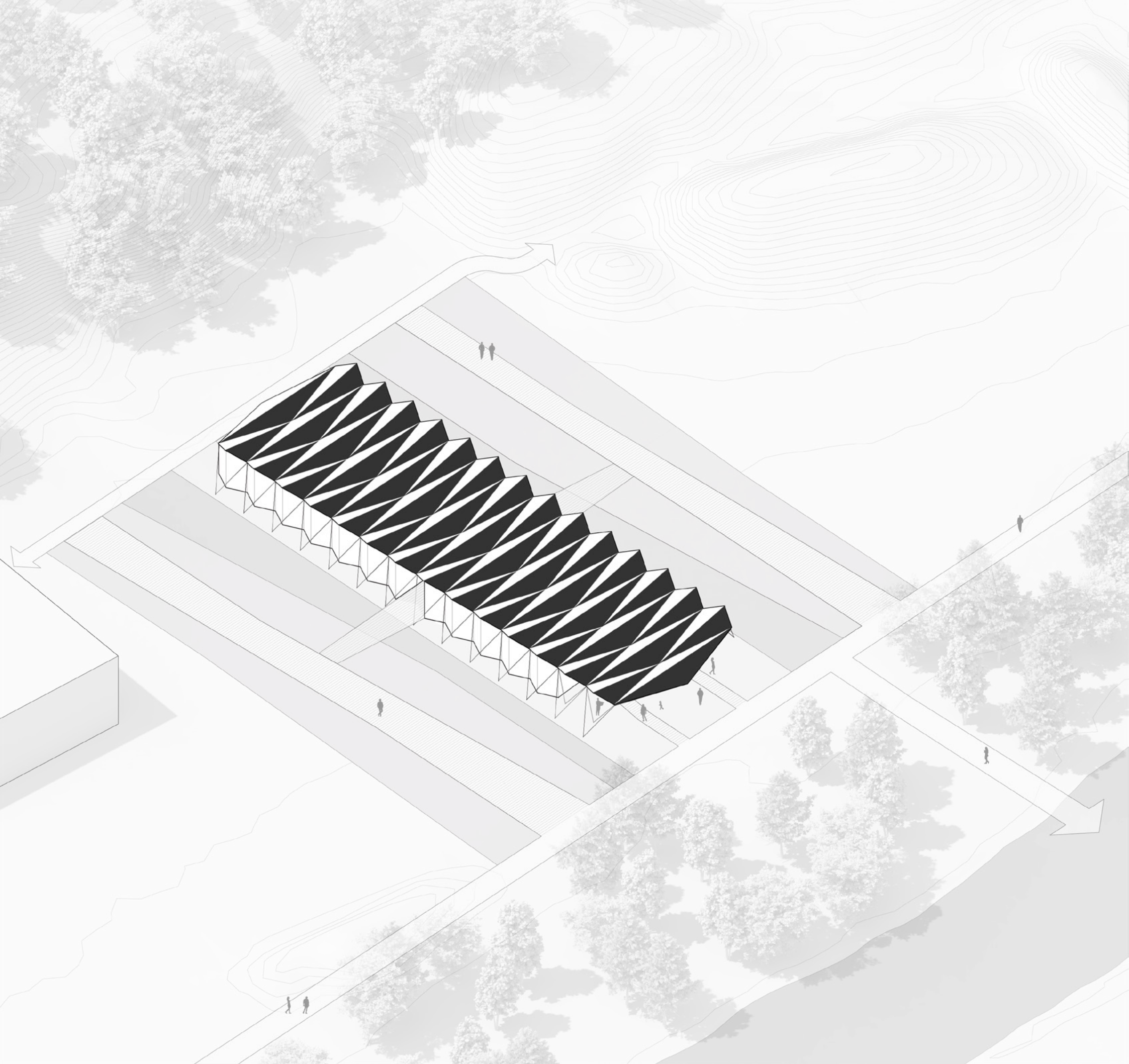
VALHALLA GREENHOUSE

ADRIAN DAHLBERG



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INITIAL PLAN 1:100 (A2)

THE SITE

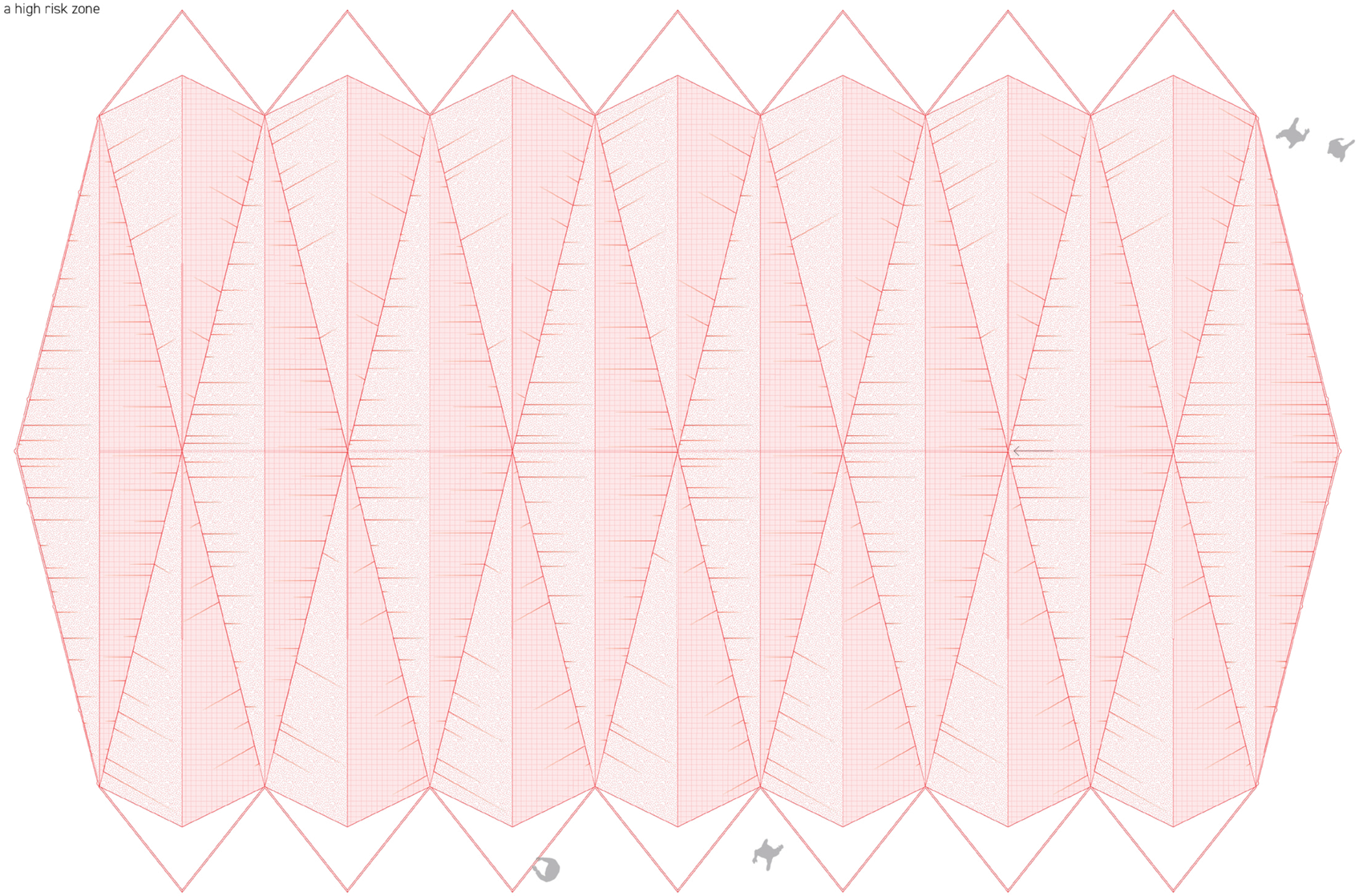
Valhalla is a central part of Gothenburg that is focused on providing opportunities for leisure and exercise forms. It offers a great variety of both outdoor and indoor activities that includes a sports center, football fields, indoor swimming pools, a skatepark and a running track. Unfortunately, city planning has failed to provide sufficient accessibility to the site, large infrastructural networks isolates the site and limits potential usage. The site's low altitude with proximity to Mölndalsån together with impermeable surfaces has turned it into a high risk zone of flooding.

INITIAL CONCEPT

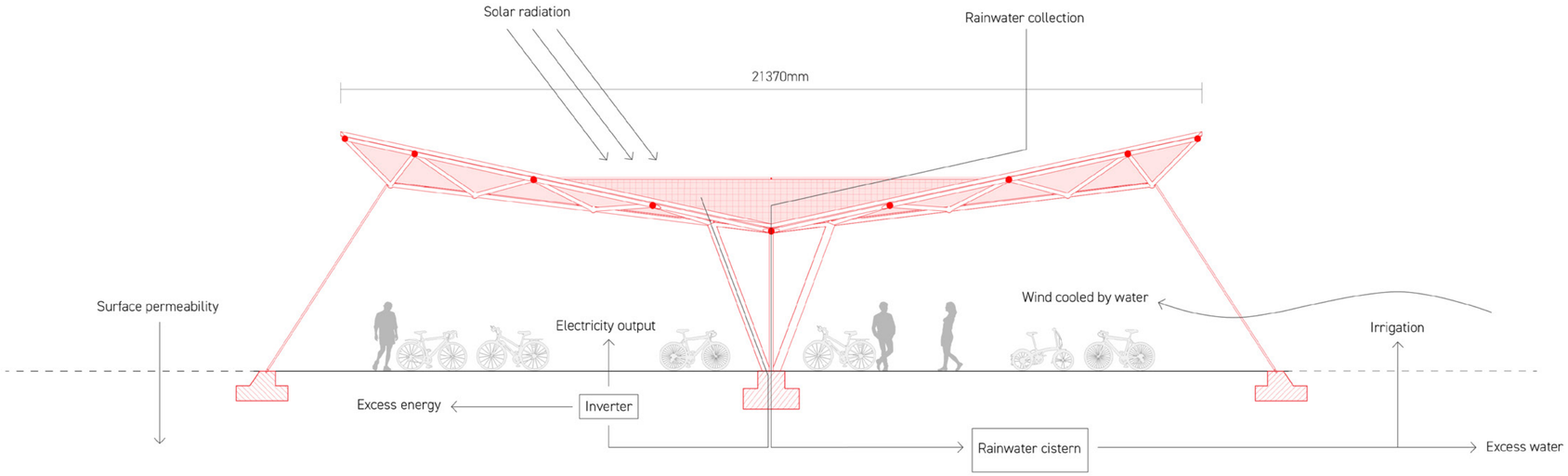
On the site of the existing parking lot between a football field and a running track I am proposing a new infrastructure that provides a connection between two frequently used bike lanes. The 690m2 surface area of the rooftop collects rainwater that can be used for irrigation purposes. Solar panels angled towards the south use solar energy for charging batteries of electric transportation forms.

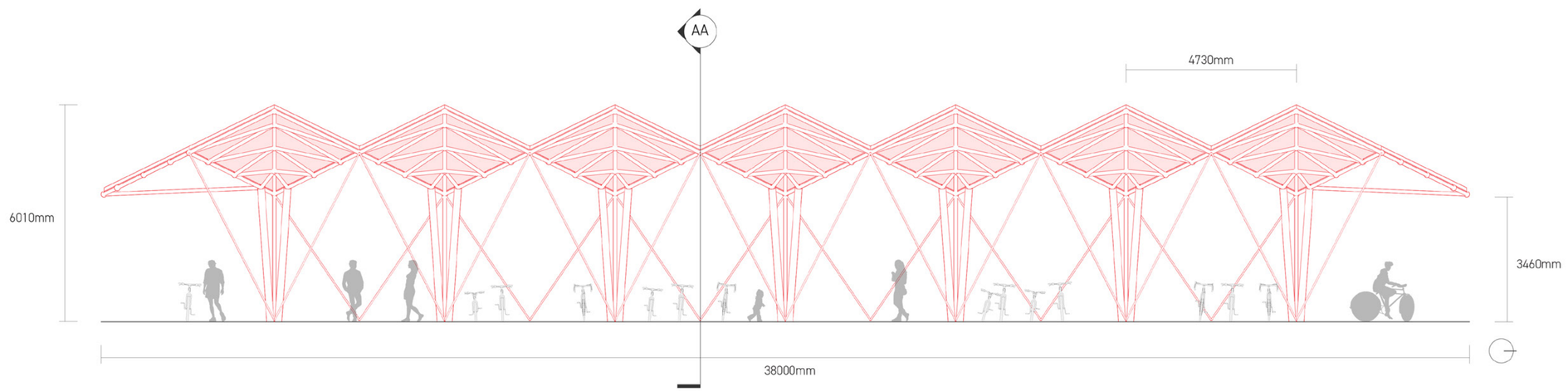
OPTIMIZATION

Red lines of the rooftop indicate the path of rainwater. It is a simulation of the water flow and where rainwater eventually accumulates. The 26° degree inclination on the roof panels makes it suitable for attaching PV panels on the south facing surfaces while polycarbonate towards north maximize daylight intake.



INITIAL SECTION AND ELEVATION 1:100 (A2)





SITE PLAN 1:200 (A2)

FLOOD RISK LEVELS

- Existing water levels
- Water level once every 50 years
- Water level once every 100 years
- Water level once every 150 years
- Water level once every 200 years
- Highest anticipated water level

FLOW PATH SIMULATOPM

- Surface runoff

SURFACE CONDITIONS

- Non-permeable surface
- Permeable surface

PRECIPITATION RATE

Days with rain per year: 173
Days without rain per year: 165
Annual ammount of rain: 470mm
Geographical data: SLU
Flood risk data: MSB

1 5 10 20m

SITE SECTION 1:200 (A2)

FLOOD RISK LEVELS

- Existing water levels
- Water level once every 50 years
- Water level once every 100 years
- Water level once every 150 years
- Water level once every 200 years
- Highest anticipated water level

GEOLOGICAL CONDITIONS

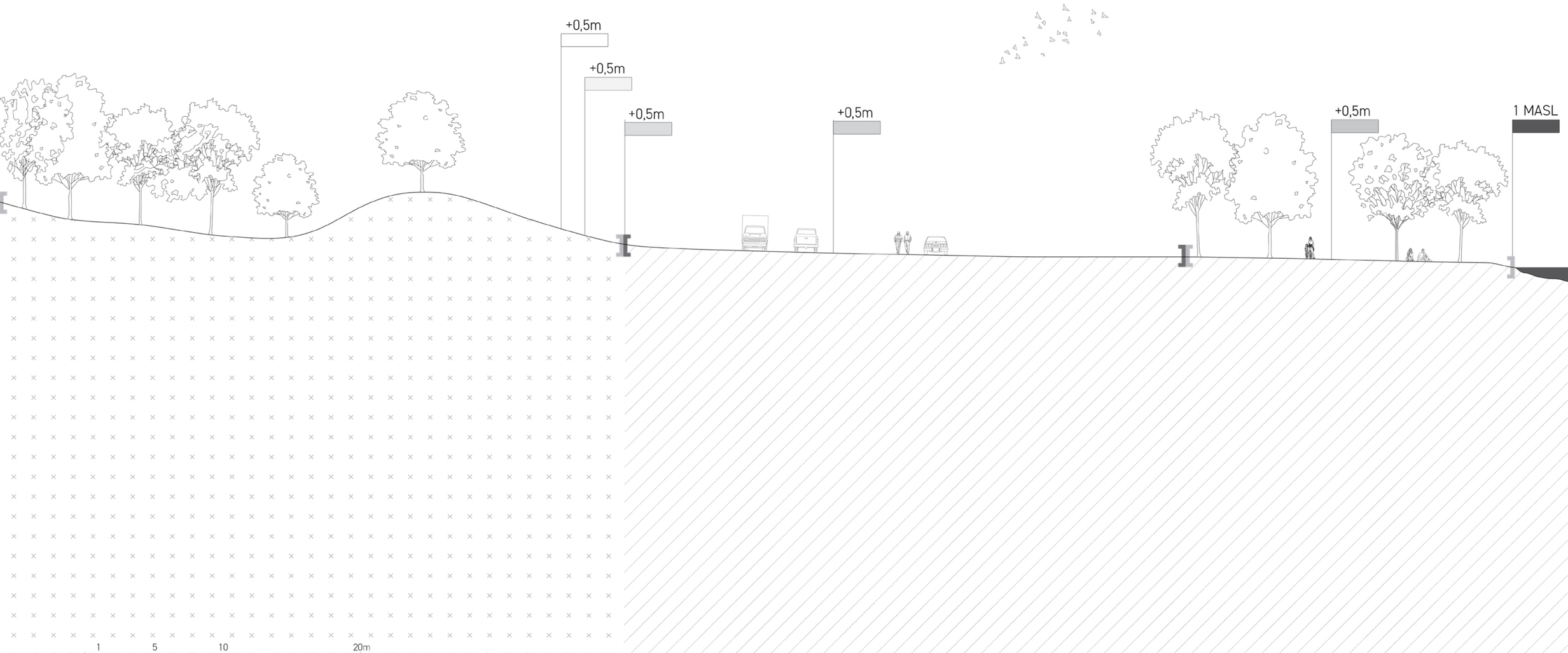
- Ancient mountain
- Postglacial clay

SURFACE CONDITIONS

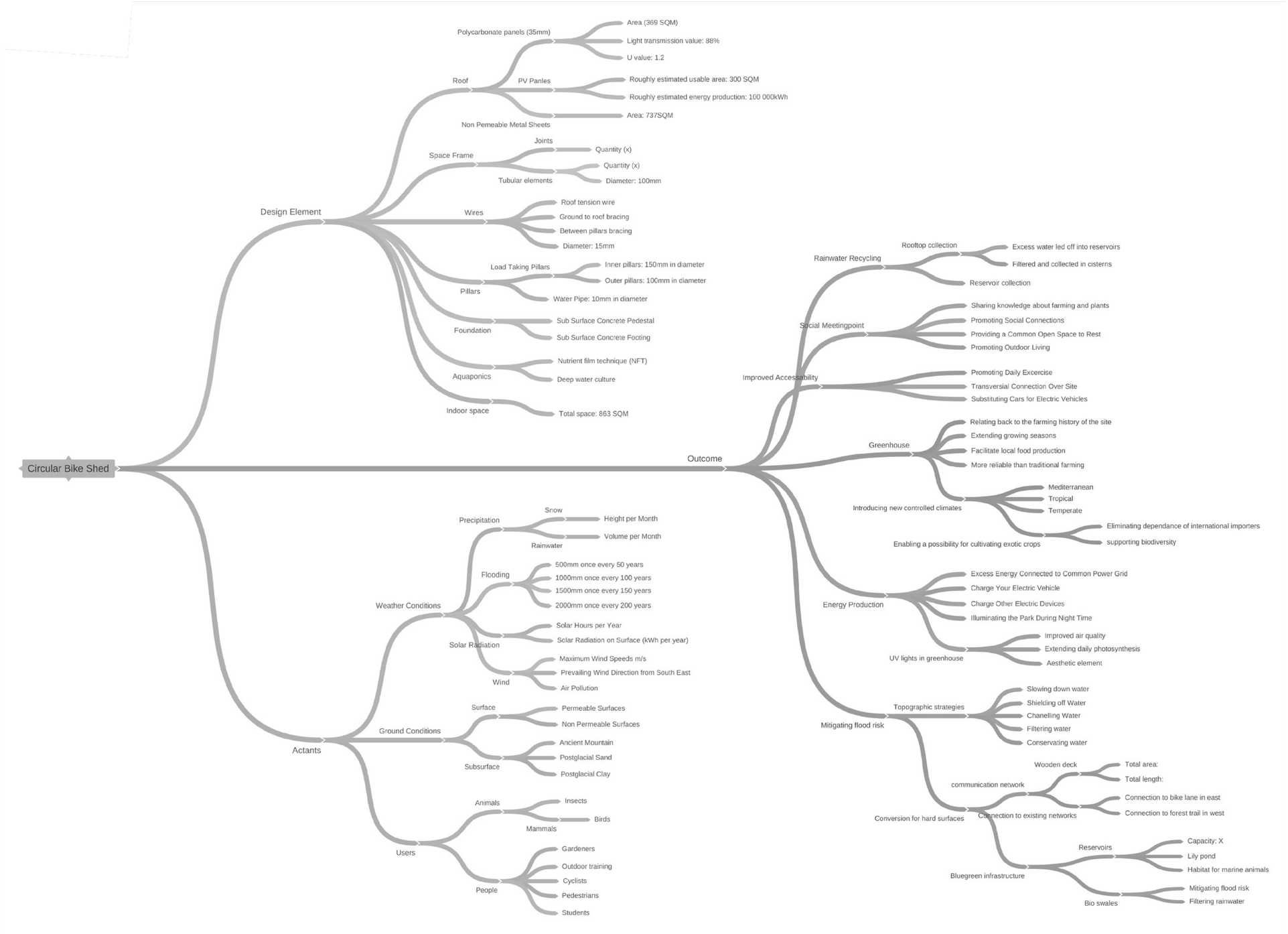
- Non-permeable surface
- Permeable surface

PRECIPITATION RATE

Days with rain per year: 173
Days without rain per year: 165
Annual ammount of rain: 470mm
Geographical data: SLU
Flood risk data: MSB



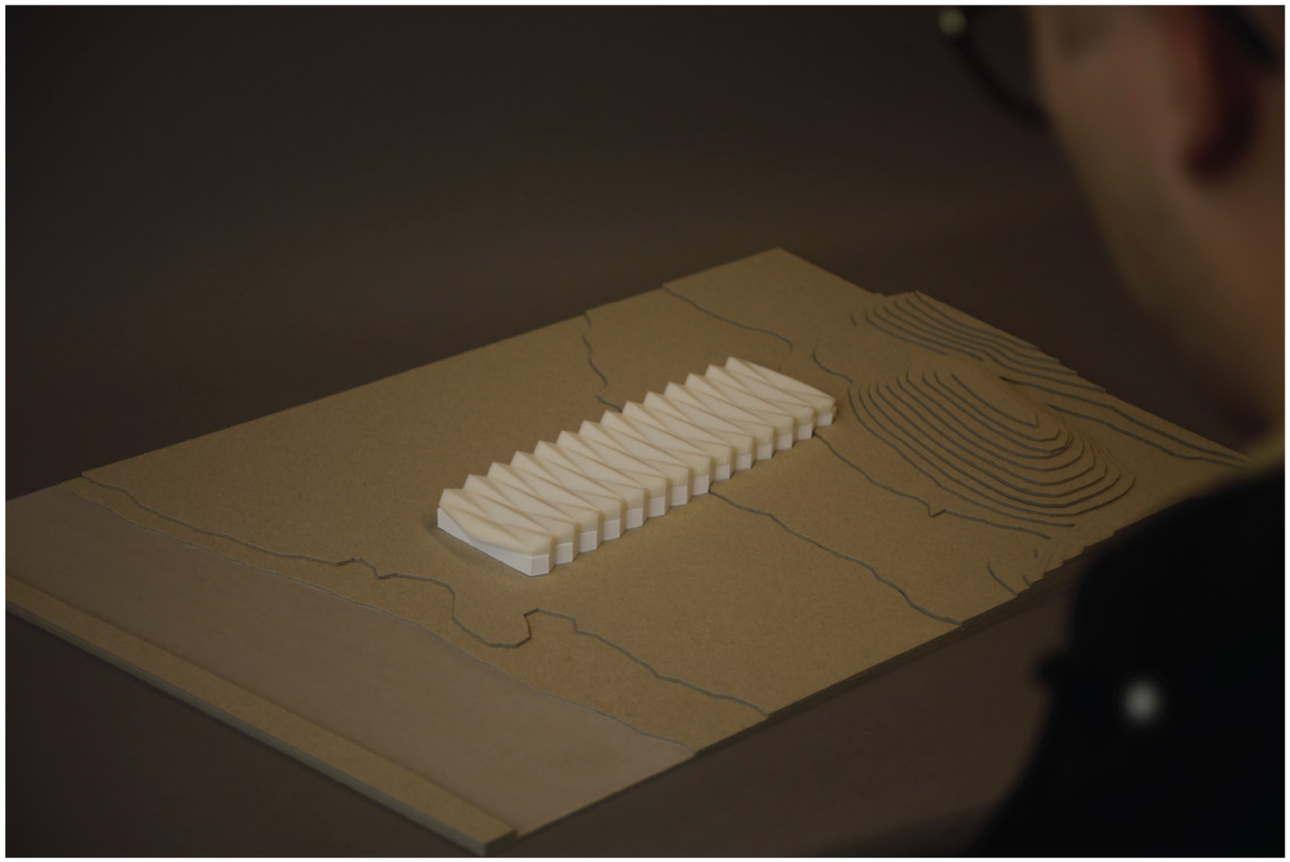
GOGGLE DIAGRAM (A2)



LANDSCAPE MODEL 1:200 (A2)

PHYSICAL MODEL

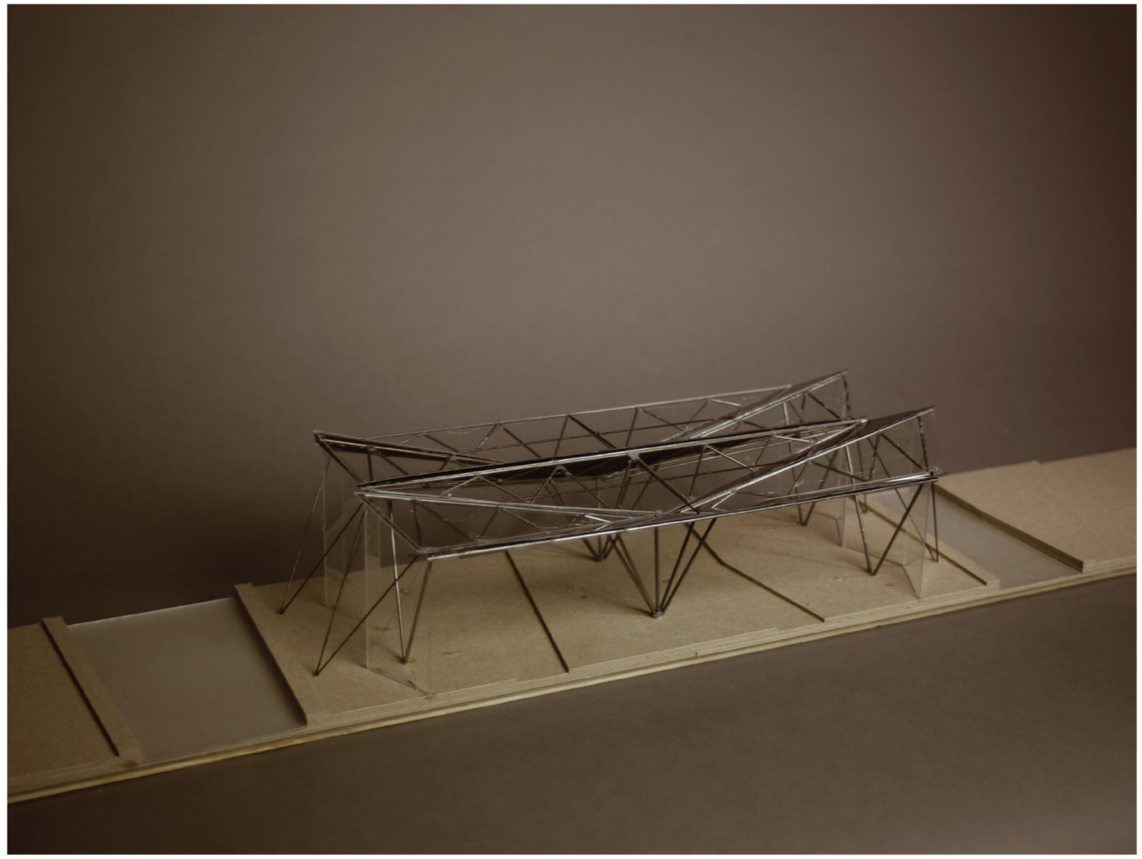
Working by hand achieves a deeper volumetric understanding. The study investigates how orientation and placement of the prototype plays a big role in how it relates to the surroundings. The outcome is optimized for the right solar exposure according to the PV panels. Topographical features were taken into consideration when designing the landscape in accordance to the surface runoff water



DETAIL MODEL 1:50 (A2)

PHYSICAL MODEL

Zooming in closer gave a better understanding of how the expression of the structure works with tension, torsion, and compression forces. It looks at the transversal relation between prototype and landscape



PLAN AND ELEVATION 1:150 (A2)

CLIMATE ZONES

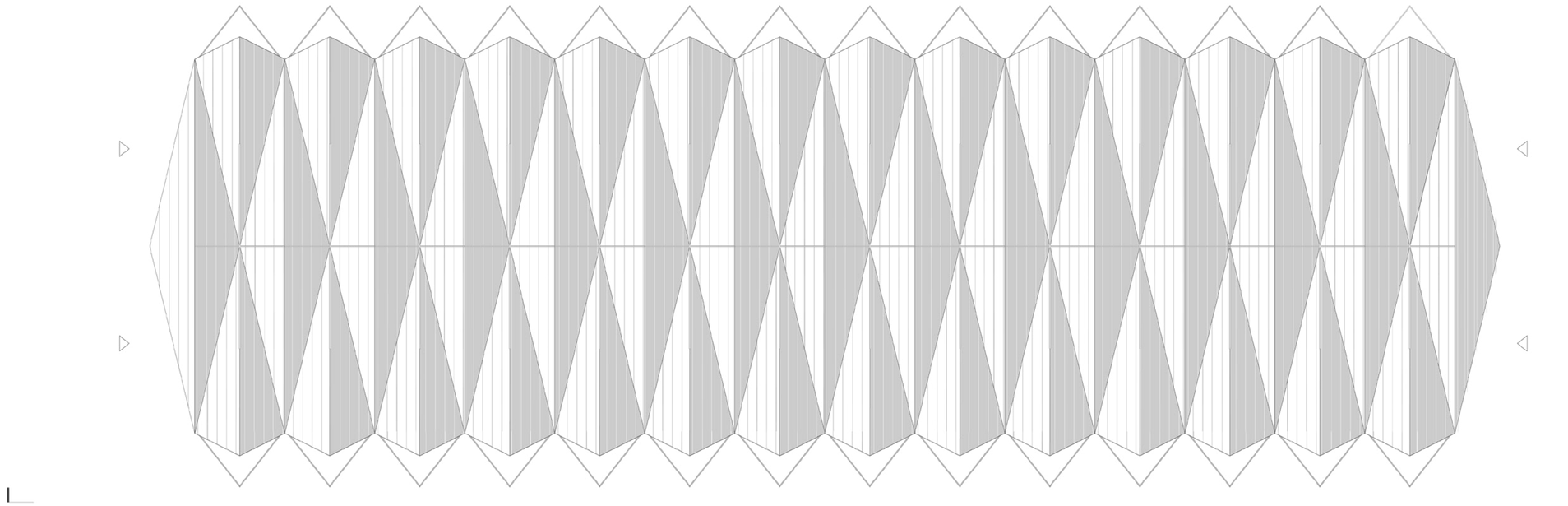
A1 Mediterranean
A2 Tropical
A3 Temperate

WATER SYSTEM

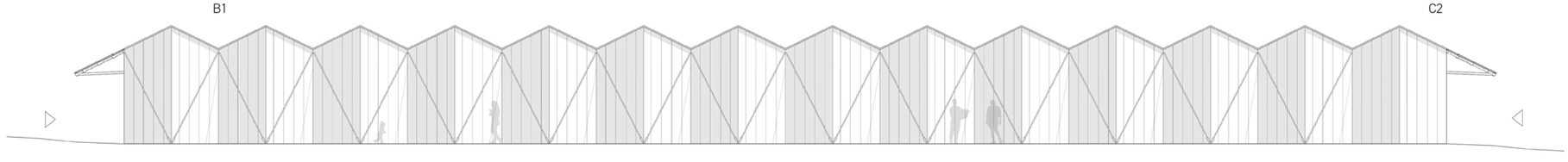
B1 Water collecting rooftop
B2 Subsurface water cistern
B3 Subsurface water pipelines

ENERGY SYSTEM

C1 Geothermal heating
C2 PV panels



A1 A2 A3



PLAN AND SECTION 1:150 (A2)

CLIMATE ZONES

A1 Mediterranean
A2 Tropical
A3 Temperate

WATER SYSTEM

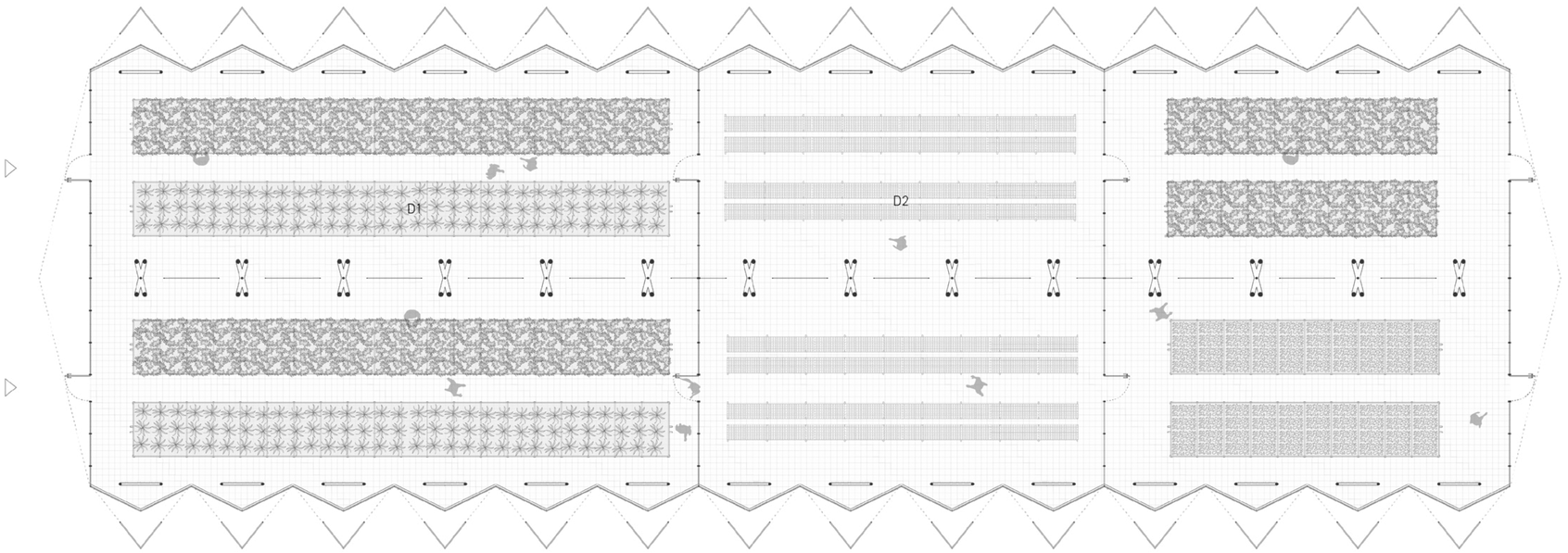
B1 Water collecting rooftop
B2 Subsurface water cistern
B3 Subsurface water pipelines

ENERGY SYSTEM

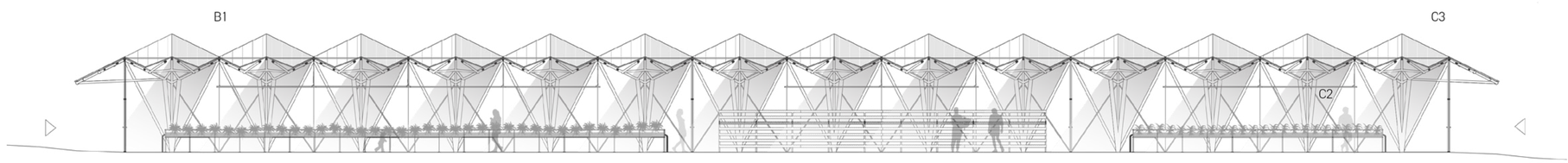
C1 Geothermal heating
C2 UV lights
C3 PV panels

CULTIVATION

D1 Deep water culture hydroponics
D2 NFT hydroponics



A1 A2 A3



DEEP SECTION 1:50 (A2)

STRUCTURE

A1 Pile foundation
A2 Steel bracing
A3 35mm polycarbonate panels
A4 Steel space frame structure
A5 Steel tension wire

WATER SYSTEM

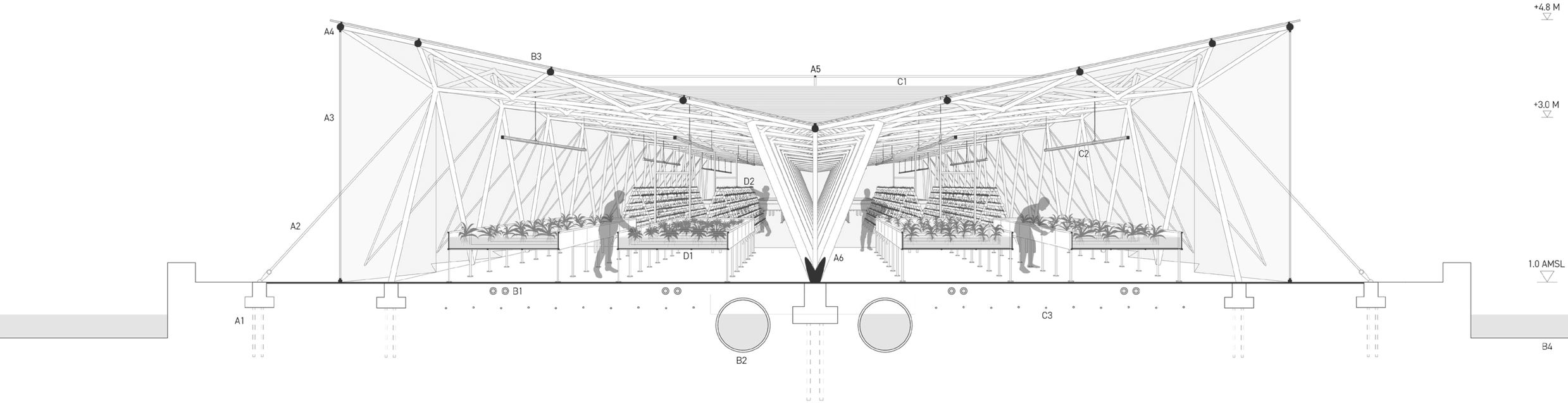
B1 Subsurface water pipelines
B2 Subsurface water cistern
B3 Water collecting rooftop
B4 Rain water reservoir

ENERGY SYSTEM

C1 PV panels
C2 UV lights
C3 Geothermal heating

CULTIVATION

D1 Deep water culture hydroponics
D2 NFT hydroponics



EXPLODED ISOMETRIC (A2)

INFRASTRUCTURE

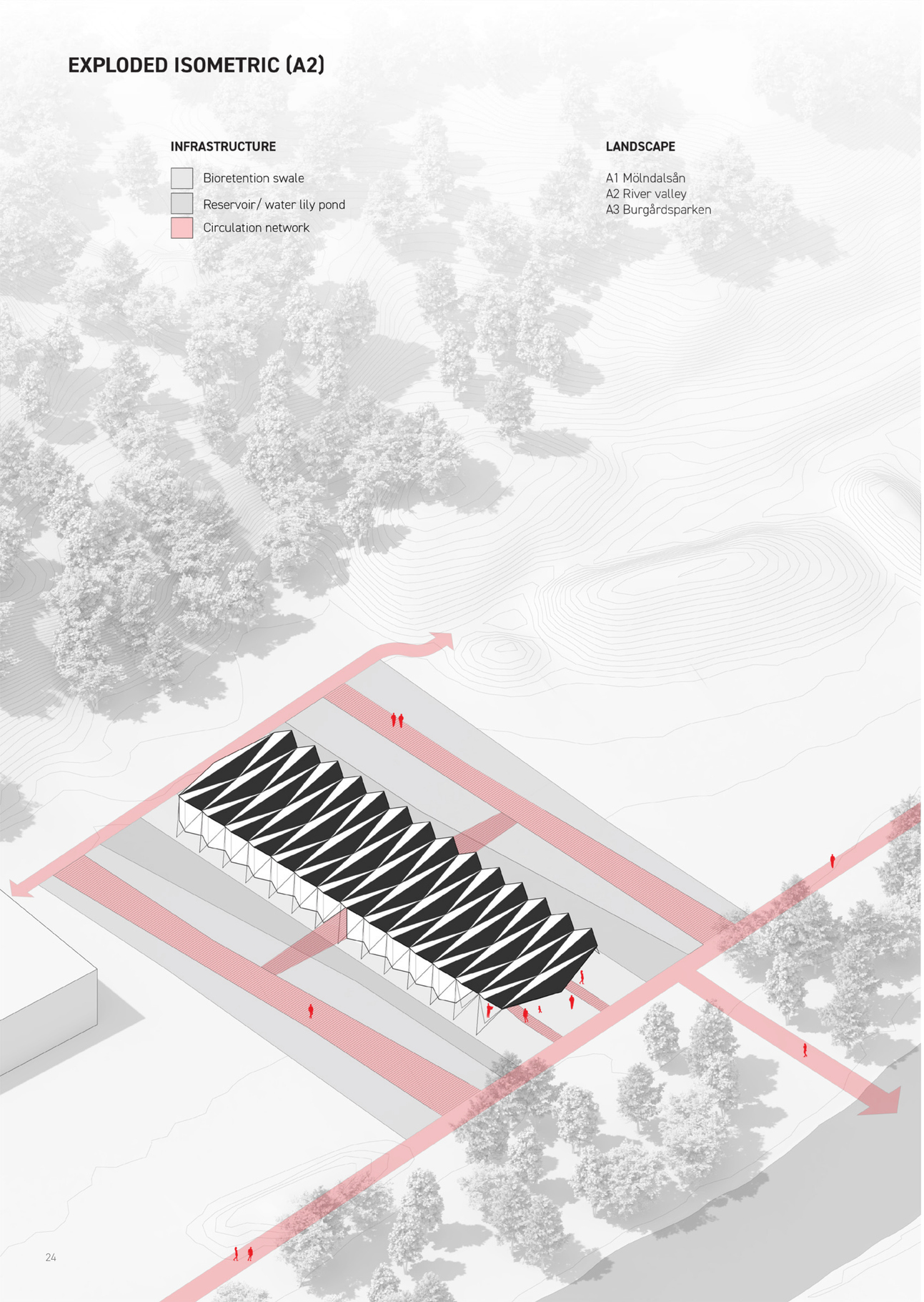
- Bioretention swale
- Reservoir/ water lily pond
- Circulation network

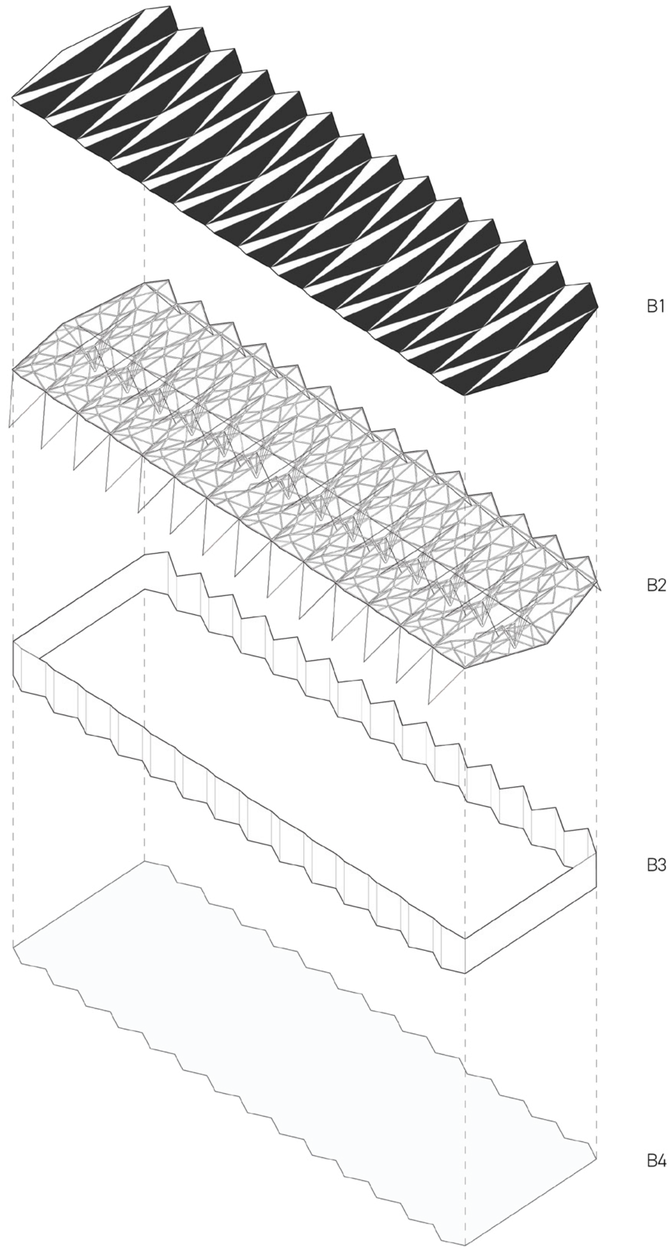
LANDSCAPE

A1 Mölndalsån
A2 River valley
A3 Burgårdsparken

STRUCTURE

B1 PC and PV roof panels
B2 Structural space frame
B3 PC facade panels
B4 Stone patio





URBAN EXPANSION (A2)

LOCATION

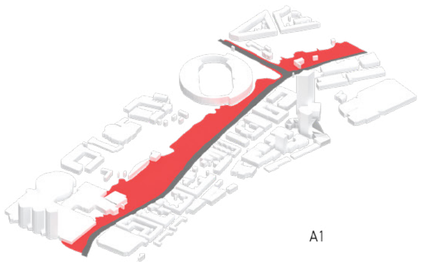
Valhalla, Göteborg
57°70'2.6"N, 11°98'99.4"E

SYSTEM GROWTH

A1 Worst case scenario flooding
A2 Zoning new development areas
A3 Converting the landscape into bioswales and reservoirs
A4 Developing a series of prototype variations

PROPOSED EXPANSION

B1 Research center
B2 Commersial greenhouses
B3 Collective greenhouses
B4 Bioswales + reservoirs + pathways
B5 The site



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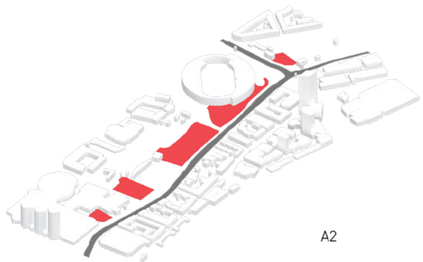

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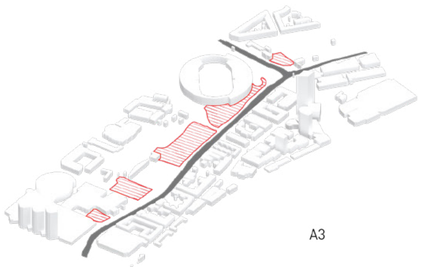

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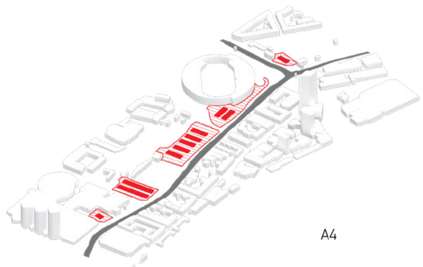

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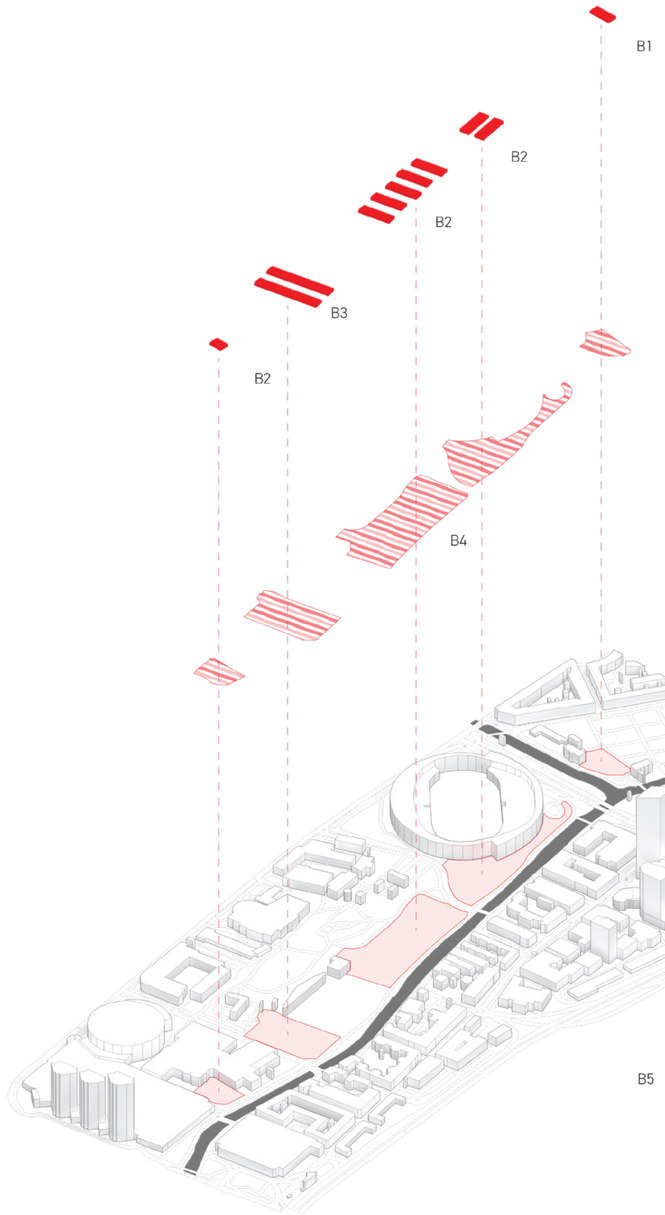


PROCESS SKETCHES (A2)

SCOPE

Introduce a new blue green infrastructure that address the current situation of flood risk and inaccessibility. It promotes social living by sharing knowledge on sustainable growth.

CONCEPT

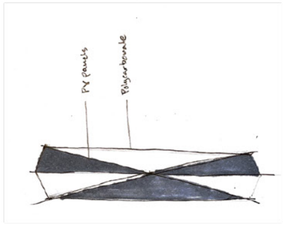
By converting the land into stripes of bioswales, reservoirs, and pedestrian networks it is possible to mitigate flood risk and utilize stormwater. Modular greenhouse prototypes promote urban farming and relates back to the history of the site.

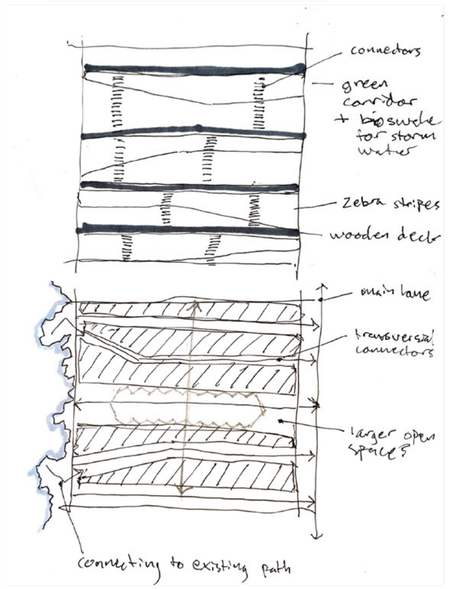
PROGRAM

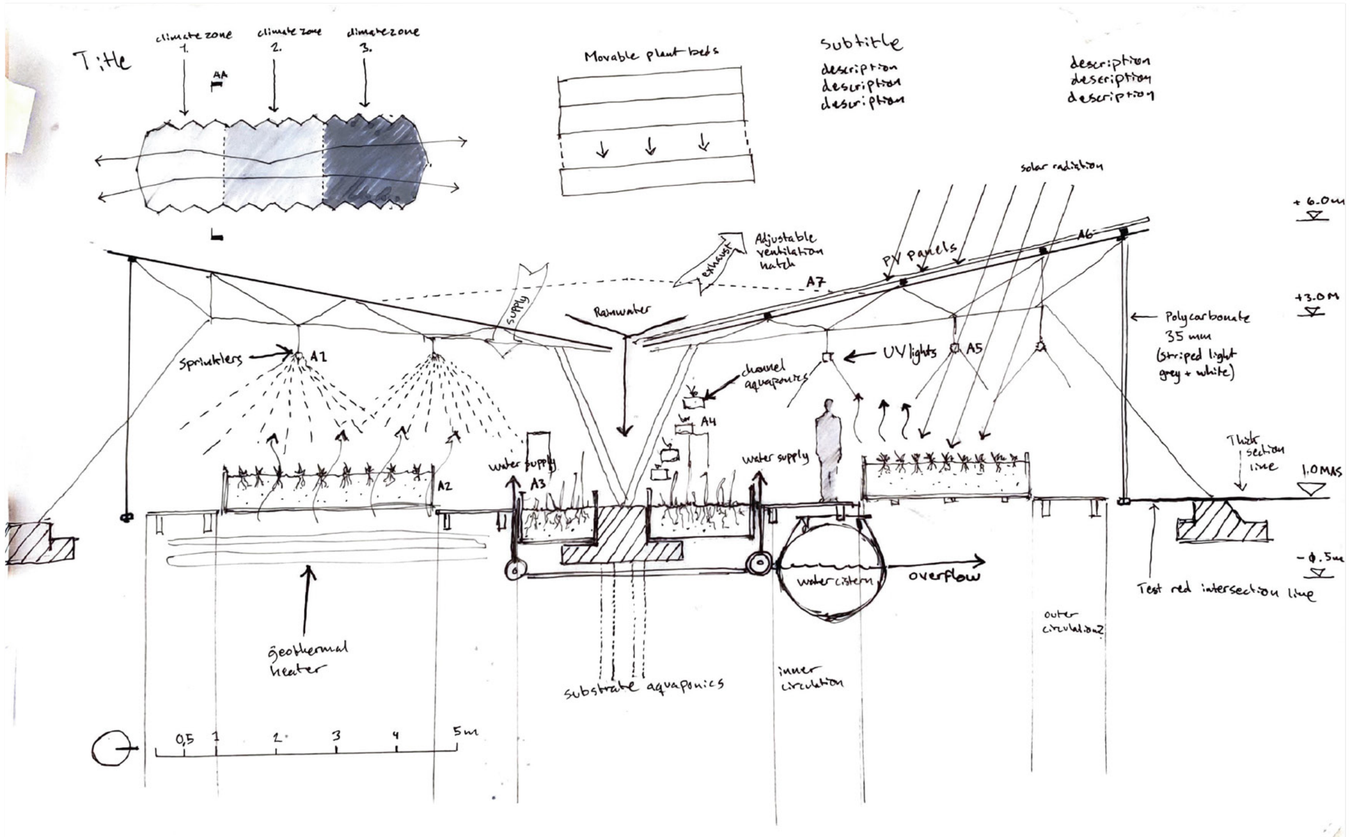
New pedestrian connections will link the gap between the forest and the existing bike lanes and thereby establish an in between meeting place for urban gardeners and city dwellers.

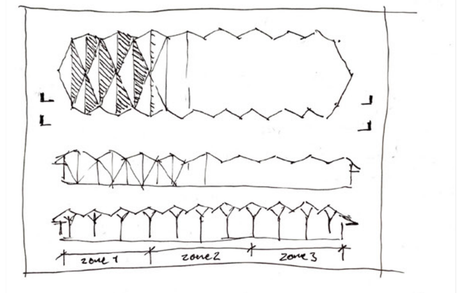
VISUALIZATION

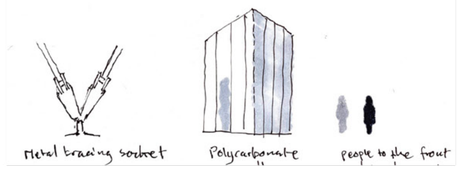
Sketching as a tool helped me to quickly test out my initial ideas. It gave me a sense of the scale and function of the prototype in relation to the context.

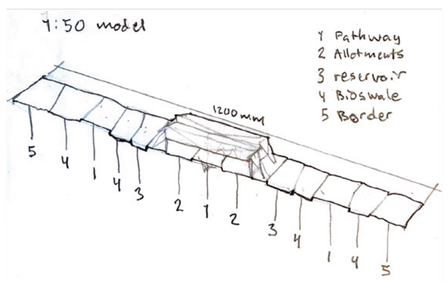












EVOLUTION TREE (A2)

PROTOTYPE DEVELOPMENT

A1 Volume study
The undulating rooftop is the result of a series of optimisation strategies of solar exposure and structural integrity. Folding angels creates a rigid shape that requires less material mass for support.

A2 Defining a structure
When researching an appropriate structure I decided to work with lightweight metal trusses supported by wires for its structural and visual qualities that conveys a sense of lightness but also due to its ability to be repurposed.

PROTOTYPE DEVELOPMENT

A3 Adapting to the program
After some conceptual iterations, the prototype underwent certain adaptations to be accustomed for the program. Building on the same structural langue, this phase meant extending the shape to fit its location. Exterior cladding was added to enclose the space.

A4 Landscape development
In parallel with the greenhouse, I was working with landscape strategies that used bluegreen infrastructural networks to establish resiliency and accessibility that would interact in a seamless way with the additional prototype.

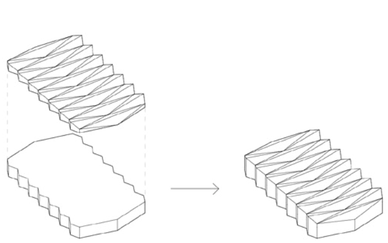
PROTOTYPE DEVELOPMENT

A5 Design proposal
When compiling all the layers into a final proposal, the overlaps between strategies, concepts and the social program initiated a new dialogue about how it potentially would respond to social and climate issues concerning valhalla and urban food production.

ACTANTS AND OUTCOME

C1 Precipitation
C2 Flooding
C3 Solar radiation
C4 Geological condition
C5 People
C6 Animals

D1 Promoting local food production
D2 Renewable energy production
D3 Mitigating flood risk
D4 Improving bluegreen infrastructure
D5 Recycling rainwater for cultivation
D6 Establish a research centre
D7 Promoting social interactions
D8 Greenhouse market



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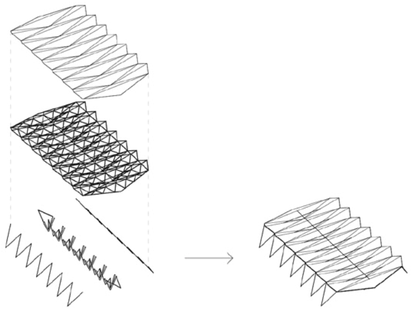

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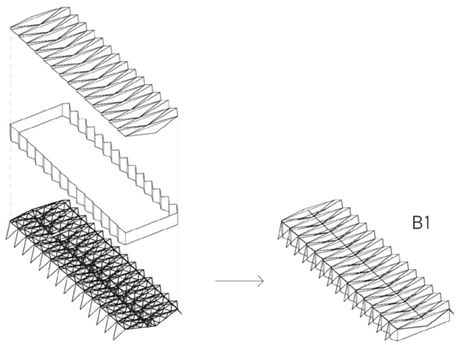

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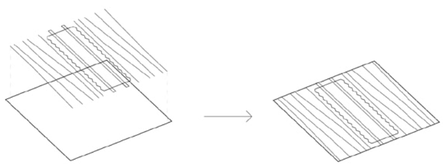

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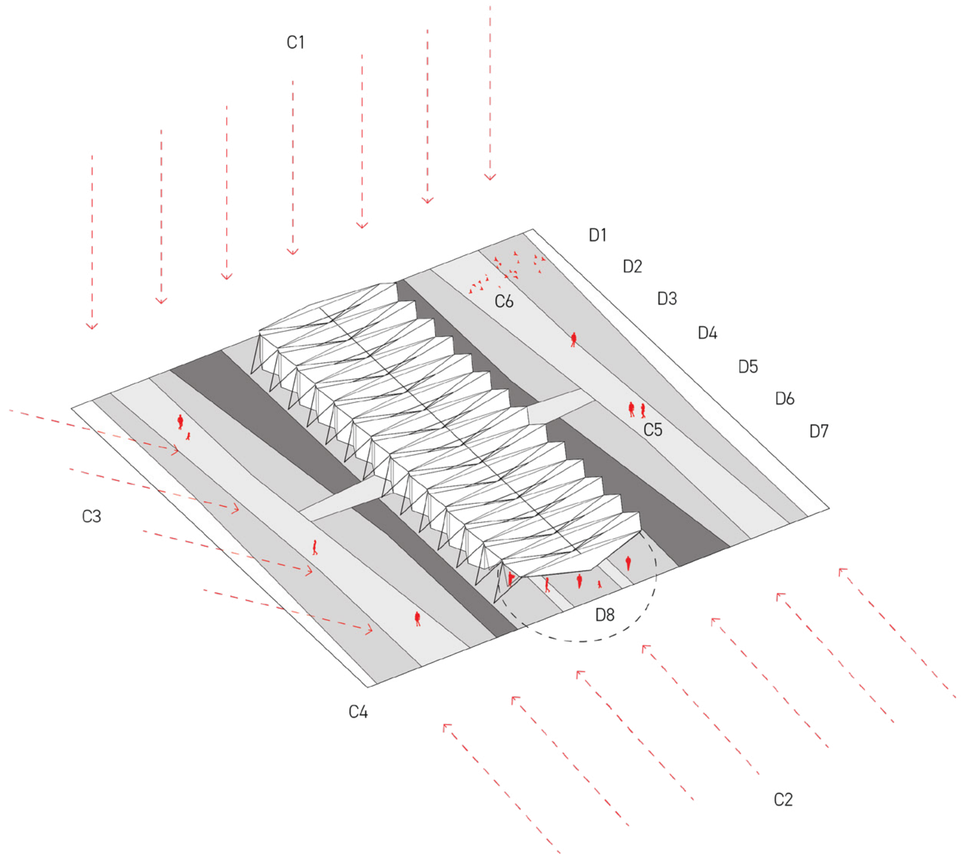

SWOT ANALYSIS (A2)

STRENGHTS

Compiled documents of the ongoing risk assessment and prevention of flooding provided by the municipality defined a starting point of risk treatment along the valley of Mölndalsån. In response to the immediate climate conditions, I have reimagined the critical situation by utilizing natural resources that otherwise constitute a threat. Rainwater is recycled for plant bed irrigation. Bioswales offers the ability to cleanse stormwater while stormwater reservoirs are accustomed for detention. These have both aesthetic and social value while also providing a new habitat for insects and mammals. The rooftop produces green electricity for the city. Aquaponic urban food production is both space efficient and does not require as many resources. The modularity of the units makes them fast to assemble and disassemble, the repetitive spaceframe is a lightweight structure that can be partitioned into separate individual climate zones. This enables the ability to cultivate more exotic crops thus striving towards a more self-sufficient food production.

WEAKNESSES

During winter months, limited sunlight and cold temperatures challenge the production rate of food and energy production. The greenhouse faces increased energy consumption to sustain cultivation. The lack of a buffer zone between inside and outside will contribute to loss of energy. One solution could be to install a double glazed facade as an extra bufferzone that eliminates the most critical cold bridges and improves the insulation capabilities. Load taking capabilities will have to be reconsidered before production. This exercise is only a mere estimation of how the forces are applied. Because spatial development has been the subject of constant adaptation and optimisation, many of the structural components have not been dimensioned according to international standards. The custom joinery and dimensioning increases the production cost substantially.

OPPURTUNITIES

As of now, the area I am working on is a large parking lot that for most of the time stands half empty. It has become a divider of the landscape and fails to invite people for a stay. My aim is to resocialize the neighborhood of Valhalla around the interest of cultivation and cleansing. There is great potential to develop the social aspects by firstly providing a more accessible circulation network that will attract more visitors to the area. The last design step is an attempt at solving this. Modularity has opened up a possibility for the polycarbonate panels to be accustomed in unique ways. They can be dismantled and transferred elsewhere in order to make the structure more or less transparent. The disintegration of the prototype allows for additional transversal circulation axes along the long side. Closer to the bike lane, the structure unfolds and invites people into the food market. Along the valley, there are similar unused "dead areas" often with non permeable surfaces that increase the risk of flooding. On the slide about urban expansion I have initiated a larger landscape strategy along the valley, accustoming the prototype for suitable purposes. The prototype could easily be repurposed for different events or seasonal changes of the programme. Depending on the placement of the prototype, the structure could include either industrial or private interests.

THREATS

Being placed in a risk zone for flooding, it is naturally more exposed to extreme flooding scenarios. If the strategy fails to mitigate surface water either due to miscalculations or very extreme scenarios, the site could face severe damage from lack of drainage. We can only estimate how future water levels and more frequent storms will behave, it is therefore important to guard ourselves with the most appropriate solutions. Unlike traditional modern farming, the cultivation process is not automized to the same extent. It relies heavily on constant maintenance work, lack of it could result in bad harvest. It is also important to consider how the prototype behaves in its surroundings. In a larger city like Gothenburg, a big issue on the topic of wellbeing is light pollution. Constant UV lights inside the greenhouse can produce unwanted light pollution for residents near the site.