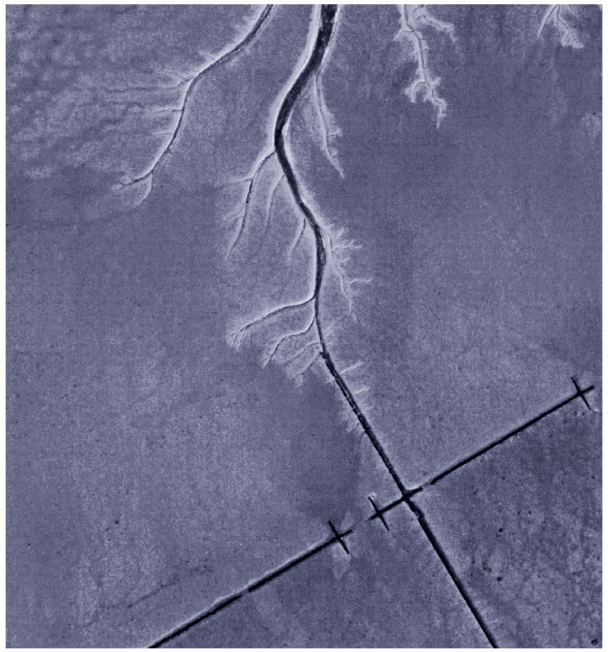
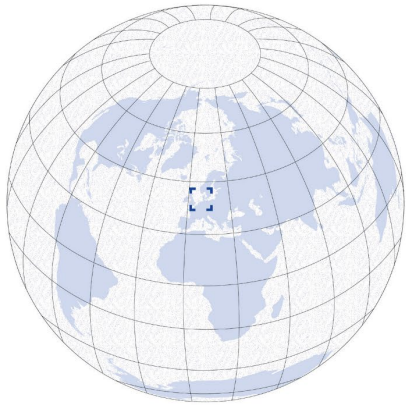


GROW WITH THE FLOW

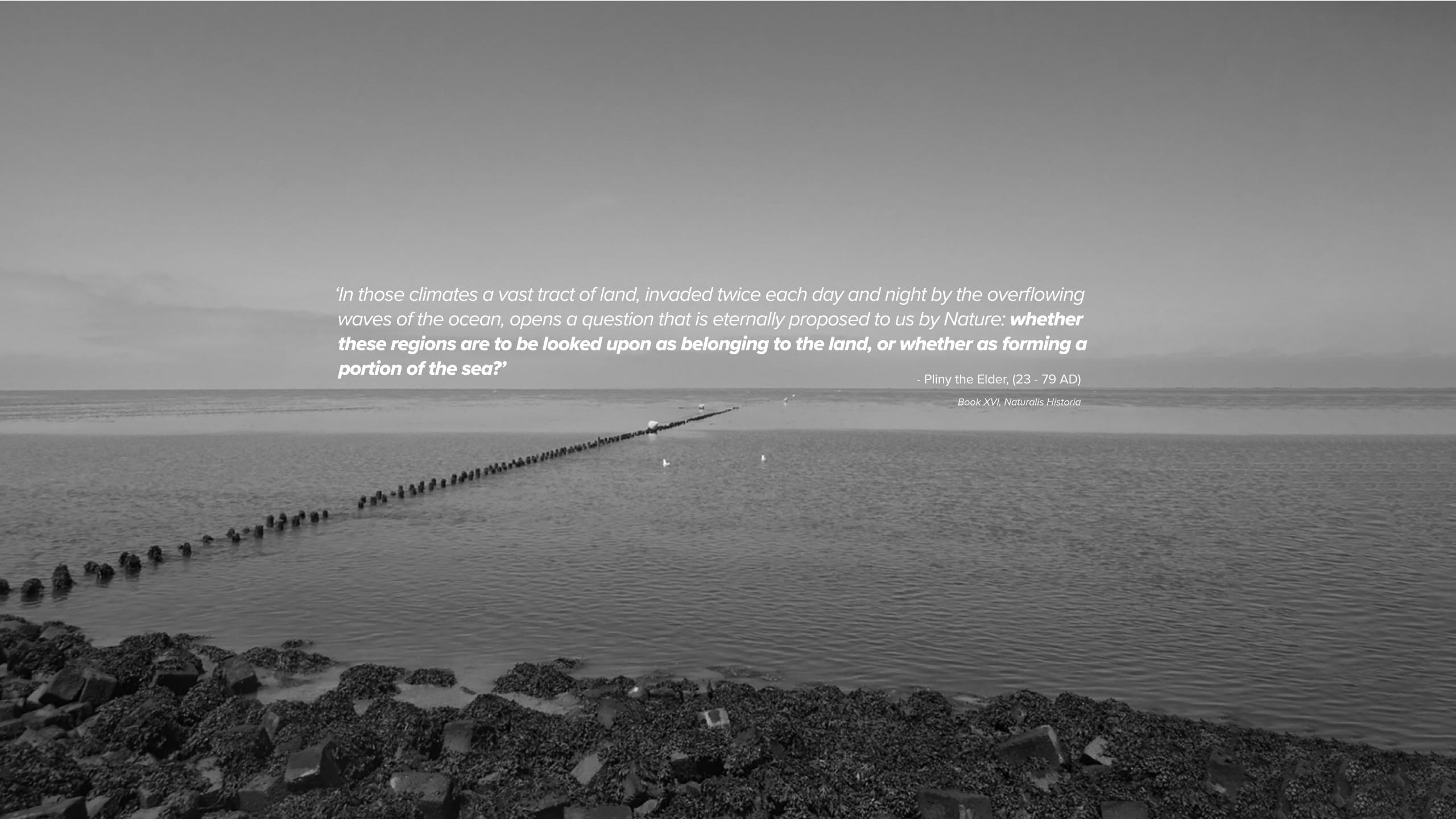
Developing a Dynamic Coastal Interface for the Wadden Sea Region

P5 presentation | 15 .01. 2024

Venne van den Boomen
First mentor: Steffen Nijhuis
Second mentor: Robbert Jan van der Veen
External examiner: Leeke Reinders



The Wadden Sea Region

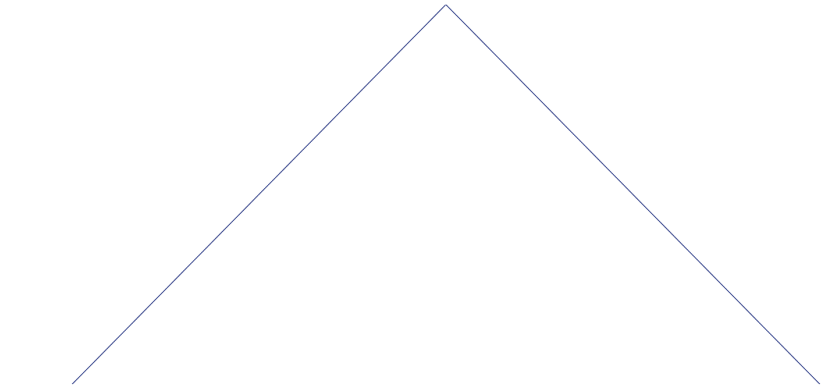


'In those climates a vast tract of land, invaded twice each day and night by the overflowing waves of the ocean, opens a question that is eternally proposed to us by Nature: ***whether these regions are to be looked upon as belonging to the land, or whether as forming a portion of the sea?'***

- Pliny the Elder, (23 - 79 AD)

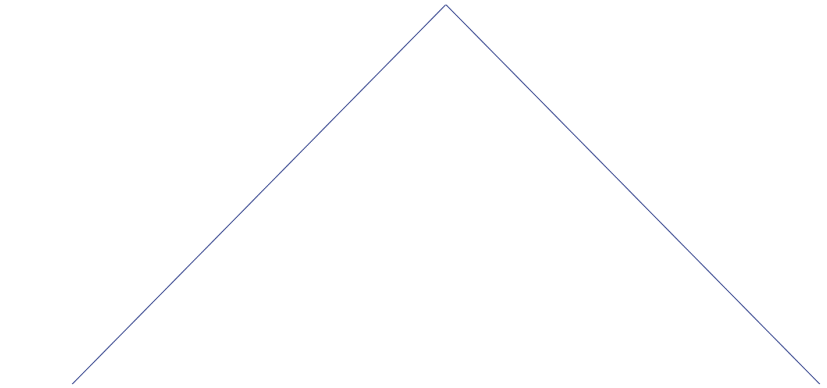
Book XVI, Naturalis Historia

Wadden Sea Region



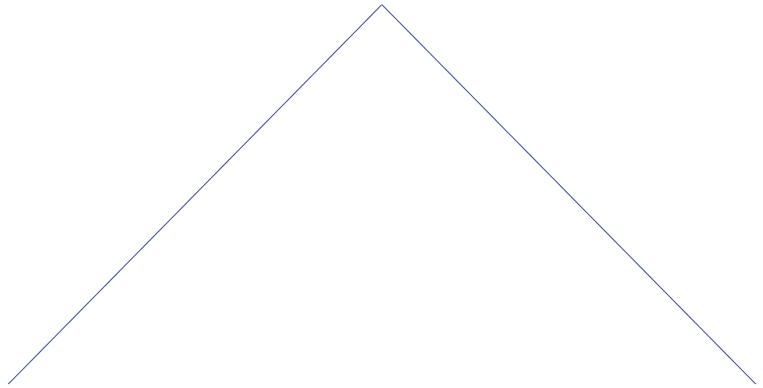
Sea OR **Land** ?

Wadden Sea Region



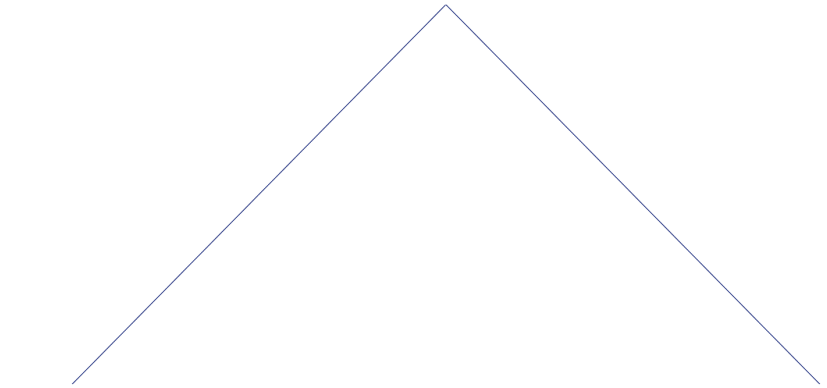
Sea OR Land ?

Wadden Sea Region



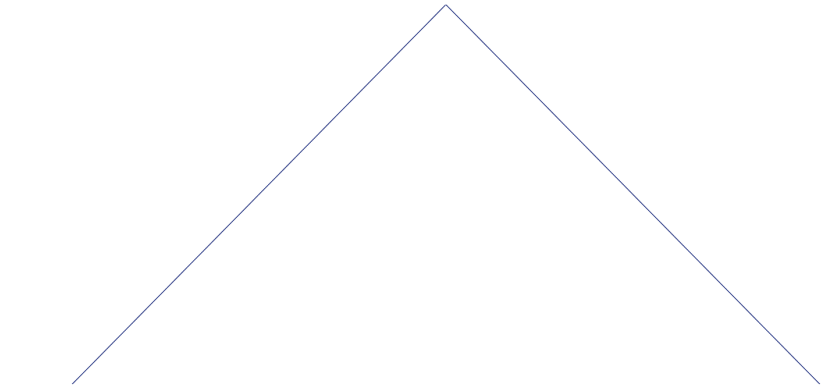
Sea OR **Land** ?

Wadden Sea Region



Sea OR **Land** ?

Wadden Sea Region



Sea OR **Land** ?

Sea AND **Land**

Sea AND **Land**

The coastal interface

Interface

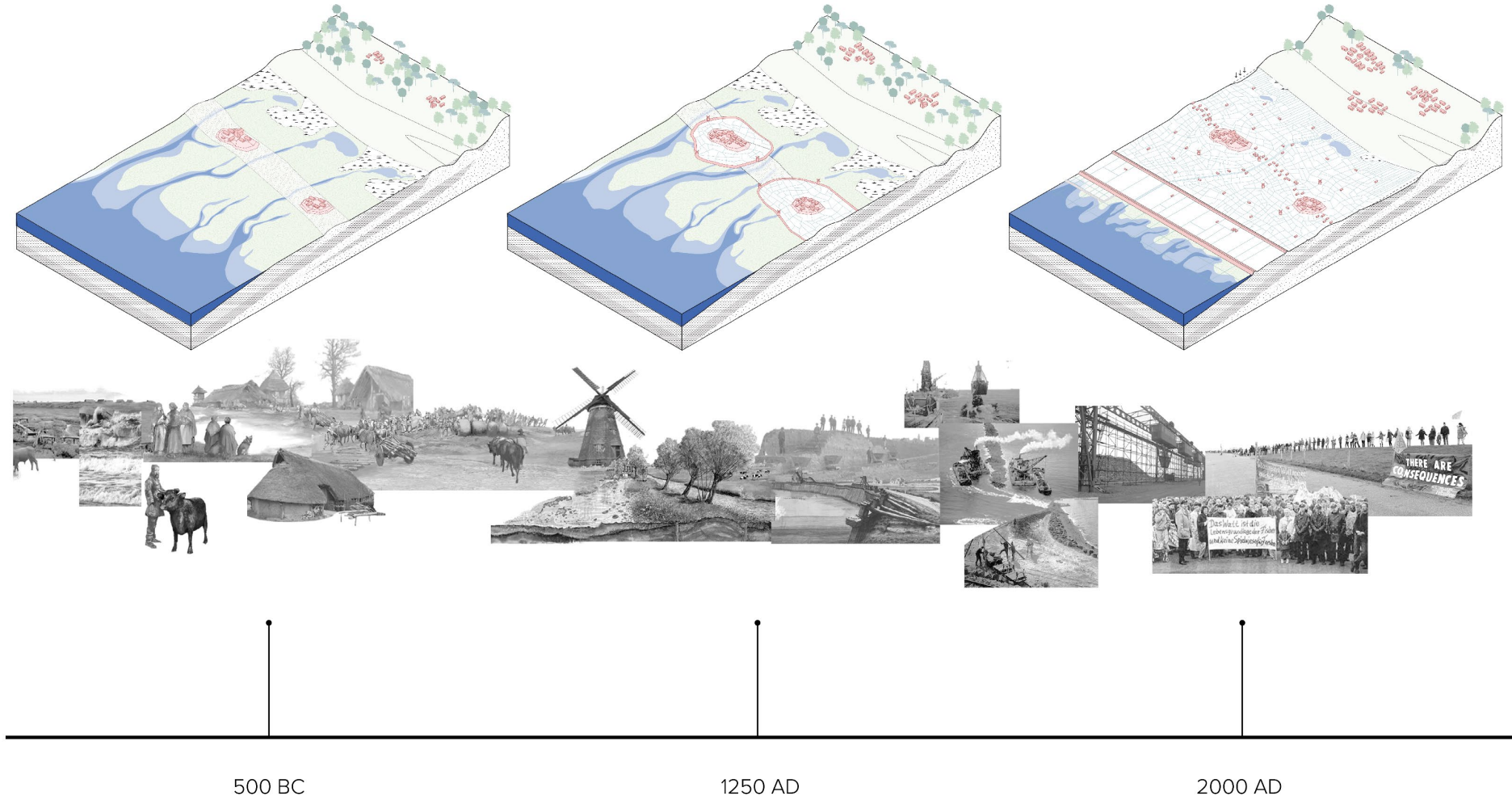
Derived from the Latin prefix 'inter-' denoting 'between,' 'among,' 'mutually,'... the term 'interface' denotes a space where interaction occurs.

"...rather than serving as a barrier or demarcation..., in essence, an interface functions as a conduit for **connection**. Interfaces, by their very essence, engender **opportunities for transformation and collaborative exchange**"

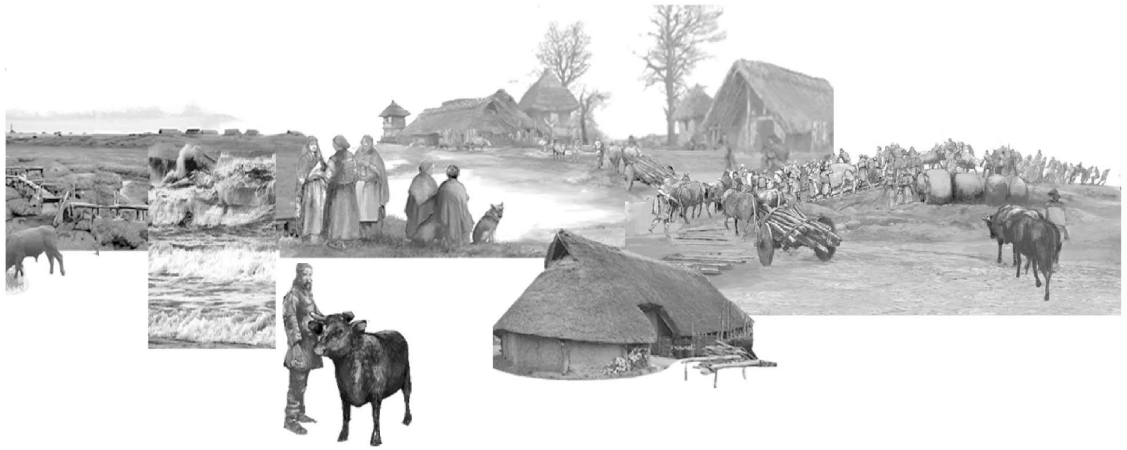
(Riccardi, 2018).

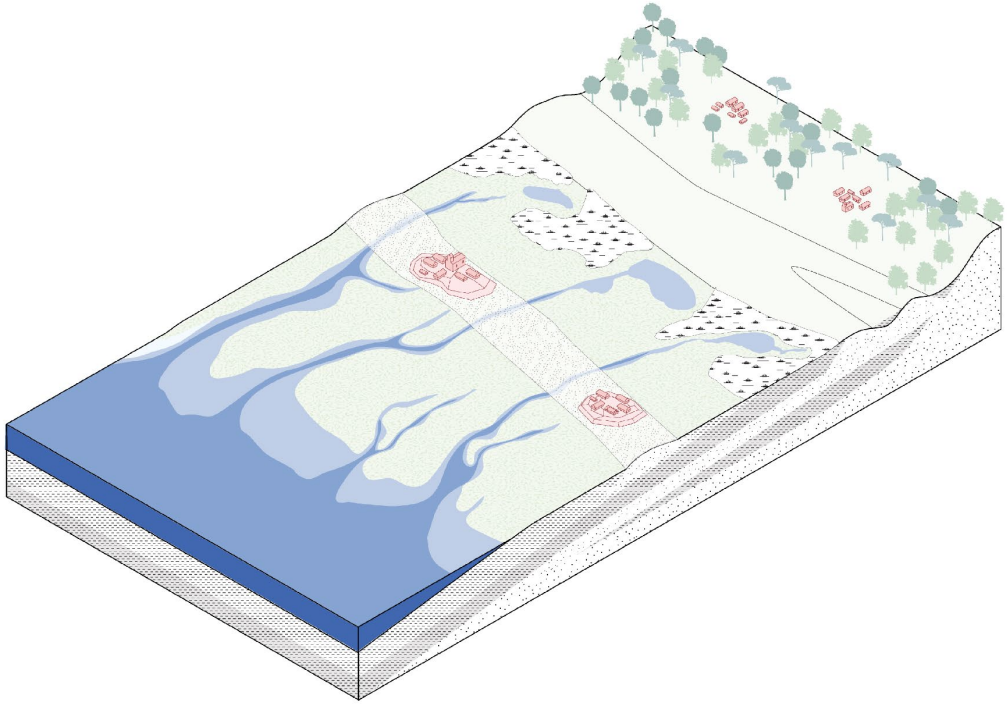
Sea AND **Land**

The coastal interface

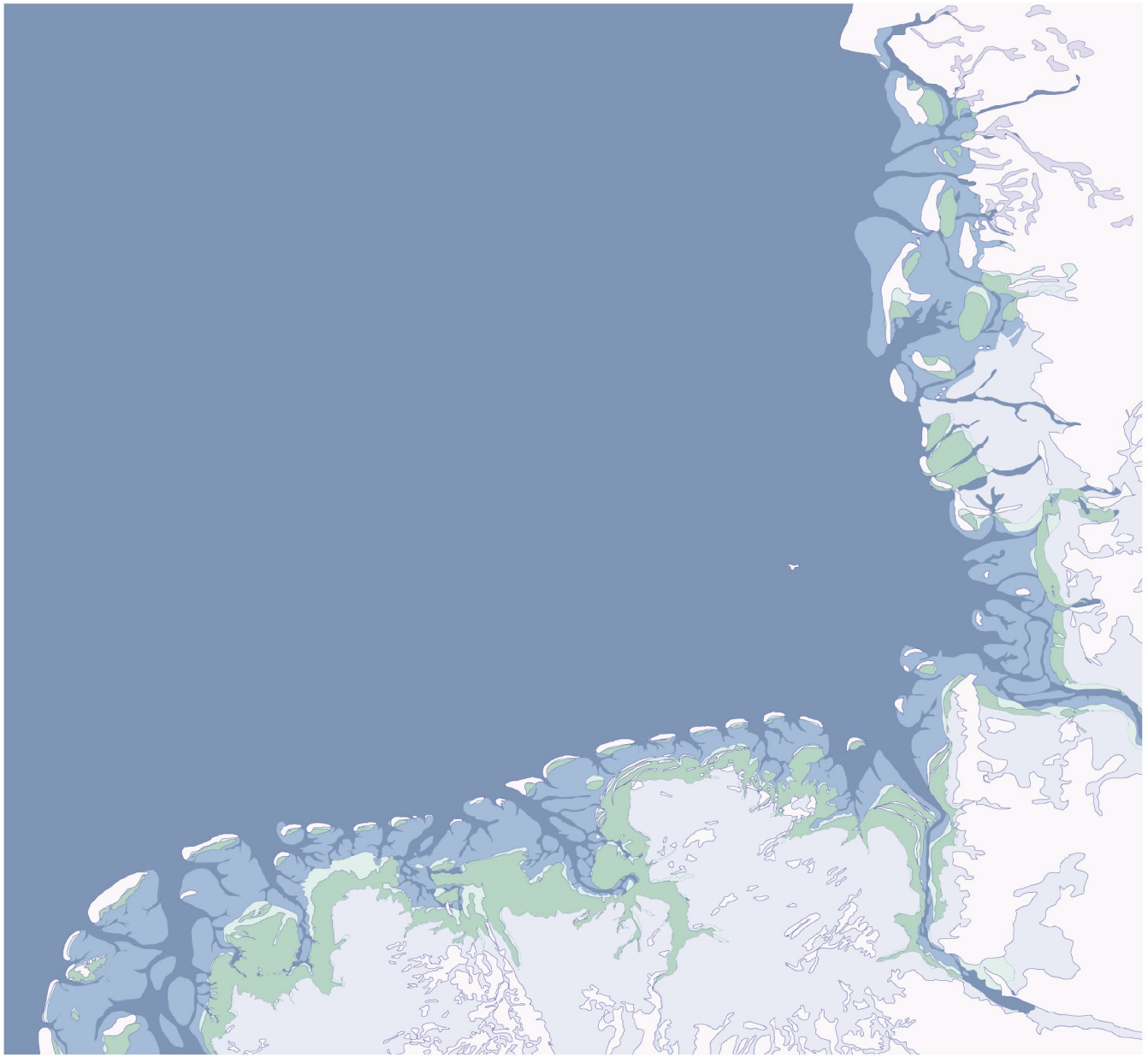


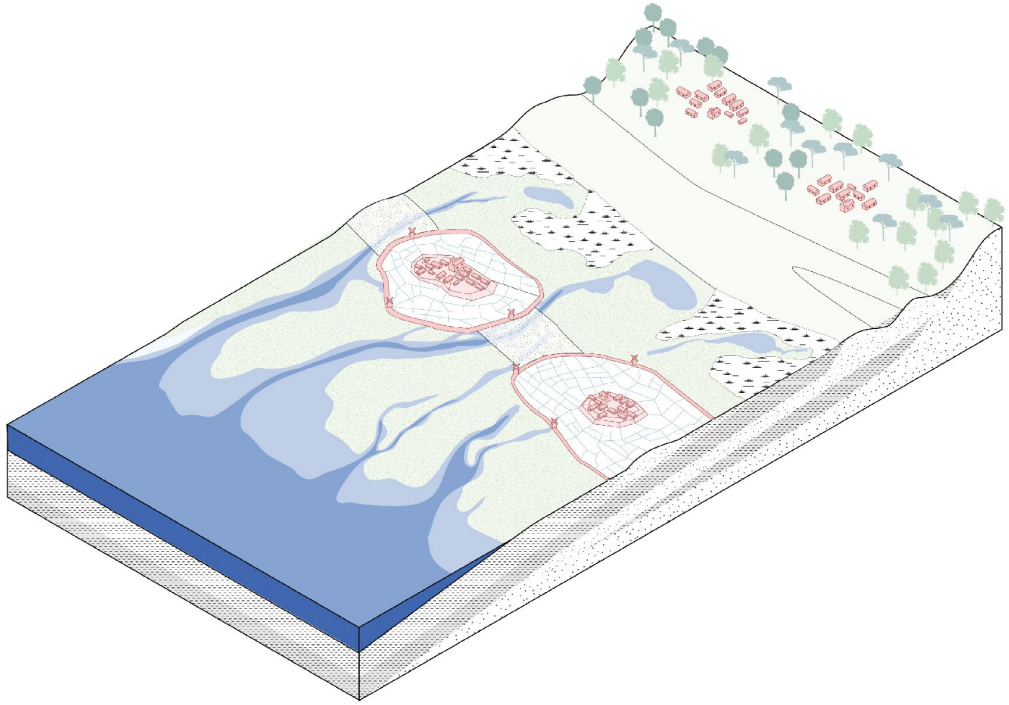
Development of the interface over time



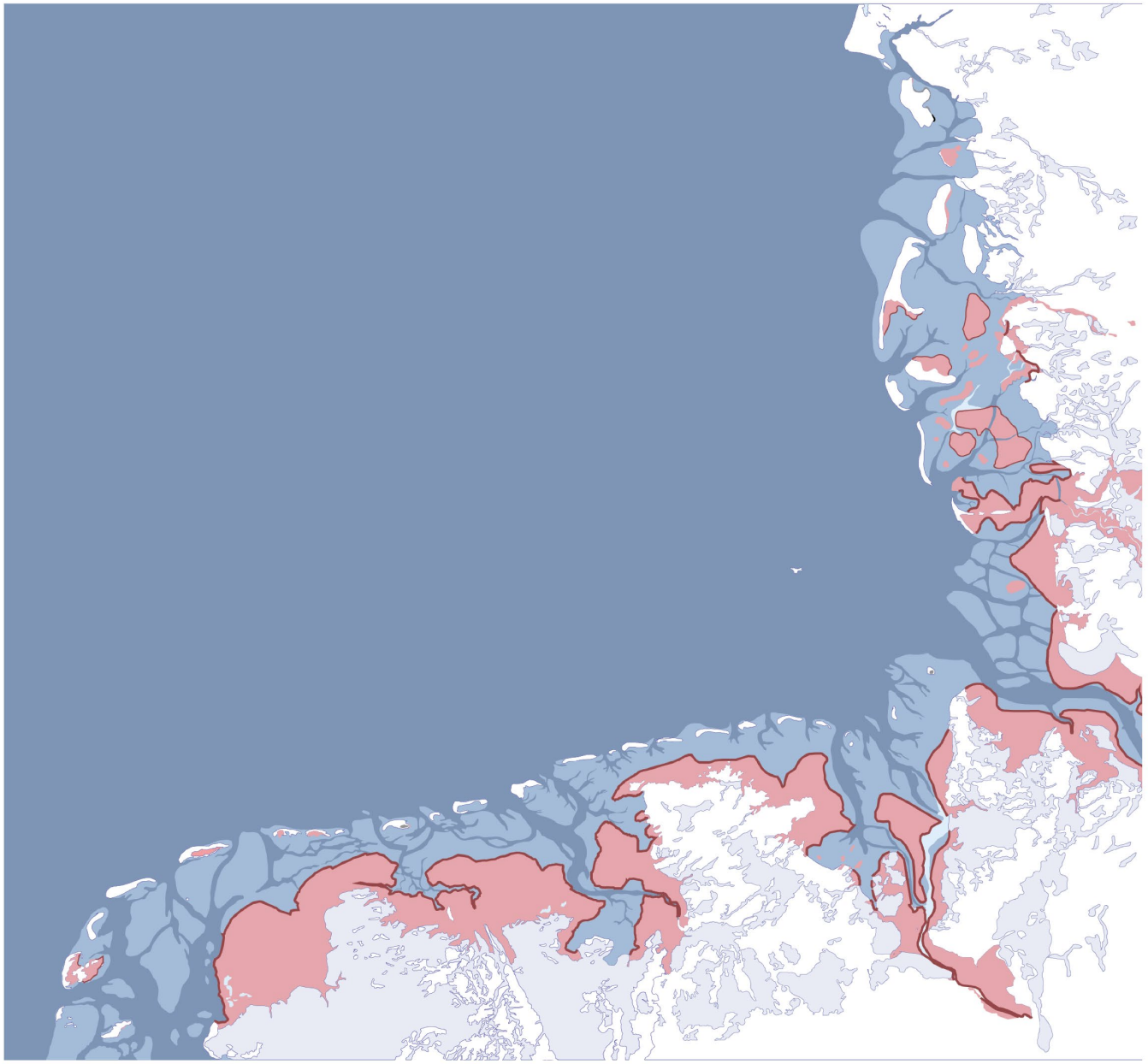


500 BC

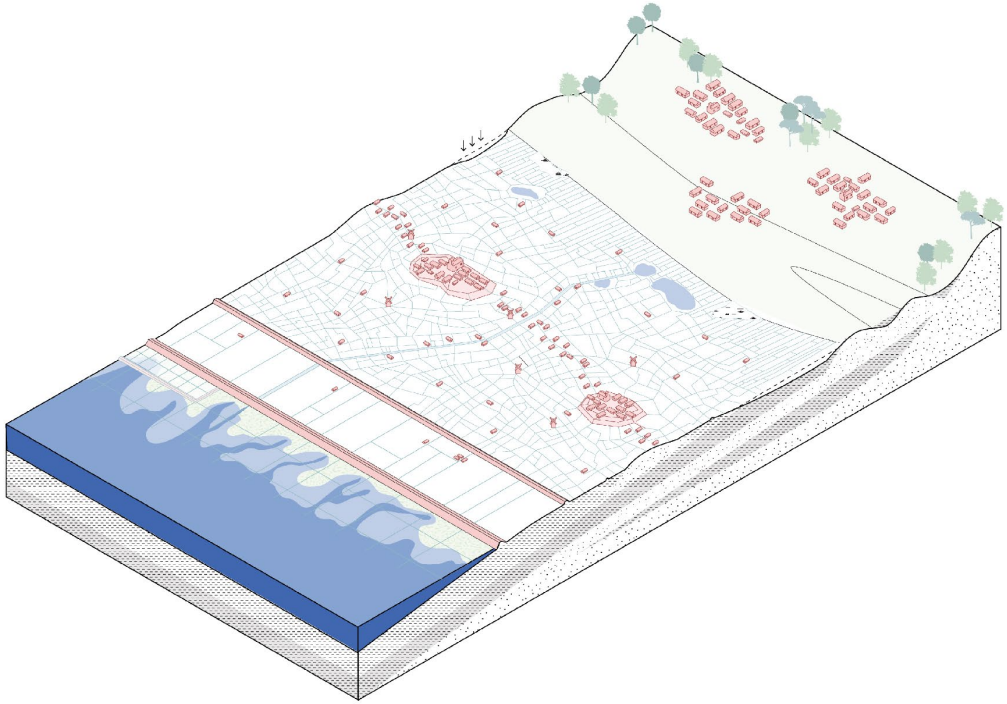




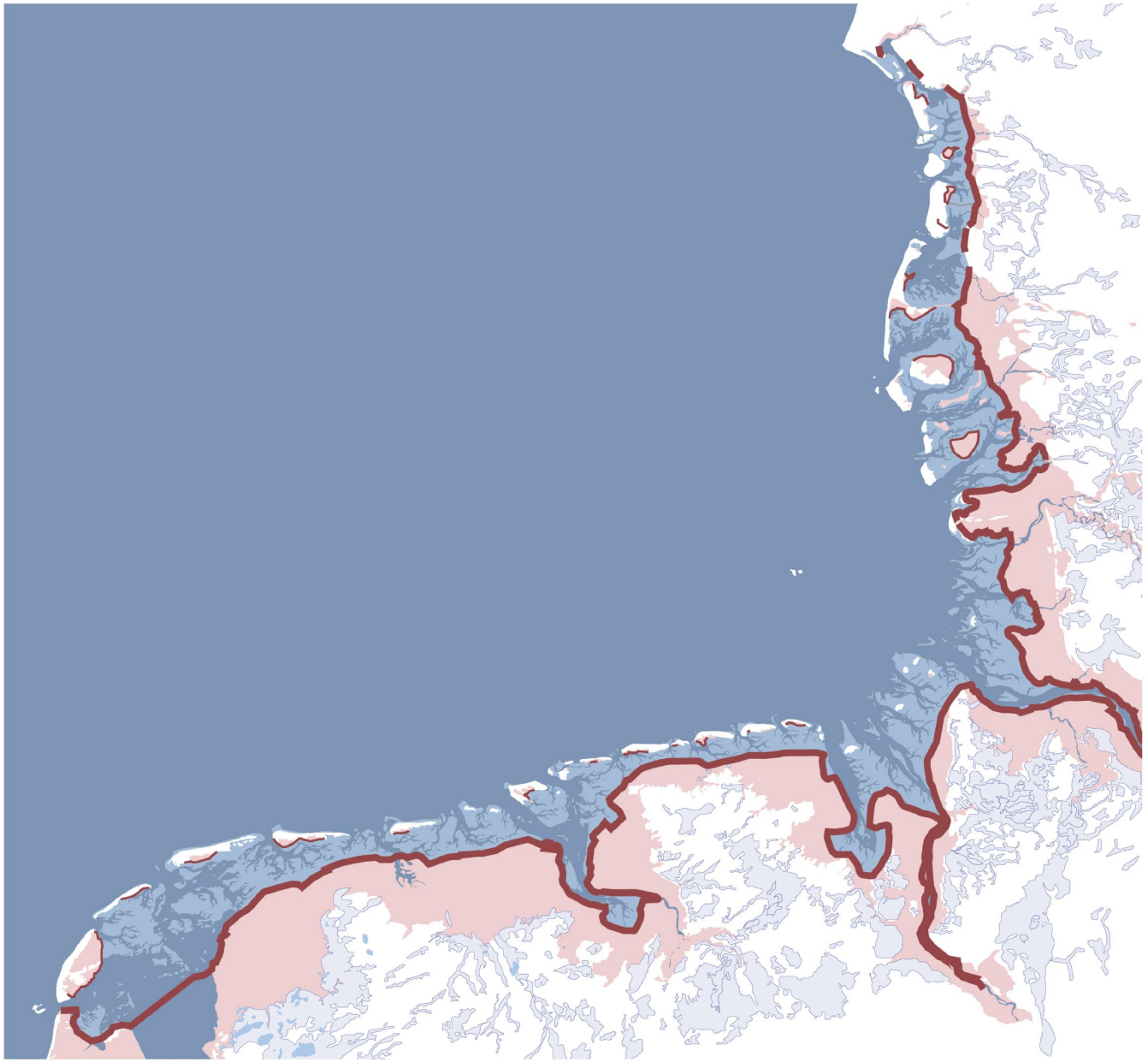
1250 AD




THERE ARE
CONSEQUENCES
Das Watt ist die
Lebensgrundlage der Fischer
und keine Spielwiese für Touristen



2000 AD

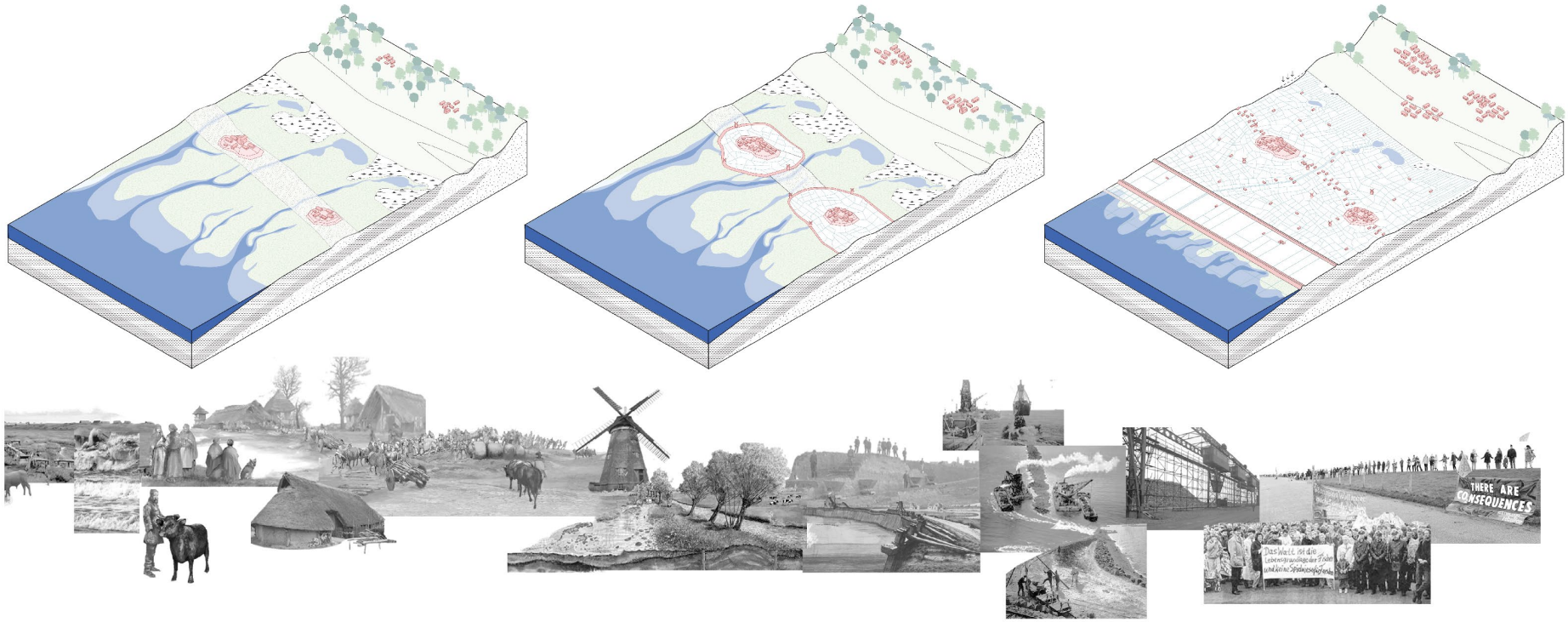


Closed-off

Divided

Harsh barriers

Artificial solutions



?

500 BC

1250 AD

2000 AD

?

What does the future interface look like?

“**Climate change** will surely become the dominant external factor in the future appearance of the Wadden Sea area, and it **will transform human constraints and opportunities.**”

John Frederiksen, chief consultant in the Danish Ministry of the Environment


0
25
50 km

Image: Hans Strooper

More heavy precipitation

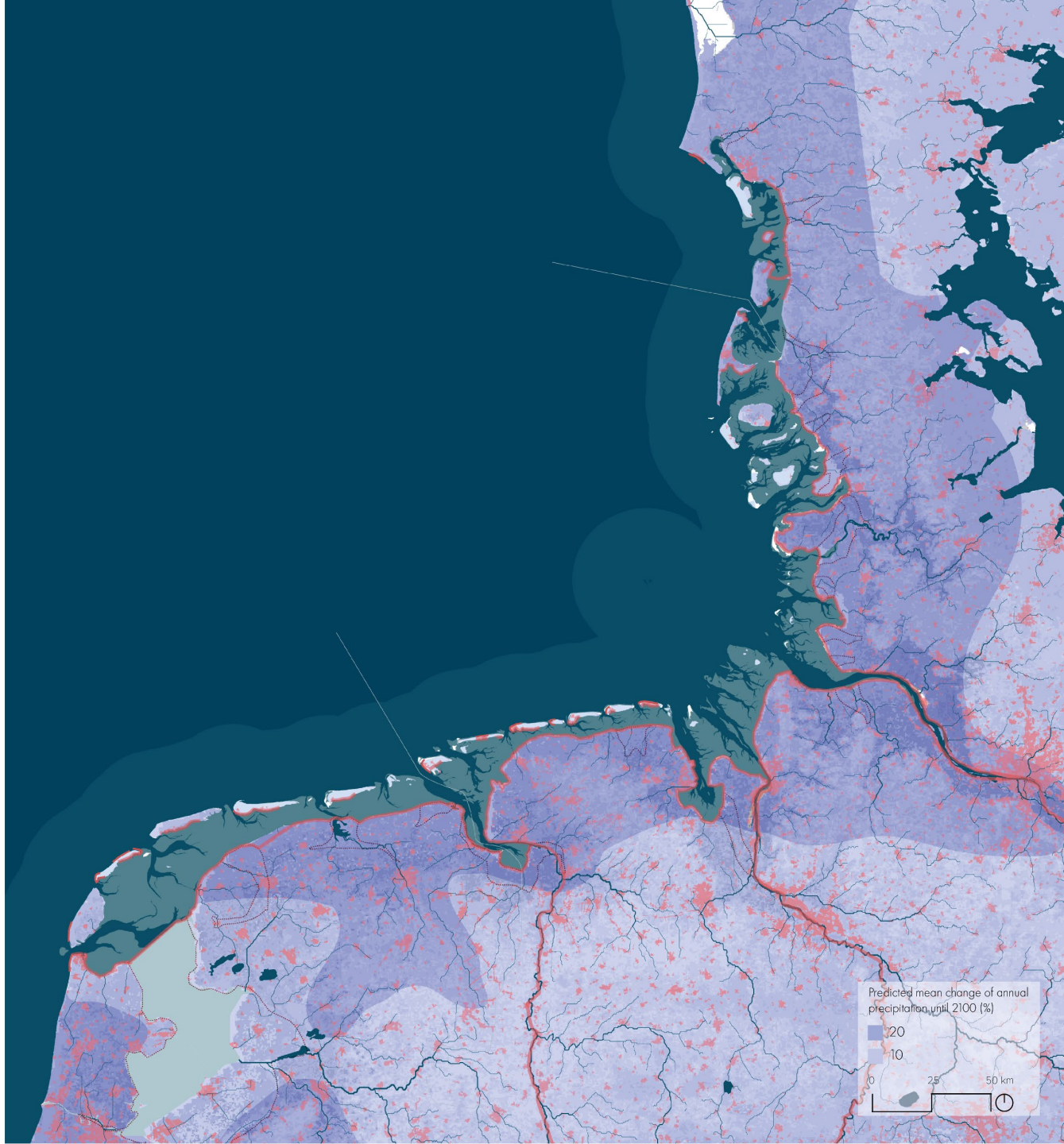
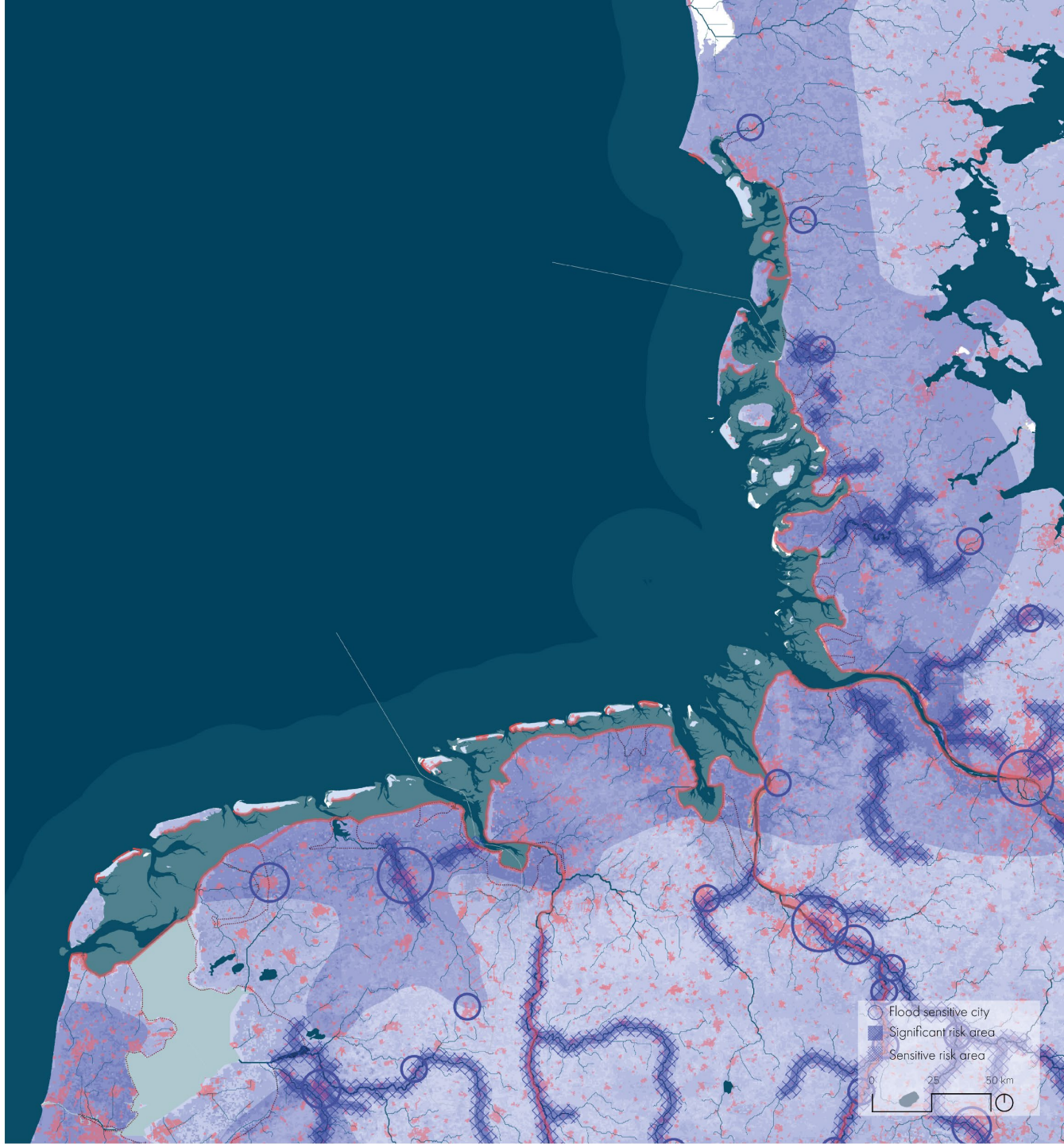


Image: Compidoc, www.flickr.com

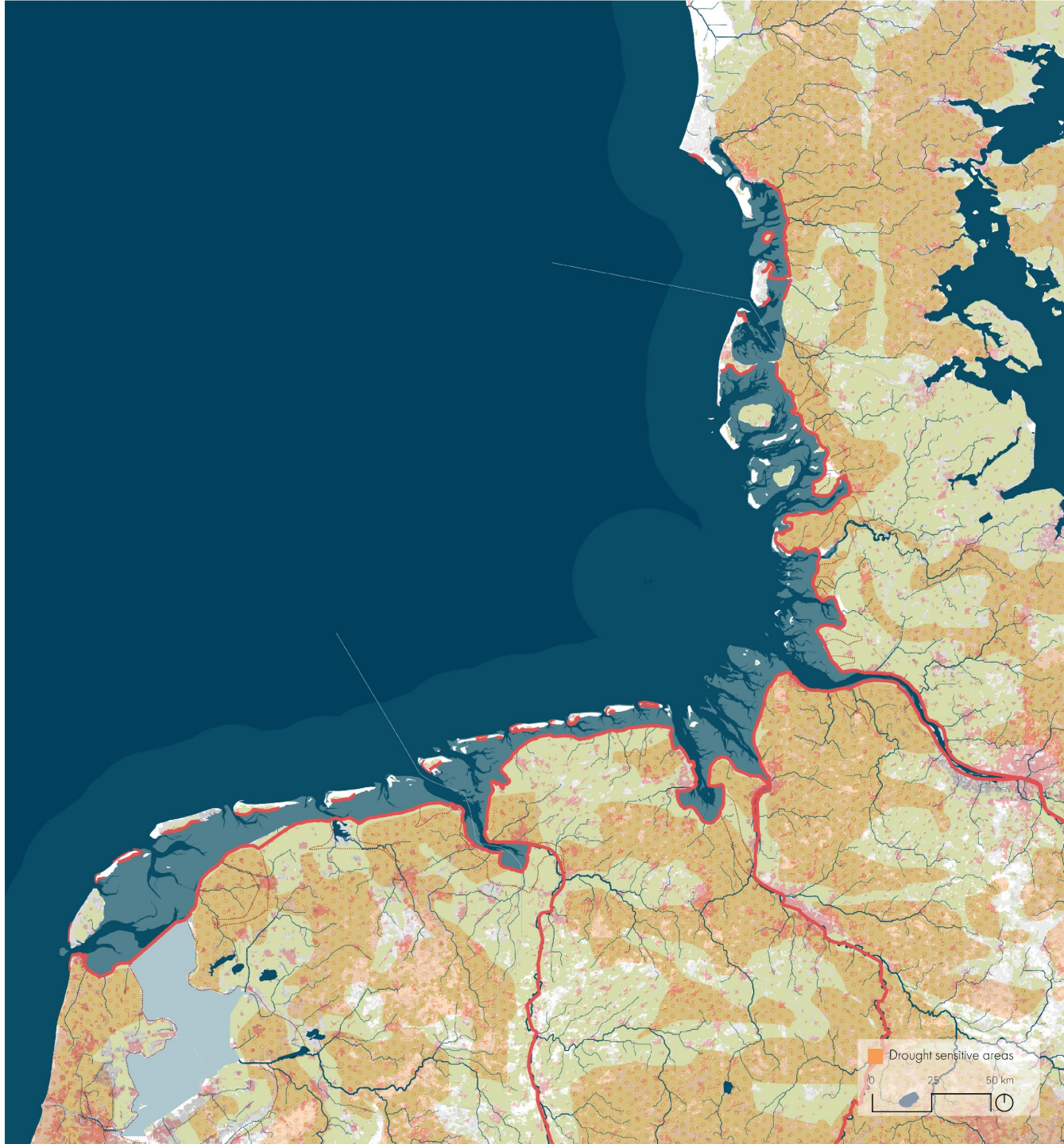
Increased flood risk



65% - 75% of the Wadden Sea Region's surface is **agricultural**

More frequent droughts

Increase in fresh water demand



Saline seepage

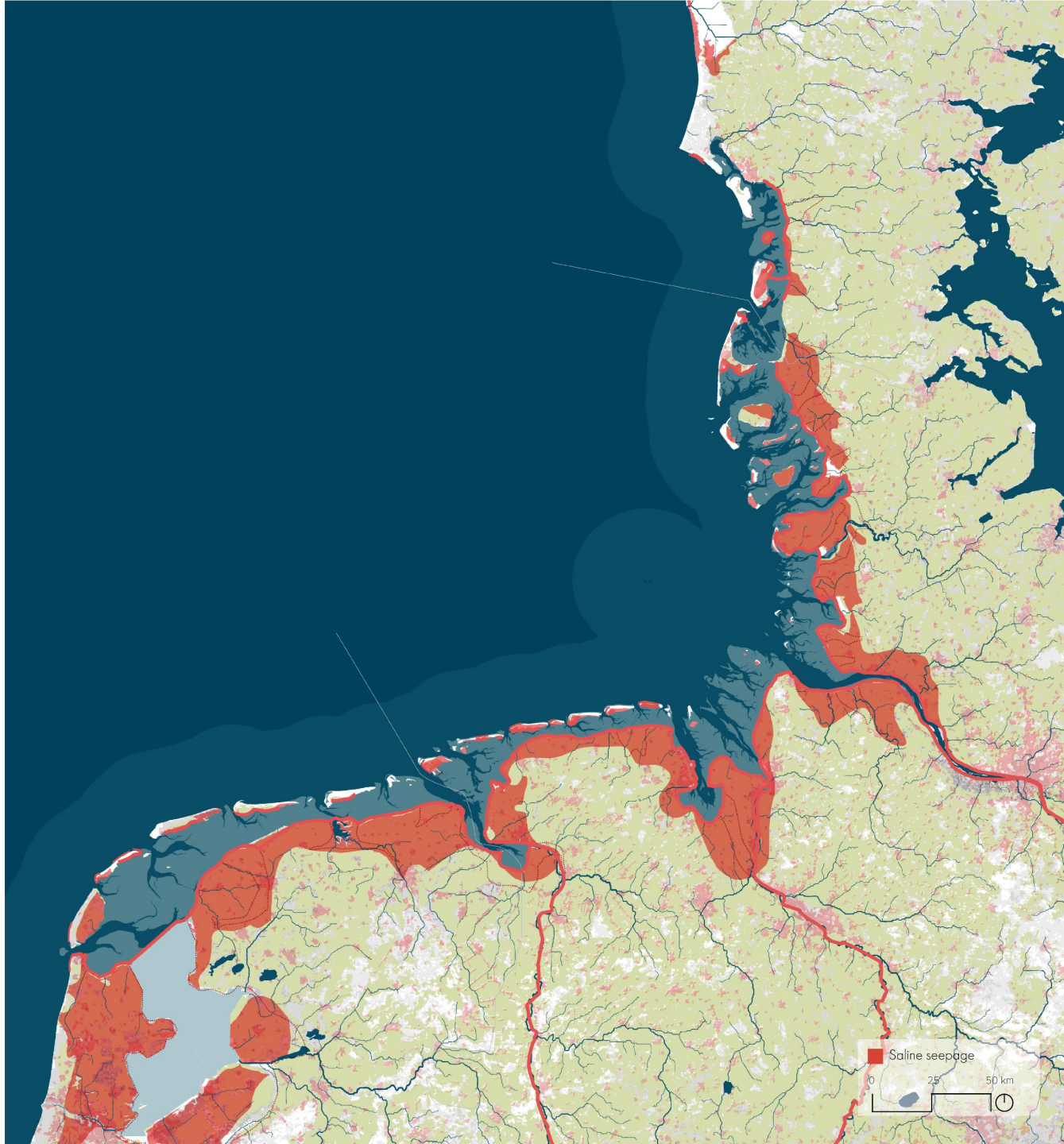
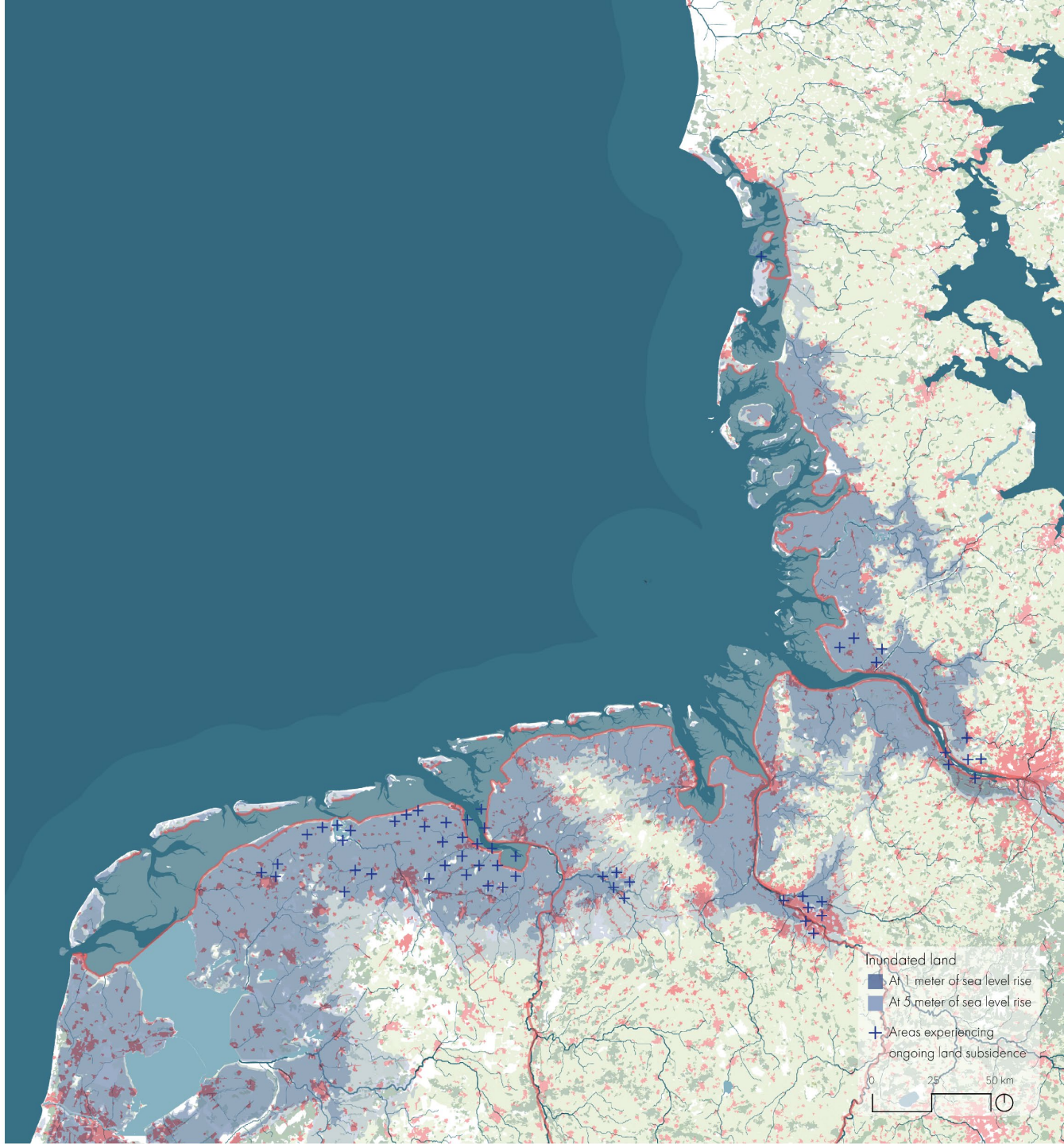


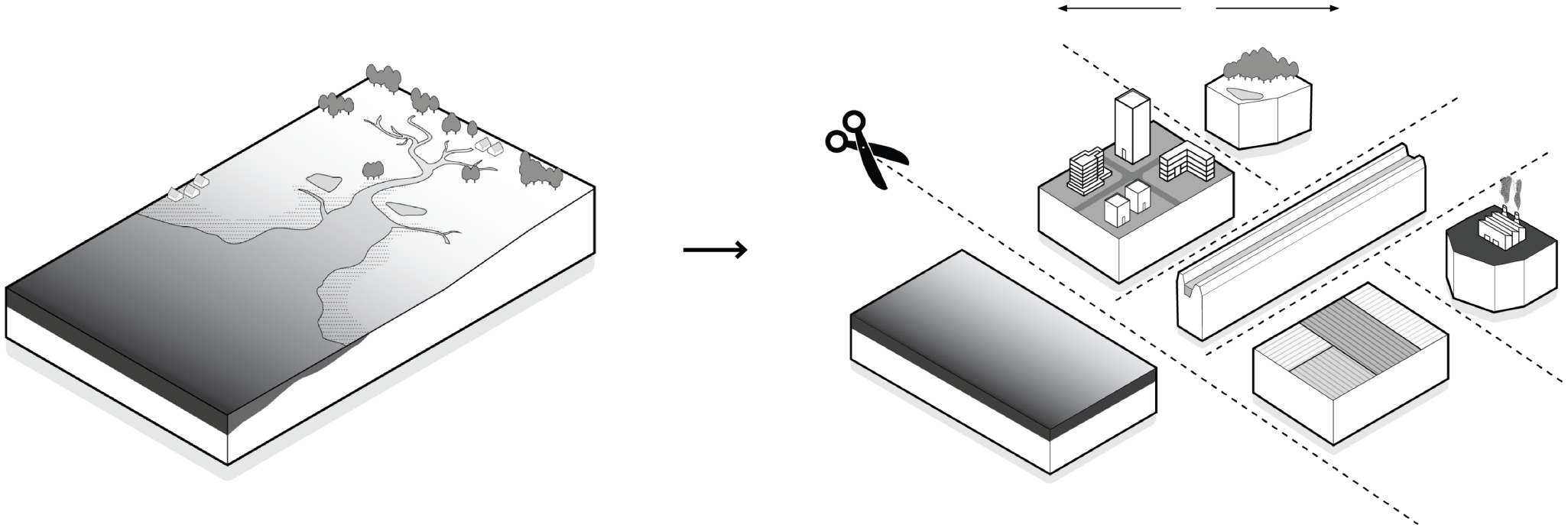
Image: Freddy Schinkel

Sea level rise

While the hinterland subsides, traditional sea dikes have to be raised artificially in order to keep up



Traditional flood engineering has fragmented and fixated the Wadden Sea Region's interface in its entirety



The lacking interface

Traditional flood engineering has fragmented and fixated the Wadden Sea Region's interface in its entirety

In an increasingly uncertain and dynamic future, must we continue this way?

The lacking interface

Traditional flood engineering has fragmented and fixated the Wadden Sea Region's interface in its entirety

In an increasingly uncertain and dynamic future, must we continue this way?

The promising interface

Or can a renewed dynamic interface adjusted to natural conditions restore the balance between sea, land and people?

The lacking interface

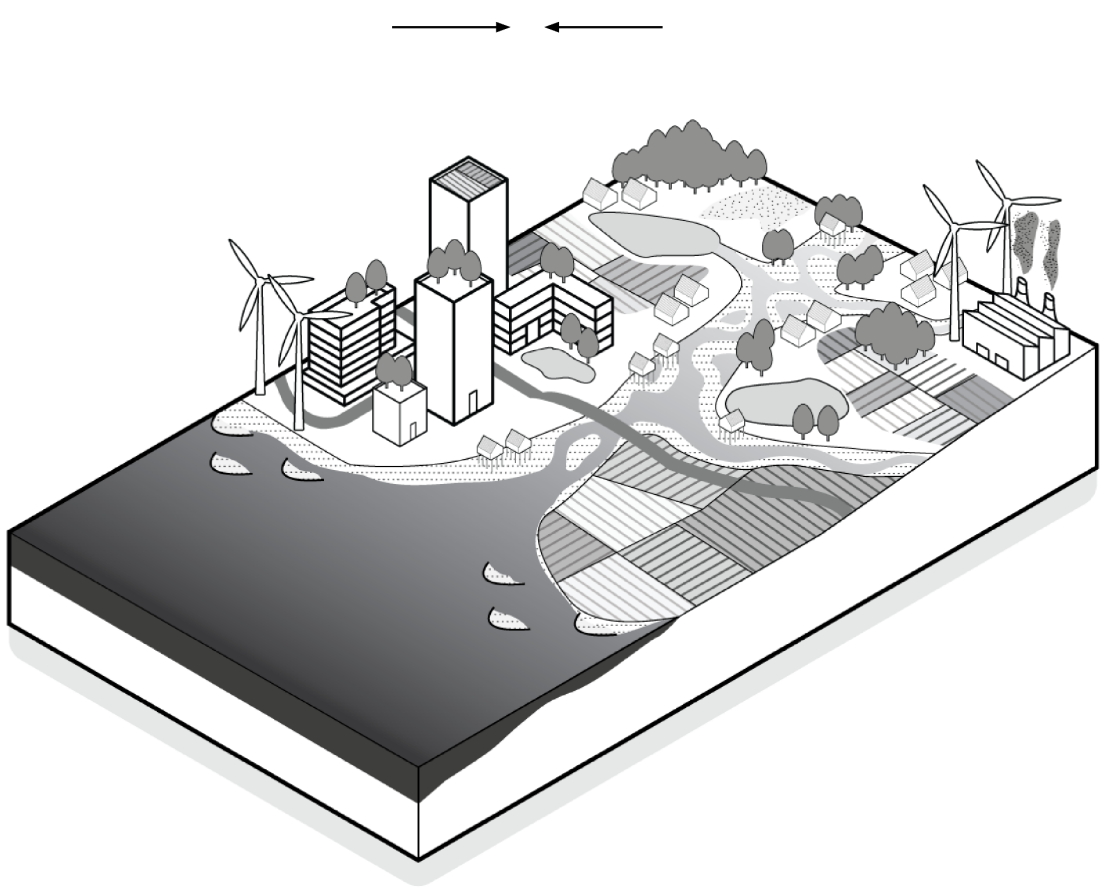
Traditional flood engineering has fragmented and fixated the Wadden Sea Region's interface in its entirety

In an increasingly uncertain and dynamic future, must we continue this way?

The promising interface

Or can a renewed dynamic interface adjusted to natural conditions restore the balance between sea, land and people?

What if "Grow With the Flow" once again can be the basis for a resilient future?



What if “Grow With the Flow” once again can be the basis for a resilient future?

Research objective

To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region

Research objective

To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region

RQ1

Understanding the interface

RQ2

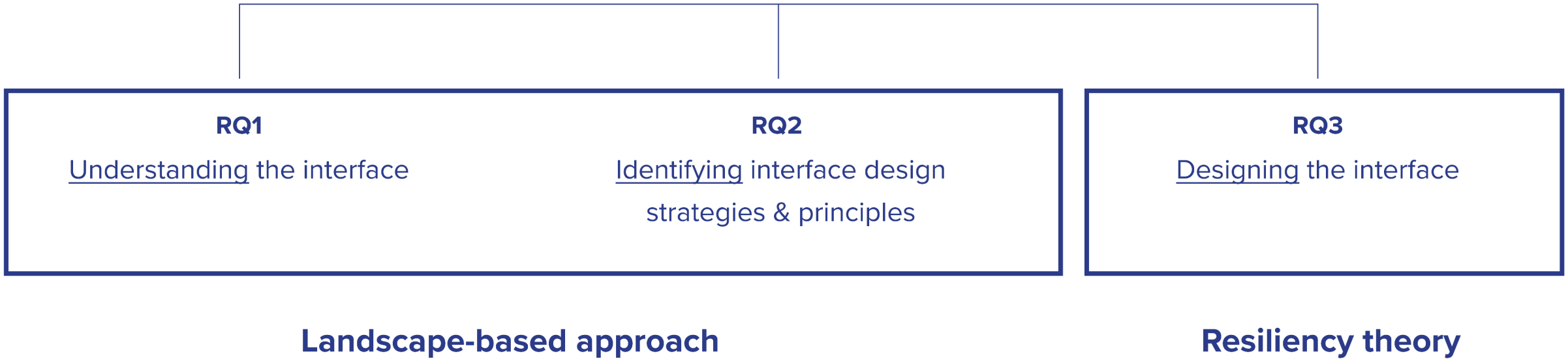
Identifying interface design strategies & principles

RQ3

Designing the interface

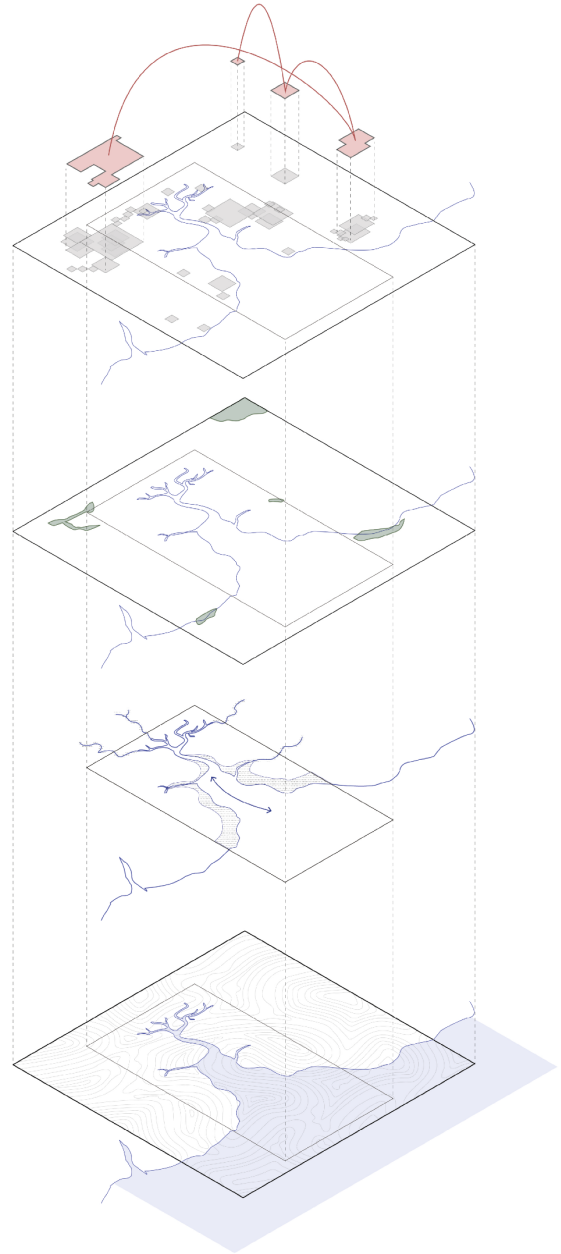
Research objective

To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region



Landscape-based approach Nijhuis, S. (2019)

The landscape as the basis to guide strategic development, working with natural dynamics for the benefit of socially and ecologically inclusive landscapes

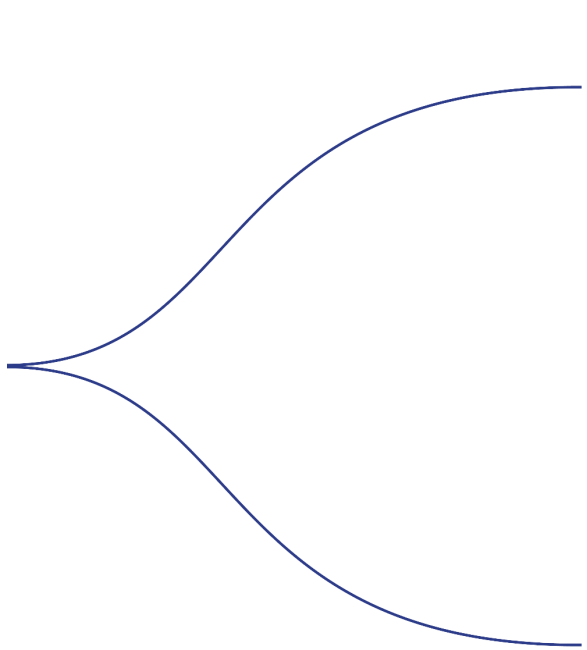


Resiliency theory Holling (1973), Ahern (2011)

In this unpredictable era of change, rather than trying to predict the future, resilient design accomodates the ability of a system to **absorb disturbance and re-organize itself**

Resiliency theory Holling (1973), Ahern (2011)

In this unpredictable era of change, rather than trying to predict the future, resilient design accomodates the ability of a system to **absorb disturbance and re-organize itself**

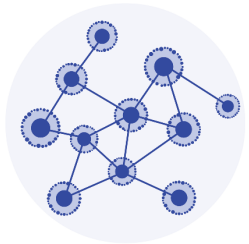


Engineering resilience

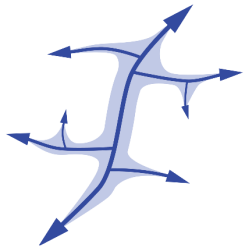
Socio-ecological resilience

Landscape-based approach + Resiliency theory

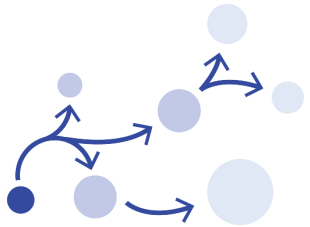
Theoretical interface guidelines



Integrated universal system

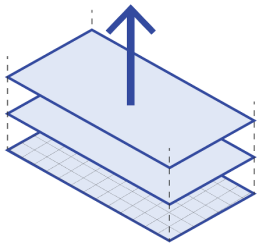


Spatial framework as connecting elements

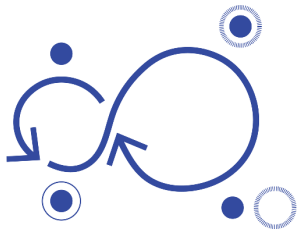


Indeterminacy & flexibility

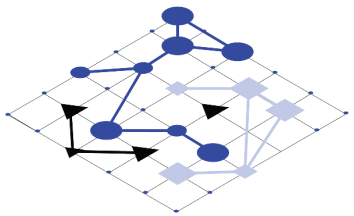
Promoting natural processes for dynamism and allowing disturbances



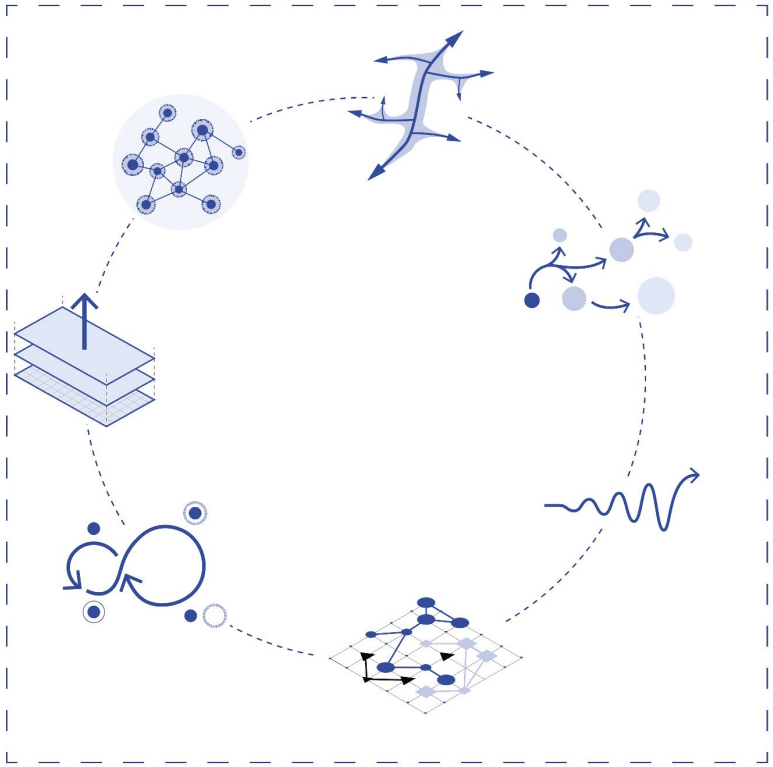
Landscape as the foundation for development



Possibility of self-organization



Complex landscapes for redundancy and diversity



?

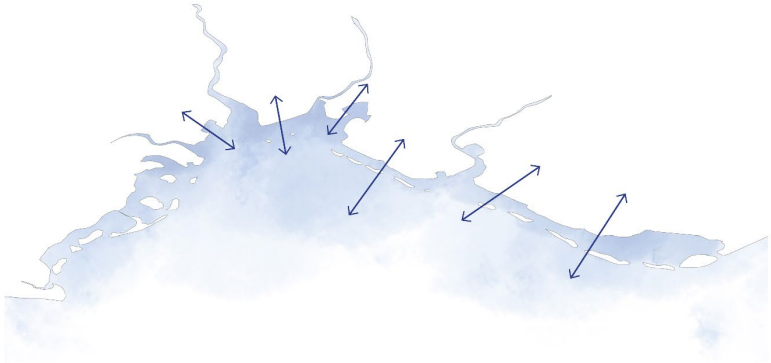
Satellite image of the Wadden Sea Region, 2018
(NASA Earth Observatory, edited by author)

Connecting theory to context

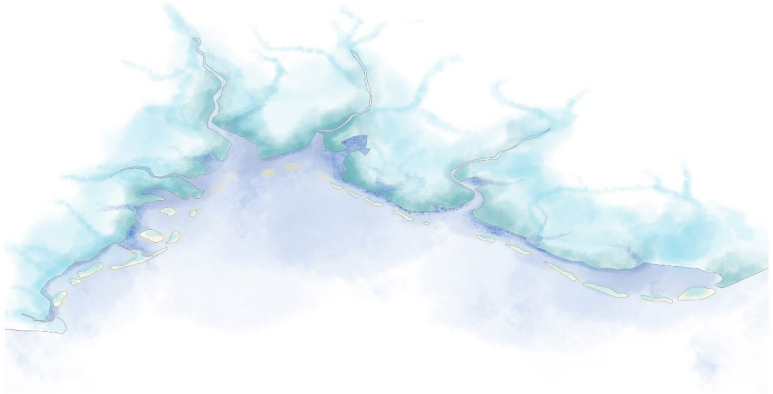
Through the development of operational design principles

To...

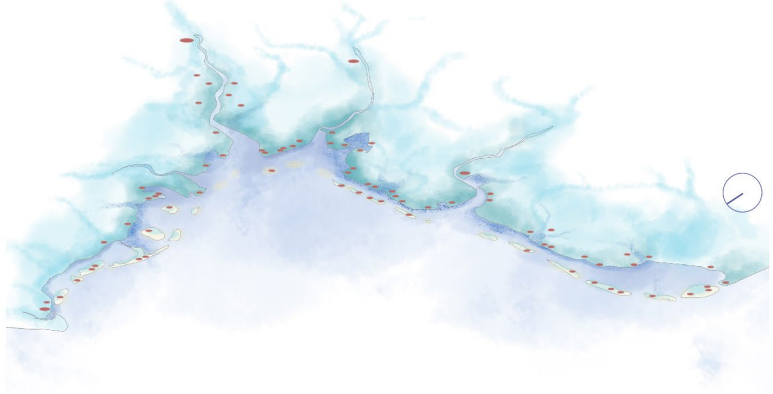
Extend connectivity between land and sea

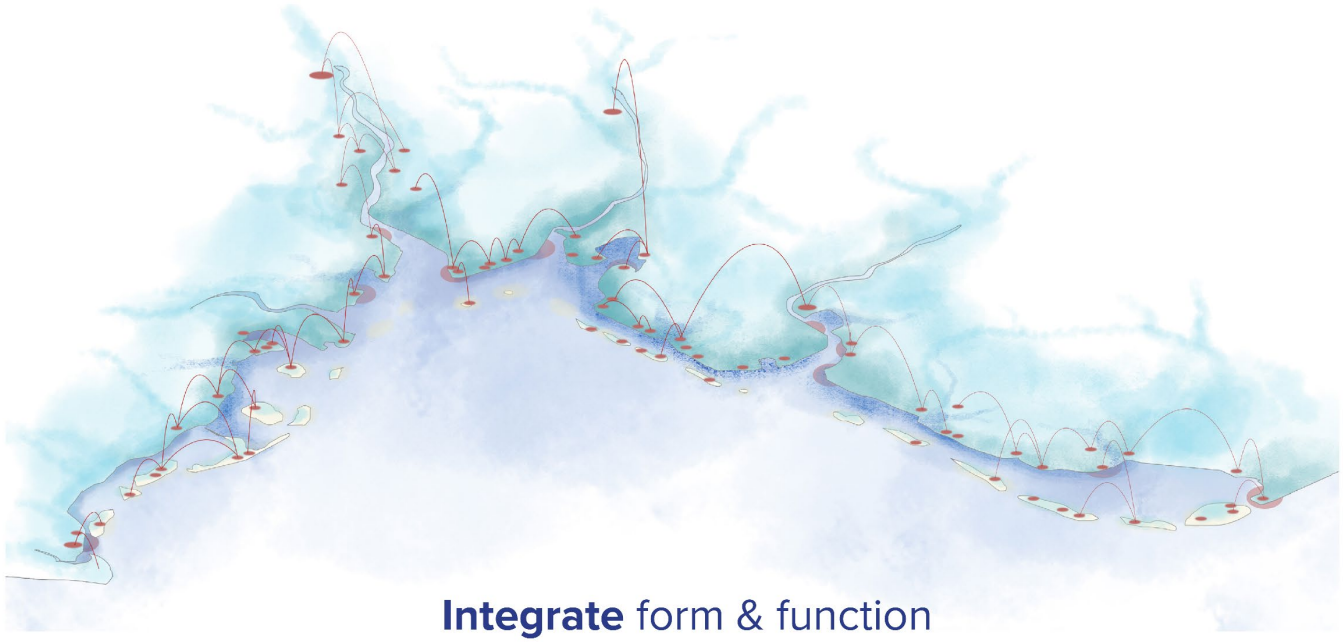


Strengthen gradients

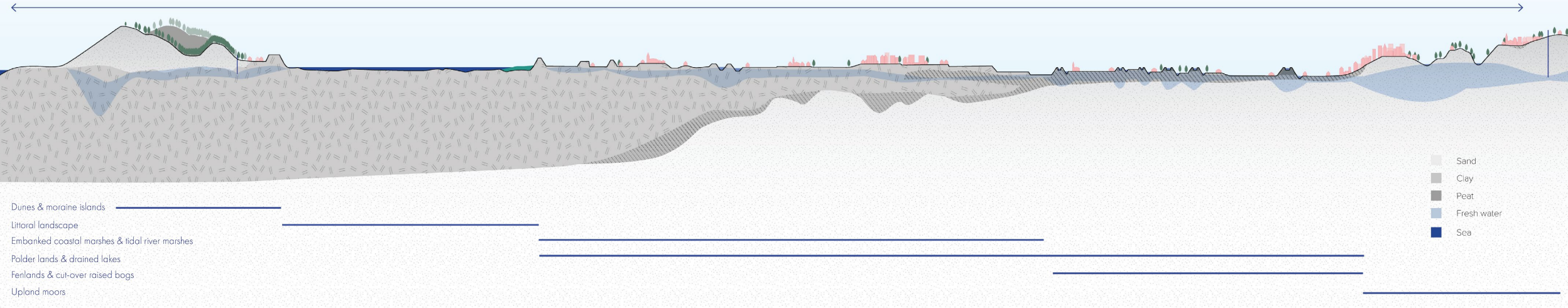


Facilitate human use



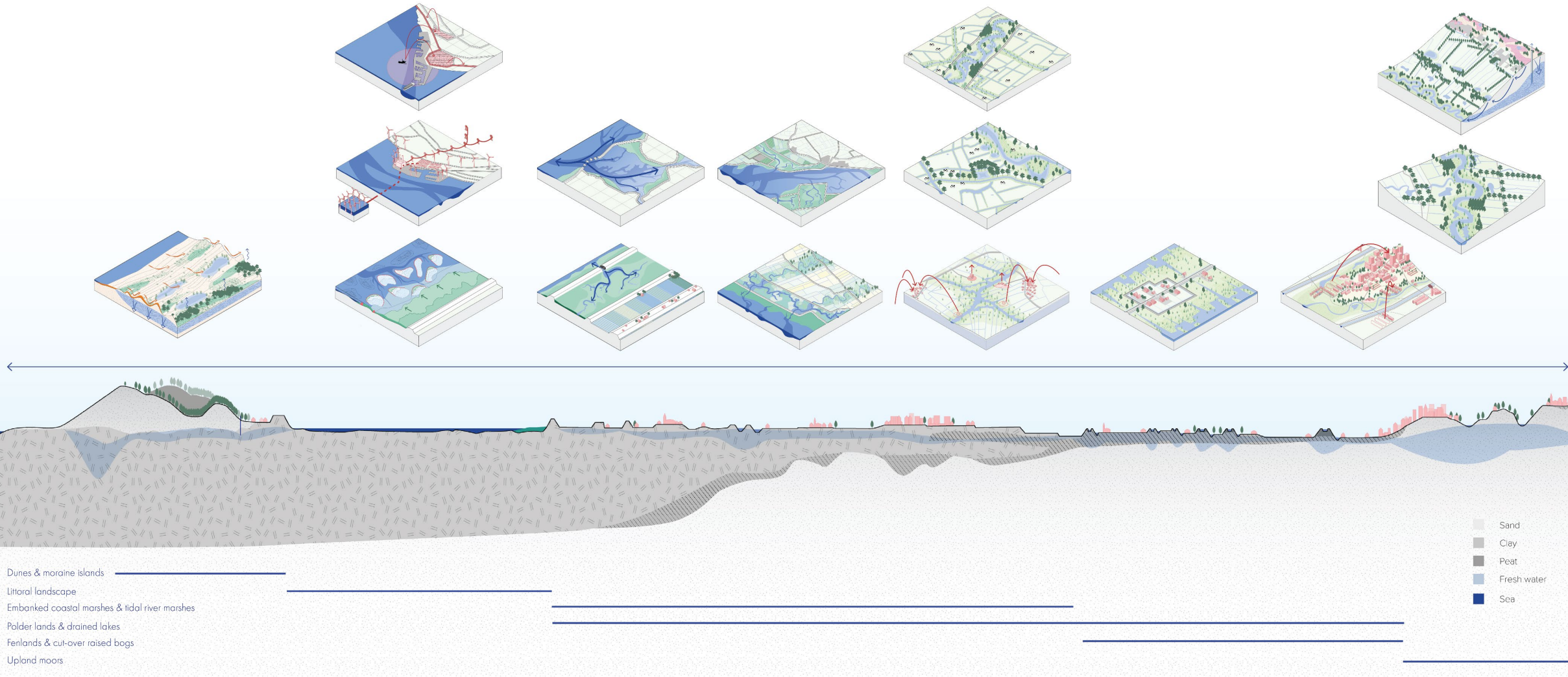


Integrate form & function



Approaching the interface as a landscape system

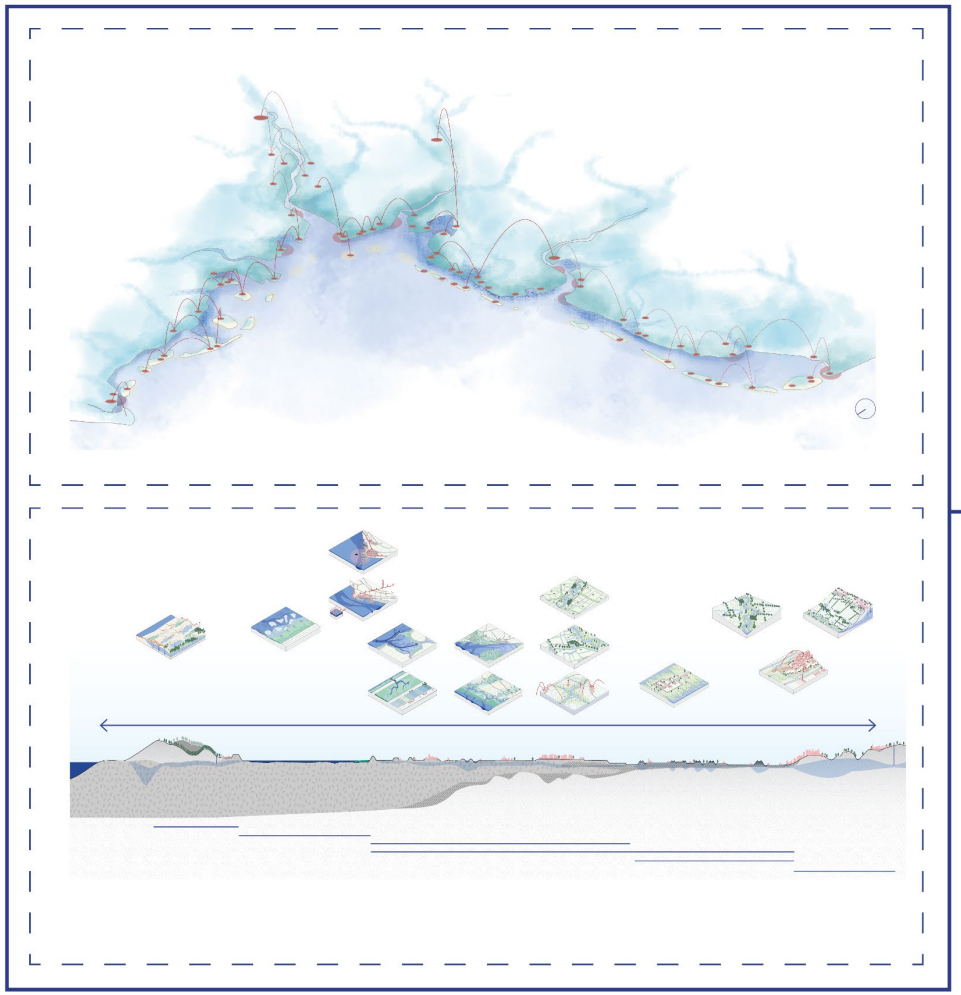
Six different types of landscapes are present along the Wadden Sea Region's coastal interface

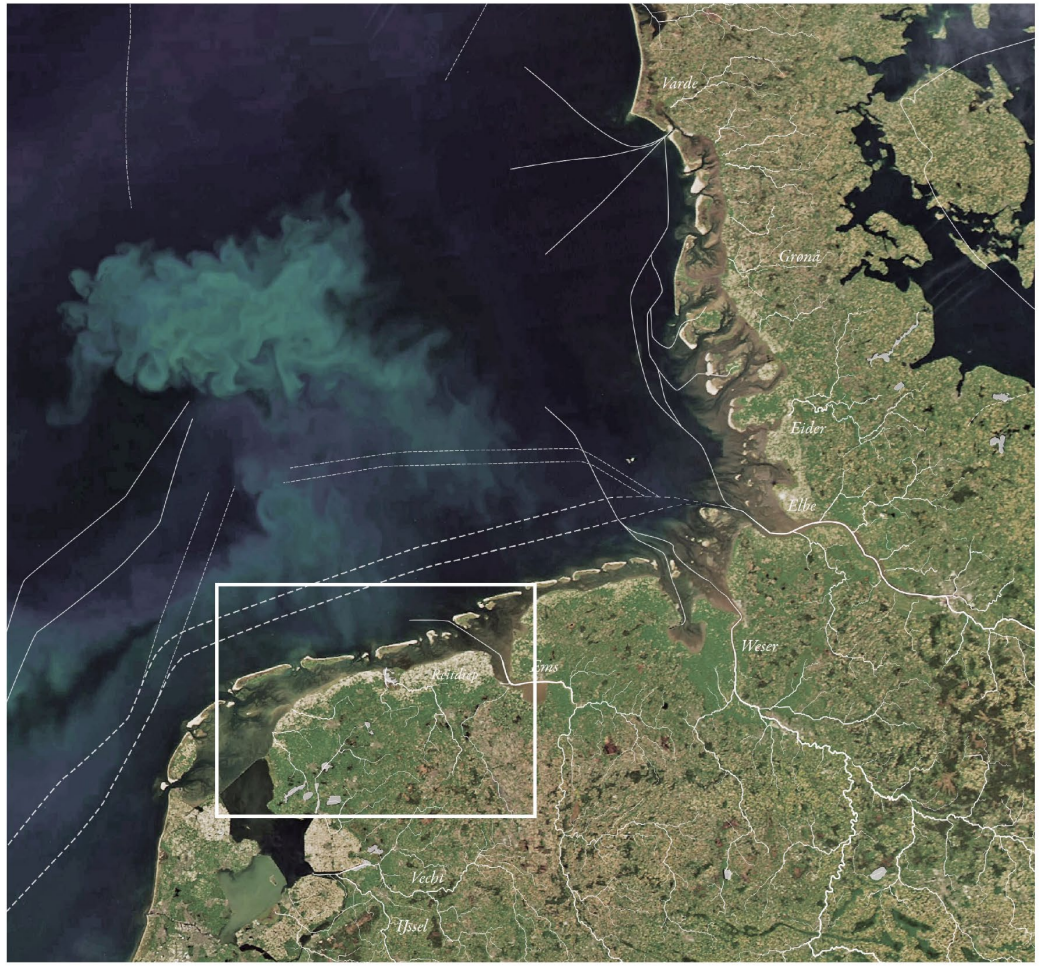


15 operational principles

By improving conditions of each typology, the overall interface will improve

Contextual application

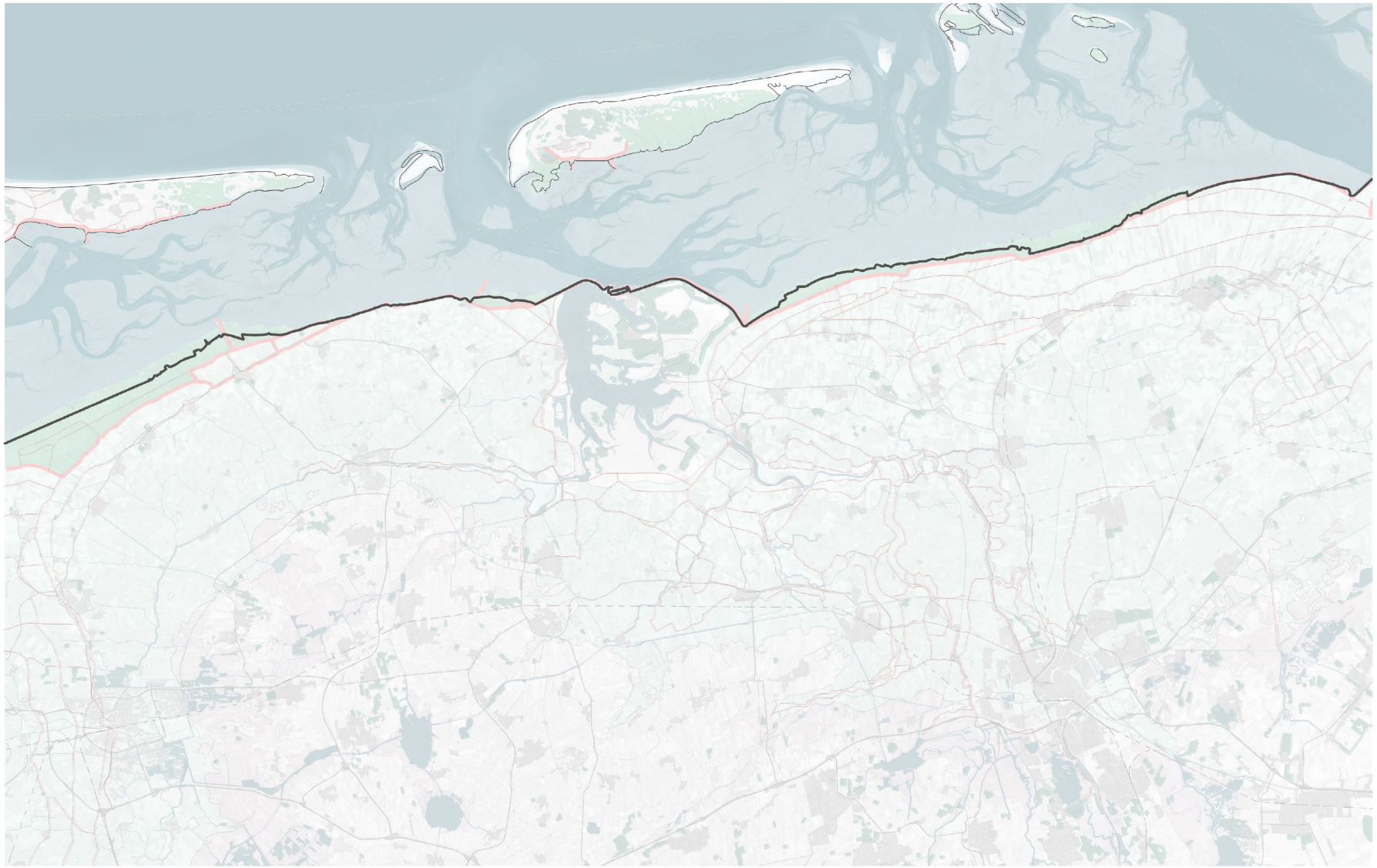


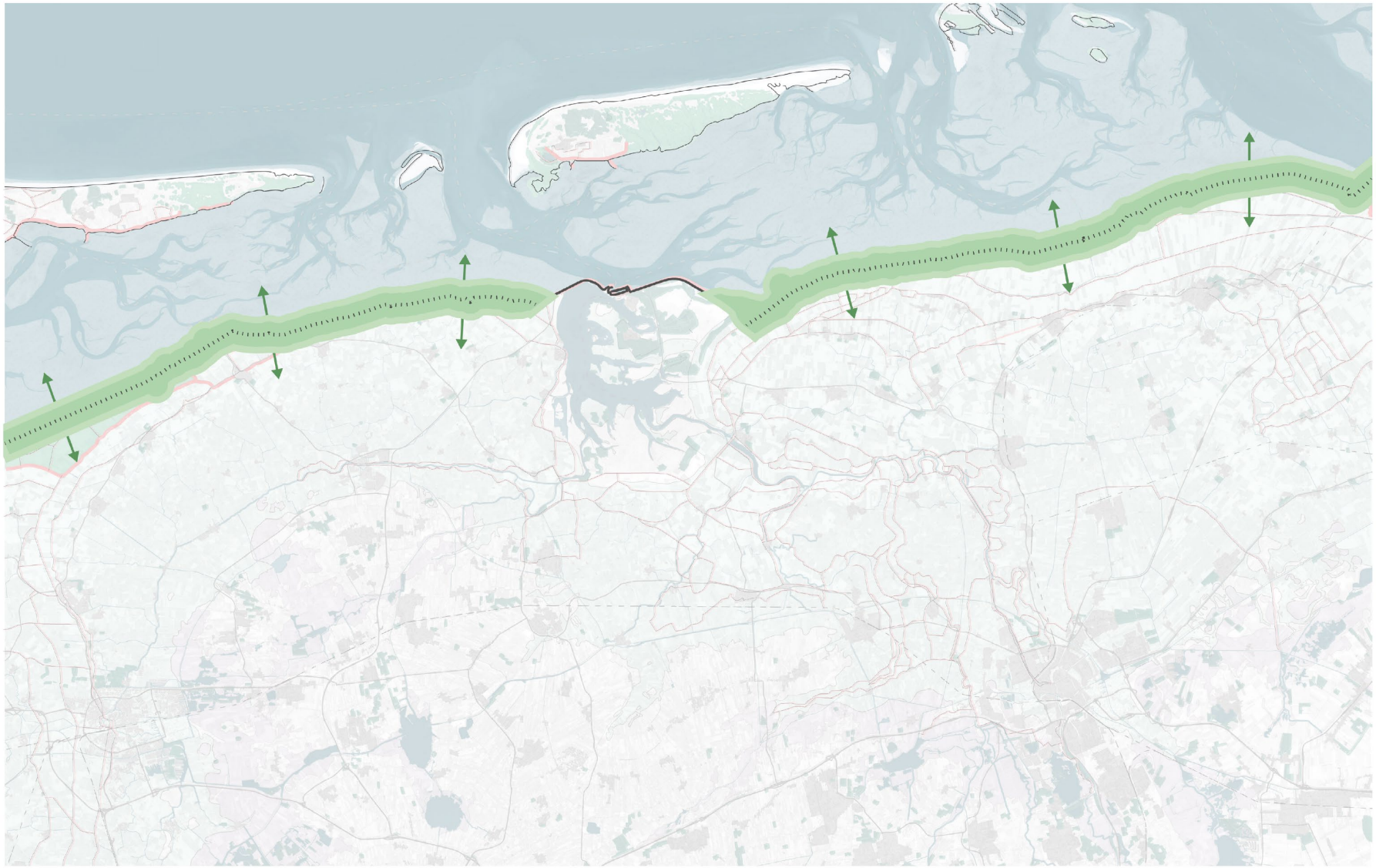


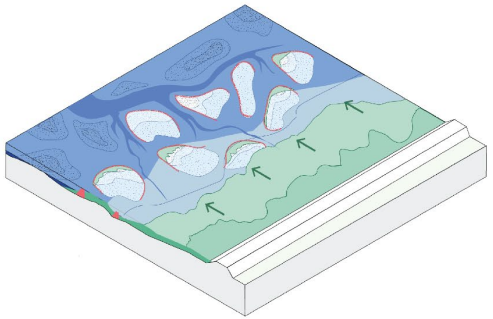
Satellite image of the Wadden Sea Region, 2018
(NASA Earth Observatory, edited by author)

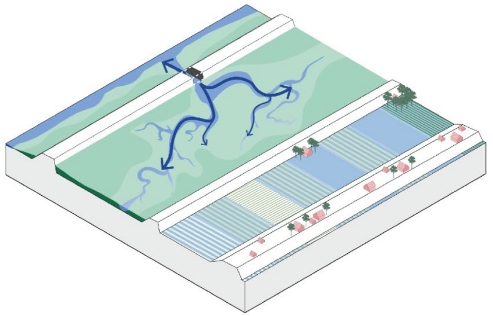
Testing the strategy & operational principles in northern Netherlands


Uithuizen
Pieterburen
Lauwersmeer
Dokkum
Dokkumerdiep
Reitdiep
Kommerzijlsterriet
Groningen
Leeuwarden
Soil structures
Sea clay
Peat
Moraine sand
Water
Mudflats
Forest
Salt marsh
Urban tissue
Motorway
Railway
Main sea dike
Historic dike
0
2,5
5km

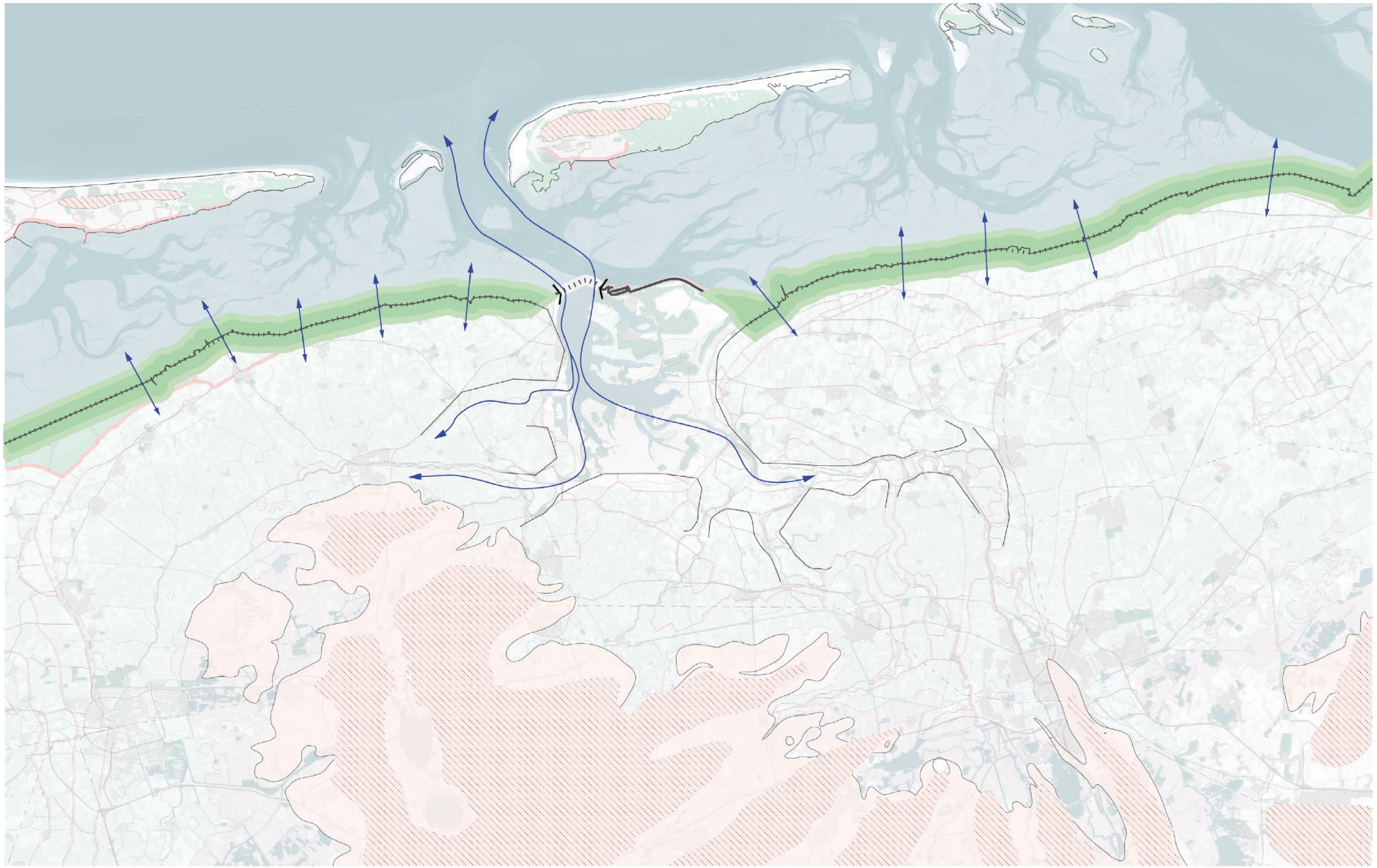

0
2,5
5km

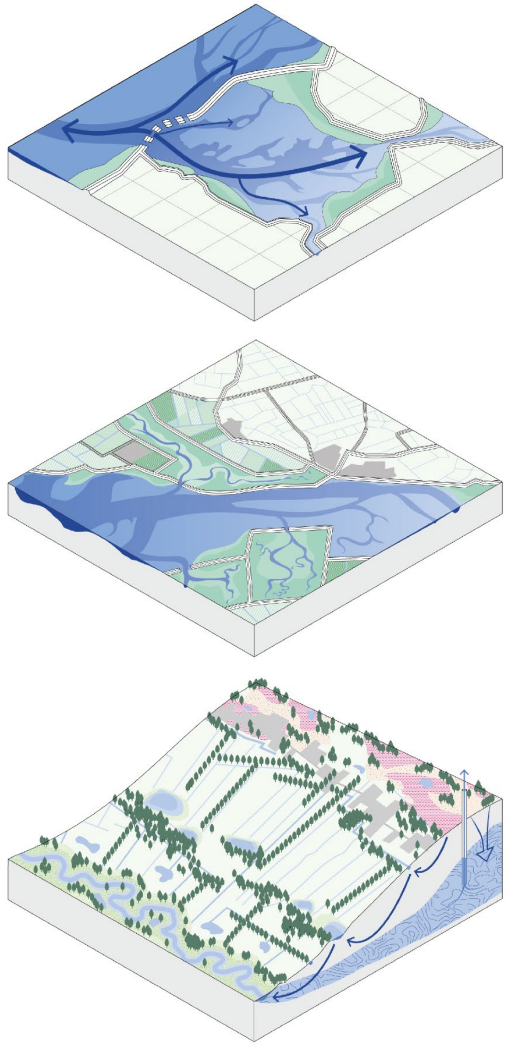






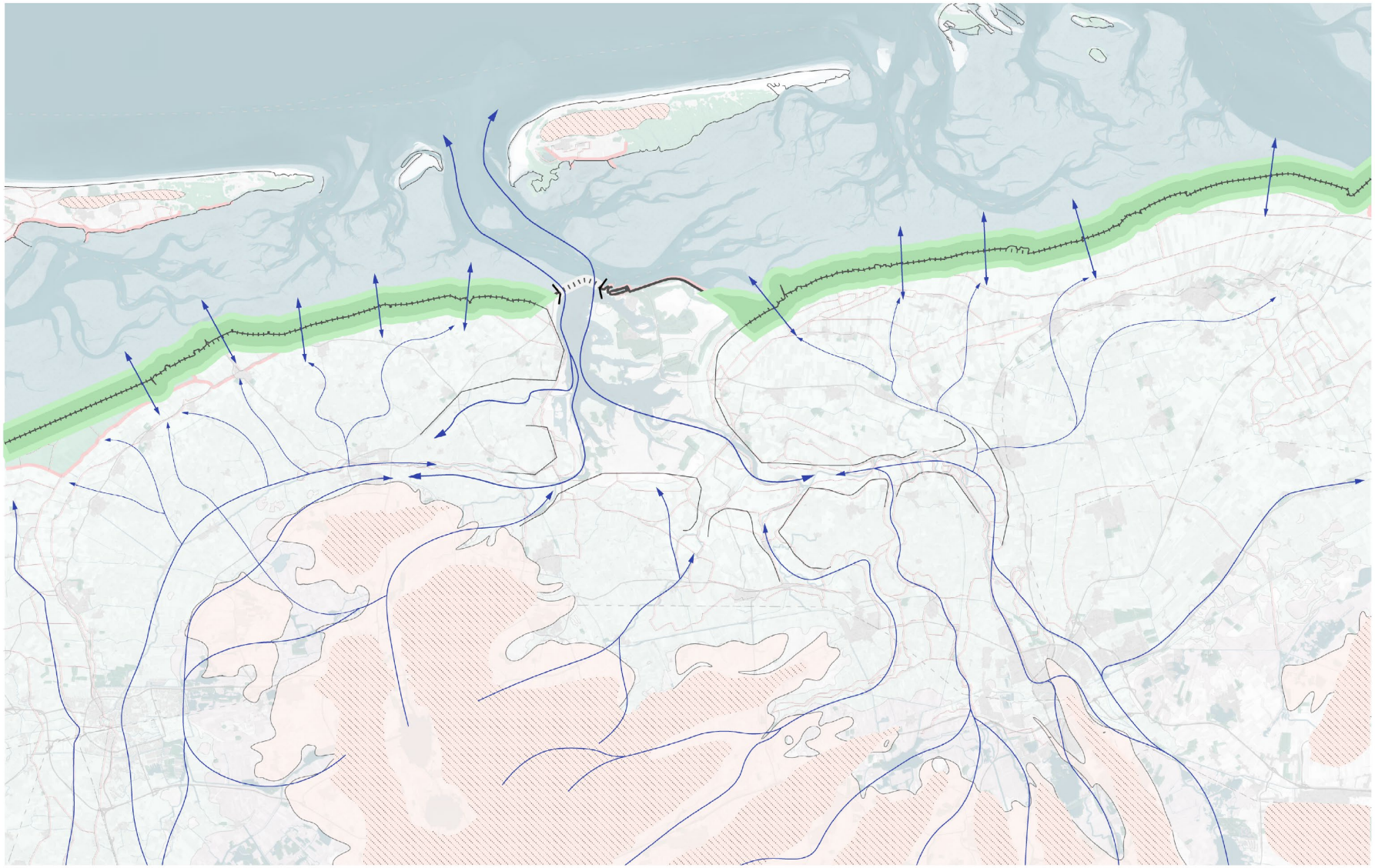
Coastal bufferzone

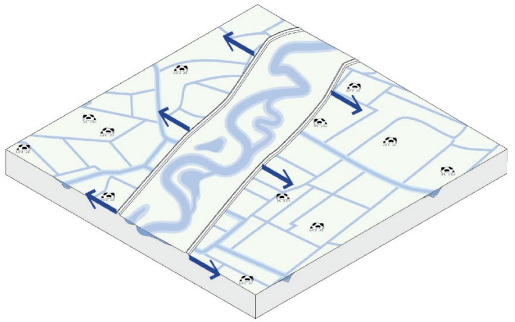




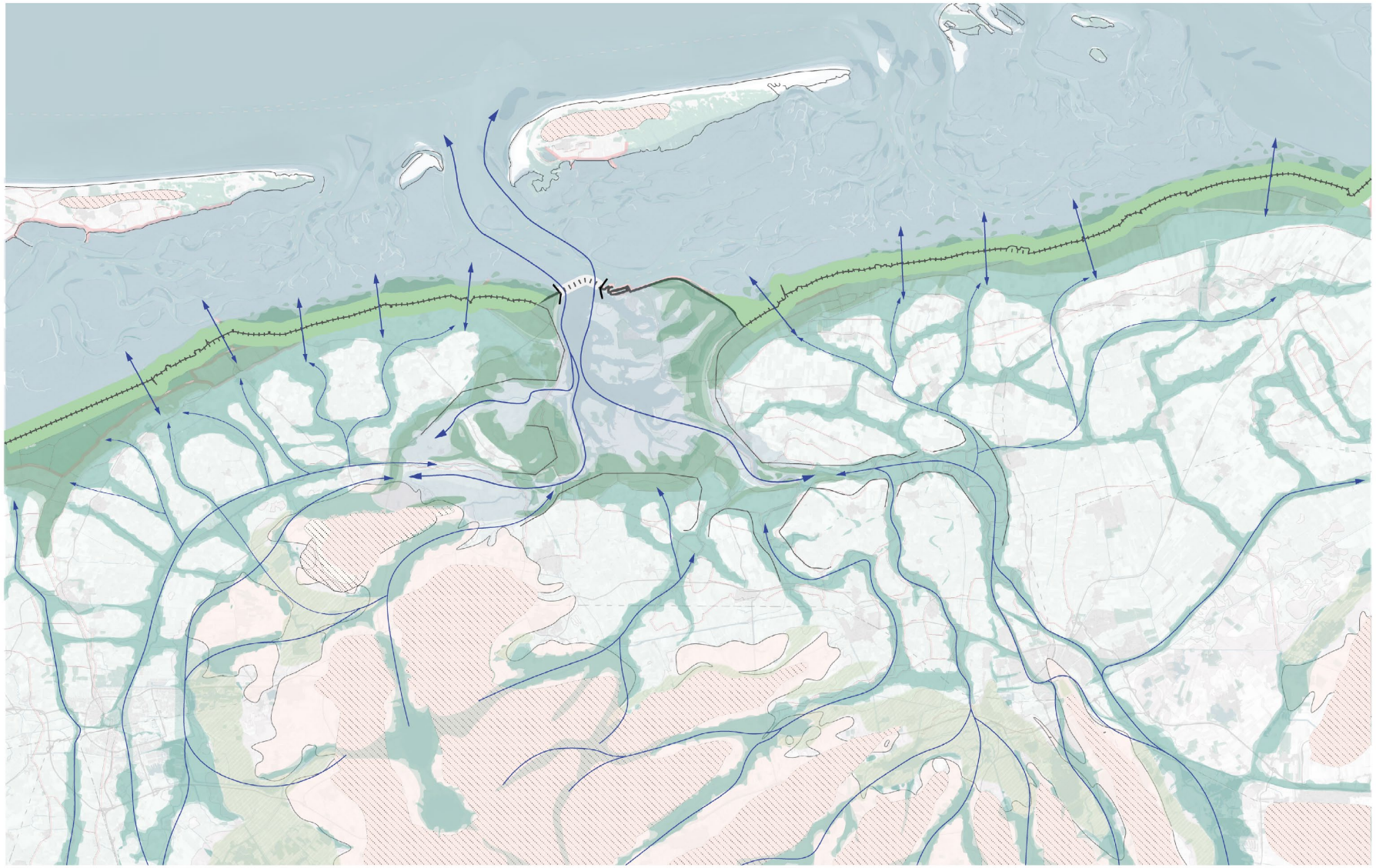
Freshwater infiltration zone

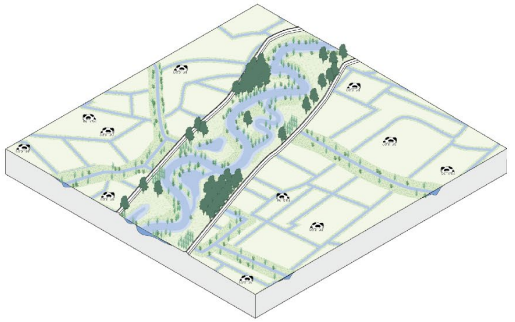
Sediment-friendly surge barrier

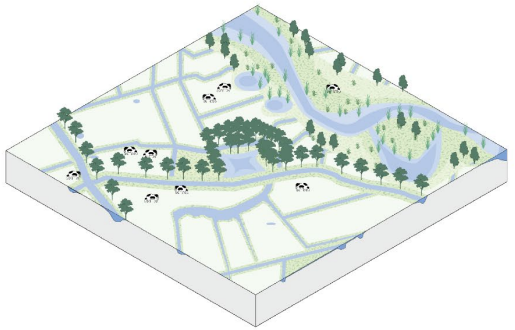


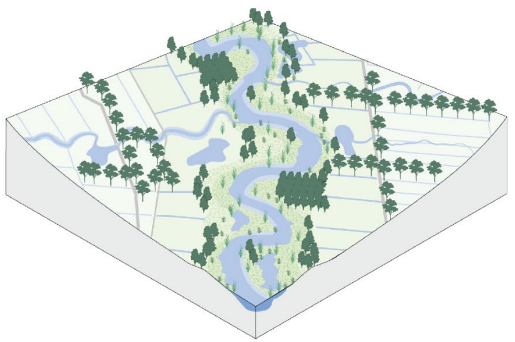


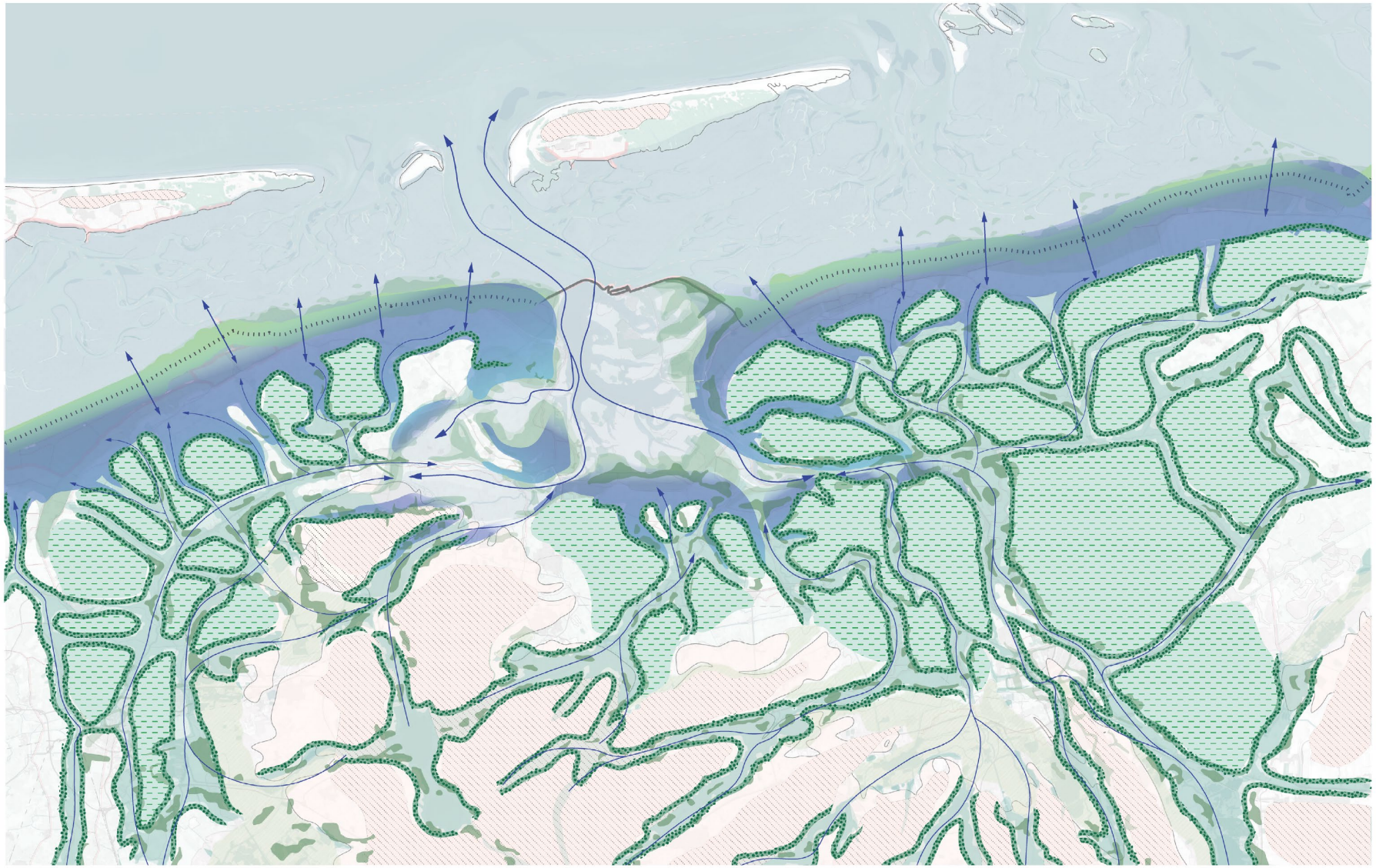
0 2,5 5km

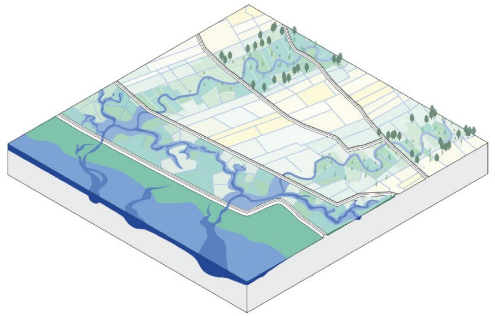

0
2,5
5km











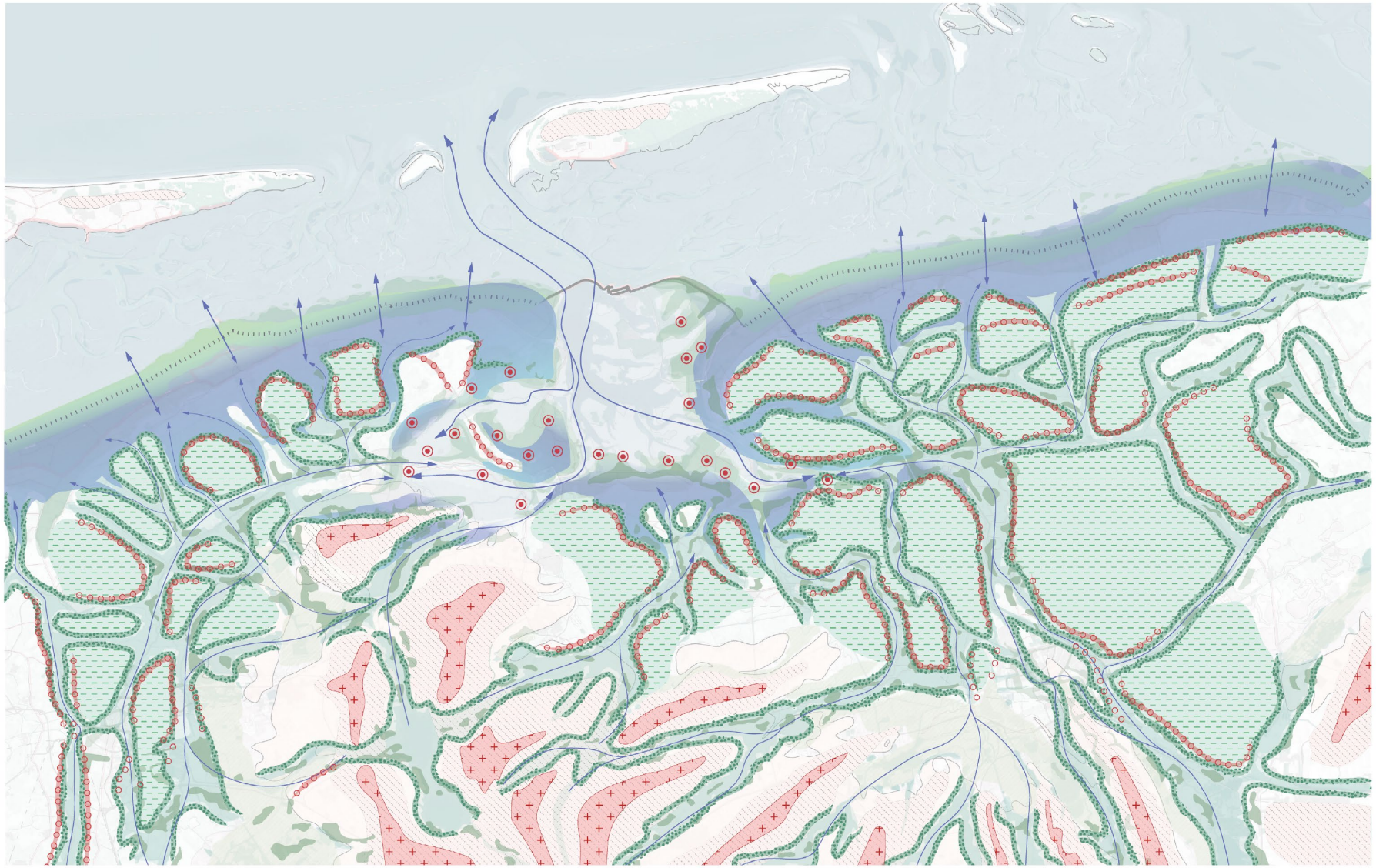
Saline agriculture

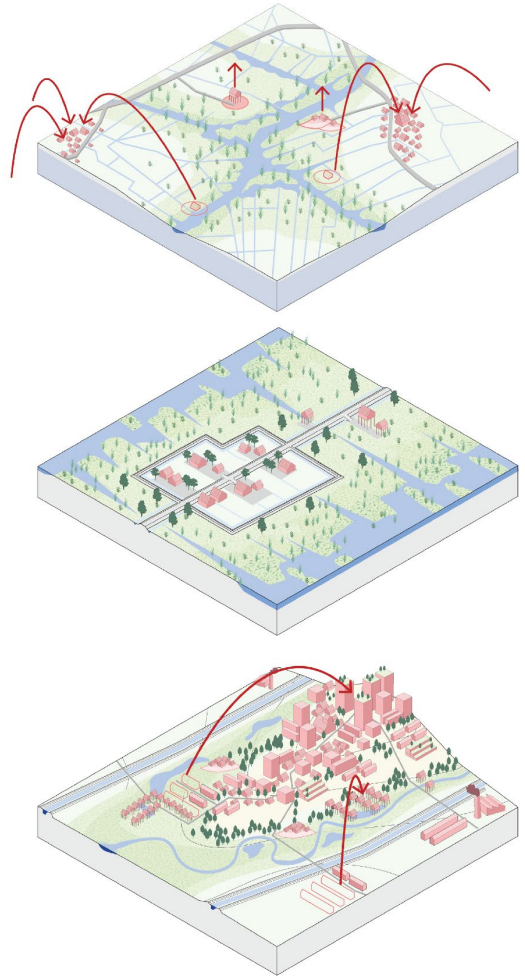
Freshwater-based agriculture

Productive forested ridge

Productive wetland

0 2,5 5km

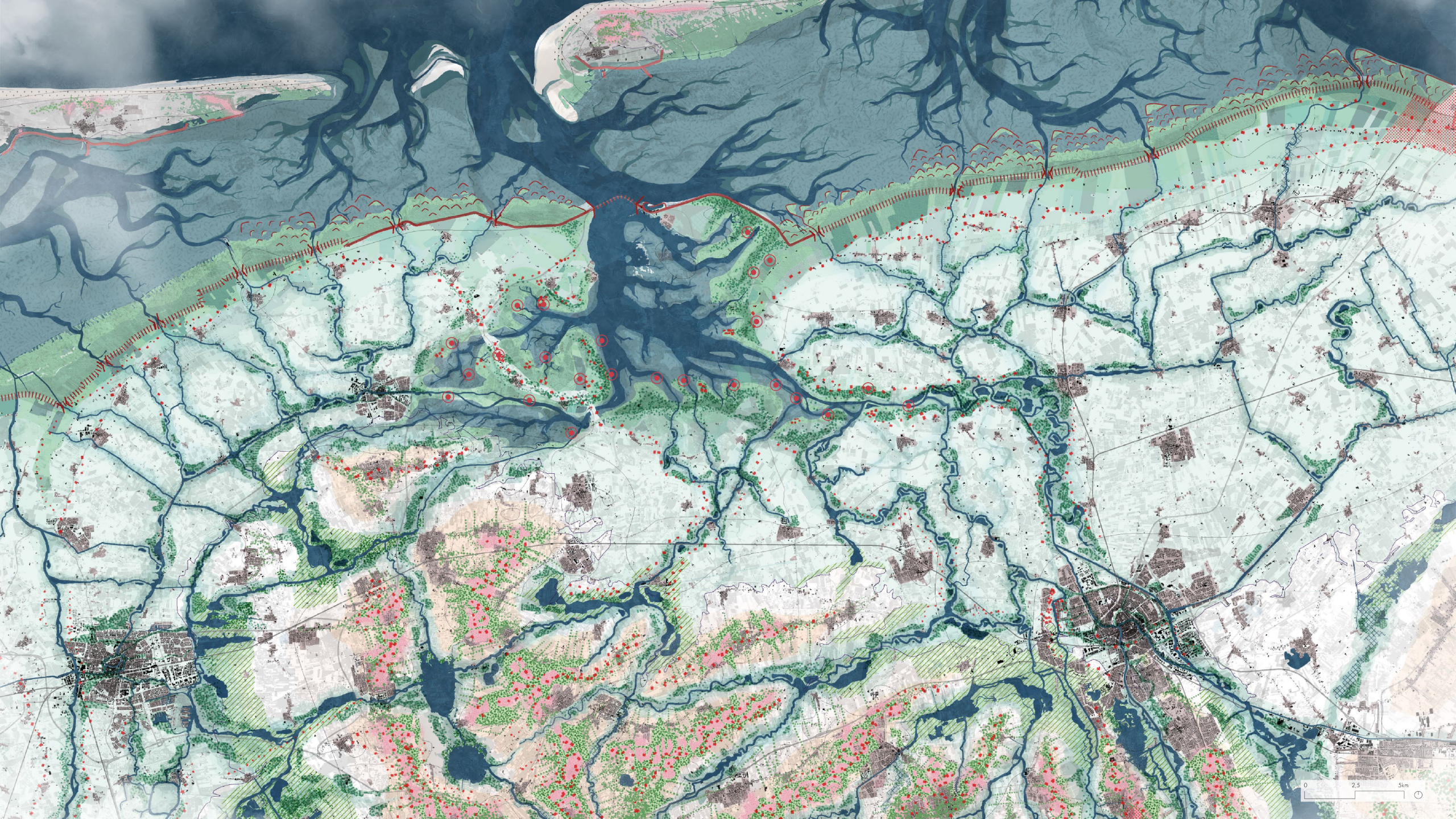


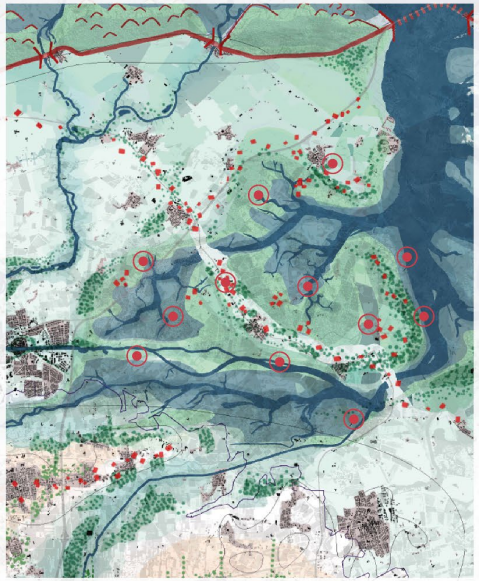


Terp village in dynamic littoral landscape

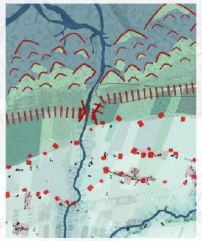
Adapted dwelling on fluvial ridge

Heath living on elevated moraine sand


0
2,5
5km

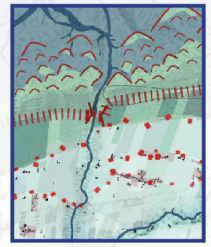


Living Lauwersmeer



The f(L)ood zone

The urban flood fringe



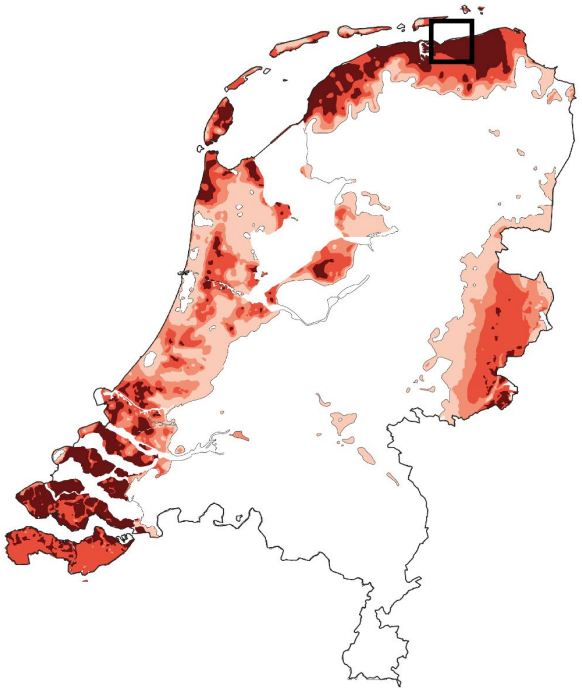
The f(L)ood zone

Combining food production with flood protection

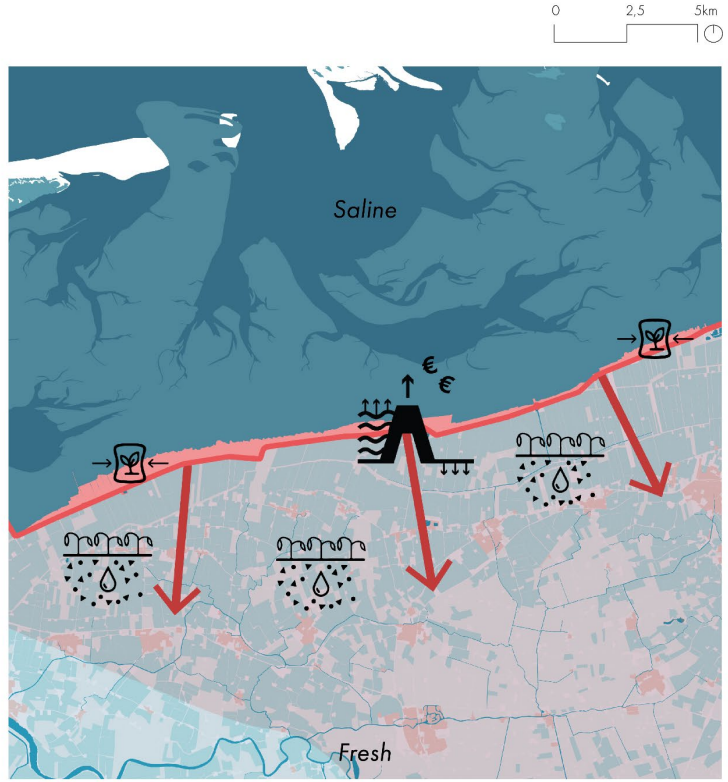
The f(L)ood zone

Zoom-in 1

Direct barrier between sea and land



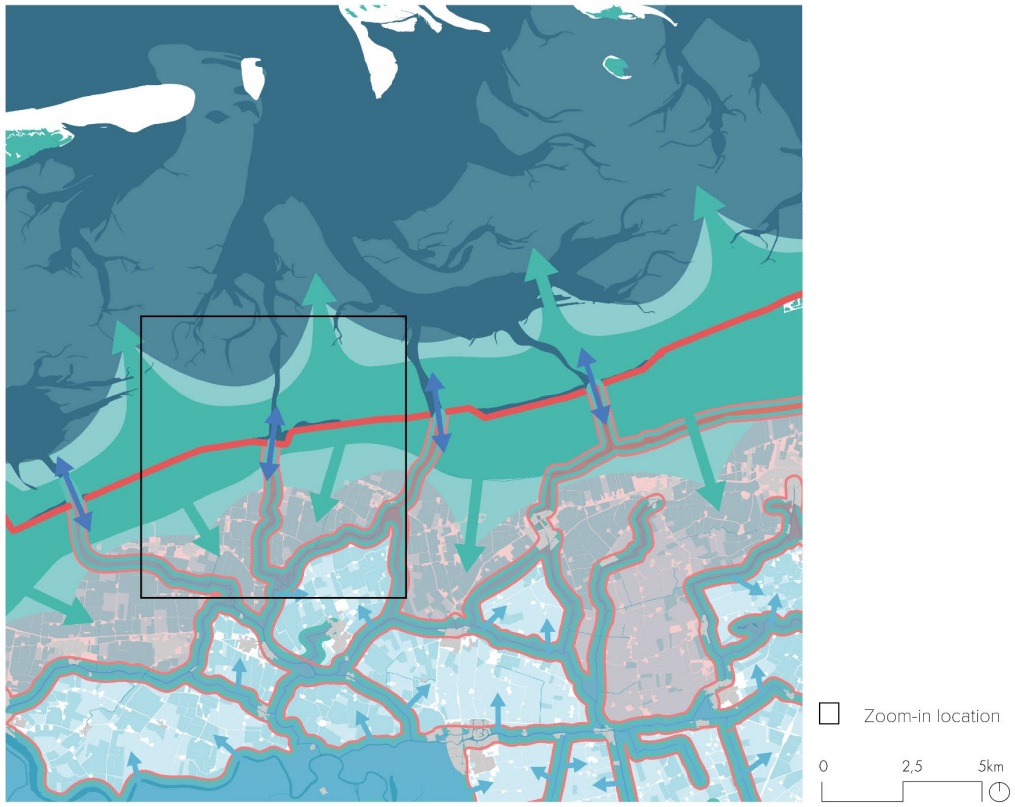
Soil salinization



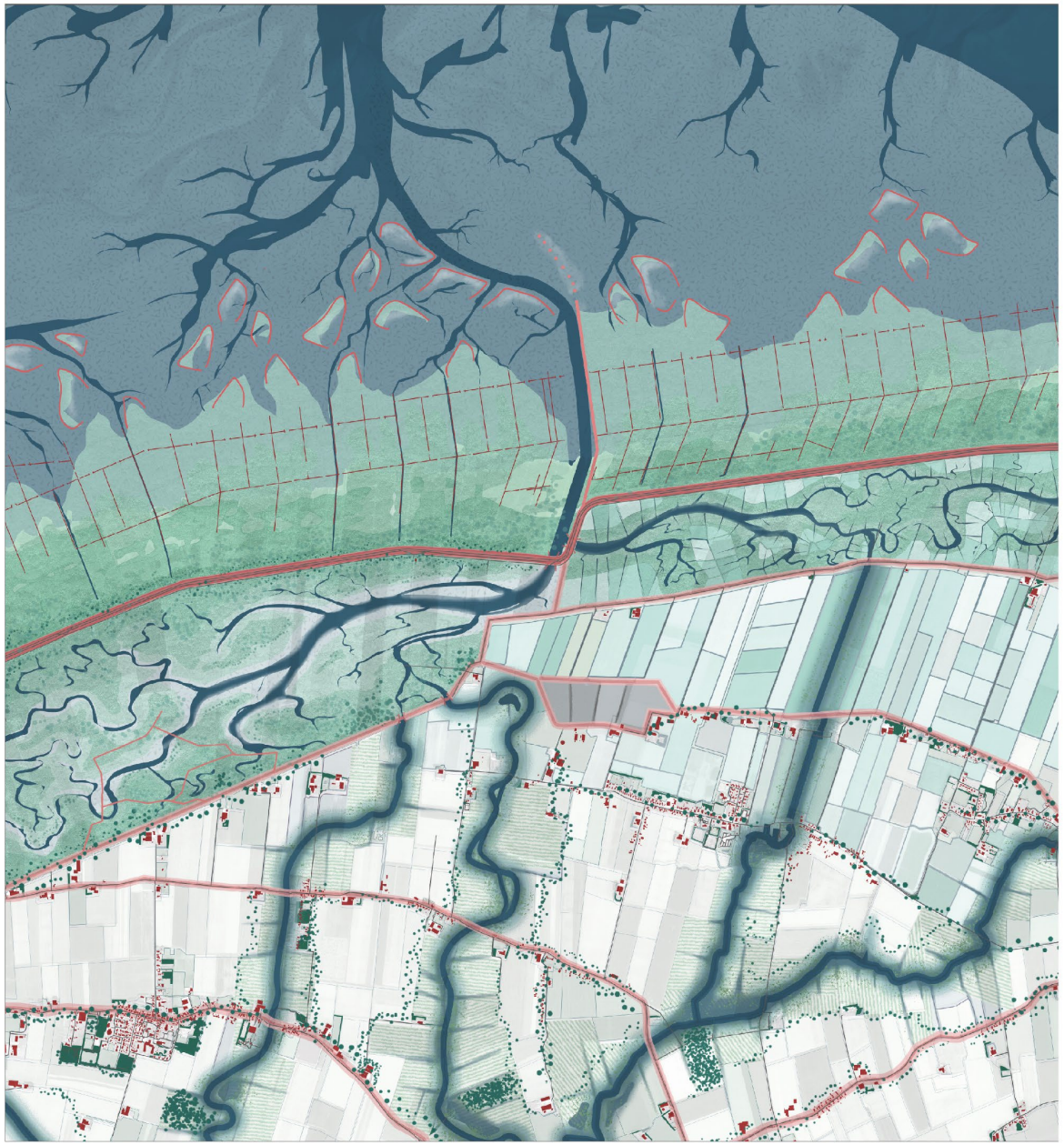
Unsustainable productive system

The f(L)ood zone

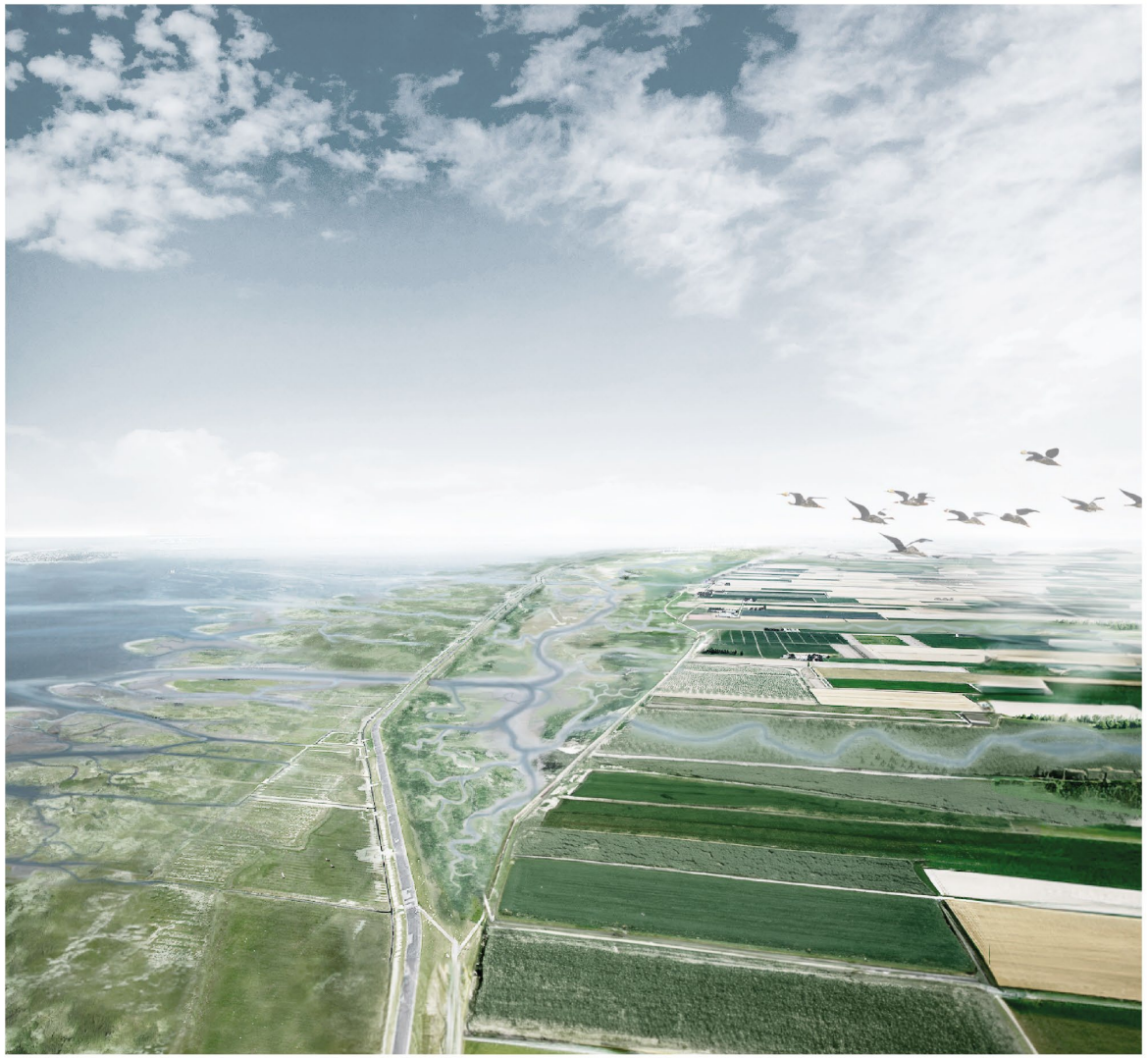
Zoom-in 1



Combining flood protection
with food production


0
500
1000m

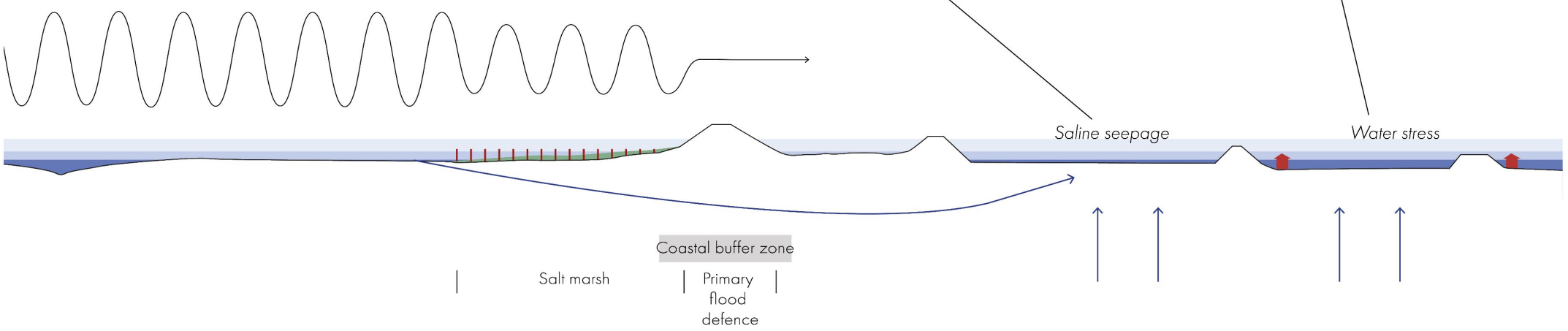
Existing



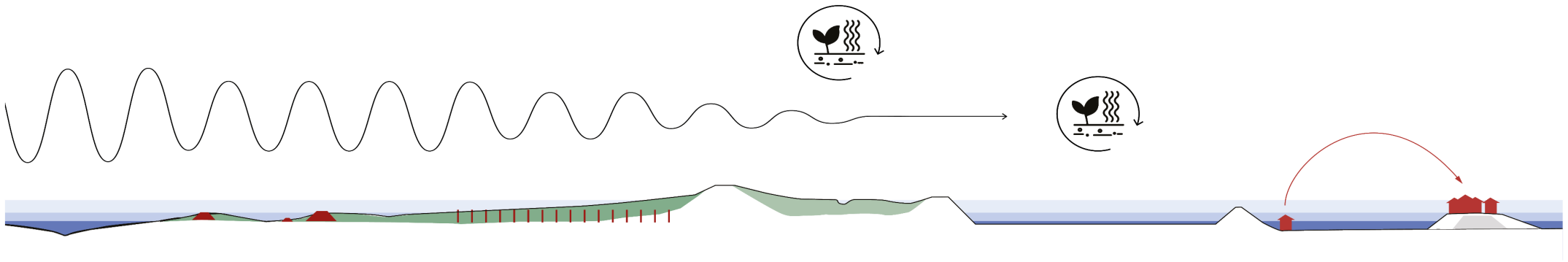
Proposal

Saline seepage

Water stress



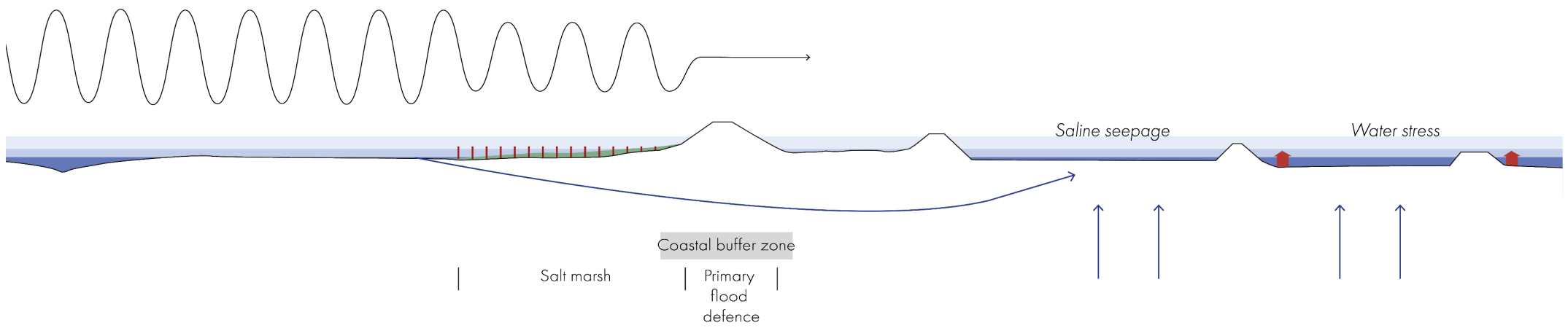
Existing



Proposal

Exended coastal buffer zone | Coastal buffer zone

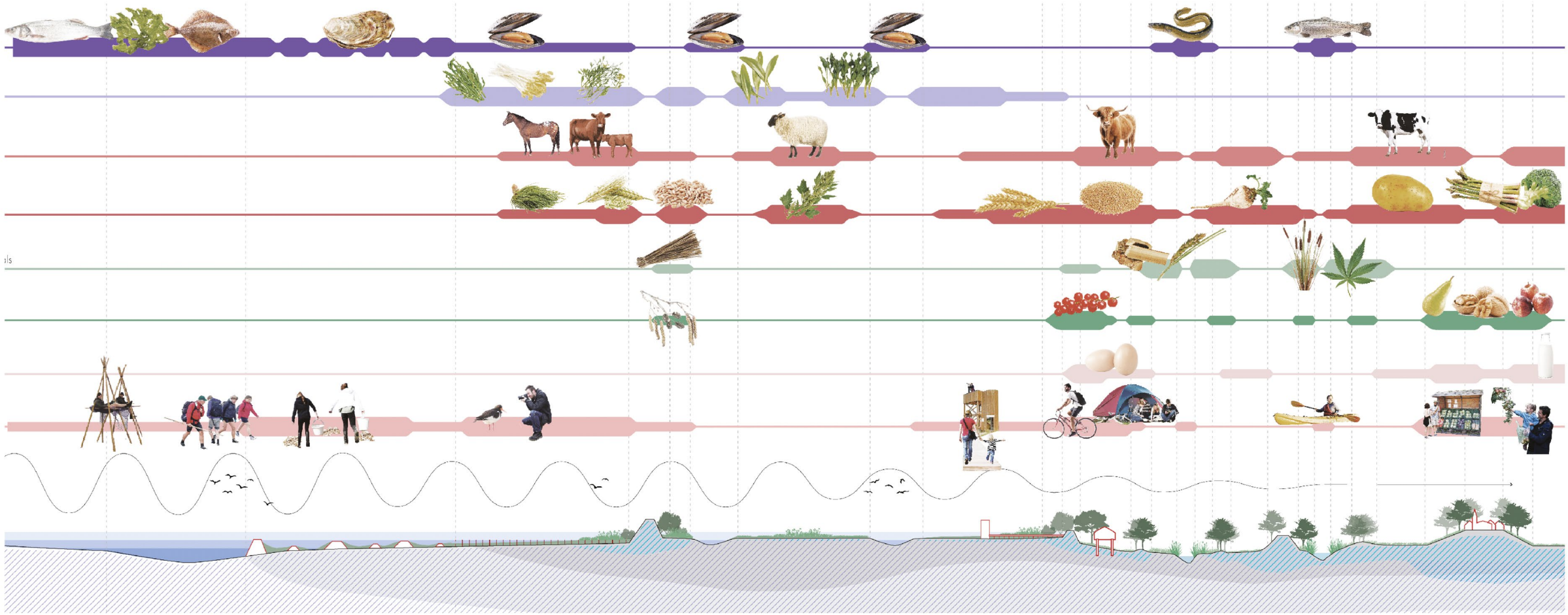
Bio-breakwaters | Additional salt marsh | Salt marsh | Primary flood defence | Double dike | Salt tolerant crops | Dwelling settlement



Existing

Coastal buffer zone

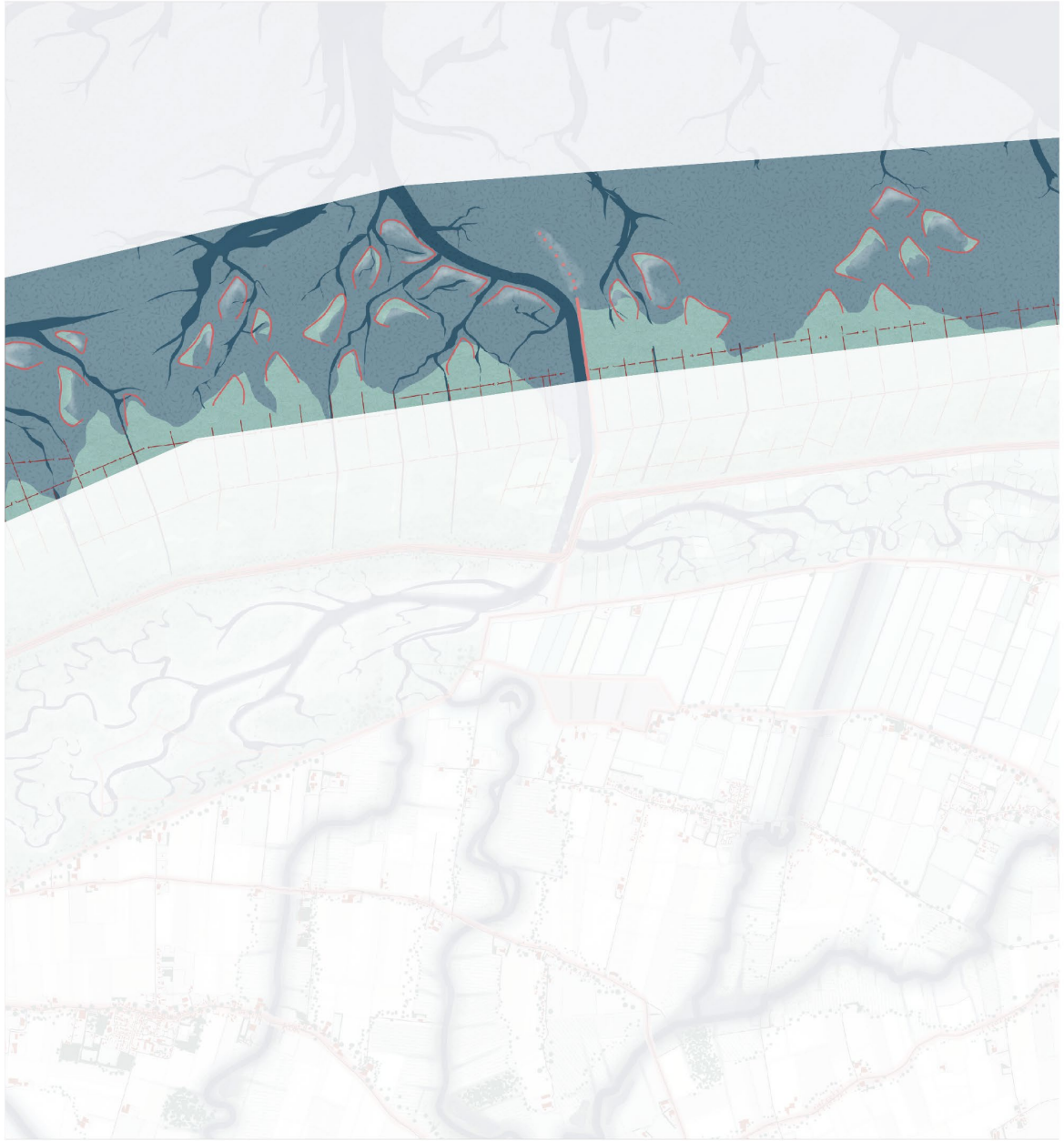
Salt marsh | Primary flood defence



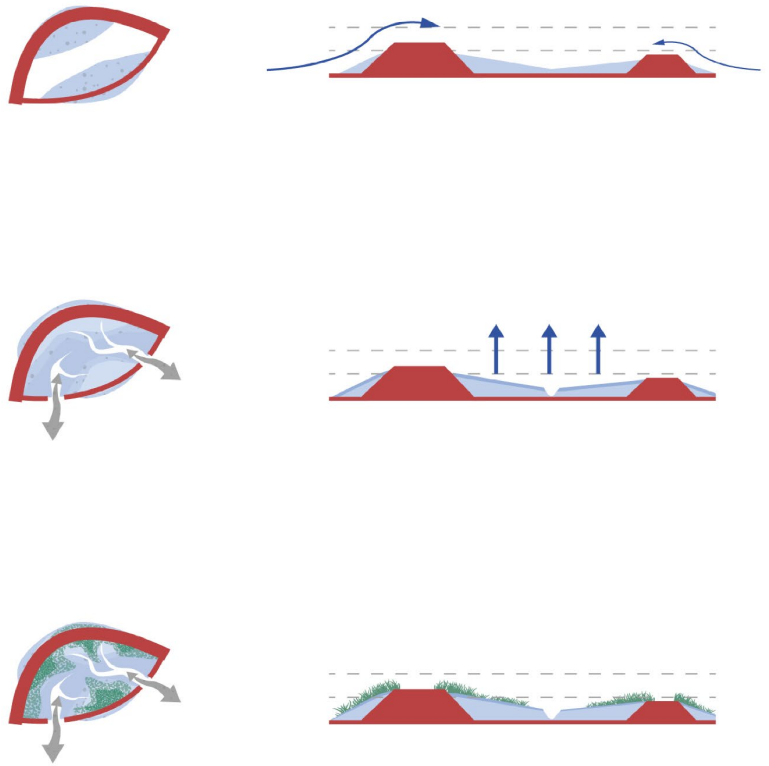
0 500 1000m

Design Zoom-in 1

Bio-based breakwaters



Bio-based breakwaters



Harnessing the transformative power of water

Existing

Year 0

Year 3

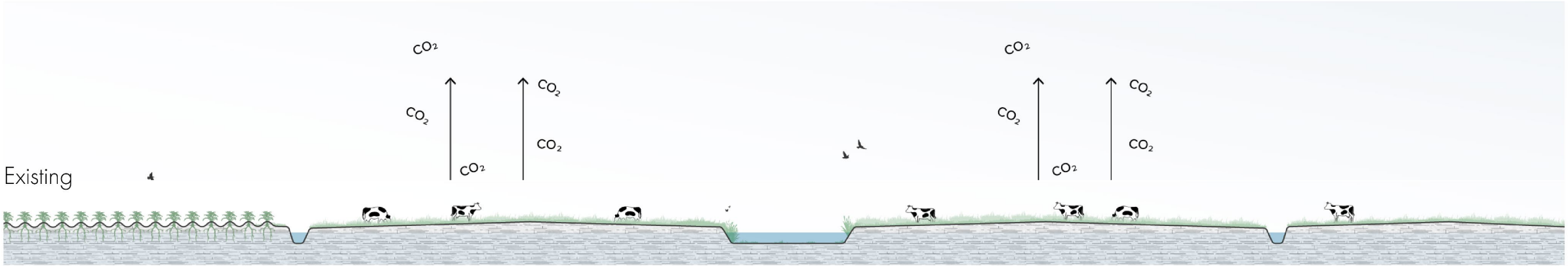
Year 8

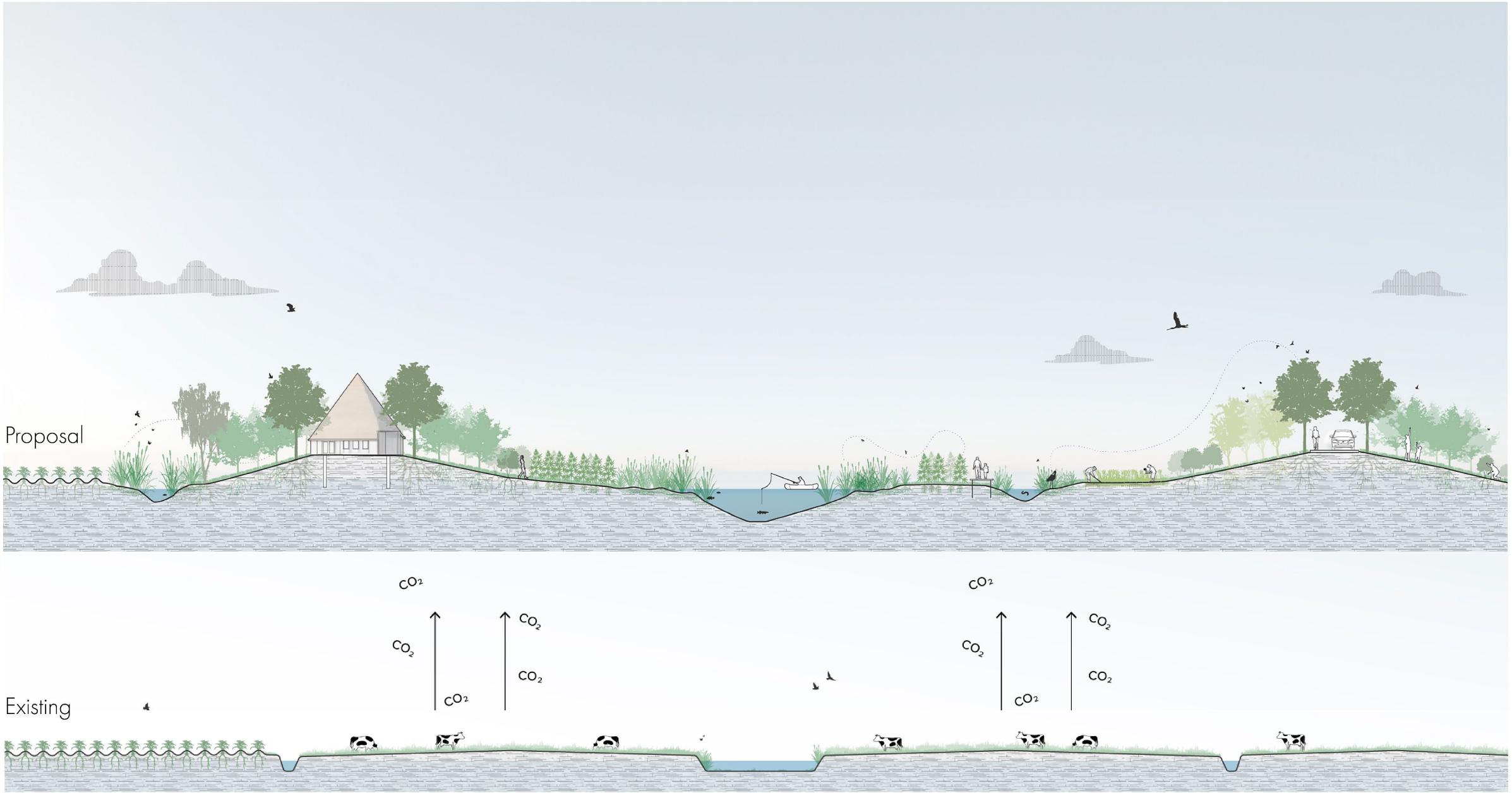
Year 15

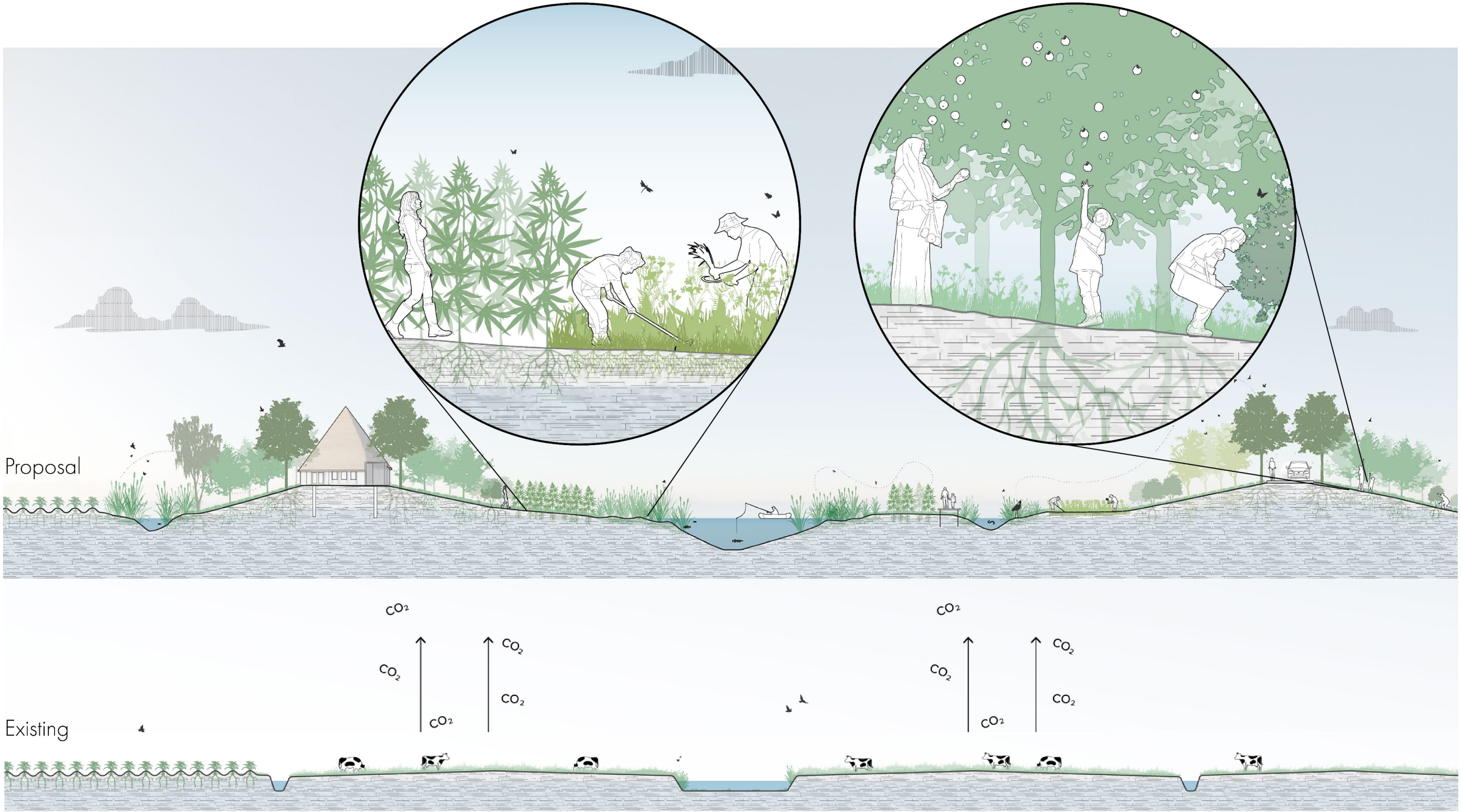
Year 25

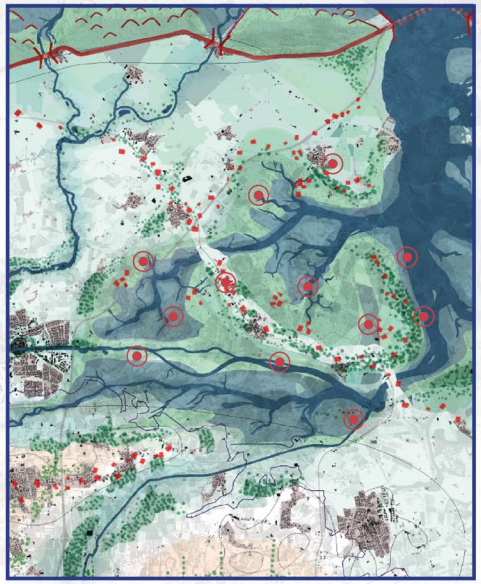
New life in the historic creeks

Existing




Proposal
Existing
CO2
CO2
CO2
CO2
CO2
CO2
CO2
CO2
CO2


Proposal
Existing
CO2
CO2
CO2
CO2
CO2
CO2
CO2
CO2
CO2



Living Lauwersmeer

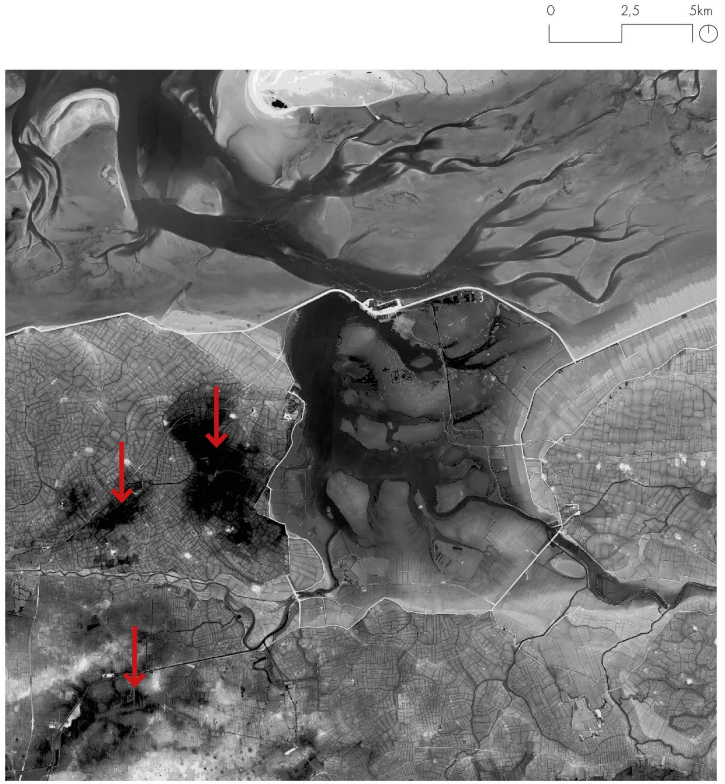
Living with the tides

Living Lauwersmeer

Zoom-in 2

Lauwersmeer, an historic inland sea was closed in 1969

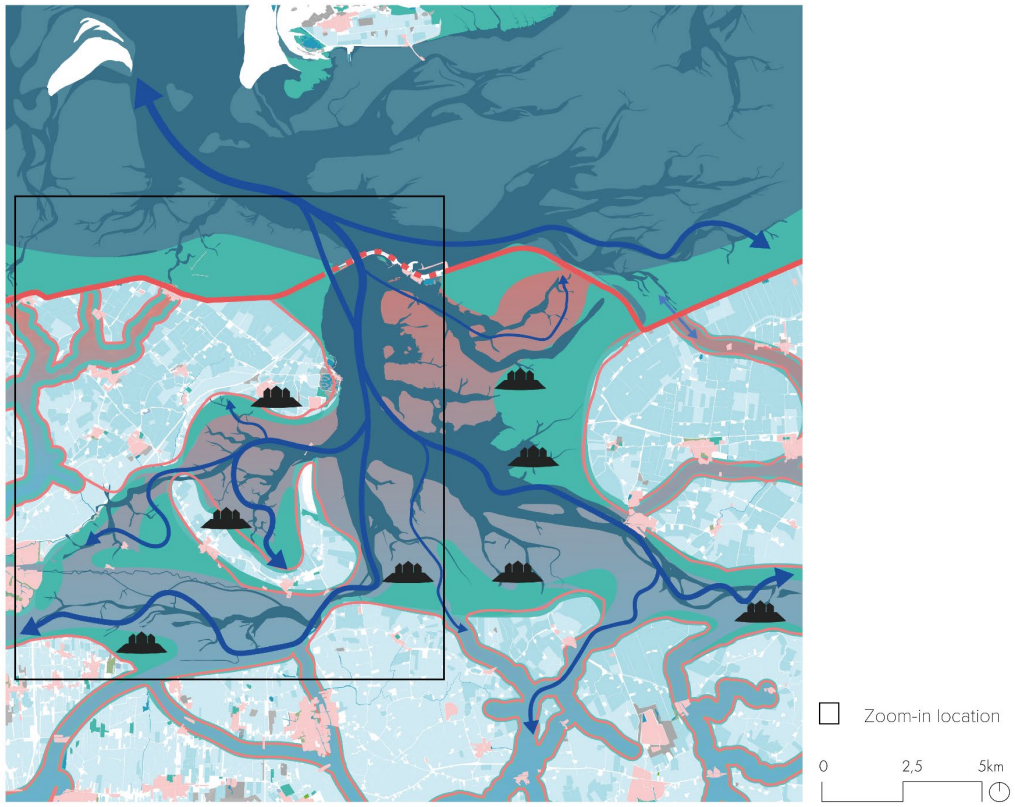
Loss of dynamic estuarine processes, cultural heritage and important nature areas of the Wadden Sea



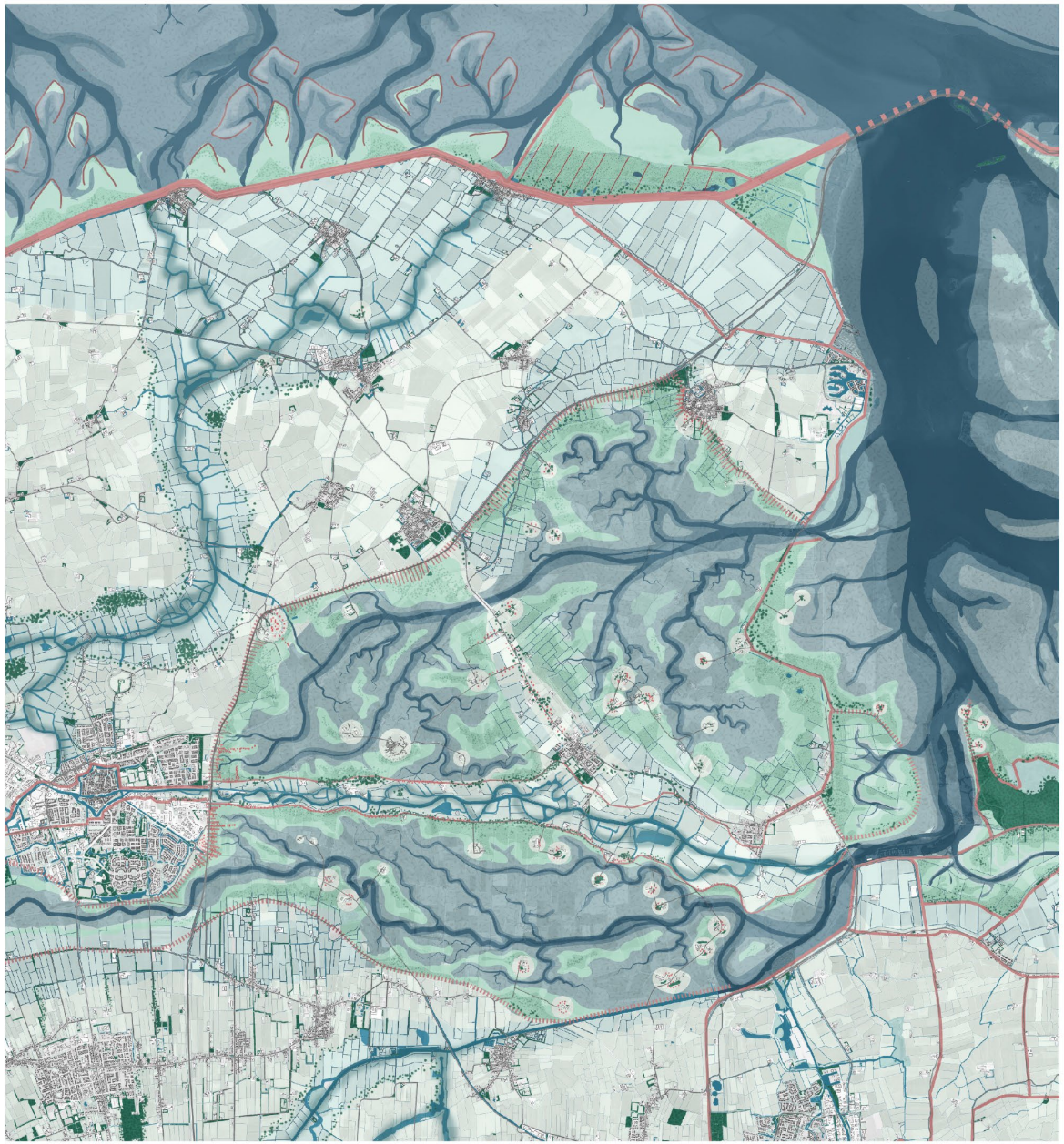
Progressive subsidence of the inland polders, increasing saline seepage and overall flood risk

Living Lauwersmeer

Zoom-in 2



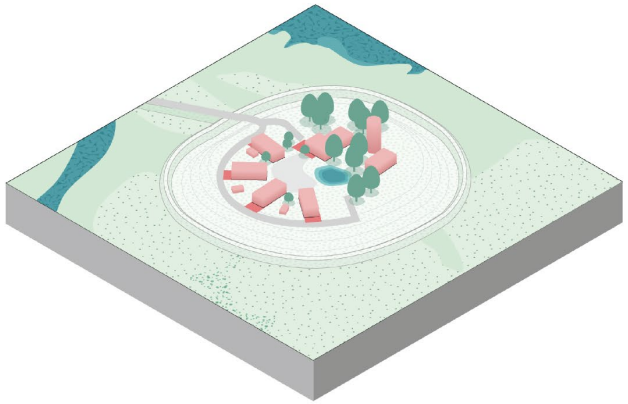
Living with the tides

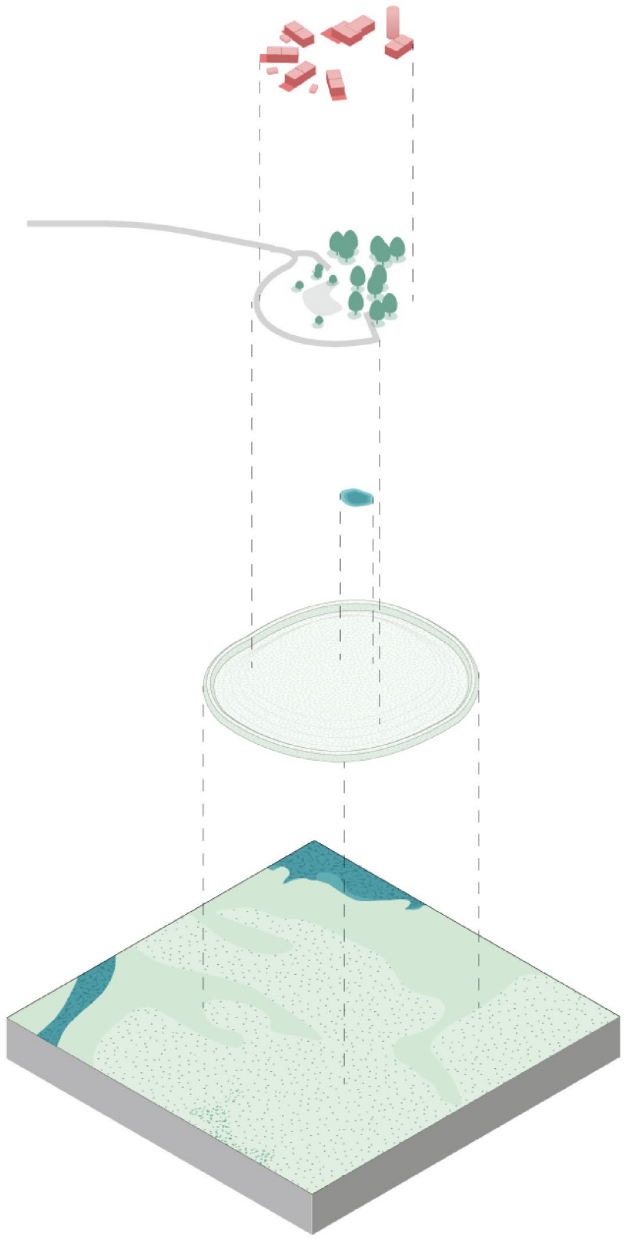

0
1
2km

Existing

Proposal

Living with the tides on terp villages





Private

Houses and their terraces

Collective

Courtyard and pathways

Collective

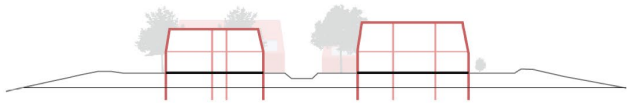
Fresh water infiltration pond

Collective

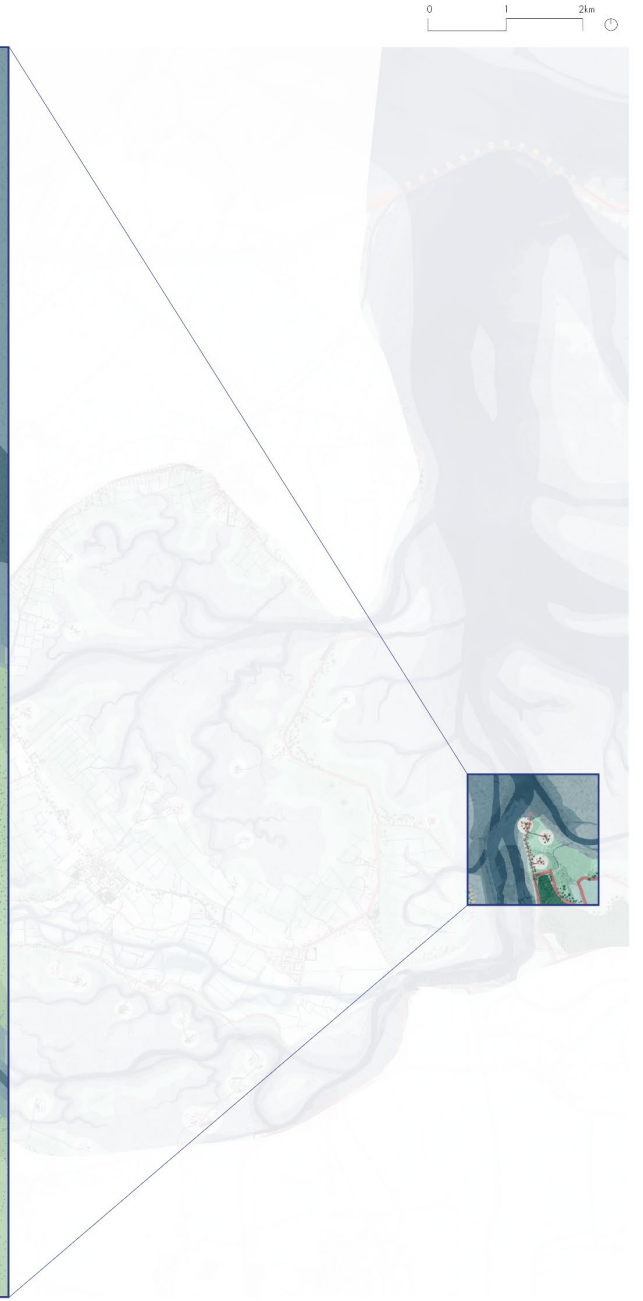
Dwelling mound & ring dike

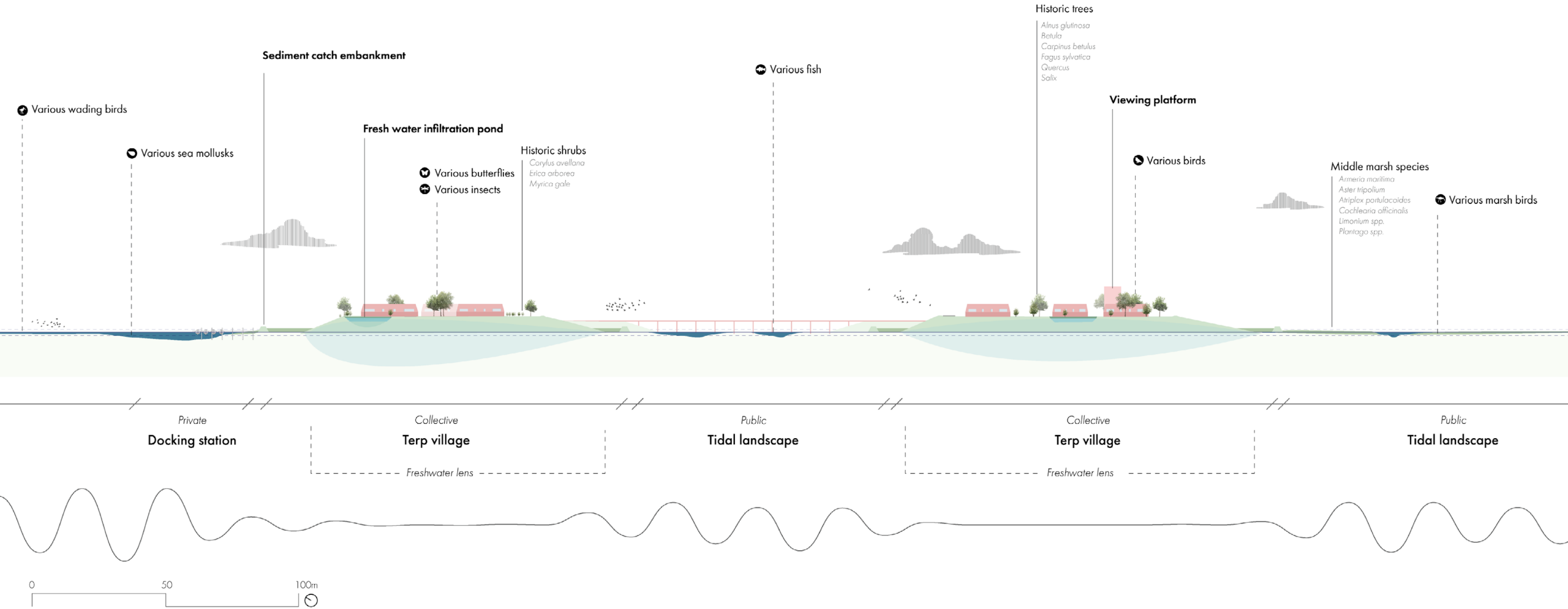
Public

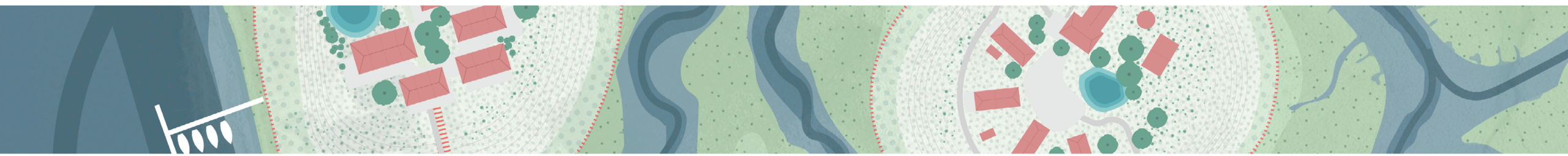
Marshland

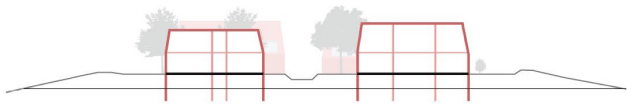


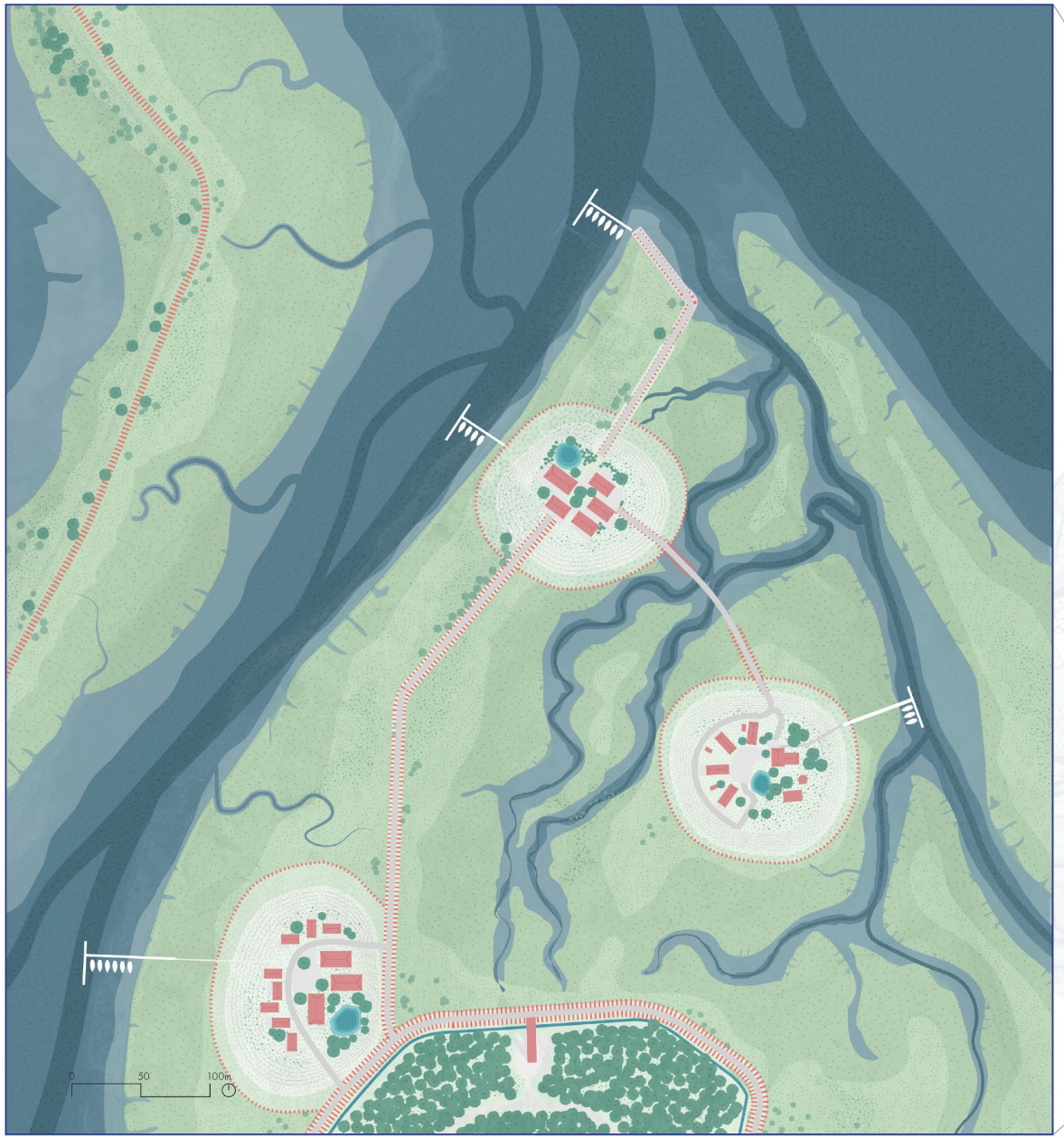

0
50
100m

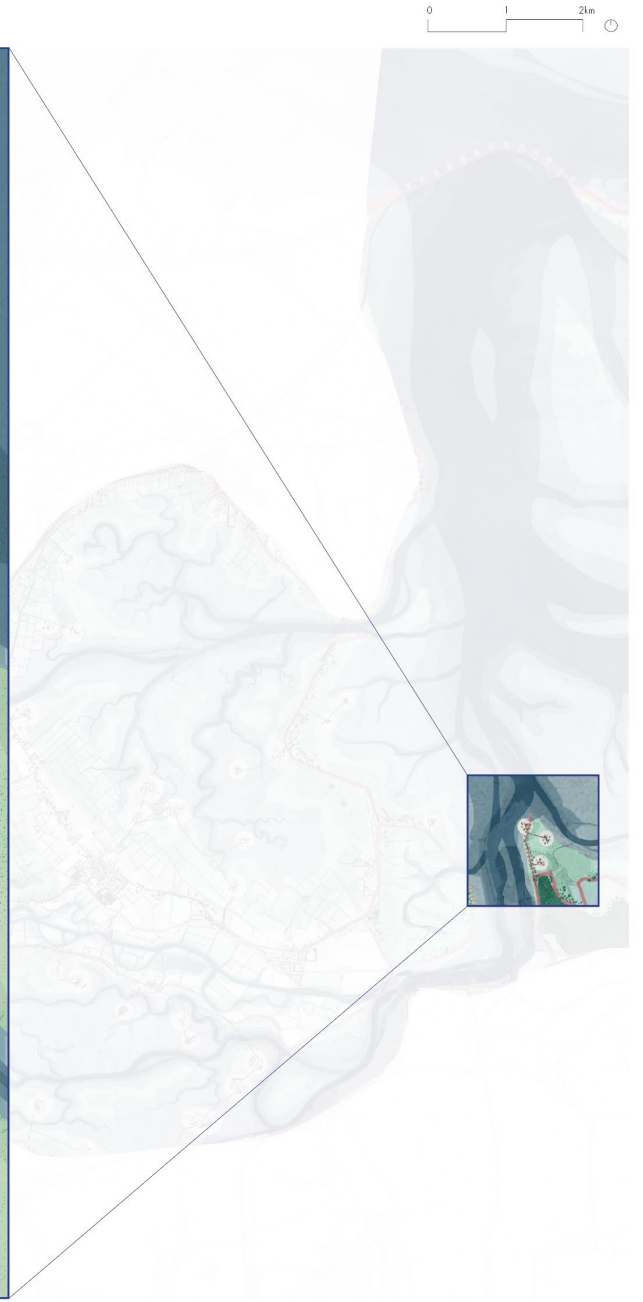

0
1
2km

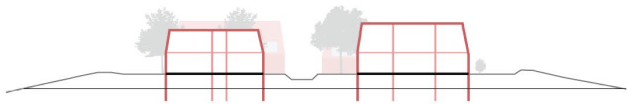

Historic trees
Alnus glutinosa
Betula
Carpinus betulus
Fagus sylvatica
Quercus
Salix
Sediment catch embankment
Various fish
Viewing platform
Various wading birds
Fresh water infiltration pond
Historic shrubs
Corylus avellana
Erica arborea
Myrica gale
Various sea mollusks
Various butterflies
Various insects
Various birds
Middle marsh species
Armeria maritima
Aster tripolium
Atriplex portulacoides
Cochlearia officinalis
Limonium spp.
Plantago spp.
Various marsh birds
Private
Docking station
Collective
Terp village
Freshwater lens
Public
Tidal landscape
Collective
Terp village
Freshwater lens
Public
Tidal landscape
0
50
100m



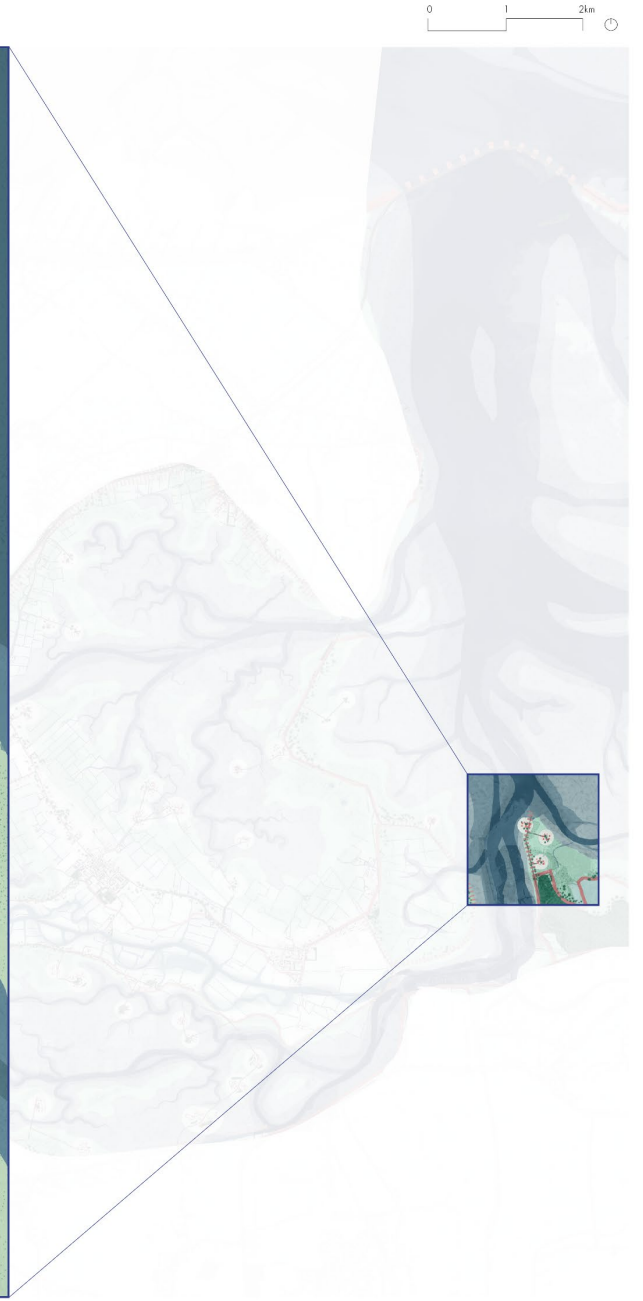


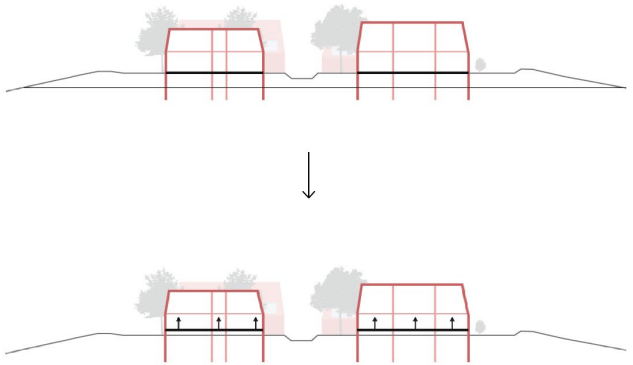

0
50
100m


0
1
2km

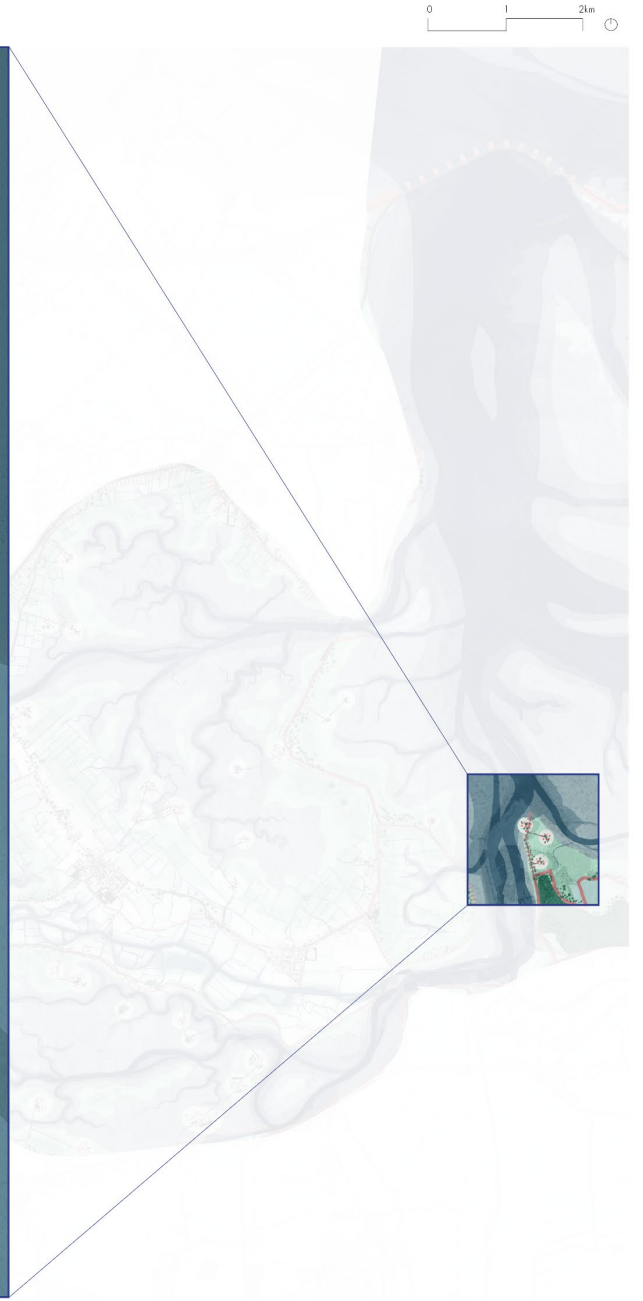


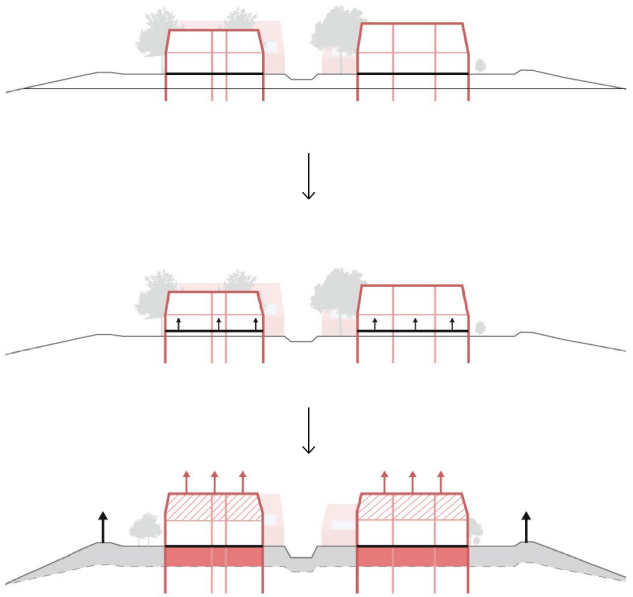

0
50
100m


0
1
2km

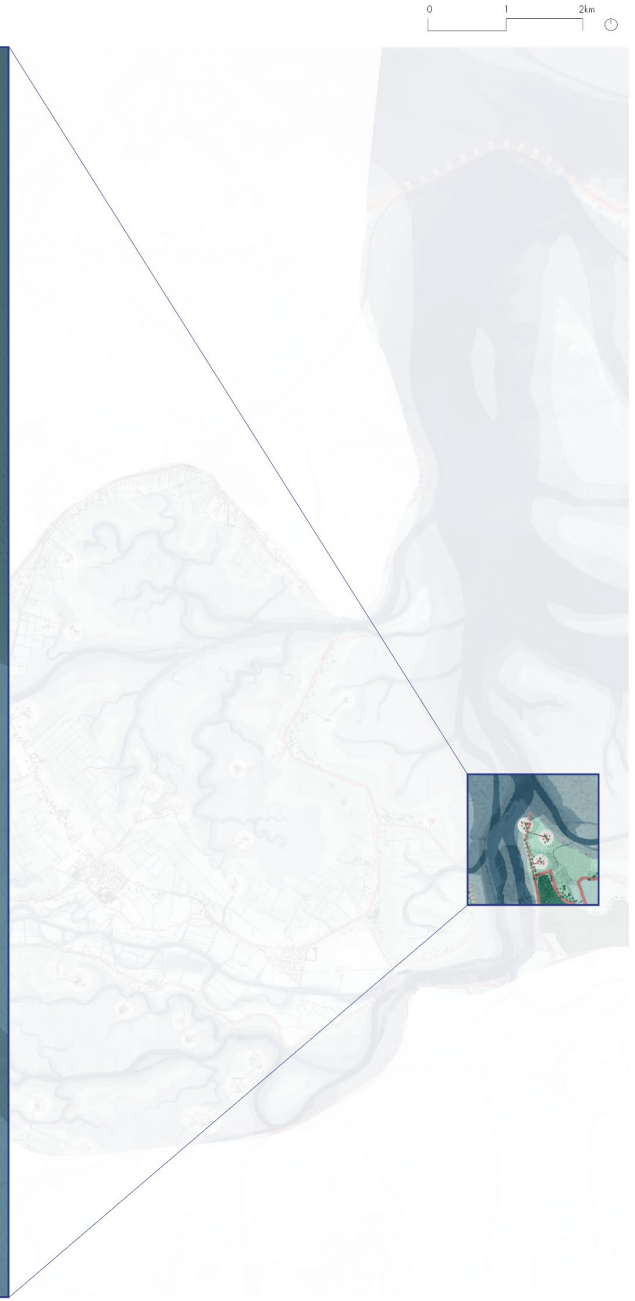


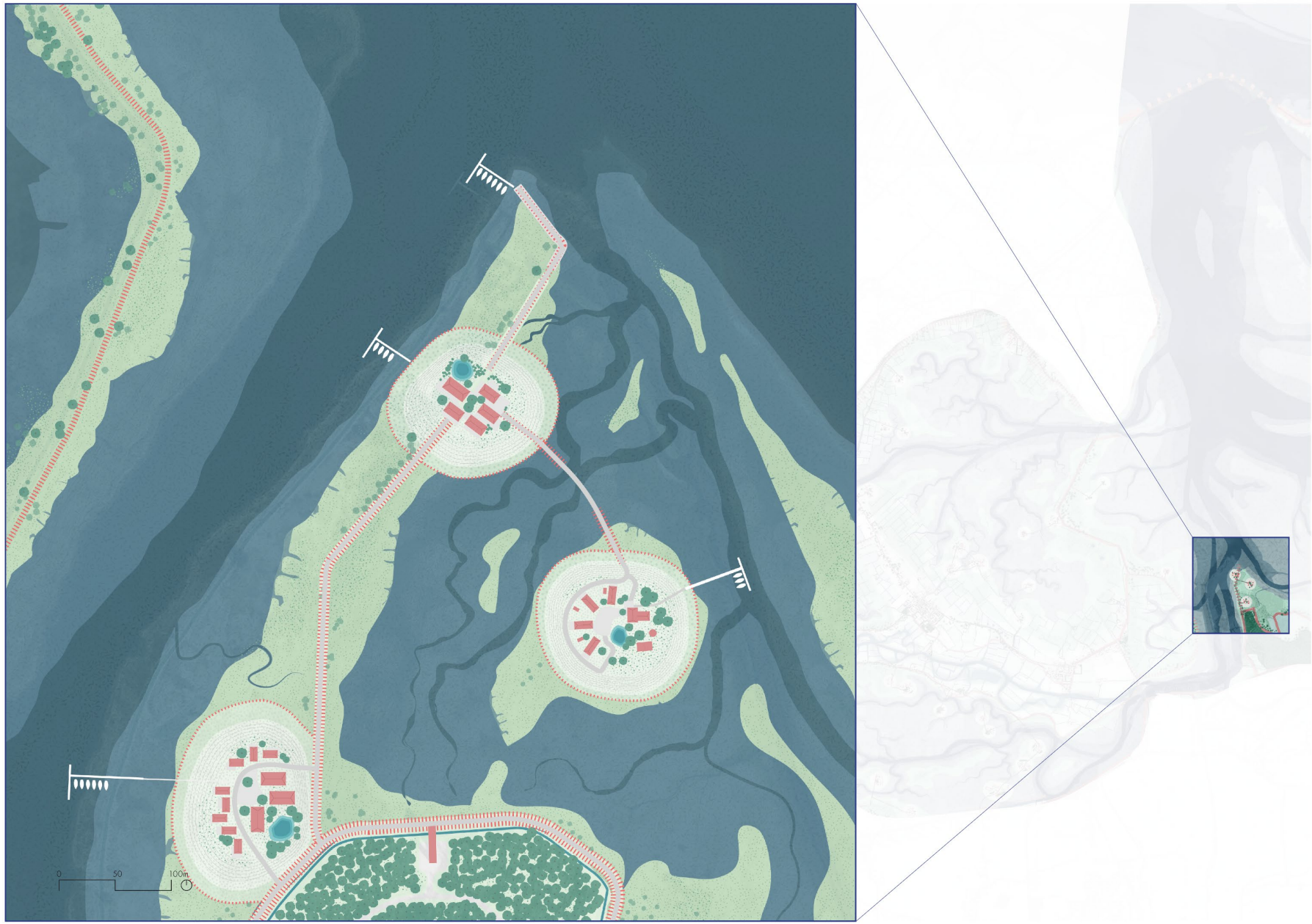

0
50
100m

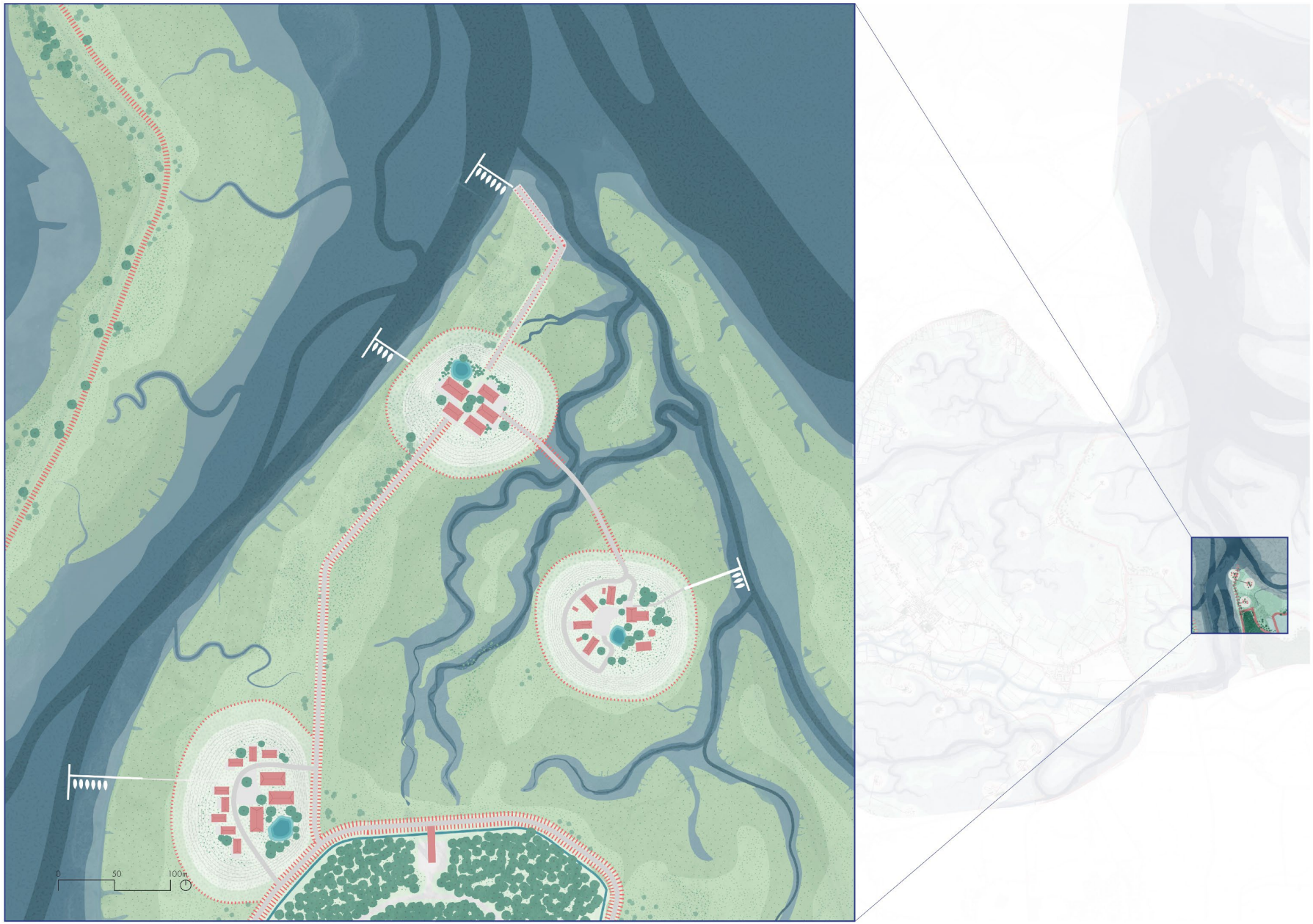

0
1
2km

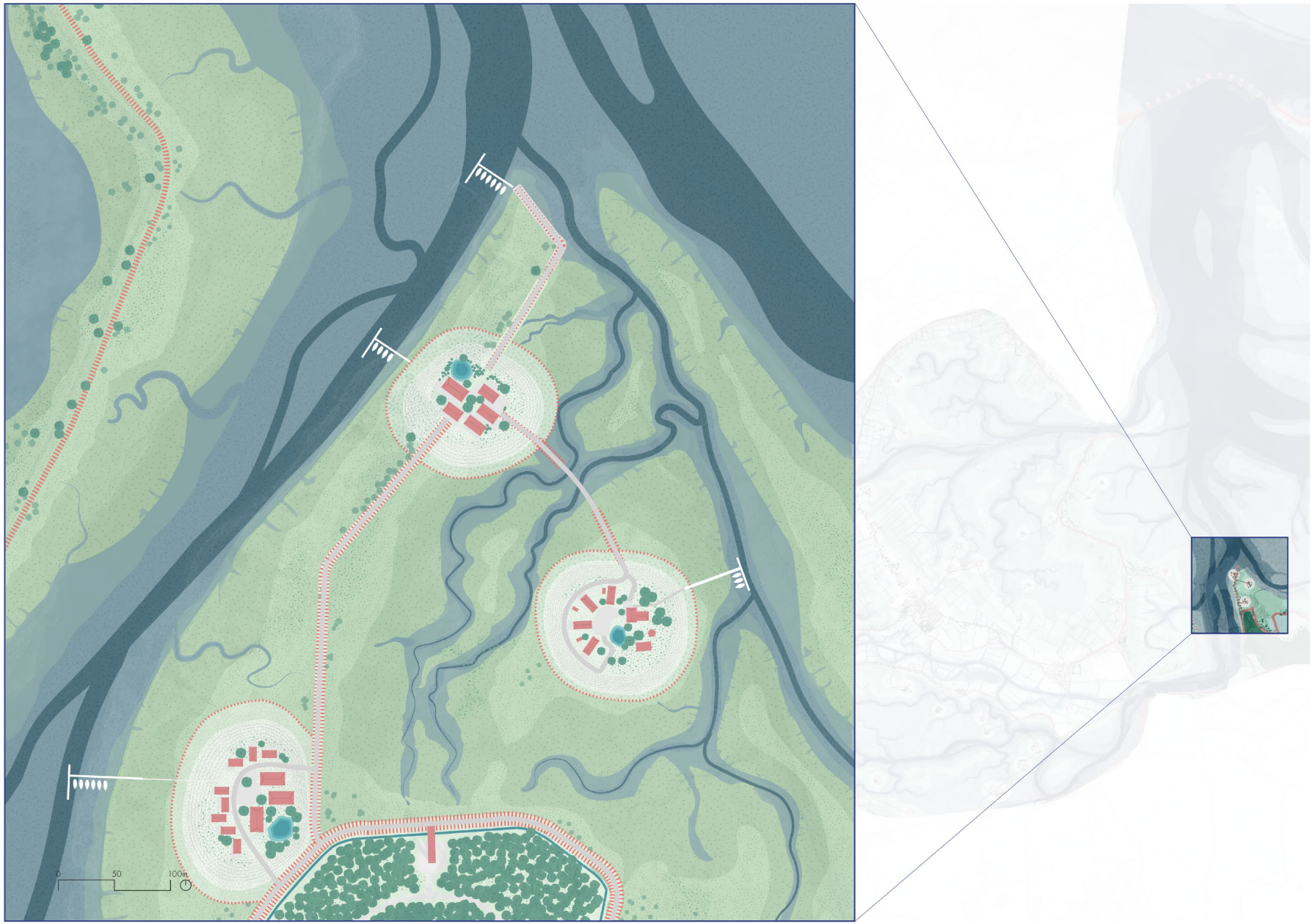


Distant future

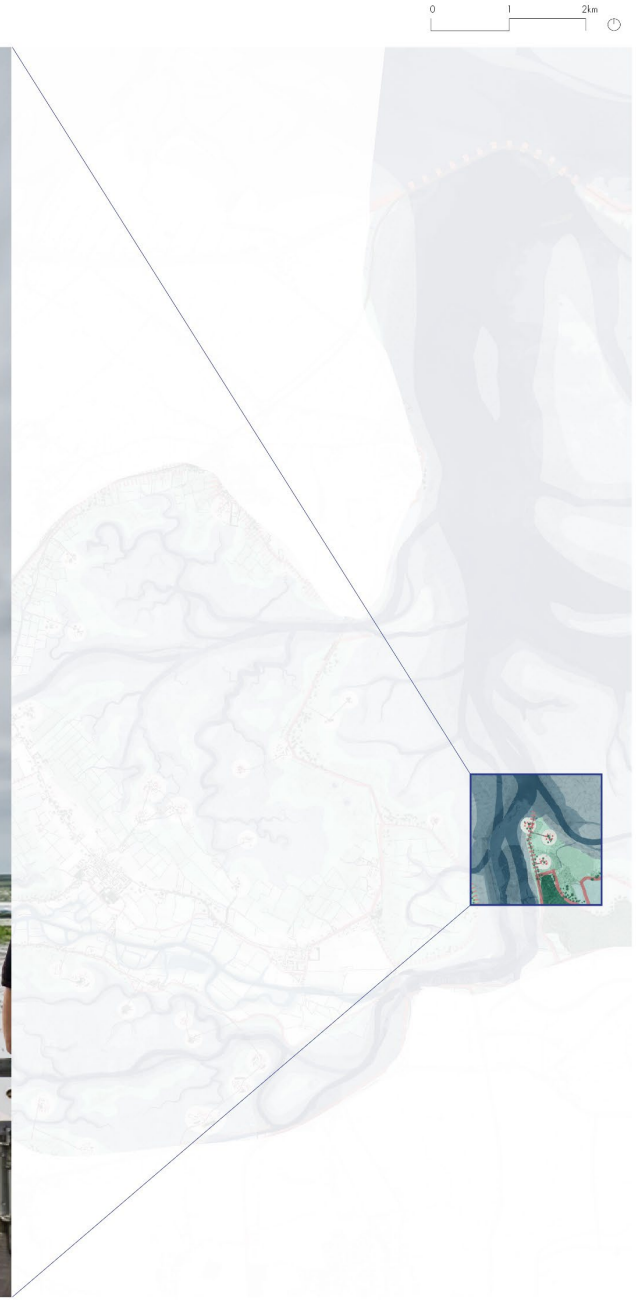



0
50
100m
0
1
2km


0
50
100m
0
1
2km


0
50
100m
0
1
2km

Existing



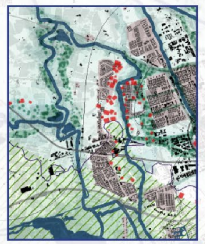
Dokkum at sea

Existing

Dokkum at sea

Existing

Proposal



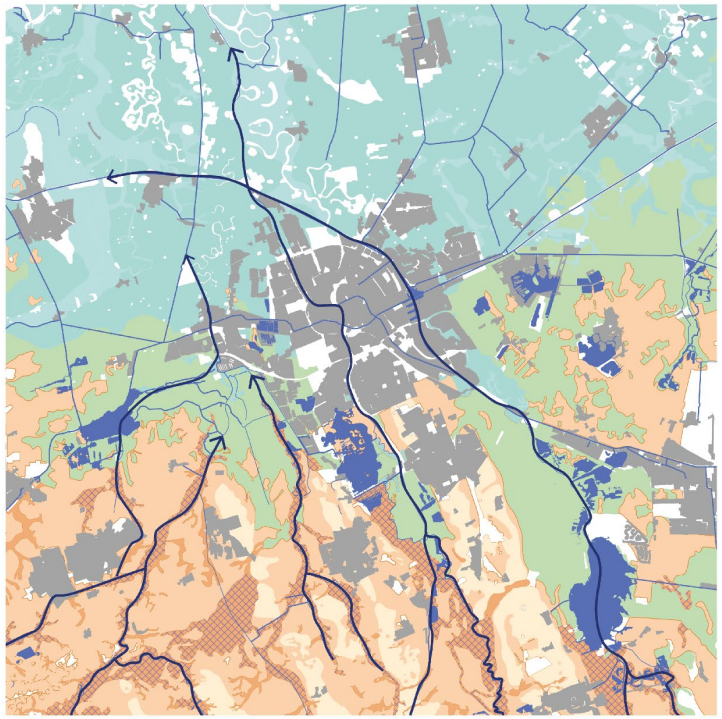
The urban flood fringe

Integrating water, nature and living at the urban fringe

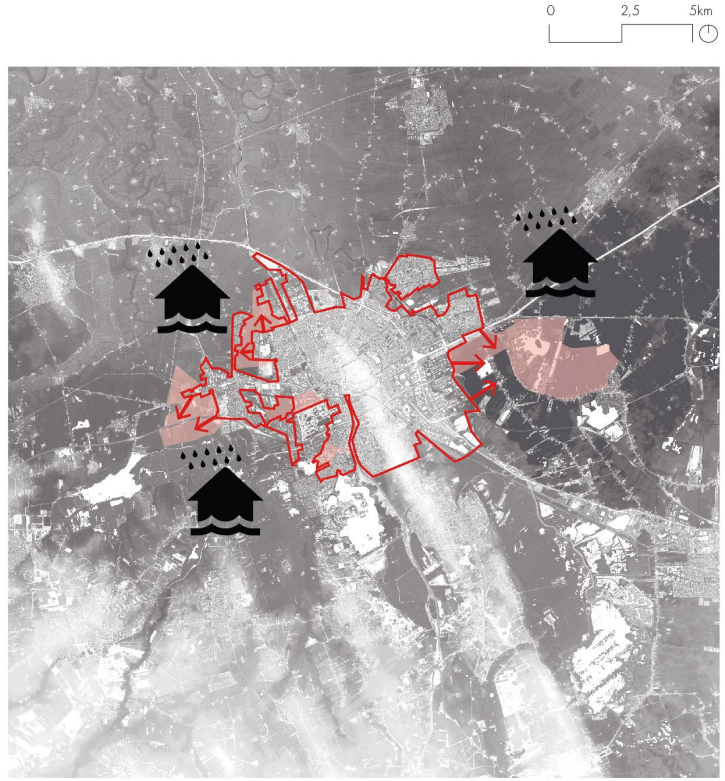
The urban flood fringe

Zoom-in 3

The city of Groningen



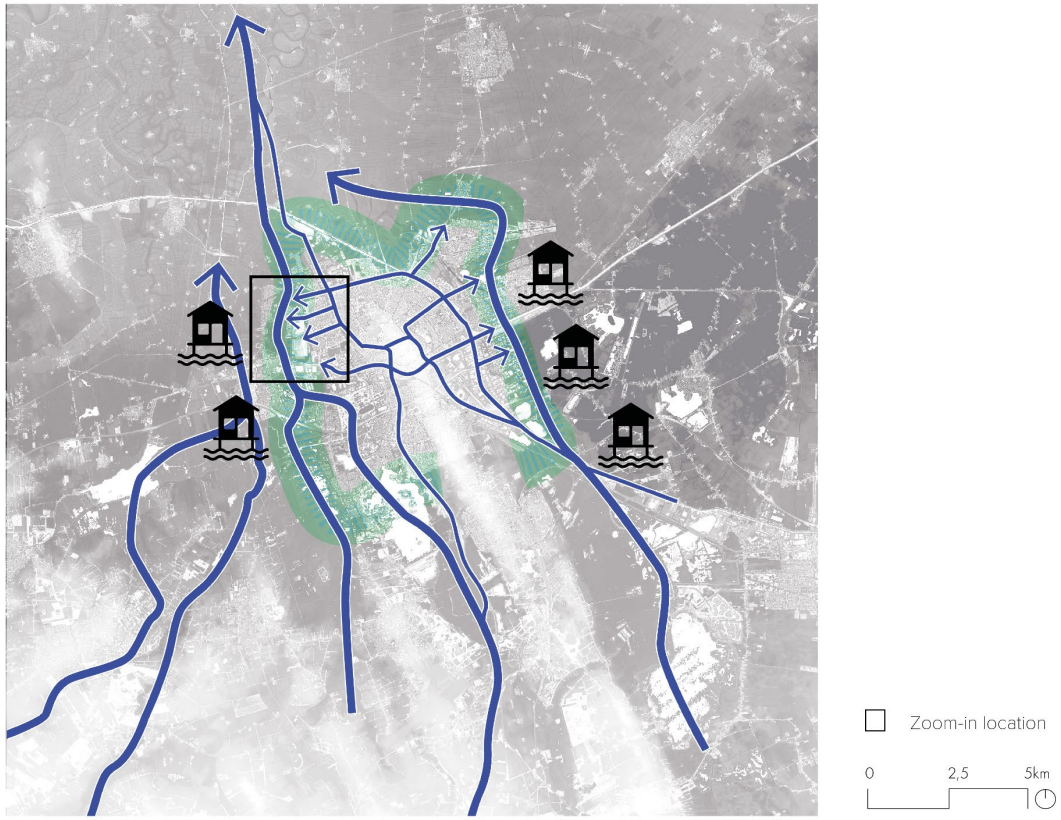
Transition zone between elevated moraine sand ridge and lower-lying peat and sea clay soils



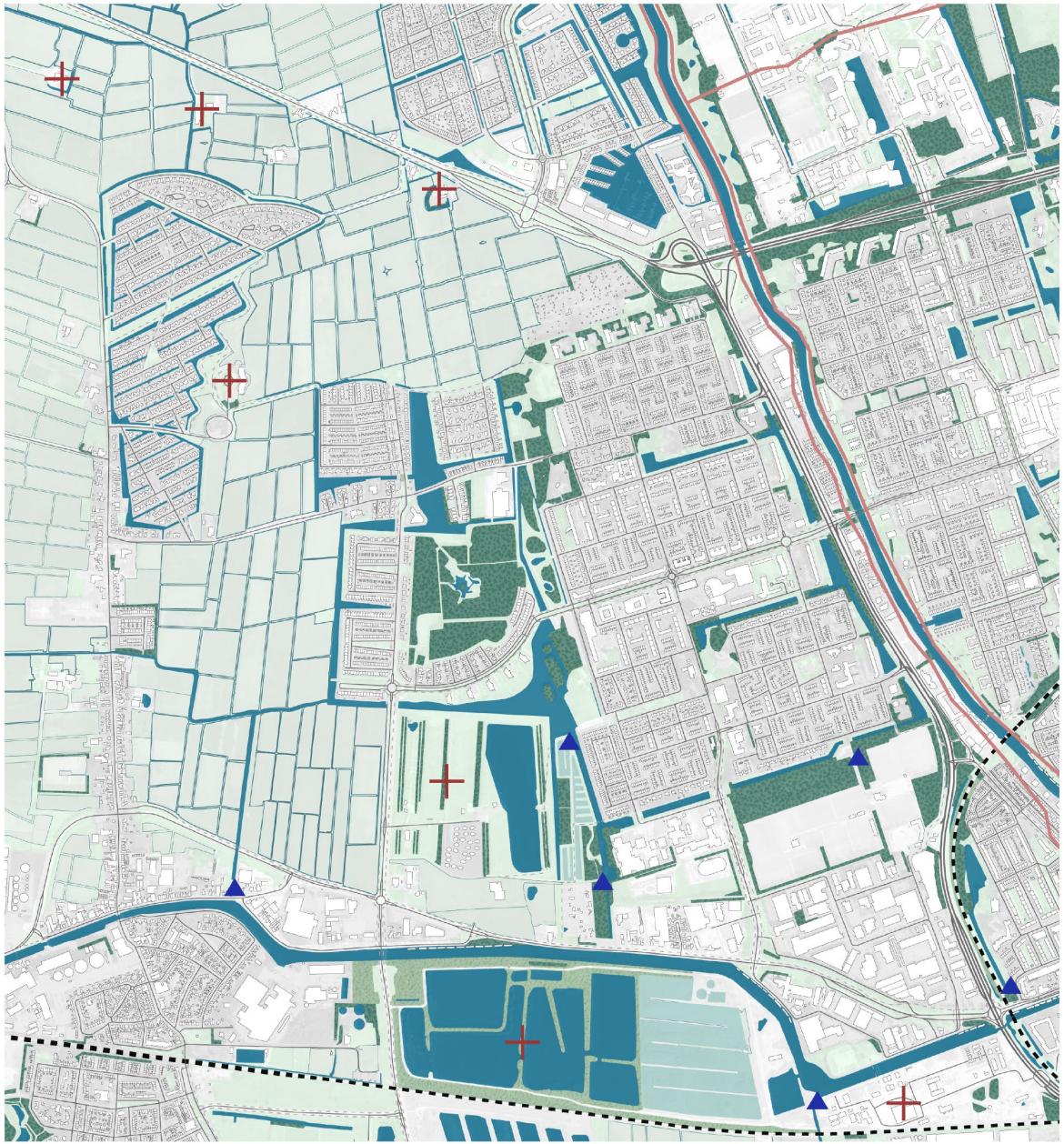
Urban sprawl into flood risk zones

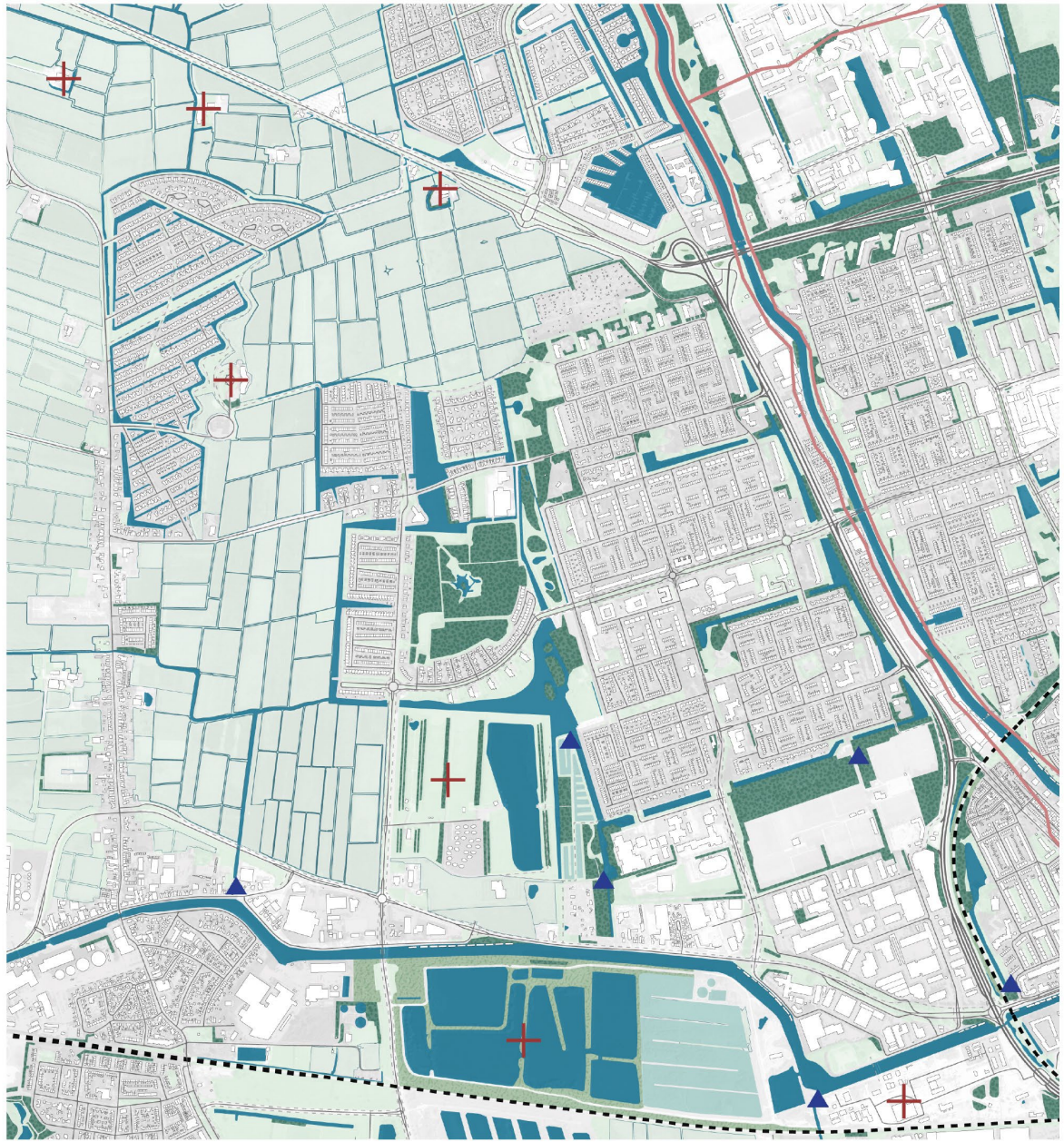
The urban flood fringe

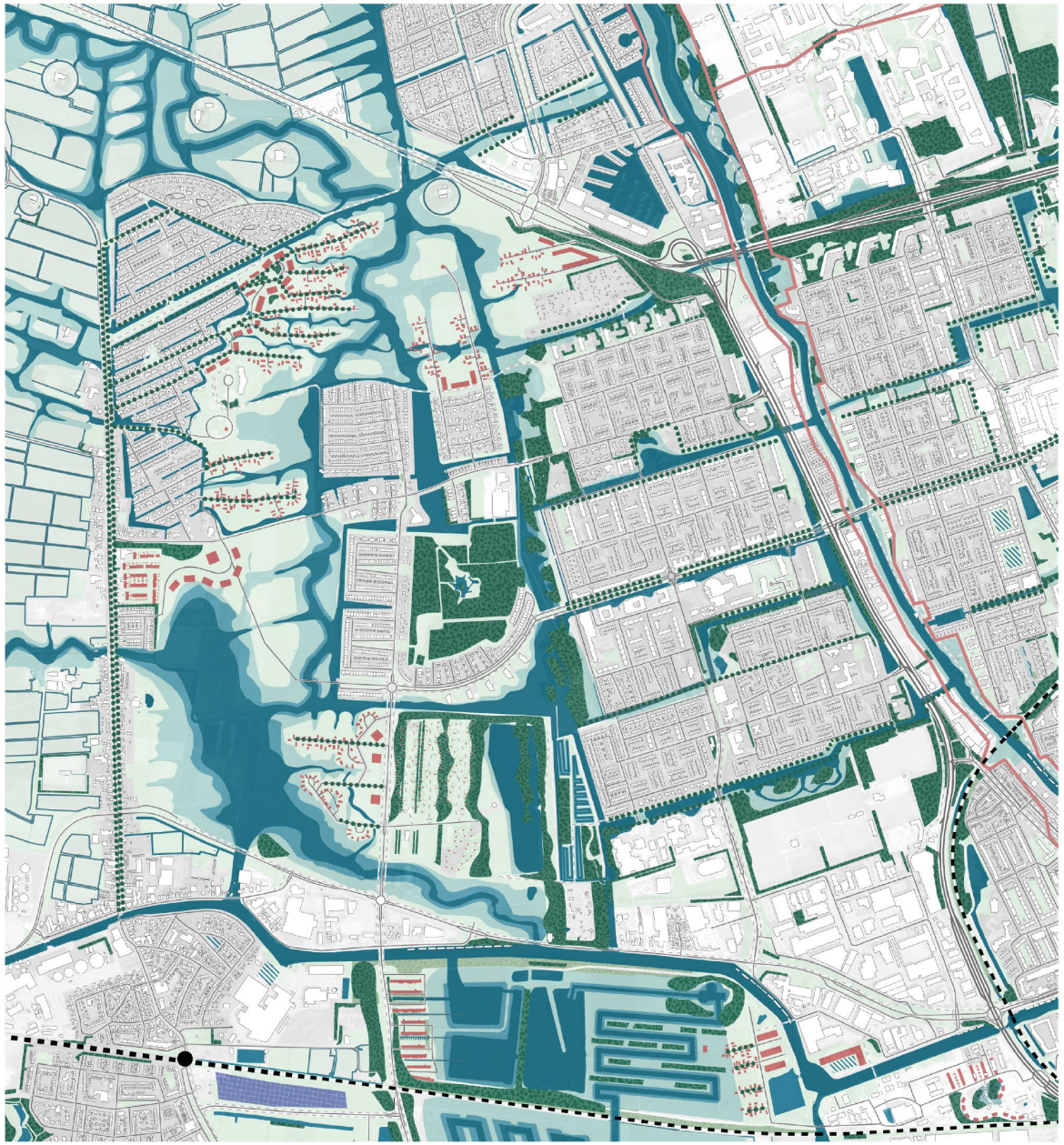
Zoom-in 3



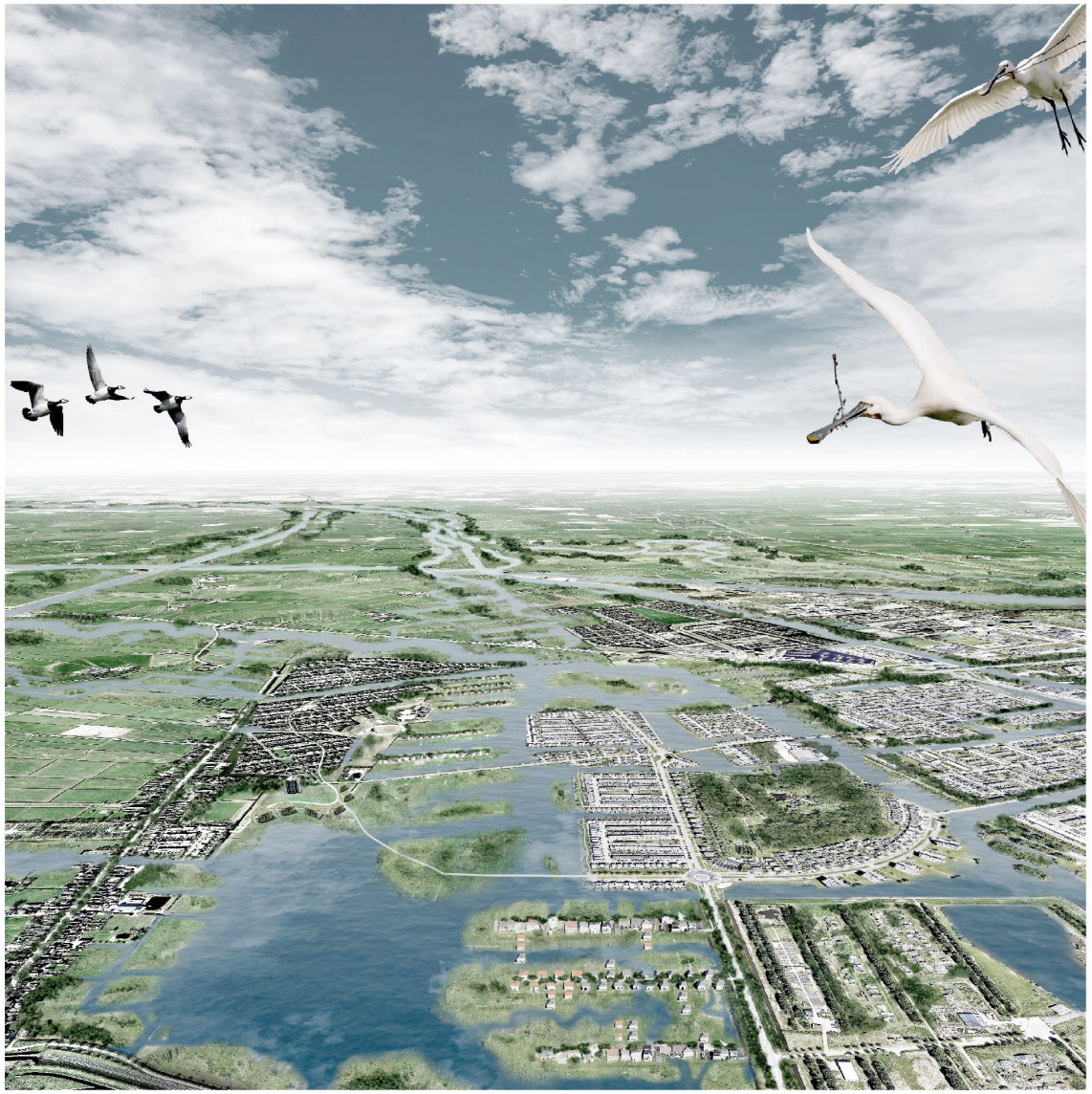
Integrating water, nature and living at the urban fringe



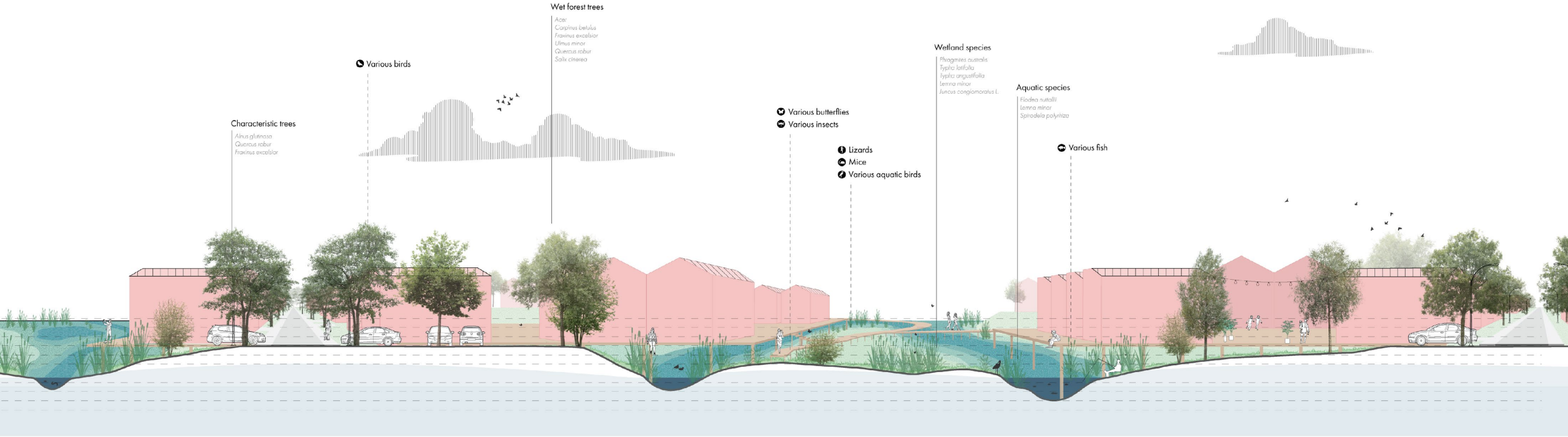



0
250
500m

Existing



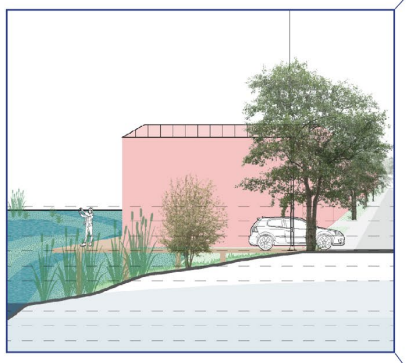
Proposal

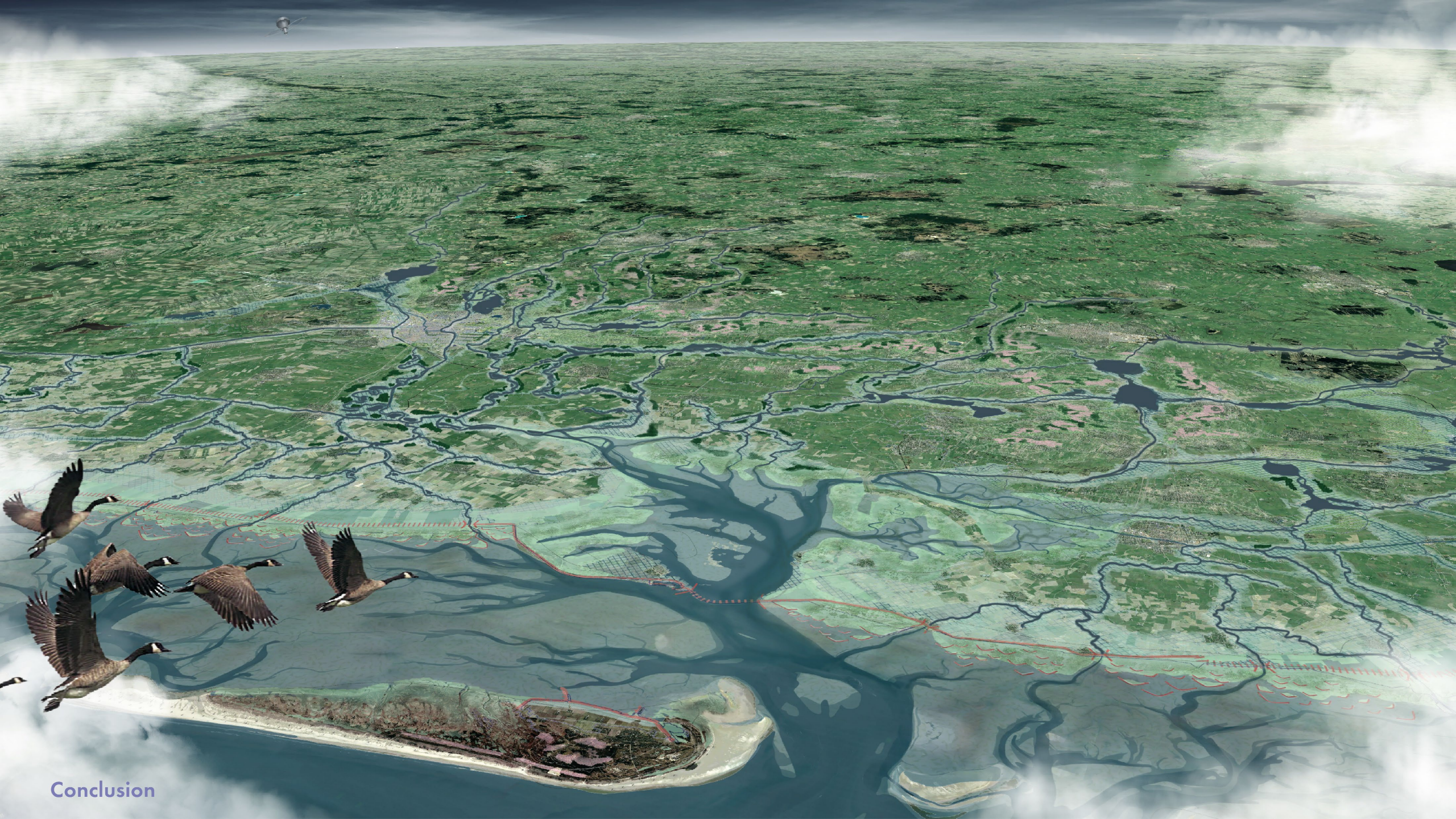


Public	Private	Public	Private	Collective	Private & collective	Public	Private	Collective	Public
Wetland	Housing & terraces	Levee street	Housing	Extending levee	Housing & community space	Wetland	Housing & terraces	Community space	Levee street

0 5 10m

Living in the urban wetland





Conclusion

Research objective

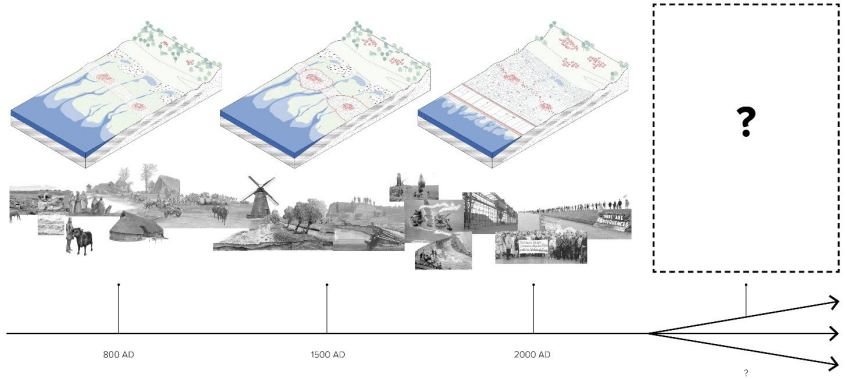
To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region

To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region

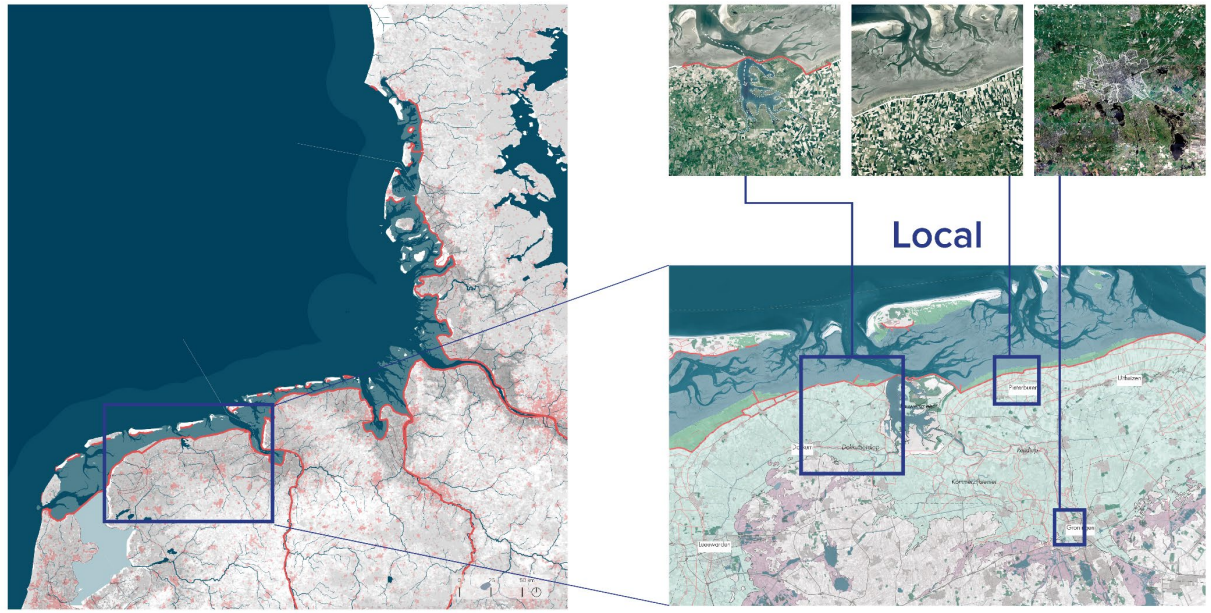
To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region

RQ1

Understanding the interface



History



Systemic

Regional

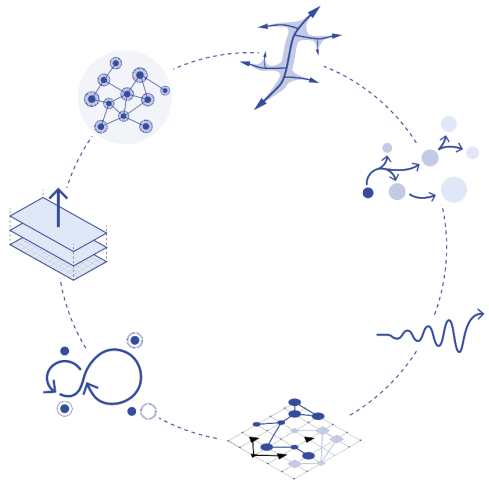
To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region

RQ1

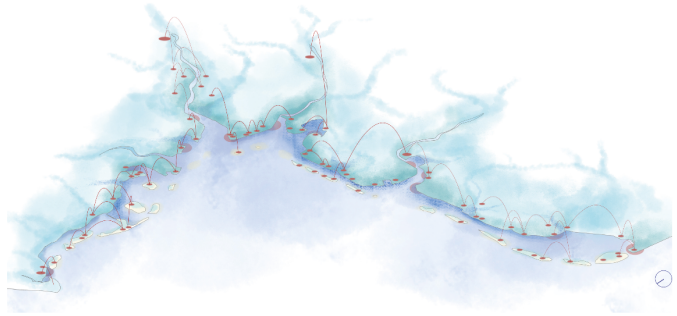
Understanding the interface

RQ2

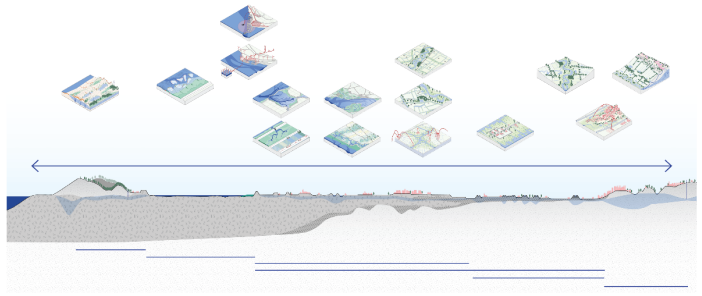
Identifying interface design strategies & principles



Theoretical guidelines



Systemic strategy



Operational interface principles

To explore the potential of a **landscape-based design strategy** for creating a **resilient dynamic coastal interface** for the Wadden Sea Region

RQ1

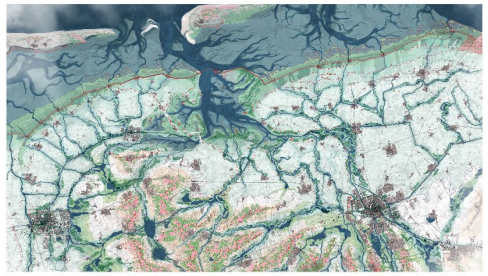
Understanding the interface

RQ2

Identifying interface design strategies & principles

RQ3

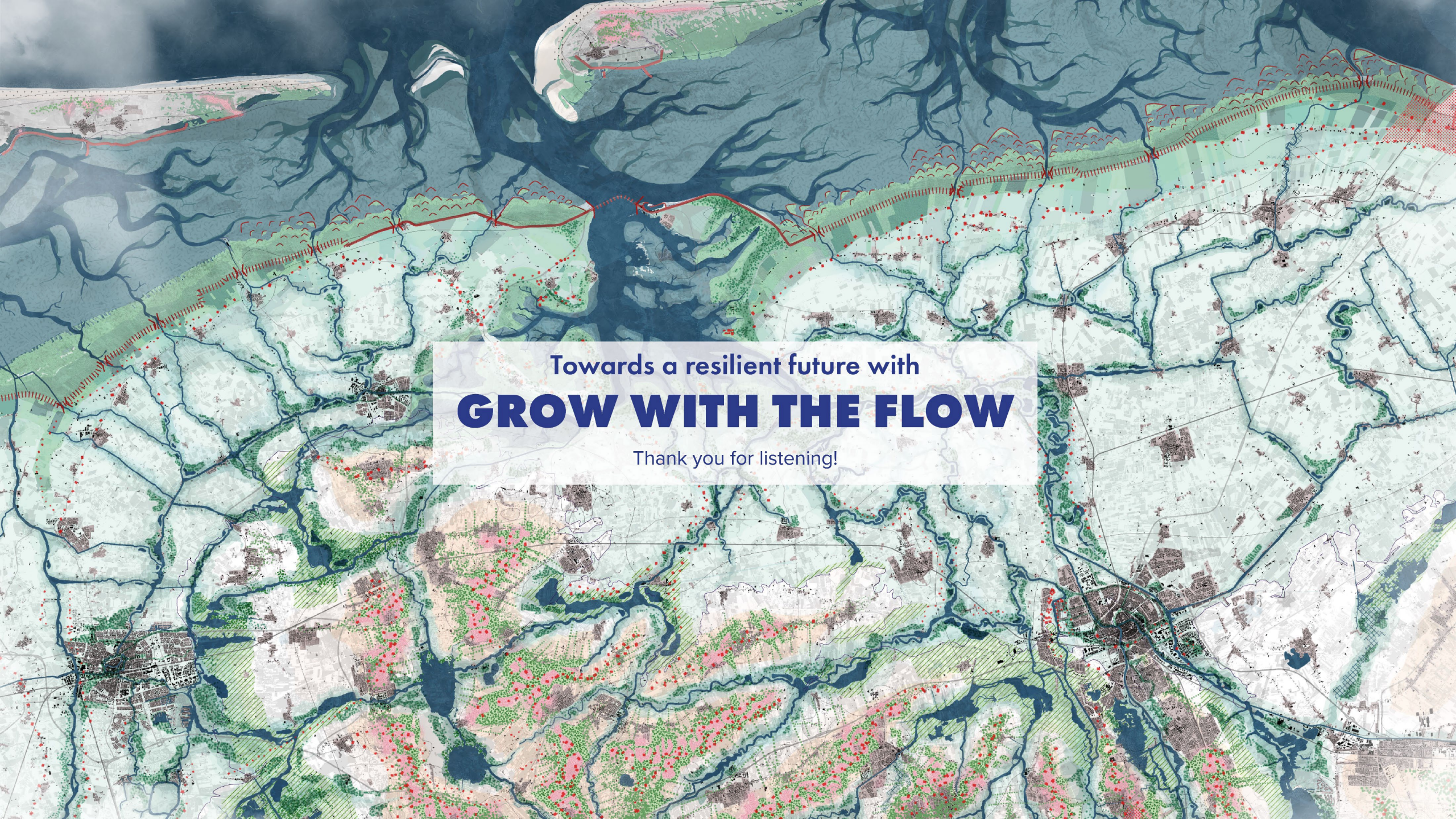
Designing the interface



Regional design strategy

3 local design zoom-ins

Numerous experiences along the new interface


Towards a resilient future with
GROW WITH THE FLOW
Thank you for listening!