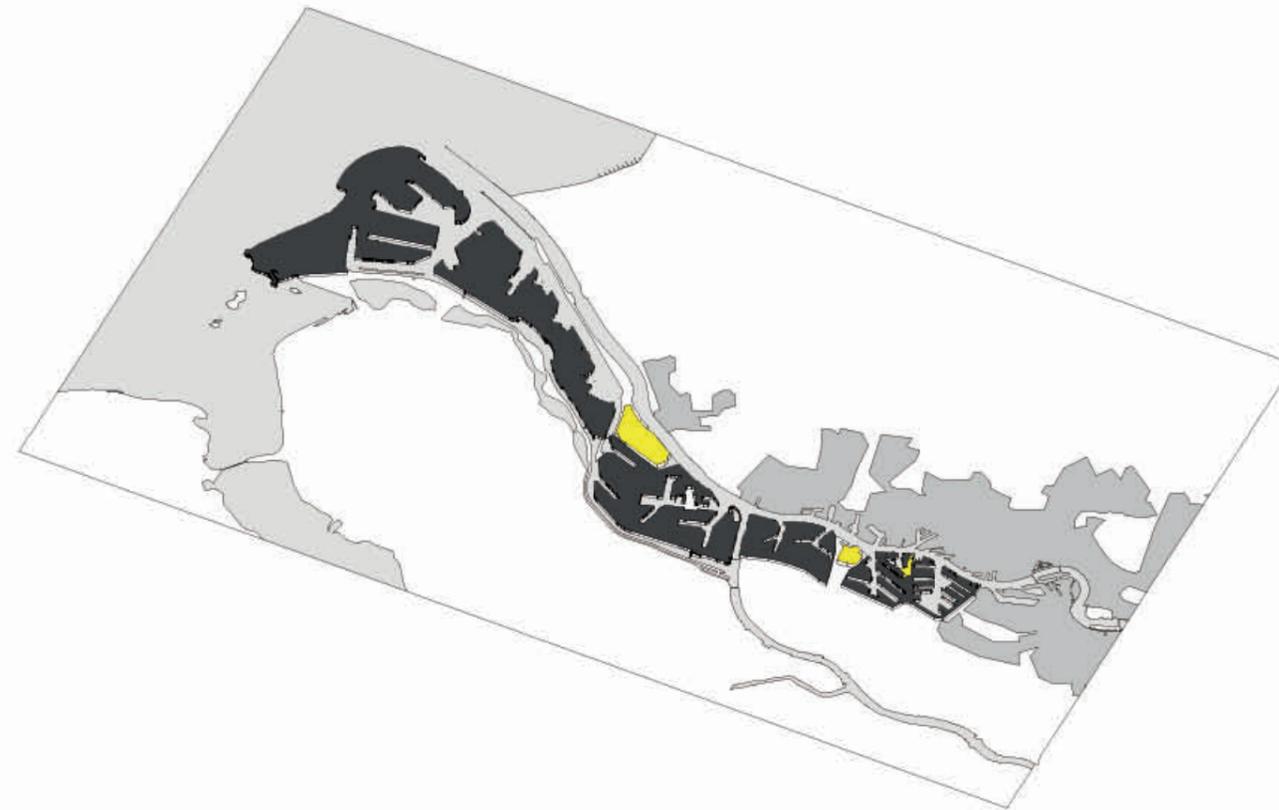# Working with Extremes; Hard or Soft approach?

2100 Vision for settlements on the southern bank of Rotterdam
:The case of Pernis

Searching the future vision & optimal method

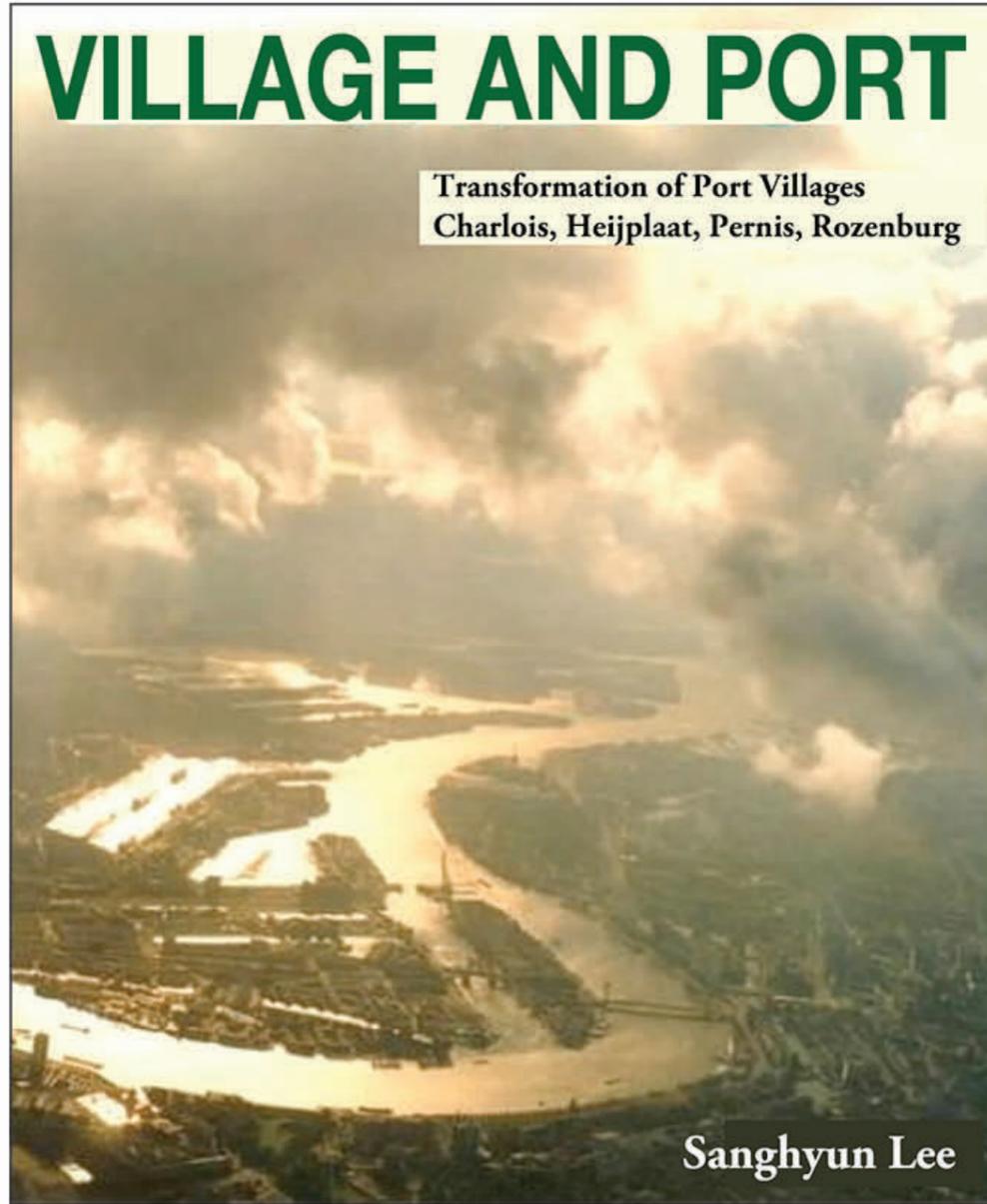## for settlements on the southern riverbank

This research focuses on ..

'Settlements'
on the southern riverbank of Rotterdam

VILLAGE AND PORT

**Transformation of Port Villages
Charlois, Heijplaat, Pernis, Rozenburg**

Sanghyun Lee
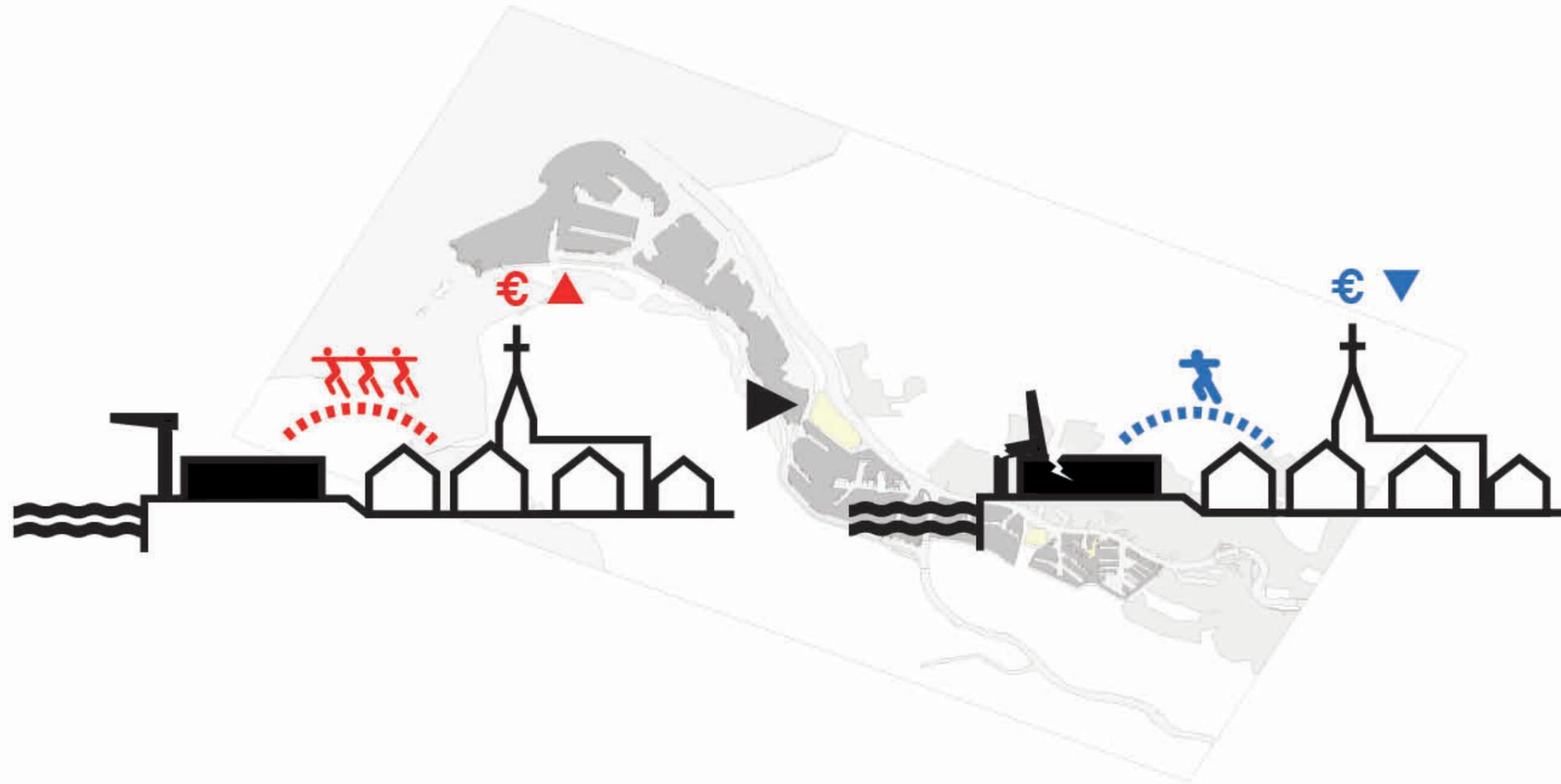
On the southern riverbank
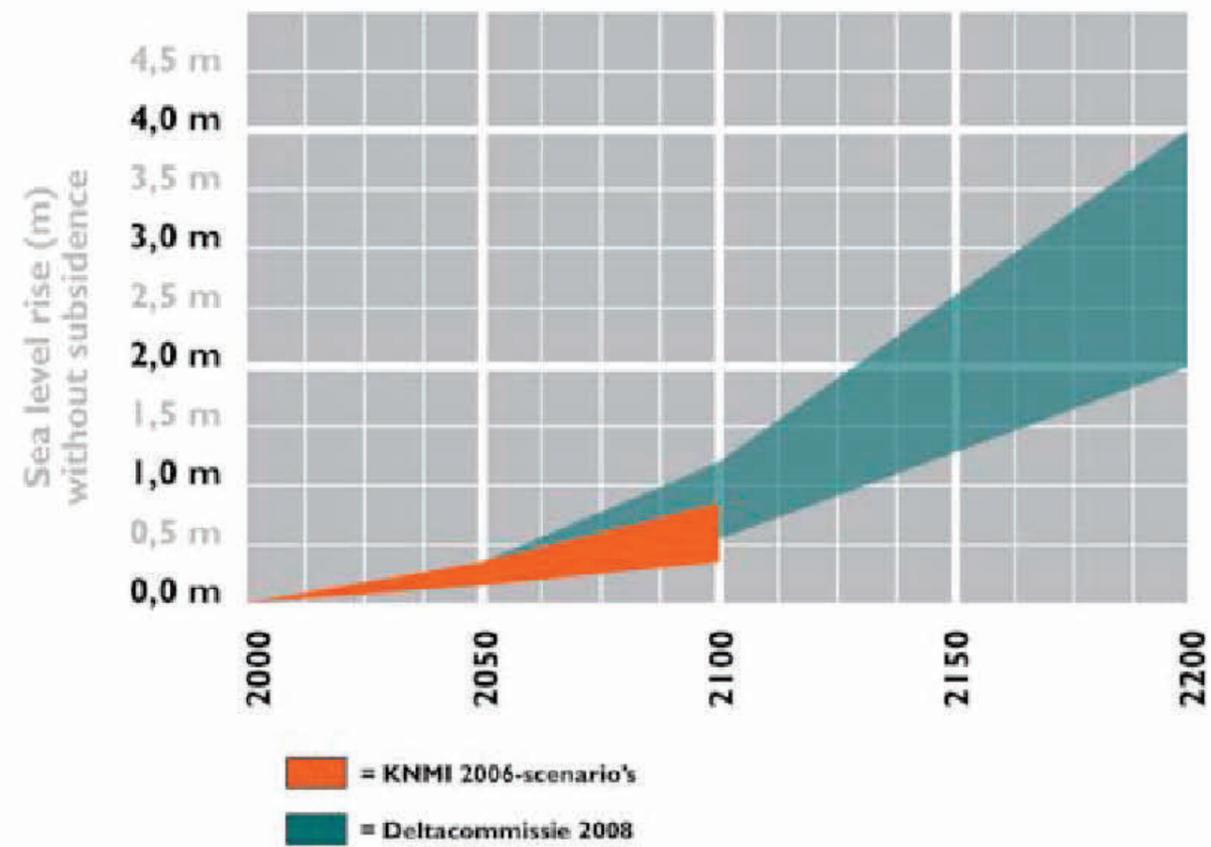of Rotterdam

Why ?

Port change

Port moves out westward

Settlements follows port **decline**

Port change is an opportunity
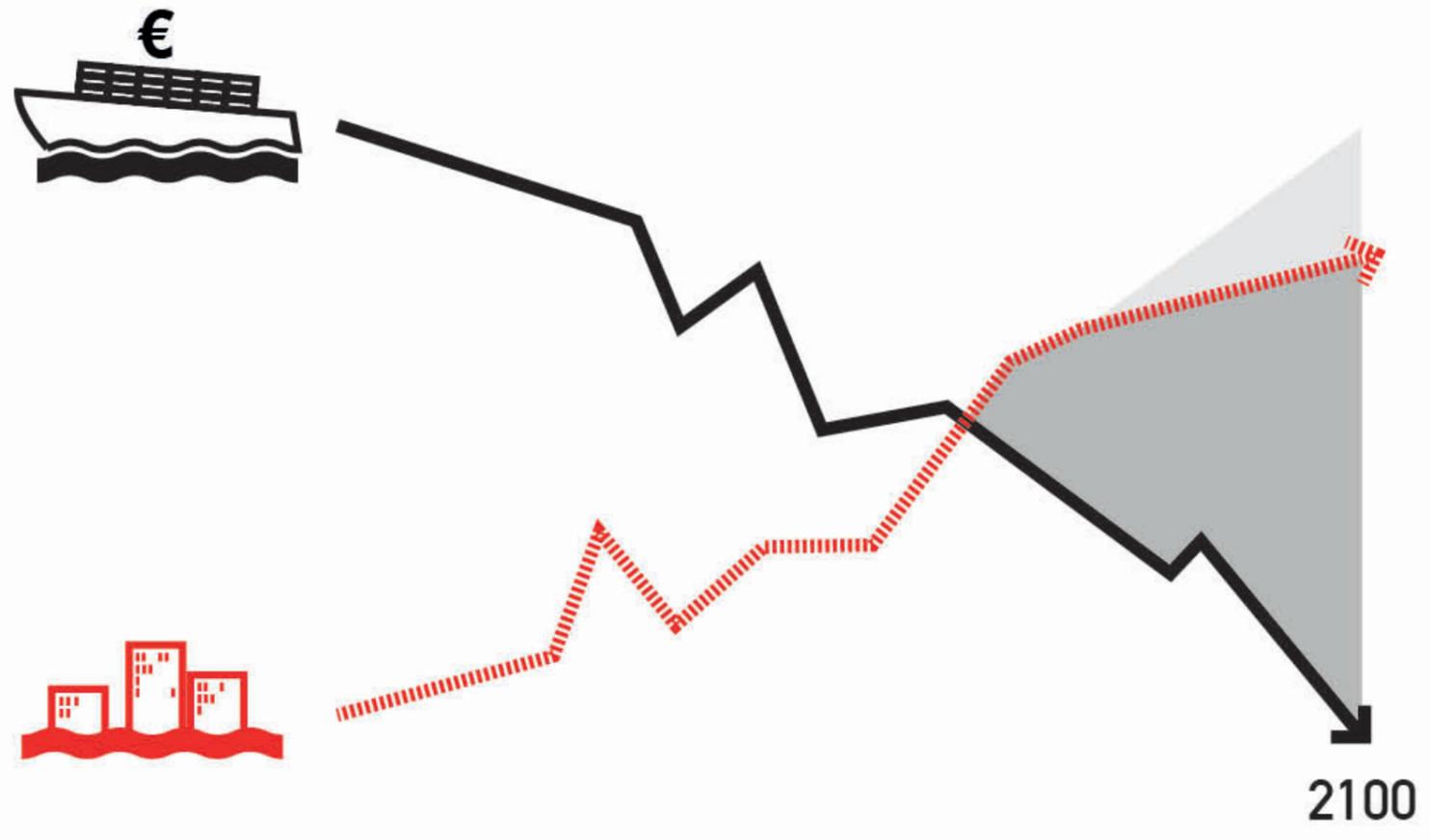to improve regional structure

Climate change

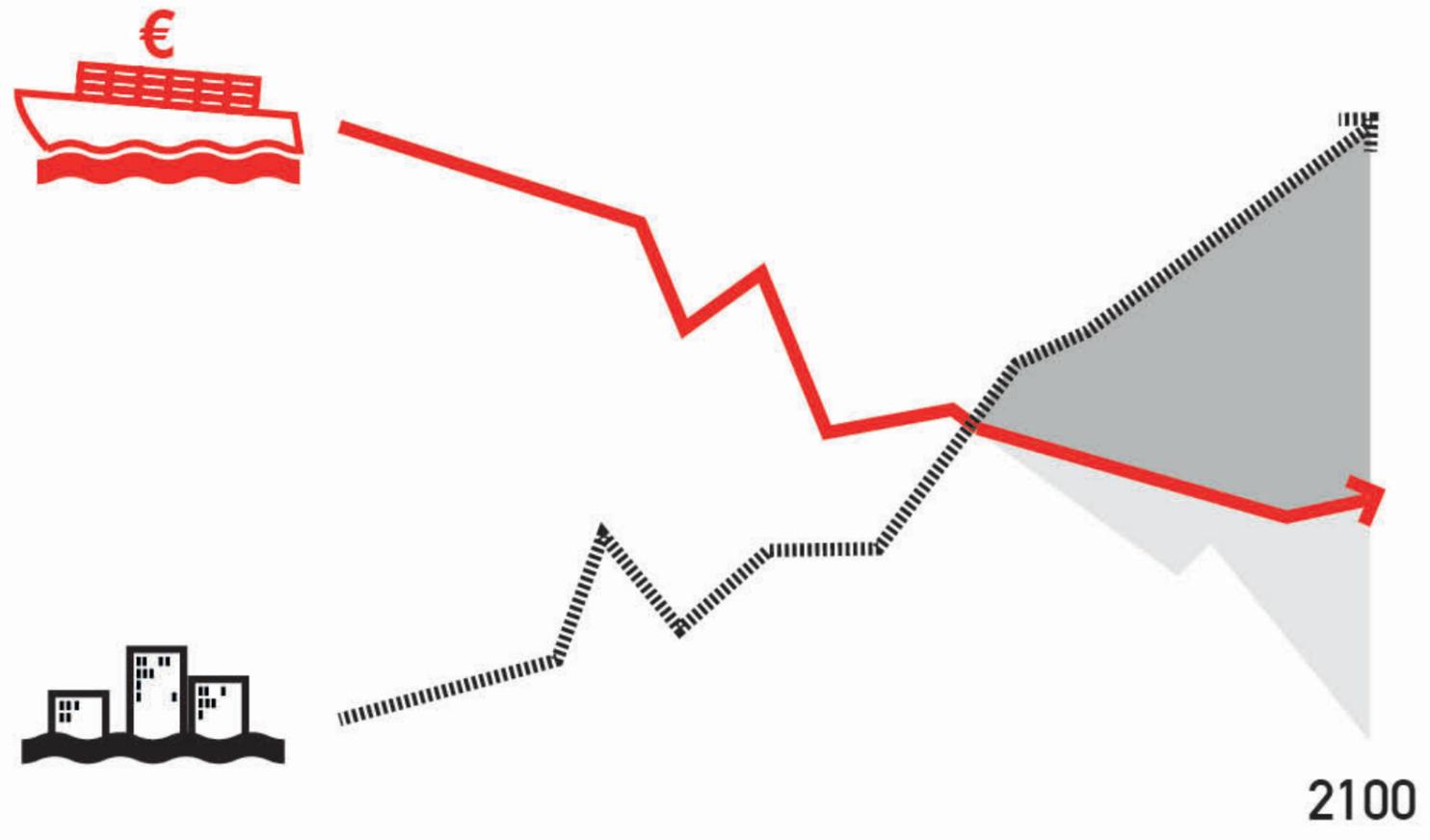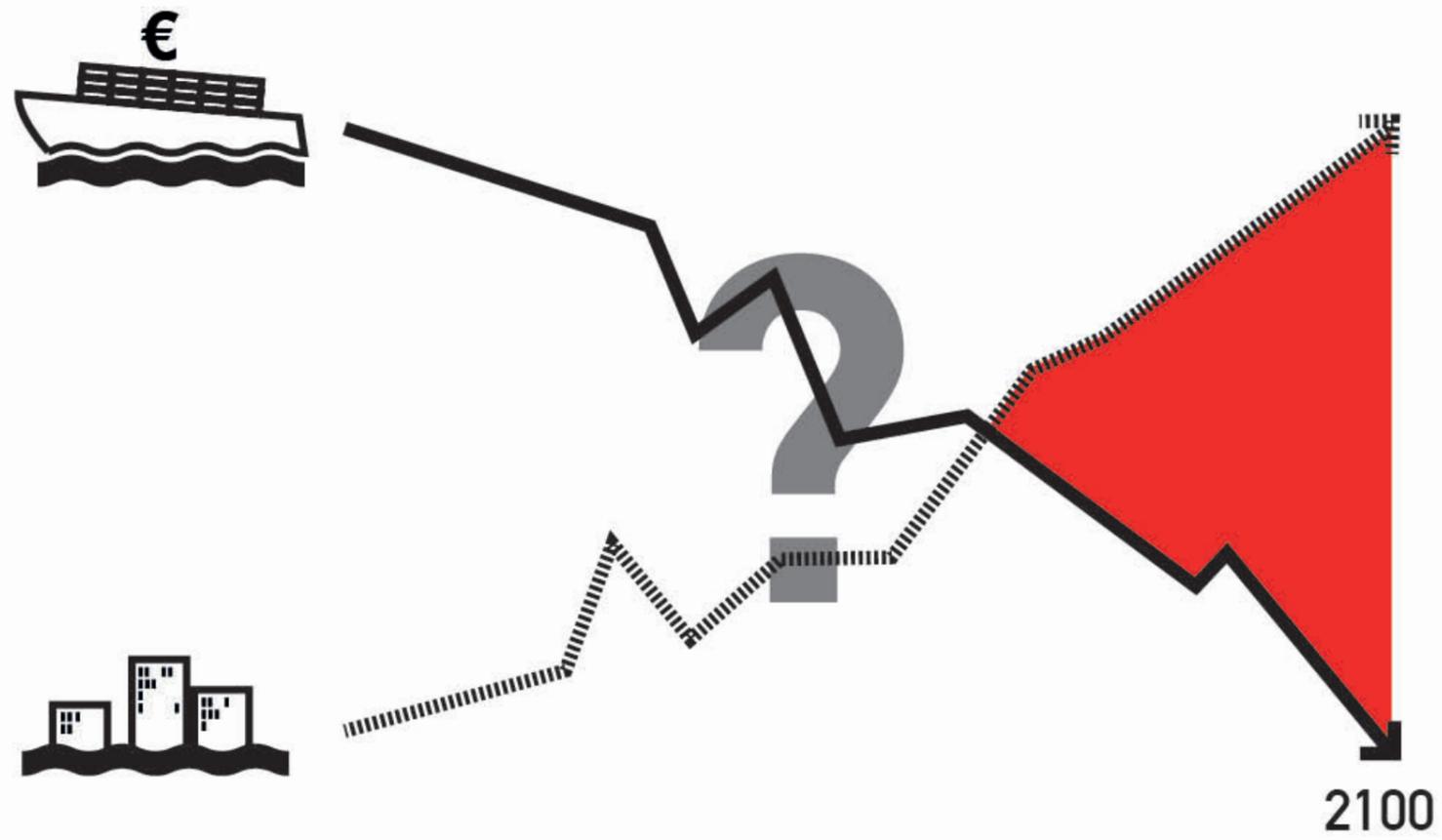Sea level rise (m) without subsidence

4,5 m
4,0 m
3,5 m
3,0 m
2,5 m
2,0 m
1,5 m
1,0 m
0,5 m
0,0 m

2000   2050   2100   2150   2200

= KNMI 2006-scenario's

= Deltacommissie 2008

Sea level rise scenarios
(Delta commitee 2008)

€

2100

Port decline + Climate change

2100

€

2100
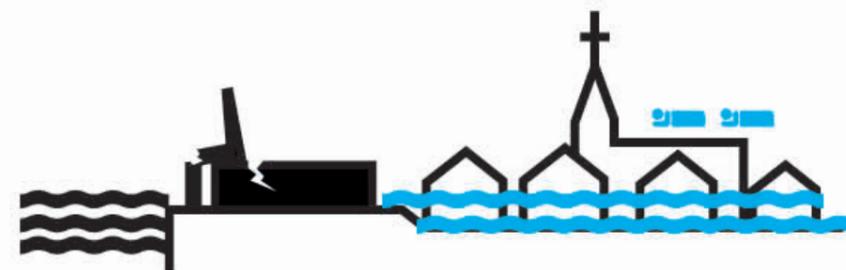
Uncertainty of the future

What kind of strategic plan and spatial intervention
can be applied in settlements on the southern bank of Rotterdam
to improve spatial quality and regional structure
coping with uncertain flood risk and port economy for 2100?

Storyline

1 Short introduction on southern riverbank

Short introduction on southern riverbank

2 Site research

Short introduction on southern riverbank

Site research + Scenarios **3**

Short introduction on southern riverbank

Site research + Scenarios

Hard & Soft approach?

4

Short introduction on southern riverbank

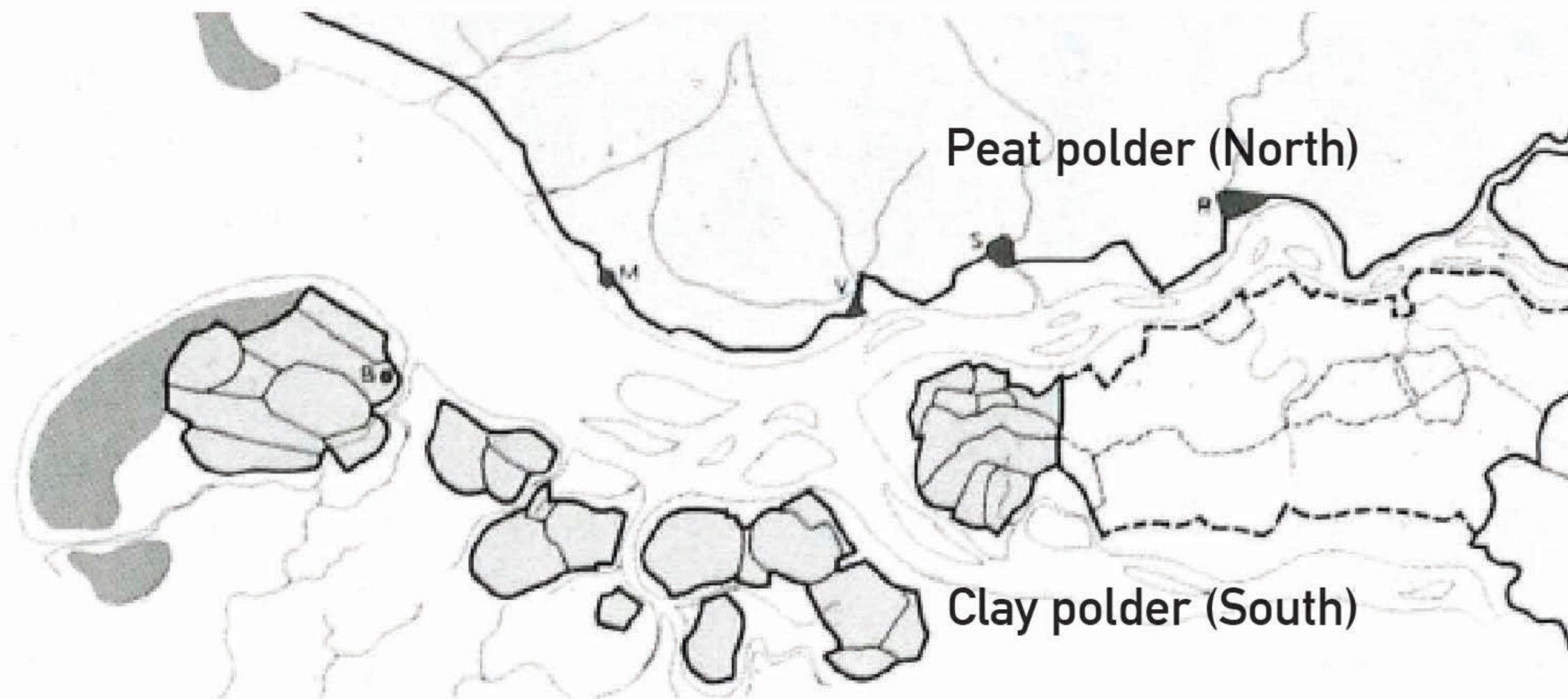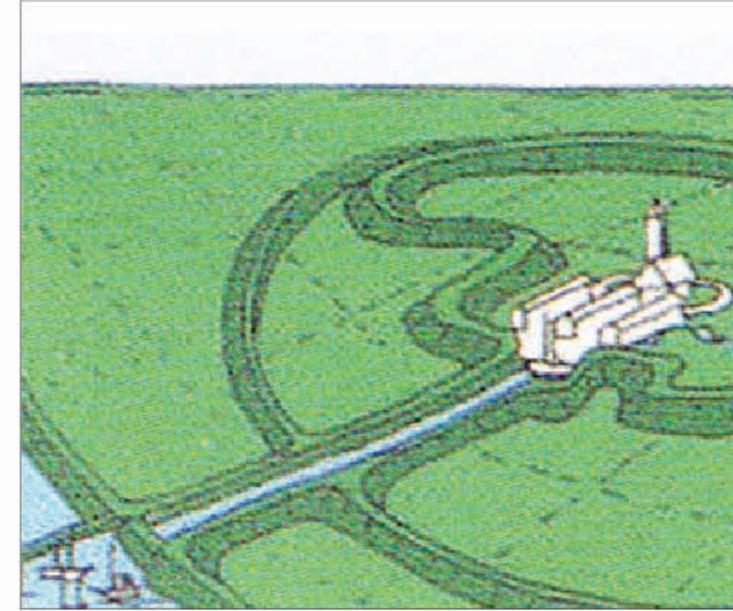Site research + Scenarios

Hard & Soft approach?

Test design

5

Short introduction on southern riverbank

Site research + Scenarios
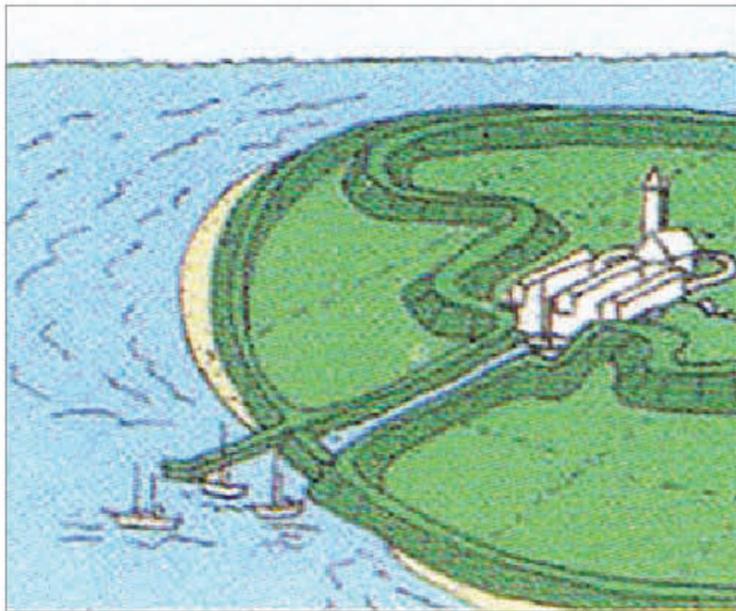
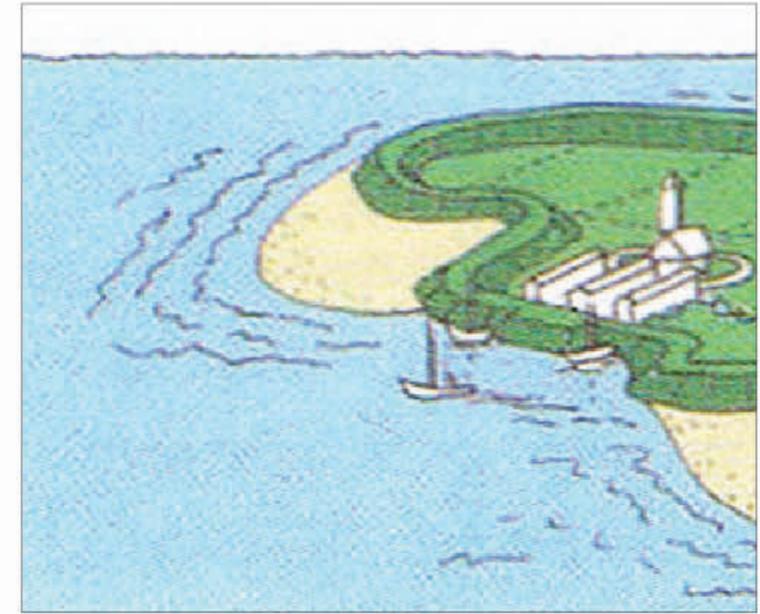Hard & Soft approach?

Test design

Design proposal

6

Landscape & History
Southern riverbank

Rotterdam region in 1400

Peat polder (North)
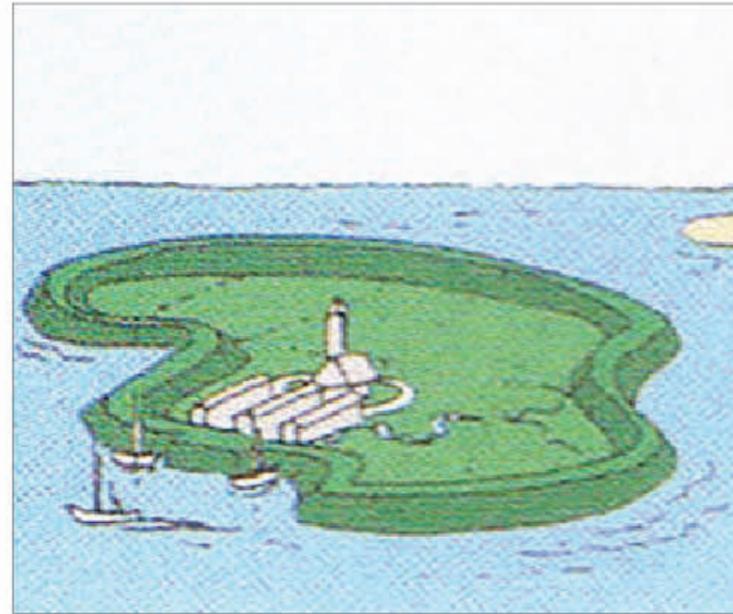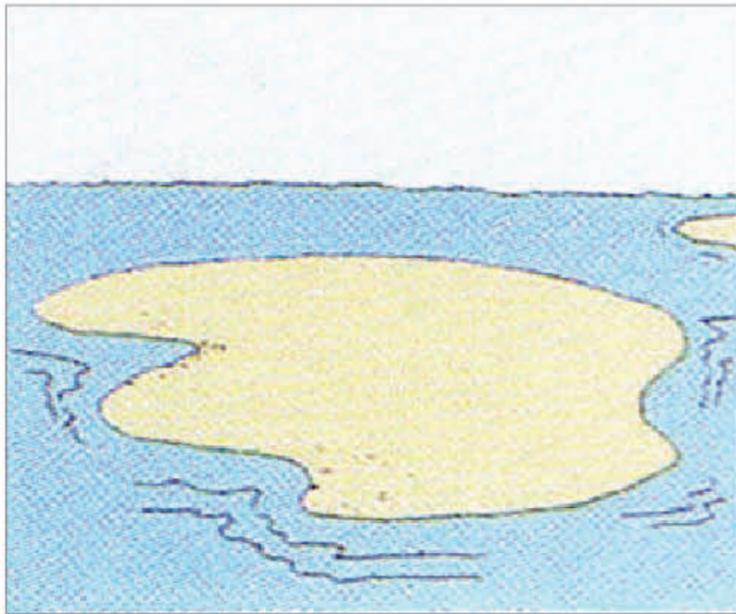
Clay polder (South)

settlement developement
on the clay polder

Settlements
Southern riverbank

Fishing village

Before 1870s
Fishing village

ship channel

Before 1870s
Fishing village

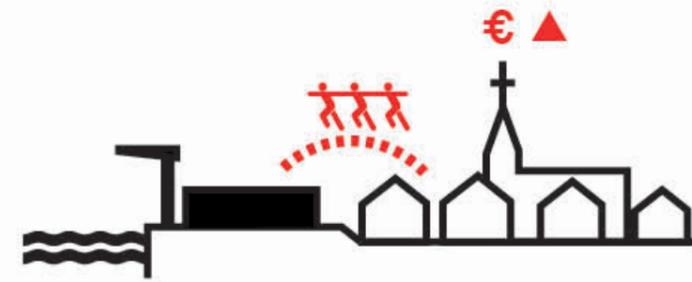1872 Nieuw Waterweg(ship channel of Rotterdam port)

Port village

Before 1870s
Fishing village

1872 Nieuw Waterweg(ship channel of Rotterdam port)
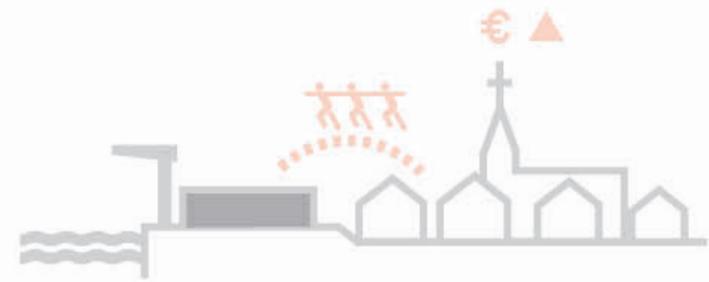
After 1870s
Port village

Post-Port village

Before 1870s
Fishing village
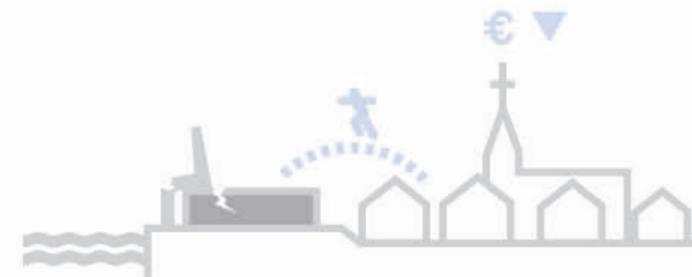
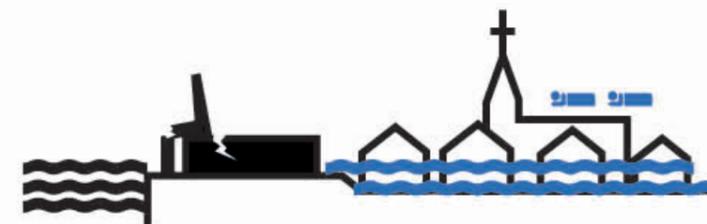**1872 Nieuw Waterweg(ship channel of Rotterdam port)**

After 1870s
Port village

After 1990s
Post-port village
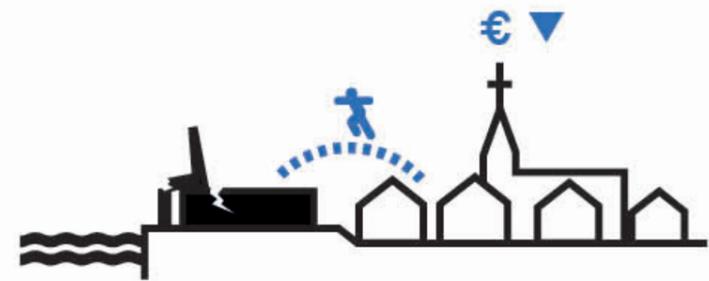
Post-Port village

Climate change

Before 1870s
Fishing village

1872 Nieuw Waterweg(ship channel of Rotterdam port)

After 1870s
Port village

After 1990s
Post-port village

After 2012
Climate change + Port decline

1850
Fishing village

Niew Rozenburg Oud Rozenburg Blankenburg Pernis De Heij Charlois Katendrecht

1880
Fishing village

Niew Rozenburg

Oud Rozenburg
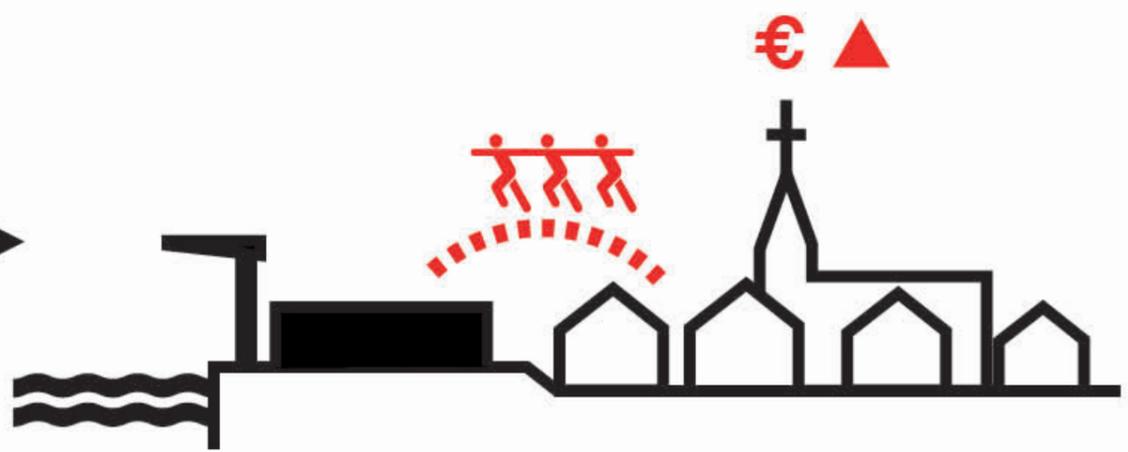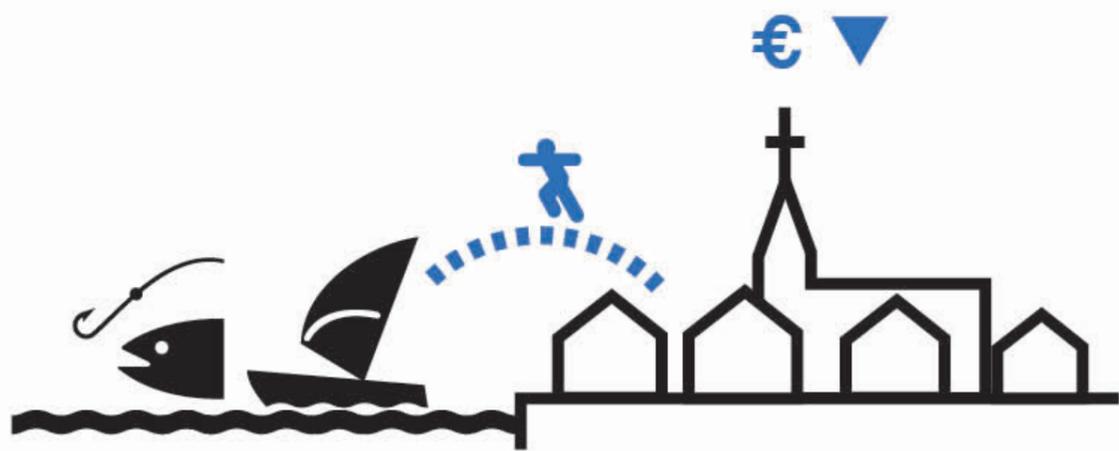
Blankenburg

Pernis

De Heij

Charlois
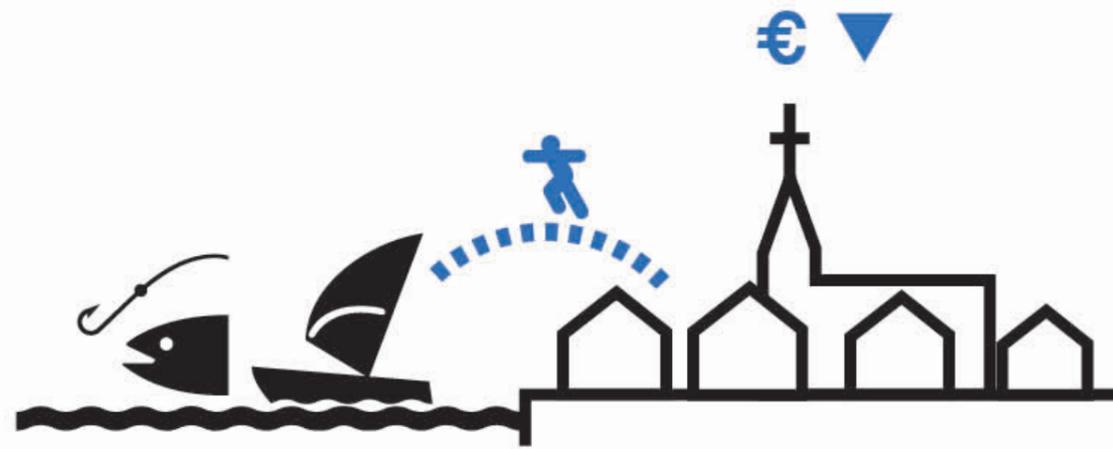
Katendrecht

1920
Port village

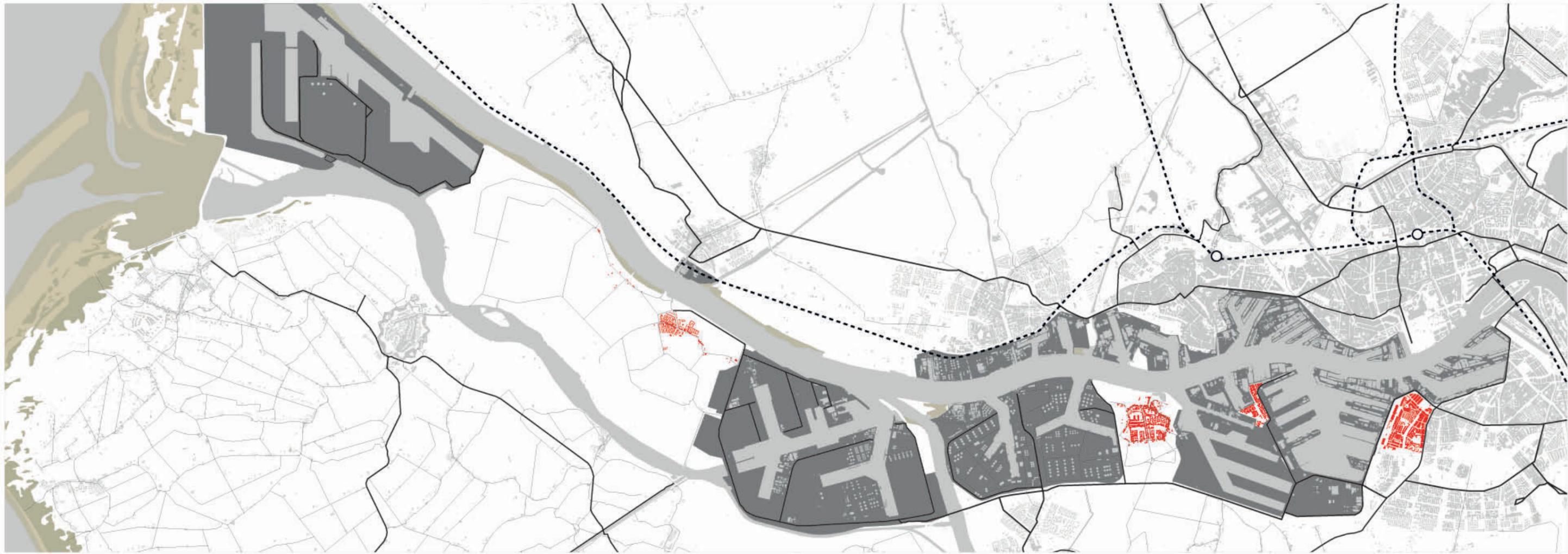Niew Rozenburg   Oud Rozenburg   Blankenburg   Pernis   De Heij   Charlois   Katendrecht
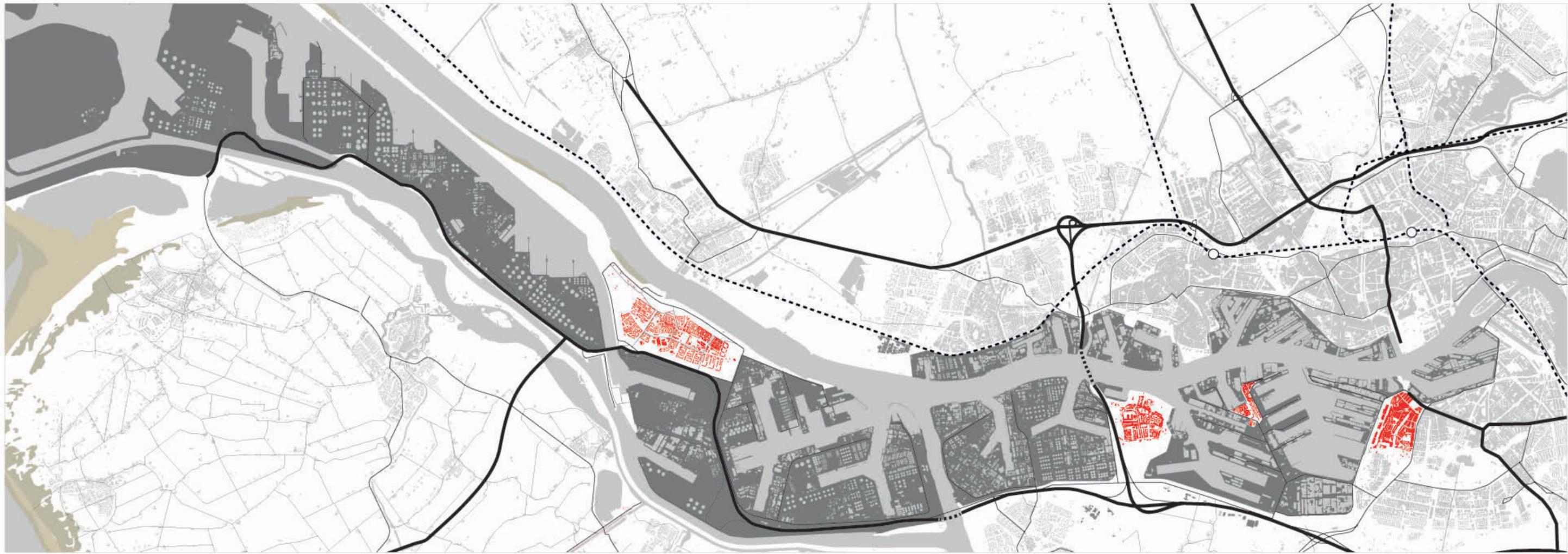
1940
Port village

Oud Rozenburg

Niew Rozenburg

Blankenburg

Pernis   Heijplaat   Katendrecht

Charlois

1965
Port village

Rozenburg

Blankenburg

Pernis

Heijplaat
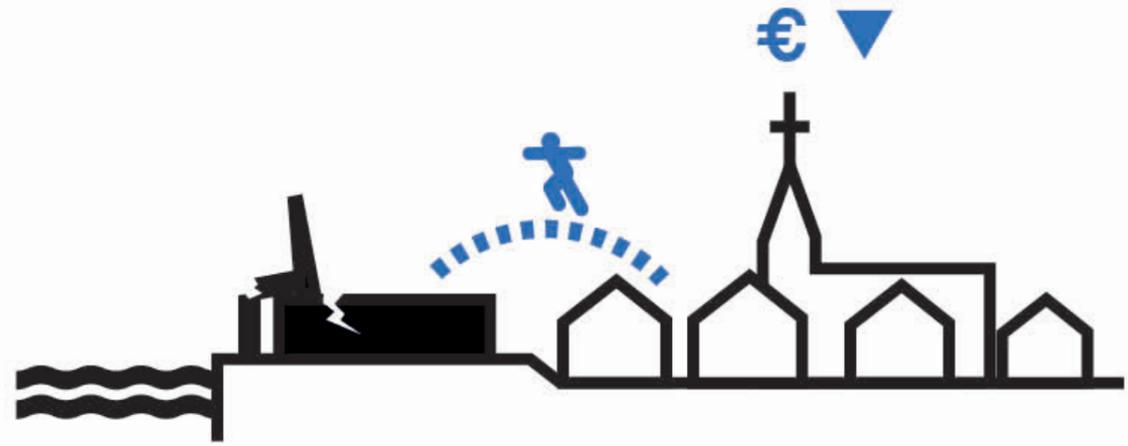
Charlois
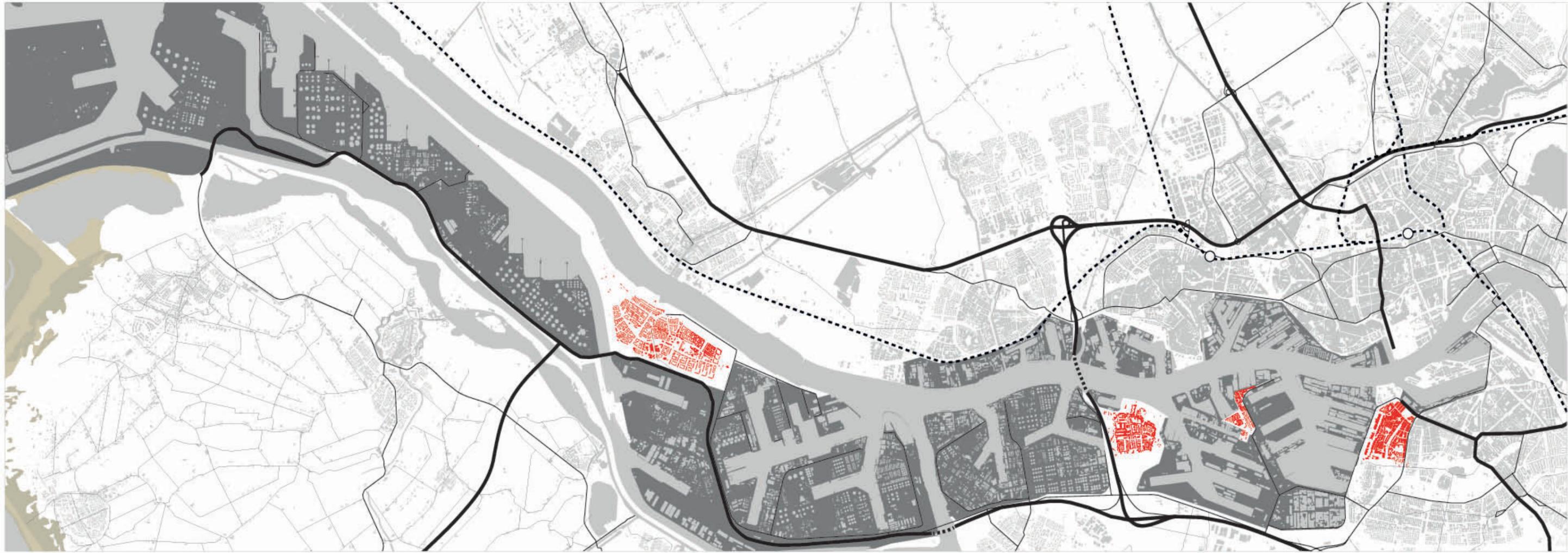
Katendrecht

1980
Port village

Rozenburg

Blankenburg

Pernis

Heijplaat
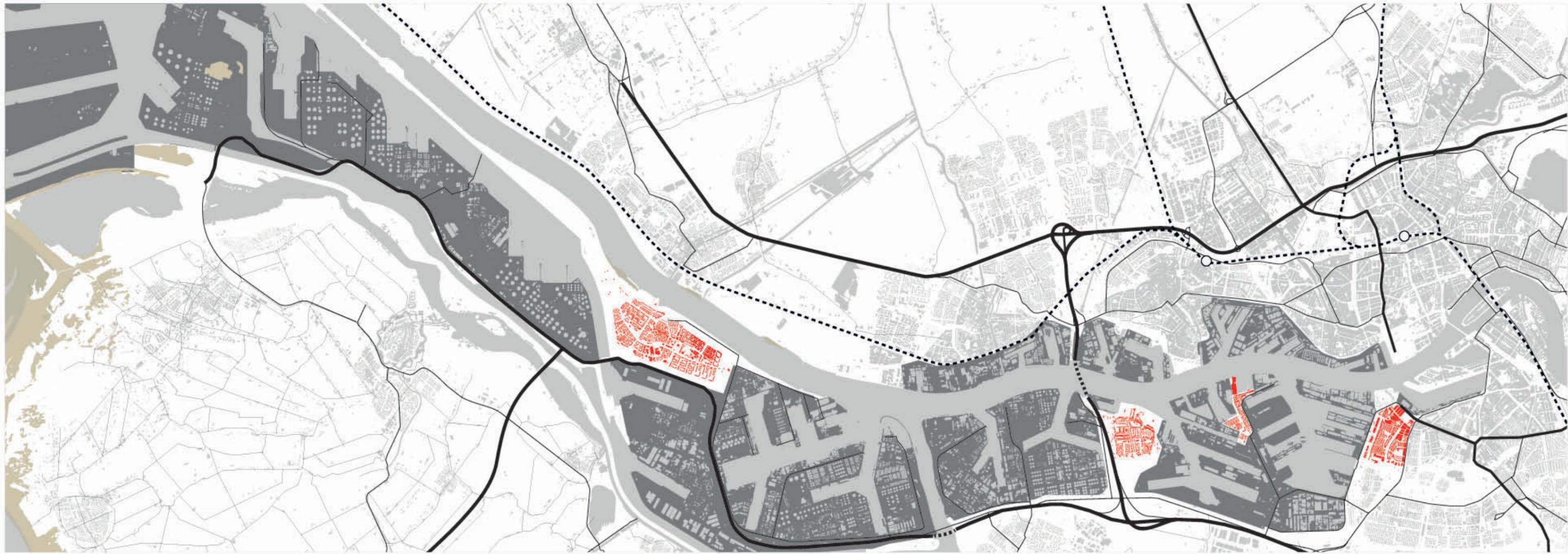
Charlois

Katendrecht

1995
Post-port village

Rozenburg

Blankenburg

Pernis

Heijplaat

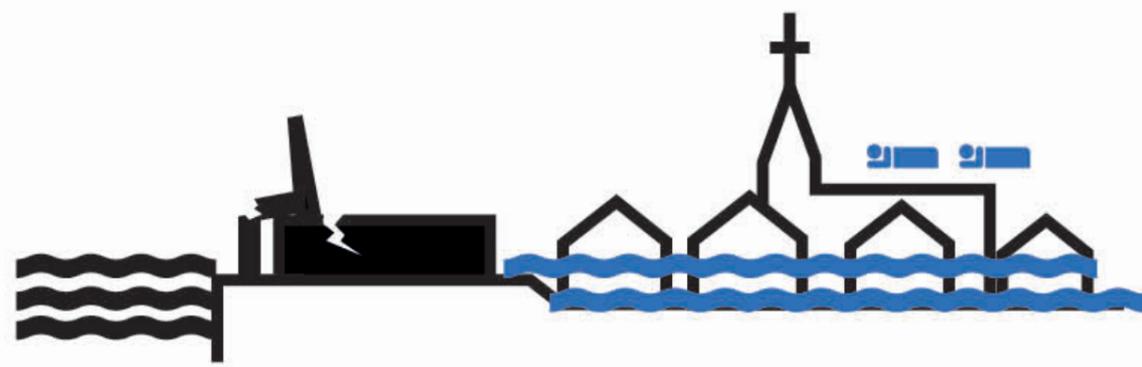Charlois

Katendrecht

2012
Post-port village

Rozenburg

Blankenburg

Pernis

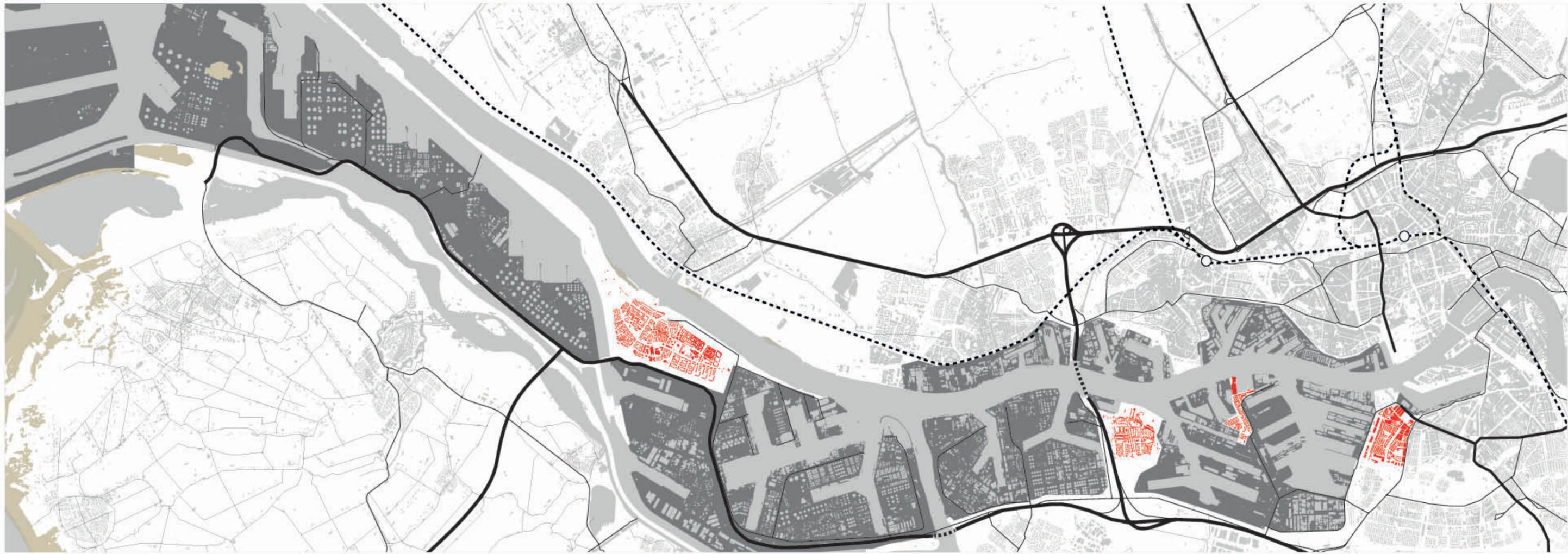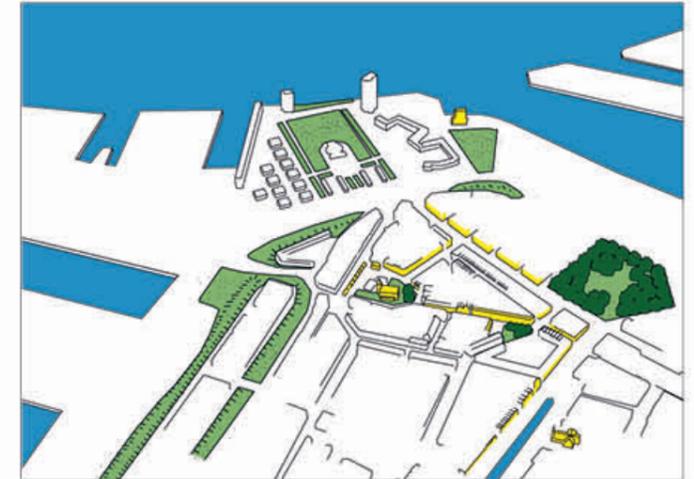Heijplaat

Charlois

Katendrecht

4 Settlements
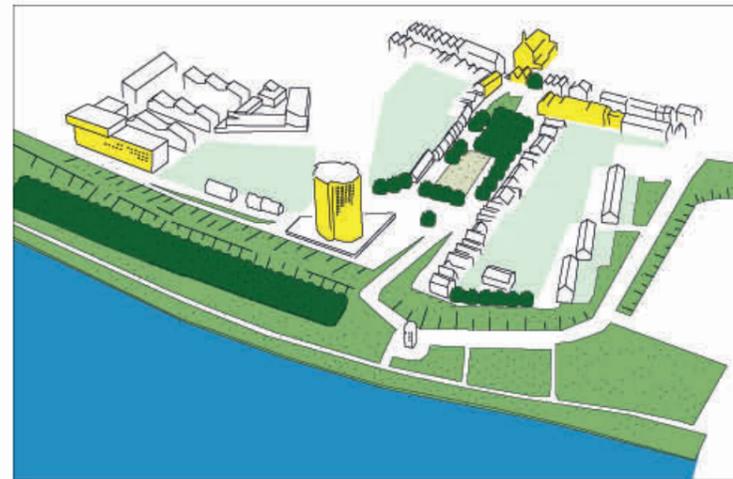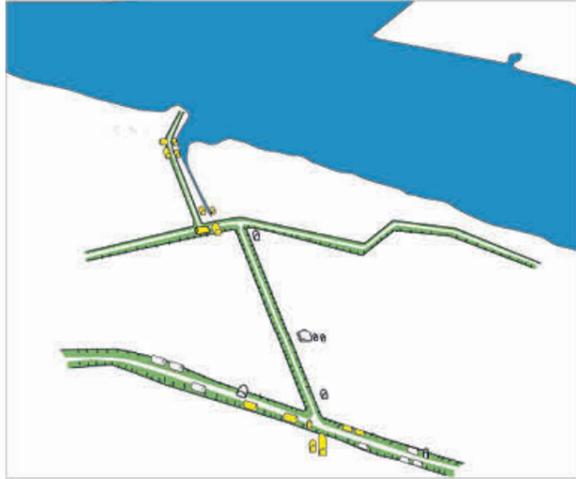## Southern riverbank

2012
Post-port village

Rozenburg
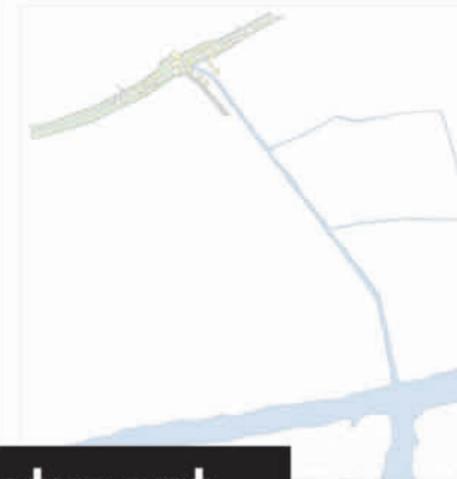Blankenburg

Pernis Heijplaat
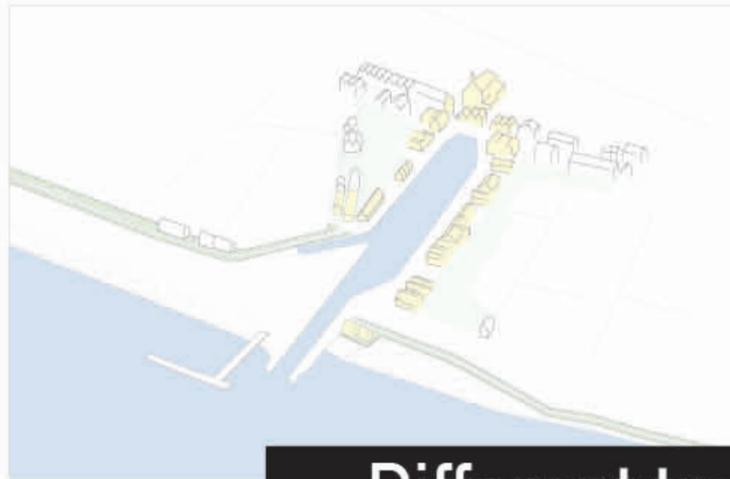Charlois Katendrecht

Rozenburg   Pernis   Heijplaat   Charlois
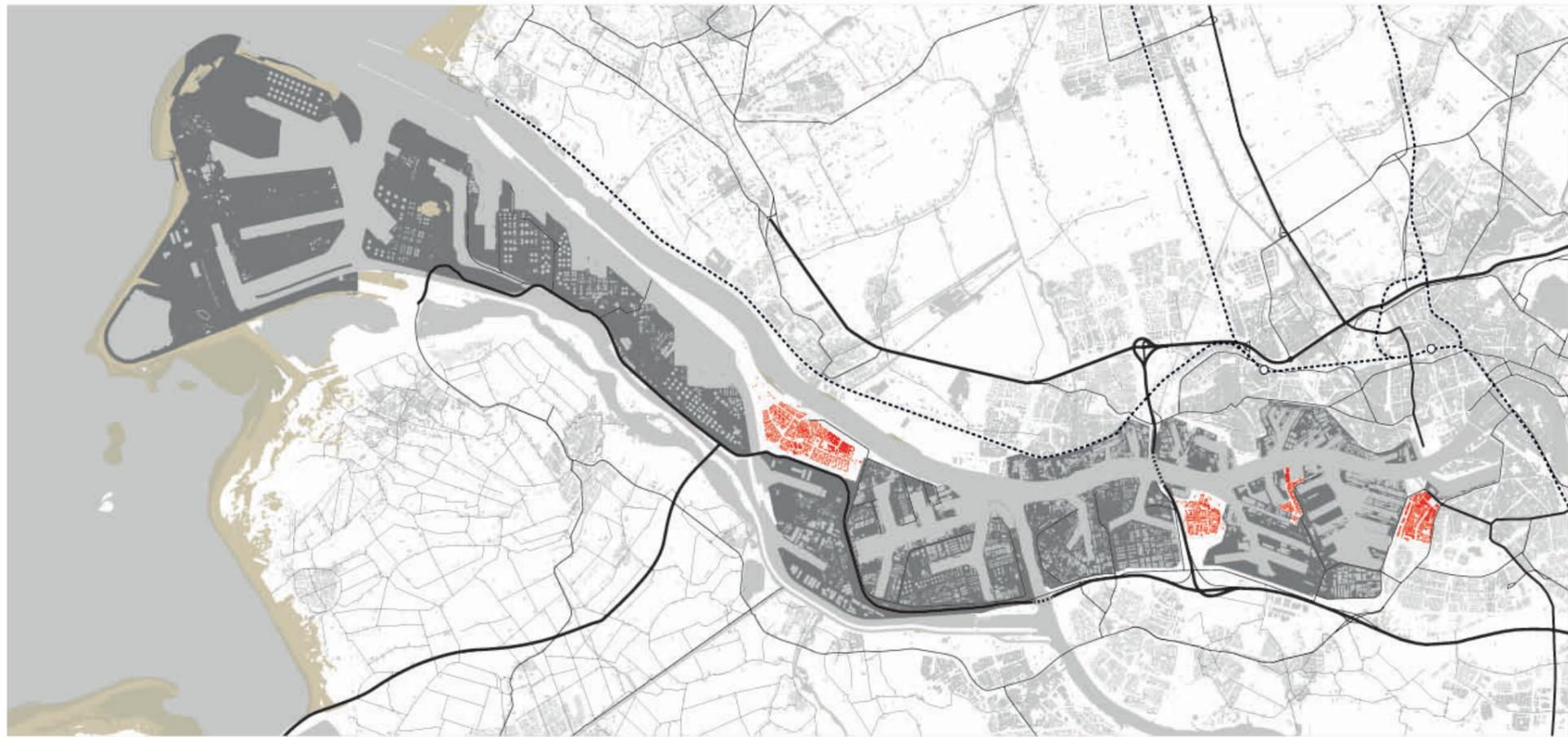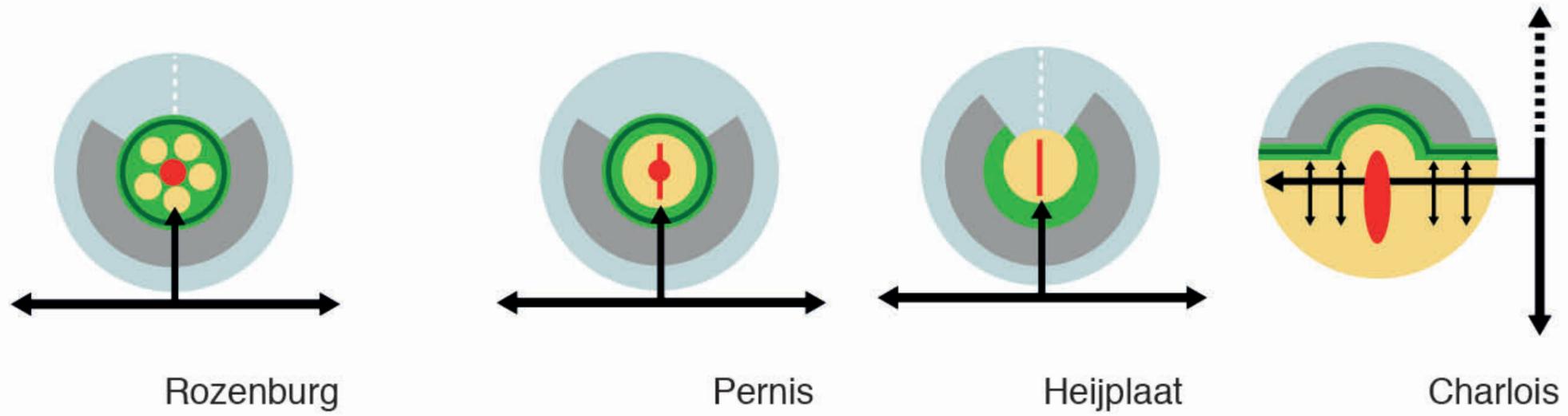
Different treatment

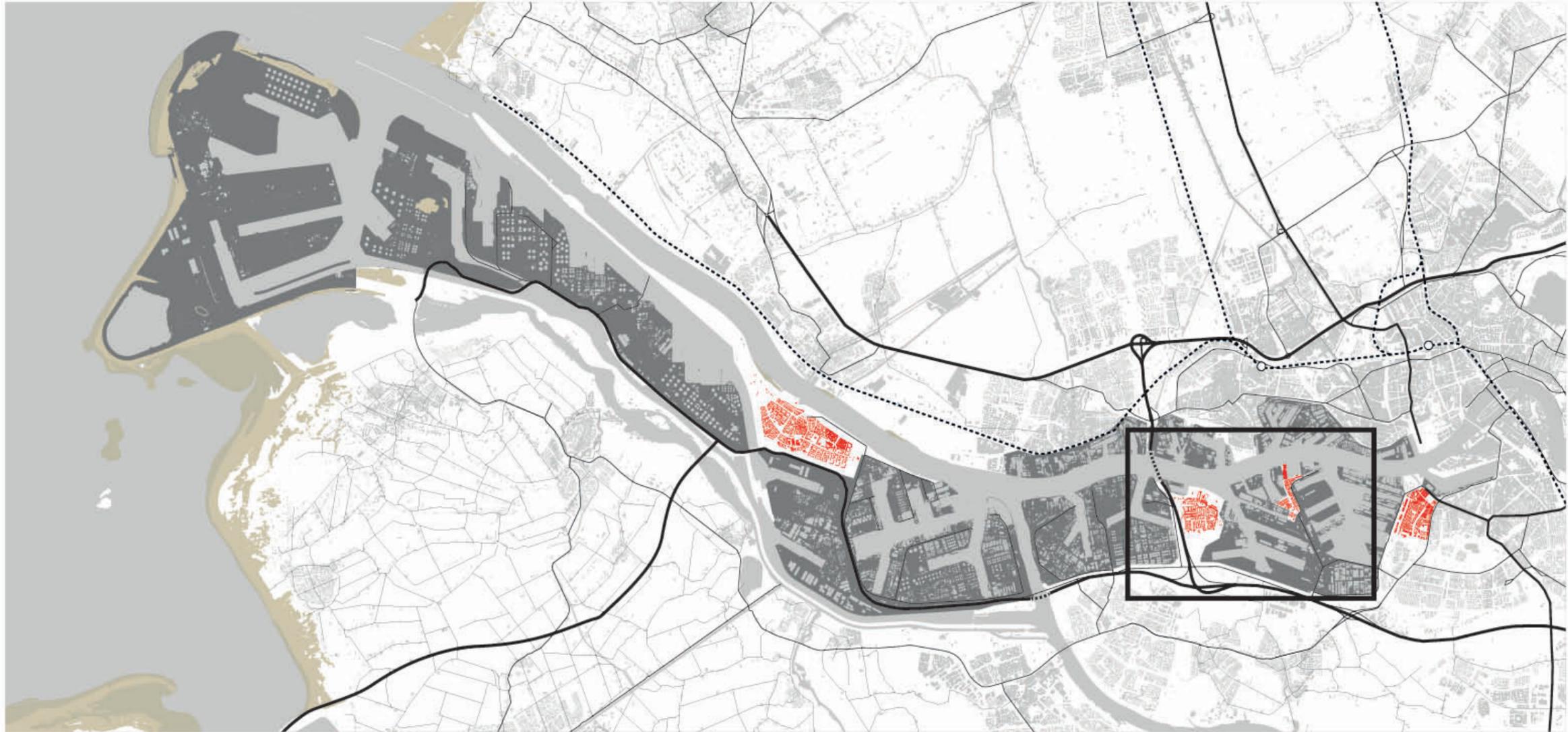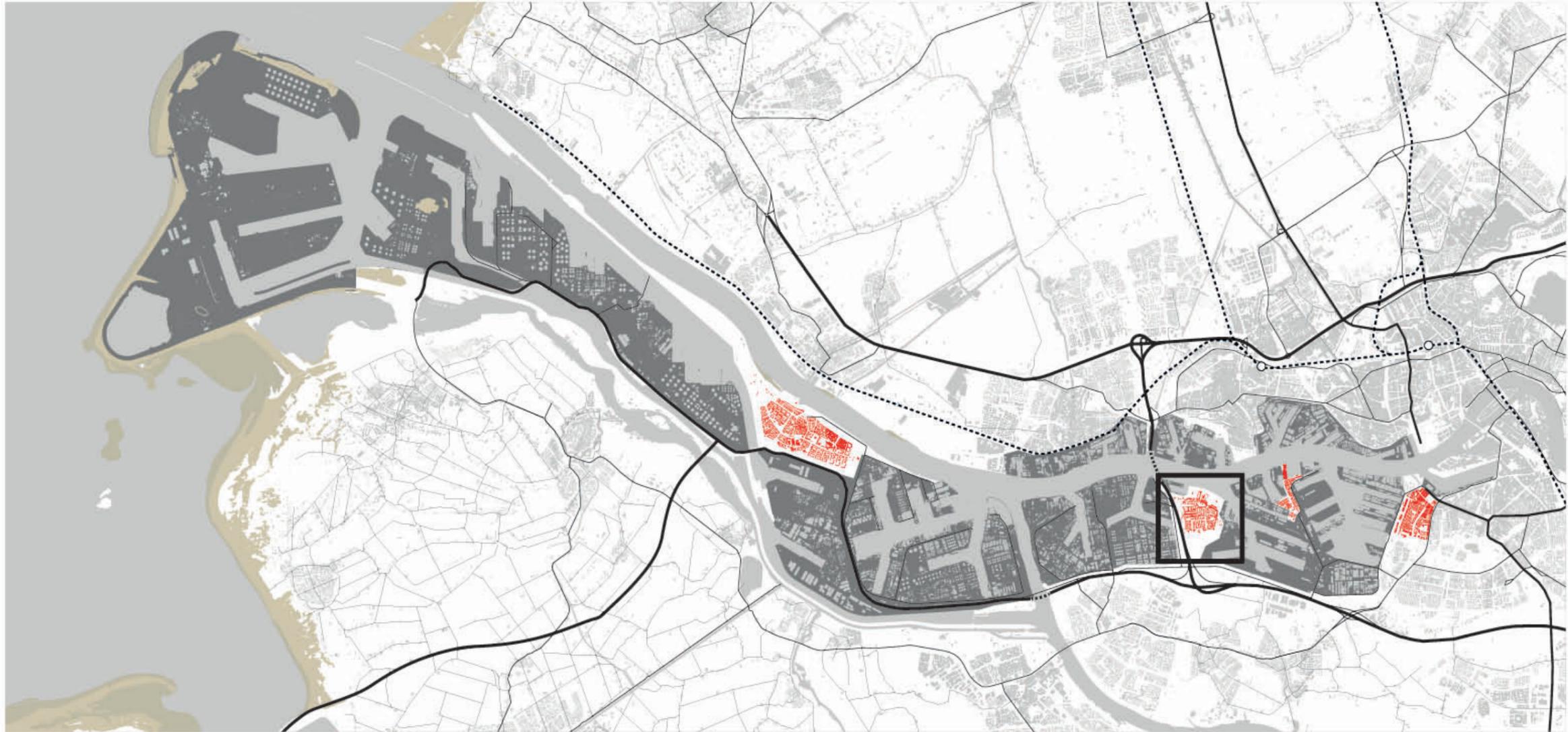Rozenburg   Pernis   Heijplaat   Charlois

Rozenburg   Pernis   Heijplaat   Charlois

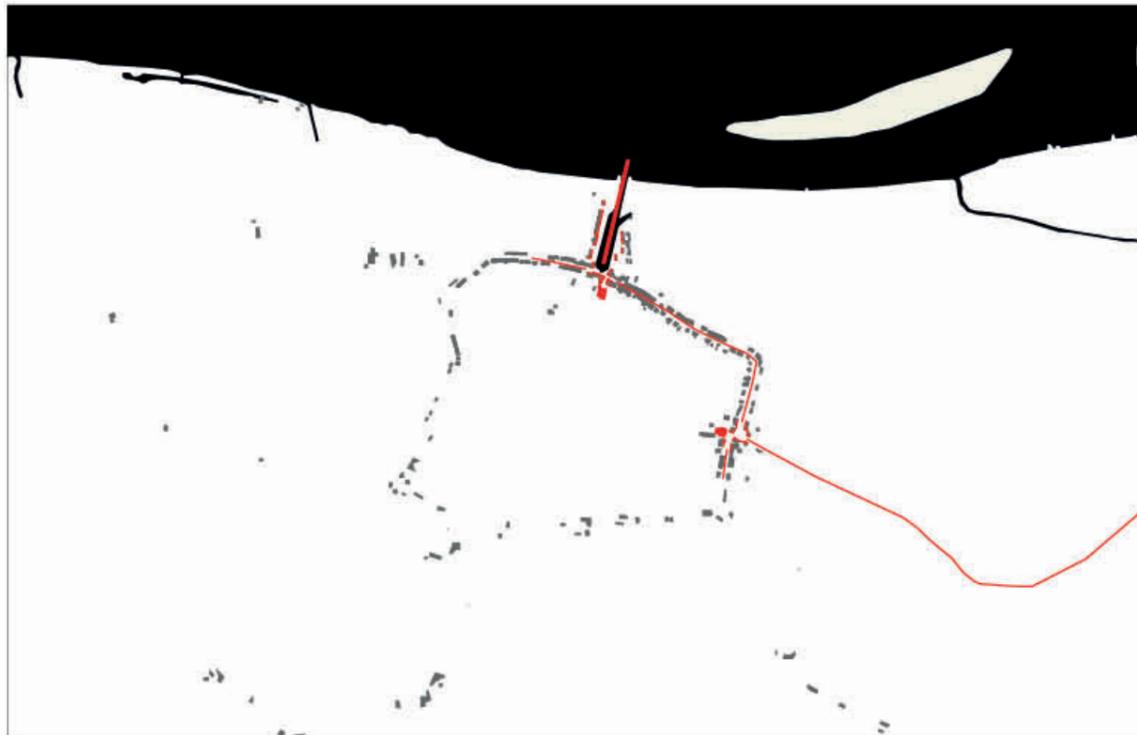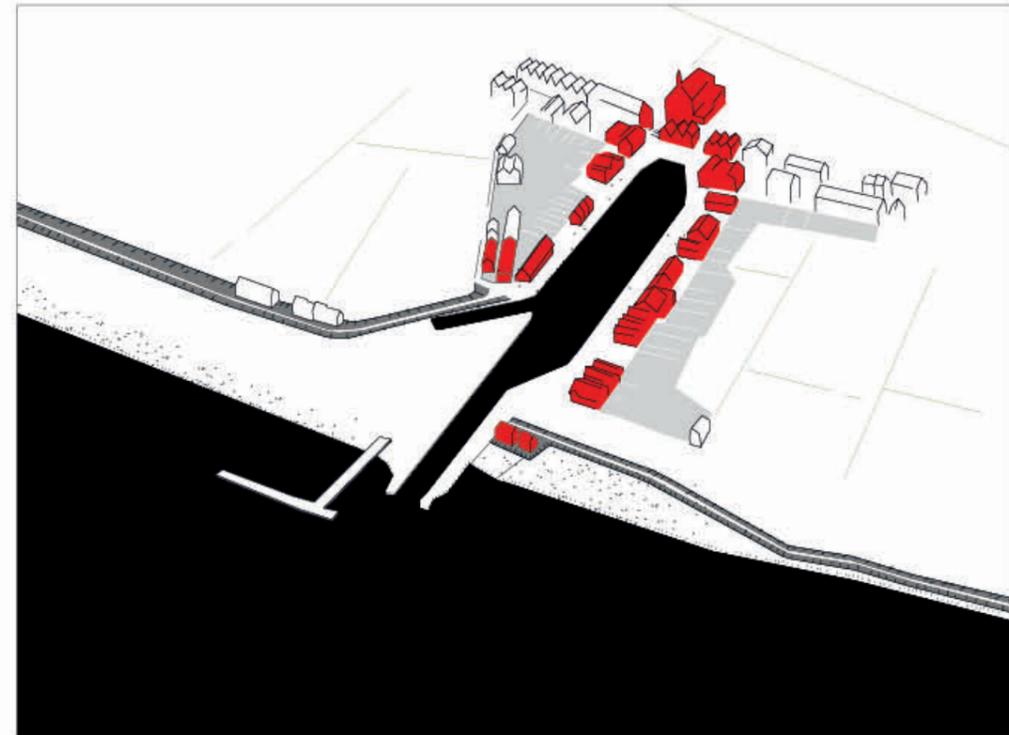Pernis-Heijplaat

Pernis

What happened in Pernis?

1850
Fishing village
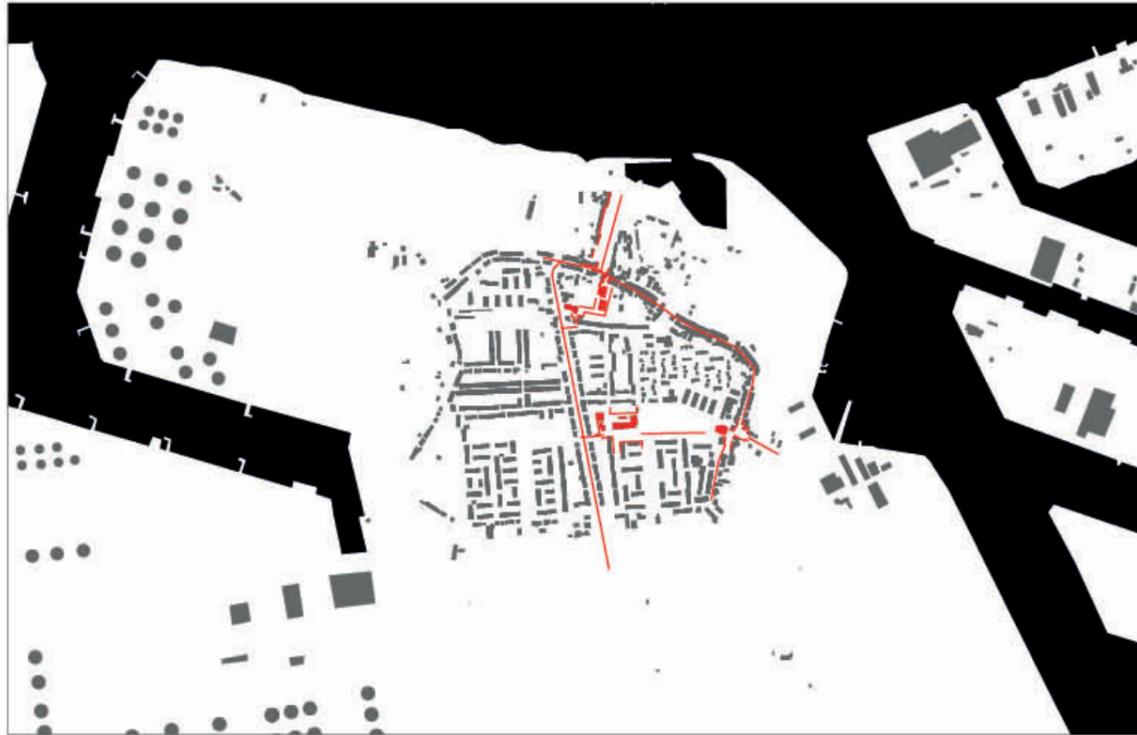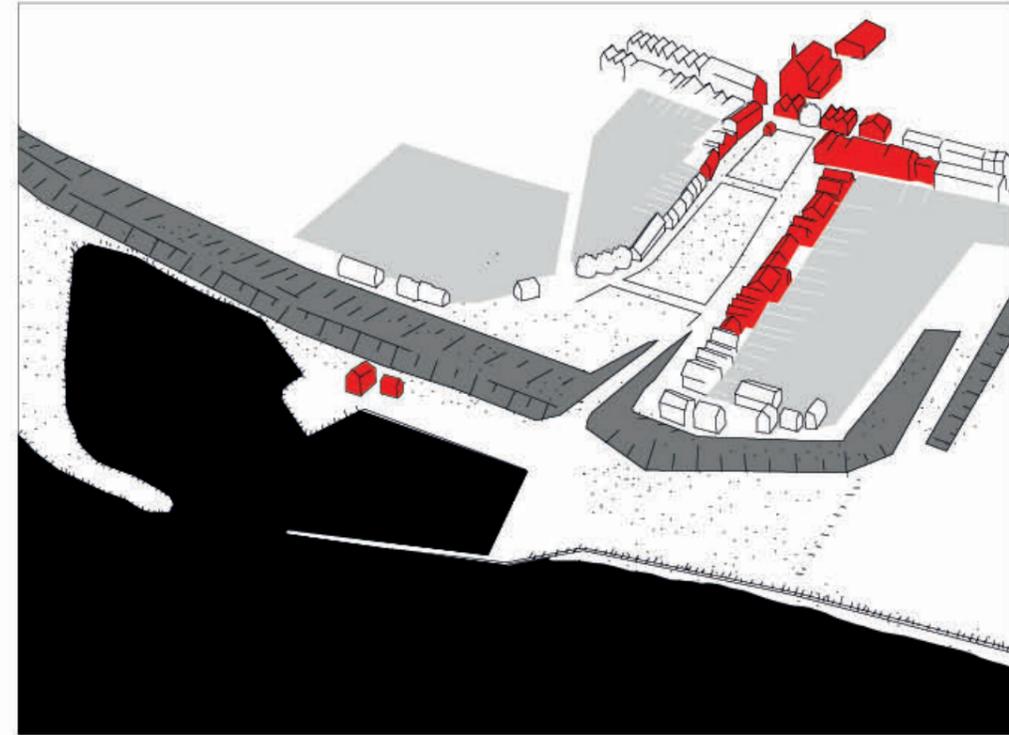

City scale

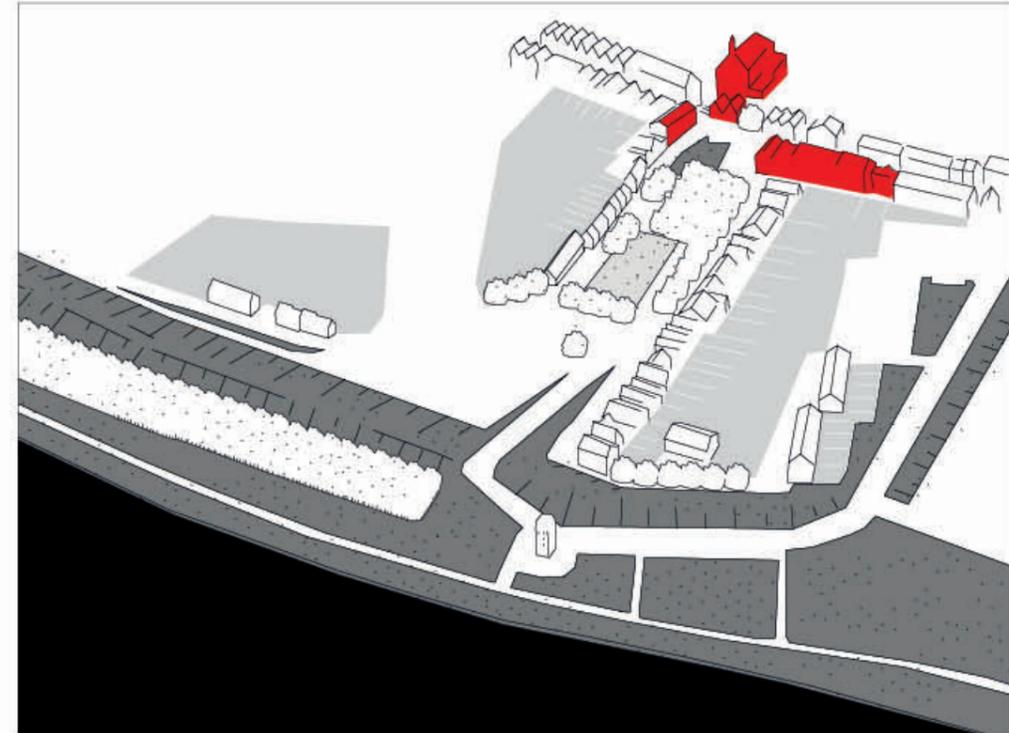Historical centre

1965
Port village

City scale

Historical centre

1995

Port village

City scale

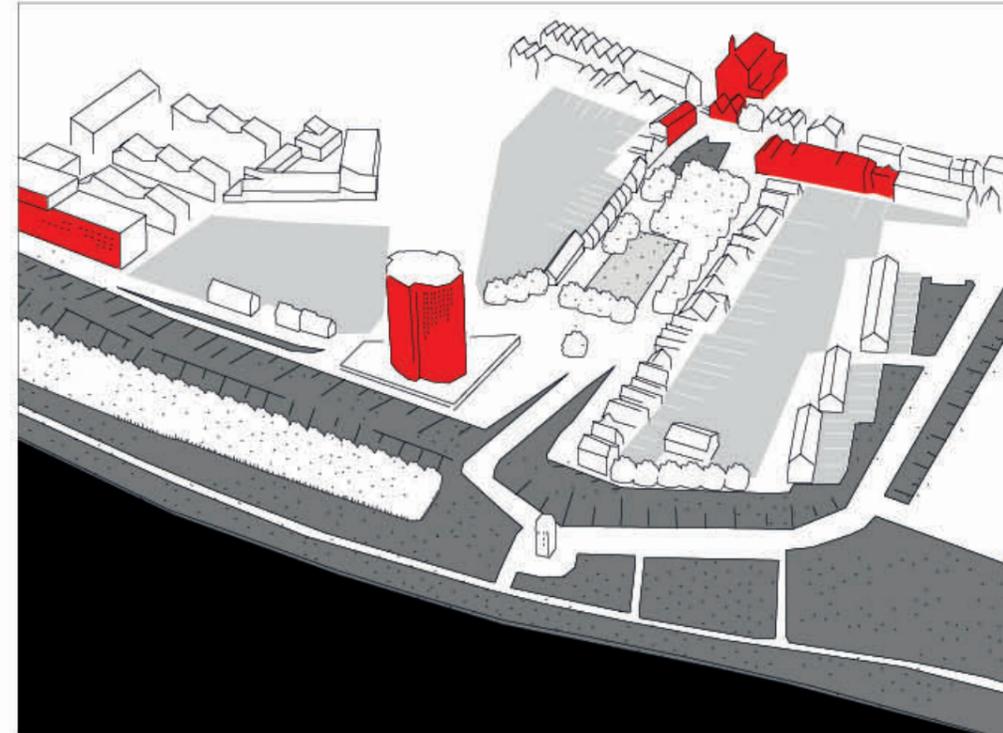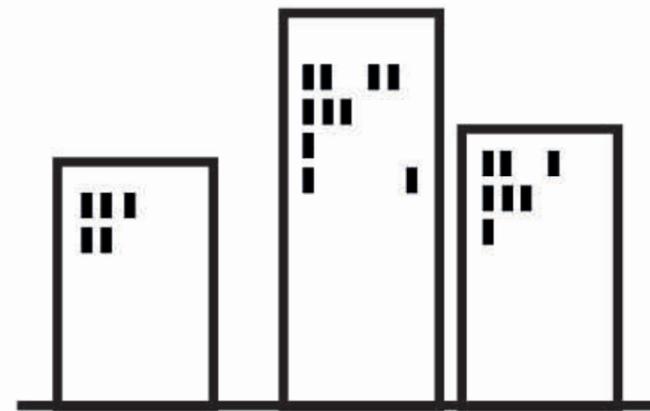Historical centre

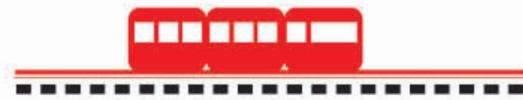# 2012
Post-port village

City scale

Historical centre

2012
Post-port village

2002 New metro line

2012
Post-port village

Waterfront

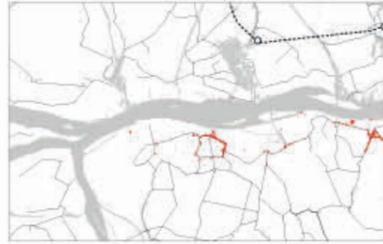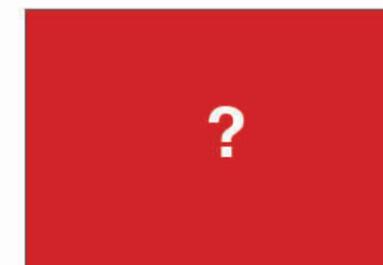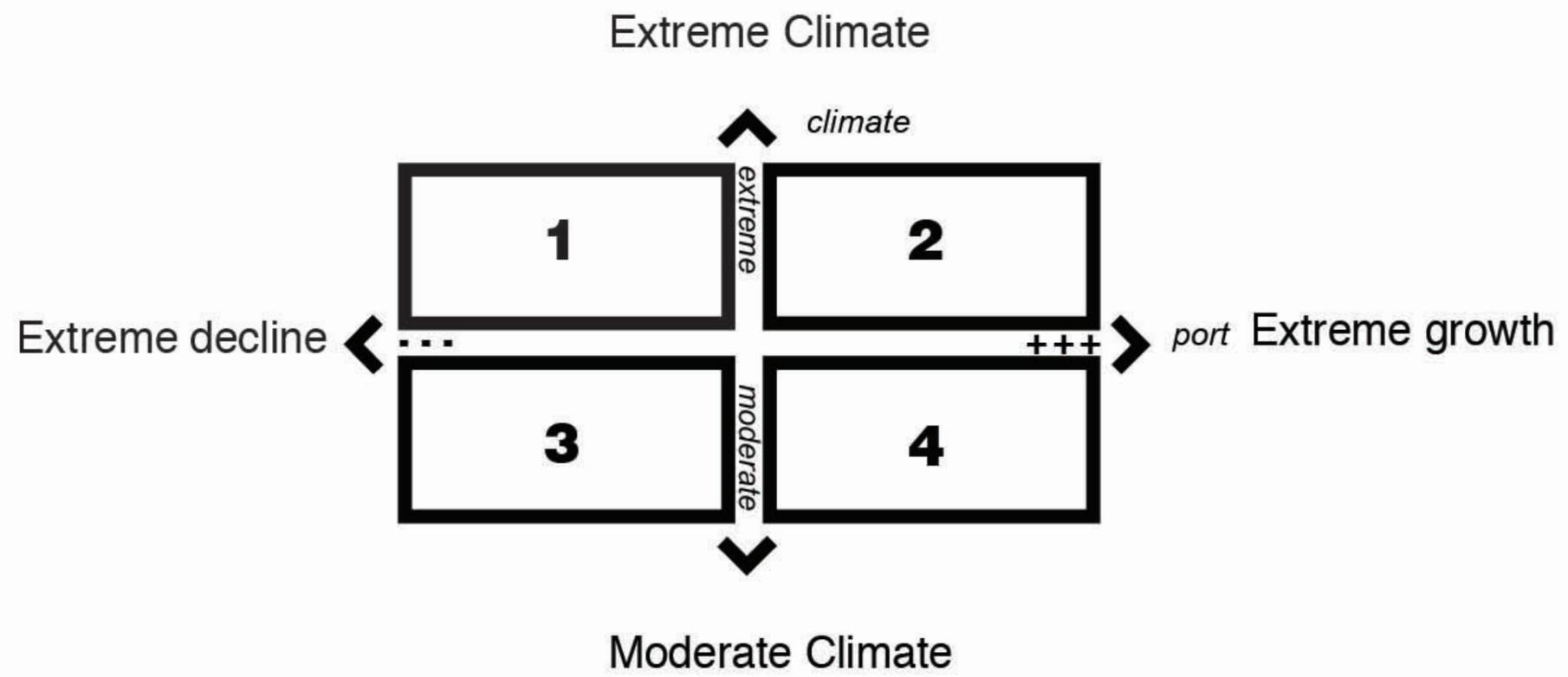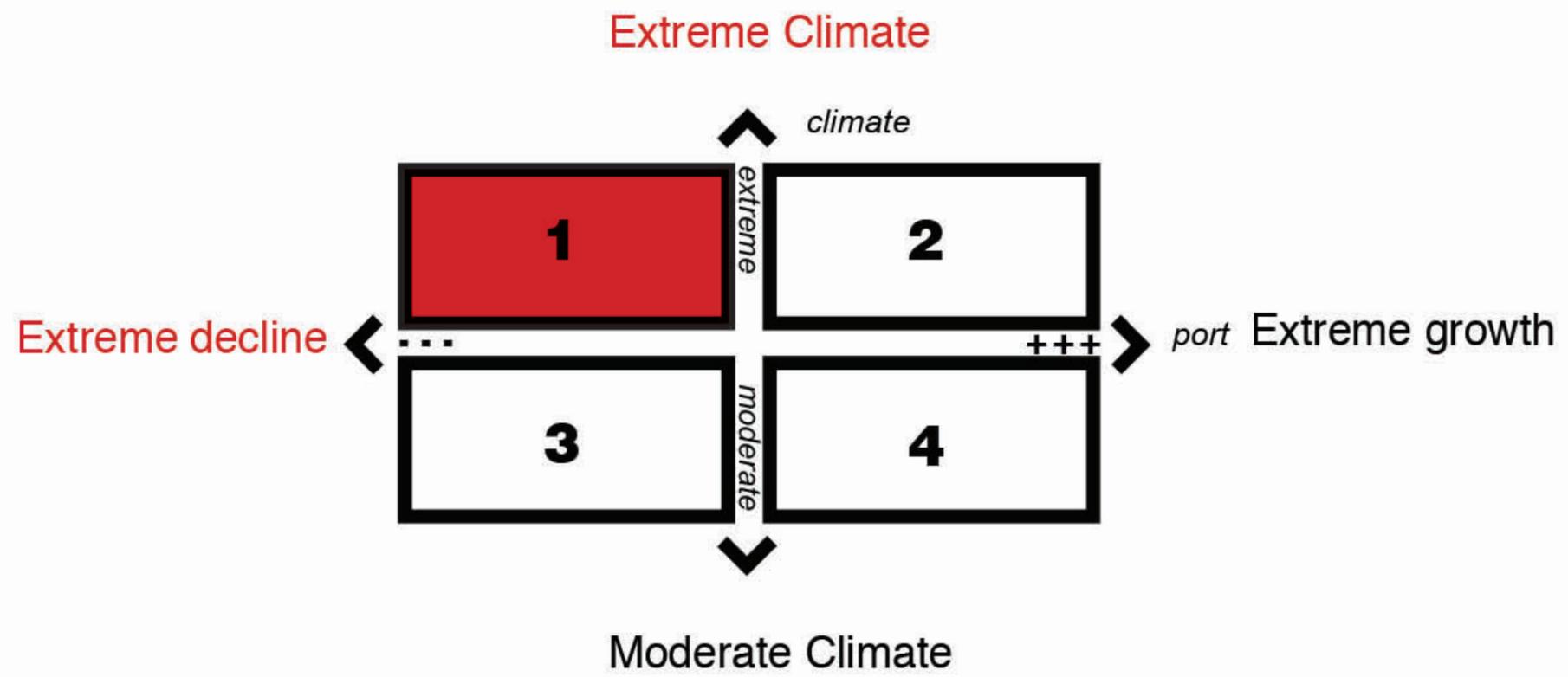Station area

1880   1940   1965   2012   **2100**

Region

Settlement

Historical waterfront

Site research +'Scenario planning'

Extreme Climate

climate

extreme

1	**2**

Extreme decline ← . . . +++ → *port* Extreme growth

moderate

3	**4**

Moderate Climate

Extreme Climate

climate

Extreme decline

extreme

1   2

· · ·   + + +   *port*   Extreme growth

moderate

3   4

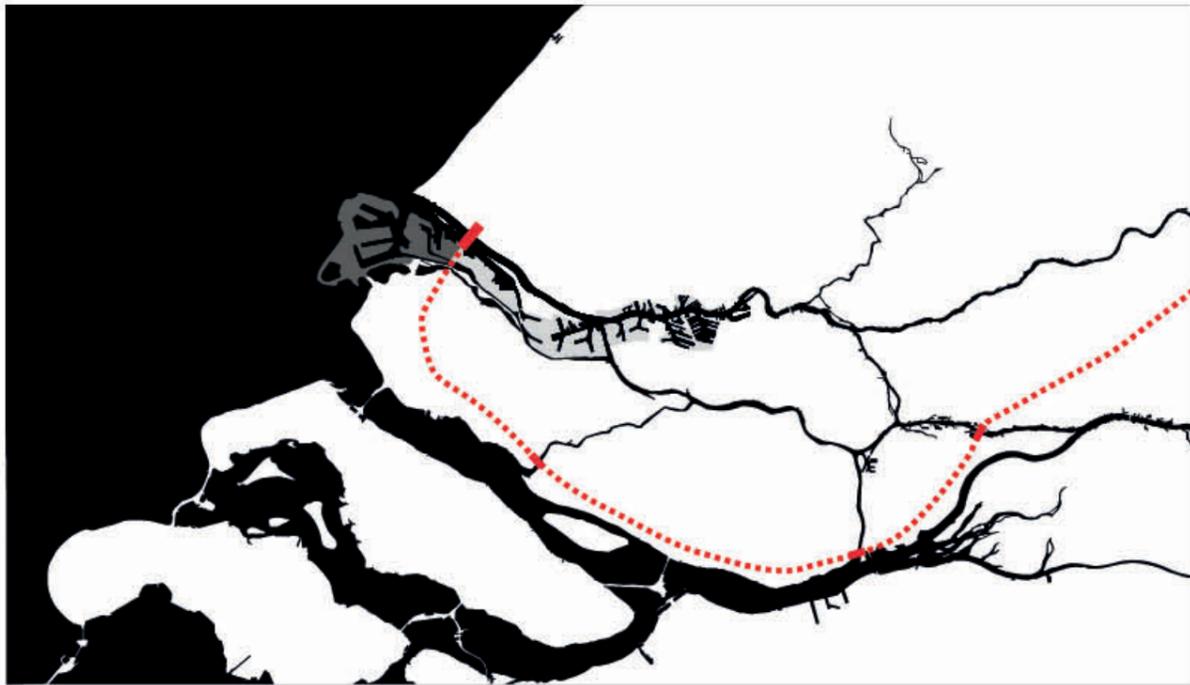Moderate Climate
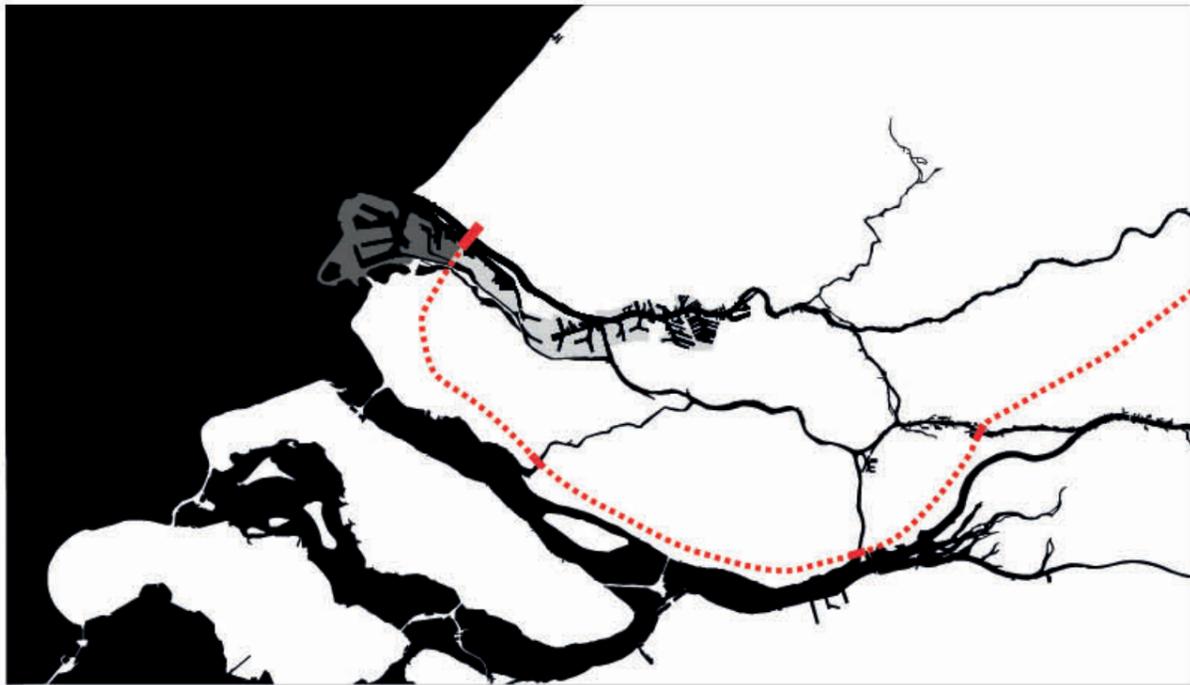
Closed system

Open system

Closed system

Closed system
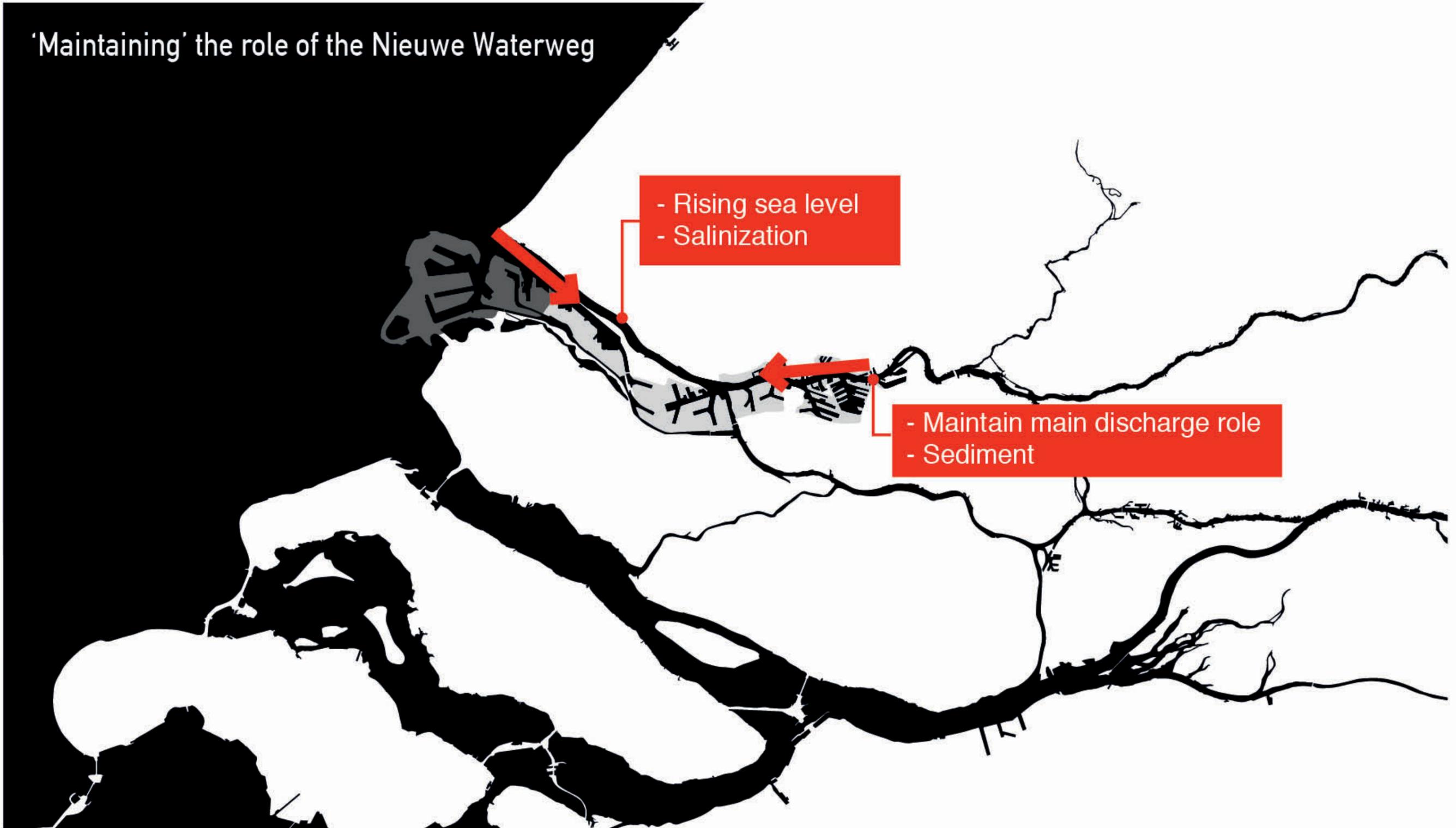
Open system

Possible future condition in
‘Port decline + Open system’

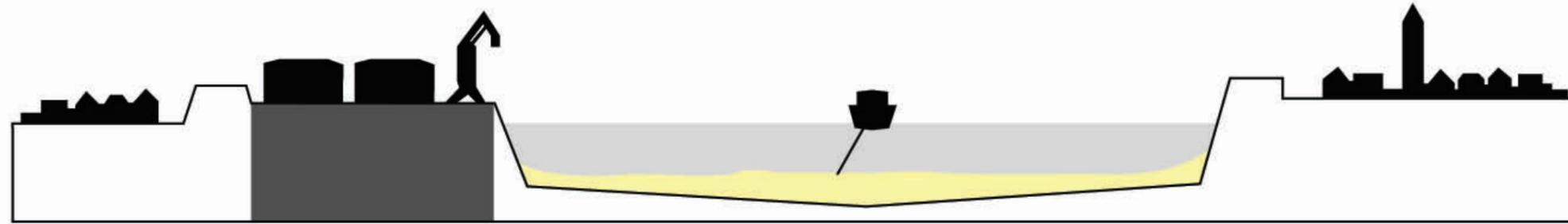'Maintaining' the role of the Nieuwe Waterweg

- Rising sea level
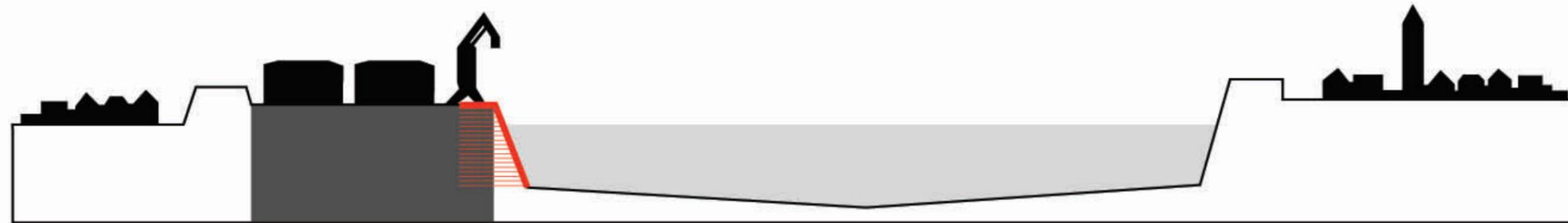- Salinization

- Maintain main discharge role
- Sediment

Current river condition
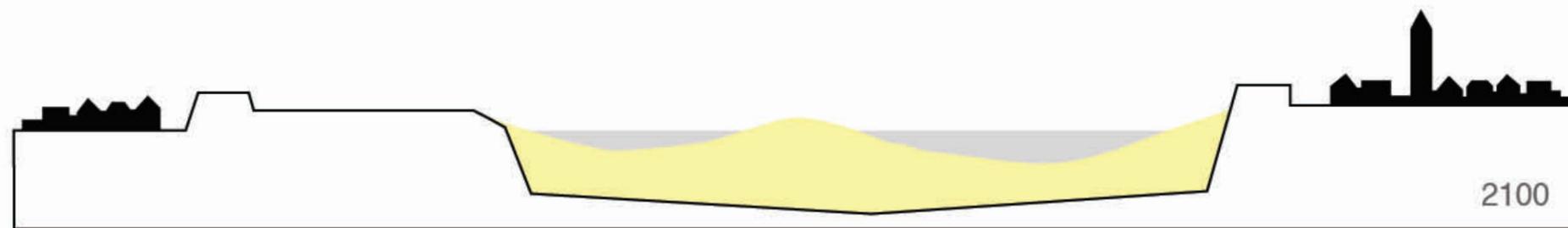

2012

Port decline, then stop management

Dredging

Quay wall

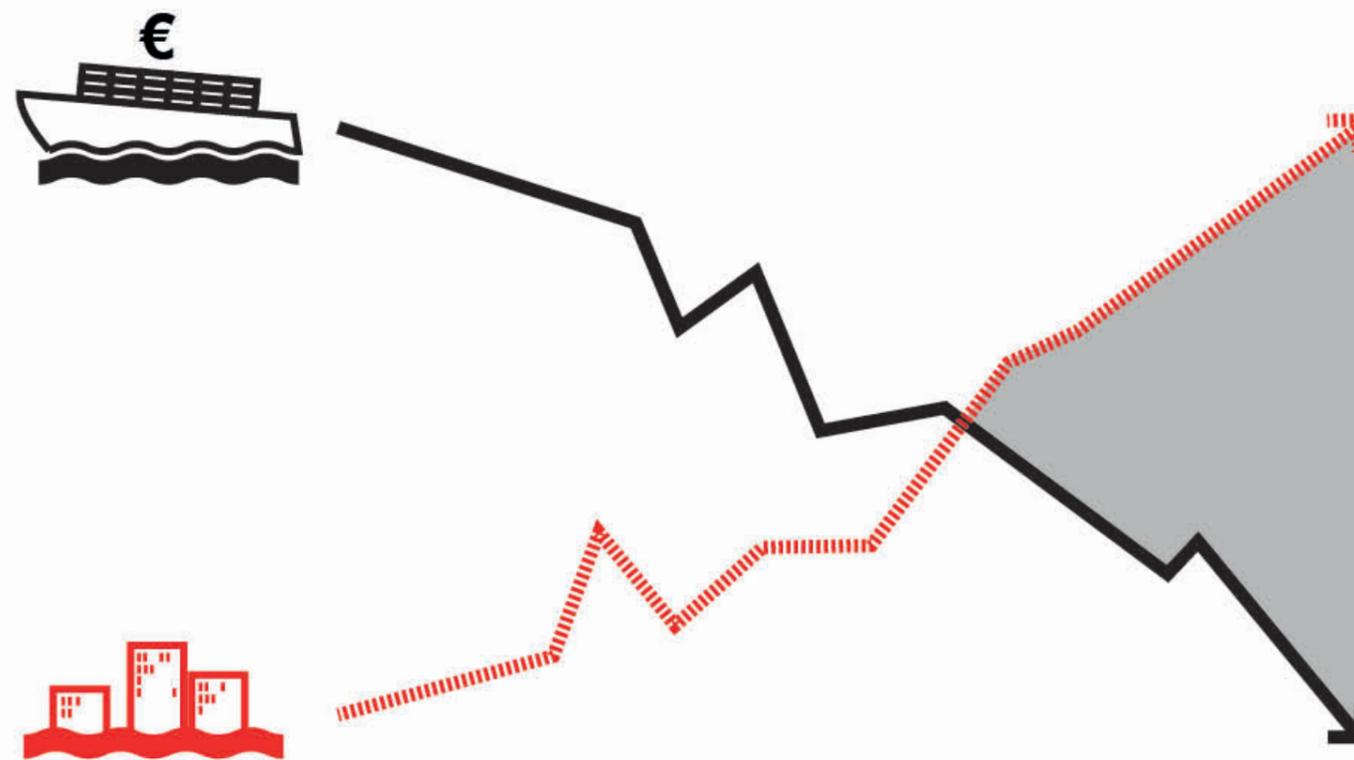# Possible river condition

2012

2100

1850

Working with Hard & Soft approach?

€

Artificial control
'HARD'

Natural process
'SOFT'

Planned cross-section with waterside stairs

2.80   6.60   13.00

Protected height +8.90
Notional max. +7.30 (+8.10)
water level
+5.40
Average high +7.10
water level
Average low -1.50
water level

Parking level
+4.00
Retaining wall 1891
Retaining wall 1838

Shop
+4.50

+8.90
Footpath
Cycle lane
1.90 1.75 Road
+4.80

Median strip
Service road

Elevated railway

Main sewer 1902
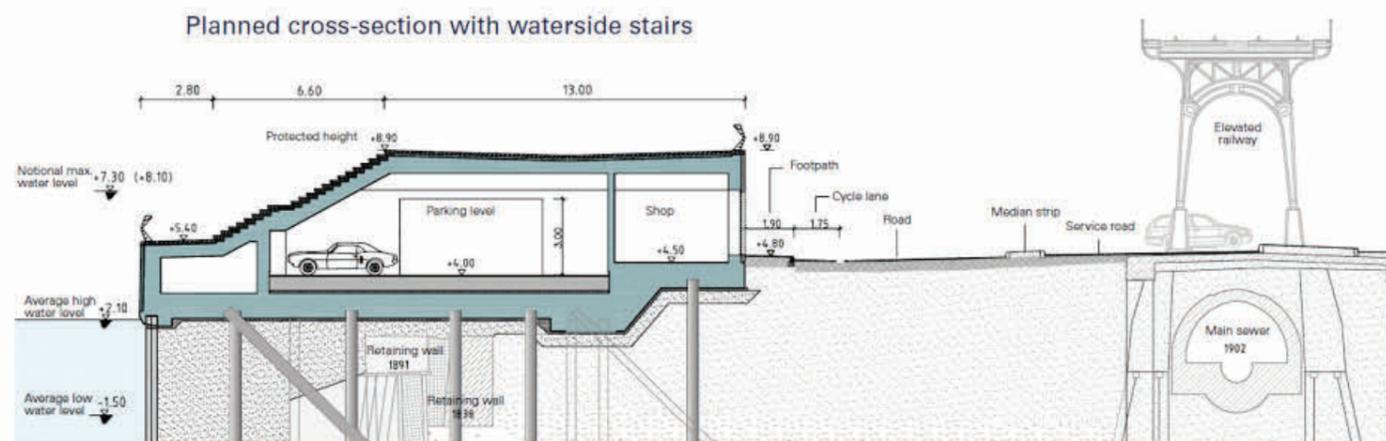
Artificial control
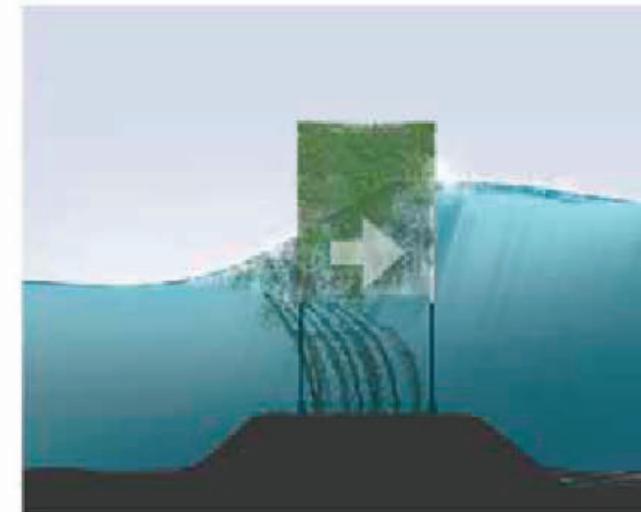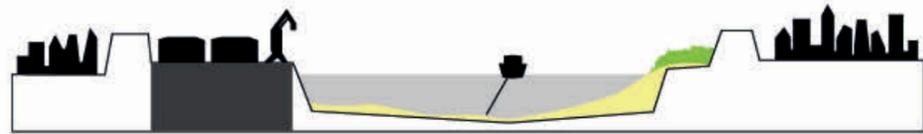## 'HARD'
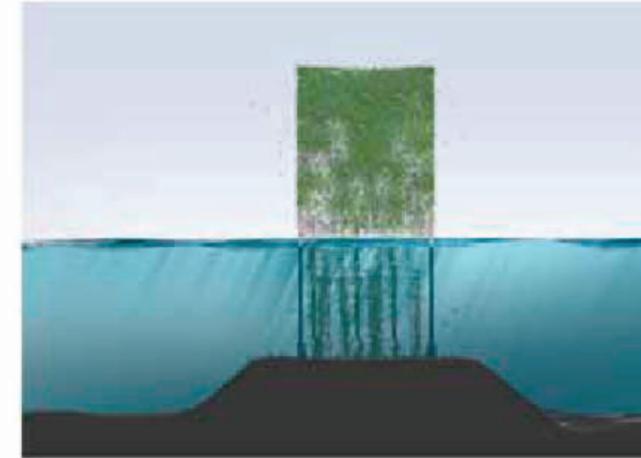
Green Structure Above/Below Water

Storm Surge Barrier

Natural process
'SOFT'

Artificial control

'HARD'
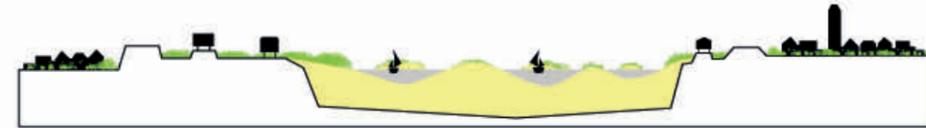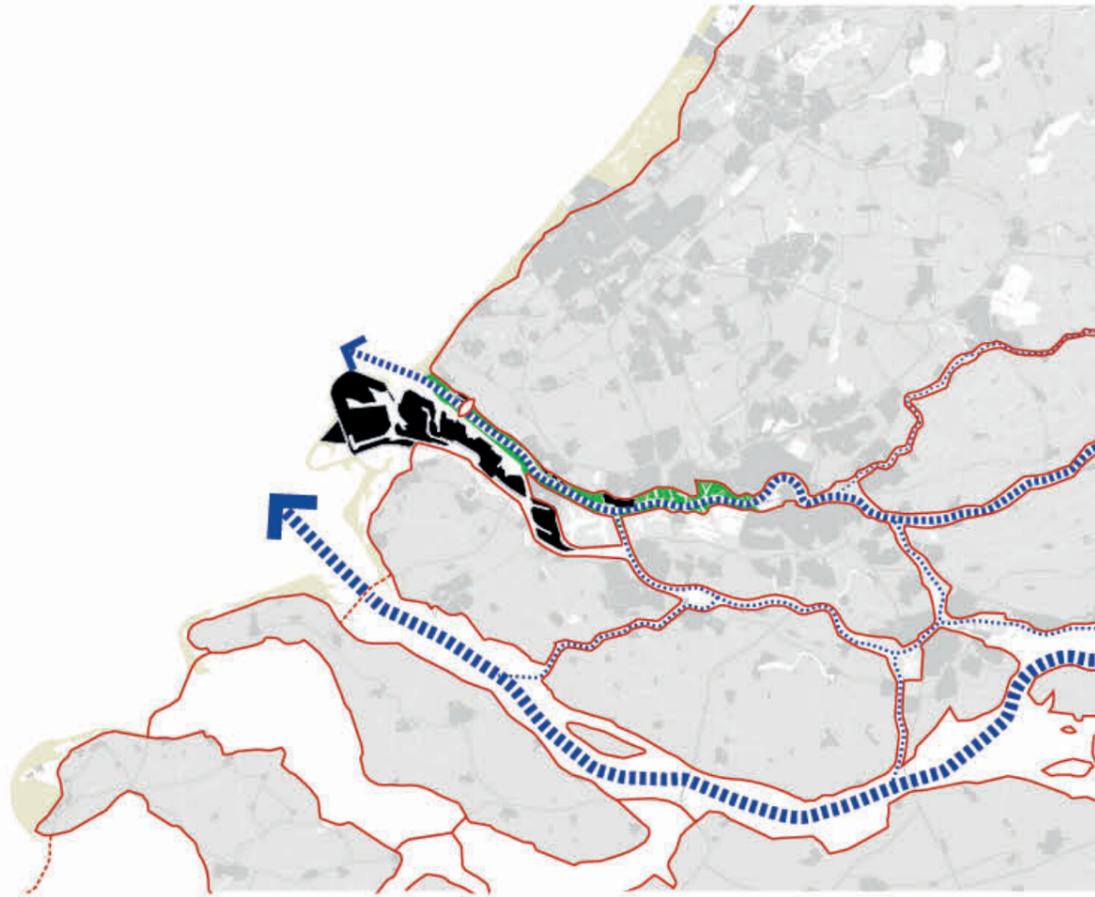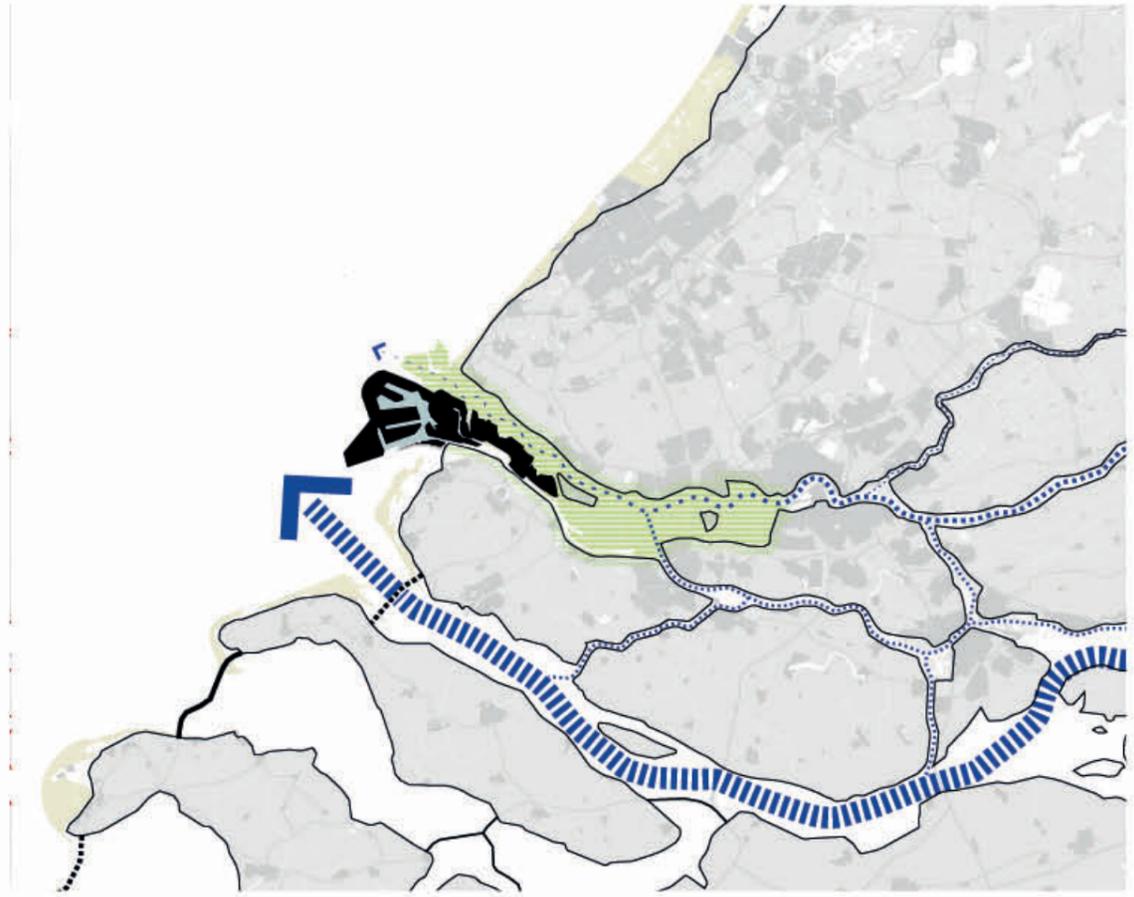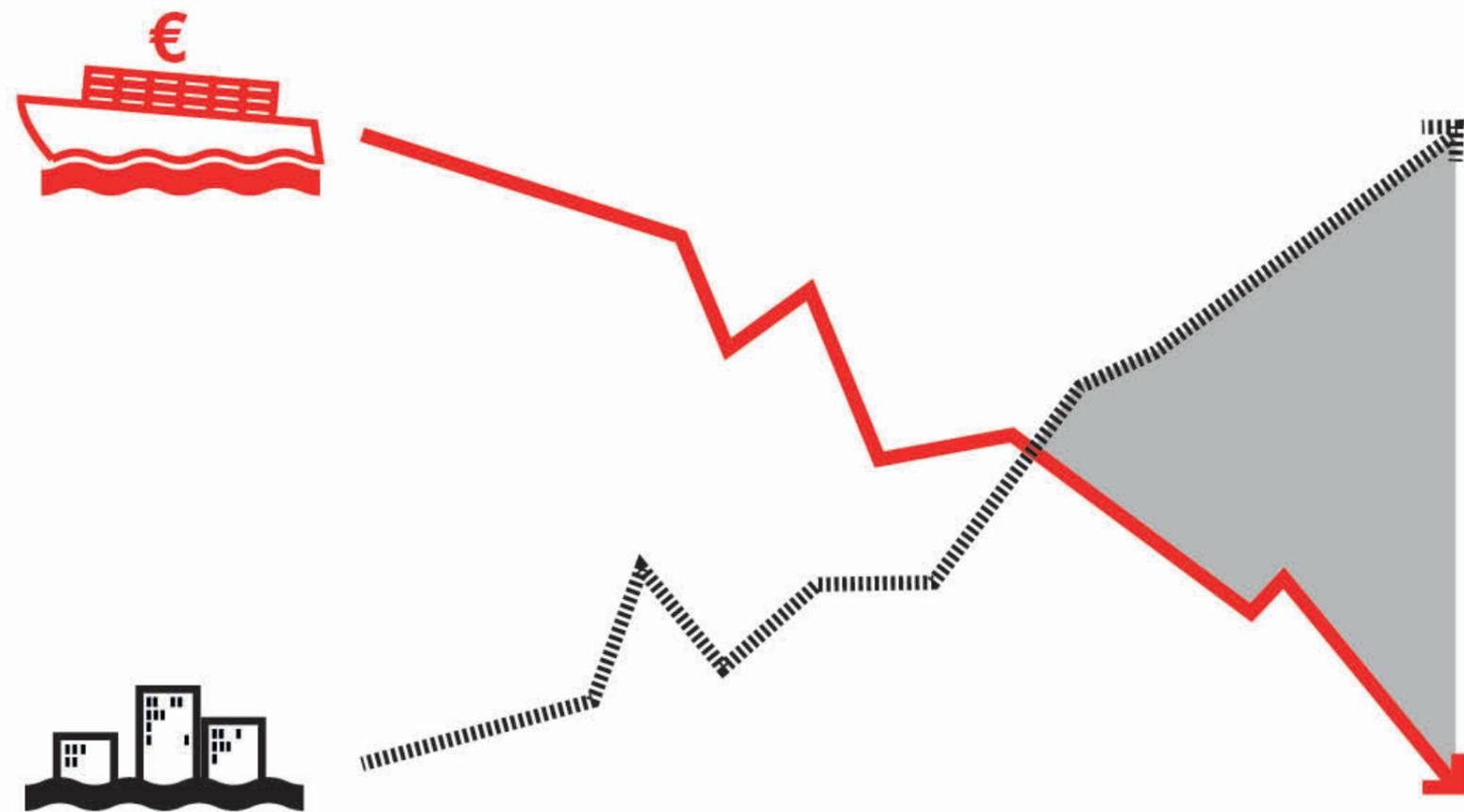
Natural process

'SOFT'

Artificial control

'HARD'

Natural process

'SOFT'

Related port change

Test the Extremes
with Hard & Soft approach

Site Research	Scenario planning

Test design

Hard approach	Soft approach
Region	
City	
Settlement	
Building	

Design proposal
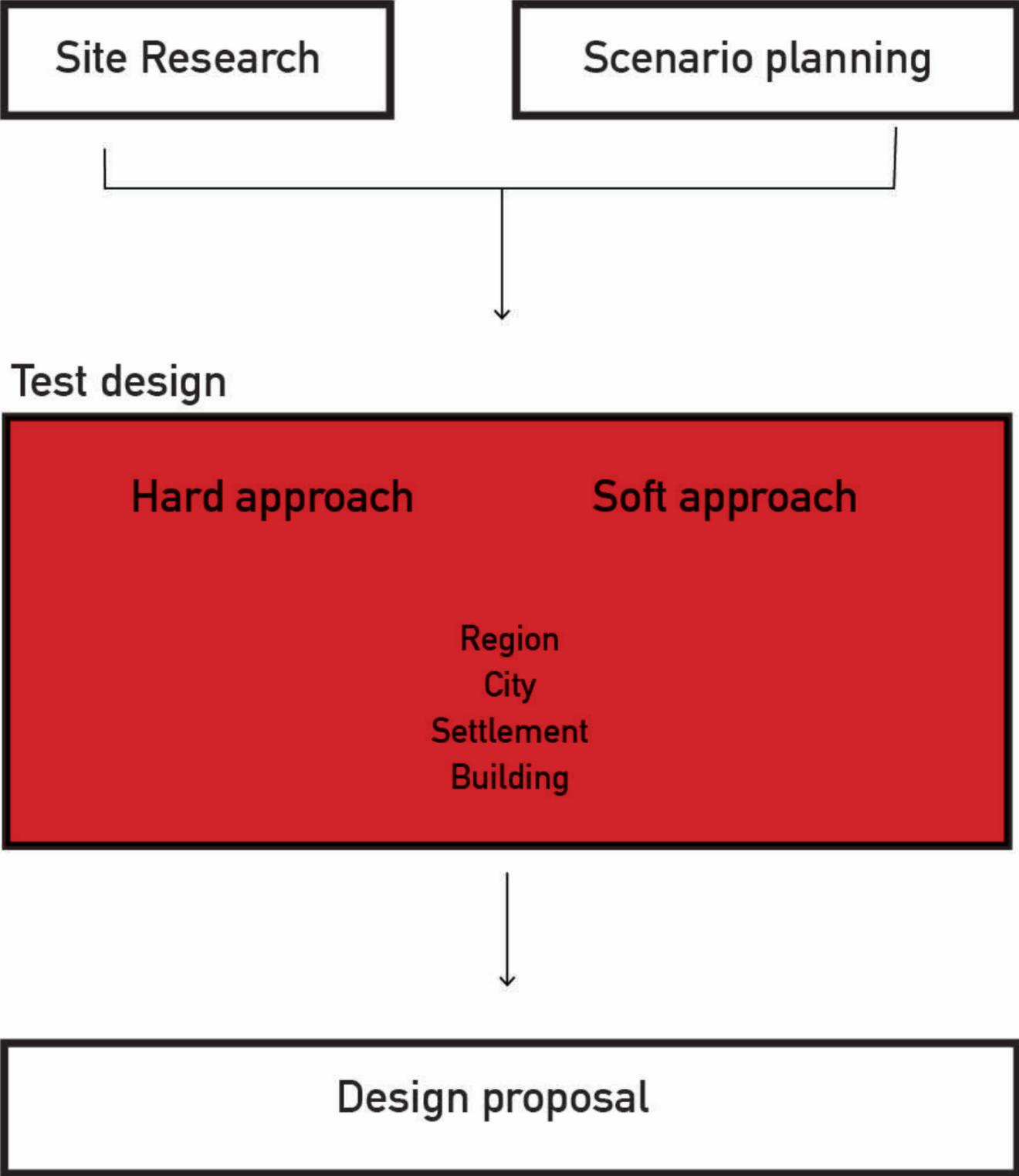
Test design with Hard & Soft approach

Possibilities

Test design with Hard & Soft approach

Comparison

Hard approach

Soft approach

Artificially control
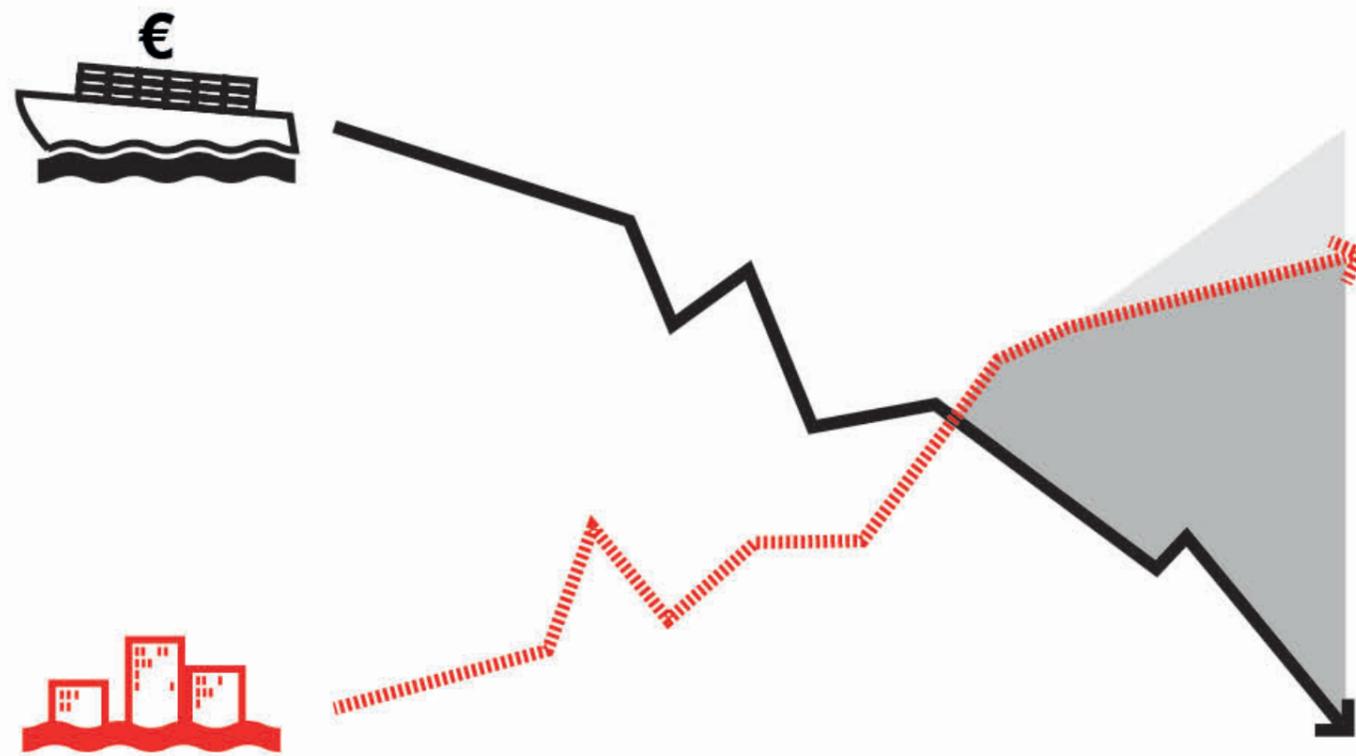
Natrual process

Hard approach

Soft approach

Water management

Hard approach

Soft approach

Different Port change

Hard approach

Soft approach

Different Port change
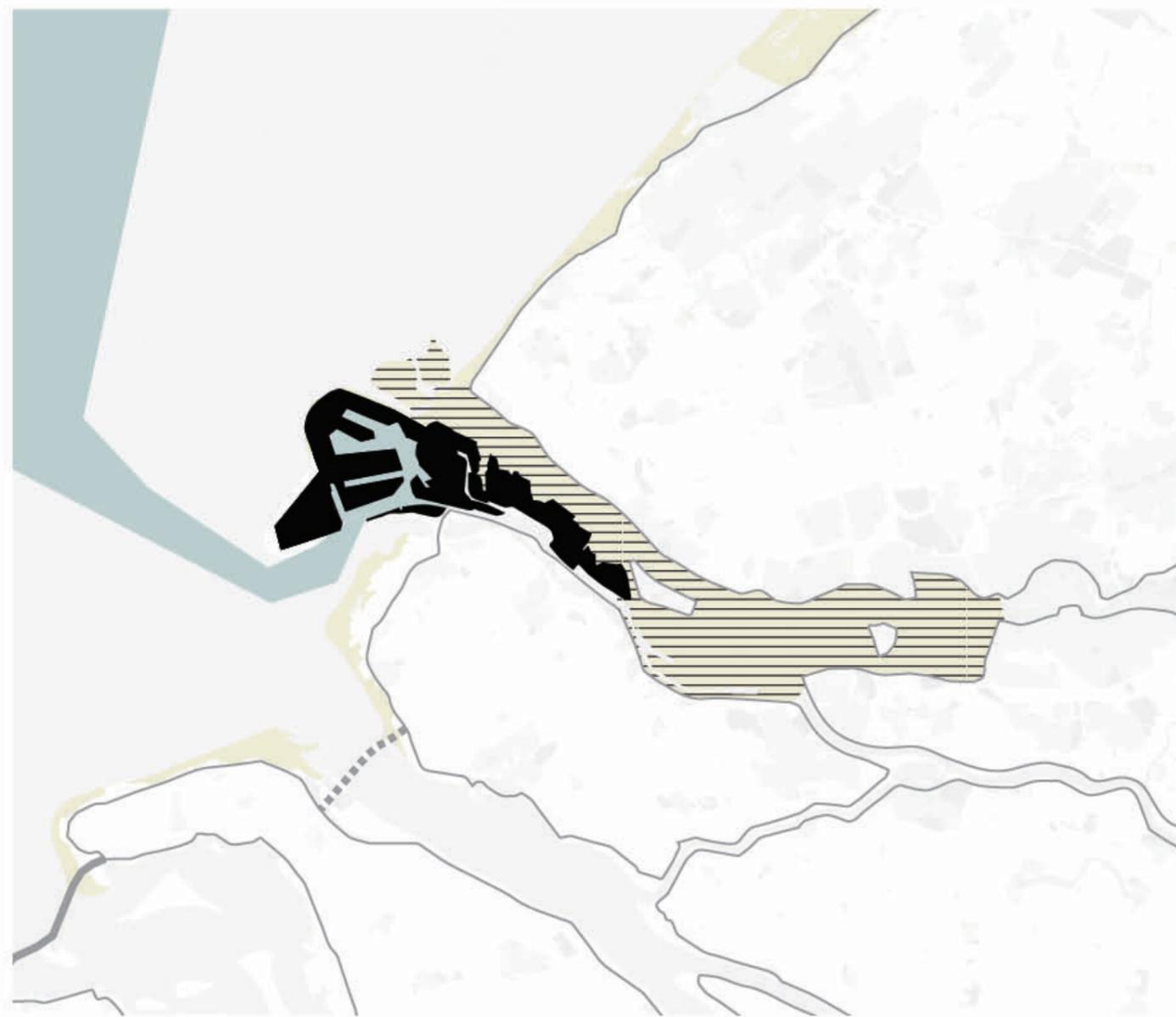

Port remains along Niuew waterweg

Port moves out westward

Different Port change

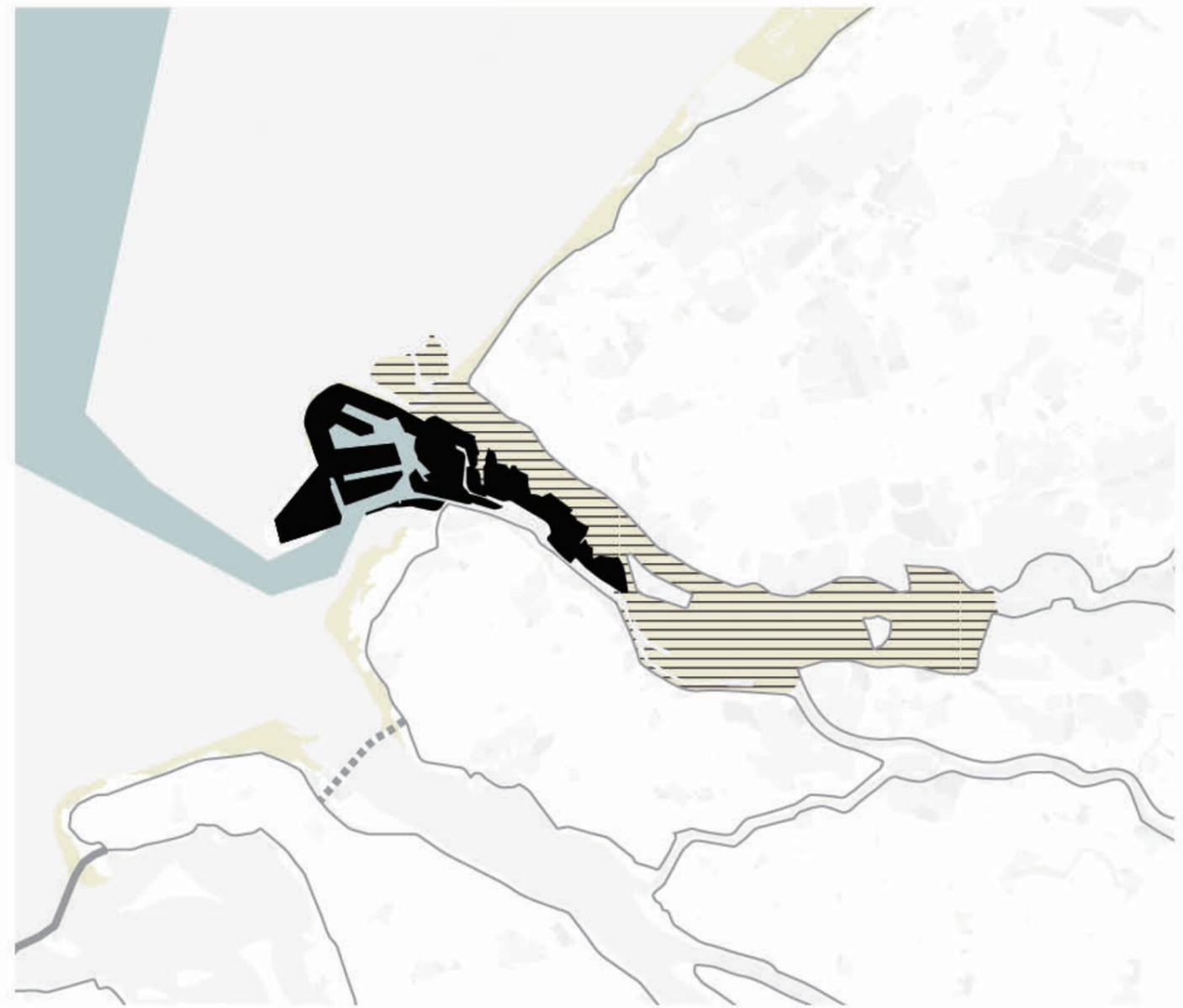

Port remains along Niuew waterweg

Port moves out westward
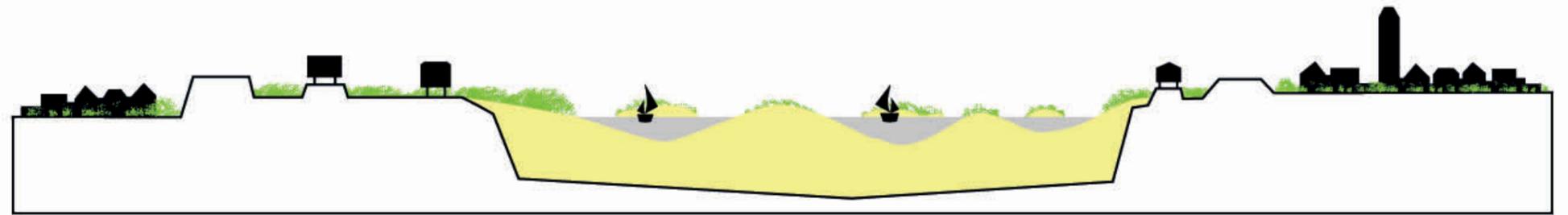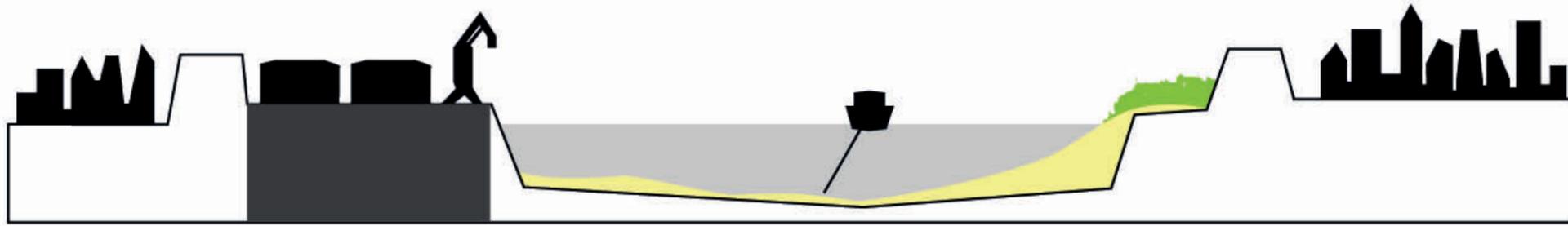
Different Port change
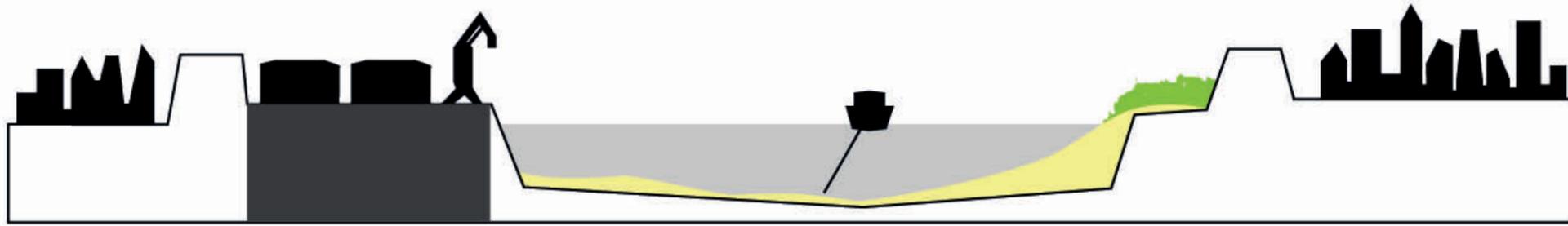

Hard approach

Soft approach

River profile

Hard: N-S River profile
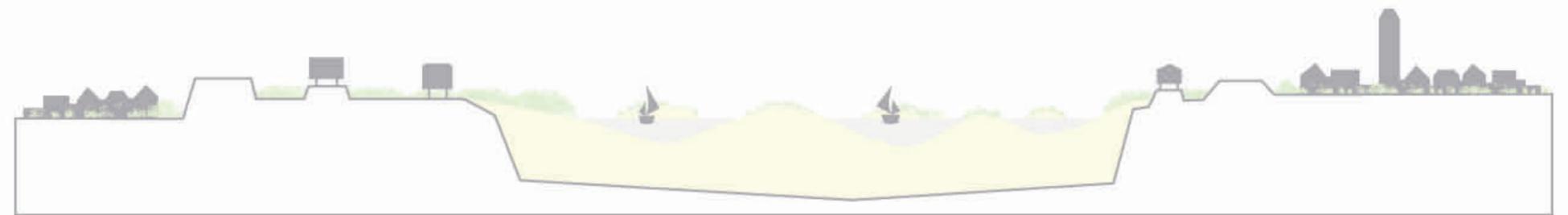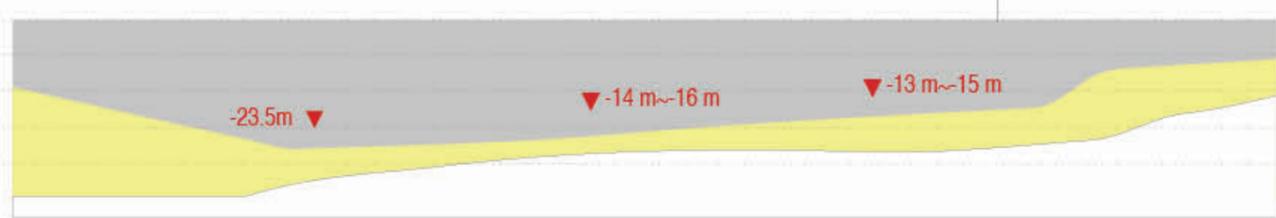
Hard: Water regime
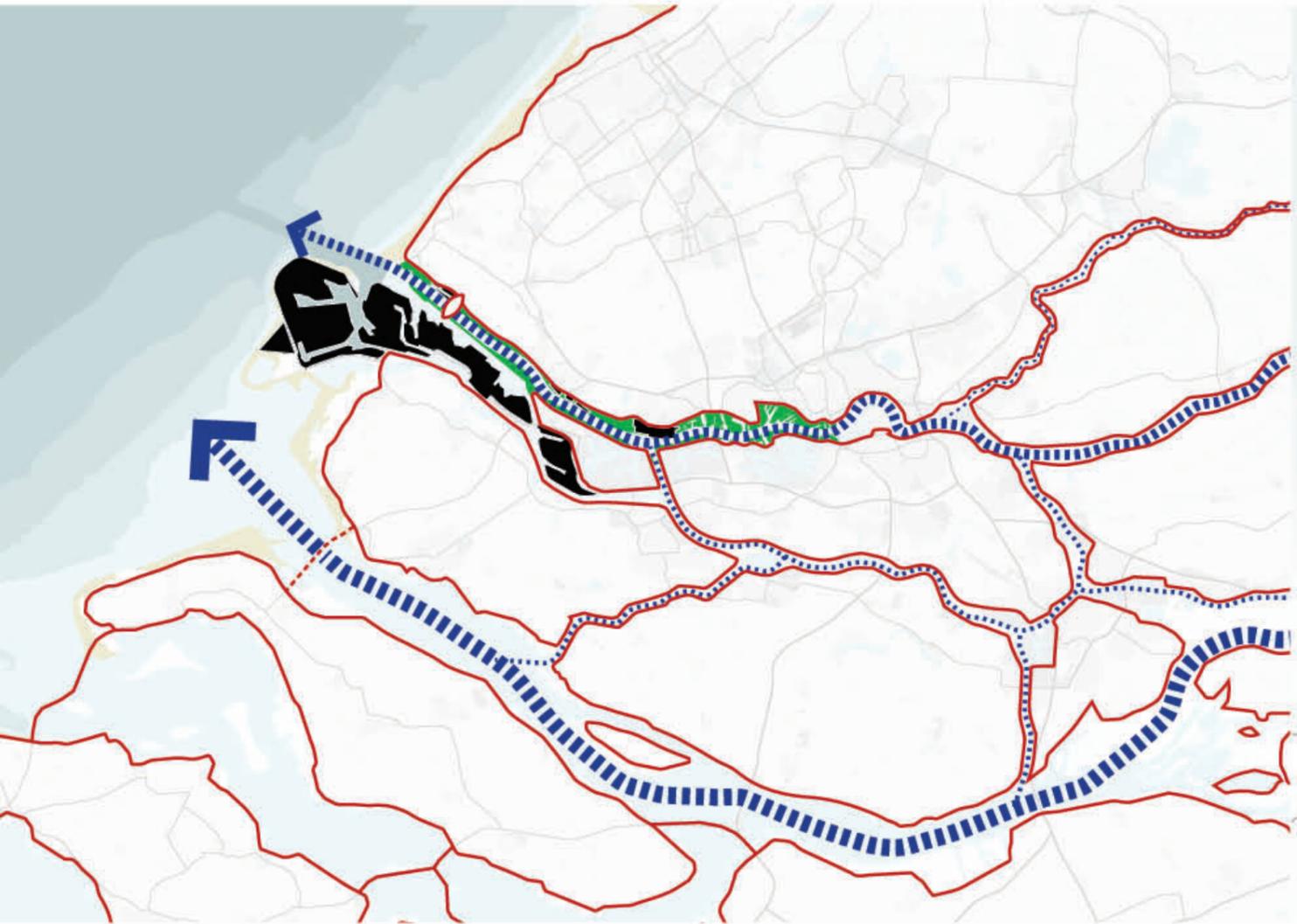
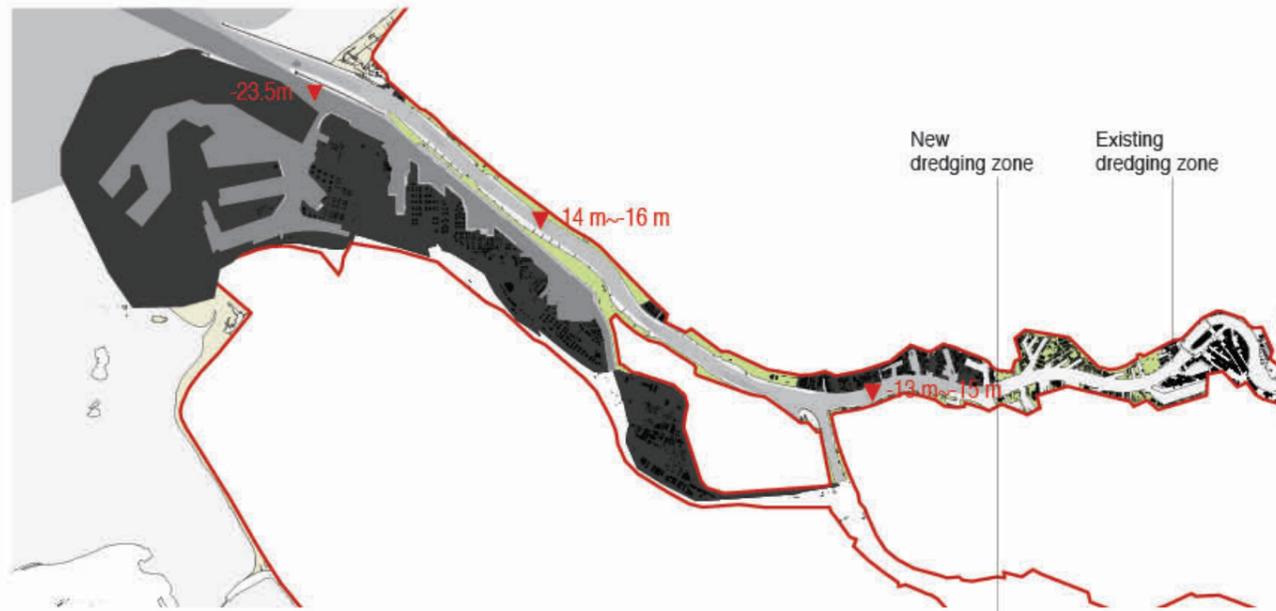

Maintaining discharge role

Lost discharge role & divert to south

Hard: W-E River profile

New dredging zone

Existing dredging zone

-23.5m ▼

▼ 14 m ~ 16 m

-13 m ~ 15 m

-2 ~ -5m

0 m
-5 m
-10 m
-15 m
-15 m

-23.5m ▼

▼ -14 m ~ 16 m

▼ -13 m ~ 15 m

0 m
-5 m
-10 m
-15 m
-15 m

-2 ~ -5m ▼

-5 ~ -8m ▼

Hard: River profile

Hard approach

← Hard approach

Sea | River

+7.1m

MHW +6.1m + wave +1.0m

Dredging for shipping

Sea | River

Ecological park as
a role of Flood plain

Wave breaker

Flood plain

+6.1m

Existing height(+5.5m) +0.6m

Soft approach →

Hard: Dike reinforcement

Hard approach
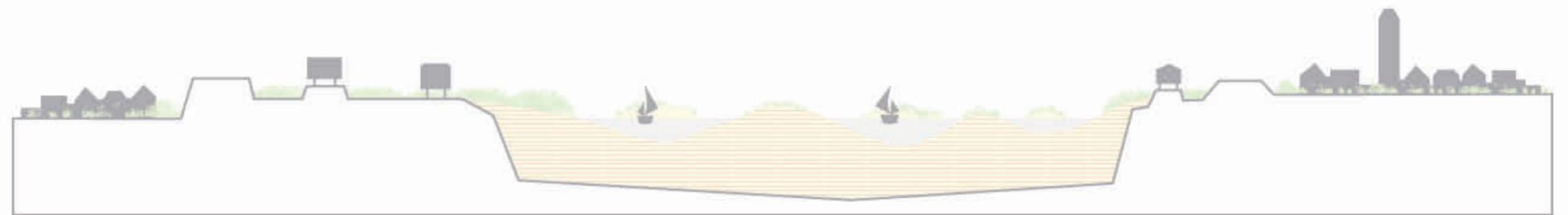
Soft approach

Soft: N-S River profile

Hard approach

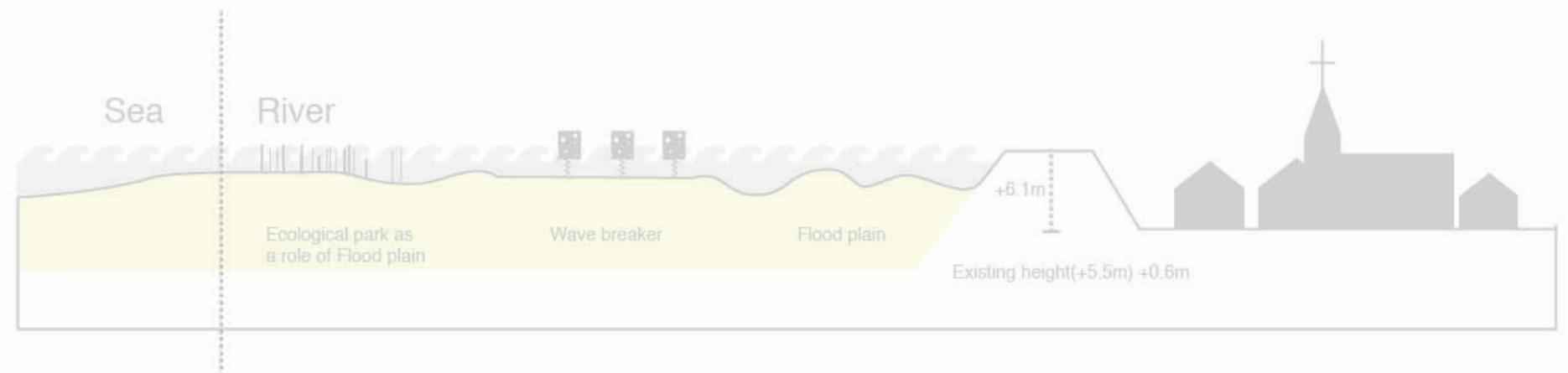Soft approach

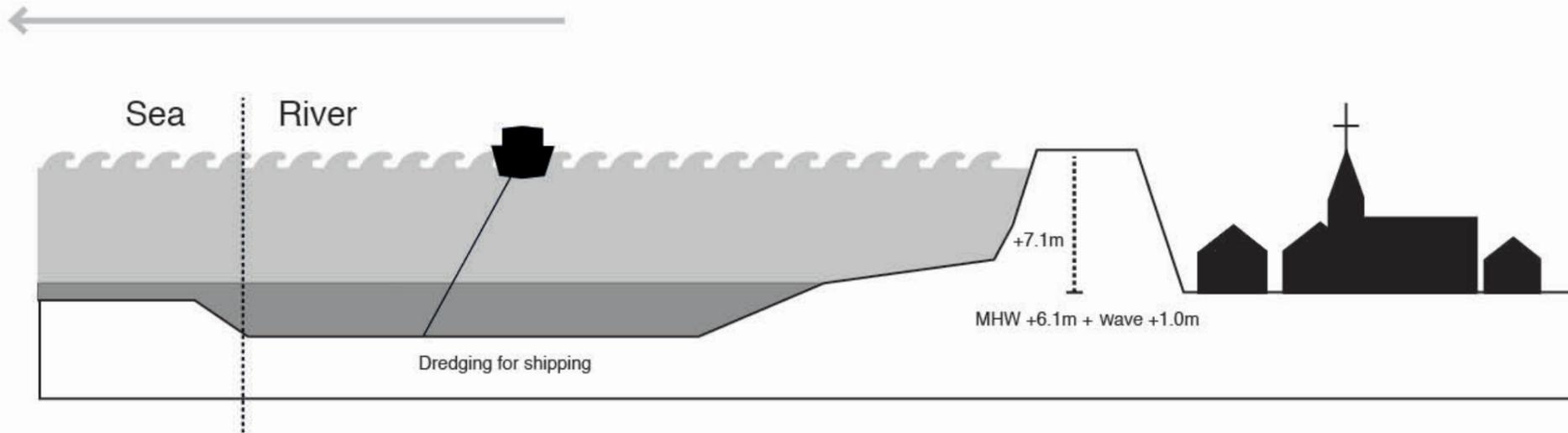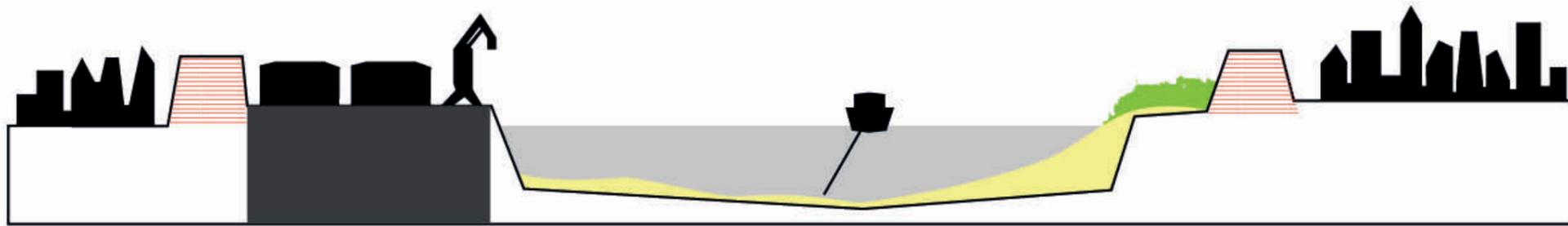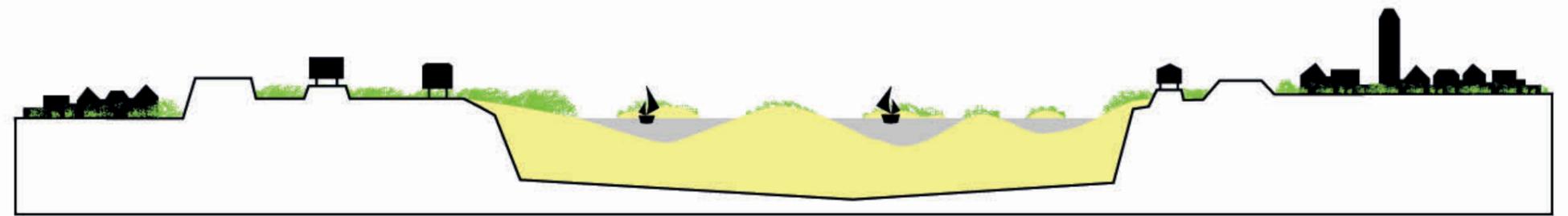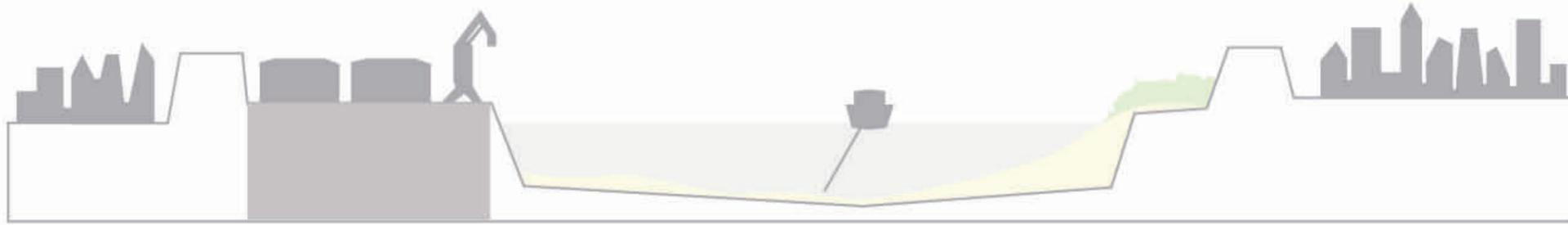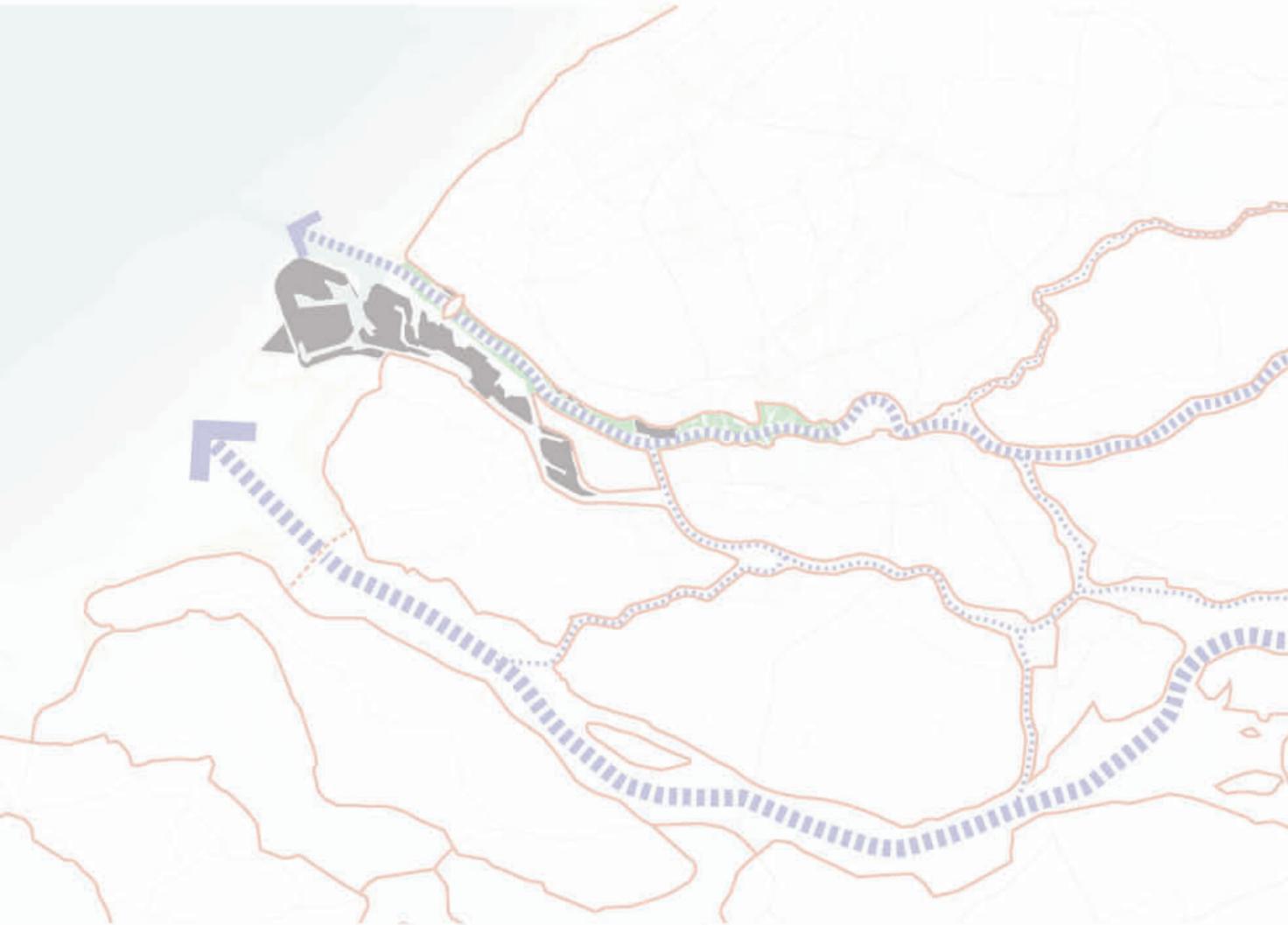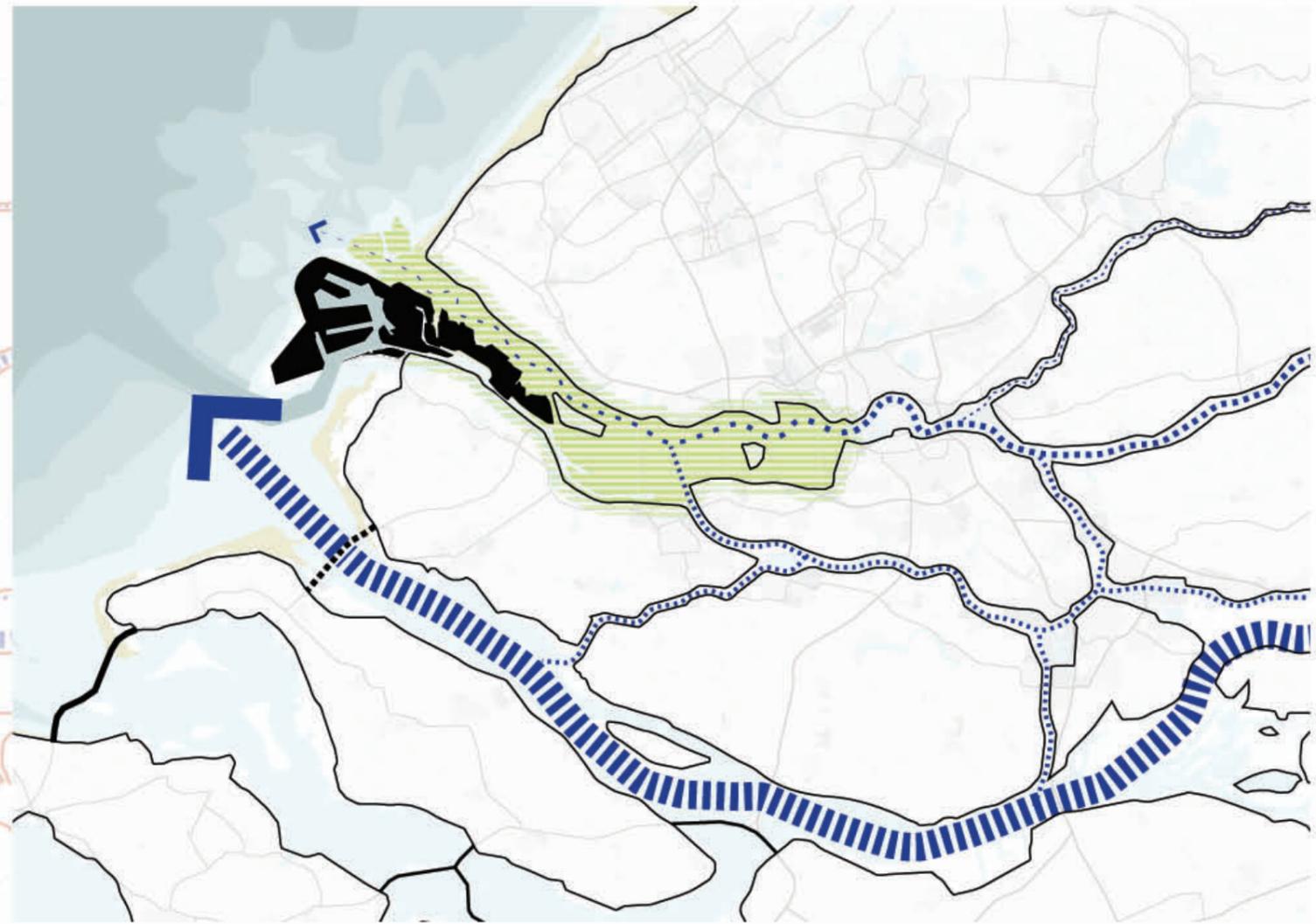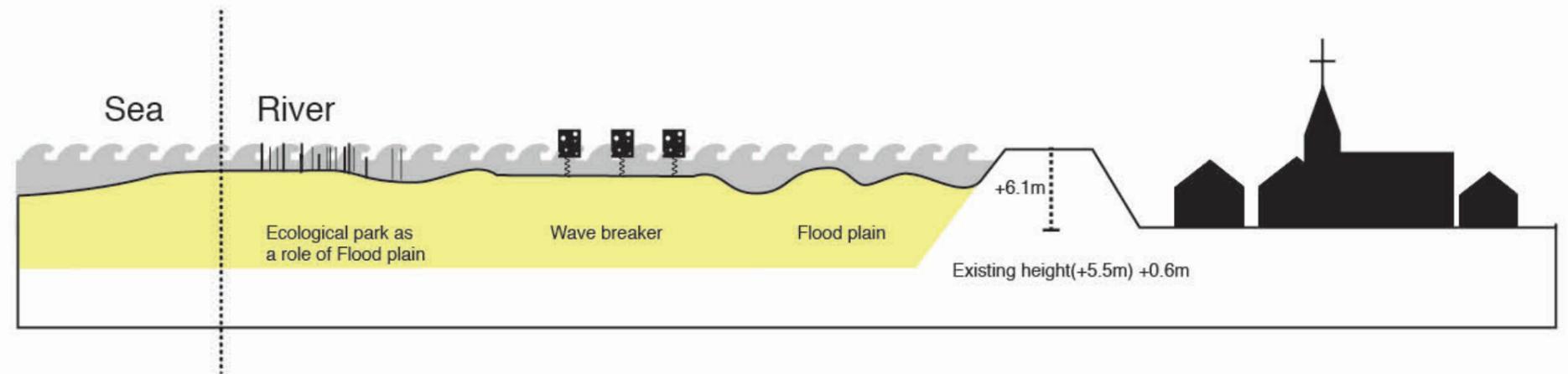# Soft: Water regime

Maintaining discharge role

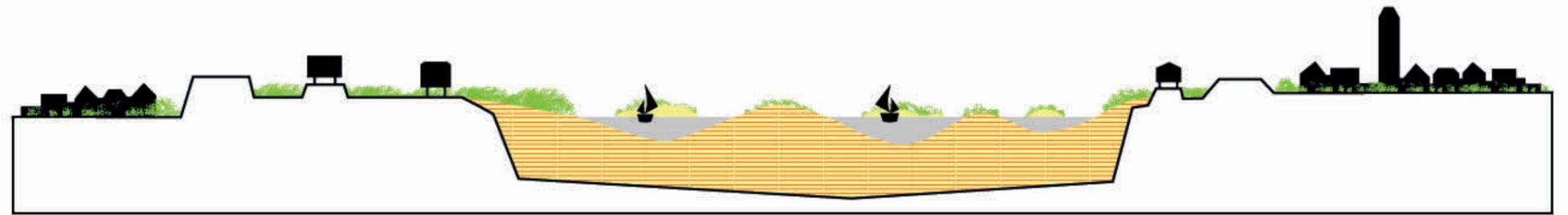Lost discharge role & divert to south
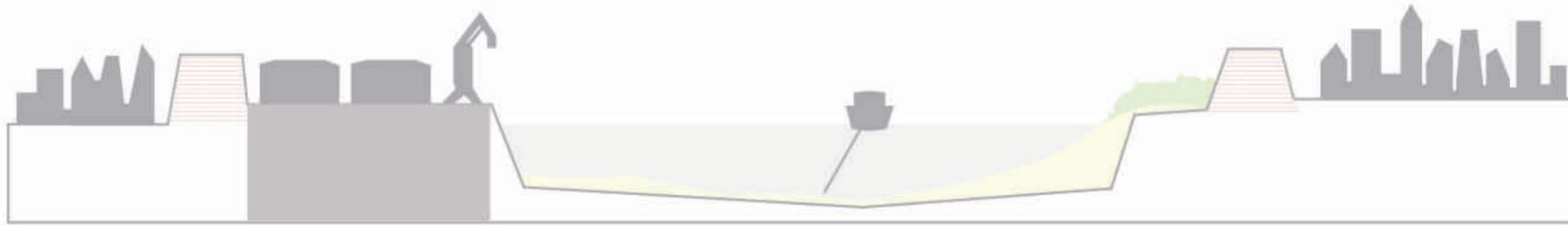
Soft: W-E River profile

New dredging zone

Existing dredging zone

-23.5m ▼

-14 m∼-16 m

-13 m∼-15 m

0 m
-5 m
-10 m
-15 m
-15 m

-23.5m ▼

-14 m∼-16 m

▼ -13 m∼-15 m

-23.5m ▼

-2∼-5m

0 m
-5 m
-10 m
-15 m
-15 m

▼ -5∼-8m

▼ -2∼-5m

Soft: River profile

Sea | River

+7.1m

MHW +6.1m + wave +1.0m

Dredging for shipping

Sea | River

Ecological park as
a role of Flood plain

Wave breaker

Flood plain

+6.1m

Existing height(+5.5m) +0.6m
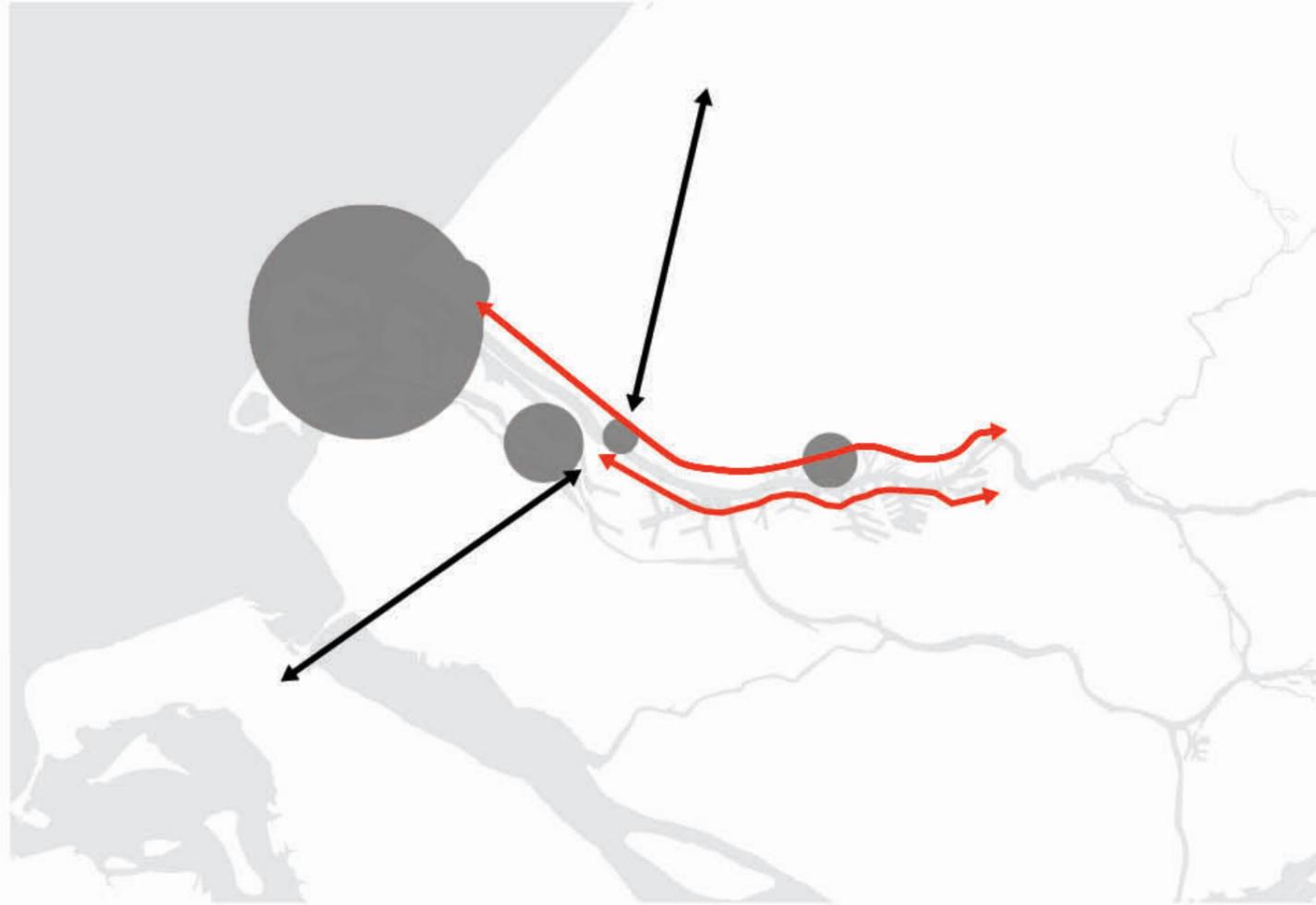
Soft: Natural buffering
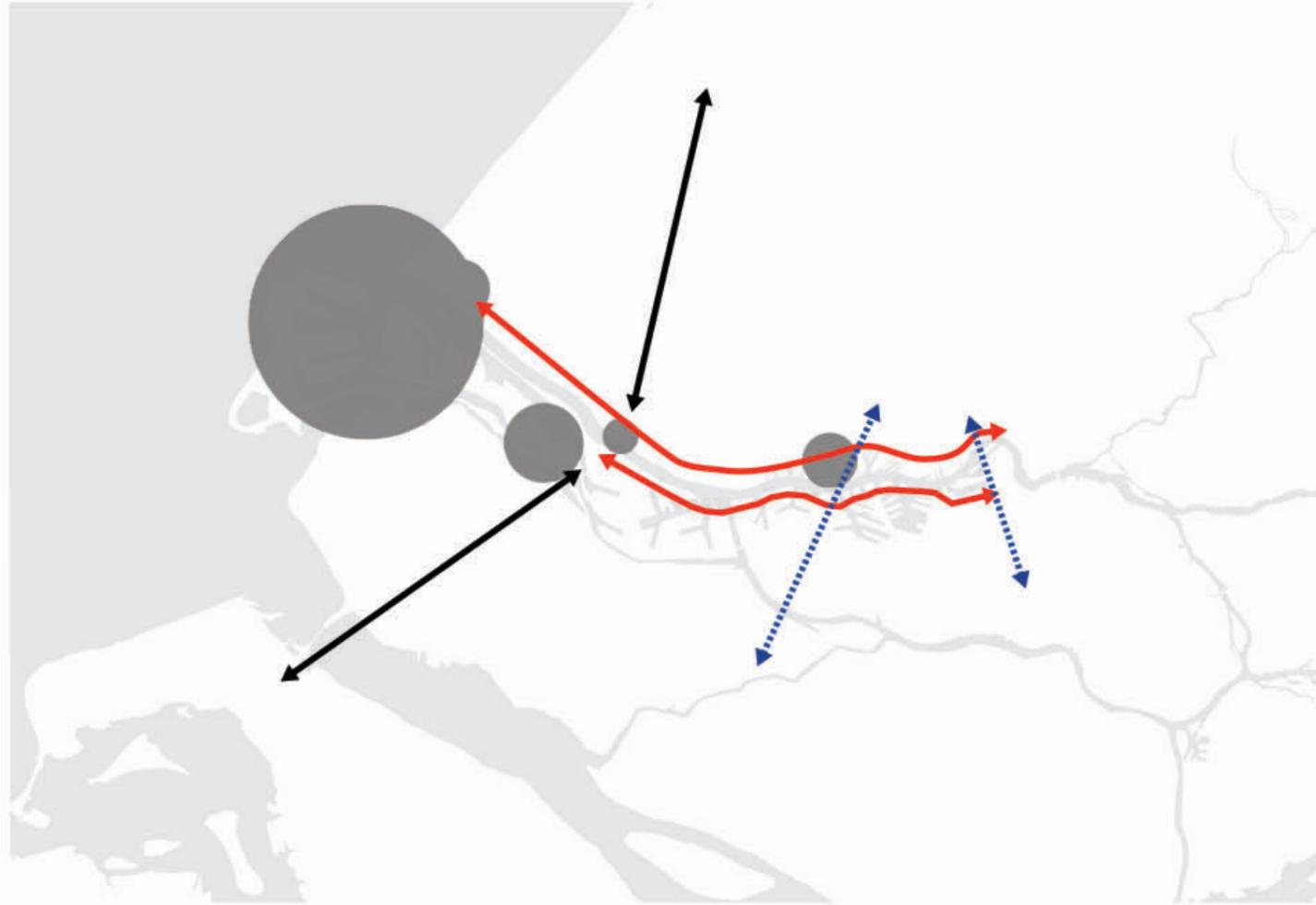
Hard approach

Soft approach
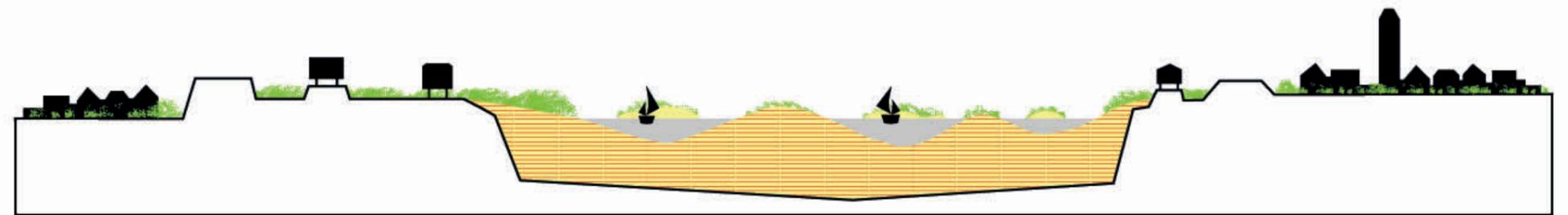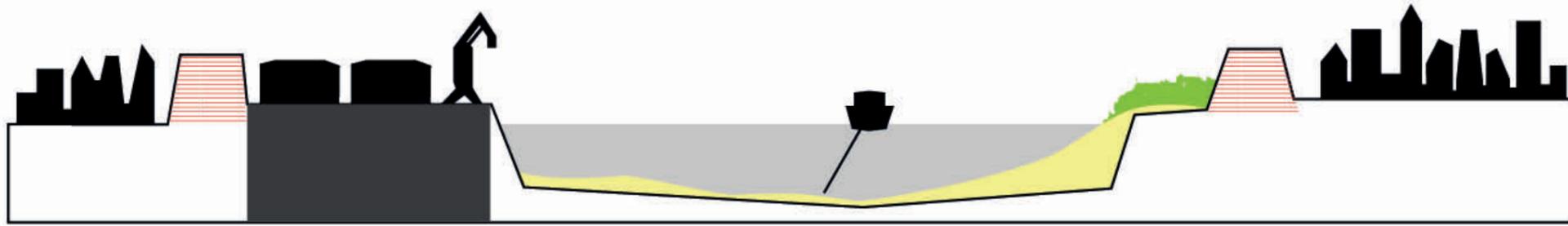
Regional structure

Hard approach

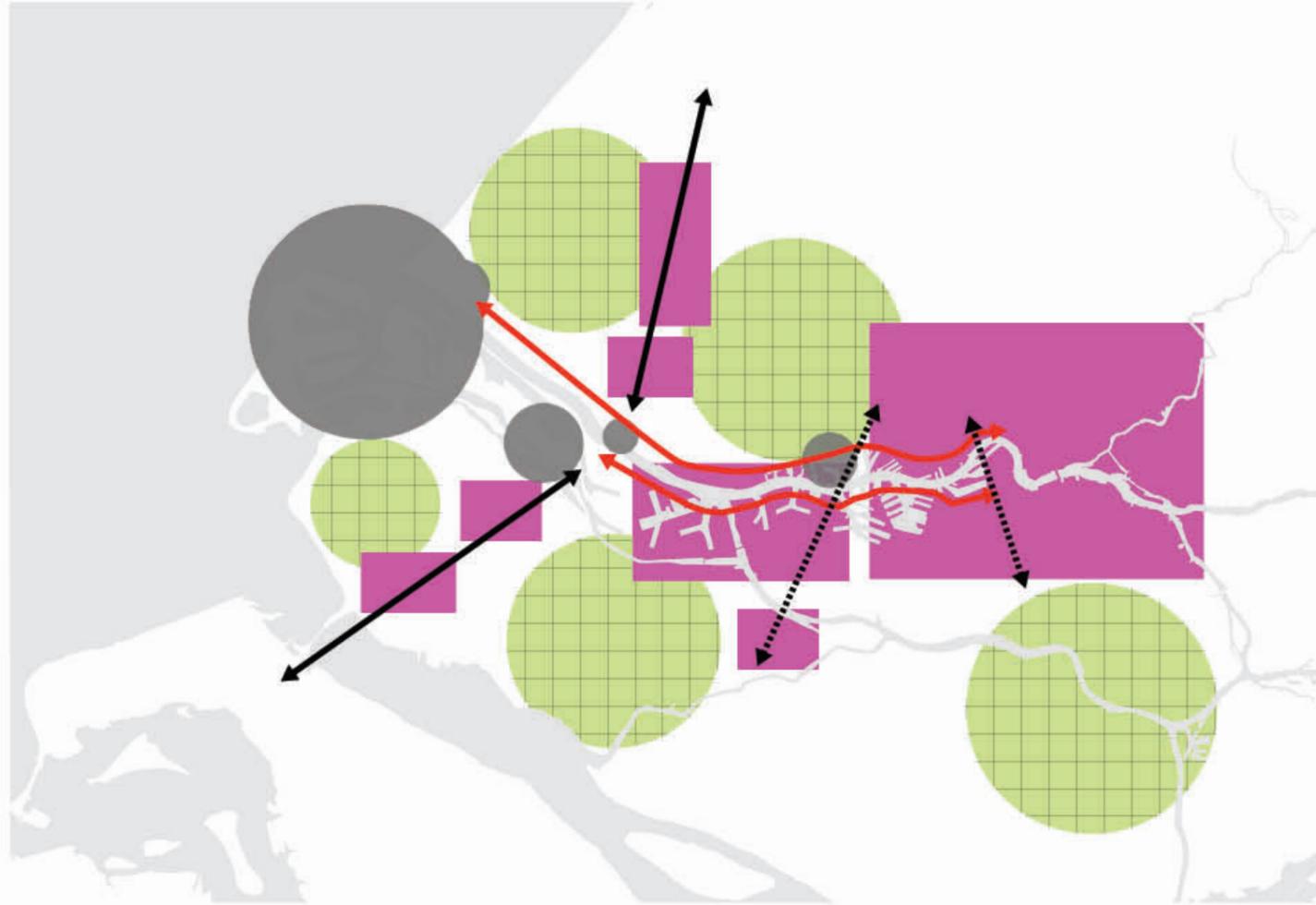Soft approach

Regional structure

Regional structure

Regional structure

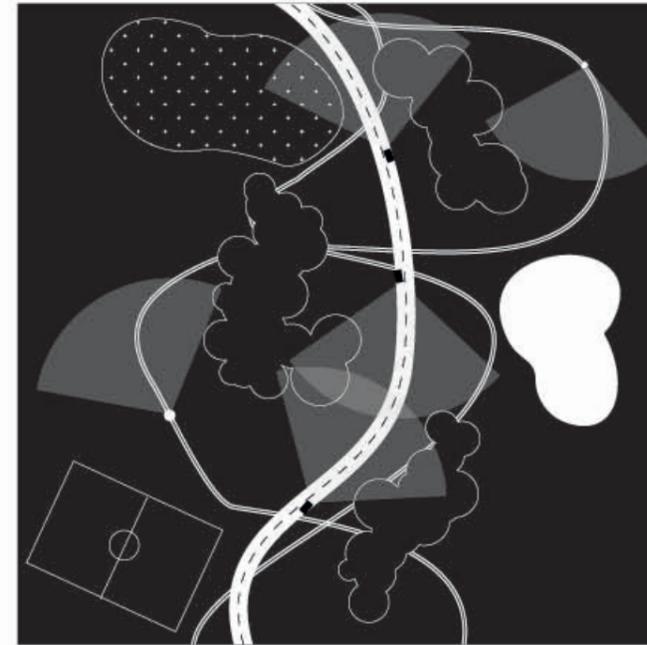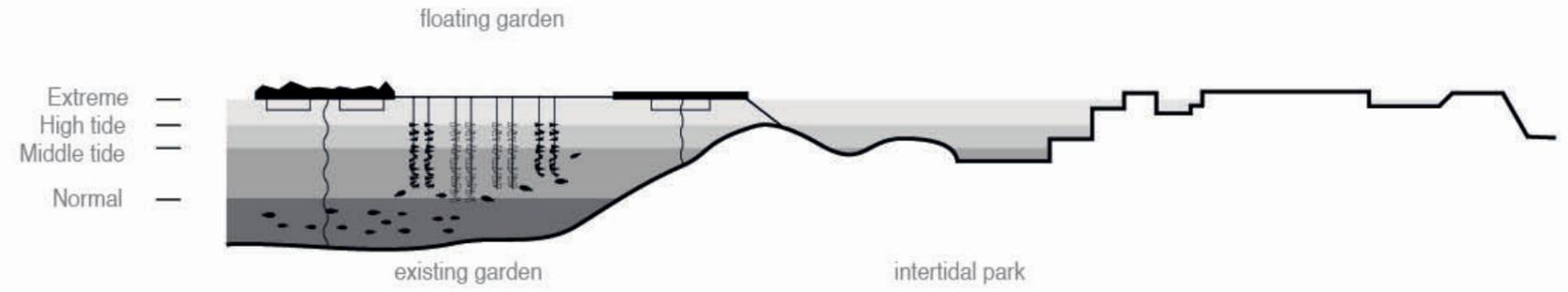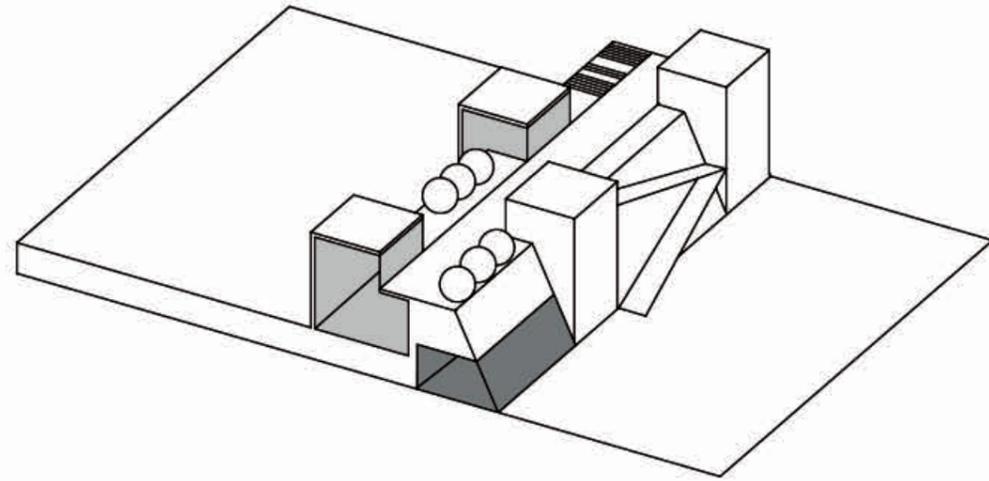# Regional structure

Regional structure

Hard approach

Soft approach

Heijplaat-Pernis scale

Hard approach

Soft approach

Heijplaat-Pernis scale

floating garden

Extreme —
High tide —
Middle tide —
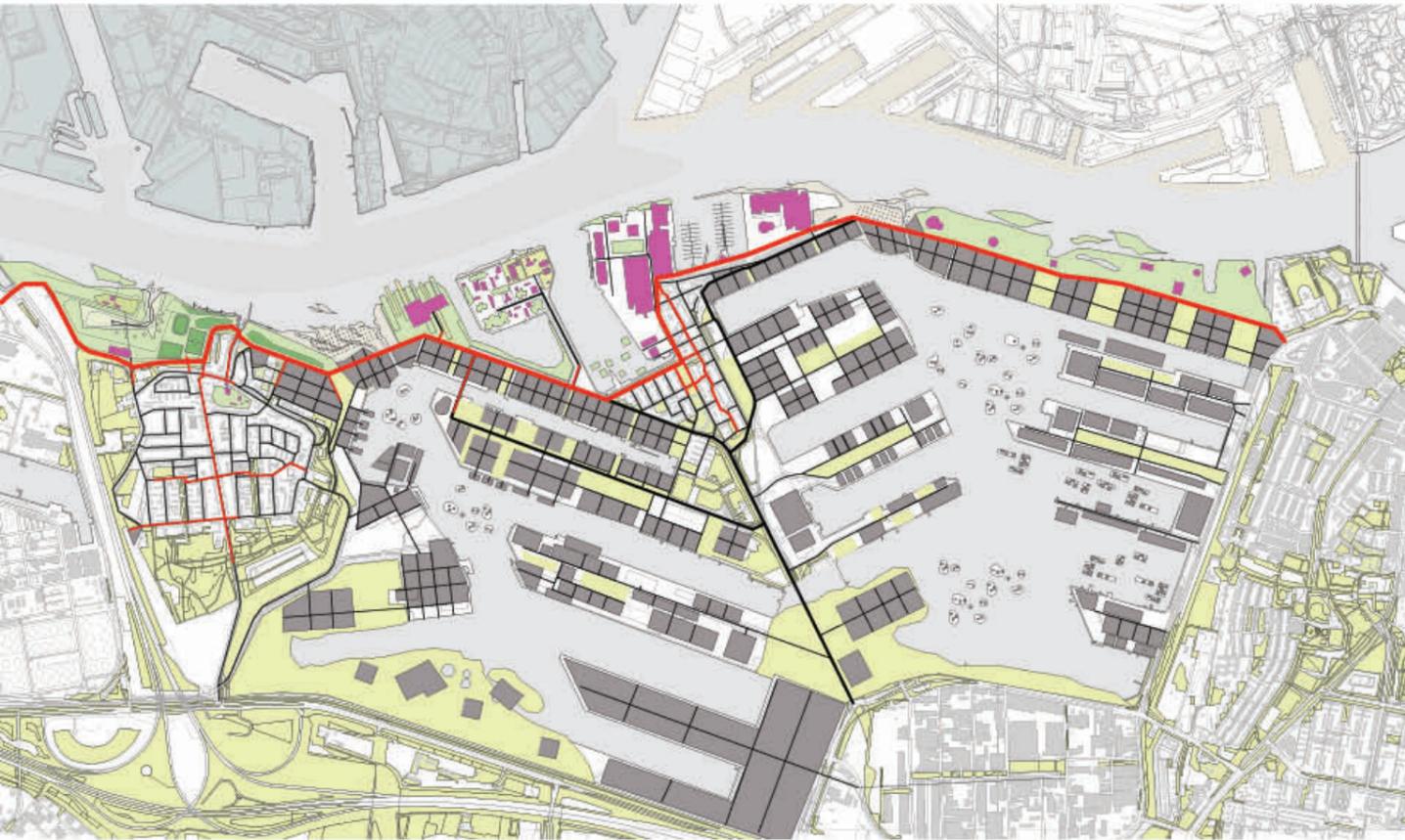Normal —

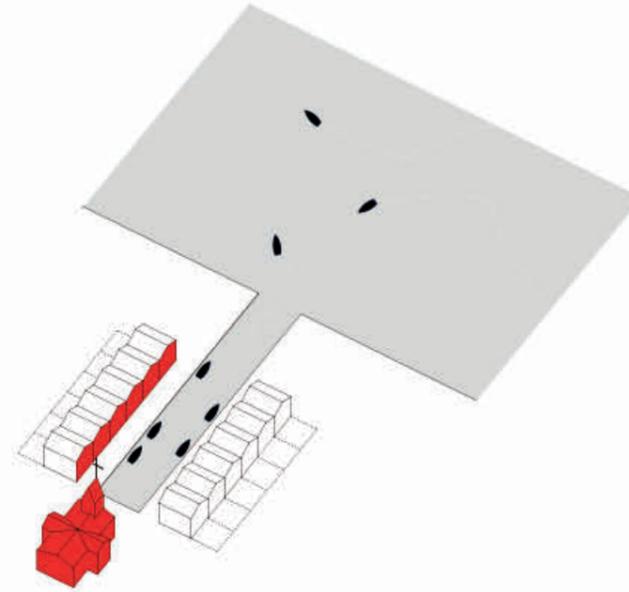existing garden

intertidal park

Hard approach
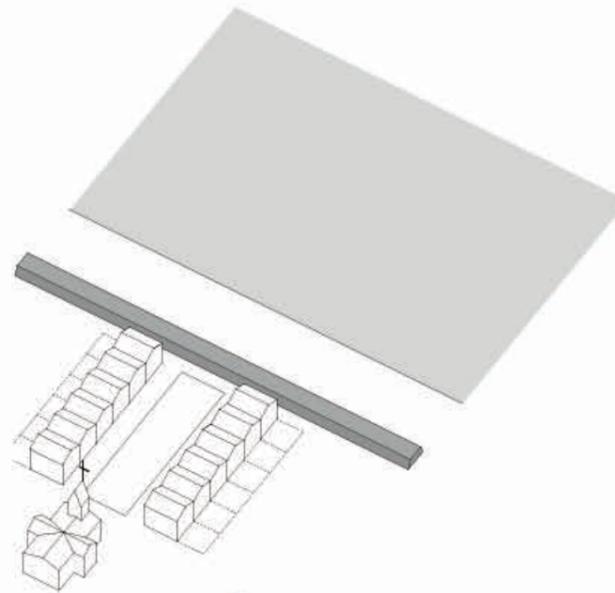
Soft approach

Heijplaat-Pernis scale
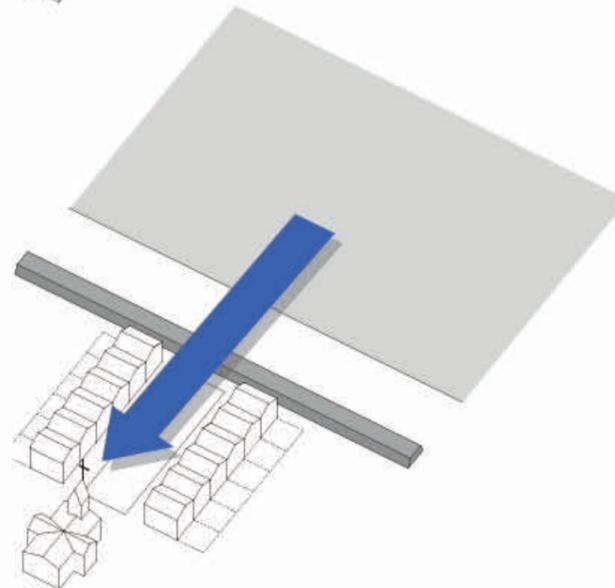
Pernis scale
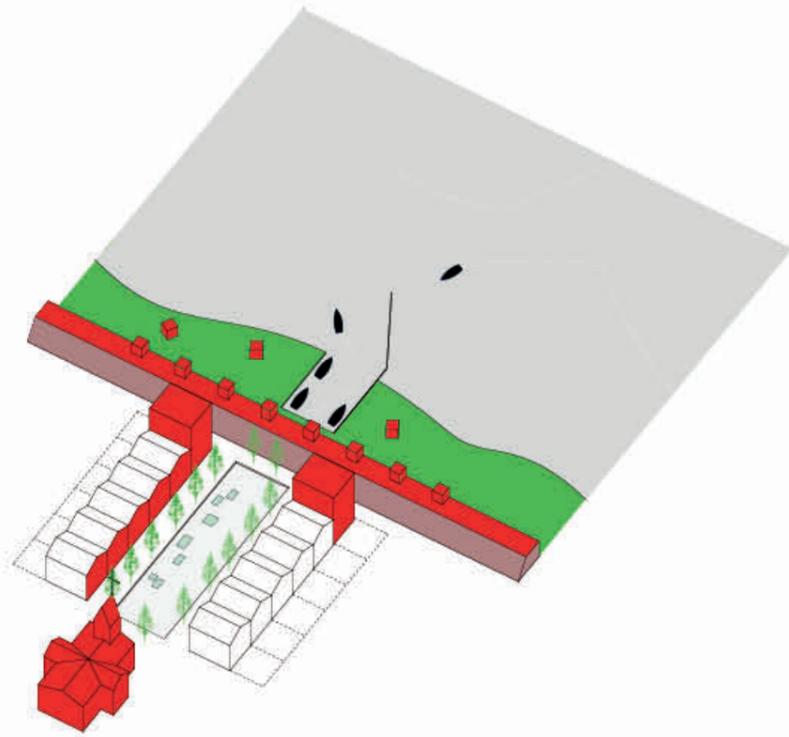

Past
Direct water relation
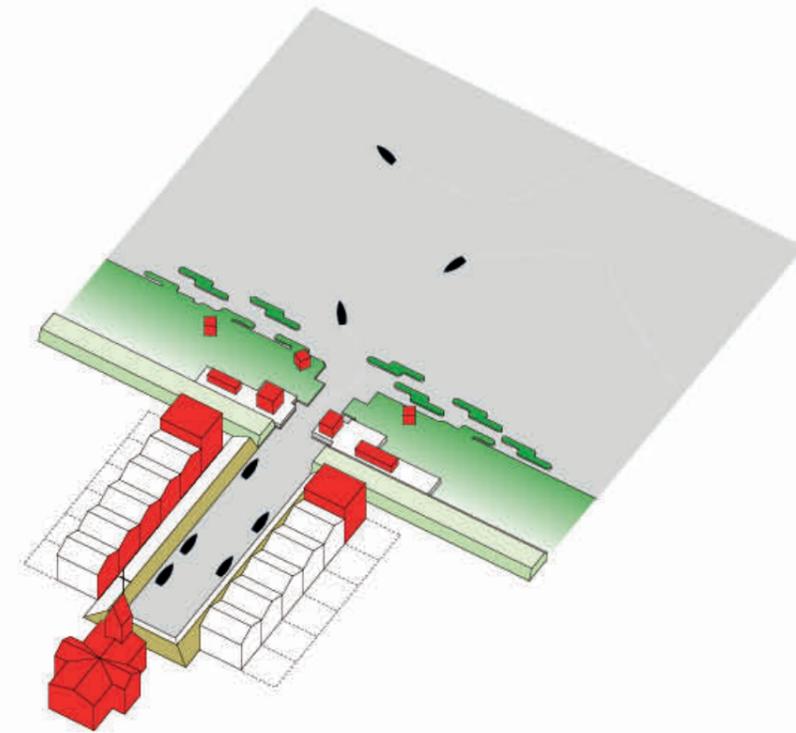
Present
Lost water relation

Future
Re-introduce water

Pernis scale

Hard approach
Sharp border

Soft approach
Gradual in/out

Hard approach

Soft approach

Pernis scale

The Optimal balance
between Hard & Soft

Hard approach ○----------✓----------○ **Soft approach**

Optimal balance
by 'Local context'

Flexibility in development
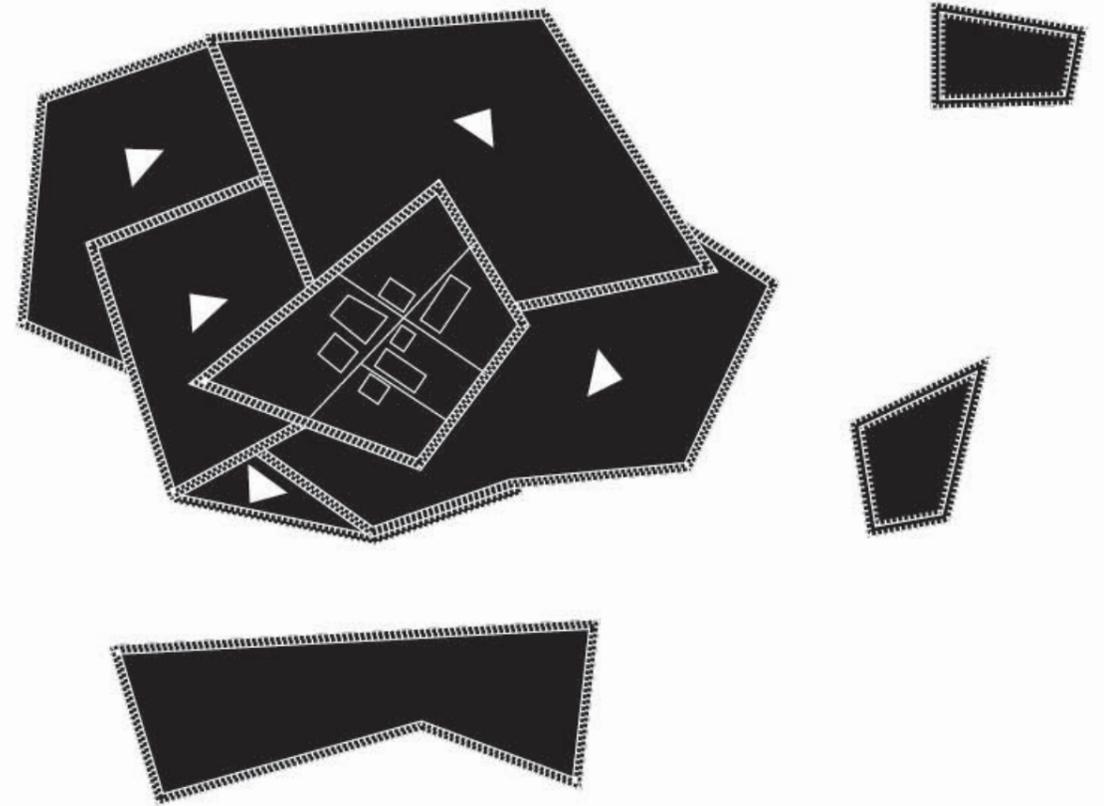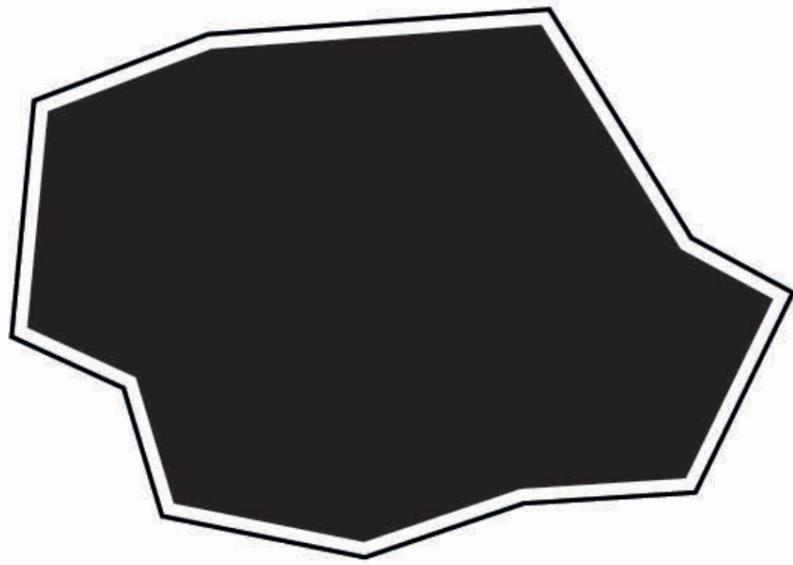
Hard approach

Soft approach

Shift approach

Hard approach

Soft approach
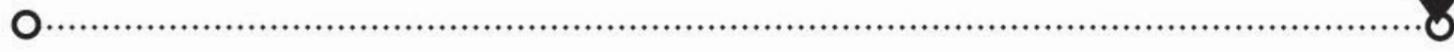
Hard approach o···o **Soft approach**

'Soft approach should be applied
mainly and firstly.'

Port change
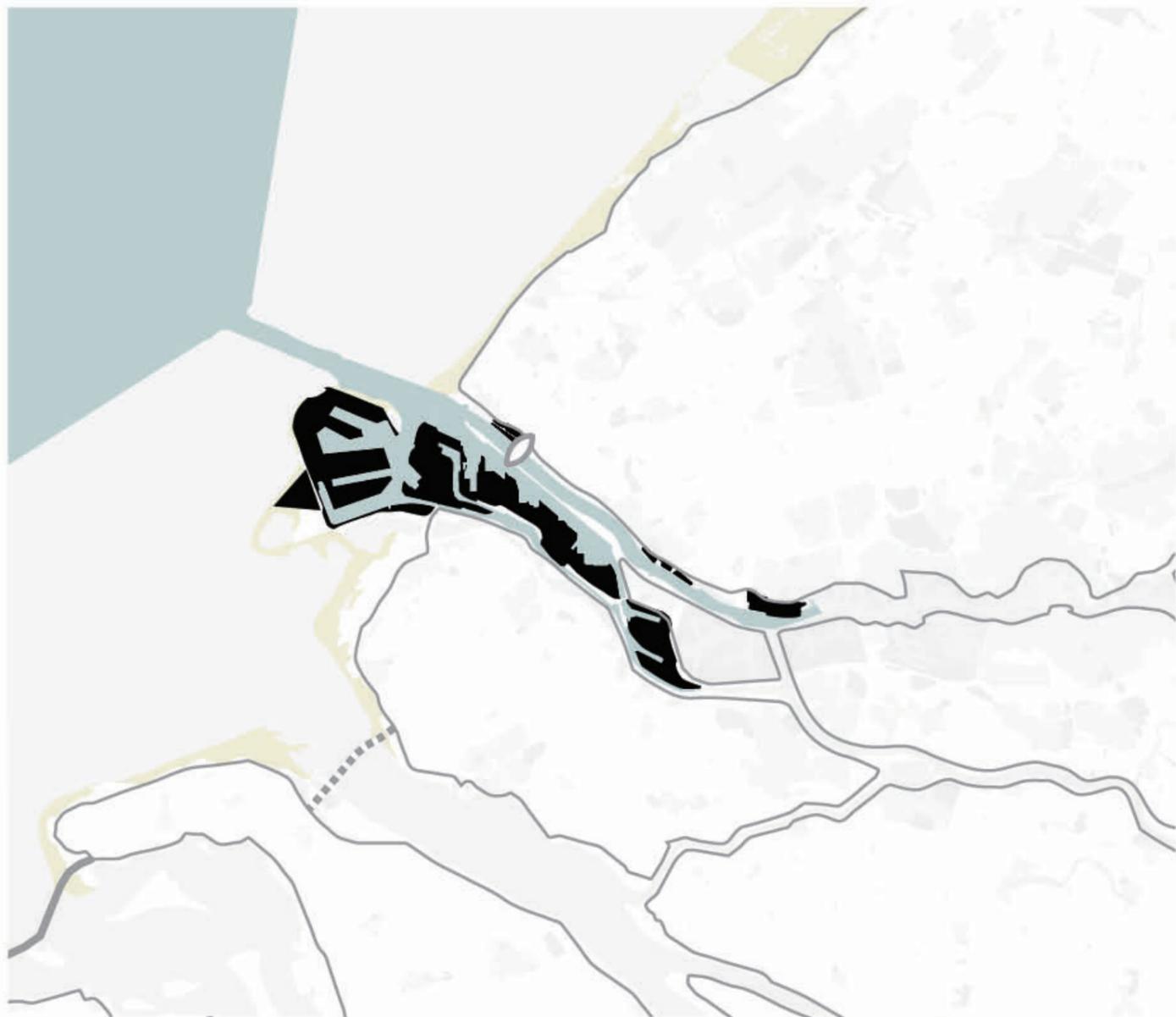
Hard approach
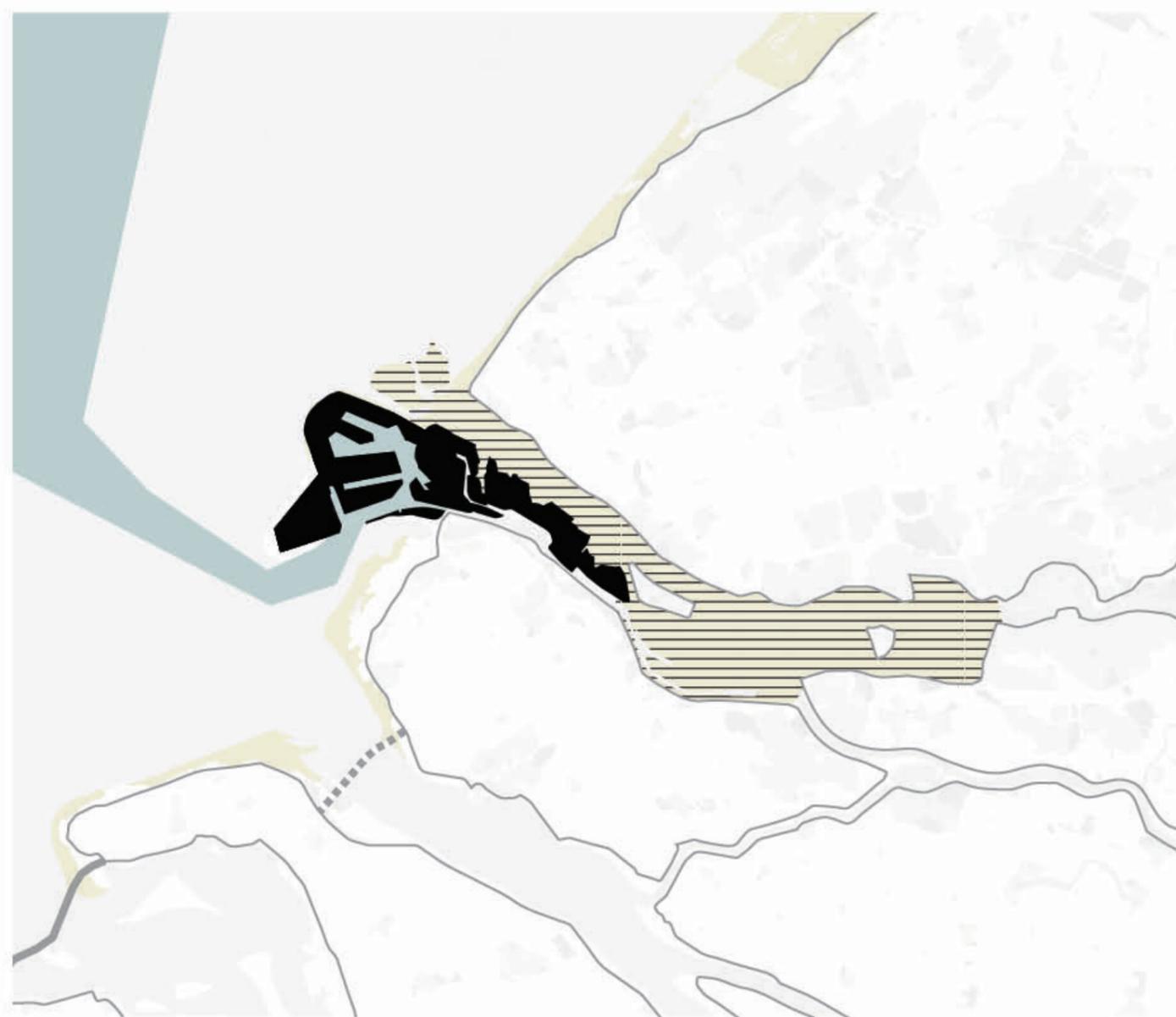
Soft approach
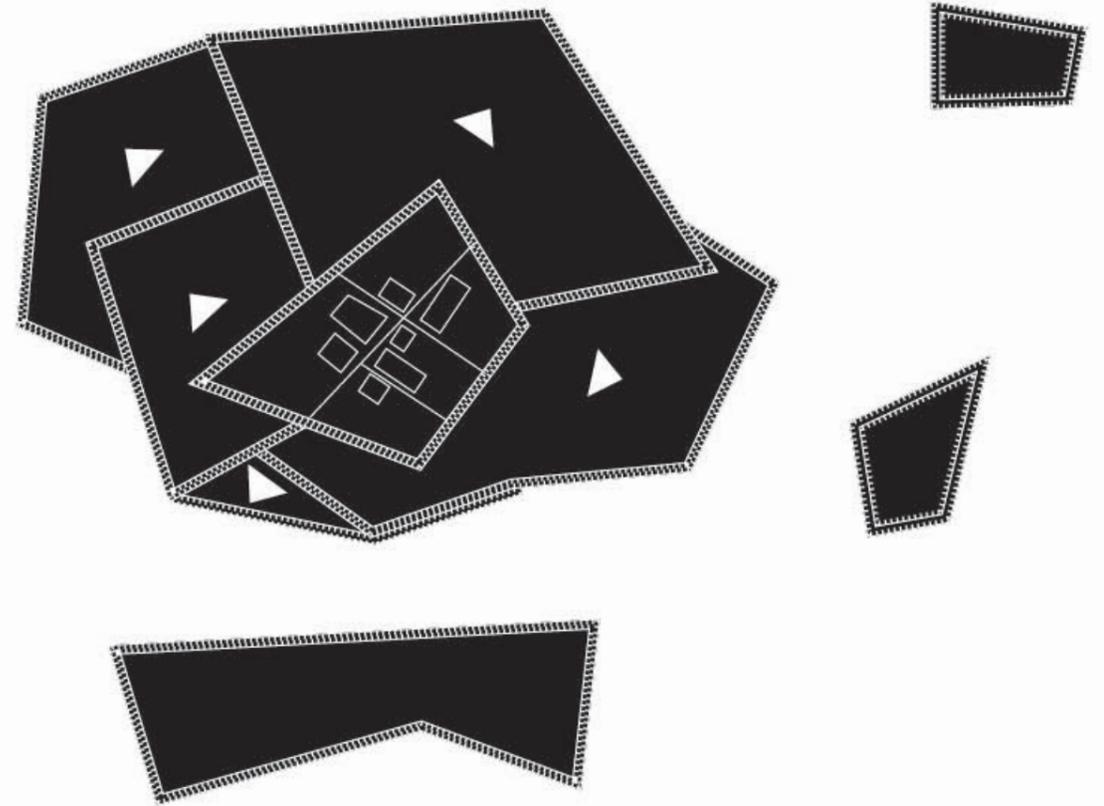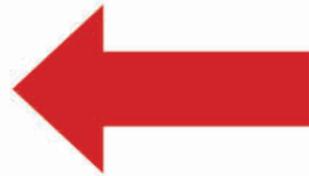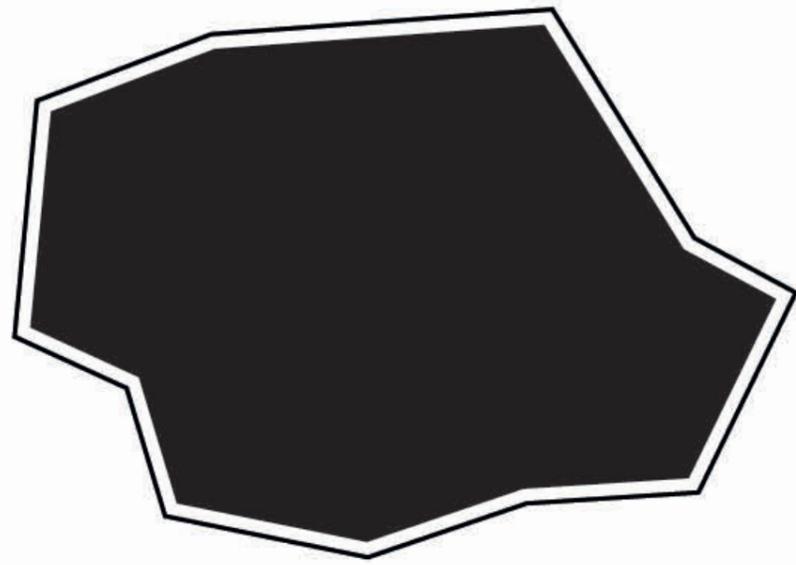
Spatial quality in settlment scale

+6.1m
+2.0m
+1.0m

+6.1m
+2.0m
+1.0m
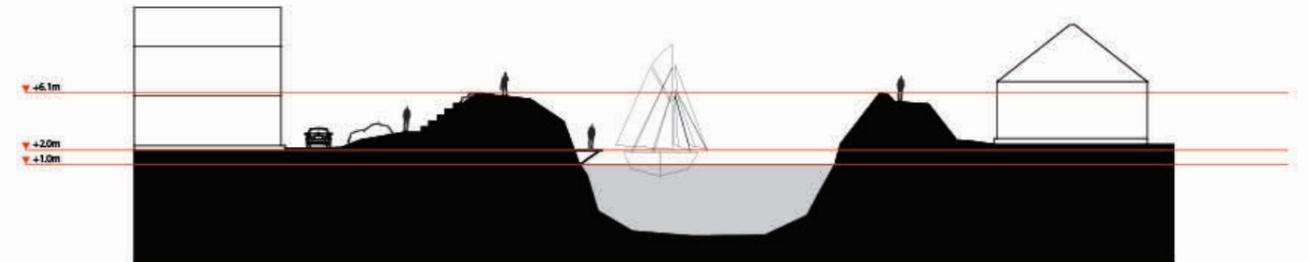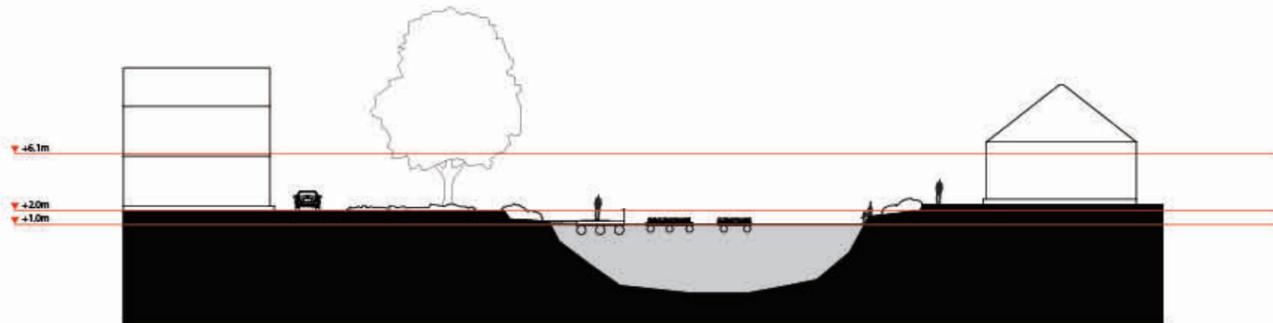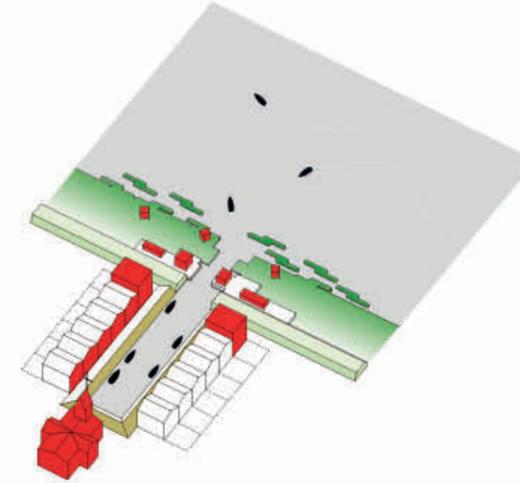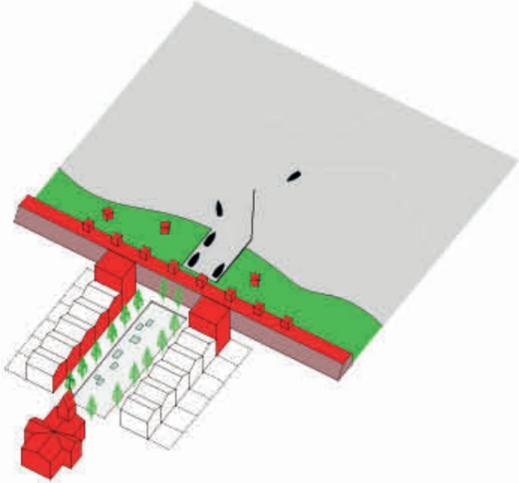
Hard approach

Soft approach

Dredging
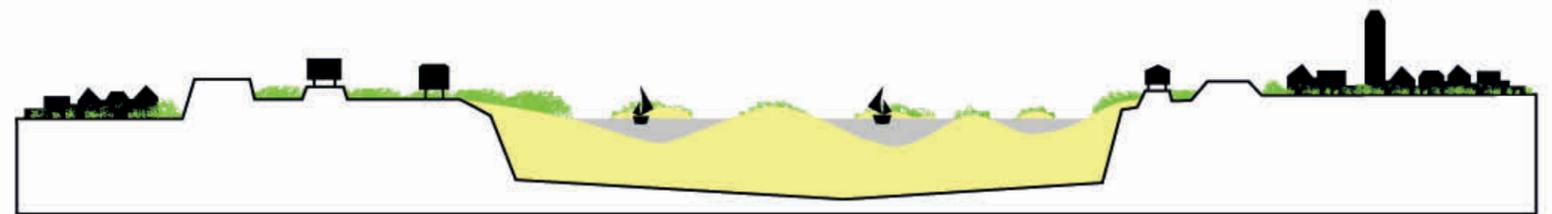
Soft approach

Mobility
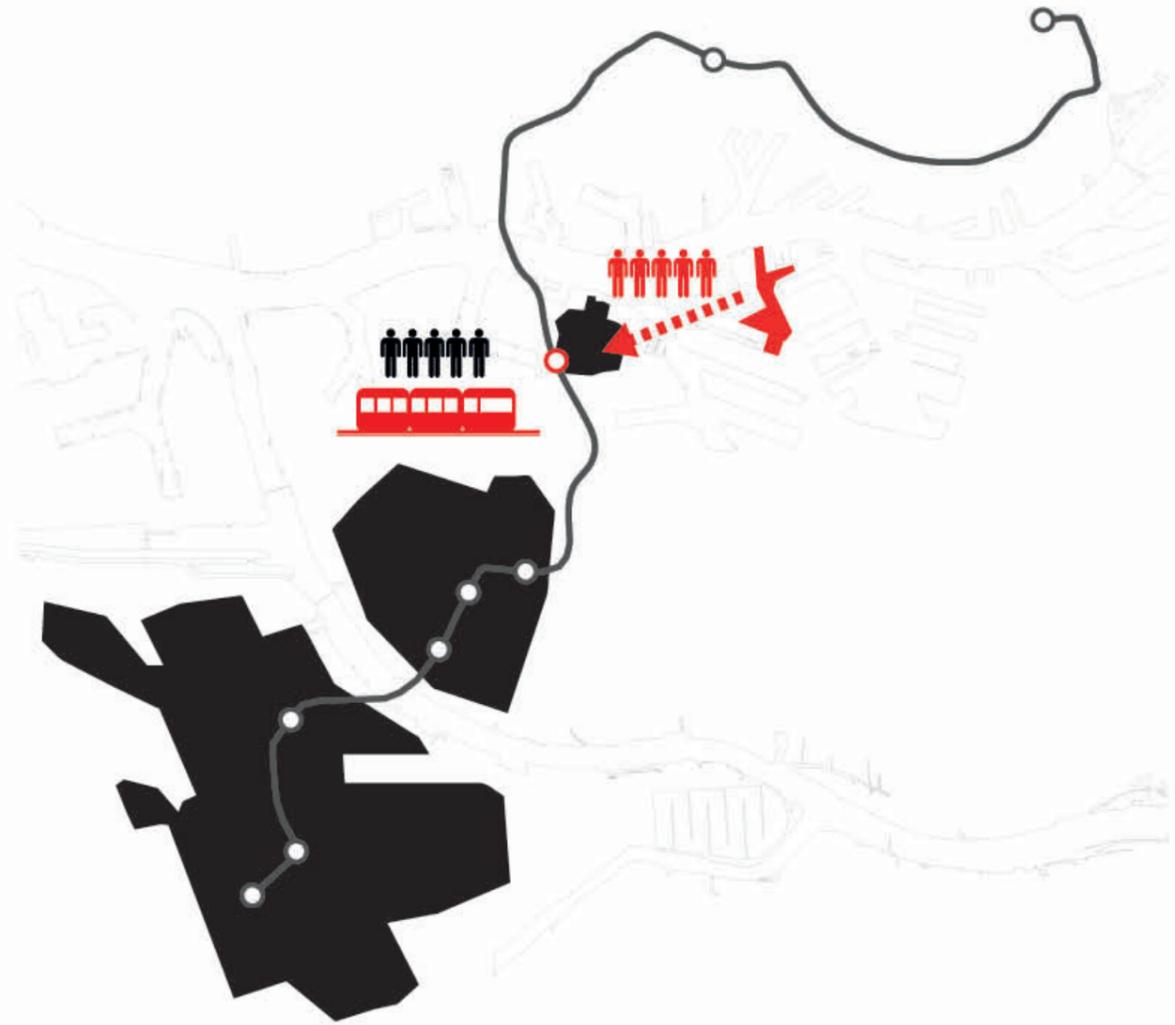
Hard approach

Hard approach   o·············✓·············o   Soft approach

'Soft approach needs supplement by
the combination with Hard.'

Proposal for Water regime
by new balanced approach

South west delta scale
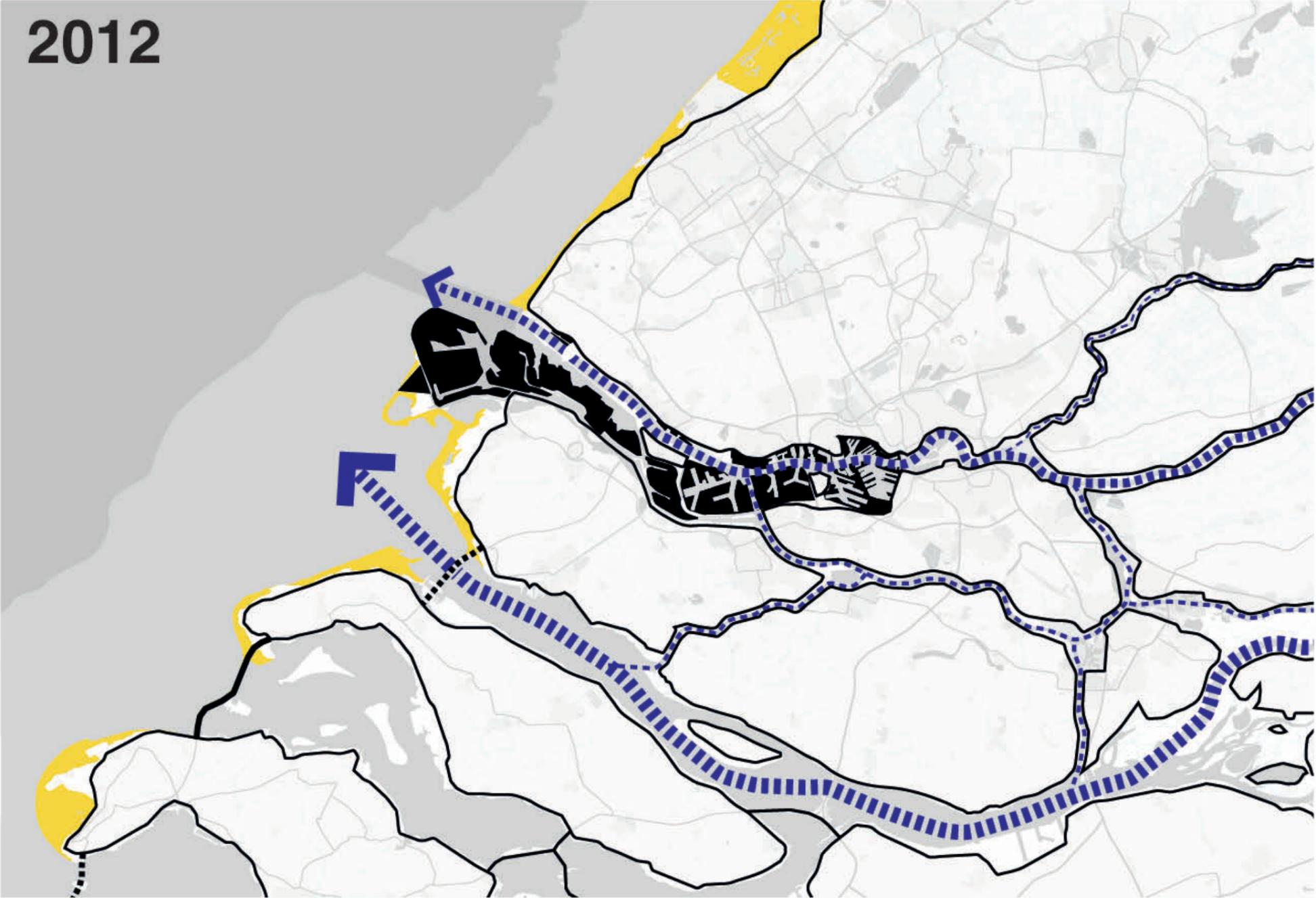
2012

Existing condition

2040
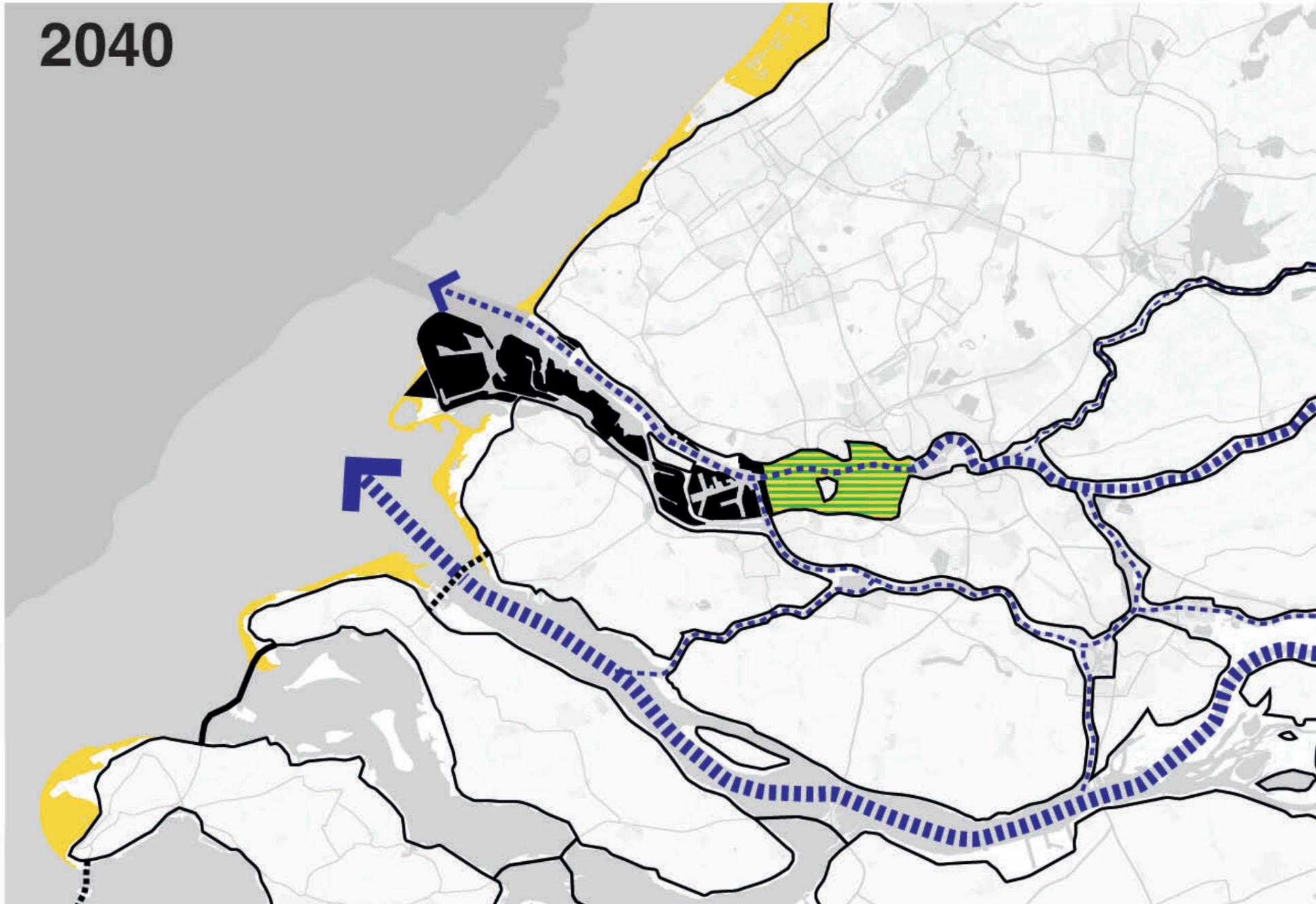
Natural sedimentation in upstream
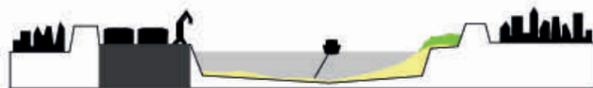
2070
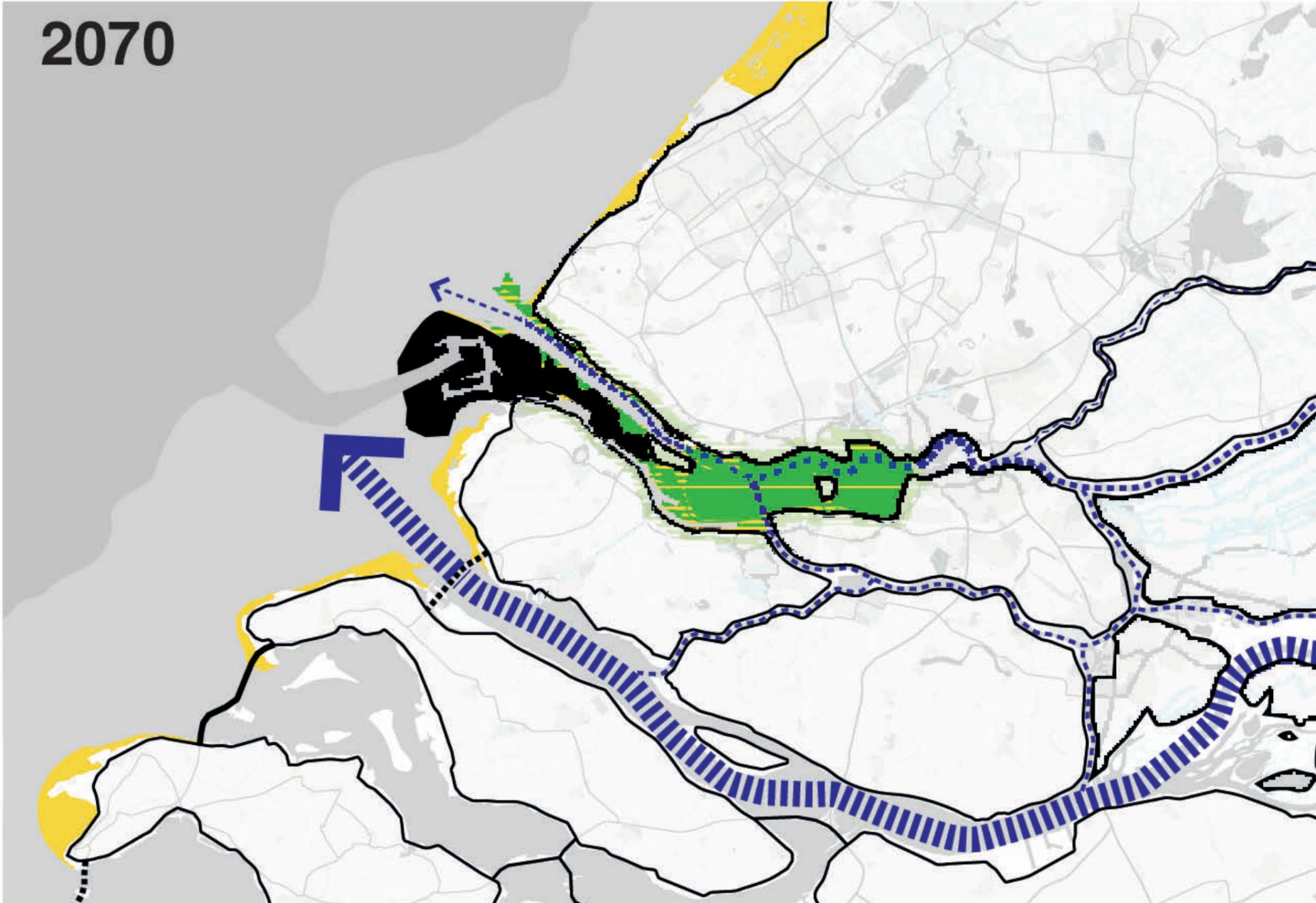
Natural sedimentation with dredging

2100
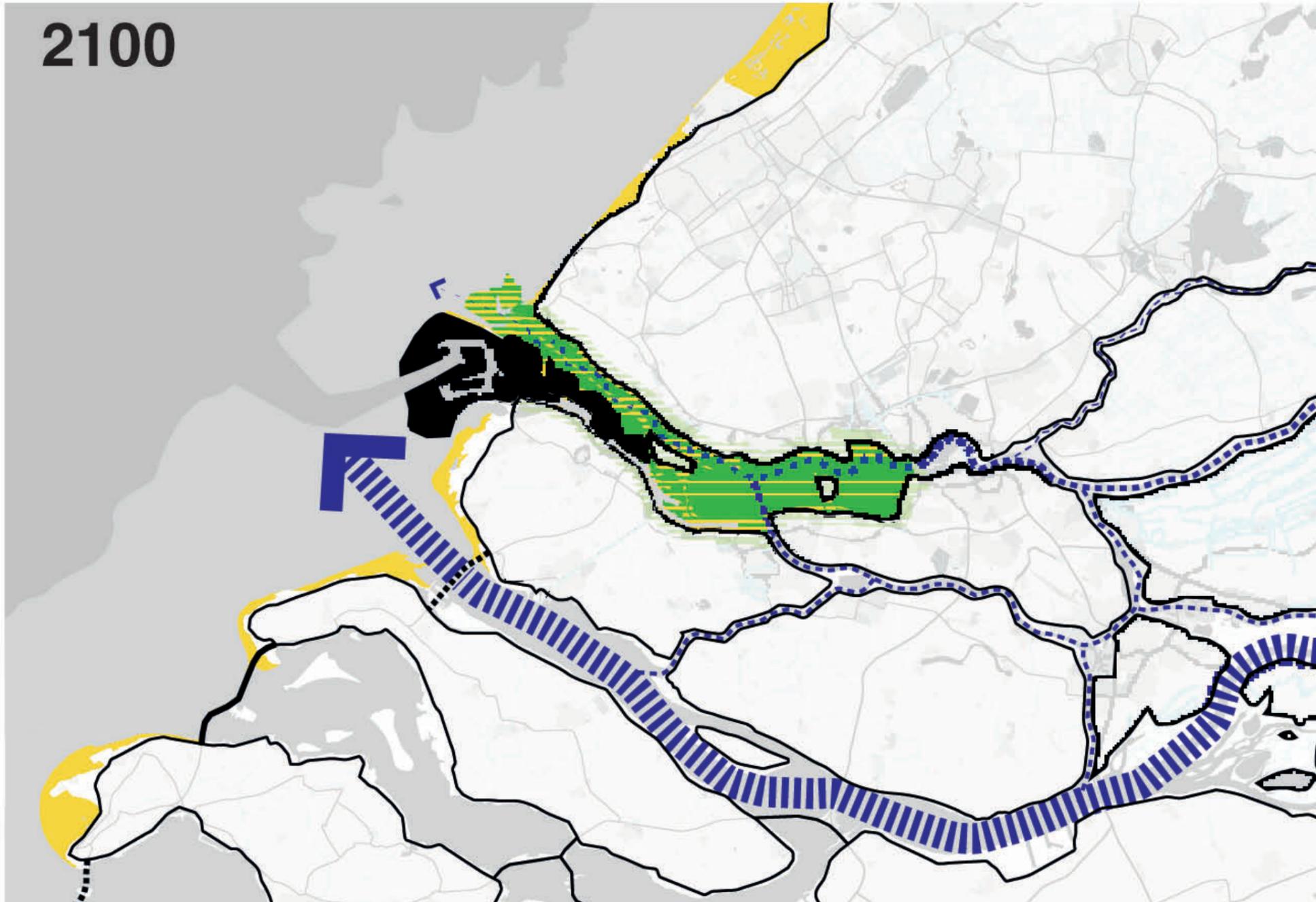
No port along Niuew waterweg

After 2100
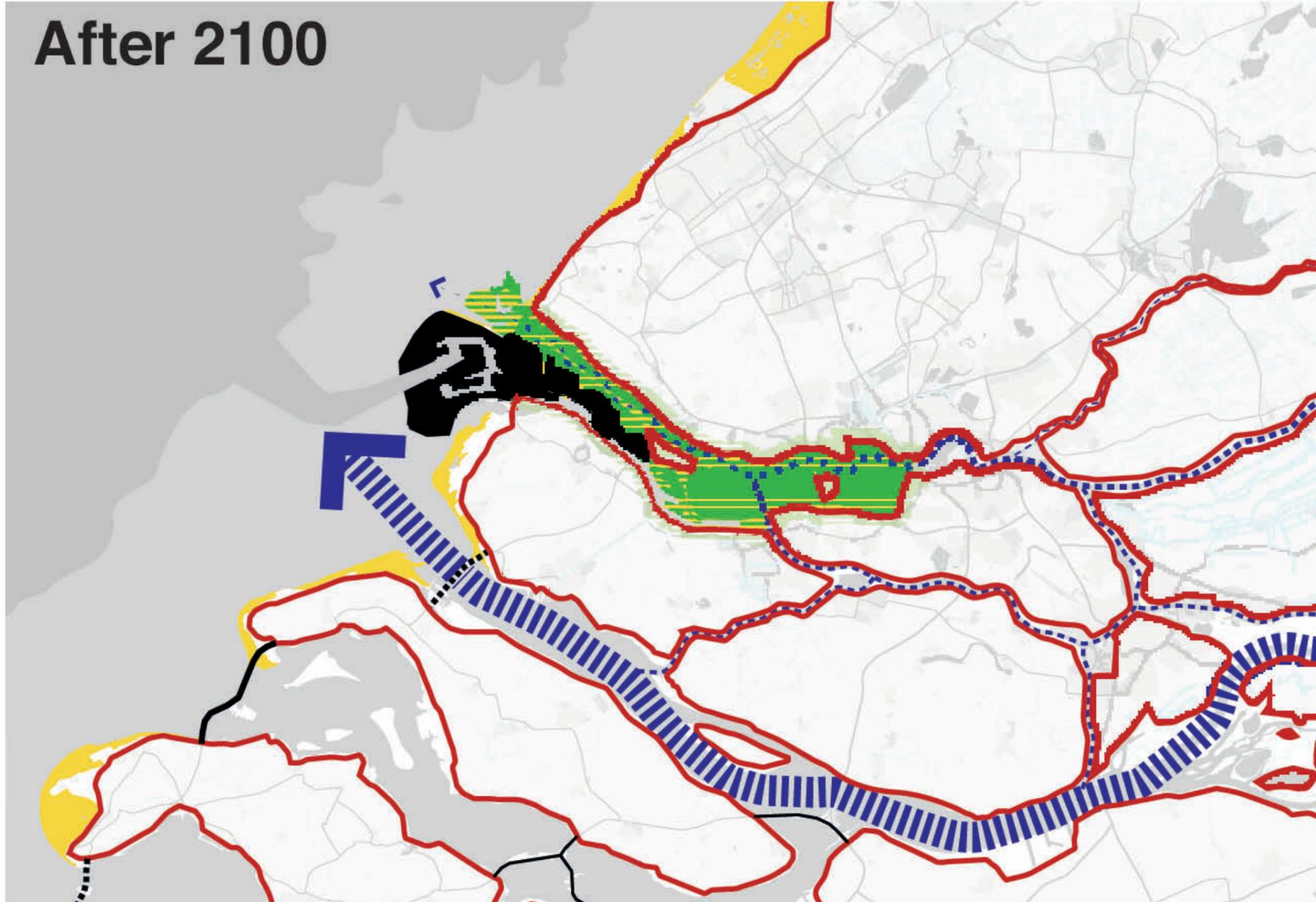
Switch to Hard approach

Phasing plan + River condition change

Phasing plan

2012   2100

Neutral project ·····················→ Future change
Improve current problem   related project

River condition

2012

Gradual river change
by **Natural process**

2100

Neutral project
Improve current problem

Future change
related project

Phasing plan

More guaranteed safety by multi functional dike
Option B

More development on the south
Option A

if more develop-
ment is required

if higher guar-
anteed safety
is required

Green connection, housing area
Phase 4: Complete

Pernis-Heijplaat connection, green connection
Phase 3

Green connection: Rotterdam south- Heijplaat
Phase 2

Key project: historical waterfront, station area
Phase 1

4 phases

More guaranteed safety by multi functional dike
Option B

More development on the south
Option A

if more develop-
ment is required

if higher guar-
anteed safety
is required

Green connection, housing area
Phase 4: Complete

Pernis-Heijplaat connection, green connection
Phase 3

Green connection: Rotterdam south- Heijplaat
Phase 2

Key project: historical waterfront, station area
Phase 1

2 options

More guaranteed safety by multi functional dike
Option B

More development on the south
Option A

if more develop-
ment is required

if higher guar-
anteed safety
is required

Green connection, housing area
Phase 4: Complete

Pernis-Heijplaat connection, green connection
Phase 3

Green connection: Rotterdam south- Heijplaat
Phase 2

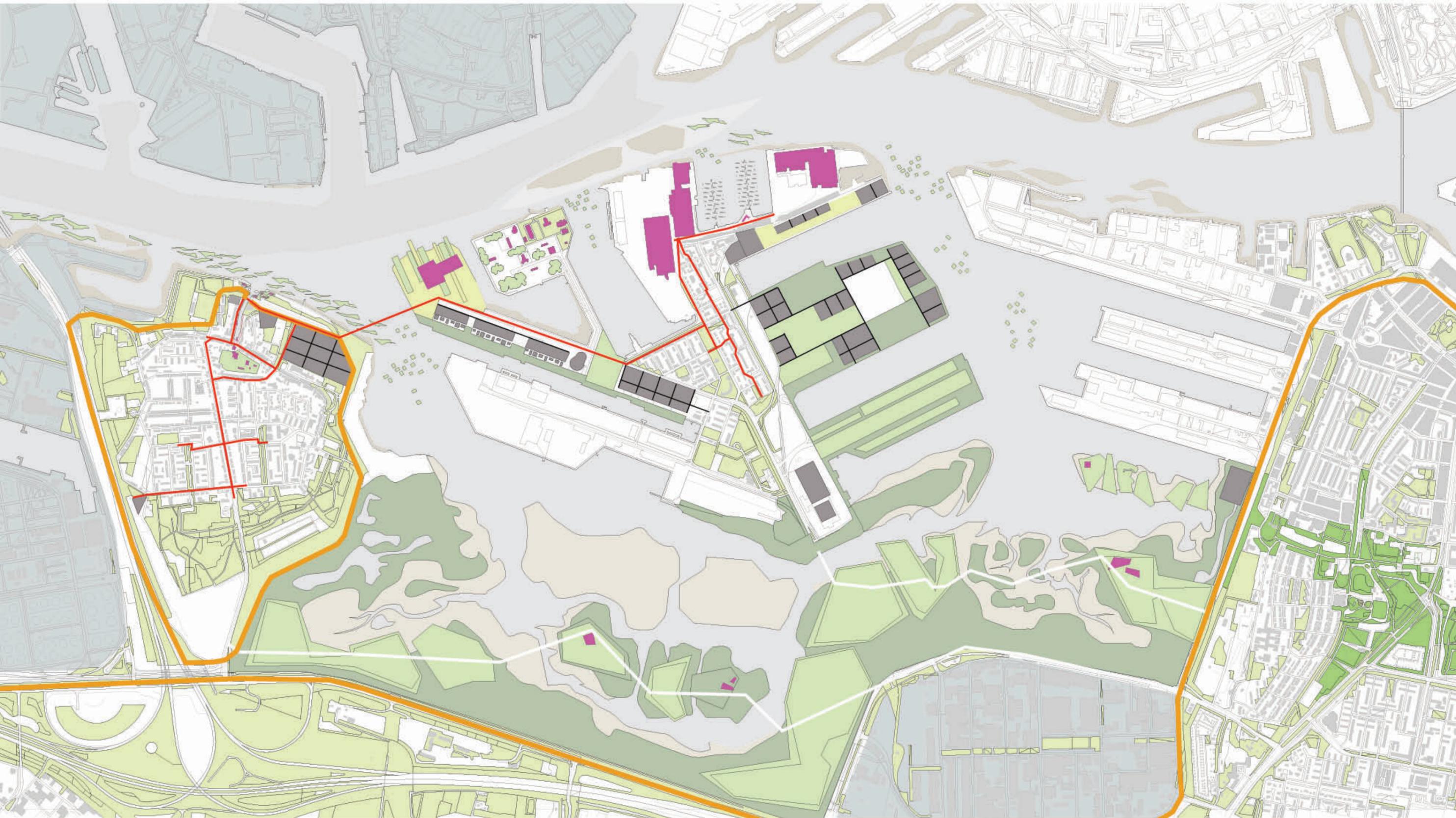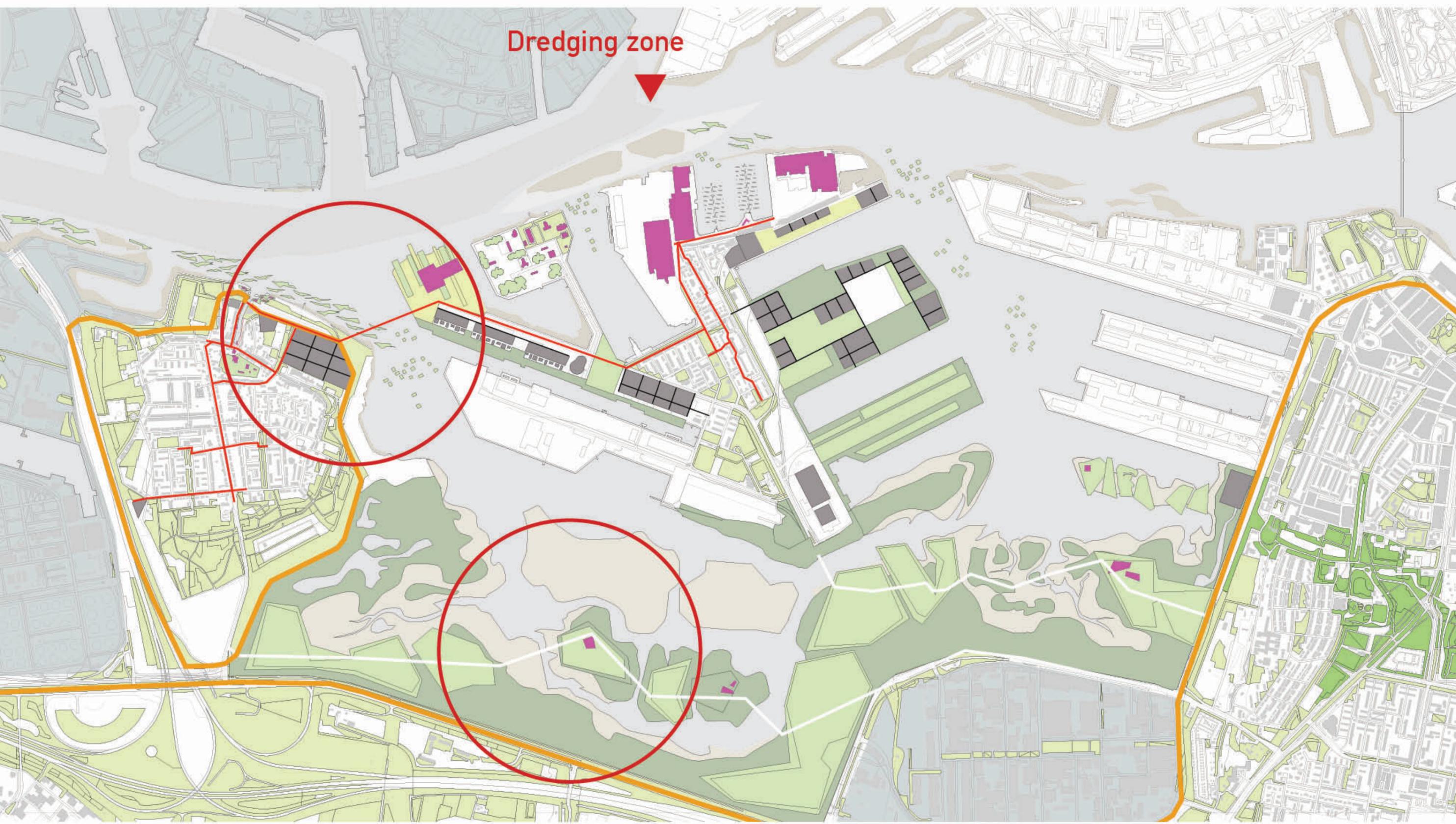Key project: historical waterfront, station area
Phase 1

2020

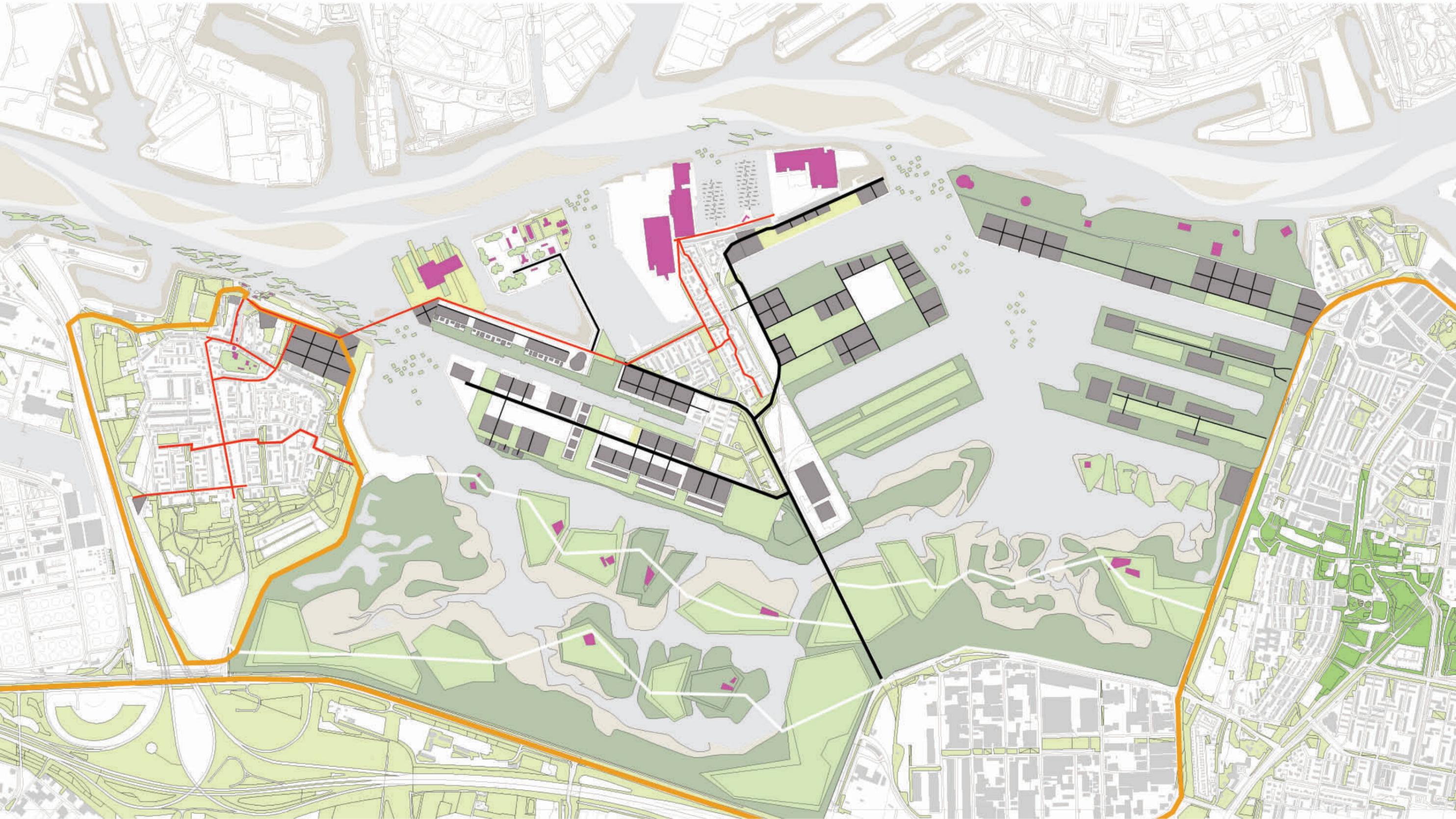# 2020

Dredging zone
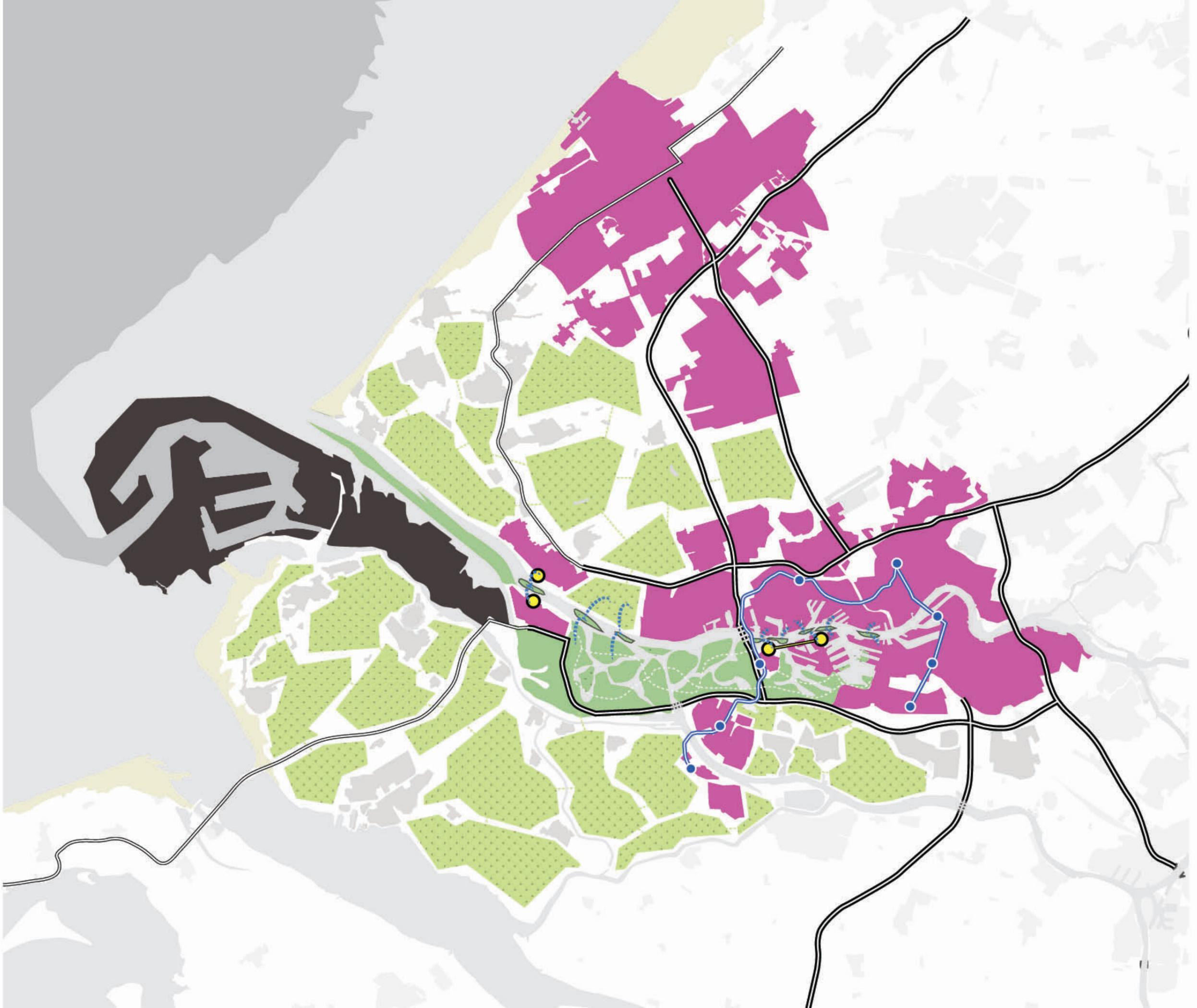
2050

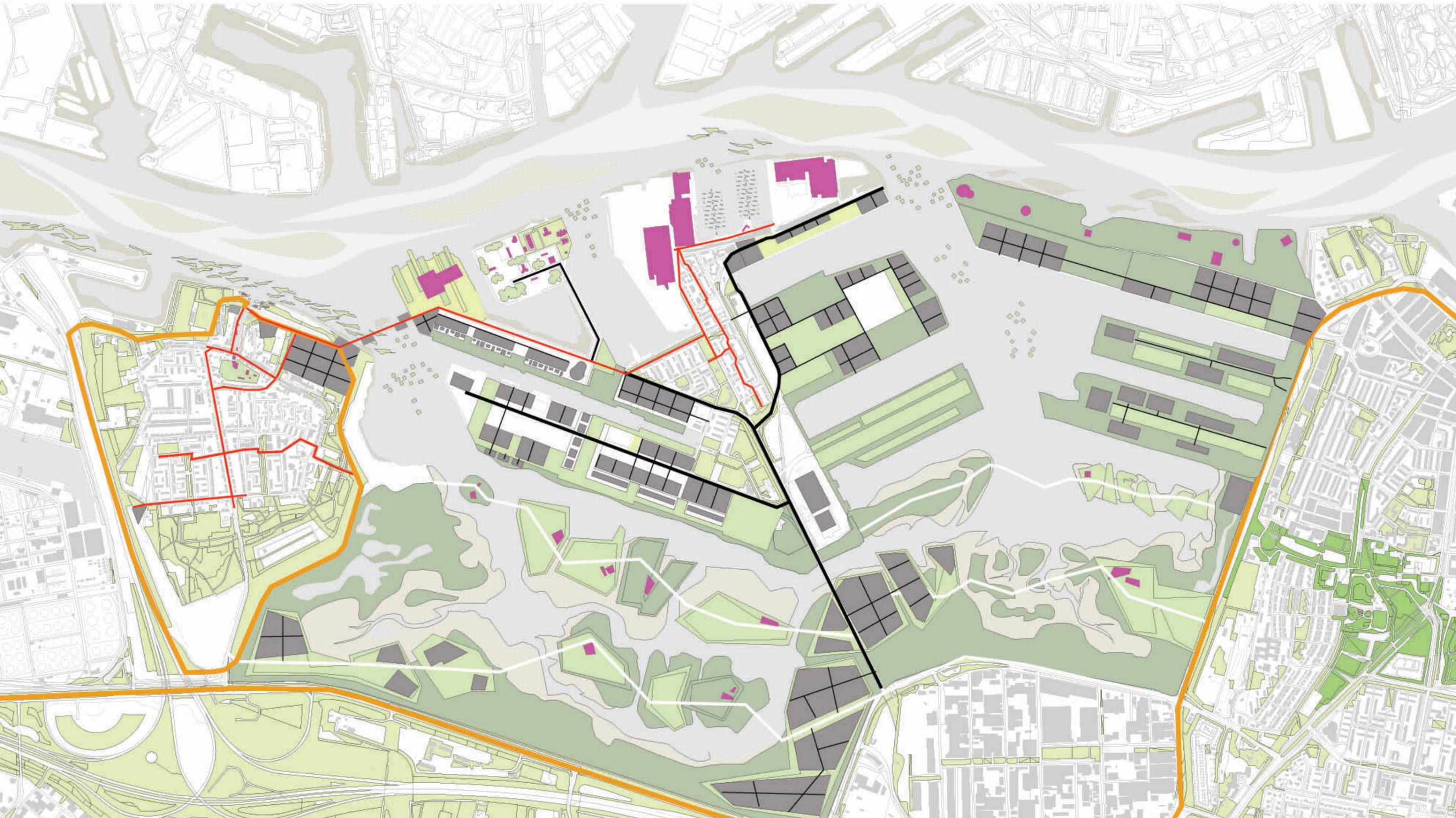# 2050

Dredging zone

2070

2070
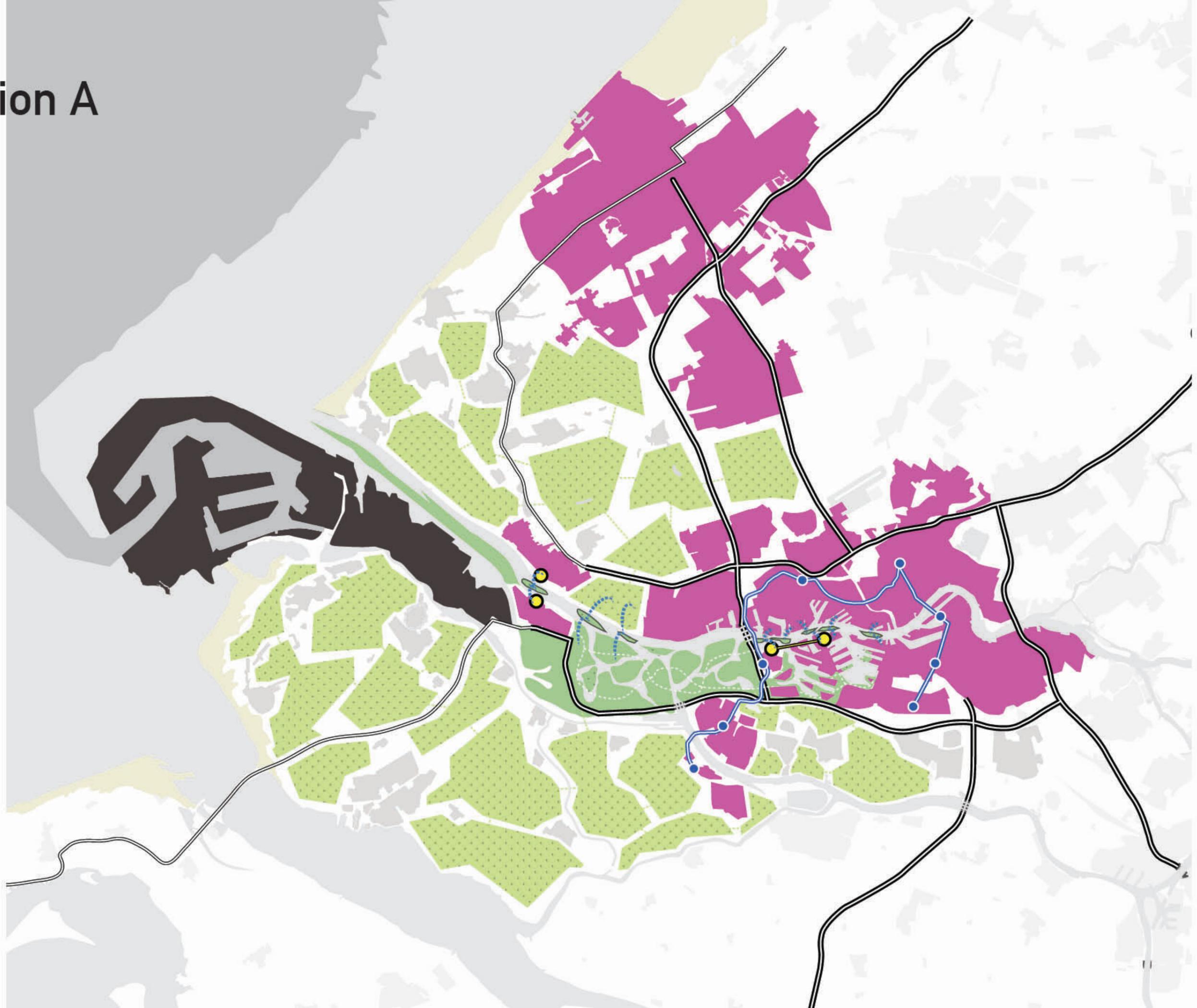
Dredging zone

2100

2100
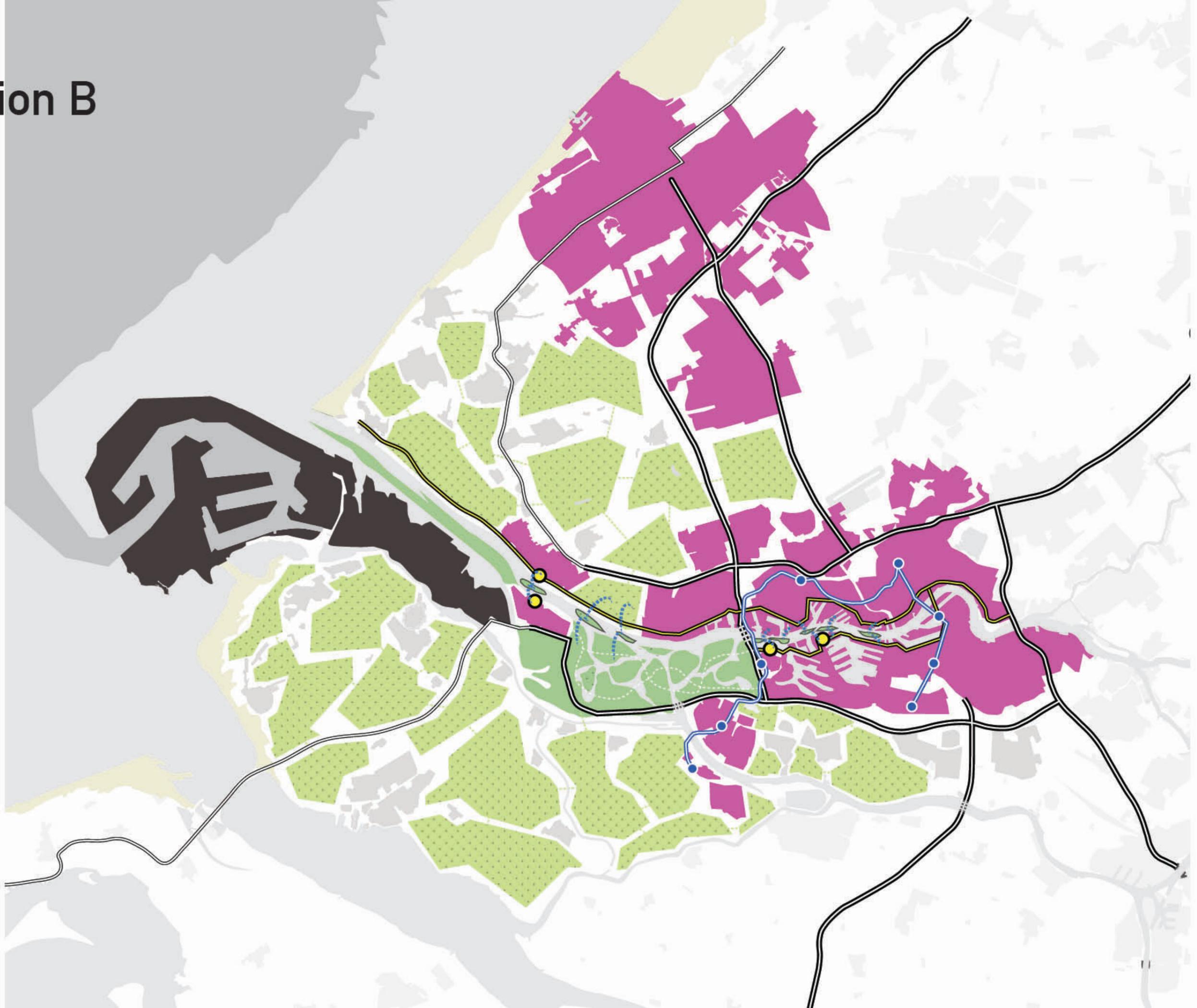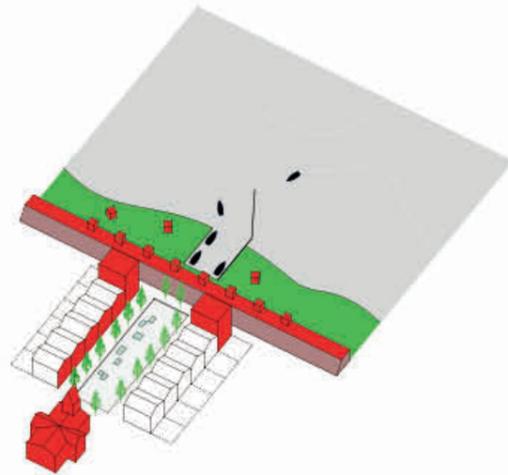
Option A: More development pressure keeping Soft approach
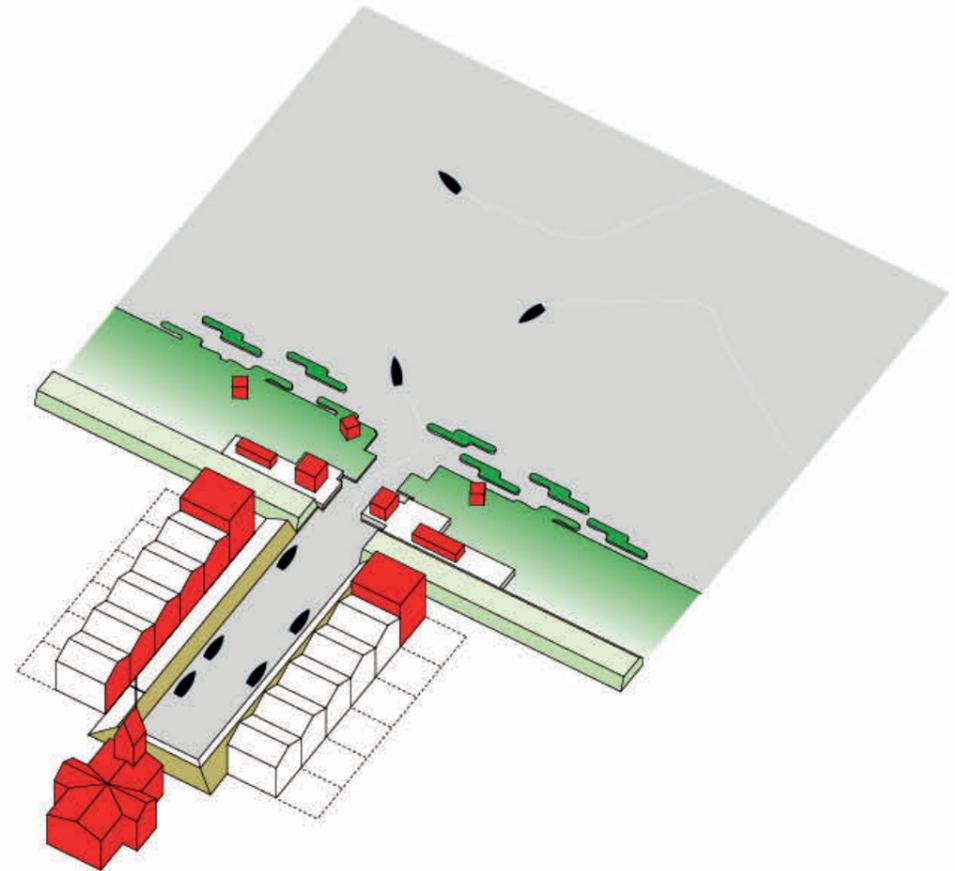
Option A
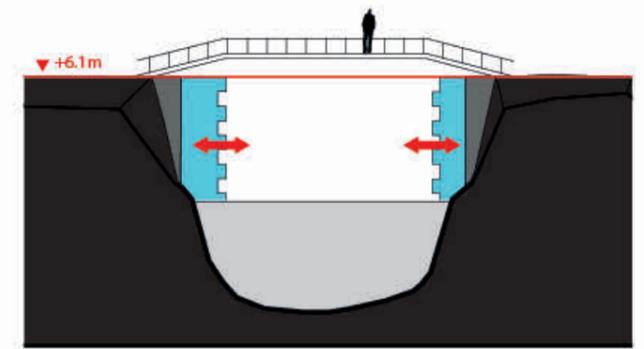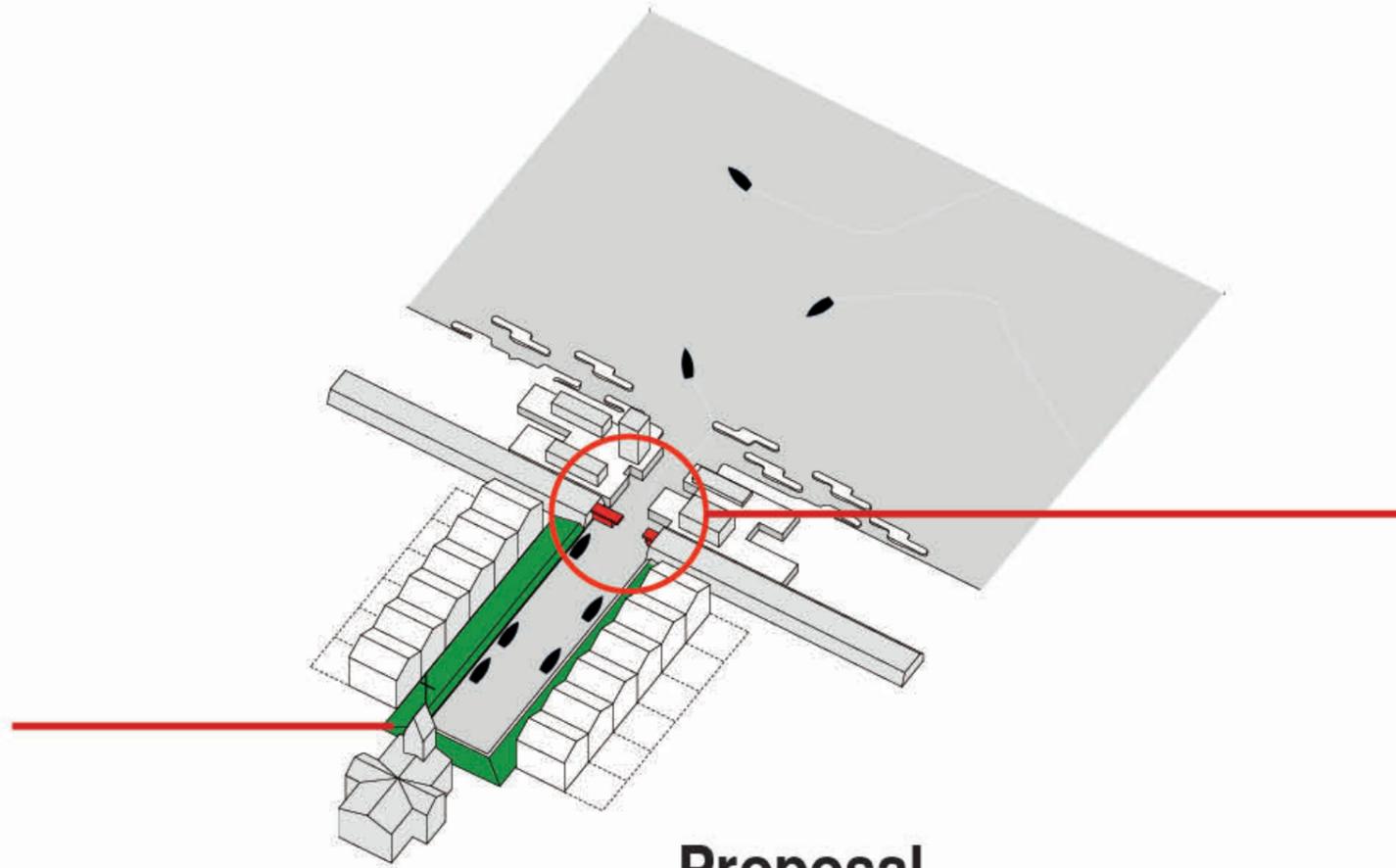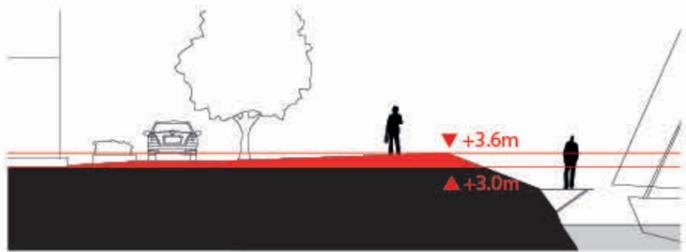
Option B: More guaranteed safety

Option B

Design idea for settlement
by new balanced approach

Hard approach
Multi-functional dike

+

Soft approach
Open port+protection along port

▼ +3.6m
▲ +3.0m

▼ +6.1m

Proposal
Permeable flood barrier + hidden dike

Phasing plan for settlement + River condition

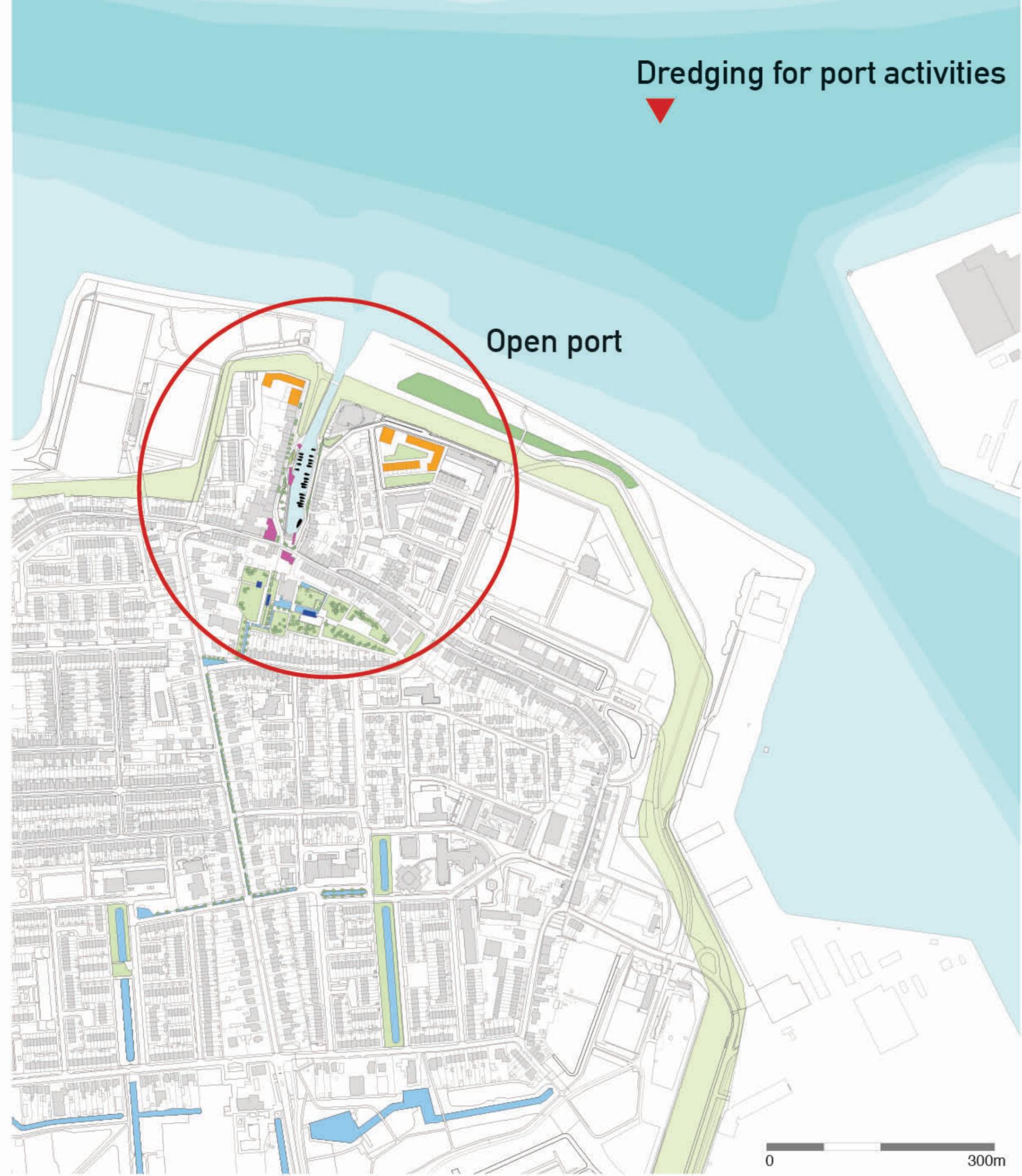2020

0   300m

2020

Dredging for port activities ▼

Open port

0   300m

2070

0   300m

2070

Landscape protection
+ Permeable flood barrier

Silting-up starts
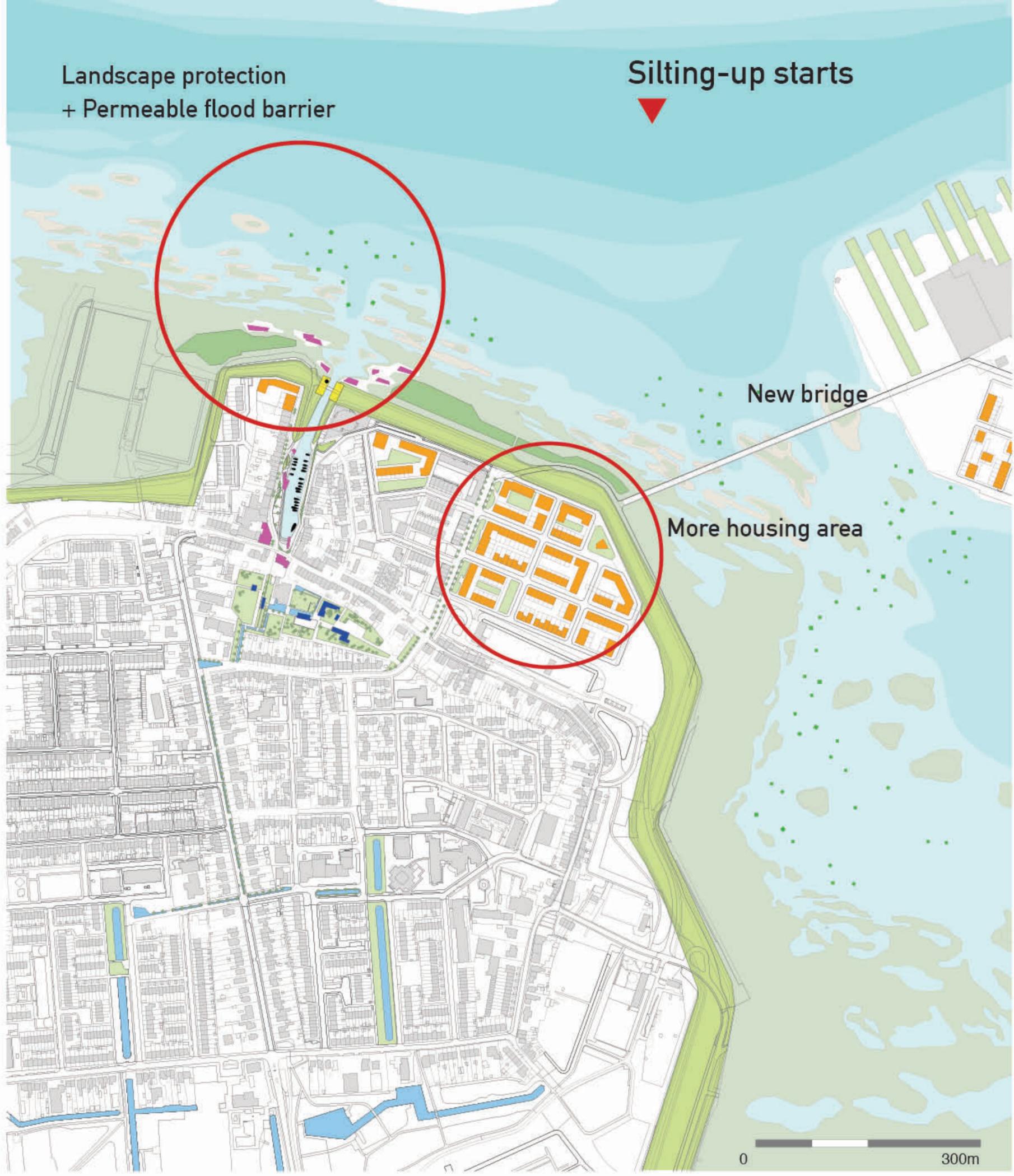▼

New bridge

More housing area

0   300m

2100

0   200m

2100

Silted-up

Development along bridge

Option A

Option A

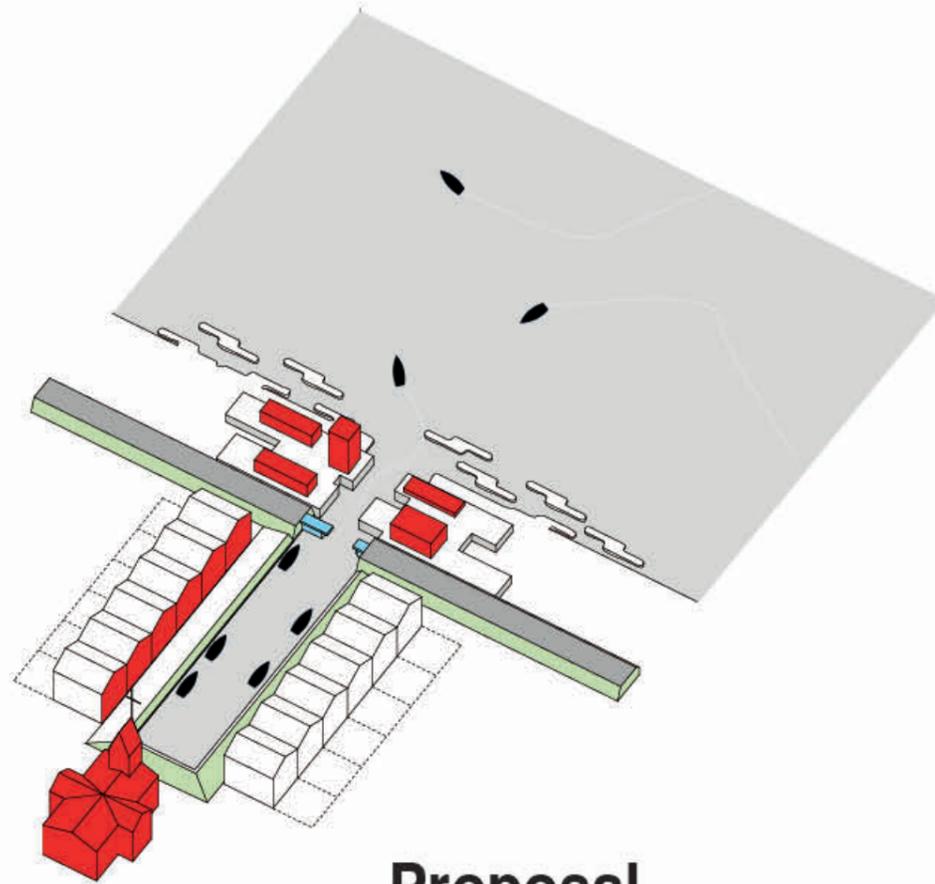Development along bridge

0   300m

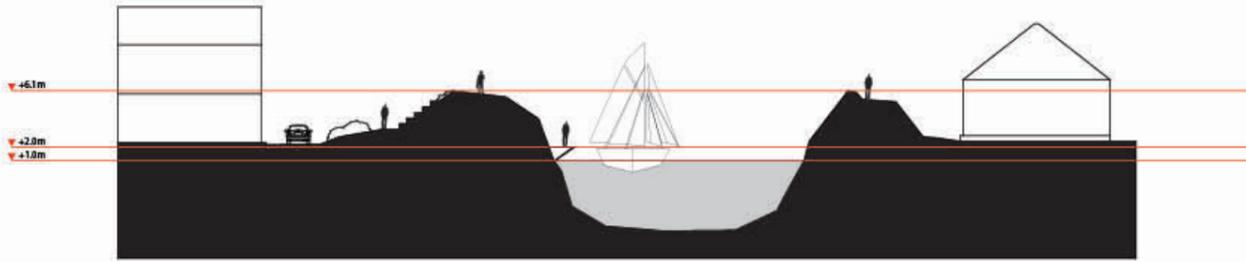Option B

0   300m

Option B

New dike

0   300m

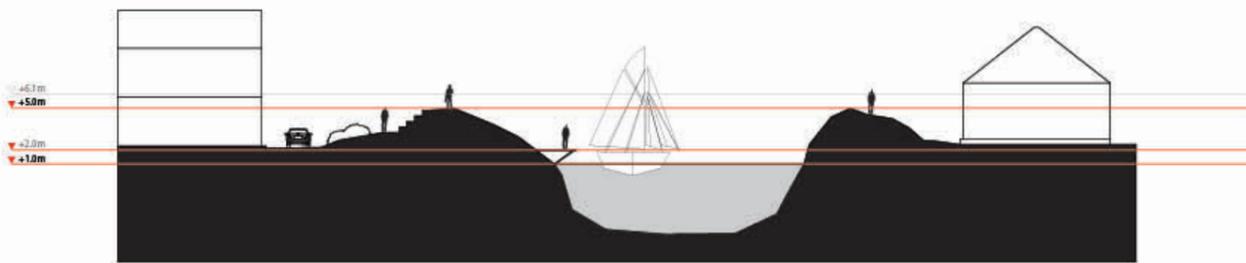# Focus plan

Proposal
Permeable flood barrier + hidden dike

Define hidden dike height
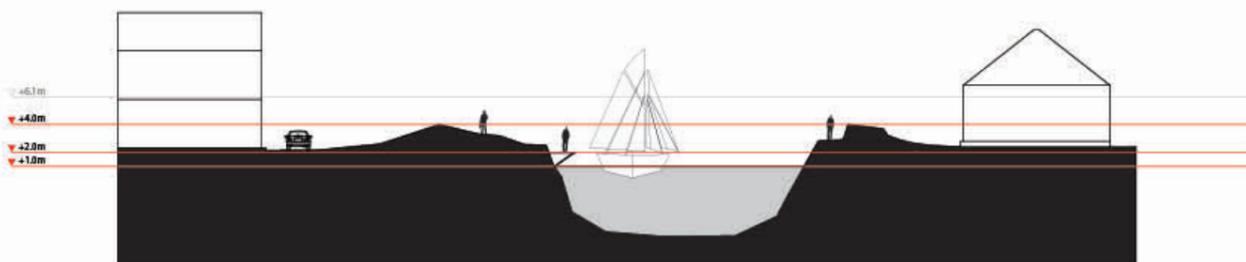by the aspects of Spatial quality & Water management

Spatial quality

+6.1m

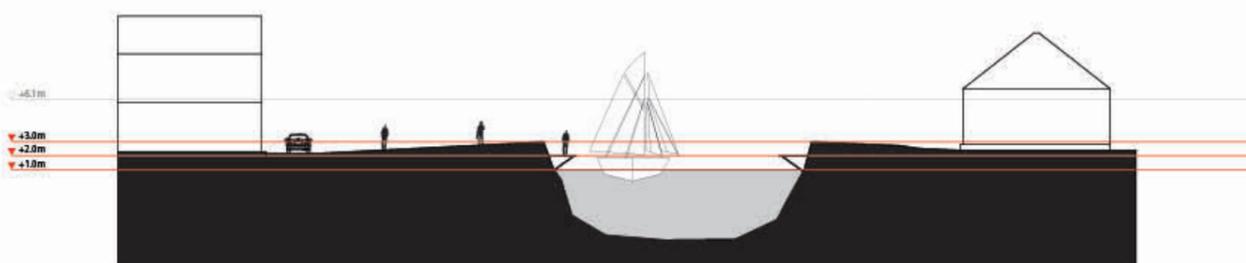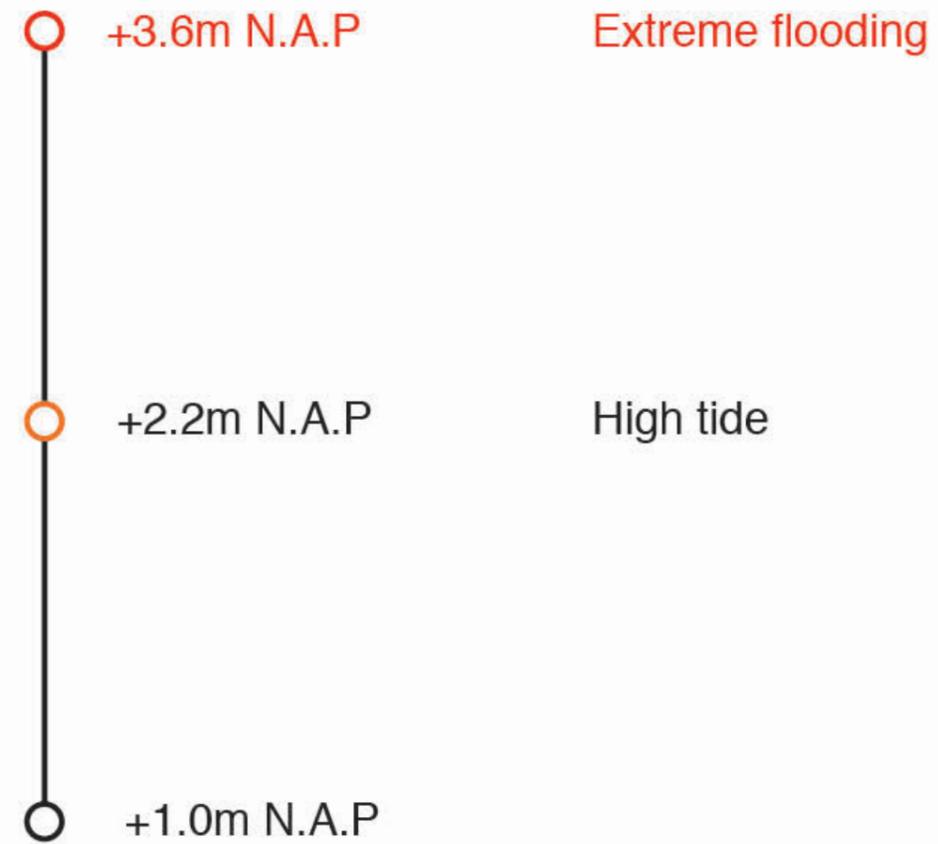+5.0m

+4.0m

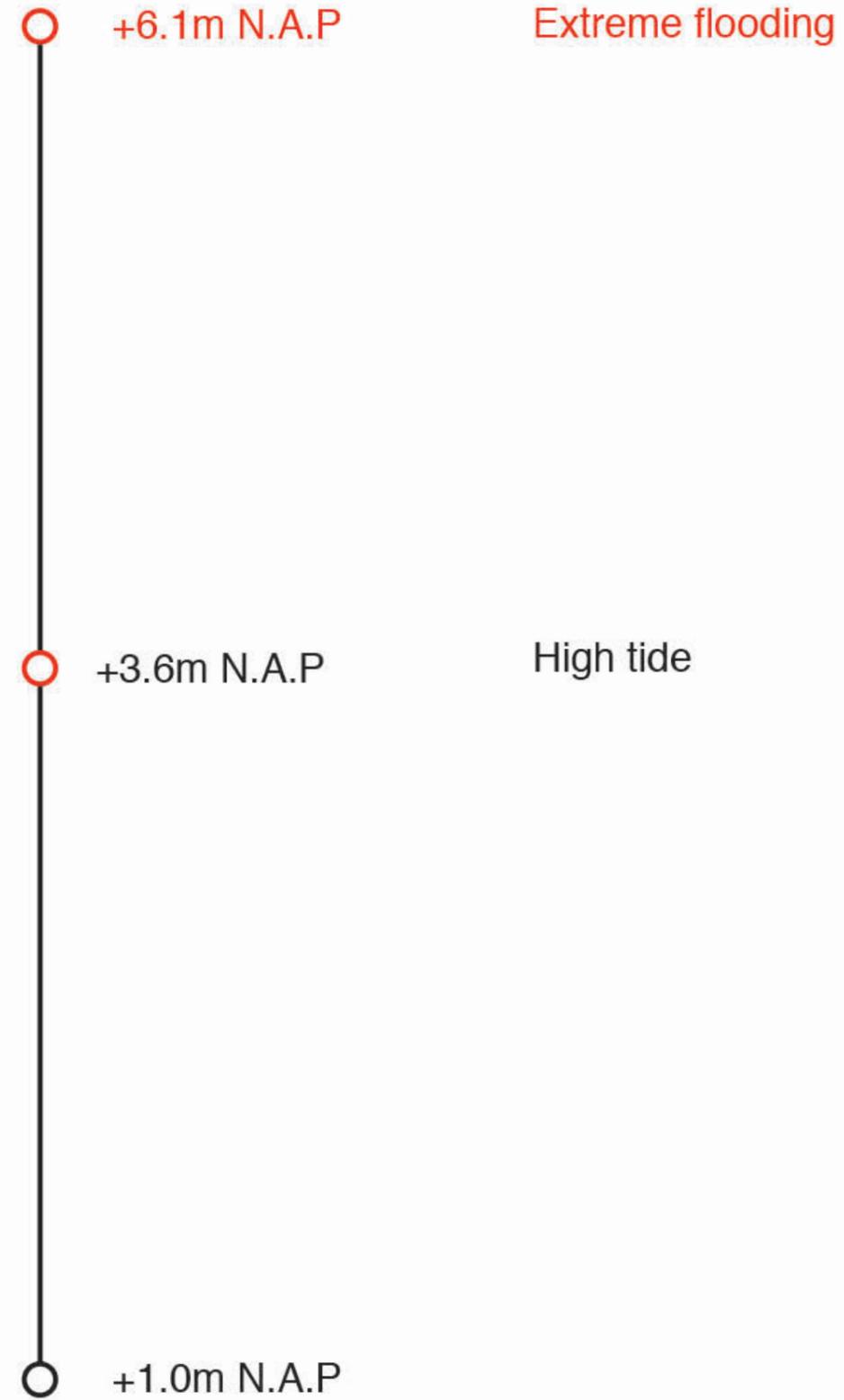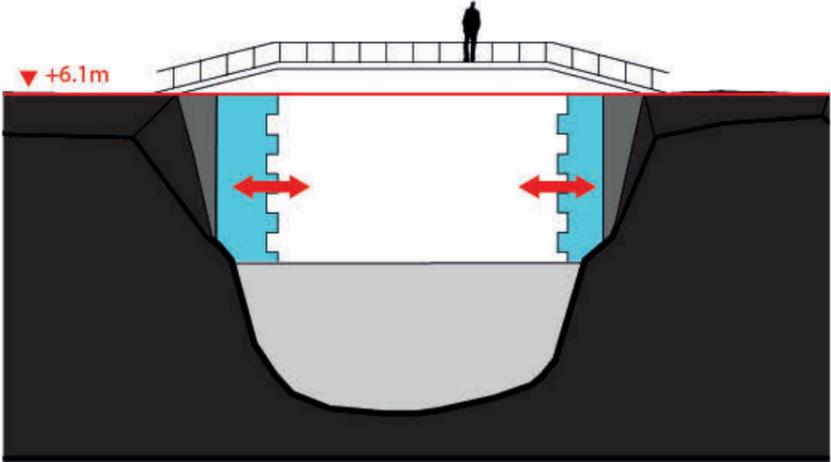+3.0m

Water management

2012

+3.6m N.A.P   Extreme flooding

+2.2m N.A.P   High tide

+1.0m N.A.P

Water management

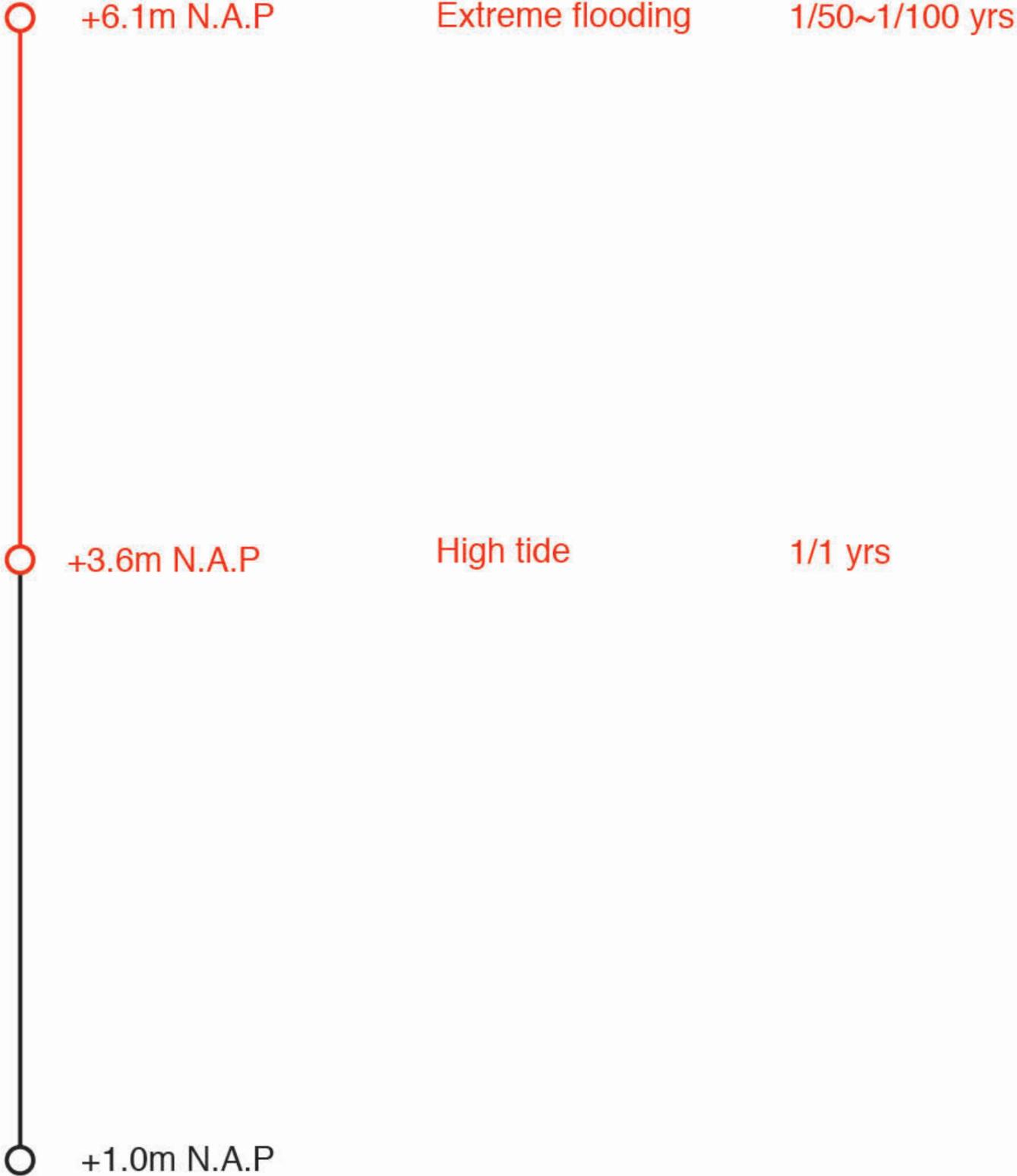○ +6.1m N.A.P   Extreme flooding

○ +3.6m N.A.P   High tide

○ +1.0m N.A.P

"+3.6m Hidden dike & Permeable flood barrier"

Permeable flood barrier

2100

○ +6.1m N.A.P   Extreme flooding   1/50~1/100 yrs

○ +3.6m N.A.P   High tide   1/1 yrs

○ +1.0m N.A.P

2100

+6.1m N.A.P   Extreme flooding   1/50~1/100 yrs

+3.6m N.A.P   High tide   1/1 yrs

▼ +3.6m

▲ +3.0m

Hidden dike

+1.0m N.A.P

Focus plan

0   50m

1. Waterfront

▼ +3.0m
▼ +1.0m

▼ +6.1m
▼ +4.0m
▼ +2.5m

▼ +1.0m

artificial mounding

artificial ridge

Natural ridge
(by natural siltation)
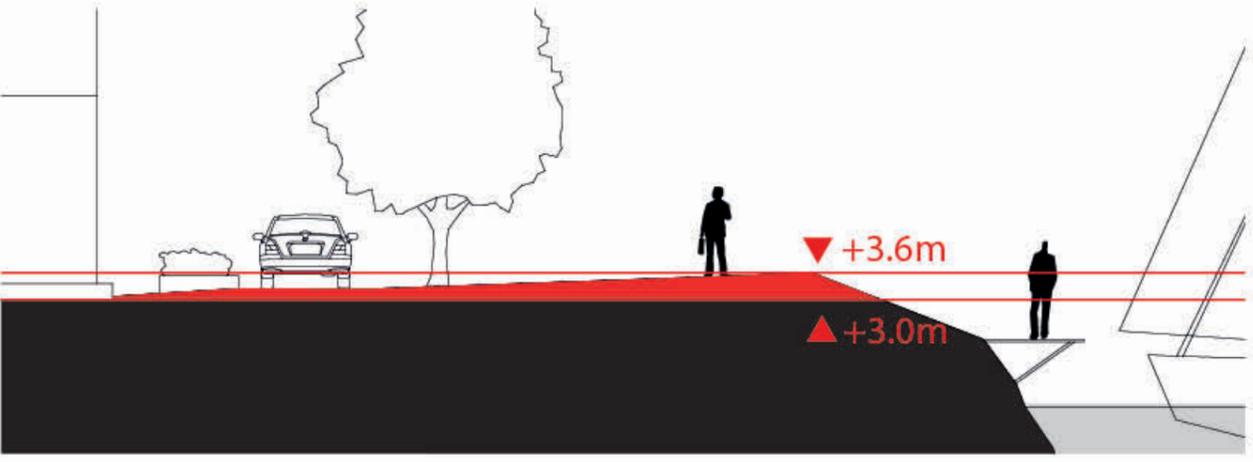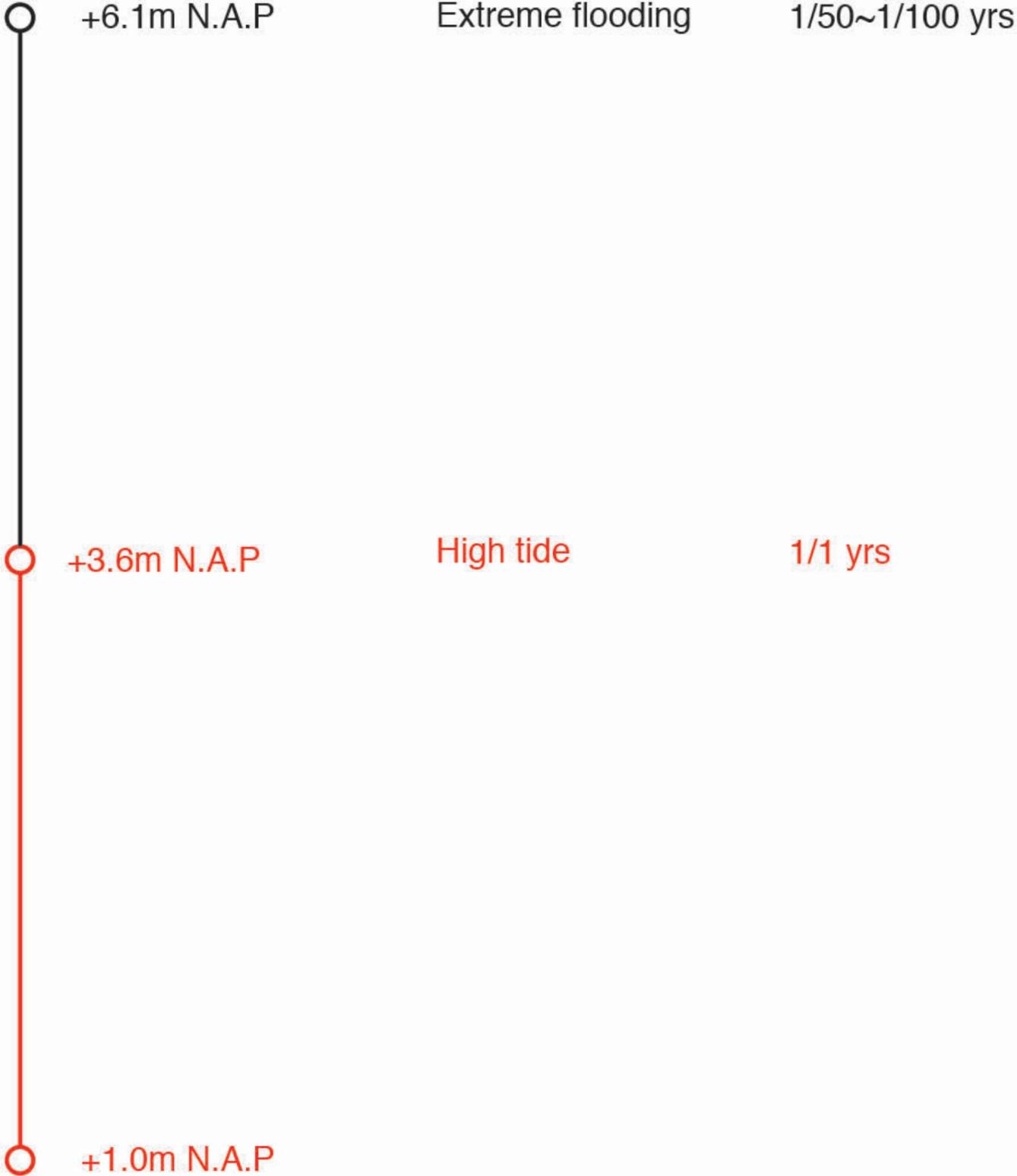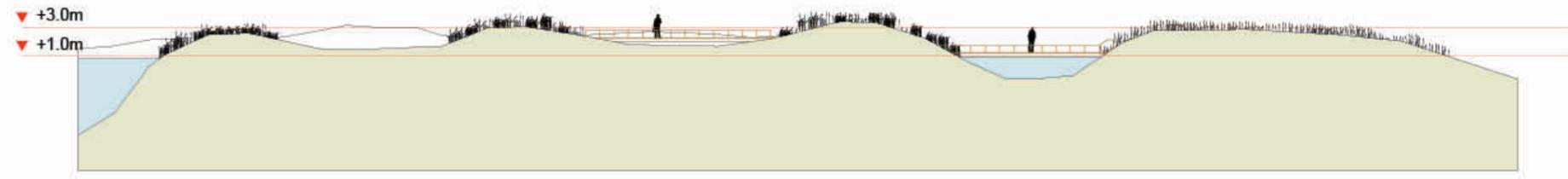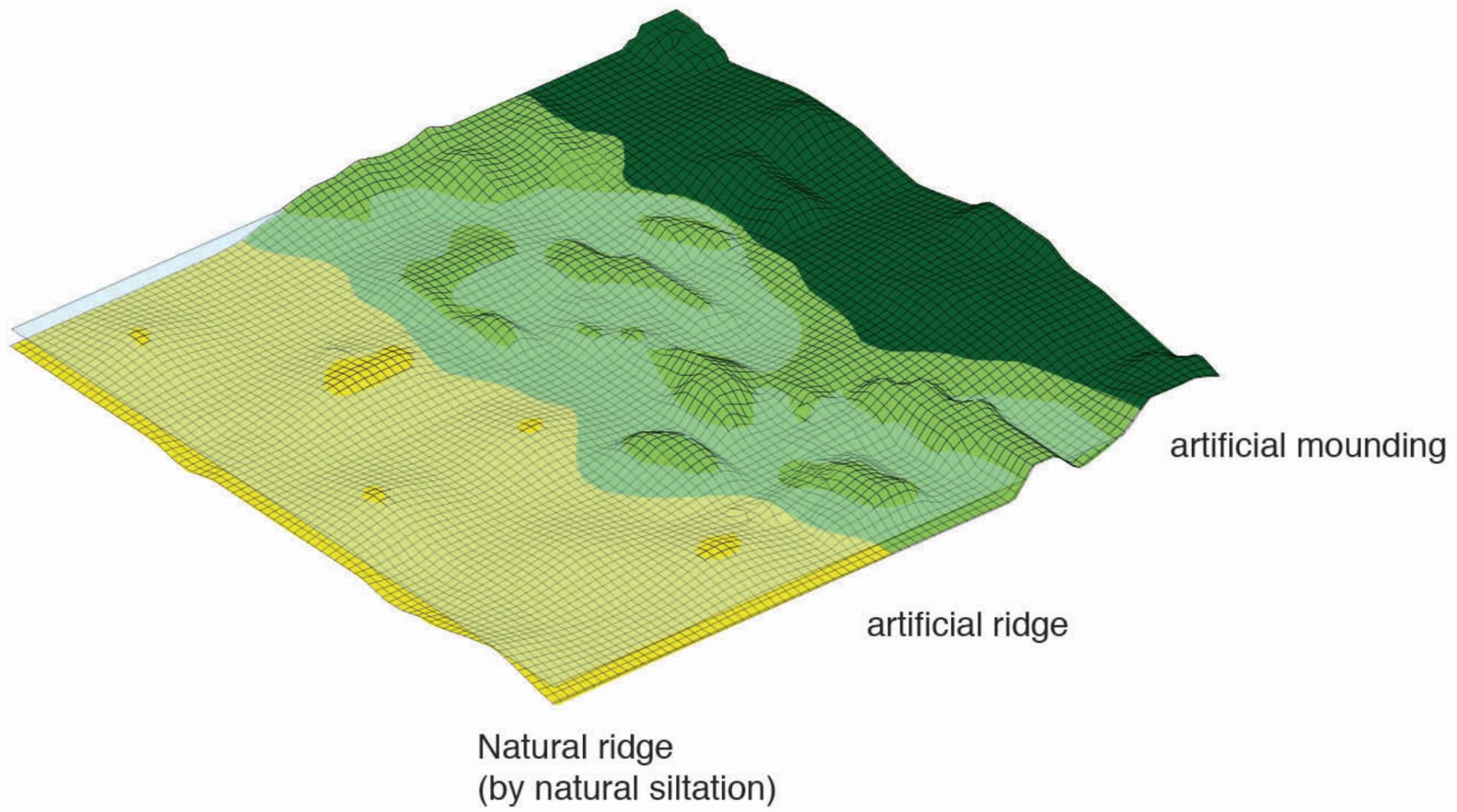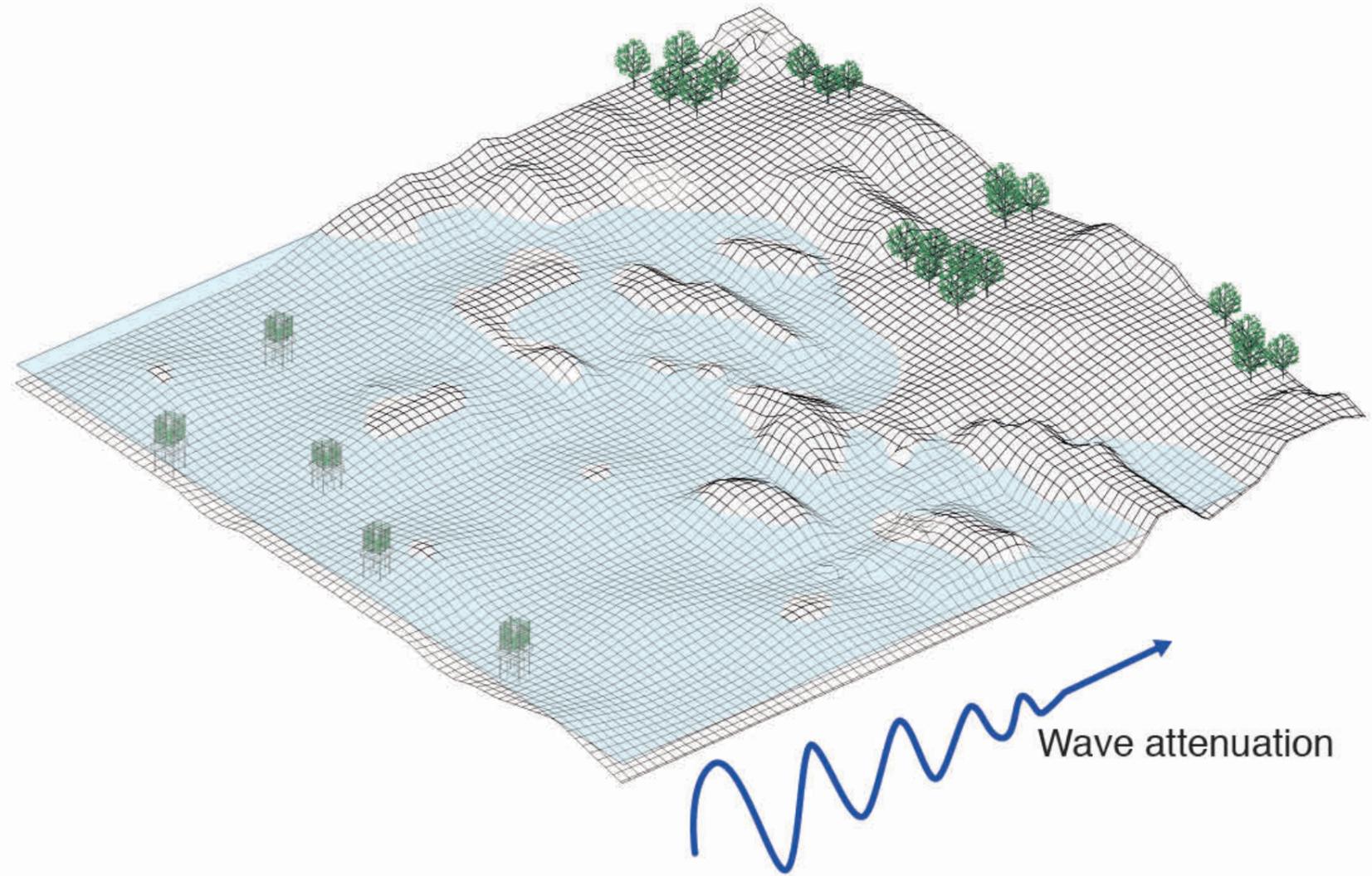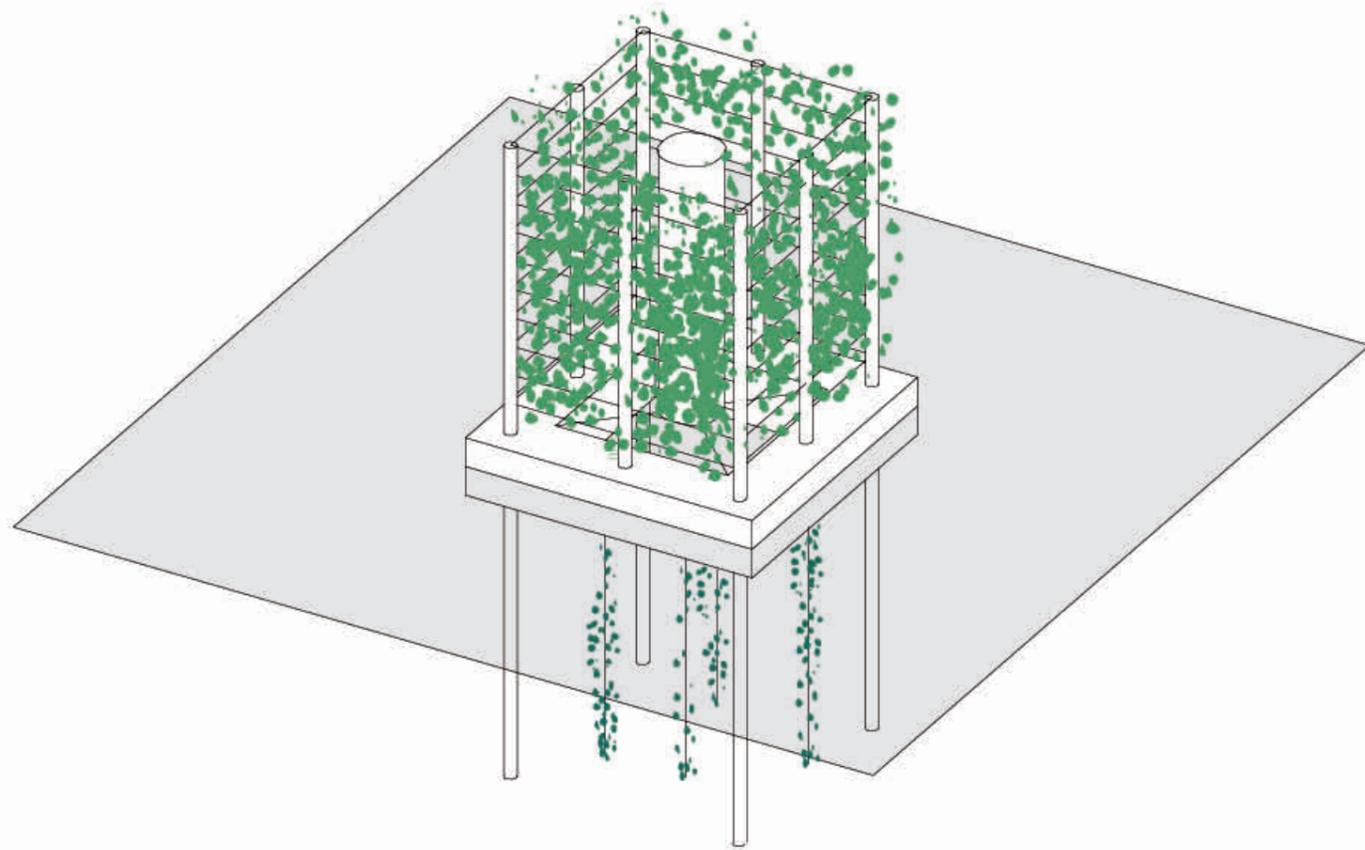
Wave attenuation

Wooden deck

Reed

▼ +1.0m

▼ +3.6m

▼ +3.0m
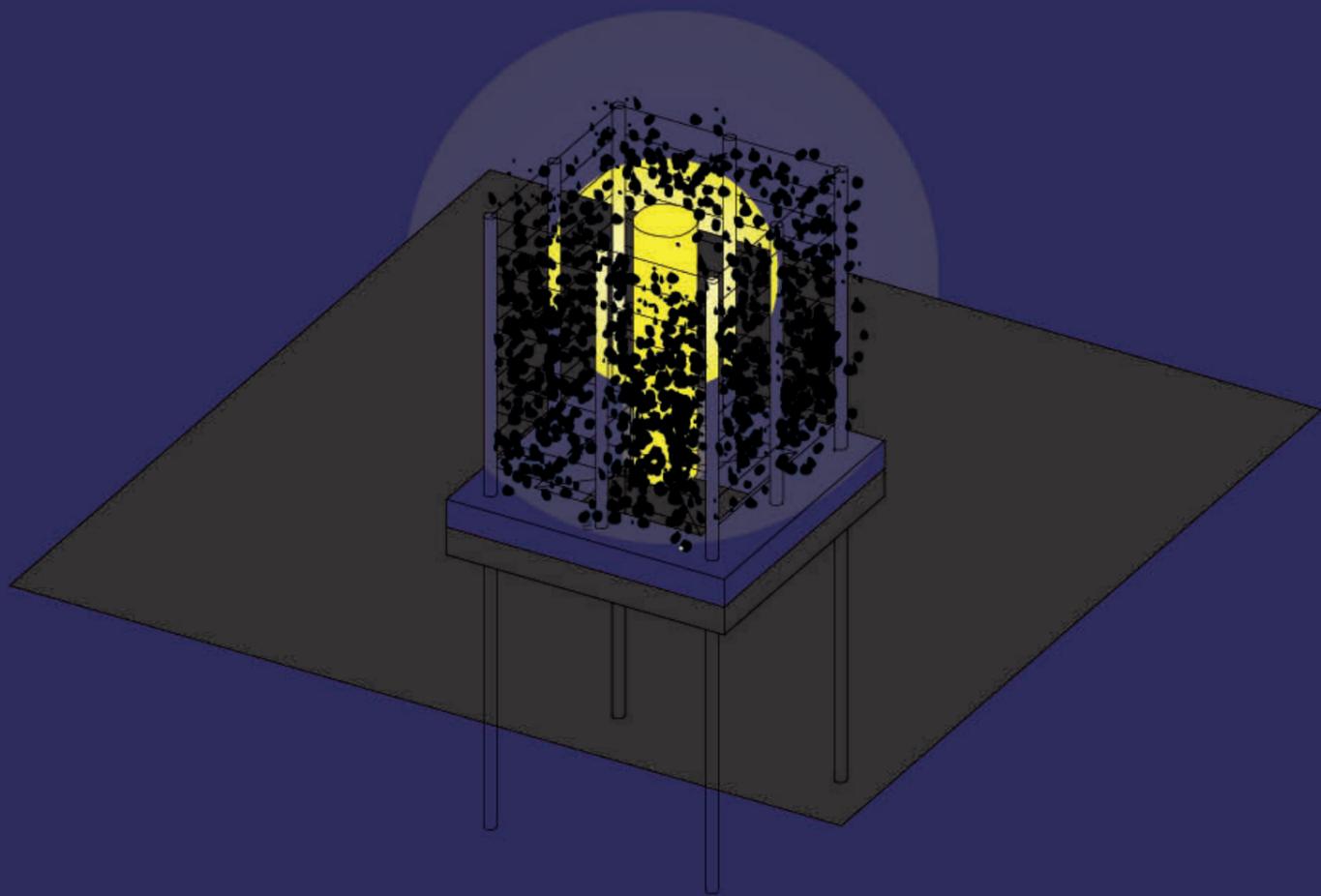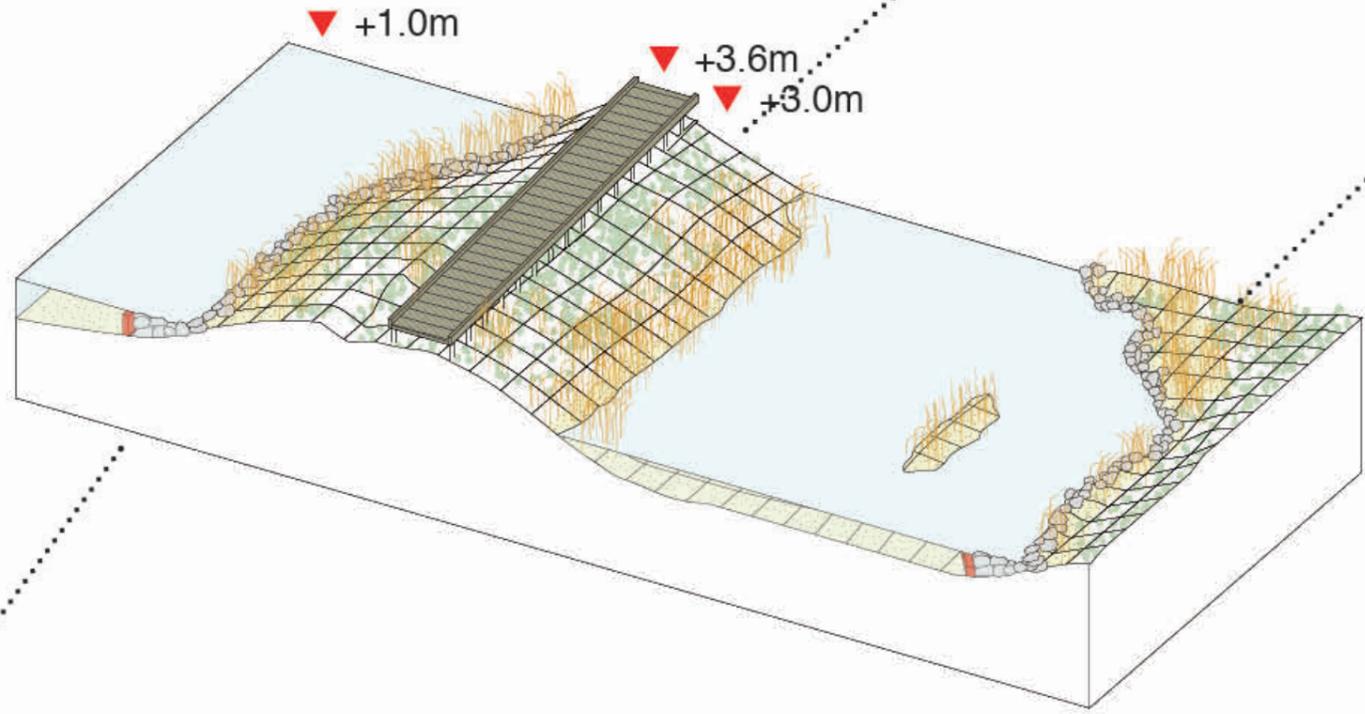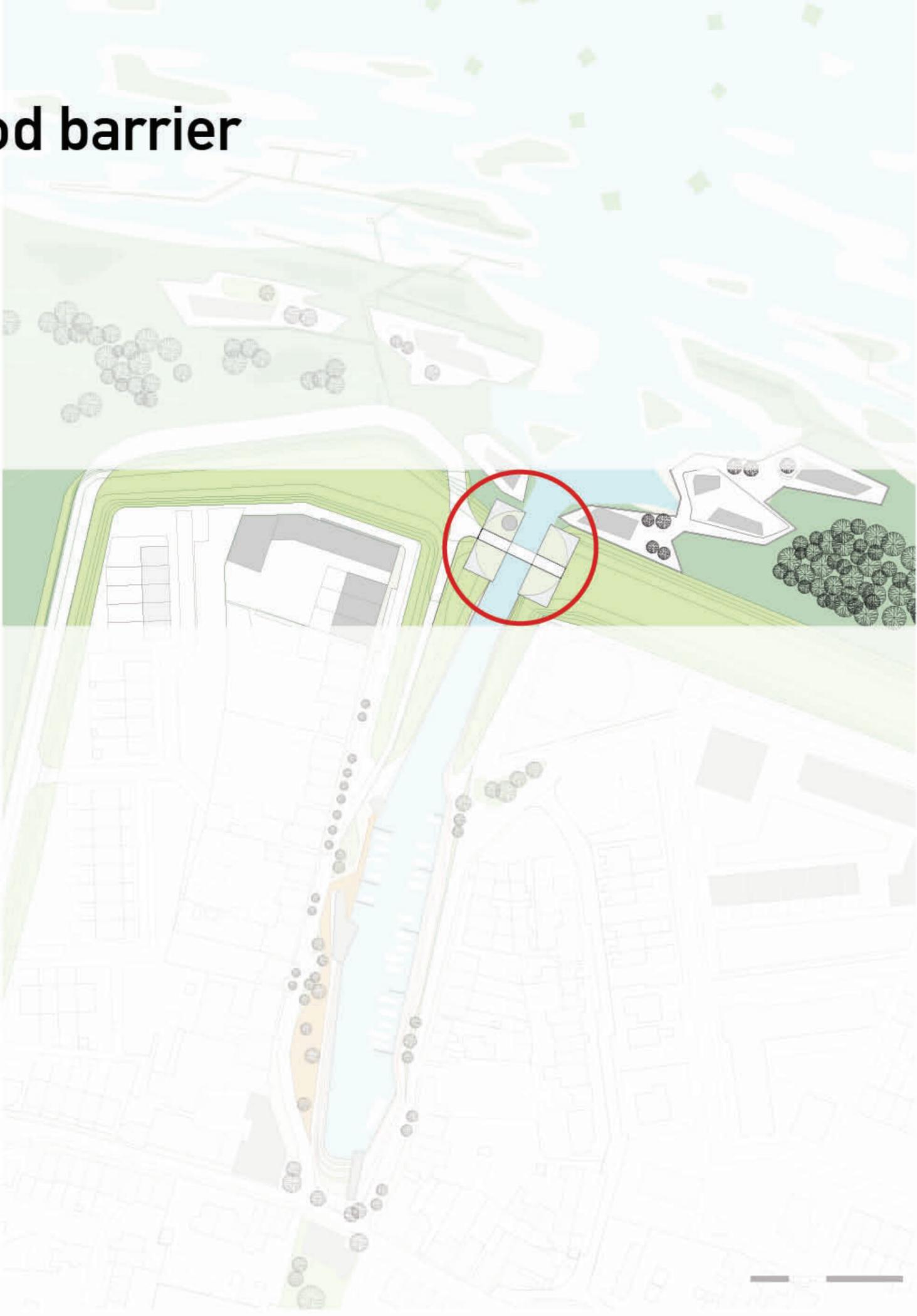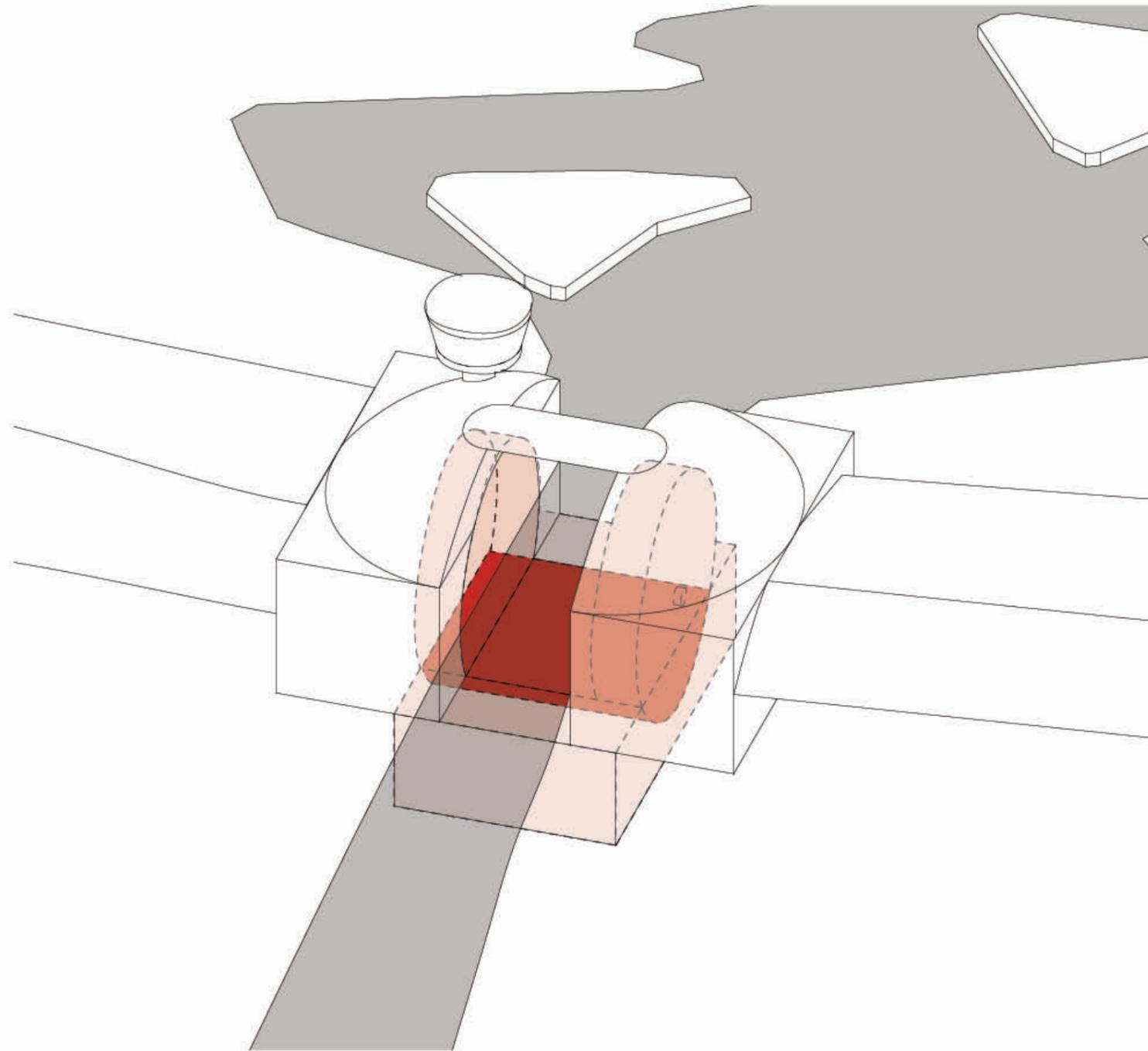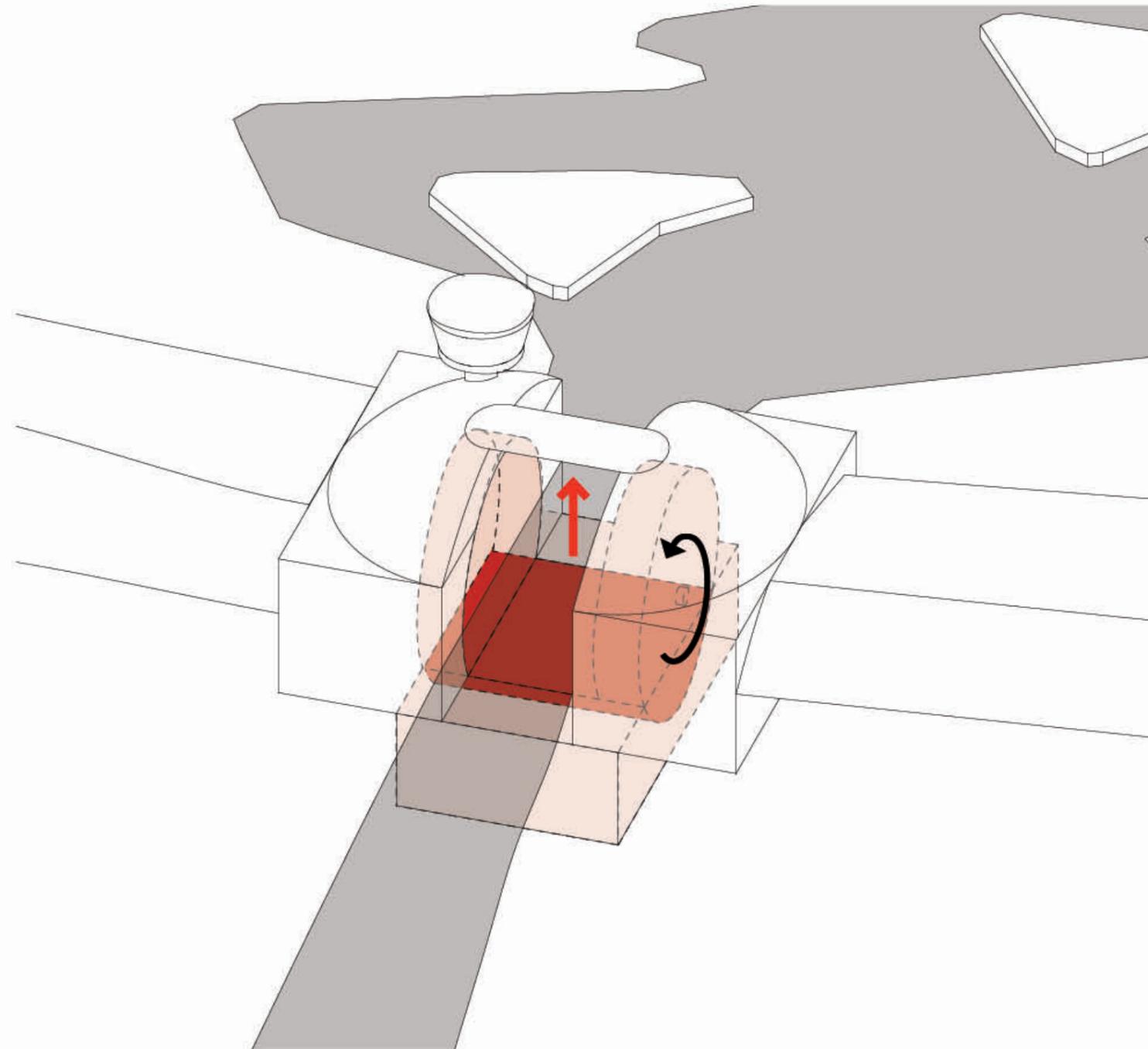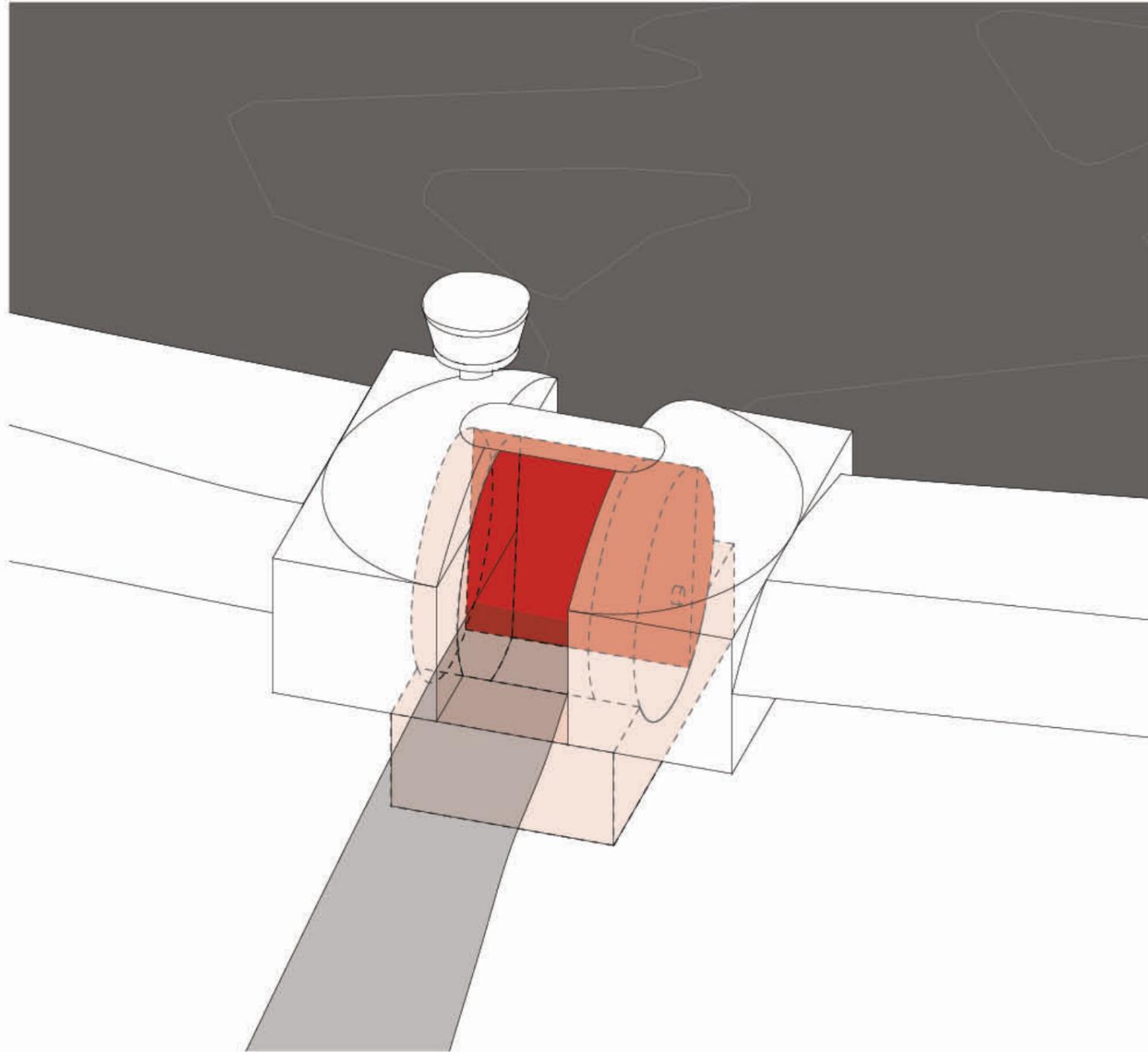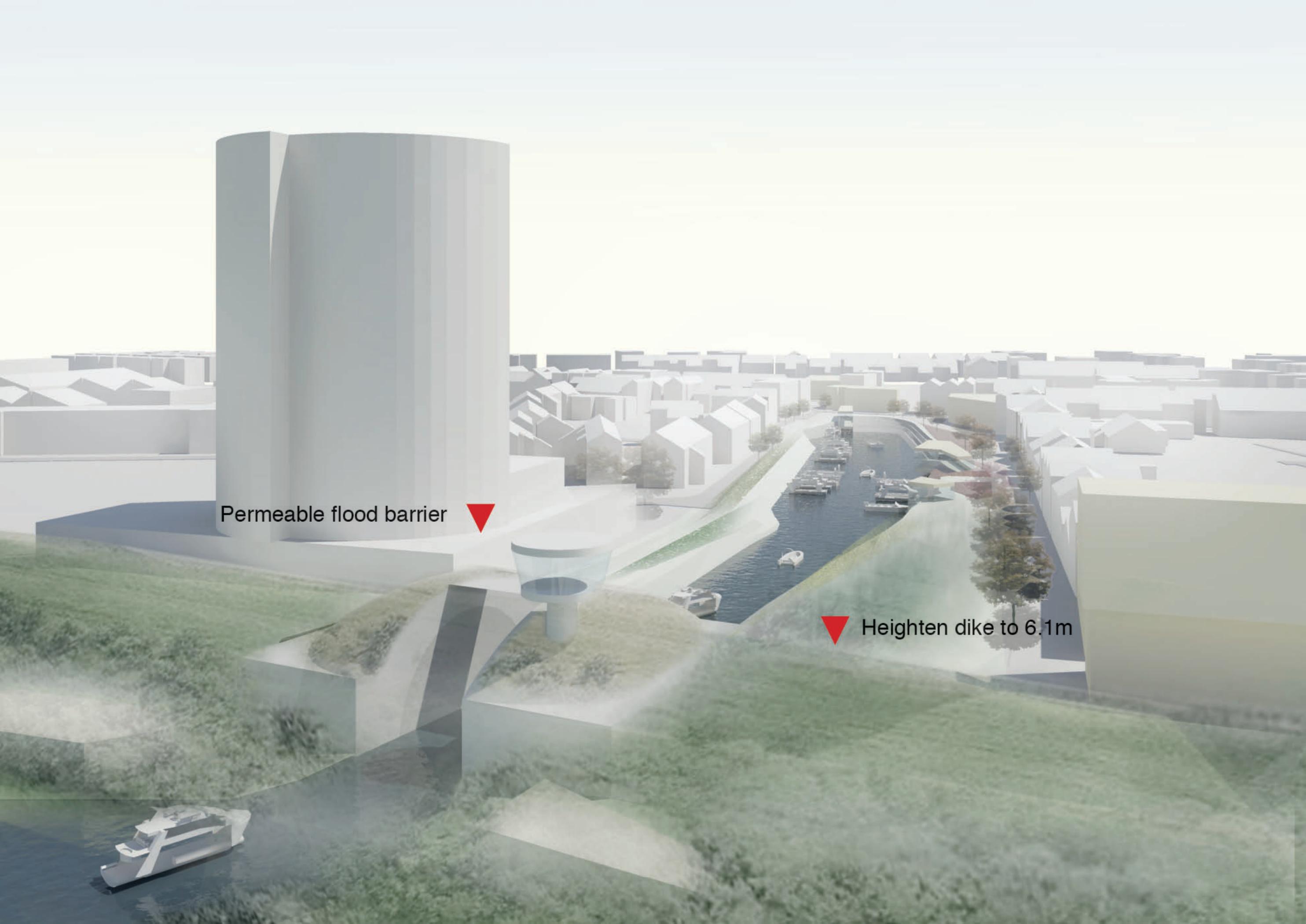
Stone

2. Permeable flood barrier

Flood barrier open (normal situation)

Flood barrier open (normal situation)

Flood barrier closed (higher flood than +3.6m)

Permeable flood barrier ▼

▼ Heighten dike to 6.1m

3. Open port
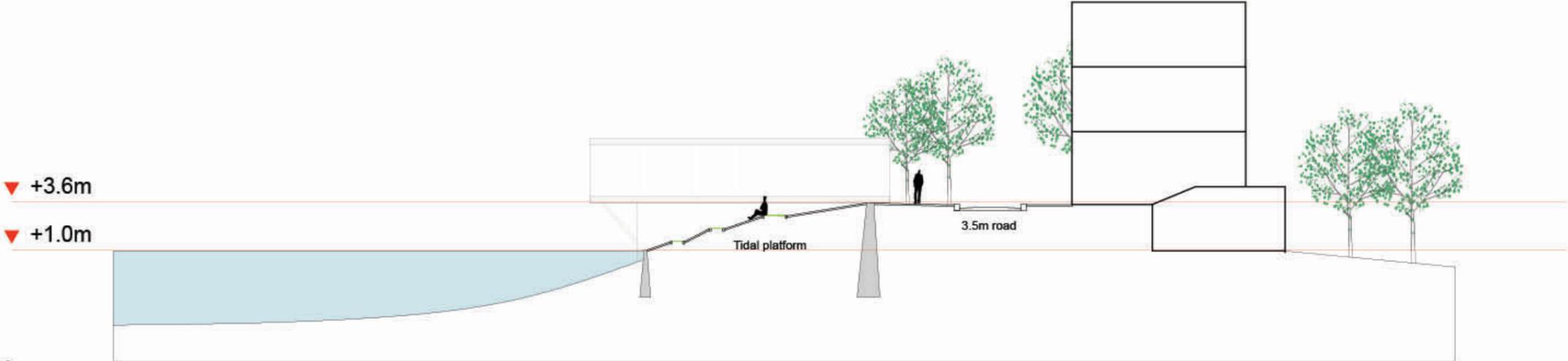
cafe

Restraurant
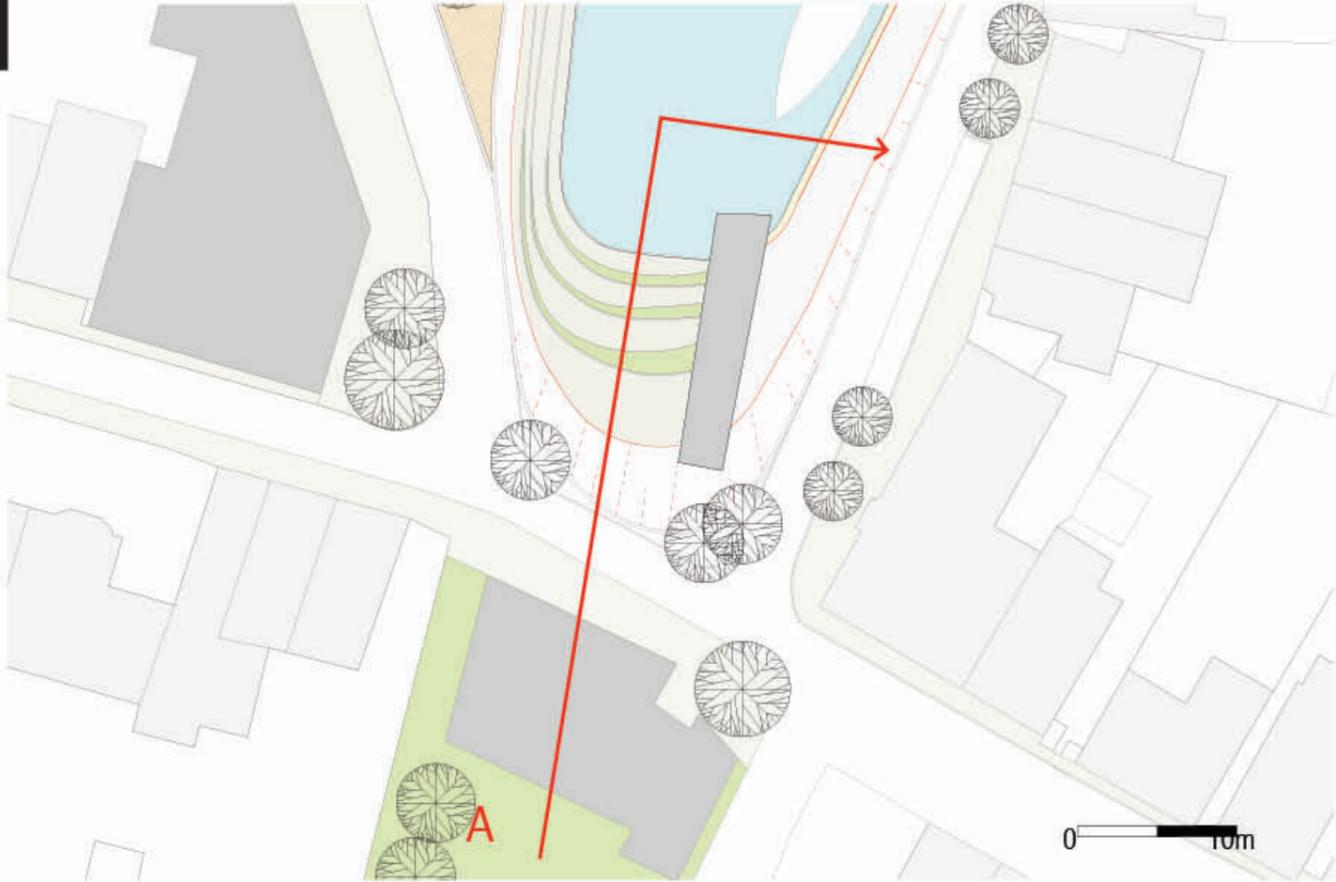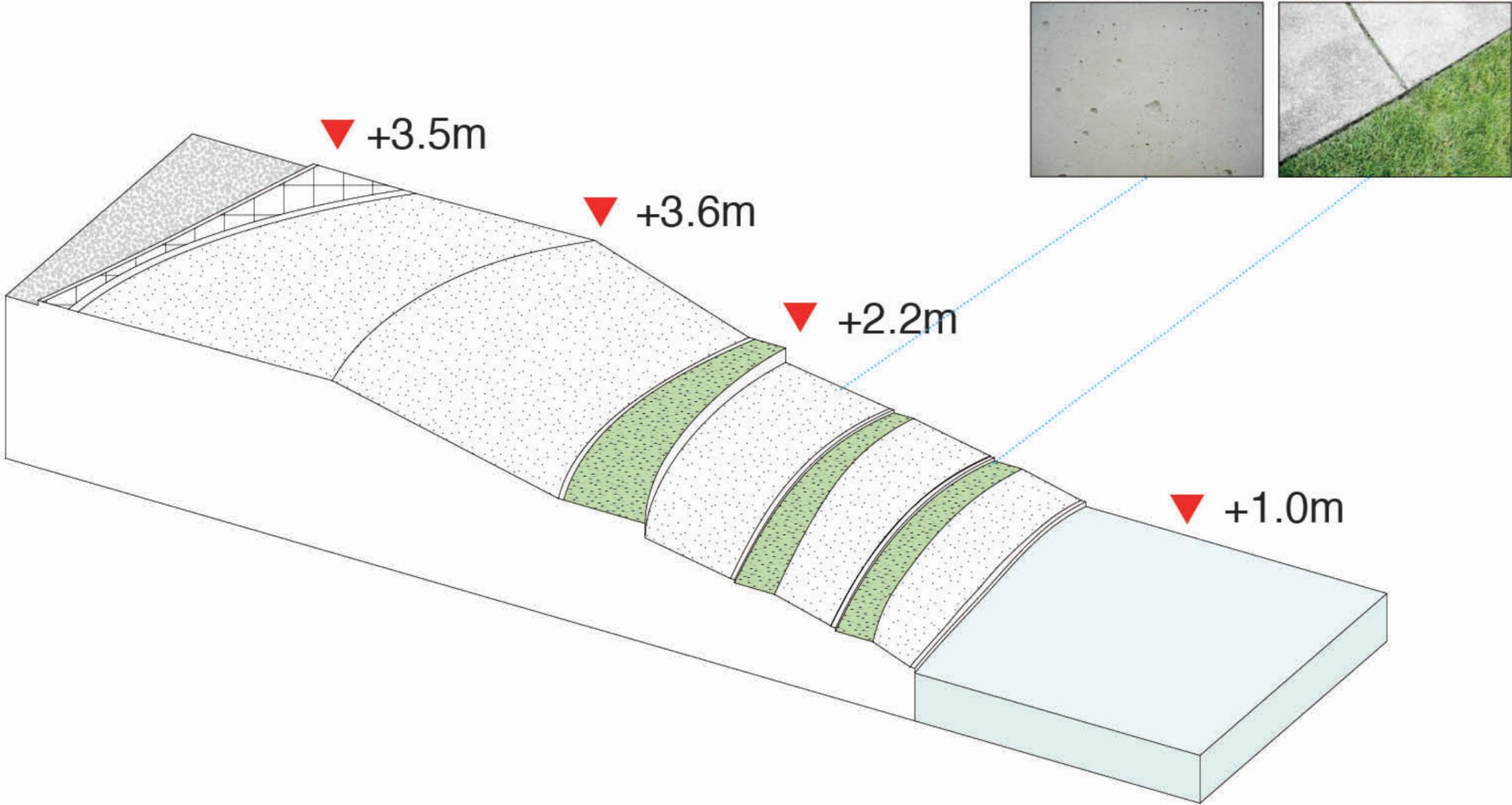
water bus
facility

Museum

0   25m

▼ 0m

▼+2.0m

▼+2.5m

▼+3.6m

▼+3.0m

▼+3.5m

▼ 0m

▼ 0m

▼ +2.0m

Slope park (+2.0 zone)

▼ +2.5m

▼ +3.6m

▼ +3.0m

Hidden slope (+3.0m zone)

▼ +3.5m

Intertidal platform (+3.5m zone)

▼ 0m

Intertidal platform (+3.5m~+3.6m)

0   10m

A

▼ +3.6m

▼ +1.0m

Tidal platform

3.5m road

A

Intertidal platform (+3.5m~+3.6m)

▼ +3.5m

▼ +3.6m

▼ +2.2m

▼ +1.0m

Hidden dike (+3.0m-3.6m)

▼ +3.6m
▼ +3.0m

▼ +1.0m

Parking   3.5m road
Wooden deck
Tidal slope
3.3m road

B

Hidden dike (+3.0m-3.6m)

▼ +3.0m

▼ +3.6m

▼ +1.0m

Slope park (+2.0m-+3.6m)

▼ +3.6m
▼ +2.0m
▼ +1.0m

3.5m road

Wooden deck

3.8m road

c

Slope park (+2.0m-+3.6m)

+2.0m ▼

▼ +3.6m

▼ +1.0m