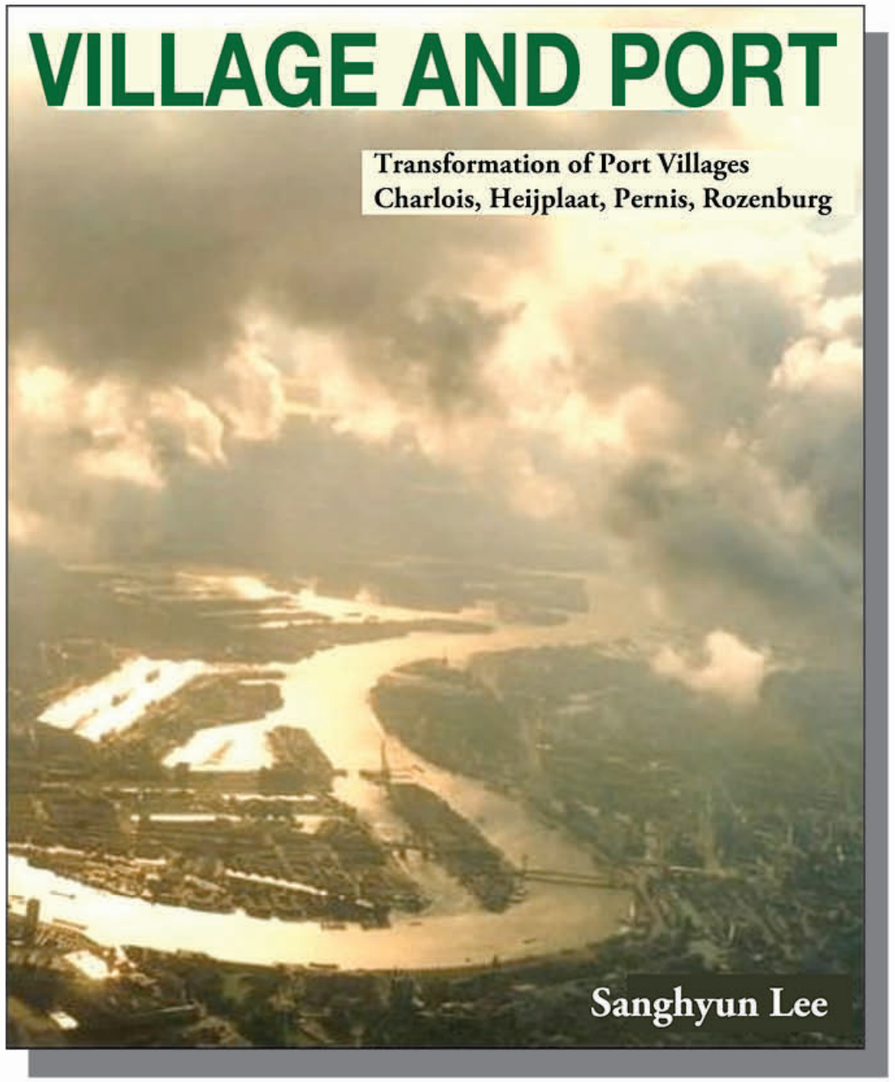
Working with Extremes; Hard or Soft approach?

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

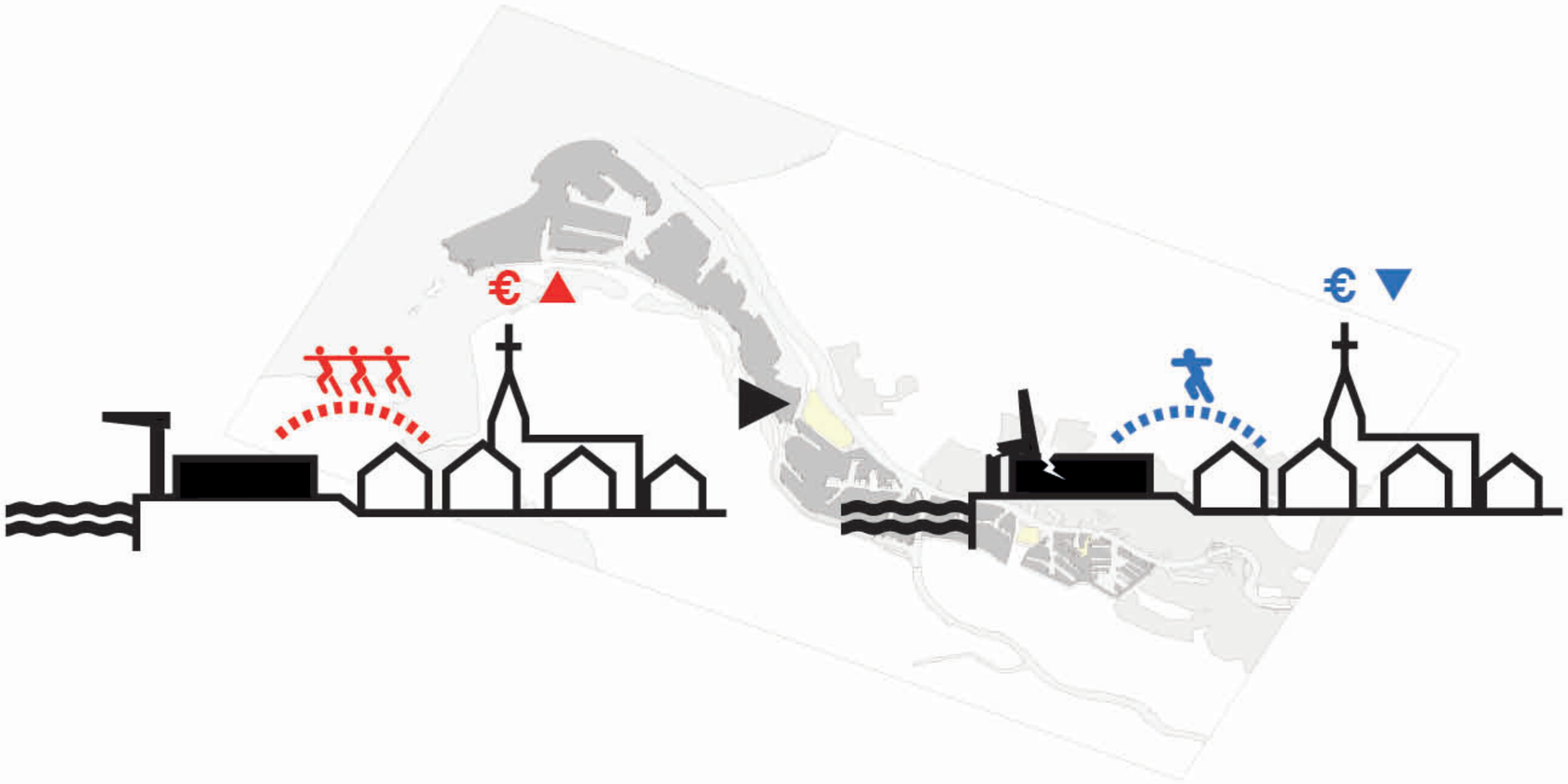


On the southern riverbank
of Rotterdam

Why ?

Port change

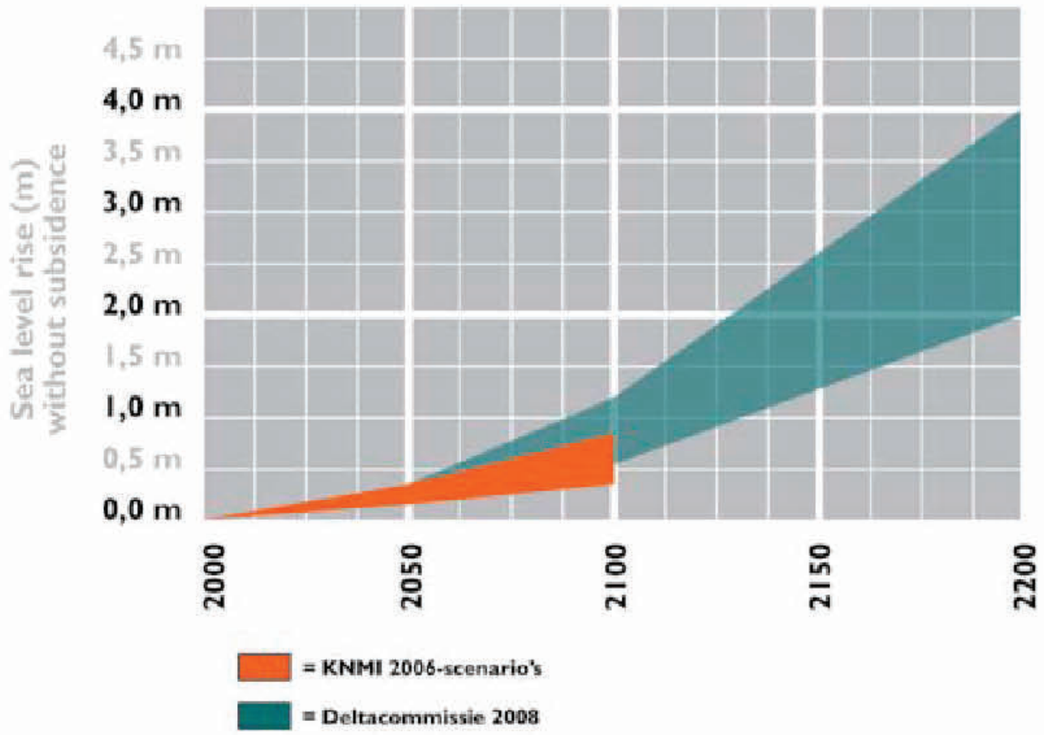
Port moves out westward



Settlements follows port **decline**

Port change is an opportunity
to improve **regional structure**

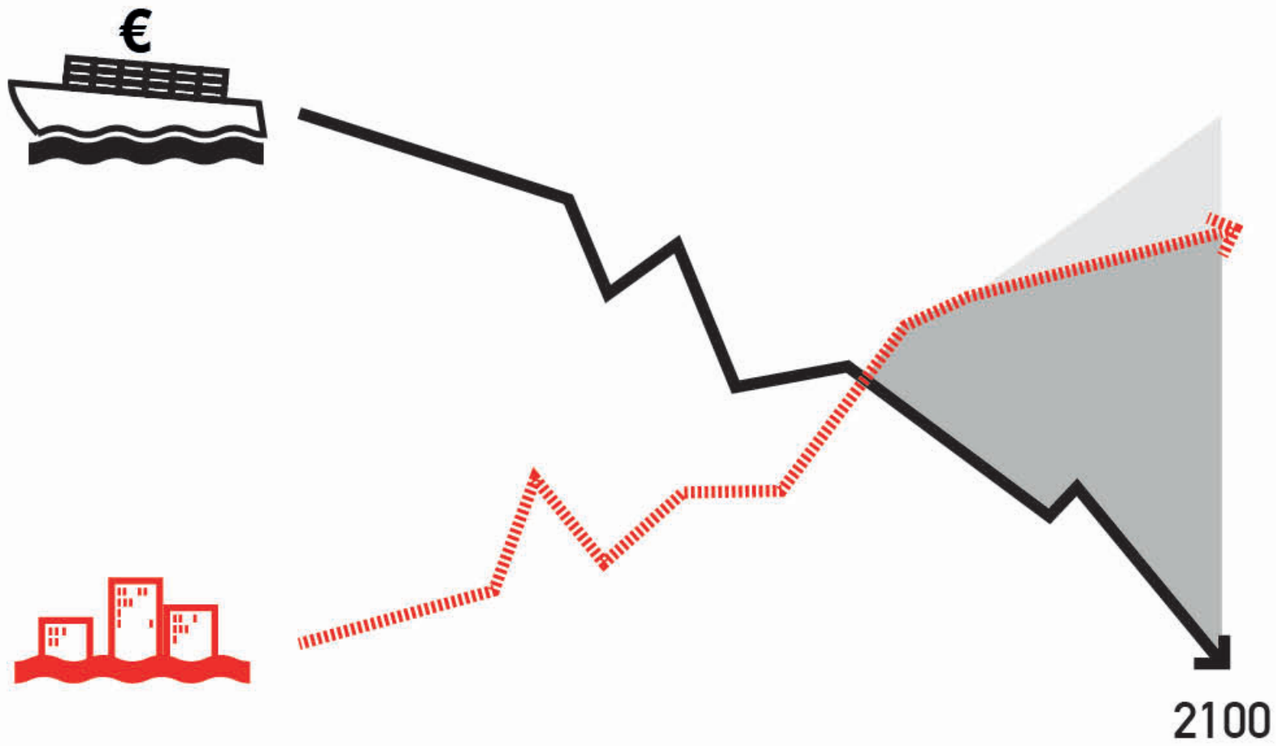
Climate change

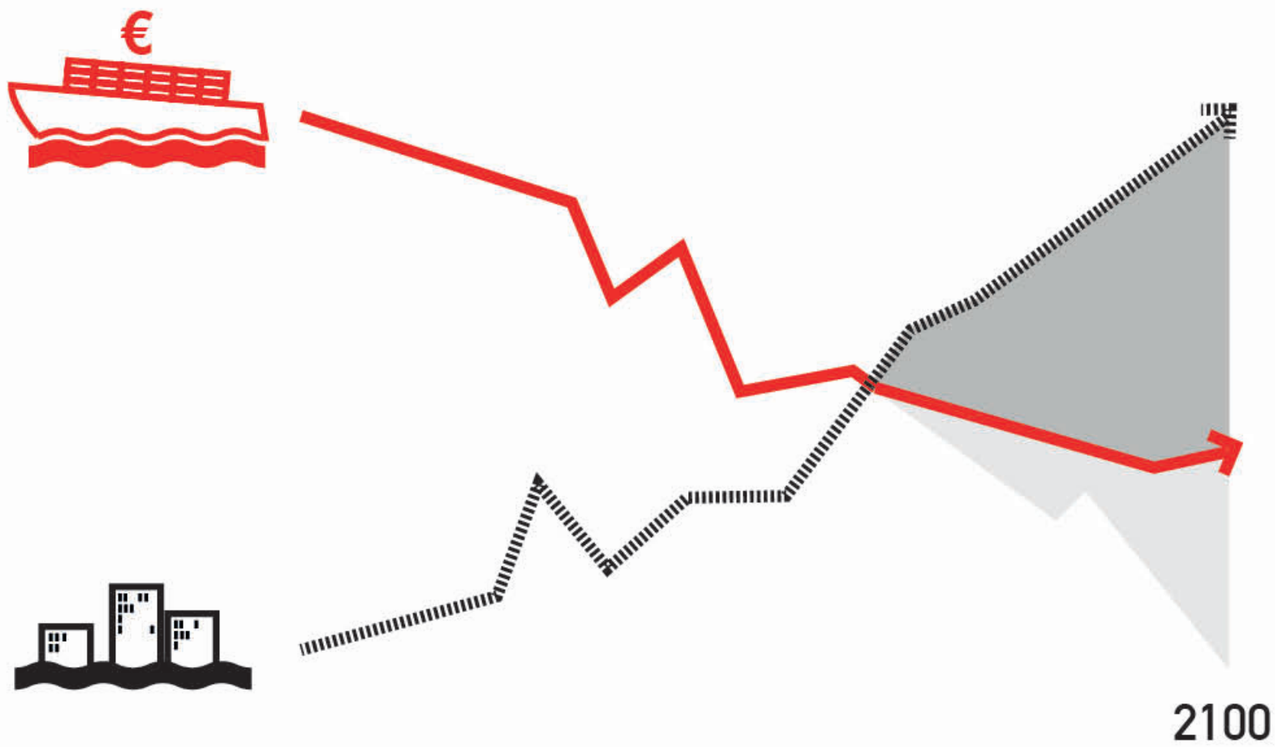


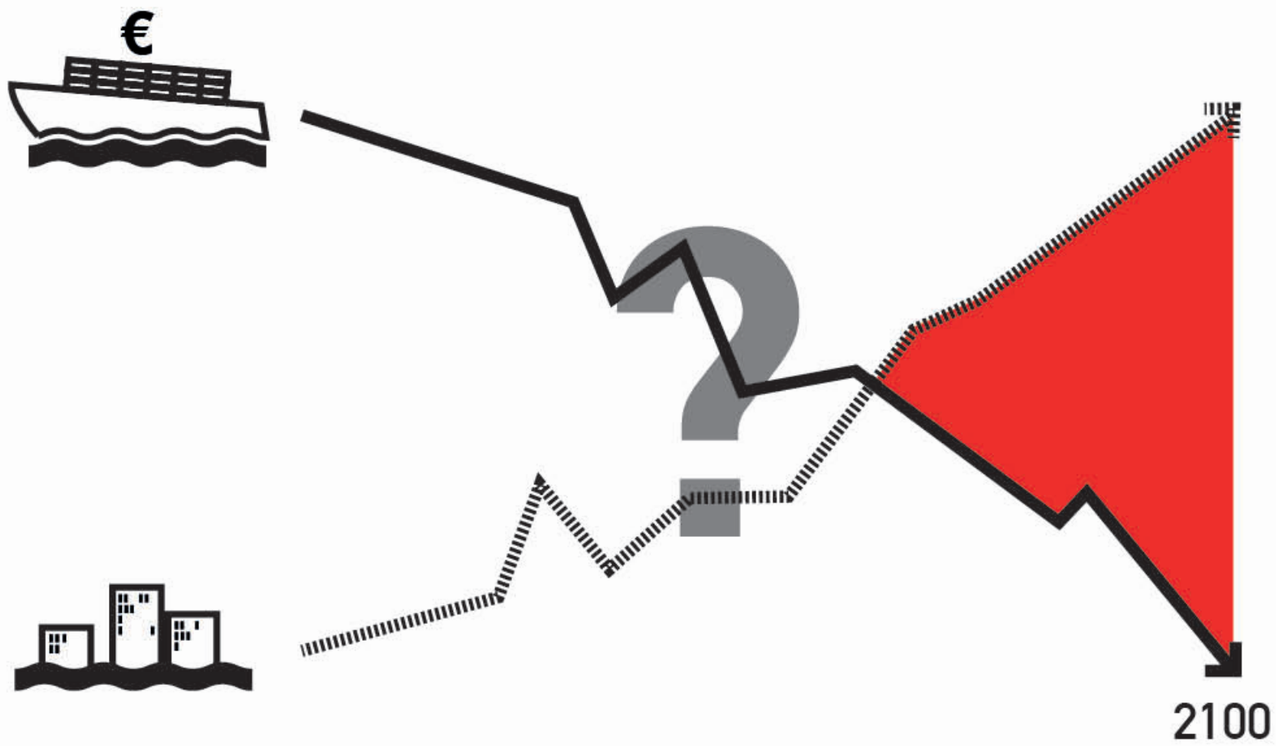
Sea level rise scenarios

(Delta commitee 2008)

Port decline + Climate change

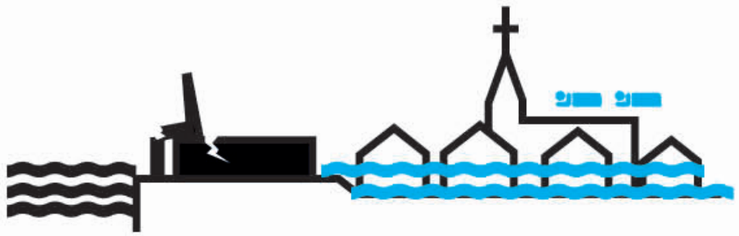

€
2100


€
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

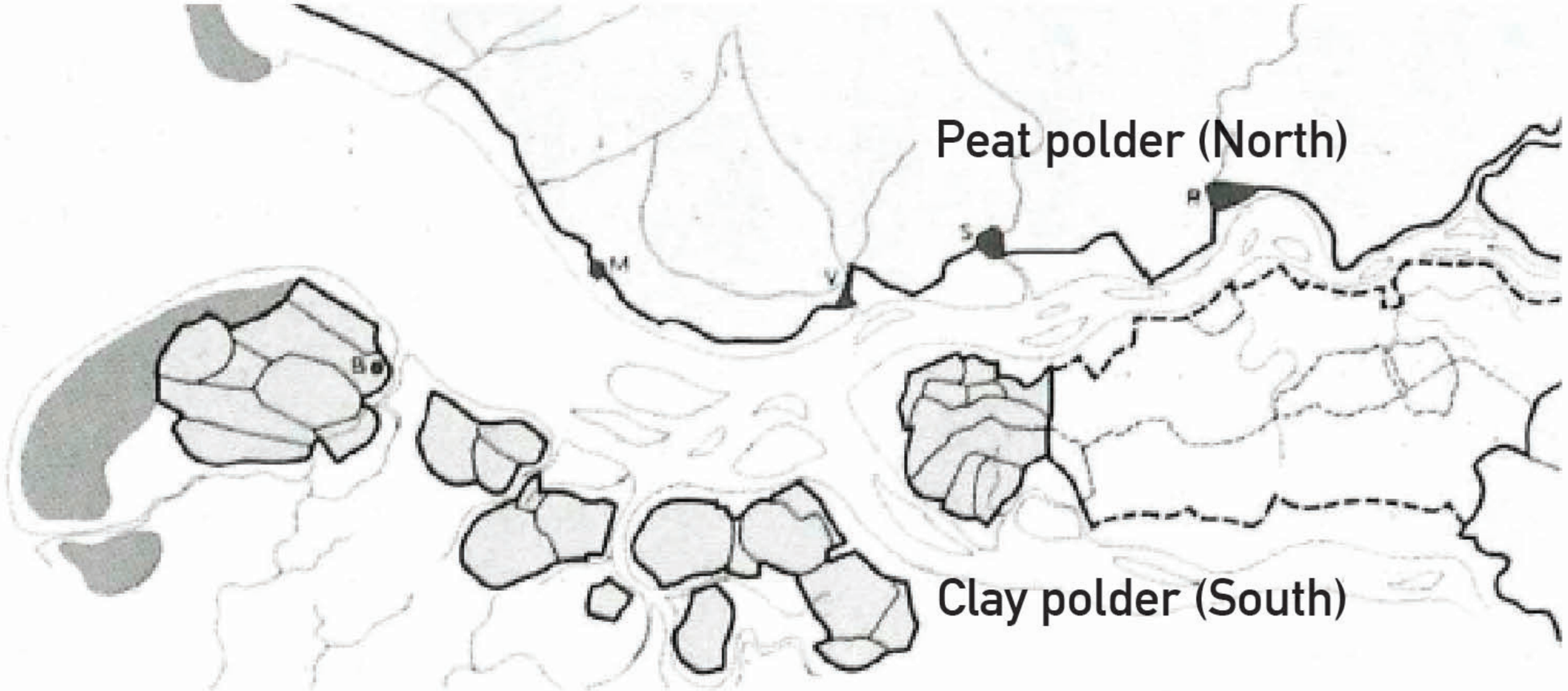
Design proposal

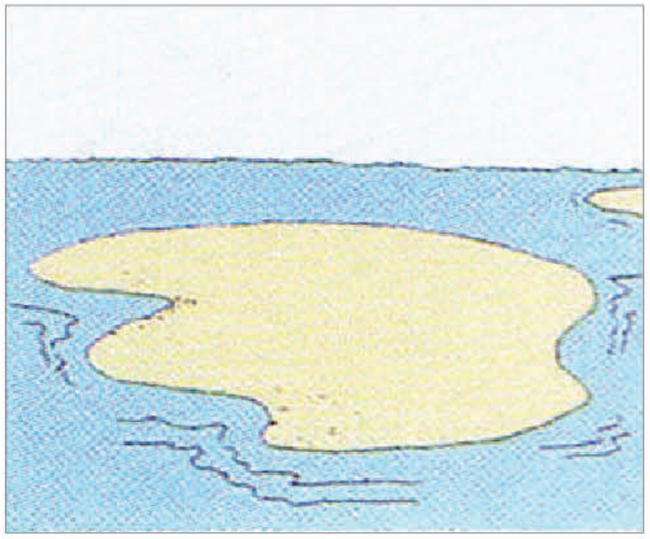
6

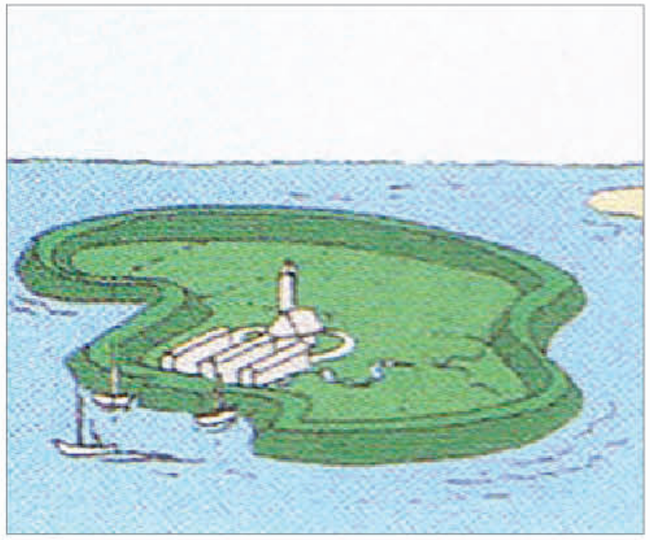
Landscape & History

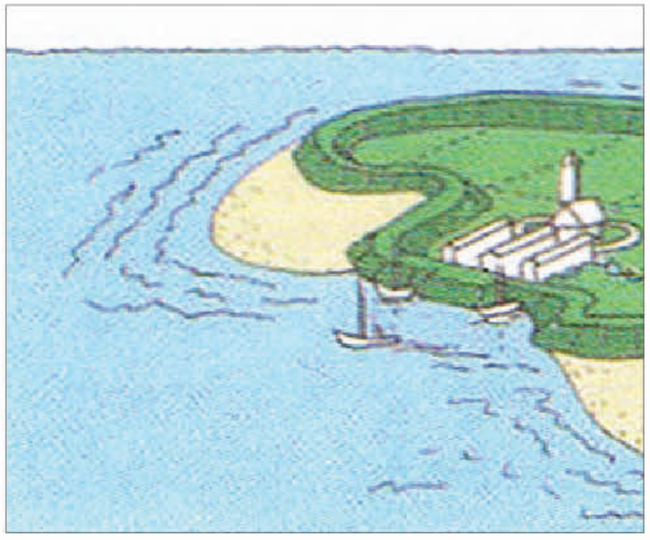
Southern riverbank

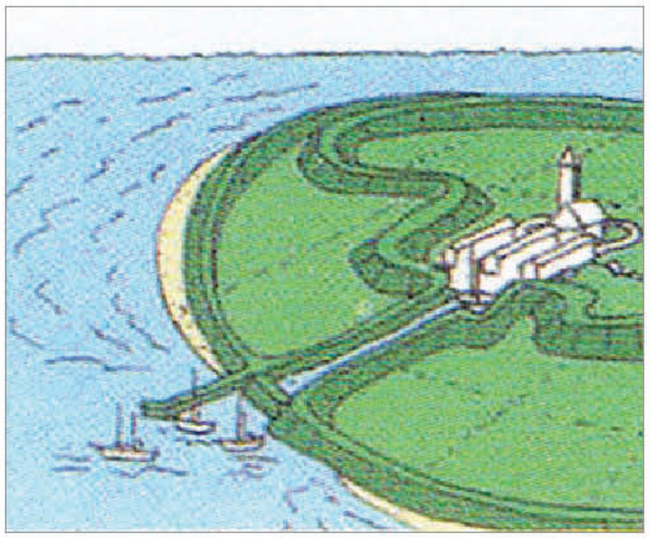
Rotterdam region in 1400

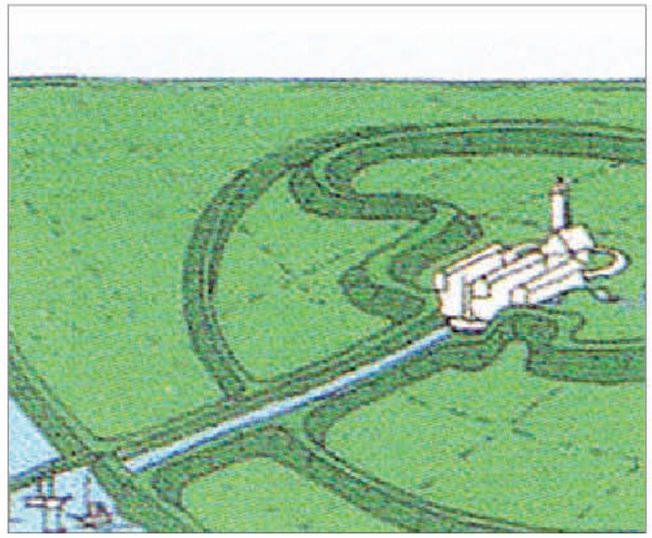

Peat polder (North)
Clay polder (South)











settlement developement
on the clay polder

Settlements

Southern riverbank

Fishing village

Before 1870s
Fishing village

ship channel

Before 1870s
Fishing village

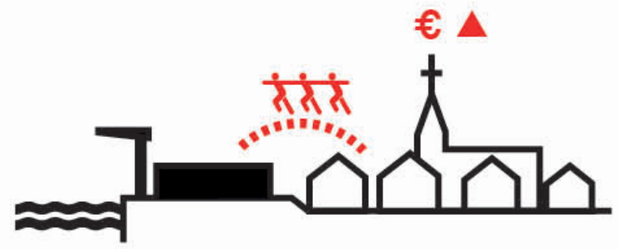
1872 Nieuw Waterweg(ship channel of Rotterdam port)

Port village

Before 1870s
Fishing village

1872 Nieuw Waterweg(ship channel of Rotterdam port)

After 1870s
Port village



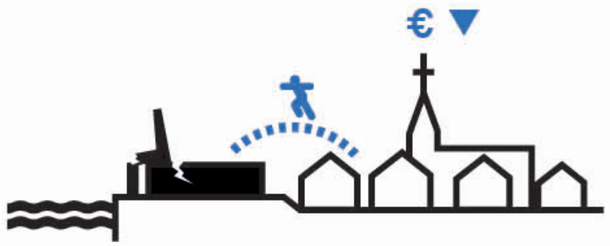
Before 1870s
Fishing village

1872 Nieuw Waterweg(ship channel of Rotterdam port)

After 1870s
Port village

Post-Port village

After 1990s
Post-port village



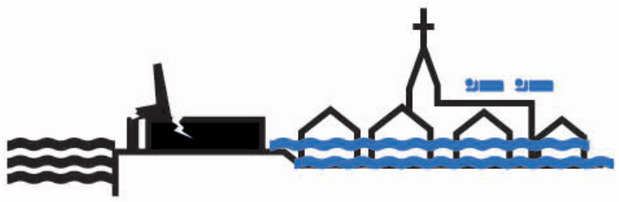
Before 1870s
Fishing village

1872 Nieuw Waterweg(ship channel of Rotterdam port)

After 1870s
Port village

After 1990s
Post-port village

After 2012
Climate change + Port decline



Post-Port village

Climate change

1850

Fishing village

Niew Rozenburg

Oud Rozenburg

Blankenburg

Pernis

De Heij

Charlois

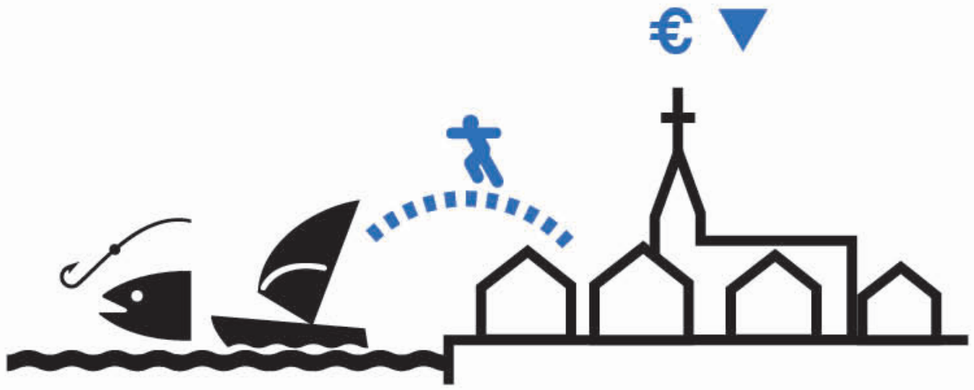
Katendrecht

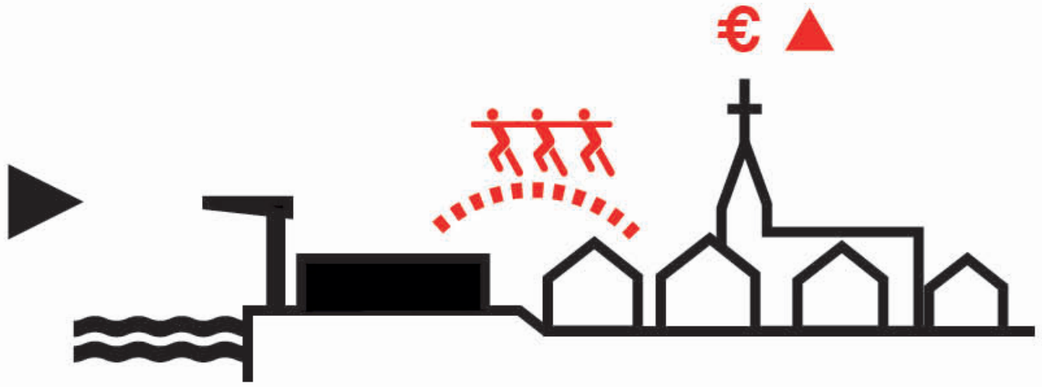
1880
Fishing village

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

Niew Rozenburg
Oud Rozenburg
Blankenburg
Pernis
Heijplaat
Charlois
Katendrecht

1965
Port village

Rozenburg

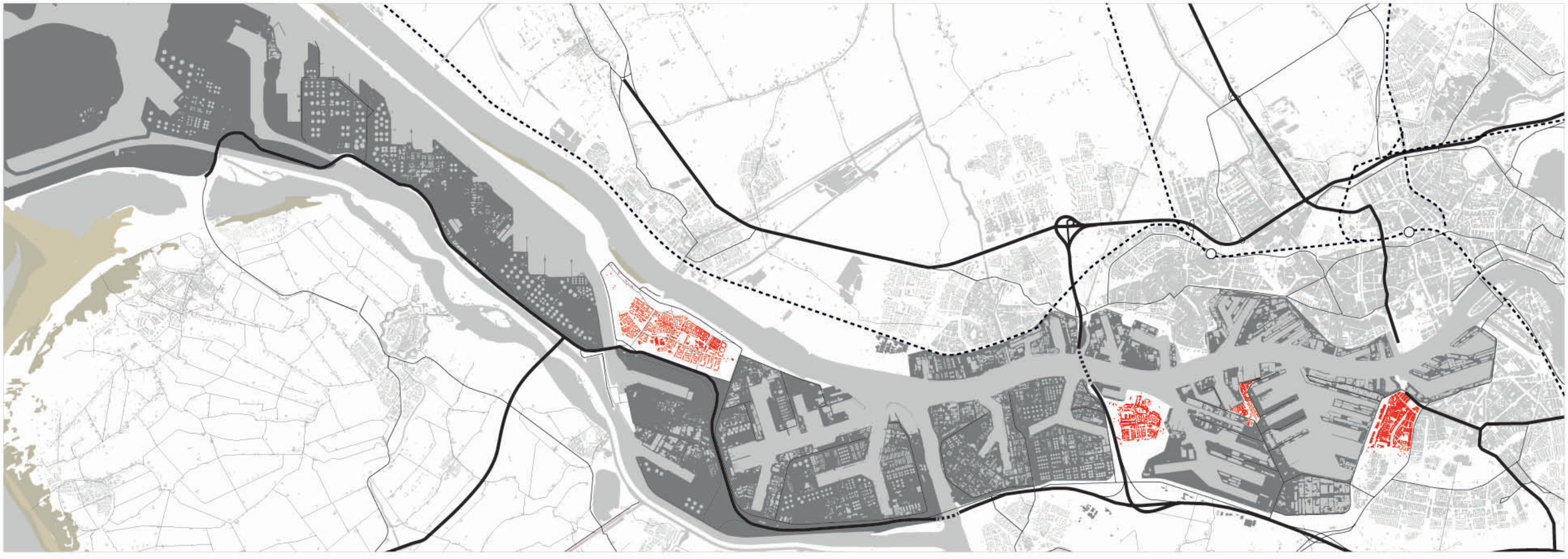
Blankenburg

Pernis

Heijplaat

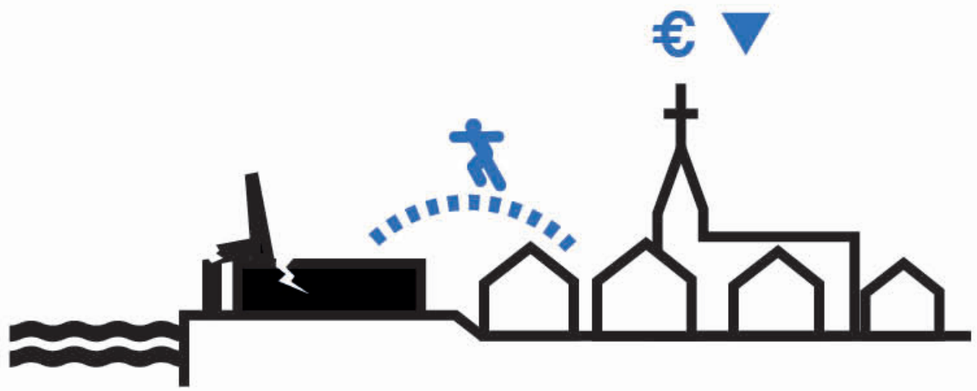
Charlois

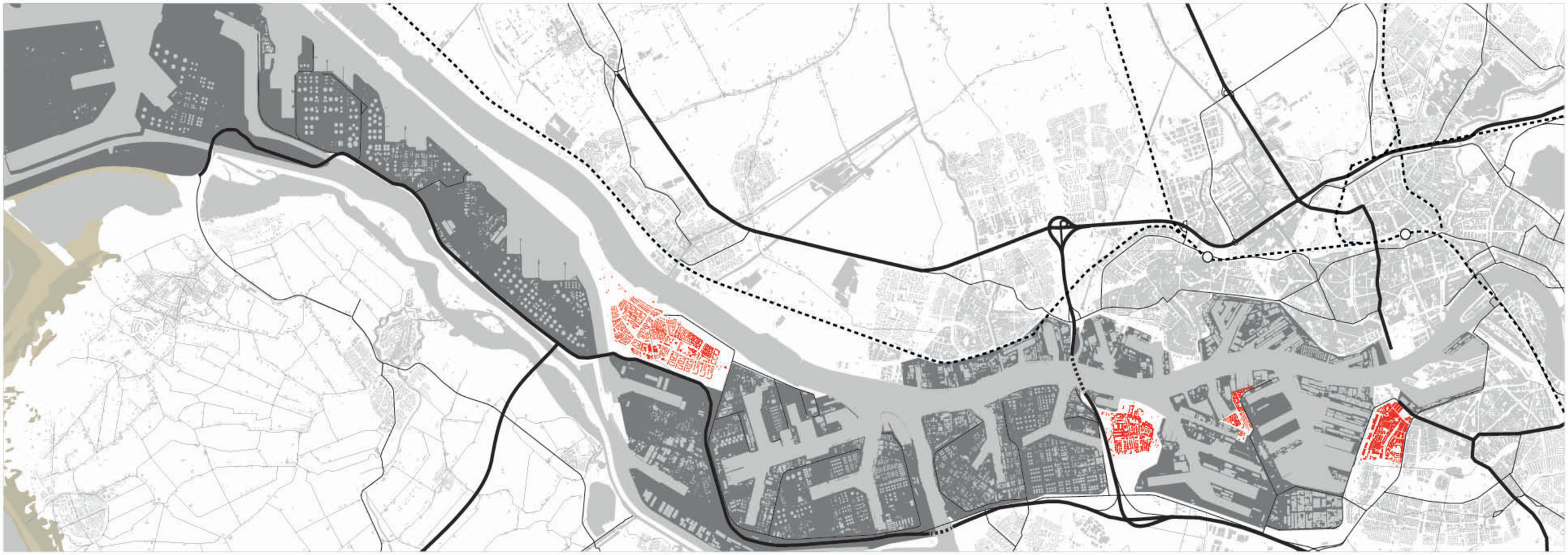
Katendrecht



1980
Port village

Rozenburg
Blankenburg
Pernis
Heijplaat
Charlois
Katendrecht





1995

Post-port village

Rozenburg

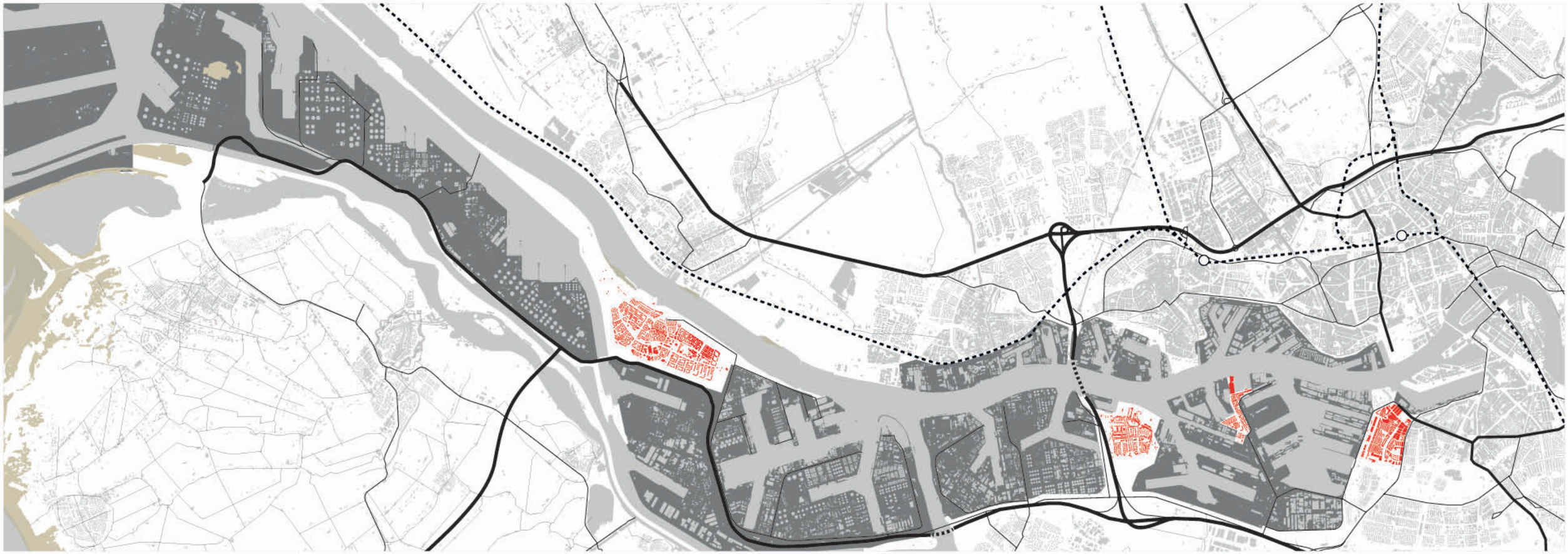
Blankenburg

Pernis

Heijplaat

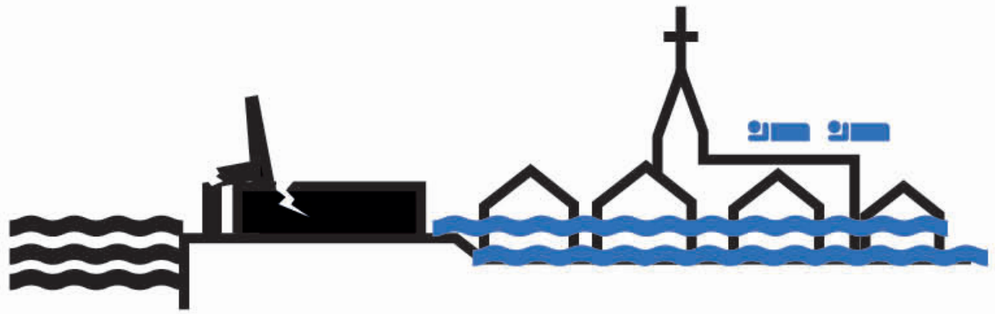
Charlois

Katendrecht



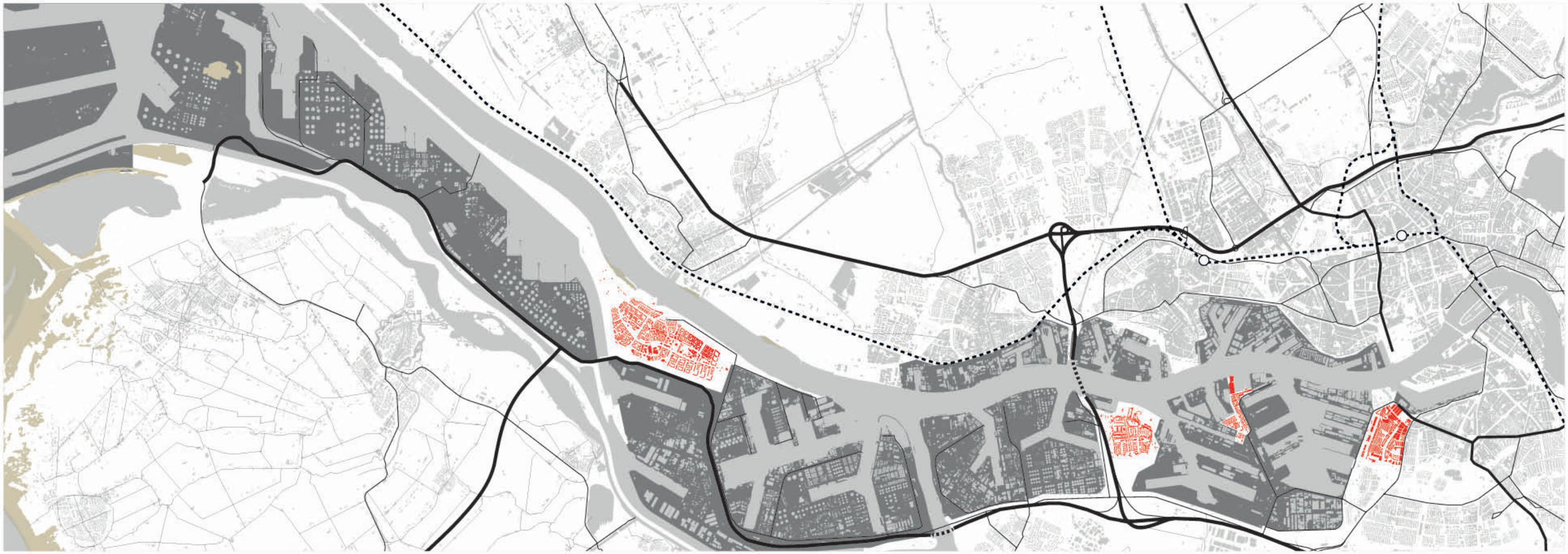
2012
Post-port village

Rozenburg
Blankenburg
Pernis
Heijplaat
Charlois
Katendrecht



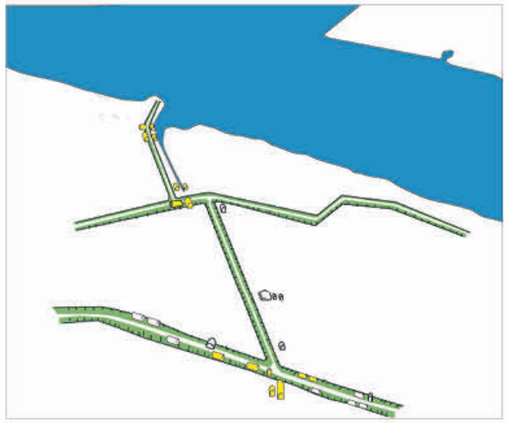
4 Settlements

Southern riverbank

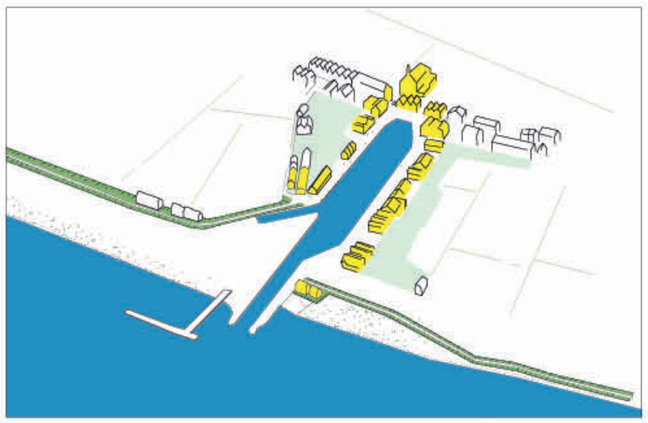


2012
Post-port village

Rozenburg
Blankenburg
Pernis
Heijplaat
Charlois
Katendrecht



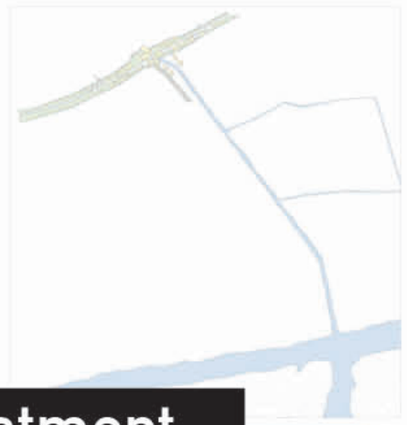
Rozenburg



Pernis

Heijplaat

Charlois



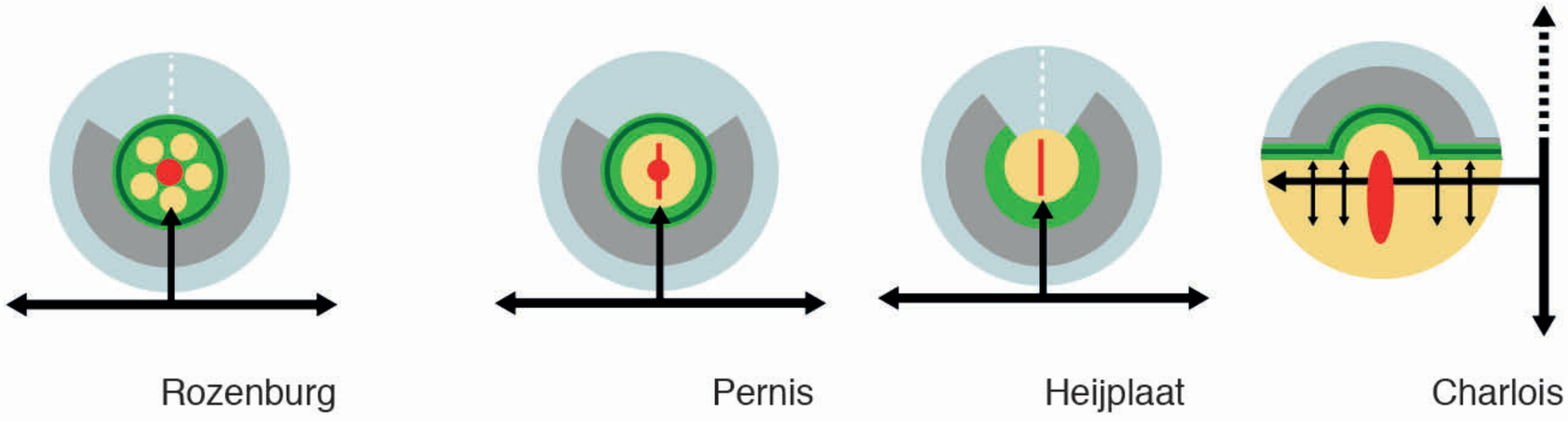
Different treatment

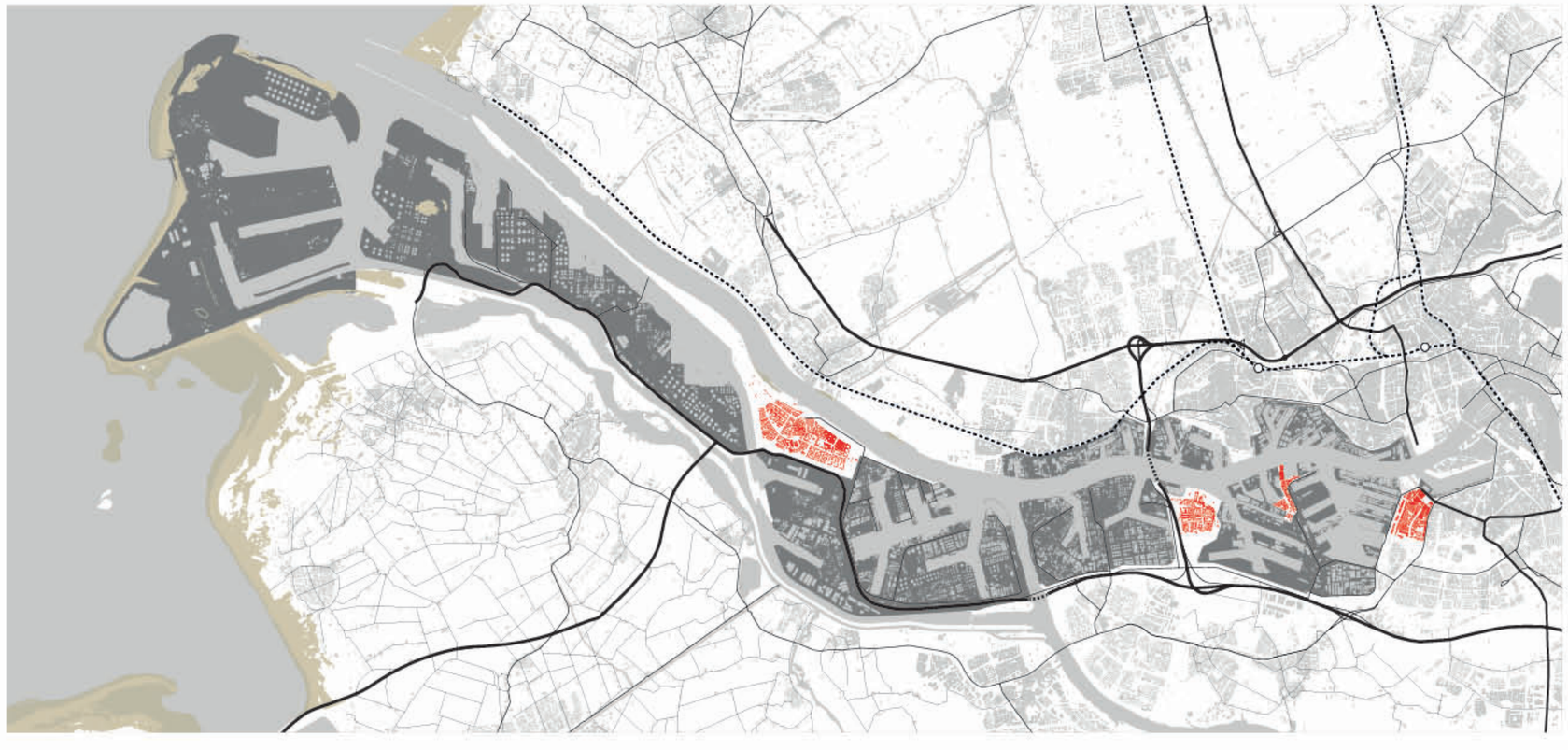
Rozenburg

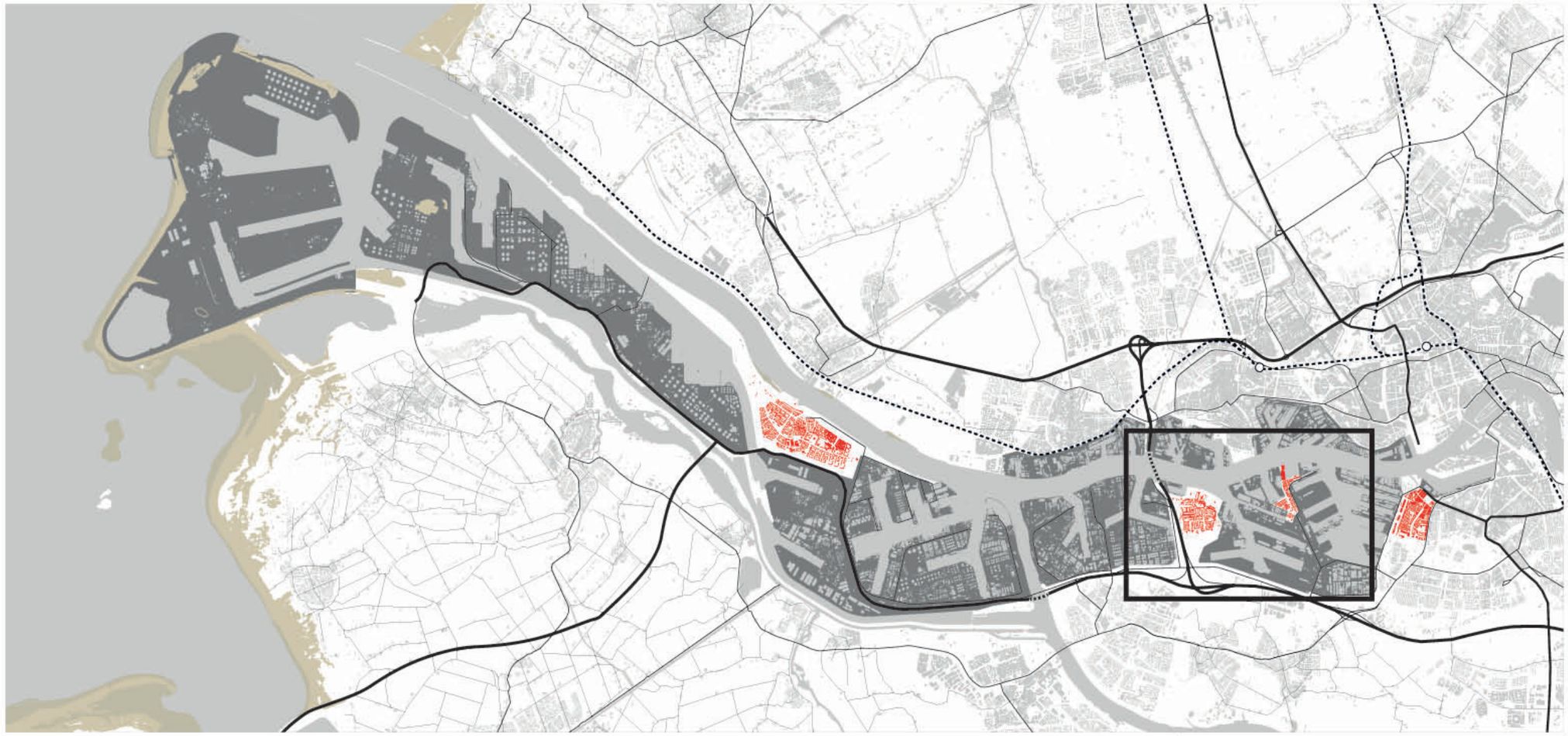
Pernis

Heijplaat

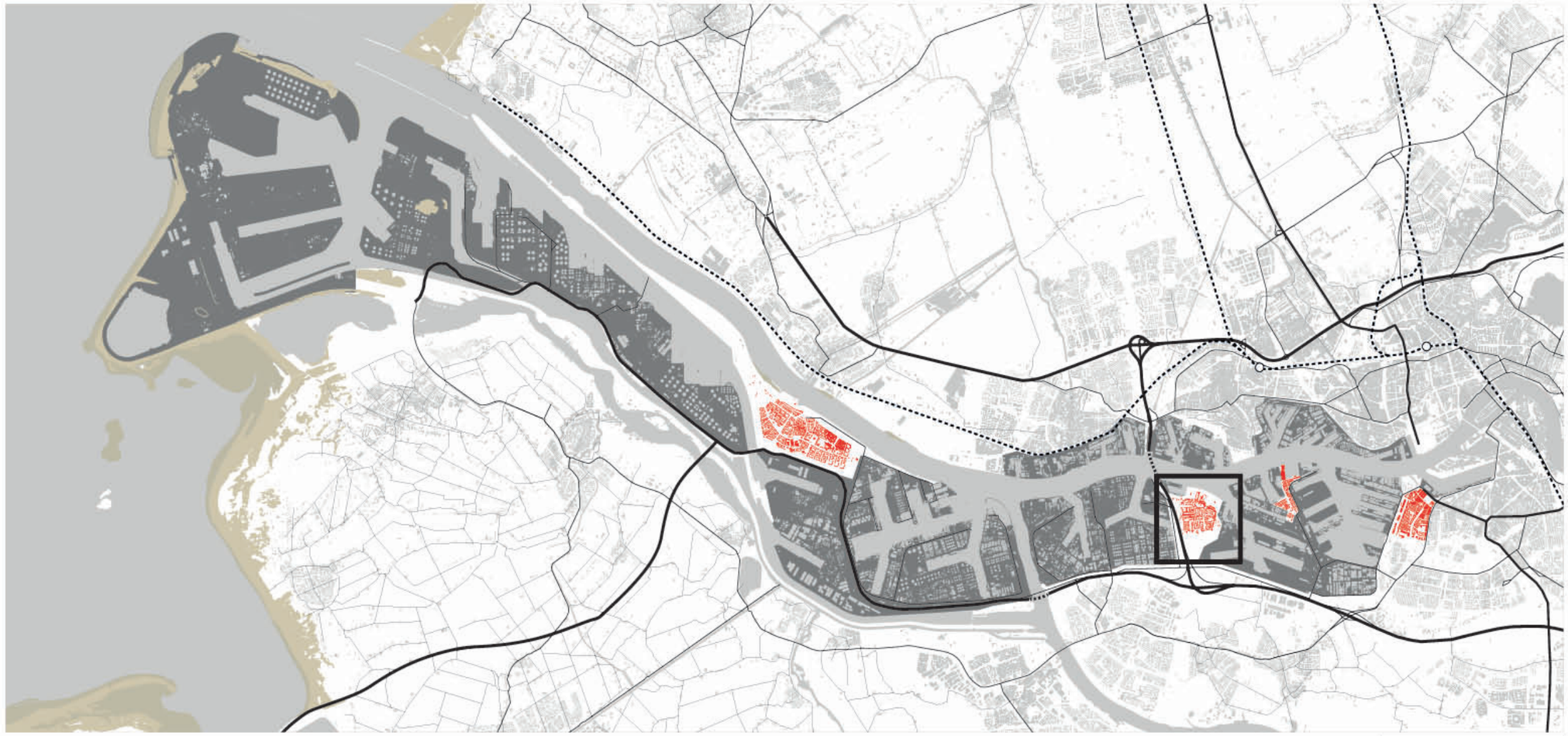
Charlois


Rozenburg
Pernis
Heijplaat
Charlois





Pernis-Heijplaat

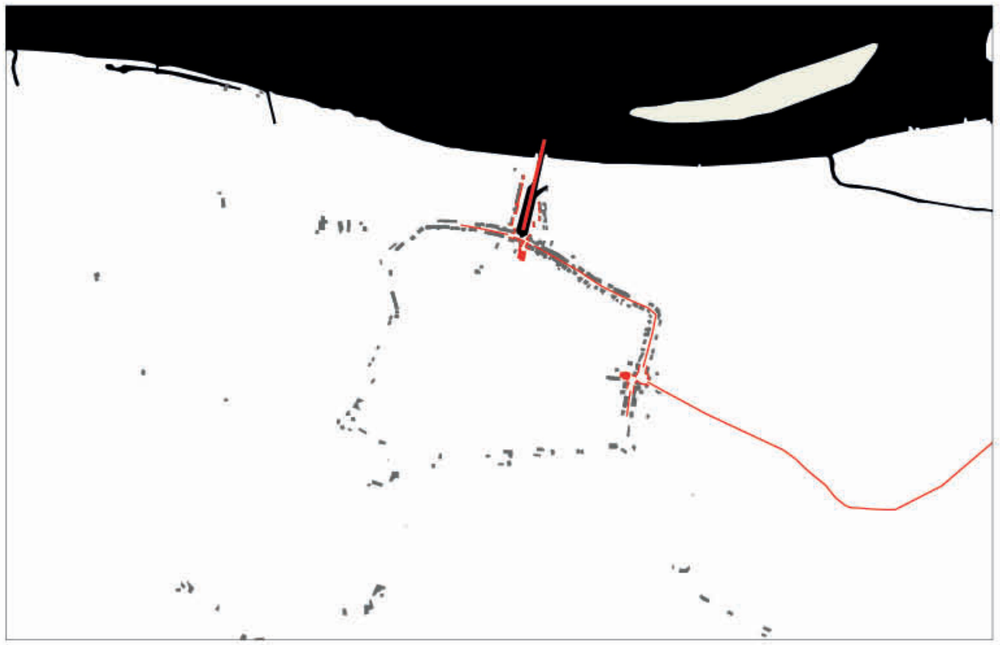


Pernis

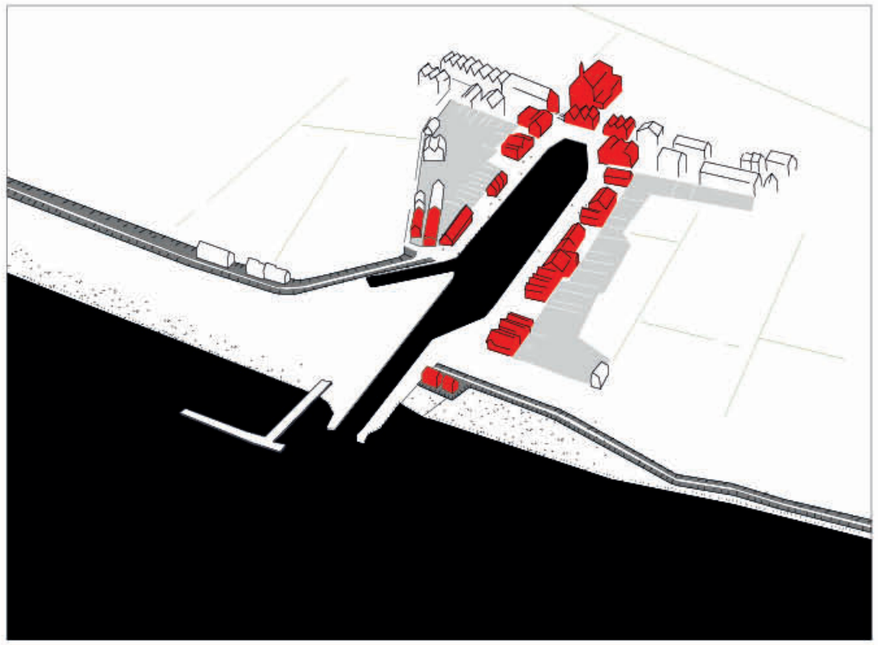
What happened in Pernis?

1850

Fishing village



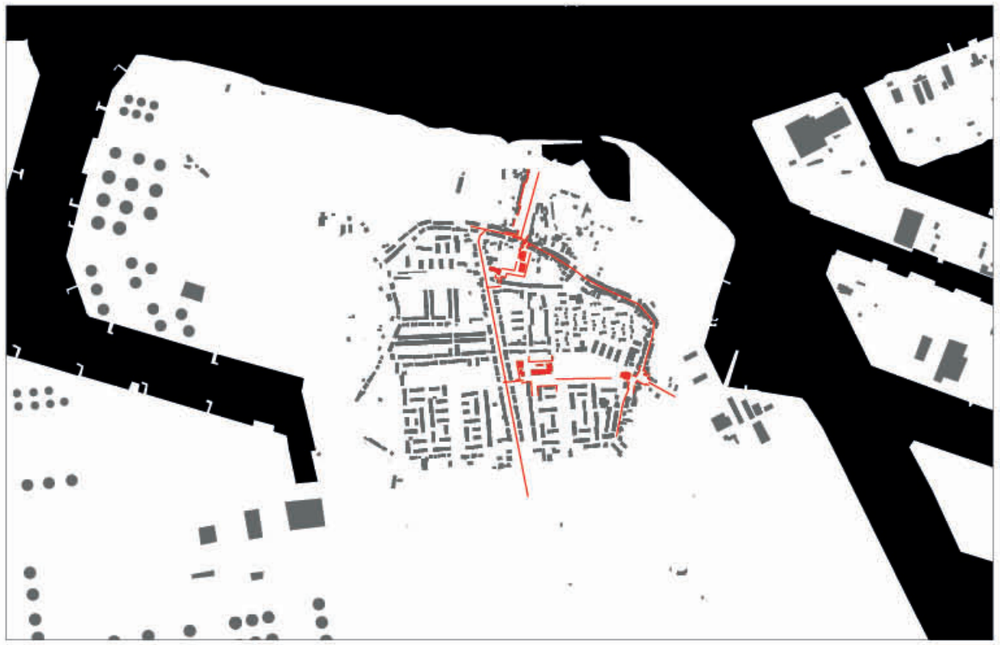
City scale



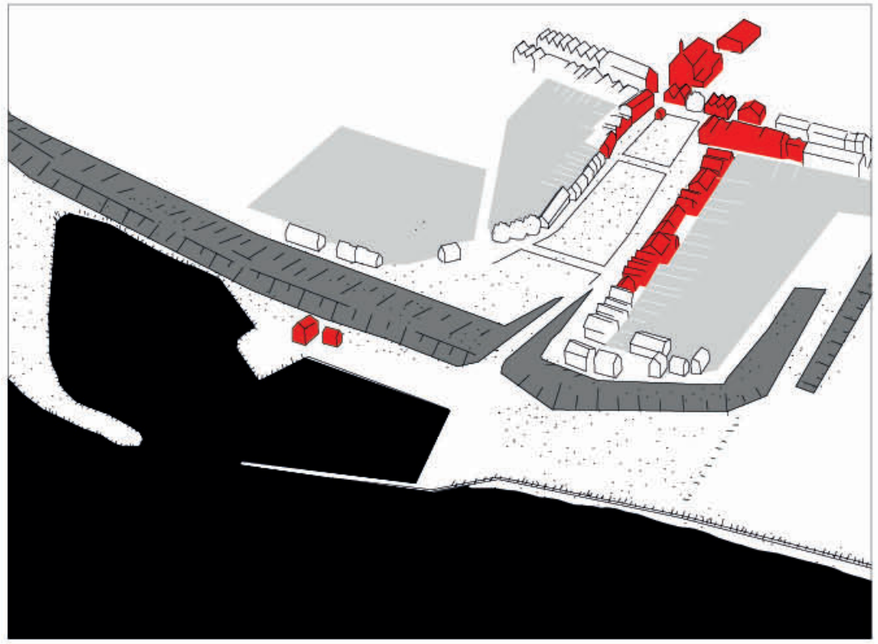
Historical centre

1965

Port village



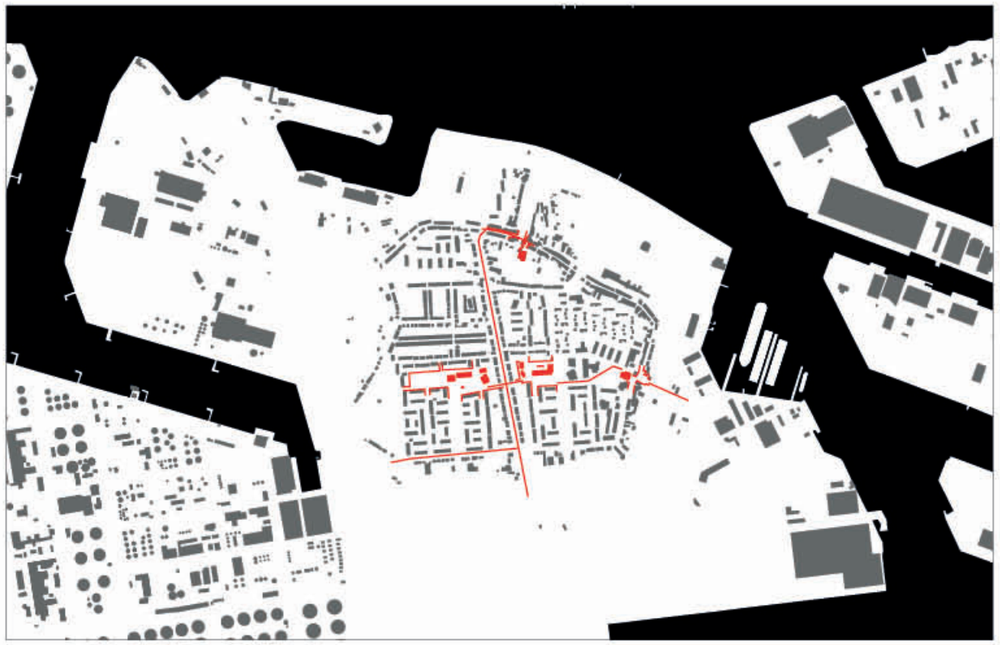
City scale



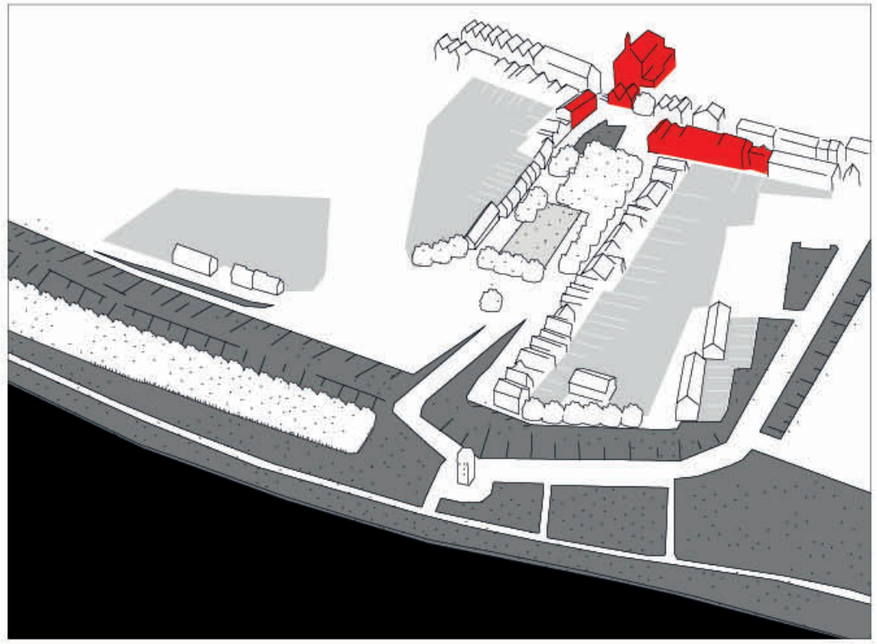
Historical centre

1995

Port village



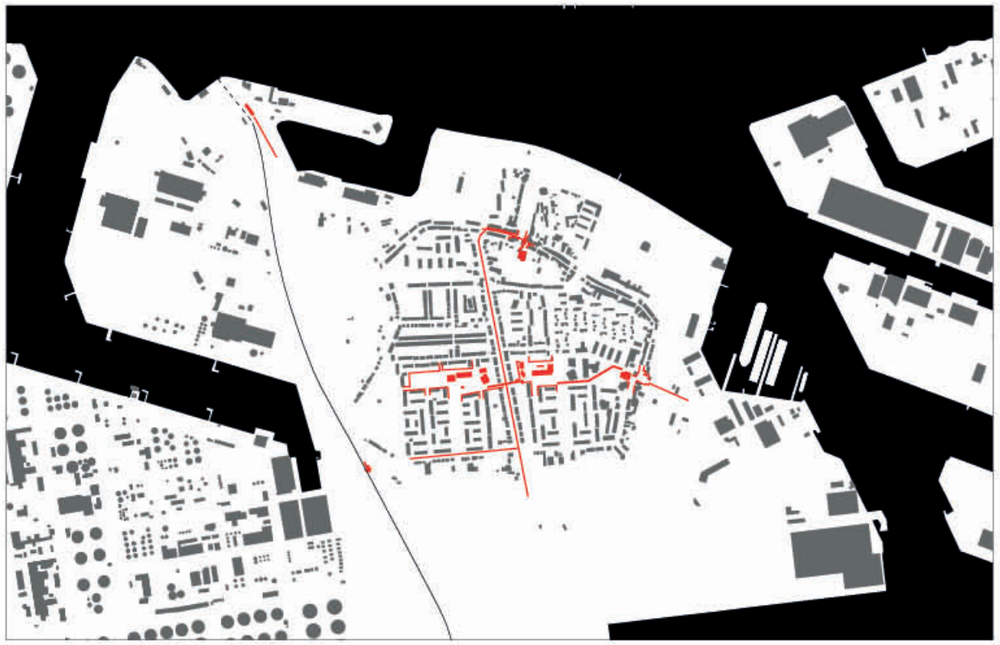
City scale



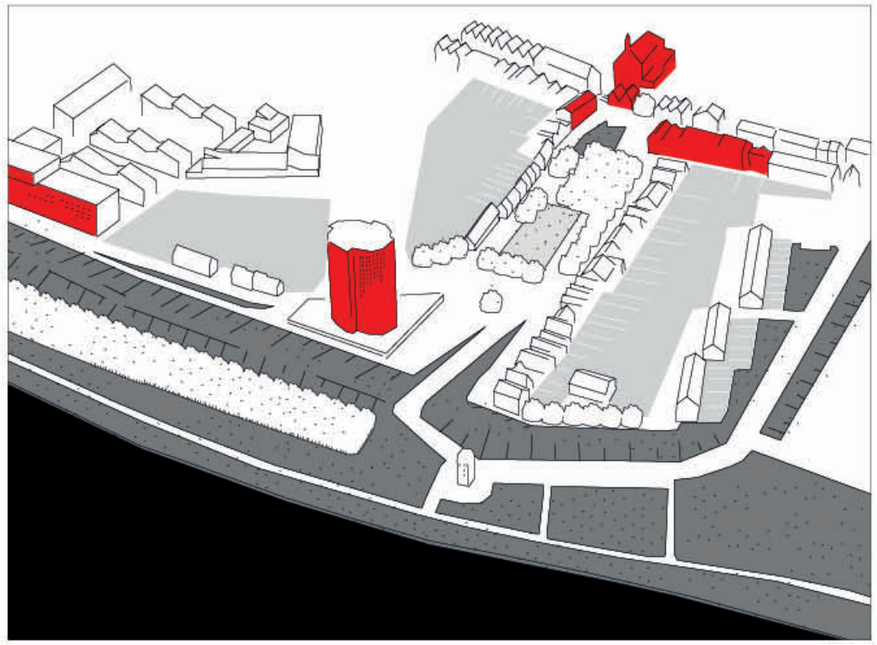
Historical centre

2012

Post-port village

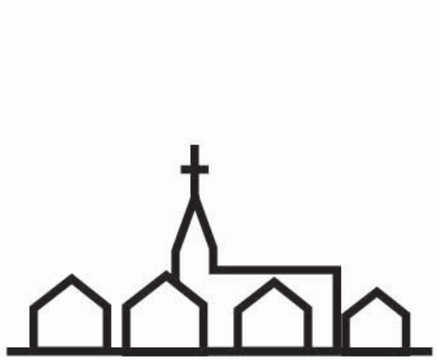


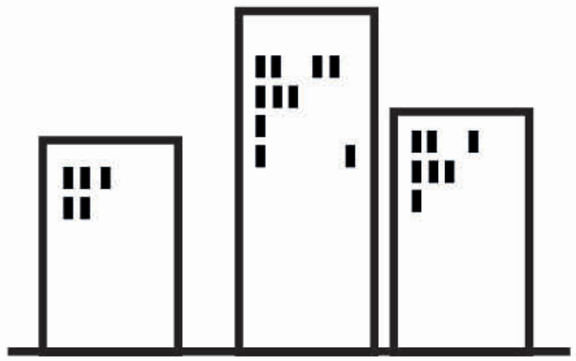
City scale



Historical centre

2012
Post-port village





2002 New metro line

2012

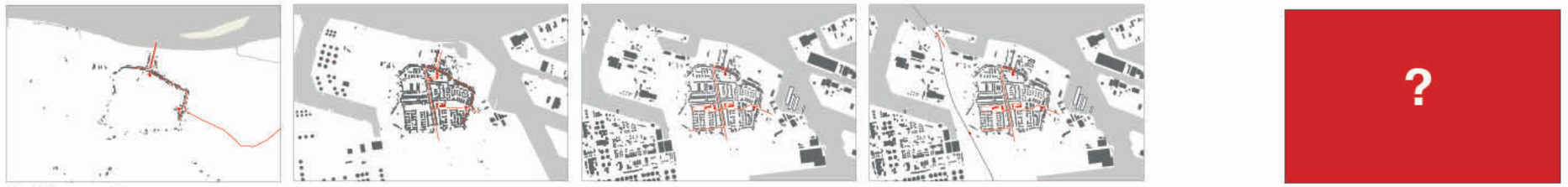
Post-port village

Waterfront

Station area

1880 | 1940 | 1965 | 2012 | 2100

Region



Settlement

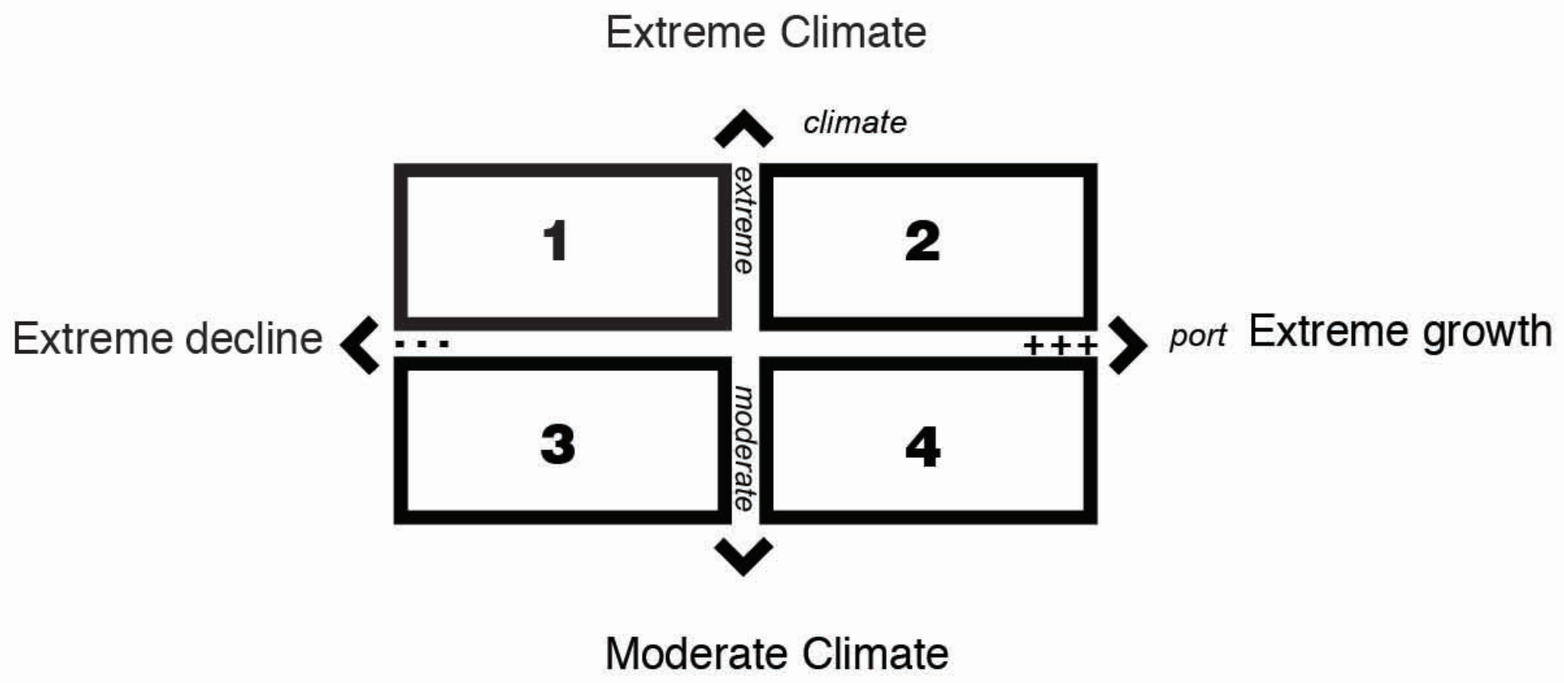
Historical waterfront

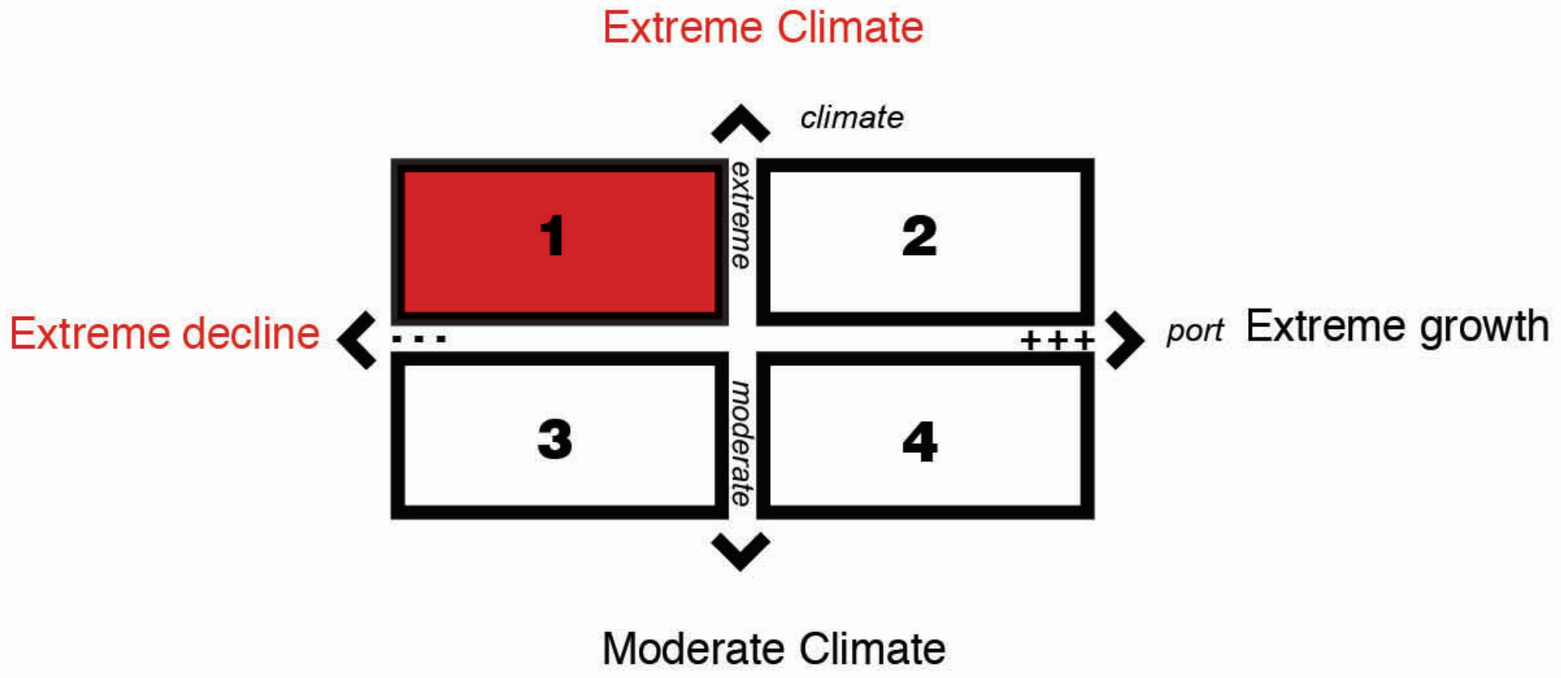
?

?

?

Site research +'Scenario planning'


Extreme Climate
climate
1
extreme
2
Extreme decline
- - -
+++
port
Extreme growth
3
moderate
4
Moderate Climate


Extreme Climate
climate
1
extreme
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+++
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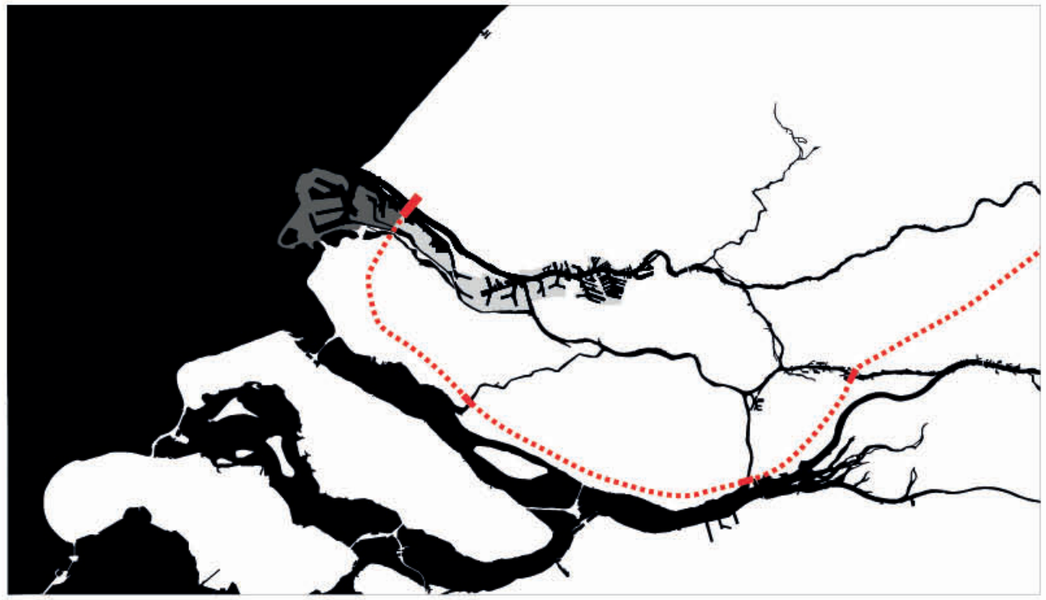
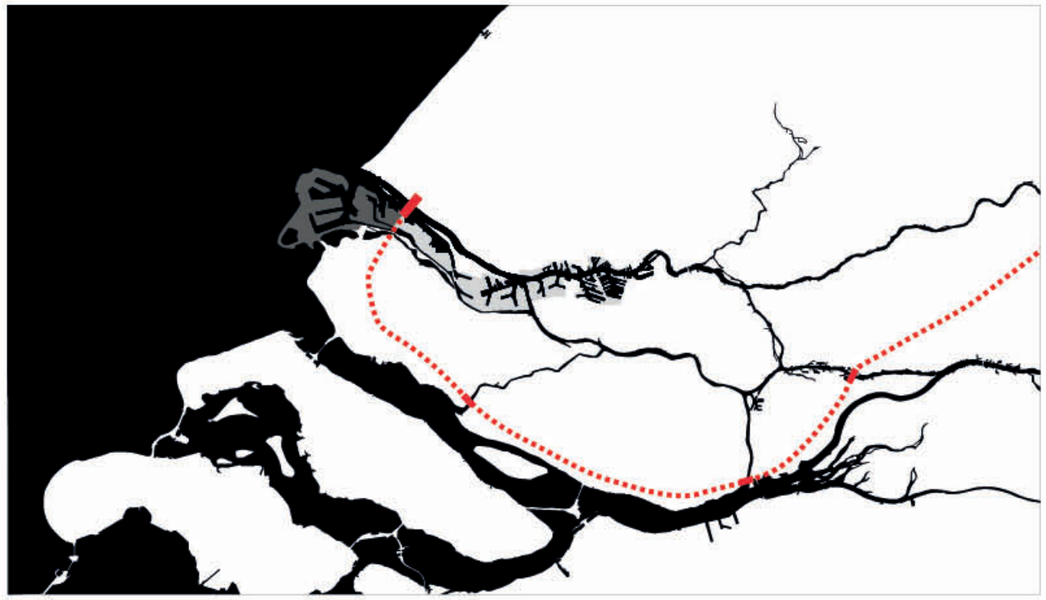
Moderate Climate



Closed system

Open system



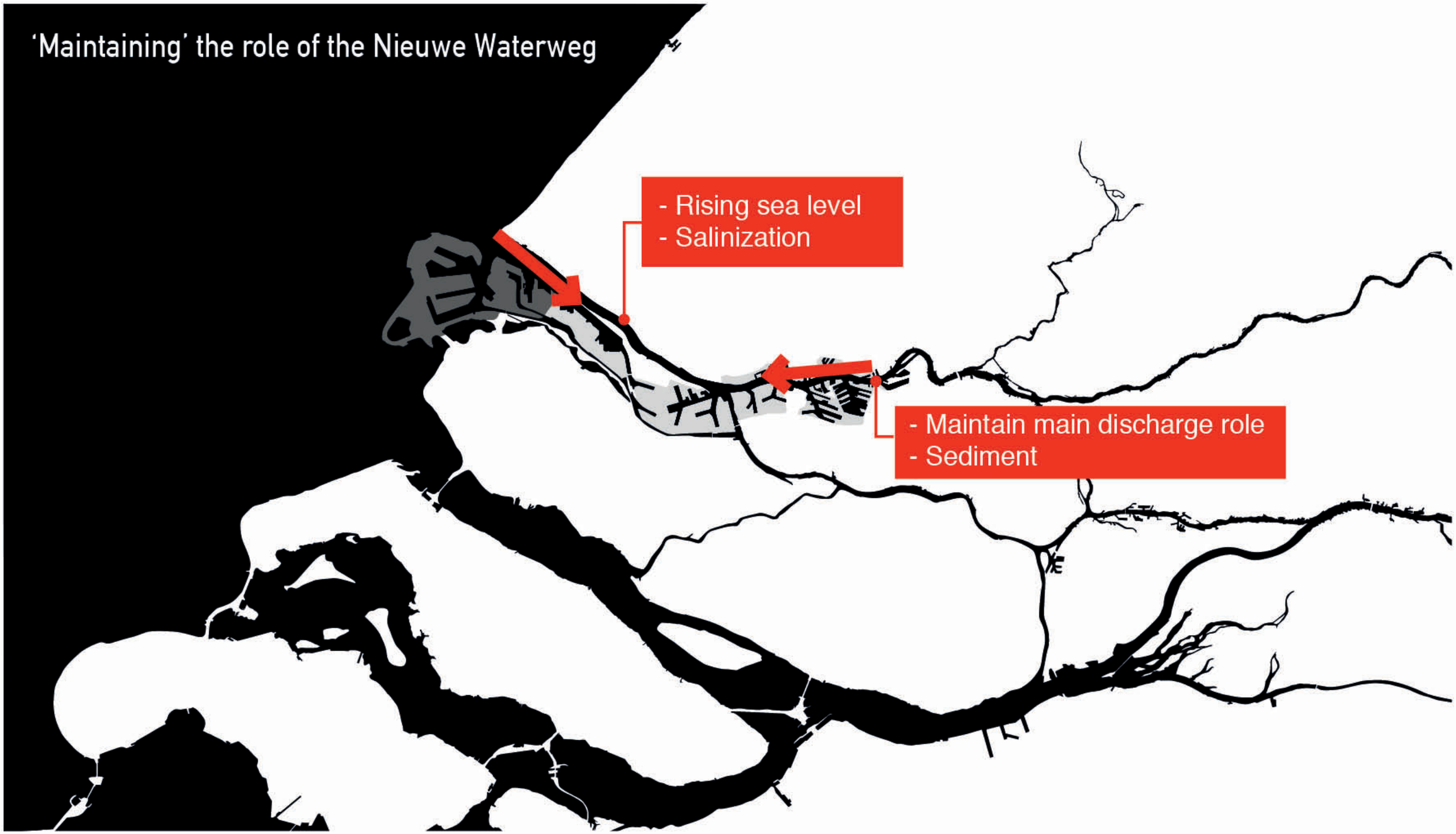
Closed system

Closed system

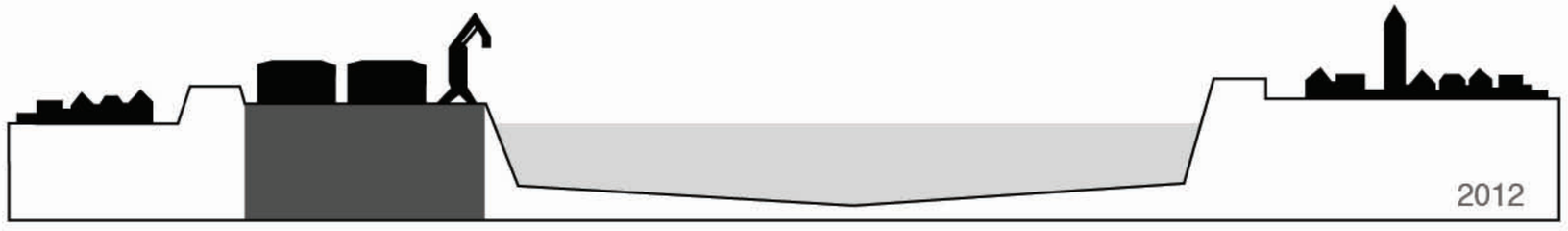
Open system

Possible future condition in

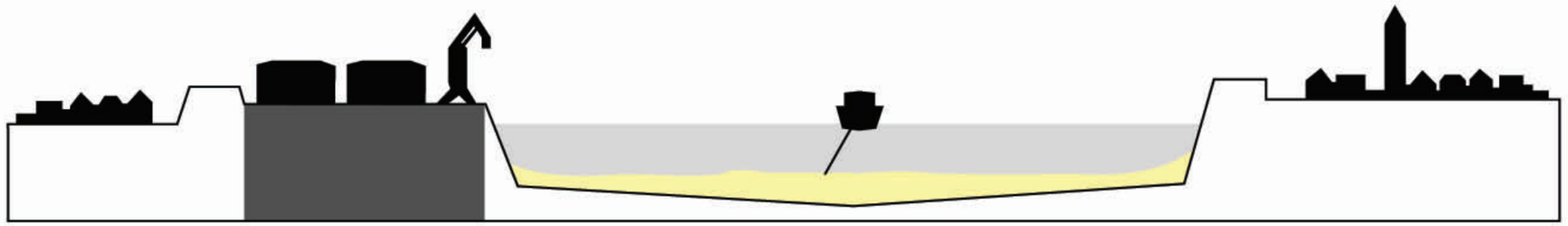
‘Port decline + Open system’


‘Maintaining’ the role of the Nieuwe Waterweg
- Rising sea level
- Salinization
- Maintain main discharge role
- Sediment

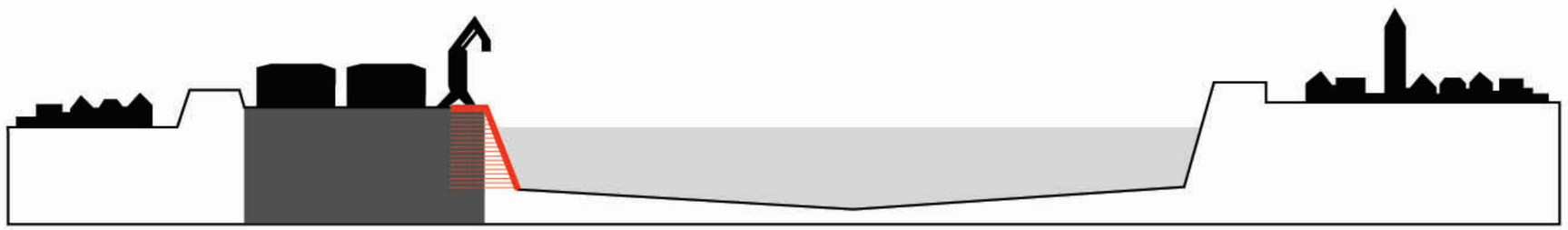
Current river condition



Port decline, then stop management

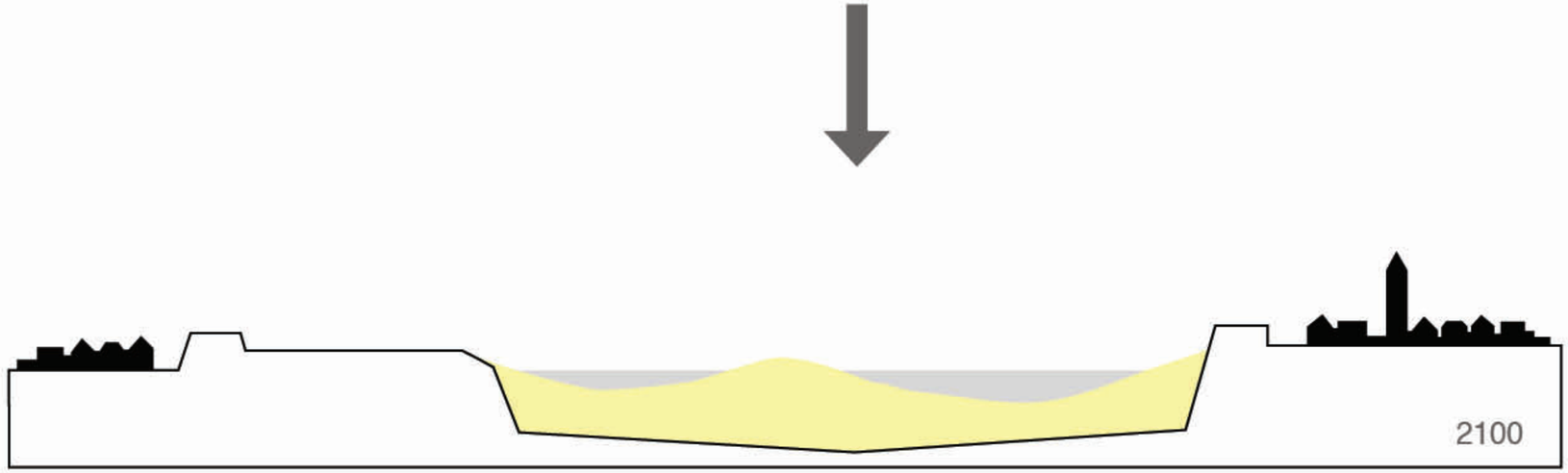


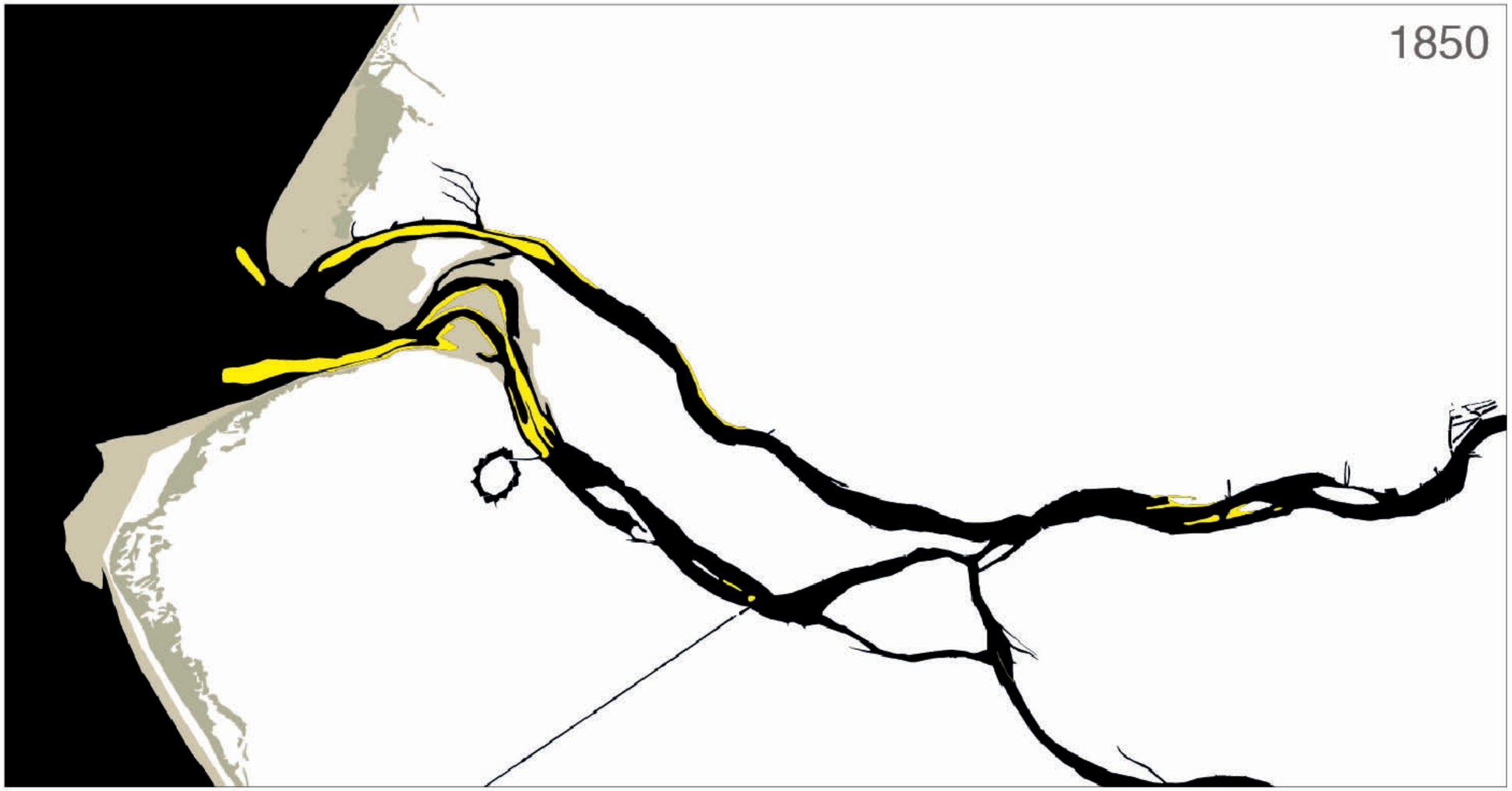
Dredging



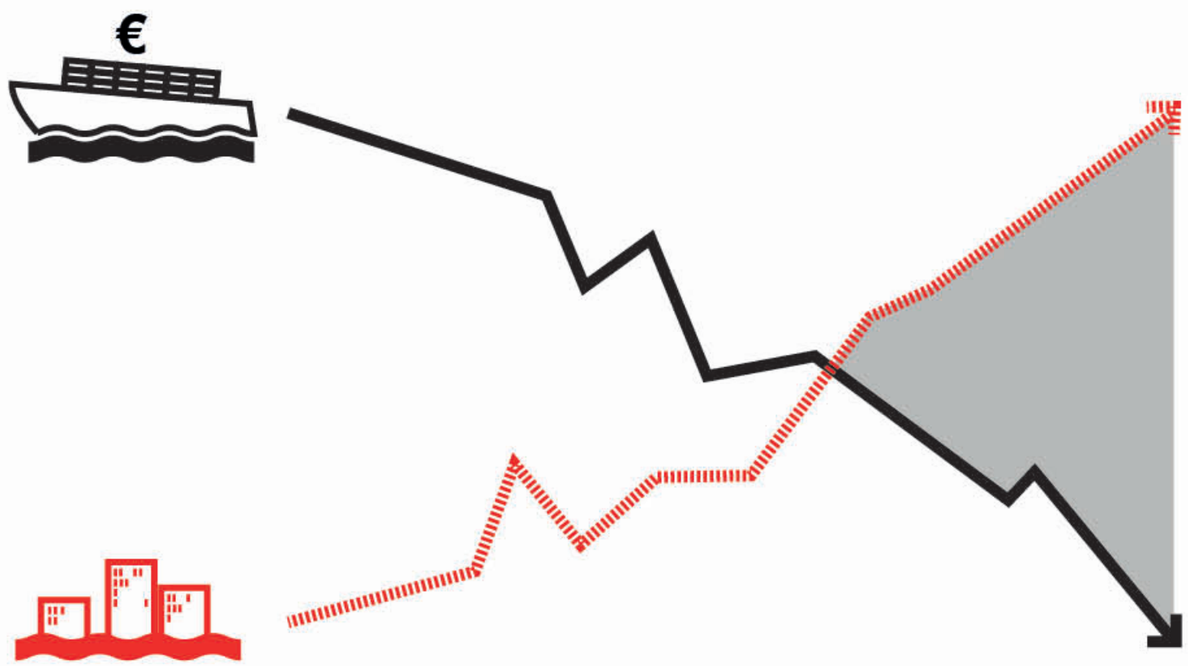
Quay wall

Possible river condition




1850

Working with Hard & Soft approach?



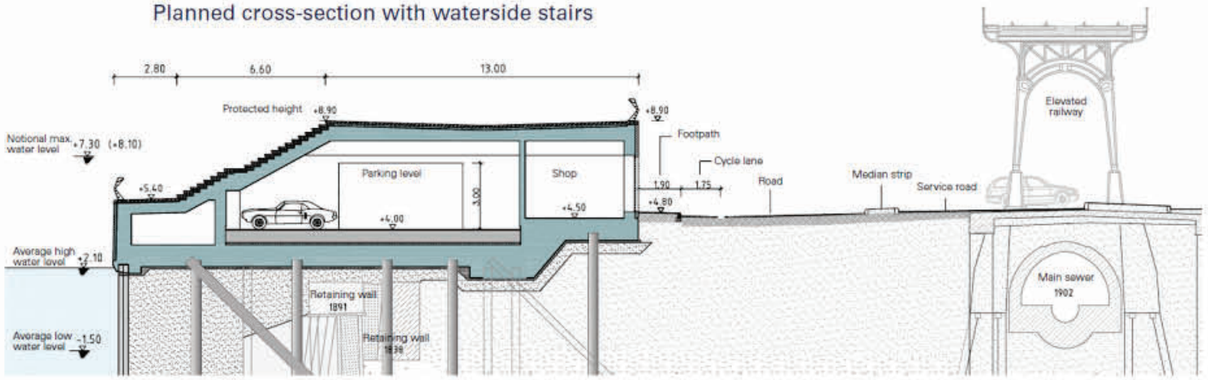
Artificial control

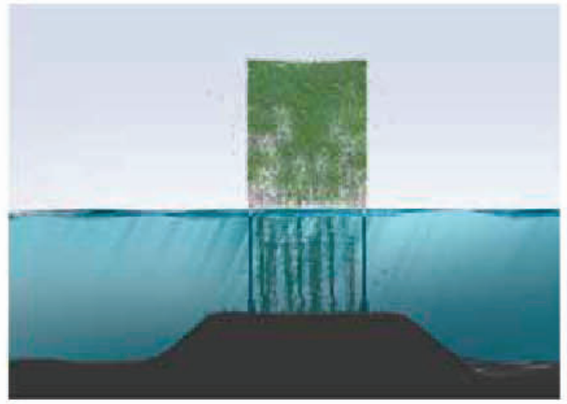
‘HARD’

Natural process

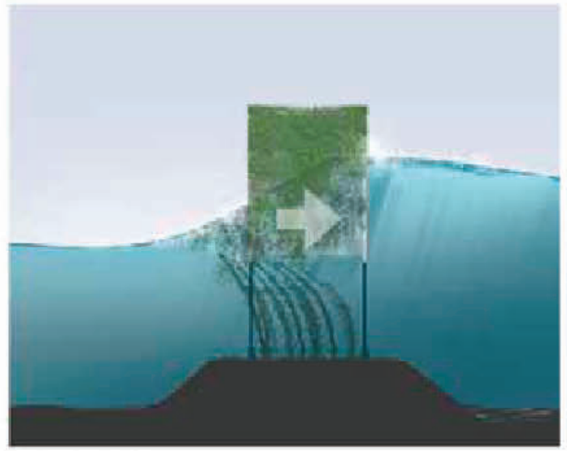
‘SOFT’

Planned cross-section with waterside stairs





Green Structure Above/Below Water



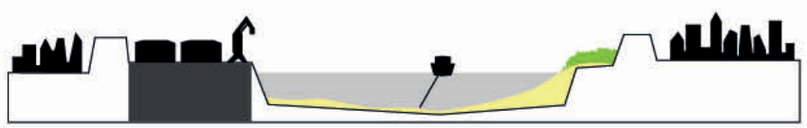
Storm Surge Barrier

Artificial control

‘HARD’

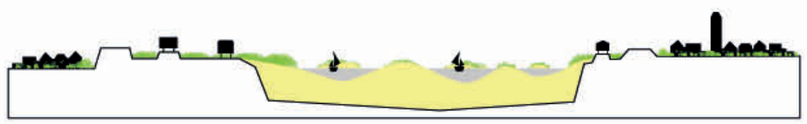
Natural process

‘SOFT’



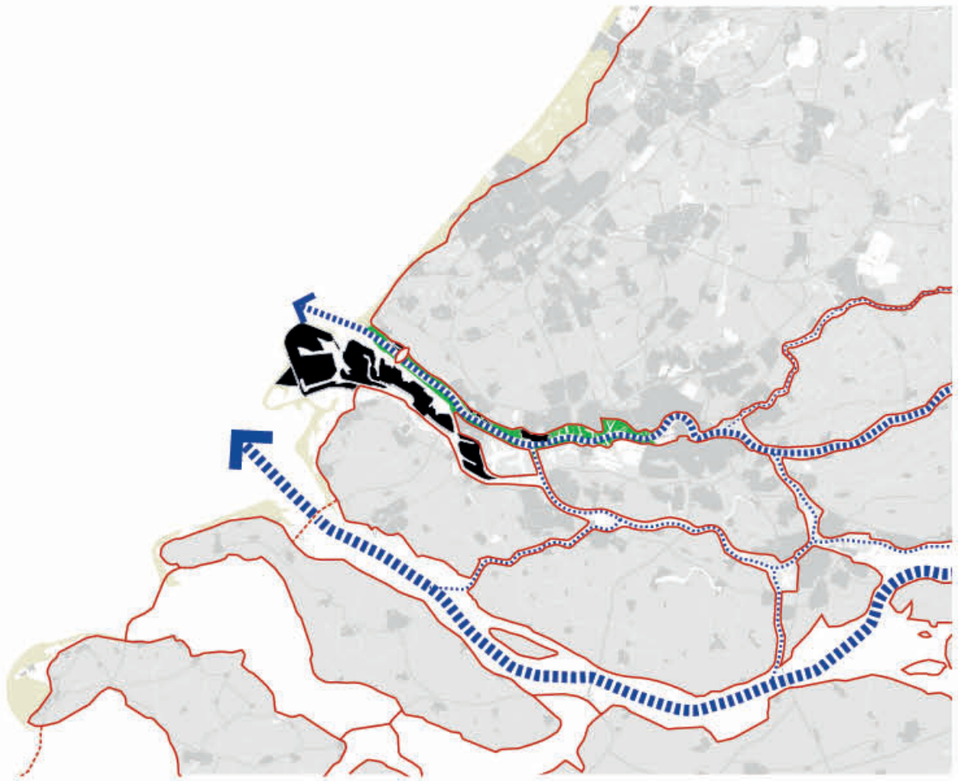
Artificial control

‘HARD’



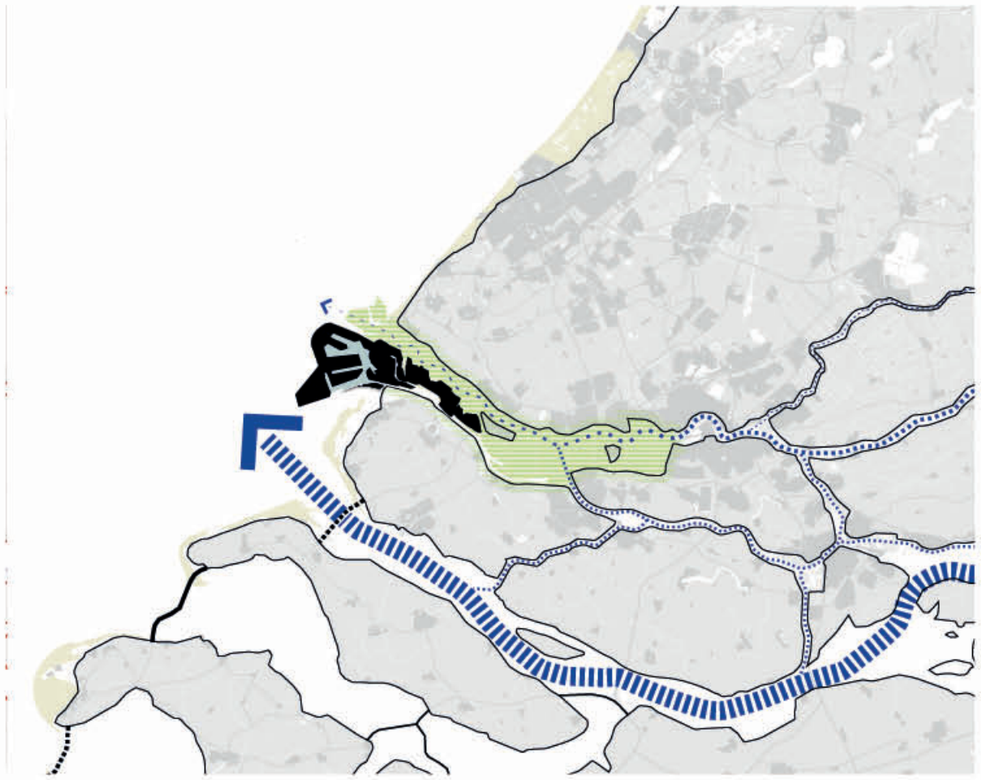
Natural process

‘SOFT’



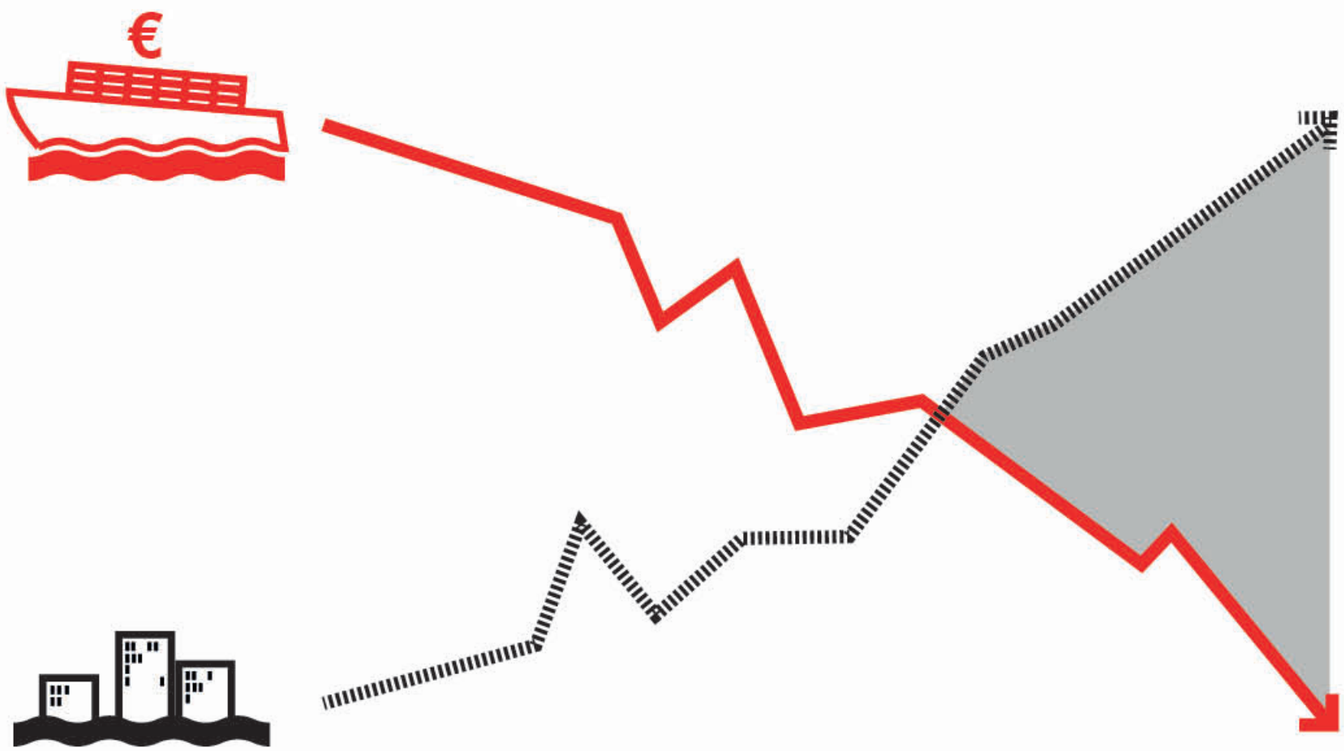
Artificial control

‘HARD’



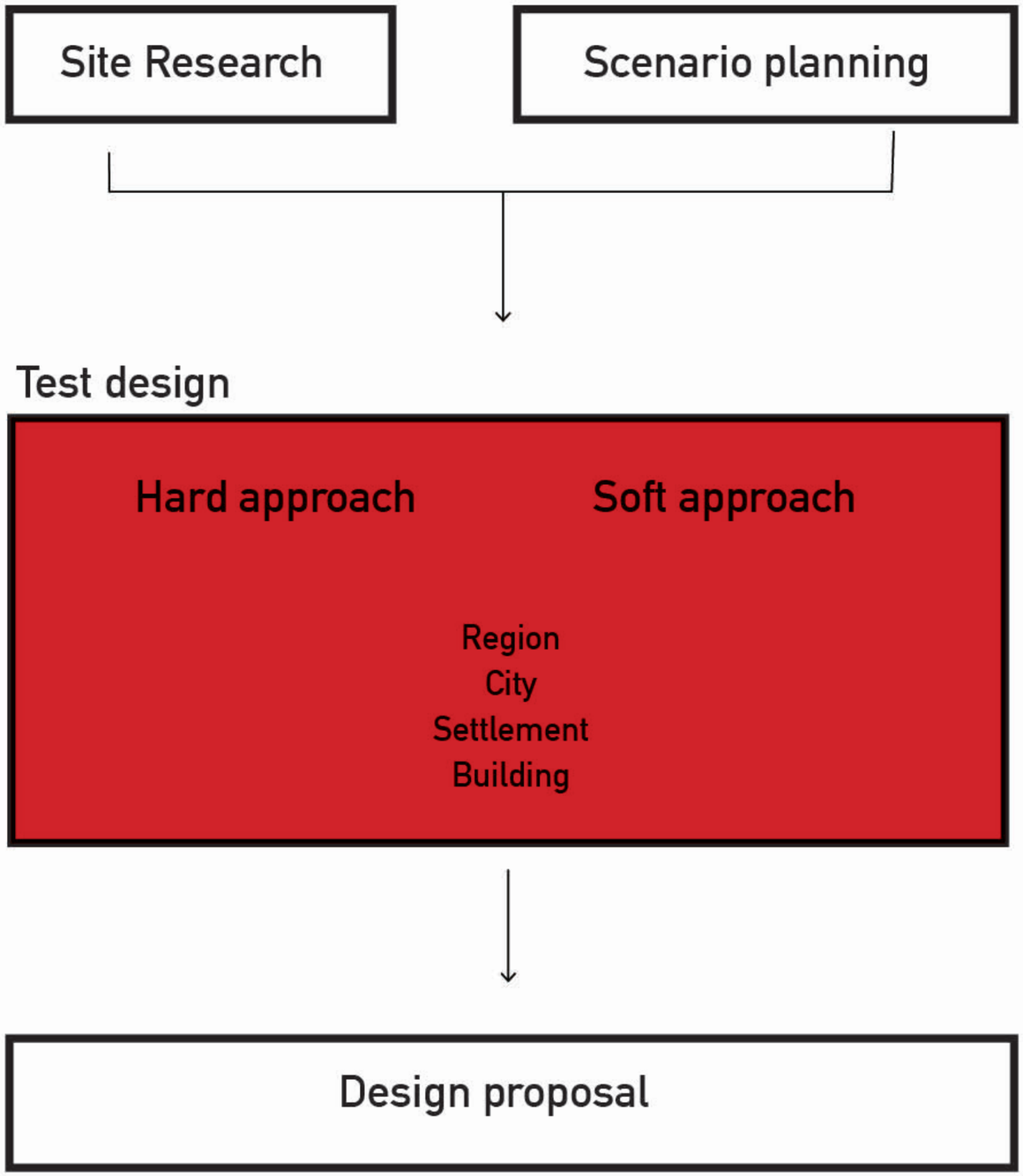
Natural process

‘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

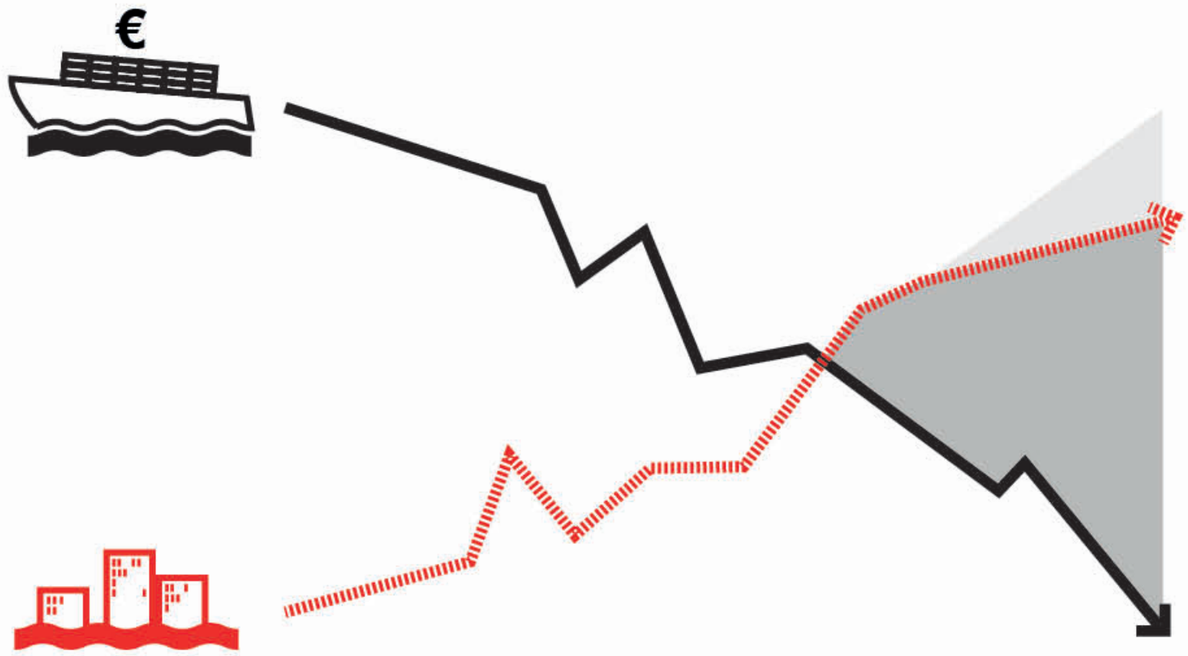
Artificially control

Natrual process

Hard approach

Soft approach

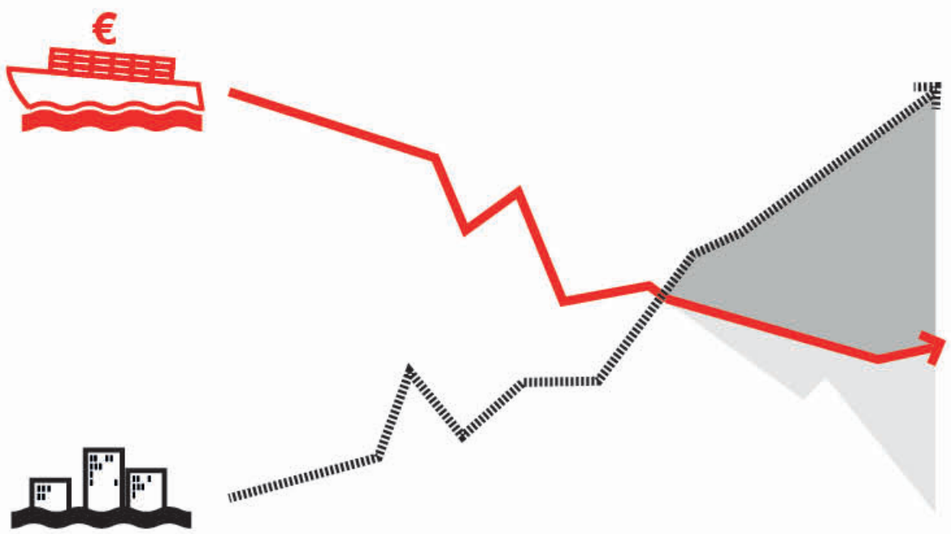
Water management



Hard approach

Soft approach

Different Port change



Hard approach

Soft approach

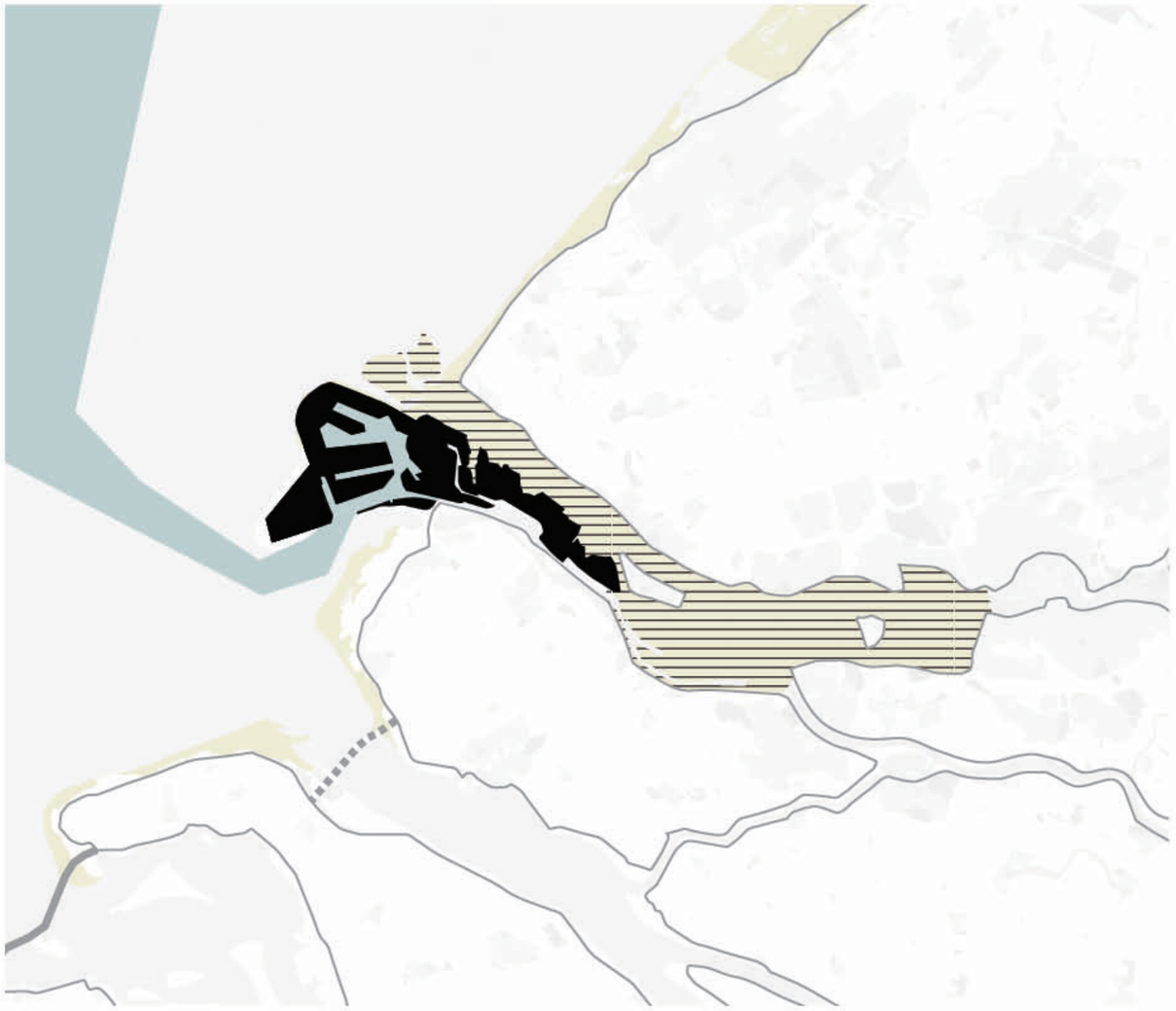
Different Port change

Port remains along Niuew waterweg

Port moves out westward

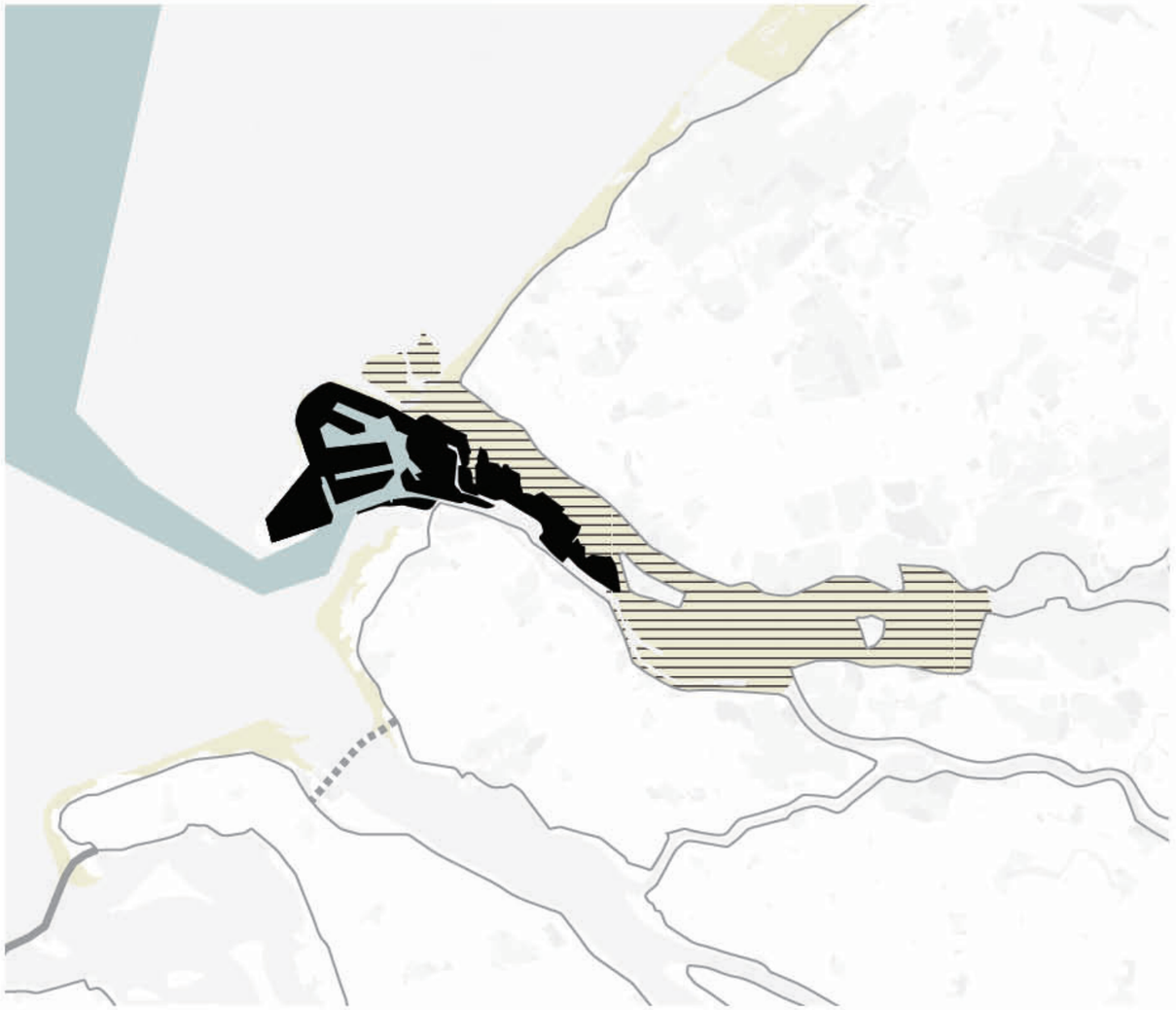
Different Port change

Port remains along Niuew waterweg



Port moves out westward

Different Port change

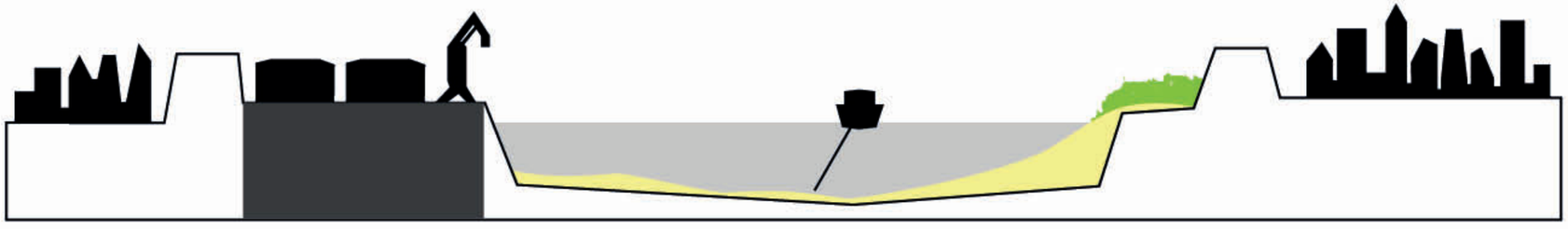


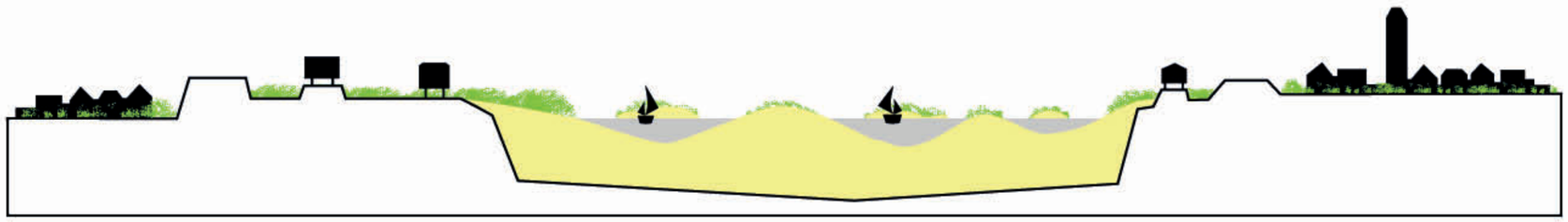
Hard approach

Soft approach

River profile

Hard approach

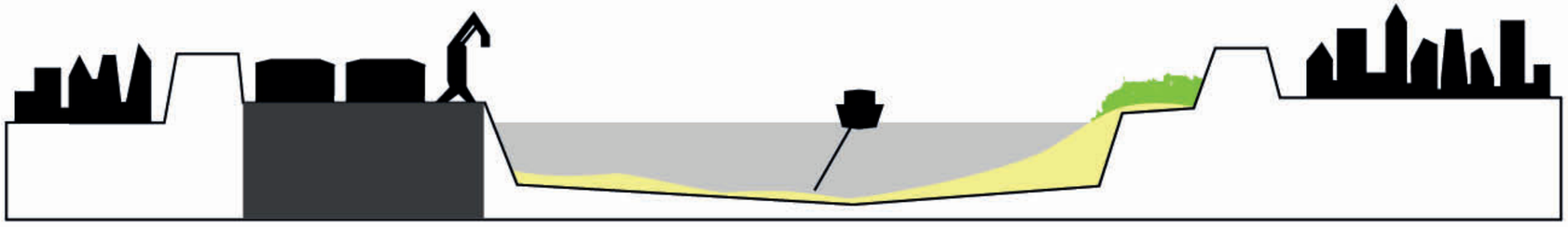


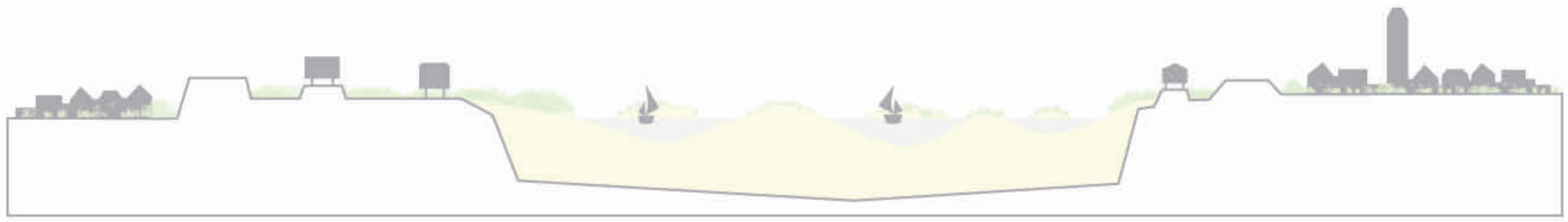


Soft approach

Hard: N-S River profile

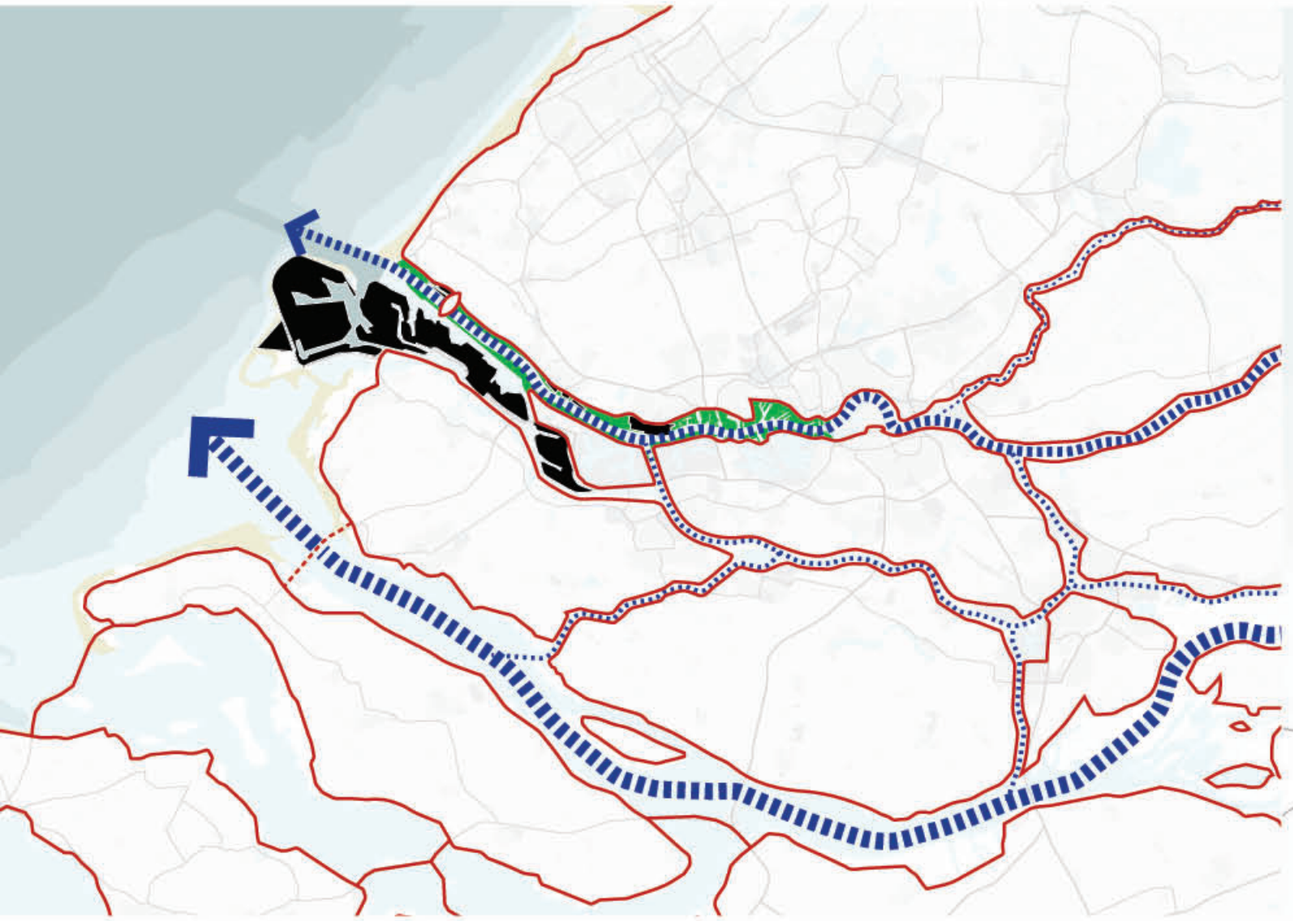
Hard approach





Soft approach

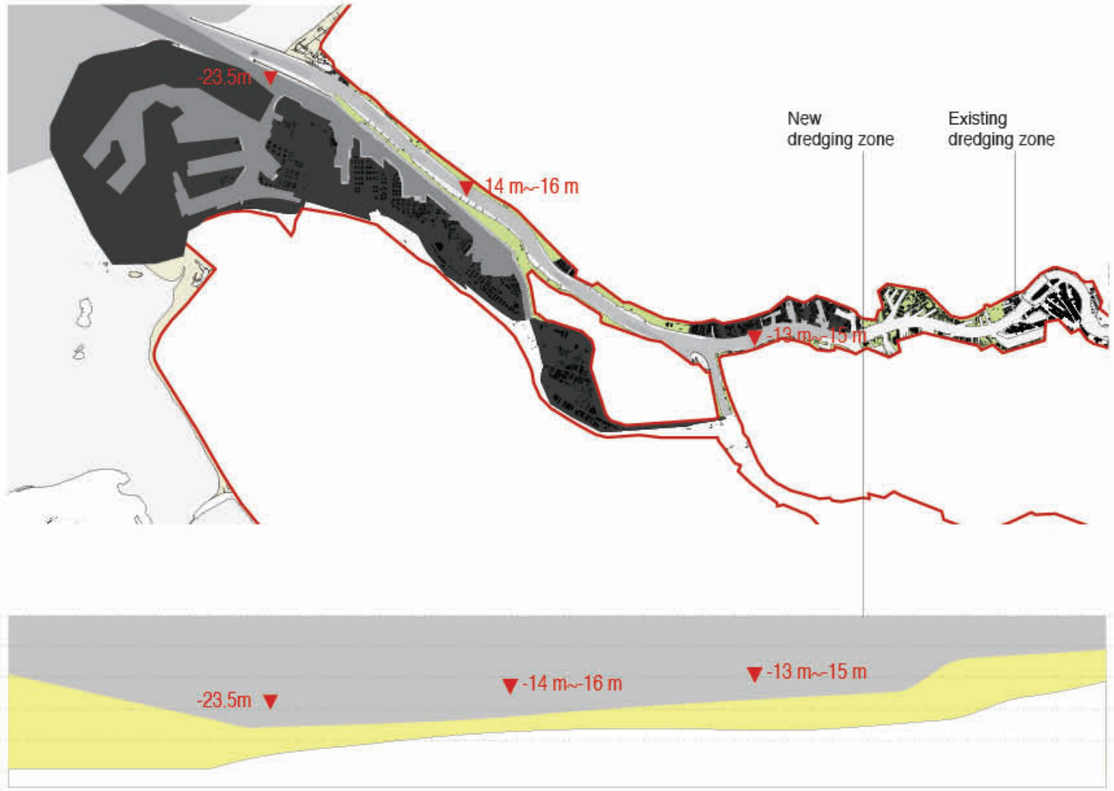
Hard: Water regime



Maintaining discharge role

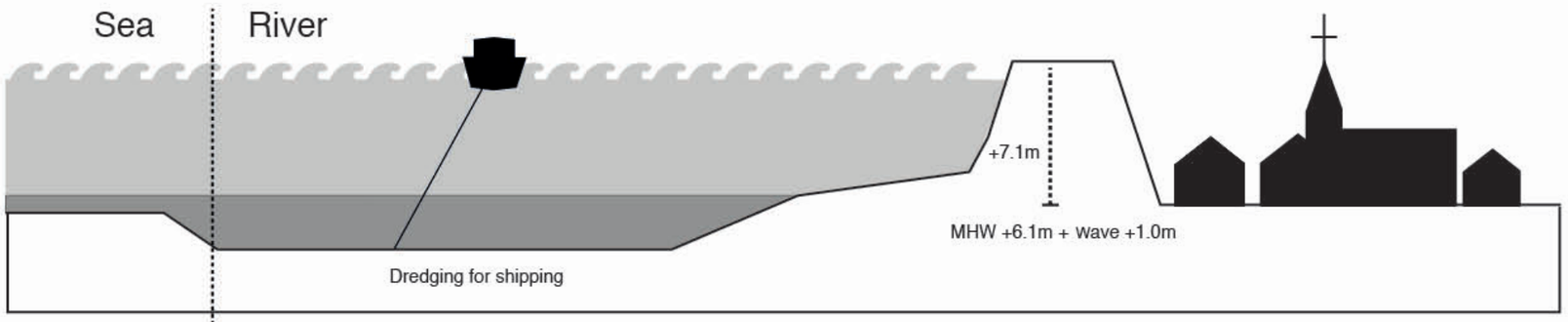
Lost discharge role & divert to south

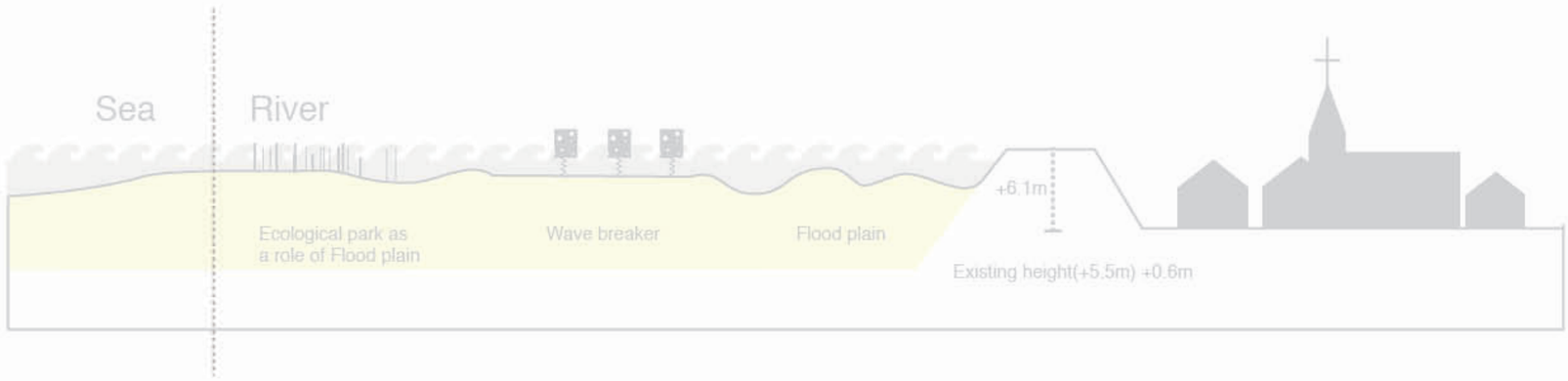
Hard: W-E River profile



Hard: River profile

Hard approach

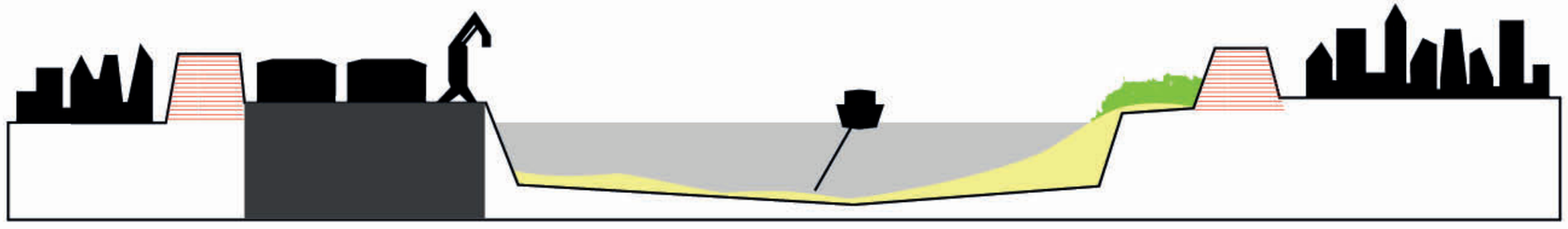


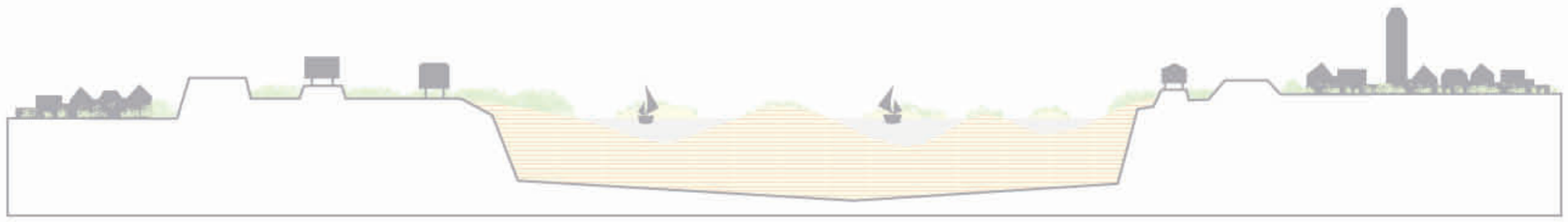


Soft approach

Hard: Dike reinforcement

Hard approach

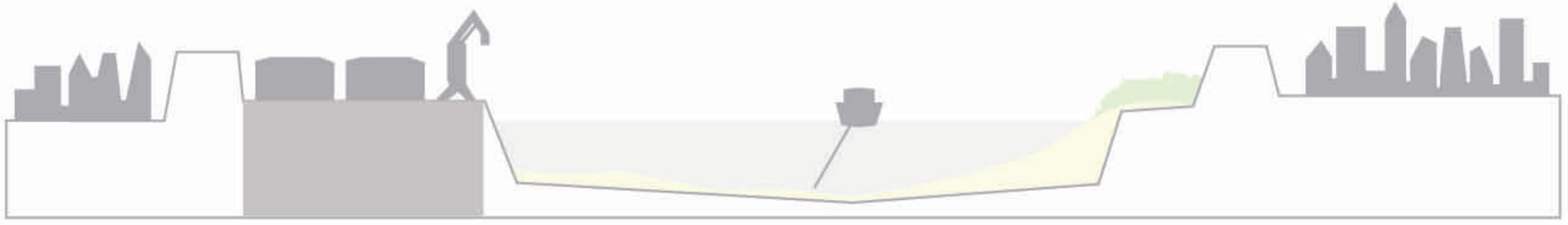


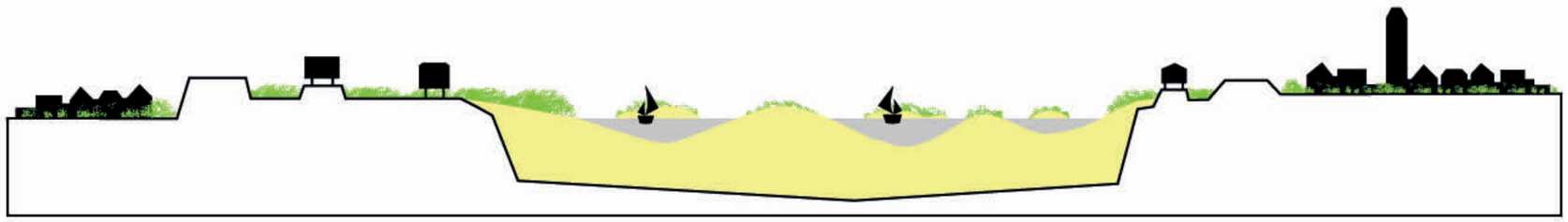


Soft approach

Soft: N-S River profile

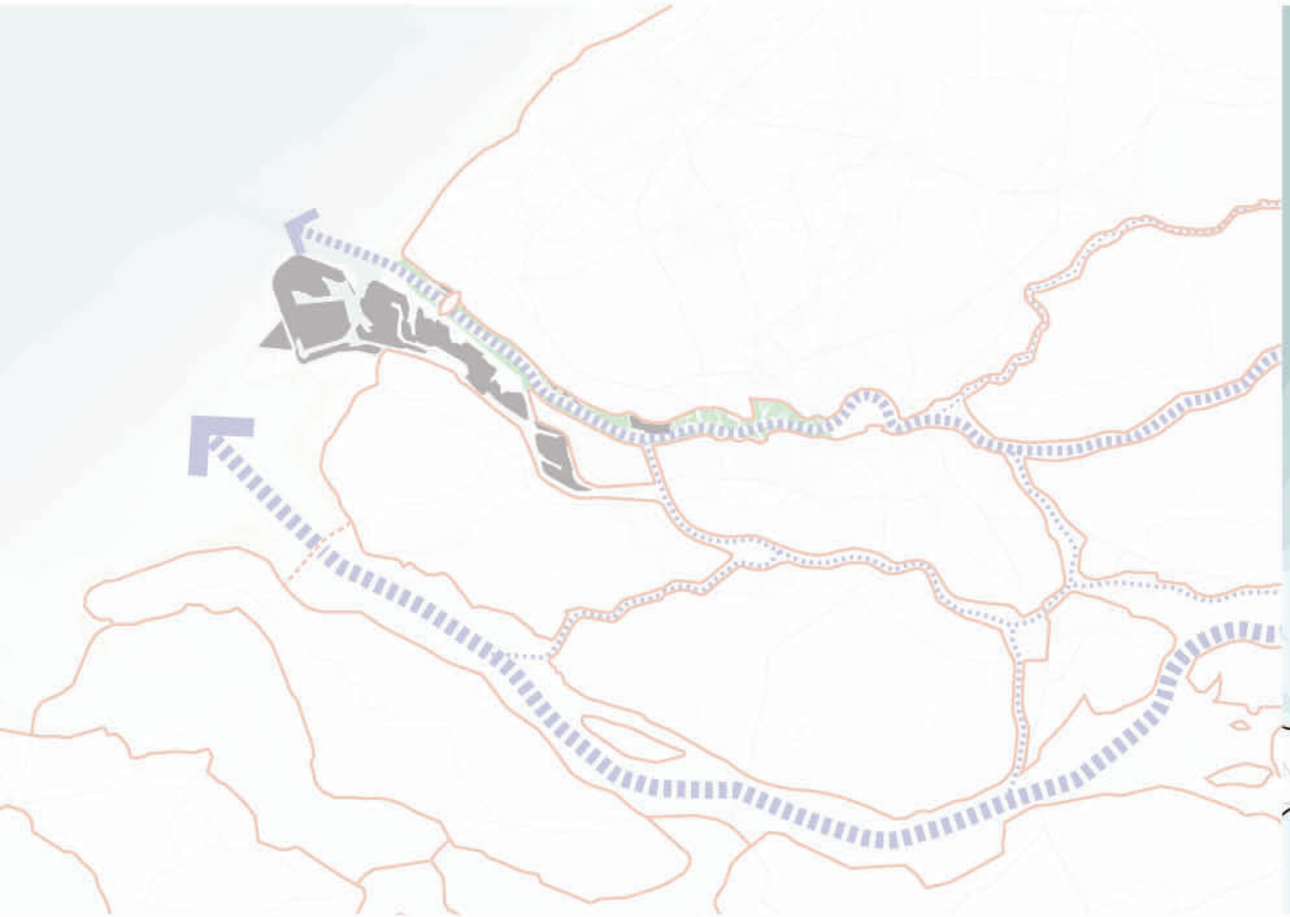
Hard approach



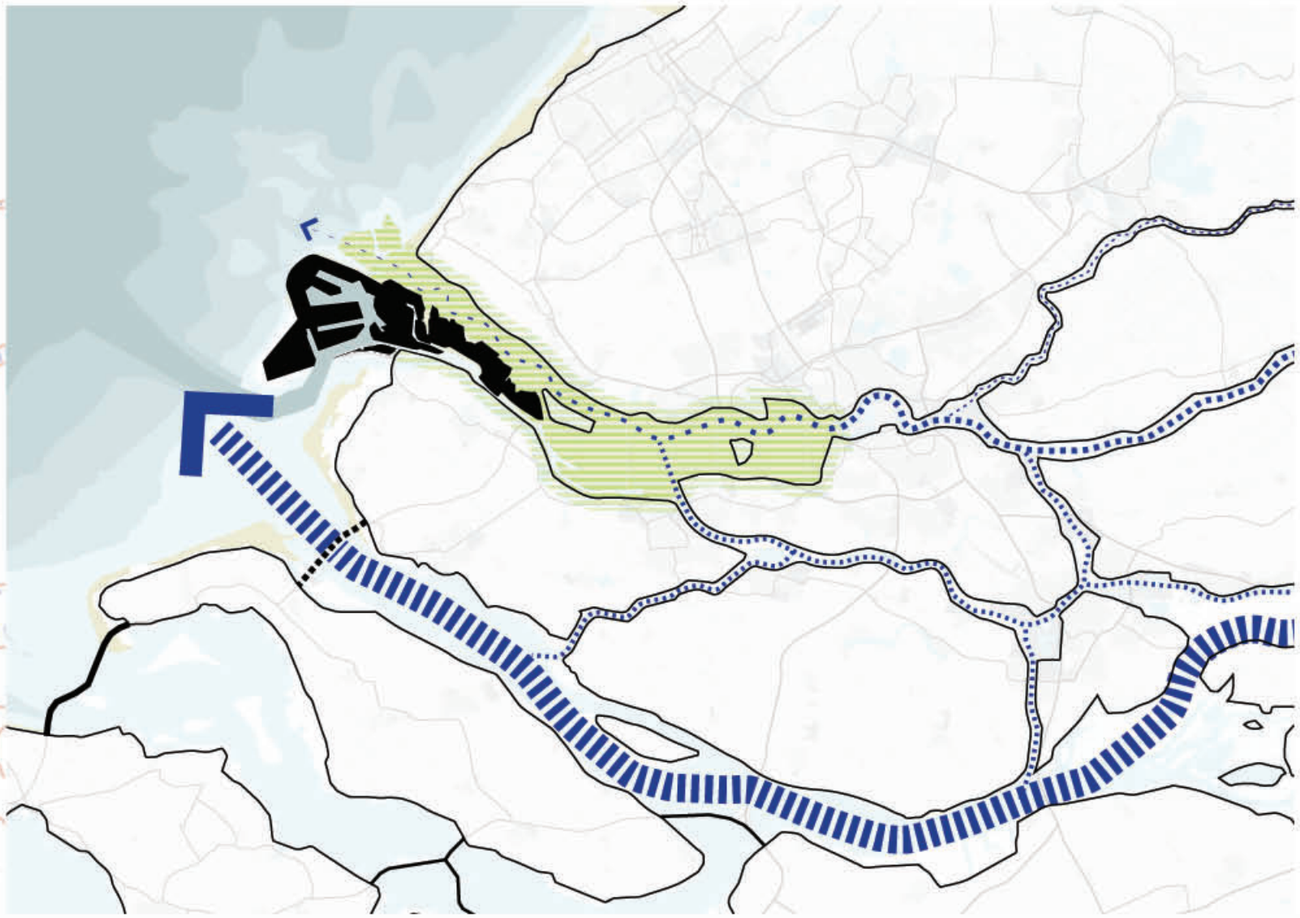


Soft approach

Soft: Water regime

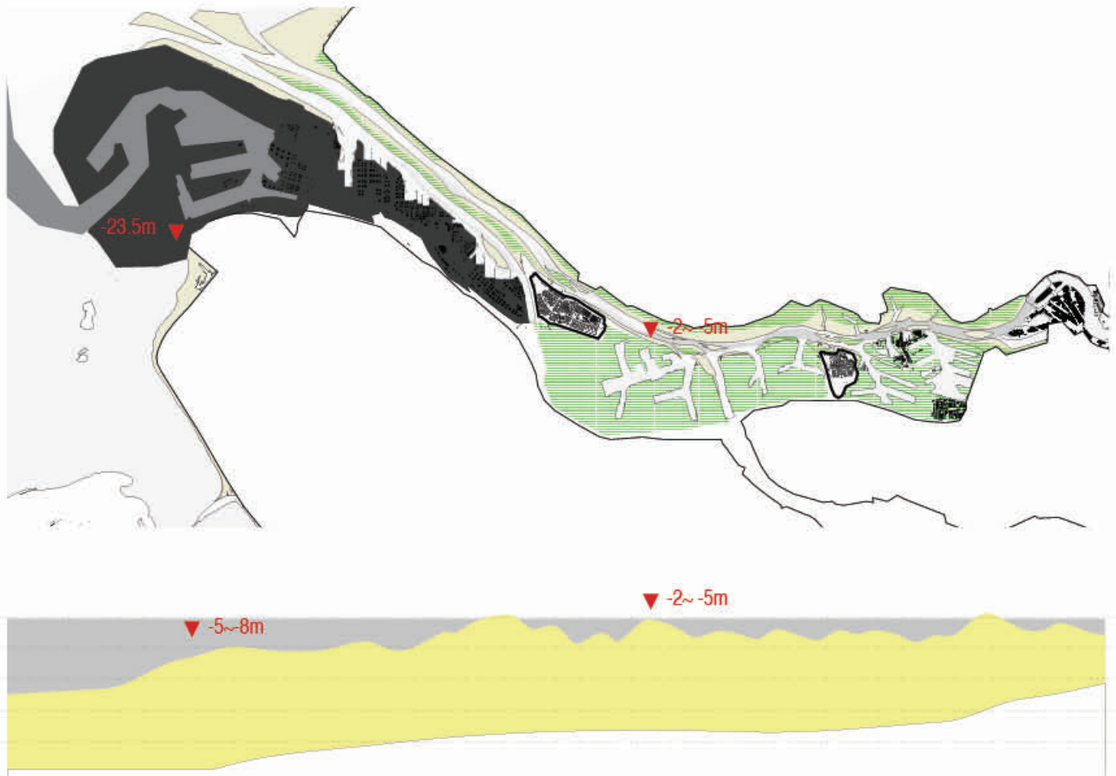


Maintaining discharge role



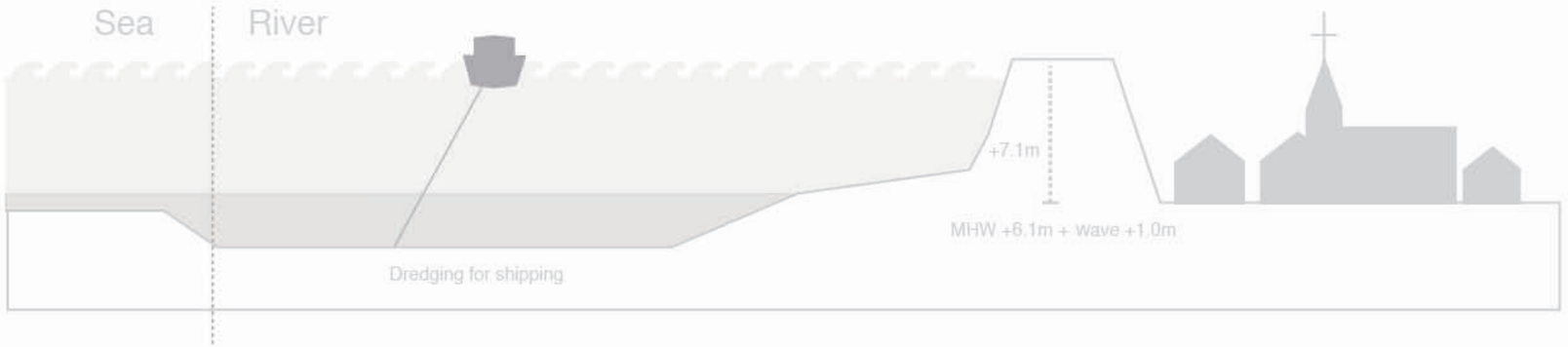
Lost discharge role & divert to south

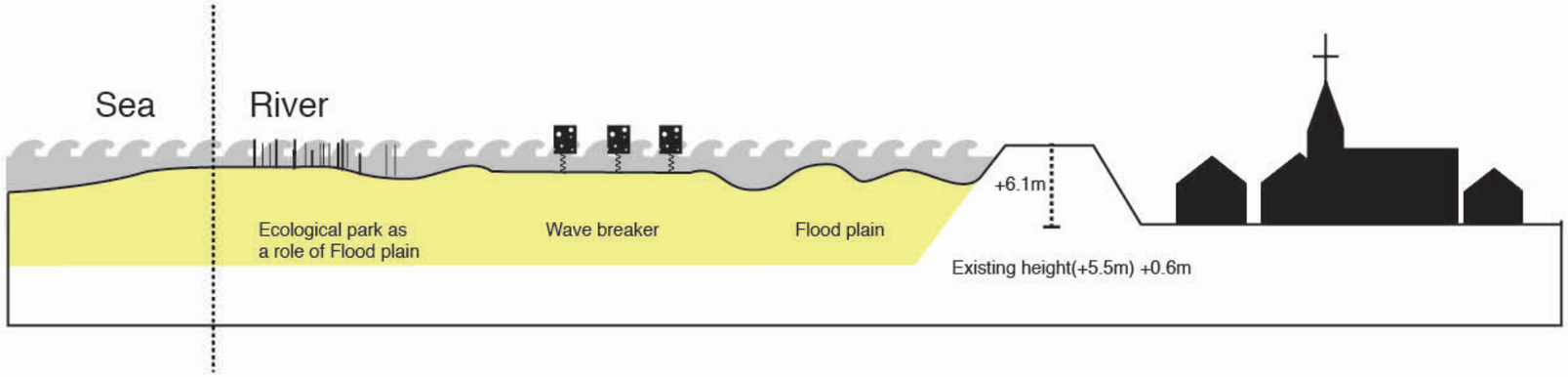
Soft: W-E River profile



Soft: River profile

Hard approach

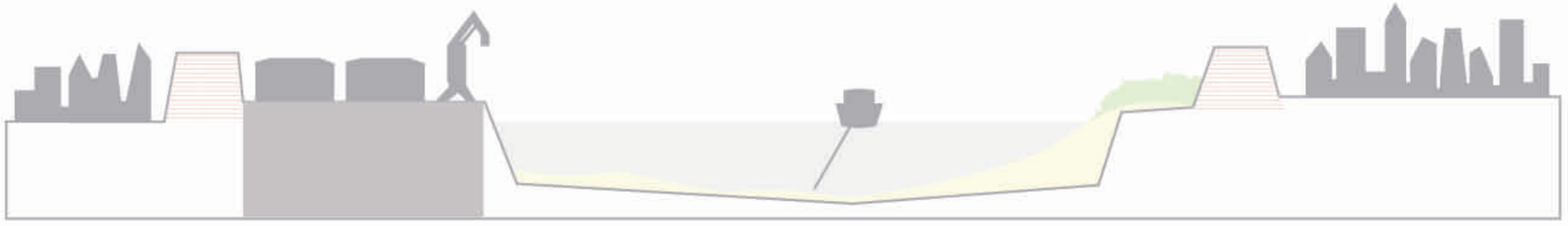


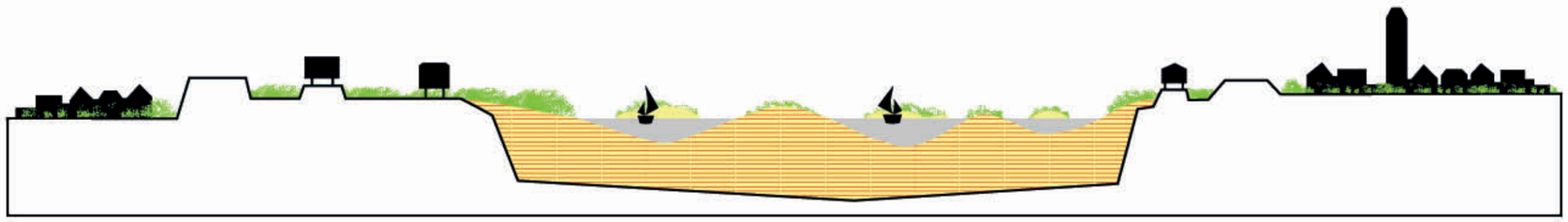


Soft approach

Soft: Natural buffering

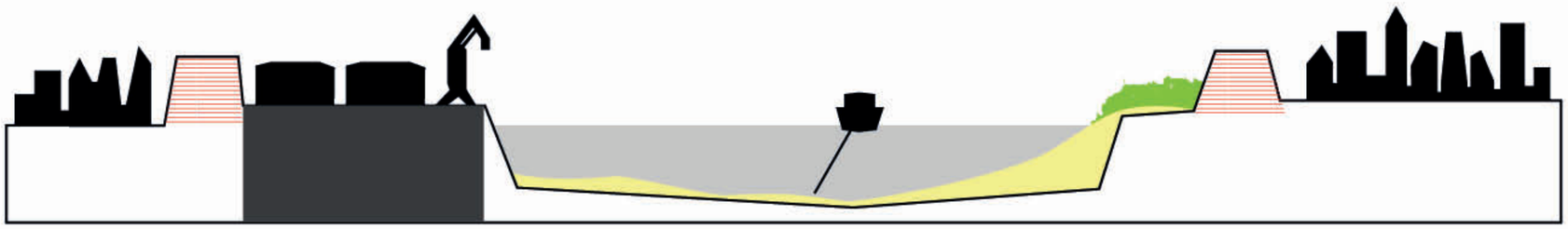
Hard approach

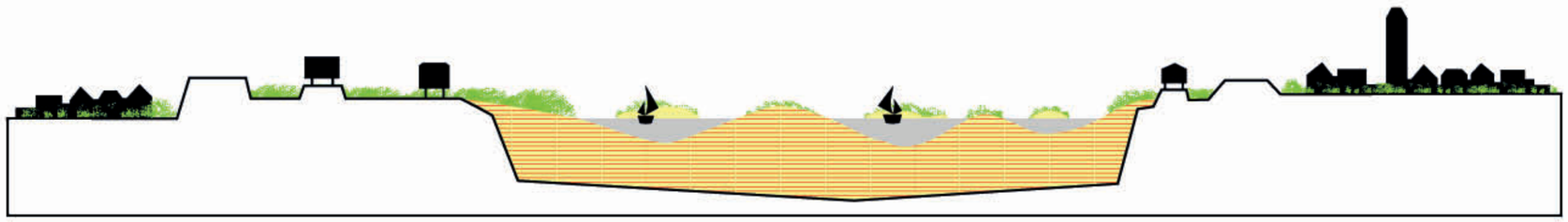




Soft approach

Hard approach





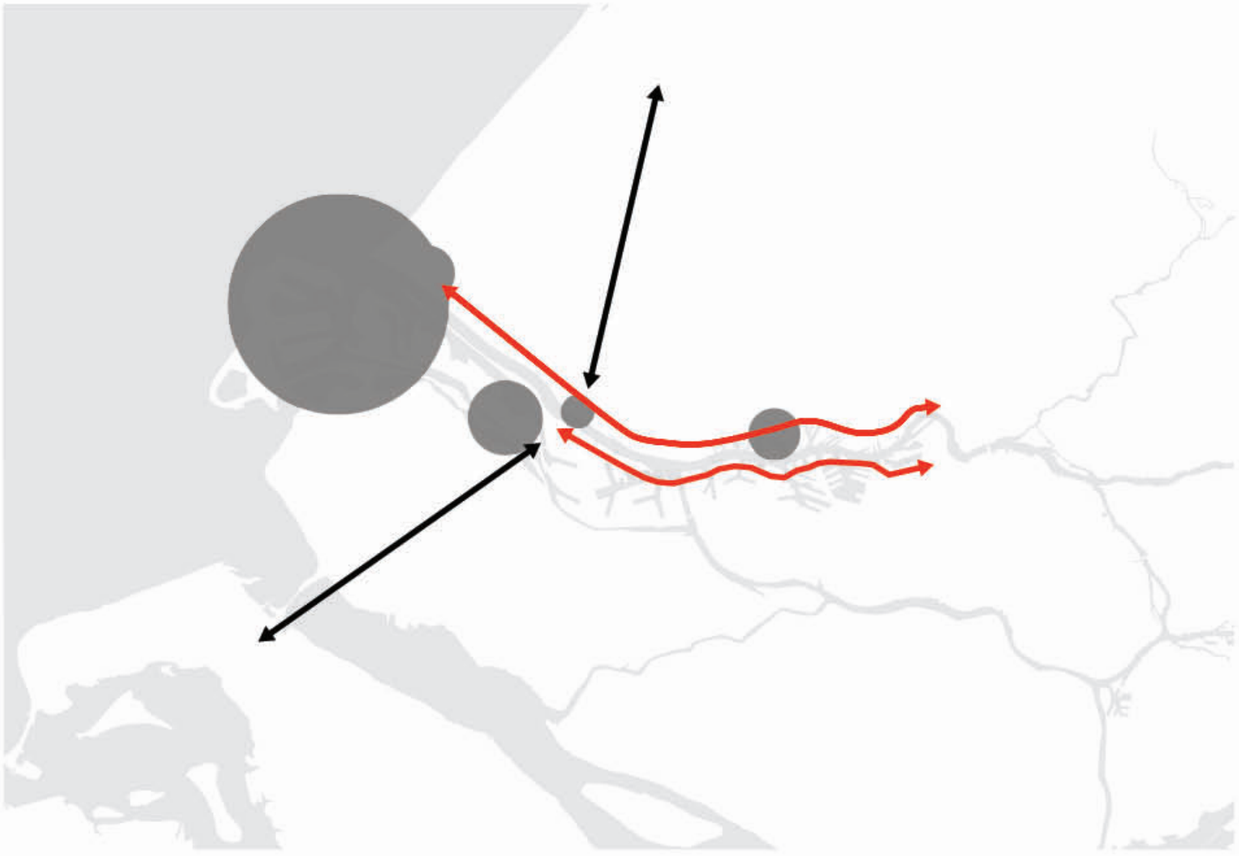
Soft approach

Regional structure

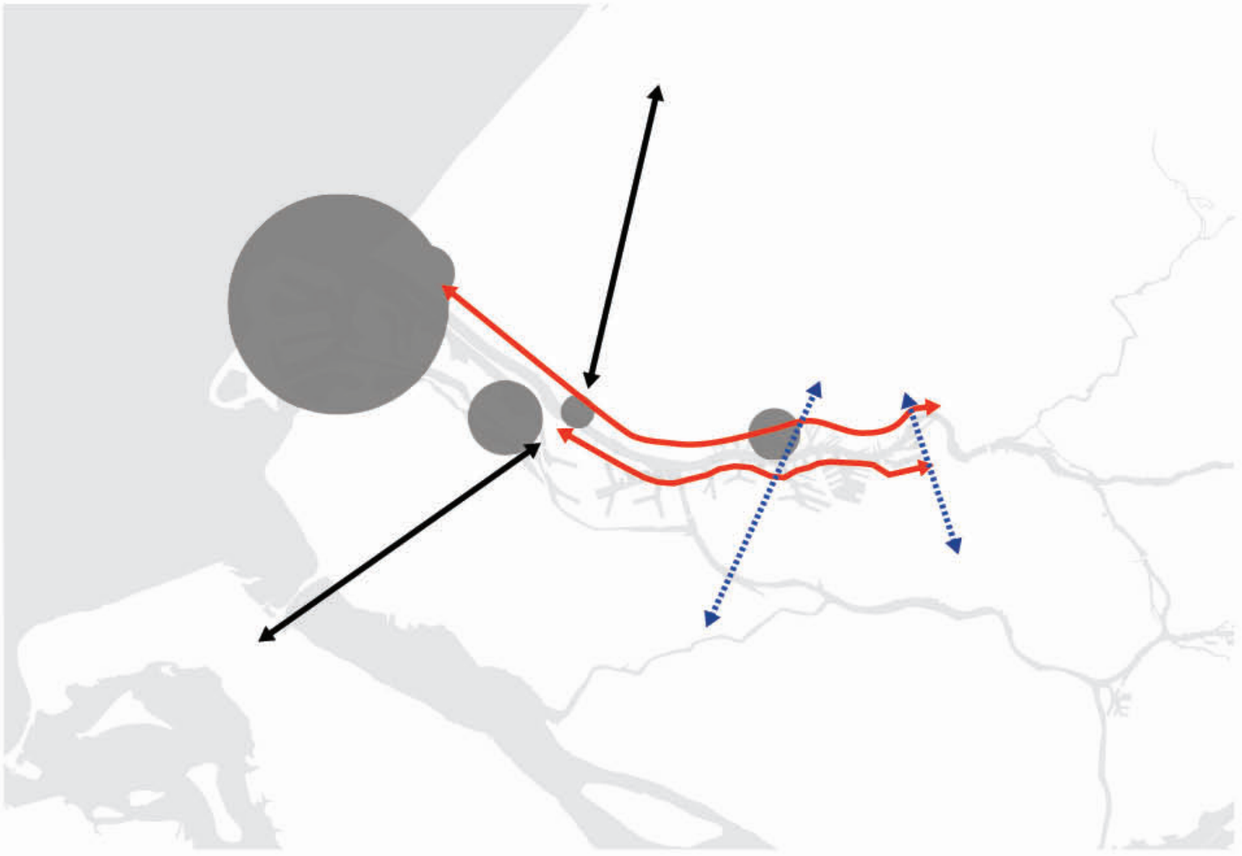
Hard approach

Soft approach

Regional structure

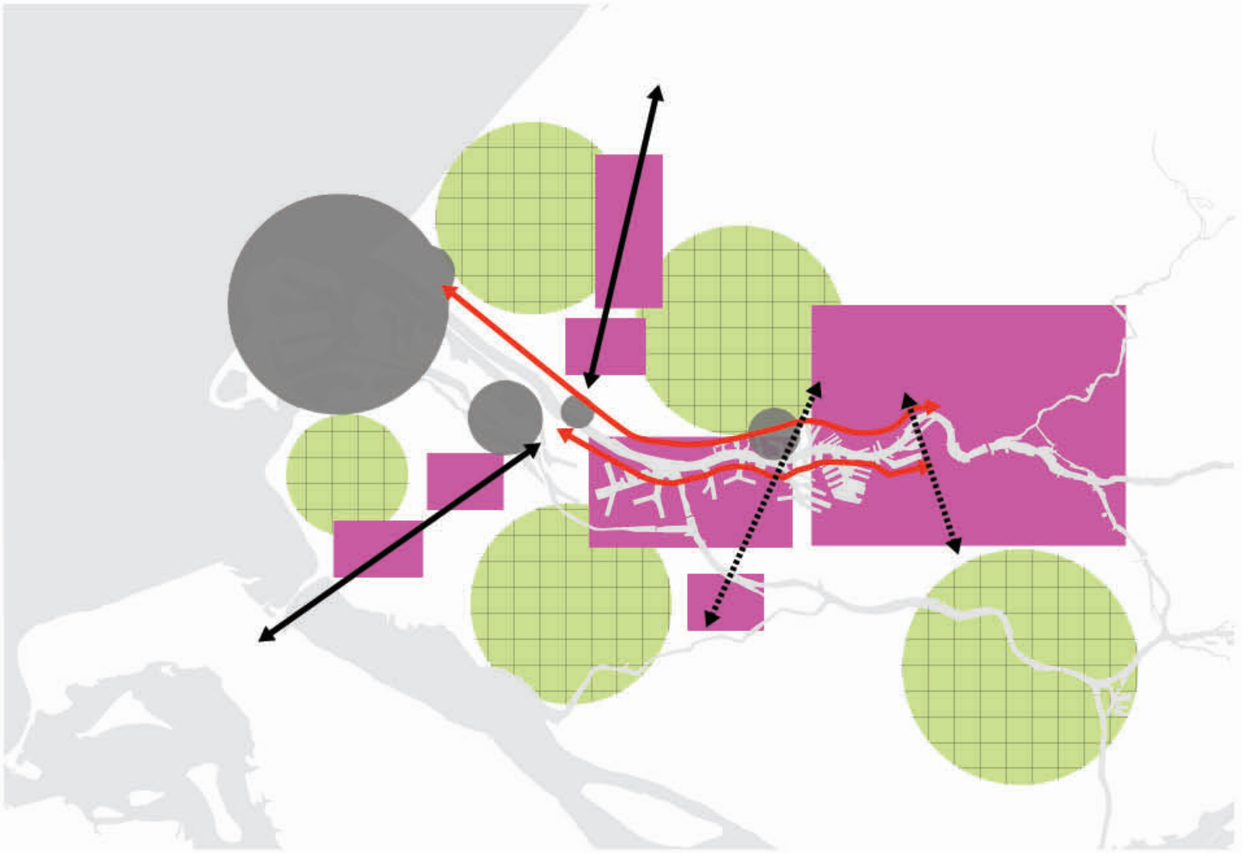


Regional structure



Regional structure

Regional structure

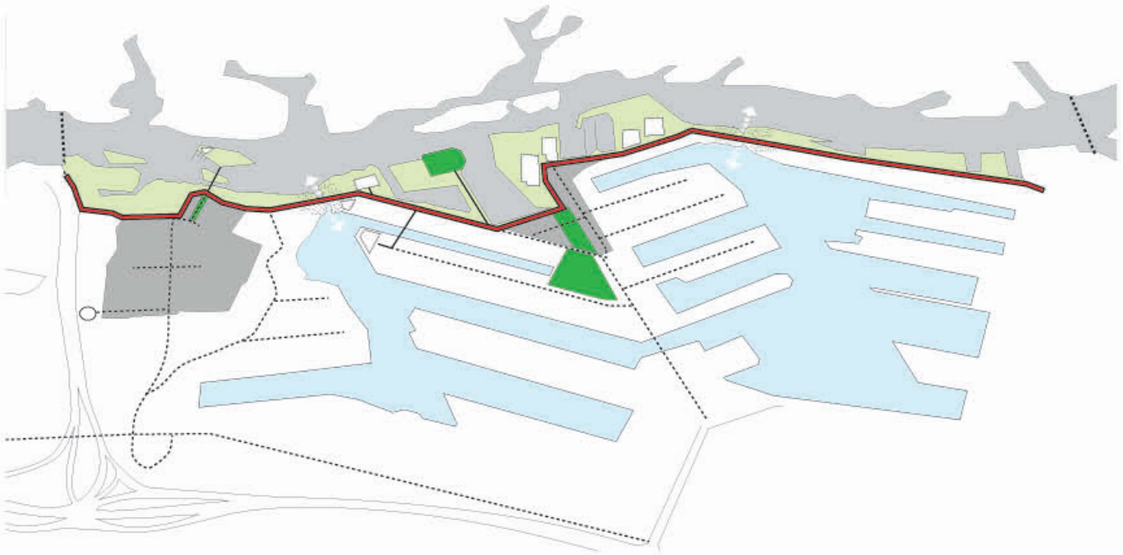


Regional structure

Hard approach

Soft approach

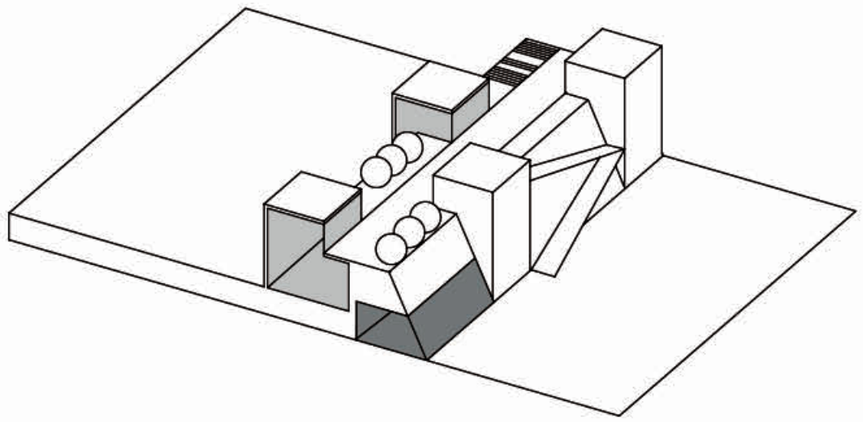
Heijplaat-Pernis scale

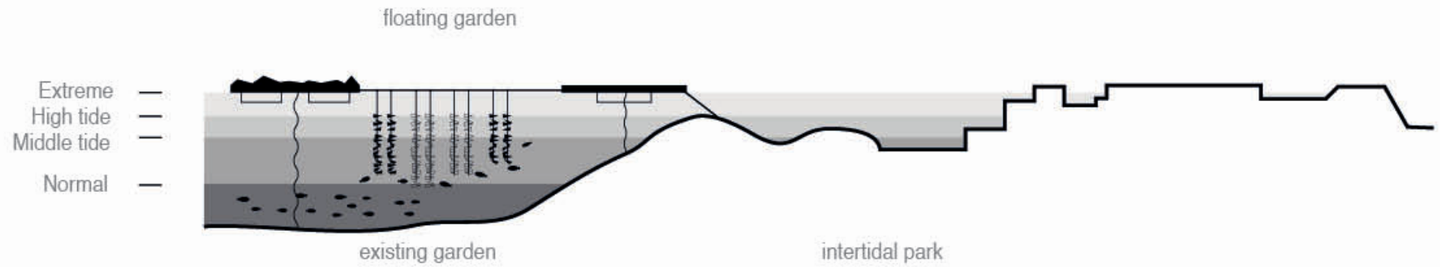


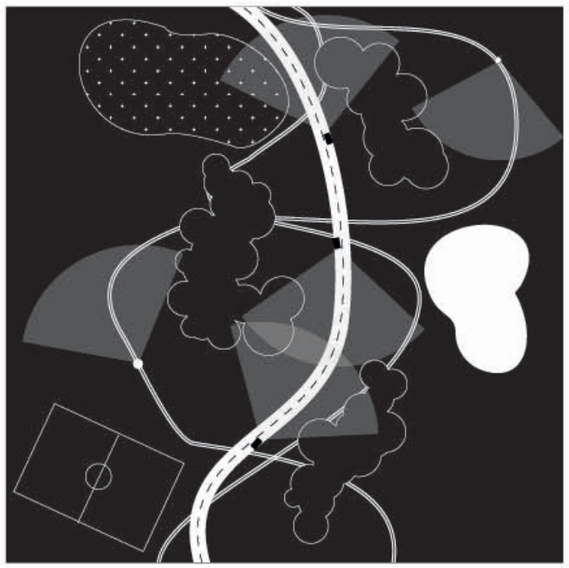
Hard approach

Soft approach

Heijplaat-Pernis scale



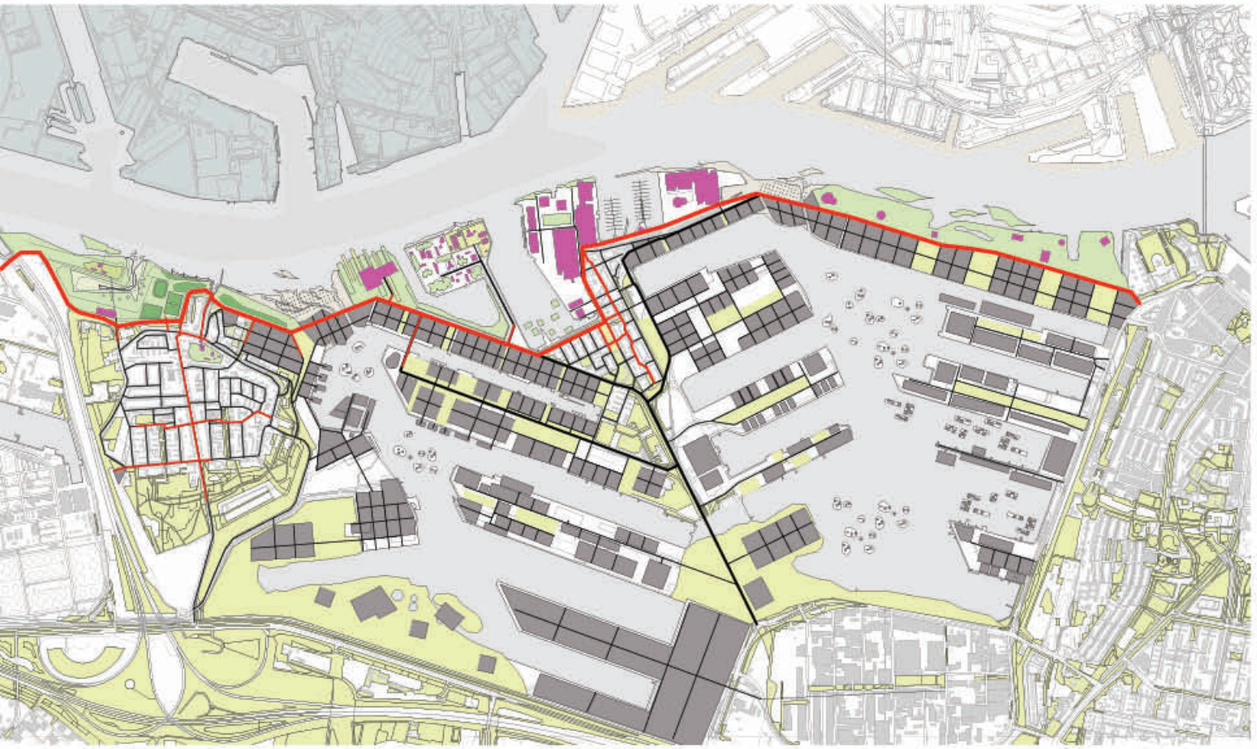


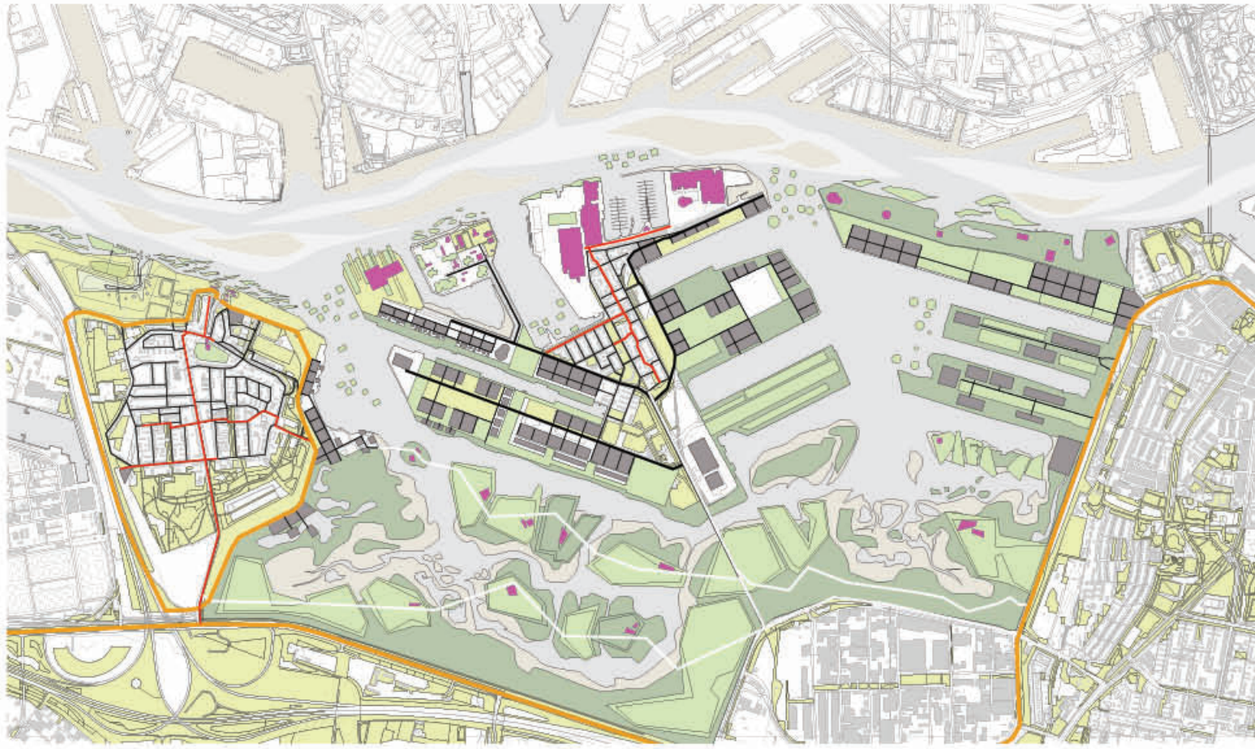


Hard approach

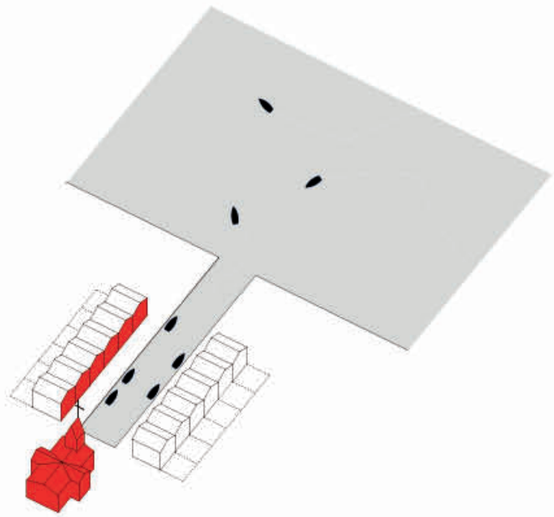
Soft approach

Heijplaat-Pernis scale

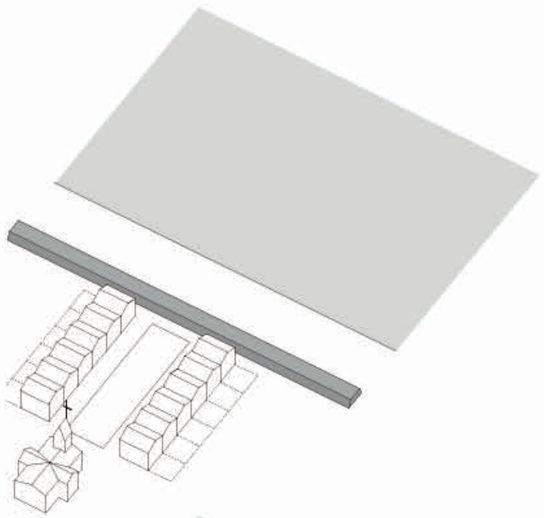




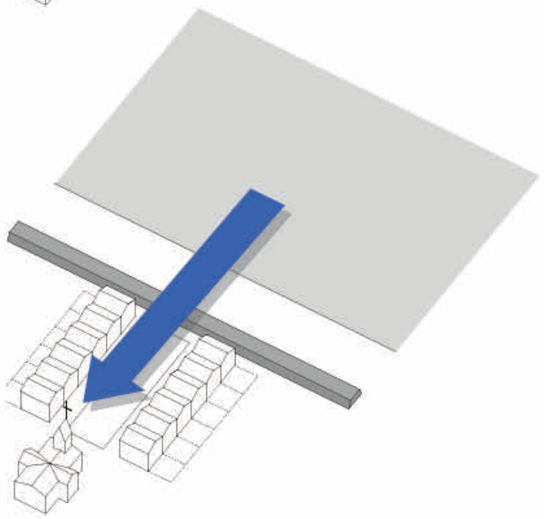
Pernis scale



Past
Direct water relation

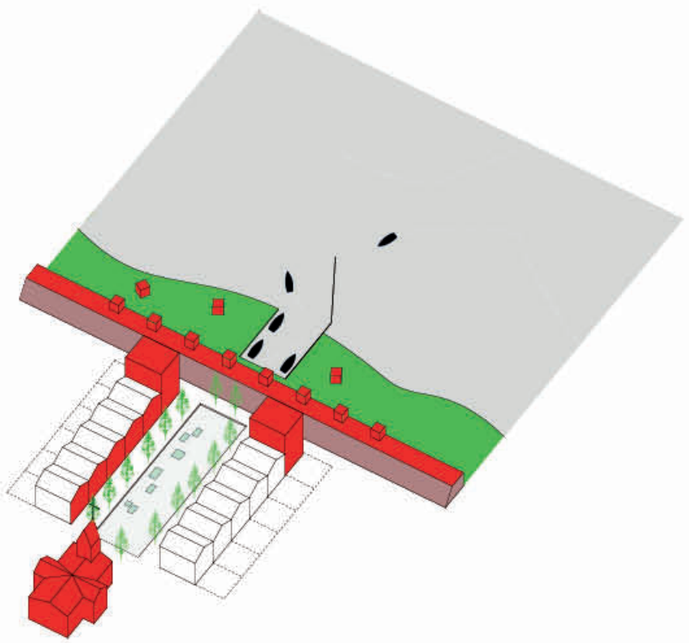


Present
Lost water relation

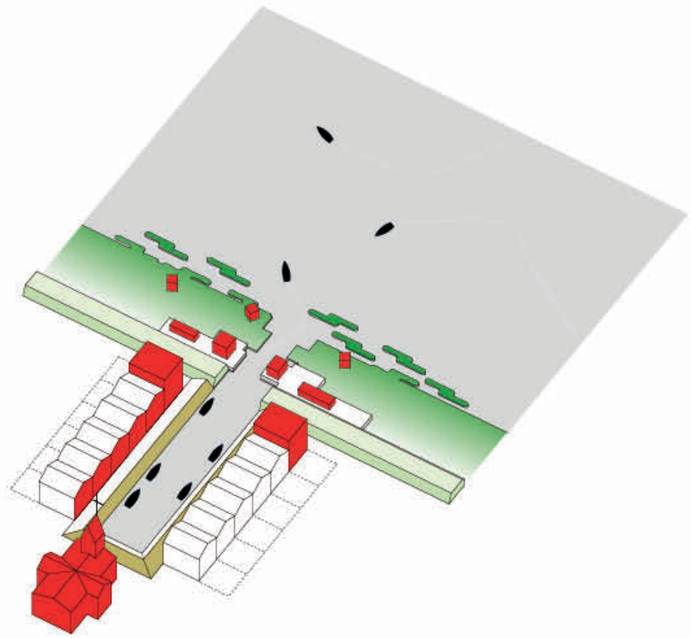


Future
Re-introduce water

Pernis scale



Hard approach
Sharp border



Soft approach
Gradual in/out

Hard approach ←

→ Soft approach

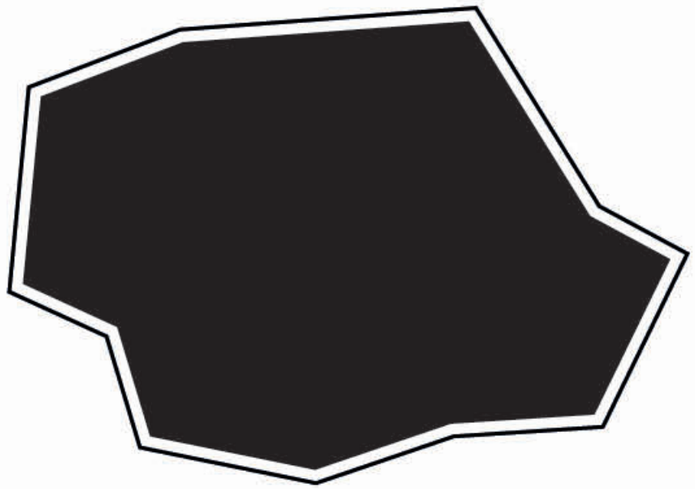
Pernis scale

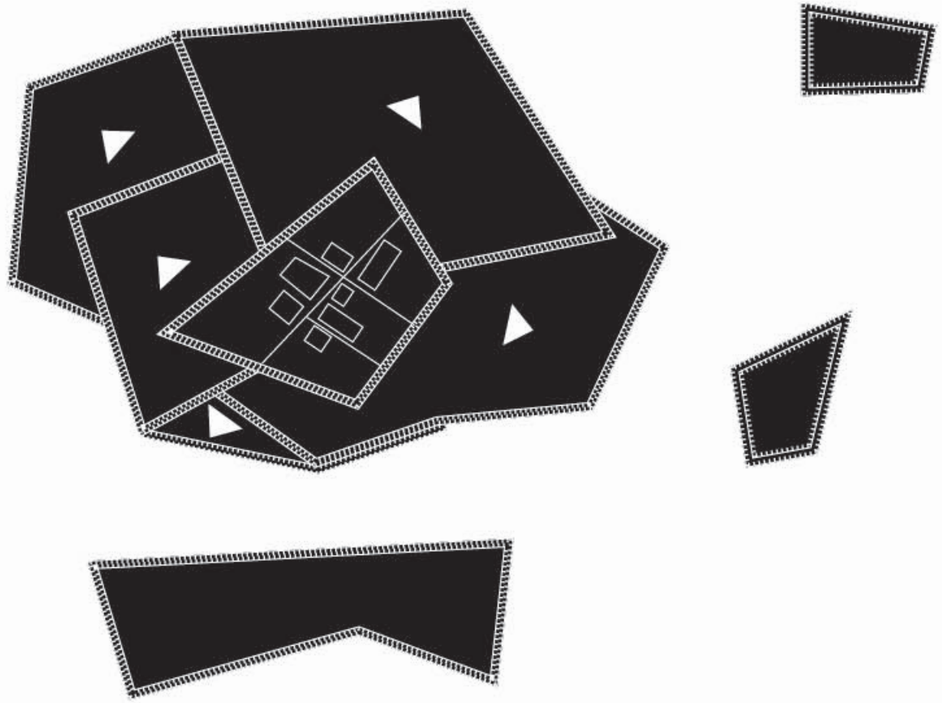
The Optimal balance between Hard & Soft

Optimal balance
by ‘Local context’

Hard approach ○ ✓ ○ Soft approach

Flexibility in development

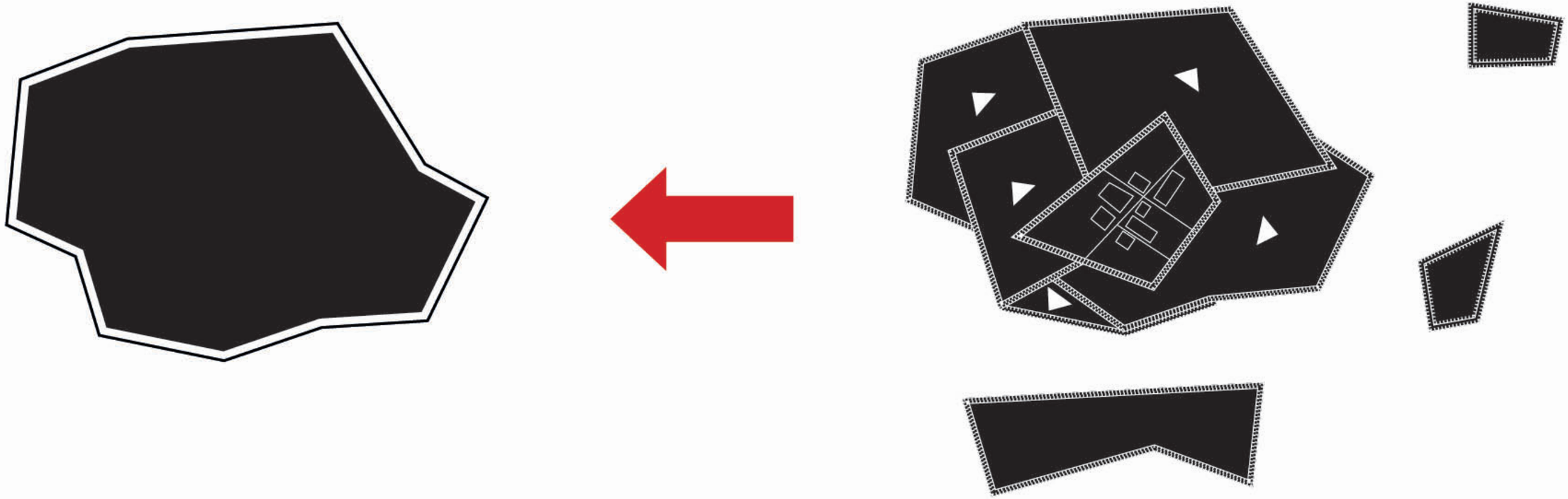




Hard approach

Soft approach

Shift approach



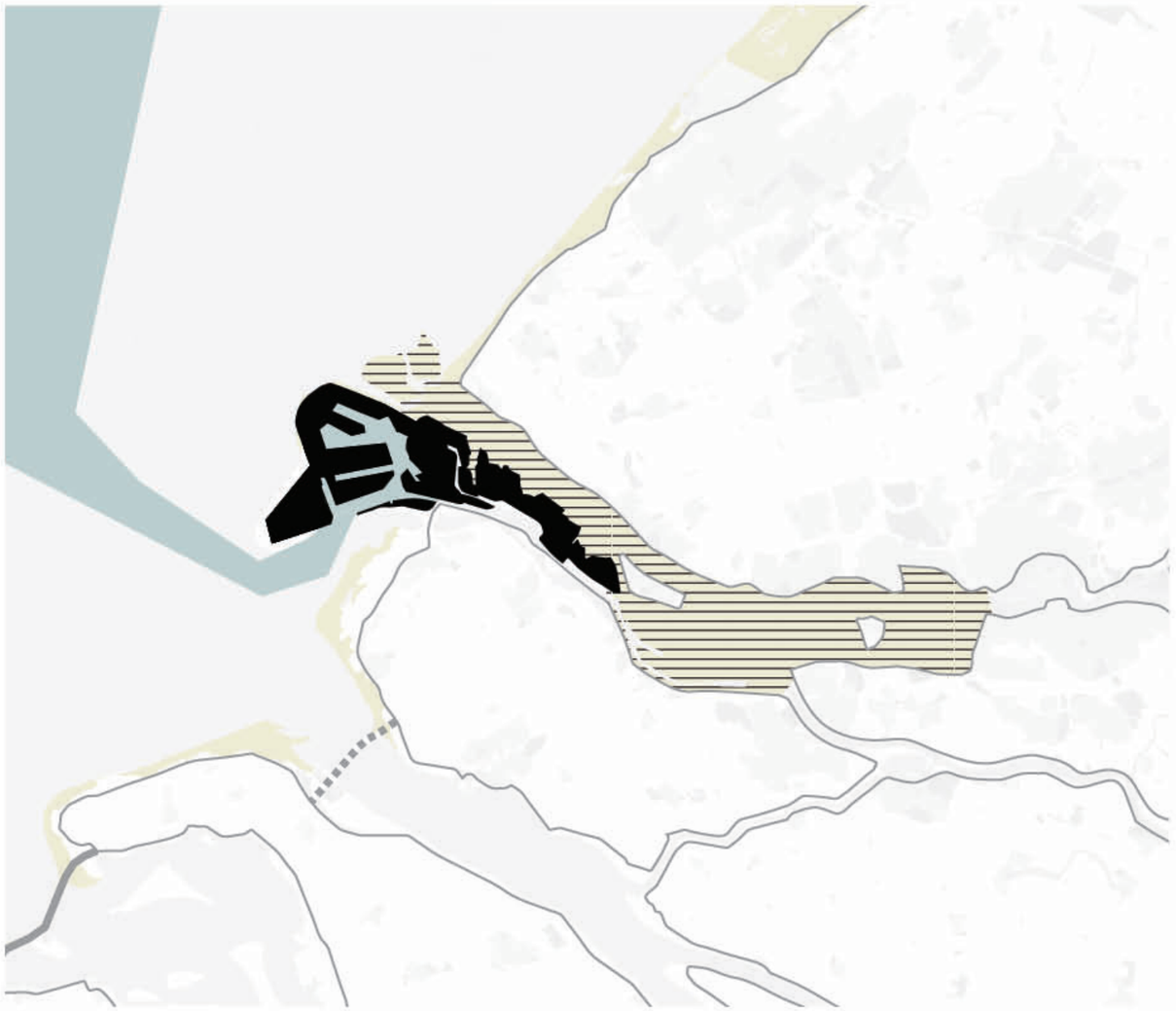
Hard approach

Soft approach

Hard approach ○ ✓ Soft approach

‘Soft approach should be applied mainly and firstly.’

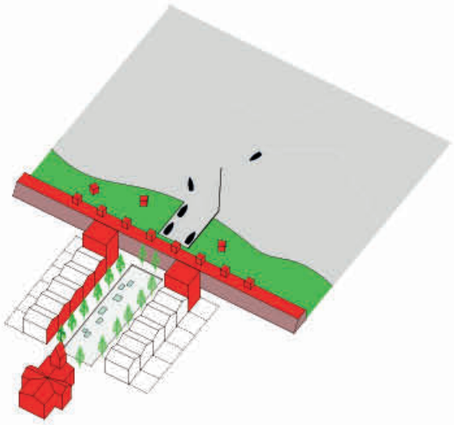
Port change

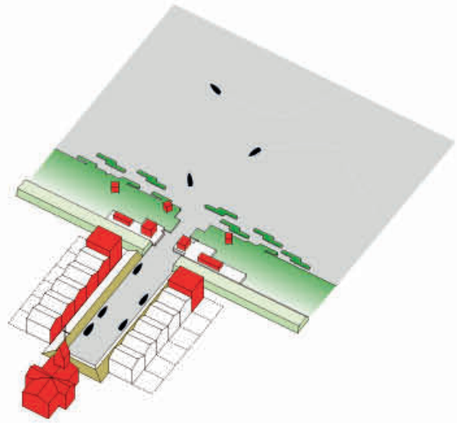


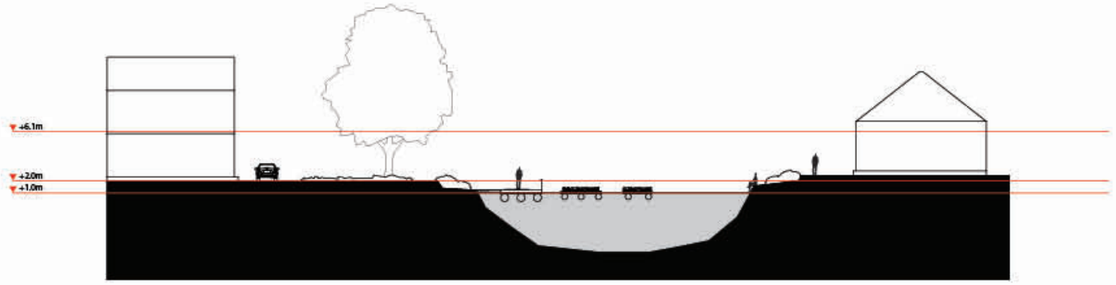
Hard approach

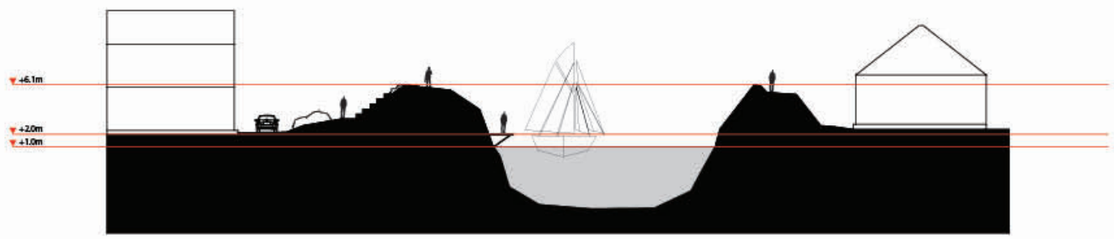
Soft approach

Spatial quality in settlment scale





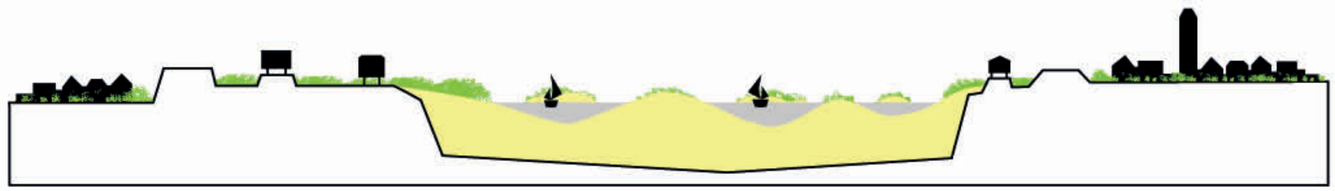




Hard approach

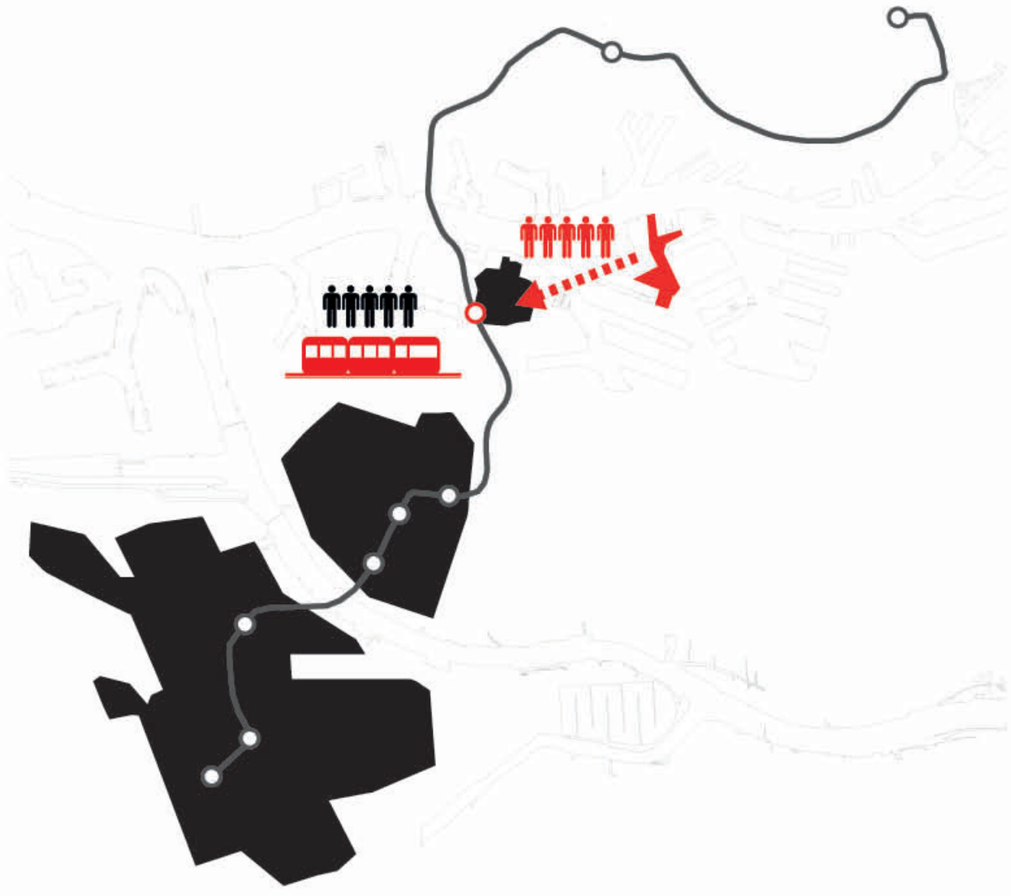
Soft approach

Dredging



Soft approach

Mobility



Hard approach

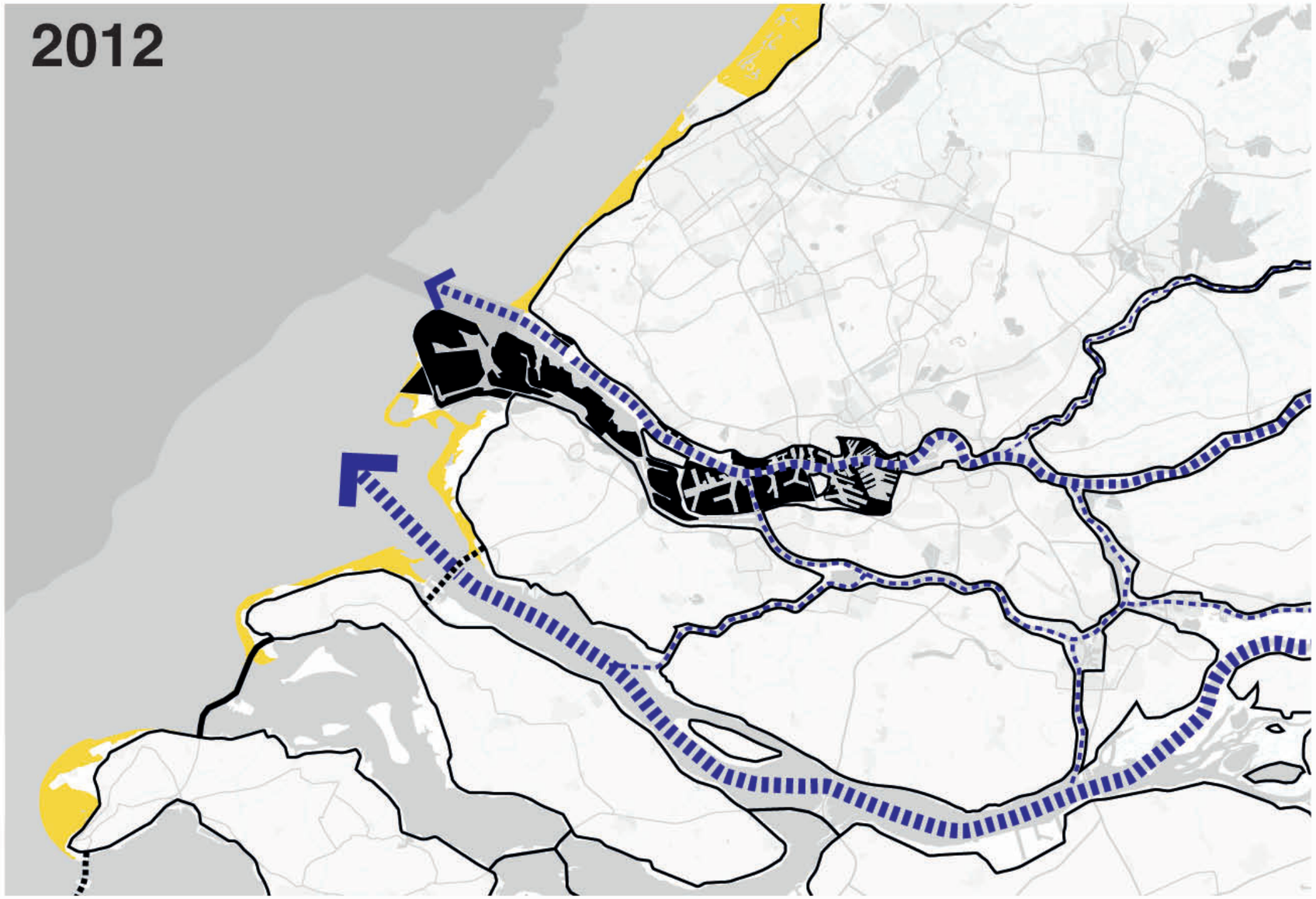
Hard approach ✓ Soft approach

‘Soft approach needs supplement by the combination with Hard.’

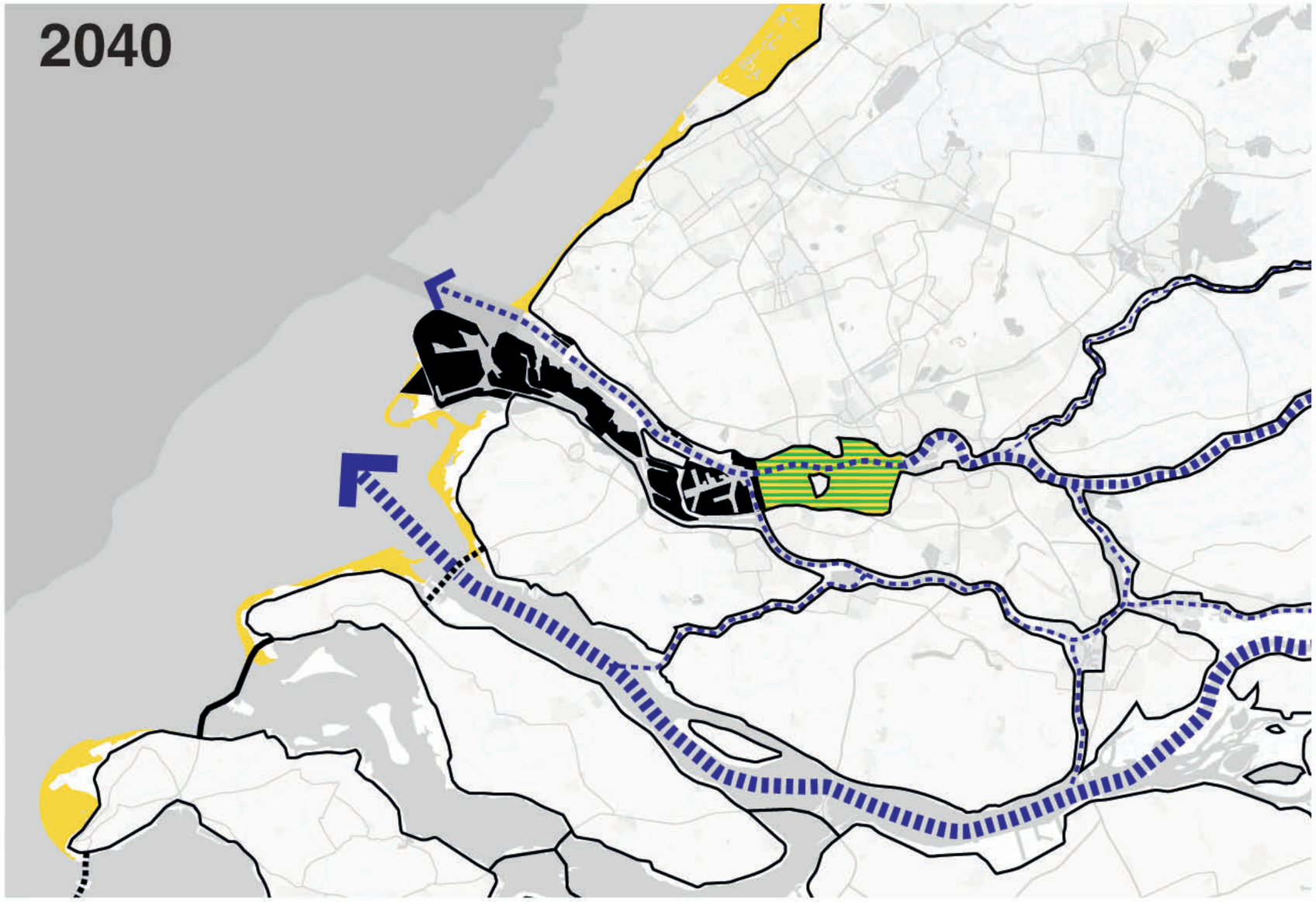
Proposal for Water regime

by new balanced approach

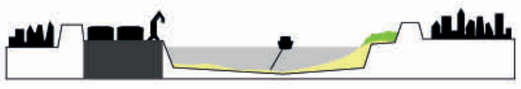
South west delta scale

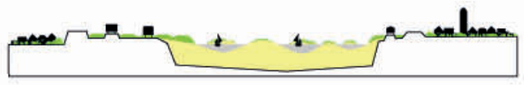


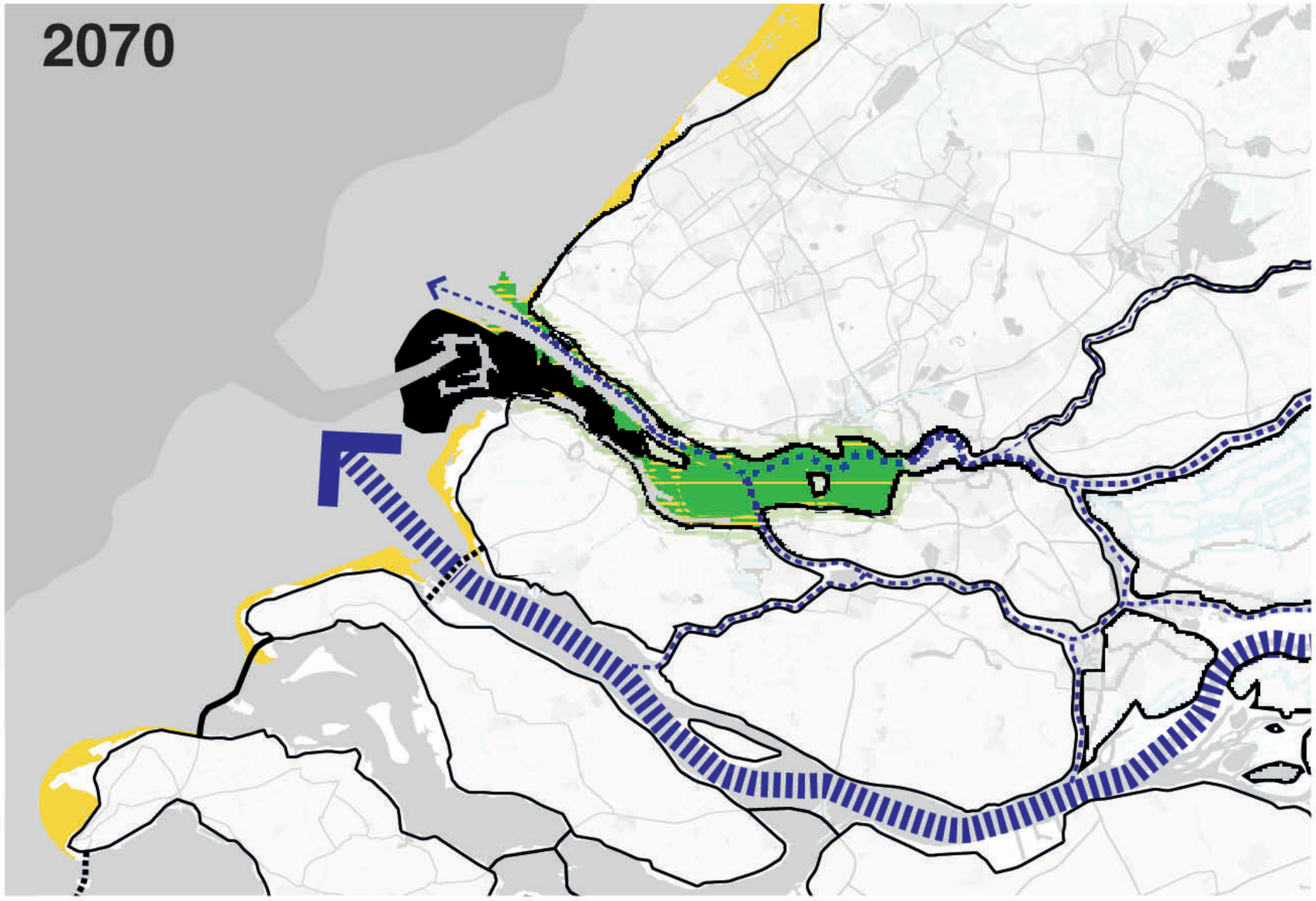
Existing condition



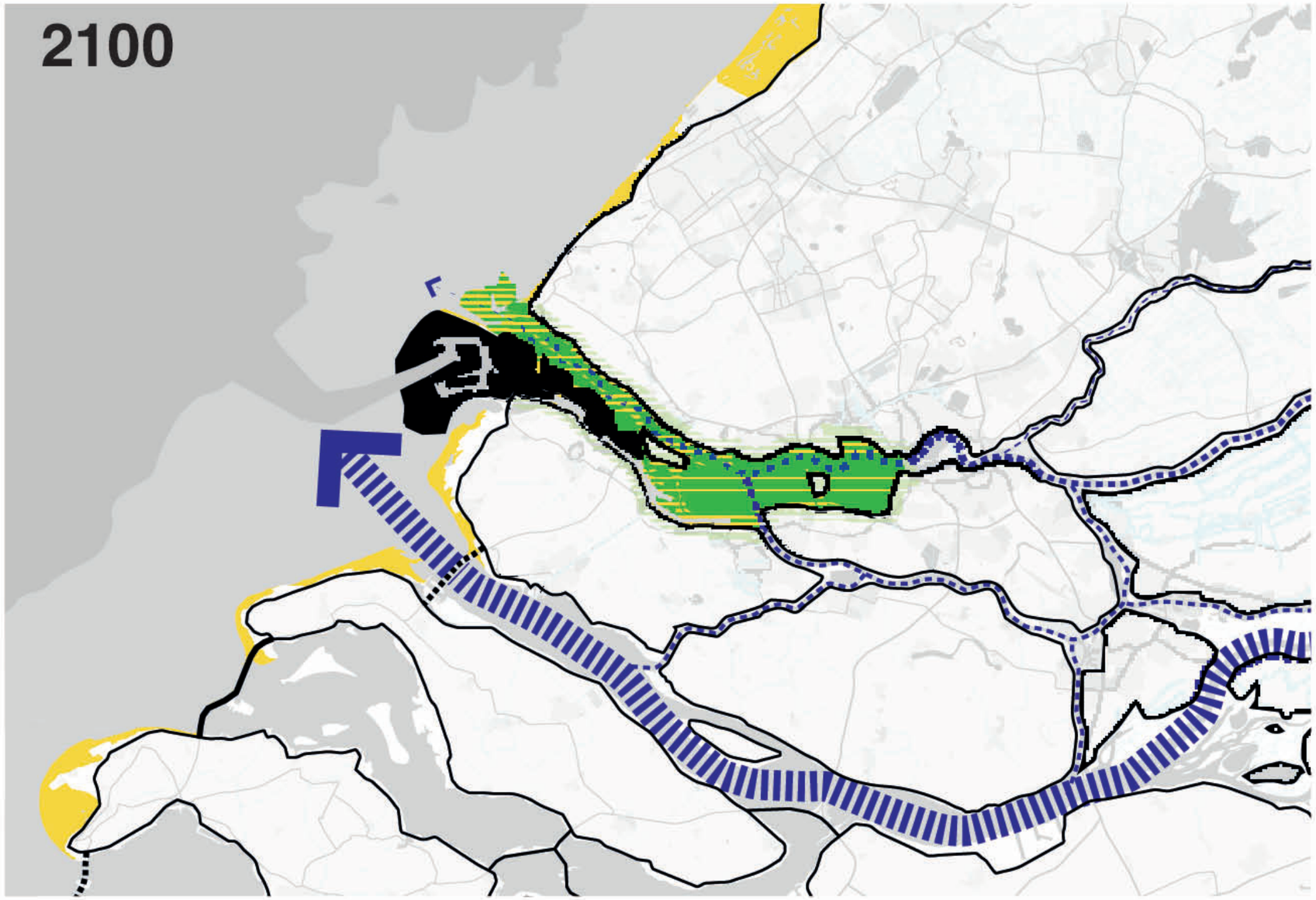
Natural sedimentation in upstream



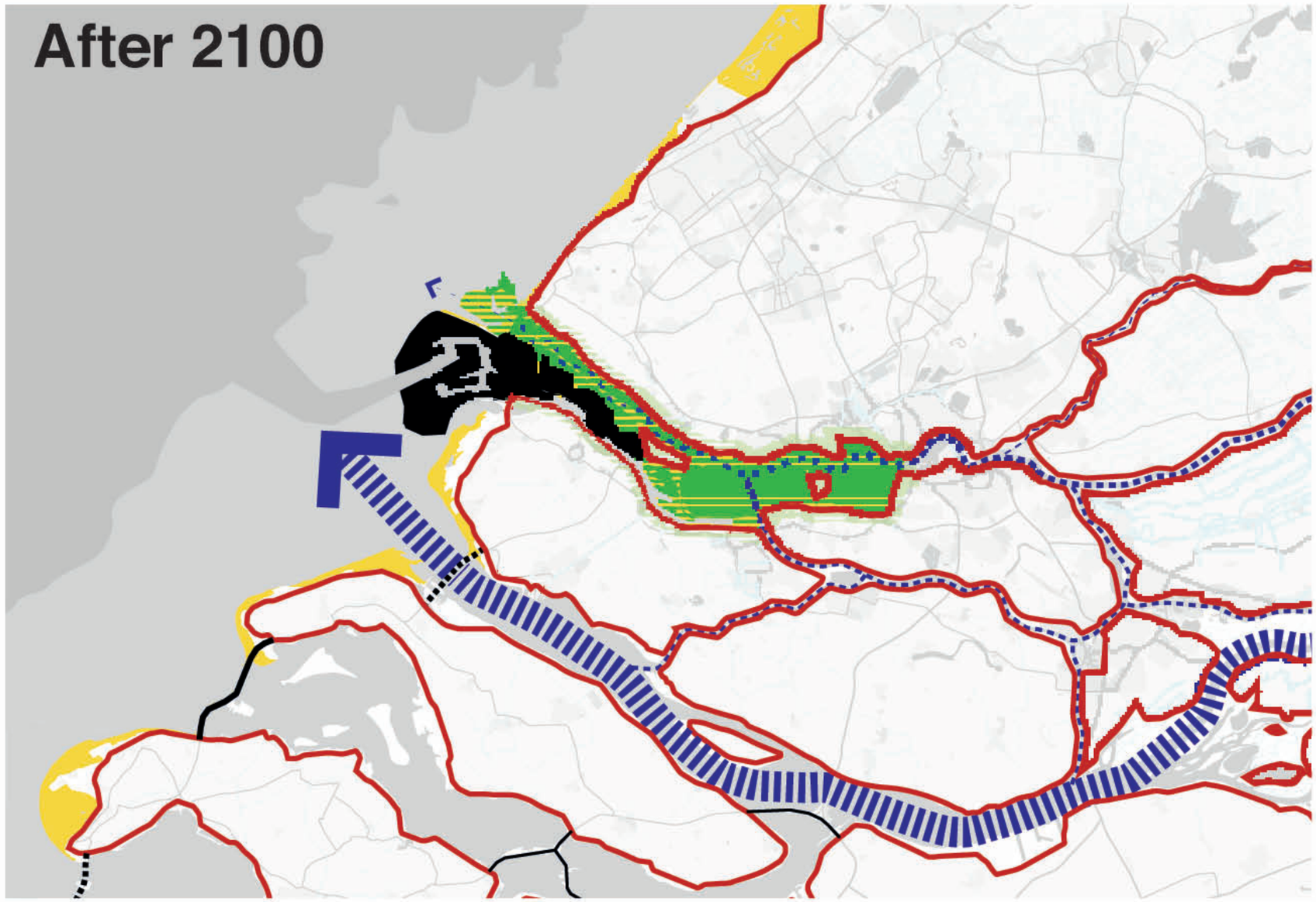




Natural sedimentation with dredging



No port along Niuew waterweg



Switch to Hard approach

Phasing plan + River condition change

Phasing plan

2012 2100

Neutral project ····› Future change related project

Improve current problem

River condition

2012

Gradual river change by Natural process

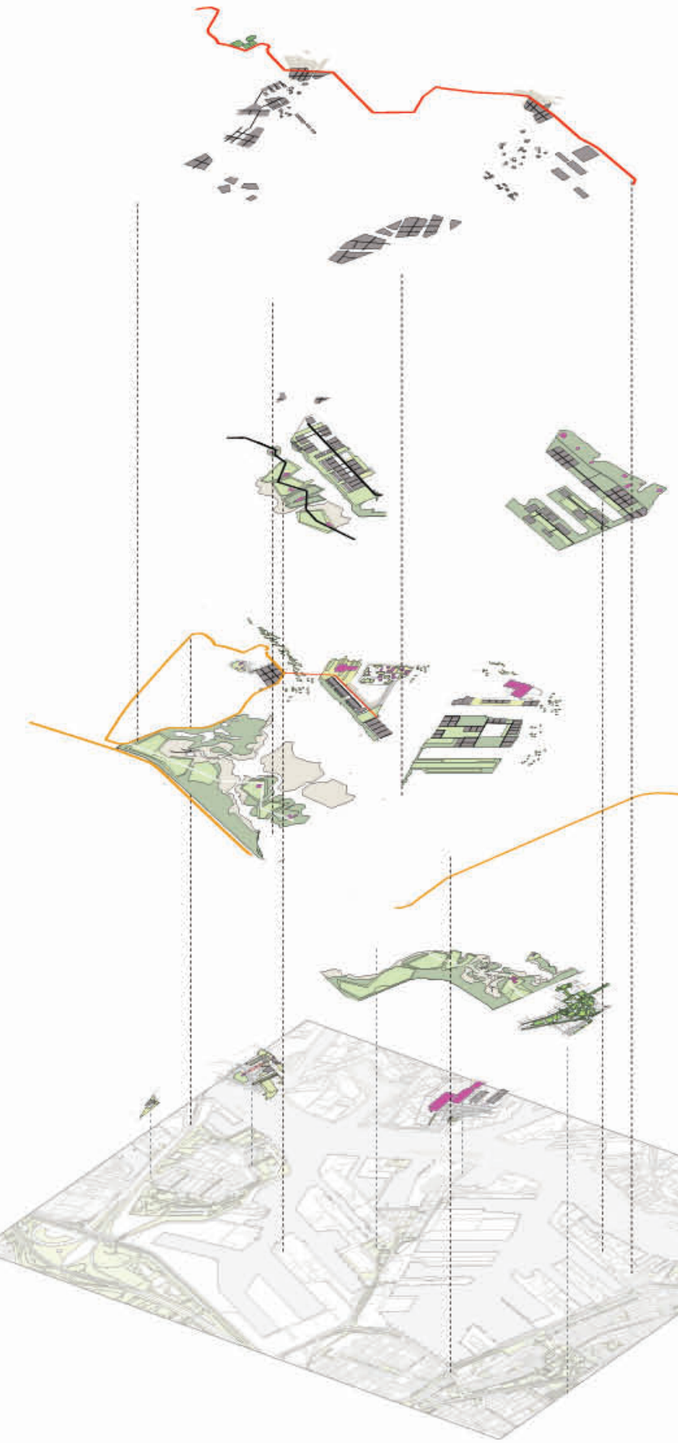
2100

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

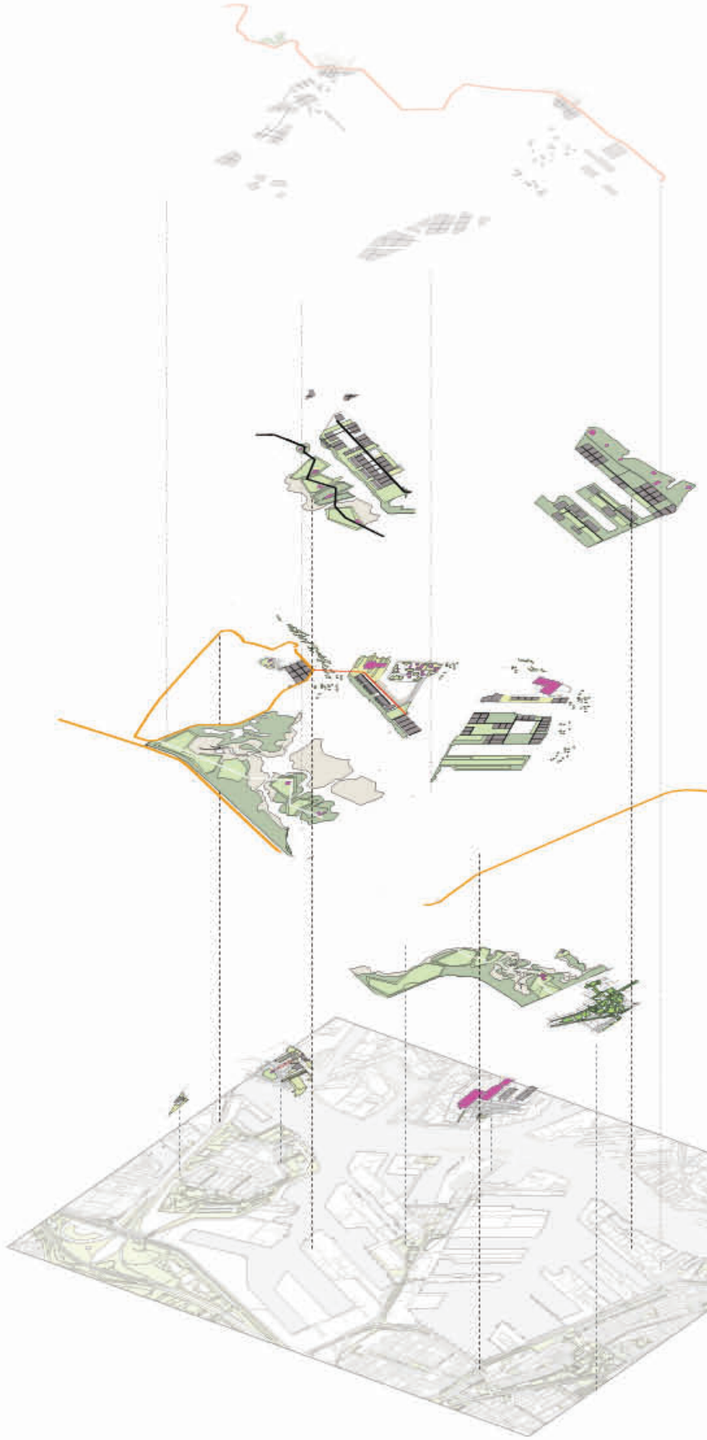
Green connection, housing area
Phase 4: Complete

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

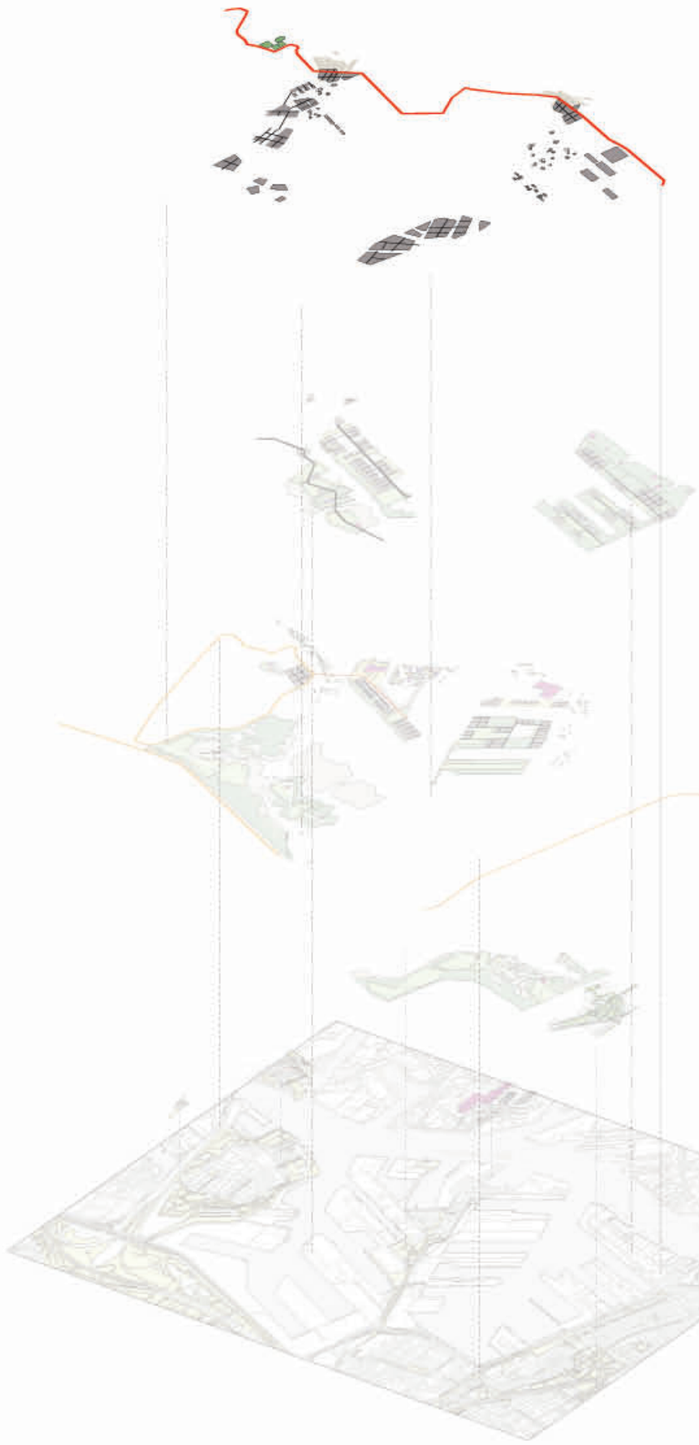
Green connection, housing area
Phase 4: Complete

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

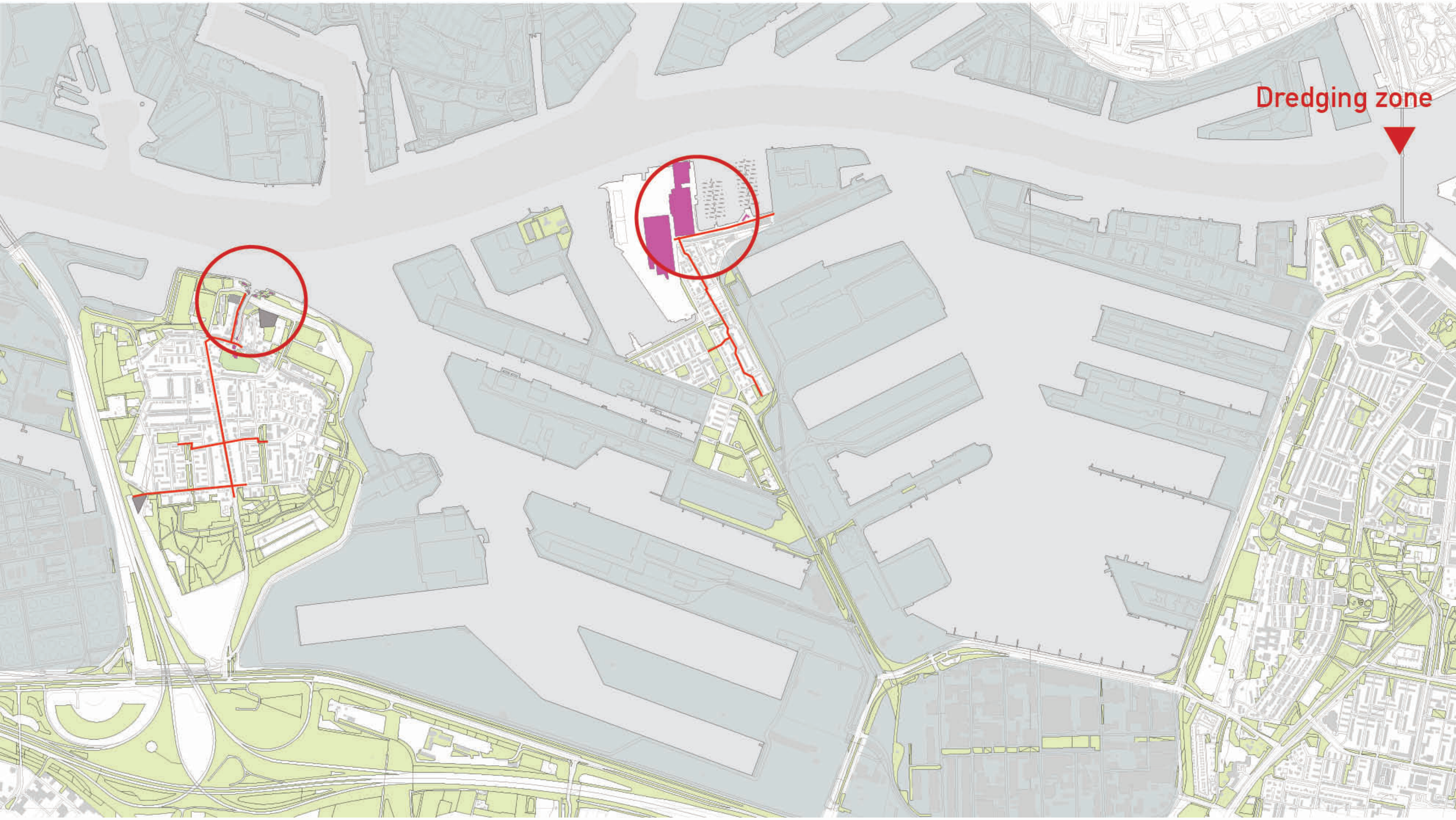
Pernis-Heijplaat connection, green connection
Phase 3

Green connection: Rotterdam south- Heijplaat
Phase 2

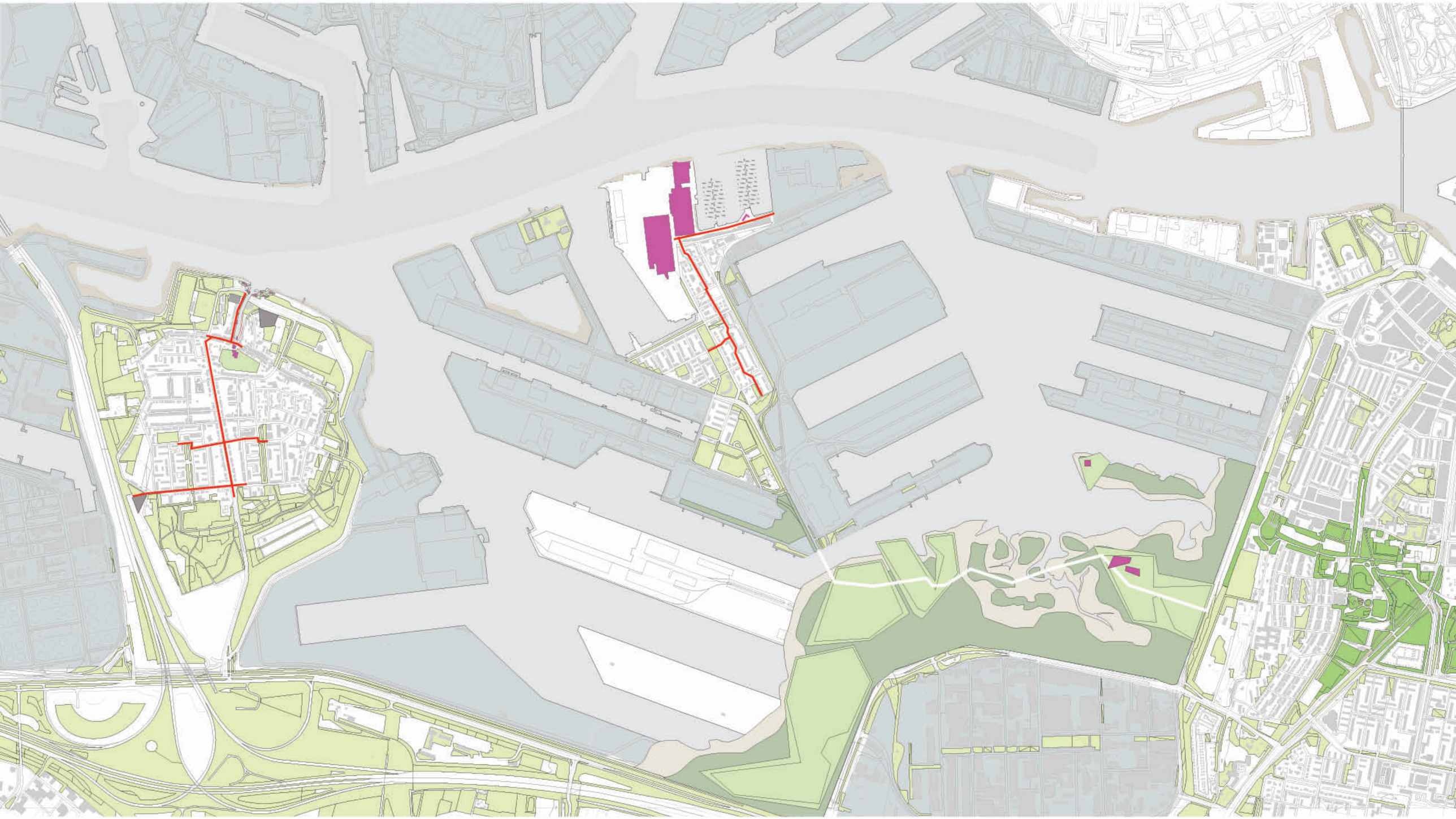
Key project: historical waterfront, station area
Phase 1

2020

2020

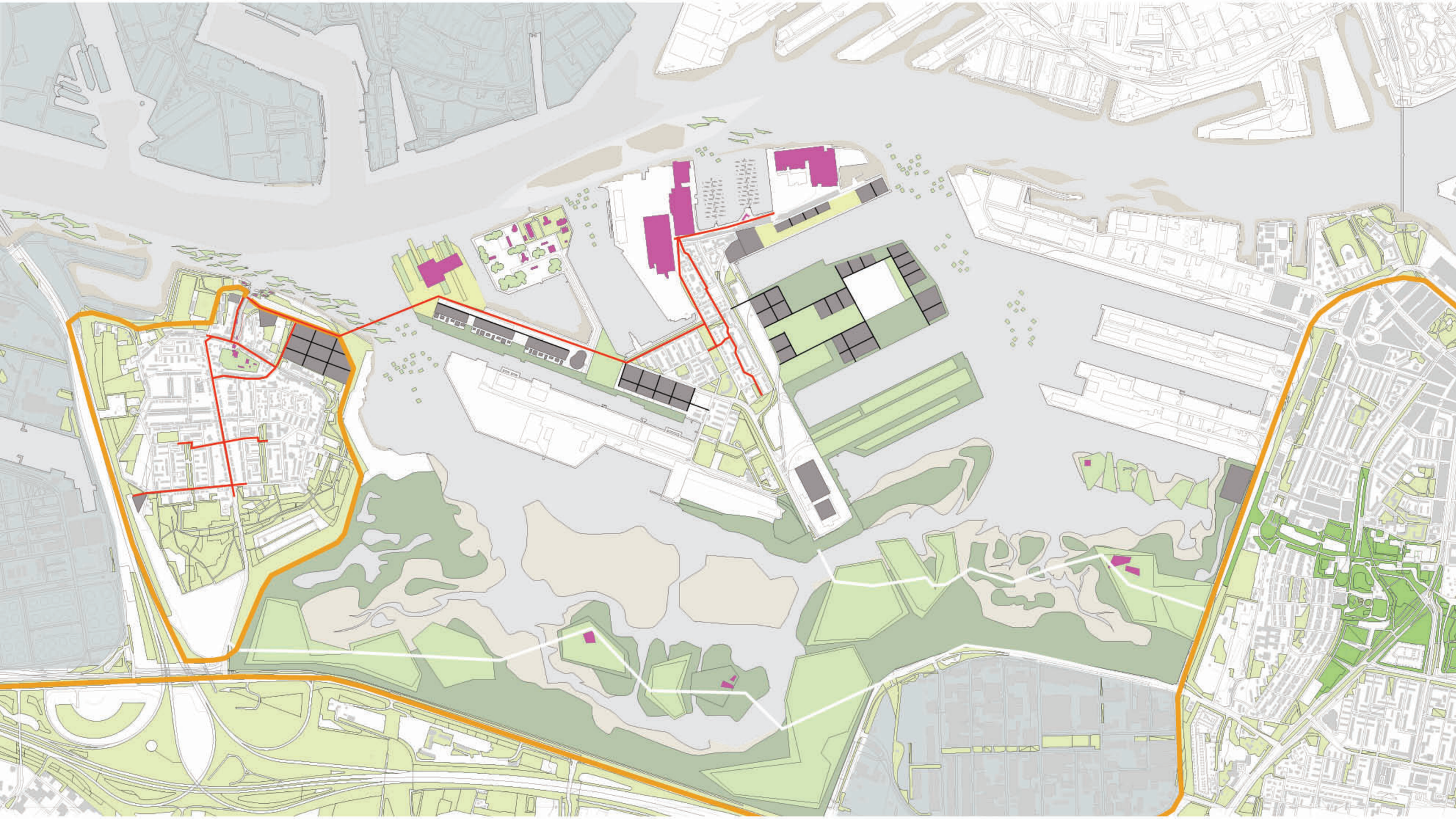


2050

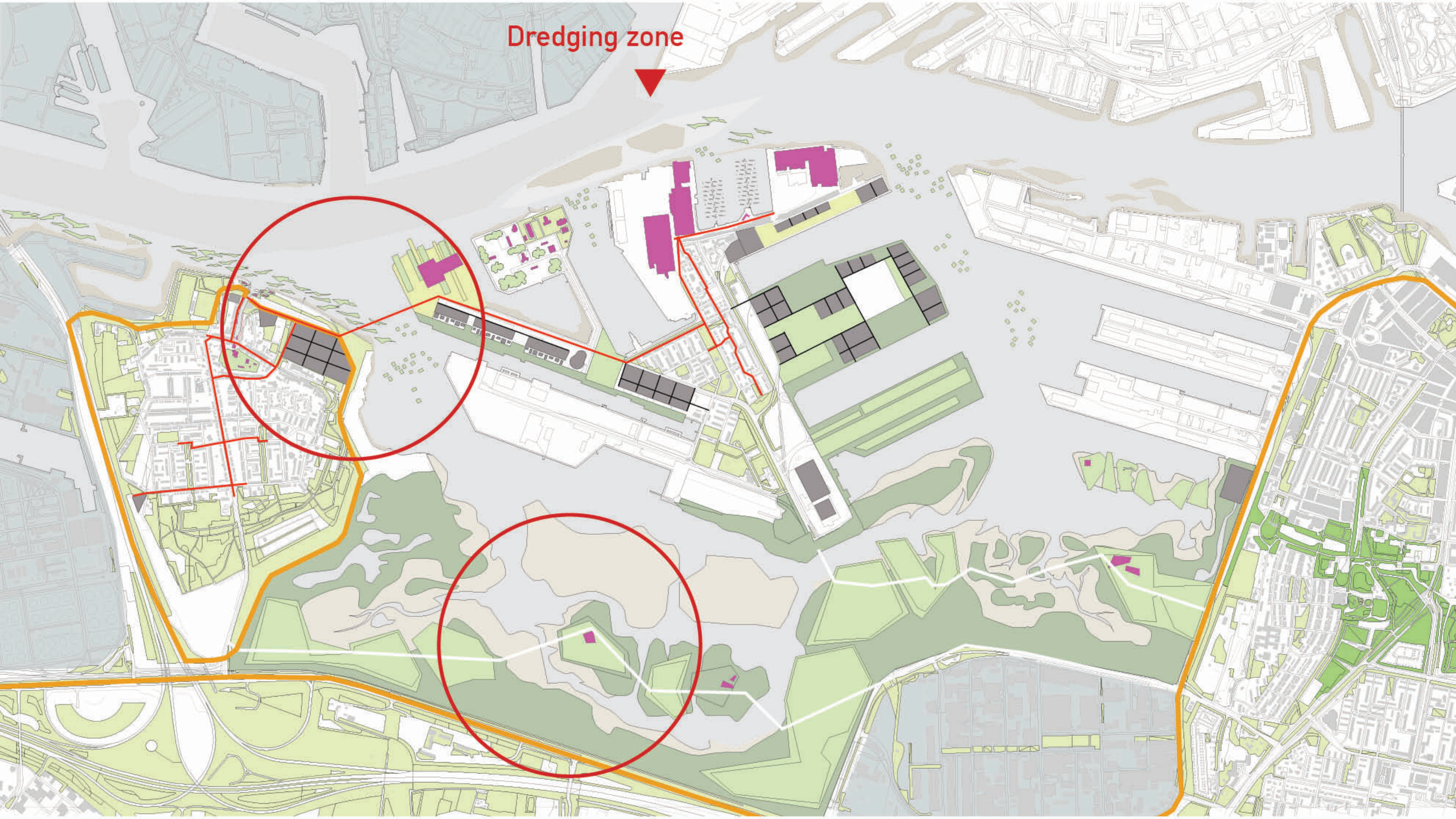


2050

2070

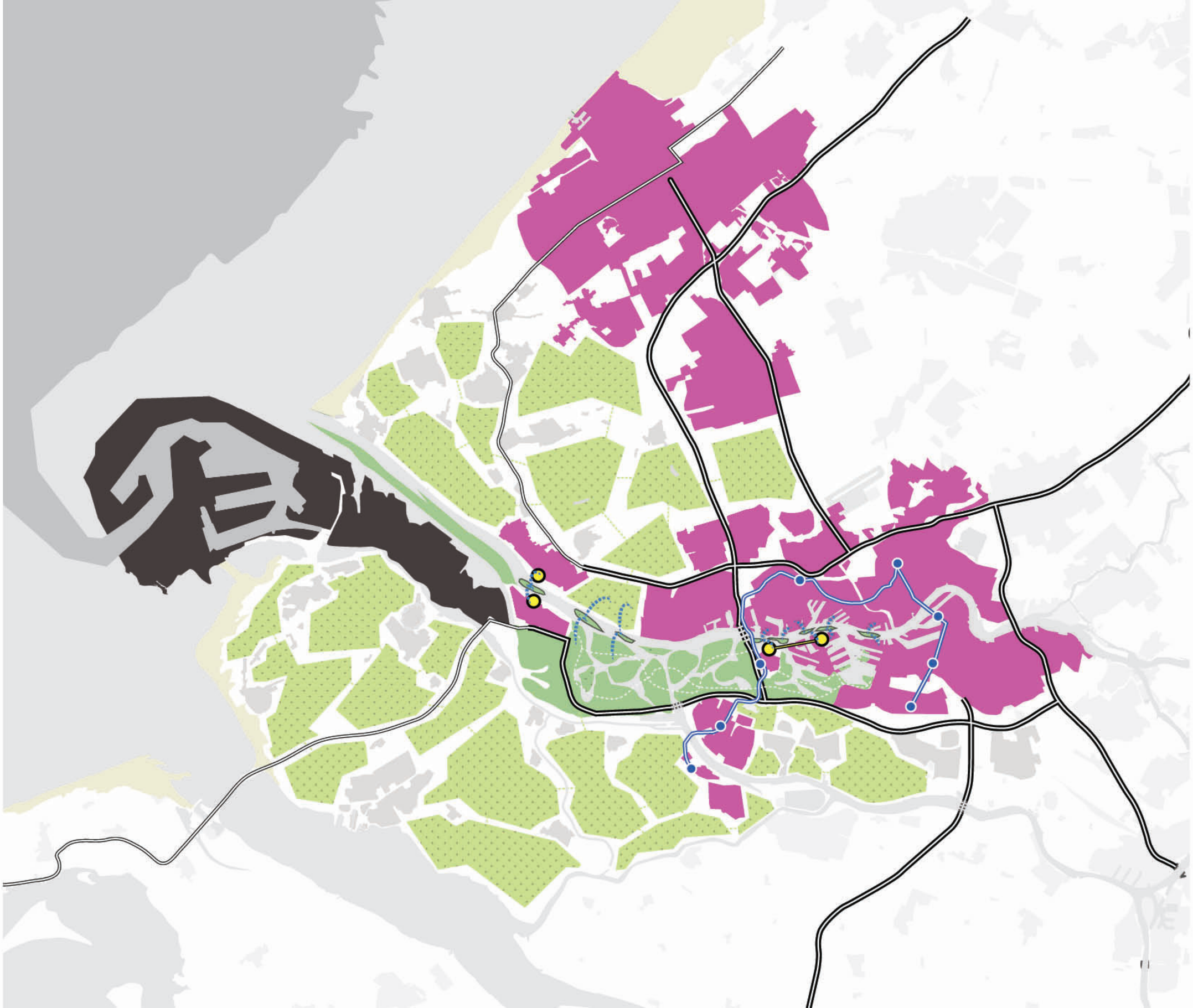


2070

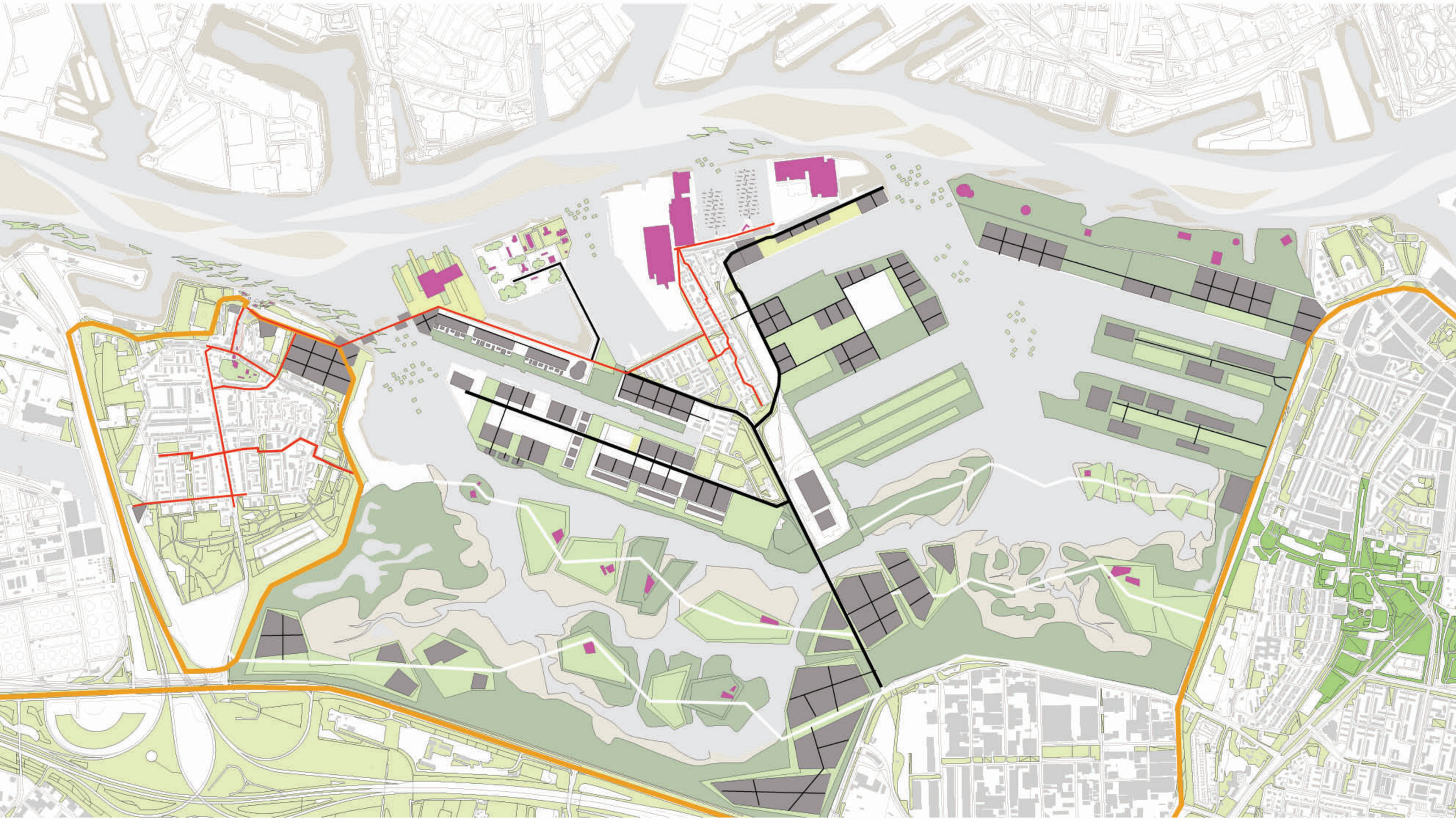


2100

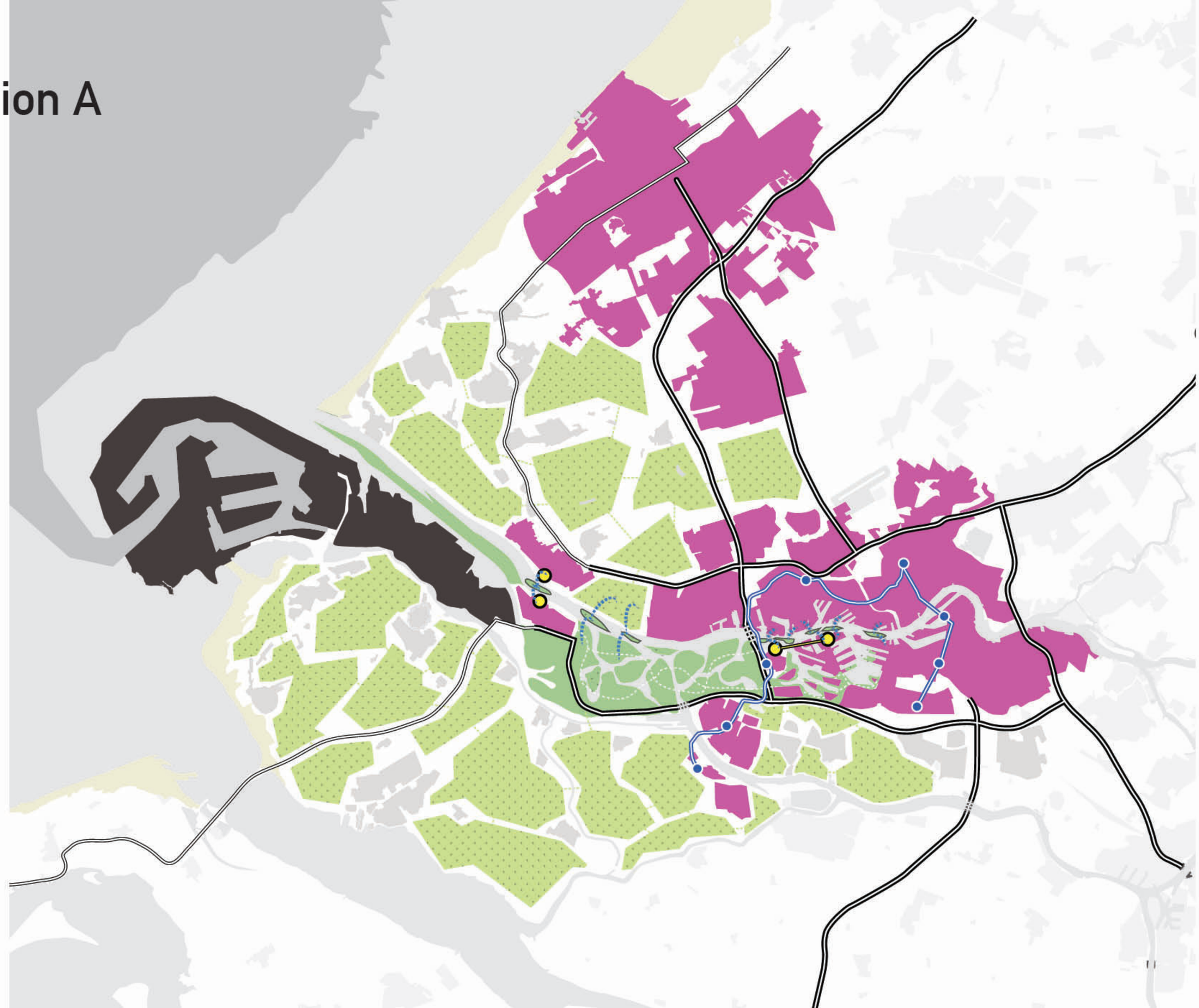
2100



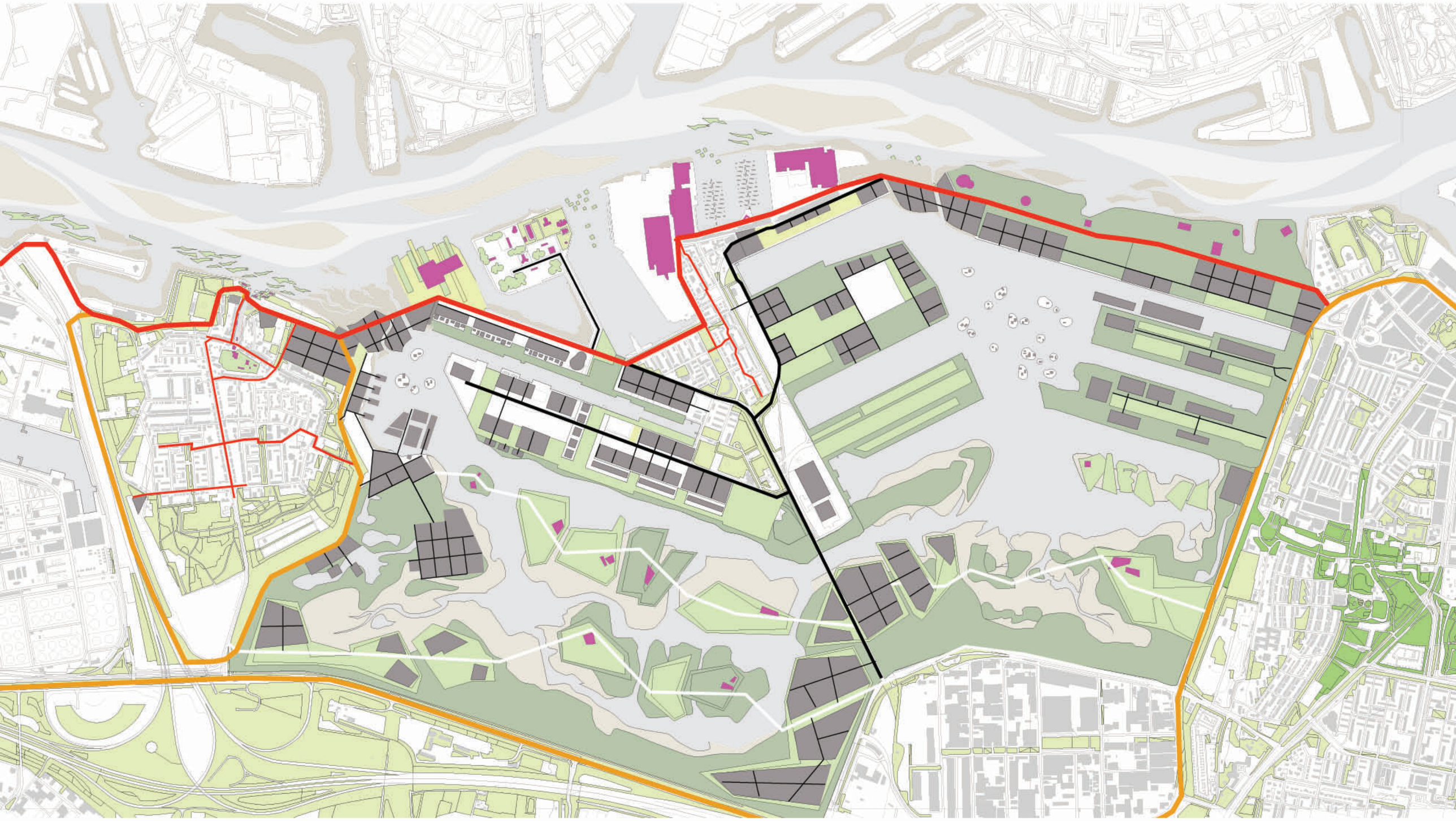
Option A: More development pressure keeping Soft approach



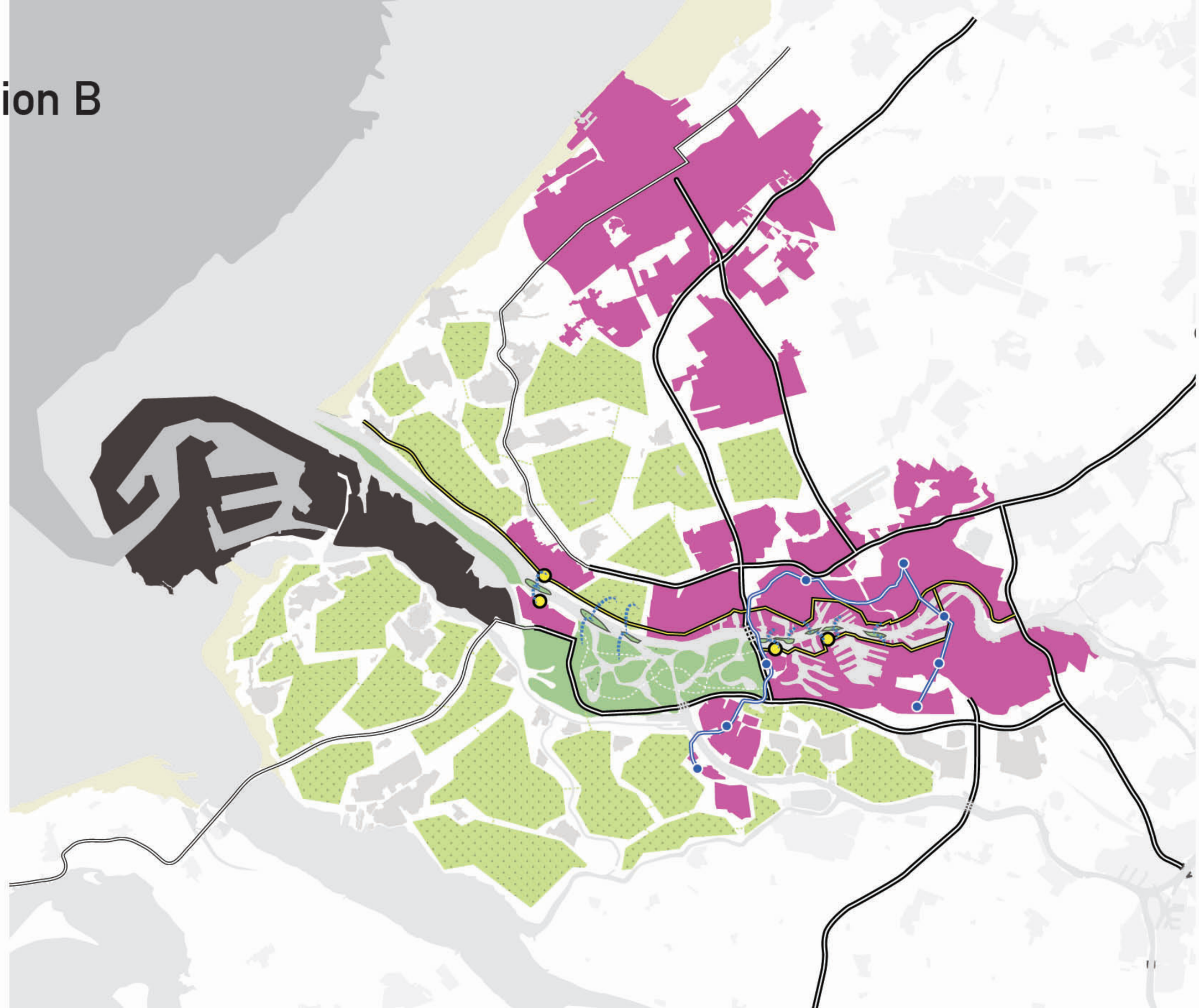
Option A



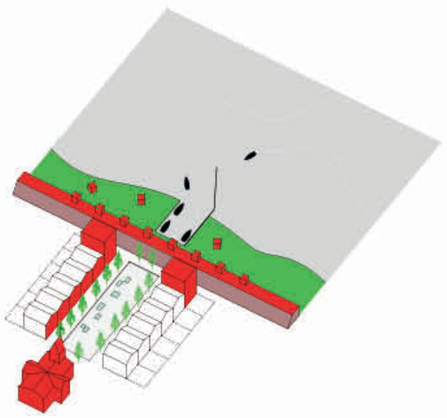
Option B: More guaranteed safety



Option B

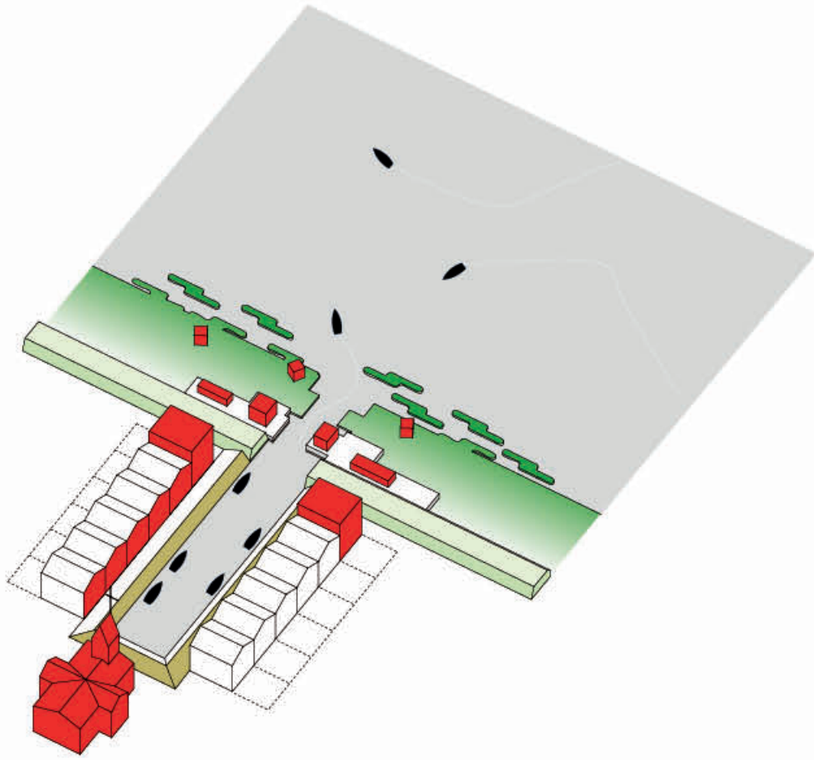


Design idea for settlement by new balanced approach

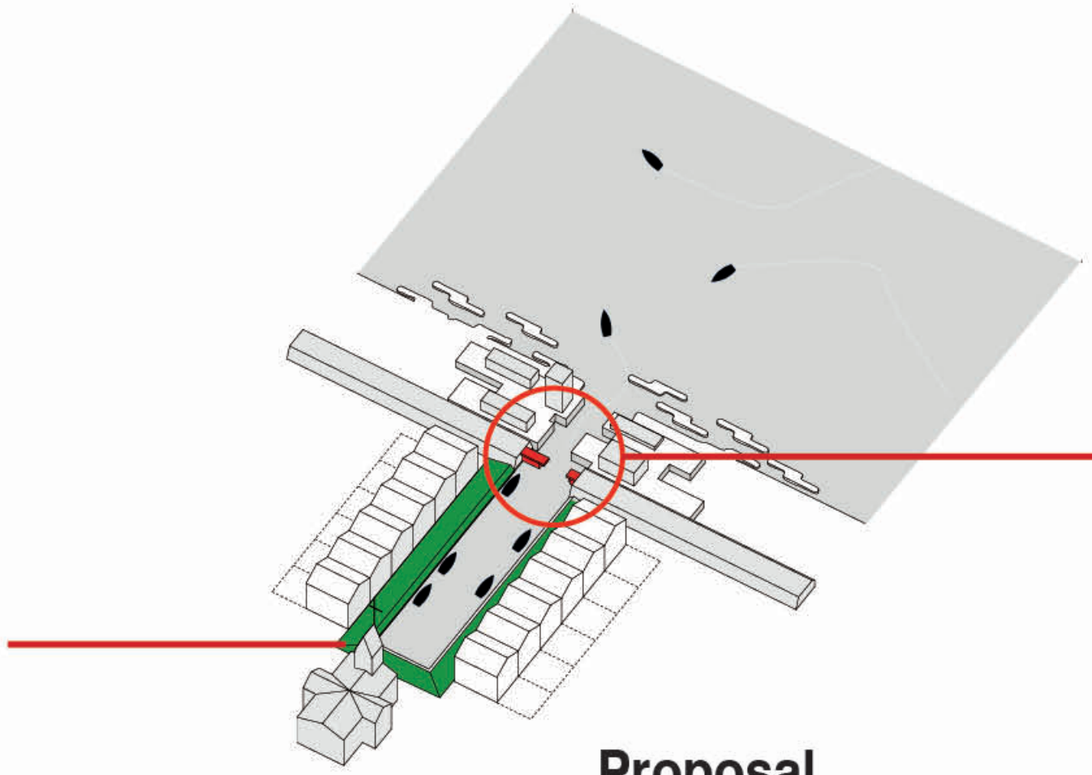


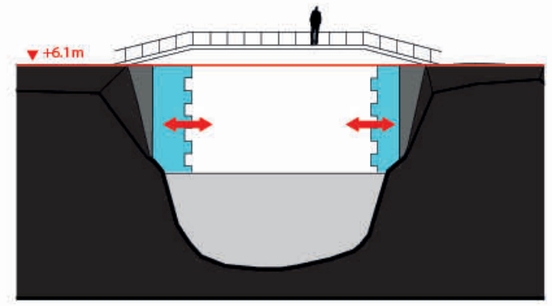
Hard approach
Multi-functional dike

+



Soft approach
Open port+protection along port





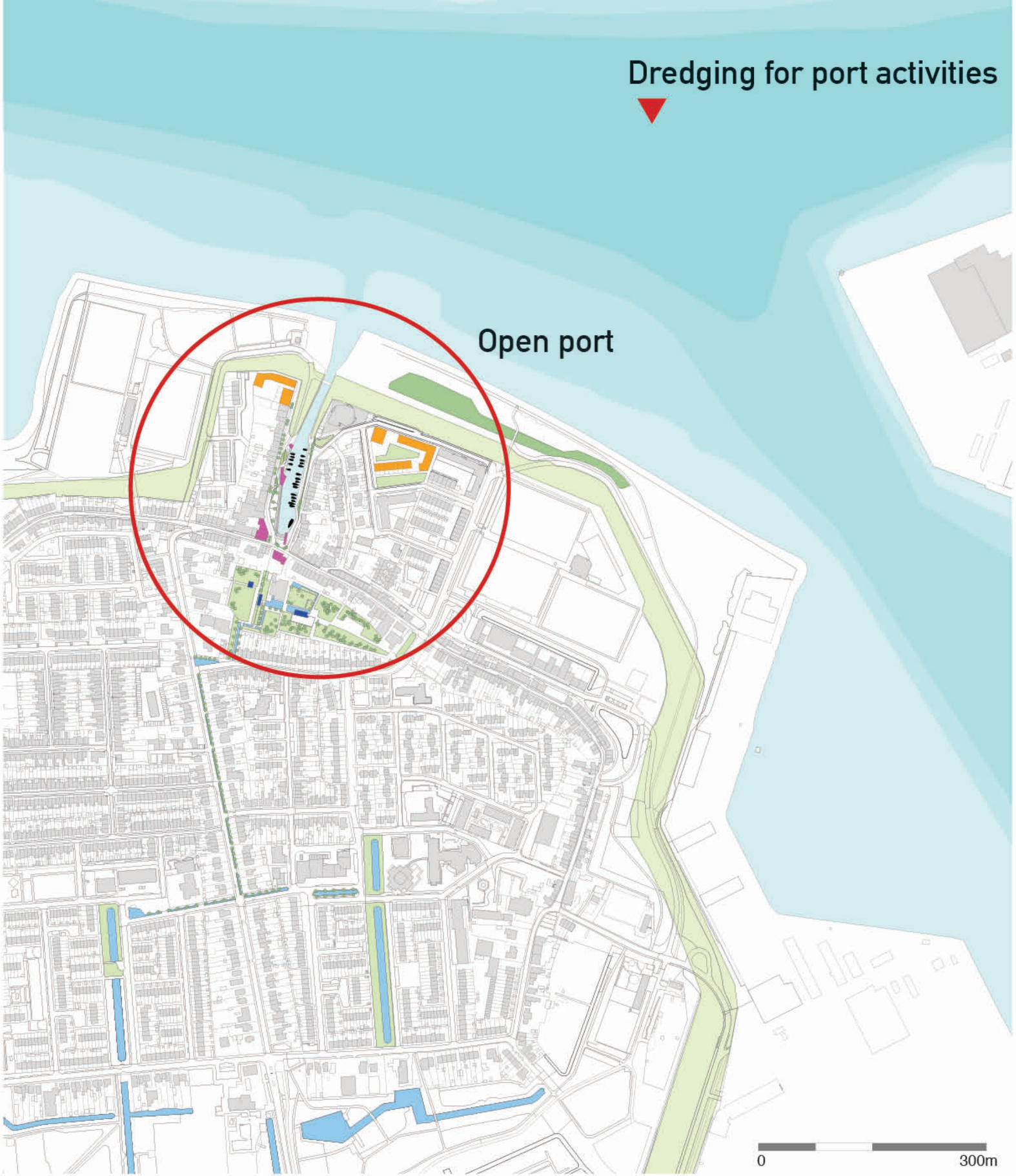
Proposal

Permeable flood barrier + hidden dike

Phasing plan for settlement + River condition

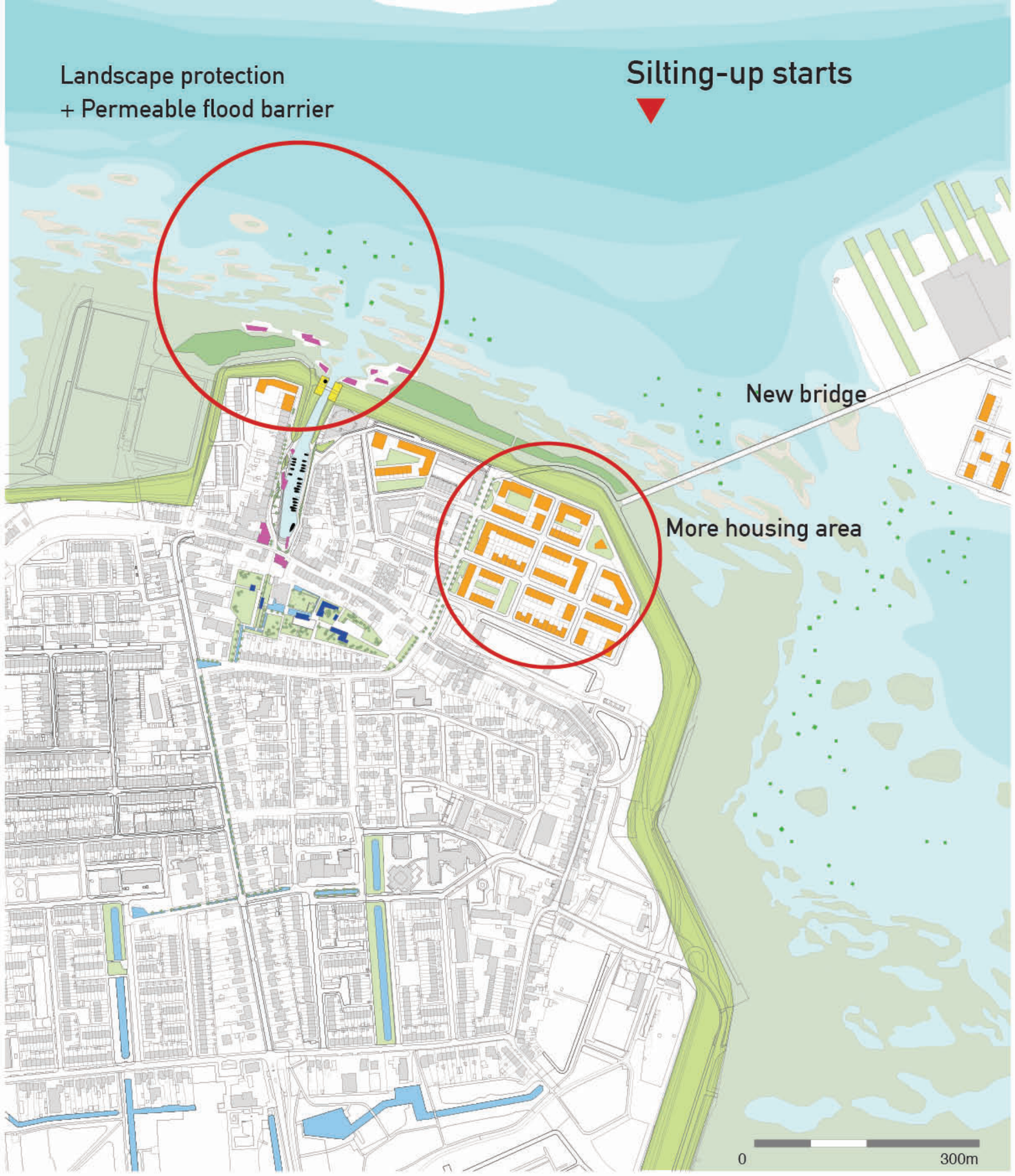
2020

2020



2070

2070


Landscape protection
+ Permeable flood barrier
Silting-up starts
New bridge
More housing area
0
300m

2100

2100

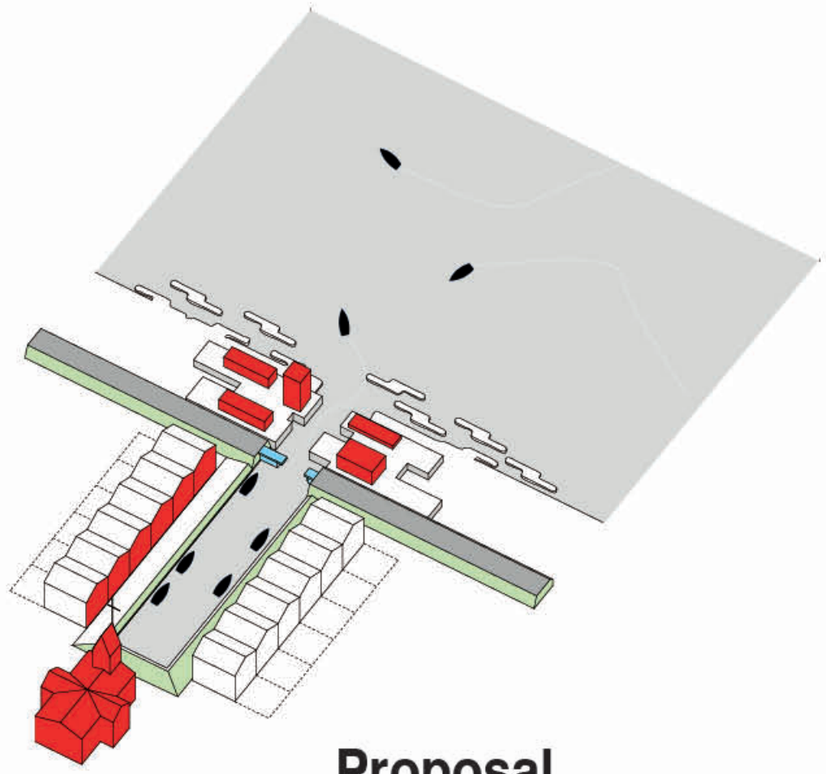
Option A

Option A

Option B

Option B

Focus plan



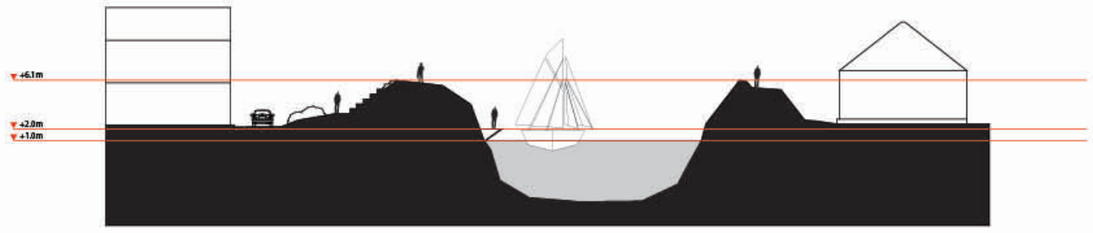
Proposal

Permeable flood barrier + hidden dike

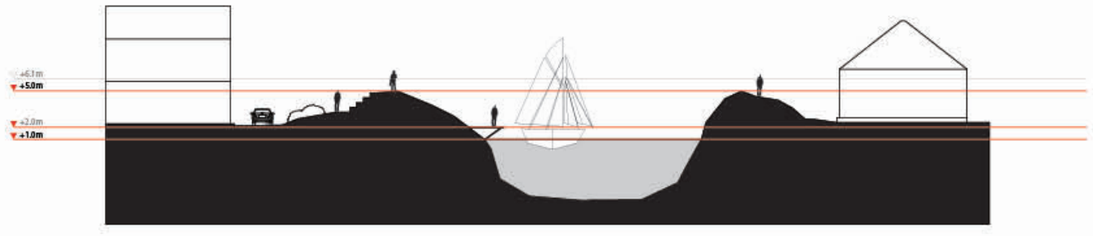
Define hidden dike height
by the aspects of Spatial quality & Water management

Spatial quality

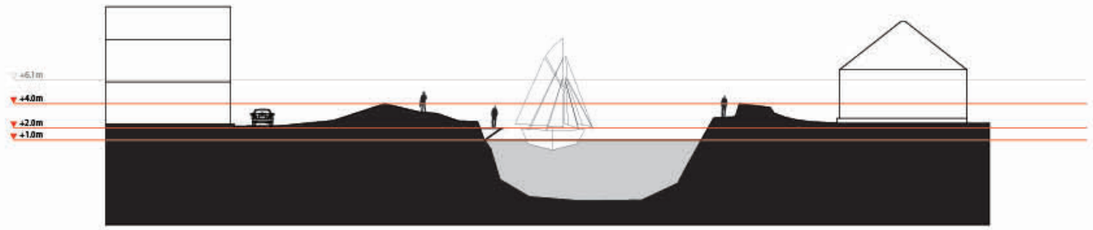
+6.1m



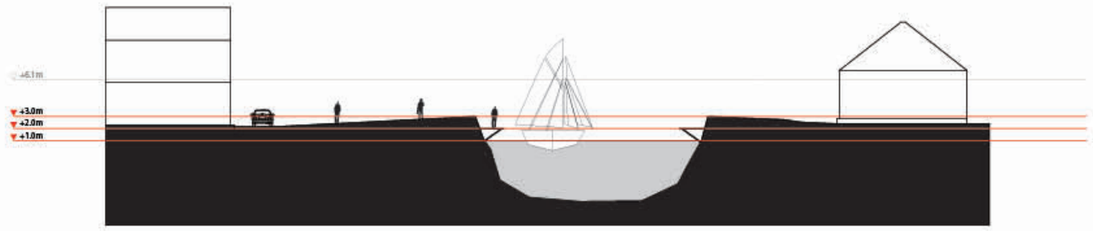
+5.0m



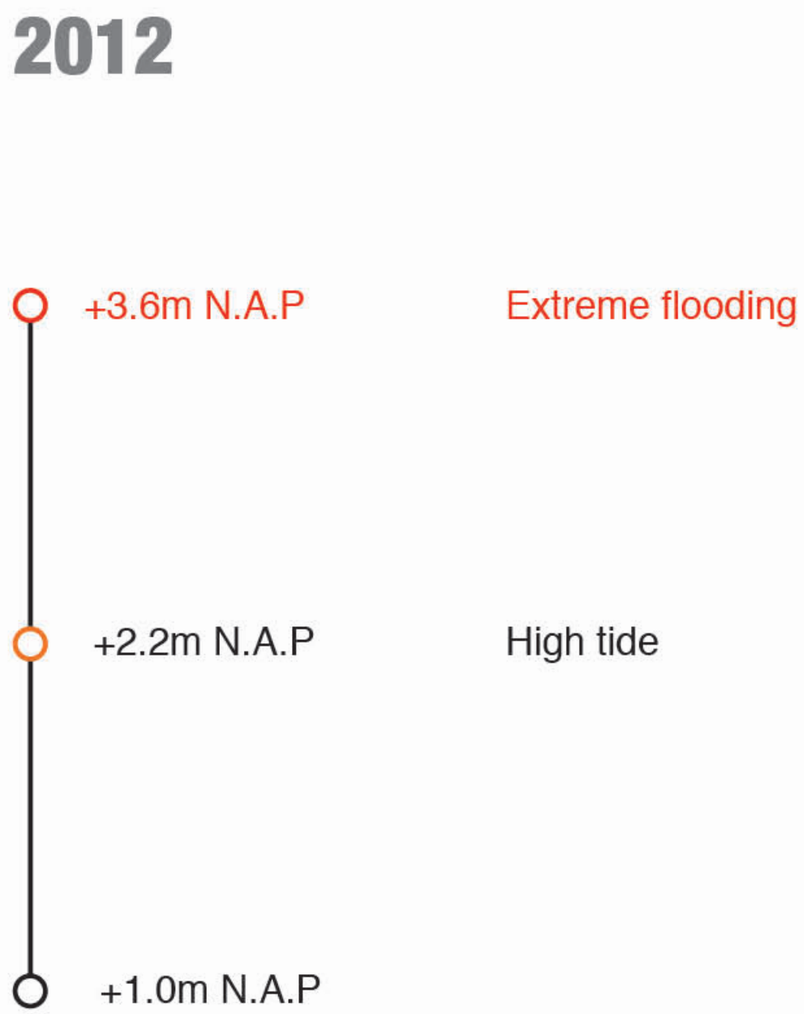
+4.0m



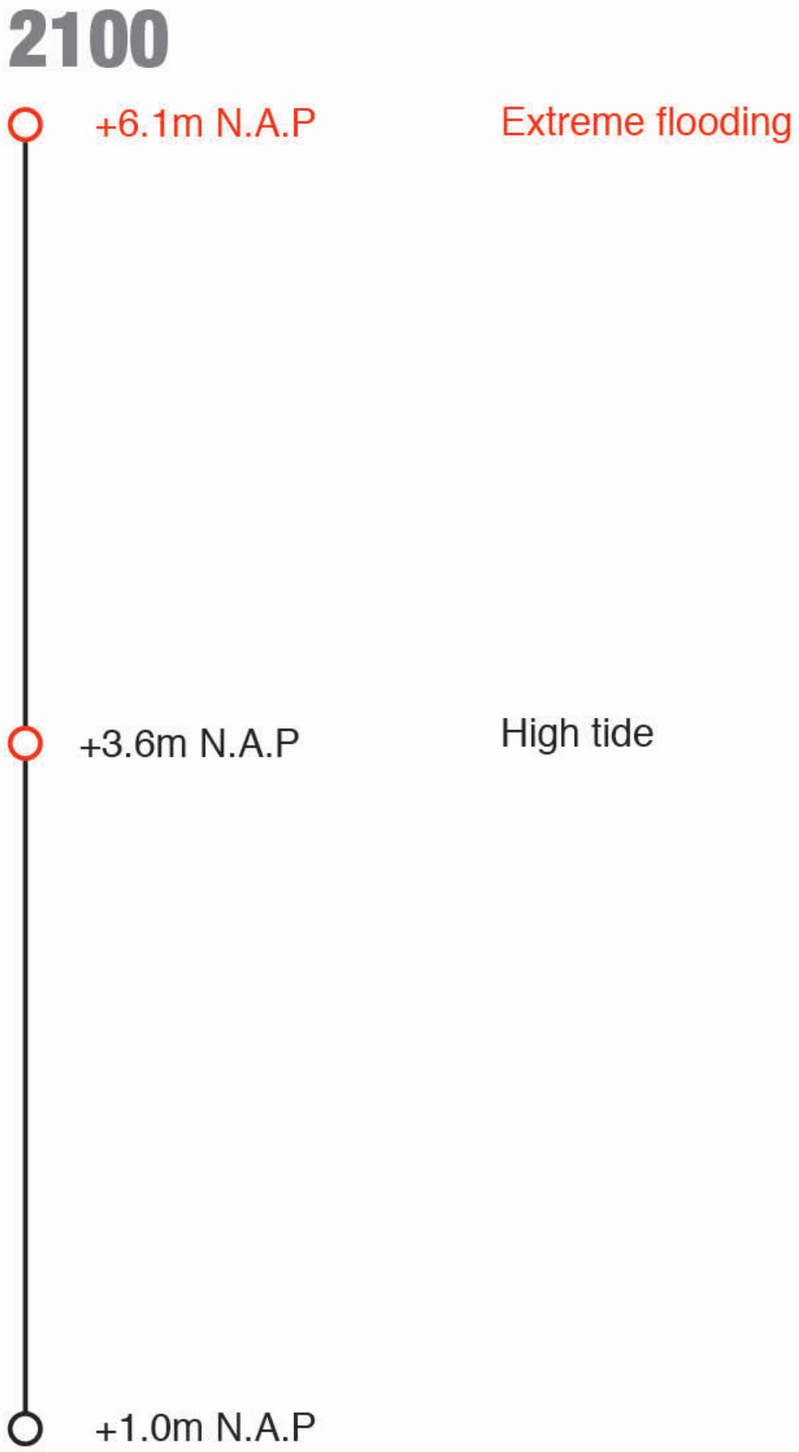
+3.0m



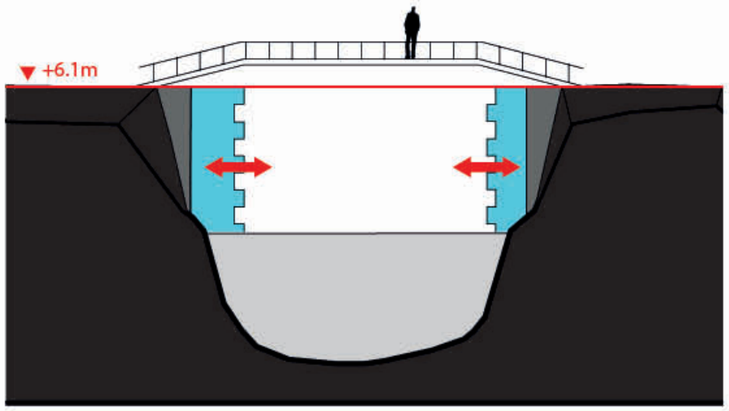
Water management



Water management



“+3.6m Hidden dike & Permeable flood barrier”



Permeable flood barrier

2100

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

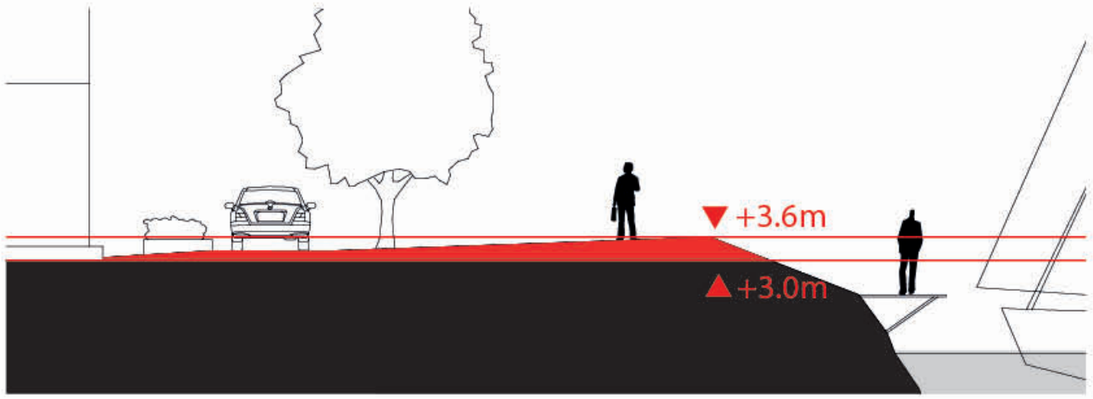
+3.6m N.A.P — High tide — 1/1 yrs

+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

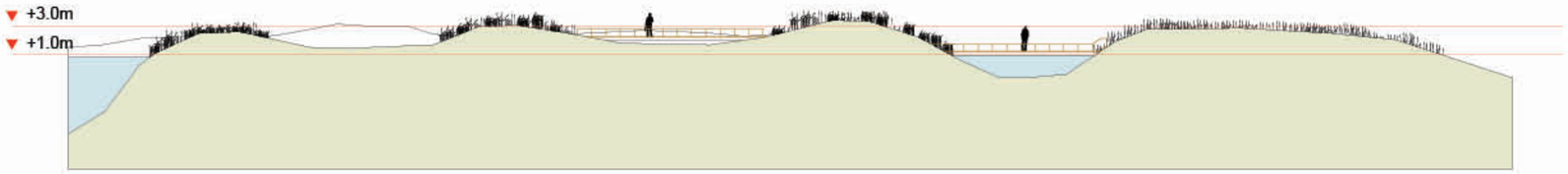


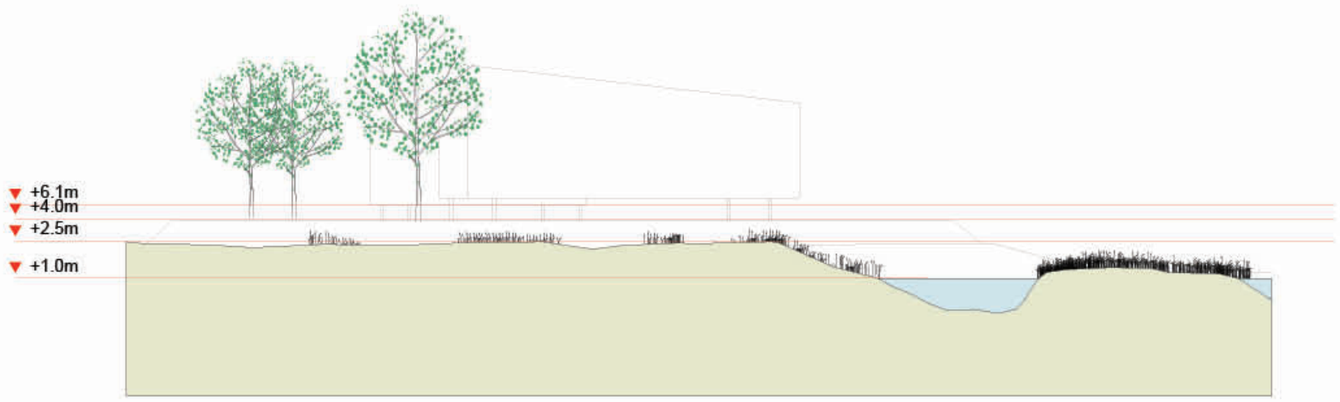
Hidden dike

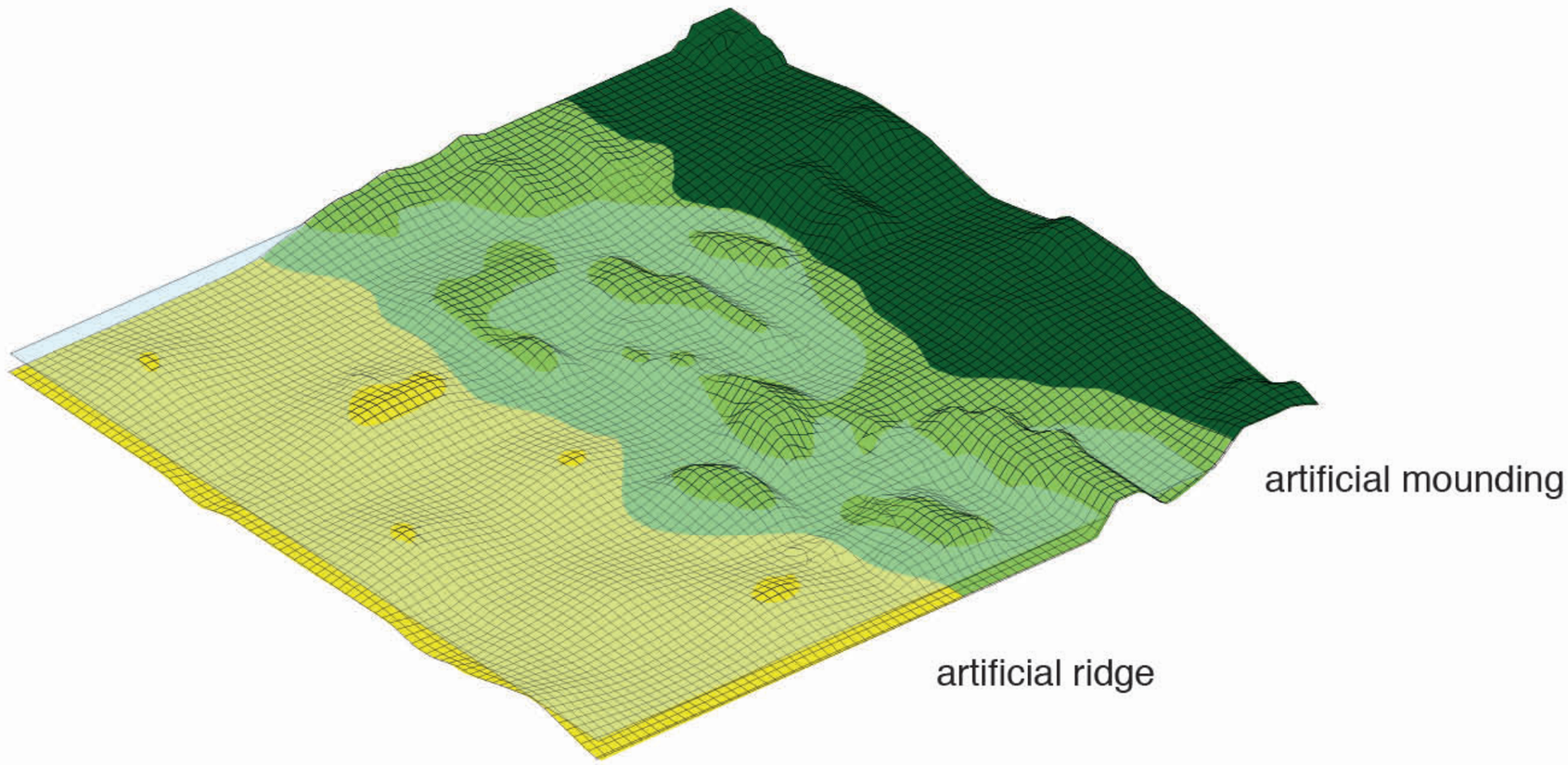
+1.0m N.A.P

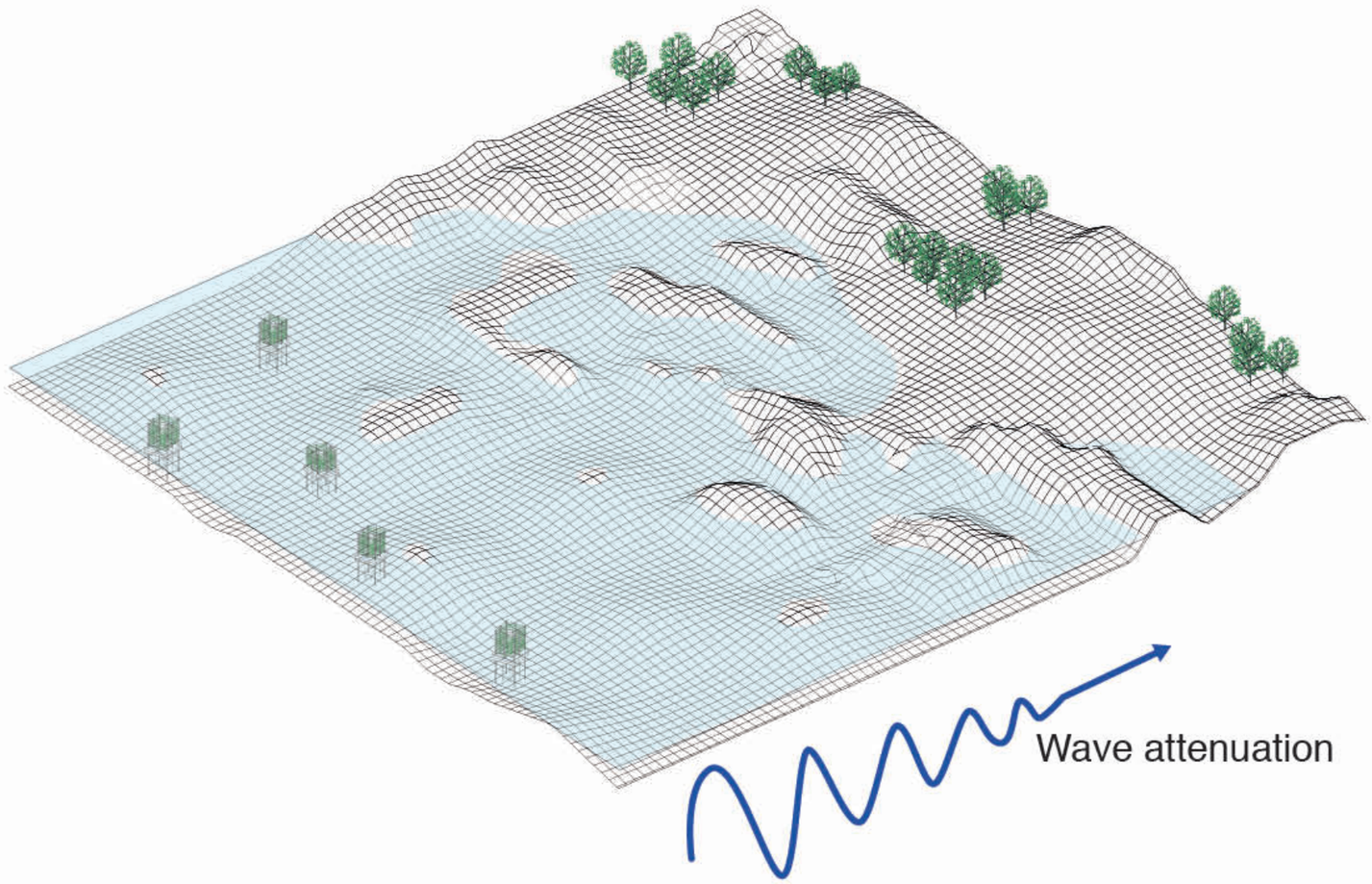
Focus plan

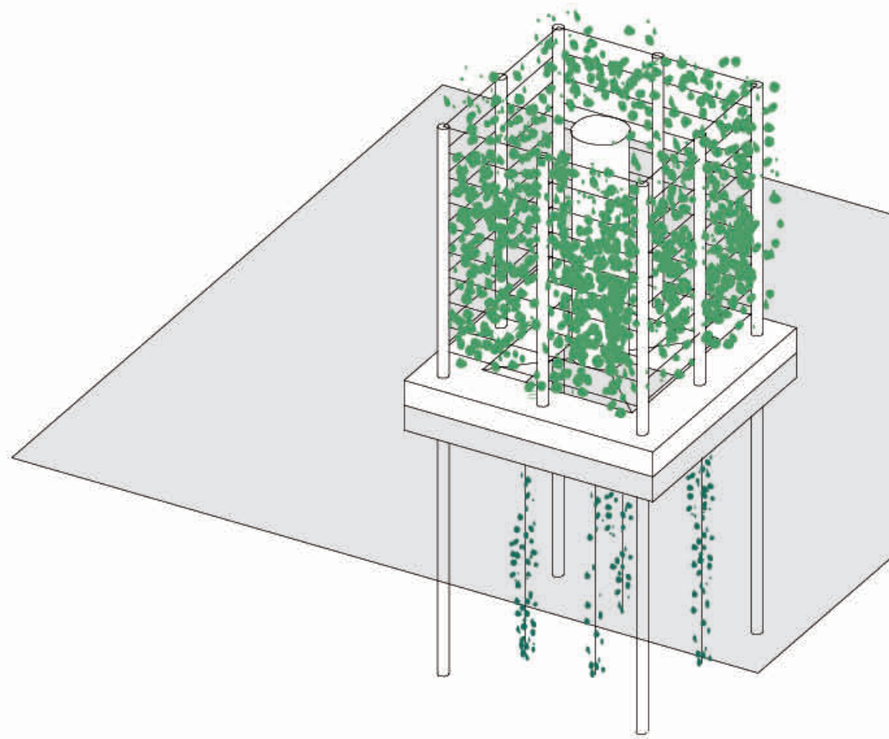
1. Waterfront

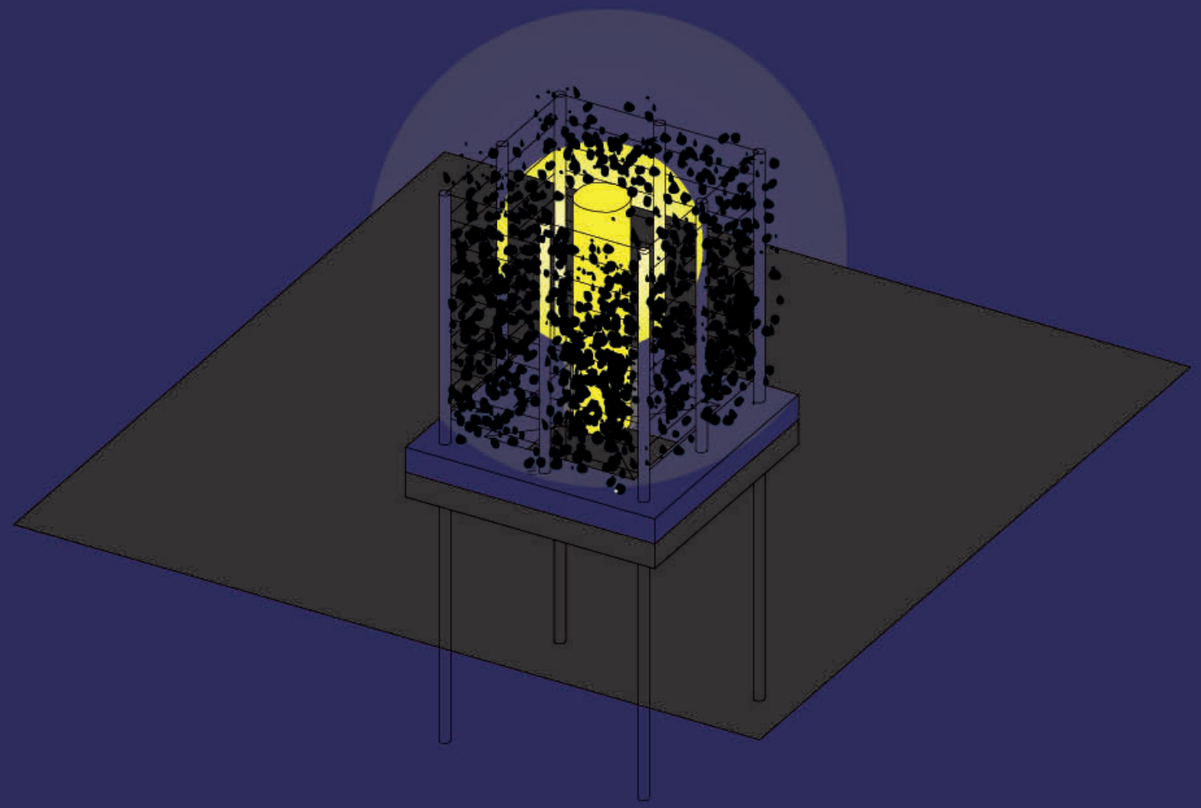

+3.0m
+1.0m


+6.1m
+4.0m
+2.5m
+1.0m


artificial mounding
artificial ridge
Natural ridge
(by natural siltation)

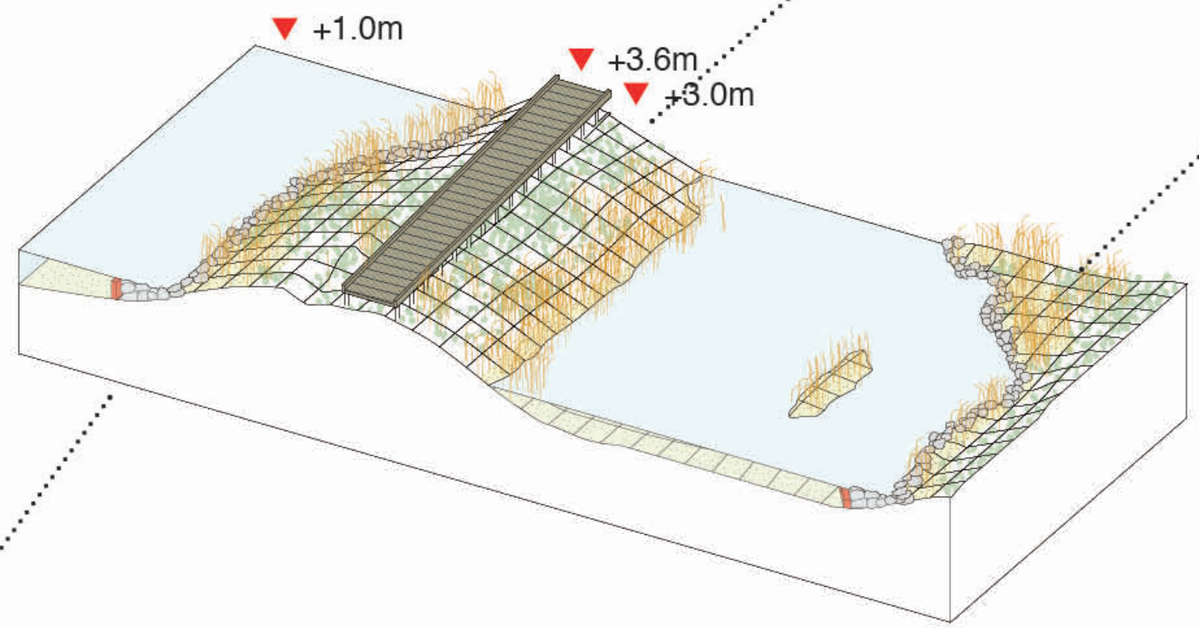

Wave attenuation





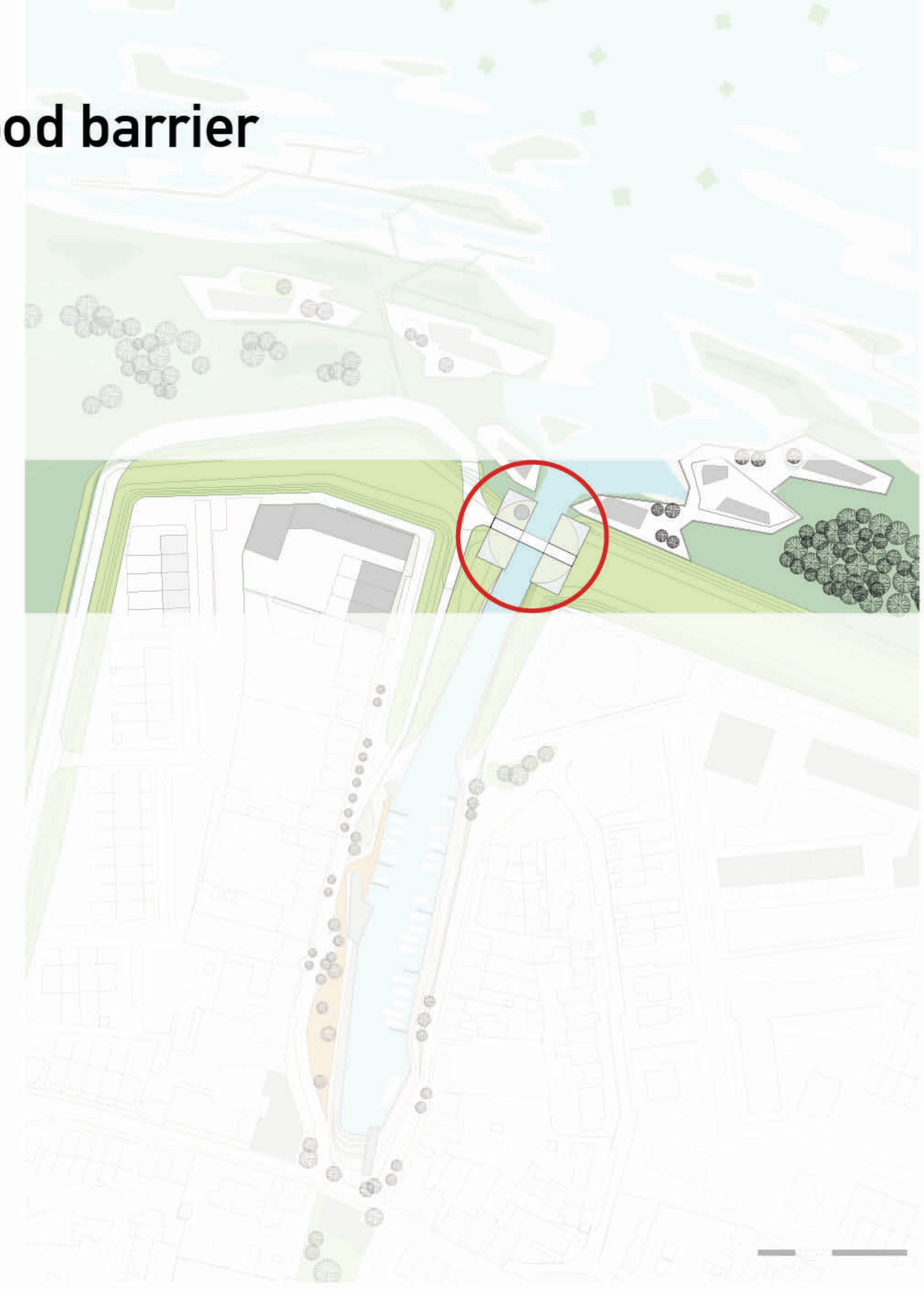
Wooden deck

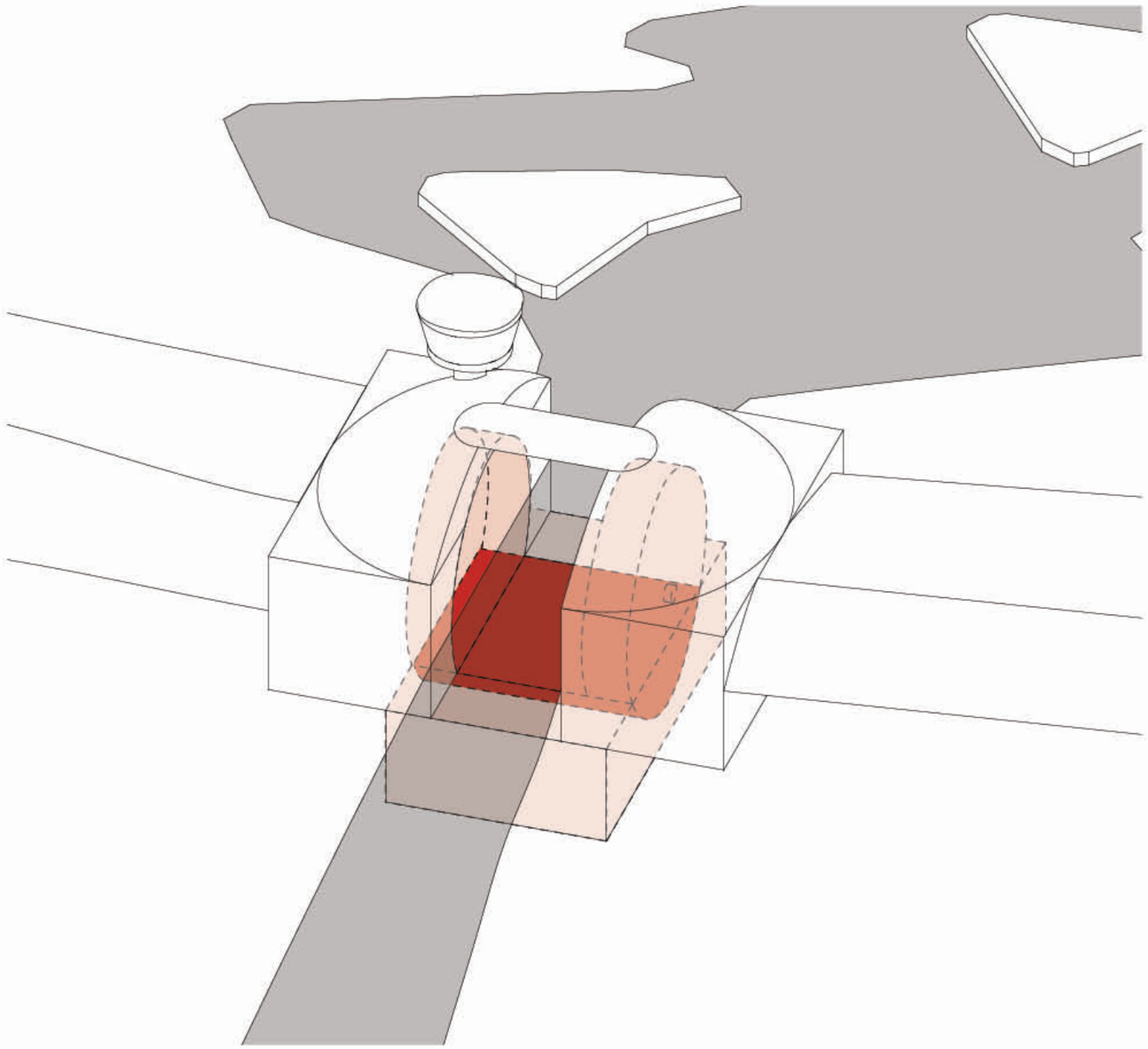
Reed



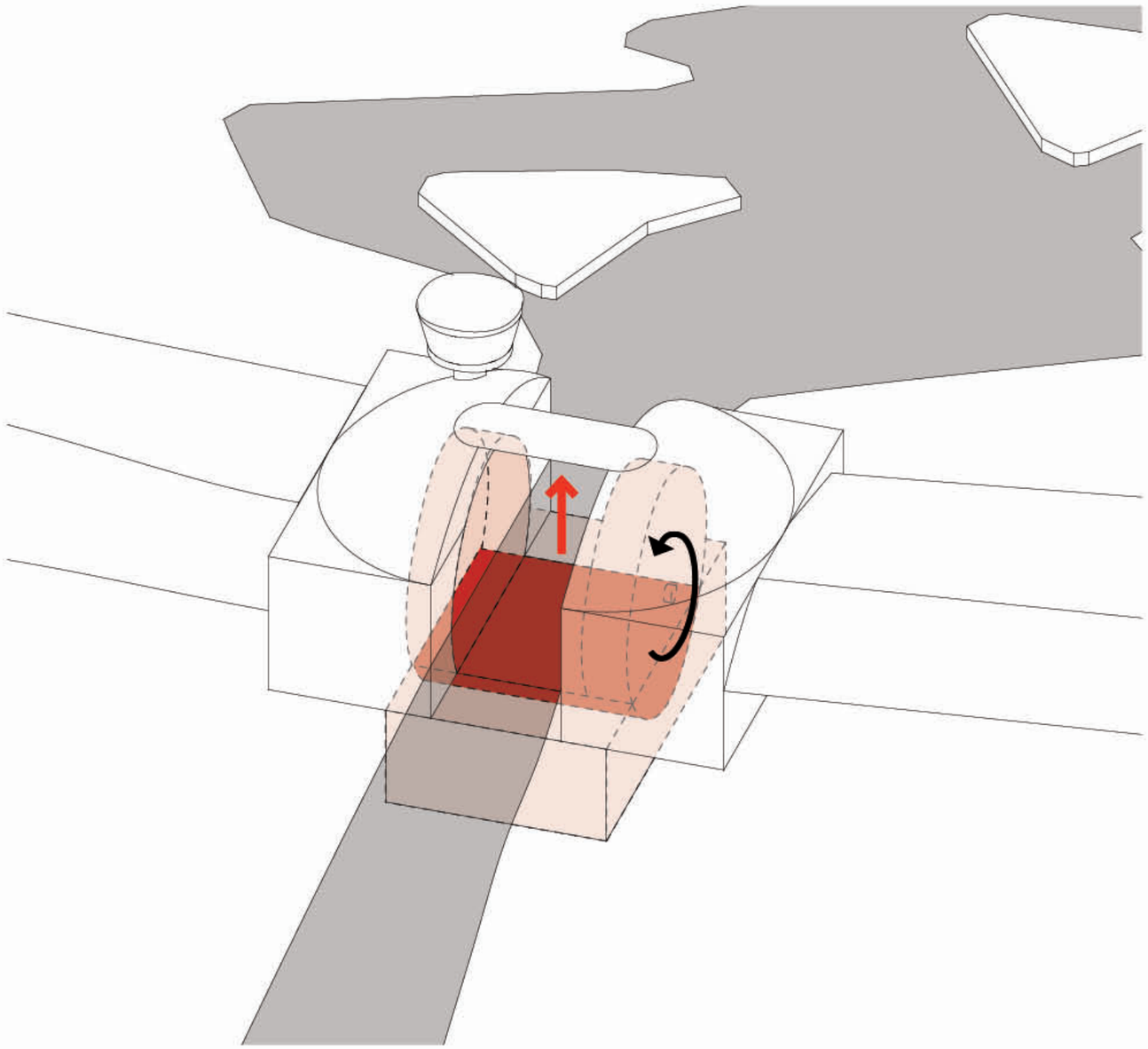
Stone

2. Permeable flood barrier

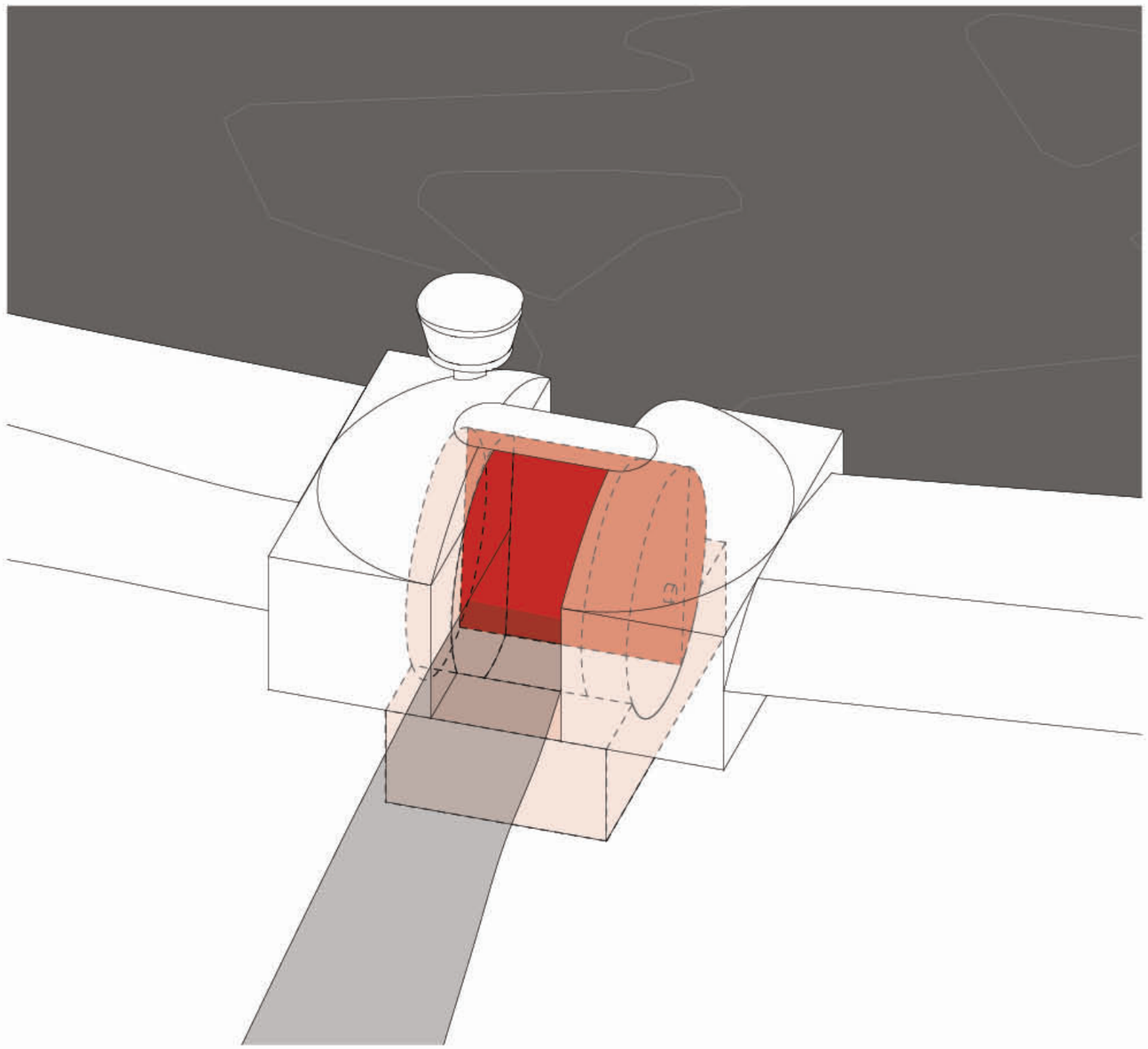




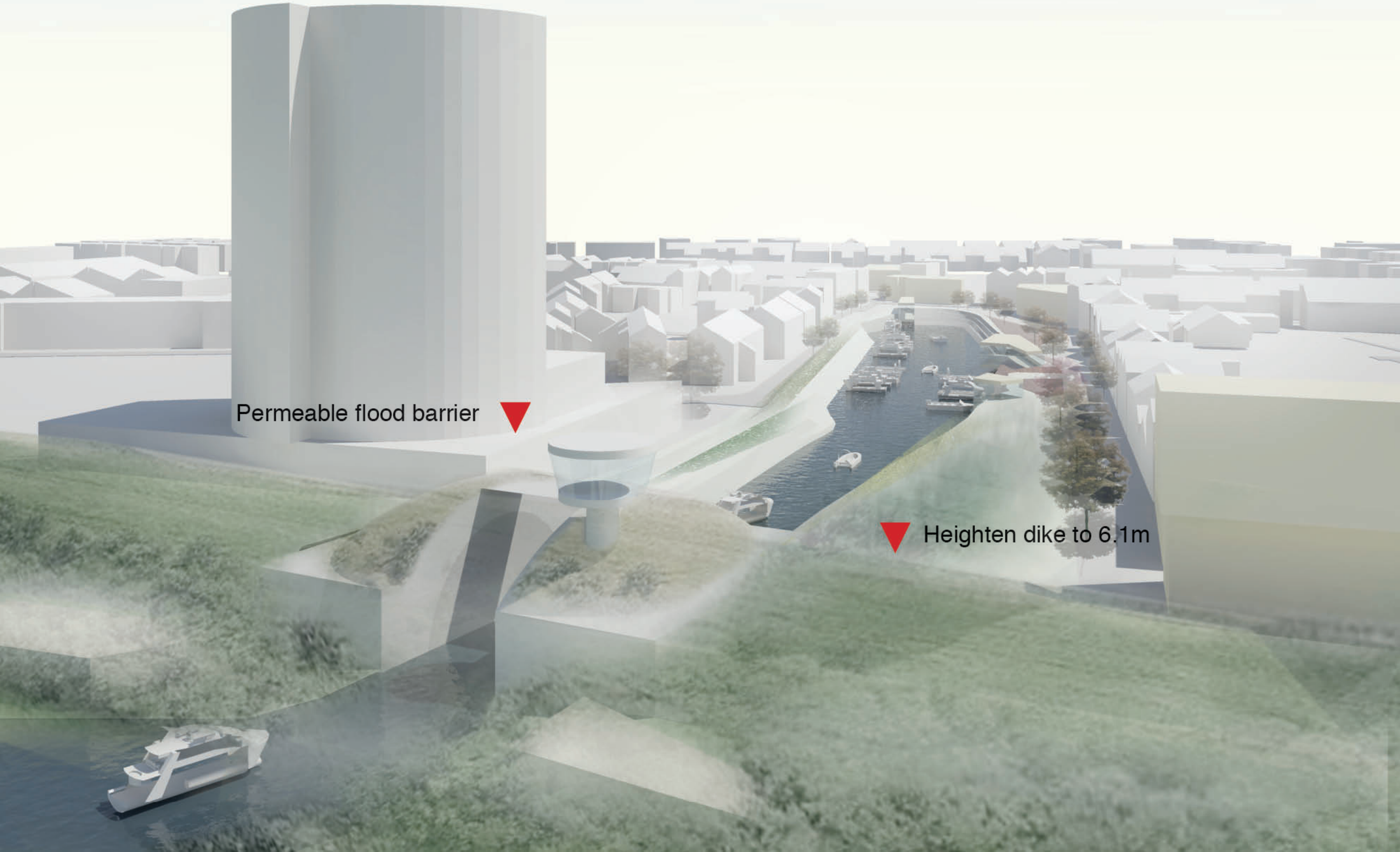
Flood barrier open (normal situation)



Flood barrier open (normal situation)



Flood barrier closed (higher flood than +3.6m)


Permeable flood barrier
Heighten dike to 6.1m

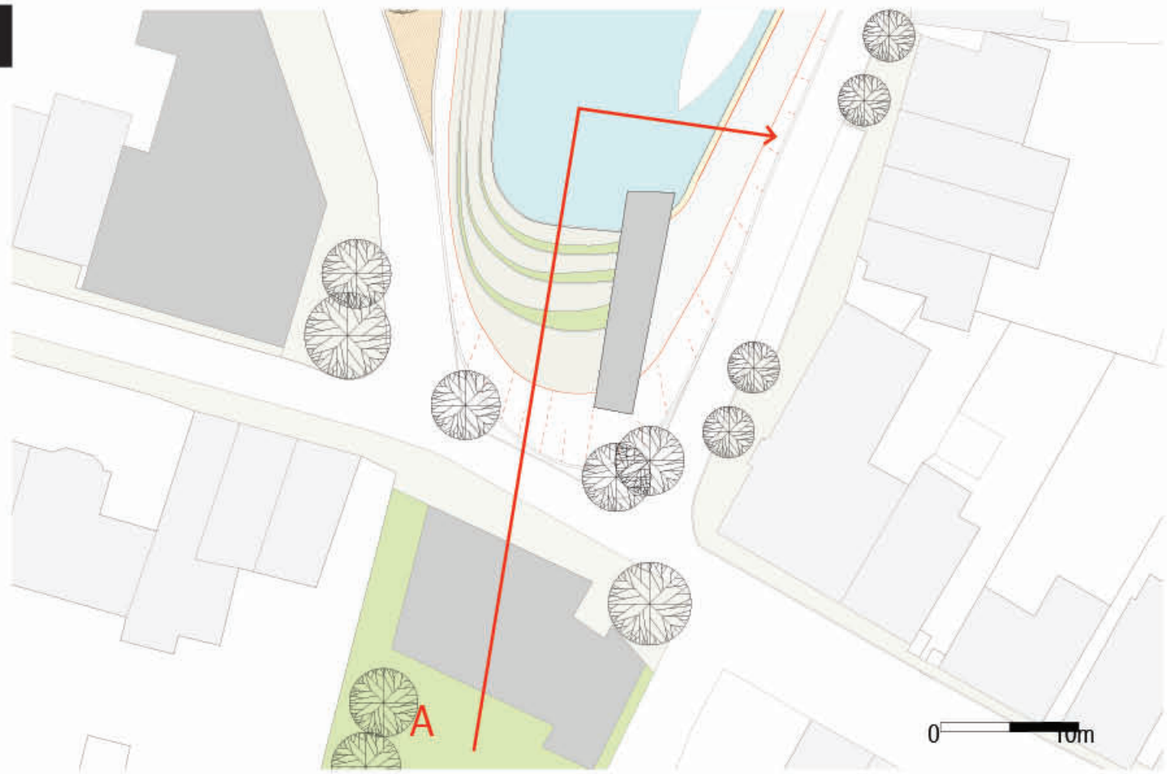
3. Open port

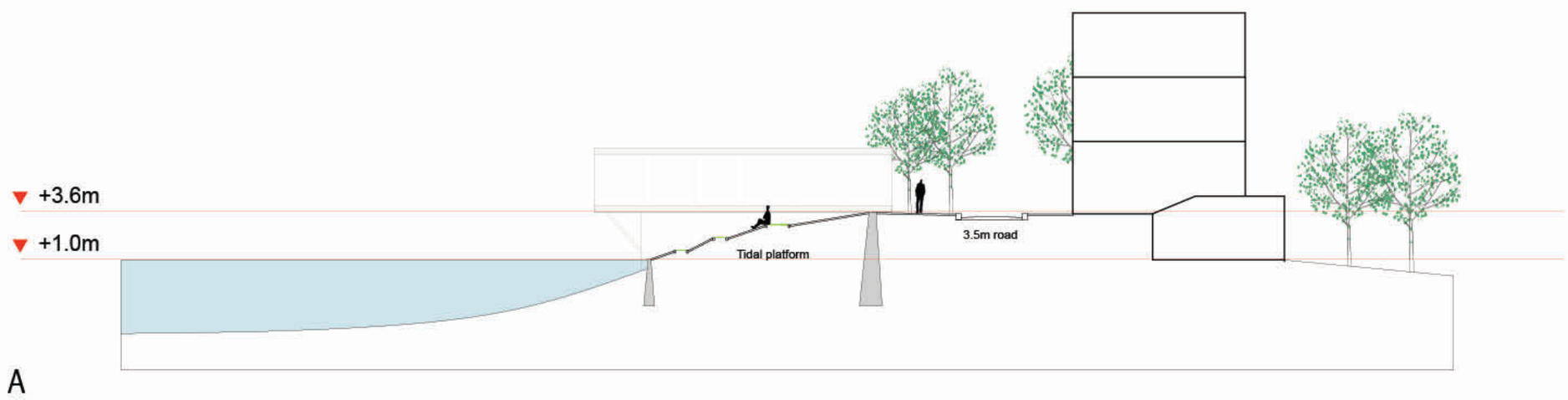

cafe
Restraurant
water bus
facility
Museum
0
25m


0m
+2.0m
+2.5m
+3.6m
+3.0m
+3.5m
0m

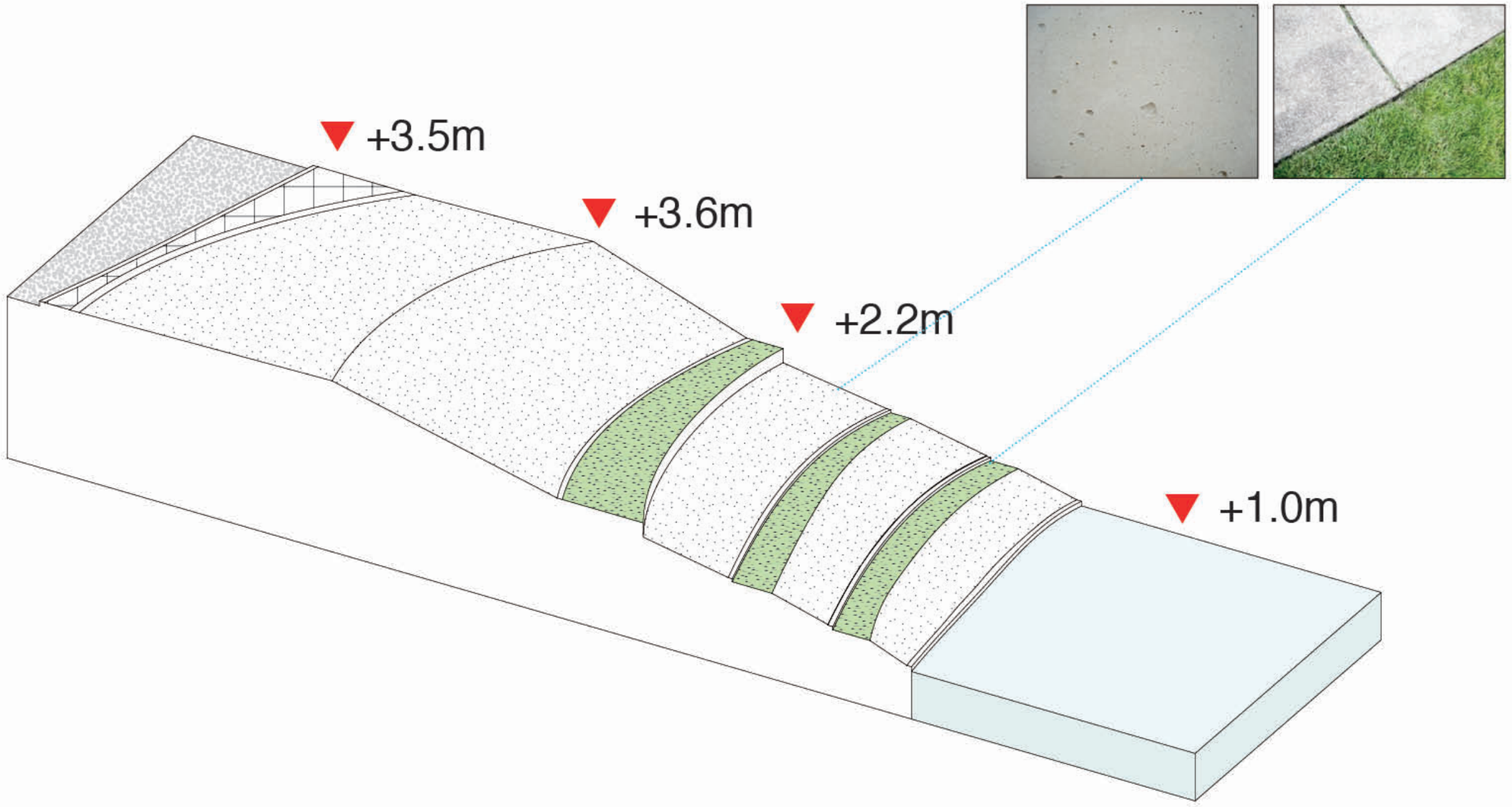

+2.0m
Slope park (+2.0 zone)
0m
+2.5m
+3.6m
+3.0m
Hidden slope (+3.0m zone)
+3.5m
Intertidal platform (+3.5m zone)
0m

Intertidal platform (+3.5m-+3.6m)

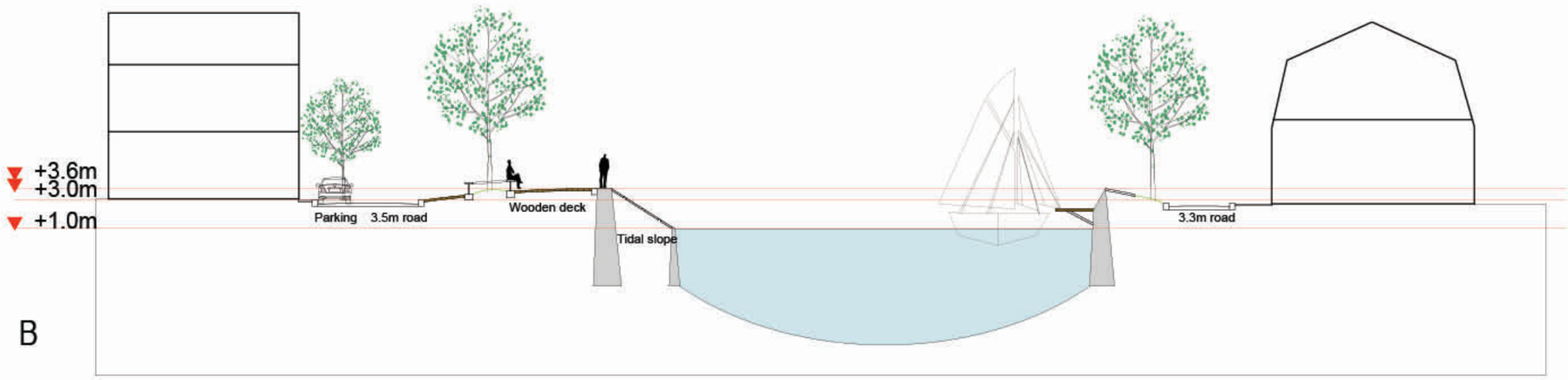




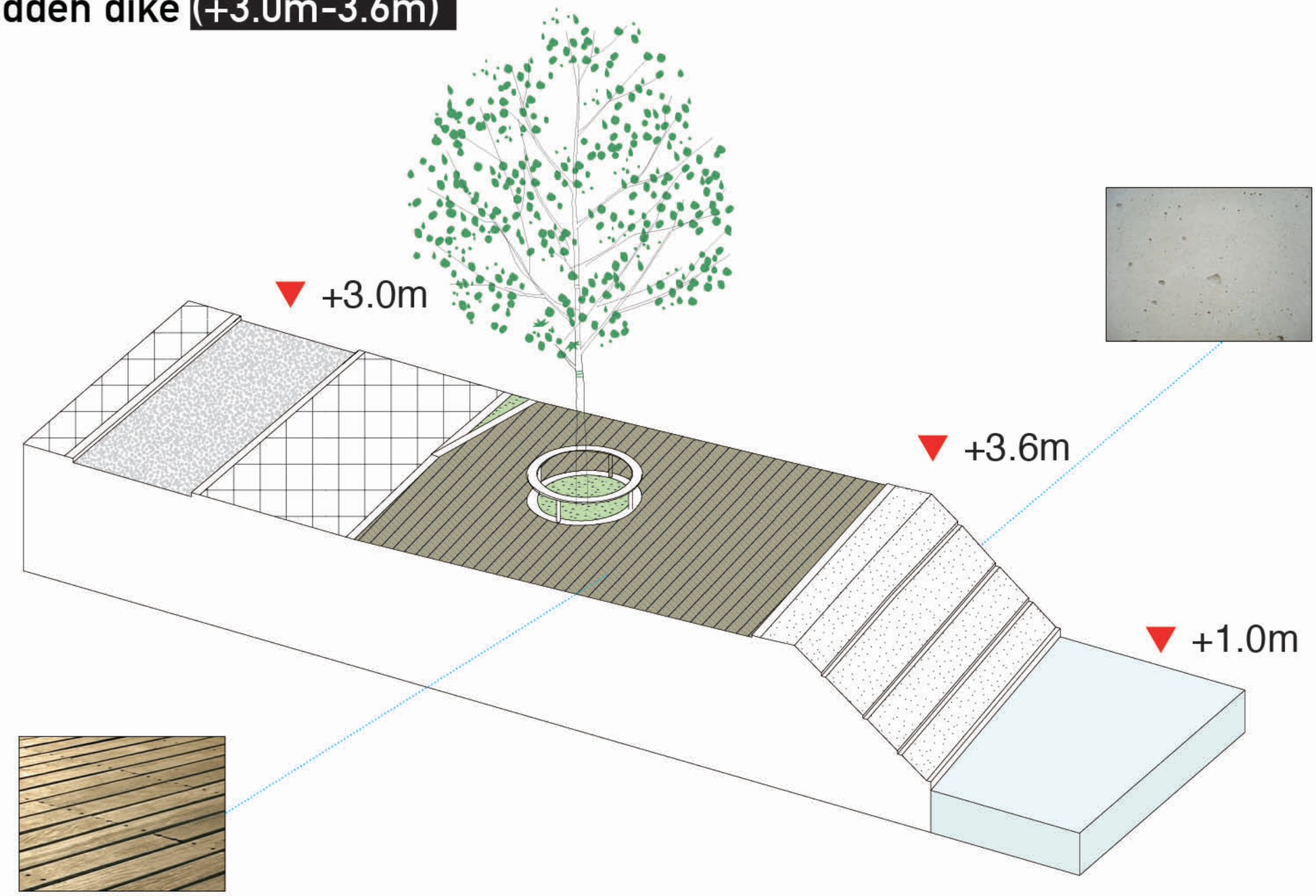
Intertidal platform (+3.5m-+3.6m)



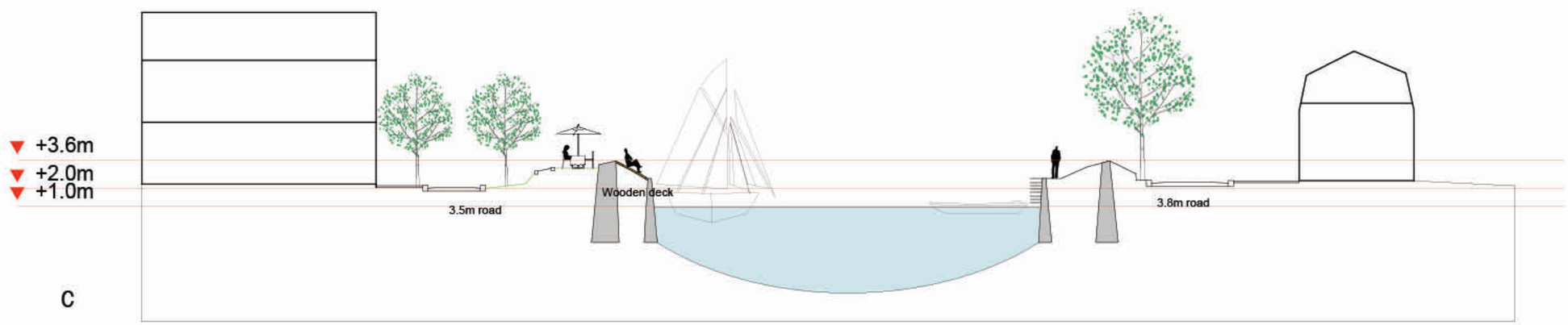
Hidden dike (+3.0m-3.6m)



Hidden dike (+3.0m-3.6m)



Slope park (+2.0m-+3.6m)



Slope park (+2.0m-+3.6m)