



BETWEEN LAND & SEA

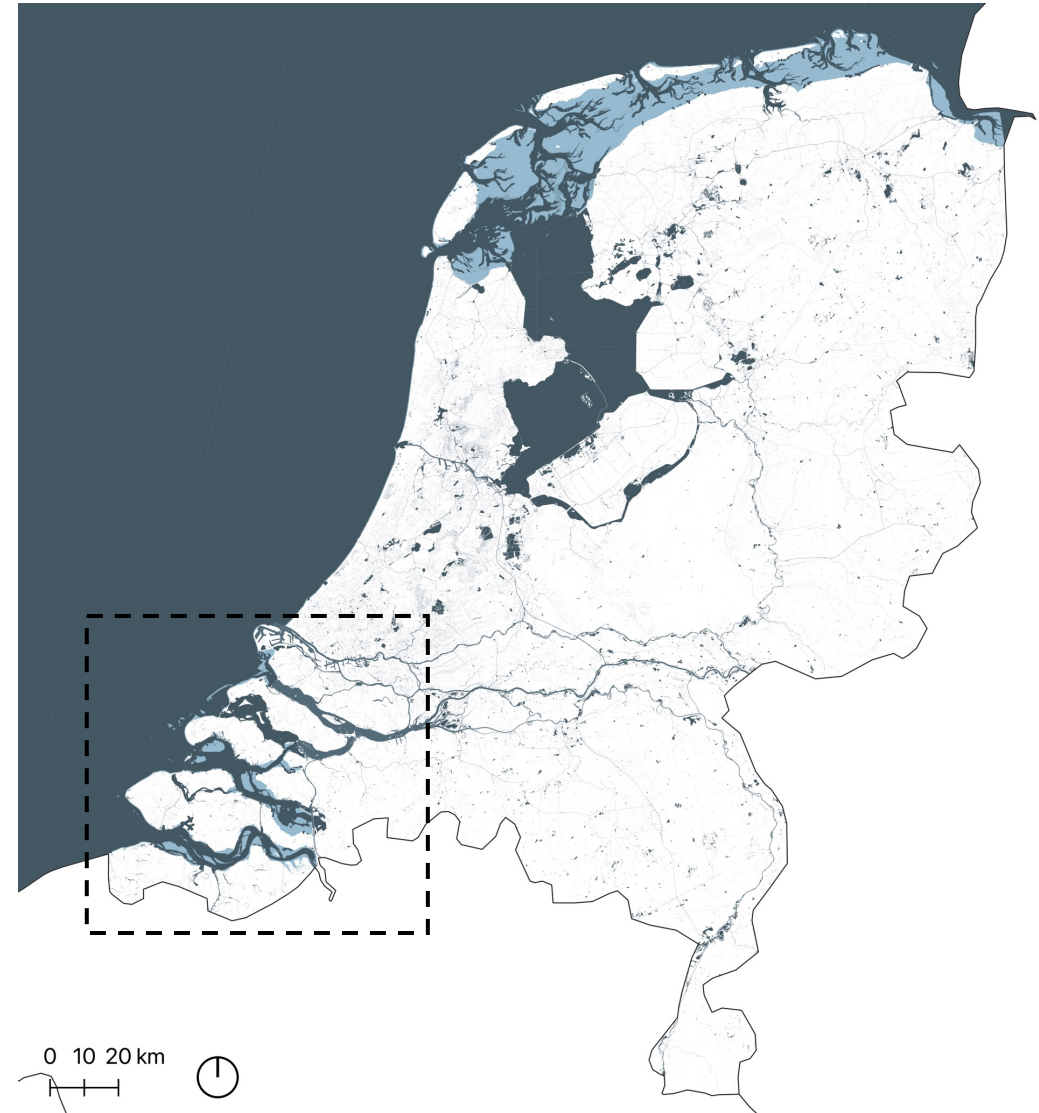
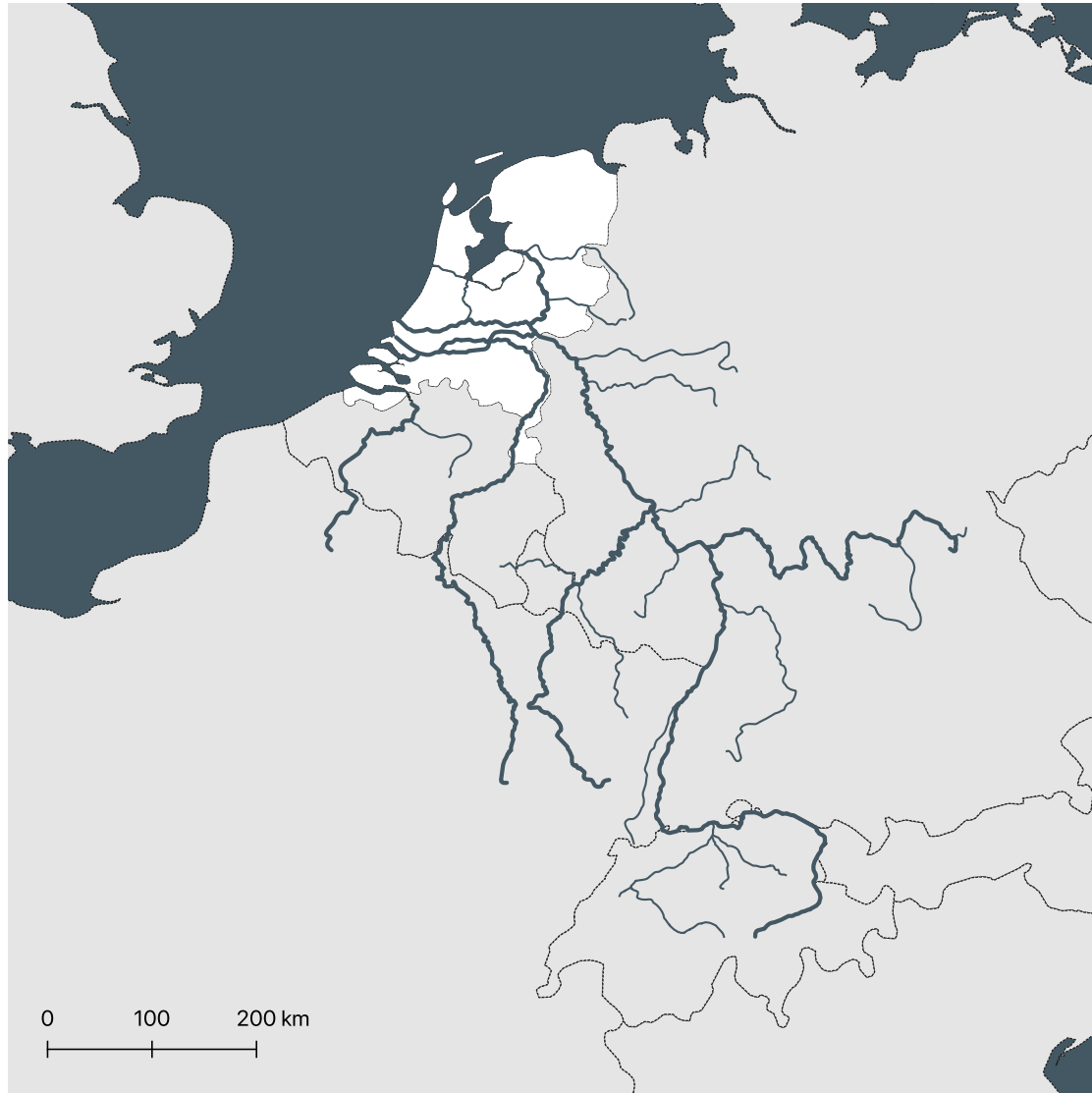
Building with nature to sustain, secure and live
on a sustainable Schouwen-Duiveland

FROUKJE OTTEMA

Studio: Metropolitan ecologies of places

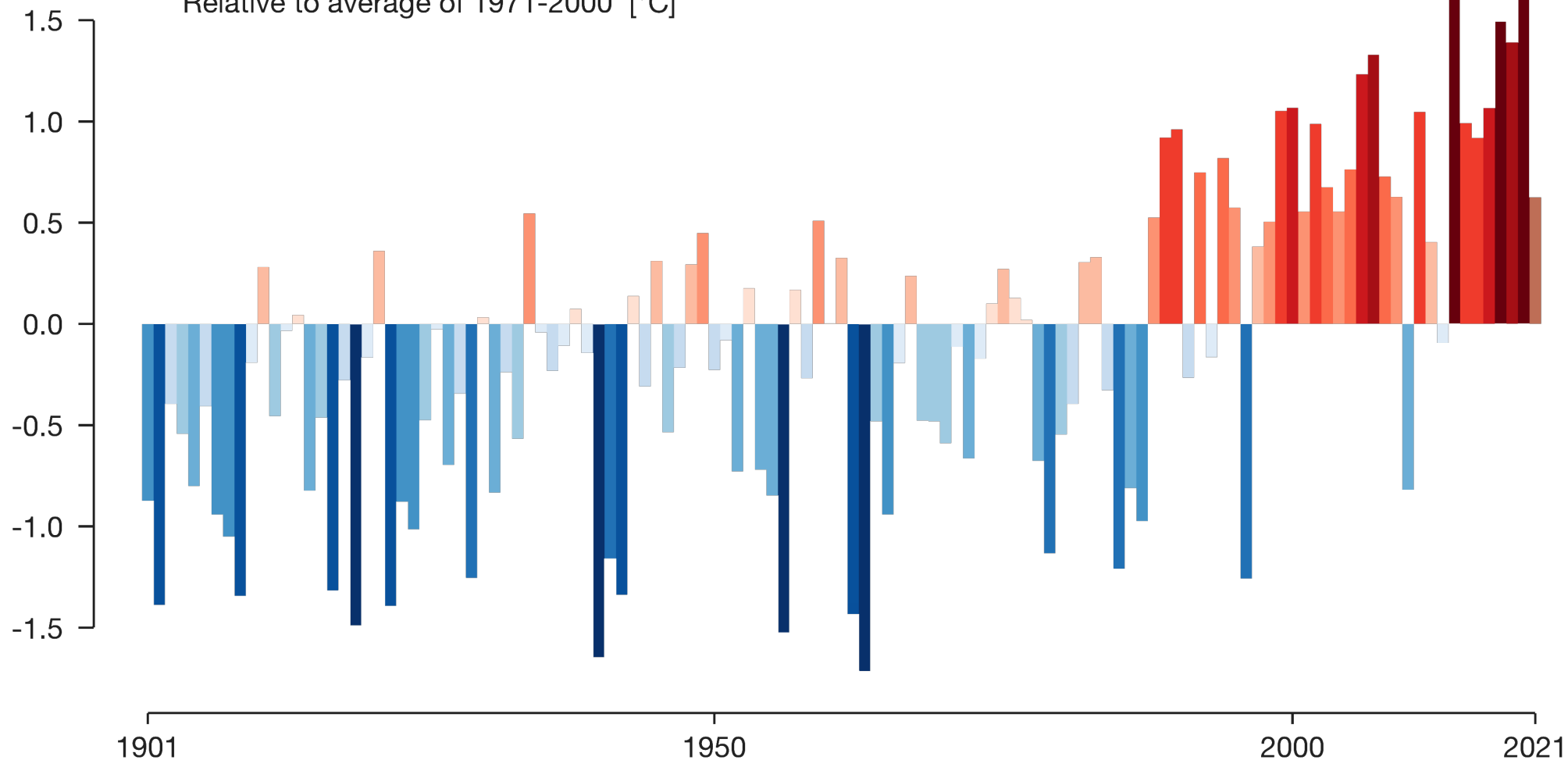
First mentor: Arjan van Timmeren

Second mentor: Nico Tillie

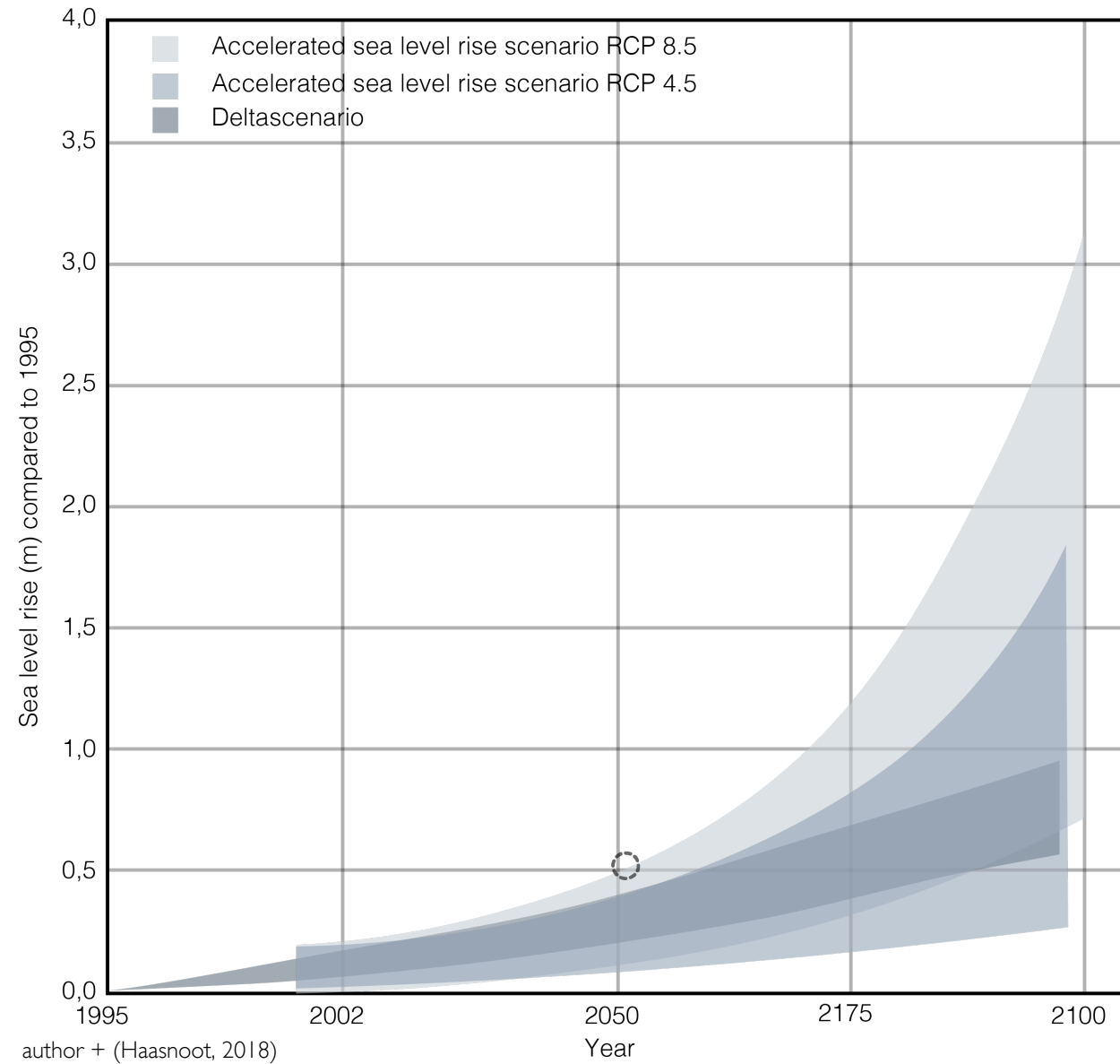


Temperature change in Netherlands

Relative to average of 1971-2000 [°C]



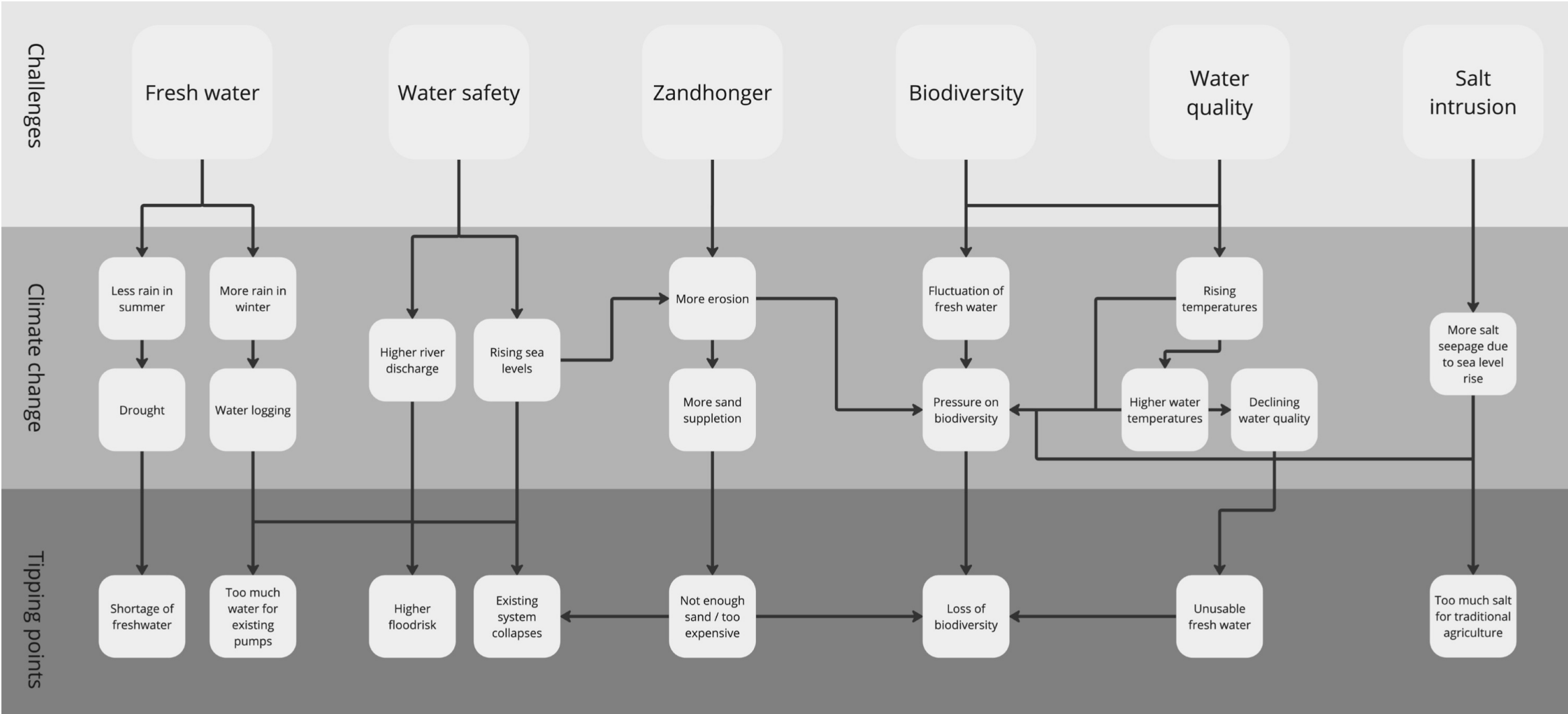
(Temperature Change in the Netherlands, n.d.)

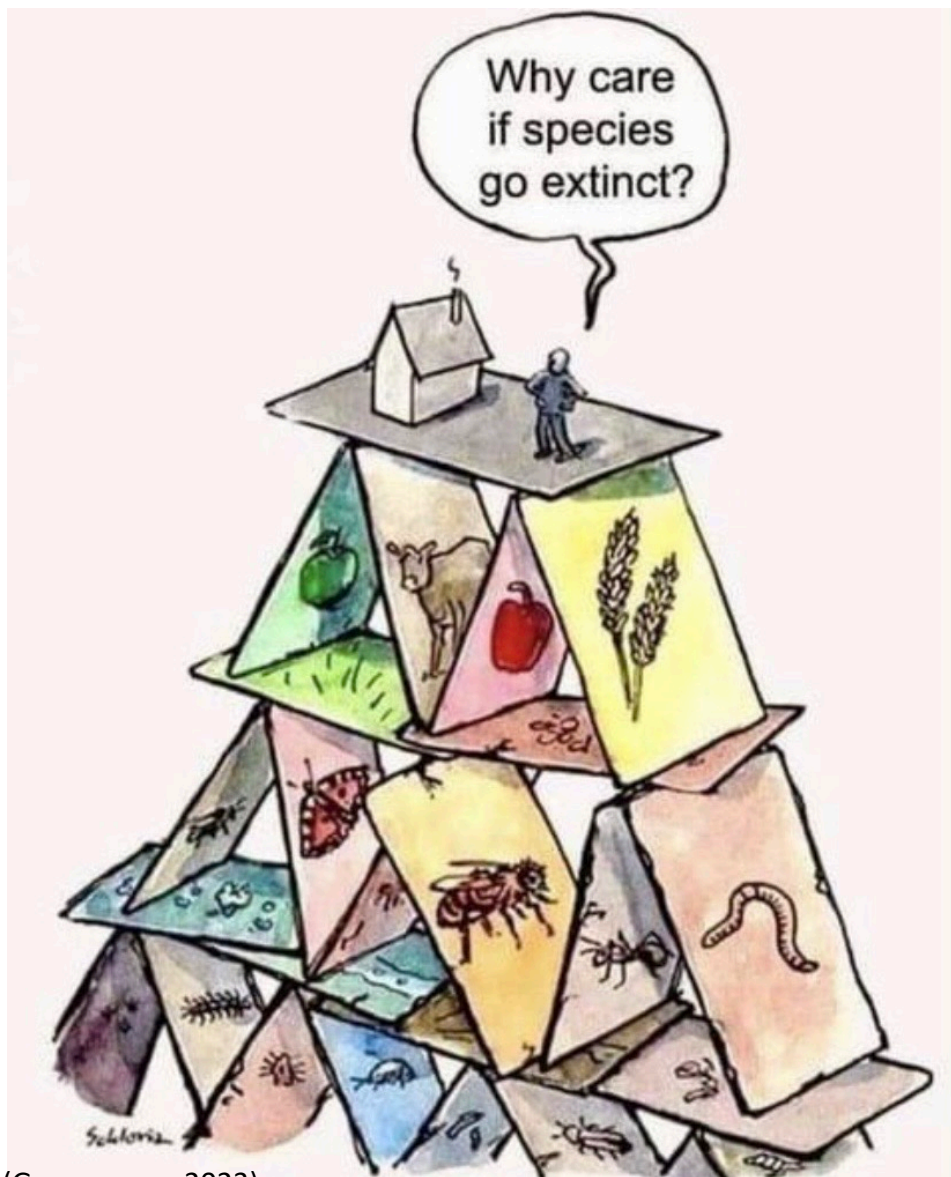


1 February 1953

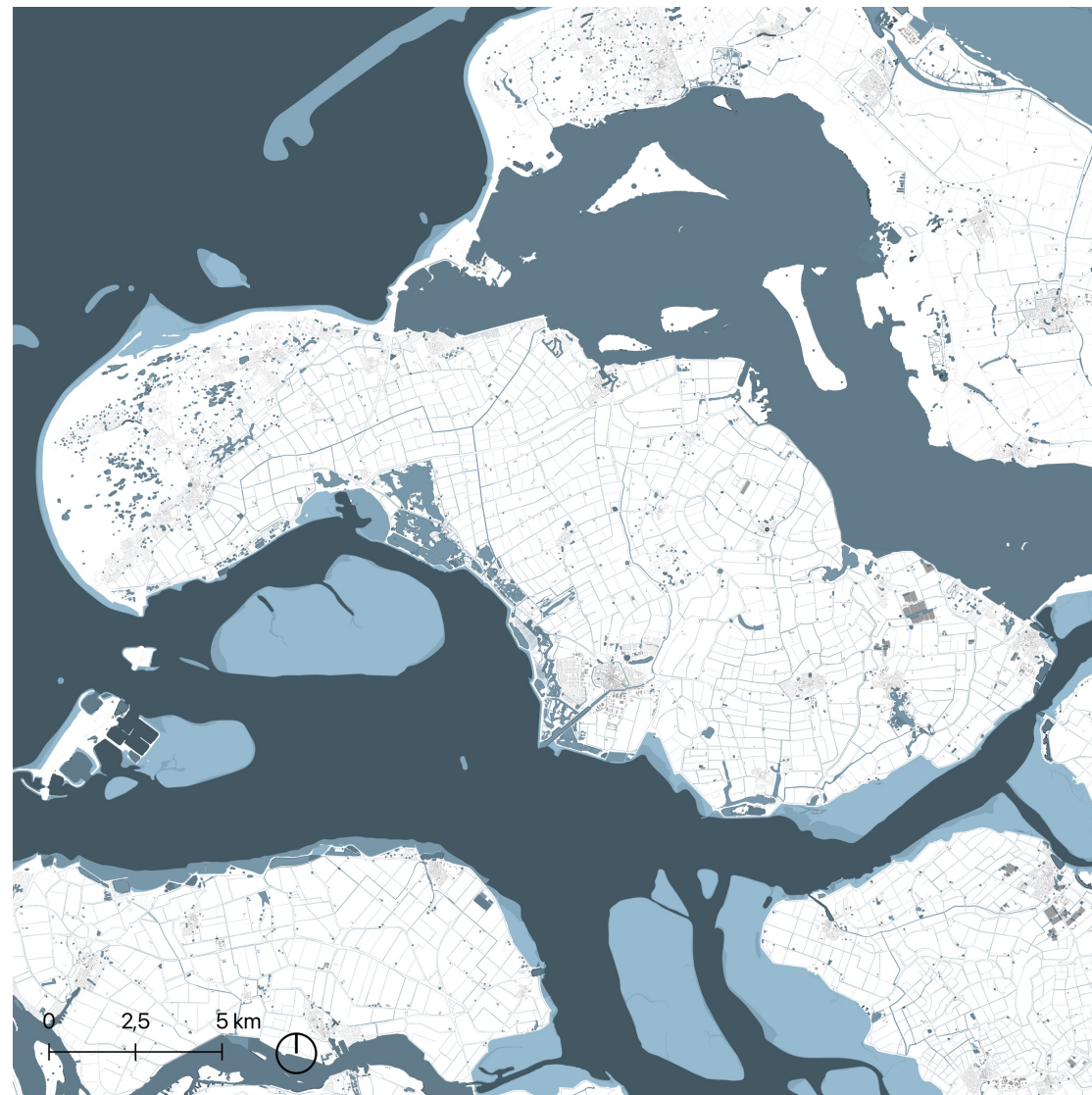
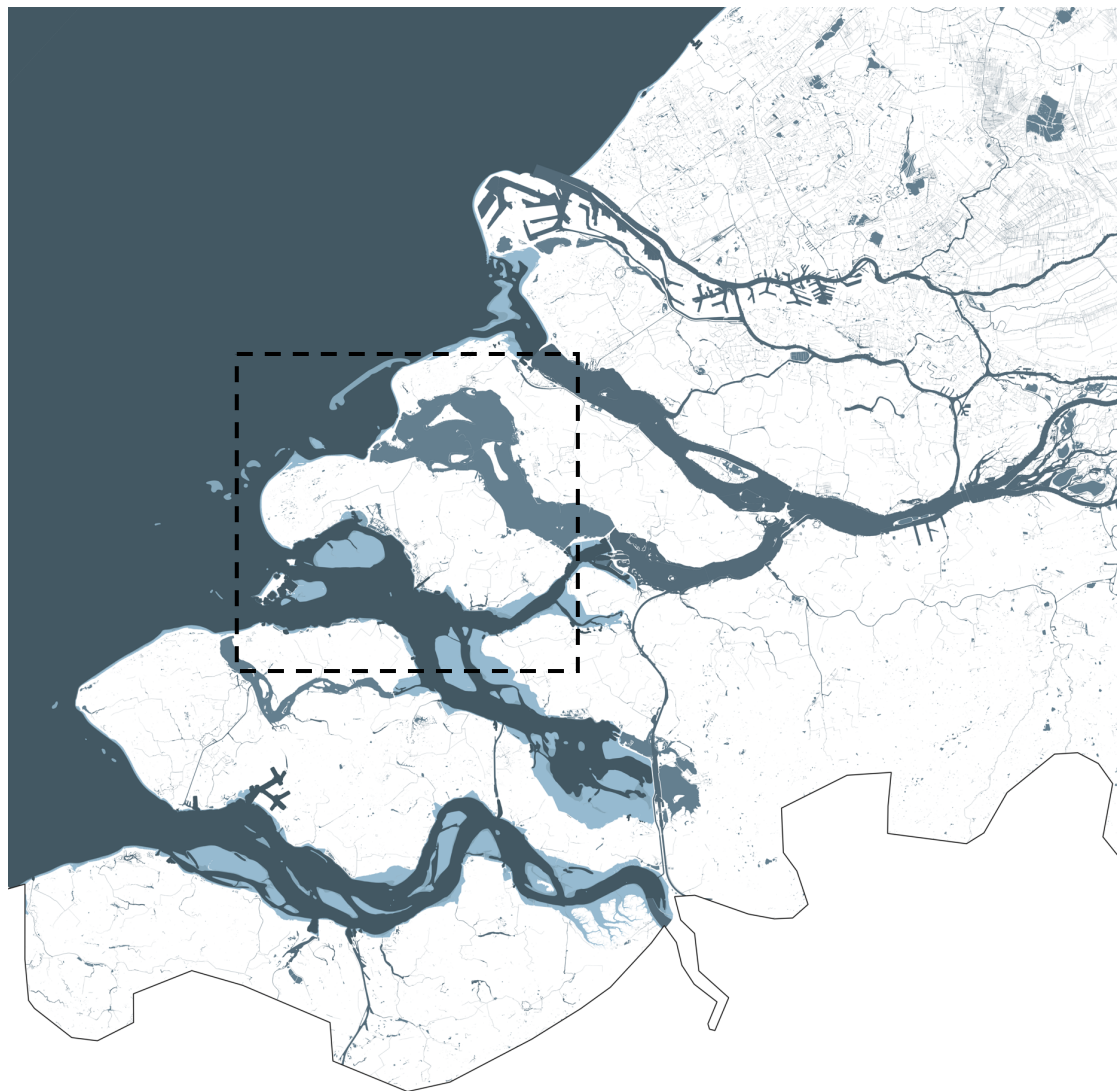


(PZC, 2018)

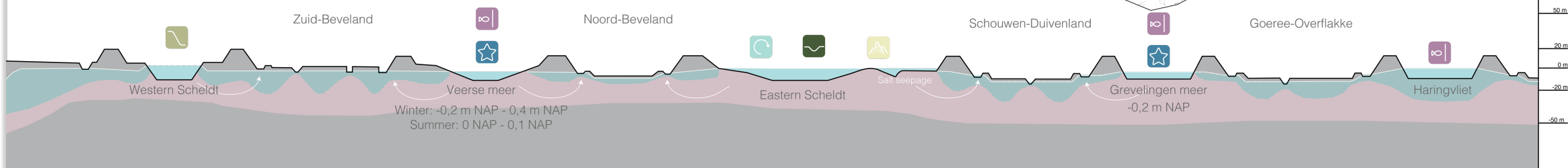
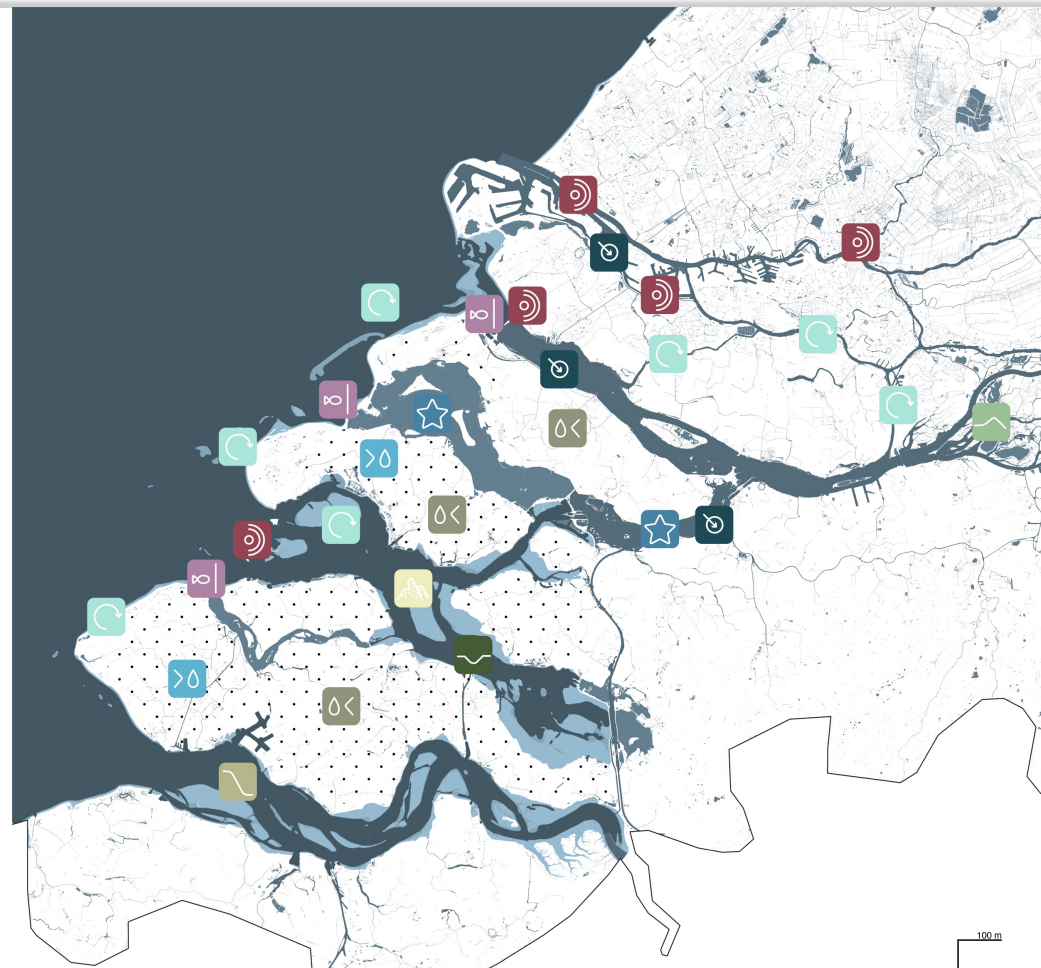




(Greenpeace, 2023)



-  Water quality
-  Zandhonger
-  Fish migration
-  Fresh water availability
-  Steepening / Siltation
-  Erosion
-  Siltation
-  Lifespan delta works
-  Overgrazing
-  Fresh water inlets
-  Drought



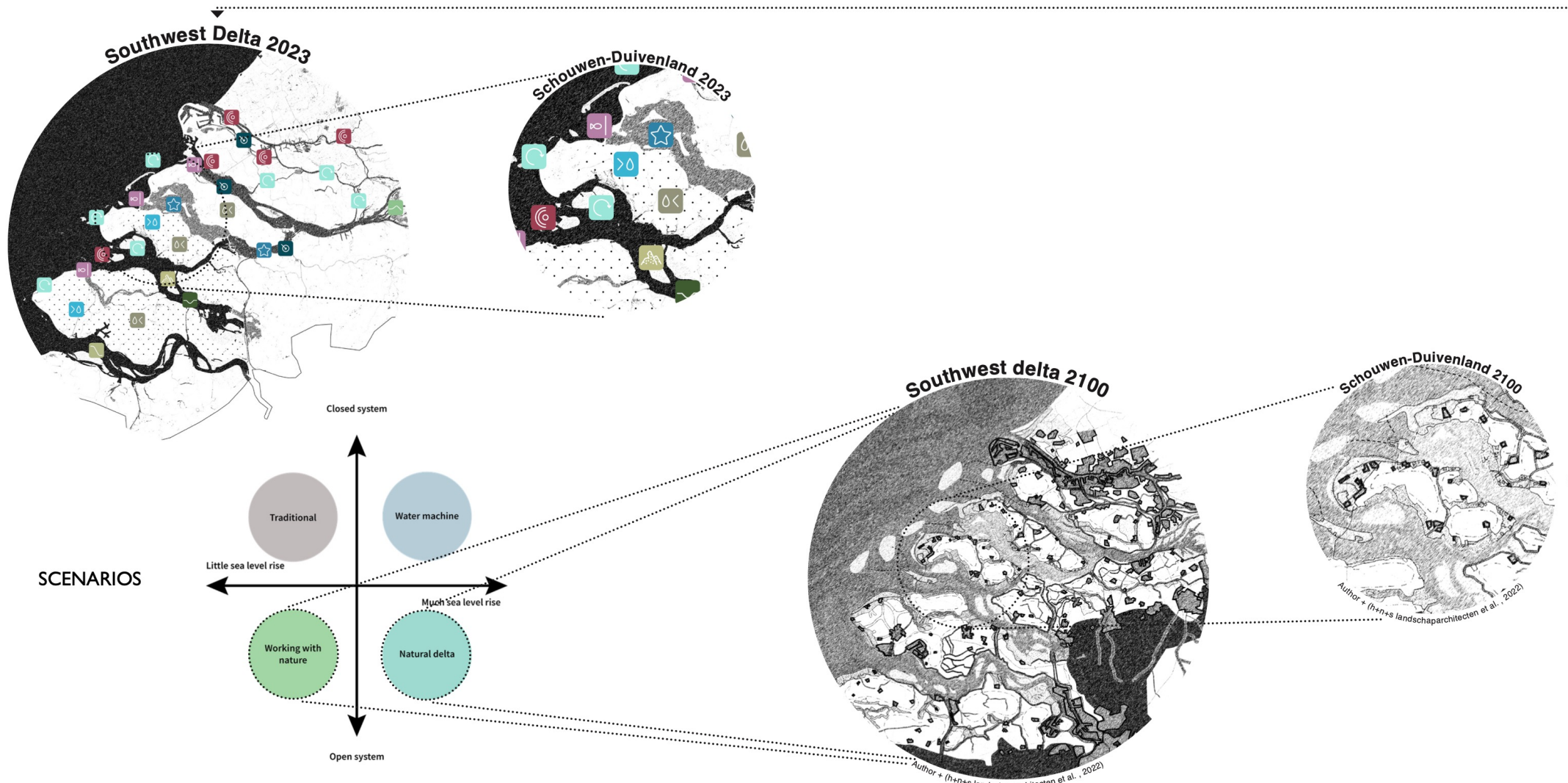
Problem statement

The Southwestern delta is facing environmental and agricultural challenges, now and in the future. By understanding what a (semi-) open delta implies for Schouwen-Duiveland, in particular for the green-blue structures, these challenges can be addressed. While implying a (semi-) open delta, the water safety of the society should at all times be guaranteed. When taking up the multiple challenges in a spatial framework, the existing qualities need to be sustained and secured.

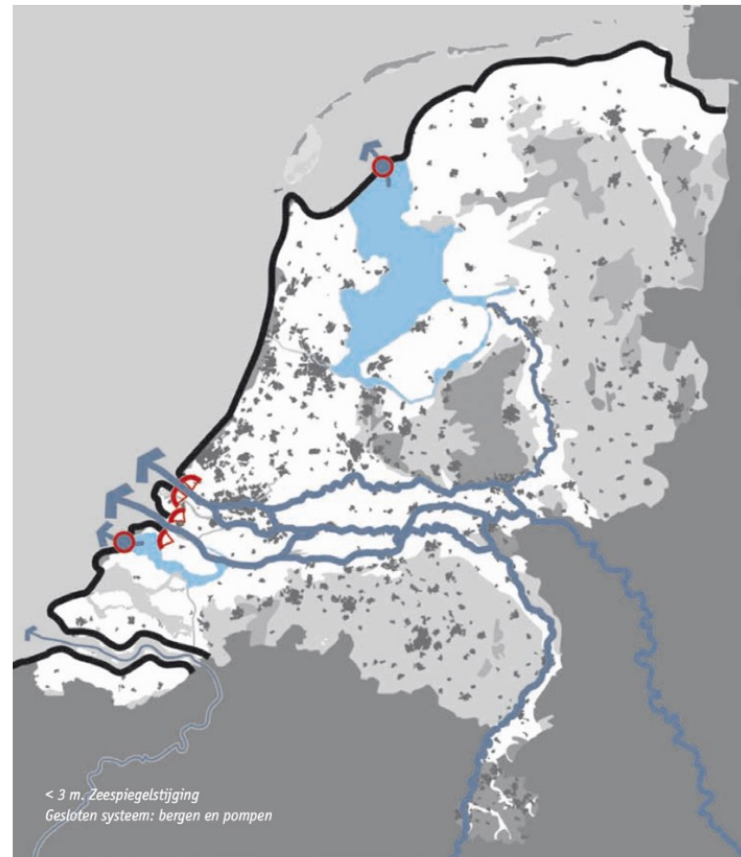
RESEARCH QUESTIONS

What would the return to a (semi-) open delta mean for the green blue network of Schouwen- Duivenland, and what spatial framework and guiding design principles would be necessary to sustain and upgrade both green blue networks and live ability, now and in the future?

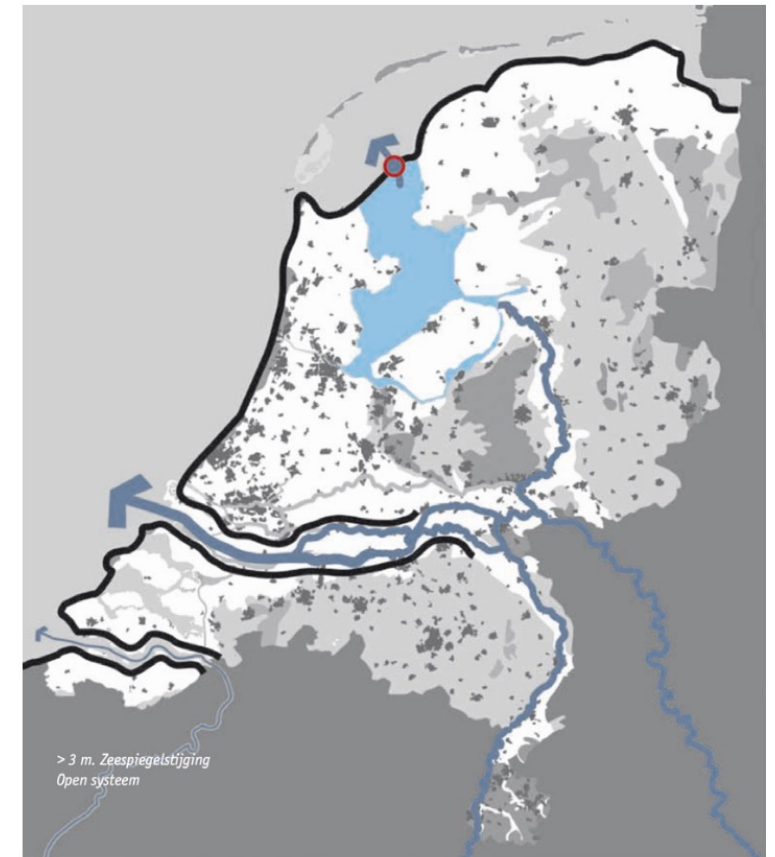
- *What is a (semi-) open delta approach?*
- *How can a (semi-) open delta solve existing and future challenges?*
- *What are the existing qualities and threats of the green-blue network and the liveability on Schouwen-Duivenland?*
- *How can these qualities be sustained and/or upgraded when returning to a (semi-) open delta?*
- *How can the green blue structures of Schouwen-Duivenland be improved when returning to a (semi-) open delta?*
- *What are the spatial implications when Schouwen-Duiveland is situated in a (semi-) open delta?*



Delta Scenarios



Closed system, (H+N+S landschaparchitecten et al., 2009)



Open system, (H+N+S landschaparchitecten et al., 2009)

Closed delta

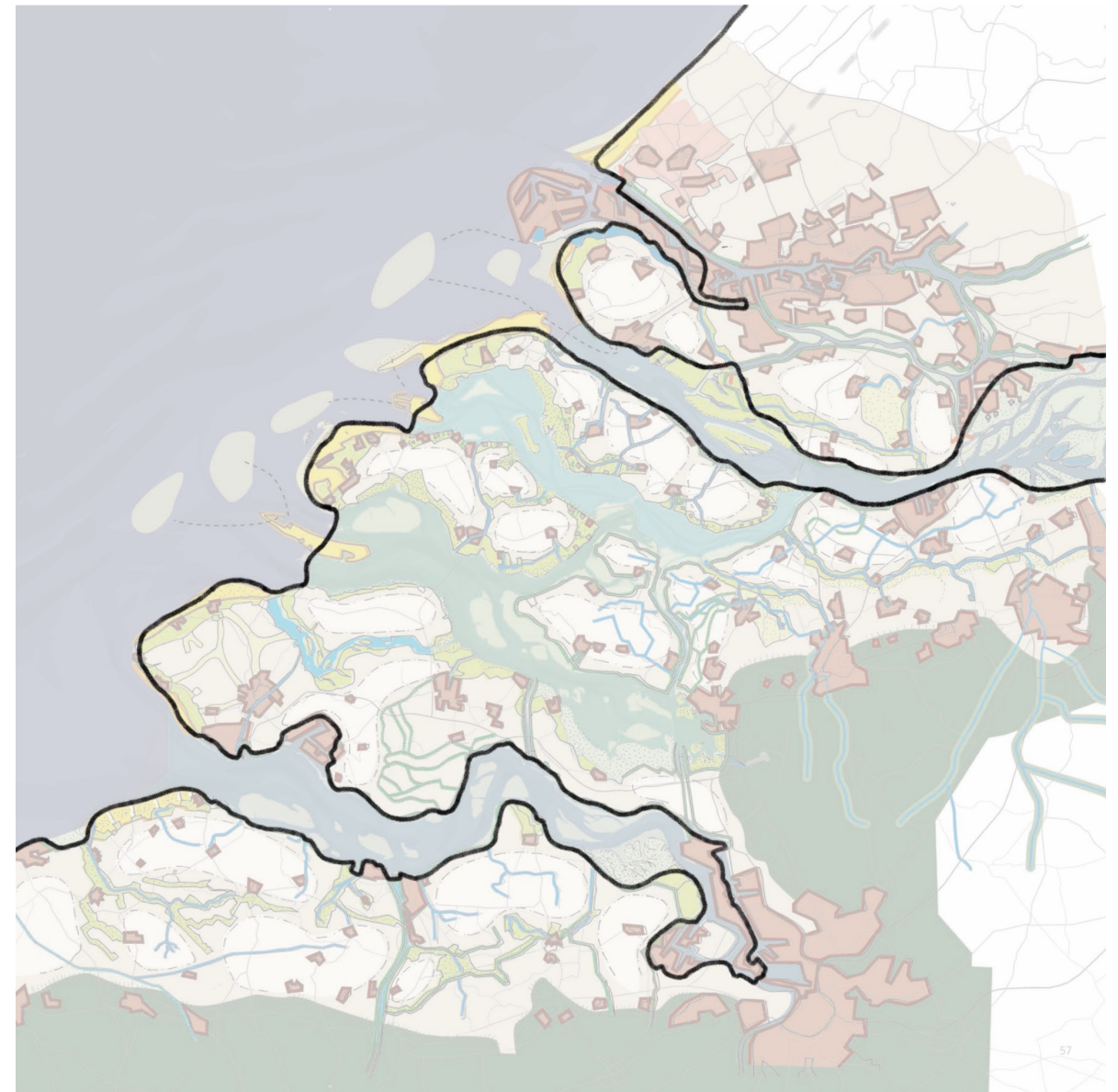
Environment

Agriculture

Living

Watermanagement

Detailed assessment can be found in the booklet: *Between Land & Sea*



Open Eastern Scheldt

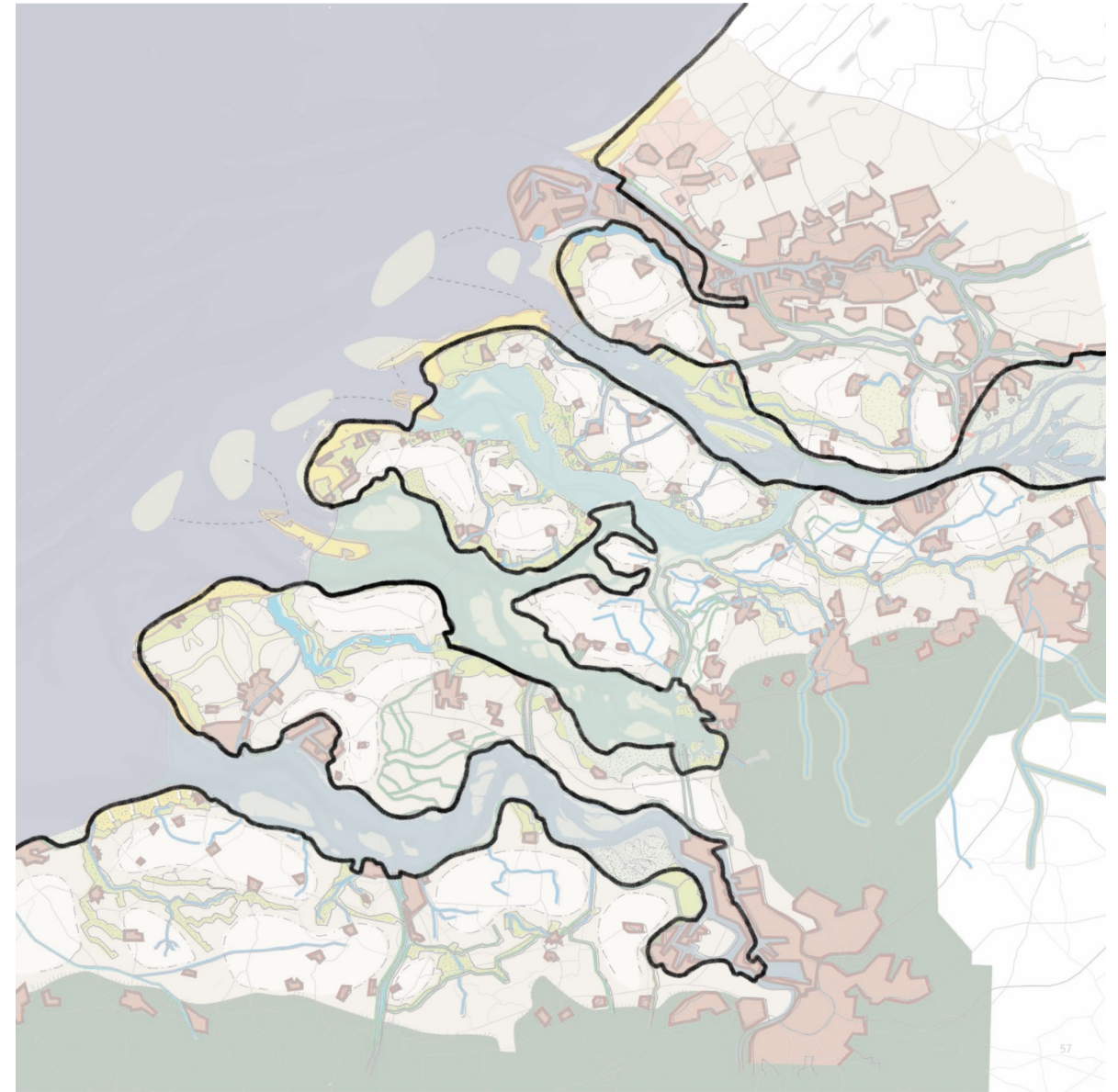
Environment

Agriculture

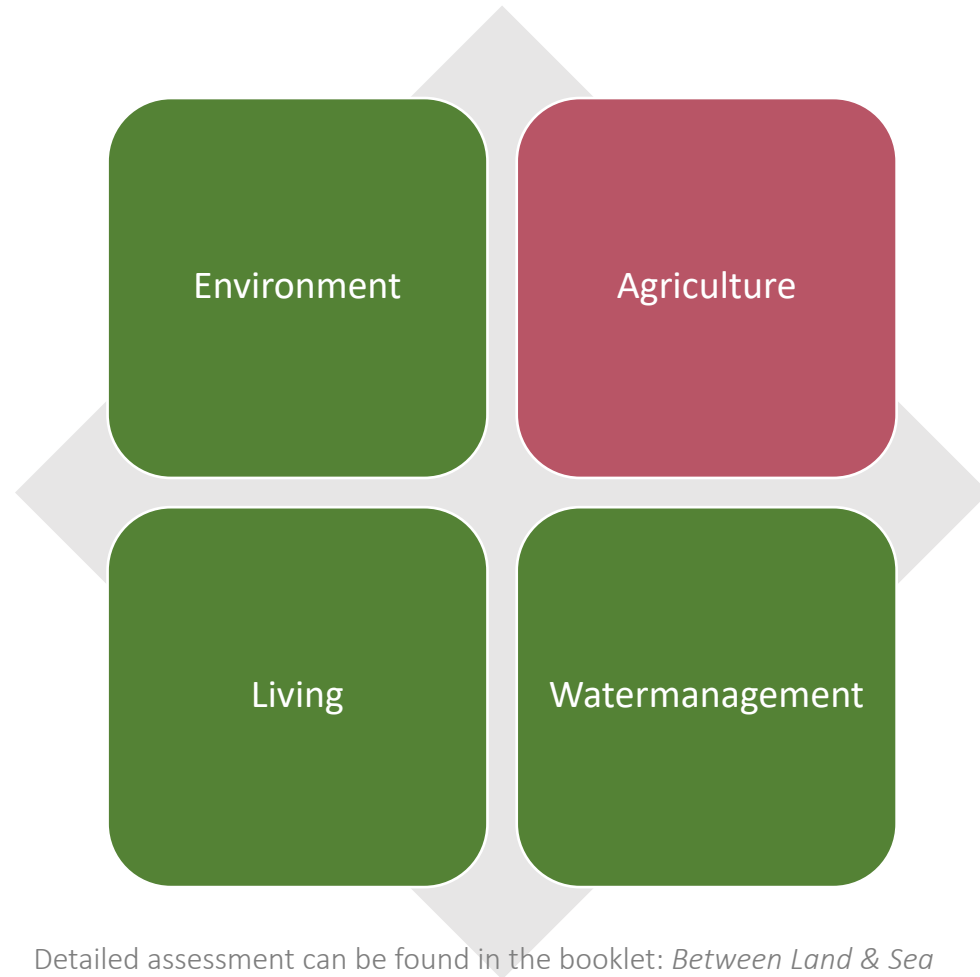
Living

Watermanagement

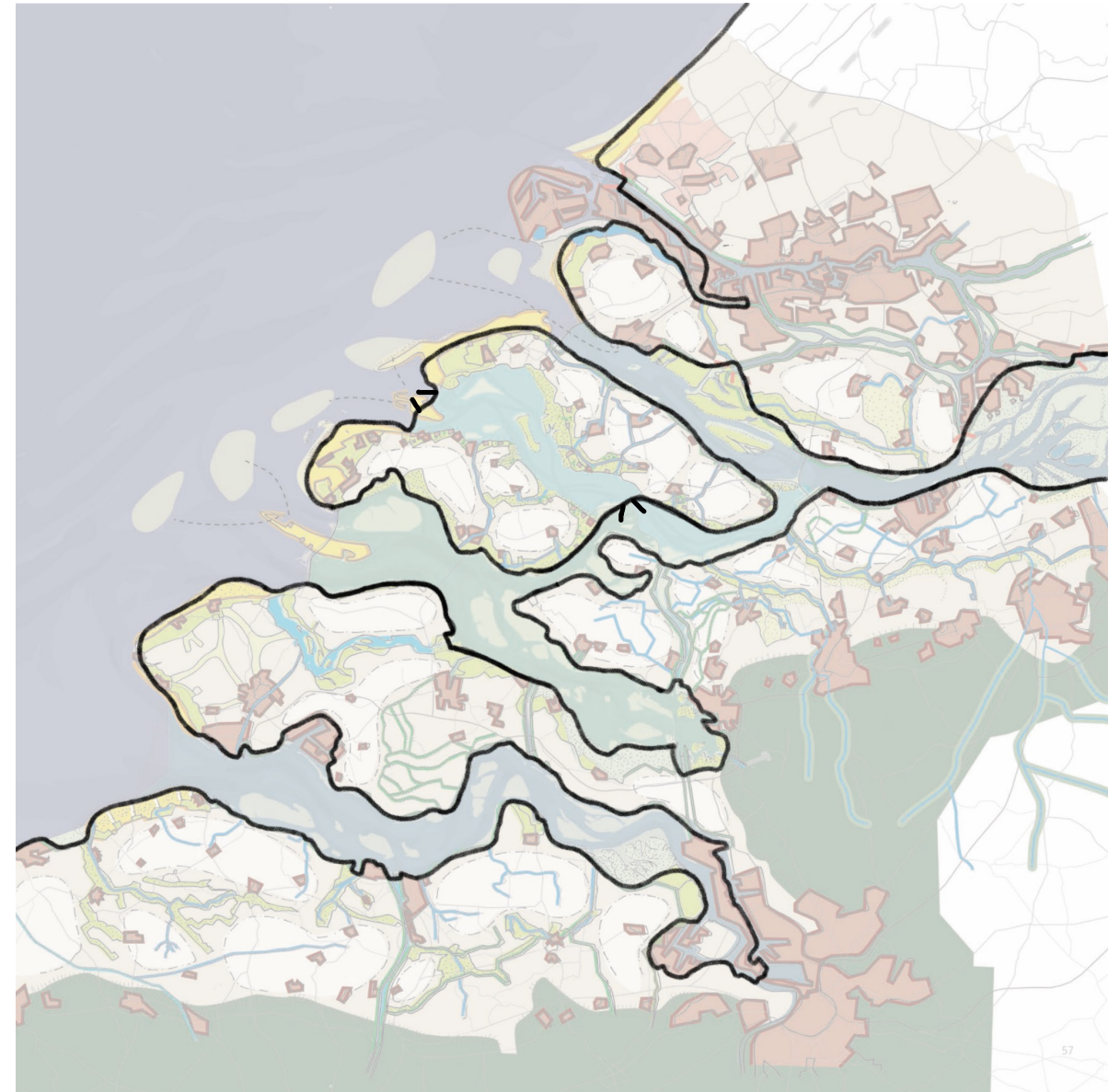
Detailed assessment can be found in the booklet: *Between Land & Sea*



Semi open delta



Detailed assessment can be found in the booklet: *Between Land & Sea*



Open Delta

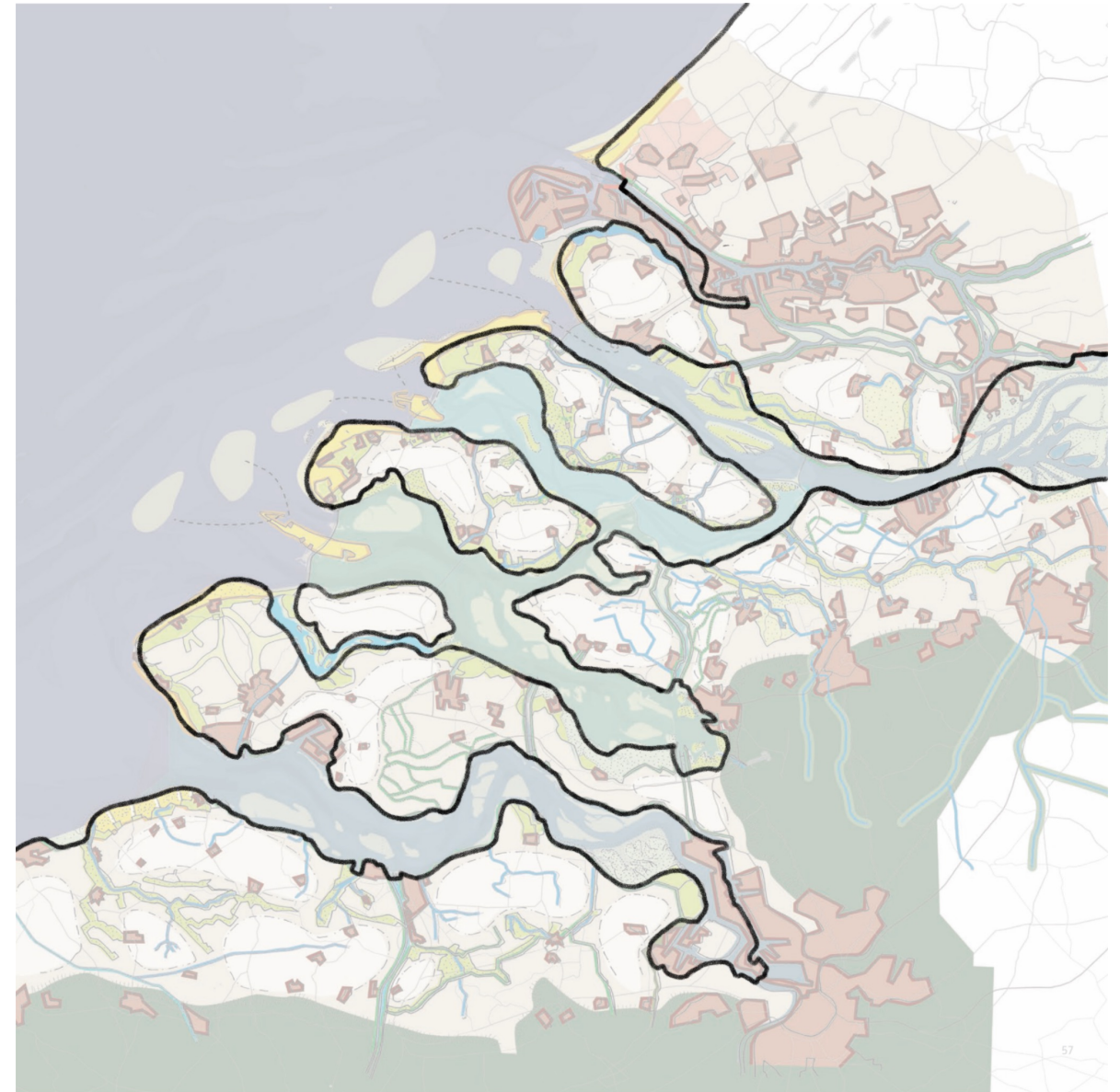
Environment

Agriculture

Living

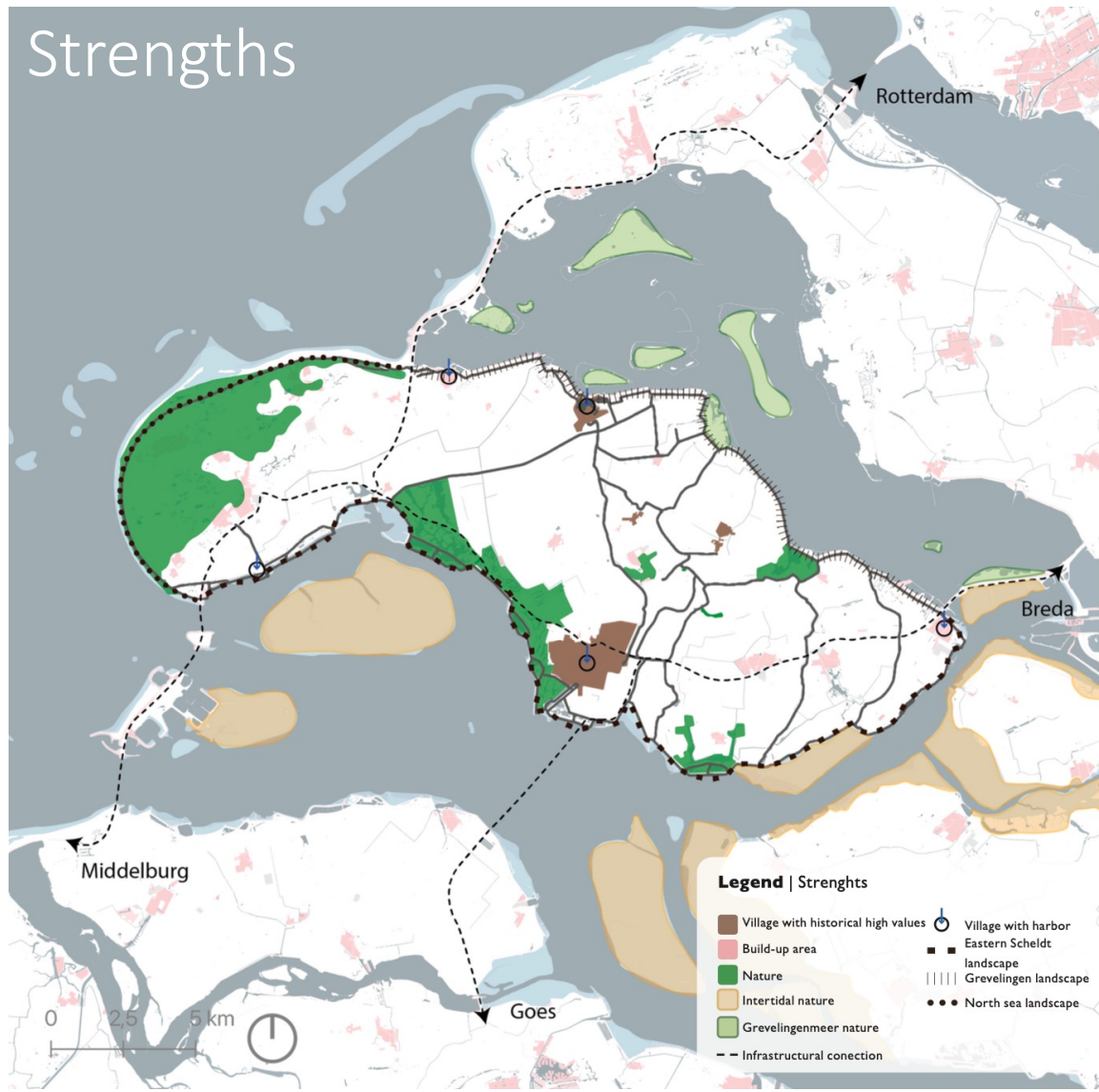
Watermanagement

Detailed assessment can be found in the booklet: *Between Land & Sea*

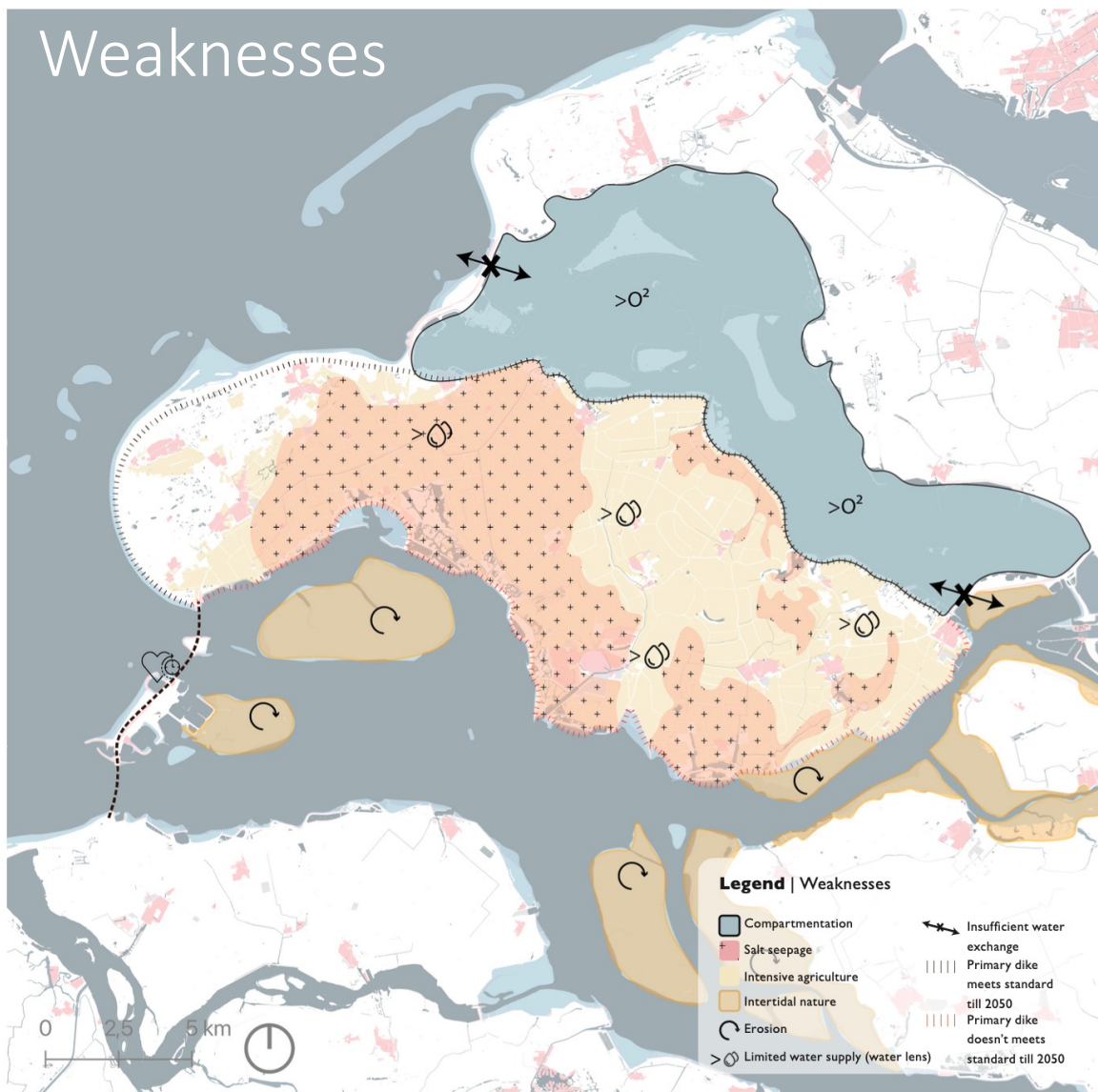


SWOT analysis

Strengths



Weaknesses



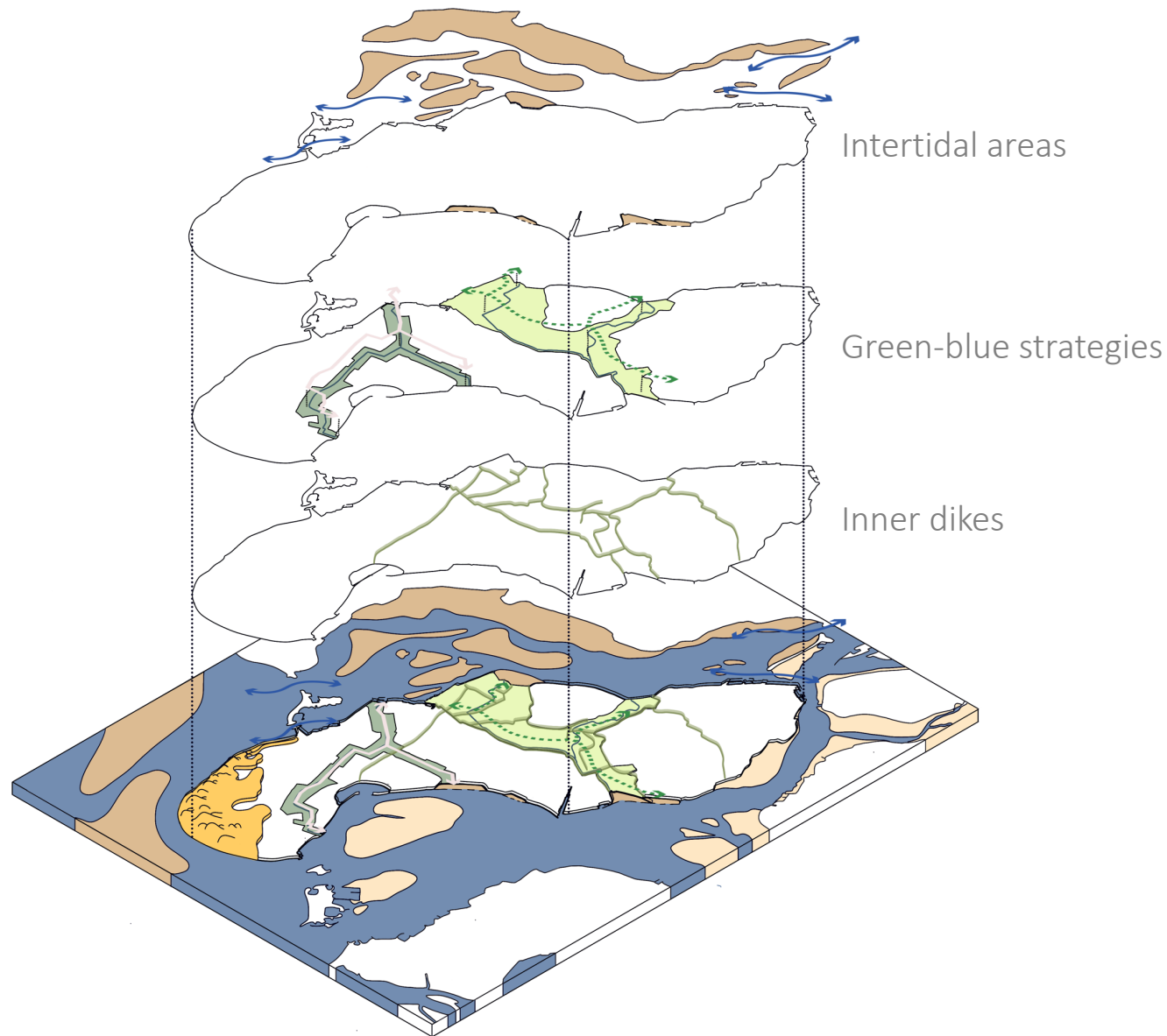
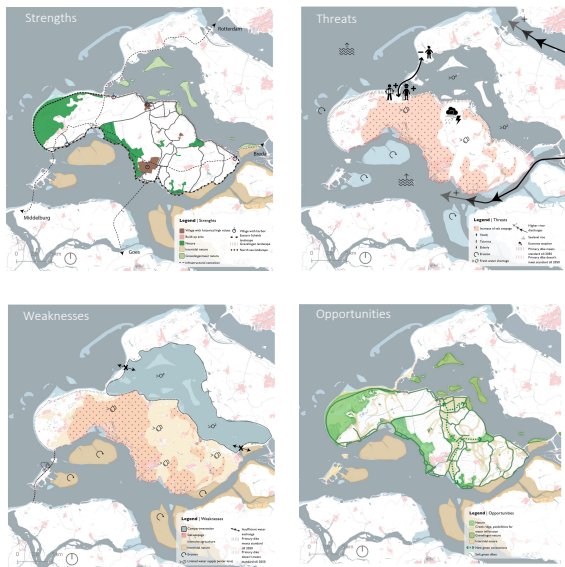
Opportunities



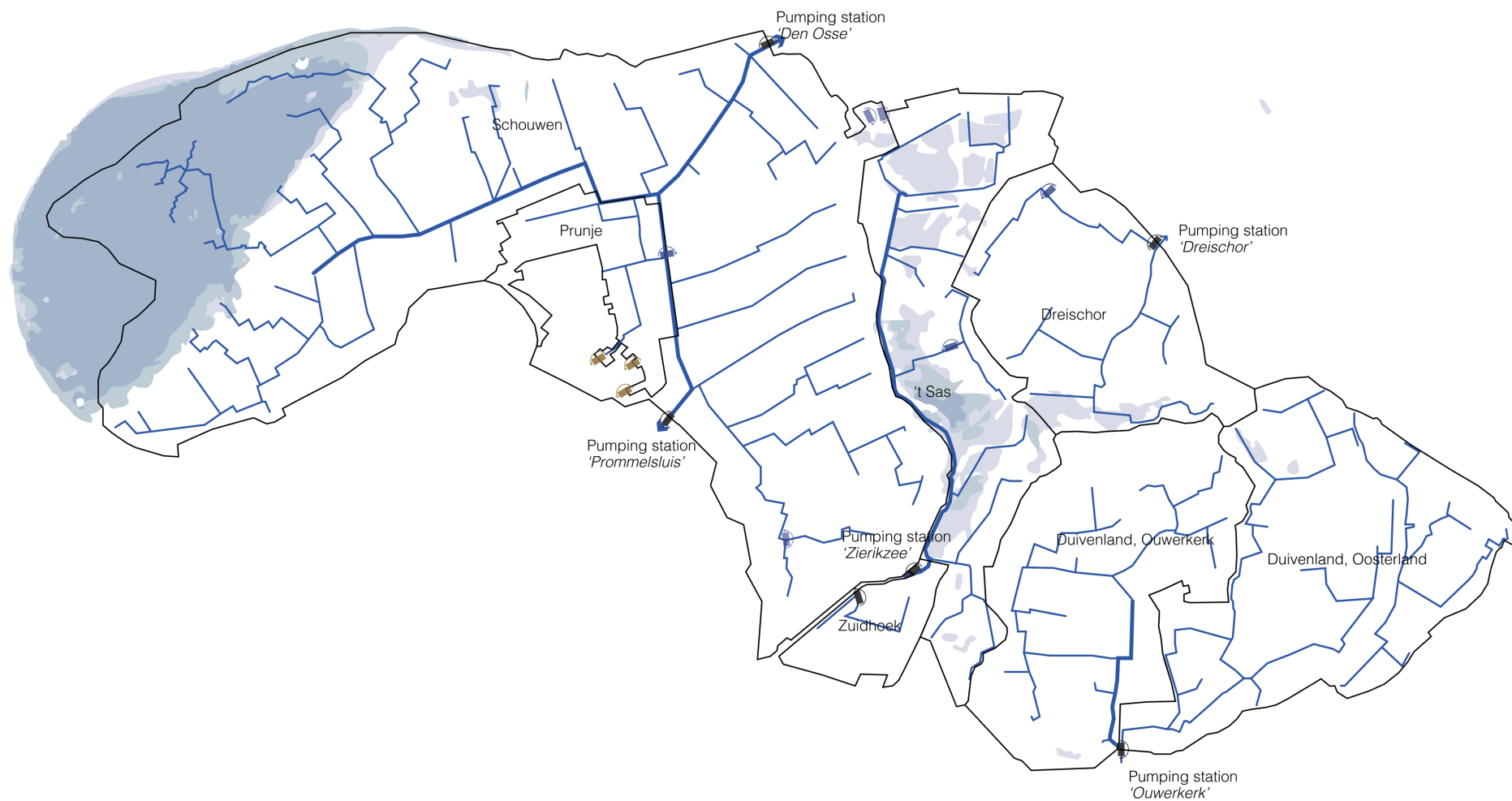
Threats



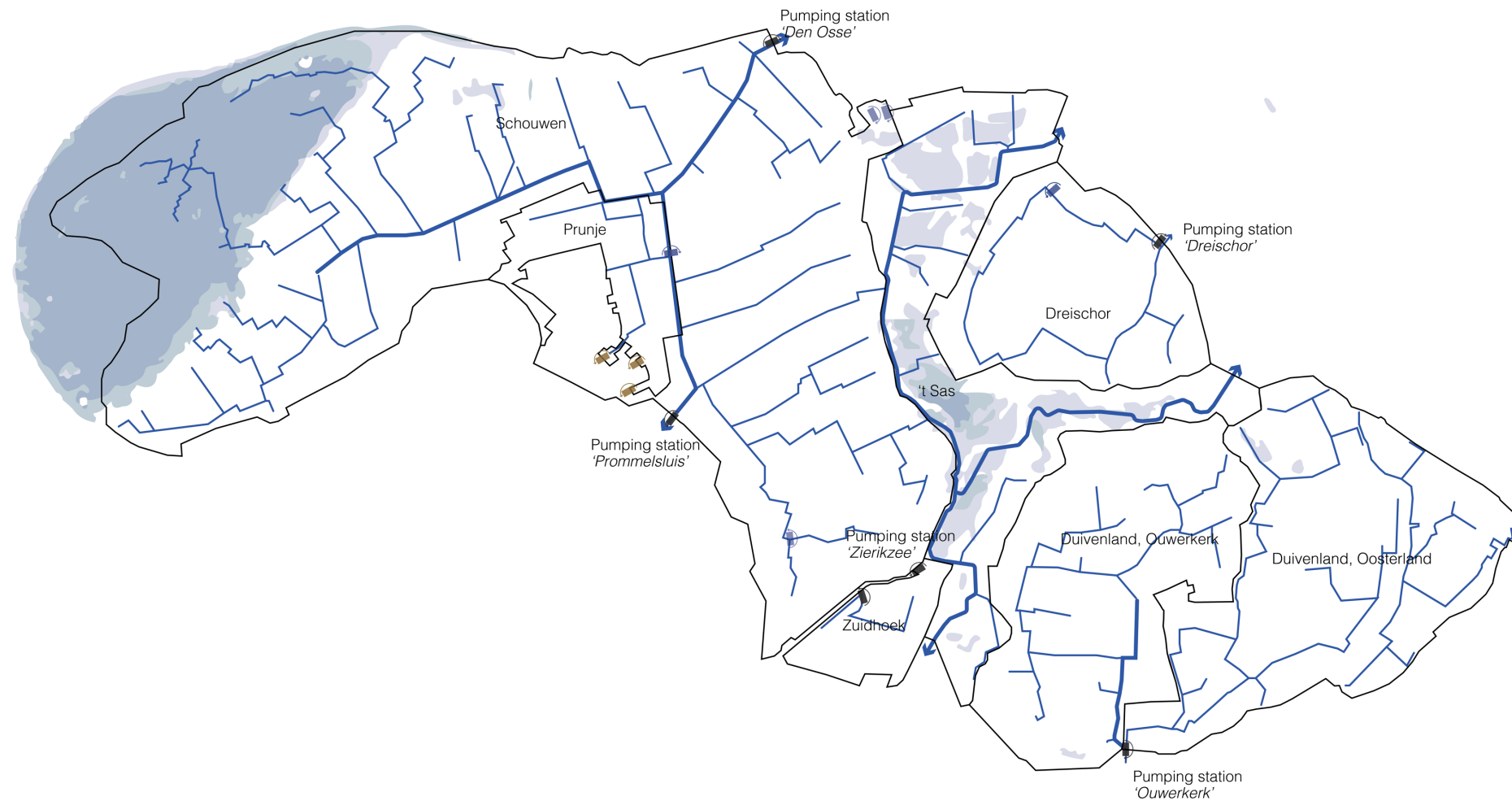
SWOT and previous analysis



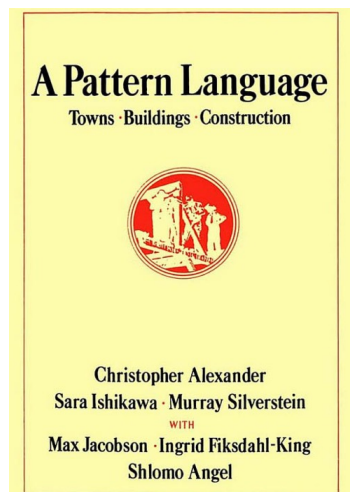
Before



After

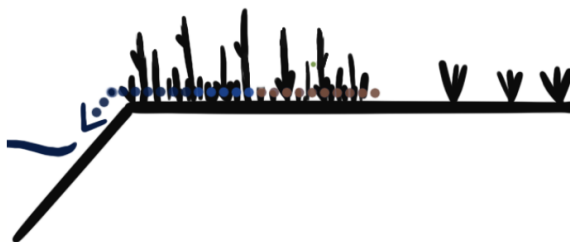


Based on



Water quality

W.3



Buffering Field Edges

Water quality improvement by buffering sown field margins

Runoff water that contains pesticides degrades the surface water quality. Buffering field edges can reduce the amount of pesticides entering the surface water.

Buffering Field Edges

Transforming the outer field margin of agricultural land into a pesticide free zone, sown with plants that buffer

Theoretical background

Planting unsprayed field margins reduces the likelihood of pesticides entering the surface water. The width of the pesticide-free zone is determined by risk analyses, with a common width of 6 meters, although other factors such as the type of pesticide, wind direction, and spraying equipment can affect its effectiveness. Researchers suggest that high vegetation in buffer strips can also reduce pesticide drift but is not yet included in model calculations.

(Bos et al. 2014)

Relation with: pattern (Flower Power B.6, Toxic Runoff Water W.2)

DECISION TREE | *Example*

Challenges

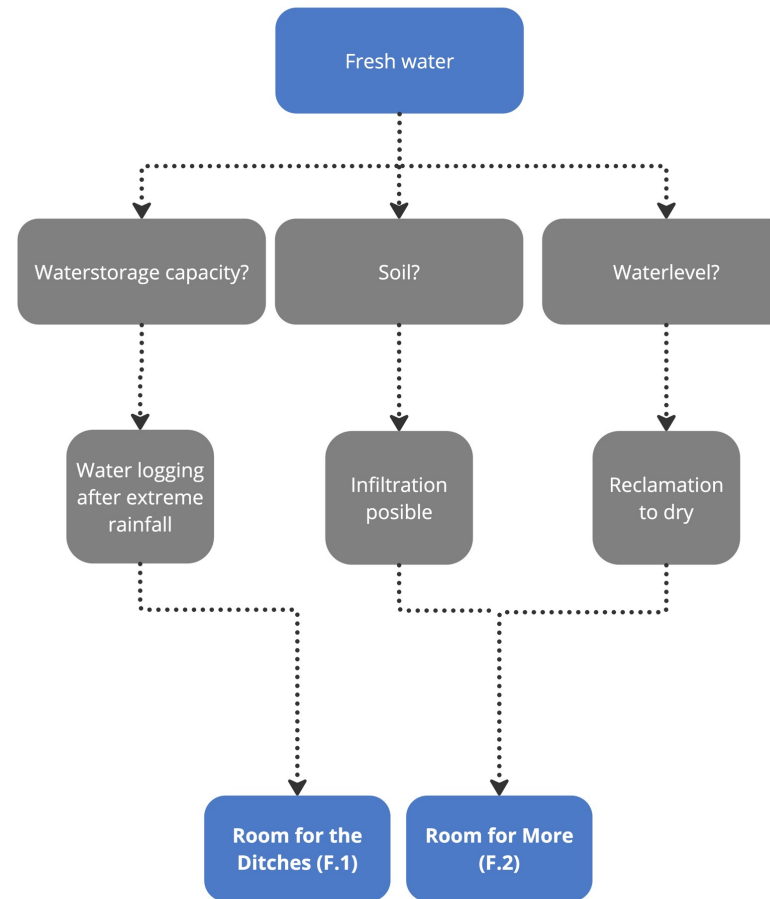
Crucial aspects

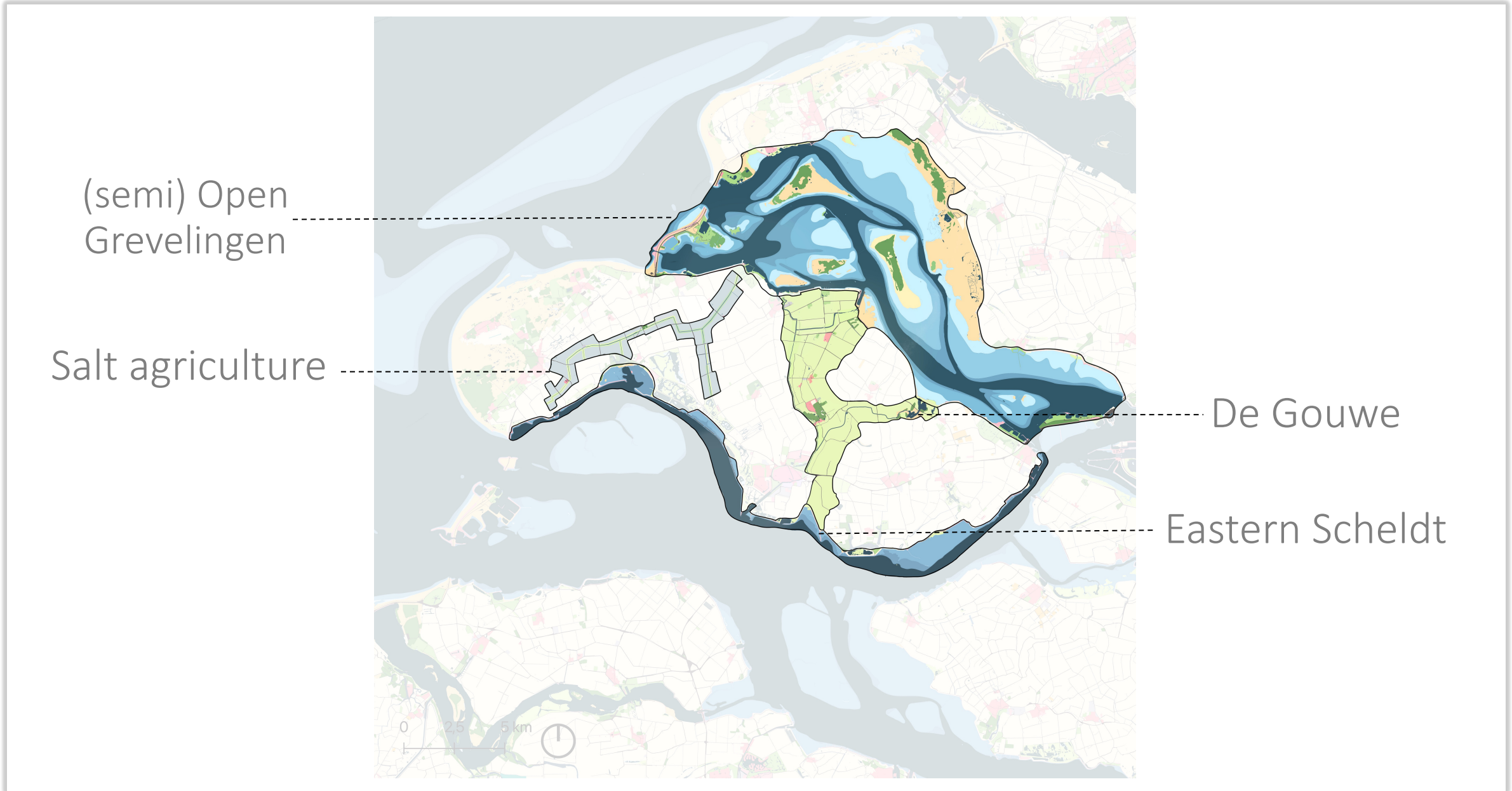
Used patterns

General patterns

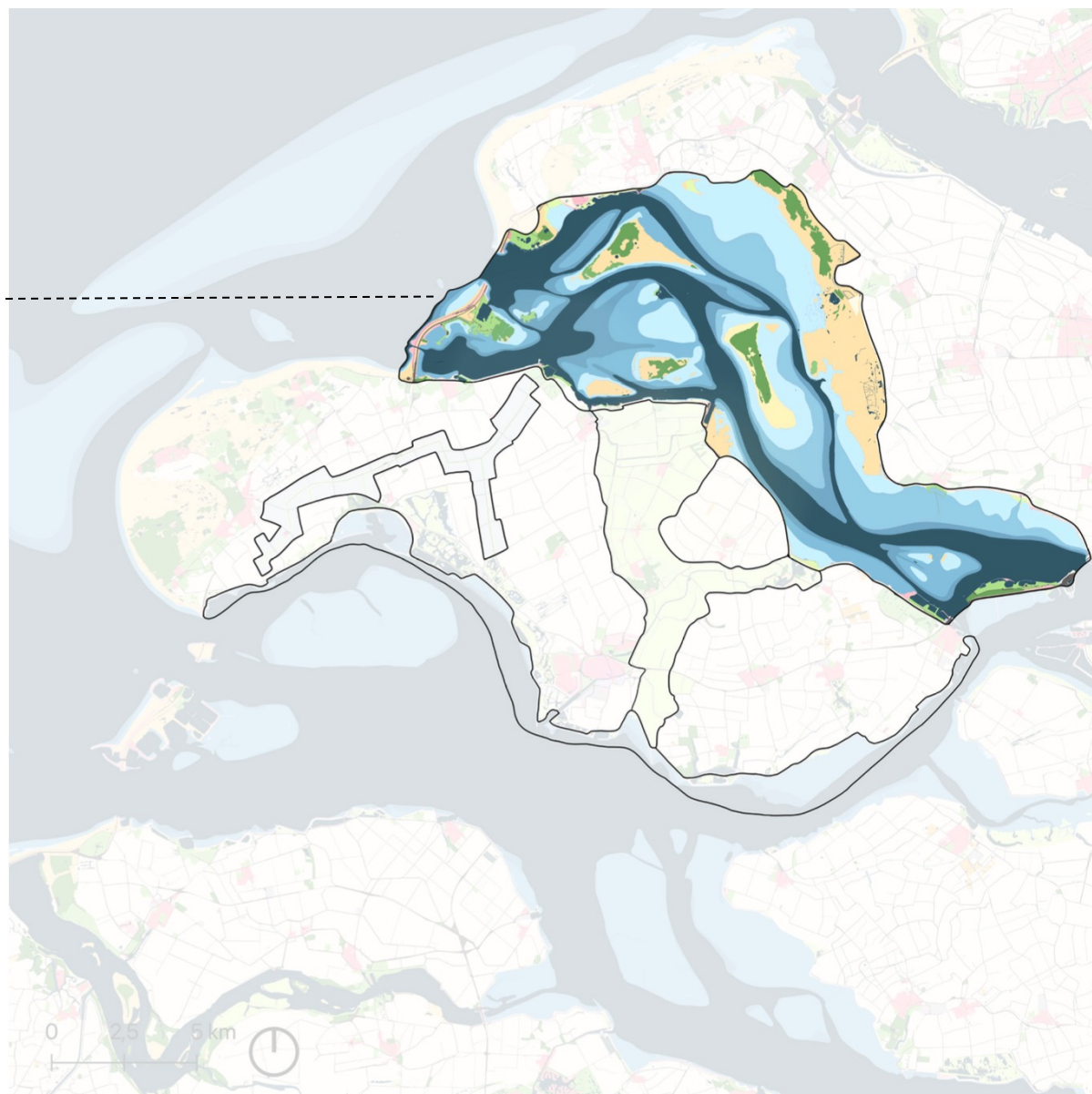
Soil and water
leading (F.3)

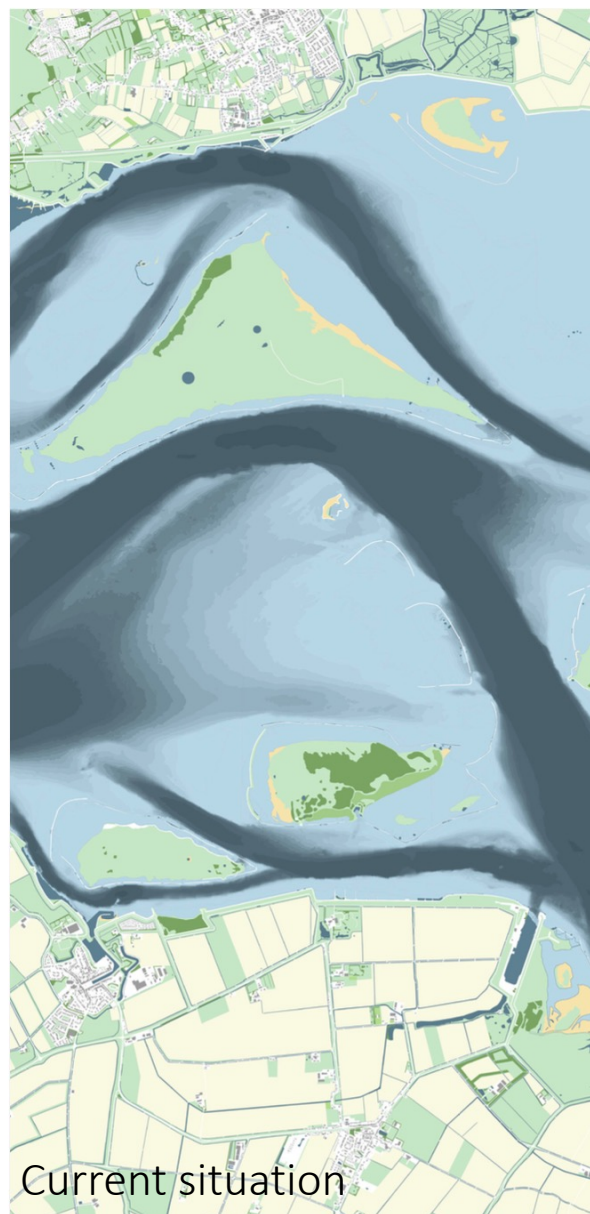
Money trees (B.8)





(semi) Open
Grevelingen





Challenges



Fish migration



Biodiversity decline



Water quality

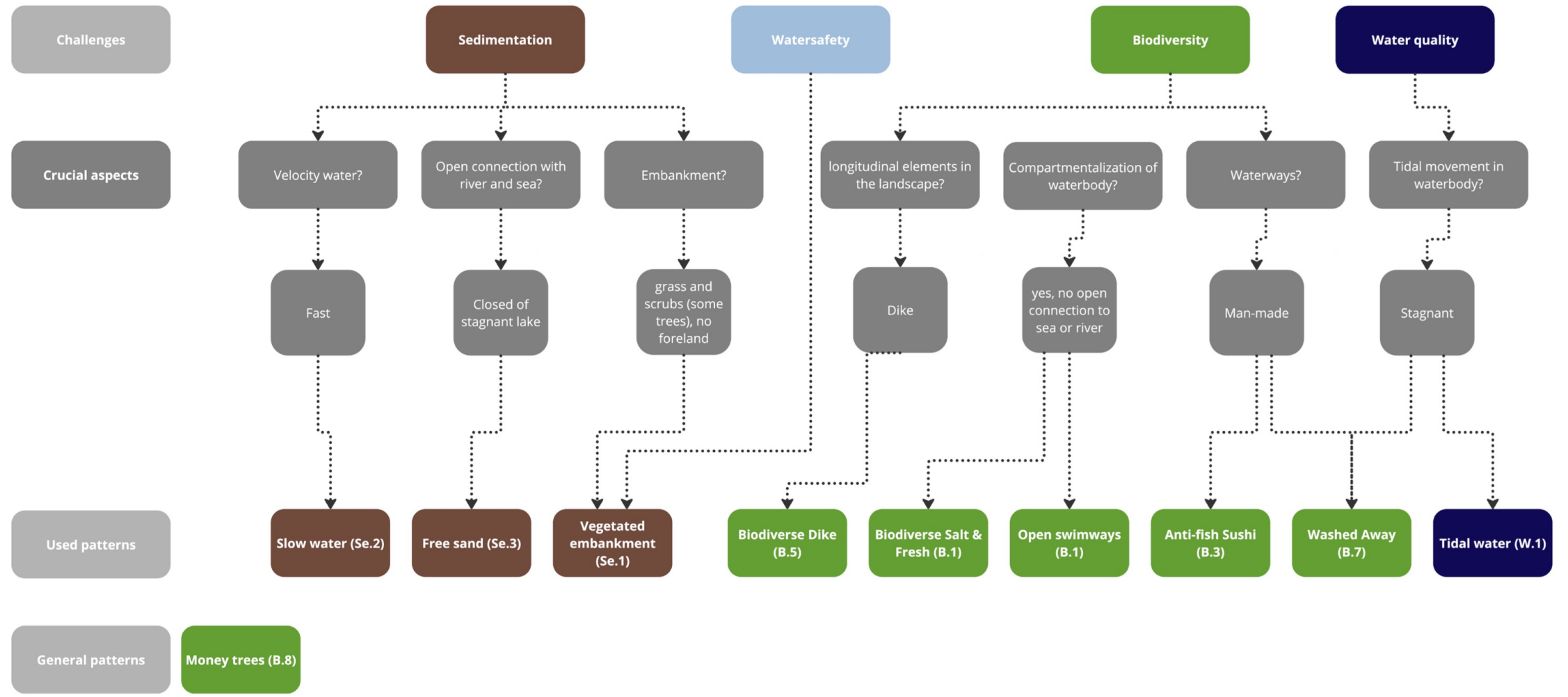


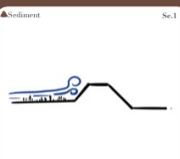
Erosion



Water safety


DECISION TREE | *Open Grevelingen*





Vegetated Embankment
Vegetated dike embankments for less wave force

A vegetated embankment at the outer dike side reduces the wave force on the dike. This makes that dikes need to be raised and strengthened less.



Slow Water
Slowing the water to increase sedimentation

Sedimentation occurs when the waterflow decreases. The transported sediment particles are being deposited and form new soil.




Free Sand
Open connections for more sedimentation

The dams and dikes in the Gevelingenmeer and Volkerak-Zoommeer have made sediment exchange with the Voerdtella and other basins impossible. The sediment supply is limited to internal sources such as existing flats and shores.



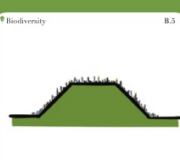
Biodiverse Salt & Fresh
Salt-fresh gradients make a more biodiverse delta

The gradient environment between the salty sea and the fresh river provide a unique ecosystem in which a wide range of flora and fauna can flourish.



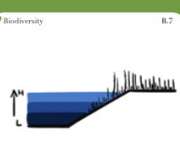
Anti-fish Sushi
Fish friendly or low RPM pumps for less fish mortality

To pump water out of the polder towards the sea, the Netherlands uses water pumps. The traditional pumps cause damage and/or death to the fish that want to pass.



Biodiverse Dike
Biodiverse dike for more drought resistance

A dike covered with multiple species of grasses instead of one type is more resistant against droughts and increases the biodiversity and ecological value of the surrounding environment.



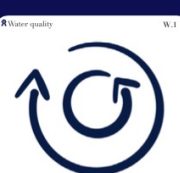
Washed Away
Dynamics slows/stops the succession of embankments

When vegetation on an embankment is exposed to tidal water and is submerging with high tides the succession of the vegetation is slowed down or even stopped.



Open Swimways
Open connections for more fish migration

A barrier-free river system is essential to ensure migratory fish can complete their entire lifecycle without facing danger, delay, and disturbance caused by migration barriers.



Tidal Water
More dynamics in water flows for better water quality

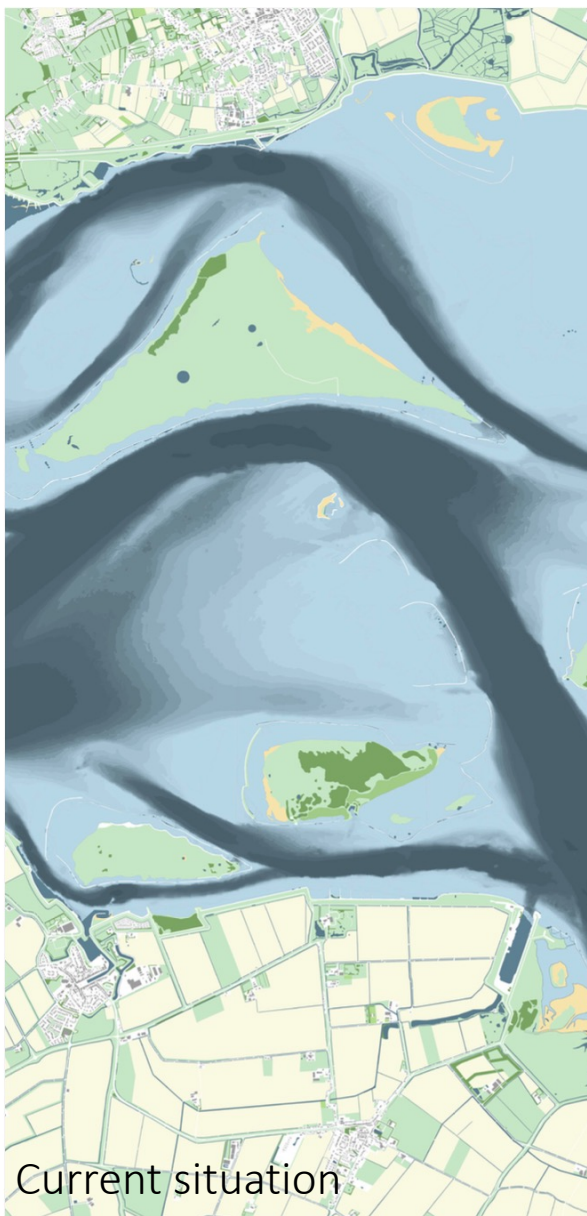
The movement in water derived from tidal movement improves the quality of the water because stratification is prevented.

DESIGN PRINCIPLES

The design principles that fit with the implementation of the (semi) open Grevelingen are: Se.1, Se.2, Se.3, B.3, B.1, B.3, B.7, B.10, and W.1. The full explanation of the cards can be found in the appendix and in the separate card deck.

Legend | Grevelingen

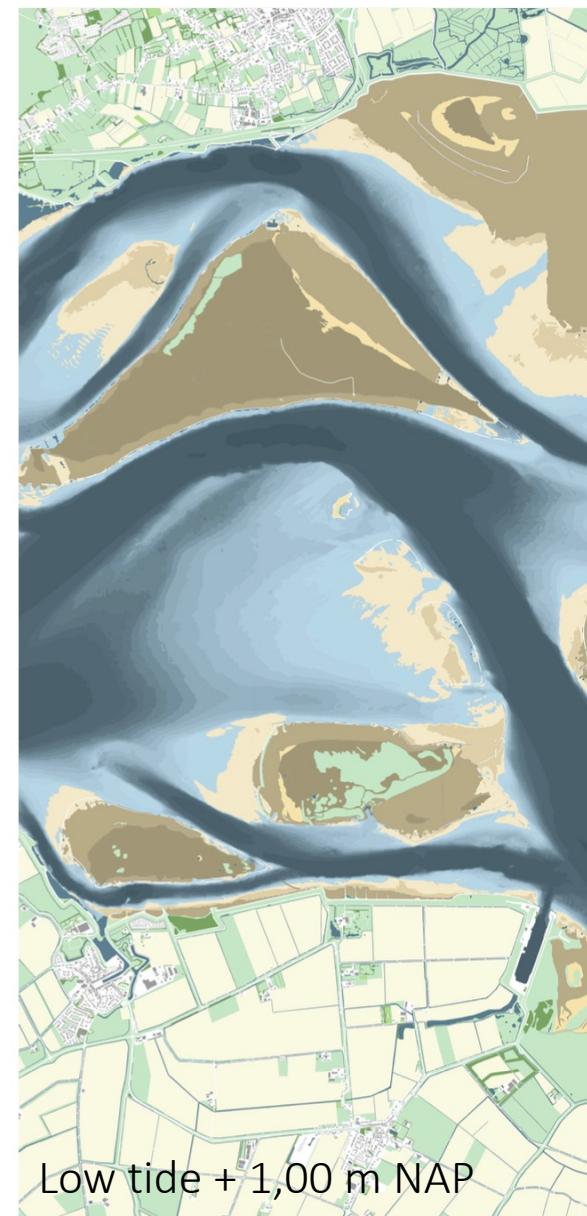
- Scrubs / Trees
 - Grass land
 - Agriculture land
 - Sand
-
- Deep water
 - Shallow water
 - 1,00 m NAP
 - 0,70 m NAP
 - 0,00 m NAP
-
- Low tide**
 - 1,00 m NAP
 - 0,70 m NAP
 - 0,00 m NAP
-
- High tide**
 - 1,00 m NAP
 - 0,70 m NAP
 - 0,00 m NAP



Current situation

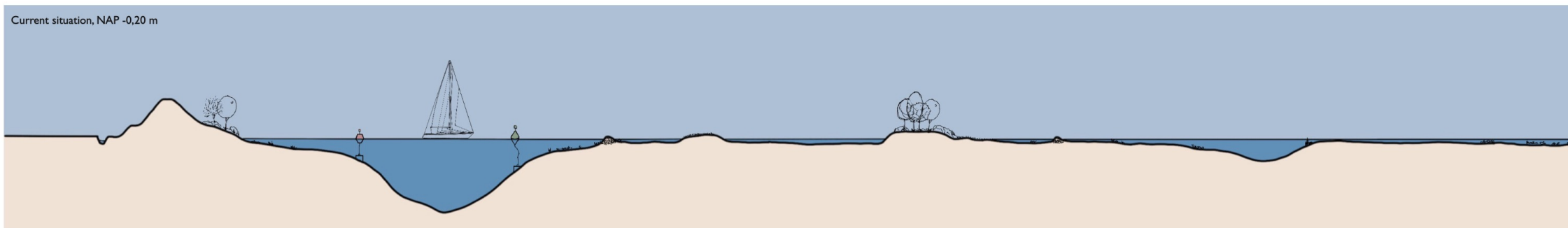


High tide + 1,00 m NAP

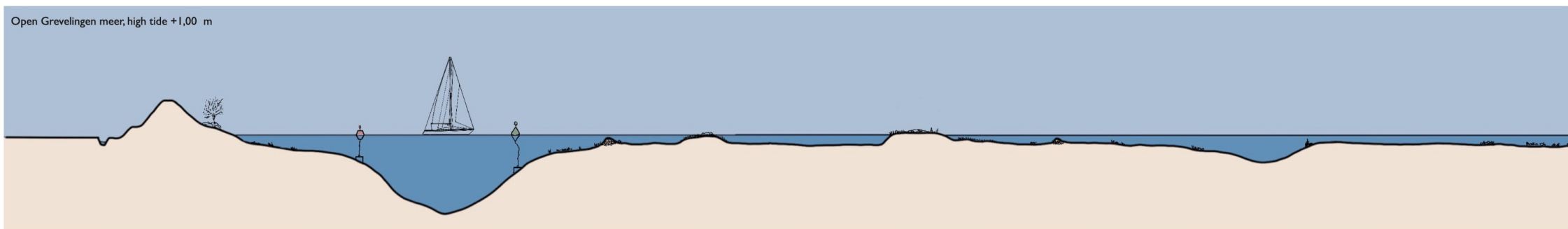


Low tide + 1,00 m NAP

Current situation, NAP -0,20 m



Open Grevelingen meer, high tide +1,00 m



Open Grevelingen meer, low tide -1,00 m



Phase 1

Challenges

- Fish migration
- Biodiversity decline

Stakeholders

- Funders
- Municipality Schouwen-Duiveland
- Central government
- Waterboard Scheldestromen
- Rijkswaterstaat
- European union

Pattern cards

- Vegetated Embankment
Vegetated dike embankments for low water levels.
A vegetated embankment at the water side reduces the peak force on the dike. This makes that dikes need to be less and strengthened less.
- Anti-fish Sushi
Fish friendly or low RPH pumps for fish mortality.
To pump water out of the polder around the city, the Scheldestromen need pumps. The traditional pumps were simple, but too difficult for fish to swim through.
- Biodiverse Dike
Biodiverse dike for more drought resistance.
A dike covered with multiple species of grasses instead of one type in winter makes dikes more drought resistant and increases biodiversity and soil quality of the surrounding environment.



Phase 2

Challenges

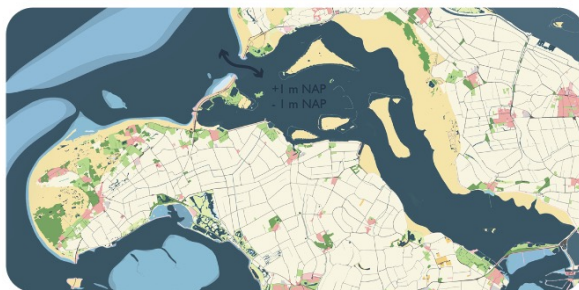
- Water quality
- Fish migration
- Biodiversity decline

Stakeholders

- Waterboard Scheldestromen
- Funders
- Municipality Schouwen-Duiveland
- Rijkswaterstaat
- Province Zeeland
- Planners
- Nature parties
- Fisheries

Pattern cards

- Tidal Water
A circular flow of water in the estuary.
- Free Sand
A dike covered with multiple species of grasses instead of one type in winter makes dikes more drought resistant and increases biodiversity and soil quality of the surrounding environment.
- Open Swimways
A dike covered with multiple species of grasses instead of one type in winter makes dikes more drought resistant and increases biodiversity and soil quality of the surrounding environment.



Phase 3

Challenges

- Erosion
- Fish migration
- Biodiversity decline

Stakeholders

- Province Zeeland
- Funders
- Municipality Schouwen-Duiveland
- Rijkswaterstaat
- Province Zuid-Holland
- Planners
- Flora & fauna
- Nature parties

Pattern cards

- Slow Water
A circular flow of water in the estuary.
- Washed Away
A dike covered with multiple species of grasses instead of one type in winter makes dikes more drought resistant and increases biodiversity and soil quality of the surrounding environment.
- Biodiverse Salt & Fresh
A dike covered with multiple species of grasses instead of one type in winter makes dikes more drought resistant and increases biodiversity and soil quality of the surrounding environment.





Kentish Plover
(staatbosbeheer, 2023)



Avocet in the mud (np oosterschelde, n.d.)



Red fescue (Dijksen, n.d.)



Common marsh grass (Scheldestorren, n.d.)



Samphire (Ophen, 2019)



Eelgrass (Govers, 2021)



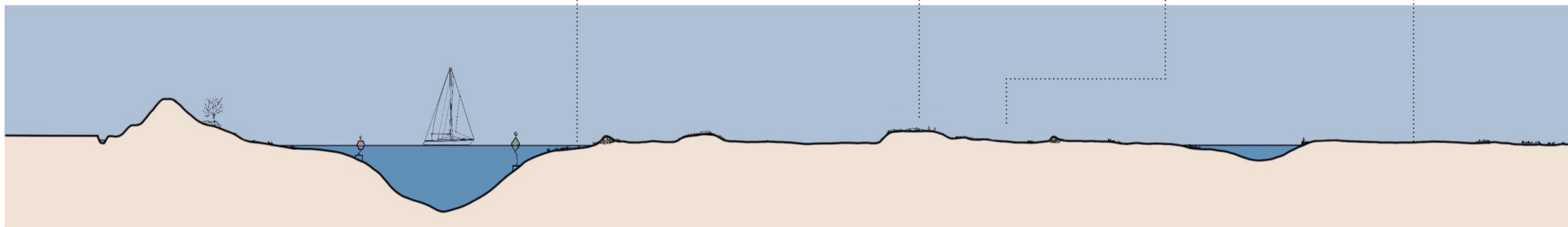
Zeerus (de Jong, 2010)



Sea purslane (Reel, 2020)



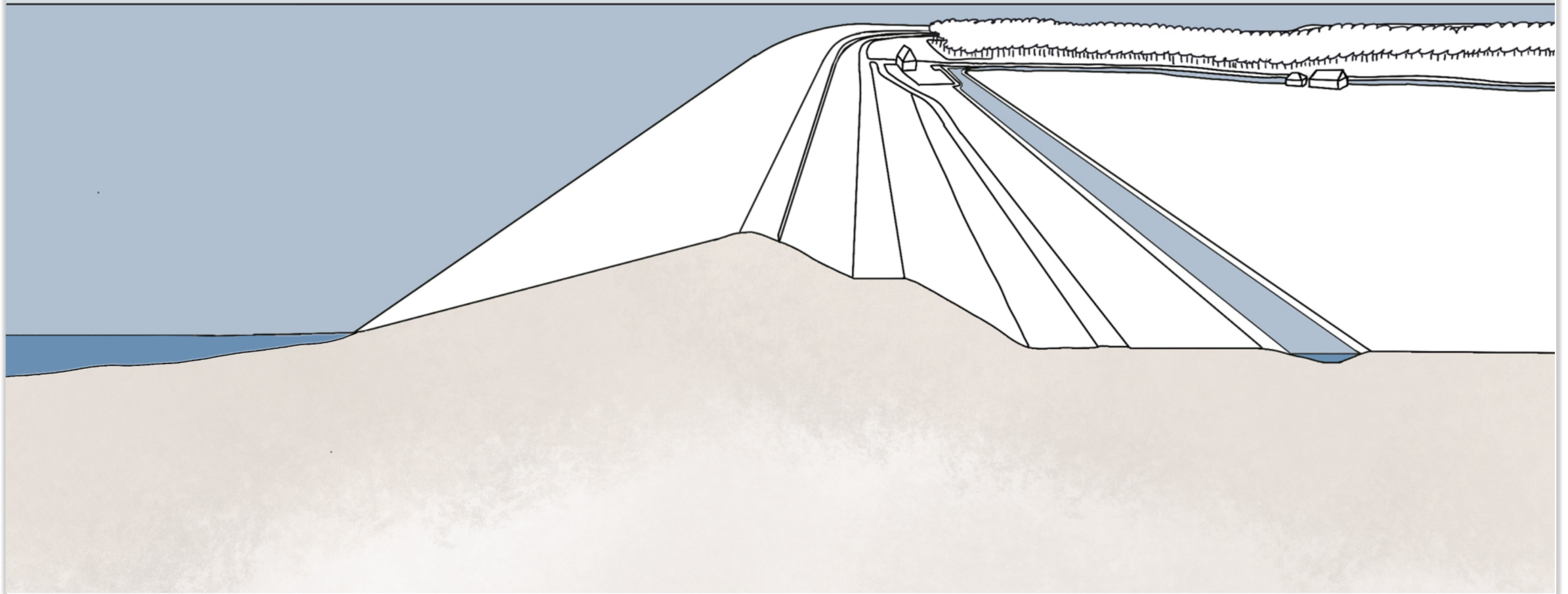
Cord grass (Itkor, n.d.)



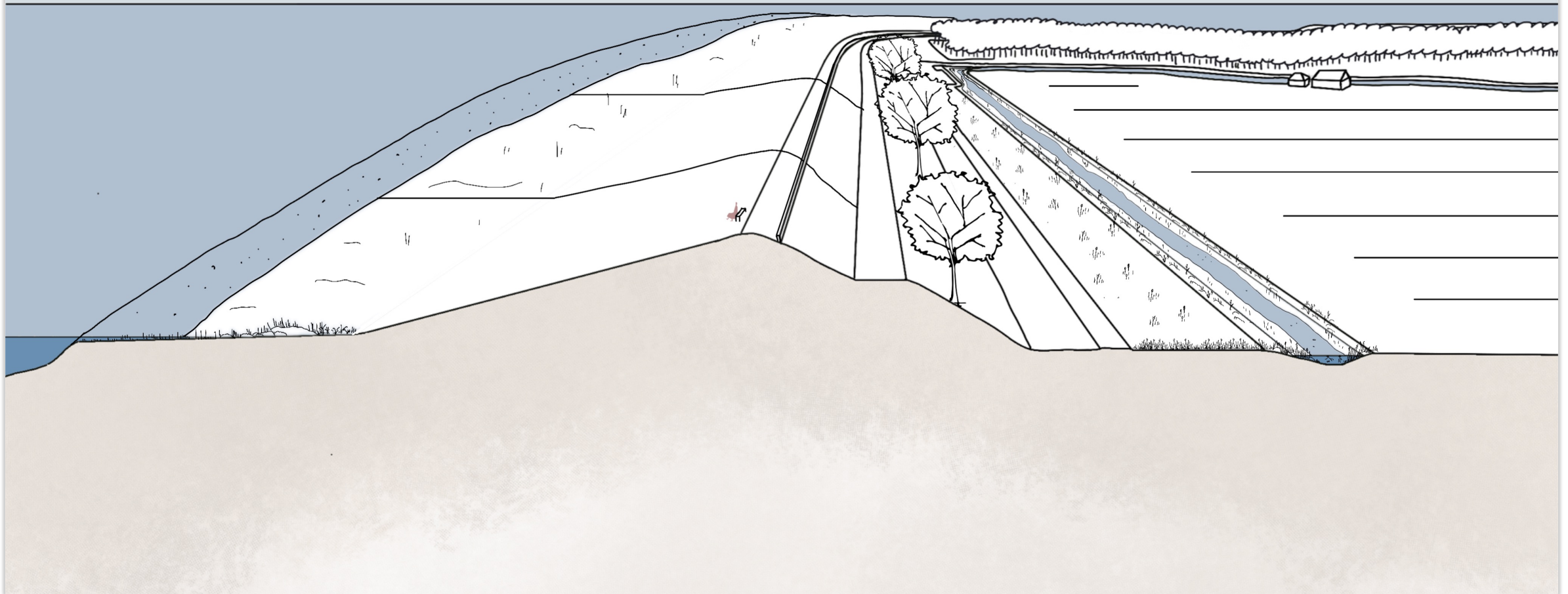
	Patern	Code	How
+	Tidal water	W.1	Reintroducing the tidal movement by opening the Brouwesdam
	Washed away	B.7	letting tidal dynamics back into the stagnant lakes
	Anti-fish Sushi	B.3	Installing new pumps or slowing down the rotation per minute
	Slow Water	Se.2	Construction of oyster dams, breakwater or other elements that slows the current
	Vegetated Enbankment	Se.1	Creating a marshland on the seaside of the dike
	Biodiverse Dike	B.5	sowing the dike with a biodiverse seed mix
	Open swimways	B.10	Connecting waterbodies by open connections and/or installing fish ladders
	Free sand	Se.3	removing dams or making bigger passages
-	Biodiverse salt & fresh	B.1	breaking the compratimalizajion by opening dams

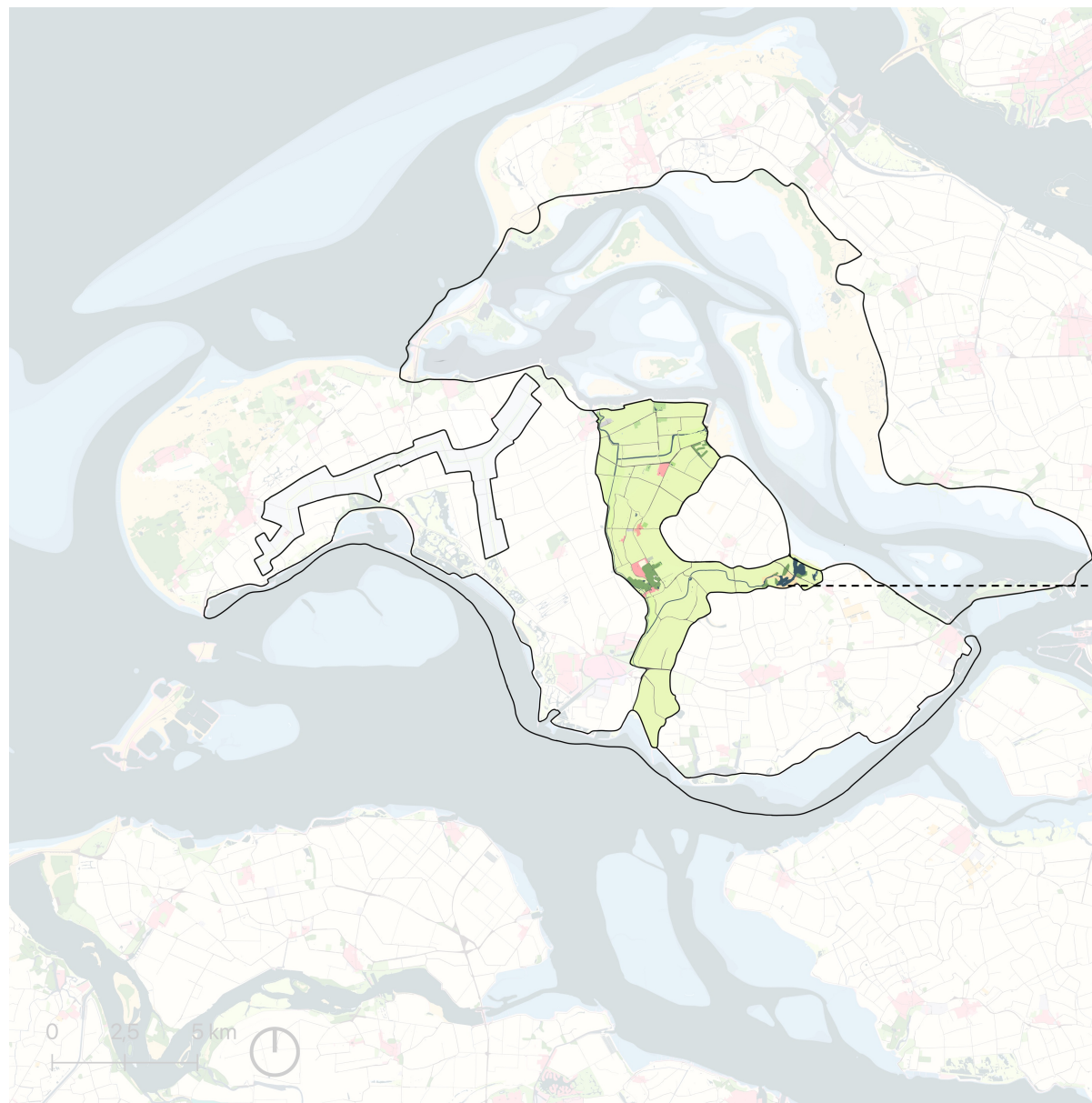


Before





After

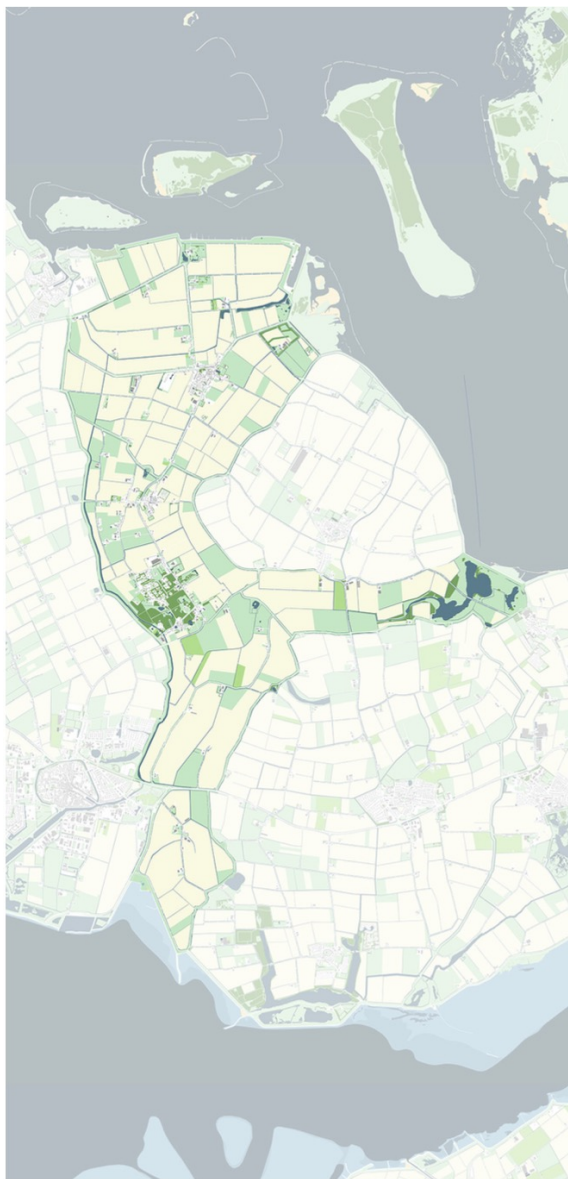





De Gouwe

Legend | de Gouwe

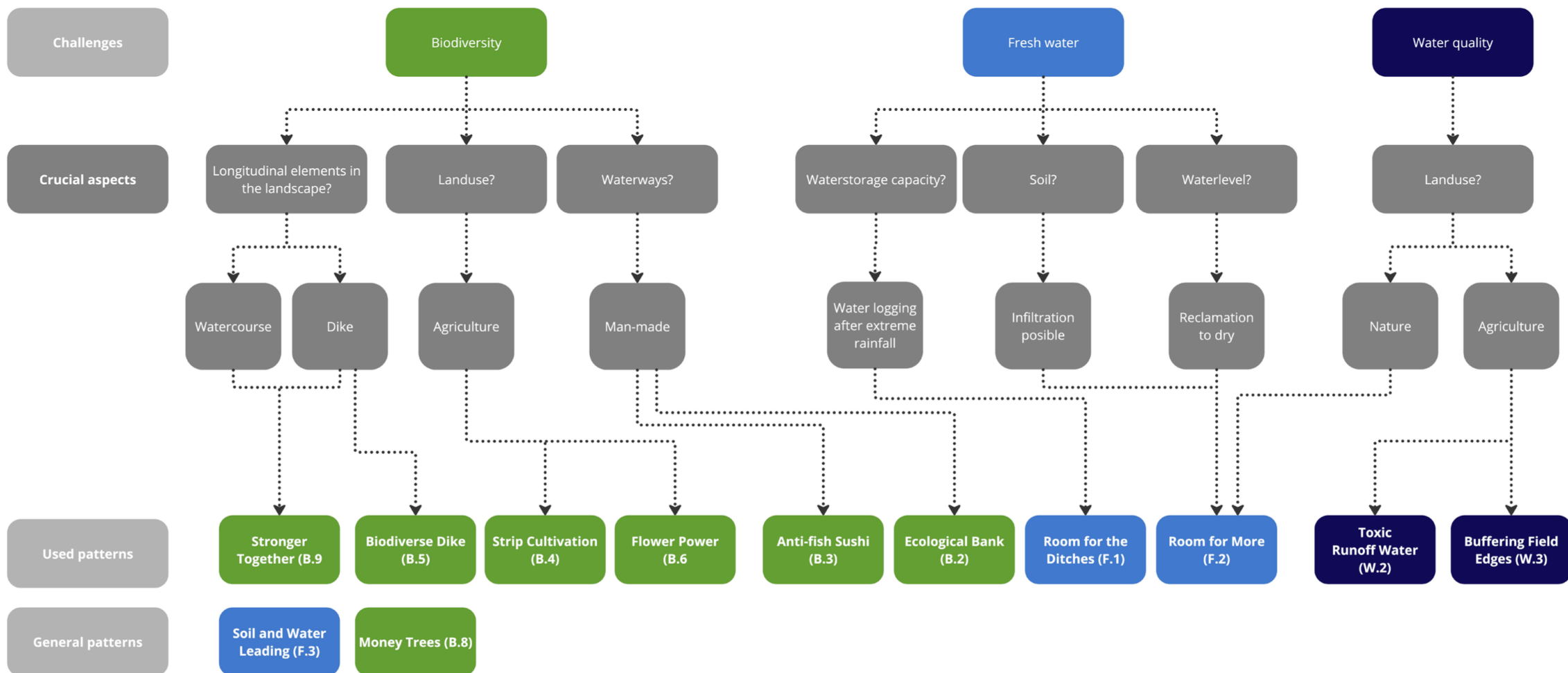
-  Scrubs / Trees
-  Grass land
-  Agriculture land
-  Sand



Challenges

-  Fresh water availability
-  Drought
-  Salinization
-  Biodiversity decline
-  Water quality

DECISION TREE | de Gouwe



Biodiversity B.2
Ecological Bank
Less steep embankments lead to more biodiversity
Desteepling the embankment of ditches gives more opportunities for flora and fauna to flourish.

Biodiversity B.3
Anti-fish Sushi
Fish friendly or low RPM pumps for less fish mortality
To pump water out of the polder towards the sea, the Netherlands uses water pumps. The traditional pumps cause damage and/or death to the fish that want to pass.

Biodiversity B.4
Strip Cultivation
Strip cultivation for more meadow birds
An effective action to increase the amount of meadow in agricultural fields is strip cultivation. Instead of one mono culture, multiple crops are planted in lines.

Biodiversity B.5
Biodiverse Dike
Biodiverse dike for more drought resistance
A dike covered with multiple species of grasses instead of one type is more resistant against droughts and increases the biodiversity and ecological value of the surrounding environment.

Biodiversity B.6
Flower Power
Flowery field edges for more biodiversity
Agricultural field edges that are cultivation free have a positive effect on biodiversity and strengthens populations of vulnerable species.

Biodiversity B.9
Stronger Together
Connecting nature areas makes them more robust
The natural environment in the Netherlands has become fragmented. Many habitats have become isolated from each other due to urban development, expansion of industrial areas, infrastructure, or intensification of agricultural land. Connecting habitats improves them.

Fresh water F.1
Room for the Ditches
A more gentle sloop in ditches give more waterstorage capacity
Flattening the edge of ditches allows more square metres of water to enter the ditch and thus increases water storage capacity throughout the system.

Fresh water F.2
Room for More
More waterstorage cappacity gives room for higher water levels
When the ditches can hold more cubic metres of water their waterstorage cappacity increases, allowing the water levels to increase as well.

Water quality W.2
Toxic Runoff Water
Reducing chemical pesticides improves the waterquality
Reducing the runoff of pollutants from agriculture into ground and surface water improves the water quality.

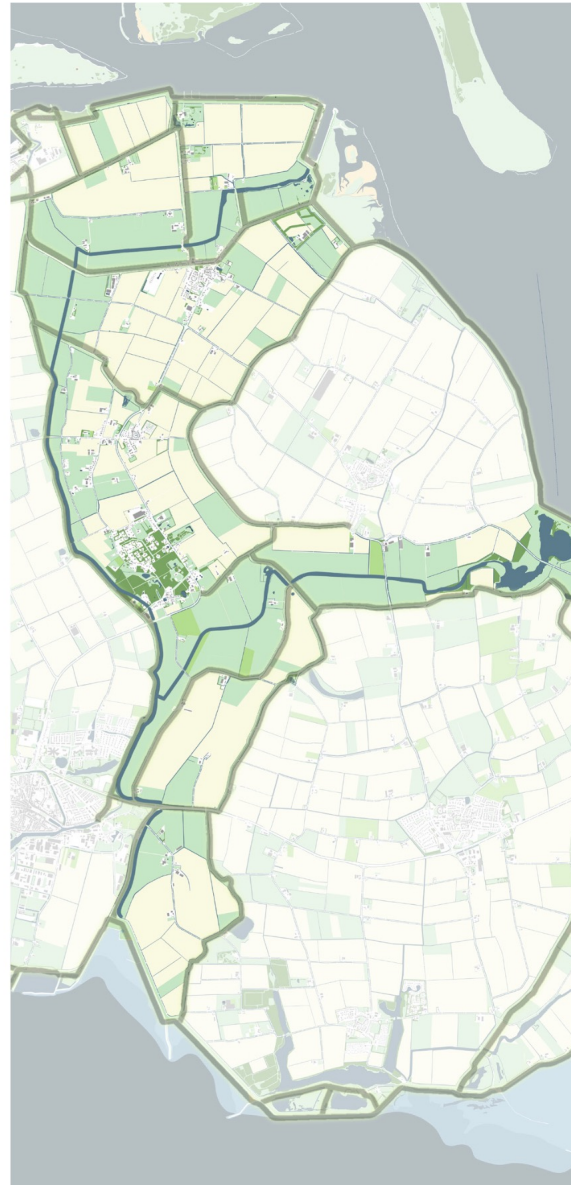
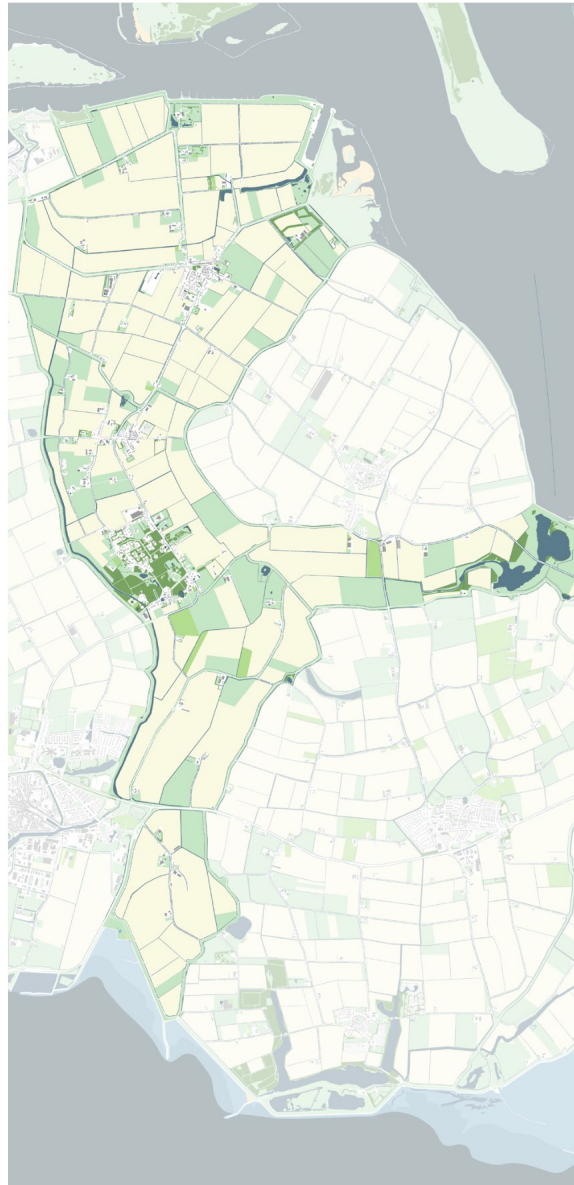
Water quality W.3
Buffering Field Edges
Water quality improvement by buffering sown field margins
Runoff water that contains pesticides degrades the surface water quality. Buffering field edges can reduce the amount of pesticides entering the surface water.

DESIGN PRINCIPLES

The design principles that are used to transform the Gouwe area are: B.9, B.5, B.4, B.6, B.3, B.2, F.1, F.2, W.2 and W.3. The full explanation of the cards can be found in the appendix and in the separate card deck.

Legend | de Gouwe

-  Scrubs / Trees
-  Grass land
-  Agriculture land
-  Sand



Phase 1

Challenges



Fresh water availability



Drought



Salinization

Stakeholders

Municipality
Schouwen-
Duivenland

Rijkswaterstaat

Waterboard
Scheldestromen

Funders

Planners

Farmers

Pattern cards

Biodiversity B.3

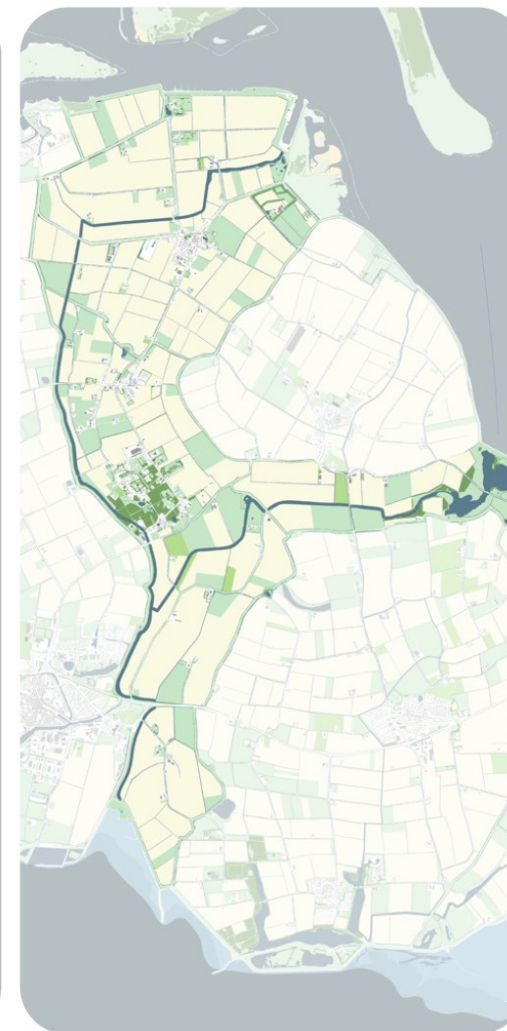
Anti-fish Sushi
Fish friendly or low RPM pumps for less fish mortality

To pump water out of the polder towards the sea, the Netherlands uses water pumps. The traditional pumps cause damage and/or death to the fish that want to pass.

Fresh water F.4

Room for the Ditches
A more gentle sloop in ditches give more waterstorage capacity

Flattening the edge of ditches allows more square metres of water to enter the ditch and thus increases water storage capacity throughout the system.



Phase 2

Challenges



Water quality



Drought



Biodiversity decline



Water safety

Stakeholders

Municipality Schouwen-Duivenland

Rijkswaterstaat

Waterboard Scheldestromen

Funders

Planners

Farmers

Nature parties

Implementers

Pattern cards

Biodiversity 0.2

Ecological Bank
Less steep embankments lead to more biodiversity. Desteepling the embankment of ditches gives more opportunities for flora and fauna to flourish.

Biodiversity 0.5

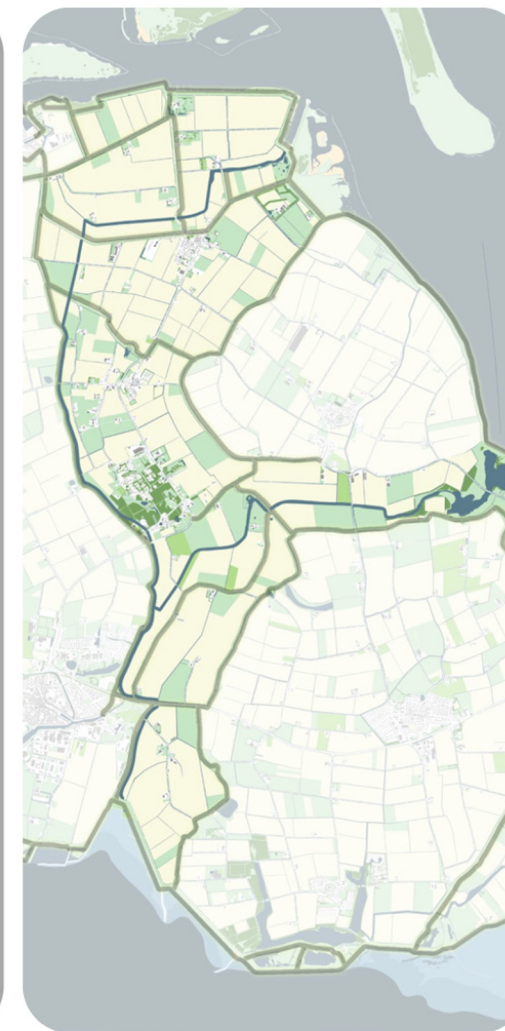
Biodiverse Dike
Biodiverse dike for more drought resistance. A dike covered with multiple species of grasses instead of one type is more resistant against droughts and increases the biodiversity and ecological value of the surrounding environment.

Biodiversity 0.9

Stronger Together
Connecting nature areas makes them more robust. The natural environment in the Netherlands has become fragmented. Many habitats have become isolated from each other due to urban development, expansion of industrial areas, infrastructure, or intensification of agricultural land. Connecting habitats improves them.

Fresh water 0.2

Room for More
More waterstorage capacity gives room for higher water levels. When the ditches can hold more cubic metres of water their waterstorage capacity increases, allowing the water levels to increase as well.



Phase 3

Challenges



Water quality



Biodiversity decline

Stakeholders

Municipality Schouwen-Duivenland

Ministry of Agriculture, Nature

Nature parties

Funders

Flora & fauna

Farmers

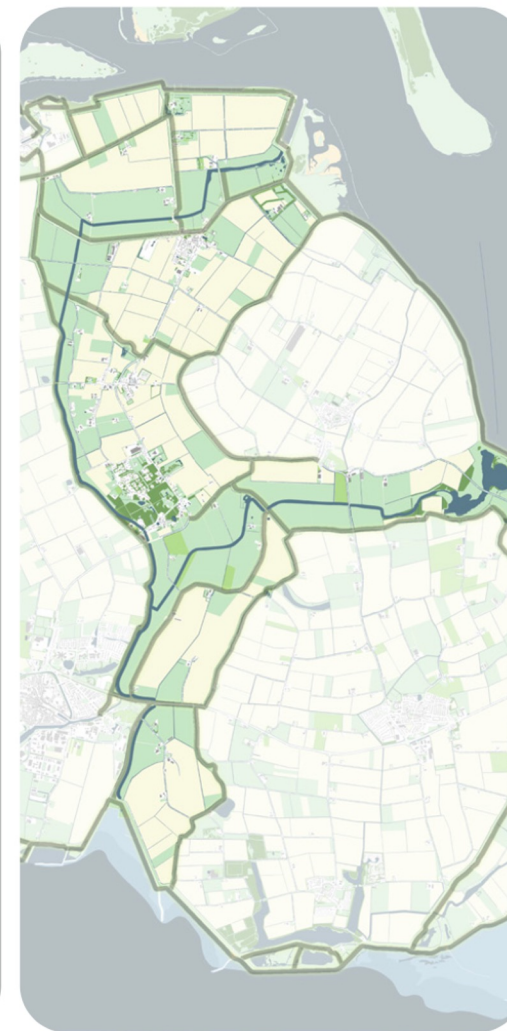
Pattern cards

Flower Power
 Flowerly field edges for more biodiversity
 Agricultural field edges that are cultivation free have a positive effect on biodiversity and strengthens populations of vulnerable species.

Strip Cultivation
 Strip cultivation for more meadow birds
 An effective action to increase the amount of meadow in agricultural fields is strip cultivation. Instead of one mono culture, multiple crops are planted in lines.

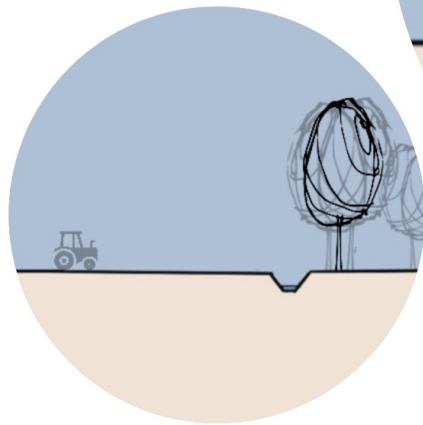
Toxic Runoff Water
 Reducing chemical pesticides improves the waterquality
 Reducing the runoff of pollutants from agriculture into ground and surface water improves the water quality.

Buffering Field Edges
 Water quality improvement by buffering sown field margins
 Runoff water that contains pesticides degrades the surface water quality. Buffering field edges can reduce the amount of pesticides entering the surface water.

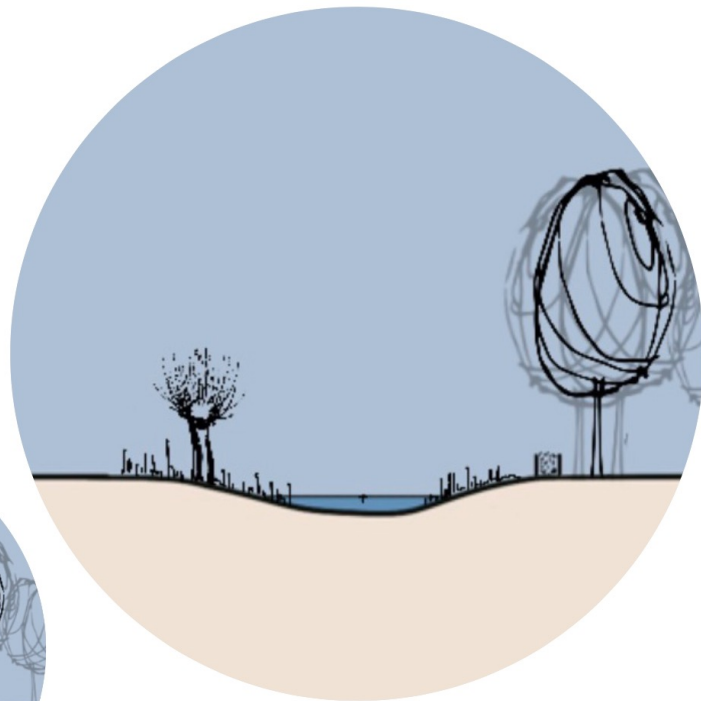


	Pattern	Code	How
+ Priority / Order -	Room for the Ditches	F.1	Ground can be excavated and used to heighten other places on the island
	Room for More	F.2	Changing 'het Peilbesluit'
	Ecological Bank	B.2	Changing the slope and adding planting
	Biodiverse Dike	B.5	Sowing the dike with a biodiverse seed mix
	Stronger Together	B.9	Connecting the different habitats with ecological routes
	Flower Power	B.6	Sowing the field edge with a biodiverse seed mix
	Buffering Field Edge	W.3	Sowing the field edge with a buffering seed mix
	Strip Cultivation	B.4	Instead of one mono cultivation, cultivating in strips
	Anti-fish Sushi	B.3	Installing new pumps or slowing down the rotation per minute
	Toxic Runoff Water	W.2	Banning chemical pesticides





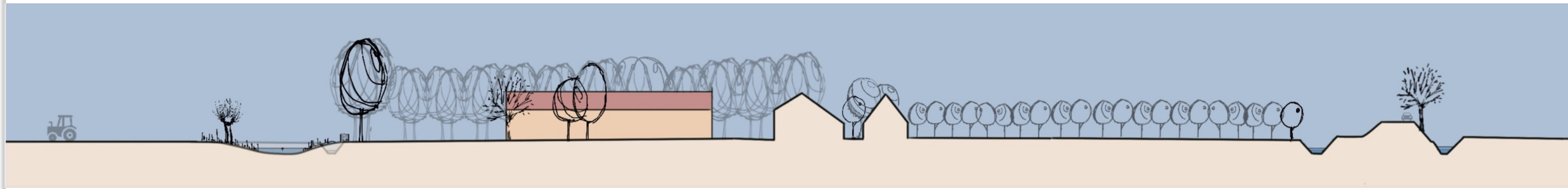
Before



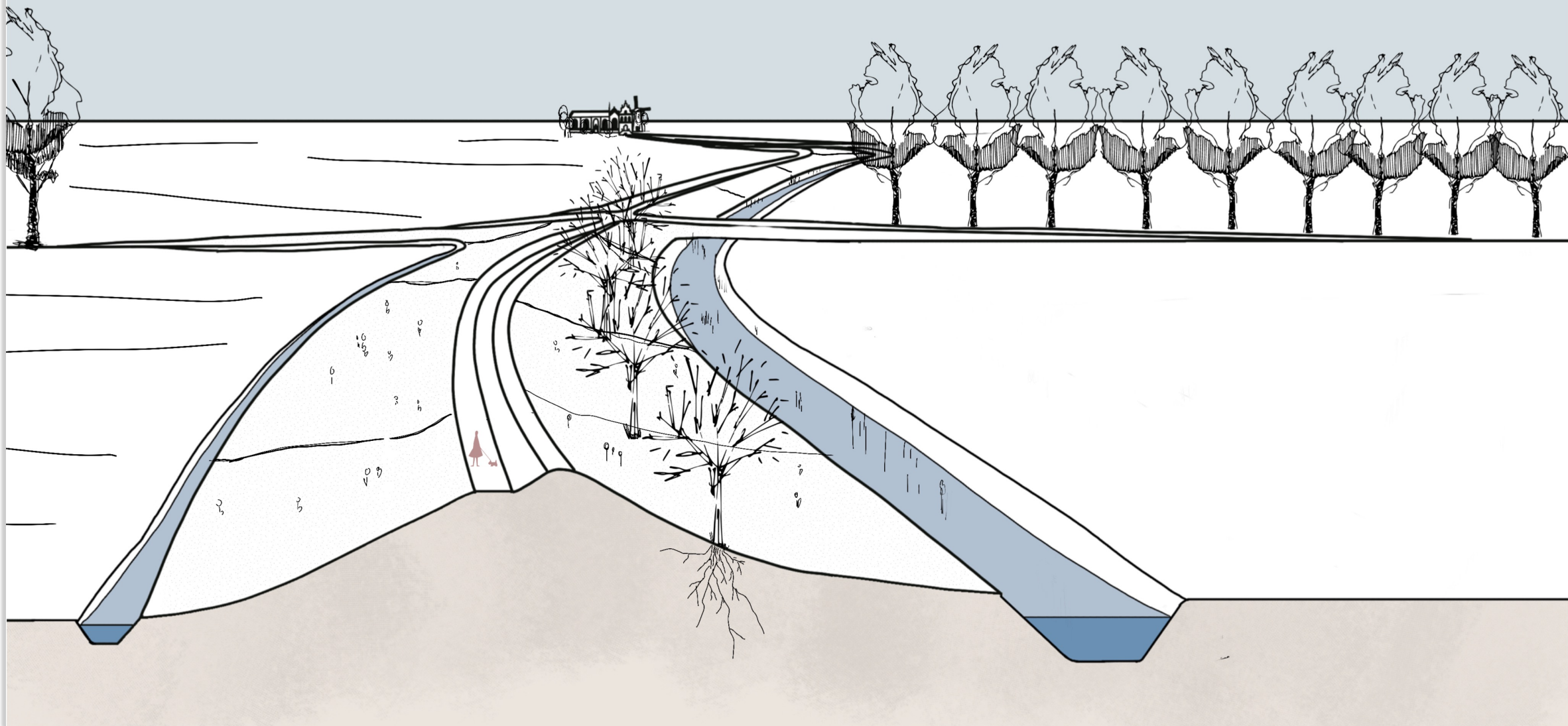
After



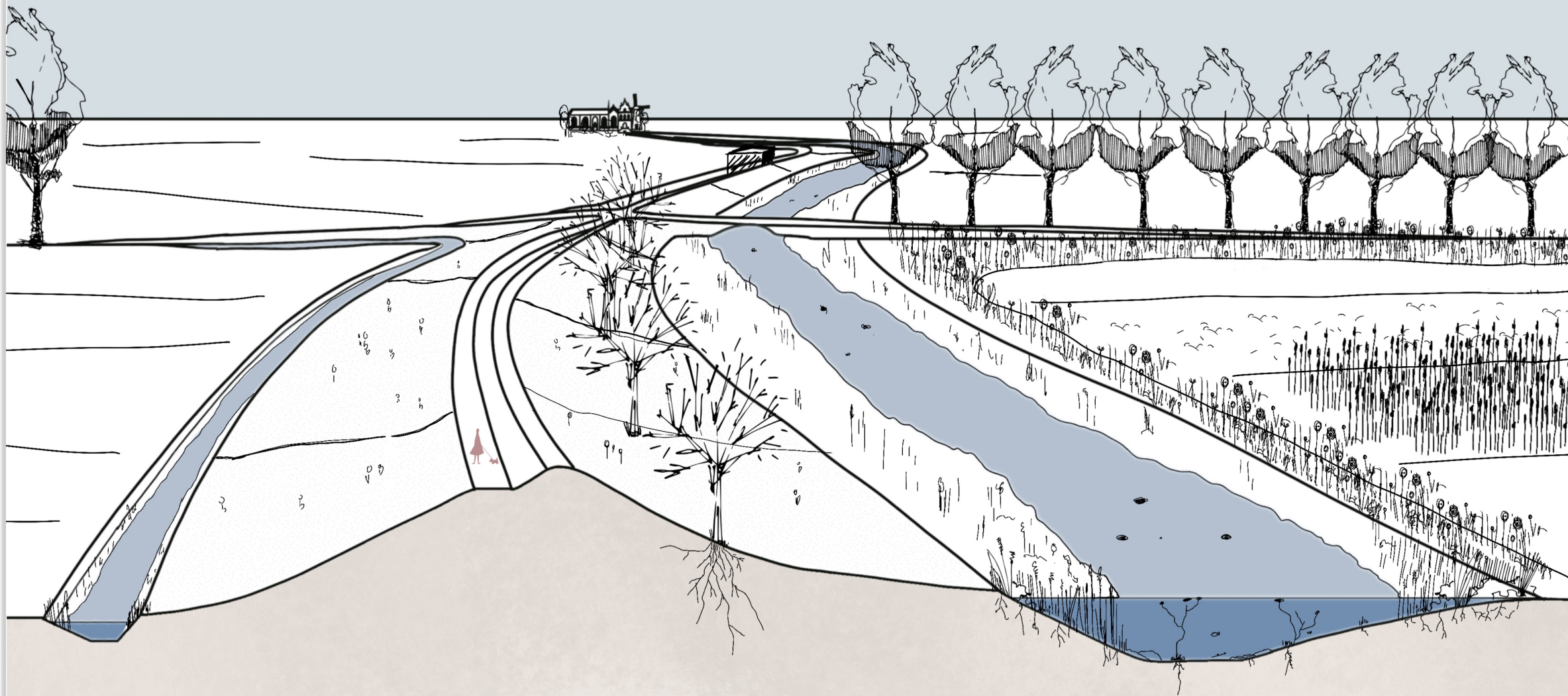
The little owl (Marle, n.d.)

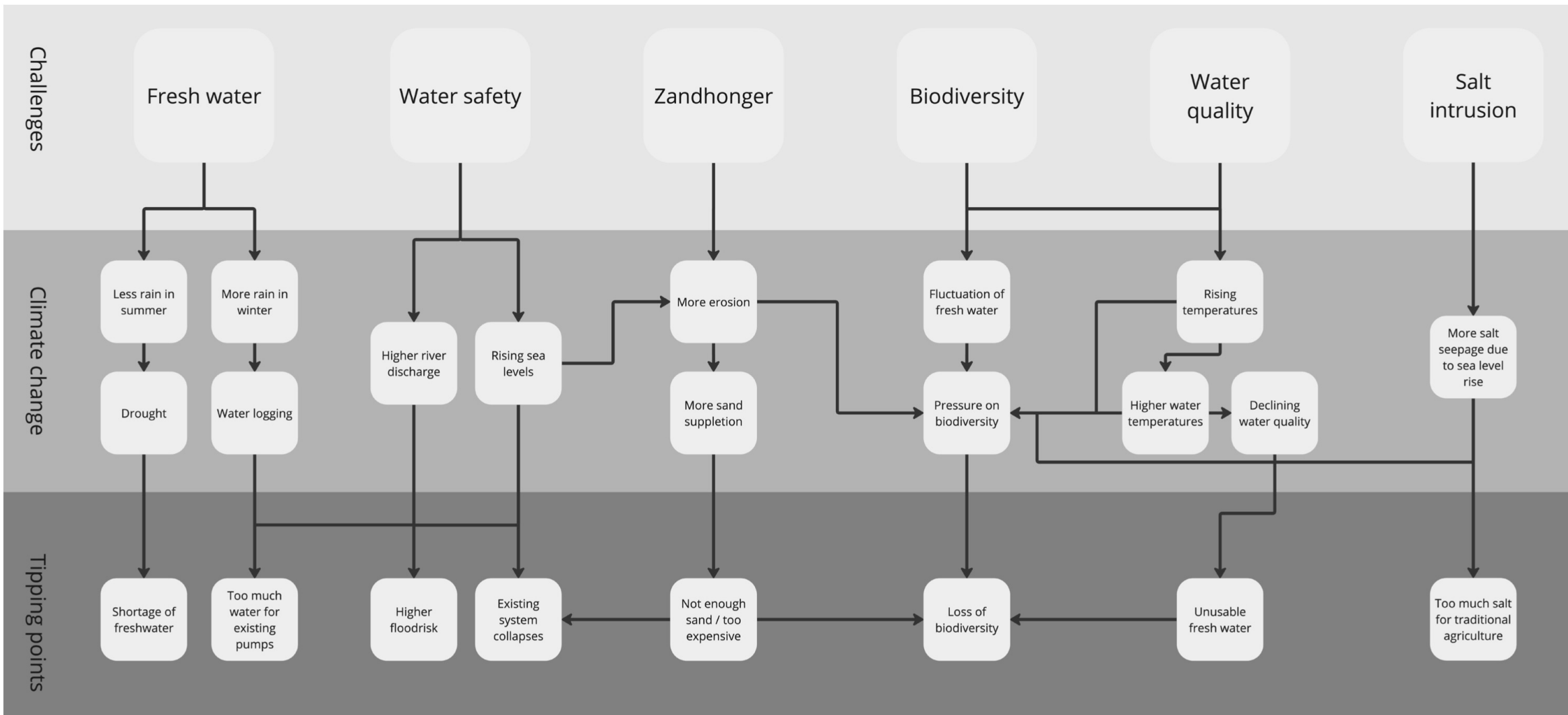


BEFORE



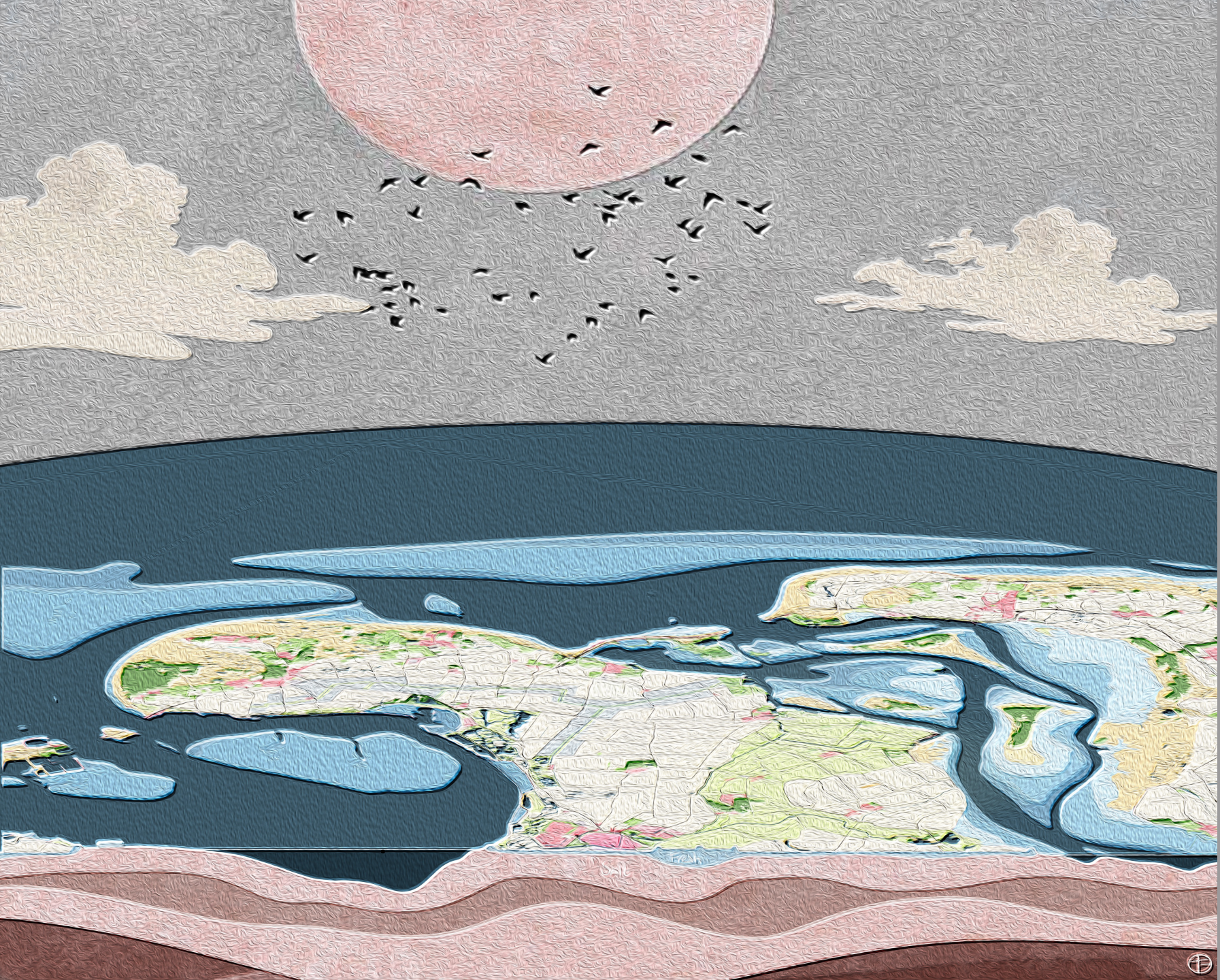
AFTER





Pattern cards





Schouwen-Duivenland | *Between Land & Sea*





BETWEEN LAND & SEA

Building with nature to sustain, secure and live
on a sustainable Schouwen-Duiveland

FROUKJE OTTEMA

Studio: Metropolitan ecologies of places

First mentor: Arjan van Timmeren

Second mentor: Nico Tillie