A HABITAT FOR *all*



Floor van Hoorn - 6095577
Architecture and Dwelling - Olv Klijn & Robbert Guis

FOREWORD

This thesis marks the completion of my two-year Master's degree in Architecture at the Technical University of Delft. In this thesis, I explore the possibility of prioritising the native animals of the site before creating dwellings.

My lifelong passion for animals was ignited at a young age, when I began horse riding. Alongside my family, I have always had cats and dogs, and when I moved out, I adopted two birds. I even considered becoming a vet, but quickly realised that I would not have the courage to operate on them, so I switched to architecture.

My personal fascination with this topic began long before I started this thesis. When I looked around the city of Haarlem, I noticed that lots of construction work was going on. This has led to the emergence of bird nests in the facades, and I have always wondered whether the right height, orientation and distance between them was considered. This marked the start of this thesis.

I would like to thank Olv Klein and Robbert Guis for guiding me over the past few months and for providing me with a variety of different perspectives. I would also like to thank Fransje Hooijmeijer for her guidance and encouragement to keep trying until I was satisfied with the result. Finally, I would like to thank my friends and family for supporting me over the past few months and for listening to all my stories about my research and design work.

Floor van Hoorn

15/04/2026, Haarlem

Figure 1 (front page): Black-tailed godwit (wandel.nl,n.d.)

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ABSTRACT

This thesis explores the possibility of designing dwellings with the current inhabitants, the animals, in mind first. Over the past 50 years, wildlife has decreased by 73%, while the human population continues to grow and take more and more of the land, further destroying the nature that we depend on. This thesis aims to raise awareness of the design process and start integrating other animals into it as soon as possible, with the aim of reducing the impact of building in nature. The Midden-Delfland area has been chosen as a case study to explore this issue, with the focus being on the 'Delfland Small Five' to gather information on designing for them.
The main question is: How can architectural design principles be created to promote biodiversity in Midden-Delfland while looking at the Small five, while recognizing that different species respond differently to different densities?
To achieve this, literature studies have been conducted to gain insight into the lives of the Delfland Small Five, while case studies have been analysed to gather information on similar buildings. The worlds of humans and animals can complement each other through dwellings designed to blend into the landscape, preventing visual disturbance for some species and enriching or limiting the vegetation required by others. This, combined with careful maintenance, can ensure that habitats are sustained. It must be kept in mind that these principles have not yet been tested in real life, and that they should be tested in a real environment to ensure the results are feasible.

READING GUIDE

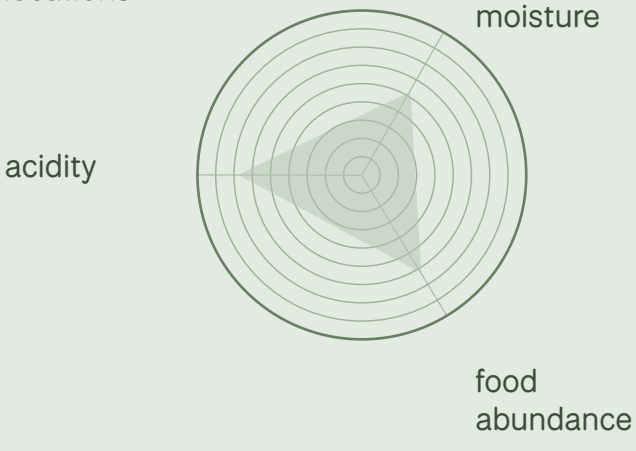
The introduction states the problem alongside its relevance, motivation, research questions and scope. This is followed by the approach, which explains the methods for this research together with the theoretical framework. This is accompanied by the design, with the research leading up to the design in the attachments. This contains detailed information about the lives of these animals and, if necessary, the plant species that they depend on. Then followed by case studies, in which different elements are examined and reformed to inform the design. The colours used in the description highlight and emphasise each animal. Finally, the joint masterplan is explained, made by the group of sustainable environment.



Photo of (flowering) plant

English name
Latin name

Early bumblebee is found on the plant on these locations



Schedule or preferred conditions of the plant

CONCEPTUAL FRAMEWORK

BIODIVESITY
When using this term in this research, ‘all’ life on Earth refers only to life in Midden-Delfland.

BIOTOPE
A biotope is the region in which certain species live and communities are formed. In this case, the biotope is limited to the Midden-Delfland region, only the base differs.

ECOSYSTEM
All the living things in an area, how they influence each other, and their effect on the environment (Ecosystem, 2026).

FLOURISH
To grow, or to develop succesfully.

HABITAT
A place where an organism lives.

REGENERATIVE DESIGN
Foccusses on creating a design that mends the surrounding instead of sustaining it, the goal of this thesis.

RESILIENCE
This research will enable the designed elements to adapt positively to stressors.

SUSTAINABLE
Sustainability is often described as something to be maintained or continued. In this project the aim is not only to mainain the biodiversity and it’s population, but to increase it. Therefore, instead of creating a sustainable environment, this project will create a flourishing environment.

THE MIDDEN-DELFLAND SMALL FIVE



BLACK-TAILED GODWIT



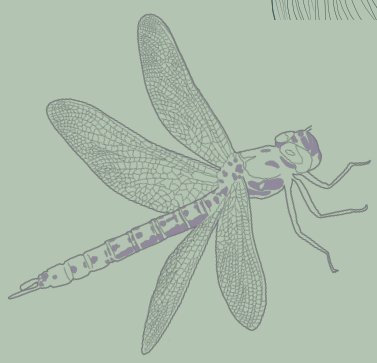
NATTERJACK TOAD



EARLY BUMBLEBEE



BITTERLING



HAIRY DRAGONFLY

Figure 2-6: Small five of Midden-Delfland (van Hoorn, 2026)

PROBLEM STATEMENT

Between 1970 and 2030, the population size of wildlife has decreased by 73% (WWF, 2024), and the biodiversity loss in Europe is accelerating, with one in five bird species currently threatened with extinction. Species inhabiting agricultural lands, grasslands, wetlands, and water-rich landscapes are among the most vulnerable (van Zoelen, 2021). Despite this alarming decline, measures to promote the numbers of species in the built environment remain limited or insufficiently implemented. For instance, the government removed the requirement for nesting and bat boxes in new constructions (Vogelbescherming Nederland, 2024).

Besides the afterthought of returning animal shelters after destroying their homes in the first place, even in 'nature inclusive' design the given principles seem to be lacking. They focus on green roofs and bird houses, which nowadays are a bit generic. They fail to support and focus on the entire habitat structures, foodnetworks and risk reductions needed across different life stages of species.

Meanwhile, The Netherlands is struggling with it current housing shortage, caused by the growth of her population, changes in household configurations. To battle the housing shortage, the Netherlands is planning to build 900.000 houses before 2030. Over a quarter of this, 247.896 needs to be built in the province of South-Holland (Rijksoverheid, sd).

In Midden-Delfland, an area between Rotterdam, Delft and The Hague, earlier mentioned failing clashes with the need of housing edging the natural environment of Midden-Delfland. Following with the lack of nature inclusive, or rather regenerative design principles across different densities in the built environment.



Figure 7: Natterjack toad (Baks, 2007)



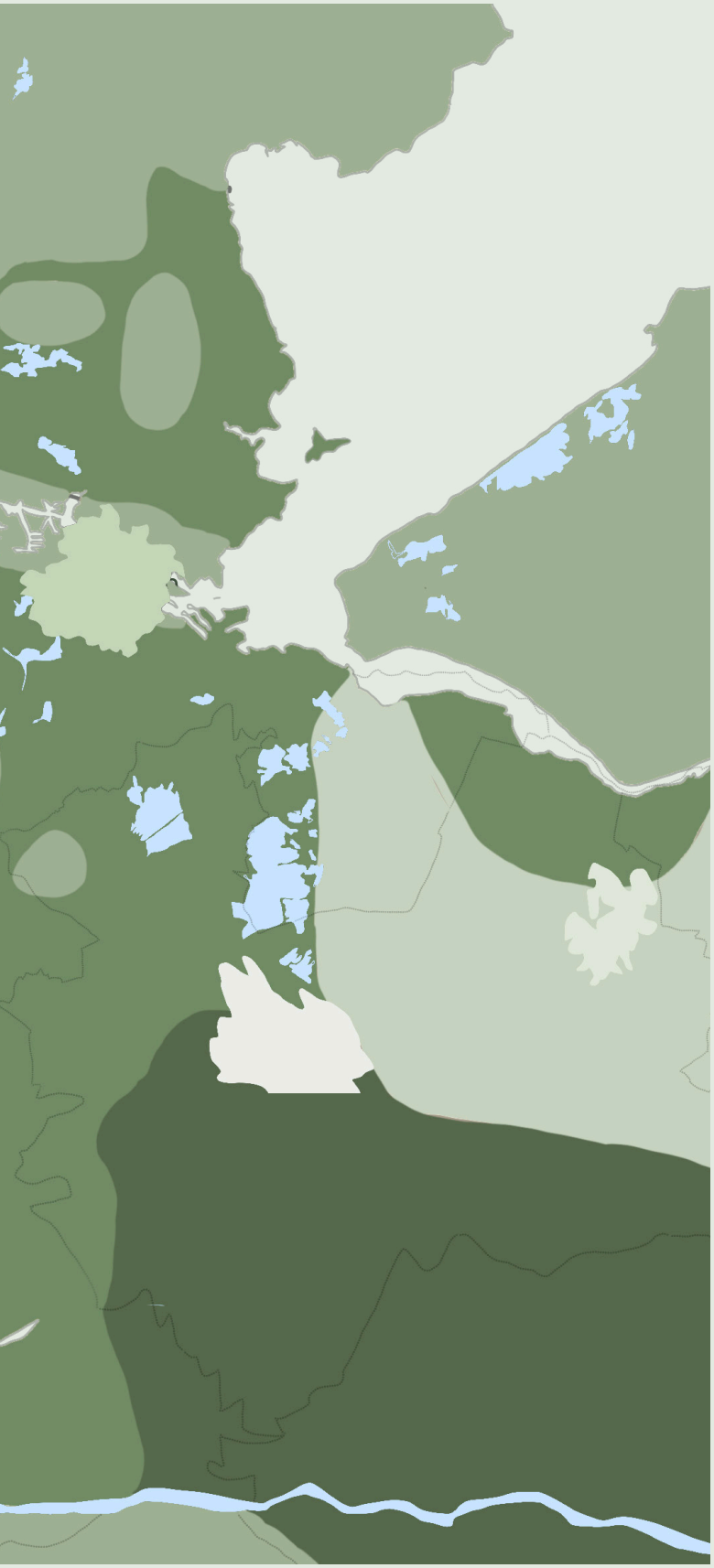
RELEVANCE

Midden-Delfland is seen as the 'green lung' of Rotterdam, Den Haag and Delft. But the pressure on this green lung is higher than ever due to the gaining ground of asphalt and concrete, as well as the increasing need for recreation space in this special landscape (Natuurmonumenten, sd). The species that reflect best to this habitat are the Midden Delfland 'Small five'. These species reflect the wellbeing of its surrounding nature, a higher population of these species indicate a healthier nature. The needs of these species will be moulded into design principles fit for other similar polders in the western part of The Netherlands.

This research goes beyond the standard 'nature-inclusive' design approach by prioritising the needs of animals over humans. It combines the primary needs of species with their preference for different urban densities. Rather than assuming that the built environment automatically destroys biodiversity, this research will demonstrate clear design principles by reinterpreting architectural elements to promote biodiversity in Midden-Delfland at different urban densities. These principles focus on water management and address the challenges posed by expected climate change over the next hundred years.The vision is to create a habitat for all by blurring the line between nature and urban areas. The research should spark interest by architects, landscape architects, and policy makes who are searching for spatial strategies that combine ecological preformance with long term climate resilience.



OBJECTIVE AND MOTIVATION



The motivation for this research stems form the still declining world biodiversity and at the same time the growing human population, with still limited architectural design responses on how to balance these two worlds. While the acknowlishment of the distress of wildlife has increased, the built environment has not responded yet with a 'nature first' approach. In this research, architectural design is seen as the unifying factor in merging the natural and urban landscapes. Rather than considering human needs first, the needs of organisms are prioritised, which is especially important in Midden-Delfland due to the growing invasion of concrete and the need for green spaces.

The aim of this research is to develop a set of architectural principles that promote the biotopes in Midden-Delfland, with a focus on the area's 'Small five'. This will be achieved by supporting food availability and landscapes, and by reducing risks across different spatial densities.

Figure 8: Soiltypes in the west of The Netherlands (F. van Hoorn, 2026)
Adapted from Grondsoort vs tuingrond, van Andel, A., (2016)

RESEARCH AND/OR DESIGN QUESTIONS

How can architectural design principles be created to promote biodiversity in Midden-Delfland while looking at the Small five, while recognizing that different species respond differently to different densities?

1. What are the key drivers for the Small five in Midden-Delfland regarding habitat, food and risk factors throughout their life cycles?

2. Which architectural systems have supported biodiversity, water management and species coexistence in comparable climates as Midden-Delfland?

3. How can principles be redefined into contemporal architecture that strengthen the habitats, food availability and risk reduction of the Small five, while being flexible enough to face the predicted climate change of the next 100 years?

4. How do different urban densities in Midden-Delfland influence the life cycle of the Big-Five, and how can the adapted design principles be redesigned to accommodate species to thrive as much as possible?

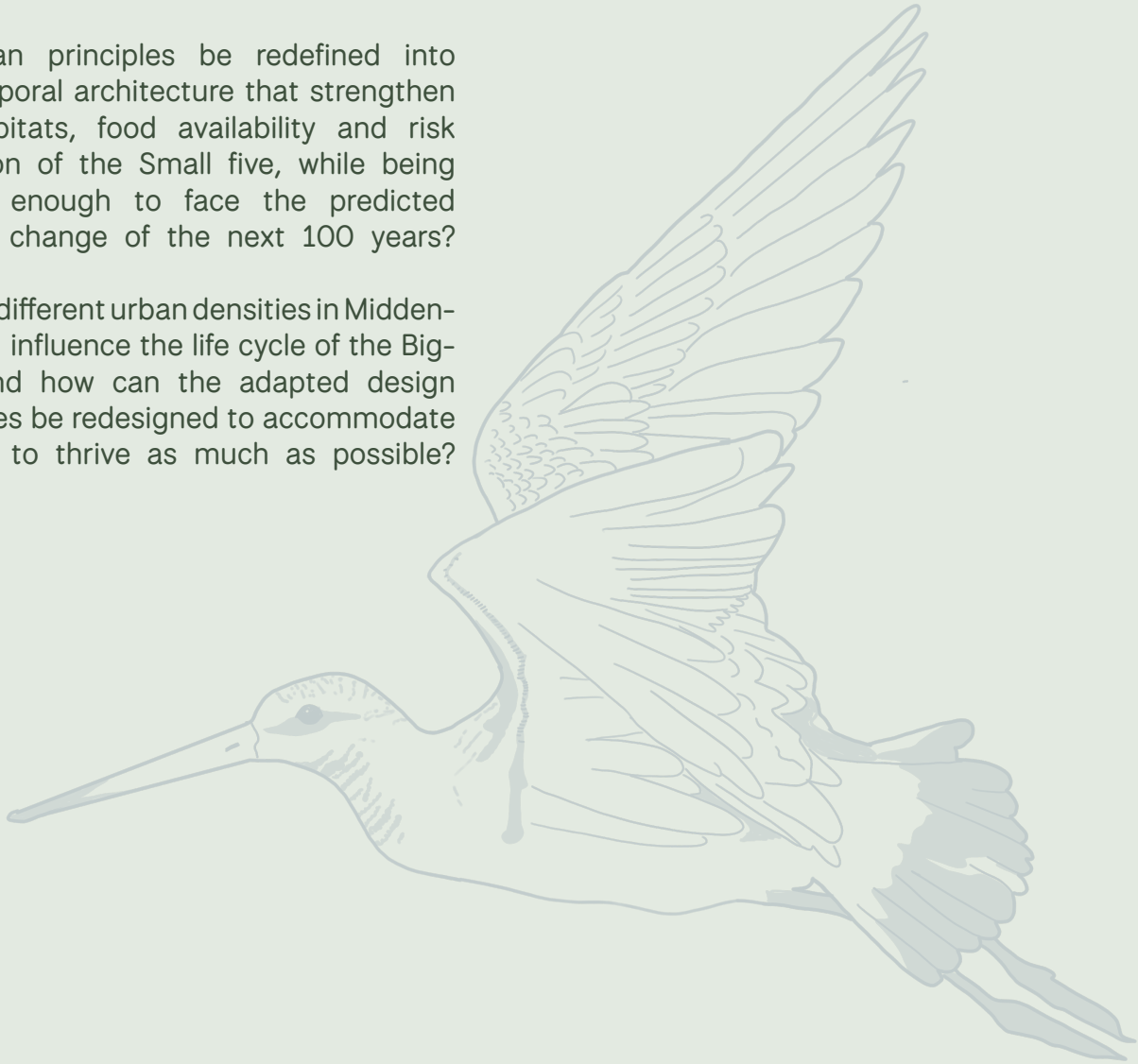


Figure 9: Black-tailed godwit (van Hoorn, 2026)

SCOPE

This research focusses on Midden-Delfland as a case study within the Dutch peat and clay polder landscapes. The Small five of Midden-Delfland are the representive ecological species in this area, therefore, their biotopes will be examined during their lifecycles on the following aspacts; food, habitat and riskfactors.

The Vlietlanden is an area in Midden-Delfland where multiple types of landscape will coexist side by side. Moreover, this area is an important missing link in the existing biodiversity corridor in the southern part of Midden-Delfland. It will be insightful to see how this connection can be established.

In the Vlietlanden, one site is selected based on the general prefered living habitats of the Small five. On this location, a typology is created based on the best

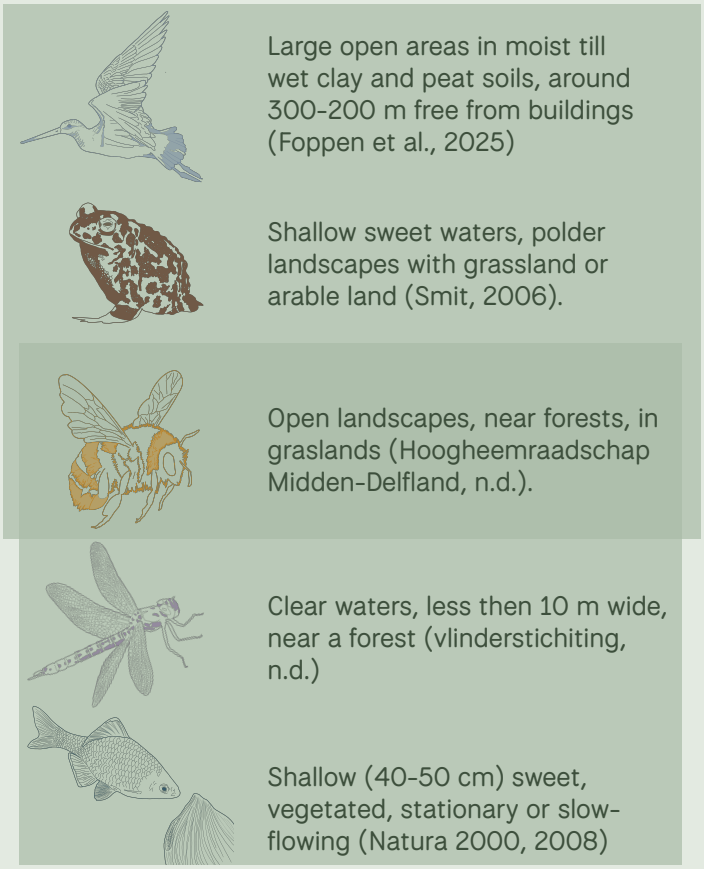


Figure 10: prefered habitats (van Hoorn, 2026)

Figure 11: To be developed locations in Midden Delfland (van Hoorn, 2026)



Approach
METHODS

This research will be conducted according to the 'research by design' principle, where knowledge gained from literature on ecology forms the basis. This knowledge will then be complemented with design principles by examining case studies in similar environmental locations. Following, these principles will be combined with literature studies. A combination of these principles and ecological knowledge will be used to create design principles that are fit for the climate and future environmental challenges of Midden-Delfland. These principles will then be refined and rechecked against the earlier derived ecological knowledge.

ECOLOGICAL LITERATURE STUDY

The ecological literature study focuses on the biotopes around the 'Small five' in Midden-Delfland. This involves the other species that they depend on for their habitat and food, as well as the risks to them throughout their lifecycle.

CASE STUDIES

A series of case studies has been selected to demonstrate the design choices made to promote biodiversity in the project location. The case studies are selected based on their incorporation of cooperation between humans and the surrounding ecological forces.

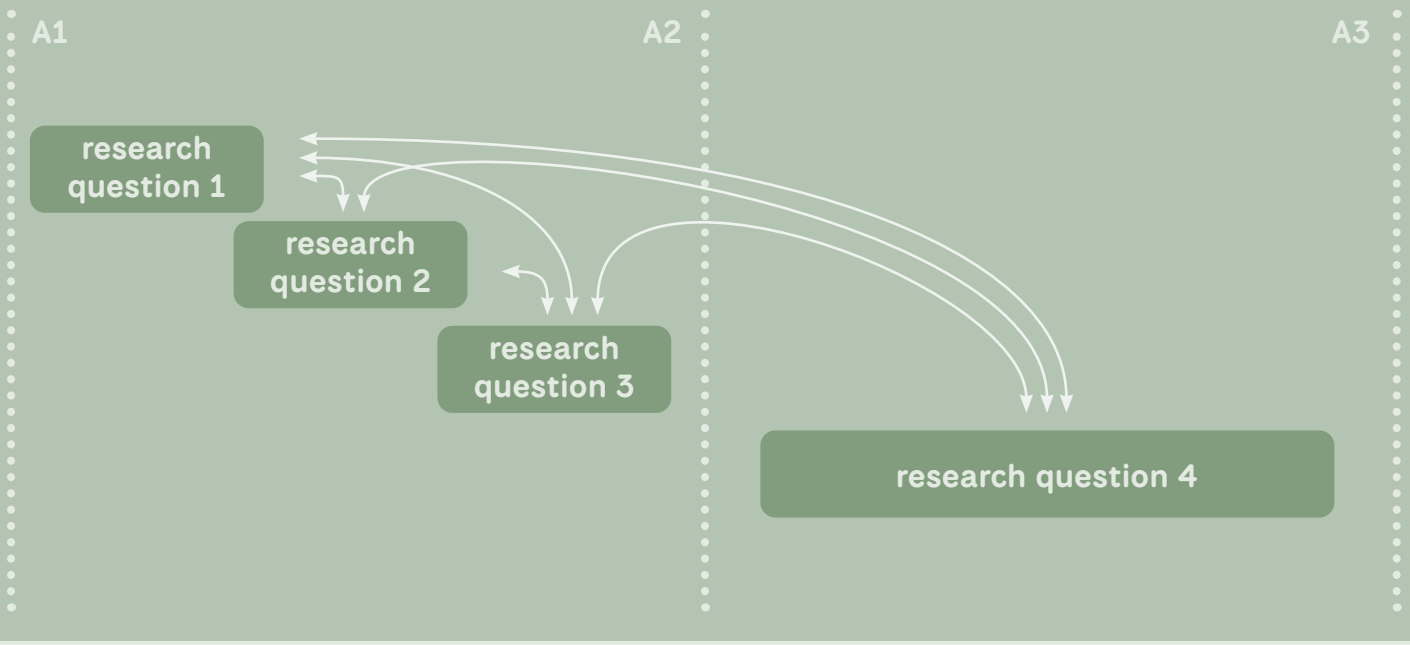


Figure 12: planning (van Hoorn, 2026)

THEORETICAL FRAMEWORK

Biodiversity is essential for human life and forms the basis of our societies. However, all indicators that track the status of nature worldwide show a downward trend. Once a species population falls below a certain point, it may not fulfil its role in the ecosystem as effectively, for example in terms of seed dispersal, pollination or grazing. This results in an unstable ecosystem. Stable populations provide resilience against diseases or extreme weather events. This decline undermines benefits to humans too, from food and clean water to spiritual well-being (WWF, 2024).

Some declines are small and not very noticeable, but these changes can cumulatively trigger faster and larger changes. Once these changes have reached a certain level, they result in significant, often sudden and irreversible changes. A tipping point (WWF, 2024). These tipping point are not to be taken lightly, the first signs have already been recognized, which will result in the following:

- **A mass extinction of coral reefs** would result in the destruction of fishing industries and the loss of coastal protection against storms. **The death of the Amazon rainforest** would result in the release of carbon dioxide into the atmosphere, with the result, change in weather patterns affecting the whole world.
- **The collapse of the sub polar gyre**, a current to the south of Greenland could cause changes to weather patterns in North America and Europe . (WWF, 2024).

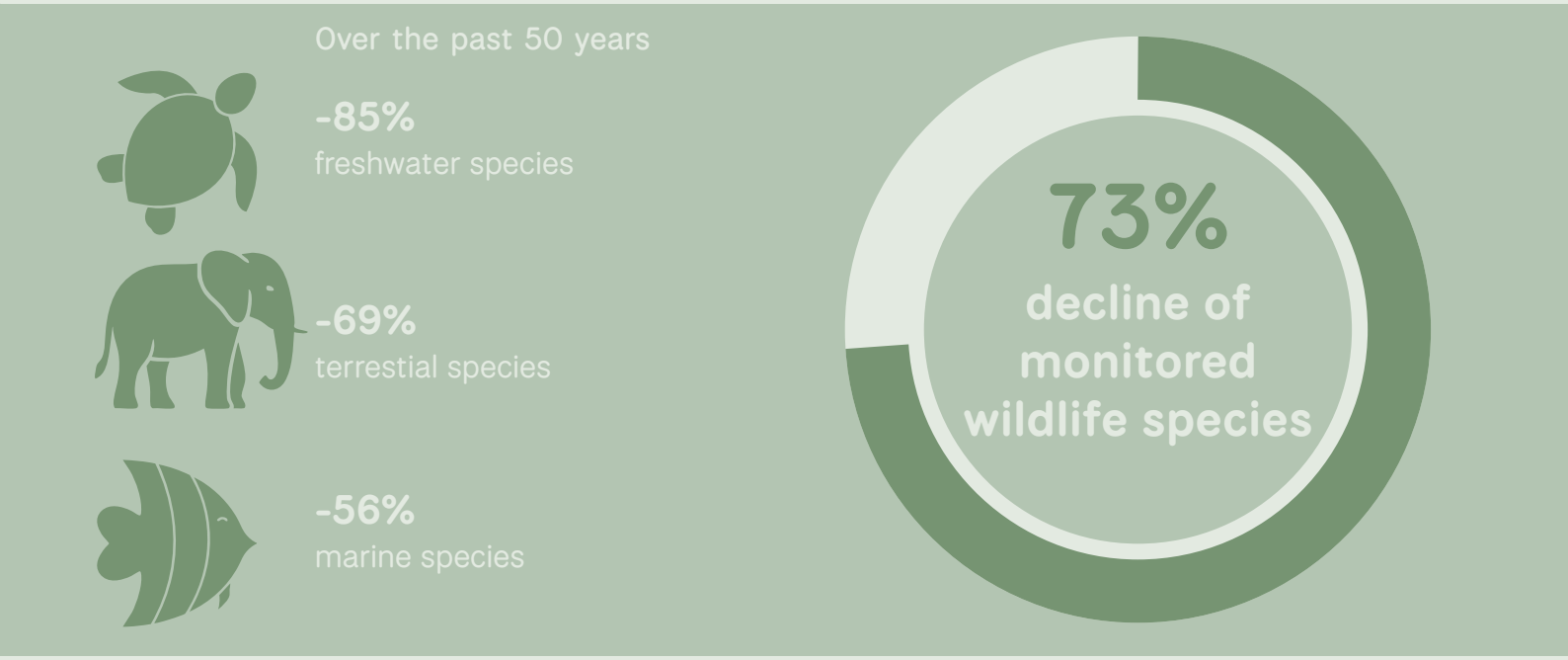
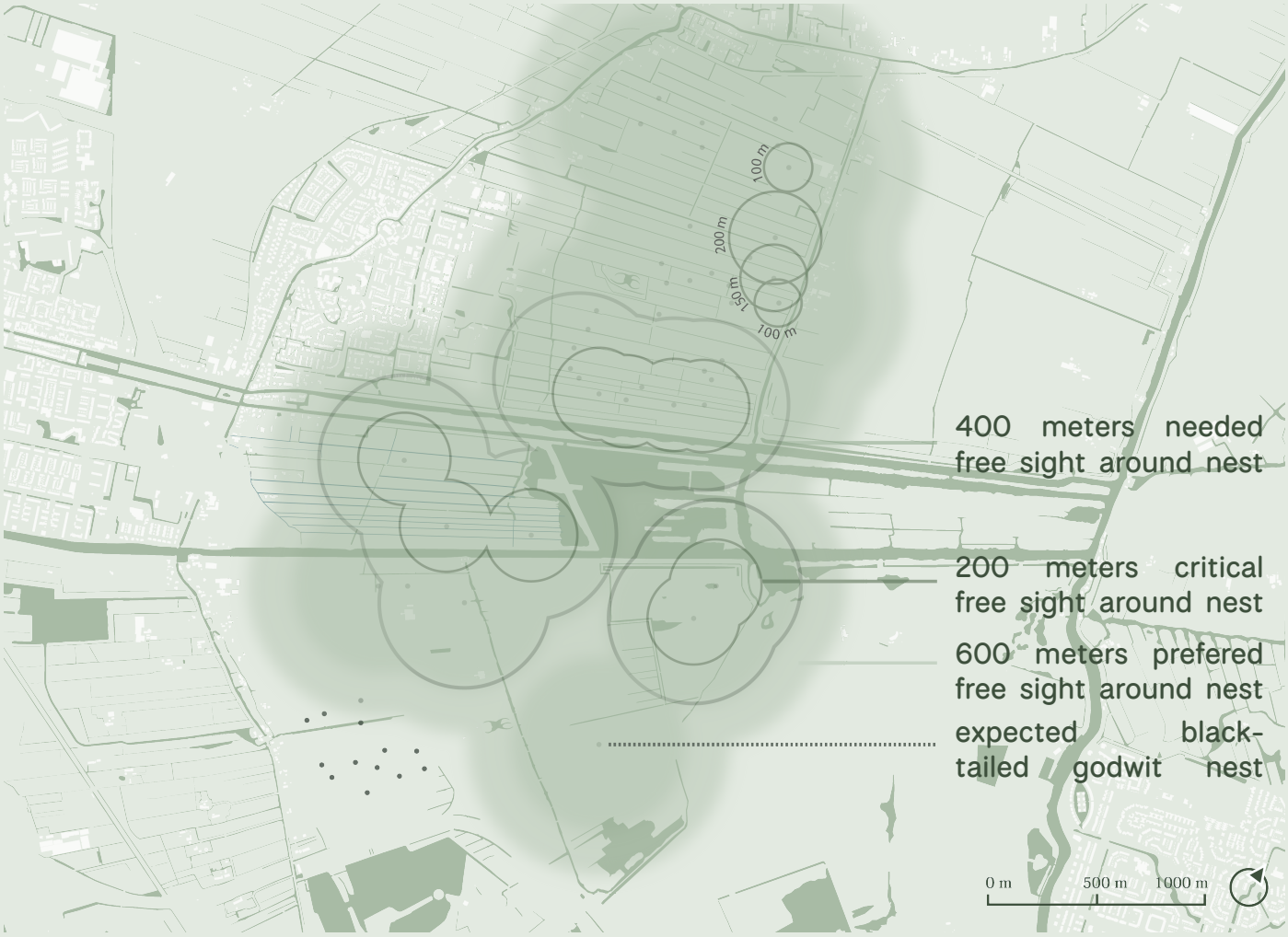


Figure 13: decline of species (F. van Hoorn, 2026)

Data from WWF (2024)



According to Halme et al. (2009) the use of indicator species is quite useful. They are needed to clssify biotopes and sites for conservation. Also, there are methods which can predict the species richness by assessing the richness of others. According to Landres et al. (1988) For decades, plant and animal species have been used as indicators of air and water quality, as well as agricultural and pasture conditions. This again demonstrates the importance of using them to evaluate the well-being of habitats.

This is also recogniced by the province of South-Holland, which proclaimed forty species as icon species. These species represent different areas of the province and, if the habitat of these species is in order, a healthy balance in the ecosystem follows (Provincie Zuid-Holland, sd). The Hoogheemraadschap of Midden-Delfland narrowed these species down to five which represented the area of Midden-Delfland the best, these are the black-tailed godwit, the natterjack toad, the early bumblebee, the bitterling and the hairy dragonfly (Hoogheemraadschap van Midden-Delfland, sd).

Midden-Delfland contains mostly agricultural land. Which has partly to do with the decline of meadow birds due to the intensivation agricultre and the strong regulation of (half) natural systems created by man (van Kleunen A., Foppen R. & van Turnhout C. 2017). Meanwhile, Kleijn et al., (2008) even go as far to mention that the worldwide decline in biodiversity is mainly driven by agricultural intensification, and again noting that mankind benefits from a range of services of nature, for example pollination.

Humans shape and alter landscapes to meet their economic, social and ecological necessities. The landscape is considered a unit of physical planning, meaning it supports these needs and can continue to provide for current and future generations (Kleijn et al., 2008).

Eventhough these aknowlishments, the actual translations into design have been minimal (Nassauer & Opdam, 2008). If mention of 'nature based' design is made, it is mostly limited to green design, biophilic design, as in Yasar (2023), which misses the importance of actually building with a nature as a first approach. This comes to light

Figure 14: expected black-tailed godwits nests, (Floor van Hoorn, 2026)

adapted from Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Aalkeer buitenpolder, Gemeente Midden-Delfland (2025).

Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Commandeurspolder, Gemeente Midden-Delfland (2025).

Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Foppenpolder, Gemeente Midden-Delfland (2025).

Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Duifpolder, Gemeente Midden-Delfland (2025).

again when looking at guide lines proposed by Scheurs et al. (2020). They are a great start, but seem a bit generic and are focussed on repopulating the area with animals, which has shown to be effective, but focusses on returing biodiversity to the city after first done away with. And these approaches seem to be limited to only species in high urban area's.

Although nature-inclusive design appears to be growing in popularity, it is still mostly confined to landscape architecture and urbanism. If applied to architecture, examples showcase the limited use in diversity, such as the nesting boxes, bat boxes, green roofs and facades as shown in Spanjar et al. (2025), eventhough their mentioning of using nature as a starting point it seems that their approach starts with the built environment.

02 RESULTS
THE DESIGN

1 **always approach nature first**

2 **design in two layers, the natural and the human**



layer 2 -> the human

the in-between

layer 1 -> the nature

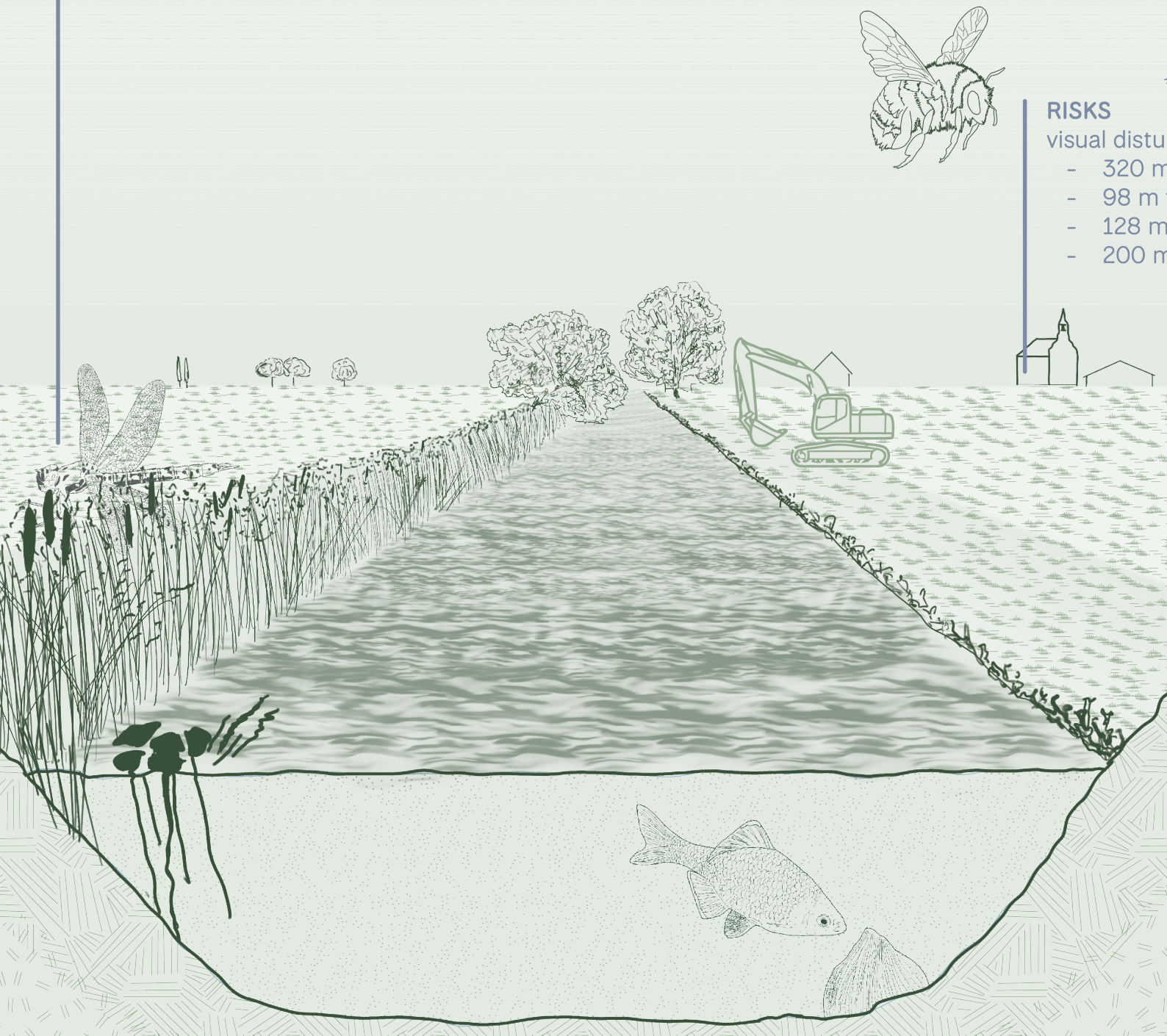
Figure 15: plan section (van Hoorn, 2026)



NEEDS BLACK-TAILED GODWIT

peat meadows, preferably extensive landscapes with higher vegetation

mostly eat soil animals, rainworms, leatherjackets, moscito larvae



RISKS
visual distu
- 320 m
- 98 m
- 128 m
- 200 m

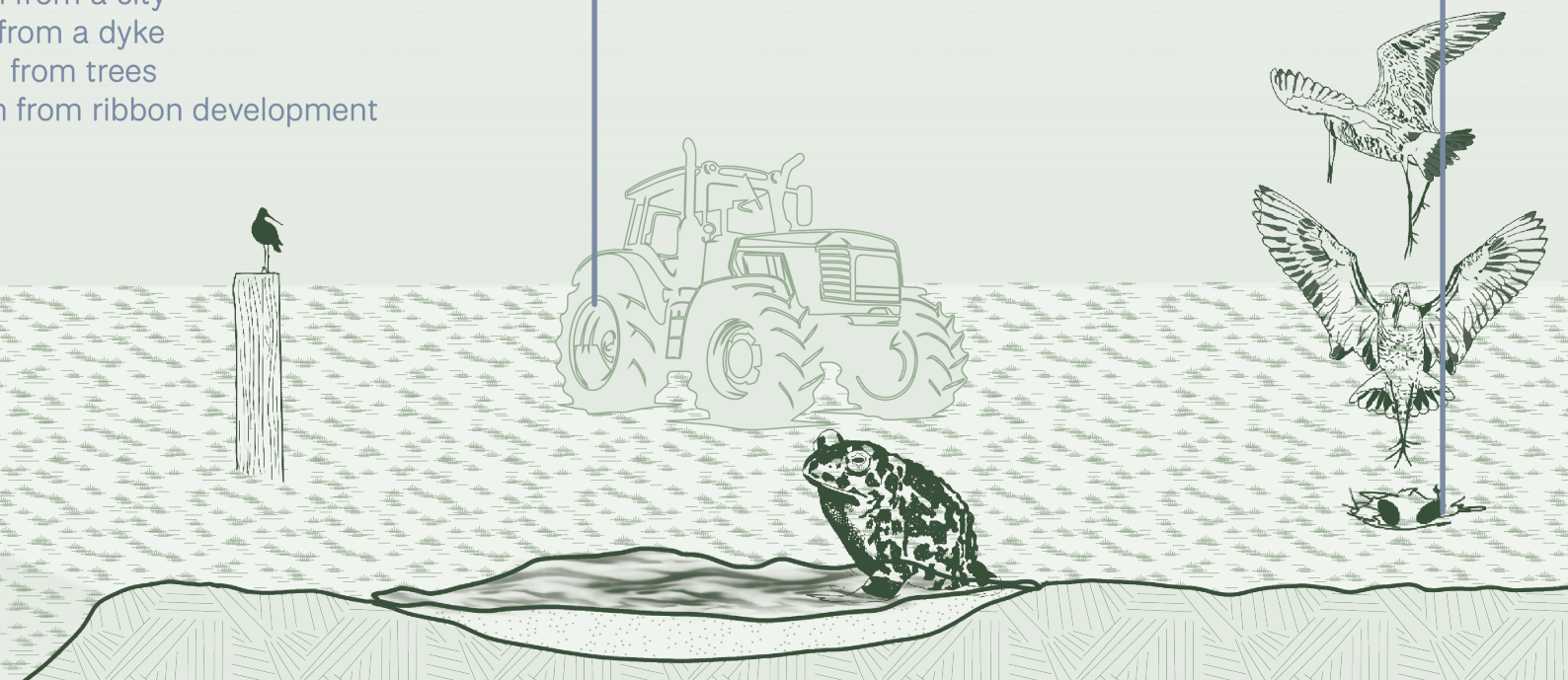
Figure 16: needs black-tailed godwit (van Hoorn, 2026)



RISKS
mowing before june 30th
lack of herb-rich landscapes

- It nests mostly on straight surfaces in areas of high grass, away from buildings (200–300 m) and high elements (300–600 m).

bance, on average preferbly minimally
from a city
from a dyke
from trees
from ribbon development



NEEDS NATTERJACK TOAD

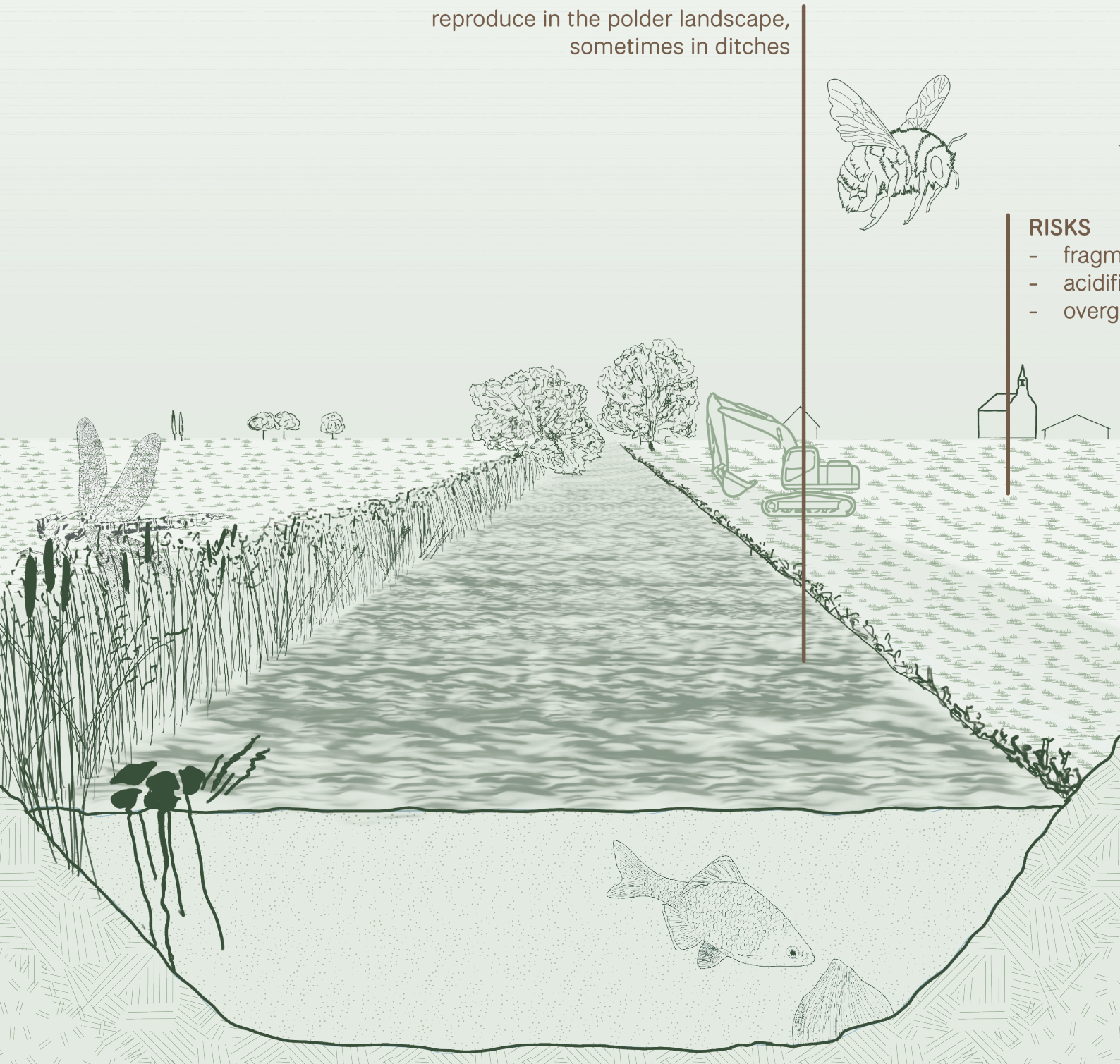
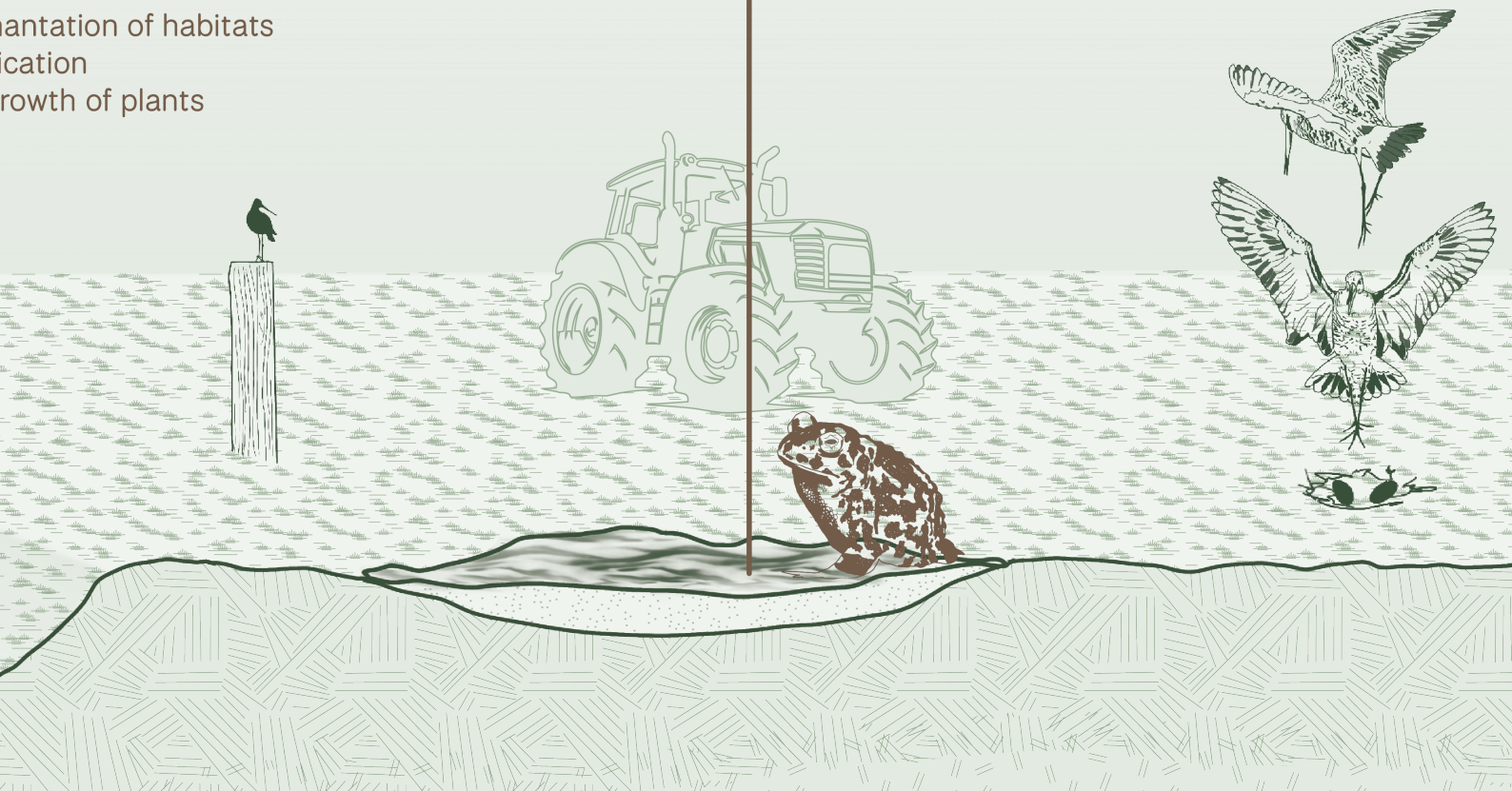


Figure 17: needs natterjack toad (van Hoorn, 2026)



- unshaded, low vegetated to bare ateas with shallow water, 5-20 cm, maximum 30-50 cm deep
- handmade pools must not be too small or deep
- eats any prey that fits into its mouth

antation of habitats
ication
rowth of plants



NEEDS EARLY BUMBLEBEE

common figwort - Scrophularia nodosa
heal all - Prunella vulgaris
common comfrey - Symphytum officinale
ground ivy - Glechoma hederacea
red clover - Trifolium pratense
red-flowering current - Ribes sanguineum
fire weed - Chamaenerion angustifolium
silver birch - Betula pendula
basket willow - Salix viminalis
dewberry - Rubus caesius
blueberry - Vaccinium myrtillus
blackberry - Rubus fruticosus

preference to bl
can help them f



It nests in old ar
walls. It hibernat
as north or west

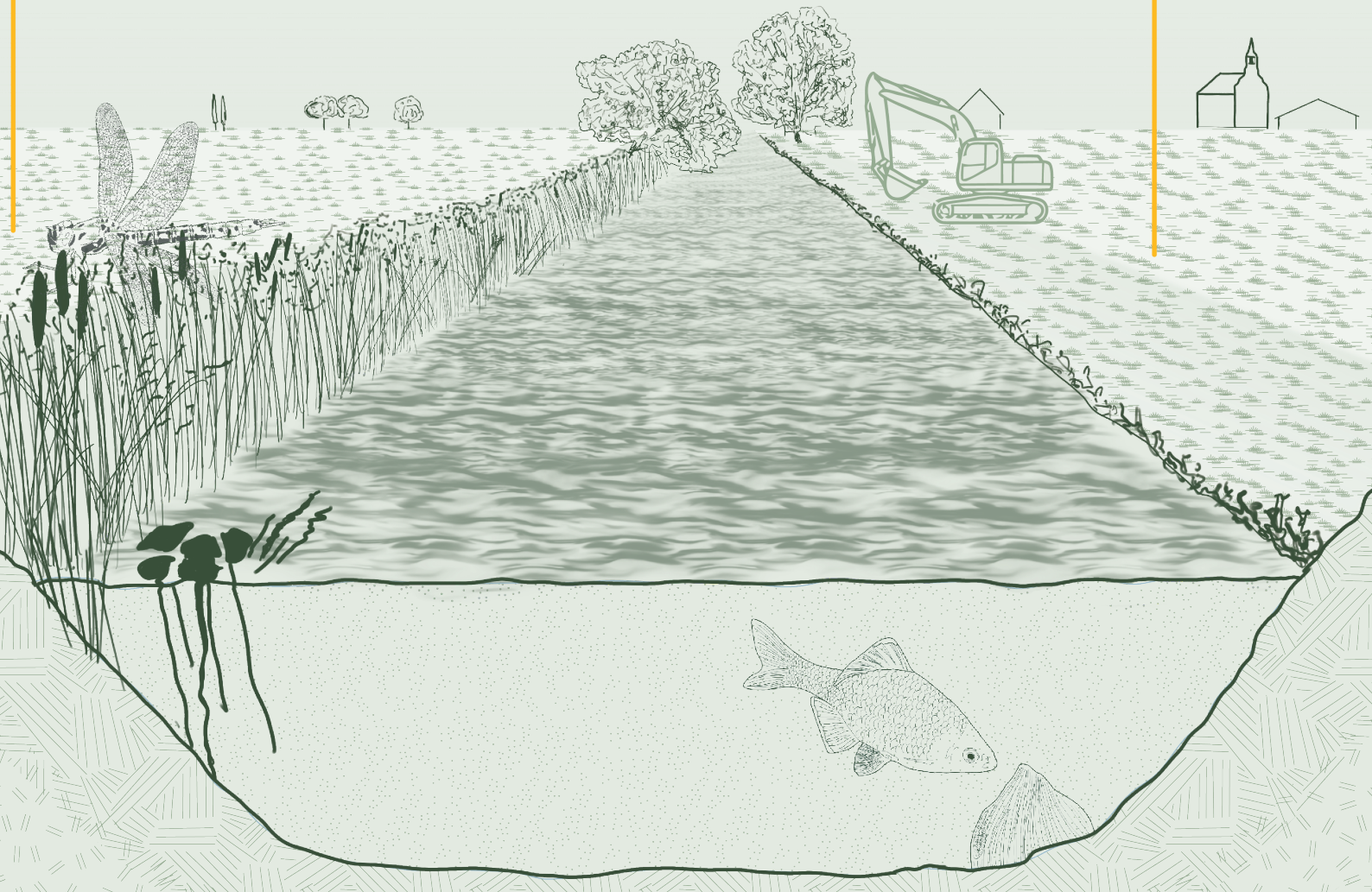


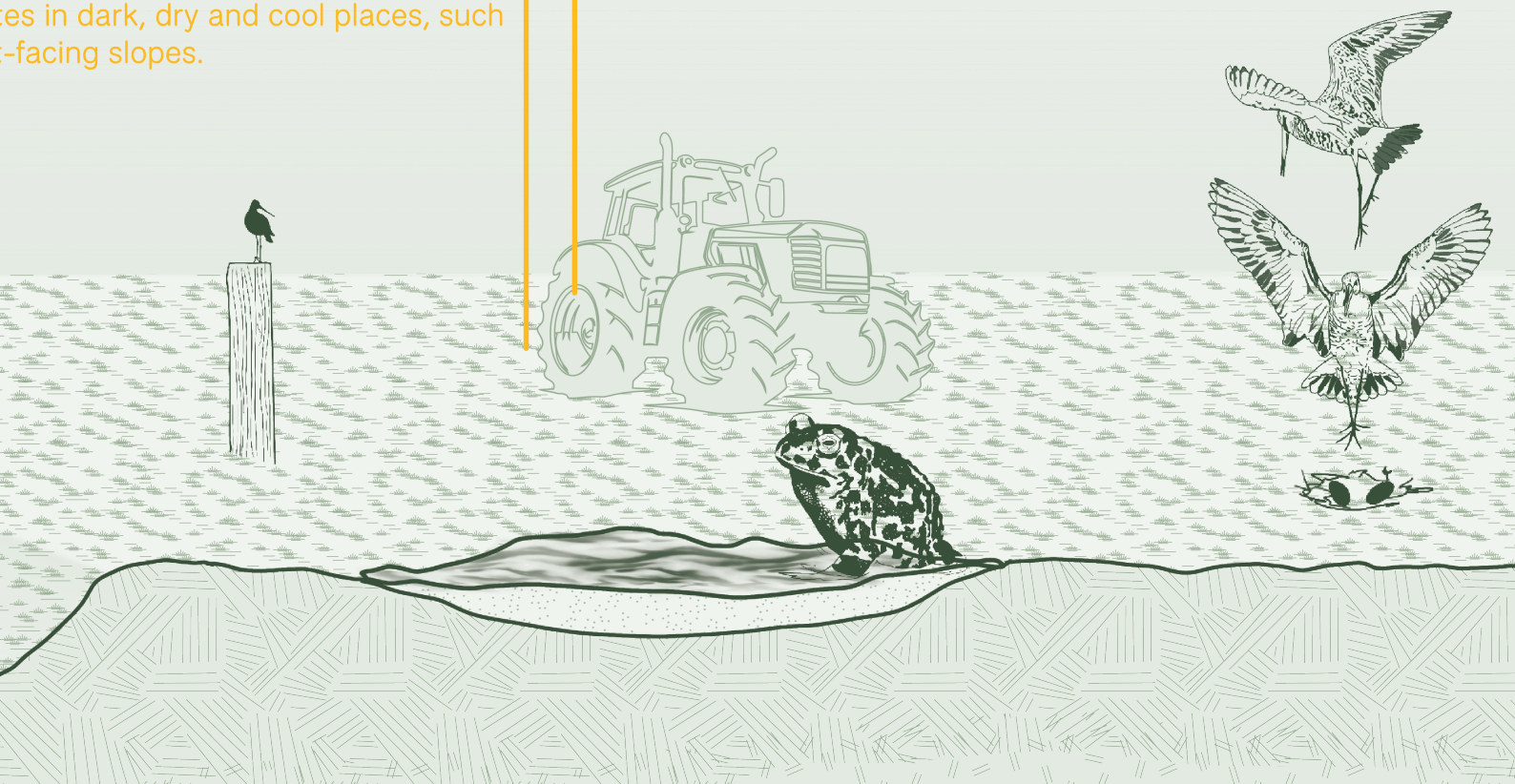
Figure 18: needs early bumblebee (van Hoorn, 2026)

ue and purple flowers, blue elements
ind nests



himal burrows or in the cavities of
es in dark, dry and cool places, such
-facing slopes.

RISKS
- fertilizers and pesticides from agriculture
- lack of variety in landscape
- often mowing



NEEDS BITTERLING

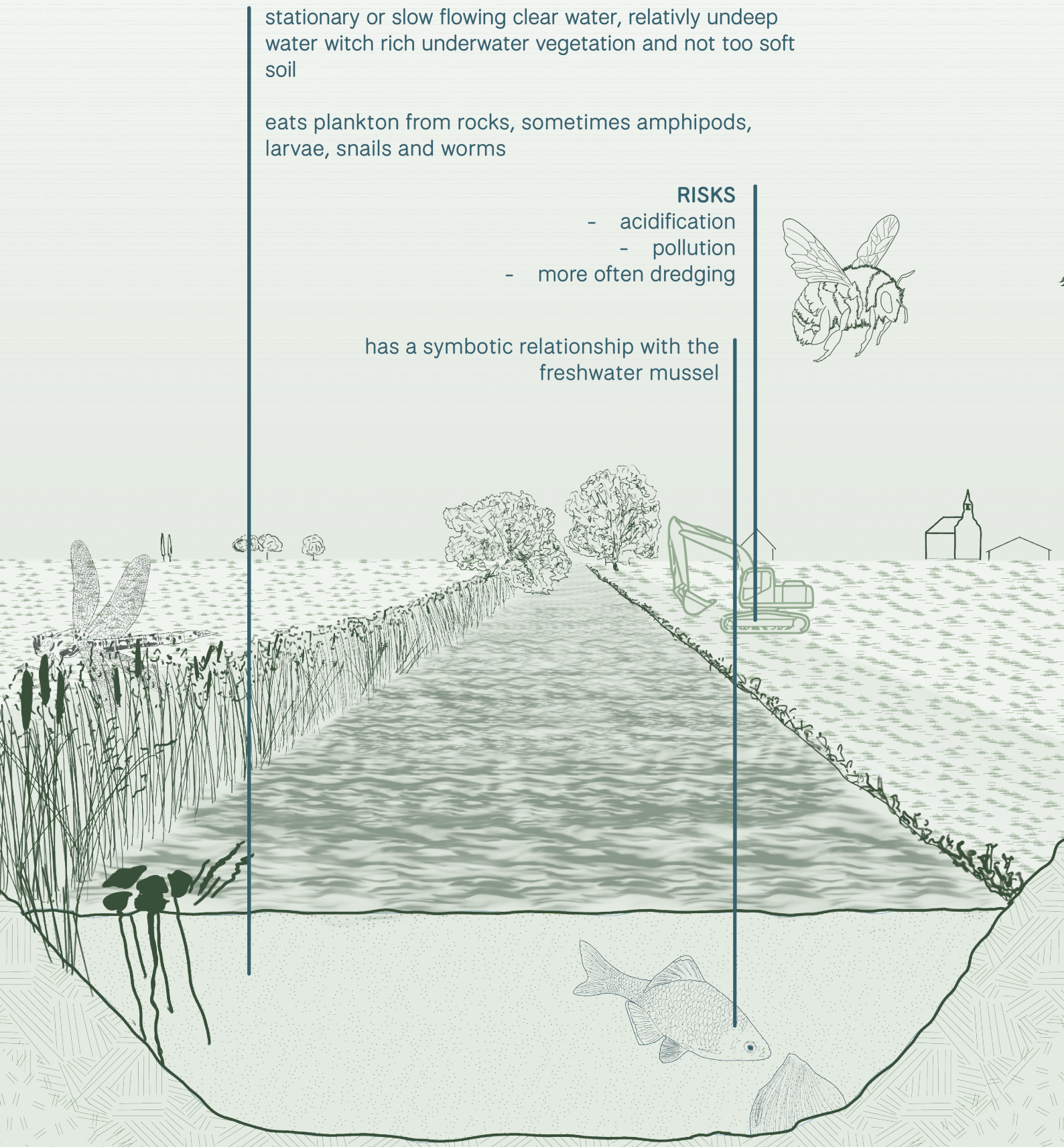


Figure 19: needs bitterling (van Hoorn, 2026)



NEEDS HAIRY DRAGONFLY

- waters < 10 m wide
- clear, moderatly nutrient poor - nutrient rich
- eggs in waterlogged plants, larvae live around the roots
- feeds on small insects: midges, mosquitos, gnats and more

bur reed - Sparganium erectum
cattail - Typha angustifolia
common club-rush - Scirpus lacustris L.
wood club-rush - Scirpus sylvaticus
sea club-rush - Bolboschoenus maritimus
marsh fern - Thelypteris palustris
reed - Phragmites australis
common bladderwort - Utricularia vulgaris
floating-leaf pondweed - Potamogeton natans
crisp-leaved pondweed - Potamogeton crispus
perfoliate pondweed - Potamogeton perfoliatus
shining pondweed - Potamogeton lucens

RISK
- lack of oxygen and waterplants
- lack of sunny sheltered spaces



RISKS
- toxic substances -> agricultu
- often dredging or dredging r time

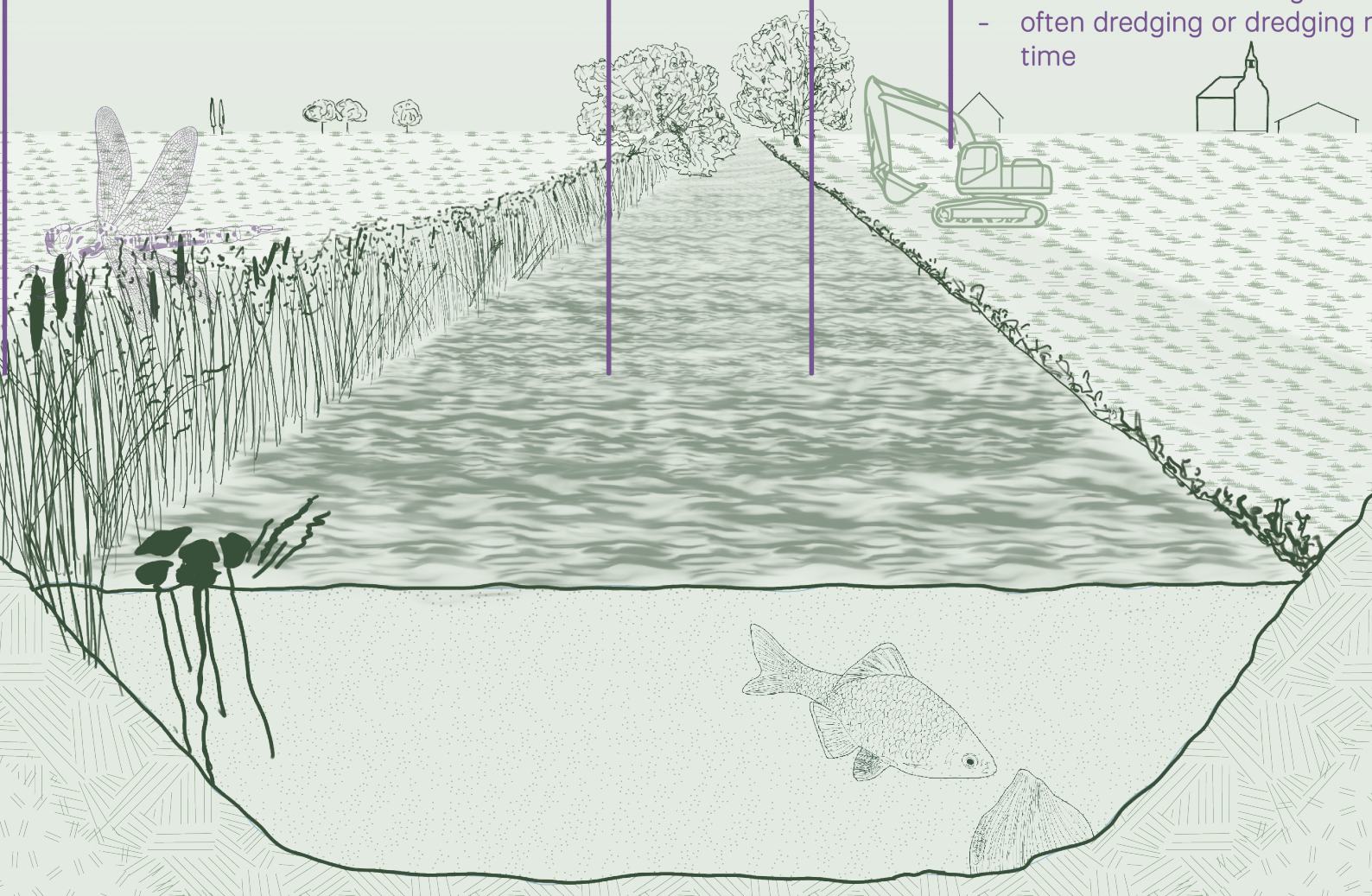
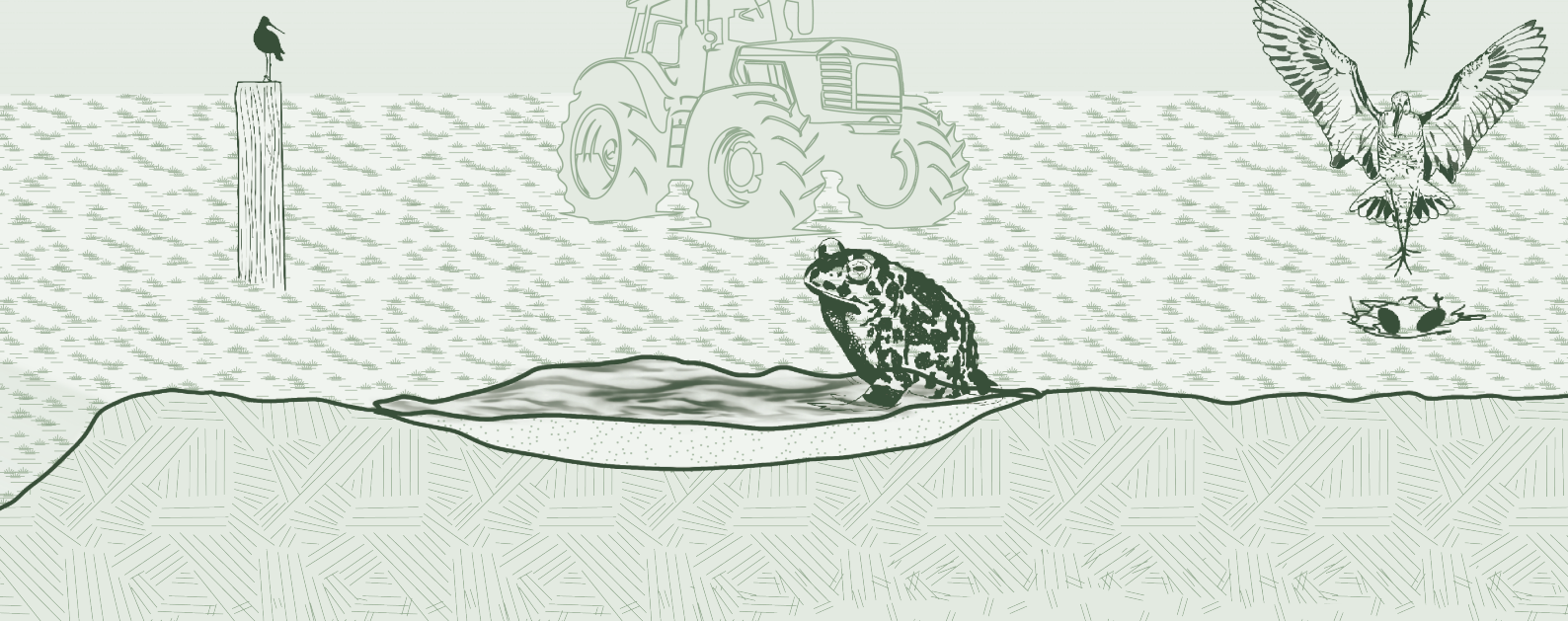


Figure 20: needs hairy dragonfly (van Hoorn, 2026)



ural or industrial
more than 400 meters at a



MASTERPLAN

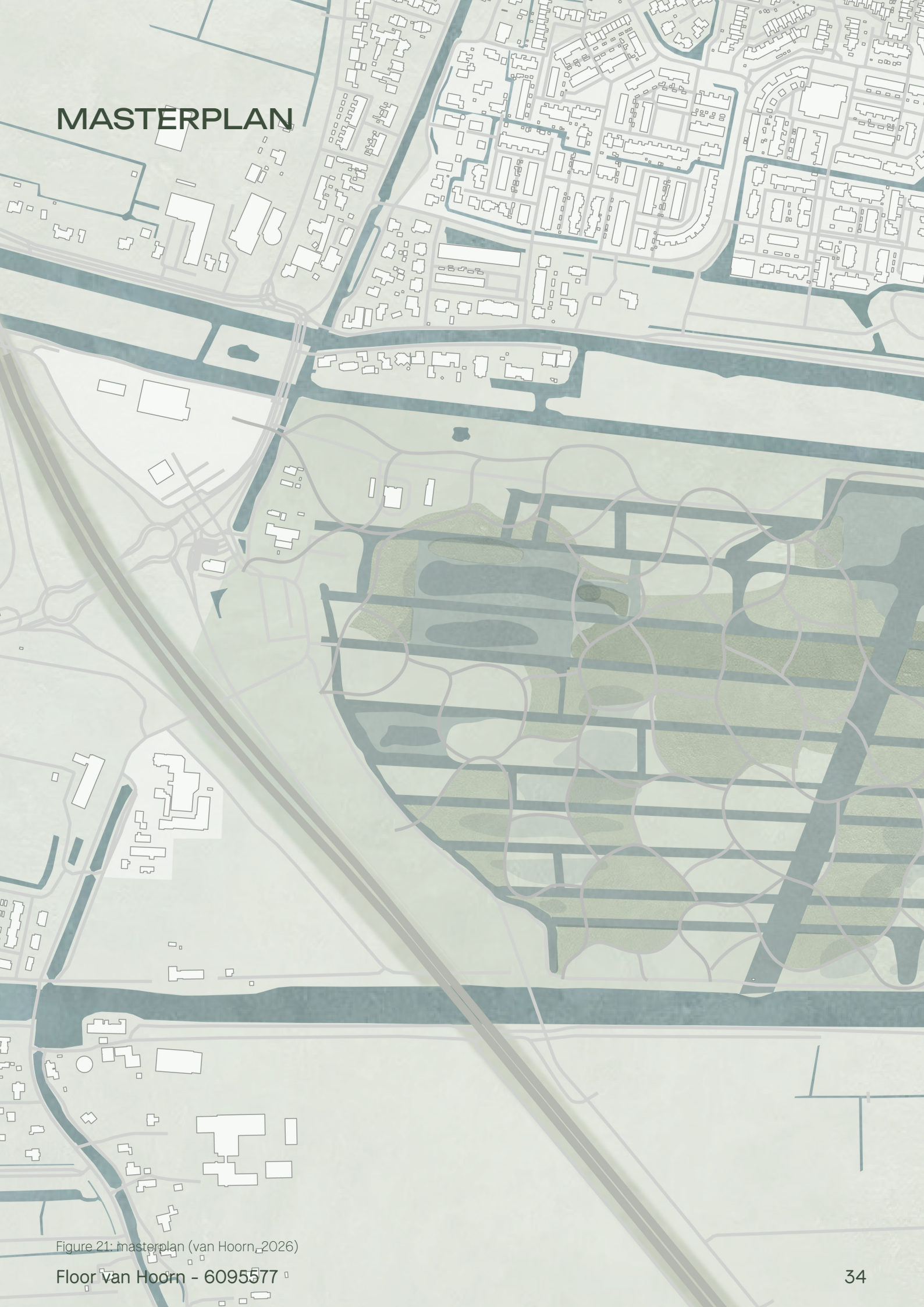


Figure 21: masterplan (van Hoorn, 2026)

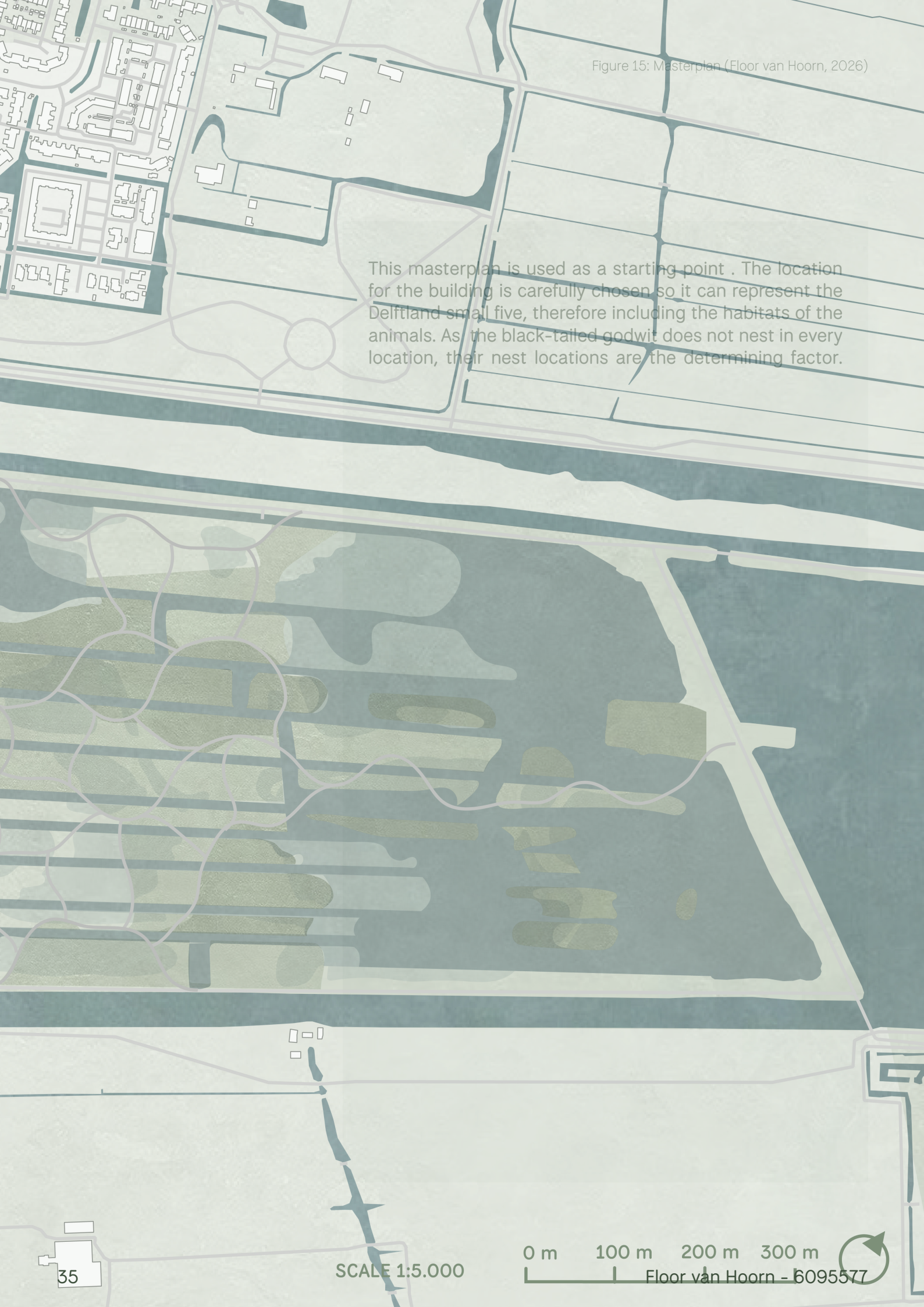


Figure 15: Masterplan (Floor van Hoorn, 2026)

FORM

The building's form is initially determined by circles. The inside of the circles is taken out, creating different spaces, inside and outside. Instead of having a accessible street with private inner gardens, this concepts turns the form inside out. This makes for a quiet outer space where the black-tailed godwit will recieve less disturbance.

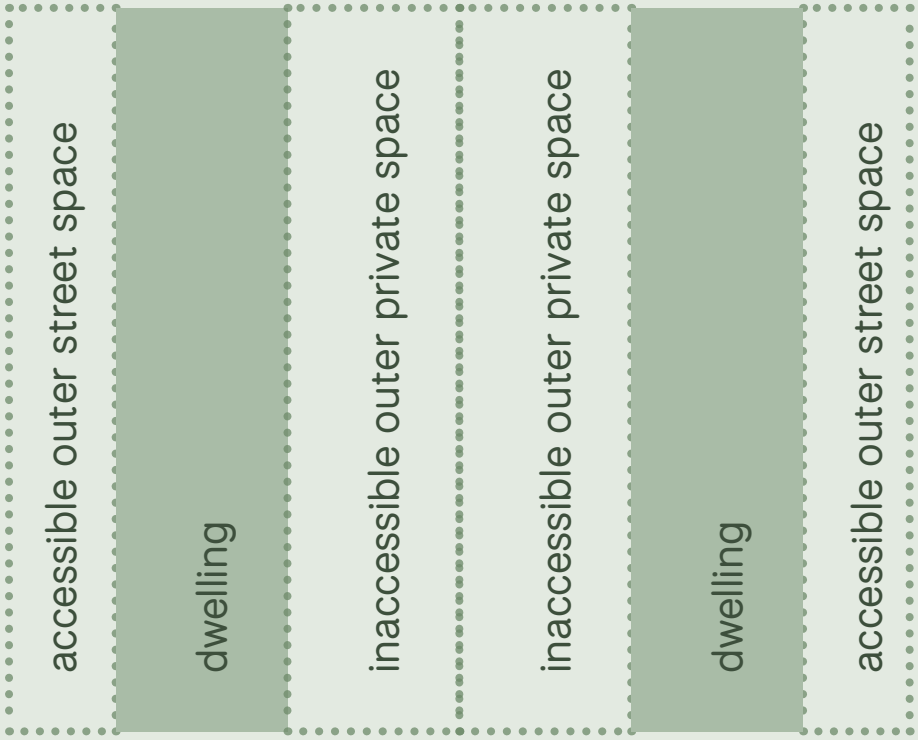
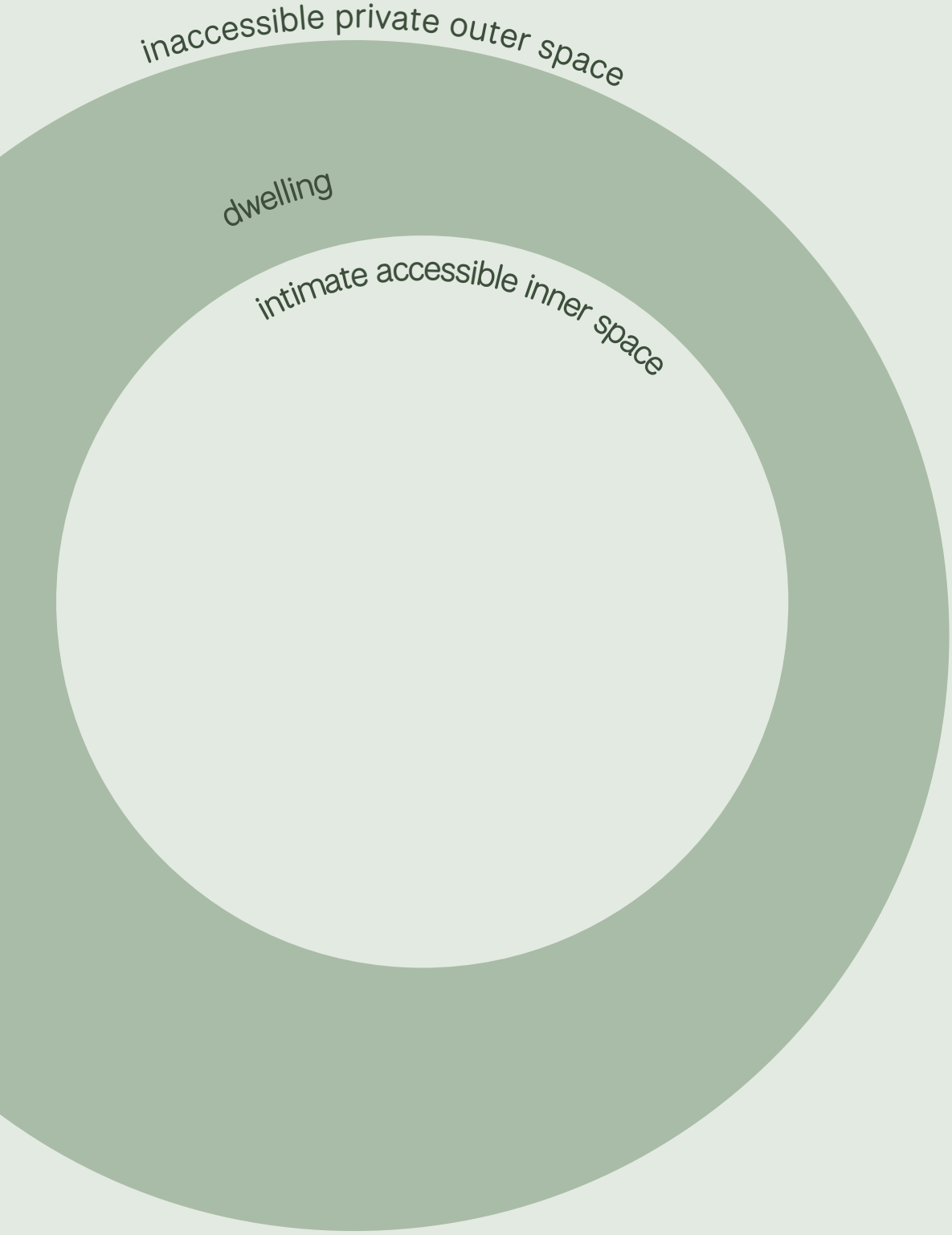


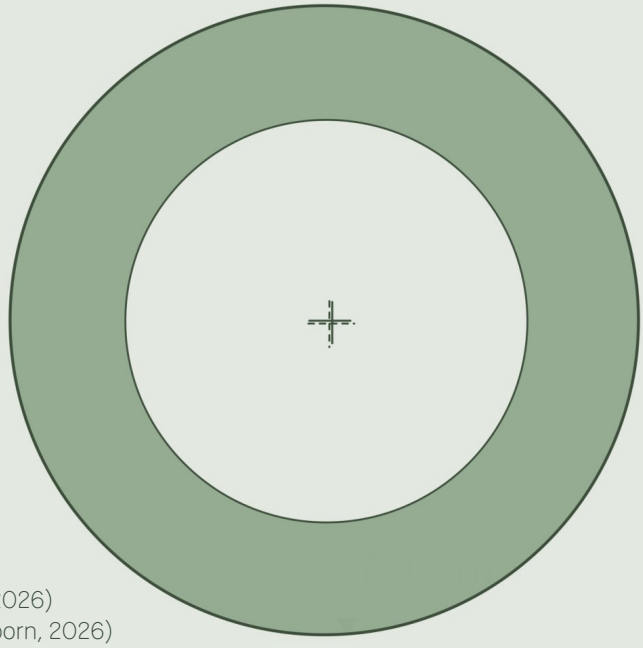
Figure 22 and 23: concept form (van Hoorn, 2026)


inaccessible private outer space
dwelling
intimate accessible inner space

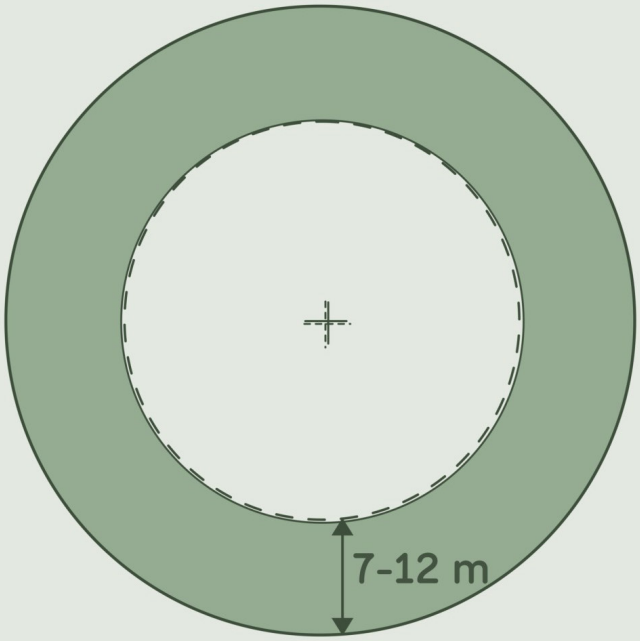
FORM

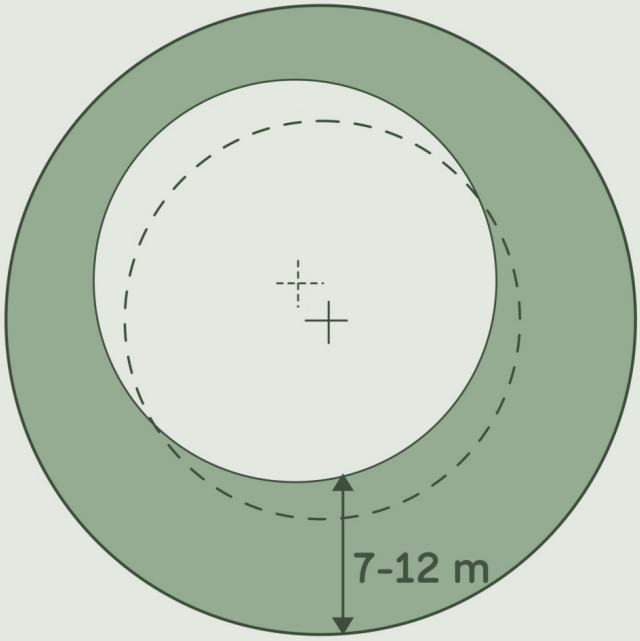
As the centerpoint of the outer circle lays at a different point then the inner circle, each main form has different depths across the form. This makes different depths dwellings, creating spaces that have a larger or smaller footage and therefore suitable for different lifestyles and owners.

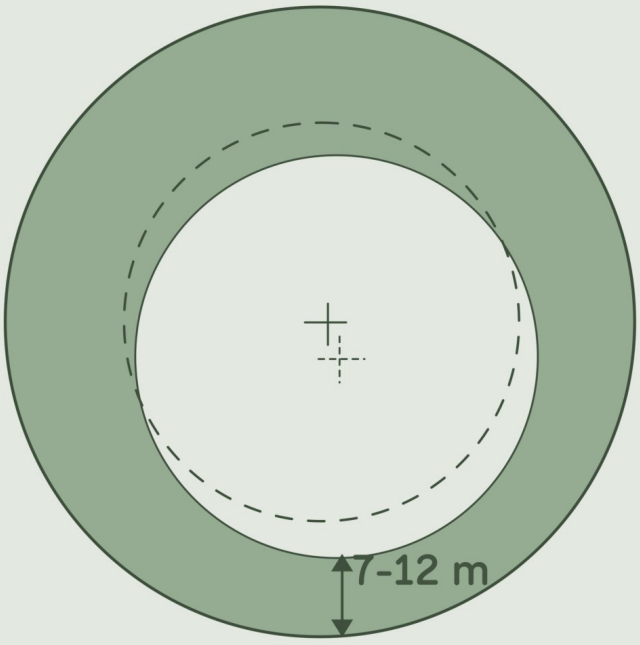
click here to watch explaination video



Video 1: concept form (van Hoorn, 2026)
Figure 24-27: concept form (van Hoorn, 2026)


7-12 m


7-12 m


7-12 m

FORM

The building's form is initially determined by circles. Each circle is positioned around the site's elevations. The higher parts push the form away, while the lower parts anchor the building. rting point . The location for the building is carefully chosen so it can represent the Delftland small five, therefore including the habitats of the animals. As the black-tailed godwit does not nest in every location, their nest locations are the determining factor.



Figure 28: concept form (van Hoorn, 2026)



SCALE 1:1.000

0 m 50 m 100 m

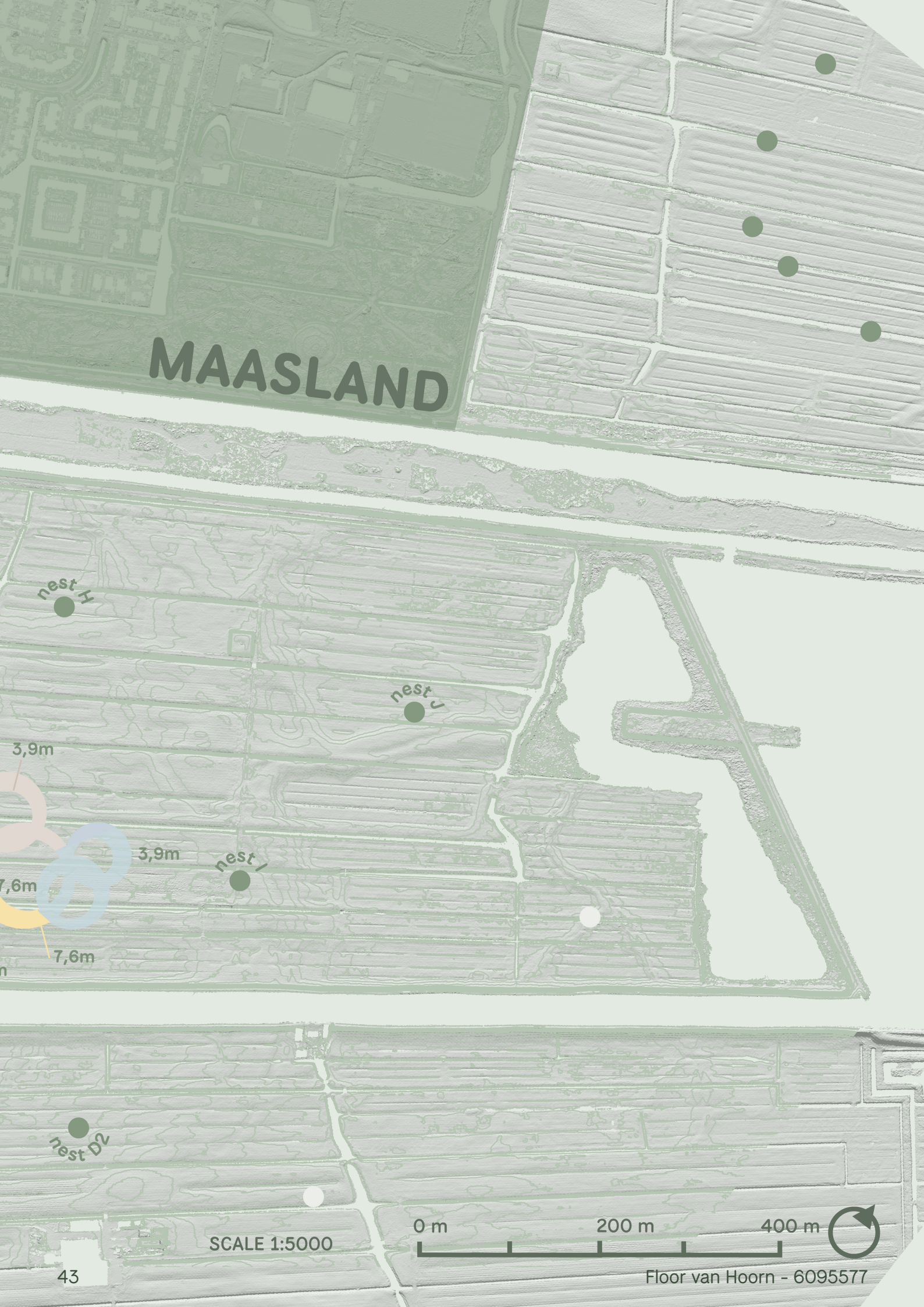
Floor van Hoorn - 6095577

BUILDING HEIGHT

The height of the buildings is determined by the angle of the endangered black-tailed godwit nests in relation to the closest dykes.



Figure 29: concept heigth (van Hoorn, 2026)



Floor van Hoorn - 6095577



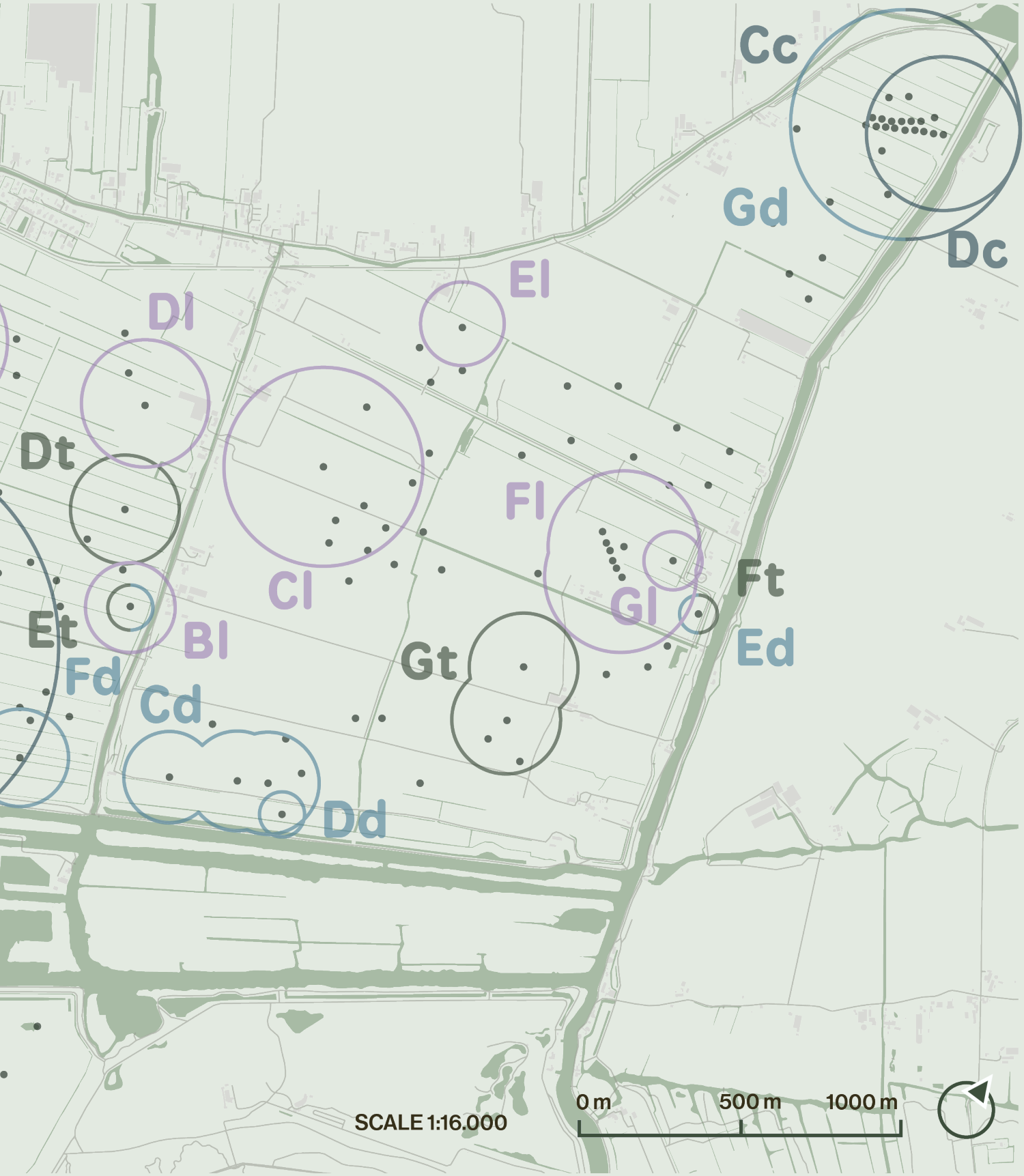
Figure 30: expected black-tailed godwit nets in Midden-Delfland with distances to a city, treeline, dyke and ribbon development (van Hoorn, 2026)

locations of nests are adapted from Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Aalkeer buitenpolder, Gemeente Midden-Delfland (2025).

Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Commandeurspolder, Gemeente Midden-Delfland (2025).

Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Foppenpolder, Gemeente Midden-Delfland (2025).

Landschapontwikkelingsperspectief Midden-Delfland 2025: Deel 5 uitwerking per polder - Duifpolder, Gemeente Midden-Delfland (2025).


Cc
Gd
Dc
El
Dl
Dt
Fl
Cl
Gl
Ft
Et
Bl
Ed
Gt
Fd
Cd
Dd
SCALE 1:16.000
0 m
500 m
1000 m

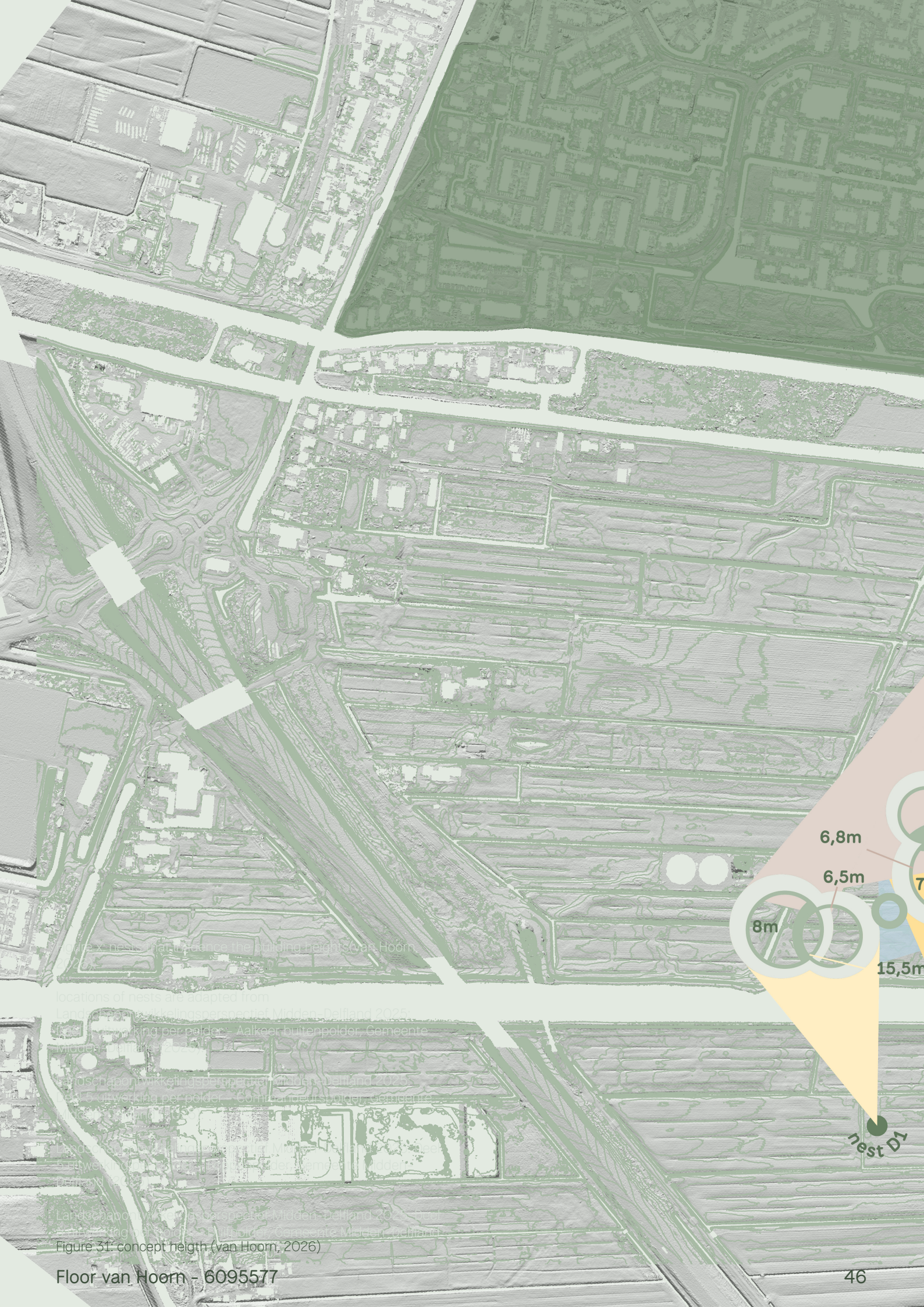
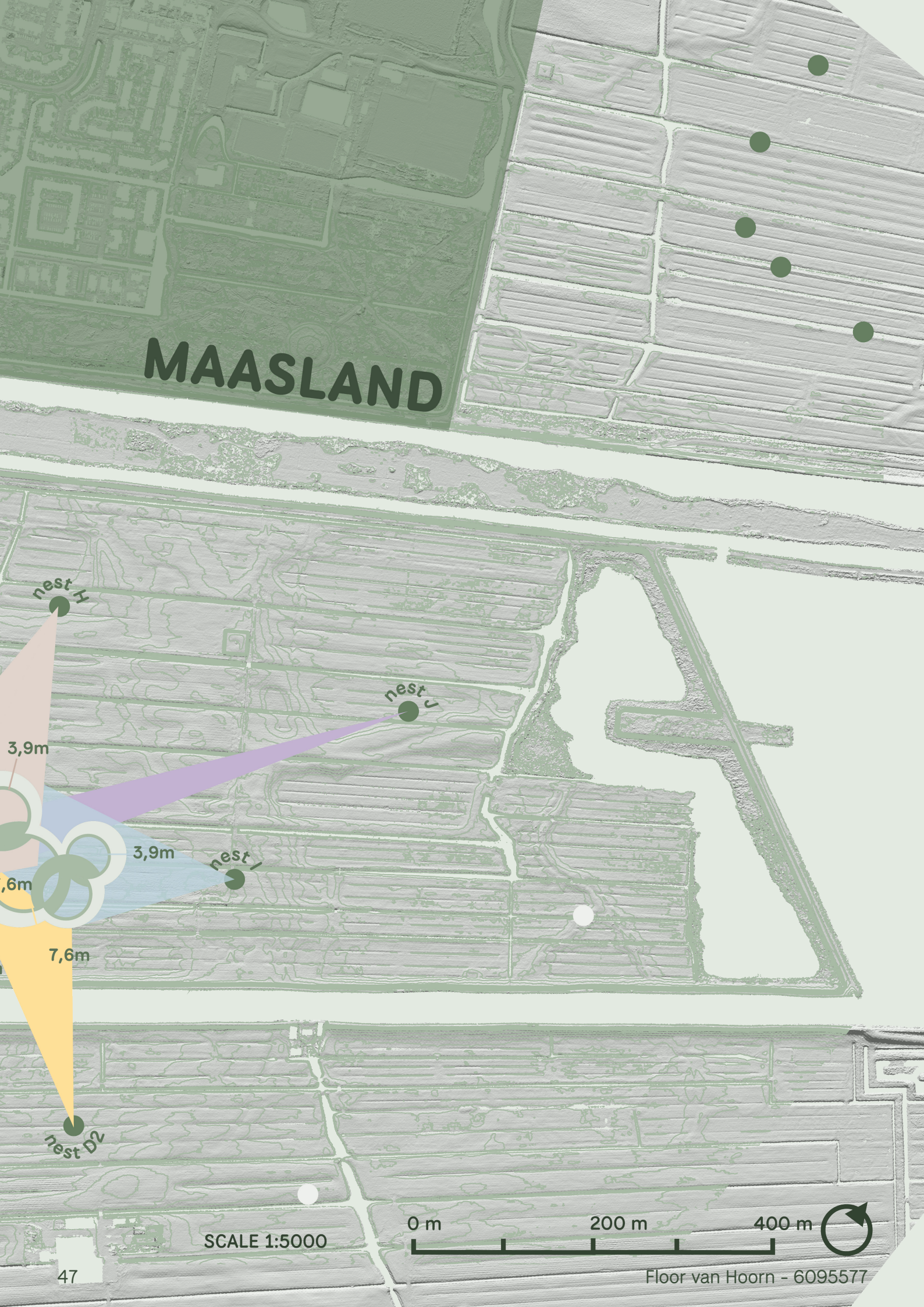


Figure 31: concept heigth (van Hoorn, 2026)



Floor van Hoorn - 6095577

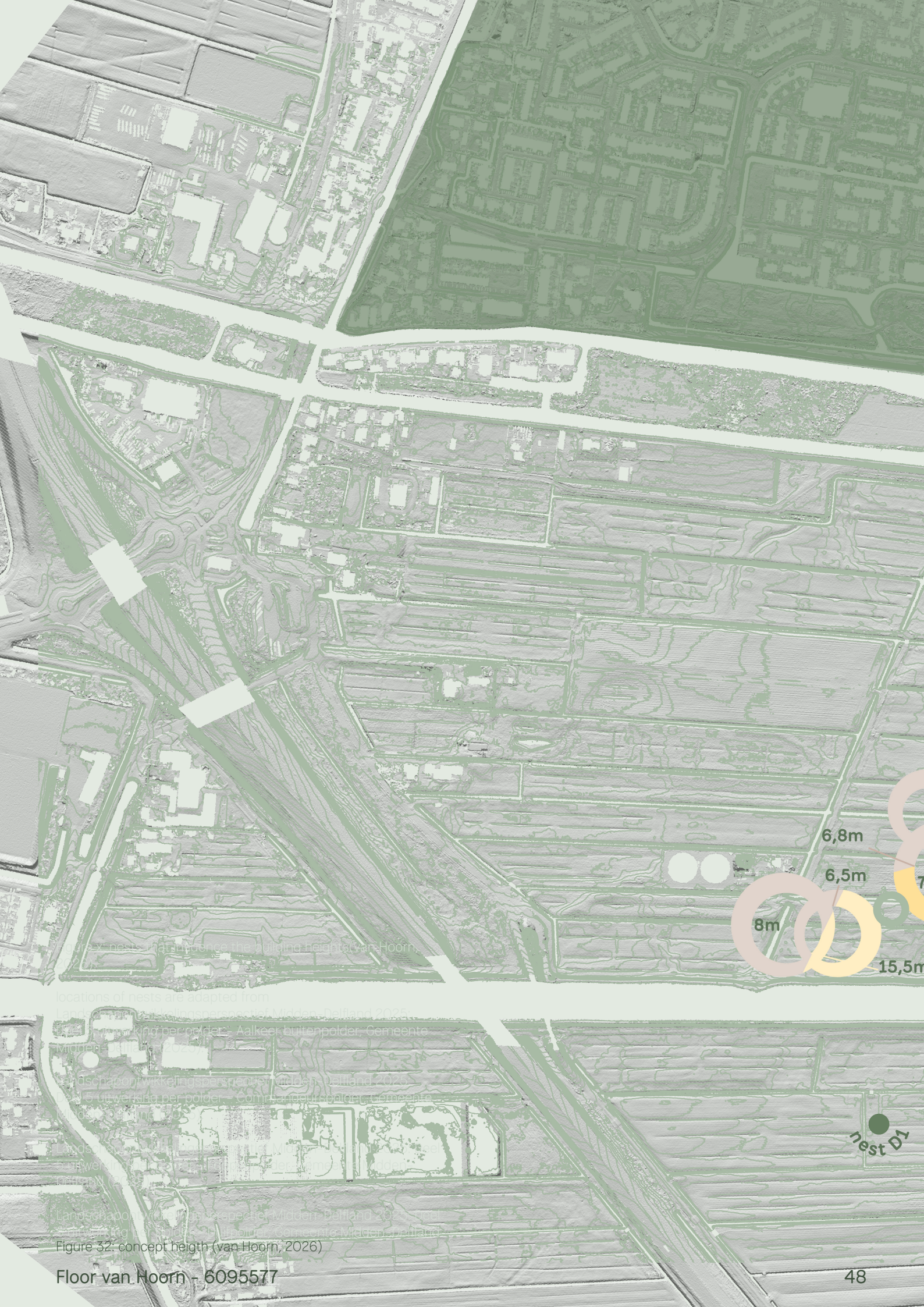
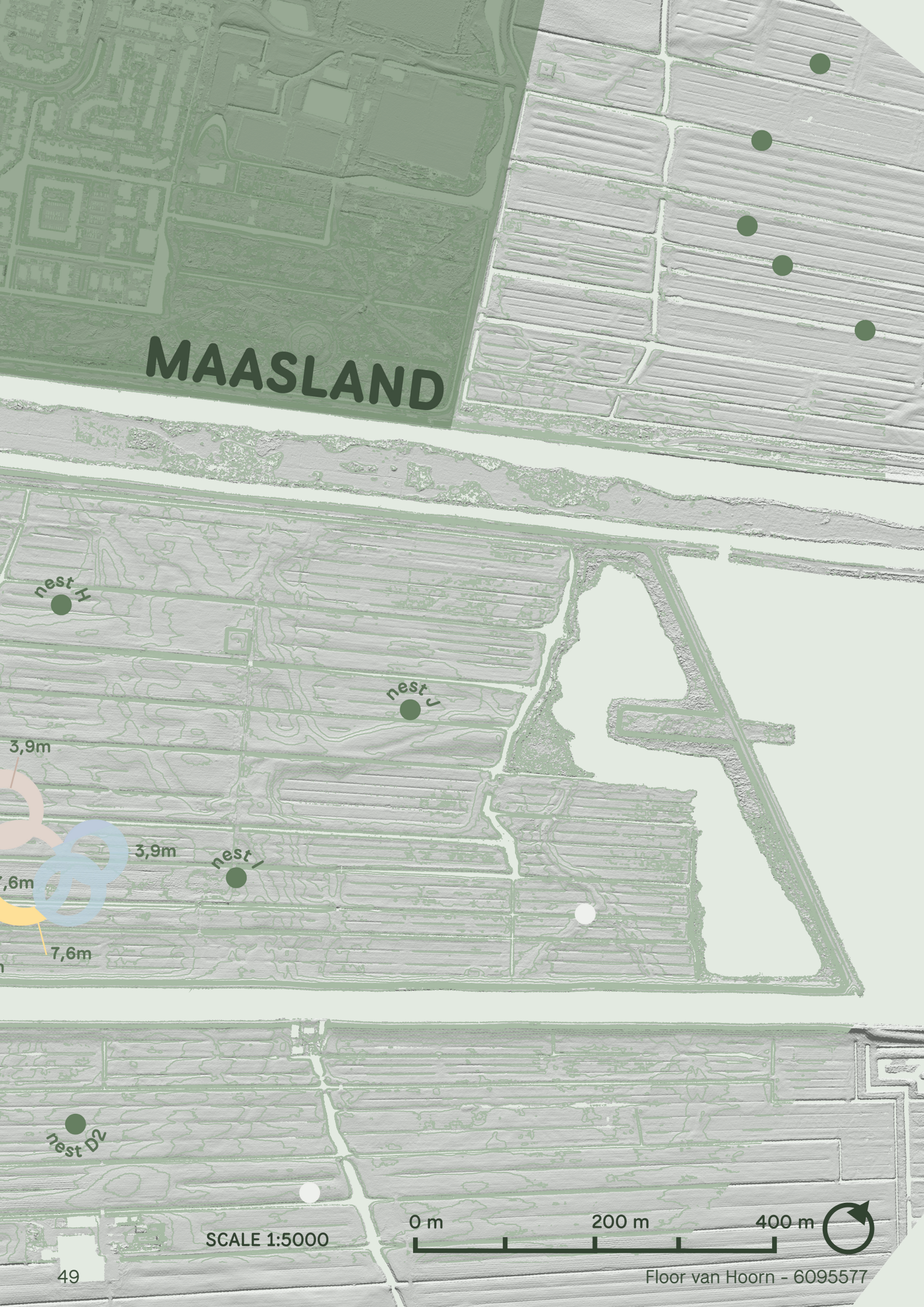


Figure 32: concept heigth (van Hoorn, 2026)



Floor van Hoorn - 6095577

object	nest	height nest (NAP)	height dyke (NAP)	height differ-ence	dis-tance to (m)	angle (deg)
c (city)	A				140	
	B				210	
	C				375	
	D				230	
	E				640	
average					320	
d (dyke)	A	-2,6	0,1	2,7	130	1,2
	B	-2,8	-0,1	2,7	130	1,2
	C	-3,2	0	3,1	140	1,3
	D	-3	0,1	3,1	50	3,5
	E	-2,9	0,1	3	60	2,9
	F	-2,9	0,1	3	70	2,5
	G	-2,8	0,1	2,9	105	1,6
	H	-2,5	0,1	2,6	145	1,0
	I	-2,0	0	2,0	120	1,0
	J	-2,6	0	2,6	220	0,7
average				2,9	98	
t (trees)	A				110	
	B				150	
	C				170	
	D				170	
	E				70	
	F				60	
	G				165	
average					128	
l (ribbon)	A				255	
	B				140	
	C				305	
	D				200	
	E				135	
	F				280	
	G				90	
average					200	

But as most of these numbers are derived from older documentations, a intevasrisation is done on the nests surrounding the Vlietlanden. The following objects are investegated; distance to a dyke and the height differance between the dyke and a nest (Ad), the distance to a group/ line of trees (At), the distance between a nest and a town boarder (Ac) and the distance between a nest and a ribbon development. The angle of the distance to the dyke seems to be the most important, therefore these number have been further elaborated.

The angle between nest and dyke is further used to detemine the building height. To specify this, the distance to the building was measured, using the angle with to the closest dyke, resulting in the building height.

table 1: values from a black-tailed godwit nest to landscape elements in Midden-Delfland (F. van Hoorn, 2026)

The building height are determined by measuring the distance from the nest to the building and the corresponding angle to the nearest dike. This results in the height. Some nests have overlapping viewinglines, the most decisive factor is the guiding principle here. Some nests are very close to the building, to meet the minimum height necessary the angle was alterated. Luckely, godwits are not mathematicians, and the difference in height is barely notacable from the nestlocation, see figure 34. Further, nests in the area have different distances to, for example, treelines and dykes as well, eventhough the literature emphasises their danger due to predetors.

nest	distance to building (m)	angle to dyke (deg)	max height of building (m)	alter-ation angle (deg)	new building height (m)
I	142	1.0	2.5	1.6	4.0
IJ	176	1.0	3.0		
HI	210	1.0	3.7	1	3.7
ID2	273	1.0	4.7	1.6	7.6
J	388	0.7	4.7		
JH	210	1.0	3.7		
H	213	1.0	3.9		
Hfar	374	1.0	6.5		
HD1	460	1.0	8.0		
D1H	256	3.5	15.7		
D2H	300	1.0	5.2	1.3	6.8
D1	234	3.5	14.3		
D2	187	3.5	11.4		
D1D2	254	3.5	15.5		

table 2: building heights derived from the angle of a nest to the nearest dyke (van Hoorn, 2026)

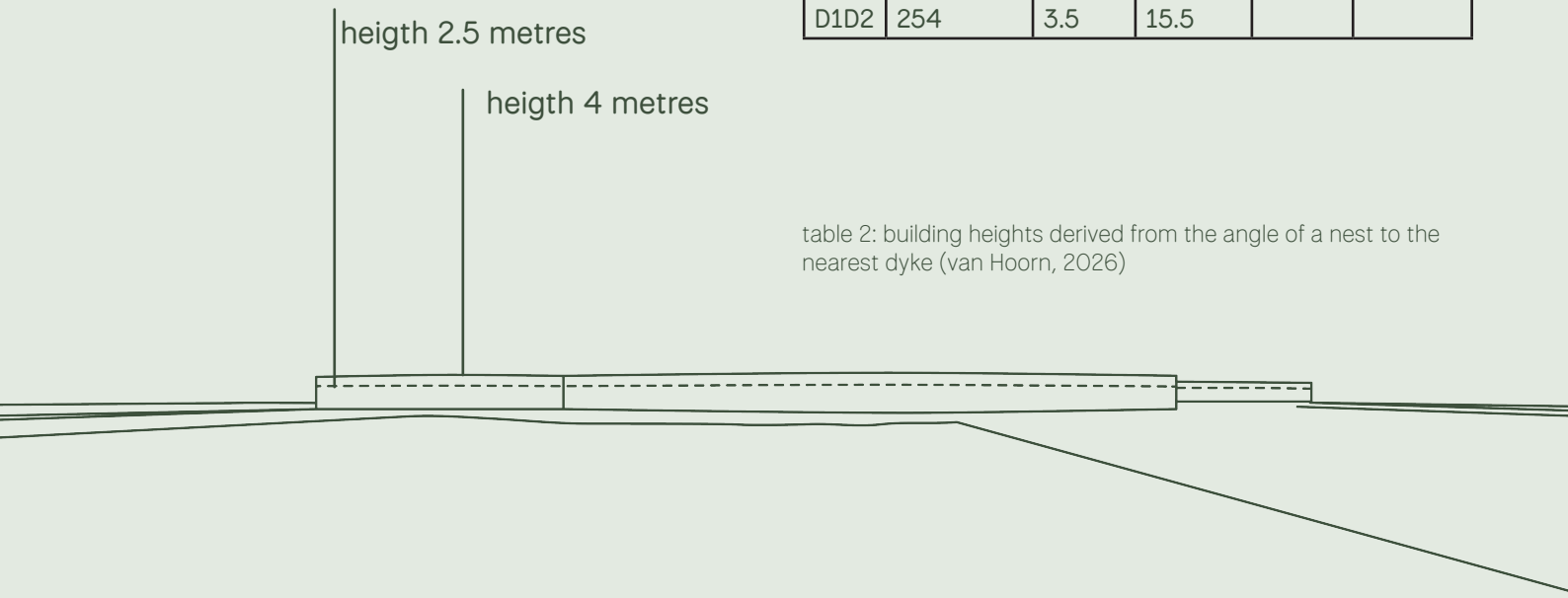


Figure 33: height difference from nest I, with angle to dyke and the alteration angle (van Hoorn, 2026)

LIFT-OFF

In the masterplan of the Vlietlanden, one of the main rules was to minimize alterations to the landscape. This principle is also used for Pratum Habitats, therefore the whole building is lifted off the ground with 600 mm. This also allows the building to breathe around changes in the climate, for example, in wetter periods, the water has space to flow.



Figure 34: concept lift-off (van Hoorn, 2026)



SCALE 1:1.000

0 m 50 m 100 m

Floor van Hoorn - 6095577

PLATFORM

The platform runs along the entire length of the building and provides walking spaces. The section of the platform that connects the two buildings is not covered with dwellings. This connects the two nature areas as defined in the masterplan and prevents fragmentation caused by buildings.

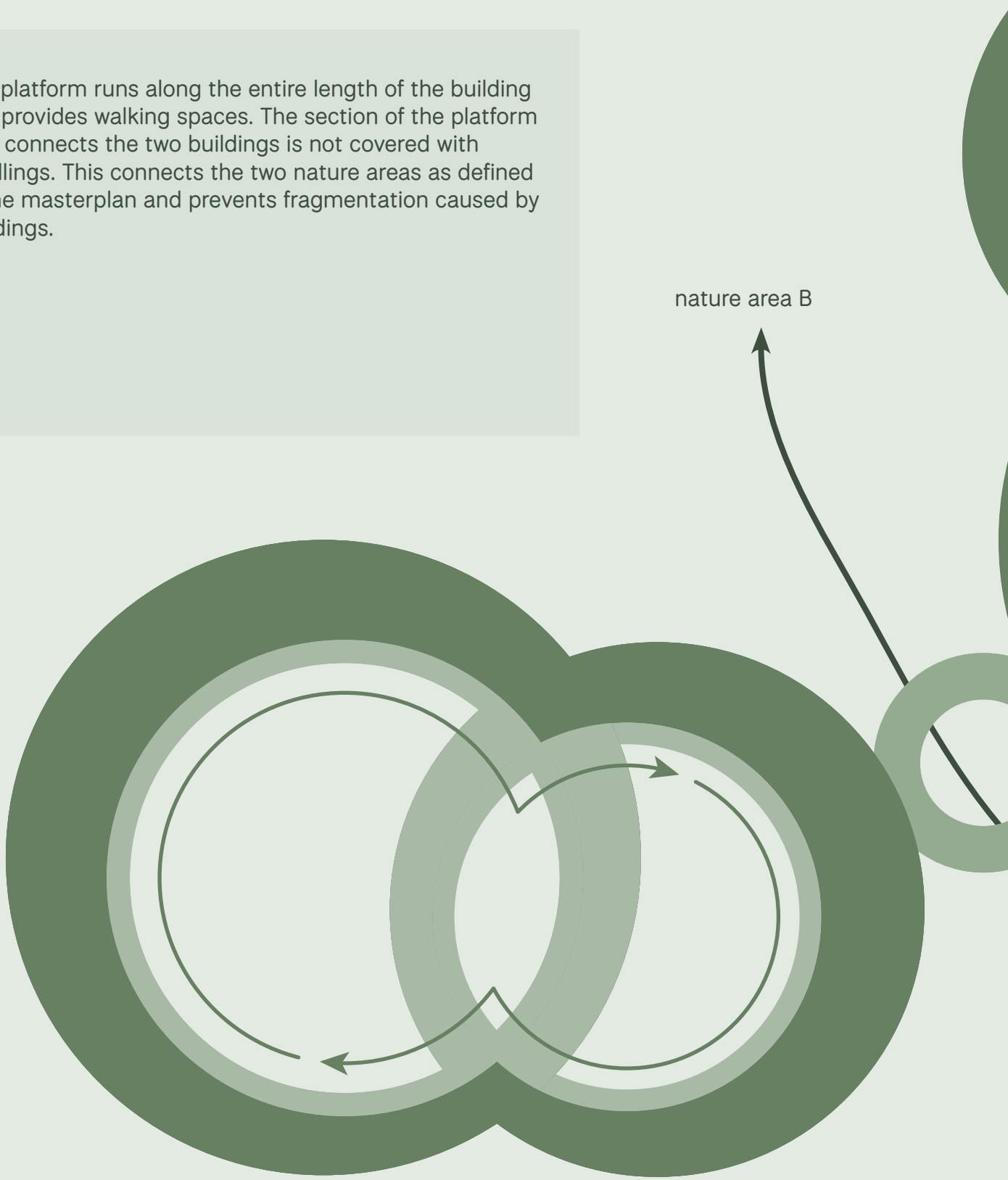
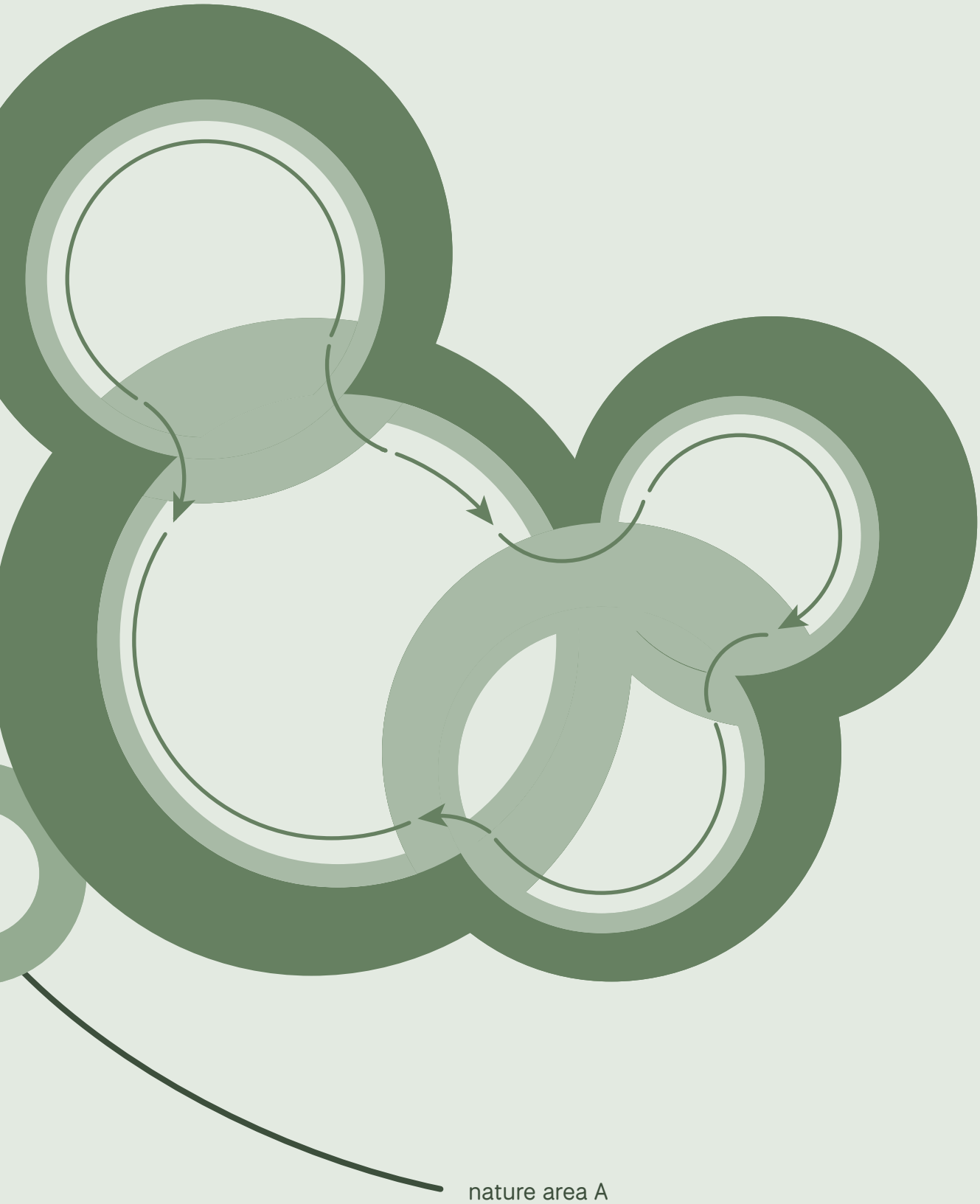


Figure 35: concept platform (van Hoorn, 2026)


nature area A

EMERGENCY ROUTE

An emergency and service route has been added to the platform footpath. This route can be used for parcel services and, more importantly, emergency services. These rings are one-way traffic, connecting seamlessly with the paths in the plan.



Figure 36: concept emergency route (van Hoorn, 2026)


SCALE 1:1.000
0 m
50 m
100 m

DITCHES

Along the ditches, the building's open character is emphasised by the removal of infill elements. The platform and roof stay, but there are no walls between this space and the ditches, making the building 'see-through' in those areas. The planting around the ditches can be a little taller, but it should not fill the ditches completely, so that the hairy dragonfly and the bitterling can thrive in their habitat. As well as considering the habitats of other animals, this approach complies with the municipality's wishes regarding view lines in the landscape.



Figure 37: concept open ditches (van Hoorn, 2026)



SCALE 1:1.000

0 m 50 m 100 m

Floor van Hoorn - 6095577

COMMUNITY SPACES

communtity spaces are located on the platform and provide foodforests for the realy bumblebee and humans. In each corner where two circles meet are guestrooms where guest can stay over.



Figure 37: concept comunity spaces (van Hoorn, 2026)


SCALE 1:1.000
0 m
50 m
100 m

NATIVE VEGETATION

The current Dutch polder landscape contains little plant variation, it is mostly made up of perennial ryegrass. While this grass is ideal for grazing cows, other animals that depend on these landscapes suffer from the lack of biodiversity, which some refer to as ‘grassphalt’ (Staats, 2021). To restore some of the landscape’s biological value, the original vegetation is used inside the building elements. With careful consideration of the plants needed to support the needs of the Delfland small five.



Figure 38: concept native vegetation (van Hoorn, 2026)



SCALE 1:1.000

0 m 50 m 100 m

MERGE LANDSCAPES

To increase biodiversity around the site, the grass and wetland landscapes will gradually merge, creating a soft edge.



Figure 39: concept native vegetation (van Hoorn, 2026)


SCALE 1:1.000
0 m
50 m
100 m

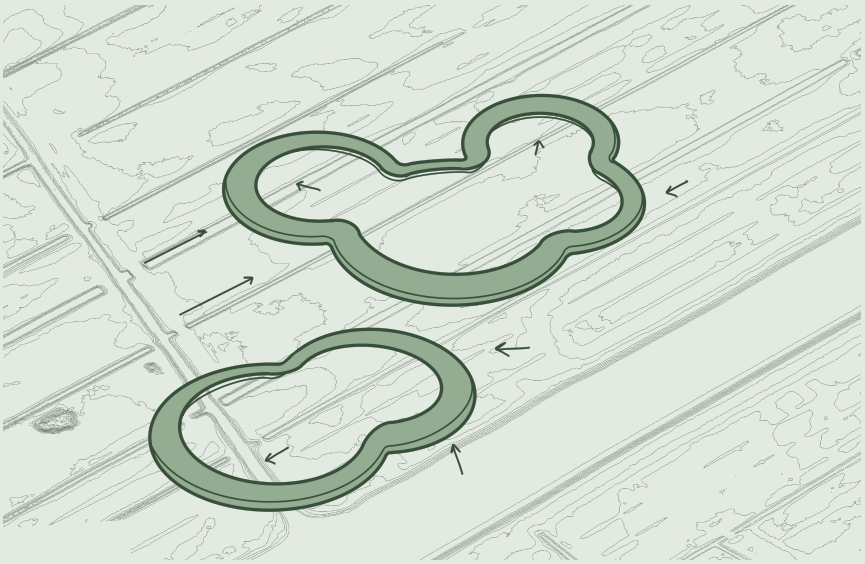
HELOPHYTE FILTERS

The helophyte filters will be used to clean the grey water from the homes, as done in the case study of Eva Lanxmeer. As there are 130 home in the plan, and 21 m^2 a home is used in Lanxmeer, a total of 2730 m^2 is needed. The dark green edges contain a surface area of 2908 m^2, therefore providing enough area to clean the gray water for the homes. But as a helophyte filter needs a sand layer, this can not be placed directly on top of the current landscape, as it would contradict the principle of minimizing influence on the natural landscape. Also this layer is needed to serve the human, not the current nature, which shows that it need to be placed on the human level.



Figure 40: concept helophye filters (van Hoorn, 2026)

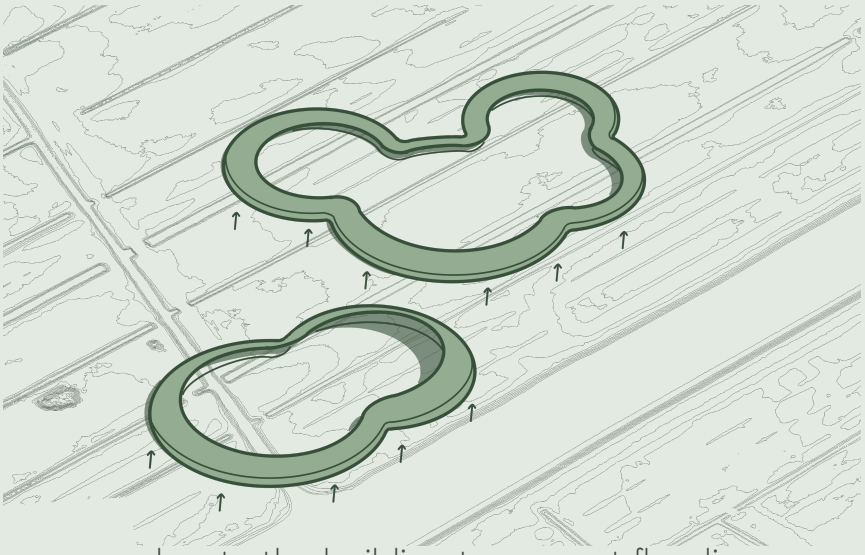

SCALE 1:1.000
0 m
50 m
100 m



move volumes around the site. elevation determines the position

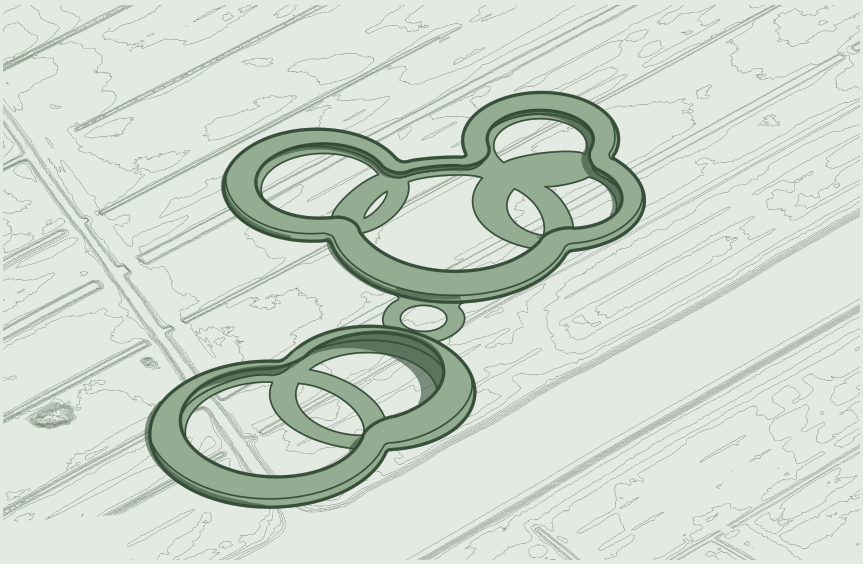


nest locations determine the building height

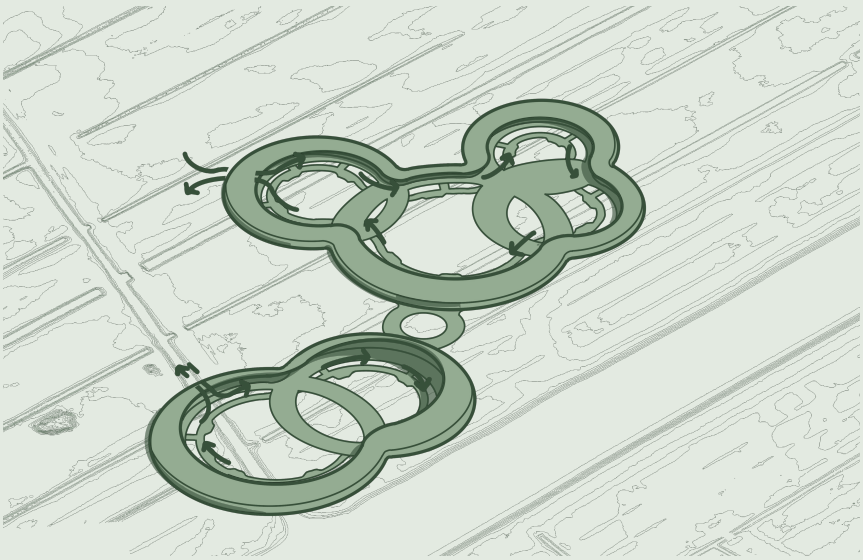


elevate the building to prevent flooding

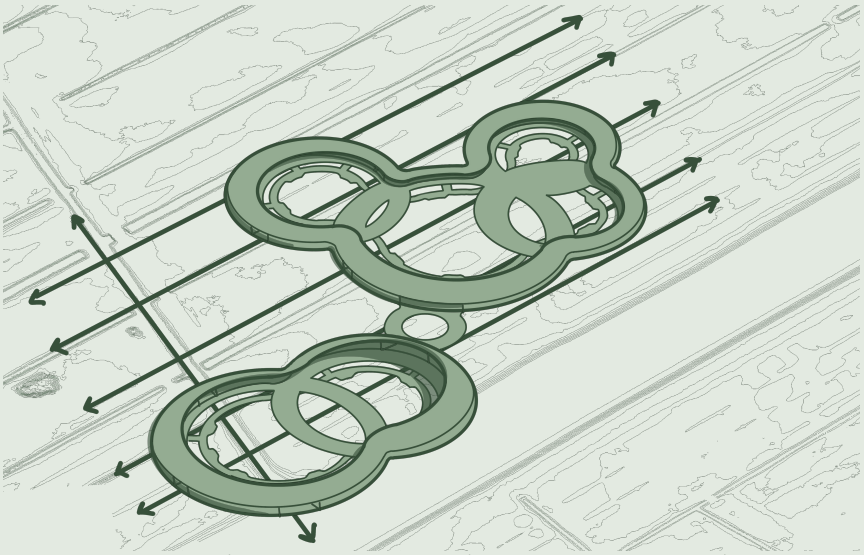
Figure 41-46: concept drawings (van Hoorn, 2026)



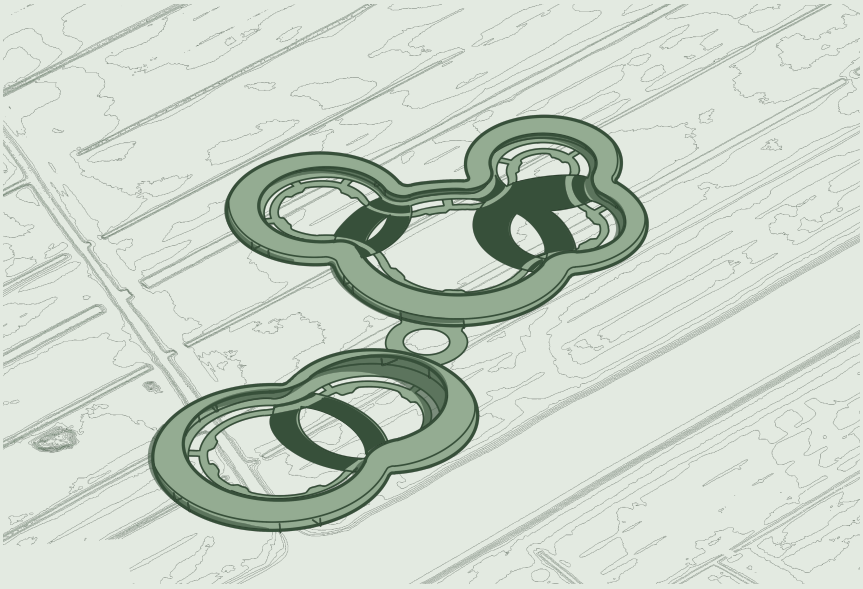
add pathway around the building volumes



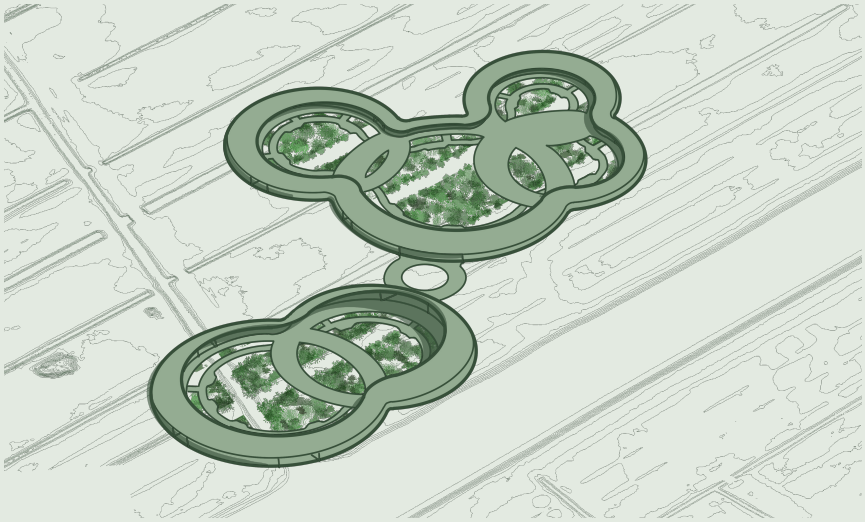
add a emergency and service route



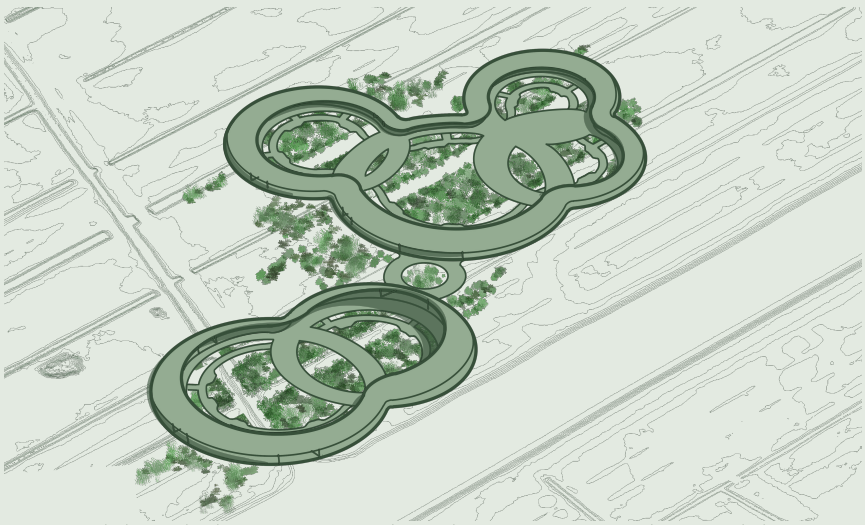
cut volumes around waterways, keep ditches open



community spaces on platform



return the old Dutch swamp landscape to return biodiversity



bleed the swamp landscape into the polder landscape

Figure 47-50: concept drawings (van Hoorn, 2026)



add helophyte filters

MOBILITY



Figure 51: mobility (van Hoorn, 2026)



As the CROW Kennisbank (2018) points out, a distance of 75–100 metres is preferred, but distances greater than this also occur in case studies such as ‘T Eemgoed’, ‘Eva Lanxmeer’ and ‘Het Schoonschip’. Therefore, the masterplan has been redesigned to incorporate possible sites for dwelling extensions (white) and parking spaces (dark green), where car-sharing is available.

According to the municipality of Midden-Delfland (2020) the parking norm ranges from 2.0 for single-family homes in the outside areas to 1.5 in Maasland, for apartments 1.6 in outside areas and 1.3 in Maasland. Finally 1.1 for small houses <50m2 in outside areas and 1 in Maasland. For all of these types 0.3 of the amount is for visitors. An average of 1.3 is calculated when creating an average of the Maasland numbers. The numbers for Maasland are used as this will be a new extension of the village of Maasland; therefore, the same parking can be expected.

As there are muiltiple homes less than 50 m2, an average is calculated from these numbers from the municipality. In total, 130 homes fall within this scope. Including six designated parking areas with 18 spaces each, this totals 108 parking spaces This is lower that the municipality 1.3x130=169 spaces. This is intended to encourage people to minimise car ownership in the area, with four cars per parking area to be shared.

SCALE 1:5.000

0 m 100 m 200 m 300 m

Floor van Hoorn - 6095577

PARKING

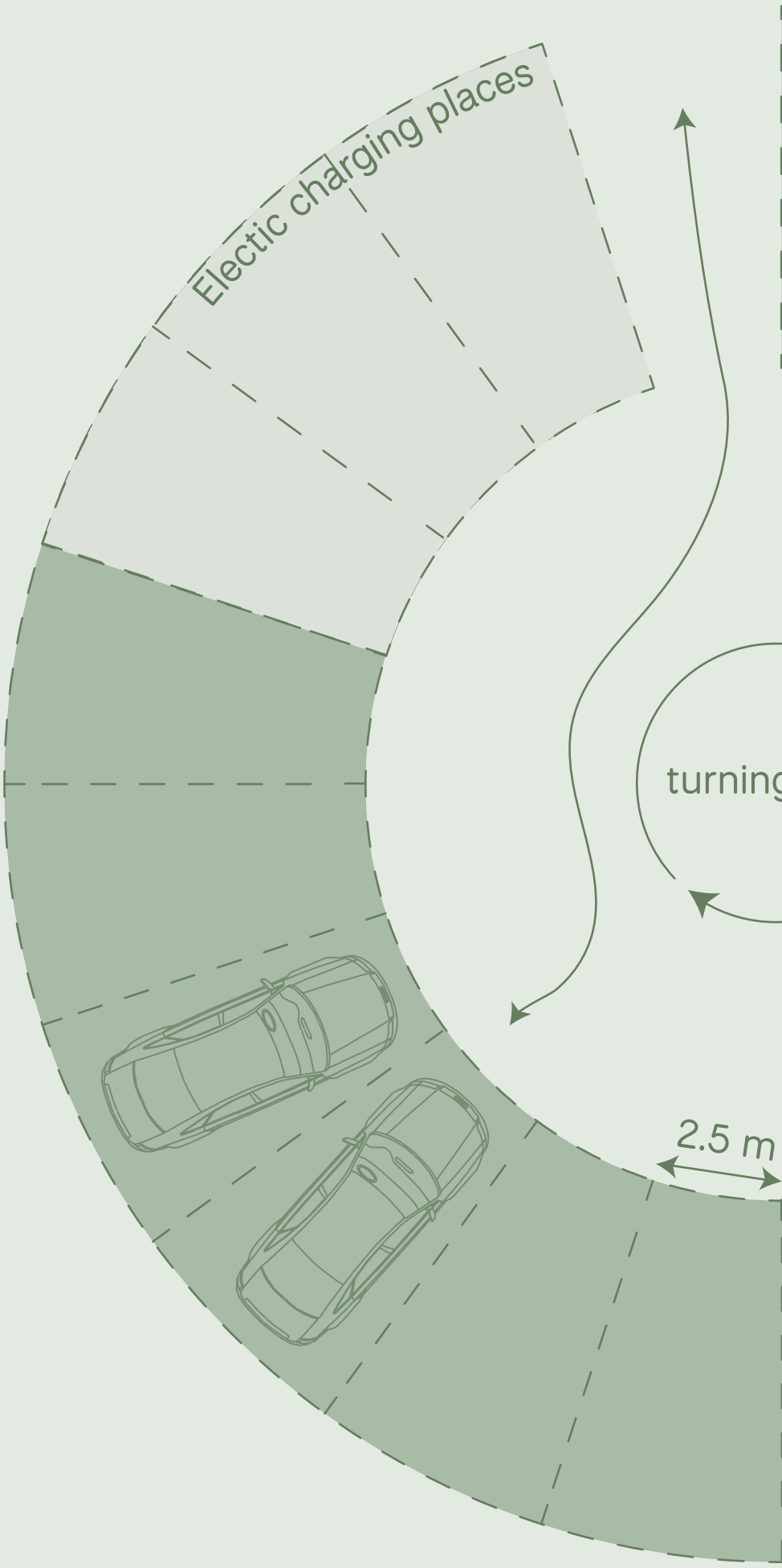
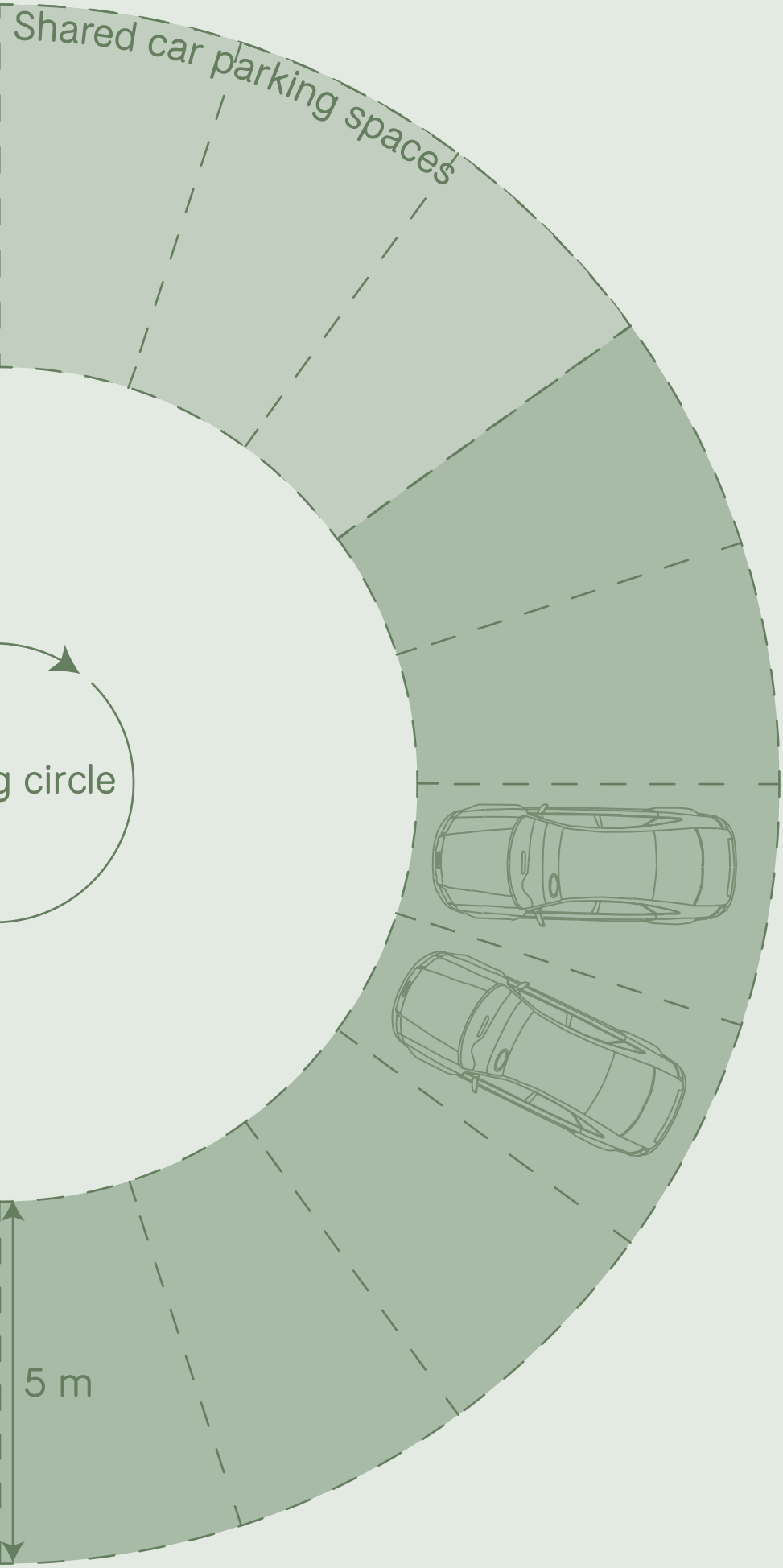
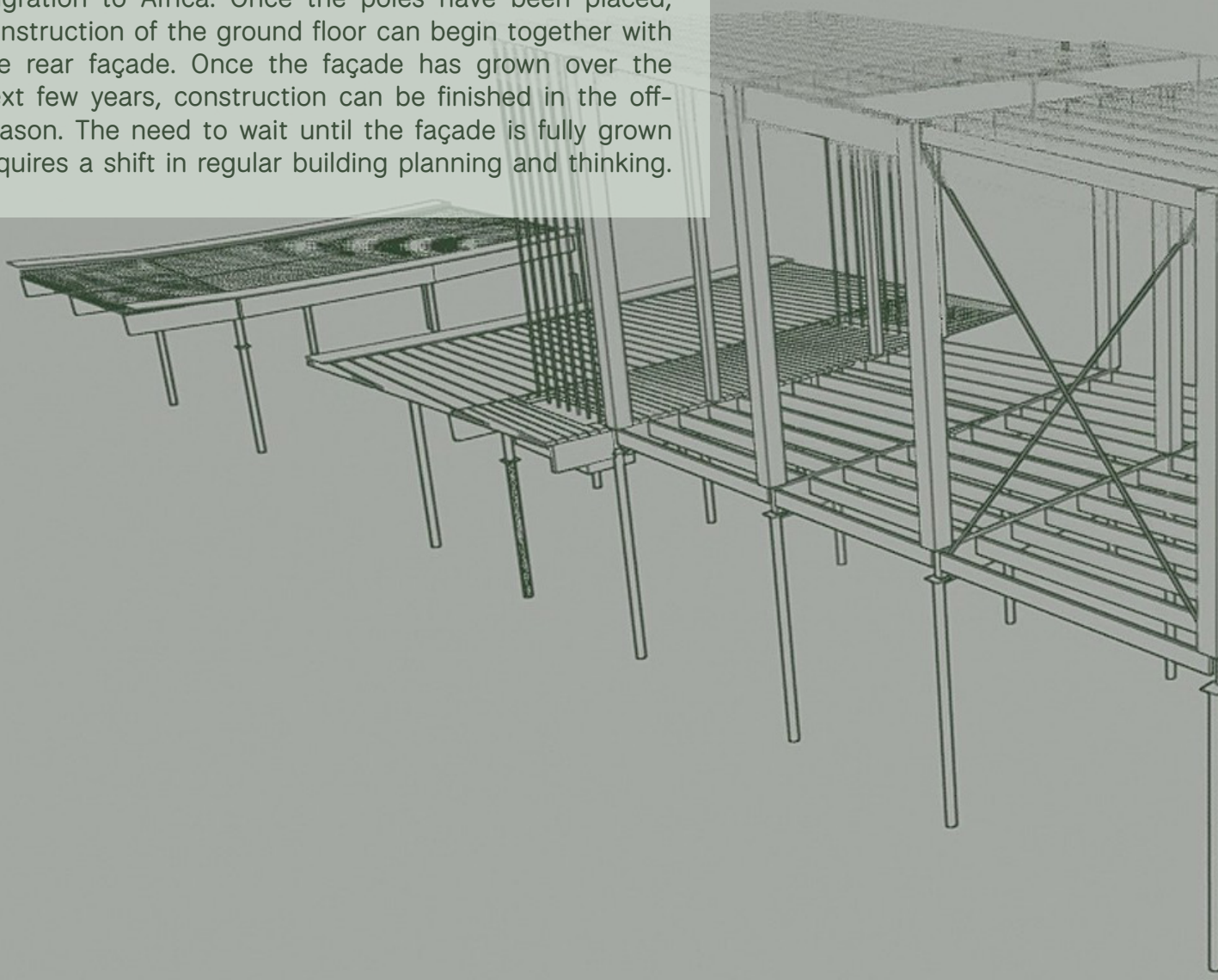


Figure 52: parking (van Hoorn, 2026)


Shared car parking spaces
g circle
5 m

PHASING

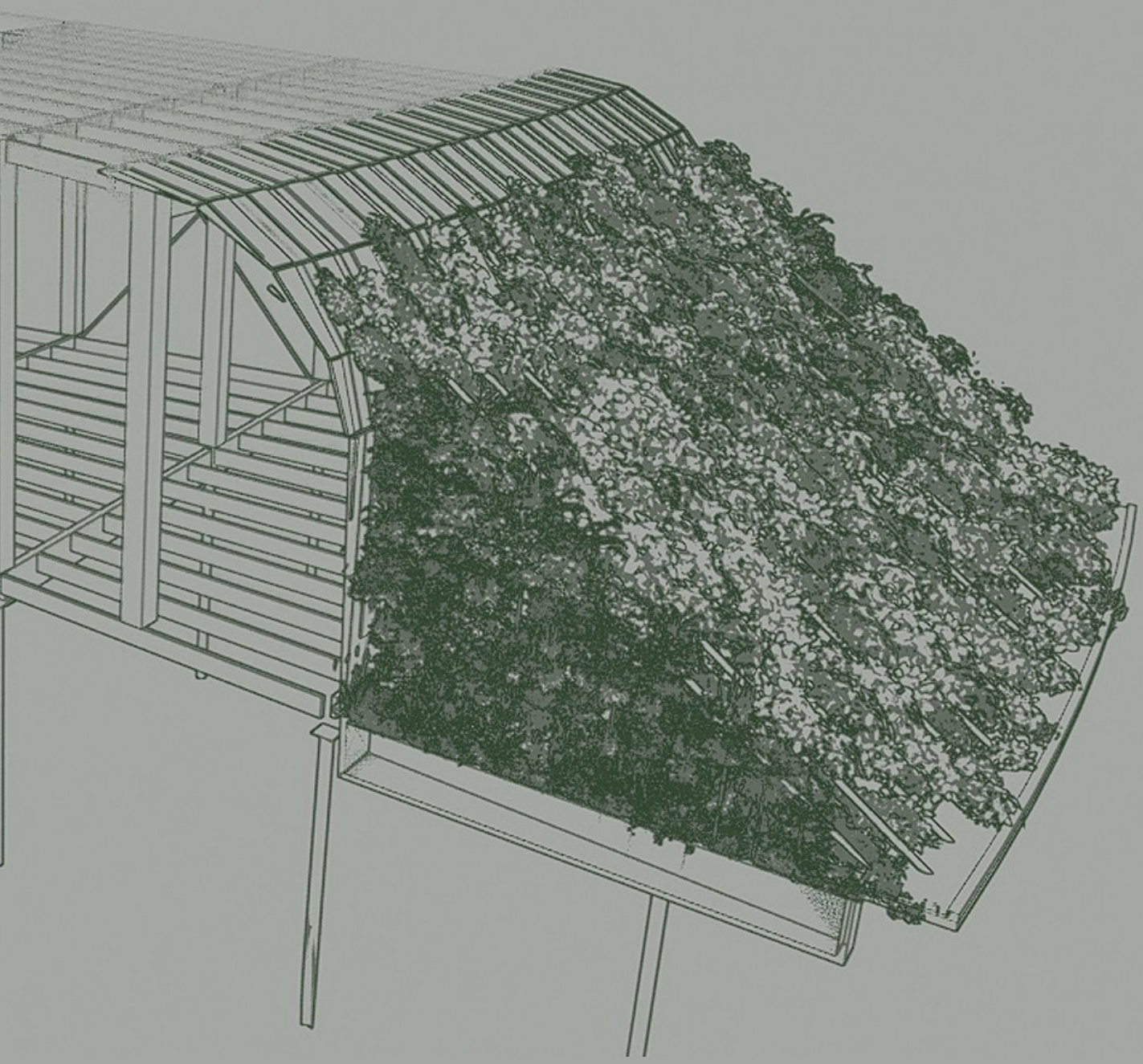
Due to the godwit's sensitivity to buildings, the green outer shell must be created first to prevent disturbance. This creates the need for phasing. Lightweight screw poles are placed using a lightweight vehicle during the godwit's migration to Africa. Once the poles have been placed, construction of the ground floor can begin together with the rear façade. Once the façade has grown over the next few years, construction can be finished in the off-season. The need to wait until the façade is fully grown requires a shift in regular building planning and thinking.



click here to watch explaination video

Video 2: phasing (van Hoorn, 2026)

Figure 53: phasing (van Hoorn, 2026)



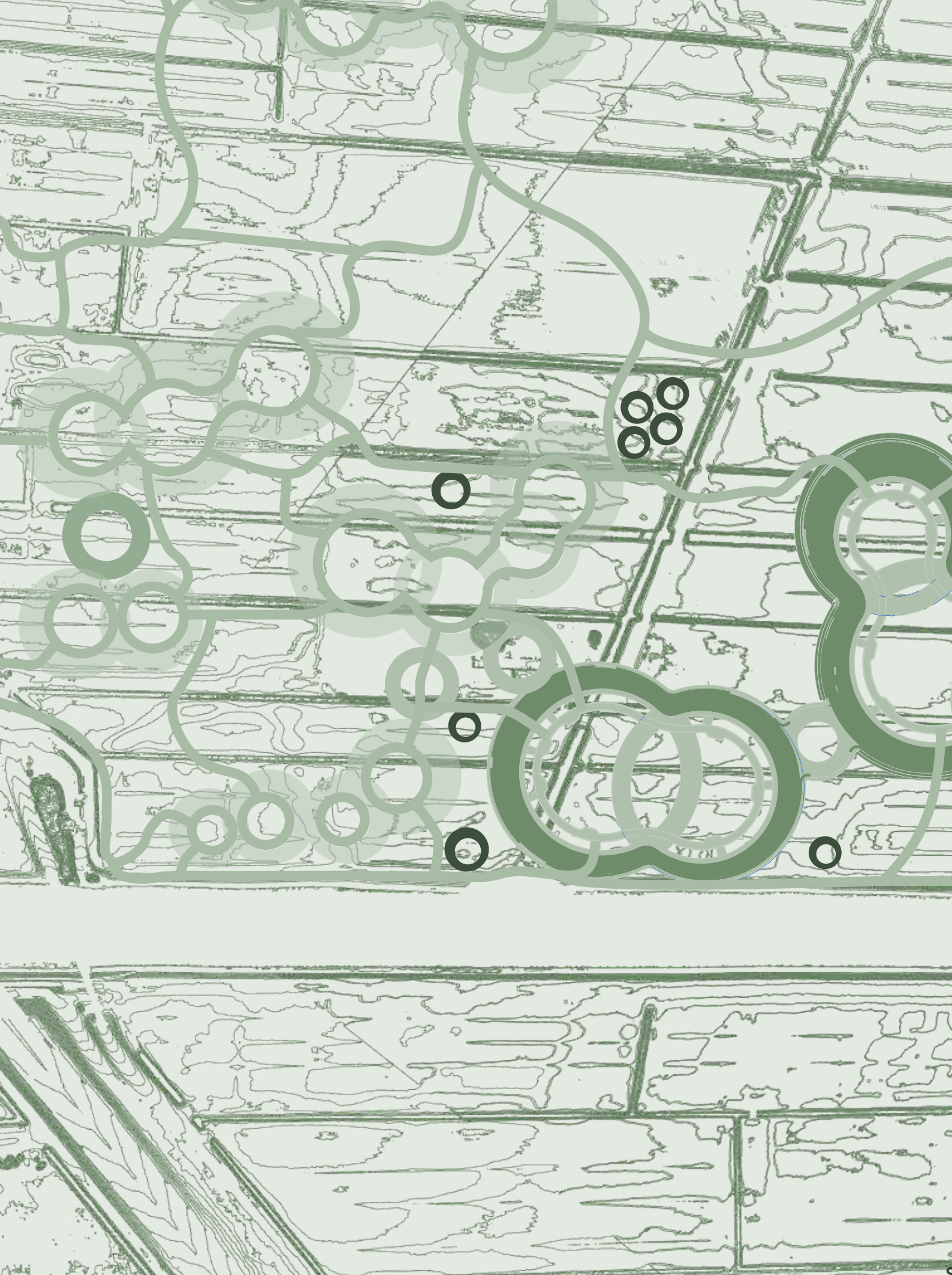
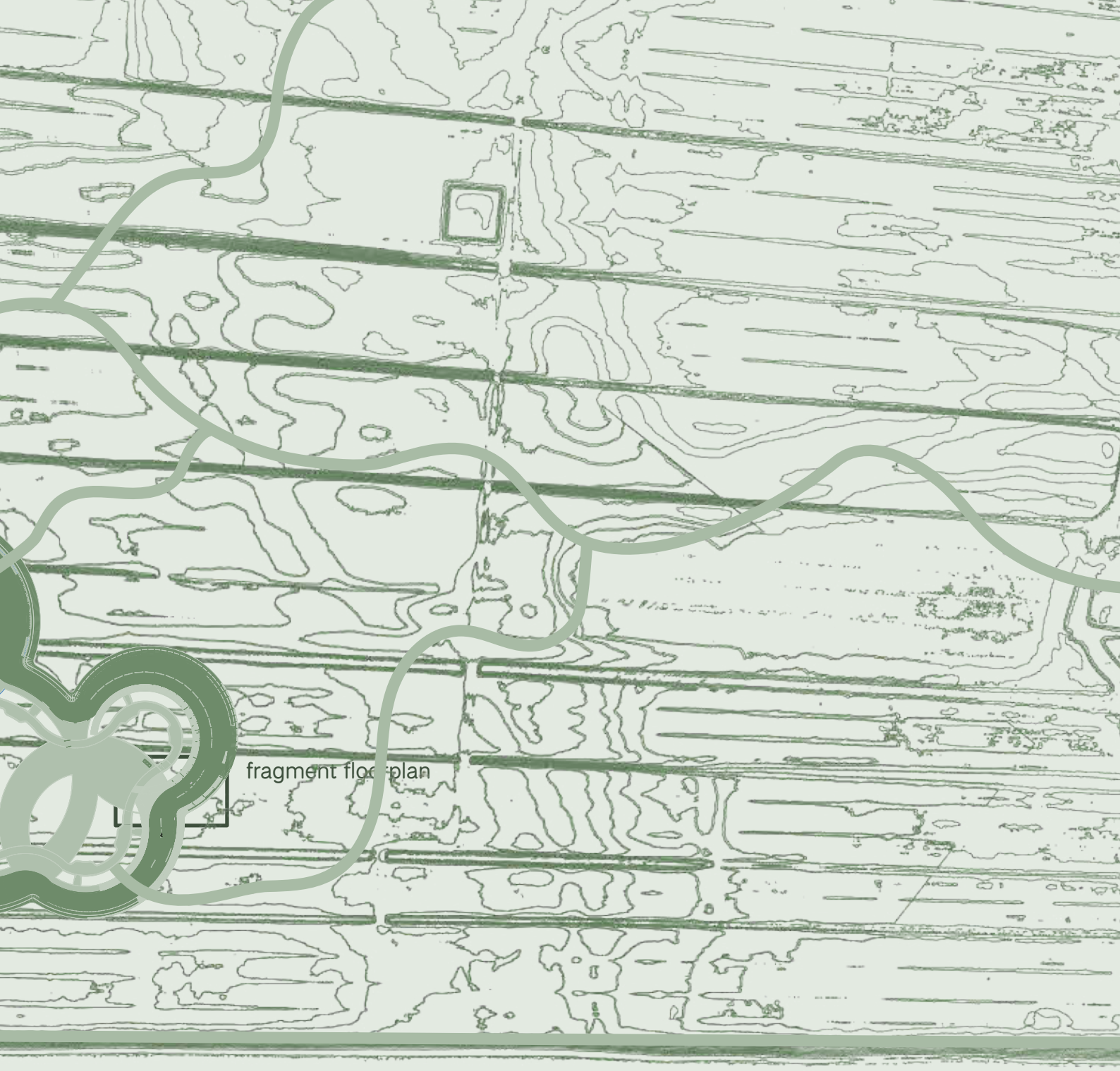


Figure 54: siteplan (van Hoorn, 2026)



SITE PLAN

SCALE 1:1250

0 m 15 m 30 m

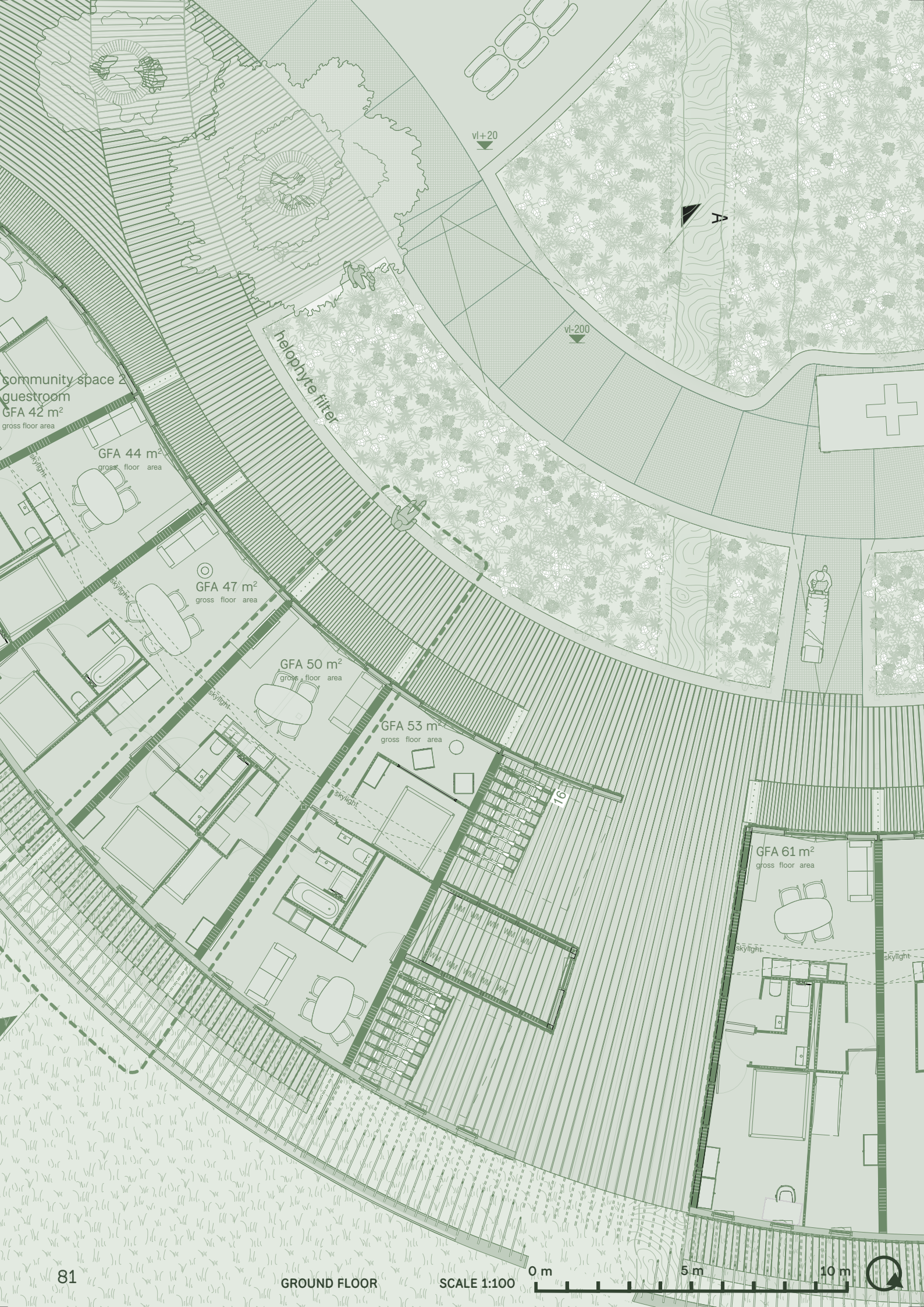


there are no apartments placed over the ditched, this to preserve the sightlines over the water. Alongside these open spaces are bike racks and shared washing machines.

Each corner where two circles collide provide spaces for the community such as places for familly and friends to stay.

The platform provides foodforests for the early bumble bee and humans,

Figure 55: floorplan, 1:200 (rescaled) (van Hoorn, 2026)



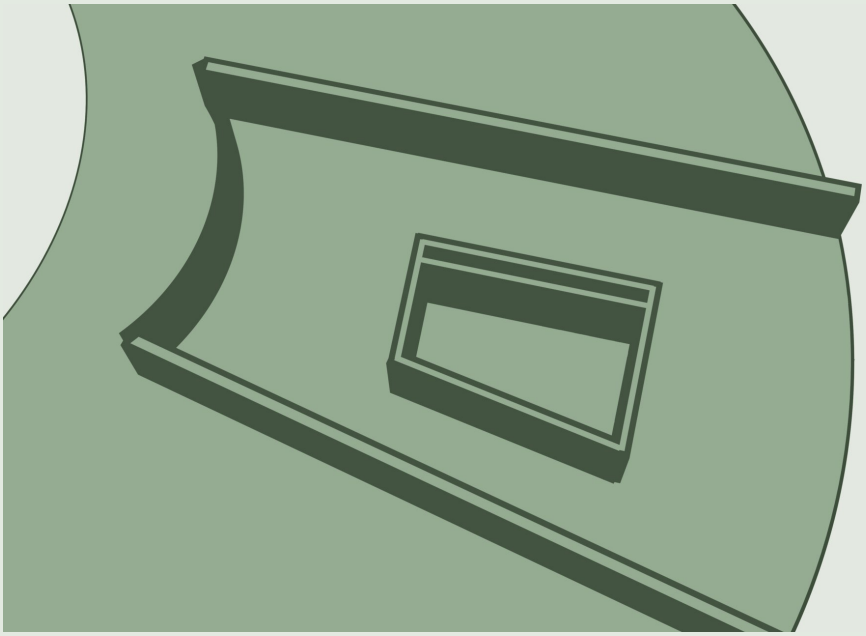
GROUND FLOOR

SCALE 1:100

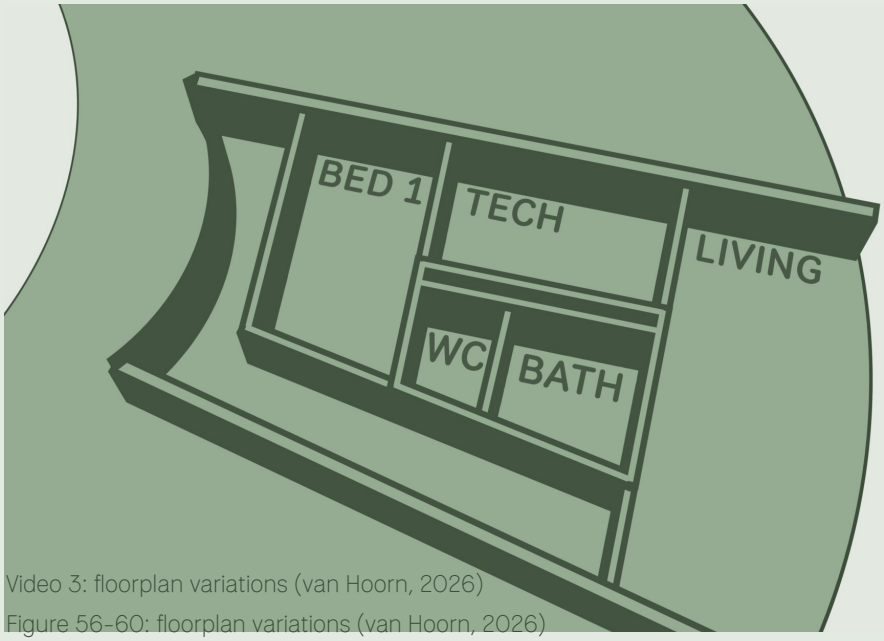
ADAPTABILITY

The adaptability is further enhanced by the open floor plan and fixed utility shaft. Other functions, such as bathrooms, kitchens, toilets and living spaces, can be located around this area.

click here to watch explaination video



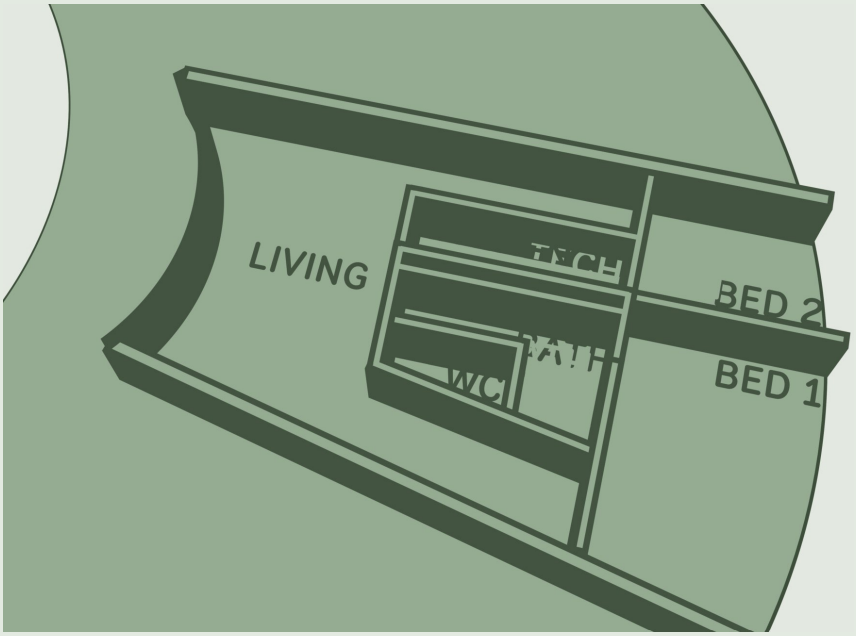
fixed core



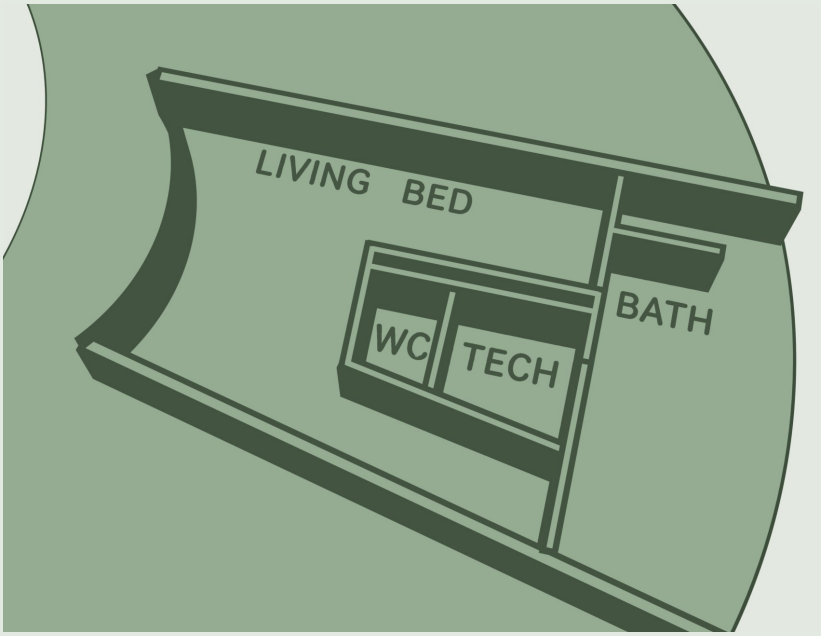
variation 1

Video 3: floorplan variations (van Hoorn, 2026)

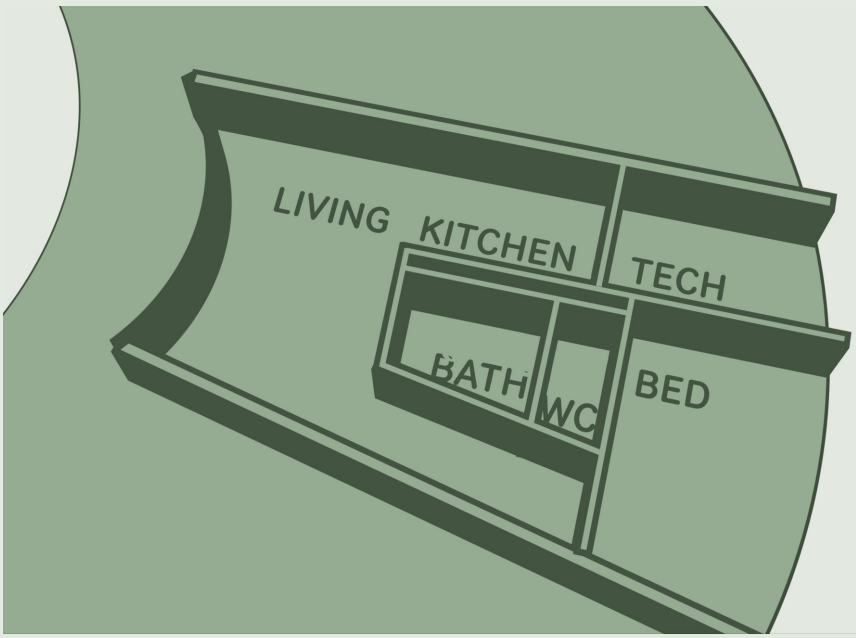
Figure 56-60: floorplan variations (van Hoorn, 2026)



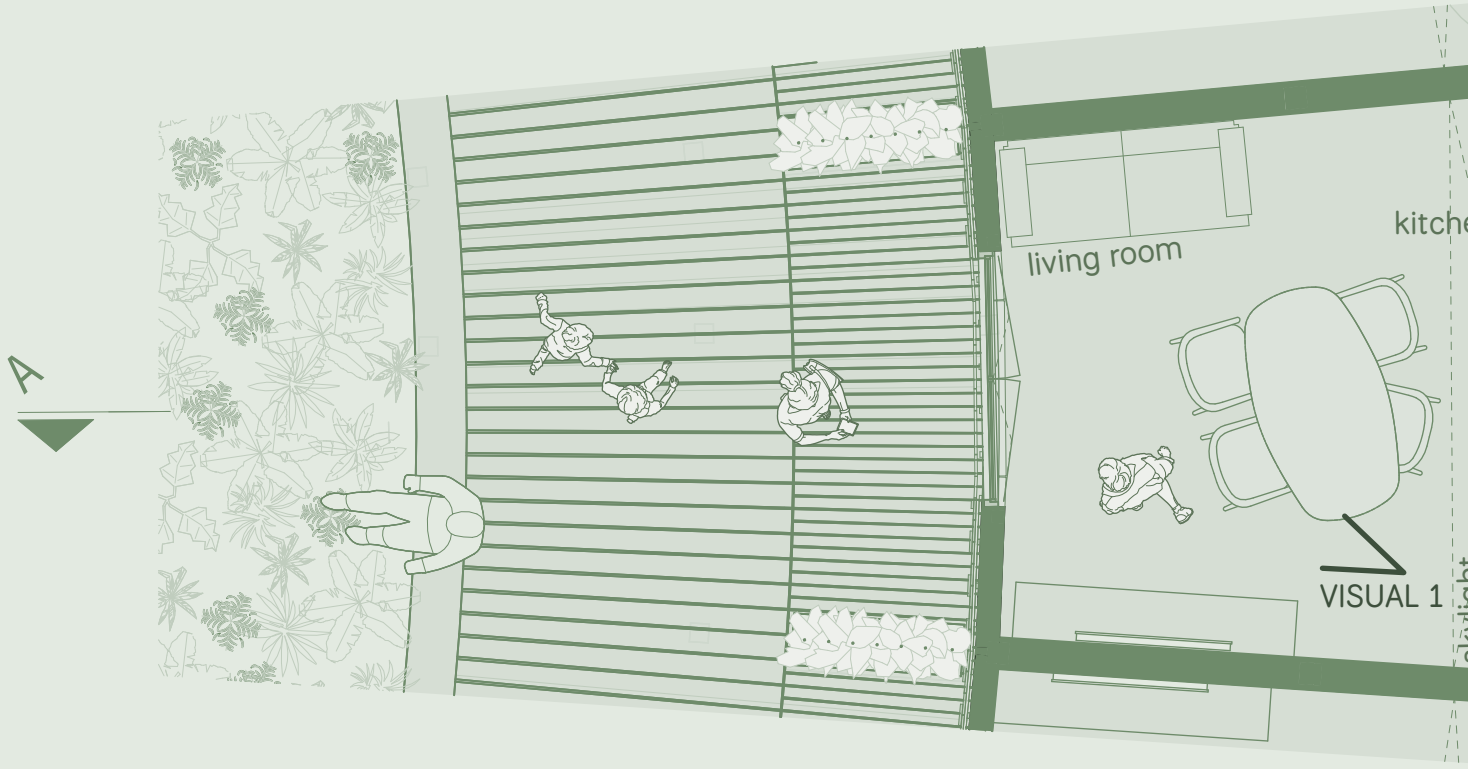
variation 2



variation 3



variation 4



variant 1, 1:60

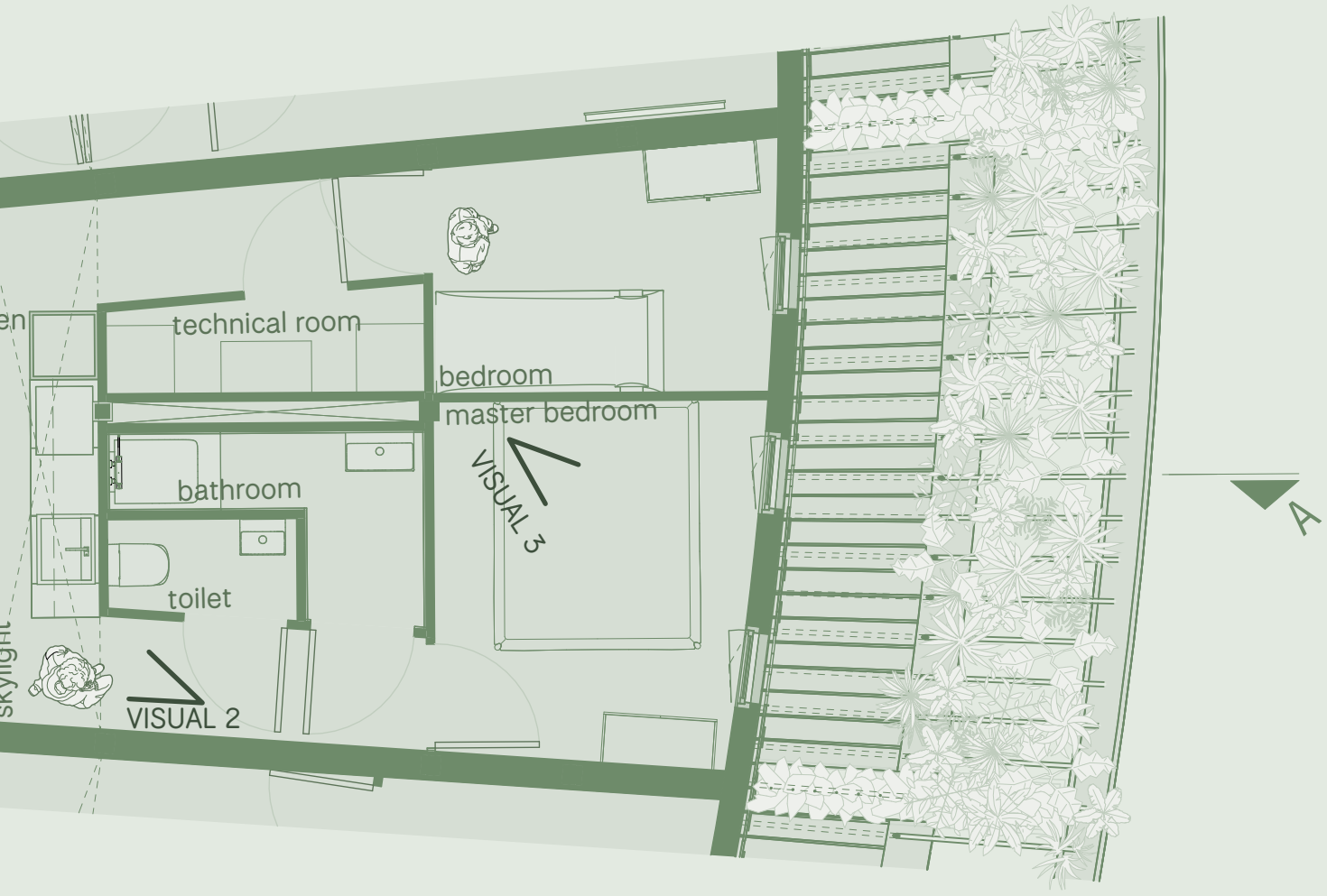


Figure 61: floorplan variant 1 (van Hoorn, 2026)





Figure 62: rendering interior (van Hoorn, 2026)





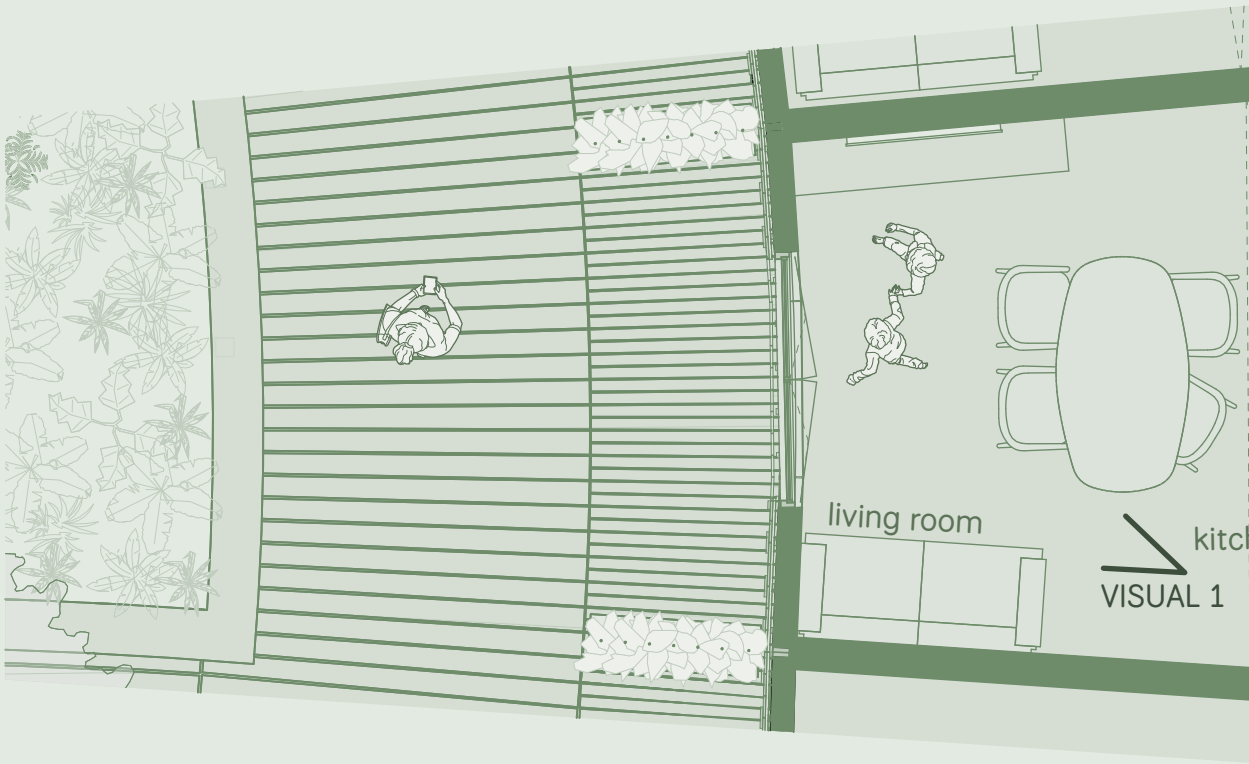
Figure 63: rendering interior (van Hoorn, 2026)

At the bottom of the green facade is a shallow pool. This pool promotes the serene effect of the facade in the room by their reflections. The pool gets its water from the downpipes.





Figure 64: rendering interior (van Hoorn, 2026)



variant 2, 1:60

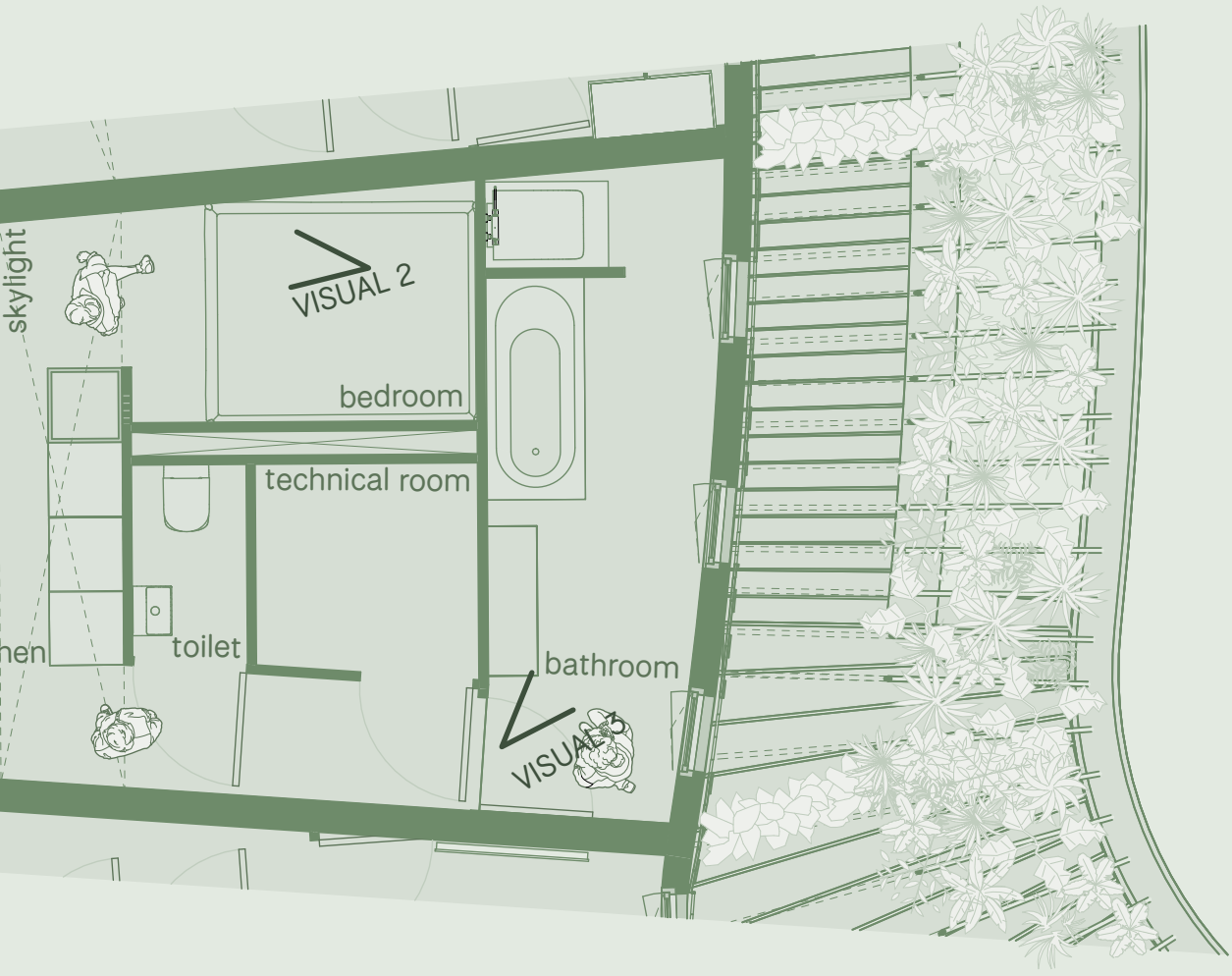




Figure 65: floorplan variant 2 (van Hoorn, 2026)





Figure 66: rendering interior (van Hoorn, 2026)



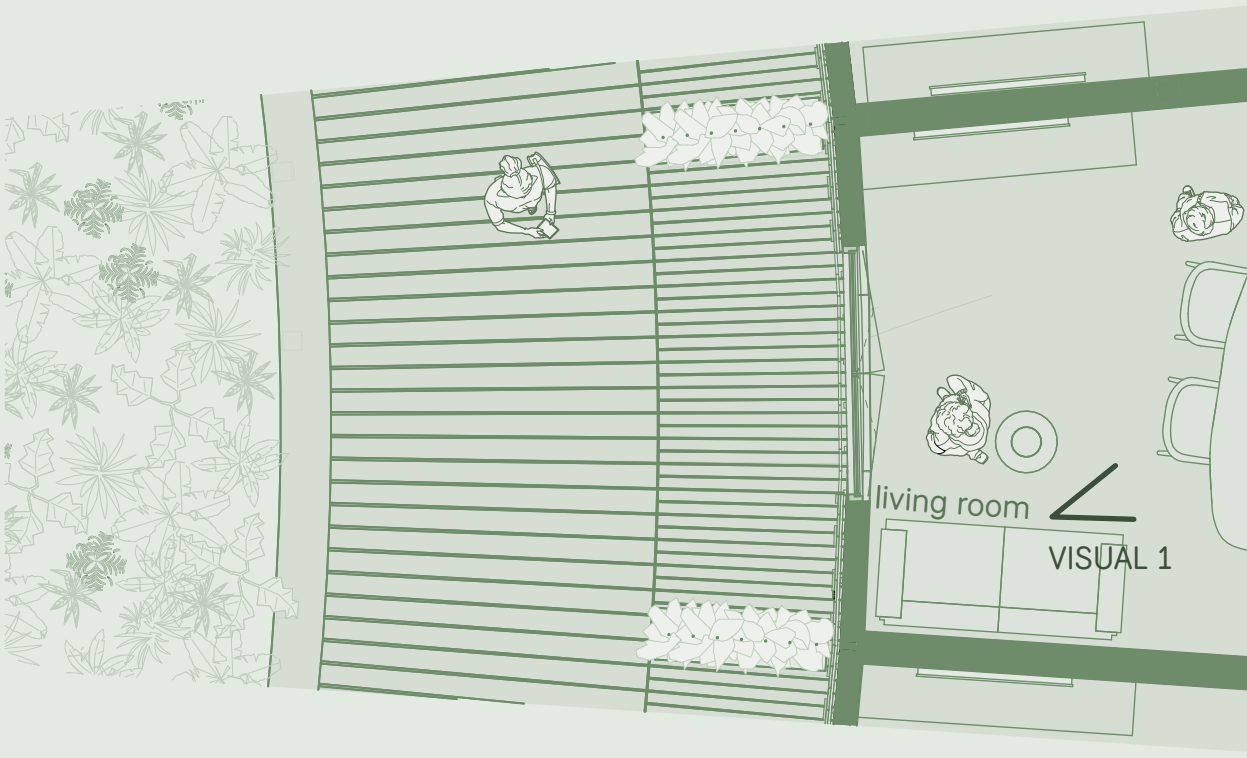


Figure 67: rendering interior (van Hoorn, 2026)





Figure 68: rendering interior (van Hoorn, 2026)



variant 3, 1:60





Figure 69: floorplan variant 3 (van Hoorn, 2026)





Figure 70: rendering interior (van Hoorn, 2026)



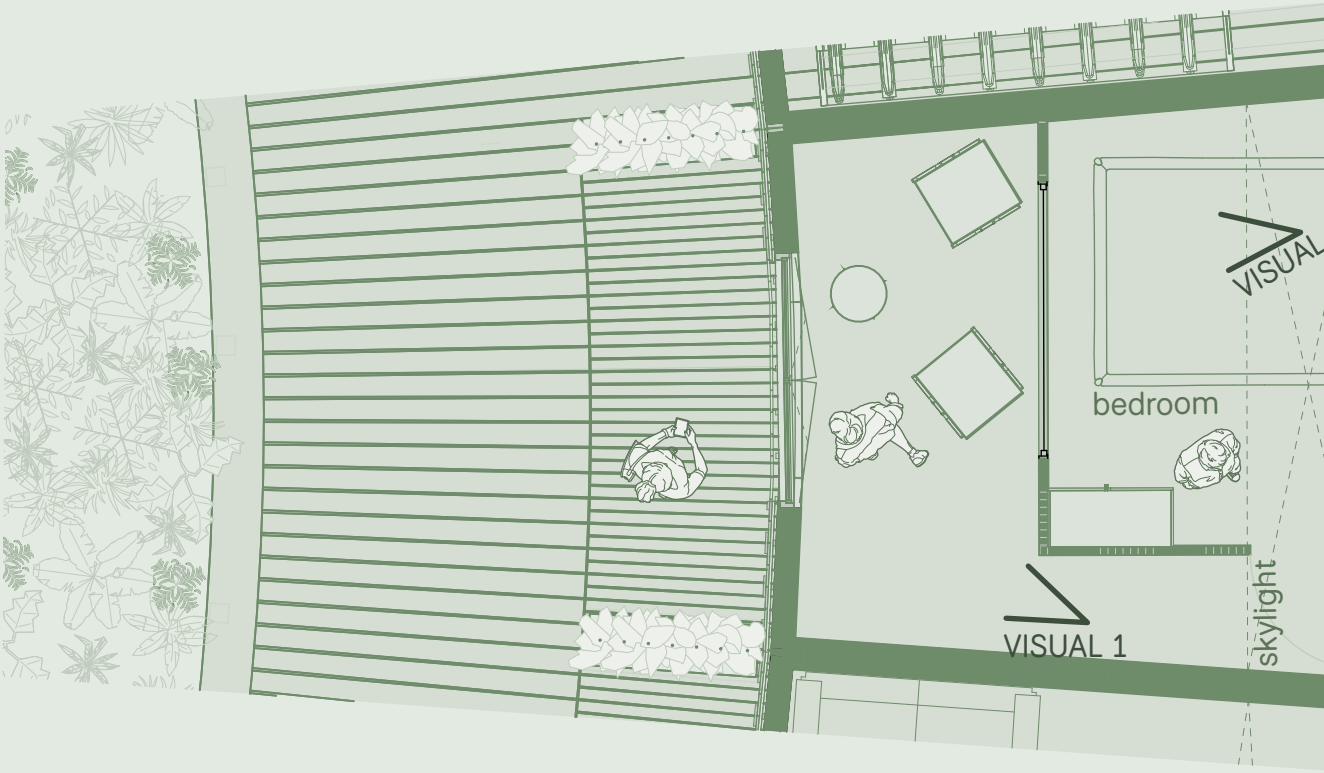


Figure 71: rendering interior (van Hoorn, 2026)

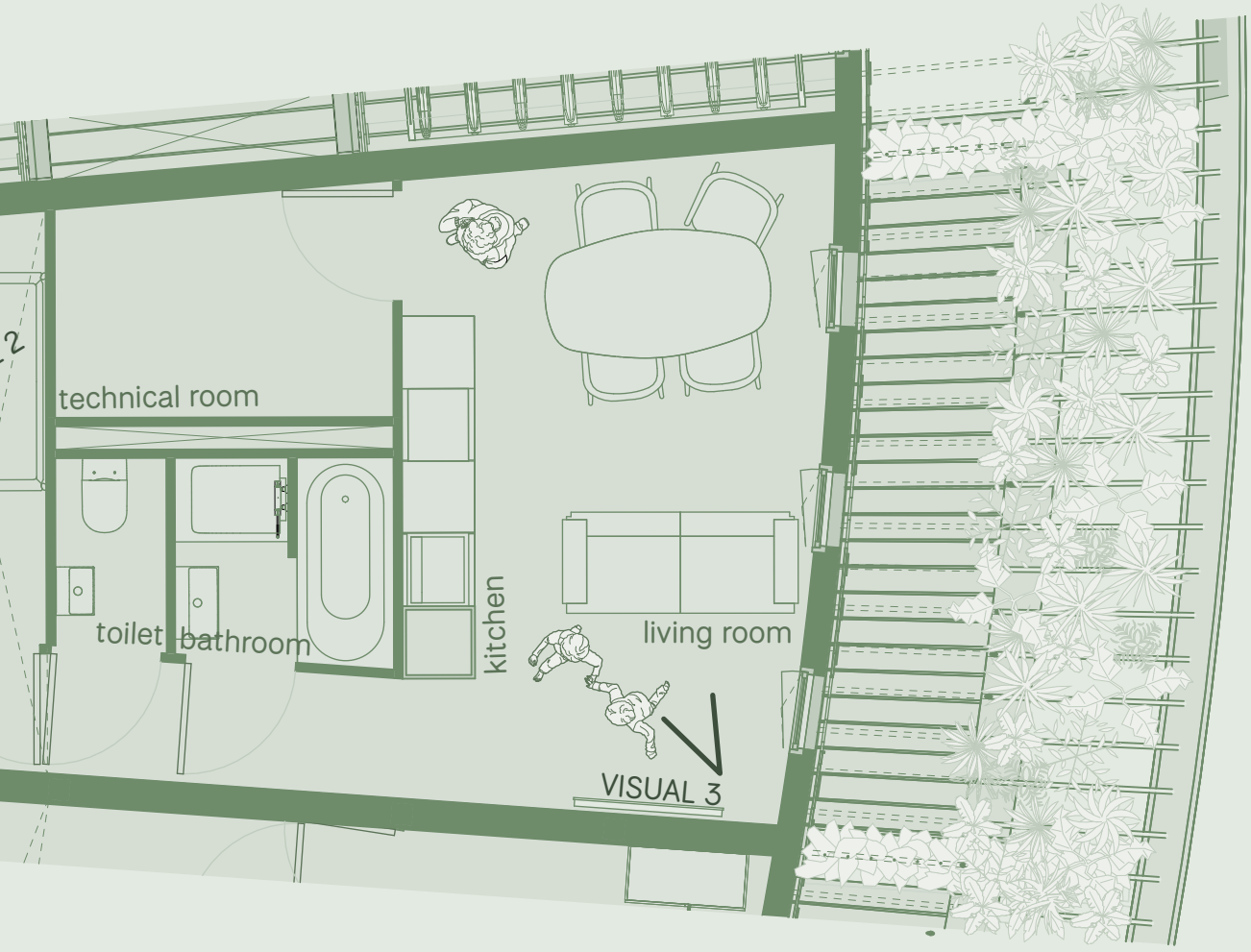




Figure 72: rendering interior (van Hoorn, 2026)



variant 4, 1:60



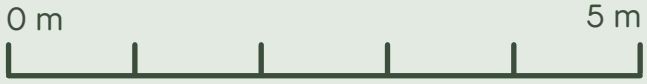


Figure 73: floorplan variant 4 (van Hoorn, 2026)





Figure 74: rendering interior (van Hoorn, 2026)



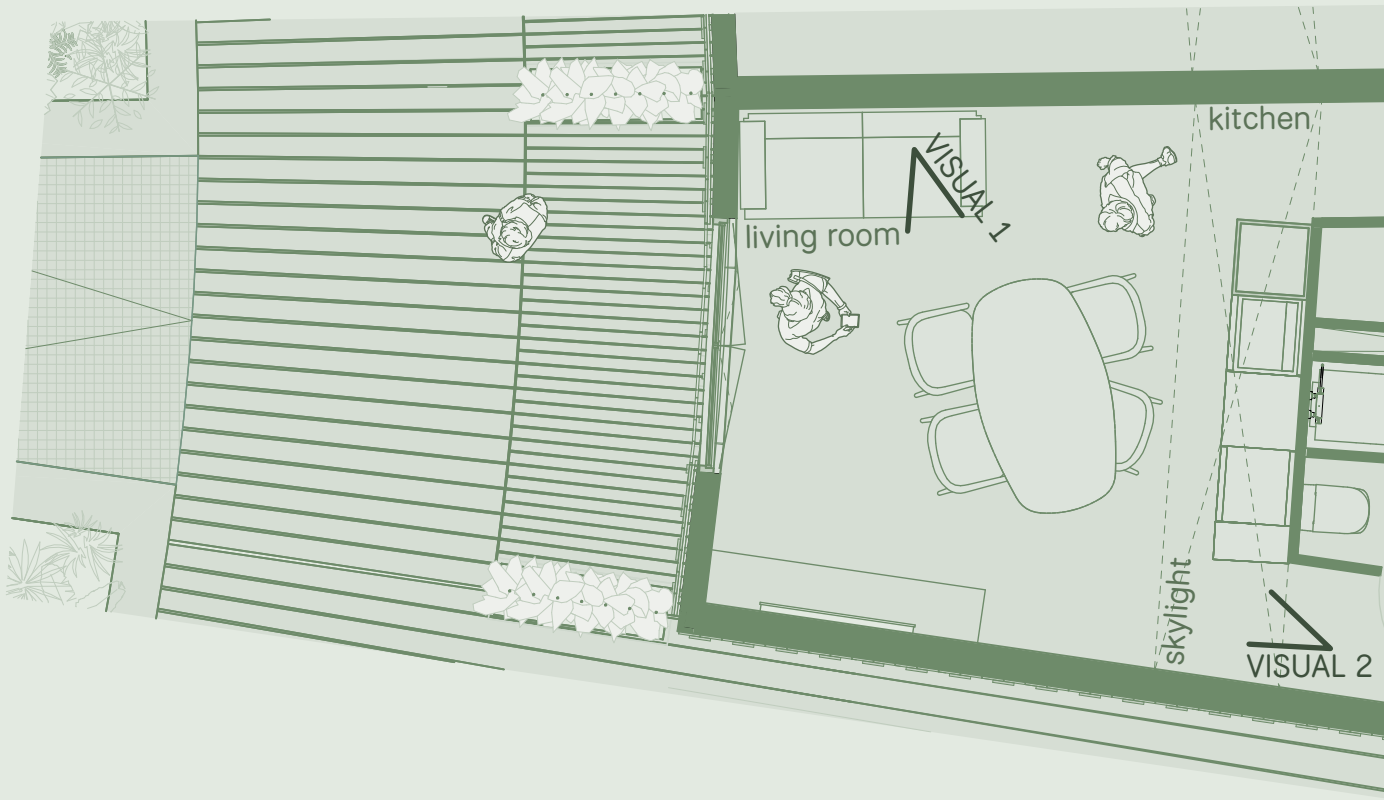


Figure 75: rendering interior (van Hoorn, 2026)





Figure 76: rendering interior (van Hoorn, 2026)



variant 5, 1:60





Figure 77: floorplan variant 5 (van Hoorn, 2026)





Figure 78: rendering interior (van Hoorn, 2026)





Figure 79: rendering interior (van Hoorn, 2026)





Figure 80: rendering interior (van Hoorn, 2026)

Figure 81: 1:20 section A-A (rescaled)(van Hoorn, 2026)

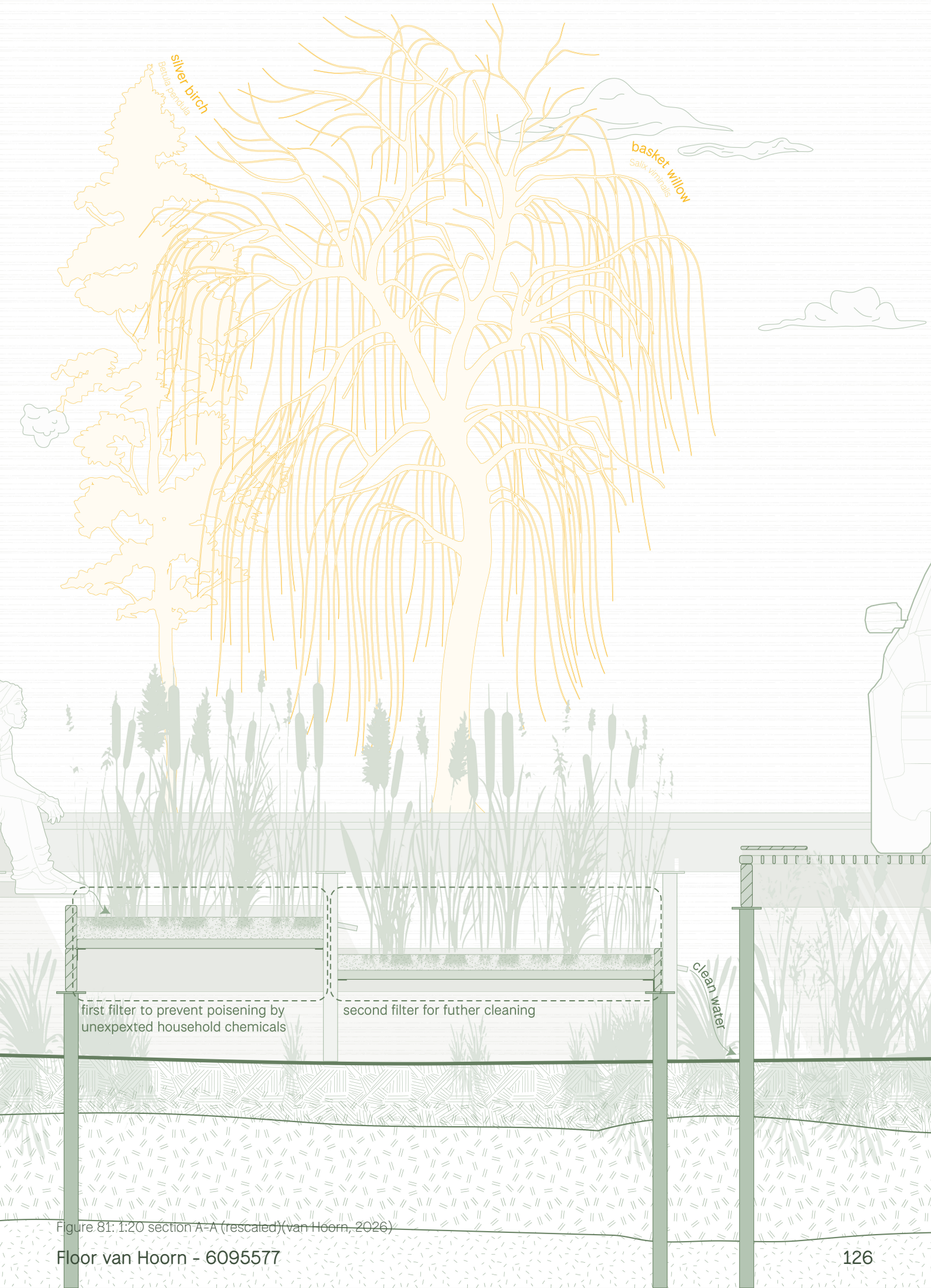
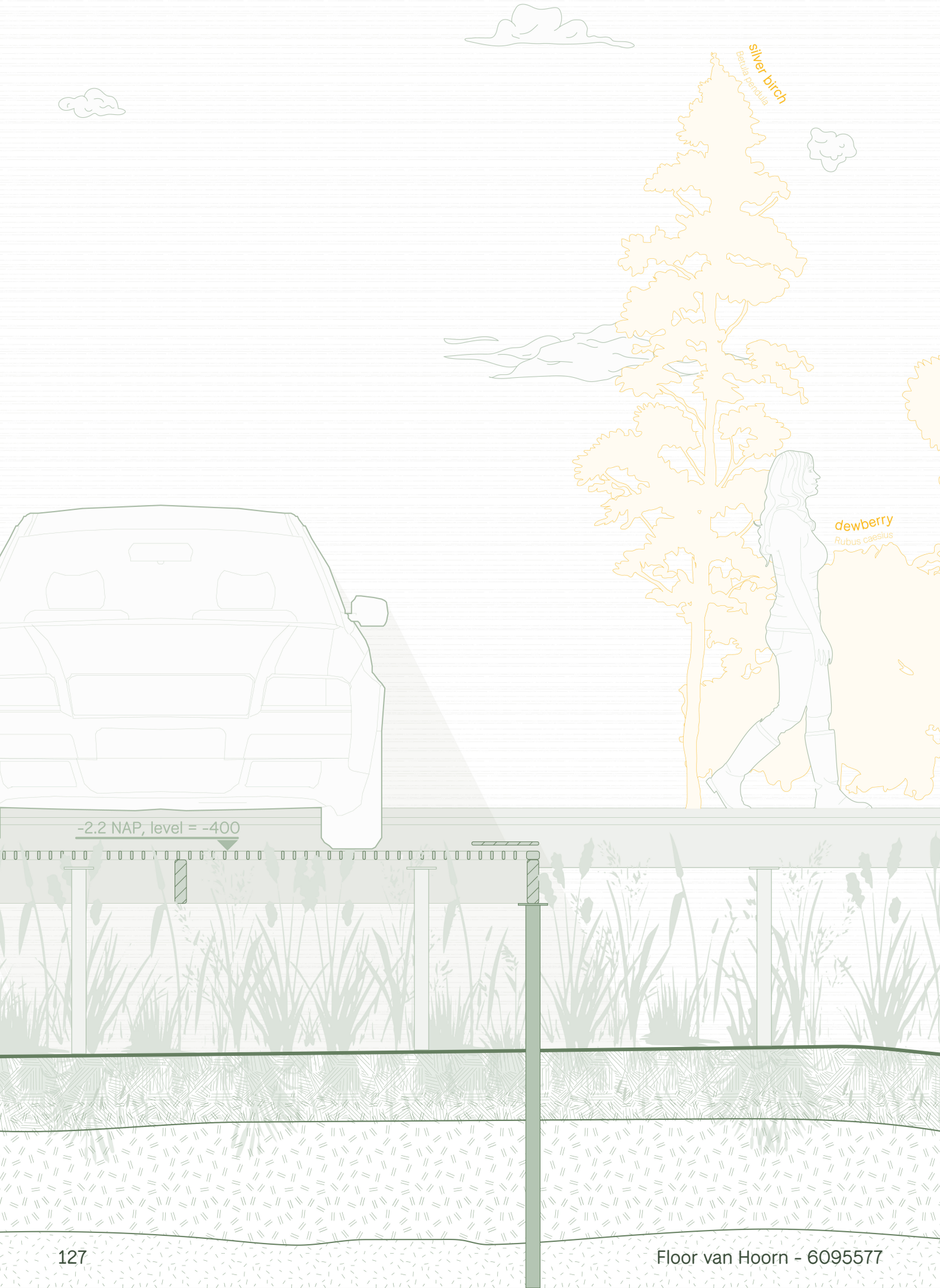


Figure 81: 1:20 section A-A (rescaled)(van Hoorn, 2026)


silver birch
Betula pendula
dewberry
Rubus caesius
-2.2 NAP, level = -400

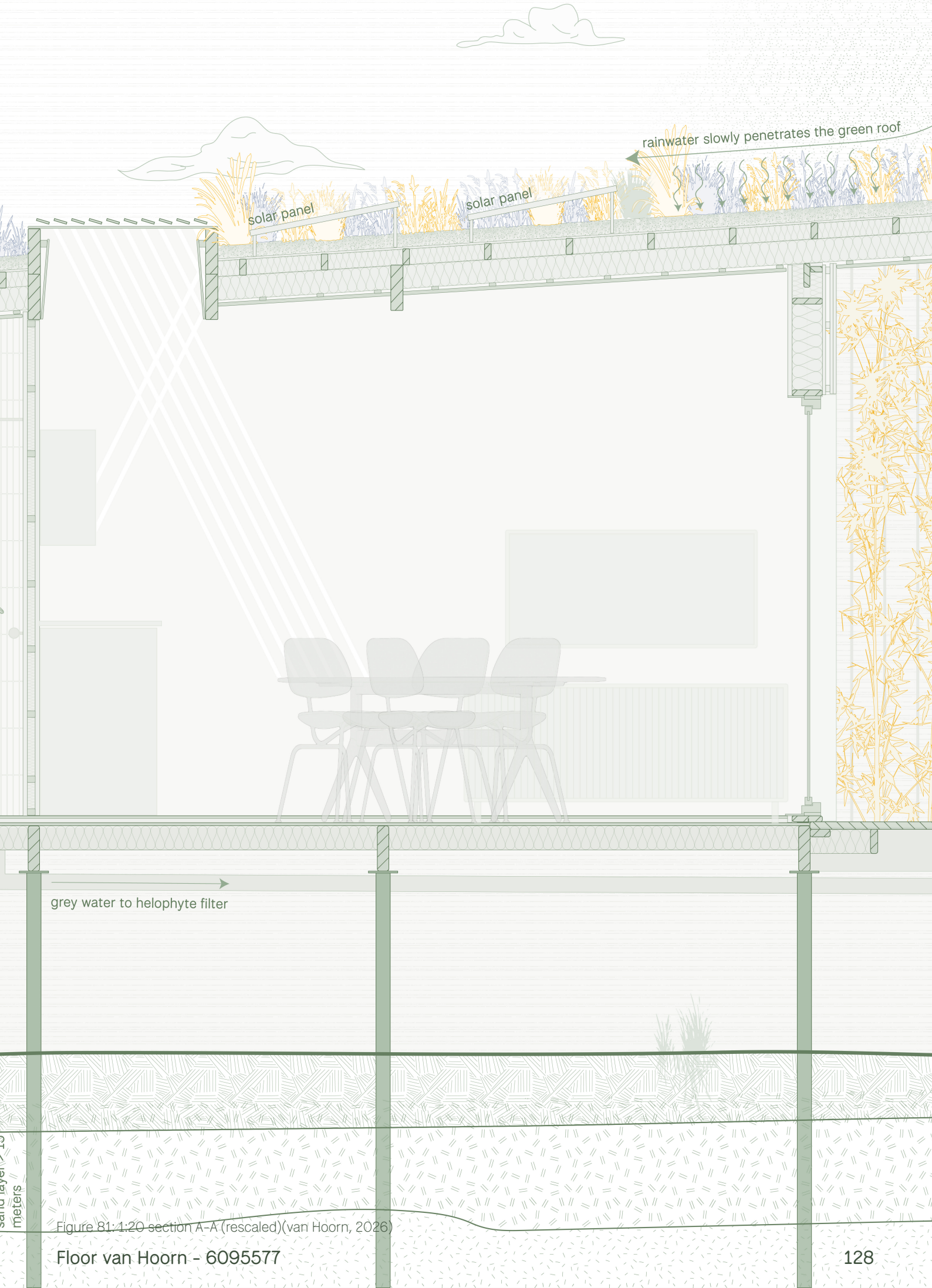


Figure 81: 1:20 section A-A (rescaled)(van Hoorn, 2026)

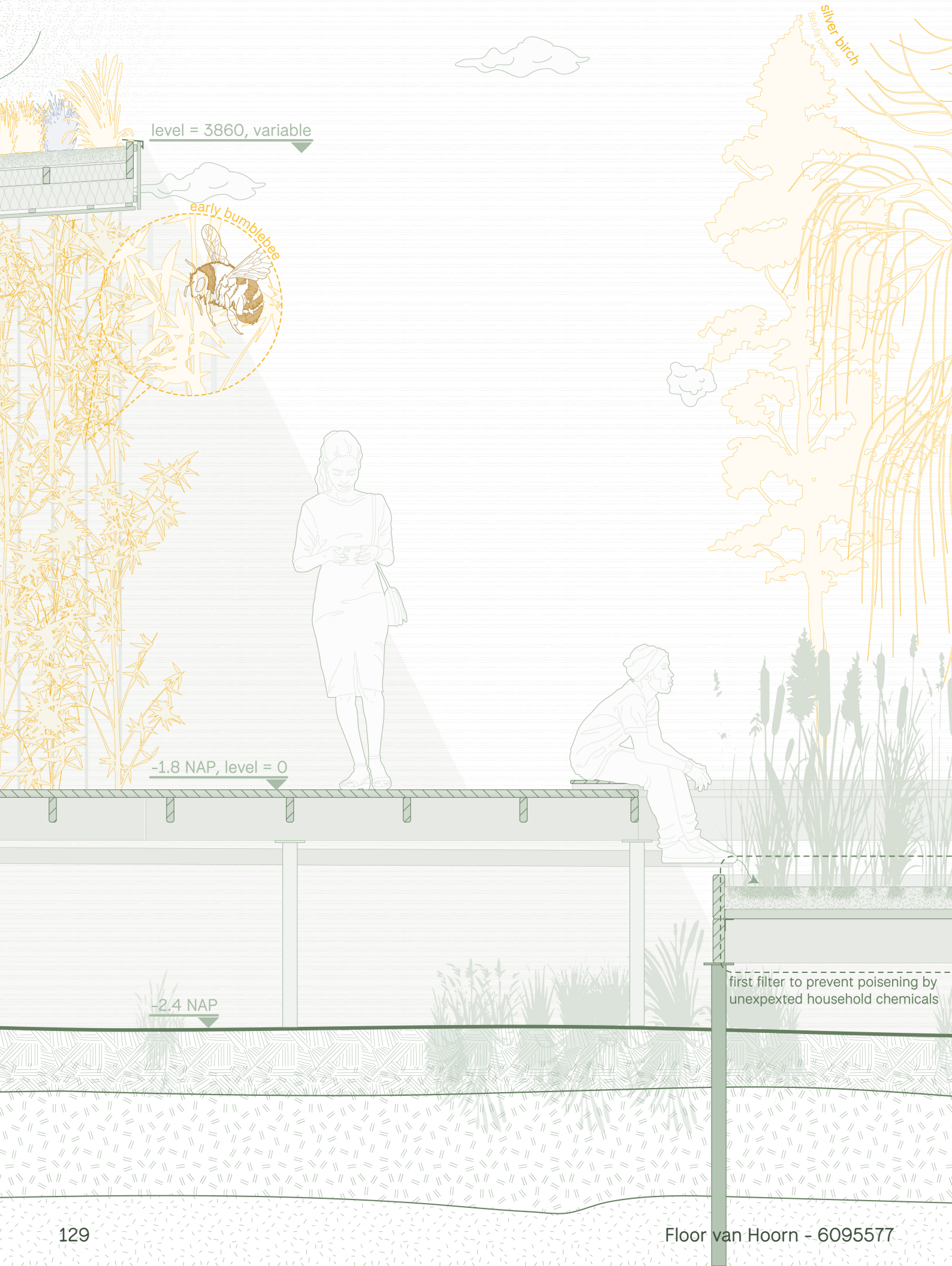
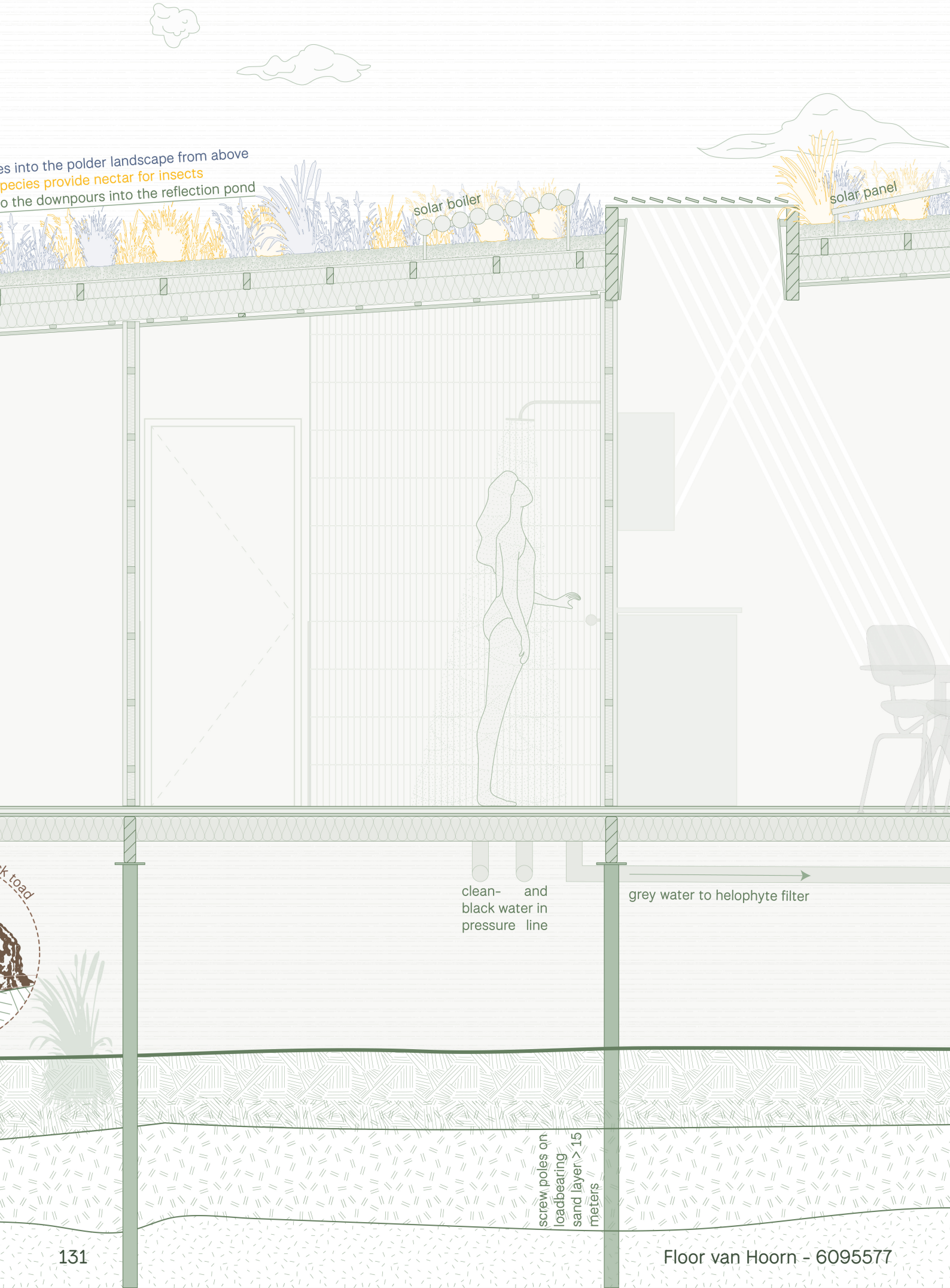

silver birch
Betula pendula
level = 3860, variable
early bumblebee
-1.8 NAP, level = 0
-2.4 NAP
first filter to prevent poisening by
unexpexted household chemicals



Figure 81: 1:20 section A-A (rescaled)(van Hoorn, 2026)


es into the polder landscape from above
pecies provide nectar for insects
o the downpours into the reflection pond
solar boiler
solar panel
clean- and
black water in
pressure line
grey water to helophyte filter
screw poles on
loadbearing
sand layer > 15
meters

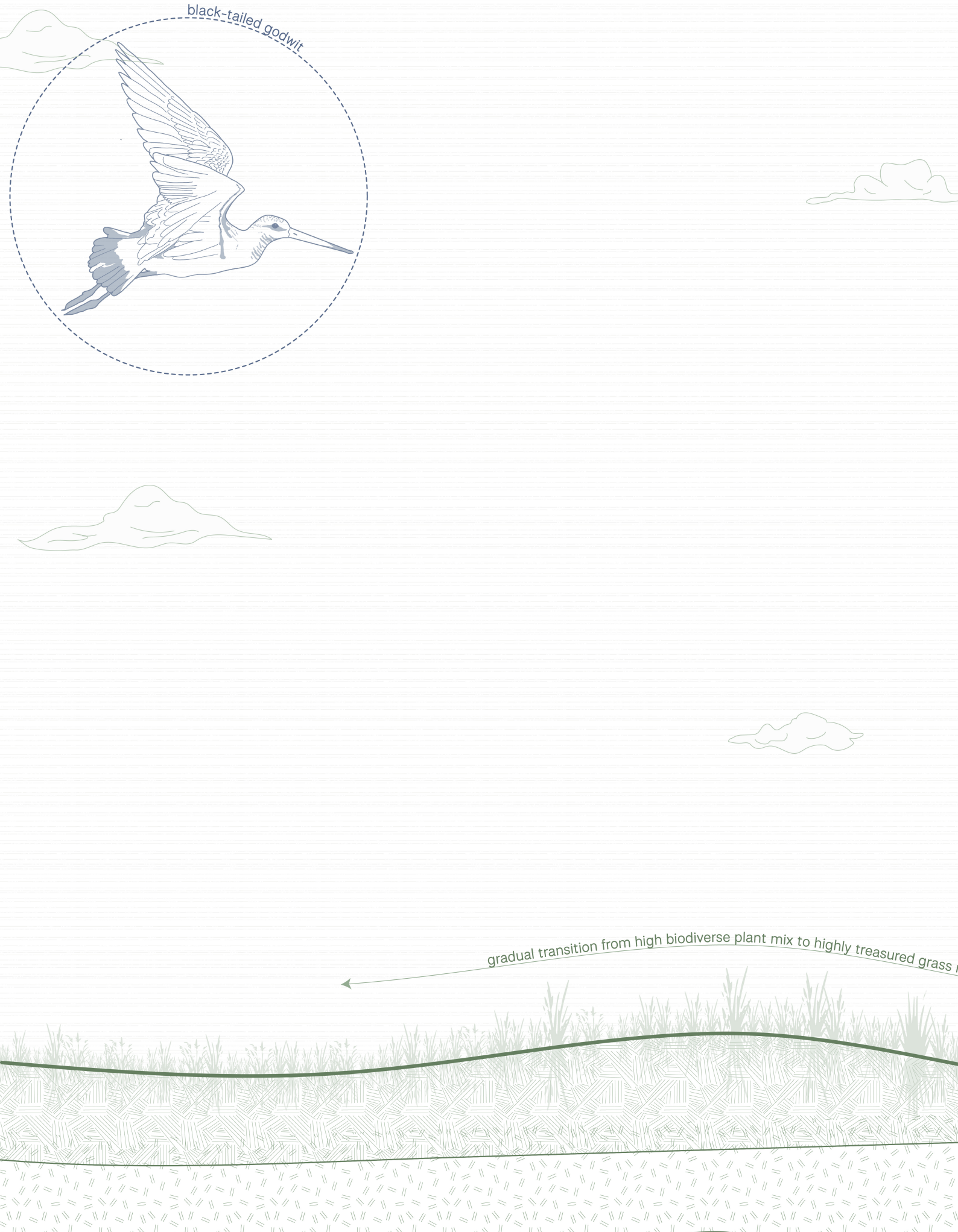
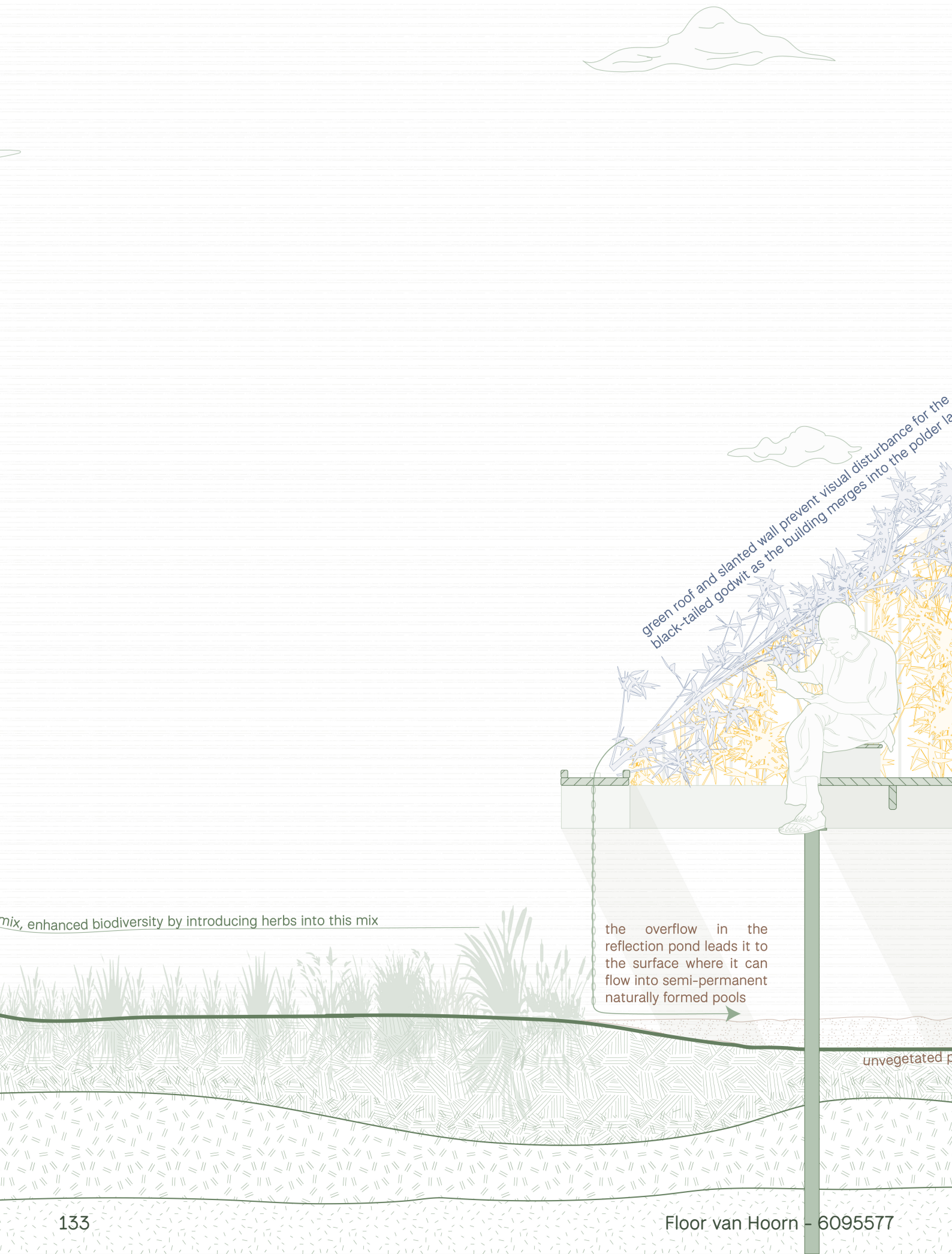
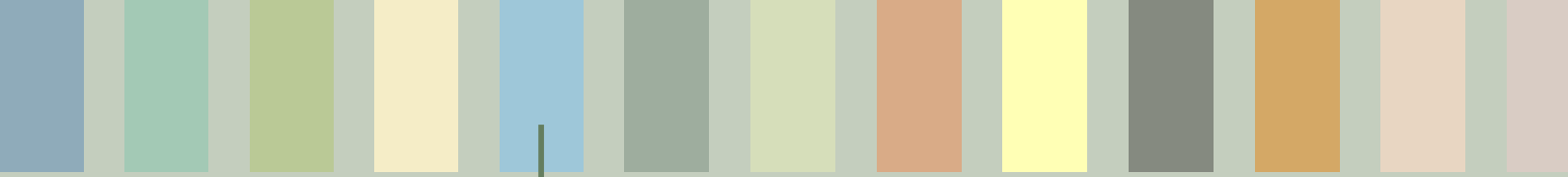


Figure 81: 1:20 section A-A (rescaled)(van Hoorn, 2026)


green roof and slanted wall prevent visual disturbance for the
black-tailed godwit as the building merges into the polder la
mix, enhanced biodiversity by introducing herbs into this mix
the overflow in the reflection pond leads it to the surface where it can flow into semi-permanent naturally formed pools
unvegetated p



hairy dragonfly

natterjack toad

black-taile

blue tints only on north and west facing facades as the early is more attracted to the colour blue and uses it to find nesting spots as well bumblebee

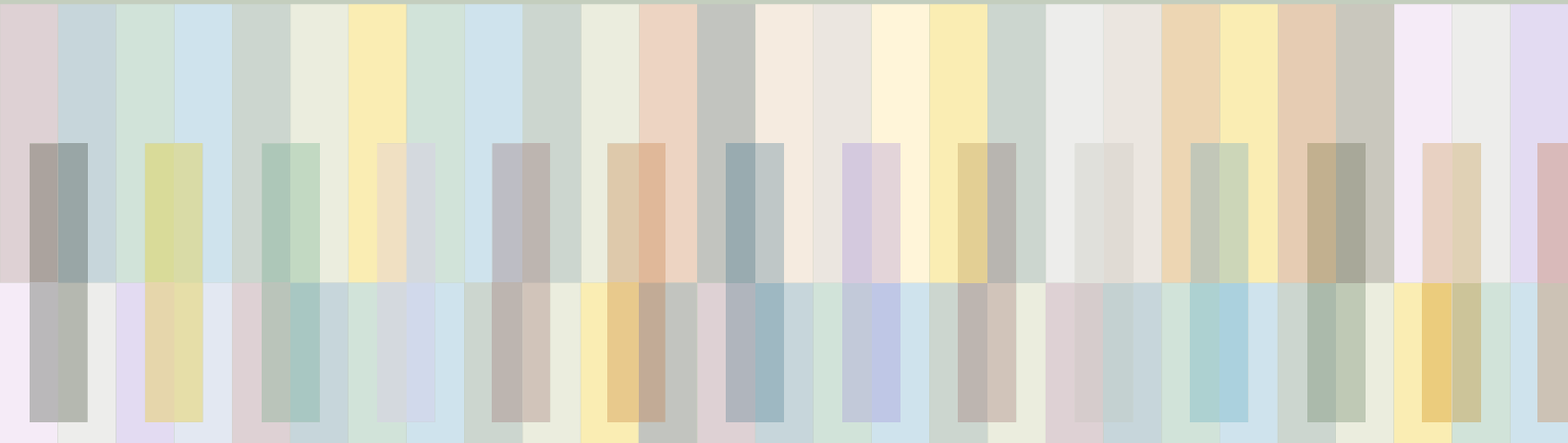
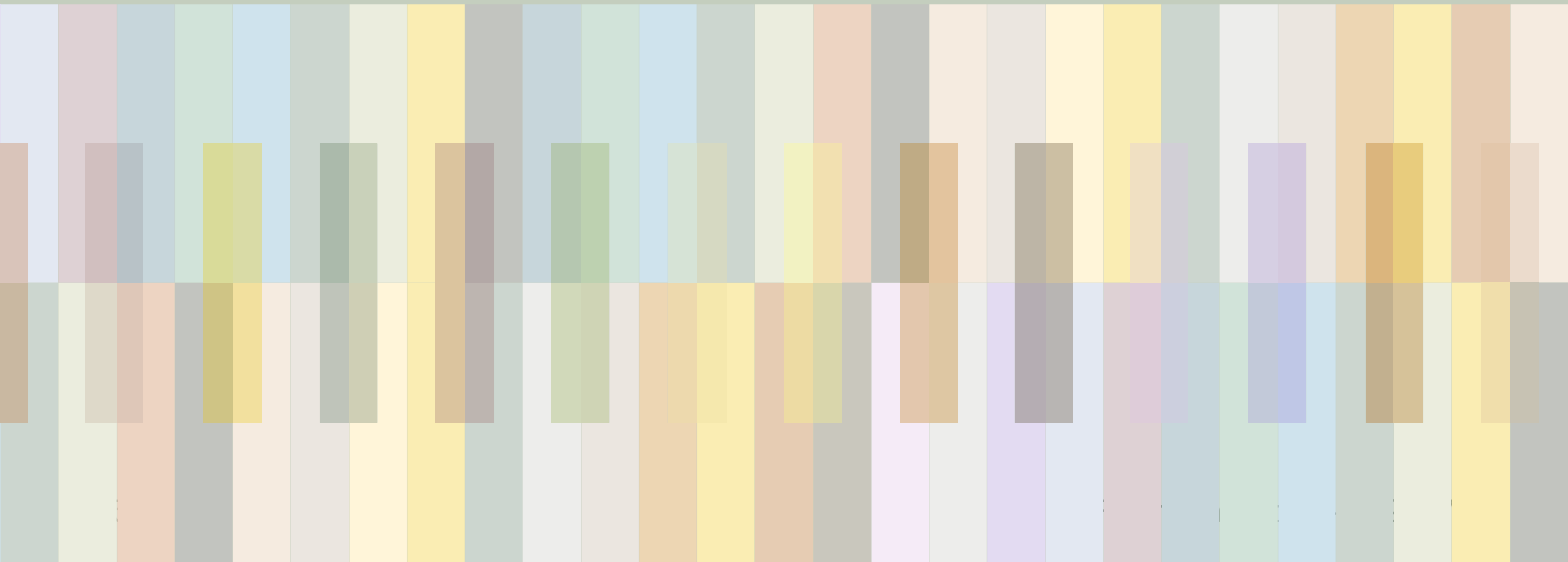


Figure 82: facade panels (van Hoorn, 2026)



tints from each animal are represented in the facade. The bottom layer consists of biobased composite sheets on which a translucent plate is assed, creating a large range of colours, repesenting the small alterations in each animal.



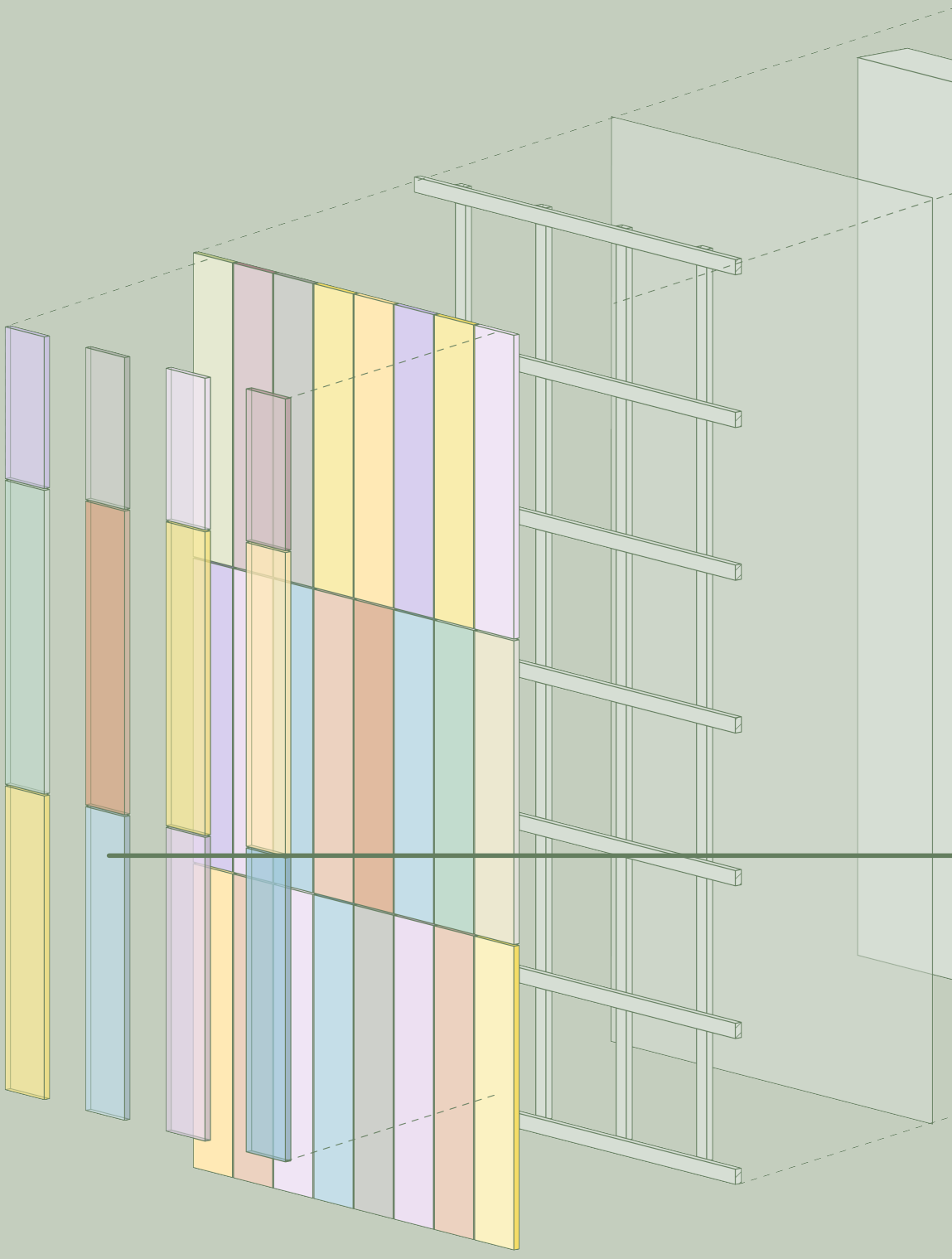
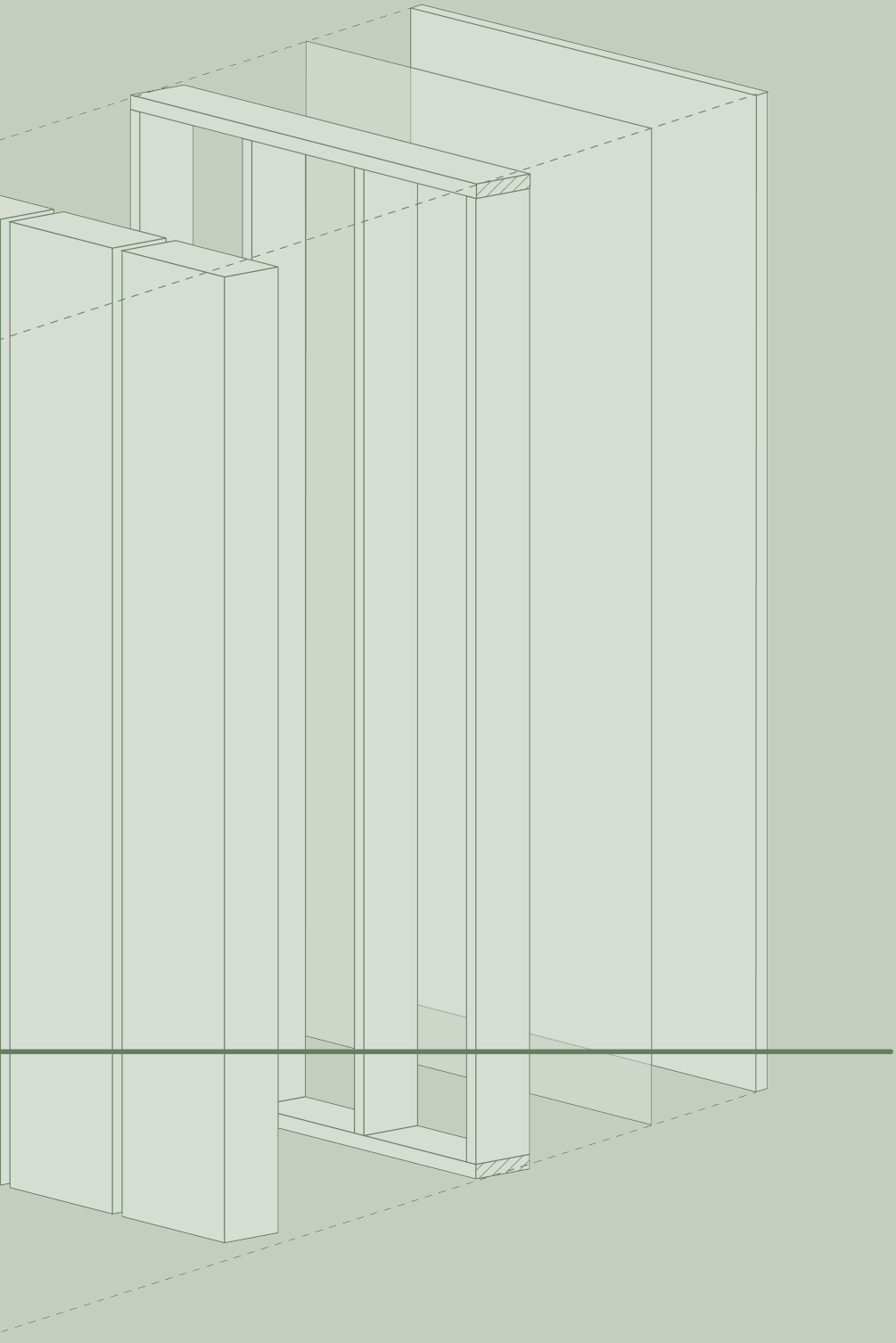


Figure 83: exploded view front facade (van Hoorn, 2026)



‘photoframe’ in facade, sightlines around the ditches remain visible.

native vegeta
biodivesity t
reducing the
‘grassphalt in

plants around waterways stimulate a suitable living place for the hairy dragonfly and the bitterling.

blue panels provide nesting places for the early bumblebee



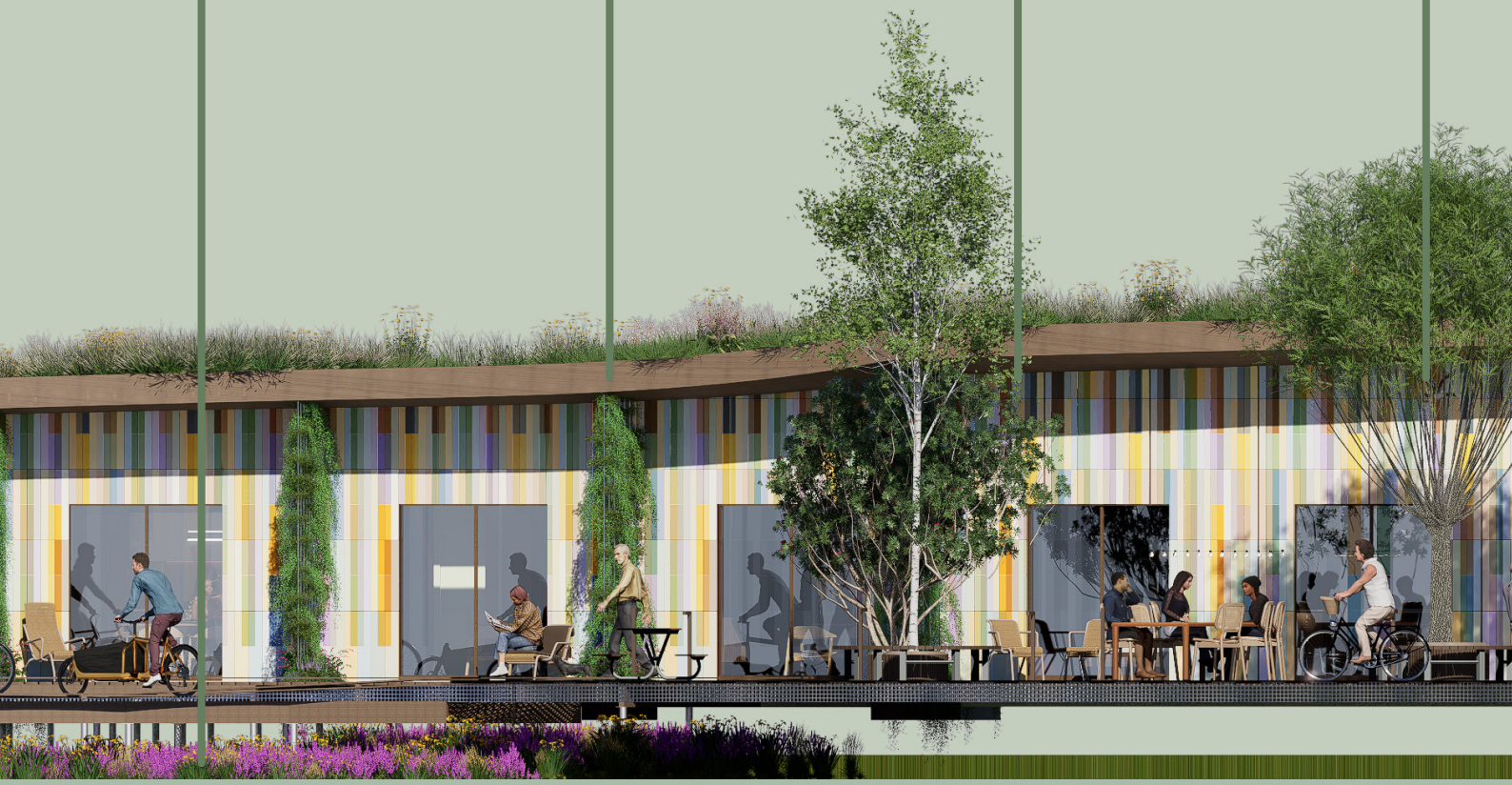
Figure 84: front facade (van Hoorn, 2026)

ation, returing
o the land,
amount of
the polder.

variable roof height, based on the distance to the nest of the black-tailed godwit. minimum 3,2 m, maximum 14 m

green roof merges into the polder landscape from above, reducing visual disturbance for the black-tailed godwit.

foodforest with combined community space. Edible plants for the early bumble bee and humans



There are several bumblebee nests in the façade. These are accessible via a hole at the bottom of the blue facade, which is a colour that attracts bumblebees and helps them to find a nesting spot. As the nests are located near the private areas of the platform, any objects placed on the platforms by the inhabitants can help male bumblebees to find the nests, as these act as recognising beacons. The nests can be accessed by removing some façade panels in order to refill the nesting materials needed in spring.



Figure 85: rendering early bumble nest in facade (van Hoorn, 2026)



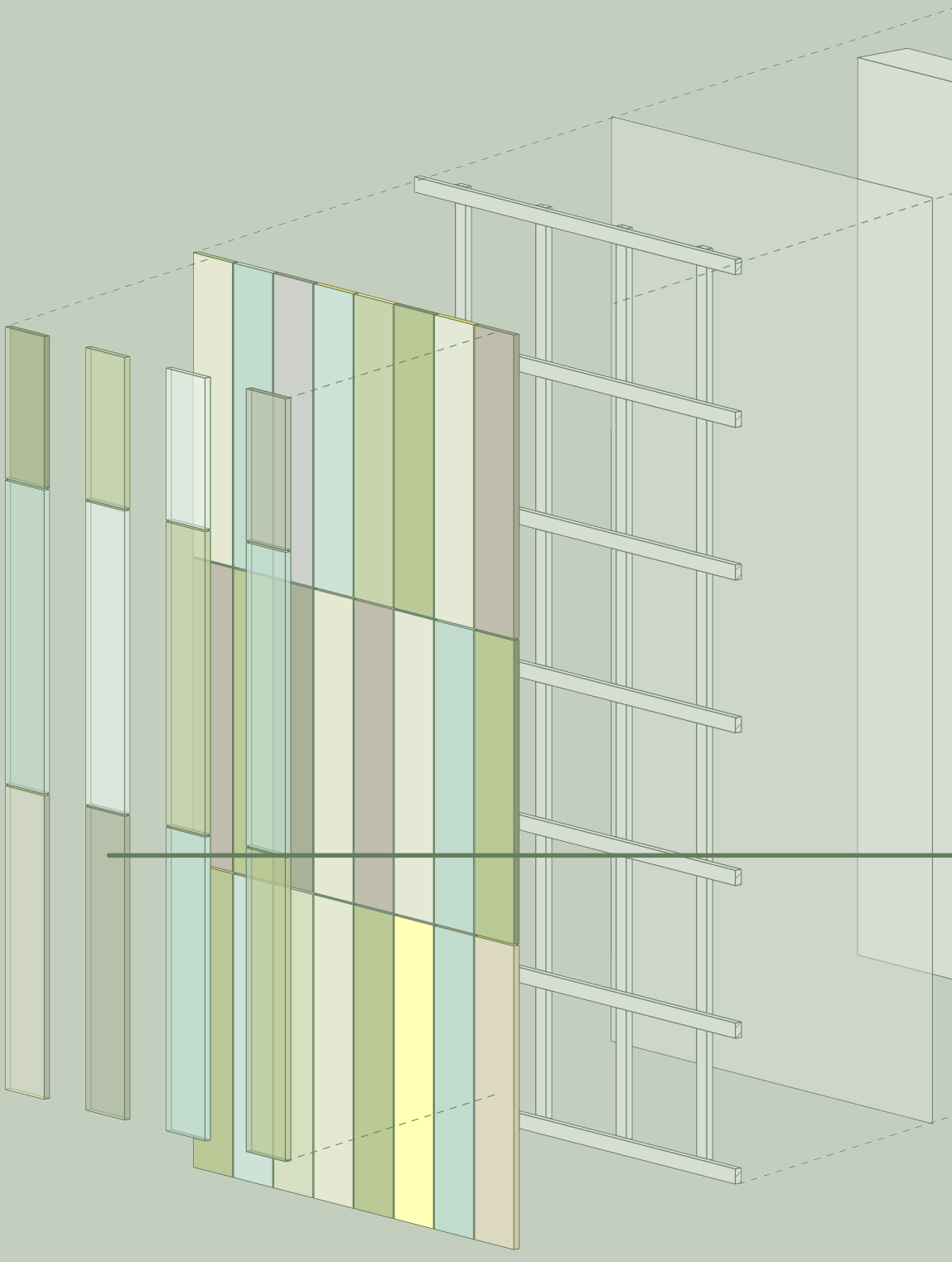
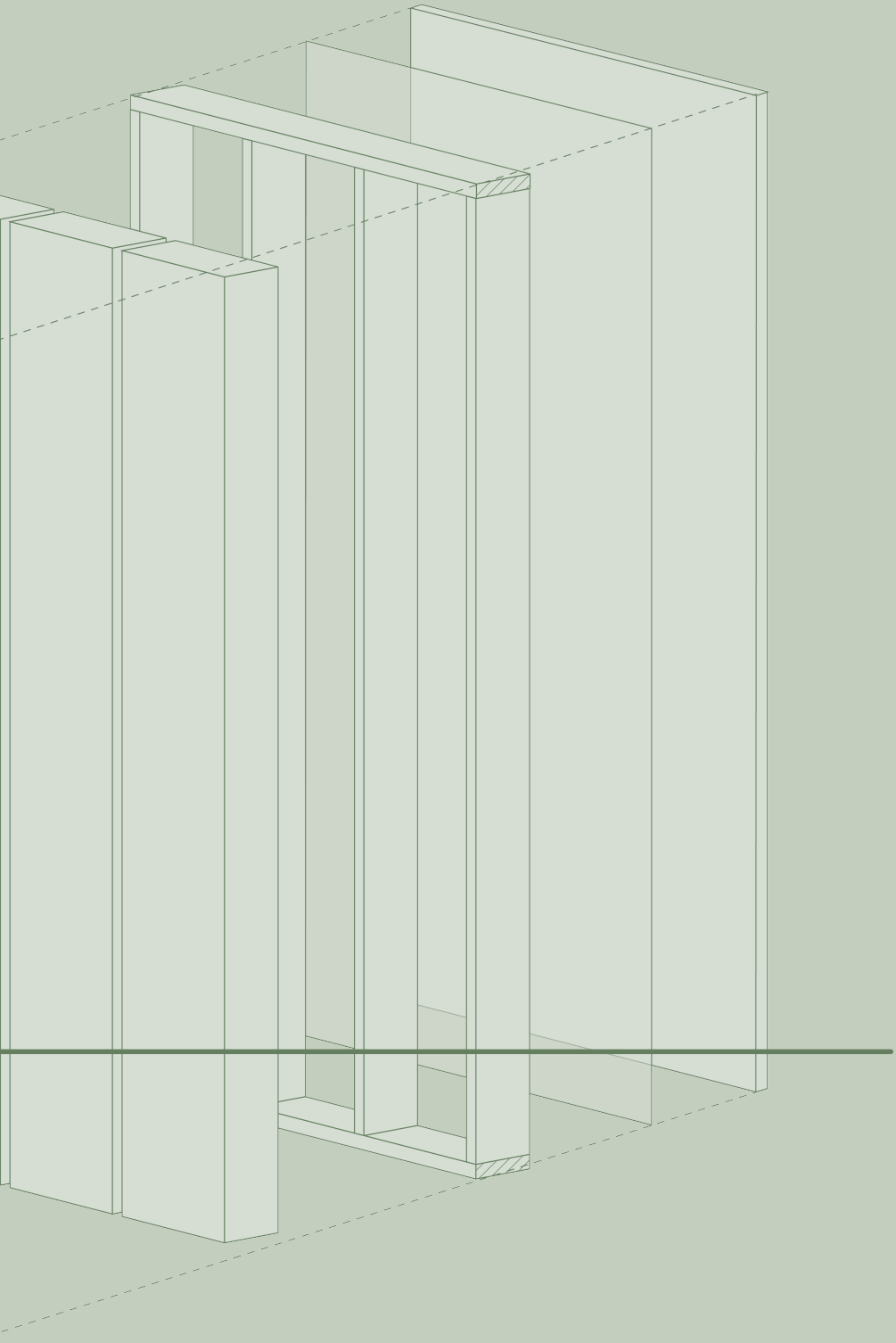


Figure 86: exploded view rear facade facade (van Hoorn, 2026)



vegetation rods are alternated with downpipes, these lead to the reflection pond, leading to the surface

native vegeta
biodivesity t
reducing the
'grassphalt in

foodforest with combined community space. Edible plants for the early bumble bee and humans

green 'curtain' provides shaded private teracces

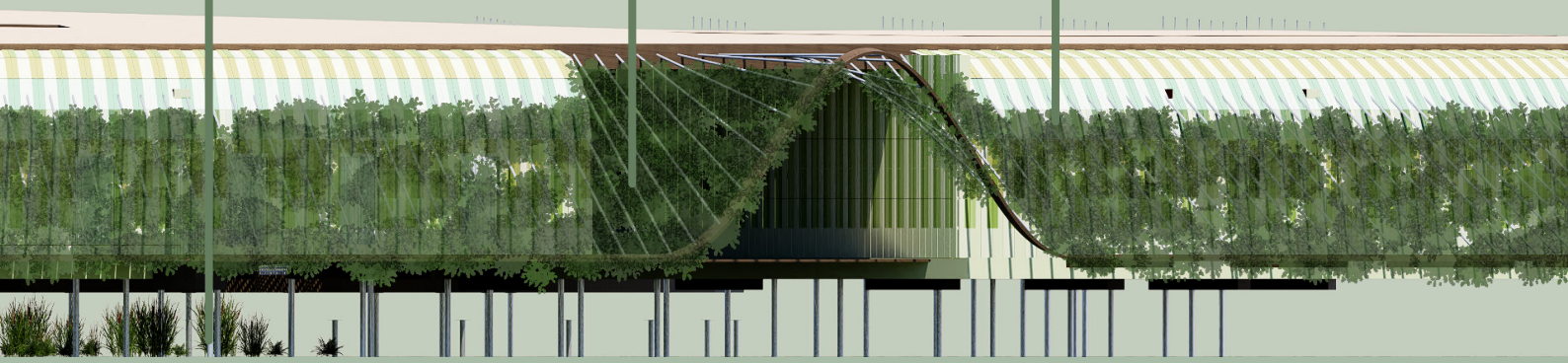


Figure 87: rear facade (van Hoorn, 2026)

ation, returing
o the land,
amount of
the polder.

green facade and roof merge into the grass landscape

‘photoframe’ in facade, sightlines around the ditches remain visible.



The platform comprises community spaces, food forests and circulation areas. The food forest provides food for the early bumblebee, starting with species such as the silver birch and basket willow, which provide nectar for the queens when they emerge from hibernation. This can be supplemented with other species, such as dewberry, blueberry and blackberry. These also benefit the human inhabitants food wise. All plants on the platform are potted to prevent the spread of invasive plant roots.

Figure 88: rendering community spaces on platform (van Hoorn, 2026)



The route for service and emergency vehicles is added behind the helophyte filters. The filters with its higher vegetation profide some shelter agains this route. Also the floor is this route is made of grates, allowing the vegetation to grow between the elements and minimize the visual impact of the route. This is further enhances by slightly (200 mm) lowering the route.



Figure 89: rendering intimate platforms from ditch habitat hairy dragonfly (van Hoorn, 2026)





The ditches are supplemented with native vegetation that is preferred by the hairy dragonfly. This also means that the water contains plants, which are needed by the bitterling. Small rocks at the bottom provide algae for the bitterlings to consume.

Figure 90: rendering intimate platforms from water habitat bitterling (van Hoorn, 2026)





The green facade running along the outer shell of the building reduces the risk of visual disturbance for the black-tailed godwit. It connects with the green roof on top, providing a completely green shell. The rooms next to this facade contain a serene environment. In the summer these native plants provide extra shade, while in winter, when they have less leafs there is more sunlight which can warm the rooms.

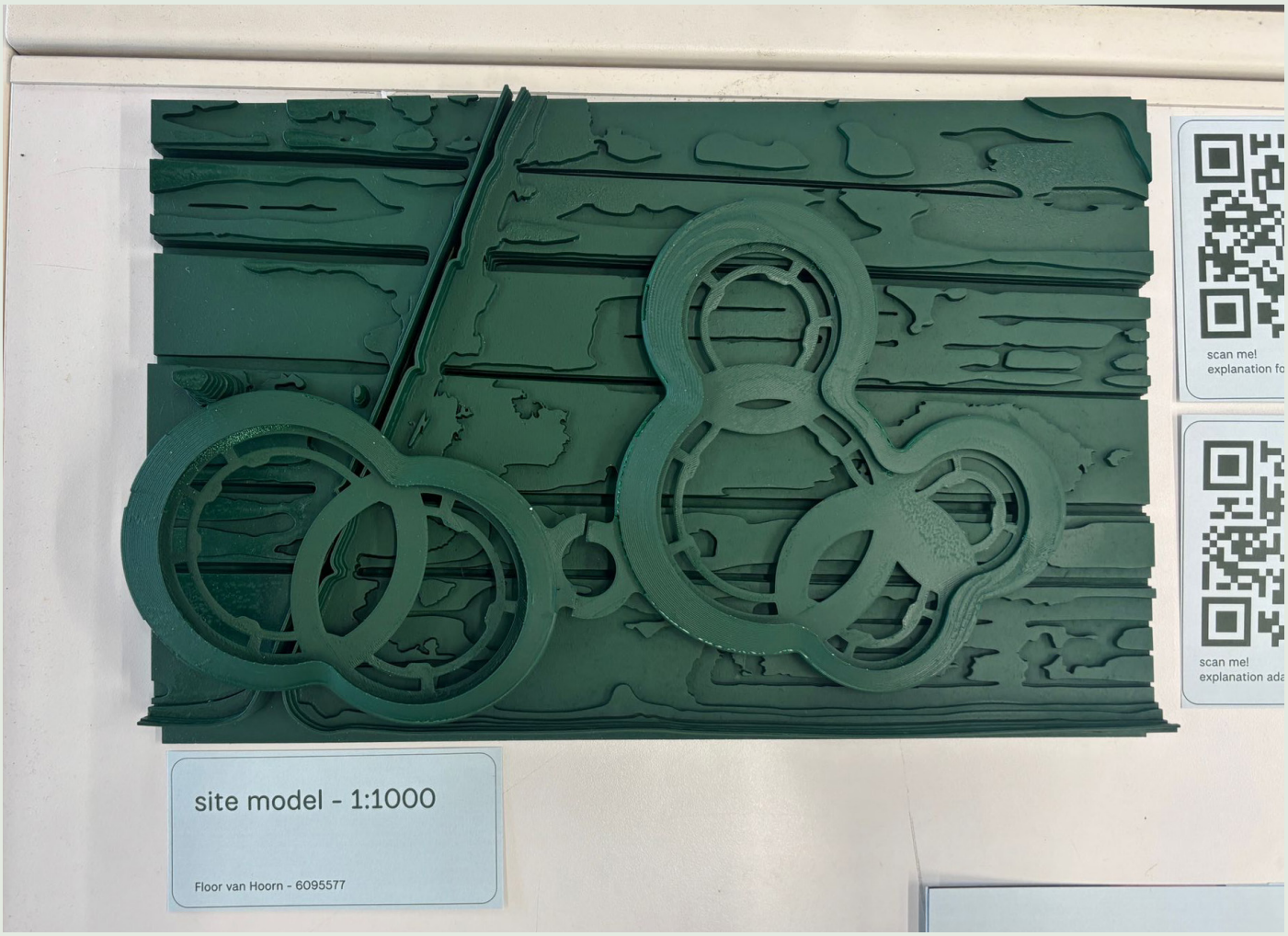
Figure 91: rendering private platform covered with greenery (van Hoorn, 2026)

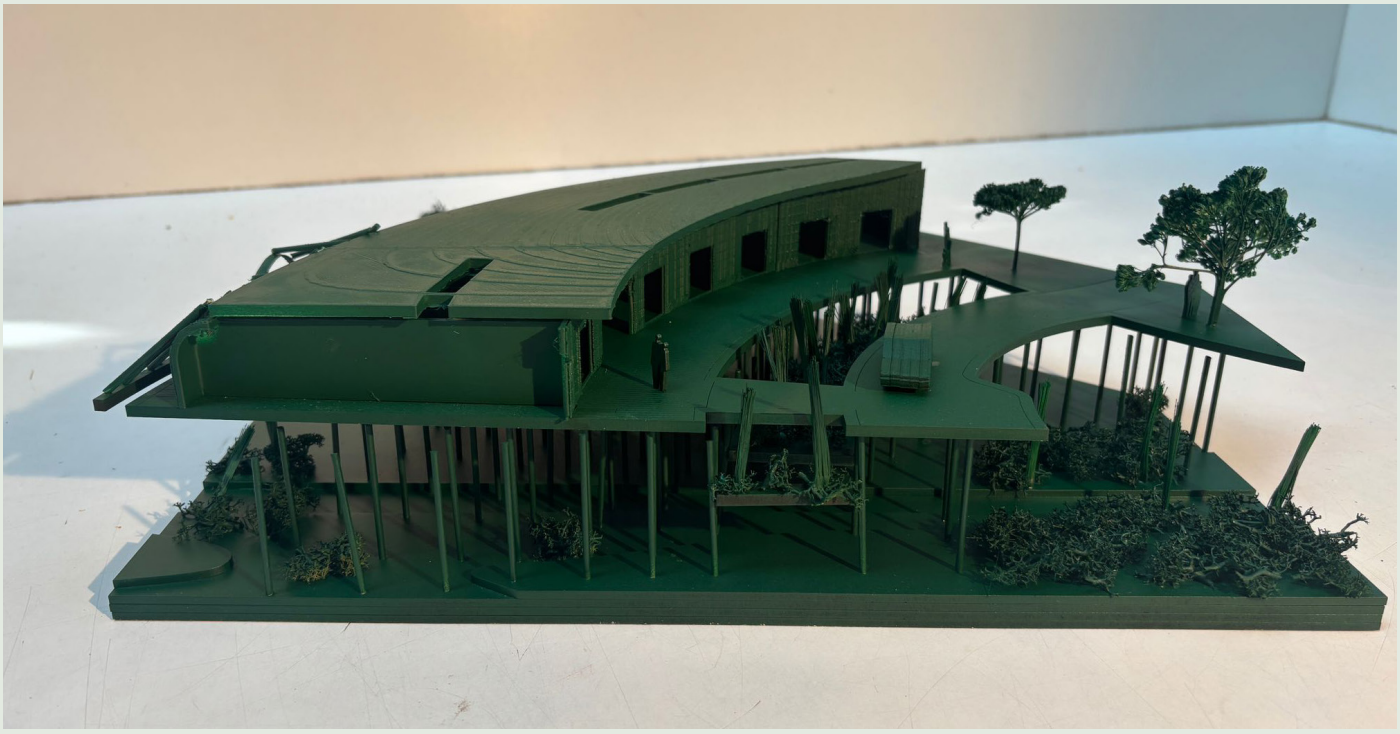


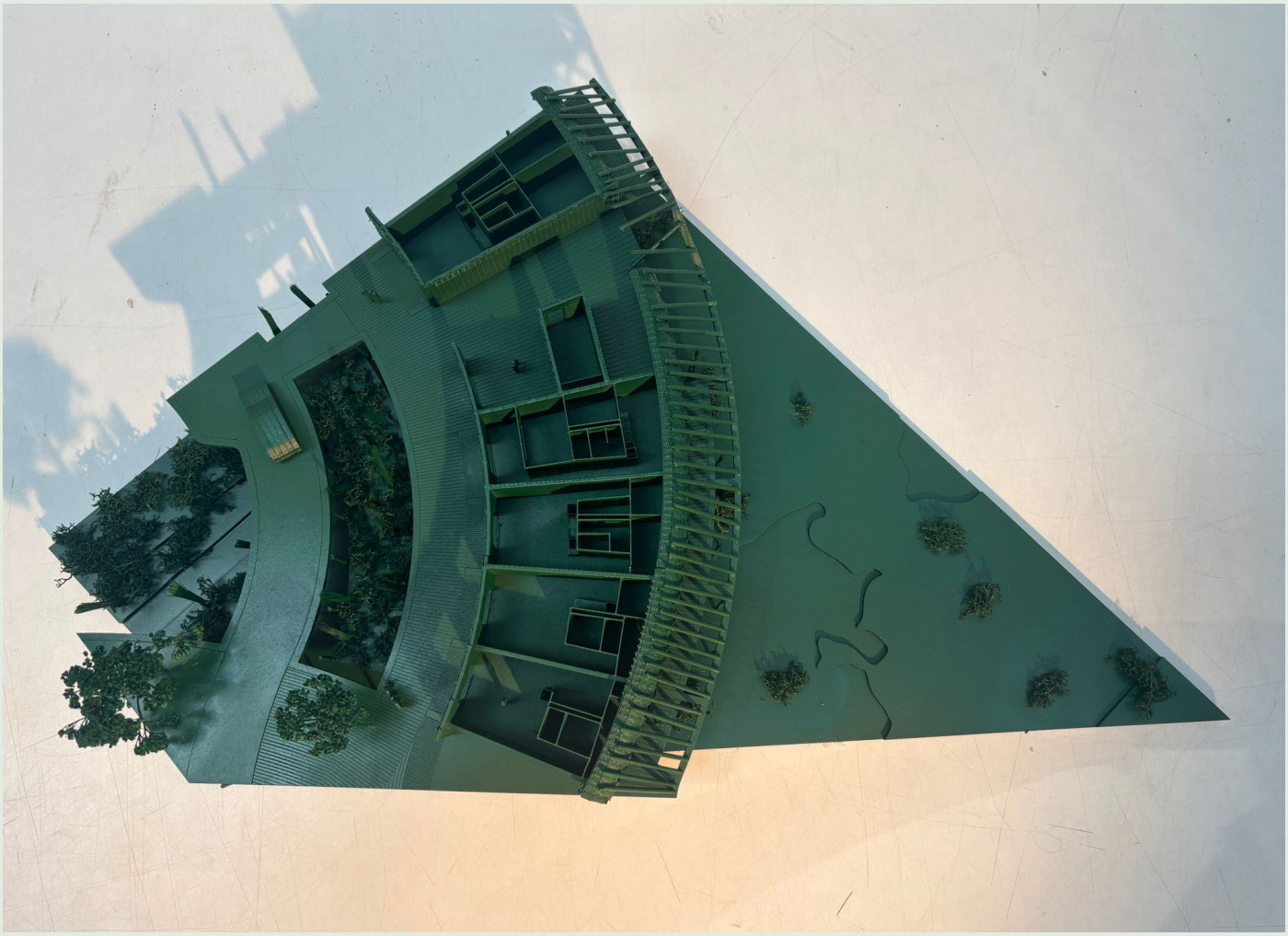
MODELS

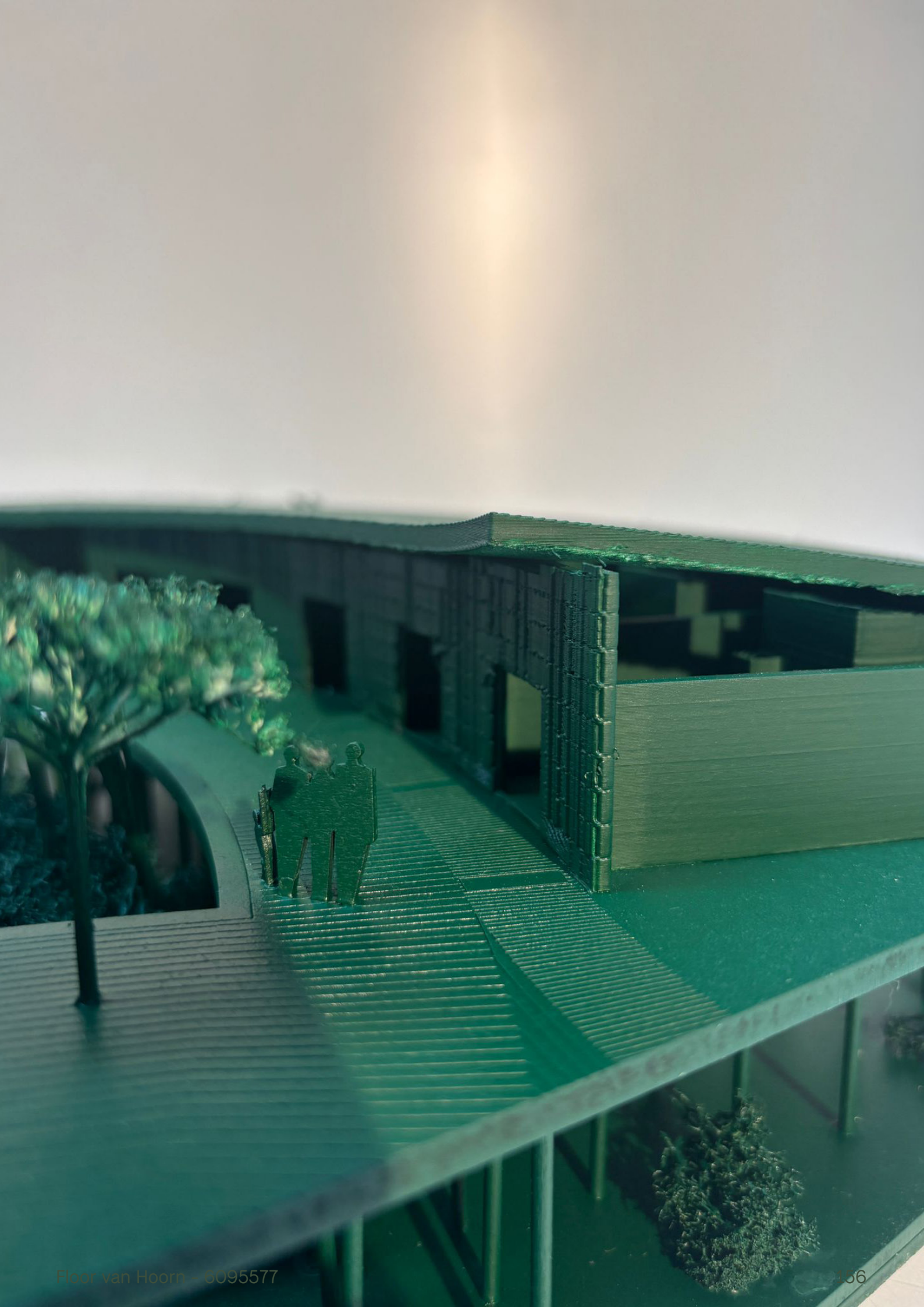

Section A-A; 1:20
fragment bumblebee nest - 1:10


Section A-A; 1:20
fragment bumblebee nest - 1:10


scan me!
scan me!
site model - 1:1000
Floor van Hoorn - 6095577








BUT WHAT ABOUT US?
We were here first...
PRATUM HABITATS
THE MIDDEN-DELFLAND SMALL FIVE
BUT WHAT'S HAPPENING RIGHT NOW?
WHAT DOES THE SMALL FIVE NEED?

03

CONCLUSION AND DISCUSSION





CONCLUSION

This research demonstrates that architectural design can promote biodiversity. However, biodiversity cannot be achieved solely through commonly applied measures, such as nesting boxes, insect hotels and green roofs. A shift in the way architecture is conceived from the outset of the design process is required. By integrating ecological needs as primary factors from the outset, architecture becomes more than a human-centred object, architecture becomes part of a broader habitat that supports both human and non-human life.

These resulting design principles are created for the specific case study of Midden-Delfland. Nevertheless, the same methodology that created these principles can be applied to other locations in the Randstad that face the same challenge of creating more dwellings while maintaining biodiversity. Rather than providing a one-size-fits-all solution, this research proposes a framework which can be adapted to fit different locations and indicator species, translating them into new architectural, urban, and landscape design principles.

Case studies illustrate how architecture, landscape design and water management can contribute to ecological resilience. Examples range from buildings that merge into the landscape to reduce disturbance, to the restoration of ecological resilience through the reintroduction of native vegetation species, to the transformation of monoculture landscapes into biodiverse ones through phasing, and to the integration of water systems as ecological infrastructure. These projects demonstrate that architecture and nature do not need to be treated as separate systems. Instead, ecological processes can form the backbone of spatial design. This reveals how buildings can become part of the larger ecological network instead of being a single entity. These strategies demonstrate that architecture can facilitate species coexistence by creating the spatial conditions necessary for habitat formation, food availability, and ecological resilience.

Analysing the needs of the Midden-Delfland Small Five in terms of food, risk factors, nesting spots and lifecycles revealed that species have different requirements. The black-tailed godwit proved to be the most critical indicator species among the Small Five, as it is sensitive to visual disturbance from buildings and predation. The design aims to integrate the dwellings into the landscape, allowing them to be perceived as part of the natural terrain rather than as isolated architectural objects. Therefore, the proposed dwellings are embedded within the terrain, reducing their visibility from the surrounding meadows. In contrast to their discreet exterior appearance, the buildings enclose an intimate inner landscape that supports both human interaction and ecological habitats. The bitterling, hairy dragonfly, early bumblebee and natterjack toad highlight the importance of healthy water systems, native vegetation and habitat diversity. Their ecological requirements translated to the integration of planted waterways, species rich vegetation and water bodies that can respond to more intense and frequent changes due to climate change and seasonal changes. These design principles support connections between species, improve water quality and provide food and breeding places accross species and lifecycles. The design translates the collective ecological requirements into an adaptive framework which is able to respond to future climatic change.

The final design tests these principles within the Vlietlanden in Midden-Delfland. Different urban densities are calculated to prevent visual disturbance for the black-tailed godwit. Resilience against climate change is achieved by acknowledging that areas will become flooded or dry, which results in buildings being

constructed on screw poles. This demonstrates how these principles can operate simultaneously within dwellings. Rather than separating ecological and residential functions, the project combines them into a single adaptive landscape system. This minimises the impact on ground-dwelling creatures while creating new habitats for species such as the natterjack toad, by giving unvegatated space back. It also gives the landscape the opportunity to flood while preventing major issues for humans. Native, non-invasive plants restore biodiversity to the area while strengthening the soil. Species-specific interventions, such as nesting opportunities integrated into the façade, further strengthen ecological connectivity throughout the project.

Ultimately, this research emphasises the importance of not treating biodiversity in design as an afterthought. Rather than approaching dwellings as objects placed in a natural environment, architecture should become an active component of ecological systems rather than an object placed within them. Designing for indicator species benefits a larger group of animals and plants, integrating landscape processes and anticipated climate change. Merging the environments in which animals and humans coexist creates a bond between them and reconnects us to the importance of each link in the cycle. Therefore, the future of building in Midden-Delfland and the Randstad does not lie in balancing nature and development, but in designing development as a link in nature.

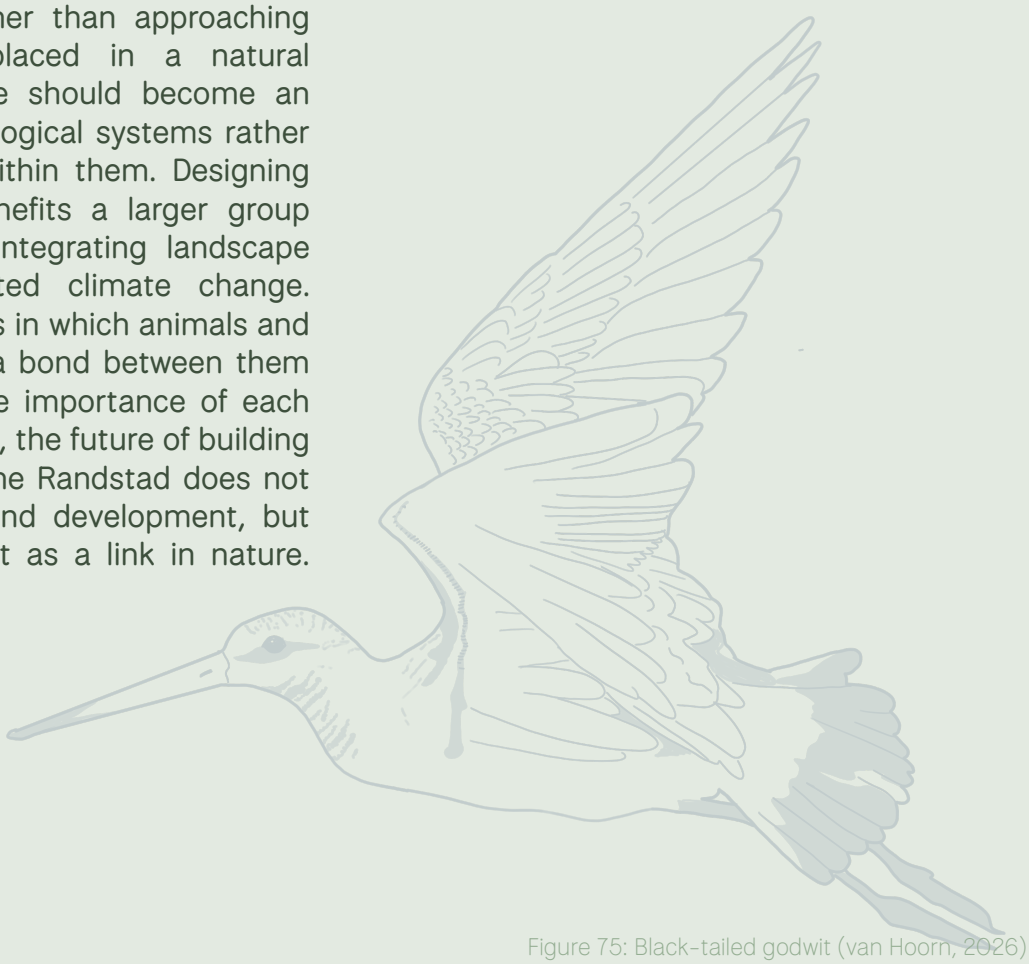


Figure 75: Black-tailed godwit (van Hoorn, 2026)

REFLECTION

This thesis focusses on the inclusion of biodiversity through architectural design, moving the inclusion of biodiversity from the outset of the design process. This is achieved by integreting ecological needs from five indicator species native to the Vlietlanden. By investegating how architectural design principles can be created to promote biodiversity in Midden-Delfland while looking at the Small five, while recognizing that different species respond differently to different densities. In order to shift the way biodiversity is approached in architectectural design, by showing that implementing this does not mean that the design hand in regarding communties or living comfort. The purpose of this reflection is to elvaluate the research and design process and to assess the effectiveness of the methodology used. Examining both the opportunities and limitations of using species centred design as a framework.

The literature study on the Midden-Delfland Small Five was sometimes problematic as not all species had detailed scientific documentation as. This resulted in a lack of different sources discribing on similar habitat conditions, food requirements, predators or life cycles. The assumption at the start of the research was that there would be sufficient ecological data available to inform the limitations of the species. As these species are well known, it was assumed that the information presented in the literature would be supported by extensive prior ecological research, providing a reliable basis for defining habitat conditions and species requirements relevant to the design process. This provides deep sufficient research to depict the necessary requirements for architectural influence on the species. It was expected that there would be little data regarding the species and design, this anticipated the use of case studies to test different ideas through the eyes of the animals.

The case studies provided insight in designing for nature. But lacked the same approach as in this thesis, causing a difficulty, in some case studies, finding design principles which are suitable. This resulted in the need for looking beyond intentional design principles. Although the limited principles intentionally used in case studies to improve biodiversity, it again highlights the need for more precedent projects that integrate biodiversity from the outset of the design process.

As the masterplan was situated in an almost empty polder, with no neighbouring structures, designing the main structure presented a challenge. Starting with typical terraced houses, the design principles gradually evolved into more intriguing forms. A literature study soon revealed some absolute no-go factors relating mostly to the black-tailed godwit, as this species is sensitive to visual disturbance. This forced a rethink of common design ideas. Other design principles followed when the outcome of the literature study was used to create a set of dos and don’ts. The façade proved difficult too, due to its length was often too repeating, resulting in many failed attempts that were not interesting enough. Tutors and experts sometimes encouraged taking another look at aspects that were not strong enough.

The final design provides a detailed overview of how architectural design can be implemented in relation to biodiversity. Resilience is largely achieved by raising the building to allow water to coexist with the native vegetation and landscape. However, more measures could be implemented to increase resilience. As expected, the density is limited to roof heights calculated to cause the least visual disturbance to black-tailed godwits. However, it was also anticipated that other species with similar requirements would be present. The black-tailed godwit proved to be the most challenging

animal to design for, as it wants nothing to do with structures. Other animals did not present any design limitations and were easier to incorporate. Technical feasability is met due to repeating similar structures throughout the plan, while social impact is achieved through an intimate inner circle.

This thesis taught different ways of using various programs together to create polished drawings and improve workflow. Although it sometimes takes more time initially, it saves time at the end of the project. The tutoring showed that if the gut feeling is that something is not good enough yet, this is also visible to others. More time is then needed to improve this aspect, which benefits the entire plan.

This thesis still lacks an answer to the question of whether this design approach will actually increase biodiversity or cause other problems. To be sure, different dwellings need to be created to ensure the expected effect is achieved.



Figure 76: Black-tailed godwit (van Hoorn, 2026)

01

ATTACHMENT
THE MIDDEN-DELFLAND SMALL FIVE



Figure 92-96: Midden-Delfland Small Five (van Hoorn, 2026), adapted from:

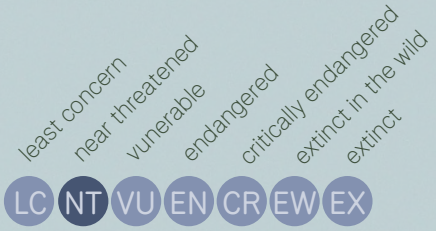
figure 92: (AGAMI, n.d.)
figure 93: (Sadler, n.d.)
figure 94: (de Graaf, n.d.)
figure 95: (Baks, 2007)
figure 96: (Feathercollector, n.d.)

What are the key drivers for the Small five in Midden-Delfland regarding habitat, food and risk factors throughout their life cycles?



BLACK-TAILED GODWIT

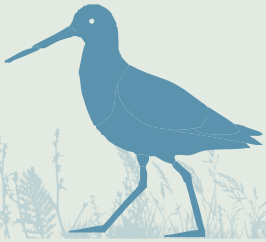
Limosa limosa

conservation status (red list)[1]	
population trend[1]	decreasing
latin name derived from	limosa - muddy
subgroup	birds
size[2]	37-42 cm
age[3]	mostly 10-15, sometimes 30
habitat[2]	open grasslands

[1](IUCN, n.d.)
[2](Vogelbescherming Nederland, n.d.)
[3](Delftse Natuurwacht, 2017)

Figure 97: Black-tailed Godwit (AGAMI, n.d.)

HABITAT



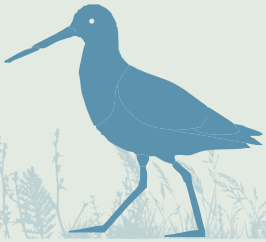
The black-tailed godwit mainly occurs in the peat meadow areas of Holland and Friesland. In the sea clay, river and high sand areas, the birds have dissapeared or are lowly occuring (van Kleunen A., Foppen R. & van Turnhout C. 2017). They mainly breed on agricultural, preferably extensive managed grasslands (Sovon Vogelonderzoek Nederland, 2025a).

FOOD



The grown bird mainly eats rainworms and other soil animals, such as leatherjackers and other moscito larvae. The chicks mainly eat invertebrates, such as flies, weevils, woodlouse and centipedes which are found in the grassy landscape. The chicks move towards soil animals after four to five weeks, when their beaks are developed enough to tread the soil (Sovon Vogelonderzoek Nederland, 2025a) (Sovon Vogelonderzoek Nederland, 2025b).

RISK FACTORS



Agriculture and soil

According to Sovon Vogelonderzoek Nederland (2025a)(2025b) are developments in agriculture are the most catasstrophic for the black-tailed godwit. These developments are desiccation, frequent and early, before (june 30th) mowing and conversion into uniform, species-poor and overly dense grass vegetation. In herb rich grasslands grow the chicks harder than in intensive managed grasslands. Another factor is desiccation. This is one of the most important difficulties, when the soil is to dry, the beaks of the birds fail to search for food in the hard soil. This issue is the greatest with moisture retaining soils, such as peat and clay. These challanges are minimimal when in dry spells there are enough wet spots near low laying areas, ditches and banks. Still, enough rain is needed to keep the topsoil moist (Sovon Vogelonderzoek Nederland, 2025a) (Sovon Vogelonderzoek Nederland, 2025b).

Predators

In general, as stated by Sovon Vogelonderzoek Nederland (2025a)(2025b), predation of nests is mainly caused by mammals, such as the fox, hermine and stone marten while chicks are mainly preyed upon by birds, such as the Marsh Harrier, Herring Gull, Buzzard and Raven. Meadow birds are particularly vulnerable to predation in years with few mice, due to the lack of alternative prey for predators in the meadow area (Teunissen et al., 2020)(Sovon Vogelonderzoek Nederland, 2025a). The mice population can be promoted by for example long grass at the edges of fields, the addition of 'mouse strips', with longer grass, more than 20 cm, in certain places. It does have to be noted that with the promotion of the mouse population more predetors might be attracted to the area (Teunissen et al., 2020). The lapwing is however succesfull in driving away predetors, therefore lowering the chances of a loss of nests and chicks (Teunissen et al., 2020) (Sovon Vogelonderzoek Nederland, 2025a) (Sovon Vogelonderzoek Nederland, 2025b).

factor	impact	solvable
overfertilisation, soil and water	n.a.	no
climate and rising of sea level	moderate	no
acidification (soil and water)	moderate	partly
desiccation	high	yes
predation	high	partly
sickness	low	no
spontanous developments	low	yes
disturbance due to presence	low	partly
disturbance caused by rising structures	low	no
loss of habitat due to development projects (construction, road building)	moderate	no
fragmentation due to habitat development projects or intensification of agriculture	high	yes
increased scale, intensification of agricultural use, change in land use	high	yes

table 3: Riskfactors of the black-tailed godwit (F. van Hoorn, 2026)

adapted from (Sovon Vogelonderzoek Nederland, 2025a)

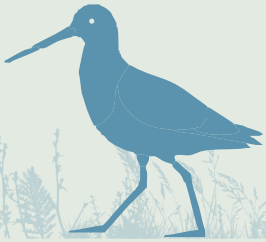
Landscape

The black-tailed godwit sees different aspects of its surrounds as an obstacle as stated in Van der Vliet (2010)(2013). It prefers to be around a hunderd meters away from a forest edge, 50 meters away from a tree line, 250-350 meters a way from a group of trees, 50 meters from a high dam without tree line or a canal without tree line and 100-1200 meters away from a village edge. These numbers are indicators for three species, one of them is the black-tailed godwit. As godwits have a higher disturbance of visual factors, I expect that these numbers are higher for the godwith than these two other species. Further there is a dislike to flat object such as roads due to constant background motion (Van Der Vliet, 2013) (Van Der Vliet et al., 2010)



The birds have a strong preference to straight survices to nest on, they avoid high elements such as buildings with 200-300 meters (Sovon Vogelonderzoek Nederland, 2025a). It is even advised to leave 300-600 meters free of high elements (Teunissen et al., 2020). Predetors can use sloping or high elements as viewingpoint (Van Der Vliet et al., 2010).

LIFECYCLE



return to same nest of last year

return
febuary



to western africa

june-august
migration

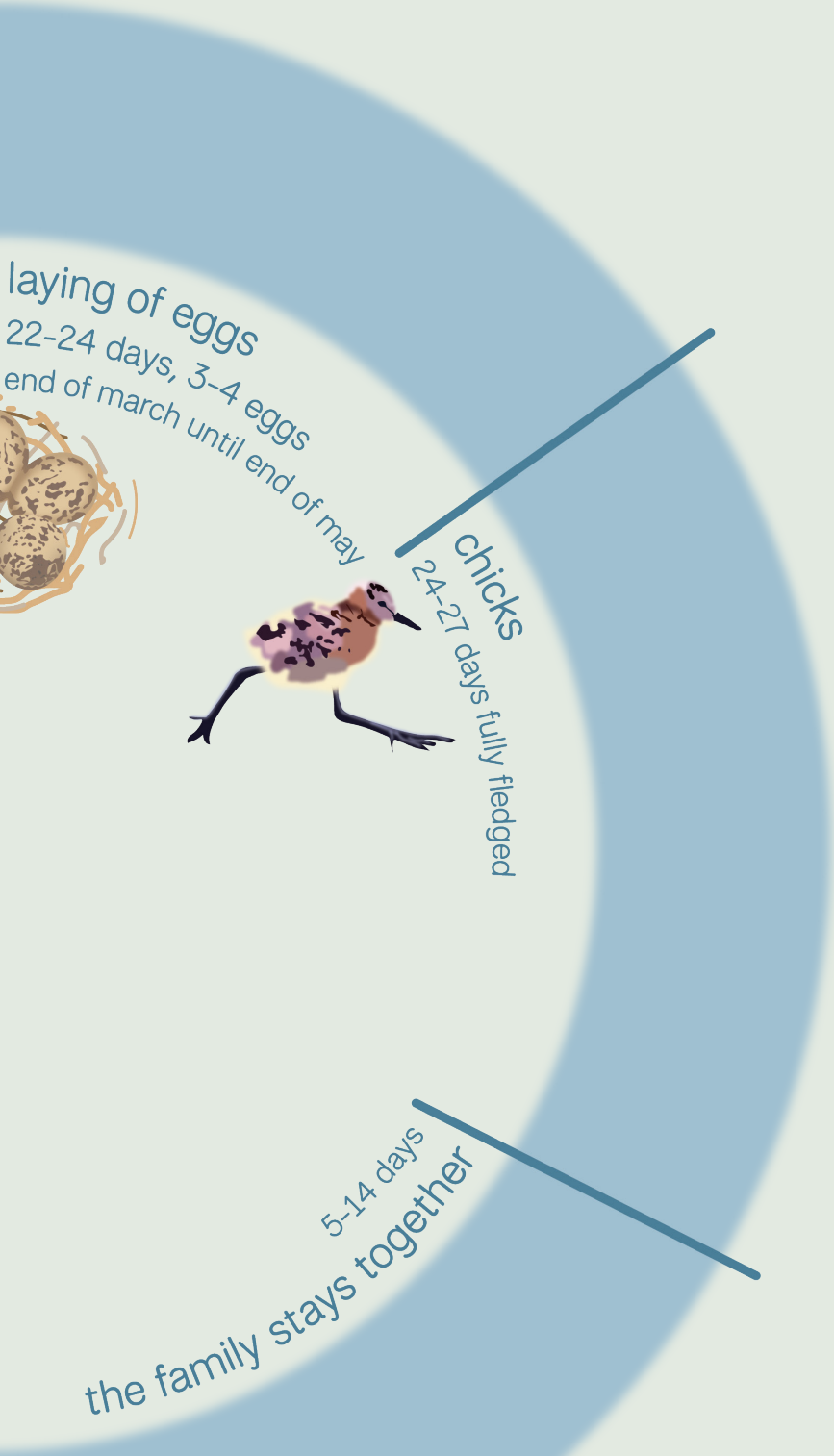


Figure 98: lifecycle black-tailed Godwit (van Hoorn, 2026)

Based on (Sovon Vogelonderzoek Nederland, 2025)



NATTERJACK TOAD

Epidalea calamita

conservation status (red list)[1]	LC NT VU EN CR EW EX (least concern, near threatened, vunerable, endangered, critically endangered, extinct in the wild, extinct)
population trend[1]	decreasing
latin name derived from	-
subgroup	amphibians
size[2]	40 mm
age[2]	3-6 years
habitat[2]	dunes, river area and polders

[1](IUCN, n.d.)
[2](Creemers & van Delft, 2009)

Figure 99: Natterjack toad (Baks, 2007)

HABITAT



According to Creemers & van Delft (2009) is the natterjack toad a pioneer species, it is present in areas with high dynamics. It is mainly present in unshaded, low-vegetated to bare, more or less irregular terrain, with areas that have an extreme microclimate, temperature and humidity wise. The terrain should also contain shallow water (5–20 cm deep, with an absolute maximum of 30–50 cm) that can heat up quickly. Most of these spawning waters are temporary, emerging during periods of abundant rainfall and disappearing later on. The authors also mention that the toad lays eggs in wide shallow bank areas of permanent waters. Most of the time, there is little to no vegetation where the natterjack toad lays their eggs, sometimes they do lay their eggs in flooded grasslands, with the grass still present in the pool. Creemers & Van Delft (2009) mention that in a polder landscape, such as in South-Holland, the natterjack toad primarly reproduce in polder ditches. The water quality seems to have little influence on the toad. The acidity can range between a pH of 5-10, salt contents till 0,5% Cl, the eggs die if this value is higher. The larvae can still develop at 0,27. Nutrient-rich and turbid water are suitable (Creemers & van Delft, 2009) .

Creemers and Van Delft (2009) note that it is important to provide enough places for the animals to seek shelter during the day and hibernate in winter. They do this by digging themselfs in, 60-180 cm during hybernation, or to simply seek spots under stones, rubbish or cracks. Or they choose hybernating spots under tree trunks, holes of small mammals, in sandy soils or deep in vegetation. They are prone to drowning during hybernation (Creemers & van Delft, 2009).

FOOD



The literature from Creemers & van Delft (2009) reveals that the natterjack toad is not very particular about its food; it eats any moving prey that fits in its mouth. What it eats is determined by availability, which can differ per location and month. The diet of adults and sub-adults mainly consists of ants, but also includes a variety of other insects and arthropods, as well as snails and earthworms on occasion. When springtails are plentiful, as they often are in pioneer situations, they are also on the menu. Juveniles eat small prey such as mites and other arthropods. As they grow, the prey becomes bigger and more varied. Larvae feed on organic material, primarily the remains of plants and animals (Creemers & van Delft, 2009).

RISK FACTORS



Predetors
The literature from Creemers & van Delft (2009) reveals that the natterjack toad gets primarly eaten by mammals such as the hedgehog, stoats, European minks and brown rats on land. And by birds such as ducks, herons, gulls, white wagtails, magpies, black crows and house sparrow, but also by the ring snake. Larvae are pray to birds, some fish species, insects, such as dragonfly larvae, water bugs, water scorpions and waterbeetles and their larvae. The eggs and larvae are preyed apon by almost all native frogs and toads. The eggs are eaten by the larvae of the natterjack toad. Due to predetation only a small amount of larvae reach the juvenille state, more in permanent waters (Creemers & van Delft, 2009). Interestingly according to the New York university (2022) the stripe on the back of toads create a visual disturbance to visual focussed predetors, making it seem as the animal is split in two halves.

stripe as visual disturbance to confuse predetors.

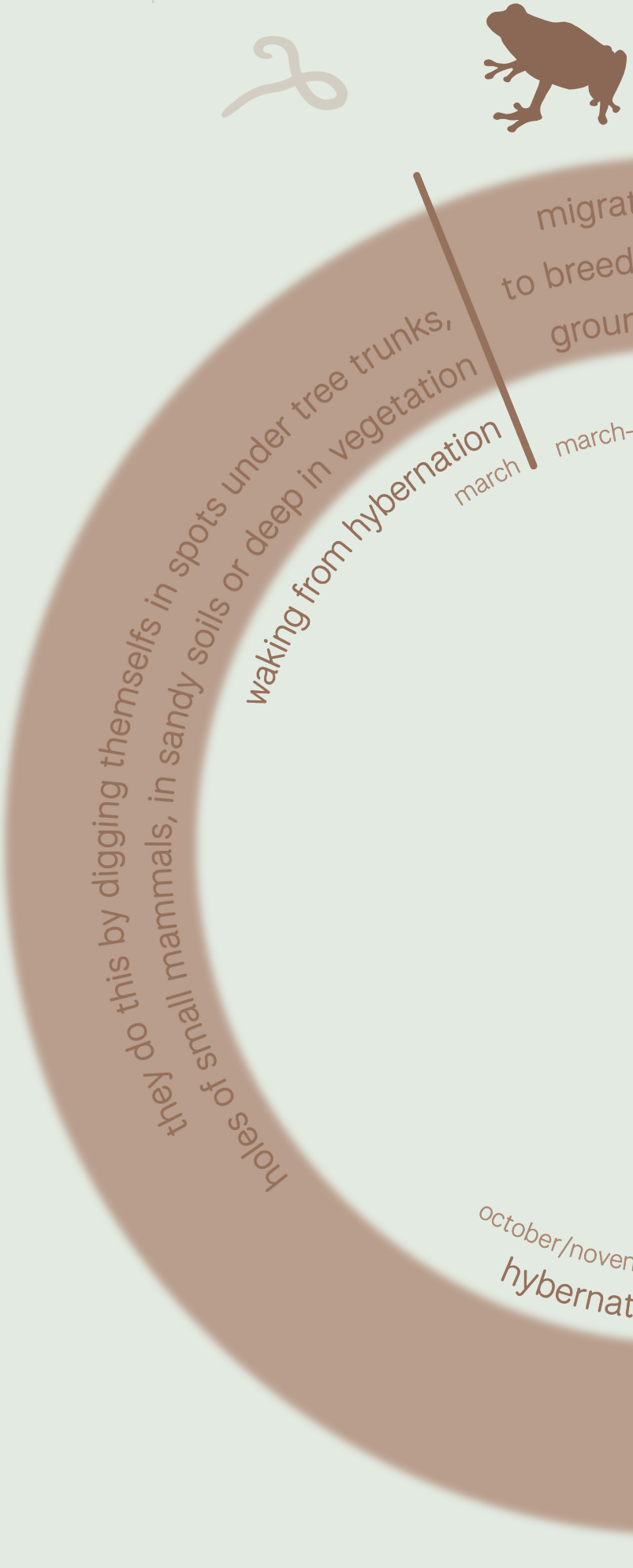
According to Creemers & Van Delft (2009) is the natterjack toad is losing its numbers due to the loss of the natural dynamic processes in the dune and river landscape. As well as by the fragmentation and acidification of breeding waters, following by the predominant factor of overgrowth of plants as result of succession. The removal of vegetation helps, as well as grazing and the creation of temporary waters. Smith (2005) mentions that local traffic and construction activities also create mortality.

Creemers & van Delft (2009) mention that when creating amphibian pools, they must not be too small and deep and therefore permanent, they also often have a relative steep slope. The species can profit from pools on a larger scale, provided that they are shallow (Creemers & van Delft, 2009).



Figure 100: Van Kappel, N. (2022, July 2)

LIFECYCLE


migration
to breeding
grounds
march-june
waking from hybernation
march
they do this by digging themselfs in spots under tree trunks,
holes of small mammals, in sandy soils or deep in vegetation
october/november
hybernation

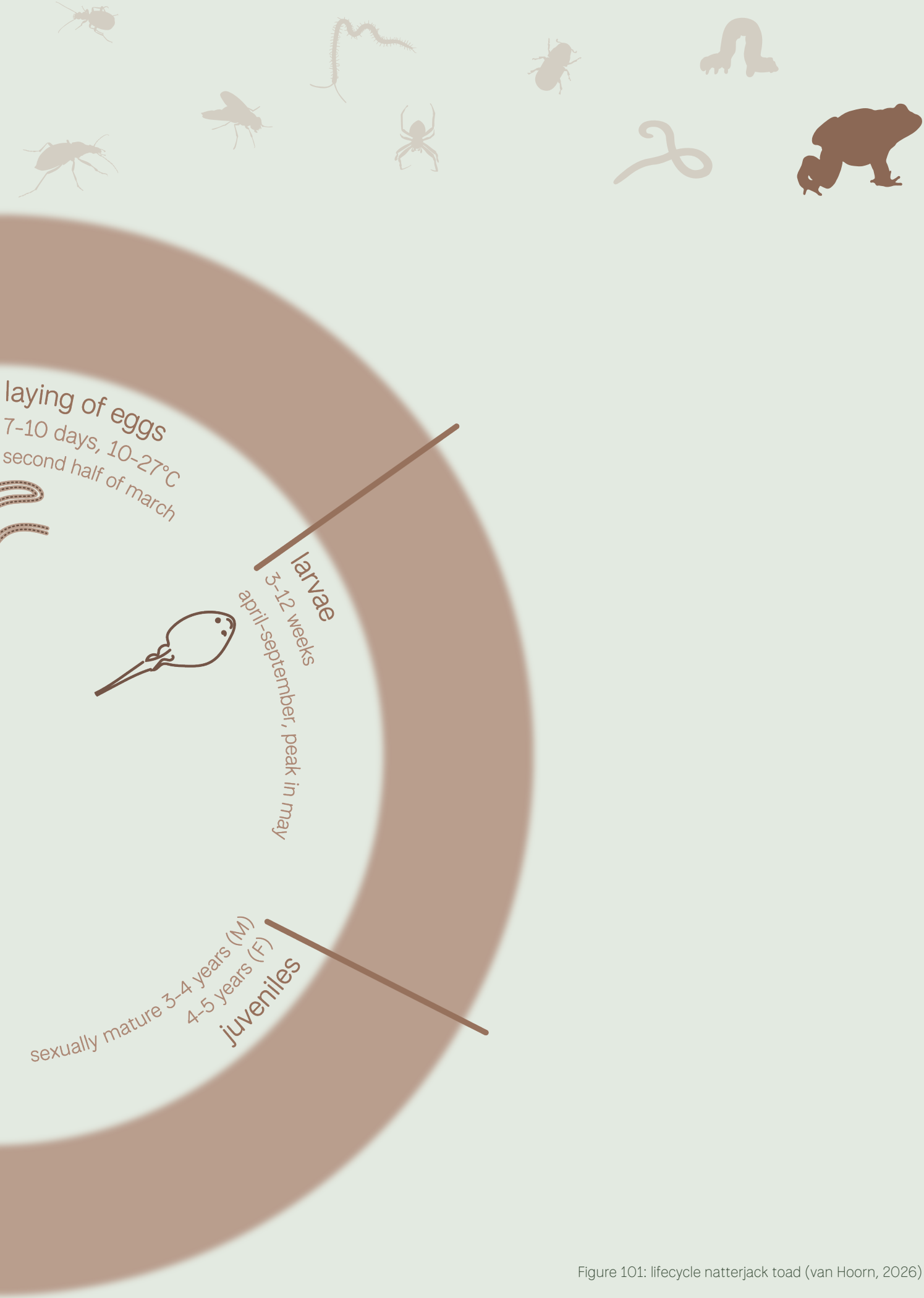


Figure 101: lifecycle natterjack toad (van Hoorn, 2026)

Based on (Creemers & van Delft, 2009)



EARLY BUMBLEBEE

Bombus pratorum

conservation status (red list)[1]	LC NT VU EN CR EW EX
population trend[1]	stable
latin name derived from	pratum - of the meadows
subgroup	insects
size[2]	11-17 mm
age[2]	< one year
habitat[2]	grasslands, meadows

[1](IUCN, n.d.)
[2](Peeters et al., 2012)

Figure 102: Close up Early bumblebee (de Graaf, n.d.)

HABITAT

According to Peeters et al. (2012) do the habitats of bee species often fall apart in subhabitats, the location of the nest is often a different one to where they get nectar. Sometimes, these subhabitats can exists in different biotopes too. The early bumblebee can be found in almost all types of landscape, but less so in open areas with low vegetation (Peeters et al., 2012). The early bumbleebee has a maximum foraging range of 674 meters, their forage area is around 26 m^2 (Knight et al., 2005)

Peeters et al. (2012) mention that despite their tolerance of different habitats, there are some requirements for both the larval stage and the adult insect. During the larval stage, the animals are influenced by temperature and moisture levels. They also feed on nectar and pollen from the nest. Adult insects need plants that produce nectar and pollen; males need structures that help them to orientate themselves during patrol flights. The females require suitable nesting sites. The climate is significant too, considering factors such as sunlight, temperature, moisture, shelter, exposure, slope angle and soil composition (Peeters et al., 2012).

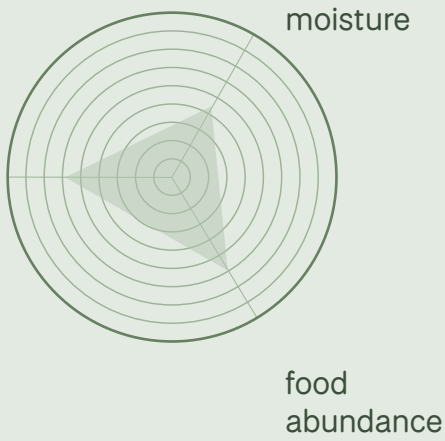
FOOD

In accordance to Peeters et al. (2012) the early bumble bee visits a wide range of plants to harvest nectar. But according to Raine et al. (2006) the Bombus Pratorum prefers firstly blue and secondly purple flowers for foraging, following by red, orange, white and yellow. It seems that bees find it more difficult to locate red flowers in complex green surroundings. This suggest that red evolved by plants as a mechanism to attract bird pollinators instead of bee pollinators (Rivest et al., 2017). The plants on the following pages are often sought after by the early bumblebee according to Peeters et al. (2012).



Common Figwort
Scrophularia nodosa

along the banks of rivers, canals and lakes

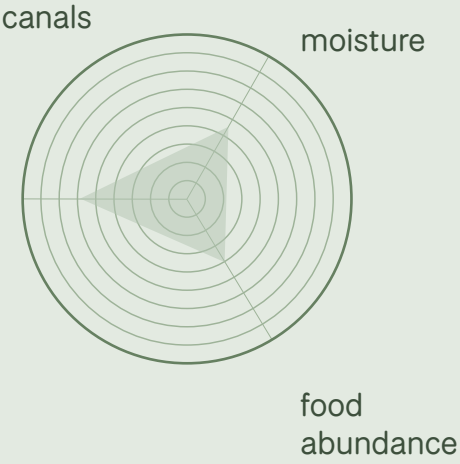


Native Dutch plant, non-invasive



Heal all
Prunella vulgaris

In low grass vegetation along the edges of bushes and canals



Native Dutch plant, non-invasive

Figure 103: Common Figwort (Flora van Nederland, n.d. a)
Figure 104: Heal all (Flora van Nederland, n.d. h)



Common comfrey
Symphytum officinale

agricultural land near ditch edges and verges

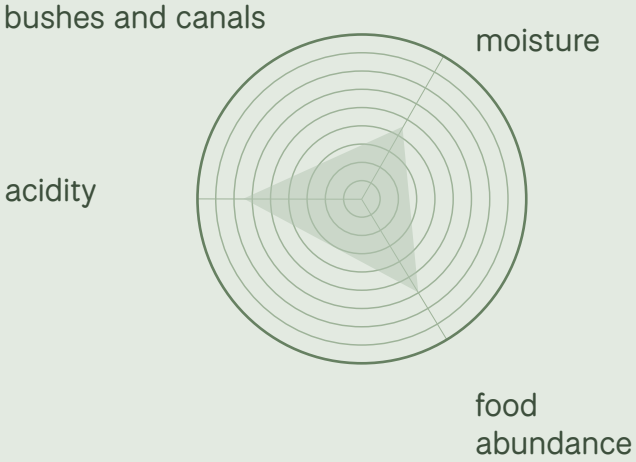


Native Dutch plant, small invasive risk due to fastgrowing roots



Ground Ivy
Glechoma hederacea

In low grass vegetation along the edges of bushes and canals



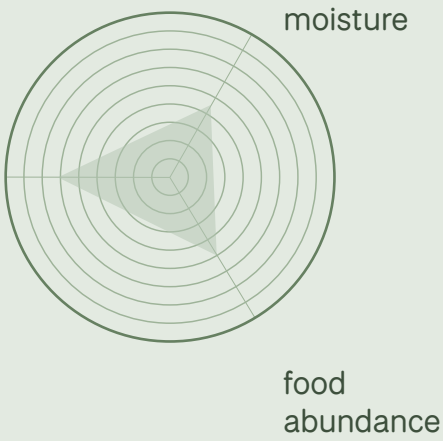
Native Dutch plant, small invasive risk due to fastgrowing rooting twigs

Figure 105: Common comfrey (Flora van Nederland, 2013a)
Figure 106: Ground Ivy (Flora van Nederland, 2013c)



Red Clover
Trifolium pratense

agricultural land near ditch edges and verges

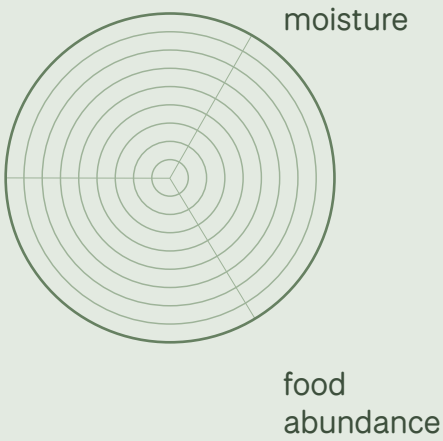


Native Dutch plant, non-invasive



Red-flowering currant
Ribes sanguineum

Built environment



Non-native plant, non-invasive

Figure 107: Red clover (Flora van Nederland, 2014)
Figure 108: Red-flowering currant (Ecopedia, n.d.)



Fireweed
Chamaenerion angustifolium

along the banks of rivers, canals and lakes



Native Dutch plant, non-invasive



Basket willow
Salix viminalis

In early spring



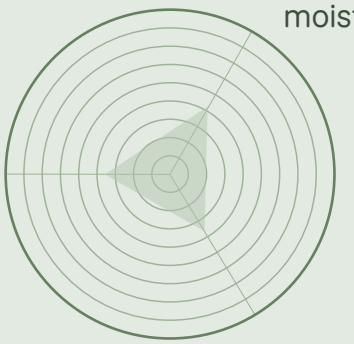
Native plant, small invasive risk

Figure 109: Fireweed (Flora van Nederland, 2021)
Figure 110: Basket willow (Flora van Nederland, n.d. l)



Silver Birch
Betula pendula

In early spring by queens

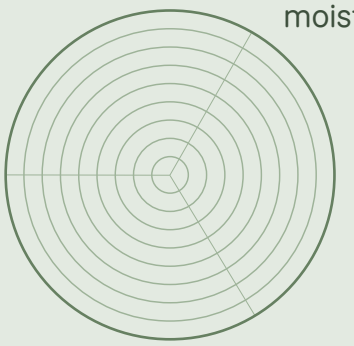


Native Dutch plant, small invasive risk in nutrient-poor soils and heathlands



Cherry Laurel
Prunus laurocerasus

Males and fameles enjoy the sweet nectar



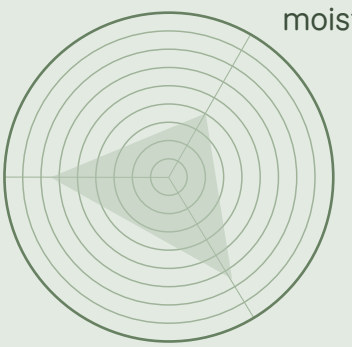
Non-native plant, invasive

Figure 111: Silver Birch (Flora van Nederland, 2019)
Figure 112: Cherry laurel (Heijnen, n.d.)



Common snowberry
Symphoricarpos albus

Built environment

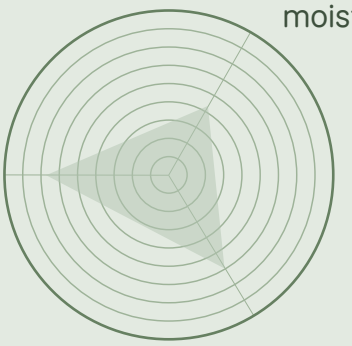


Non-native plant, invasive



Dewberry (edible)
Rubus caesius

along the banks of rivers, canals and lakes



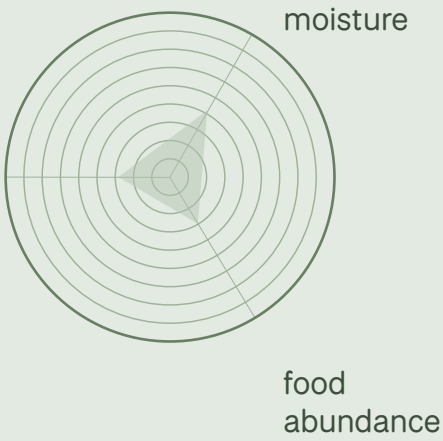
Native plant, small invasive risk

Figure 113: Common snowberry (Flora van Nederland, 2020)
Figure 114: Dewberry (Flora van Nederland, n.d. d)



Blueberry (edible)
Vaccinium myrtillus

In woods

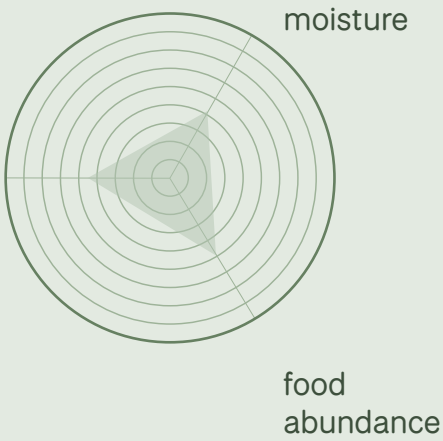


Native Dutch plant, non-invasive



Blackberry (edible)
Rubus fruticosus

In woods



Native plant, small invasive risk

Figure 115: Blueberry (Flora van Nederland, n.d. b)
Figure 116: Blackberry (Flora van Nederland, n.d. n)

RISK FACTORS

Parasites
According to Peeters et al. (2012) are the Bombus sylvestris and B. campestris parasites of the early bumble bee. Other parasitoids of the early bumble bee and other kinds of bumble bees are the parasitic wasp, Syntretus splendidus, blowflies and humpback flies. Ones who are found in nests are the fly Brachicoma devia, the ant wasp Mutilla europaea and bronze wasps Melittobia. Other damage to nests can be done by hedgehogs, badgers, moles, earwigs and (shrew) mice. The caterpillars of the wax moth Aphomia sociella mainly feed on storage cells and brood cells. The grown animals are preyed apon by robber flies, spiders, and birds such as shrikes and bee-eaters (Peeters et al., 2012).

Agriculture
Peeters et al. (2012) mention that agriculture poses an issue for the early bumblebee due to the intensive use of fertilizers and pesticides and the rapid crop rotation. The limited spare spaced where the bees can live are challenged by being overridden by vehilces, fertilizers and pesticides. Returing native herbs the use of nitrogen-fixing legumes, such as clovers instead of using fertilizer can help. As well as plating a herb rich strip between fields or in fallow fields. Further, a variety of small landscape elements, such as scrub, hedgerows, thickets, wooded banks and grassland can help Peeters et al. (2012).

Lowbog area - laagveengebied
As stated in Peeters et al. (2012) are lowbog areas low in bees, not due to the lack of food, but due to the lack of nesting spots and the microclimate. Bees need dry nesting places (Peeters et al., 2012).

Overall challanges
According to Peeters et al. (2012) pose monotome landscape a challenge, bees need a small varieting landscape. Different plants and heights, this can also mean a transition in managed and unmanged areas.

Nesting spots
Based on Peeters et al. (2012), the preservement of old scrubs and partially free-standing dead trees is challenged due to the removal of these elements in which the early bumblebee nests pose a risk. Early bumblebees nest underground, in tree hollows, and in old bird and mammal nests, preferbly in, dark, dry and not too hot spots. For hybernation, the queens search for spots that are facing west or north, on a slope or near the foot of trees (Peeters et al., 2012).

Research by the 'Bijenstichting.nl' done by Molenaar (2022) mention that bumblebees are not agressive and can nest in cavity walls. They do not damage the inside of the walls and need old nesting materials gathered by the old inhabiters of the nests, they also have a preference for nesting underground (Molenaar, 2022). Further they often fly slow and low over the ground (Bijenstichting, n.d.). If these materials are not available due to man-made boxes, they can be subsituted with hay, moss, carton or woodchips. Old mice droppings can stimulate bumblebees to nest in the spot. An opening of 16-18 mm diameter is needed (Molenaar, 2026)(manufactum, n.d.) As bees are attracted to the colour blue, even nestingboxes are sold with a blue entrance, in order for the animal to help find a nestingspot (manufactum, n.d.).

Food
According to Peeters et al. (2012) does often or too early mowing of grasslands and verges removes the plants of which they eat. On former (semi)rich agricultural land only extenisve grazing is not enough, haymaking grows different flowers, not often found on these agricultural lands. Use native flowers and bushes in gardens and parks (Peeters et al., 2012).

LIFECYCLE



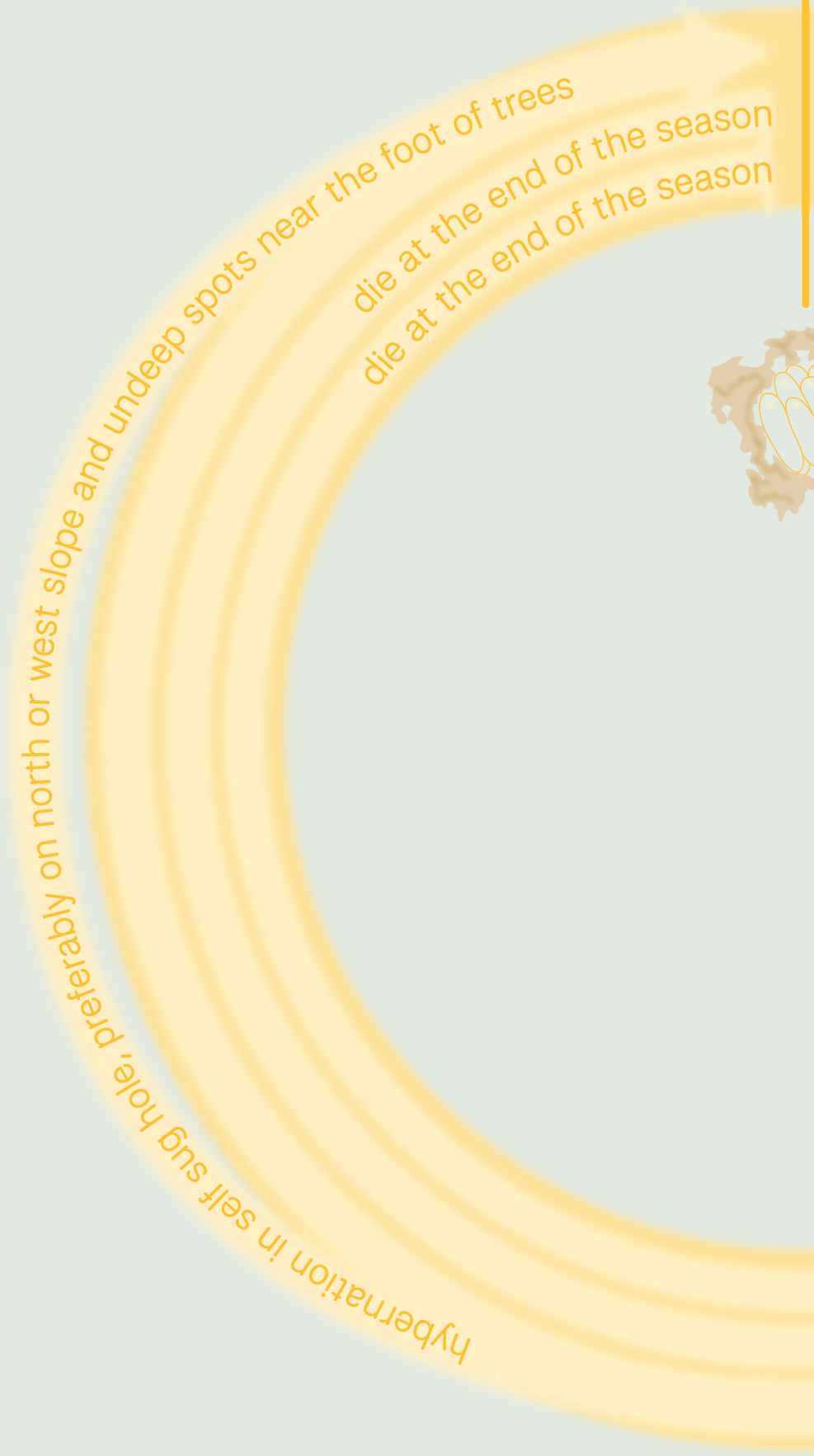

die at the end of the season
die at the end of the season
hybernation in self sug hole, preferably on north or west slope and undeep spots near the foot of trees



Figure 117: lifecycle early bumblebee (van Hoorn, 2026)

Based on (Peeters et al., 2012)



BITTERLING

Rhodeus amarus

conservation status (red list)[1]	
population trend[1]	increasing
latin name derived from	amarus - bitter
subgroup	fish
size[2]	5-10 cm
age[2]	0 - ±5 years
habitat[2]	sweet, undeep, slow-flowing or still waters

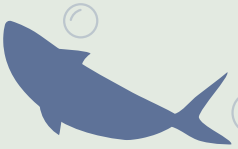
[1](IUCN, n.d.)
[2](Peeters et al., 2012)

Figure 118: Bitterling (Feathercollector, n.d.)

HABITAT

As stated by Ministerie van landbouw, visserij, voedselzekerheid en natuur (2008), the bitterling is mostly found in stationary or slow flowing, clear and relatively undeep waters of lakes, locks and ponds with an rich underwater vegetation and a not too soft soil. The vegetation ensures that young fish are protected against predetors. In flowing and deeper water the species can be found along the edges of the water (Ministerie van landbouw, visserij, voedselzekerheid en natuur, 2008).

FOOD



According to the Ministerie van landbouw, visserij, voedselzekerheid en natuur (2008) the bitterling mostly eats plankton, they graze the algae from rocks. Sometimes they eat amphipods, insect larvae, snails and worms (Ministerie van landbouw, visserij, voedselzekerheid en natuur, 2008).

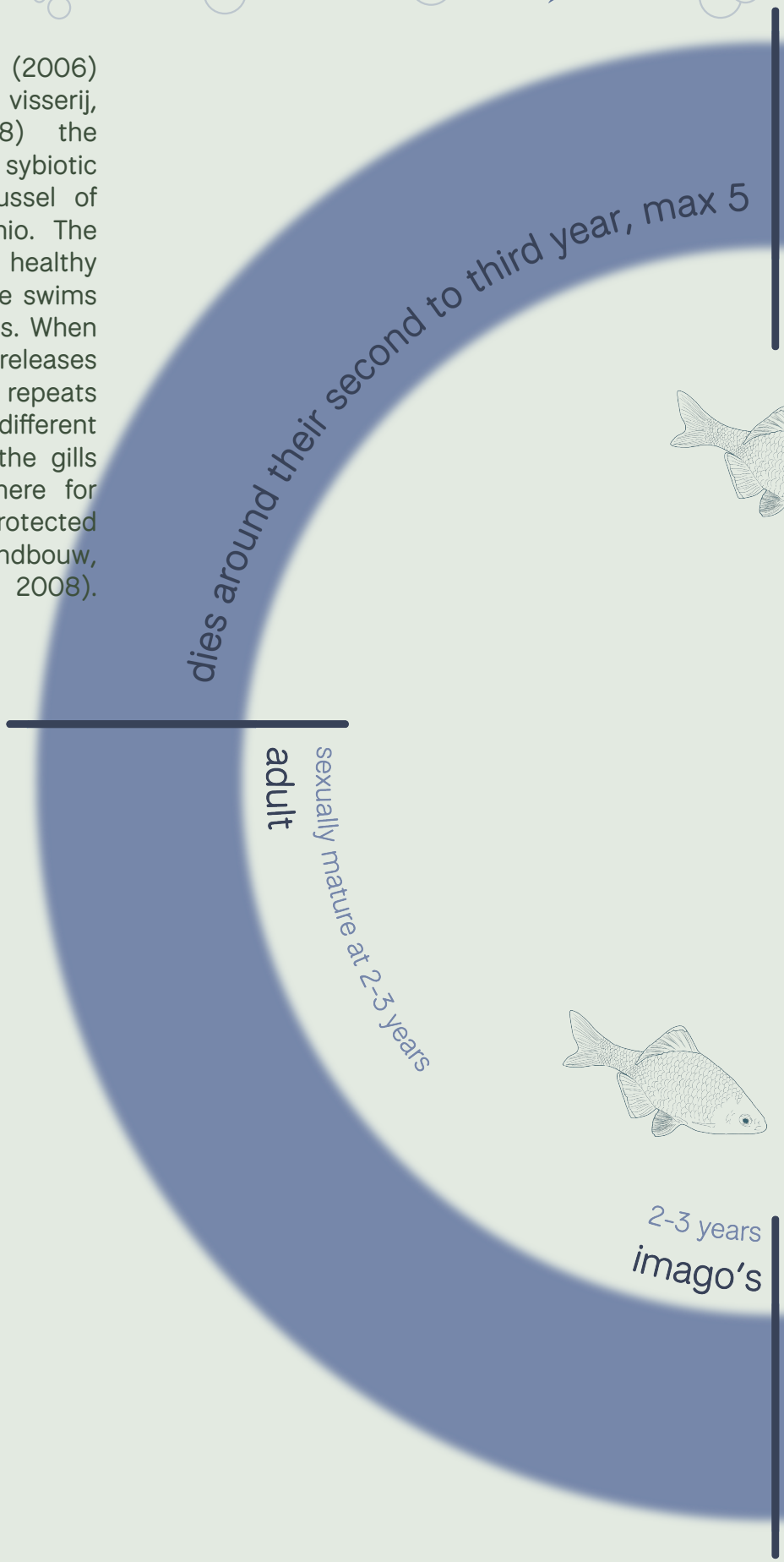
RISK FACTORS

habitat
The Ministerie van landbouw, visserij, voedselzekerheid en natuur (2008) mentiona that due to the more intensive use of the cultural landscape, pollution, acidification, canalisation and more frequent dredging occured. This has concequenses on the water vegetation, fresh water mussels and therefore the bitterling. Management needs to focus on less invasive forms of ditchmanagement, such as fased drenching, further, the water quality is of importance. Due to the intensive ditch management freshwater mussels fail to fully develop, therefore less reproduction possibilities for the bitterling as he needs large mussels (Ministerie van landbouw, visserij, voedselzekerheid en natuur, 2008).



LIFECYCLE

According De Lange & Van Emmerik (2006) and Ministerie van landbouw, visserij, voedselzekerheid en natuur (2008) the bitterling reproduces by forming an sybiotic relationship with large freshwater mussel of the genera Anodonta, particularly Unio. The male fish creates a terretory around a healthy mussel. When a sexually mature female swims by, he tries to lure here to lay her eggs. When the female has swum away, the male releases his sperm over the mussel. The male repeats this pattern with different females and different mussels. The eggs develop between the gills of the mussel, the larvae remain there for two to three weeks where they are protected from predetors (Ministerie van landbouw, visserij, voedselzekerheid en natuur, 2008).



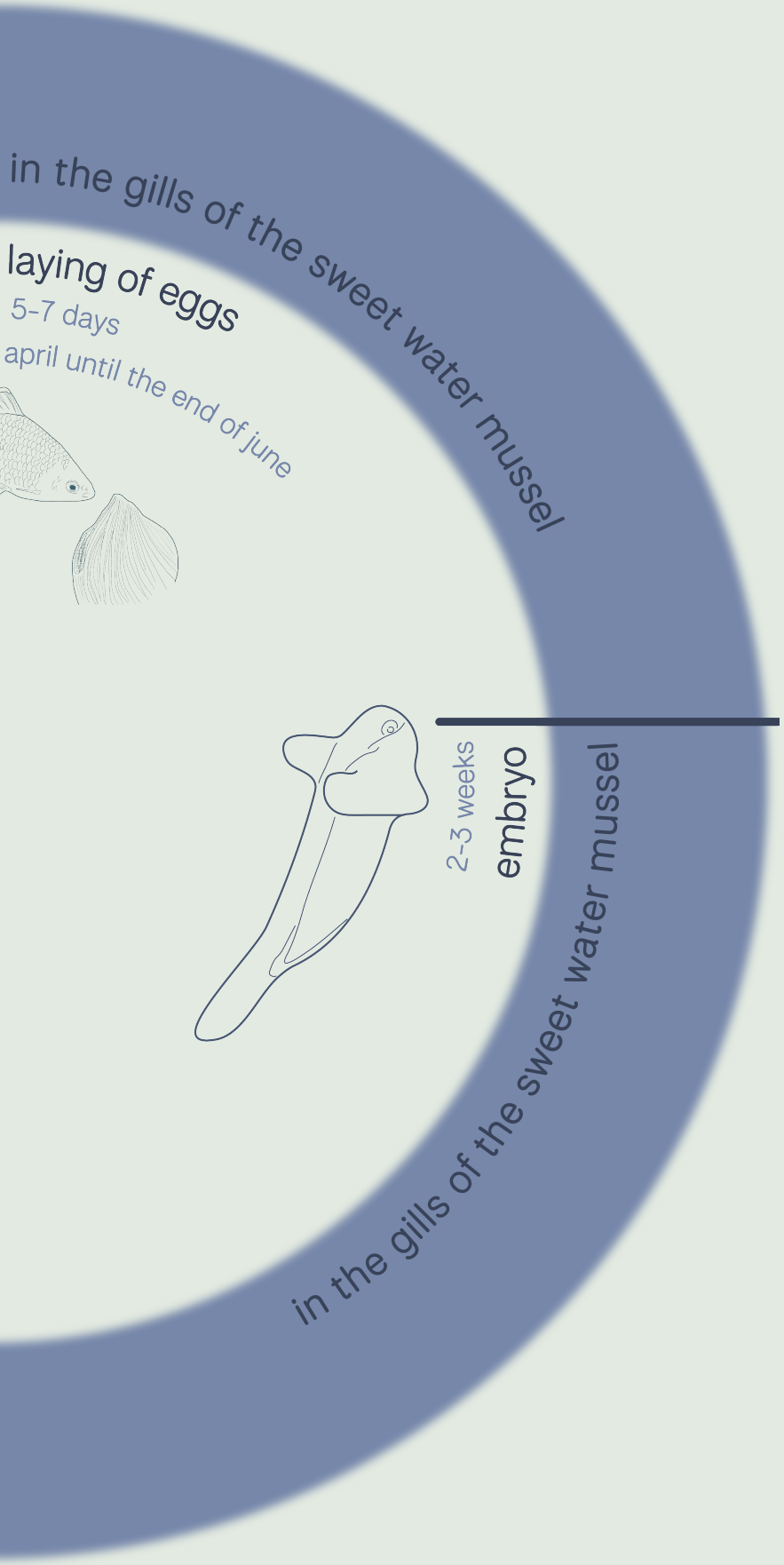


Figure 119: lifecycle early bumblebee (van Hoorn, 2026)

Based on (De lange & van Emmerik, 2006)



HAIRY DRAGONFLY

Brachytron pratense

conservation status (red list)[1]	least concern, near threatened, vunerable, endangered, critically endangered, extinct in the wild, extinct LC NT VU EN CR EW EX
population trend[1]	stable
latin name derived from	pratense, of the meadows
subgroup	insects
size[2]	54-63 mm
age[3]	3-4 years
habitat[2]	clear, sweet, nutrient rich waters, less then 10 meters wide

[1](IUCN, n.d.)
[2] (Vlinderstichting, n.d.)
[3] (Shropshire Dragonflies, n.d.)

Figure 120: Hairy dragonfly (Sadler, n.d.)

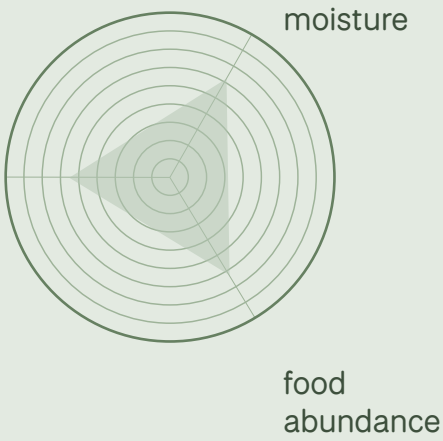
HABITAT

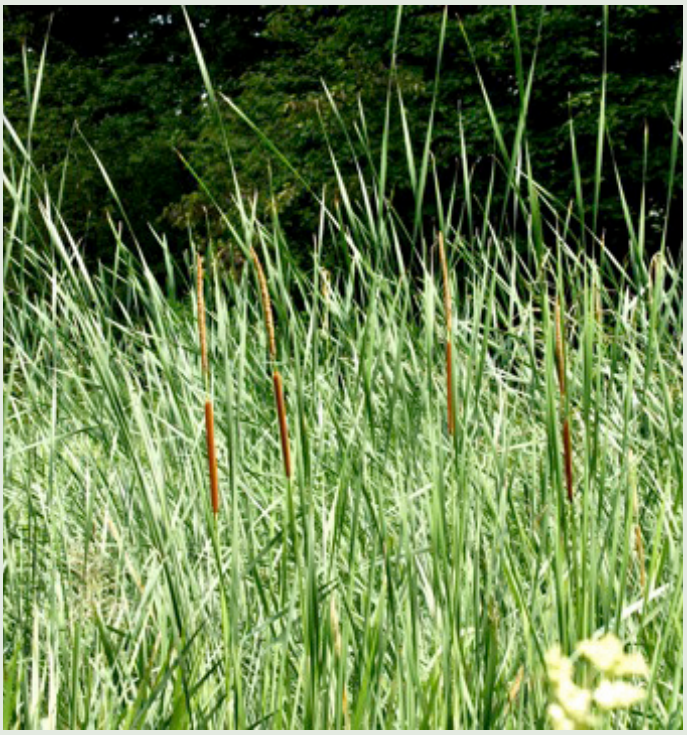
According to Dijkstra & Kalkman (2002) the hairy dragonfly flies near clear, moderately nutrient-poor to nutrient-rich water with a well developed, often high bank and aquatic vegetation. They fly mostly near forests. The hairy dragonfly prefers waters less than 10 meters wide. They are most often seen in lowland peat bogs, on these banks are often water bur-reed, cattail, rushes, marsh fern, reed, and in the water pondweed, bladderwort. On sandy soils a thick organic layer of a minimum of five centimeteres is needed (Dijkstra & Kalkman, 2002). But ponds with the same conditions should be able to habitat this species as well (British Dragonfly Society, 2017).



Bur-reed
Sparganium erectum

banks





small cattail
Typha angustifolia

banks

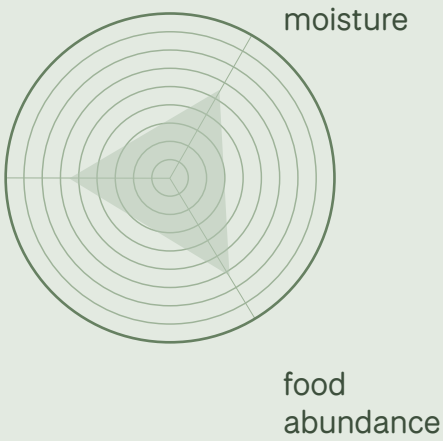
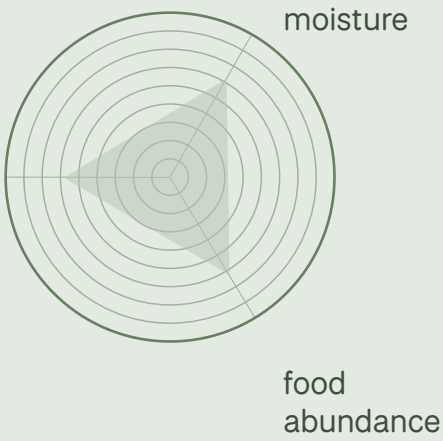


Figure 121: Bur-reed (Flora van Nederland, n.d. o)
Figure 122: small cattail (Flora van Nederland, 2013 b)

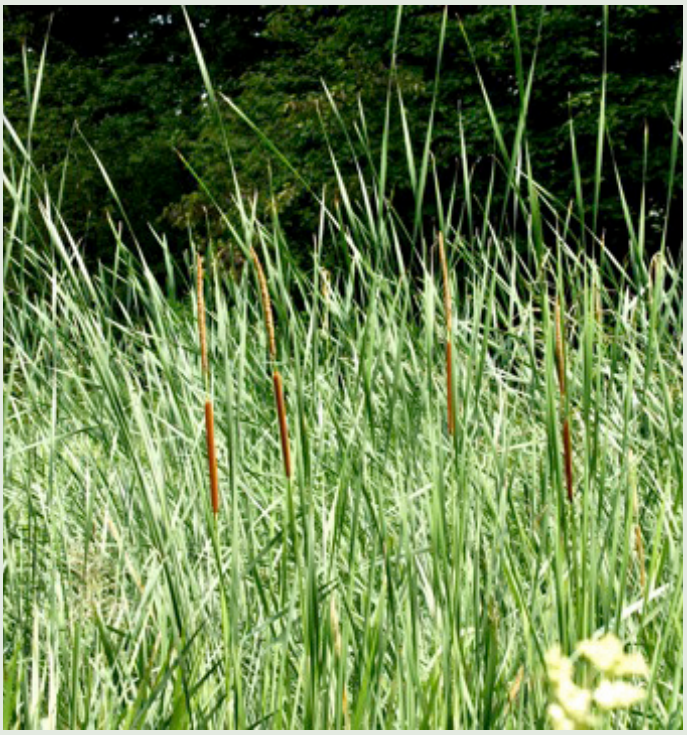


common club-rush
Scirpus lacustris L.

banks

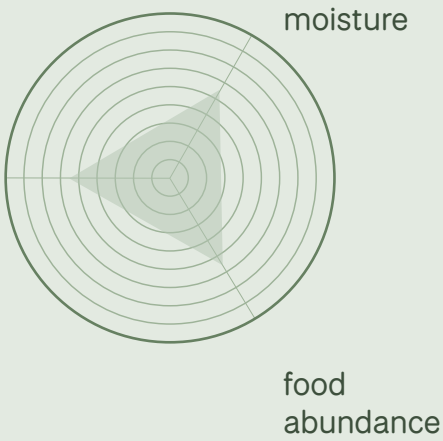


Native Dutch plant, small invasive risk due to fast growing roots



wood club-rush
Scirpus sylvaticus

banks



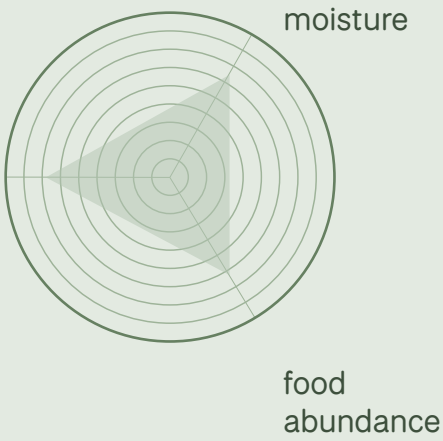
Native plant, non-invasive

Figure 123: Common club-rush (Flora van Nederland, n.d. m)
Figure 124: Wood-clubrush (Flora van Nederland, n.d. c)



Sea club-rush
Bolboschoenus maritimus

banks



Native Dutch plant, non-invasive



marsh fern
Thelypteris palustris

banks

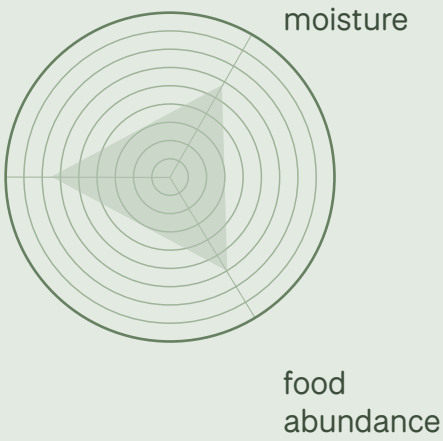
Native plant, non-invasive

Figure 125: sea-clubrush (Flora van Nederland, n.d. k)
Figure 126: marsh fern (Hortus Botanicus Leiden, n.d.)



reed
Phragmites australis

banks

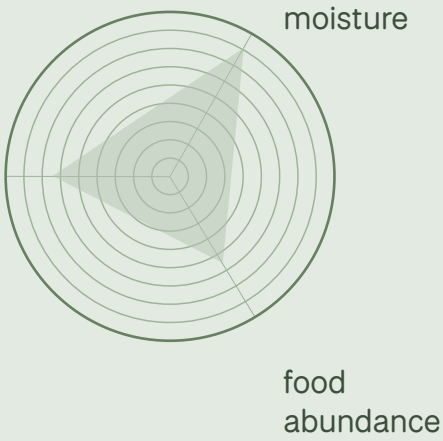


Native Dutch plant, non-invasive



common bladderwort
Utricularia vulgaris

underwater vegetation



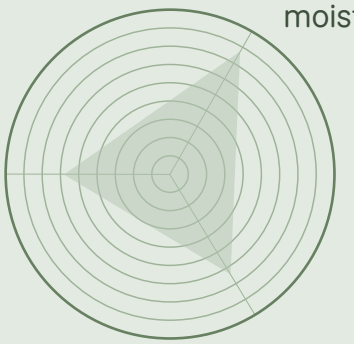
Native Dutch plant, non-invasive

Figure 127: reed (Flora van Nederland, 2013 d)
Figure 128: common bladderwort (Flora van Nederland, n.d. j)



floating-leaf pondweed
Potamogeton natans

underwater vegetation

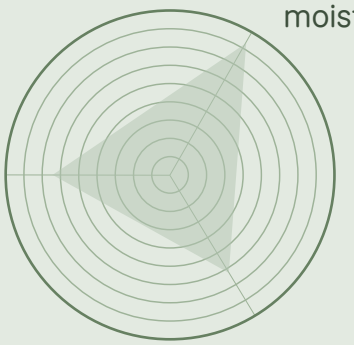


Native Dutch plant, non-invasive



crisp-leaved pondweed
Potamogeton crispus

underwater vegetation



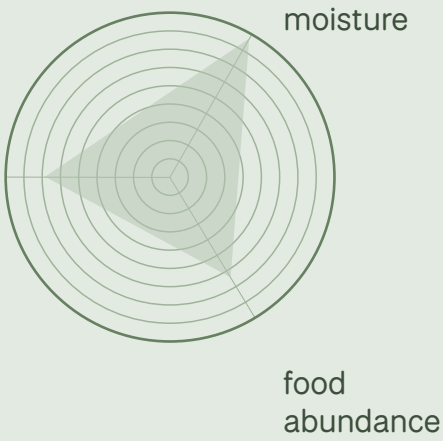
Native plant, non-invasive

Figure 129: floating-leaf pondweed (Flora van Nederland, n.d. f)
Figure 130: crisp-leaved pondweed (Flora van Nederland, n.d. g)



perfoliate pondweed
Potamogeton perfoliatus

underwater vegetation

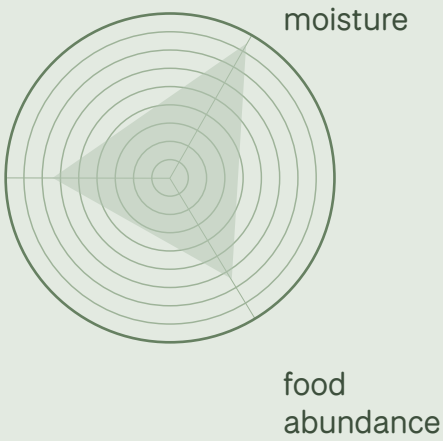


Native Dutch plant, non-invasive



shining pondweed
Potamogeton lucens

underwater vegetation



Native Dutch plant, small invasive risk in stagnant water

Figure 131: perfoliate pondweed (Flora van Nederland, n.d. e)
Figure 132: shining pondweed (Flora van Nederland, n.d. i)



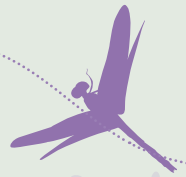
FOOD

Dragonflies eat a variety of insects such as midges and mosquitos (British Dragonfly Society, 2017). But also gnats, wasps, moths, butterflies, bees or each other. They often catch prey in mid air (Shropshire Dragonflies, n.d.).

RISK FACTORS

According to Dalley et al. (n.d.) dragonflies are sensitive to toxic substances such as agricultural or industrial wastes, further the water must contain enough oxygen to sustain the animals during their larvae states. An abdundant growth of waterplants is important for the larvae to hide from predetors. The adults require sunny sheltered places, provided by trees and bushes a few meters from the water edge. If the plants create to much shading, waterplants will lessen and therefore threathen the animals in the larvae stage. If the waterways need to be dredged, only do short lengths and no more than 400 meters at a time and preferbly no more than once every four years. The damage can be short lived if the animals and plants repopulated quickly. In dry periods the animals struggle, if there are trees or bushed this affect can happen more easily due to the drinking of water of the plants, this must be prevented by reducing the amount of trees and bushes very close to a waterbody (Dalley et al., n.d.).

LIFECYCLE




die after a few weeks
peak in end of may - mid june
a few weeks
imago's

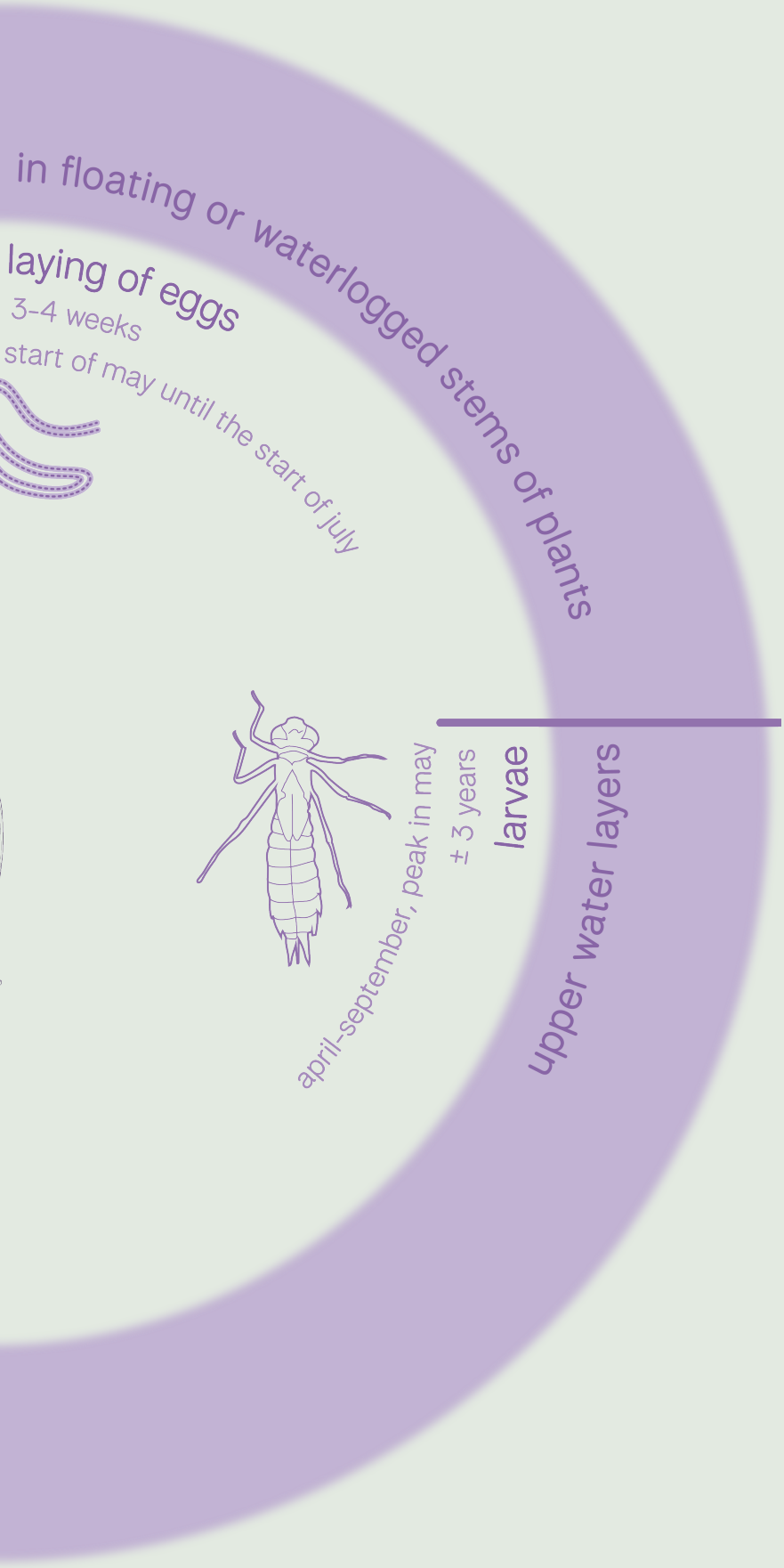


Figure 133: lifecycle hairy dragonfly (van Hoorn, 2026)

Based on British Dragonfly Society, 2017)

02 ATTACHMENT
CASESTUDIES







‘T EEMGOED

location	Oosterwold, Almere, the Netherlands
architect	CEPEZED

‘T eemgoed consists of 82 homes, laid in 7 man-made dykes. The landscape around the houses is cared for by the inhabitants by for example maintaining a vegetable garden. The yield is shared between member and investments for the gardens is done together. There is a collective building where activities can take place such as having a cup of morning coffee, a party or movienights (Eemgoed, n.d.).

Figure 134: ‘t Eemgoed (Cepezed, n.d.)

1 parking is located at the edges of the plan. There are no designated shared vehicles.

2 there are shared spaces such as gardens and a community building. These buildings are managed together and everyone is responsible for these elements. Tasks are distrubuted amongs the inhabitants and rules are decided by a owners' association. There are multiple working groups where the tasks are distributed amongst personal intrests.



Figure 136: 't Eemgoed (Cepezed, n.d.)

2 arrow slits provide a centered view to a certain spot. The inside is barely visible from the outside.



Figure 135: arrow slit (Brittain, 2018)



Figure 137: 't Eemgoed (Cepezed, n.d.)

1 when the slope faces north or west this can provide nesting spots for the early bumblebee

2 the slope can be used for planting the different plants the early bumblebee forages on

3 window is hidden behind the slope, makes it difficult for the black-tailed godwit to see the movement behind it



4 the top of the slope can provide spots for predetors to searh for godwits in the fields

5 a small square can provide trees that the early bumblebee forages on in the early spring when the queens first emerge

6 higher area's in the talud can create hybernation spots for the toad

7 lack of water in the plan makes it hard for the bitterling and the natterjack toad to reproduce

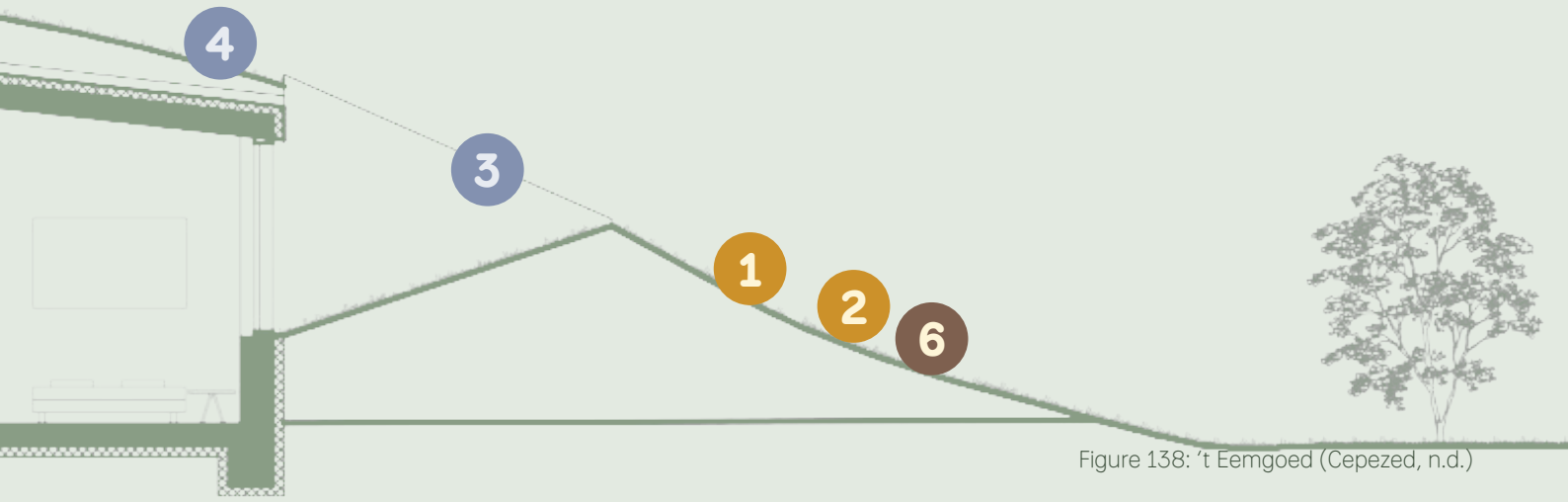


Figure 138: 't Eemgoed (Cepezed, n.d.)

adjusted by author (van Hoorn, 2026)

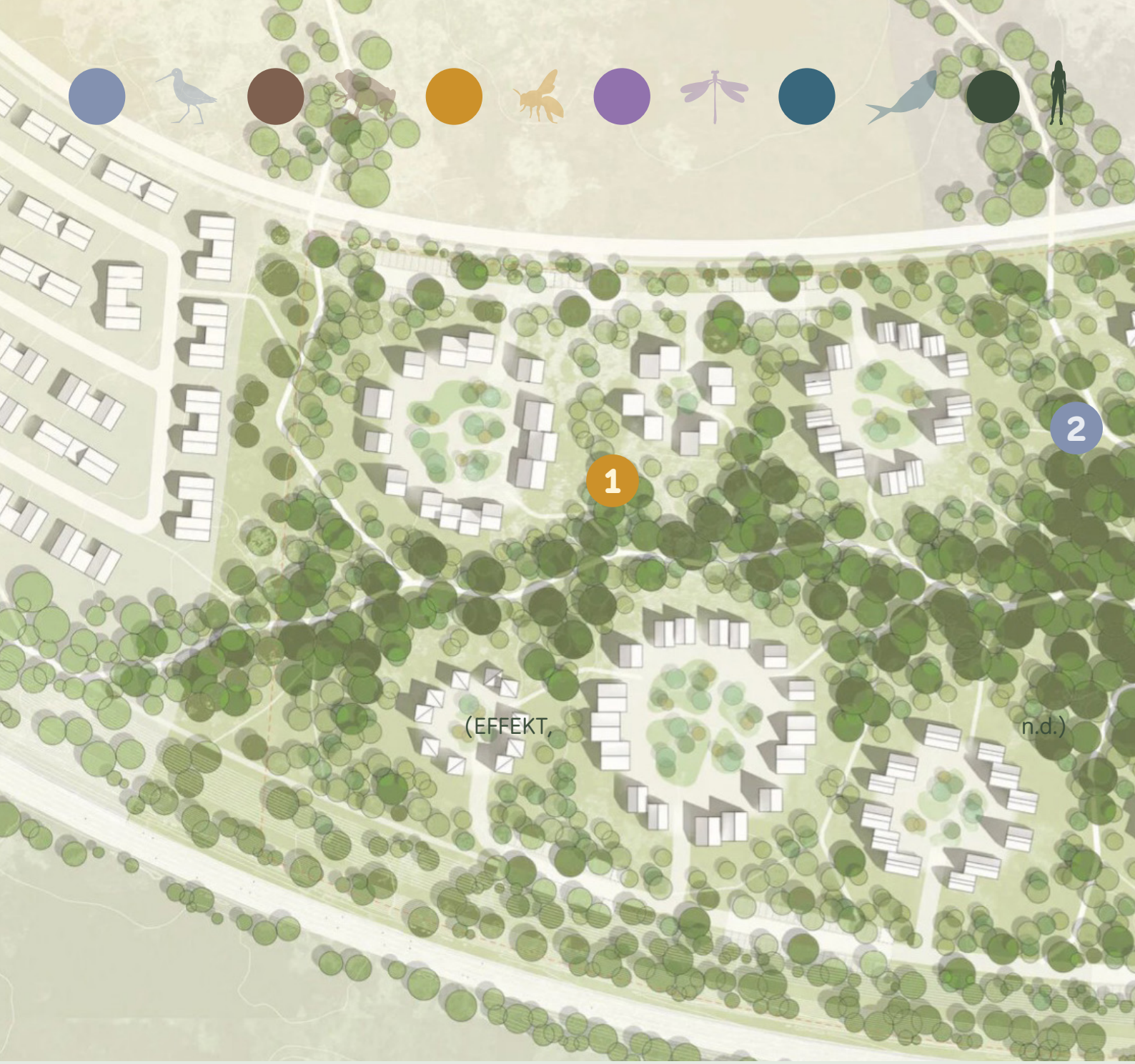


NATURBYEN

location	Middelfart, Syddanmark, Denmark
architect	Effekt

Naturbyen is located in Middelfart, Denmark. In this residential area, a new way of housing is developed where the focus is on afforestation, increased biodiversity and with sirculair resources in suburban areas. Besides achiving these elements, it also creates a healty and socially connected neighbourhood. This neighborhood consists of small communities, combined of 220 homes in a newly planted forest on the orignally empty agricultural plot, therefore helping to reach the goal of coving 20 percent of Denmarks landmass by forests by 2100.

Figure 139: Naturbyen (EFFEKT, n.d.)



(EFFEKT, n.d.)

1 the open and more dense landscape creates different habitats for the early bumblebee to forafe

2 the tree covered area will make the black-tailed godwit stay away

3 vegetation is too dense for the natterjack toad

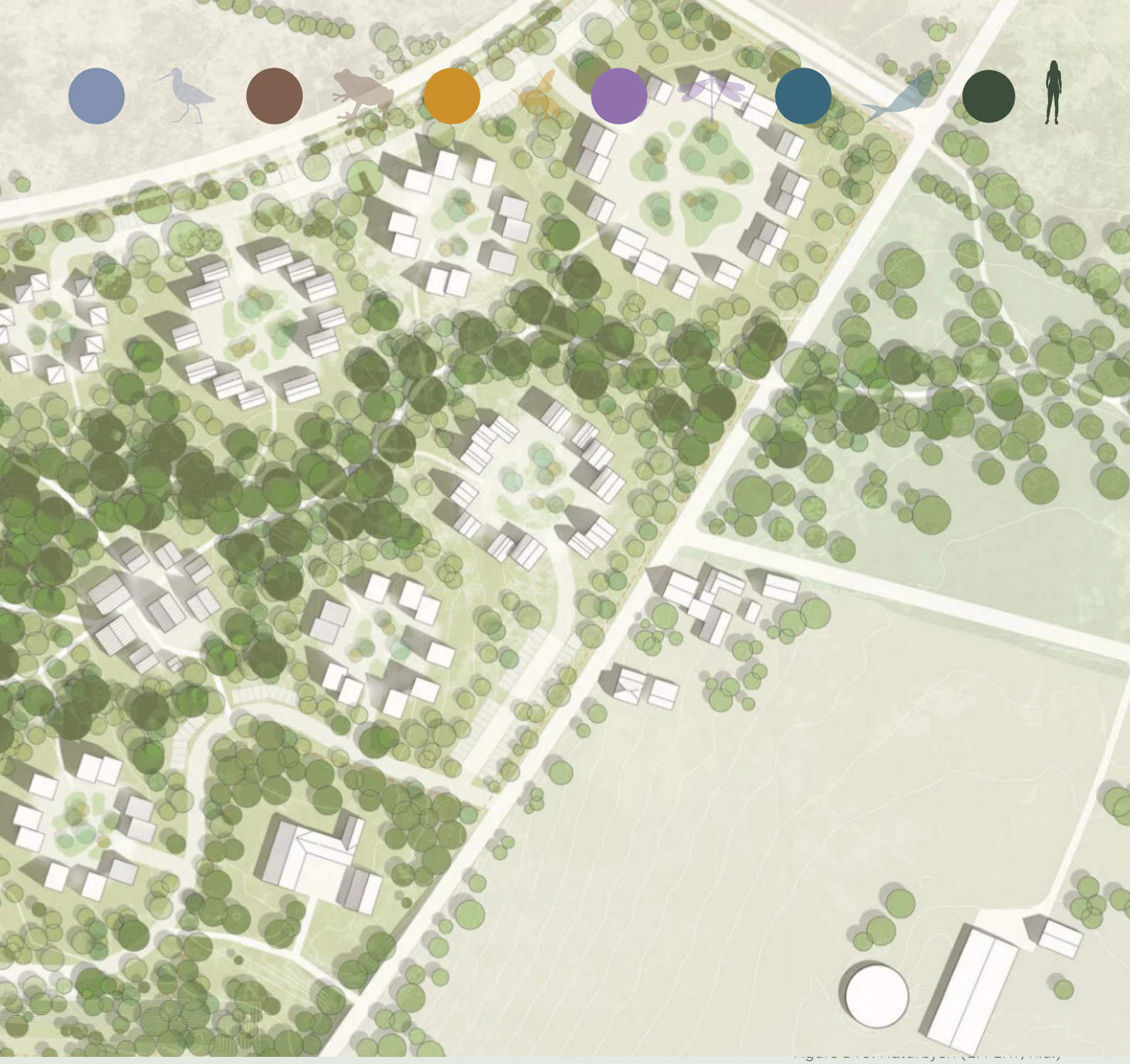




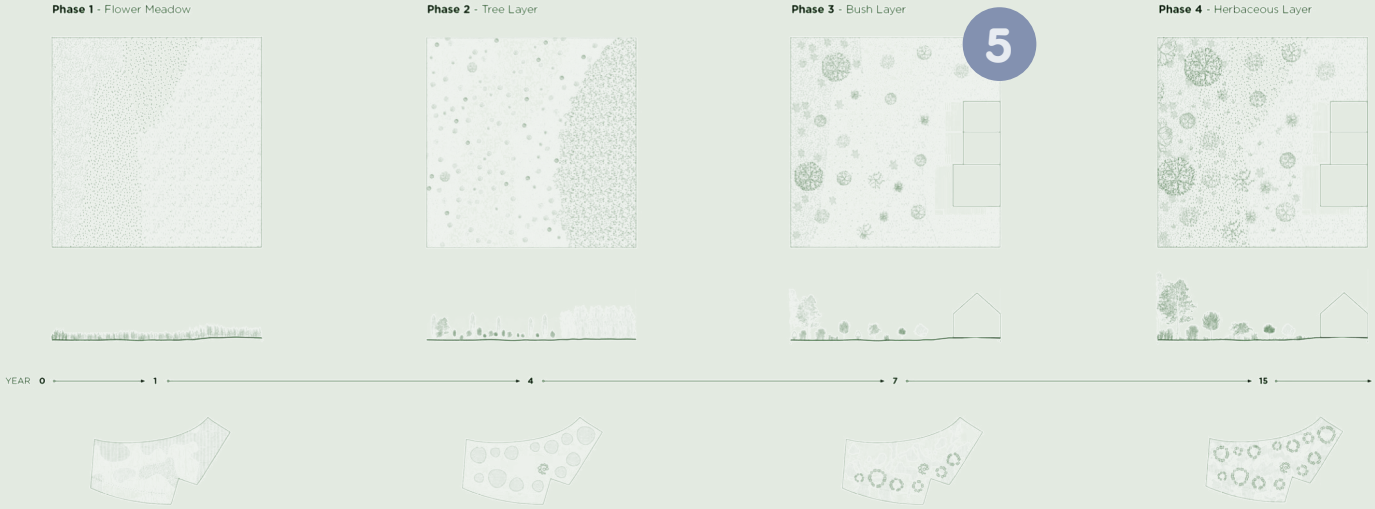
Figure 141: cluster sizes (EFFEKT, n.d.)

Figure 142: Phasing (EFFEKT, n.d.)

Figure 143: layering (EFFEKT, n.d.)

all adjusted by author (van Hoorn, 2026)





landscape succession strategy



4 different sizes clusters provide a variation in built and unbuilt space, therefore also space for animals and plants

5 the different succesion layers provide different plant types, feeding different animals across lifecycles.

6 open area’s create viewlines across the landscape, the godwit prefers to see far



Figure 144: Naturbyen (CEBRA, n.d.)

7 the hills create nesting spots, when in the right orientation

8 the hills can create advantage points for predetors

9 the hills create nesting spots





Figure 145: Naturbyen (EFFEKT, n.d.)



ARANJANI PAVILION

location	New Delhi, India
architect	Tara Lal

The pavilion was designed with the goal to connect the visitors with nature. The spiral shape guides people towards the centre where a stone is placed under a void in the roof. The stone is symbolic to stone markers often found in india's sacred groves where these markers have symbolic mening. The structure is created with invasive plant species. The plants placed on the roof are native, sometimes edible or medicinal an hold cultural significance (Peacock, 2026).

Figure 146: Aranyani pavilion (Peacock, 2026)



Figure 147: Aranyani pavilion (Peacock, 2026)

Figure 148: Aranyani pavilion (Peacock, 2026)

1 the native plants can provide nectar for the bumble bee

2 the green roof blends with the canopy of the trees. Only the facade material pops out

3 The path is behind the lowered wall of the structure, this would prevent visible obstacles for the godwit

4 The lack of flowing watersources makes it difficult for the bitterling to exists in this landscape


1
3



Figure 149: Aranyani pavilion (Peacock, 2026)

5 the small pond can provide an egg laying spot for the natterjack toad however, it does miss some vegetation for the larvae to feed on.

6 the small pond can provide an egg laying spot for the hairy dragonfly however, it does miss some vegetation for the larvae to feed on.



Figure 150: Aranyani pavilion (Peacock, 2026)

7

the bamboo like facade holds the opportunity to be an nesting spot for the early bumble bee when in the north-west or southern orientation



UGAKEI CIRCLES

location	Ugekai, Japan
architect	Third nature architects

The Ugakei circles are a concept of regenerative traveling, creating a posibility to travel responsibly. The site is located between Osaka, Kyoto and Nagoya on a old campsite. It aims to reconnect visitors with nature and the landscape. The campsite consists of three zones, an overnight area with cabins and glamping platforms, a traditional campsite and a nature focused leaning hub. A central building hosts a welcome point, reception and a workshop space. The buildings incorporates features as renewable features with repurposed building waste, as well as collecting rainwater and using reclaimed wood and bricks (third nature, n.d.).

Figure 151: Ugakei circles (third nature, n.d.)

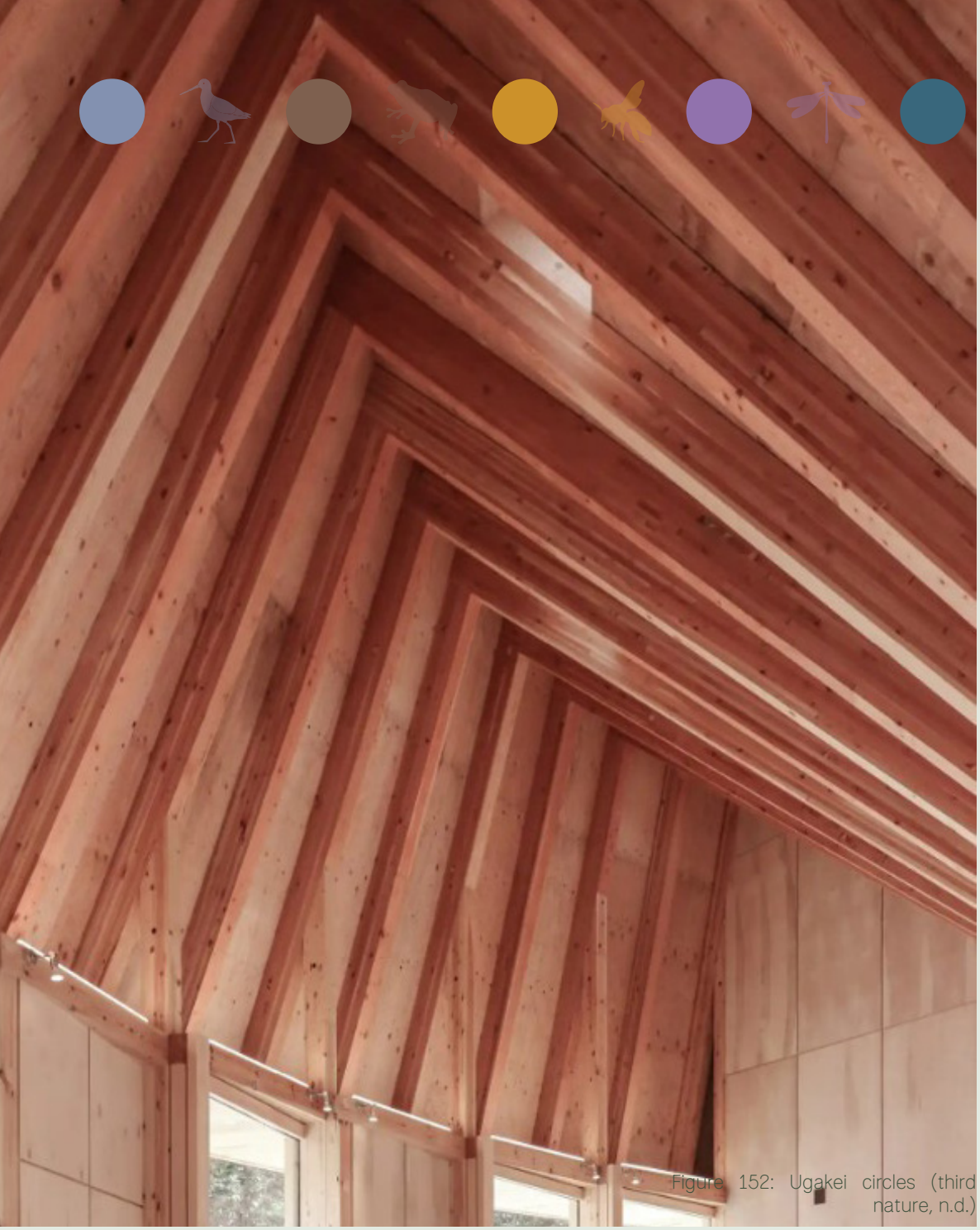
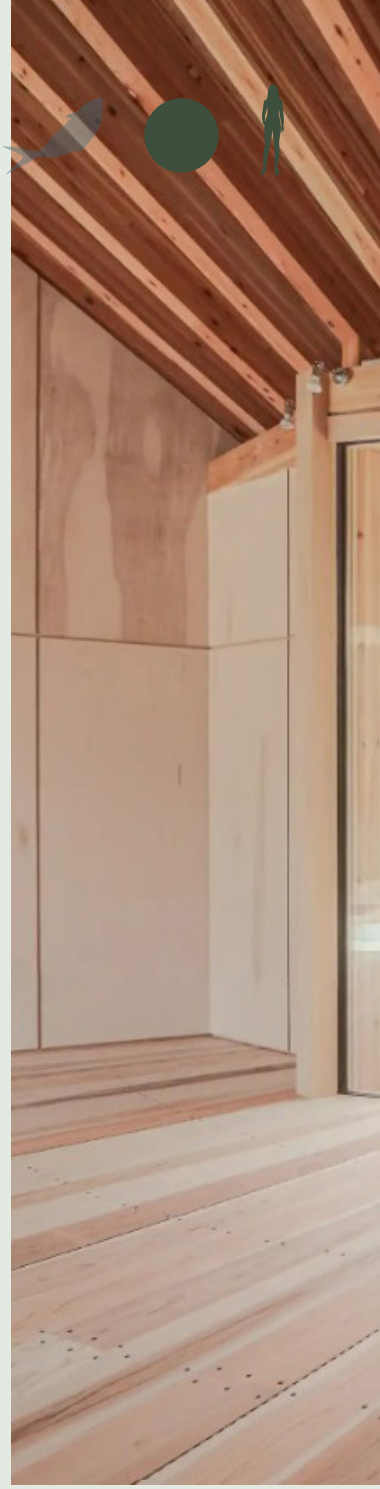


Figure 152: Ugakei circles (third nature, n.d.)



1 the opening in the roof provides an space where objects can be placed which are not visible from the outside of the building, preventing visible obstacles for the godwit

2 the small amount that the building is elevated allows the site to breathe under the building. leaving the animals in the ground intact, which can in their turn provide food for the godwit and natterjack toad.



Figure 153: Ugakei circles (third nature, n.d.)



Figure 154: Ugakei circles (third nature, n.d.)

1 the opening in the roof provides an space where objects can be placed which are not visible from the outside of the building, preventing visible obstacles for the godwit

3 the hidden tree can provide nectar for the queen when they awaken early in the spring



Figure 155: Ugakei circles (third nature, n.d.)

4 the stream can host nesting spots for the bitterling when containing sweet water and a sandy bottom

5 the stream does lack begetation for the dragonfly to nest in, but is a great start

6 the undeep and slow flowing water make the eggs of the toad stay put

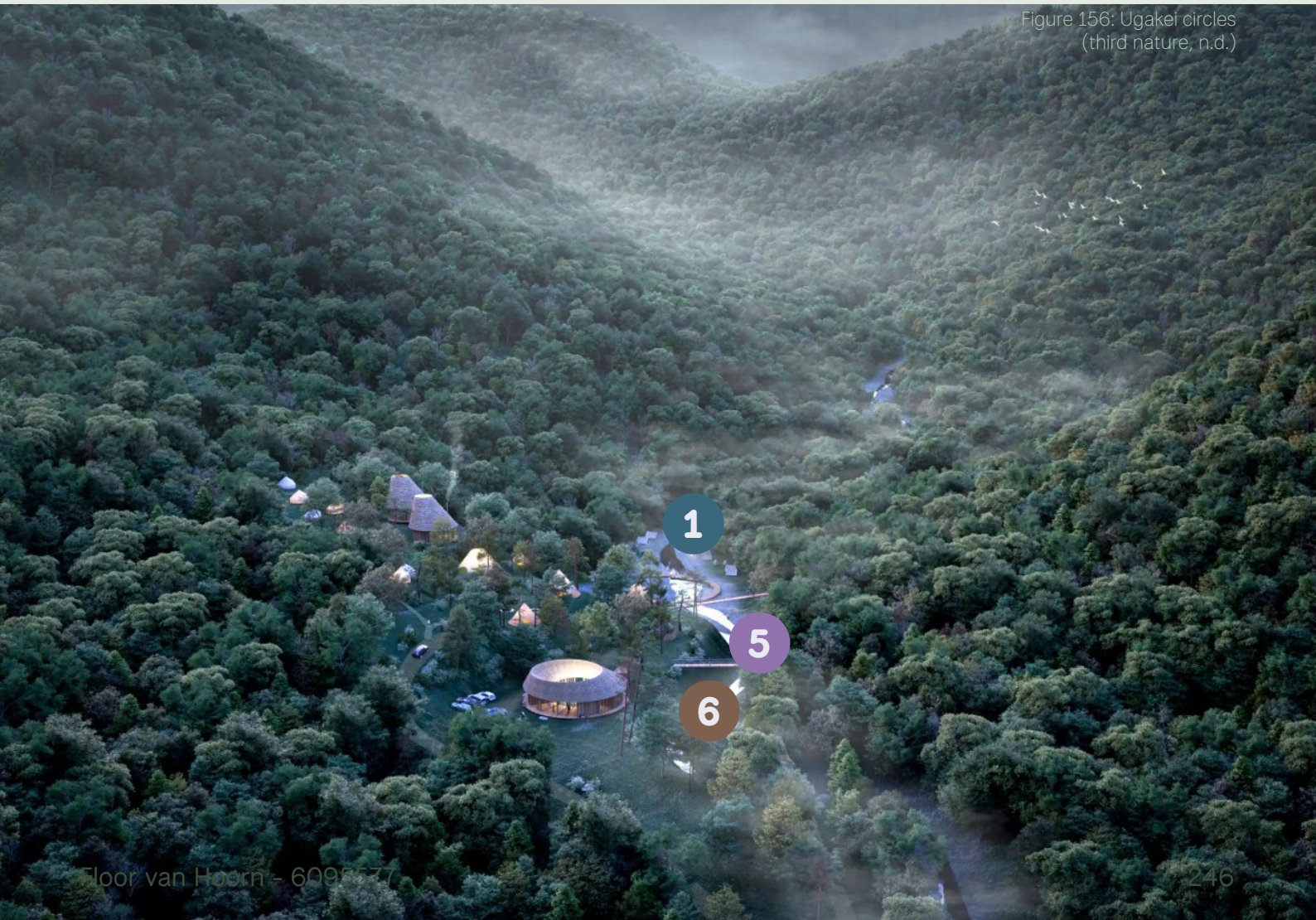


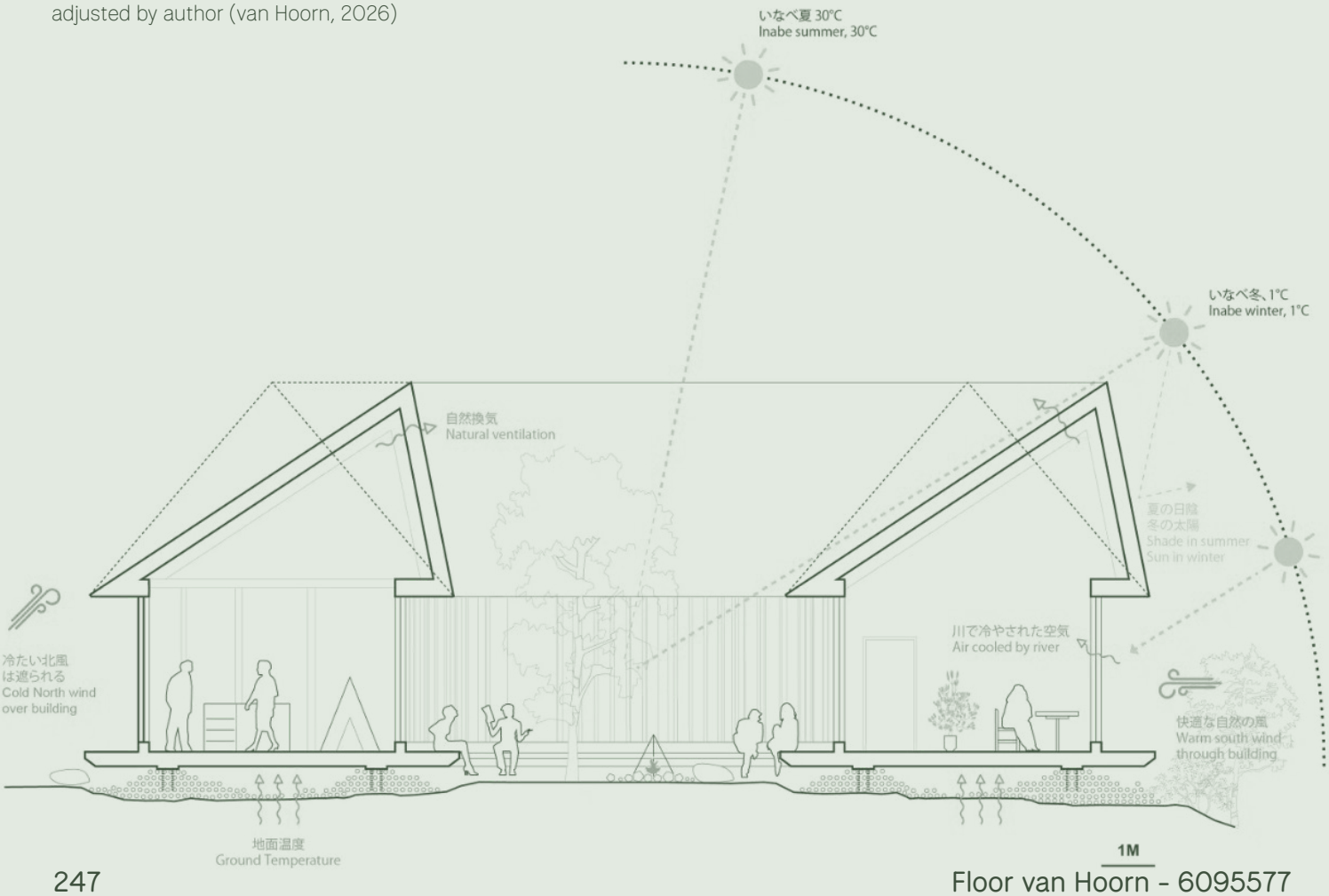
Figure 156: Ugakei circles (third nature, n.d.)

7

The roof's design works with the sun to prevent overheating in summer and keep the building warm in winter. The floor benefits from the cool ground in summer and the relatively warm ground in winter.

Figure 157: Ugakei circles (third nature, n.d.)

adjusted by author (van Hoorn, 2026)





HE:AL CAMPUS

location	Esch-sur-Alzette, Canton of Esch-sur-Alzette Luxembourg
architect	Effekt

The HE:AL campus, located in Esch-sur-Alzette, Luxembourg, aims to promote continuous learning and improvement over the next 10 years through a regenerative approach. The project aims to serve not only as a research project, but also to create urban developments that regenerate resources.

The focus is on minimising tarmac and optimising green spaces to create a campus that blends seamlessly with the surrounding greenery. The biodiversity of the area will be increased by creating a variety of habitats for animals and plants, such as dry grasslands, wet areas, and birch and cherry tree corridors. Existing buildings and infrastructure will be reused and new buildings will use passive principles.

Figure 158: HE:AL campus (Effekt, n.d.)

1

different types of plants and alternating landscape create a good foraging landscape for the early bumblebee





Figure 160: HE:AL campus (Effekt, n.d.) adjusted by author (van Hoorn, 2026)

Figure 161: HE:AL campus (Effekt, n.d.) adjusted by author (van Hoorn, 2026)





From monoculture to biodiversity
Expanding the wetland and adding a new 'urban nature'







Landscape typologies
HE:AL(ing) Landscape

Figure 162: HE:AL campus (Effekt, n.d.)

adjusted by author (van Hoorn, 2026)



Climate resilience through water management
HE:AL(ing) Landscape

2 different types of plants and alternating landscape create a good foraging landscape for the early bumblebee

3 the meadow area with lower plants create a area for the black-tailed godwit, taking the distance to trees and buildings out of account

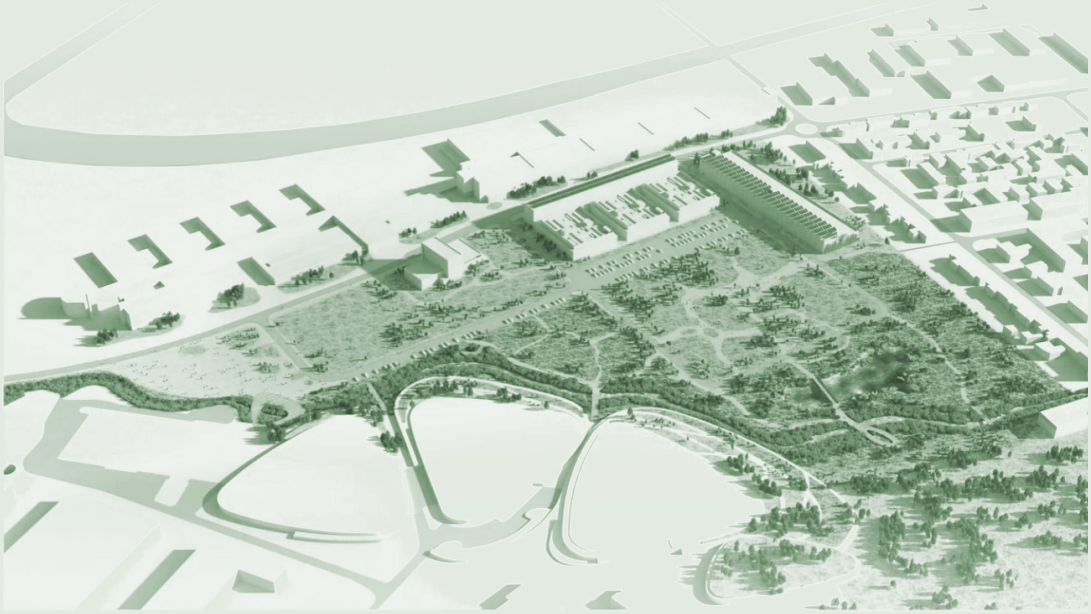
4 pond and (temporary) meadows creates egg laying spots for the toad

5 the creek if sandy bottom creates terretoria for the bitterling

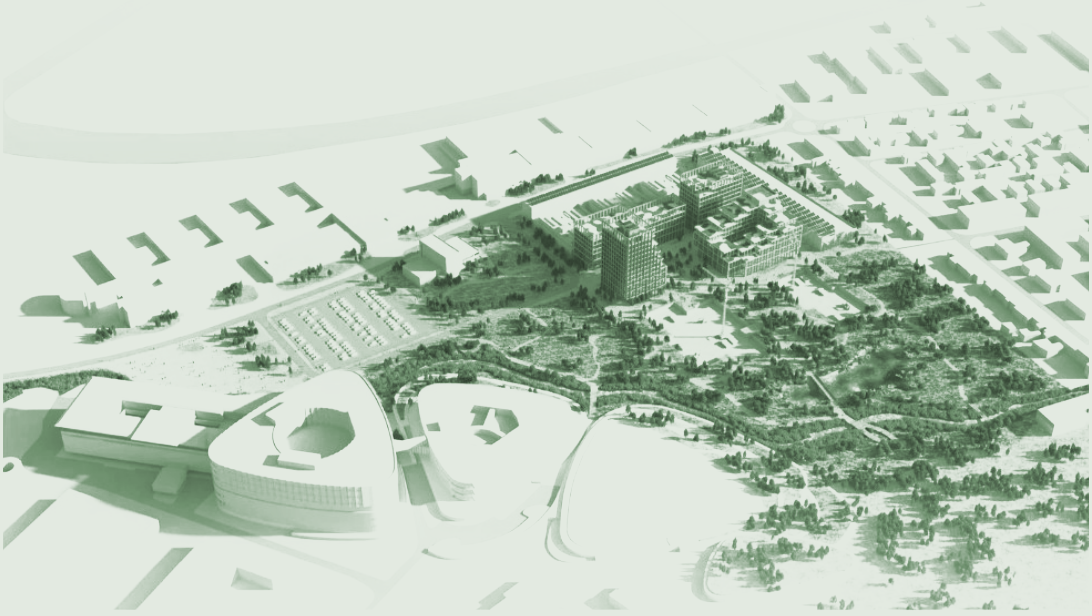
Figure 163: HE:AL campus (Effekt, n.d.)

Figure 164: HE:AL campus (Effekt, n.d.)

adjusted by author (van Hoorn, 2026)



HE:AL Phasing
Organic development



HE:AL Phasing
Organic development

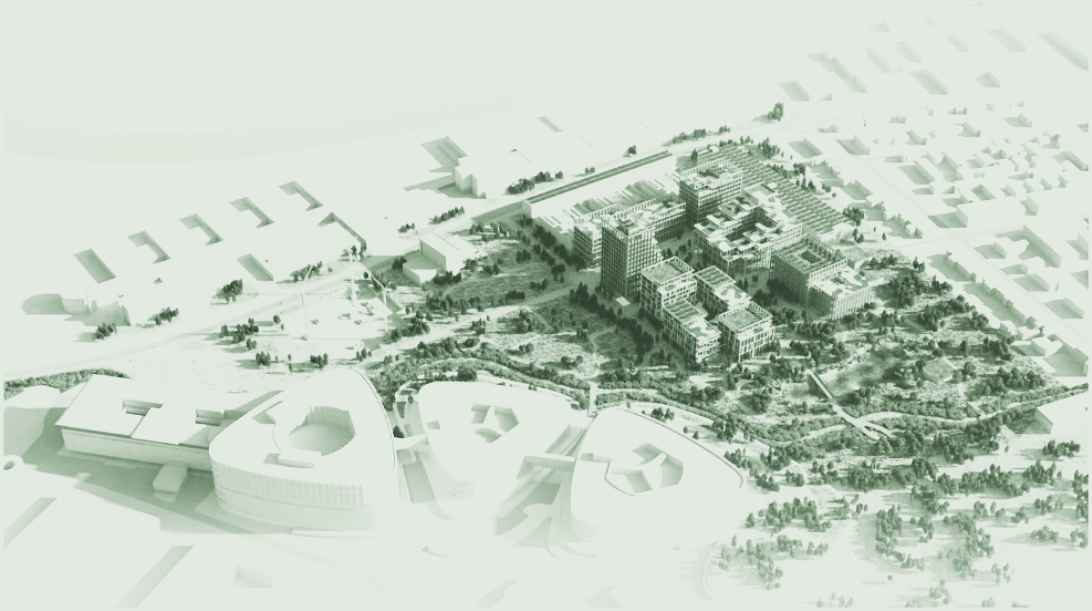
2

phasing creates a transition into the new landscape, hopefully not scaring away the original inhabitants

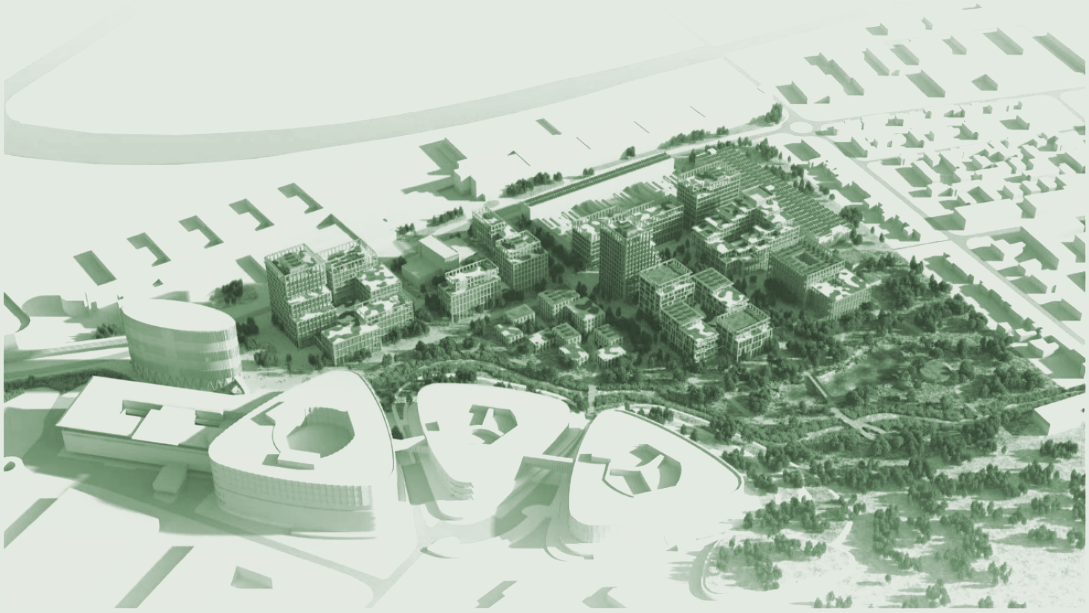
Figure 165: HE:AL campus (Effekt, n.d.)

Figure 166: HE:AL campus (Effekt, n.d.)

adjusted by author (van Hoorn, 2026)



HE:AL Phasing
Organic development



HE:AL Phasing
Organic development



EVA LANXMEER

location	Culemborg, Gelderland, the Netherlands
architect	Joachim Eble Architektur and Orta Atelier

Eva Lanxmer focuses on combining living, working, recreation, food production and harvesting drinking water. From the beginning of the project, the focus has been on fulfilling the high standards for the settlement in terms of cultural history, landscape, water, energy, the use of building materials, mobility, and the participation of inhabitants in the development and management of the neighbourhood. The settlement currently accommodates 350 households, who collaborate in communal gardens, share cars and generate energy (Lanxmeer, n.d.).

Figure 167: Eva lanxmeer (EcoEngineers, 2018)



Figure 168: grey water management (Lanxmeer, n.d.)

adjusted by author (van Hoorn, 2026)

1

the plan consists of around 350 households and has around 7280 m^2 of helophyefilters, which clean only the grey waters. This is around 21 m^2 per household.



Figure 169: rain water management (Lanxmeer, n.d.)

adjusted by author (van Hoorn, 2026)

2

rainwater is captured on the roofs, and is led to a retention system. these pools are supplemented with water from the watercleaning company. With this, the filters are flushed daily.

Figure 170: rain water management from paving (Lanxmeer, n.d.)

adjusted by author (van Hoorn, 2026)

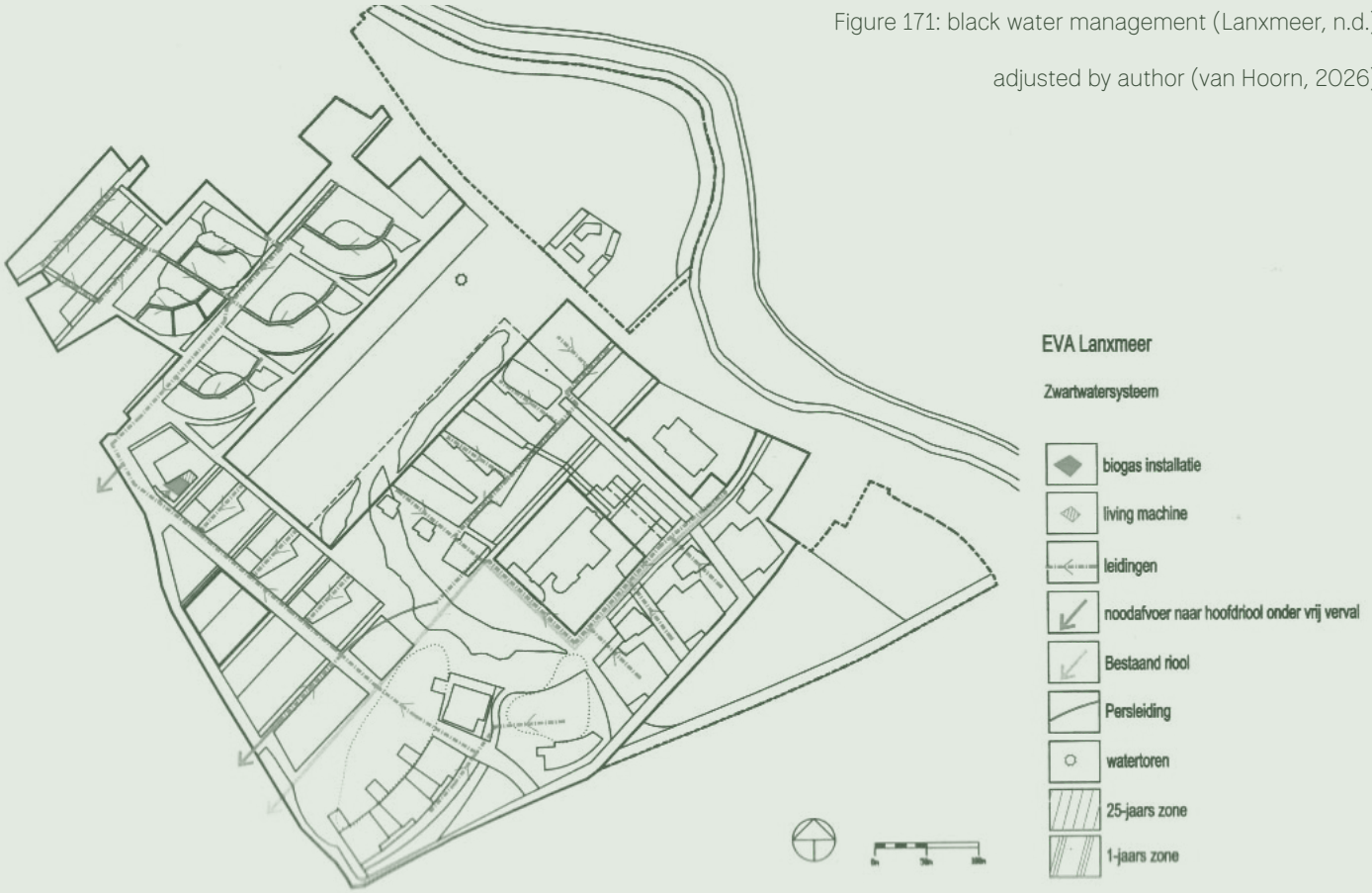


3

the rain water from paving is led to wadi, away from the waterwinning areas to prevent pollution.

Figure 171: black water management (Lanxmeer, n.d.)

adjusted by author (van Hoorn, 2026)



4

The sewage water was intended for use in a biogas installation. However, it is currently out of use, so the sewage water is discharged into the main sewer at the edge of the site. Biological waste could be added to the biodgas installation.

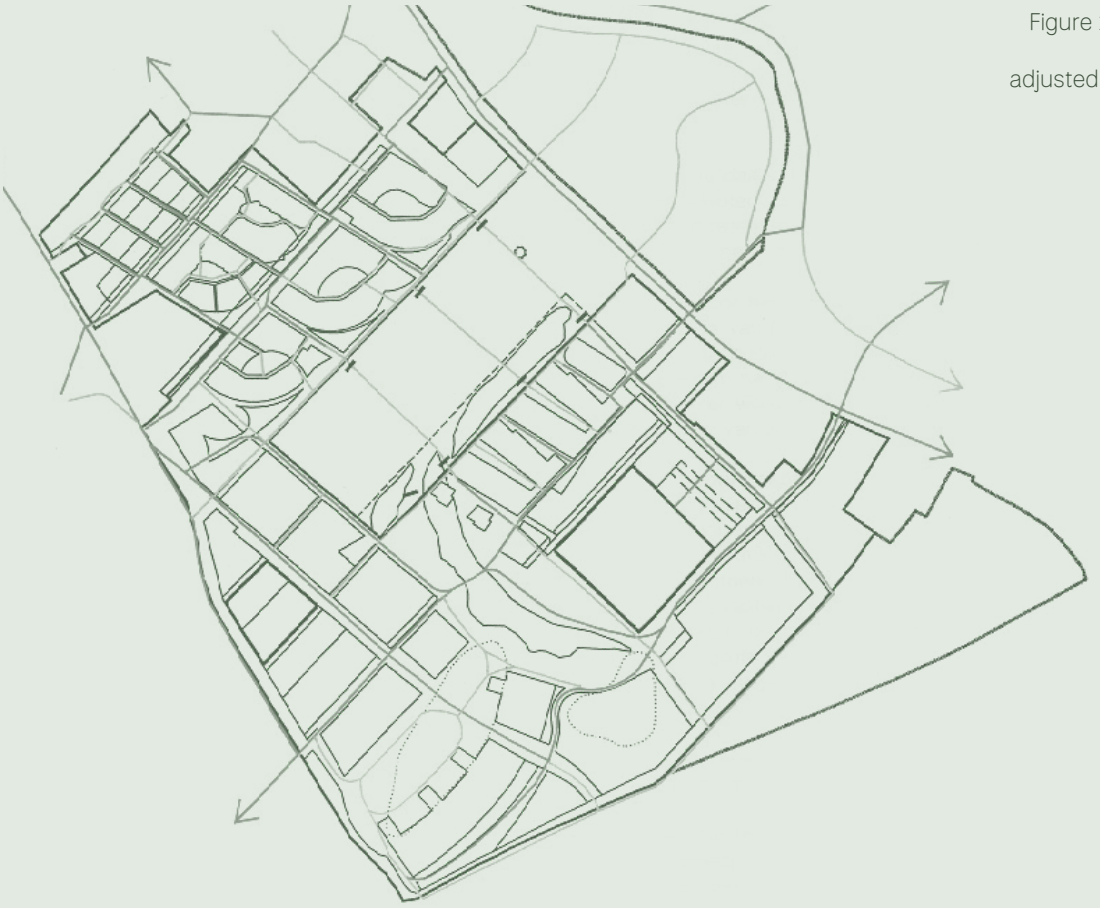


Figure 172: mobility (Lanxmeer, n.d.)

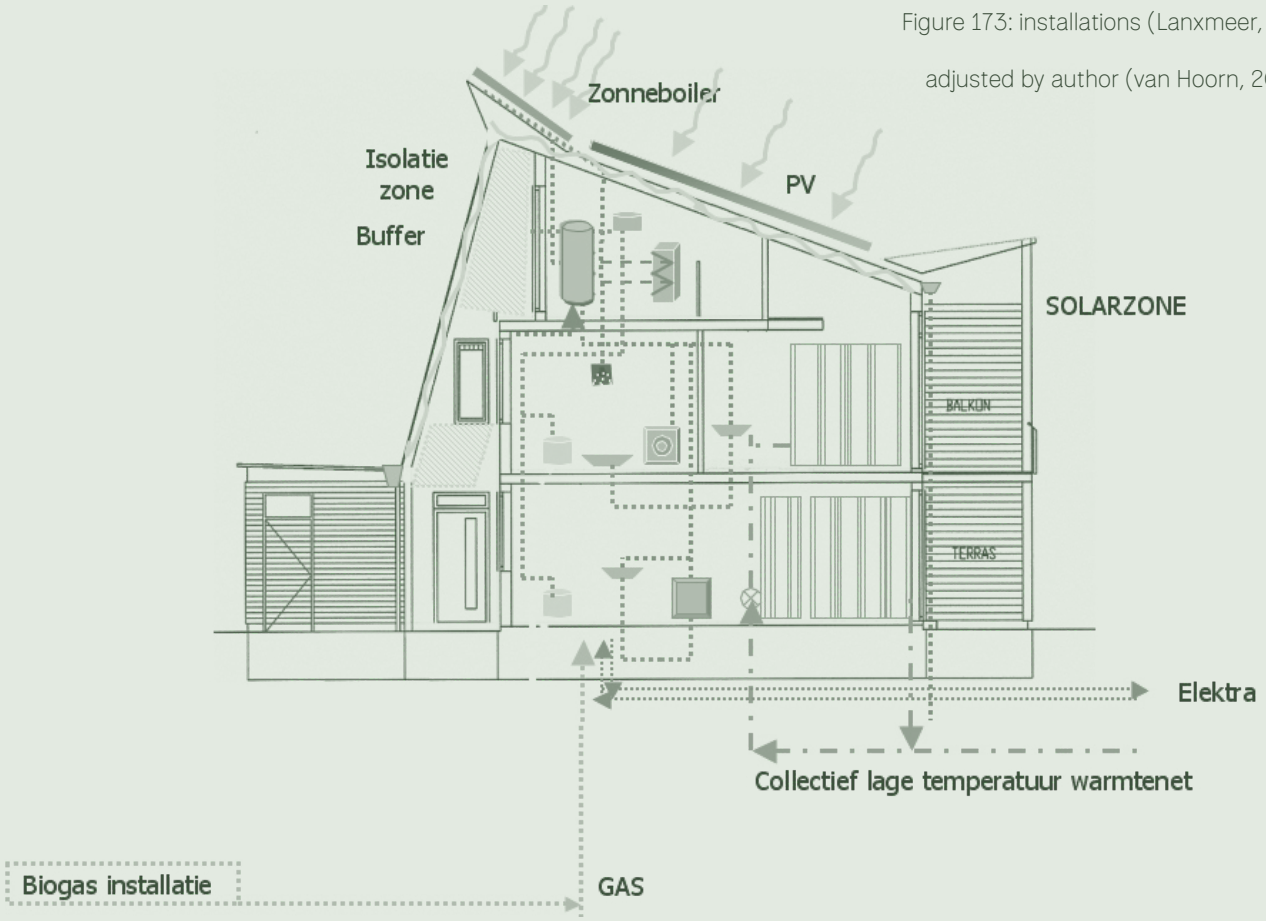
adjusted by author (van Hoorn, 2026)

5

parking is located at the edges of the plan, the yellow paths are intended for pedestrians. The red paths are routes with other traffic functions. The homes are accecible by car for emergency services and loading and unloading.

Figure 173: installations (Lanxmeer, n.d.)

adjusted by author (van Hoorn, 2026)



6

Besides using solar panels for energy, the sun is also used to preheat the water.

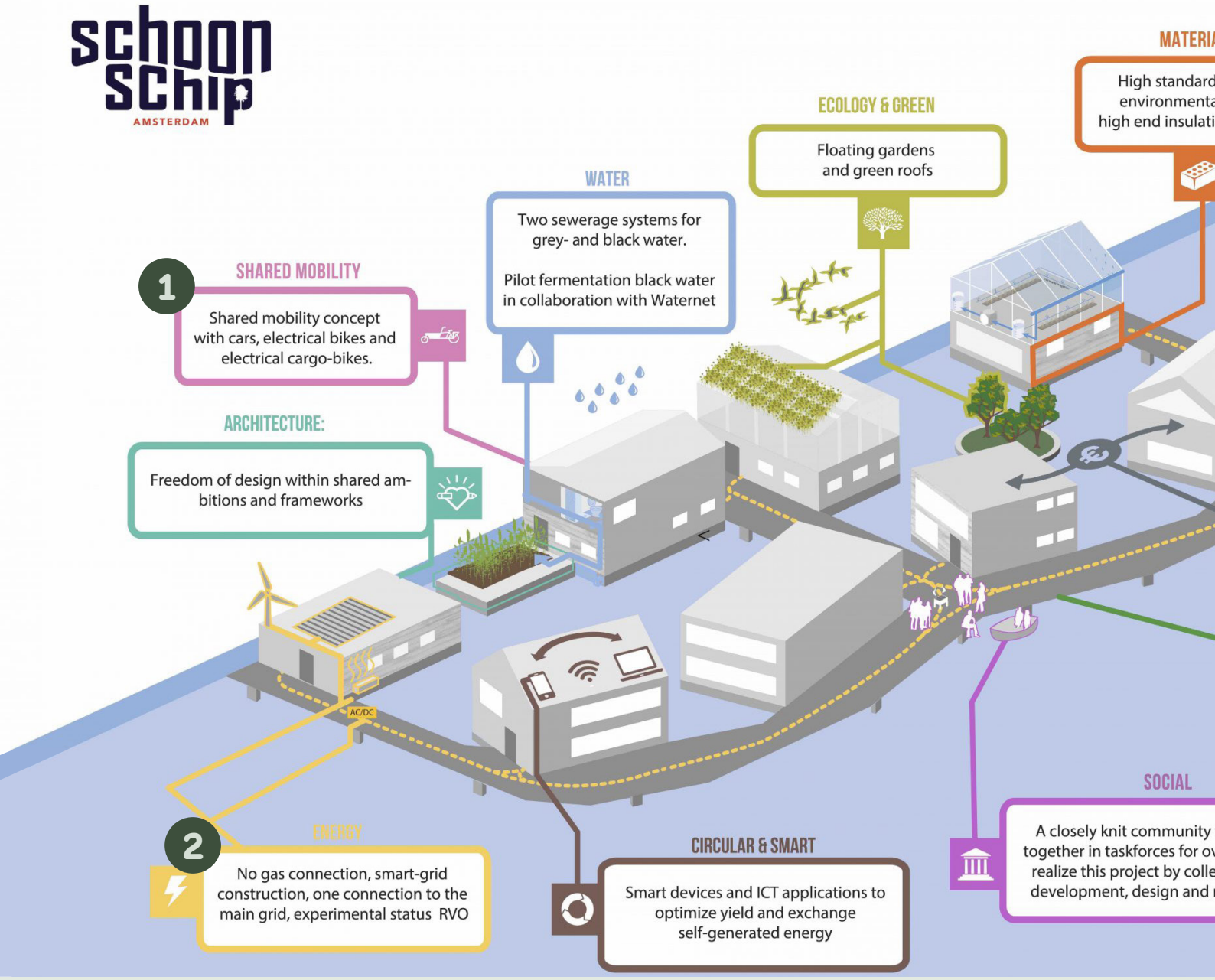


SCHOONSCHIP

location	Amsterdam, North-Holland, the Netherlands
architect	multiple

Schoonschip in Amsterdam is a floating neighbourhood comprising 46 households living on 30 floating homes. The residents focus on doing their shopping as a group to minimise waste, reduce their need to travel and buy locally. There are also floating gardens and nesting places for birds. In addition to using plants to purify the water. The mobility hub is for neighbours to share and the neighbourhood is working with the municipality to extend this to other areas. The communal space is used for meetings, yoga, movie nights, and so on. Finally, Schoonschip has a smart grid where they generate and share energy amongst themselves (Schoonschip, n.d.).

Figure 174: Schoonschip (Schoonschip, n.d.)



1 parking is located at the edges of the plan and vehicles are shared.

2 energy is genereted and stored in each home, and is able to be shared. There is only one connection to the grid in need

2 there are community spaces where meetings, parties and for example movienights can take place.



Figure 175: the plan
(Schoonschip, n.d.)

03

ATTACHMENT
BUILDING TECHNOLOGY





INSTALLATIONS

GRASS-HERB ROOF

The Sempergreen (Sempergreen, 2026) flower-green green roofs feature a variety of flowering plants that provide nectar for early-season bumblebees, whilst also creating greenery that blends into the polder landscape to minimise visual disturbance for the black-tailed godwit. The roof is applicable to different roof angles, therefore suitable for every angle in the plan.



Figure 176: green roof (Sempergreen, 2026)

INSTALLATIONS
SOLAR PANELS

The matt solar panels in colour prevent reflection. Therefore reducing the risk of scaring overflying birds away. The green colour merges with the grass-herb roof. It's maximum capacity is 180 WP/ m^2.

According to ANWB (n.d.), the conversion factor is 0,85-0,95. The least feasible number is used in this case. This means that the solar panels generate 180*0,85= 153 kWh/m^2.

When using the average usage of 2260 kWh/y, 2260/153=14,77 m^2 of solar panels are needed per home.



Figure 177: matt green solar panel (Solarix, n.d.)

persons in household	average usage per year in kWh
1	1600
2	2410
3	2950
4	3510
5+	3880
average per household	2260

table 4: averawge usage of power (NIBUD, 2026)

INSTALLATIONS

BATTERY

When combined with a battery and a smart grid, residents can share energy in periods of need, as done in the case study of Schoonschip. A battery can also come in handy when there are power shortages on the grid.

AlphaESS battery Hybrid has a capacity of 3,8 kWh (Solar Concept, 2025)

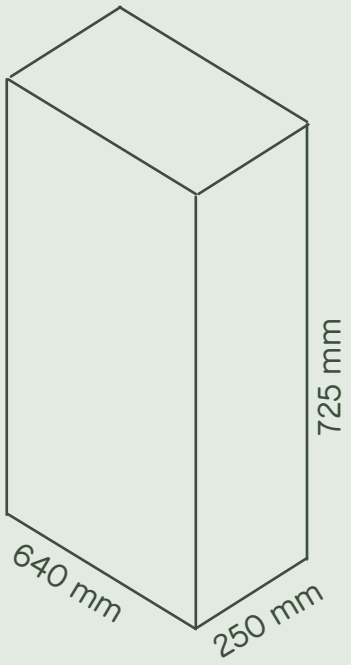


Figure 178: sizes battery (van Hoorn, 2026)

INSTALLATIONS

SOLAR HEATER

A solar heater will preheat the hot water needed. A systems such as the VSCH300 contains the elements for the roof, the boiler and all the fixing hardware. Its boiler has a capacity of 300 liters (Holland solar heating, n.d.).

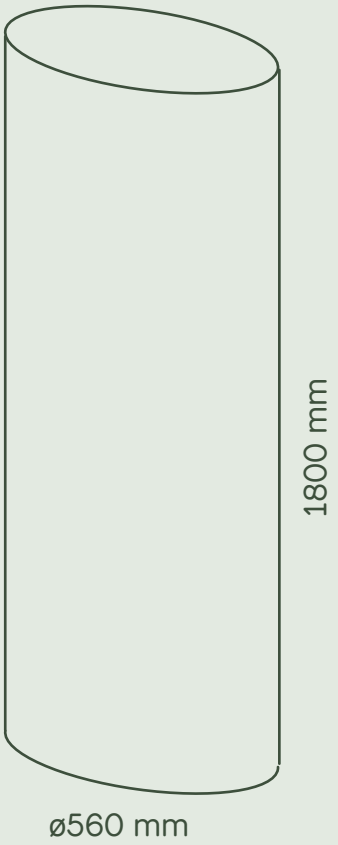


Figure 179: sizes solar heater (van Hoorn, 2026)

INSTALLATIONS
VENTILATION

In the homes a ventilation unit type D will be used. This means that it has mechanical in and outflow.

The average square footage of the apartments is around 70 m^2, with a average height of 3,3 meters. 70*3,3=231 $m^{3.}$.

The Itho Daalderop WTW-unit HRU ECO 300 P has a capacity of 300 m^3h, therefore also suitable for somewhat larger apartments (Itho Daalderop, n.d.).

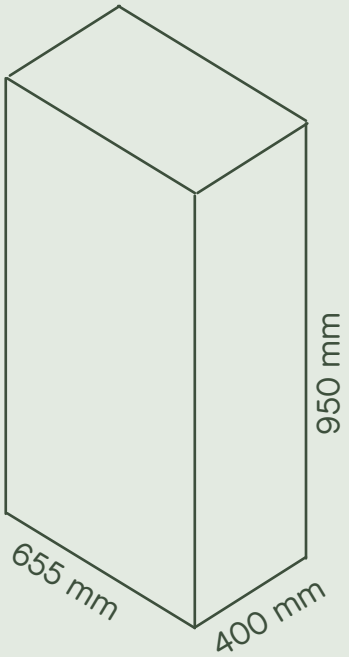


Figure 180: sizes ventilation unit (van Hoorn, 2026)

INSTALLATIONS

HEAT PUMP

The final installation needed will be a heatpump. The heatpump will have a small element on the roof to capture air.

TECHNICAL DRAWINGS

FLOORPLAN FRAGMENT, 1:20 (SCALED)

FOR DETAILED SECTION SEE SECTION A-A. P. 92

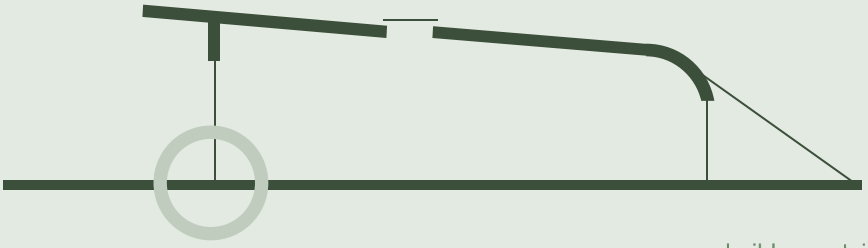


Figure 181: floorplan fragment, 1:20 (rescaled) (van Hoorn, 2026)

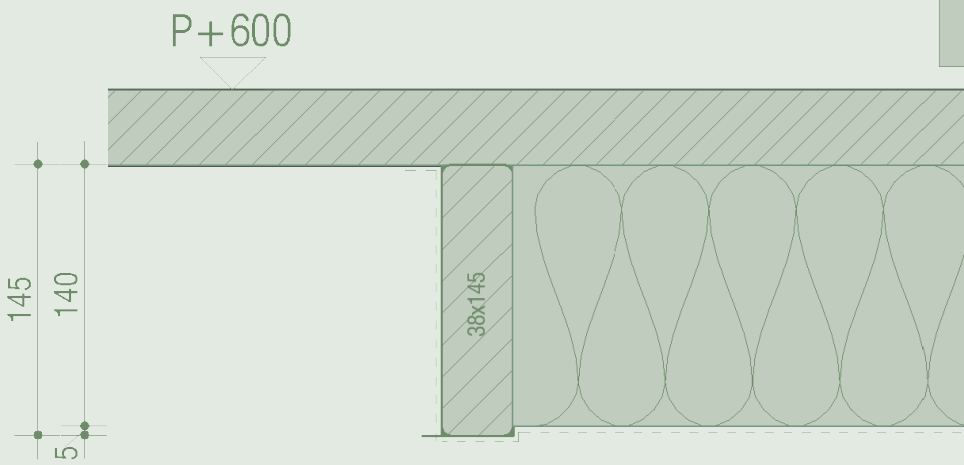




TECHNICAL DRAWINGS



buildup, outside-inside, Rc = ≥ 4,7 m^2K/W
- 2x20 mm recycled plastic facade cladding
  transparant and opague panels in colour
- 44 mm cavity wall with horizontal and vertical battens (22x44 mm)
- 180 mm timberframe wall filled with Isolena insulation
- 2x12,5 mm gypsum board



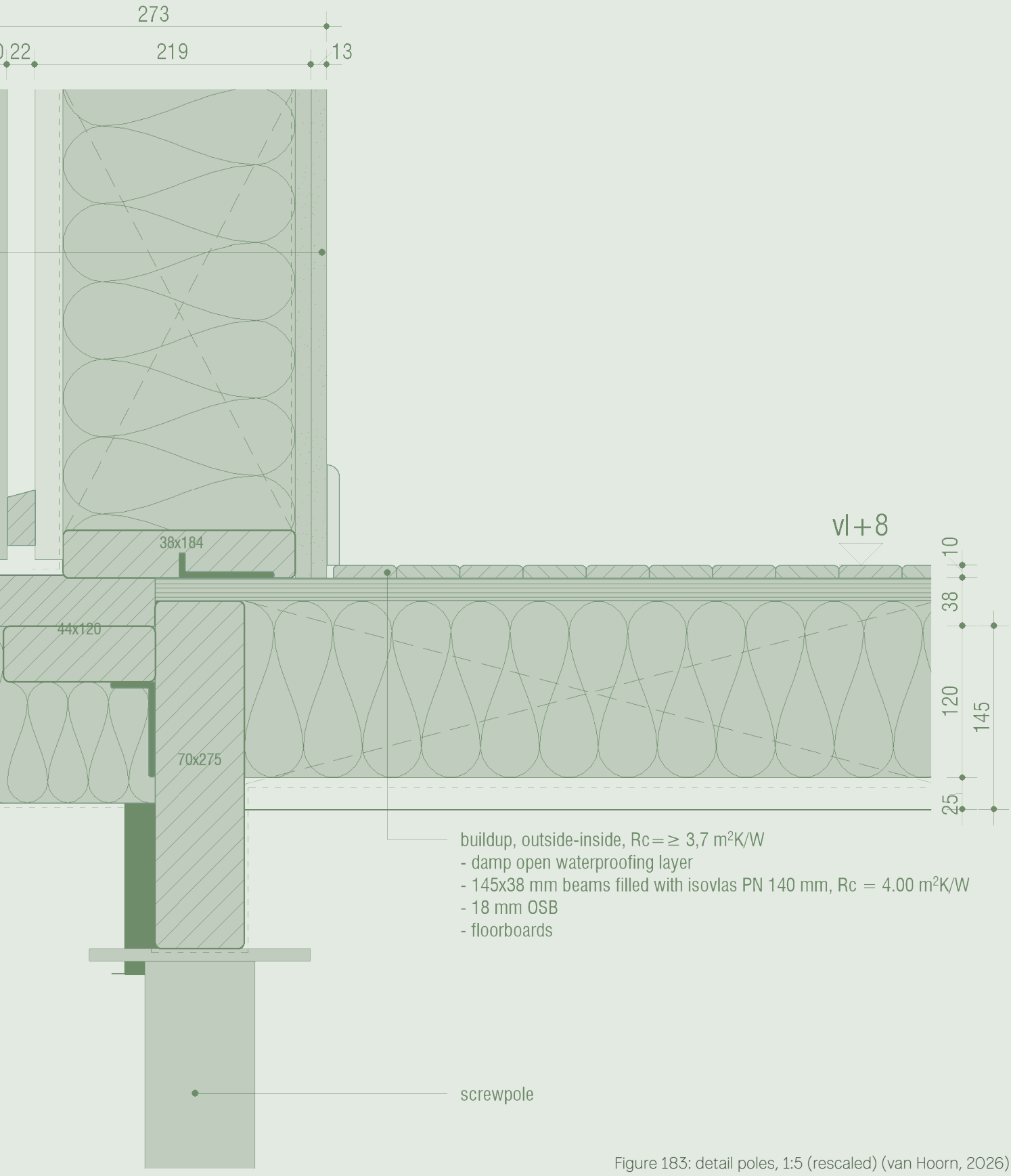
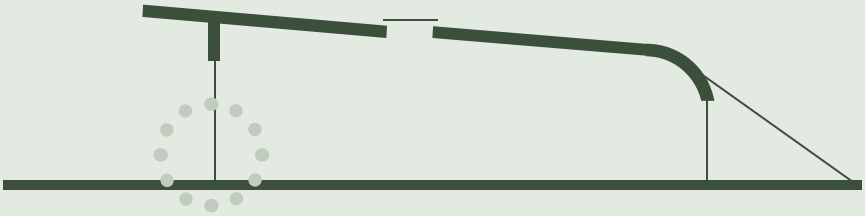


Figure 183: detail poles, 1:5 (rescaled) (van Hoorn, 2026)

TECHNICAL DRAWINGS



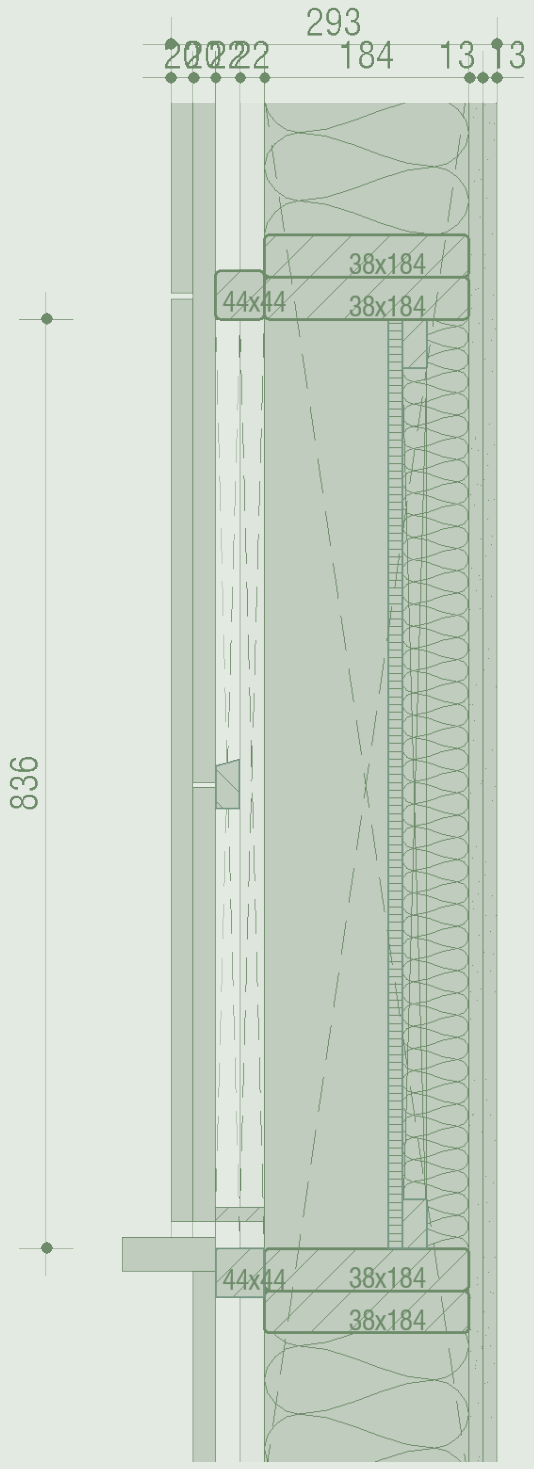
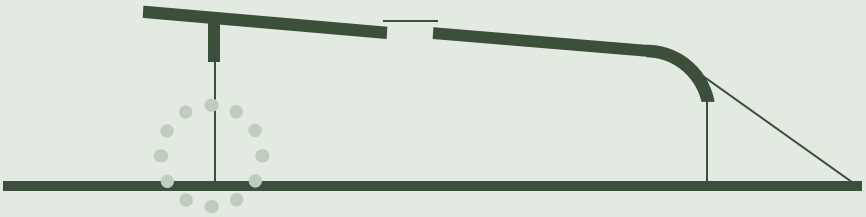


Figure 184: detail early bumbeblee nestbox, 1:5 (rescaled) (van Hoorn, 2026)



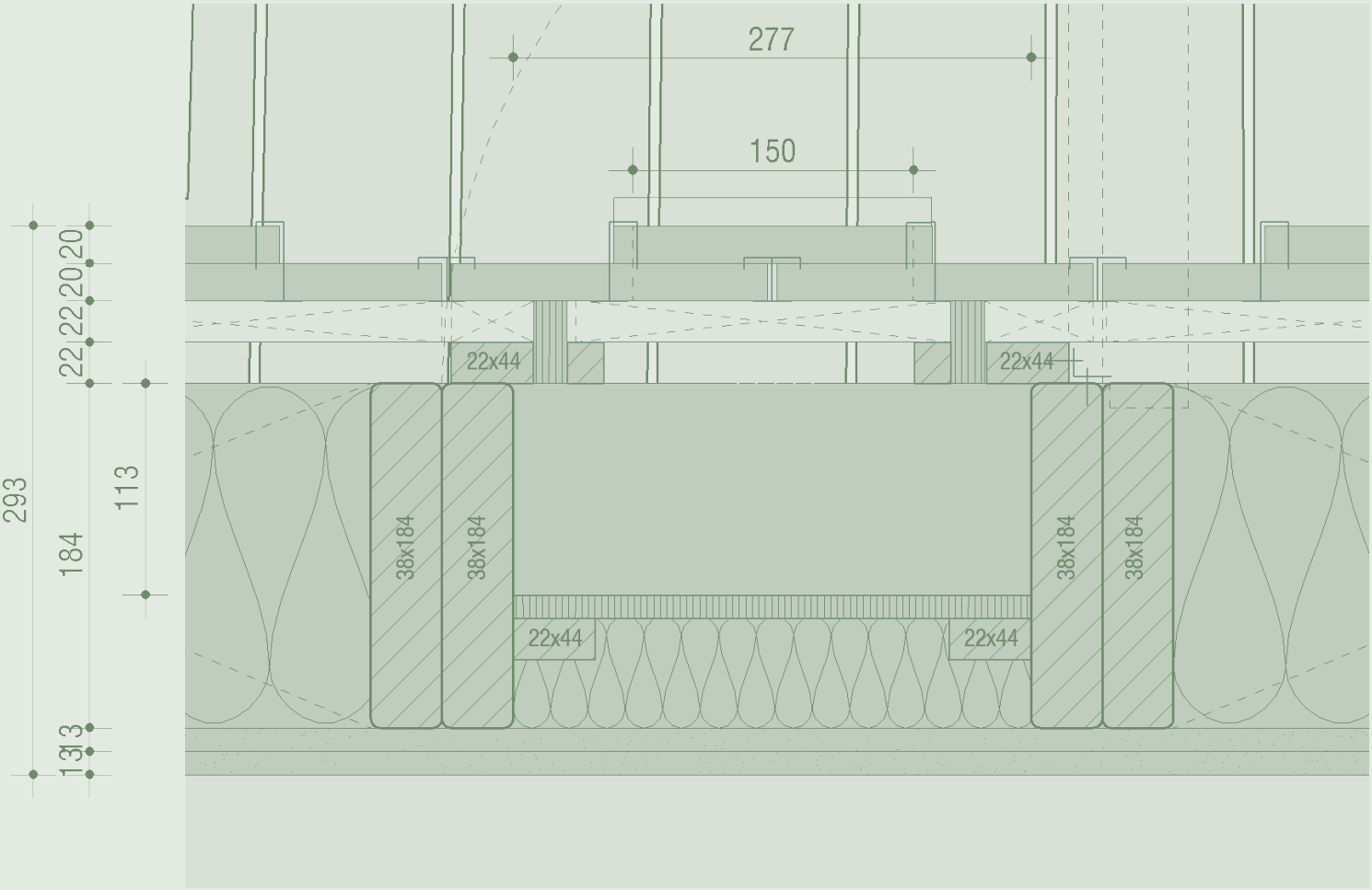
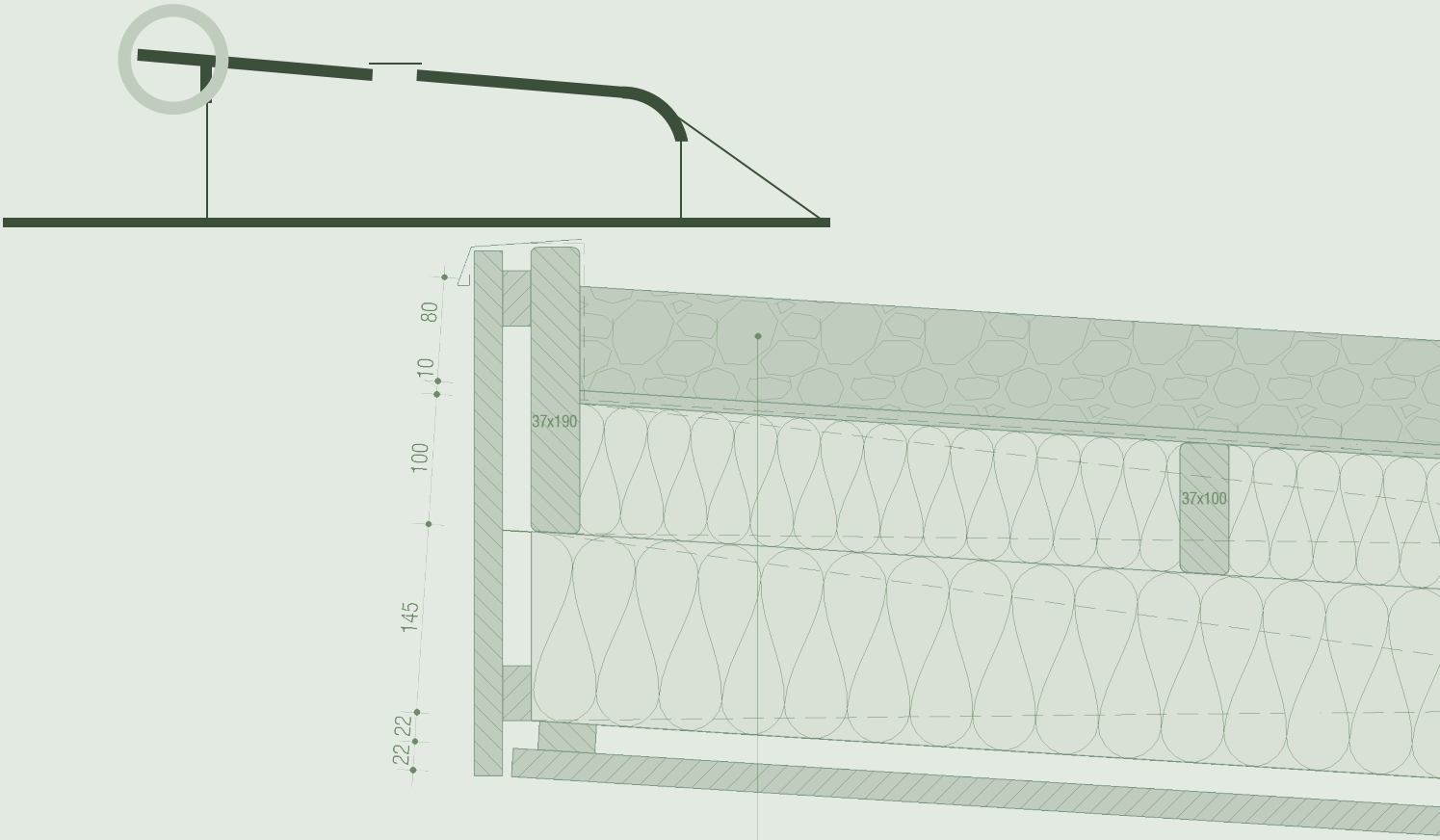


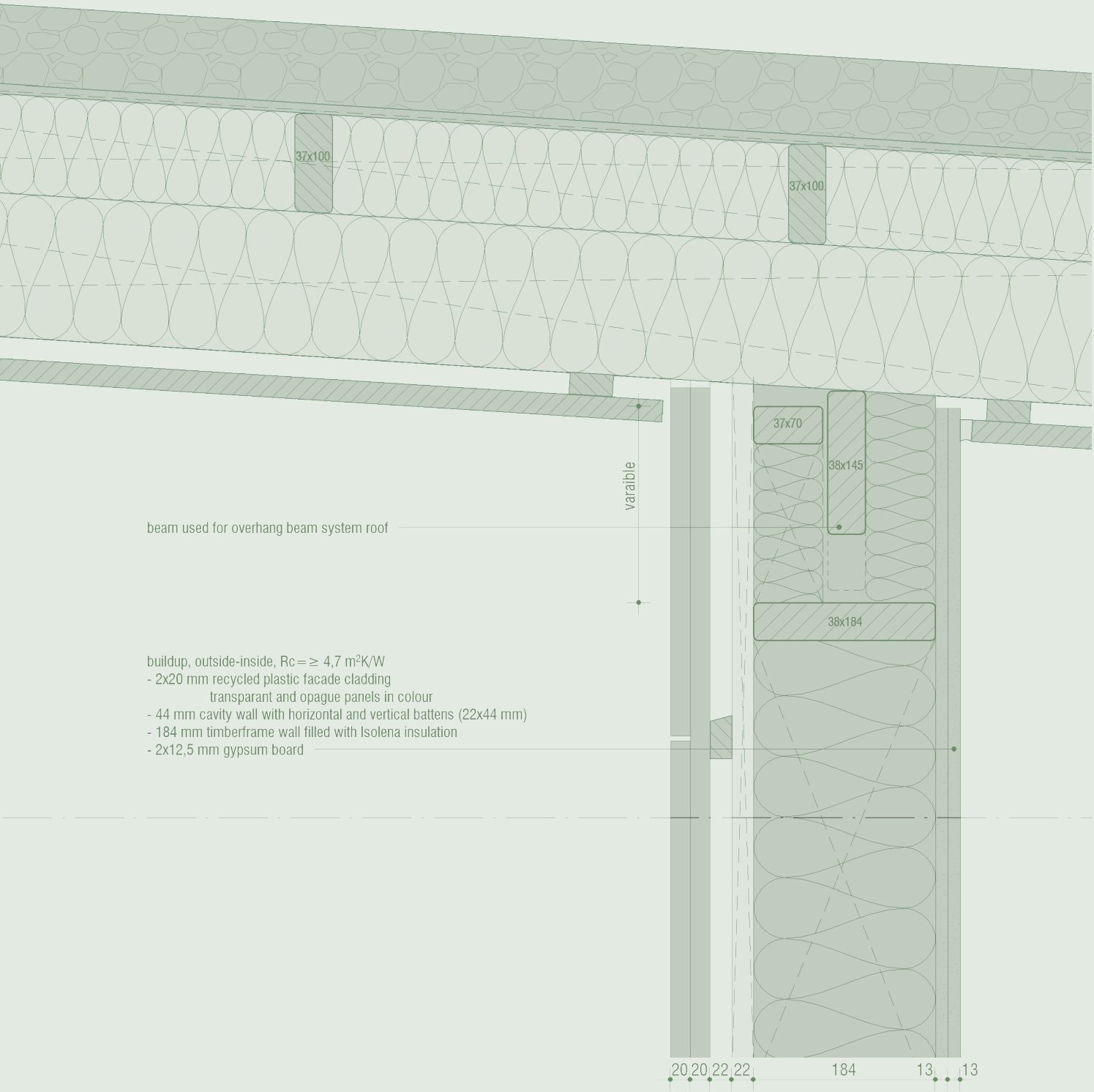
Figure 185: detail early bumbeblee nestbox, 1:5 (rescaled) (van Hoorn, 2026)

TECHNICAL DRAWINGS



buildup, outside-inside, Rc=≥ 6,3 m²K/W
- 40 mm Sempergreen sedum and herb mat
- 10 mm drainage layer
- Root barrier membrane and waterproofing layer
- 100 mm beam system filled with Isolena premium insulation
- 145 mm beam system filled with Isolena premium insulation
- 22 mm cavity with battens
- 22 mm ceiling boards

Figure 186: detail roof overhang, 1:5 (rescaled) (van Hoorn, 2026)


37x100
37x100
37x70
38x145
varaible
beam used for overhang beam system roof
38x184
buildup, outside-inside, Rc=≥ 4,7 m²K/W
- 2x20 mm recycled plastic facade cladding
transparant and opague panels in colour
- 44 mm cavity wall with horizontal and vertical battens (22x44 mm)
- 184 mm timberframe wall filled with Isolena insulation
- 2x12,5 mm gypsum board
20 20 22 22
184
13
13

TECHNICAL DRAWINGS

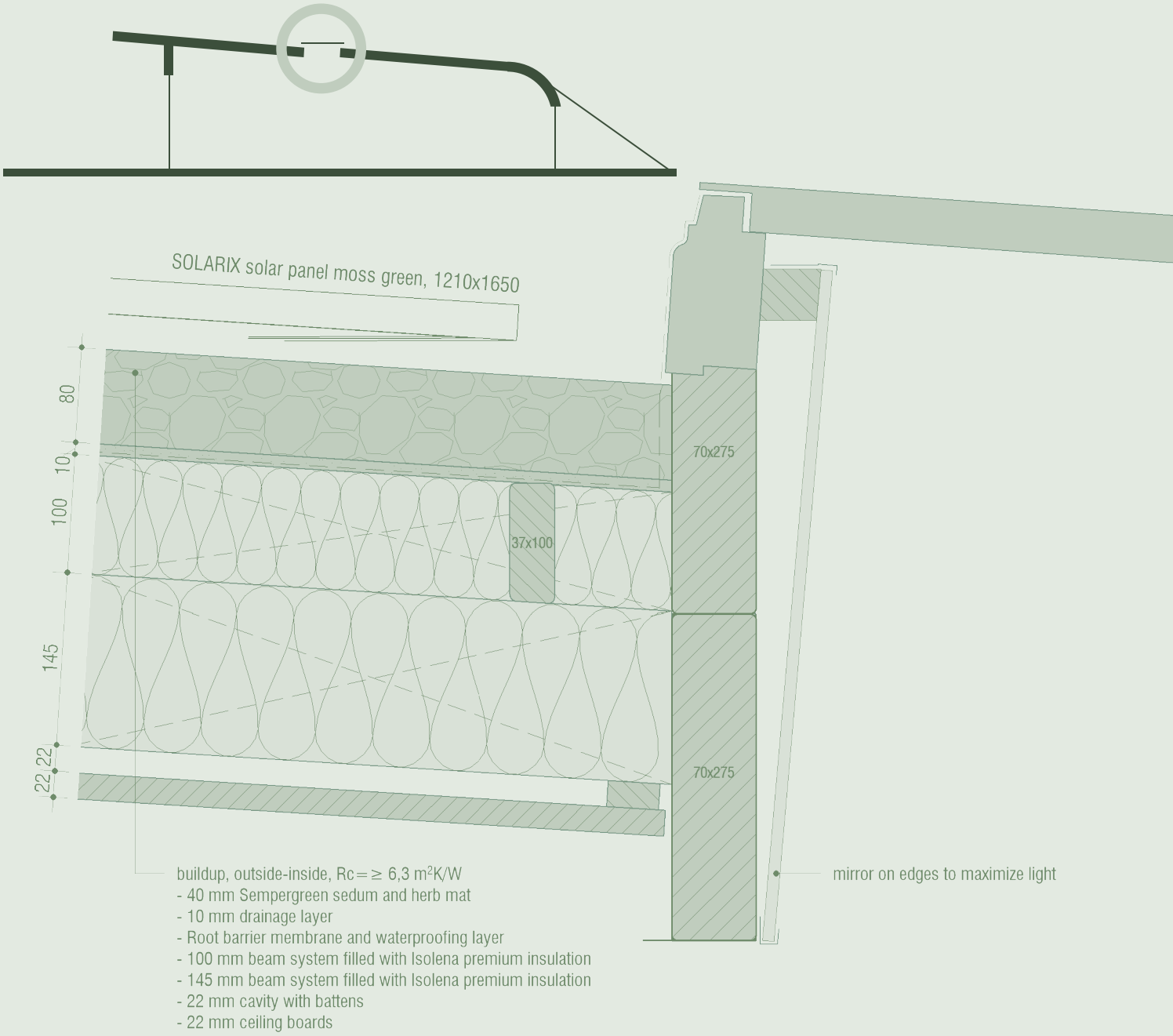
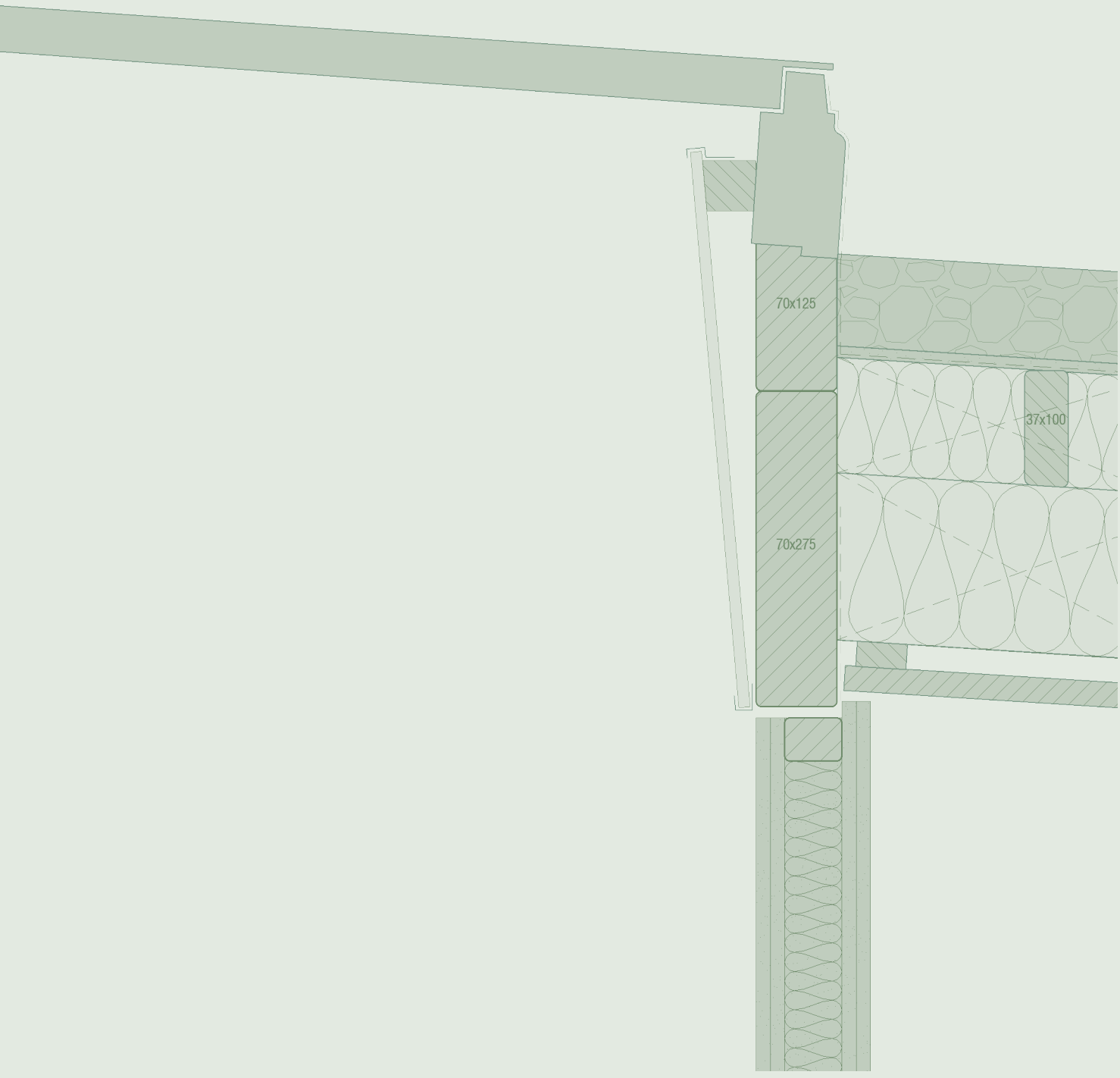
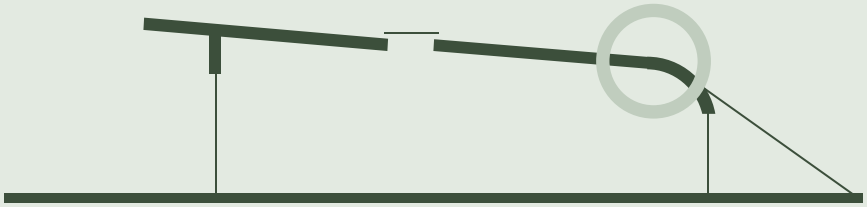
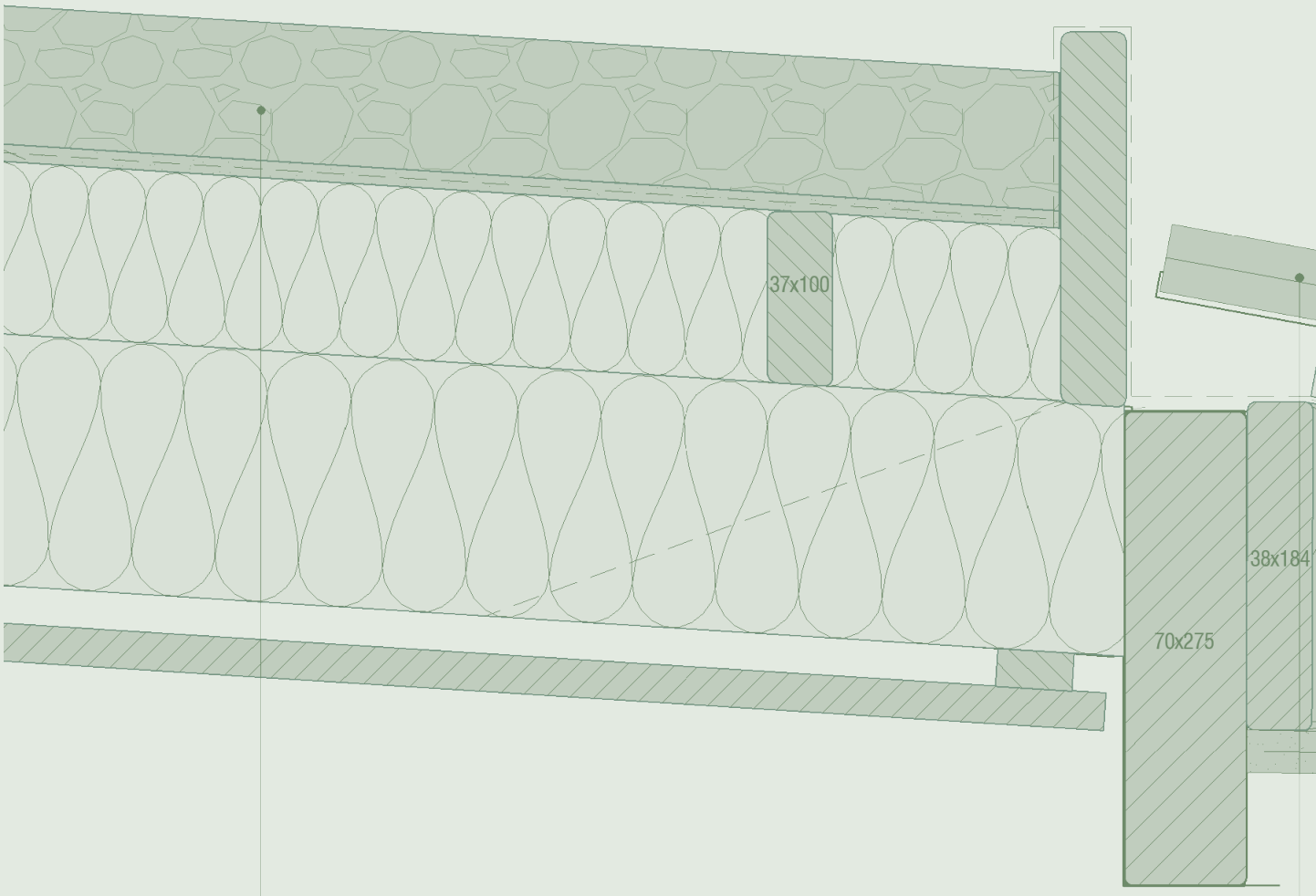


Figure 187: detail roof skylight, 1:5 (rescaled) (van Hoorn, 2026)

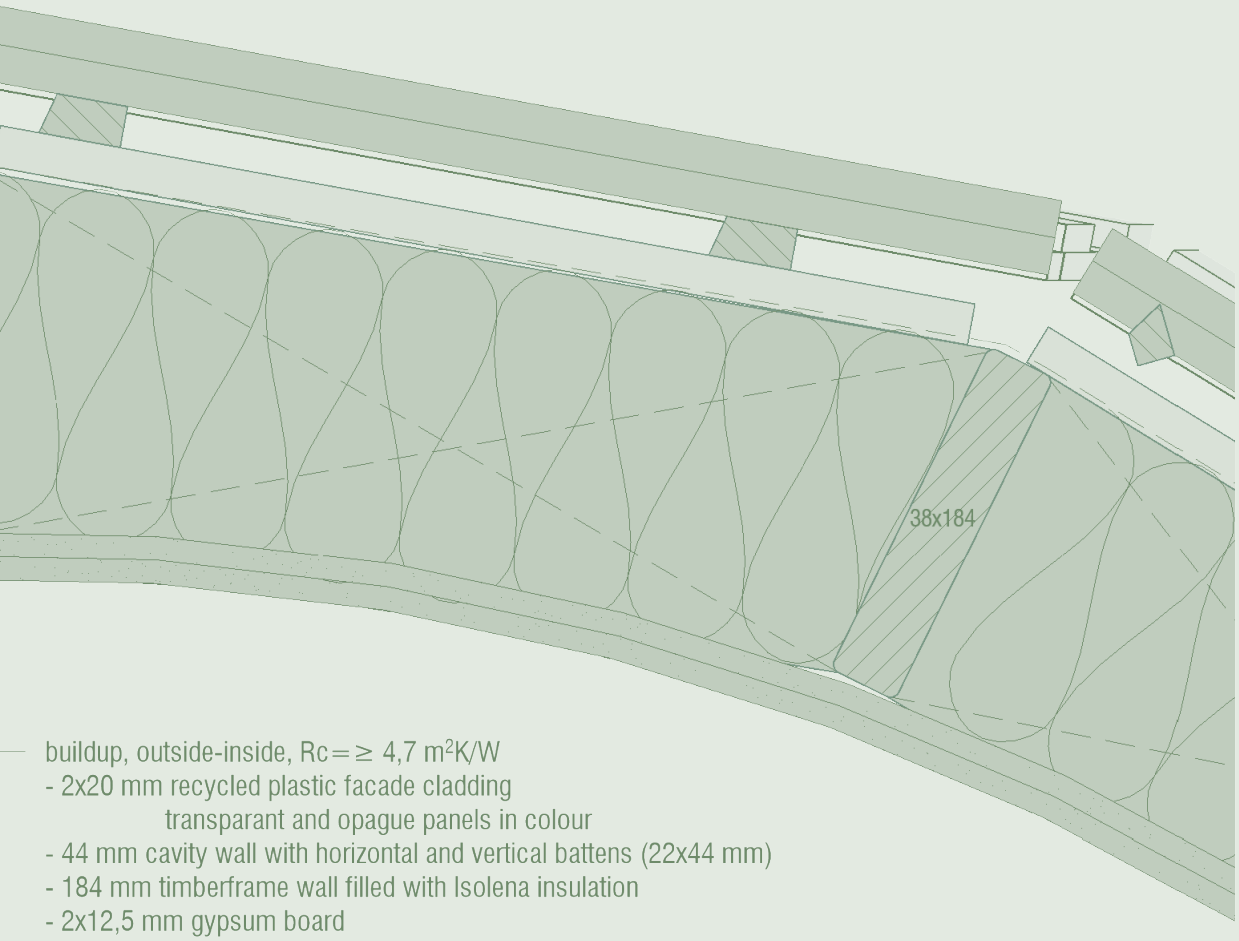

70x125
37x100
70x275

TECHNICAL DRAWINGS





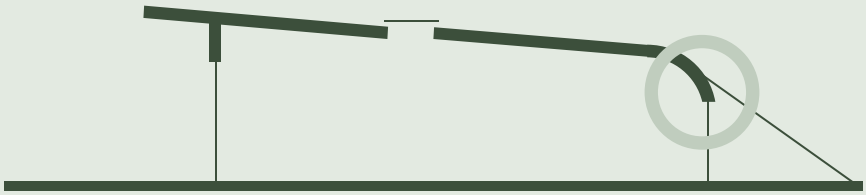
buildup, outside-inside, Rc = ≥ 6,3 m^2K/W
- 40 mm Sempergreen sedum and herb mat
- 10 mm drainage layer
- Root barrier membrane and waterproofing layer
- 100 mm beam system filled with Isolena premium insulation
- 145 mm beam system filled with Isolena premium insulation
- 22 mm cavity with battens
- 22 mm ceiling boards



buildup, outside-inside, Rc = ≥ 4,7 m^2K/W
- 2x20 mm recycled plastic facade cladding
  transparant and opague panels in colour
- 44 mm cavity wall with horizontal and vertical battens (22x44 mm)
- 184 mm timberframe wall filled with Isolena insulation
- 2x12,5 mm gypsum board

Figure 188: detail roof, 1:5 (rescaled) (van Hoorn, 2026)

TECHNICAL DRAWINGS





buildup, outside-inside, Rc = ≥ 4,7 m^2K/W
- 2x20 mm recycled plastic facade cladding
  transparant and opague panels in colour
- 44 mm cavity wall with horizontal and vertical battens (22x44 mm)
- 184 mm timberframe wall filled with Isolena insulation
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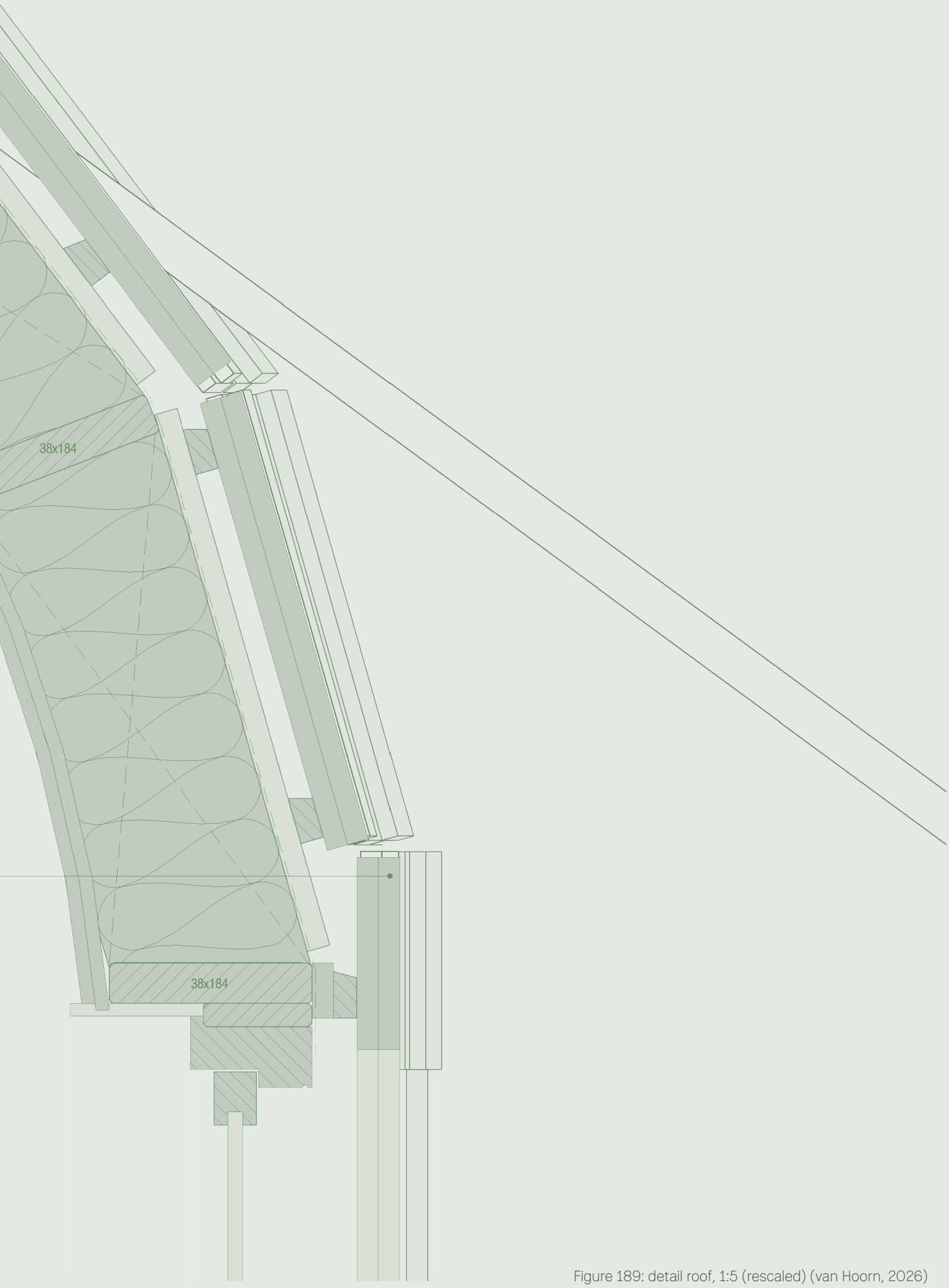


Figure 189: detail roof, 1:5 (rescaled) (van Hoorn, 2026)

TECHNICAL DRAWINGS

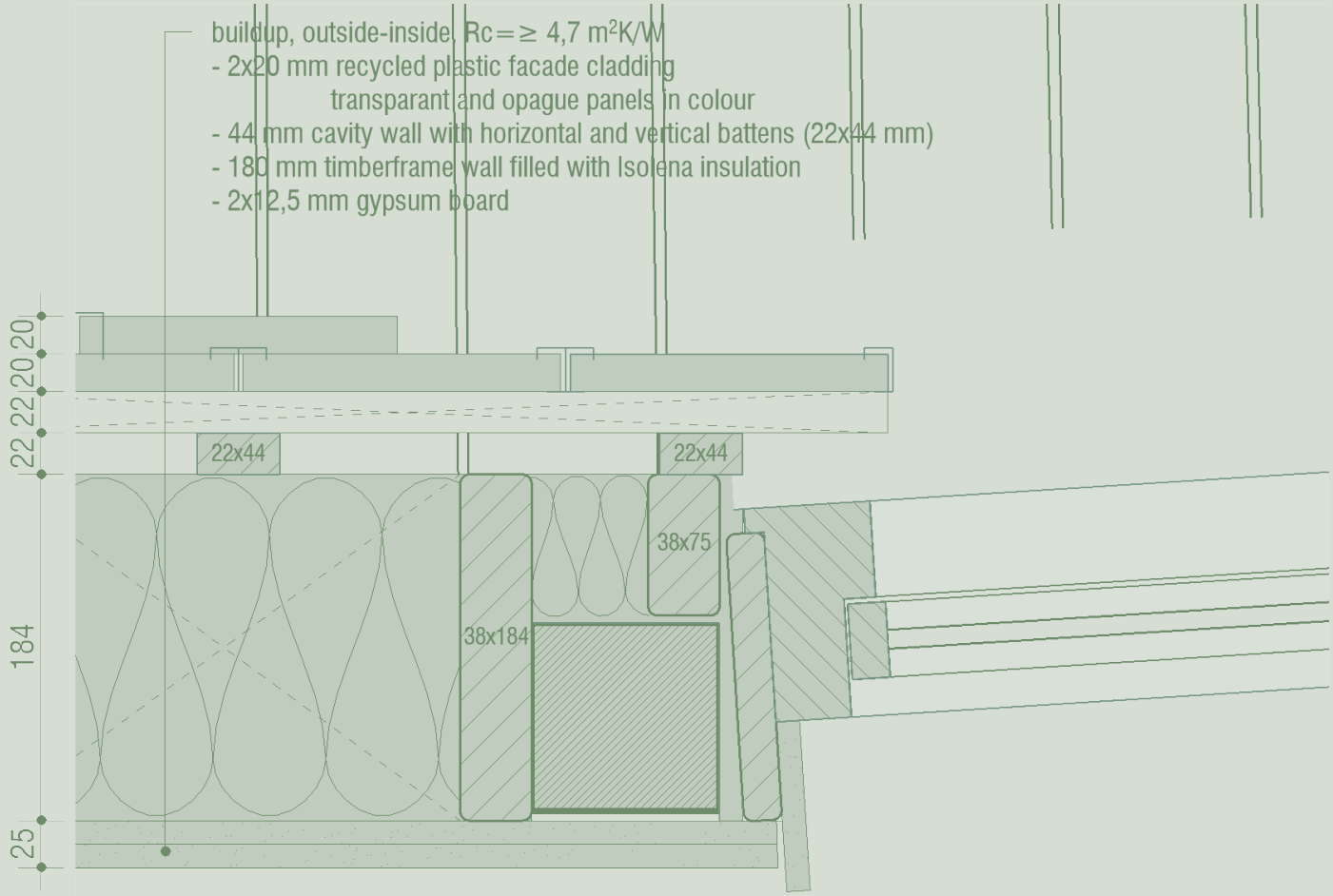


Figure 190: detail vertically, window, 1:5 (rescaled) (van Hoorn, 2026)

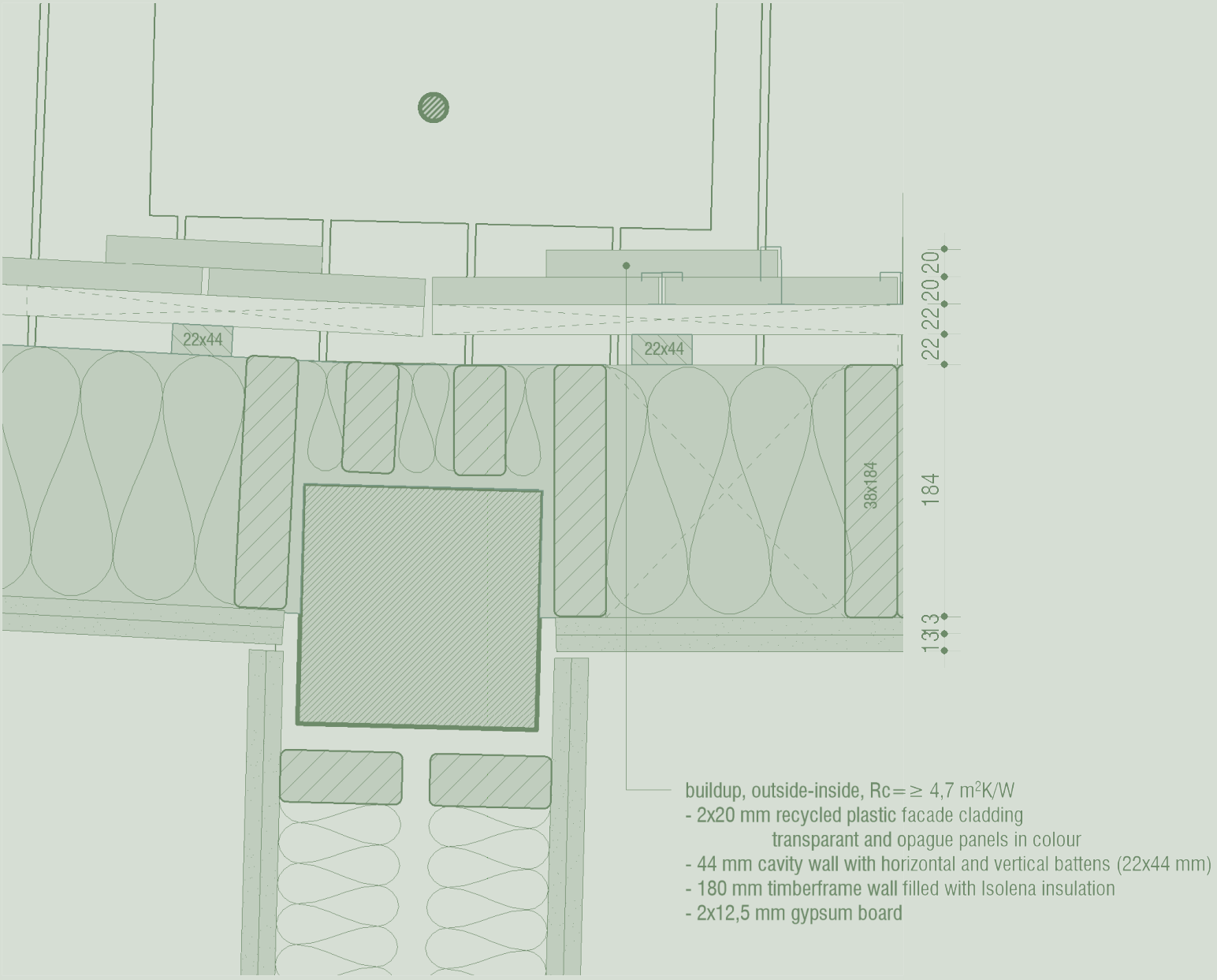
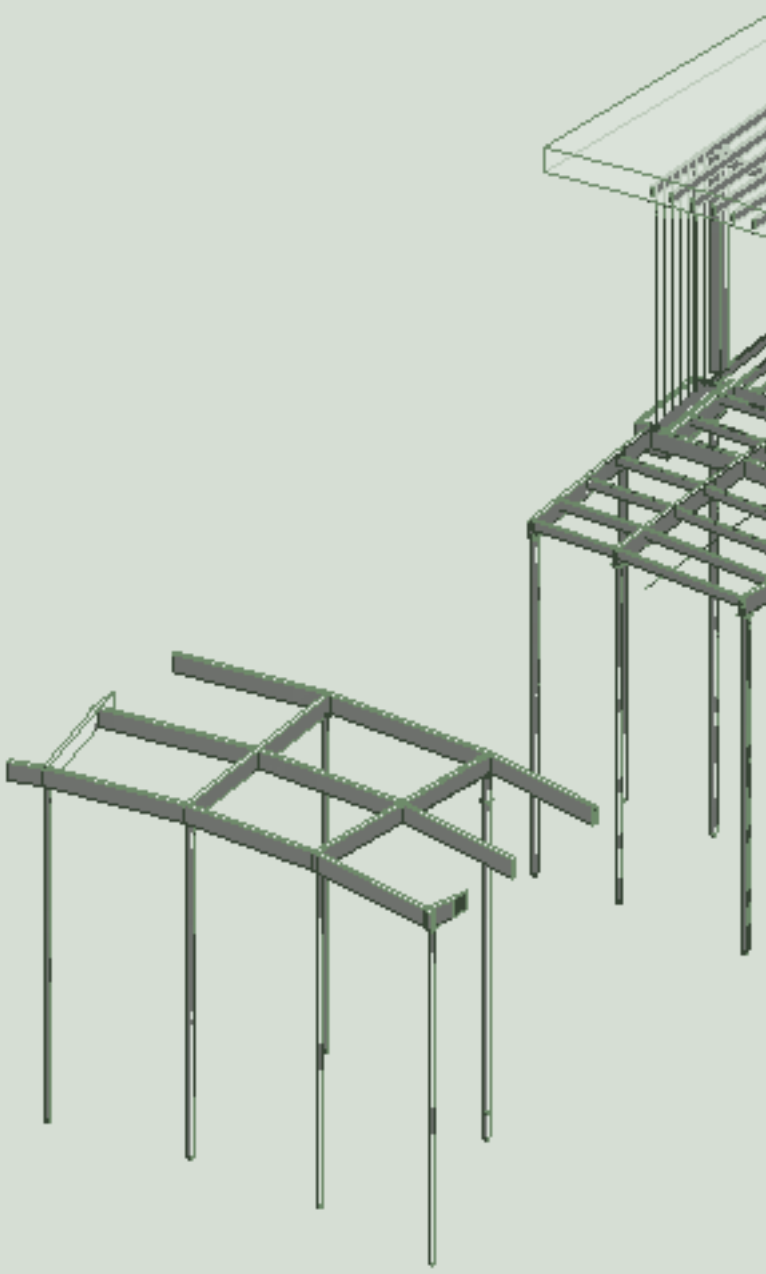


Figure 191: detail vertically, partition wall, 1:5 (rescaled) (van Hoorn, 2026)

TECHNICAL DRAWINGS
CONSTRUCTION



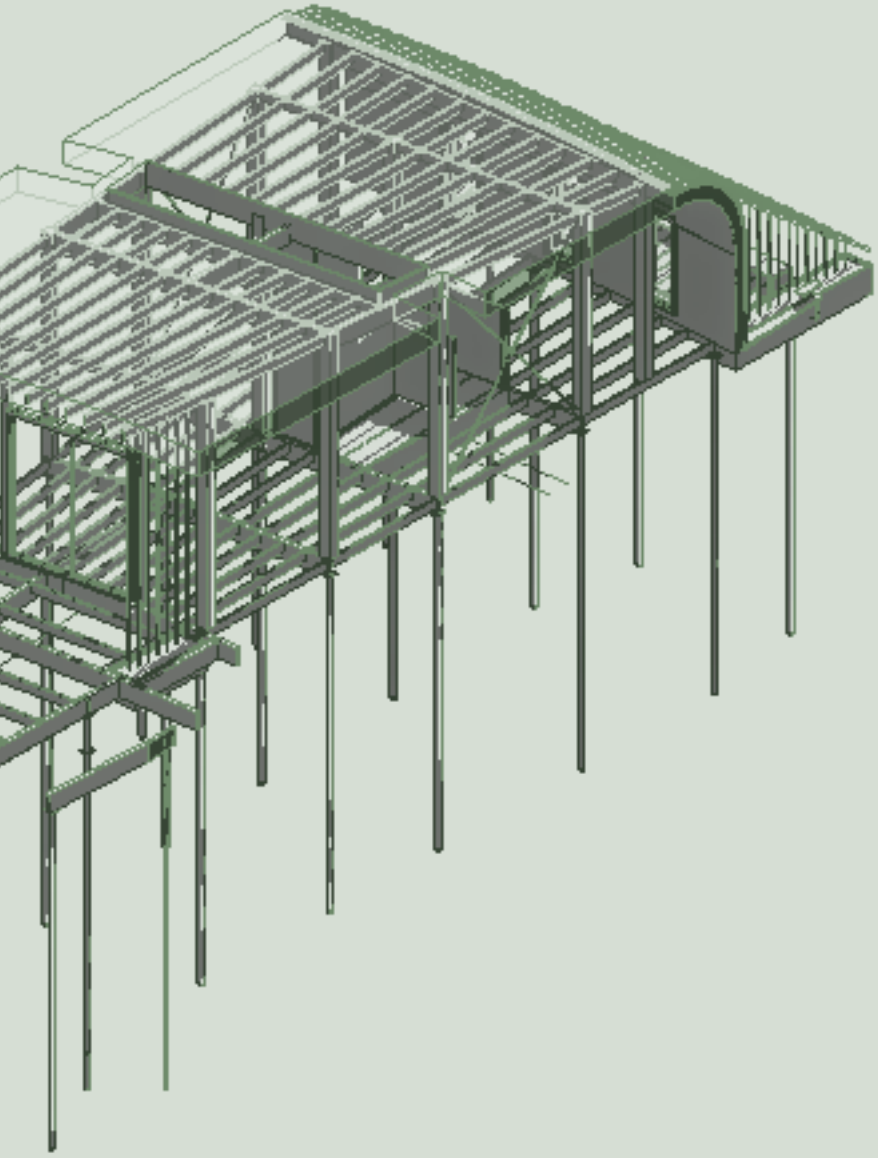


Figure 192: 3D view construction (van Hoorn, 2026)

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A HEALTY AND SUSTAINABLE LIVING ENVIRONMENT IN *Midden-Delfland*

A1 presention

Graduation studio AR4AD150 Advanced Housing Design *Ecologies of inclusion*

Responsible supervisior **Olv Klijn**
Supervisor **Robbert Guis**

Amélie Niemeijer, Ara Wartan, Floor van Hoorn, Floris de Bruïne, Lisa van Dijk, Meike Traa
5089778, 5024129, 6095577, 6172954, 5286026, 5303583

June 10, 2026

THE PLAN
Introduction

The design task for the Advanced Housing Design course began with the assignment of a group theme: sustainable environment. Within this framework, the Midden-Delfland area was analysed in relation to municipal ambitions and the future scenario developed by ZUS, SWECO and FLUX Landscape Architecture in 2022. This scenario, which explores the transformation of the landscape into a series of differentiated ecological systems, formed the foundation for the group's masterplan. Based on this analysis, the Vlietlanden was selected as the project site due to its ability to represent the full range of landscape conditions present within the broader regional vision.



I THE PLAN

II RESEARCH

III VISION

IV MASTERPLAN

V THEMES

THE PLAN

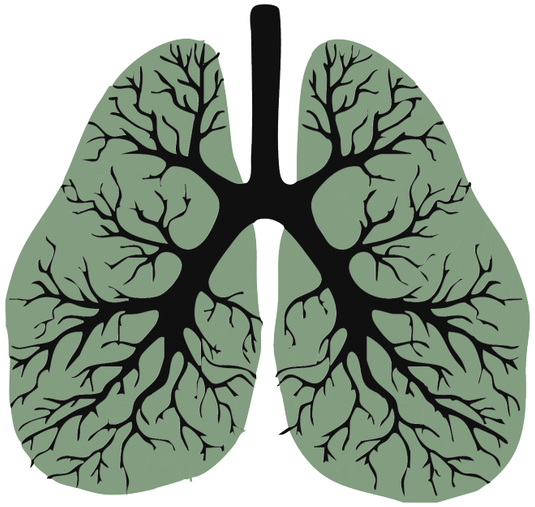
Sustainable environment
The starting point for this group was the theme of sustainable environment. Within this framework, the Midden-Delfland area was analysed, including the municipality's ambitions and the future scenario developed by ZUS, SWECO and FLUX Landscape Architecture in 2022. This scenario, which explores a transformation towards diverse landscape typologies, formed the basis for the development of the masterplan. The Vlietlanden was selected as the project location, as it contains the full range of landscape conditions described in the ZUS proposal. This creates an interesting setting for the project, as traditional building methods will no longer suffice. Therefore, new ways of living, coexisting and community building must be explored.

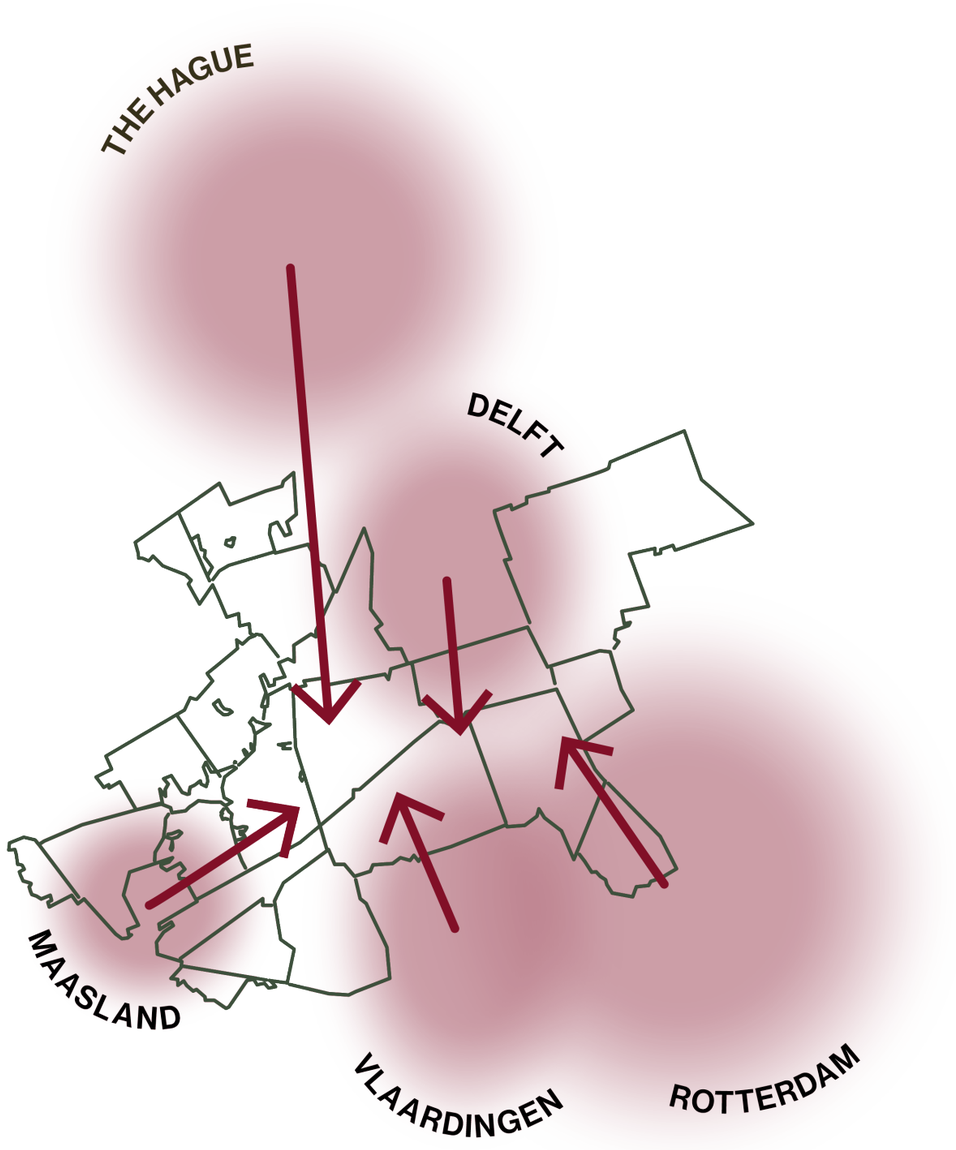
Vision
The foundation laid by ZUS is further developed through a set of supporting ambitions. The project aims to define a new way of living that fosters a healthy and sustainable society, in which sustainability is approached not as a purely technological solution, but as a spatial and ecological condition. In this approach, sustainability goes beyond interventions such as solar panels and instead actively contributes to the restoration of biodiversity, community and natural systems.
Human inhabitation is positioned in relation to ecological systems in a way that supports coexistence rather than dominance, allowing the landscape to function as a dynamic and evolving system while still accommodating living, working and recreation.

Masterplan
The masterplan is guided by a set of spatial principles: the natural landscape is leading, water dynamics structure spatial organisation, ecological zones define accessibility and development, and built interventions remain minor to and adaptable within the landscape.
The masterplan is based on a fundamental principle: the natural landscape forms the foundation of all spatial interventions. Elevation differences within the area are used to create overflow zones that respond to extreme weather conditions, such as heavy rainfall, and function as water buffers that can be utilised during periods of drought. Rather than controlling water, the design embraces seasonal fluctuations, allowing lower areas of the Vlietlanden to flood more frequently and operate as dynamic ecological systems. In doing so, the pressure on existing water pumping infrastructure is reduced.
The ecological structure is further informed by the existing nesting locations of the black-tailed godwit. These birds return to the same nesting sites annually and are highly sensitive to spatial disturbance. This has led to the designation of inaccessible nature zones, particularly towards the eastern edge of the site where ecological value is already high. These areas are strategically aligned with key sightlines to preserve the identity and visual openness of the landscape, in accordance with ambitions of the municipality.
Surrounding these protected areas, buffer zones are introduced where limited recreational use is permitted. These zones mediate between strictly protected nature and areas where development is allowed. All spatial interventions are carefully positioned to maintain existing sightlines and landscape continuity.
An organic cellular structure is overlaid onto the landscape, functioning as a spatial framework that organises development zones, accessibility, and ecological areas. This structure enables a flexible approach in which areas can expand or contract over time in response to environmental conditions and social needs, while ensuring that development remains confined within clearly defined boundaries. In this way, urban expansion is controlled and the ecological integrity of the landscape is protected.
Mobility within the masterplan prioritises slow movement. Cars are treated as guests, only a limited number of routes accommodate vehicle access, while parking is concentrated at the edges of the site. The existing mobility hub is reinforced and expanded to support public transport and cycling infrastructure, encouraging alternative modes of transport.
Together, these strategies establish a spatial framework in which ecological performance is prioritised, while enabling new forms of inhabitation that are embedded within the dynamics of the landscape.

Themes
Each group member uses the masterplan as a foundation to explore a specific aspect of living within this landscape through one of the following themes: biodiversity, healthcare, work, education, recreation, or production. These thematic explorations act as repeating layers on top of the masterplan. While small adjustments to the spatial configuration are possible, they must remain consistent with the core principles of the masterplan.
The objective is to develop a comprehensive understanding of how different societal functions can be integrated within this framework, ultimately contributing to a refined and cohesive vision for a new way of living in which ecological, social, and spatial systems are in balance.

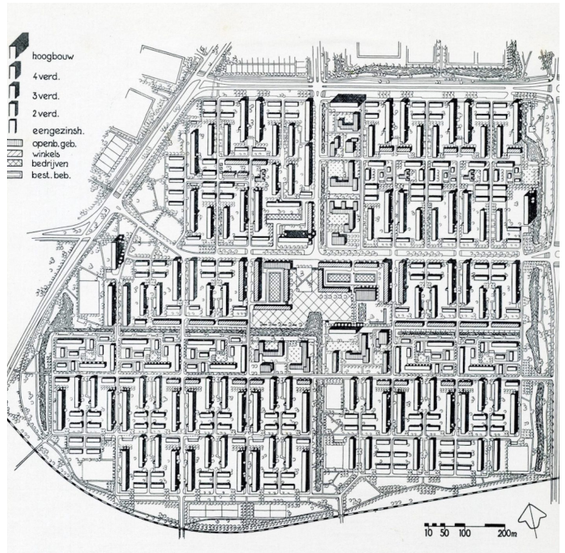
RESEARCH





THE GREEN LUNG IS UNDER PRESSURE FROM BUILDINGS, RECREATION AND PEOPLE

RESEARCH
Dutch urban planning



Pendrecht, Rotterdam

Wederopbouw
1940 - 1965



Stedenwijk Noord, Almere stad

Flevopolder
1950 - 1986



Ypenburg, Den Haag

VINEX
1995 - 2005

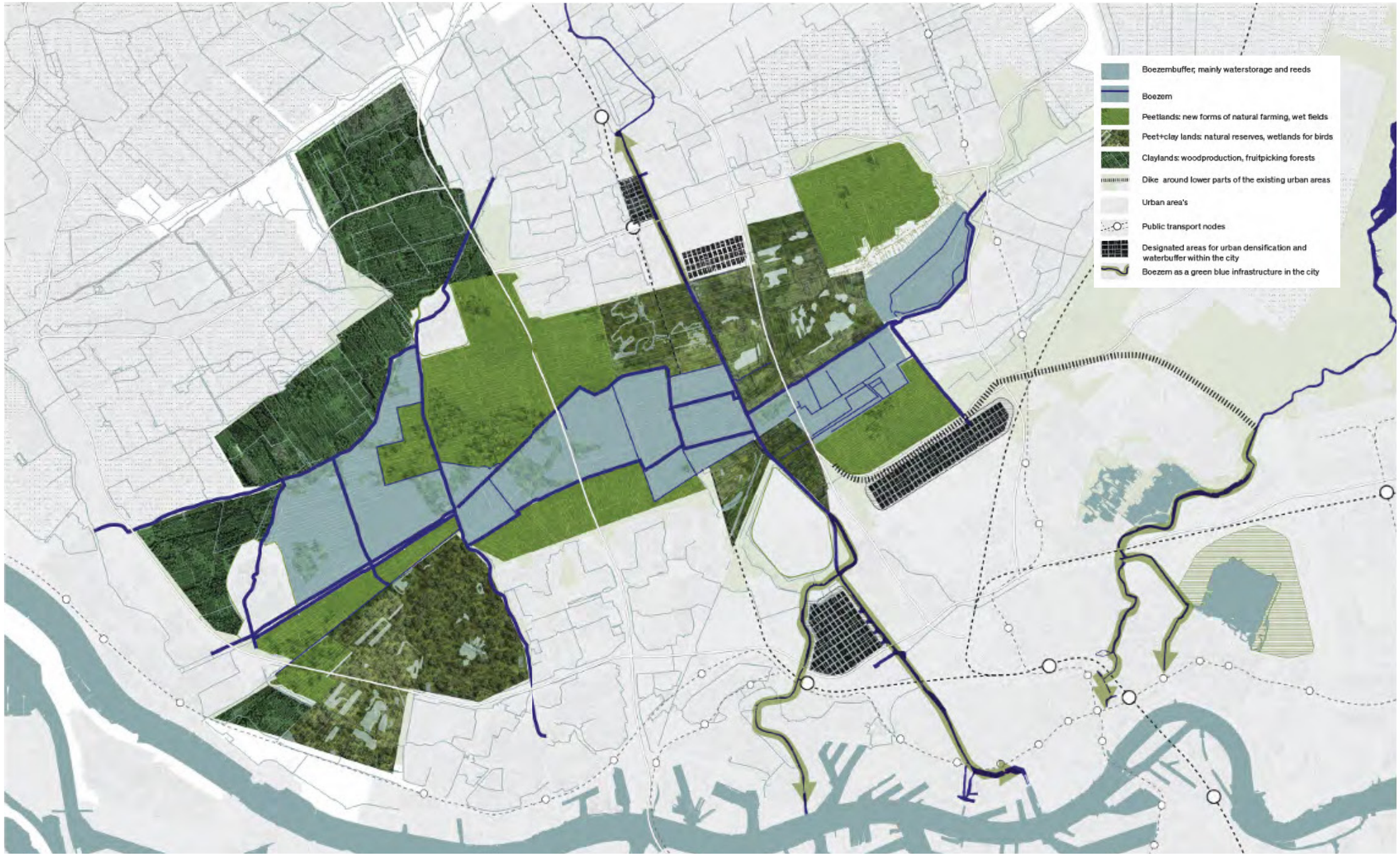


Marktkwartier West, Amsterdam

Modern urbanism
2005 - now

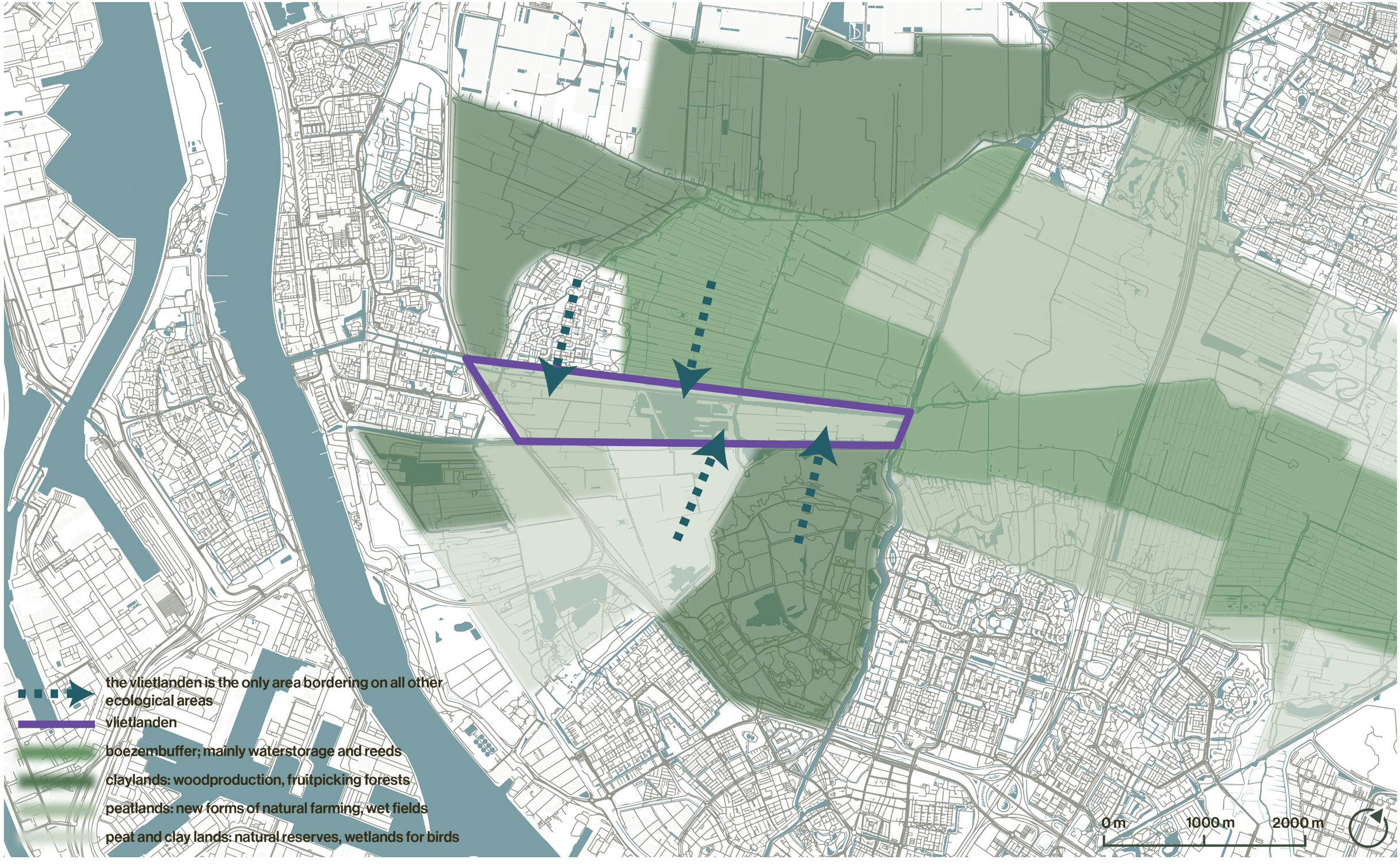
RESEARCH

Plan by ZUS

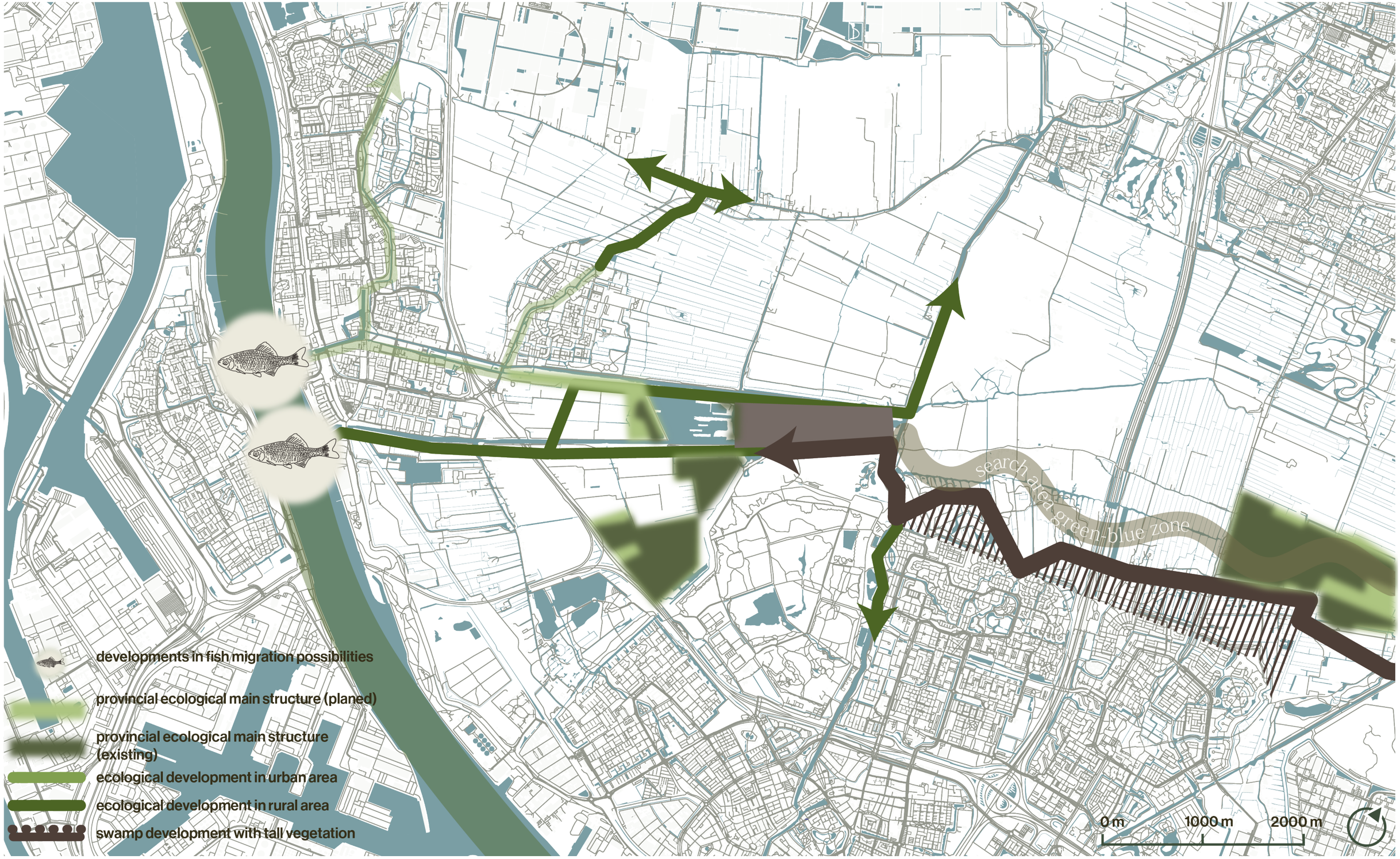


Designing a new way of living that creates a healthy and sustainable society, where sustainability goes beyond technical solutions such as solar panels and actively contributes to the restoration of biodiversity and natural systems

RESEARCH
Vlietlanden ZUS

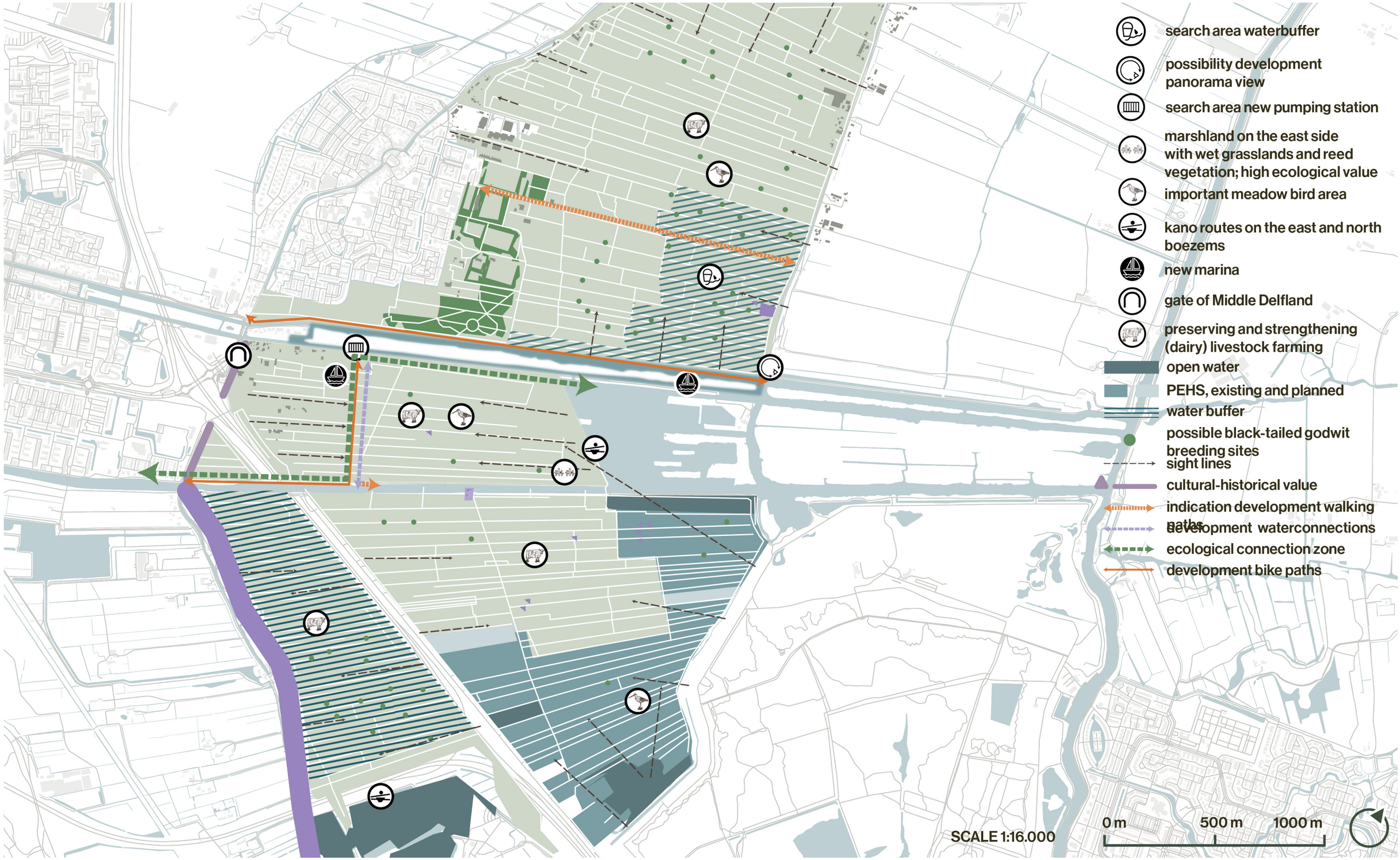


RESEARCH
Natural networks

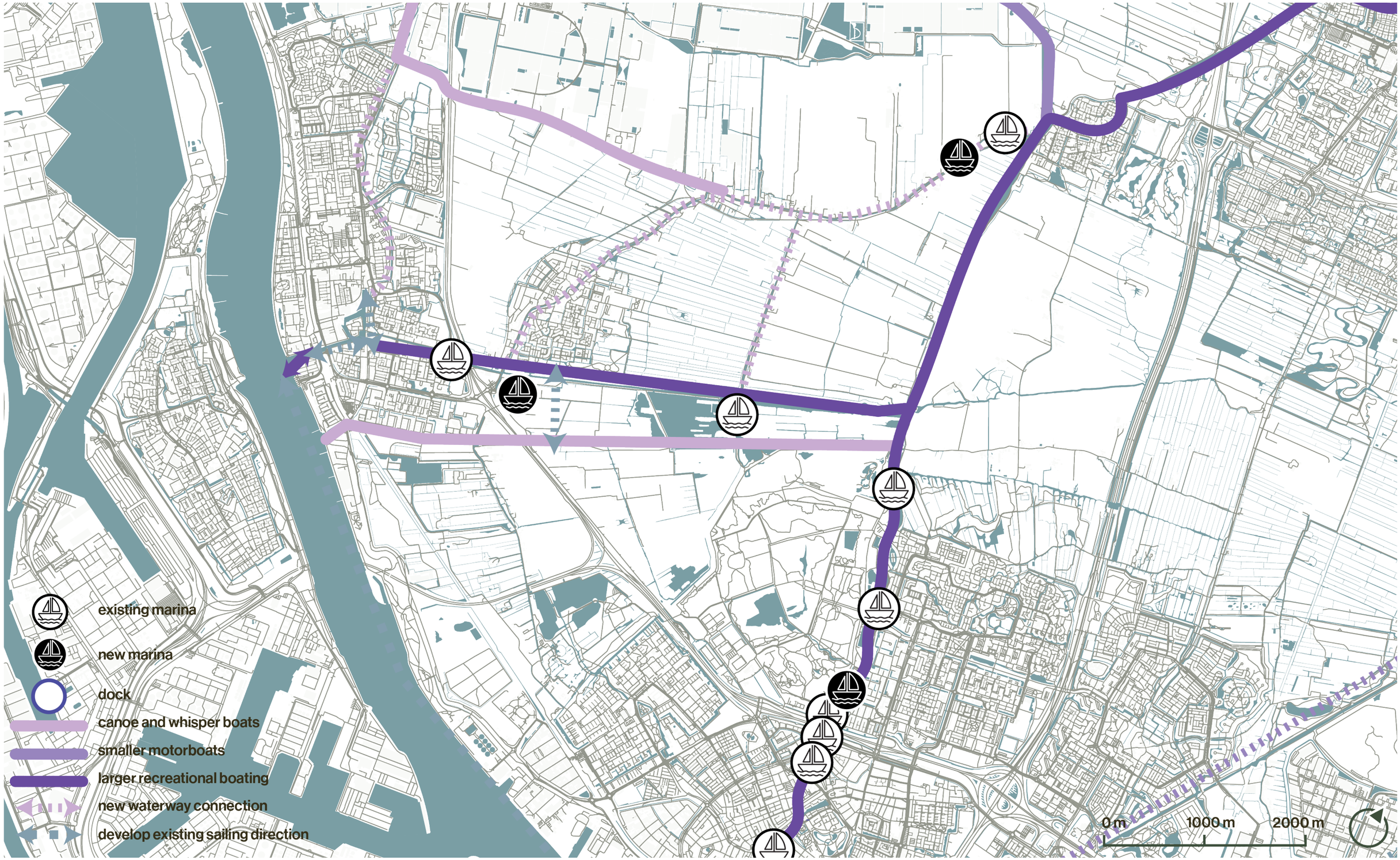


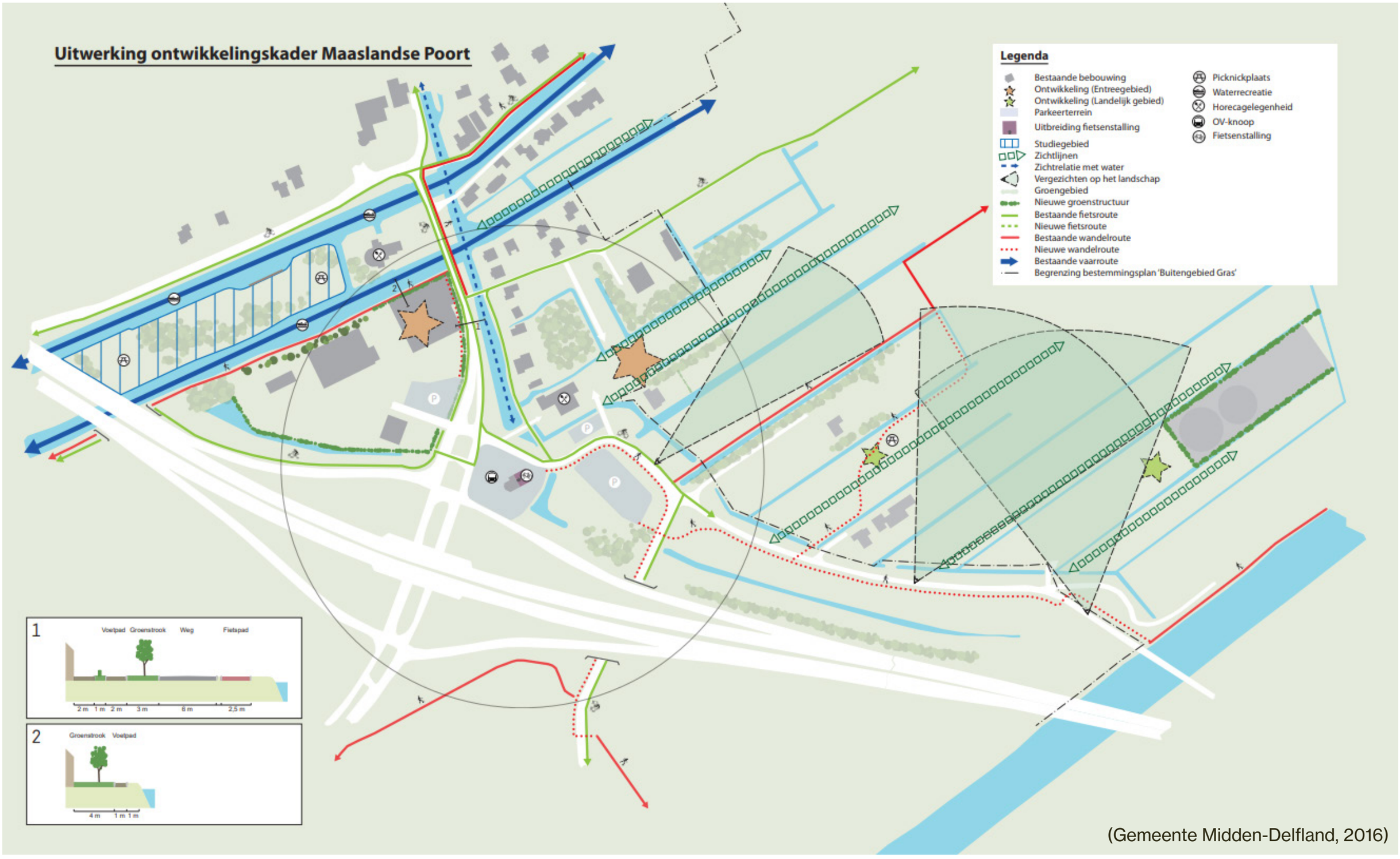
RESEARCH

Vision municipality Midden-Delfland



RESEARCH
Water recreation





(Gemeente Midden-Delfland, 2016)

VISION

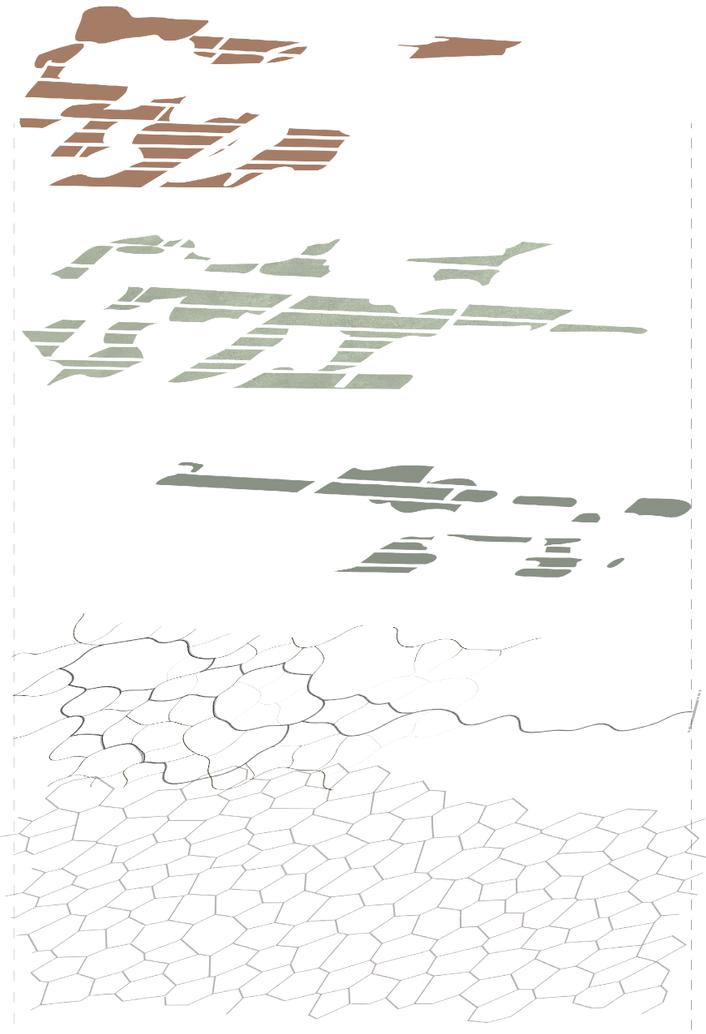
“A healthy living environment for people and nature, where humans, animals and natural systems are functioning in balance. A community is being formed here, where everyone plays their part in striving for this healthy living environment. This project is a pilot in nature driven approaches to production, health care, recreation, work, education, biodiversity and water in the built environment.”

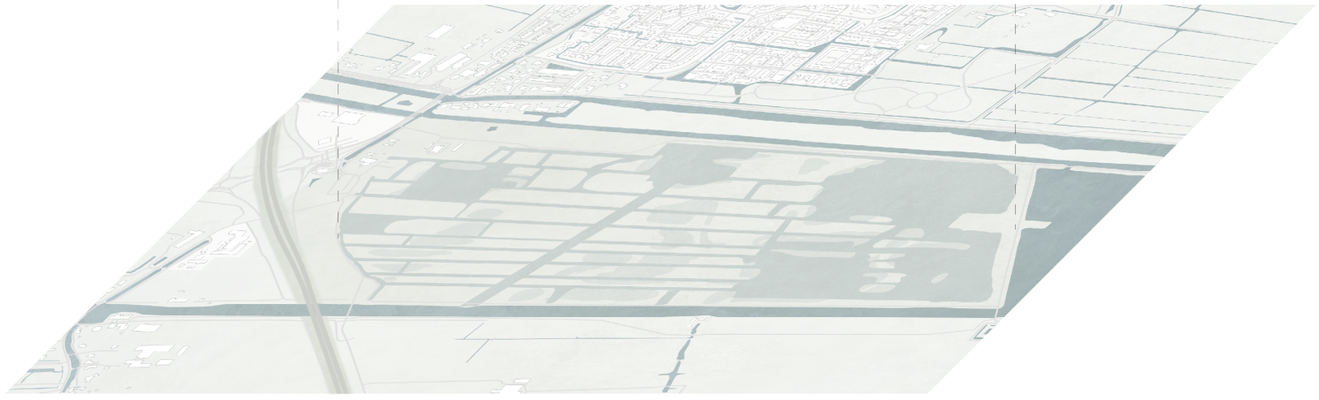
VISION

Six pillars of a healthy living environement



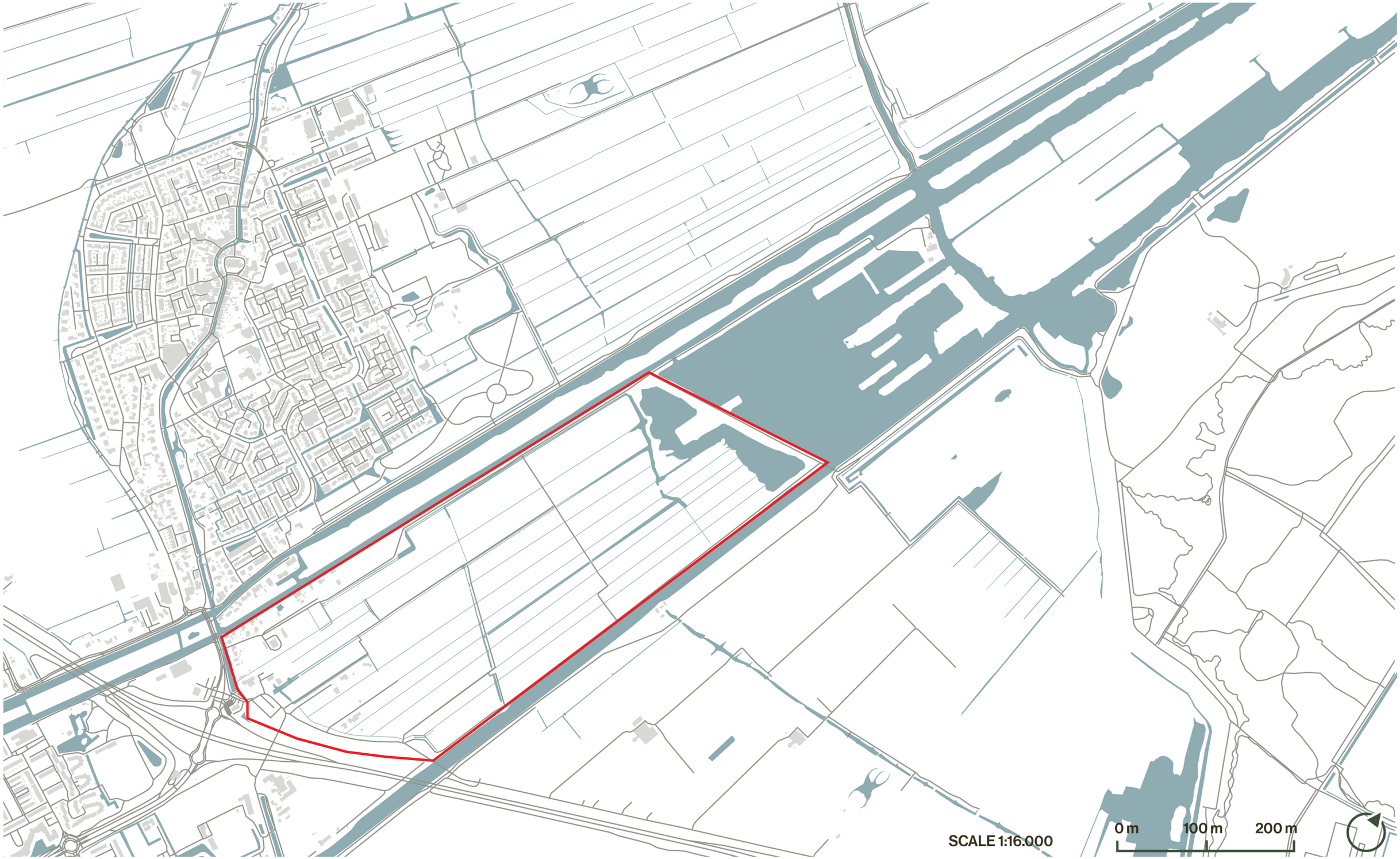
MASTERPLAN





MASTERPLAN

Current situation



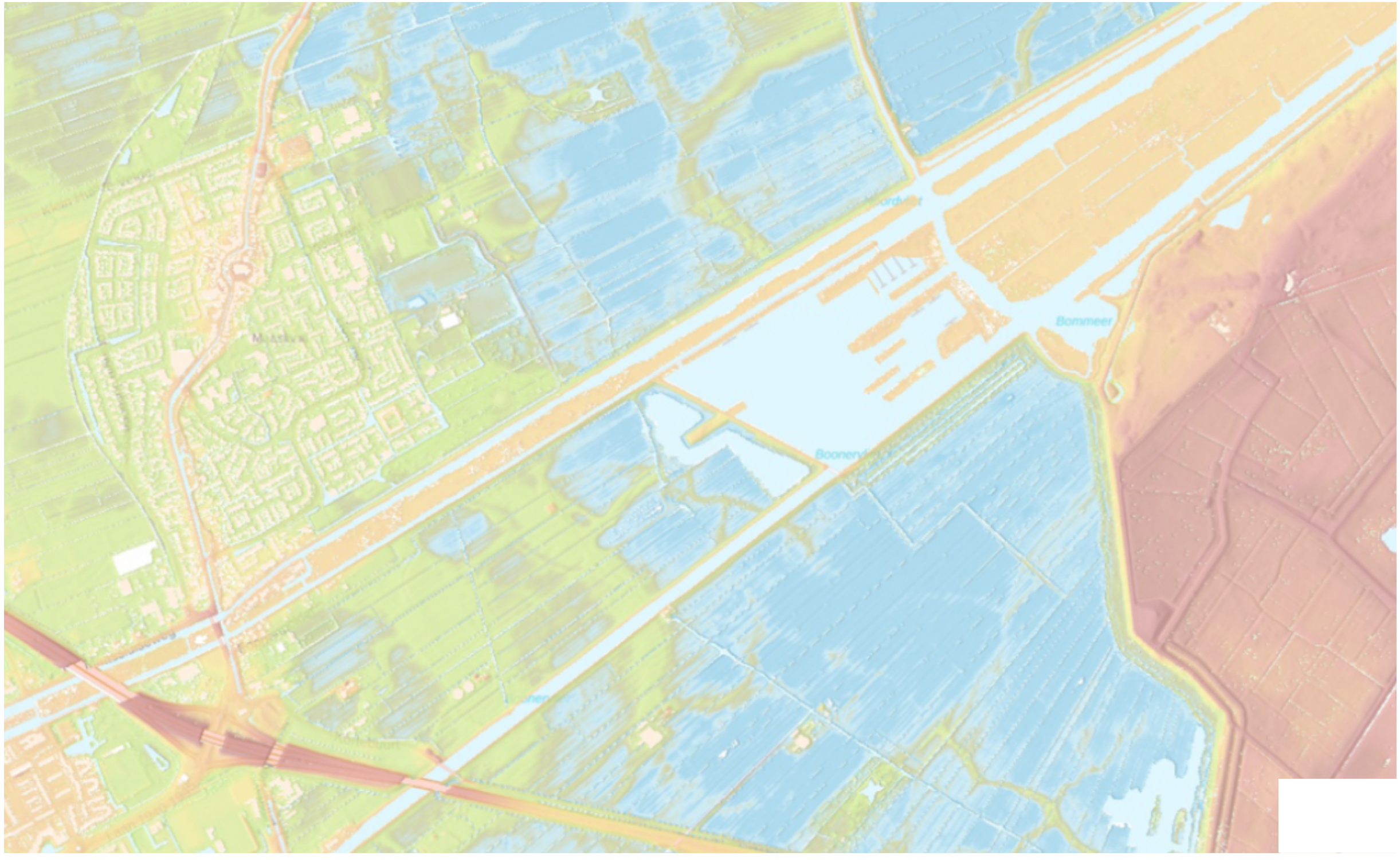
MASTERPLAN

Historic polder stucture *19th century*



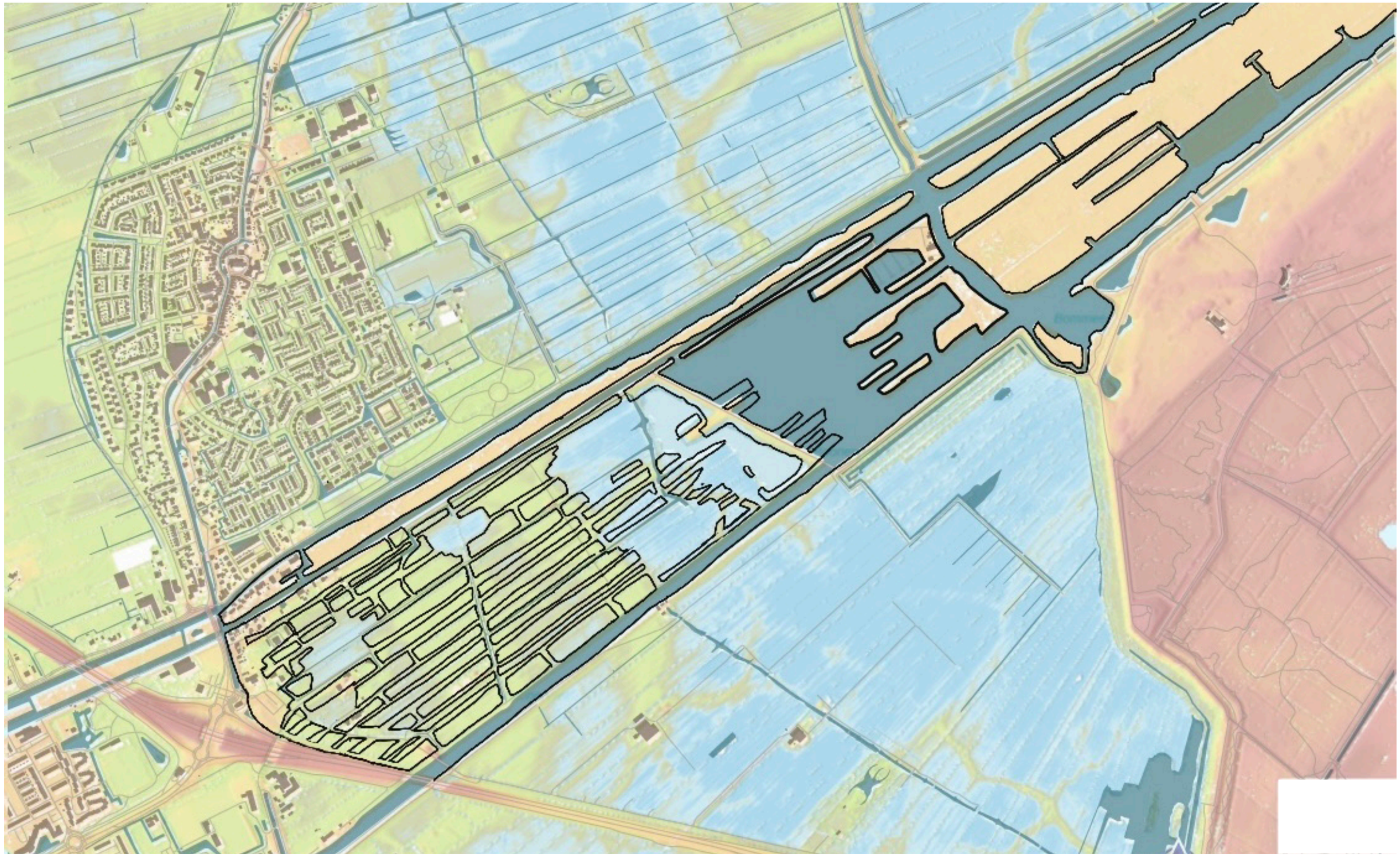
MASTERPLAN

Height map Foppenpolder



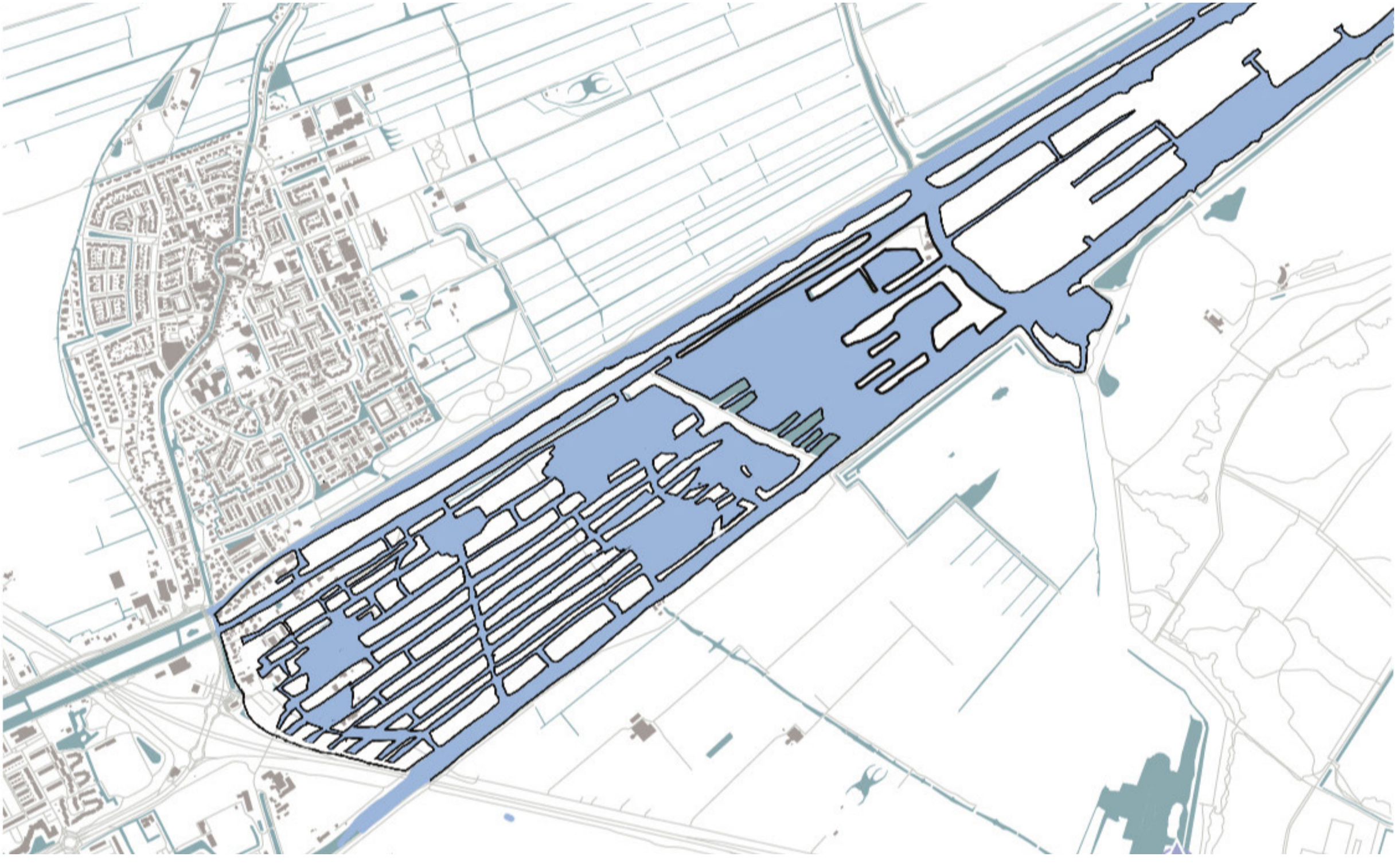
MASTERPLAN

Height map Foppenpolder/New landscape



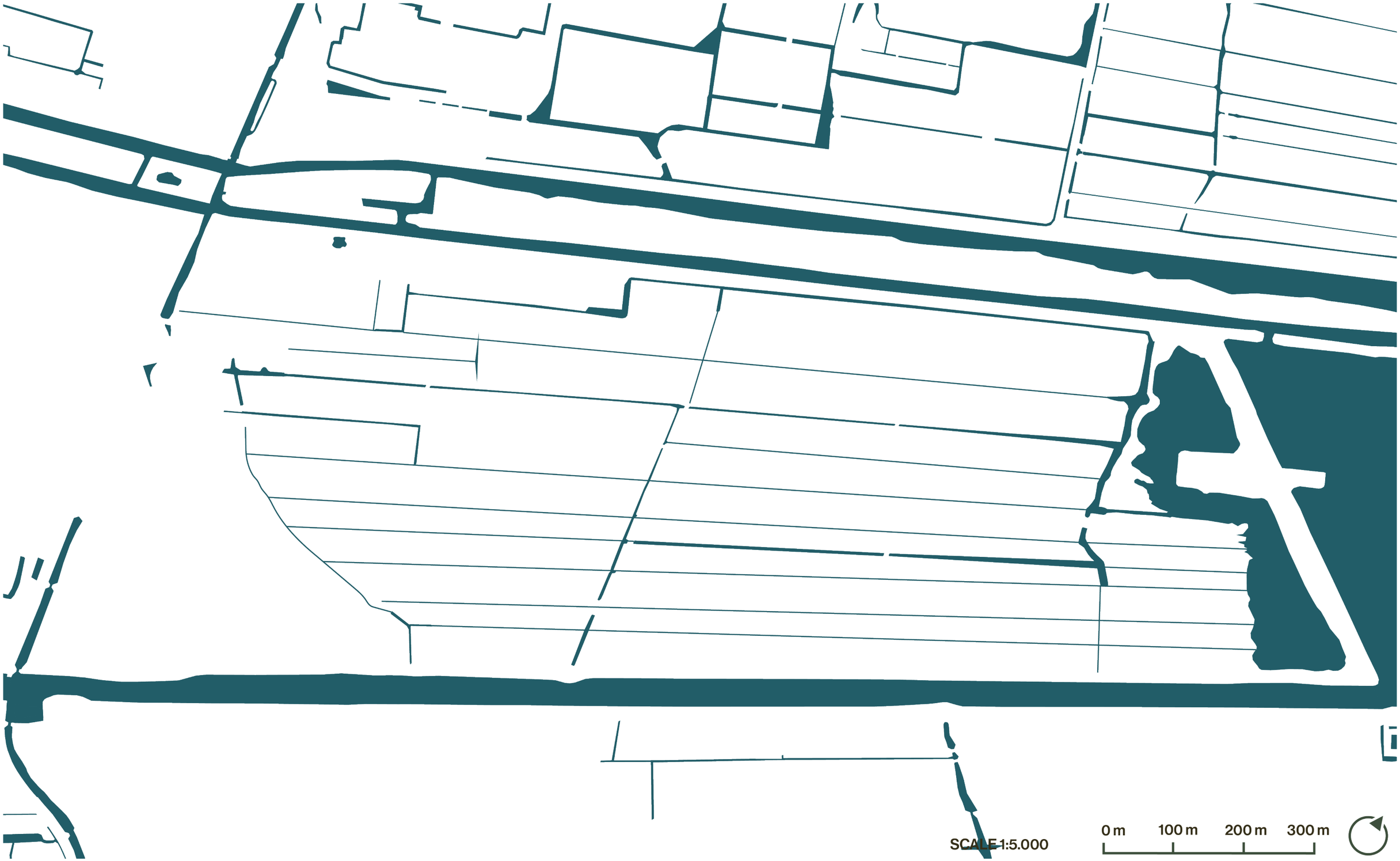
MASTERPLAN

New landscape sketch



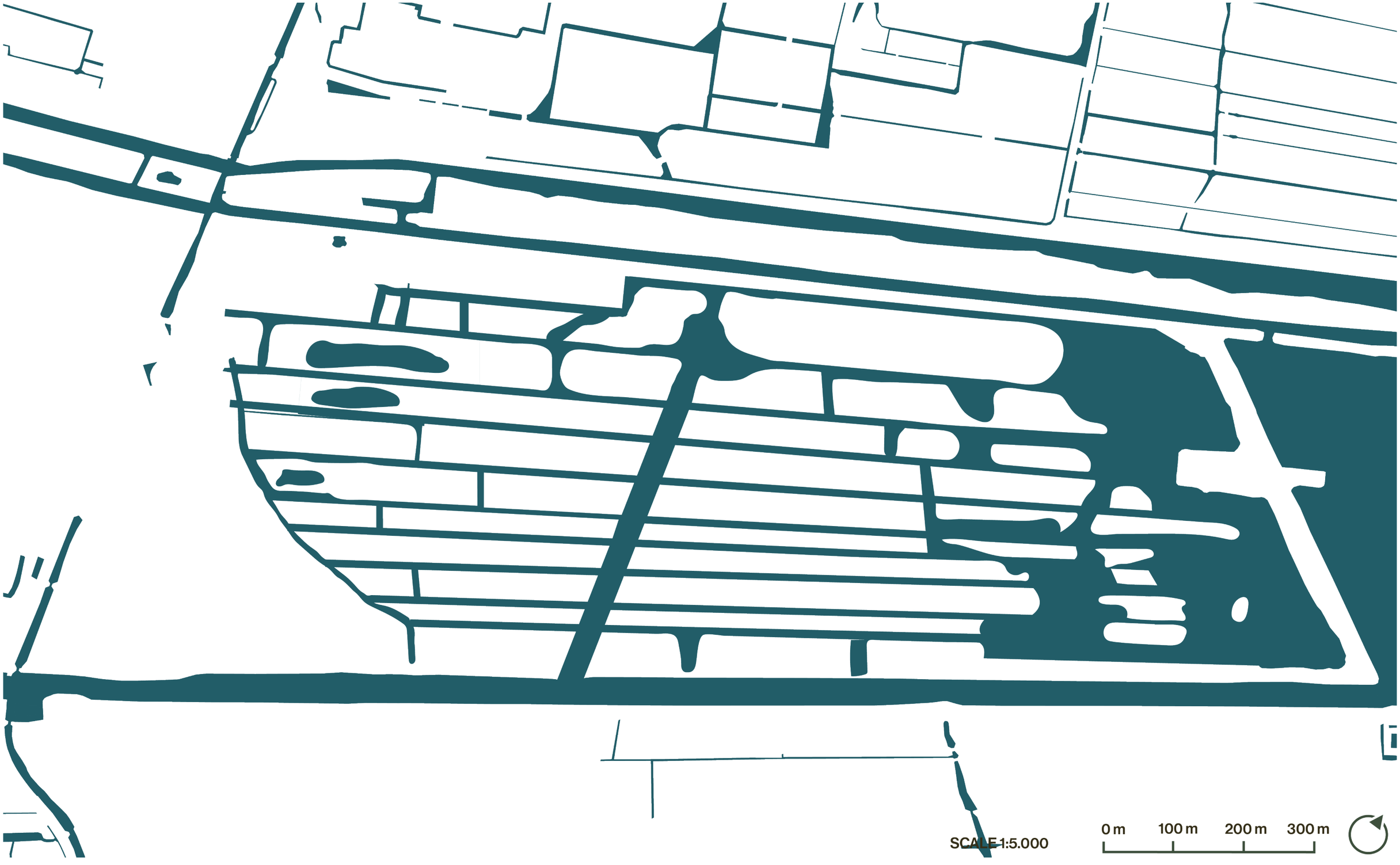
MASTERPLAN

Current water landscape



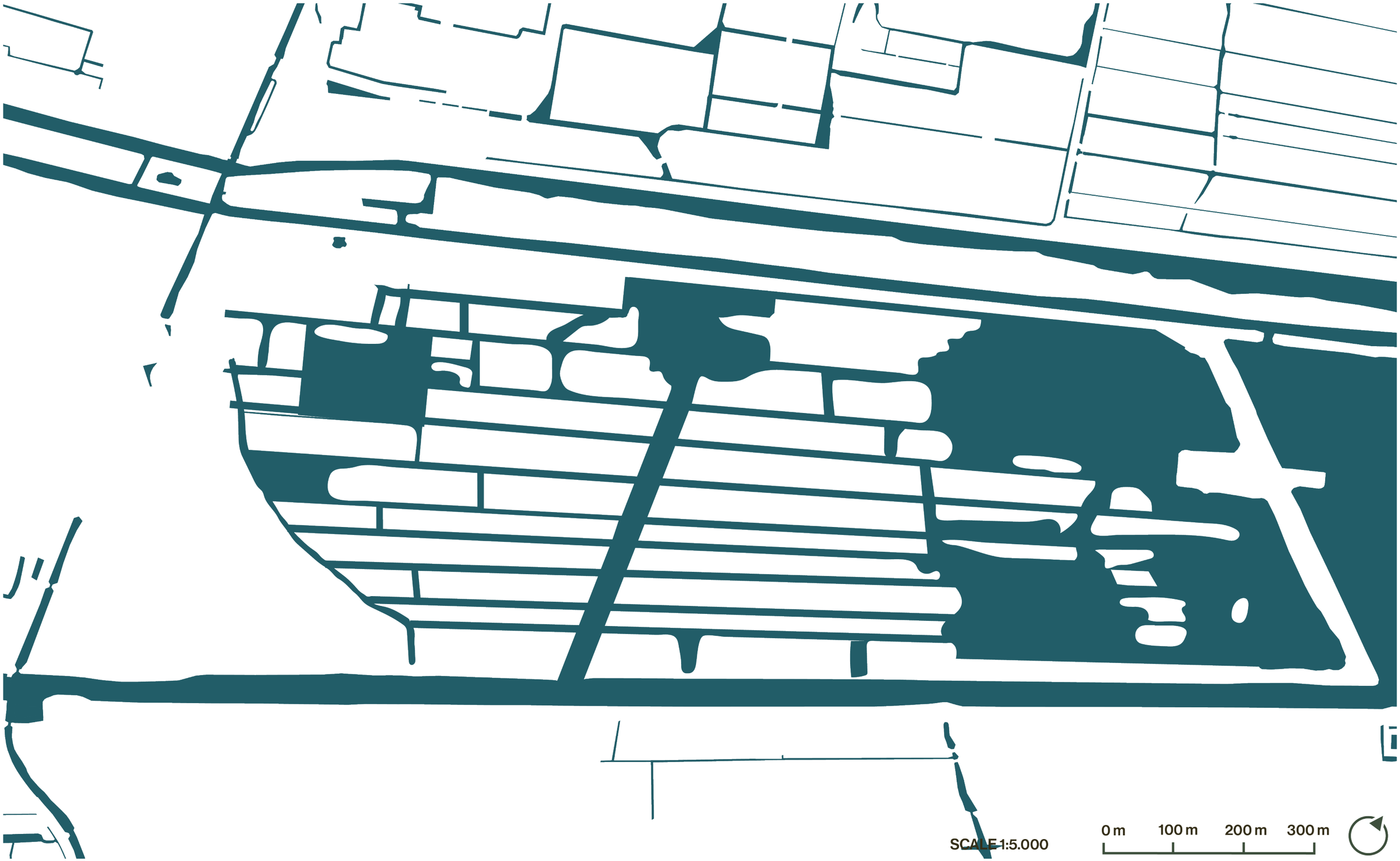
MASTERPLAN

New water landscape *Dry situation*



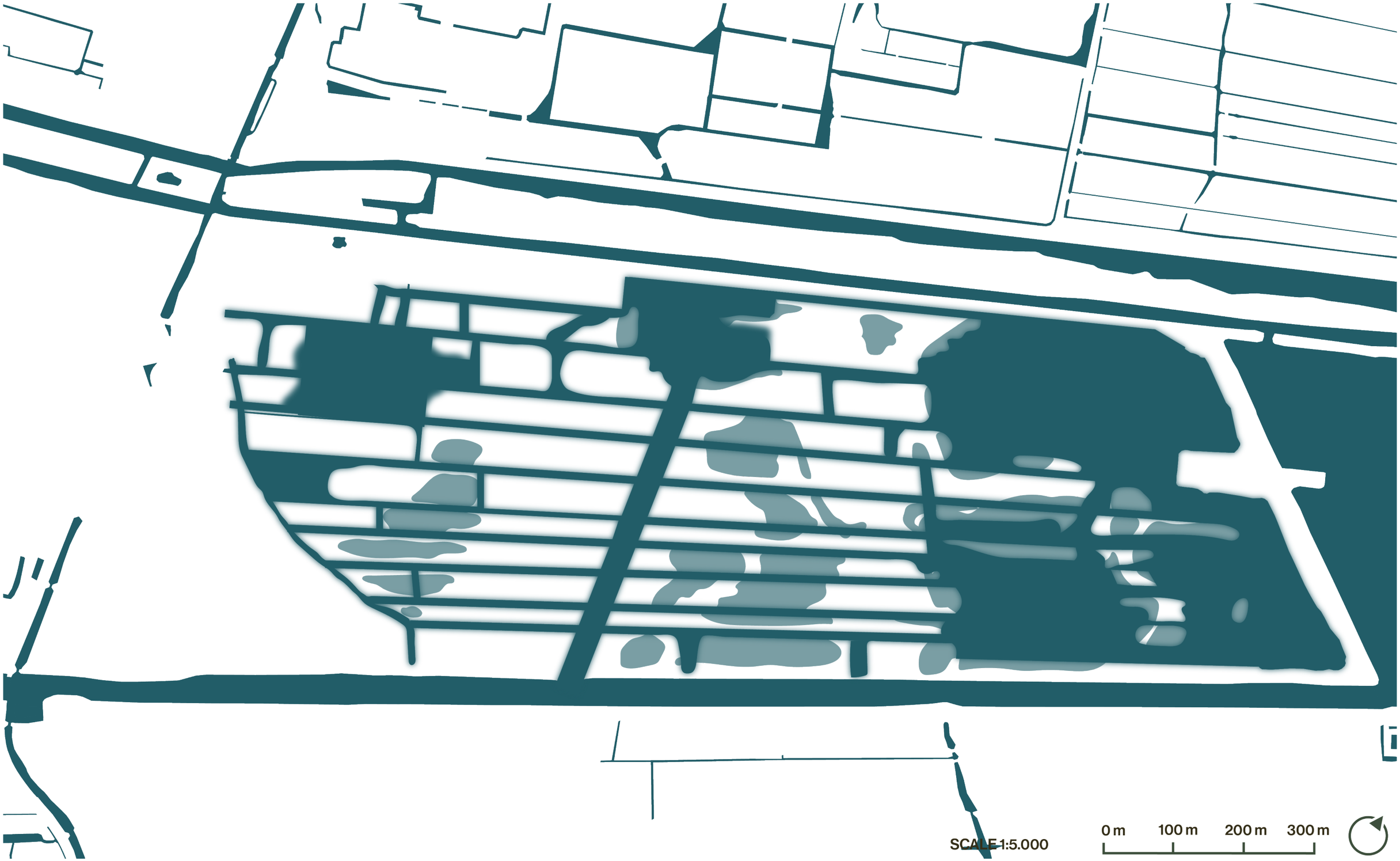
MASTERPLAN

New water landscape *Regular situation*



MASTERPLAN

New water landscape *Wet situation*

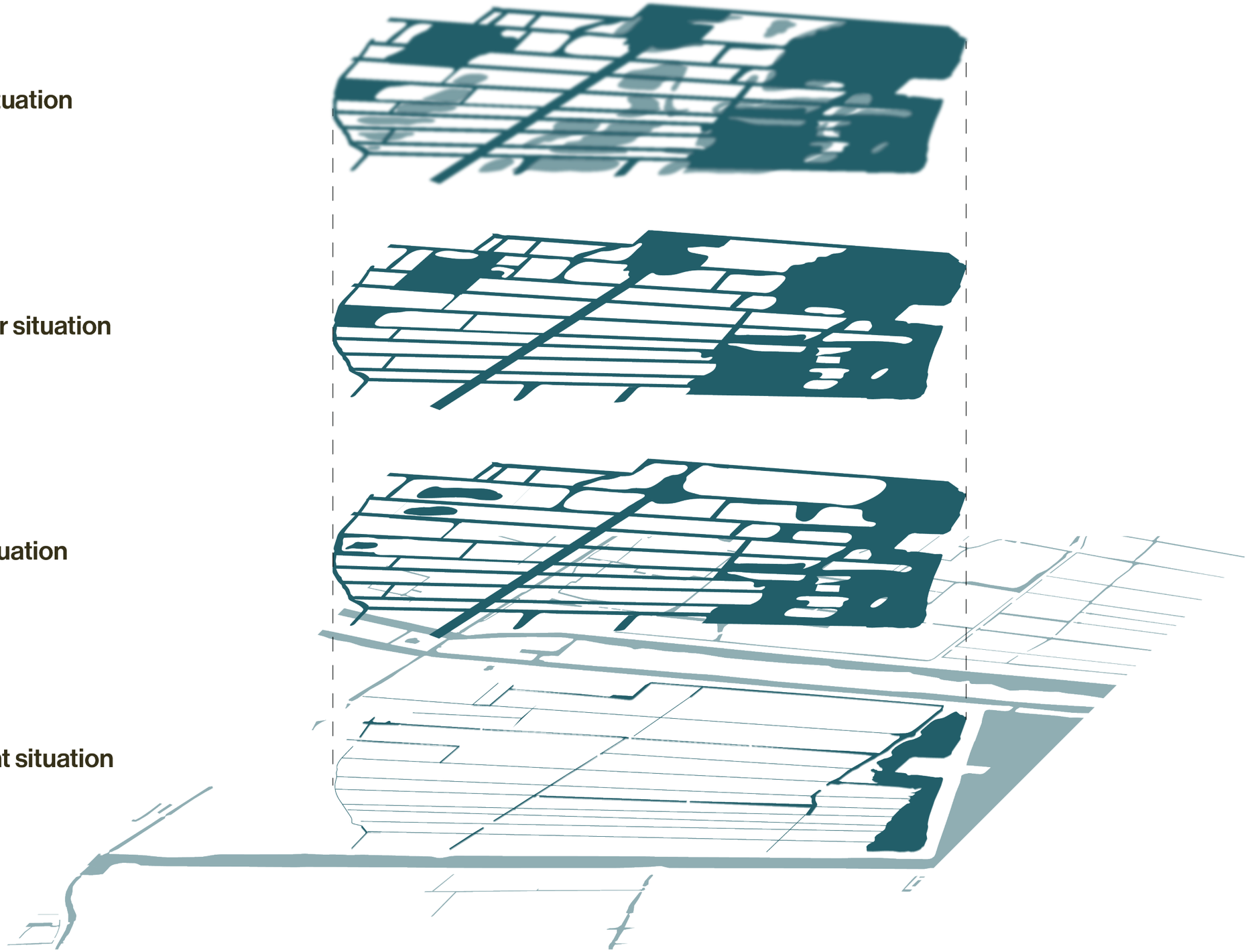


wet situation

regular situation

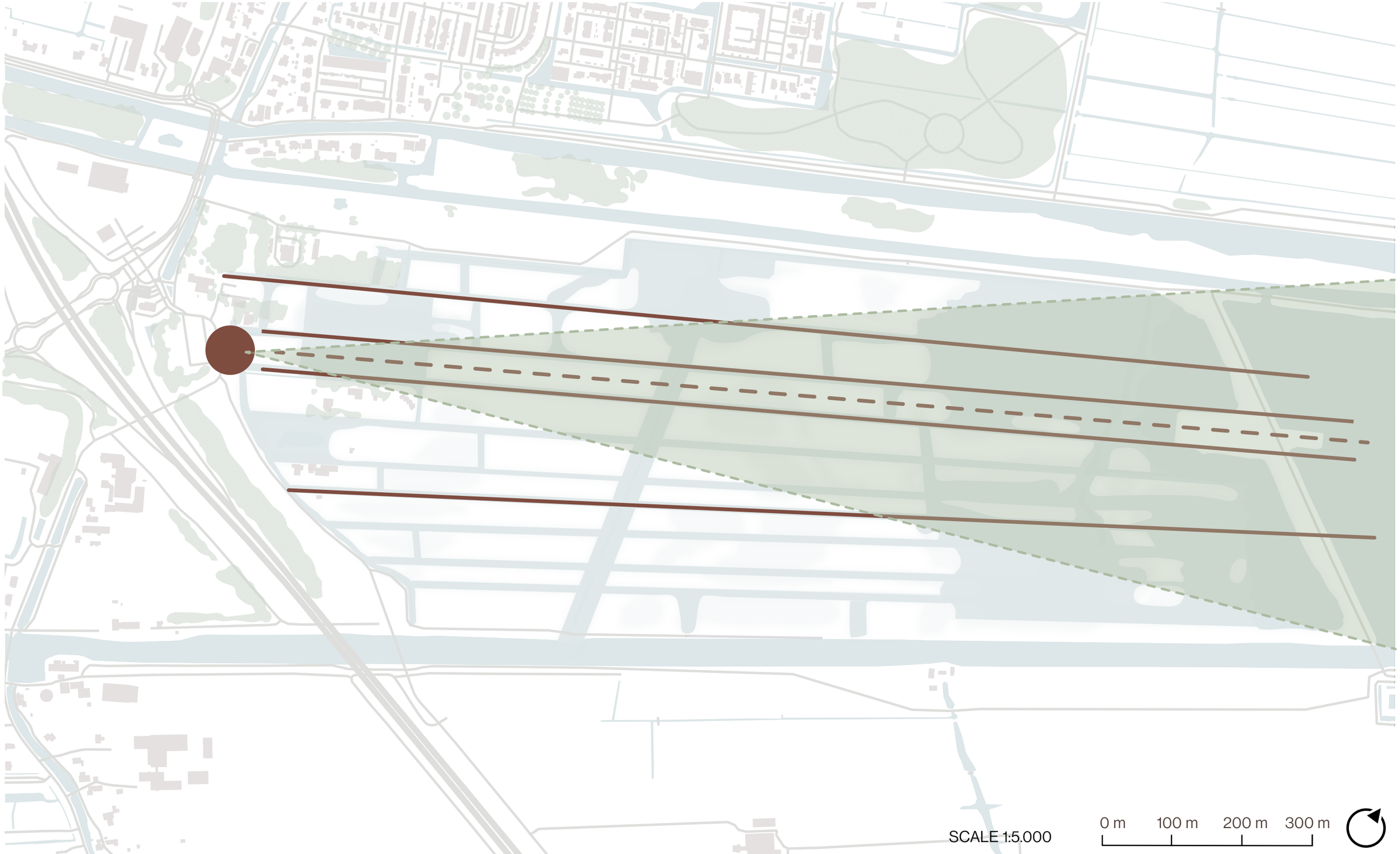
dry situation

current situation



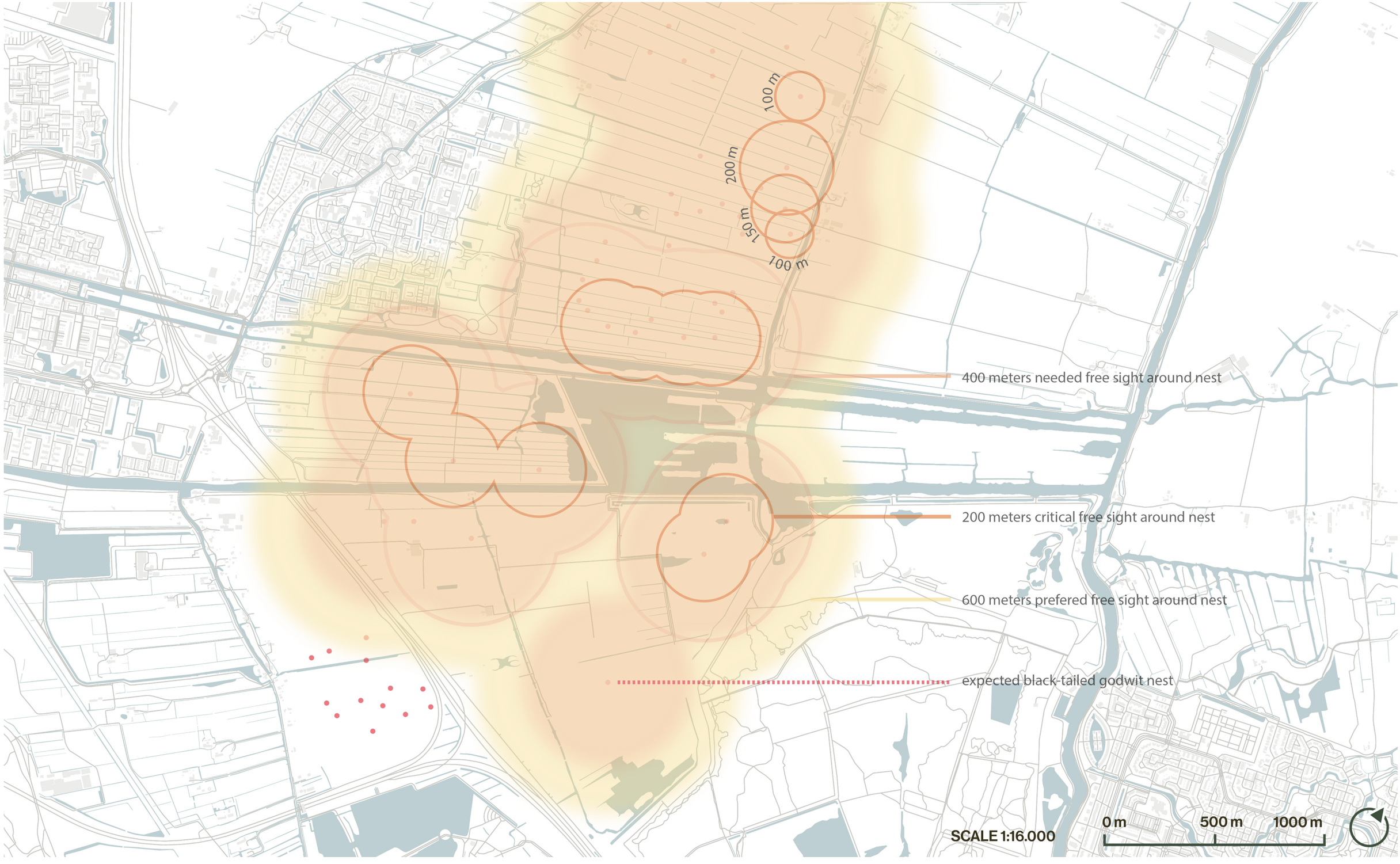
MASTERPLAN

Sight lines and vistas



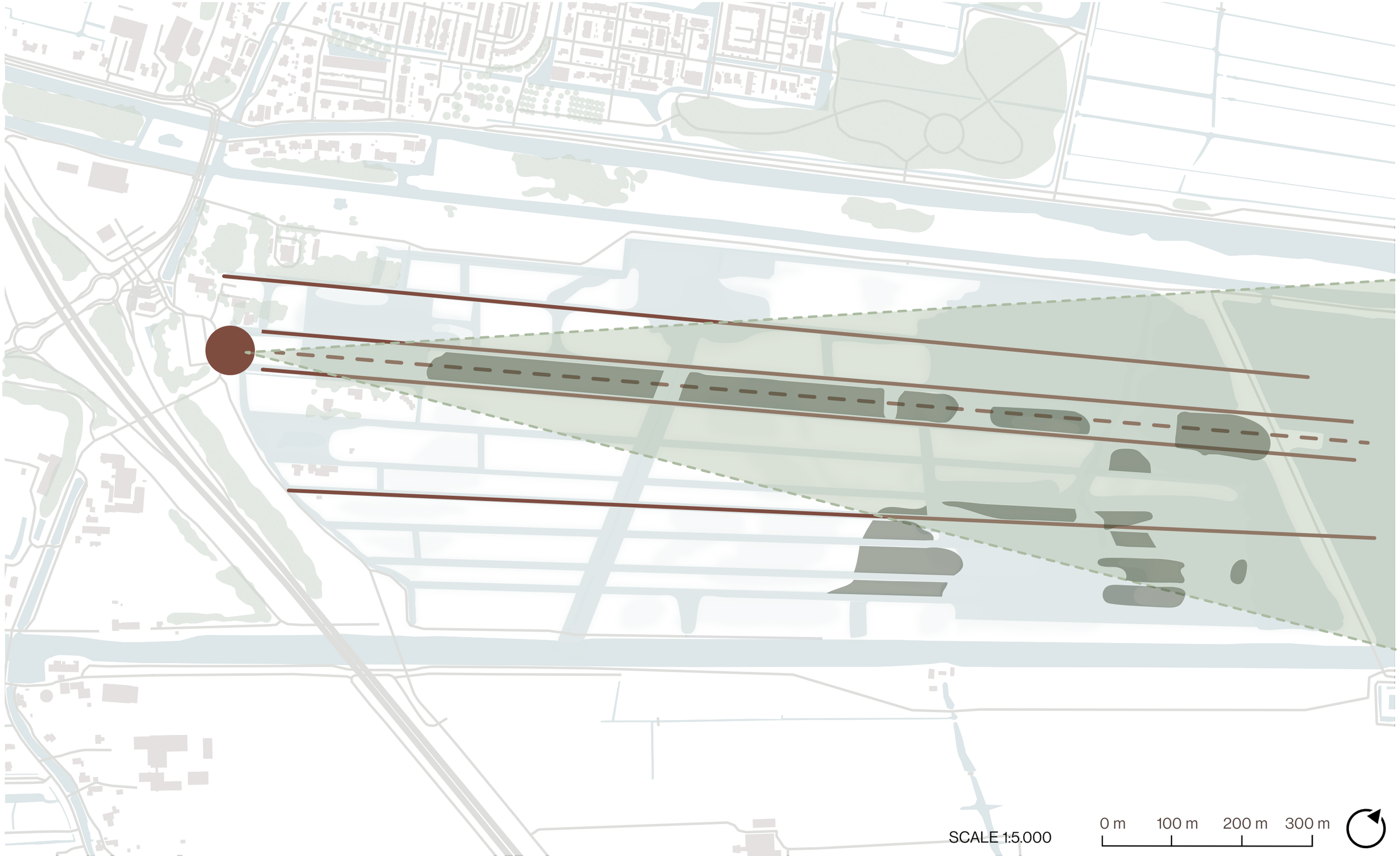
MASTERPLAN

Birds nests *Grutto*



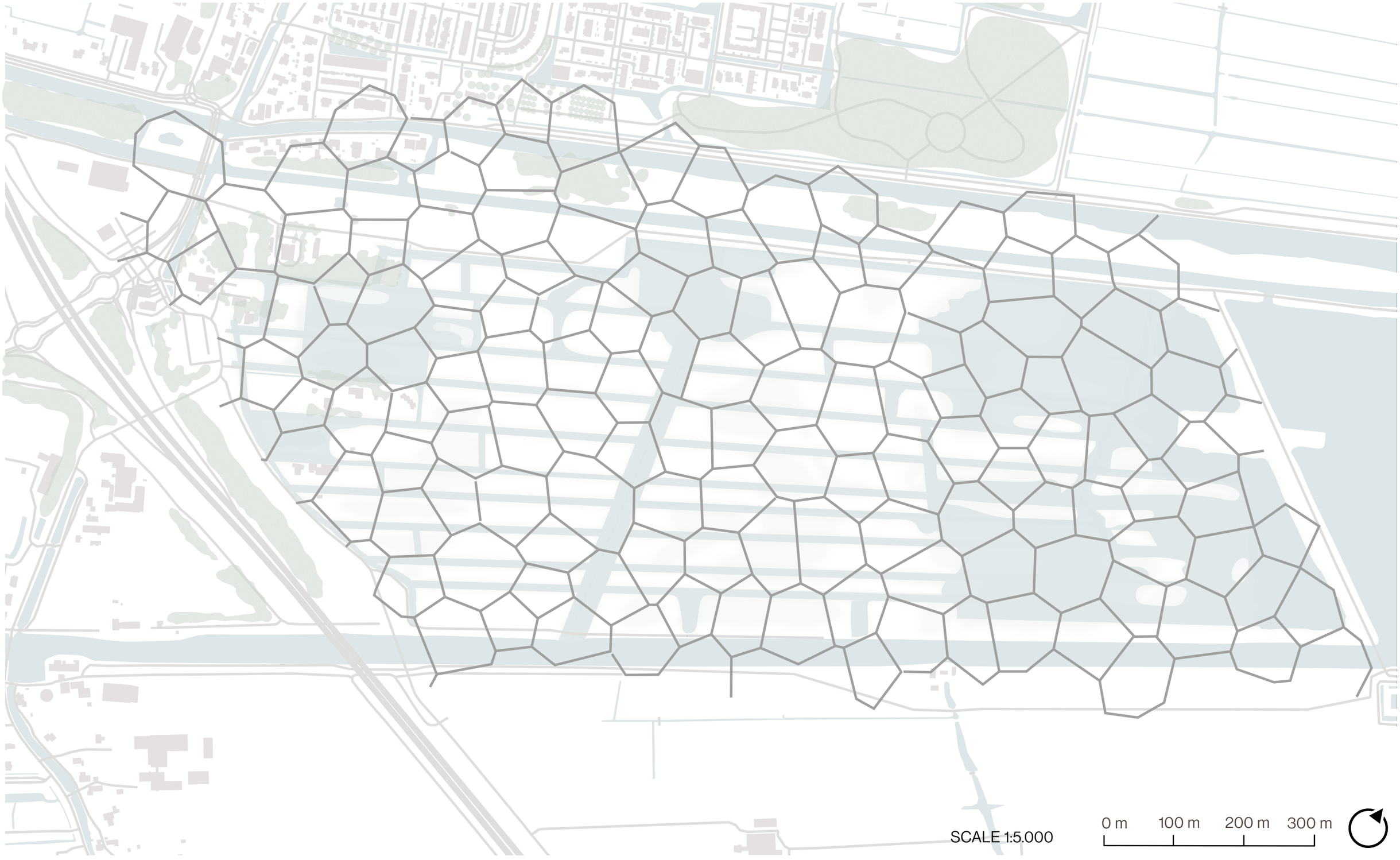
MASTERPLAN

Green zones



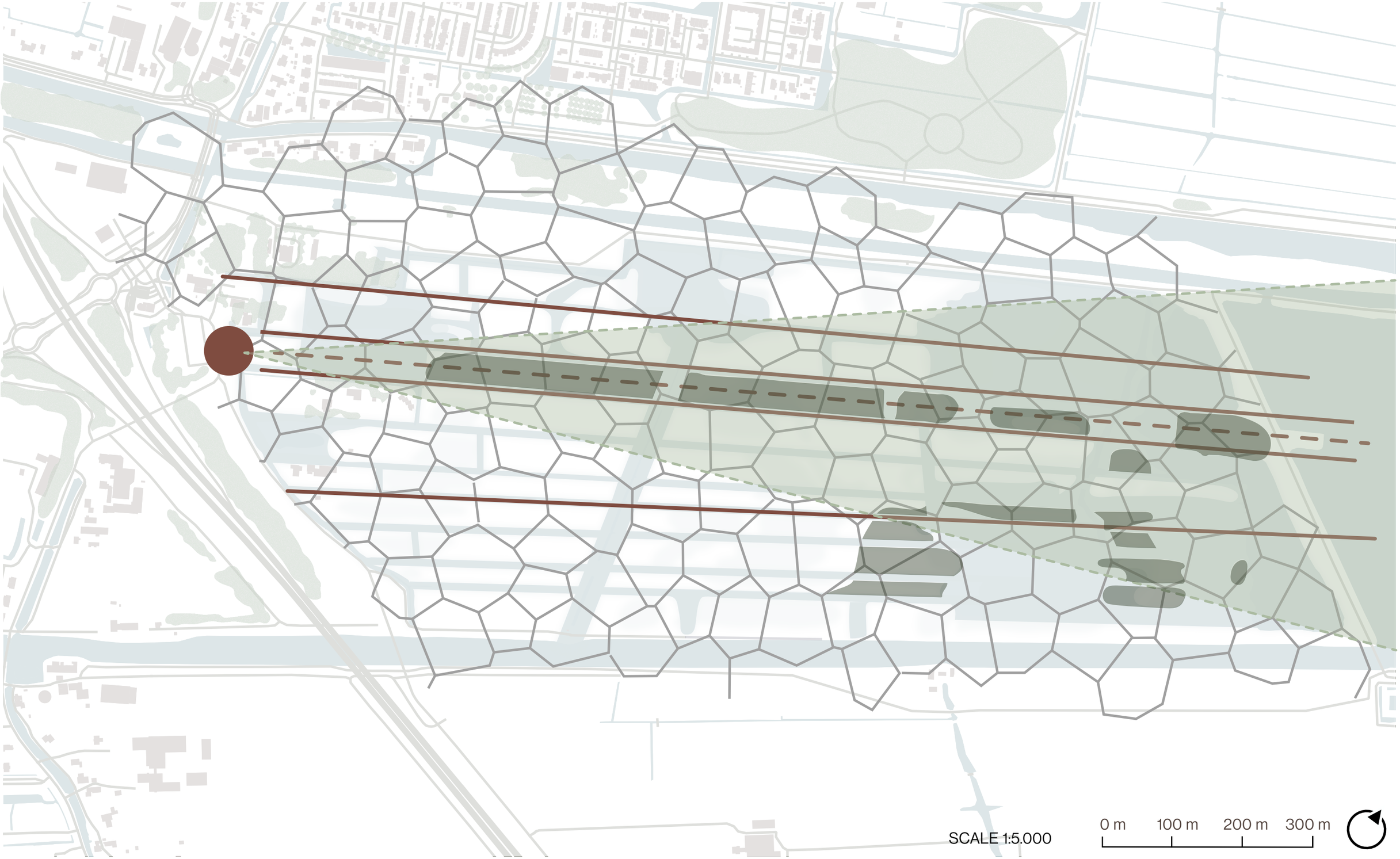
MASTERPLAN

Cell pattern



MASTERPLAN

Cell pattern



MASTERPLAN

Main roads

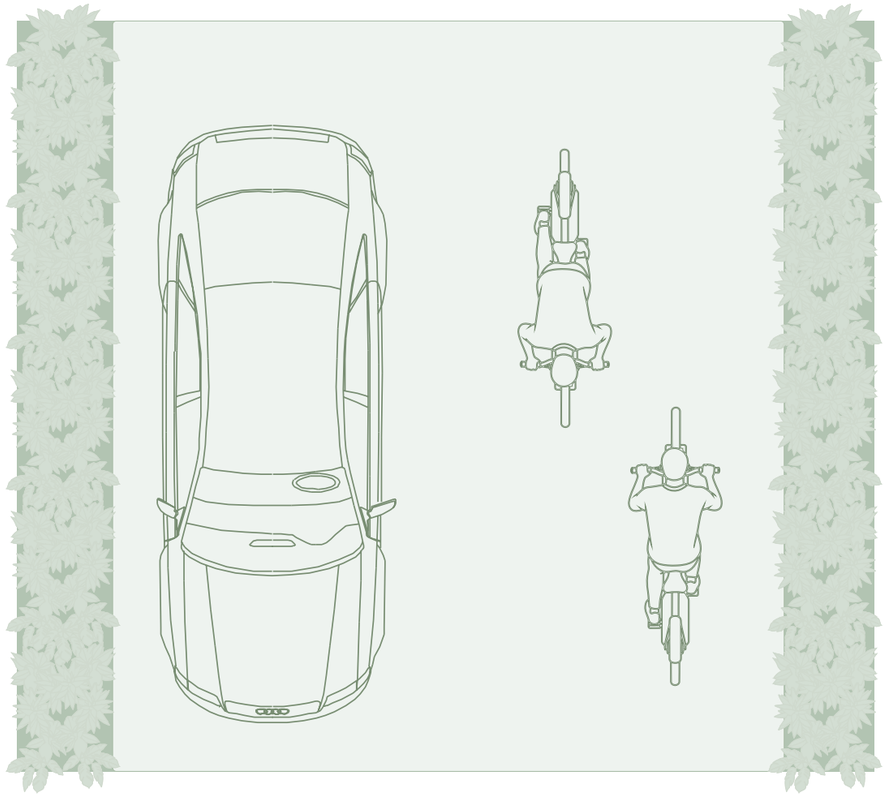
Main routes
Car as guest

SCALE 1:5.000

0 m 100 m 200 m 300 m

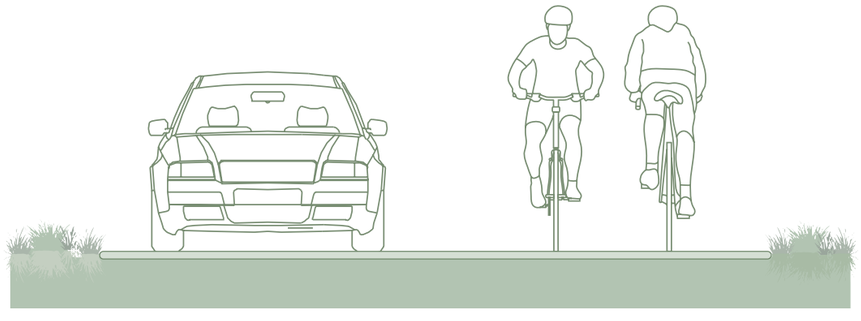
MASTERPLAN

Main roads



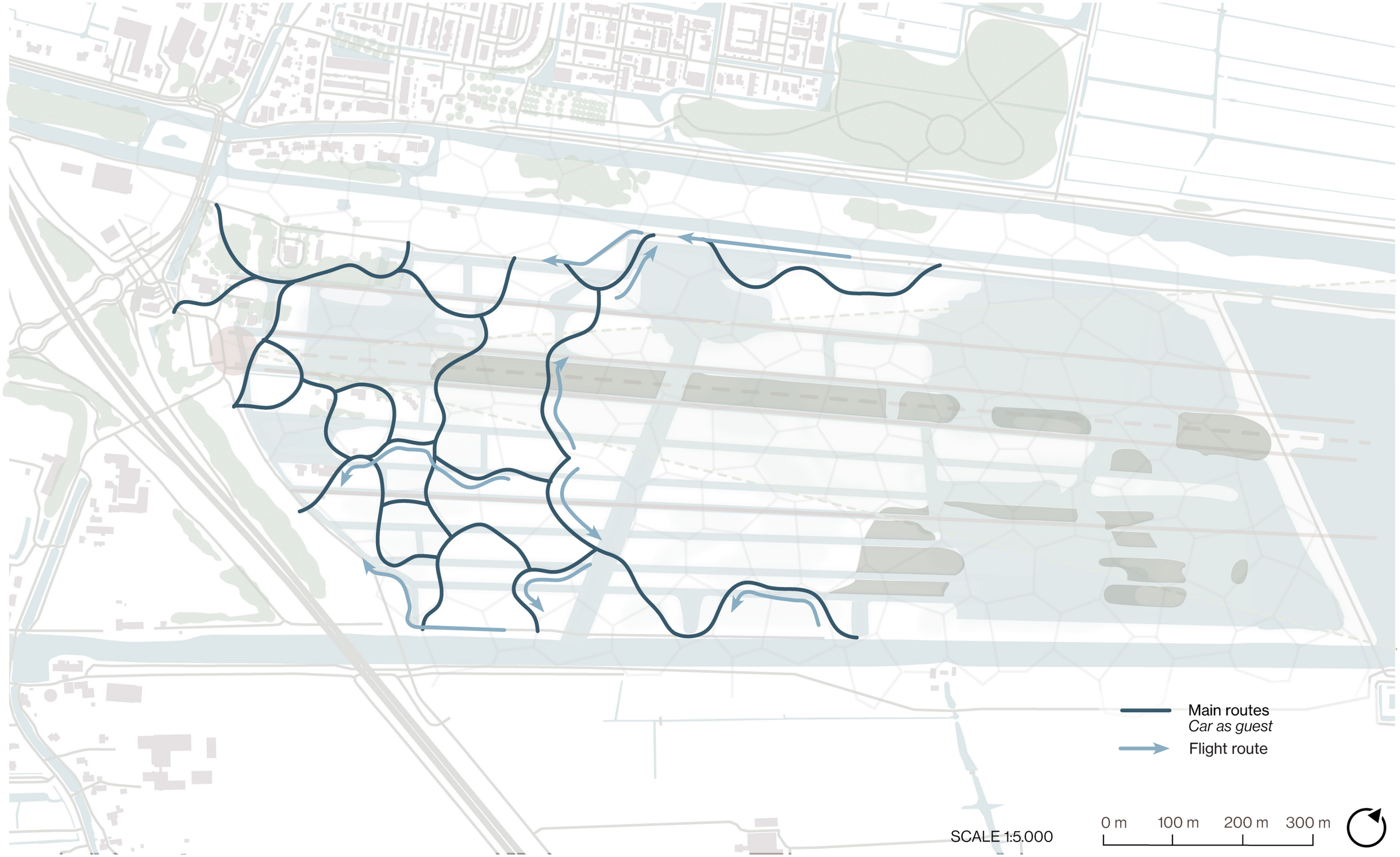
4,5 meters

main road on ground level

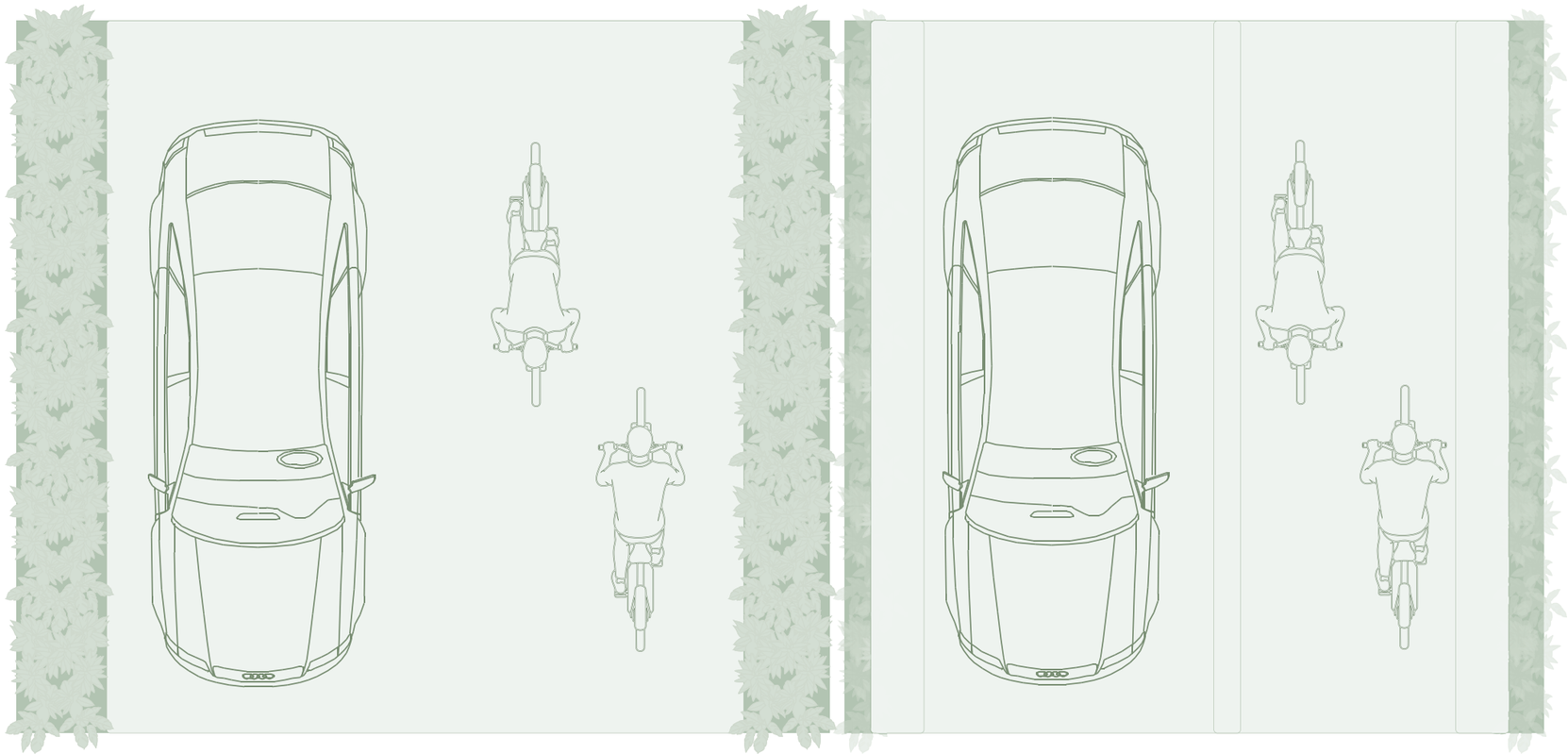


MASTERPLAN

Flight routes

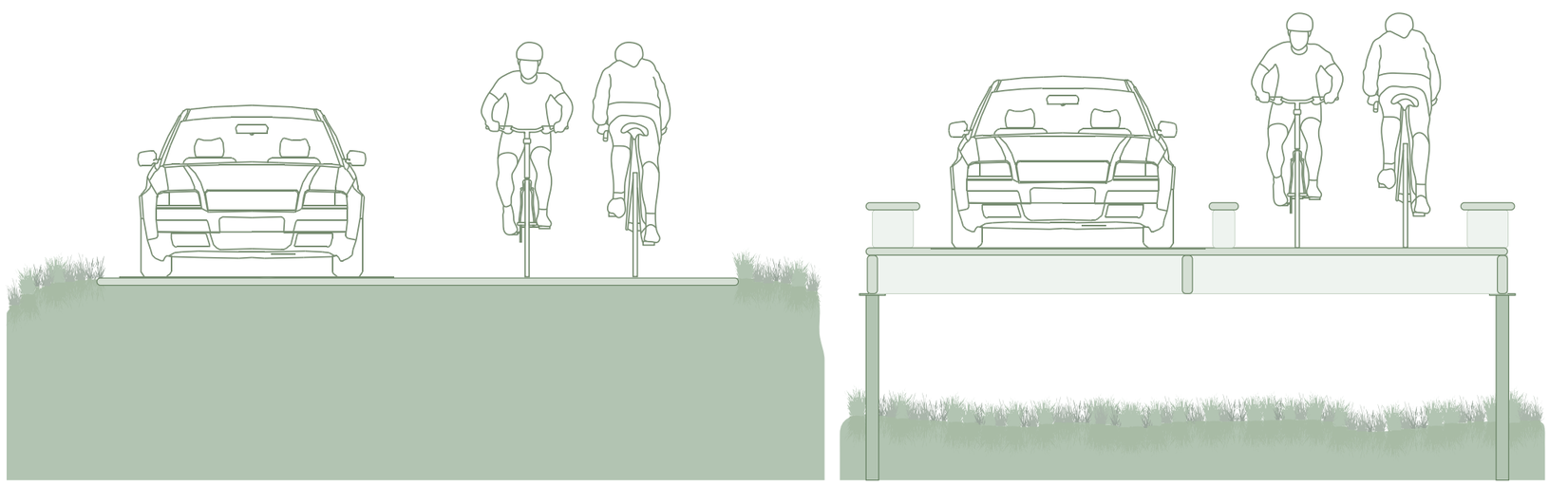


MASTERPLAN
Flight routes



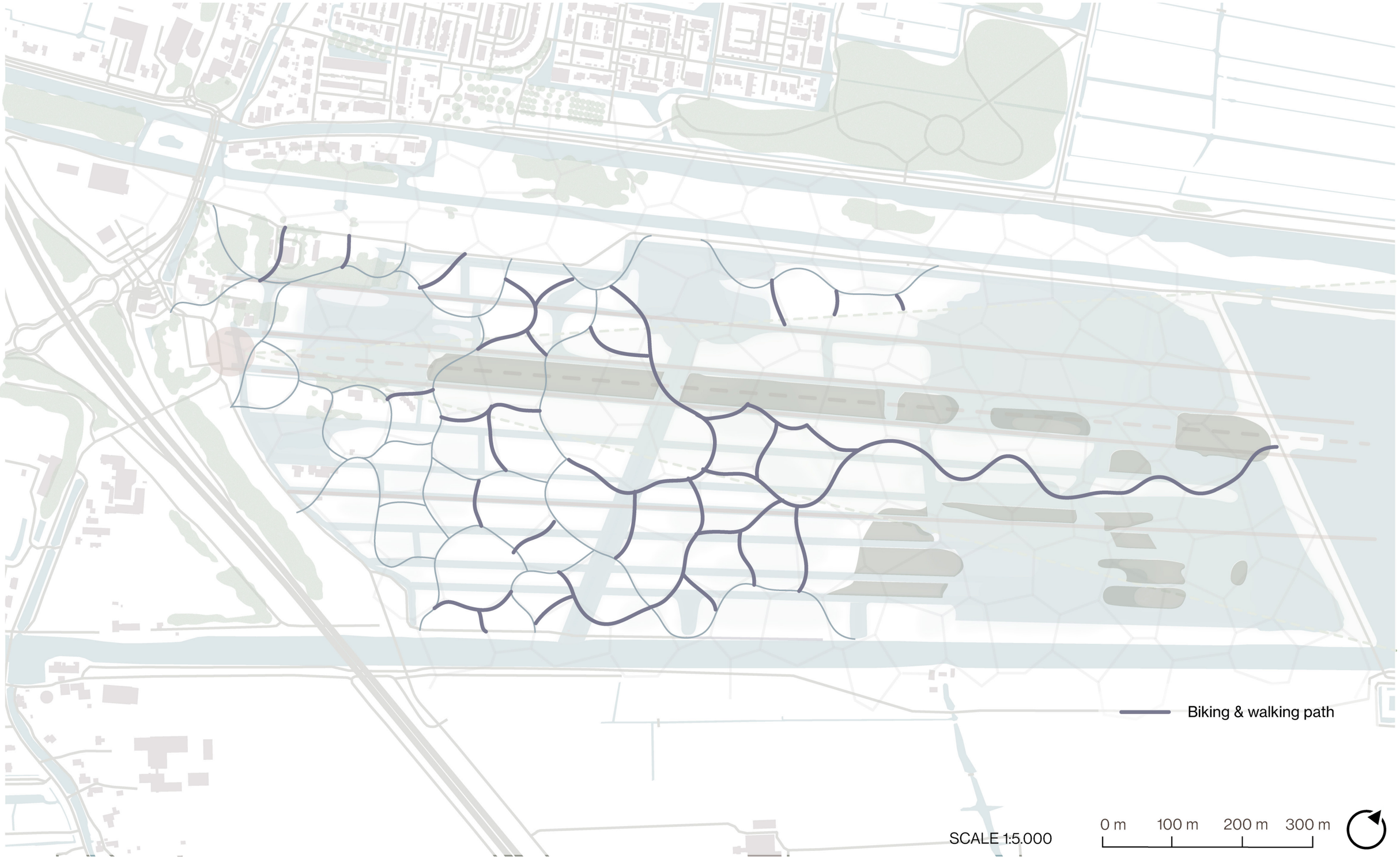
4,5 meters
main road heigthend

4,5 meters
main road heigthend



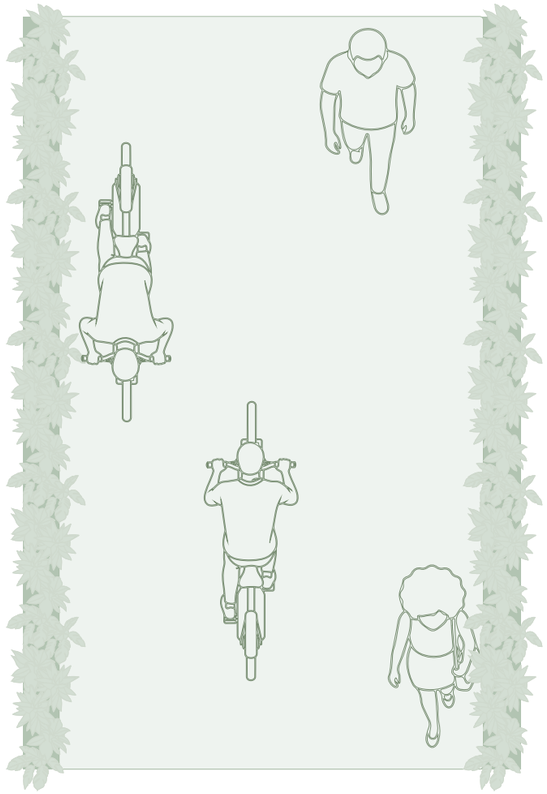
MASTERPLAN

Secondary roads

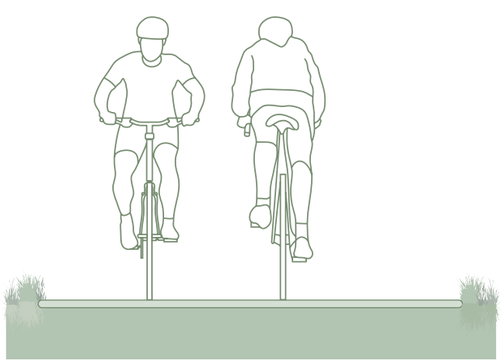


MASTERPLAN

Secondary roads

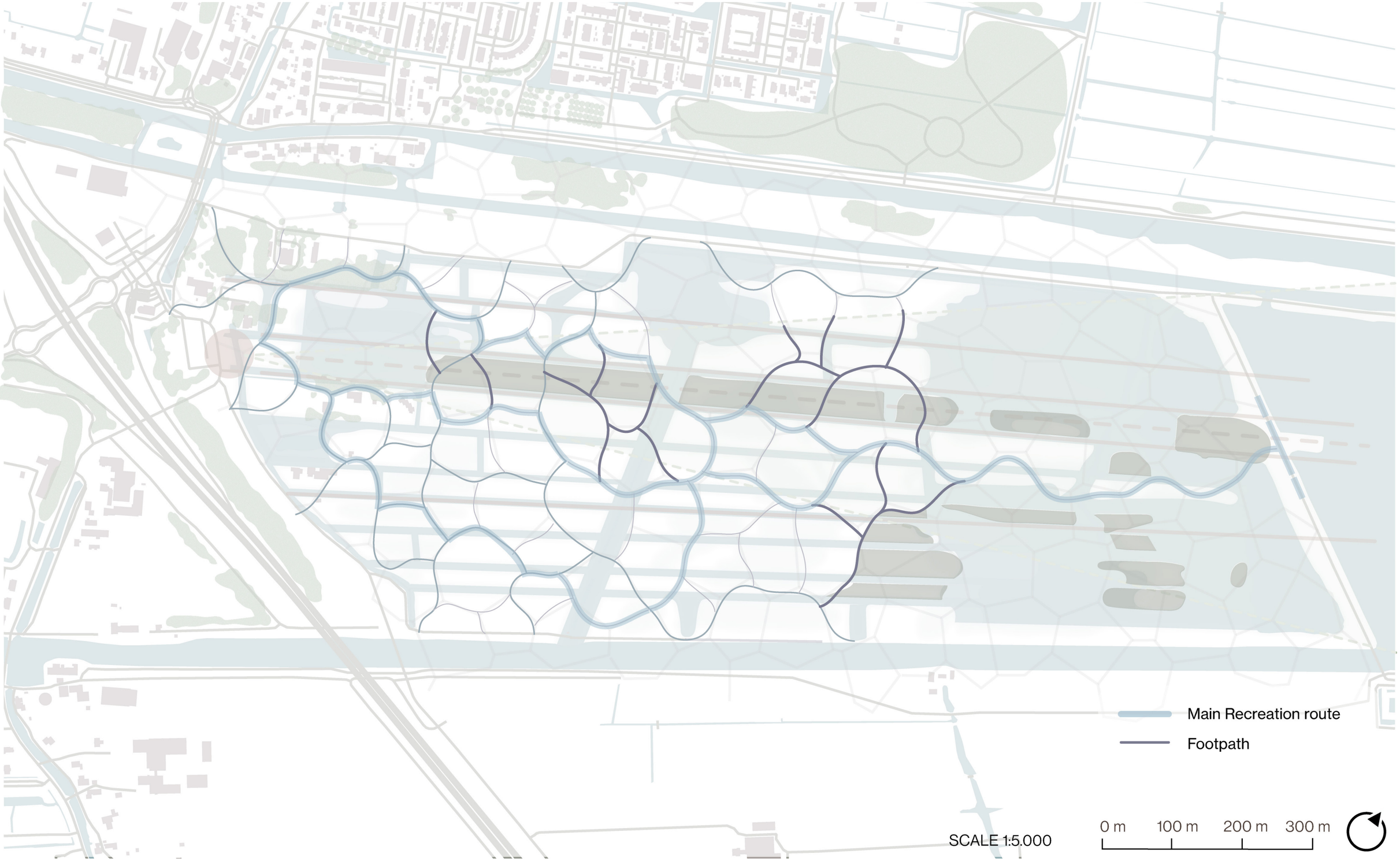


2,5 meters
walking/cycling
path



MASTERPLAN

Walking paths



MASTERPLAN
Mobility

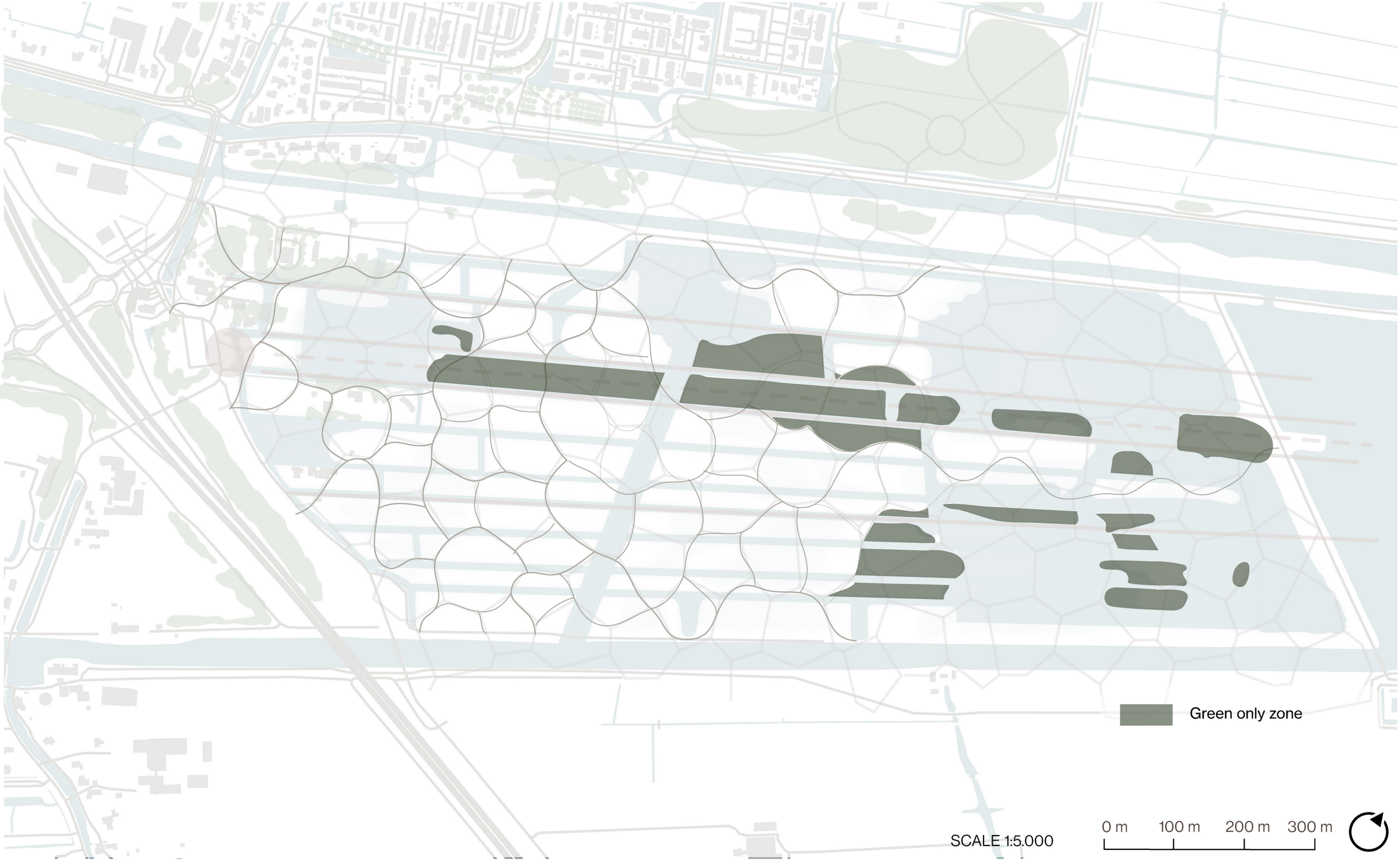
Bus stop
Mobility hub + Bus hub
Parking visitor
Parking resident

SCALE 1:5.000

0 m 100 m 200 m 300 m

MASTERPLAN

Land use restriction plan *Green only zone*



MASTERPLAN

Impression *Green only zone*



MASTERPLAN

Land use restriction plan *Nature buffer zone*

Green only zone
Nature buffer zone

SCALE 1:5.000

0 m 100 m 200 m 300 m

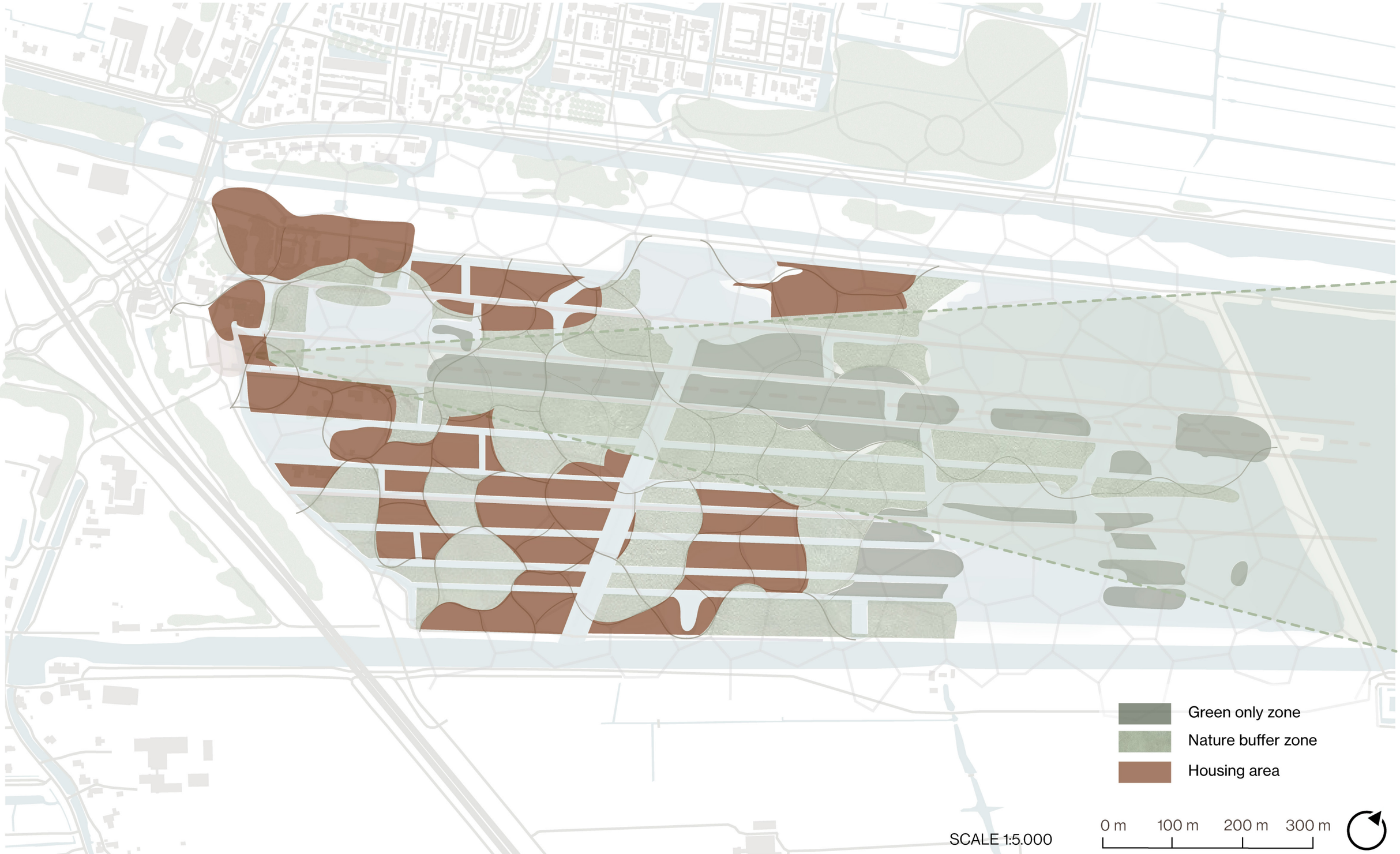
MASTERPLAN

Impression *Nature buffer zone*



MASTERPLAN

Land use restriction plan *Housing area*



MASTERPLAN

Impression *Housing area*



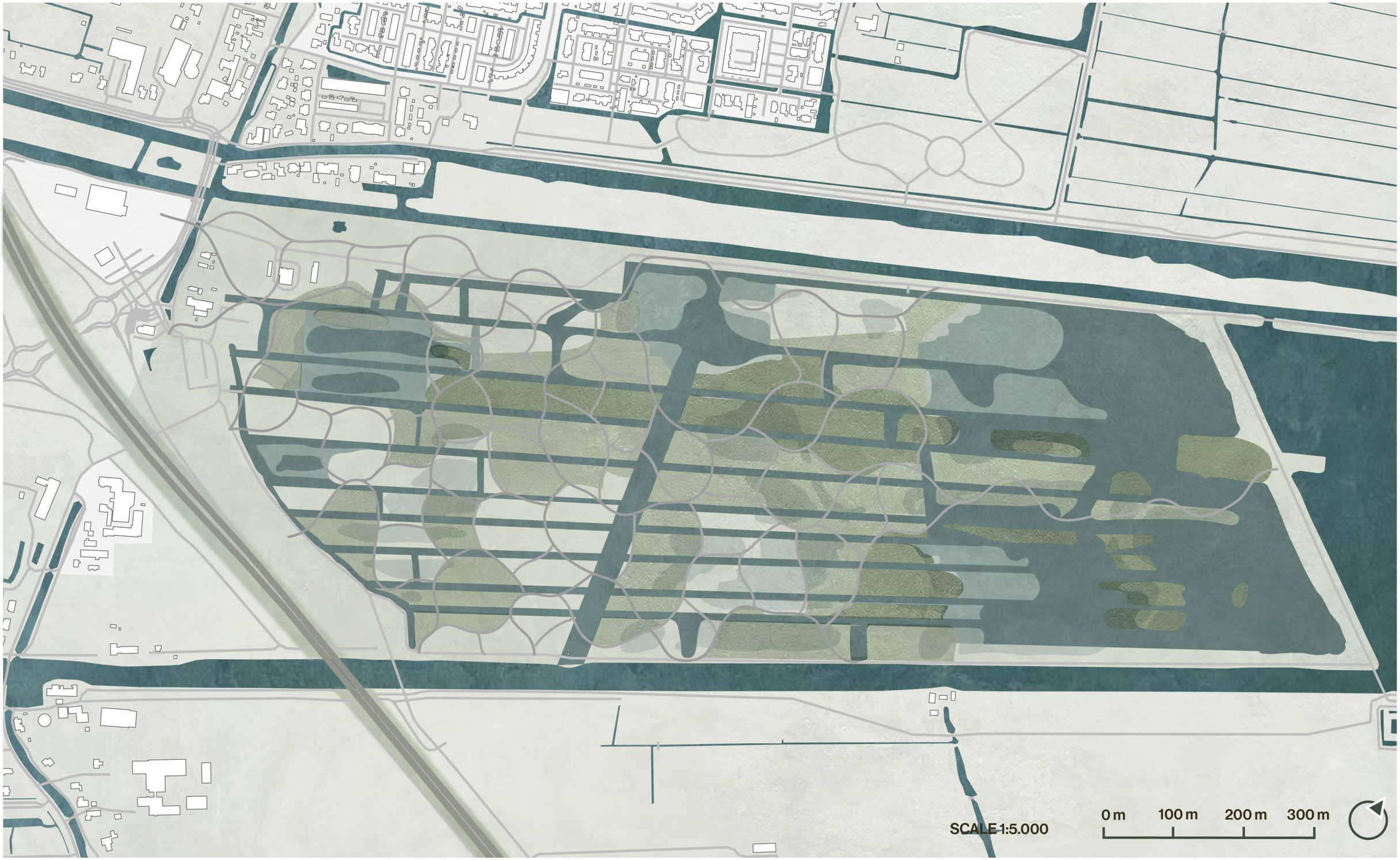
MASTERPLAN

Land use restriction plan



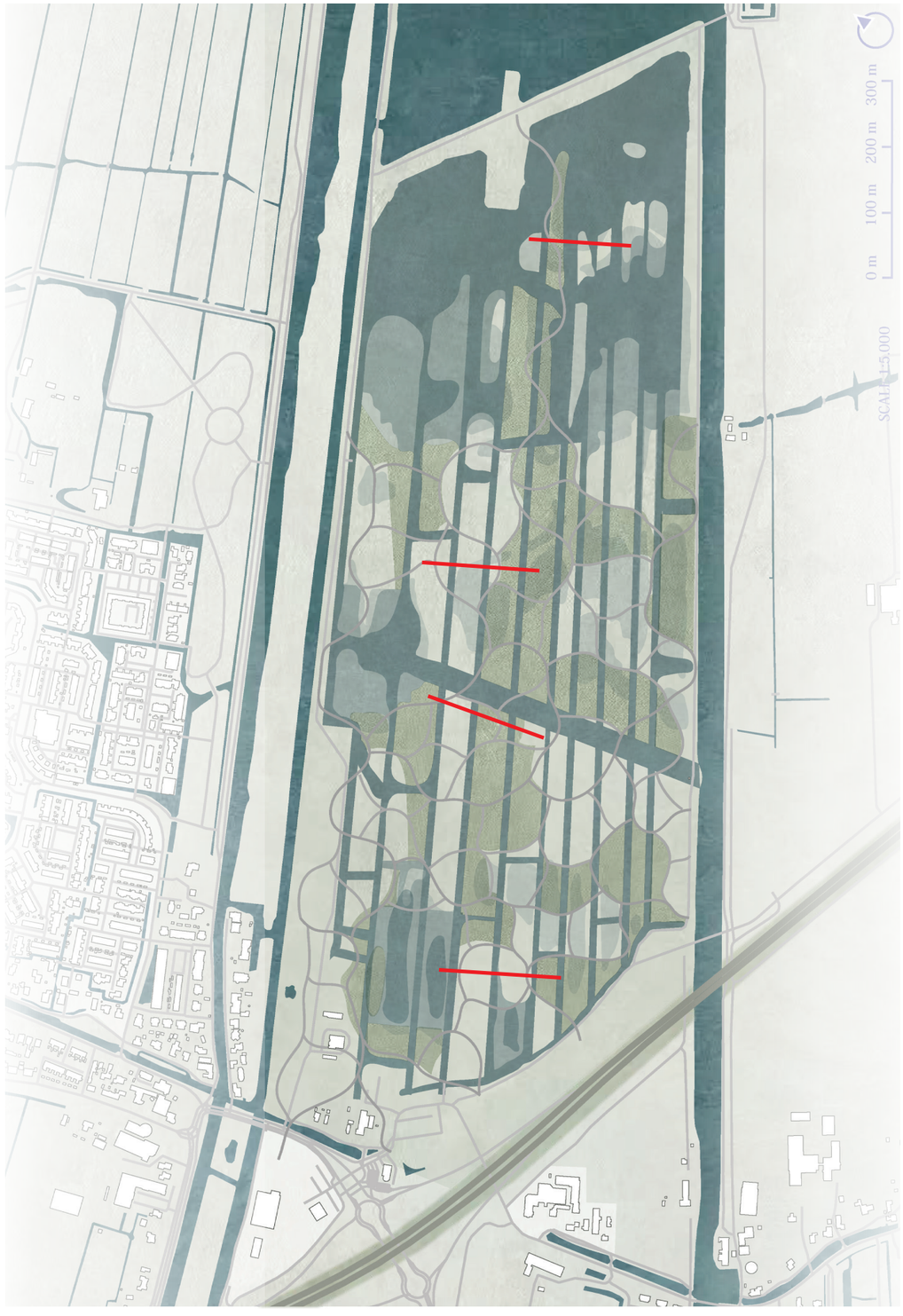
MASTERPLAN

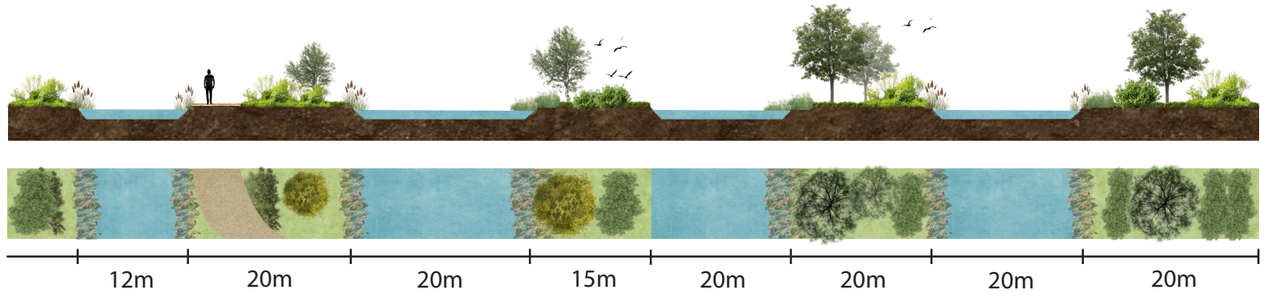
Impression of the masterplan

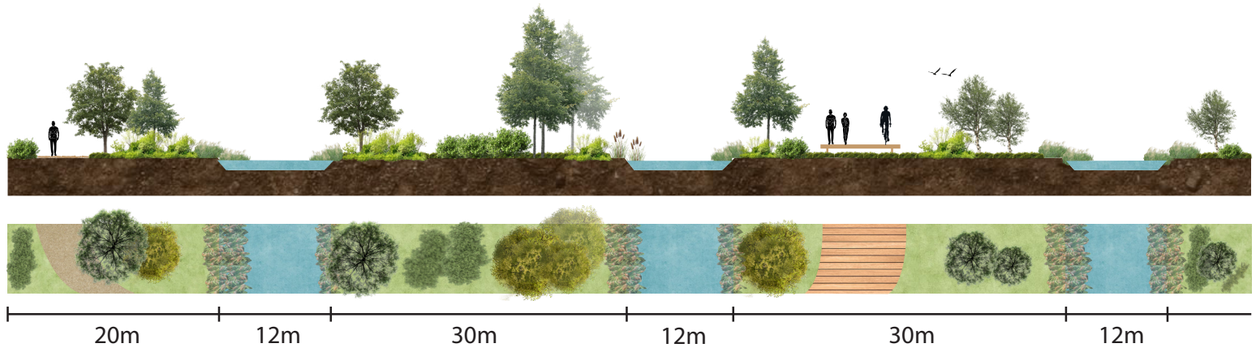


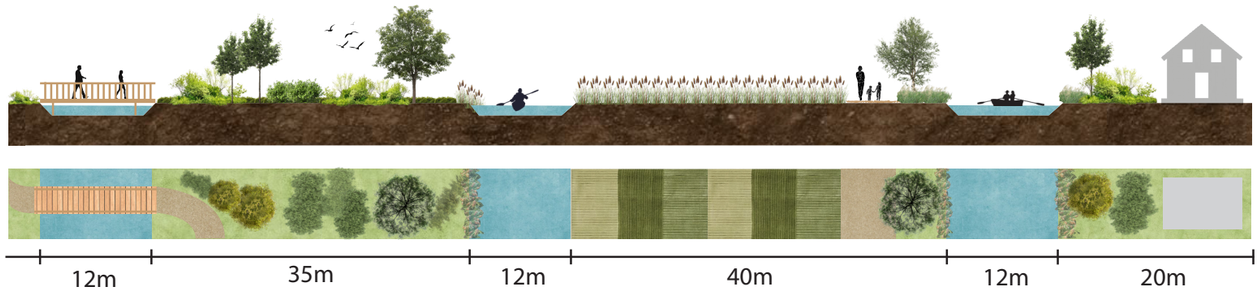
MASTERPLAN

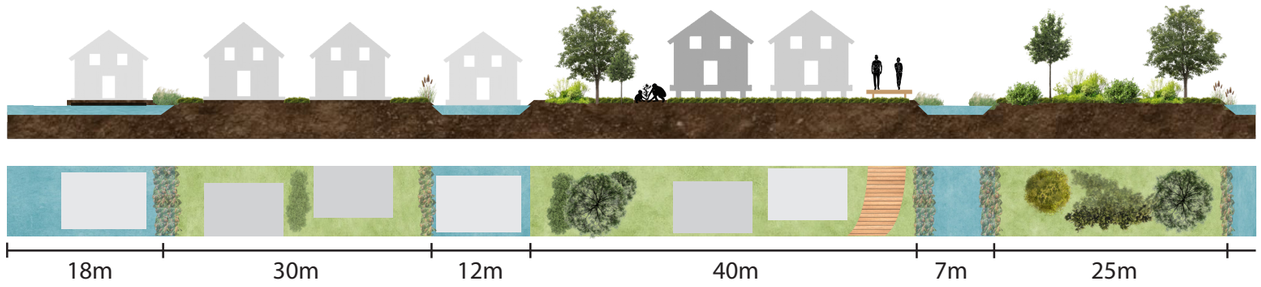
Section of the masterplan

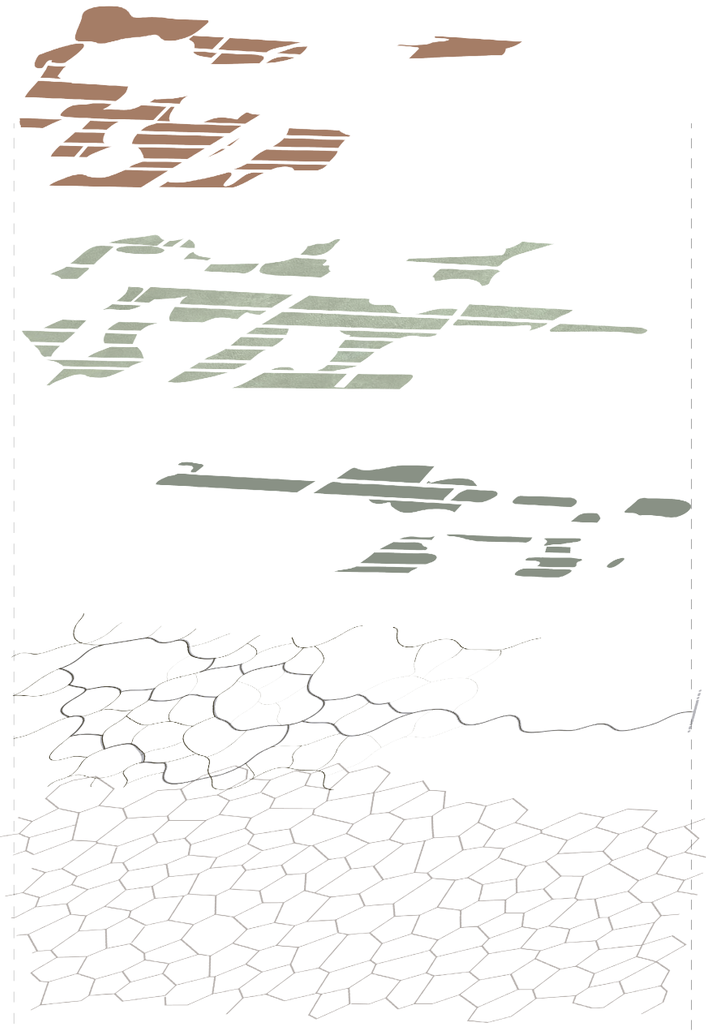


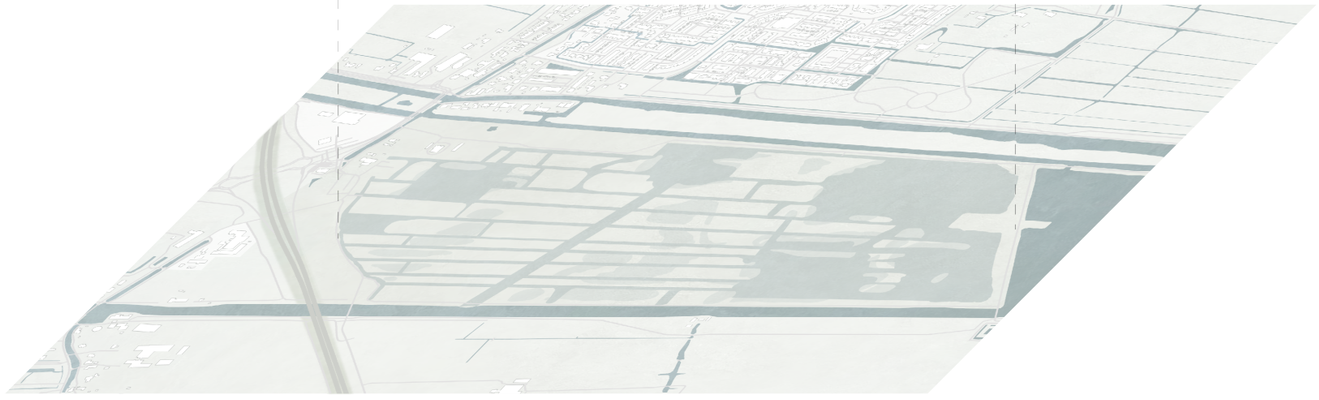






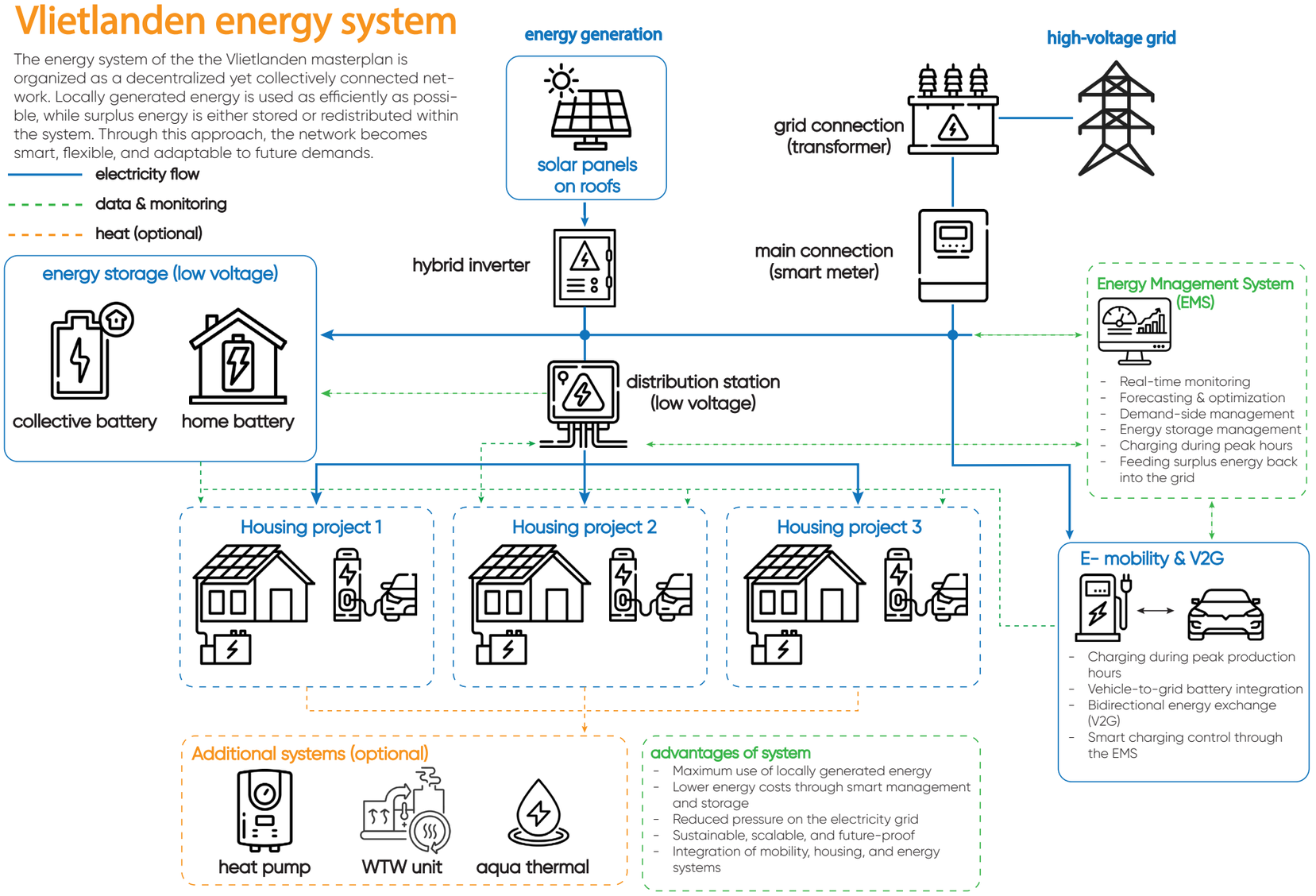






The energy system in the Vlietlanden masterplan is designed as a decentralized yet connected smart grid. Each housing development produces its own renewable energy through rooftop solar panels, while still being linked to a shared local network and the wider public grid. When there is surplus energy, it is first exchanged between neighbourhoods before being stored in both collective and individual battery systems. Electric vehicles also play a role, acting as temporary storage through Vehicle-to-Grid (V2G) technology and charging during times of peak solar production.

An Energy Management System (EMS) continuously monitors energy demand, weather conditions, storage levels, and consumption patterns to optimize how electricity is distributed and used. This approach helps reduce strain on the national grid, increases the use of locally generated energy, and lowers overall costs. The system is designed to be flexible and scalable, creating a strong connection between mobility, housing, and renewable energy generation.



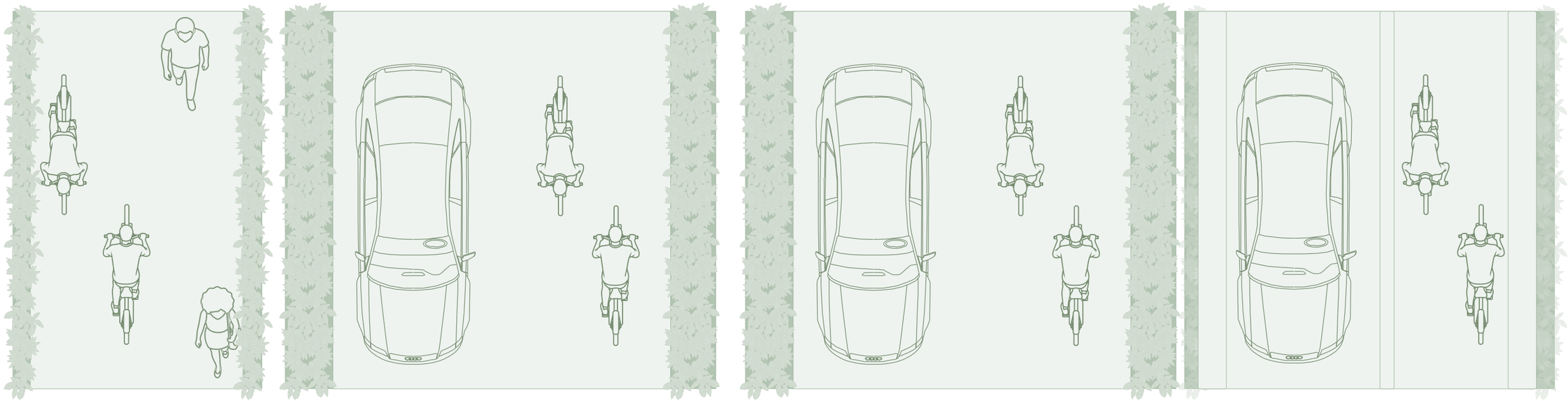
MASTERPLAN

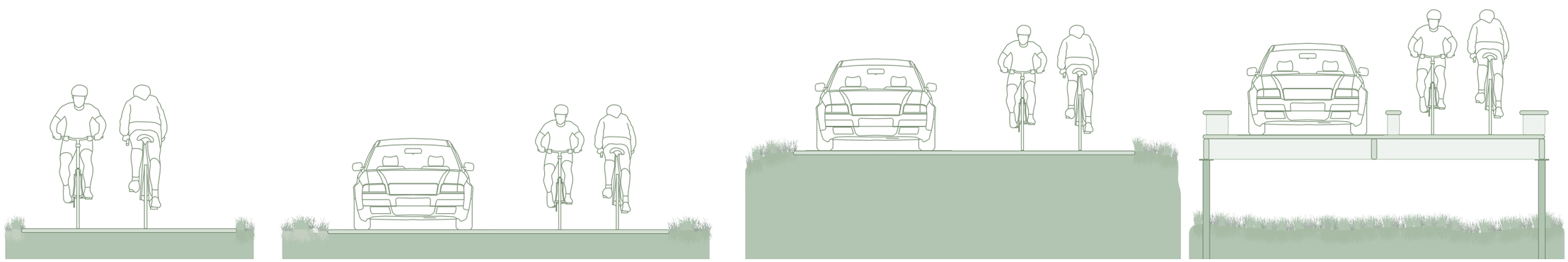
Infrastructure *Roads*

The masterplan includes different routes. Each one is designed differently according to its function. The main roads are wide enough for two cars to pass in each direction, as well as having a cycle lane in every direction.

As the plan focuses on the land as a natural system, some areas may be prone to flooding. To ensure safe movement to and from a location, elevated flight routes are created. These are located on a dike or a platform.
Recreational paths are at ground level and suitable for bikes and pedestrians travelling in both directions. These paths have a shell layer on top, which allows ground-dwelling creatures and rainwater to pass through, while providing a clear path for visitors.

These paths are part of the new way of living that this plan has introduced. The focus is on nature first and foremost, with elements added to encourage living in this location. You cannot always access these paths, but this further promotes the connection with nature and living with the elements, due to their availability throughout the year.



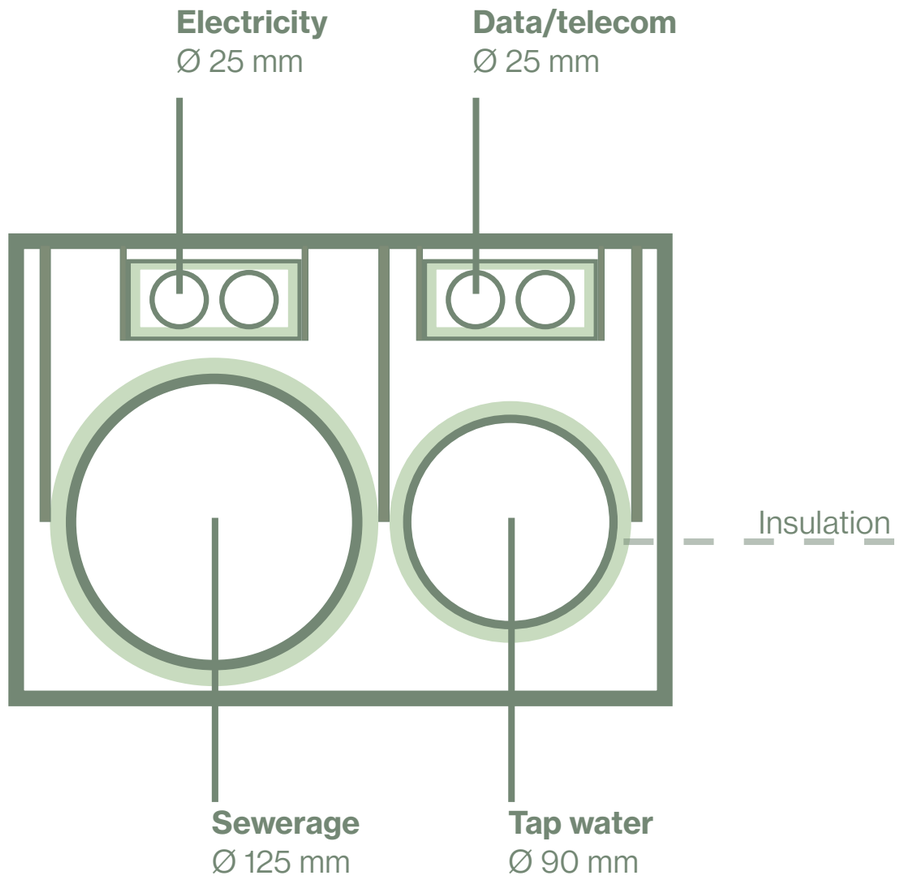


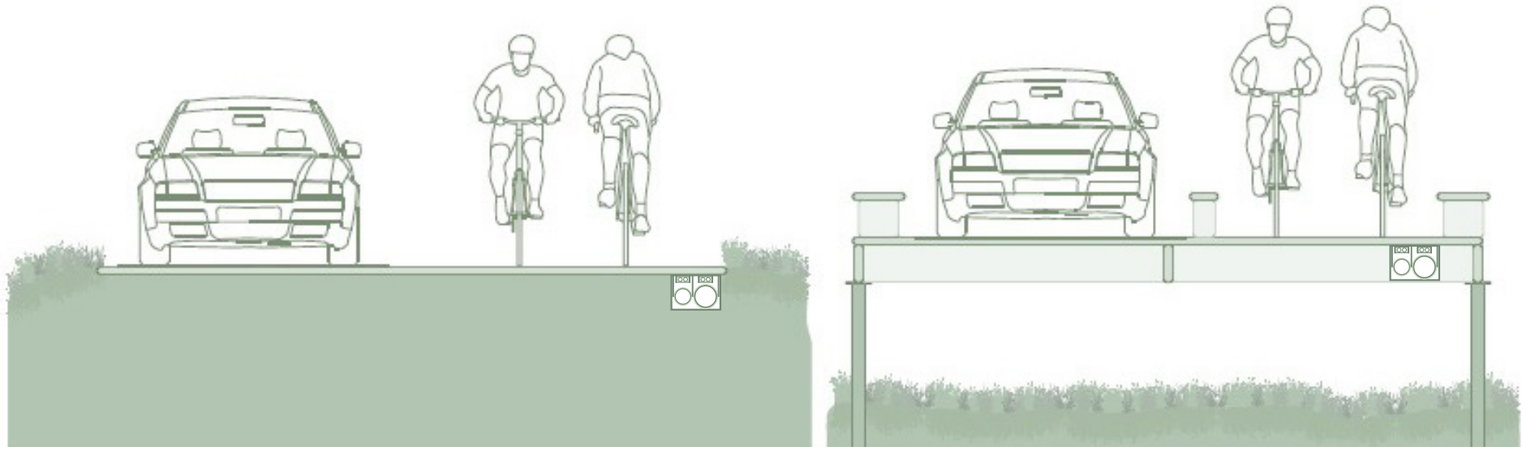
MASTERPLAN

Infrastructure *Services*

The different projects within the masterplan are each connected to a larger water and electricity system. There are three types of structures: water supply, water drainage, and electrical cables. These three structures are located beneath the flight routes. The different pipes and cables are clustered in one tunnel that can be mounted underneath the flight route structure. Because this is above the ground, the pipes and cables need to be insulated to prevent them from any damage frost might cause. Besides, the electrical cables need to be placed higher than the water structures to avoid any possible water damage.

In the masterplan, there is a division between grey water and wastewater. Only the wastewater is discharged into the larger sewer system. As a result, the sewer pipe can be smaller than normal (125 mm). The tap water pipe and the electrical cables are regular sized. Depending on the number of houses per project, the size of the cables and pipes can be enlarged if necessary.





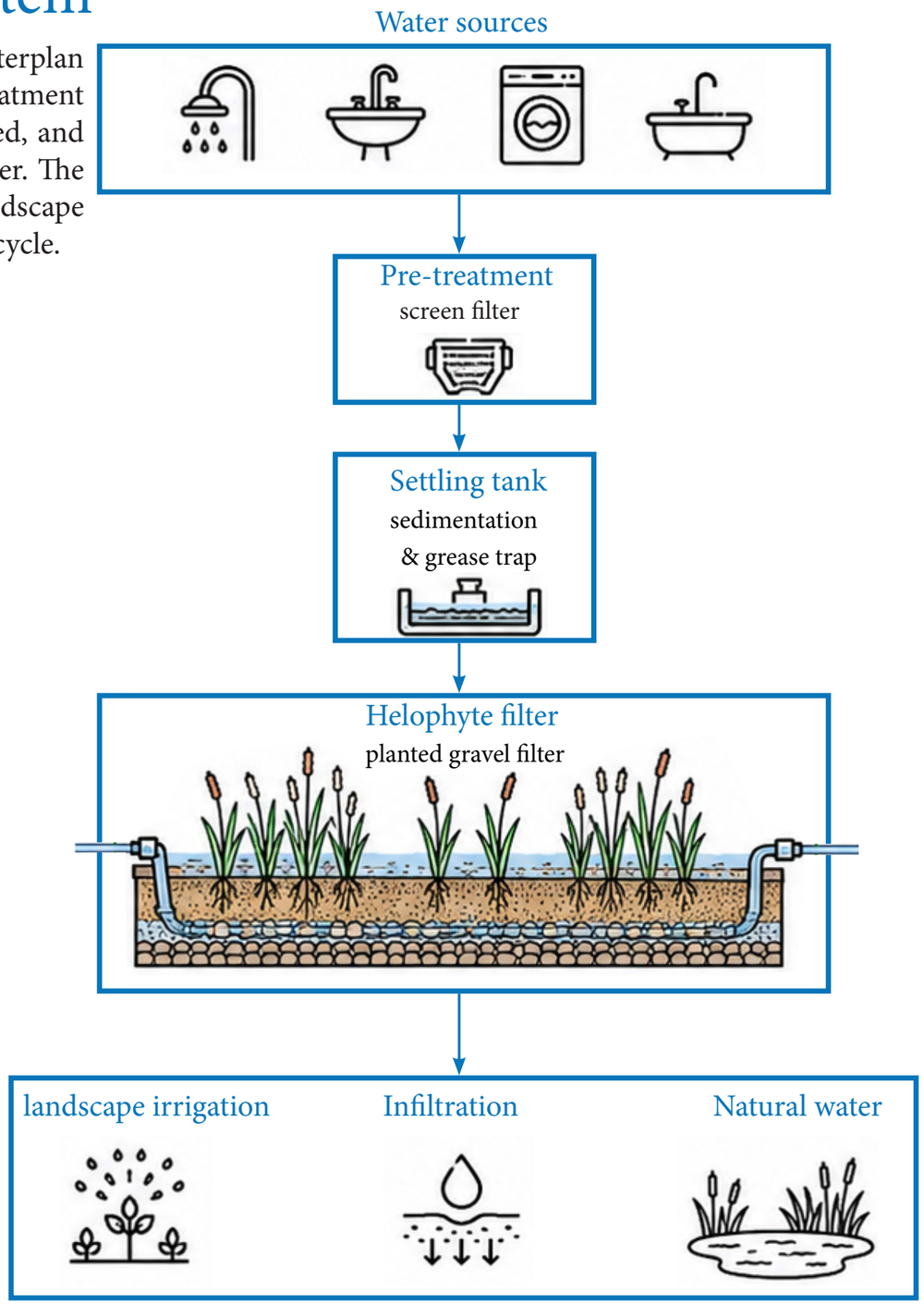
Greywater within the settlement is treated locally through a natural helophyte filtration system integrated into the landscape. Water from showers, sinks, and washing machines is guided through planted gravel beds, where reeds and microorganisms gradually purify the water before it is returned to the surrounding environment.
Rather than relying on energy-intensive technical systems, the filtration process works together with natural biological cycles. In this way, water becomes visible again as part of daily life, reinforcing the relationship between the settlement and its surrounding ecology. The helophyte filters are not only infrastructural elements, but also contribute to biodiversity and the spatial quality of the landscape itself.

Vlietlanden water system

The water system of the Vlietlanden masterplan is organized as a decentralized, natural treatment network. Greywater is collected, pre-treated, and purified through a planted (helophyte) filter. The cleaned water is then safely reused for landscape irrigation or returned to the natural water cycle.

system advantages

- Natural & sustainable treatment
- Low energy consumption
- Improves local biodiversity
- Reuses water locally
- Reduces pressure on freshwater resources
- Scalable & decentralized
- Low operational costs



RAINWATER

Within the masterplan, the plan builds on the strategy proposed by ZUS, FLUX and SWECO (2022). In the future, the Vlietlanden area will be transformed into a water buffer retaining excess water during wet periods for use during dry periods. This is particularly relevant in the context of the polder, where continuous drainage accelerates subsidence. By working together with the water and giving it space within the plan, rather than pumping it away, we aim to counteract this subsidence. For this reason, rainwater will be allowed to discharge directly onto the landscape rather than into the sewer system. This maintains higher groundwater levels and contributes to a more climate-adaptive and resilient environment.

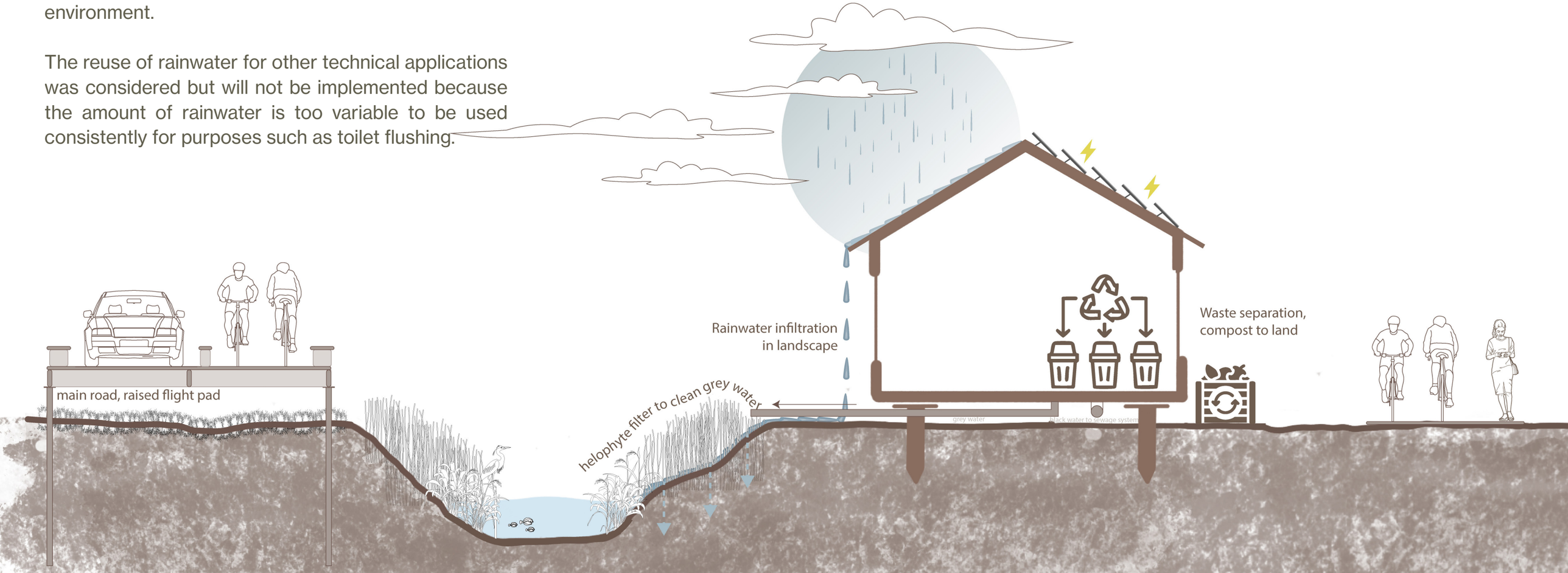
The reuse of rainwater for other technical applications was considered but will not be implemented because the amount of rainwater is too variable to be used consistently for purposes such as toilet flushing.

WASTE MANAGEMENT

Waste management within the settlement is approached as an extension of its broader ecological values. Each dwelling is equipped for selective waste sorting: separating glass, packaging, and residual waste at source, encouraging residents to develop more conscious consumption habits as part of daily life. Depending on location within the settlement, waste is either collected directly from the dwelling or consolidated at central collection points, emptied on a weekly basis to minimise disruption to the car-light environment.

Residents are also encouraged to compost their organic waste, returning nutrients directly to the soil and closing the cycle between consumption and cultivation. Composting is understood here not as an obligation but as a natural extension of living in close relationship with the land.

More broadly, the hope is that the settlement fosters a way of living that tends towards generating less waste: through local food growing, shared facilities, repair, and reuse. The ambition is not simply to manage waste better, but to make it less necessary in the first place.



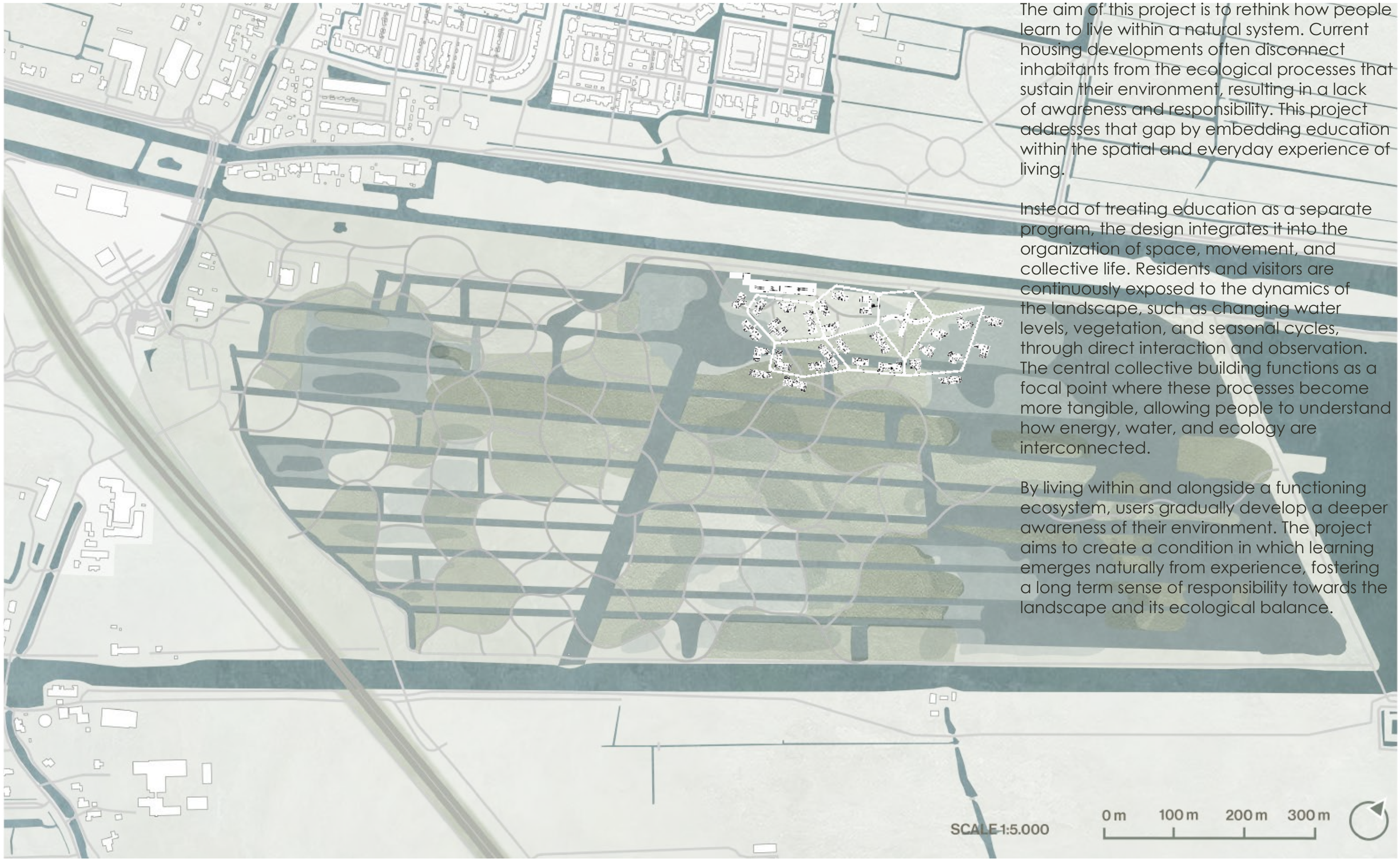
MASTERPLAN

Six pillars of a healthy living environement



EDUCATION

EDUCATION
Location



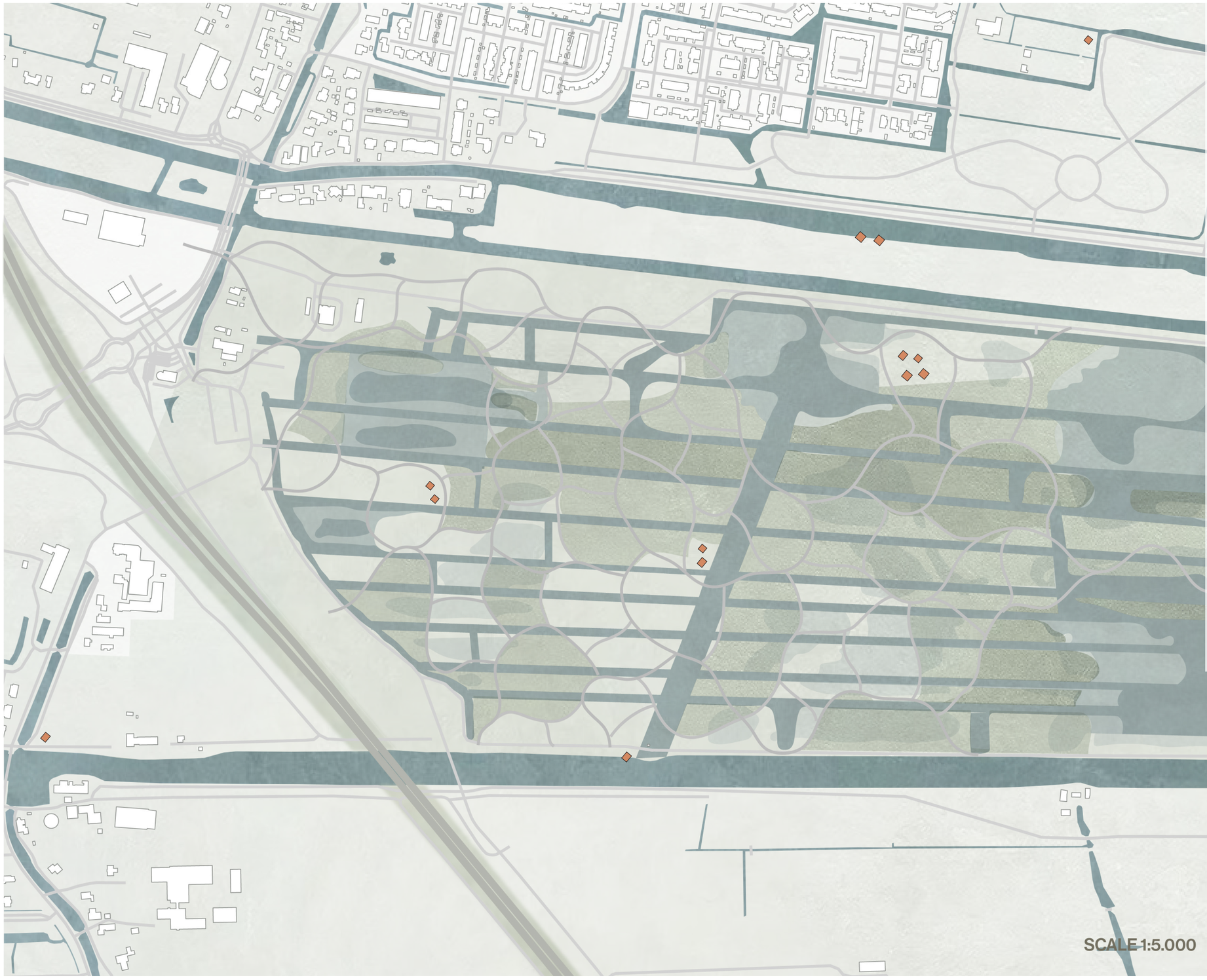
The aim of this project is to rethink how people learn to live within a natural system. Current housing developments often disconnect inhabitants from the ecological processes that sustain their environment, resulting in a lack of awareness and responsibility. This project addresses that gap by embedding education within the spatial and everyday experience of living.

Instead of treating education as a separate program, the design integrates it into the organization of space, movement, and collective life. Residents and visitors are continuously exposed to the dynamics of the landscape, such as changing water levels, vegetation, and seasonal cycles, through direct interaction and observation. The central collective building functions as a focal point where these processes become more tangible, allowing people to understand how energy, water, and ecology are interconnected.

By living within and alongside a functioning ecosystem, users gradually develop a deeper awareness of their environment. The project aims to create a condition in which learning emerges naturally from experience, fostering a long term sense of responsibility towards the landscape and its ecological balance.

RECREATION

RECREATION
Location



This project provides multiple catalog houses, which can be placed anywhere in or close to nature. By changing the the balance between inside and outside, the residents get the opportunity to be more in contact with nature within their own house and be more outdoors, which will enhance a healthy living environment.
One part of the house is insulated, of which only certain rooms can be heated. This part of the house is more compact and includes box beds. The other part of the house is not insulated, but is wind and water proof, surrounded by glass folding doors. This area is can be used as a living space. During winters it might be colder, but when it gets warmer outside the folding doors can be opened and this living space becomes a part of nature.

PRODUCTIVE LANDSCAPE

PRODUCTIVE LANDSCAPE

Location



Productive Landscape

This project proposes a new community settlement that inhabits this transition by treating the landscape as simultaneously ecologically, materially, and socially productive. Water and soil gradients dictate land use, which dictates the space for habitation. Three new actors – the new farmer as landscape guardian, the seasonal worker, and the hybrid resident – share a community organised around collective production. A hexagonal dwelling typology, sheltered beneath a productive greenhouse envelope, dissolves the boundary between interior and landscape. Living here means participating in the productivity of the land.

BIODIVERSITY

BIODIVERSITY

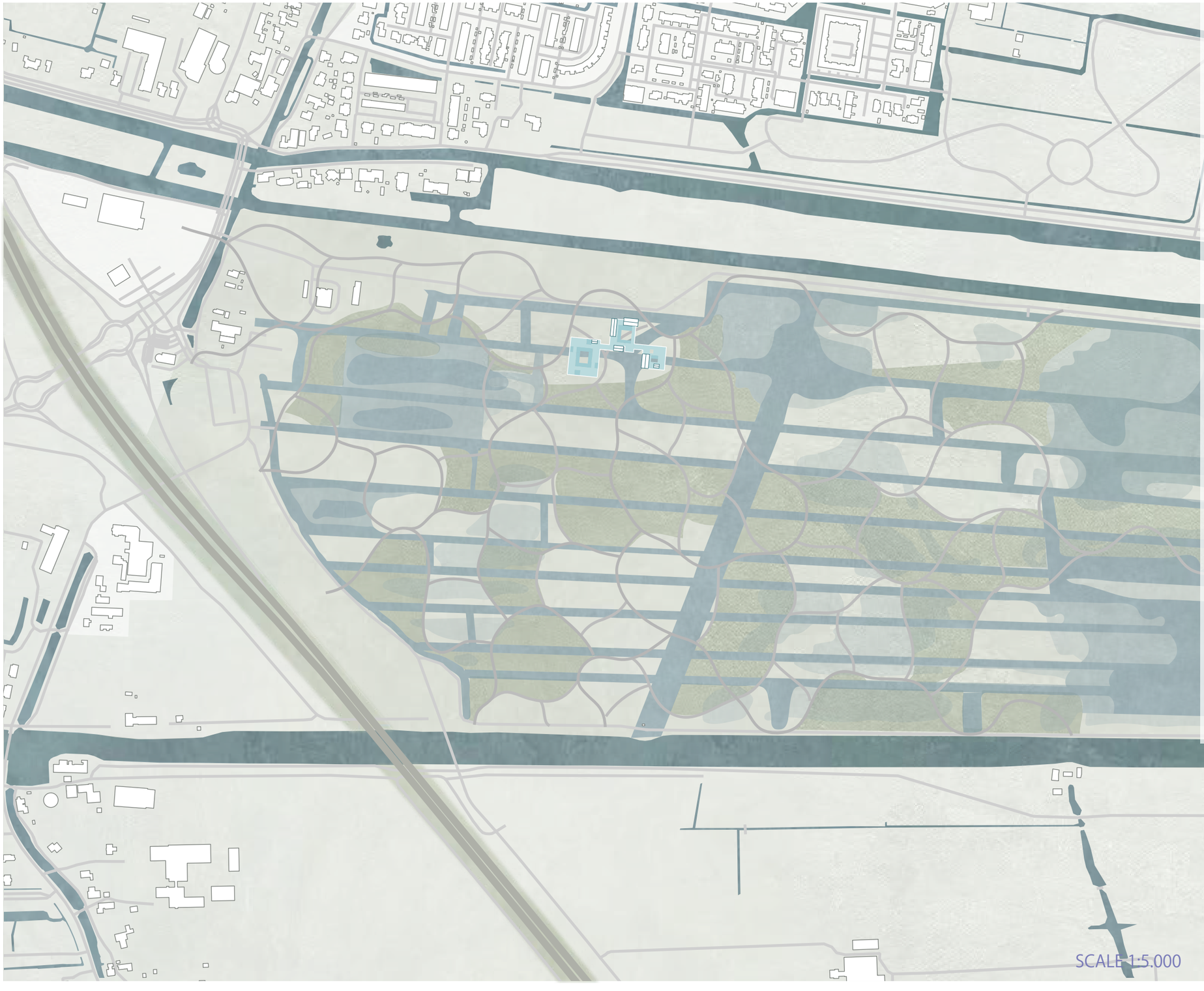
Location



The aim of looking through the lens of biodiversity is to actively address the loss of biodiversity caused by human activity. The plan is to change the current design system, with the natural taking priority. We must consider what species lives in this area before humans arrive, what these animals need to survive in their habitats, and how this can coexist with humans. The result will be a habitat in which animals can thrive and increase their numbers, creating a stable biodiversity that is needed to sustain them and us.

HEALTH CARE

HEALTH CARE
Location

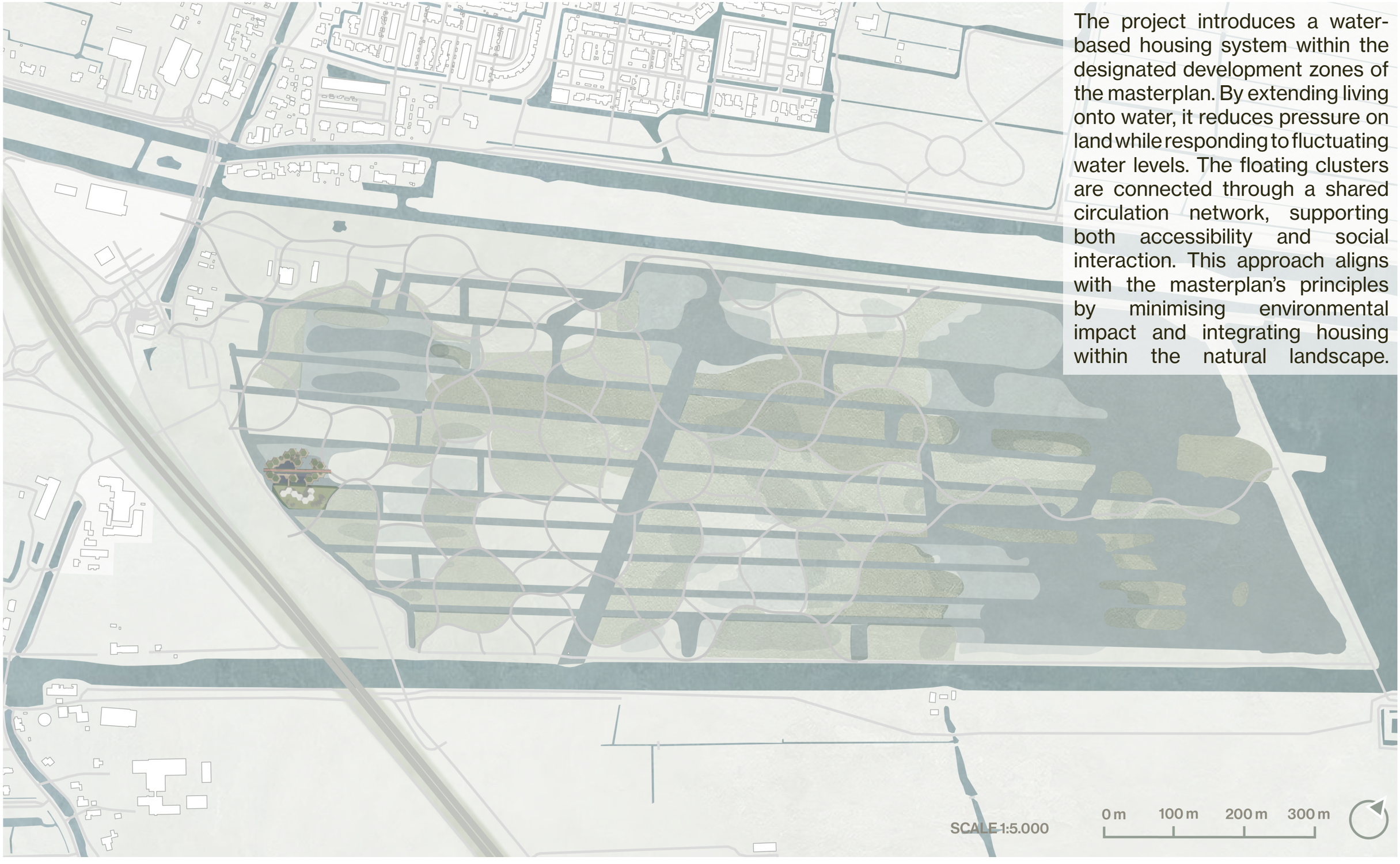


Within the masterplan, it is also important to consider how people adapt alongside ecological and productive factors. This is particularly relevant in the context of healthcare, where it adds another layer of depth to the project's core principle.

Within this sub-theme, dementia is taken as the starting point, as it will put increasing pressure on healthcare and society in the future due to an ageing population. Besides this, the parallels between the condition of dementia and the polder landscape form an interesting starting point for the project; both are characterised by changing environmental conditions, uncertainty and a loss of control.

In this context, the project seeks to find a new way of living in the polder landscape for people with dementia. The result is a stable and stimulating living environment for people with dementia, where care and nature come together to create a healthy, liveable and sustainable world.

WORK



The project introduces a water-based housing system within the designated development zones of the masterplan. By extending living onto water, it reduces pressure on land while responding to fluctuating water levels. The floating clusters are connected through a shared circulation network, supporting both accessibility and social interaction. This approach aligns with the masterplan's principles by minimising environmental impact and integrating housing within the natural landscape.