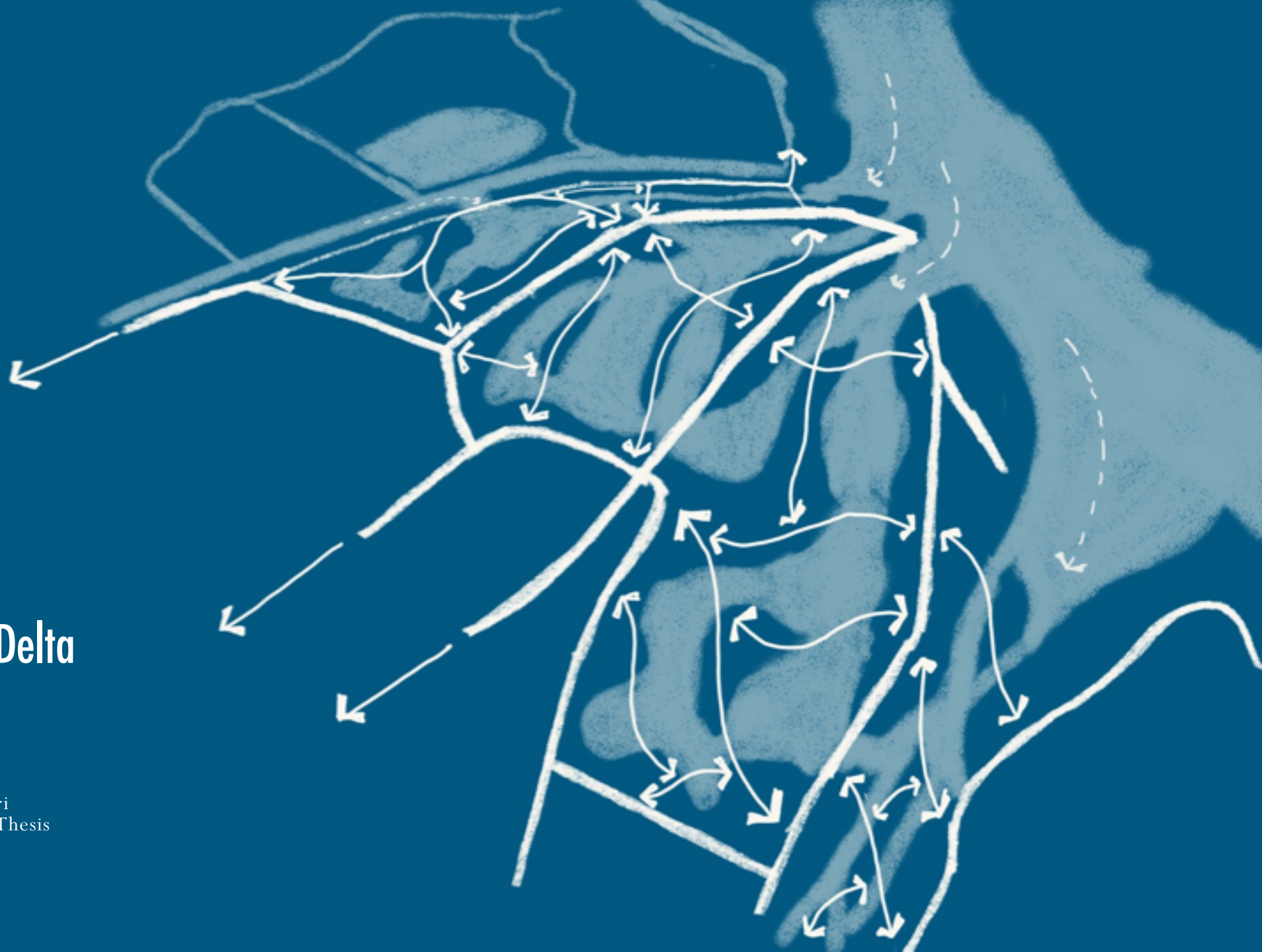
Towards Resilient Delta

By

Timothy Radhitya Djagiri
MSc Landscape Architecture Thesis



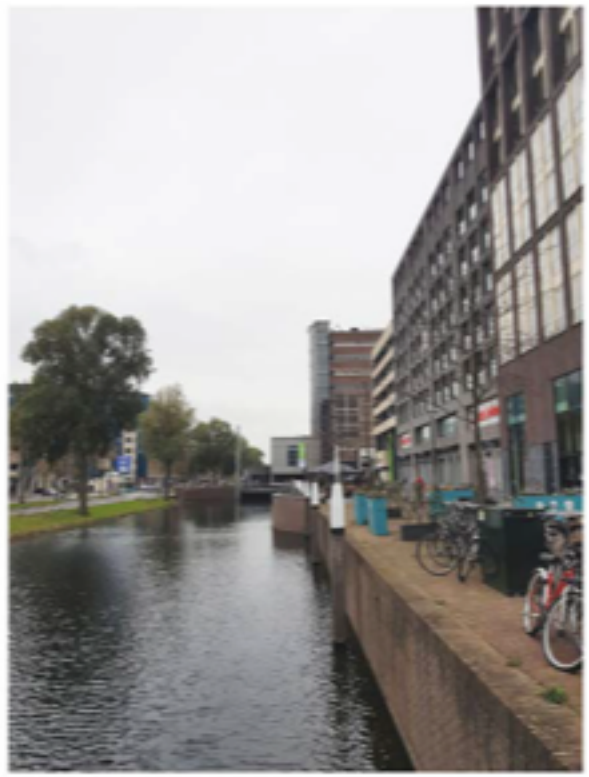
How is our relationship with the dynamics of nature?

Afloat.

Image source: Rijkswaterstaat

Image source: Rijkswaterstaat, 2011

Image source: LOLA Landscape Architecture, 2014



1953 1958 1970 1986 1993 1995 2008 2018

North sea flood

1,836 people died
20,000 farmlands flooded
47,000 buildings damaged
100,000 people evacuated

Delta Comitee established (1953)

Ijssel barrier started construction (1954)

Delta Works initiated (1958)

Hollandse Ijsselkering (1958)

Club of Rome report (1972)

Resistance to damming the Eastern Scheldt grew (1970)

Eastern Scheldt decided to be closable barrier (1976)

Volkerak dam (1970)

Haringvliet dam (1971)

Brouwers dam (1972)

Plan Stork (1986)

Eastern Scheldt barrier (1986)

River high water

200,000 people evacuated
170 km2 floodplain inundated (1993)
Total damage 100 mil. EURO in 1993 & 400 mil. EURO in 1995 with the cost of evacuation.

Natuurbeleidsplan (1990)

Room for the River as policy(1996)

Natura 2000 (1998)

Duursche waarden (1989)

Blauwekamer Grebbeberg (1992)

Room for the River underway (2006)

Delta Committee II (2008)

Annual Delta Programme (2010)

Maeslantkering (1997)

34 projects along river floodplains (2006 - 2016)

Depoldering Noordwaard (2015)

Room for the Waal (2016)

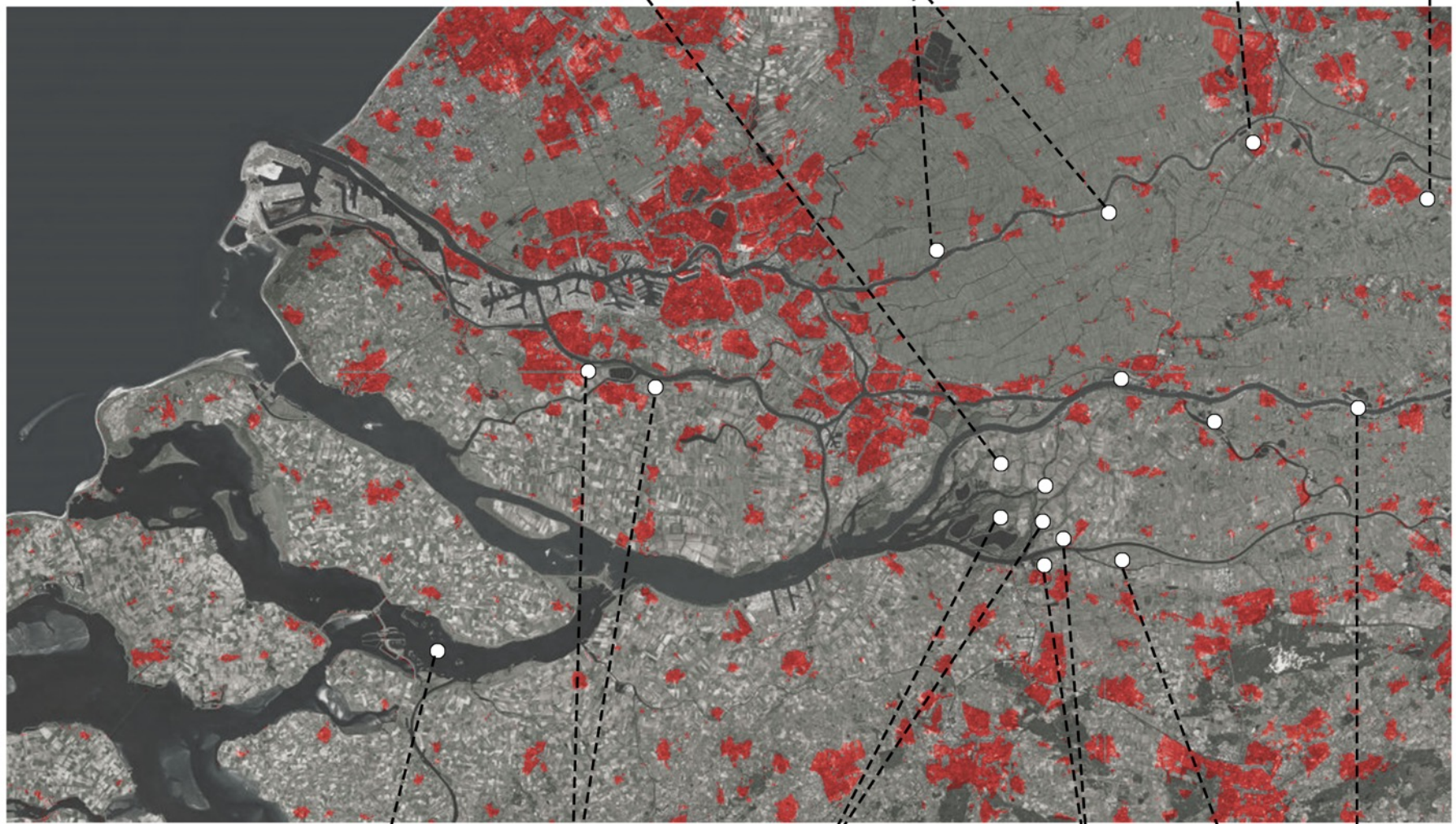
Large scale enclosure of the delta from sea

Environmental movement

Climate adaptation & nature restoration

Future adaptive delta

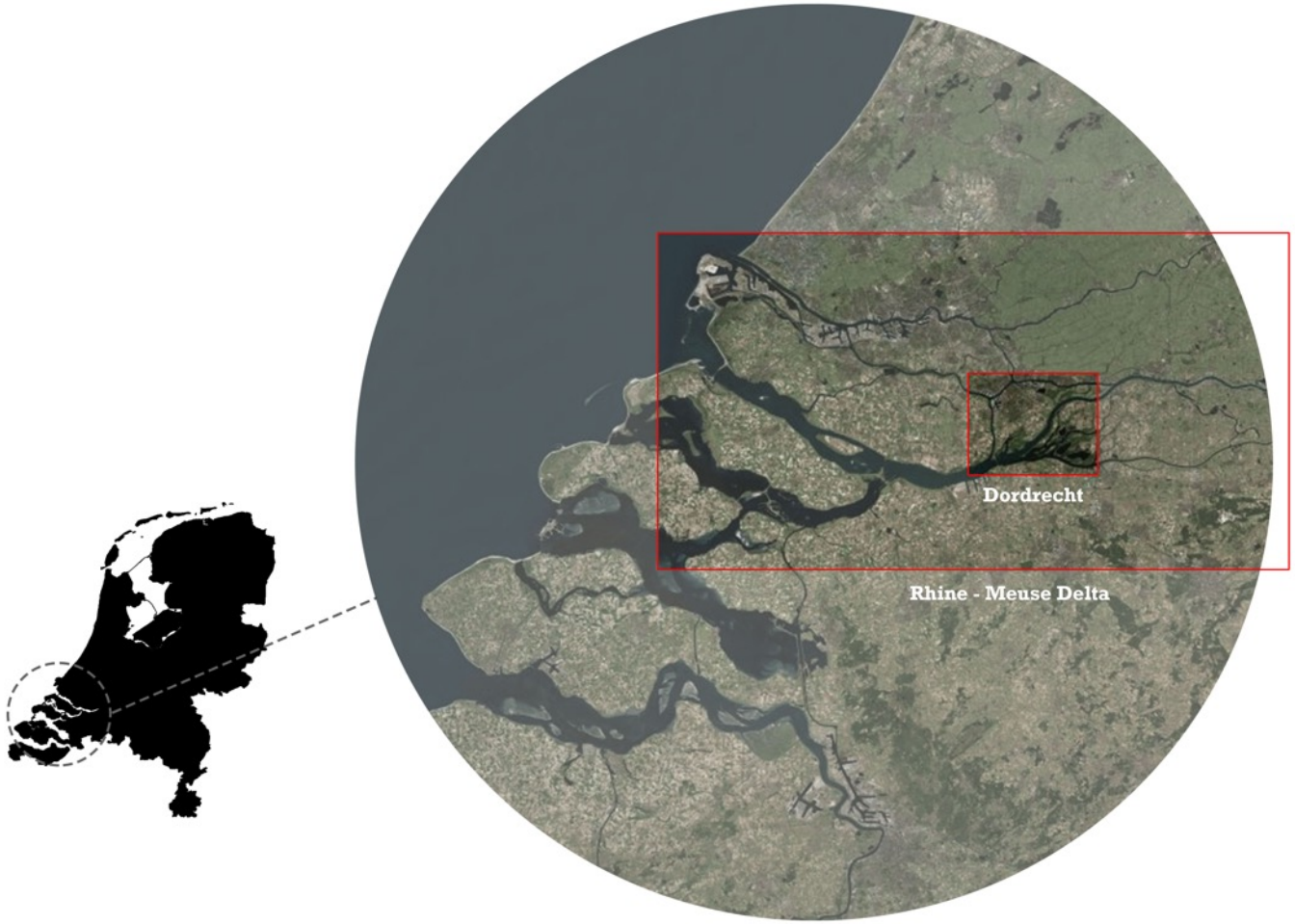
Room for the River
2006-2016



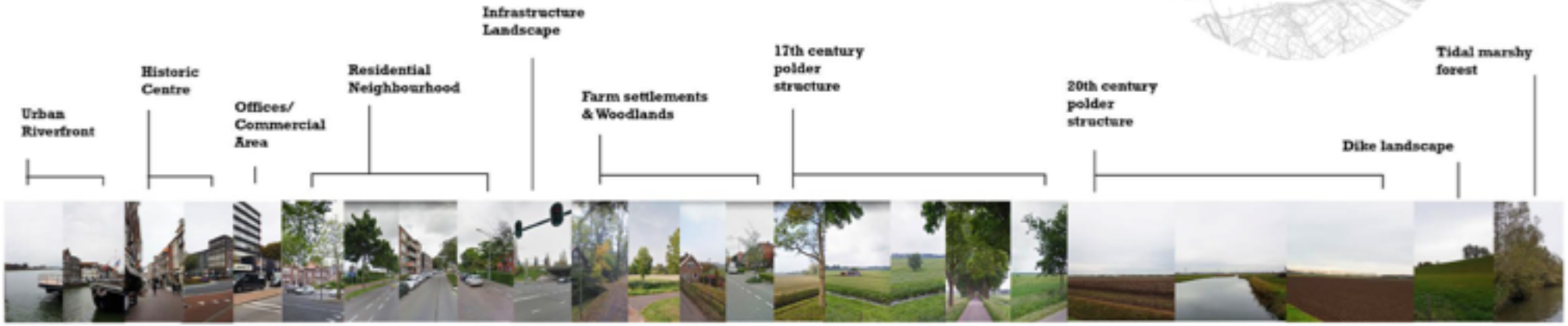
Depoldered landscapes of Noordwaard

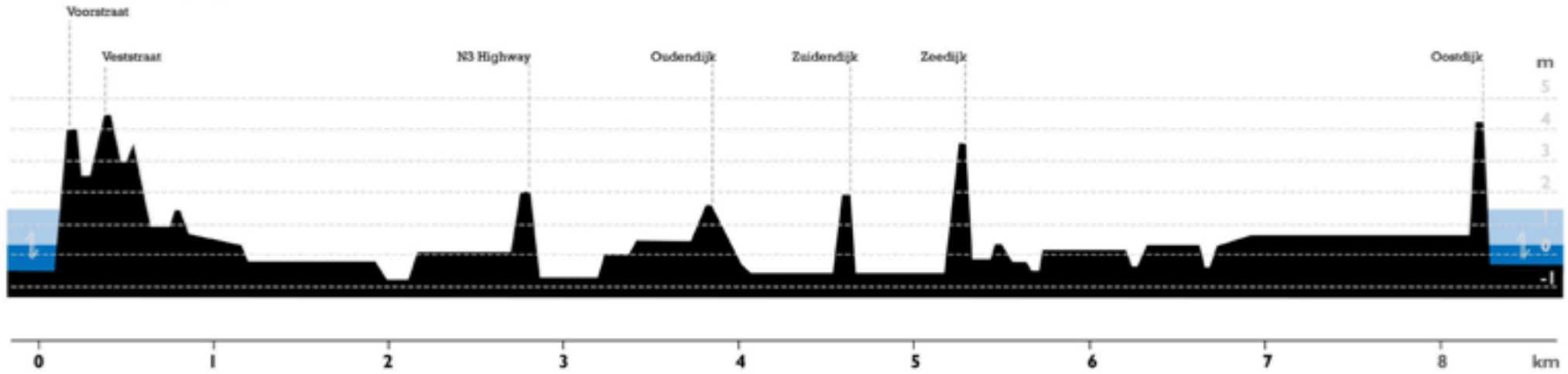
How can we live with the river?

Dordrecht as research by design site




Historic city centre
Noord
Protective dike of Dordrecht
Dordtse Biesbosch
Beneden Merwede
Oude Maas
Nieuwe Merwede
Dordtse Kil
Hollands Diep
Amer
Biesbosch National Park

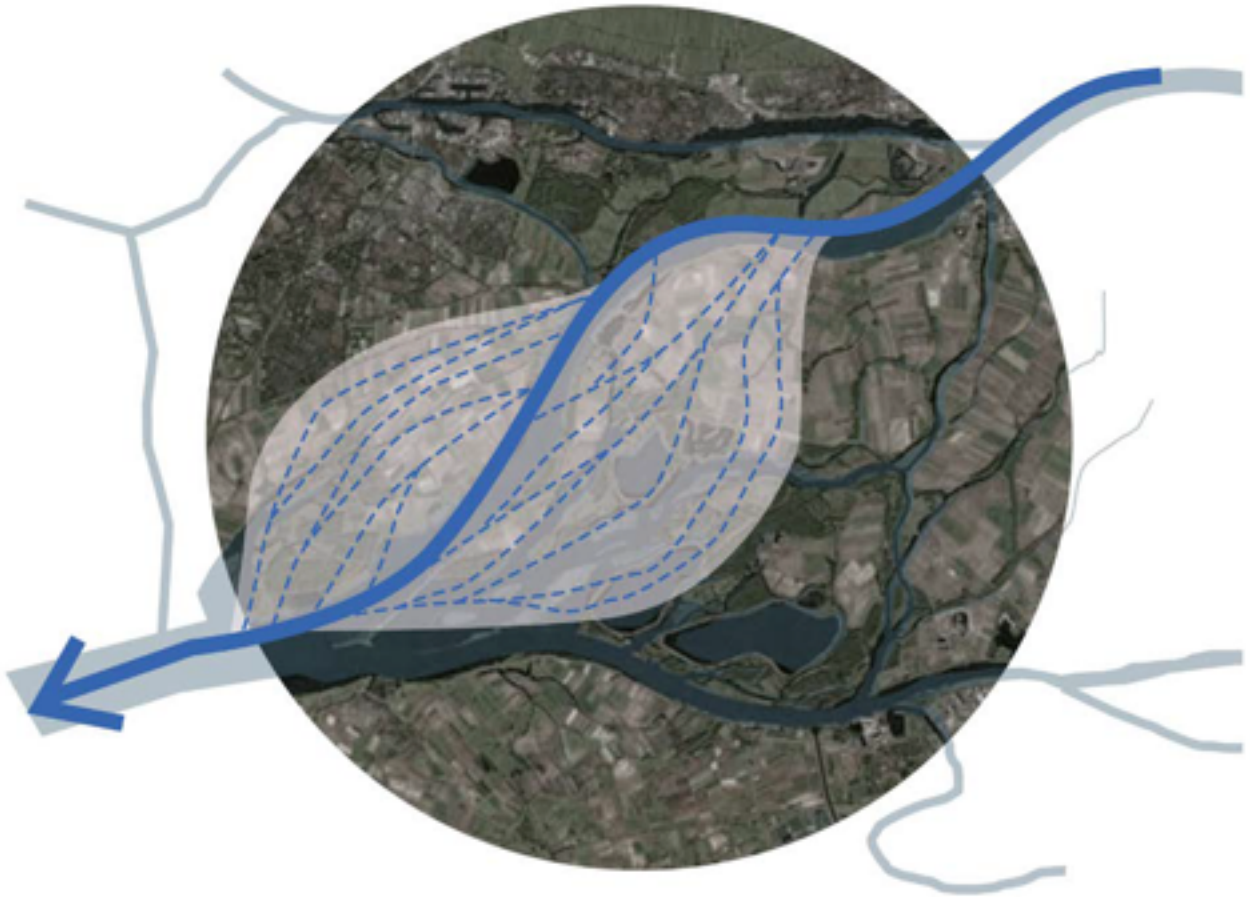

Urban Riverfront
Historic Centre
Offices/ Commercial Area
Residential Neighbourhood
Infrastructure Landscape
Farm settlements & Woodlands
17th century polder structure
20th century polder structure
Dike landscape
Tidal marshy forest

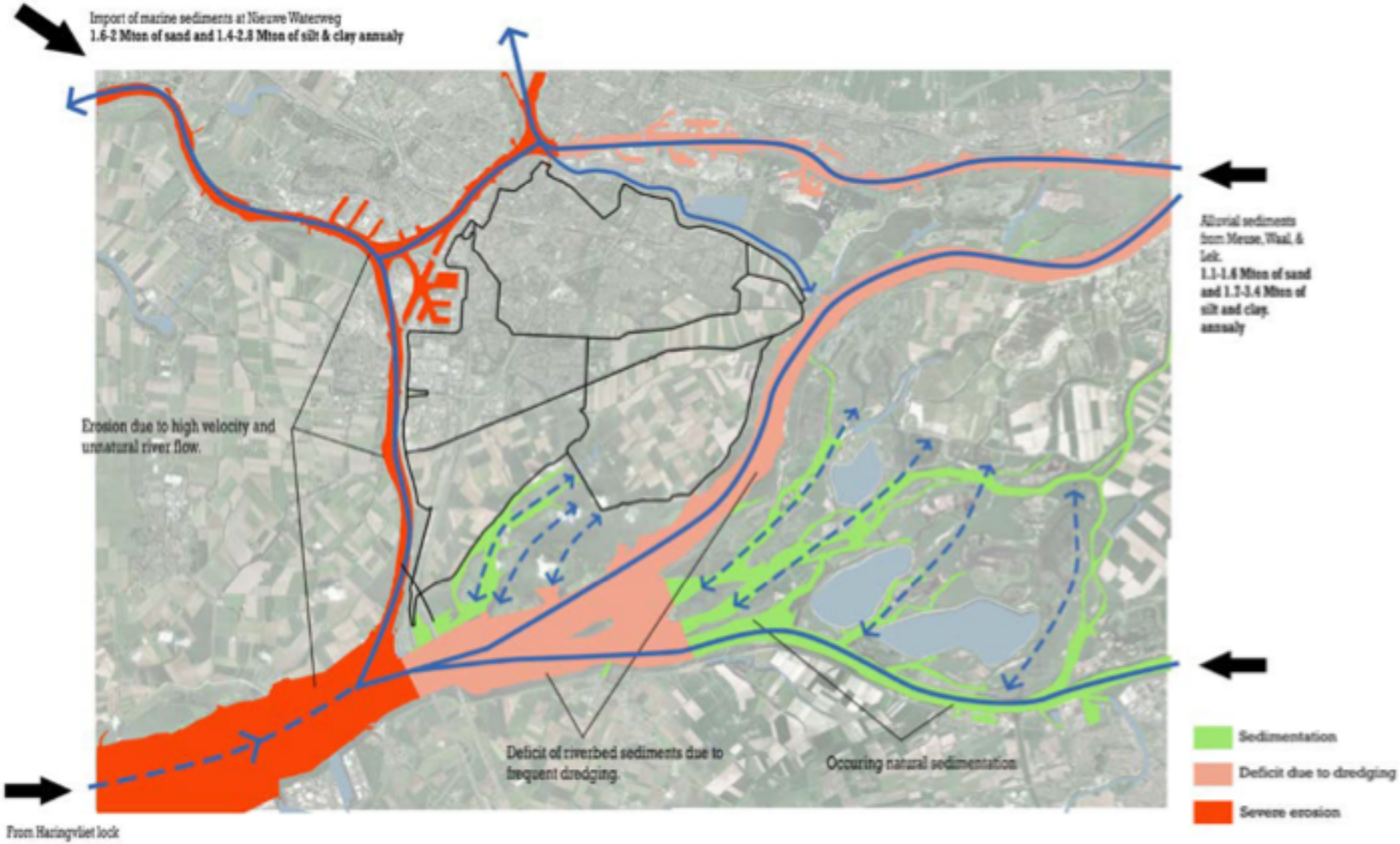

Voorstraat
Veststraat
N3 Highway
Oudendijk
Zuidendijk
Zeedijk
Oostdijk
m
5
4
3
2
1
0
-1
0
1
2
3
4
5
6
7
8
km

Main research question

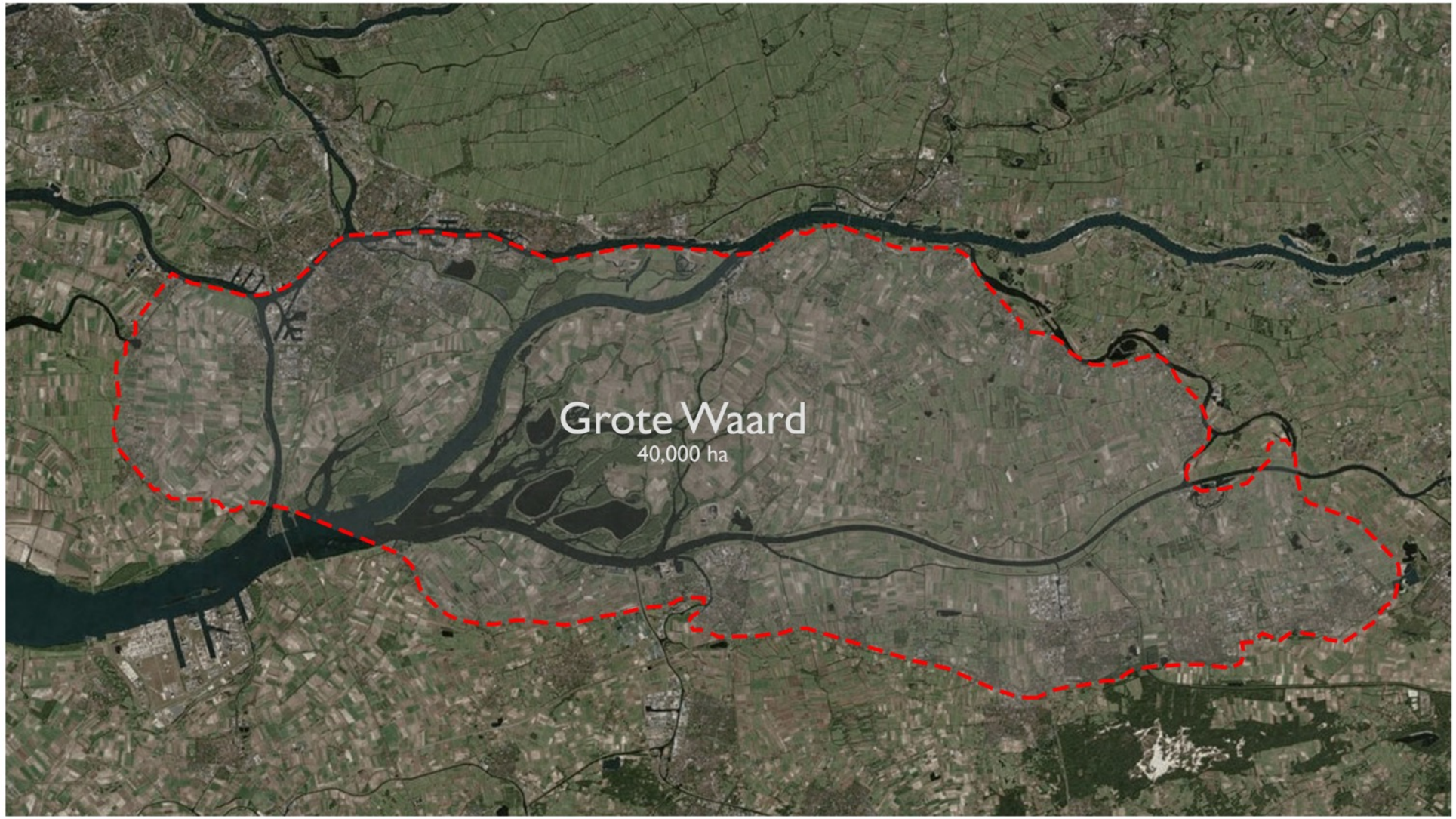
How can the dynamics of river delta landscape be integrated with the urban landscape of Dordrecht as measure of water safety, to increase climate resiliency and generate unique landscape qualities in the urbanised delta?

Hypothesis

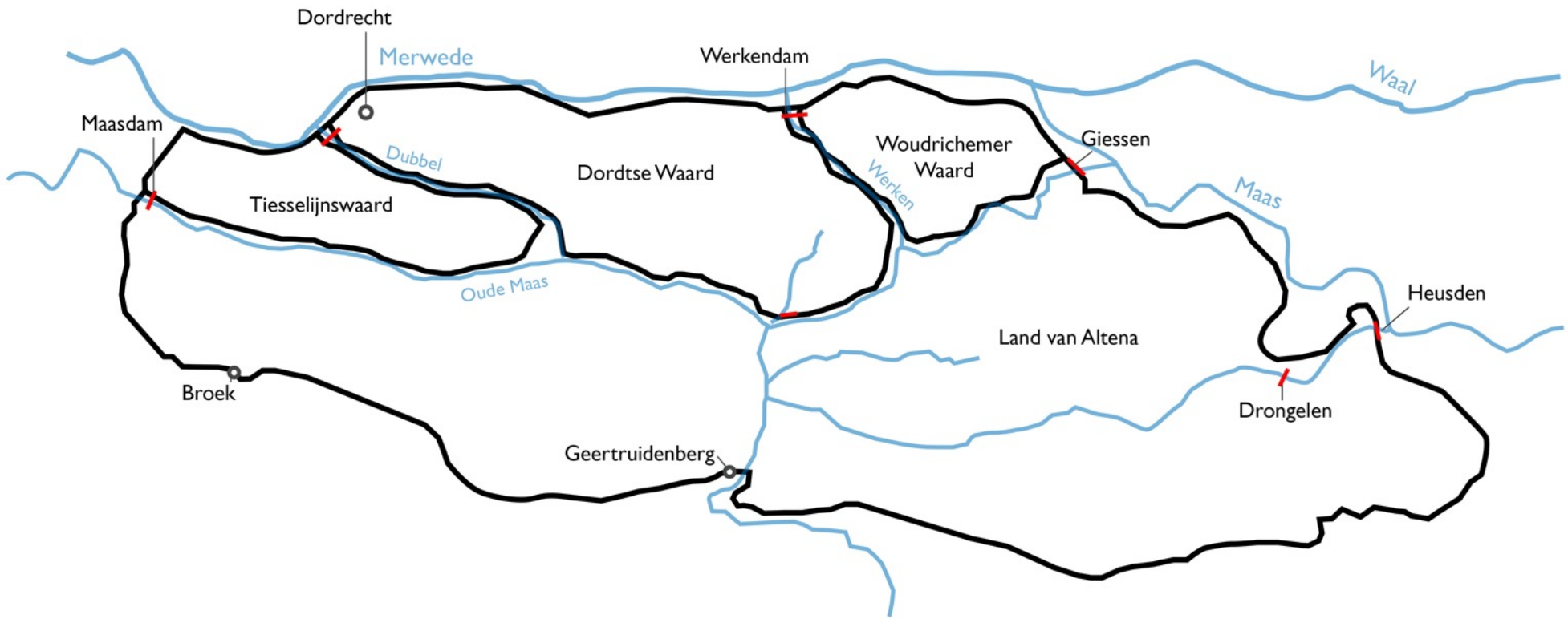



Import of marine sediments at Nieuwe Waterweg
1.6-2 Mton of sand and 1.4-2.8 Mton of silt & clay annualy
Alluvial sediments from Meuse, Waal, & Lek.
1.1-1.8 Mton of sand and 1.7-3.4 Mton of silt and clay. annualy
Erosion due to high velocity and unnatural river flow.
Deficit of riverbed sediments due to frequent dredging.
Occuring natural sedimentation
From Haringvliet lock
Sedimentation
Deficit due to dredging
Severe erosion

A reading from the past



Morphology based on: de Wit, Saskia. (2009). Dutch Lowlands, & Atlas van Nederland in het Holocene



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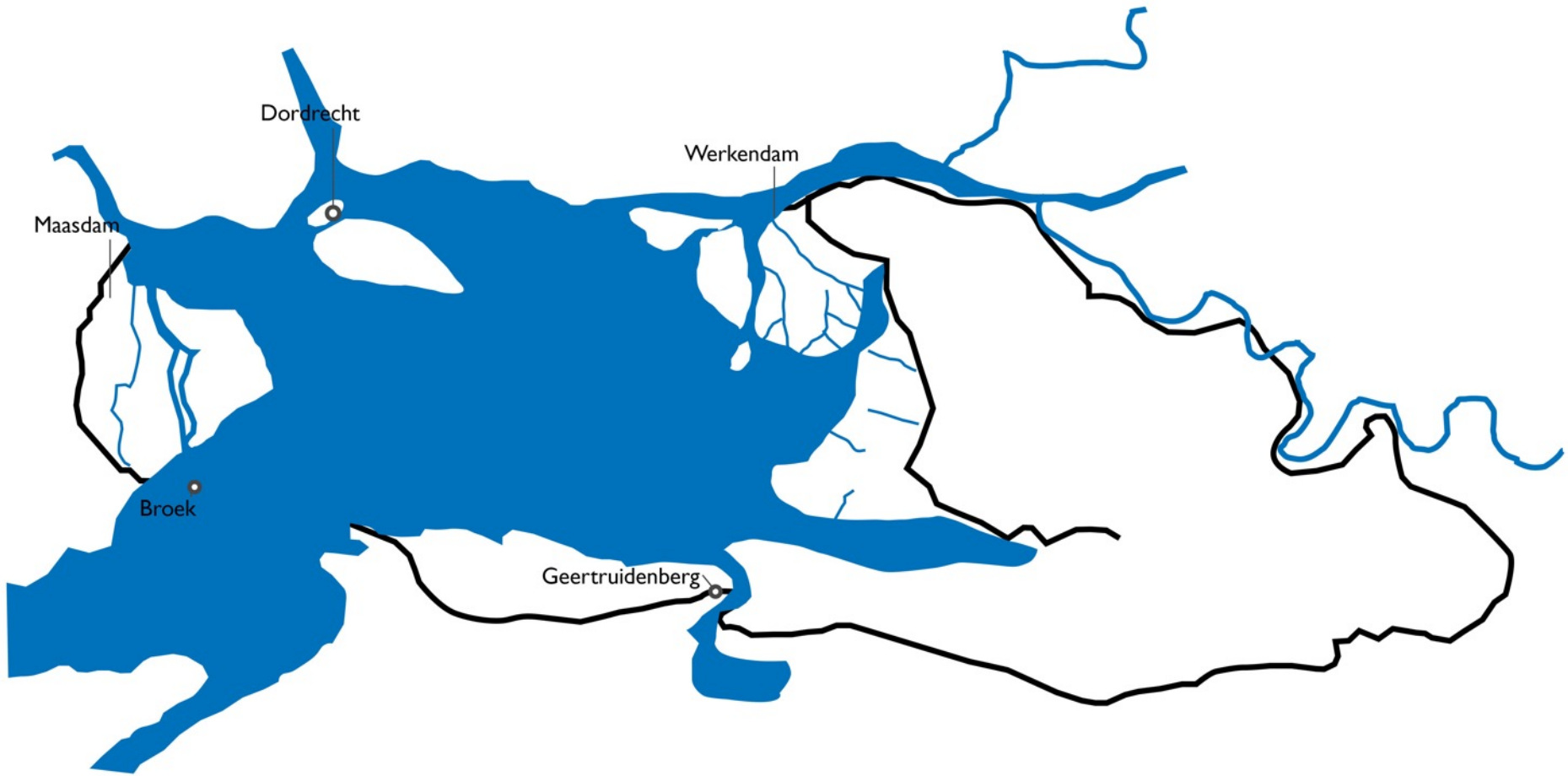

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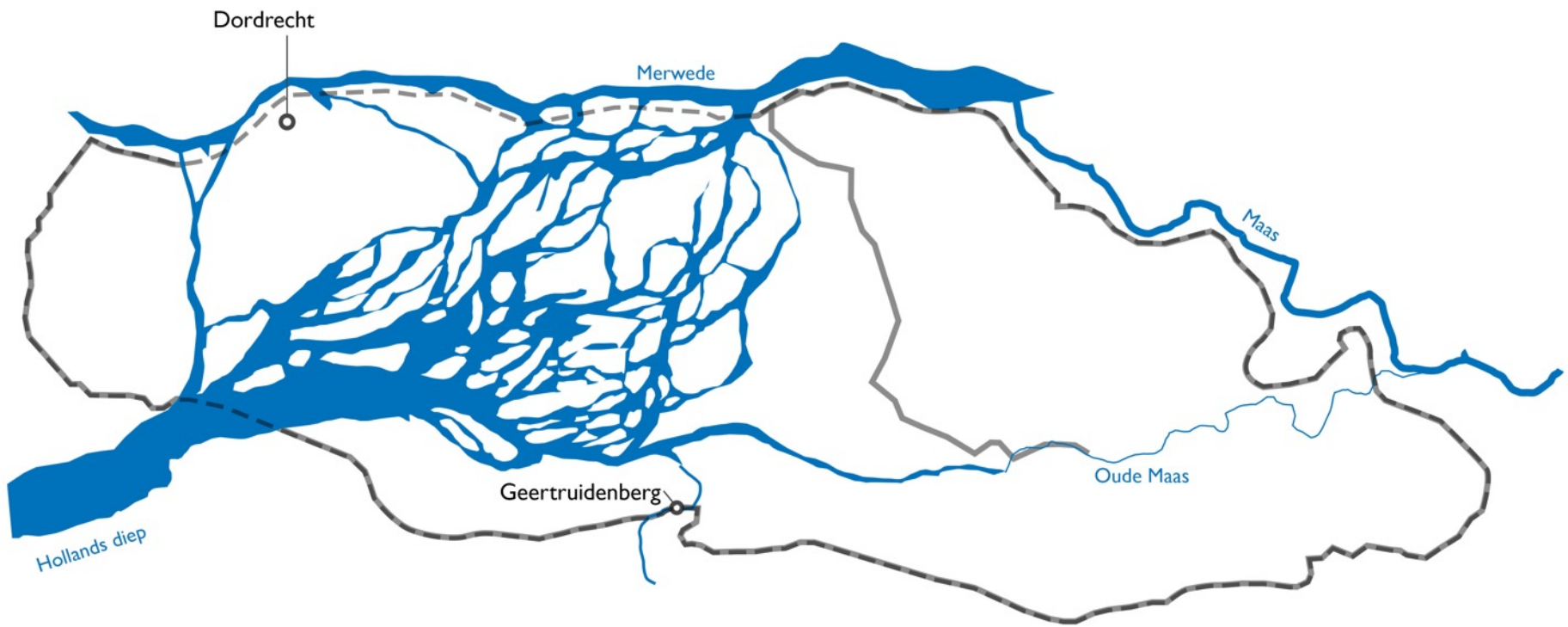
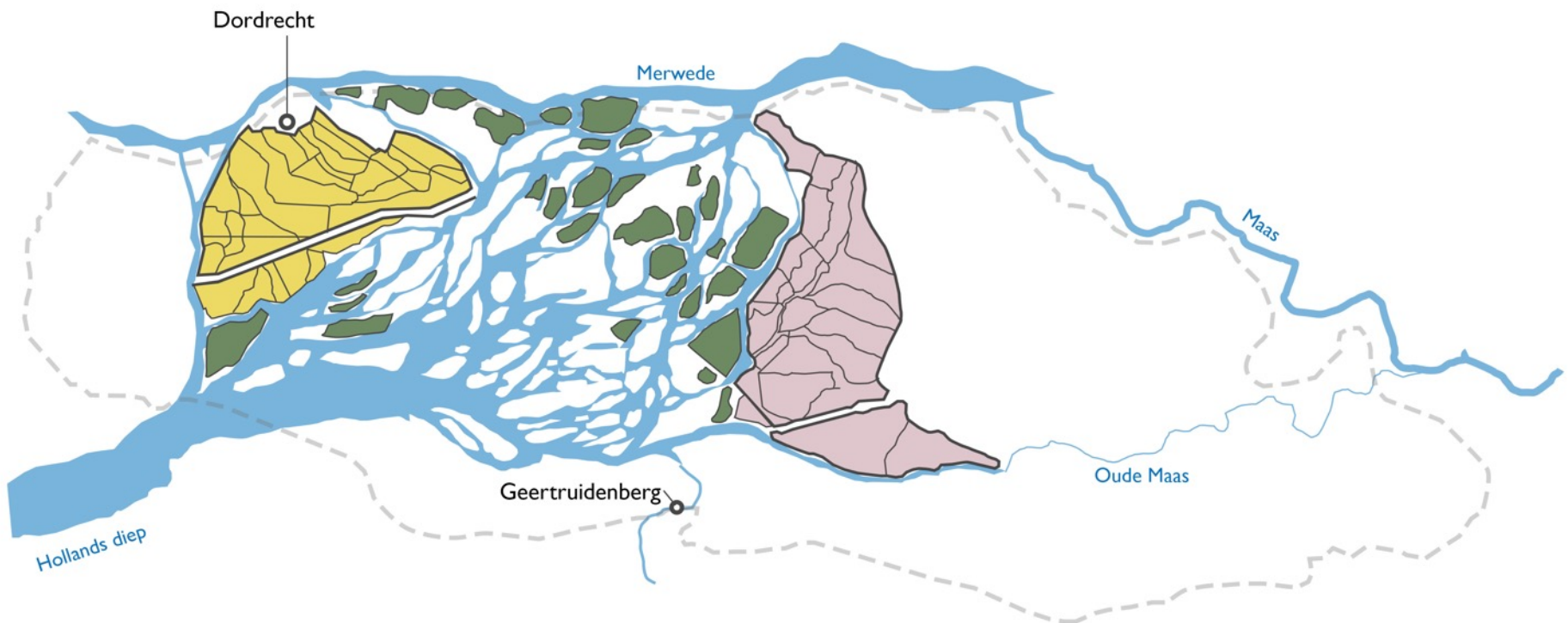


Morphology based on: de Wit, Saskia. (2009). Dutch Lowlands, & Atlas van Nederland in het Holocene



Morphology based on: de Wit, Saskia. (2009). Dutch Lowlands, & Atlas van Nederland in het Holocene

After St. Elizabeth Flood 1425-1600

1600-1700

1700-1800

1800-1925

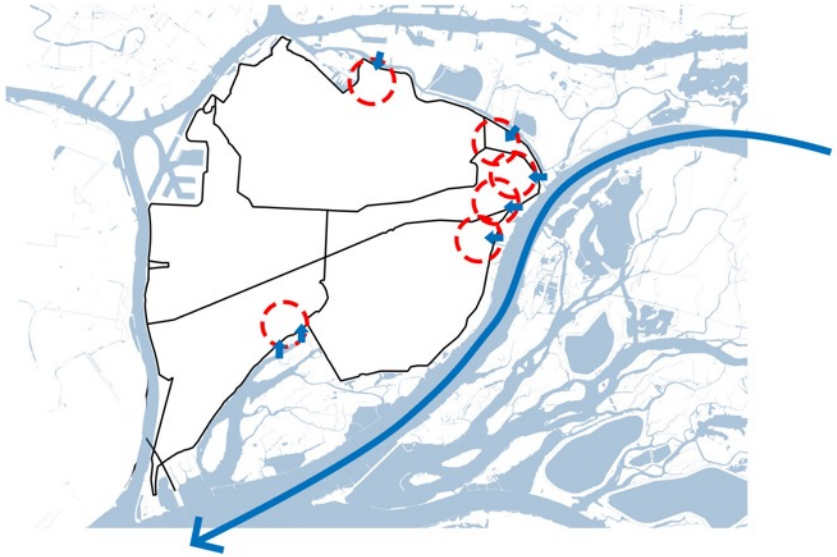
A vision for the future

A connection with the river landscape outside of the dike to let the river dynamics take over the polder landscape. Processes of sedimentation and erosion as well as fluctuating river water will transform the polder landscape overtime.

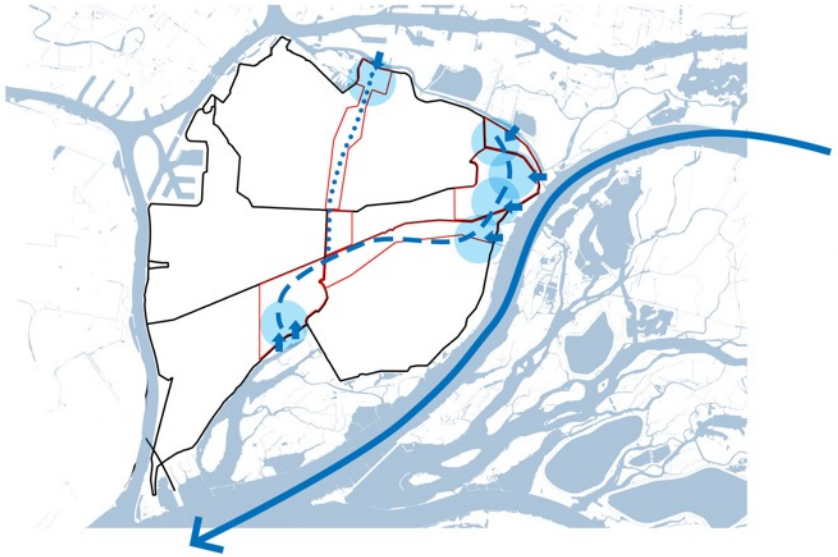
A living experience on emerging marshy riverine landscapes where people can live close to the biologically diverse new gradients in between land and water. The new landscape will therefore becomes everybody's backyard all the way towards the horizon.

An accessible dynamic landscapes where people can move through to visually and spatially experience the emerging ecologies. Close to the ground, on the gradient, on top of dikes, and viewpoints allows different way to experience the landscape and always changing with the water level.

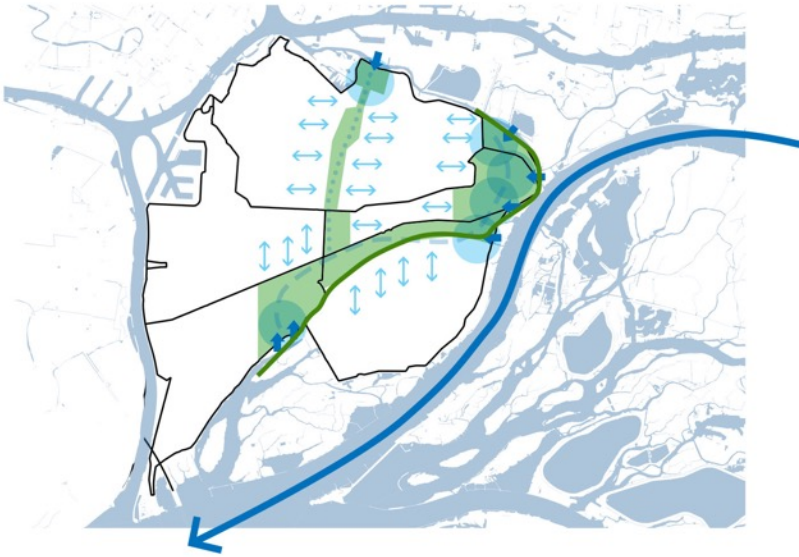
A restoration of the landscape structure and dynamics of marshy landscapes, mudflats, and land accretion which is directly influenced by the rivers and evoke the cultural history of living on the river and with the river.



Invite the river

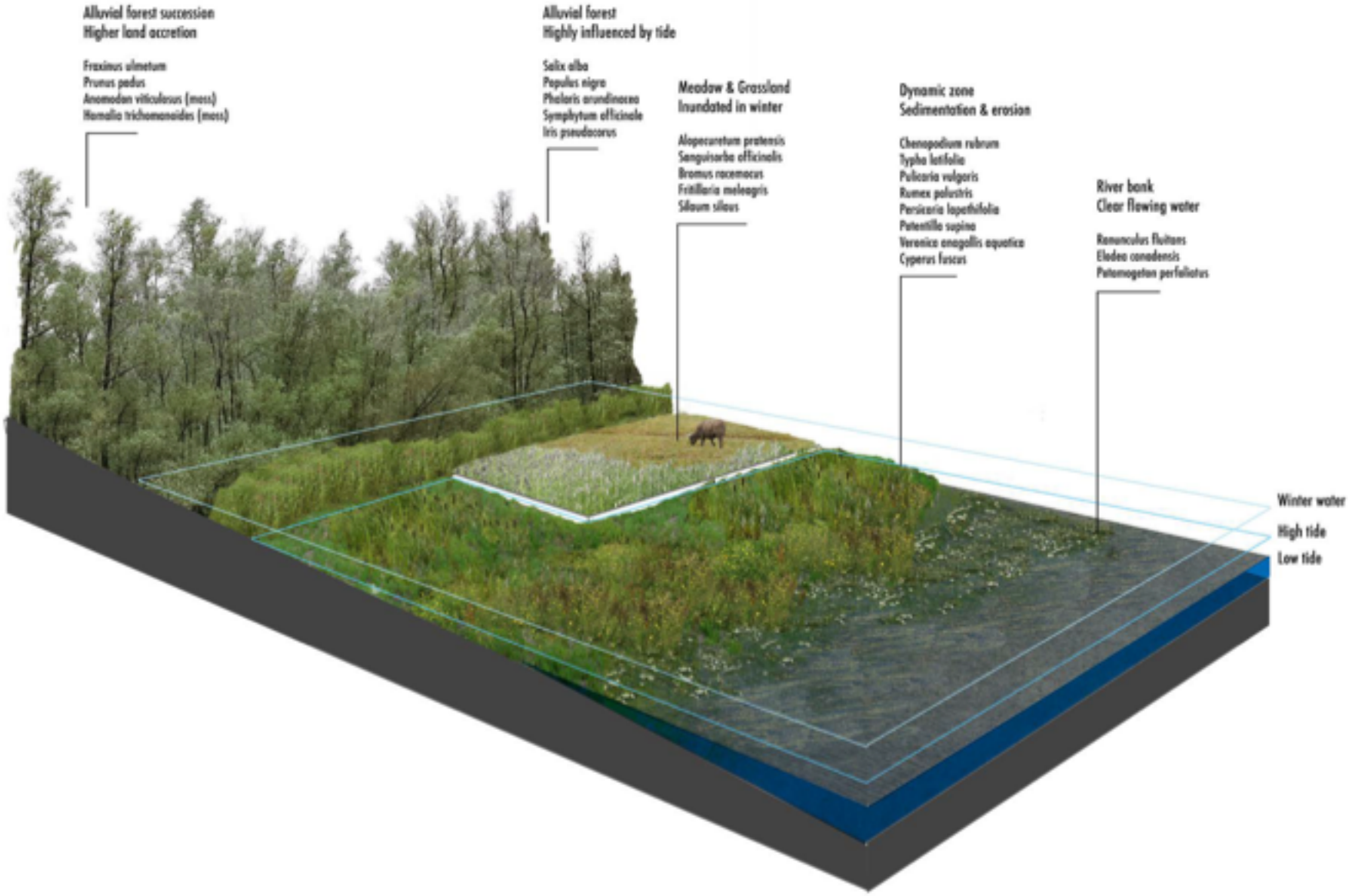


Establish new green & blue network

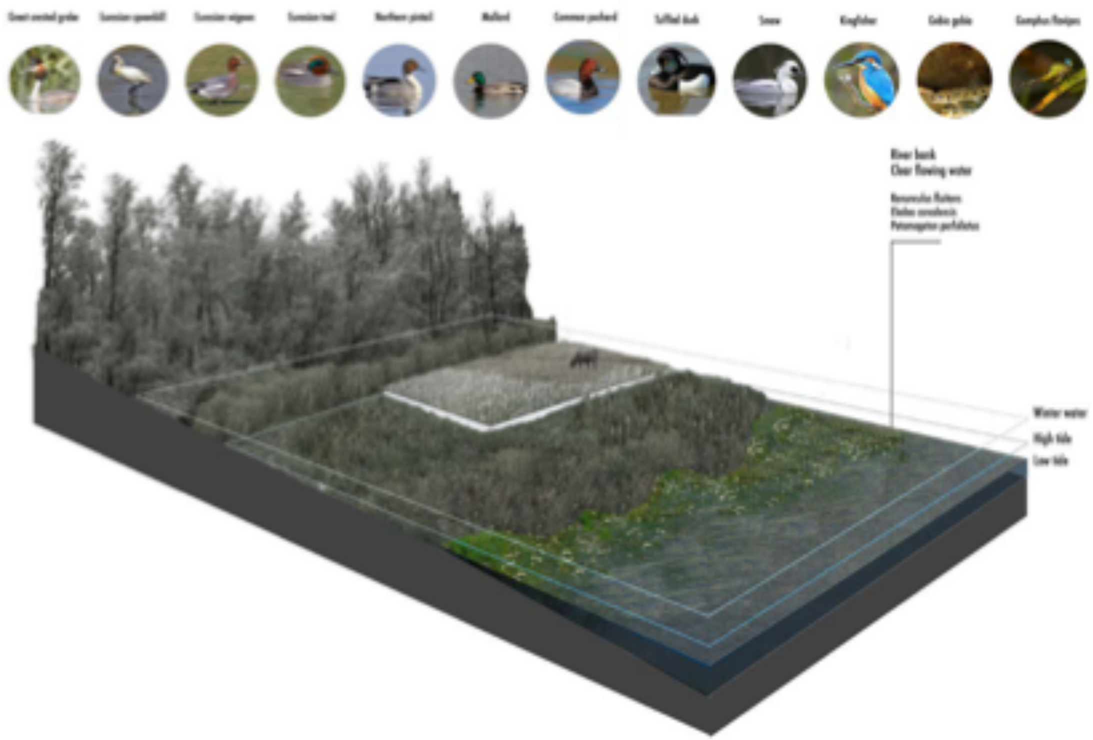


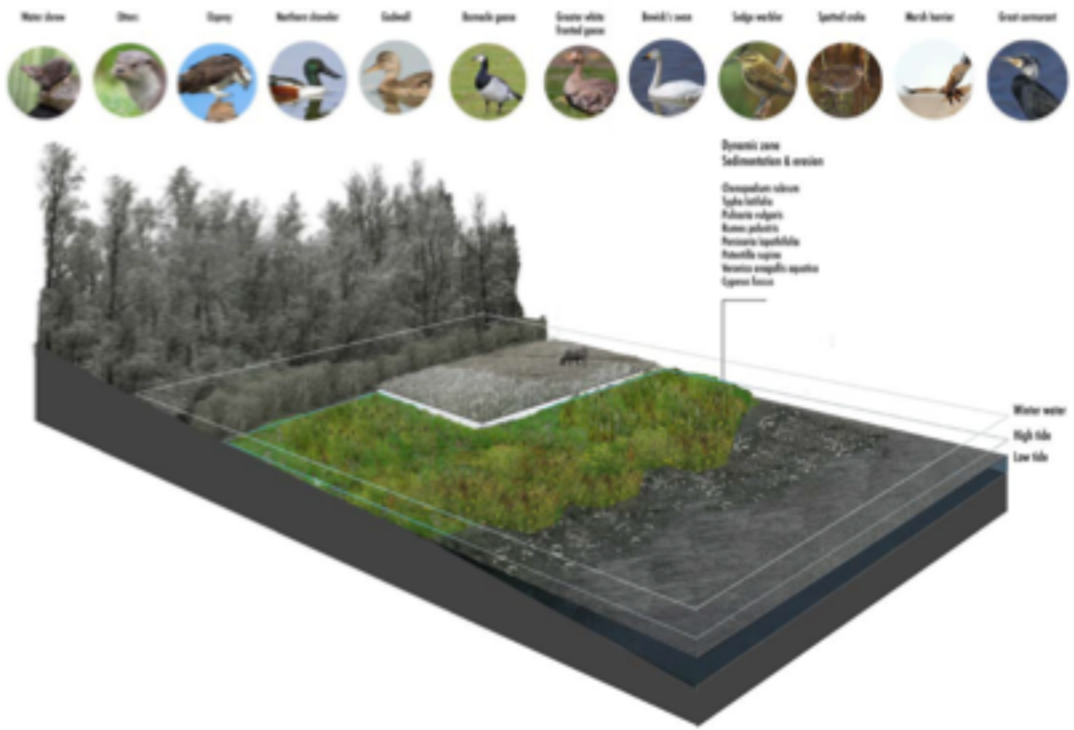
Develop dynamic zones

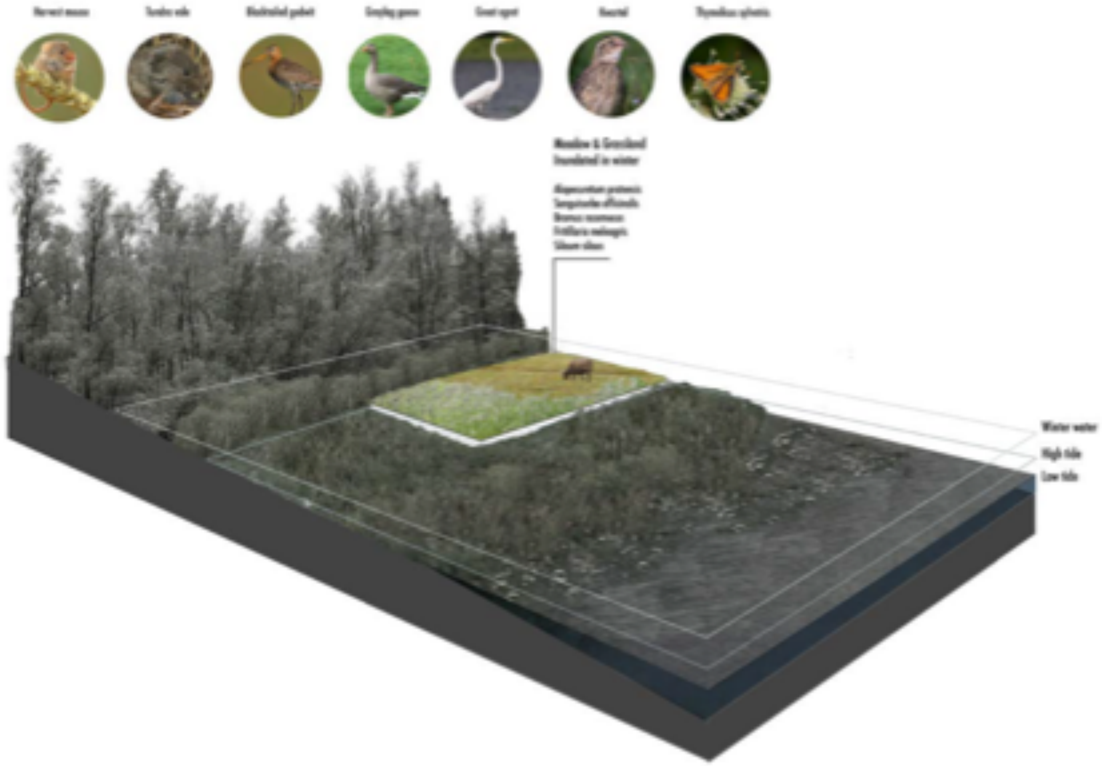
Transformation into a dynamic landscape

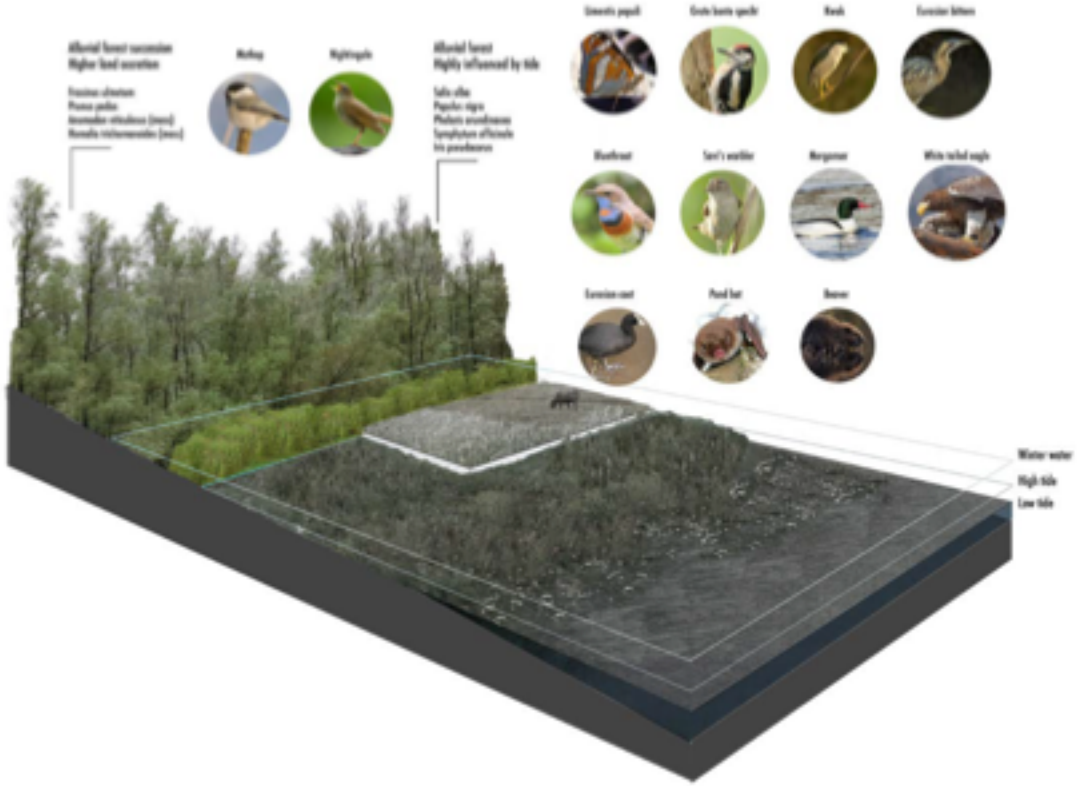


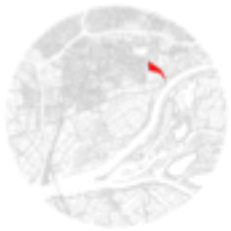
Emerging Ecologies


River bank
Clear flowing water
Ranunculus fluitans
Elodea canadensis
Potamogeton perfoliatus
Winter water
High tide
Low tide

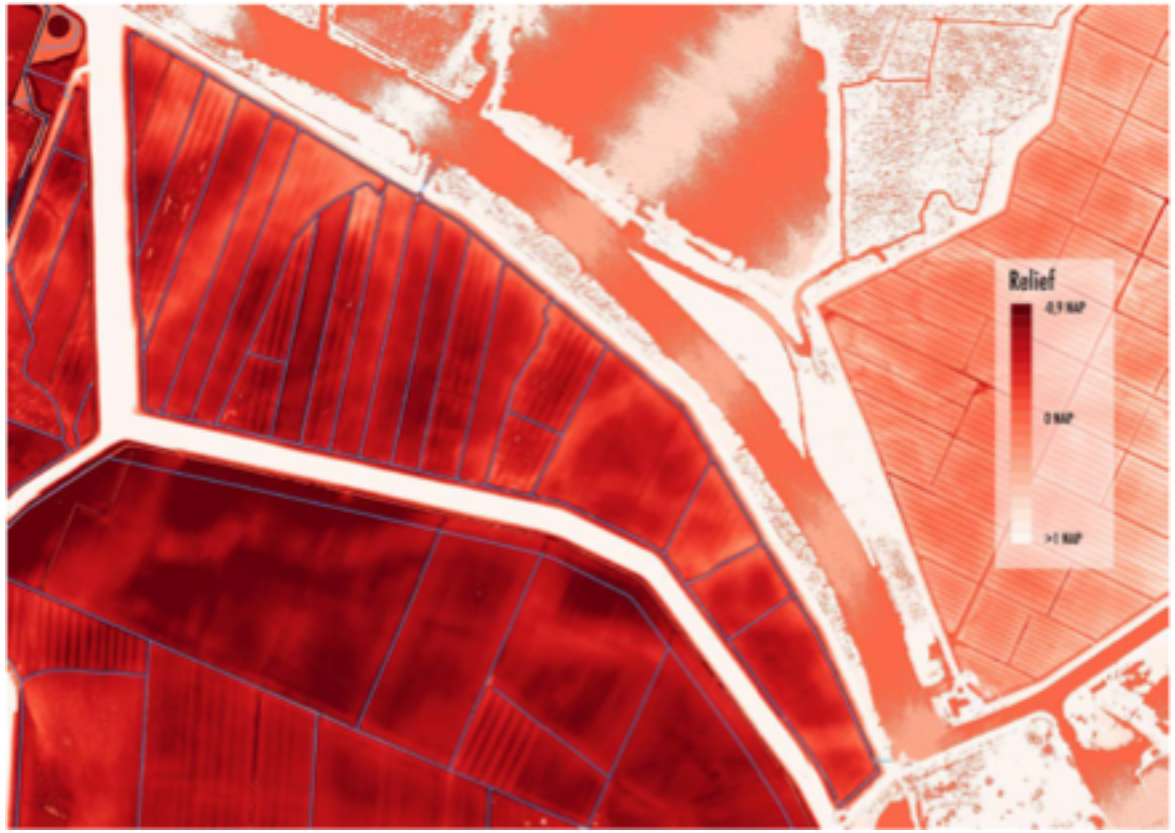

Dynamic zone
Sedimentation & erosion
Chenopodium rubrum
Typha latifolia
Pulicaria vulgaris
Rumex palustris
Persicaria lapathifolia
Potentilla supina
Veronica anagallis aquatica
Cyperus fuscus
Winter water
High tide
Low tide


Harvest mouse
Tundra vole
Blacktailed godwit
Greylag goose
Great egret
Kwartel
Thymelicus sylvestris
Meadow & Grassland
Inundated in winter
Winter water
High tide
Low tide

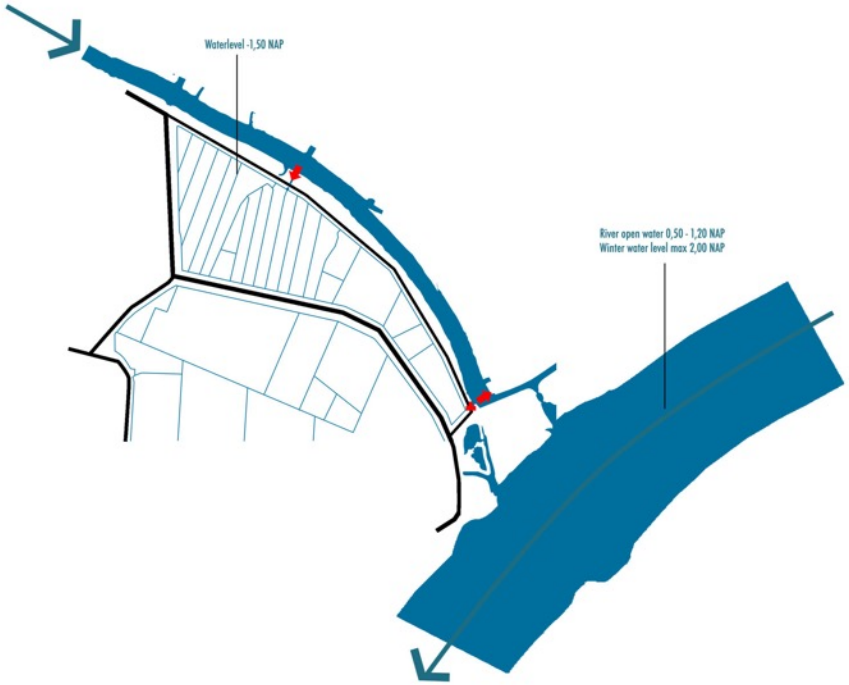

Alluvial forest succession
Higher land accretion
Nightingale
Alluvial forest
Highly influenced by tide
Salix alba
Populus nigra
Phalaris arundinacea
Symphytum officinale
Iris pseudacorus
Grote bonte specht
Kwak
Eurasian bittern
Bluethroat
Savi's warbler
Merganser
White tailed eagle
Eurasian coot
Pond bat
Beaver
Winter water
High tide
Low tide

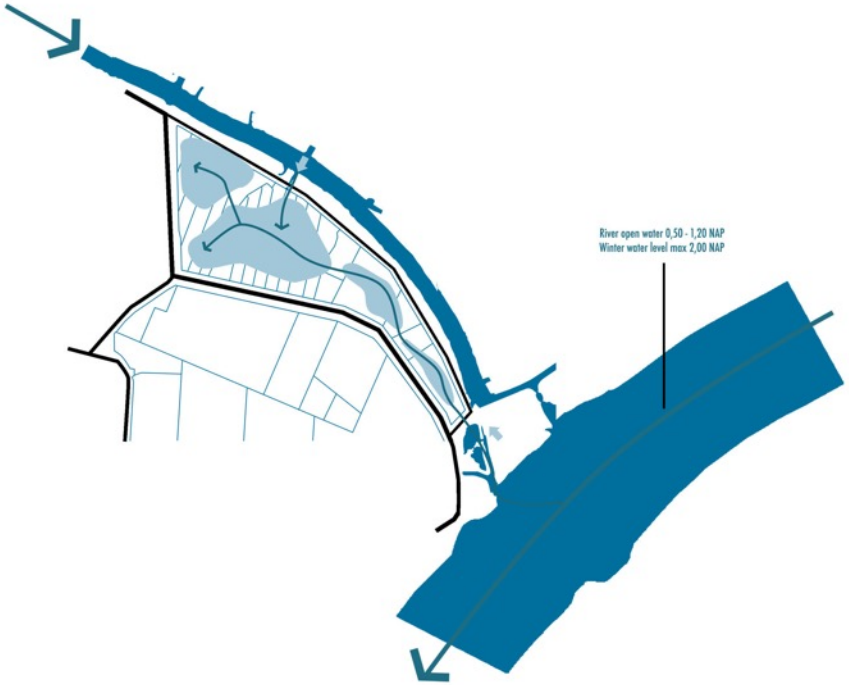


Site in focus: Noordboven Polder

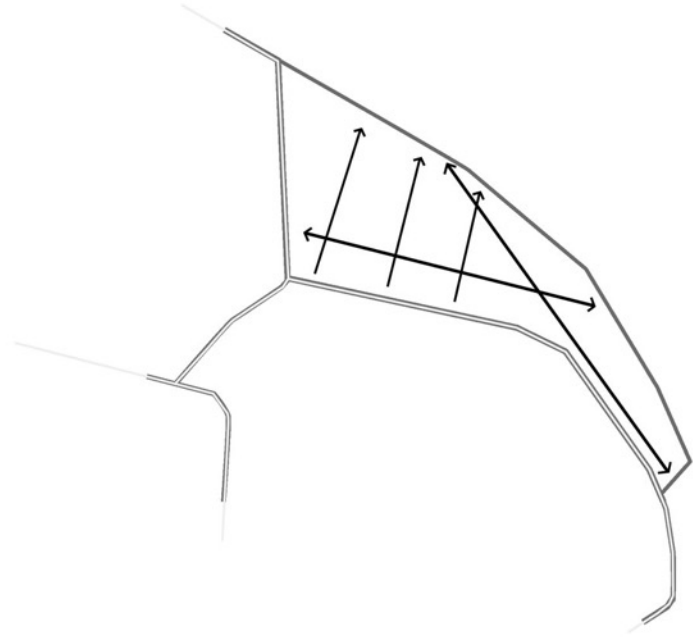


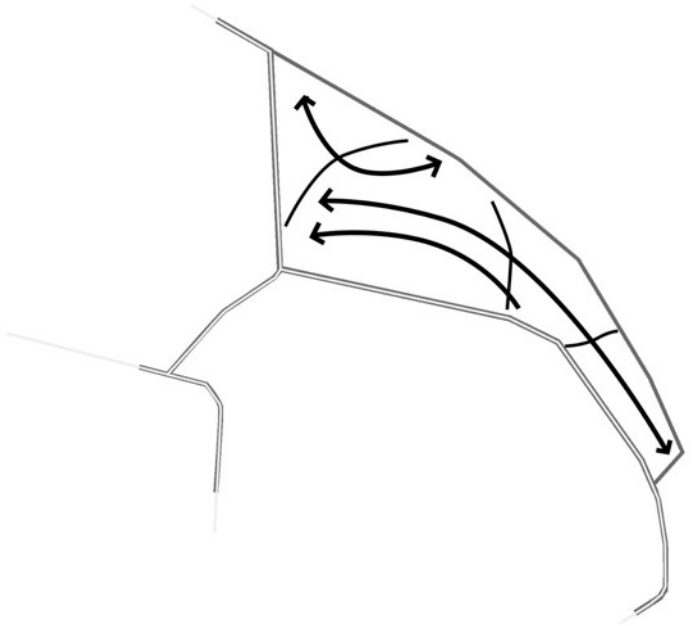
Water system



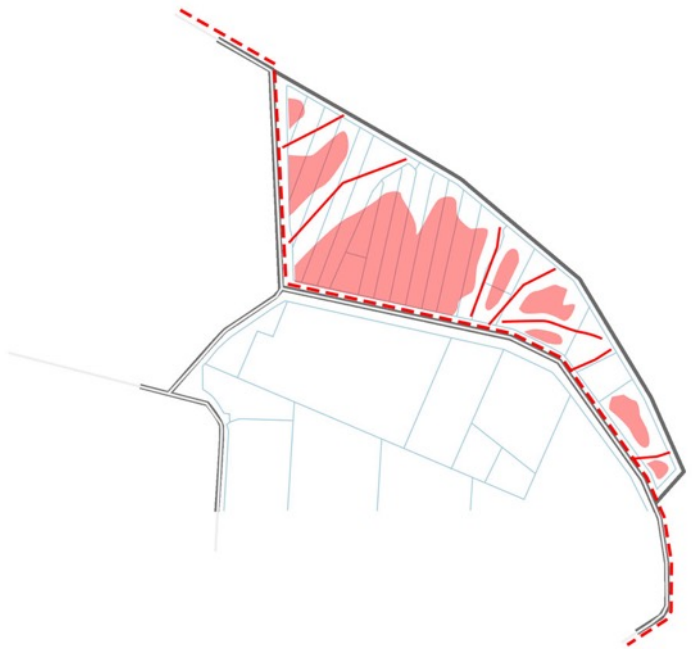


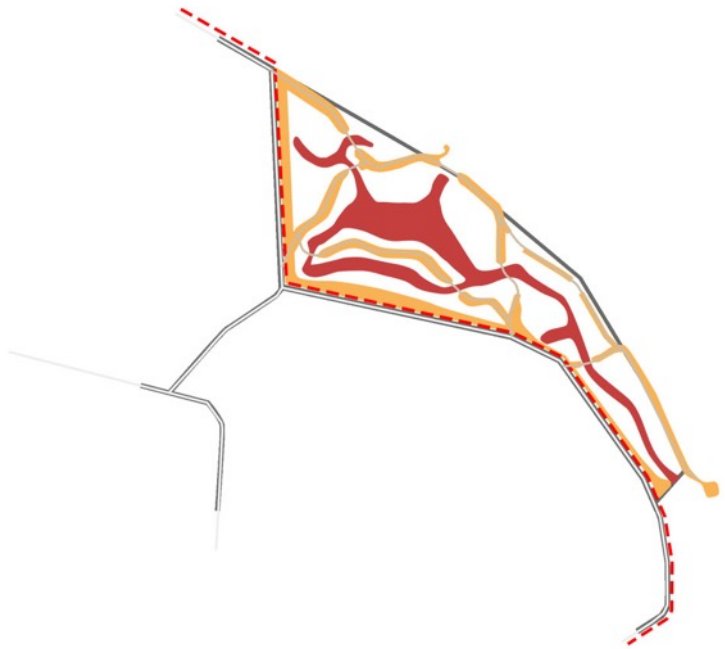
Spatial Structure



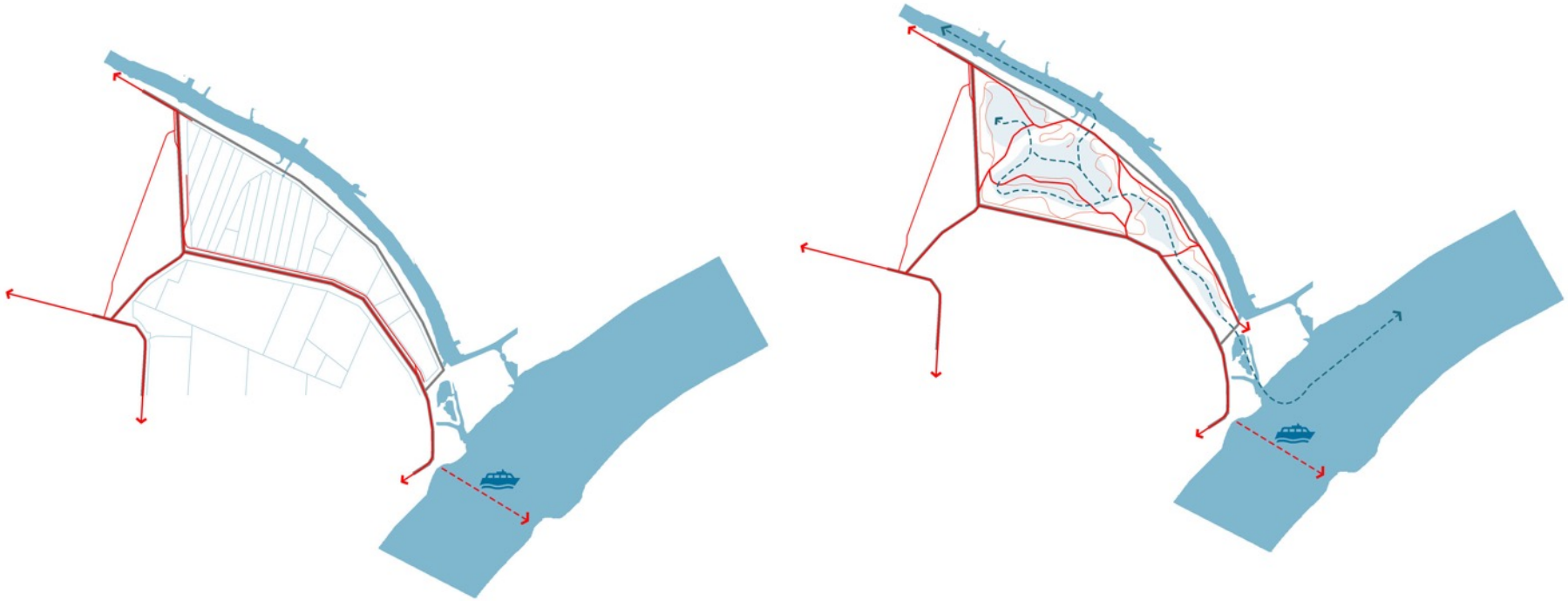


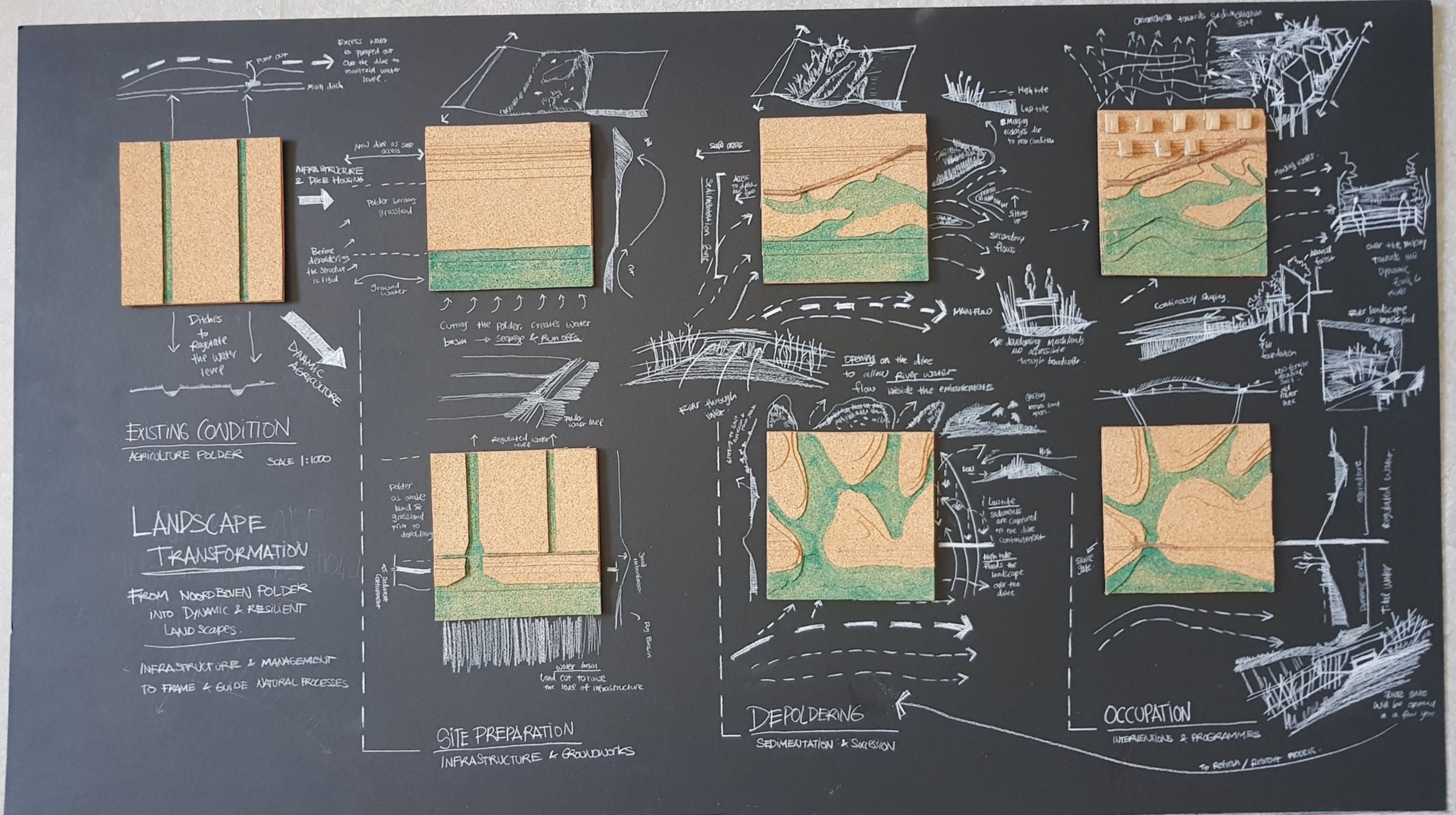
Relief



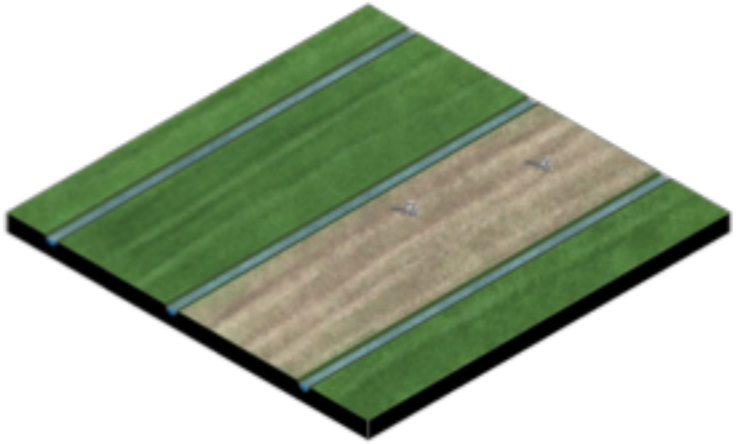


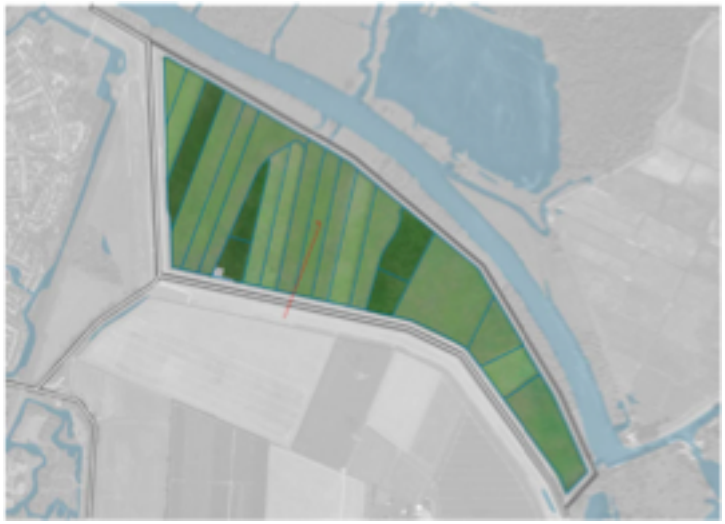
Accessibility



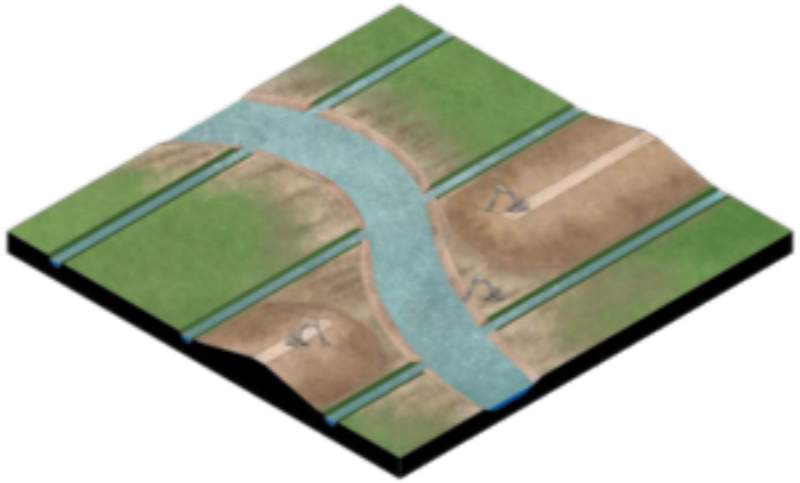

EXISTING CONDITION
AGRICULTURE POLDER
SCALE 1:1000
LANDSCAPE
TRANSFORMATION
FROM NOORDBOVEN POLDER
INTO DYNAMIC & RESILIENT
LANDSCAPES.
INFRASTRUCTURE & MANAGEMENT
TO FRAME & GUIDE NATURAL PROCESSES
Ditches to Regulate the water level
DYNAMIC AGRICULTURE
Main ditch
INFRASTRUCTURE & DIKE HOUSING
Polder becomes grassland
Cutting the polder creates water basin → seepage & run offs
SITE PREPARATION
INFRASTRUCTURE & GROUNDWORKS
Land cut to raise the level of infrastructure
DEPOLDERING
SEDIMENTATION & SUCCESSION
Opening on the dike to allow river water flow inside the embankments
Secondary flows
MAIN FLOW
High tide
Low tide
OCCUPATION
INTERVENTIONS & PROGRAMMES
Continously shaping
To Return / Restart Process

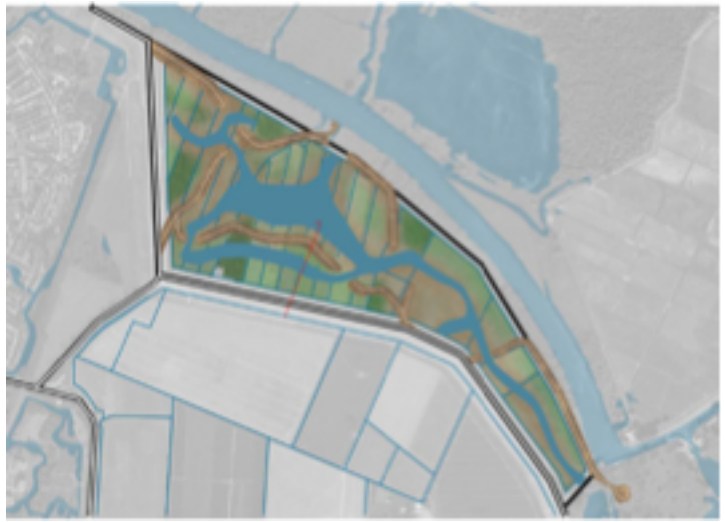
Phase 0: Existing Condition



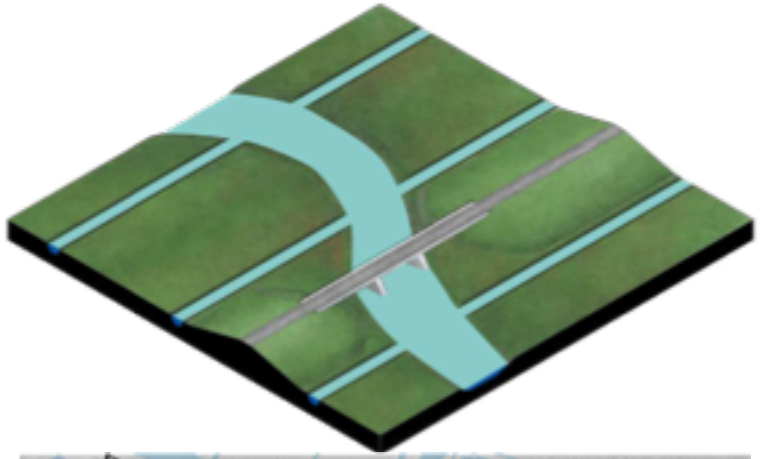


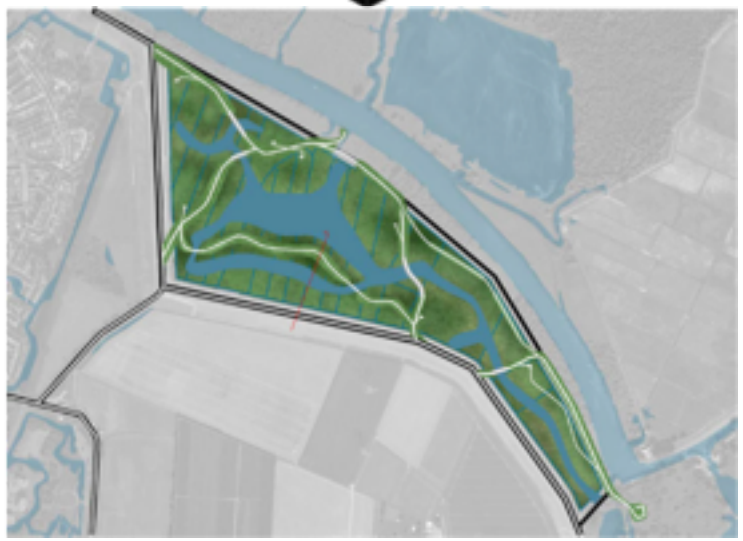
Phase 1: Groundworks 2020-2022



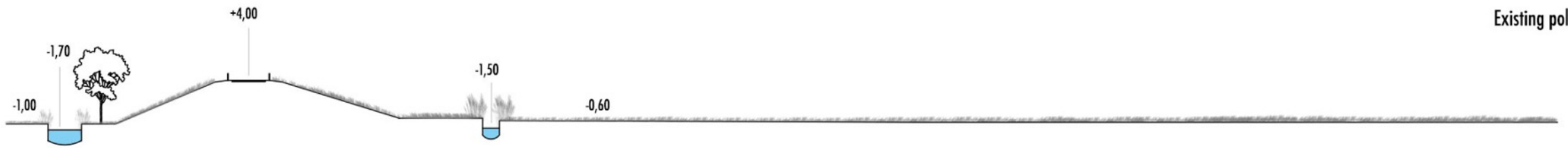


Phase 2: Connecting infrastructure 2022-2025

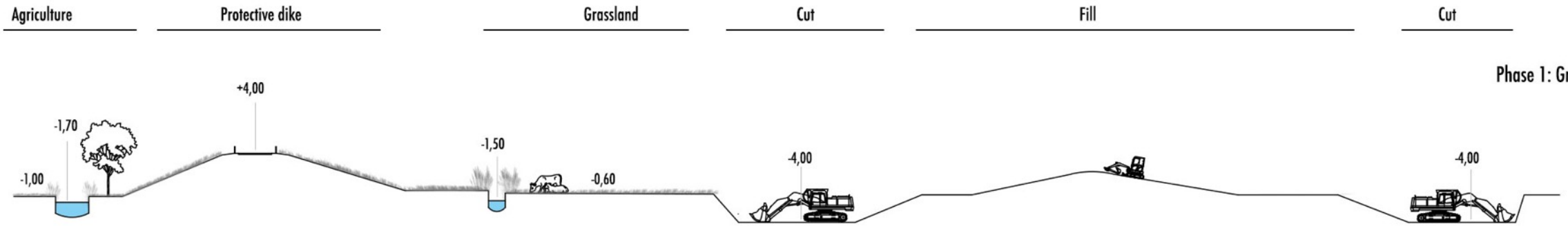




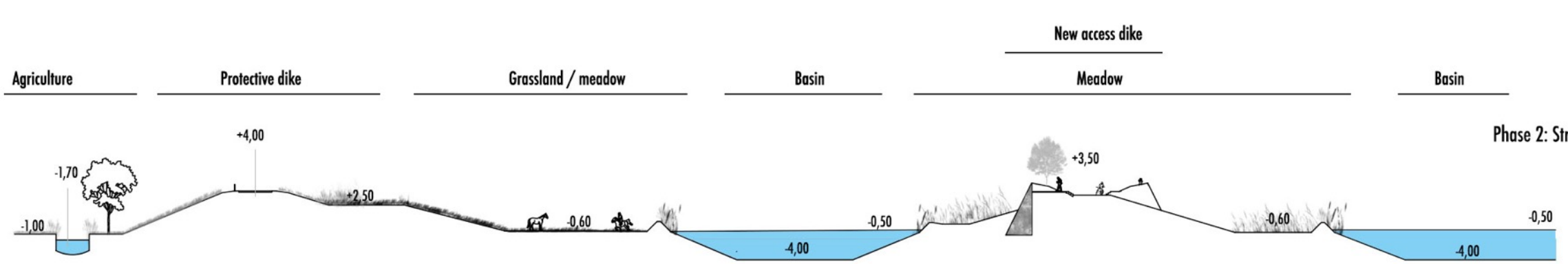
Existing polders



Phase 1: Groundworks



Phase 2: Structures

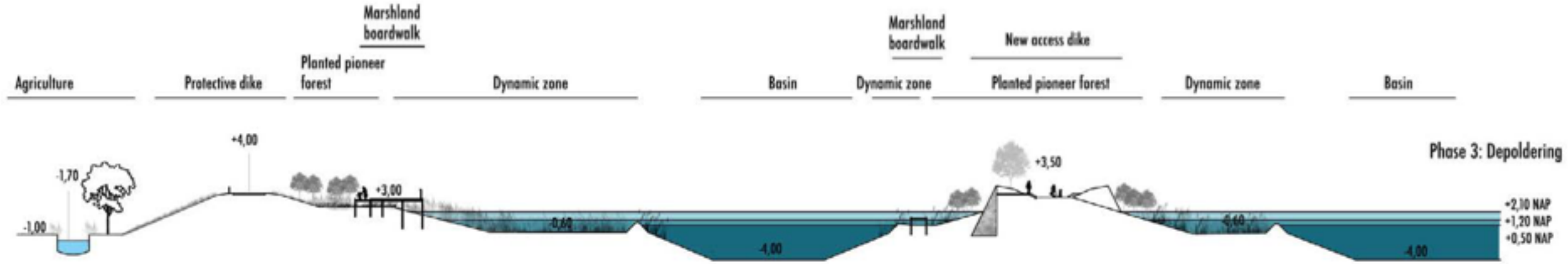


Phase 0: Existing Condition

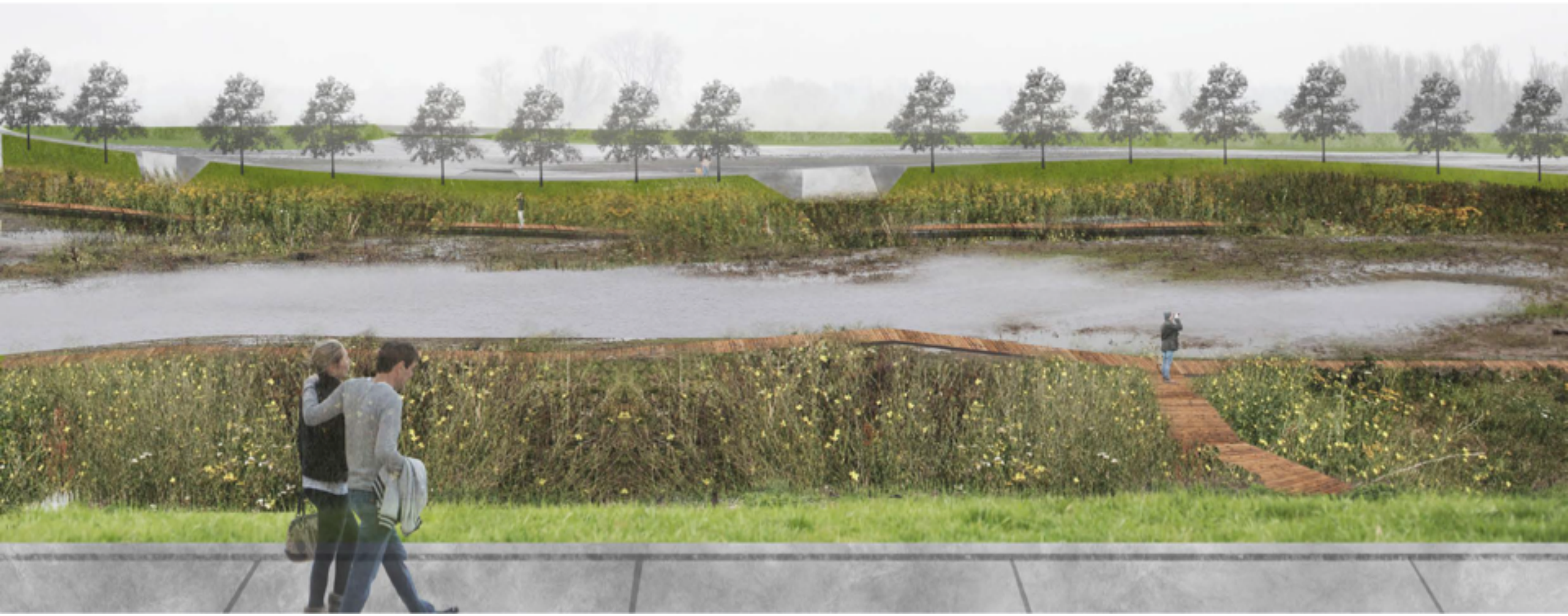
Phase 1: Groundworks 2020-2022

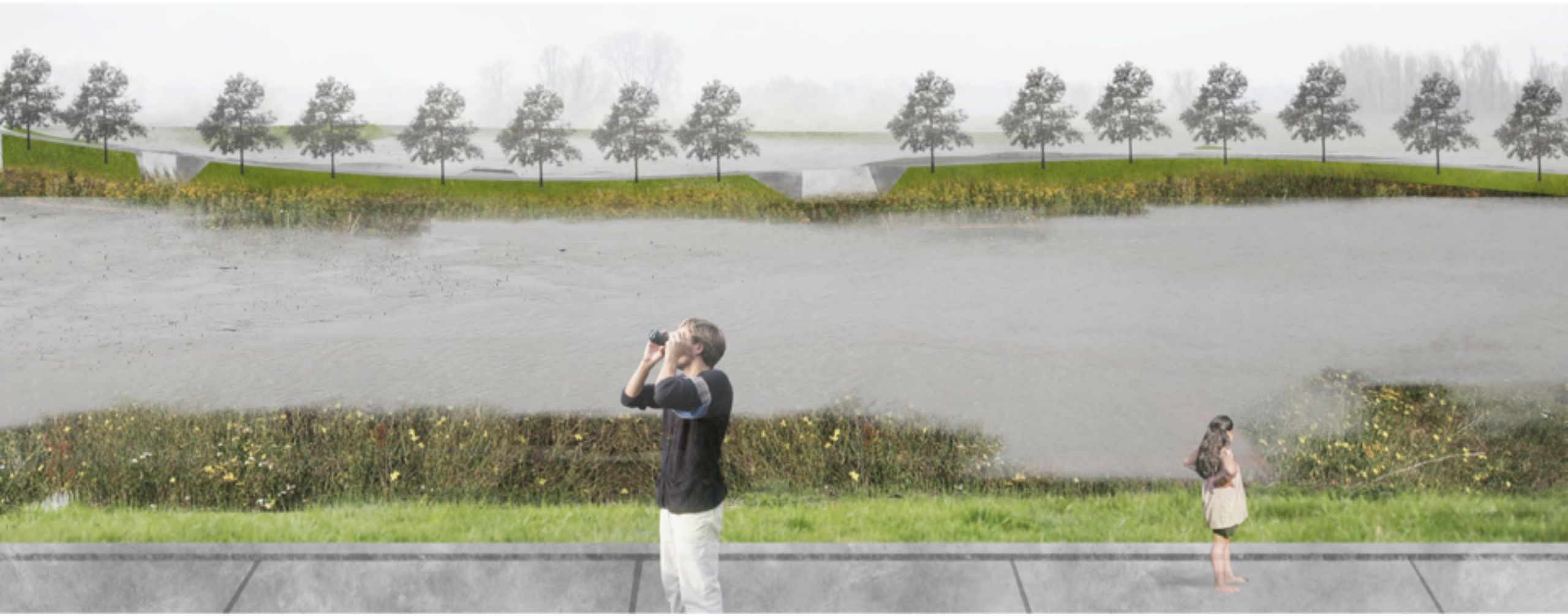
Phase 2: Connecting infrastructure 2022-2025

Phase 3: Depoldering & natural processes 2025-2030

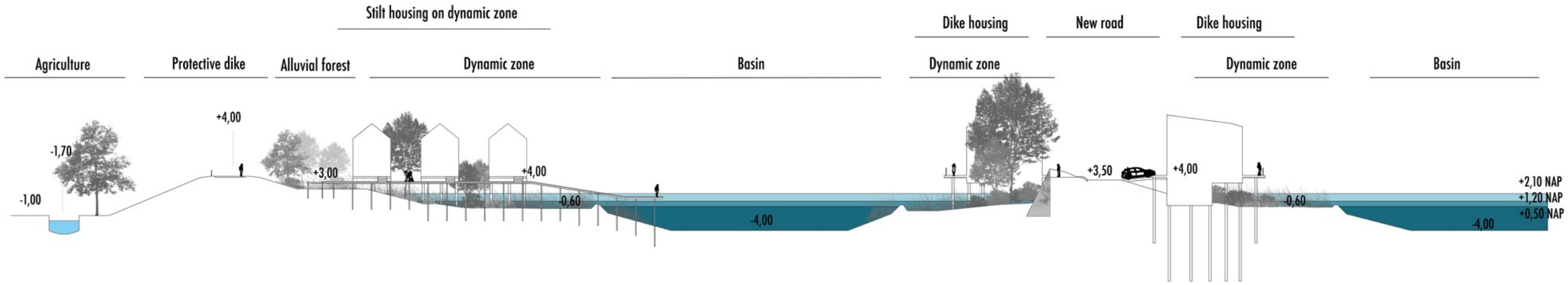


Phase 3: Depoldering & natural processes 2025-2030

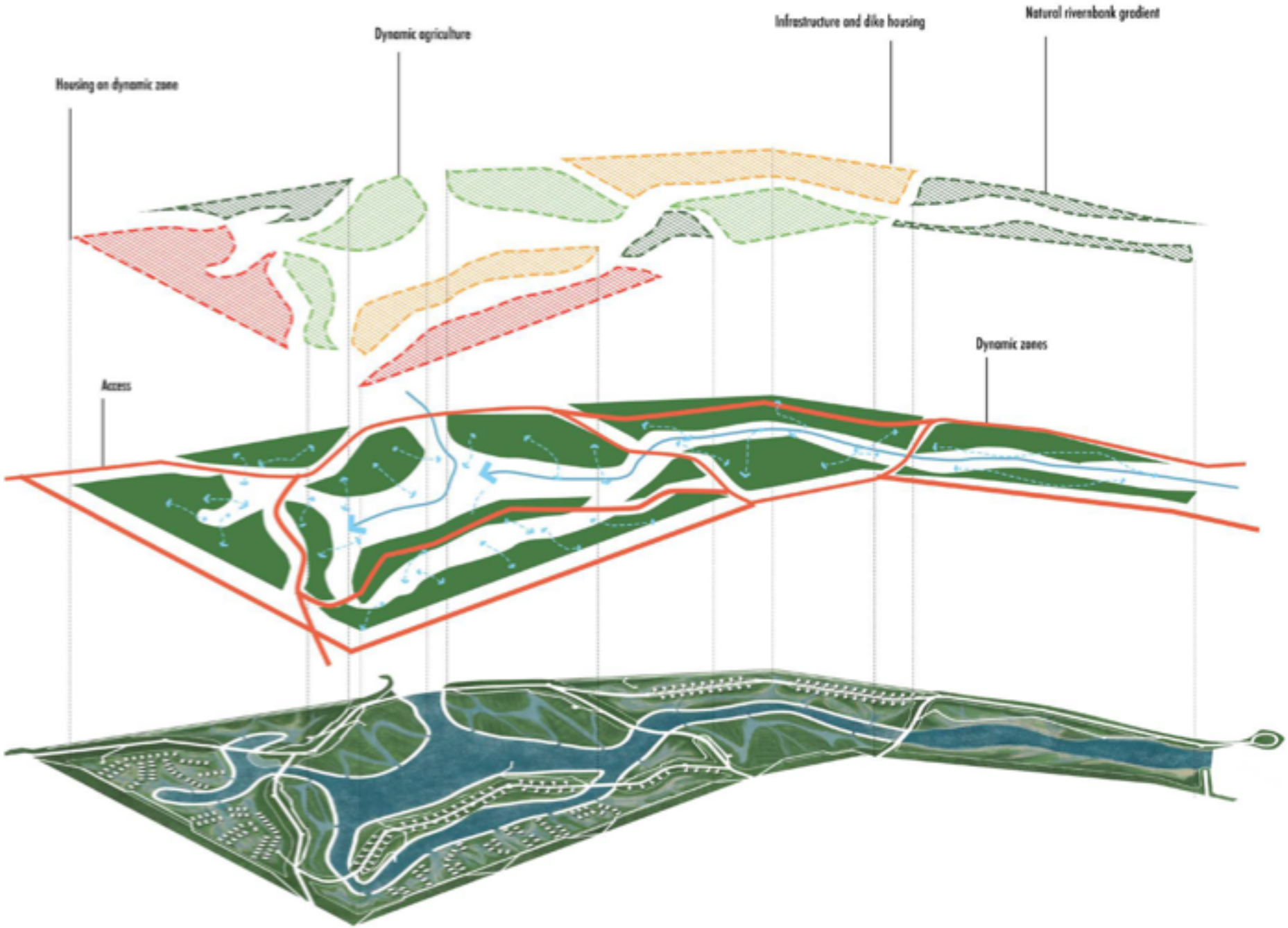




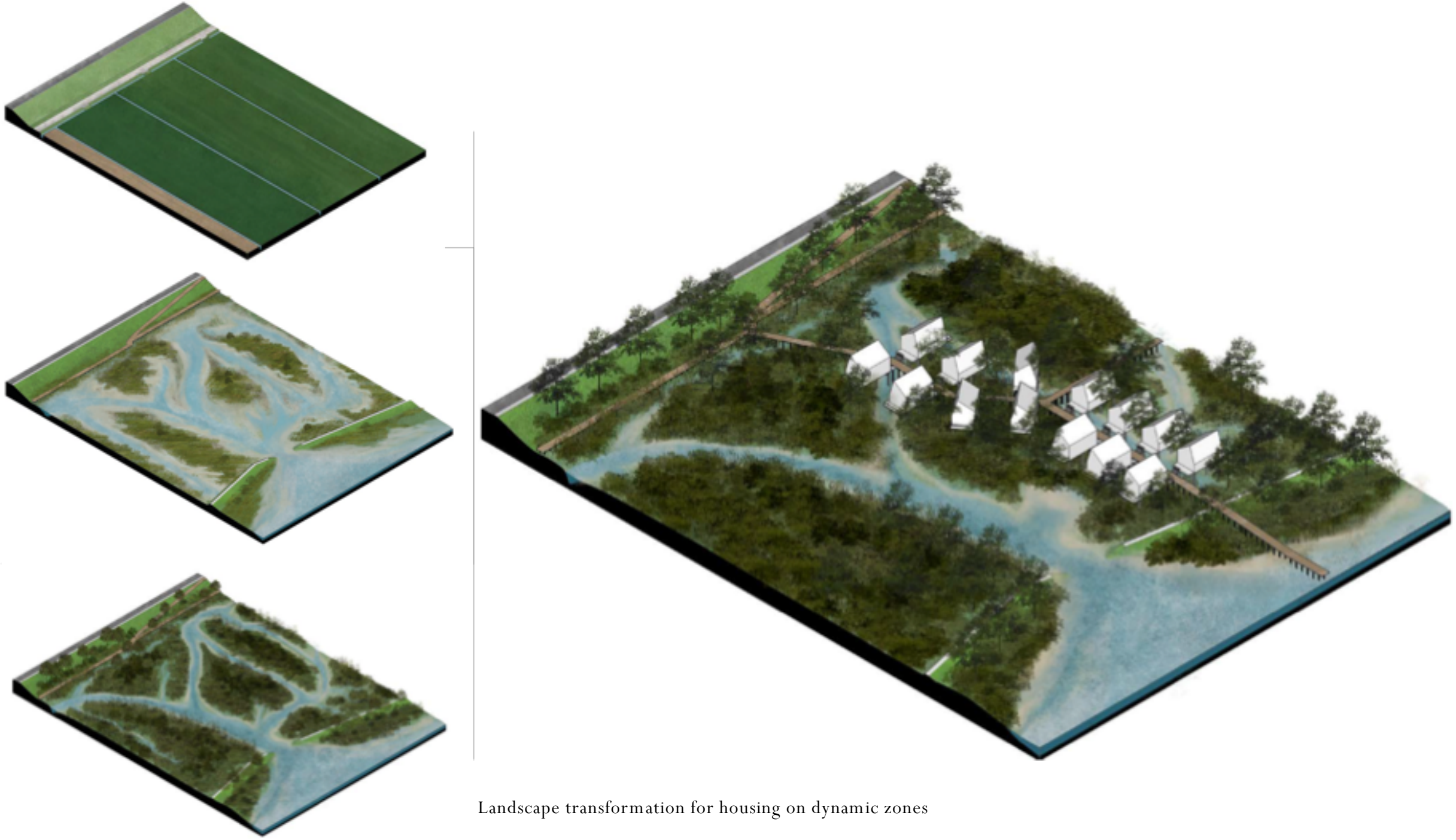
Phase n: Occupation 2030-n



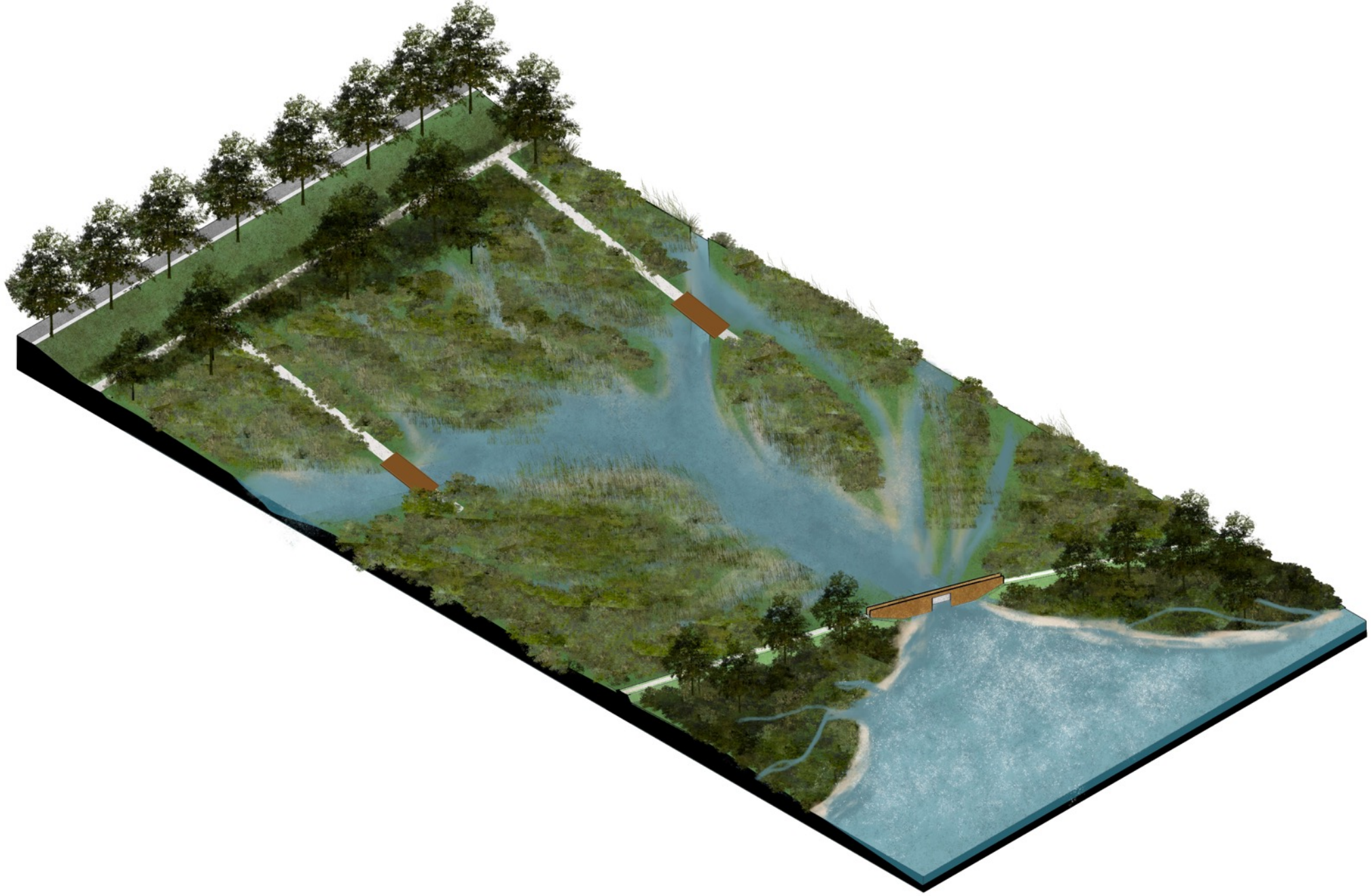
Phase n: Occupation 2030-n


Housing on dynamic zone
Dynamic agriculture
Infrastructure and dike housing
Natural riverbank gradient
Programmes
Access
Dynamic zones
Dynamic zones
Green-blue network for Noordboven polder

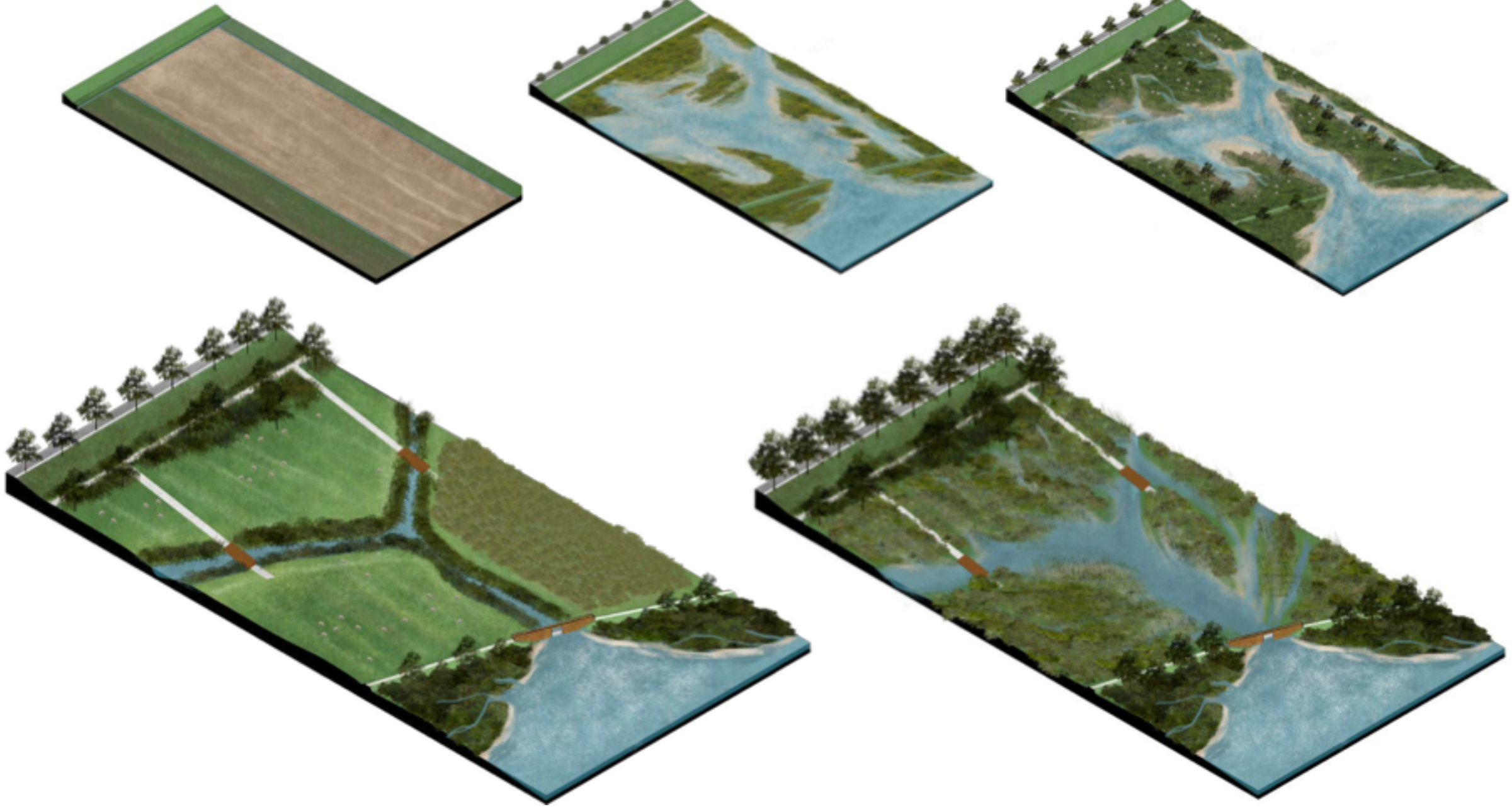
Landscape transformation for housing on dynamic zones



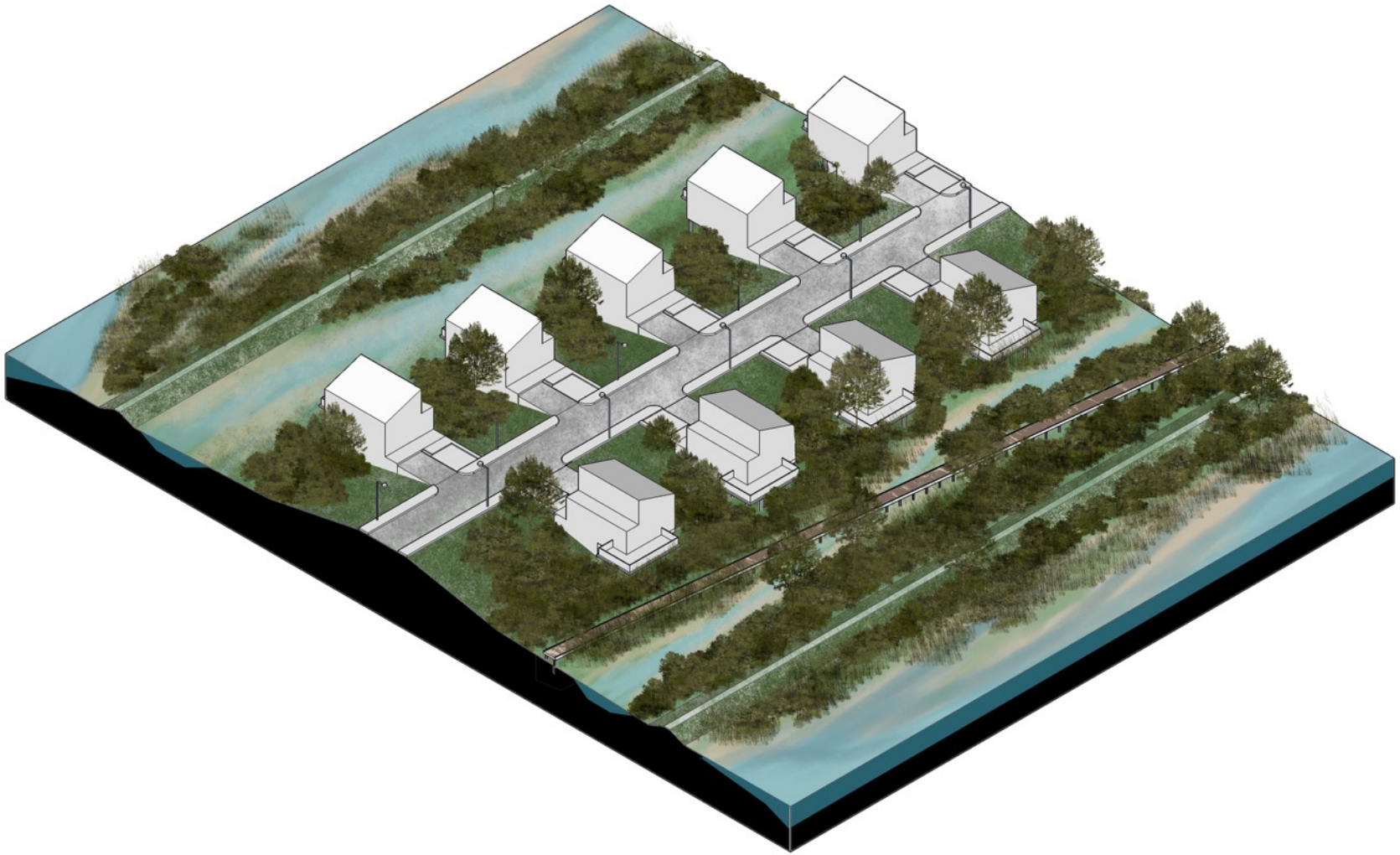
Landscape transformation for housing on dynamic zones



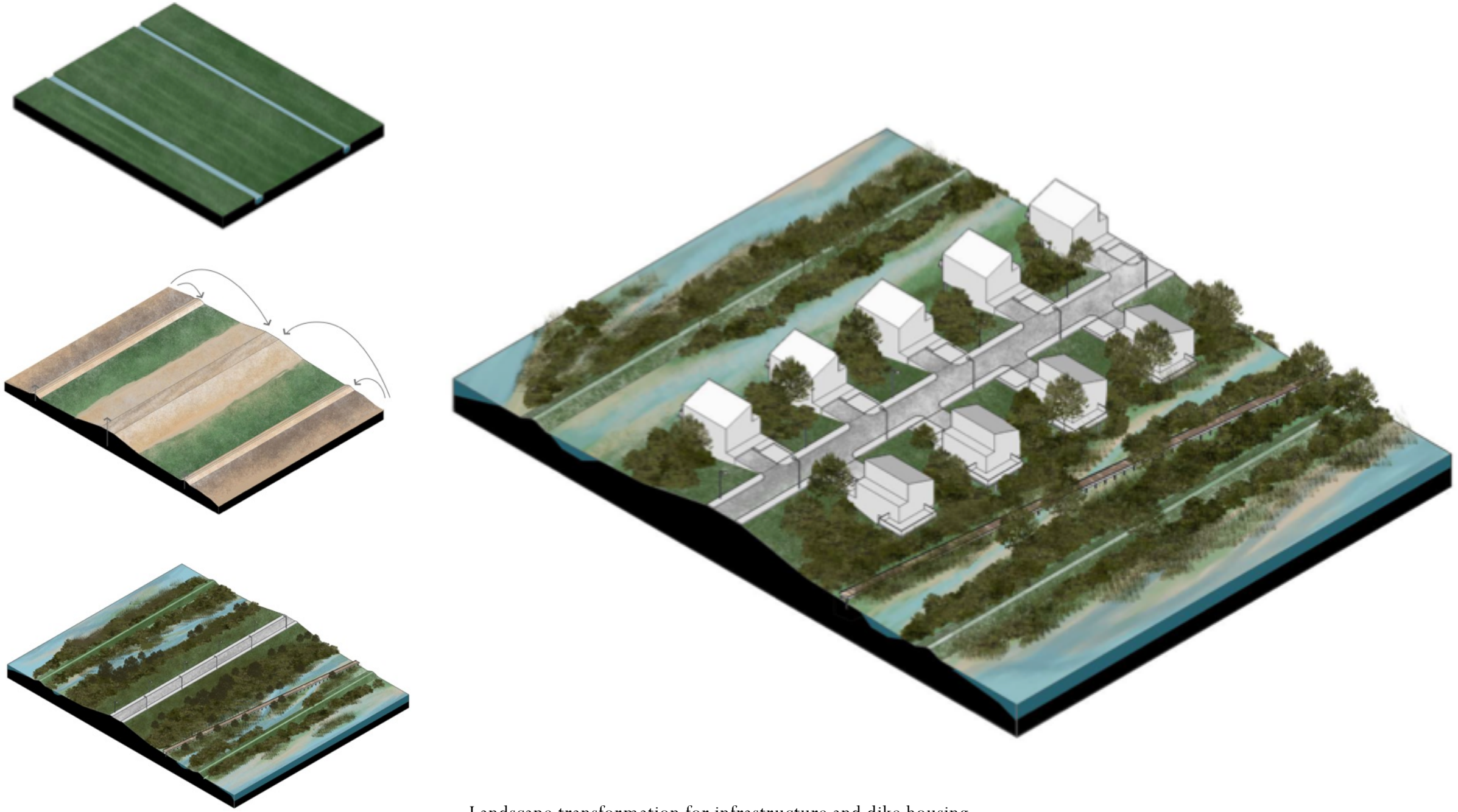
Landscape transformation for dynamic agriculture



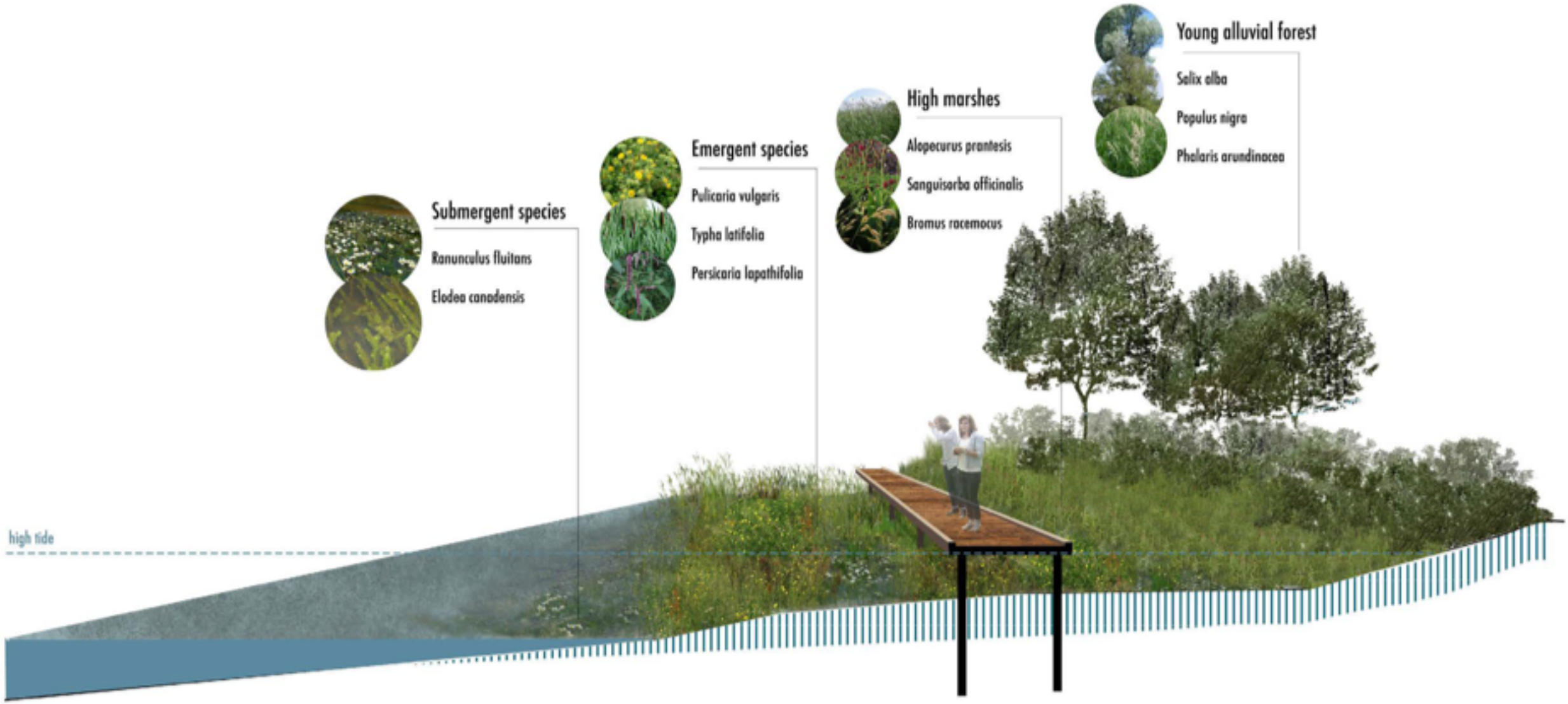
Landscape transformation for dynamic agriculture



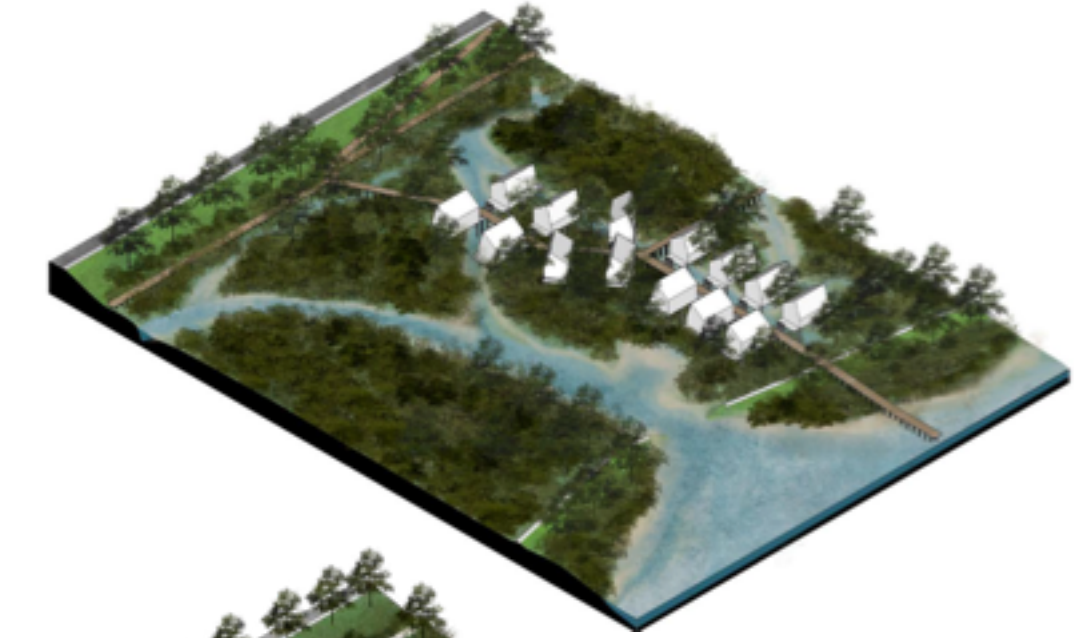
Landscape transformation for infrastructure and dike housing

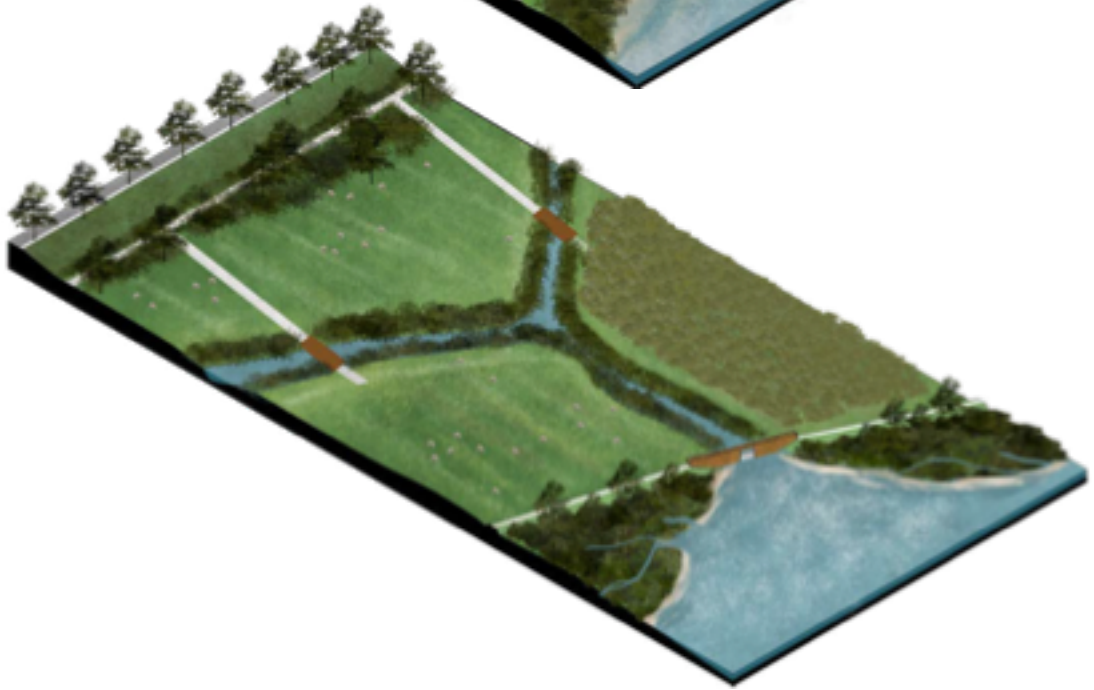


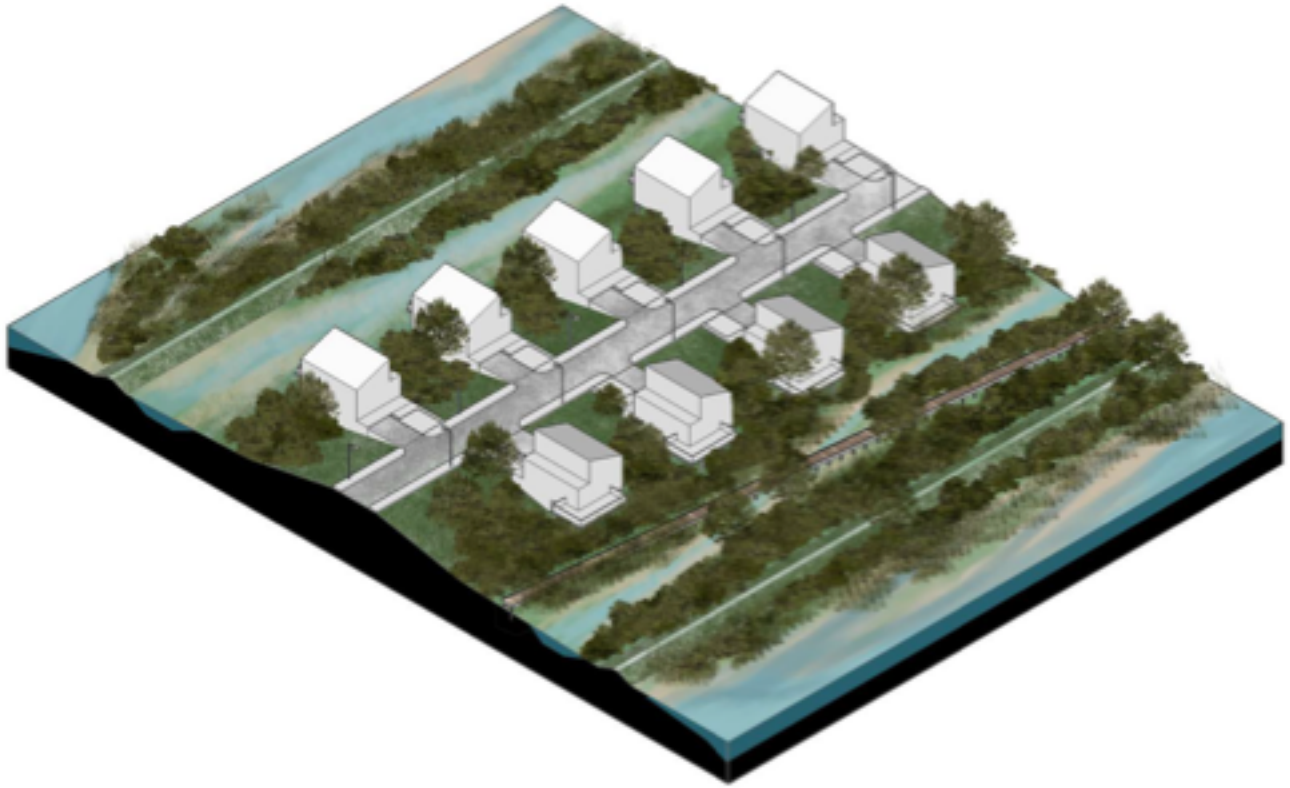
Landscape transformation for infrastructure and dike housing



Landscape structure for riverbank gradient







Infrastructure as formal component and structuring agent

A resilient and dynamic future for Dordrecht

Let it Flood

Normal tidal regime 0,50-1,50 m NAP

Annual high tide 1,5-2,20 m NAP

Extreme water level >3,00m NAP