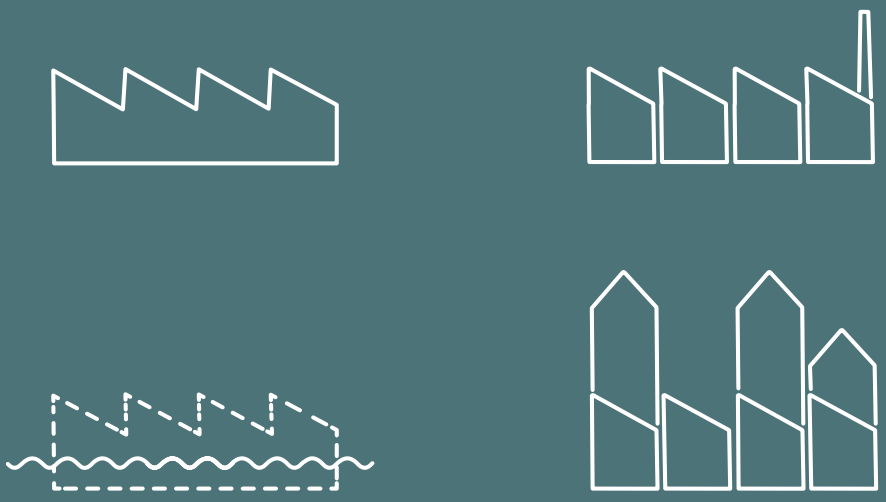
CLIMATE ADAPTIVE DELTA CITIES

A strategy for the transition towards climate adaptive redevelopment of post-industrial port sites in the Rhine-Meuse delta in the Netherlands

The case of De Staart in Dordrecht



P5 Report

Jasmijn Ponssen

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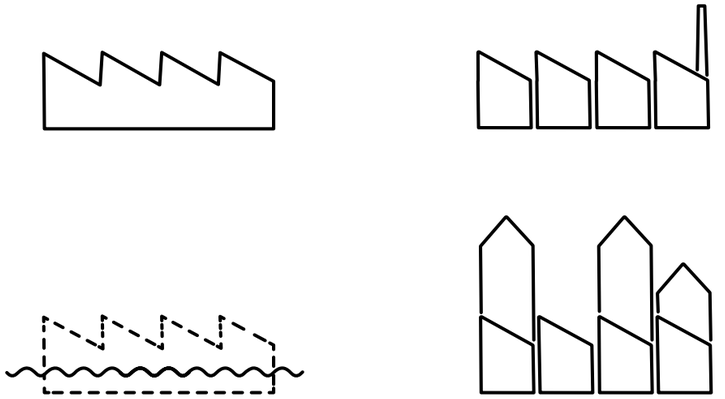


Delft University of Technology
MSc Architecture, Urbanism and Building sciences
Master Track Urbanism
Graduation studio: Planning Complex Cities
Interdisciplinary Graduation Lab: Delta Futures Lab

All images by author, unless referenced otherwise. See image reference list at the end of the report

P5 Report
Jasmijn Ponssen
Student number: 4434684
January 14th, 2022
First Mentor: Dr. Arie Romein
Second Mentor: Dr. Claudiu Forgaci

PREFACE

This report is the result of 10 months research on climate adaptation in the redevelopment of post-industrial port sites in the Rhine-Meuse delta. The outcomes of the project are very interesting, but also rather complex. If you do choose to take the plunge with me in the facinating world of urban area redevelopment and transition theory: welcome! The project identifies vulnerabilities and challenges, but also opportunities and solutions in the system. I hope it activates and empowers actors in the built environment to rethink redevelopment approaches for post-industrial port sites. Seeing them as ever on-going processes, where innovation should come into existence through collaboration. On a personal note, it was a discovery of the impact a local project and an individual can have in the transitions needed in today's climate crisis.

I would like to thank my two mentors, Arie Romein and Claudiu Forgaci for guiding me throughout the graduation process: your questions, curiosity and support were very valuable to guide me. You motivated me to 'embrace the complexity' and work creatively, and Arie for his trust and personal guidance in the sometimes difficult pandemic period. Discussing and mirroring the complex elements of the project strongly enriched its storyline.

Also, I would like to thank Diego Sepulveda for the lively discussions and brainstorms we had at the beginning of the graduation studio; Gregory Bracken for the inspiring group sessions on theory; Rodrigo Cardoso for reviewing my methodology carefully; and Herman van der Wolff for adding a valuable perspective to the discussions after the presentation as Delegate of the Board of Examiners.

Furthermore, I would like to thank all the interviewees for their openness, time and ideas. Our conversations gave me many colourful insights into practise and hopefully the dynamic planning approach for de Staart inspires you as well, to start acting there, or integrate the concepts in other projects. Also, I would like to thank the DeltaFuturesLab for their interesting lectures and discussions, they gave me a broader understanding of management in the delta, which can be very technical as well! Finally, I would like to thank all of my fellow students, friends and family for the loving support, interesting conversations and the welcome distractions too. Without all of you, I could not have accomplished this.

ABSTRACT

"We find ourselves at the tipping point in moving from one era to the next" (Rotmans & Verheijden, 2021).

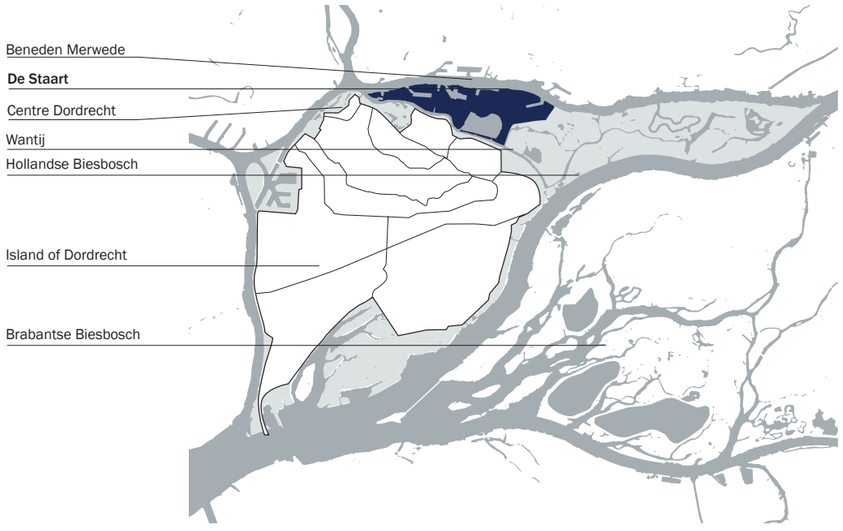
The climate crisis will require far-stretching changes to our urban systems, also called a transition. However, the direction in which our society will transition is still deeply uncertain. To become less vulnerable, cities and urban areas need to increase their adaptive capacity, establishing an evolutionarily resilient region. Delta cities in the Netherlands are governed through a decentralised and neo-liberal governance model, giving responsibilities for the long-term to local actors. As a result, climate adaptation relies on being integrated in local urban redevelopment projects to produce the necessary innovations that are needed for the transition.

In the Netherlands, post-industrial port sites are redeveloped into mixed-use residential areas which should have an innovative and adaptive character to function as pilots for the regional transition towards a climate adaptive system. Nevertheless, in many cases short-term responsiveness and econmic values get the overhand, reducing the innovative value of experiments and the contribution pilot projects make for the essential transition. This leaves redeveloped neighbourhoods and the delta region vulnerable to the effects of the climate crisis and is predicted to result in a chaotic transition from the existing to the climate adaptive system (Rotmans, 2021).

This urbanism graduation project therefore studies the following question: how can post-industrial port redevelopments contribute to the transition towards climate adaptive delta cities? Comparative case study research of cases in the Rhine-Meuse delta is used first to compose an understanding of mechanisms behind the integration of climate adaptation and industrial and societal transitions in post-industrial port redevelopment projects. Next, the case study lessons for adaptation are integrated with transition principles in a redevelopment strategy for a representative case and regional pilot for climate adaptation: de Staart in Dordrecht. Here, the Dynamic Adaptive Policy Pathways framework (Haasnoot et al., 2013) proves to be a promising methodolgy for making the complex and interdisciplinary transitions more insightful.

An urban design simulation for a section of de Staart shows how the policy pathways should be used in combination with an inclusive process, a spatial framework and a set of dynamic rules to esure that short-term actions contribute to the long-term transition pathway and adaptation under uncertain future contexts remains possible. The strategy for climate adaptive redevelopment of post-industrial sites shows that it can improve local liveability through its inclusive process and accellerate the regional transition by being connected in a regional network. The project shows promising qualities for bridging the gap between ambitions towards realising climate adaptive delta cities and it can be a valuable design and redevelopment strategy for application in practice. Nevertheless, applicability in different context than the Rhine-Meuse delta can be evaluated by performing similar research under different cultural contexts.

Key words: Post-industrial port sites, Urban area redevelopment, Dynamic Adaptive Policy Pathways, Climate crisis, Transition, Dordrecht, Rhine-Meuse delta



De Staart is an exemplary post-industrial area, situated in between Dordrecht's city centre and the Biesbosch. Similar to other industrial sites in the Rhine-Meuse delta region, heavy industries sprouted around 1900 and left the area for de Maesvlakte or abroad in the 1990's. Some still remain today, but many open spaces are left behind. Dordrecht aims to redevelop these into a dense neighbourhood with 7.000 houses that is connected to the Biesbosch and city. Also, being a sandbank, it makes a suitable evacuation hill for 60.000 people of the low-lying city polders, that cannot leave the island of Dordrecht in time during a flood event. This project will explore how these challenges can come together in a strategy for Climate Adaptive Delta Cities.

Figure 1: De Staart as sandbank north of the island of Dordrecht, situated in the Rhine-Meuse Delta.

TABLE OF CONTENTS

01 INTRODUCTION

Summary | This first chapter identifies societal trends that create challenges for the urbanisation of post-industrial port sites in urbanised delta regions. Responding to the long-term climate crisis is a challenge in the decentralised governance model, which uses short-term market-led urban area redevelopment to address society's large challenges. Seeing we are urbanising post-industrial port sites outside the protection of dikes the require innovations which are currently not scaled-up, there is an increase risk of producing a water vulnerable delta region. Therefore, the graduation project studies how post-industrial port redevelopments can contribute to the transition towards a climate adaptive delta region.

Figure 2: Stadswerven in Dordrecht, the tip of de Staart closest to the city centre. Former ship wharfs being transformed to a residential neighborhood. (Funda, 2021)

INTRODUCTION

In this first chapter, the problem field is analysed in order to formulate the problem statement, which results in the aim of the research. The problem rises from previous research in the growing academic field of climate adaptive redevelopment, where a practical problem is repeatedly addressed: little operalisation of climate adaptive ambitions in urban area redevelopment. When placed in context, this gives rise to multiple urgencies that require theoretical explanation and practical solutions, which is the focus of this thesis.

BOX 1 | 600 YEARS AFTER THE ELIZABETHFLOOD

In 1421, the Saint Elizabeth flood devastated nearly the entire Island of Dordrecht and radically changed the city's position in the delta region (Figure 3). Now, in 2021, 600 years later, we are again worrying about such a scenario due to the increasing pressure of climate change. Extreme weather causes floods in the delta, as happened in Limburg in the summer of 2021 (Figure 4).

In this graduation project, I explore a challenge that is close to my home. Growing up on the island of Dordrecht the water was never far away. Worries about how we might escape the island if an emergency occurred were in some way part of a collective understanding. The islanders of the delta in some way always understood they needed to be self-reliant and the city had a more inward looking orientation.

To rethink the delta system, its cities and the way they organize and develop themselves is what this project is about. It provides insights in the power fields behind our built environment and discovers pathways for an inclusive transition to a more sustainable system. As an urbanist with a strategic approach, this project sheds some light on how future urban places can shape people's behavior for the better. Critically reflecting on our current planning system and using imageability to see how nature, industry and residents can claim their right to the city and offer a perspective for a more just transition to Climate Adaptive Delta Cities.

Figure 3: The Saint Elizabeth flood in Dordrecht in 1421, radically changing the delta system around Dordrecht. (Unknown)

Figure 4: Floods in Limburg in the summer of 2021. (Orange Pictures, 2021)

CONTEXT

Delta regions are often centres for economic, cultural and social productivity due to their well-connected situation. Historically, these centres for trade urbanised rapidly despite the risks posed by the river and sea because water was an essential connector for trade and business: a typical European urbanisation pattern (Zhao et al., 2017). The Rhine-Meuse delta in the Netherlands is a good example of this: a poly-centric metropole that developed along the region's waterfronts (Figure 5). Over time, the Netherlands built extensive water defence structures to keep the water out and guarantee safety and prosperity.

Currently, the region's knowledge economy, creative sectors, Port of Rotterdam and metropolitan diversity together establish an attractive region for in-migrating businesses and inhabitants (Fielding, 1992). In the past, the cities in the region were allowed to expand extensively, resulting in the polycentric delta metropole (Zonneveld & Nadin, n.d.). But today, urbanisation strategies focus on developing within city boundaries due to the limited about of open space available in the Netherlands (Verstedelijkingsalliantie, 2018).

Figure 5: Urbanisation patterns around the water in the Netherlands. The Rhine-Meuse delta is heavily urbanised with the polycentric metropole of the Southern Randstad. (Own illustration)

CITY - PORT RELATIONSHIPS

To understand today's position of the port in the city, this paragraph provides a historical perspective before diving into today's challenges for post-industrial sites. Figure 6 shows that the relationship between the city and the port evolved over time, the shifting spatial arrangements representing changing society-work paradigms (Hoyle, 1989 in Zhao et al., 2017). When industries scaled up, ships grew larger and people's attitude towards industry changed: the port did not fit in the city centre anymore. Former port locations in the Rhine-Meuse delta have become commercial city centres today and the port and industrial productivity are located far away from the centre.

POST-INDUSTRIAL PORT SITES

While often still in operation, port locations are currently under pressure to be vacated by the industrial productivity tenants for two reasons: (a) to be redeveloped into living environments (b) the risks that due to climate change they cannot stay in operation as regional adapation strategies may cause a need to shift the port productivity out towards the sea entirely (to protect the cities of the region). These soon-to-be post-industrial port sites are attractive densification locations as their large surface area has the potential to house many new inhabitants. It is expected that 40.000 new homes will be developed in these post-industrial port sites in the Rhine-Meuse delta the coming years (Provincie Zuid-Holland, 2016; Verstedelijkingsalliantie, 2018).

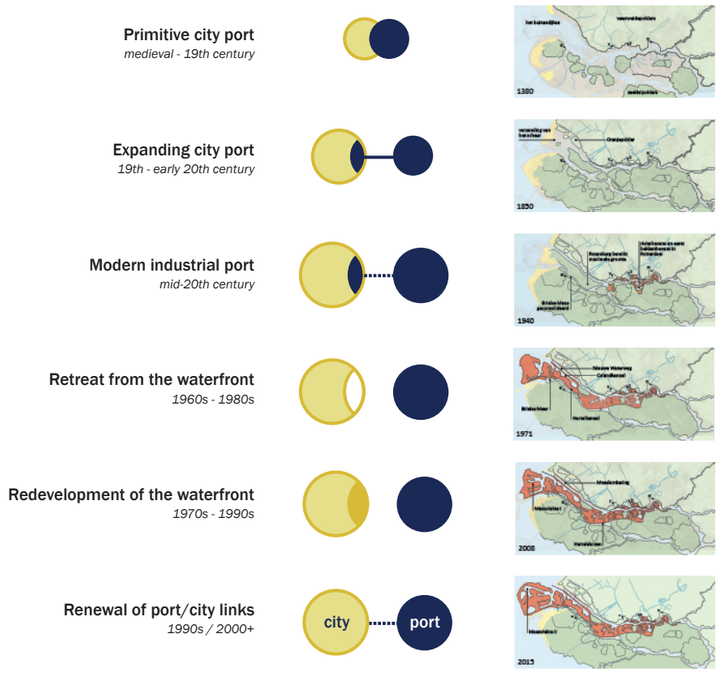


Figure 6: Evolving port-city relationships throughout history, maps of the city and port of Rotterdam in the Meuse-Rhine Delta. (Adapted from Hoyle, 1989 and De Urbanisten, 2014)

Figure 7: Medieval – 19th century: The embankment of the river becomes a place of communication and commerce: spatial and functional connection between the city and port. (Unknown, 1275)

Figure 8: 19th – early 20th century: The city is growing inland and orienting itself more towards the railway station. The port is expanding on the river banks and its trade and commerce are connected to city life. (James Webb, 1895)

Figure 9: Mid-20th century: Industrialisation and up-scaling of ships causes the port to expand along the river banks towards the sea. (Unknown, 1935)

Figure 10: 1960s – 1980s: After WOII, the city is rebuilt without recognising the former port structure, water makes room for the car. Industries and ships are upscaled and move even further towards the sea. (Unknown, 1965)

Figure 11: 1970s – 1990s: The city starts acknowledging the qualities of its waterfront and redevelops waterfront areas into highly urban areas such as the Kop van Zuid. (Van Zuid, 2020)

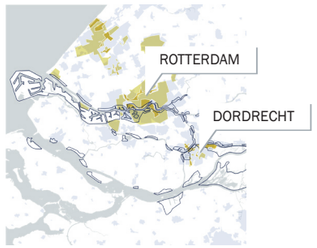
Figure 12: 1990s – 2000+: Links between city and port are re-established as the city aims to mix productivity and living evironments, for example in M4H. (DELVA, 2019)

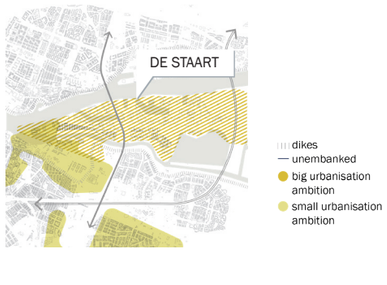
PROBLEMATISATION

URBANISING DELTA REGION

The municipalities of Rotterdam and the Drechtsteden are planning to redevelop waterfront sites into residential areas to meet the growing housing demand (Figure 13) (Verstedelijkingsalliantie, 2018). The redevelopment plans present attractive, mixed-use neighbourhoods for many households and companies. Municipalities use these new high quality parts of the city as means of attracting certain target groups of residents, competing with surrounding cities for for example knowledge workers (Fielding, 1992). The mixed-use character of these redevelopment projects shows that this is where the city wants to reconnect with the port.

In Dordrecht, 70% of all planned houses should be realised on post-industrial port sites: their ambition is to build 7.000 houses of the total 10.000 houses on de Staart.





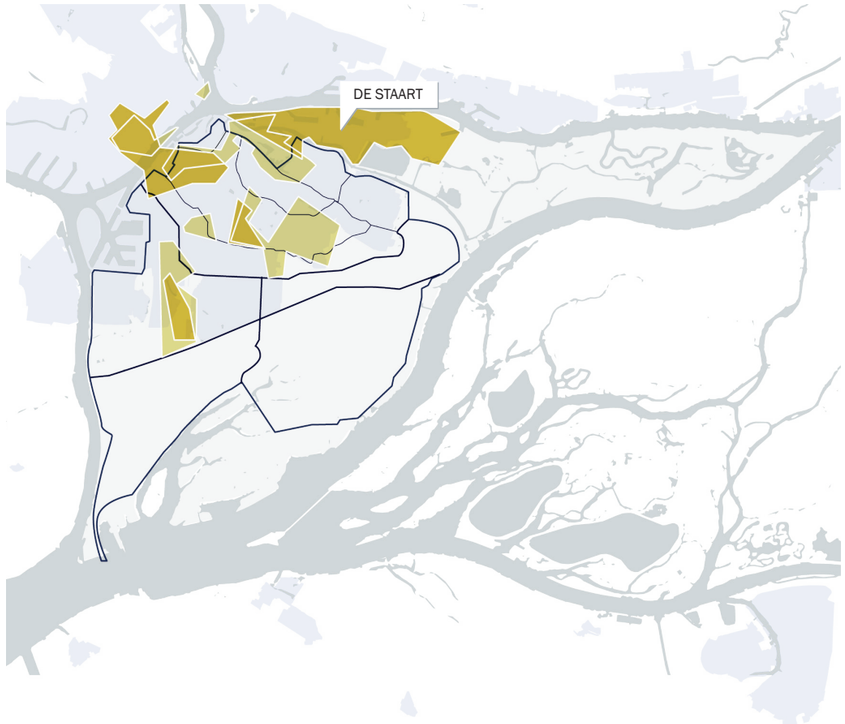
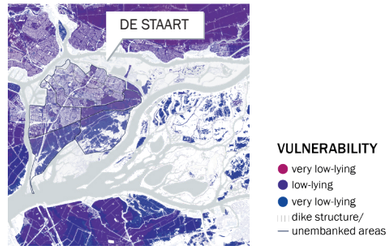


Figure 13: Development plans for the Rhine-Meuse delta region. Many waterfront sites will be redeveloped. (Based on Verstedelijkingsalliantie, 2018; Gemeente Dordrecht, 2021; pbl, 2012)

CLIMATE CHANGE AND WATER

However, at the same time the low-lying cities in the Rhine-Meuse delta are seriously threatened by the effects of climate change (Figure 14). As the climate is expected to heat up by at least 1,5 °C (IPCC, 2018), water is becoming a growing, yet uncertain, risk factor (Ministry of I&W, 2016). Lying at the interface of the river and sea, the water affects the region from multiple directions: through precipitation, sea level rise, increased fluvial discharge and land subsidence / ground water problematics (Ministry I&W, 2021). Furthermore, the ecosystems may also change when sea level rises, extending the brackish biotope further upstream, where it can effect Dordrecht's rare sweet water tidal nature (Van Veelen & Stone, 2013).



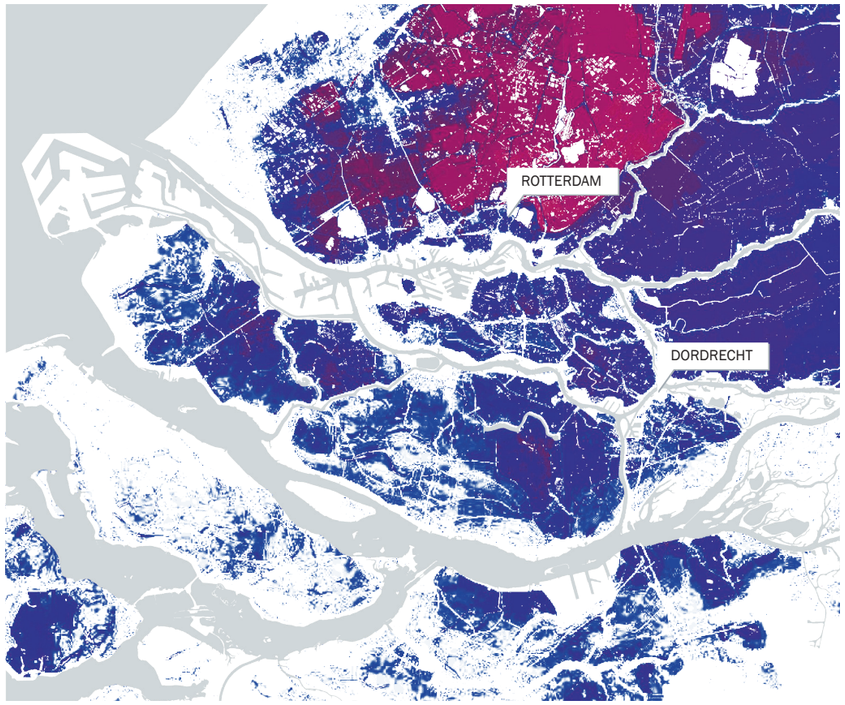


Figure 14: The soil heights in the Rhine-Meuse delta. A system of dikes create protection of the urbanised areas. The (former) port sites are however located outside of the dikes, on heightened soils. (Own illustration, based on AHN 2018 and Ministry of I&W, 2021)

FROM PORT TO POST-INDUSTRIAL

Next to the cities along the river, the port functionality and its associated location along the Rhine-Meuse delta is also going to change in the coming years. The existing industries are vulnerable to climate change for three reasons:

1. Sea level rise might require water authorities to close the Maeslantkering permanently to keep cities safe, blocking the accessibility of the Nieuwe Waterweg and 50% of the port locations situated along the rivershores.
2. The reduced certainty of river navigability due to strongly varying water depths may also reduce the certainty associated with transporting goods over the sometimes suddenly shallow rivers (Verbeek, 2013 in Van Veelen & Stone, 2013).
3. Many of the industries still rely on fossil fuels for their production and whether they will be successful in the transition towards green industries is doubtable (Wetenschappelijk Bureau GroenLinks, 2021). This transition is needed to achieve the climate agreements of Paris (2015) and Glasgow (2021) of max. 1.5°C global heating.

As a result, the unembanked (outside the protection of dikes) post-industrial sites with all the associated infrastructures that the former industries leave behind can make place for new types of production and living (Figure 15).

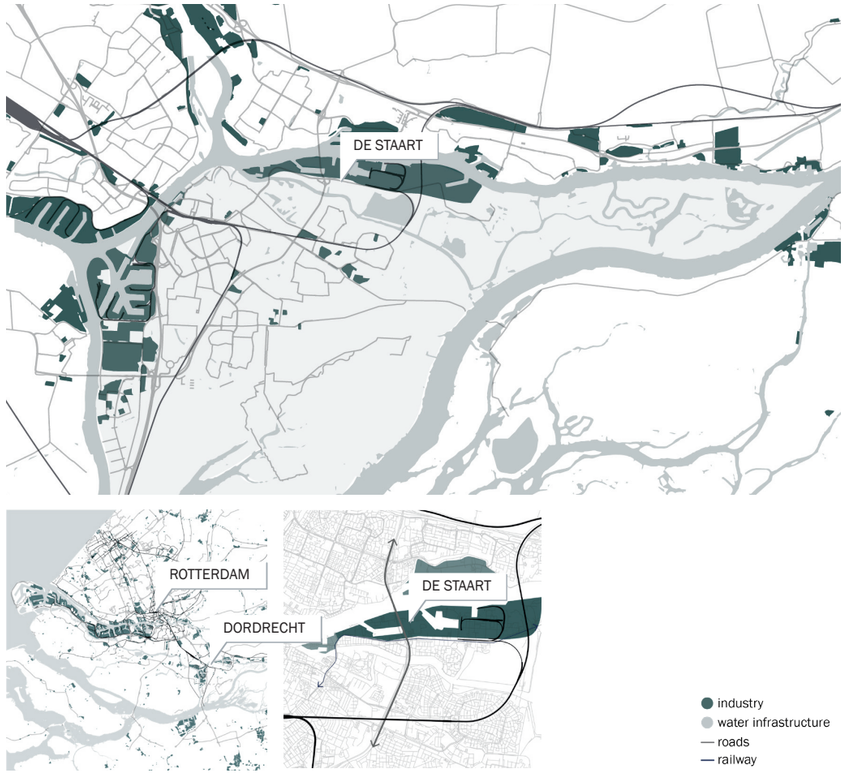


Figure 15: Productivity along the river, sea and canals. Railways, highways and water are used as infrastructure for industry, influencing the landscape beyond the industrial sites (Own illustration, based on BBG, 2008; OSM, 2021)

WATER-THREATENED URBANISATION

Dutch policy is criticised for its short-term focus, as its urbanisation strategies allow for water vulnerable sites to be redeveloped. Figure 16 shows that urbanisation areas (red) often coincide with areas that need to be spatially adapted to become water resilient in 2050 (Waterschap Hollandse Delta, 2016). On the one hand, low-lying polders are developed into neighbourhoods, which might flood in case of a more likely flood event due to sea level rise or increased peak river discharges. On the other hand, unembanked riverfront areas are urbanised: it is expected that between 80.000 and 100.000 people will be living in areas outside of dike protection in Rotterdam and Dordrecht in 2050, compared to 65.000 people today (Kennis voor Klimaat, 2014). While these post-industrial port sites are often on heightened grounds, adaptive capacity and innovative water resilient concepts are not yet widely implemented (Berg et al., 2013). The main type of housing typologies that are sketched for these sites, including de Staart, are comparable to that of M4H in Figure 12 on page 13: highly dense mixed with many companies.

In the face of the emerging knowledge economy, cities use waterfront redevelopment sites for their catalytic mechanisms and as flagships (Van Bueren et al., 2016) to compete with others cities in attracting certain groups of future residents (Fielding, 1992; ter Heide & Smit, 2016). This gives these redevelopment projects a political value, and gives rise to client-based development (Lei, 2011), which might get priority over implementing, long-term and expensive climate adaptition ambitions (Storbjörk & Hjerpe, 2013)

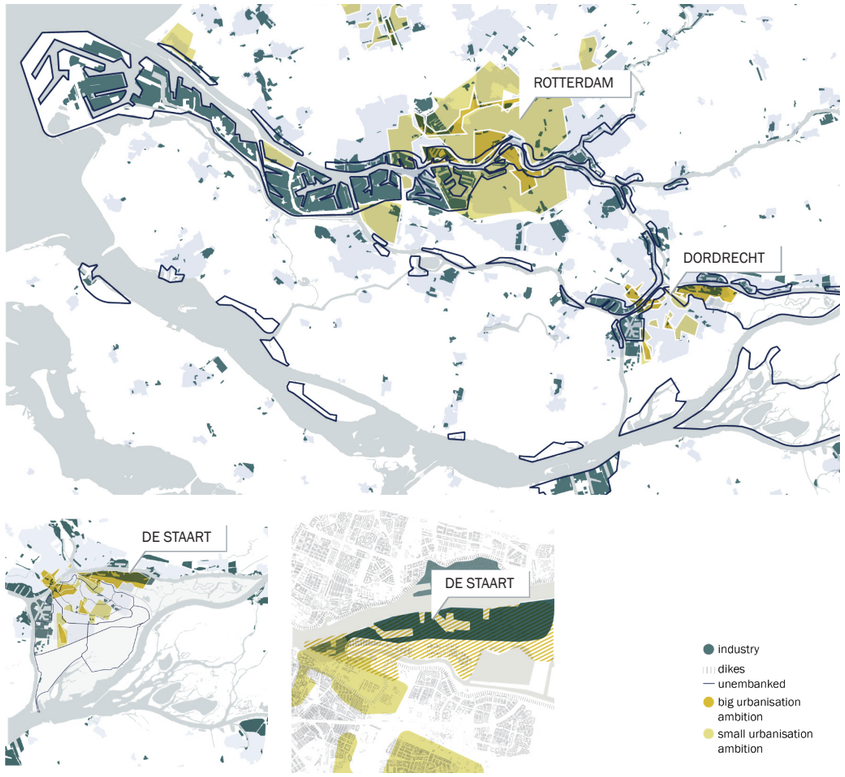


Figure 16: A combination of the urbanisation agendas and water threatened areas in the Rhine-Meuse Delta. Some of the urban redevelopents are located in water vulnerable areas, adding complexity to the development agenda.(Adapted from the Verstedelijkingsalliantie, 2018; Waterschap Hollandse Delta, 2016)

DECENTRALISING DEVELOPMENTS

The Netherlands has a long tradition of managing adaptation of the landscape to environmental challenges from the water and integrating these large interventions with spatial development (Meyer, 2016b). Until recently, the Dutch water management culture has been very technocratic and strategies are formulated top-down, which has separated civil society from the risks posed by the water (Berg et al., 2013). However, as the country has shifted from a networked governance model to a neo-liberal model (Maarten Hajer & Zonneveld, 2000; Monbiot, 2016), the Dutch government, Rijkswaterstaat (water ministry) and Provinces take a facilitating role in the 'Participation Society' rather than decide and provide in the 'Welfare State' model (VNG, 2020; Zonneveld & Nadin, n.d.) to respond to the current biophysical and societal urgencies.

Consequentially, more responsibilities are decentralised to municipalities, who are expected to address climate change adaptation and to "manage, merge and balance various societal interests and priorities" (Storbjörk & Uggla, 2015). In urban area redevelopment, municipalities often collaborate with market parties and civil society actors in public-private partnerships to redevelop urban areas, sharing risks and resources (Heurkens, 2012). The large challenges are hereby reduced to UAD projects, rather than making big gestures (Ministerie van BiZK, 2020).

Long-term sustainability hereby relies on local actors from the market and civil society, which calls for a more active relationship between society and the water, whereas they used to rely on the national government to provide a safe living environment (Meyer, 2016b; Ministry I&W, 2021).

LITTLE LOCAL OPERALISATION

Within the decentralised governance model, we rely on the urban and project scale to embed climate adaptation in urbanisation (Ministry I&W, 2021) and produce a safe delta region with enough homes. Nevertheless, the effectiveness of the outcomes of urban area redevelopment projects is lower when compared to national or regional planning (Storbjörk & Uggla, 2015). This makes the future urbanised delta region vulnerable to the uncertain threats posed by water in the face of the changing climate. The damages done by a changing climate can be high:

"If the current climate change scenario progresses, this will cost between € 33 en 87 billion euros in damage; if we move into a more extreme climate change scenario, the amount may end up between € 55 en 124 billion." (Ministry I&W, 2021)

Nevertheless, these high costs can be overcome if we adapt de region early on.

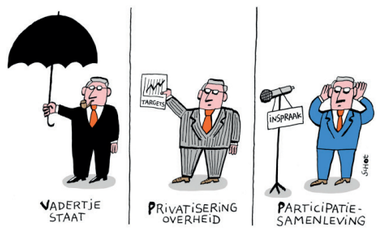


Figure 17: The shift from the welfare state to the privitising government to the participation society. Market and civil society actors are expected to carry out more responsibilities. (Van der Schot, 2017)

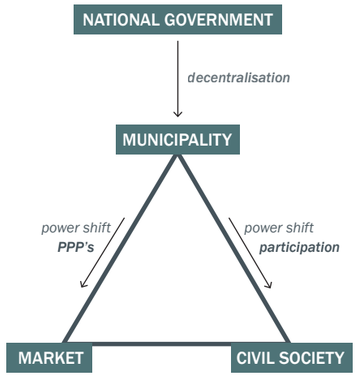


Figure 18: Decentralisation and power shifts in the Dutch governance model. Local municipalities collaborate with civil society in Public Private Partnerships (PPPs) and civil society actors through participation. (Own illustration).

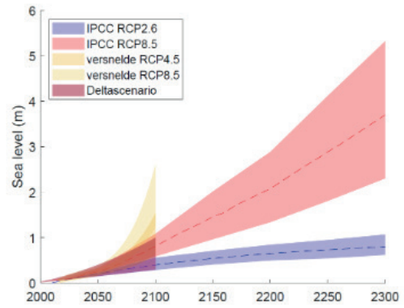


Figure 19: Climate change scenarios with different long-term effects and uncertainty. The Deltaprogramme of the Netherlands focuses on the medium- and soft- scenario, but the future could enroll more radically, however uncertain this may be. (van den Hurk & Geertsema, 2020)

The redevelopment of unembanked post-industrial port sites is not without complexity, as Figure 20 on the next page shows, they are part of a big system with multiple uncertain threats and transitions.

River and delta

In the large system of the river, long-term, deeply uncertain changes will occur (Haasnoot et al., 2013), depending on the climate scenario. The IPCC sketches three main scenarios, which will have varying effects on biophysical and societal aspects (IPCC, 2021). Climate change has many effects, but water is the biggest threat in the Rhine-Meuse delta region. Climate action relies on intergovernmental collaboration (Shaib, 2016) but current policies lack bottom-up communication with civil society and market actors, who in the end play a crucial role in the redevelopment projects that urgently require adaptation, such as the post-industrial port sites on the riverfronts.

Polycentric delta metropole

The Rhine-Meuse delta region in home to a poly-centric metropole. At the regional scale, competition and culture are big influences on urban development patterns. The competition between cities for urban development projects and market investors conflicts with setting high adaptation demands for developing parties: eg. if Rotterdam is very flexible, but Dordrecht sets high demands, developers are more likely to develop in Rotterdam. Furthermore, financialisation can result in an inequitable distribution of development and adaptation (de Jonge in Heurkens, 2012). When (politically charged) redevelopment projects receive the most attention and funds to develop, it is important that other water vulnerable areas are not neglected, which could otherwise give rise to growing inequalities in the region.

Post-industrial port sites

Locally, there are many site inherent complexities for the redevelopment of post-industrial port sites. First, due to their industrial past, these sites often have contaminated soils and need new infrastructure suitable to a more intensive land-use (Van Veelen & Stone, 2013). Second, their water-threatened situation in the city poses additional challenges for redevelopment. The outer dike situation was necessary for good port functionality, but may require more water safety interventions for the future water pressures that result from climate change. Third, these inner-city developments have complex ownership-situations, many different interests area at stake and the municipality's steering possibilities are limited due to private land-ownership (Provincie Zuid-Holland, 2016).

Mechanisms

Climate change action requires long-term thinking and resilience-building to uncertain effects, but currently is not part of people's everyday life (Haasnoot et al., 2013; Kennis voor Klimaat, 2014). Instead, municipalities are pre-active, i.e. preparing to act by setting guidelines rather than proactively implementing change when planning for urban development projects (Storbjörk & Uggla, 2015). Furthermore, not all individuals feel responsible for their stewardship in relation to the changing climate (Latour, 2018) and due to the financialisaton of urban development, do not want to pay the price for long-term, uncertain elements when redevelopment projects are more short-term and risk averse (Adger et al., 2013). Correspondingly, researchers and water authorities are realising that we need to see climate adaptation as a socio-ecological transition (Ministry I&W, 2021) with cultural and political dimensions (Adger et al., 2013; Eriksen et al., 2015).

To summarise: the time horizons, spatial scales, degrees of uncertainty and concreteness are not aligned when trying to integrate climate adaptation and urbanisation in the redevelopment of post-industrial sites. This is the knowledge gap the thesis will adress.

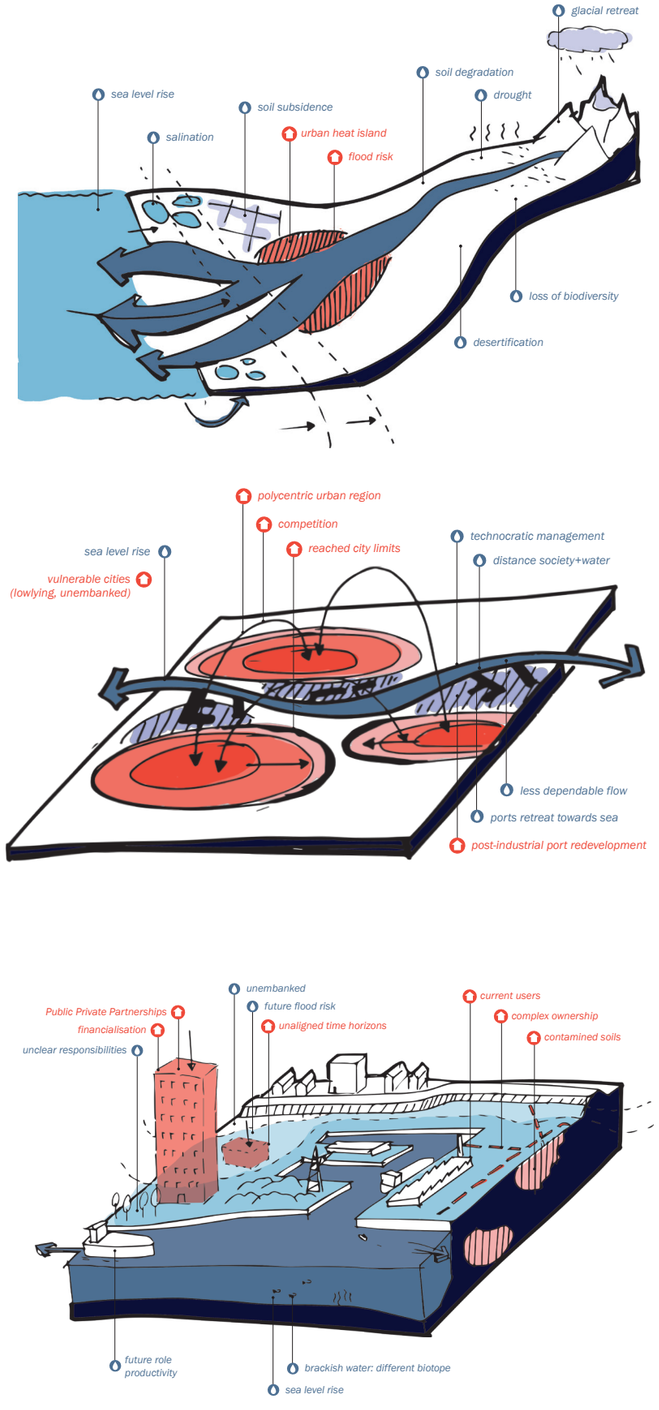


Figure 20: The complexity of interconnected challenges in urbanisation, vulnerabilities created by the water system and urbanisation on the different scales and the governance thereof. (Own illustration)

PROBLEM STATEMENT

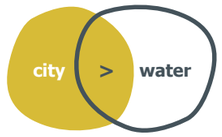
To conclude, the main problem this thesis addresses is:

Little operalisation of climate adaptation innovations in the redevelopment of post-industrial port-sites, resulting in a vulnerable Rhine-Meuse delta region.

AIM OF THE RESEARCH

The aim of the research is therefore to:

Integrate climate adaptation with urbanisation in the redevelopment of post-industrial port sites so that they contribute to the transition towards a climate adaptive, resilient delta region.



RESEARCH QUESTION

Therefore this thesis focuses on the following main research question:

How can post-industrial port redevelopments contribute to the transition towards climate adaptive delta cities?

To develop a climate inclusive governance and planning model, the thesis first identifies the Dutch spatial climate adaptive, inclusive redevelopment strategy for post-industrial port sites in the Rhine- Meuse delta region, this thesis first identifies policies and strategies of different societal sectors for the different challenges at mulitple scale levels (SRQ1).

As identified in the problematisation, integrating climate adaptation in redevelopment depends on the actions of local actors. As it will require deep changes in their behavior and to spatial and social structures of our society: it will rewuire a transition. That is why SRQ2 studies and assesses existing strategies on their performance towards making a contribution to the essential transition.

Next, SRQ3 investigates the mechanisms behind the operationalisation of climate adaptive policy in post-industrial port redevelopment projects to identify why certain processes do or do not work in producing water resilient spatial outcomes.

The last two questions strive to intervene within the mechanisms of the system to design alternatives for planning, design and governance that works to make water resilient adaptation more integrated at the local scale (SRQ4) and contributes to regional resilience as well (SRQ5).

SRQ1: What water vulnerabilities and urbanisation challenges lie ahead for the Rhine-Meuse delta region and its post-industrial port sites and what strategies and plans are drawn up to address them?

SRQ2: How well do recent urban redevelopment strategies in cases perform in contributing to the transition towards a climate adaptive delta region?

SRQ3: Why is adaptive capacity (mis) integrated in the post-industrial port redevelopment projects?

SRQ4: What interventions in redevelopment processes can be used to integrate climate adaptive capacity in redeveloped post-industrial port sites in the Rhine-Meuse delta region?

SRQ5: How should local redevelopment projects contribute to the establishment of a climate adaptive delta region?

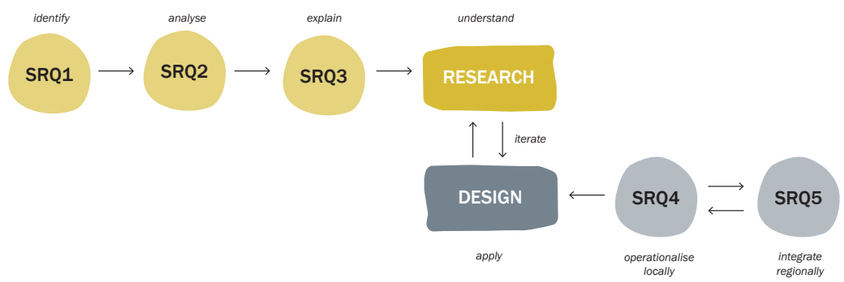


Figure 21: The relationship between the sub-research questions and theory and design. First understanding the system to build the theory, then applying and iterating the theory by testing it in a local and regional design.

OUTCOMES

The outcomes of the thesis has theoretical and practical strategy and design dimensions to address multiple knowledge gaps. The theoretical dimension addresses the knowledge gap on how to make a local project and climate adaptive actions contribute to the regional transition to establish a resilient delta region within the decentralised governance model (Campbell-Johnston et al., 2019; Eriksen et al., 2015; Baynes & Wiedmann, 2012). Next, it will iteratively make the transition from theory to design by identifying what the mechanisms behind successful integration of water adaptation and urbanisation are (Owen, 2020) and understanding what the barriers and opportunities are for integrating and mainstreaming climate adaptation in redevelopment processes (Uittenbroek et al., 2013).

The design section then develops interventions at the scale of the urban area while reflecting on the delta region: addressing different mechanisms behind transitions in the planning system, based on the opportunities and weaknesses identified in the theoretical stage. The design has a strong integrative focus: aiming for multilevel water resilient policy integration (Ministry I&W, 2021; Provincie Zuid-Holland, 2016; VNO-NCW & MKB Nederland, 2021); socio-ecological integration in urban riverfronts (Forgaci, 2018); and cross-scalar integration (spatial, temporal and institutional).

Last, the project has a symbolic and narrative value: giving an image to the transition and tools for inclusive redevelopment of a spatially and socially vulnerable site.

To conclude, the outcomes of the thesis are:

1. An understanding and critical reflection of the Dutch planning system and its ability to make water resilient ambitions operable in local redevelopment projects in the decentralised governance context and to connect them to make them perform for the regional transition.

2. Systemic interventions that integrate long-term climate adaptation in redevelopment processes and outcomes.

3. A strategy for applying the Dynamic Adaptive Policy Pathways at the scale of the urban area for the redevelopment of post-industrial port sites under the deeply uncertain context.

4. A design simulation of the implementation of the above for a representative case and regional pilot: de Staart. Evaluating the strategy's performance to making water adaptation integrated in post-industrial port redevelopment projects and their contribution to regional resilience.

CONCLUSION

This chapter has introduced the context and analysed the way in which the practical problem unfolds in this regional context. The problem analysis showed the multi-scalar and -sectoral nature of the problem. It introduced the aim, research questions and outcomes. The next chapter will position the thesis in a larger body of research, which will then be the foundation for the research design.

02 THEORY

Summary | The theory chapter positions the project within a larger theoretical context to develop principles for the research and strategy design. The paper proposes that a local project can contribute to a regional transition though a panarchy of adaptive cycles. However, adaptive capactiy and dynamic planning are essential elements for this. Therefore, the Dynamic Adaptive Policy Pathways methodology will be tested in the strategy because it embeds these values and may promote an evolutionarily resilient delta region.

Theory Paper

Conceptual Framework

Figure 22: Placemaking and awareness raising through artist work Warten auf den Fluss, wainting for the flood.(Observatorium, 2014)

INTRODUCTION

This chapter will connect three main theories to build a theoretical understanding of the mechanisms behind local projects that contribute to a regionally resilient system. It was written in the form of a paper for the theory course that was connected to the graduation programme. The abstract on the right page summarises the main narrative of the theoretical background, which is also summarised in the theoretical framework in Figure 23. The chapter concludes with the conceptual framework that guides the research and design.

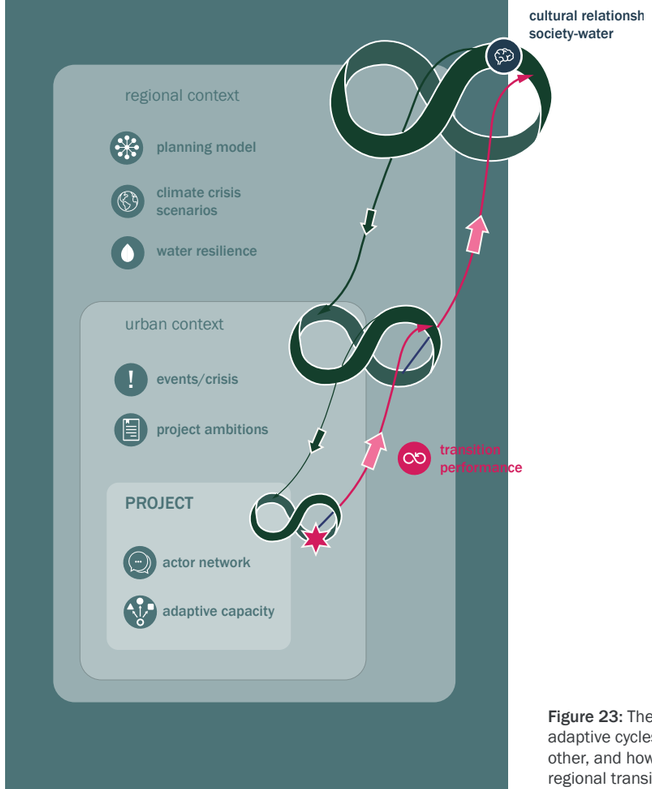


Figure 23: Theoretical framework, showing how adaptive cycles of different scales influence each other, and how a local project can contribute to a regional transition that is dynamically resilient. (Own illustration, based on Gunderson & Holling, 2002)

LOCAL ADAPTATION FOR THE REGIONAL TRANSITION

Positioning small-scale redevelopment projects in the regional transition towards dynamically resilient Climate Adaptive Delta Cities in face of the climate crisis.

Abstract *In adapting to a changing context caused by the long-term climate and short-term housing crisis, the Netherlands relies on small-scale projects in the decentralised governance model. However, worries arise about this planning system's capacity to realise a resilient region. Transition theorists suggest we are in a lock-in, unable to change our practices in time to adapt to the long-term climate crisis (Rotmans, 2021). The climate crisis demands such large societal changes that transformative adaptation is needed where culture, space and governance need to adapt dynamically in a deeply uncertain context.*

Building on a literature review, this paper positions the role of a local redevelopment project in the regional transition. Connecting the Panarchy of Adaptive Cycles to the Dynamic Adaptive Policy Pathways framework underlines the value of a local project. Small projects should: experiment to enhance adaptive capacity, which is spatial and procedural; connect sectors and scales to have a transition performance; and inspire a cultural shift in actors and institutions, towards more stewardship for Climate Adaptive Delta Cities.

Some paradigm changes in urban planning are needed to increase the value a local project can have for the adaptive pathway and to ensure a transition of the decentralised model towards an evolutionarily resilient system that keeps dynamically adapting. Future strategies should focus on an open planning attitude, knowledge sharing and a balance between the three planning perspectives: hierarchical, individualist and egalitarian. While the paper's rationale is theoretical, the translation of the Panarchy of Adaptive Cycles to the Dynamic Adaptive Policy Pathways is promising to make adaptive planning more applicable in practice and testable in future research.

Keywords Climate change adaptation, Panarchy of adaptive cycles, Dynamic adaptive policy pathways, Adaptive *planning, Transition, Rhine-Meuse delta, The Netherlands*

Jasmijn Ponssen
July 2021, Delft University of Technology
Theories of Urbanism (AR3U023)
Theory tutor: Dr. Gregory Bracken
Mentors: Dr. Arie Romein, Dr. Claudiu Forgaci

INTRODUCTION

The climate crisis rises the urgency for taking action in either mitigating or adapting to the effects of climate change. While the past years it was believed that the development of extreme climate scenarios could be mitigated, a high-end scenario has become more likely to unroll, which would involve +-2°C heating and might result in 18 meters of sea level rise in 2300 (IPCC, 2014, 2021; KNMI, 2021). This will have consequences for our society's system, directly and indirectly affecting our society's physical environment and occupational patterns (Rockström et al., 2009). Some spatial and socio-economic elements are particularly vulnerable to the threats posed by the changing context due to climate change, but what these effects entail exactly is deeply uncertain (Frantzeskaki et al., 2019; Wise et al., 2014).

In the low-lying Rhine-Meuse delta in the Netherlands, addressing vulnerabilities especially revolves around maintaining a flood resilient urbanised delta metropole region. Most economic activity and urban development in face of the housing crisis are also happening in the water vulnerable delta region, which is redeveloping both low-lying polders and unembanked sites such as post-industrial port sites. A resilient system has become both a goal and strategy in the face of the climate crisis. Here, resilient strategies refer to "the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation." (IPCC, 2014)

Resilience can be achieved through multiple kinds of changes in the system (Roggema et al., 2012a) that can be called adaptation pathways: "bundles of strategies and actions that support the achievement of a long-term vision" (Frantzeskaki et al., 2019, p. 778). Reducing and coping with the effects of high-end climate change requires "the balancing of mitigation (reducing the emissions of greenhouse gases), adaptation (making society less vulnerable to climate change by responding to immediate impacts) and

transformation (fundamental, deep, systemic changes to institutions), as well as acceptance of residual damages" (Tinch, 2015 in Frantzeskaki et al., 2019, p. 777). These pathways can be categorised, from slight to radical change, as: incremental, transformative, or transitioning. In addressing the large and complex challenge of the climate crisis (and integrating it with other societal agenda's such as urban development), Roggema (2012a) argues that transformative or transitioning actions are needed, radically changing our spatial land-use patterns and behaviors. These big changes cannot be supported through the existing planning system, and new modes of governance should develop to support the large scale transformative adaptation (Frantzeskaki et al., 2020).

For addressing many societal challenges, ambitions and vulnerabilities, the Dutch planning model relies on small-scale projects and actors in the neoliberal and decentralised governance model (Gunder, 2017). Urban area redevelopment projects have become the arenas where climate adaptation and urbanisation agendas are layered with other societal ambitions (Petersen & Heurkens, 2018). While some of these small scale projects show traces of a new system emerging, the operalisation of innovative strategies that address the housing crisis and climate change is criticised for a lack of adaptive capacity seeing the outcomes are traditional: belonging to the current system, rather than the new system (Roggema et al., 2012a). On the one hand, the effectivity of the current planning system to produce a resilient system in the long-term is questionable (Kim & Lim, 2016; Kramer & Van Bueren, 2021). On the other hand, no clear guidelines are formulated for understanding the attributes of a small-scale project that contributes to long-term adaptive pathways in ensuring a resilient spatial and social structure at the large scale.

Therefore, this research chapter explores the following research question: How can a local urban area redevelopment project such as de Staart in Dordrecht contribute to large-scale regional transition to establish a resilient system? Building on literature, it first provides a theoretical understanding about resilience and adaptation. Next, it reflects on the current Dutch planning system and positions bottom-up adaptation projects in a more practical framework for adaptive planning. The insights can help planners and actors in local projects to connect themselves and their project to the larger complex systemic transitions that are needed in adapting to the effects of an high-end climate change scenario.

RESULTS

This section first outlines an understanding of the key concepts of resilience and adaptation in the context of the Rhine-Meuse delta in the Netherlands, which faces both urbanisation and climate adaptation urgencies. Second, it positions these theories and the local projects within an overarching conceptual model.

Theoretical background

The climate crisis is an increased sense of urgency for addressing the "long-term change in the earth's climate, especially a change due to an increase in the average atmospheric temperature" (Dictionary, 2021). What it means to address and act upon climate change in the built environment depends on and is mediated by cultural and social factors. "Cultures are dynamic and reflexive and so are in turn shaped by the idea of climate change. Hence culture, and its analysis, is central to understanding the causes and meaning of, and human responses to climate change" (Adger et al., 2013). In the context of the decentralising governance model in the Netherlands the cultural and social factors are becoming more important, seeing that responsibilities are shifting from the central national government towards smaller elements of the institutional landscape, such as the region and municipality (Gunder, 2017).

Climate change impacts spaces differently depending on site-specific vulnerabilities, determined by local biophysical, cultural and social characteristics. The low-lying delta landscape in the Netherlands is vulnerable to the water and has over time developed a highly formalized water management system, using a complex system dikes to protect areas from the water (Meyer, 2016). As a result, a distinction can be made between embanked areas, which are protected by dikes, and unembanked areas, which are situated outside of the protection of a dike ring. Port sites are unembanked, and therefore their soil has in the past often been heightened to avoid flooding. Their future vulnerability to the short crises and gradual changes of climate change is a function of three factors:

1. "Exposure, the change in climate and what is affected, e.g., how many people are living in an area that could be inundated by the sea level rise or affected by change in coastal storms;
2. Sensitivity is the direct effect of climate change on systems, e.g., changes in crop yields or runoff;
3. Adaptive capacity, the ability of a system to adapt to climate change, reduce adverse effects or take advantage of beneficial effects." (Smith, 2001 in McCarthy et al., 2003).

Vulnerability needs to be acknowledged in combination with the predicted climate risk, "probability or likelihood of occurrence of hazardous events or trends multiplied by the impacts if these events or trends occur" (United Nations Environment Programme, 2021). The uncertain nature of the climate risk in combination with the predicted big impact, has activated many sectors in the Netherlands to explore the risks and spatial impacts of different climate change scenarios. Especially water vulnerable areas are urbanised, such as post-industrial unembanked port sites, the vulnerability, risk and impact are likely to increase and the need for integrated adaptation solutions grows (Solecki et al., 2015).

Figure 24 shows that multiple strategies can achieve a resilient system in the long-term, depending on the system's capacity and the type of disturbances resulting from the changed context. Davoudi (2012) distinguishes three different types of resilience:

1. Engineering resilience: "the ability of a system to return to an equilibrium or steady-state after a disturbance" (Holling 1996, p.33 in Davoudi)
2. Ecological resilience: "the ability to persist and the ability to adapt" (Adger, 2003, p. 1 in Davoudi et al., 2012)
3. Evolutionary resilience: "In this perspective, resilience is not conceived of as a return to normality, but rather as the ability of complex socio-ecological systems to change, adapt, and, crucially, transform in response to stresses and strains (Carpenter et al., 2005). Systems are conceived as "complex, non-linear, and self-organising, permeated by uncertainty and discontinuities" (Berkes&Folke, 1998, p. 12)." (Davoudi et al., 2012)

In addressing resilience, it is important to consider "Resilience for whom and to what? When? Where? And why?" (Meerow et al., 2016). Seeing a large part of the GDP and citizens are situated in delta regions worldwide and that the urban waterfront population is growing, a water resilient urbanised delta system is important. Urban resilience refers to "the ability of urban systems to continuously develop short-term coping and long-term adaptation strategies- considering, and in response to constantly changing system dynamics and complexities

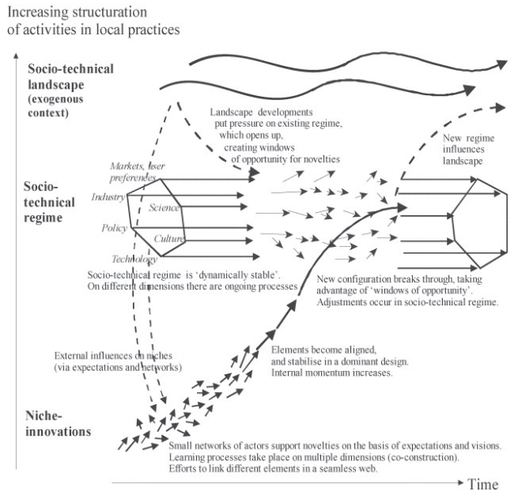


Figure 24: Multilevel perspective on transition pathways showing the interaction between scales (Geels & Schot, 2007)

over a range of spatial and temporal scales-to mitigate hazards, withstand and absorb shocks, rapidly bounce back to baseline functioning, and more effectively adapt to disruptive events by bouncing forward to better system configurations." (Yamagata & Sharifi, 2018). In this sense, the transition towards an open-ended planning paradigm that established evolutionary resilience should be the focus of future urban planning strategies: Climate Adaptive Delta Cities.

Conceptual frameworks

To achieve Climate Adaptive Delta Cities, big changes, transitions, are needed in different scales and sectors of the planning system. Actions addressing the climate crisis can be grouped into mitigating and adapting actions. "Mitigation is needed to avoid the worst effects of climate change" (Smith et al., 2003, p. 1), it entails actions taken to reduce impact on climate change. Whereas adaptation means changing the system in such a way that it can deal with the changing context, building resilience and/or transitioning to new ways of living. "Adaptation to climate change has the potential to substantially reduce many of the adverse impacts of climate change and enhance beneficial effects" (Smith et al., 2003, p. 1).

Whether a system, region or community is able to achieve resilience by adapting its spaces and habits to the impacts and risks of climate change depends on its adaptive capacity (IPCC in Smith et al., 2003). Adaptive capacity relies on socioeconomic characteristics and is a function of: "wealth; access to technology; stable and effective institutions; systems in place for dissemination of information; equitable distribution of power; well-functioning social systems" (Adger, 1999 in Smith et al., 2003). Furthermore, Adger (2003) argues that the capacity of individuals to adapt to climate change depends on their access to resources, whereas "the capacity of societies depends on the ability to act collectively in the face of the threats posed by climate variability and change", also called the coping capacity (Dunford et al., 2015). Last, it is important actors feel responsible for the planet, which is called stewardship (Latour, 2014). Adaptation thus entails social, cultural dimensions next to the technical, environmental and spatial aspects.

Panarchy of Adaptive Cycles

To establish Climate Adaptive Delta Cities, adaptation should be considered as a non-linear process through the model of adaptative cycles. This model puts emphasis on the two phases of adaptation, which involves a slow period of growth and accumulation, and a fast phase of reorganisation towards a new system (Resilience Alliance, 2021), as shown in Figure 25 on the next page. Thinking in adaptive cycles and change as a process "provides a more complete view of system dynamics that links together system organization, resilience, and dynamics" (Resilience Alliance, 2021). When a window of opportunity occurs (for example in the form of a crisis) a new system can emerge, either

introducing new or building on old spatial patterns, ecosystems as well as governance models and networks (Roggema et al., 2012b). A transformation from one system into the next does not happen overnight, and usually a potential future system already emerges in niches while another large scale system (regime) is still functioning (Wise et al., 2014).

Adaptive cycles exist at multiple spatial and temporal scales and can be nested and interrelated in a panarchy model of adaptive cycles (Figure 26) (Resilience Alliance, 2021; Roggema et al., 2012b). The model shows that experimentation at the small scale can destabilise and activate change in a scale level higher if many novelties are aligned in a similar direction or one proves to be successful. Simultaneously, the large and slow system provides memories and culture of the past and can allow for recovery of small adaptive cycles (Resilience Alliance, 2021; Wahl, 2017).

Ensuring resilience can be achieved in three different ways: spontaneously; responsively by adapting after a disaster event (and having faced damages); or proactively by adapting spatial and social structures in preparation of a potential climate risk that is more gradual in nature (Kim & Lim, 2016). Focusing on adaptation, an important distinction should be made between reactive and anticipatory adaptation. “Anticipatory or preventive adaptation that predicts and responds to vulnerabilities before damages are incurred and reactive adaptation that gears up to limit the recurrence of damage only after effects of climate change have been felt and damage done, in order to limit recurrence of the damage. If adaptation is mainly reactive, then damages will be much greater.” (Repetto, 2008, p. 2). As we are currently aware of the risks of the climate crisis and the vulnerabilities of our delta metropoles, we should be able to achieve anticipatory adaptation, but the current system is failing to produce the innovations needed. Rotmans (2021) explains this as a lock-in: where the established system is too rigid and resists change. Here, it is likely that a very chaotic transition across sectors will occur if an adaptive planning paradigm does not emerge soon (Rotmans & Verheijden, 2021). There are many types of transition and adaptation patterns, of which Figure 28 provides and overview.

The way in which society transitions towards the next system depends on the predominant governance perspective. Middelkoop et al. (2004) distinguish three main perspectives: the Hierarchist (controling nature and water top-down); Egalitarian (making natural processes guiding in development); and Individualist perspective (prioritising economy over nature). The Individualist focuses on the short-term, whereas a more Egalitarian perspective has a focus on the long-term, the first resulting in responsive action and a crisis, the latter in more pre-active strategies. A more hybrid perspective will probably be needed for the transition.

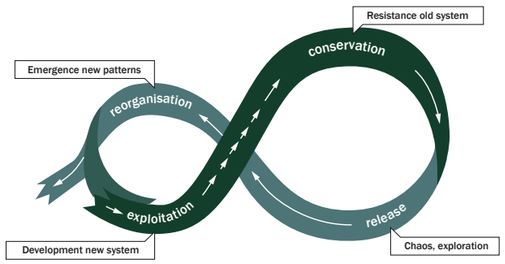


Figure 25: An adaptive cycle showing a period of emergence and conservation and of destruction and reorganisation. The model supports a shift from linear thinking to adaptive and dynamic system thinking. (Adapted from Gunderson&Holling, 2002)

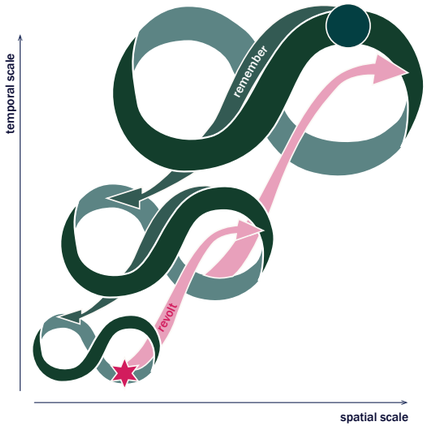


Figure 26: A panarchy of adaptive cycles indicating interscalar interachtions. Small, short-term projects can have the capacity to cause a revolt in larger scales, whereas the larger and slower scales set the context and create stability. (Adapted from Gunderson&Holling, 2002)

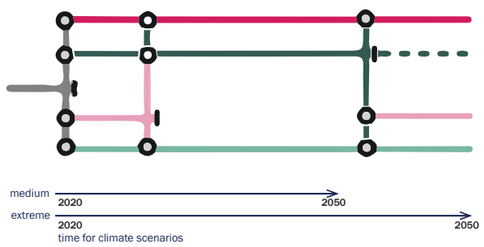


Figure 27: A Dynamic Adaptive Policy Pathways framework, indicating different adaptive pathways as a metromap with stations (decision-nodes) when a dead-end is reached (a tipping-point in the system). It invites planners to navigate dynamically between pathways and explore their spatial and societal implications. A strategy for resilience becomes dynamic and adaptive rather than linear when continuously monitoring the performance of the system and the evolvement of the changing context. (Adapted from Haasnoot et al., 2013)

Dynamic Adaptive Policy Pathways

As some may find transition theory abstract and fuzzy (Roorda et al., 2014), operational models are emerging. The Dynamic Adaptive Policy Pathways framework is increasingly recognised for stimulating dynamic and adaptive decision-making and planning under deeply uncertain contexts. It requires planners to “create a strategic vision of the future, commit to short-term actions and establish a framework to guide future actions. A plan that embodies these ideas allows of its dynamic adaptation over time to meet changing circumstances” (Haasnoot et al., 2013, p. 485). The following section will discuss how this framework, developed for water mangement could be used to position a local redevelopment project in a larger regional transition, and what is needed to connect the short- and long-term.

The Dynamic Adaptive Policy Pathways invites actors to think about the long-term, positioning the current strategy and future strategies on a metro map as shown in Figure 27. It maps different actions that can establish a resilient system, each having a different lifetime and impact on societal aspects. The lifetime is studied for transient scenarios, which study a range of future contexts for the system, including social, political, technological and environmental dynamics. Their impacts will influence the components of the internal system, and if the effects are strong, they can result in a tipping point, meaning an action is no longer able to produce a resilient system and a different pathway needs to be selected, as represented by the decision nodes (Haasnoot et al., 2013). Respectively, different pathways (groups of actions) for achieving a resilient region can be explored and evaluated spatially, socially and economically (Berg et al., 2013). What the preferred pathway will be in the metro map depends on the governance perspective (Middelkoop et al., 2004).

The Dynamic Adaptive Policy Pathways methodology aligns with the panarchy model of adaptive cycles because it operationalises conceptual adaptation into a tool for action. It embodies the paradigm shift from a linear to a climate adaptive planning paradigm. Working with the pathways stimulates long-term, preparative thinking, avoiding responsive decision-making that addresses short-term crises. Adaptation is not only determined by what is currently happening or expected to happen, but also by what is experienced over time as the future unfolds (Yohe, 1990) and by policClimate Adaptive Delta Region “is not understood as a fixed asset, but as a continually changing process; not as a being but as a becoming.” (Wahl, 2017).

This perspective makes actors of different scales in planning system understand that resilience can be achieved evolutionary, next to engineering it. The framework invites actors to think dynamically and to dance “between persistence, adaptability and transformability across multiple scales and timeframes (Holling & Gunderson, 2002; Walker et al., 2004; Folke et al., 2010 in Wahl, 2017), connecting the social dimension to resilience and adaptation (Adger et al., 2013).

Transformative paradigm shifts towards adaptive planning

Establishing a new spatial, social and cultural system is expected to be (partially) supported by the current planning system, though some paradigm shifts and more fundamental changes will be required (Frantzeskaki et al., 2020). Shifting from masterplans to frameworks and dynamic rules (Makers District et al., 2019). Implementing the Dynamic Adaptive Policy Pathways and stimulating transformative adaptation requires multiple paradigm shift in spatial planning, as identified by Yamagata & Sharifi (2018):

1. Actors should move from rigid blueprint planning to adaptive planning, with ‘learning by doing’ in stead of predicting and preventing’;
2. Acknowledge human – nature stewardship (Latour, 2018) and increase the awareness of stakeholders through participation (Eriksen et al., 2015);
3. More social inclusion through equitable planning strategies;
4. Build on local (ecological) knowledge (McMillen et al. 2017);
5. Reform institutions for a culture of collaboration,
6. “ranging from cross-sectoral collaboration, through

Transition patterns			Adaptation patterns
Empowerment: niches gain power (bottom-up)	Reconstellation: New regime is installed (top-down)	In squeezed (top-down and bottom-up)	A Constellation alters its functioning either through interacting or merging with other constellations within or from outside the societal system
Reconfiguration: niches scaling up and becoming empowered by the regime	Radical reform: regime is reformed according to the cultures and structures of an outside constellation	Teleological: regime adapting by allowing outside influences to reconstellate and simultaneously incorporating novel functioning in these processes	Re-positioning: orienting towards new target groups or markets, assuming a new role or identity
Substitution: niches scaling up and becoming empowered in spite of the regime	Revolution: a constellation outside the regime invades the societal system and replaces the incumbent regime	Emergent: niche functioning and influences from outside the societal system team up without active influence of the incumbent regime	Re-organizing: structurally growing or shrinking, forming or merging groups, divisions or specialties.
Backlash: niches initially gain power or popularity but fail to become the new mainstream	Collapse: the reconstellation does not lead to a new stable societal system	Lock-in: an innovation gains influence in the societal system but fails to completely replace the regime, co-existing with it in a locked-in state	Innovation: mechanization, automation, modernizing infrastructure, employing new or different technology, knowledge or expertise

Figure 28: Transition and adaptation patterns (Ernst, 2016, adapted from De Haan and Rotmans, 2011)

collaboration between cities, to inter- and trans-disciplinary collaboration" (Yamagata & Sharifi, 2018);

7. Understand the value of sense of place as "an integral component of urban resilience and is essential for formation, maintenance, and growth of social networks. Sense of place improves urban resilience and reinforces social networks by strengthening feelings of trust and reciprocity, providing incentives for collective action, and facilitating pooling of skills and resources in the community" (McMillen et al. 2017);
8. Dimensional, spatial and temporal interrelationships and interlinkages: avoid silos, think cross scalar linkages;
9. Resilience-oriented land-use planning: to minimise risk and maximise absorption capacity; and
10. Resilient urban infrastructure.

To establish this paradigm change in the Netherlands and establish a dynamically resilient delta region, there are two important roles for local projects, such as de Staart, in the pathways framework for transformative adaptation. On the one hand, local redevelopment projects are likely to innovate and experiment in fast-moving adaptive cycles, testing different configurations within the existing system or even breaking with the existing regime is easier in a small project. Successful lessons in a local project can inform decision-making at a strategic level within the adaptive policy pathways by producing new knowledge, while at the same time being part of a certain pathway (Haasnoot et al., 2013; Kim & Lim, 2016). For example, before constructing the Delta works in the Netherlands, multiple small projects were constructed to test the principles and to explore possible sectoral integrations (Meyer, 2016). On the other hand, multiple small projects can together establish a resilient region as they increase the adaptive capacity by embodying flexibility, creativity, diversity, efficiency and adaptability (Yamagata & Sharifi, 2018). The long duration and integration challenges of urban redevelopment projects for urban resilience "reminds us to stay mindful of the limits of prediction and control that we face as participants in such complexity" (Wahl, 2017). In this mindset, the urban waterfronts they together produce are not seen as an end-product, but an ever adapting process. Furthermore, the experiences actors gain in the redevelopment processes of experiments can be adapted or adopted in further projects (Roorda et al., 2014) and influence the regional policy pathway (Haasnoot et al., 2013), when they prove to be successful.

Consequentially, planners should balance between learning and continuity. To using the Dynamic Adaptive Policy Pathways framework and stimulating creative, experimental projects at the small scale (Resilience Alliance, 2015 in Wahl, 2017). Increasing urban evolutionary resilience means connecting scales, actors, system elements and sectors creatively and equitably. By starting with local projects, adaptive planning can help to bridge "longer term sustainable development and shorter term crisis management, allowing sectors to develop common strategies" (Sellberg et al., 2015). Urban planning is becoming more acceptant of a complex state of non-equilibrium dynamics (Yamagata & Sharifi, 2018), continuously moving through the different stages of the adaptive cycle and the Policy Pathways map. When using this planning mindset, actors of all scales are challenged to think adaptively and turning the climate crisis and transition towards a future water resilient, urbanised delta region into an opportunity (Gunderson & Holling, 2002 in Davoudi et al., 2012).

DISCUSSION

By connecting the Dynamic Adaptive Policy Pathways framework to the Panarchy of Adaptive Cycles, this chapter has bridged a more abstract, theoretical understanding about adaptation towards a practical position of local pilots and niche experiments in the larger transition towards Climate Adaptive Delta Cities. However, different perspectives about the role of a local project might be possible when applying different adaptation theories. The combination maintains awareness of the complexity, dynamics and uncertainties, while enabling actors to translate their conceptual position into concrete actions for the present. The paper is part of a paradigm shift in urban planning towards adaptation and resilience, but the long-term relevance of the theories applied has not been proven yet. Therefore it remains uncertain whether the operalisation of the theories helps to build adaptive capacity. Nevertheless, it raises consciousness about the stewardship we all have in addressing society's challenges (Latour, 2014).

Some uncertainties remain around the mechanisms behind establishing the transition through local projects. Research points out that there is little operalisation of climate adaptation in urban redevelopment projects (Petersen & Heurkens, 2018; Programmateam NAS, 2020; Runhaar et al., 2018), which might result in maladaptation or reactive adaptation (Verheul & Hoorn, 2021) or a very chaotic transition (Rotmans & Verheijden, 2021). Transformative adaptation relies on multiple deeply uncertain factors.

First, local projects need to be innovative to increase adaptive capacity and test new pathways (EcoShape, 2016). Currently the experimental character can be reduced due to societal or political resistance for 'fuzzy' or uncertain projects (De Kruif, 2021); reactiveness on short-term crises (Arènes et al., 2018); lack of focus due to overcomplexity (Kramer & Van Bueren, 2021); and little formalisation on what innovative means, making it difficult to set requirements for developers.

Second, the external factors influencing the planning system require adaptation of many aspects of society. Some aspects may stay out of scope in planning, while they do need to be included for justice as well as for finding possible synergies (Sellberg et al., 2015). The actual process of using policy pathways locally and regionally should be equally relevant as the theoretical value of the frameworks, but was not studied in this chapter.

Third, to make an impact for a long-term resilient system, projects at the bottom of the panarchy need to scale up by triggering adaptation at the larger scale when faced with a changing context. If governmental structures are closed or hinder inter-scalar learning, or planning is too top-down, this might result in stagnation. On the other hand, if no top-down coordination happens, a lack of long-term vision can reduce the inter-scalar integration. A balance needs to be sought between a strong, yet decentralised government (VNO-NCW & MKB Nederland, 2021).

Last, the question remains whether frameworks that reduce complexity in support of more tangible actions results in better strategies and resilience in the long run. In fact, awareness of the complex and interrelated nature of the societal challenges can result in more creative and innovative solutions (Saiu, 2017). Therefore, co-producing the frameworks such as the Dynamic Adaptive Policy Pathways is important to keep actors conscious of the complexity. Nevertheless, the true position of these frameworks in planning requires more exploration and will be tested in the design chapter.

CONCLUSION THEORY PAPER

Faced by pressures of the climate crisis in a decentralised planning model, this paper explored the following research question: How can a small-scale urban area redevelopment project contribute to large-scale regional transition towards a Climate Adaptive Delta system?

By reviewing literature and theoretical concepts about resilience, a small project such as de Staart can be positioned in the panarchy as a fast cycle that is both influenced by the larger planning culture as well as having the capacity to create a revolution in the larger system. Translating the conceptual panarchy of adaptive cycles to the practical Dynamic Adaptive Policy Pathways helps in understanding how evolutionary resilience might be achieved. At the large scale, planning paradigms need to shift, but this can only happen when new practices and spatial strategies are tested at the local scale: a cultural shift. Here, it is essential to establish an open, inclusive planning culture where learning between scales and sectors is possible, aiming for an early transition and building integrative approaches that embed dynamics and complexity and establish an evolutionarily resilient system. While the challenges we face are big, the role of a small local project is key, especially at the tipping point we are now. Small projects should:

1. Experiment to enhance adaptive capacity, which is spatial and procedural;
2. Connect sectors and scales to have a transition performance;
3. Inspire a cultural shift in actors and institutions, towards more stewardship for a Climate Adaptive Delta Cities paradigm.

While the position of a local project in the larger systemic adaptive pathway in this paper is relatively conceptual, future research should aim to make the concepts more practical and site-specific. Furthermore, the panarchy model underlines the importance to draw lessons from experiments, making research on realised projects with an innovative character relevant in developing adaptive policy pathways. Last, ways to enhance a more open, dynamic planning paradigm should be studied and promoted to make actors see adaptation as a way to add quality and to support transitions with inter-scalar and -sectoral integration. Adaptation to the climate crisis is highly complex and involves environmental, technical, social and cultural change. Therefore, integrated research by design proposals that include adaptive management strategies, spatial solutions and policy pathways can promote understanding what the transition might bring us in the long- and short-term: building on local projects to achieve an evolutionarily resilient region.

CONCEPTUAL FRAMEWORK

The different components of the theoretical framework and location specific practice come together with the transition mechanisms in the conceptual framework in Figure 29. It shows how the housing crisis, industrial transition and water adaptive ecosystem can synergetically integrate the climate crisis in the redevelopment of post-industrial port sites. As explained in the theory paper, local projects need to embed adaptive capacity under the deeply uncertain context to establish the transition towards a more dynamically resilient planning paradigm.

The Climate Adaptive Delta City "is not understood as a fixed asset, but as a continually changing process; not as a being but as a becoming." (Wahl, 2017).

Together, a network of climate adaptive delta city projects can establish a cultural shift, changing the way in which we think about our stewardship for the world. Planning will be about embedding the long-term in the short-term by using the Dynamic Adaptive Policy Pathways in an open way.

CONCLUSION CHAPTER

This chapter has positioned the thesis within a larger theoretical context, in order to develop the conceptual model that can be used to understand the role of a local project in the regional transition towards a resilient system and to analyse other projects to understand practical challenges for achieving this. Based on the knowledge gap between theory and practice, the project will research and test pathways towards the transition. Due to the context-dependent nature of the problem, comparative case study research is used to understand the mechanisms of the existing system holistically (Roggema, Kabat, et al., 2012; Solecki et al., 2015). The findings will be translated to a strategy for the redevelopment of a post-industrial case as a pilot in the region such as de Staart, exploring how the Dynamic Adaptive Policy Pathways can establish a Climate Adaptive Delta City that is evolutionarily resilient.

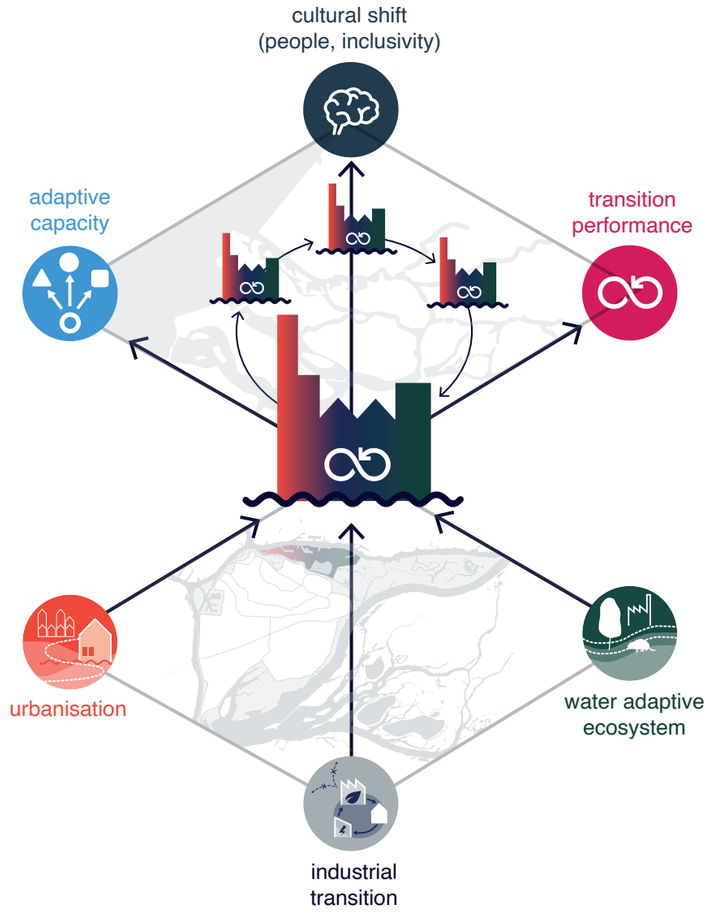


Figure 29: Conceptual framework: local redevelopment projects of unembanked post-industrial port sites that integrate today's and tomorrow's challenges dynamically. The Climate Adaptive Delta City bridges the current end-product focussed system and the future adaptive system by integrating adaptive capacity, contributing to the regional transition and networking to cause a cultural shift, establishing a more sustainable relationship with the planet. (Own illustration)

03 METHODOLOGY

Summary | The methodology chapter outlines the project's structure. Case study research is used as the main methodology as it aligns with the strongly contextualised and complex urban area redevelopment projects. To understand different facets of the projects, both spatial and social analysis methods are used. The project is structured as following: by comparing three cases in the Rhine-Meuse delta, mechanisms behind adaptive redevelopment are understood and strategies for climate adaptive post-industrial port redevelopment are developed. Next, the findings can be integrated in the Dynamic Adaptive Policy Pathways methodology and tested in a representative case: de Staart in Dordrecht.

Figure 30: Industrial heritage in post-industrial port site Stadswerven in Dordrecht. (Bouw en Uitvoering, 2021)

INTRODUCTION

This chapter explains how the resarch approach, comparative case study research, is operationalised. First, an overview of the alignment between the project's components is presented in the methodological flowchart. Next, the different methods for each of the steps of the case study are explained. Finally, the selected cases, all post-indstrial port redevelopment projects, are introduced.

METHODOLOGICAL FLOW CHART

The methodological flowchart in Figure 31 provides an overview of the different research components and their alignment. The problematisation and research questions provide the direction for the theoretical framework, which in turn is used to establish the foundation for the theoretical explanation behind the phenomenon. Furthermore, the theoretical framework supports the analytical and design approaches: aligning methods and research types. The research in the analytical stage uses different methods to investigate the cases on the 6 components of the conceptual framework (Figure 29). Next, research and theory inform the design stage, which is used to translate the threats and opportunities for the case locations and region into Guiding Principles, a Spatial Framework and simulation of the Dynamic Adaptive Policy Pathways. Finally, the framework indicates that different cases will be used at different parts of the project.

The specific role and relationship between the cases and the different research components will be explained in the next pages before diving further into the specific methods used.

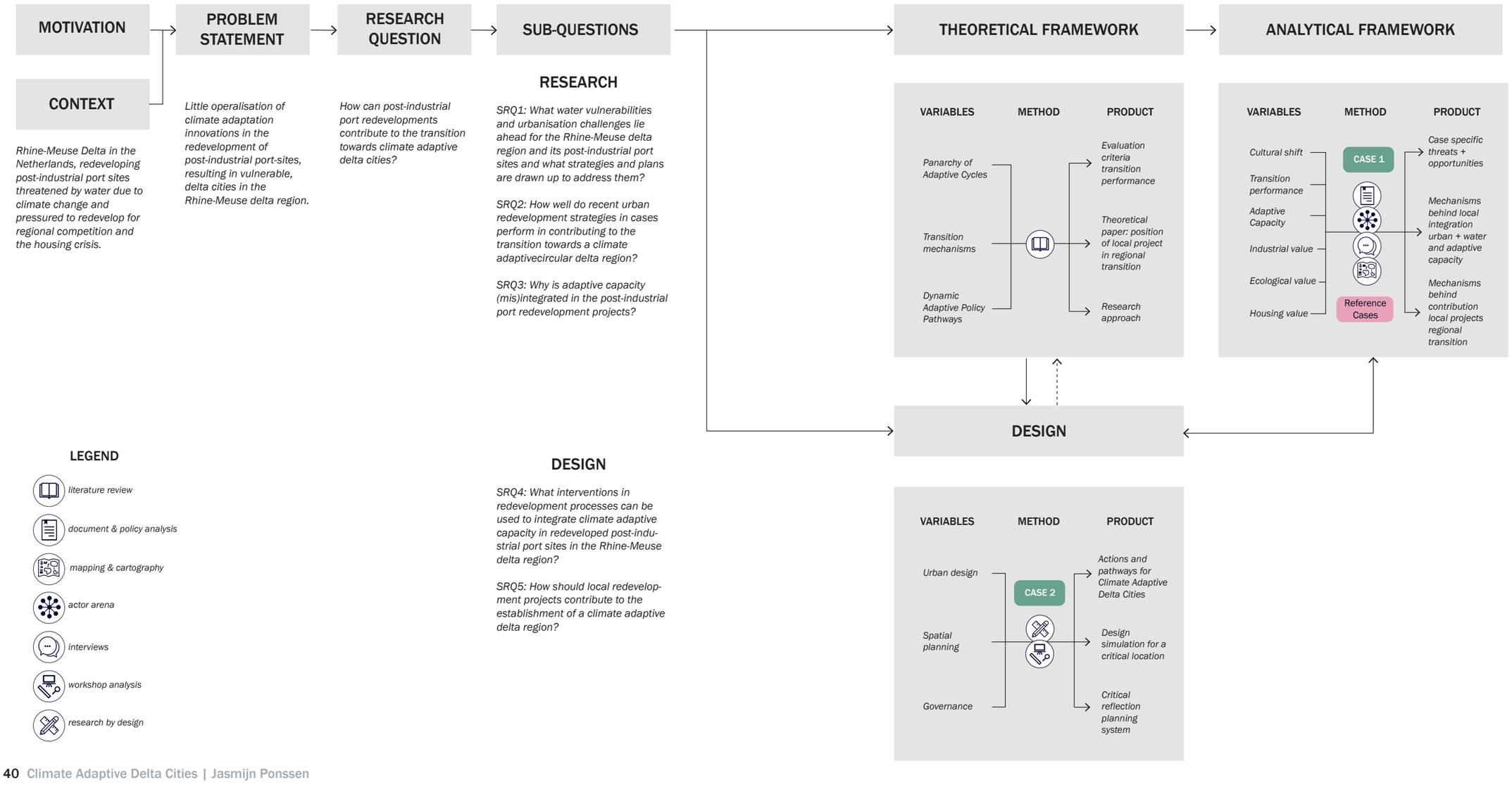


Figure 31: Methodological flowchart illustrating the relationships between the different research components and their variables, methods and products. (Own illustration, format adapted from Bodde, 2018)

METHODS

As the methodological flowchart introduced, the research will use multiple methods to be able to understand the mechanisms behind and develop a strategy for the transition towards climate adaptive delta cities. For each of the phases the methods will be briefly introduced below, a more elaborate explanation can be found in Appendix 6 |.

Context & theory

Studying policy documents, interviewing experts and reviewing newspaper articles is used to understand the problem context. Next, the project's theoretical part builds on a literature review, which a) frames the problem and build the analytical framework, and b) builds a theoretical reference to compare the findings of the case study to during the project's next stages (Creswell, 2018).

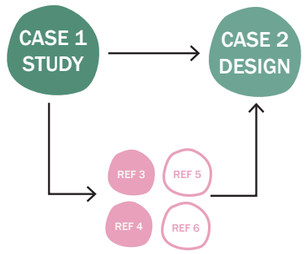


Figure 32: Case 1 and Cases 3-6 create the backbone for the research stage, which together establish the input for design Case 2. (Own illustration)

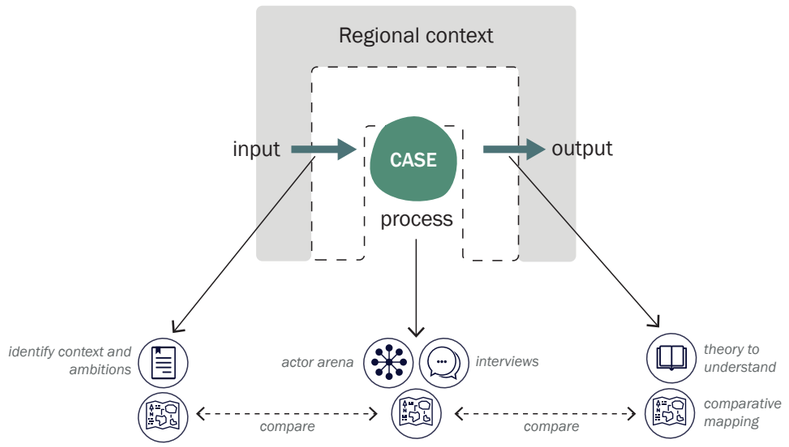


Figure 33: The different methods for analysing the focus case, studying the context, input, process and output. By mapping input and output for key documents throughtout the development process, the effectiveness of the process becomes clear. A simplified, yet similar method is used for the other two cases to make them comparable. (Own illustration, based on Heurkens, 2012)

Comparative Case Study Research

For the further research and design parts of the project, case studies are used as the main method, due to the importance of studying urban development processes as a contextualised system (Roggema, 2012). As Figure 32 shows, cases are used for different purposes throughout the research and design process. An in-depth case study (1) is compared to two reference cases (3+4) and two references (5+6), to make the findings more generalisable (Yin, 2003). Figure 33 shows that for each of the cases, the context will be studied, related to the actor arena and evolution of values over time. different methods are used to analyse input, process and output, such as comparative mapping and interviews (Figure 33).

Finally, the transition performance for each of the cases can be assessed. While each case is different, comparing their resulting case profiles (Figure 32) can be used to compare spatial, process and systemic characteristics and draw some generisable conclusions (Van Bueren et al., 2016). Understanding the process that can be translated to design principles and a theory that can be tested in the design case 2 (Figure 30), the specific approach for the design will be explained on the next pages.

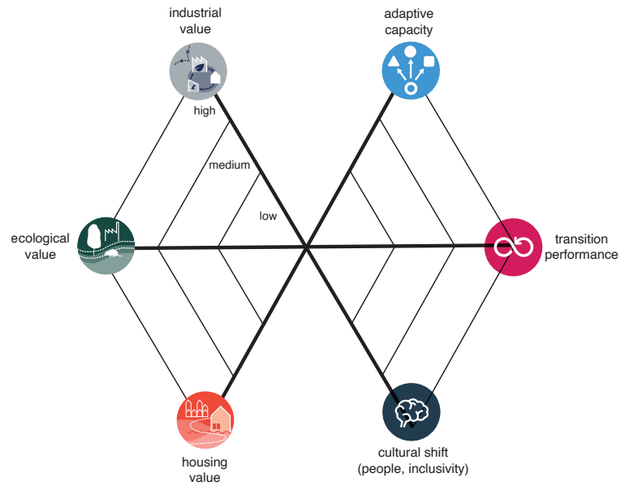


Figure 34: Mapping the performance of cases on predominant values and the way they contributed to the larger transition (each profile including intended and realised values). Using these butterfly diagrams makes the comparison between different processes more insightful. (Own illustration)

Dynamic Adaptive Policy Pathways

In the design Case 2, the conclusions from the previous stages will be tested and iterated using research by design in the Dynamic Adaptive Policy Pathways methodology. This will result in generalisable design principles; a set of actions that can be applied to multiple contexts; and a site-specific redevelopment strategy for the design location, de Staart, to use the housing crisis as leverage for a climate adaptive and transitioned area and delta region.

The Dynamic Adaptive Policy Pathways (DAPP) methodology and its products (the policy pathways map, a development strategy and implementation plan) have proven to be effective tools to support a adaptive planning paradigm in water management (Haasnoot et al., 2013). Other research showed the promising possibilities DAPP has for spatial planning (Berg et al., 2013; Van Veelen & Stone, 2013). This thesis therefore applies the DAPP methodology to the case of de Staart, studying how multiple deeply uncertain sectoral transitions, their interrelations and spatial performances can be made insightful for all actors of the power field: from decision-makers to industrial workers and from project developers to nature organisations. It will make room for complexity: “Set an overarching strategic framework, ensuring policy coherence across government and greater collaboration with business and civil society.” (Green Innovation Policy Commission, 2021)

The method consists of 10 steps, which are represented as a continuous cycle in Figure 35. As Haasnoot summarises, this integrative approach includes: “transient scenarios representing a variety of relevant uncertainties and their development over time; different types of actions to handle vulnerabilities and opportunities; Adaptation Pathways describing sequences of promising actions; and a monitoring system with related contingency actions to keep the plan on the track of a preferred pathway.” (Haasnoot et al., 2013, p. 489).

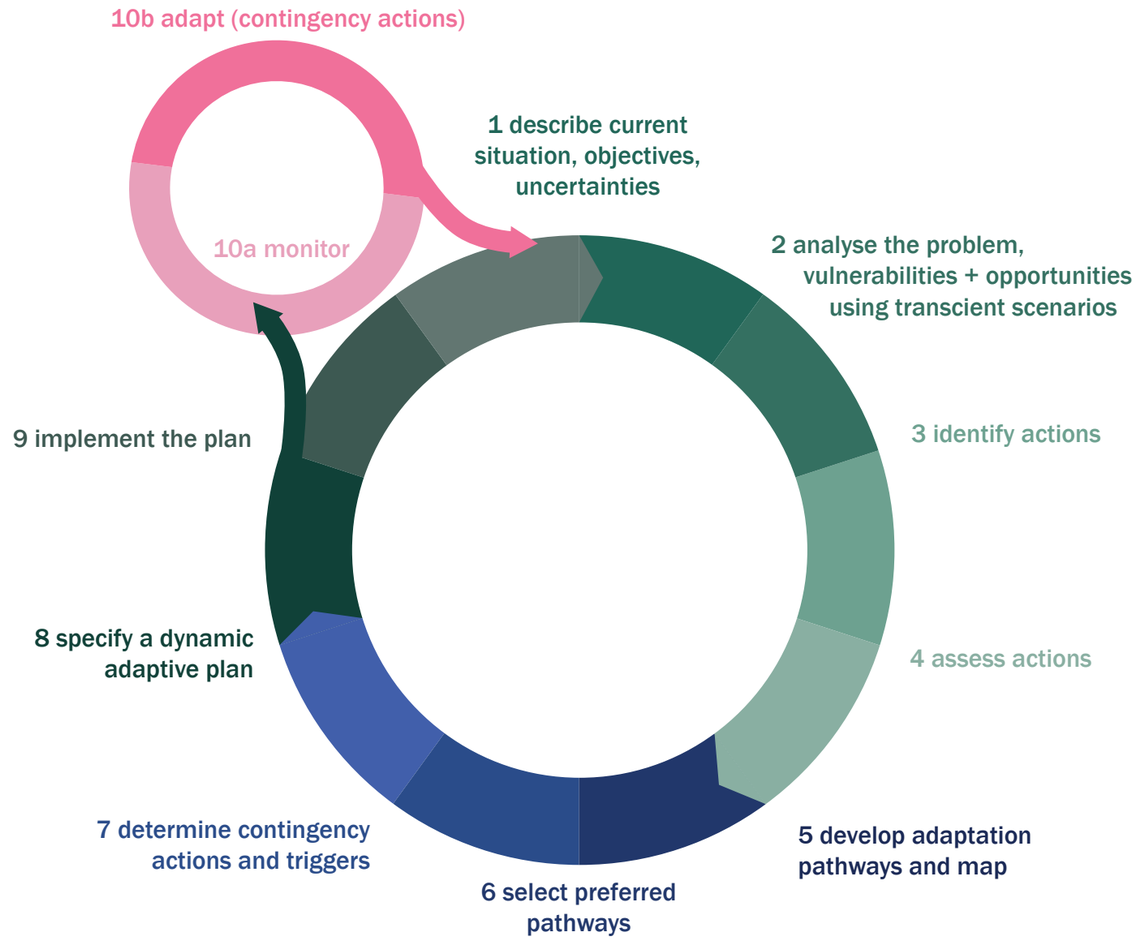


Figure 35: Dynamic Adaptive Policy Pathways method (adapted from Haasnoot et al., 2013)

CASE STUDY SELECTION

To be able to draw semi-generalisable conclusions as input for the design the selected cases need to be comparable. Therefore the selected cases all have water adaptation challenges due to their water vulnerable situation (Ministry I&W, 2021) and possibilities for adaptation (Wageningen University, 2021) and are embedded in collective regional urbanisation strategies (Verstedelijkingsalliantie, 2018) or explorative studies for future urbanisation (IABR, 2021). The specific selection criteria can be found in Appendix 1 |.

Figure 36 shows that the design case de Staart is situated in the same municipality, Dordrecht, as the main research case Stadswerven, to unsure internal and external findings can be applied and tested. Moreover, The two comparison cases, Merwe-Vierhavens and Rijnhaven, are also situated in a similar context, Rotterdam. As they are all in the same regional context, a reflection on the region's planning system will also be supported by the research. Next, to compare the existing policies for de Staart to the reference cases, the International Architectuur Biënnale Rotterdam (IABR) on de Staart was analysed as well. Finally, smaller cases were analysed that were brought forwards in interviews, using them to create a broader picture of redevelopment processes in the Rhine-Meuse delta region.

As a result, both generic academic conclusions can be drawn that support at better solving the knowledge gap while local practical solutions are used to simulate the context specific operalisation of solutions in local post-industrial port redevelopment projects, that use the housing crisis as leverage for the regional transition.

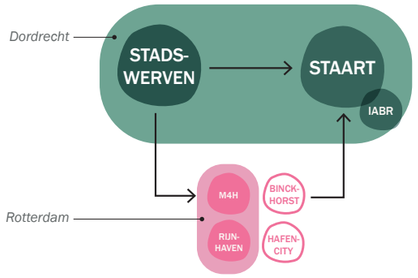


Figure 36: Comparing the different cases on their water resilient and urbanisation performances and their process. (Own illustration)

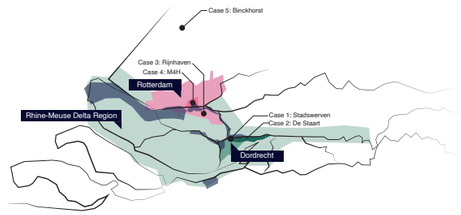


Figure 37: The cases in the Rhine-Meuse delta region. (Own illustration)

CONCLUSION

The methodology chapter has introduced the overall design of the project. It summarised how theoretical concepts can be used in a methodology to reseach, analyse and design a strategy for the redevelopment of post-industrial port sites, using de Staart as a test case. Specific methods were introduced briefly to understand the different activities taken in the graduation project. The following chapters will illustrate the application of the methodology, starting with the comparative case study research, followed by the analysis and design chapter for de Staart: first answering the sub-research questions and then answering the main research question.

04 CASE STUDY RESEARCH

Summary | The comparative case study in this chapter constructs principles for climate adaptive delta cities after identifying generalisable trends in post-industrial port redevelopment projects in the Rhine-Meuse delta region. Furthermore, expert input from the Internationale Architectuur Biënnale Rotterdam was used to further specify the biggest challenges and opportunities for the transition towards a climate adaptive delta region. The principles developed range from grounded experiments with stakeholder participation that can scale up to building on crises for momentum: briding the gap between ambitions and realisation.

Figure 38: The old water tower near de Staart is redeveloped into a hotel and restaurant that are an attractor for the region. (Villa Augustus, 2018)

RHINE-MEUSE DELTA REGION

INTRODUCTION

The chapter starts off with an introduction to the Rhine-Meuse delta region. This is followed by a summary of the case profiles. The conceptual framework is used to structure the analysis for each of the cases, answering SRQ1 about identifying strategies and making them comparable by working systematically. The full case profiles can be found in the Appendix. Next, the cases are compared, aiming to assess the transition performance of the redevelopment projects (SRQ2). Finally, the chapter concludes with principles for the design that tackle the mechanism behind more and less successful projects (SRQ3).

SYSTEM OF THE RHINE-MEUSE DELTA REGION

The Rhine-Meuse delta region is the selected region for studying the integration of water adaptation in local redevelopment projects with the aim of establishing a climate adaptive, water resilient urbanised region. The region is very vulnerable for the future effects of climate change, and will need to adapt its regional water system in the long-term. Regional adaptation pathways are already being drawn up, but the urban water management system is heavily fragmented due to the reliance on local redevelopment projects for urbanisation as well as the realisation of public goods.

Figure 39: Drierivierenpunt, where three rivers come together. Dordrecht, Papendrecht and Zwijndrecht each with their centres oriented towards the point. (Swart, 2021)

UNDERSTANDING CONTEXT

To first understand the boundaries and input created by the context of the local redevelopment project, this paragraph will outline a perspective on the historical development of the Dutch delta state, in which the Randstad as we know it today has grown.

HISTORY DUTCH DELTA STATE

The timeline in Figure 45 shows the different development stages of the Dutch delta state. Through history, the water management and delta cities evolved together: culturally transitioning from an Egalitarian (living in balance with nature) to an Individualist perspective where water management was organised by communities towards an ever more Hierarchist paradigm, where the state controls the water and nature is separated from society: seeing water as infrastructure for the port. As we are currently approaching a tipping point, the need to rethink the delta metropole's urban and water paradigm grows: having multiple pathway directions open (Deltares, n.d.).

ACTORS

In parallel, water management and the Dutch government went from intertwined to separated. After WW II and the Great Floods, urbanisation and the delta works were integrated, but this disappeared due to decentralisation. Presently water is also influenced by private actors such as the Port of Rotterdam, who use the water as infrastructure for economic and industrial activity. Currently water is managed more systemically at the unconstitutional scale of the region and urban area. Municipalities and developers are more responsible for adaptation and transition experiments. However, the interviewees did not all fully agree with this strategy in producing a dynamically resilient delta metropole.

ADAPTIVE PATHWAYS

When considering the Panarchy model of adaptive cycles, each time a different pathway is taken can symbolise a transition into a new system on the large scale. On the other hand, the entire history of delta management until now might also be seen as a single adaptation cycle, seeing all delta management strategies as a gradual move towards increased control of the dynamic delta. In that sense it is only now that we are perhaps at a turning point towards a completely different adaptation cycle, seeing the reintroduction of nature in Room for the River projects, Building with Nature concepts and adaptive redevelopment as the experimentation phase, preparing us for a larger systemic transition.

When regarding the possibilities for the future of the delta, in the Panarchy model of adaptive cycles, a large scale regional or national transition will influence projects on the local scale, while also depending on them. Furthermore, the feasibility of the pathways (seawards, protected closed/open or move along) depend on the actors in the system and their willingness and capacity to act and operationalise large paradigm changes. Water management and urbanisation have become hybrid issues, with a regional and municipal component, and an international component. In the big transitions, there is a high value of experiments, as they will show us the possibilities and challenges of different strategies (Meyer, 2016b).

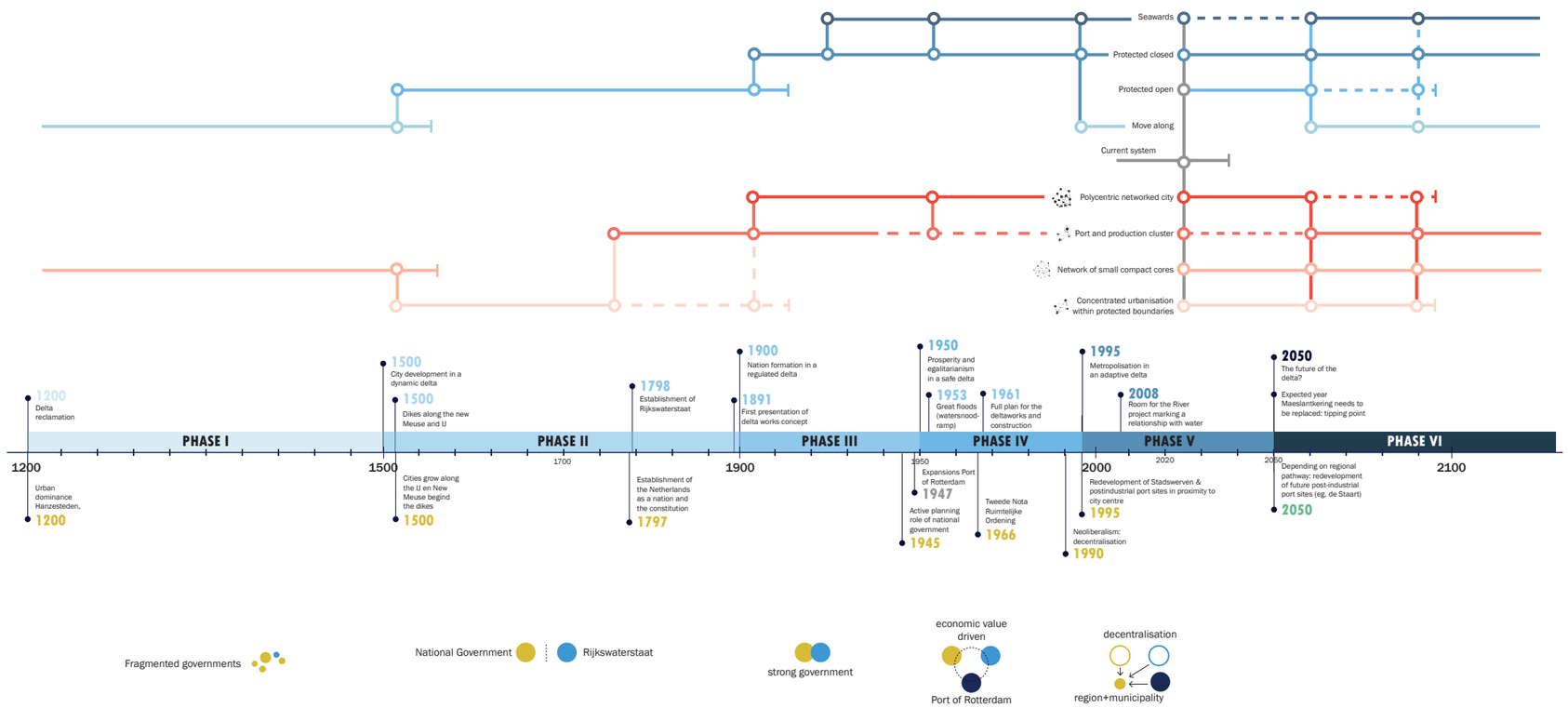


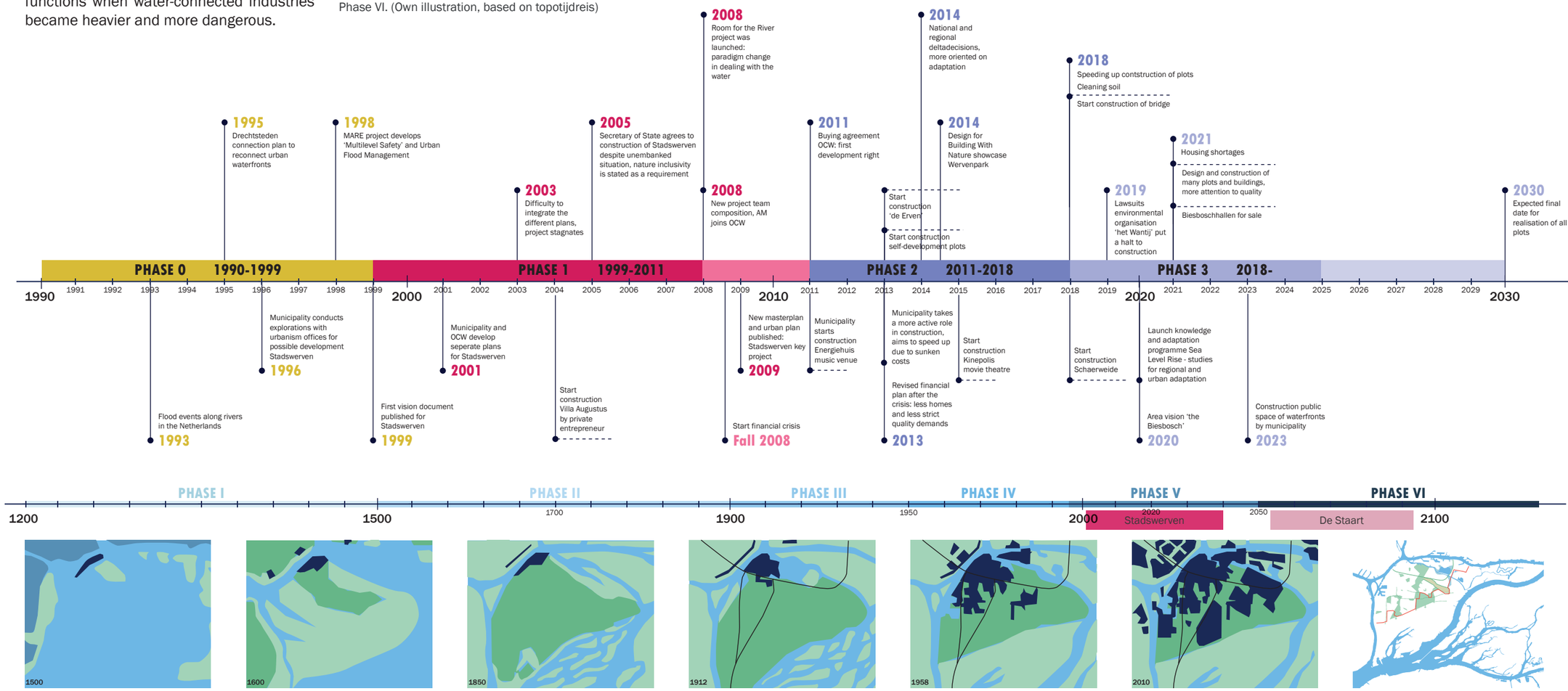
Figure 40: Timeline of the development of the Delta State, based on the book by Han Meyer (2016). The policy pathways indicate that transitions in the water management strategy are influenced by the context and take a long time to develop. Also, relationships between urban and water actors evolved over time. (Own illustration)

HISTORY DRECHTSTEDEN

Figure 42 illustrates how the island of Dordrecht came into being and how the large scale systemic changes influenced its position in the Delta and urban region. Dordrecht used to be the most important port in de delta area until the Saint Elizabethflood changed the river system radically and made the city less accessible. When rivers were dammed, Rotterdam took over its port position. Later, technology made rivers more accessible again, resulting in industrial port development in Dordrecht on the stable sandy grounds. Meanwhile, low-lying city polders were reclaimed and urbanised gradually. The railway did result in the city turning its back to the water, which was increased by the separation of functions when water-connected industries became heavier and more dangerous.

Figure 41: Timeline Stadswerven and maps illustrating green and water structure of the area (Own illustration)

Figure 42: Timeline with delta phases for the region, the maps below show the development of the water system and urbanisation patterns. Stadswerven is part of Phase V and the Staart might be redeveloped in Phase VI. (Own illustration, based on topotijdreis)



STADSWERVEN

Stadswerven was redeveloped as part of a plan to reconnect the cities around the Three Rivers Point, when a new paradigm around mixing functions and societal relationship with the water emerged: acknowledging the risks of climate change and becoming a self-sufficient city in the delta. Dordrecht connected Stadswerven's redevelopment to international knowledge programmes about Urban Flood Management, and tried to implement innovative interventions in the area.

However, the timeline in Figure 41 shows that Stadswerven's redevelopment took a long time to take flight: it started in 2000, and will likely be finished in 2030. The process stagnated a lot due to financial crises and conflicts within the collaboration. Over time, its innovative value was reduced as the market actors leading the redevelopment found it too risky and needed a return on their investment during the crisis: building traditional rowhouses. However, as the market improves, the municipality-led public space development can become higher in quality and the most recent housing developments have a higher density.

STADSWERVEN

Figure 1: Description

FACTS

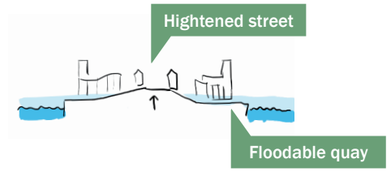
Location	**Dordrecht, the Netherlands**
Surface	**21 ha**
% water	**47%**
Housing	**1600 houses to 900 houses**
Businesses	**-**
Functions	**Café, office from home, public plinths**
Owner	**Developer combination (plot) Municipality (public space)**
Develop. stage	**Implementation, maintain**

SYSTEM

The selected focus case for the research phase is Stadswerven in Dordrecht (Figure 36). This case is exemplary of the problematics arising in the decentralised planning model facing a lack of operalisation of climate adaptation ambitions in the redevelopment of post-industrial port areas as introduced earlier. The historical study of the site establishes an image of redevelopment processes in Dordrecht in public private partnerships and supports an understanding of the different mechanisms behind integrating water adaptation and urbanisation in local projects so that they make a contribution to the regional transition and resilience. The full case report of Stadswerven can be found in Appendix 7 |.

DESIGN PRINCIPLES

- Multi-level water safety for the city
- Hightened street level, floodable quays
- Tidal park to make water experienceable by residents. Attractor for the region
- Urban quays and formal public waterfronts



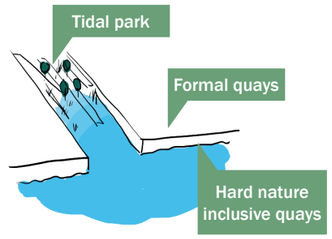


Figure 43: Stadswerven (Gemeente Dordrecht, 2021)

VALUES + ADAPTIVE CAPACITY

Over time there have been varying degrees of focus on water management (flood safety and the types of interventions for adaptation), urbanisation (housing volumes), and biodiversity (ecological zones and connections to the larger network), Figure 44.

The plans started out as what we would now call ‘more tranditional, formal urbanism’, with hard quays, high density (1000+ homes) and little attention to nature inclusivity. This evolved around 2003, when the secretary of state only allowed the redevelopment of the unembanked site if the redevelopment was nature inclusive. The plans became more green, with a Building with Nature showcase. Furthermore, a conflict around inequality between the different cities in the Drechtsteden also made the theatre for the region disappear from the plans.

Next, the financial crisis and joint vision making with the new OCW meant a revision of the urban plans. Lower density (+-600 homes) and weaker emphasis on quality made the project more feasible in the market at that time. However, a growing attention for the climate crisis and biodiversity combined with a national housing shortage does mean more quality and density can be realised in the last development parts of the area.

Nevertheless, as plans were already formalised in the past, new values and innovative and integrated adaptation solutions were not realised in the site, while it had the potential to function as an experiment for innovate water adaptation strategies. Instead a single dike and small tidal park were built to make the area water resilient. Some parts of the public space will also be floodable, but overall the main concept could be higher performative in adaptive capacity.

TRANSITION ARENA

For Stadswerven, Figure 45 gives an overview of the actors involved in the redevelopment process. The municipality took initiative for the project, collaborating with research. In later stages, the ground was sold to a developers combination (OCW). Residents were not included integrally in the area’s redevelopment process. The project also received much political attention from the college of B&W and in the public debate, as it became a key project for the city and the upgrade of its city centre and competitive position in the region and as flood management pilot. Actors in the context, such as designers, artists and residents were connected to the project at selected stages, for example when new plans were made or when a placemaking project was launched.

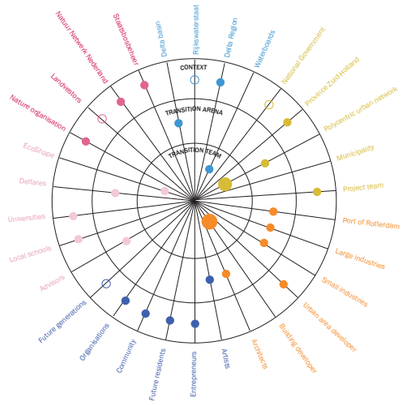


Figure 45: Stakeholder arena for Stadswerven. (Own illustration)

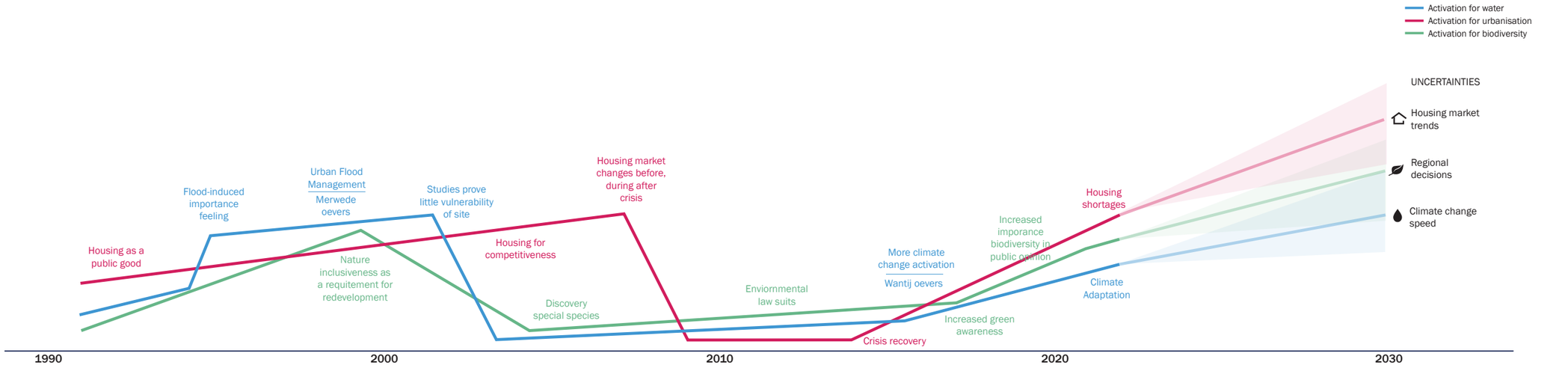


Figure 44: Timeline with different focus elements in the context and redevelopment plans. Maps for the key urban plans show urbanisation, adaptation and nature inclusive interventions. (Own illustrations)

BOX 2 | COLLABORATION IN THE REDEVELOPMENT OF STADSWERVEN

Based on interviews with actors of Stadswerven from different sectors, the actions, awareness and activation for integrating climate adaptation are now related to the stages of development. The complete summary of the answers of the interviewed actors can be found in Appendix 4 |.

The collaboration between actors started in Phase 0, when the municipality collaborated with the waterboards, province and knowledge institutions and designers to draw up plans in an open way: studying what the role of Stadswerven could be for the larger regional transitions. An international learning network (MARE) was set up, so that cities from all over Europe could learn from adaptation strategies in an international context. The concept of Urban Flood Management and Multilayer safety emerged from this phase. It was after the industrial users left the area that more actors were involved in the redevelopment process.

Architects, urban designers, water engineers, ecologists and artists were invited to play their role for the area at specific points with clear purposes. On the one hand, this was appreciated by them as there was a clear assignment. On the other hand, a landscape architect (Interview 1.3, 2021) argued that it might be better if they were included earlier on in the process: making the plans more integrated and ensuring the values they represent are embedded in the design. This does result in more complexity, but might bring more performative outcomes in the long run.

OCW was included when a first sketch was made for the area. In the beginning they operated at a distance from the municipality, which created some challenges to integrate values over time, slowing down the process. This conflict could have been resolved according to a developer (Interview 1.4, 2021) if more attention had been paid to really agreeing to certain points before moving to the next development step. Others (urbanist and politician) agree with this point, at a certain point both public and private sides had made investments in the area, and the area received a lot of public attention, and therefore they were keen to take action, despite unfavorable contextual conditions (for example a bad housing market requiring cuts in programme and quality).

Furthermore, regarding participation, the planning culture in Dordrecht is politically considered to be rather open and focused on participation as an interview with a political figure of the municipality pointed out. However, a representative of a nature organisation (Interview 1.5, 2021) was frustrated with the closed attitude of the municipality for input they did not want to hear. For example, this organisation criticised the plans and actions of the municipality for not paying enough attention to nature and laws around nature in their actions. They did attempt to discuss this with them, but the municipality was not as open to this criticism. When an urbanist from the municipality (Interview 1.1, 2021) was confronted with this, they suggested that finding the balance between different interests: the polluted soil had to be cleaned to allow for construction, but this did put a threat on the habitat of rare species. On the other hand, the politician's (Interview 1.2, 2021) opinion is not in line with his view, stating that participation is a very important dimension of Dordrecht's planning culture.

After a period of stagnation due to the crisis and challenges in aligning visions, shared vision making helped a lot to come to an agreement between the developing parties and municipality. Climate adaptation did become an important value at that time, but it was not embedded in the design at the beginning as it would involve changing plans and increasing costs. It is now that adaptation is more integrated in the designs, despite the ecological adaptive value being criticised for being only display green (Interview 1.6, 2021) and rather formal, highly urban public space . Furthermore, the adaptive value of the area is also criticised as it was expected to be an innovative testing ground, but in the end only ended up constructing a dike as the central axis of the area (Interview 1.6, 2021).

As the housing market is improving at the moment, more adaptation values can be embedded in the designs and buildings (Interview 1.1, 2021; Interview 1.4, 2021) as more funds are available. Nevertheless, for Stadswerven much of the plans was already formally agreed on (Interview 1.1, 2021), meaning that plans could no longer be adapted to changing planning paradigm contexts (Interview 1.3, 2021; Interview 1.5,

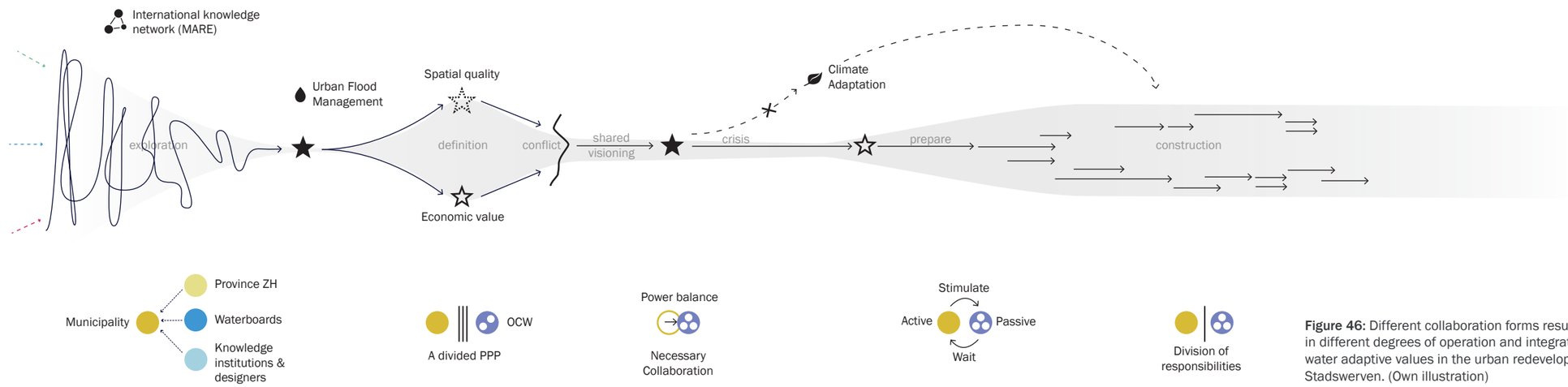


Figure 46: Different collaboration forms resulting in different degrees of operation and integration of water adaptive values in the urban redevelopment of Stadswerven. (Own illustration)

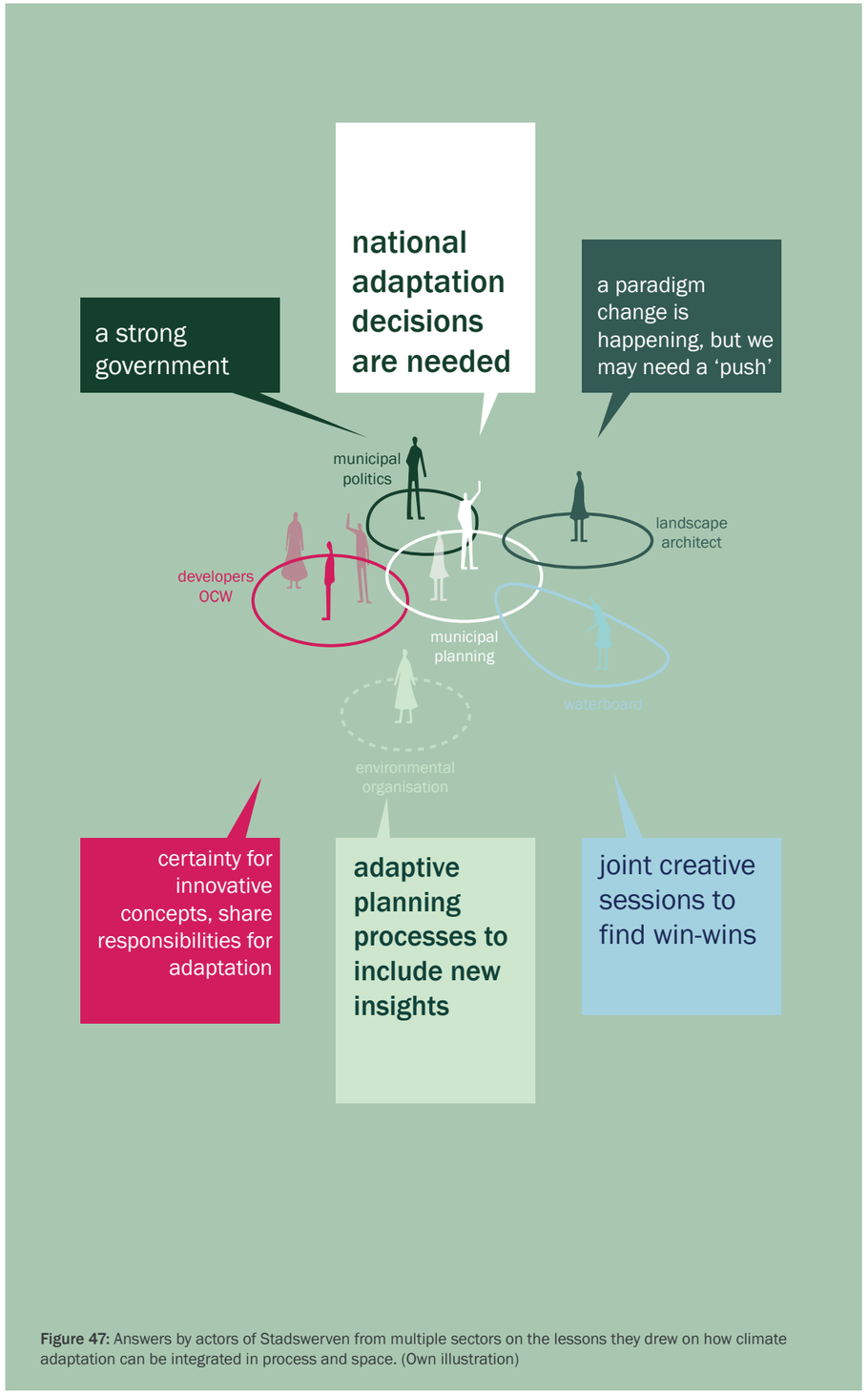


Figure 47: Answers by actors of Stadswerven from multiple sectors on the lessons they drew on how climate adaptation can be integrated in process and space. (Own illustration)

FINDINGS INTERVIEWS ACTORS

A more in-depth description of the findings can be found in Box 2 | and Appendix 7 |, but the key-take aways are summarised below.

Lessons for climate adaptation:

- Identify core goals for the area, to check performance of projects. Keep adapting plans to changed context and new insights, but avoid becoming reactive
- Ensure rights for future generations and nature with a representative in the process
- You need to embed some quality values in development rules, to ensure private actors realise them

Collaboration/process lessons:

- Personal relationships and trust are important. External actors can mediate
- Open and complex over closed and fast. Find conflicts and synergies early on. Creativity in joint-problem solving
- Find short-term wins in long-term projects, urbanists can be the guardian for the long-term

Transition lessons:

- Central actor to steer for regional pathway, which interacts with local projects
- Cultural shift is slow, but you can push/ stimulate people to embrace their stewardship for climate adaptation.

RIJNHAVEN

FACTS

Location	**Rotterdam**
Surface	**25 ha**
% water	**80%**
Housing	**2.500**
Businesses	**-**
Functions	**Restaurants, cafés, offices**
Owner	**Private (plots) & municipality (water+public space)**
Develop. stage	**Design, near implementation**

SYSTEM

The Rijnhaven is a former port area in close proximity to the city centre of Rotterdam. As the timeline shows, its redevelopment process had three phases. Each phase and its main climate adaptation and urbanisation actions will be summarised in connection to the management form, before reflecting on the adaptive capacity of the process and evaluating the contribution to a cultural change and the larger transition in the planning system.

CONTEXT

Around 2000 “technological advancements made it possible to move many port-related activities out of the area and farther out of the city, gradually hollowing out these harbours’ port-related economic foundations and opening opportunities for new uses and imaginaries.” (Jansen et al., 2021) The municipality of Rotterdam uses these sites to expand its housing stock while also improving the liveability of the city through the rediscovery of the urban waterfront. Despite the external ambitions, the redevelopment processes face multiple complexities resulting from the site specific characteristics are similar across most post-industrial sites: soil contamination, sound contours, landownership, etc. (Hobma, 2013).

DESIGN PRINCIPLES

- Reconnecting city with water
- Innovating with process and built environment, not always successful but lessons learned are valuable
- Adapting plans to include new values, such as ecology
- Connecting private investments in big residential programme and public investments to build high-end public space for the city, though it required a large proportion of public investments as well

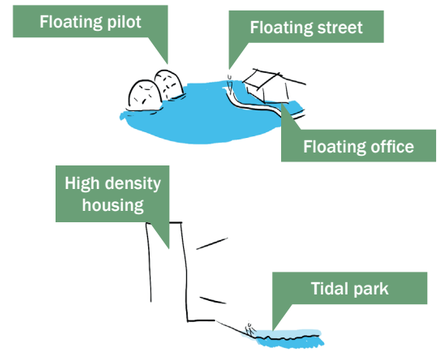


Figure 48: Rijnhaven, Rotterdam. (Barcode Architects, 2020)

BOX 3 | REDEVELOPMENT PROCESS OF DE RIJNHAVEN

The Rijnhaven is a former port area in close proximity to the city centre of Rotterdam. As the timeline shows, its redevelopment process had three phases. Each phase and its main climate adaptation and urbanisation actions will be summarised in connection to the management form, before reflecting on the adaptive capacity of the process and evaluating the contribution to a cultural change and the larger transition in the planning system.

PHASE 1

During the Kop van Zuid- (1980's) and the CityPorts (2004) planning programmes, the area gained interest for transforming to for economic redevelopment purposes. By redeveloping the port and its direct surroundings and quays, the city wanted to attract high-income groups and international companies and change Rotterdam's image.¬¬¬¬ Here, the ambitions for water resilience were high as well, the aim was to build a floating neighbourhood on the Rijnhaven and open up the possibility to walk around the port inlet, (a)Round Rijnhaven.

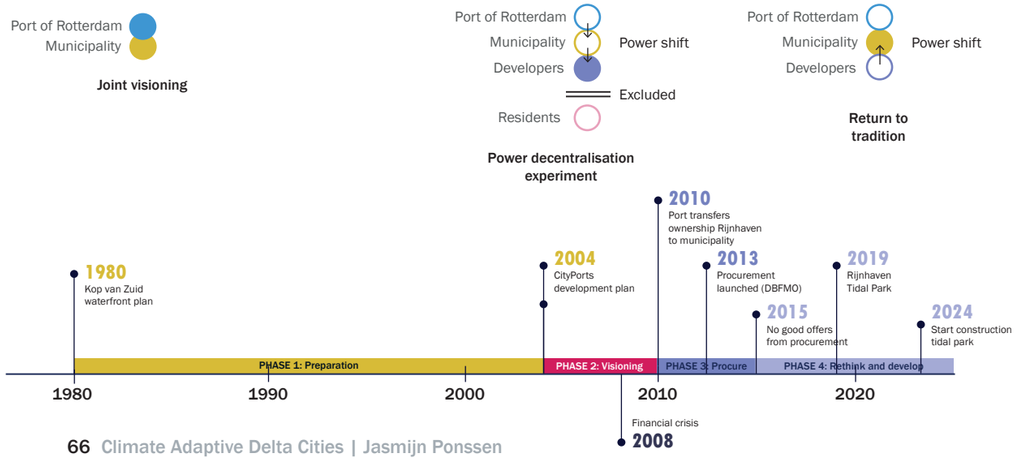
The CityPorts programme set high ambitions for sustainability, revolutionary delta technology and innovative approaches to area development (Programmabureau StadshavensRotterdam, 2011 in Ernst et al., 2016). To launch the project, placemaking initiatives and an experimental floating pavilion was constructed in an open and learning collaboration between knowledge institutions, municipality, private companies and local stakeholders. Despite resistance of local companies, its realisation resulted in new NEN norms, guidelines for other floating development.

PHASE 2

The financial crisis marks the beginning of the second phase: the (a)Round Rijnhaven would not be realised due to a "cooling-down of the city's economy because of a lack of area developments" (Ernst et al., 2016). In response to the crisis, the municipality launched a procurement for the whole Rijnhaven, without setting strong demands for a floating development but focusing on waterfront development that contributed to improving quality of life.

PHASE 3

Nevertheless, there were no feasible offers for the redevelopment of the whole area under a 30 year DBFMO contract, which forced the municipality to take more control of the project. The water adaptive and urbanisation concept shifted towards a different focus. In the end, a tidal park will be realised that also contributes to biodiversity as an important new public value. The park will be paired with three high-rise towers, which should express the allure of the city (SITE, 2021). Ernst (2016) criticises the procurement procedure for being closed (due to existing procurement policies), and inhibiting participation of local stakeholders and residents.



BOX 4 | TRANSITION PERFORMANCE RIJNHAVEN'S REDEVELOPMENT

In this box, the transition performance is analysed for different elements of the urban area redevelopment project. The interventions are connected to De Haan and Rotmans' (2011) typologies of adaptation and transitions, which are explained in the Theory chapter.

(a)Round Rijnhaven

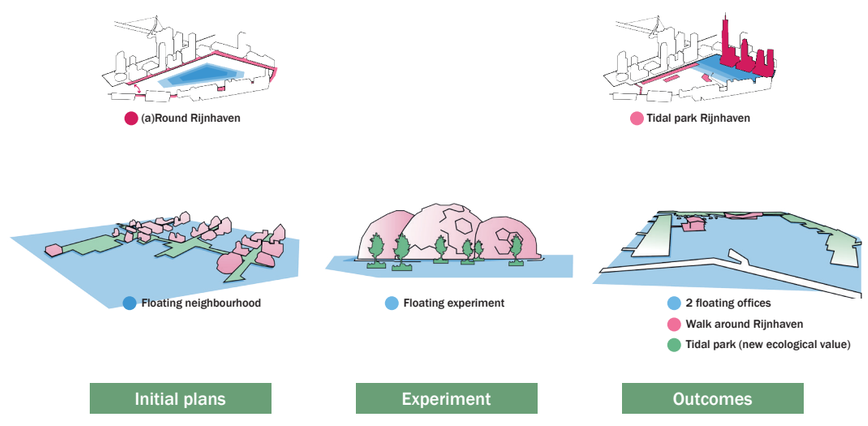
The main aim of the (a)Round Rijnhaven project was strengthening socio-economic characteristics of the area and city, the focus was initially not on sustainability and innovation. Furthermore, the management was semi-innovative, a collaborating role of municipality with other local regime actors. As a result, it is more a re-organising project, adapting the roles and spaces of the current system.

Floating Pavillion

The floating pavilion had the aim of transitioning to sustainable urban water management. Innovation concerned both physical and management dimensions and a new culture of open participation was used for the area. It employed a top-down and bottom-up approach simultaneously. Scaling-up was resisted by the regime, and only occured in a different location. The project was supposed to be a substitution of the existing system, but failed to scale up and become the new mainstream: a backlash. The backlash was partly caused

Figure 50: (left) Development process of de Rijnhaven and collaboration forms. (Own illustration)

Figure 49: (below) Plans - experiment - outcomes for de Rijnhaven. (Own illustration)



by financial issues but mainly by the procurement procedure (which was an innovation adaptation). The procurement asked for both innovative spatial (urban area) solutions and process concepts (development). This combination, asking the existing regime to reform according to the structures of an outside constellation can be called a radical reform. However, due to existing legislation the project became isolated to the project, a lock-in, not becoming part of a larger transition any more. As the project in the end did not result in sustainable urban development or area, it can be called a collapse: "the attempted re-constellation did not lead to a new stable societal system" (Ernst et al., 2016)

Tidal Park

The tidal park was planned top-down, regime has changed and climate adaptation is more mainstream, an teleological transition pattern. Municipalities have learned from different kinds of experiments and 'shop' from the catalogue of options to finally decide a type of intervention and management form that suits them.

Choosing a tidal park can be linked to branding the new inner-city part, as ecological value has become increasingly important to the public, making the sustainable intervention contribute to the socio-economic aims of the city as well as the urban sustainability transition.

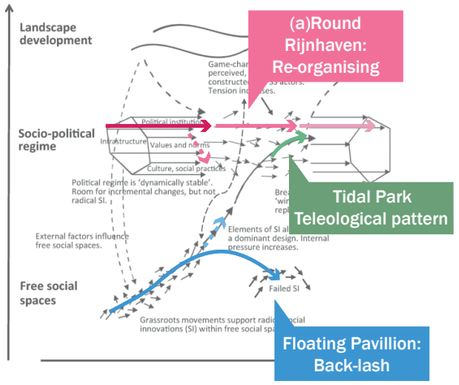
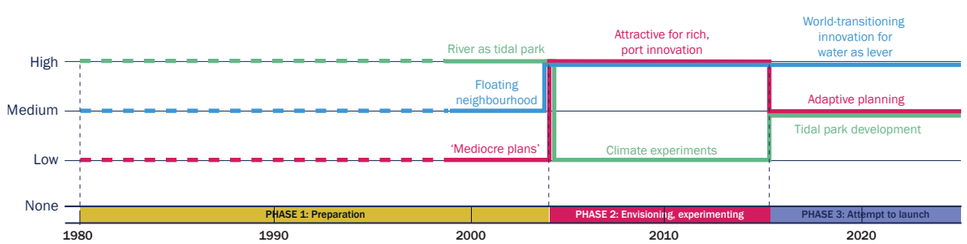


Figure 52: (above) Transition typology patterns for different interventions in the Rijnhaven. (Adapted from Geels & Schot, 2007)

Figure 51: (below) Evolving values over time. (Own illustration)



CASE CONCLUSION RIJNHAVEN

In terms of starting a larger transition, the Rijnhaven redevelopment was not very effective internally. Rather than spatial and social innovation, economic development became the most important driver. While the Rijnhaven will in the end be adapted to climate change, the project does not have the desired effect on urban and regional cultural and systemic transitions: for which new modes of governance and spaces would have needed to emerge. McCormick (2013) suggests that there were ambitious goals, which were not realised due to a lack of communication and harmonisation with neighbouring interest groups and future owners. The failed procurement showed that it "is only through collaborative action that urban sustainability projects can be effective" (McCormick, 2013).

Furthermore, the niche developments (experiments) in the Rijnhaven failed to scale-up and generate radical innovations due to obstacles in the transition process. First, scaling of the floating development was not achieved as essential requirements were not met: financial means, institutional and political reform, security of public support and cultural legitimacy (Geels, 2013 in Ernst et al., 2016). Second, a niche location can offer protection and generate radical innovations. In Rijnhaven, this was not the case as it was part of a large inner-city development where the stakes were high. Rotmans (2011) "advocates 'reduced regulation' areas for transition experiment". Ernst (2016) suggests that M4H and RDM, other CityPort areas, may provide better opportunities for experiments.

MERWE-VIERHAVENS

FACTS

Location	**Rotterdam**
Surface	**190 ha**
% water	**36%**
Housing	**5.500-6.500**
Businesses	**New makers, creatives**
Functions	**Diverse public programme**
Owner	**Complex ownership, private and public**
Develop. stage	**Design, partially implementation**

SYSTEM

Merwe-Vierhavens (M4H) is an industrial area wedged between Rotterdam and Schiedam, and it covers an area the size of the city centre of Rotterdam. The site has a different position in the city than Rijnhaven but its redevelopment into an innovative climate adaptive mixed-use area was also part of the CityPorts programme since 2005. The redevelopment process of M4H can be divided into three main phases, as the timeline shows, which is described in Box 5 |. Finally the adaptive capacity and transition contribution of the project is assessed before comparing it to the Rijnhaven and Stadswerven and findings from other reference projects.

DESIGN PRINCIPLES

- Adaptive spatial framework
- Guiding principles for development
- Start transition with experiments in niches
- Private-sector led development motivated by inspiring images for the future. It can take some time, but it builds the foundation for innovative actions

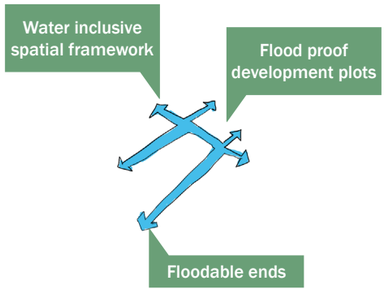


Figure 53: Soundport in Merwe-Vierhavens. (Hanswijk, 2016)

BOX 5 | REDEVELOPMENT PROCESS OF MERWE-VIERHAVENS

The research for Merwe-Vierhavens' (M4H) relied on previous research, combined with an interview with Emiel Swinnen, from the Lanscape architecture firm DELVA. M4H's redevelopment process can be described using three phases.

PHASE 1

Initially, plans were drawn up for the future of post-industrial port areas in Rotterdam by the municipality and port authority. However, conflicts about the division of responsibilities prevailed, and the outcomes were considered 'too mediocre' for Rotterdam (Frantzeskaki & Loorbach, 2013). As a result, it was decided to work towards a more innovative strategy for the port areas. In large and diverse teams (over 100 stakeholders from different sectors), strategies were drawn up for the area to envision the future for the area. After many explorations for this sub-area of the larger plan, experts from diverse fields created building blocks for innovative urbanisation concepts, supported by a transition team (DRIFT & Doepel Strijkers Architects (DSA)).

The outcomes of their design was that the municipality needs to actively steer towards 'value creation'. DRIFT and DSA concluded that the communication of which image M4H should have is very important in gaining interest of investors. When the identity and the climate robust spatial ambitions are aligned, you are more likely to succeed in creating an innovative area.

PHASE 2

The CityPorts programme (2004) International Architectuur Biennale Rotterdam (2005) marked the start of searching for the identity, spatial configurations and position in the urban system for M4H. While the current industrial users were also rethinking their business and the municipality was collaborating with the Port of Rotterdam to understand the potential of the site, experiments by external creative actors were also promoted in 'Free Zones'.

The searching phase resulted in the Gebiedsplan Merwe en Vierhavens gebied (2009), which focused on interweaving climate adaptation with an attractive environment for rich professionals for economic development. The following key points emerged:

- Re-inventing delta technology;
- Volume and value (more efficient industries, knowledge intensive high-end productivity);
- Crossing borders (city and port in proximity in synergy, remove barriers);
- Floating communities (quality for all Rotterdammers);
- Sustainable mobility (different, clean transportation modes). (Projectbureau Stadshavens Rotterdam, 2009)

PHASE 3

Finally, the last stage was marked by the Ruimtelijk Raamwerk, that was a co-creation by a joint project team of the municipality Rotterdam and the Port of Rotterdam (the Makersdistrict), which was supported by designers as mediators (Swinnen, 2021). This strategy acknowledges the complexities resulting from stage in which the shift from current use towards future uses should occur; underlines the challenges posed by all the transitions the city faces; and emphasizes the role M4H's redevelopment should have for the city as a whole in the larger shift towards a more sustainable society. Moreover, the plan describes principles and identity and can be used adaptively, rather than a masterplan, meaning there is enough space for flexible development and the reception of innovation (Swinnen, 2021). This strategy was not a masterplan with a linked businesscase: but an open invitation to participate in the redevelopment of M4H (Peek, 2015 in Peek & Stam, 2019), an organic development strategy.

While some experiments are emerging and first plots are being redeveloped, the organic redevelopment of the site is going slowly. Swinnen (2021) explains that this might be the effect of a too passive attitude of the municipality. For example, Mercedes Benz worked on a proposal for the redevelopment, but saw too much uncertainty and risk in the project and backed out in the end.

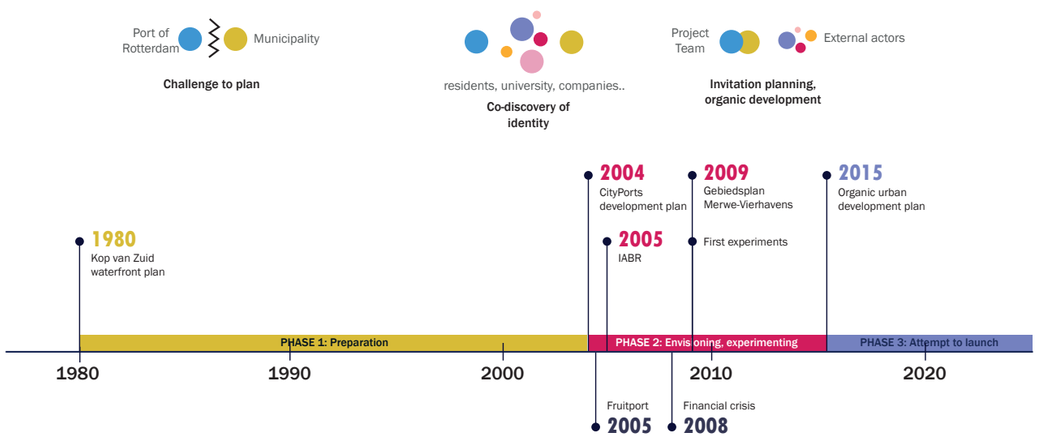
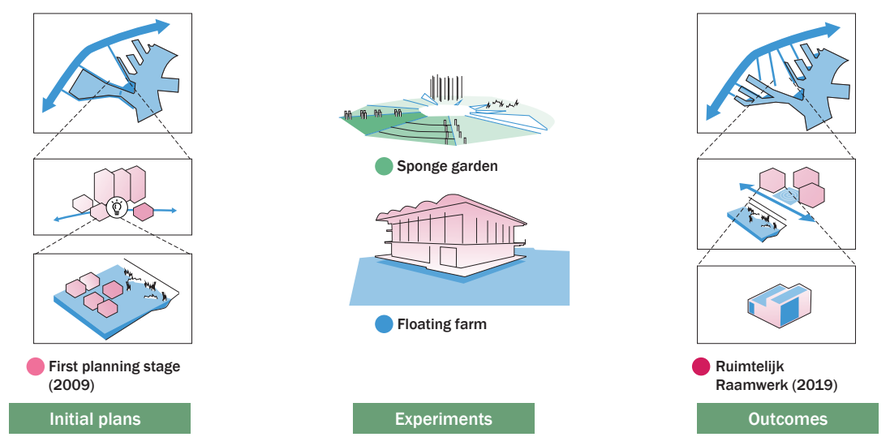


Figure 55: (left) Development process of Merwe-Vierhavens and collaboration forms. (Own illustration)

Figure 54: (below) Plans - experiment - outcomes for Merwe-Vierhavens. (Own illustration)



BOX 6 | TRANSITION PERFORMANCE M4H'S REDEVELOPMENT

In this box, the transition performance is analysed for different elements of the urban area redevelopment project. The interventions are connected to De Haan and Rotmans' (2011) typologies of adaptation and transitions, which are explained in the Theory chapter.

Experiments

In the first stages, joint visioning resulted in a shift in perspective: it helped to find innovative solutions (watersquare) and to understand feasibility (floating pavilion), it also changed perspectives (from water as a threat to an opportunity). Multiple experiments have been developed, as niche innovations in 'Free Zones'. The projects are however niches within an urban context, their capacity to scale up and/or influence the city and community of practice is still uncertain. A more open approach might be needed, offering "opportunities for new connections between water and other issues: rather than seeking to convince other domains that water is a really important issue, it might be more fruitful to actively seek for openings in other sectors and networks to present water as an opportunity." (Frantzeskaki & Loorbach, 2013)

Spatial Framework

Nevertheless, there has been a radical revolution, which is a transition in the larger regime that results from emerging values around adaptiveness, flexibility and collaborative planning: the ruimtelijk raamwerk means municipalities, developers and the port re-position themselves to facilitate other initiatives. An innovation in planning culture was actively taken (regime) to facilitate innovative initiatives (niches). Furthermore, the framework embeds innovation in the site's identity, which steers innovation in the right direction. To support the innovative and climate adaptive identity of the site, the project team does take some intentional actions, such as developing a tidal park.

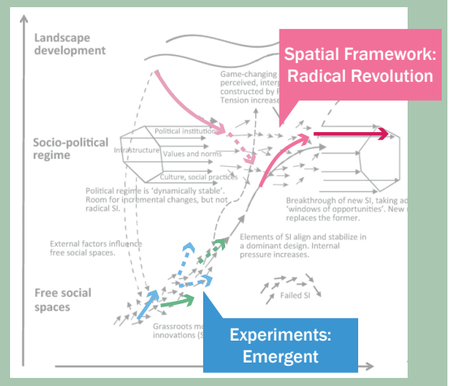


Figure 57: (above) Transition typology patterns for different interventions in M4H. (Adapted from Geels & Schot, 2007)

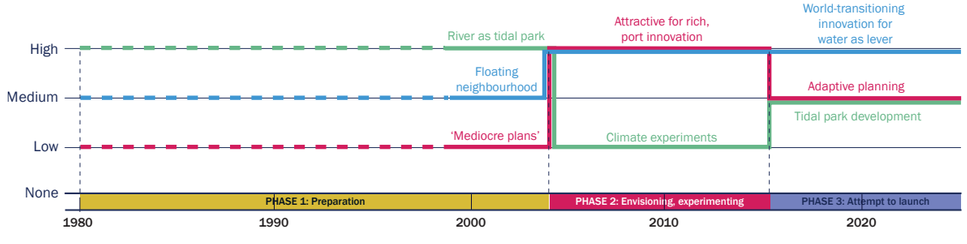


Figure 56: (below) Evolving values in the redevelopment process of M4H. (Own illustration)

CASE CONCLUSION M4H

Over time, the ambitions for making M4H contribute to a larger systemic transition influenced both the processes, plans and spatial developments. External and internal push factors resulted in innovations in niches, which have the potential to scale up in the future due to the adaptive planning framework and organic development strategy. These experiments have the potential to scale up and cause a transition (here or elsewhere) due to: (1) their real-life setting: they are not externalised from reality, (2) the parallel evolvement of spatial form and governance structure and (3) the research attention the project receives means that other locations can also learn from the project and adopt the adaptive paradigm.

By combining strategic planning interventions and bottom-up initiatives and innovative urban concepts (based on niche projects), the joint-venture of municipality and Port of Rotterdam discover the future identity for the site in co-creation with local actors and residents. The collaborative visioning and experimenting lies the foundations for a future port and city interaction where "people are pulled in rather than pushed out" (Jansen et al., 2021), searching for an integral vision with diverse pathways and short-term actions and their co-benefits (Frantzeskaki & Loorbach, 2013). Furthermore, by establishing a broad team, the electorally attractive concerns might be avoided of becoming priority in the redevelopment, as the interests of stakeholders from diverse sectors need to be taken into account. The Ruimtelijk Raamwerk enhances the adaptive capacity of the area, making it less vulnerable to external crises.

The question remains whether the adaptive capacity might be too high and the municipal attitude too passive, as the realisation is moving only slowly. Opposingly, taking time to discover the identity and opportunity different projects have for increasing value for the city will increase quality and long-term sustainability (Frantzeskaki & Loorbach, 2013; Meyer, 2016). Furthermore, a new division of responsibilities should come along with the new planning model, and the responsibility for adaptation are still vague. The national government might need to set legislation to support adaptive capacity integration (Swinnen, 2021) and more long-term, flood-risk based business cases (Veerbeek et al., 2010 in Francesch-Huidobro et al., 2017). Finally, it might also become the responsibility of designers to critically advocate climate adaptive capacity in urban designs (Swinnen, 2021).

INTERNATIONAL ARCHITECTUUR BIËNNALE ROTTERDAM: DE STAART

FACTS

Location	**Dordrecht**
Surface	**450 ha**
% water	**38%**
Housing	**7.000 - 12.000**
Businesses	**Industry, energy, waste**
Functions	**Start-ups, businesses, bio-based industry**
Owner	**Private ownership**
Develop. stage	**Initiative, exploration**

SYSTEM

De Staart is a post-industrial area on a sandbank north of the island of Dordrecht, and is the extension of Stadswerven to the east. It is situated on a sand bank between the river Beneden Merwede and the smaller Wantij river, which links the national park the Hollandse Biesbosch to the Merwede and larger ecological structure. De Staart is gaining pubic attention due to its possibilities for urbanisation, water safety and ecological connections in redevelopment (IABR, 2021; Gemeente Dordrecht, 2021). The area is still in the initiative stage and therefore the strategy recommendations of this project can be valuable for future development, enhancing the transition performance of this regional pilot.

The IABR atelier Dordrecht focused on the redevelopment of de Staart, using water safety as leverage (Figure 58). The overall project and its six sub-projects were studied in depth to understand the existing strategies for the area and planning approach the municipality of Dordrecht is taking to redevelop the site, seeing the IABR as a large workshop on adaptive redevelopment of a post-industrial site.

DESIGN PRINCIPLES

The IABR designs were studied as if it were a workshop that was part of the study: analysing the outcomes; assessing their characteristics; interviewing the main designers about their design; and brainstorming with them about future realisation of their climate adaptive redevelopment projects, which were grounded in realism. The findings can be found in Appendix 5 | and are summarised in the profiles on the next pages.

CONCLUSIONS

The following overall conclusions can be made about the IABR:

- Feasibility and realisation strategies are easier for plots/buildings than for axis.
- Adaptability and long-term thinking did not concern itself with dynamics and changeability under uncertainty, but mostly involved robust design concepts.
- The biennale actors did not consider the larger context and regional adaptation decisions (especially the architects).

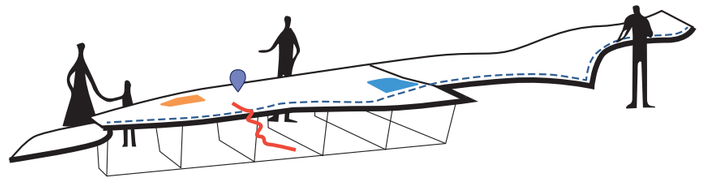
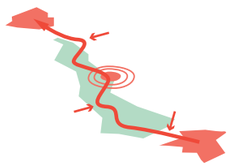


Figure 58: Adriaan Geuze presenting around a model for de Staart with the different sub-projects at the Internationale Architectuur Biënnale Rotterdam (IABR) Atelier de Staart: Water safety as leverage. (Stichting de Stad, 2021)

Figure 59: Model of de Staart at the exposition in Dordrecht during the summer of 2021. (Own illustration)

CHOOSING FOR CONNECTION
VenhoevenCS Architecture + Urbanism

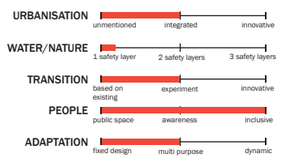
Concept



Description

A bridge crossing the entire island of Dordrecht as an evacuation route while also connecting different parts of the city in the day-to-day life. “The elevated climate-adaptive escape route forms a special cycling and walking path through the treetops of Stadspark XL, provides safety after a flood, bridges barriers within the city, and connects De Staart across the Wantij with the city.” (IABR, 2021)

Analysis



How to Realise?

See it as an evacuation infrastructure investment.

Start with a prototype at critical site (disconnected neighbourhood)

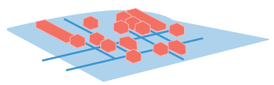
Realise public programme at the ends as destinations.

Make use of the landscape and other urban plans: a degree of realism makes plans more appealing.

(Interview Martijn Tjassens Keizer, VenhoevenCS, 2021)

LIVE ON THE WATER
PosadMaxwan

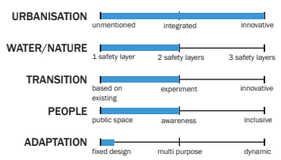
Concept



Description

A high density neighbourhood surrounded by high quality public space. A diverse urban fabric results in a self-supporting, lively area (energy production, new mobility types, amenities, school). Inclusive as it should be accessible to all, rather than other floating neighborhoods, which can be enclaves for the rich (IABR, 2021)

Analysis



How to Realise?

Find a closed businesscase for the more expensive public space as well. Flood-proof houses can become more affordable when you include flood risk.

More long-term, large scale planning.

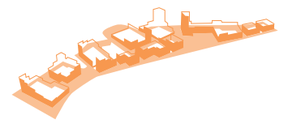
More freedom and flexibility with legislation to densify underused areas.

Participation with future users, as current users fear change.

(Interview Rients Dijkstra, PosadMaxwan, 2021)

START WITH THE OUTDOOR SPACE
Studio Donna van Milligen Bielke and Ard de Vries Architects

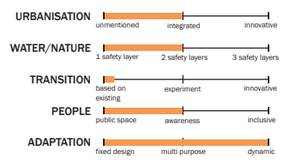
Concept



Description

Outdoor space should be the leading principle for the development of De Staart. Outdoor space should have a dual function: for public space and as evacuation infrastructure in case of flooding. (IABR; Van Milligen-Bielke, 2021)

Analysis



How to Realise?

- Creative images to convince.

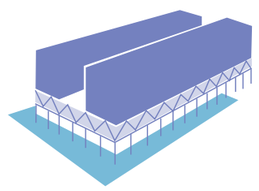
- The municipality needs to want something for an area: eg. be very convinced about public space quality.

- The need of an evacuation space for the island makes the realisation of the project important (business case).

(Interview Donna van Milligen Bielke, Studio DVMB, 2021)

BUILD FOR FLEXIBILITY
EGM architects

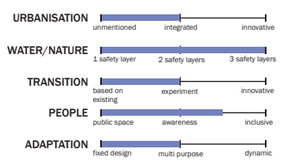
Concept



Description

A multi-purpose buildingblock typology that includes three layers: a floodable ground floor for start-ups; a mixed-use first floor that can also function as evacuation space; and housing programme on top. (IABR, 2021) The structure as a masterplan, adaptable uses resulting in a resilient and inclusive community (Balajti, 2021).

Analysis



How to Realise?

Participation of municipality and developer for shared goals and values

Sustainable design for a realistic price

Layering goals to find synergies

Start off with placemaking events, catalysing buildings and public space that invites people to discover the place, municipality should prepare the site

Strive for a unique identity for Dordrecht

(Interview Zita Balajti, EGM, 2021)

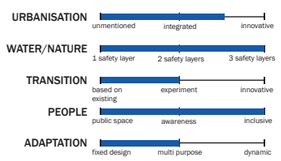
INCREASE POTENTIAL
West 8

Concept

Description

A Ruimtelijk Raamwerk that connects Dordrecht to the region, connects areas of the city and connects the city and land: using transitions and goals of today as lever. The route along the Wantij makes nature accessible and links different public buildings that gain regional importance as well. By making these places part of daily life, people will know how to find them in case of a flood event. (IABR; van der Pluym, 2021)

Analysis



How to Realise?

- Use momentum of crises (corona, floods).

- Start with the easier industrial places (Wantij and west industry).

- Start by addressing local problems in the problem areas (south).

- The need to make prototypes to show it is feasible.

- SDG’s give ammunition to load interventions.

- Adding layers of meaning to convince.

(Interview Marco van der Pluym, West8, 2021)

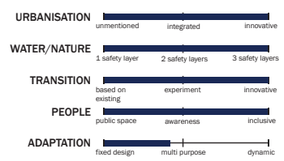
START DE STAART
Gemeente Dordrecht

Concept

Description

The Gemeente Dordrecht (Ellen Kelder in particular), participated in the biennale to launch the debate around the future for de Staart. The project generated ideas; resulted in public and political attention; and gave rise to new research agendas and developments that contribute to using transitions (eg. water safety) as lever for positive development of de Staart. (Kelder, 2021)

Analysis



How to Realise?

- Organic development: seize all opportunities in the right direction

- Participation projects for industry and residential areas

- Connect to research as a national pilot project to solve problems and attract attention

- Zero-regret actions now that improve liveability today and improve conditions for development in the future

- Do not wait for a regional adaptation decision, it will be too late. (Kelder, 2021)

CASE STUDY RESEARCH

CROSS-CASE COMPARISON

This section compares the four cases to answer the first three research questions. The findings were also compared to reference cases discussed by the 15 interviewees to produce more generalisable findings.

SRQ1: What water vulnerabilities and urbanisation challenges lie ahead for the Rhine-Meuse delta region and its post-industrial port sites and what strategies and plans are drawn up to address them?

The cases have different positions in the region. The Rijnhaven and Merwevierhavens are both situated in the same delta and polycentric urban region: the Rhine-Meuse estuary and the south of the Randstad. In comparison to Dordrecht with de Staart and Stadswerven their position is a bit more downstream towards the sea, and more in the centre of the metropole region. The climate adaptation threats and urbanisation agendas are therefore slightly different, the area is more under the influence of the sea, and its housing market is more under pressure. Due to decentralisation in the Netherlands, municipalities are increasingly responsible for adapting the region to the growing housing demand and water pressures: safeguarding long-term water resilience, while also responding to current crises.

Furthermore, the comparative case study analysis shows that in many (post-)industrial port areas each of the cases took a unique approach to integrate climate adaptation to the uncertain threats of the climate crisis and housing to lighten the pressured housing market. Different coalitions of stakeholders are reinventing the future port-city relationship. In reconnecting the city with water, the ports and industry, the waterfront is also rediscovered, making water a connected part in society. Some cases (Stadswerven and Rijnhaven) replace the industry completely, while others attempt to reintegrate (future) industries in the urban fabric (M4H, Binckhorst and de Staart). Furthermore, to realise the developments, each case had a different management form: from hierarchist to egalitarian and individualist, which each showed their own effectiveness in achieving the project's innovation ambitions. Due to the differences between the cases, the research cannot conclude with an exact explanation for mechanisms behind adaptive capacity, having a contribution to the larger transition and influencing the cultural shift. Yet, some conclusions can be drawn about recurring themes that provide a direction for interventions in the planning system and urban area redevelopment processes to make climate adaptive redeveloped port sites more mainstream.

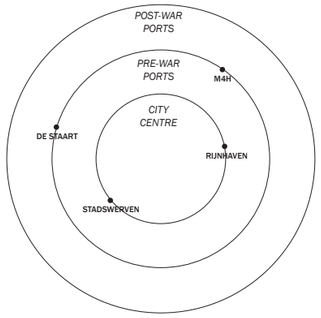


Figure 62: Case's position in the network.

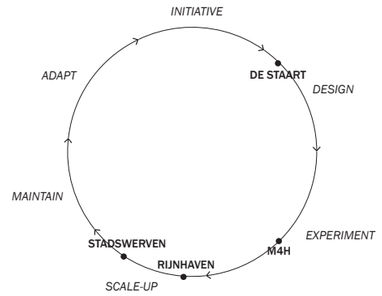


Figure 63: Development stage of cases.

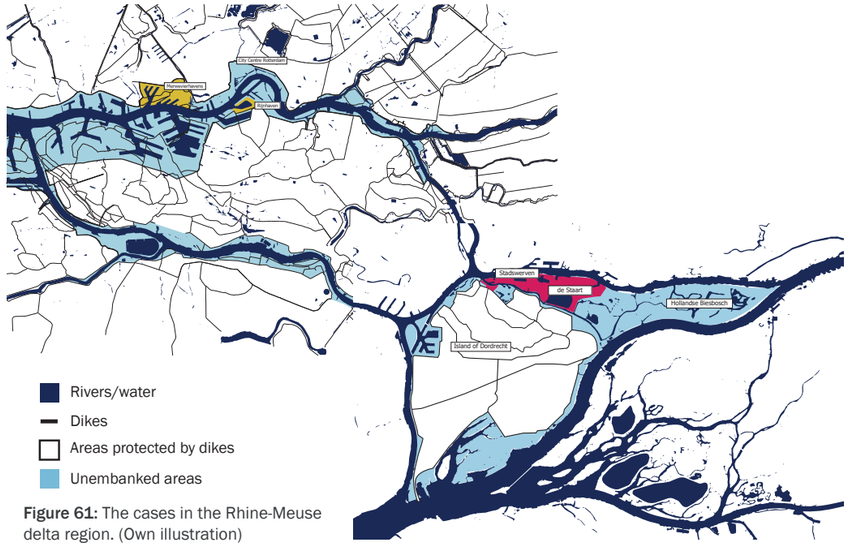


Figure 61: The cases in the Rhine-Meuse delta region. (Own illustration)

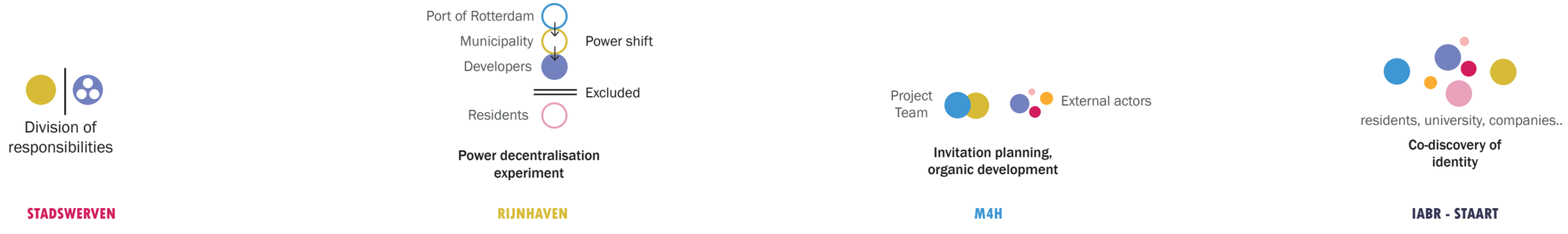


Figure 60: Different collaboration forms in the cases. (Own illustration)

CROSS-CASE COMPARISON

The four cases represent four projects where climate adaptation and urbanisation played a large role. Figure 65 shows that differences can be found in the six elements of the framework, represented as butterfly diagrams. The cases differ internally over time (intentions vs outputs) and in comparison with each other.

SRQ2: How well do recent urban redevelopment strategies in cases perform in contributing to the transition towards a climate adaptive delta region?

Balancing Values

Each of the cases had its own balance between industry, housing and ecology. Where cases initiated around 2000 keep little industrial value and did not find ecology as important from the onset, the younger cases intend to seek a balance between the three elements. This can also be related to their position in the network, where old cases in proximity to the city centre have more political pressure to urbanise. The final realisation of high performing public space can depend on the actor arena as well, seeing that Stadswerven set little ambitions for private developers in face of a crisis and as such did not realise high performance projects. Furthermore, in the context of regional competition, municipalities and private actors are sometimes very action-keen, and already start building without proper participation processes or internal agreements. When this decreases the climate adaptative qualities, it can result in a vulnerable area.

The overall reduction trend between cases of intentions and realised strategies indicates that a long-term vision is needed, using rules or principles to ensure silent stakeholders (such as nature) and higher ambitions (innovation in water adaptation) are integrated in private party-led development. This is especially important seeing the increasing decentralisation and facilitation and flexibility centred planning approaches of today (M4H).

Adaptablity

Furthermore, whether new values and external opinions can be included in the projects depends on the adaptive capacity and process design of the project. For example, M4H was more open to a participation process and joint-visioning than Rijnhaven and Stadswerven. In the beginning this resulted in complexity and a longer planning process, however, in the end the conflicts in collaboration and societal resistance towards plans in Rijnhaven and Stadswerven meant that they had to open up their process in the end as well. Furthermore, if the plans are more flexible such as in Rijnhaven and M4H, it is possible to adapt the plans to changing contexts later on. This proved to be difficult in Stadswerven as they formalised the plans early on and the project has a duration of 30 years. As such, innovations can be implemented all throughout the process.

Transition icons

Next, scales are interdependent and project within the network learn and influence each other and the overall planning paradigm. This results in a challenge as innovations are easier and faster to realise at the small-scale than at the regional scale. Nevertheless, the market actors and municipalities do seek certainty for making big investments and tend to wait on a regional delta decision. Simultaneously, the region waits for pilots to explore different pathways. Furthermore, not all projects are strongly connected to research, reducing the amount learned from projects. M4H gains a lot of attention, but Stadswerven, which was an important delta pilot in the past, receives little academic attention, meaning the processes behind its low performance does not influence the larger transition. Rather, we need might need icons of success and failure.

Impact Experiments

A commonly used strategy for innovating in urban area development is experiments. Each of the cases launched experiments that test their initial ambitions for an area. However, these experiments can be disconnected from reality too much and

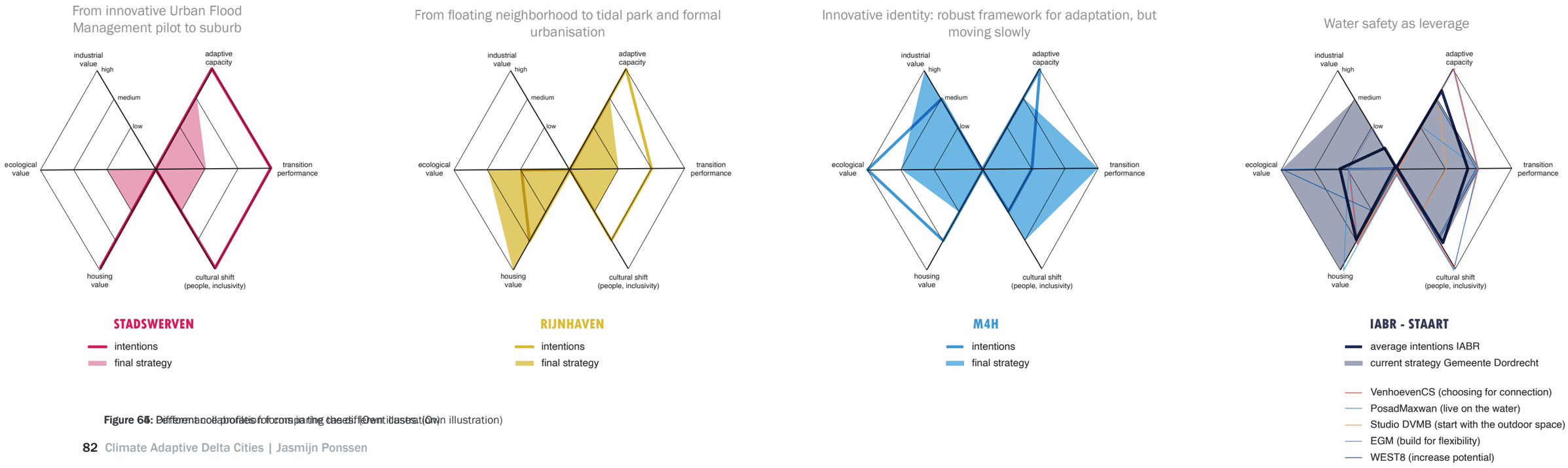


Figure 65: Different profiles for comparing the different cases (Own illustration)

as a result have little impact on the real system. The experiments with a tidal park at Stadswerven did not result in process innovation, but its lessons did influence the development of large tidal parks in Rotterdam and de Rijnhaven. Nevertheless, these tidal parks remain government investments that are only feasible when connected to highly dense urban programme (Feijenoord City and Rijnhaven's skyscrapers). The ecological value of these tidal parks near highly dense buildings remains uncertain, and some interviewees suggested this might need more attention. Furthermore, it is striking that the experiments often have a spin-off effect for other developments in the region, but are not scaled up internally. For example, the initially planned floating neighbourhood at de Rijnhaven will not be built there, but might be constructed at de Staart and M4H.

Institutionalising the New System

Furthermore, in the decentralised model, local plans need to be aligned with provincial legislation and strategies. Also, municipalities and local actors are given the opportunity to participate in the strategies of the province. A challenge for aligning strategies is that we are making use of non-institutionalised planning scales: the region and the urban area. Existing planning instruments are therefore not very effective at steering new forms of development. As such, planning instruments need to evolve in the coming years to empower municipalities, communities and market actors to innovate and scale-up.

CROSS-CASE COMPARISON

SRQ3: Why is adaptive capacity (mis) integrated in the post-industrial port redevelopment projects?

The case study research showed that in a bottom-up transition, learning and collaboration is very important. For that reason De Staart's and other redevelopment projects should learn from other cases in the region, which is facilitated by this chapter. Integrating the possible interventions in the mechanisms in Figure 66 will enhance the performance projects have in transitioning towards Climate Adaptive Delta Cities while also achieving today's quantitative goals.

One of the challenges is that the different scale levels are waiting on each other to act. This is natural, big transitions can take a long time to happen (Hajer, 2010), just like the adaptation decision for the Deltaworks took many years and spatial experiments before a decision was made (Meyer, 2016b). Nevertheless, working towards the transition, a local project is the ideal place for testing pathways. Innovative experiments, connected to reality, can form the basis of new inter-scalar and -disciplinary collaborations that make scaling-up and implementing novelties easier. Furthermore, making innovative projects public icons contributes to the cultural transition needed, as people can connect with the future and their position therein.

Another challenge in implementing long-term values lies in the collaboration: the problem of many hands, climate uncertainty, moral hazard, organisational behavior, behavioral economics (Repeto, 2019). The interviews underlined the importance of awareness, activation in actors; openness, participation and joint vision making for integration in the process; and finally knowledge sharing and learning between local adaptation projects so that a local project can contribute to a regional transition.

Last, the balance between adaptive capacity and flexibility vs. rigid plans to implement is also a challenge. On the one hand, actors need certainty and are reactive to crises on the short term. On the other hand, the long-term needs to be guaranteed and complexity, for example through participation, can bring forwards creative solutions. Therefore, the Dynamic Adaptive Policy Pathways methodology, used for connecting short- and long-term, is combined with a participation strategy to achieve the societal and spatial transitions needed. The guiding principles for the strategy will be concluded on the next page.

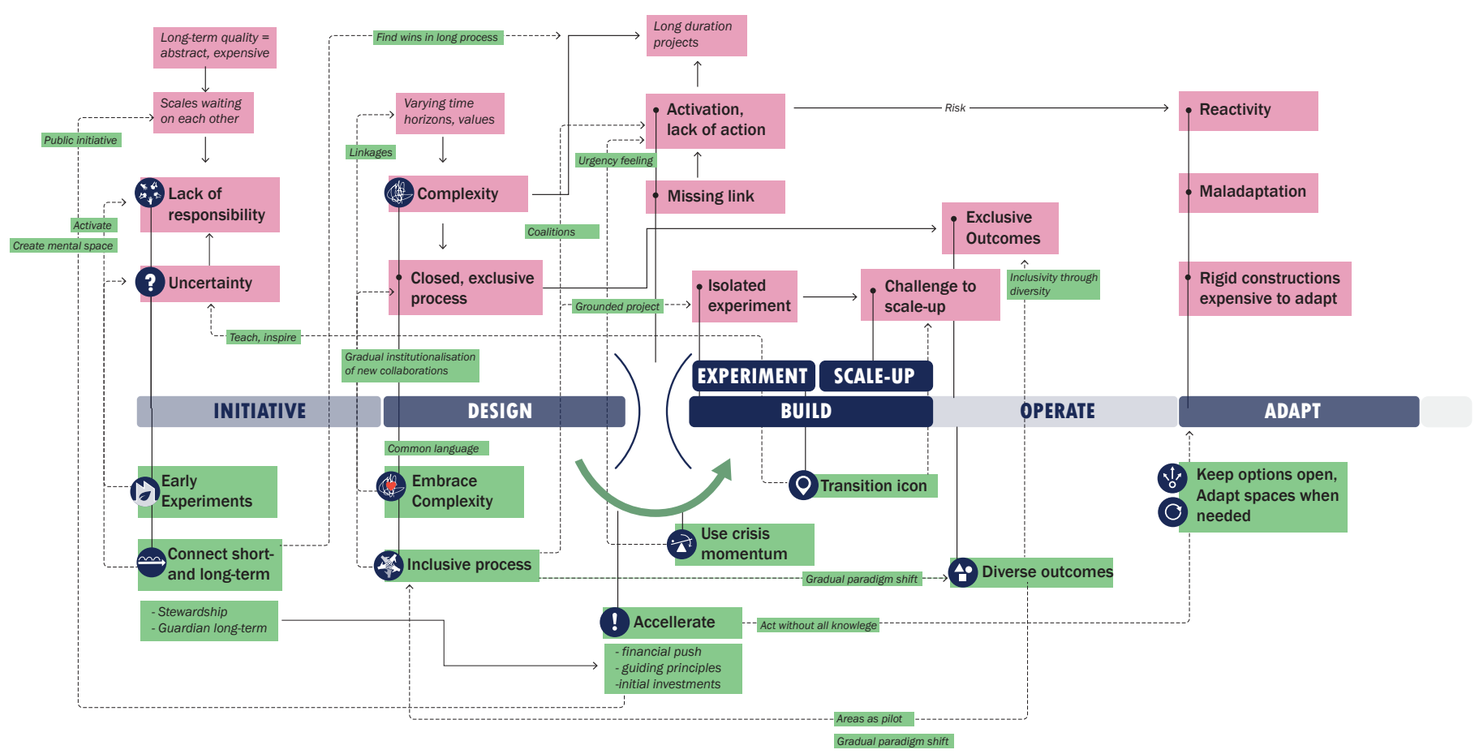


Figure 66: Mechanisms behind transition performance, aligning process and space. (Own illustration, based on case study research and interviews).

ADAPTIVE PLANNING PRINCIPLES

To conclude, from the case study research the following guiding principles emerged.

The aim is to move from a linear, constructivist planning paradigm to a more adaptive paradigm. Therefore it is essential to establish a transition towards a new planning paradigm that ensures the following elements.

1. ADAPTIVE CAPACITY | EMBED UNCERTAINTY

Plans embed uncertainty. Projects are no longer seen as rigid masterplans, but are allowed to adapt when new contexts evolve, technologies emerge and coalitions are formed.

2. TRANSITION PERFORMANCE | INTERSECTORAL AND -SCALAR INFLUENCE

Short-term, local innovations are stimulated to start, experiment, scale-up and influence the existing system. Giving small projects within the decentralised governance model the responsibility and possibility to influence the transition.

3. CULTURAL SHIFT | HUMAN DIMENSION

Projects contribute to the transition, which relies on personal and large systemic change and can take a long time.

TRANSITION DESIGN PRINCIPLES

Last, the case studies illustrated that, the climate crisis will require deep changes, or transitions, in many sectors (or regimes): affecting patterns of occupation and patterns in the landscape. The transitions that are required most post-industrial port sites, such as de Staart, are summarised in the design principles below.

1. INDUSTRY | GREEN INDUSTRIAL TRANSITION

The transition to Green Industries involves the shift from global to local, moving from a depletion and destruction to a form of symbiosis and restoration.

2. DELTA | INTEGRATED WATER RESILIENCE

The transition in our water management from technology-based to nature-based solutions. Water adaptation needs to take into account more uncertain and extreme climate change effects and thus be more integrated with other sectors.

3. HOUSING | ADAPTIVE HOUSING

The transition towards more synergetic relationships with water, nature and industry. More flexible forms of housing and blocks to allow for preparedness and responsiveness to market dynamics.

05 TEST CASE DE STAART

Summary | In this chapter, the conclusions of the research are integrated with the Dynamic Adaptive Policy Pathways methodology. The strategy for climate adaptive post-industrial port redevelopment is tested by performing a ‘design simulation’ for de Staart’s redevelopment. The development of pathways created a need for dynamic documents such as a Spatial Framework and Dynamic Rules, which ensure multiple pathway directions stay open for long-term adaptive redevelopment. The simulation shows that the redevelopment of the post-industrial plots can work as leverage for local liveability, water safety and ecology. Furthermore, experiments and learning can result in a bottom-up, networked climate adaptive region, which is resilient to the deeply uncertain effects of the climate crisis on housing, industry, water and nature.

Figure 67: Ebracing Complexity: patterns of individuals depnd and influence the transition of the group. (Wainscoat, 2018)

FACTS EXISTING SITUATION

Location	**Dordrecht, the Netherlands**
Surface	**450 ha**
% water	**38%**
Residents	**5.300 people**
Businesses	**Industry, energy, waste, storage, transport, construction**
Develop. stage	**Initiative, exploration**

INTRODUCTION

In this chapter, the lessons from theory and the case study research are integrated in a redevelopment methodology, whose application is simulated in the following pages for de Staart. Figure 68 summarises the adapted Dynamic Adaptive Policy Pathways (DAPP) methodology. For a full explanation of the DAPP, see the Methodology chapter.

However, it is important to note that the methodology would be better suited as a communication tool and instrument for joint discovery of the future. By together understanding the uncertainties of the future and the interrelatedness of actions within pathways, DAPP could bring isolated stakeholders together. This strategy will be further explained in Step 8: specify a dynamic adaptive plan.

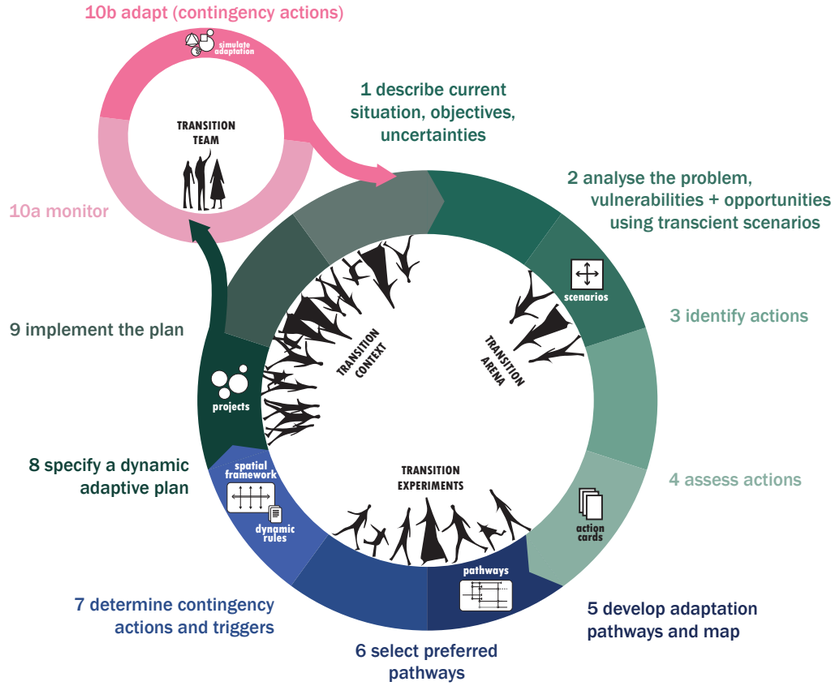


Figure 68: (top) Adjusted Dynamic Adaptive Policy Pathways methodology in an inclusive process with dynamic documents, which is simulated for de Staart in this design chapter. (Adapted from Haasnoot et al., 2013)

Figure 69: (left) Design test case de Staart as representative case and pilot for the redevelopment of post-industrial port sites in the Rhine-Meuse delta region. (Deltaprogramma, 2020)

1. HISTORY, CURRENT SITUATION, OBJECTIVES AND UNCERTAINTIES

"The first step is to describe the study area, including the system's characteristics, the objectives, the constraints in the current situation, and potential constraints in future situations. The result is a definition of success, which is a specification of the desired outcomes in terms of indicators and targets that are used in subsequent steps to evaluate the performance of actions and pathways, and to assess the sell-by dates of actions." (Haasnoot et al., 2013)

BOX 7 | HISTORY OF DE STAART

Historically, Dordrecht's situation in the delta has been its reason for existence. It used to be the Rhine delta's most important port city, only losing this position after the Saint Elizabethflood in 1421, when the estuariums landscape shifted dramatically. Nevertheless, this is when de Staart came into being as a sand bank of the Beneden Merwede river. When the city started growing in economic activity during the industrial revolution, it also expanded onto de Staart, which had until then been used as farmland and production grounds willows and reed (as construction materials), see Figure 71. The first industries sprouted close to the city centre, the 'Stadswerven', or the city's ship wharfs (Case 1). Gruadually more industries developed further to the west (Figure 72).

Later on, larger industries developed further away from the city centre towards

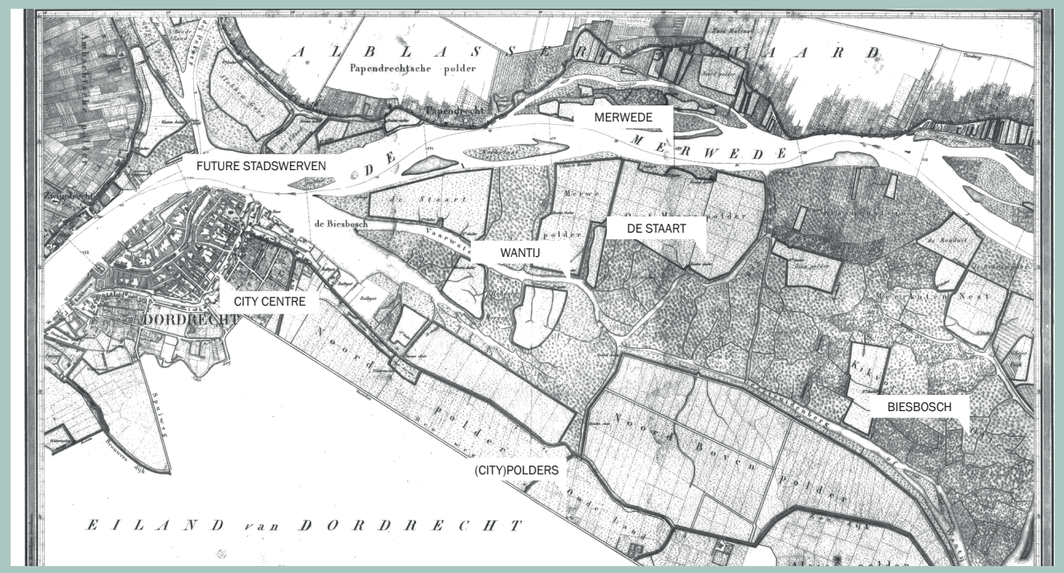


Figure 71: De Staart came into being after the Saint Elizabethflood (1421), as a sandbank in the new delta configuration. Over time, the tidal nature was poldered, used for Grienden (willow and reed harvest). (Gemeentelijke Prentverzameling, 1833)

Figure 72: Around the industrial revolution, the area was redeveloped into the first industrial expansion of the city, for a ship wharf (right). Along with the second expansion in the image went the construction of a residential neighbourhood in 1920. (Gemeentelijke Prentverzameling, 1920)

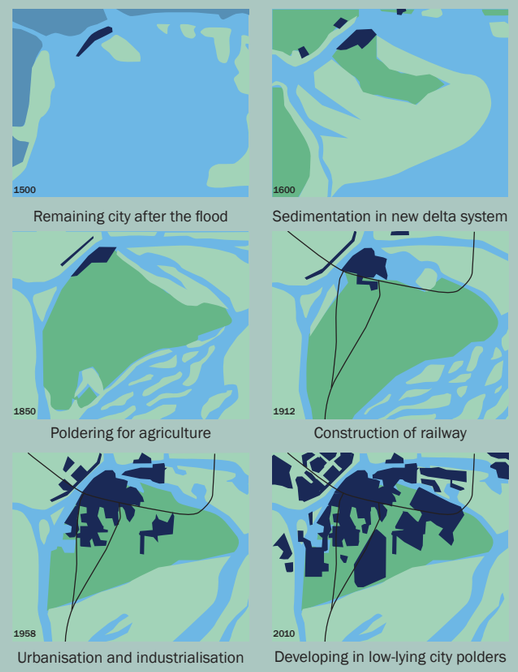


Figure 70: Historical development of the island of Dordrecht after the Saint Elizabethflood in 1421. (Own illustration, basedon van Dijk, 2021 and Topotijdreis, 2021)

the Biesbosch, which went along with housing development along the Wantij river (Figure 73). In the reconstruction era after WW II, big industries were constructed as well as the N3 highway. Some residential programme was developed on de Staart, but the main residential additions were located in the low-lying city polders. These were monofunctional neighbourhoods, separated from work and with only a commercial centre (Figure 74).

Figure 73: Heavy industries at de Staart, the Merwedecentrale for energy was closed in 1984, leaving behind a blackfield that is now occupied by a McDonalds and storage units.(Gemeentelijke Prentverzameling, 1962)

Figure 74: Urbanising the low-lying city polders into monofunctional residential neighbourhoods, connected to the national expansion plans. Today, these neighbourhoods are especially vulnerable (De Dordtenaar, 1989)

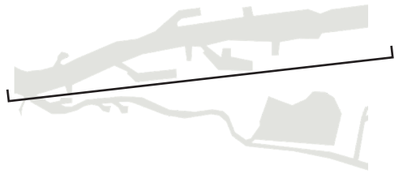
Today, many of the earliest industries have disappeared, and their former grounds have either been redeveloped (Stadswerven) (Figure 76), re-used in a semi-efficient way (small entrepreneurs), or are blackfields with dangerously contaminated soils. The large petrochemical industry still remains on the site, along with water processing and maritime industries (Figure 75). Many scandals about cancer related effects of the PFAS contamination were in the news, and some neighborhoods even needed to be demolished due to the health risks.

Figure 75: Petrochemical industry next to former waste dump site, which is replaced by a waste processing factory (Siebe Swart, 2018)

Figure 76: The former shipwharfs redeveloped into Stadswerven, the area connected to the city centre with the Prins Clausbrug. Some industrial heritage remains, in the tidal park and Biesboschhallen. (Funda, 2021)

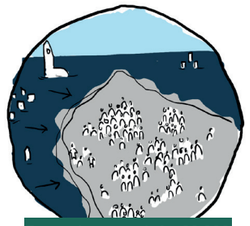
CURRENT SITUATION, VULNERABILITIES, OPPORTUNITIES, AMBITIONS

The figure below outlines the most important vulnerabilities, opportunities and ambitions that are translated into objectives that should be addressed in designs and strategies for the area's redevelopment. In the box on the next pages, the characteristics of de Staart will be explained more in depth.

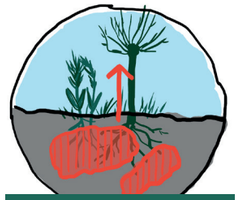


Set an identity for Dordrecht as innovative climate adaptive city

Enhance flood risk awareness by connecting people and water



Evacuation grounds for 60.000 evacuees during flood event



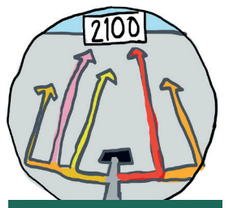
Clean toxic soils and water to make future programming possible

Enhance liveability under extreme weather conditions

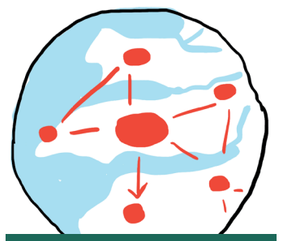
Build 7.000 - 10.000 houses

Designing and experimenting with new technologies for co-existence of nature, industry, housing and water

Vulnerable groups co-design for the transition



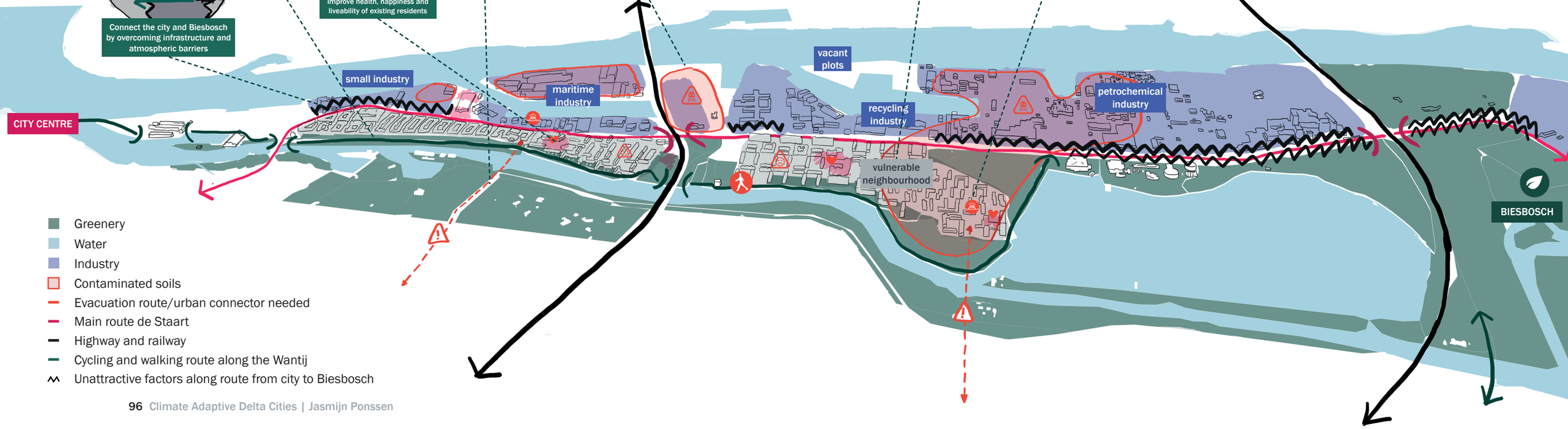
Experiment for informed pathway decision making



De Staart as innovative pilot for the regional transition

Connect the city and Biesbosch by overcoming infrastructure and atmospheric barriers

Improve health, happiness and liveability of existing residents



BOX 8 | SPATIAL ANALYSIS OF DE STAART

CURRENT SITUATION

The following section will analyse the system of the post-industrial port site de Staart. Site-specific place typologies are identified; followed by the ambitions for redevelopment and a reflection on the current development strategy. Some of the characteristics can be valid for other post-industrial sites as well.

The map below positions de Staart on the island of Dordrecht, connecting the densities of jobs/km2 per neighbourhood. The city centre is very mixed and diverse, but the further you move away from it, the less mixed the fabric is. It is clearly visible that most jobs and industries are situated on the north and west banks of the island. The Figure 79 also shows the divided regimes of the landscape.

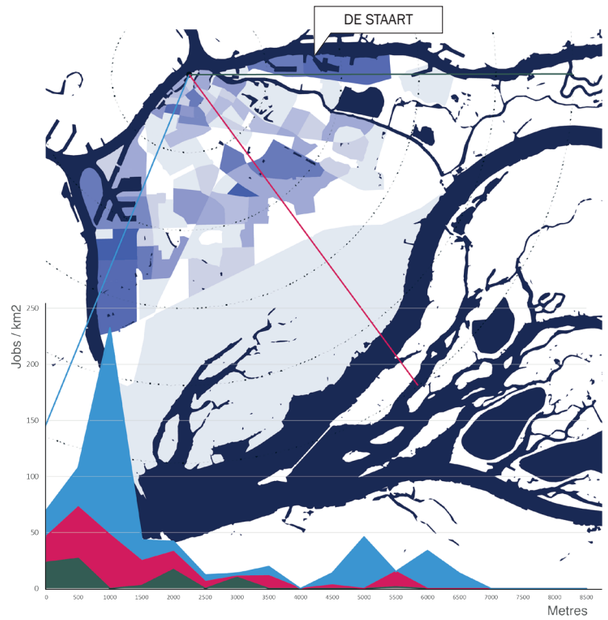


Figure 77: Work on the riverfronts, live in the low-lying city polders. Based on Berger (2006) mapping of Drosscapes.

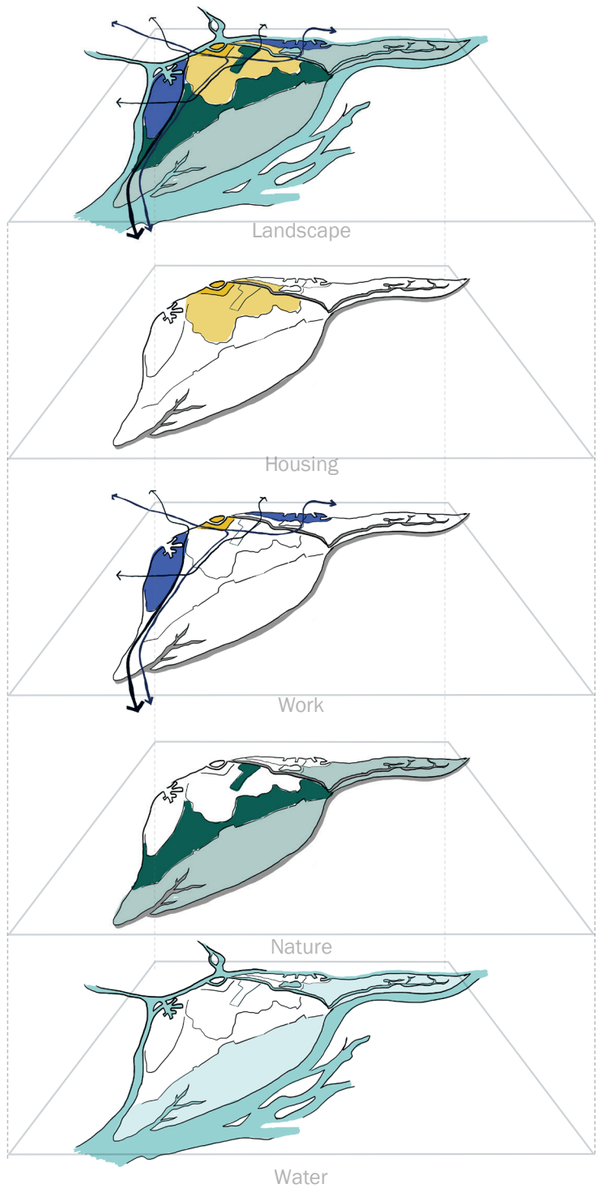


Figure 78: Different layers of the island of Dordrecht, clear division of functions. (Own illustration)

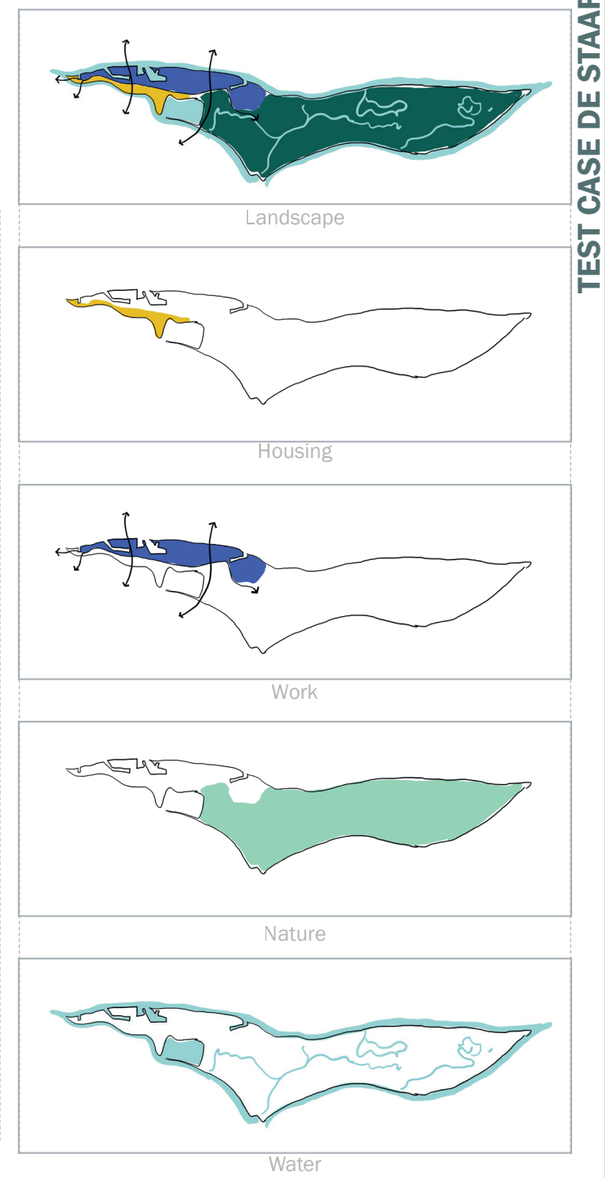


Figure 79: Different layers of de Staart, clear division of functions. (Own illustration)

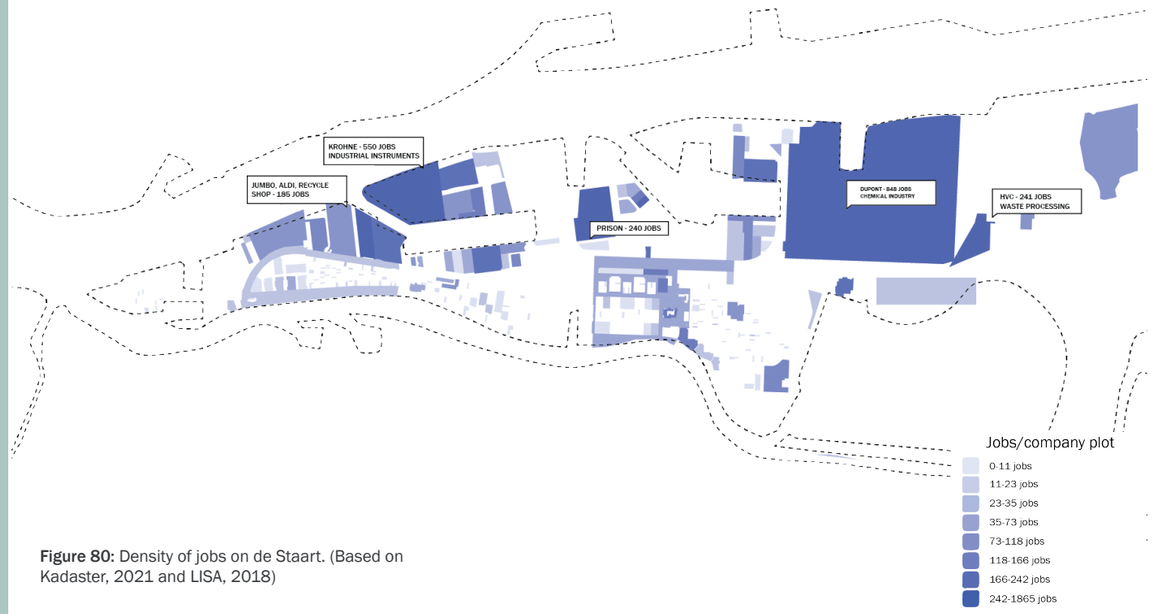


Figure 80: Density of jobs on de Staart. (Based on Kadaster, 2021 and LISA, 2018)

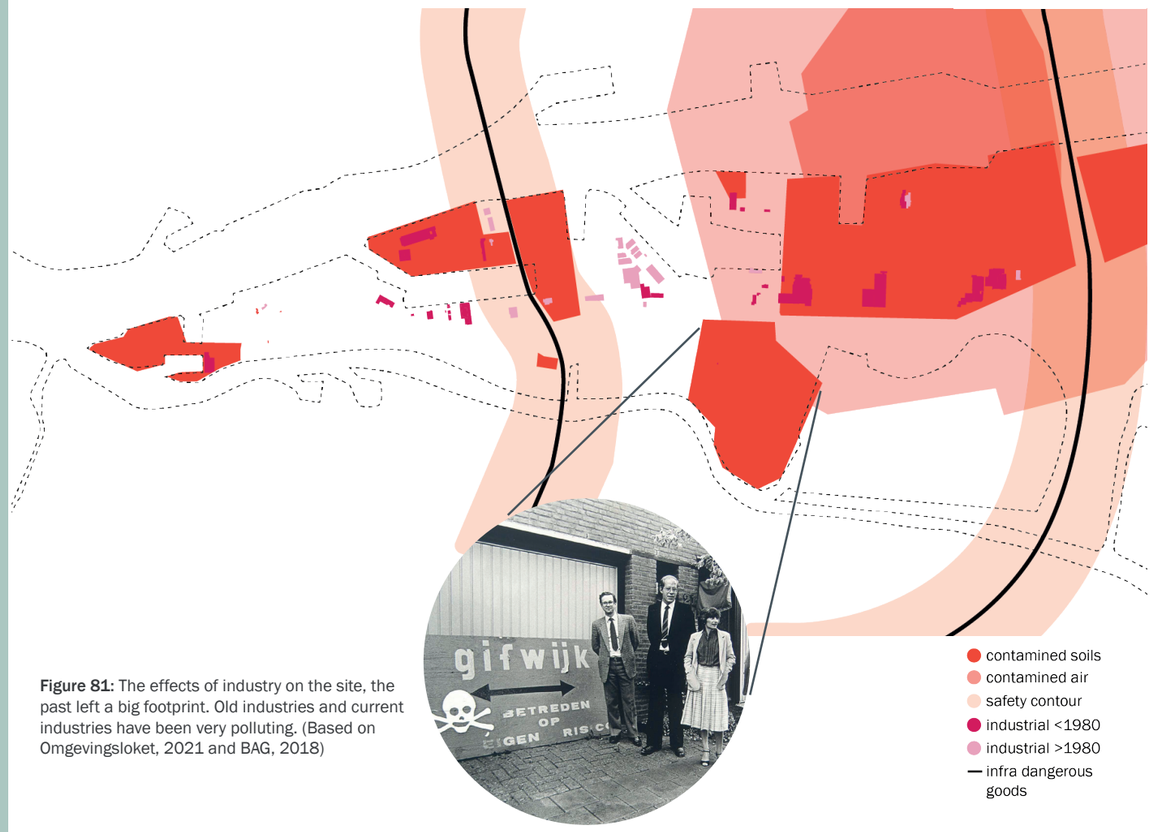
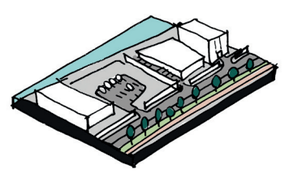


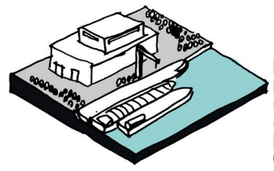
Figure 81: The effects of industry on the site, the past left a big footprint. Old industries and current industries have been very polluting. (Based on Omgevingsloket, 2021 and BAG, 2018)

EMPLOYER

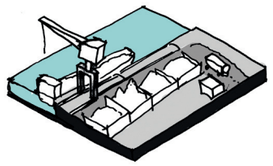
De Staart is a very industrialised site, with industries from the first industrial revolution in the west (nearby the city centre) and large scale chemical industries to the west (nearby the Biesbosch). As industries stretched out along the sand bank, social housing projects developed alongside it. The industries to the city centre have disappeared as they were too polluting or did not support the modern society. The larger industries to the east still employ a lot of people.



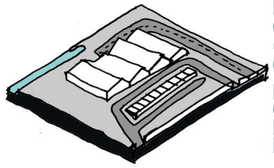
Small companies



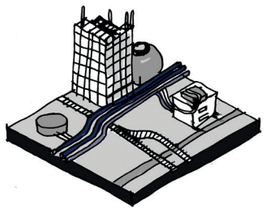
Marine industry, water dependent



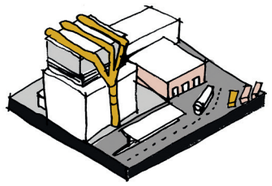
Rough industries, water dependent



Recycling, waste-processing industries



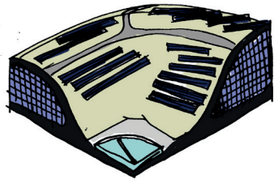
Polluting chemical industry



Waste processing

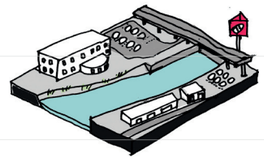
POLLUTED

Its industrial past has resulted in polluted soils and air. To the east, blackfields remain that have a big soil cleaning assignment. To the west, recent scandals about chemical industries polluting the water with PFAS are in the news. If the area is to be redeveloped, the contaminated soils are a big assignment. Last, the railways and highway have sound and safety contours that might make development challenging in current legislation.

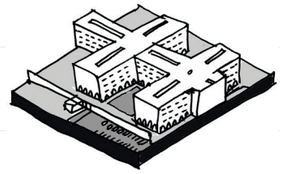


Waste hills

Demolished neighbourhood on toxic soil, replaced by park



Former industry, polluted soil deserted



Prison on polluted soils of former factory

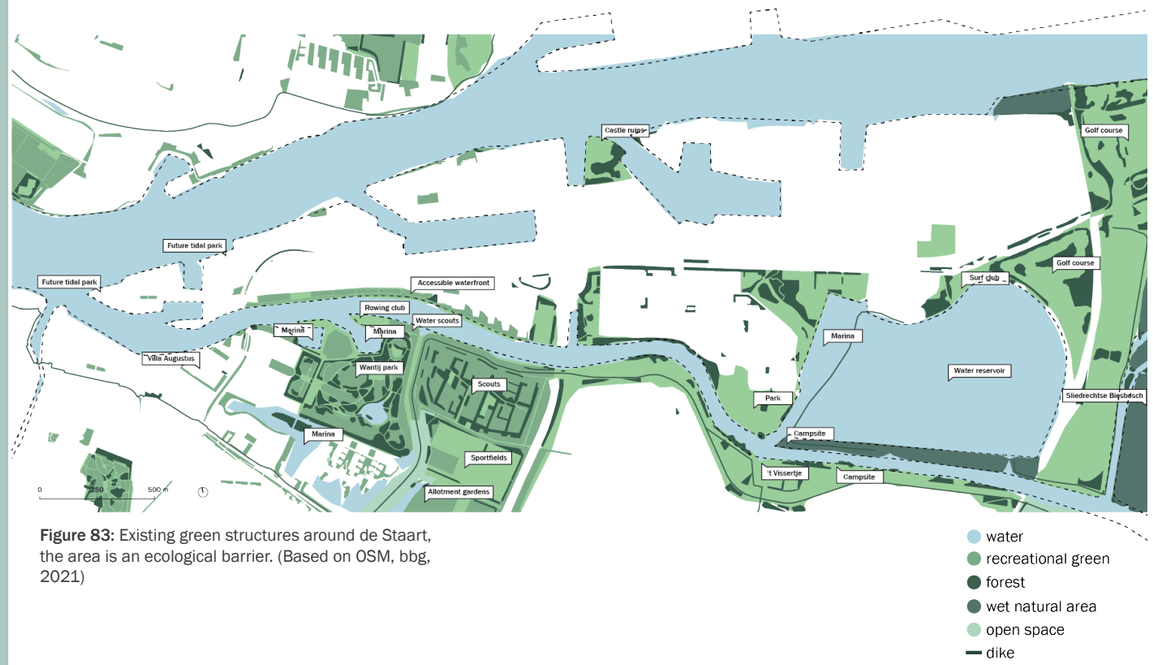


Figure 83: Existing green structures around de Staart, the area is an ecological barrier. (Based on OSM, bbg, 2021)

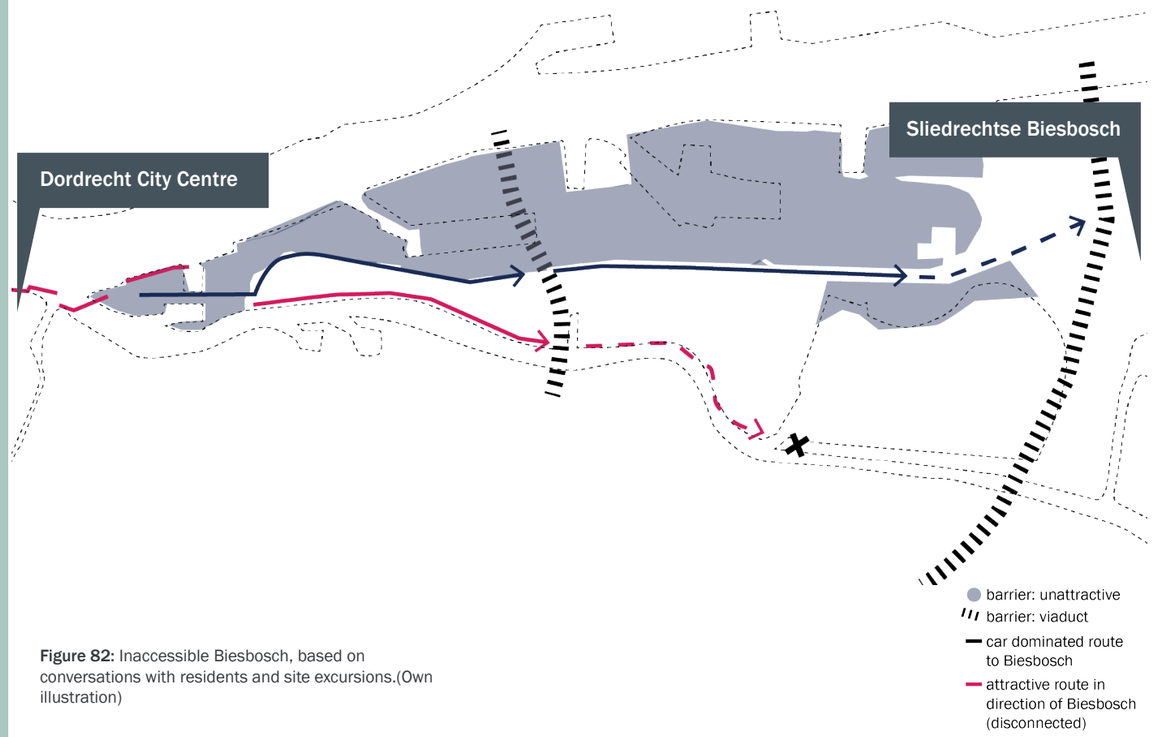


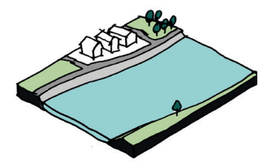
Figure 82: Inaccessible Biesbosch, based on conversations with residents and site excursions.(Own illustration)

ECOLOGICAL POTENTIAL

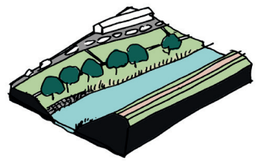
De Staart is a sandbank wedged between two rivers, the Beneden-Merwede and Wantij. The natural reserve the Hollandse Biesbosch starts east of the industrial area, which the municipality aims to reconnect with the city via the Wantij river (south). The area itself is not green however, and the river banks are hard: they can be seen as an ecological blockage.

BARRIERS TO REACH NATURE

The area itself is not easily accessible, with only one 'street-level' bridge to the east, near the city centre. With the redevelopment of Stadswerven a new bridge is constructed to connect de Staart with the city. Nevertheless to reach nature from the city and Staart is a challenge, the Wantij cycling route is disconnected and the route along the spine of the area is unattractive along fenced industries and passing two viaducts.

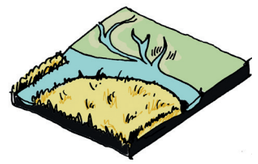


Hard quays along Beneden-Merwede

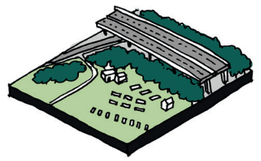


Cycling route along Wantij

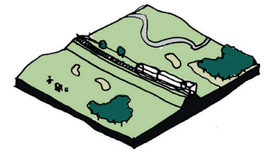
Biesbosch visitor centre



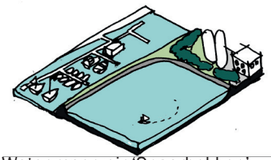
Unique sweet-water tidal nature



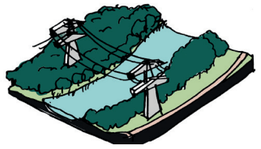
Safety zones around high-way used as community farm



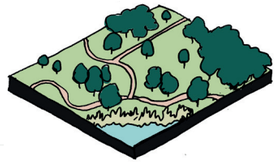
Safety zone around railway used as privatised golf course



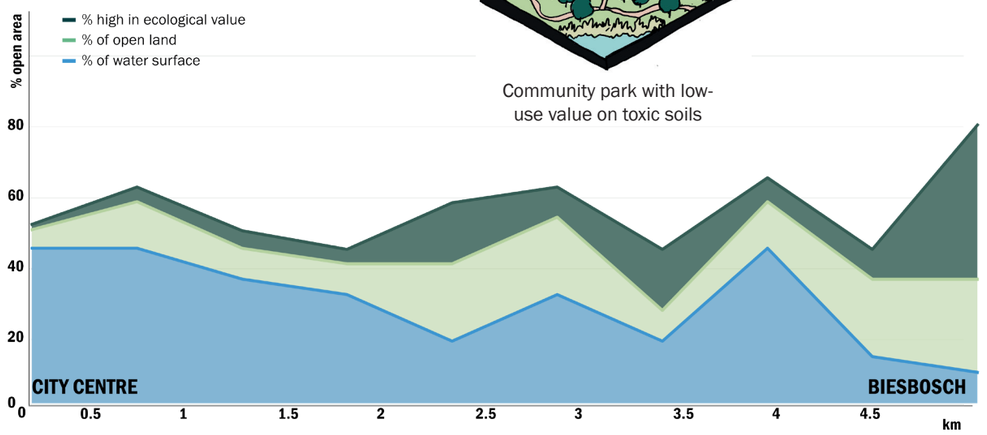
Water reservoir 'Spaarbekken' and small harbor



Inaccessible waterfront near Biesbosch, lined with energy infrastructure



Community park with low-use value on toxic soils



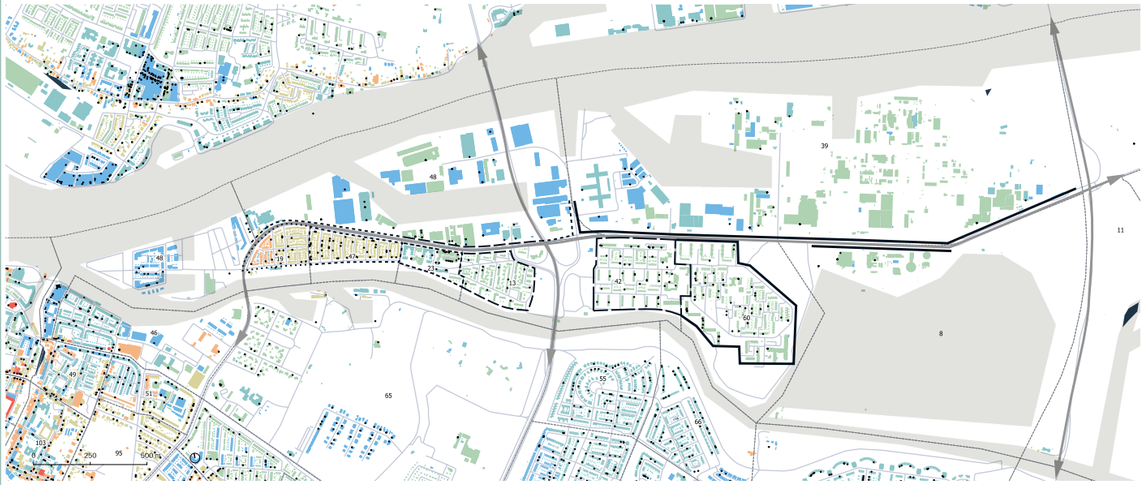


Figure 85: Building ages and closed/openness relationship with programme on the north side. (based on LISA, 2018 and BAG, 2021).

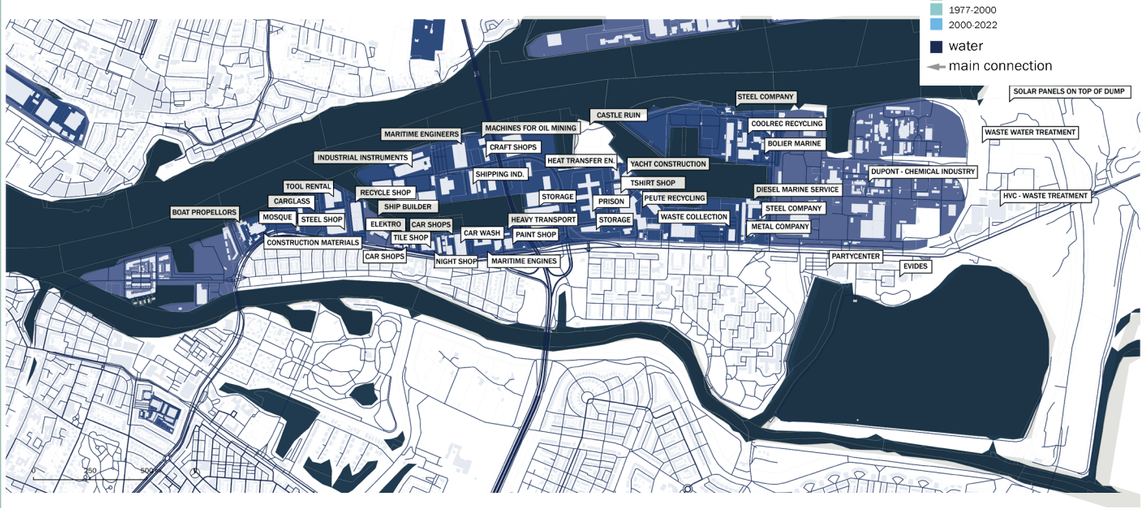
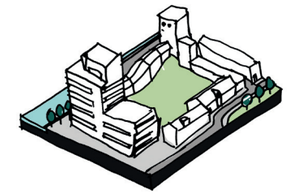


Figure 84: Softer industries to the west, maritime industries to the north, heavy chemical and waste processing industries to the east and city services to the south (recycling and shops). (Own illustration, based on Kadaster, 2018 and BAG, 2018).

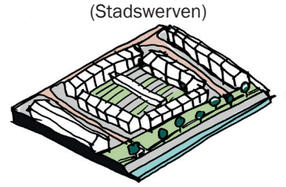
ISOLATED & VULNERABLE

The map to indicates how the residential and industrial buildings developed from west to east. As industries became heavier, the neighbourhoods became more closed. De Staart is disconnected from the surrounding urban fabric, with some 'Staartenaren' never leaving the area at all. Residents find a lack of amenities and little public transport accessibility as problems.

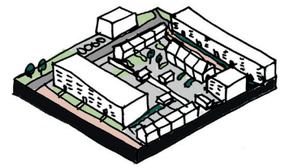


First redevelopment project (Stadswerven)

First housing development of de Staart

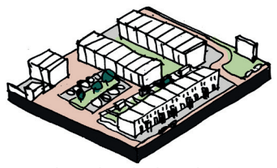


Rowhouses of the 1930's



Portico tenements near the highway

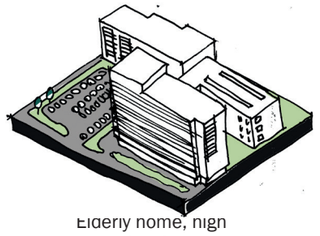
Flats closing off neighborhood to the street



Low density housing from 1960's

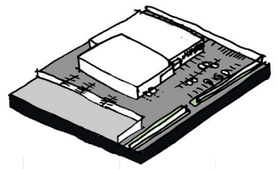
CLOSED TO HEAVY INDUSTRY, OPEN TO OLD INDUSTRY

De Staart has multiple types of industries: marine industry, small-scale industries, waste processing, recycling industry and heavy industry. Some of the heavier industry (near the prison and from the highway towards the city center onwards) has already disappeared and been partially replaced by small-scale businesses.



Elderly home, high density

Many amenities disappeared, turkish supermarket remains



Big supermarkets, far away from most houses, mostly regional function

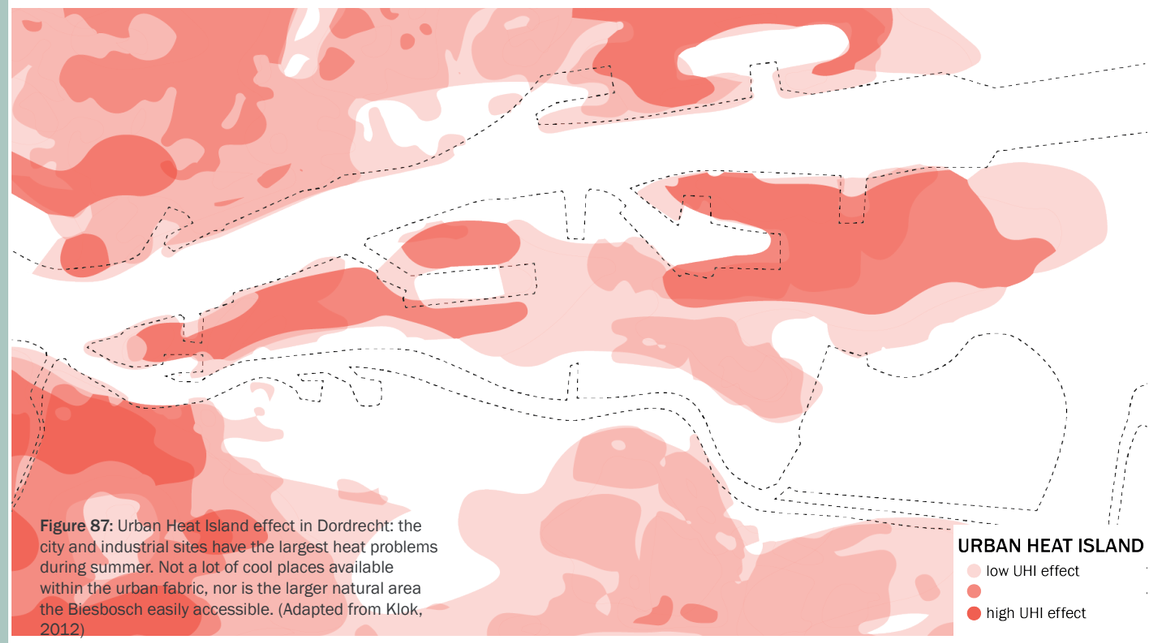


Figure 87: Urban Heat Island effect in Dordrecht: the city and industrial sites have the largest heat problems during summer. Not a lot of cool places available within the urban fabric, nor is the larger natural area the Biesbosch easily accessible. (Adapted from Klok, 2012)

CLIMATE CHANGE EFFECTS

The climate crisis will increate the problems of the urban heat island, resulting in health threats for vulnerable residents in the city. As Dordrecht is disconnected from nature, and de Staart is very stony, it is important to improve accessibility to cool places.

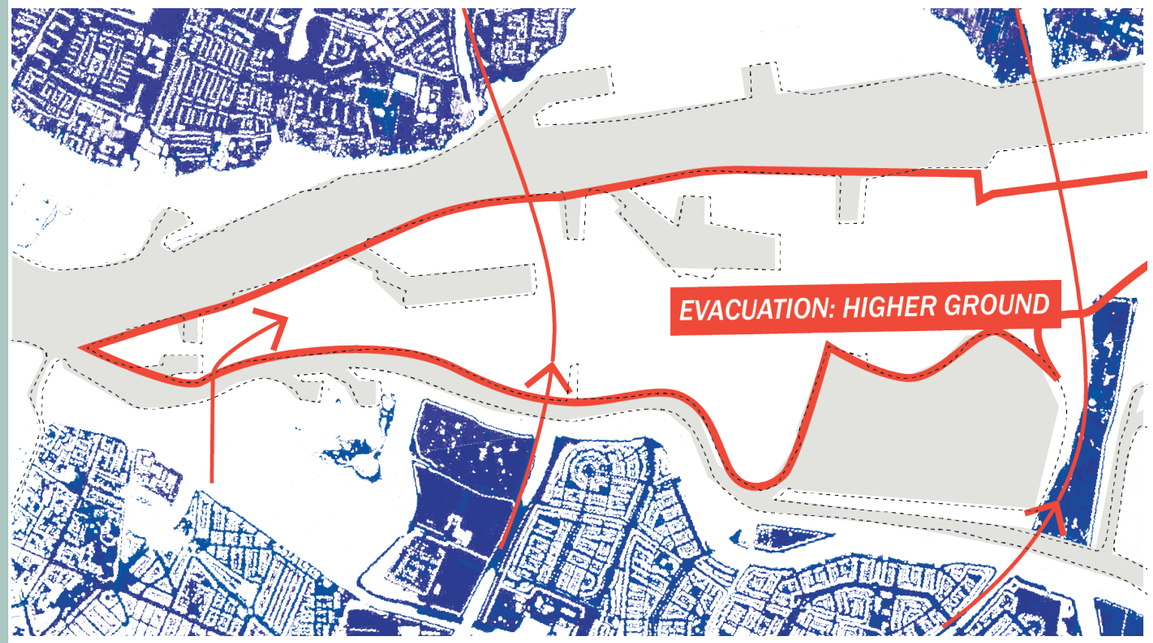


Figure 86: Flood risks are high in the low-lying city polders, that are influenced by both the sea and river. De Staart is situated on a higher sand bank and can function as evacuation grounds in case of a flood event..(Own illustration, adapted from AHN, 2021)

EVACUATION GROUNDS

The IABR (2021) explored how de Staart should be developed if it were an evacuation ground for Dordrecht. The rest of Dordrecht is very low-lying, and it is likely 60.000 people (half of the population of the island of Dordrecht) cannot leave the island in time. Therefore the Staart can function as a place of refuge. Connections and adaptable buildings are therefore important to be able to accommodate this amount of people.

Figure 88: Current redevelopment strategies and actions for de Staart. (Based on interview with project leader de Staart, Ellen Kelder, 2021).

OBJECTIVES

The municipality of Dordrecht is already taking the initiative to redevelop de Staart. After the redevelopment of Stadswerven and the Biennale project, the first publicity is gained for the area.

The next steps for the IABR projects can be categorised in the following types: knowledge sharing, prototyping and implementation.

As the studies for the IABR were both visionary and grounded in reality, they have the capacity of being realised today as experiments (Brugmans & Kelder 2021). Many of the designers feel actively engaged in trying to push their designs towards realisation as they are convinced about their value. For example EGM is presenting their design to developers, and PosadMaxwan underlined this in the interview as well.

However, the municipality of Dordrecht seems to be in the lead. During the closing meeting of the IABR atelier in Dordrecht they mentioned taking the following steps:

1. Contributing to national research agenda;
2. Finding subsidies for prototypes;
3. Realising a part of the network (the cycling DordTrack);
4. Activating politics, ensuring de Staart is included in political agendas.

There are some major barriers though, which the municipality wants to include as well:

1. Which is the vulnerability of the neighbourhood, adressed with a participation trajectory;
2. The toxic soils, which the municipality aims to find a subsidy for;
3. And the complexity of the industrial plots which all have existing owners, the municipality aims to give them an open invitiation to join a discussion about the future of their business;
4. Building bridges over waterways remains a challenging process.

UNCERTAINTIES

Uncertainties that are present at the site and influence the future of the area include:

The city as a project: an isolated, decentralised planning perspective

As a result of decentralisation, more responsibilities lie in the hands of the municipality and local (market) actors. Nevertheless, the case study research showed that local actors lack the instruments and mindset to realise the long-term. Furthermore, many actors work in silos, resulting in isolated projects. A water adaptation and nature development project in the Dordtsche Biesbosch that was part of Room for the River illustrates this well, as it was developed without any integration of public use. Furthermore, while the context is deeply uncertain, visions for climate adaptation are seen as endpoints and plans by decision-makers, not as possible options for the future. For example, Marco Stam (Wethouder Housing in Dordrecht) said about the IABR floating neighbourhood: “The vision is there and we need to start realising it step by step” (Stam in EenVandaag, 2021).

The acute crisis vs the slumbering disasters

The housing crisis is very urgent and pressing, but we should not overlook the long-term and more slumbering, abstract transitions that do not have a directly visible economic balance sheet. Nevertheless, the climate crisis can become very expensive when newly constructed neighbourhoods are flooded, as the floods in Limburg this summer have shown. Furthermore, the Corona Crisis illustrated how the abusive relationship humans have with nature cannot continue much longer, as it causes both human and financial damage.

Uncertainties & Certainties

There are many urbanisation ambitions for the Rhine-Meuse delta region, namely more or less 1 million houses in the coming 10 years. (These houses and their neighbourhoods will be constructed faster than the actual transition in other sectors will happen: for example, we do not have a new paradigm in our relationship with water yet (still relying on dikes and the national government to keep us safe whereas more personal responsibility and living with the water is a likely future perspective).

While the current housing demand is very certain, the other changes that will happen in the near future are highly uncertain. Nevertheless, they do require to be taken into account today: so that we avoid lock-ins, maladaptation and inefficient investments. For example, a new neighbourhood in a low-lying polder that should optimally be flooded in 15 years’ time as part of a Room for the River project. This is a big challenge for the current decentralised and neo-liberalist governance form of today. As the management during the Corona Crisis has shown, our society and managerial structures struggle with keeping a long-term focus and keeping an open mind for different scenarios, especially when some scenarios have severe impacts on society (undesirable futures). That is why the following section will explore the practical application of the main question for the case of de Staart:

How can the redevelopment of the post-industrial port site de Staart contribute to the transition towards a climate adaptive Rhine-Meuse delta region?

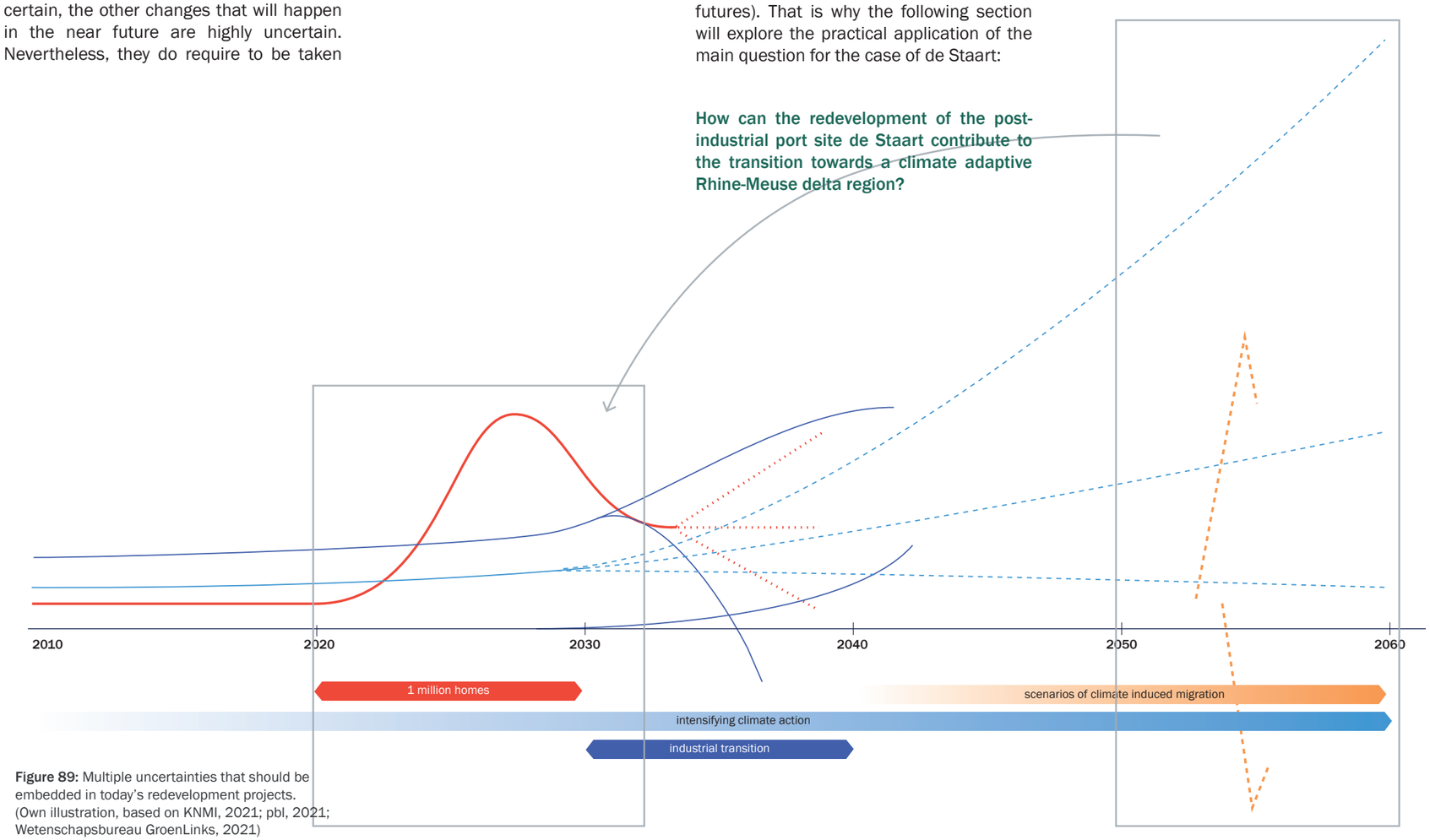


Figure 89: Multiple uncertainties that should be embedded in today’s redevelopment projects. (Own illustration, based on KNMI, 2021; pbl, 2021; Wetenschapsbureau GroenLinks, 2021)

2 ANALYSE PROBLEM AND VULNERABILITIES USING TRANSIENT SCENARIOS

The scenarios project multiple futures on the Rhine-Meuse delta region and de Staart and illustrate how society might act and respond to these futures. In each of the scenarios the aim is to sketch responses that can meet the definition of success: a transitioned, water resilient delta region. The purpose of this exploration is to identify responses, or actions to the different contexts (Haasnoot et al., 2013), which form the basis for the Dynamic Adaptive Policy Pathways in the later steps of the process.

As Figure 90 shows, using scenarios avoids thinking only about a desirable future, and the likely future, rather it promotes the exploration of probable futures (Colin et al., 2019). The impact of the scenarios will be explored by studying the impact on society in general, to the impact on de Staart and finally the impact on a plot (Figure 91).

Trends

Future socio-economic developments, migration patterns and industrial transitions and climate change its effects will require changes to the delta metropole system. This paragraph develops four scenarios (Figure 92) based on a cluster with trends that apply to society in general: migration patterns and climate change rates, and a trend cluster related to the sector at hand: industrial transitions.

Trend cluster in society in general (migration and housing market)

The migration patterns and climate change rates cover a medium-end and high-end scenario. The medium scenario (SSP2-4.5) causes 15-40 cm sea lever rise (SLR) in 2050 and 39-94 cm in 2100, which is likely to go along with a high urbanisation of the Randstad. The high-end climate scenario (SSP5-8.5), which results in 16-47 cm SLR in 2050 and 54-121 cm in 2100 and maybe even 18m in 2300 (!) (KNMI, 2021), which is connected to out-migration of the Randstad in the long-term. While these migration patterns are not directly connected to the climate change scenario, the trends are simplified due to limitations of the research.

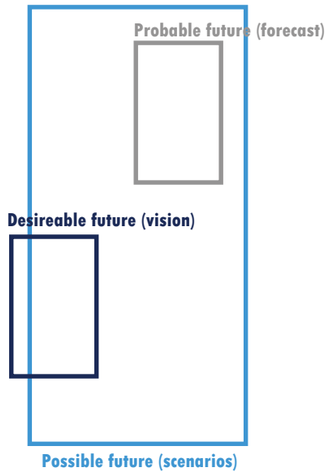


Figure 90: Using scenarios to take into account multiple possible futures. (Own illustration, adapted from Dewulf, 1999)

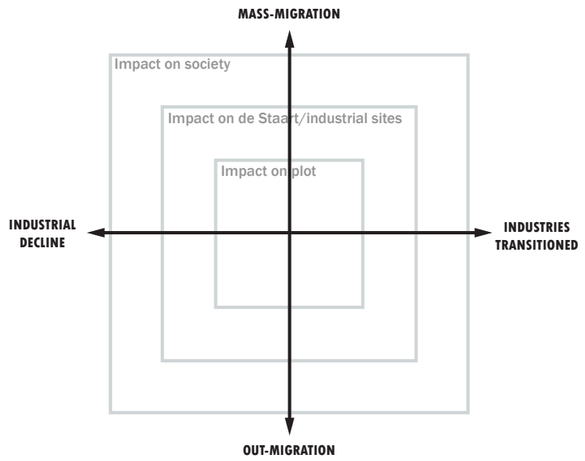


Figure 91: Exploring the impact of a scenario on our society and built environment (Own illustration, adapted from Dewulf, 1999)

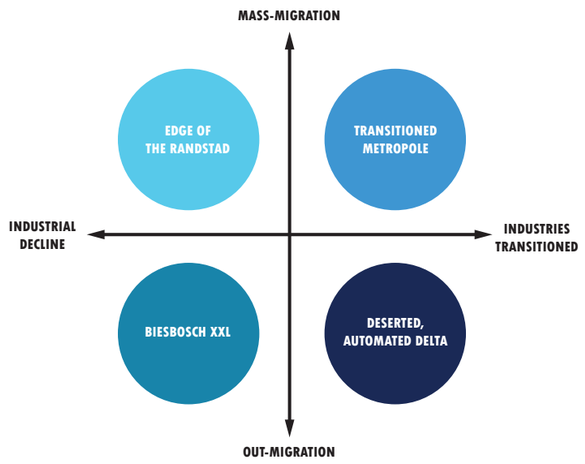


Figure 92: The four scenarios explored. (Own illustration)

Trend cluster related to sector at hand (industrial revolutions)

The other trend cluster is related to the case study typology at hand: the transition of industries and port activities and occupation. On the one hand, a successful transition can have a mitigating effect on the climate crisis, but it needs to happen fast as research of the UN shows that we only have 10 years left to avoid extreme climate change (UN, 2021 in Wetenschappelijk Bureau GroenLinks, 2021a). The trend axis reaches from a successful transition, with green industrial bloom, to an unsuccessful transition where industries leave.

Green Industrial transition politics are progressing slowly, as the results of the Climate Top in Glasgow (2021) showed: the Netherlands is running far behind other countries in taking strong steps in the direction of the transition. Our incrementally, stepwise developed system is optimised so much that we are currently in a lock-in (Loorbach, 2021). In the end, transition expert Loorbach (2021a) expects a crisis-like and chaotic transition stage towards the new equilibrium, rather than smooth transformations of the existing system.

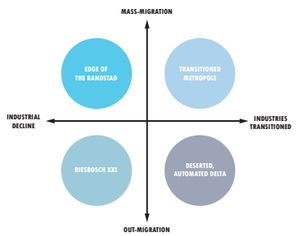
Politicians are more optimistic and try to steer towards transformations of the heavy industries, that currently represent ¼ of greenhouse gasses, towards the Green Century. Their knowledge and funds are needed and we need them for the production of products necessary for the transition in other sectors, for example making wind turbines and batteries, but also for buying new green products (Wetenschappelijk Bureau GroenLinks, 2021a). However, this transition requires a dramatic turnaround, seeing their CO2 emissions have not reduced in the past 10 years.

SCENARIO 1 | EDGE OF THE RANDSTAD

In this first scenario, the attractive knowledge economy of the Randstad gradually pulls more migrants to the region. Additionally, climate induced migration can result in peaks of refugees the EU needs to accommodate. Rotterdam extends itself until Dordrecht, which benefits from the growth in population.

However, as national policies focused too much on maintaining existing industries, the transition towards the Green Economy was more disruptive and chaotic. Many of the previous industrial occupiers went bankrupt and the new innovative companies have located in innovation clusters abroad. Rather than an economy driven by the port, the Netherlands find other means for productivity, such as a digitalised knowledge economy. Perhaps the country relies on other countries for production.

The rivers and ports are no longer used as infrastructure for inland industries, and only the seaports to the west will be used for the import of goods. As the region redevelops its urban waterfronts into residential areas, the river functions as a central sponge park, where ecology and recreation come together and which can absorb peak rainfalls and higher river fluctuations.



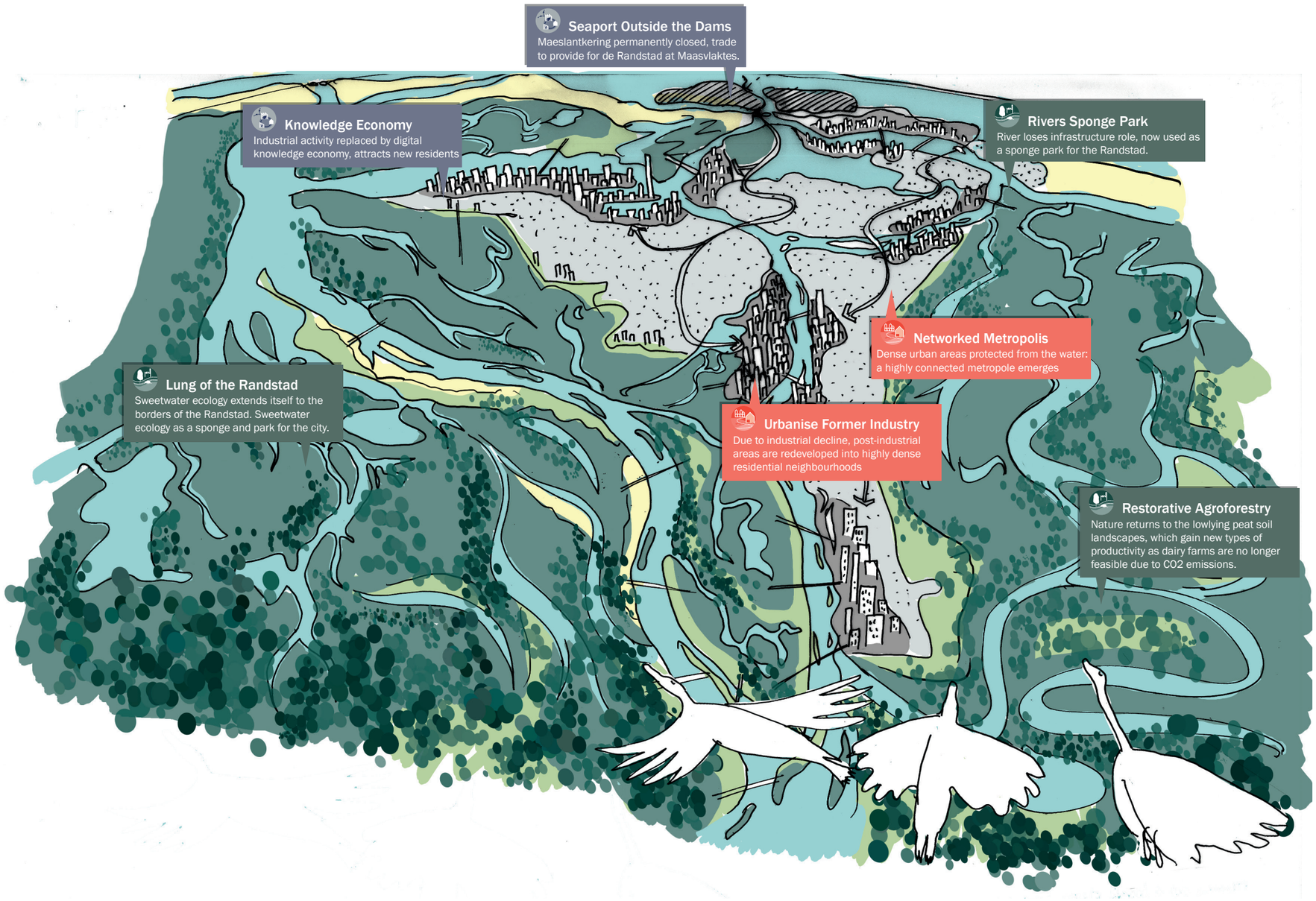


Figure 93: Scenario 1, Edge of the Randstad. Bird's eye impression on the future of the delta metropole region (Own illustration).

SCENARIO 1 | EDGE OF THE RANDSTAD

As the region no longer has a thriving industrial function, industrial sites are redeveloped into highly urban residential areas. The tidal park is layered with public functions and is accessible to its users. Sedimentation ensures flood protection and more buffer zones establish a safe area for living.

Locally, the interest of investors, high ground prices and high densities developed enable a business case in which remediation of the contaminated soils, redevelopment of the industrial sites and the development of high quality public space are possible. De Staart is the edge of the Randstad towards the delta landscape, and after fully replacing the industry, the Biesbosch becomes a park for the region.

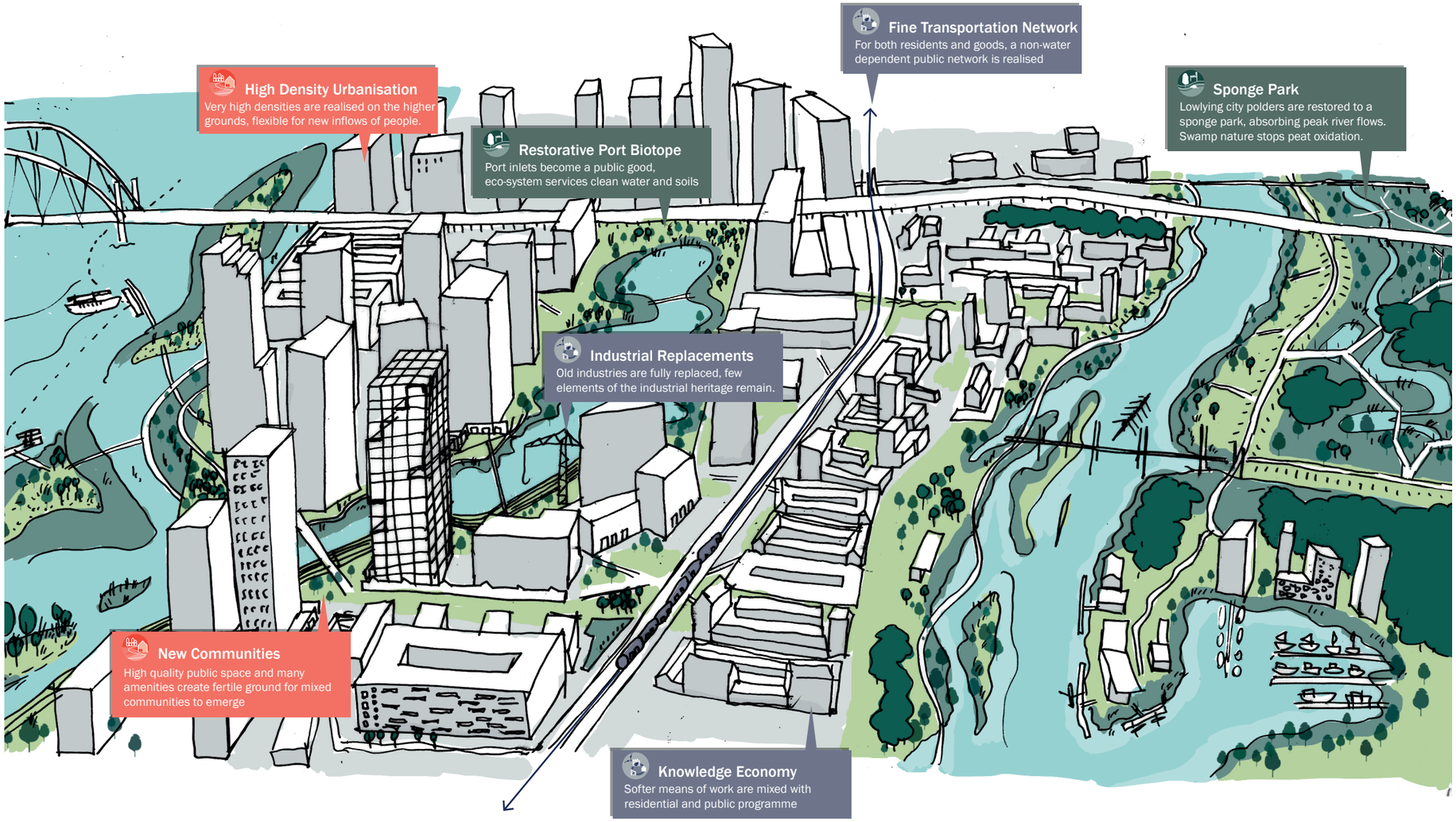


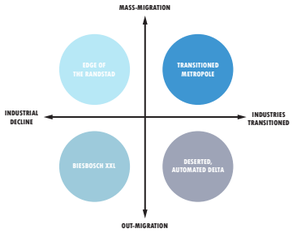
Figure 94: Scenario 1, Edge of the Randstad. Future perspective for the redevelopment of a section of de Staart (Own illustration).

SCENARIO 2 | TRANSITIONED METROPOLE

The climate crisis results in climate induced migration of southern Europeans and Africans to the cooler parts of the globe, such as the Netherlands. A sudden stream of new migrants need to be rapidly accommodated in the region and next to shelter, the refugees look for work, amenities and a social network.

In addition, the industrial sector has successfully transitioned to the Green Economy. The former industrials have made way for new industries, which establish more climate adaptive and local networks in the region that also target the mitigation of climate change. These world-leading innovative green industries give the Netherlands a competitive position and the region attracts more new companies and employees. A very open economy emerges that shares knowledge across the world in the transition to a more Green Economy.

Products and raw materials come from less far away, but do still rely on the water as a sustainable means for transportation (at a smaller scale than we are used to today however). This means that the delta can be closed, yet openable through sluices. The few international connections that remain will make use of the Maasvlaktes outside the protection of the dams. Meanwhile, the metropole keeps growing behind the dams.



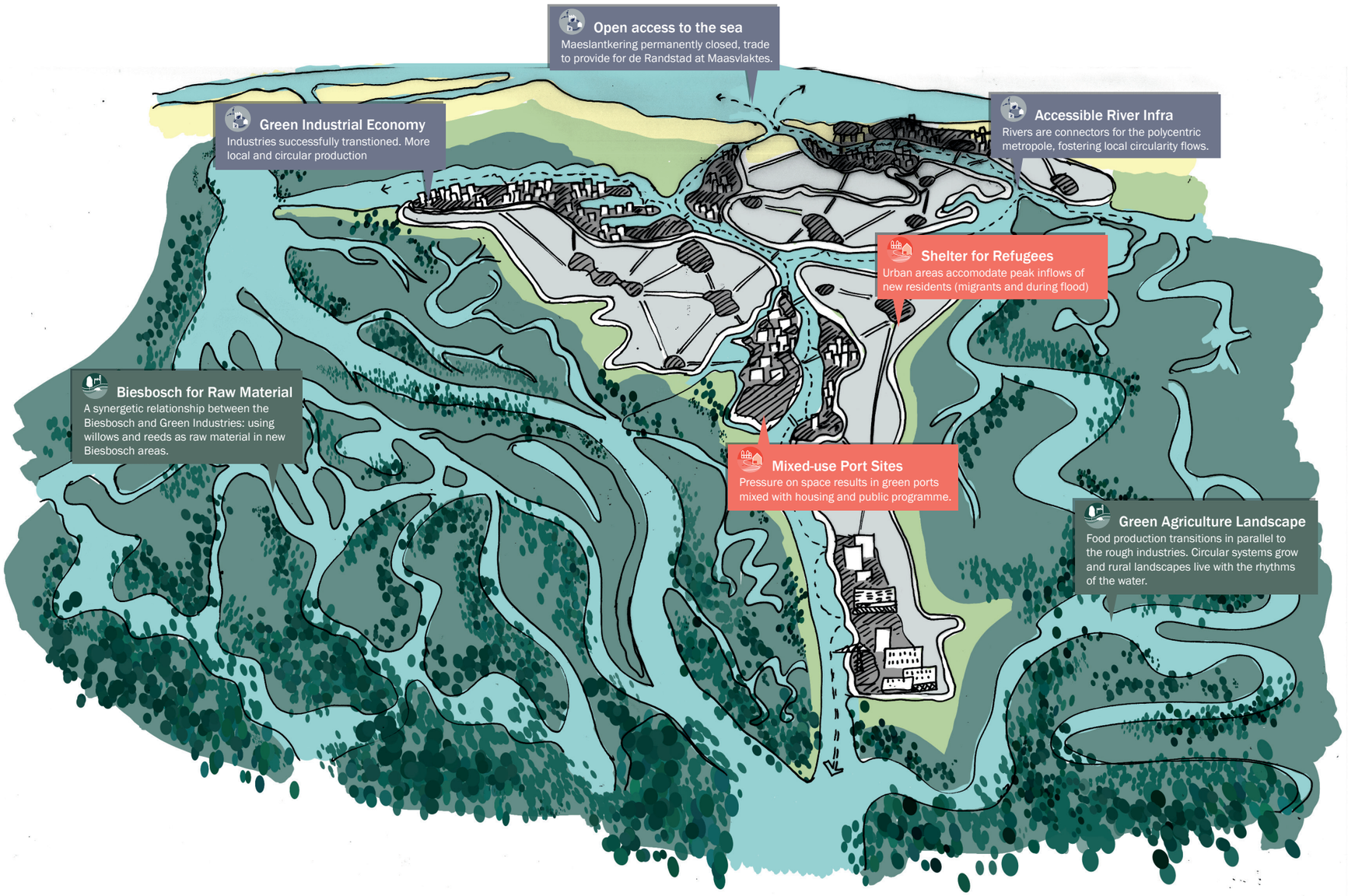


Figure 95: Scenario 2, Transitioned Metropole. Bird's eye impression on the future of the delta metropole region (Own illustration).

2
IDENTIFY ACTIONS USING TRANSCIENT SCENARIOS

SCENARIO 2 | TRANSITIONED METROPOLE

A big demand in housing, which could see very sudden increases when the area is flooded with refugees. Buildings needs to be adaptable to house migrants more temporarily as well as permanently, seeing many parts of the globe will become uninhabitable. While green industries set up new networks and infrastructures, they need to be able to adapt to support the peaks migration streams to the area. For example, by producing new housing units locally and making furniture.

Due to the growing pressure on space, new relationships between industry and housing emerge, made possible by more flexible legislation. On the one hand, industries become less heavy and are more suited to combine with housing. On the other hand, people become more flexible and accepting towards living in a mixed area.

New modes of area based governance evolved to support the transition towards the green economy, and communities reclaim their right to the city.

On post-industrial sites, new ways of co-existence between industry, housing, nature and water are discovered. One site can have all elements co-existing in each other's proximity, and adaptive networks improve community building and social cohesion between residents by engaging in public space and work. System dependencies are more local and an inclusive network strengthens the resilience of the region.

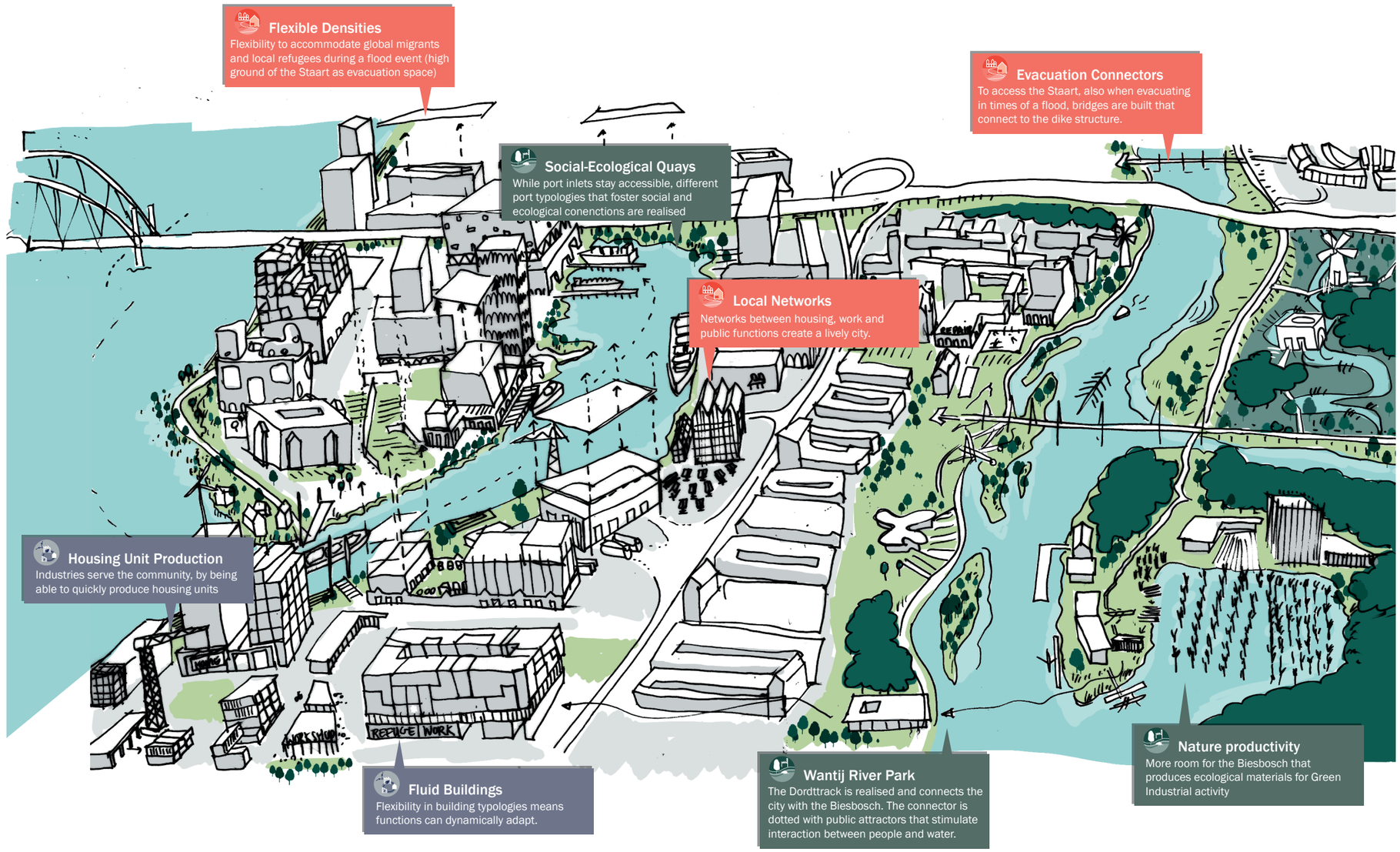
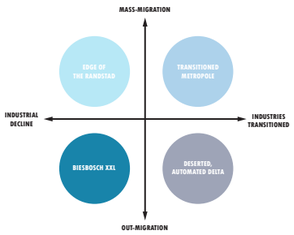


Figure 96: Scenario 2, Transitioned Metropole. Future perspective for the redevelopment of a section of de Staart (Own illustration).

SCENARIO 3 | BIESBOSCH XXL

Due to very high levels of sea level rise and flood risks, a big move away from the Randstad happens. Perhaps this is due to a failure to make a national delta decision, or a cultural shift that people started to understand the risks of living in a flood prone area. Due to resistance of the existing system, the transition towards the Green Industrial Economy became more disruptive and chaotic.

Due to a lack of certainty about a safe and innovative future in the short-term governance model, industries moved away from the Randstad. As a result of this economic shrinkage and the continuous floods and crises in the region, many people choose to migrate East, searching safety in the higher ground. Only a few people stay behind. The water is allowed to take over and nature remediates the era of occupation over time.



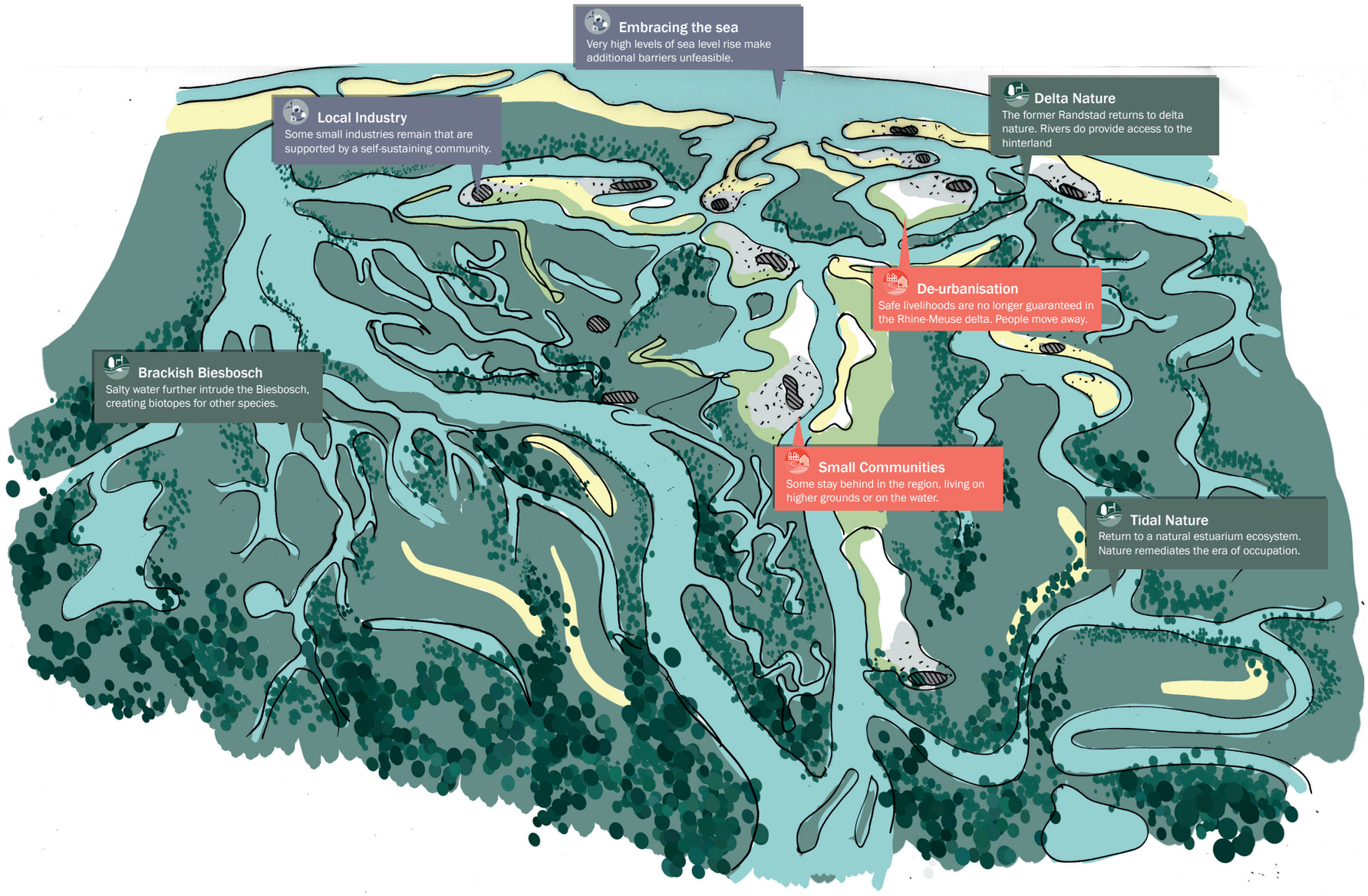


Figure 97: Scenario 3, Biesbosch XXL. Bird's eye impression on the future of the delta metropole region (Own illustration).

SCENARIO 3 | BIESBOSCH XXL

The residents of the post-industrial site are some last staying behind, they live in floating dwellings or on the higher ground of the sandbank that is the Staart. These communities can live in floating neighbourhoods or flood-proof buildings, for example on poles. Connecting infrastructure makes use of former higher routes, such as dikes and viaducts, but also uses the water for transportation. Productivity and communities are self-sufficient through local energy, food and housing production and materials are used circularly. The communities live more in balance with nature and synergies are found between restorative ecology, bio-based industry and food.

Tidal nature and wetlands have taken over the polders surrounding the area, and transport over water becomes more widely used.

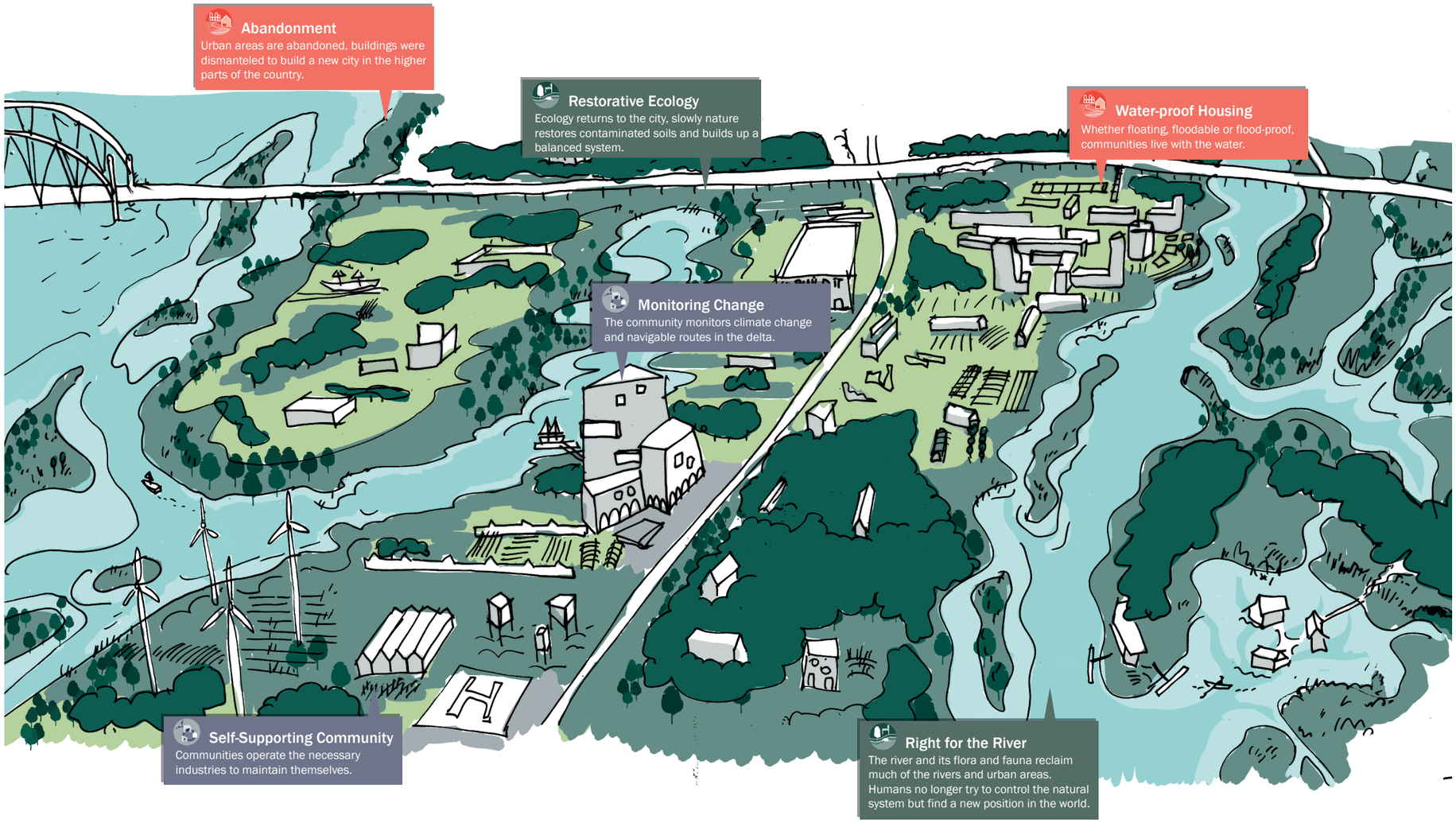
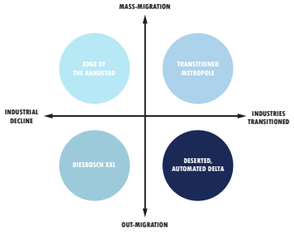


Figure 98: Scenario 3, Biesbosch XXL. Future perspective for the redevelopment of a section of de Staart (Own illustration).

SCENARIO 4 | DESERTED, AUTOMATED DELTA

Due to very high levels of sea level rise and flood risks, a big move away from the Randstad happens. Perhaps this is due to a failure to make a national delta decision, or a cultural shift that people started to understand the risks of living in a flood prone area. Furthermore, due to a lack of certainty about a safe and innovative future in the Rhine-Meuse delta, industries also moved away from the Randstad. As a result of this economic shrinkage only a few people stay behind. The water is allowed to take over and nature remediates the era of occupation over time.



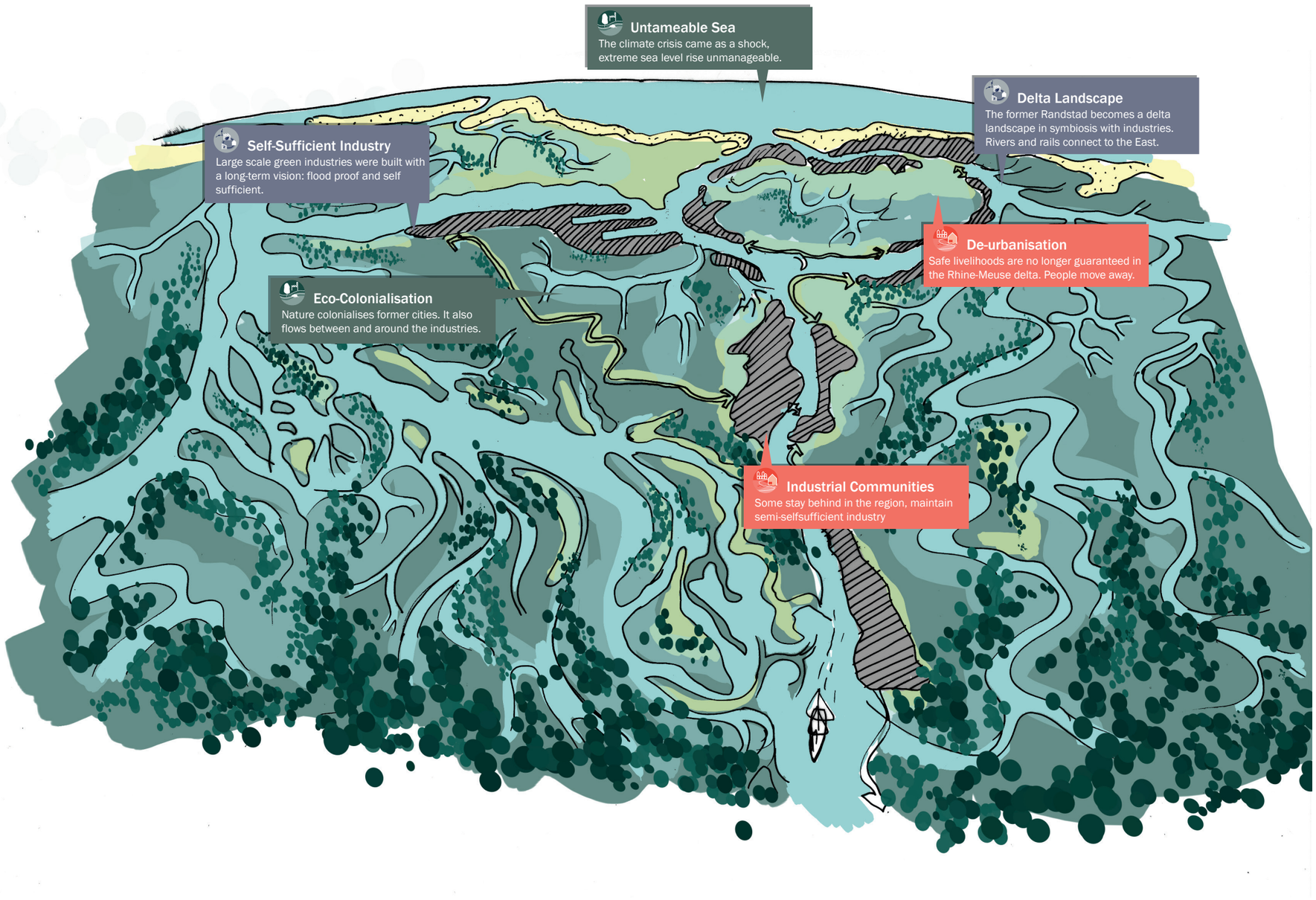


Figure 99: Scenario 4, Deserted, Automated Delta. Bird's eye impression on the future of the delta metropole region (Own illustration).

SCENARIO 4 | DESERTED, AUTOMATED DELTA

In this scenario, adapted industries dominate the future of the Staart. Either because industries started adapting their businesses early on with a long-term vision, understanding that a radical transition is needed to survive. Meaning the big petrochemical industrials on the site, such as Chemours, were able to transition to more green industrial practises. Or because innovative, new industries started their practices in the Staart and could scale up when the industries of the past system disappeared. The new industries have not only adapted their ways of production and scale, but also built their factories to be water resilient and automated, being able to survive also when sea levels rise extensively.

At the same time, residents and housing programme has not developed as much in the Staart region. This could be the result of a long-term focused housing policy, stopping houses to be built in the flood-prone delta region early on and building a new metropole on the higher ground in the east of the Netherlands. This situation could also be the result of a laissez-faire attitude of the Dutch government, meaning market parties took into consideration flood risks in the price of houses and insurances, making houses unaffordable and too risky in the low-lying delta. Finally, it can also be the result of a series of floods, damaging the previously constructed neighbourhoods beyond repair and changing resident's relationship with the delta landscape: making it a dangerous place to live, and decreasing the demand for new houses in the delta region.

As the area is still productive industrially, some people need to stay behind. Dikes function as connectors between floating neighbourhoods. Floating houses and some flood-proof buildings on the Staart are connected to the industries through systemic work relationships.

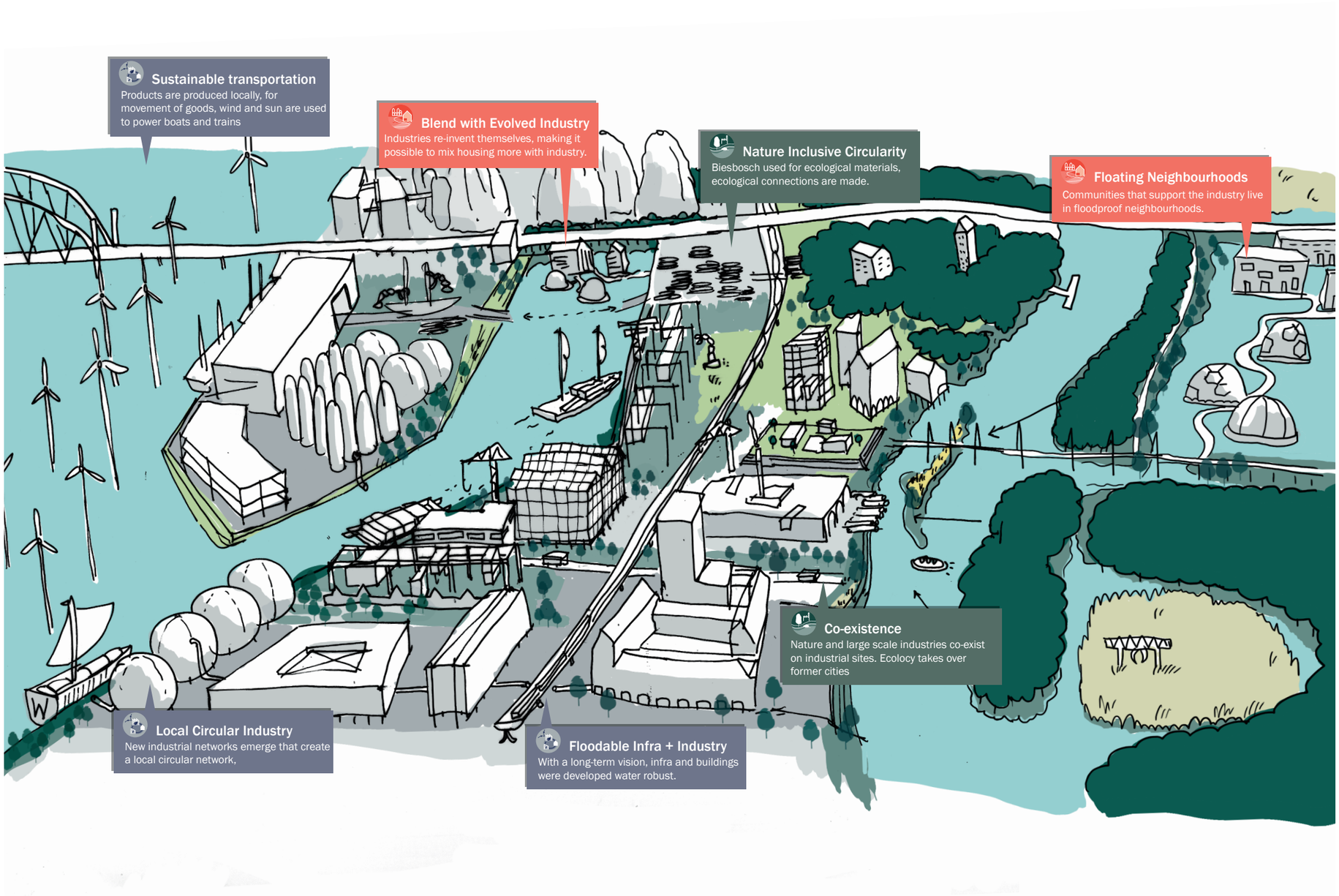


Figure 100: Scenario 4, Deserted, Automated Delta. Future perspective for the redevelopment of a section of de Staart (Own illustration).

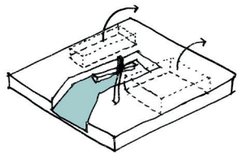
3 IDENTIFY ACTIONS

In the third step, actions concluded from the scenarios are identified that can be taken to meet the definition of success (Haasnoot et al., 2013), which is a transitioned, reslient delta region.

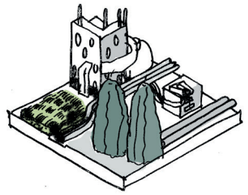
Each scenario has shown a different transition direction with different types of associated actions for the different regimes of the landscape.

In an iterative process, the actions of the right page were developed. The actions represent possible directions for urban area redevelopment of post-industrial sites. While these actions have been developed specifically for de Staart, they can also be applied to other industrial sites in transition. The actions are grouped in the three spatial dimensions of the conceptual framework: industry, housing and delta rivers. This does not mean that each action below a category only targets one dimension: the assessment of actions in the next step shows that each action has multiple layers and a different performance regarding the transition and dimensions of the conceptual framework.

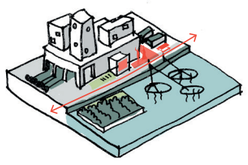
INDUSTRY



1 Industries leave

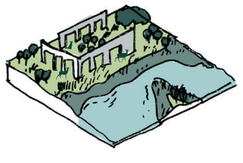


2 Big industries transfrom to Green Industry



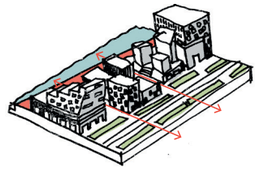
3 Small, bio-based, circular industry replaces old practices

4 Floodproof operations



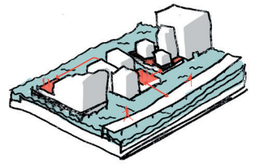
5 Move all occupation, ecological remediation and reclamation

HOUSING

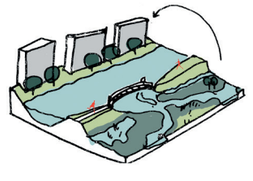


1 Redevelop industry into housing, city street at water

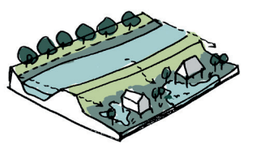
2 Floating, self-supporting communities with small industry



3 Build water resilient buildings (floodable or flood-safe) and infrastructure

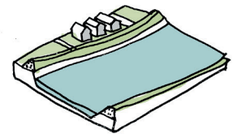


4 Residents from city polders move to higher grounds or East of NL, make place for tidal nature

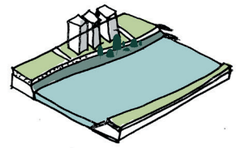


5 City polders adapt housing programme, also making room for the river

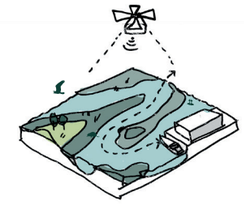
DELTA RIVERS



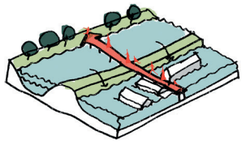
1 Heighten dikes and build new barriers



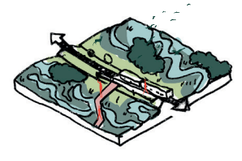
2 Heighten grounds



3 Rivers tidal nature, technology keeps rivers navigable. Sedimentation as protection against sea level rise



4 Build bridges to access Staart as evacuation grounds during flood and for daily use



5 Room for the River in polders, usable as park via water resilient infrastructure

4 ASSESS ACTIONS

To evaluate how well each of the actions contribute to achieving the aims of the project, the actions are now assessed to the 2 x 3 criteria of the conceptual framework. Industrial value, ecological value and housing value on the one hand, and adaptive capacity, transition performance and cultural shift on the other hand.

As the table shows, some of the actions require quite an investment, which might not be realistic from day 1. Nevertheless, the do-nothing scenario is the most expensive due to high vulnerabilities in a locked-in system: that is why we need imageability to think about the alternatives (Rotmans, 2021).

Last, it is important to note that the evaluation and identification of these actions shouls be seen as a simulation, they should be developed and assessed by a multidisciplinary team in a real-life context.

Action	Impact									
	Housing	Nature	Industry	Transition	Adaptive Capacity	Cultural shift	Sell-by date	Costs	Payer	Benefiter
CURRENT SYSTEM							2030	++++++	All	None
INDUSTRY										
Industries leave	0	+	---	–	0	0	-	+++++	Industry	Ecology
Big industries transform to Green industry	–	+	+++	++	+	0	2100	++	Industry	Industry
Bio-based, circular industry replaces old practices	-	+	+++	+++	+	0	2100	+	Industry	Industry
Floodproof operations	0	0	+	0	++	+	-	++	Industry	Industry
Small-scale industries support self-sustaining communities	+	++	+	++	+	++	-	+	Community	Community
Launch diverse, grounded, short-term experiments	+	+	++++	+++	+++	+++	initial	++	Coalition	Coalition
HOUSING										
Redevelop industrial sites into housing	+++	-	-	-	+	0	2100	+++	Industry	Developer Residents
Residents from city polders move to higher grounds	0	+	0	+			2100	+++	Municipality, Residents	Water Boards
Build water resilient buildings (floodable or flood-safe)	++	-	+	0	+	+	-	+	Building owners	Building owners
Move to the east of NL, demolish/move former cities	---	+++	+	++	+++	++++	-	+++++++	All	All
Floating self-supporting communities	+	++	+	+	++	+	-	++	Community	Community
WATER										
Heighten dikes/barriers	+	-	-	-	0	0	2050	++++	Water boards	Water boards
Redevelop (city) polders into tidal nature, in open connection to the sea	-	+++	0	++	-	+++	-	+++	Residents, water boards, governments	Ecology
Make more Room for the River behind dams, using farmland and low-density city polders	+	+++	0	+	++	++	-	+++	Governments, water boards, rural population	Water boards, ecology, cities
Sedimentation in rivers to protect against sea level rise	0	++	–	++	0	++	2100	0	Indirect costs for industries (loss of river access)	Cities, ecology
Develop smart-technology to keep rivers navigable to connect hinterland with the North Sea	0	0	+	+	++	0	-	+	Governments	Industry, delta communities
Heighten grounds	+	0	+	0	+	0	2050	++	Water boards, local land owners/developers	Users of land
Build bridges + spaces to access de Staart as evacuation grounds	++	-	-	0	++	++	initial	+	Water boards, municipality	Polder and high ground residents
Build water resilient railway connection to East	+	0	+	0	+	+	2100	+++	Province, municipality	Community, industry
Build water resilient streets +3m	+	0	++	+	+++	+	-	++	Local land owners	Community, industry
ECOLOGY										
Ecological take-over of the area	0	+++	+	++	+	+++	-	+	Nature, direction by province	Nature
Remediate soils with tidal nature	++	+++	0	0	+	++	initial	++	Land owners, municipality	Users
Integrate ecology in the development	+	++	+	++	+	++	-	+	Coalitions	All
Expand the Biesbosch to rural polders	-	+++	0	+	0	++	-	++	Province, rural residents	City dwellers, ecology
Expand the Biesbosch to city polders	–	++	+				-		Province, city polder residents	City dwellers, ecology

ACTION CARDS

To communicate about possible actions and make their details and related strategies more insightful (Haasnoot et al., 2013), actions cards can be used. These cards can be used for co-creation and participation. As a result, you do not have to be an expert to participate in the redevelopment of the complex site. The cards in Figure 101 provide an overview of the actions' performance, relevant stakeholders, and makes a suggestion on how the action might be realised in terms of a coalition and investment scheme.

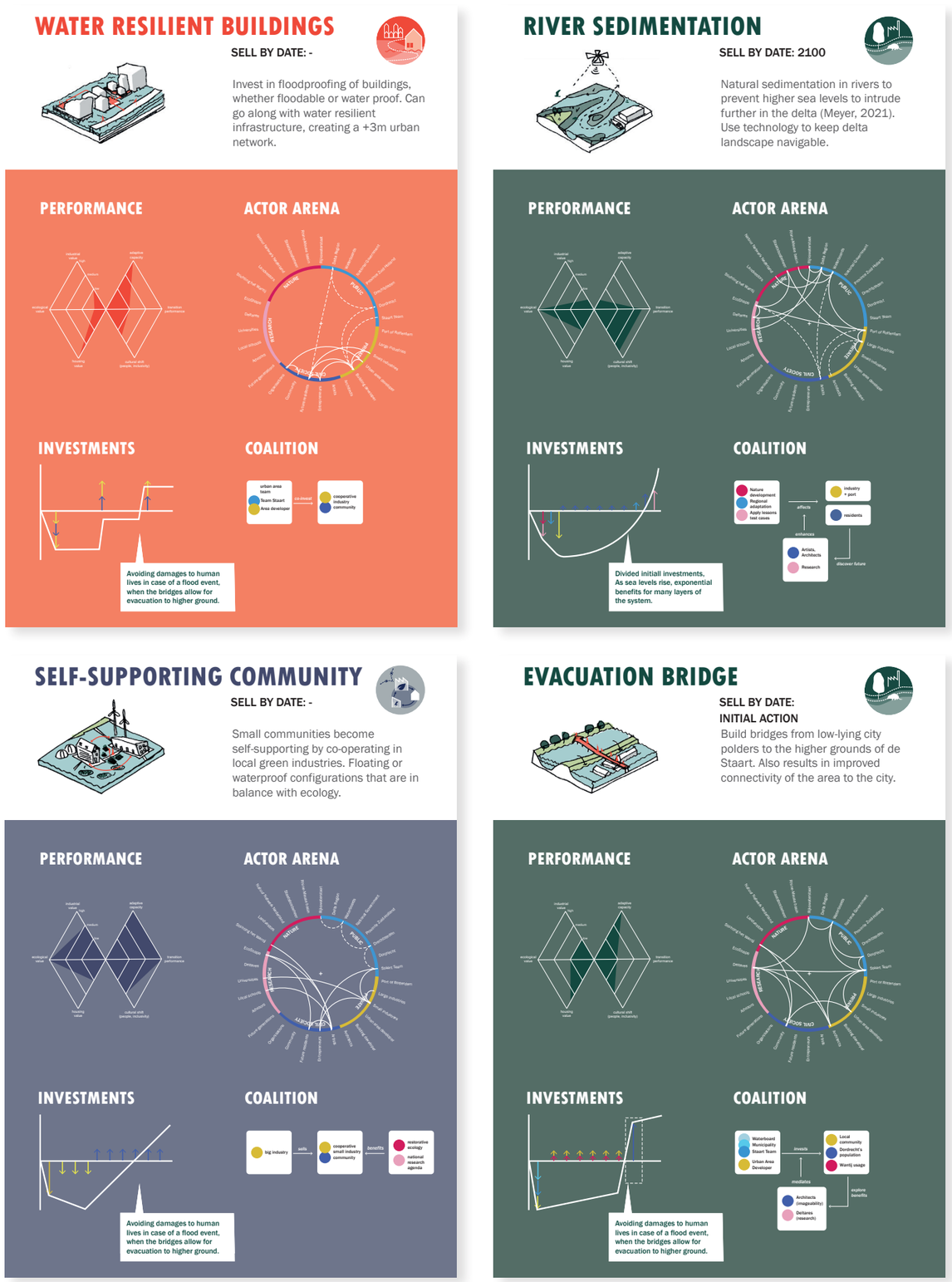


Figure 101: Profile cards for make actions and their implications more insightful (Own illustration).

5 ADAPTATION PATHWAYS

A pathways map can now be developed by the team of actors (Figure 103), showing the lifetime of actions and interdependencies. The map can be read like a metro map: when a dead-end is nearly reached because an action is no longer adequate to achieve the goal, you can change tracks. Some pathways, combinations of actions, will be better than others, and the pathways can be assessed on performance.

Figure 102 shows that the pathways are organised according to transition principles (Lieftink, 2021). In order to make certain pathways possible, initial experiments are needed to stimulate the transition of a regime or landscape (Rotmans, 2021). These are essential to make pathway that are different from our current mindset feasible. Other pathways will only become feasible at a later stage in the future, either because they depend on a deep cultural shift, or because they require very large investments that are not realistic at present due to high uncertainty around climate change and the direction of transitions and regional delta decisions.

The map is organised according to the different sectors and you should select a pathway for each sector. Some combinations are more logical than others. Time was used as a unit on the x-axis, because there are multiple uncertainties included in the lifespan of actions (housing, climate, industry). However, actions

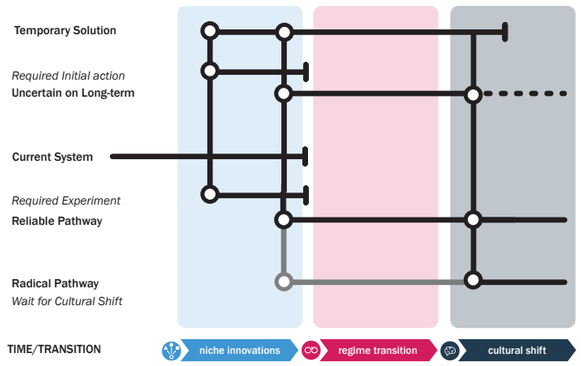


Figure 102: (top) Concept behind pathways organisation (Own illustration)

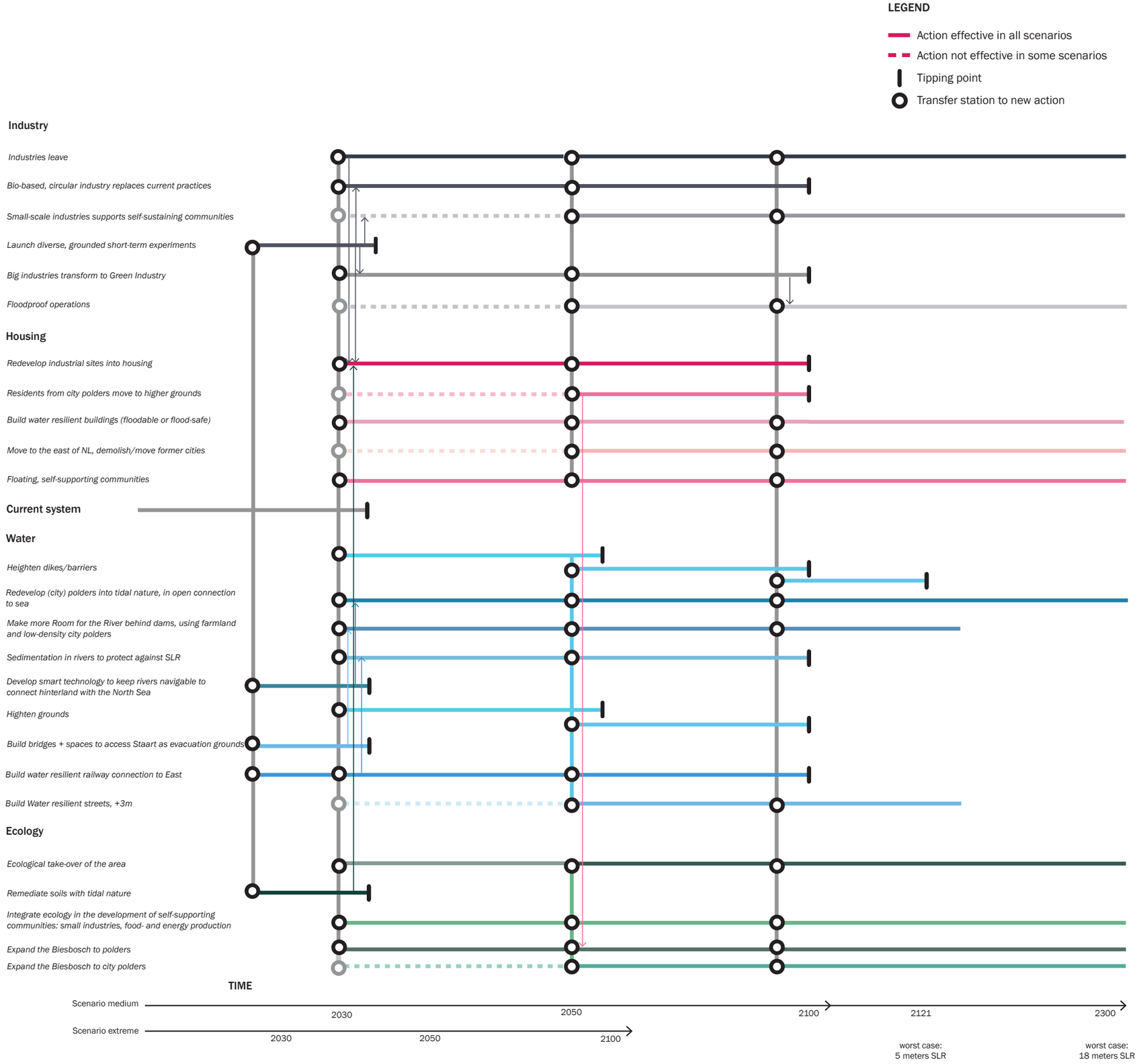


Figure 103: (right) Dynamic adaptive policy pathways for de Staart in Dordrecht. (Own illustration, based on Haasnoot, 2013)

6 PREFERRED PATHWAYS

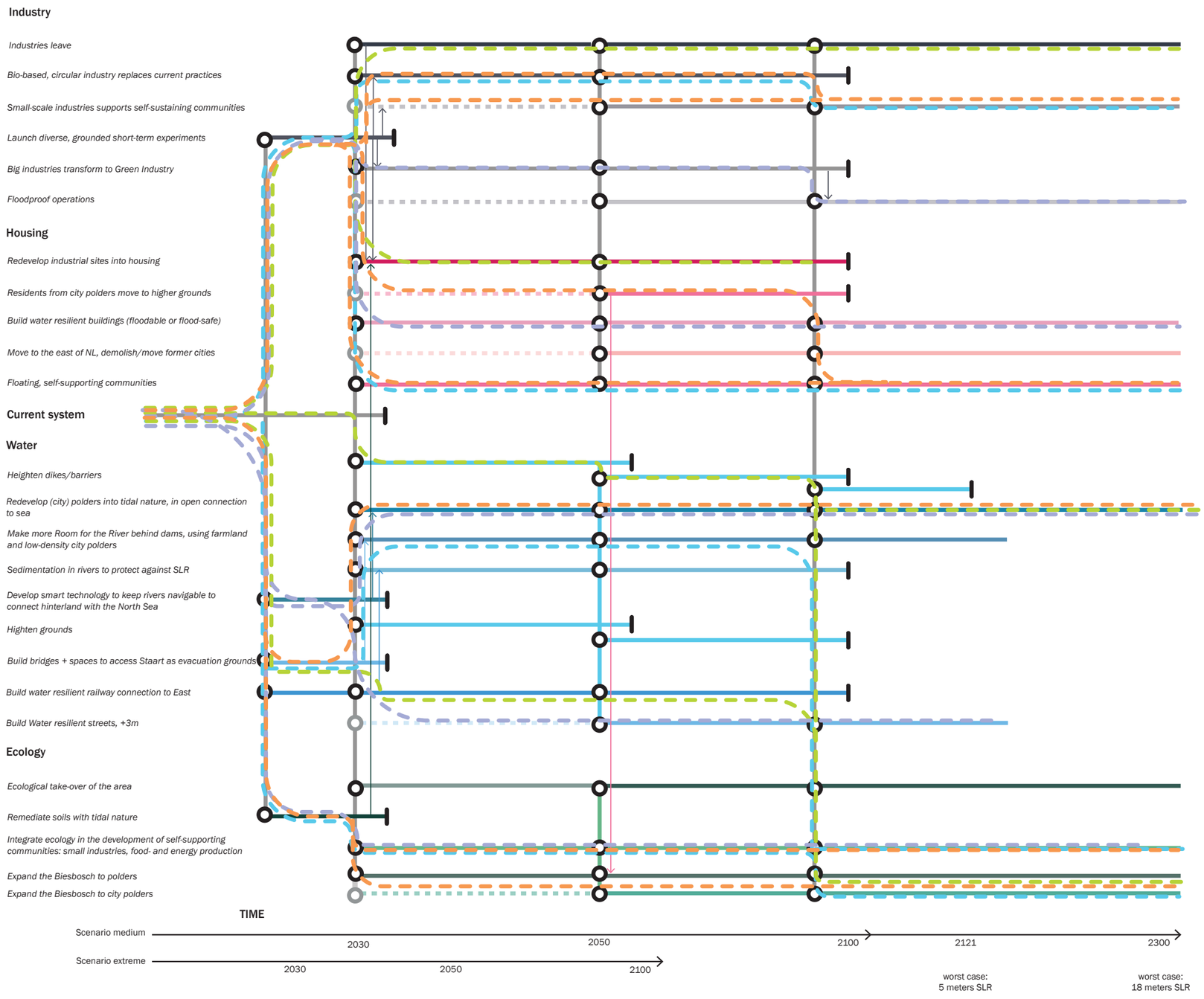
In the sixth step, physically and socially robust pathways are selected by decision-makers, which should preferably be organised in an open and democratic process. Multiple preferred pathways form the basis for the dynamic adaptive plan.

Participatory Process

In the strategy of the project, the development and selection of pathways should be developed in a real-life setting participatory process. Nevertheless, to illustrate possible preferred pathway directions, three different archetypes of perspectives are used. The thesis uses three archetypes of perspectives: Hierarchist, Egalitarian and Individualist. “Hierarchist believes in controlling water and nature, assigning major responsibilities to the government. (...) The Egalitarian focuses on the environment and equity, resulting in strategies for decreasing water de-mands by adapting functions to their environment (...). The Individualist adheres to a liberal market and a high trust in technology and innovation.” (Hoekstra, 1998 and Middelkoop in Haasnoot et al., 2013, p. 494)

Transition Performance

Furthermore, there are also pathway directions that contribute to the transition more than others, for example due to innovative value. Seeing that de Staart is seen as a pilot for the regional transition, this is an important factor too. This perspective favours directions that are very different from our current system, seeing Nature Based Solutions as the most promising in establishing a more sustainable cultural relationship between humans, nature and water.



LEGEND

- Action effective in all scenarios
- Action not effective in some scenarios
- Tipping point
- Transfer station to new action
- Preferred Pathway Hierarchist
- Preferred Pathway Egalitarian
- Preferred Pathway Individualist
- Preferred Pathway Transtion Pilot

Figure 104: Preferred pathways. (Own illustration, based on Haasnoot, 2013)

Figure 104 shows the preferred pathways for the three perspectives and the pathway with the highest transition performance. Where the preferred pathways overlap, a socially robust direction is found. Where they diverge, a decision point can be found, giving rise to a debate about the next direction.

Figure 104 also shows that the Hierarchist perspective rarely overlaps with other preferred pathways. The Egalitarian preferred pathways coincide the most with the preferred pathway for innovative transition and finds some similarities to the Individualist preferred pathway.

Conclusion

From this analysis, it can be concluded that the preferred pathway selected depends on the governance modes of the future, and is uncertain, which is also illustrated in Figure 105. Nevertheless, from the perspective of developing a strategy for a high transition performance, a hybrid governance model between the Egalitarian and Individualist will be the best direction. However, the Hierarchist model might also be suited to build quick and large scale interventions when needed.

However, new governance models do not develop right away, making an initial experimental stage advisable, where different stakeholder coalitions discover different pathways to understand what the most physically and socially robust directions are. Finally, a future governance model may emerge and a larger scale pathway is selected, scaling up experiments for urban development.

After selecting a preferred pathway, which could occur after an initial explorative experimentation phase, the area should use the elements of the pathway as guidelines for future development and possible adaptation.

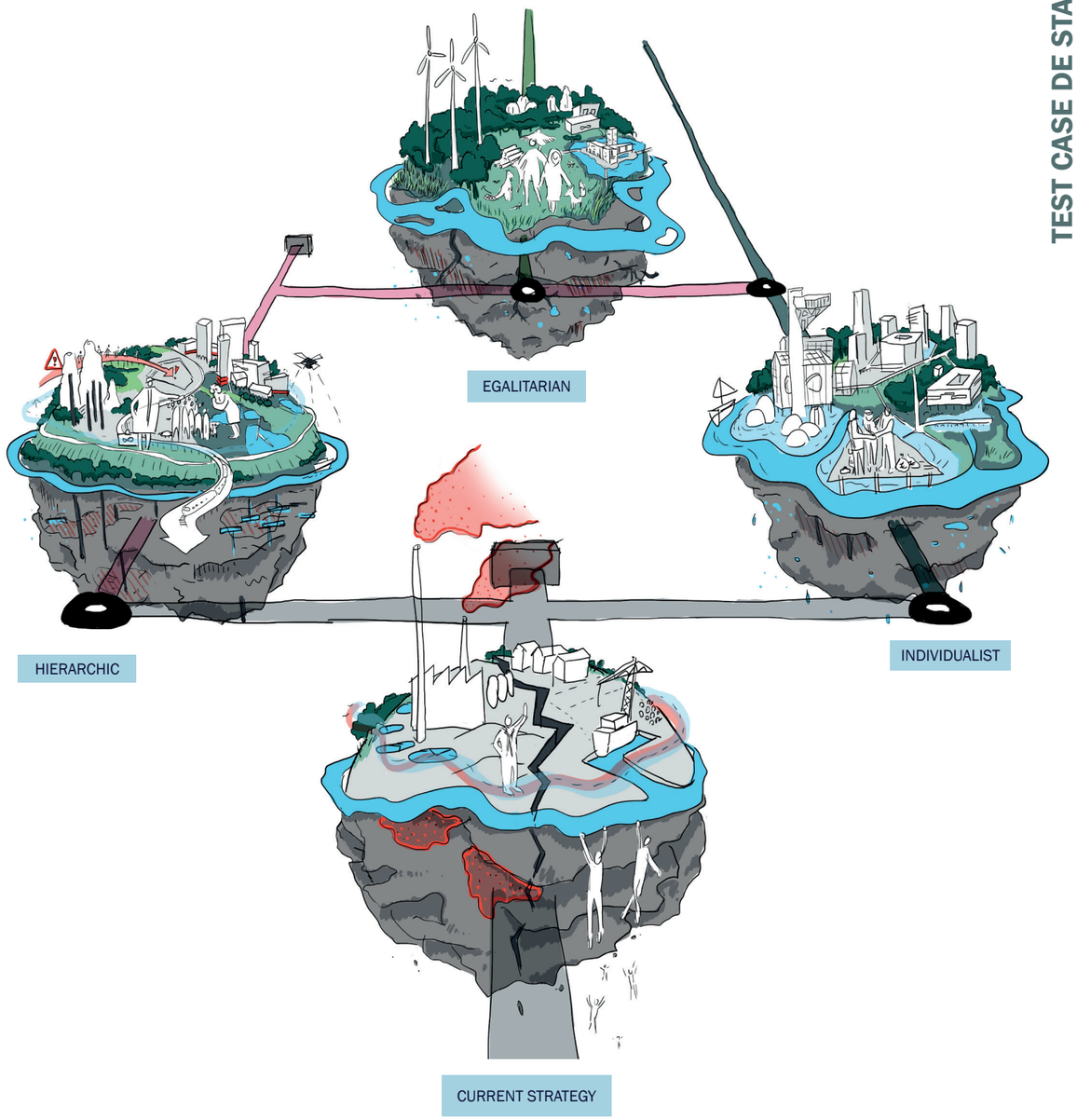


Figure 105: Different preferred policy pathways for each of the worldviews (Hierarchist, Individualist, Egalitarian) result in diffrent spatial outcomes. A combination of worldviews is also possible, resulting in hybrid pathways. (Own illustration)

7 DETERMINE CONTINGENCY ACTIONS AND TRIGGERS

After selecting a preferred policy pathway, the seventh step is to prepare for one or more preferred pathway(s), "defining actions to get and keep each of the pathways on track for success" (Haasnoot et al., 2013) This requires a strategy for redevelopment that can also be applied in different projects within the Rhine-Meuse delta, and likely also in other contexts.

To answer SRQ4: What interventions in redevelopment projects can be used to integrate climate adaptive capacit in the redevelopment of post-industrial sites in the Rhine-Meuse delta? First, the DAPP methodology inclusive of multiple values makes a strong contribution to a more climate adaptive paradigm. Second, a more open and egalitarian governance model is needed for producing innovative outcomes that have a contribution to the larger transition. Third, a spatial framework and set of dynamic rules are needed to guarantee direction within the uncertainty of adaptive redevelopment, which will be explained later on.

A participatory and dynamic process should be used to develop the pathways, decide on a preferred pathway, launch experiments and start projects. Figure 106 shows that in the different development stages, early participation is needed to build a network that allows for grounded experiments that can contribute to the discovery and feasibility of pathways.

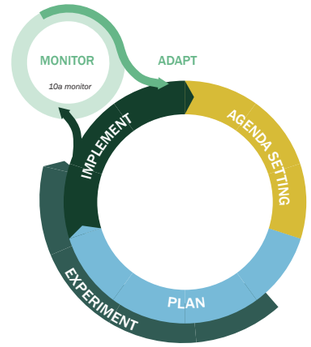
Growing Network

When the project progresses, more actors can be involved in the process. Based on Roorda's (2014) transitions in urban development principles and the cases study conclusions, the transition team, consisting of actors that are actively involved with the transition, should first take the initiative and explores options for the area. Next, more relevant stakeholders are invited to the transition arena, which should be openly accessible. Here, people jointly discover future pathways, which can result in coalitions for transition experiments. These experiments are supported by the municipality, but it is very important that they are grounded enough to be realistic and scalable. Experiments can affect the cultural shift by becoming transition icons or by being adopted by next development.

Interconnected scales and actions

The Panarchy model of Adaptive Cycles explains that actions and scales are interconnected. Therefore, we should to start off with experiments for each of the pathways (or two desireable directions) to understand technical requirements, new management forms and lie the basis for a new societal system and human psychological relationships with the transition. What determines the boundaries of an experiment? Well, a redeveloped industrial building can be an experiment for the urban area, but the urban area in turn can be an experiment (or pilot) for the region, etc.

Last, when the area has been redeveloped, it remains important that the transition team



remains responsible for monitoring the area's performance and the progression of the climate crisis, which is highly uncertain. However, contingency actions and triggers should be developed together, such as keeping track of sea level rise and the housing market and recognising when a tipping point for one of the actions is reached: for example when a 1m protective barrier was built and models are sure to predict more than 1m sea level rise, you start adapting the area and its buildings.

Additionally, regional decisions add more uncertainty to today's redevelopment. Therefore, the arena and owners in the area should adapt their spaces when needed. The exact responsibilities for this stage can change when a different kind of governance model becomes the predominant model in the future.

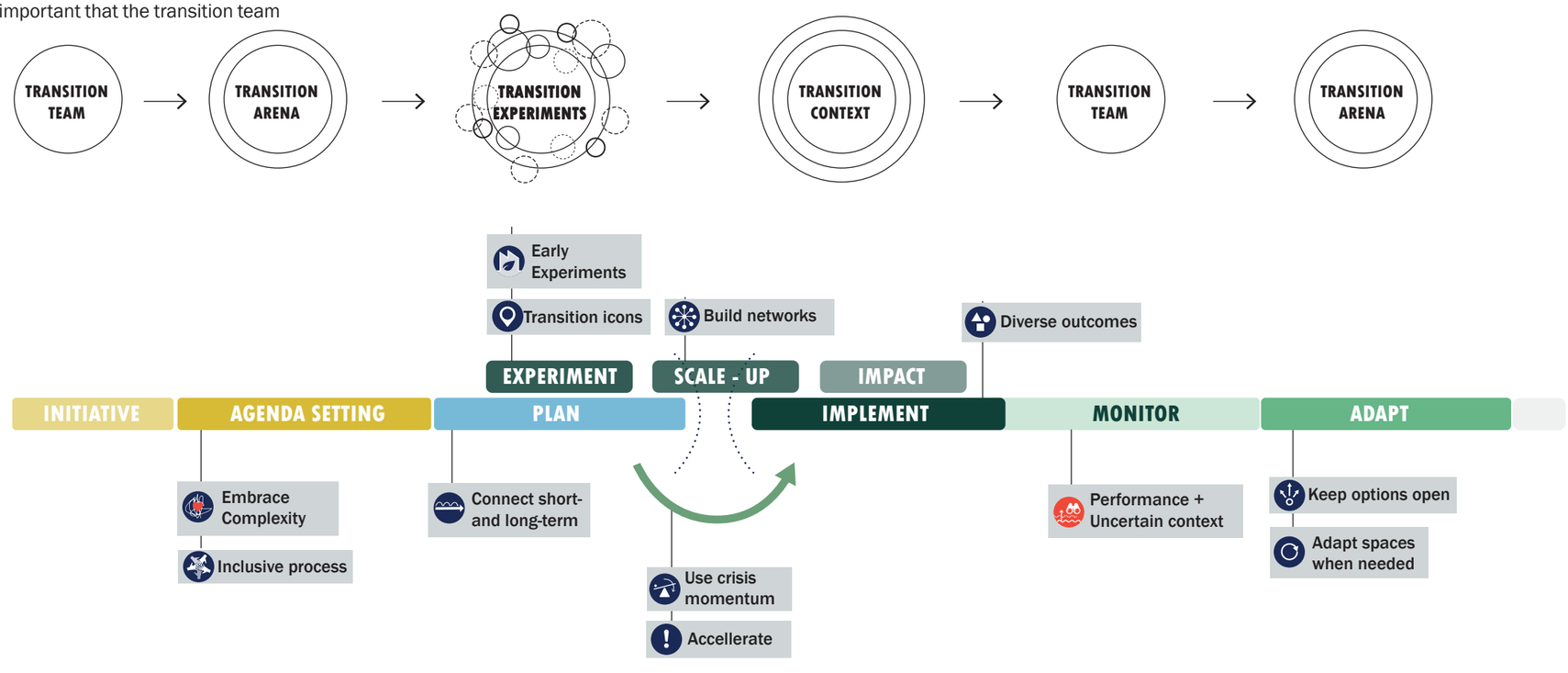


Figure 106: Stages for the redevelopment of post-industrial sites to enhance the opportunity to contribute to the larger transition. (Own illustration, based on Roorda et al., 2013)

INTERRELATED TRANSITIONS

The timeline in Figure 107 shows a strategy for redeveloping de Staart, where de Staart should start redeveloping today with experiments that influence local, municipal pathway decisions and actions. The projects need to be realised with a lot of flexibility, to ensure adaptation to future contexts remains possible. In this way, the paradigm of developing open-ended projects starts from the bottom-up and the Climate Adaptive Delta City emerges and changes dynamically.

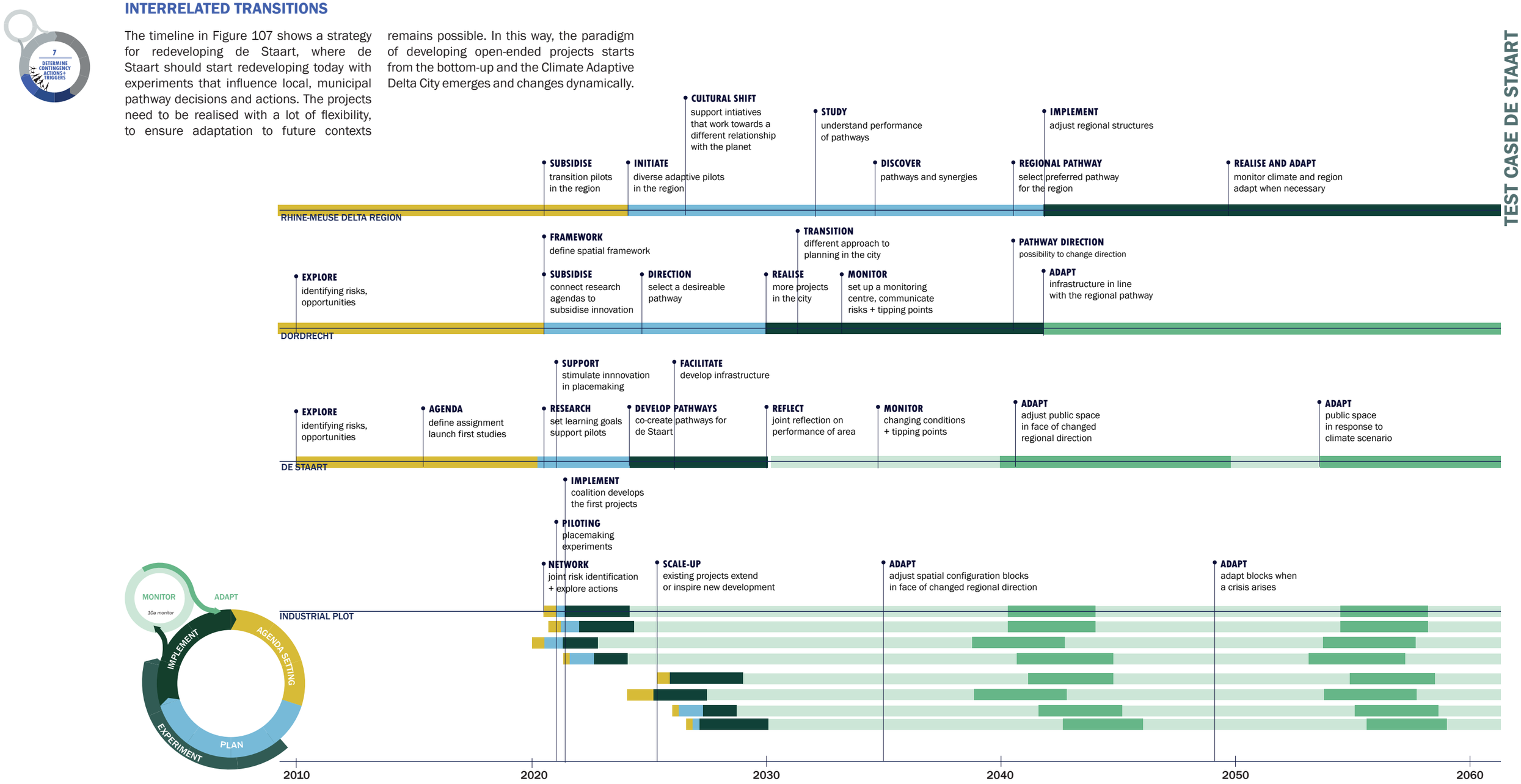


Figure 107: Indicative timeline for the transition from adaptive experiments to a climate adaptive city, to a climate adaptive delta region. De Staart should start early on with redevelopment (in a highly uncertain context) and adapt when regional adaptation pathway decisions are made or other changes in the context occur. (Own illustration)

INTERRELATED TRANSITIONS

As a result, local redevelopment projects such as de Staart are able to use the housing crisis as leverage for transitioning towards the Climate Adaptive Delta City. The housing crisis is quite certain in the short-term, but the industrial transition and climate crisis are more long-term and uncertain, but can have a big impact on the spatial configurations, as the scenarios illustrated. Therefore, ensuring short-term redevelopment is innovative in its open-endedness, climate adaptation and integration of housing, water, nature and industry, will a) support the transition and b) establish a dynamically resilient region that is ever evolving.

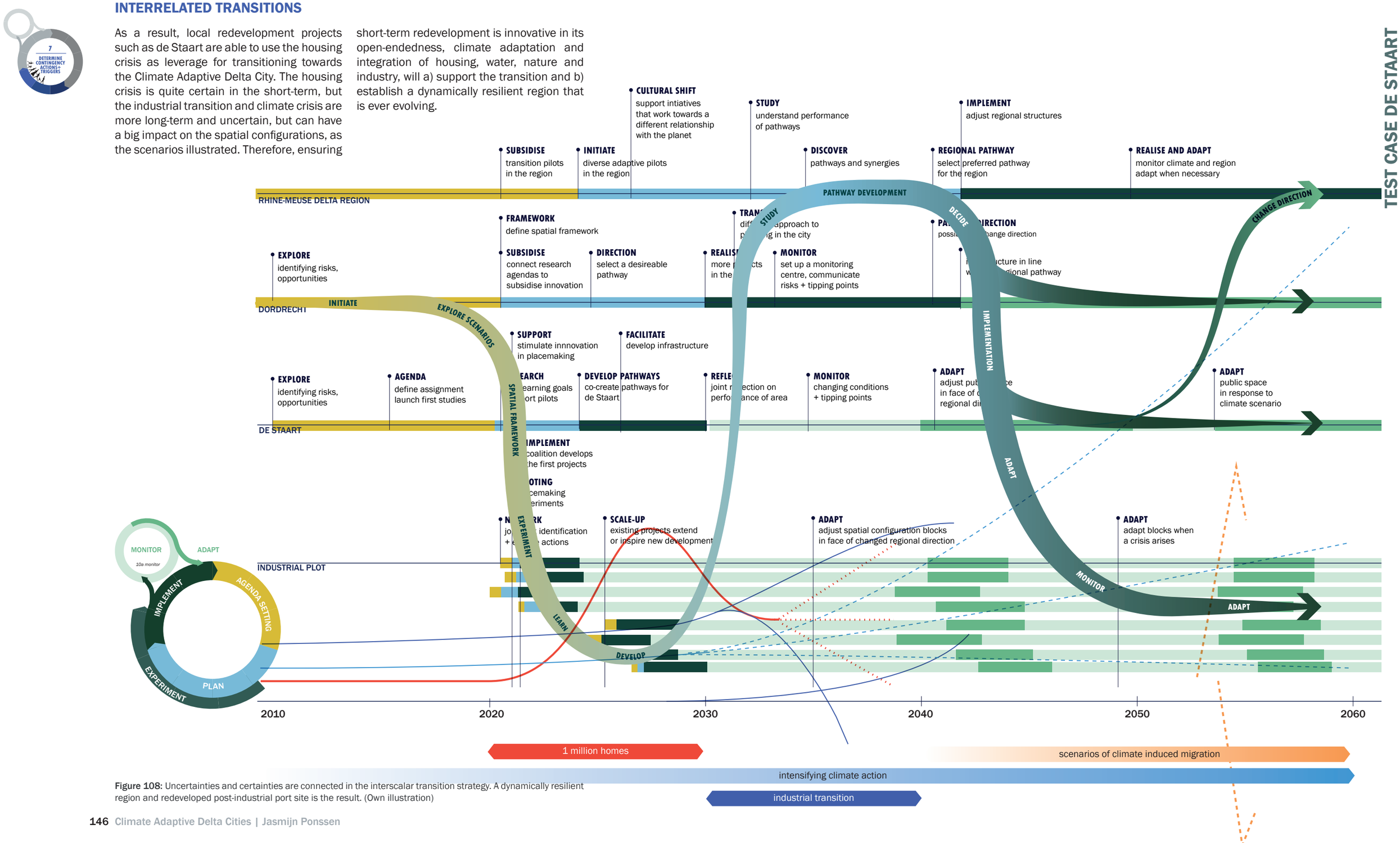


Figure 108: Uncertainties and certainties are connected in the interscalar transition strategy. A dynamically resilient region and redeveloped post-industrial port site is the result. (Own illustration)

8 SPECIFY A DYNAMIC ADAPTIVE PLAN

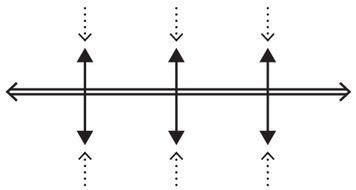
Next, all results are brought together into a dynamic adaptive plan. It answers the following question: "Given the set of pathways and the uncertainties about the future, what actions/decisions should be taken now (and what actions can be postponed)? (Haasnoot et al., 2013) And it includes dynamic documents that can guide redevelopment in the short-term to contribute to the long-term.

The past section showed how there are multiple preferred pathways for de Staart, and which pathway will in the end be selected is uncertain, just like the climate change scenario that will unroll. Nevertheless, there are some short-term actions to be taken now:

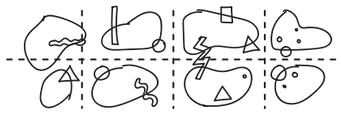
- A Spatial Framework with infrastructure to support development, adaptability and restoring of values for justice;
- Dynamic Rules that guide redevelopment, which will go more gradually. These incorporate rules that enables co-existence of different pathways;
- Experiments and initial projects that set the identity for the site.

Applying the Spatial Framework and Dynamic Rules avoids lock-ins (keeps options open to switch to another pathway), enables new pathways (by fostering a new connection) and allows for co-existence of different pathways (for example industry next to housing).

As the diagram in Figure 109 shows, some of the spatial framework elements need to be implemented early on, as they may have restorative qualities or because they are essential for the future development of the area, and some elements can develop more incrementally. Furthermore, the framework can be adapted to changing contexts and pathway directions, as its rules ensure reservations for multiple actions that might be needed in the future.



a reliable, adaptable framework

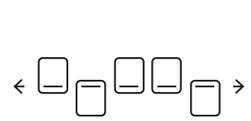


dynamic rules for flexibility and adaptability for future programmes

Figure 109: A reliable, flexible framework and dynamic rules to guide development. (Own illustration)

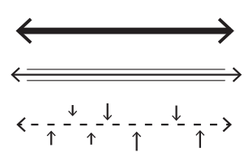
DEVELOPMENT STRATEGY FRAMEWORK

The spatial framework and its corresponding infrastructures and projects can be developed in different ways, depending on the direction in which the governance model evolves (hierarchist, egalitarian or individualist). A combination of redevelopment strategies is also possible as illustrated on the following pages. Furthermore, some elements of the spatial framework are more likely to be supported by a certain type of perspective. Therefore hybrid governance is needed, which the framework promotes.



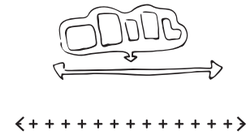
1. INDIVIDUALIST

Each plot makes a contribution to the development of the framework, the government only passively sets performance indicators (comparable to Oosterwolde in Almere, MVRDV). There is a lot of freedom for actors, whether market developers or civil users, to develop the framework in such a way that it best suits their demands.



2. HIERARCHIST

There area three options from this perspective: proactive initial action before development, reactive action after redevelopment and conservating a part of the network, making maybe slight adaptations. It can receive funds from private developments by increasing the ground price, but this is difficult as the land is owned by private actors. Therefore, the muncipality might first buy the plots and them sell them as a package deal, giving more control ofver the final programme. (similar to the large park developed in Hafencity,



3. EGALITARIAN

Here, there are two options. First, coalitions of actors of multiple plots jointly invest in the development. The framework might also be constructed by an external party, allowing the plot occupants to lease the public space. Second, restoration of certain values in the network for the good of ecology or future generations is a more egalitarian approach to developing the framework. In these elements, natural value comes above functionality for industry and residents, though synergies remain possible of course.

DEVELOPMENT PROGRAMME

While the framework offers a reliable structure for redevelopment, the redevelopment of the plots and realisation of projects remains more uncertain. It depends on the specific pathway in which direction the redevelopment will go, but it is likely that redevelopment in the coming years will be focused on addressing the housing crisis and restoring ecological and social value. Furthermore, experiments at the site and at other locations will provide more clarity on the performance of different pathways.

To ensure a just transition in the area, a participatory process is needed that makes redevelopment open to all. In this way, the redevelopment does not just benefit new residents and industries, but the existing users as well. While the transition can be painful and difficult to accept for some, having the opportunity to be a part of it, will make people more open to change (Rotmans, 2021).

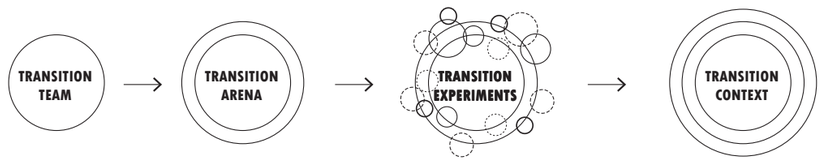


Figure 110: Participation for all types of actors throughout the redevelopment process. (Own illustration, based on Roorda et al., 2014)

FRAMEWORK TO GUIDE DEVELOPMENT

The Spatial Framework (Figure 111) for de Staart support the different transition pathways, to ensure adaptation and to guarantee co-existence of different pathways. The exact positioning of the axis is based on the socio-spatial characteristics of the site (see previous chapter for the analysis of the location). It guarantees opportunities (low-hanging fruit) are seized; it bridges the biggest internal and external barriers to integrate and diversify the disconnected mono-functional islands and connect the isolated Staart with the city of Dordrecht and the regional network.

The exact future of the different connectors cannot be specified like in a masterplan, as their functionality demands depend on internal and external uncertainties. Internal uncertainties include the preferred pathway selected and the multiple transitions in the future. External uncertainties are the climate change effects, putting varying pressures on public space and buildings. Instead, as shown in the next pages, the different layers of the Spatial Framework are explained, which should each be combined with a set of Dynamic Rules.

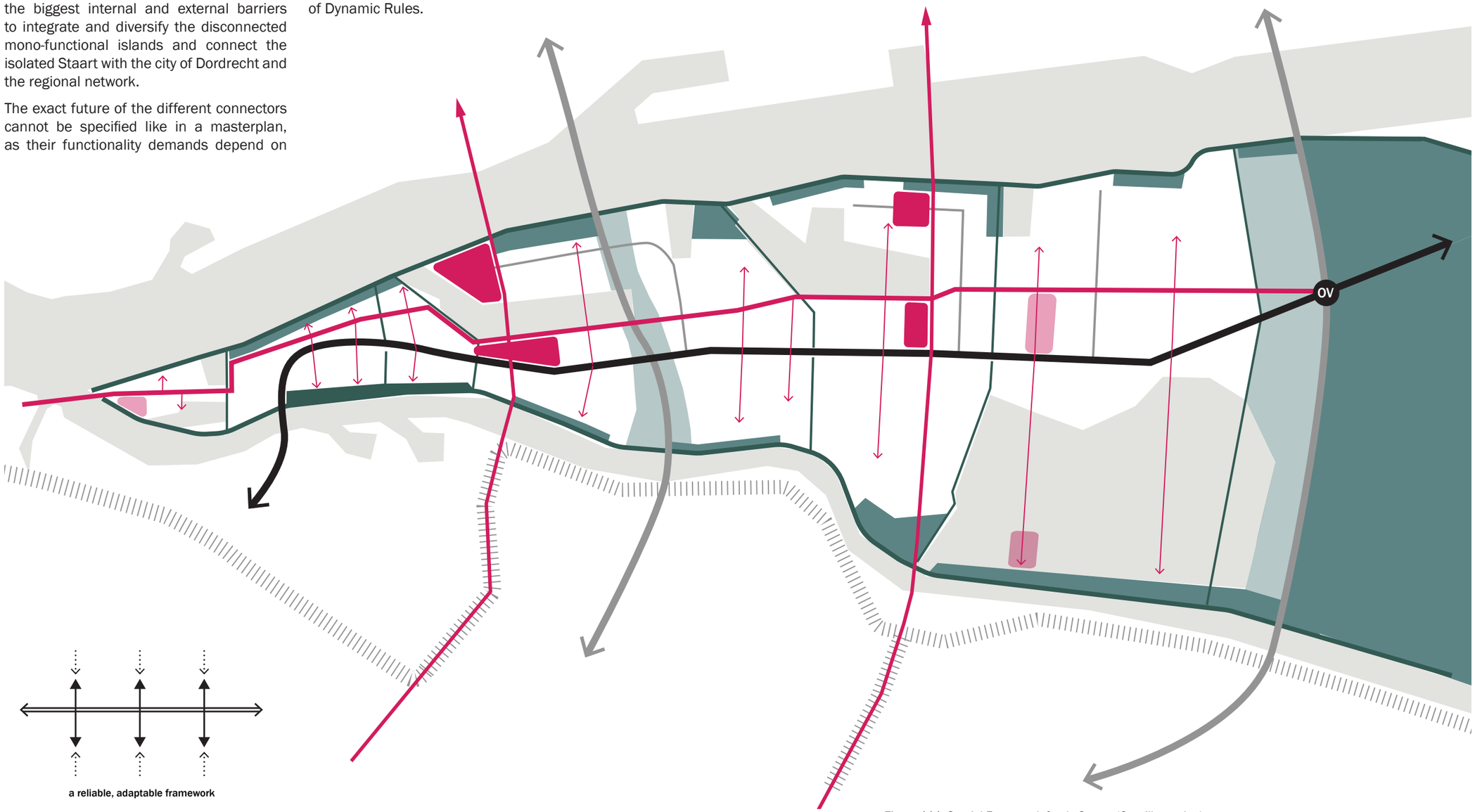


Figure 111: Spatial Framework for de Staart. (Own illustration)

BOX 9 | LAYERS OF THE SPATIAL FRAMEWORK

EVACUATION CONNECTOR

The Evacuation Connector guarantees that de Staart is more interwoven with the urban fabric and ensures that the residents of the lowlying city polders can access the area as flight hill (VenhoevenCS in IABR, 2021). It connects to the city's dike structure and bridges the Wantij, to reach public destinations (buildings, squares) that can also function as evacuation centres during a crisis. These connectors should be constructed early on by the municipality in collaboration with water boards (Kelder, 2021).

hierarchic action

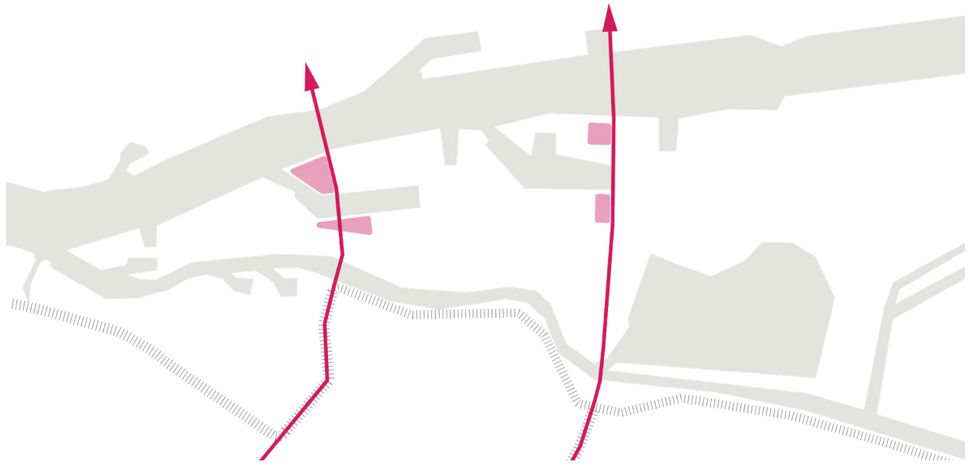


Figure 112: The Evacuation Connectors, linking public destinations inside and outside de Staart. (Own illustration)

1 A high network, connecting existing structures

2 Adaptable public spaces and builidings for evacuation (IABR, 2021)

WANTIJ TRACK

The Wantij Track connects the Biesbosch in the West to the city in the East. The river already runs there, but the ecological value needs to be enhanced by replacing hard quays with soft tidal river edges. In making this connection, social layers need to be integrated: a healthy and attractive cycling route that makes the currently under-discovered Biesbosch more part of the city's recreational network (Gemeente Dordrecht, 2020) and the possibility for residents to access the water and appropriate the riverfront. From the egalitarian perspective, this restorative intervention should be taken as soon as possible. Last, the connector makes the area more attractive immediately for future residents, while also enhancing trust in the area for investors and developers.

egalitarian improvement axis

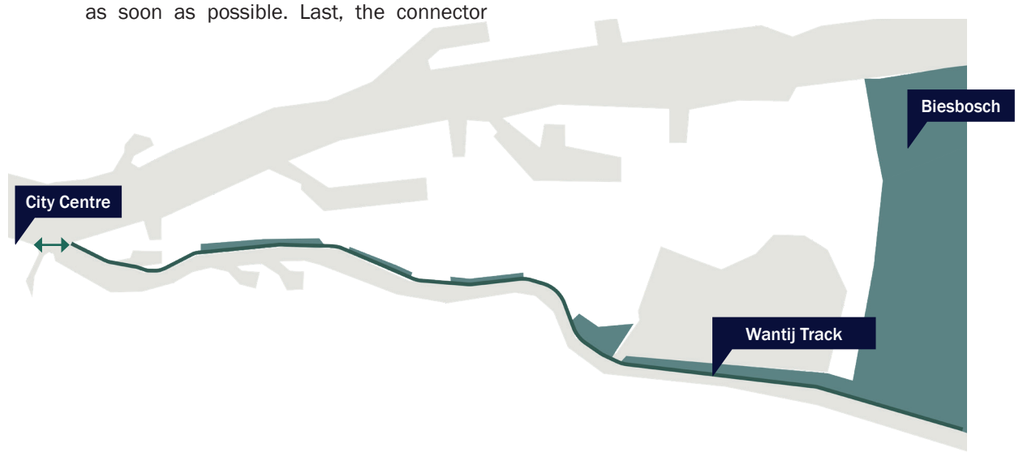
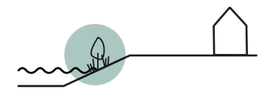
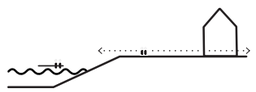


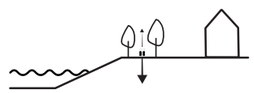
Figure 113: Wantij Track connecting the city and nature while improving the ecological network. (Own illustration)



1 Continuous ecological connection in tidal range of Wantij river.



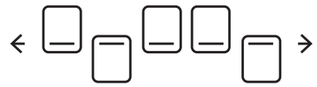
2 Accessibility of the water, room for appropriation by residents (Geuze, 2021) or industries.



3 Attractive and green waterfront cycling route connecting the city and Biesbosch.

CITY STREET

The city street can develop as industries are gradually transformed: the new programme depending on the pathway for the area. Each development of the plots should make a contribution to the city street, collaborating with the municipality to integrate long-term values. The route runs along attractive (softened) quays and waterfronts and has a more human dimension due to the stepwise section of bordering buildings and interesting public plinths. A structure should be built or reserved that can be used for the construction of a +3m street level, or for shading installations in summer (Lieftink, 2021).



individualist developement

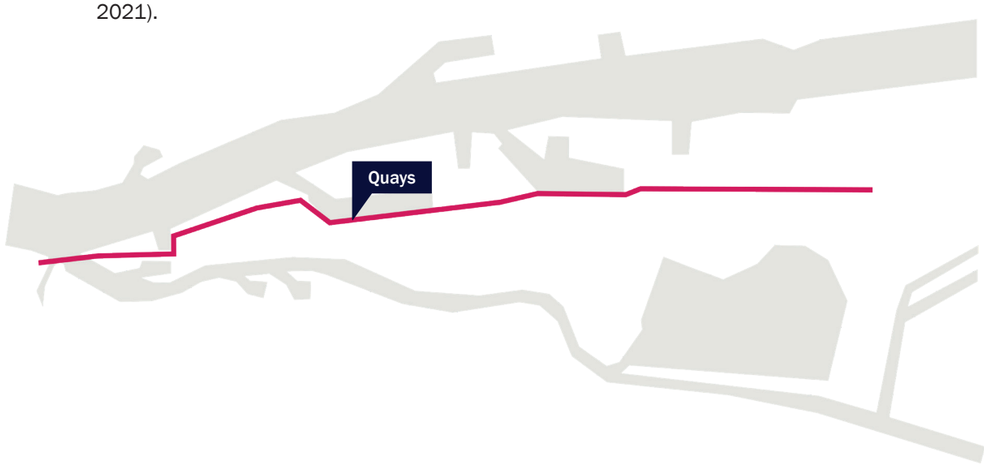
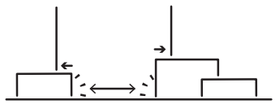
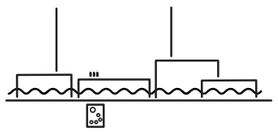


Figure 114: City Street. (Own illustration)



1 Human dimension, plinth activation.



2 Water resilient and adaptable subsoil infrastructure, structure for hightened street (Lieftink, 2021)

3 Adaptable structure for shading during hot summers.

MERWEDE TIDAL PARKS

De Merwede Riverfront can incrementally develop as a tidal park. In the early stages, ecological value of the hard concrete quays should be restored. Gradually, when the plots lining the Merwede are redeveloped into new programme, park functions or green industries can improve the ecological network with patches of green. To ensure a public riverfront, views over the river and soft functions (no heavy industry) need to border the river.

individualist developement

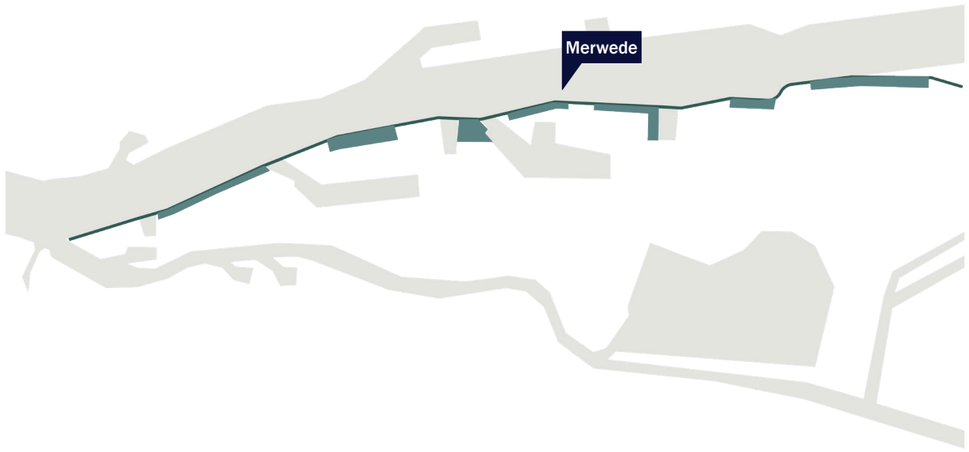
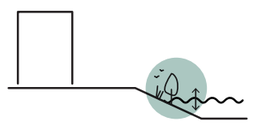
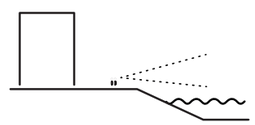


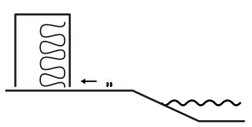
Figure 115: Merwede Tidal Parks. (Own illustration)



1 Ecological value at tidal zone of river.



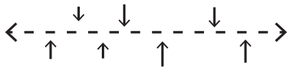
2 Ensure views over the river, recreational use of tidal parks.



3 Soft functions in plinths at waterfront, entrances make promenade attractive.

FINER URBAN GRAIN

Smaller city streets are constructed when the area develops itself further and more buildings are redeveloped, new industries emerge and public functions are built. In a response to the development and needs of the future programme, the exact layout of the streets can be adapted. Nevertheless, the dynamic rules guarantee a liveable street that supports synergies between programmes and connectivity between neighbourhoods.



hierarchic responsive action

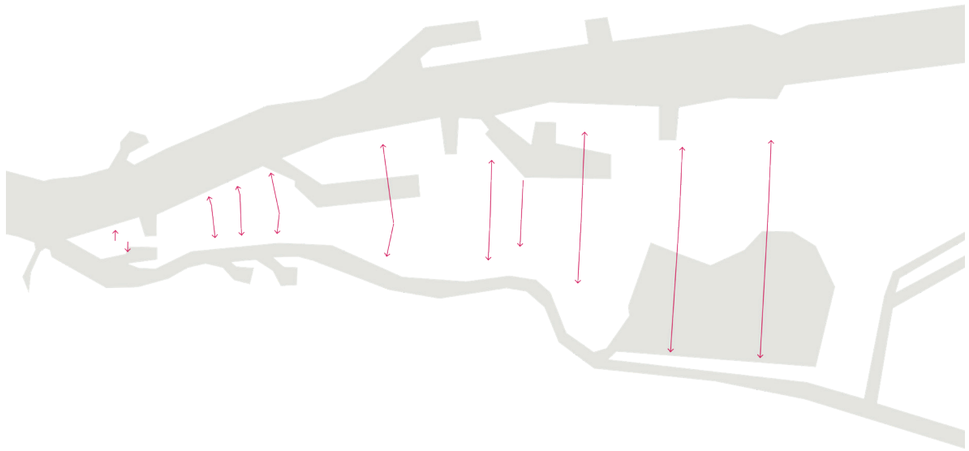
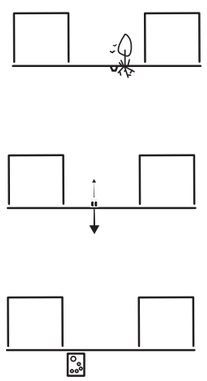


Figure 116: Finer Urban Grain Connections (Own illustration)



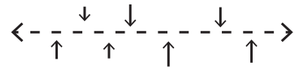
1 Ecological, water buffering wadi

2 Pedestrian continuity has priority

3 Water resilient and adaptable infrastructure, such as a cable gutter

ECOLOGICAL CORRIDORS

The ecological network becomes finer as new plots are redeveloped. Each plot makes a contribution to the ecological network by integrating green in the buildings and local streets. These patches will be linked via hierarchic responsive action by ecological corridors that are built in response to urban redevelopment and are in connection with the water. The Dynamic Rules ensure ecological value in the first place, but also allow for industrial continuation crossing the corridor and a pedestrian green walking route. Ensuring the improvement of the streets can also function as a convincing factor for investors.



hierarchic responsive action

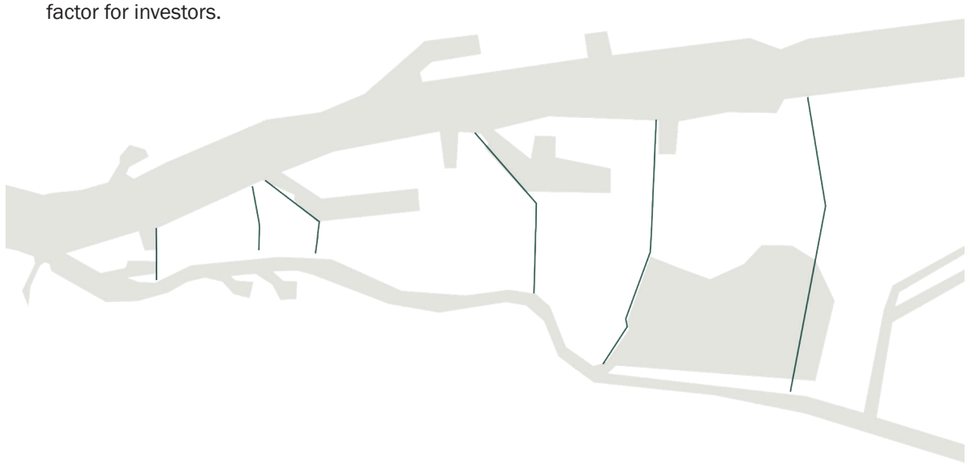
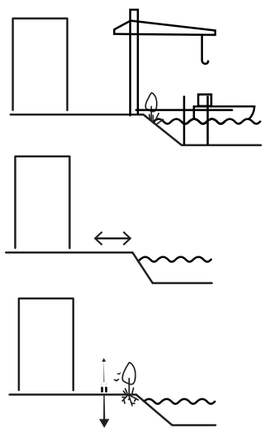


Figure 117: Ecological Corridors. (Own illustration)



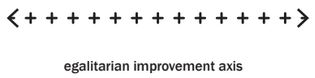
1 Softened quays and streets that maintain access for industrial transfers.

2 Reserve space for water adaptation interventions.

3 Continuous green route for animals, plants and pedestrians.

MOBILITY TRANSITION

The existing backbone of de Staart is improved as a social connector, rather than functioning just as an access road for industries and cars. More bus stops connect two railway stations Dordrecht Central Station and a new stop at the East of de Staart. The road becomes more permeable in stead of a barrier, giving priority to ecological and pedestrian crossings. Furthermore, better public transport makes the transition towards more sustainable mobility attractive, while also ensuring affordable public transport for the vulnerable social housing neighbourhood.



egalitarian improvement axis

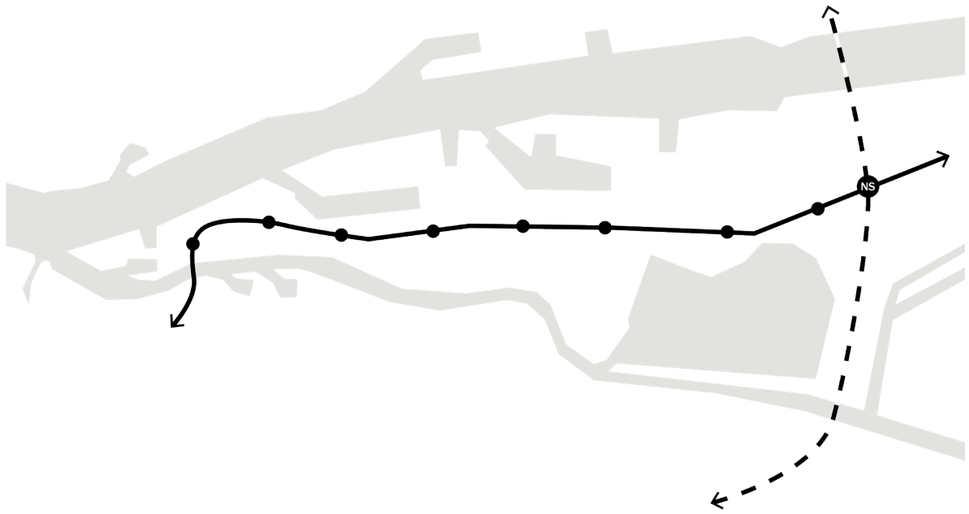
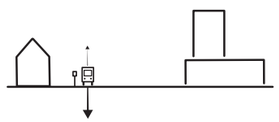
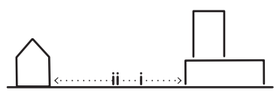


Figure 118: Mobility Transition. (Own illustration)



1 More frequent bus stops, running between existing Central Railway station and the new Staart Stop.

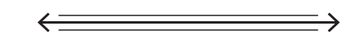


2 A more crossable street for ecology and people, making the area into one neighbourhood, avoiding a divided North and South.

3 A more attractive, green city entrance for Dordrecht and de Staart.

INDUSTRIAL BACKBONES

Some of the old industries will disappear gradually, new industries will emerge and some will be redeveloped (Loorbach, 2021 in Wetenschappelijk Bureau GroenLinks, 2021b). While the future scale, material needs and access needs of de Staart's industries and residential programmes are uncertain, some accessibility needs to be preserved at least during the initial stages. Nevertheless, if new programmes will emerge in the post-industrial area, the industrial backbones can be adapted to be more mixable with, for example, residential programme. Furthermore, the street can be also used as access road for cars and emergency vehicles during a climate crisis because they connect the main evacuation squares with the regional network.



hierarchic conservation, slight adaptation

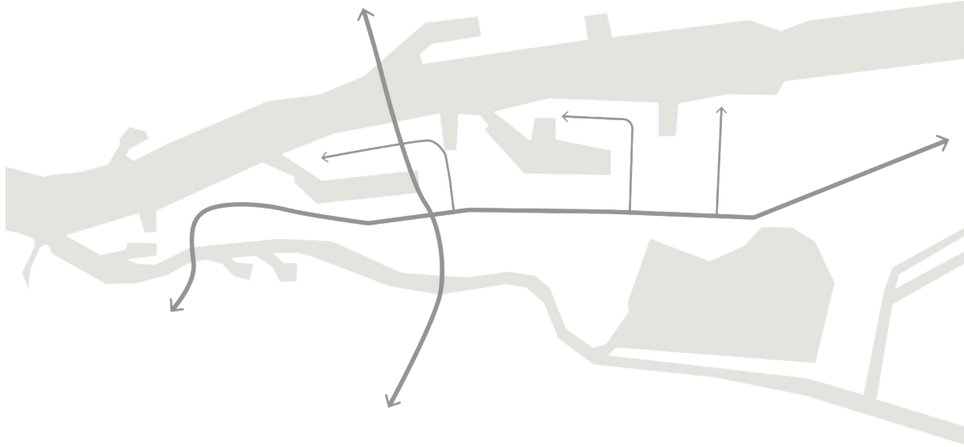
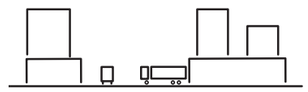
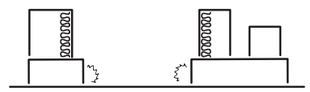


Figure 119: Industrial Backbones. (Own illustration)



1 Maintain accessibility of industries by trucks.

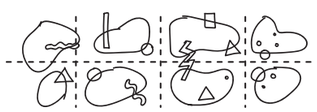


2 'insulating' functions or constructions lining the industrial backbone, avoiding nuisance.

3 Accessibility of emergency squares, connecting to the regional network.

DYNAMIC RULES FOR PROGRAMME

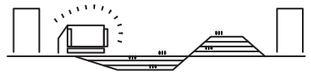
While the framework offers a reliable structure for redevelopment, the development of the programme is more uncertain. To enable 'peaceful co-existence' of different pathways and to stimulate synergies between them, a set of dynamic rules was designed for the places and buildings. The predominant vlaues for each of the plots should be determined by the final users under their future context and additional rules can de developed when a preferred pathway is selected for de Staart in the future as well. The transition team should monitor the different developments and in turn initiate adaptation of the framework, the rules nd the already developed programme and infrastructures.



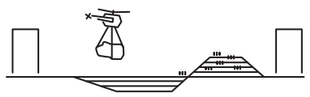
full flexibility for the programme of the selected pathway

PUBLIC SQUARES AND PARKS

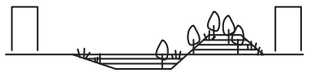
1 Include water resorption, for example a water square



2 Inviting conditions for public usage, for example placemaking events.

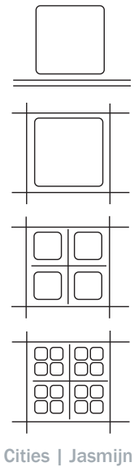


3 Underlying infrastructure for emergency embedded in design



4 Maintain options to adapt, for example more intense greening should remain possible

PARCELLATION: HUMAN SCALE & ACCESSIBILITY



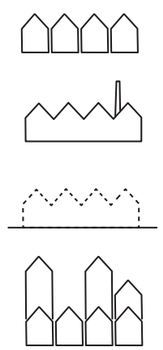
0 Existing, closed lots.

1 Maintain the large scale of current plot, but make waterfront accessible to pedestrians & cyclists

2 Preferably, make the network finer on the ground floor level

3 When possible, introduce a small grain on the +3m level

BUILDING RULES



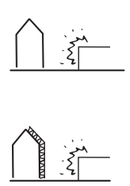
0 Existing programme

1 Redefinable

2 Dismountable

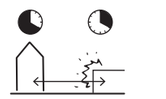
3 Extendable

MIXING RULES: MULTIPLE OPTIONS



1 Accept

2 Insulate buildings

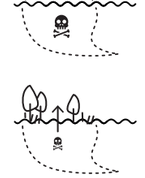


3 Public buildings/soft industries as insulation

4 Co-existence, different time schedules

5 Insulating planning of plots/area

SOIL POLLUTION, REMEDIATION



1 Existing industries seize soil, water and air pollution immediately

2 Vacant lots with contaminated soils should be remediated early on

3 New development is eco-remediation inclusive. The foundation for a healthy redeveloped urban area

9 IMPLEMENT THE PLAN

Finally, the direct implementation of the actions that should be taken immediately and establishment of the monitoring system (Haasnoot et al., 2013) is illustrated in a design simulation for the most experimental and innovative pathways for de Staart.

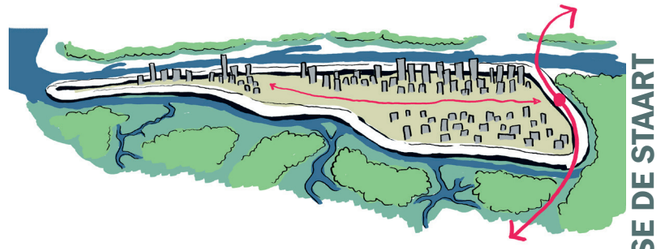
The design simulation of the development of a section of de Staart on the following pages illustrates how the Dynamic Adaptive Policy Pathways, framed by the Spatial Framework and Dynamic Rules, can support the transition towards the Climate Adaptive Delta City. Next, a few example projects illustrate how participatory initiatives in niches will start the transition from the inside out (Roorda et al., 2014). Finally, a relection on the impact of the regional transition and resilience is made.

As explained previously, multiple pathway directions can result in a resilient delta city. However, each of the governance perspectives will prefer a different redevelopment pathway, as can be seen in Figure 120. The selected pathway for de Staart combines elements from the different perspectives, which calls for a hybrid governance model (Middelkoop et al., 2004). Using the principles of the transition implies that de Staart's redevelopment will start with experiments, followed by a definite pathway decision and further redevelopment. When this has informed a regional delta decision and the future unrolls further, the area can be adapted.

To realise the strategy, the hybrid governance model uses three types of actions (Middelkoop et al., 2004). First, direct and coordinated actions, fitting to the hierarchic perspective, that might be needed to unlock future pathways. Second, restorative actions that improve the existing situation, especially for vulnerable groups and silent stakeholders such as residents in the vulnerable social housing neighbourhood and the beaver and sea eagle. Third, individualist actions that illustrate how de Staart will slowly develop itself, learning within the network, which is explained on the next page.

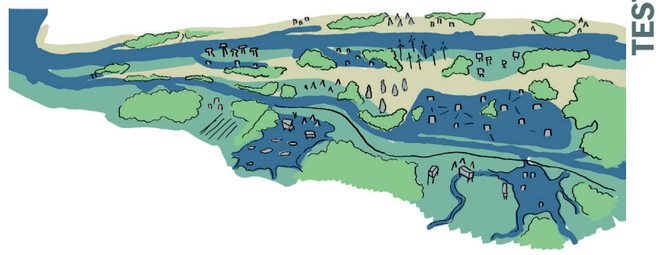
Hierarchist

- Industries leave
- Redevelop industries into housing
- Highten dikes/barriers
- Develop polders into tidal nature
- Water resilient railway connection to the east



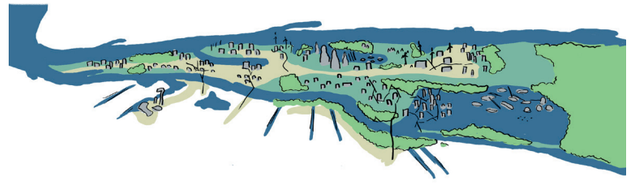
Egalitarian

- Bio-based circular industry replaces old practices
- Floating, self-supporting communities
- Room for the river, in farmlands
- Integrate ecology in the development of self-supporting communities: small industries, food- and energy production



Individualist

- Big industries transform to Green Industry
- Build water resilient residential buildings
- City polders redeveloped into tidal park for recreation
- Water resilient street
- Integrate ecology in the redevelopment for branding



Regional pilot: experiments with multiple preferred pathways that differ from the current paradigm.

- Small and transitioned industries
- Hightened streets, different types of adaptable/resilient buildings
- City polders possibly opened up as tidal nature, residents can move to the Staart
- Nature inclusive redevelopment and soil remediation

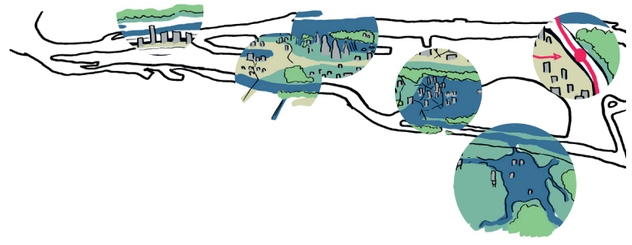


Figure 120: Design for how different preferred pathways come into spatial expression at de Staart. When aiming to use de Staart as pilot for the region, it should combine different innovations to understand their performance and make an informed regional delta decision. (Own illustration)

Transition strategy

To discover innovative climate adaptive principles, de Staart's redevelopment strategy builds on experiments that are first anchored, then stimulated to exchange and finally build a network for climate adaptive delta cities (Figure 121).

Experiments start off on post-industrial sites that are already vulnerable as they eg. have been abandoned, have contaminated soils or are low in productivity. A network of new industries, communities or ecology (or a combination of the three) is established and a circular and sustainable network starts to develop. When the future becomes more clear, it is also easier to decide which types of pathways will produce a resilient urban area and region. As a consequence, the area and region will adapt.

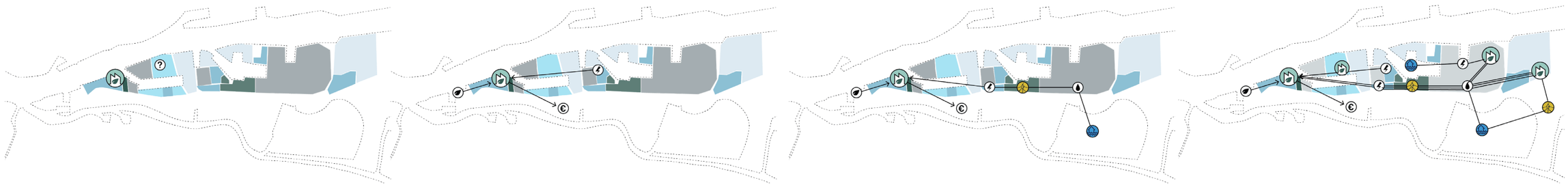


Figure 121: Establishing a network for the Climate Adaptive Delta City. (Own illustration, based on Delva et al., 2021)

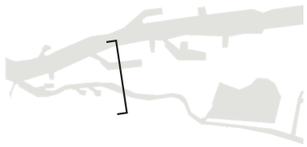
Existing situation

Pathways selected: Explore and experiment, a preferred pathway is not defined yet.

Challenge: Use the Staart's redevelopment as leverage for a just transition towards Climate Adaptive Delta Cities in the Rhine-Meuse delta, while also restoring local problems.

The section in Figure 123 shows that in the current situation, there are many vulnerabilities and problems on de Staart, which can be solved by using the redevelopment and transition as leverage for a more climate adaptive and liveable neighbourhood. The problems are caused by the site's past: industrial traditions pollute the soil, air and water. Due to the dangerous heavy industries, the industrial side of de Staart was fenced off, making in inaccessible to the vulnerable social housing neighbourhood next to it. Additionally, the residents of the social housing neighbourhoods feel particularly isolated due to a lack of bridges crossing the Wantij river and too infrequent access to public transport (Dekker, 2018).

This specific section of de Staart has potential to be redeveloped in the near future because it contains many vacant plots and low-productive industries. Furthermore, it is in close proximity to the city centre of Dordrecht and finds itself in a critical position in the Spatial Framework. The development simulation on the next pages will show how the site might develop itself for one of the pathways selected by the team of stakeholders. In this case it is the pathway that has the highest transition performance.



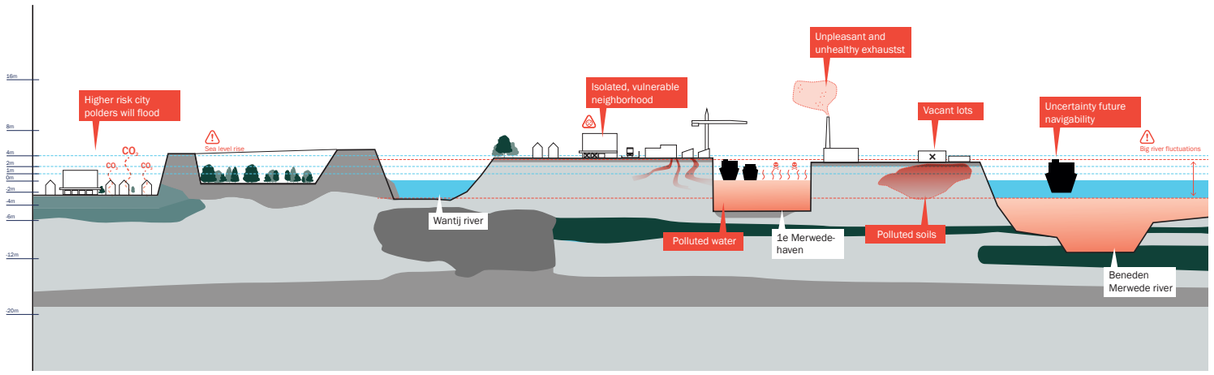


Figure 122: Plan representation for the existing situation of a representative section of de Staart with short-term redevelopment potential. (Own illustration)

Figure 123: Existing situation exemplary section of de Staart, including main site specific challenges (Own illustration, based on Studio Marcovermeulen, 2021)

Short term: now – 2030

Pathway selected:

- **Industry: Launch diverse grounded experiments**
- **Housing: Experiment with self-supporting communities**
- **Water: Build bridges for evacuation and connection**
- **Ecology: Eco-remediation of soils and water**

Result: 2.000 houses over the entire Staart, first infrastructure, placemaking, new technologies

In the initial stage, the municipality will take first actions that stimulate the development, such as the development of the City-Biesbosch cycling track and the initiative of the project team location (Figure 124). Additionally, they will take corrective actions that restore ecological value in the area, focusing especially on the water edges that offer opportunities for rich biodiversity due to the special sweet water biotope (Wageningen University, 2021). Furthermore, the municipality invests in participation of the existing residents, who can appropriate the public space through public discussions on what types of activities on the water front would be desirable.

For the larger projects, the municipality can collaborate with the region and waterboards. The waterboard would be interested to co-invest in the evacuation route towards the higher grounds of the Staart due to the amount of money saved in the long term.

Next, the municipality collaborates with diverse project teams consisting of existing and new (industrial and market) stakeholders to launch experiments of scale that will enable future pathways to be enabled. For example experiments with eco-soil remediating industries, supported by national research programmes and investments of landvestors and urban area developers who will gladly make use of the new technologies in their future projects. Opportunities for development and linking along are monitored in the participation centre, where local actors can discuss the future of the area and build a network for the transition.

In all spatial interventions, the actors take into account the Spatial Framework and Guiding Principles, so that their spatial configurations do not result in a lock-in.

Figure 124: Plan representation for the initial development stage for a section of de Staart. (Own illustration)

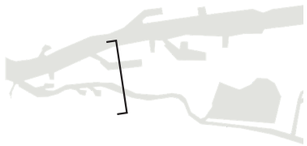
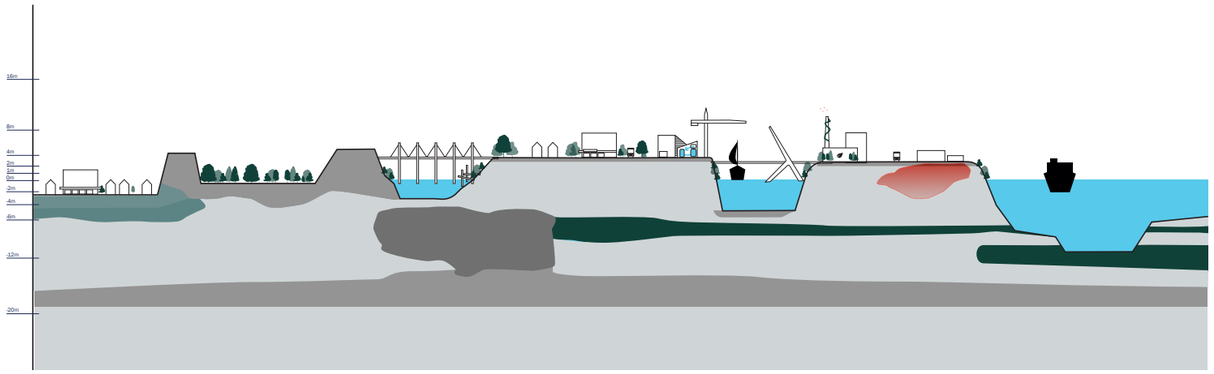
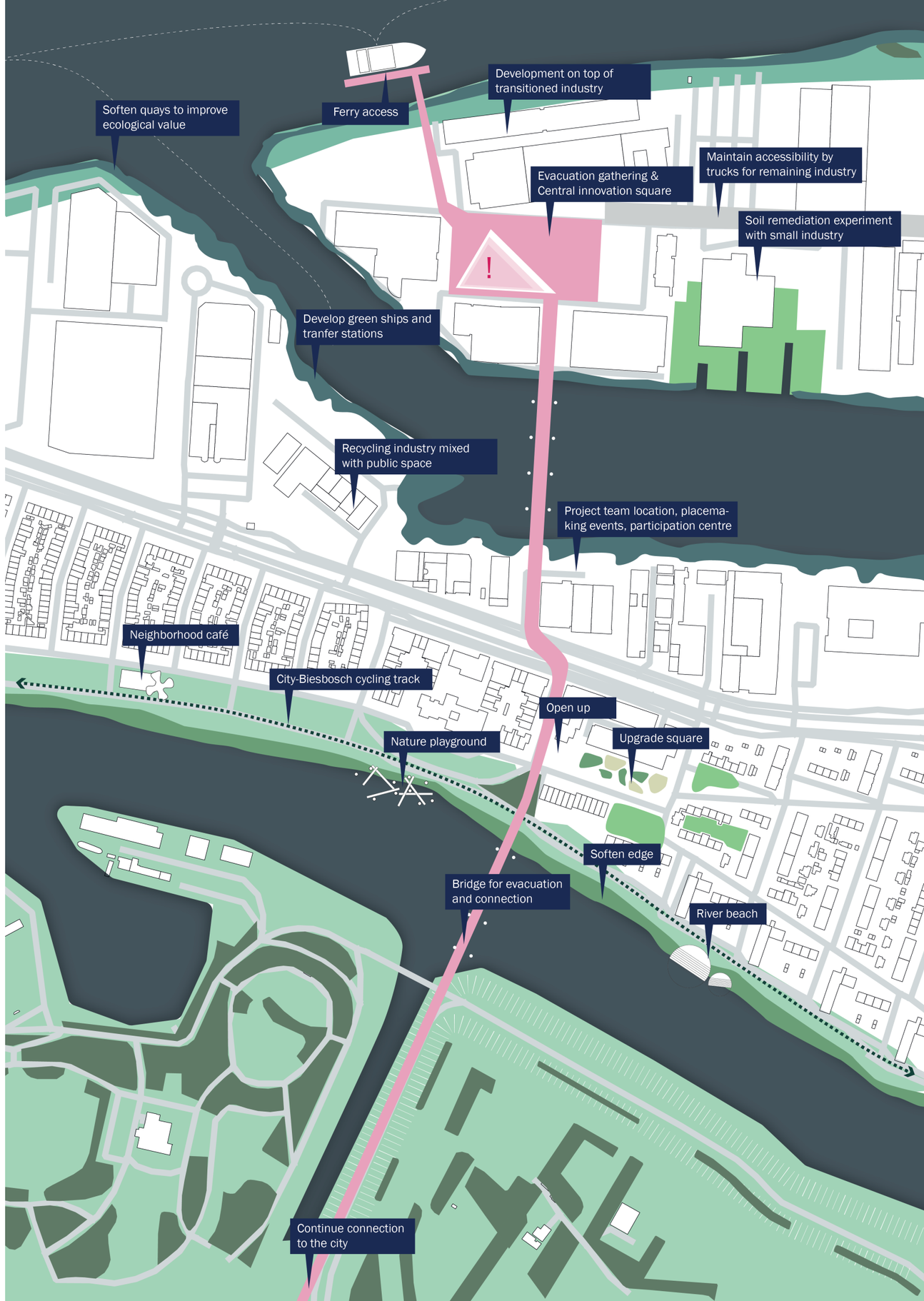


Figure 125: Section after initiative phase (Own illustration)





Medium-term: 2030 - 2050

Pathways selected:

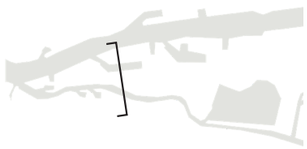
- **Industry: Bio-based circular industries and small-scale industries that support local communities**
- **Housing: Redevelop industrial sites into housing**
- **Water: Redevelop polders and quays into tidal nature**
- **Ecology: Integrate ecology in the development of housing**

Result: opportunity for 10.000 houses on the entire Staart, nature development, transitioned industries, community

During the development stage, the government takes a more passive attitude when the market takes over. While respecting the Spatial Framework, developers, entrepreneurs, local residents and other organisations have a lot of freedom to launch projects in the area. They can either build further on existing experiments, or be attracted to develop in the area as it is now a well-known and interesting area to build in.

To decide and monitor the direction in which the area is moving, the municipality engages with other local and regional actors in the 'Transition Monitoring Centre', where impacts of a project are made insightful and pathway decisions can be made. Moreover tipping points and climate change are monitored so that the area can be adapted when needed.

As the regional and local pathways become more clear and the development starts moving in a certain direction, bigger investments in public space are possible. For example the tidal park can be developed when no water dependent companies exist around the inlet, and more people live in the area that could benefit from the park. However, without many residents, new parks and ecological connections remain valuable as they restore a past ecological deficit and can remediate damages in the ecosystem (polluted soils and water).



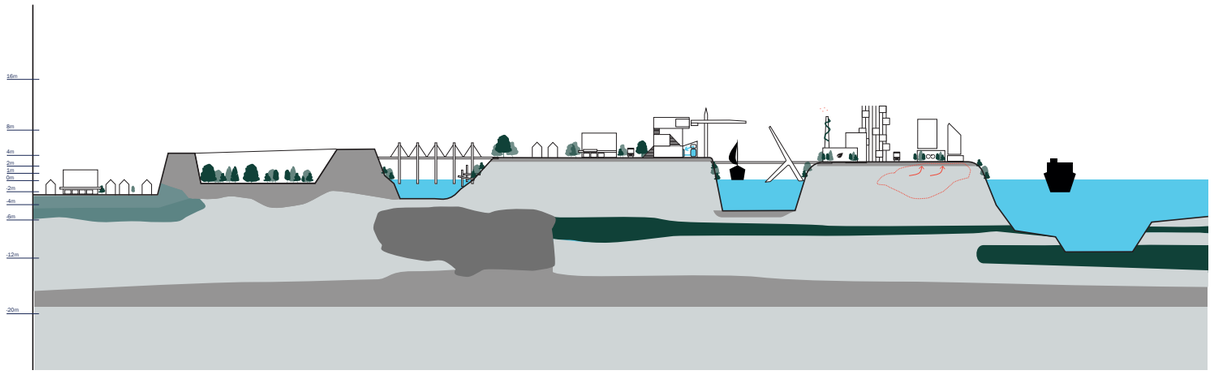
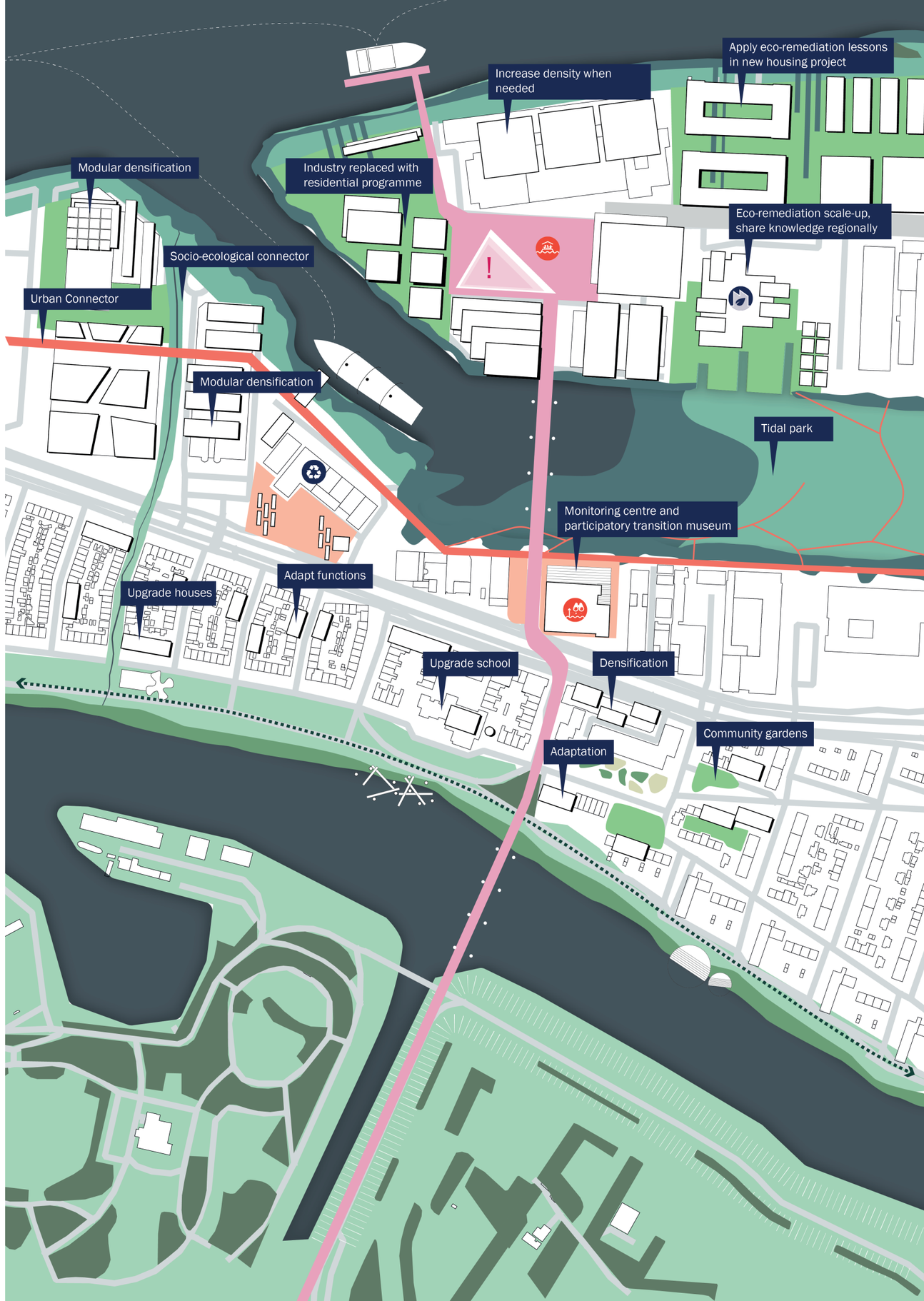


Figure 126: Plan representation for the initial development stage for a section of de Staart. (Own illustration)

Figure 127: Section after implementation phase (Own illustration)



10 MONITOR + ADAPT

As time progresses and more post-industrial sites in the region are redeveloped, a preferred pathway for the region is likely to become more clear and a decision can be made on the future of the delta. When this decision is made, de Staart can adapt itself to become aligned to the regional delta decision.

Long-term: 2050 -

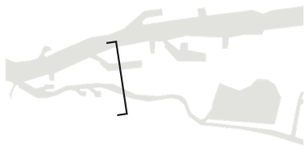
Pathways selected:

- Industry: Bio-based circular industries that support local communities
- Housing: Residents low-lying city polders move to higher grounds, self-supporting communities
- Water: Redevelop polders and port-inlets into tidal nature
- Ecology: Expand the Biesbosch in city polders

Result: Adapting to the regional delta and urbanisation decisions

Having been constructed along the adaptability principles and within the spatial framework, adaptation is easily possible. The reserved space at the waterfront might be used for a park, but a small dike or urban promenade remain possibilities. The urban street might become +3m elevated when needed, or might be able to develop into a green park street. The medium density buildings can be dismounted and moved to the east of the Netherlands, or be extended to become very dense.

The long-term future of de Staart may be uncertain, but its water resiliency, procedural inclusivity, river rights, transition contribution and housing development are certain. The pathway decision-makers choose may be uncertain, but the short-term actions we take today make sure that options remain open and pathways are unlocked. The dynamic adaptive policy pathways make taking action today possible for an uncertain but urgent future, which is essential because the doing nothing is also a decision and the outcomes of that pathway will be disastrous.



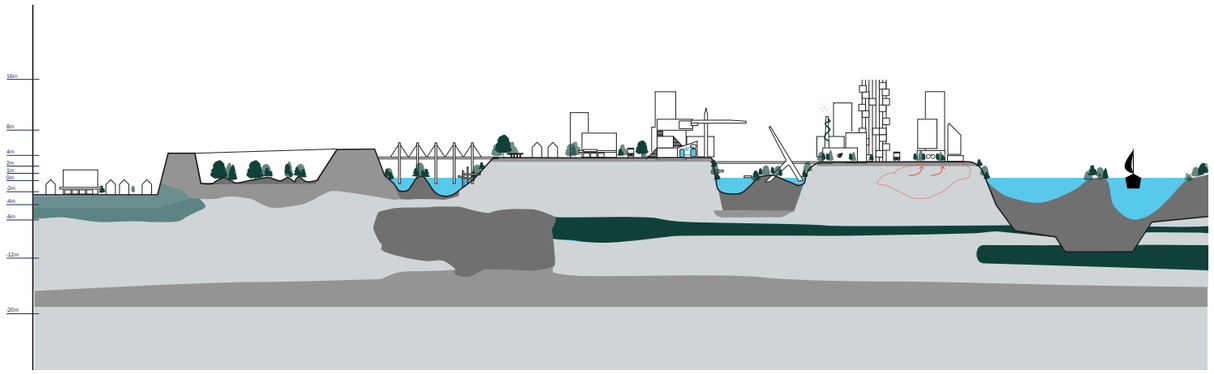


Figure 128: Plan representation for the monitor and adapt phase for a section of de Staart. (Own illustration)

Figure 129: Section after adaptation (Own illustration)

10a MONITOR

MONITORING CENTER AND STEWARDSHIP

One of the first steps to kickstart the development is the construction of a Monitoring Centre (Figure 132), that doubles as a transition arena work location, engaging transition museum and flight hill during a flood event.

Initially it functions as a centre for collective empowerment: having a shared workplace for the interdisciplinary project team, where actors from all sectors work on site, learn from each other, find synergies and new coalitions arise. Being open to all and mingling public and private, existing and new stakeholders, trust increases (Edelman, 2021) and windows of opportunity can be seized.

The implementation stage is about keeping the transition alive and monitoring the performance of the area and its projects and experiments in relation to changing conditions in the context, for example climate change progression, adapting the framework, rules and pathways when necessary. By "organising networking events, seeking publicity, plugging in the transition agenda into other processes" (Roorda et al., 2014), the transition is kept alive.

The museum layer engages people in the transition and discovery of pathways. The interactive exposition allows for stakeholders to understand the implications of a possible future intervention on the system and transition, enhancing their feeling of stewardship for the long-term (Latour, 2014). Next, it is an impulse for local change, creating trust for the area's development

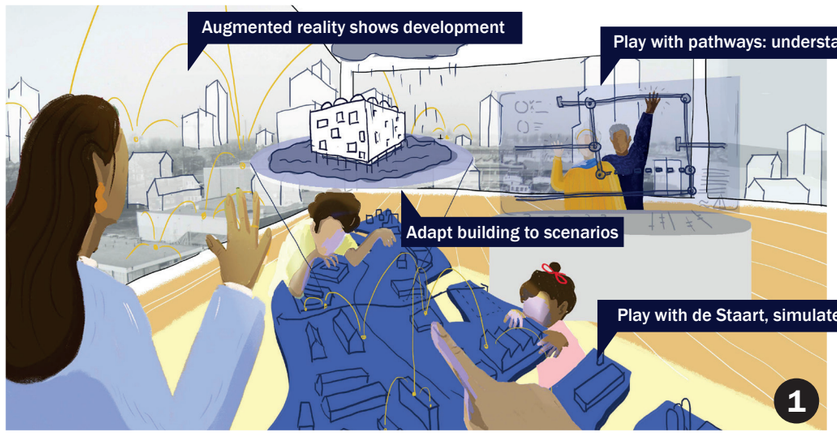


Figure 130: Interactive exposition that aims to enhance feelings of stewardship and empower local actors to discover the dynamic adaptive policy pathways. (Own illustration)

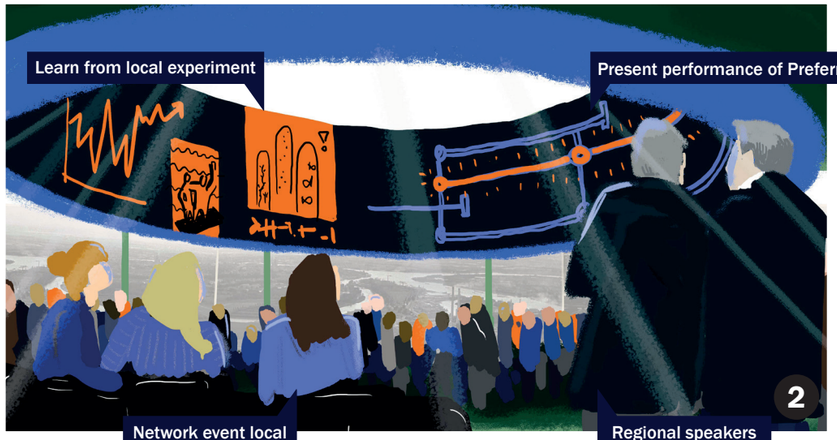


Figure 131: Organising networking events in the Monitoring Centre where the preferred pathway is monitored, experiments have a platform to present and regional actors can learn from each other and collaborate (Own illustration).

(Resilience Alliance, 2021) and enthusing people for the future images as they are better able to position themselves in it.

Last, the centre's public space design fosters awareness and activation. Its façade displays the progression of the climate crisis make people aware of the urgency of the abstract climate crisis. Its stairs that double as flight hill during a flood event make the citizens of Dordrecht ever more aware of the vulnerability of their island in the delta. Yet the possibility to act in the museum and in the workplaces makes the abstract crisis more tangible (Rockström et al., 2009): empowering residents to act.

To conclude, the centre is a symbol of the climate crisis and an icon for the transition.

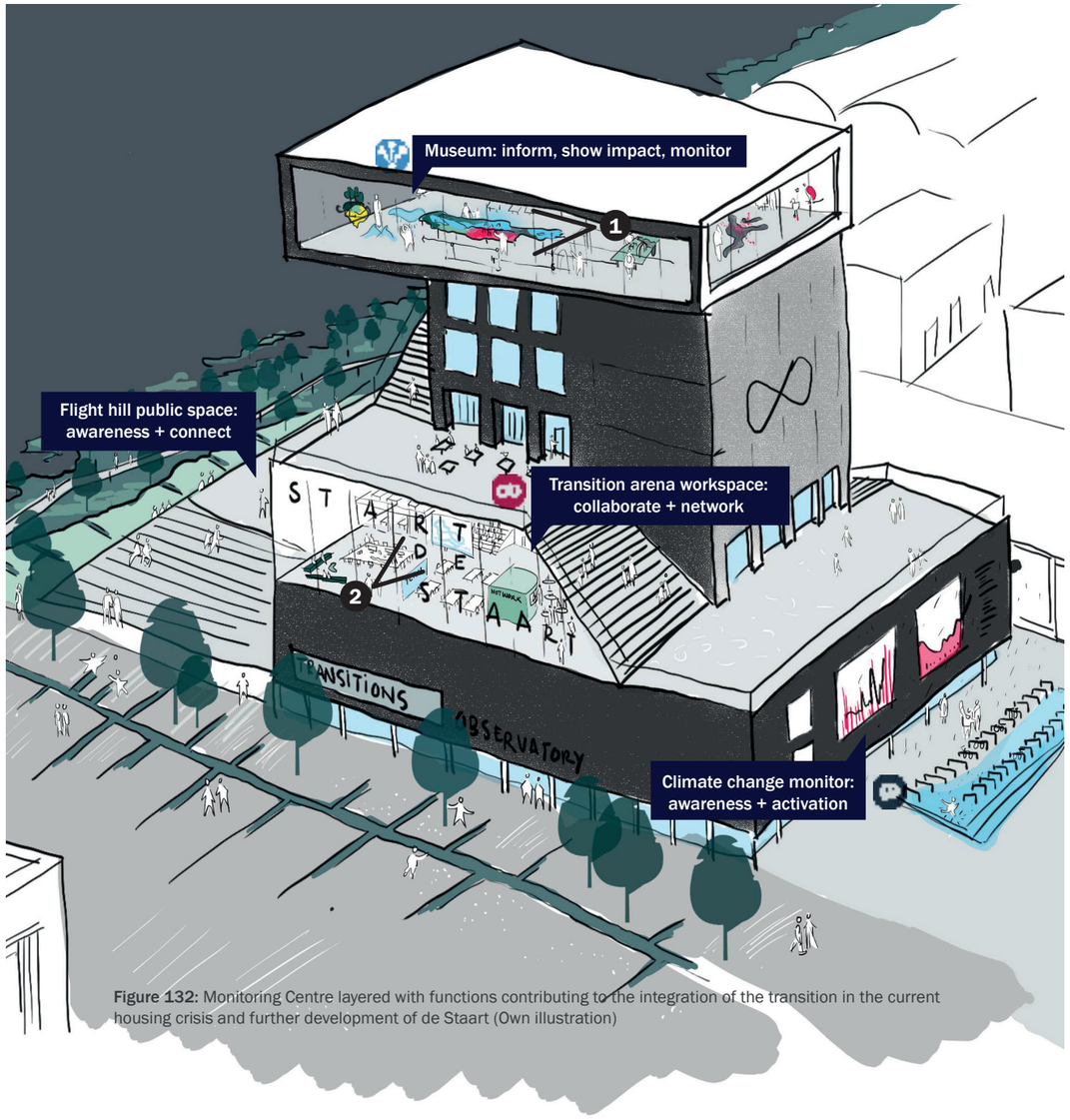


Figure 132: Monitoring Centre layered with functions contributing to the integration of the transition in the current housing crisis and further development of de Staart (Own illustration)

EXPERIMENTS: PHYTOREMEDIATION

In parallel to the transition arena and pathway discovery, multiple experiments in line with the different preferred pathways are launched. These experiments should not directly be about achieving specific goals, but should explore possible practices that contribute to the pathway direction. The experiments can also include other ongoing or planned activities linked to the transition, reinforcing them and broadening the perspective (Roorda et al., 2014). If some of the experiments are successful, they demonstrate that the preferred pathway is attainable. Their insights can be integrated in the Dynamic Rules and Pathways and shared via the Monitoring Centre.

The Eco-remediation Experiment on the north side of de Staart (Figure 120) is an example of such a radical, short-term action. Change agents are given freedom to experiment and learn by doing (Roorda et al., 2014). Over time, if the experiment is successful, the location can become an icon for innovation, symbolising the new paradigm. It can start to become a public hotspot and known reference. Furthermore, its lessons can be adopted or adapted in redevelopment projects, or result ins pin-off projects.

Figure 133: A scientist entrepreneur giving a tour around the experiment site, teaching and inspiring residents, developers and researchers. The principles can be used to solve the challenges of contaminated soils in the region's post-industrial sites (Own illustration).

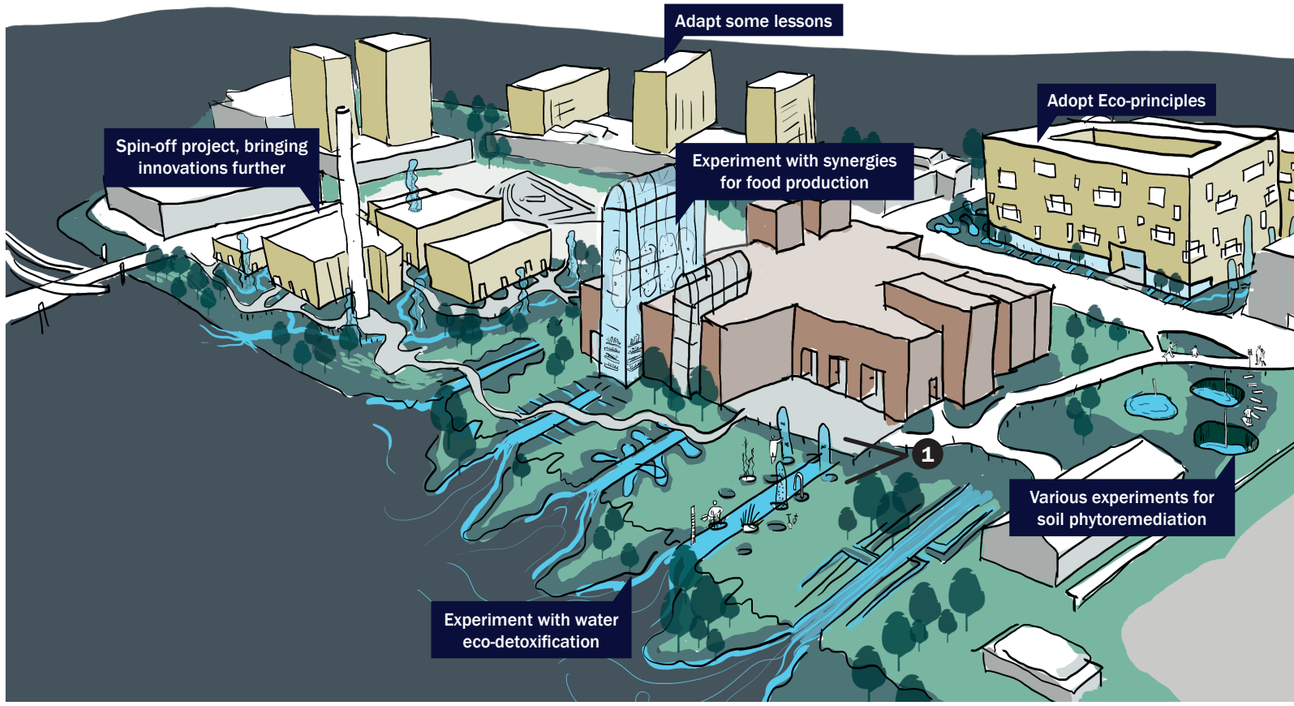


Figure 134: Ecoexperiment for phytoremediation of soils and water. Its lessons can be adopted, adapted in other redevelopment sites and inspire projects in the region (Own illustration).

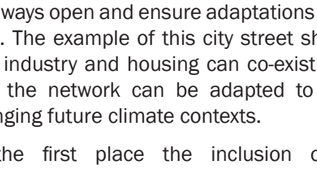
10b
ADAPT

ADAPTIVE CITY STREET

The redevelopment of the post-industrial urban fabric of de Staart remains uncertain as it depends on the preferred pathway that will be determined in an inclusive participatory process, determining and discovering the meaning of the post-industrial area collectively. The Spatial Framework and Dynamic Rules keep pathways open and ensure adaptations over time. The example of this city street shows how industry and housing can co-exist and how the network can be adapted to suit changing future climate contexts.

In the first place the inclusion of a water resilient and adaptable subsoil infrastructures are able to support varying population densities. Second, the infrastructure above ground can offer shading during hot summers, but also a heightened walking route if water levels rise +4m (Lieftink, 2021). Third, the human dimension rules (stepwise density from the street and a +4m rooftop landscape), ecological connector and public functions lining the street ensure a liveable streetscape, whatever the future context will be.

Second in front of the Figure 120, shows that the urban street also runs along the quays. Industries can adapt their transit in such a way that passage along the water is possible, or industries disappear, meaning the waterfront of the port inlet can be fully redeveloped into a public park. If passage of people is truly not necessary or required, a valuable ecological connection remains as the tidal range of the quays is softened, offering a habitat to a variety of species (Wageningen University, 2021).



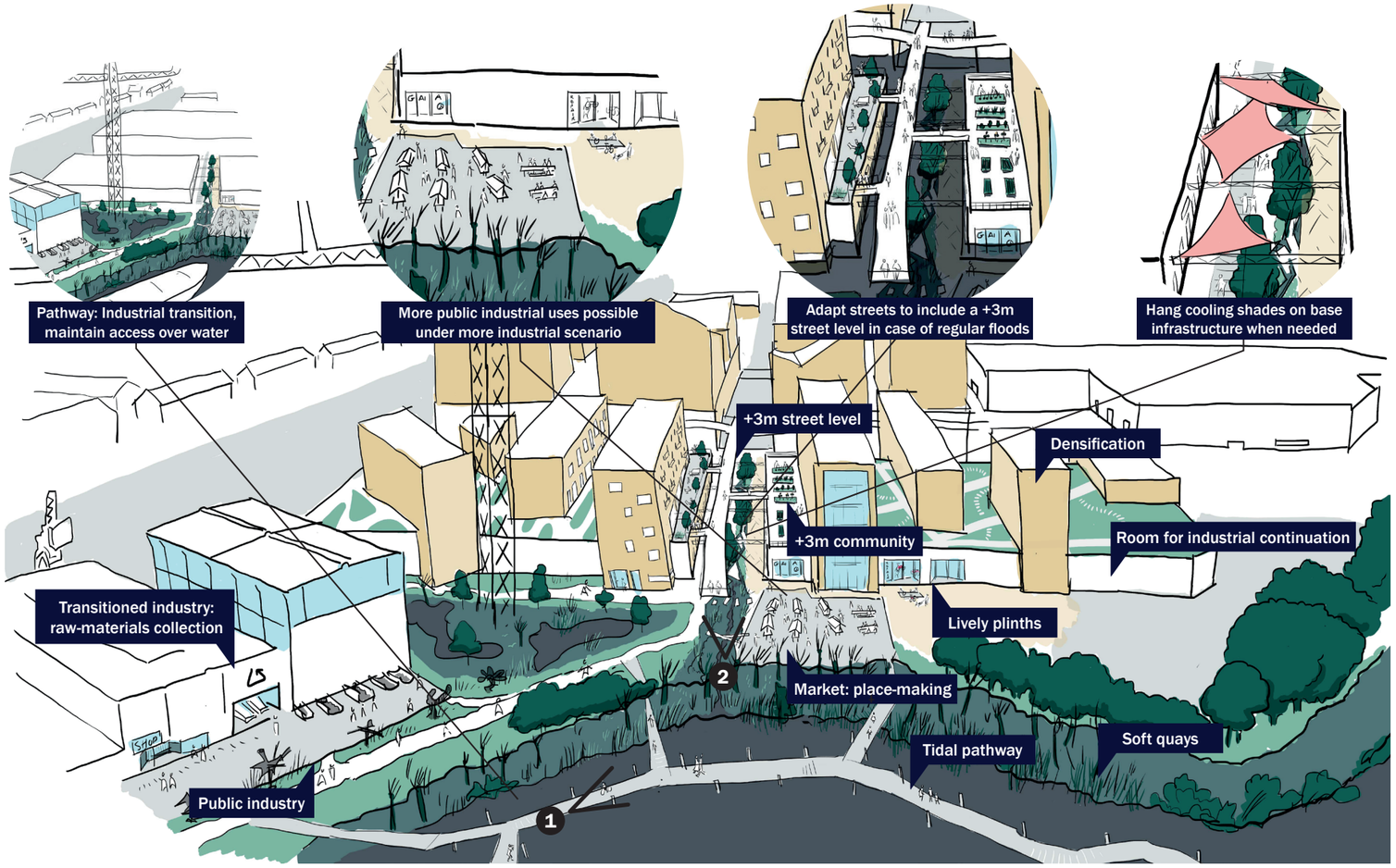


Figure 135: A possible future image of a post-industrial site at de Staart. The dynamic rules and spatial framework keep options open for uncertain future scenarios and different preferred policy pathways. Some no-regret measures are also included, such as the softening of the quays. (Own illustration)

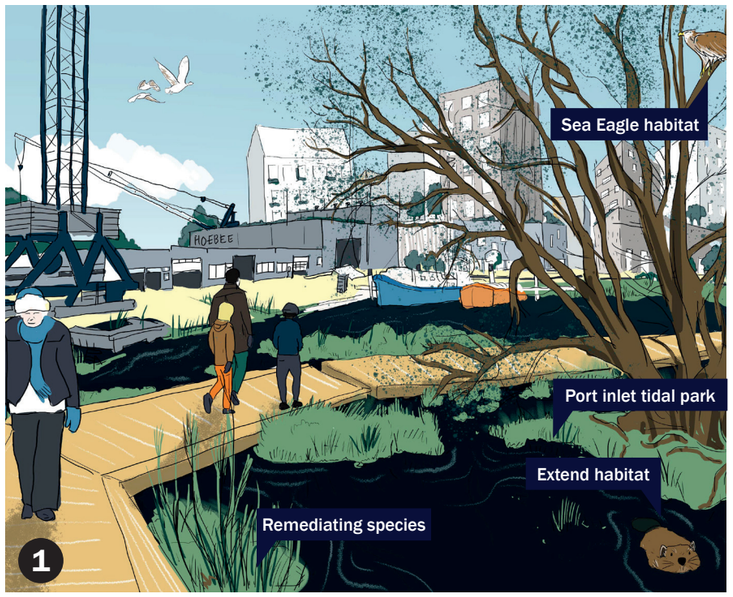


Figure 136: (left) The quays' edges can be softened for ecological value and redeveloped into a tidal park when the industrial occupancy allows it. Species of the sweet-water tidal nature can extend their habitat to the Staart. (Own illustration)

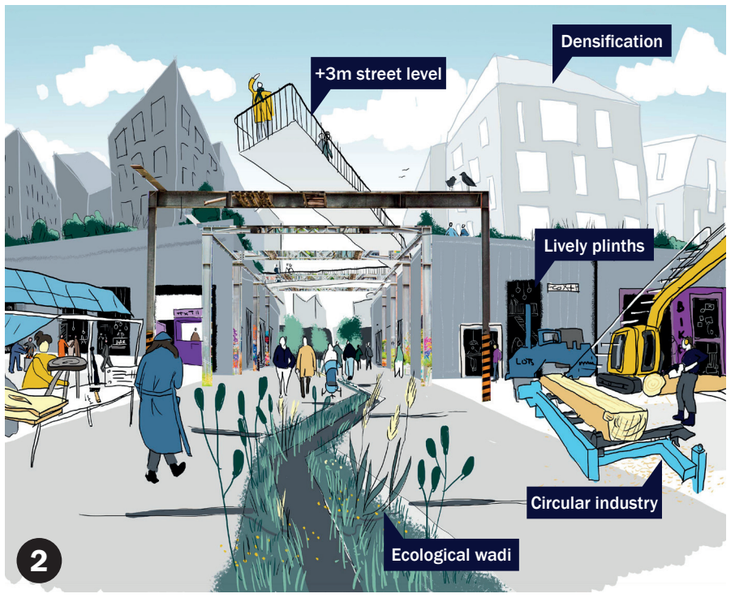


Figure 137: (right) Adaptable City Street to ensure multiple pathways remain possible and to guarantee co-existence of industries, housing and ecology in all stages of development and under different future contexts. (Own illustration)

ADAPTIVE CITY STREET

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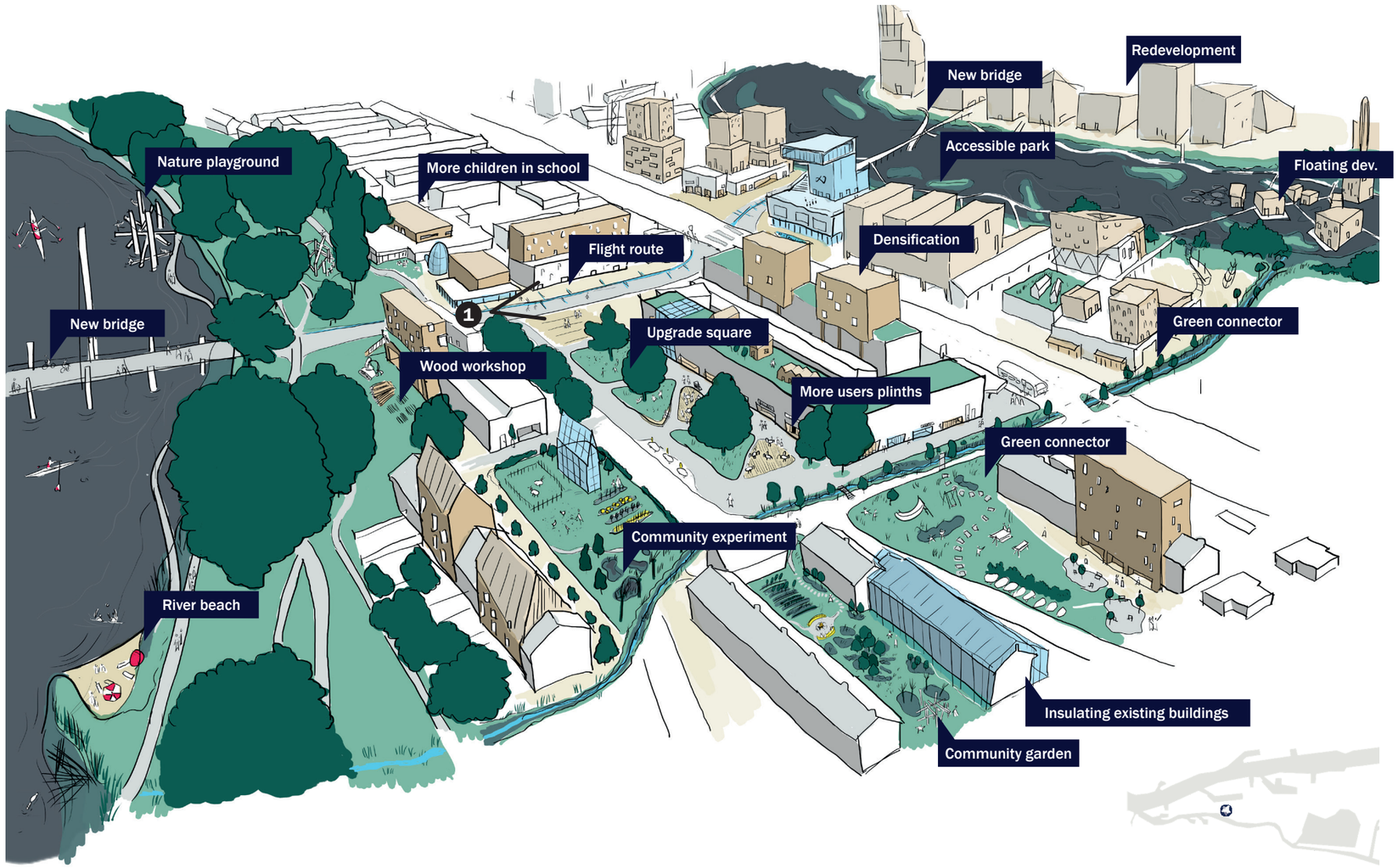

Figure 138: (above) The redevelopment works as leverage for the vulnerable social housing neighbourhood. The square has more users and the area becomes more integrated in the city's urban fabric. (Own illustration)

Figure 139: (right) The changes in de Staart have a postitive effect on the neighbourhood and its residents. Communities are engaged to improve the liveability of their neigbourhood and benefit from the framework developments around them. (Own illustration)

CONNECTORS AND EVACUATORS

The bridge is an initial investment that needs to be taken to unlock the potential of de Staart as an integrated neighbourhood of the city and as a refuge during a flood crisis. Its position in the Spatial Framework is fixed, as it is aligned with the existing dike structure of the city. However, the places it lands are dynamic and uncertain. Nevertheless the evacuation route does link important public places and buildings in the network, such as the Evacuation Square and Monitoring Centre.

Next, the cycling track on the north bank of the Wantij river also visible in Figure 126 is also a more resilient structure for the area. It connects the city and Biesbosch in an attractive cycling route. As such, it is not an evacuator for a climate emergency, but it does improve the liveability of the city when the gradual effects of climate change become more severe. During hot summers, it is a route that urban residents can use to reach the cooling nature of de Biesbosch, which is currently only accessible via an unappealing route along industry. The route itself becomes a destination for the city and local residents, giving them the opportunity to line the waterfront with public functions they want, such as a nature playground and river beach (examples from conversations on the street with local residents).

Last, if the future scenario will result in a more deserted but eco-industrial programme for the delta city, the waterfront can adapt itself to support work processes. An example is the harvest of reeds and willows for ecological construction materials.

Figure 140: The softened waterfront and cycling route along the Wantij river creates space for appropriation and ecology. By being able to access and connect with the water, the city's residents become more aware of the flood risk and the fact that they live on an island in a delta. (Own illustration)

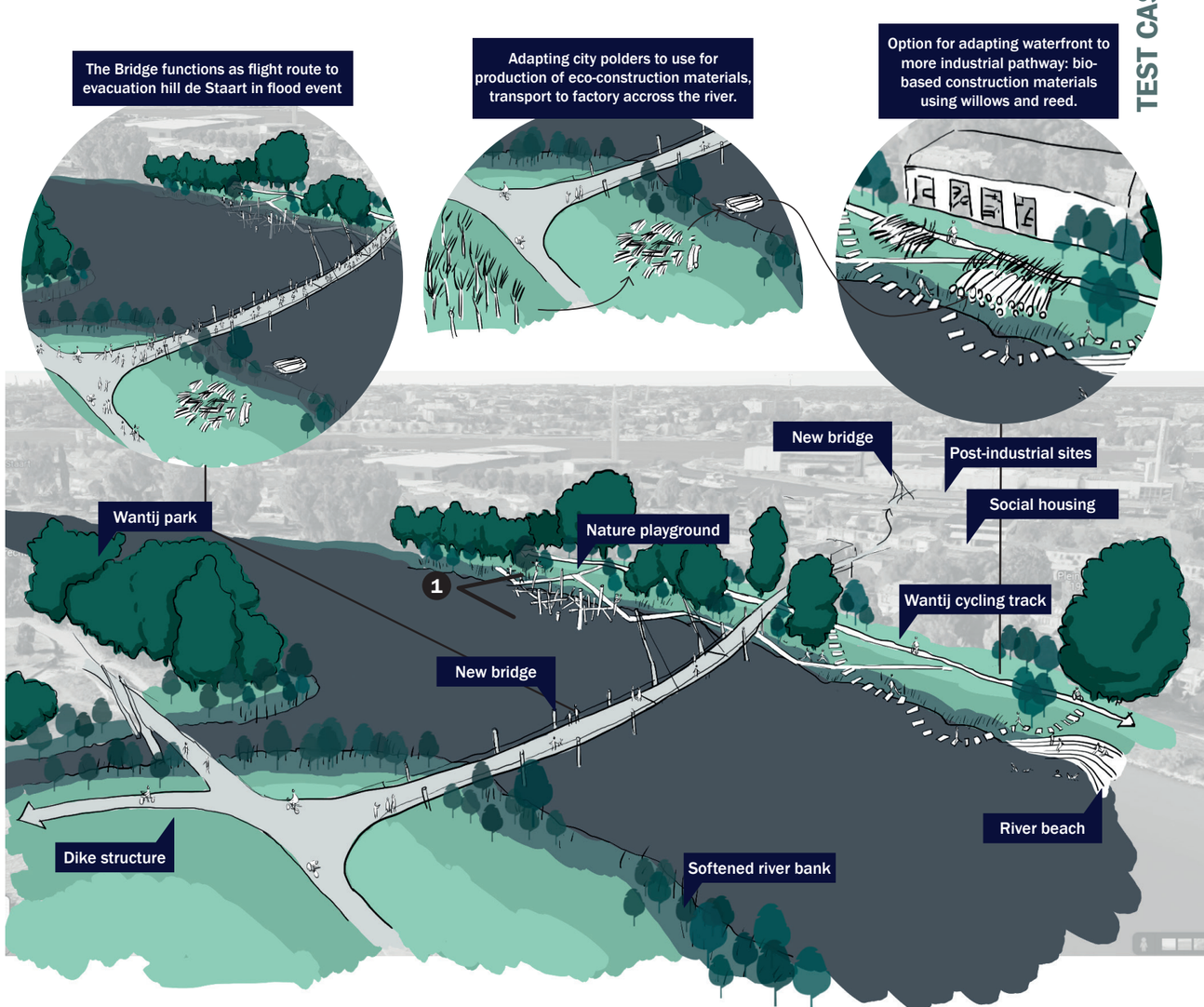

Figure 141: Multiple pathways keep open along the Wantij's edges: industrial uses or places for communities, or a combination of both. The bridge is an important connector, linking de Staart with the rest of the city and providing infrastructure for evacuation in case of a flood event that floods a part of the island of Dordrecht. (Own illustration)

CONCLUSION: DE STAART AS PILOT FOR THE REGIONAL TRANSITION

To conclude and answer SRQ5: How should local projects contribute to the establishment of a climate adaptive delta region? De Staart will gradually design and develop pathways, build experiments, and redevelop the post-industrial sites, adapting when needed to uncertain future contexts. Together with other pilot areas in the region, an interdisciplinary knowledge sharing network is constituted, informing a regional delta strategy (Figure 142). Finally, paradigms shift: people's relationship with water and nature changes and the city is considered an open-ended adaptive process. The strategy and its projects promote stewardship: enhancing responsibility for the changing climate and empowering people to make an impact.

Local frameworks within regional frameworks supported by monitoring centres ensure tipping points are identified and the area is adapted timely. In response, the delta region embraces complexity and change and adapts its systems. By embedding the long-term in the short-term and building adaptively, evolutionary resilience is established. And by developing pathways and experiments in an open process, no one feels left out.

As a result, the redevelopment of the post-industrial port site de Staart can truly contribute to the regional, long-term transition, while also improving local liveability for humans and nature and integrating climate adaptation with today's other challenges such as the housing crisis and the industrial transition.

The main question will now be answered in the floowing conluclusions chapter, combined with recommendations for actors working in practice and decision makers. Finally a reflection will conclude the graduation project.

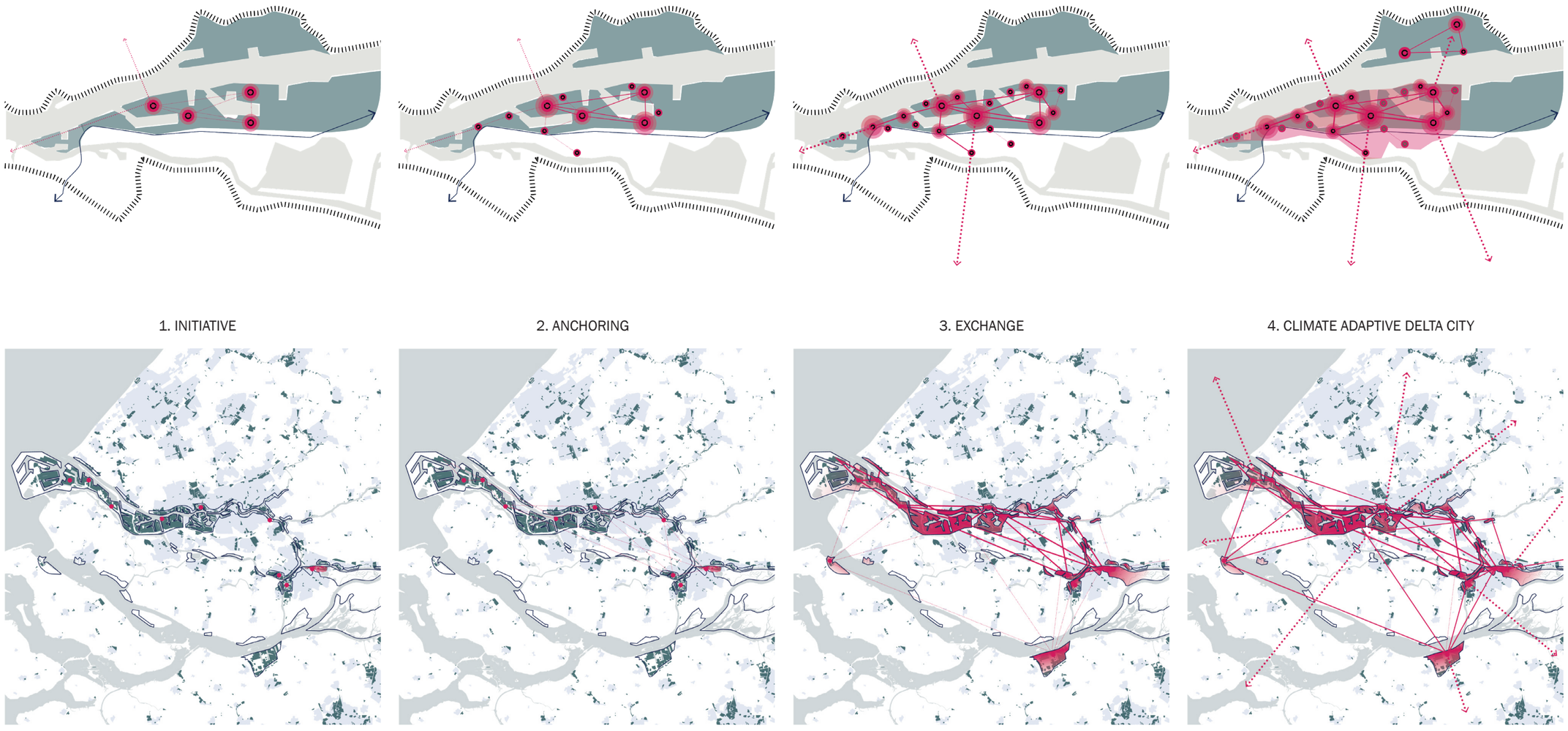

Figure 142: The gradual transition in the Delta region, using experiments within pilots that simultaneously interact, establishing Climate Adaptive Delta Cities. (Own illustration).

06

06 CONCLUSION

The main conclusions of the project are:

Vulnerabilities | If post-industrial port sites are redeveloped in a linear and non-adaptive way, it can result in a delta region that is vulnerable to long-term uncertainties of the climate crisis and its related socio-spatial regional transitions.

Challenges | In decision-making processes, private and local actors prioritise profit and concrete projects over ecology and quality and uncertainty. Therefore, a long-term guardian or value inclusive planning instrument is needed. Flexibility and continuous adaptation is difficult to embrace by all stakeholders: a paradigm shift is required. Experiments intended to change the system don't make the intended impact yet: we need grounded experiments that can scale-up and transition icons. Our current planning system hinders implementation of innovations, the new system should be institutionalised.

Mechanisms | Personal relationships and collaboration is essential. We need to overcome inter-scalar waiting. Projects' long duration and complexity can result in a lack of responsibility feeling. Actors' tendency towards the short-term raises need for instruments that allow for connecting the short- and long-term, such as the Dynamic Adaptive Policy Pathways.

Strategy | Multiple instruments are needed for climate adaptive redevelopment of post-industrial port sites: Dynamic Adaptive Policy Pathways, developed in a participatory process; Dynamic Rules that allow for co-existence of different pathways and programmes; a Spatial Framework to guide development. Aiming to transition towards Climate Adaptive Delta Cities: use public investments to unlock the area's potential; promote experiments as icons for the transition; create room for adaptability; empower a network of stakeholders in the transition arena; establish coalitions early on, and building on experiments.

Transition | The transition towards a climate adaptive delta region can be initiated locally, but does rely on networked and connected redevelopment projects. Through an inclusive process, the redevelopment of post-industrial port sites can work as leverage for the transition, but also for improving the local quality of life and ecological values. Embracing Climate Adaptive Delta Cities means understanding that under the deeply uncertain context, the future of the delta region and its post-industrial port sites cannot be master planned, but should be given the time to emerge.

Figure 143: Biodiversity is an increasingly recognised dimension of climate adaptation and a water resilient city and region. De Hollandse Biesbosch functions as a tidal park and is connected to the city through the Wantij river. (Holland.com, 2021)

CONCLUSION

In many recent redevelopment projects of post-industrial port sites in the Rhine-Meuse delta, such as projects on the island of Dordrecht or in Rotterdam, climate adaptation was included too little in designs; adaptive ambitions were hardly operationalised in strategies and outcomes; and experiments were not scaled-up internally sufficiently. In the decentralised governance model in the Netherlands, municipalities collaborate with market actors to redevelop post-industrial port sites into mixed-use neighbourhoods. Nevertheless, while these projects do set out with high ambitions, they are reduced over time due to cost-saving in response to for example a financial crisis. As a consequence, there is a risk that the many houses (1 million) that should be constructed for the current housing crisis are produced in a linear and non-water resilient way, resulting in delta region that is vulnerable to deep uncertainties of the climate crisis and regional transitions (SRQ1). Therefore, this graduation project explored the following main question:

SRQ 1 | What water vulnerabilities and urbanisation challenges lie ahead for the Rhine-Meuse delta region and its post-industrial port sites, and what strategies and plans are drawn up to address them?

How can post-industrial port redevelopments contribute to the transition towards Climate Adaptive Delta Cities?

The theoretical framework established that under the deeply uncertain context of the climate crisis and the direction in which our society will move (industrial transitions and housing market dynamics), the most reliable approach is to aim for a dynamically resilient site, city and region. Here, the climate adaptive delta region "is not understood as a fixed asset, but as a continually changing process; not as a being but as a becoming." (Wahl, 2017), for which the Dynamic Adaptive Policy Pathways is a promising methodology.

Theory indicated that a transition is needed to move to the climate adaptive paradigm, which demands deep changes in our institutions, spatial configurations and culture. Under today's decentralised and neo-liberal governance model in the Netherlands, regional adaptation and the transition rely on small-scale projects and local market actors. Urban area redevelopment projects should be used as a strategy to a) contribute to the transition (experiment, innovate and make an impact) and b) produce a quantitative assignment (no. houses and water resilient performance). This requires multi-scalar and -sectoral connections within the complex system, as the influences between different temporal and spatial scales in the panarchy model of adaptive cycles explains that a niche innovation can contribute to a larger scale transition. Niche innovations in local redevelopment project can contribute to a large-scale regional transition when they are supported by the relevant stakeholders (investors and users) and are recognised as experiments that provide a solution to society's challenges.

Comparative case study research is a suitable methodology to investigate this context-dependent and complex matter (Yin, 2003). Four existing regional pilots were studied on their performance at adaptability, transitions and integrating values. The comparison gave a better understanding of mechanisms in the redevelopment processes of post-industrial port sites. These were used to develop interventions in the planning system of the Netherlands, but that of the Rhine-Meuse delta in particular, that can improve the conditions for climate adaptive outcomes that make a contribution to the transitions needed to establish a transition. These findings are generalisable to the Rhine-Meuse delta region, but are likely to inform other contexts as well. The transition performance of the cases varied in the next four main concluding topics (SRQ2):

SRQ2 | How well do recent redevelopment strategies in cases perform in contibuting to the transition towards a climate adaptive delta region?

1. Balancing values

First, all cases aimed to build more houses and adapt to climate change, and some tried to integrate ecology and industrial transitions in their plans. Often quality in terms of value for silent stakeholders (nature) and long-term resilience (water adaptation) reduced over time, especially in decentralised and flexible developments led by private actors that were not combined with institutional reform in the public sector. For example, in many cases the innovative quality was reduced in face of the financial crisis. Therefore, we may need a guardian for the long-term and planning instruments that guarantee inclusive redevelopment for all values.

2. Climate adaptive

Second, climate adaptive delta cities, which should be continuously changing, requires flexibility, which can be difficult to embrace by all stakeholders in an interactive manner. A traditional project requires certainty and direction and a very passive role of the government is not yet appreciated by all stakeholders. Therefore, a paradigm shift is needed in how we think about the city, moving towards dynamic resilience means embracing complexity in the process and dynamic plans that allow for the implementation of innovation in the long-duration of redevelopment.

3. Impact experiments

Third, the delta region and port cities use the cases as pilots and small experiments within them for developing climate adaptative actions of the urban riverfront. As we rely on them greatly in the decentralised governance model in the Netherlands, the experiments need to make an impact: they should be innovative and scalable (Roorda et al., 2014). Within the cases, different actor coalitions first experimented with new concepts, both spatially and procedurally. The comparison showed that alignment between innovative projects and processes is co-beneficial because it results in 'grounded experiments', that are more likely to scale-up. However, some experiments did not scale-up internally, but inspired principles for adaptation in the delta region (for instance multi-layer safety in Stadswerven) or in other projects (floating experiment in de Rijnhaven), becoming icons for the transition. Nevertheless, if scale-ups are only realised for economic benefit, for example for a green identity without a feasible business case (for example realised through big public investments), it is not likely to be a realistic concept to apply along all the river's edges, also where there is a lack of economic potential. Therefore, there is a need for scalable, innovative experiments and pilots.

4. Institutionalising new system

Fourth, it is a challenge to steer innovation with the existing planning instruments within the non-institutionalised scales of the urban area and region. To really make creative pilot projects scalable, the planning and governance model needs to evolve. Here, Merwe-Vierhaven's spatial framework and dynamic rules are promising examples that guide ad-hoc redevelopment that contributes to the long-term. Over time, new roles for actors will emerge and the planning model should be adapted gradually over time.

SRQ 3 | Why is adaptive capacity (mis)integrated in the post-industrial port redevelopment projects?

Last, the interviews of the case study research brought forwards mechanisms in the planning system behind operable innovative redevelopment processes (SRQ3). The most important findings were:

- The importance of the collaboration and personal relationships. Values are not always aligned, but it is better to discover possible conflicts early on.
- Overcome inter-scalar waiting by using local projects in an adaptive planning paradigm to innovate and create more certainty for a regional delta decision. Multi-disciplinary teams that network, co-create designs and collaborate between scales and sectors are important for this.
- The long duration and complexity of challenges and actor networks results in a lack of feeling responsible and reactive behaviour (Repetto, 2008). Stewardship can be improved using open processes, participation, joint-vision making, knowledge sharing, learning and providing insight in the impact an individual can make on the system (Adger et al., 2013).
- Last, the challenge of local actors' urge towards certainty of the short-term calls for design and strategy instruments that either embed the long-term in concrete projects or allow for adaptation over time (Haasnoot et al., 2013).

The interventions in the planning system to integrate the lessons from the case study research were integrated in a strategy for using the Dynamic Adaptive Policy Pathways (DAPP) framework for climate adaptive redevelopment of post-industrial port sites. The theoretical strategy was iterated and tested for the case study De Staart in Dordrecht, studying how the short-term redevelopment projects in face of the housing crisis can embed uncertainty and

climate adaptive innovations in support of the long-term, large scale transitions. The projects in the Internationale Architectuur Biënnale Rotterdam case study provided an understanding of the current redevelopment approach, and they can be seen as a highly professional workshop of two years, exploring with innovative climate adaptation concepts for de Staart, and identifying the role redeveloped sites can have as pilots for the water safety of the island of Dordrecht and the transitions in the Rhine-Meuse delta region. Interpretations of the interviews pointed out that the spatial concepts were strong and developed, while there were shortcomings in strategies for the process. As the research showed that process and project alignment is essential for operable climate adaptation, a climate adaptive redevelopment strategy is valuable for Dordrecht to make the area more evolutionarily resilient and impactful for the regional transition.

SRQ 4 | What interventions in redevelopment projects can be used to integrate climate adaptive capactiy in the redevelopment of post-industrial port sites in the Rhine-Meuse delta region?

The design and strategy simulation showed that in order to redevelop a post-industrial port site with all its complexities into a climate adaptive area, a set of instruments is needed (SRQ4): Dynamic Adaptive Policy Pathways, developed in a participatory process; using Dynamic Rules that allow for co-existence of different pathways and programmes; and a Spatial Framework to guide development. In the aim of using pilot projects and experiments as leverage for the transition to climate adaptive delta cities, public investments are needed to unlock the area's potential; experiments that become icons for the transition and can be adapted in future redevelopment; as well as empowering a network of stakeholders in the transition arena: establishing coalitions early on. Coalitions should include public, market and civil actors in investments to integrate nature, industry and housing in designs and outcomes and improve local liveability and quality while also contributing to long-term regional goals.

Design can play a valuable role for long-term and complex redevelopment processes. First, it can visualise the policy pathways in a tangible way so that informed decision making is accessible to people with all kinds of backgrounds. Second, it can engage people in the long-term by producing attractive images for the future that convince people to stay on board (for example, use images of a preferred pathway to inspire developers) or be more accepting towards change. Third, it can explore and visualise how transitions in different sectors can be integrated and produce win-wins, stimulating stakeholders to co-create the future of an area together. Fourth, design simulations, such as in an interactive museum with a maquette, holograms and augmented reality, can show the impact of different scenarios on the region, urban area and building. Here, simulations can show the influence a local project can have and what the impact of certain action pathways is on the site's resilience. Fifth, the language of buildings and public space can contribute to a paradigm change in people's mindset, establishing a new relationship with water and nature and opening up new policy pathway directions that for example let the water in more in the delta region.

SRQ 5 | How should local projects contribute to the establishment of a climate adaptive delta region?

By integrating the principles, the redeveloped Staart can make a contribution to the transition towards a climate adaptive delta region (SRQ5):

- Its public icons and public space design can inspire innovation, create mental space for change and enhance certainty for redevelopment.
- Its participatory process makes people aware of the climate crisis, while empowering them to co-create and act collaboratively as well (for example in the museum), which can also result in less losers in the shift from the old to the new system: it turns the transition into something positive. As a consequence, it bridges the gap between ambitions and realisation because project teams are engaged early on and convinced of projects' underlying purposes. Finally, user values are integrated in the designs and will be more aligned in the spatial outcomes, while users are also aware of the open-endedness of the redeveloped neighbourhood.
- Its open planning culture that is connected to a regional knowledge network develops principles for institutional reform. Also it promotes the implementation of transition arena principles, where co-creation is used to make the transition more just and realistic in realisation.
- Last, its network with other post-industrial port redevelopment projects in the Rhine-Meuse delta ensures learning and collaboration, integrating new knowledge in designs and adaptation and responding to uncertain future contexts when needed.

To conclude, for a post-industrial port redevelopment project to contribute to the transition towards climate adaptive delta cities, it is needed to include the long-term in the short-term, which can be achieved using the Dynamic Adaptive Policy Pathways Framework combined with an inclusive process and a Spatial Framework and set of Dynamic Rules. This design and redevelopment strategy provides certainty in a deeply uncertain context (using public investments that are zero-regret); stimulates integration and collaboration (by designing integrated solutions); accelerates redevelopment (by stimulating networks); and monitors (when adaptation is needed). An open-minded culture is needed, where flexible and dynamic should not mean a government that leans back, but one that actively networks, collaborates and empowers people to jointly discover pathways towards a resilient future. Through an inclusive process, the redevelopment of post-industrial port sites can work as leverage for the transition, but also for improving the local quality of life.

Nevertheless, the processes of co-design, redevelopment and the transition as a whole are not expected to be smooth or easy: it is more likely that society and redevelopment projects will face complexity and chaos. However, complexity, chaos and good crises should not go to waste because they mobilise change (Wahl, 2017). The design simulation in the graduation project provides insights in how the transition can manifest itself, but in the end: the transition to climate adaptive delta cities cannot be masterplanned but should be given the time to emerge and adapt over time.

Recommendations

The project's theoretical, research and design explorations on climate adaptive delta cities produced promising outcomes to apply in practice and test in future research. Using the Dynamic Adaptive Policy Pathways for the redevelopment strategy and design process of de Staart and other complex post-industrial port-sites in an interdisciplinary transition team combined with participation of a broader audience because it is likely to contribute to a more just transition and adaptive planning paradigm that corresponds with the high uncertainty of the climate crisis. Furthermore, the project pointed out that interscalar and -sectoral collaboration is very important to produce a resilient delta region, therefore promoting alignment between institutions is recommendable.

Future research can evaluate the operability and effectiveness of the redevelopment strategy by monitoring a redevelopment process of a pilot project: assessing inputs, process and outputs both spatially and socially (according to the complex adaptive system). Finally, future reserach could study whether the findings about mechanisms behind integrated climate adaptive redevelopment are similar in different contexts. Therefore a comparative case study research that uses similar methods but uses cases in a different location and culture than the Rhine-Meuse delta in Netherlands can provide valuable insights for working towards a more adaptive delta cities paradigm accross the globe.

REFLECTION

"We find ourselves in a moment of unrest, it can feel like we are in a permanent crisis and many of us feel restless. This makes sense because the unrest in the world reflects the unrest we all feel. We are at the change of an era, where it is likely everything is going to change." (Translation of Rotmans, 2021)

This transition requires deep changes for both individuals and our society's system as a whole (Haasnoot et al., 2013; Latour, 2018; Rotmans, 2021).

To position the graduation project in a larger picture, this final chapter reflects on the societal and scientific relevance of the project and challenges during the graduation process, related to the chosen methodology, data collection and ethical dilemmas.

SOCIETAL RELEVANCE

In the face of the increasingly pressing climate crisis, many spatial and socio-economic layers of our society need to become radically different, such as the green industrial transition and new ways of housing. In a society where there is a lack of trust (Edelman, 2021), insufficient application of innovative concepts and a lack of long-term and integrated plans (Frantzeskaki & Loorbach, 2013), the need for rethinking the planning system and the way in which we develop our built environment is ever more urgent (Roggema et al., 2012). Therefore this graduation project is driven to provide a perspective on an inclusive transition towards a climate adaptive society, studying a specific typology of place in the researcher's proximate context where many of the transitions are at play: post-industrial port sites in the Rhine-Meuse delta region in the Netherlands. The project offers one perspective on this transition, but there are other ways as well.

To understand what a local project can mean for this transition, the existing system was first analysed on its capacity for adaptive urban redevelopment and the essential cultural shifts. While the research revealed an increasing awareness and motivation for climate action across different sectors, this motivation does not (yet) result in highly innovative redeveloped post-industrial sites. On the one hand, the transition requires a more spiritual and personal approach that is embedded in local cultures, meaning the strategy focuses on ways of empowering local actors in small, short-term developments to have a larger and long-term effect on changes in the system. On the other hand, the transition requires more organic and dynamic forms of planning under deep uncertainty, of which the thesis illustrates the applicability and value. Communication between different fragmented societal pillars and scales is needed and many actors need to be activated. If de Staart is redeveloped adaptively and contributes to the regional transition as a pilot using the integrated governance model, it can be beginning of a more water resilient society that is constructed from the bottom-up, which lives more in balance with the planet.

Bridging the gap between ambitions and actions and transitioning towards a more resilient system is a highly complex and ongoing process, but with this project I have made an attempt to work on it.

ADVANTAGES AND LIMITATIONS METHODOLOGY

Building on a theoretical framework and a comparative case study research, this thesis designs a theory and empiric evidence supported strategy for more adaptive post-industrial port redevelopment.

For the research, one case study was studied in depth from a historical perspective and two cases still under development were analysed to validate, extend and compare the findings. To enhance the internal transferability, the selected cases were located in the same region. To increase external validity and distinguish between recurring challenges, project-, or actor-specific issues, the representative interviewees were asked about previous project experiences and findings were compared with literature. However, as the different sites were redeveloped under different circumstances and findings are coloured by the researcher's and interviewees' perspectives, the conclusions should be seen as directions and not as concrete facts. The underlying mechanisms identified behind the barriers and opportunities behind the realisation of more inclusive, water adaptive urbanisation of post-industrial port sites can be valid in other contexts as well. Furthermore, the findings are likely to be more applicable to other countries with planning cultures similar to the Netherlands. Also, as future redevelopment projects will take place in a deeply uncertain context, the findings should be used critically.

Next, in the design section of the project, the existing Dynamic Adaptive Policy Pathways methodology from water management was tested for applicability in urban area redevelopment. Here, I integrated uncertainties like the housing market and industrial transitions with climate change. For future research and projects it is particularly interesting to study the real-life applicability of the theoretically promising adaptive planning methodology at the scale of the urban area, as these projects require more certainty and practical action than regional planning. The project did develop strategies for addressing these challenges: combining adaptive planning with a robust spatial framework. Nevertheless, the Dynamic Adaptive Policy Pathways approach is rather complex and requires collaboration of many sectors for it to work. The operability and understandability of the large maps is questionable, but can be overcome by using action cards or the museum that makes adaptation and pathways more insightful and concrete for local actors.

DATA COLLECTION AND ANALYSIS LIMITATIONS

Multiple data collection methods were used, each with their advantages and shortcomings. While spatial data and quantitative data were easily accessible via databases of the Dutch government, some data sources provided diverging information, for example regarding their predictions about regional water threats. A more thorough evaluation of sources might have been necessary to identify problems more exact.

Social data about the redevelopment process of the cases was acquired via interviews, through which a rich set of qualitative data was collected. Some uncertainty remained about whether sufficient perspectives were collected to fully understand the cases. However, Yin's (2003) principles were followed, interviewing until repetition of answers is found and using the snowball method to ask interviewees about important stakeholders in the process to interview in combination with a stakeholder network analysis.

Limitations in time made a broad interviewee sample for the comparison cases impossible. Therefore a representative expert (urbanist) was interviewed for the comparison cases and experiences in reference projects to confirm or contradict existing hypothesis. Also, I build forwards on interview samples and case study research by previous researchers. The comparability of the previous research was not a 100% match as the other researchers had a slightly different study topic, but they also focused on transitions in the redevelopment of post-industrial port sites, so their conclusions were informative to the project.

Last, questions remain about the reliability of the interpretation of the data. I attempted to work with as little bias as possible: systemetically asking open questions, transcribing interviews and analysing data. However, interpretations of the data by more researchers would produce more reliable conclusions.

ETHICAL DILEMMAS

While developing scenarios, ethical dilemma's emerged immediately which I tried to overcome in the strategy. One adaptation action benefits some industrial sectors, group of people, or element (nature, water..) more than the other. For example, when trying to extend wetlands for ecology and water resorption in low-lying peatlands, some communities have to abandon their cultures and homes. However, it is important to also discover these more inconvenient spatial impacts of future delta decisions. The thesis therefore proposes an inclusive participatory approach to policy-making, decision-making and redevelopment. It aims to empower all to use the different climate, housing and economic crises ahead as a leverage for a better society: supporting the right to the city (Latour, 2014) and rights of nature (Wageningen University, 2021).

Co-creating the Dynamic Adaptive Policy Pathways roadmap and a framework with guidelines and stimuli for action in the short-term action improves the activation and understanding of actors in embracing the transition. As a consequence, it enables us to identify critical places for the start of the redevelopment as well as neglected areas that should be improved as well for a just transition. The images and maps in this project aim to include as many groups and dimensions, but it is only through open design processes that the city can discover the needs and possibilities of a place. The transition will not be easy, but the design simulation hopefully shows that imagebility can connect people and make the future more tangible. As transition expert Rotmans says (2021):

"In the end, all change demands a mental transition. Our future and the debate becomes more spiritual. The transition will bring chaos, maybe even wars at the short term, but on the long term the chaos helps us forwards. In other large transitions, artists, writers and philosophers gave an image to the future – today it can be creatives, architects, hackers..."

The project aimed to bridge sectors and rethink the planning system holistically. Nevertheless, the actions developed and recommendations made were not fully unbiased, as they were coloured by my perspective as urbanist on the importance of spatial quality and restoring the balance with nature. Complexity, chaos and conflict should not be tried to be overcome, as I discovered during this project that in the friction innovations can emerge and debates are held to make difficult, yet essential decisions. The outcomes are a showcase of a more inclusive and adaptive planning paradigm and I hope they inspire policy makers and empower local actors to make a difference in the transition and 'Start de Staart!'

07 BIBLIOGRAPHY

Figure 144: The Port of Dordrecht - in the future a site for post-industrial redevelopment? (Port of Rotterdam, 2020)

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Figure 48	Barcode Architects. (2020). Rijnhaven [Photograph]. Top010. https://nieuws.top010.nl/rijnhaven-gebiedsontwikkeling.htm
Figure 53	Hanswijk, F. (2016). Merwe-Vierhavens [Photograph]. Vers Beton. https://www.versbeton.nl/2016/10/ondernemers-over-de-aantrekkingskracht-van-oude-havengebouwen/
Figure 58	de Goeij, A. (2021). Vluchthaven de Staart [Photograph]. Stichting de Stad. stichtingdestad.com/wordpress/gallery/vluchthaven-de-staart-08-09-21/
Figure 67	-

FIGURE	SOURCE
Figure 69	Deltaprogramma. (2020). De Staart als waterrobuuste schuillocatie [Photograph]. https://magazines.deltaprogramma.nl/deltanieuws/2020/05/de-staart-als-waterrobuuste-schuillocatie
Figure 71	Gemeentelijke Prentverzameling. (1833). Plattegrond van de stad Dordrecht en een groot gedeelte van de Staart, met oevermetingen en peilingen in de rivier de Merwede. [Photograph]. Regionaal Archief Dordrecht. https://beeldbank.regionaalarchiefdordrecht.nl/search/detail/id/E3B7D6AF0EA78330C96E0AA726157E71/showbrowse
Figure 72	Gemeentelijke Prentverzameling. (1920). Kaart voor de Staart [Photograph]. Regionaal Archief Dordrecht. https://beeldbank.regionaalarchiefdordrecht.nl/search/detail/id/BC2BAFF2AC8711E489FB00163E535DC5/showbrowse
Figure 73	De Merwedecentrale. (1962). [Photograph]. Regionaal Archief Dordrecht. https://beeldbank.regionaalarchiefdordrecht.nl/search/detail/id/66C16250BE878A00094B066D8EA6E794/showbrowse
Figure 74	De Dordtenaar. (1989). Luchtfoto van Stadspolders gezien naar het westen [Photograph]. Regionaal Archief Dordrecht. https://beeldbank.regionaalarchiefdordrecht.nl/search/detail/id/E7960C14EAFC083DAC4D52ACE9907514/showbrowse
Figure 75	Swart, S. (2018). Chemours Dordrecht [Photograph]. Siebe Swart Areaal.
Figure 76	Funda. (2021). Werf van de Biesbosch [Foto]. https://www.fundainbusiness.nl/winkel/dordrecht/object-41200378-werf-van-de-biesbosch-92/
Figure 143	Holland.com. (2021). Nationaal park de Biesbosch [Photograph]. https://www.holland.com/be_nl/toerisme/activiteiten/natuur/nationaal-park-de-biesbosch-3.htm

08 APPENDIX

Figure 145: Expansion plans for de Staart in 1920.
(Gemeentelijk Archief, 1920)

APPENDIX 1 | SITE SELECTION MATRIX

Considerations behind the different case study locations. (Own illustration)

Case	Water	Urbanisation	Development stage	Consideration
Stadswerven, Dordrecht	Tidal Park, nature inclusive adaptation	540 homes	Construction and Maintain, partially finished	Selected case for the research stage. It is suitable for the research as the redevelopment is partially finished, yet criticised for a low operation of adaptation ambitions. Interesting as it has not been studied as intensively compared to cases in Rotterdam.
De Staart, Dordrecht	Biesbosch extension, function as a refuge for a self-supporting island of Dordrecht	Speculative	Initiative, exploratory studies by IABR are being conducted	Selected case for the final design stage, as it is a project at the beginning of development. Design explorations reveal the possibilities of the site for both redevelopment and adaptation (where the area can play a role for the city safety as well during an extreme flood event).
Maasplateau, Dordrecht	Urban quays, protective role for the water vulnerable neighbourhoods behind it.	550 homes	Design, masterplan visions produced by Mecannoo	Okay for design stage, not a typical port site, but does have an industrial character and sufficient ambitions for redevelopment and adaptation.
M4H, Rotterdam	Partially flooding, partially keeping the water out	3.500 - 5.000 homes	Design and Preparation, first project will soon start construction	Suitable as a comparison case during the research stage. Similar adaptation challenges, while perhaps more successful in implementing than Dordrecht. Interesting to compare the planning instruments used, outcomes and strategies.
Rijnhaven, Rotterdam	Partially floating park, tidal park	2.000 - 2.500 homes	Construction starts in 2021, project delivery in 2035 (funding aquired)	Good as a comparison case during the research stage as well. Similar adaptation challenges and strategies implemented, both Stadswerven and Rijnhaven try to play an innovative role in adapting the region to climate change.
Maashaven, Rotterdam	Tidal Park, Nelson Mandelapark	2.000 homes	Design, project delivery in 2025 (funding aquired)	Also suitable as a comparison case, perhaps more difficult to study briefly as a reflection/comparison case as it has received less academic attention than the Rijnhaven.
Feyenoordcity, Rotterdam	Tidal Park Feyenoordcity	3.000 homes	Initiative, design finished in 2022, project delivery in 2025 (funding of 27,4 million acquired)	Suitable as a comparison case due to its tidal park. However, the plans are not as far developed when compared to the Maashaven and Rijnhaven, which are more similar to the main focus case, Stadswerven.

APPENDIX 2 | OVERVIEW INTERVIEWEES

Actor #	Name	Role	Details
0.1	-	Researcher at TU Delft in urban area development	March 2021. Zoom interview, open and orienting
0.2	-	Delta Futures Lab expert water managemetn Rhine-Meuse basin	April 2021. Zoom interview, open and orienting
1.1	-	Municipality urban planning	May 14th, 2021 10:30-11.30 zoom semi-structured interview. May 27th, 2021 16:00-17:30 unstructured interview
1.2	-	Municipality politics	May 26th, 10:00-10:45, semi structured interview
1.3	-	Landscape architect	May 17th, 2021 13:30-14:15 semi-structured interview
1.4	-	Developer from OCW	June 4th, 09:00-10:00, teams interview, semi-structured interview
1.5	-	Activist from a nature organisation in Dordrecht	May 1st, 2021 17:00-18:00, telephone interview, semi-structured
1.6	-	Waterboard	April 29th, 2021 12:00-12:45, telephone interview, semi-structured
1.7	-	Water expert at Deltares	April 29th, 2021 12:00-12:46, zoom interview, semi-structured
2.1	Rients Dijkstra, PostadMaxwan	Urbanist	September 9th, 2021, in-person interview, semi-structured
2.2	Martijn Tjassens Keizer, VenhoevenCS	Architect, urban designer	September 17th, 2021, 14:00-15:00. In-person interview, semi-structured
2.3	Zita Balajti, EGM	Architect	September 23rd, 14:00-15:50. In-person interview, semi-structured.
2.4	Marco van der Pluym, WEST8	Urbanist	October 5ht, 2021. 21:00-22:45. Zoom interview, semi-structured
2.5	Donna van Milligen Bielke, DVMB	Architect	October 10th, 2021, 10:00-10:40. Zoom interview. Semi-structured
2.6	Ellen Kelder, Gemeente	Project leader, transition agenda Green-Blue	October 5th, 2021, 16:00-17:00. Zoom interview, semi-structured
3.1	Emiel Swinnen, Delva LA	Landscape architect Merwe-Vierhavens	September 17th, 2021. 16:00-17:00. In-person interview, semi-structured.

APPENDIX 3 | INTERVIEW QUESTIONS

Interview questions for the semi-structured interviews in Case 1 and 2 (Own illustration)

Aim	Theme	Keywords	Questions
Publishing and privacy	**Privacy**	Record	Do you agree that I record this interview?
		Publish	Do you agree that I publish the outcomes of the interviews in my report? The answers wil be anonimised (it will only be published from which sector you are) and only a summary and some quotes will be published.
Understanding the stakeholder network	**Organisation**	When	When were you involved in the redevelopment of Stadswerven?
		Role	What was your role in the redevelopment process?
		Collaborate	With whom did you collaborate during the redevelopment process?
		Involvement, responsible	With which spatial elements were you involved and for what part of it were you responsible?
Understanding stakeholder perspective and role	**Spatial**	Goals	Which goal/interest was your most important driver for being involved in the redevelopment of Stadswerven?
		Success, achieving goals	Were you successful in achieving your ambitions/goals in the redevelopment process?
		Process ambitions	In what way did the redevelopment process of Stadswerven support you achieving your ambitions? And in which way did it not support it?
Understanding awareness water challenges and process effectiveness	**Climate adaptation and water**	Involvement with public space	Were you engaged in the development of public space and climate adaptation?
		Awareness vulnerabilities	Are you aware of the vulnerabilities caused by climate change in the future for the area? What vulnerabilities/challenges do you think there are in Stadswerven?
		Actions for climate change	What kind of actions did you take/were taken in adapting the area to climate change?
		Process integration water adaptation	How did the redevelopment process of Stadswerven support the implementation and integration of water adaptation ambitions?
	Lookout towards the future	Lessons	Which lessons have you drawn from the redevelopment of Stadswerven that you would like to share?
		Change in process, Ideas	In what way would you change the redevelopment process of Stadswerven to make water adaptation more integrated in the redevelopment?
		Decentralised model, future proof	Do you think urban area development in the current decentralised planning model will be able to meet the challenges of the future?

Interview questions for the semi-structured interviews with IABR participants

Aim	Theme	Keywords	Questions
Publishing and privacy	**Privacy**	Record	Do you agree that I record this interview?
		Publish	Do you agree that I publish the outcomes of the interviews in my report?
Understanding project and design process	**Context**	Role	What was your role in the biennale project?
		Goal, assignment	What was the assignment or goal for your biennale project?
	Spatial	Project, water adaptation, urbanisation	Could you explain the project and how water adaptation and urbanisation are integrated?
Ideas on how this might be achieved	**Implementation, mechanisms**	Realise, implement	Do you have ideas on how this project could be realised? Who should be responsible for it? Where should you start?
		System	For achieving the values of the project (eg. water safety as lever), what should change in the planning system?
		Experience, project	Do you have experience with a project where climate adaptation (or quality) was integrated well with urbanisation? Why did/didn't this work?
Applicable elements	**Reflect**	Lessons, Staart as a pilot	Which lessons have you drawn from the biennale that you would like to share? What would you differently?
Positioning Biennale in transition	**IABR in bigger picture**	Role, biennale	What is the role of a biennale in the larger transitions for de Staart?
Closing	**Open end**	Miss, add	Is there something that we went over too fast, or that you would still like to add?

APPENDIX 4 | INTERVIEW OUTCOMES STADSWERVEN

Actor #	Role	When and how involved?	Main interest	Input for water adaptation	Actions for water adaptation	Outcomes for water adaptation	Input for urban adaptation	Actions for urban adaptation	Output for urban adaptation	Adaptation lessons for the future	Part of larger transition?	Collaboration	Collaboration lessons for the future	Integrating urban and water lessons	Long-term climate adaptation lessons	What were challenges from the context?
1.1	Municipality urban planning	2001-present, active role as urban planner within Dordrecht municipality. Before Stadswerven involved with the Drechtoevers project.	Spatial quality: what is best for the city	Merwede side: needed to do fit in with the demands of Rijkswaterstaat (not a lot of creativity possible). South side changed over time in the planning process, more greening possible due to less shipment.	Explorative studies, international learning (MARE project), regional concept development (multilayersafety), convincing politics, setting rules, weighing off interests, weighing off feasibility and quality, active stimuli and spatial kickstarters	Urban Flood Management concepts, multilayer safety, building with nature tidal park, bridge connection to city, 5m central axis in the area as flood bank, making water and tides experienceable to increase awareness. River as tidal park together with Rotterdam. Try to compensate for lost ecological value within the project: sometimes it is needed to clean the soil.	There's a housing shortage in Dordrecht, we needed to change the plans according to changes in the market. Furthermore, conflicts between the cities around the Drierivierenpoint about inequality if Dordrecht had the big theatre also made us change the programme. The financial crisis gave us less funds and we still had a lot of sunken costs... The search for identity	Changing the amount of houses, reducing quality, developing some parts ourselves, giving out plots for owner-occupied self development. We needed to keep more heritage than we expected, so the plans for public space changed as well. Cheaper parking solutions.	Some successes (eg. Villa Augustus, the movietheater, etc.), but also some losses: we had to reduce a lot of quality in the developments that happened during the crisis. More heritage in public space to establish a new identity for the area.	Being adaptive in phasing and development, within the complexity and long duration of inner-city redevelopment. Build a framework and decide the core qualities for the area, then you should just act whenever you can. Flexible plans and mindsets are important, keep adapting your plans to new circumstances.	In the complexity of the Stadswerven redevelopment, we have learned a lot of lessons that are useful to other municipalities and ourselves, we try to learn from these projects and implement the lessons in future projects.	In a complex process with so many actors you need to determine the core qualities together and then continue. In SW it worked counterproductive that we agreed on details at an early stage, that made adaptation difficult.	It is important to organise a good collaboration, having the right parties at the right time around the table, and also bringing in good designers. External designers are powerful and convincing, especially if a strong argument needs to be made and you do not want to damage the personal relationship. Strong images can help to decide which path to take. Furthermore, as the process is so long, try to look for short-term wins for people involved to keep them motivated, while you as an urbanist stay the captain for long-term quality	It helped a lot to do pilot projects and experiments exploring the possibilities. This helped because people then do not feel the need to really agree on details and take responsibility but become more creative instead.	Dordrecht as an island is rather vulnerable to the water. Internally we can solve many problems, but we also depend on external factors. We can't solve these problems by ourselves, you need larger scale actors for this. These long-term decisions are essential to us, they will offer more certainty. We are now waiting for a decision to be made at the national scale.	Biodiversity and nature inclusivity became more important throughout the process, we had to weigh off whether we should clean soil and remove trees or keep every small part of biodiviersity. The financial crisis made us reduce the amount of apartements, parking concepts and housing typologies.
1.2	Municipality politics	2010, political involvement.	A new neighborhood for the city	Urban Flood management, water urgencies, climate change	The highest dike in Dordrecht	Implementing the concept of multilayer safety, a very innovative tidal park	Changes in the housing market: different demands of people (in housing typology and general demand)	Revising the plans, more houses that have a front door at the street	A reduction in quality during the crisis, but you can see an increase in the quality today as the market is improving. The area is very important to the city, it will become an extension of the city center.	You need to know what the identity and purpose of the area will be for the city. Then you know how to adapt your plans while still ensuring quality.	Climate adaptation is becoming an increasingly important factor for us, we are embedding it more and more in out future projects such as Maasplateau and Amstelwijck.	-	-	In new projects we embed demands for adatation from the beginning, this makes it easier when private parties tender for developing. Competition between cities does make it difficult to set too high demands.	Some challenges are very big and require more steering and a strong government.	Financial crisis
1.3	Landscape architect	2019-2020, hired for landscape design	Fulfilling the assignment, personal value: greening, ecology, useable to the city.	Restrictions set by Rijkswaterstaat, which were communicated by the municipality	Making water experienceable, floodable public space	We did not consider long-term adaptation scenarios, we only had a fixed assignment. We did try to make the water experienceable, so that people became aware of the vulnerabilities of the site.	-	-	-	In general we see ourselves as advocates for biodiversity. However, as we weren't part of the team of SW from the starting point, we could not embed these values in the plans. So here we just tried to preserve the existing ecological value and connect it to the industrial heritage.	Developers are becoming more aware of the urgency of climate adaptation adn the added benefits to their area. Municipalities should make it vital requirements for the development.	Involved for a short period of time for a very specified assignment.	Being involved from the beginning of the process and at key moments to make climate adapation the starting point and everything else a spin off. Rather than working in silos, we should be developing public space, buildings and infrastructure at the same time so that issues can be resolved early on. Participation is a good thing too, but not all municipalities are open to this yet, depending on their mindst and resources.	It can be very complex to try to integrate all sectors, many disciplines around the table can make conclusion drawing difficult. But you should do it at key moments. It is about checking alignments as well.	On the one hand you see a paradigm change, which is happening slowly. On the other hand you see that people need a push/stimulus.	Actors from different sectors might be making plans and strategies for the area as well. You can risk finding out about conflicting interventions at a late stage when no interaction happens between the different sectors.

Actor #	Role	When and how involved?	Main interest	Input for water adaptation	Actions for water adaptation	Outcomes for water adaptation	Input for urban adaptation	Actions for urban adaptation	Output for urban adaptation	Adaptation lessons for the future	Part of larger transition?	Collaboration	Collaboration lessons for the future	Integrating urban and water lessons	Long-term climate adaptation lessons	What were challenges from the context?
1.4	Developer from OCW	2001, as a project developer. First in a junior position, later a more controlling role	Making profit, we are a market party after all. But also adding something good to a city. We are sometimes seen as a party who comes briefly to a city, but we want to leave it a bit better.	-	-	-	Multiple opinions of different actors within OCW and of the municipality. The housing market. The province setting demand for the area.	We adapt the type of housing to what is feasible in realising for the market. In the beginning we could not come to agreement with the municipality on how to realise the plans. In and after the crisis we changed the programme and housing typlogies according to the demand.	Before crisis: not that much was built. During the crisis we had to start due to sunken costs, but as the market was weak, we only built low quality housing. Now the market is improving so we can make higher densities and more quality.	The outcomes would not necessarily have been different when we would have collaborated in a PPP. Though perhaps it would have forced us to really find shared values from the beginning.	We are becoming more aware of the climate crisis and want to leave the world safe for our future generations.	We collaborated with other market developers in OCW. The collaboration with the municipality was a bit difficult in the beginning, but after a revision period we came to a joint plan.	Get the actors around the table at an early stage. Make sure you agree on values and decisions before taking action. The alignment of values is very important because it might otherwise result in conflicts later on.		Climate adaptation is very important, but it is difficult for us to be fully responsible for it. You might need national steering and certainty around new innovative concepts to be able to realise it. Also, in municipalities like Dordrecht it is more difficult for them to set high demands in adaptive capacity when compared to Amsterdam, who has a really high land value and has more power.	The financial crisis
1.5	Activist from a nature organisation in Dordrecht	2010, as an activist for more nature inclusive development along the Wantij and Biesbosch	Nature inclusivity and protecting biodiversity	The actions and plans made by the municipality	Proposing alternatives for more nature inclusive plans, for keeping trees and zones with high ecological value	Law suits, slowing down process.	-	-	-	The building with nature (wervenpark), public space and quays in Stadswerven lack ecological value, it does not fit in with the laws around natureprotection. In stadswerven a symbiosis would have been possible between climate adapation and biodiversity, this was not successful. Now the adaptation was only hightening the soil.	Biodiversity is becoming increasingly important and people are more aware of it. The rights for the river and nature are a growing concept but need to be embraced more by different actors.	The municipality of Dordrecht was rather closed to opinions they did not like. We did lobby with GroenLinks, but because plans were already determined, they could no longer be adapted to become more nature inclusive. We are now collaborating with Wageningen university in a research project on how to integrate city and river.	A more open, adaptive political culture that can respond to new findings/insights and listens to silent stakeholders such as nature. Involve all to participation and listen to each other. A less top-down planning approach. Currently, democracy is reduced because municipalities have given too much power out of hands to private parties.	Ecological value of the 'stepping stones' in Stadswerven is reduced because the green spaces are also programmed to be used a lot by visitors and inhabitants. The parks are show green. The quays are not soft enough to be of ecological value. The parks are completely enclosed by buildings, making them not very habitable by animals.	Preserve and try to improve what is already there. Be adaptive in your plans to be able to include new insights in the planned buildings and public spaces. Also, there was an action urgency because the municipality already had a lot of sunken costs - if the muncipality becomes financially involved in the development, does this benefit the quality of the planning?	Involvement of market parties, financial crisis, urgency to build: it all reduced the ecological value the area was in the first place set out to have.
1.6	Waterboard	Involved from the water perspective, also involved as a sutainability advisor in other projects in working life.	Water management combined with ecology and cultural value	Translating long term thinking to short term actions	Action is needed as a result of the changing climate. Questioning whether we need to keep heritage at all costs.	-	-	-	-	Thre is a lack of long term thinking: bestuurders tend to be more reactive and short term, which is human. A challenge is how you translate teh longterm to actions now. Developers think in economic lifespan, they are usually only climate adaptive if it is in the contract. Urbanists tend to draw a lot without thinking about the process. they can think that it is there when they've drawn it.	Cities are quite resilient at the moment, but in face of future climate change effects we need to adapt.	There are discussion structures where people in a decision function from different sectors are involved to think about the longterm.	We need regional plans, but also bottomup communication structures. Furthermore governance should be open to unwanted advice. Bring together urbanists, engineers and ecnomics and have them think about the big challenges toegether (such as diversity) and have them think: what can it bring to us? what kind of city do we want to build? how do we want to enricht this? Bring plans together in time to see win-wins and problems. As an advisor for sustainability you need to be critical.	You may need indicators for sustainability. Sometimes it might be good to calculate things (eg. In a BIM model) which allows people from all sectors to see the performance of the area. A growing database can offer tools.	Operability and process is very important, but often overlooked. Don't just make spatial plans, but immediately think who you should involve. Try to bring together the right actors at the right time. Phasing of the process is imporatnt: when do you need to set rules, when do you need to informally conduct research by design?	Short term reactive thinking can get in the way of addressing the long-term needs.
1.7	Water expert at Deltares	Tidal park (Wervenpark)	Water management, different layers of usage (swimming, industry, ecology in relation to water quality)	Research input in the Wervenpark, analysing performance of the project and lessons for further applications of concept.	Tidal park	Tidal park	-	-	-	Take all the use layers into consideration when planning. Port sites consist for a large area of water, also think about the quality in what you are planning to do with it.	-	Interdisciplinary team	-	-	-	-

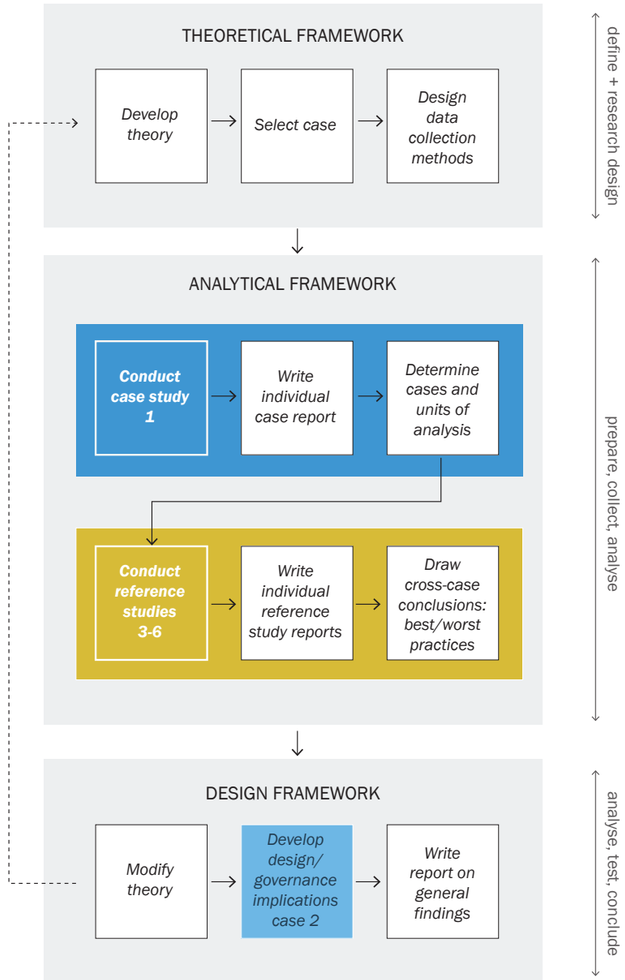
APPENDIX 5 | INTERVIEW OUTCOMES IABR DE STAART

Actor	Actor #	Role	Goal, Assignment	Project, Water Adaptation, Urbanisation	Ideas for Implementation, Who, Where	Changes in Planning System	Reference projects, Experience	Lessons IABR	Position IABR	Adaptive capacity	Culture shift	Transformative capacity	Notes Jasmijn
Rients Dijkstra, PostadMaxwan	2.1	Urbanist	A floating neighbourhood in a high density	A study for a floating neighborhood. Innovation and challenge lies in making it in a high density and establishing a high quality public space with a good atmosphere surrounding the houses (as this lacked in other projects).	Analyse the existing users: Move them, combine them, buy them out, densify them. Study whether the current users are high quality companies/industries to understand which ones can leave. Study the types of industries and take a regional focus to see where they might go. Create the foundation for a supportive system: flexible legislation. Participation with the future residents, the existing users only have too much fear of change.	Municipalities focus on the day-to-day, and are less visionary or long-term thinking, developers are too sensitive for market developments. For the long-term and implementation of innovative concepts you will need a (national) government)	-	On the one hand, you need design to seduce and gain interest in the plans. On the other hand, your plans should not be too naïve. The business model behind a project needs to be OK, or at least point at feasibility in some way so that developers do not discard the idea after making the first calculation.	It shows the grimness of the anthropocene: we really need to act.	Build in safe places or safe ways, a floating neighbourhood will always be safe in case of a flood.	Fear of change when participating with existing users. To realise innovative concepts, you need a culture shift in residents, the development world and legislation (and the way in which mortgages are given out).	The need for a stronger national government to focus on the long-term.	Innovative ways of building in need for businesscases and large scale experimenting
Martijn Tjassens Keizer, VenhoevenCS	2.2	Architect, urban designer	A flight route with linkage opportunities. Connect other aspects: 15 minute city, StadsparkXXL for new modes of mobility. Also include the SDGs.	It is a connection, it should connect at least two points of interests, but public places along the way is a good idea. For example: for education, public transport, art routes. Make use of existing landscape routes and connect places of interest.	Make a prototype, study it well. See how you can position it in a critical site. Their designs are not very extreme but rather pragmatic. Then develop it in different stages. The municipality and government should invest in it, see it as an infrastructure investment similar to a dike. Do not connect too much programme (housing) to it, it should be a self-standing object. For the experiment, share investments. Do not make it a profit generator.	Municipalities focus on the day-to-day, and are less visionary or long-term thinking. For the long-term you will need a (national) government. Include SDG's in accounting will make inclusive investments more feasible.	Marconiplein, also uses SDGs to test value of project.	The role of the urbanist is to put SDG's sustainability and adaptation on the agenda. However, collaboration is needed to solve the assignments. The process is important: dream together with the developer and architect: what can your building add to the neighbourhood?	[A big gesture, storytelling.]	The whole island becomes safer when people can flee in times of need. A flight route that is used daily as well and connects isolated neighbourhoods to give them more opportunities.	Make flight route part of daily life, so that inhabitants know where to go in case of an emergency. Do not take water safety for granted.	Innovations should start off as an experiment, which should be analysed and then can be scaled up.	Create places where water safety is clearly expressed to enhance awareness about risks
Ellen Kelder, Gemeente Dordrecht	2.6	Project leader, transition agenda Green-Blue	Integrate transition agendas in the Staart redevelopment. Actively connect with research/culture/subsidy /political programmes to promote the inclusion of multilayersafety (Water resilience) in the challenges of today (urbanisation, inclusivity, energy transition).	Put the Staart on the agenda; find opportunities; get conversation started (for residents and companies).	Actions are going to be taken today, make sure you connect more meaning to these actions. 3 areas: Biesbosch, Staart South, Staart North. Biesbosch and Wantij can be connected to delta nature development (RWS); Staart South to improvement of liveability of a vulnerable neighbourhood (partnership participation, improve using Wantij and neighbourhood (groenecirkels); Staart North more long-term transition in productivity and industries, study opportunities for synergies (cirkellab). "how to use water safety, delta nature, housing crisis, energy transition etc. as lever?	Cities and regions do not think about risks enough in their development strategies. National adaptation strategies taking too much time, local action required to ensure safety [lack of trust between scales]. Sectors do not integrate their projects with other goals (eg. Room for the River redevelopment only focused on nature, not recreation in Dordt) We rely on organic development which means "seizing opportunities that contribute to your goal".	Vlijweide, Dordrecht: proposals where developers were responsible for public space, soil cleaning, housing programme, nature restoration (set clear goals from the onset)	Start off where you can, gain trust while adding value/quality of life. Find businesscases for the big challenges, see how you can come to an integrated approach. Think about the system: what can be positive spin-offs of your first steps? (eg. Better green route means a) improved quality of life in staart zuid, b) more interest in investment, c) more accessibility of nature, d) less car dependency companies, future possibilities for redeveloping their parking lots into housing programme). Research agenda: searching for ways to solve the PFAS puzzle and businesscases for the redevelopment	Visualising the future enthuses key stakeholders (politicians, investors, existing companies).	Do not make rigid plans but develop organically. You need to know where you want to go, and then steer into the right direction (act on every possibility you see).	In a society depending on local actors, you need to empower locals to benefit from transitions through participation.	You need to manage projects into the right direction to make sure a pilot/experiment will set a larger change into motion. Connect to research projects, funding, etc. to gain more momentum.	In the current planning system, we rely more on the initiative and enterpreneurial attitude of individuals than the robustness of the system (if a certain actor is very strong, more happens: it's not fully rational).

Actor	Actor #	Role	Goal, Assignment	Project, Water Adaptation, Urbanisation	Ideas for Implementation, Who, Where	Changes in Planning System	Reference projects, Experience	Lessons IABR	Position IABR	Adaptive capacity	Culture shift	Transformative capacity	Notes Jasmijn
Zita Balajti, EGM	2.3	Architect	A pioneering mixed-use building that could function as a refuge while also being affordable for starters (solving local problem)	On top of the contaminated soil semi-industrial startups can rent a place for an affordable price. The floor on top functions as a separation between the industry and the residential programme and in case of an emergency it can house refugees. On top of that you'll find housing programme and food production on the roof. Due to the many different programmes it is 24/7 in use. It is a superblock with 700 housing units, and 5000 people during a flood.	Start off with placemaking events, katalysing buildings and public space which allows people to already discover the site. Participation of municipality and developers to share values. EGM presented their project to investors to enthuse them about the concept. They asked: "can we build it somewhere else too?"	See the building as a masterplan. A robust structure, flexible infills that can be customised for site specific challenges	Rijnhaven, M4H	Layering means finding synergies (participation). The role of the architect/urbanist is to enthuse and convince others about sustainable aspects. The municipality should prepare the site. Developers don't set too high demands for themselves. It is too expensive to build fully sustainably. If they start accounting according to the 6 capitols approach, maybe it will become more feasible. Only setting rules does not work, you need all actors to share the values to build truly sustainable cities.	The IABR meant a shift in competing with Rotterdam to discovering Dordt's own identity and role in the polycentric metropolitan network.	Too temporary and flexible can be unsustainable (burning man festival). See the building as a masterplan, flexible infills that can be customised to site specific challenges.	More community oriented living, different roles of people in planning system.	A first project can start a larger shift	(1) Long-term does not really mean adaptability, or at least, that is not the message she explained. (2) The developers asked whether it could be built somewhere else as well, which it could. The question is whether uniqueness is truly necessary or whether masterplan buildings are so similar in customisability that they all become similar.
Marco van der Pluym, WEST8	2.4	Urbanist	Lead the IABR Dordrecht, integrate the Groeiagenda and Climate adaptation (7.000 houses and refuge for 60.000 people). How can we bring these two together and create: 1. Awareness about water risks 2. A boost for the productive Staart which is currently in decay: afvoerputje (productive landscape: waste processing, prisons, etc.) 3. Improve the residential side, which lacks amenities, schools and public transport	A Ruimtelijk Raamwerk that: is coarse; balances between free dreams and hard boundary rules; uses landscape as a guiding principle (to strengthen the river edges and connect them, valuable for biodiversity); established subcultures and identities within sub-areas; uses images to convince; uses SDGs for broad businesscases.	Make use of the momentum of crises (corona, summer floods). Start with the easier places (Wantij and west industry). Start in the west (where it's easiest), then move east. The need to make prototypes to show it is feasible. Also start in the problem areas (south), address local problems. The seed has been planted, but how to continue? SDG's give more ammunition to load interventions. Adding more layers of meaning can make a connection more convincing.	Do not think in stamps but in the system as a whole, what will be the impact of my intervention? Mixing can be difficult (investors only focus on one type of programme)	Nieuw-Crooswijk: interventions were integrated in masterplan, but not all actors understood their purpose. STRIJP-S: successful in placemaking and upscaling industrial area. Wijnhaven Island: (Kees Kristiaans) only had a development strategy as product. No masterplan but development strategy with images for the future. Hafencity in Hamburg (KCAP) also produced a water resilient city, but with a different societal relationship with water.	"Normal" people need imagination. (an abstract study with volumes and maps does not speak to everyone, make drawings and models to show the outcomes)	Produce goodwill in local politics. Explore problems in freedom from reality to come to innovative ideas.	Multilayered safety as layers for all interventions in de Staart: how water safety can be used as leverage for de Staart.	New cultural relationships with water, embedding the short-term in the long-term.	Experiments and first actions are needed to be able to scale up	Systems thinking and research by design to (1) test the implications and possible positive side effects of your interventions and (2) understand critical actions.
Donna van Milligen Bielke, DVMB	2.5	Architect	To build the multifunctional city and build in a high density that can also function as a safe haven during a flood event.	An innovative redevelopment strategy for an industrial site, establishing an unique identity for de Staart by starting with public space (that should function as an appratus for evacuation)	The municipality needs to want something for an area: eg. be very convinced about public space quality. The rescue ground sets the urgency for the business case of the project.	Strong municipality, think outside your project boundaries	Kunstwerf, Groningen: designers should be critical and creative	SDGs force you to keep thinking about all topics, keep naming them, keep checking them. Donna sees them as reminders for societal interest.	Discover: what is important? You do not make such plans for a developer/paid opdrachtgever. Through a more creative exploration you end up at something realistic.	Multilayered parts of the city.	As an architect, start seeing the public space and all its functionalities as a starting point (a multi-purpose apparatus)	-	The importance of the freedom of creativity to produce innovative outcomes. The need for direction.

APPENDIX 6 | METHODOLOGY

Analytical framework illustrating how the different cases and stages of the research together result in the outcomes, which is one the one hand a design and planning strategy and on the other hand a theoretical reflection. (Own illustration, based on Yin, 2003)



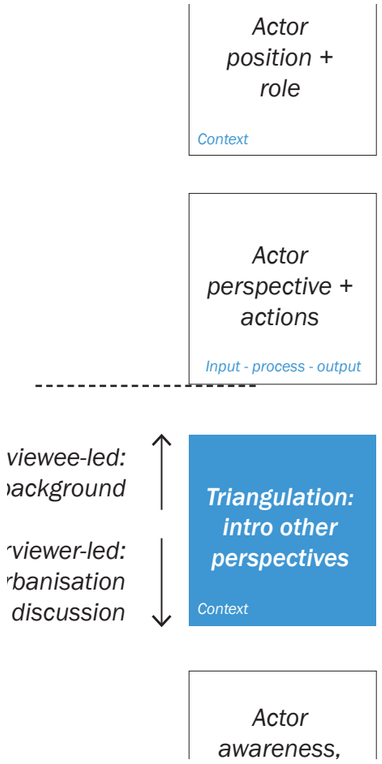
INTERVIEWS

Interviews will be used throughout the project for different purposes. First to define, then to analyse and finally to reflect. The methodological approach for the interviews will differ, moving from open to more structured discussions. Each of the approaches will now be introduced more in depth.

At the beginning of the project, interviews will be used to identify the main problematics and challenges regarding climate change and urban redevelopment. Here, the researcher uses unstructured discussions and interviews with experts and academia to gain more insights in the specific problematics in the Dutch planning system to define the research direction of the project.

Next, semi-structured interviews are conducted with actors that are involved in the redevelopment process of Case 1. Actors from different sectors and scales of the institutional landscape should be interviewed. As shows, the first part of the interview should be more interviewee-led, to understand their perspective and role in the redevelopment process. Next, triangulation with other viewpoints (of other actors) or conflicting issues will be introduced, and then the actors are challenged to debate and discuss their awareness and activation for integrating water adaptation in the project. Finally, based on their experiences, they are asked where they think the planning system could improve to make adaptation more integrated and establish a water resilient region within the decentralised governance model. The table in Figure 34 gives a more in depth overview of the different questions for this research stage.

Together, these semi-structured interviews will help to build a thorough understanding of the case and the redevelopment process and in what way different actors collaborate and are able to find integration opportunities, in other words, to find the mechanisms behind the final water adaptive performance of the area. The questions on the one hand test theories about operationalising long-term goals in short-term projects, planning instruments, and the different perspectives on adaptation. On the other hand, they have



an open way of questioning to find out new information, unknown to the researcher. For this purpose, the interviews should be able to branch out into a discussion, but it is important that goals, process and future lookout are discussed to be able to draw comparisons between different stakeholders.

Finally, by contrasting and comparing the findings of Case 1 to an in-depth interviews and discussions with urban planners (a representative) involved in the comparison Cases 3-8, case specific and generic lessons can be concluded, which establish the input for the design. The outcomes of the design stage will be reflected on with interviewees in either a workshop or a questionnaire (depending on Covid situation).

Data analysis

Transcripts of the interviews will be coded in Atlas.ti to identify trends between stakeholders from different sectors (adacemia, private sector, public sector, civil society and environment) and scales (macro, meso, micro).

As mentioned, the sampling strategy for the interviews is for the focus research case based on a snowballing strategy, where the interviewees are asked about connections they have in the netword and whether they know people who would like to participate in the research. Furthermore, actors will be identified through the policy documents and plans analysed. For the comparison Cases 3-8, a representative actor will be interviewed (due to time limitations). For the final design Case 2, the urbanists involved in the IABR will be contacted for an interview and the stakeholders of Case 1 will likely be interested to participate in an interview/ workshop about the case as these two cases are situated in the same municipality (which will be explained in the section about case selections).

ANALYTICAL FRAMEWORK

The analytical framework explains how the different elements of the research will be brought together to move from a theoretical understanding of the problem, towards analytical conclusions and design interventions. The different dimensions of the conceptual and theoretical framework are combined using two frameworks in order to be able to synthesize ideas and draw conclusions from the complexity to answer the research questions.

The analytical and design stage of the thesis make use of the Dynamic Adaptive Policy Pathways map to on the one hand historically reflect on policies, strategies and actions, and on the other hand look forward to the future at the possibilities for a future context. They are used to show the theoretically underlined important adaptive thinking and design attitude. Additionally, an adjusted version of the layers approach is used to connect and integrate the different variables and aspects of the system in spatial and social layers that recognise differences in "the dynamics, the time rhythm and the changeability" of the different scales (Roggema et al., 2012). This also integrates the different safety layers regarding water pressures (Rijkswaterstaat, 2020). As a result, lessons can be drawn and tested in the case study projects, which can be seen as complex, contextualised living labs. By combining lessons from practise and theory, the design can illustrate possible improvements, answering the main research question.

To answer the main question, the study combines an inductive and a deductive approach, the study aims to find some key principles, while recognising the importance of heterogeneity and the value of difference of the compared cases (Galderisi & Colucci, 2018). Figure 146 illustrates that the theory built from literature research, policy analysis (deductive) is used to reflect on the inductively produced conclusions about the process and the performance of in- and out-puts of the focus Case 1 (SRQ 1-3), which are compared to the more compactly studied Cases 3-8. On the one hand, by comparing, generic lessons applicable to other situations can be separated from case specific mechanisms. The more externally generisable outcomes of the study can contribute to the line of research that strives towards a globally "integrative approach to plan and develop the interface between cities and large seaports sustainably." (Van Bueren et al., 2016) On the other hand, comparing and testing interventions derived from Cases 3-8 to developing design, governance and planning interventions in the current planning system in the Rhine-Meuse delta to contribute to the adaptation transition (SRQ 3+4). Finally in SRQ 5, design for Case 2 can contribute to integration of water adaptation and urbanisation by visualising and reflecting on the possible outcomes of policy pathways thinking in climate change scenarios. By communicating and testing with actors, the findings can be tested for relevance and the theory can be iterated.

To make the cases comparable and to make the complex adaptive system analysable, different focus variables (Figure 26) are studied and compared to identify recurring patterns and relationships and understand the mechanisms behind climate adaptive performance. The layer approach links these dimensions in different temporal and spatial scales, mediating between "different types of knowledge (expert and local knowledge), and to achieve improved integration of different types of measures, tools and norm systems (in particular between formal and informal approaches" (Birkmann et al., 2010). By comparing the cases on these variables, interesting observations about recurring patterns and relationships can be made that can help in.

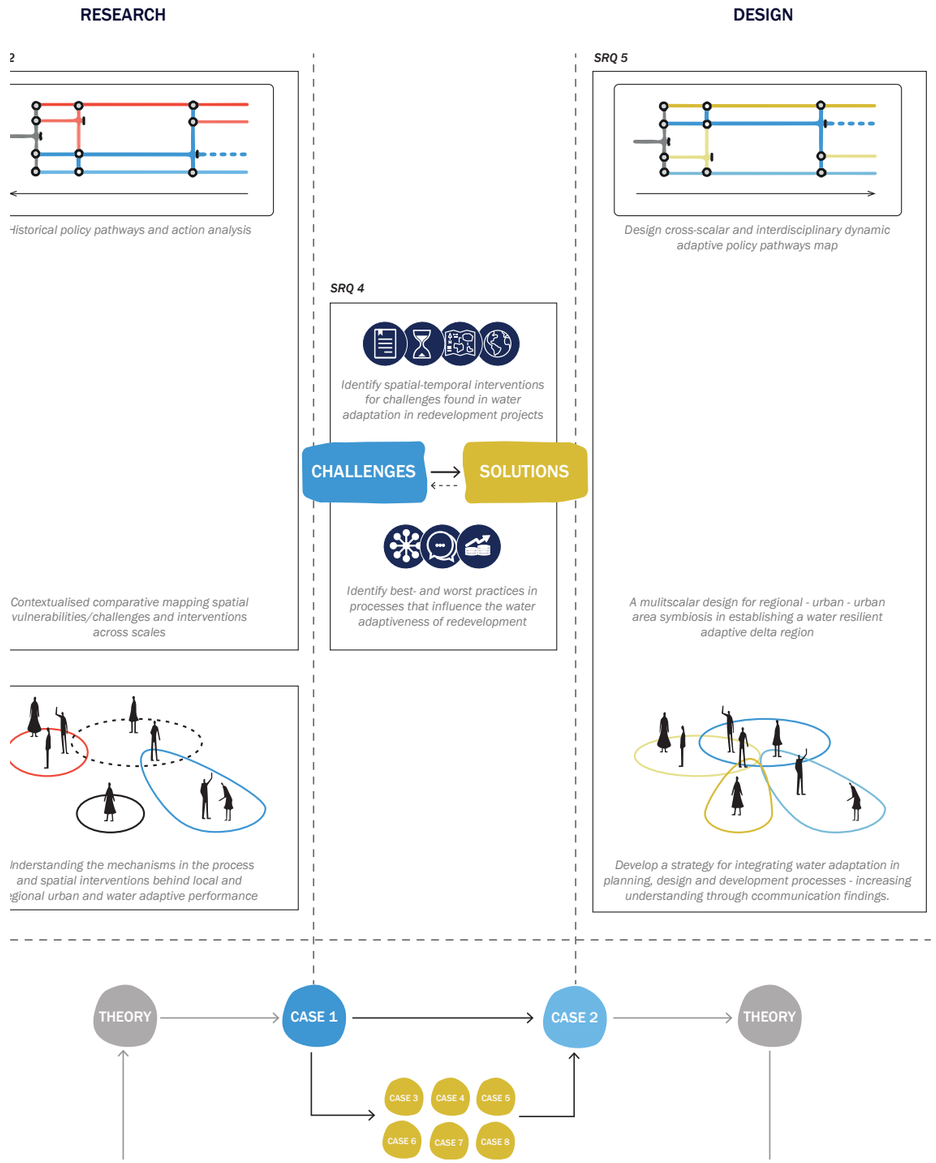


Figure 146: Analytical Framework showing how different research components and frameworks together structure and answer the main research question (Own illustration, parts adapted from Roggema et al., 2012 and Haasnoot et al., 2013)

APPENDIX 7 | FULL CASE REPORT STADSWERVEN

UNDERSTANDING CONTEXT

To understand the boundaries and input created by the context of the local redevelopment project (Figure 44), this paragraph will outline a perspective on the historical development of the Dutch delta state, in which the Randstad as we know it today has grown. Next, pathways for the future of the delta region will be outlined in a Dynamic Adaptive Policy Pathways map to introduce the possibilities for future adaptation to the risks posed by the climate crisis.

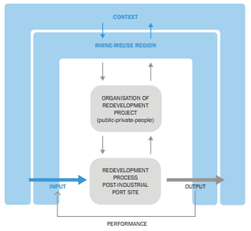


Figure 147: Sub-research question 1 focuses on the context and the inputs it provides to the local project.

HISTORY DUTCH DELTA STATE

The water system, the Dutch state and the urban development have evolved together, as enablers and dependent factors. As cities grew due to the favourable conditions along the water, the water was increasingly tamed and formalised, changing the ecosystem as edges were hardened, flows were formalised, beds were deepened. Han Meyer (2016a) roughly divides the historical development of the delta state into six phases, which are set out in the timeline in Figure 148.

Phase I starts roughly around 1200, when the sea started to take more influence of the area around Almere and the south-west delta, which is currently the Rhine-Meuse delta. In this period, the Rhine still had a dominant transportation function and the Hanzesteden along it were the most important trade cities of the Netherlands. In this period, many attempts were made to reclaim land in Zeeland to use it for agricultural purposes.

There was a turnaround in the urbanisation and economic concentration when the IJ and New Meuse were embanked and a more formal water management system was introduced, which allowed people to make the peat landscapes more dry and habitable.

In this Phase II cities such as Rotterdam and Amsterdam began to grow behind the dikes. Cities in the delta had important trade functions, such as Middelburg and Goes in Zeeland and Dordrecht in Zuid-Holland. Later in this phase the provinces of the Netherlands were united in a single nation (in 1797), followed by the establishment of the national water governmental body, underlining the county's dependence of water management, both for safety and prosperity.

Phase III starts roughly around 1900, when the technical advancements of the industrial revolution inspired and enabled more control of the delta. Already in 1891 the first sketches were made for the delta works concept, which would only be executed in 1960. During this period the river pathways were formalised, the New Waterway was constructed and the railway network was constructed. This resulted in more dominance to the cities in Holland compared to the cities in Zeeland. Furthermore, the railway network meant cities internally shifted their urban orientation to the railway station from the waterfront.

The end of World War II marks the beginning of the next Phase IV, where industrial development and the big ports gained more influence in the national planning. To reconstruct the country, the Dutch government took a more active role and established national planning offices. After the Great Floods in 1953, the realisation of a highly safe delta became a priority and the Deltaworks and Zuiderzeeworks were constructed. Meanwhile, the national planning offices ensured egalitarian urban development and prosperity across the whole country, rather than focusing it on Holland.

Phase V started roughly around 1990 and is characterised by a different approach to dealing with the water and urbanisation. On the one hand, the floods along the rivers in 1993 and 1995 gave rise to a more adaptive and nature inclusive delta management strategy. The Room for the River project was intended to increase the capacity of the river landscape in peak situations, while also recovering the estuarian nature. On the other hand, metropolisation in the west of the country meant growth of the big cities. Furthermore, ever increasing ship sizes

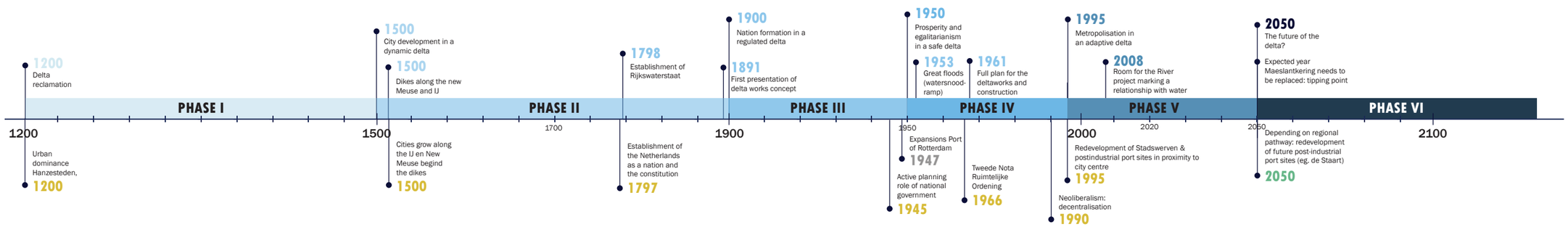


Figure 148: Timeline of the development of the Delta State, based on the book by Han Meyer (2016). Transitions in the water management strategy are influenced by the context and take a long time to develop. (Own illustration)

meant the port of Rotterdam expanded even further out towards the sea. In this context, Stadswerven and other post-industrial port sites were (planned to be) redeveloped.

Finally, when thinking about the future of the delta, a so-called 'tipping point' of the water management system will be reached around 2050, when the Maeslantkering needs to be replaced. There is a growing sense of urgency about the climate crisis and the effects of sea level rise scenarios on the delta metropoles, and in preparation of Phase VI, many explorations about future strategies are conducted. Faced with many uncertainties, a decentralised government and an increasingly international economy, the question is whether adaptation to the future societal and hydrological context with be preparatory or reactive. Seeing the vulnerabilities of the Dutch delta region, a mitigating and adaptive approach is needed, but the coming years will show which pathway the Delta will take.

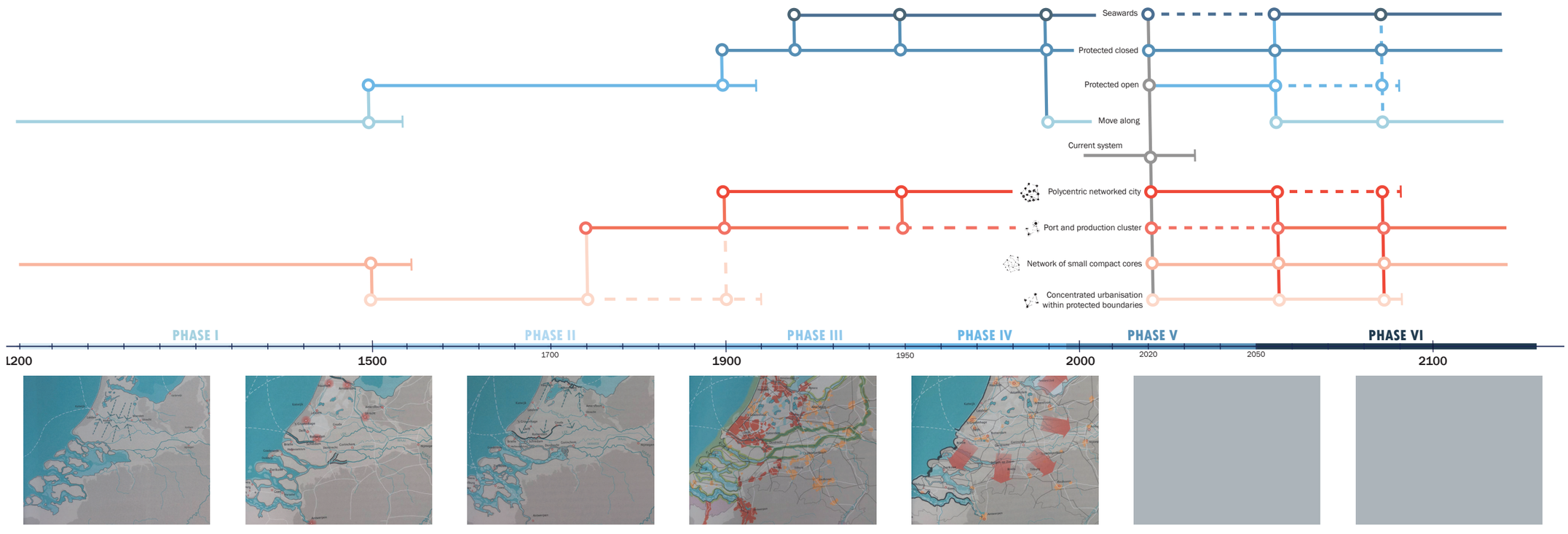
ADAPTIVE PATHWAYS

Figure 149 maps the different urbanisation and water management strategies according to four main overarching strategies based on the Deltares scenarios and Studiomarcovermeulens concepts for urbanisation. The maps below the timeline present different maps for each of the previously described strategies, and they show how urbanisation and water management are intertwined in the Netherlands.

When considering the Panarchy model of adaptive cycles, each time a different pathway is taken can symbolise a transition into a new system on the large scale. On the other hand, the entire history of delta management until now might also be seen as a single adaptation cycle, seeing all delta management strategies as a gradual move towards increased control of the dynamic delta. In that sense it is only now that we are perhaps at a turning point towards a completely different adaptation cycle, seeing the reintroduction of nature in Room for the River projects, Building with Nature concepts and adaptive redevelopment as the experimentation phase, preparing us for a larger systemic transition.

When regarding the possibilities for the future of the delta, in the Panarchy model of adaptive cycles, a large scale regional or national transition will influence projects on the local scale, while also depending on them. Furthermore, the feasibility of the pathways (seawards, protected closed/open or move along) depend on the actors in the system and their willingness and capacity to act and operationalise large paradigm changes. Watermanagement and urbanisation have become hybrid issues, with a regional and municipal component, and an international component. In the big transitions, there is a high value of experiments, as they will show us the possibilities and challenges of different strategies (Meyer, 2016b).

Figure 149: Dynamic Adaptive Policy Pathways map indicating the pathways taken in urbanisation and water management throughout history. The future adaptation scenarios are mapped to the right, where a decision is yet to be made about the future national strategy to adapt to the effects of climate change.. (Own illustration)



ACTORS

Throughout the phases of the delta state, the relationship between the state and water boards have changed a lot as is represented in the diagrams below the timeline. Considering the history of institutional structure related to the different adaptation strategies supports a better understanding of the current system, and might also provide input for which governance strategy is needed in the future.

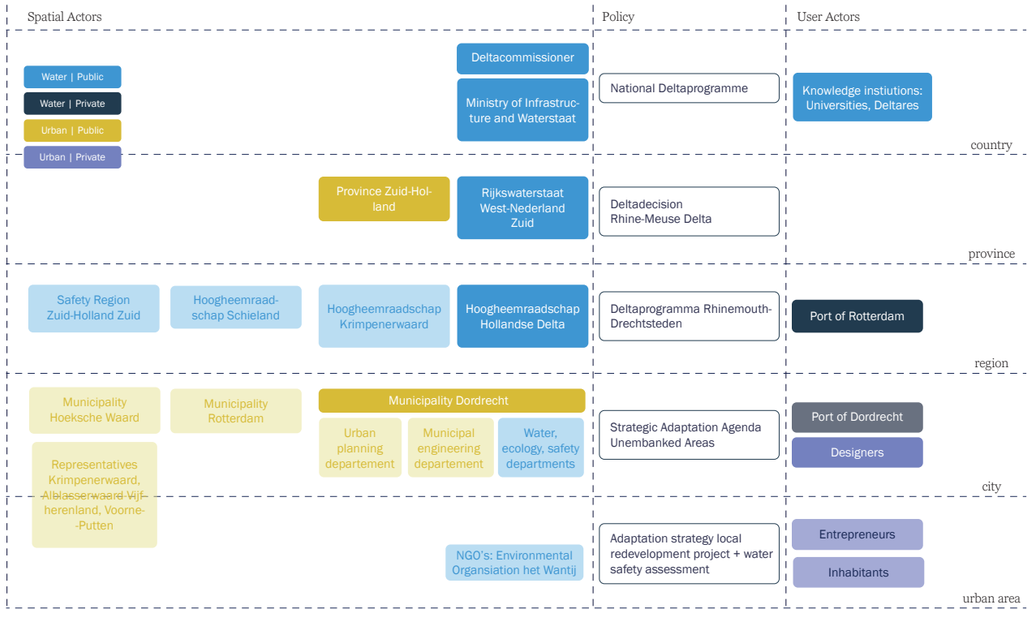
The relationship between the different cities was formalised in Phase II in 1798, when the Dutch state and Rijkswaterstaat were established. At the time, their role division was very clear. In Phase III the two States gained more influence and national planning was needed as the industrial revolution asked integration of plans and structured development. The different institutions started to gain more influence in Phase IV, but operated more separately from each other. In the reconstruction after the war, attempts were made to integrate urbanisation assignments with the delta management strategy, but in the end they were developed rather separately. Currently, governments are decentralising and depending more on the region and municipality for operalisation (in the neoliberal context). At the same time, water boards are pulling more assignments towards themselves, but it questioned whether they should be in the lead when trying to integrate nature, water and city. Actors from the municipality that were interviewed argued that a national strong government is needed that makes a decision about a large scale adaptation pathway. On the other hand, the national scale is not there yet and is using experiments and bottom-up case studies as ways of exploring the adaptive capacity and feasibility and spatial effects of different strategies before deciding. Hybrid pathways at the moment are of course also possible, but in the end the zero-regret decisions of local actors might not contribute to the final regional transition, resulting in maladaptation and unnecessary investments.

The map of actors outlines different important actors that influence the water adaptation strategies at national and regional scale. In the participation society, municipalities and private actors are invited to influence the decision making. Furthermore, designers, artists and knowledge institutions contribute to the decision-making by visualising the possibilities, supporting the paradigm change, calculating and exploring the different scenarios.

In the past, the Port of Rotterdam had a determining factor in the way in which the water system was managed, and the city has become separated from the water and ecology. Perhaps this needs to be turned around now, seeing water damage may be more expensive than the (3-4%) GNP generated by the ports. We can no longer keep adapting our water system to the depths of ships, we need to make international agreements on max depths, as deepening the rivers is reducing the ecological and water safety of the rivers. However, while these urgencies are important, the port is a crucial actor as we do depend on it for economic prosperity.

In the deltaplans and urbanisation strategies made today, the region is gaining increasingly more influence, despite it not being an official constitutional actor. The focus on the region can be explained by systems thinking, understanding that the formal borders set out by Provinces do not necessarily cover the biophysical systemic unit or the usage patterns.

The different plans drawn up for urbanisation and water management at different scale levels need to correspond to each other in order for a large systemic change to happen. The operability of future pathways is currently tested by studying adaptation strategies at the local scale. Here it is important that this process is inclusive and open so that many actors and opinions are taken into consideration before deciding the regional strategy. On the other hand, others argue the challenge of integrating nature, city and water is so complex that a more technocratic decision needs to be made at the national scale, which however requires a stronger government than we have at the moment.



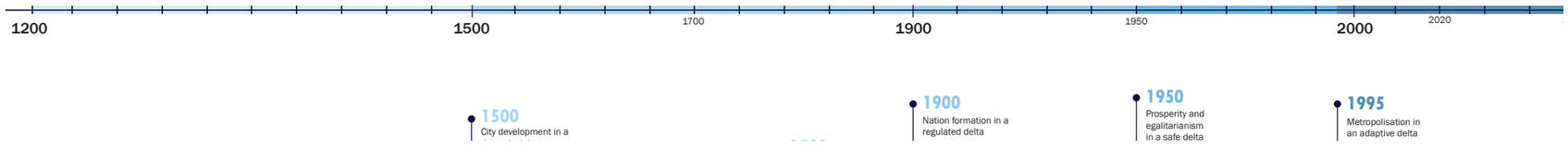


Figure 150: Institutional map of important actors for the large scale, categorised in urban and water and public and private, set out at their main scale level and linked to their main policy documents. (Own ill.)

Figure 151: Timeline with the delta state phases linked to diagrams for the relationship between the urban and water actors. (Own illustration)

INTERACTION PROCESS AND CONTEXT

Next, the conceptual framework helps us to understand that the context constitutes the input for the development and processes at the local scale (FIGURE). Similarly, the outputs of the local projects influence the urban and regional system (Panarchy of Adaptive cycles). This paragraph will therefore first explain how the case study of the Drechtsteden (and Stadswerven within it) developed within the different phases of the region. Thereafter the chapter will zoom into the specific redevelopment of Stadswerven, identifying the development process and actions; studying how trends in the context influenced decision-making within the adaptation pathways; analysing how the actor relationships and governance structure influenced the outcomes; and concluding with an understanding of mechanisms behind the integration of water adaptation in the redevelopment. This part of the research is based on policy analysis, document analysis, interviews with actors and comparative mapping.

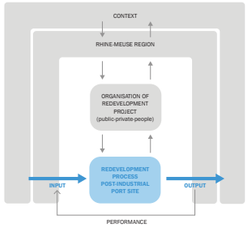


Figure 152: This part of the research focuses on the local redevelopment process, its input and output to the context.(Own illustration)

HISTORY DRECHTSTEDEN

The timeline in FIGURE shows how the focus Case 1, Stadswerven in the Drechtsteden, evolved over time. This paragraph will briefly explain how the island of Dordrecht came into being, and how the different large scale systemic changes influenced its position in the Delta and urban region.

In Phase I the island of Dordrecht was a small island still under the influence of the sea. The city on the island functioned as a port and was (and still is) influenced by the tides. The Saint Elizabethflood changed the water system greatly, as the river currents changed, which resulted in an increase in sedimentation behind the island and of the rivers surrounding it. As a result of this, Phase II started, which at the scale of the region that Rotterdam gained dominance as a sea port compared to Dordrecht, that became less accessible due to shallowing rivers. At the same time, the new land resulting from the sedimentation could be poldered, and could be used as farming ground. The dikes built during the 16th century still provide the main structure for the city today (Gemeente Dordrecht, 2015). In the 19th century the city expanded with a new layer around the city center, of which the Stadswerven are seen as an 'unfinished' part as they were functioning as an industrial port at the time.

In Phase III, around the industrial revolution, the city started growing as a port again: shipwharfs and ports developed together with industries on the stable grounds of the sandy soil parts of the city (north east and south west of the city centre). Furthermore, the introduction of the railway and the technical advancements in deepening the river beds meant increased connectivity for the city. As a result, the city centre turned its back towards the orginal port side at the Drierivierenpunt (where 3 rivers come together) and started to orient itself more towards the railway station. When the Woningwet (Housing Law) was introduced in 1902, an expansion plan and guidelines for housing became obligatory, and the city structured its urban growth according to the plans of J.E. van der Pek of 1917. These plans were adapted over time to for example fit in with the garden city movement in 1930.

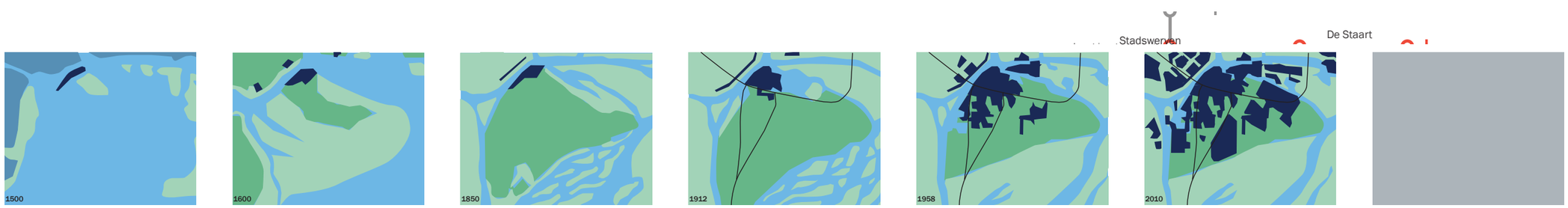
In Phase IV the port developed further, proving job opportunity for the city. The city itself grew further into the poldered island in the South West direction. These urban and port expansions happened according to the separation of functions concept, keeping work, housing and relaxation as separate functional areas in the city. As a consequence, the port areas and residential areas are monofunctional in their urban fabric.

When looking towards the future in Phase V, a different planning paradigm about mixing functions was introduced. Densification in stead of expansion, mixing of functions instead of separating them, and a rediscovery of the waterfront in search of identity in stead of the internal focus were trends that can be recognised when exploring the different planning documents for the city and Drechtsteden. As a result of this different planning attitude, the urban waterfronts of Dordrecht, Zwijndrecht, Papendrecht and Sliedrecht became the focus for redevelopment, and plans for urbanising the waterfront and redeveloping post-industrial sites were first launched.

Regarding the transition towards Phase VI, the municipality still faces uncertainty around which pathway to take. Due to the city's position in the delta and the large amount of polders, it is relatively vulnerable to the effects of climate change. The city is an island in the delta, and in case of a flood event not all people can be evacuated in time using the bridges. Therefore the aim of the city is to become self-sustaining in the coming years. Before adapting the city, the municipality is conducting different experiments and studies to see how it should urbanise and adapt its water system. Stadswerven is such an example that is part of Phase V, where different principles around urban flood management were discovered and building with nature concepts were tested. The architecture biennale of Rotterdam is currently studying the possibilities of extending the role of de Staart (which Stadswerven is part of). They have concluded that the Staart, which is a relatively high sand bank in the delta, could be used as a refuge island for the city. These studies and findings are communicated regularly with the region and province, seeing how together region and city can come to a delta strategy.

To conclude, the city's position within the larger regional system shows a strong connection for both the water system, port functionality and urbanisation. As the water system at the regional scale was formalised, this enabled for an increase in the development of the city.

Figure 153: Timeline with delta phases for the region, the maps below show the development of the water system and urbanisation patterns. Stadswerven is part of Phase V and the Staart might be redeveloped in Phase VI. (Own illustration, based on topotijdreis)



HISTORY STADSWERVEN

development analysis will show. Before becoming a post-industrial port redevelopment site, this focus case study used to have an industrial function as a shipwharf. When these companies went bankrupt in the 1990s, the municipality of Dordrecht was able to publish their plans for redevelopment, which fit in the larger strategy of reconnecting the urban waterfronts of the cities around the Drierivierenpunt. The timeline below shows the different development phases for the site, which has seen some hiccups resulting from external influences and internal challenges. Linked to it are maps that show the water system and ecological value (water adaptation factors) and how they evolved over time.

During Phase 0, many exploratory studies were conducted, studying the possibilities for urbanisation and urban flood management. At the time, the site was considered water vulnerable due to its unembanked position, but the studies proved it was relatively high situated and could in fact function as a flood refuge in case of a disaster event.

In 1999 Phase 1 started when the first vision document was published. The municipality was in search of collaborators from the private sector to make plans for the redevelopment. In this phase Development Collaboration de Werven (OCW) was established with multiple developing parties. The municipality and OCW both developed plans with separate urbanism offices, resulting in a misaligmment of interests and a difficulty to integrate them. As a result, the project stagnated for some time, which took until 2008. At the beginning of 2008 new actors joined the project team and joint plans were made. However, the financial crisis then further slowed down the process.

The municipality saw the area as a key redevelopment project for the city and pushed the development by taking the initiative for redevelopment of some key projects. While OCW had development right for the different plots, they decided to wait with development as the housing market was too risky. In 2013 the plans were revised (less density) and a water adaption experiment project for Building with Nature was launched, though it had more a placemaking nature than being truly connected to nature inclusive development.

In Phase 3 the development started to speed up, the housing market was better. Public space designs were criticised by nature organisations however, as biodiversity and climate adaptation were becoming more important societal values. As a result, the municipality focuses on a stronger greenblue network and more nature inclusivity, but this is difficult to still implement in Stadswerven, seeing the plans were already formalised in 2010. Currently (2021) many plots are under development and can be realised in a higher density as there are big housing shortages. The bridge will be finished soon, connecting the Stadswerven to the city center. In the coming years the public space for the area will be constructed, which focuses on making water experienceable by the people.

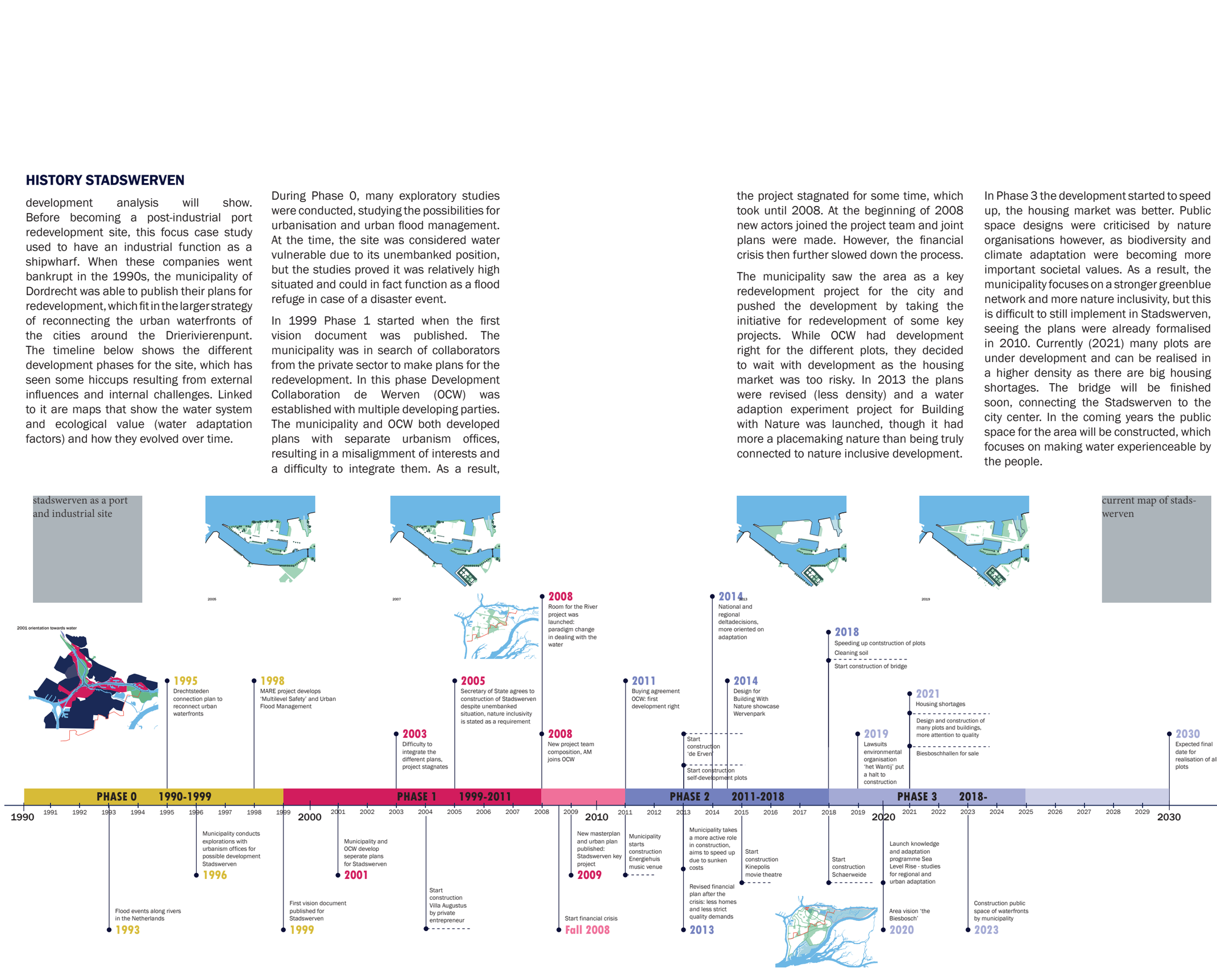


Figure 154: Timeline Stadswerven and maps illustrating green and water structure of the area (Own illustration)

WATER ADAPTATION INTEGRATION AND PRIORITISATION IN PLANS

Over the different development phases of Stadswerven, the context changed and priorities changed as well. This influences the performance of the spatial outcomes of the redevelopment process, as different societal or technical values are the determiners for assessing performance.

The analysis of the different plans (four main plans were analysed) has shown that over time there have been varying degrees of focus on water management (flood safety and the types of interventions for adaptation), urbanisation (housing volumes), and biodiversity (ecological zones and connections to the larger network).

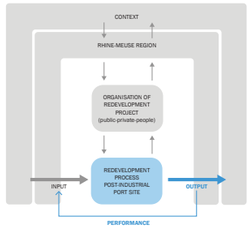


Figure 155: Studying performance in relation to temporal contextual + internal changes.

The plans started out as what we would now call 'more tranditional, formal urbanism', with hard quays, high density (1000+ homes) and little attention to nature inclusivity. This evolved around 2003, when the secretary of state only allowed the redevelopment of the unembanked site if the redevelopment was nature inclusive. The plans became more green, with a Building with Nature showcase. Furthermore, a conflict around inequality between the different cities in the Drechtsteden also made the theatre for the region disappear from the plans.

Next, the financial crisis and joint vision making with the new OCW meant a revision of the urban plans. Lower density (+-600 homes) and weaker emphasis on quality made the project more feasible in the market at that time. However, a growing attention for the climate crisis and biodiversity combined with a national housing shortage does mean more quality and density can be realised in the last development parts of the area. Nevertheless, as plans were already made in the past, truly innovative and integrated adaptation solutions were not realised in the site, while it had the potential to function as an experiment for innovate water adaptation strategies. Instead a single dike and small tidal park were built to make the area water resilient. Some parts of the public space will also be floodable, but overall the main concept could be higher performative in adaptive capacity.

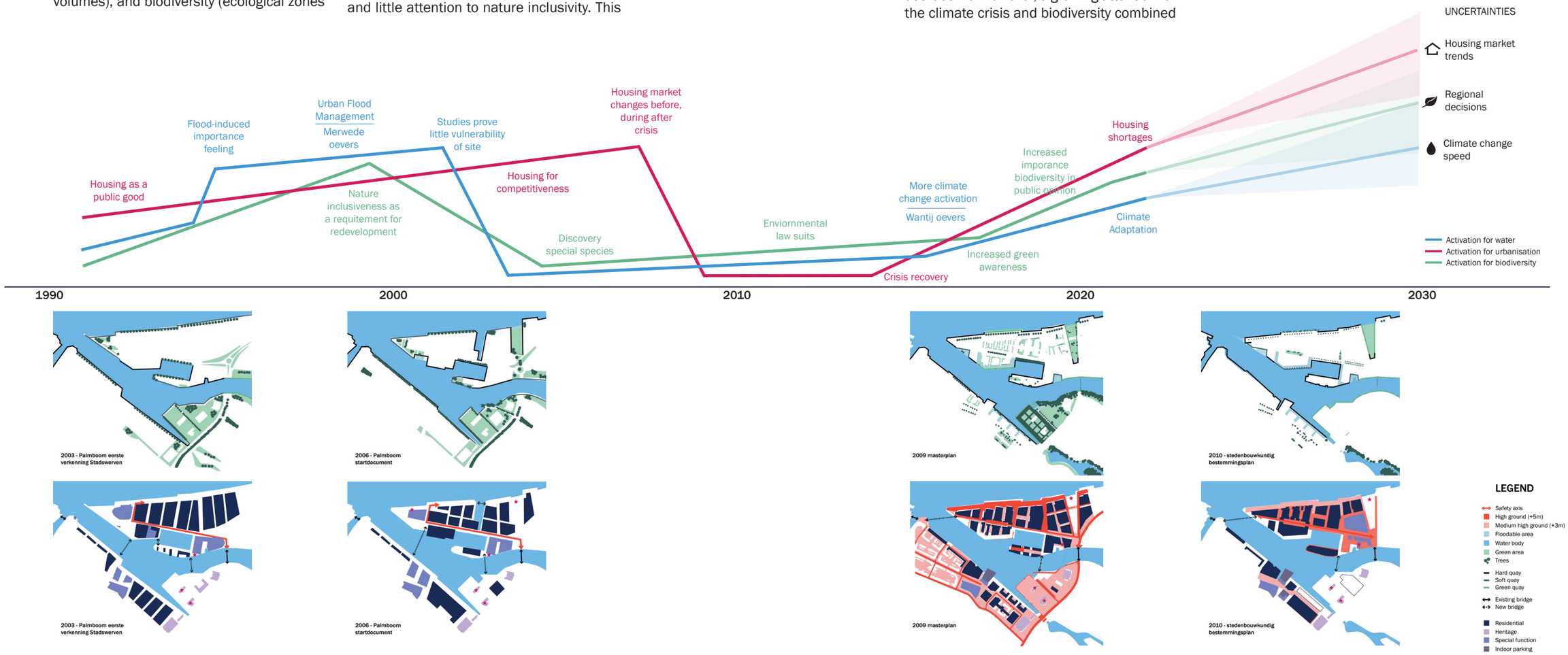


Figure 156: Timeline with different focus elements in the context and redevelopment plans. Maps for the key urban plans show urbanisation, adaptation and nature inclusive interventions. (Own illustrations)

ACTORS

Similar to the region, an actor network with the most important actors for the project can be drawn up FIGURE. The network was established using interviews and analysing policy documents and plan books, which showed who were involved, when and how. It is expected that different institutional structures influence the outcomes and performance of the project regarding public (external) and internal values for both urbanisation and water adaptation. In the end, the network of actors for this case will be compared to other cases to be able to evaluate what collaboration forms inspire climate adaptive actions and make adaptation integrated in the process and outcomes (Figure 54).

For Stadswerven, the municipality and the developers combination OCW were key stakeholders with a lot of power and a lot of interest. At the same time, the context was set by the region, province and country as the site had to take into account many legislation and respond to regional strategies. Furthermore, local actors such as entrepreneurs and inhabitants were included in the planning process through participation. The project also received much political attention from the college of B&W and in the public debate, as it became a key project for the city and the upgrade of its city centre and competitive position in the region.

The municipality took a leading role in the process, taking initiative for projects and finding the right partners for the different assignments throughout the planning and design process. Here, they invited the developers with building right for a large part of the site, while also developing plots themselves when needed. Over time, the municipality learned to become more flexible in their thinking, understanding that it is not possible to 'roll out' the redevelopment in the complex situation, compared to a more straightforward development project.

OCW is the developers combination for the area, and consists of AM, DuraVermeer and JP van Eesteren, relatively big developers in the country. They obtained developing

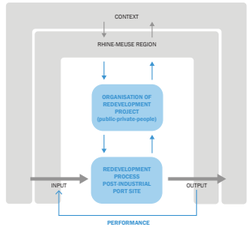


Figure 157: Studying performance in relation to temporal contextual + internal changes.

rights for the plots at the northern side of the area. Other developers were also part of Stadswerven but they were only part of smaller redevelopment projects, sometimes developing for their own specific purpose and sometimes developing to sell.

External actors, such as designers, engineers and artists were also connected to the project, but were not directly part of the internal project team. They were hired for development, explorative studies and designs when needed.

The port of Dordrecht and Rotterdam also had influence on the planning process, as the site is situated in proximity to the port and waterways. As a result, the quays and buildings should not be too vulnerable on the Merwede side of the area, as shipping and port activities are expected to continue for some time.

Finally, waterboards and the province are also included in the process. First, the area needs to correspond to their visions and legislation. Second, the area plays the role of an experiment in the larger transition: port redevelopment and water adaption integrated.

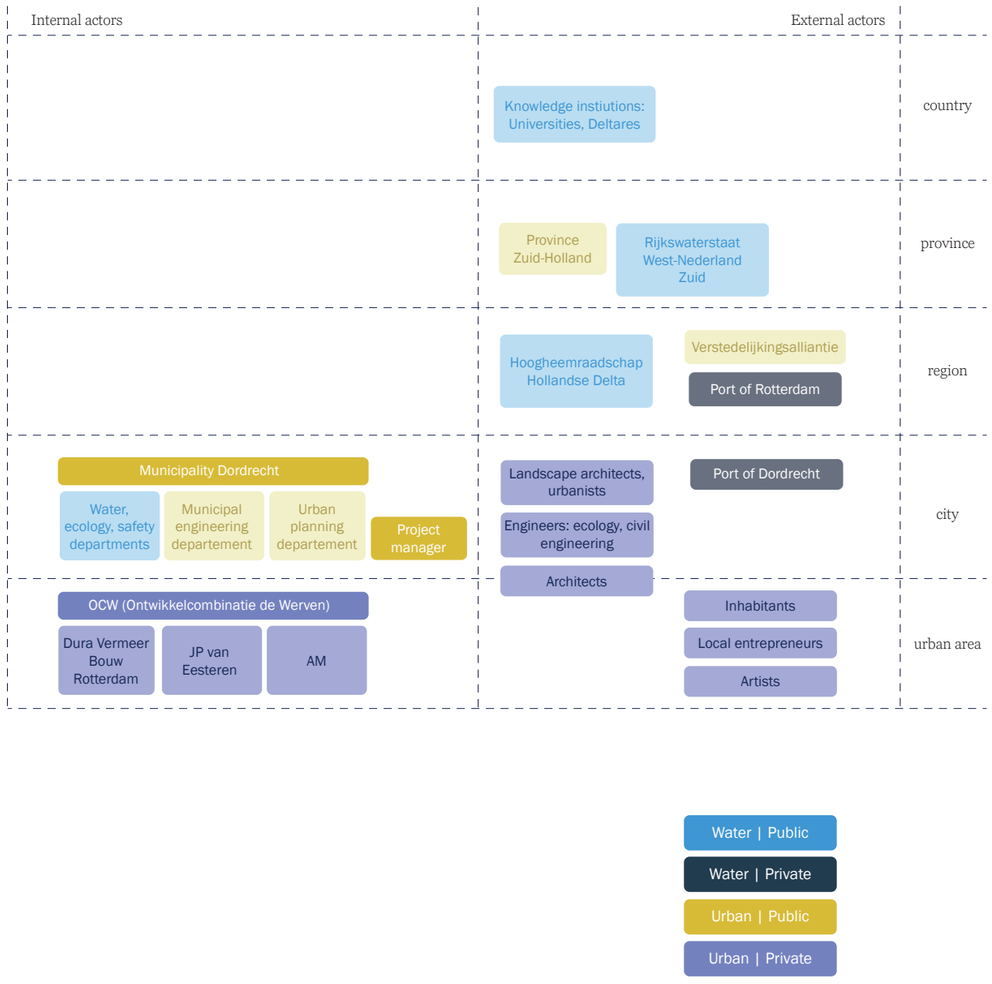


Figure 158: Important actors for Stadswerven mapped, categorised for their predominant scale and on whether they are internal/external to the project. (Own illustration)

COLLABORATION

Based on interviews with actors of Stadswerven from different sectors, the actions, awareness and activation for integrating climate adaptation are now related to the stages of development. The complete summary of the answers of the interviewed actors can be found in Appendix 4 |.

The collaboration between actors started in Phase 0, when the municipality collaborated with the waterboards, province and knowledge institutions and designers to draw up plans in an open way: studying what the role of Stadswerven could be for the larger regional transitions. An international learning network (MARE) was set up, so that cities from all over Europe could learn from adaptation strategies in an international context. The concept of Urban Flood Management and Multilayer safety emerged from this phase. It was after the industrial users left the area that more actors were involved in the redevelopment process.

Architects, urban designers, water engineers, ecologists and artists were invited to play their role for the area at specific points with clear purposes. On the one hand, this was appreciated by them as there was a clear assignment. On the other hand, a landscape architect [3] argued that it might be better if they were included earlier on in the process: making the plans more integrated and ensuring the values they represent are embedded in the design. This does result in more complexity, but might bring more performative outcomes in the long run.

OCW was included when a first sketch was made for the area. In the beginning they operated at a distance from the municipality, which created some challenges to integrate values over time, slowing down the process. This conflict could have been resolved according to a developer [4] if more attention had been paid to really agreeing to certain points before moving to the next development step. Others (urbanist and politician) agree with this point, at a certain point both public and private sides had made investments in the area, and the area received a lot of public attention, and therefore they were keen to take action, despite unfavorable contextual conditions (for example a bad housing market requiring cuts in programme and quality).

Furthermore, regarding participation, the planning culture in Dordrecht is politically considered to be rather open and focused on participation as an interview with a political figure of the municipality pointed out. However, a representative of an environmental organisation [5] was frustrated with the closed attitude of the municipality for input they did not want to hear. For example, this organisation criticised the plans and actions of the municipality for not paying enough attention to nature and laws around nature in their actions. They did attempt to discuss this with them, but the municipality was not as open to this criticism. When an urbanist from the municipality [1] was confronted with this, they suggested that finding the balance between different interests: the polluted soil had to be cleaned to allow for construction, but this did put a threat on the habitat of rare species. On the other hand, the politican's [3] opinion is not in line with his view, stating that participation is a very important dimension of Dordrecht's planning culture.

After a period of stagnation due to the crisis and challenges in aligning visions, shared vision making helped a lot to come to an agreement between the developing parties and municipality. Climate adaptation did become an important value at that time, but it was not embedded in the design at the beginning as it would involve changing plans and increasing costs. It is now that adaptation is more integrated in the designs, despite the ecological adaptive value being criticised for being only display green [5] and rather formal, highly urban public space [3]. Furthermore, the adaptive value of the area is also criticised as it was expected to be an innovative testing ground, but in the end only ended up constructing a dike as the central axis of the area [6].

As the housing market is improving at the moment, more adaptation values can be embedded in the designs and buildings [1,4] as more funds are available. Nevertheless, for Stadswerven much of the plans was already formally agreed on [1], meaning that plans could no longer be adapted to changing planning paradigm contexts [3,5].

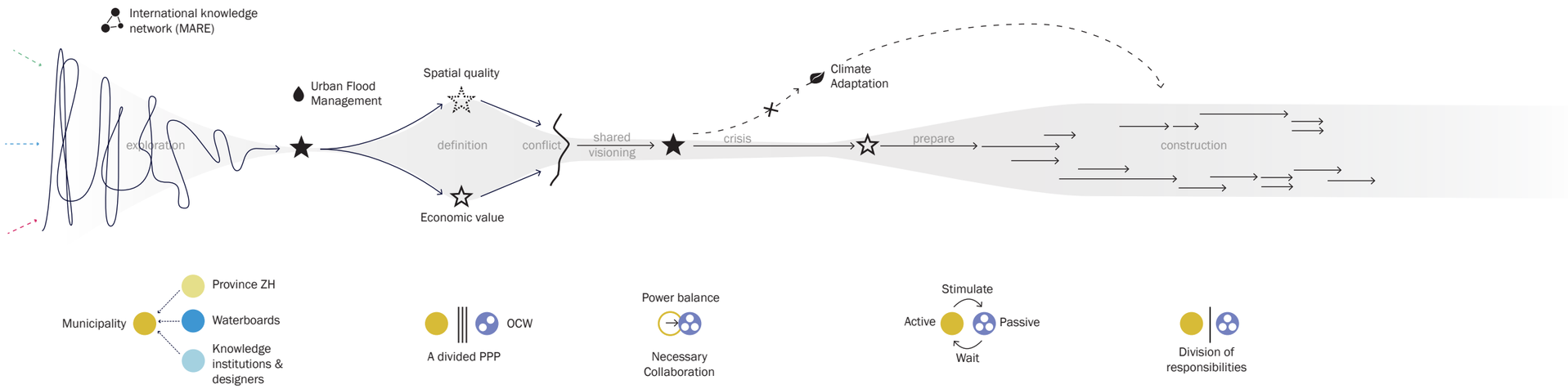


Figure 159: Different collaboration forms resulting in different degrees of operation and integration of water adaptive values in the urban redevelopment of Stadswerven. (Own illustration)

FINDINGS INTERVIEWS ACTORS

After identifying some first mechanisms behind the operability of water adaptation strategies and integrating it in urban redevelopment, this paragraph summarises the main lessons actors of Stadswerven have drawn from the redevelopment project. In each of the drawings, lessons and ideas the actors had for improving the planning system in moving towards a water resilient region and water adaptive urban areas are outlined.

First as FIGURE shows, regarding integrating adaptation in urban redevelopment, a lot comes down to the challenges of the complexity of redevelopment projects. The urbanist and politician from the municipality and the developer seem to agree that in the long duration of the redevelopment, it is very important to identify core goals for the area to be able to keep testing new development to them, which could be a framework, identity vision or list of goals. Within this you need to keep steering and adapting your plans to the changing context and knowledge. Here, the landscape architect and environmental actor think inclusivity is highly important to ensure rights of future generations, nature and ecology are embedded in plans. The waterboard and municipal planner think that long-term thinking is very important, but difficult for individuals to do. Therefore, they argue that as a planner you need to keep steering for the long-term, while dividing your strategy into short-term actions, which can be 'wins' for the actors of the process.

Second, the answers in FIGURE indicate that the collaboration between actors from many sectors is important: sometimes it is better to make the process more complex and include more opinions than to be closed and fast in decisions. The developer and landscape architect both think you need to get all relevant actors around the table soon to get all opinions on the table and study alignments between different goals and plans. If people together need to search for solutions to big challenges, it is likely that they will start thinking creatively on how to combine challenges and find win-wins. The urban planner agrees with this, having learned from Stadswerven that open, creative sessions about challenges help to find integration and joint vision making within the complexity of interests. The waterboard agrees with this, and sees it that you need to balance between formal decision making and creativity. Moreover he thinks designers should keep the process and people behind spaces always in mind when drawing up plans. Last, the developer and planner both think the relations in the process are important: the developer avoids late conflicts through early discussion, whereas the planner assigns external designers to bring to light the more challenging topics for the redevelopment. Experts tend to have a fresh sight on the site and also do not need to stay for a long time in the project team.

Third, the actors were asked about lessons they have learned (FIGURE), or ideas they had for embedding long-term adaptation in the process in contributing to a water resilient delta region. Here, most actors agree that the some challenges, such as climate adaptation, are so large that they require a more central actor to think and steer for a strategy. The politician is of opinion that we need a strong national government for this. The waterboard thinks you need to balance between strong plans at the regional scale, while also including bottom-up communication. The planner agrees and explains that long-term regional adaptation decisions need to be made, as many plans depend on the type of spatial approach the region will take. Currently, the municipality is making no-regret interventions, but this could result in overdimensioning or even maladaptation. The environmental actor is of the opinion that it might be worrying if local public actors are integrated in the development process, as they become too financially involved and can not simply be the representative of the public good. Last, the landscape architect reflects that you need to balance between the gradual, slow paradigm change which is happening and changing people's mindset and actions and the need for a push/stimulus, which could be done through steering and stimulating.

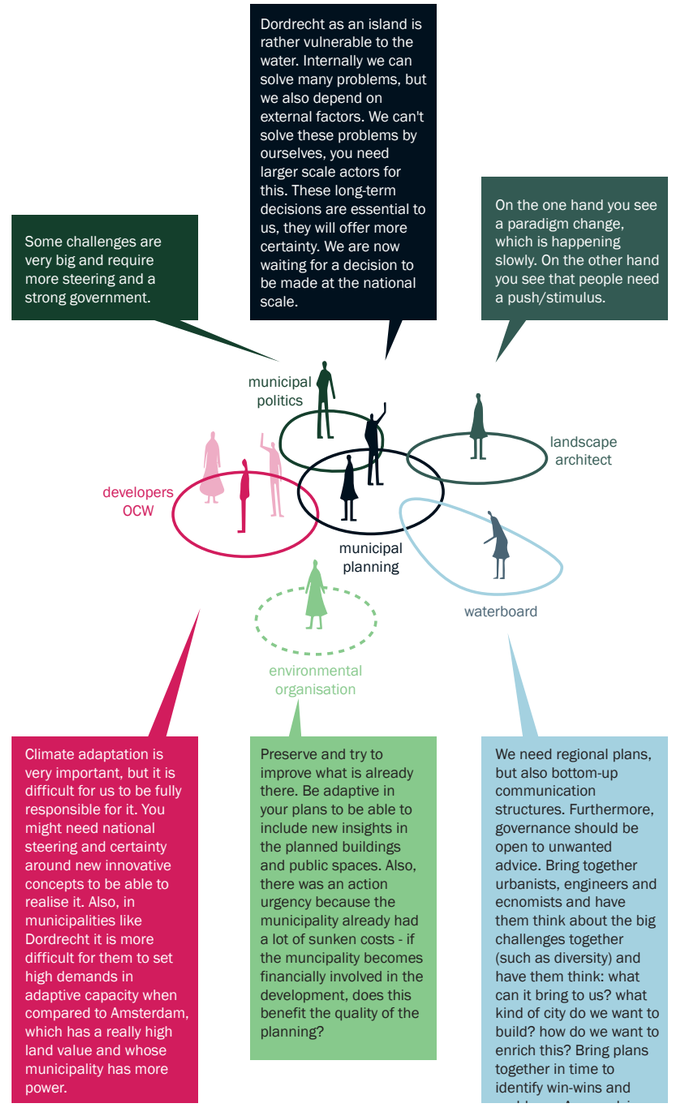


Figure 160: Answers by actors of Stadswerven from multiple sectors on the lessons they drew on how climate adaptation can be integrated in process and space. (Own illustration)

LESSONS FOR COLLABORATION

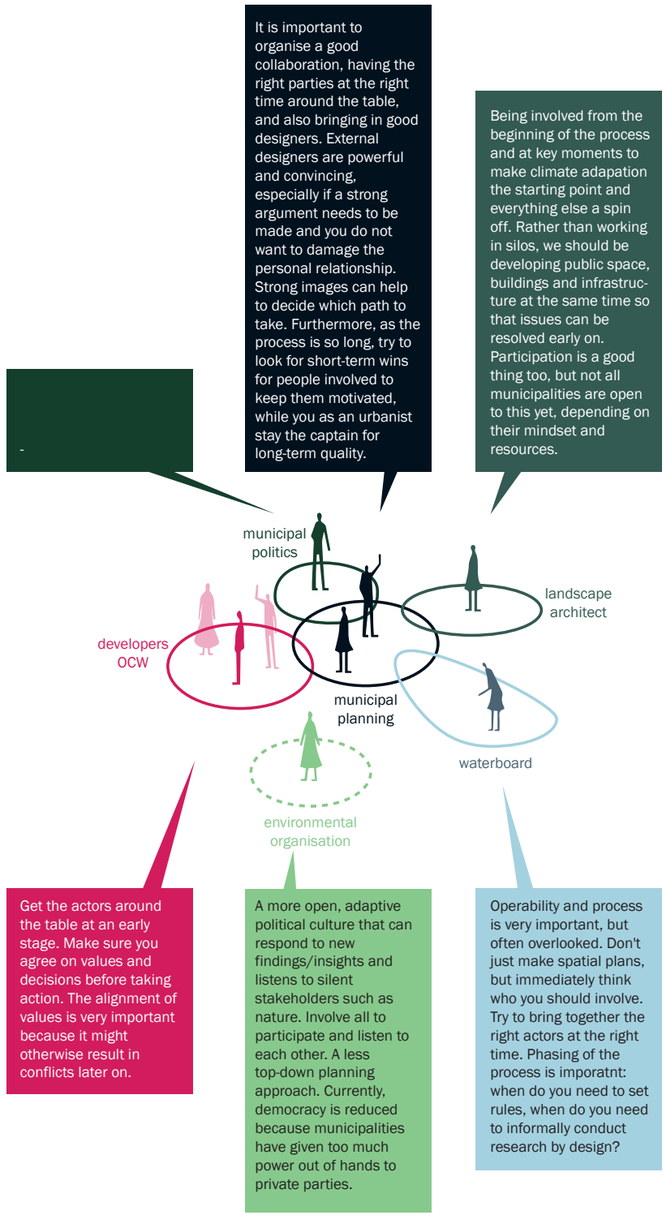


Figure 161: Lessons learned about the collaboration between the actors in the redevelopment process of Stadswerven and the impacts the collaboration made on spatial outcomes. (Own illustration)

LESSONS FOR EMBEDDING LONG-TERM ADAPTATION IN THE PROCESS

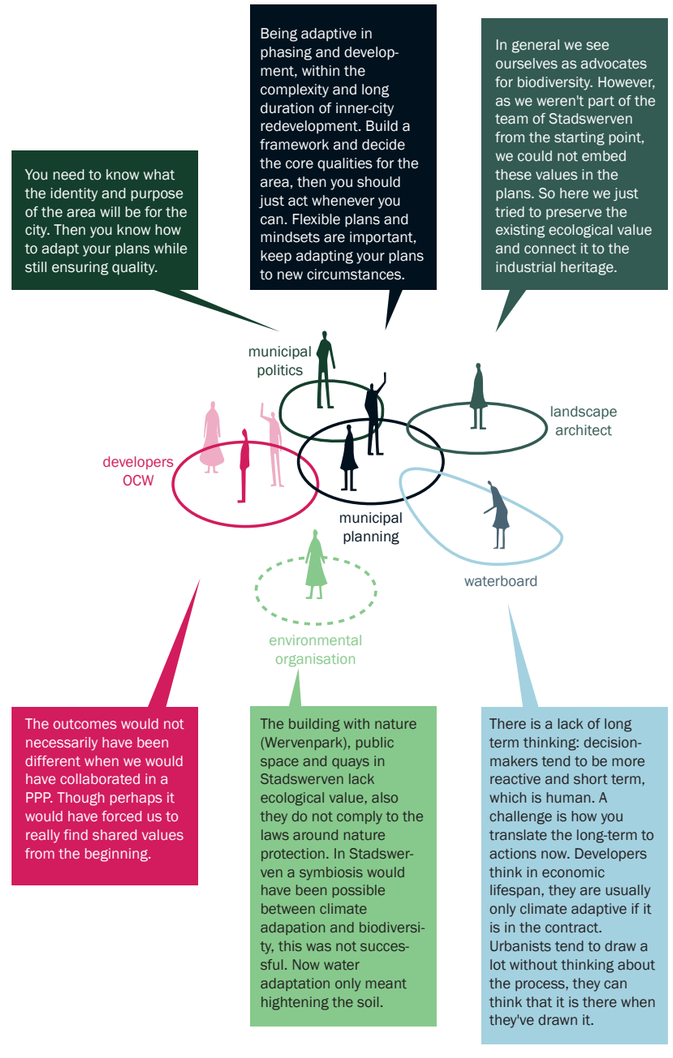
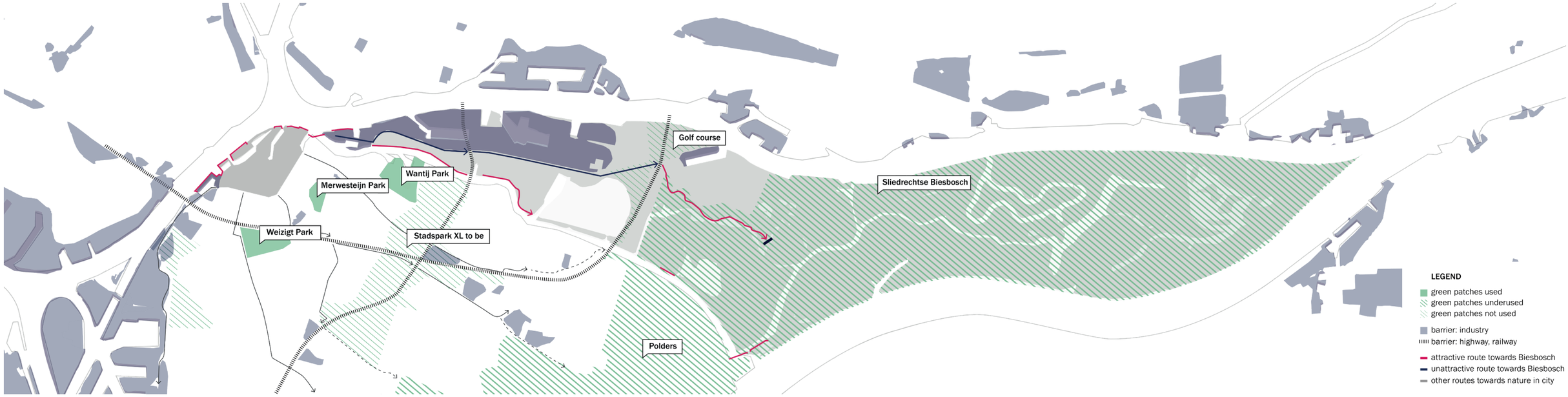


Figure 162: The lessons actors have drawn about how to embed long-term adaptation in the process and space within complex inner-city redevelopment projects like Stadswerven. (Own illustration)

APPENDIX 8 | ANALYSIS MAPS

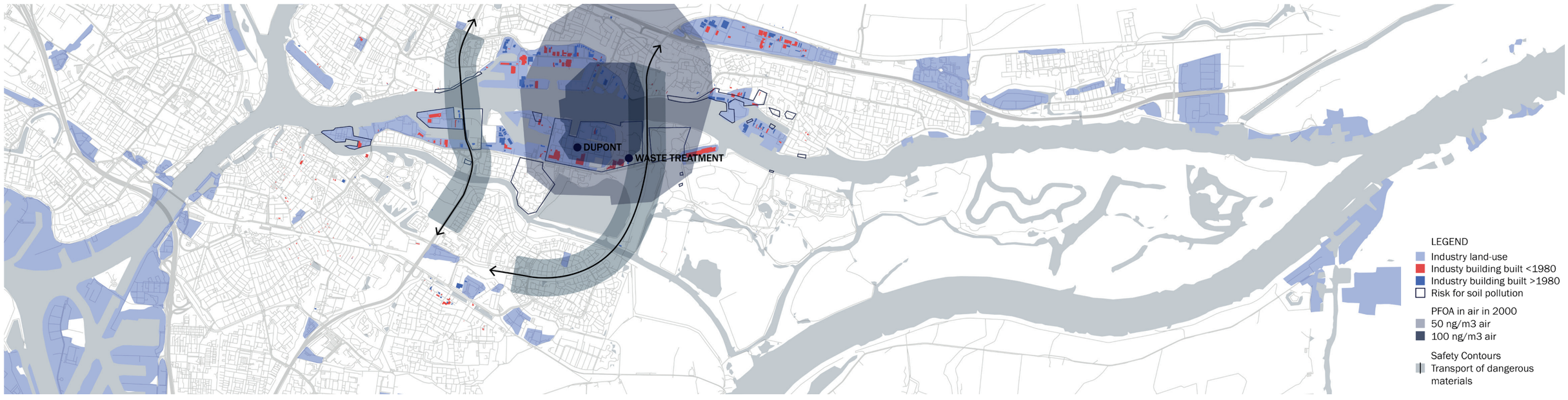
(IN)ACCESSIBILITY OF NATURE



(IN)ACCESSIBILITY OF COOL IN EXTREME SUMMERS

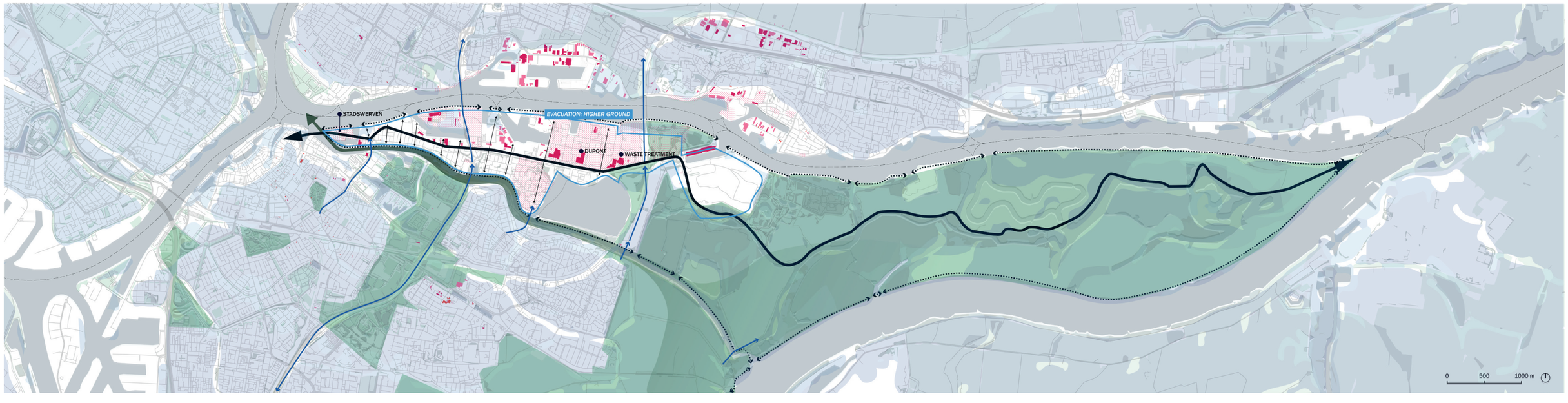
FUTURE FLOODS, USE DE STAART AS HIGHER GROUNDS FOR EVACUATION

INDUSTRIAL PAST: POLLUTED SOILS AND AIR

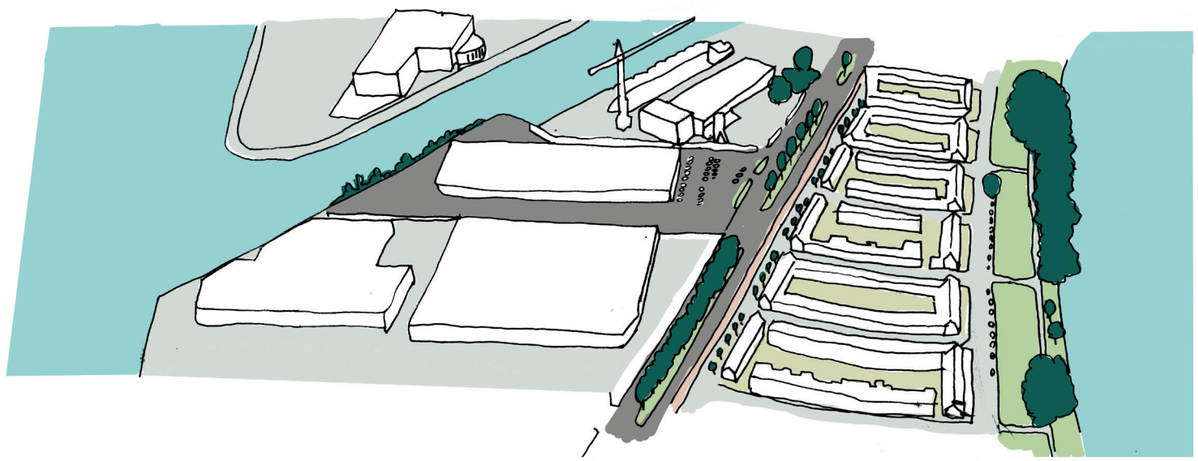


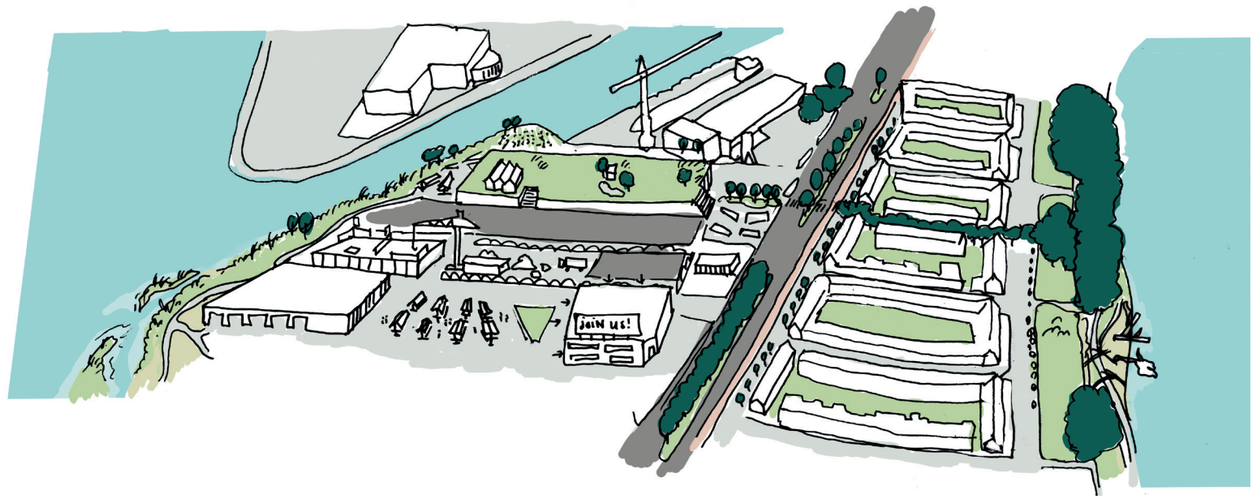
DIFFERENCES BETWEEN POORER AND RICHER NEIGHBOURHOODS

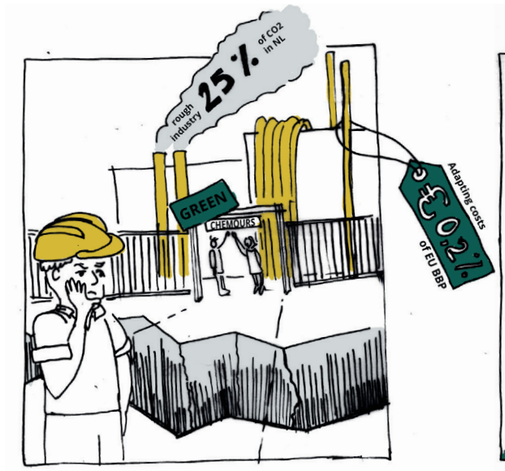
EARLY VISION MAP, based on WEST8 in IABR (2021)



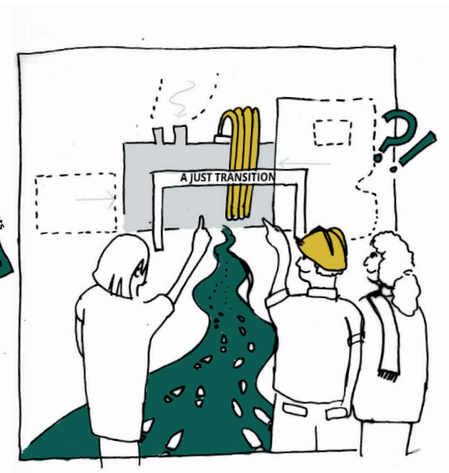
APPENDIX 9 | DESIGN EXPLORATIONS





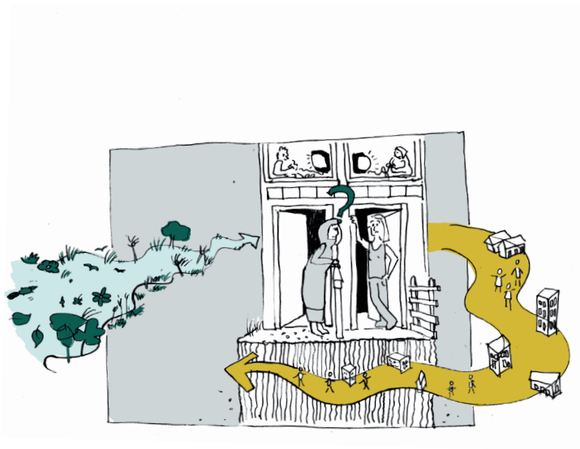


Closed transition planning: resistance against exclusive strategies that feel incomprehensible



Joint imagining of pathways towards the green economy, taking steps together in the direction of the uncertain future.

Opening doors for jobs in new industries for former employees



Hmm.. Do you know what's going on around us?

Thanks to the new development, the neighbourhood improved a lot!