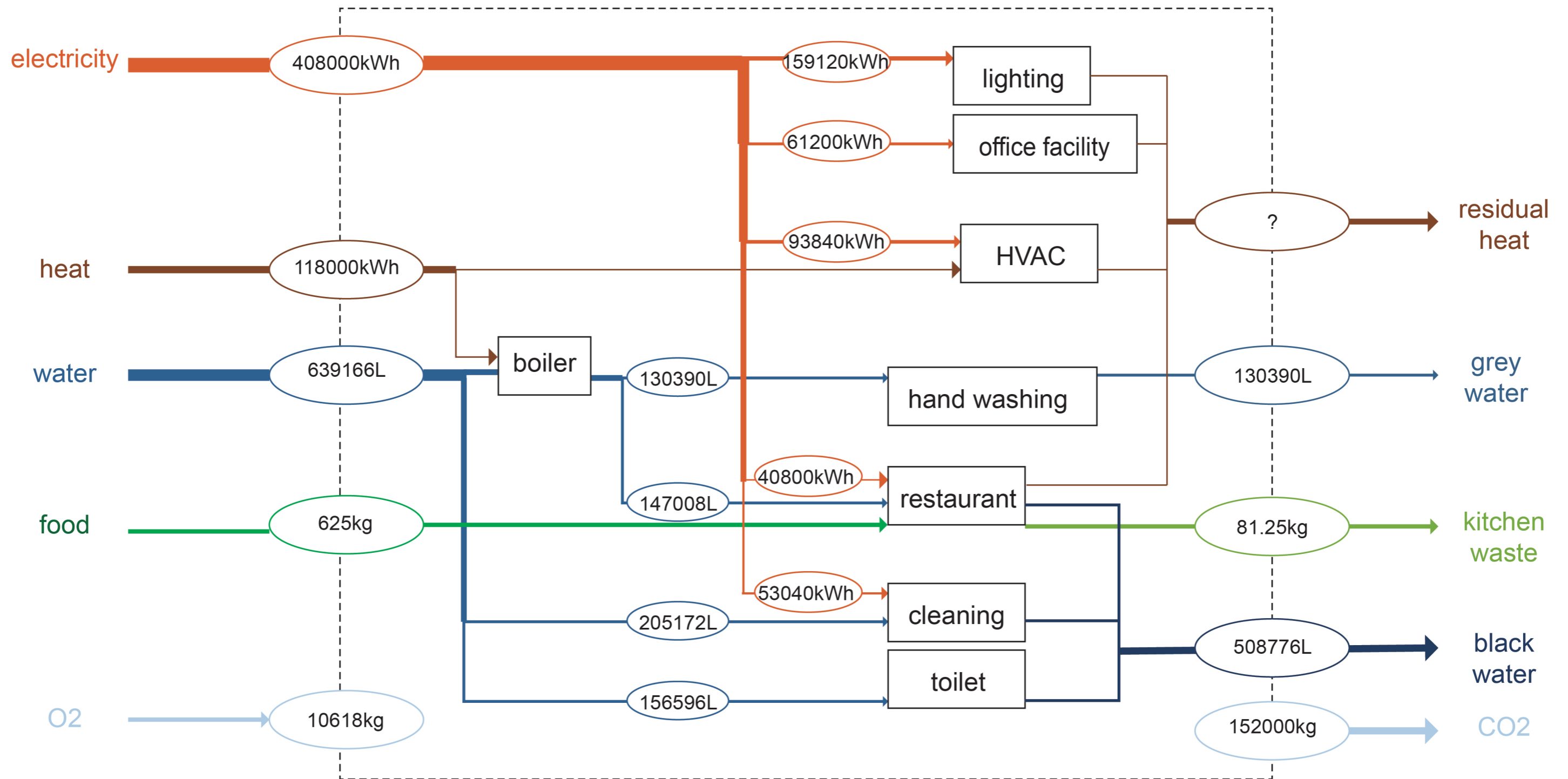
Flow

1000m² farm



Flow

1000m² office



Flow



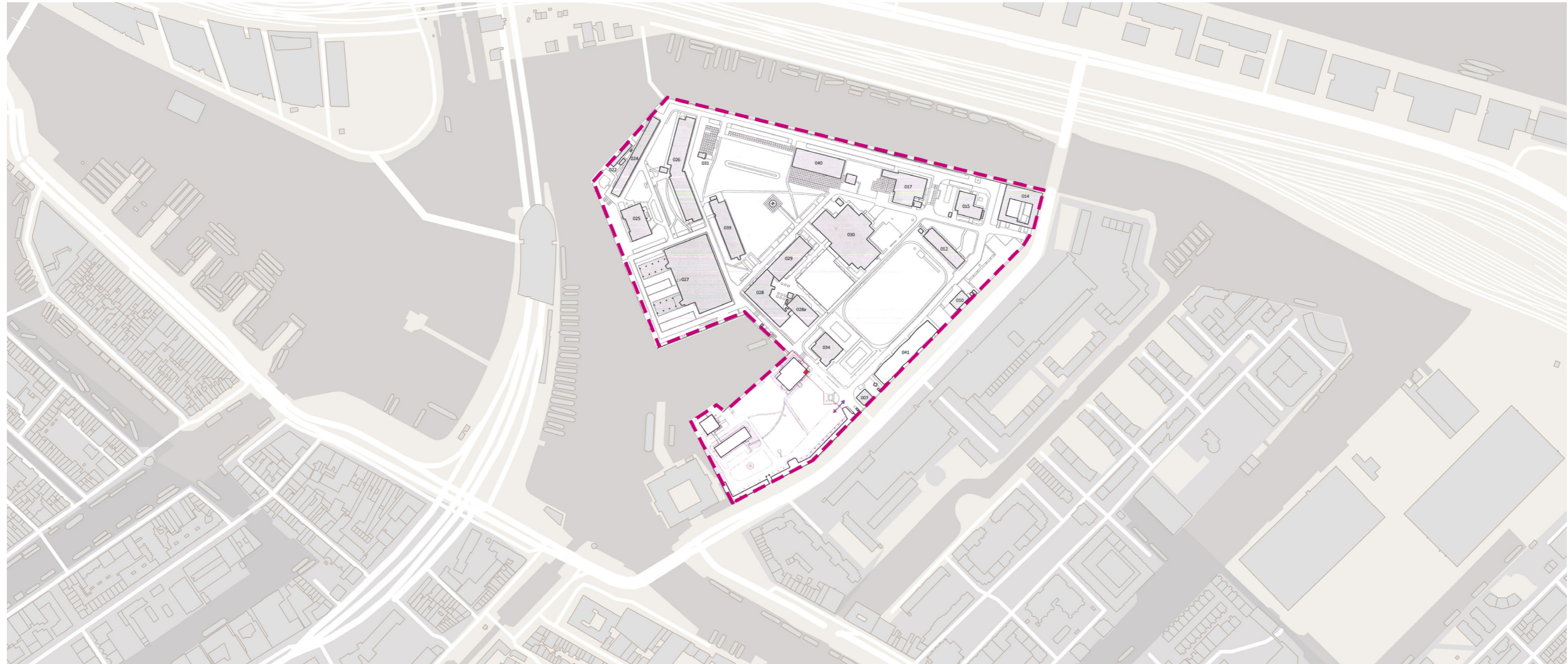
Office space for each worker in Amsterdam -- 24m² average

* Voss, J. (2000). Revisiting office space Standards. Grand Rapids, MI: Haworth, 1-6.

* Report from JLL

Flow

balanced area



REQUIREMENT

OFFICE

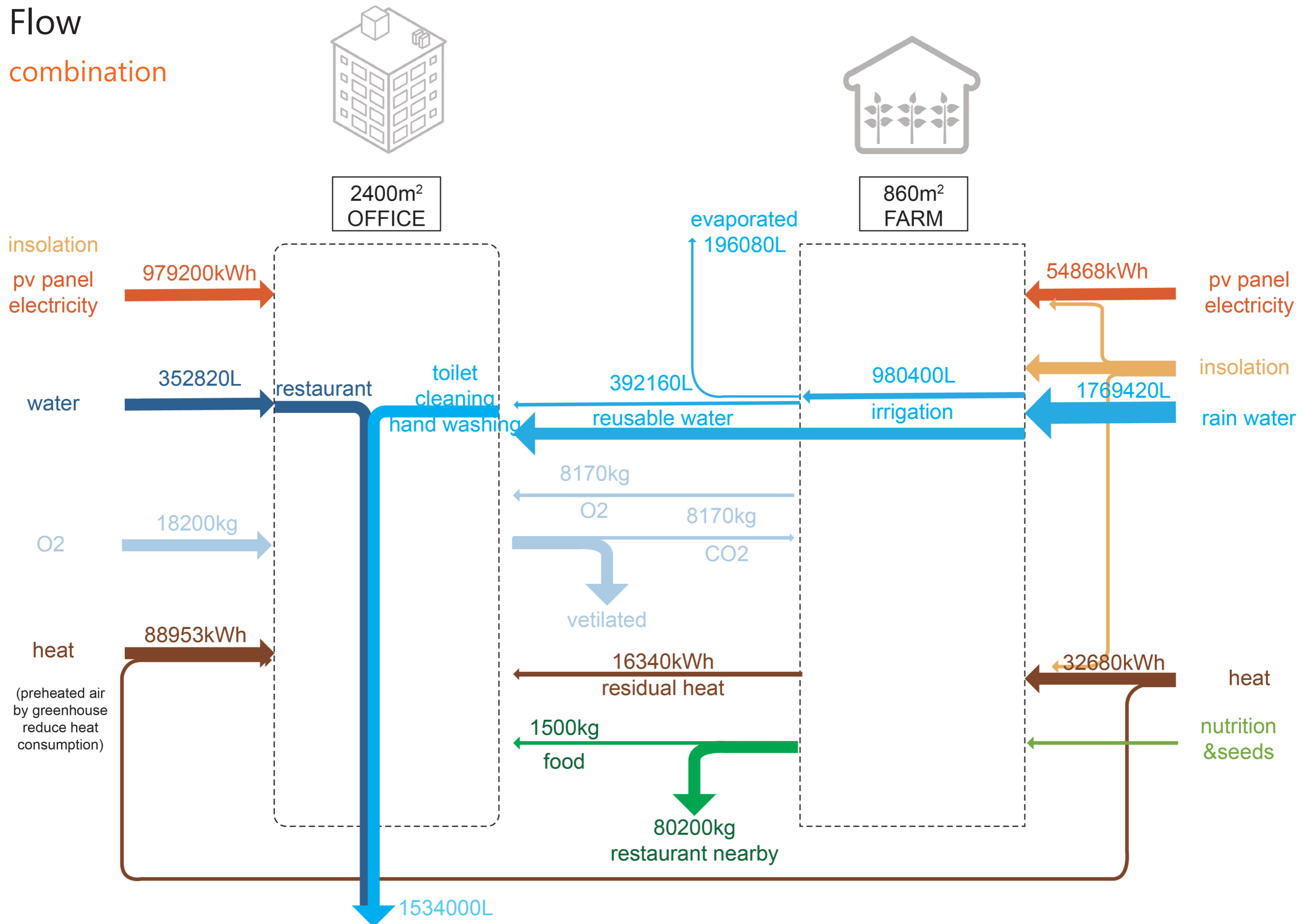
Area.....around 2400 m² (containing around 100 people, 24 m² each in Amsterdam)

FARM

Area..... 800 -1000 m² (daily supply for office and restaurant nearby)

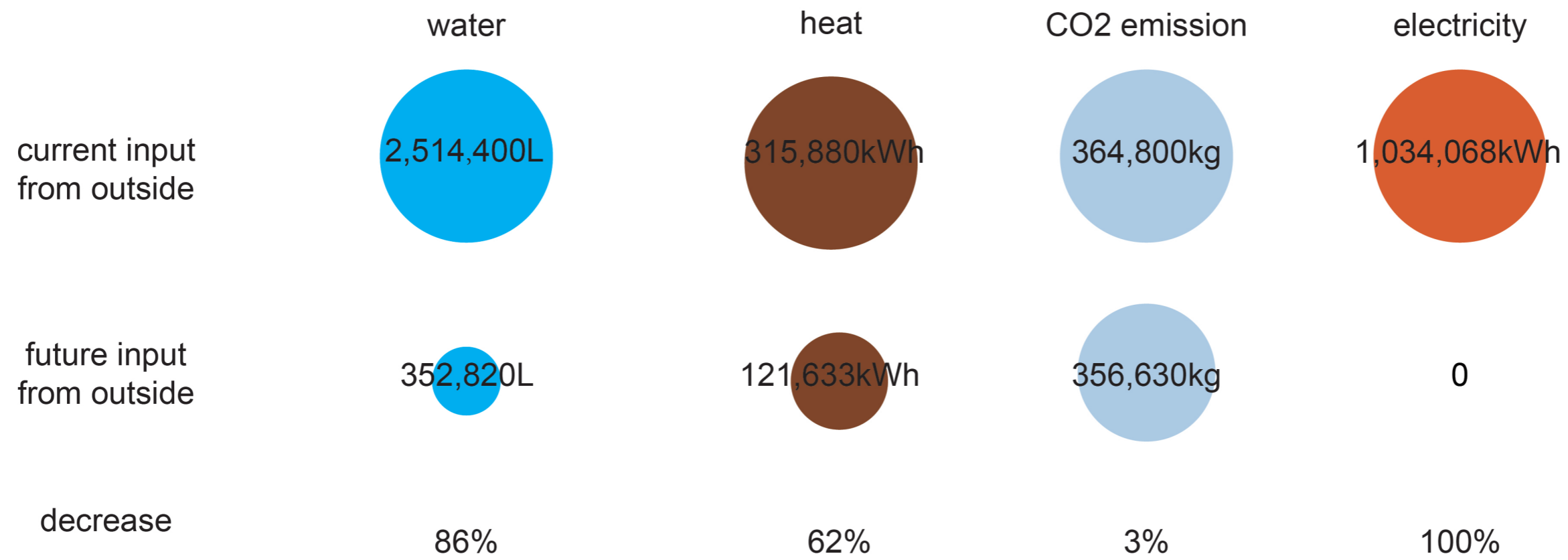
Flow

combination



Flow

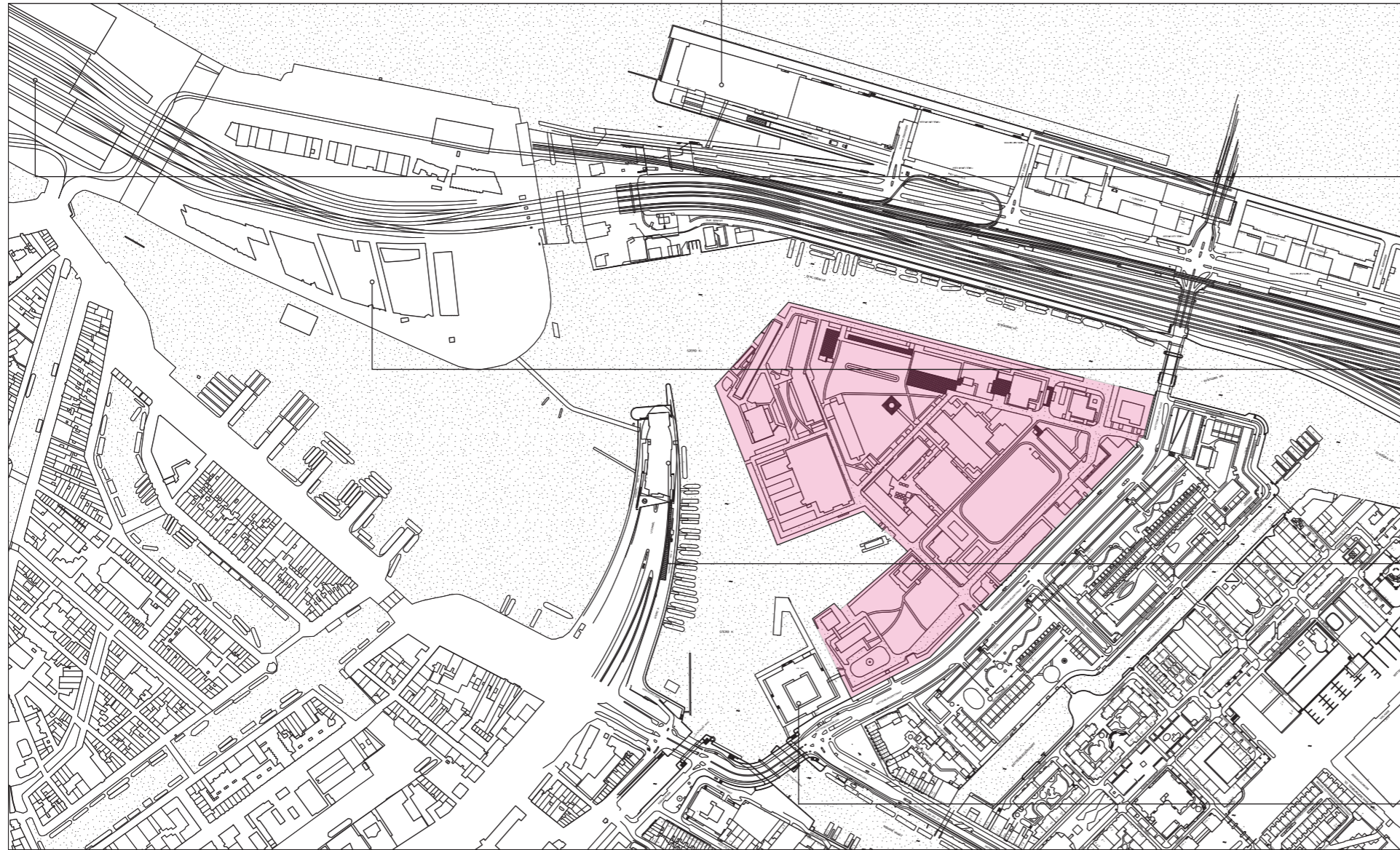
combination



*CO₂ in construction and energy production process not calculated

3. CONCEPTUAL DESIGN |

Surrounding



Muziekgebouw
aan 't IJ
concert hall



Amsterdam
Central Station



Openbare
Bibliotheek
Amsterdam



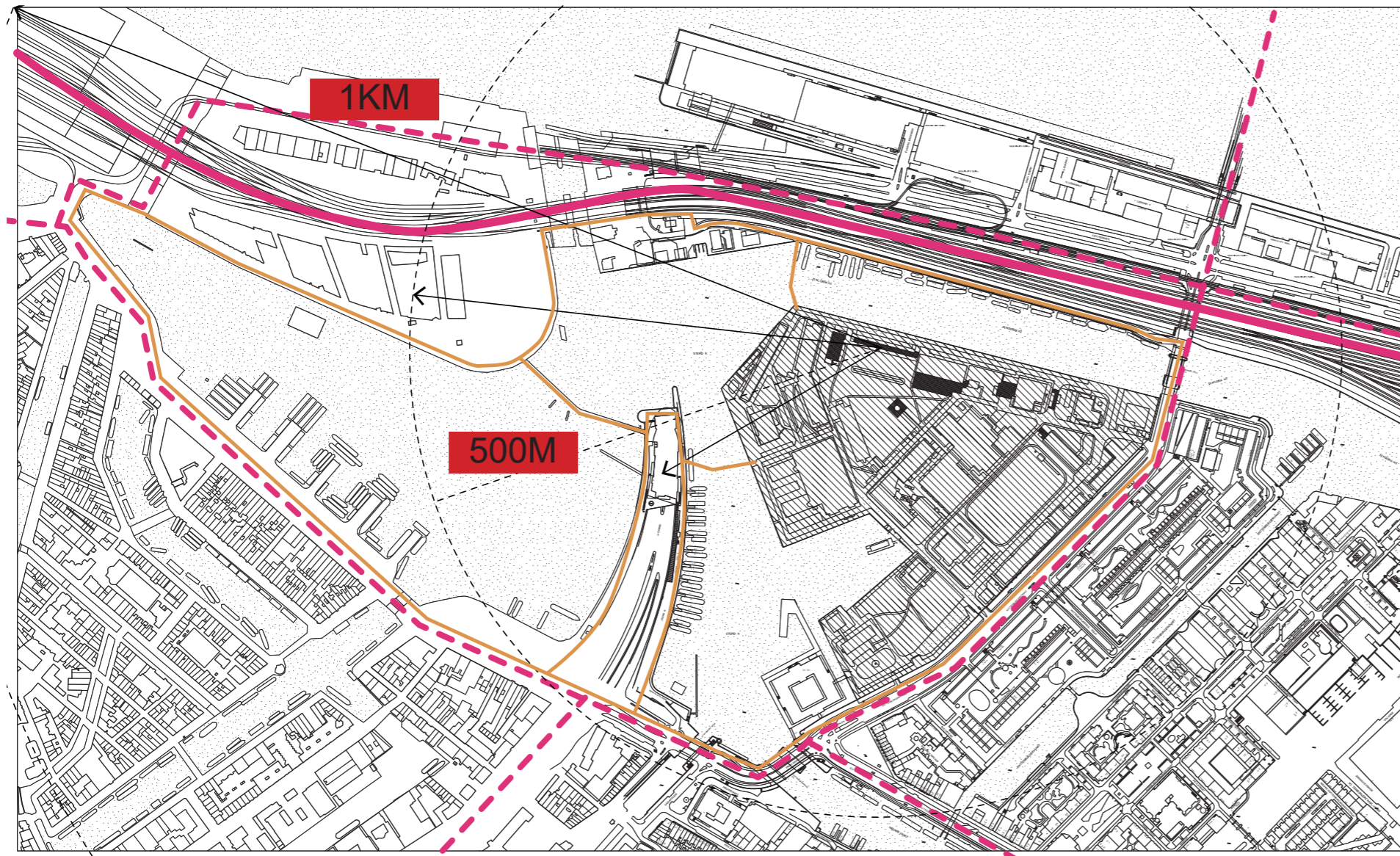
NEMO
Science Museum



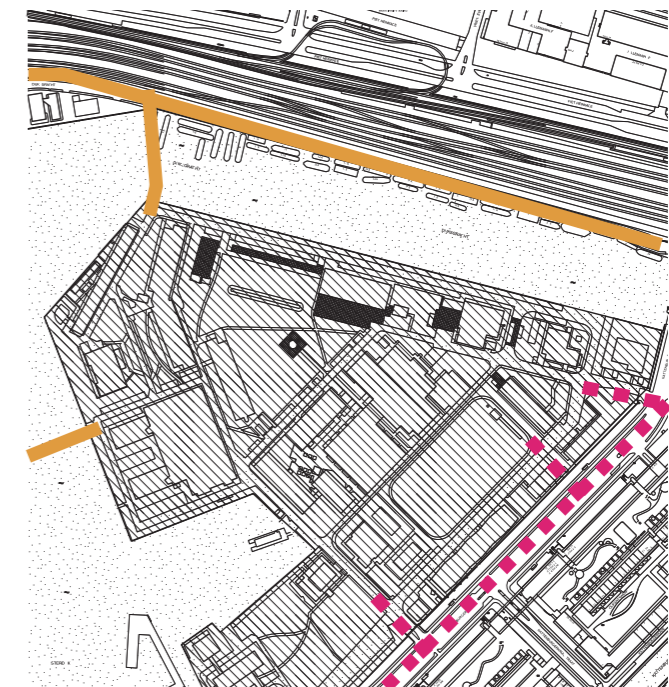
Het
Scheepvaartmuseum

Connect surround

Amsterdam Central Station



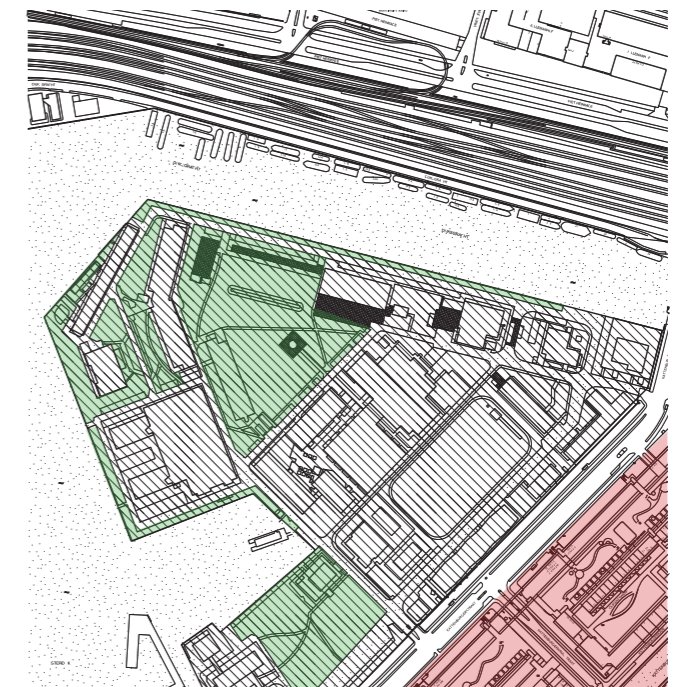
north side easy to reach for office workers





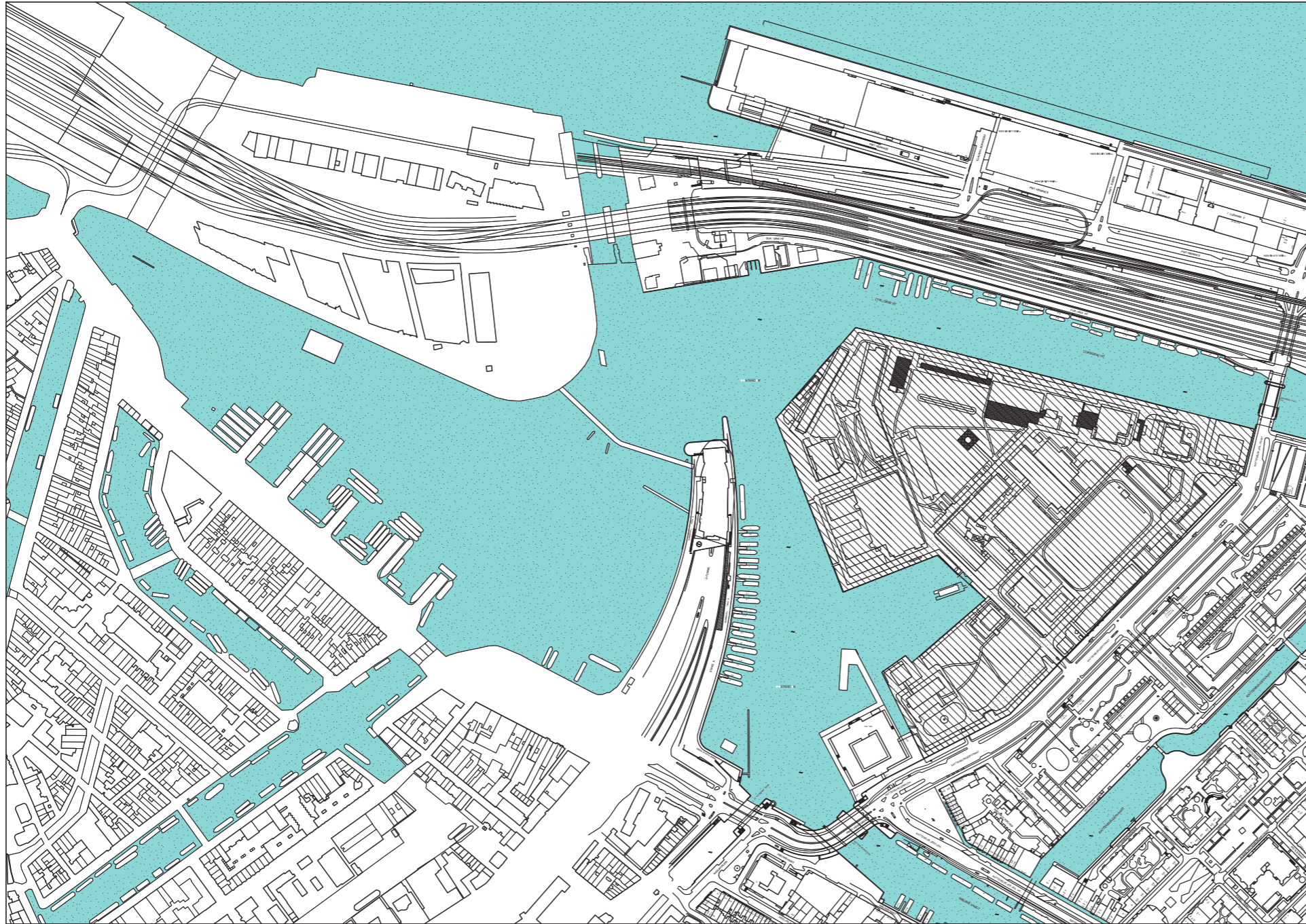
- train
- - - car drive
- bicycle & walk



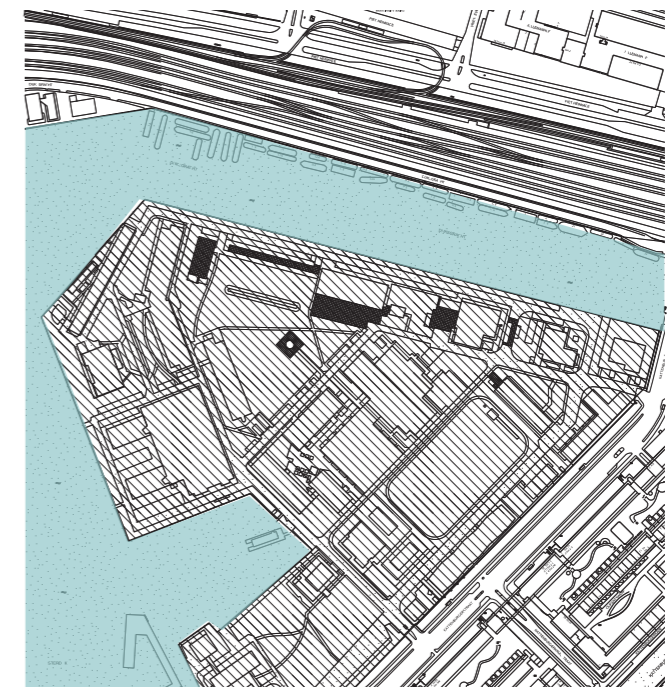
Sub entrance--south side
(Attract citizens nearby)



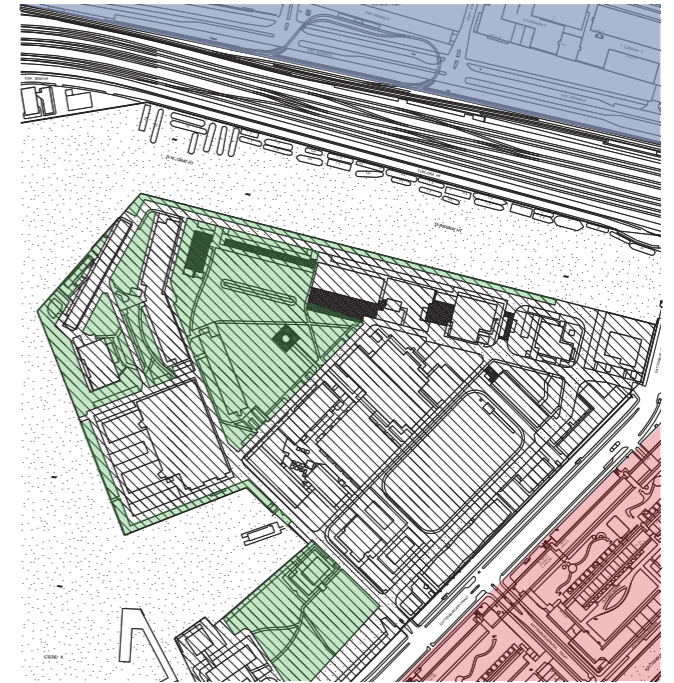
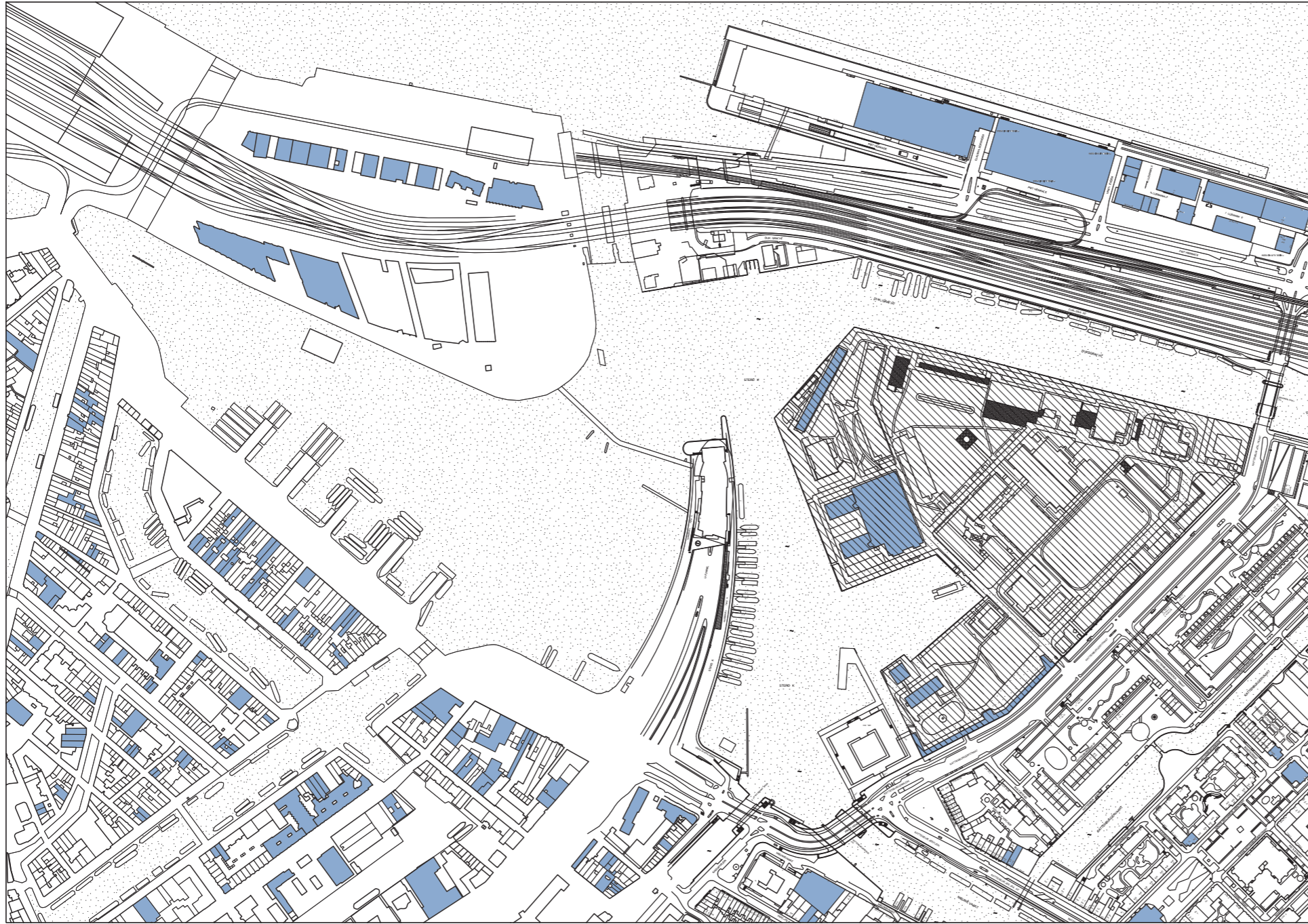
-  Parks & Sports
-  Living areas



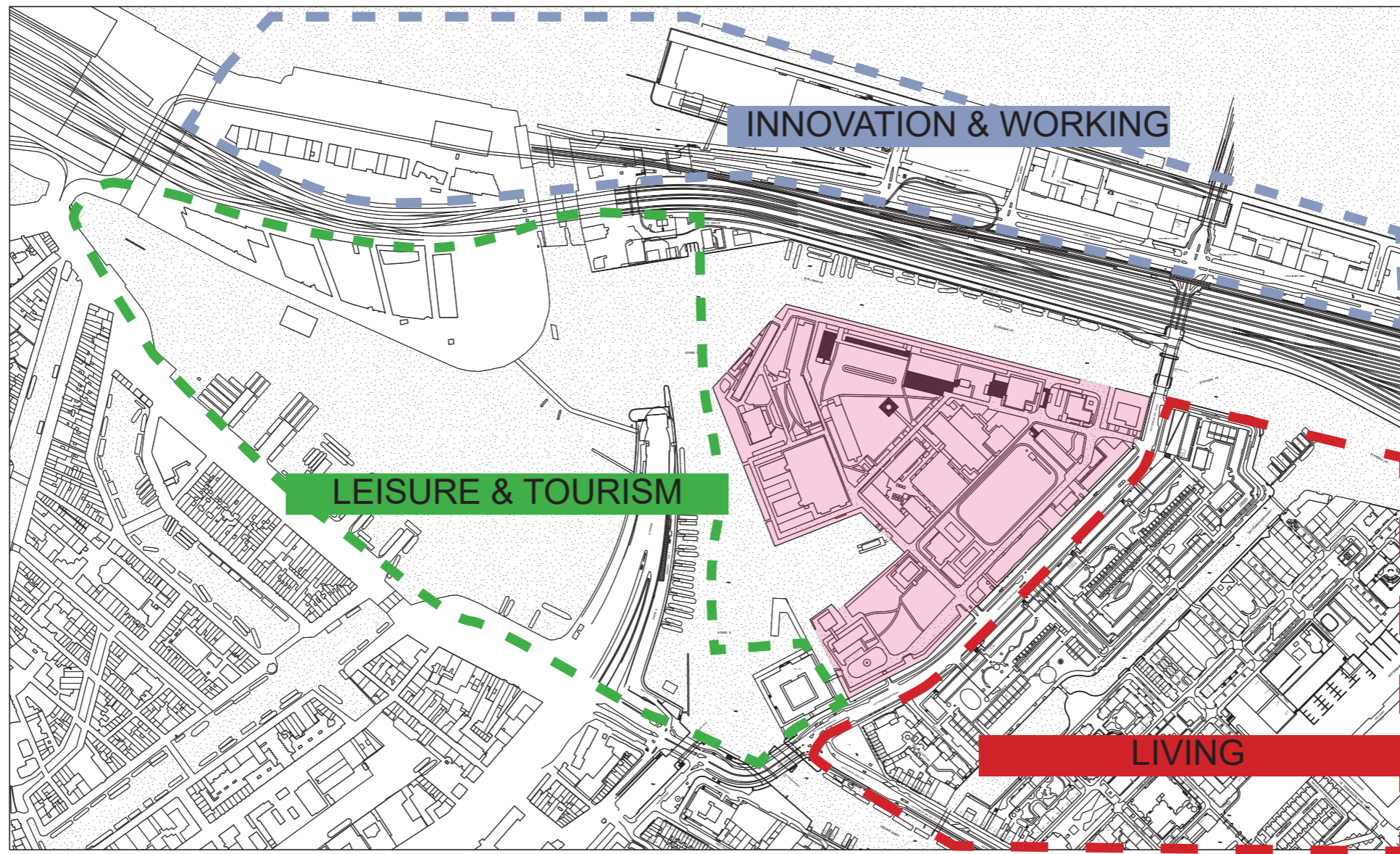
Nice river view on north & east side



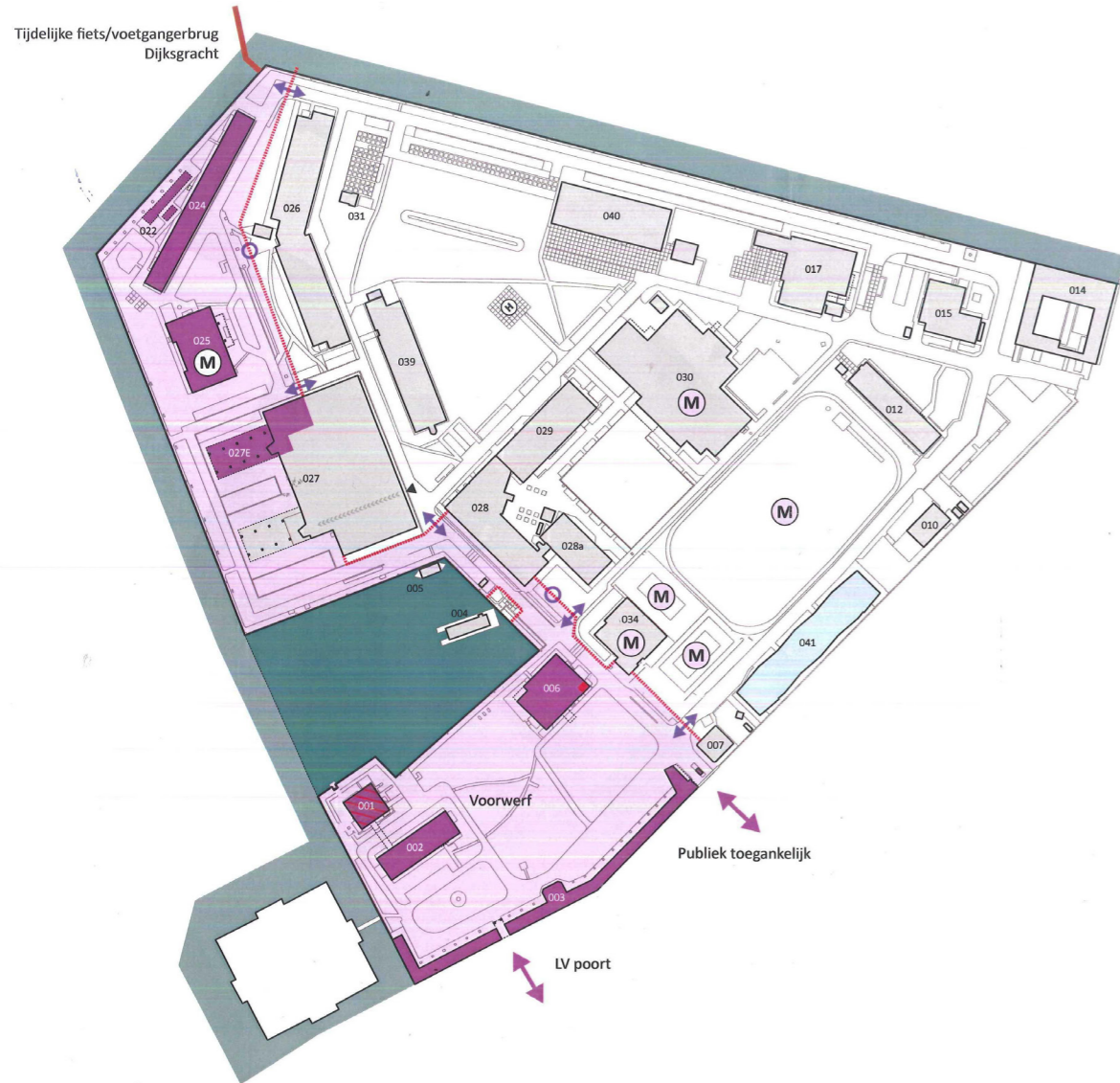
Water



Office buildings



Future development



now



future

- defensie terrein
- defensie gebouwen
- depot Scheepvaartmuseum
- publiek toegankelijk terrein
- publiek toegankelijk water
- overgedragen gebouwen
- defensiebelang
- medegebruik na EU16
- afscheiding, gaashek
- mil. gecontroleerde toegang

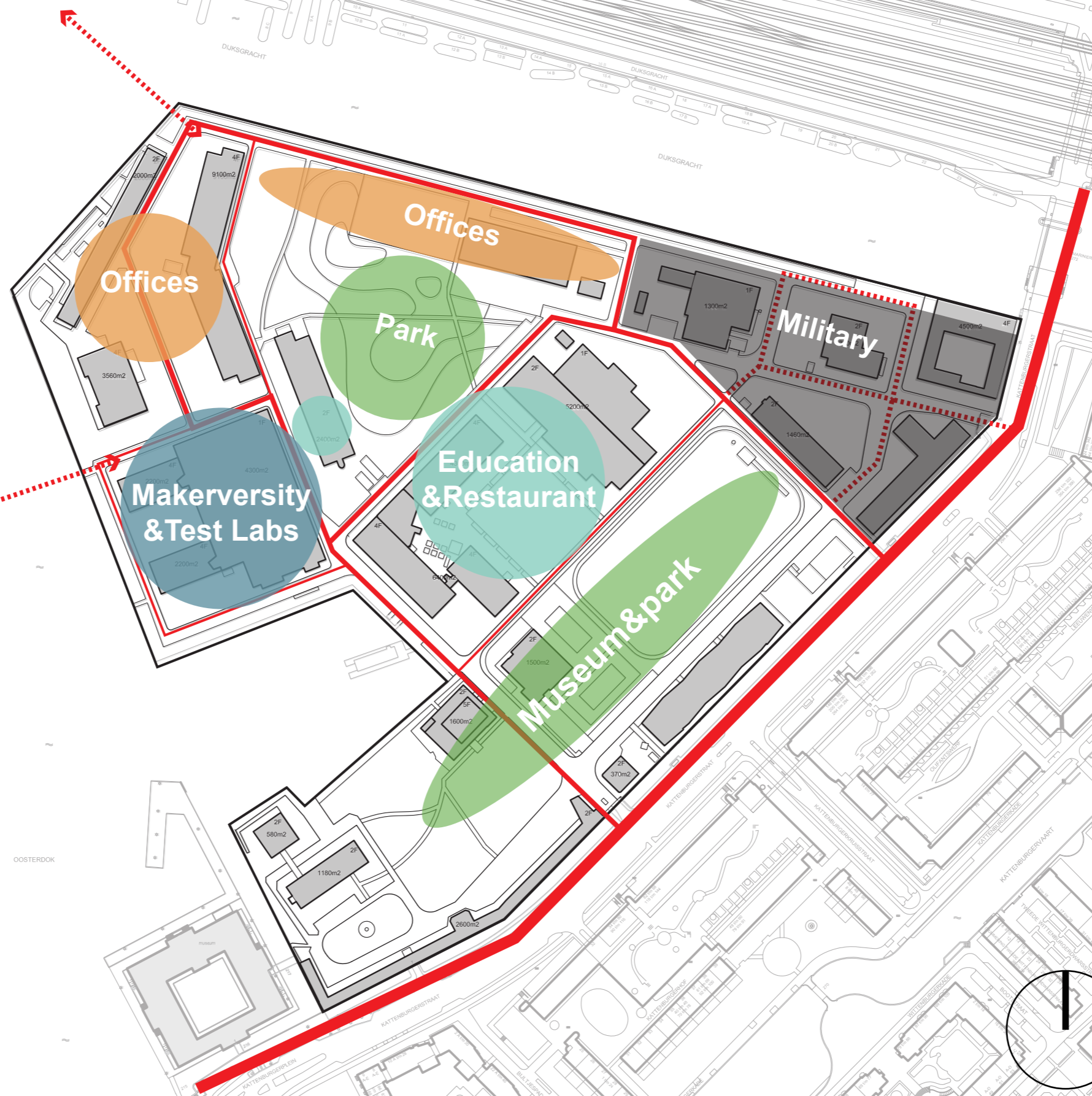
Fase 4 vanaf jul '18
 zonering Marineterrein
 versie 5.2
 02 september 2015

A3 / 1:2000

0 m 50 m 100 m 150 m

Bureau MARINETERREIN Amsterdam

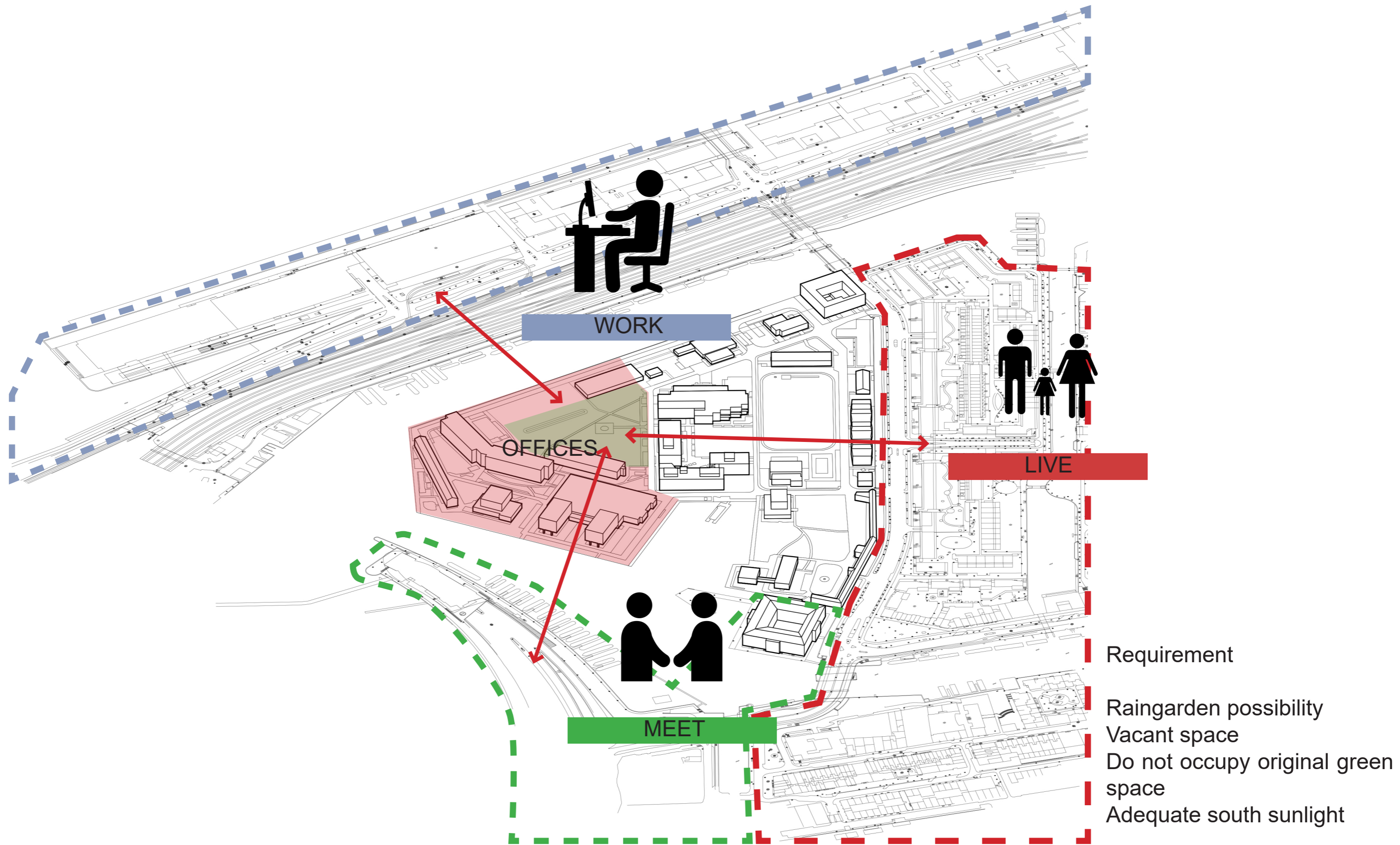
Future masterplan



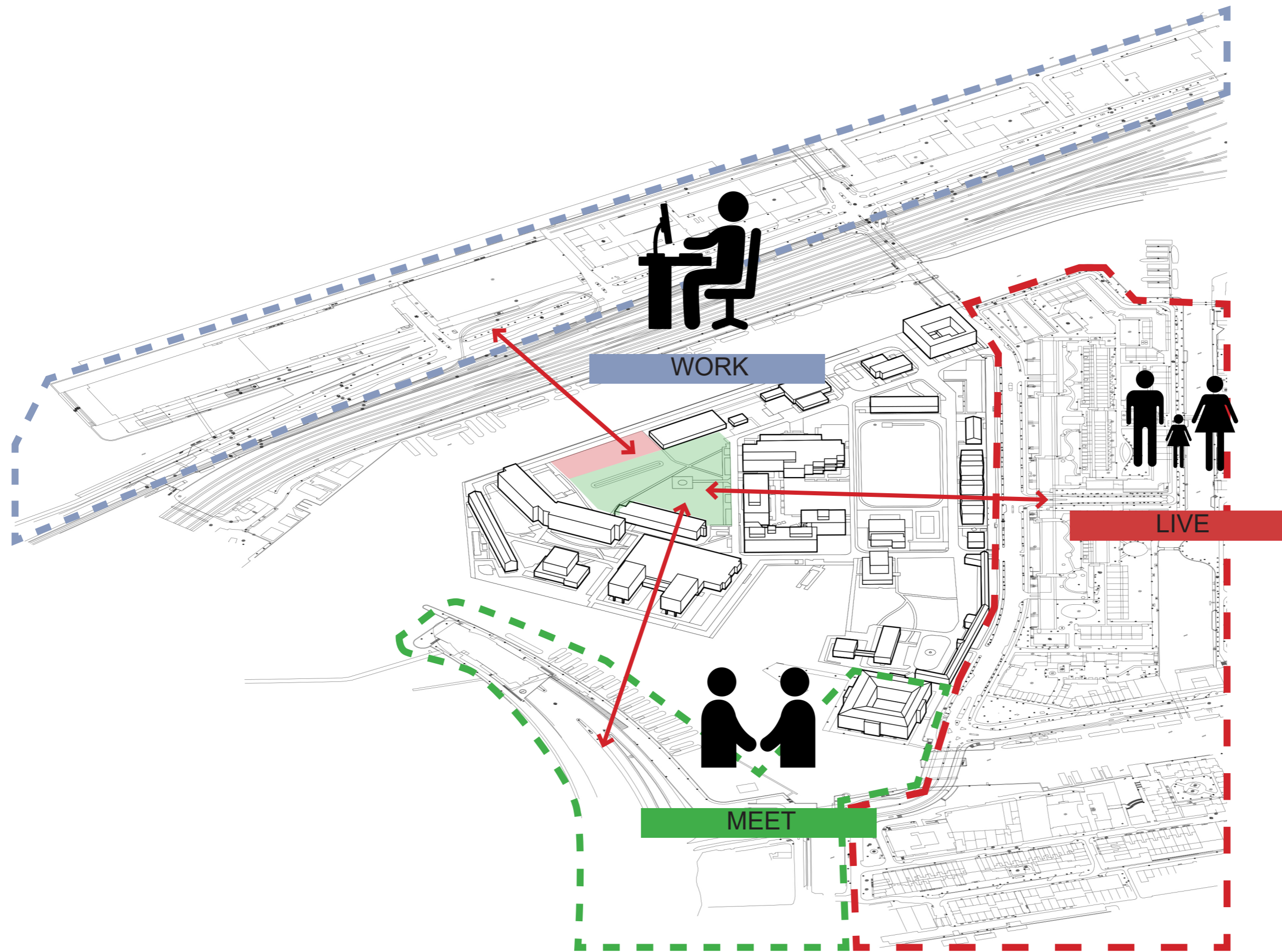
Future green development



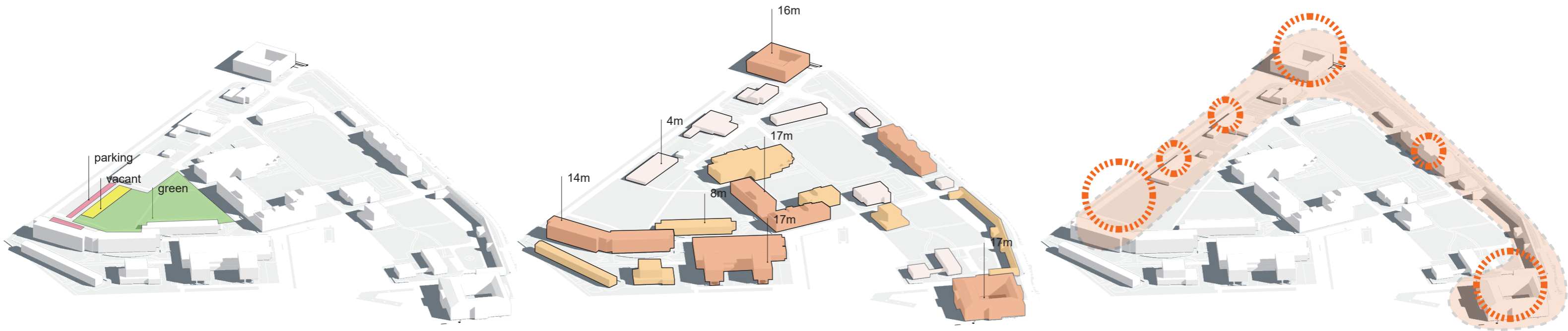
Potential location



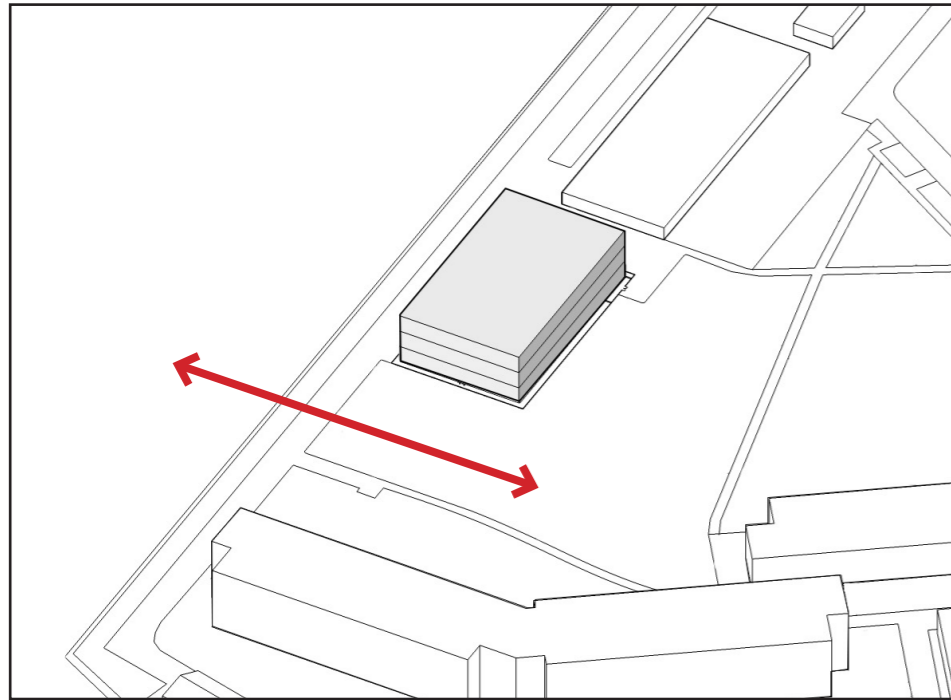
Potential location



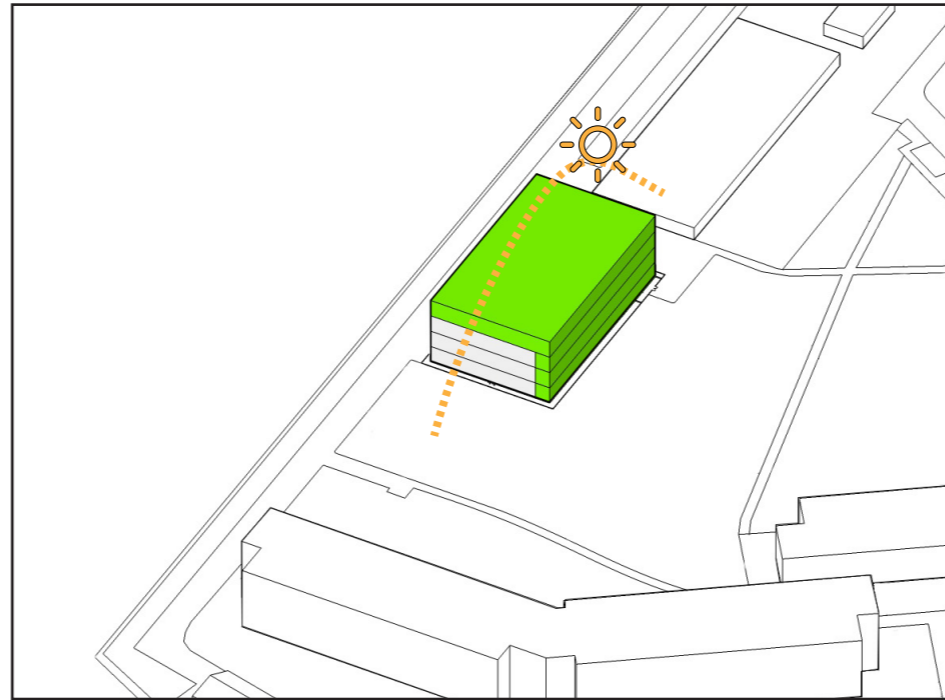
Conceptual design



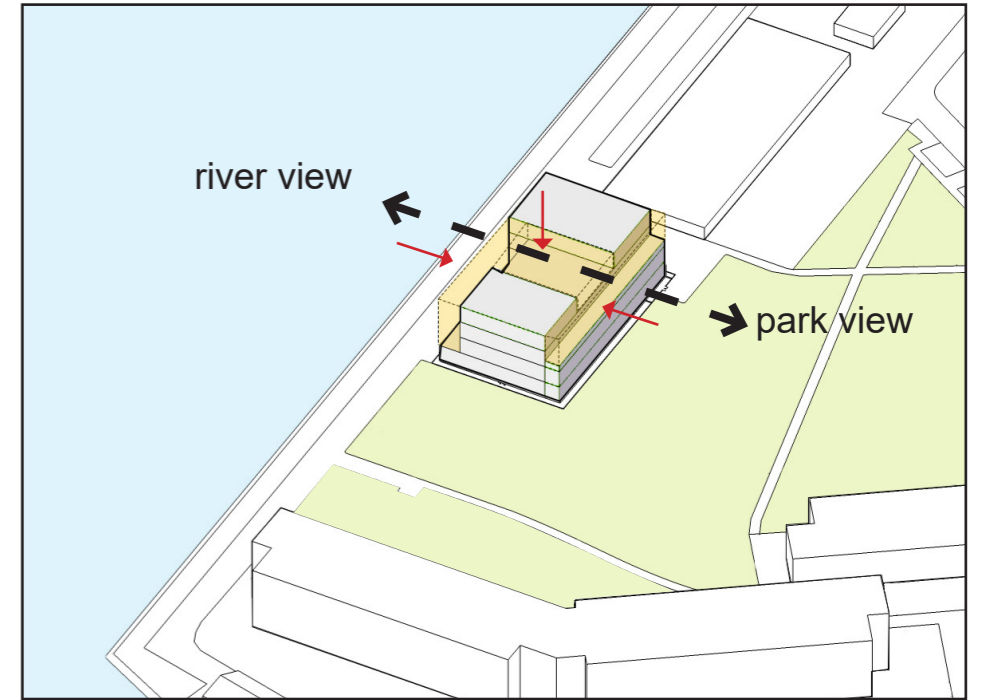
Conceptual design



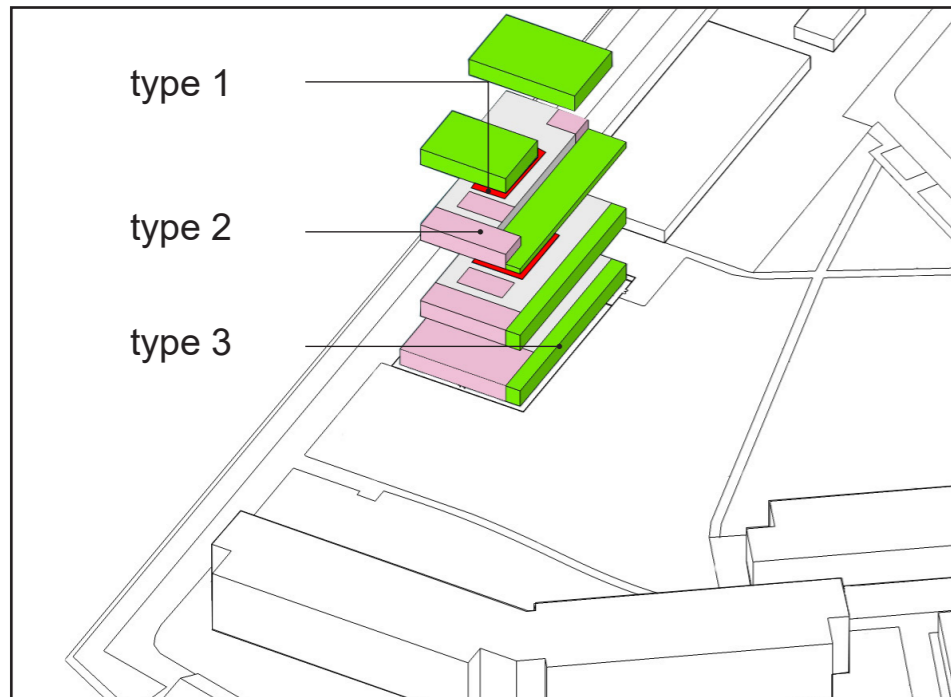
STEP 1.
Office box
Use existing parking plot



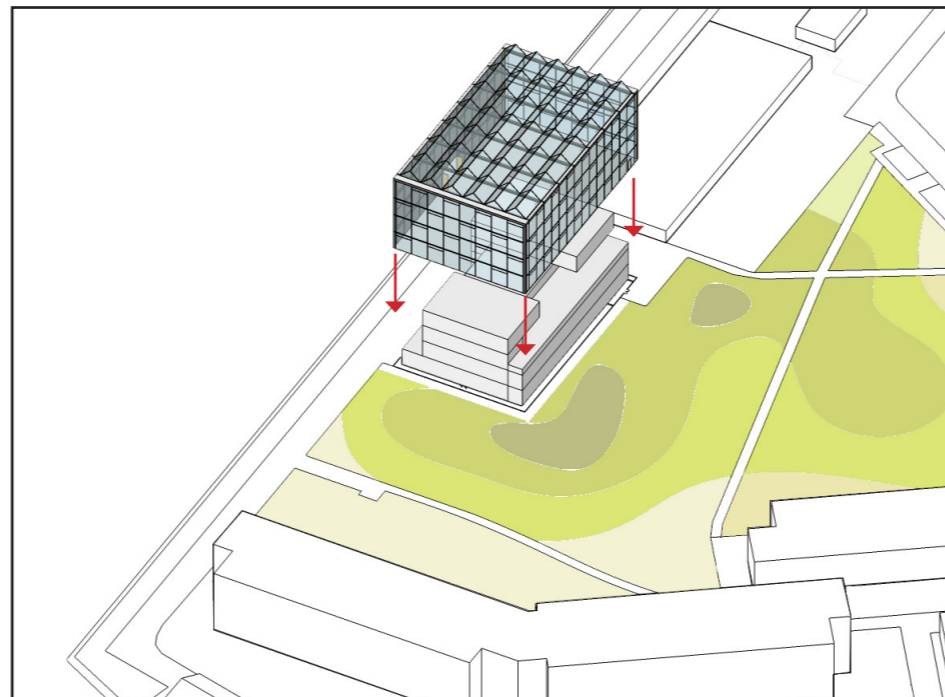
STEP 2.
Add farming



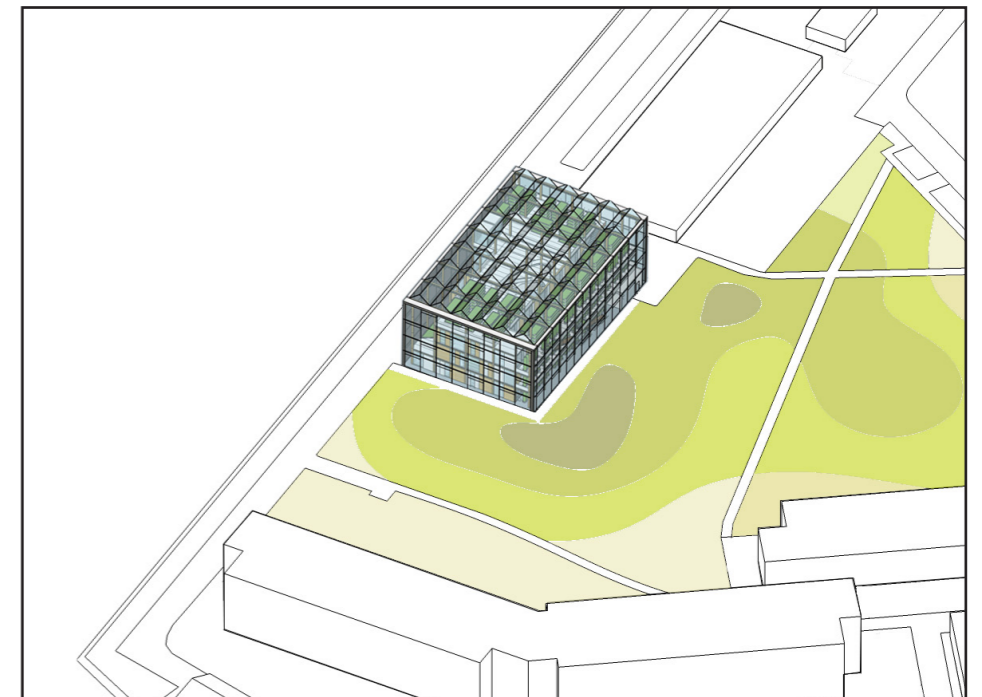
STEP 3.
Terrace creation



STEP 4.
Typology divide



STEP 5.
Add envelope
Raingarden design



FINAL.
Farmwork





KONINK



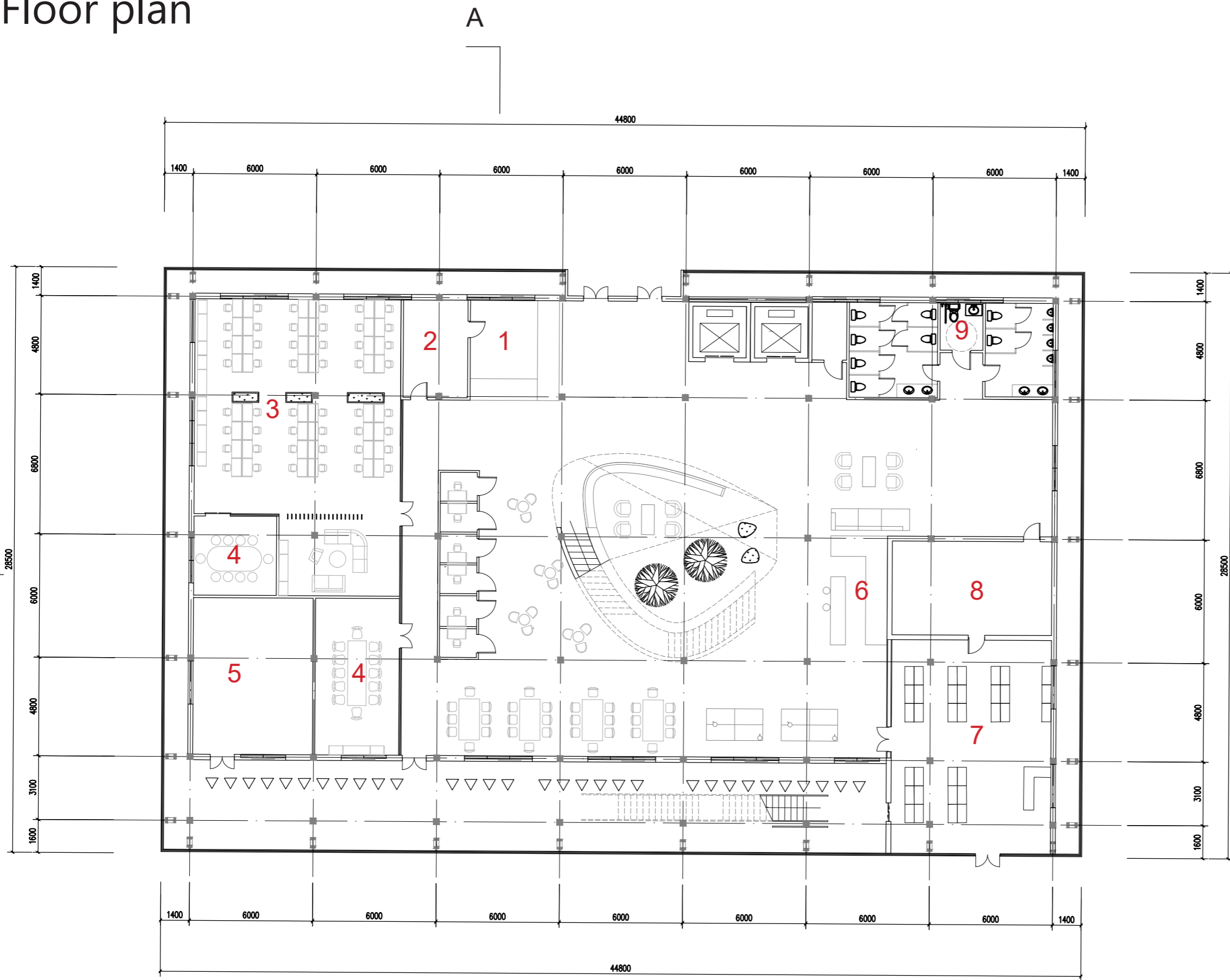


4. FINAL DESIGN |

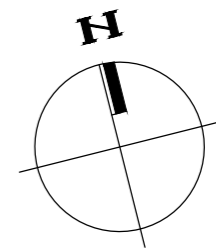
Masterplan



Floor plan

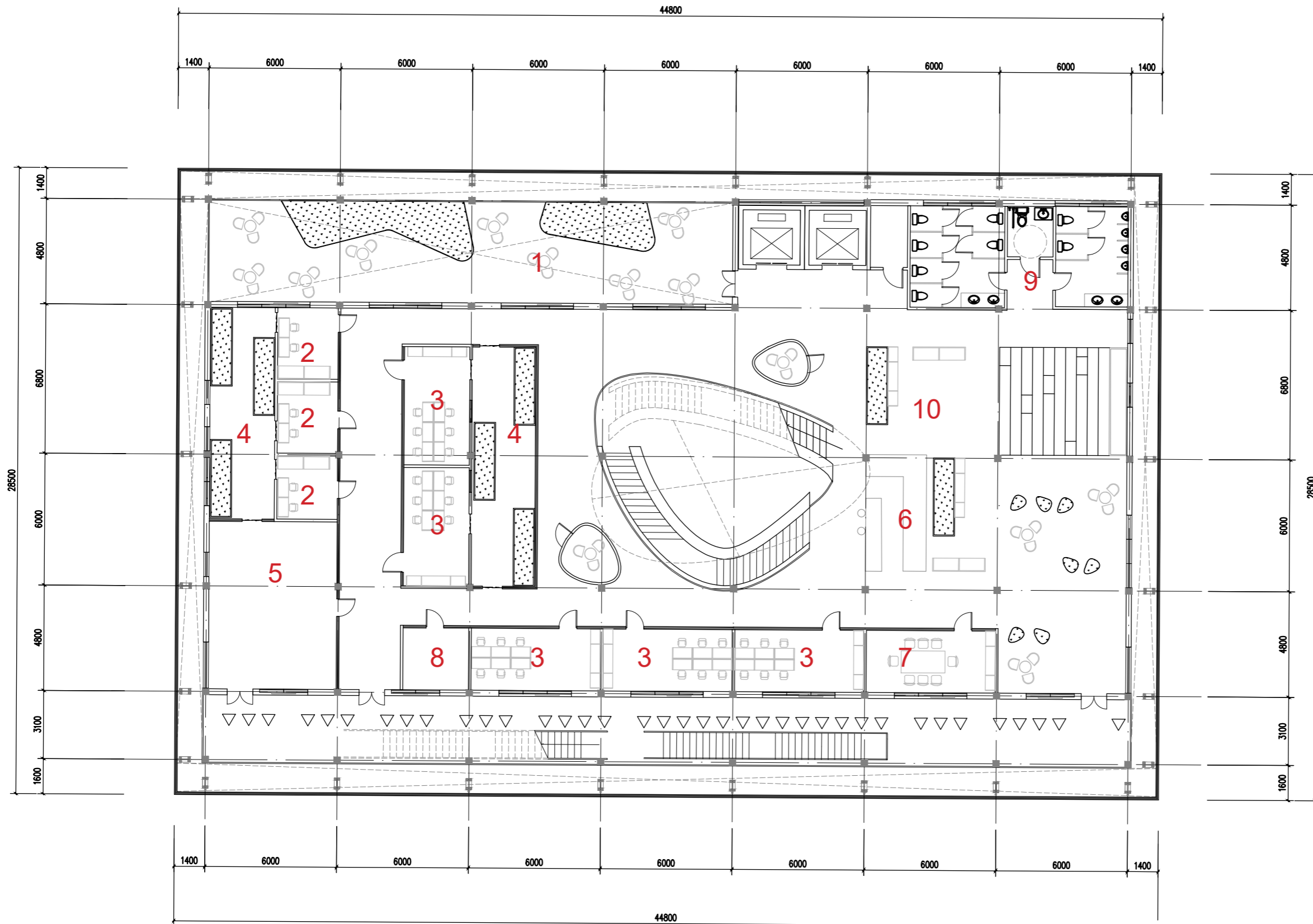


1. reception
2. storage room
3. dedicated desk office
4. meeting room
5. farm machine room
6. pantry
7. market
8. market storage room
9. toilet



OF

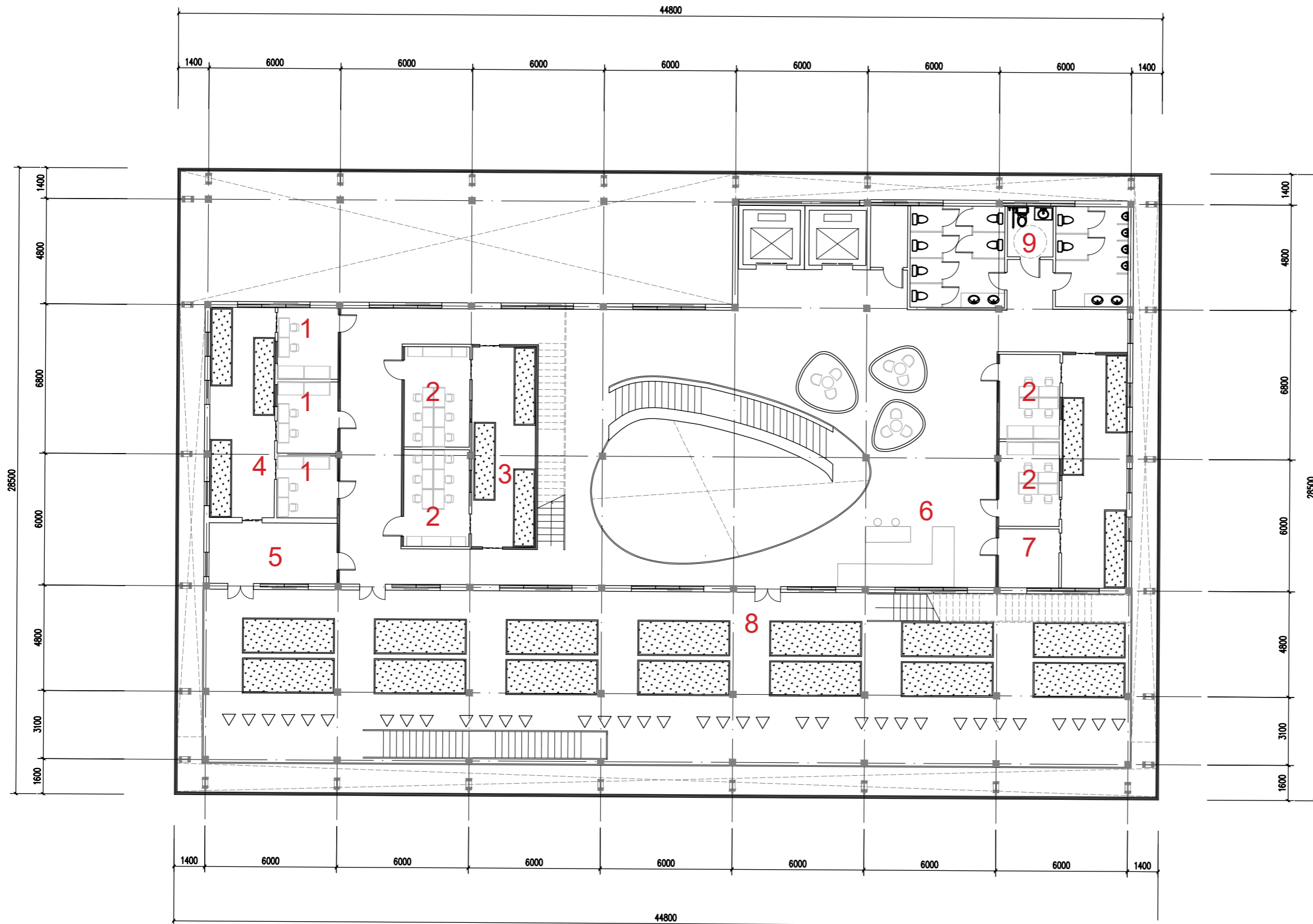
Floor plan



1. terrace
2. 2 ppl private office
3. 6 ppl private office
4. farming room
5. farm machine room
6. pantry
7. meeting room
8. printing room
9. toilet
10. reading&media

1F

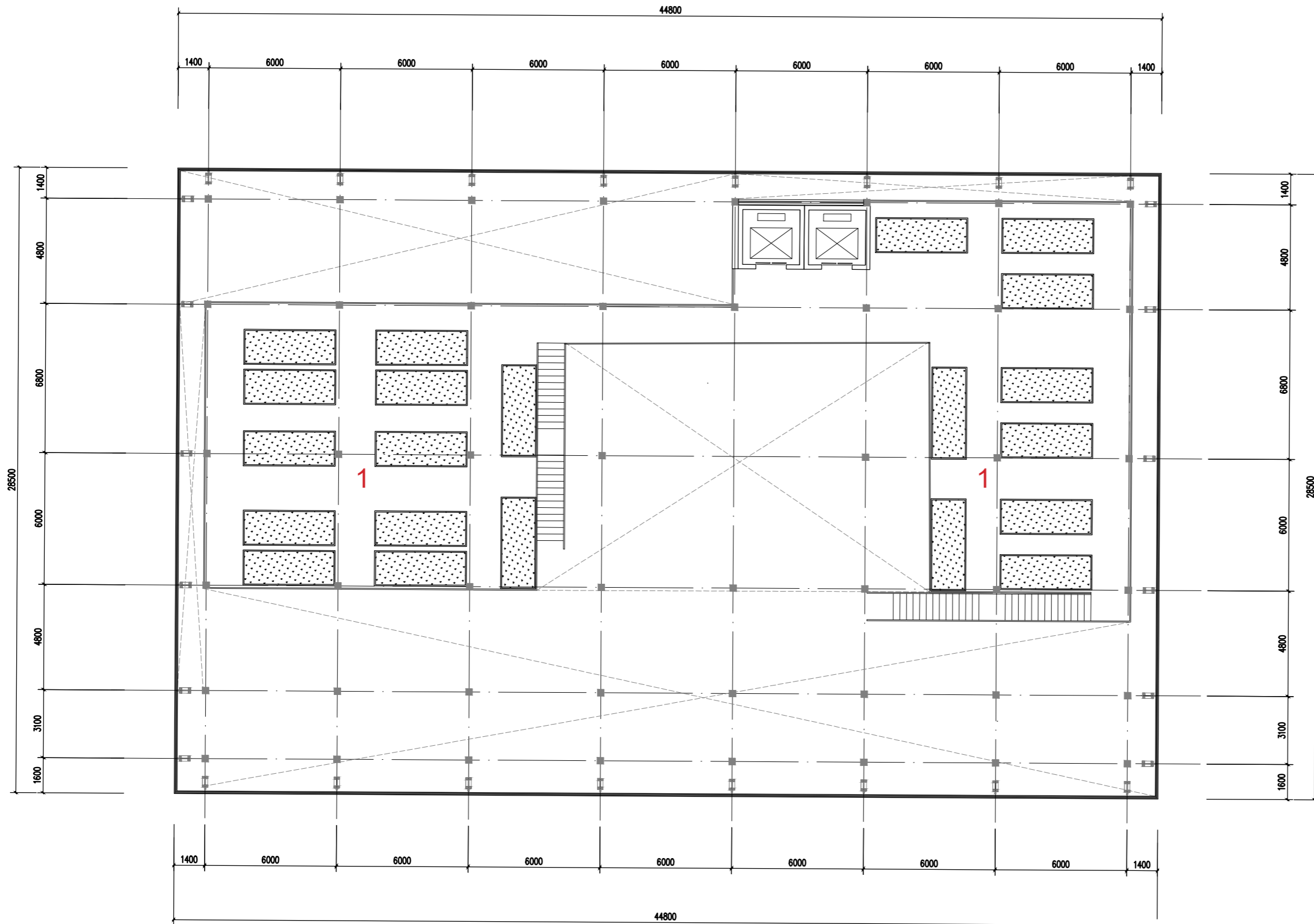
Floor plan



- 1. 2 ppl private office
- 2. 6 ppl private office
- 3. 4 ppl private office
- 4. farming room
- 5. farm machine room
- 6. pantry
- 7. printing room
- 8. farm
- 9. toilet

2F

Floor plan



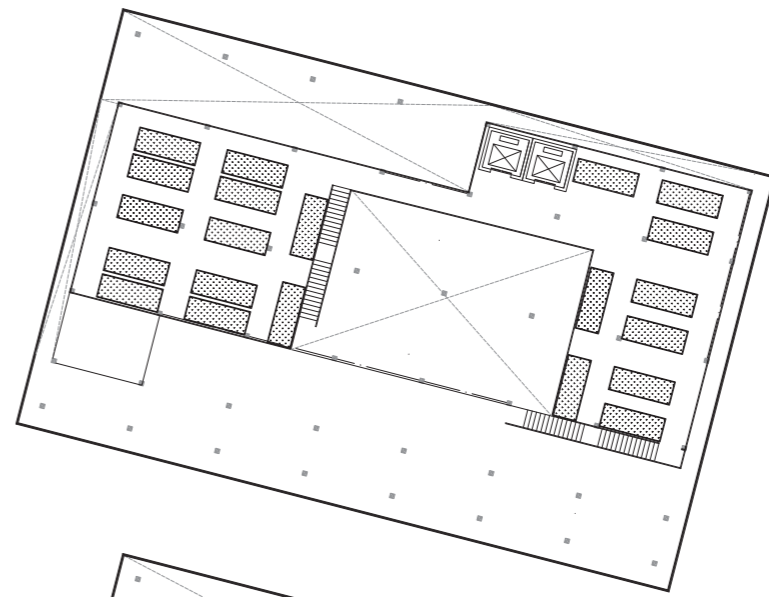
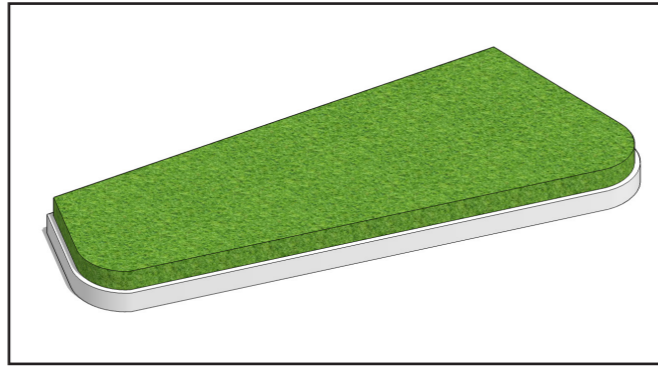
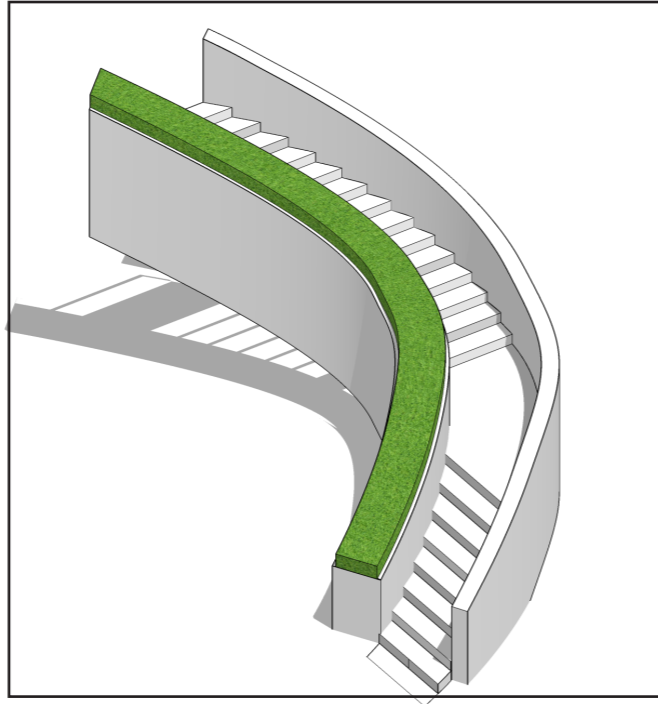
1. farm

3F

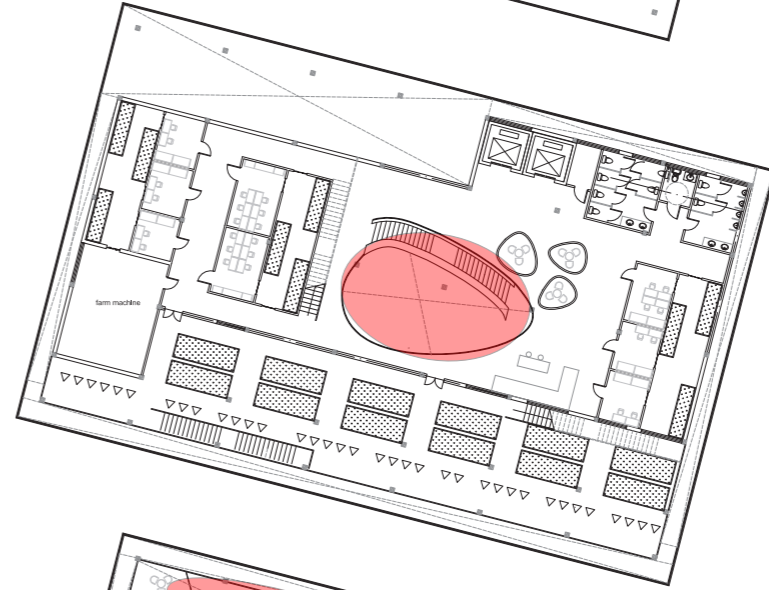
TYPE 1



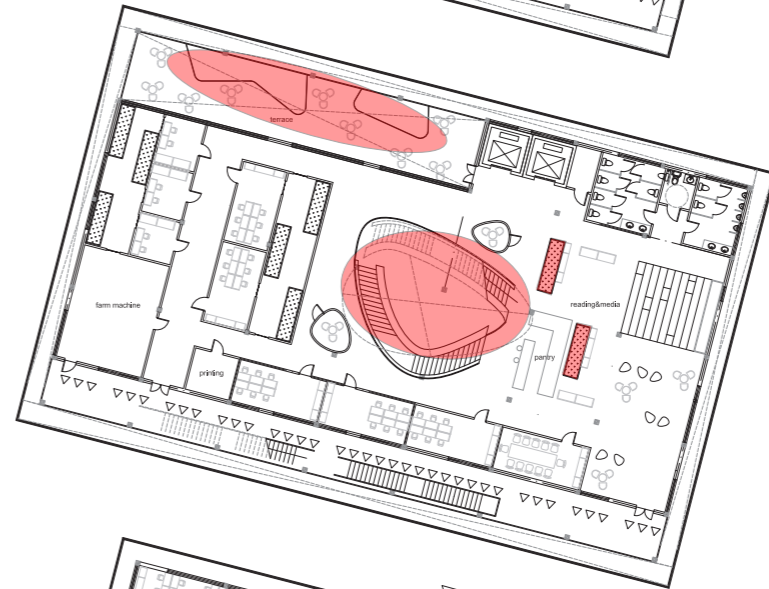
soil-based
decoration



3F



2F

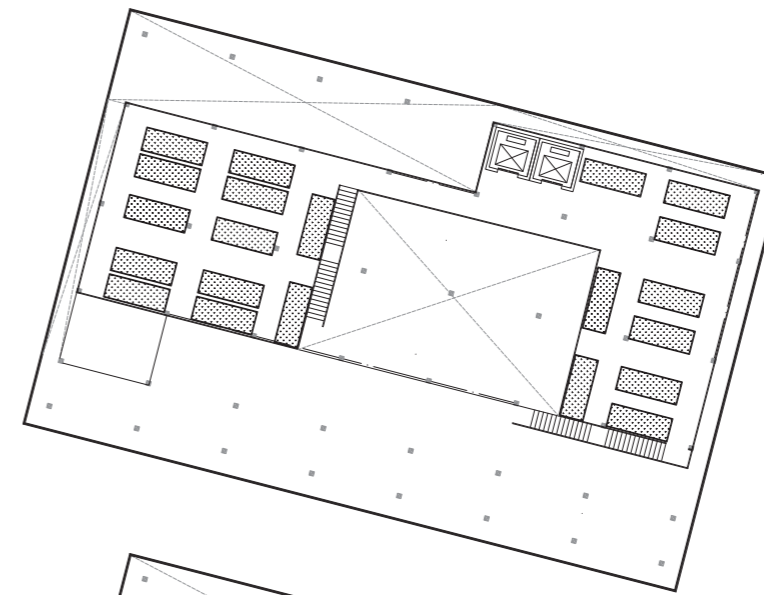
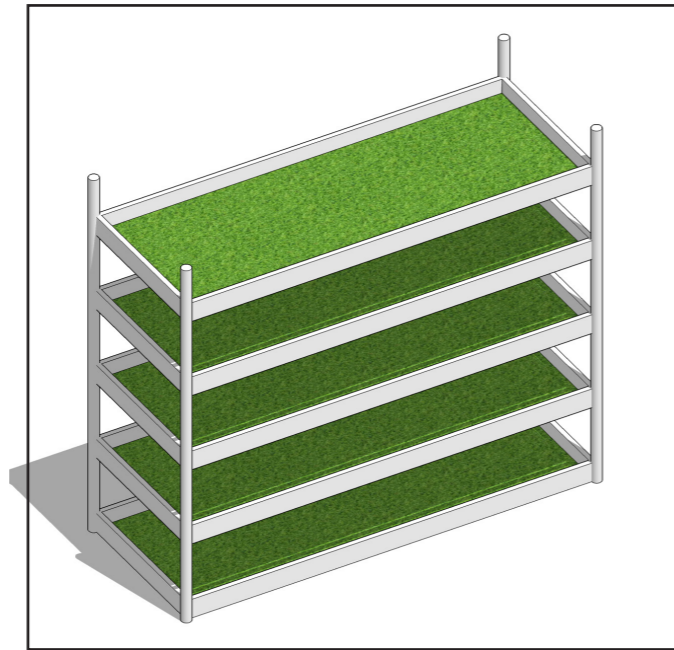


1F

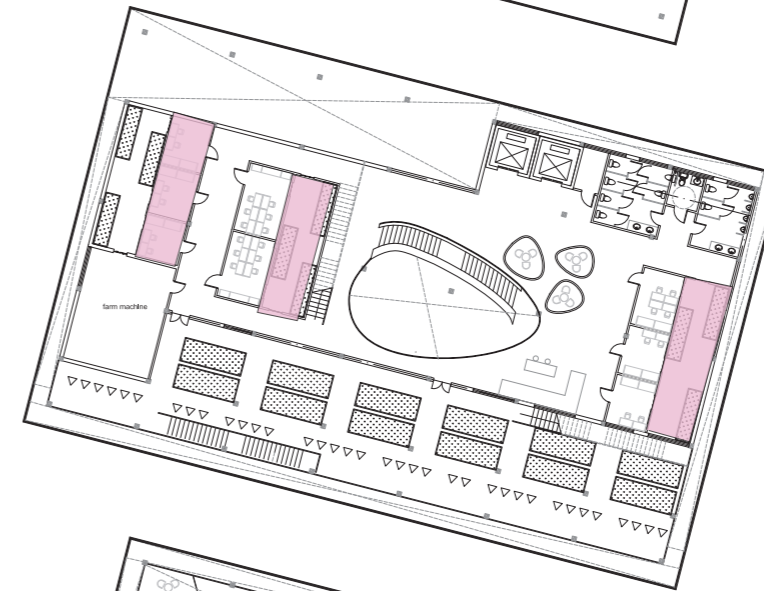


0F

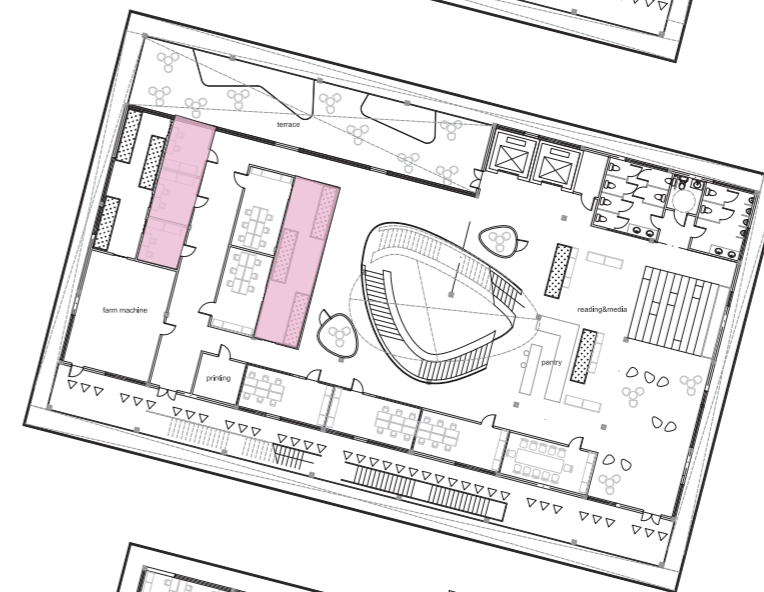
TYPE 2
hydroponic
decoration, production
LED suppliment



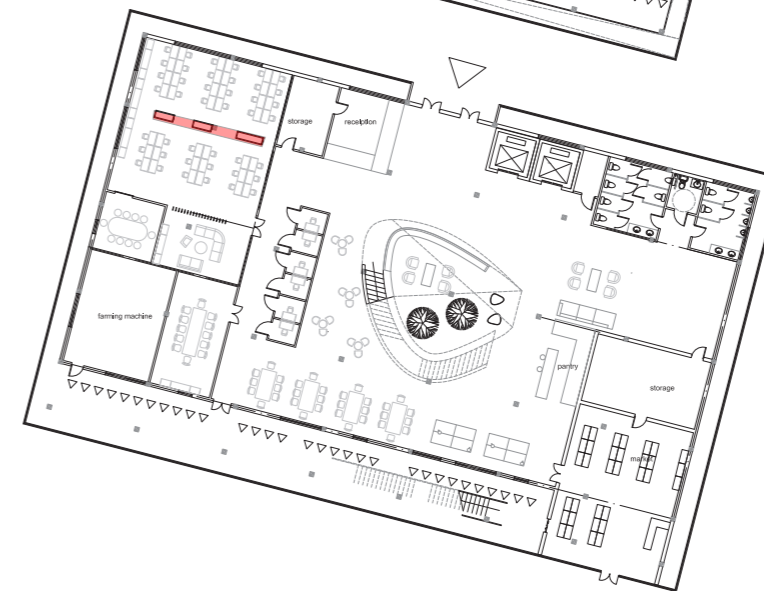
3F



2F



1F

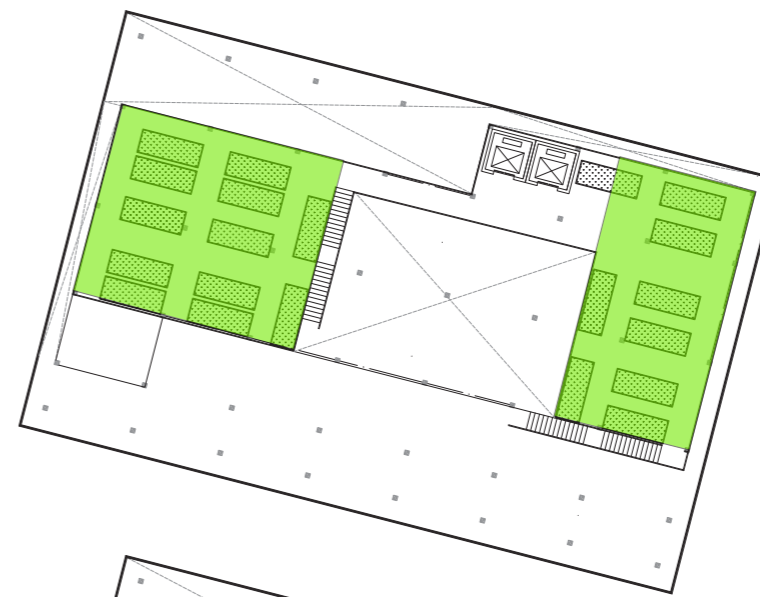
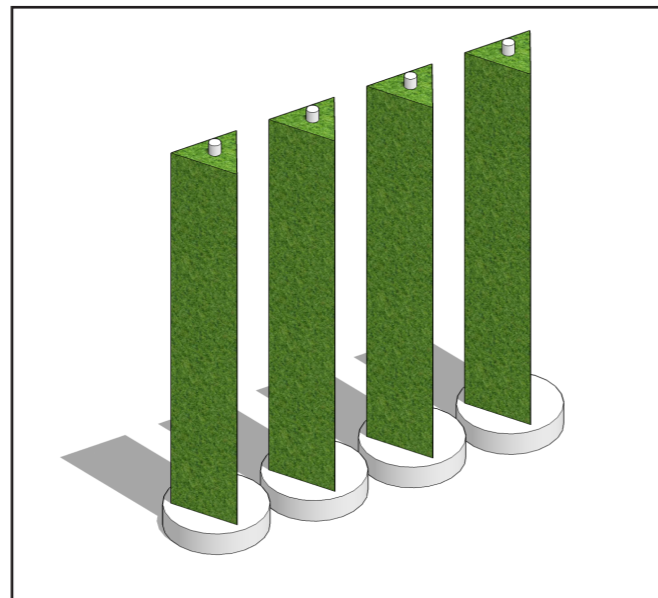
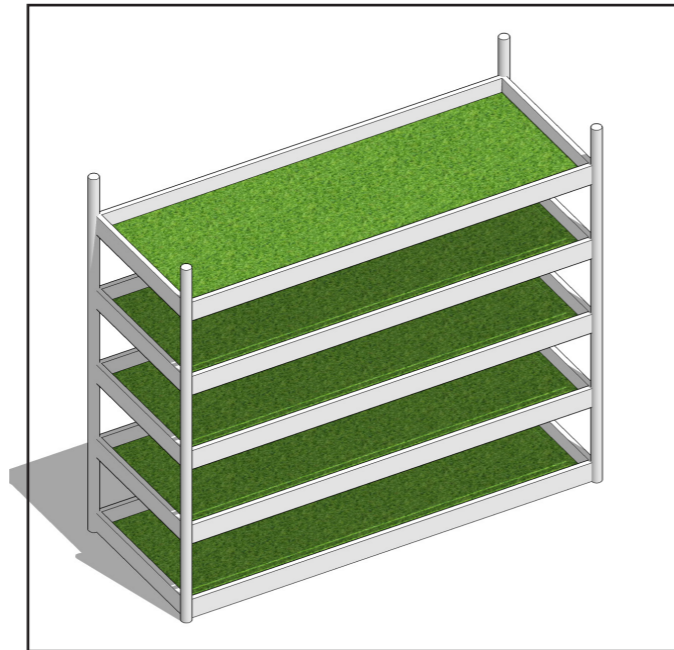


0F

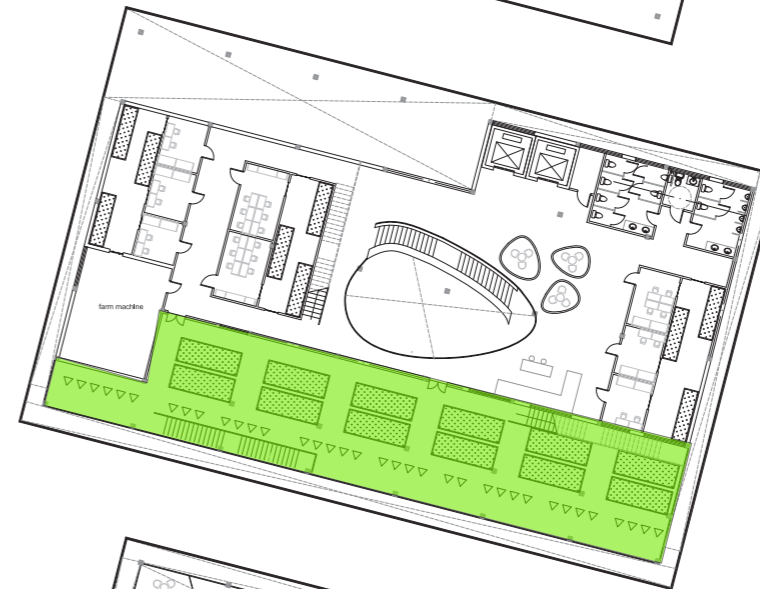
TYPE 3



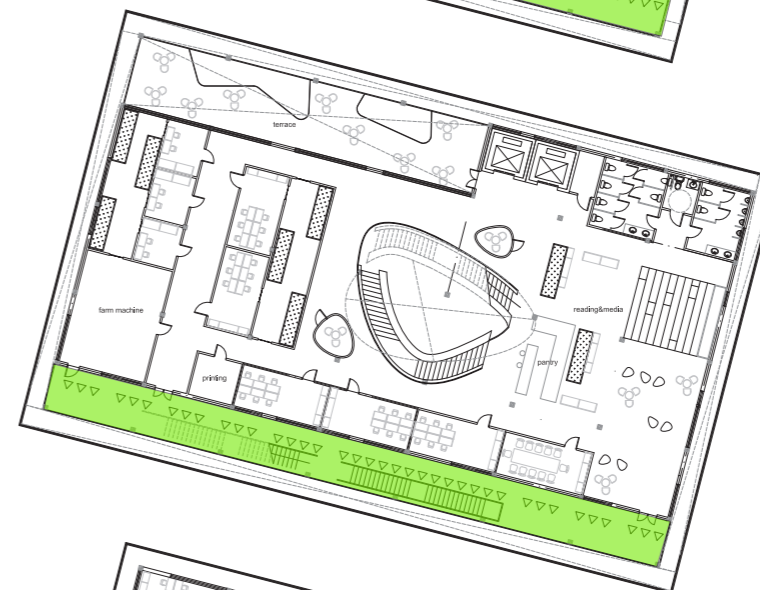
hydroponic
mass production



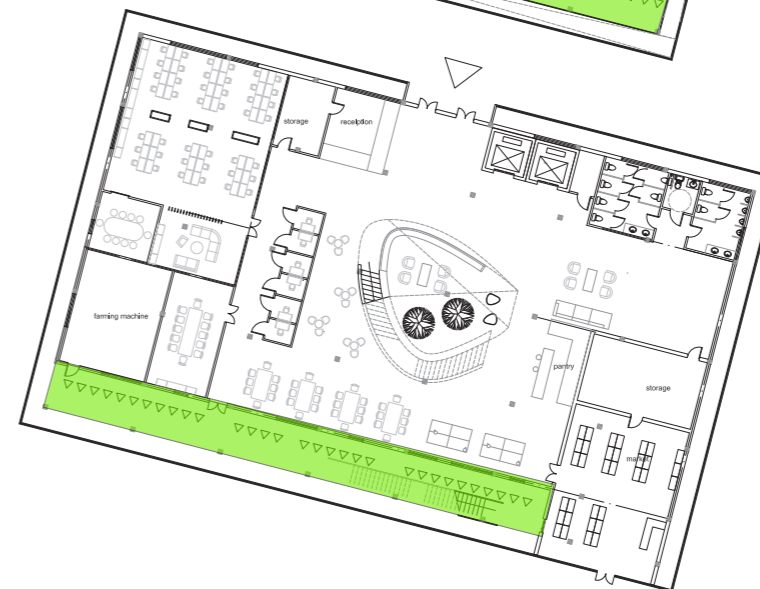
3F



2F



1F



0F

Indoor farming

Hydroponic vertical greenhouse--810m²

Yield: 95kg/m²

Water consumption: 1140L/m²

water recycle rate: 40%

Electricity: 63.8kWh/m²

CO₂ consumption: 1/10 crop weight

O₂ production: 1/10 crop weight

Heat consumption: 38kWh/m²

Total production: 76950kg

Traditional soil based farm--50m²

Yield: 9.16kg/m²

Water consumption: 64L/kg

water recycle rate: 40%

Electricity: 63.8kWh/m²

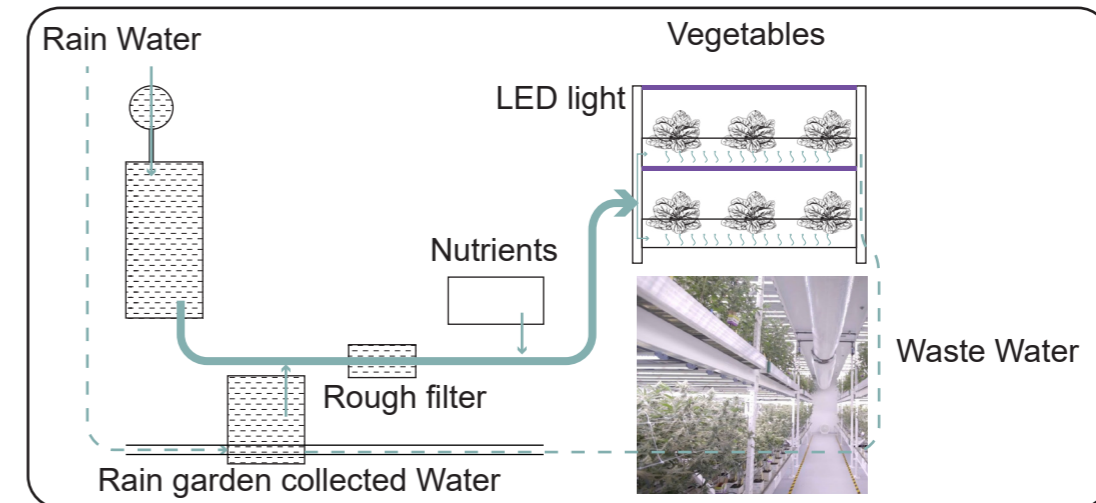
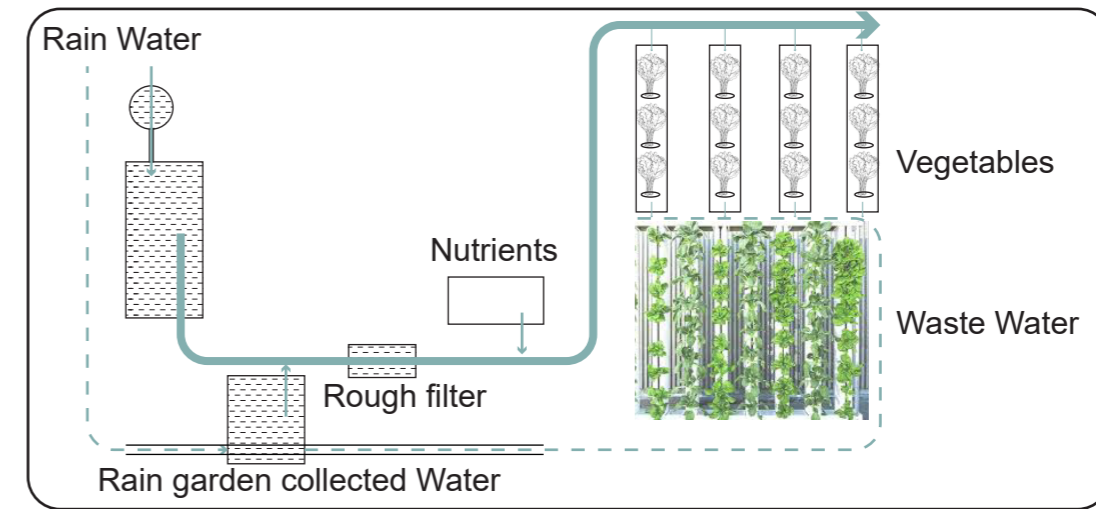
CO₂ consumption: 1/10 crop weight

O₂ production: 1/10 crop weight

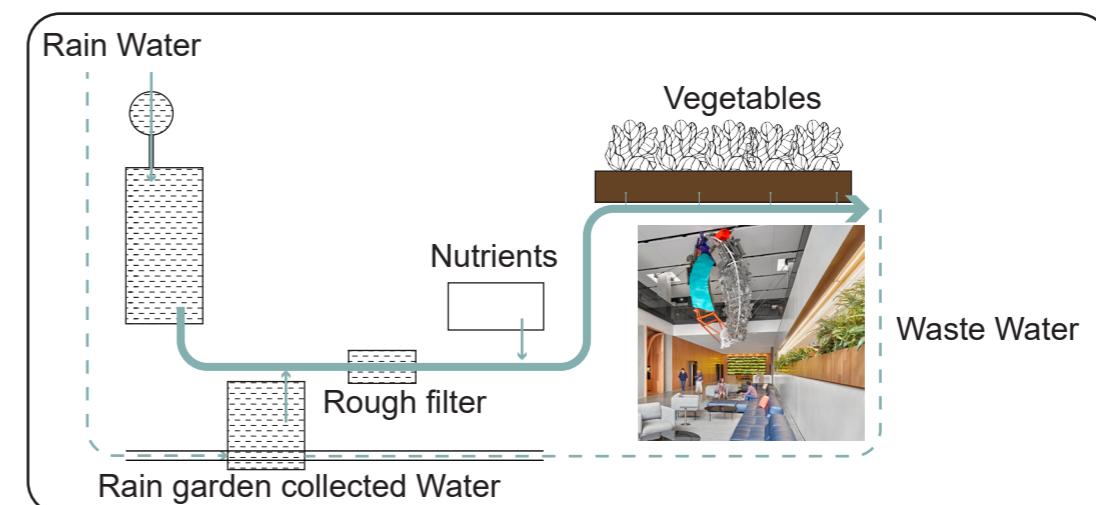
Heat consumption: 38kWh/m²

Total production: 458kg

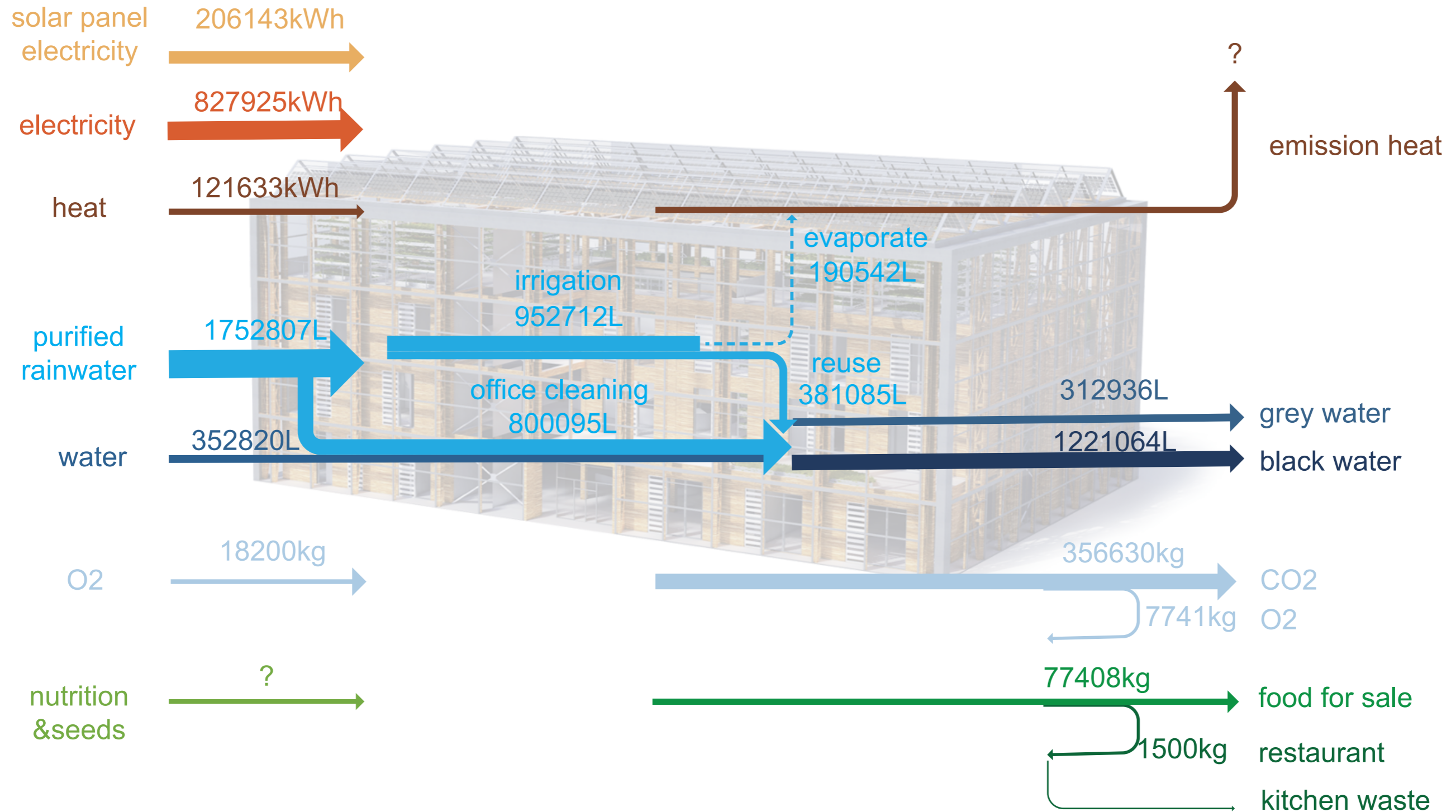
Hydroponic System



Soil-based Farming



Flow



*roof area
611 transparent solar panel
collect 975118L rainwater

Mass production



rooftop



south facade

Indoor farming

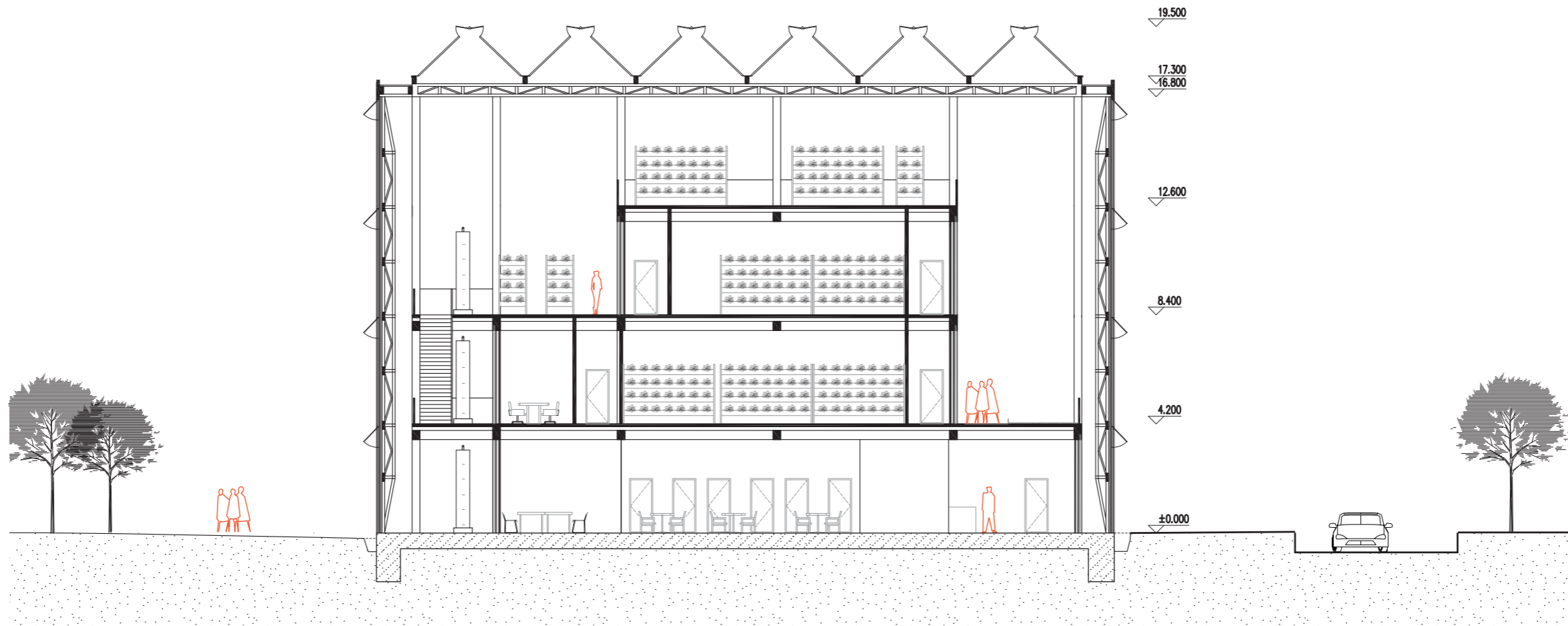


public space



office

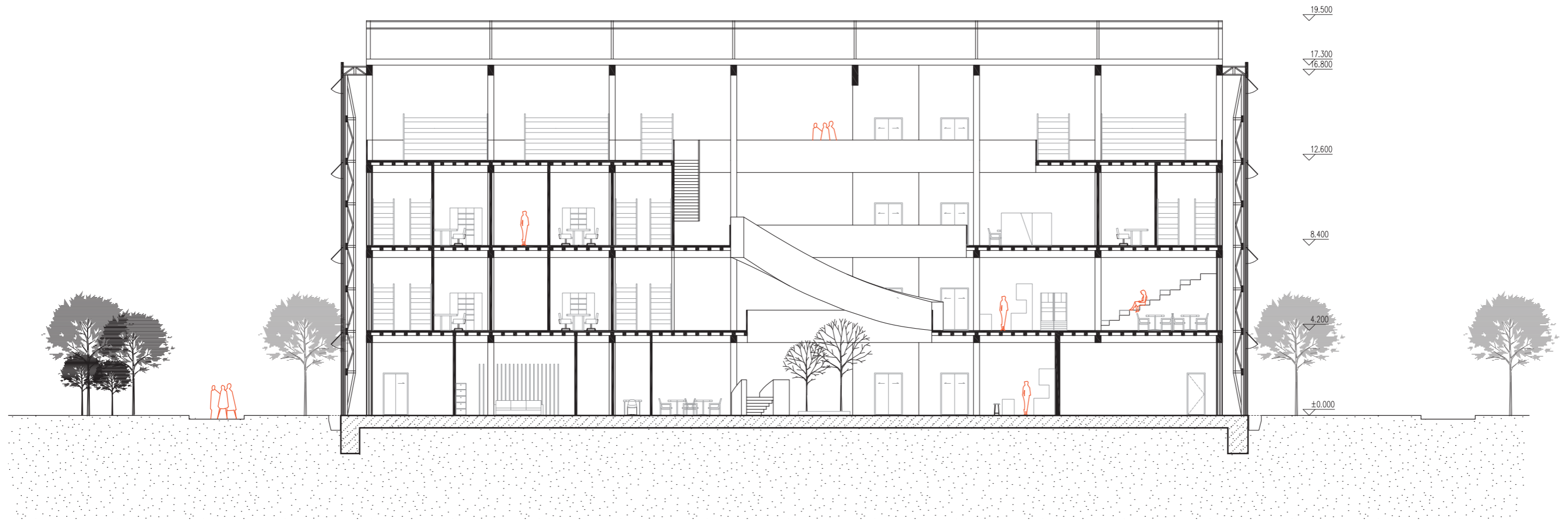
Section



A-A SECTION

1-200

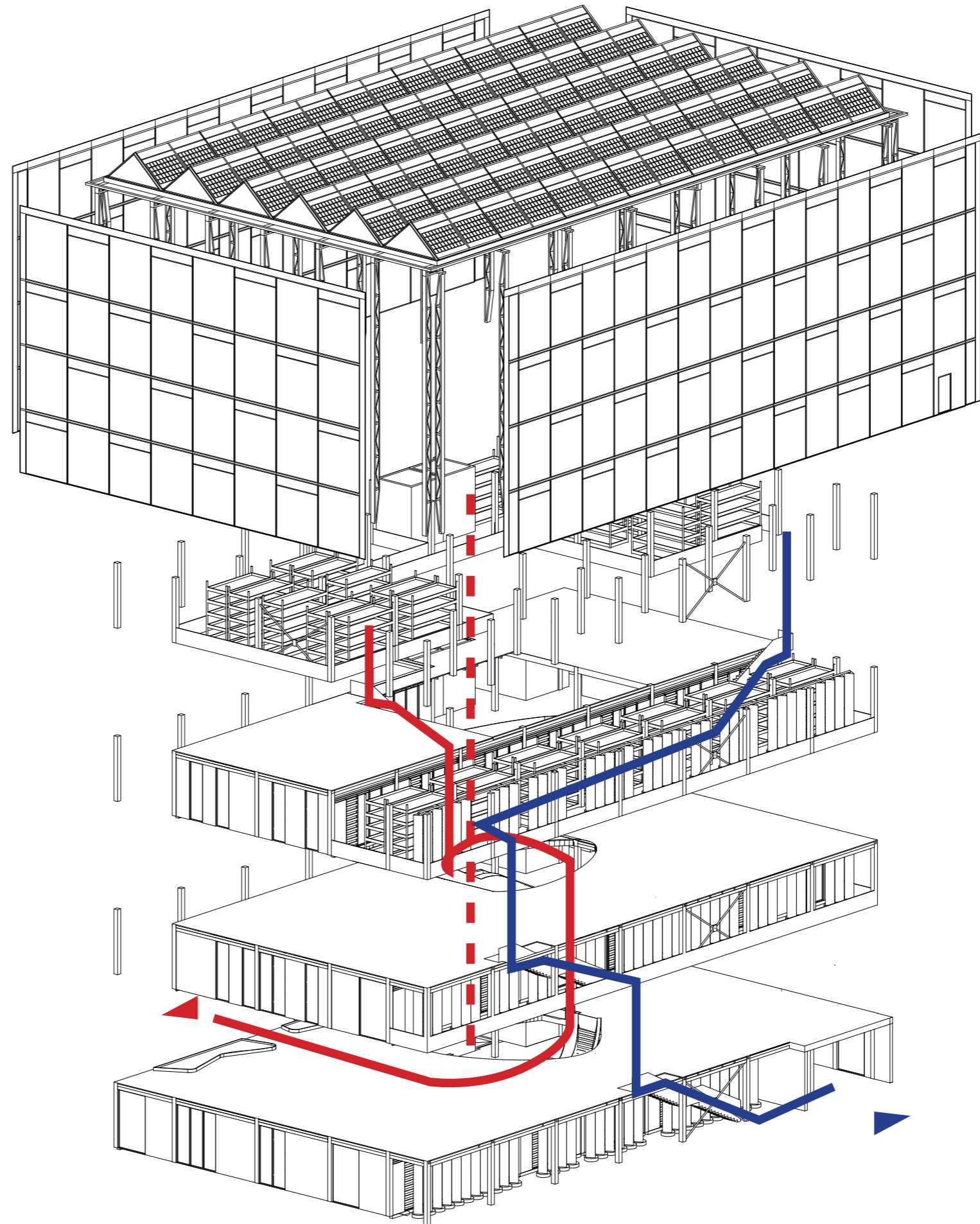
Section



B-B SECTION

1-200

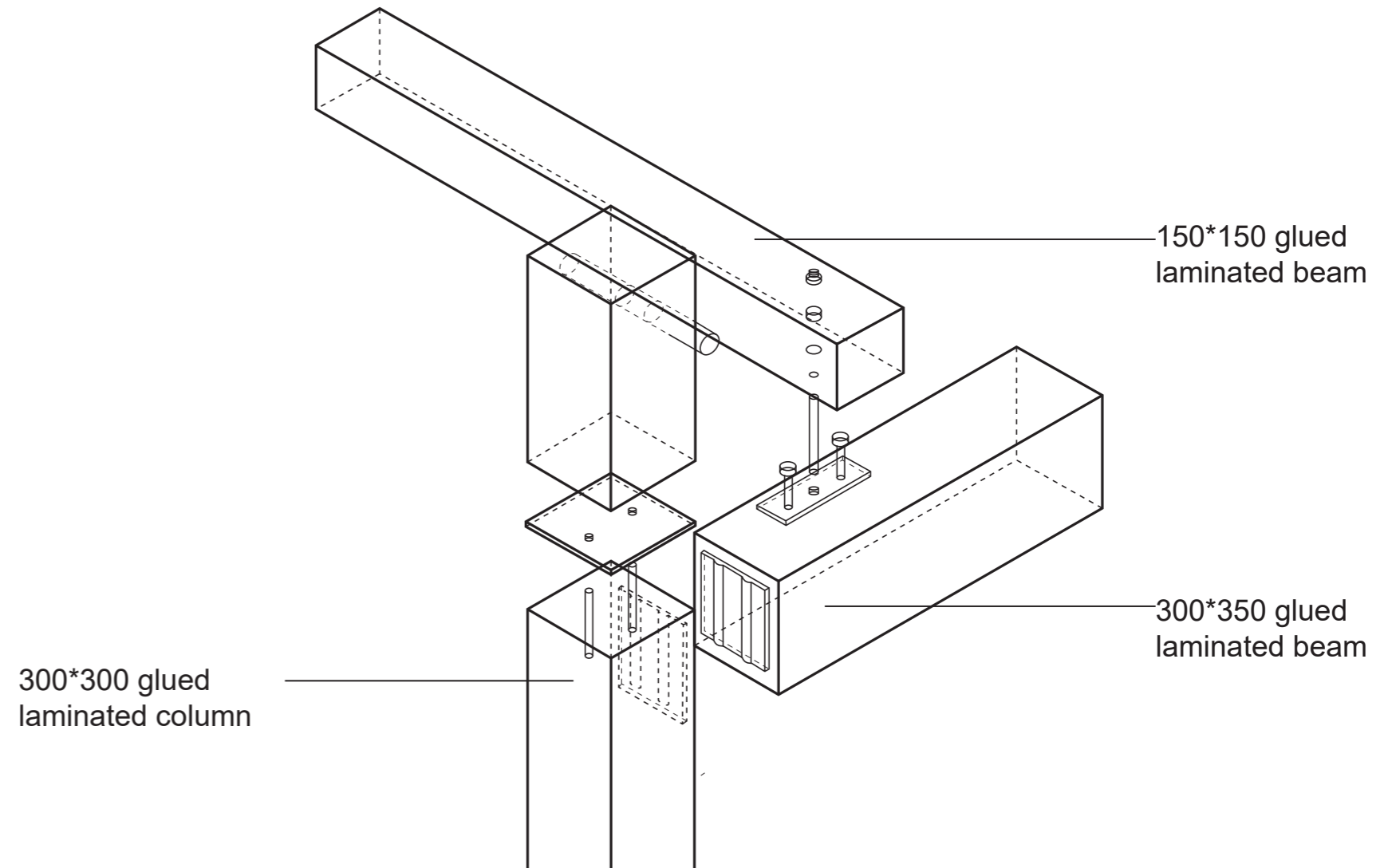
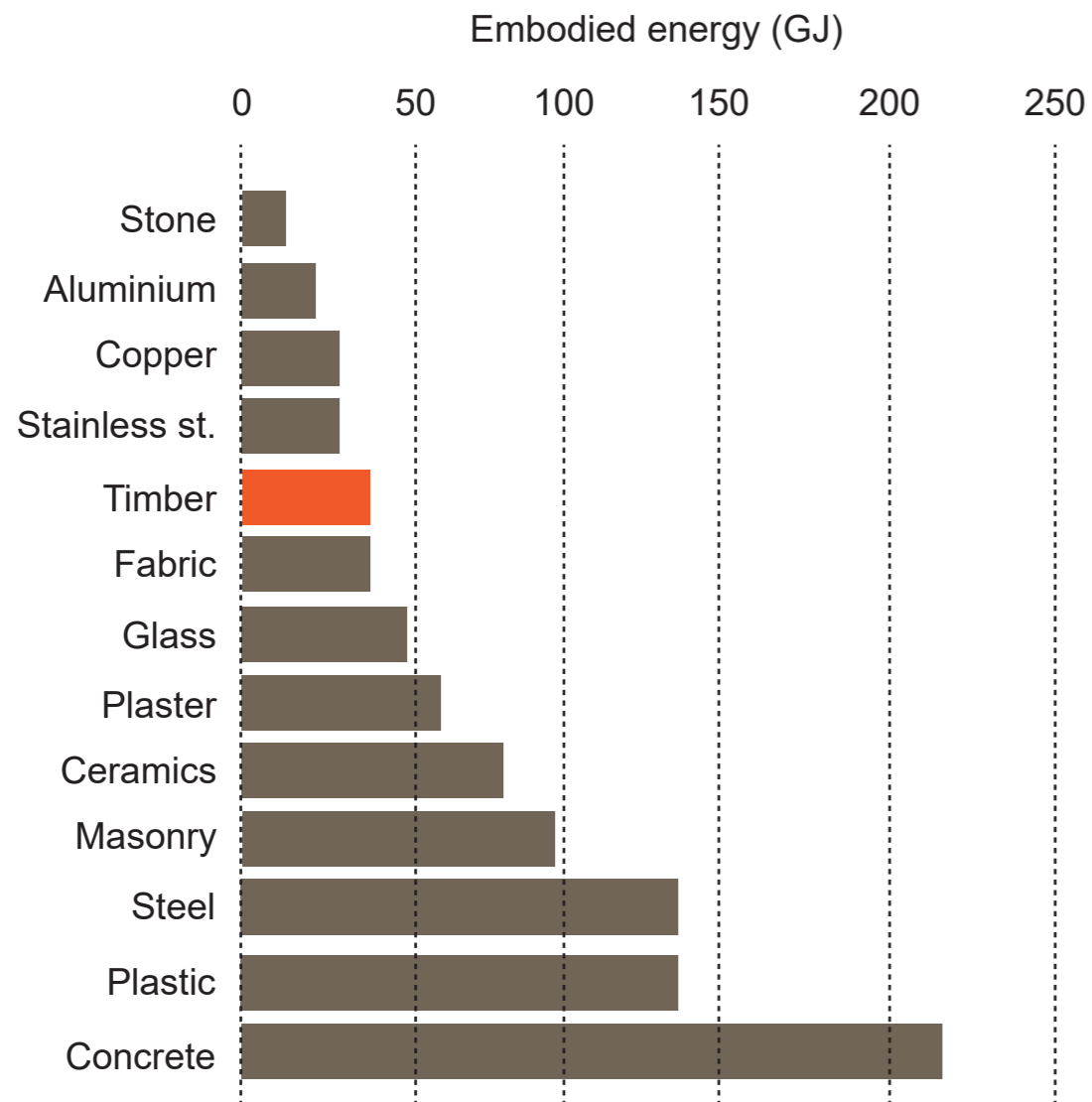
Circulation



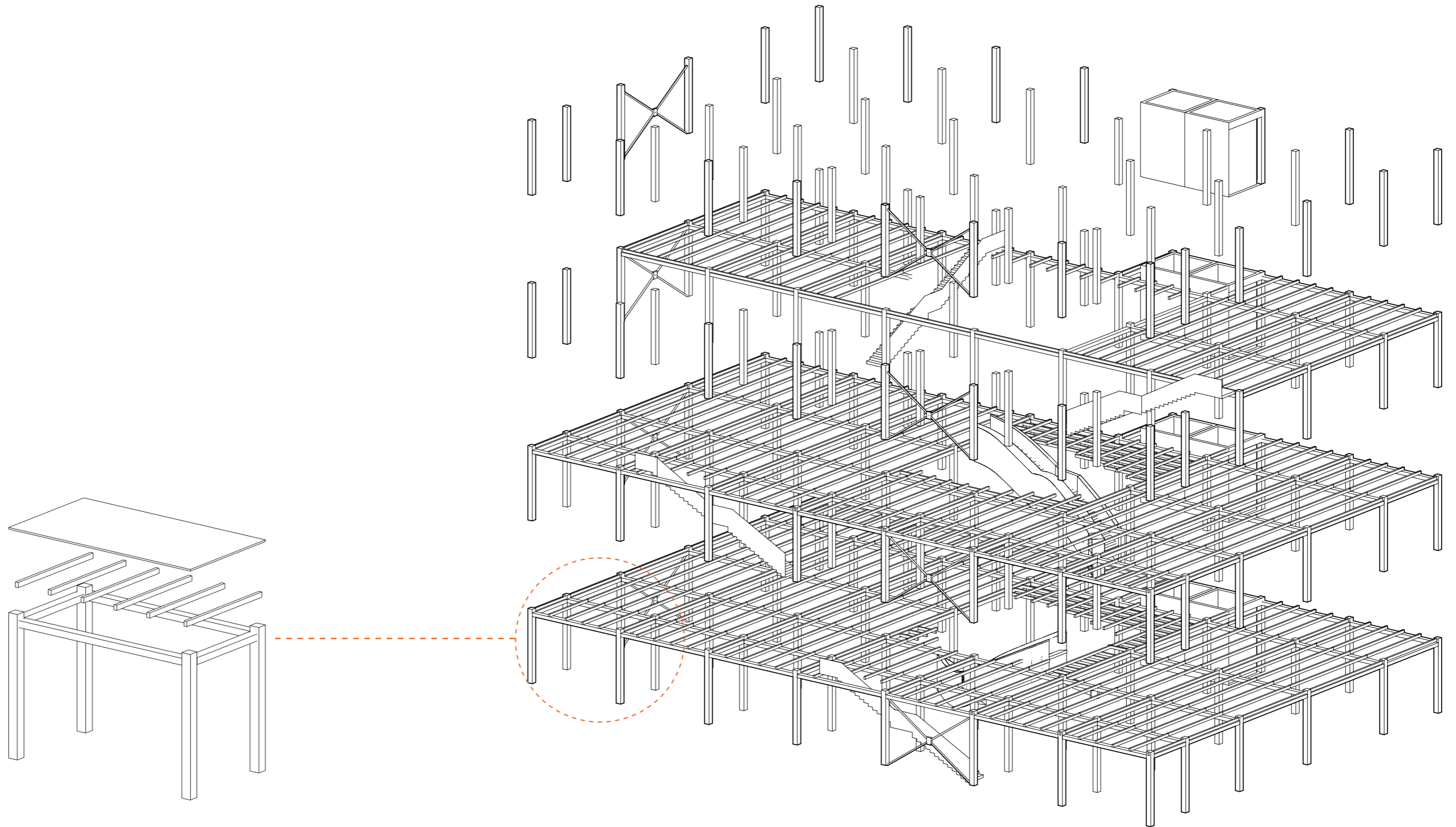
— office worker

— citizens

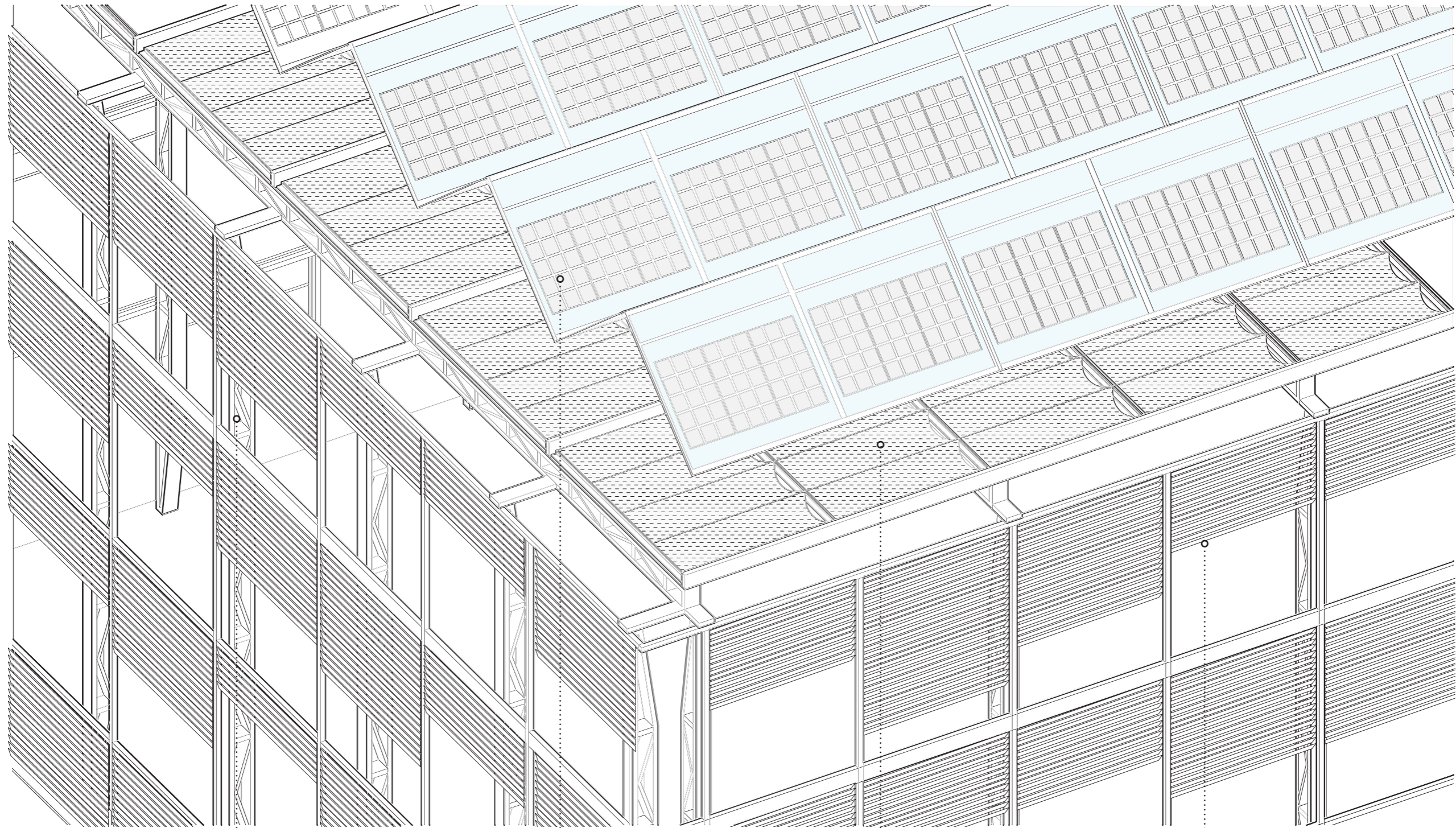
Timber structure



Structure (inside)



Structure (outside)



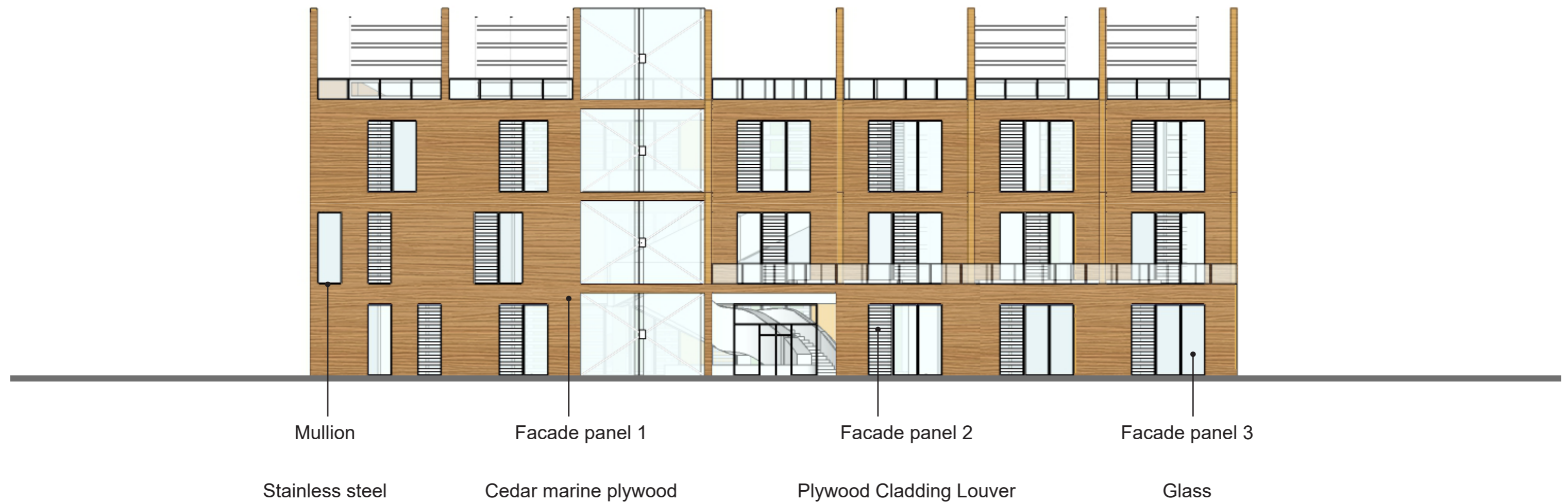
glued laminated wood

transparent solar panel
(1.6m*0.9m)

horizontal solar shading screen

vertical solar shading louver

Flexible facade (inside)



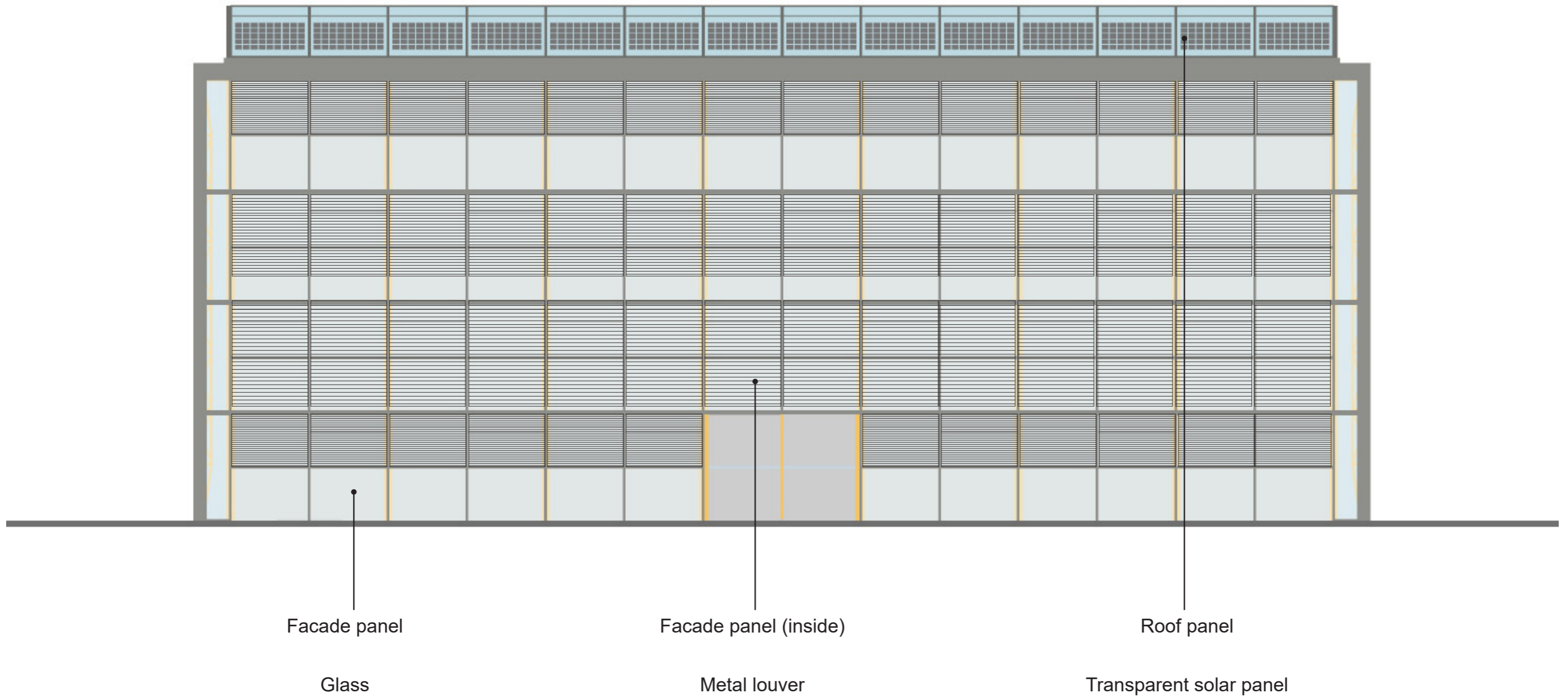
Movable facade panel 2

Organic material--wood

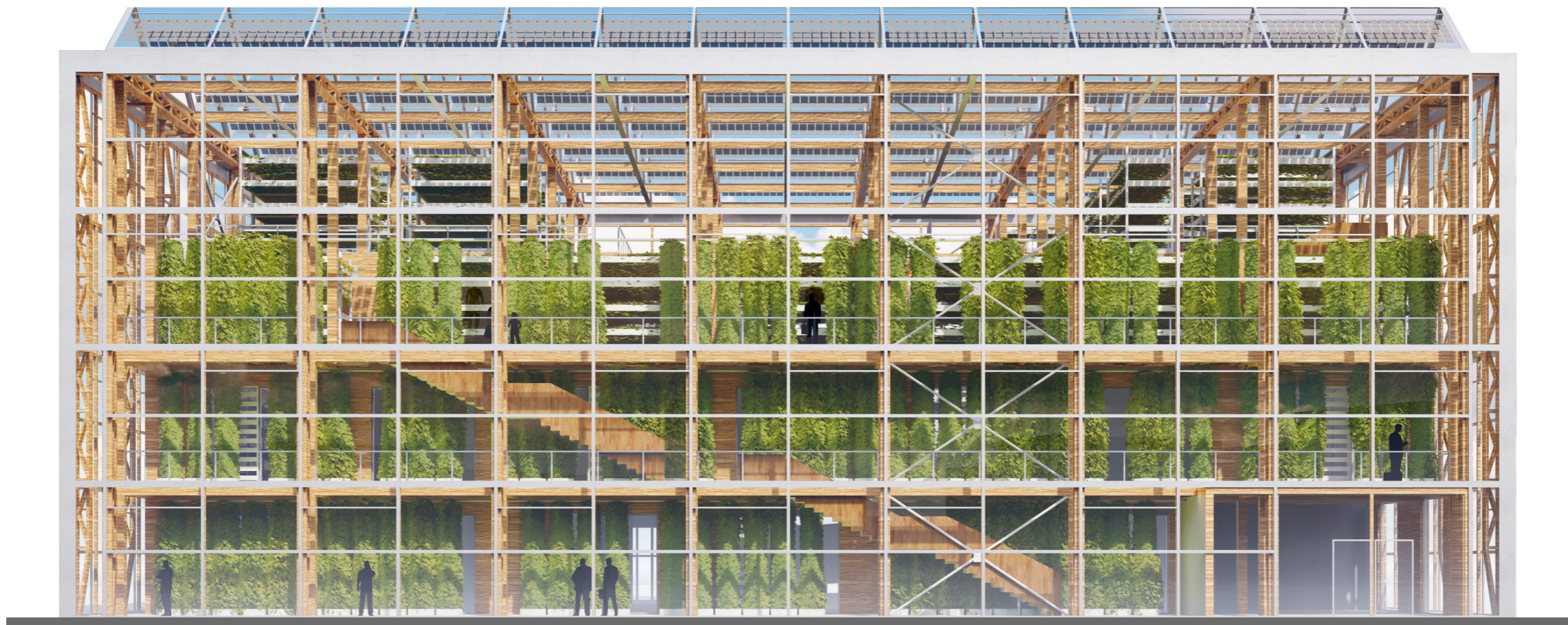
Provide choice of psychological security

Provide possibilities for future building function updates

Flexible facade (outside)



Elevation



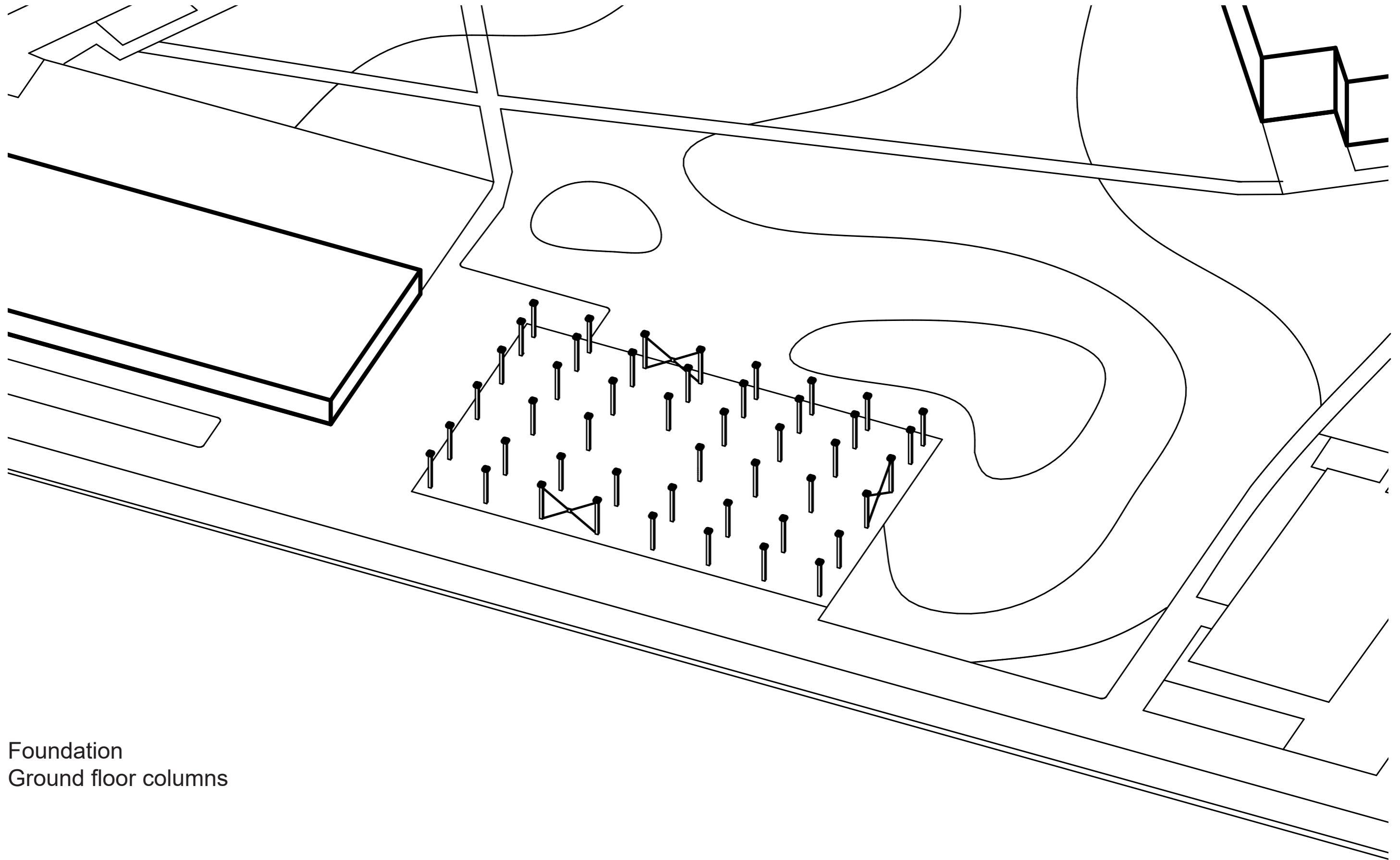
SOUTH-WEST FACADE

Elevation



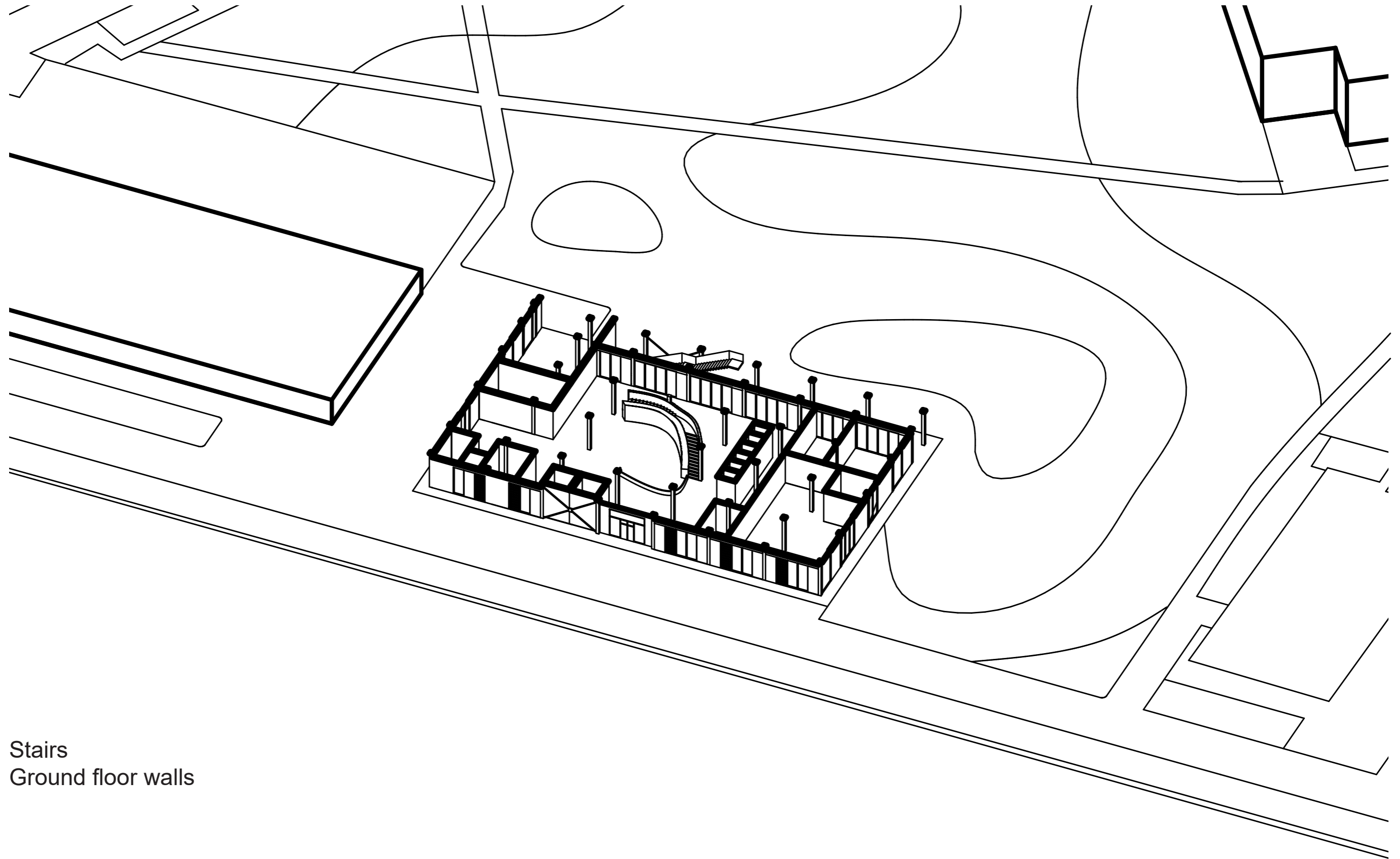
MORTH-WEST FACADE

Construction sequence



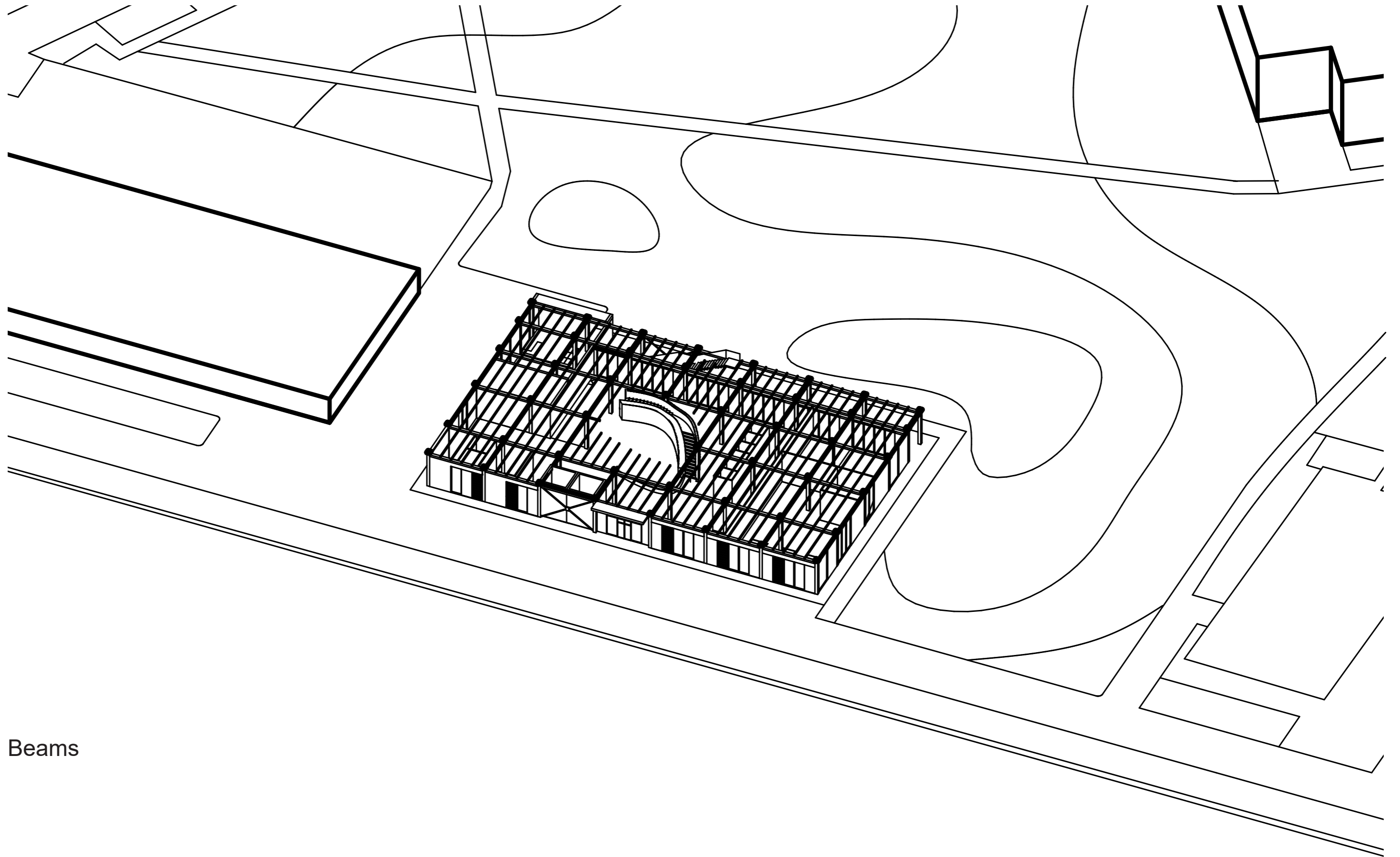
Foundation
Ground floor columns

Construction sequence



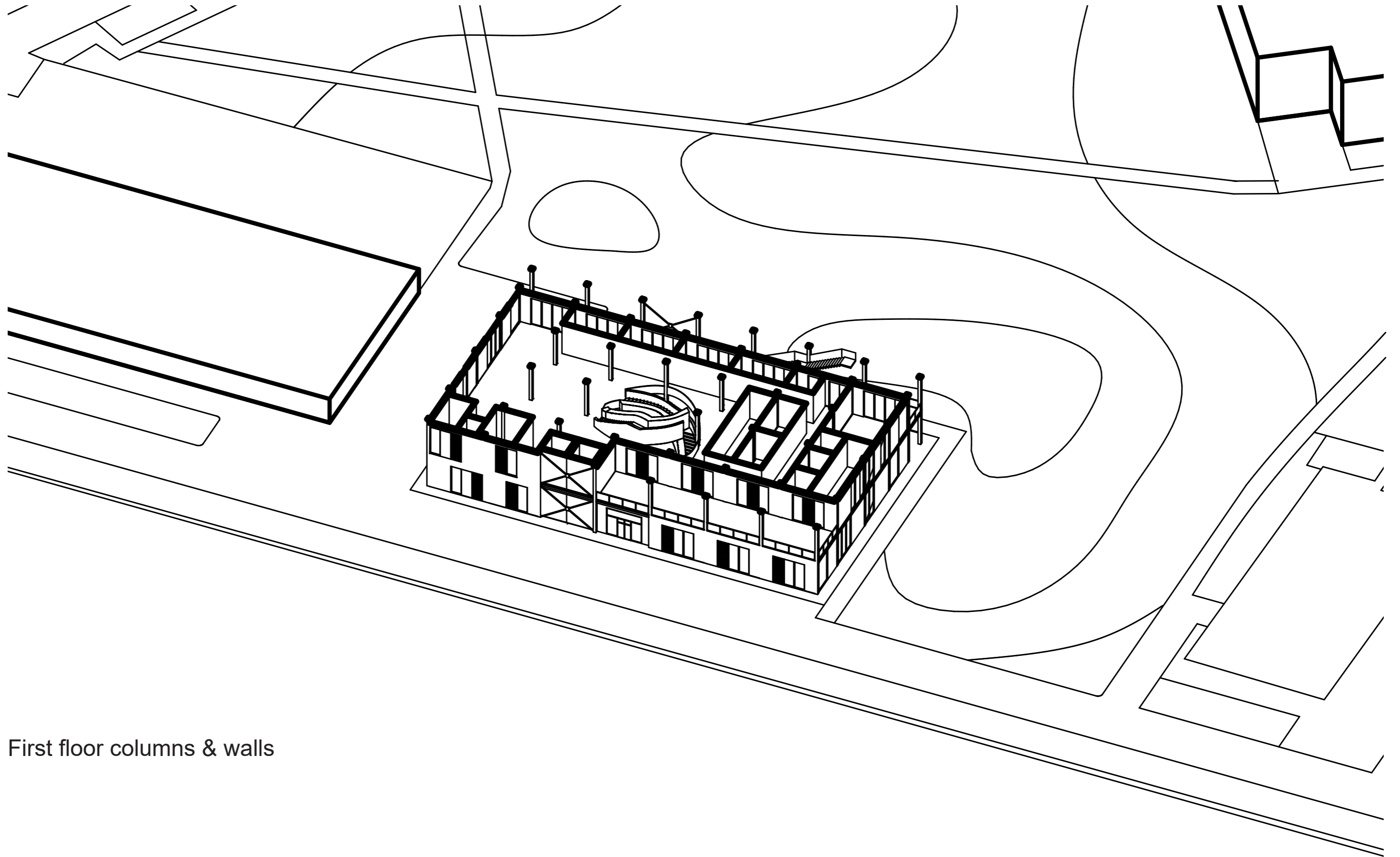
Stairs
Ground floor walls

Construction sequence



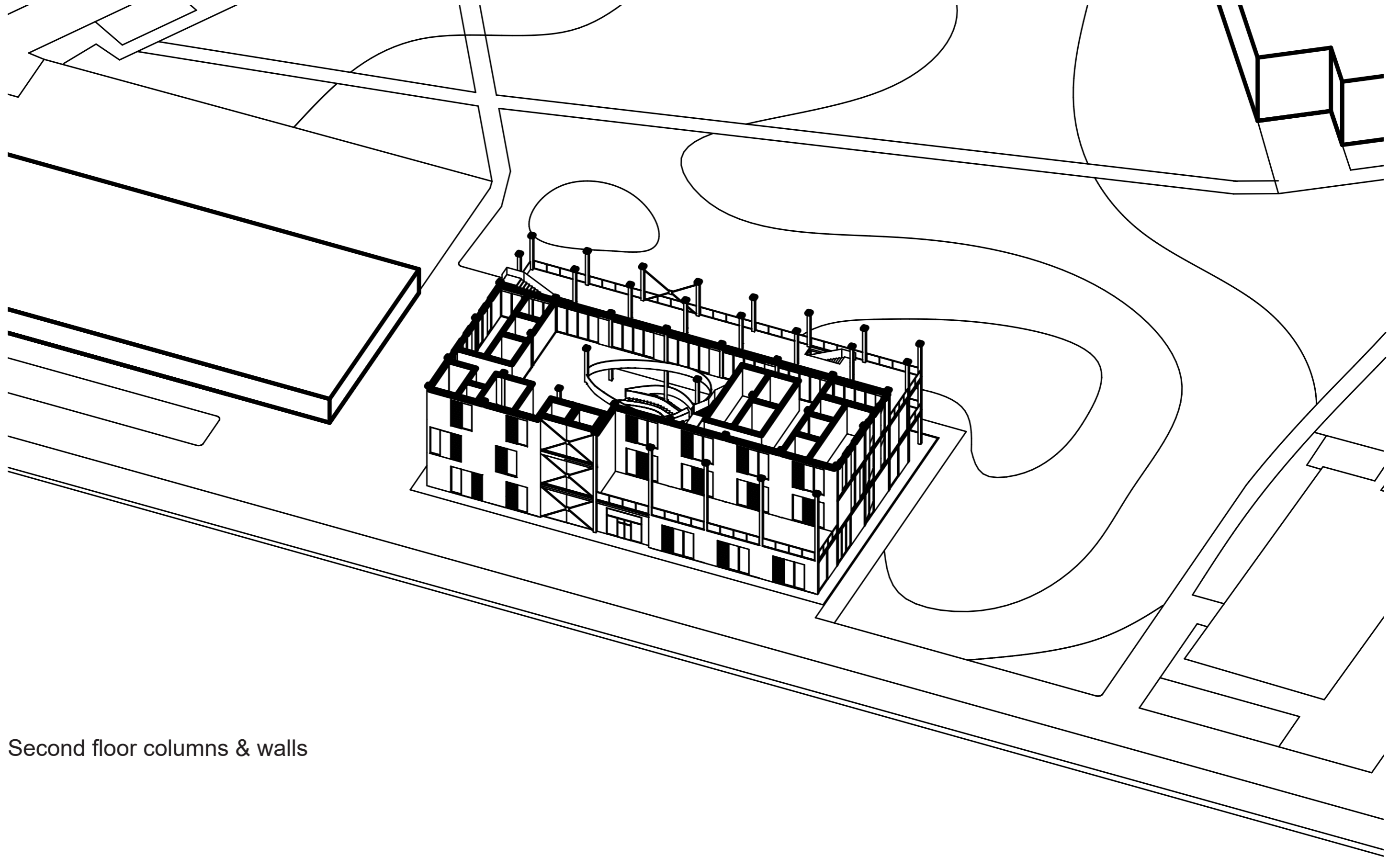
Beams

Construction sequence



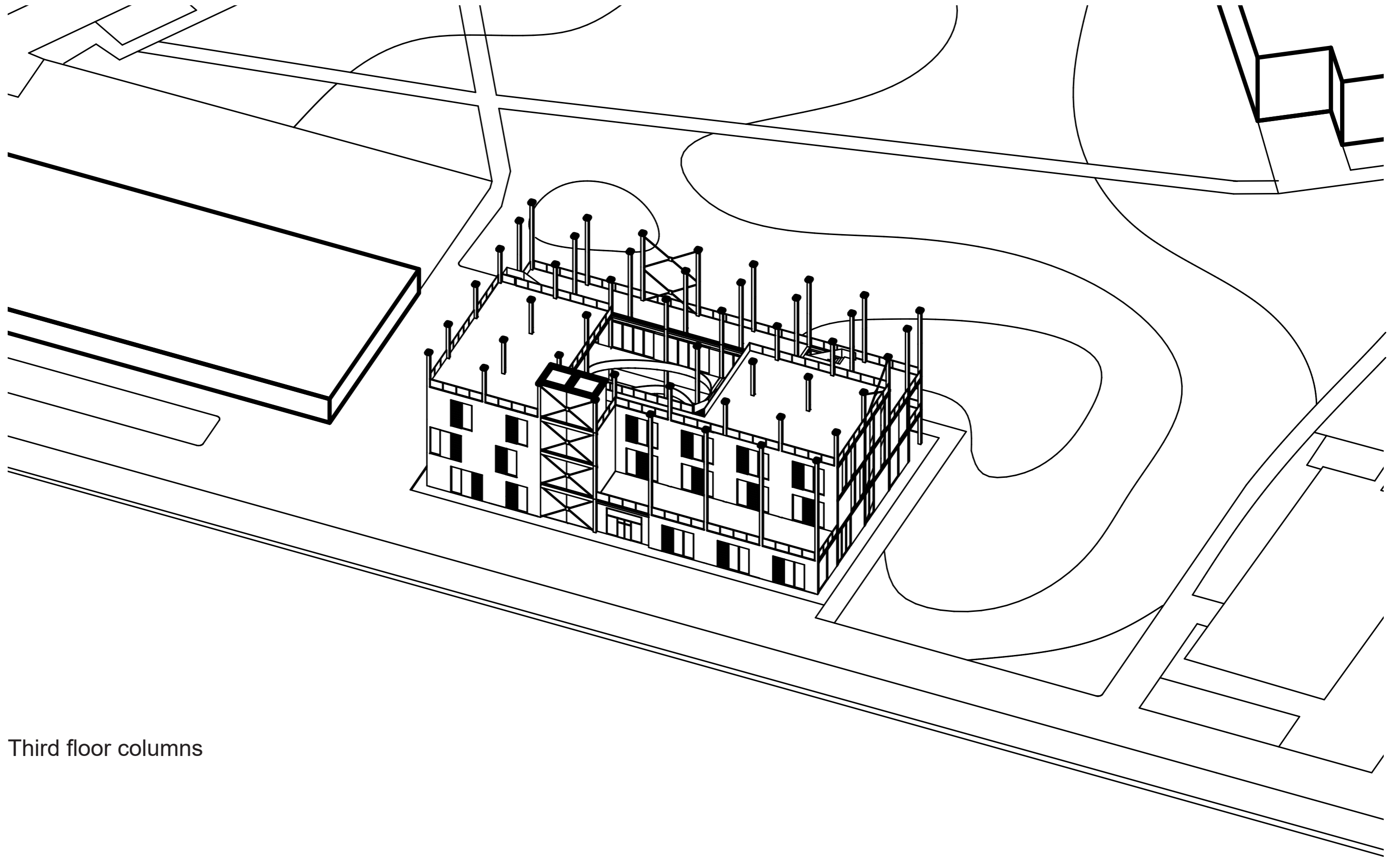
First floor columns & walls

Construction sequence



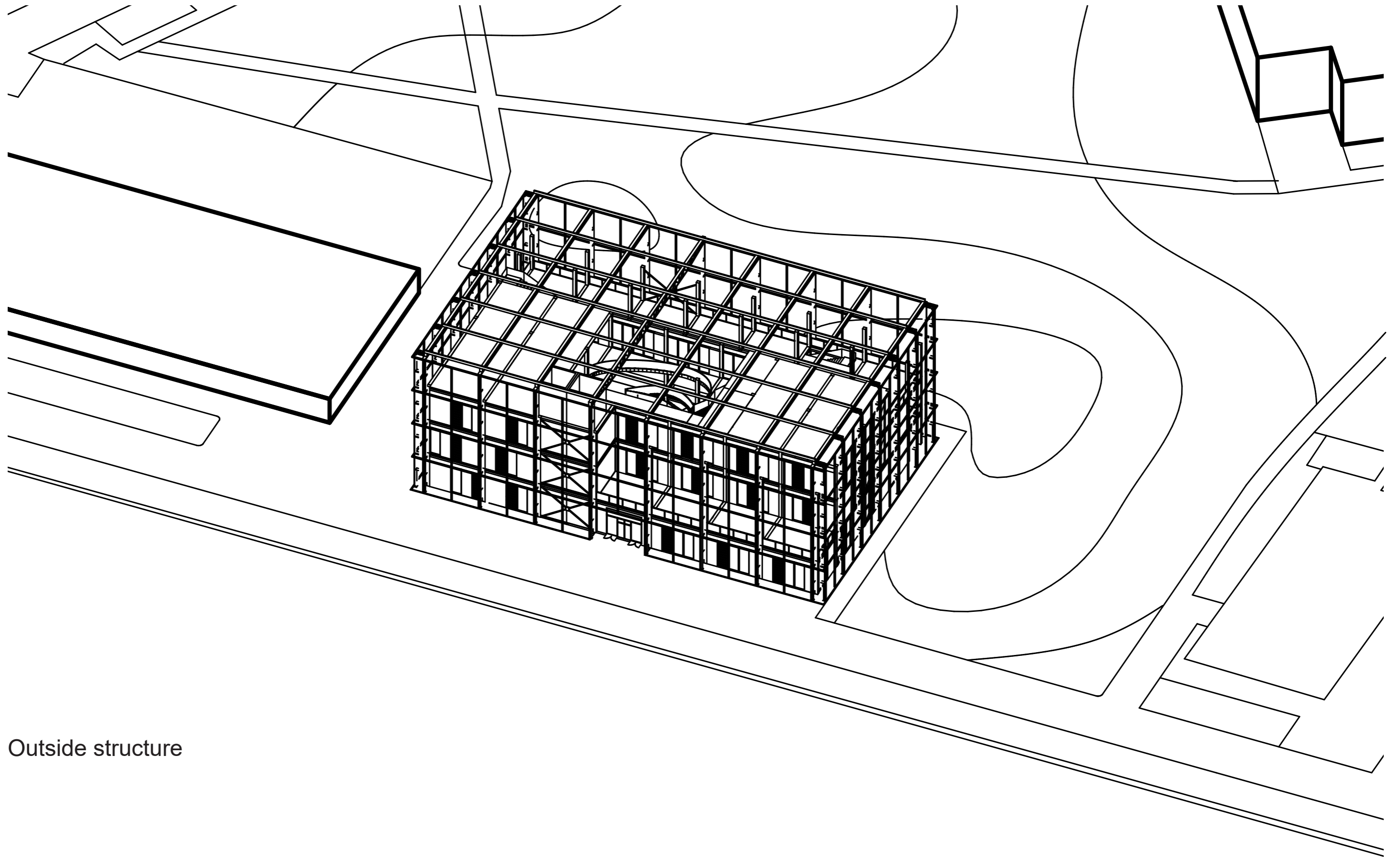
Second floor columns & walls

Construction sequence



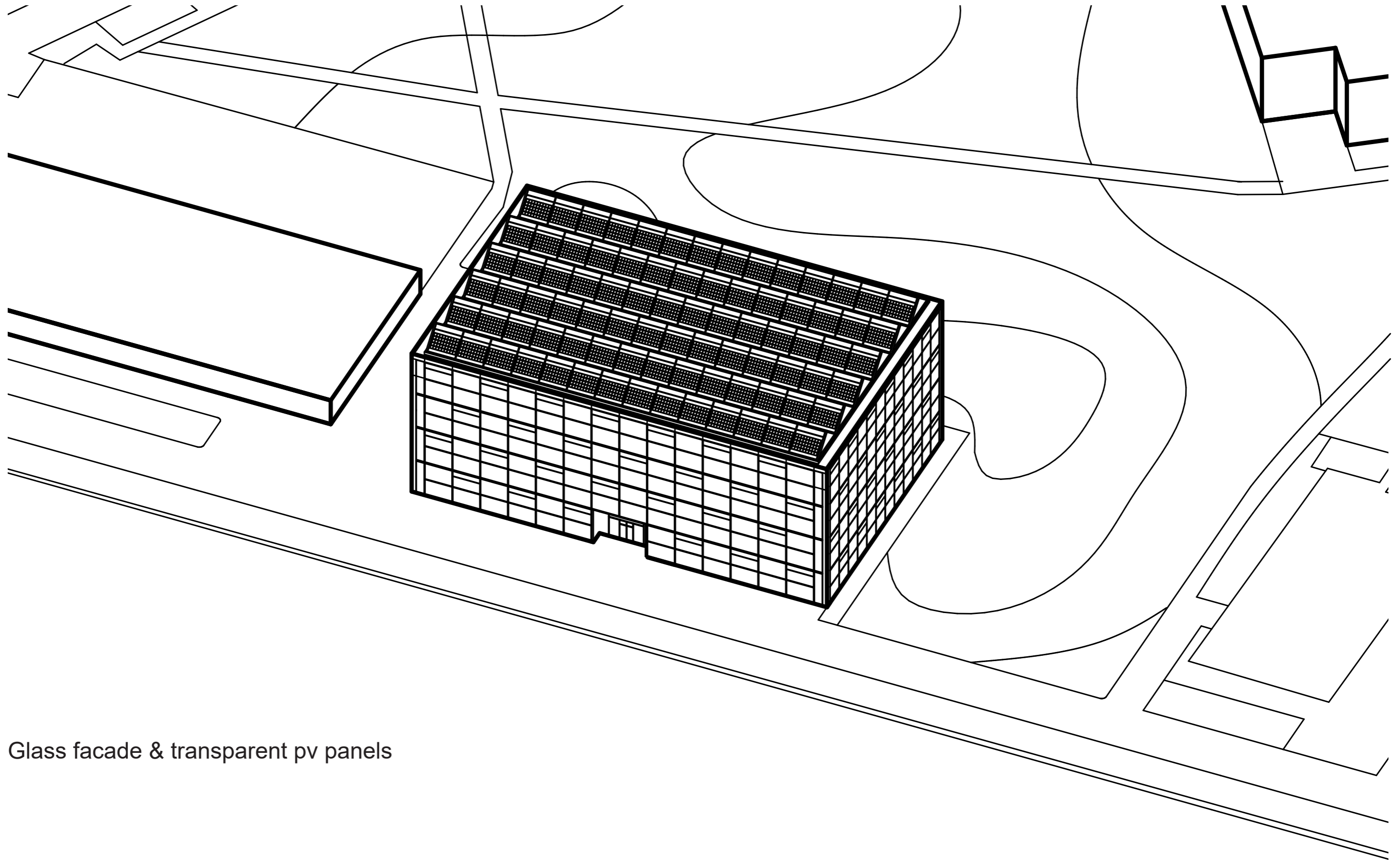
Third floor columns

Construction sequence



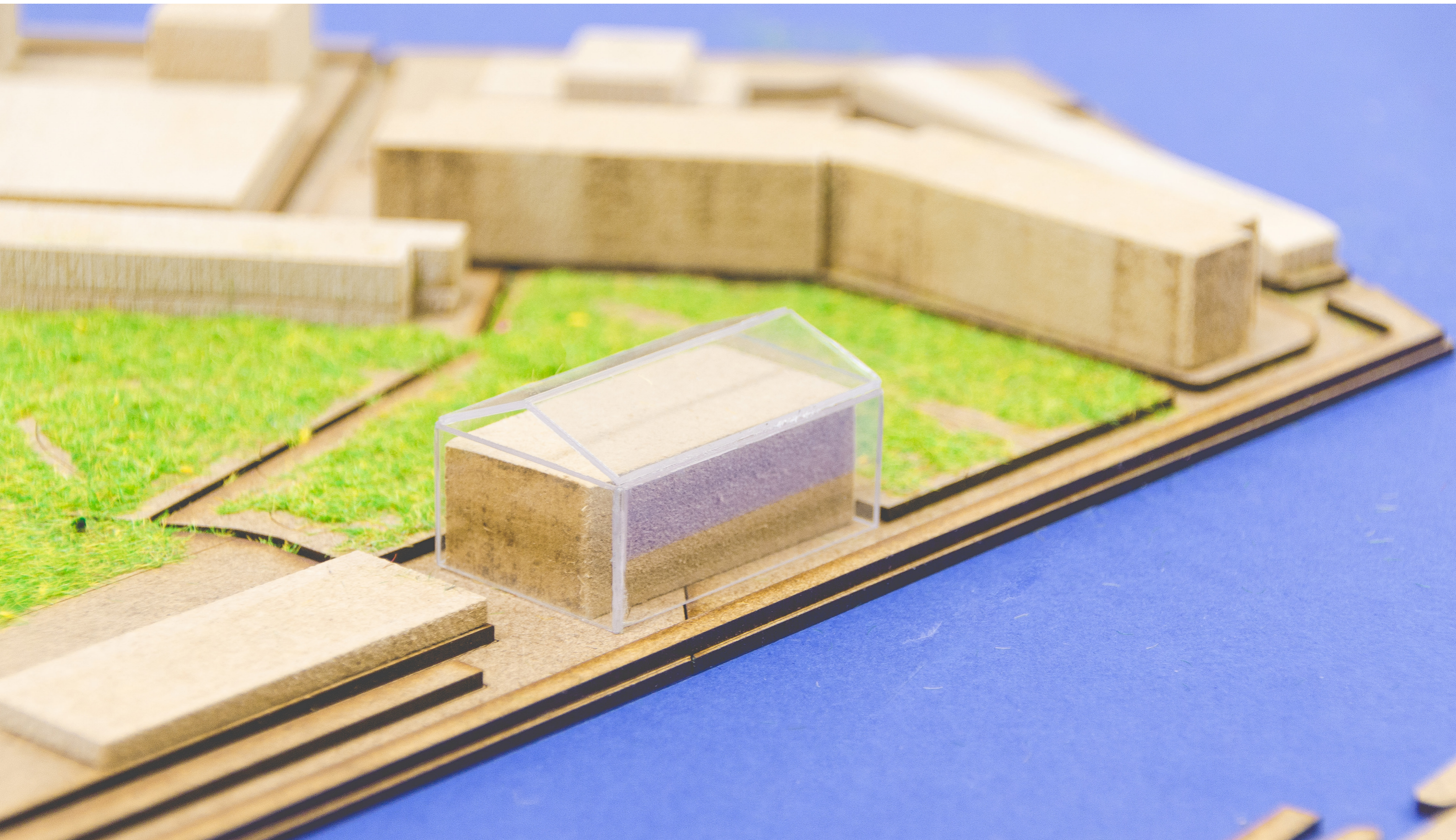
Outside structure

Construction sequence



Glass facade & transparent pv panels

Model



Model



Model



ROOFTOP FARM

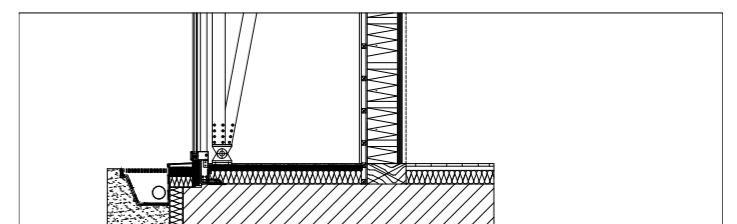
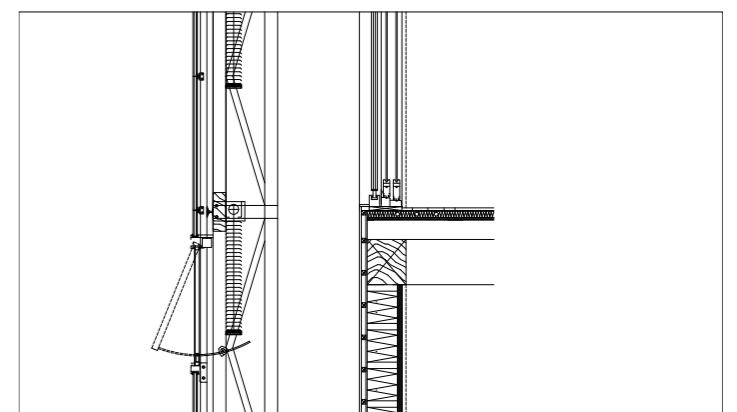
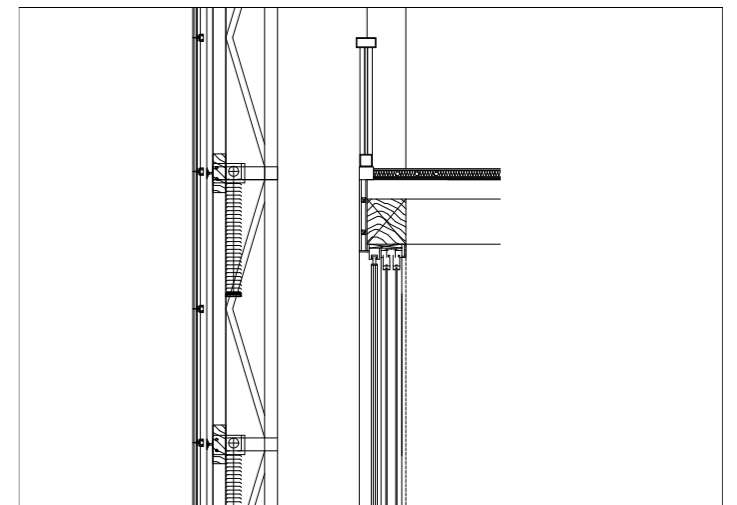
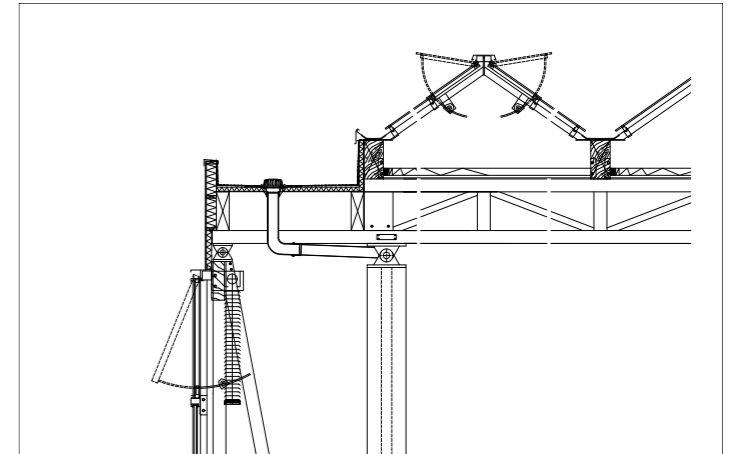
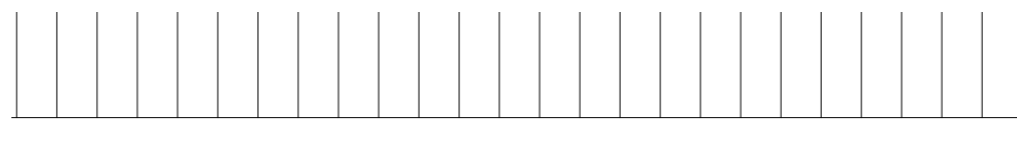
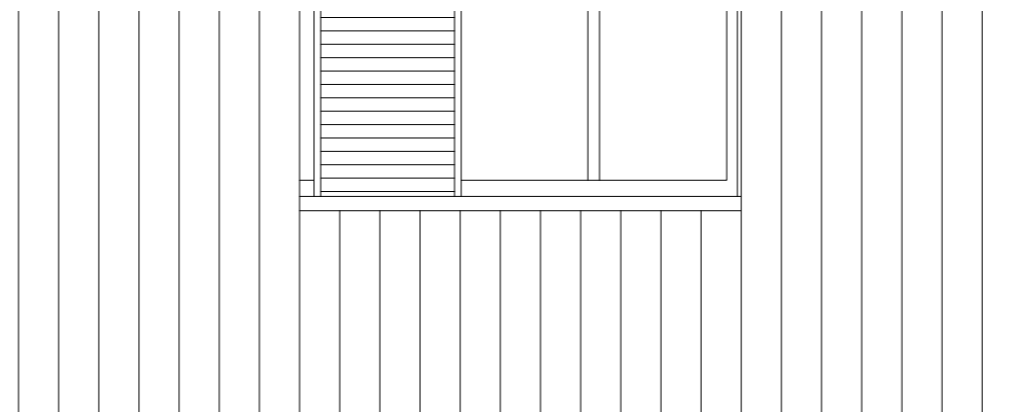
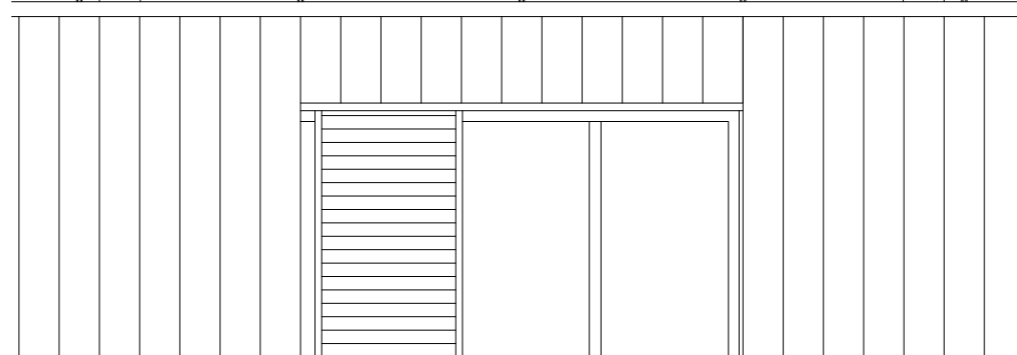
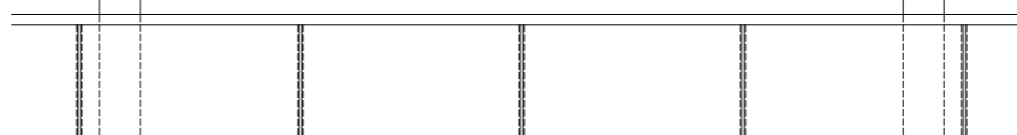
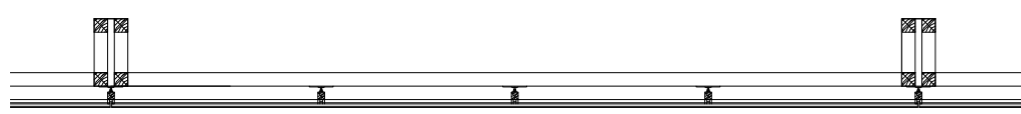
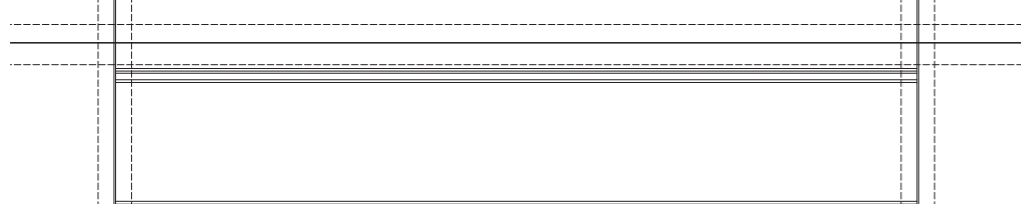
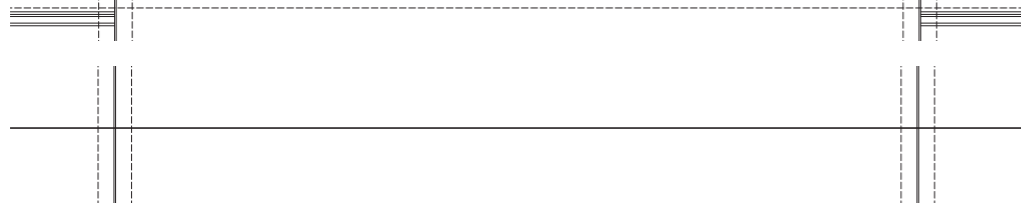
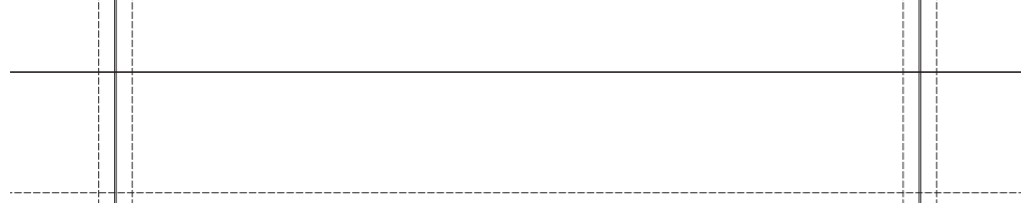
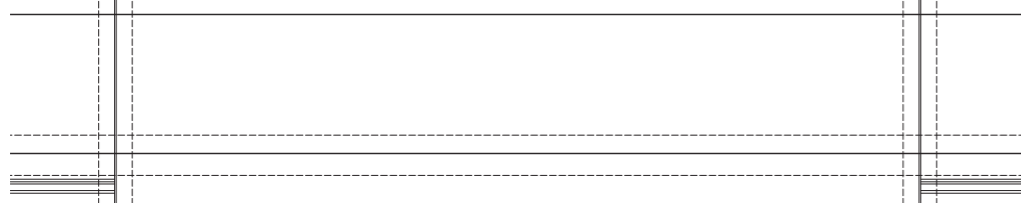
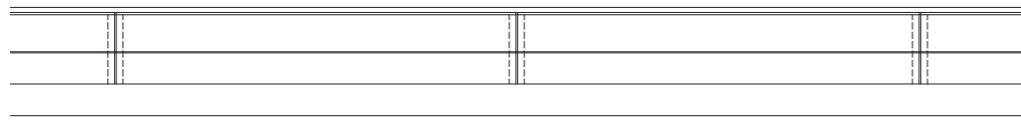


CENTRAL STAIRS



TERRACE

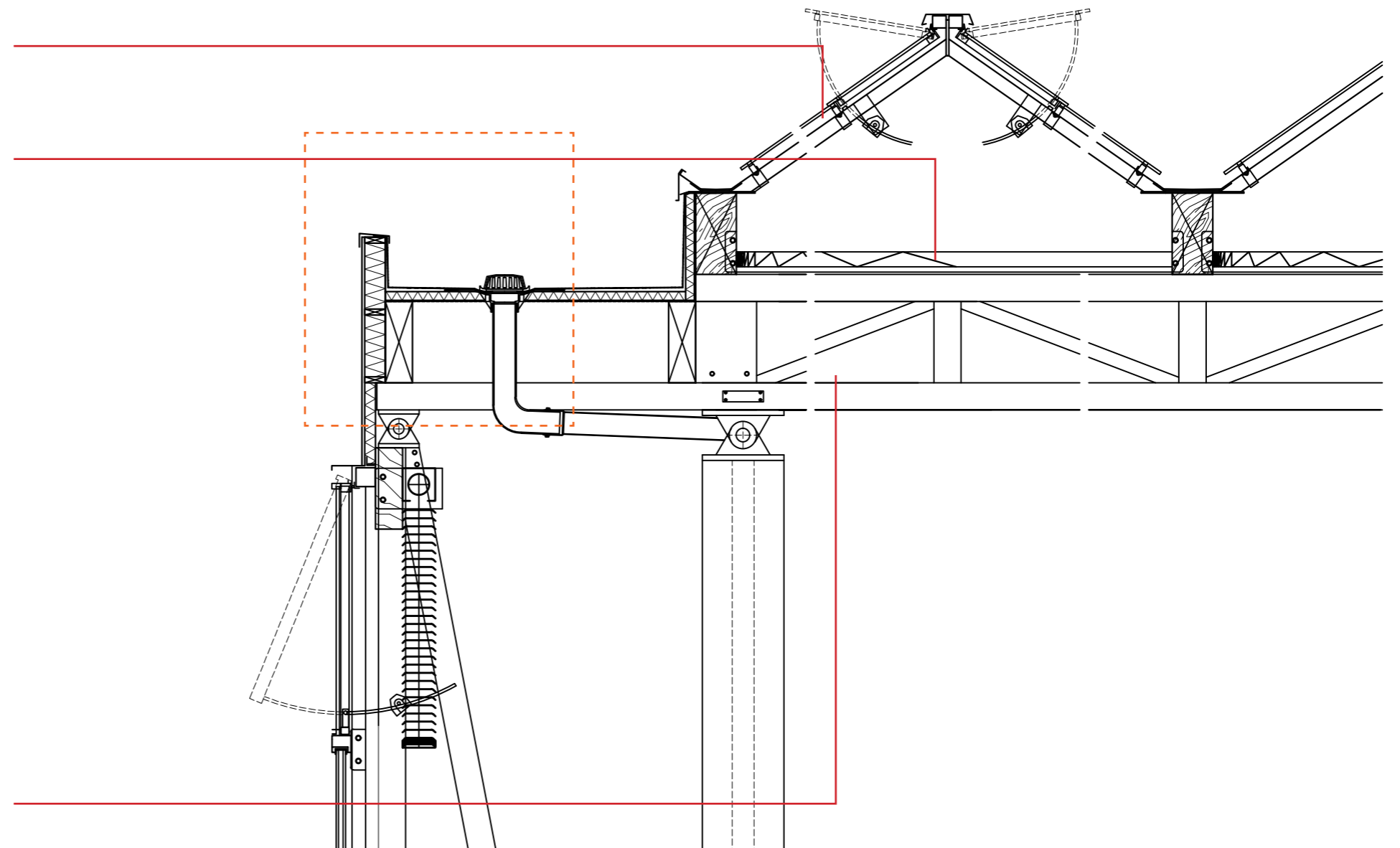
Facade detail



Detail rooftop

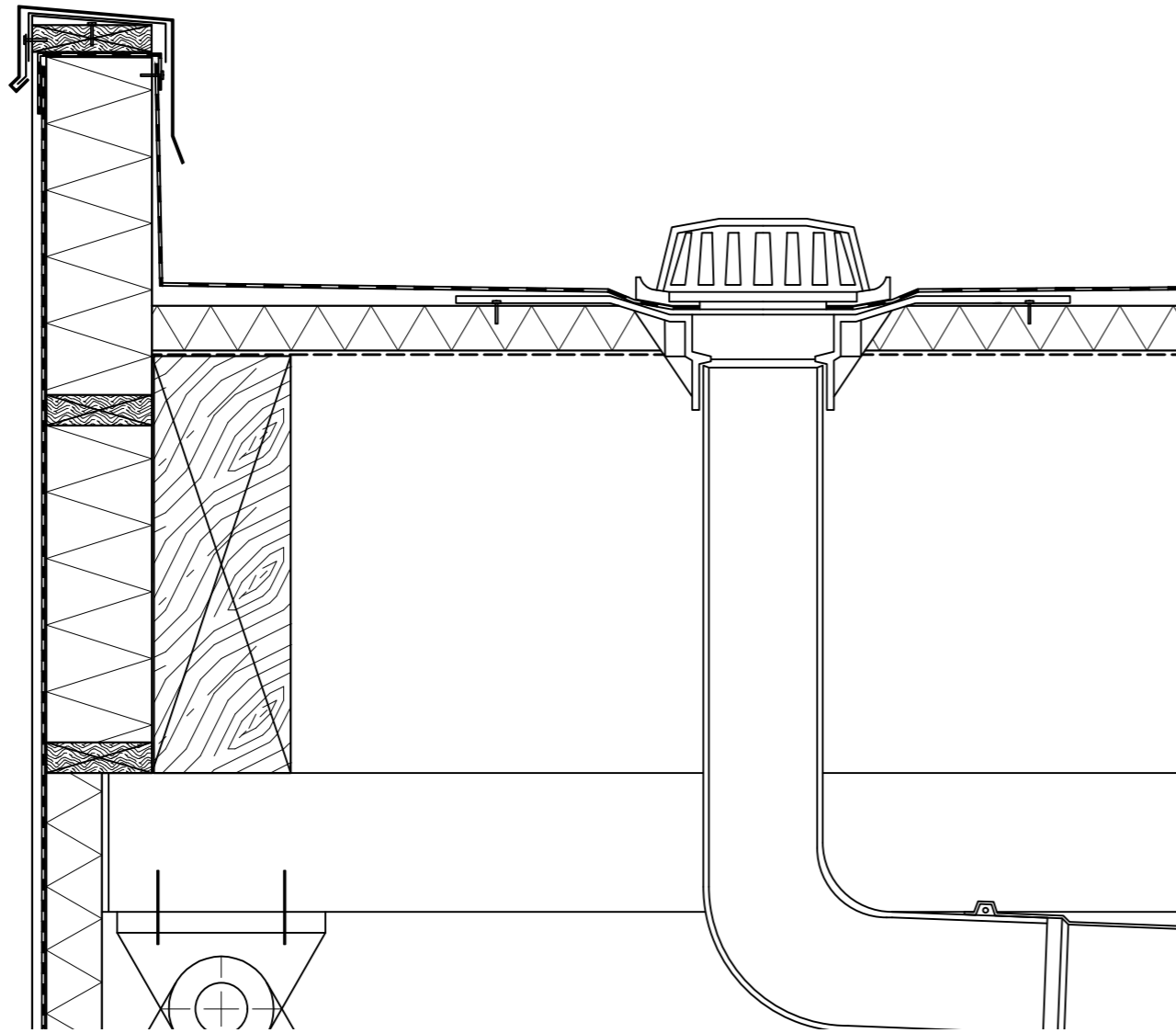
transparent PV panel

solar shading screen



glued laminated timber

Detail 1-20



Detail 1-5

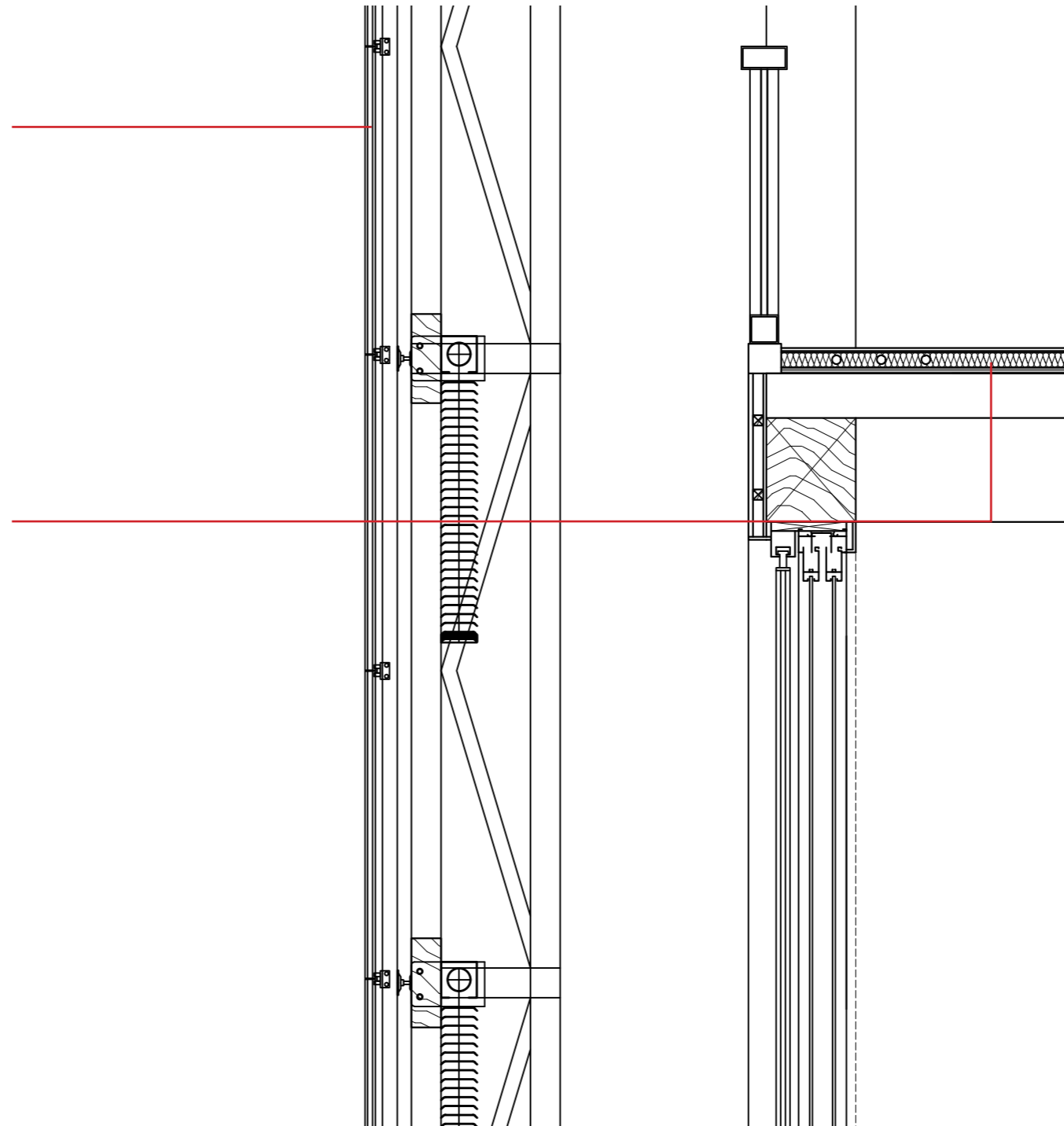
Detail double facade

Outside facade

double layer laminated glass
cross laminated timber

Rooftop floor

granitic plaster
cement mortar
underfloor heating system
thermal insulation
marine plywood
50*100mm timber substructure



Detail 1-20

Detail double facade

Floor

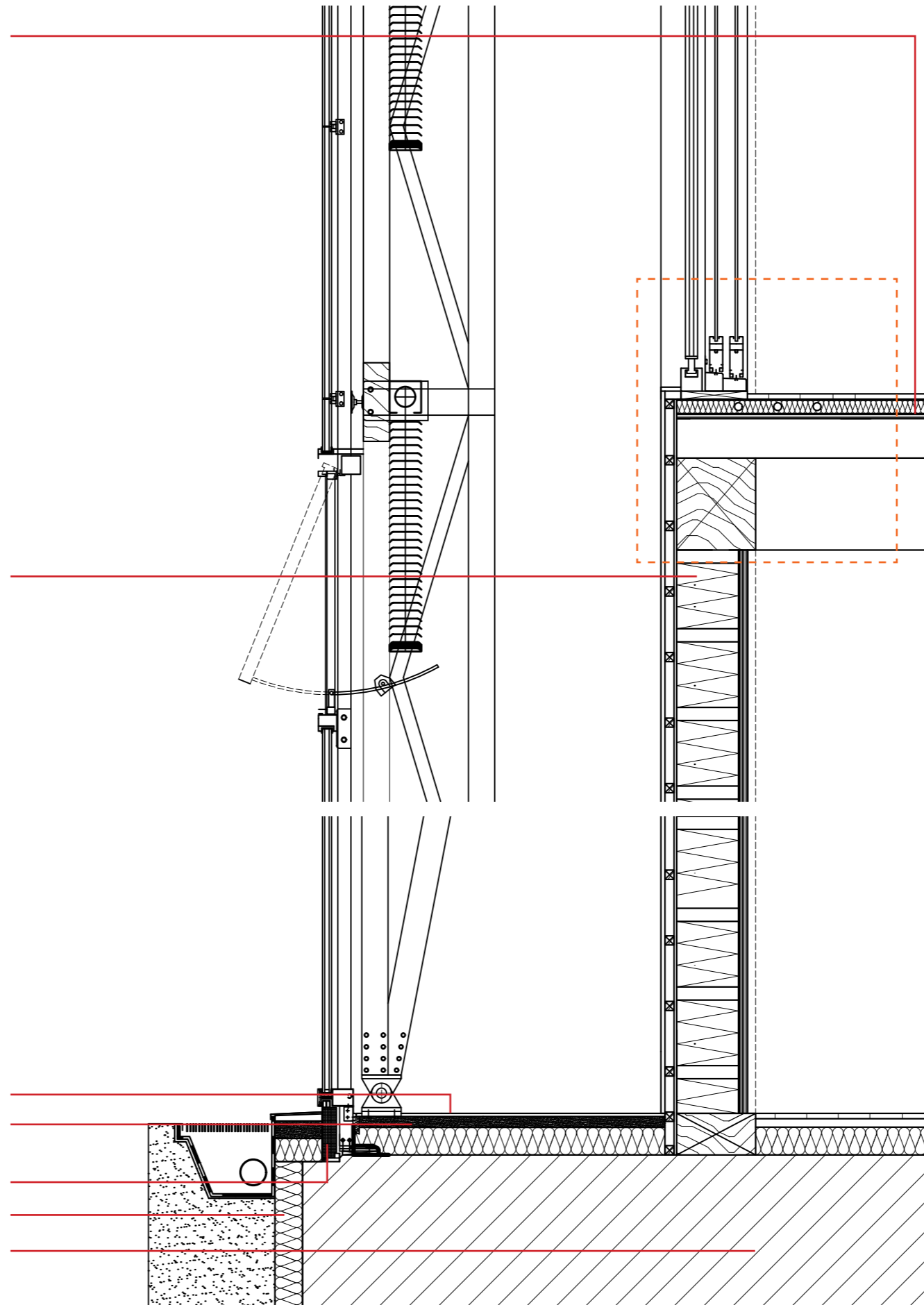
20*120mm hardwood flooring
underfloor heating system
thermal insulation
marine plywood
50*100mm timber substructure

Facade with timber cladding

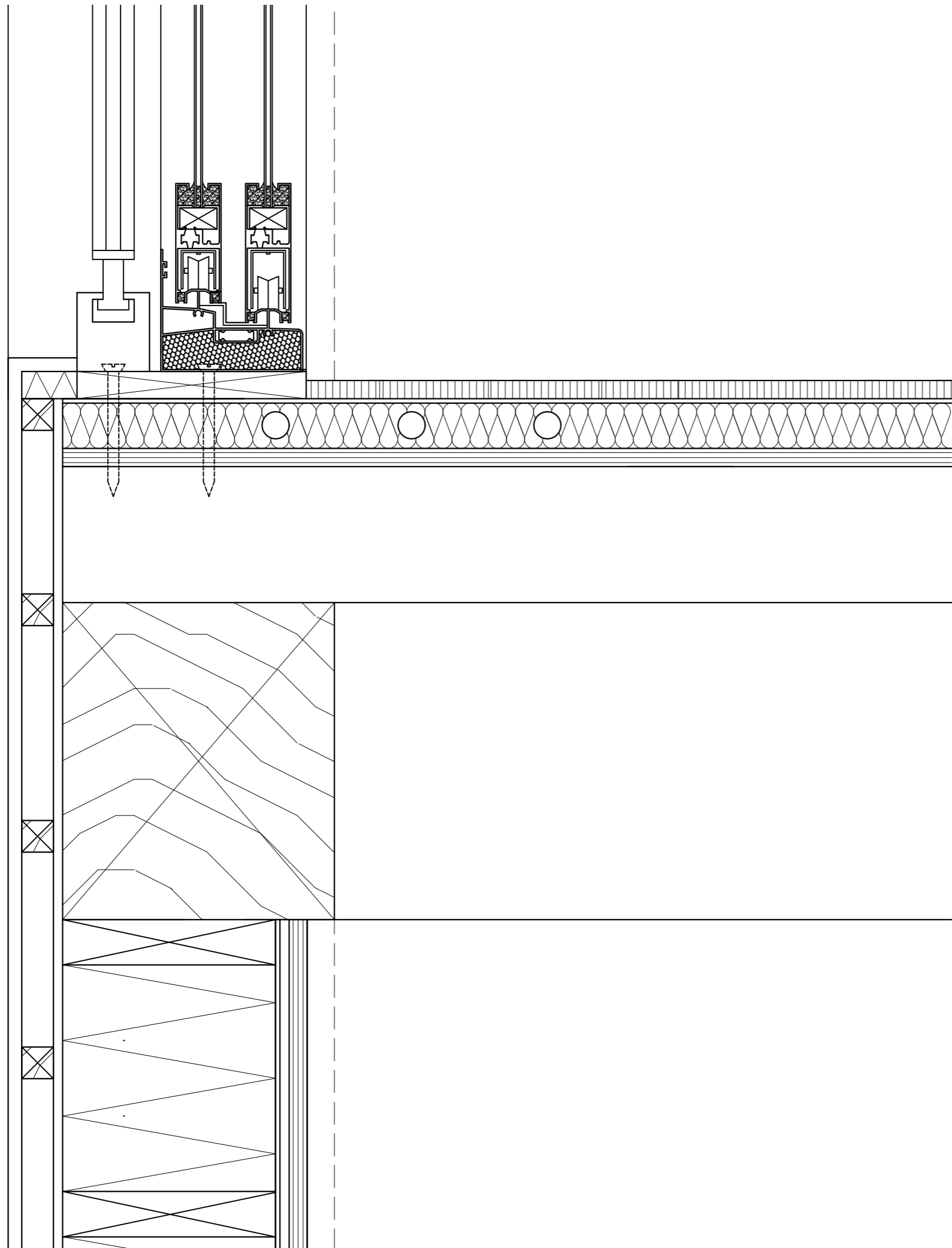
20mm marine plywood
horizontal lath
thermal insulation
5mm PCM
10mm cement
20mm wood cladding board

Foundation

slate floor covering
lime mortar
PCC coated insulation panel
glass wool insulation
concrete ground bearing slab



Detail 1-20

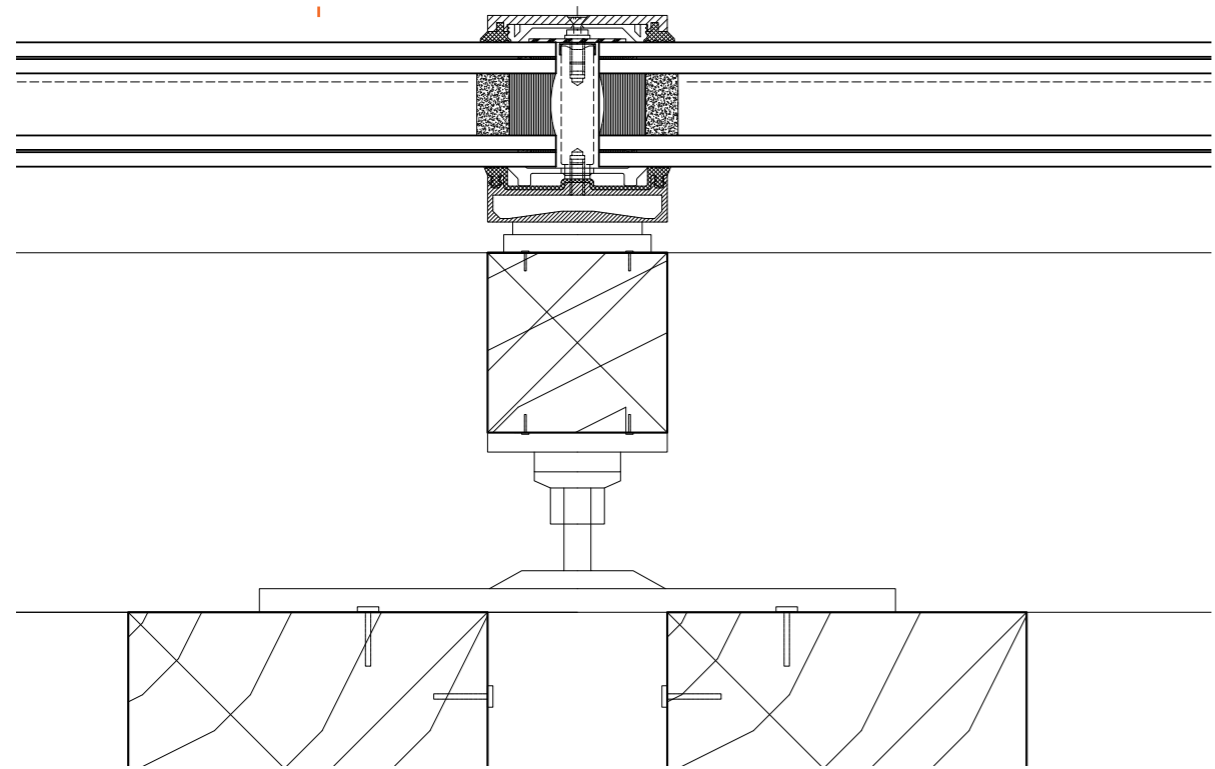
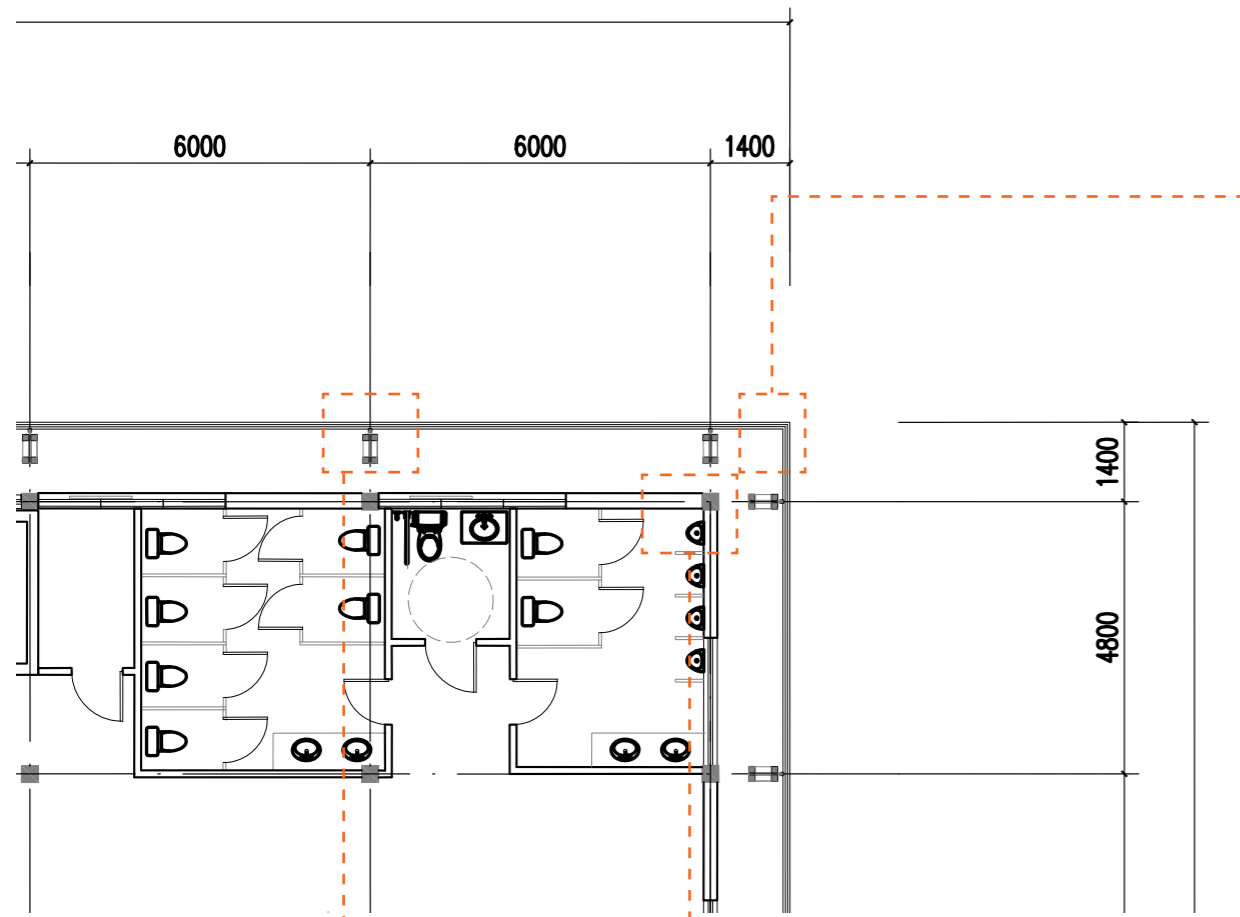


Detail 1-5

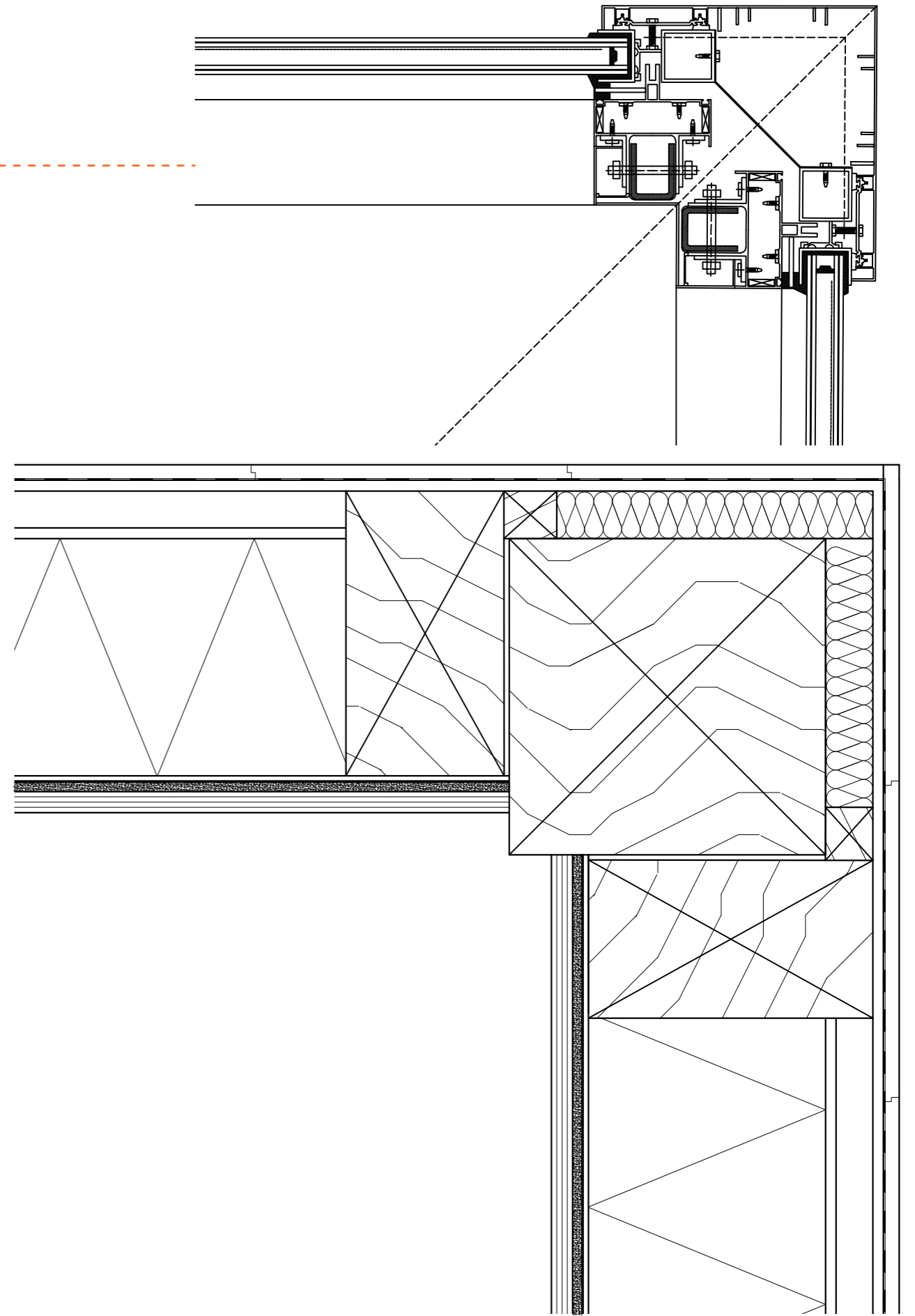
Detail horizontal



Detail 1-20

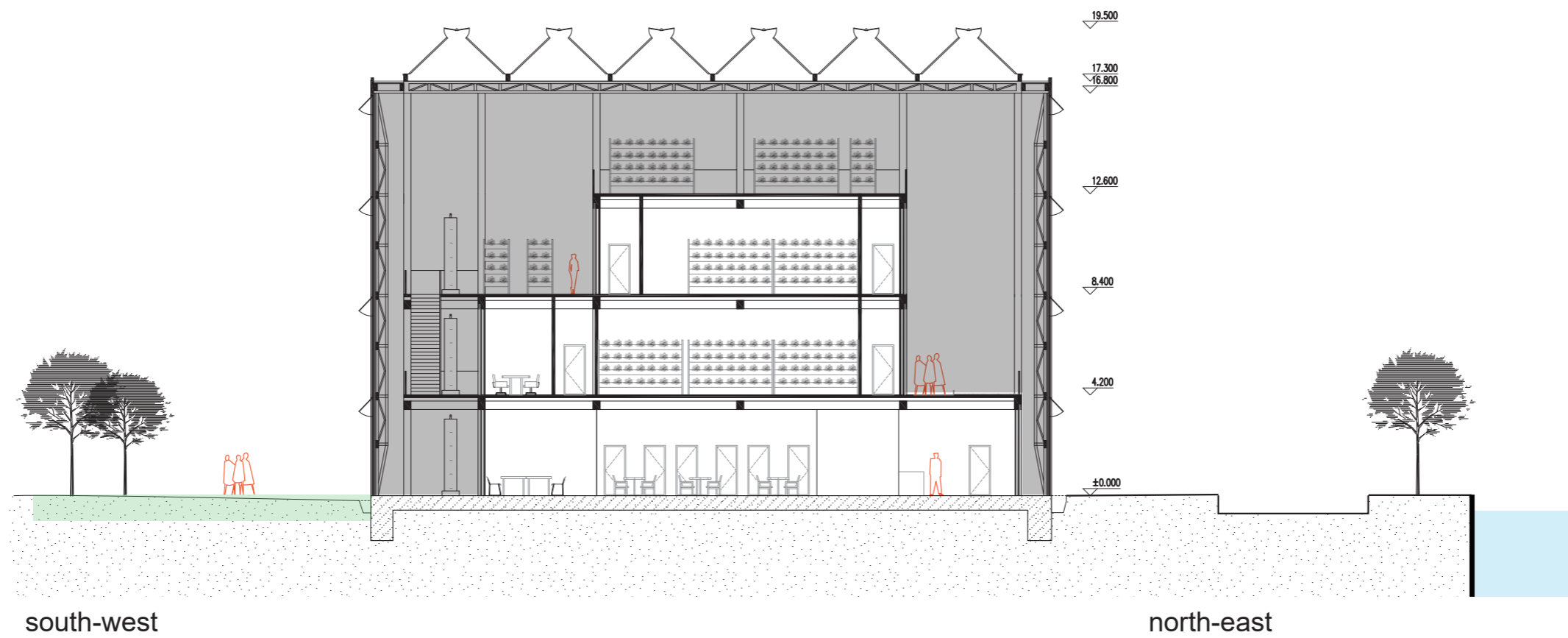


Detail 1-2



Detail 1-5

HOW IS THE RESEARCH APPLIED?

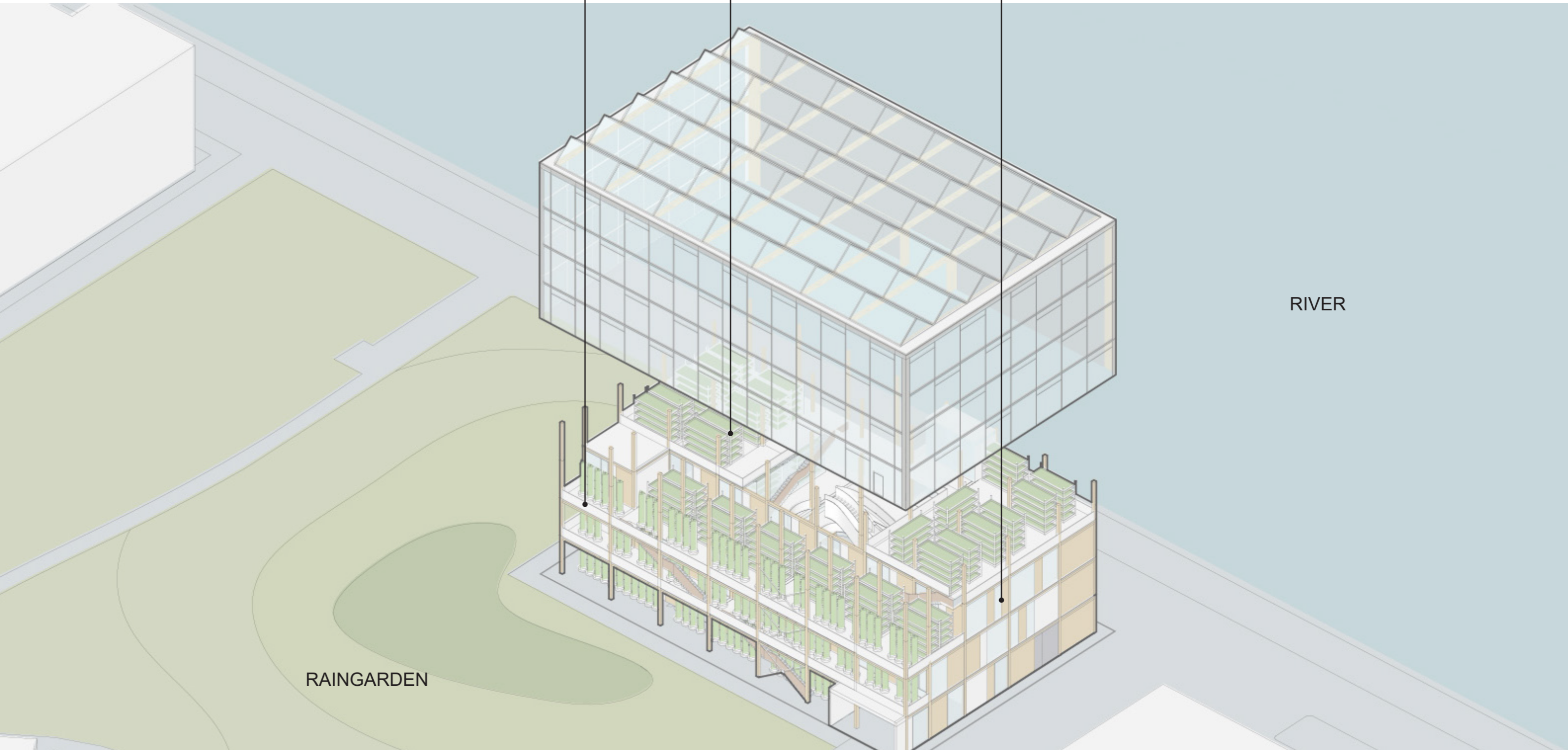


An intermediate climate between indoor & outdoor

THE INTERLAYER

VERTICAL FARM

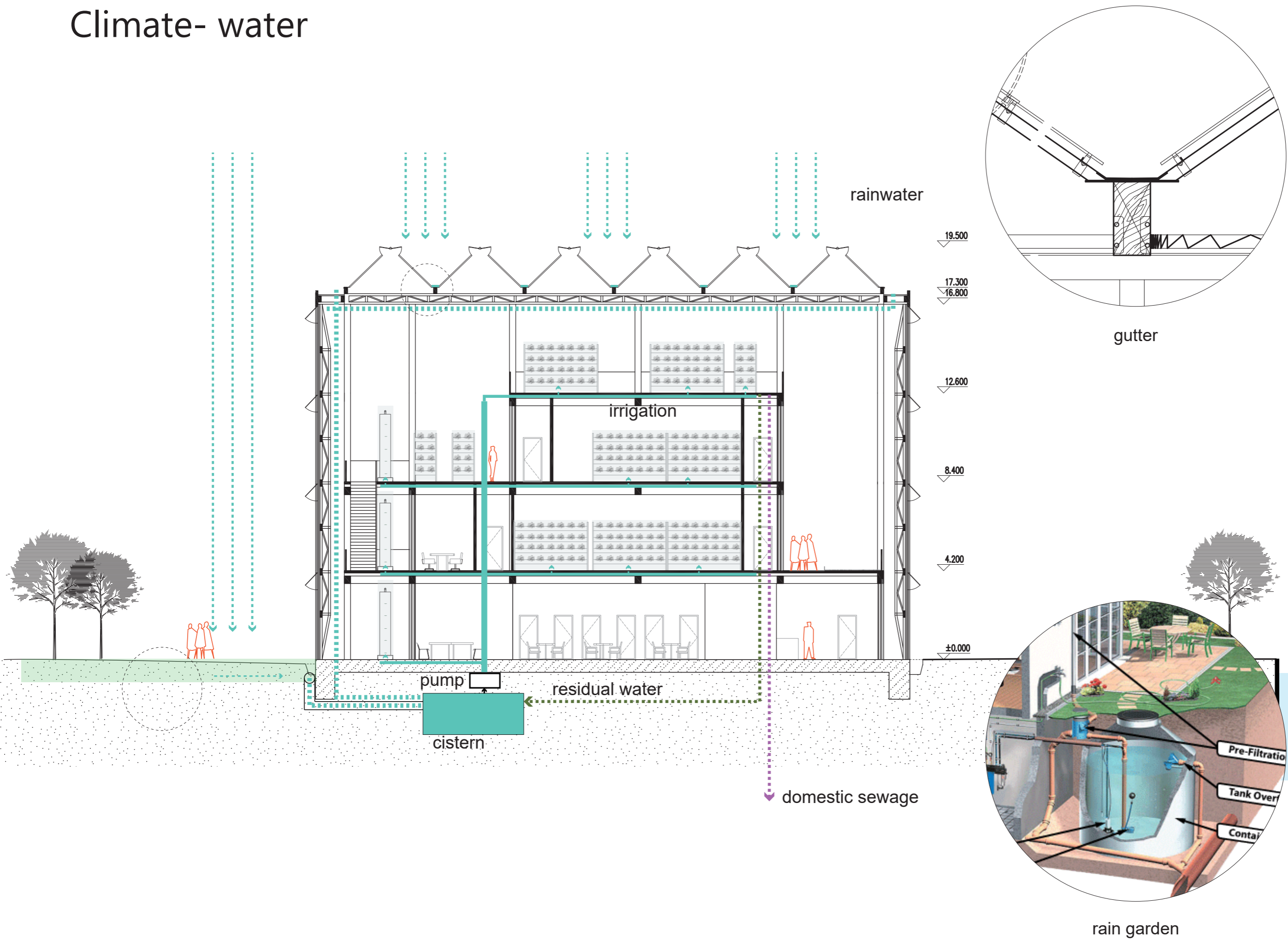
OFFICES



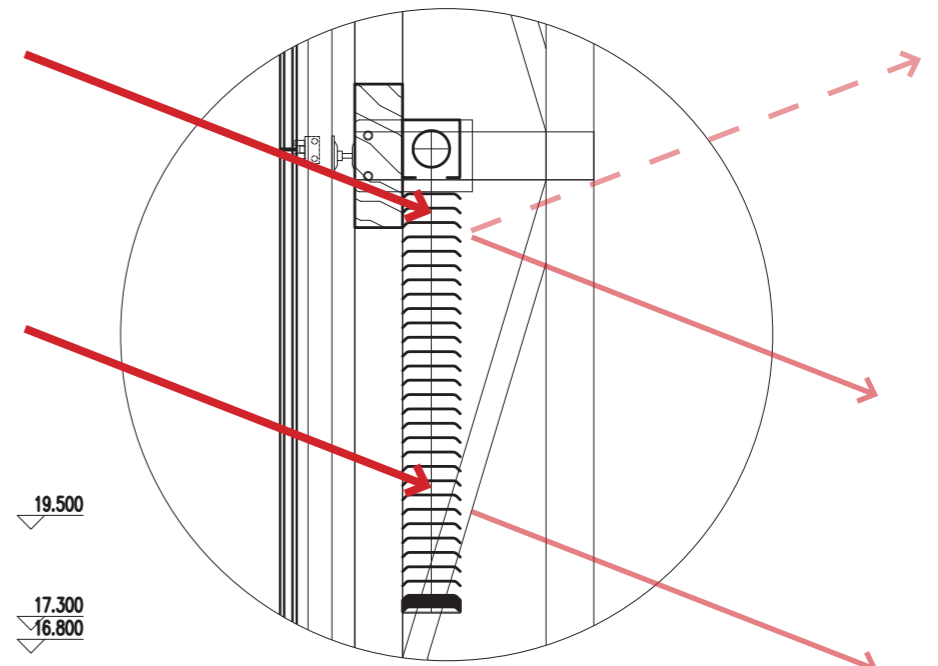
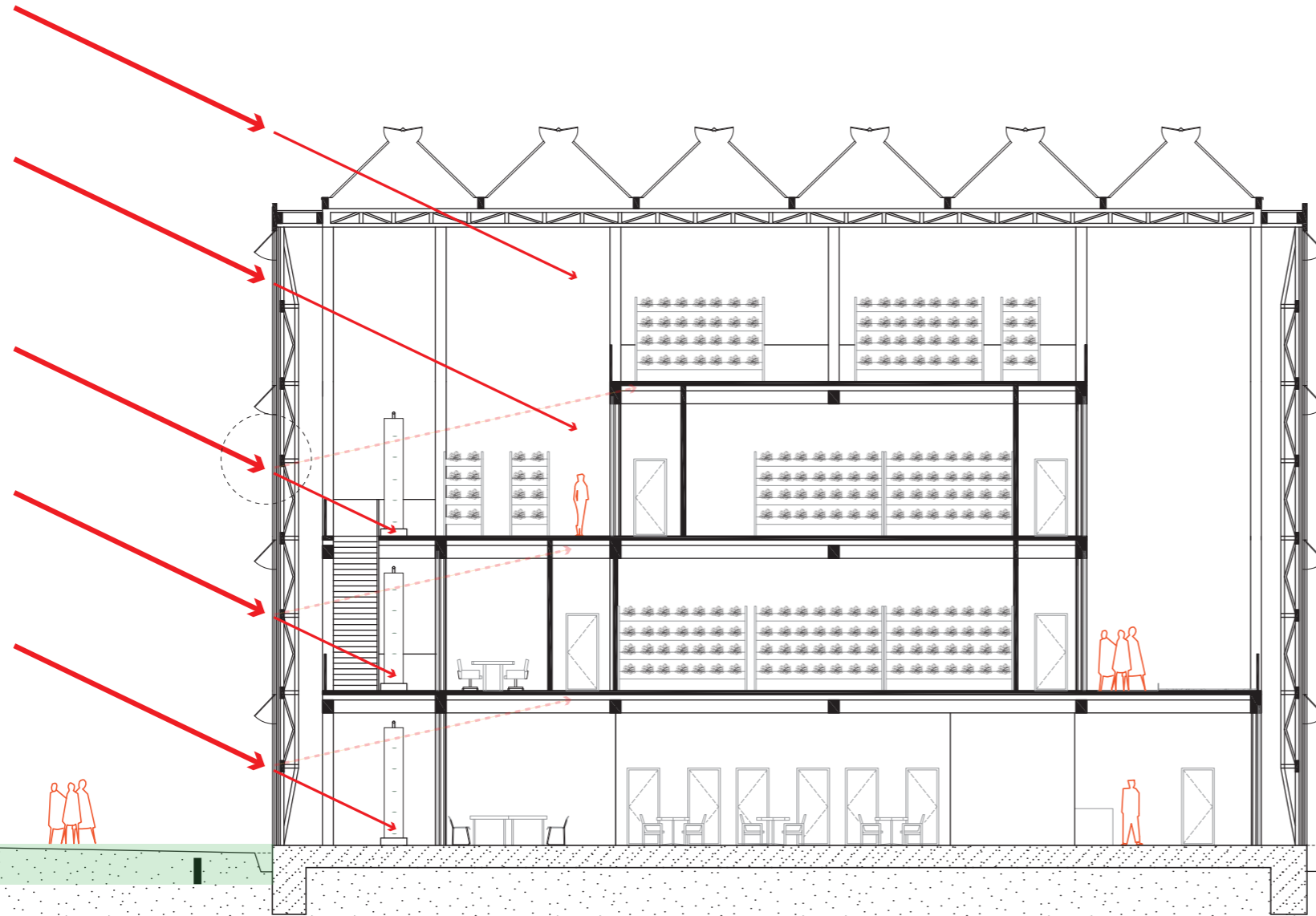
RIVER

RAINGARDEN

Climate- water



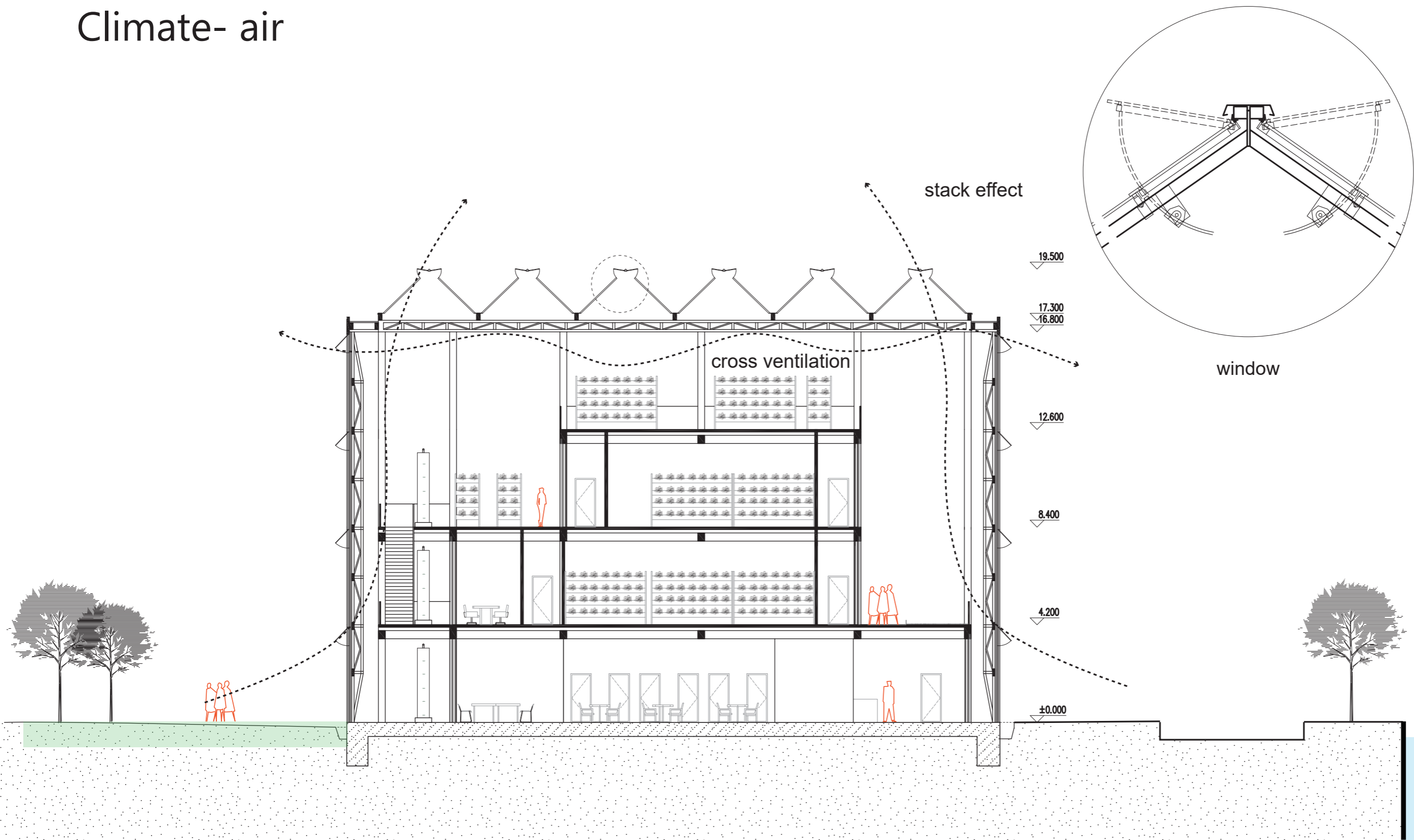
Climate- natural light



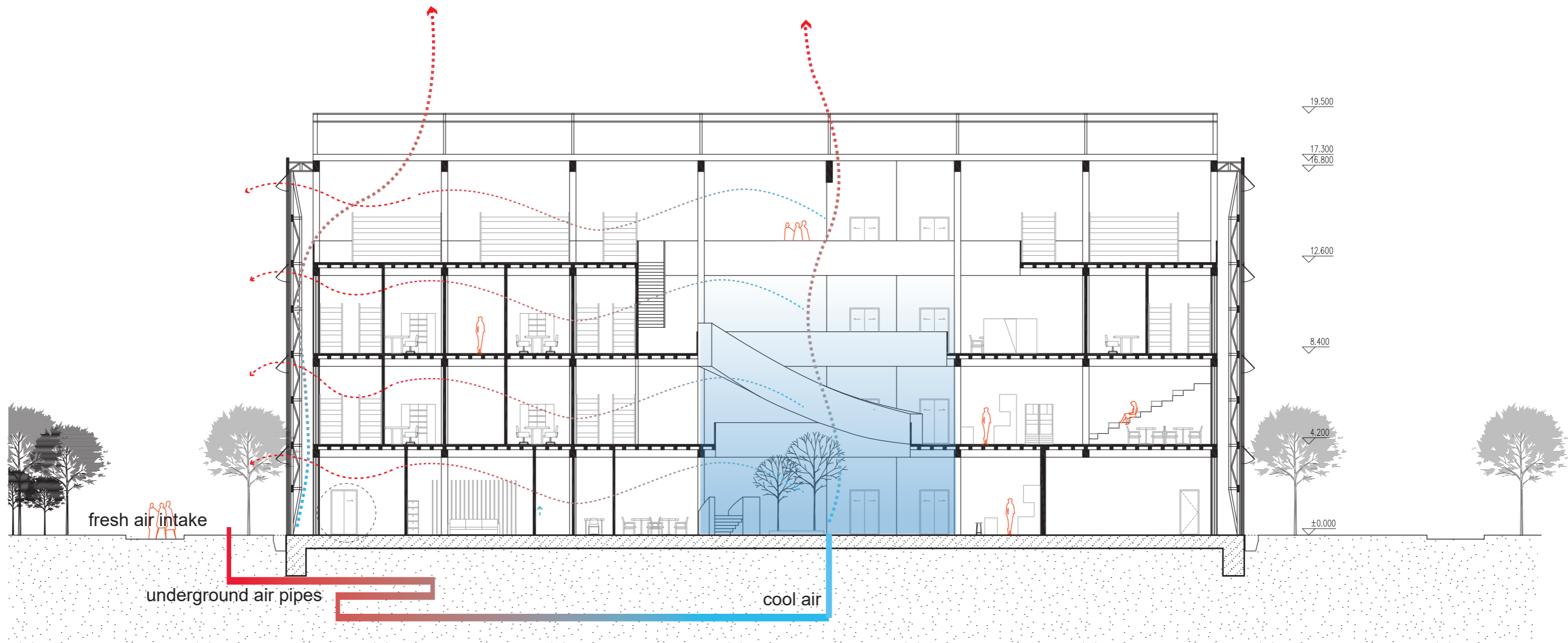
19.500
17.300
16.800
12.600
8.400
4.200
±0.000

natural light reflection

Climate- air



Climate- heat



SUMMER

THANKS TO

Lamers, E
Zaag, Ir. E.J. van der
Krieger, J. de
Korthals Altes, Dr.mr. E.

MY FAMILY AND ALL MY DEAR FRIENDS.

