

LET THE WATER FLOW

BREGJE WALKATE

GRADUATION PROJECT

FORM, STRUCTURE & AESTHETICS

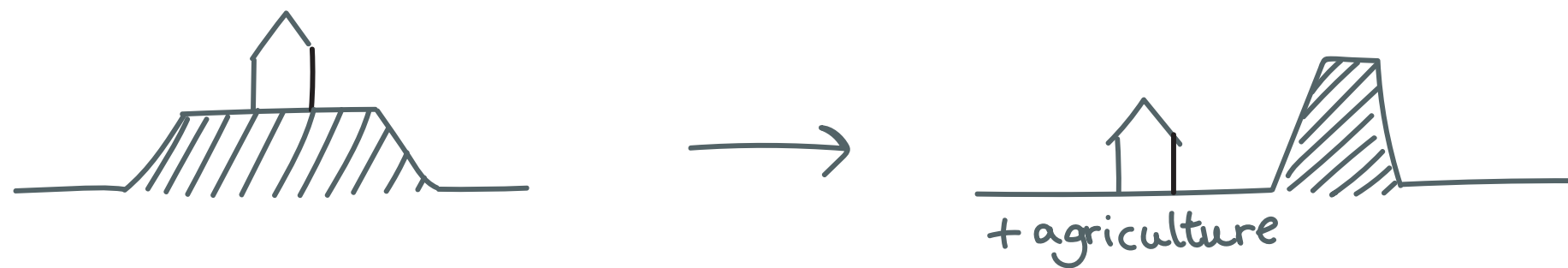
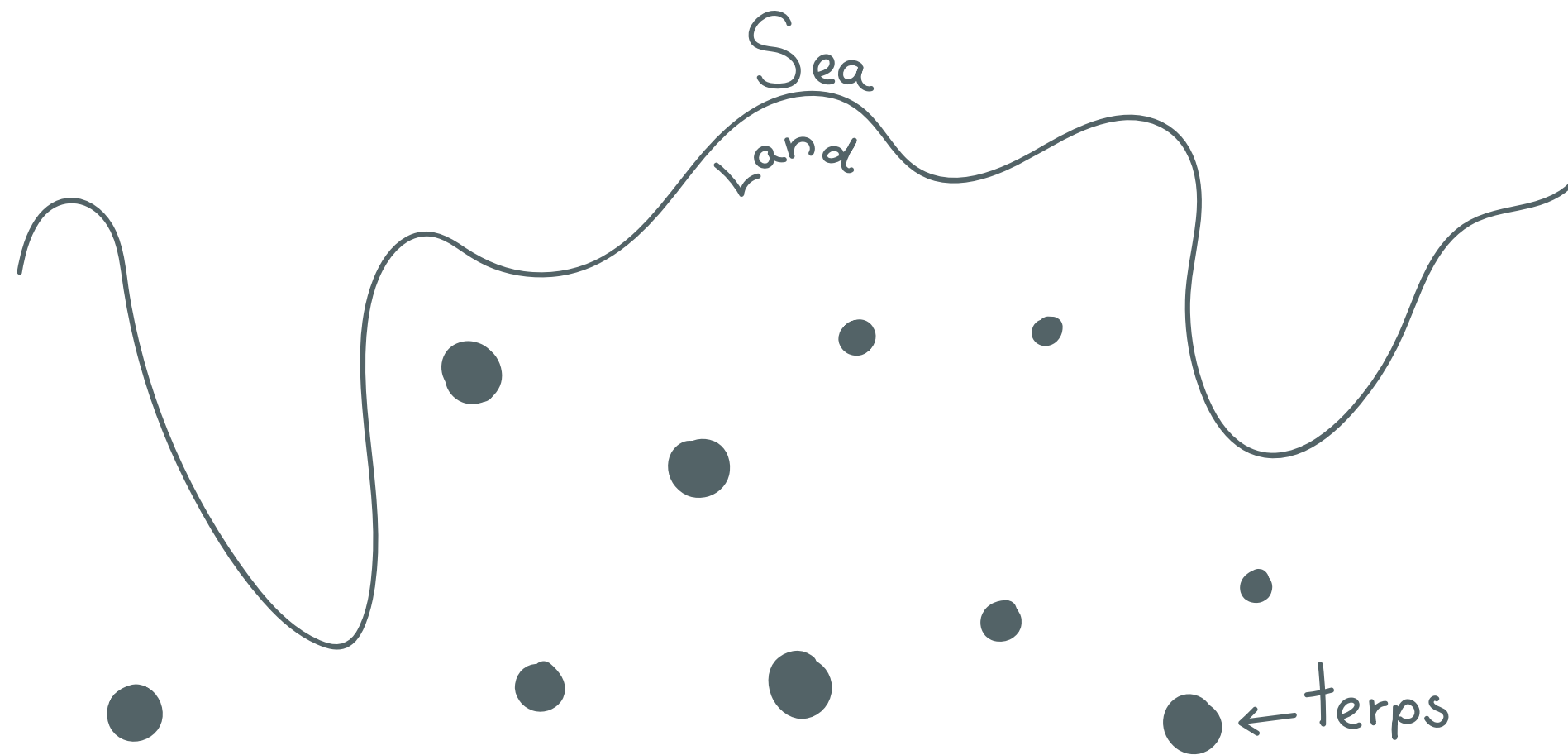




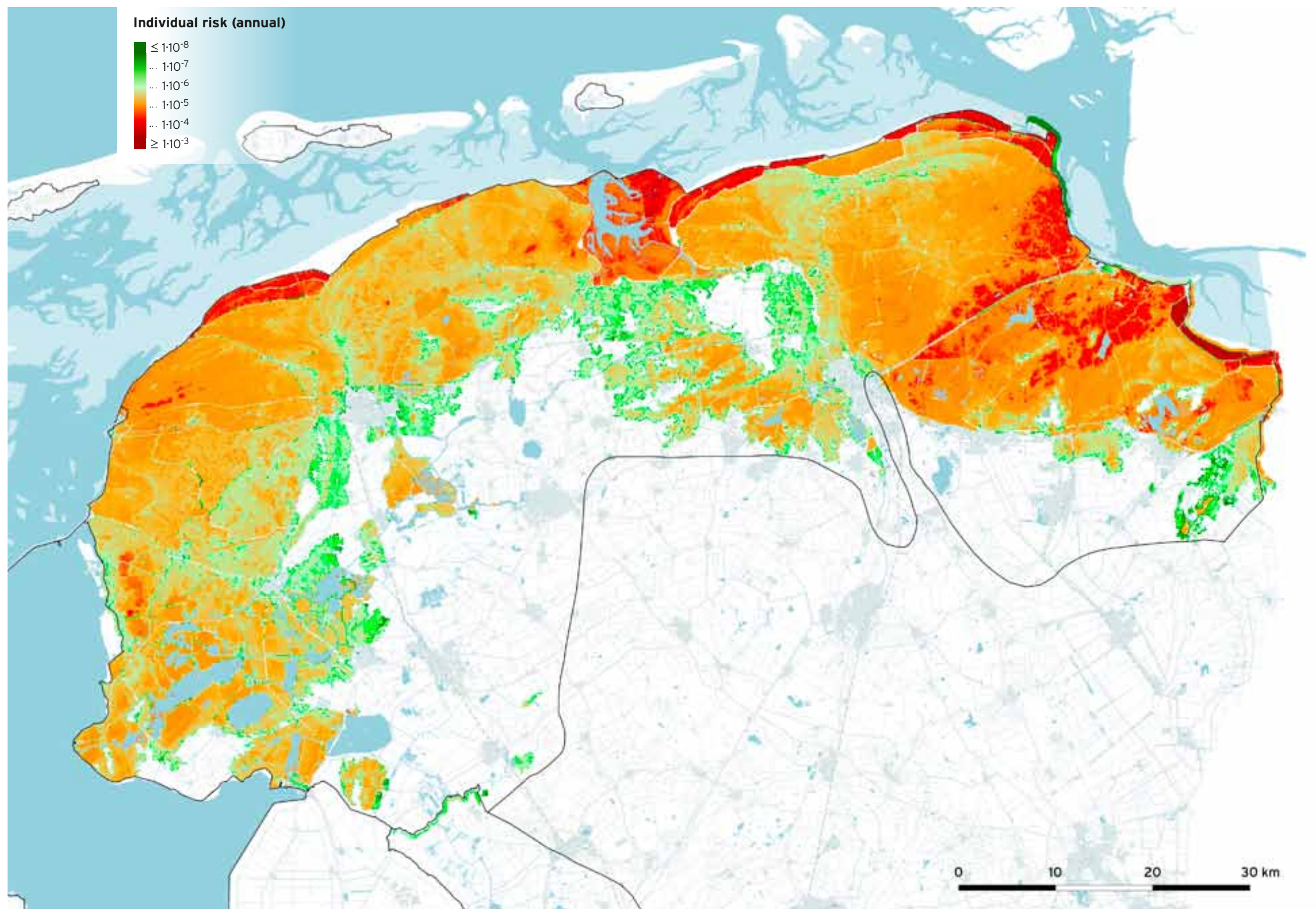
Groningen landscape (own photo, 2023)



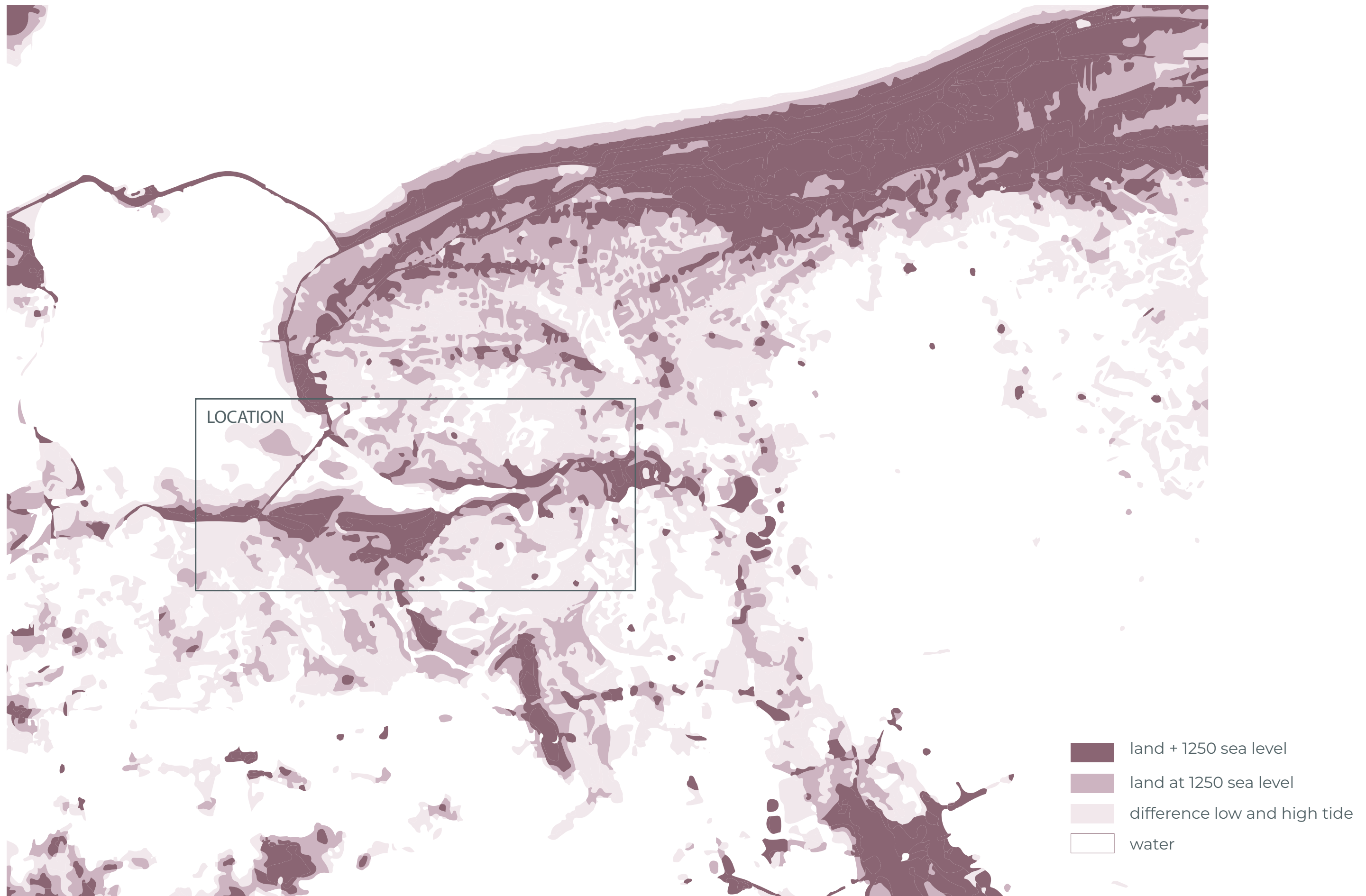
Groningen landscape (own photo, 2023)



own work, 2023



Flood risk analysis (Jongejan et al., 2013)



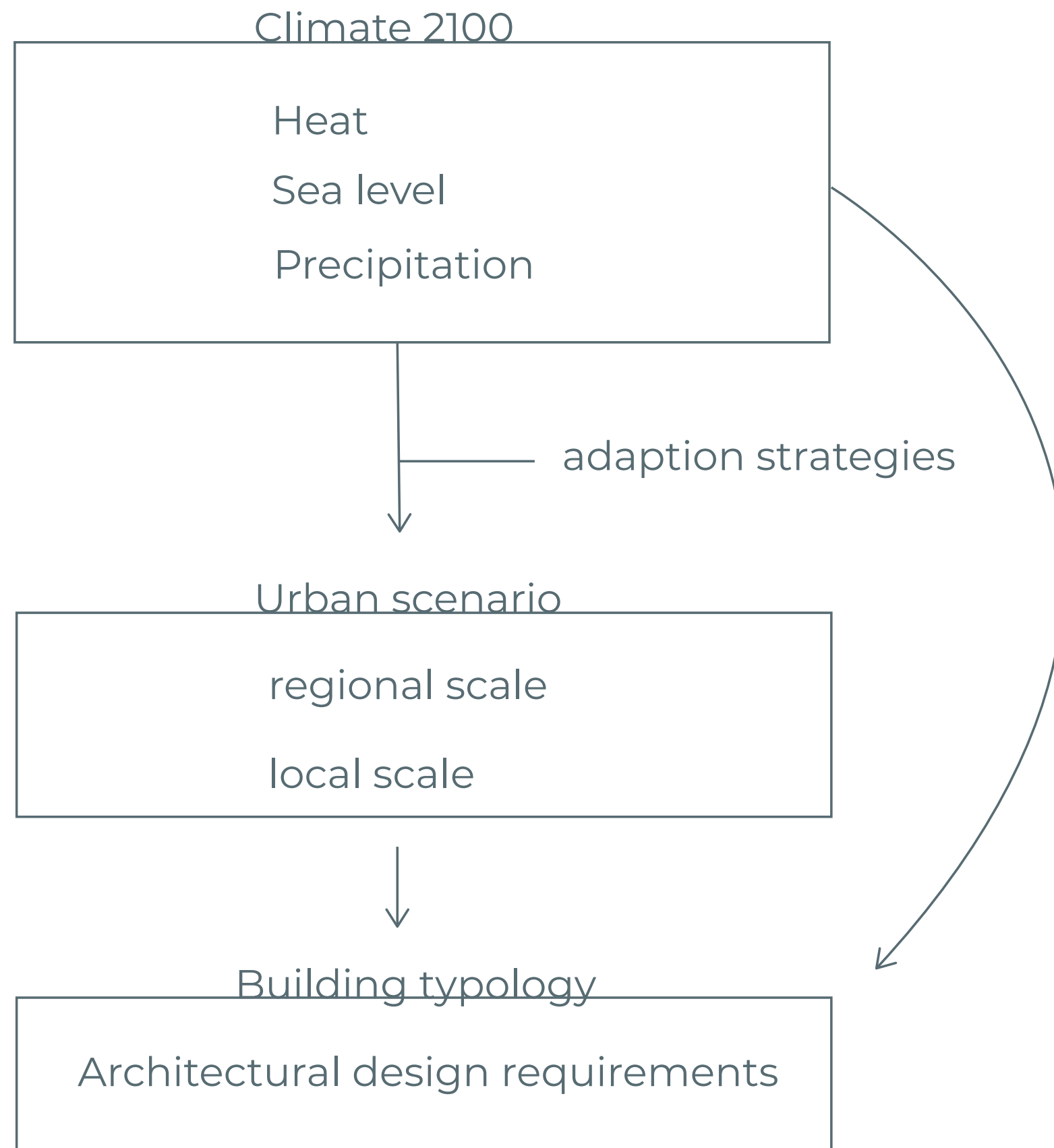
Area North Groningen, 1250 mm above sea level in 2100 (own work, 2023)

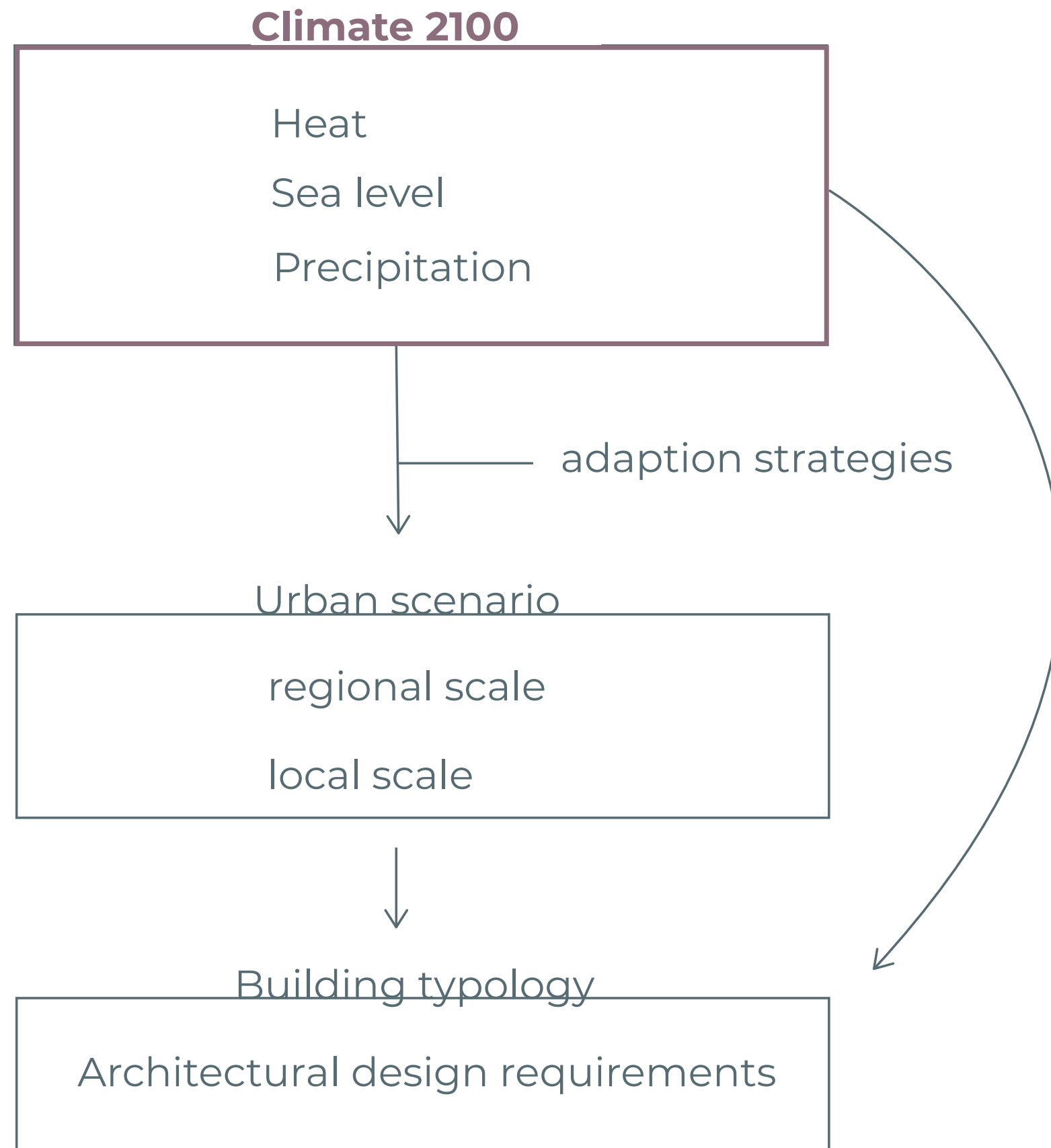
*“To what extent can the **building typology** of a **cultural centre** be **adapted** to the **climate** in the North Groningen area **in a 100 years**?”*

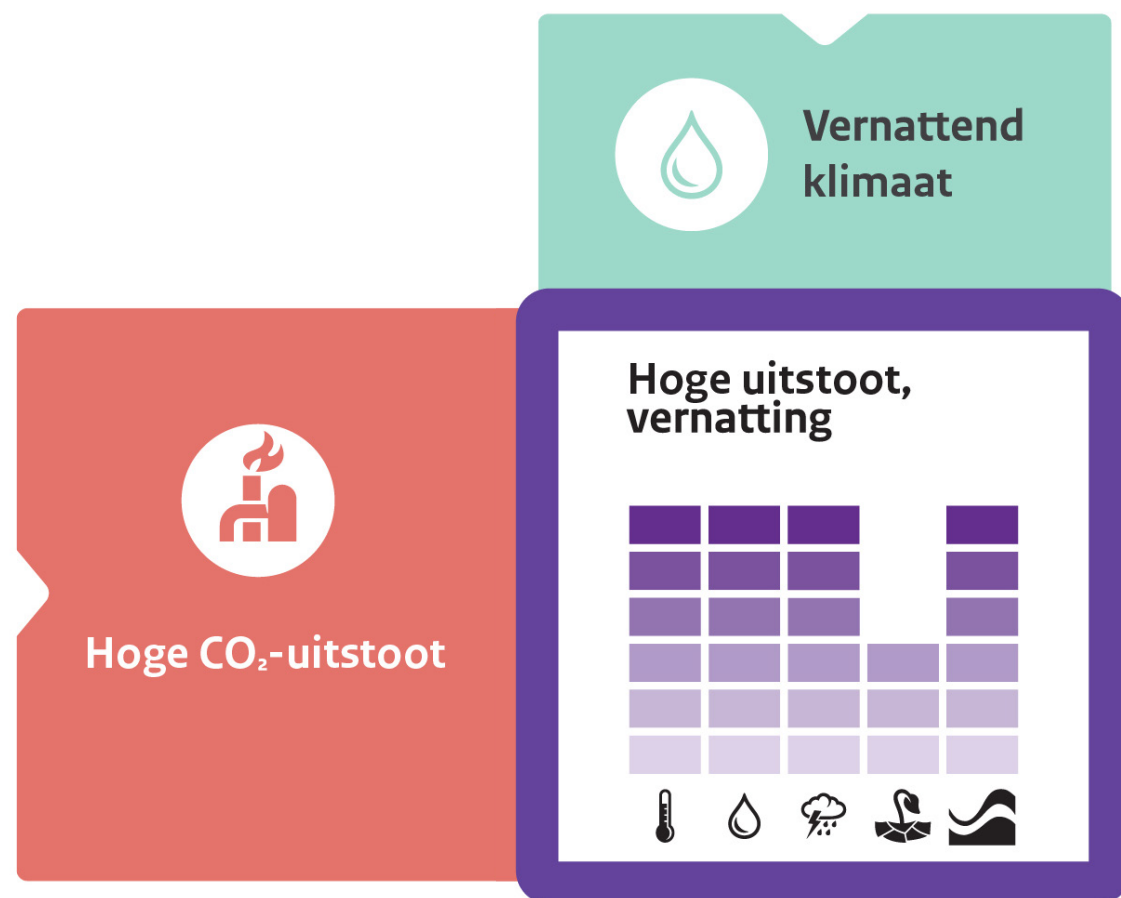
RESEARCH

DESIGN PRINCIPLES

ARCHITECTURAL DESIGN



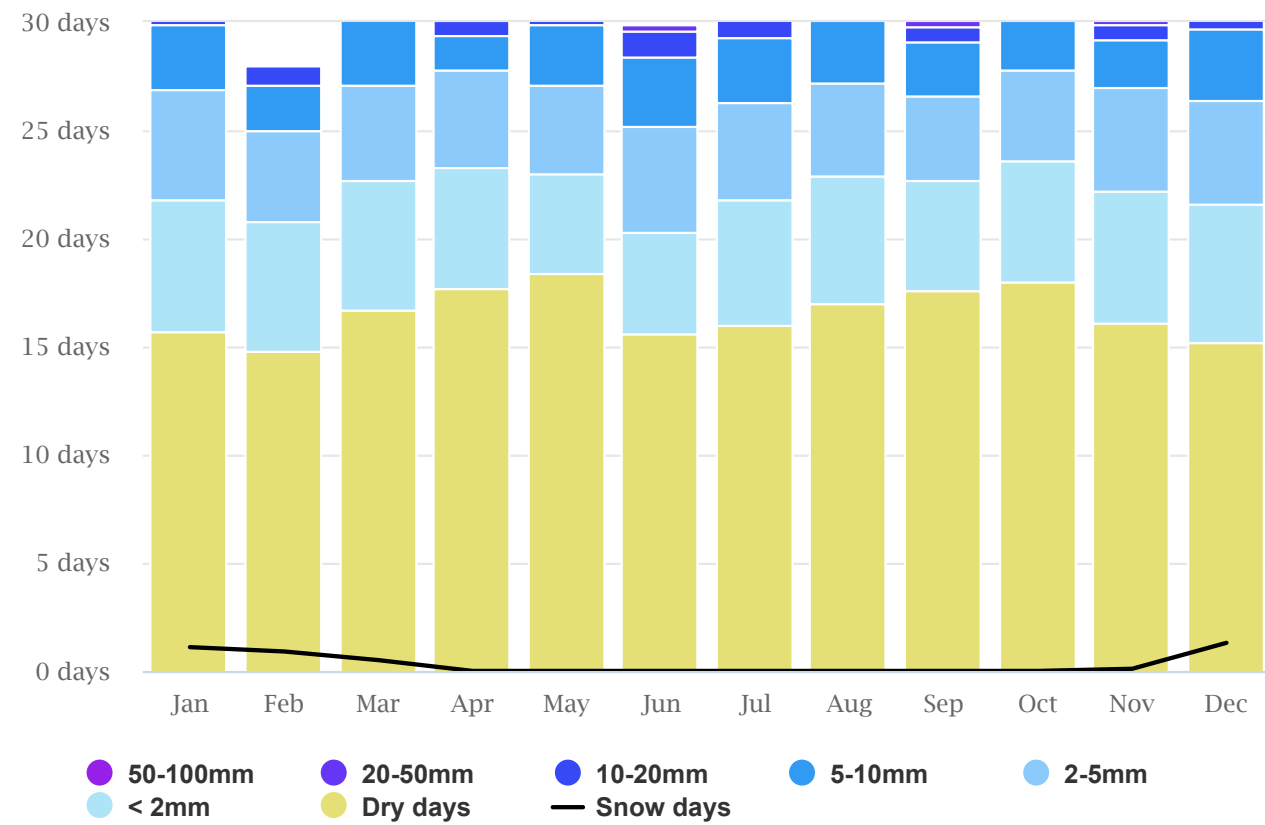




- ++ temperature increase
- + wetter winters
- ++ extreme summer showers
- + draught
- ++ sea level rise

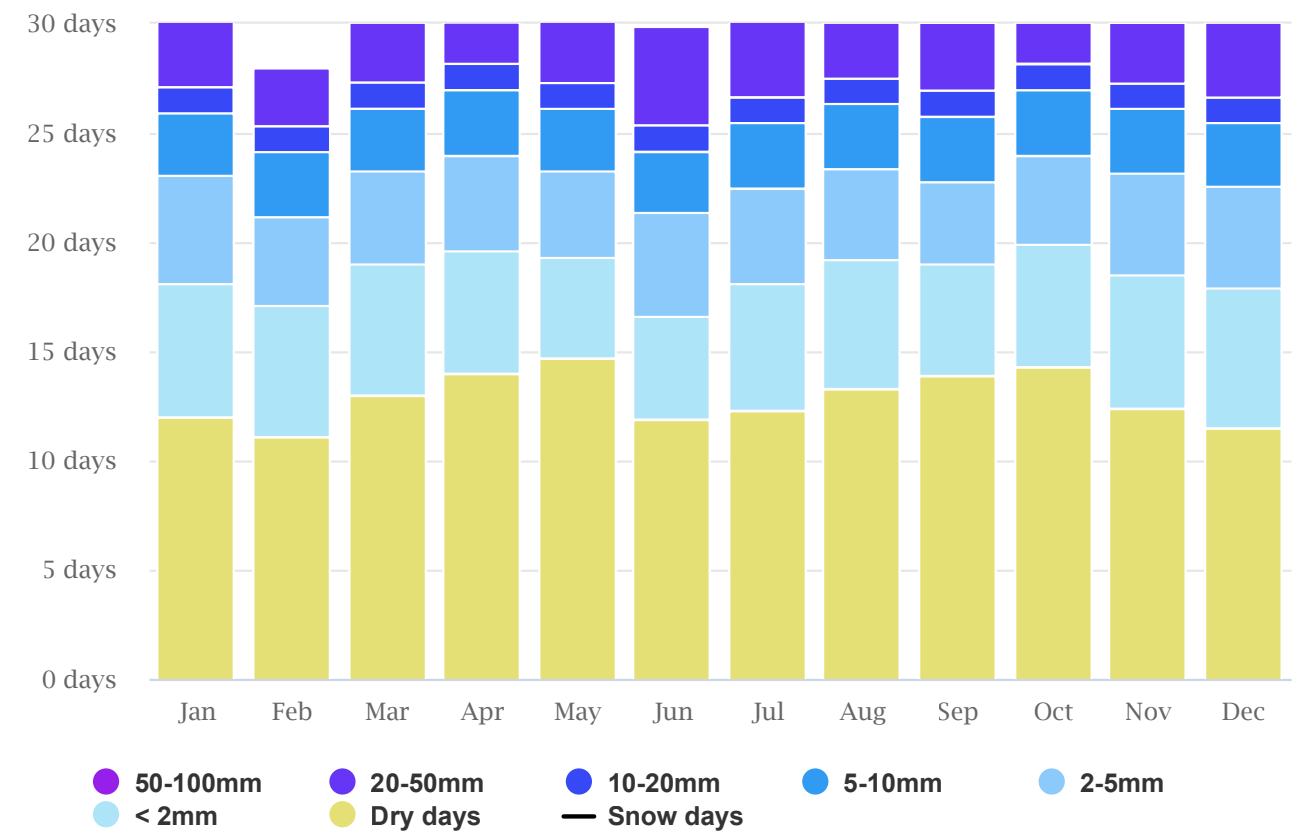
Selection of climate scenarios Netherlands 2100 (KNMI, 2023)

2023

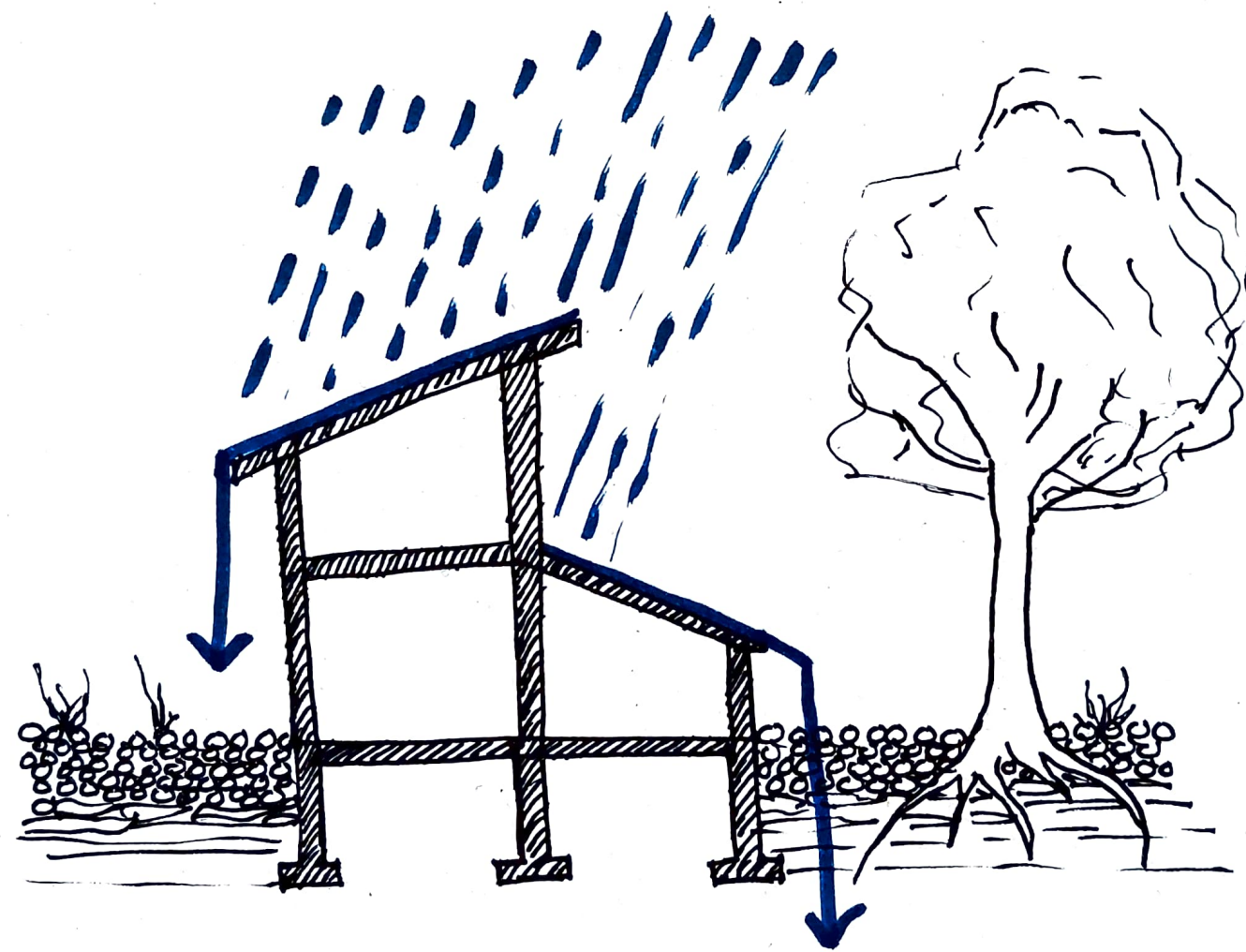


Precipitation days Groningen in 2024 (Simulated Historical Climate & Weather Data for Groningen, 2023.) and (KNMI, 2023)

2100

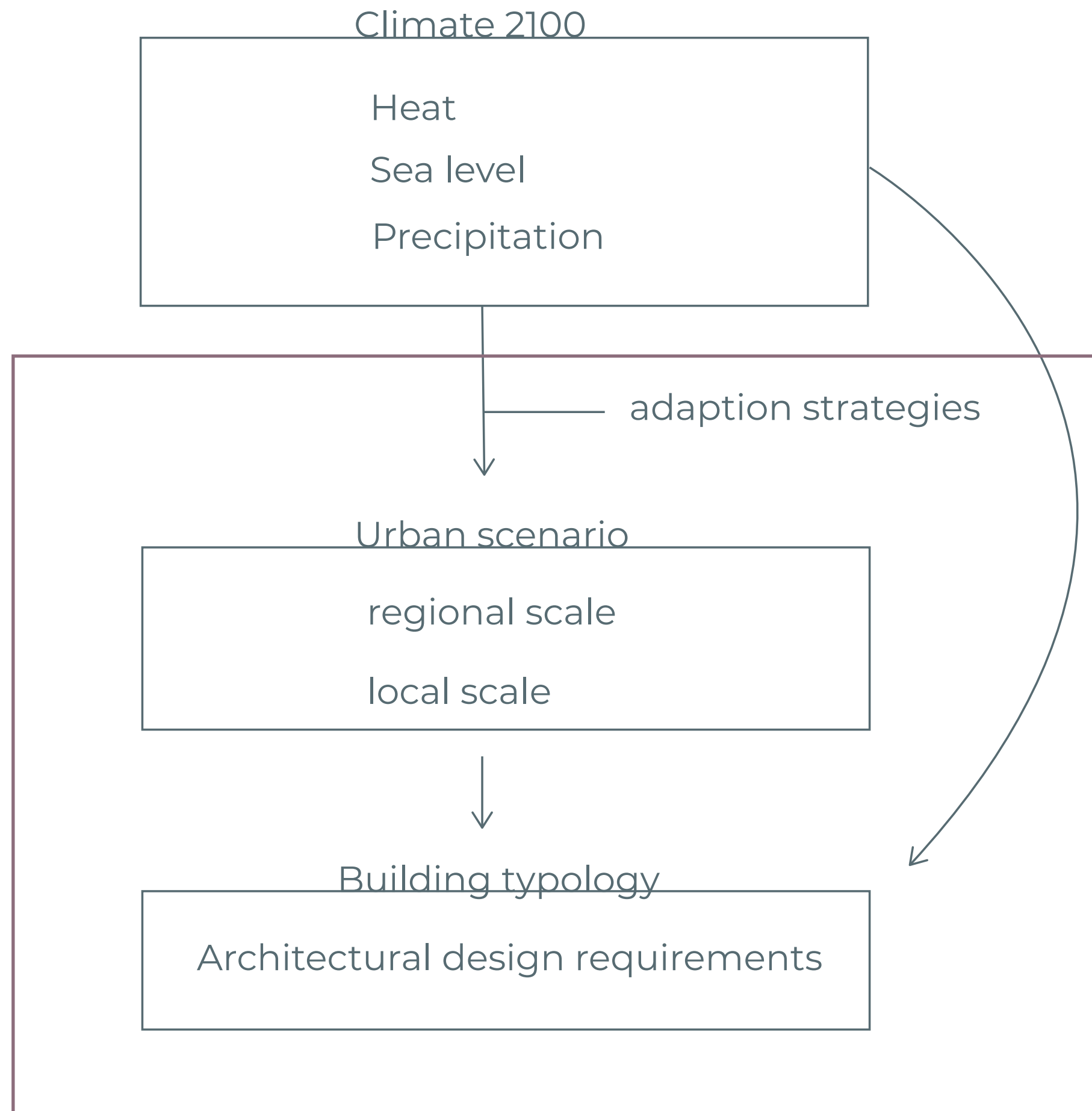


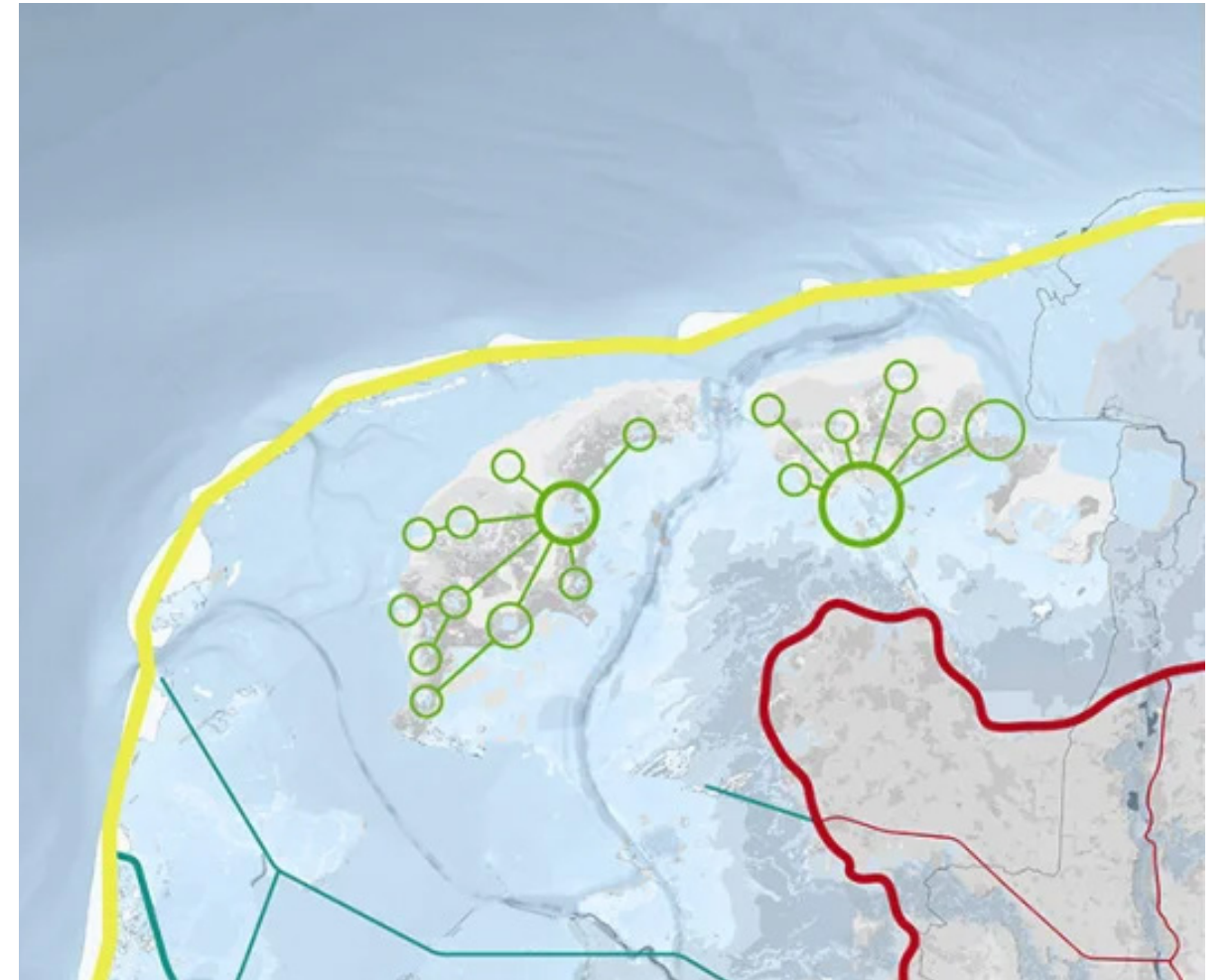
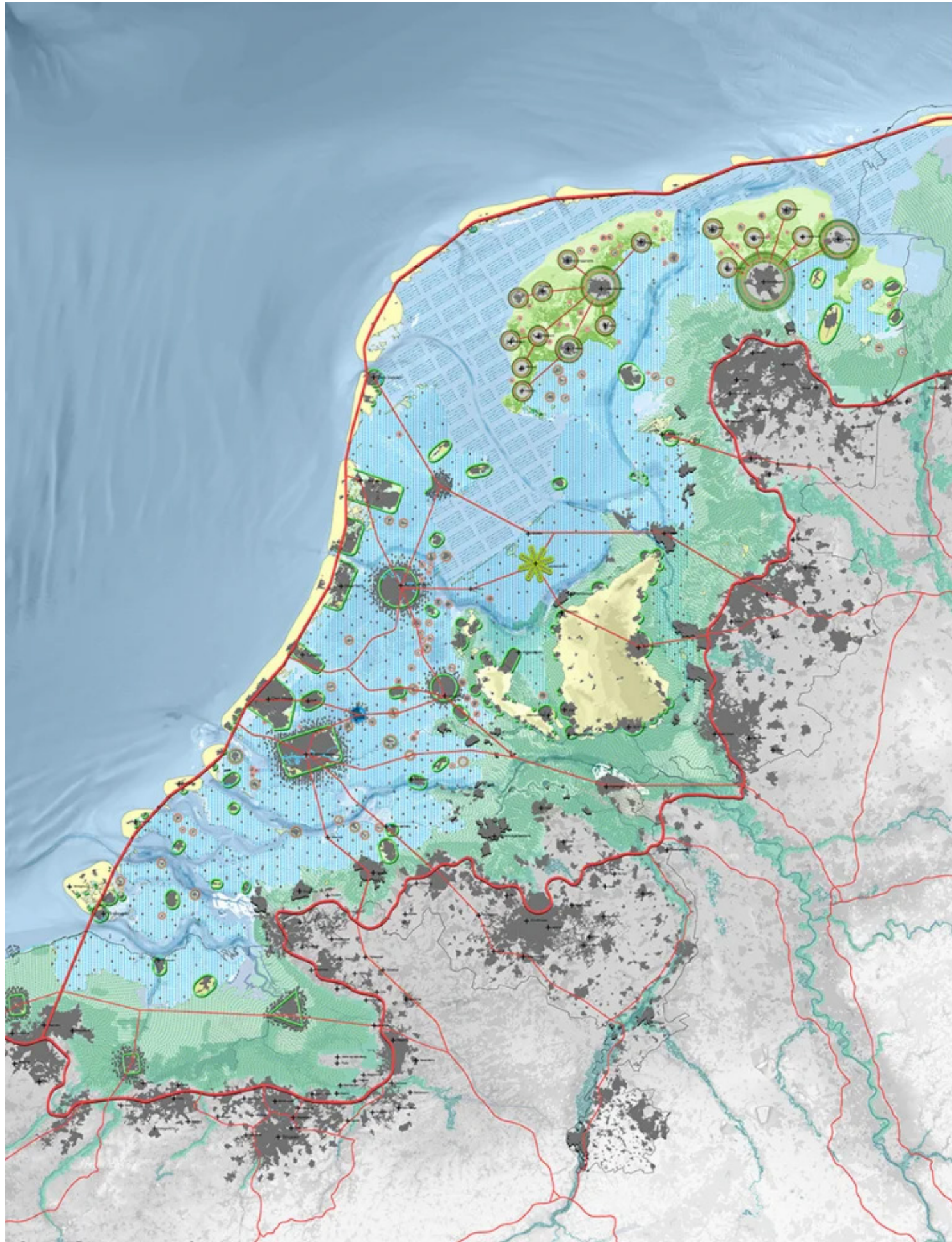
Precipitation days Groningen in 2100 based on (Simulated Historical Climate & Weather Data for Groningen, 2023) and (KNMI, 2023)

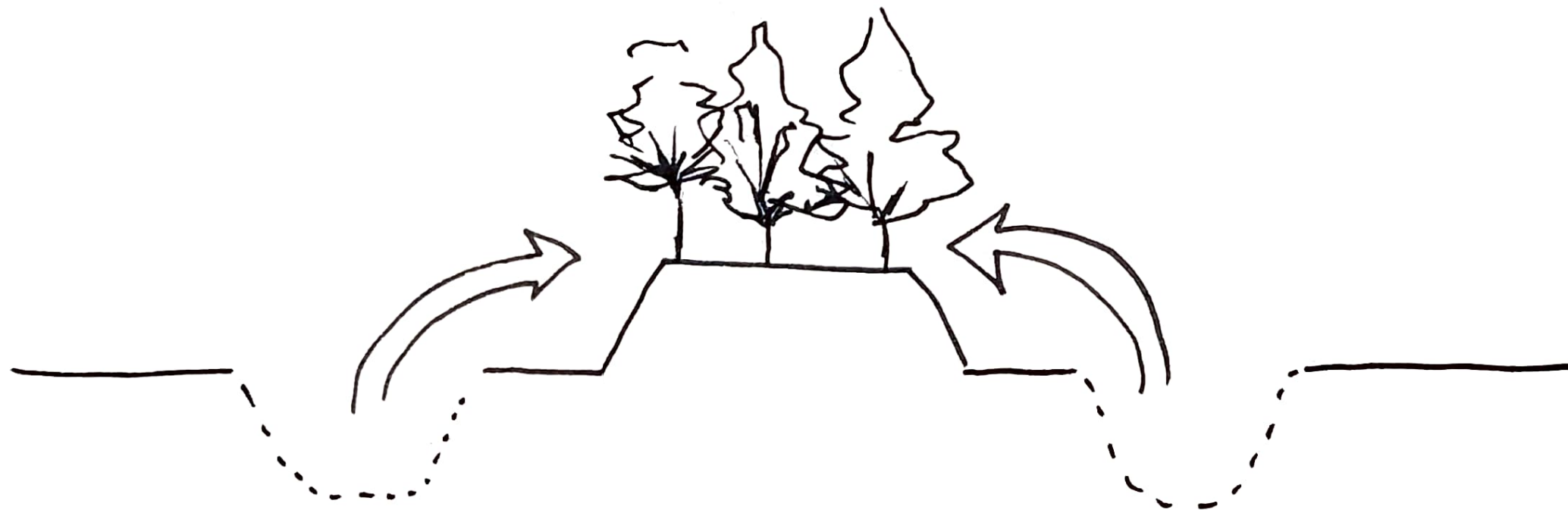


porous LANDSCAPE TO HOLD WATER

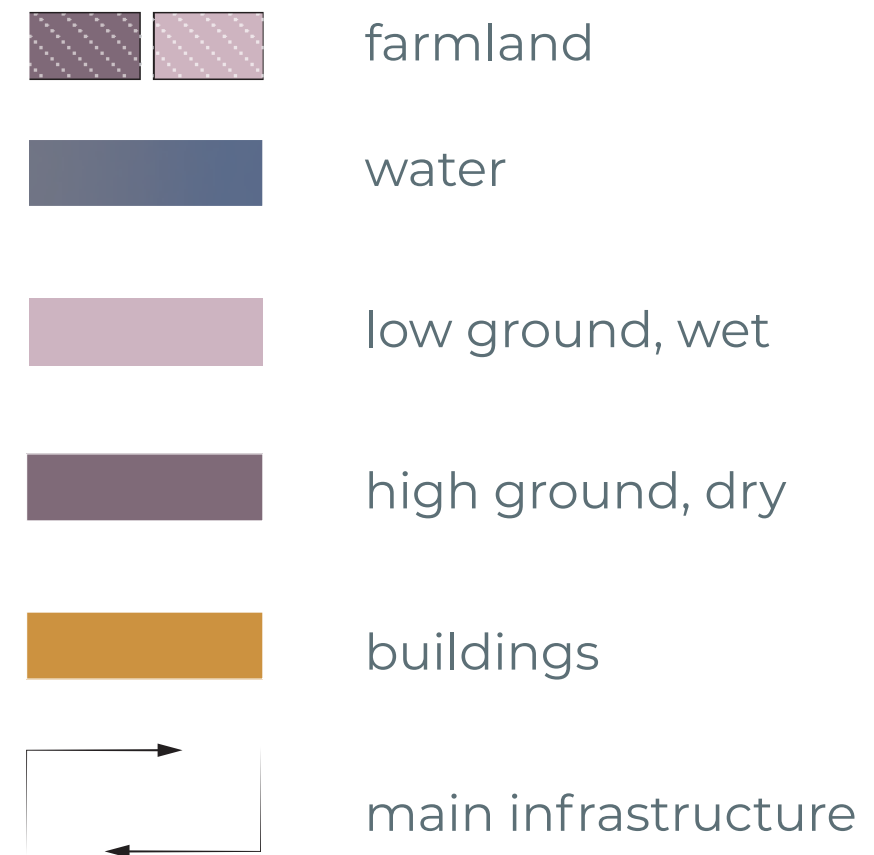
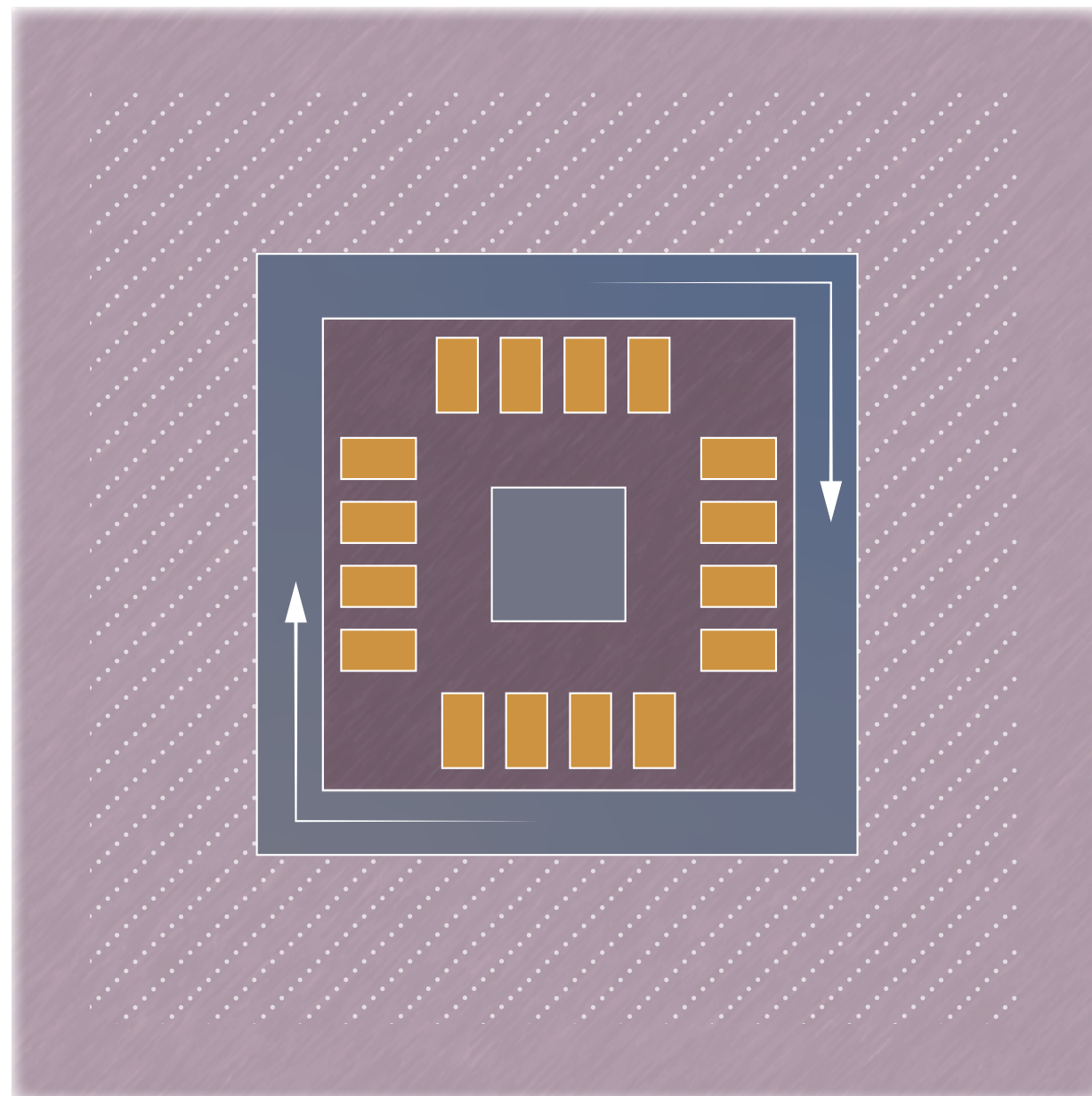
Water regulation principles (own work, 2023)



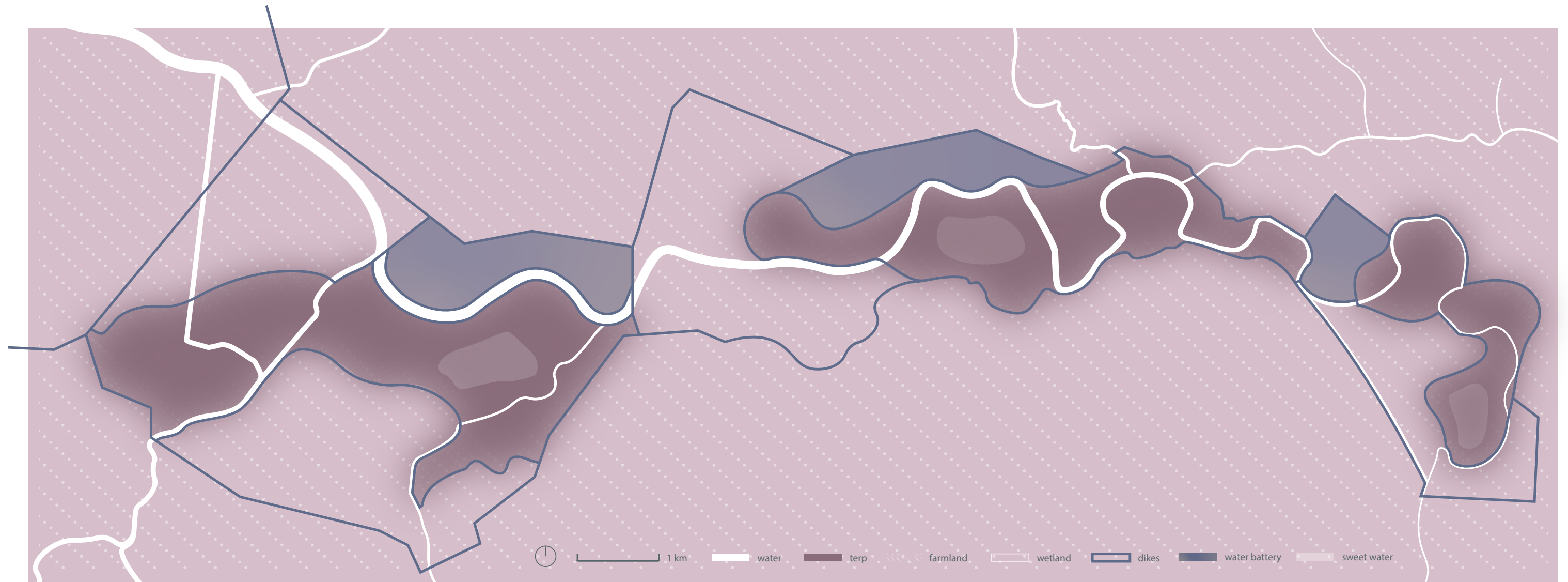




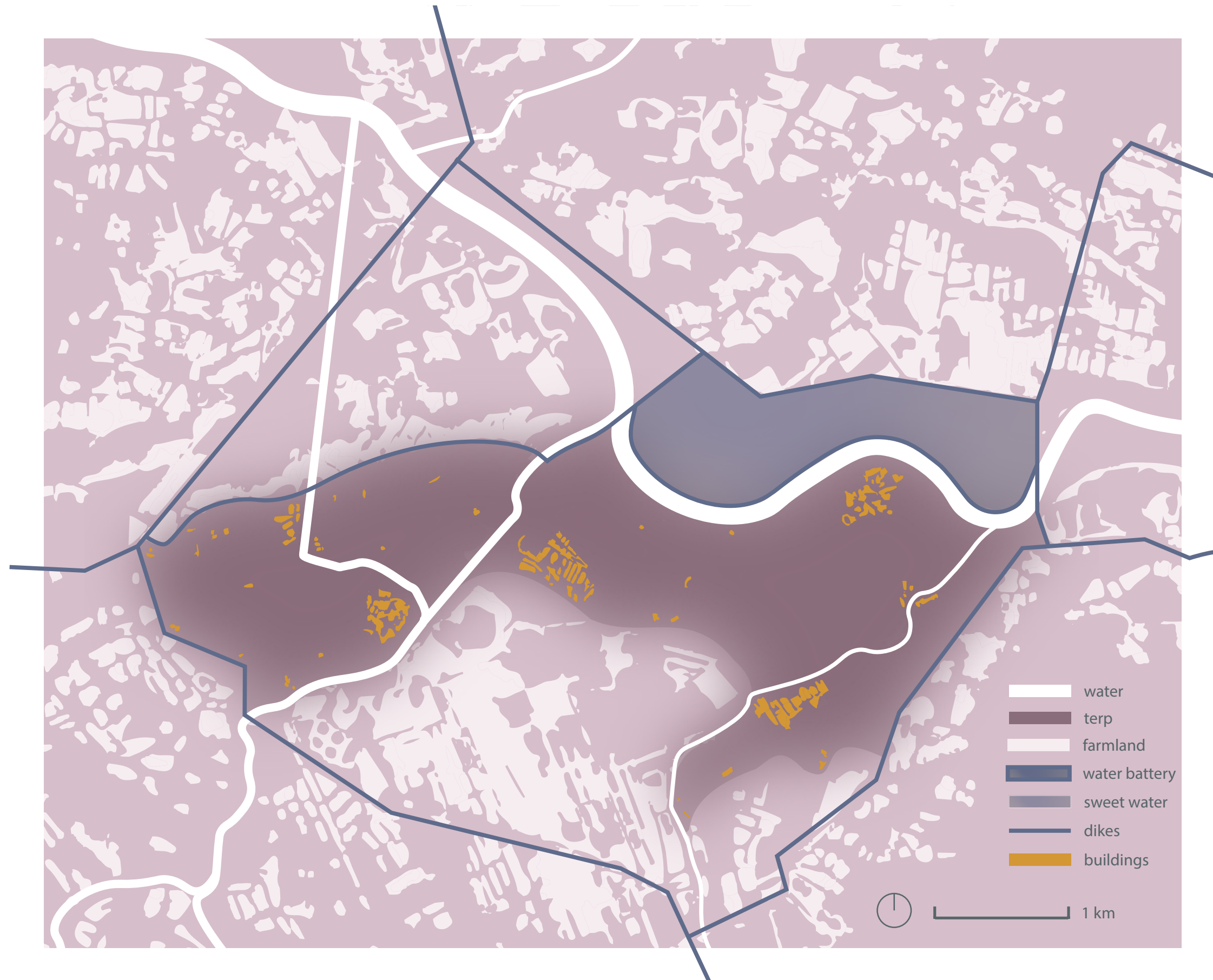
Own work (2023) inspired by the lecture of Lieke de Jong (october, 2023)



Urban concept, 1:2000 (own work, 2023)



Future scenario regional masterplan Reitdiep (own work, 2024)



Future scenario regional masterplan (own work, 2024)

RESEARCH

DESIGN PRINCIPLES

ARCHITECTURAL DESIGN



Cultural center

Opening hours 10 - 22

For all ages

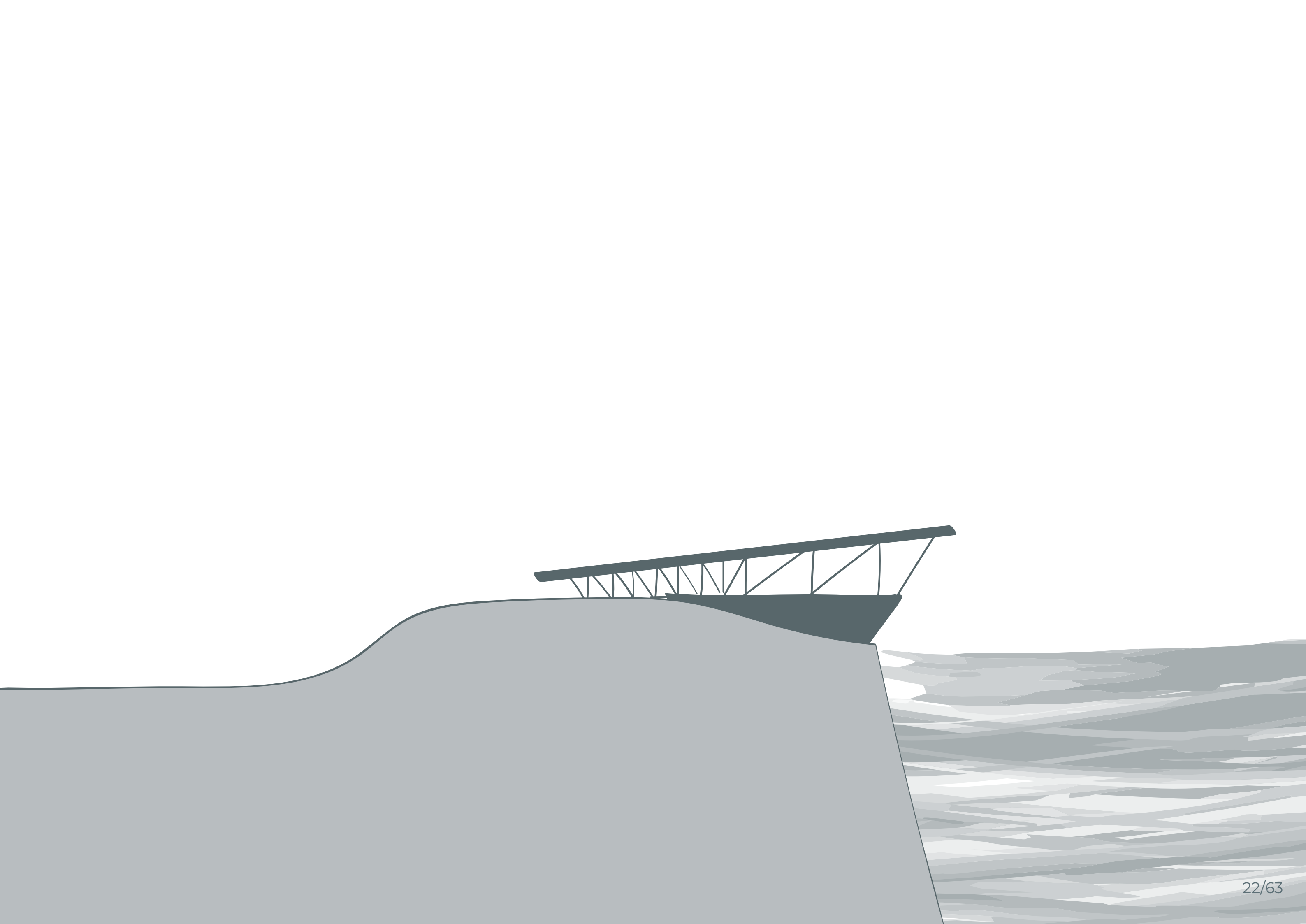
Encourage social interaction

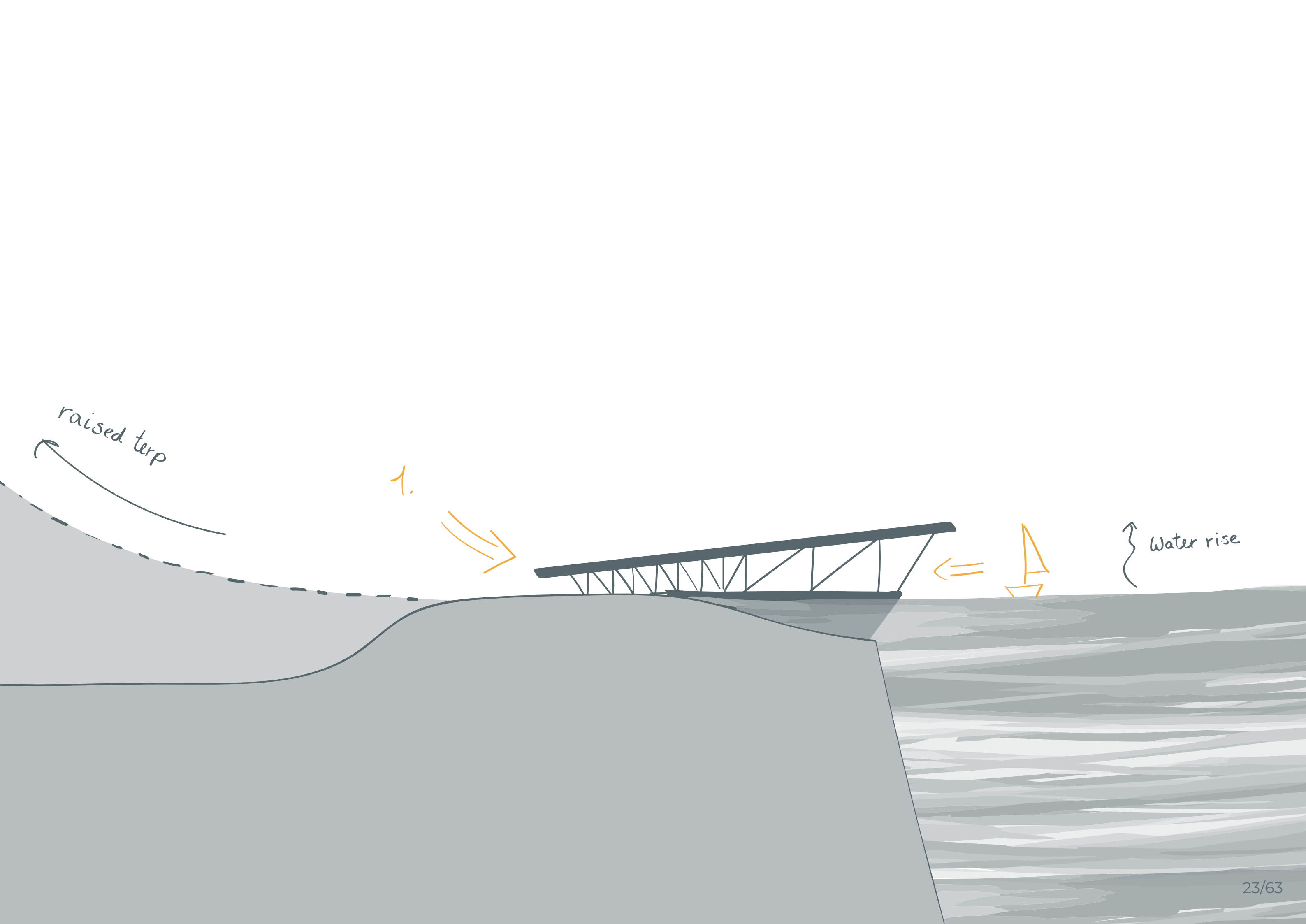
Concert possibilities in afternoon and evening

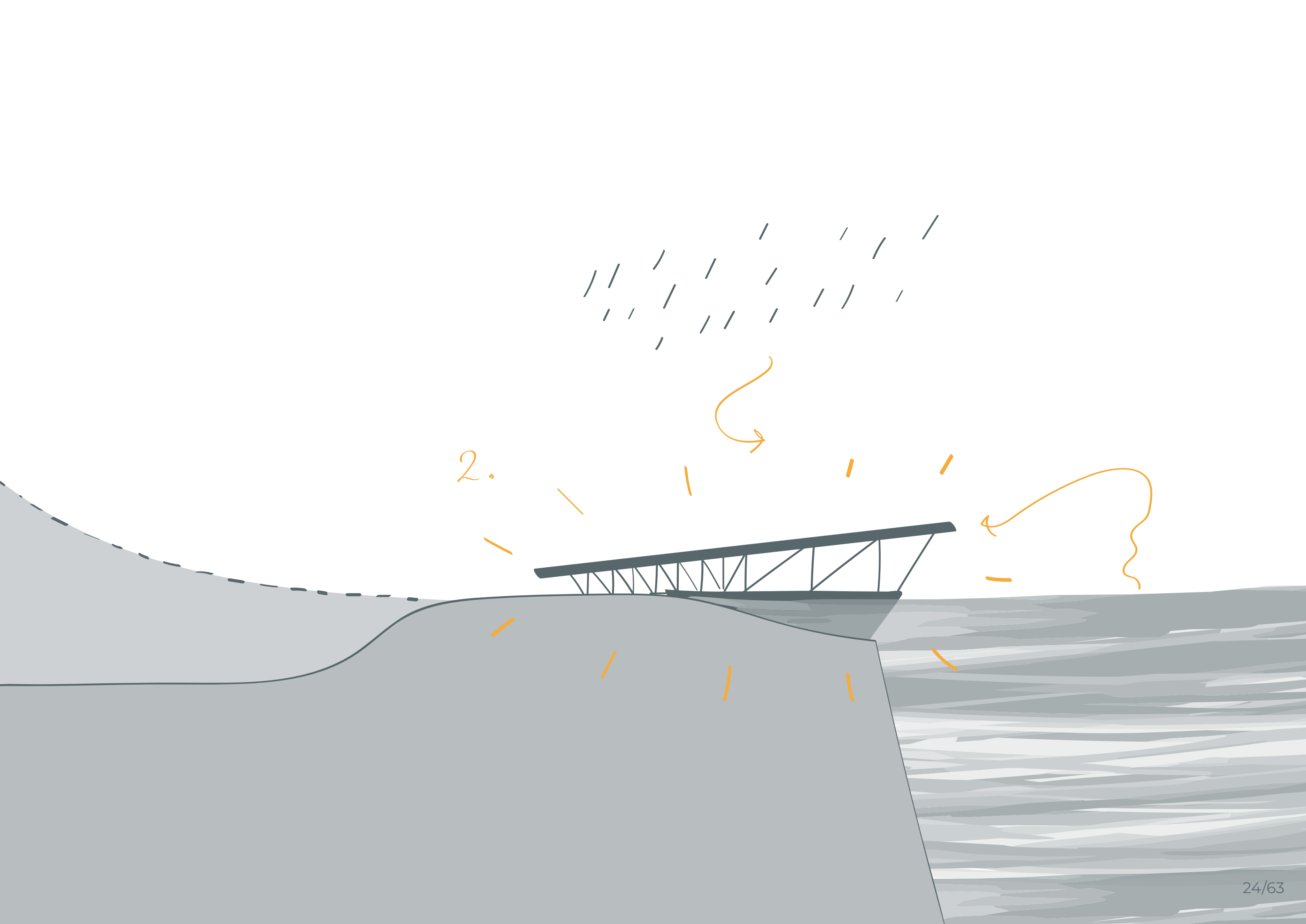
Stage hall 1000 tot 5000 m³ for accoustic quality.

Encourage social interaction

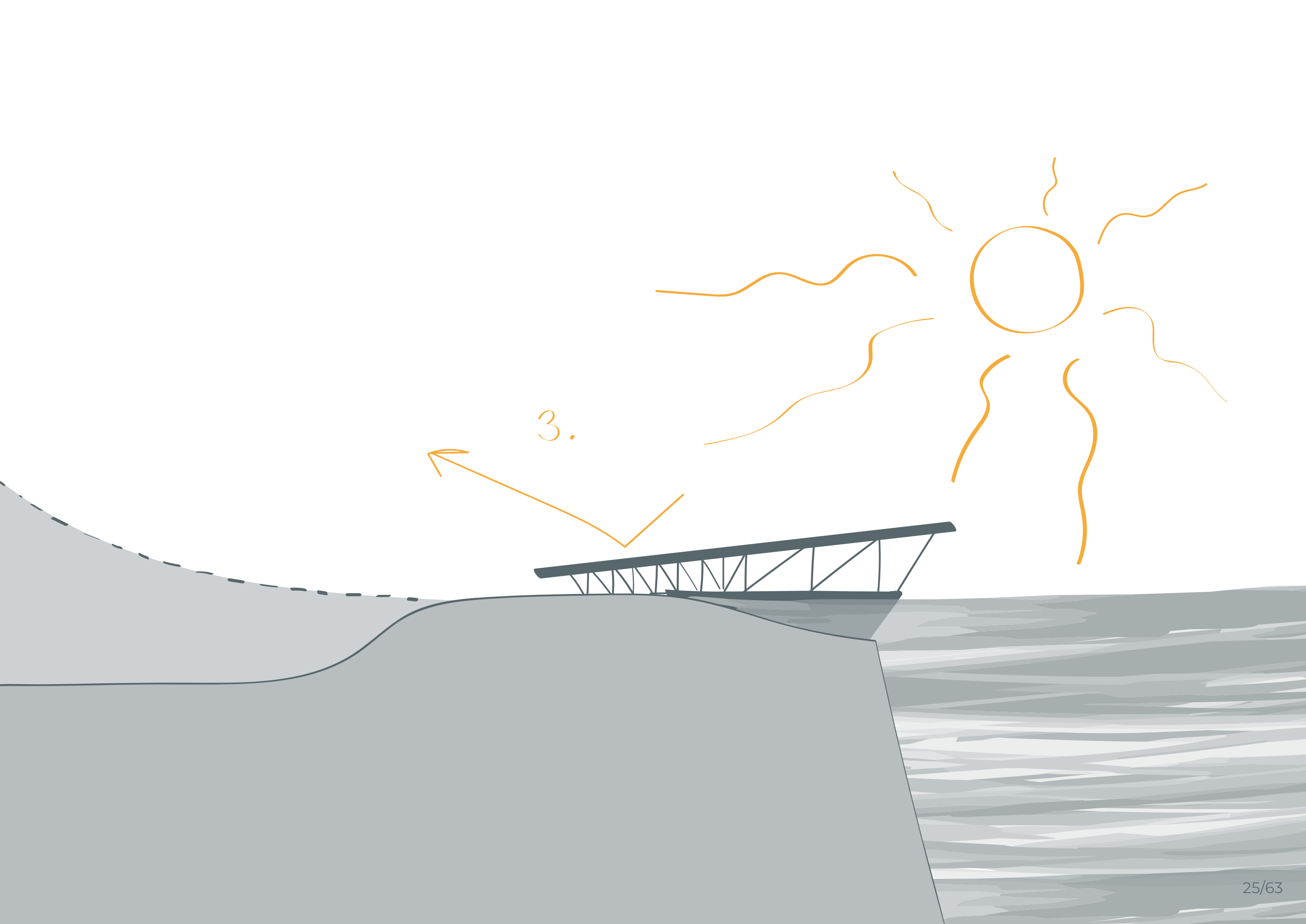
Culture center impression, own work (2023)







2.

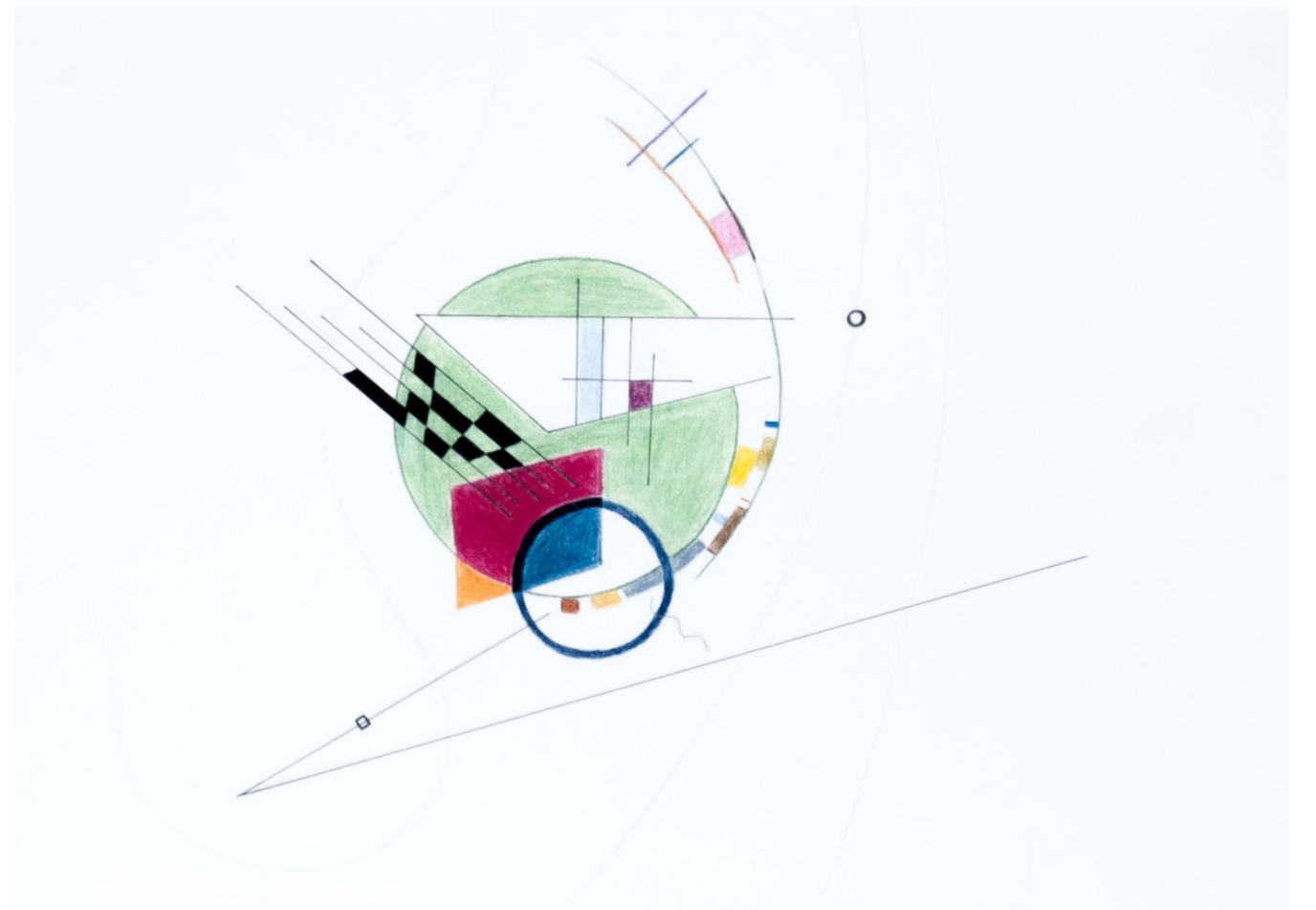
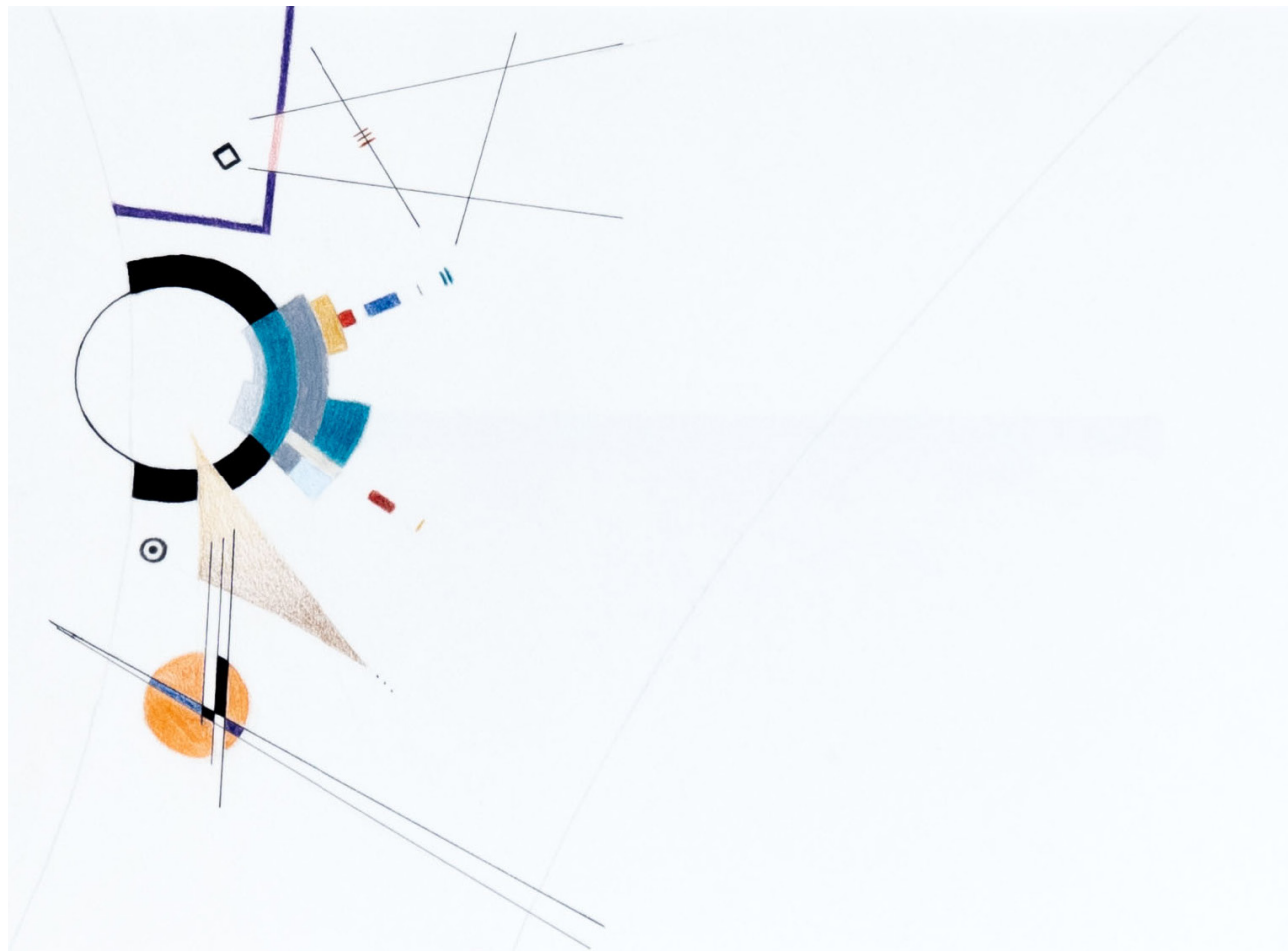


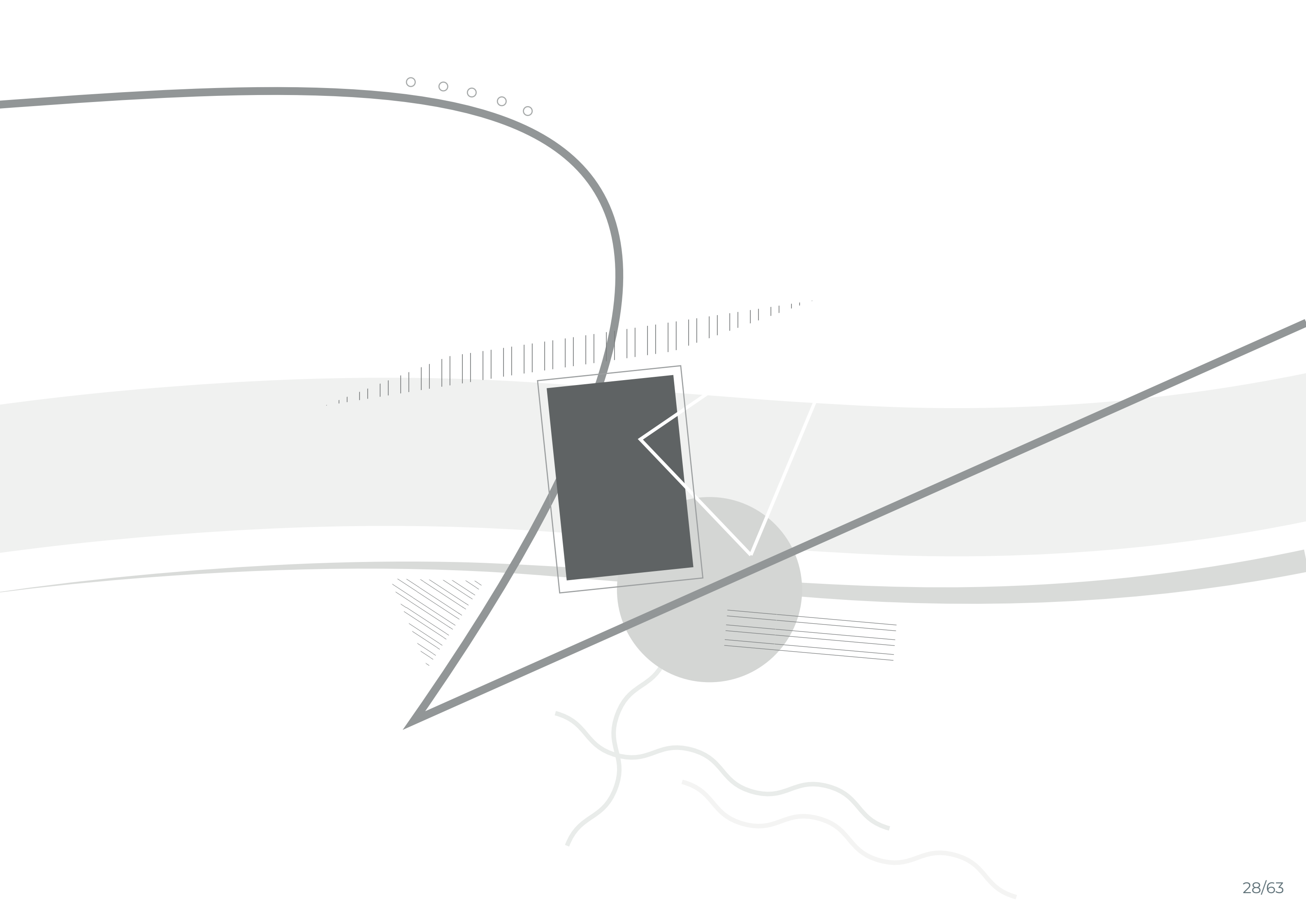
3.

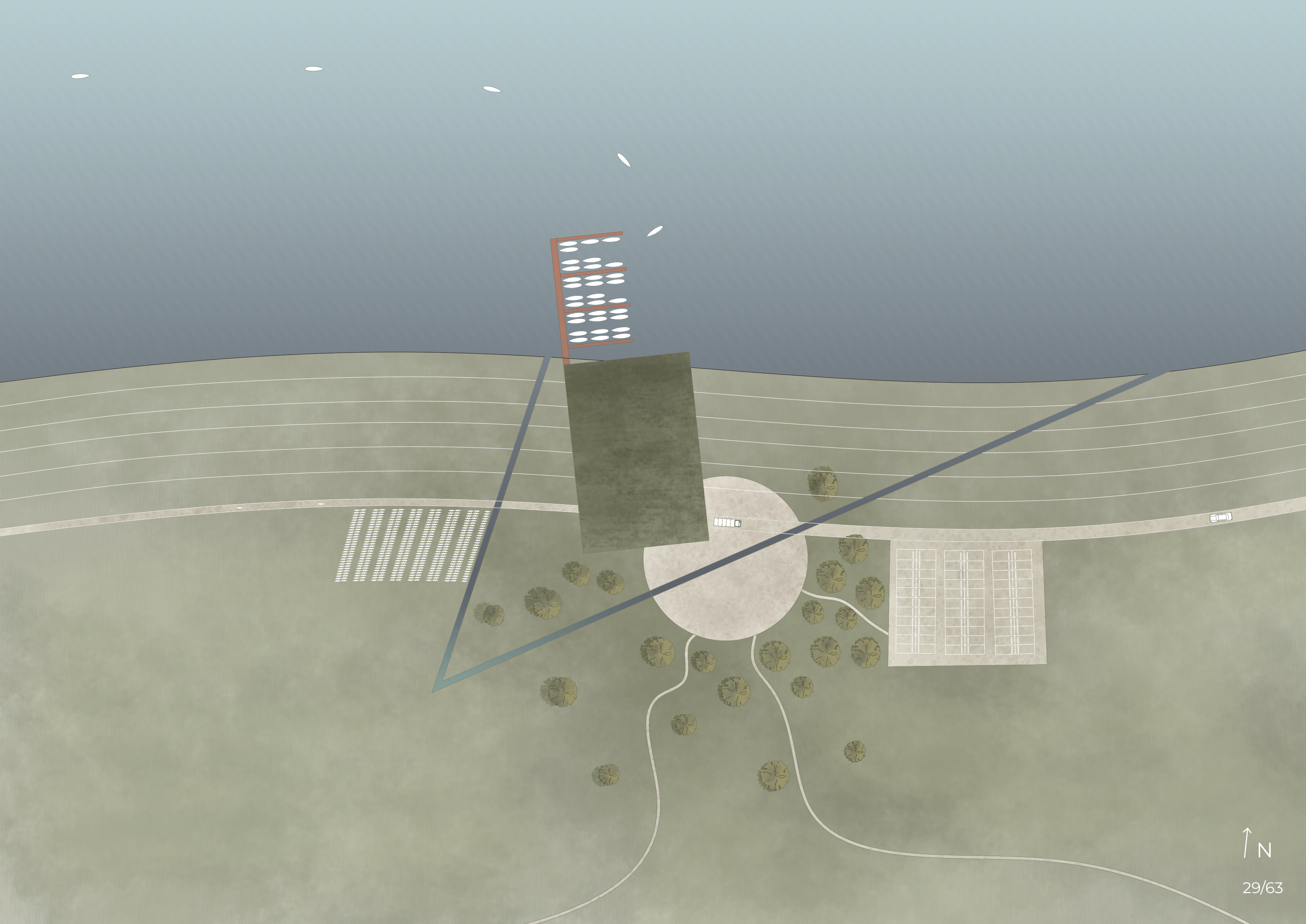
RESEARCH

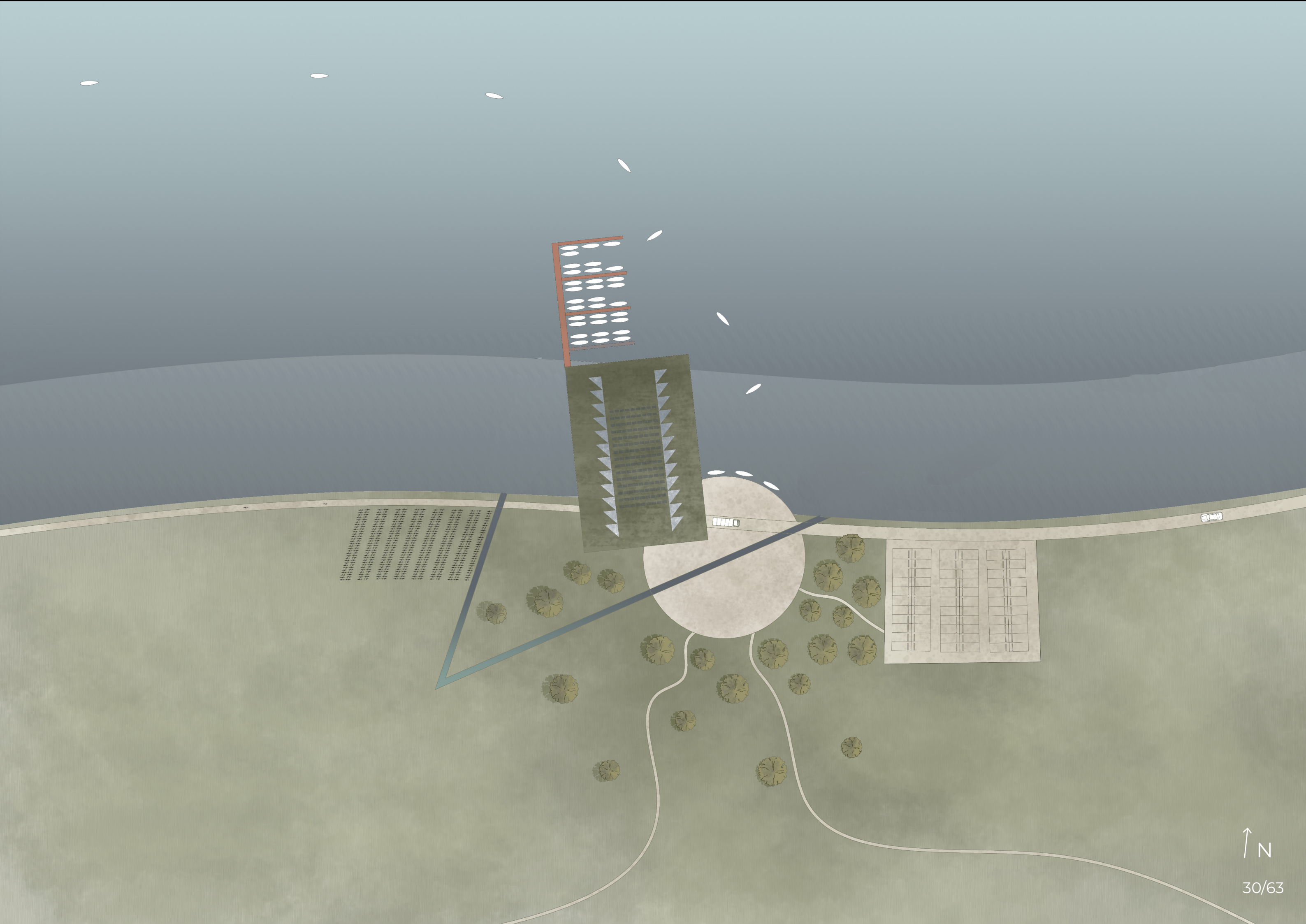
DESIGN PRINCIPLES

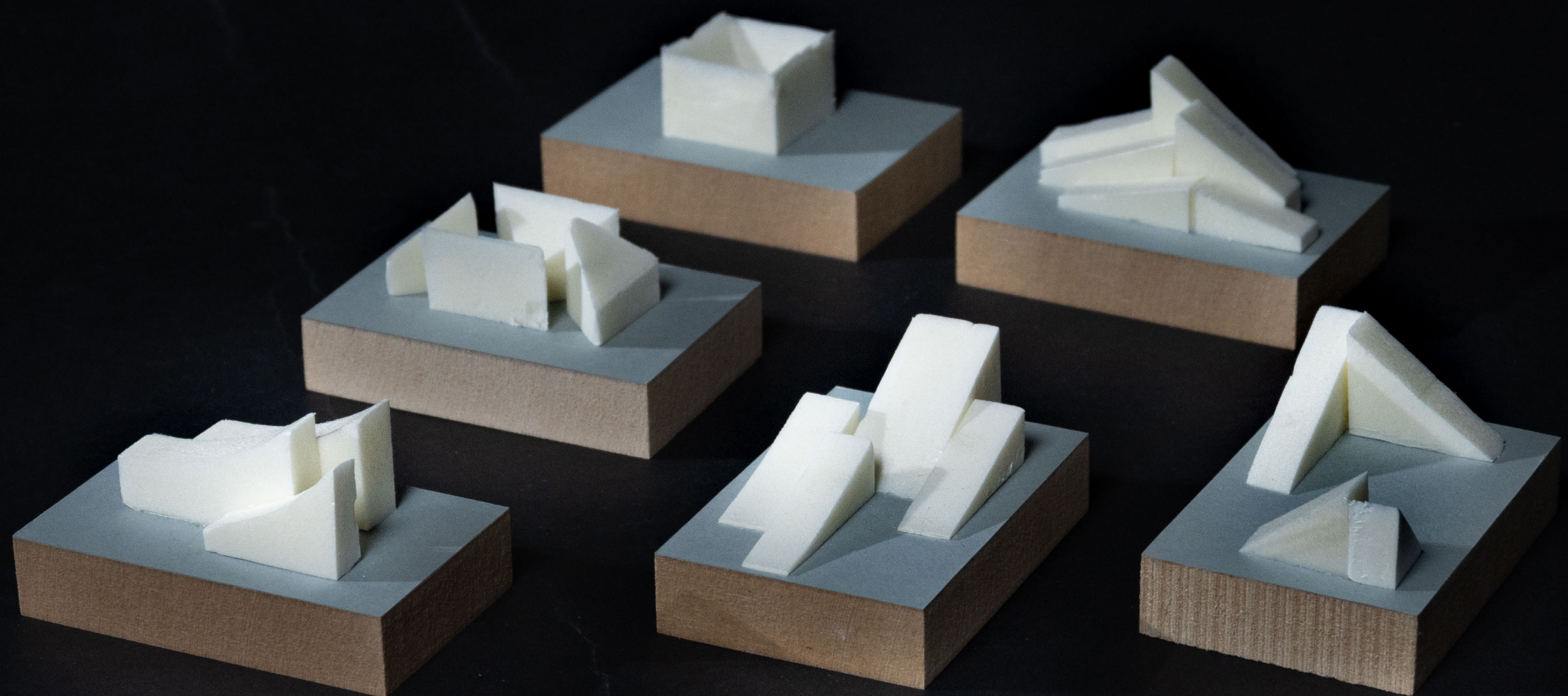
ARCHITECTURAL DESIGN



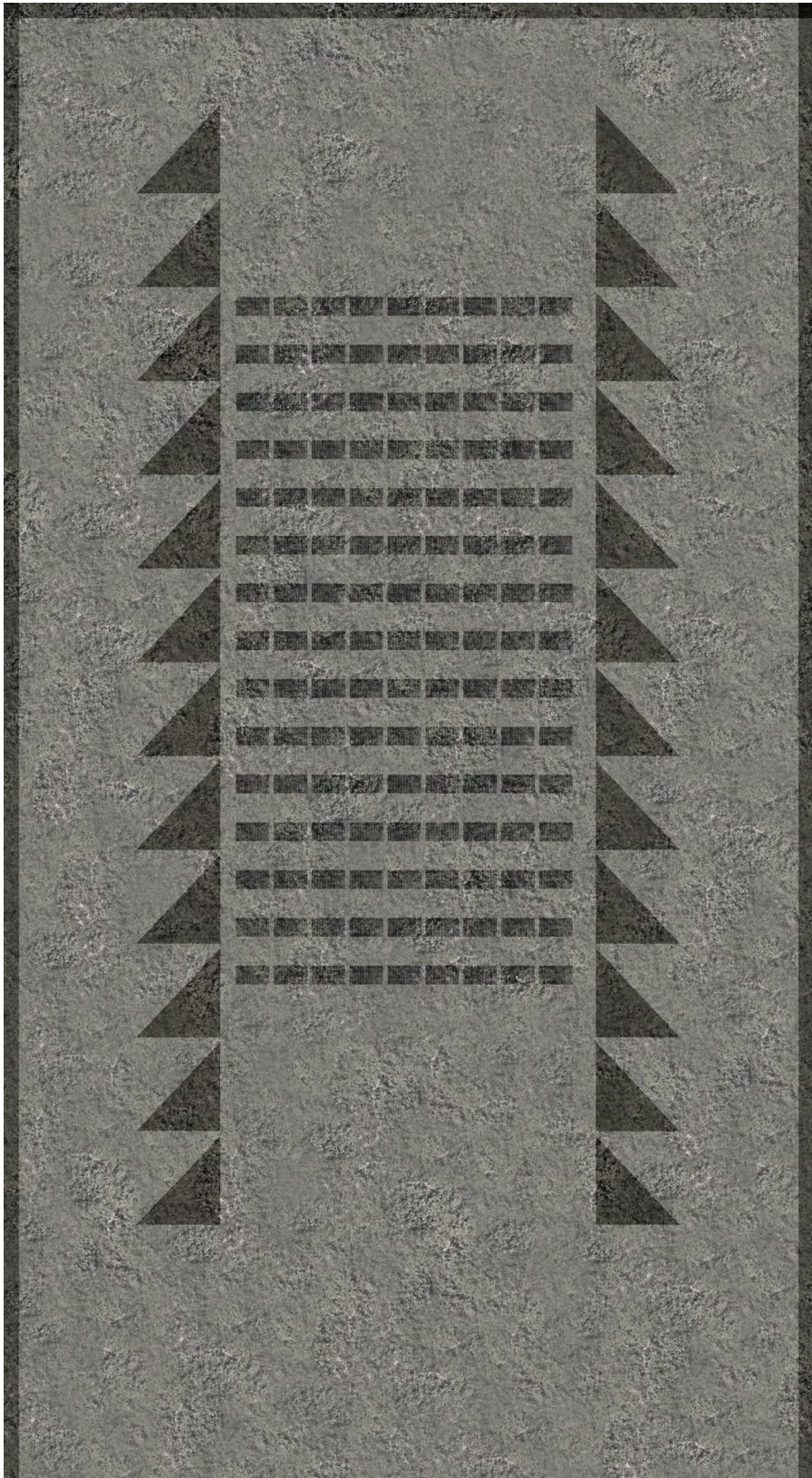




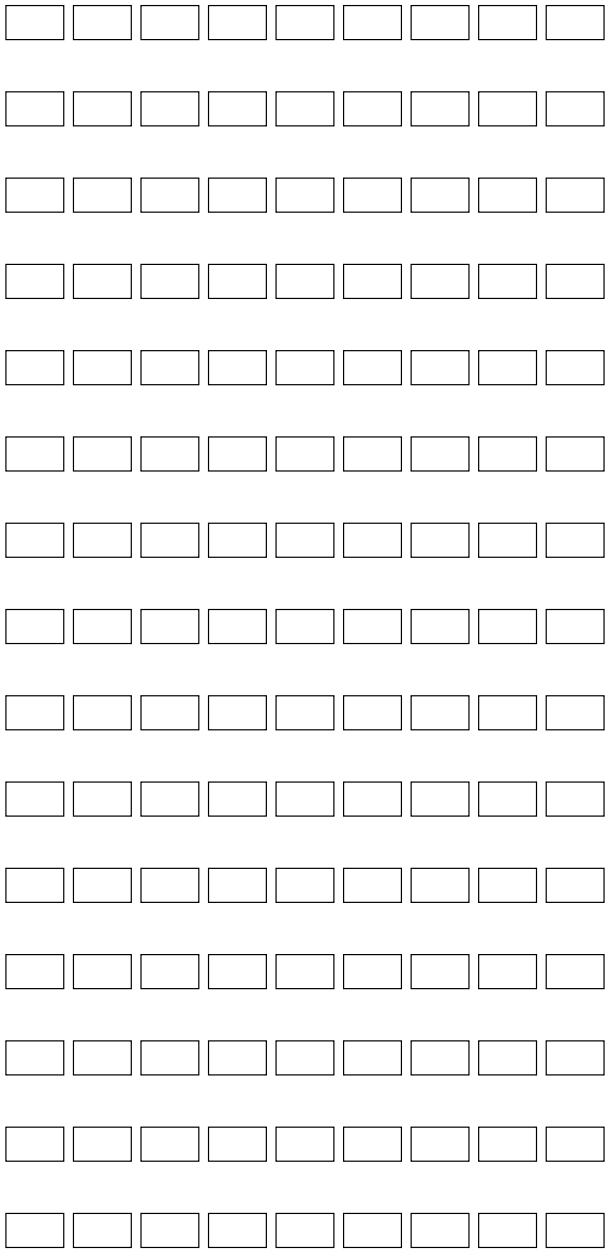






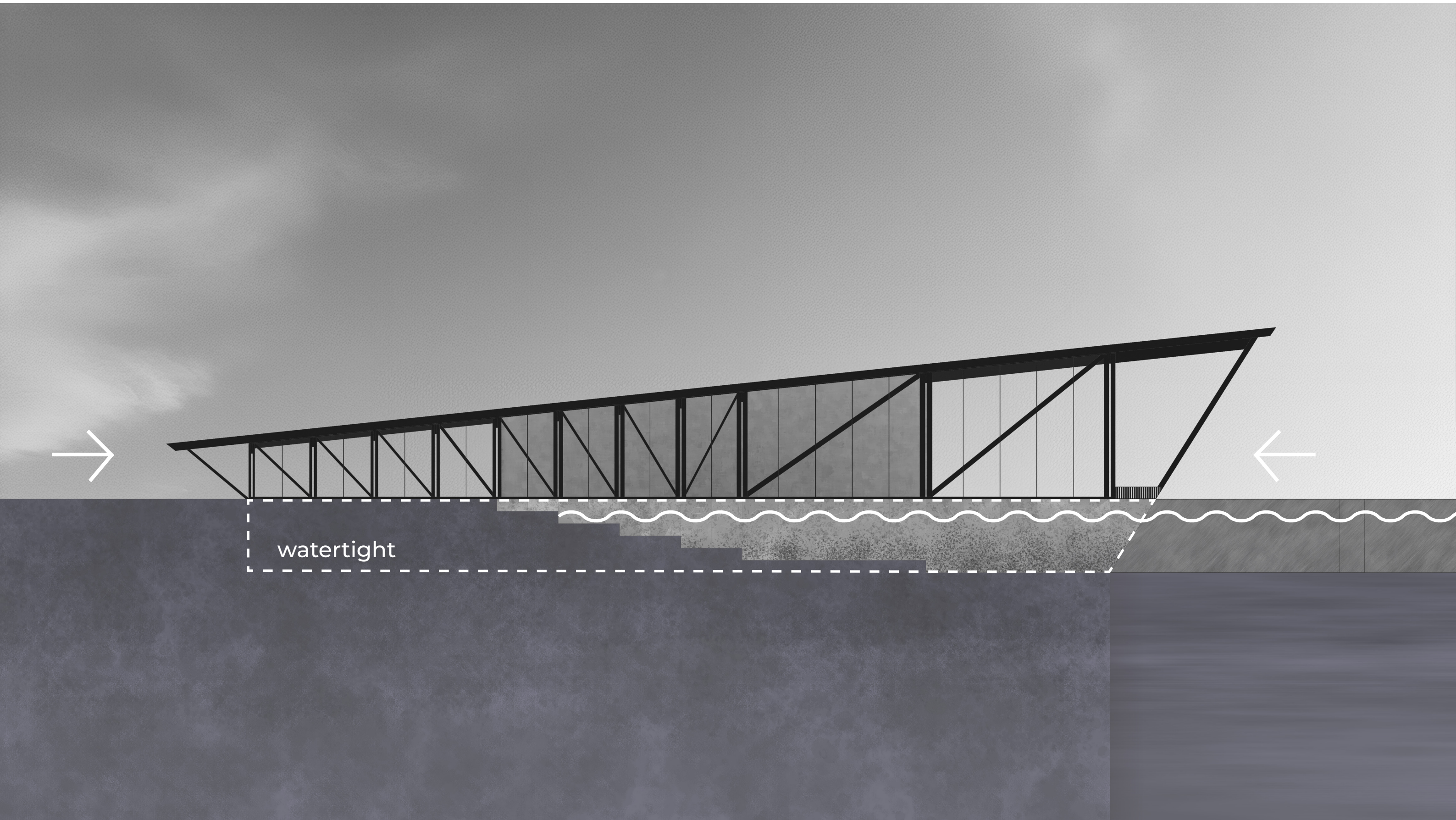


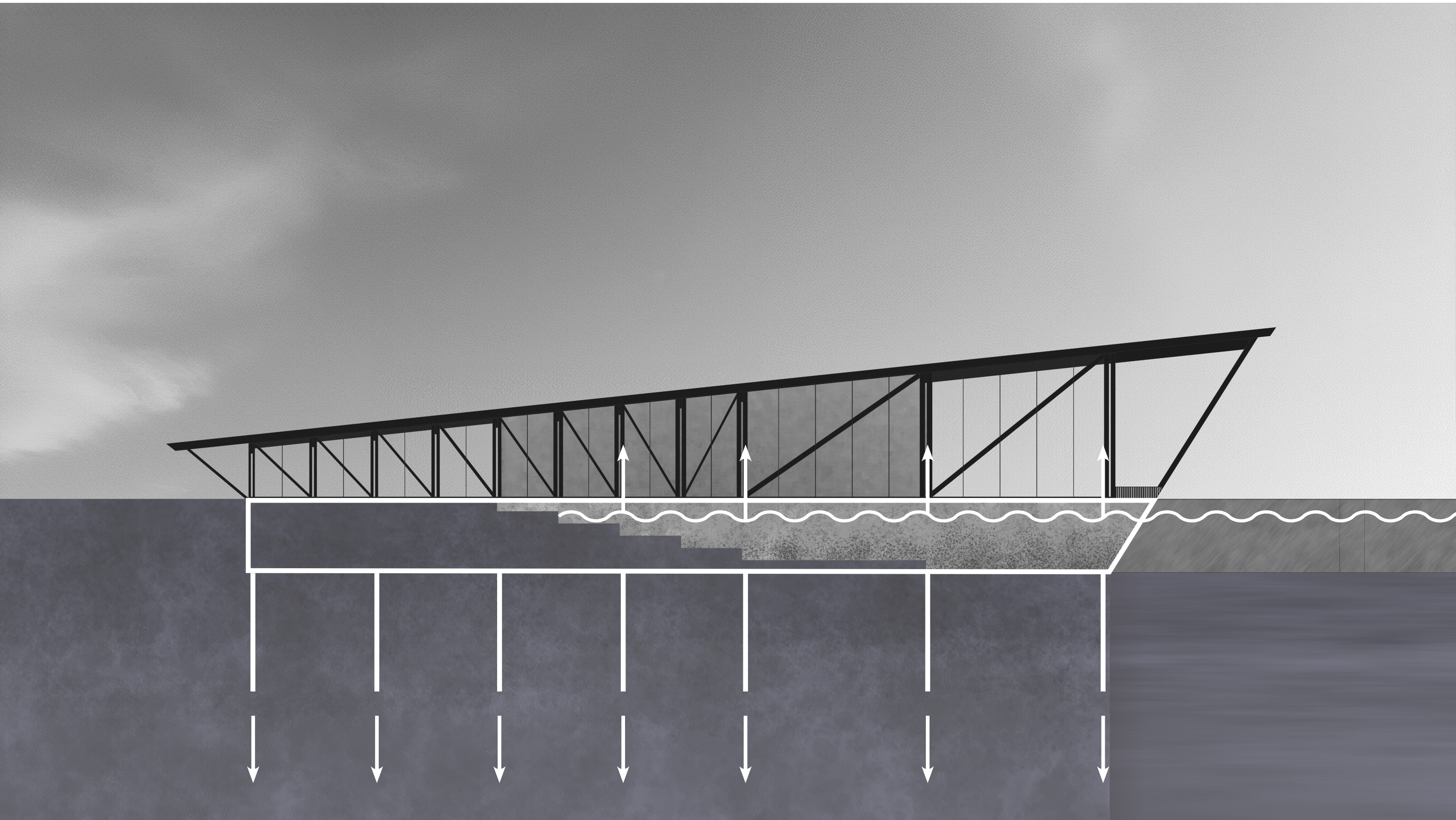
9 panels (20 m)

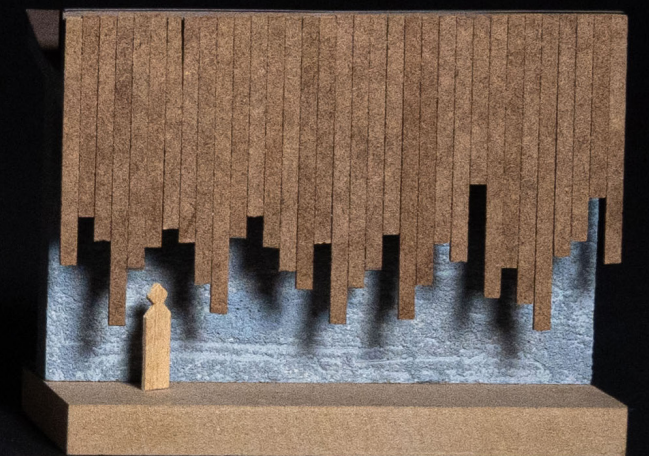
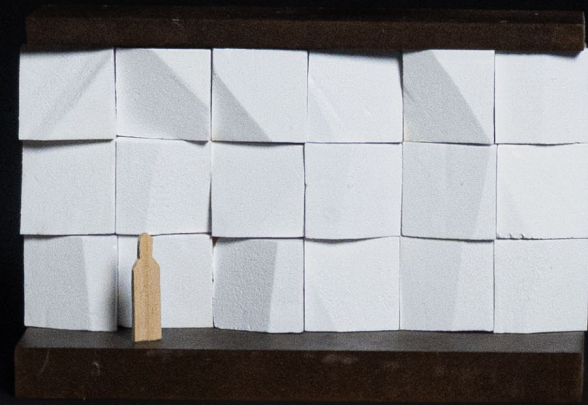


14 rows (35 m)

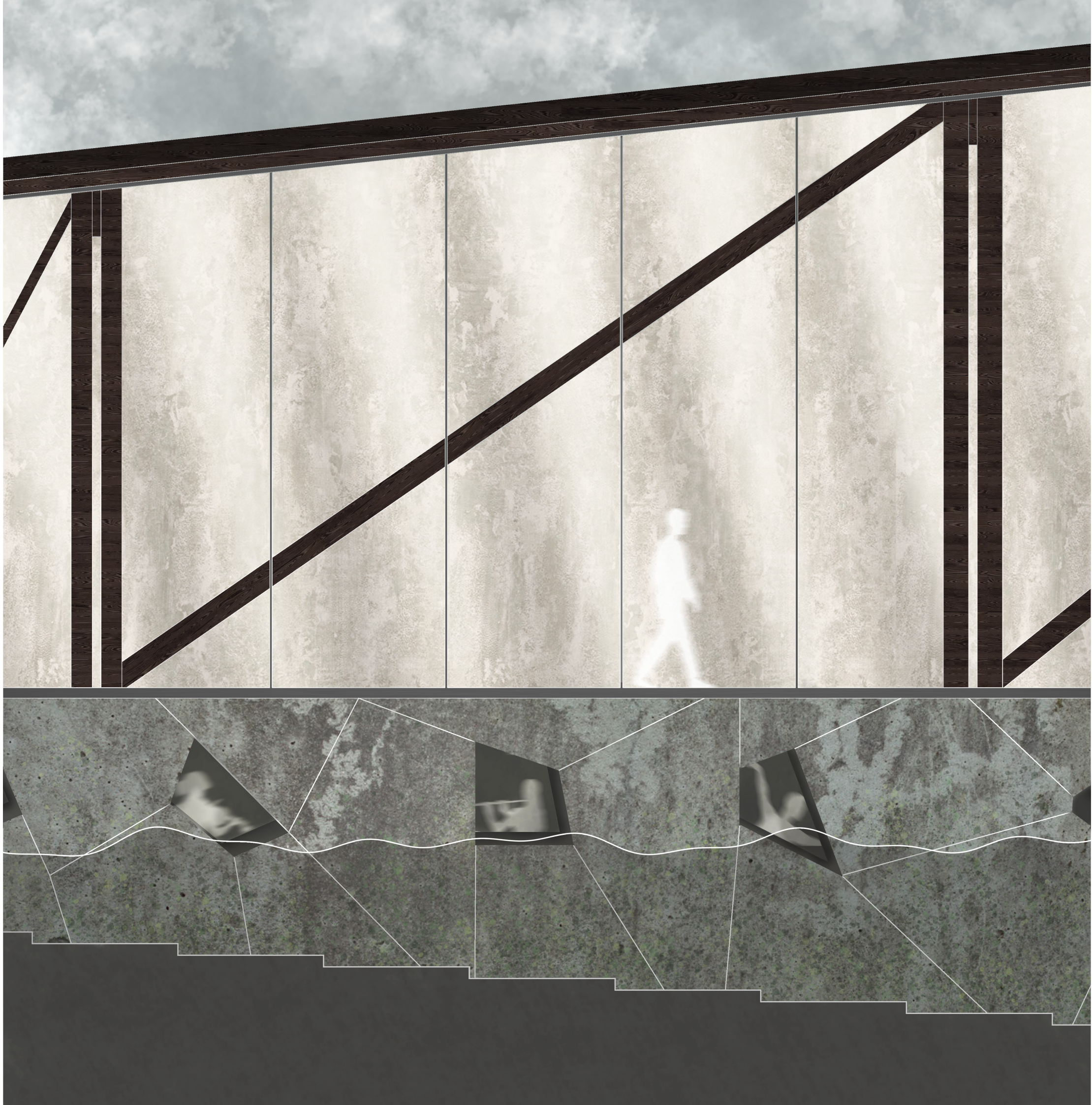
meets BENG requirement of 30 000 kWh/year





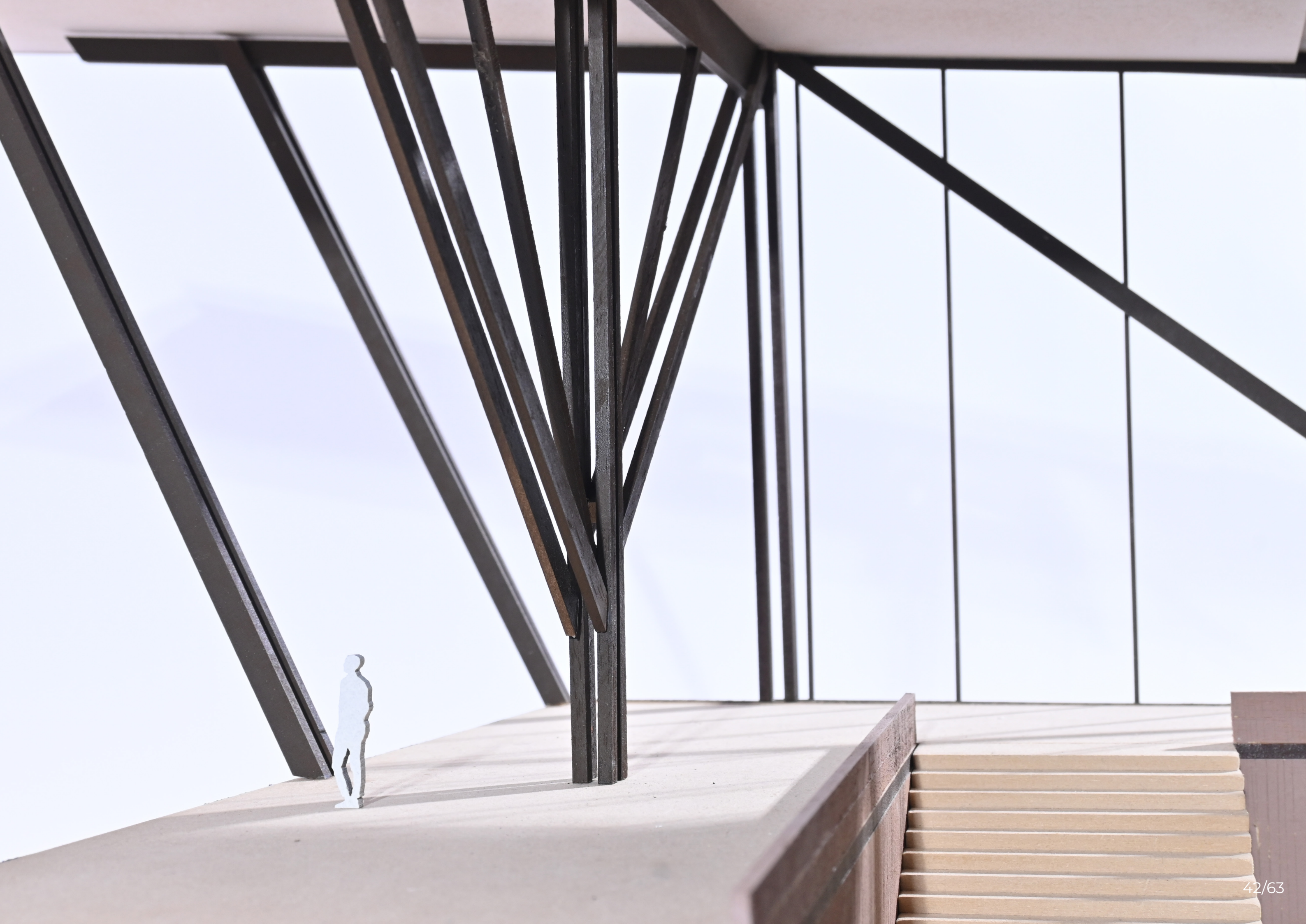




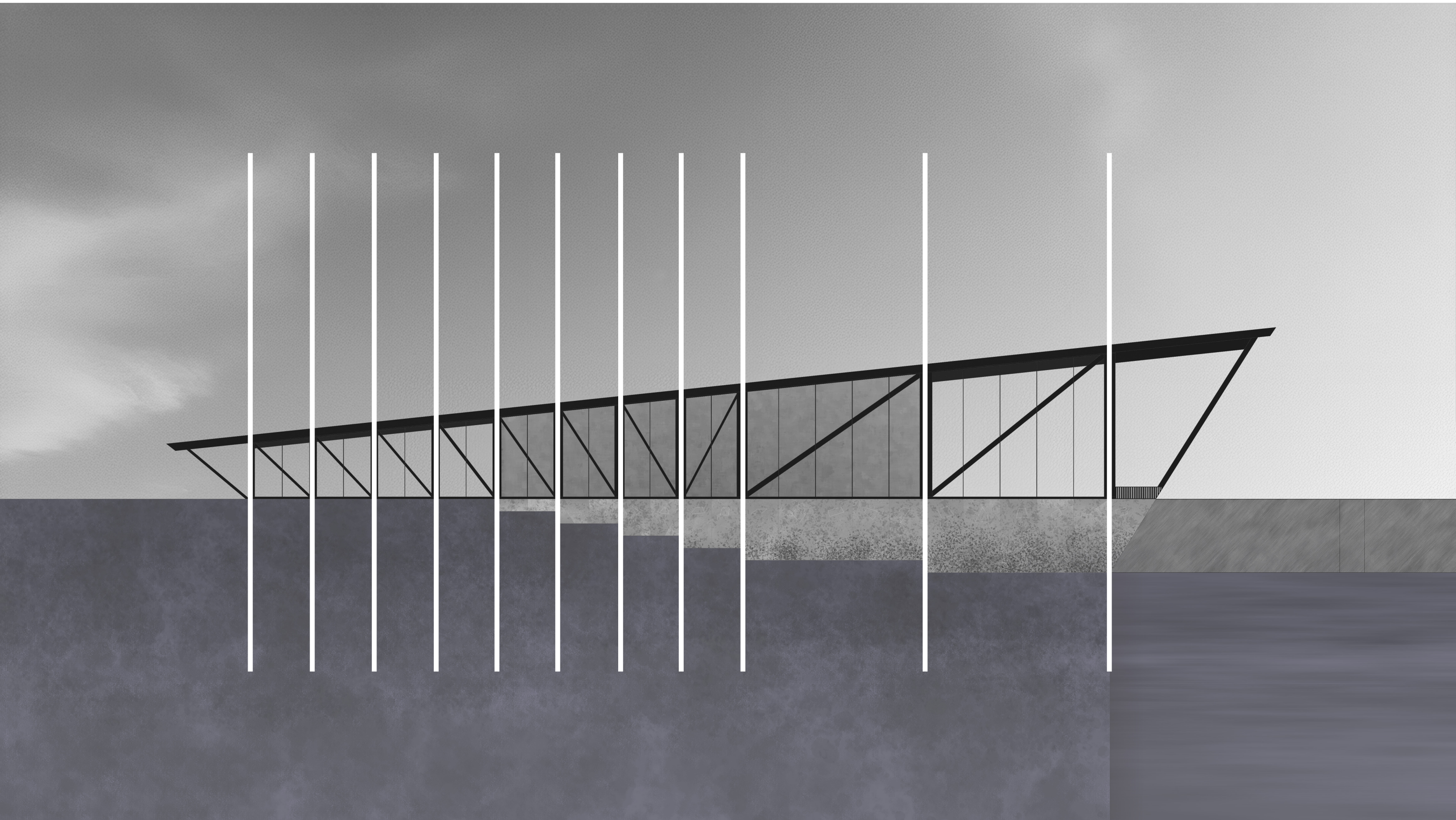


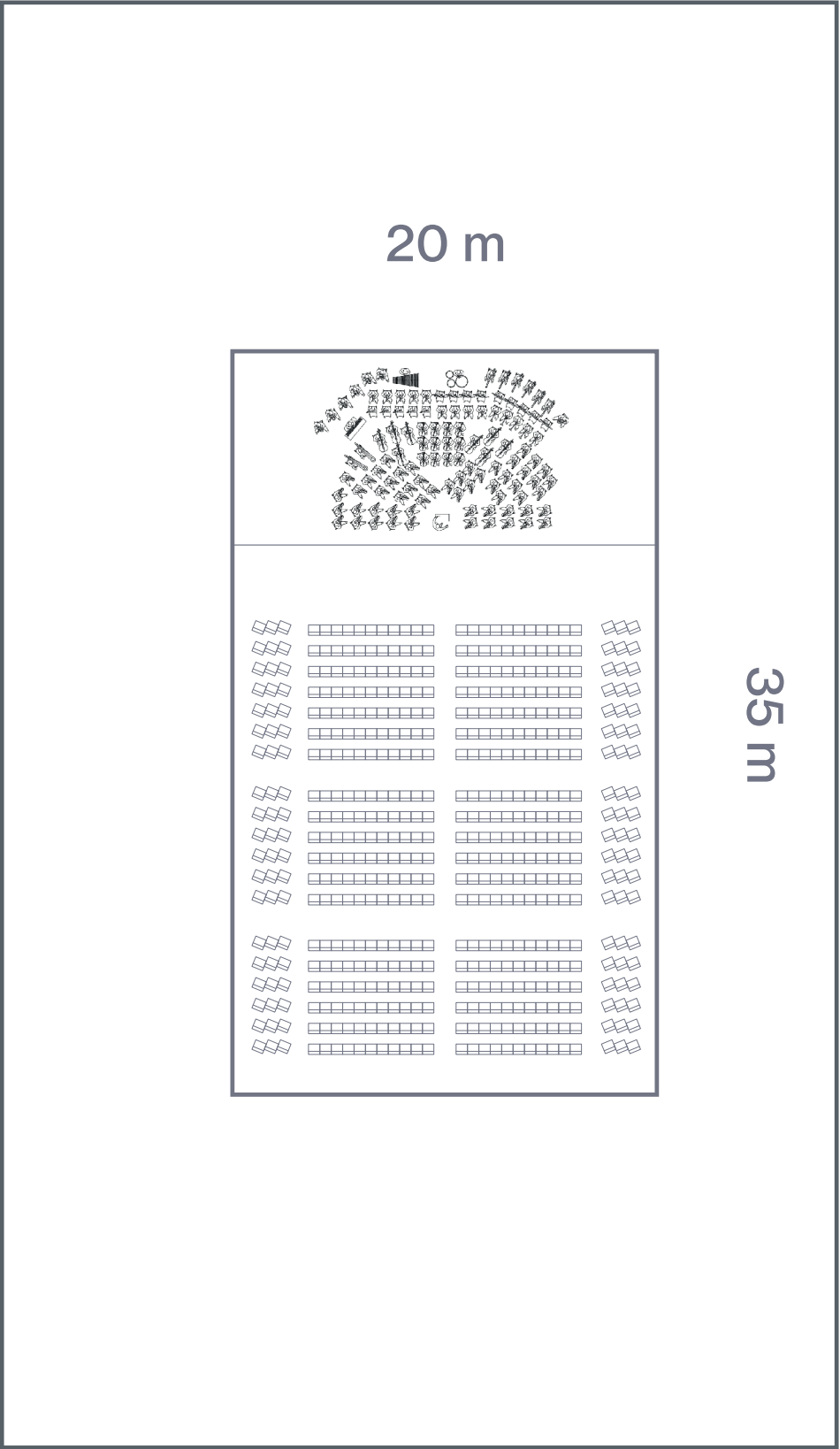


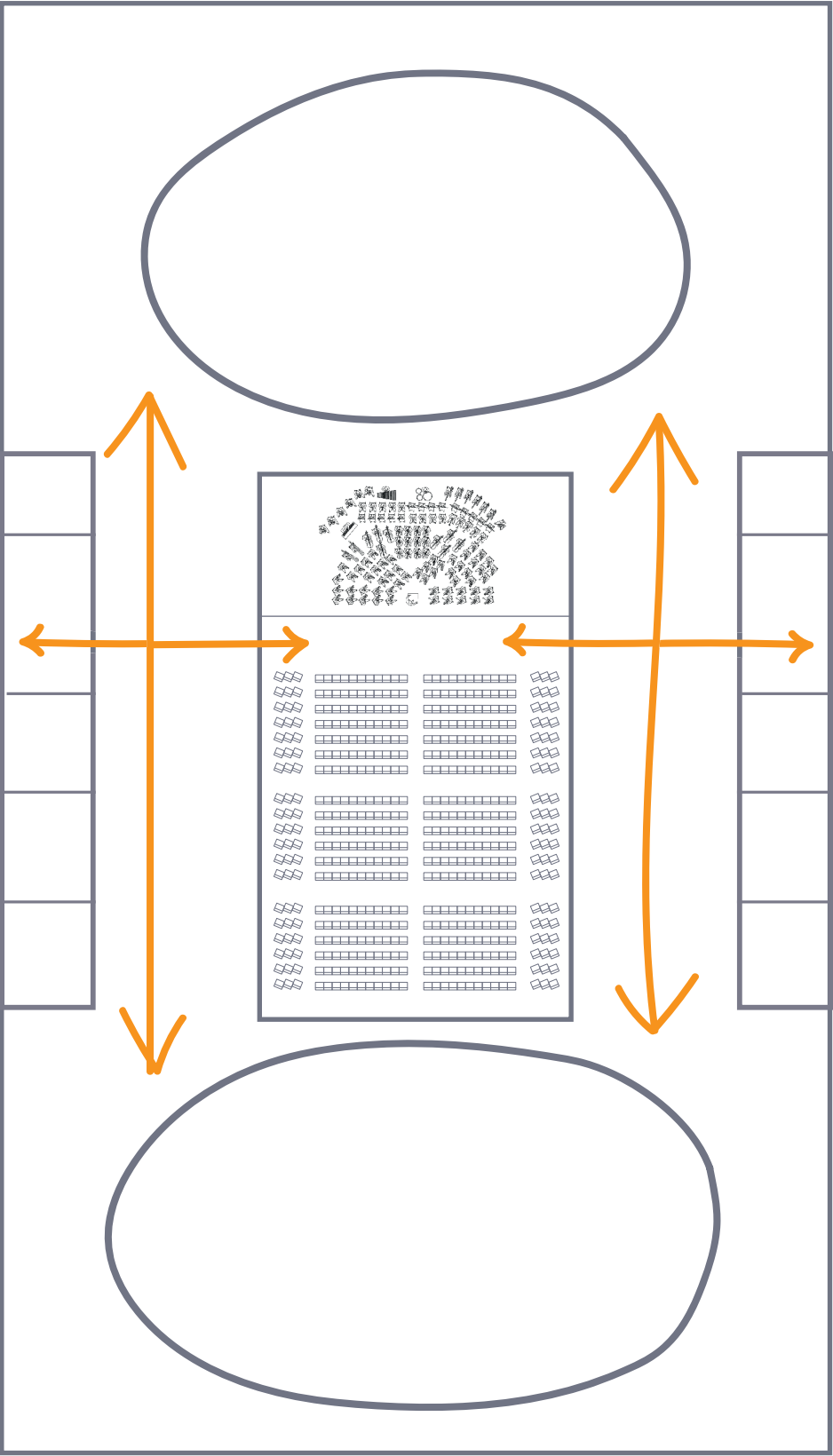


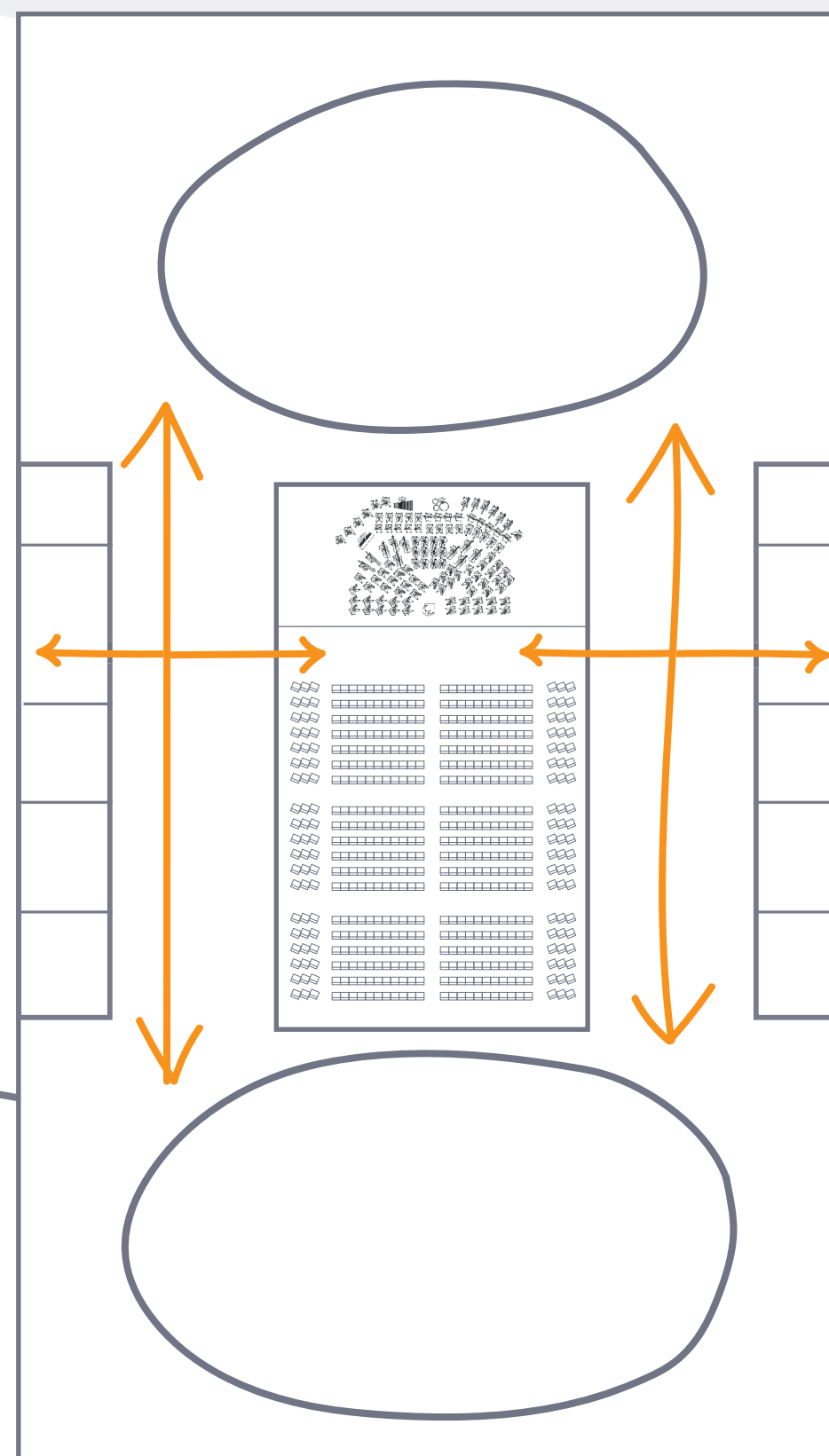












current NAP

+ 6000 terpmount

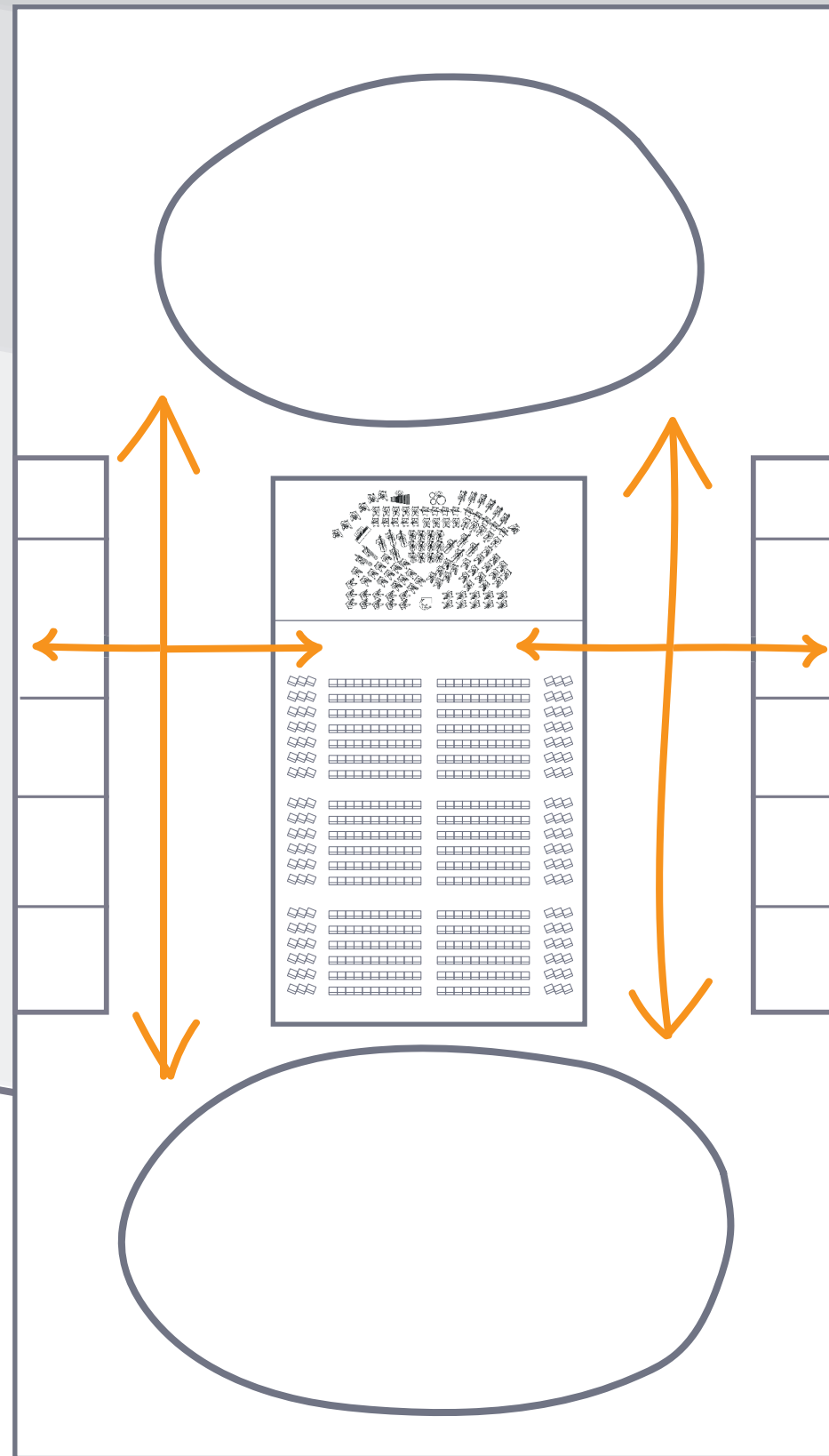


Entrance A

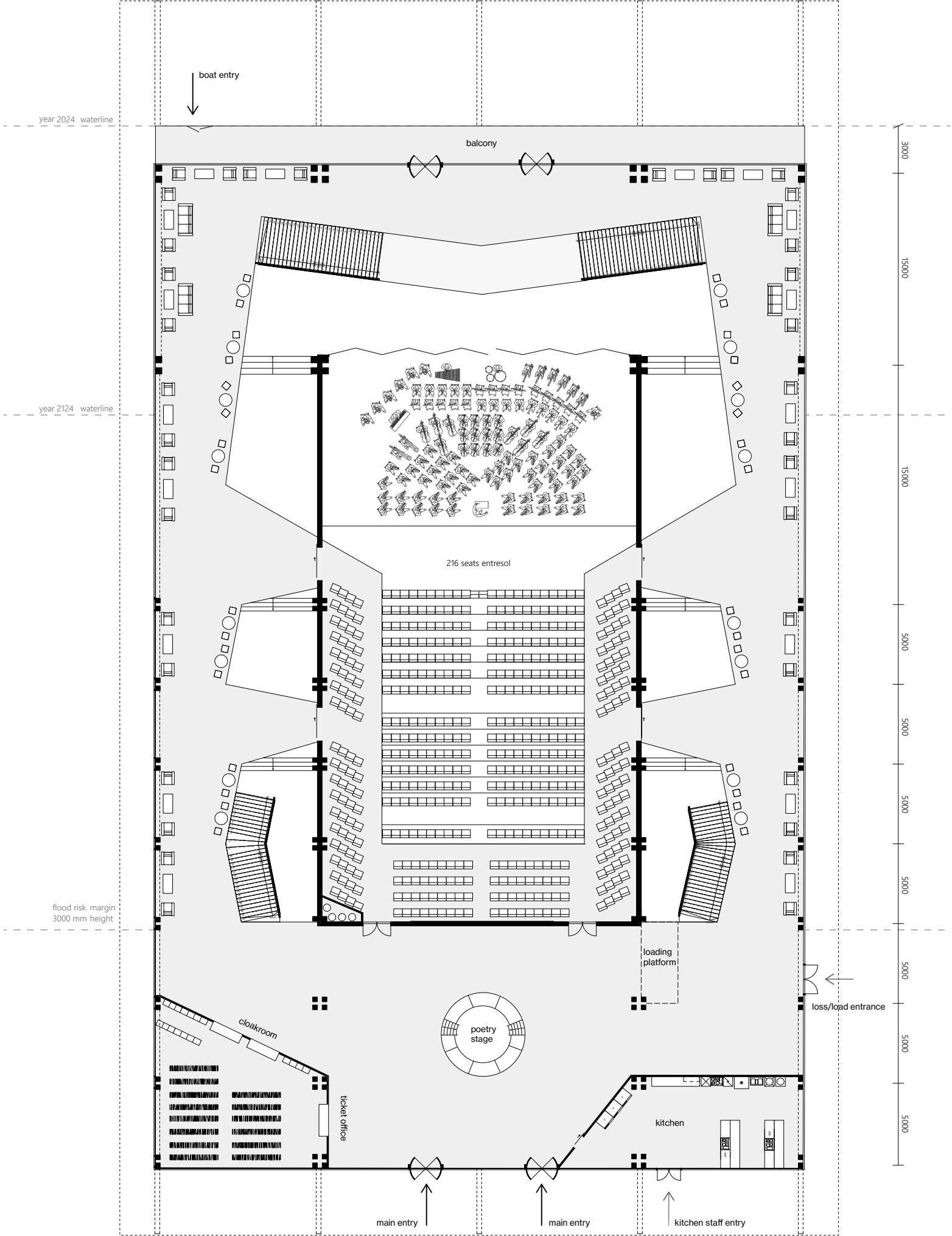




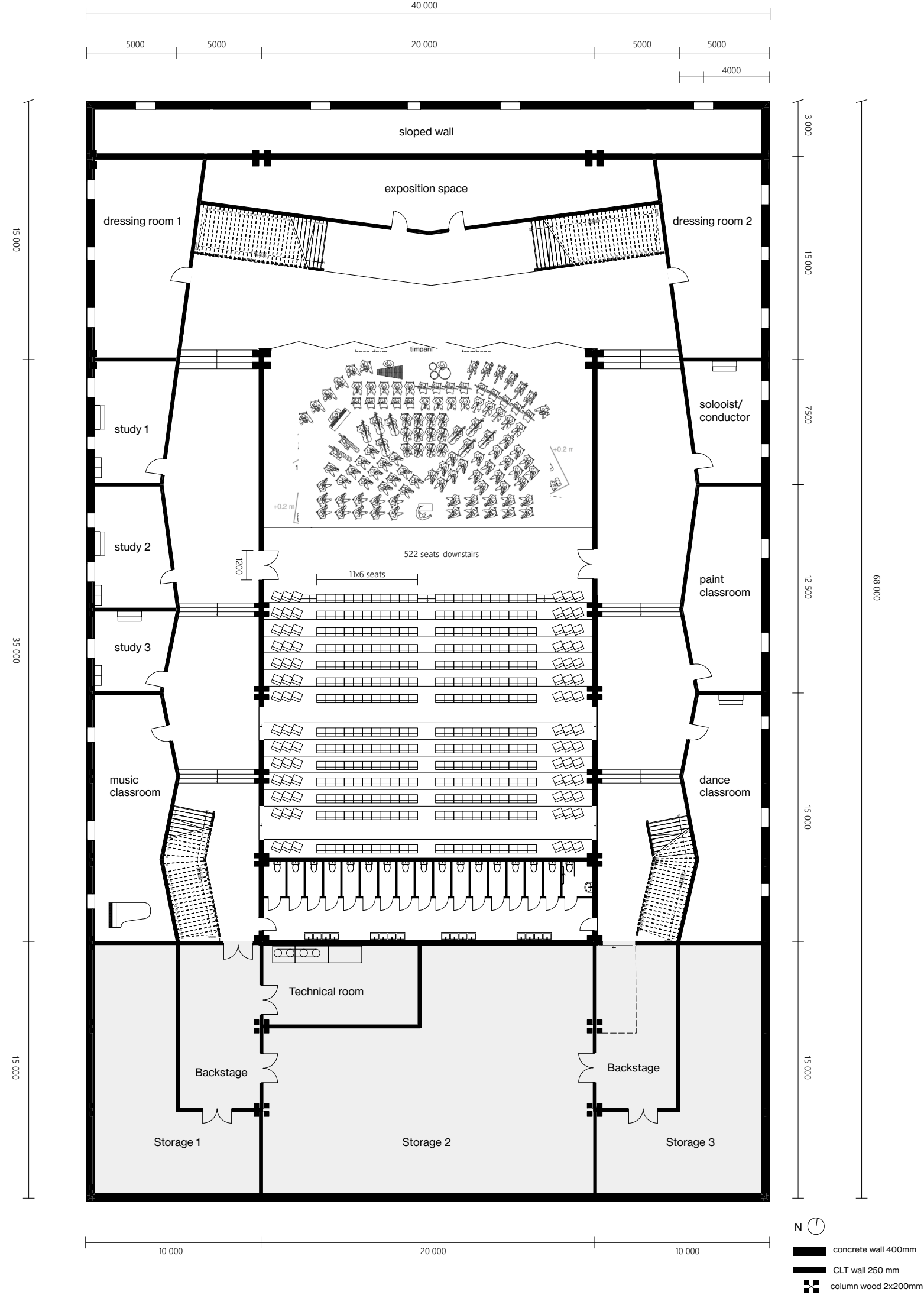
Entrance B

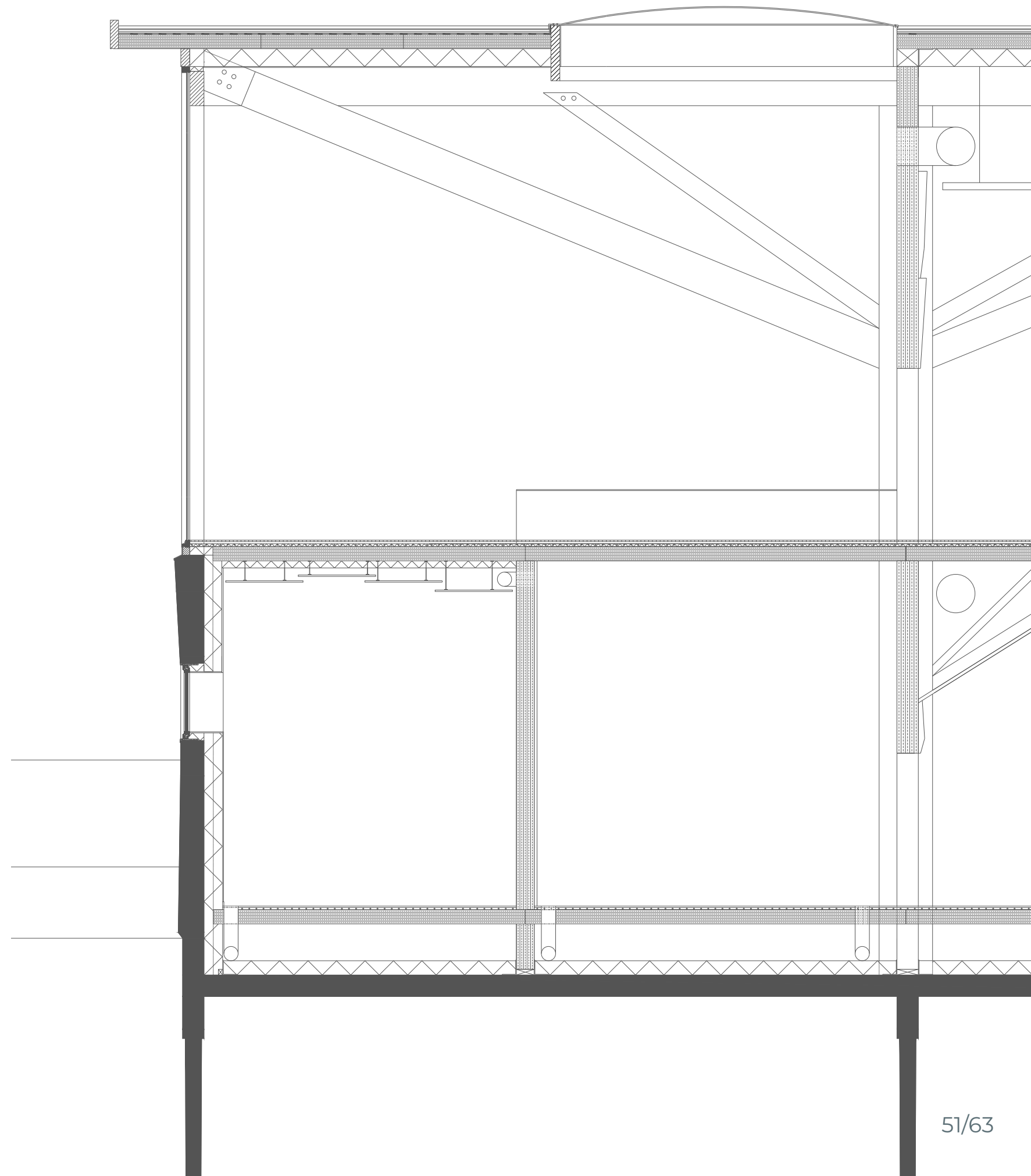


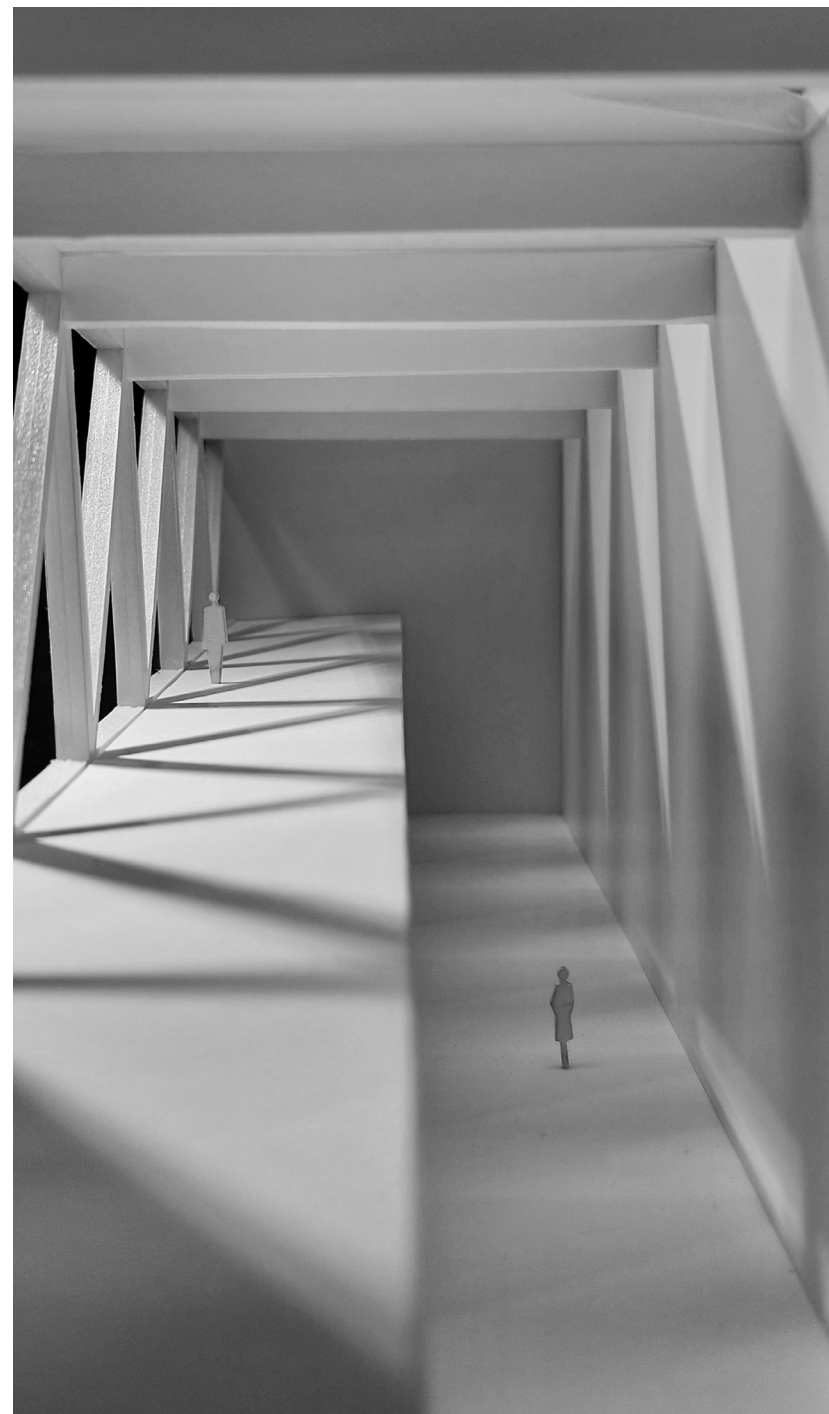
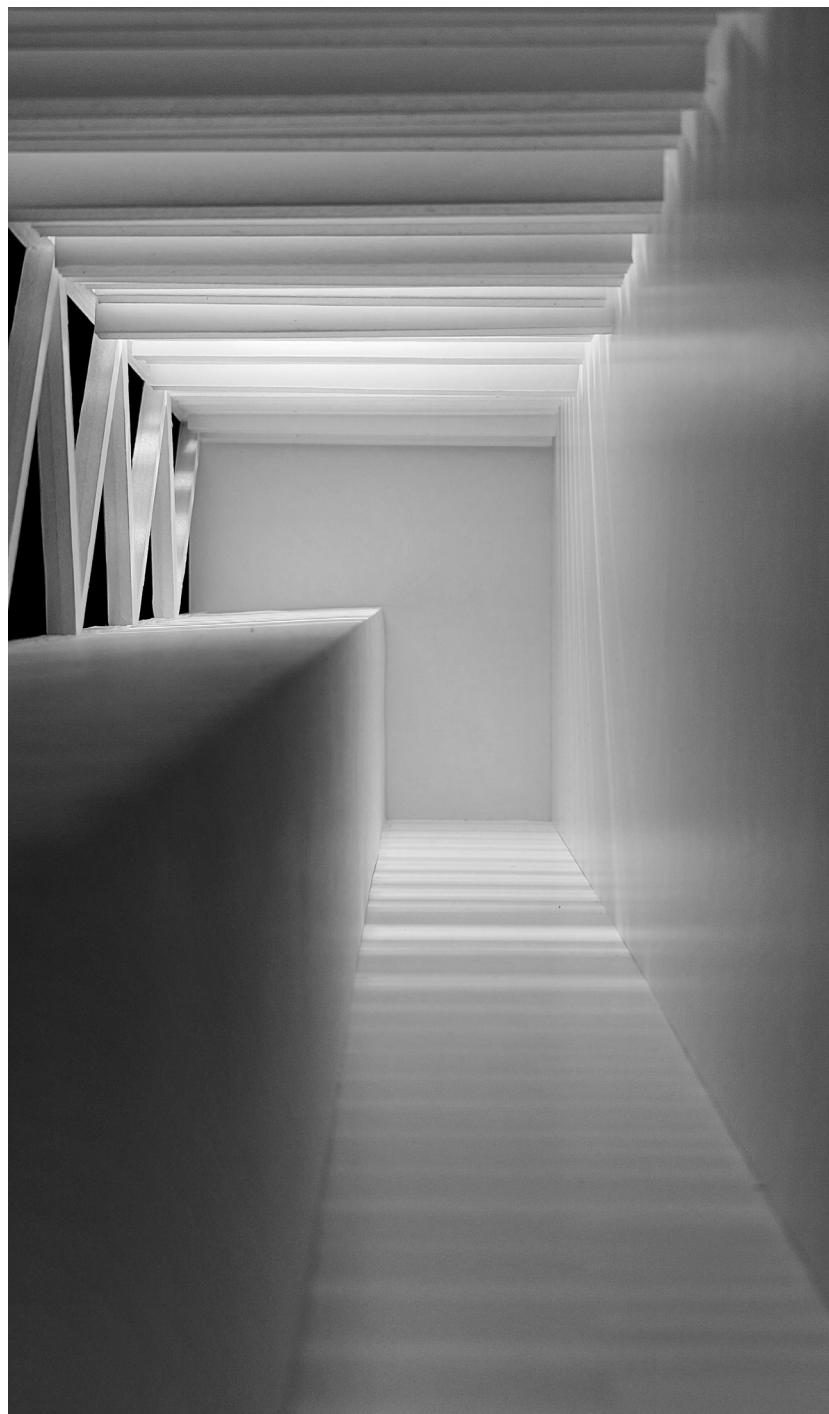
Floor plan ground level

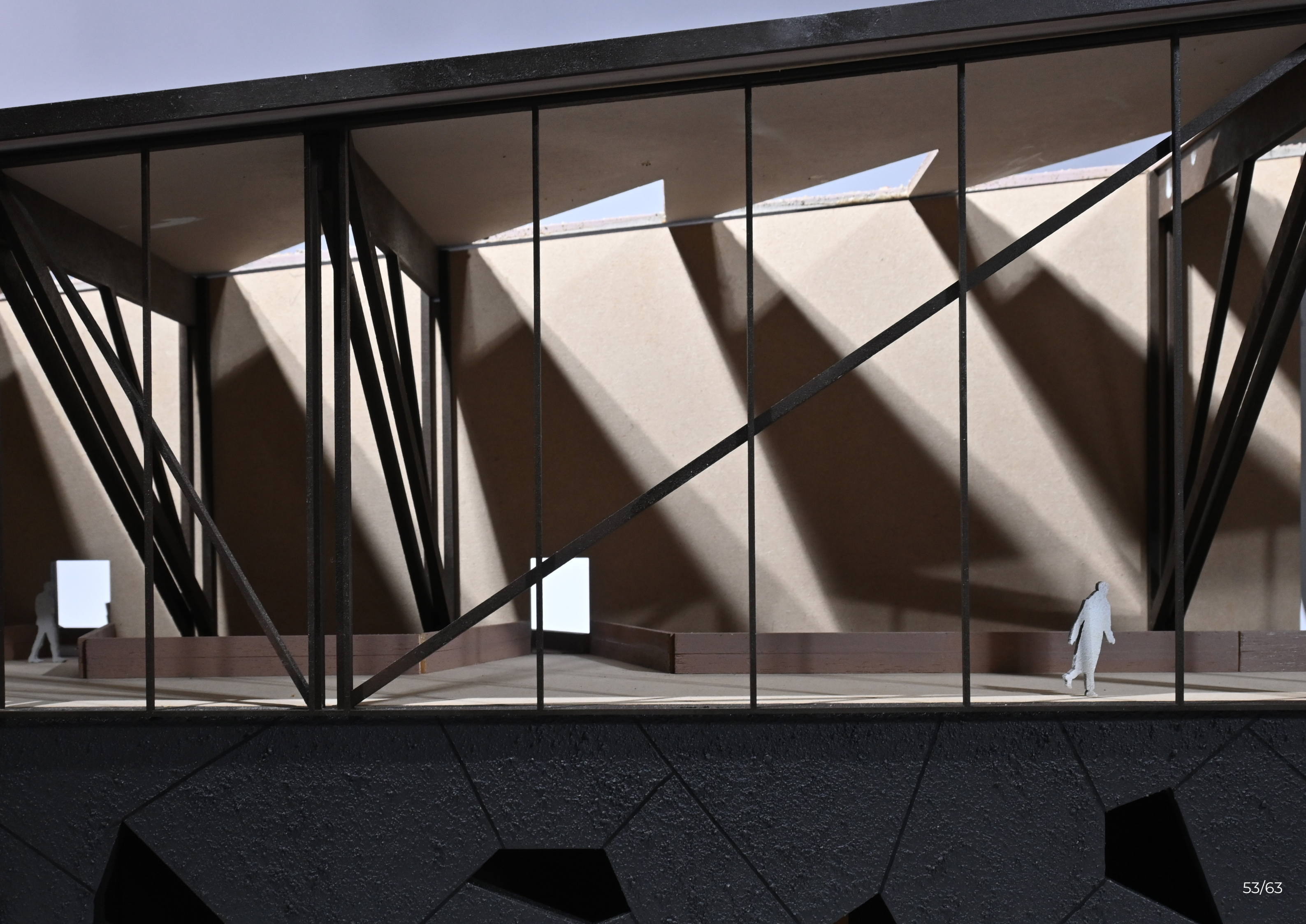


Floor plan underground -1



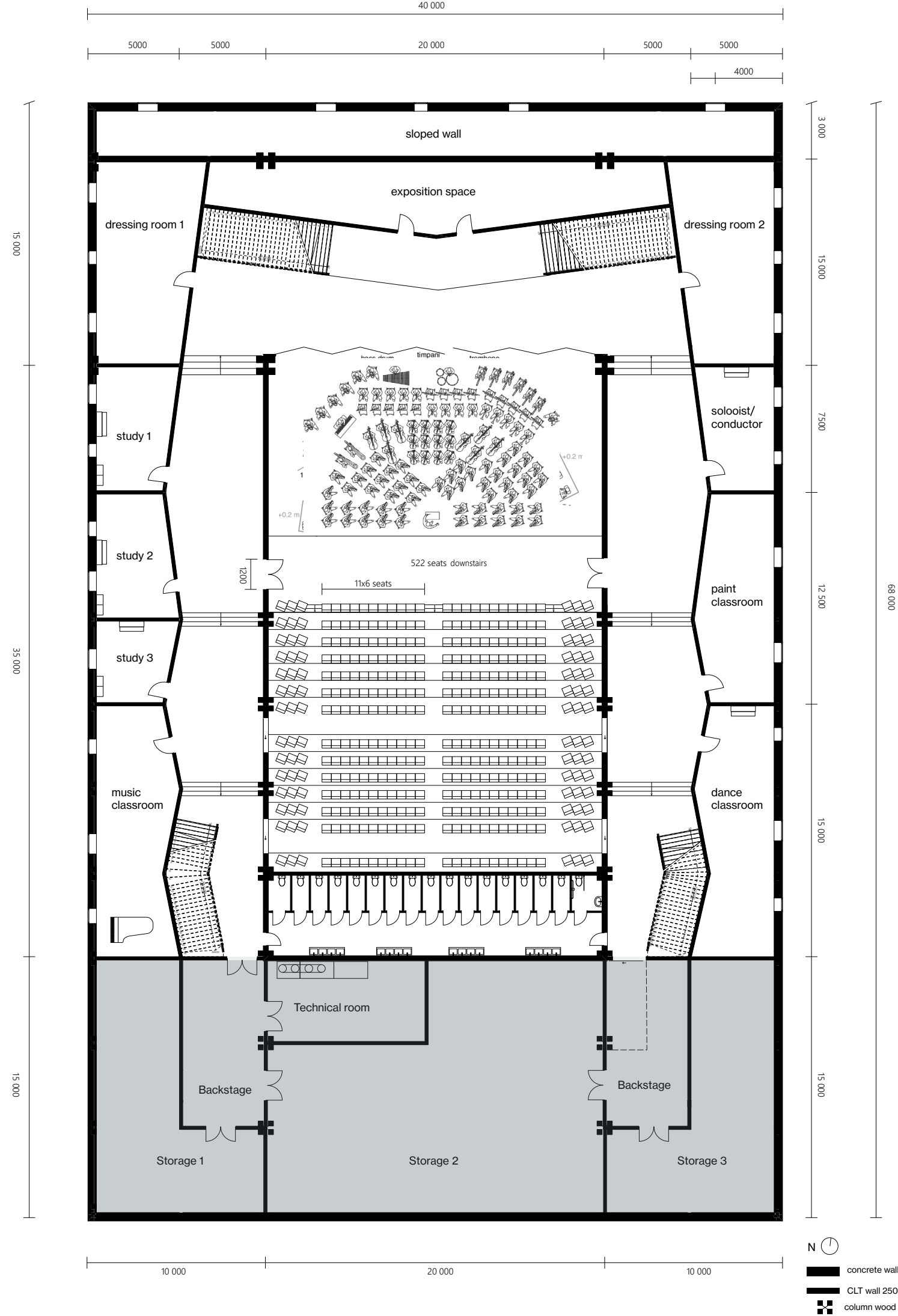








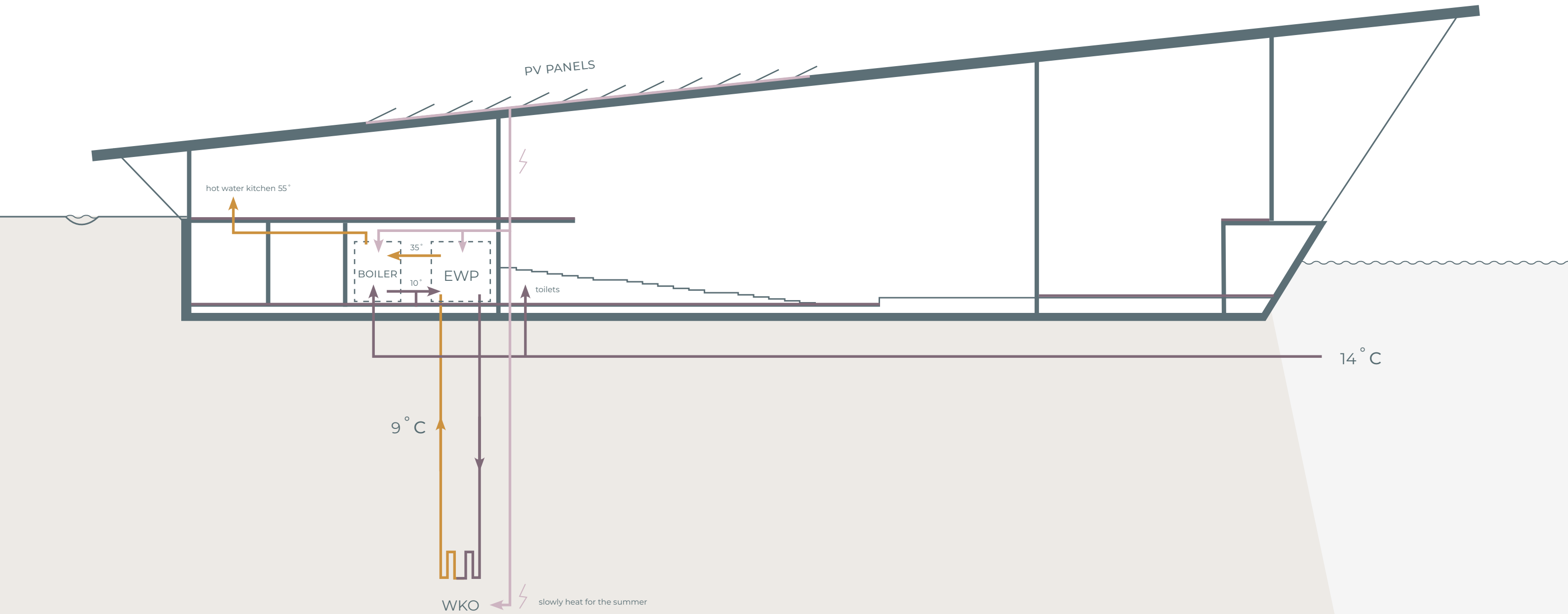
Floor plan underground -1

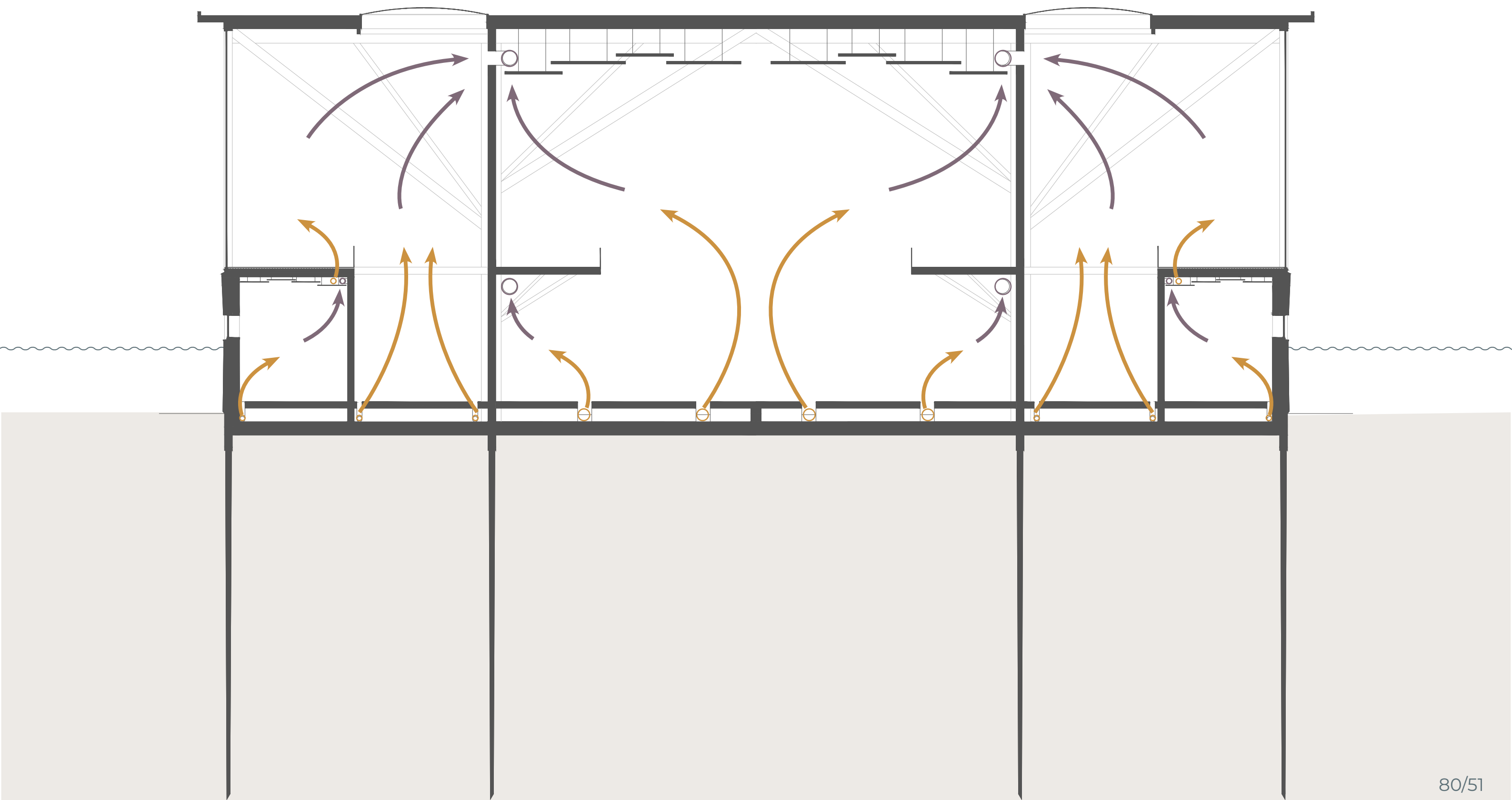




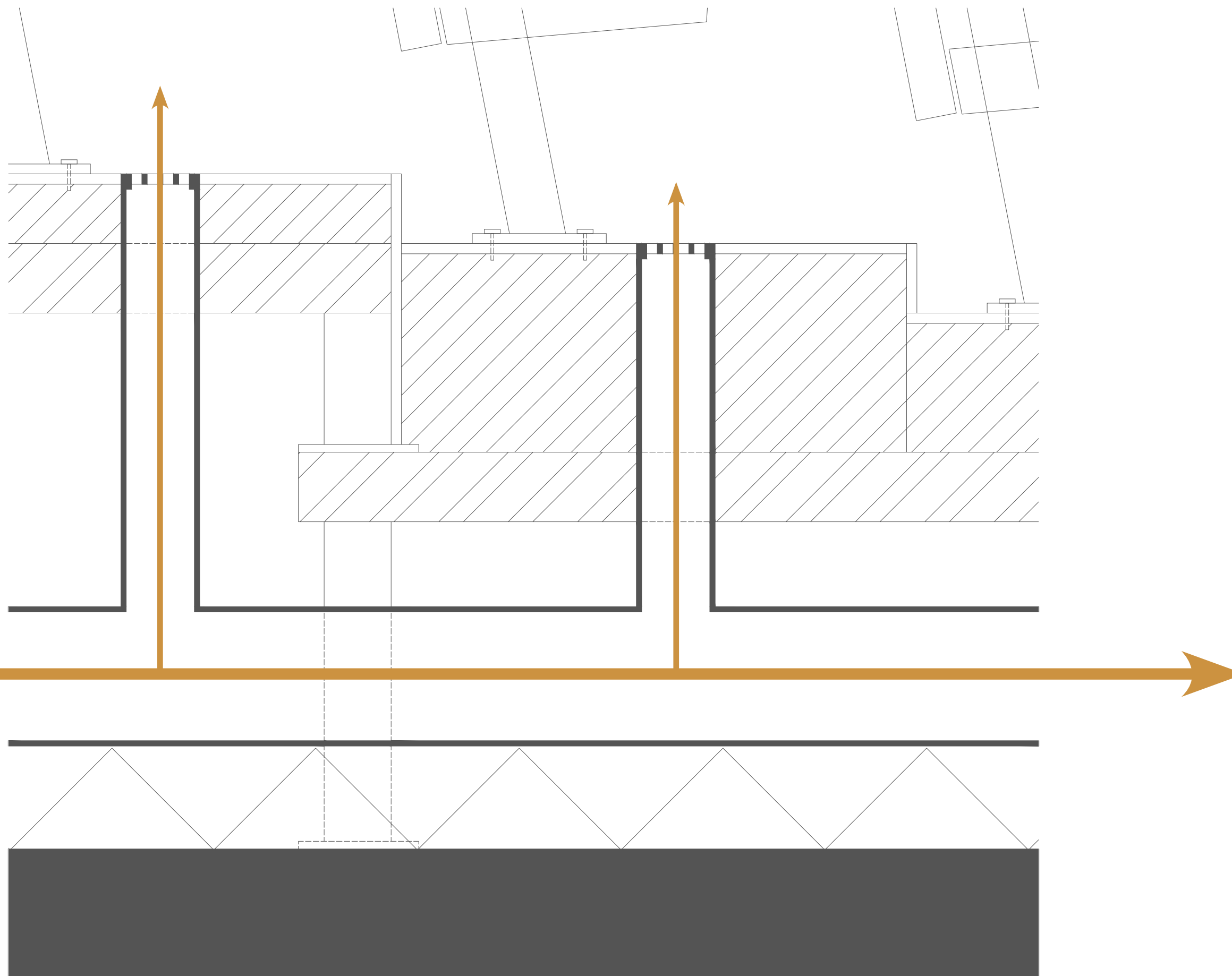


WINTER

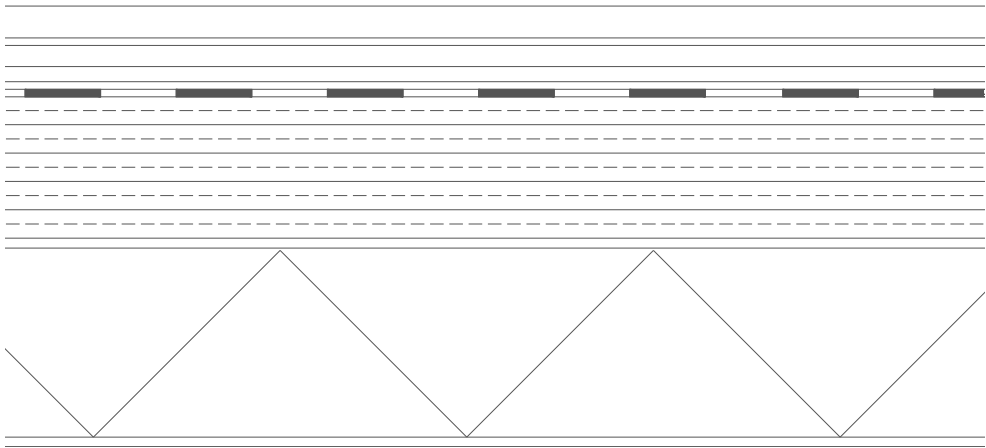




$V = 6 \text{ m}^3/\text{seat}$
 $d_{\text{round}} = 540 \text{ mm}$



roof



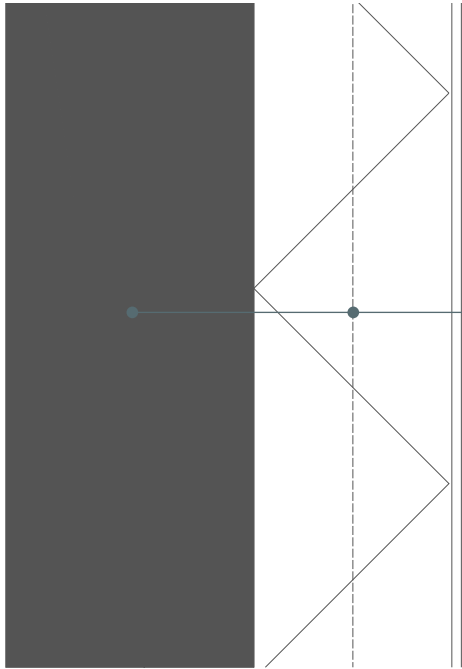
negligible degree of insulation

$R_c = 8,68 \text{ m}^2 \text{ K/W}$

current norm
new construction:

$6,3 \text{ m}^2 \text{ K/W}$

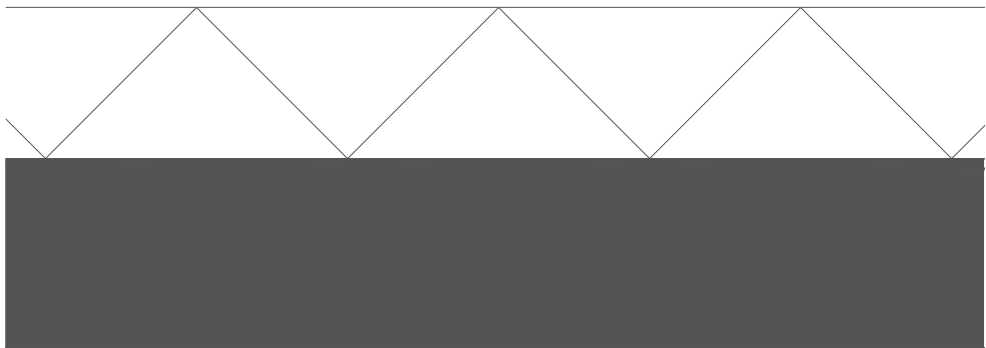
facade



$R_c = 7,32 \text{ m}^2 \text{ K/W}$

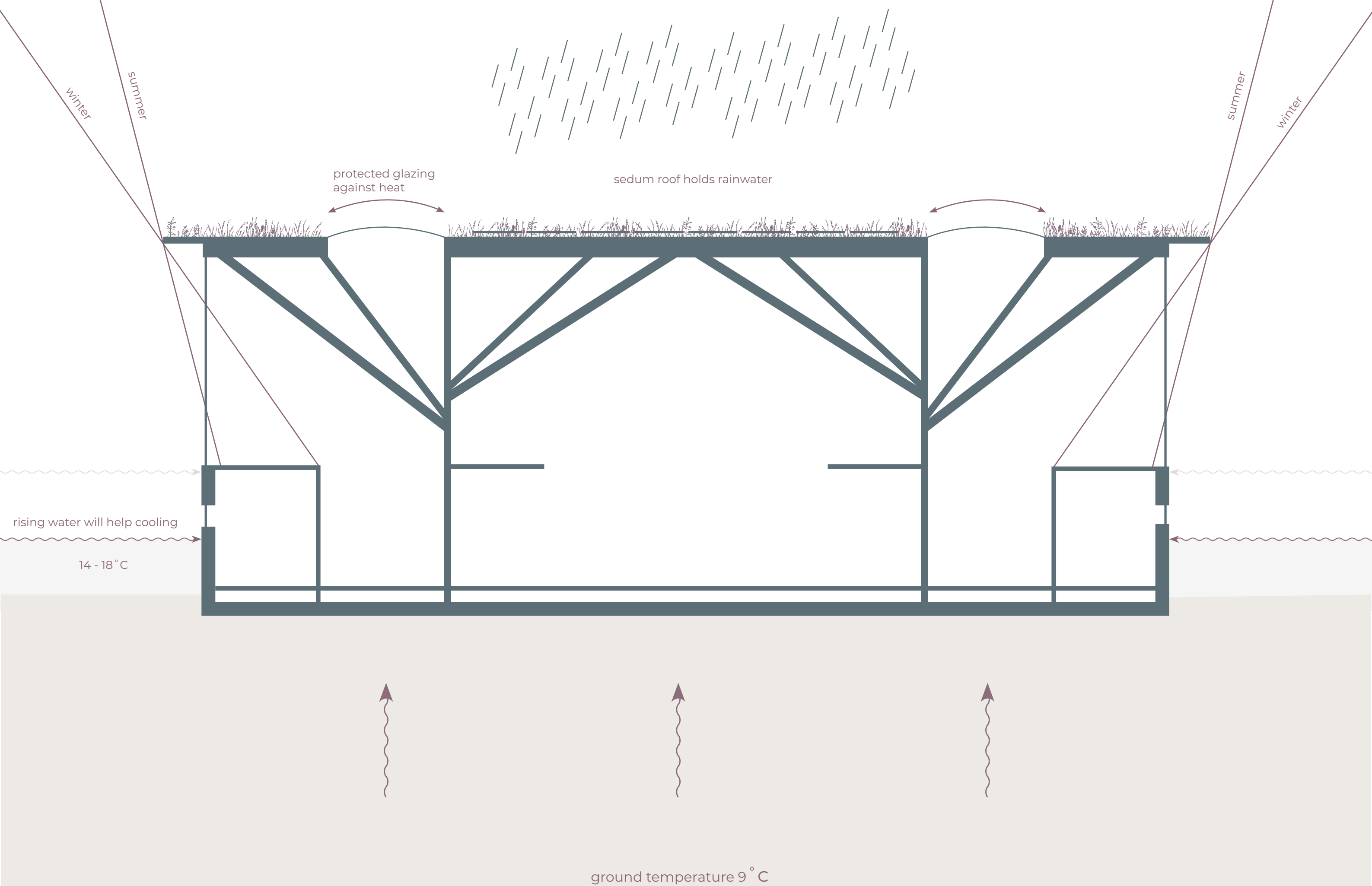
$4,7 \text{ m}^2 \text{ K/W}$

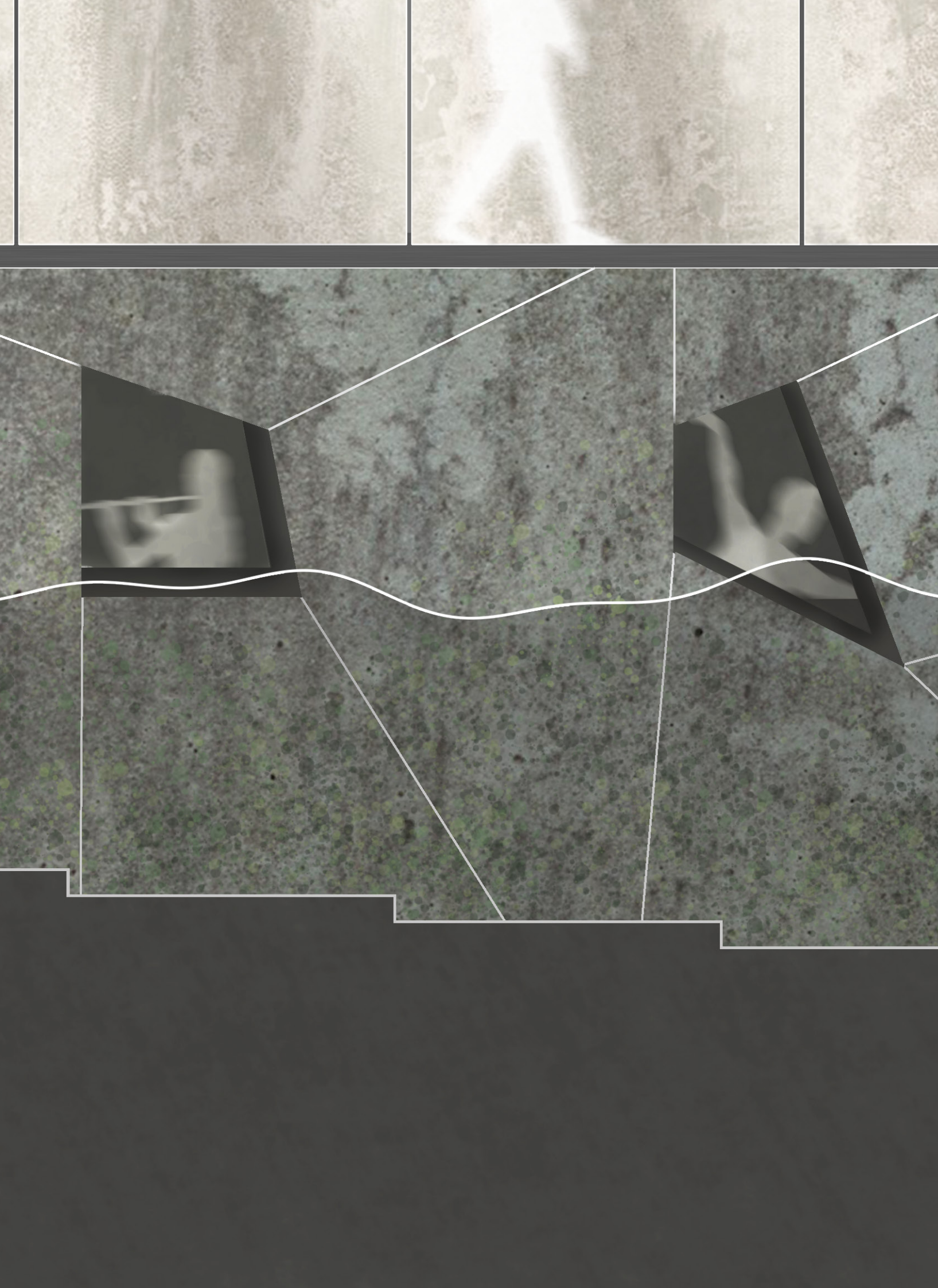
floor



$R_c = 5,89 \text{ m}^2 \text{ K/W}$

$3,7 \text{ m}^2 \text{ K/W}$

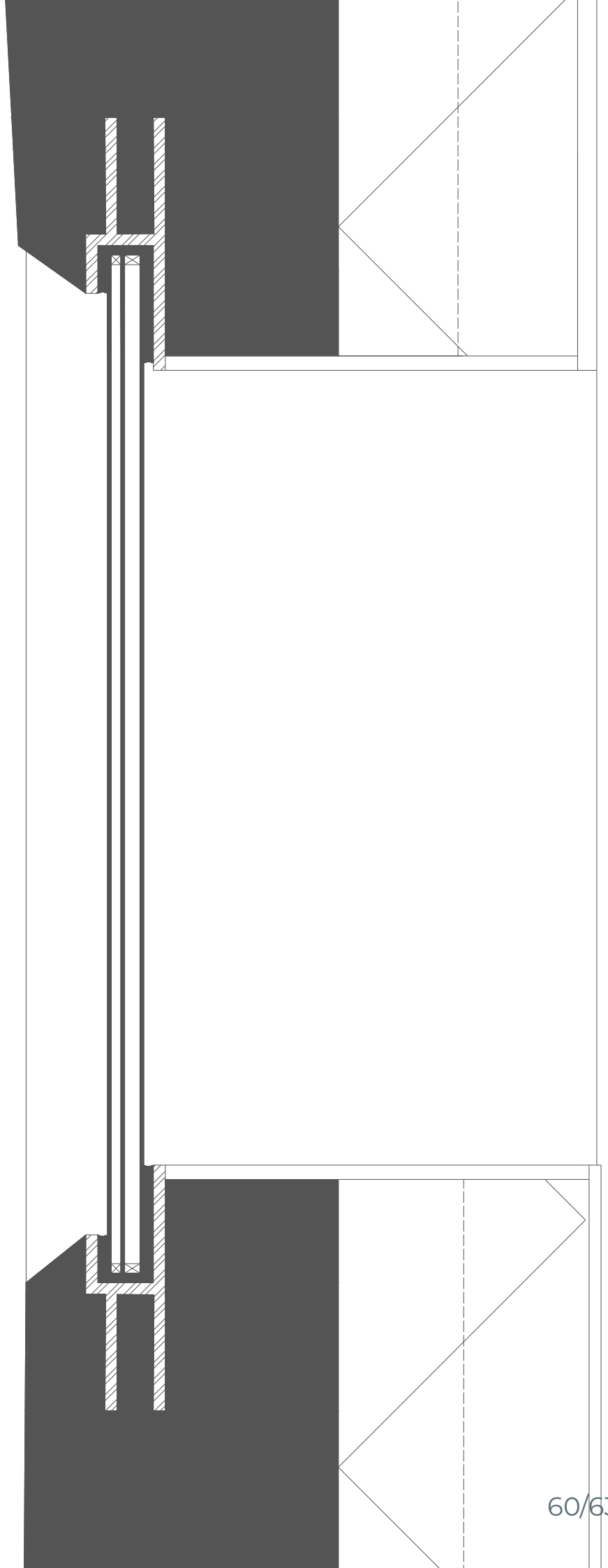


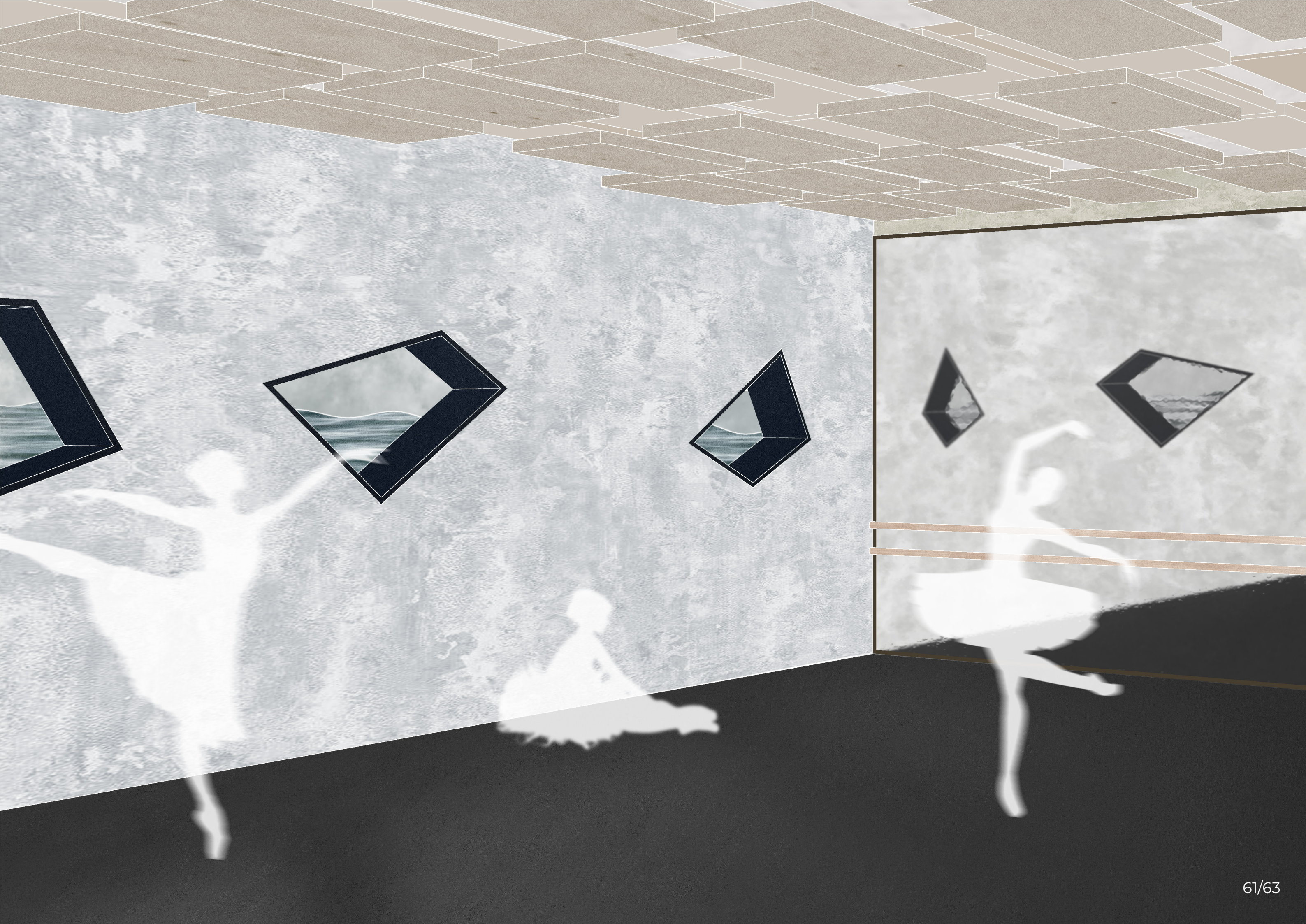


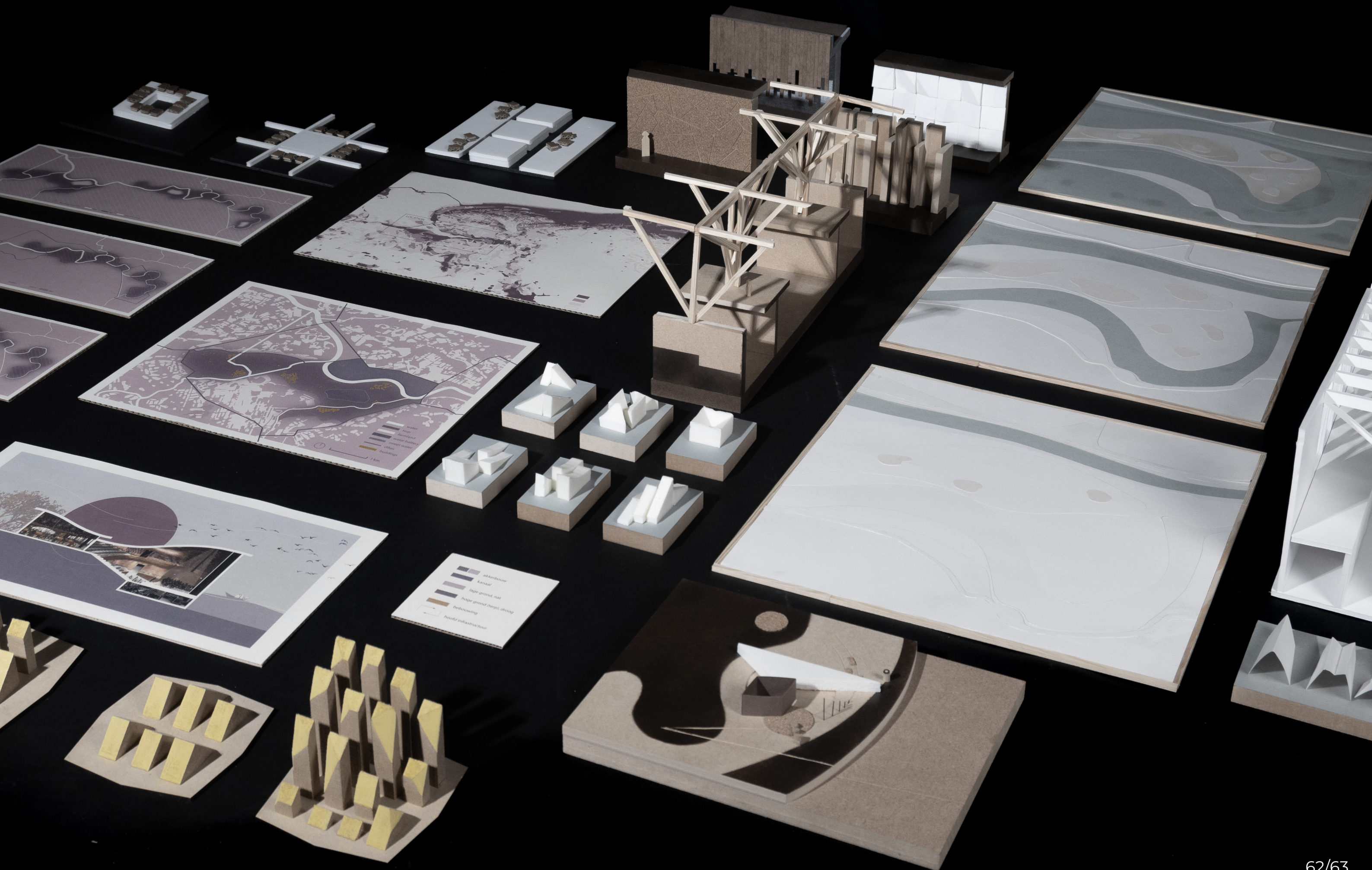
flood risk margin
up to 3000 mm



NAP waterlevel 2124
+ 4000 mm







LANDSCAPE

FORM

INTERIOR

TECHNOLOGY



PROGRAM OF REQUIREMENT

RESULT

concert hall	stage 200 m ² (10 x 20 m) hall at least 1000 m ³ for accoustics	stage 10 x 20 m = 200 m ² hall 35 x 20 m = 700 m ²
foyer	1 m ² per person small stage, reception, cloakroom	300 m ² + 900 m ² open space poetry stage, reception, cloakroom
community rooms	700 m ² dressing rooms, kitchen, classrooms	900 m ² dressing rooms, kitchen, classrooms
storage	twice the stage area, 400 m ² minimum	600 m ²
exposition space	50 m ² may be combined with other function	80 m ²
terrace	outdoor, seats for 200 people	outdoor, seats for 200 people
technical equipment	100 m ²	100 m ²
toilets	1 toilet per 20 people	20 toilets, including disabled
total	2.850 m²	3.780 m²

PARKING SPOTS

car 2 per. per car
 66 places

132 people

bike 1 per. per bike
 15 rows of 30 bikes

450 people

boat 4 per. per boat
 39 places for boat length of 6 m

156 people

TOTAL = 132 + 450 + 156 = **738 parking spots**

concert hall seats = 522 downstairs + 216 entresol = 738 seats

39 boats 6m length

450 bikes

66 cars



PV SOLAR PANELS

multi-crystalline PV panel has a efficiency (rendement) of 13 %

$E_{incoming} = 0,13 * 1000 = 130 \text{ kWh/m}^2 \text{ per year}$

needed to meet BENG requirement = 30 000 kWh/year

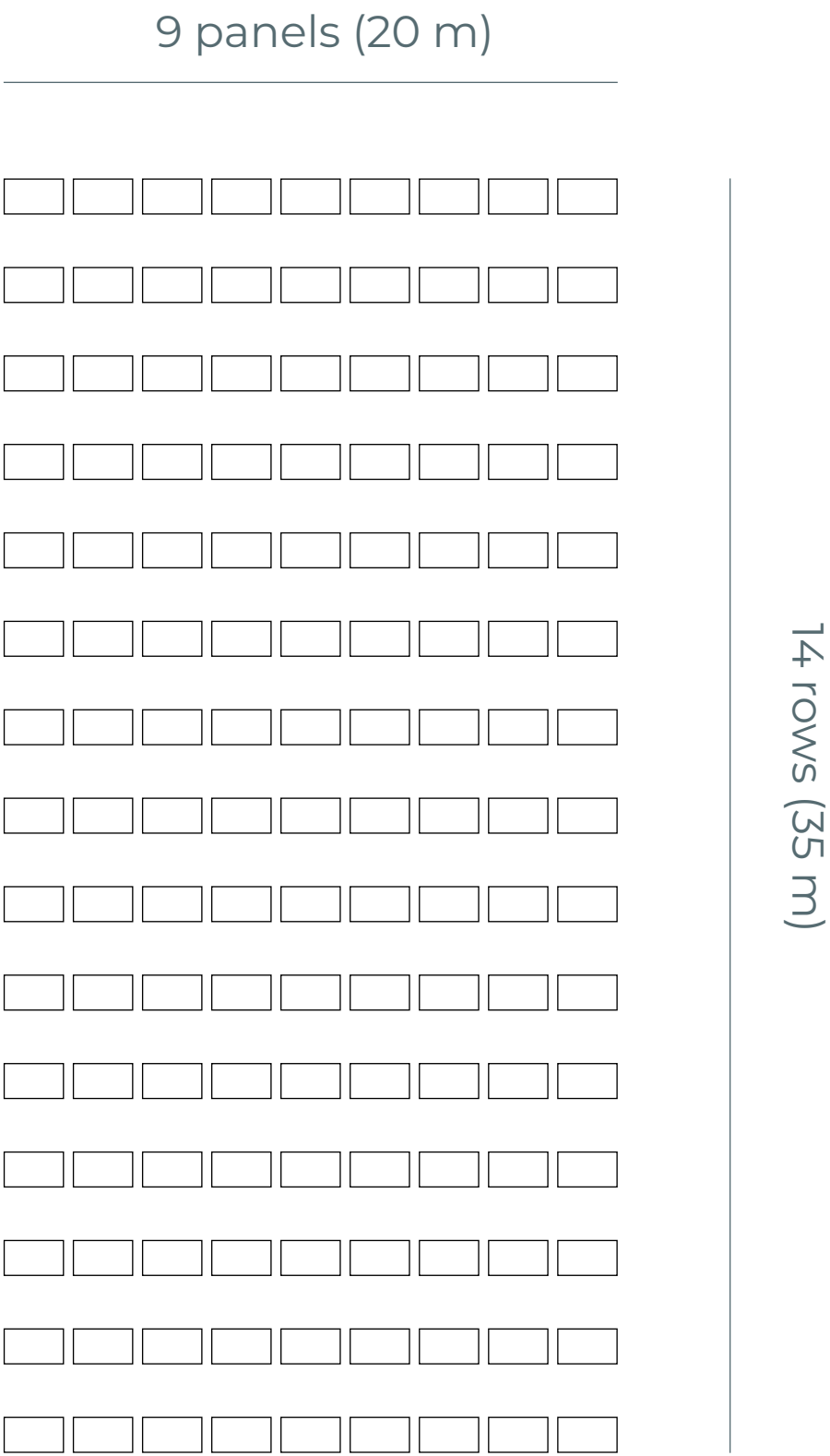
$\text{roof area covered by PV panels} = 30\,000 / 130 = 230 \text{ m}^2$

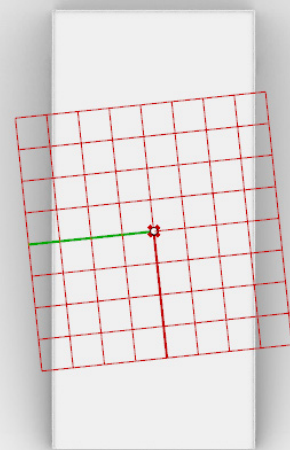
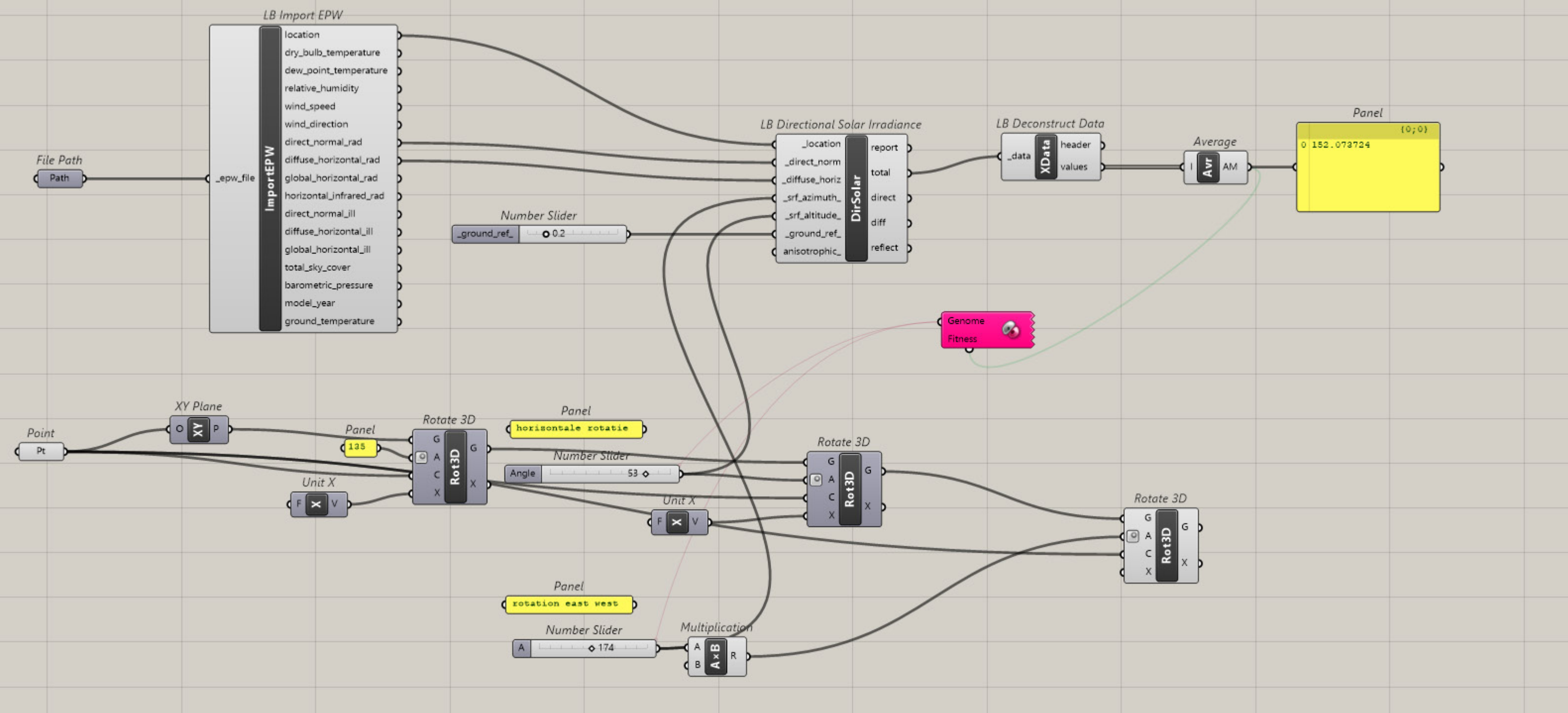
1 PV panel dimensions = 1000 x 1700 mm

$\text{total amount of PV panels needed on the roof} = 230 / 1,7 = 135 \text{ panels}$

marks exactly the area of the concert hall underneath

angle of 52° C according to grasshopper optimatisation





Indicatief BENG-label

Project

projectnaam

KENTALLEN

Gebruiksoppervlakte Ag	m²	2400
Verliesoppervlakte/Volume	m²/m³	0,22
Ugemiddeld	W/m²K	0,499
Glaspercentage*ZTA-zonwering	%	0,12564
% Natuurlijke ventilatie	%	0
% Daglicht	%	80
Elektriciteitsproductie /Ag	kWh/m²	12,6

BENG indicatoren

Energiebehoefte

< 190

161 kWh/m²

Primair fossiel energiegebruik

< 70

67 kWh/m²

Aandeel hernieuwbare energie

> 40

43 %

Dit energielabel geeft een indicatie van de energiezuinigheid van het ontwerp.
Versie 2.01 09122020 Alleen te gebruiken voor onderwijsdoeleinden.

4575334

Primair verbruik

Categorie	Percentage
verlichting	33%
verwarming	32%
ventilatoren	22%
overig	10%
koeling	3%

Warmte- en koudebehoefte per maand [MJ]

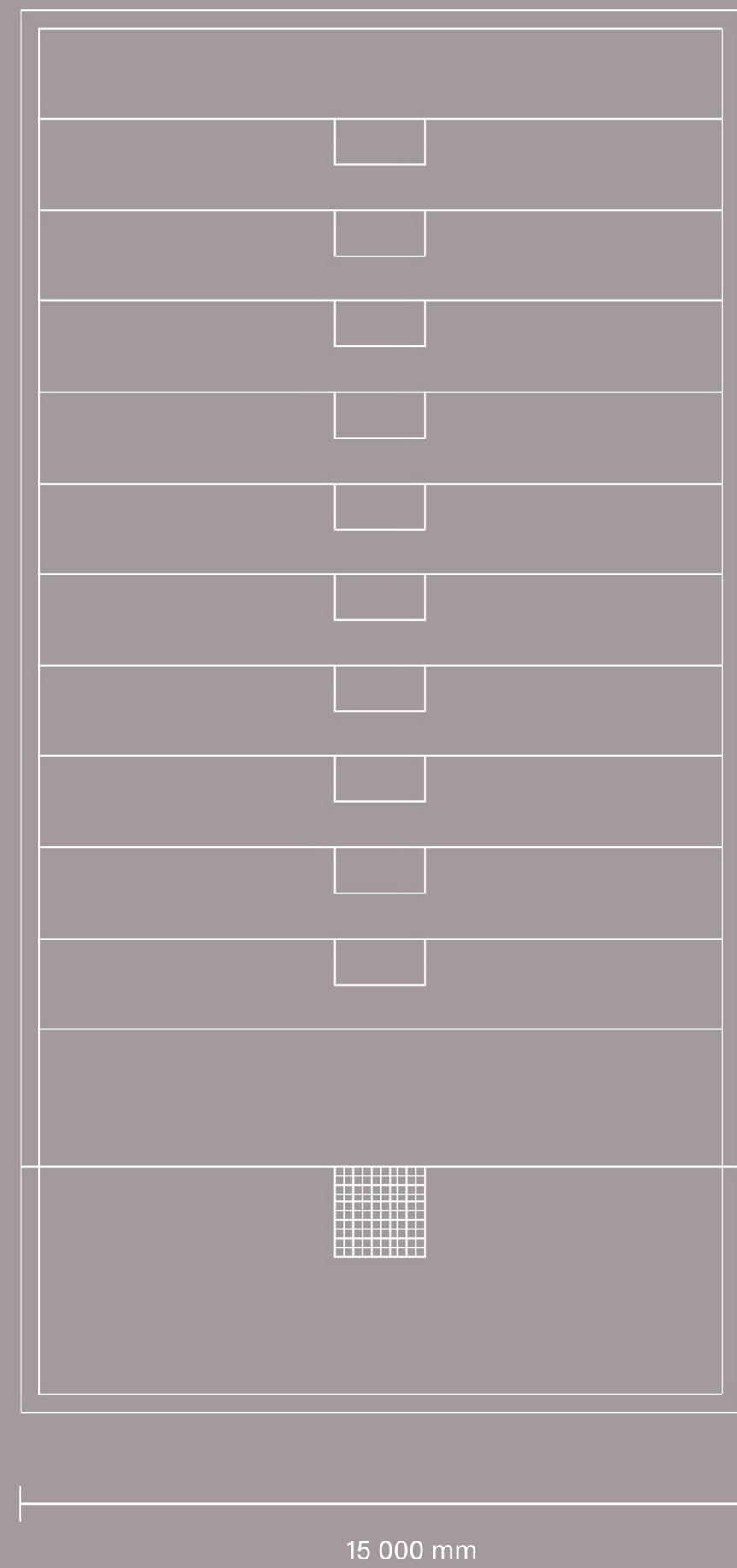
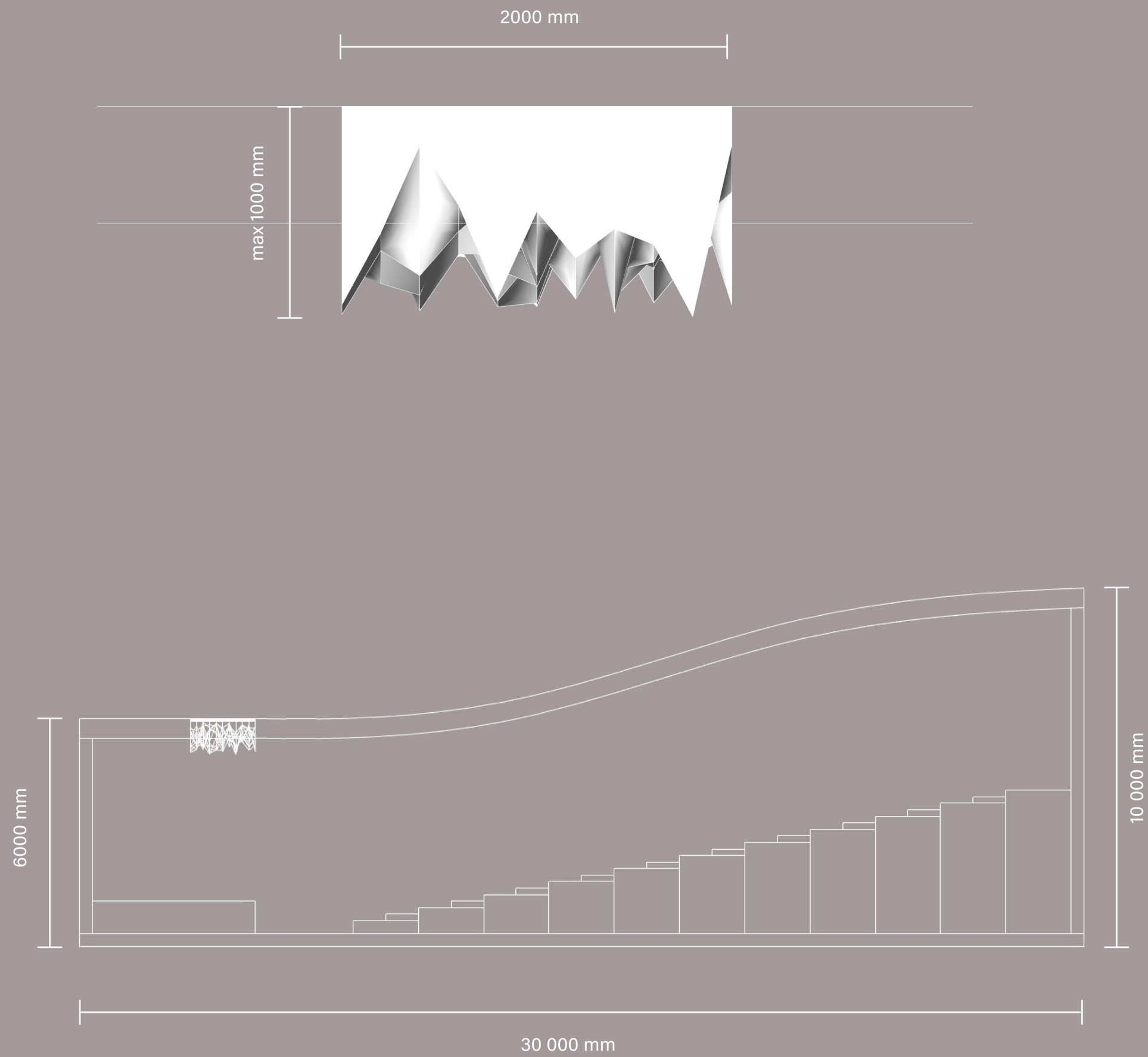
maand	Warmtebehoefte [MJ]	Koudebehoefte [MJ]
1	102000	0
2	89000	0
3	52000	0
4	16000	0
5	3000	0
6	0	9000
7	0	11000
8	0	10000
9	1000	1000
10	22000	0
11	65000	0
12	95000	0

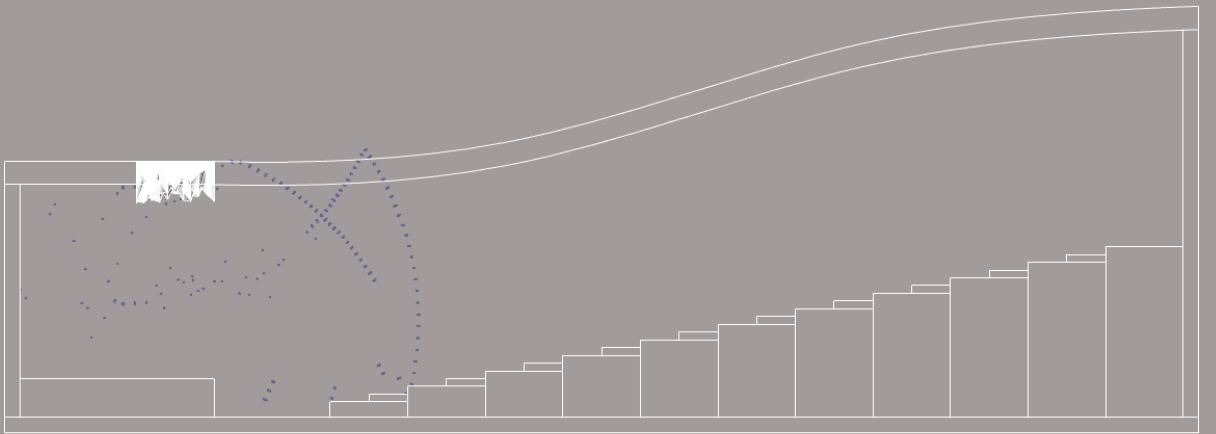
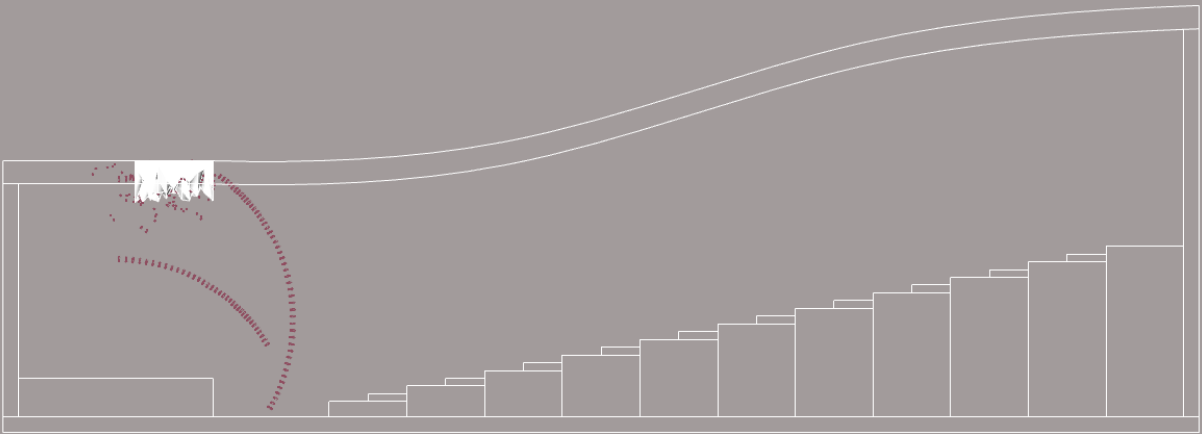
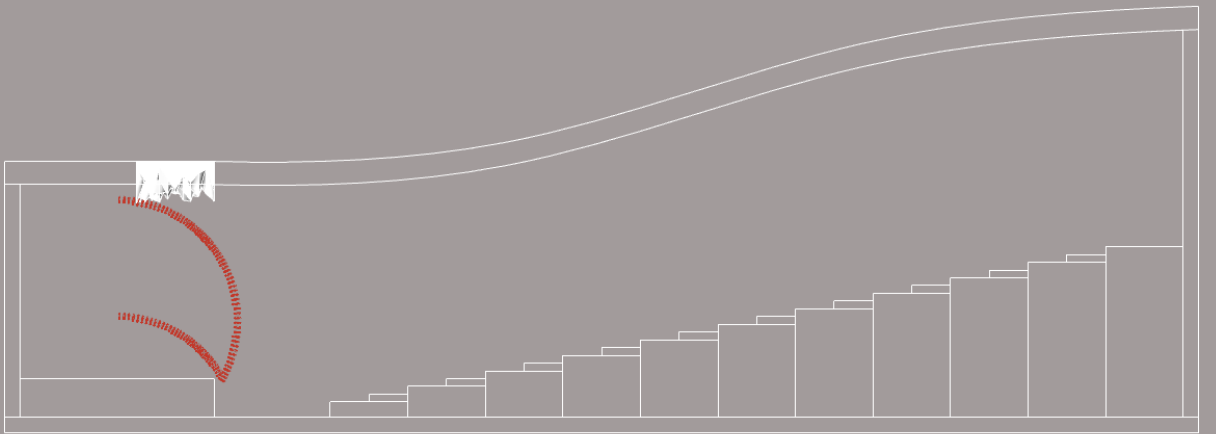
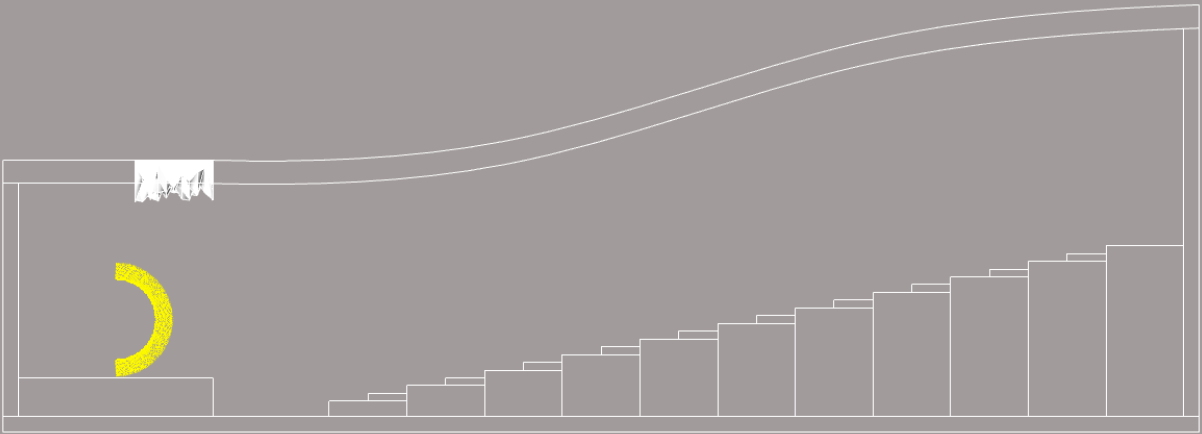
■ Warmtebehoefte ■ Koudebehoefte

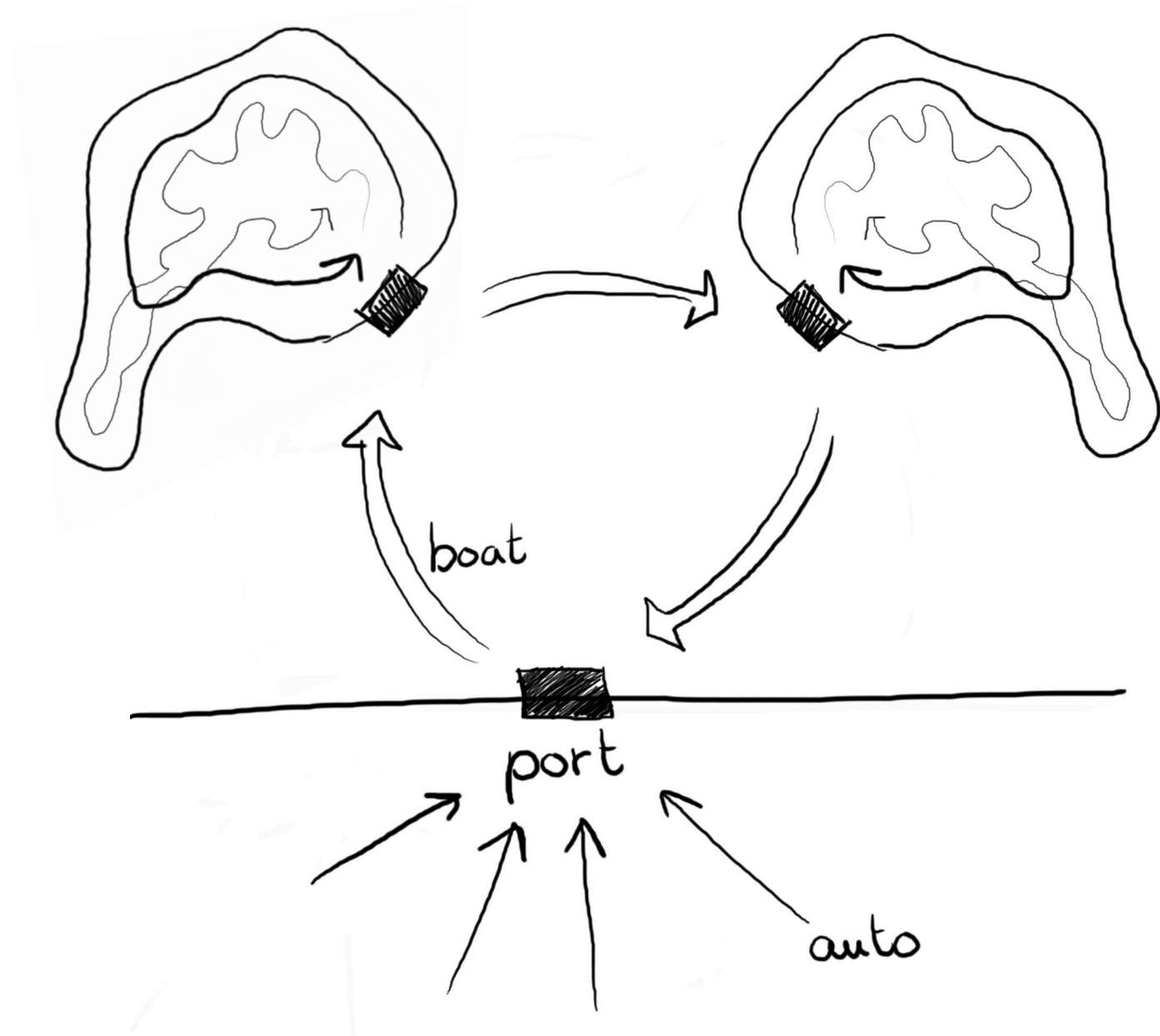
Nagalmtijd volgens Sabine

Frequentie [Hz]	Nagalmtijd [s]
125	1.2
250	1.05
500	0.85
1000	0.75
2000	0.65
4000	0.65

68/63





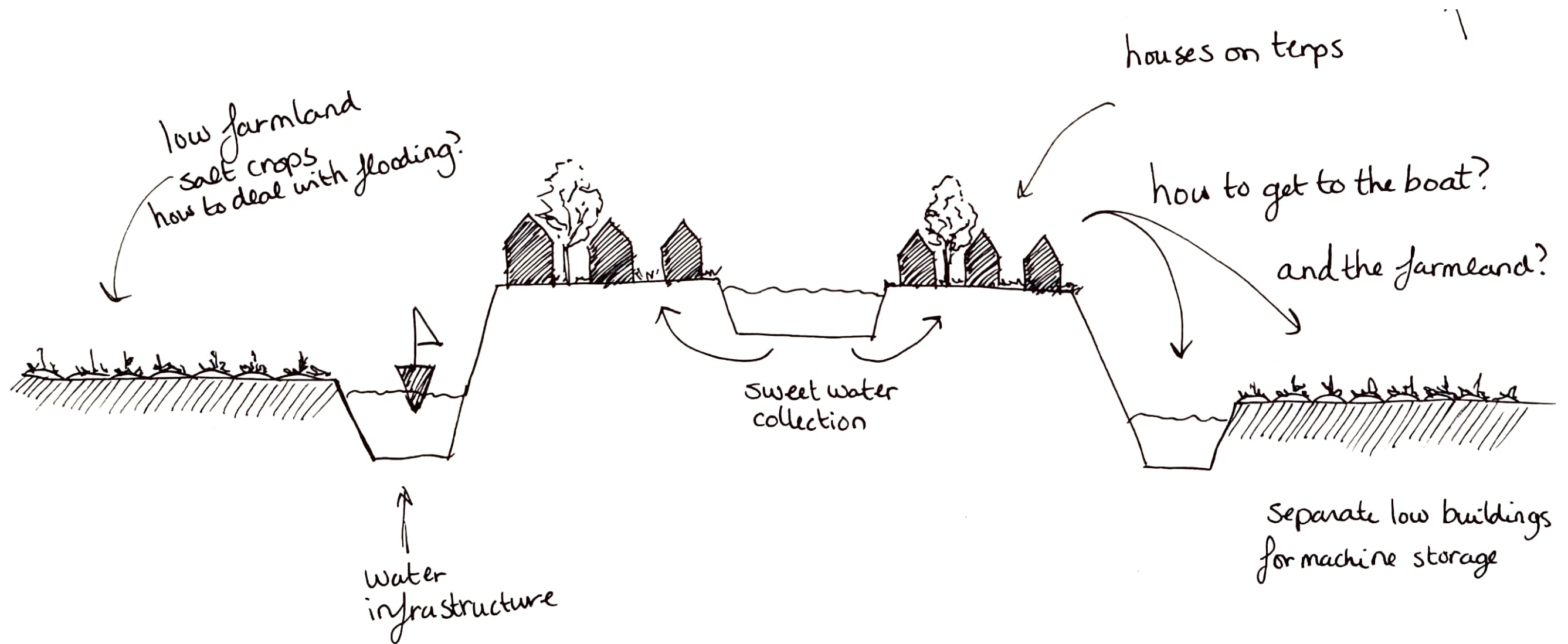


Own work, 2023

People will mainly travel by water.

Like the islands in the Wadden Sea, a boat will sail regularly to take travellers from the mainland to the terps.

On the terps, residents can move on by car, bicycle or on foot.



Intersection of future scenario 'terpen water landscape', own work, 2023