

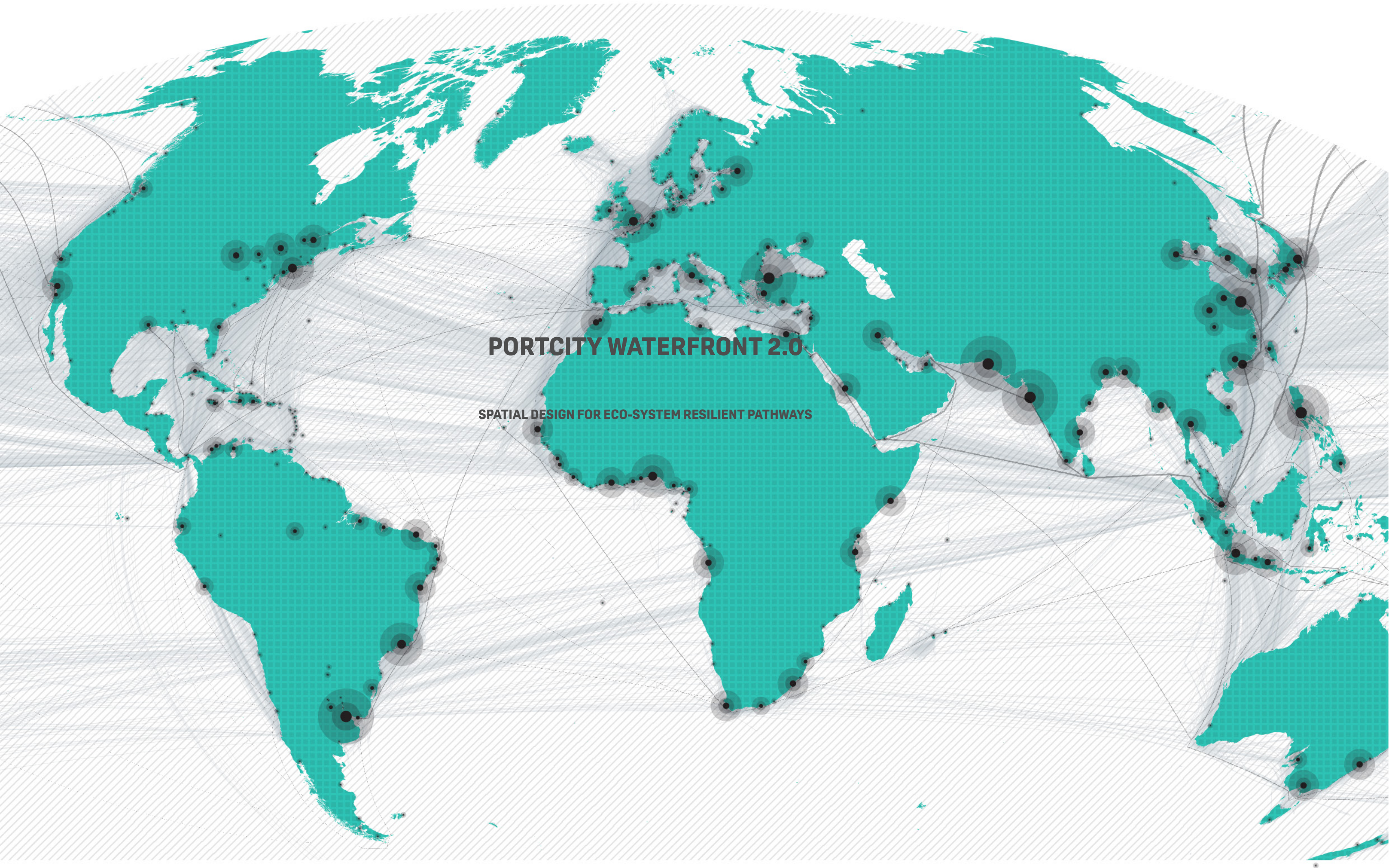
Waterfront 2.0



Master Thesis
Student: Alexander Stal
1st mentor: Fransje Hooimeijer
2nd mentor: Rients Dijkstra

Delft University of Technology
Faculty of Architecture and the Built Environment
Track Urbanism

July, 2023

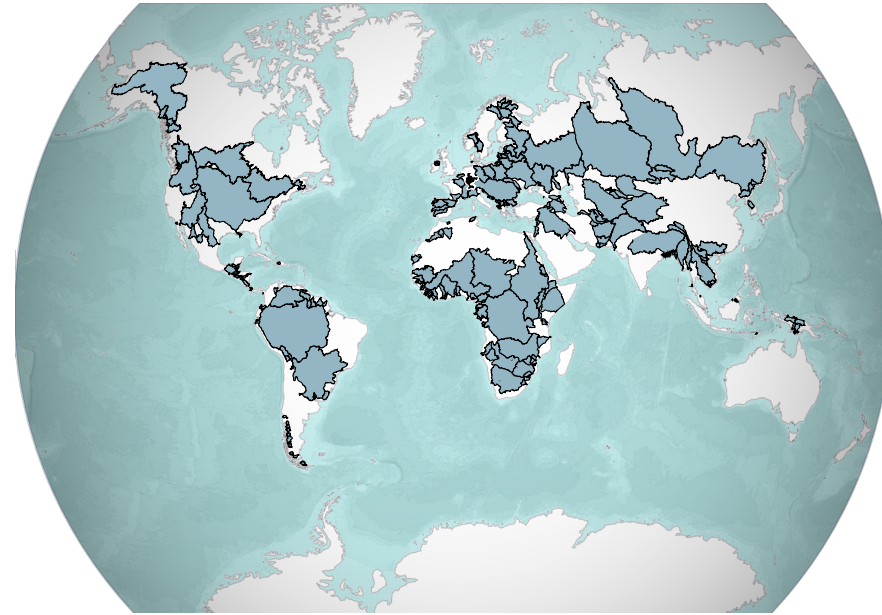


PORTCITY WATERFRONT 2.0

SPATIAL DESIGN FOR ECO-SYSTEM RESILIENT PATHWAYS

Spatial scope of research

subsection:



[GLOBAL SCALES] RIVER BASINS

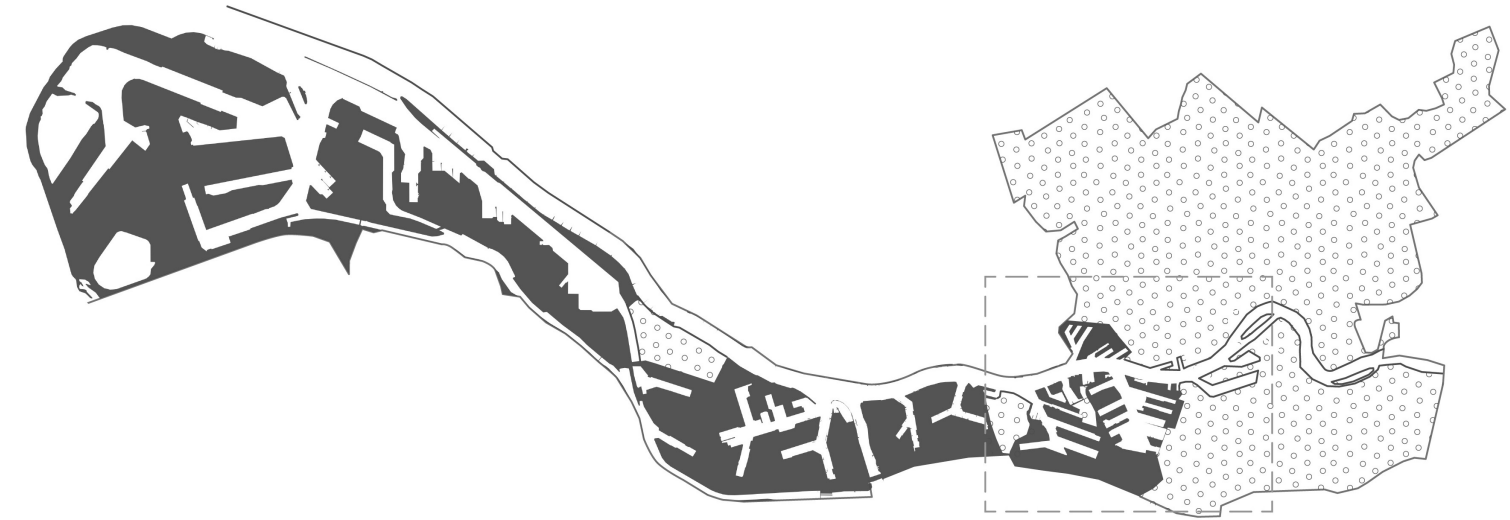
- RIVER BASIN
- TRADING ROUTES
- Rhine-Meuse-scheldt basin

sources: By author (2023)

[MACRO SCALE] ROTTERDAMDAM

- port area
- city area
- portcity interface

sources: By author (2023)



[MACROSCALE] RHINE-MEUSE-SCHELDT

-
- estuary

sources: By author (2023)



[MESO SCALE] STADSHAVENS

- Stadshavens Rotterdam
- Waal-Eemshaven
- Item first on the legend list
- Item first on the legend list

sources: By author (2023)



Spatial scope of research

subsection:



CityPorts in transition

CityPorts development program Rotterdam



woningvraag



500 meter wonenn van de maas

The sustainable & resilient portcity

Global transition

The eco-system resilient portcity

Bouncing forward to a new system state, aiming for sustaining desirable functioning.



The sustainable port-city

Provides sustainable equilibrium between social-, economical and environmental goals.

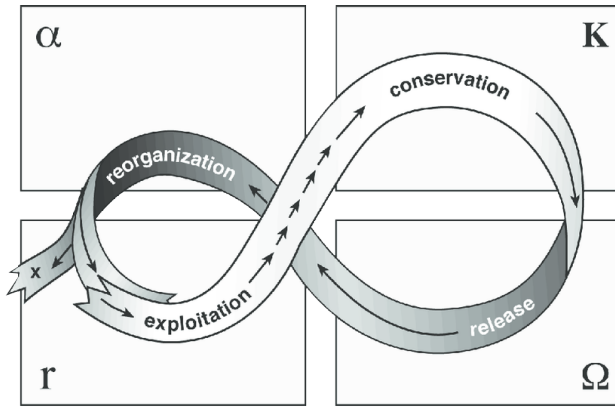


figure 3. [TITLE] (Holling 199. , Adapted by author)

- I. Exploitation
- II. Conservation
- III. Release phase
- IV. Reorganisation phase.

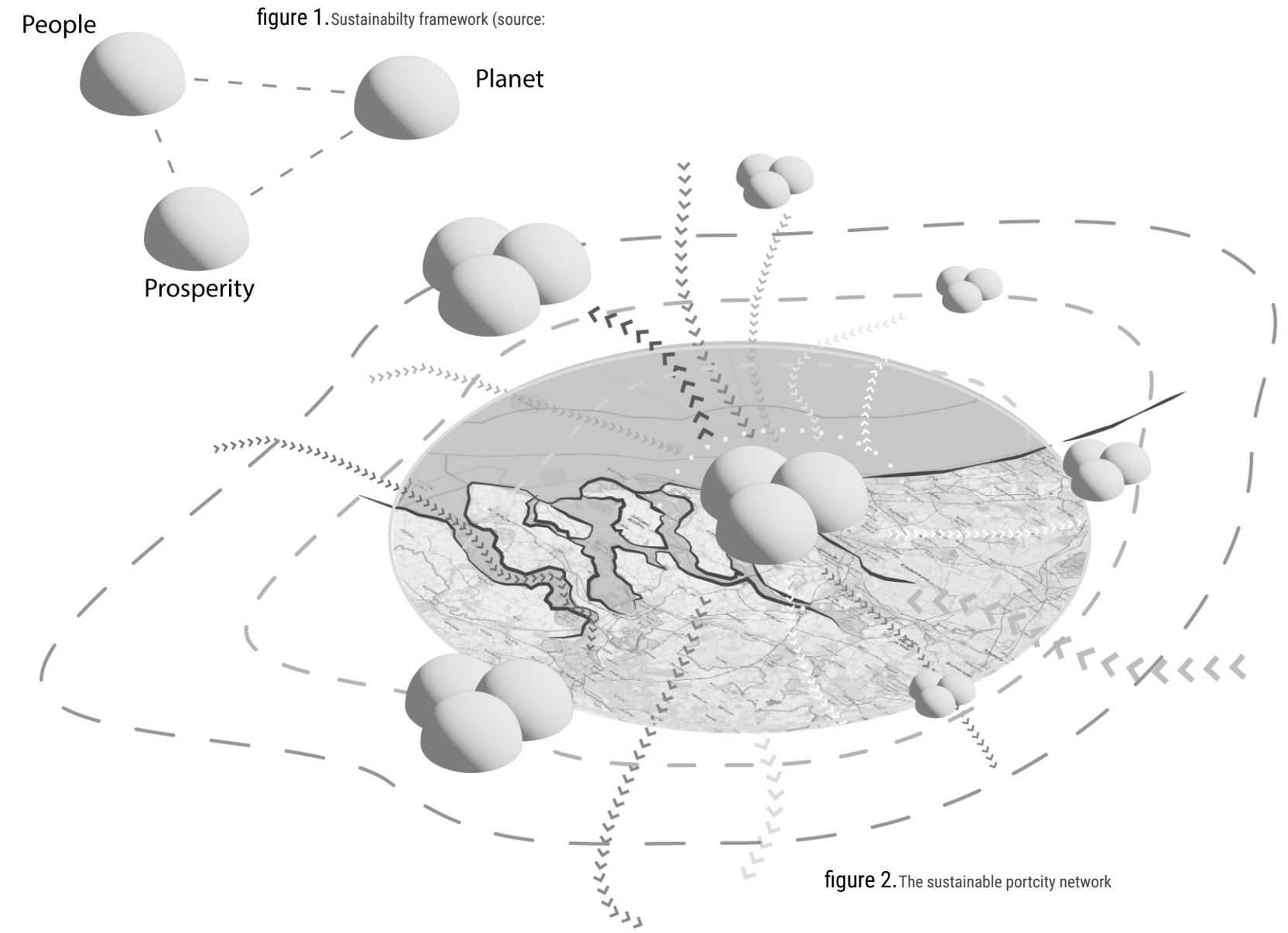
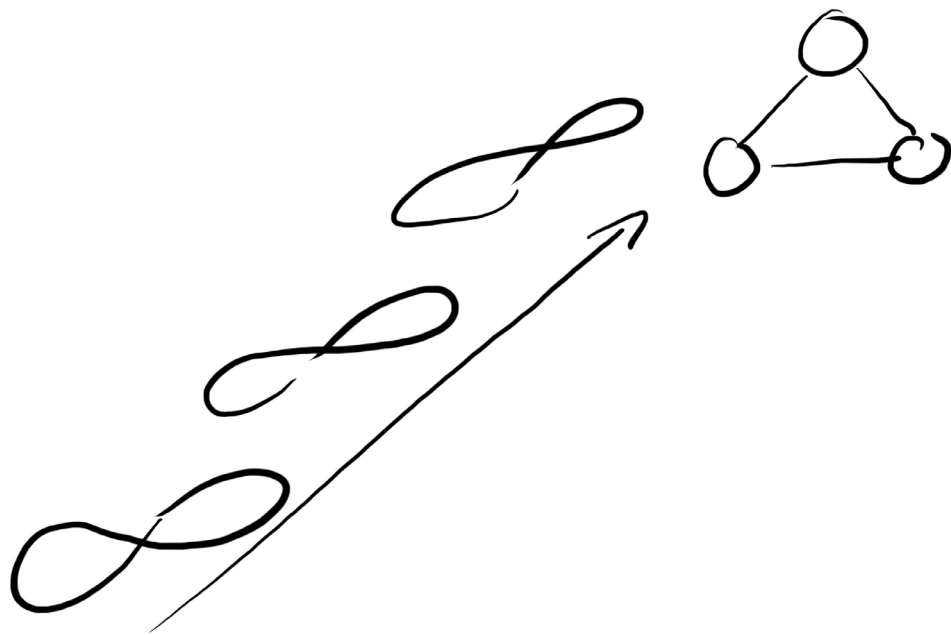


figure 2. The sustainable portcity network

The sustainable eco-system resilient portcity

Transitioning towards a 'Green economy'

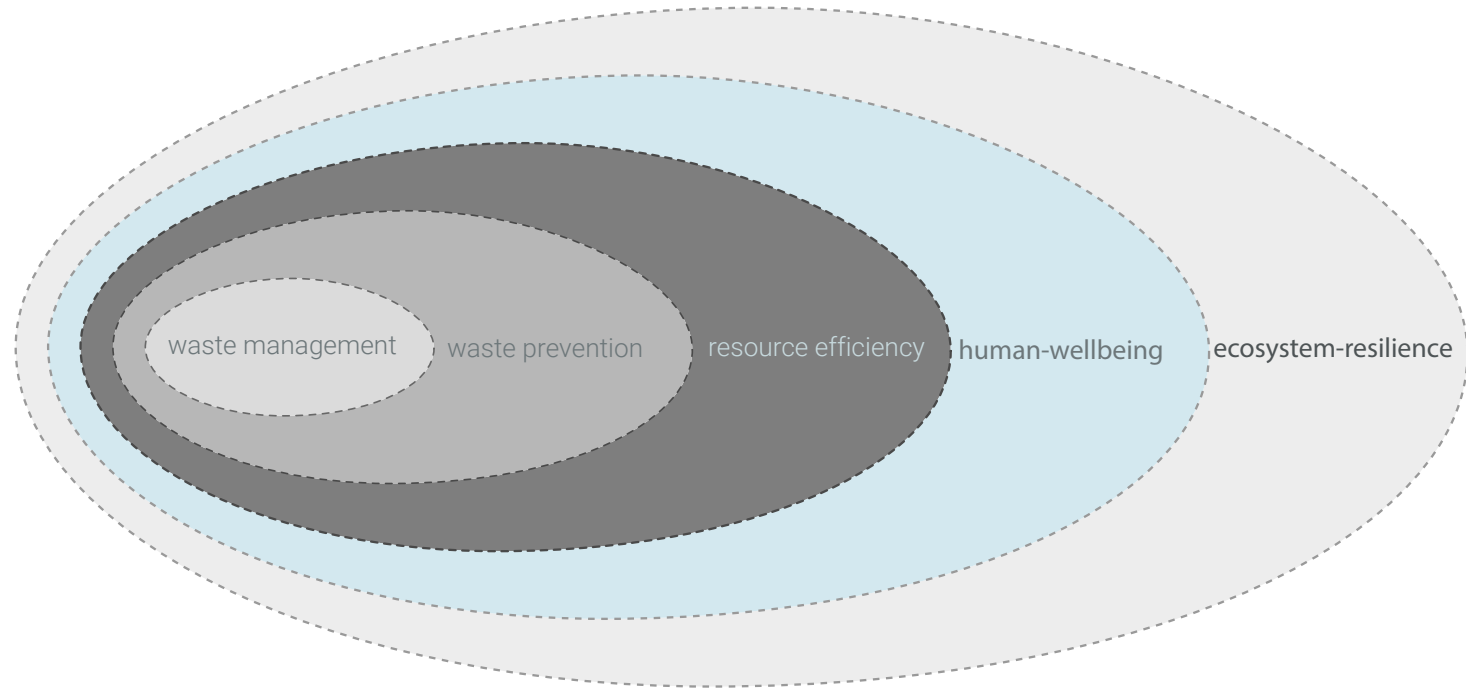


figure 5. Green economy focus areas (UN.. 202..)

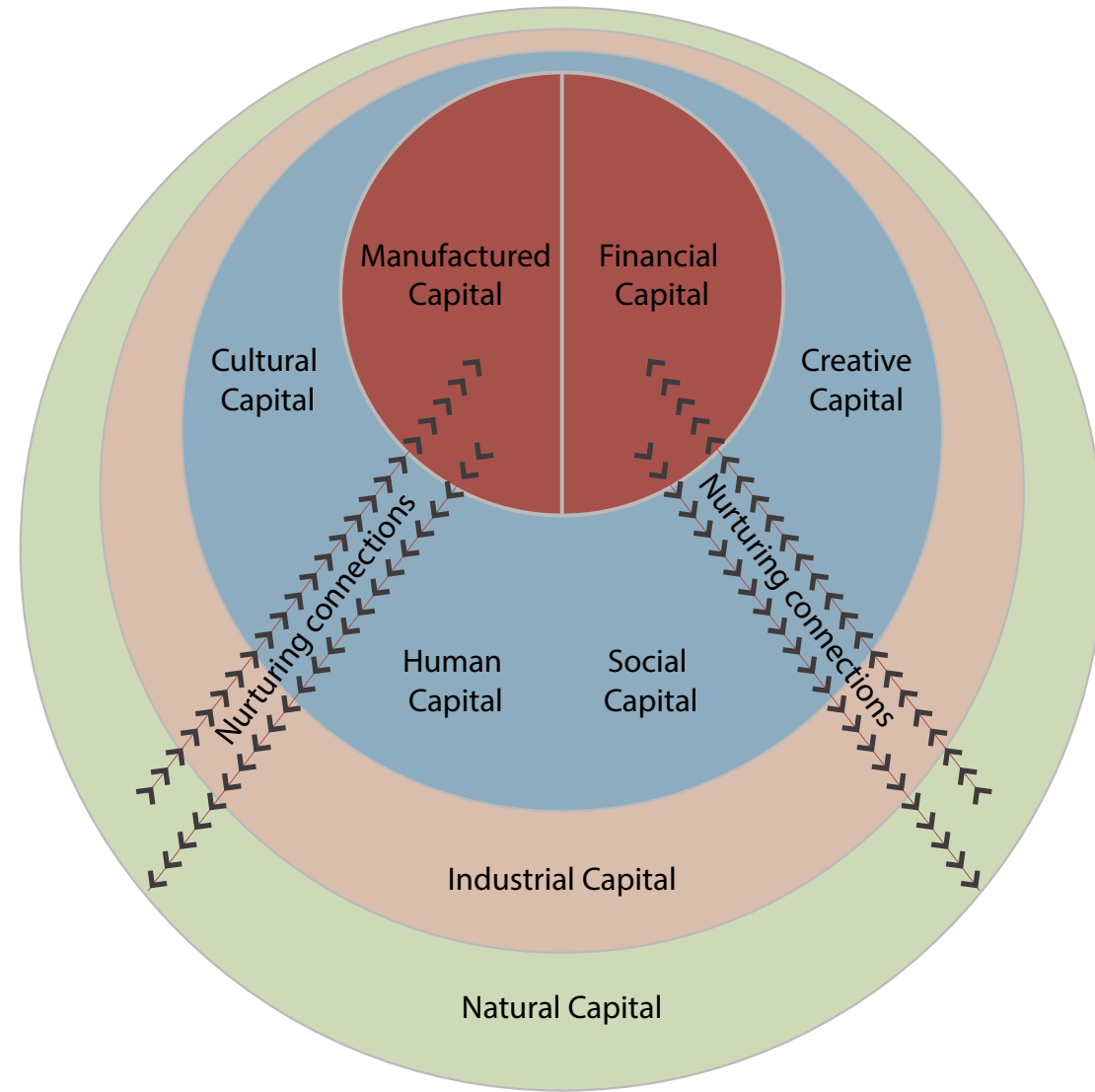


figure 4. Natural capital in capital system. (Jansen adapted by author)

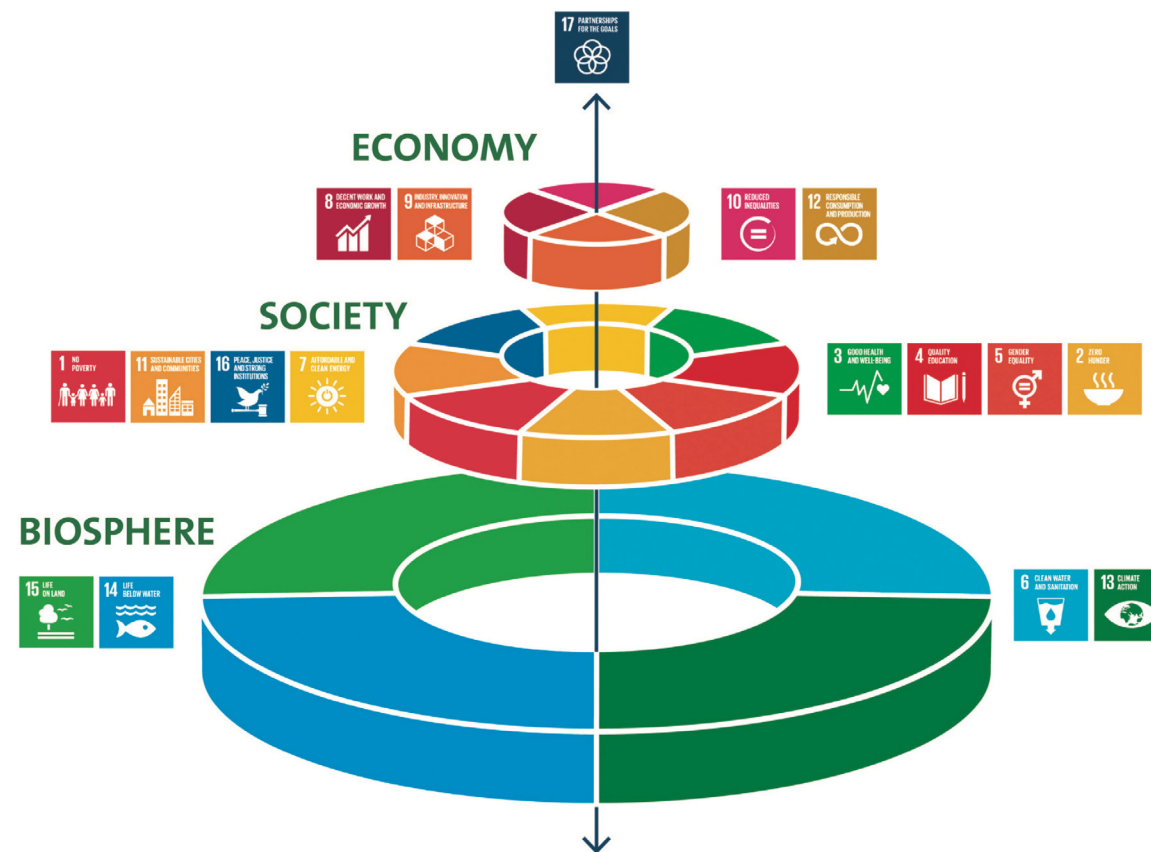
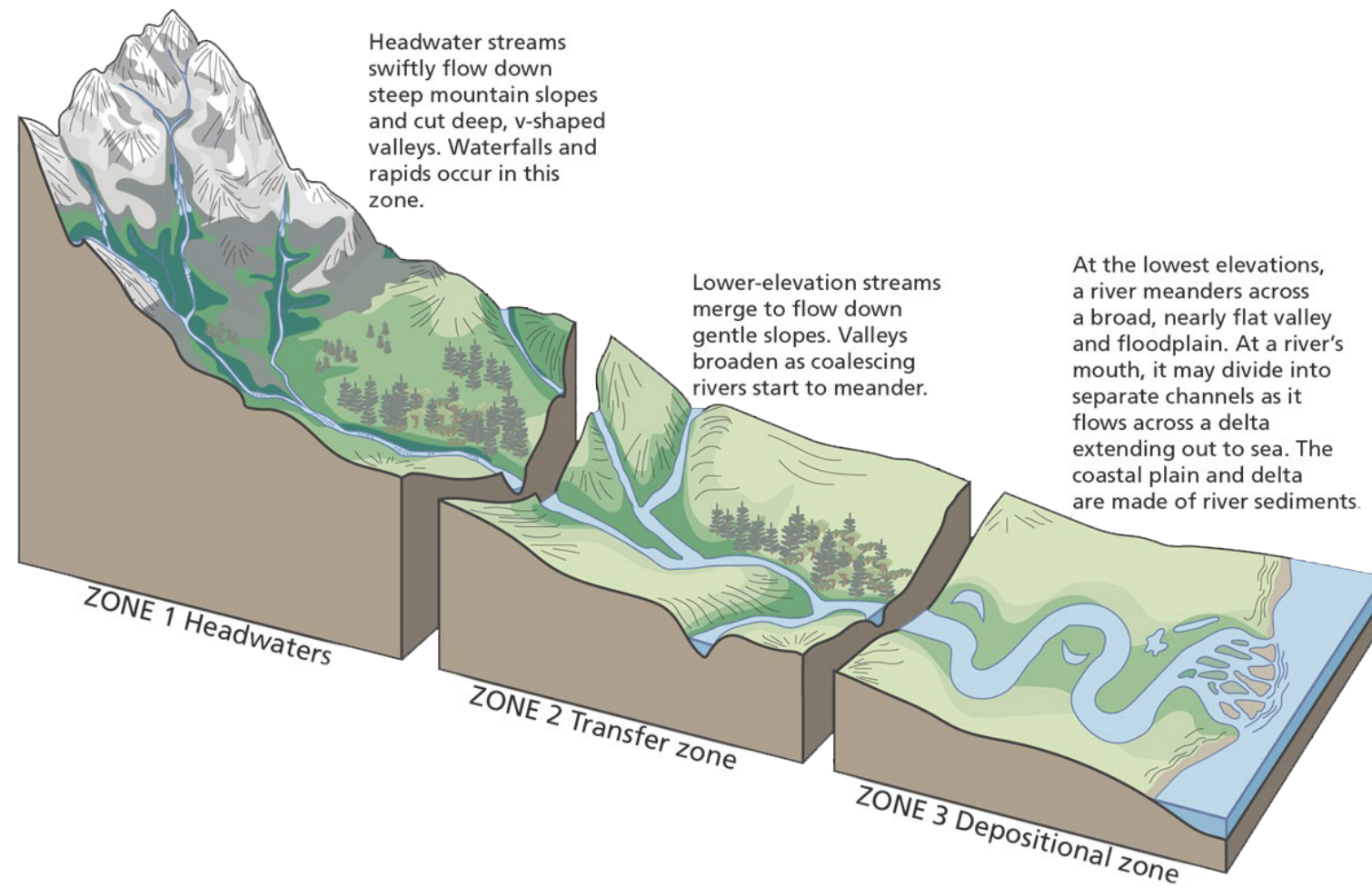


figure 6. sustainable economy framework (UN.. 202..)

1. Reviving the flexible port design concept

Synthesis RbD scenarios

rewilding

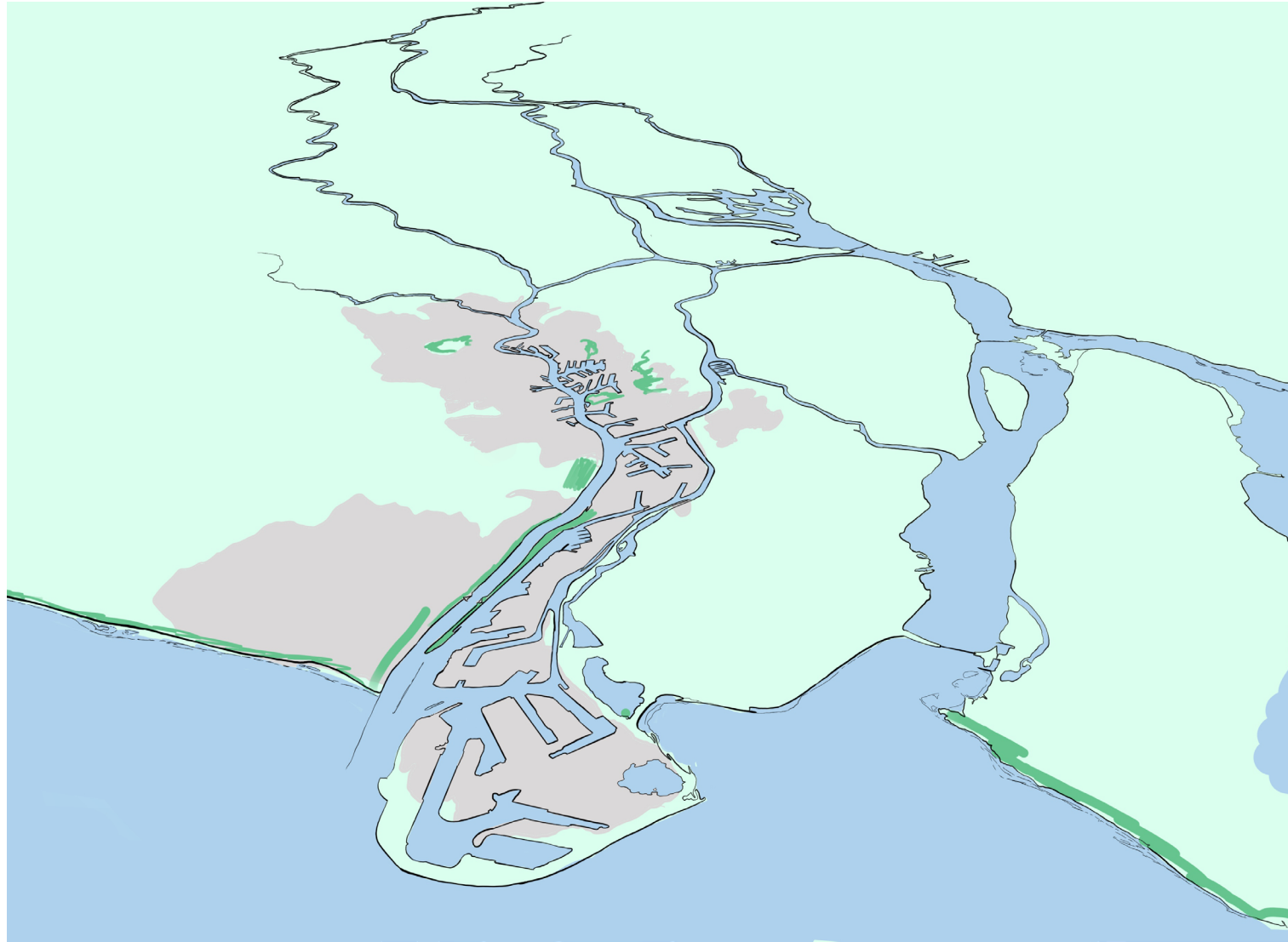


river byp

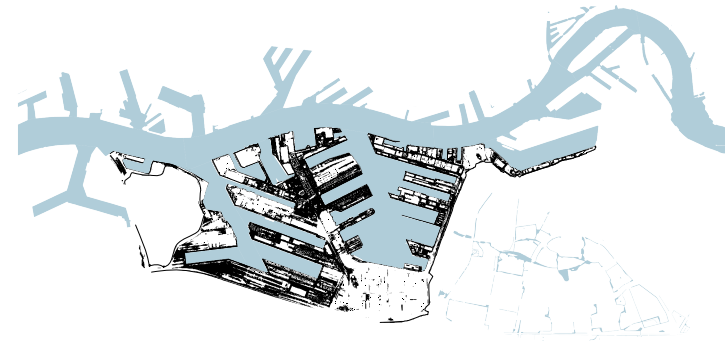


The case of Rotterdam

Seeking pathways towards sustainability



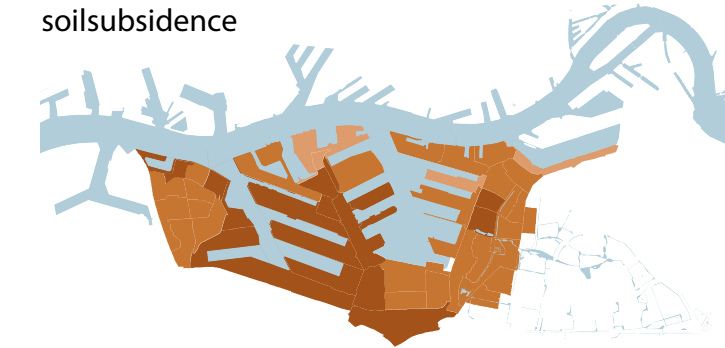
Floodrisk



+ 25% vulnerable buildings due to rainfall



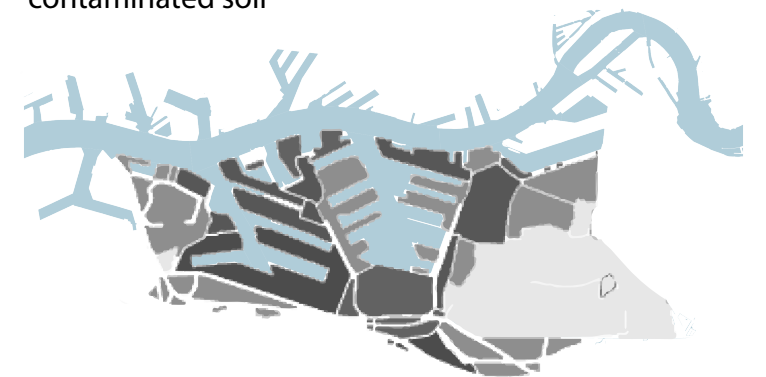
soilsubsidence



Urban heatisland



contaminated soil



Introduction

subsection:

Main research question:

How can the increase of natural capital support social- and economical ecosystem resilience in port-city waterfront transformation? (Design research for Waalhaven Rotterdam)

Sub research questions

- (Research paper)

How can urban design and urban planning practice play a role in mainstreaming urban-NBS on a strategic level to utilise ecology in redevelopment of former port areas with mixed-use land-use? (Case: CityPorts Rotterdam)

- analysis

- design research

- proposal

Hypothese

Ontwerpers en planners hebben de rol van catalysator in het verwezenlijken van green economy concept.

Het post-industrieel waterfront project heeft de historische functie gehad van vernieuwing.

Het post-industrieel waterfront ligt in de intersectie van sociale, economische en ecologische.. Dus de plek om een grote impact te hebben wereldwijd.

Op stedelijk en landschappelijk niveau samenwerken met de natuur geeft de beste resultaten.

Main research question:

How can the increase of natural capital support social- and economical ecosystem resilience in port-city waterfront transformation? (Design research for Waalhaven Rotterdam)

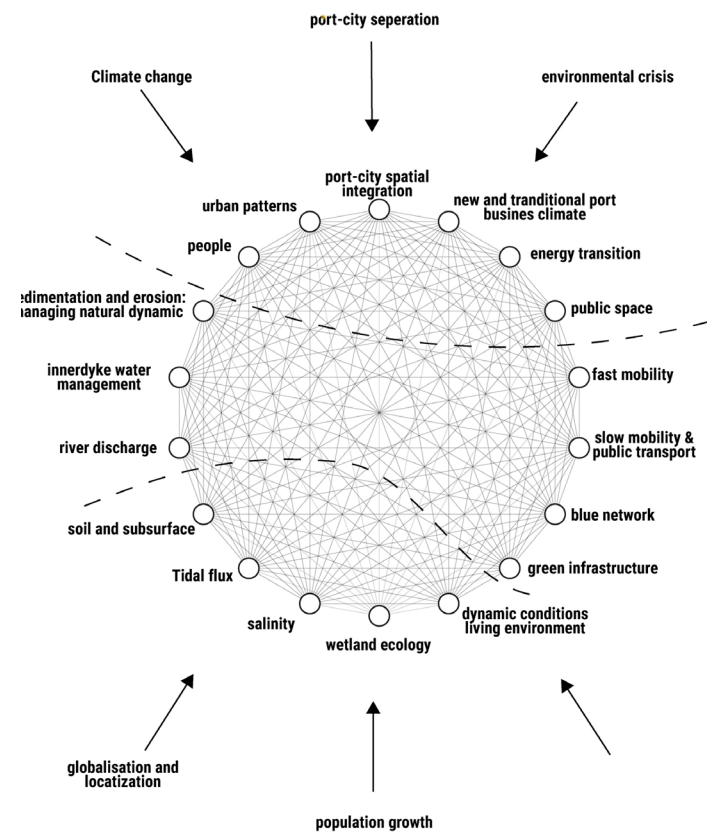
Sub research questions

- (Research paper)

How can urban design and urban planning practice play a role in mainstreaming urban-NBS on a strategic level to utilise ecology in redevelopment of former port areas with mixed-

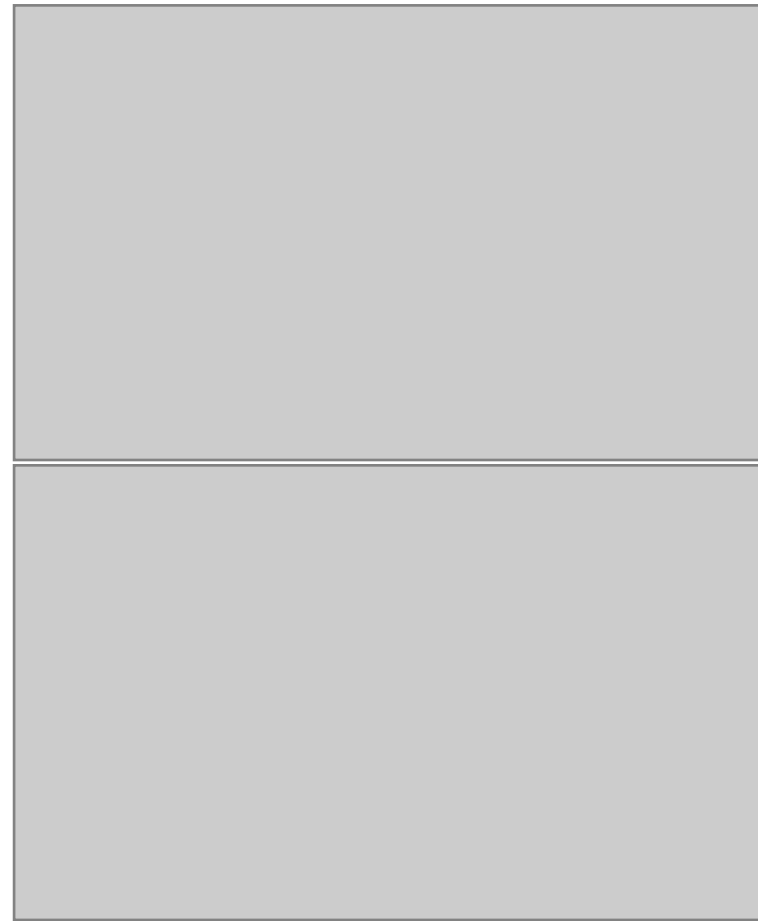
Research approach

System analysis



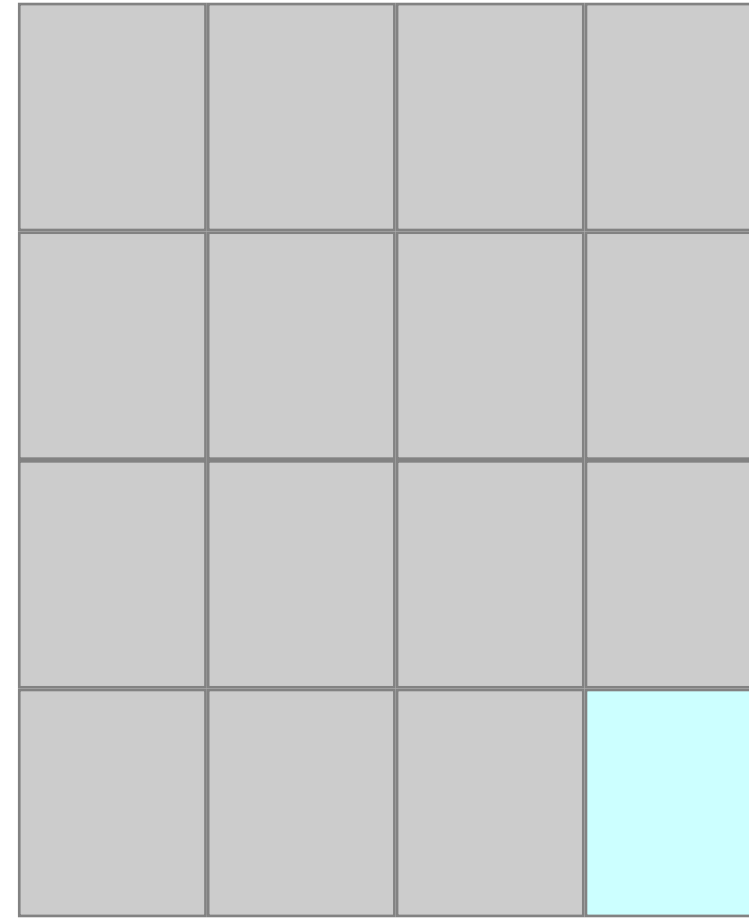
System anysis Delta region (Han Meyer, adaptaed by author 2023)

Research paper.
- literature review
- case-study



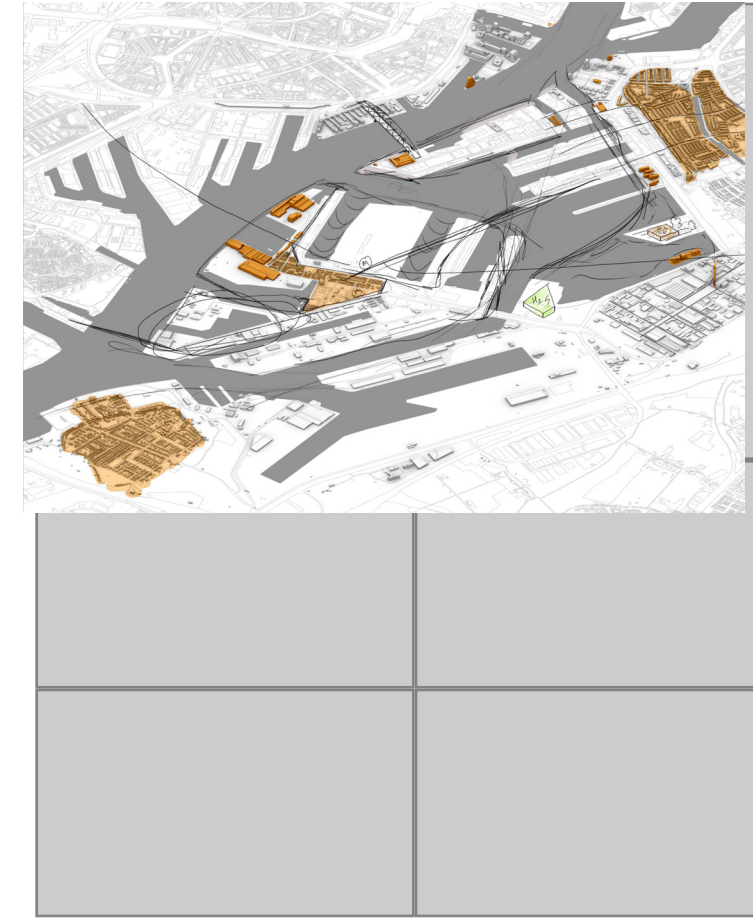
System anysis Delta region (Han Meyer, adaptaed by author 2023)

research by design
- 16 scenarios



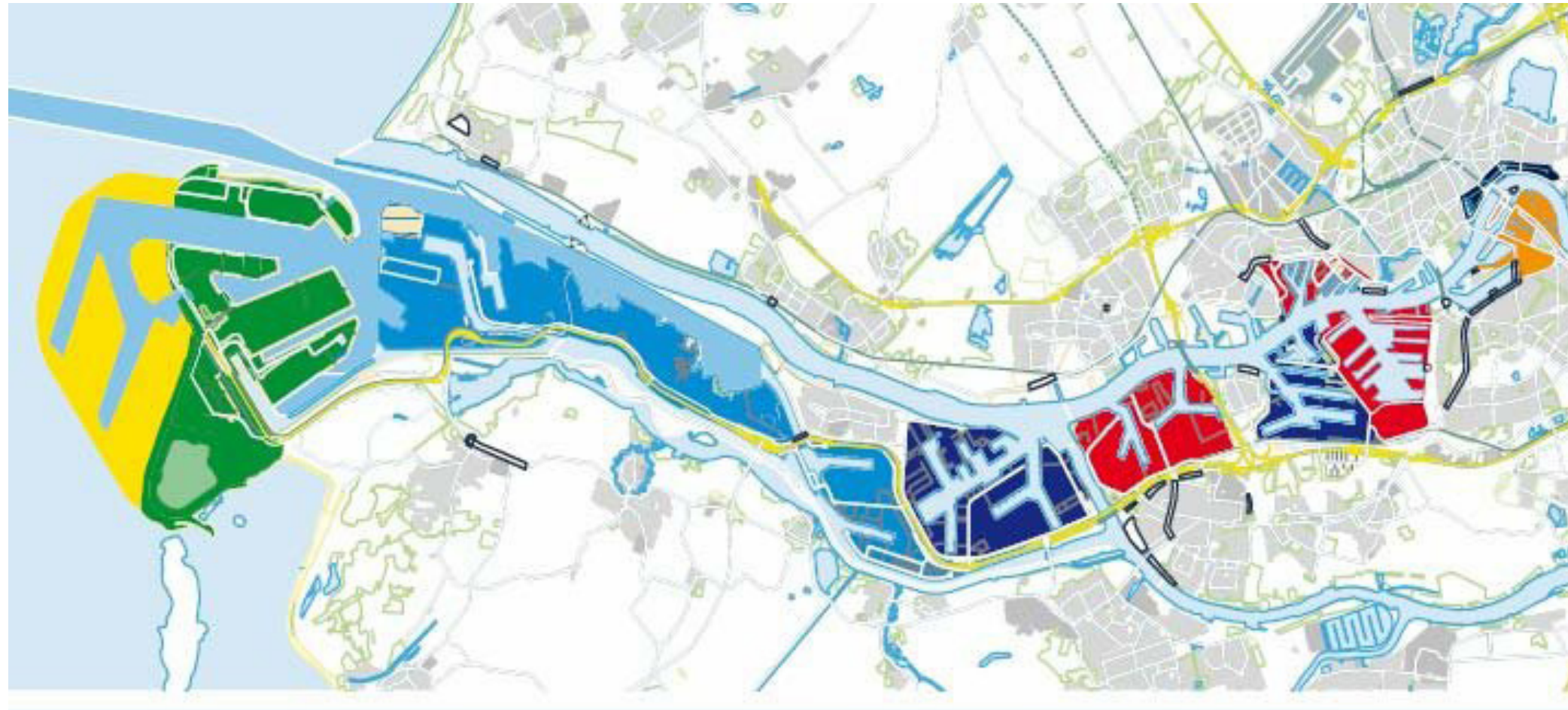
Meyer
Sijmons
Logica (Maxwan 199..., adaped by author 2023)

Design proposal



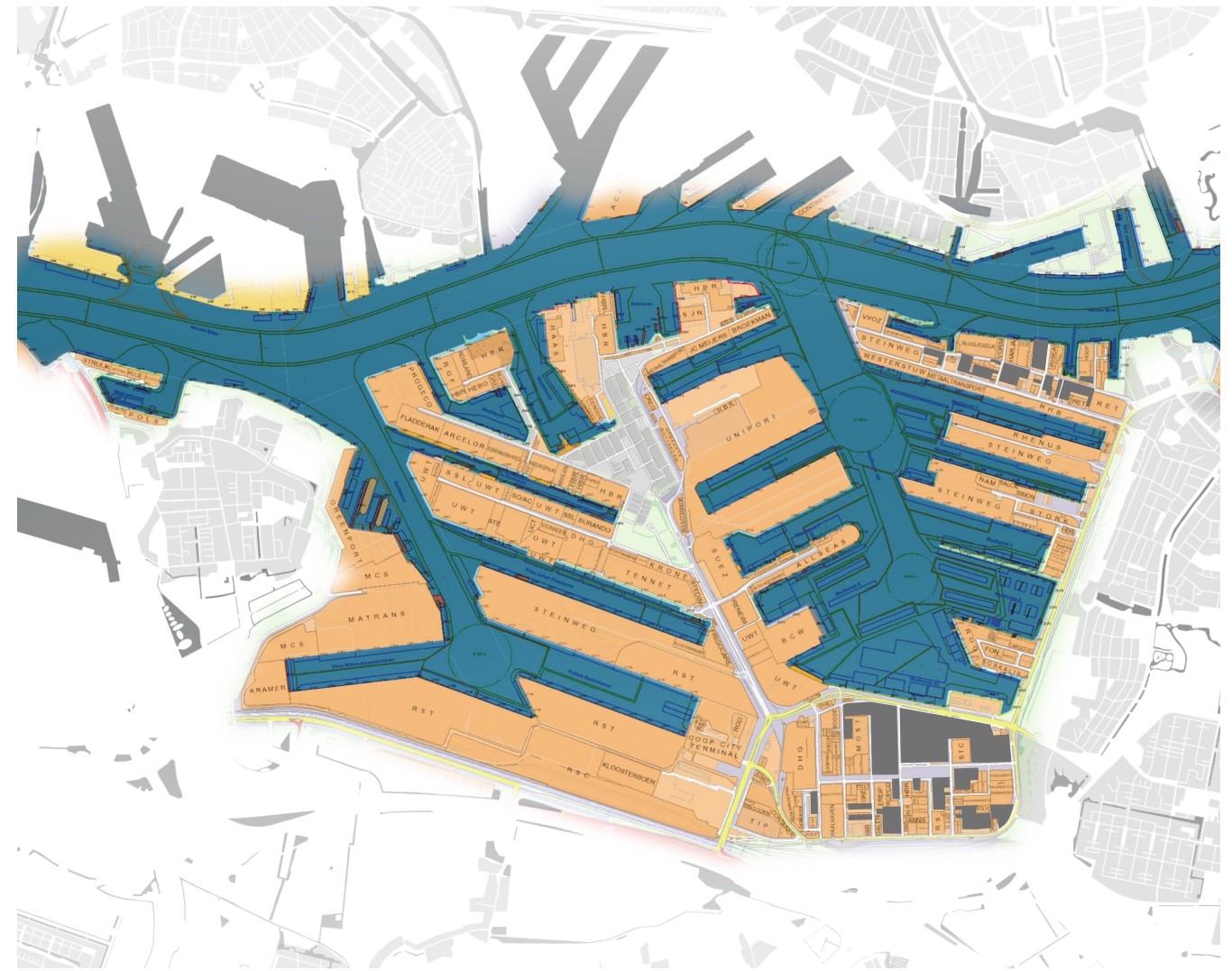
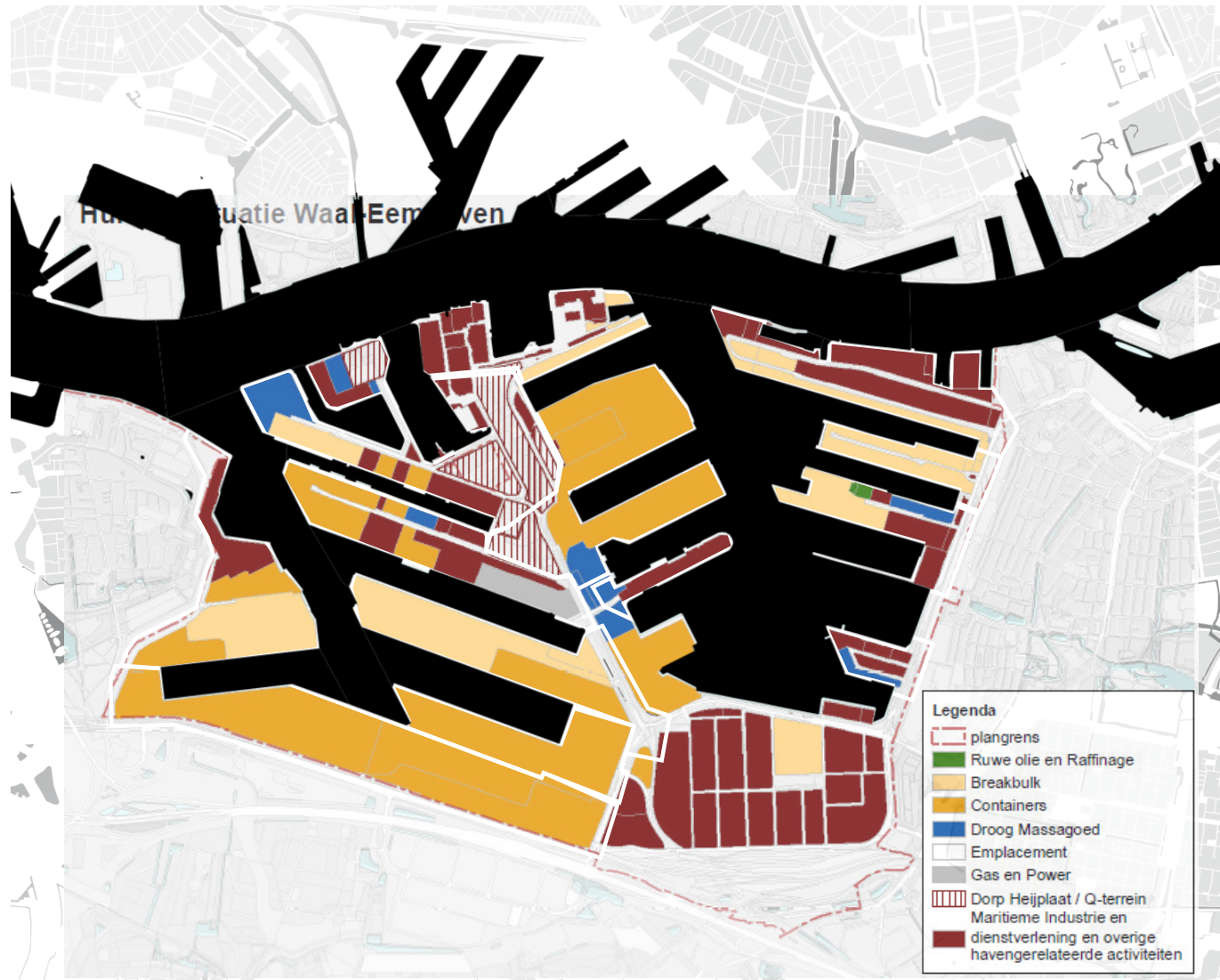
System anysis Delta region (Han Meyer, adaptaed by author 2023)

Research approach



STAGE	SYMBOL ○ City ● Port	PERIOD	CHARACTERISTICS
I Primitive port/city	○●	Ancient/medieval to 19th century	Close spatial and functional association between city and port
II Expanding port/city	○●●	19th – early 20th century	Rapid commercial/industrial growth forces port to develop beyond city confines, with linear quays and break-bulk industries
III Modern industrial port/city	○●●●	Mid – 20th century	Industrial growth (especially oil refining) and introduction of containers/ro-ro require separation/space
IV Retreat from the waterfront	○●●●	1960s – 1980s	Changes in maritime technology induce growth of separate marine industrial development areas
V Redevelopment of waterfront	○●●●	1970s – 1990s	Large-scale modern port consumes large areas of land/water space; urban renewal of original core
VI Renewal of port/city links	○●●●	1980s – 2000+	Globalization and intermodalism transform port roles; port-city associations renewed; urban redevelopment enhances port-city integration

Port functions

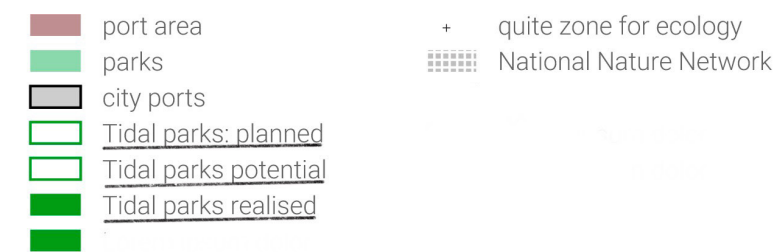
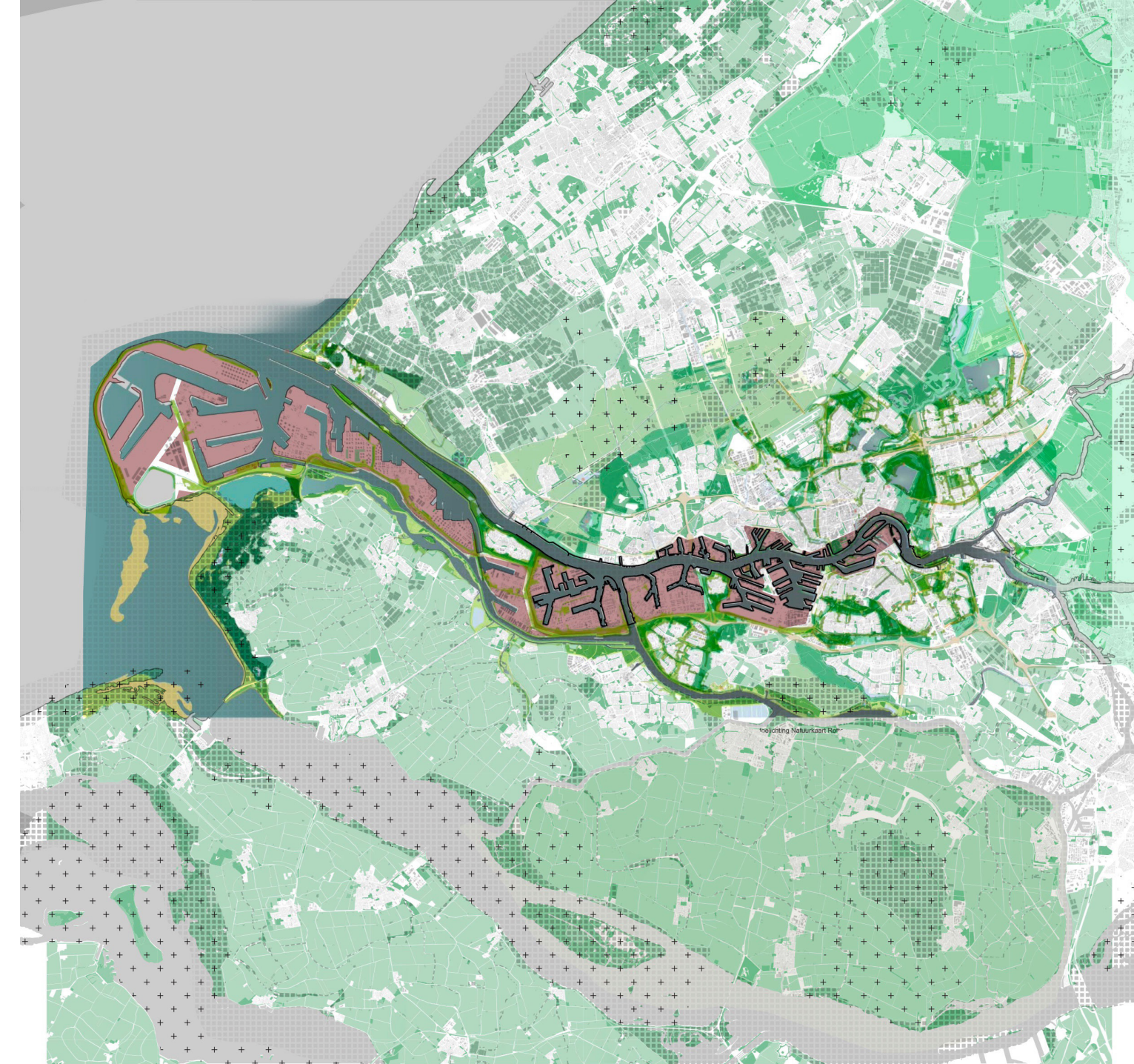
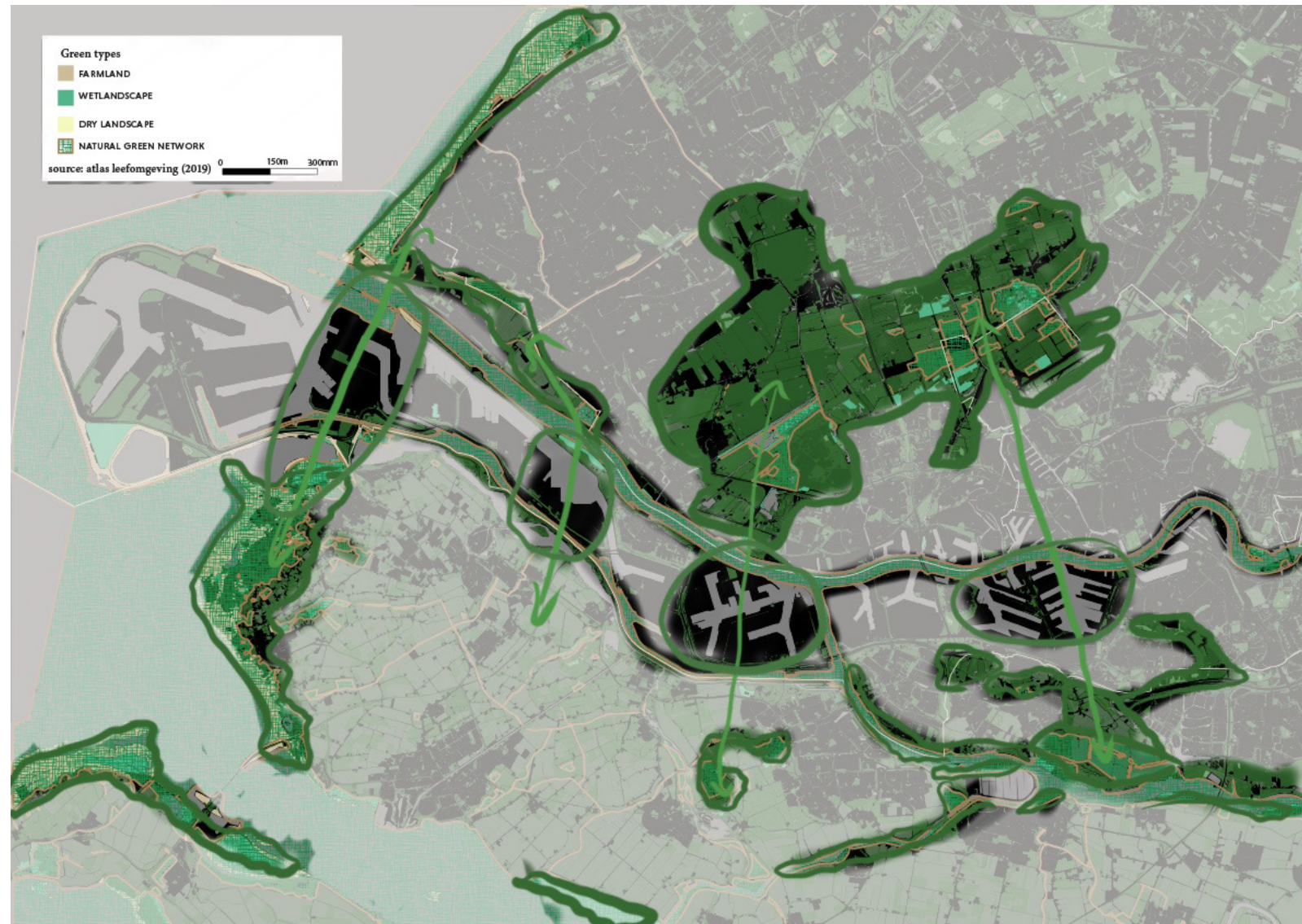


Portcity separation

fossil fueled developmet



Challenge theme 2: Greening

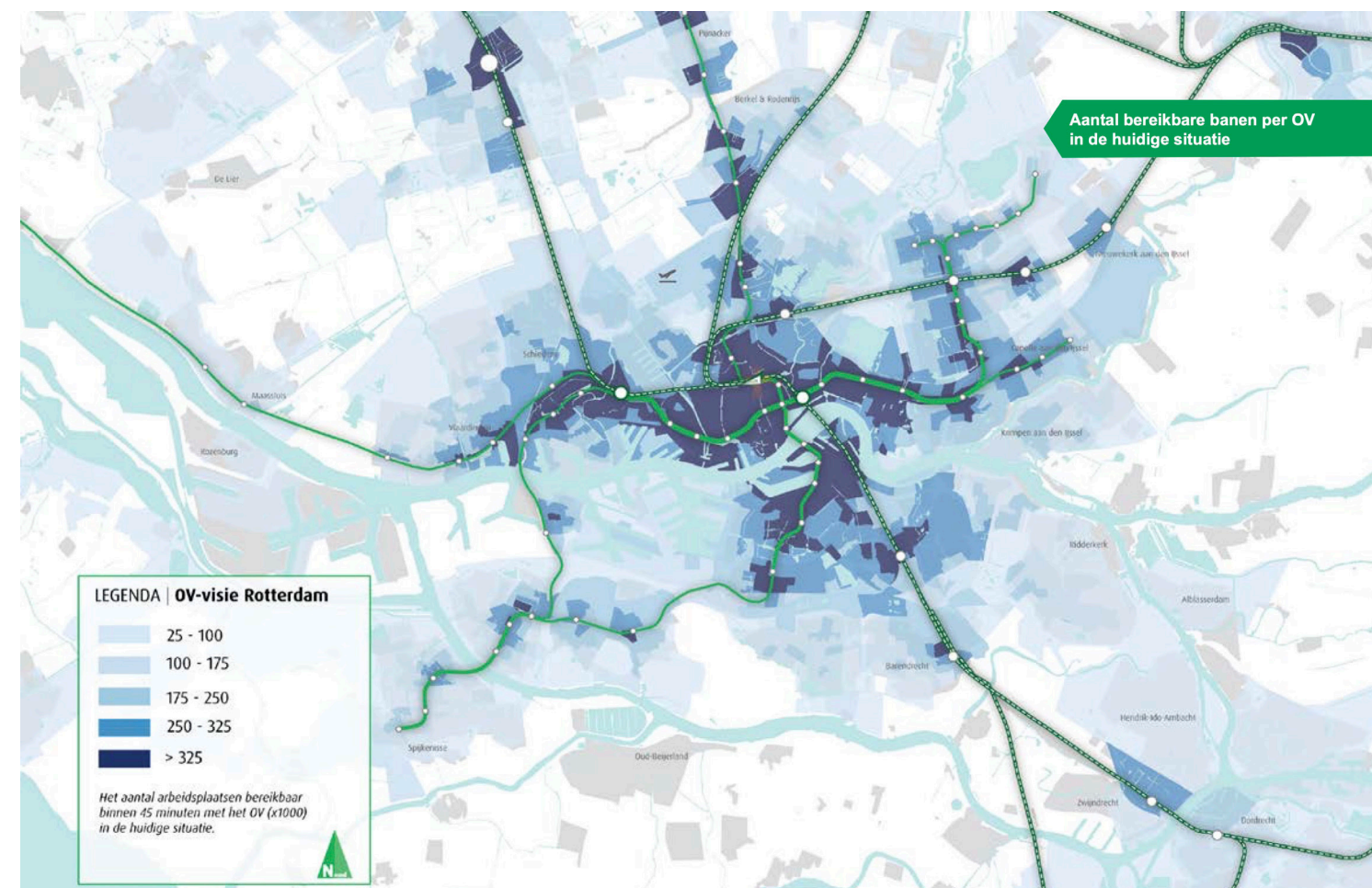
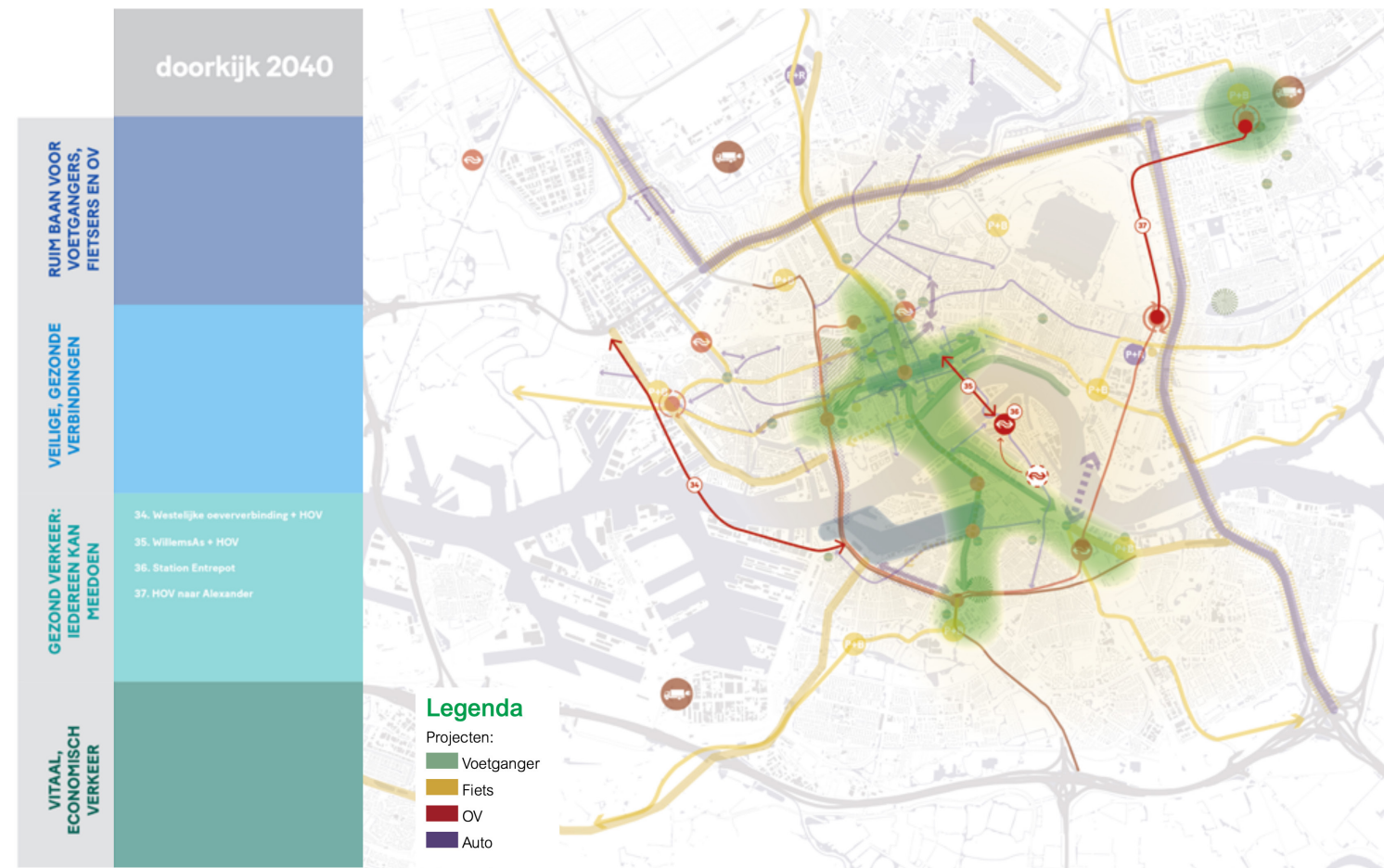
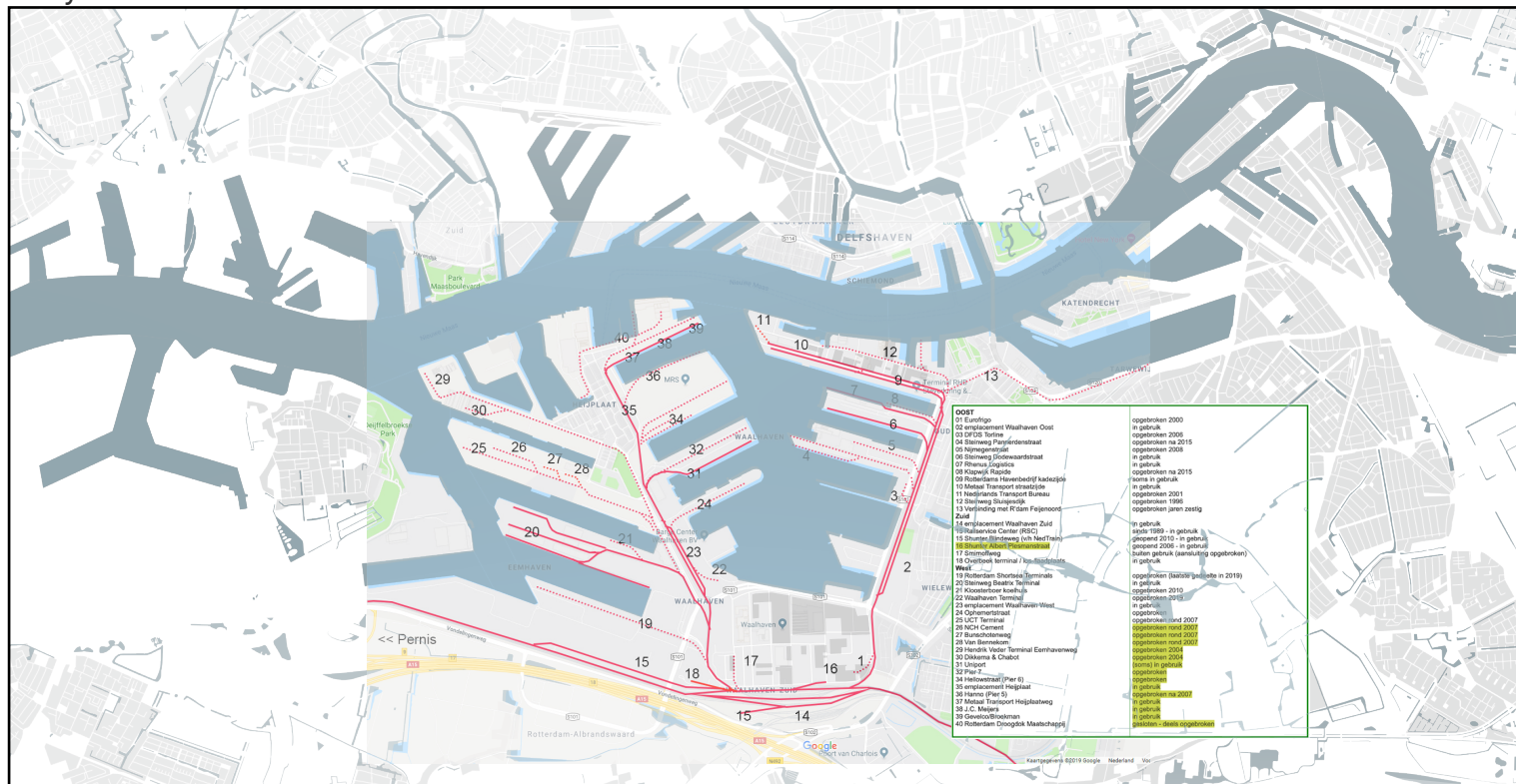


Natuurkaart - kerngebieden en verbindingen



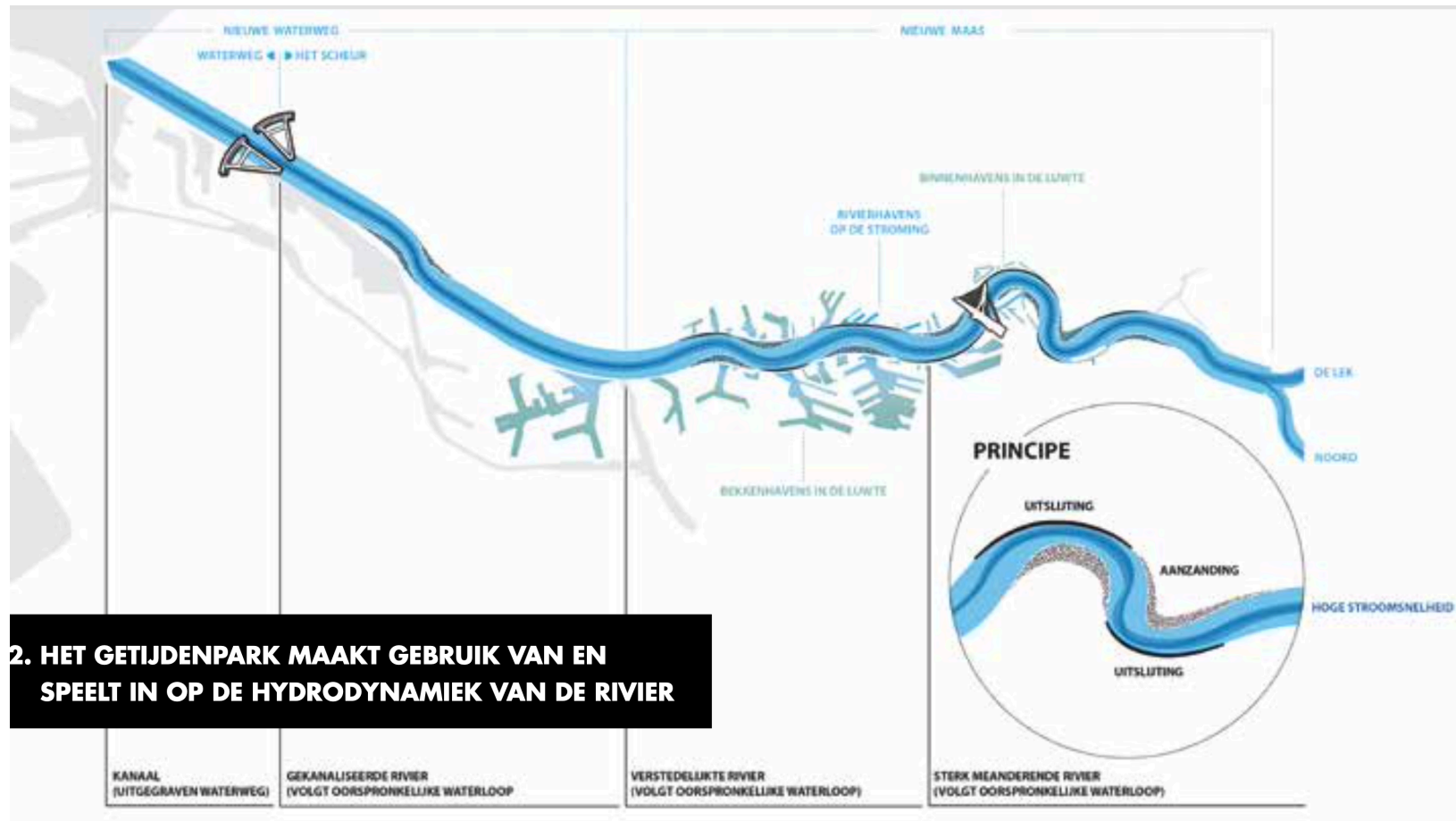
Challenge theme 3: Infrastructure and mobility

Synthesis RbD scenarios

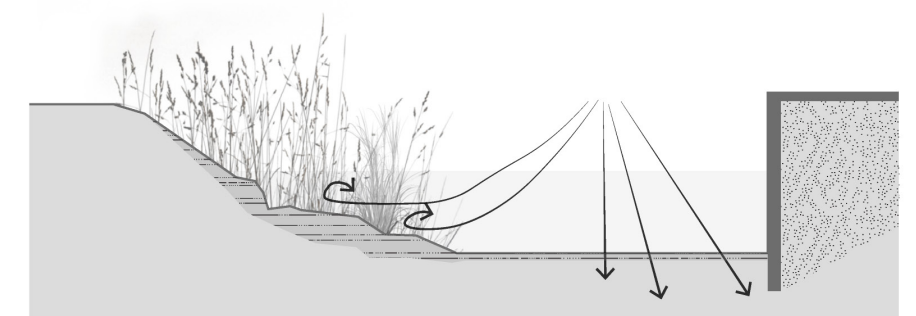
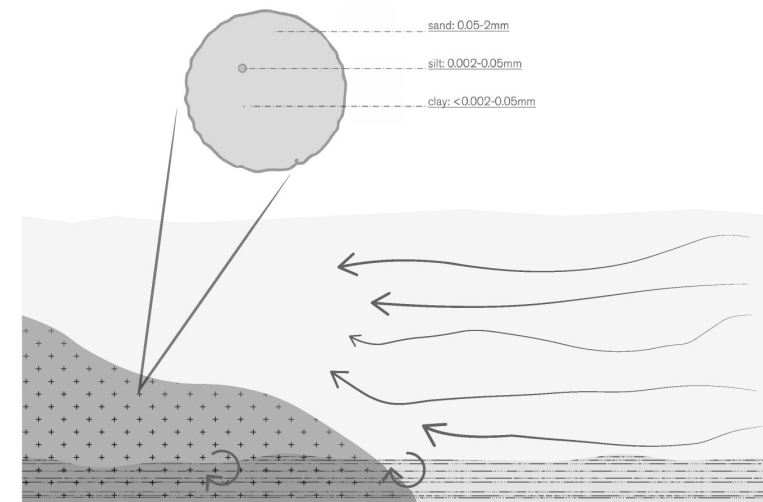
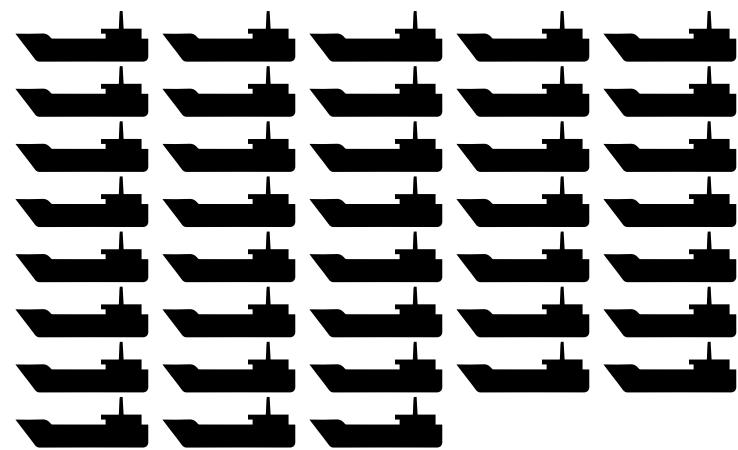
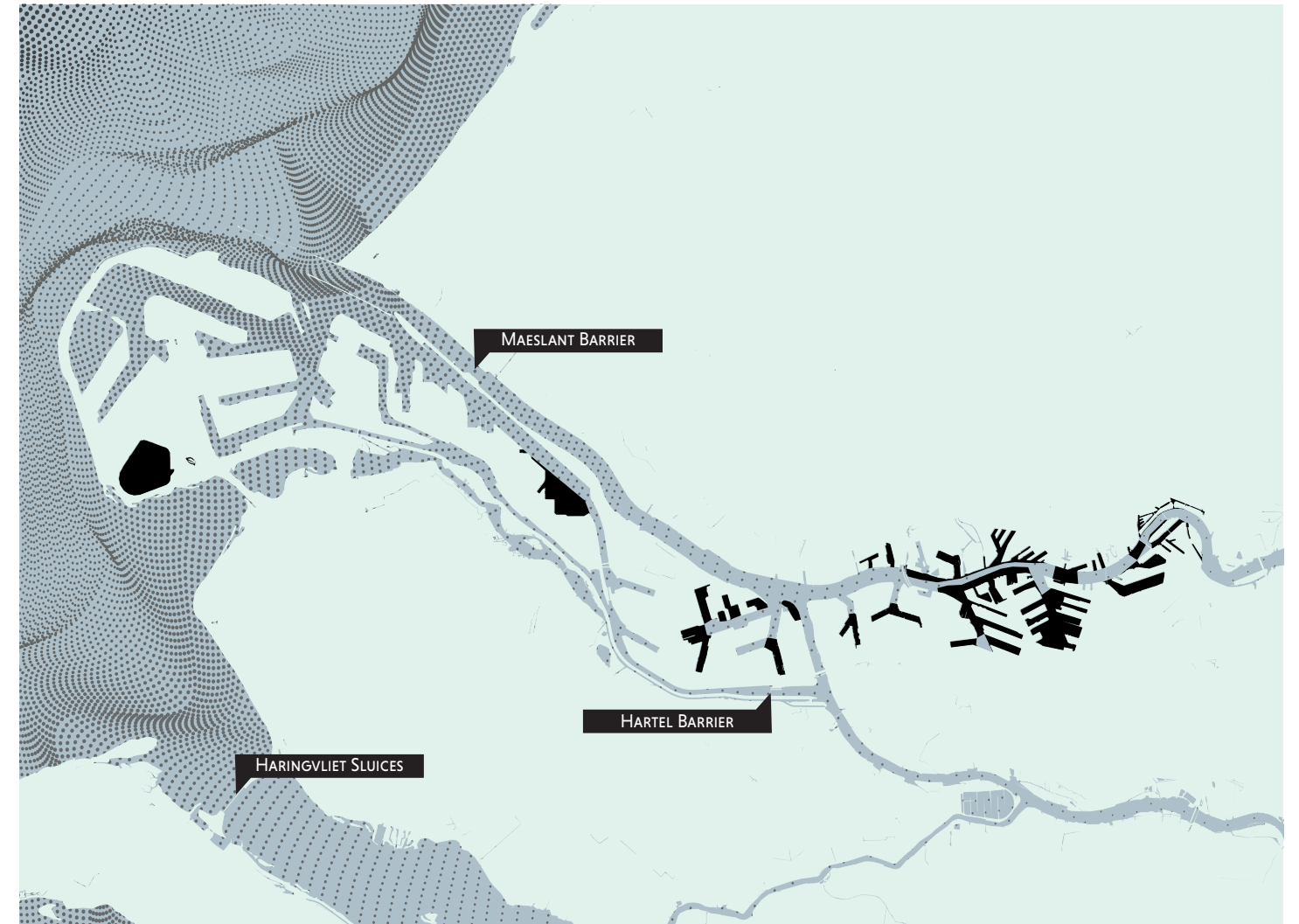


Challenge theme 4: Hydrology, sediments and quays

subsection:



2. HET GETIJDENPARK MAAKT GEBRUIK VAN EN SPELT IN OP DE HYDRODYNAMIEK VAN DE RIVIER



Problem statement

system analysis: main themes in the Waalhaven transision

portcity

green

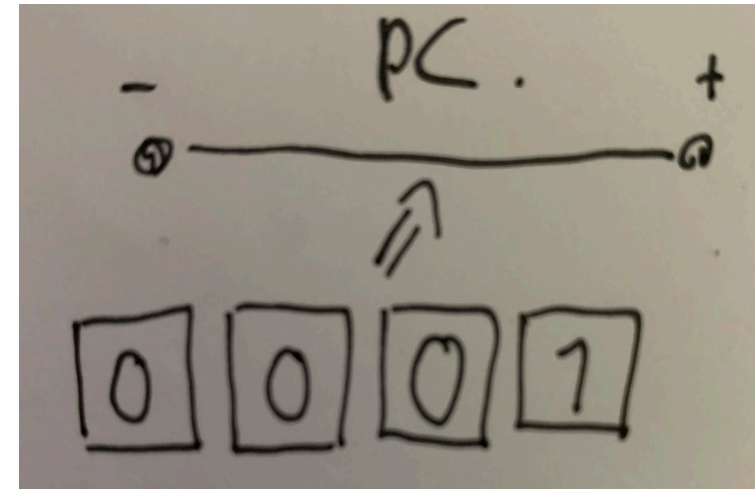
infrastructure

hydrology

Research by design: 16 scenarios

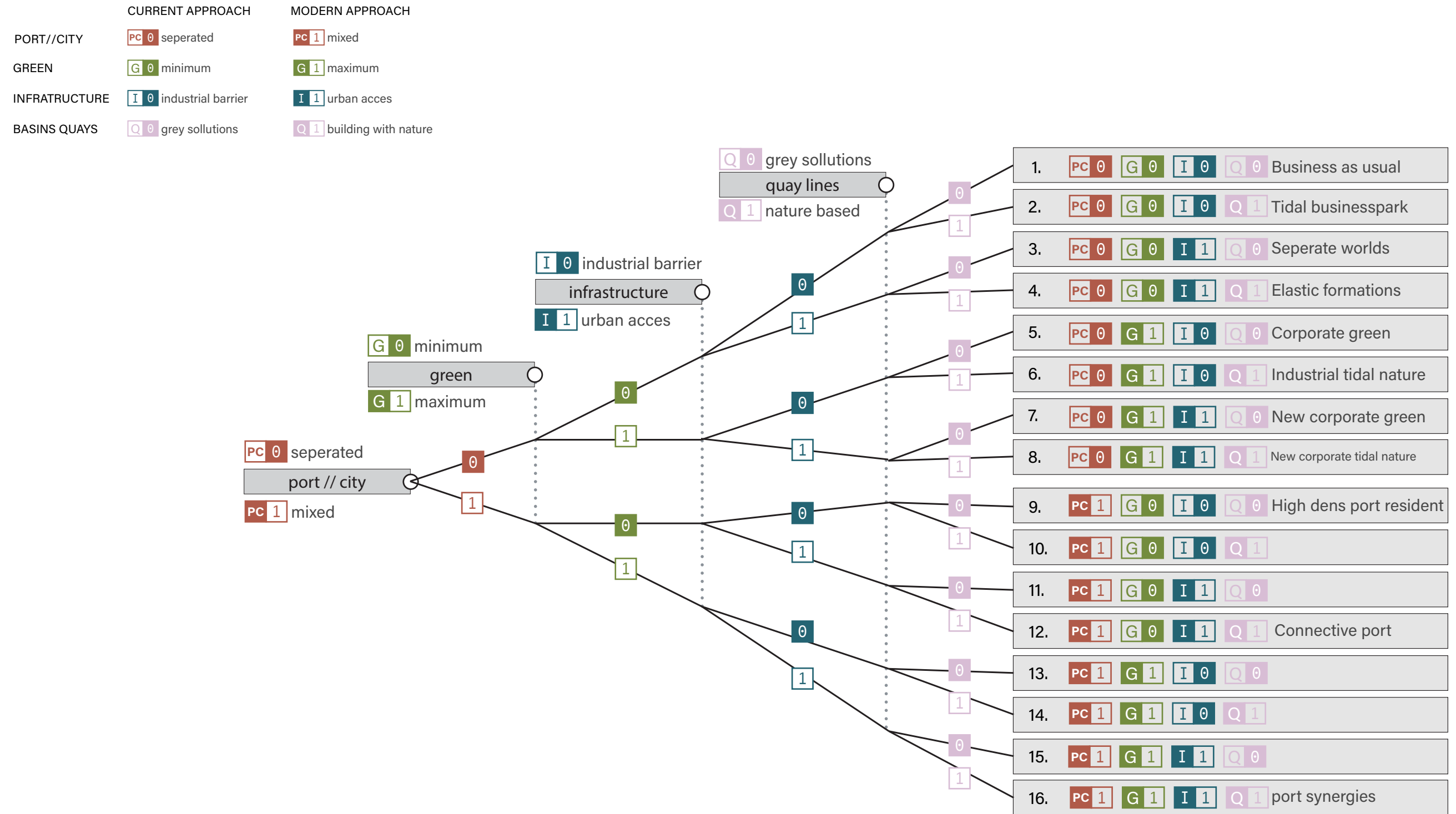
system analysis: main themes in the Waalhaven transition

	CURRENT APPROACH	MODERN APPROACH
PORT//CITY	PC 0 seperated	PC 1 mixed
GREEN	G 0 minimum	G 1 maximum
INFRASTRUCTURE	I 0 industrial barrier	I 1 urban acces
BASINS QUAYS	Q 0 grey sollutions	Q 1 building with nature



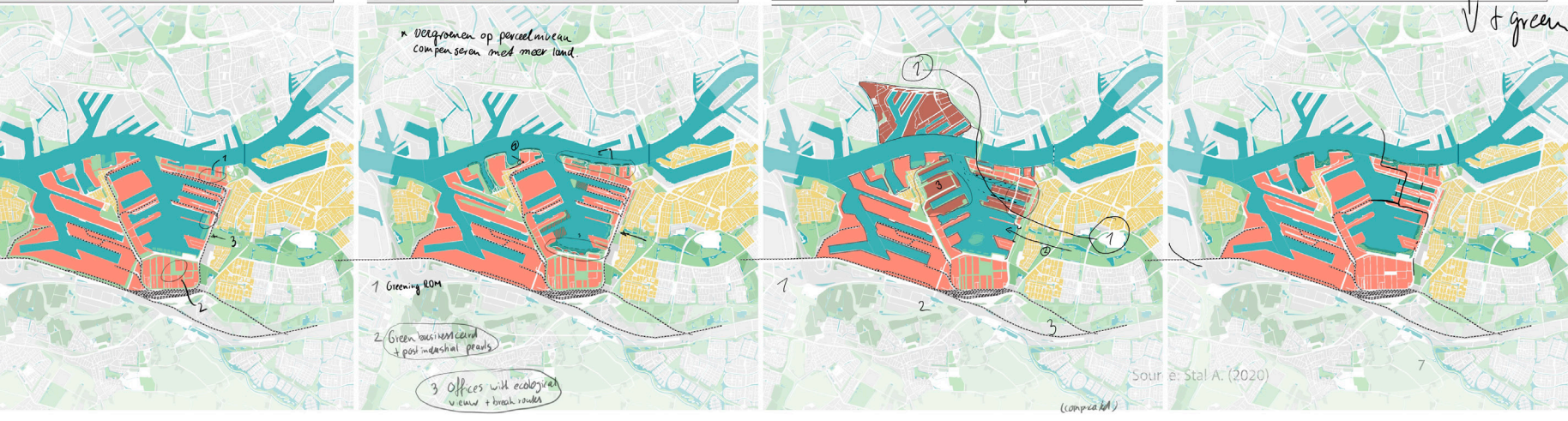
Research by design: 16 scenarios

system analysis: main themes in the Waalhaven transition



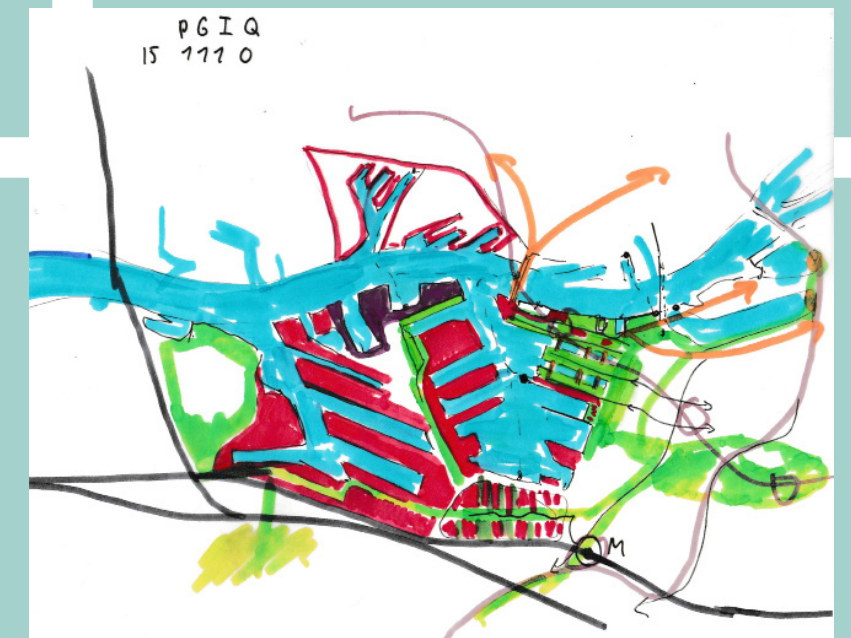
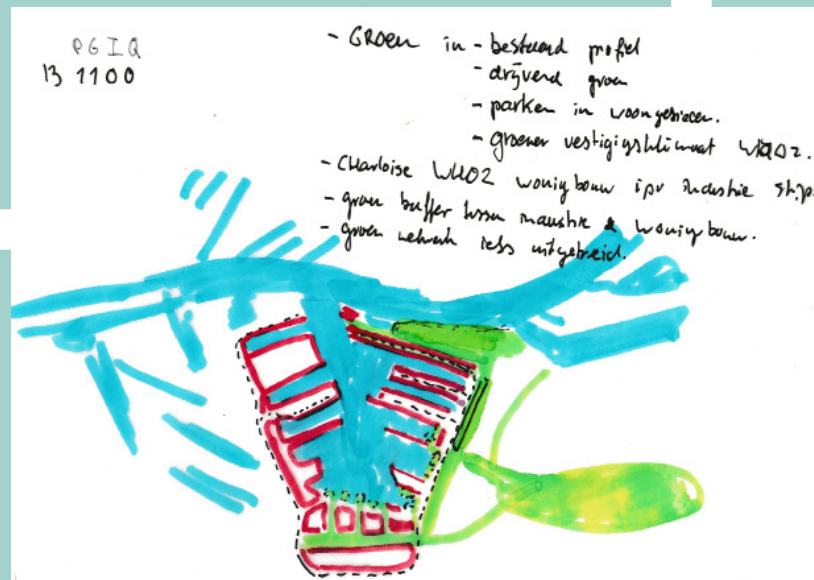
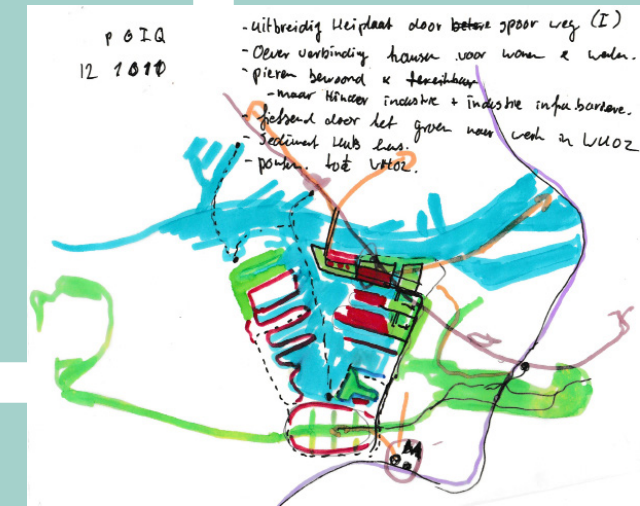
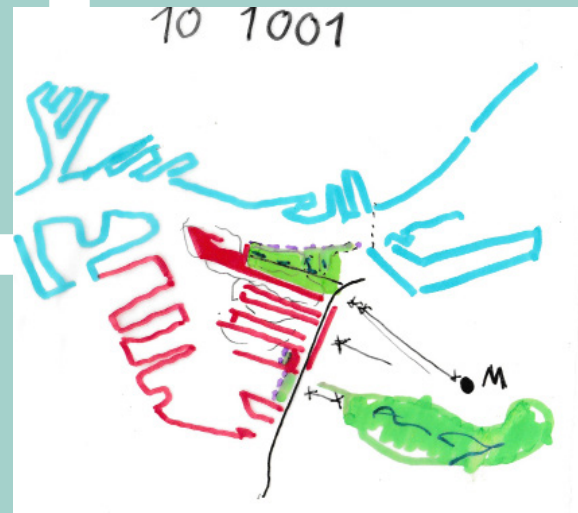
Research by design: 16 scenarios

system analysis: main themes in the Waalhaven transition



Research by design: 16 scenarios

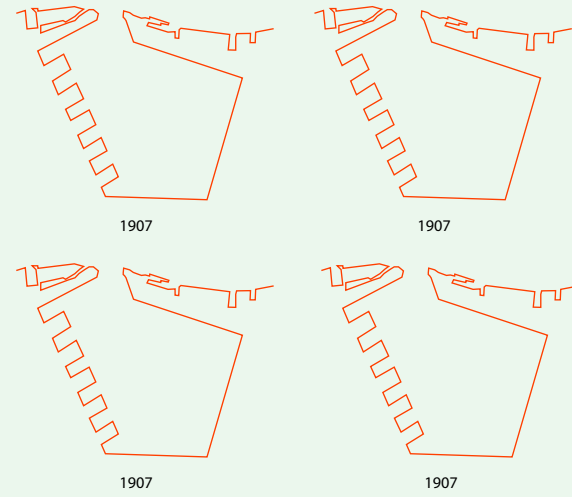
system analysis: main themes in the Waalhaven transisition



Research by design: design guidelines following scenario research

Synthesis RbD scenarios

1. Reviving the elastic port design concept from 1904 by de Jonge.



2. (Re)using former portcity infrastructure



3. Linking interventions to direct local context and global scale.

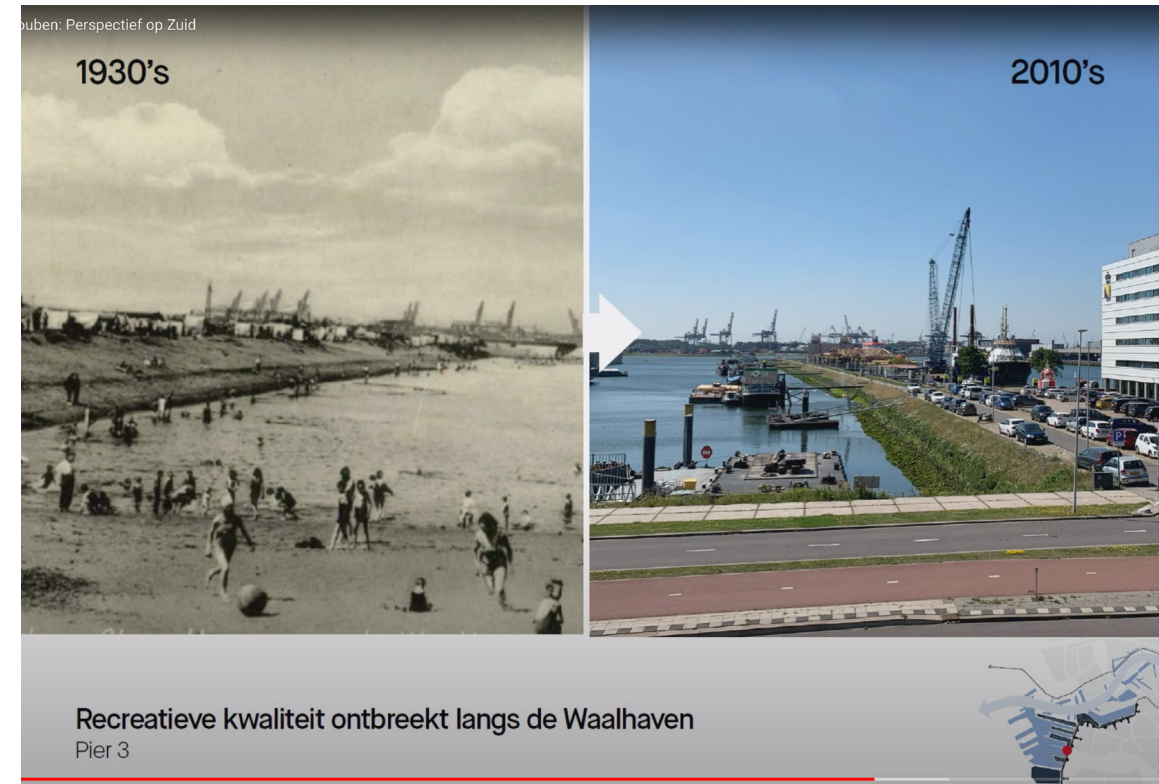
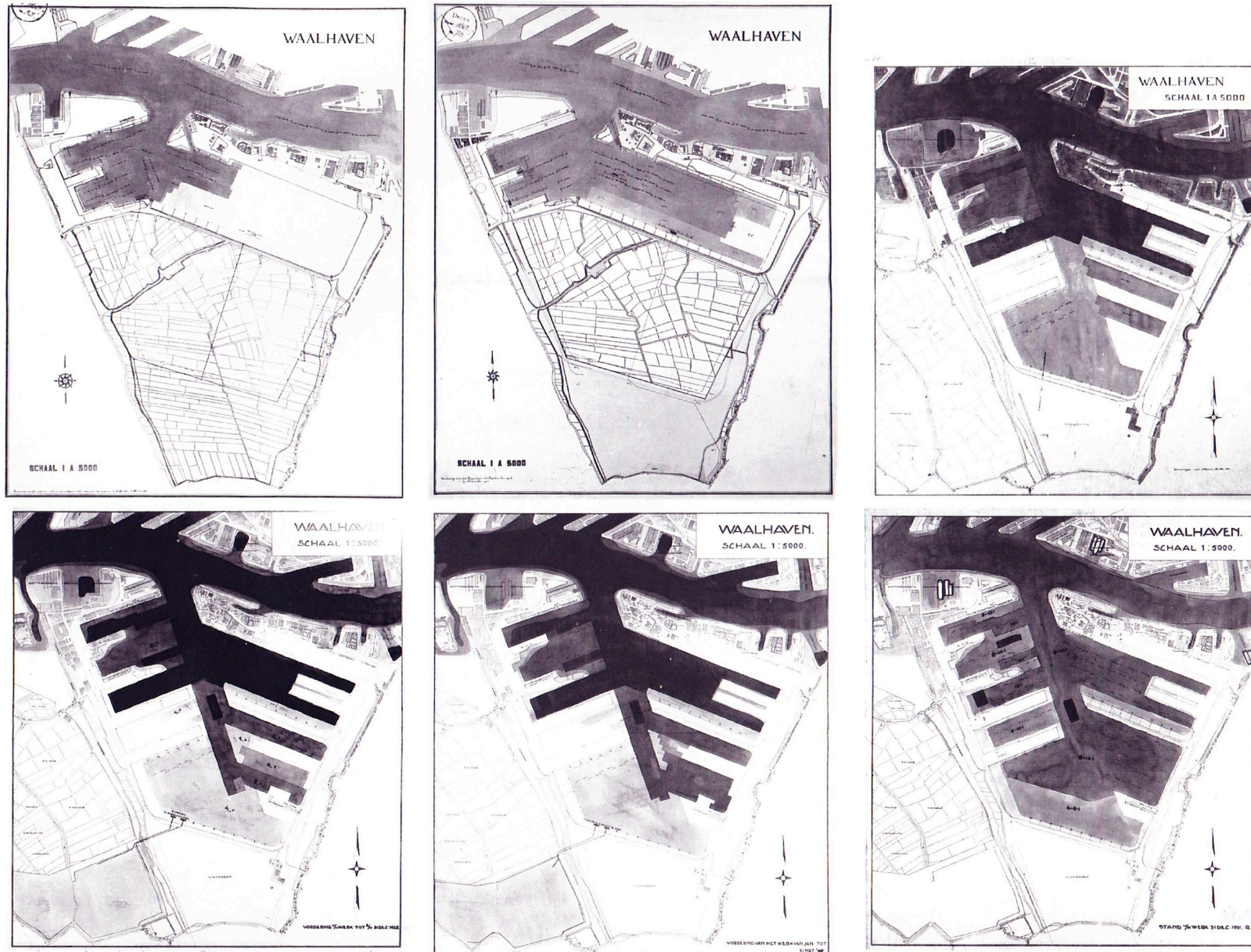
I. Adjacent neighbourhoods

III. Sluisjesdijk als schakel tussen zuid&noord, oost&west, haven&stad

III. Advancing the former portcity waterfront imaginary

1. Reviving the flexible port design concept

Synthesis RbD scenarios



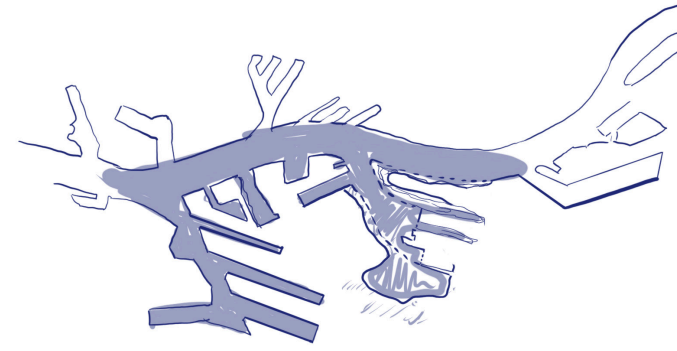
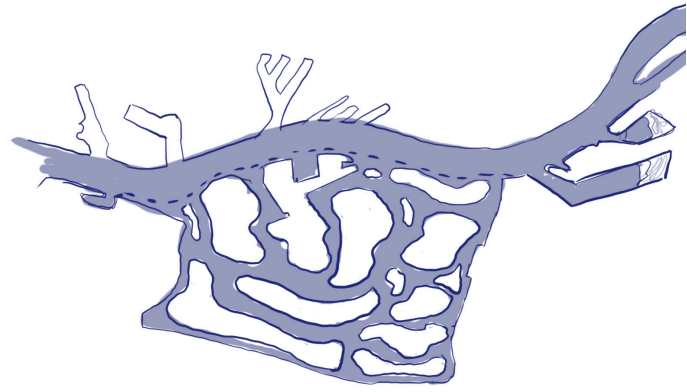
1. Reviving the flexible port design concept

Synthesis RbD scenarios

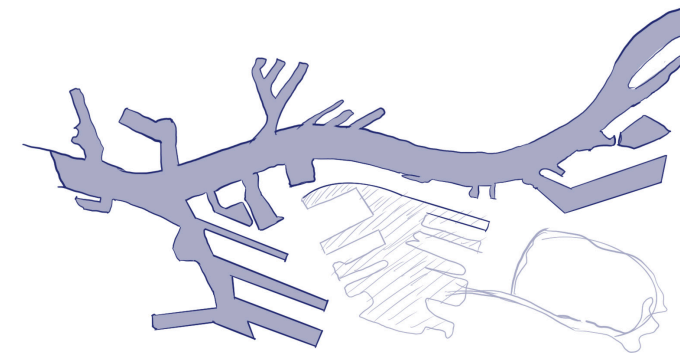
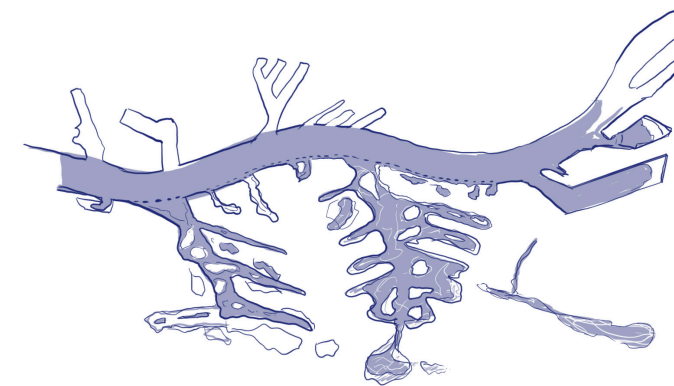
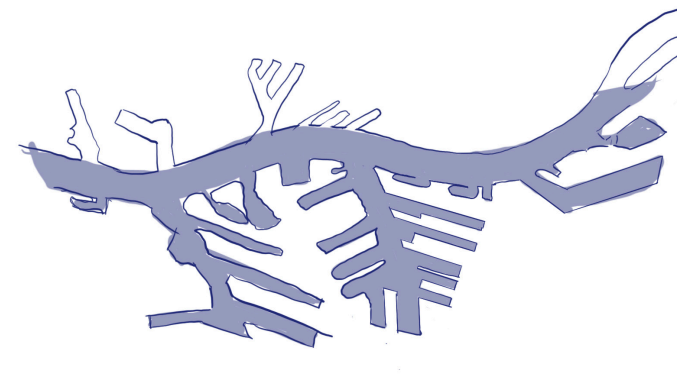
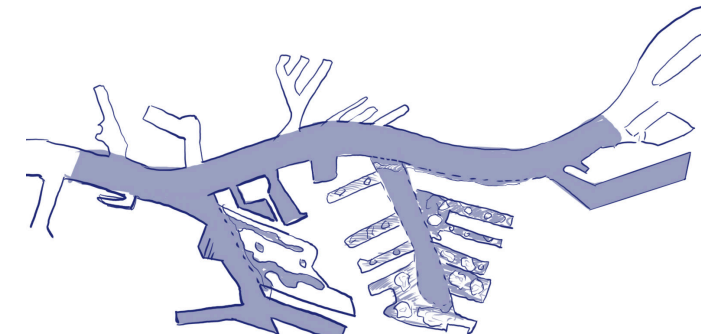
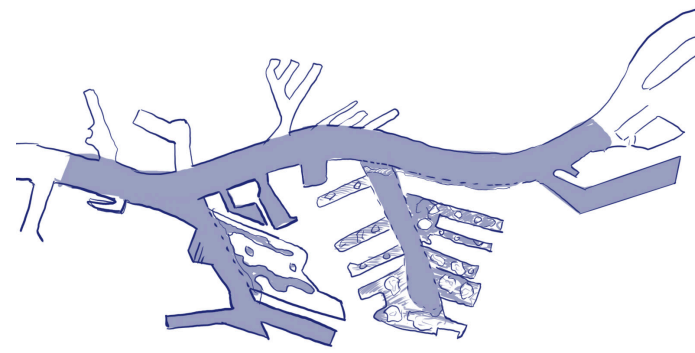
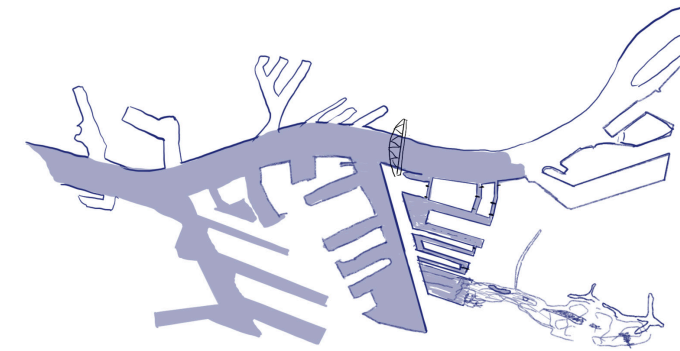
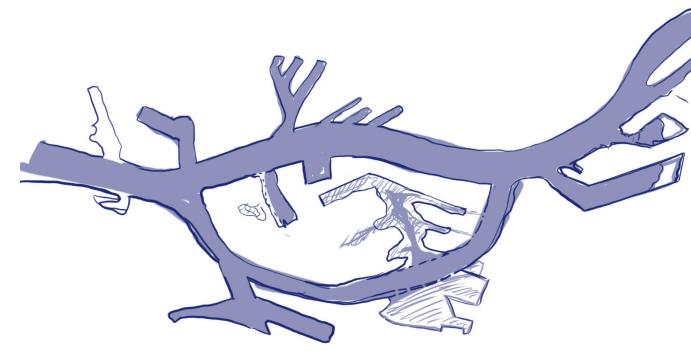
What?

river bypass

rewilding



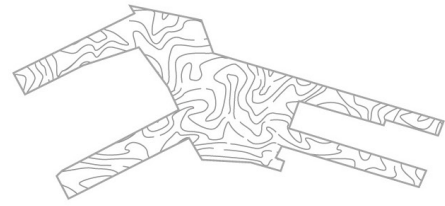
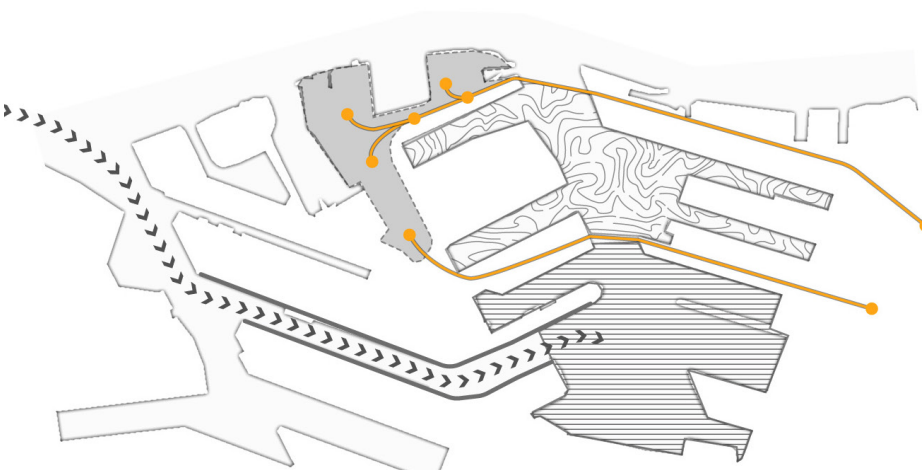
port dictates change



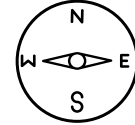
1. Reviving the flexible port design concept

Synthesis RbD scenarios

Bypass route



Subtidal ecological zone



RDM included in Rotterdam South



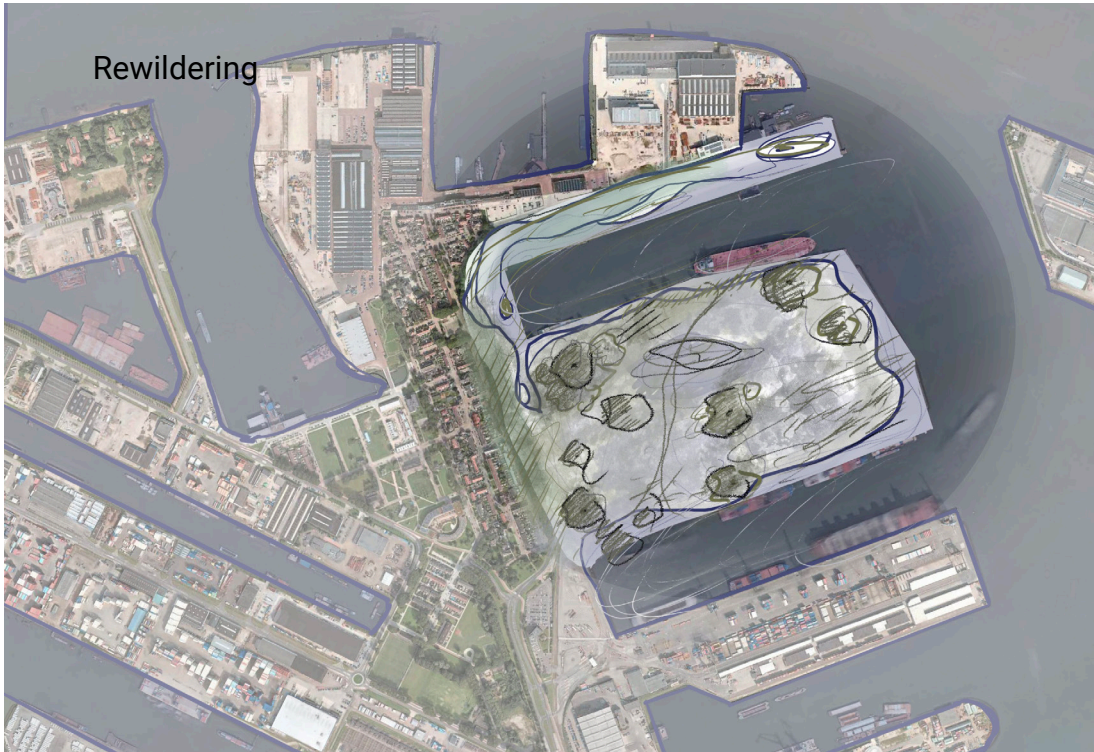
Revitalising residential area Heijplaat



Portcity identity maintained by south water passage.



Rewilding



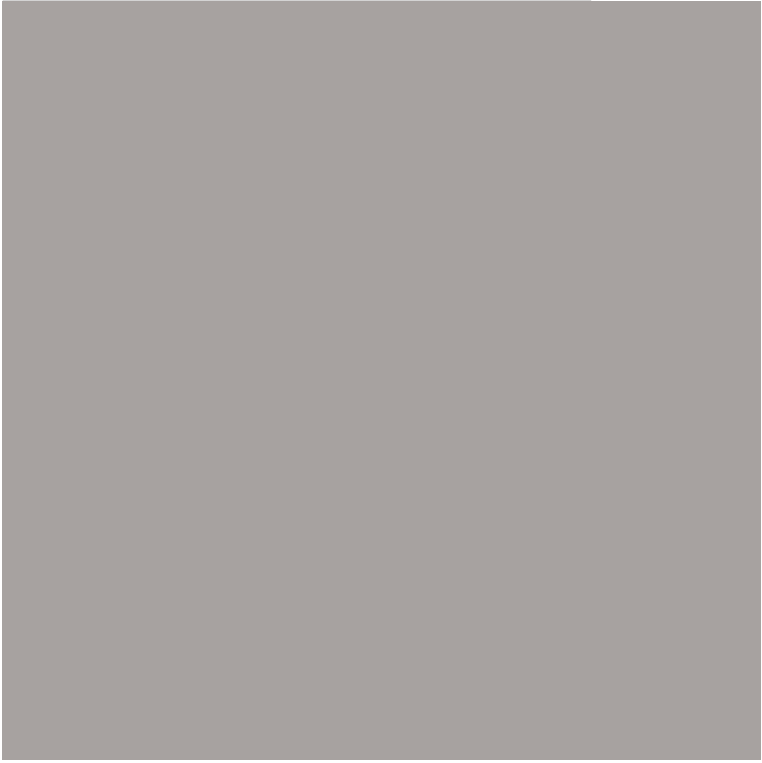
2. (Re)using former port and urban regimes.

Synthesis RbD scenarios


barriere woz



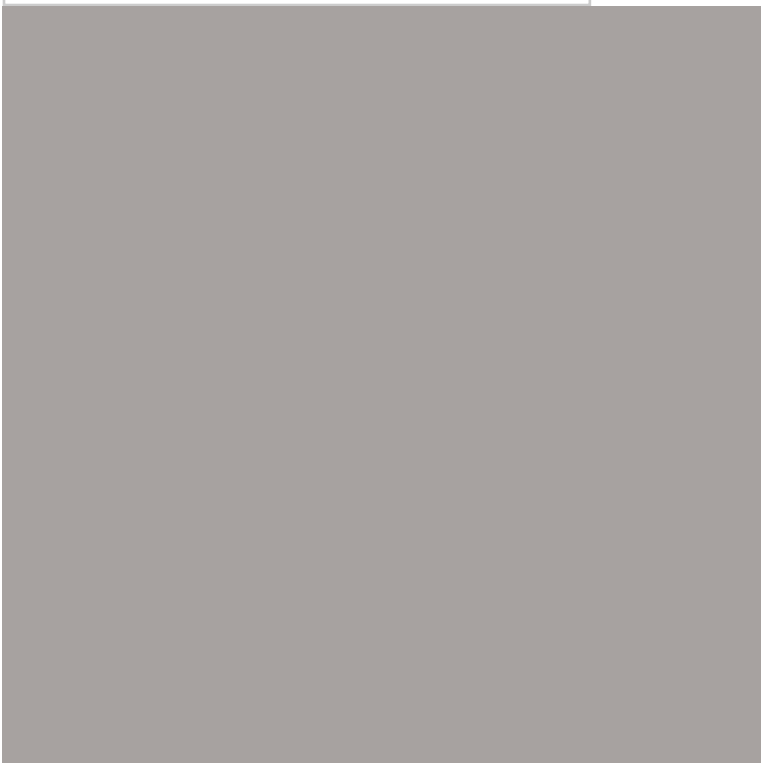
heijplaat waterfront



Waalhaven zuid barriere



Kade en bassin bodem onderhoud



2. (Re)using former port and urban regimes: Waalhaven oostzijde

Synthesis RbD scenarios

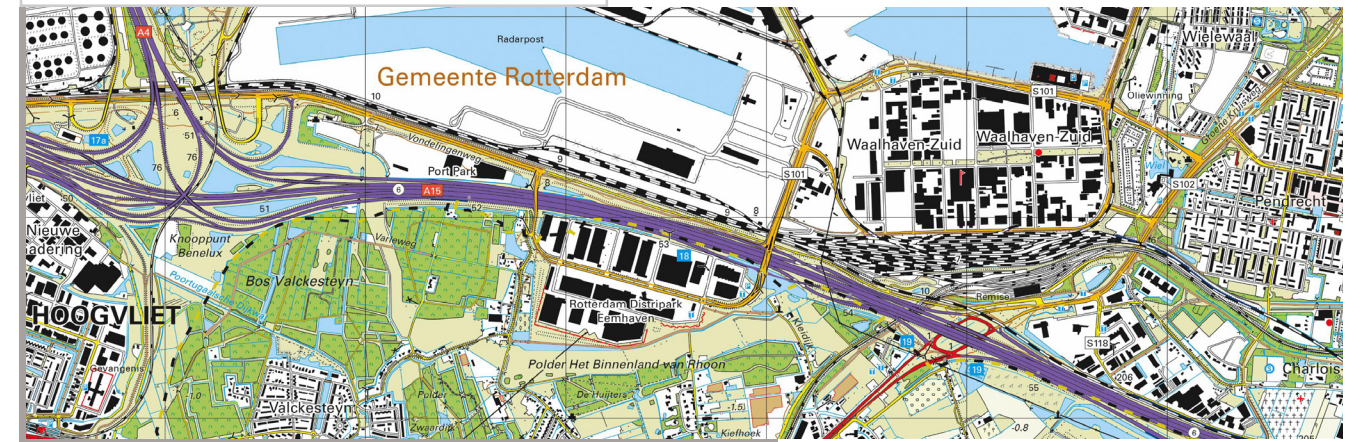
barriere woz



heijplaat waterfront

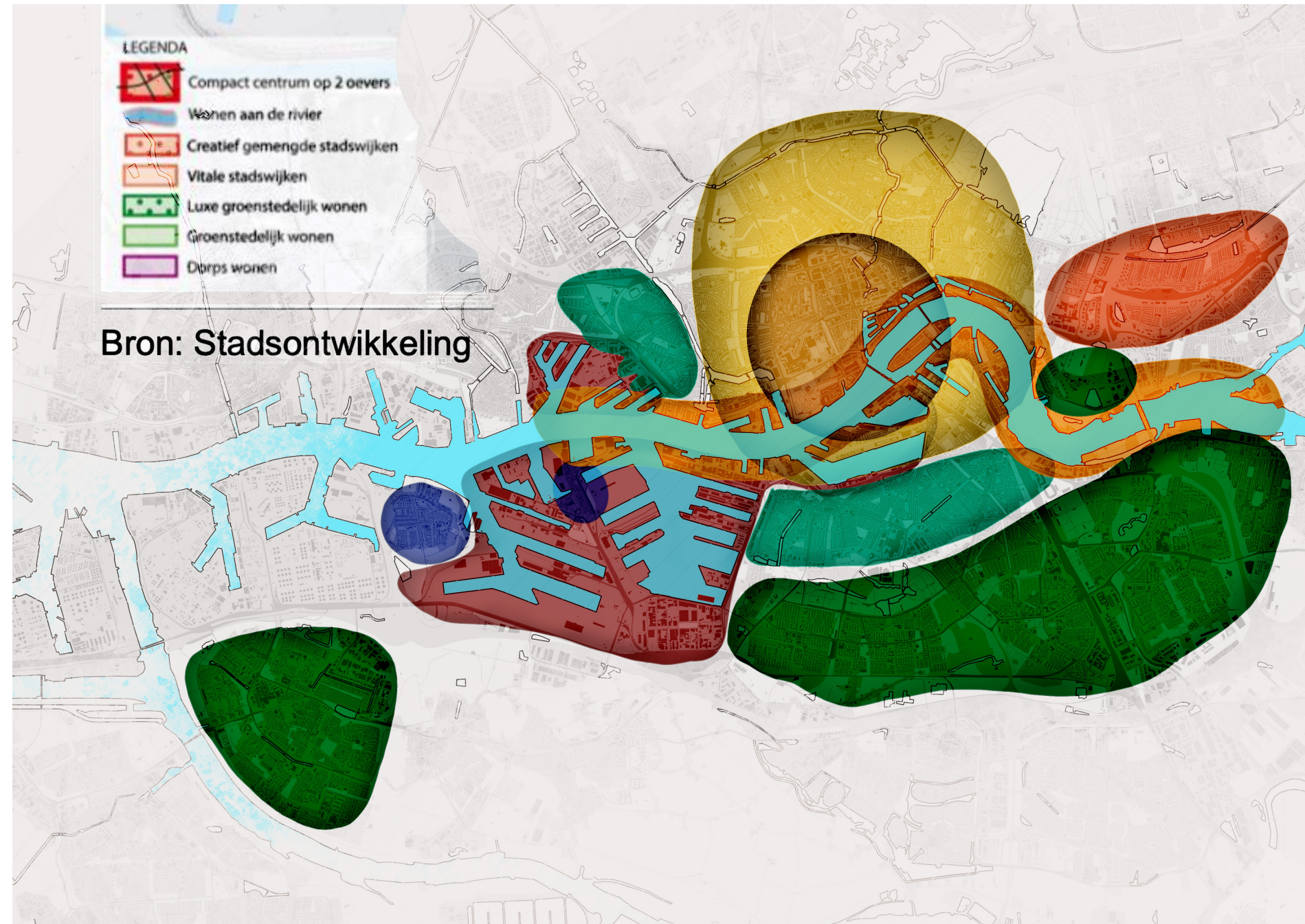


Waalhaven zuid barriere



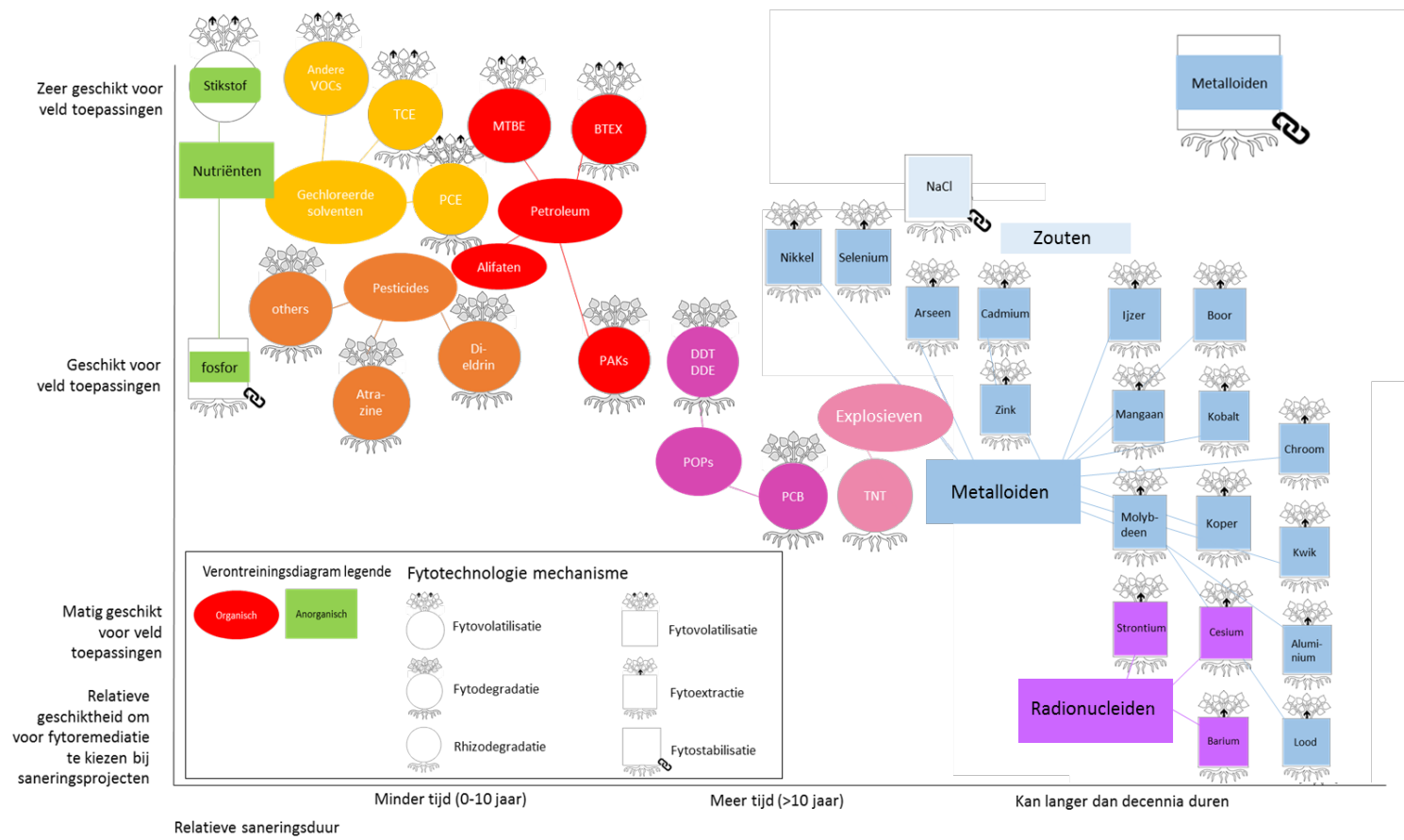
2. (Re)using former port and urban regimes.

Synthesis RbD scenarios

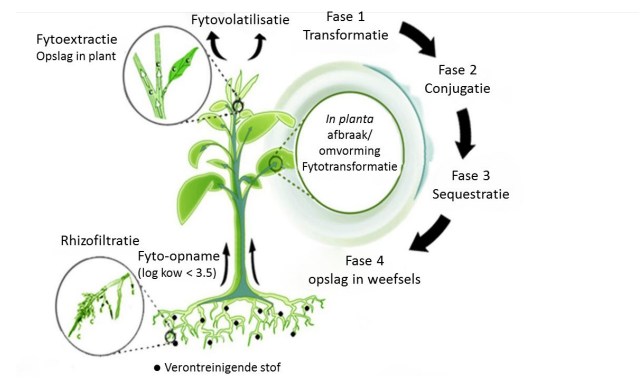


2. (Re)using former port and urban regimes.

Phytoremediatie



Figuur 8: Overzicht van het fytoremediatie potentieel van sommige verontreinigende stoffen en bijhorend fytoremediatie mechanisme

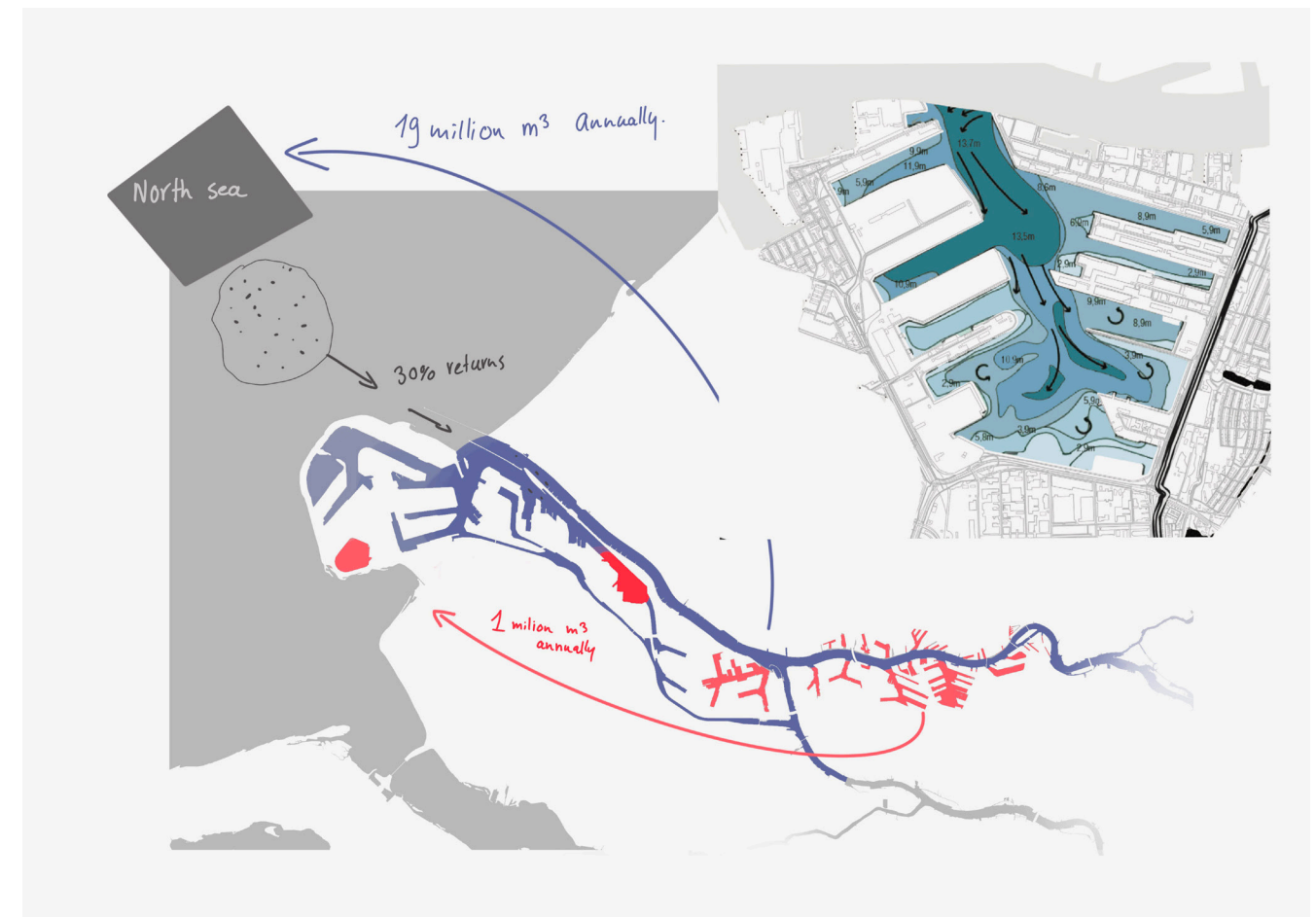
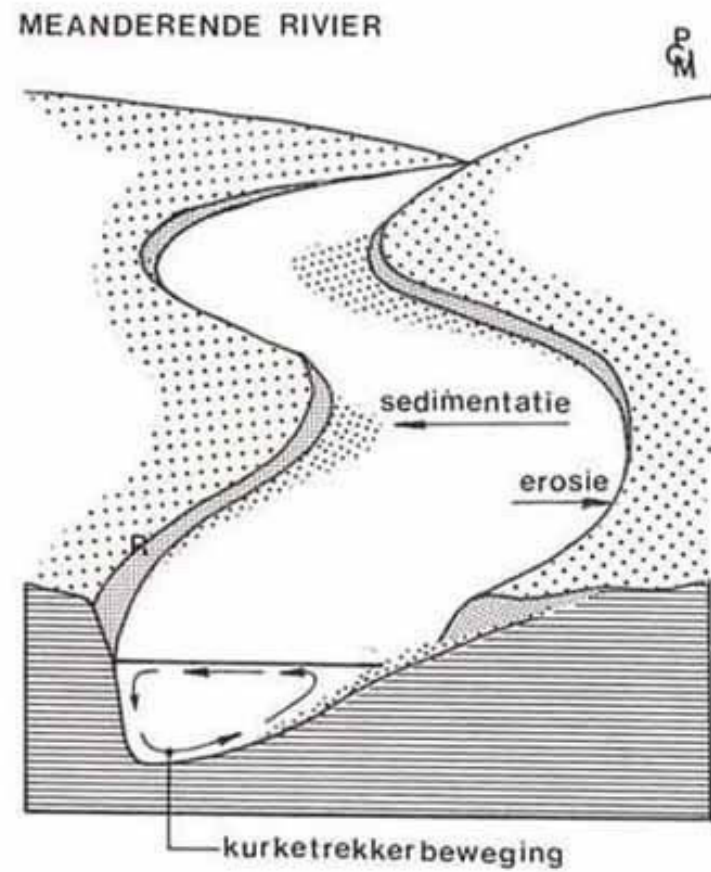


Figuur 1: Plant opname, omvorming en afbraak van verontreinigende stoffen in de plant. (groen-lever-model) Aangepast naar Van Aken et al. (2009).

2. (Re)using former port and urban regimes. Dredging

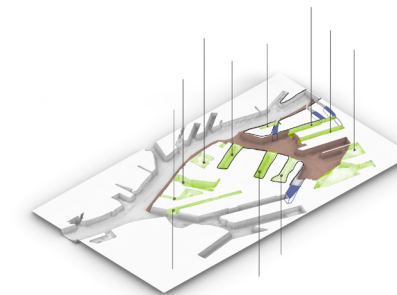
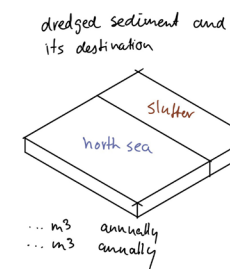
Synthesis RbD scenarios

Kade en bassin bodem onderhoud



Sedimentation

Analysis
Synthesis



Sediment types and further use
fine → hard
clean → polluted
constitution

natural sedimentation basin
... m³ annually.

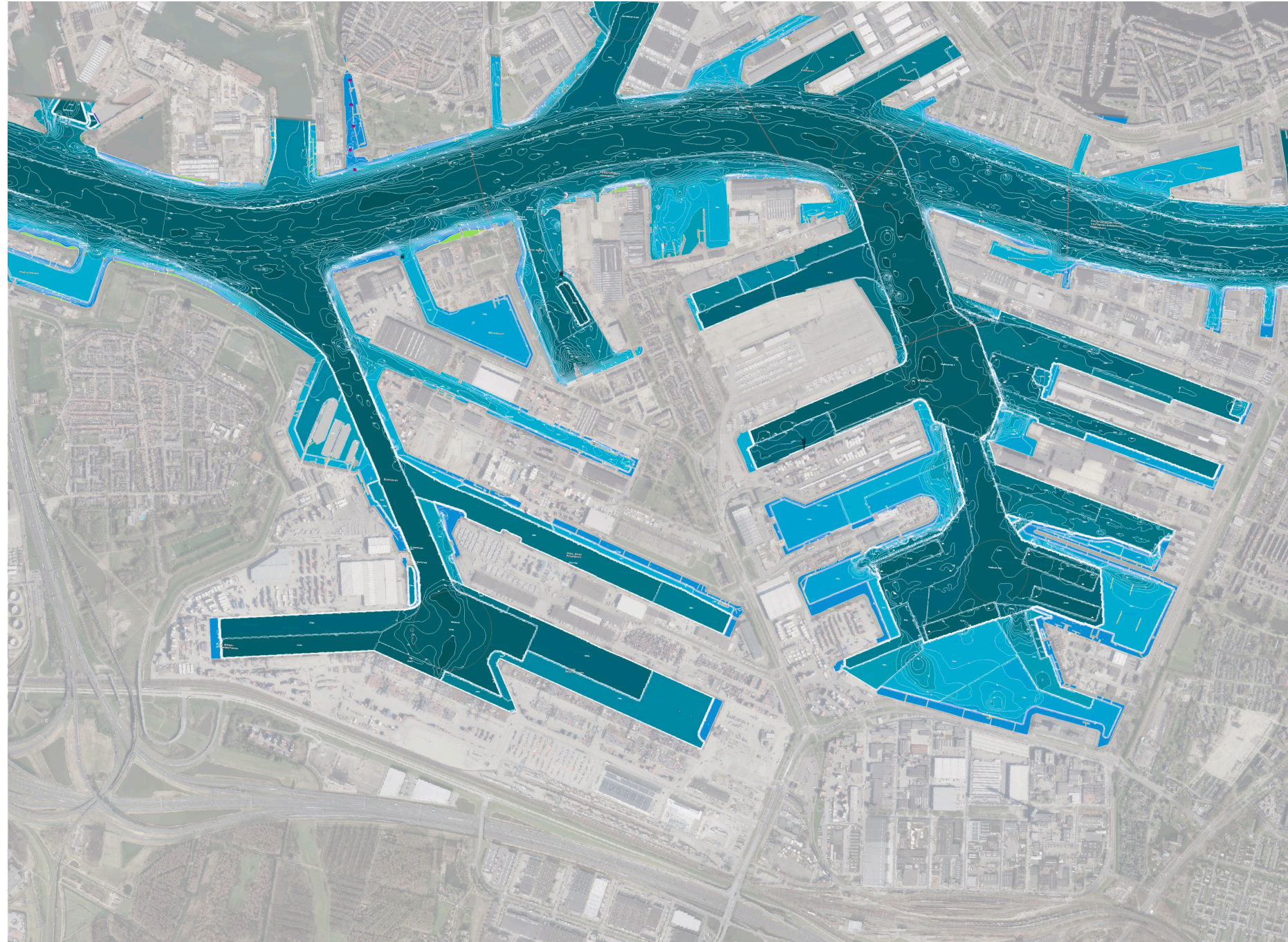
Basin current depths.

Kunnen we sediment daarvoor
verwaken op locatie?
- Deels en daarom lab.
Hoeveel silt kan er worden
opgeslagen in WU?

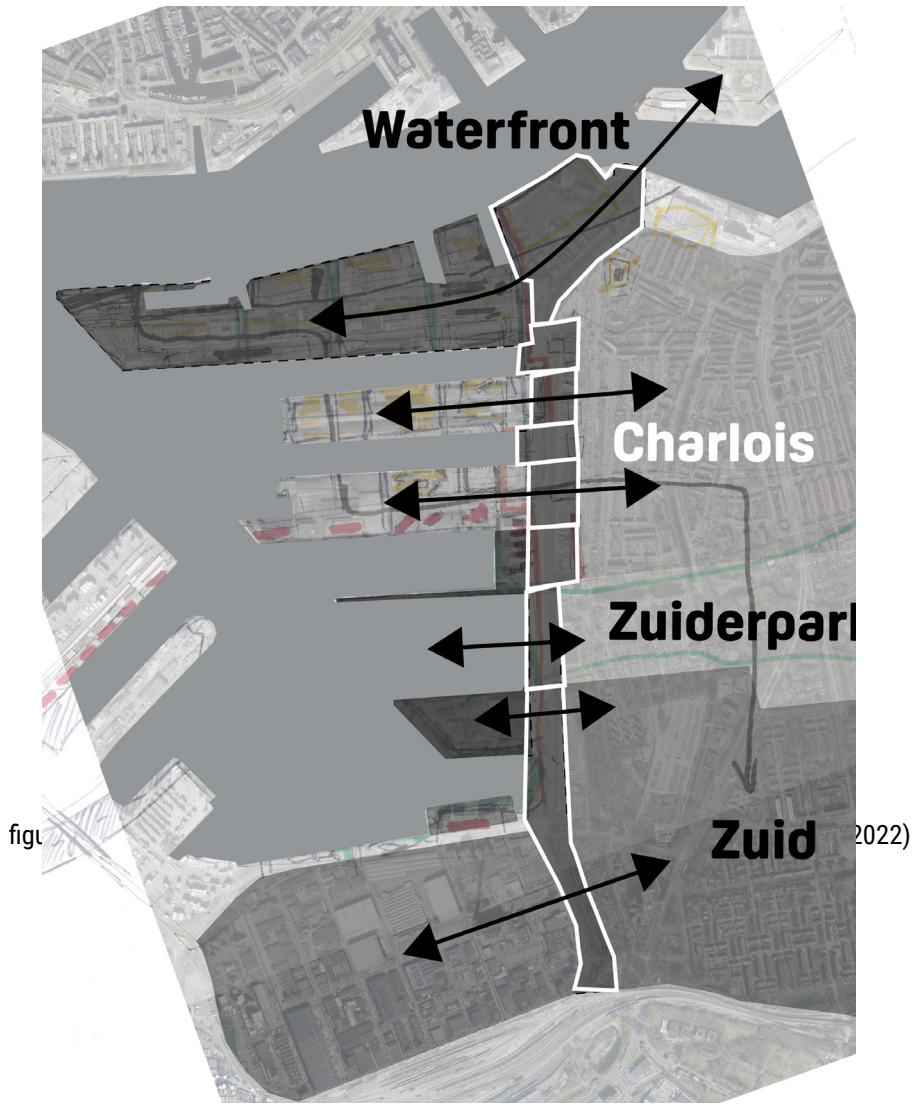
Welke type opslag/verwerking is
er in de WU?

3. Relating to local context: Rotterdam waterfront

Synthesis RbD scenarios



3. Relating to local context: waterfront imaginary 2.0



3. Relating to local context: Charloise

Synthesis RbD scenarios



figure 9. CAPTION: map/image/figure/diagram/sketch/photo showing: (Source, 2022)



figure 10. CAPTION: map/image/figure/diagram/sketch/photo showing: (Source, 2022)



figure 11. CAPTION: map/image/figure/diagram/sketch/photo showing: (Source, 2022)



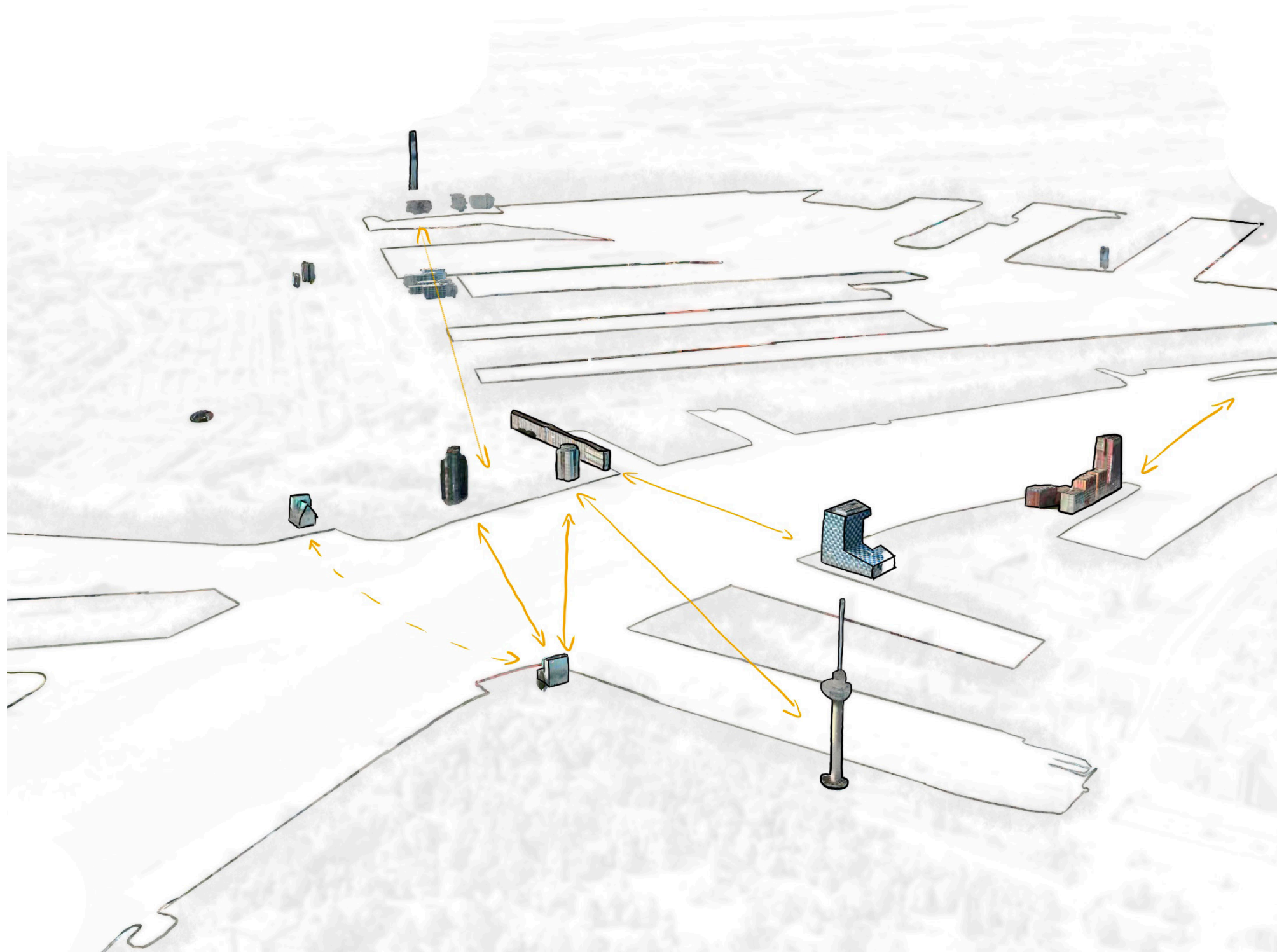
figure 12. CAPTION: map/image/figure/diagram/sketch/photo showing: (Source, 2022)



figure 13. CAPTION: map/image/figure/diagram/sketch/photo showing: (Source, 2022) 34

3. Relating to local context: Waterfront landmarks

Synthesis RbD scenarios



3. Relate to city context: Link east-west, north-south, port and

Port and city // Rotterdam South and Port // Citycenter North and South // From Feijenoord to Schiedam



3. Relate to global context: exportproduct resilient portcity waterfront

Duurzaam ruimtelijk havenstad management als export product

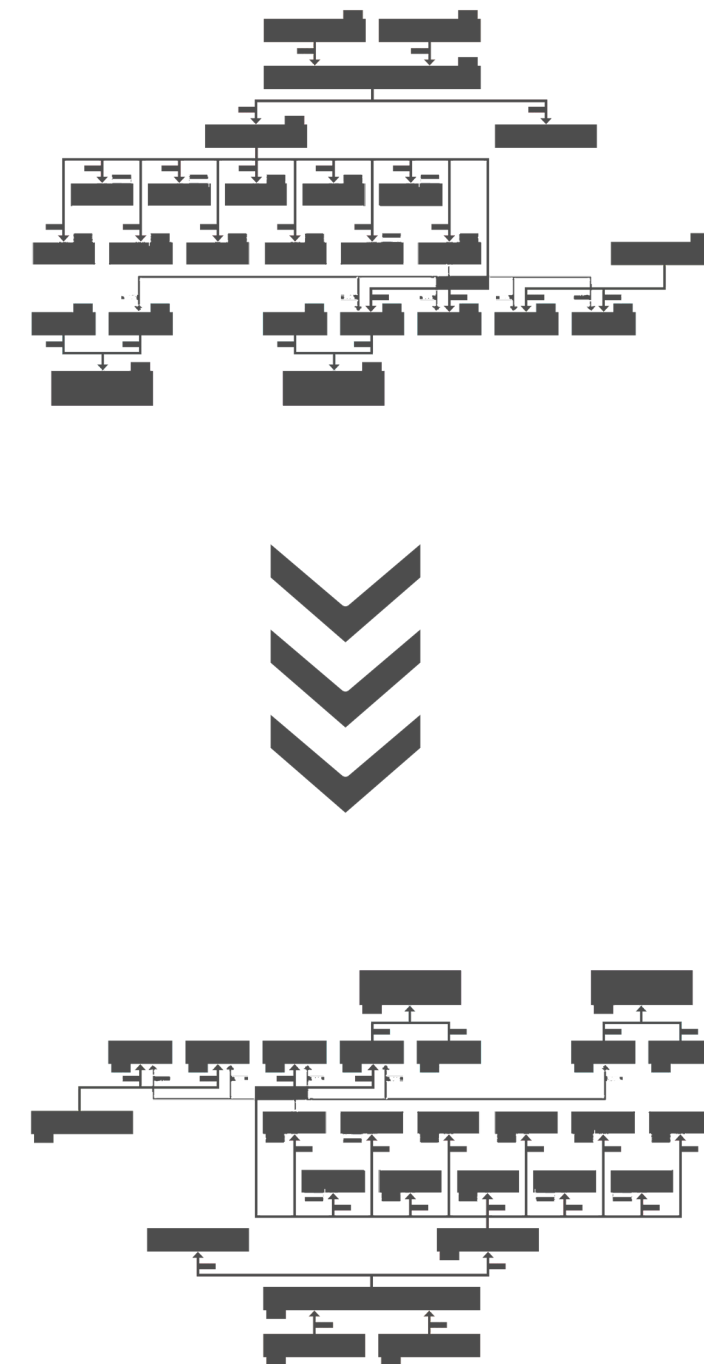
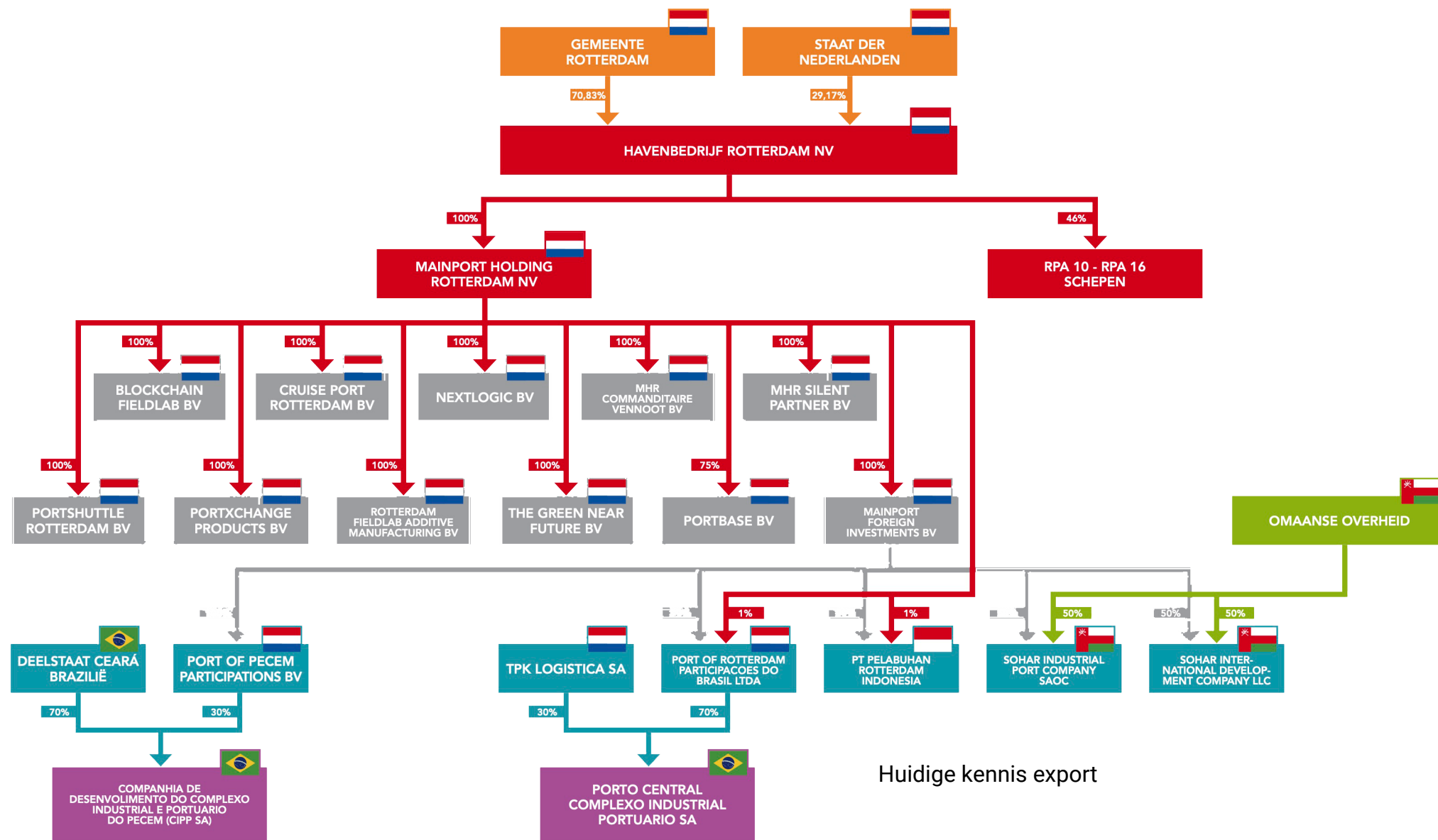
Experiment

Demonstrate

Evaluate

Innovate

Knowledge export



Huidige kennis export

Further advancing scenario 16

Port//city [ON]

Green [ON]

Infrastructure [ON]

Quay [ON]



explore full implications

explore full implications

potential increase of natural capital

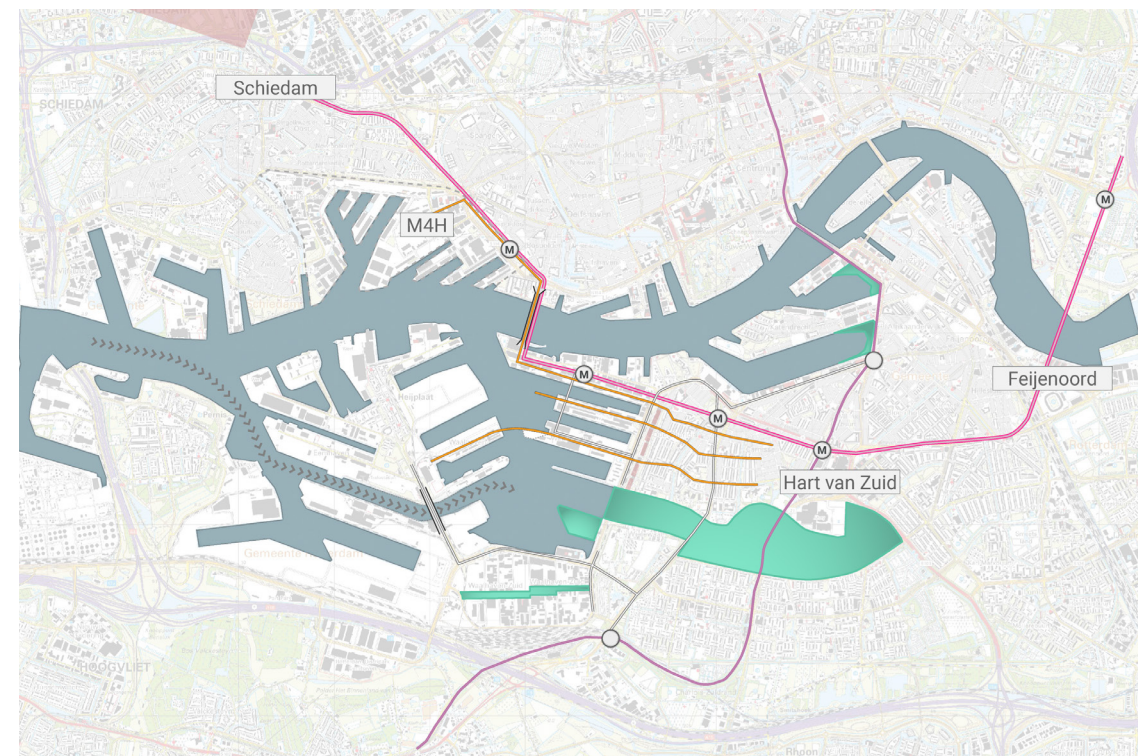



figure 15. CAPTION: map/image/figure/diagram/sketch/photo showing: (Source, 2022)


Covered so far









In summery


1.  **Researching urban challenge areas characteristic in former port, mixed-use spatial development.**

Research paper:
Constructing L.E.N.S. to assess qualitative indicators for urban-NBS.
Case-study: spatial strategy recommendations for nature-based planning and design.

System analysis:
understanding systems to identify current strengths, weaknesses, threats.
Identify interrelationships and dependencies that can inform interventions and mitigate trade-offs later on this research.

2.  **Prioritizing context specific challenge for the Waalhaven, Rotterdam. Then prepare a frame for further research by design.**

PORT//CITY	 seperated	 mixed
GREEN	 minimum	 maximum
INFRASTRUCTURE	 industrial barrier	 urban acces
BASINS QUAYS	 grey sollutions	 building with nature

3.  **Exploring the interrelations between context specific urban challanges.**

Research by design: scenarios
16 scenarios reveal insights that emerge from the in interrelations of multiple urban challanges and approaches.

outcome: 4 main lessons.

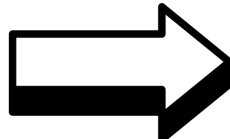
4. **Formulating design guideliness**

Lesson 1. Het oorspronkelijke elastische haven ontwerp benutten.

Lesson 2. Het voormalig haven regime aanpassen

Lesson 3. Antwoord op aanliggend Katendrecht, Charloise, Zuiderpark, Pendrecht.

Next up:

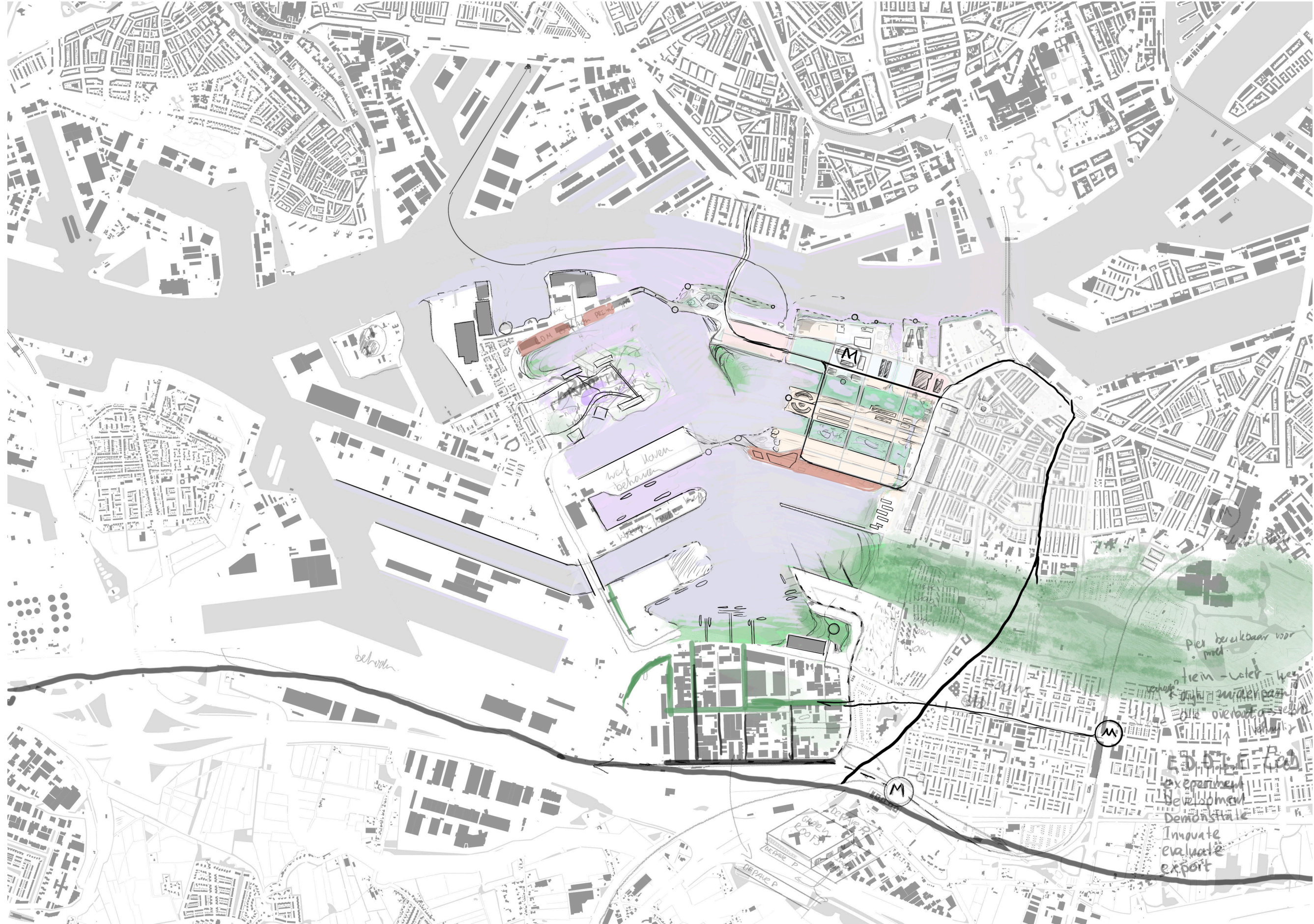
5.  **Advanced proposal by informed refinement of scenario 16**

Research by design: scenarios
further exploration in the potentials, limitations and unpredictabilities when refining the most progressive scenario.

answering the main research question by deconstructing the final proposal.

Proposal

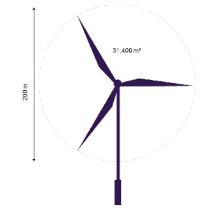
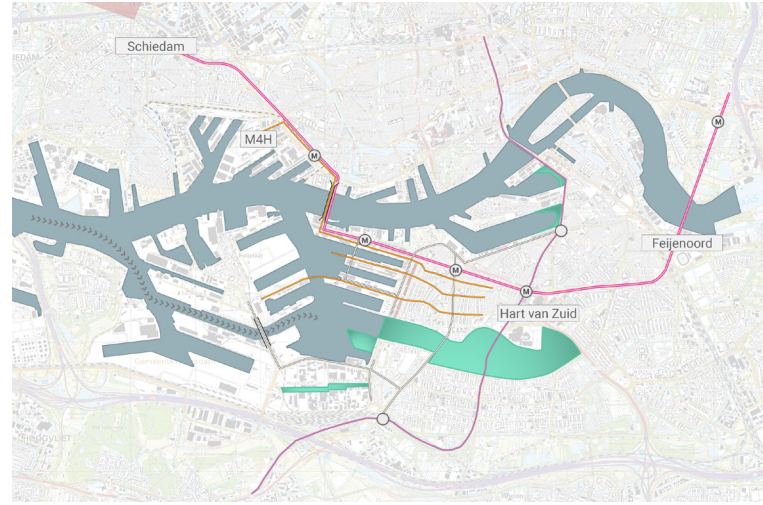
meso design plan



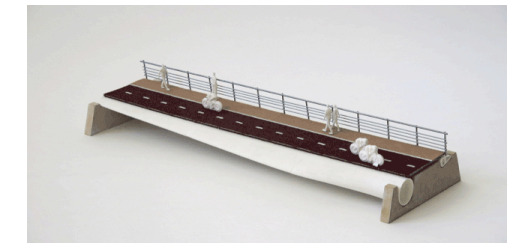
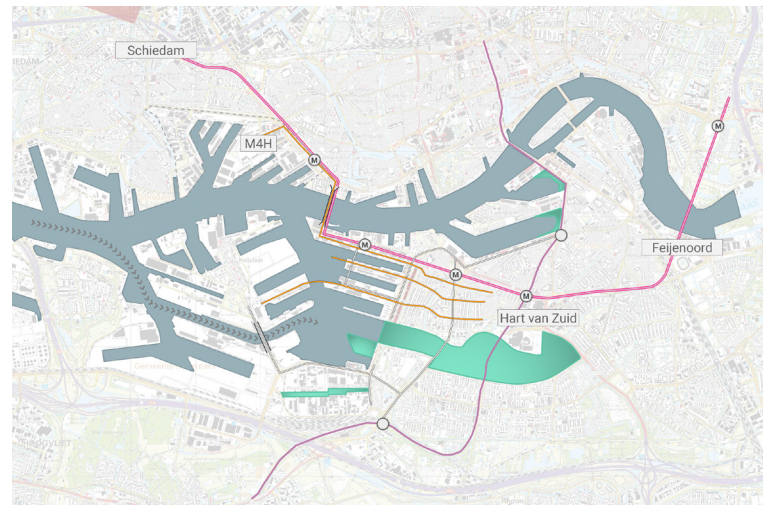
Proposal: The flexible port 2.0

Integrating RbD lessons

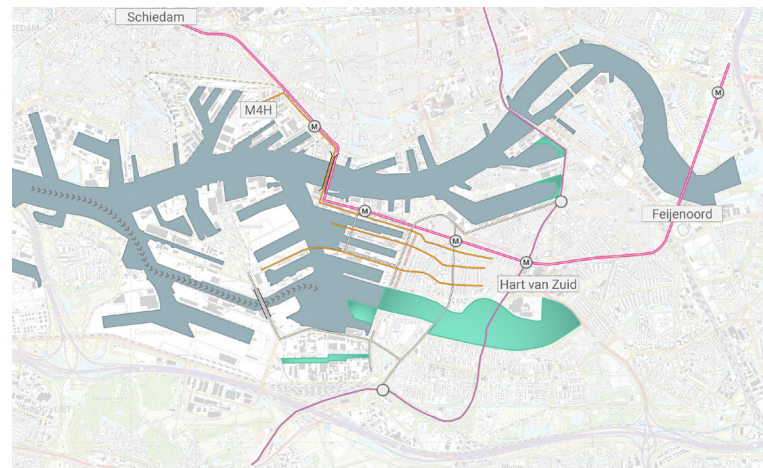
1. Reviving the flexible port design concept



2. (Re)using former port and urban regimes.



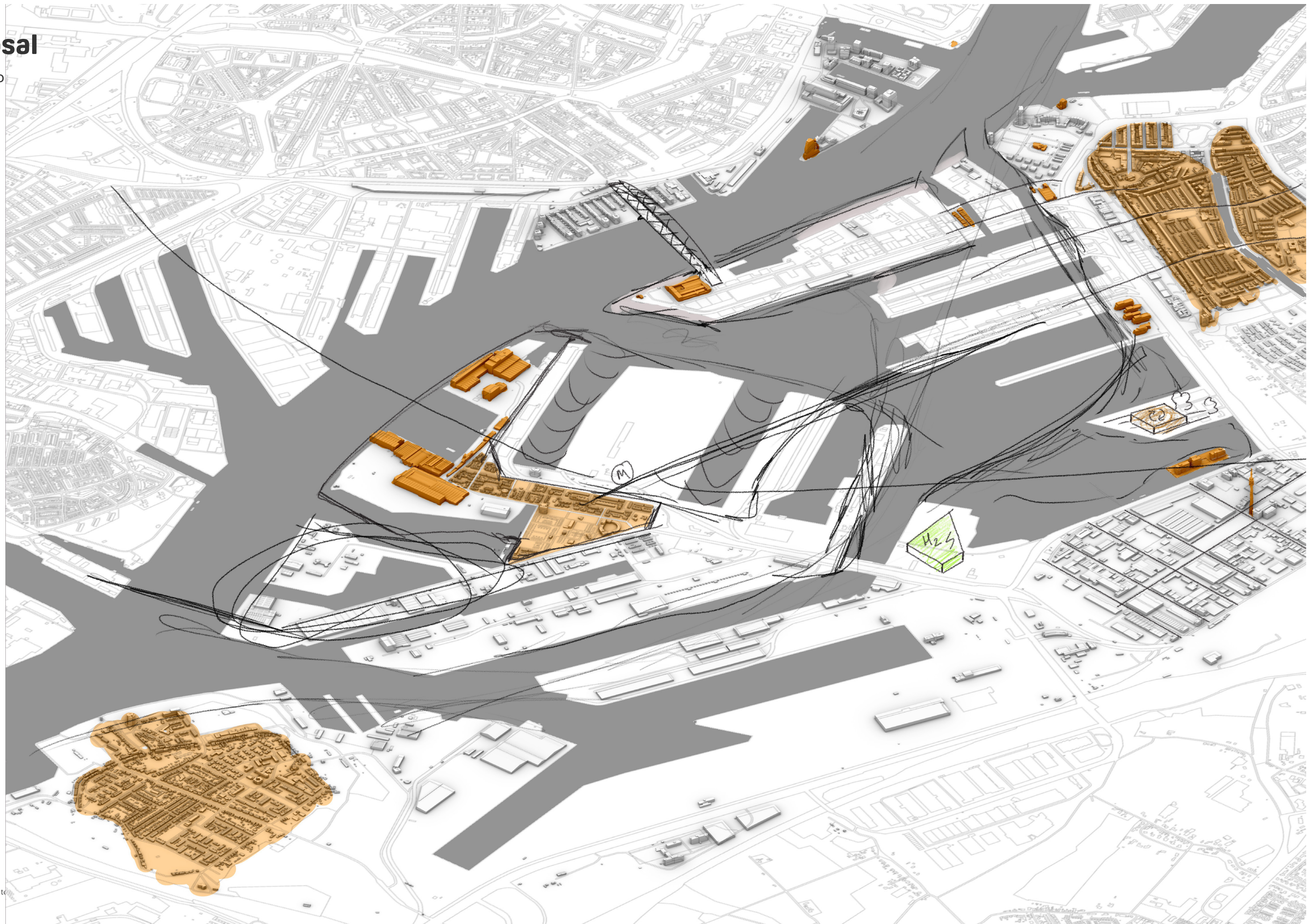
3. Relating to local context: Charloise



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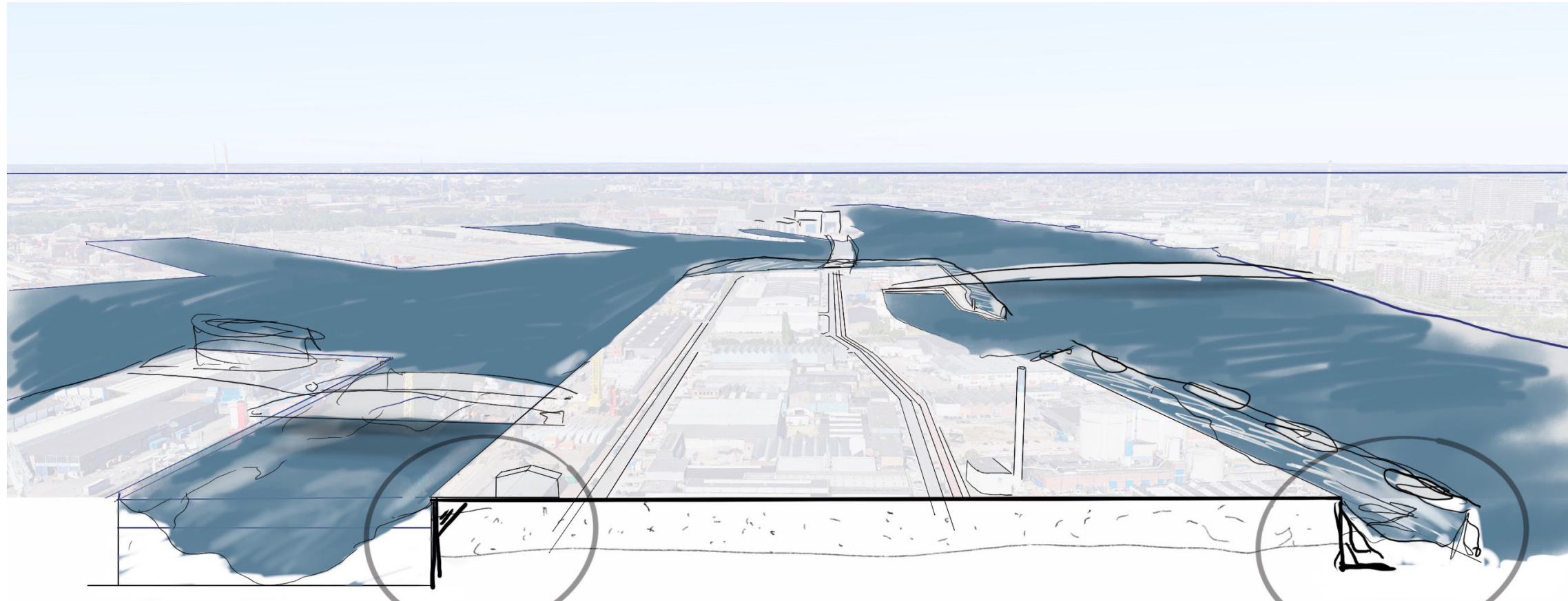
Proposal

subsectio



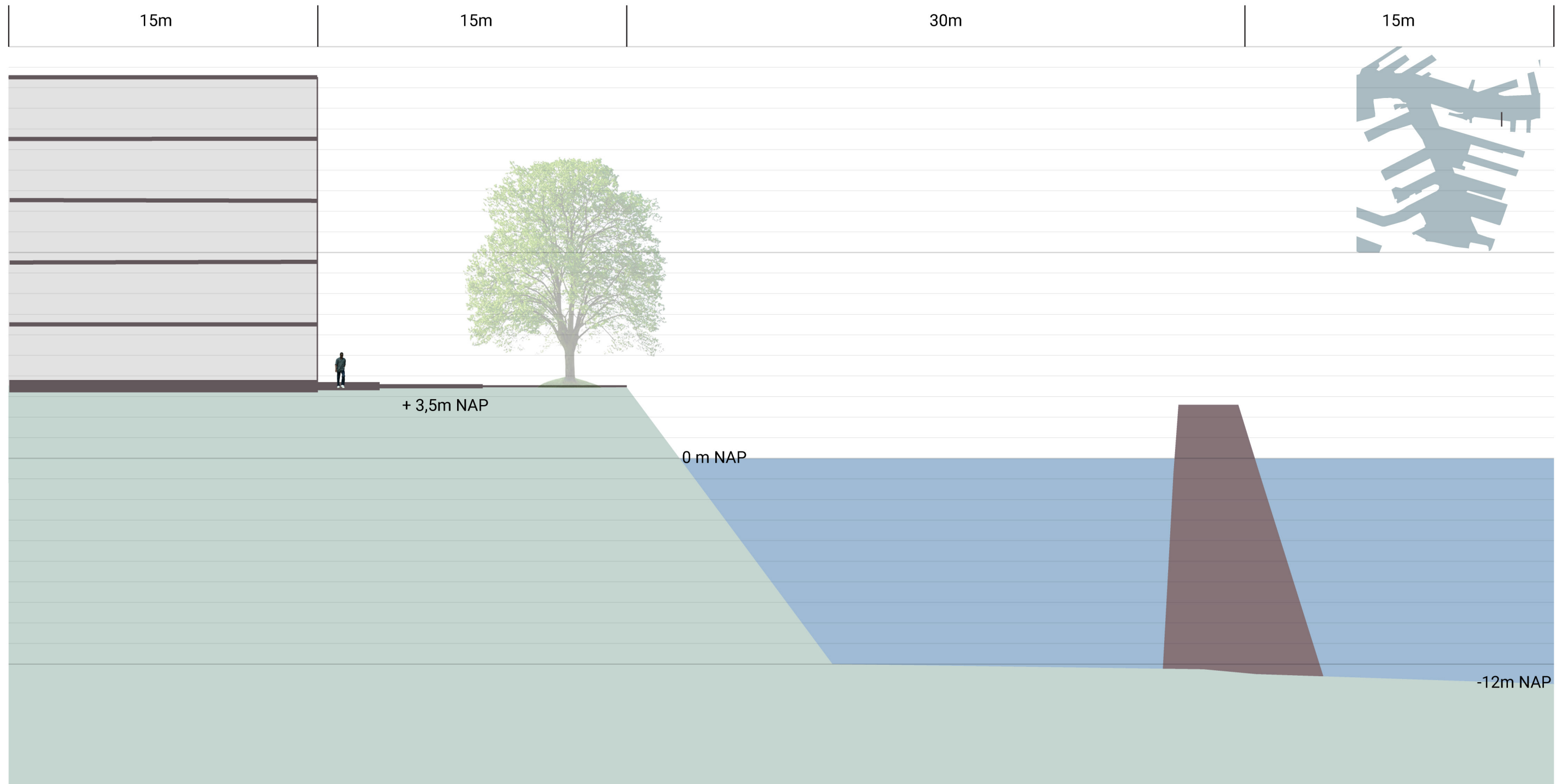
Proposal

meso design plan



Proposal

meso design plan



1:200

Proposal

meso design plan



1:200

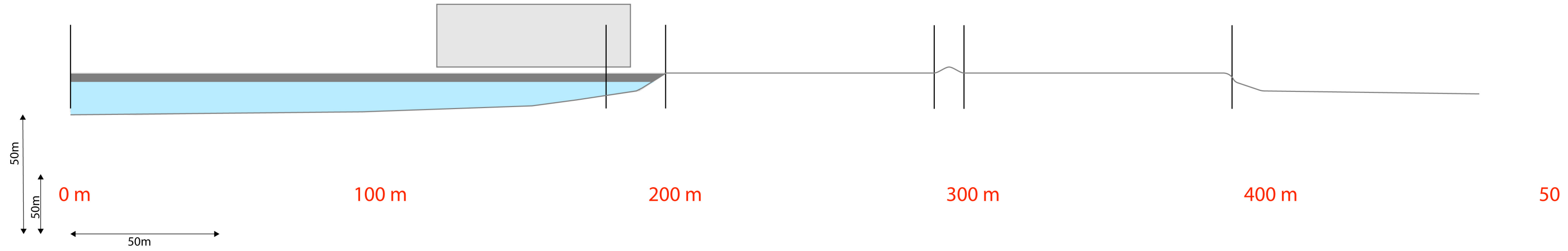
TITEL OF THIS AWESOME MAP.

- | | | |
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| <input type="checkbox"/> Item first on the legend list | <input type="checkbox"/> Item first on the legend list | <input type="checkbox"/> Item first on the legend list |
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sources: WeetIkHetWeerStation (Stal, 2022)

Proposal

eco-gradient



Proposal: Sediment Lab

Growing sustainable port resource manager



Conclusion

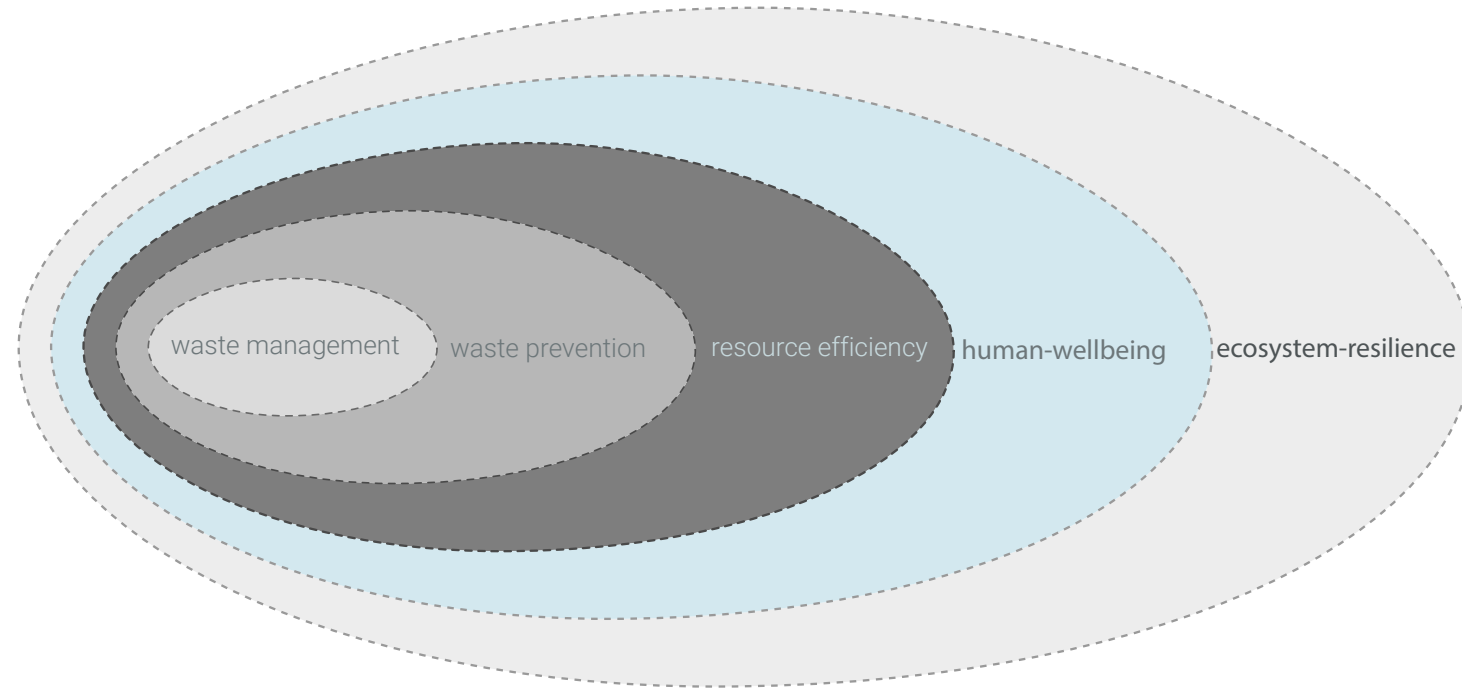


figure 18. Green economy focus areas (UN.. 202..)

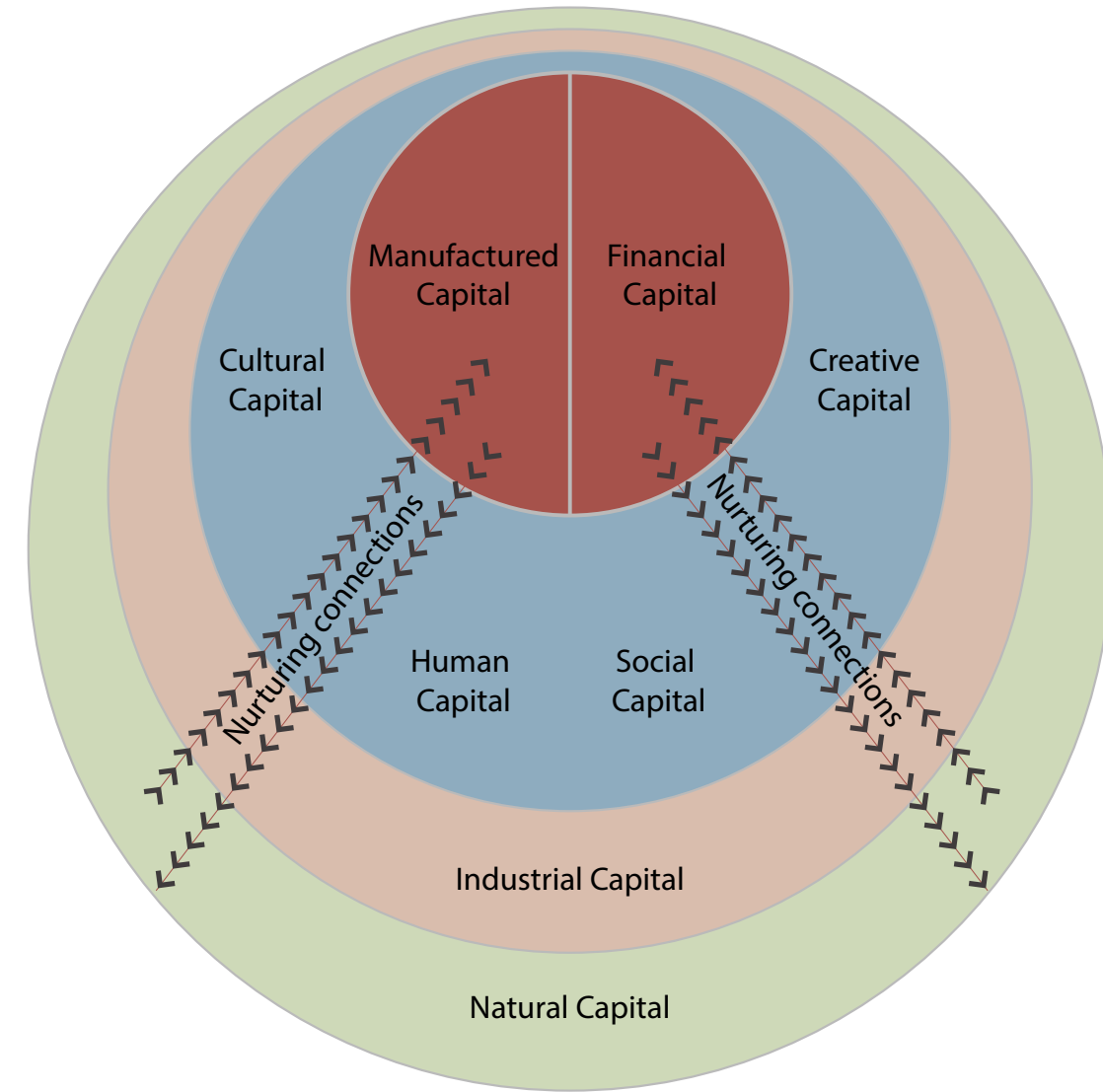
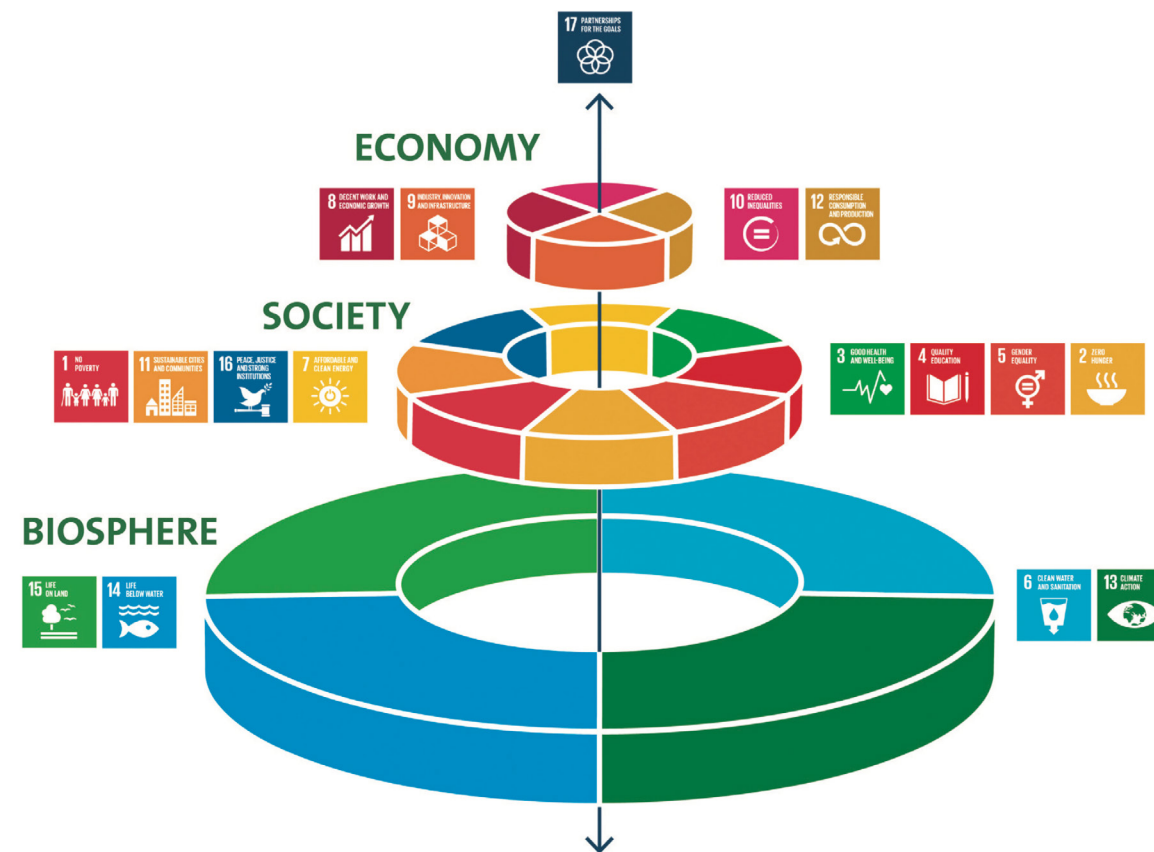


figure 17. Natural capital in capital system. (Jansen adapted by



omy framework (UN.. 202..)

End

Graduation project: [Title]

Alexander Stal

4112792

First mentor: Fransje Hooimeijer

Second mentor: Rients Dijkstra