raising waters

a circular water-based vision for an adaptive future of South-Holland

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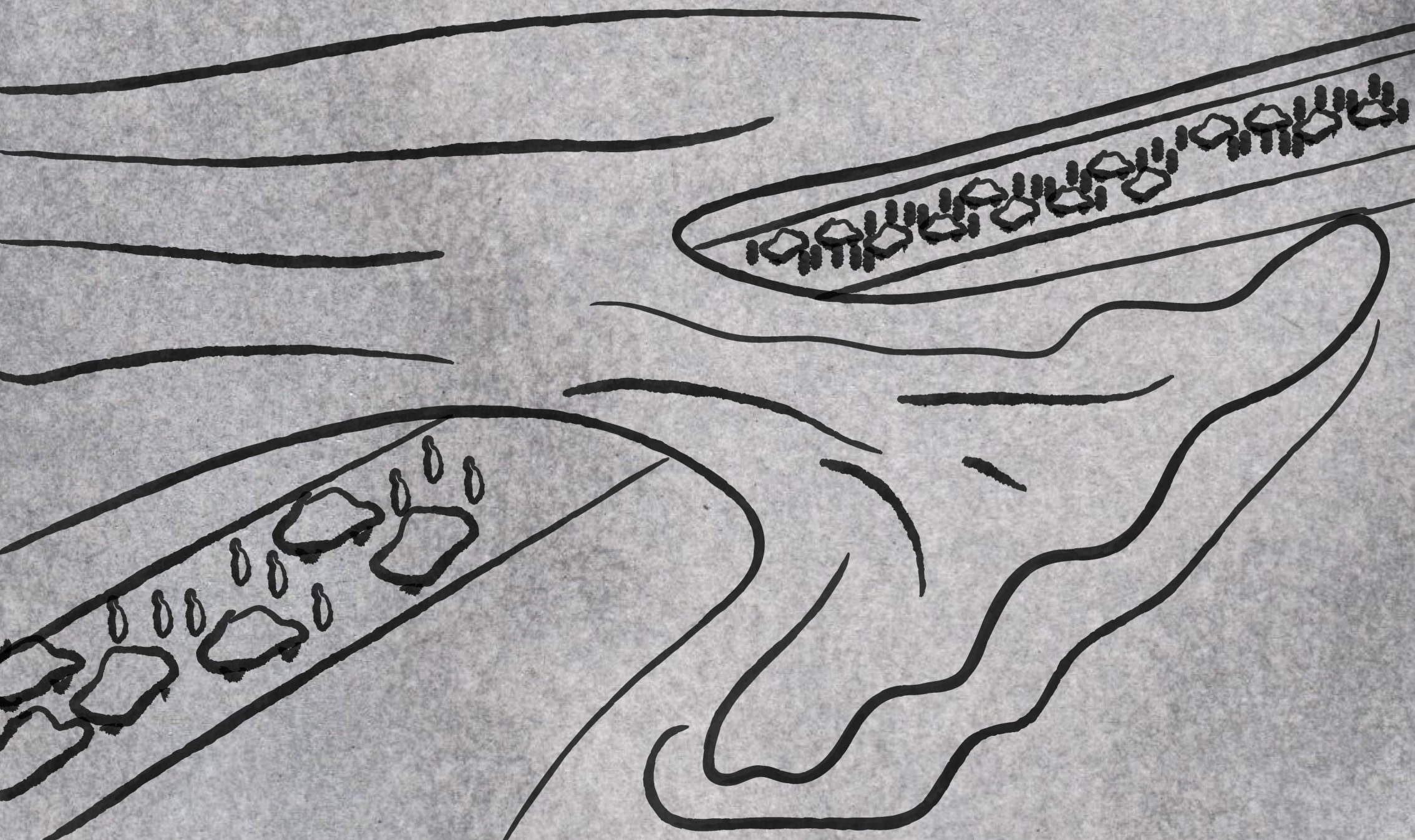

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01 | Cover picture: Coastal protection, key project two

abstract

The Netherlands, and in particular South–Holland, is to a large extent below sea level, making the region vulnerable to environmental challenges linked to climate change. According to IPCC, a sea-level rise of two to five metres is not excluded, while the Delta committee advised the government recently to not invest in new infrastructure in the west of the Netherlands, due to a high risk of flooding.

This project proposes a vision for the cultural and economic adaptation of the province of South–Holland in a scenario of a three-metre sea-level rise in 2100. Exploring the historical Dutch approach to water management, the project believes that adaptability can be achieved through a cultural shift in that approach. A shift is realised using education and stakeholder strategies from fighting the water to opening the dikes and adapting to it. Through research by design and vice versa, a new delta landscape was shaped, strengthening the existing potential of the area. The potentials lay in environmental, economic, and cultural aspects of the area. The future environment is not only adaptive but also a desirable living environment for humans and non-humans.

The result of this project is a better understanding of how a more circular economy approach can be an adaptation tool to the irremediable consequences of sea-level rise in delta landscapes, using the South Holland region as a case study. By exploring the consequences and further adaptation to this new scenario spatially, this project is an example and a trigger for other delta landscapes to explore the different challenges that they will face, presenting a possible and desirable future.

Keywords: delta landscapes, sea-level rise, adaptive design, climate change, water management, south-holland, spatial planning

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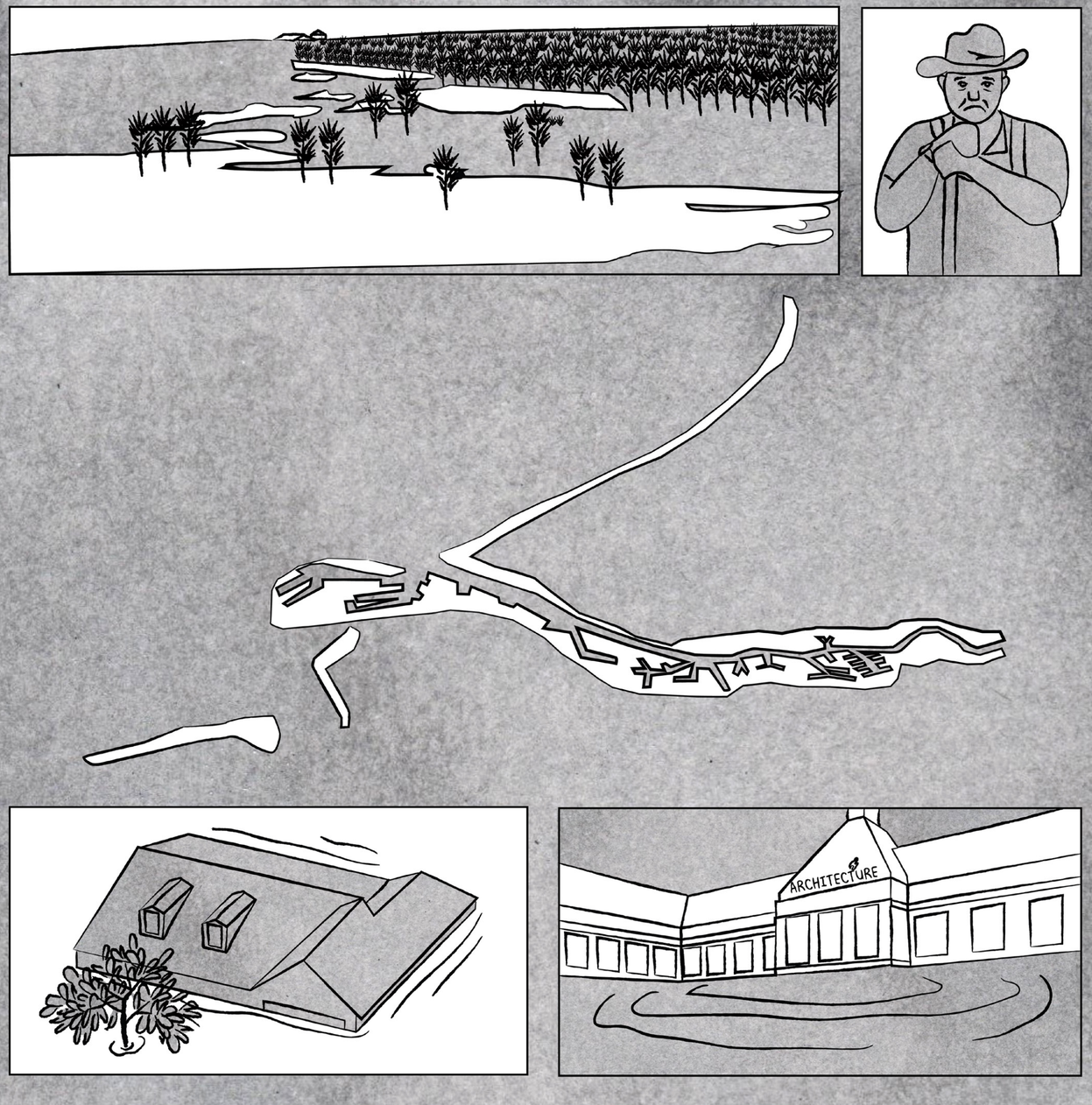
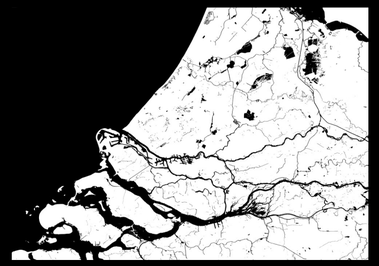


oo opening

“It doesn’t stop; every morning it begins all over again. One day, it’s rising water levels; the next, it’s soil erosion; by evening, it’s the glaciers melting faster and faster; [...] Every month, the measurements of carbon dioxide in the atmosphere are even worse than the unemployment statistics. Every year, we are told that it is the hottest since the first weather recording stations were set up; sea level keeps on rising; the coastline increasingly threatened by spring storms; as for the ocean, every new study finds it more acidic than before. This is what the press calls living in the era of an ‘ecological crisis.’”

Bruno Latour (2017, p.7)



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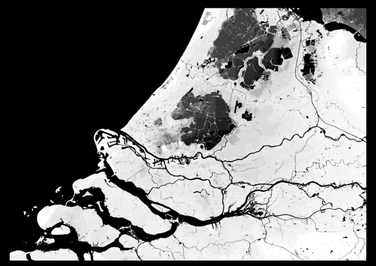

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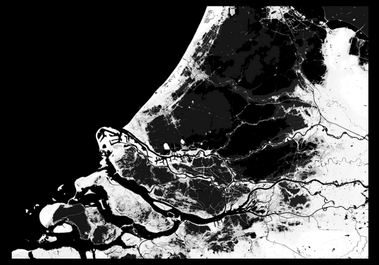

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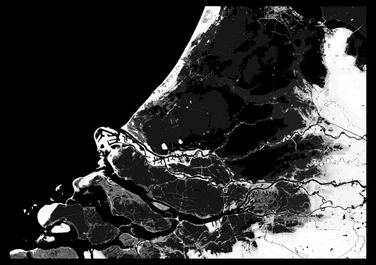

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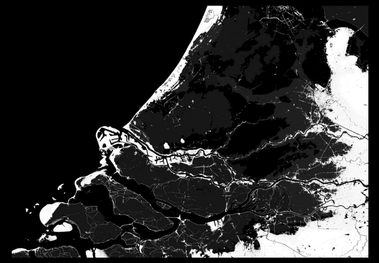

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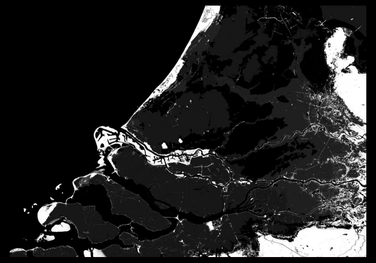


08 | +3m

0.1 problem statement
and research question

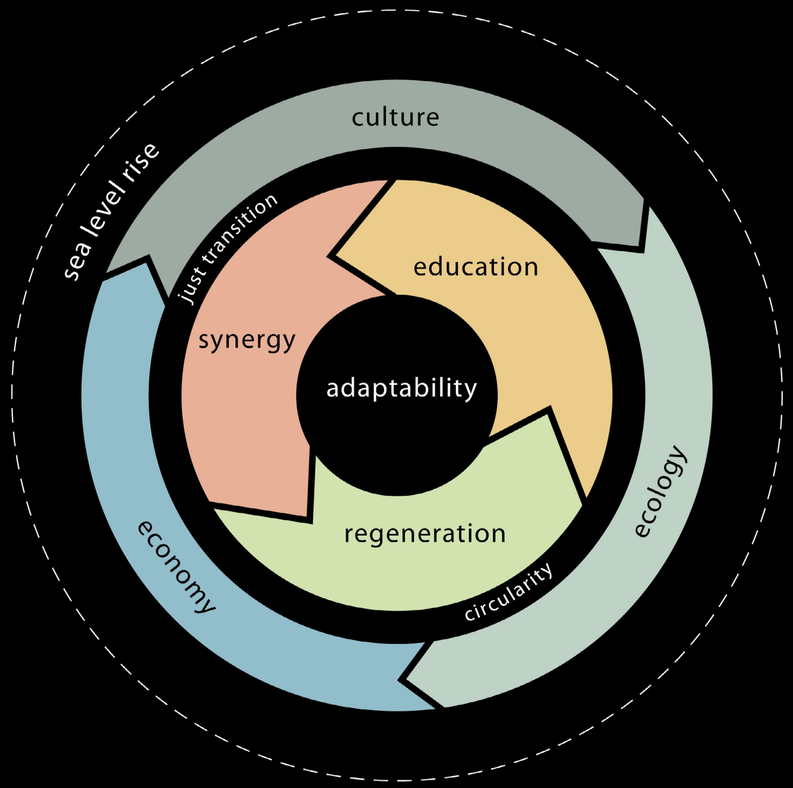
Environmental challenges such as climate change and sea-level rise cause irremediable changes in the landscape of delta areas. The Netherlands, and in particular South Holland, is to a large extent below sea level. The land inside the diked area is, due to the drainage of water, subsiding 25mm/year (Erkens et al., 2016), making it extremely vulnerable to flooding. Given these conditions, it is crucial for the region to strategically adapt its way of living and producing.

Using a three metres sea-level rise scenario, the project proposes an adaptation of the region by studying three particular aspects: ecology, economy, and society. From the ecological aspect, the project aims to use the national landscape as a potential, shaping a new land with the use of the most suitable soil types, heights, and natural landscape. The project also aims to use the natural growth of the dunes as one of the main barriers and bring back the flora and fauna associated with coastal landscapes. From the societal aspect, the project aims to be sensitive to populational needs when it comes to the needed densification and to the cultural aspects of the country, protecting cultural heritage and reducing the need for relocation. Finally, from an economical point of view, the project proposes a circular adaptation of the current production, especially in the food industry. It claims in particular that a new circular approach to the aquaculture industry could play a role in helping societies to transition toward a more sustainable economy. This can bring not only ecological benefits such as healthier eco-systems and better management of local resources but it can also be an opportunity to create new types of jobs and educate people.

In short, the aim of this project is to understand to what extent a more circular approach towards the current economy and a change of behaviours can be an adaptation to the irremediable consequences of sea-level rise in delta landscapes, using the South Holland region as a case study. This leads to the main research question: *"How can South Holland's economy and culture adapt to the inevitable consequences of flooding by following a circular approach?"*. This is asking a lot from society, therefore one sub-question is *"Which strategy can help with creating the mental shift that needs to happen?"* Regions are complex and dependent on different stakeholders.

Two sub-questions following this are *"How can synergies be reached on all levels of the region?"* and *"How can the landscape inform a new spatial development?"*.

How can South Holland's economy and culture adapt to the inevitable consequences of flooding by following a circular approach?



09 | Conceptual framework

0.2 conceptual framework

the function

The conceptual framework describes the relationships between different theories and concepts used in research and design. It can be used as a guide throughout the project to keep the relations between different themes clear. Regional design is constant zooming in and out and the conceptual framework helps to not lose structure while doing this. The basic structure shows different levels that are nested into eachother. The utmost being the scenario and the core showing the overall goal. The rings in the middle are describing different entities. There are multiple relationships between the topics which are shown through their circular movement. The additional concepts for a smooth transition are shown in the in-between ring.

The research is working in the scenario of a three metres sea-level rise. In and through this setting South Holland should become adaptable. The main tools used for this endeavour are education, synergy and regeneration. The identified main drivers for this change are ecology, economy and culture. For the research, they also represent the foundation of society and are therefore crucial for the transition. The shift towards adaptability shall happen in a just and circular way.

the tools

Education shall be used in all its forms. Its main goal is shaping awareness. Learning from natural processes and each other is key to the strategy of the project. Education shall happen formally and informally. Institutions shall be strengthened and the possibility for higher education widened. Working together with institutions is a crucial part of the success of the transition. This also includes cultural places like museums, theatres or concert halls. Because there will be a cultural shift concerning water management it is even more important to work on all levels of the people's lives together and make the shift with them. Therefore one main focus lies on communication as part of educating people. This way experts and other persons who are interested in making the change, can inform the citizens and at the same time learn about their desires for the future.

Synergy is especially important when talking about the emerging economy and the physical layout of the built environment. By smartly merging certain locations, information can be easily transmitted. These new proximities shall lead to an increase in innovation. This will be crucial for the success of a new water-based economy. Furthermore, synergy is seen as an important tool to achieve social justice. Certain activities, programs and facilities can work together and inform each other. This can make the public realm more diverse, accessible and vibrant. Leading to spatial integration and a decrease in marginalised neighbourhoods. Concerning ecology, synergy shall be used to create an environment where humans and non-humans can inform each other and benefit from working together. By understanding the natural environment and its boundaries the urban and production areas of humans can use natural processes and at the same time foster thriving natural habitats.

Regeneration as a tool means that there will be limits shaped by the ability of the system to regenerate itself. Processes will have to be put in places that have the ability to be self-sustaining. Certain systems will have to be repaired in order to function as regenerators. The introduced systems shall therefore be nature-based as much as possible.

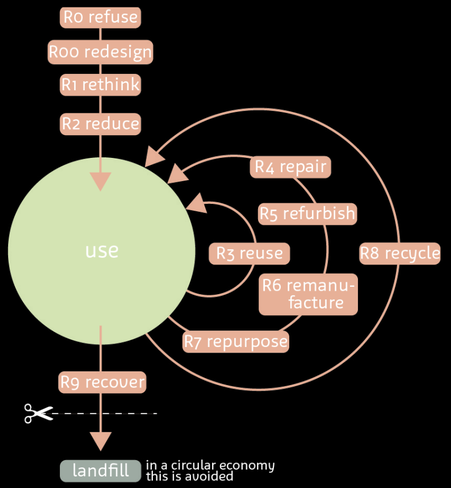
Working together to create an adaptive system in a water-based future, the tools shall help to reshape culture, ecology and economy. The transition shall happen in a just and circular way.

social justice

The three-metre sea-level rise will affect all of us, no matter the wealth, ethnicity, origin, or social status. It does not matter whether you live in a region that will flood or not, because the consequences of climate change will influence all of us. One could say that it is just a diffusion of the problem. While designing new possibilities for the reshaped Netherlands, spatial justice has an important role. Not only do we want the final product to be just, but also the transition should happen in a just way. The UN designed the Sustainable Development Goals to be a guide for sufficient development. These form a guideline for many that are developed right now.

The term 'spatial justice', however, has not been used until recently. In previous articles, it has rather been described as "territorial justice, environmental justice, the urbanisation of justice, the reduction of regional inequalities, or even more broadly in the generic search for a just city and a just society" (Soja, 2009, p. 1). Spatial justice can therefore be defined as "the fair and equitable distribution in space of socially valued resources and the opportunities [as well as the burdens (Liebig et al., 2016)] to use them" (Soja, 2009), as well as "the equity of commitments and civil responsibilities among a society and equity of extent problems among different groups" (Talen, 2002). Spatial justice has a wide range of impacts, including economics (e.g. poverty, unemployment), political (e.g. power distribution, political representation) and cultural aspects (e.g. language, religion, nationality) (Rashidzadeh, 2010).

In this project, the focus of spatial justice is on the distribution and accessibility of resources, services, and facilities. This is done by a distribution of cities, ports and agricultural areas, as well as a good connection between cities by improving the water infrastructure and public transport. Furthermore, there is a focus on the social aspect of spatial justice: By using the opportunity of the relocation, participative planning is used as a tool to integrate different social groups to aim for a just city. Therefore the relocated citizens, the future users of the cities, can help the planners to construct a sustainable and adaptable plan. Participative plans are more likely to adapt to socio-economic changes since the participants are also those who undergo and stimulate future changes (Cogan & Faust, 2010, in Ahmed et al., 2019).



10 | Circularity

circularity

A 'circular economy' is a widely used concept that is increasing in general importance, as we see with (socio-spatial) justice and sustainability. However, the circular movement started only in the early 1970s (Watson, 2020) with the awareness of the negative effects of consumerism on the environment by events like the pollution of the ocean by plastic (Qu & Balz, 2022). Results include a better regulation of sustainable waste management (Watson, 2020). This shows that strong policy persuasion is crucial for the effective implementation of the movement toward a circular economy (Deutz, 2020), including a complementary shift in the relevant economic flows towards a circular loop (Mathews, 2015).

A booming economy has always been a good sign for countries, it means the country is well developed and the inhabitants are living a good life. But what if a booming economy now is a cause for bad circumstances in the future? Economic growth means that we need more (limited) natural resources. In the current linear process, "from mining to producing and consuming, and then disposing" (Qu & Balz, 2022, p. 21), these resources are condemned by their users as waste quickly.

A circular economy means optimising the manufacturing flows: slowing down the closed and narrowed loops of production in an economically and environmentally sustainable way (Het Groene Brein, 2019; Circle Economy, n.d.). This can be done in several ways. A 10-R-ladder has been designed to show diverse ways of making an economy circular. At the same time, this tool can be used to estimate how circular an economy or company is. This has also been done for this project. For more information, please see chapter 4.1 circular material transition under the subchapter "circularity and sustainability evaluation".

In general, the system starts with manufacturing a new product with renewable sources using renewable energy, leading to a sustainable product. These products should be used as long as possible (Circle Economy, n.d.) whereby the consumer, the citizens, play an important role. If the life cycle of a product is extended maximally, it should be repaired or, when this is no longer possible, recycled (Ministerie van Algemene Zaken, 2021). Recycling can either be done by disassembling the product and seeing whether the components can be used somewhere else, or by disassembling it and reusing the materials. Therefore the used product is no longer waste, it can be seen as waste being the new raw material (Ministerie van Algemene Zaken, 2021). This, and eliminating waste in general (Ellen MacArthur Foundation, n.d.), is a pursuit that we must work towards, since, according to the European Parliament (2021), the EU produces 2,5 billion tonnes of waste every year (European Parliament, 2021).

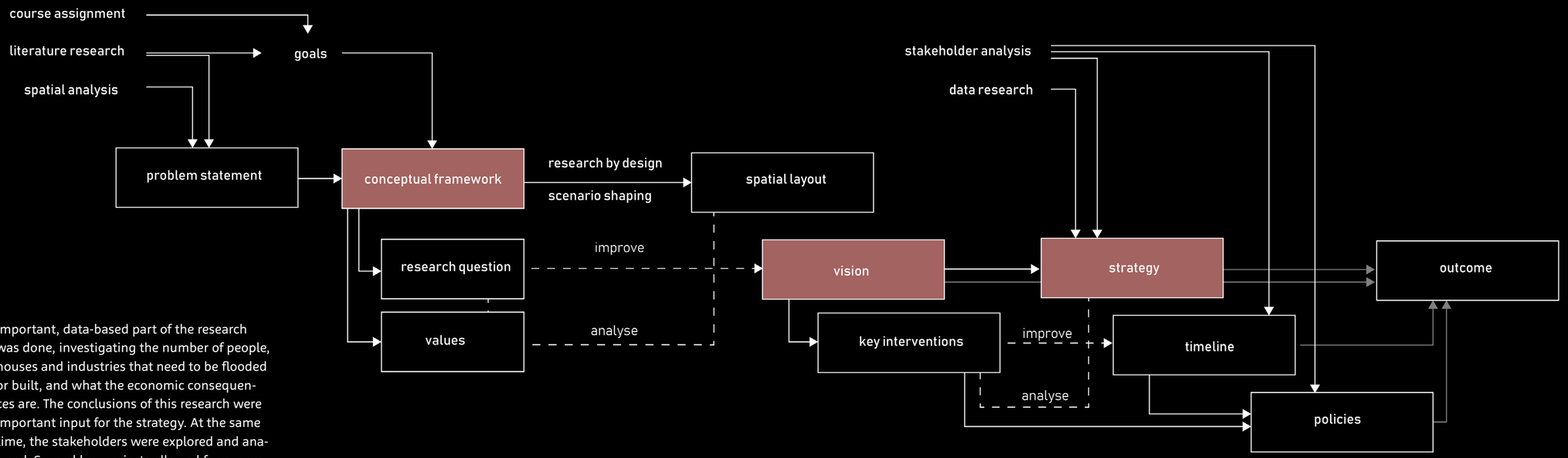
For this project, the connection between circular economy and sustainability is very important. Even though circularity is a particularly important component of sustainability, not everything that is circular is sustainable (Het Groene Brein, 2021). Therefore, the economic loops should not only be closed, but they also have to be reduced and narrowed. In our future scenario, this is done by making sure that every urbanised area is provided with food supply possibilities, like agri- or aquaculture, an industrial area and a port close by which is connected to other local and global ports. Furthermore, the urbanised areas are well connected via rail- and water infrastructures, leading to sustainable transport opportunities for residents and (local) produced products and goods.

0.3 methodology

To provide an answer to the research questions, several methods were used in this project. By using multiple methods, an attempt was made to create the most examined vision possible. Firstly, a lot of research has been done, to find out more about the problems happening in the region and the world. Research set the tone for the project. At the same time, a spatial and social investigation was done, analysing subjects like infrastructure, natural landscape, density, and cultural heritage.

With all this knowledge, the conceptual framework emerged naturally. Also, a well-argued step towards the vision could now be taken. Research by design was an important method. It allowed investigating the consequences of certain interventions. “Design, analyse, improve.” Since flooding has such a great spatial impact, an early start with spatial planning was inevitable. This meant that the vision was spatially based early in the process.

The vision then emerged. The severity of the flooding immediately raises many questions that are necessary for the strategy. An important, data-based part of the research was done, investigating the number of people, houses and industries that need to be flooded or built, and what the economic consequences are. The conclusions of this research were important input for the strategy. At the same time, the stakeholders were explored and analysed. Several key projects allowed for a more detailed study of the stakeholders but were also a checkpoint to see how the vision works on a small scale. This all resulted in the outcome of the project following the questions and values we stated in the beginning.



0.4 defining value

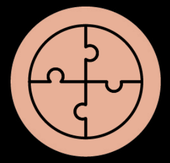
Besides the key concept, the project is guided by five different values. These values are considered in each of our decisions as well as they are used as inspiration. The individual values are a composition of different important concepts in this project.

adaptive

Adaptability is a broad concept used through different scales, timeframes and subjects. In the vision for 2100, it is highly important to be adaptable to water including adaptable water management. For a short timeframe, it is important to be adaptable to the tides. The water can then raise to four metres during one tide cycle (12 hours and 25 minutes) (Ministerie van Infrastructuur en Waterstaat, 2022). For a longer timeframe, it is important to be adaptable to the rising sea-level caused by global warming. As shown in the chapter "1.1 uncertain urgency – the challenge of sea level rise", this increase is happening over many decades leading to a need for a landscape that rises with the water.

Furthermore, the long-term vision for a country needs to be adaptable to the needs of its human and non-human inhabitants. Previously it was mentioned that in the past, we noticed how rapidly and radically economics can change leading to a mental shift of the citizens and vice versa. This always had an impact on our estimation and use of the ecology.

Adaptability is such a broad concept due to the high amount of things we can, and sometimes have to be adaptable to, to live in symbioses with the future.



inclusive

Inclusivity has different scales and stakeholders. It is not only about making the design for everybody but also with all the stakeholders. This also includes the silent stakeholders who are not able to express their opinion in a, for humans, understandable way, like animals, nature, and water.

Furthermore, the design should enable new connections between different sectors of the economy, leading to a circular economy. This new shaping and organising of facilities also mean that there are new opportunities to create spatial justice. As mentioned in chapter social justice, this task is only fulfilled if everybody in a system is affected by the same opportunities and burdens at the same time (Soja, 2009). Stakeholder participation plays an important role in the design process of an inclusive city leading to a socially just country.

regenerative

A regenerative design can be defined as a system with loops that never stop: A health system that recovers ecologically and socially on its own (Regeneration Design, 2021). This project is a long-lasting proposal where nature, humans and future innovation can exist together. With the right tools, South Holland can regenerate itself after it adapted to the new, but increasing water level.

However, a regenerative design is not only about the inhabitants, but also about the relation between economy and ecology. The use of renewable sources will help us to extend the economic loop, creating a sustainable and circular economy. At the same time, this will stop the exploitation of limited sources we have, as well as the natural habitats and their inhabitants.

sensitive

Reshaping a country is a very difficult, but also emotional task. The Netherlands used to fight the water for hundreds of years, but the rising sea level is getting too dangerous. Hence, we let the water in controlled, to preserve as much cultural heritage as we can, to make sure the Dutch cultural identity can remain within the borders of the newly shaped land. This does not only take a sensitive way of dealing with the built environment and the inhabitants but also with nature. Furthermore, for reshaping a country we need to convince everybody. This can only be done sensitively, to make sure that the mental shift is happening smoothly. Especially when it is about relocating people and leaving their homes, it is highly important to talk to the individuals about their concerns and needs, instead of treating the society as a whole.

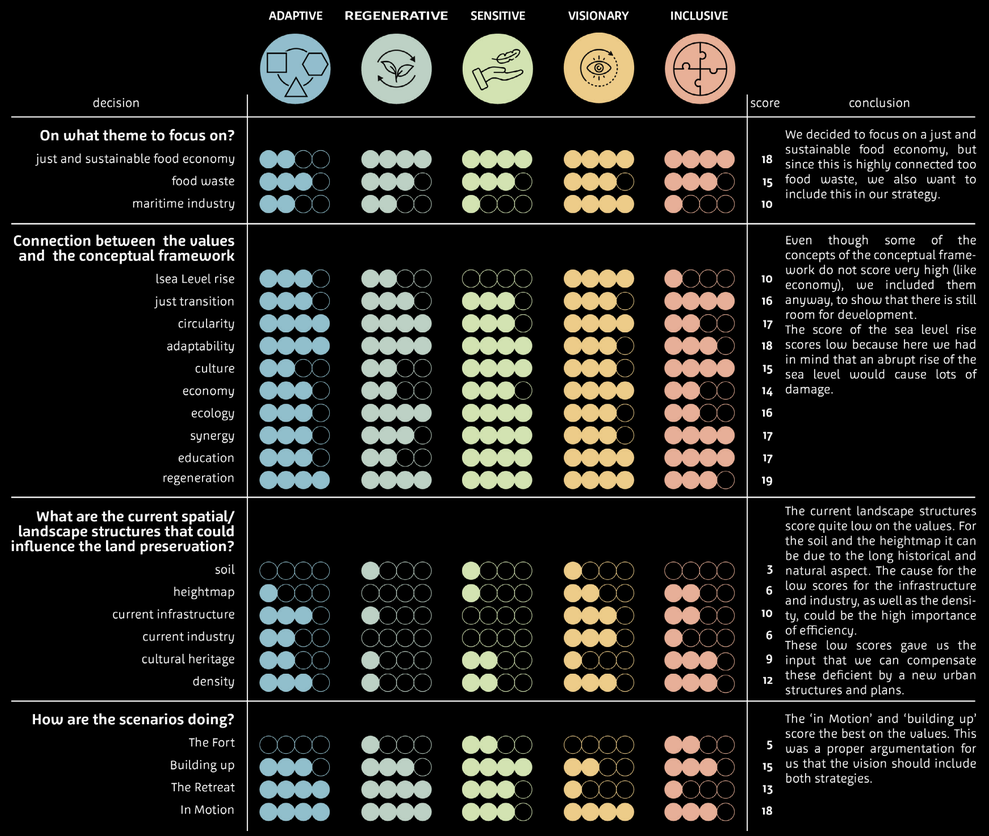
visionary

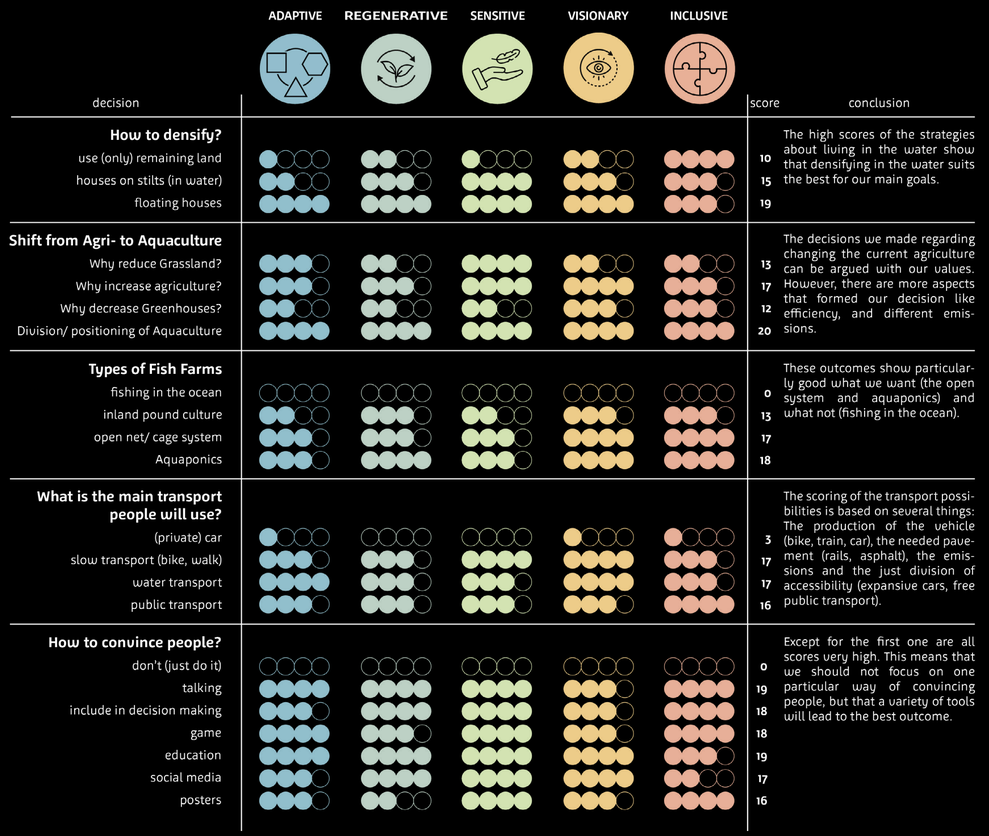
The main condition of an adaptive and regenerative existence is the visionary plan. A visionary plan for South Holland does not only include water management and adaptable cities, but it also aims for sustainability, regenerative and circular system-loops, and social justice. Only if we balance all components, the plan can be sustainable through time. We aim to make a design that lasts at least seven generations. We cannot predict what the future will be like, but we can make sure that there still will be enough time, resources, and space for the future.

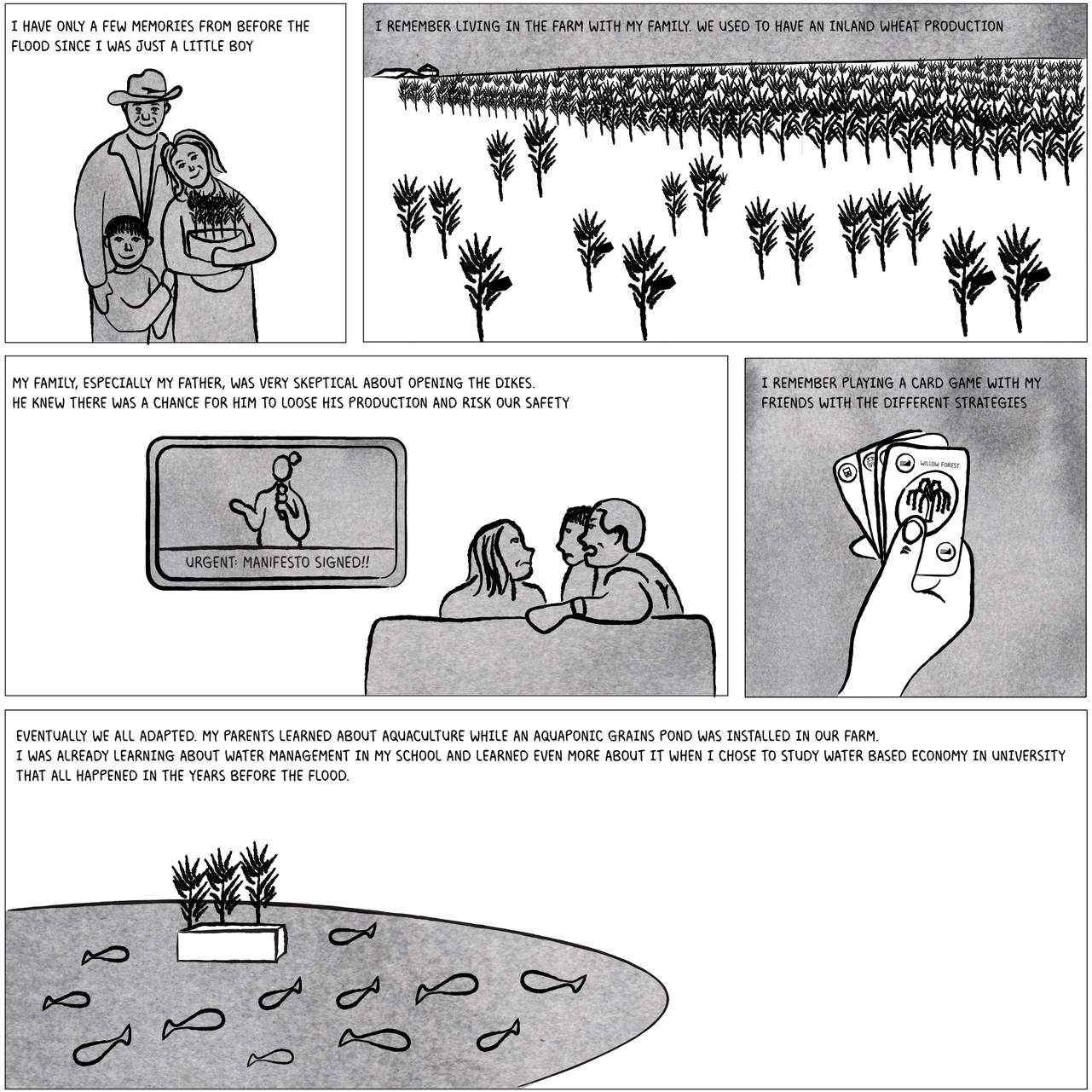
assessment framework

While reshaping an existing country, a lot of hard decisions have to be made: Which city to keep, which one to flood? Which farmer has to give up his land? And what kind of consequences can we expect? In this project, these decisions were based on the previously defined values and their importance. The option with the highest score was used for the design. In this way, it was possible to compare different options which were normally not comparable due to their contradiction.

The rankings are based on, for example, reading literature, of (previously) gained knowledge obtained during courses in the MSc Architecture, Urbanism and Building Science at the Delft University of Technology. Additionally, some information became clear during the process of research by design and vice versa. However, it has to be acknowledged that the rankings are considered for these specific questions for the purpose of this particular project. In other contexts, the rankings can be different.







01 urgencies and potentials

“However, instead of doing less damage to the environment, it is necessary to learn how one can participate with the environment by using the health of ecological systems as a basis for design. The shift from a fragmented to a whole systems model is the significant cultural leap that consumer society needs to make – through framing and understanding living system interrelationships in an integrated way.”
(Reed, 2007, p.1)

1.1 uncertain urgency
the dutch attitude

The Dutch have a broad history of water management. The country is famous for its dikes, sluices, mills, and polders. This special relationship with water started more than 2000 years ago in the north of the country. The small dikes that were built could unfortunately not withstand the strong North Sea. In 1287 one of the worst floods in history, the Sint Lucia's Flood, washed away the northern part of the country, killing over 50,000 people and creating the Zuiderzee (ThoughtCo, 2019).

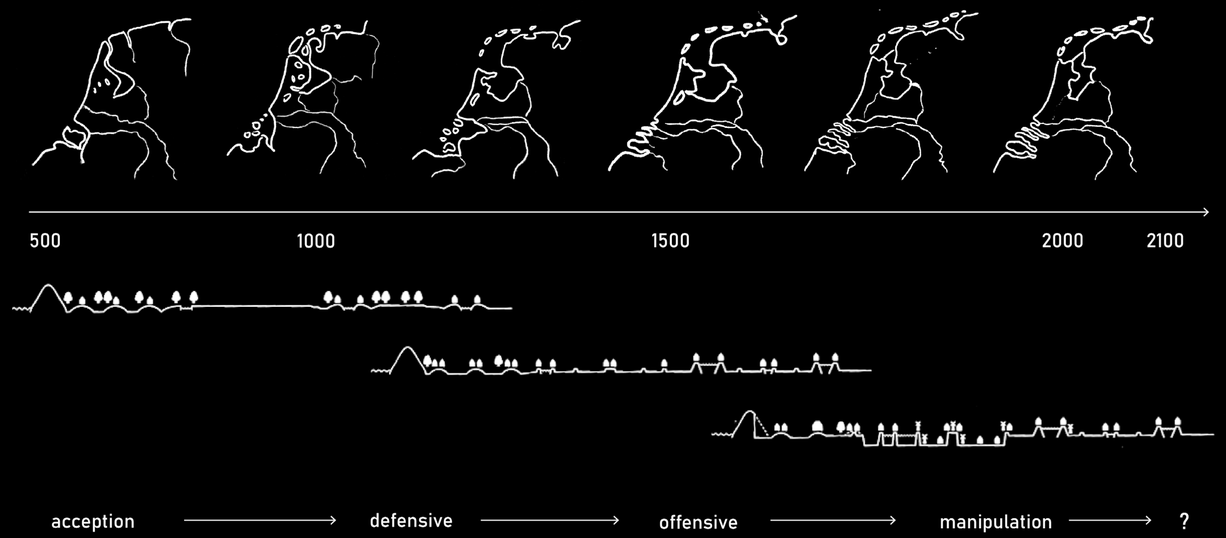
After this, the attitude changed from accepting to offending the water. The Dutch started building stronger dikes and made the first steps in the process of reclamation of land. This is a process where land is reclaimed from the water by pumping away water through little canals. After the Middle Ages, the attitude changed from defending to offending. Dikes got bigger, sluices were built, more land was reclaimed, and windmills became a symbol for the area.

The 17th century is called "The Golden Age" in the Netherlands. After centuries of kings and dukes ruling the county, the Republic of the Seven United Netherlands was founded at the end of the 16th century. This led to the provinces being very independent and gave them more freedom to offend the water. After a few centuries of offending against the water, the Netherlands is now in a state of manipulation. As more storms and floods occurred, larger projects were set up. One of the biggest was building the Afsluitdijk ("Closing Dike"), turning the Zuiderzee into a lake (ToughtCo, 2019). Another large project was the North Sea Protection Works, protecting the South-West of the Netherlands from the sea. This project was a result of the Delta Act of 1958. This act was made after another devastating flood in 1953, flooding the whole province of Zealand and parts of South Holland and Noord-Brabant. With this act, a new system of regulating and administrating the dikes was realised.

In the last century, manipulation became even more clear. In 1986 a whole new province was realised in the area that used to be the Zuiderzee. The 20th century was a period when spatial planning was at the top of the priority list of the government. They published various memoranda in which every square metre of the land was designed.

This history of offending the water led to the country being in a lock-in effect. This is a term usually used in situations with businesses and consumers but it can be used more broadly. According to Markus Eurich and Michael Brutscher (2014), a "lock-in effect refers to a situation in which consumers are dependent on a single manufacturer or supplier for a specific service and cannot move to another vendor without substantial costs or inconvenience." Neoliberalism is a political-economic system where the government is making market-oriented policies, counting on economic individualism. "[This] conned us into fighting climate change as individuals" (Lukacs, 2017). The responsibility lies with the wrong actors.

The current strategy of the government is to strengthen and higher the dike system to protect against rising sea levels and heavy weather. "Sober and efficient" is the motto of the project that is realising this (Havermans, 2020). The government is desperately trying to find spatial benefits in this strategy. "Climate change is included in the new standards", concerning the strategy on how to manage the projects. The Netherlands is in a lock-in effect: there must be a huge shift in society to change this behaviour. This project aims to show a way out of the lock-in, showing an alternative way of living with the water. This alternative should be adaptive for every future possible.



14 | Historic Dutch approach towards water

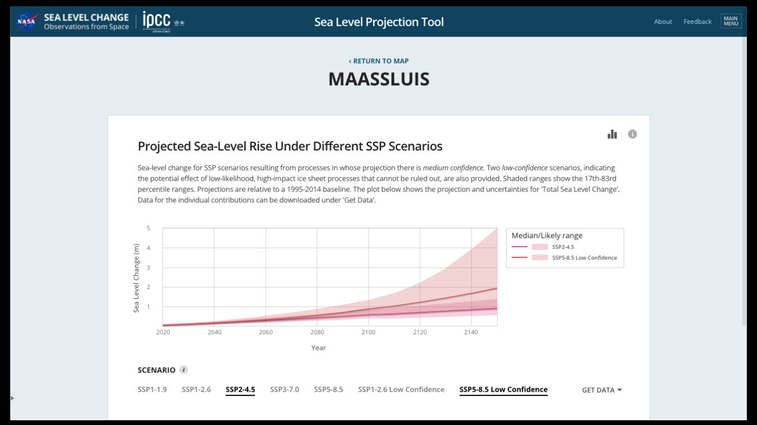
the challenge of sea level rise

The sea-level rise puts especially coastal areas into a precarious situation. The Netherlands, being to a big part built below sea level is especially vulnerable. Due to excessive drainage of water in peat areas, the land subsidence increased in the last years and is now at a rate of 25mm/year (Erkens et al., 2016).

Referring to the latest IPCC, NASA provides an online sea-level projection tool. The location of the Maassluis shows a sea-level rise of +0,93m by 2150 in a scenario of +2,4˚C global warming and net zero emissions by the middle of this century. This is the estimated increase of temperature if we manage to follow the goals of the 2021 Glasgow Climate Change Conference (Summary Report 31 October – 12 November 2021, 2022). In contrast, the worst-case scenario, which is also including the uncertainty of the melting Arctic ice, projects a sea-level rise of up to +5m by 2150. (IPCC AR6 sea-level Projection Tool, n.d.)The wide range of projected outcomes of global warming and their effect on the coastal areas leave us with a feeling of uncertainty and a need for adaptive planning.

There are many different parameters influencing the predictions of the projected sea-level rise. This results in a complex system where every change can have a different impact on the projection. Whereas some are easier to evaluate on their future impact, especially the research concerning the impact of the melting of the Antarctic ice is very uncertain. Recently this uncertainty increased even more. Scientists refer to this as “deep uncertainty”. If something is this insecure it makes it particularly hard to take action on the issue. One path towards it is to design with an adaptive approach (M Haasnoot et al, 2020).

In December 2021 the Commissioner for the Delta Programme, Peter Glas, sent advice to the legal advisor of the Rijkswaterstaat, Jasper van Kempen, and the director of Water and Soil at the Ministry of Infrastructure and Water Management, Jaap Slootmaker. In this official document concerning housing and climate adaptation (Deltacommissaris, 2021) Glas refers to the latest IPCC report and advises rethinking new “investments into the lowlands of the Netherlands, the floodplains along the major rivers and areas outside the dikes along large waterways.” He especially highlights investments into vital infrastructures such as “energy, communication and healthcare, but also investments in housing, industrial estates, ports and transport and buildings for public administration.“ (Deltacommissaris, 2021, p.7-8) This means that he sees basically all investments into the built environment in a large part of the Netherlands as non-profitable and undesirable. This letter will most probably have a major influence on local but also international future investments in the Netherlands. It is therefore of utmost importance to imagine how the influence of sea-level rise will structurally change the Dutch landscape.



15 | Projected Sea Level Rise at the Maassluis (IPCC AR6 Sea Level Projection Tool, n.d.)

According to Haasnoot et al (2020), the Dutch coastal adaptation strategy faces three major challenges concerning sea-level rise. One of the three major challenges highlighted is to take decisions because there is still a high level of uncertainty concerning the height of the water when old water management systems have to be replaced or maintained. Building upon different timescales for adaptation measures it will be hard to take no- or low regret decisions. Therefore they call for flexible short term solutions while at the same time exploring their limits.

The second challenge highlighted is the decrease in the estimated lifespan of different existing or planned implementations. Depending on the speed and height of sea-level rise the calculated capacities of for example storm surge barriers, sluices or water pumps will arrive at the limit of their power way faster. For example, the Maeslant Barrier which is currently protecting Rotterdam has to close now once every 15 years. This changes drastically with sea-level rise, going to three times a year at +1m and to 30 times a year at +1,5m. At this rate navigation from the inner city harbour will be highly disrupted. Furthermore, it will hamper the outflow of the rivers which will lead to the necessity of increasing the upstream river dikes to protect the areas from flooding.

The third big challenge will be the social capacities to go through with decisions. There will be a high demand for large and probably transformative decisions which will take a long time to realise. Thereof multiple will take place at the same time. Therefore, the researchers call for a steep learning curve in institutions to be able to cope with the urgencies. They also highlight the results of Neo-Atlantis (Olsthoorn et al., 2008) which states that although the Netherlands’ technical solutions may be feasible “the societal and political processes may be too slow to keep up with the rate of change” (M Haasnoot et al, 2020, p 11).

The biggest urgencies that will need transformative measures will concern large pumps for draining the rivers, the building of new defence barriers for floods, possibilities for new freshwater storage and a change of agriculture to be adapted to salty conditions or an increase of supply. “These are fundamental changes to the current water management system, and thus require time for planning and implementation.” (M Haasnoot et al, 2020, p 11).

To help overcome paralysis in making decisions it may be helpful to consider that sea-level rise is not a matter of whether but of when. With this thought, undesired lock-ins and regret of investments can be avoided (M Haasnoot et al, 2020).

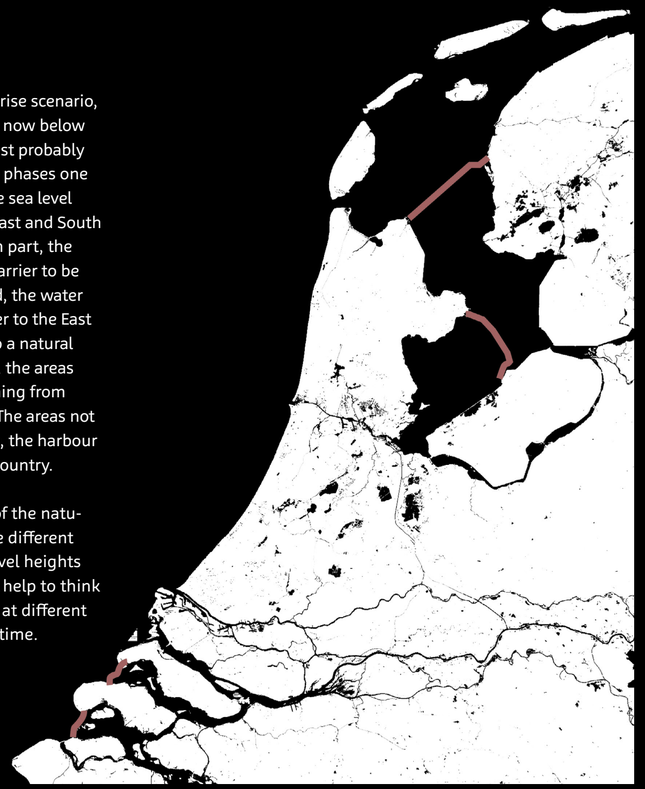
rising water

Let's try to envision this change of mentality. Let's try to not fight the water anymore but live with it. For this, the project is creating a vision for the Netherlands in a scenario of a +3m sea-level rise. A height that is not the worst-case projection but also not putting full trust into reaching the climate agreements. In this setting, this project investigates what would happen if the water is not blocked out but let in.

A big part of the Netherlands is protected from the North Sea by huge sea barriers, most of which were constructed during the Delta Act of 1958, as described in the chapter "The Dutch attitude" In the North of the country, the Afsluitdijk (afsluiten translates as „to lock") keeps the water from coming into the Ijsselmeer. A bit further to the South the Markerwaarddijk acts as a barrier between the Ijsselmeer and the Markermeer. In the South, in the area of Zeeland, the Brouwersdam and the Oosterscheldekering protect the land from the North Sea.

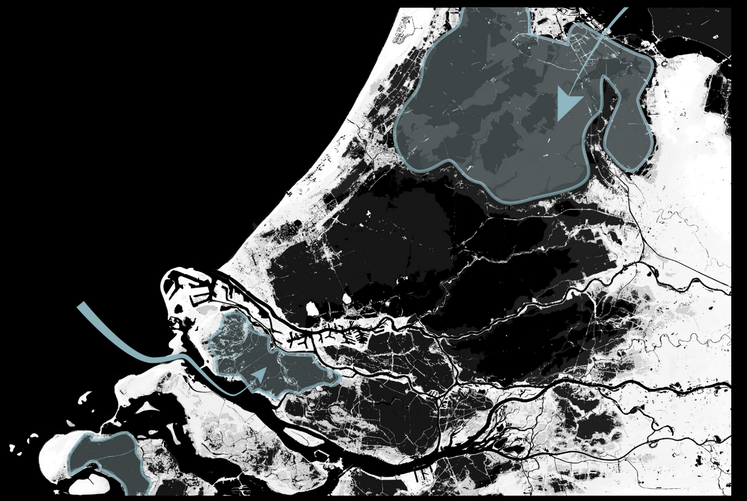
In the case of opening the dikes, this means that these big sea barriers would have to be opened and the water gradually let into the land. Following natural borders, the water would come in, in four phases. The first two are happening at a +0m sea-level rise scenario, which means that those areas are now below sea level. The old Rhine would most probably form a horizontal barrier between phases one and two of the flooding. When the sea level rises to +0,5m more areas in the East and South would flood. In the more northern part, the river Hollandse Ijssel will be the barrier to be overcome by the water. In Zeeland, the water will gradually make its way further to the East of the country until it stops due to a natural height difference. As the last step, the areas between the two waterfronts coming from North and South will be flooded. The areas not to be flooded will be the coastline, the harbour of Rotterdam and the East of the country.

According to this interpretation of the natural flow of the water, there will be different phases related to different sea-level heights and the passing of time. This will help to think of different measures introduced at different locations over a longer period of time.

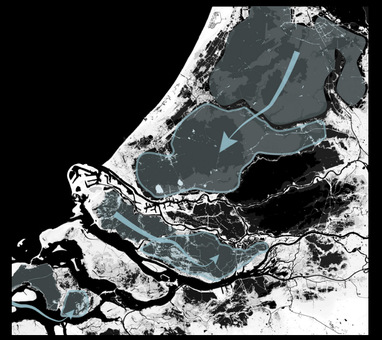


16 | water land relation and in red the most important sea barriers

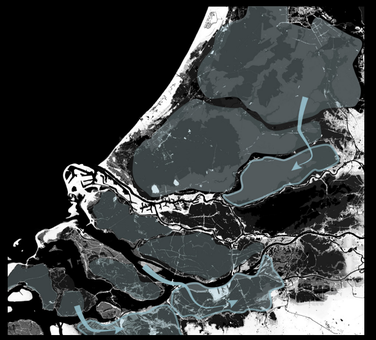
Here one can see the sequence of the water coming in. The assumptions depend on the guided opening of the main sea barriers. Furthermore, it is important to open the dikes not too late because the different developments in the areas rely on different sea-level heights. If the sea level is already too high, the water will come in too quickly and the natural borders will have no chance to withstand the forces.



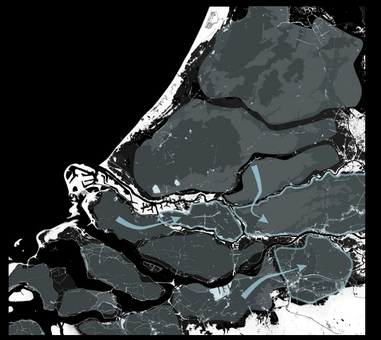
17 | The first phase of flooding (+0m)



18 | The second phase of flooding (+0m)

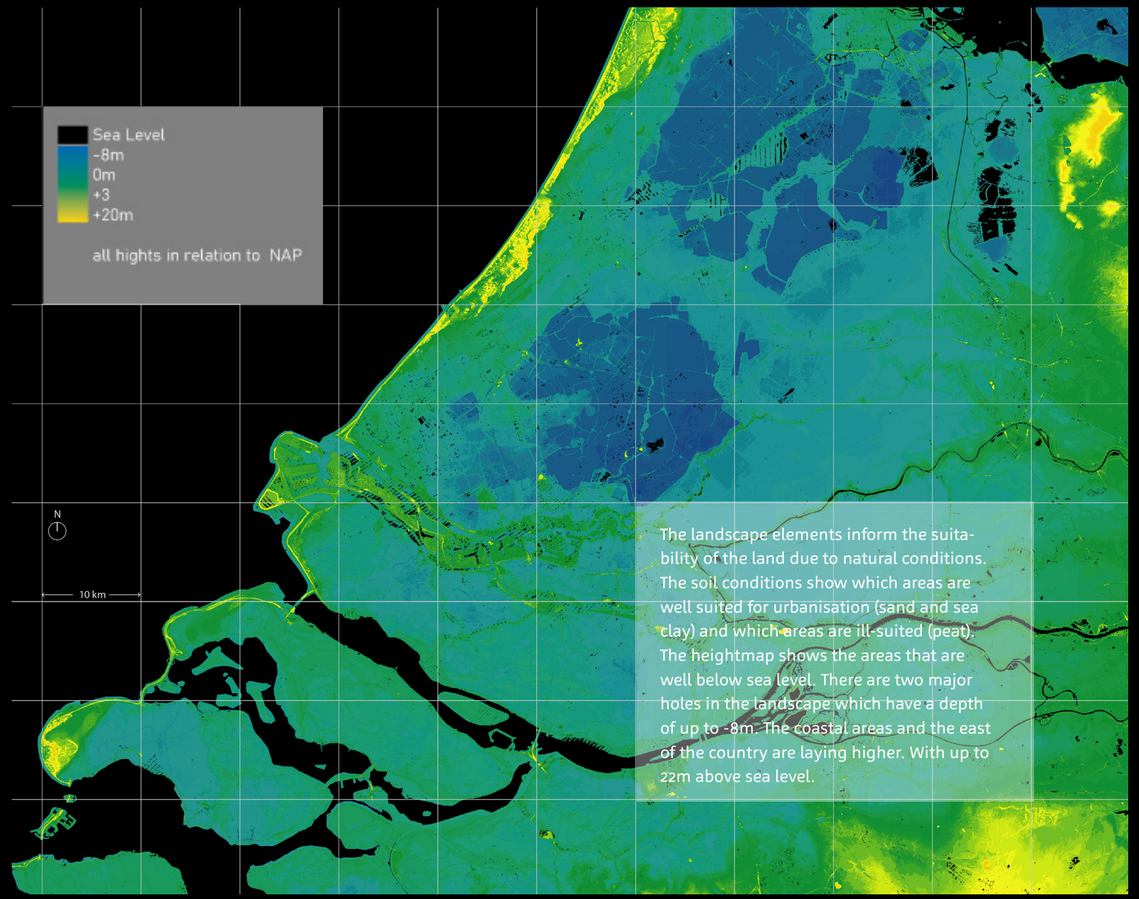


19 | The third phase of flooding (+0,5m)



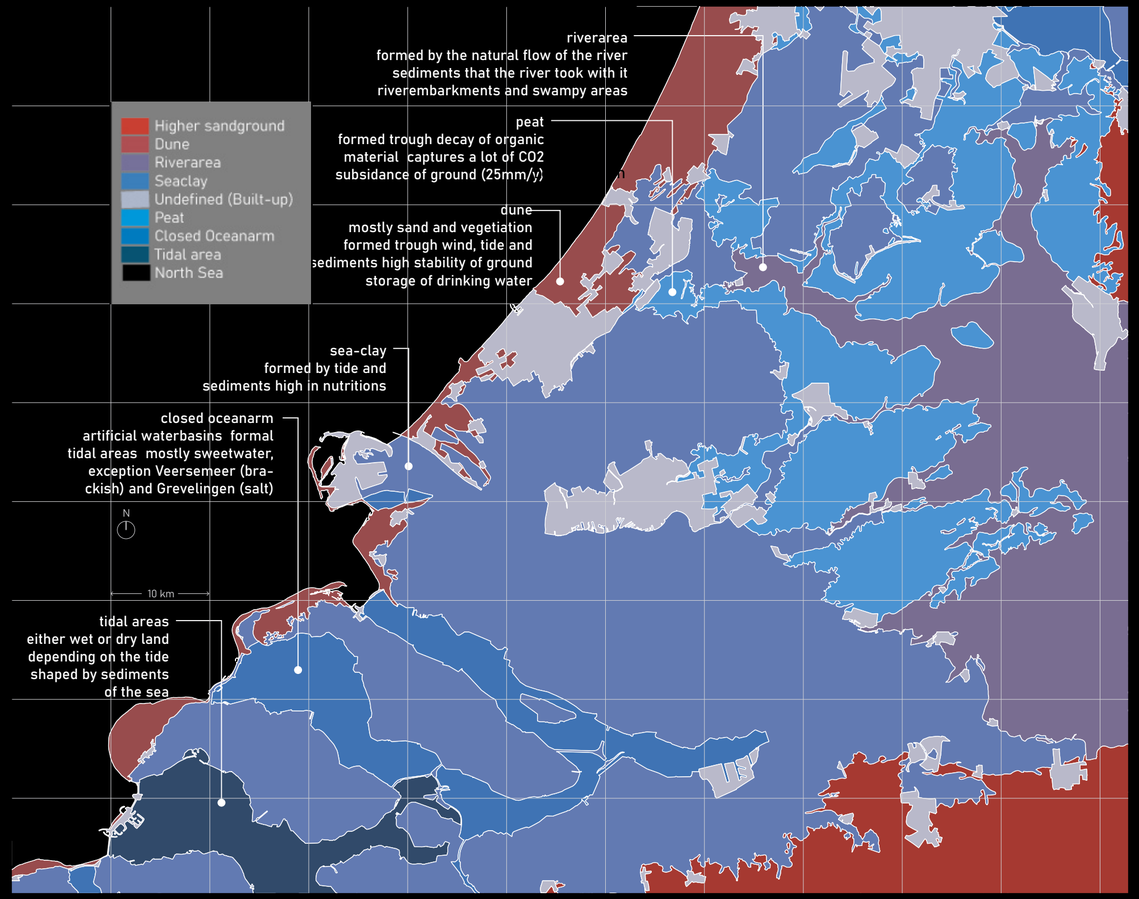
20 | The fourth phase of flooding (+1m)

1.2 landscape as potential



The landscape elements inform the suitability of the land due to natural conditions. The soil conditions show which areas are well suited for urbanisation (sand and sea clay) and which areas are ill-suited (peat). The heightmap shows the areas that are well below sea level. There are two major holes in the landscape which have a depth of up to -8m. The coastal areas and the east of the country are laying higher. With up to 22m above sea level.

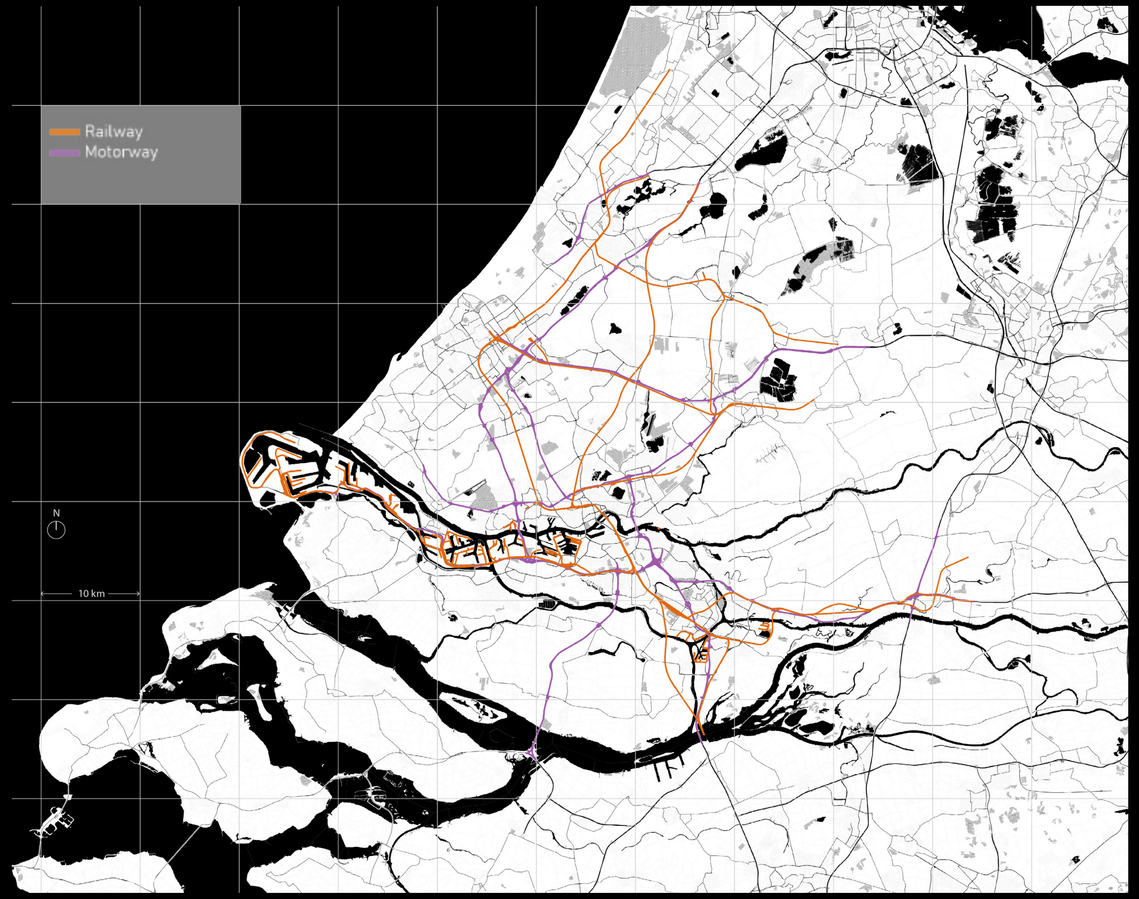
21 | HIght map South-Holland (PDOK, 2022)



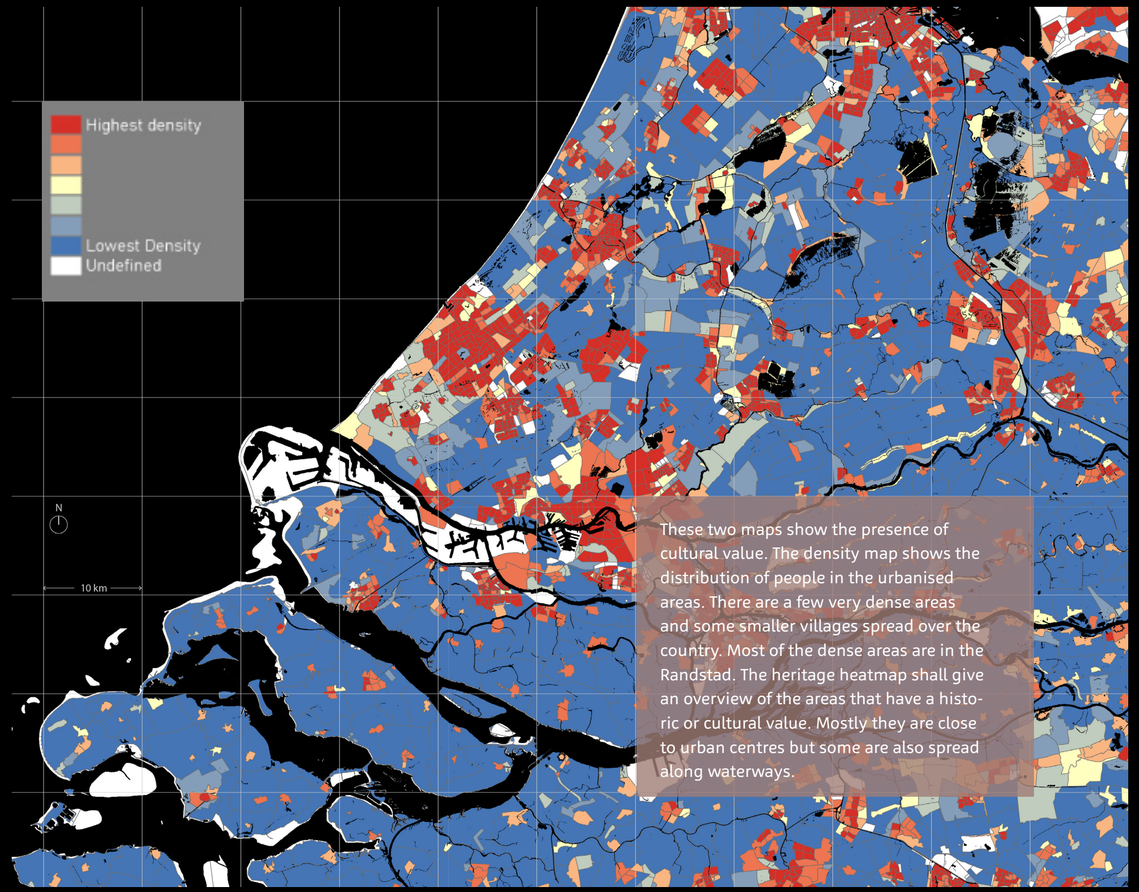
22 | Sub soil in South-Holland (PDOK, 2022)

The physical manifestations of the economy became visible in the data about industries and infrastructure. These maps show the presence of major infrastructural elements and the production capacity. The industry shows clusters of manufacturing around the main urban areas and along rivers. The infrastructure network connects the urban centres and the harbour with each other. The railways at the harbour are mostly used for the transport of goods.

23 | Industries connected to the fish and aqua sector (LISA, 2022)

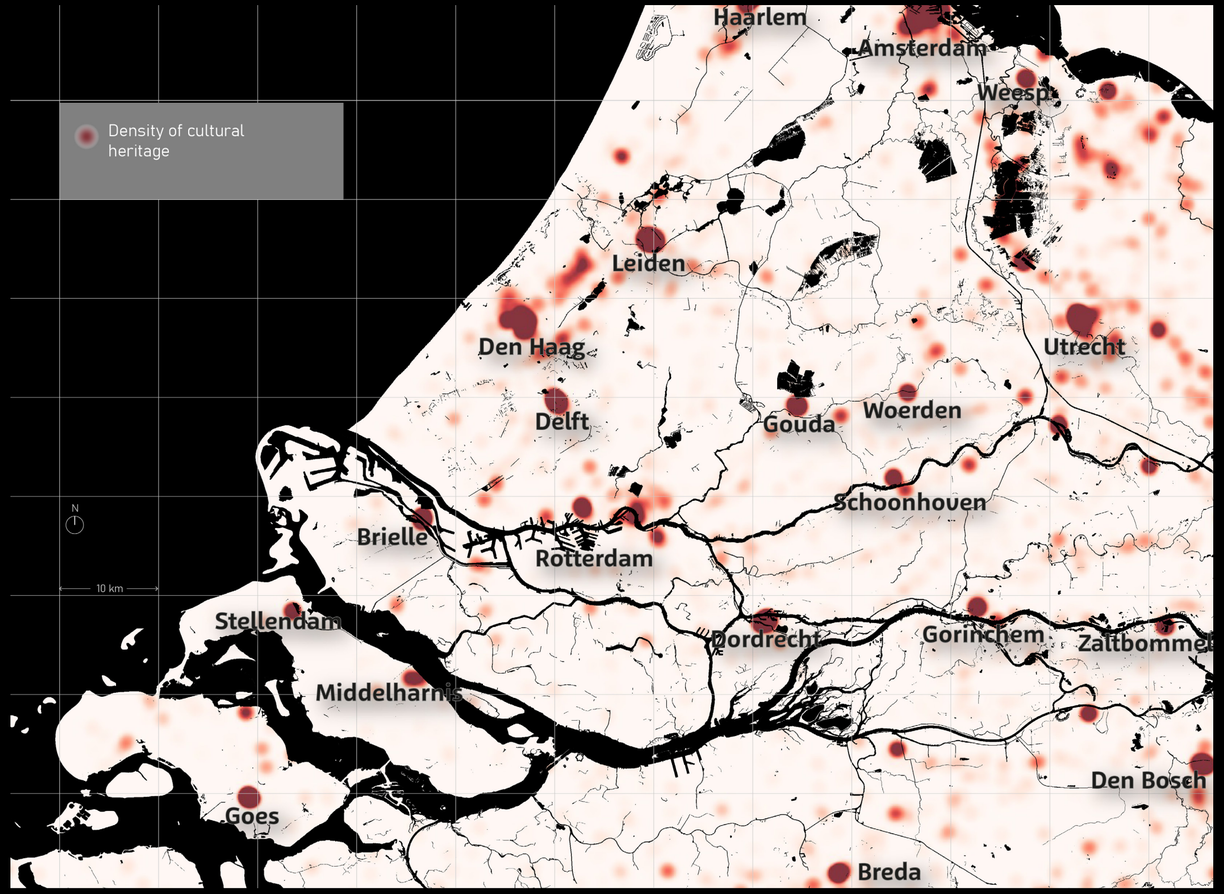


24 | Infrastructure in South-Holland (OpenStreetMap, 2022)



These two maps show the presence of cultural value. The density map shows the distribution of people in the urbanised areas. There are a few very dense areas and some smaller villages spread over the country. Most of the dense areas are in the Randstad. The heritage heatmap shall give an overview of the areas that have a historic or cultural value. Mostly they are close to urban centres but some are also spread along waterways.

25 | Inhabitants densities in South-Holland (PDOK, 2022)



26 | Cultural heritage in South-Holland (Natura2000, 2022)

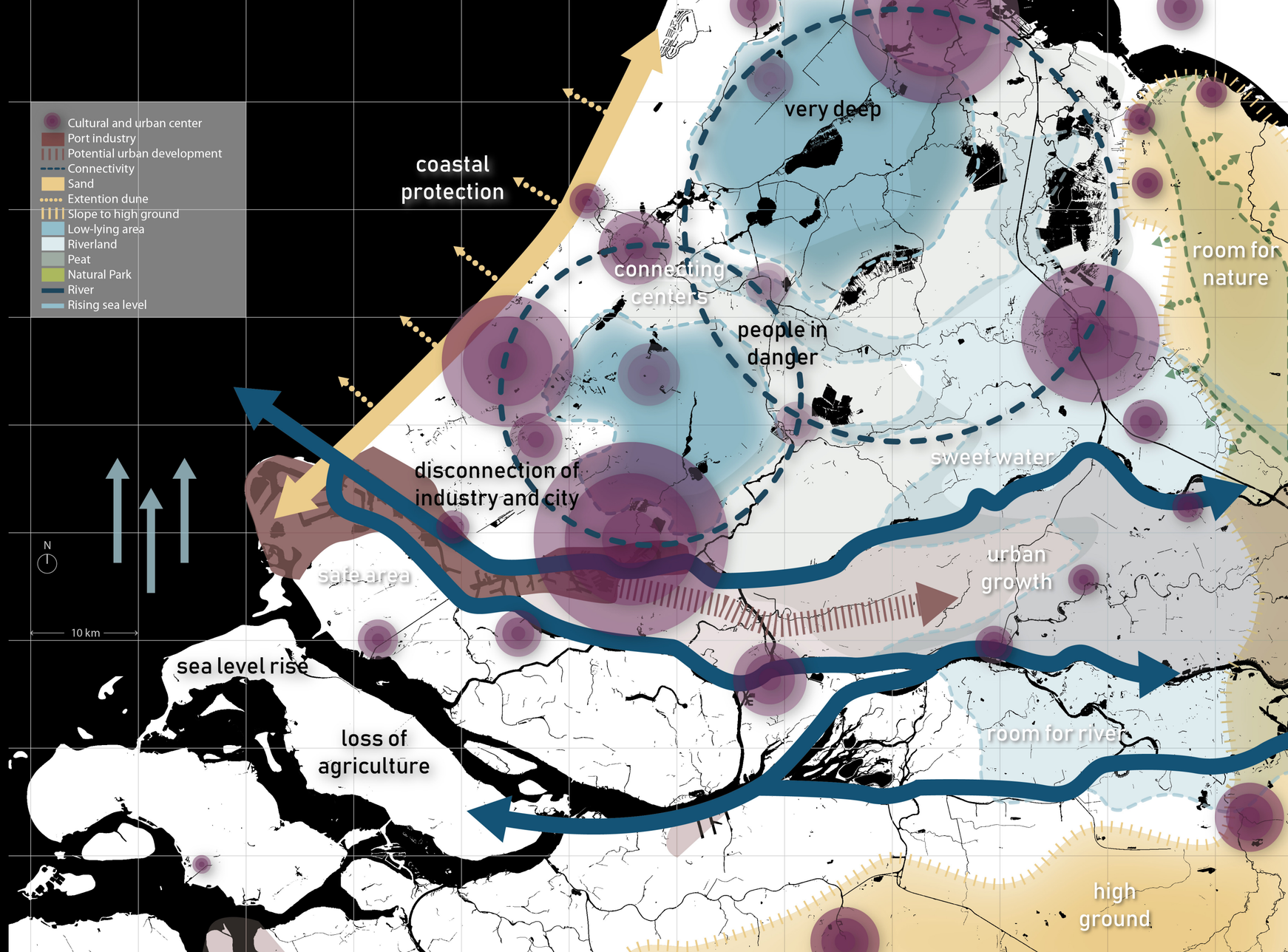
keeping or letting go

When comparing and overlapping the different spatial conditions a few potentials and urgencies become clear.

Urgencies
The land is vulnerable to sea-level rise, especially because there is a lot of land below sea level. Furthermore, there are some deep holes in the landscape which are mostly agricultural land but also partly highly densified. This puts a lot of people in danger. Additionally, disconnections between the industrial harbour area and the urban landscape are visible.

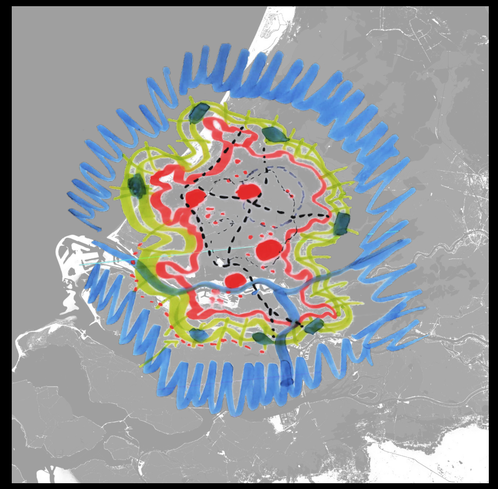
Potentials
The area's potential lies in its really strong urban centres that are already or could be very well connected. Furthermore, there are multiple growth potentials for nature. This includes room for the river, expanding the national park Veluwe and expanding the coastal areas towards the sea. The natural landscape offers places that are above sea level, for instance, the harbour of Rotterdam and the East of the country. There lies a potential for urban growth between two river arms since this will be in the last phase of flooding and therefore there will be a lot of time to prepare for it. The peat landscape offers highly nutritious areas but at the same time also subsides a lot when built upon. The Riverland informs about the areas that are close to sweet water reservoirs.

There are a lot of different potentials and urgencies concerning the region, touching upon a variety of subjects. In the next step, they were used to develop and support the spatial and economic vision for South Holland.

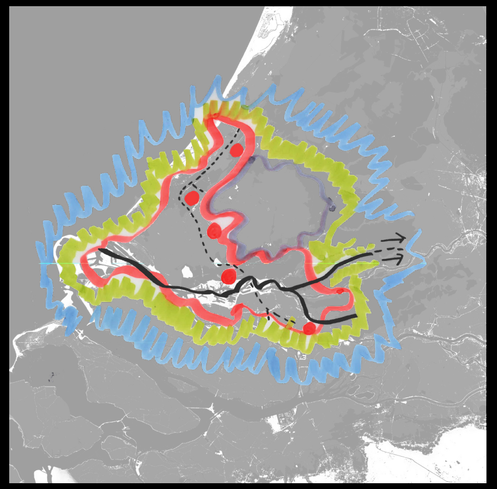


27 | Potentials and urgencies in the region of South-Holland

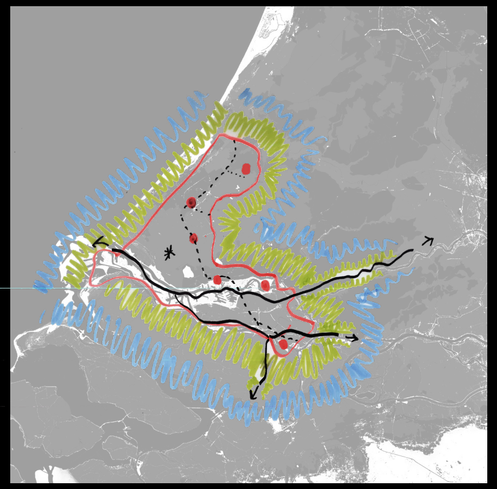
exploring different structures



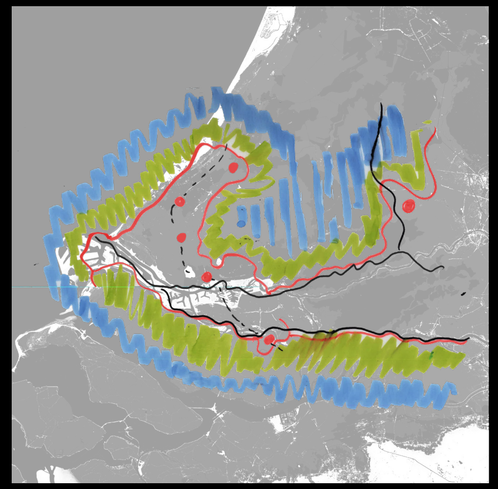
Developing the spatial layout had its starting point in connecting the naturally higher grounds of the harbour and the coast. The urban centres were preserved by creating a protective and productive buffer surrounding them.



In a second step, the hole has been taken into consideration and was considered as a sweet water basin that could function as drinking water storage and at the same time as a water buffer. Furthermore, the connecting potential of the riverways has been included.

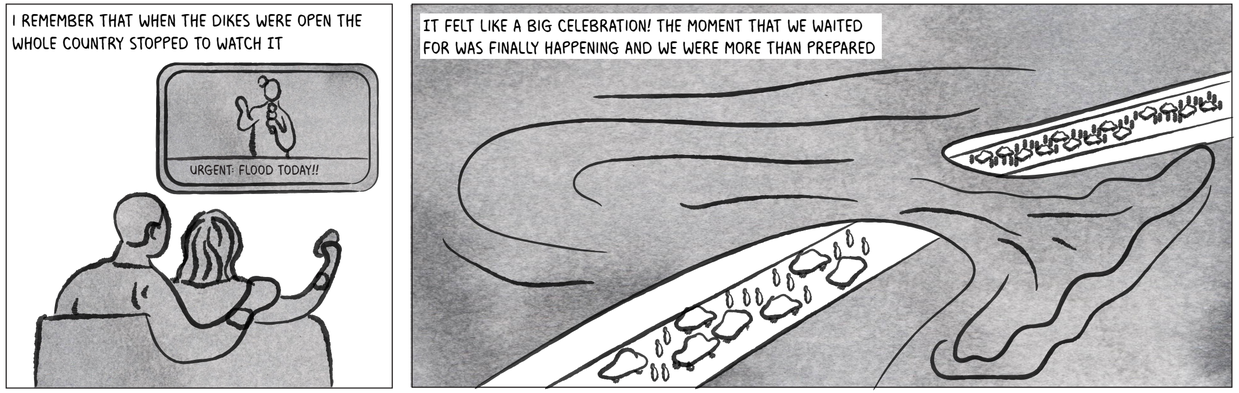


In the next step, the hole was not being protected anymore and the buffer zone was guided around the shape.

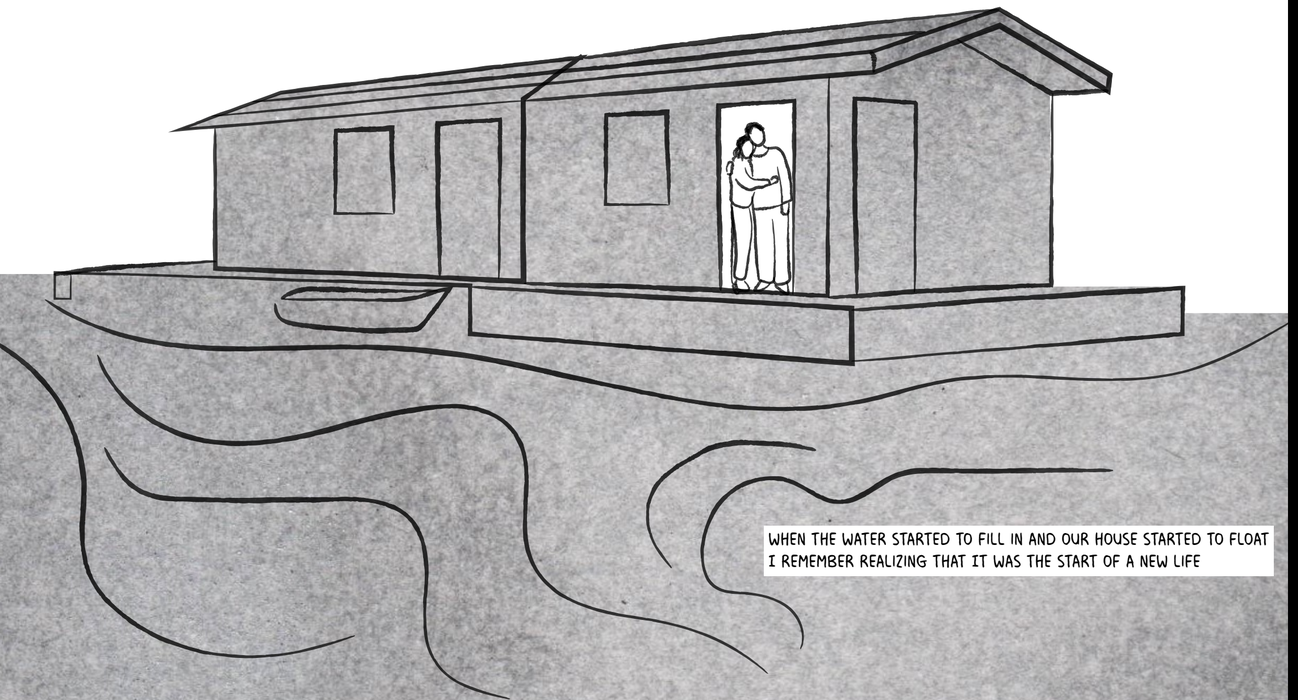


In the last step, the potential of the two river arms has been taken advantage of. The buffer follows them and through that creates an on land connection to the east.

28-31 | Series of different structures to shape the protected land



I REMEMBER THAT I HAD JUST RENT MY FIRST FLOATING HOUSE WITH MY GIRLFRIEND AT THE TIME. SHE LATER ON BECAME MY WIFE



02 shaping the future

“As towns and cities go underwater, as wild-fires ravage our communities, we’re going to pay. And we have to decide whether we’re going to pay to react or pay to be proactive.”
(Alexandra Ocazio-Cortez, 26th March, 2019)

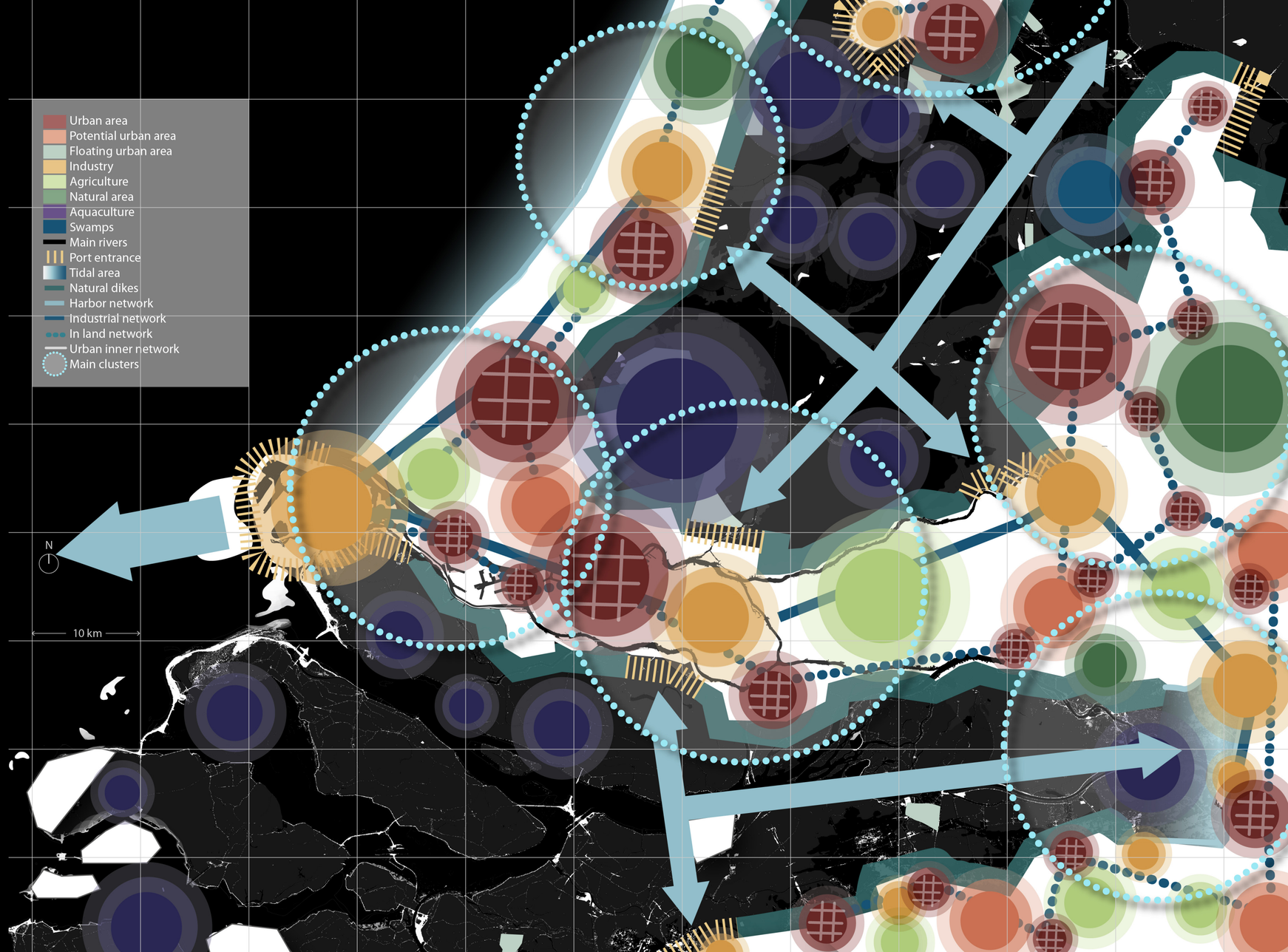
2.1 vision
vision statement

The year is 2100. The inevitable consequences of climate change caused a three-metre sea-level rise, flooding the majority of South Holland province. These new conditions led to a mental shift, supported by education. The historical Dutch approach towards water changed from fighting against it to learning a sustainable way to live in harmony with it, leading to a strategic adaptation.

Main urban areas were culturally and geographically preserved, following the economic and population trends growth of the Randstad region during the 21st century. On top of this sensible cultural approach, the soil types and natural formation were taken into consideration, strengthening the qualities of the land. South Holland is now an aquacultural innovation hub and home to a multiplicity of fauna and flora.

The economy shifted to a regenerative water-based economy where food is mainly produced through circular fish farms, aquaponics cultivation and permaculture, the energy is produced partly through algae, and ships and harbours are the main logistic infrastructure for local connectivity and global trade.

The new aquacultural production landscape created new jobs and research areas linked to the cultural shift towards a necessary sustainable approach to ecology and water. Based on the Dutch water knowledge, the region becomes a visionary example of a Delta area that adapted to the inevitable flooding situation in a nature-based way, exploring the potentials of past landscapes and economies of cities, acting strategically on an unavoidable issue.



33 | Vision map for South–Holland

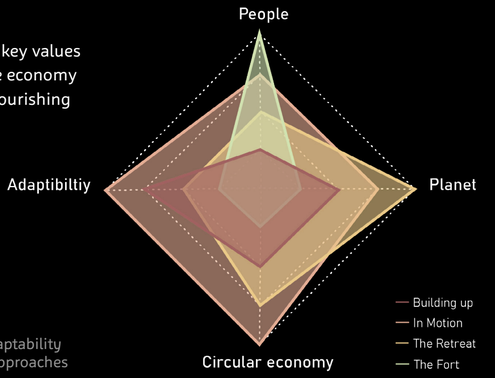
34 | Four different approaches towards a strategy that reacts to the sea level rise

four different approaches

As stated in the last chapter, there are several options for managing the possible flood in South Holland. To see what the consequences of certain strategies would be, different approaches were made using two axes. One axis goes from preserving to developing, and another axis goes from avoiding risks to grasping opportunities. This results in four approaches. Firstly, there is the fort: preserving structures and avoiding risks of negative influences. This is the way the Netherlands is managing water now, by manipulating the water to stay outside. When there is a flood or when the sea level rises, raising and strengthening the dikes would be the solution (Havermans, 2020).

An approach that is actualising development preferences while the desired quality is upheld, is here called the retreat. In this approach, everyone would leave the area that would be flooded and move to a safe space. This would result in the east of the country replacing the Randstad as the centre of the country. The area that will be flooded can either be dismantled or left to its own devices to let nature flourish. The same development preferences could be also realised while grasping and developing opportunities, shown in an approach like in motion. The region would be made floodable, resulting in water-based cities where everything is either floating on the water or located underwater. This approach is relying on innovative water technology, grasping every opportunity possible. That is also possible while preserving desired structures, in an approach like building up, the most compromising strategy. Cities, landscapes, or important heritage, based on certain values, could be saved by cleverly protecting them. The land would be preserved using new landscape-based technologies.

These approaches can be rated on key values such as most opportunities for the economy to become circular, adaptability, flourishing ecology, or social justice. Different approaches rate differently. For a detailed analysis of the approaches, see the appendix. The goal of this design tool is not to choose one and design that in the best way possible. It gives an idea of the main takeaways of every scenario, showing the urgencies and possibilities in their most extreme way. This project aims to insert different parts of every scenario in the right areas.



35 | People, planet, prosperity and adaptability evaluation on the four different approaches

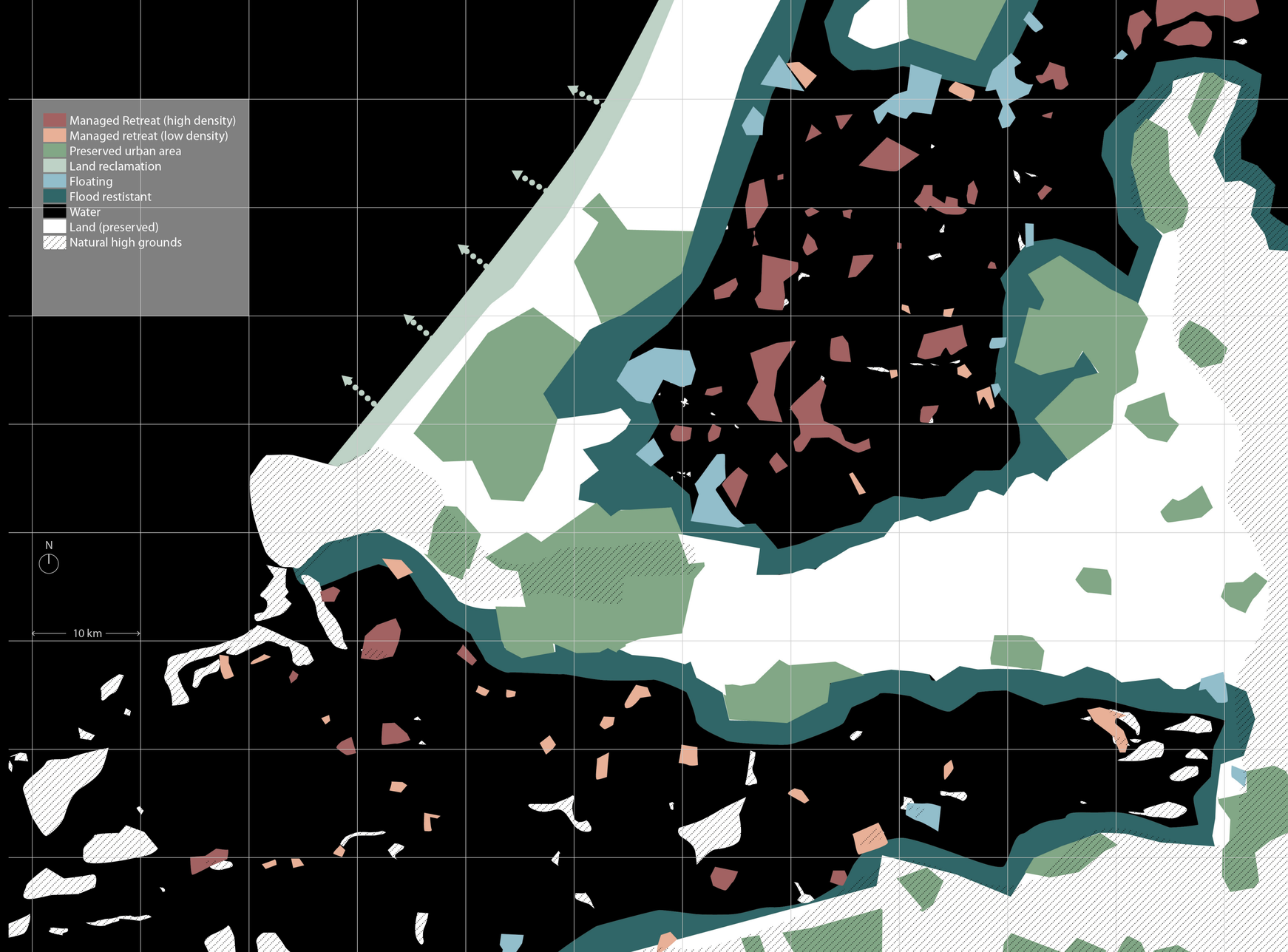
approaches made spatially

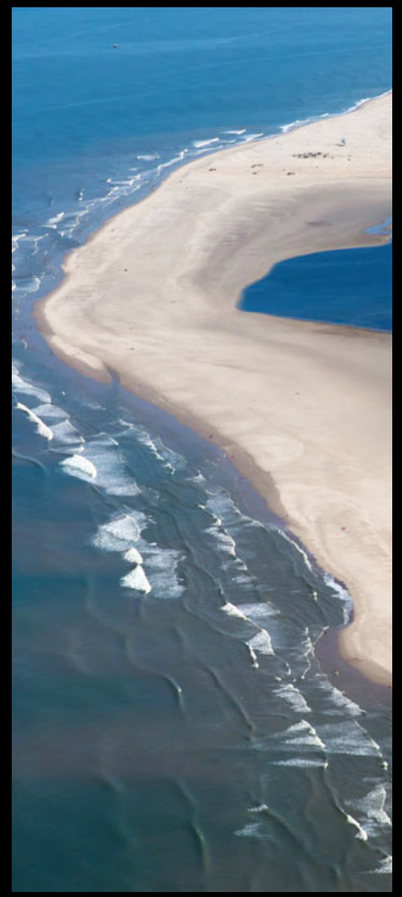
After carefully looking at the different guiding layers from the landscape, economic and infrastructural given, and cultural heritage a shape had been formed. It tries to keep as much culture as possible and relocate the least people while at the same time letting go of the areas that are very vulnerable to flooding. These are especially the previously described deep holes and the peat landscape that is vulnerable to land subsidence.

By following the natural guidance of the big rivers a border has been created. The rivers will constantly bring new sediments and through that strengthen the border, and at the same time provide drinking water. The coast will be strengthened to keep the water from entering the preserved areas. Regarding the economic and at the same time cultural value the biggest cities are being reserved. These include Rotterdam, Den Haag, Leiden, Dordrecht, Utrecht, Amsterdam, Delft, Den Bosch and a few smaller ones. In this way, the natural and cultural givens shaped the relationship between land and water.

Looking back at the different approaches which have been developed before – the retreat, the fort, building up and in motion – it becomes clear that the region will have all of them to different extents and at different locations. The big urban areas with a lot of heritage will be protected by a flood-resistant buffer zone and by strengthening the coast. In the buffer zone, urbanisation will be able to live with water. Present residential areas that touch this future protective belt will turn into floating cities. And lastly, there are urban areas that will be flooded completely in the future. There are two different densities related to them, very dense and less dense centres. Both of them require a managed retreat but the denser ones will be more difficult.

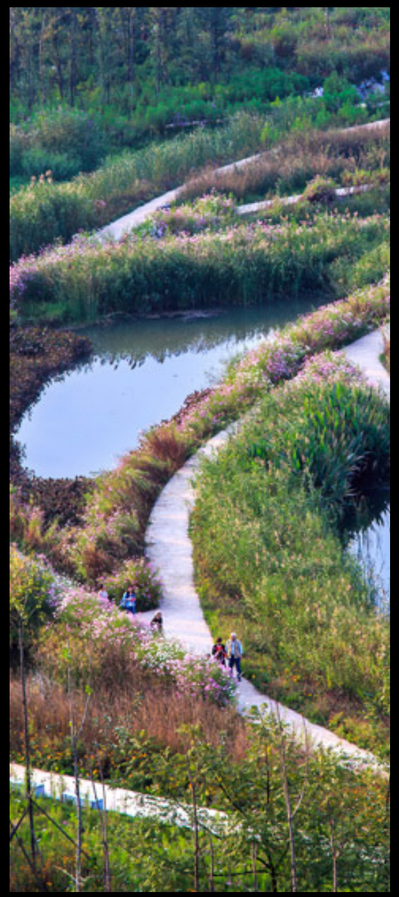
In the future there will be different kinds of urban environments, some will be interacting directly with the natural environment, and others are protected by it. What is true for all of them is that they are very closely connected with nature, creating a new environment in symbiosis.



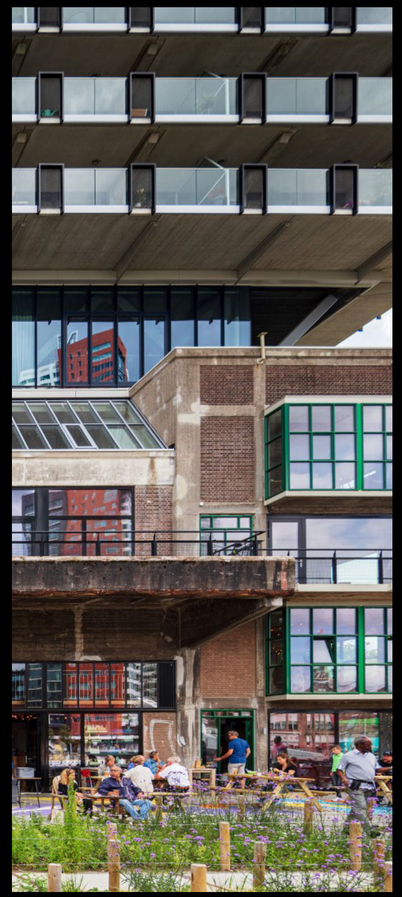


37 | Zandmotor at the Dutch coast (Rijkswaterstaat, 2021)

38 | Estuarin landscape (van Eden, 2021)



39 | Wetland (Xing & Yu, 2015)



40 | Densifiying in existing fabric (Archmospheres, n.d.)

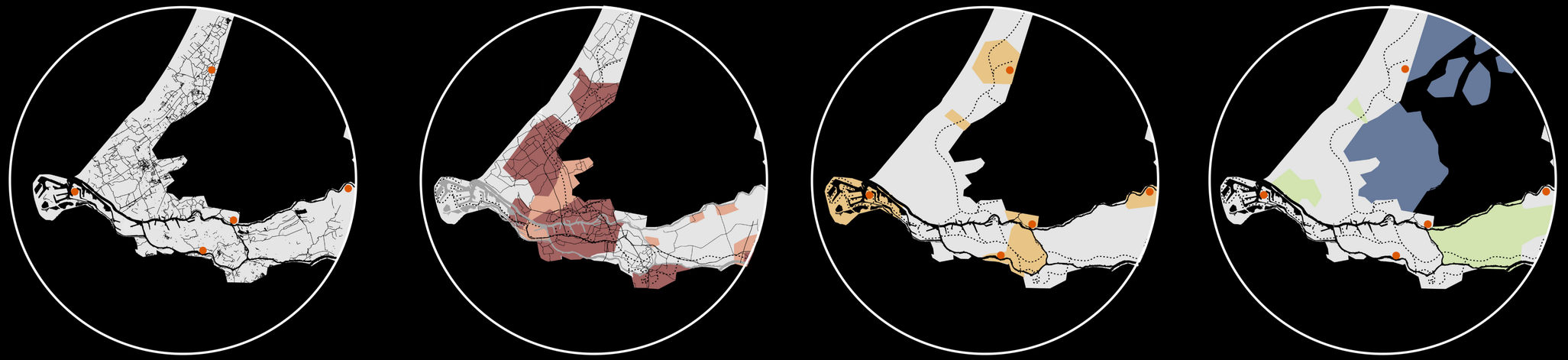
41 | Living in the water (Ten Voorde, 2018)

42 | Living on the water (Rubin, 2022)

2.2 the patchwork
spatial elements

To explore the spatial potentials of the area a patchwork was created. The spatial elements that were used to compose this patchwork can be divided into four categories: the water elements, the urban forms, industries and agri-/aquaculture.

The water elements are namely the main canals, rivers and waterways, that were kept as they were with the addition of new harbours. The urban forms are the main urban areas, or cities that were kept, the potential urban areas for densification, the motorways, primary and secondary roads, and railways. The industries are the main industrial areas and need infrastructures such as ports, railways and canals. Finally, the agri-/aquaculture category consists of the areas selected for agricultural or aquaculture production and needed infrastructures such as railways and canals.



43-46 | Diagrams explaining the spatial elements
water elements, urban forms, industries, agri- and aquaculture

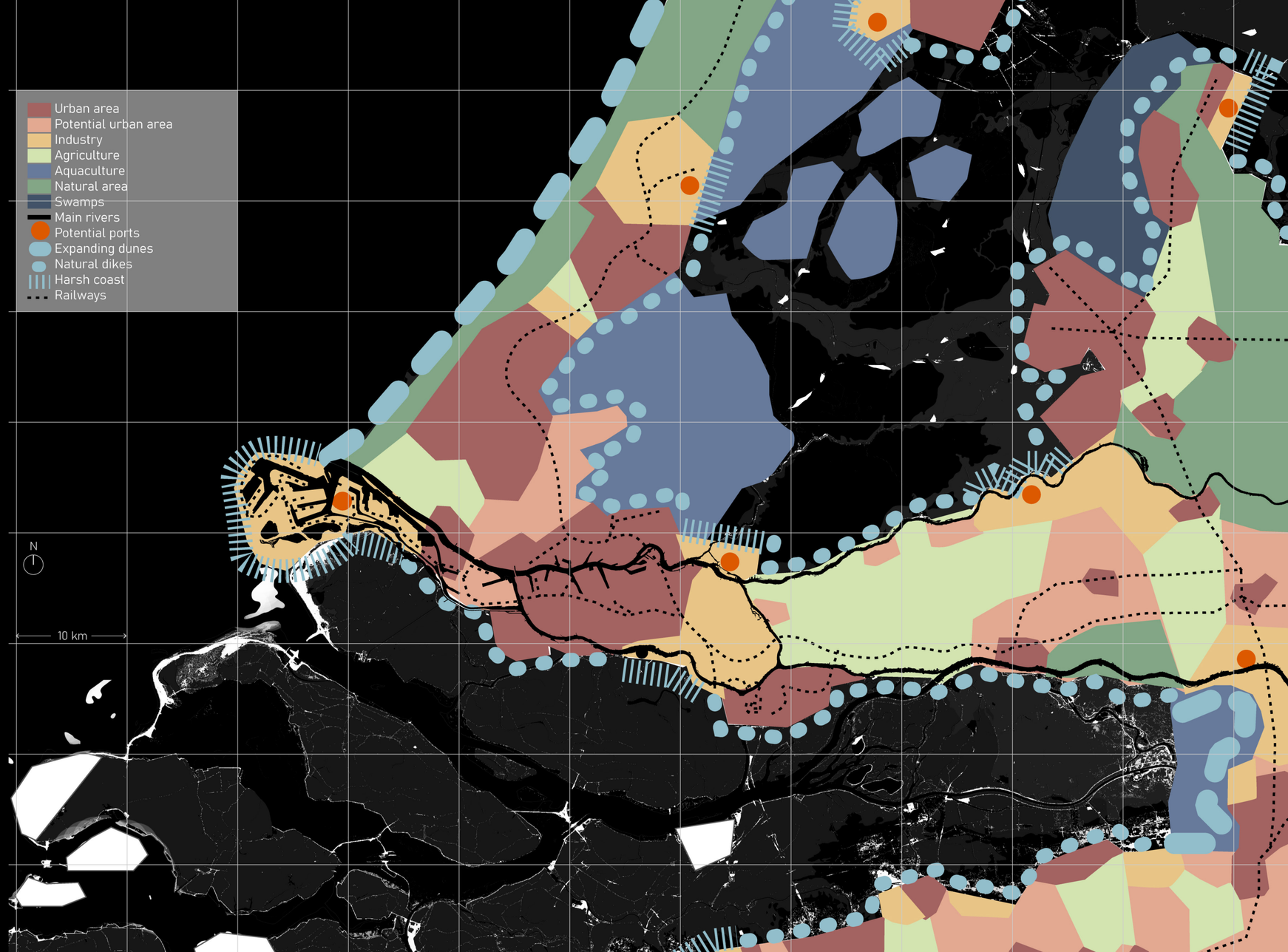
patchwork

The patchwork is composed of the different spatial elements defined in the previous pages and organised in clusters. Each cluster was created using an existing urban area as the starting point and then connecting it to agriculture, nature, industries and potential urban areas for expansion. The clusters are connected by a high-speed mobility system, strengthening the relationship between each cluster and allowing relationships between cities that did not exist before. To further promote the connection between the clusters that are separated by the water and facilitate the national and transnational flow of materials and people, new potential ports were positioned strategically close to the industrial areas.

This spatial organisation promotes circularity since the production, distribution, selling and consumption centres are close to each other and optimised to be easily connected. In that way, each cluster is created to be self-sufficient and able to produce circularly.

The position of each patch was carefully thought to follow its current land use and natural conditions, such as soil type and height. In areas where the soil type was not favourable for densification, for example, the land was used for agriculture, while where the height was too below sea level aquaculture ponds were thought to be positioned. Areas that already have a strong infrastructure connected to a bigger city are reserved for future densification.

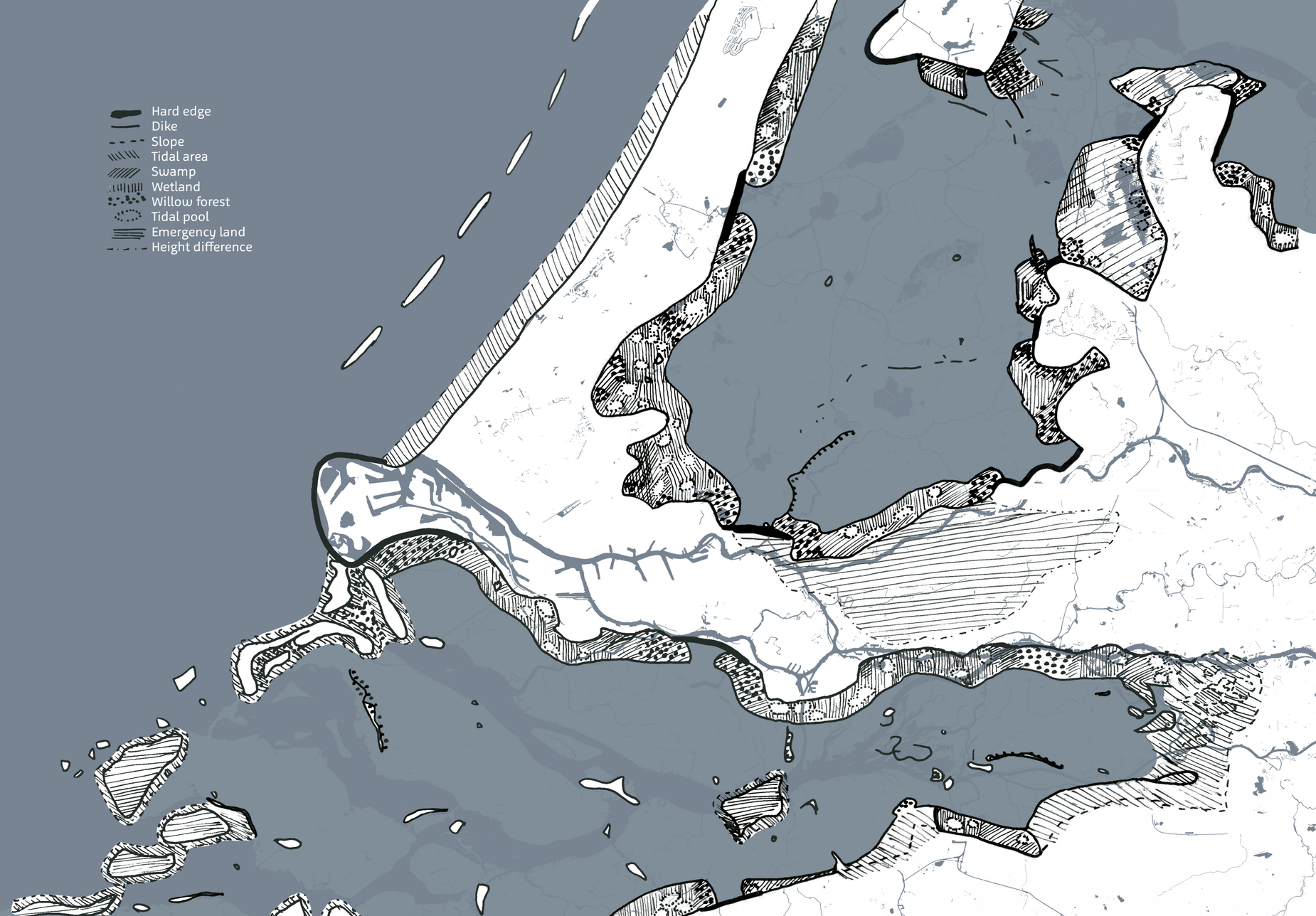
The transition between water and land was also studied and followed the natural conditions and landscape of the different areas. In the coastal areas, the growth of dunes will be promoted, while in the harbour areas, a harsh coast will appear. A natural double dike system will be implemented along with the other parts of the project area. The relationship between water and land was further explored on a coastal map.



between water and land

Water and land literally shape this project, but what does the transition zone, from now buffer zone, look like? The buffer is created by the double dike system that is used to protect the remaining land, and it refers to a water buffer where the water can expand freely during the different tides. The mapping of the functions here depends on, for example, whether there is a city or a harbour at the coast. A harbour would need a harsh coastline with deep enough water for the boats. The cities, however, are linked to new recreational areas like wetlands and new willow forests. These willow forests have also been implemented around the harbours, to break down the waves.

During flow, the buffer zone can be filled with water, but when the water retreats during ebb, there will remain some small ponds where aquaculture can take place.



identity potential of spatial areas

The land components that make up the patchwork – urban, potentially urban, agriculture, industrial and natural – are spread over the preserved areas. Every bigger urban centre is in direct proximity to the other component. In this way, there are several clusters spread over the region that all have their main spatial components. This decentralised approach allows them to produce, process and distribute within their zone. The clusters are very well connected by rail and waterways. This way they may be independent in their production chain but they can trade nationally and globally. Furthermore, it allows them to have their own speciality and identity within the bigger region.

Nature's closest – Leiden
The cluster around the city of Leiden lies between the coast and the new water area. Its proximity to large nature areas and the rich history of the place make up the city's identity as a cultural and recreational centre.

Knowledge hub – The Hague and Delft
The area around The Hague also includes Delft. With their big Universities, this area is focusing on research and education. Especially the subjects of water and agriculture will be explored here.

Innovation centre – Rotterdam and Dordrecht
Driven by the port of Rotterdam the cluster is the central spot in the region for innovation and experimentation. Because of its big agricultural area, food is one of its main interests.

Scattered collective – Gorinchem, Leerdam, Geldermalsen, Culemborg, Vianen
The previously small towns are growing fast. Because of their multiple sub-centres, they are investigating networked government and polycentricity. They are working together to form a collective whole and establish a sharing community. Communal living concepts, worshipping the commons and goods exchanges are their main focus.

Connector – Utrecht
The area of Utrecht is at the core of distribution. With its location between the local shipping routes and the transnational train tracks, it is situated perfectly to strengthen the region's connectivity to other European countries.

Waterscapes – Den Bosch
Because of its new contact with the ocean, Den Bosch turns into a water city. Here people and water live in symbiosis, and new innovative forms of living are being explored.

2.3 port network and identities
national port network and identity

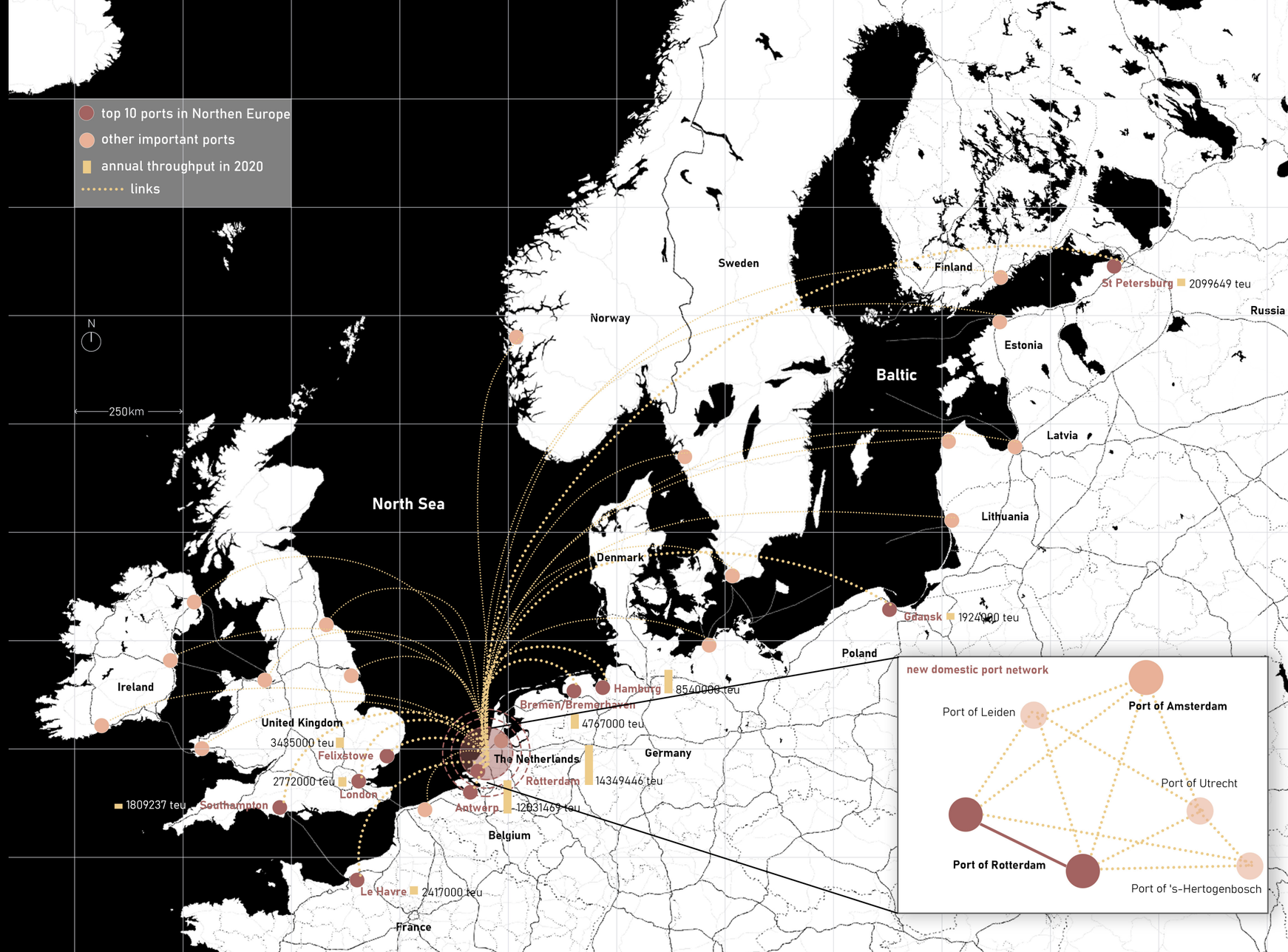
According to the previous analysis, with a sea-level rise of three metres, the current area of the port of Rotterdam will be almost the last safe area in the entire province of South Holland. Forced by economic, social and cultural needs, some major areas such as Leiden will be protected, but there are still large areas that will be flooded. This means that in the future the densification of ports will be an important part of urbanisation and the reliance on water transport will increase significantly. Also, the floating ports will become a new trend and construction hotspot.

A new network of domestic ports will be created. About the identity of the ports, in addition to the ports of Rotterdam and Amsterdam continuing to play an important role in global trade, the port of Rotterdam will focus on innovation and the interaction of actors involved in the new economy. The ports of Leiden and Utrecht, with their newly developed geographical advantages, will play a huge role in internal transport. The former will be a cultural and recreational centre and the latter, due to its proximity to agricultural and aquaponics areas, will become a new centre for food distribution. And the infrastructure network will lead to different transport links between the ports.

transnational port network

According to international goods flows to and from the Netherlands (CBS, 2019), more than half of all goods enter and leave the country by maritime transport and inland shipping. With the context of rising sea levels, water transport will increasingly become an important mode of transport for participation in international trade. And based on a regional view, among the top 10 trading partners of the Netherlands (CBS, 2020), Germany, Belgium, the United Kingdom, France, and Sweden are the main destinations for both domestic exports and re-exports. The conversion and upgrading of Dutch ports will certainly have an important impact on the countries in the region.

As a result of changes in the domestic port network and the creation of new central ports and the transfer of different functions, the port of Rotterdam and the port of Den Bosch will dominate the flow of knowledge about a water-based economy and the flow of new economic products towards other countries. Due to its long experience and knowledge of living with water, in the future, the Netherlands has great potential to become an innovation hub for water-based socio-economic and cultural transformation.

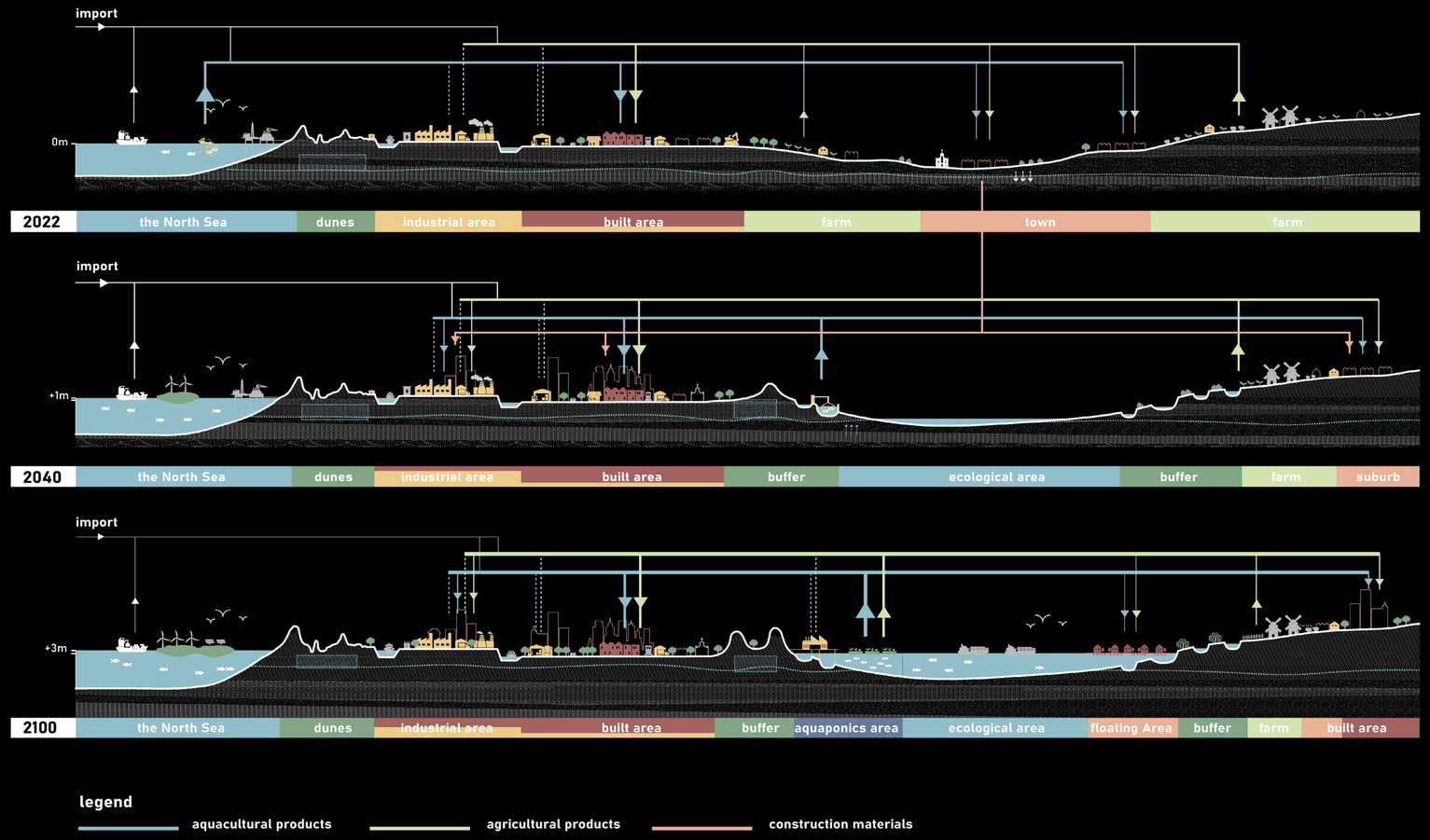


systemic landscape sections

As sea levels continue to rise, urbanisation will shift towards preserved urban areas and port areas to provide more housing for people who need to move away due to flooding as well as additional people. It will also be a great opportunity to promote social justice while promoting mixed living as well as mixed living and working.

The dramatic change in the landscape will create new ecological zones and support an important production link in the circularity of the new food industry - aquaponics. The additional internal water area will also be used for vital internal water transport and to support new floating ports and floating communities. The new buffer zone will also be involved in the process of food production and temporary storage, as well as acting as a protective structure and providing a new recreational area for people.

About the change of flows, traditional fishing farms, which pollute the sea, will be eliminated, and aquaculture and agriculture will be combined into a new circular aquaponics system, supported by research institutes with advanced technology and knowledge. New environmentally friendly materials such as seaweed will be used for packaging, and organic waste from the food industry and residual heat from factories will be recycled to produce new clean energy. Building and infrastructure materials from the flooded areas will be recycled and reused to participate in densification. Changes in the landscape will affect changes in domestic industries, which will also affect the level of dependence on global trade, and ultimately more local production and consumption will occur in 2100.



52 | Systemic landscape section

2.4 societal shift
relocating people

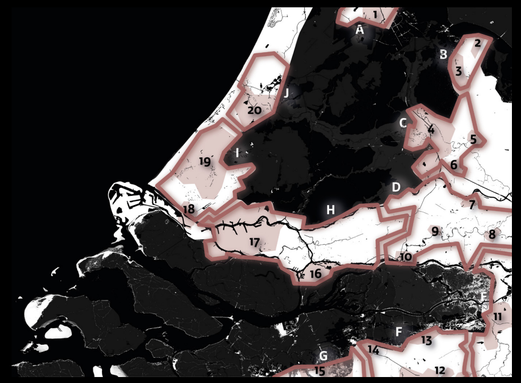
In the previous part, we have seen that a majority of the province will be flooded. This will not only have spatial material-based consequences but also social, as whole societies will need to be relocated. It is important to investigate who these people are and what their living conditions are. Doing this thoroughly will have great societal, economic, and political benefits. One of the main reasons to prepare for flooding is the ability to save the society and economy. It is therefore important to research the current society. In this part, society will be investigated. In the next chapter, the economic losses and consequences are discussed.

3,6 million people are living in South-Holland, a fifth of the Dutch population. By 2100 a population of 4,6 million people is predicted (CBS, 2019). With the new shaped land, this will mean that 2,6 million people currently living in South-Holland can stay (their cities will not be flooded), 1 million people who are living in South-Holland at the moment will have to move since they will be flooded and 0,9 million people will be added to this population somewhere on the safe land. This will happen due to newborn residents and migration. The UN-Habitat published in 2022, that a good livable city would have a density of 15000 residents/ km². The UN-Habitat is an organisation of the United Nations to promote urbanisation as a positive transformative force for people and communities (UN-Habitat, 2022). With this density we would need 307km² to locate everybody. However, the first calculations based on the patchwork, show that the previous shown assigned urban area could be 5.672km². This would mean that 85 million people would fit into the new South Holland. Nevertheless, a density of 15.000 residents/ km² is not typical for the Netherlands, since Den Hague is the densest city in the Netherlands with a density of 6.600 residents/ km² (Rijksoverheid, 2020).

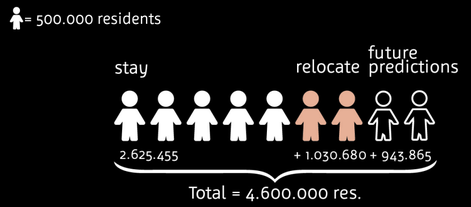
Based on the map shown in the chapter *identity potential of spatial areas*, a new more detailed calculation is made. This calculation, as shown in the appendix, shows where the relocated residents will go to. This is based on the sizes of the new cities in proportion to the total amount of square kilometres of urban areas. Most people will move to Utrecht (4) (14,37% of the residents that have to be relocated), Rotterdam (17) (21,86%) and Den Hague (19) (16,46%). For more detailed information about how many people have to move to which city, please have a look at the appendix. The decision not to follow the UN-Habitats density is based on the fact that this does not fit into the identity of the Dutch cities, as well as a less high density leaves enough space for the future for the cities to expand. However, while talking about 'relocating residents', it is important to notice that they will not be asigned to a random or the closed by city. The residents will have the possibility to decide for themselves where they want to move to. The above calculations is an attempt make the potential numbers per location more tangible.

Utrecht, Den Hague and Rotterdam are part of the Randstad region. The Randstad is an agglomeration of cities that shape a ring around what is called the Green Heart. Following predictions of the CBS (2019), in 2100 there will be living 4,6 million people in the province. One million people will have to move, as their city will be dismantled and built up somewhere in a safe area. To get an image of the people living there, now will follow a comparison using two COROP-areas.

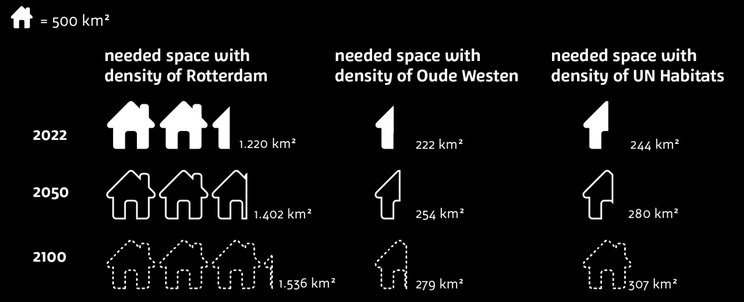
53 | Grafic showing the km² of urbanised area



54 | Possible distribution of relocated inhabitants according to km² of urbanised area in the cluster



55 | Movement of residents in South Holland

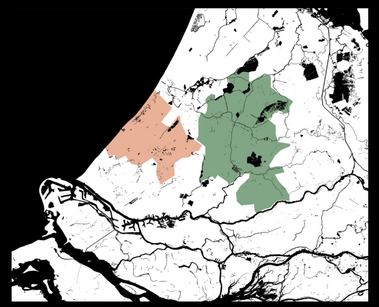


56 | Grafic showing the km² of urbanised area according to different densities

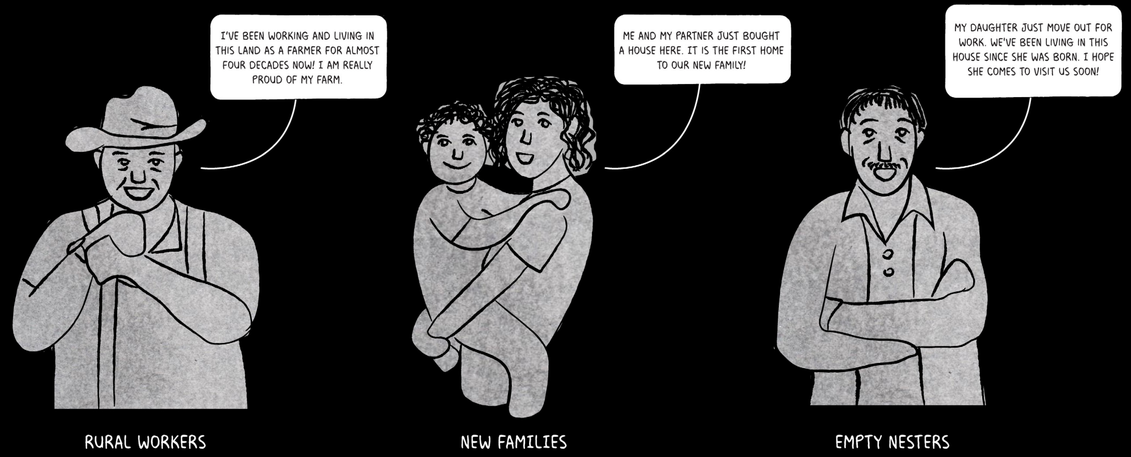
57 | Personas for the two areas analysed

COROP stands for *Coördinatiecommissie Regionaal Onderzoeksprogramma* (Coordination Commission Regional Research Programme) and iclude regional areas that follow a so-called nodal classification and are used for analytical purposes (CBS, 2011). Every COROP area has a central core, usually a city, and a surrounding area, always consisting of one or more municipalities.

For this research, The Hague agglomerate and East-South-Holland are being compared. This is because, for South Holland, these areas give a good representation of the extreme difference between the city and the rural area. What generally stands out is that the Green Heart, which forms the East-South-Holland region, is a region that is growing, but there are not a lot of people moving in or out of the region. Not from within the Netherlands, but also not from outside of the country. This is visible in the migration background; more than half of the people in The Hague have a migration background, whereas in the Green Heart, less than 20%. For more detailed numbers, see the appendix.



58 | Two COROP areas for comparison (orange: The Hague agglomeration, green: East-South-Holland). Source: CBS, modified by the authors.



59 | Personas for the Green Heart more in detail

The growing aspect of the Green Heart makes sense when looking at other data. For example, there are a lot of young families living here (children and middle-aged people), whereas in The Hague it is mostly people between 25 and 45. There are a lot of married people, above the Dutch percentage of 45%. A lot is being built in the Green Heart. There is a growth in the housing stock, mostly privately owned. The value of a house has more than tripled in the last 20 years. In The Hague, more than half of the houses are rented, whereas in the Green Heart almost 65% are privately owned.

In The Hague, there are more people with a migration background and one-person households than the average in the Netherlands. The average income is around the average in the Netherlands. In the Green Heart, on the other hand, the average income is higher than the national average. For a detailed data overview, see the appendix.

When concluding the data that has been researched, a few personas show up. In The Hague, there is one person with a migration background, renting a house, non-married, with a job in non-commercial services. In the Green Heart, there is a family with parents having a job in energy and manufacturing, with their own house. It is important to remember that these are extreme generalisations. It is good to combine this research with other methods to get a better picture and to have a participation program.

towards a new lifestyle

Two movements are happening at the same time concerning the urbanised area. On one hand, a million people will need to be relocated to safe parts of the region. On the other hand, there already is a huge demand for housing because of a housing shortage and population growth in the Netherlands. Together this demands huge densification of urbanised areas in the region. Referring to the values this project aims for, it is extremely important to do this in an adaptive, regenerative, sensitive, visionary but especially inclusive way.

They promote a new strategy of sustainable neighbourhood planning. The key features they mention are a vibrant street life, walkability, and affordability. With these three features, economic efficiency, socially equal, and sustainable cities are achieved. Vibrant street life is good for the economy but also satisfies spiritual needs and creates safety. Walkability brings people to public spaces, reduces congestion, and boosts the economy. High density in cities will help achieve this, as there will be a natural demand for more services. Mixed land-use and social mix also boost proximity. Affordability brings equality to the city. This is easier when functions are mixed; everyone will share the same benefits and burdens.

They recommend doing this using five principles:

- Efficient street network
- High density
- Mixed land-use
- Social mix
- Limited land-use specialisation.

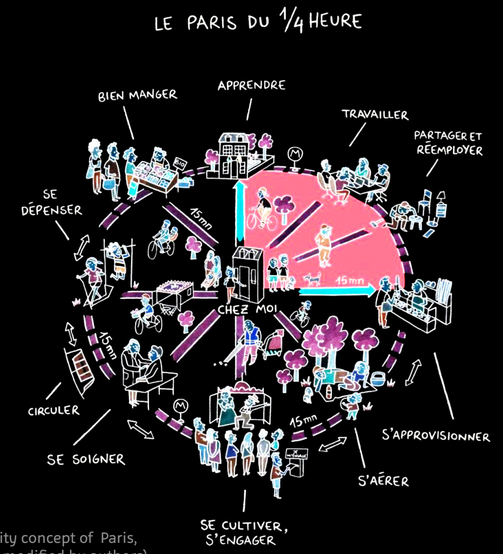
These five principles will lead to compact, integrated and connected cities. The new urbanised area will have the benefits of a small town such as proximity, walkability, and a vibrant street life. This makes it easier for the people that need to be relocated because they are already used to this lifestyle. People will be even better connected to a larger mobility system that brings them to other clusters of neighbourhoods. But quoting the UN-Habitat, “besides good planning and design decisions, the application of these principles also require supporting legal frameworks, an analysis of the local society and economy, appropriate infrastructure technology and capacity, and the institutional capacity to enforce decisions”. For this, see the strategy chapter. The concept of cities with high proximity is an ongoing trend in spatial planning, which was boosted by the COVID-19 pandemic. People realised the space close to them. Paris is an example of a city where the 15 min city is a concept that is openly received and implemented as a design feature.

An important critique to keep in mind is that equal proximity is not the same as equal accessibility. Spatial planners and policymakers should keep being aware of inequality in cities and be ready to adapt to new situations.

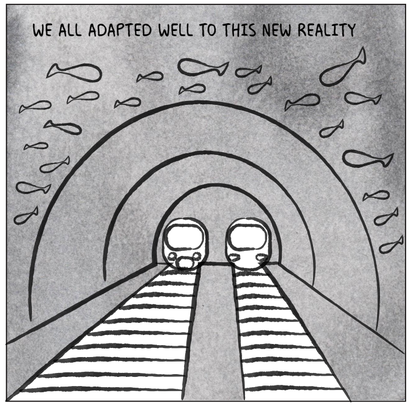
mobility as a spatial justice tool

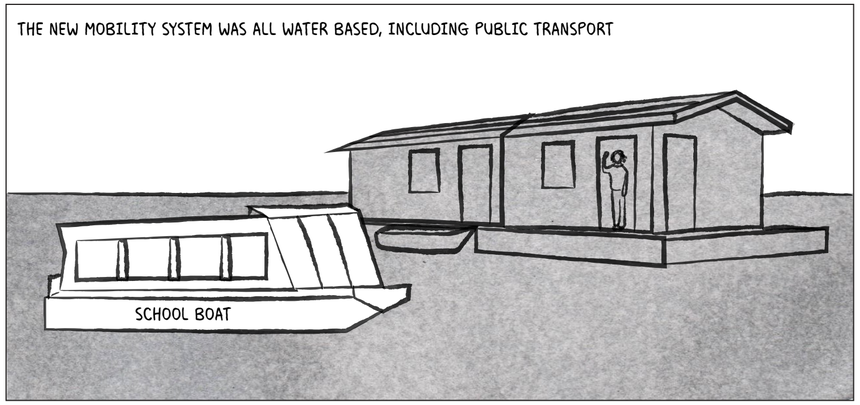
A sufficient mobility network is key for well-working cities. In the previous paragraph, the small-scaled neighbourhoods were stated as a base. It is important to connect the different neighbourhoods using an innovative system, otherwise, there is still a high dependency on private cars when getting from one cluster to another, excluding some parts of society. Proximity is one of the most important features of a just city, giving everyone the same accessibility and thus opportunities for education, public space, and other basic needs. Therefore, a new mobility system is designed, overtaking the car system. An important rule was to never lose time on what it takes now to get from a certain city to another. To read more about the new mobility system, see the first strategic project.

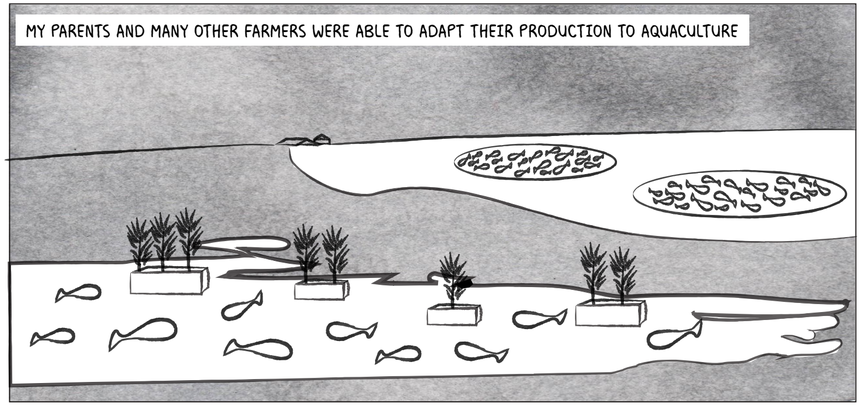
Besides making the region accessible to everyone, a new mobility system is also a tool for the cultural shift that will need to take place. People will naturally see their current train system change to a faster and more efficient one, eventually making them independent from private cars. Then, the metro transport within clusters will develop, making every new space already accessible. By making public transport free, the shift from private automobiles to public transport is made even more attractive, giving everyone the same accessibility.

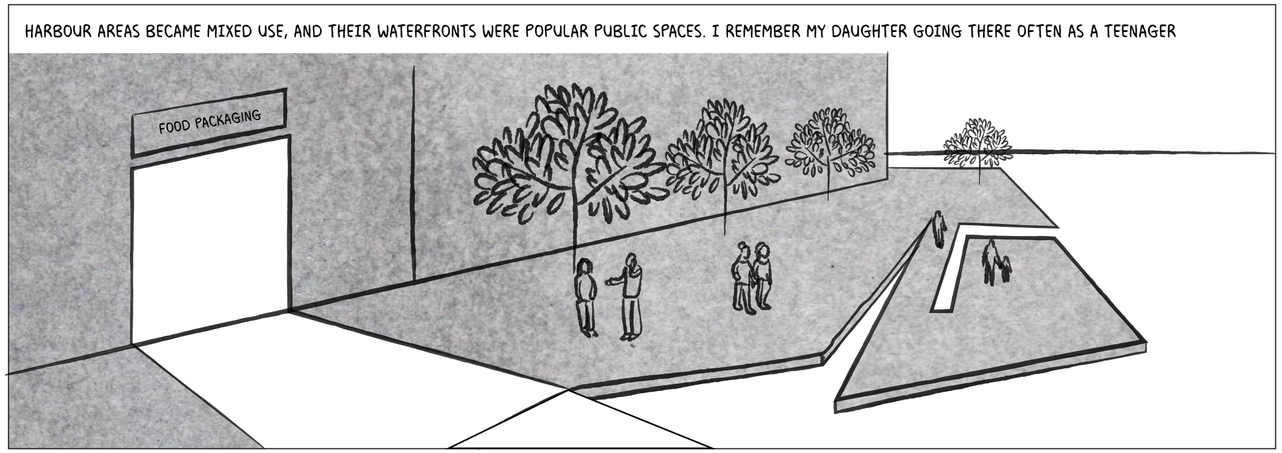


60 | 15 minutes city concept of Paris, (Kurz et al., 2021, modified by authors)









03 a circular economy

“What should economies be aimed at? For over half a century, the goal has been economic growth – but while the global economy has quadrupled in size since the 1970s, human deprivation persists, environmental degradation is deepening, and inequality is at the heart of it all. It’s clear that we need richer concepts and measures of what our economies should be aimed at.”
(Kate Raworth, 9th January, 2013)

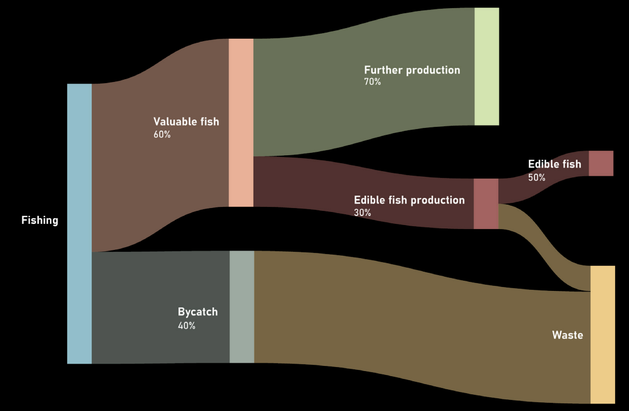
3.1 water based food industry
the truth about fish industry

With the rising water, we must reorganise the land that is left. In the patchwork, it is visible that parts of agriculture had to give space for the densifying of cities. Therefore, the conclusion was made that there will be a shift in diet towards a water-based diet, considering that most of the land-farm animals will not remain as an important food supply as it is now. Additionally, the loss in the agricultural area must be replaced by aquaponics (see next chapter) since the need for fruits and vegetables will remain. This will cause an immense increase in fish consumption per capita. Whereas in 1961 the consumption was 9.0 kg per person, it increased to 20.2 kg in 2015 and 20,5 kg in 2017 (Food and Agriculture Organization of the United Nations, 2018). Between 1954 and 2014 fisheries and aquaculture production more than eight folded. Whereas the world population increased by 1,6% and the production of meat from land animals by 2,8%, the fish industry grew by 3,2% in 2016 (Coppola et al., 2021). These numbers lead to the fact that we are fishing more than the ocean can regenerate, we are overfishing and exploiting the ocean (WWF, 2021). This is not only bad for the natural habitat of thousands of species, but it also has big effects on global warming. According to Seaspiracy (Tabrizi, 2021), the ocean can absorb twenty times more carbon dioxide than the rainforest. More than 90% of the CO_2 is stored by the ocean due to the fish that breathe air out underwater and thereby store the CO_2 that came along (Tabrizi, 2021).

Research showed that a big part of the waste created in the fish production chain contains the parts of edible fish that are not used anymore and will be thrown away. These parts (heads, bones, viscera, fins, muscle-trimmings, skin and scales) (Coppola et al., 2021) sum up to almost 50% (nearly 32 million tonnes) of the fish material that is condemned as waste. Additionally, “more than 70% of the total fish caught is subjected to further processing before being placed on the market” (Coppola et al., 2021).

Furthermore, fish waste also consists of undersized fish and bycatch, which are immediately disapproved for the human food industry. Approximately 40% of the world‘s annual marine catch per year is bycatch. In the US, the bycatch per year goes up to 20% of the total caught fish (Hirsh, 2020). Bycatch includes all the unwanted fish that is caught: undersized (fish that are simply too small) or unwanted (different species) fish, shellfish, crustaceans, and others (Living Foods B.V., n.d.). For fishers, bycatch is a waste since they are financially not interesting. Therefore, fishers used to throw this fish back into the sea, but often the fish were already dried out before they reached the water again. Hence, new European legislation was preserved in 1983: the Common Fisheries Policy (CFP). This policy prohibits the action of throwing the fish back into the sea and forcing the fishers to bring the bycatch to land. This led to big logistic problems on board and on in the distribution centres, as well as economic problems for the fishers since the bycatch has barely any value. However, the EU thought that this legislation was needed because they thought that fishers were not actively trying to filter the fish while the net is still in the water. This is due to the high prices of special, more selective, nets (Hanseeuw & Vanderperren, 2014).

However, this fish waste and the bycatch are still valuable products that can be processed into many other products as long as they stay in the cold chain (Living Foods B.V., n.d.). By using fish waste as a new raw material, products for healthcare (food supplements, proteins), animal food, beauty products (cosmetics, fish leather) (Vislijm, 2019) and even bioplastic can be produced (Visafval Als Verpakking, 2021). More than 70% of the total



62 | Sankey diagram of fish products

caught fish are immediately condemned for other purposes than for human food (Coppola et al., 2021). The closest big companies who, among others also in the Netherlands, collect wish waste to recycle are Lipromar and Bioceval, both in Germany. Lipromar is a circular company that uses fish waste that is still edible to produce fish oil and proteins. Everything they cannot use anymore is sent to Bioceval. Bioceval produces fishmeal for animal feed (Wallbrink Crossmedia, 2021). In the Netherlands, smaller companies like A. van de Groep & Zonen and Visser are growing quickly too.

Making the fish industry more circular can be done in several ways. In this design proposal, we shift the fishing industry from global fishing in the ocean to a local way of farming fish in fishponds. Thereby the fish can contribute to new aquaponics, a circular way of agriculture using water and fish as sources for nutrients, and the fish are kept close to the industry where they will be processed and their waste will be used as a new raw material for other products. Therefore, the circular economy loop will not only close but will also narrow down, leading to a new sustainable food production industry.

aquaculture

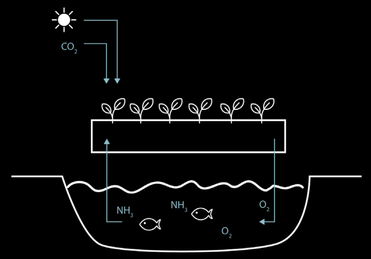
As mentioned in the last paragraph, fish can be used as a sustainable way of cultivating food. Besides reusing the waste, there are several other things that can be done with fish, making use of the existing lives of the fish.

Firstly, in aquaponics, the cultivation of plants and aquatic animals in a recirculating environment, fish are used as converters, while also retrieving clean water because of the plants (White, 2021). A basic explanation of how this works would be that waste created by the fish provides nutrients for plants, and plants clean the water for the fish. The fish excrement contains ammonia, which is a useful nutrient for plants. Together with sunlight and CO_2 from the air, the plants photosynthesise to form O_2, which can then be used by the fish (White, 2021).

Fishing is extremely polluting and destroying the biodiversity of the sea. Fish farms already form a more sustainable alternative. Being able to regulate everything results in no waste. Fish farms can be in large nets in the sea, in tanks on land or in water ponds (Piedrahita, 2003; Valdemarsen et al., 2012). These are all good alternatives for fishing. Using ponds is the most ecological way, as the

fish are in their most natural habitat. Planting water plants helps the fish stay alive (Stroming, 2017). For this, sunlight and wind directions must be kept in mind while designing.

Algae production can function as a renewable resource for biofuels. Algae grow in saltwater or brackish water. The vegetable oil can be used directly and has only water as a by-product when it is used as fuel (Biotechnology Innovation Organisation, n.d.).



63 | Aquaponics explained. Made by authors.

from agriculture to aquaculture

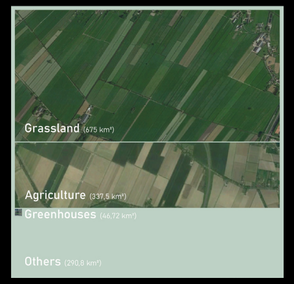
Once the dikes will be open a large part of the land that will be lost currently has an agricultural function. To better understand this type of economical production and to create the most suitable adaptation, a map of the different types of crops was created.

From this map, a simplified diagram illustrates the proportions between the main categories of crops. The diagram shows that of the 1350 kilometres square of land used for this type of economical production, almost half of it is used for grassland, while one quarter is used for agriculture, and the other quarter is the sum of other types of production and greenhouses.

A second map was then created illustrating the current productive land that will be flooded. In a new context where water is predominant, aquaculture will be used as an adaptation for agriculture and most of the crops that can be grown also in the water will be grown through aquaponics, a concept explained in the previous chapter.

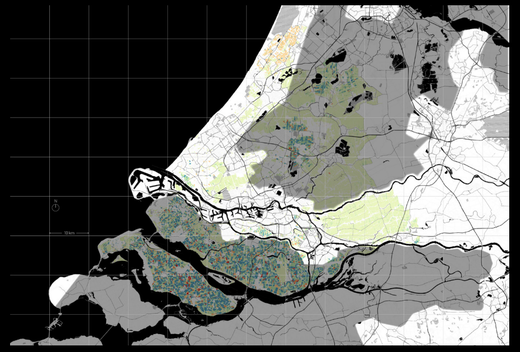
Inland agriculture will be used for the types of crops that cannot grow through aquaculture. In a reduced number, greenhouses, grassland, and other forms of cultivation will be used for specific types of crops.

A table (see appendix) was created with all the different types of crops that are currently cultivated in South Holland and the possibility to be adapted to aquaponics, both in sweetwater and saltwater. This knowledge was further used to create the new agri-/aquaculture land use map that will be explained in the new agri- and aquacultural production.

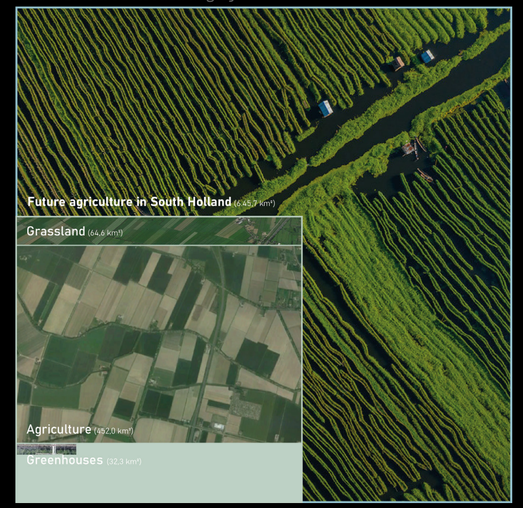


64 | simplified diagramm showing current agriculture in South Holland

65 | Map of different types of crops in South Holland



66 | Map showing the agricultural crops andthe area that will be flooded in grey



67 | Future change of proportions in agricultural production thowards a water based sector

3.2 new economy
more than circular production

For the new economy to thrive the natural conditions of the land and water were of utmost importance. Due to different landscape conditions, there are a variety of opportunities for agri- or aquacultural use. The holes in the landscape offer deep waters, peat landscapes are rich in nutrients, tidal areas work with changes in the water level, and the stages of sweet water coming from the rivers mixing with the saltwater of the ocean create multiple different conditions for a rich flora and fauna.

Next to the landscape conditions themselves the ports and industrial areas connected to them play a significant role. Because the ports are an entrance to the urban clusters, they are also the first place where food is being collected and then processed and distributed. The urban centres are the areas where the products can be bought and consumed.

Building the new economy based on what the estuarine conditions of the native landscape offer, is making the system more productive, circular and regenerative. It will not exploit the commons but work with nature. Combined in one system the economy and the ecosystem will help each other to thrive.

new agri- and aquacultural production

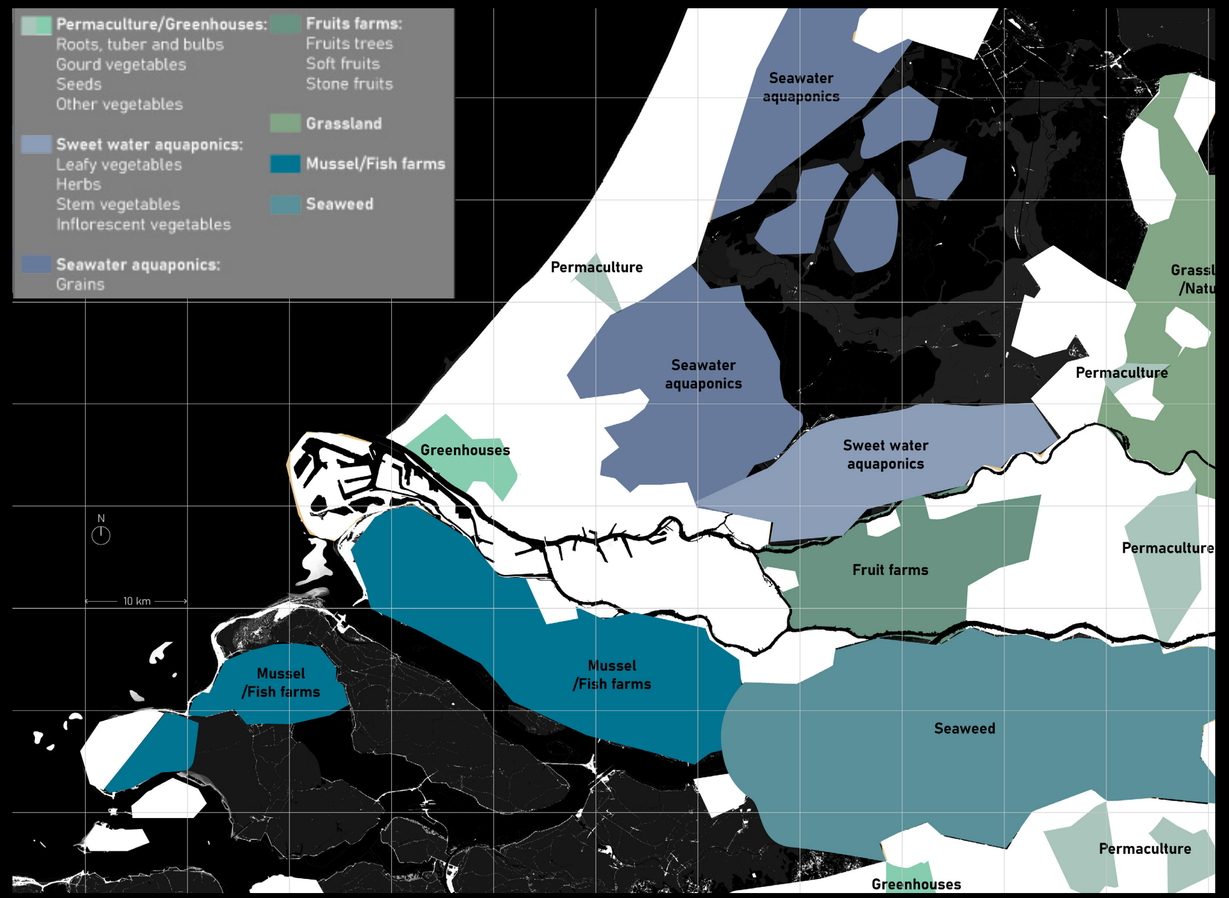
The new agriculture and aquaculture land uses were defined based on the most suitable adaptation for each type of crop. After mapping and categorising the current types of crops into stem vegetables, legumes, grains, soft fruits, inflorescent vegetables, leafy vegetables, flowers, fruit trees, stone fruits, grassland, herbs, seeds, roots, tuber and bulbs vegetables, and gourd vegetables, each one of this categories was carefully adapted to the new scenario.

Recent papers regarding aquaponics claim that certain types of crops can be adapted to saltwater aquaponics. Saltwater aquaponics, also known as marine aquaponics, is a combination of plant cultivation and fish rearing. The system is similar to standard aquaponics except that it uses saltwater instead of fresh water, which is most commonly used. This new approach is known to be even more circular than freshwater aquaponics because it allows for the cultivation of crops linked to coastal and marine fish production, reducing the pollution of fish farms for example. (Gunning, D., et al., 2016).

However not every type of crop can be adapted to marine aquaponics. From the most recent literature, it is believed that grains adapt better to saltwater. To mention an example, after selecting the most salt-tolerant strains, the University of California at Davis was able to grow barley irrigated with pure seawater and obtained half the normal yield per acre. (Vysotskaya, L., et al., 2010). Therefore in the new land use map, the current grain production in South Holland will be adapted to be cultivated in saltwater.

Other crops that are known to grow efficiently through aquaponics, such as leafy vegetables, stem vegetables, herbs, and inflorescent vegetables, were thought to be cultivated in freshwater aquaculture locations.

Inland cultivation will be left to those types of crops that cannot adapt to aquaponics or are not economically viable with the current technology, such as roots, tuber and bulbs vegetables, gourd vegetables, and seeds. These types of crops will be grown through permaculture or in greenhouses. Fruit trees, soft fruits, and stone fruits will be grown on fruit farms. Grassland will also be cultivated inland. Mussels and fish farms and seaweed will be produced mainly in the coastal areas and can be linked to aquaponics. The spaces where food production is cultivated are thought to be not only productive areas but also places of leisure, close to where the food is consumed. Due to the patchwork approach of clusters, these cultivation locations are also thought to be close to the next production phases, such as processing and packaging. A more detailed example of the circularity of the food production in the project, especially linked to marine aquaponics, can be found in one of the key projects.



69 | Map of the agri- and aquacultural landuse based on the suitability of the land for specific crops

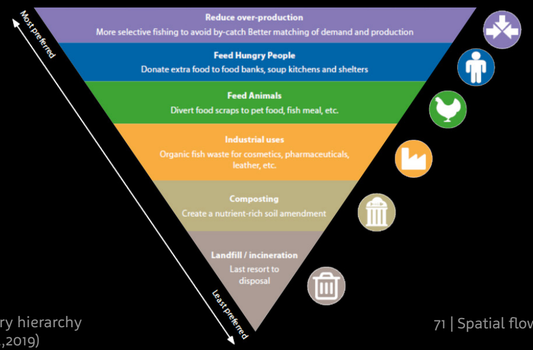
3.3 new economic flows
a circular water based food industry

After the current conditions and potential of the land have been analysed, the new productive spaces will be reorganised based on different natural or landscape conditions and can be divided into four main types: diversified crop farm, mussel/fish farm, aquaponics system and urban farm. The aquaponics system can be combined with seaweed production and fish scale treatment to produce new usable food packaging materials to replace existing plastic products. In addition to large-scale logistics distribution centres at ports, storage space and retail space can be combined within cities to form new retail warehouse models that are able to integrate online and offline shopping and handle the packing and distribution process at the same time. (Specific examples of practice can be found in the Shanghai Hema Fresh model.)

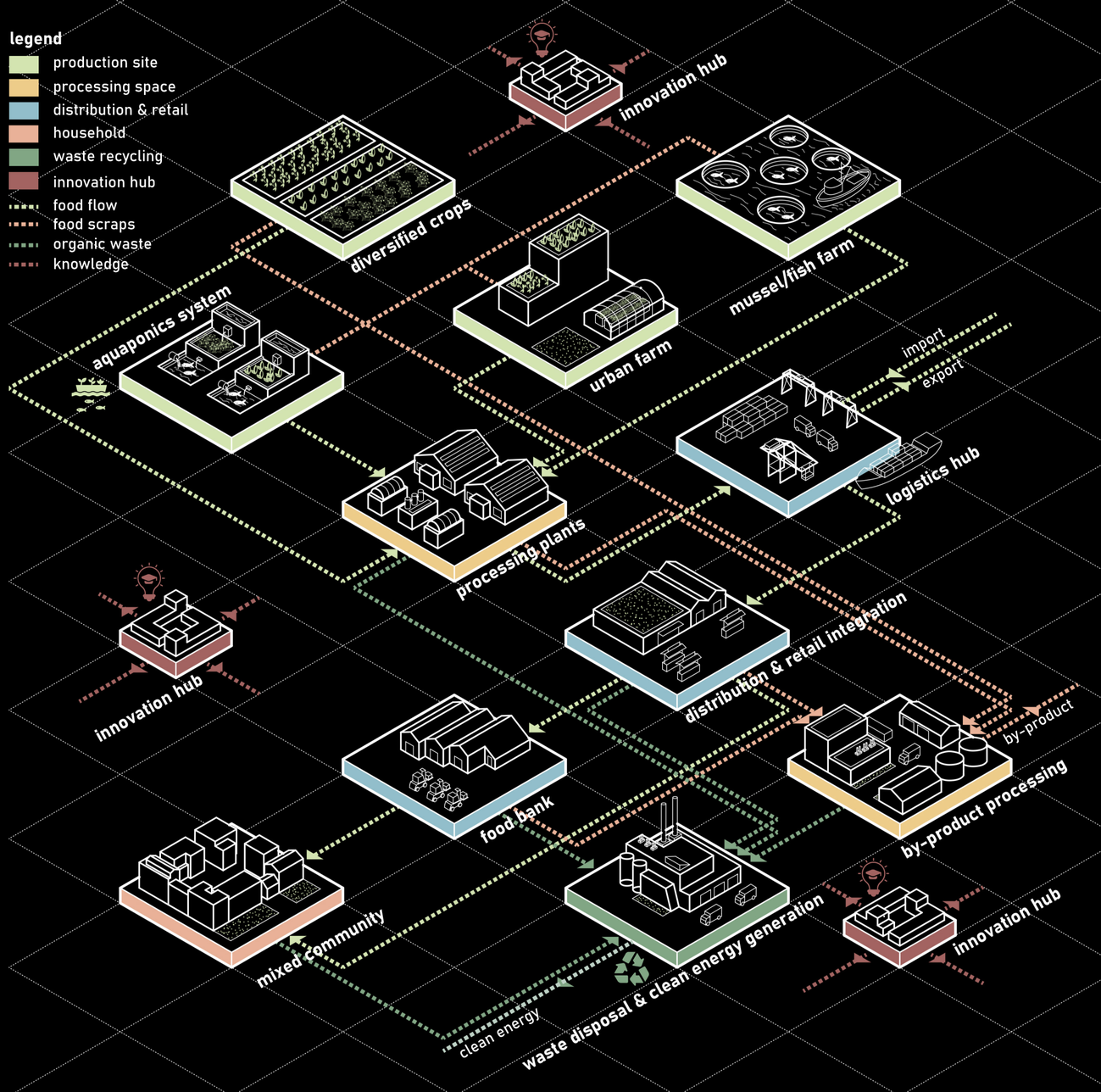
According to the 'Food Recovery Hierarchy', there are many ways to reduce food waste. Based on field research and the content of interviews with the heads of the Food Bank Rotterdam, "Food Bank Rotterdam is a non-profit foundation working together with the FEBA, collecting all available foodstuffs, temporarily storing fresh products and distributing food parcels to support the poorest people in the city region and neighbouring areas." This initiative is effective in reducing extra food waste and goes a long way in promoting social justice.

The recycling of organic waste will be an increasingly important part of the circular food industry. The port of Schiedam is already experimenting with the use of organic waste and residues to produce clean energy to replace natural gas for the neighbourhood's energy supply. Furthermore, food scraps from the production space, processing space, distribution and retail space can be recycled and reprocessed to produce pet feed, fish meal, organic fertiliser, soil amendment, etc., which can then be sold and utilised.

Throughout the whole circular process, research institutions and innovation hubs with different specialisms will be dispersed to enable the flow of knowledge and skills. For instance, those approaching aquaponics will research the effects of salty and sweet water on food product type, yield and quality.



70 | Food recovery hierarchy (Burch, et al.,2019)



71 | Spatial flow hart of food

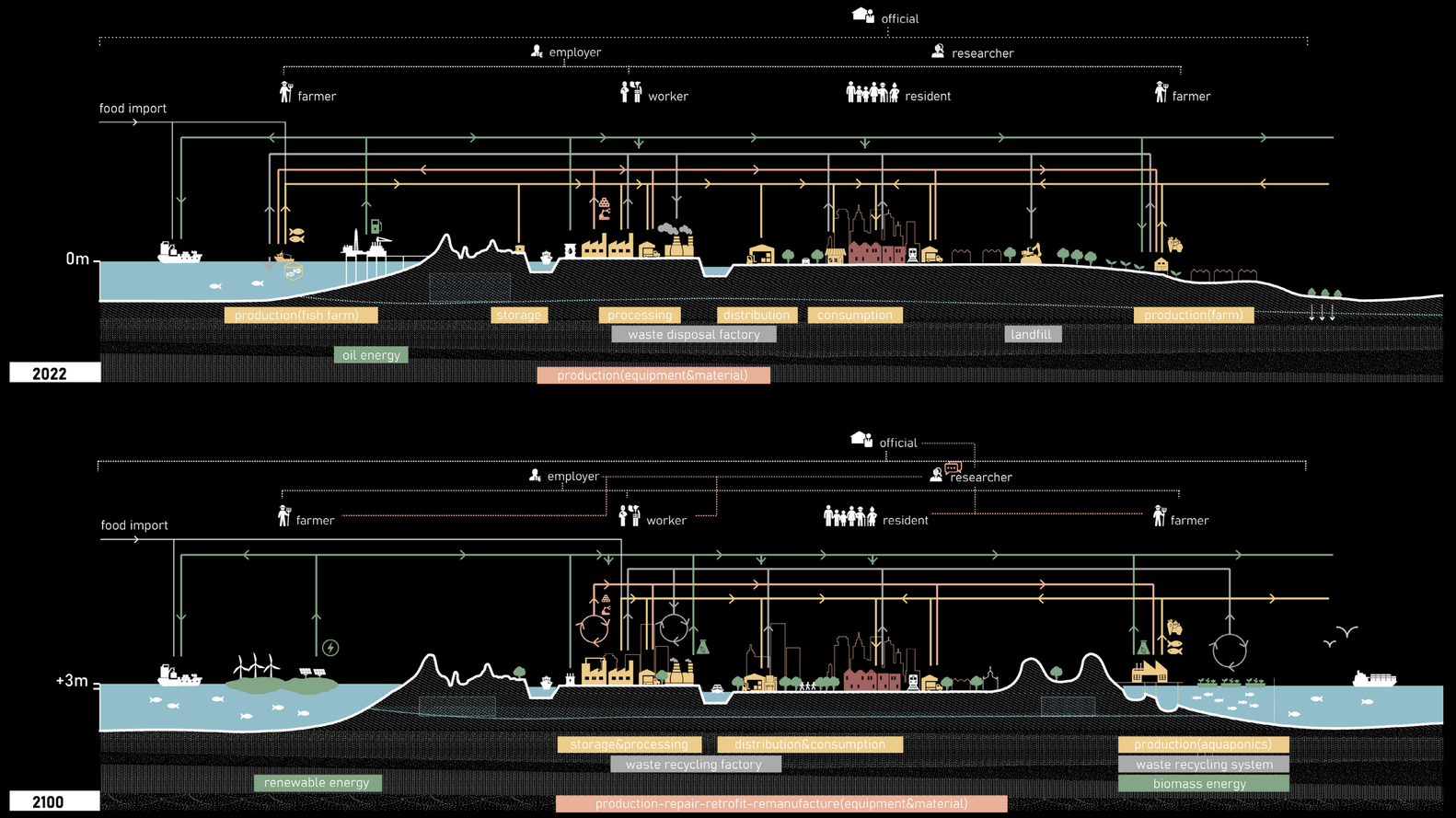
transition to circularity

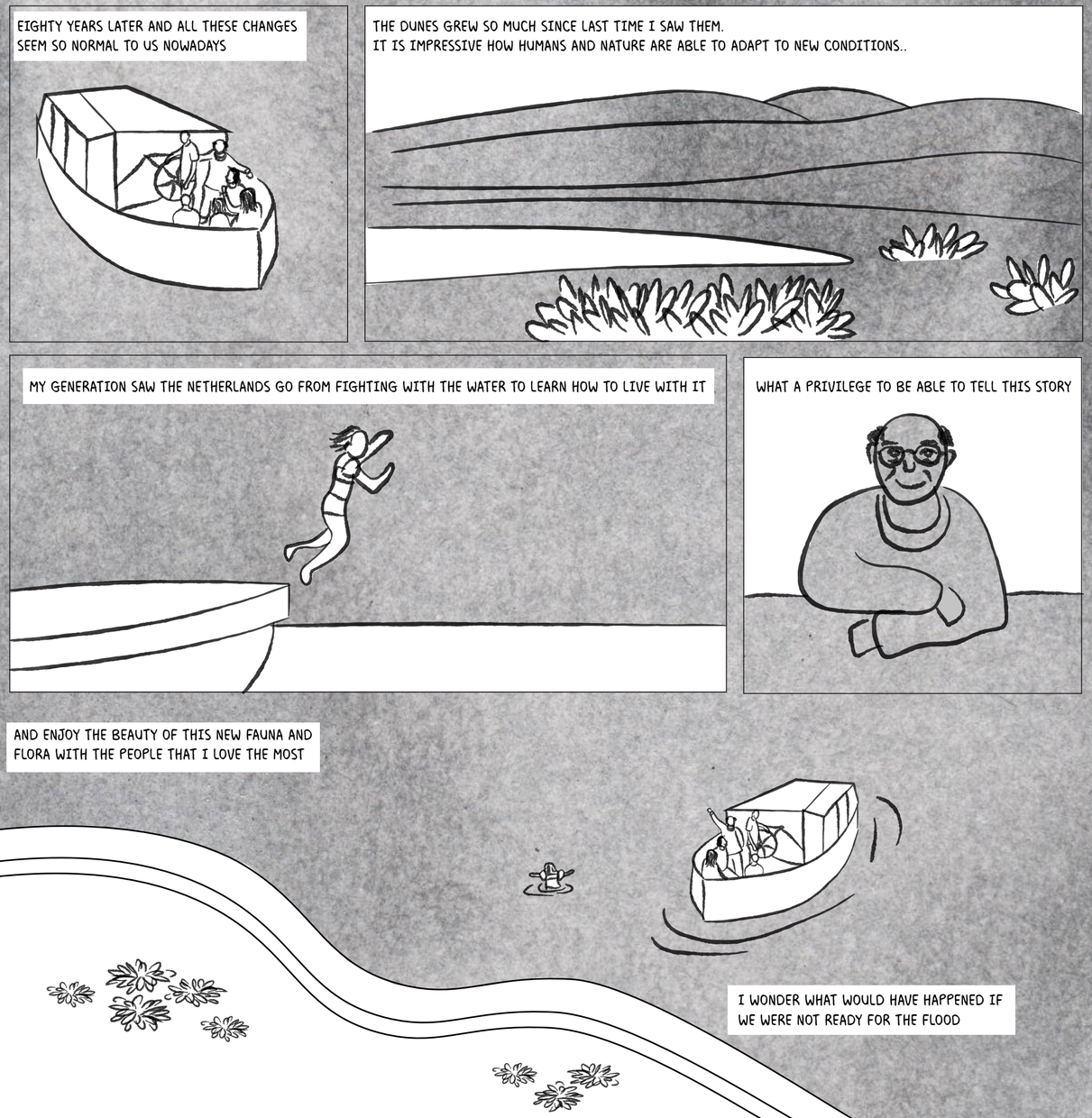
Fish farms that are polluting the marine environment will be gradually banned and the production sites for aquatic products moved to internal waters. Some links like storage, processing, and packaging can be merged instead of the current long chain with high emissions and food loss from transport. Then some smaller loops can be created: the aquaponics system combines aquaculture and agricultural production while allowing for self-cycling of waste and the production of sustainable packaging materials from seaweed; the storage, processing, and waste recycling processes take place in the port, where the waste and residual heat are collected for clean energy production; clean energy is also produced with renewable and algae resources from the sea and inland waters.

Furthermore, through the sharing model such as service and facility sharing, the production, repair, retrofit and remanufacturing processes of the relevant equipment and facilities are optimised and the product life is extended. At present, the involvement of the different stakeholders is relatively separate and the links between what concerns them and the measures they could take are not very clear. With urbanisation and urban densification, various types of education and innovation centres in cities, such as institutions close to natural areas that study the impact of salt and fresh water on production, or in ports that study the optimisation of production facilities, will emerge and link up with each other to form networks of knowledge flows. Farmers will learn more about new skills and knowledge that they can apply to their production, and practice will in turn drive innovation. Business employers and investors will learn more about technology trends to make more rational decisions on the allocation of capital. Policymakers will also be kept abreast of developments to ensure that policies are implementable.

This can serve as a link between the different actors and as a window for public participation. When education becomes a more important part of the circular economy, there will be more opportunities for different stakeholders to communicate with each other.

72 | Systemic section of circular food production industry





04 strategy

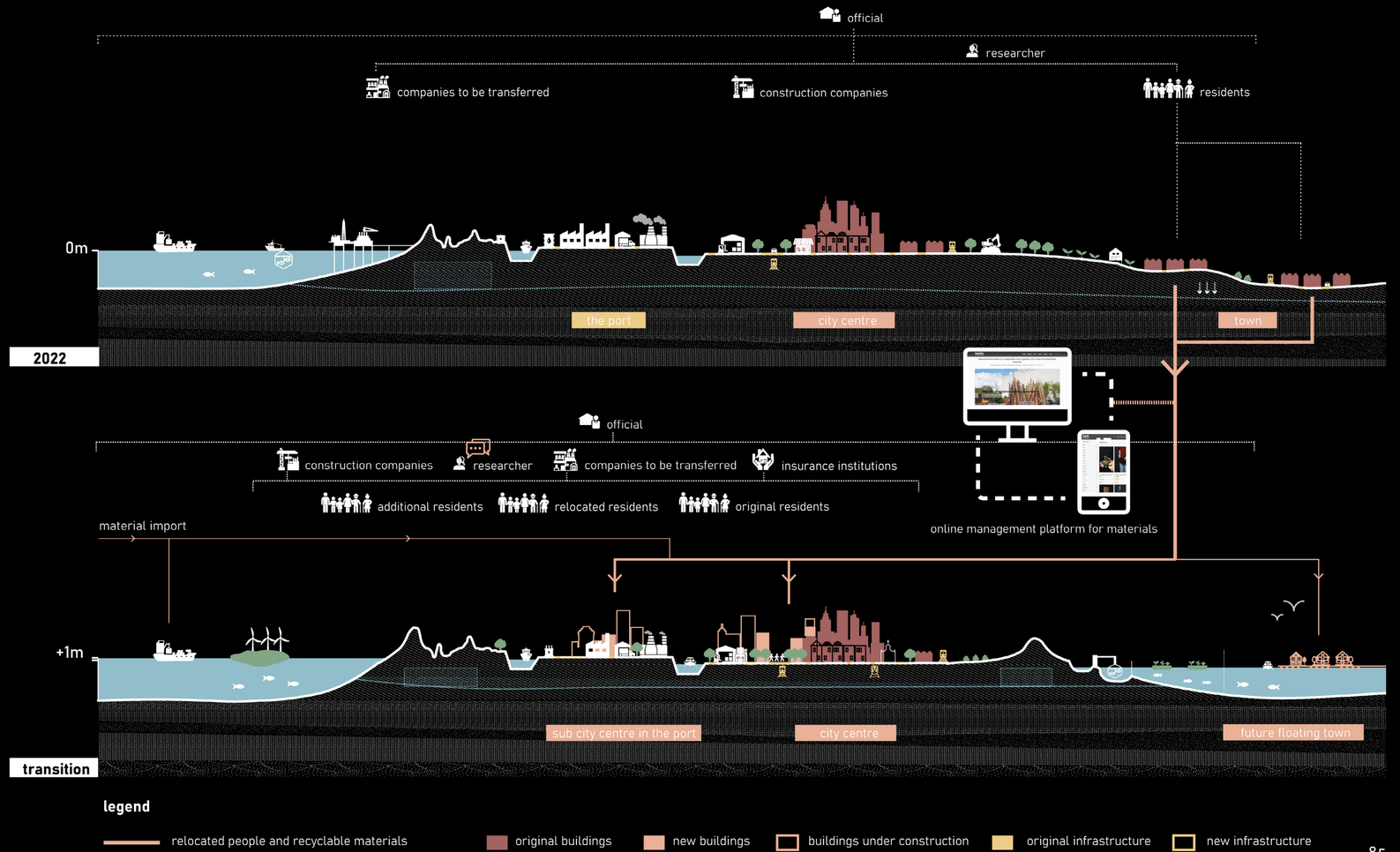
“I think this whole notion of equality being a commonwealth of us all and making us stronger as a group and stronger as individuals, is the thing that we’ve realized, and we are using. You have to actually take into consideration what people, who are minorities, have to say, because you get more clever decisions. [...] And it’s going to be frustrating, and we’re going to be angry sometimes, but nobody is going to take away the pleasure of doing it, because we’re doing it for ourselves, our kids, and we’re doing it for this country and for the world.”
Land shaped by women (13’30”, 2020)

4.1 circular material transition
circular resource mining

There is a long way to go between now and the achievement of the vision, and the transition between now and then is most important and gradual. Using circularity as an approach, during the transition period, people who are living in the flooded area will, first of all, be prepared for relocation, including liquidating their transferable assets, i.e. avoidable losses, and negotiating with the government and insurance agencies to come up with a compromise relocating plan and compensation and risk aversion measures that are acceptable to all parties. At the same time, urbanisation and densification will continue, as will the industrial transformation of the economy, which will attract people with new jobs and closer proximity to public services (education, health, etc.). This is where social justice can be progressively achieved in a circular process of transfer.

Materials from buildings and infrastructure that can be recycled and reused will also undergo a process of collection, storage, distribution, retrofit, remanufacturing, and reuse. Since in the future the areas that will be flooded in the plan will be returned to nature, it is also important to consider and research how to minimise the bad effects of human intervention on nature when it comes to relocation. The vast majority of recycled materials come from buildings and infrastructure, and new online platforms will be needed for the intelligent management, distribution, and trading of materials. Many research institutions, companies and funding authorities can work together to create a platform for sharing resources and information, while also giving the public real-time information on where various materials are going and how they are being reused. Taking Rotor, a cooperative design practice in Belgium that investigates the organisation of the material environment as an example, they said „the ‚Reuse Toolkit' is a set of documents with guidelines regarding different aspects of reusing building elements" and they also have a company that focuses on the reuse of building elements called Rotor Deconstruction (Rotor DC).

The temporary storage of the materials will be close to the place where the densification will be performed in the first phase according to the timeline. These materials will be used for future urbanisation and densification (in cities and ports) and new floating communities.



reducing flood loss

It is known that most of the economic values in the Netherlands are located in the lowest part of the country, and therefore in the areas that are most prone to flood. In these areas, failure of one of the elements in the flood defence system will most likely lead to the flooding of large parts of the dike ring area. A disaster in this part of the country would have severe consequences. In this chapter, we will talk about the economical consequences that major flooding could cause in South Holland.

When it comes to flooding on a large scale, the economical losses can be classified into two categories: direct damages, which are the ones that occur inside the flooded area, and indirect damages, which occur outside of the flooded area. Another distinction can be made between tangible damages that can be priced, and intangible damages for which no market prices exist, such as cultural losses for example. In table 1 an overview of the different types of damages caused by flooding can be found.

A wide range of economic modelling for flood damage had been published in the past few years. These models are usually based on empirical flood damage data from the past such as the catastrophic flood in 1953 in the Netherlands. A paper published in 2008 used stage-damage functions to estimate the direct damage in different types of land use, namely general land use (for example urban area), infrastructure (for example railroads), households (house types), companies (for example industry) and public utilities and facilities (for example pumping stations) (Jonkman, S., et al., 2008). These were used to estimate the maximum damage as a function of selected flood characteristics like water depth and flow velocity. The following equation published in the paper describes how the elements in the direct damage model are combined to estimate the total physical damages in a flooded area:

Category		Tangible damages	Intangible damages
Direct damages	Physical damage	Loss of capitals (residences, vegetation, cars, industry, infrastructure)	Fatalities, loss of ecosystems, loss of culture
	Interruption of business	Interruption of production (within the flooded area)	Social disruption, emotional damages
Indirect damages		Interruption of production (outside the flooded area)	Hindrances because of damages within the flooded area

75 | Different economic damages (adapted from Ranneft, M. W., 2020)

$$D = \sum_{i}^{m} \sum_{r}^{n} \alpha_i(h_r) D_{\max,i} n_{i,r},$$

76 | Equation used to calculate loss

Where:

$D_{max,i}$ = maximum damage amount for an object or land use category
i = damage or land use category
r = location in flooded area
m = number of damage categories
n = number of locations in the flooded area
h_r = hydraulic characteristics of the flood at a particular location
$\alpha_{i(hr)}$ = stage-damage function that expresses the fraction of maximum damage for category i as a function of flood characteristics at a particular location r ($0 \leq \alpha_{i(hr)} \leq 1$)
$n_{i,r}$ = number of objects of damage category i at location

This model implies that economically speaking, a category of land use has a higher value than others. To understand the value of different categories, the project used the same land-use organisation used in a Master's thesis published in 2020 (Ranneft, M. W., 2020). The categories were reduced into residential areas, commercial use, recreation, semi-developed, agriculture, water, airports, railways, roads, nature reserves, and greenhouses.
To acquire the land use data the author used Bodemgebruik CBS2015. Because of the large variety of residential and commercial areas, an estimation was used to average the value of the properties and gain an estimation of damage by a flood. This was done by combining the 26 categories of "CBS grondgebruik" into the eleven different categories mentioned before. The way each category value, retrieved from the Master's thesis, was estimated is in the appendix.

By creating a grid of damage per square metre, it was possible to make the damage estimation spatial by using the different values per category and applying the differentiation of categories in the map of the project area. In short, each flooded unit of the grid had a different value based on the current land use.

Land use category	Estimated value per m²
Residential	212 €
Commercial	433 €
Recreational	108 €
Semi developed	13 €
Agriculture	2 €
Water	-
Greenhouses	52 €
Airport	155 €
Railroads	353 €
Roadways	109 €
Nature reserve	11 €

77 | Values from land use categories (source: Ranneft, M. W., 2020)

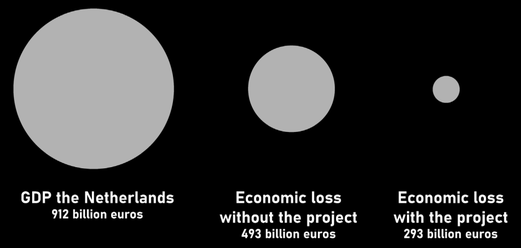
That allowed a calculation of the total economic loss in the area in case of a catastrophic flood, 493 billion euros, but also the total economic loss in case of a flood only in the area not protected by the proposed dike and coastal protection system, 283 billion euros. That means that using the new dike system would avoid an economic loss of 210 billion euros if a catastrophic flood would happen after the new system of dikes is built. That is almost the entire GDP of Portugal in 2021 (211 billion euros) (Eurostat 2021).

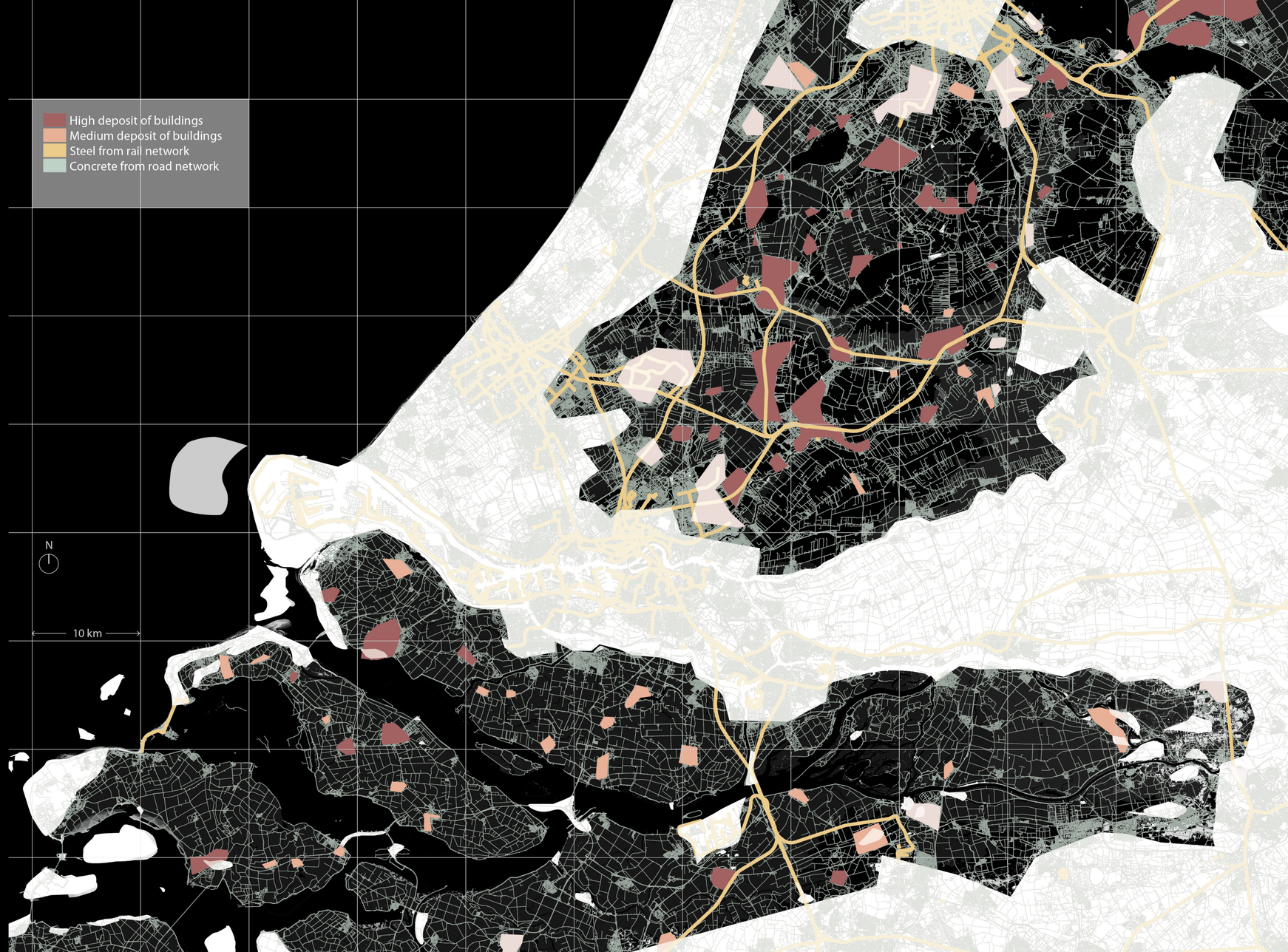
Currently, there is already software that allows a more precise spatial visualisation of the economic loss linked to flood risk such as the Global Flood Risk Tool, developed by Royal Haskoning DHV. (Royal Haskoning DHV, 2022). The GFRT combines parallel computing performance with an interactive, easy-to-use interface, so you can visualise the impact of global flooding and build informed resilience strategies for regions, cities, airports, and industrial sites. This tool could be used in the project on a smaller scale not only to inform companies and other stakeholders about the economic impact of a flood but also to convince them to adapt and relocate.

The economic loss calculations were made based on a scenario where everything outside of the dikes would be damaged. However,

the project considers that a large part of the material outside the new dike system could be retrieved and reused, creating material circularity and renovation. Even though it is hard to economically calculate how much of this material would actually be retrieved, the map aims to show this potentiality and later this report will touch upon potential policies to promote this retrieval by the different stakeholders.

In the map the potential of material mining in the flooded area becomes a bit more clear. For simplification reasons, the urban areas have been classified into two categories, high and medium density. Here materials like bricks, concrete, wood, steel and glass can be mined from the buildings in the area. Another source for mining is the train tracks and the abundance of roads, made mostly out of asphalt. Making this abundance visible shows the richness of materials and the need for them to be used as resources in the transformation process. Additionally, it becomes clear how much area is sealed. Opening up the surface is an important step in creating healthy soil where the ecosystem can regenerate.





78 | Economic damage in case of flooding (top)
79 | Main resources available for mining (right)

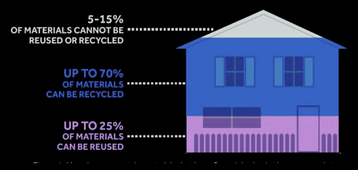
circular material flows

When faced with relocation, minimising economic loss and environmental impact is what should be given significant consideration. According to the Zuid-Holland circular in 2050 (Peters et al., 2019), the construction industry is currently a big polluter and only 5% of construction and demolition waste is recycled. The traditional demolition process results in the loss of value of many materials that can be reused due to the sorting and collection of waste after demolition. (Liu et al., 2005) If building owners, demolition companies and managers can optimise the process by planning and assessing the value of the building in advance and deconstructing the building rather than demolishing it by blasting it with heavy machinery, more time and money will be spent upfront but more components and materials can be recovered and reused later. 'In a typical home deconstruction, up to 25% of materials can be reused and up to 70% of materials can be recycled.' (Delta Institute, 2018)

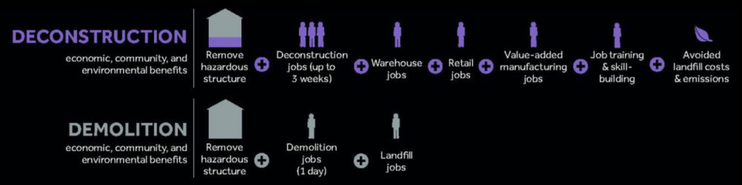
"Deconstruction needs to be separated into two categories, depending on the relation to structural or non-structural elements" (Gaetano Bertino et al., 2021). As can be seen from the table, demolition is the fastest and easiest. Both types of deconstruction are relatively more demanding in terms of equipment, personnel skills, time, and coordination. So why is deconstruction a better option?

Criteria	Demolition	Non-Structural Deconstruction	Structural Deconstruction
Definition	Arbitrary destruction of building in order to quickly clear the construction site	Removal of building components not affecting the structural integrity of the building	Removal of building components completely integrated in the building and with structural function
Time	Few days	Few days	Days or weeks
Costs	Low	Medium	High
Equipment	Expertise required for cranes, excavators, and wrecking balls	Simple tools required. Special expertise is usually not required	High range of tools and equipment required. Special expertise could be required
Safety conditions	High	Standard	High
Degree of de-constructiveness	None	High	Variable

81 | Comparison between deconstruciton and demolition (Michael, 2018)



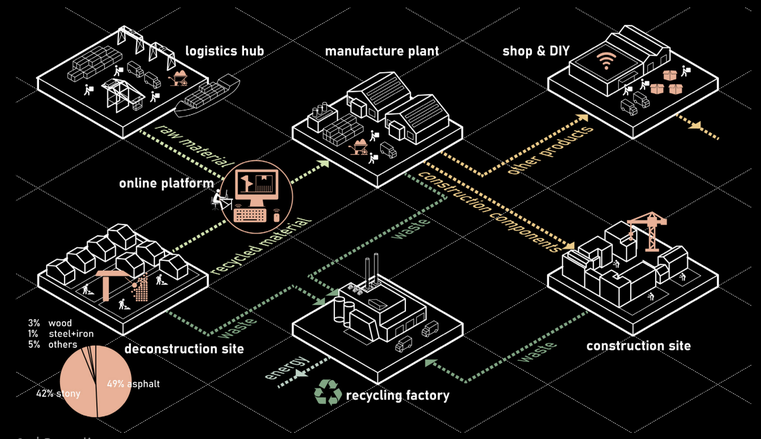
80 | Materials with value in the reuse market (Delta Institute, 2018)



82 | Economic, community and environmental benefits of deconstruction and demolition (Delta Institute, 2018)

Because from an environmental perspective, our goal for circularity is not only to reduce economic losses but also to reduce environmental impact. Rather than being landfilled, if materials and components can be recycled and reused twice, this is the path to a sustainable transition. At the same time, according to the Delta Institute's document about deconstruction and material reuse, the implementation of this process can also have potential social benefits, such as 'the potential workforce development partnerships, the potential for workforce training and contractor training, and the potential for local reclaimed materials to be used in restoration and preservation of historic structures.' (Delta Institute, 2018)

Firstly, whatever the material, it is managed through an open online management platform so that the public can keep track of the flow and use of all types of materials. Secondly, the manufacturing of raw materials and the remanufacturing of materials that have been recycled can be pooled together in shared facilities and equipment. The processed materials and related products can be sold for other uses such as DIY furniture through the integration of online and offline, a way to stimulate the value of marginal materials that cannot be used for large-scale construction and to promote employment in handicrafts and carpentry. Other materials are processed and sent directly to sites where new buildings are to be constructed or old buildings are to be renovated for use. Throughout the material flow, the waste generated will be centrally recycled to recycling centres for combustion with energy recovery.



83 | Recycling process

Even though there will still be waste that cannot be recycled and disposed of which has to be landfilled, the waste of the material will be greatly reduced and the value of the material will be fully utilised in the optimisation process. At the same time, in addition to the construction industry, other manufacturing industries such as carpentry will also be boosted.

4.2 circularity and sustainability evaluation
the r-ladder

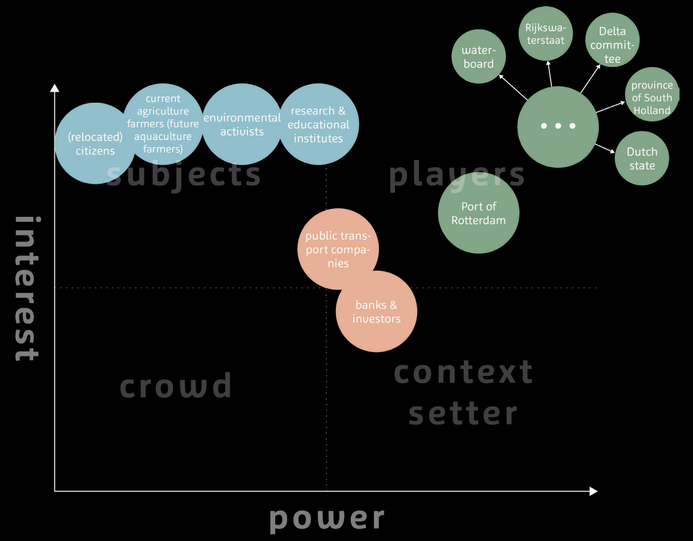
In chapter 3 we tried to define the circular economy. However, it is hard to measure how circular an economy is. Therefore, a 10R-ladder is designed that enables tracking down the process of a circular economy transition (PBL Netherlands Environmental Assessment Agency, 2017). Additionally, to the 10 R's from the original R-Ladder, we included 'redesign' since we, as urban designers, believe that redesigning is different from rethinking. As a rule of thumb, the ladder can be read as those strategies which are higher on the ladder (R0, R1, R2) need fewer resources and are therefore less harmful to the planet than those at the bottom (R9, R10, R11) (PBL Netherlands Environmental Assessment Agency, 2017).

Graph shows how the different elements as well as the main values of this project would fit on the 10(+1) R-ladder.

4.3 stakeholders

Changing urban plans has a big influence on everybody in the concerned areas. Hence, it is important to have a close look at the individual stakeholders. For this project, all stakeholders are highlighted in a matrix that is included in the appendix. These matrices show the current, as well as the transitional connectivity between the different stakeholders. The twelve stakeholders we considered the most important are shown in the diagrams on this page.

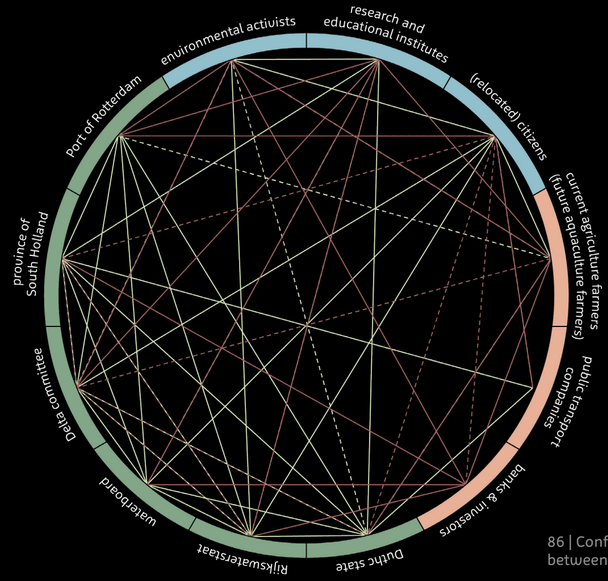
Some stakeholders need a further explanation. With *environmental activists*, organisations like Greenpeace, Extinction Rebellion and the Embassy of the North Sea are meant.. Additionally, Staatsbosbeheer is also included in this cluster, so all organisations that give a voice to the silent stakeholders, nature, are connected. Rijkswaterstaat is an implementing organisation of the Ministry of Infrastructure and Water Management (Ministerie van Infrastructuur en Waterstaat) and is responsible for the larger water bodies like rivers and the sea. Additionally, the *Rijkswaterstaat* is in charge of the protection against bigger storms. This is done by securing water defences and alarming other organisations against large storms. The *waterboard* (in Dutch: Waterschappen), on the other



85 | Power and interest diagram

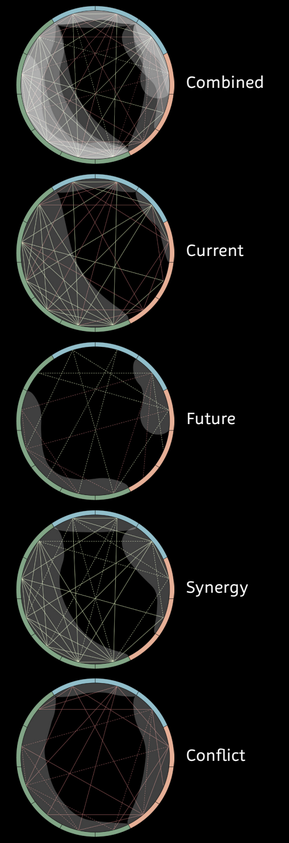
hand, is responsible for the smaller scale water structures and the water quality. Whereas the Rijkswaterstaat protects the Netherlands from flooding from the North Sea, the waterboard is protecting it on a regional scale from floods caused by in-land rivers by strong dike structures (Ministerie van Infrastructuur en Waterstaat, 2021). In contrast to the Rijkswaterstaat, the waterboard is elected every four years. The next elections will be on the 15th of March, 2023 (Kiesraad, 2022). The *Delta Committee* (Deltacommissie) was first set up three weeks after the flood disaster of 1953 and again in 2007 under the name 'sustainable coastal development committee' (in Dutch: commissie duurzame kustontwikkeling). The Delta committee has an advising role for the state in water management (Deltacommissie, 2010).

The interest-power diagram shows that the public stakeholders have the most power and interests, whereas the private and civil stakeholders also have high interests, but significantly less power. The high importance of the public stakeholders is also visible in the connectivity diagram, where they currently have many connections between each other and the other sectors. Most of the synergy connections, in the current as well as the future, come from the public stakeholders. However, even though the private stakeholders have less power, they could oppose the project since most conflicts come from their side. Furthermore, the increase of future connections with the private stakeholders should be a provocation for participation in future plans.



86 | Conflicts and synergies between stakeholders

The same twelve stakeholders are used in the circle diagram, showing current and future synergy as well as the conflicts. While analysing the different connections, as shown in the smaller diagrams, different important relationships popped up, like when the private stakeholders are highly linked to others, or where the most current conflicts are happening.



87 | Series of analysing the civic – private – public relations

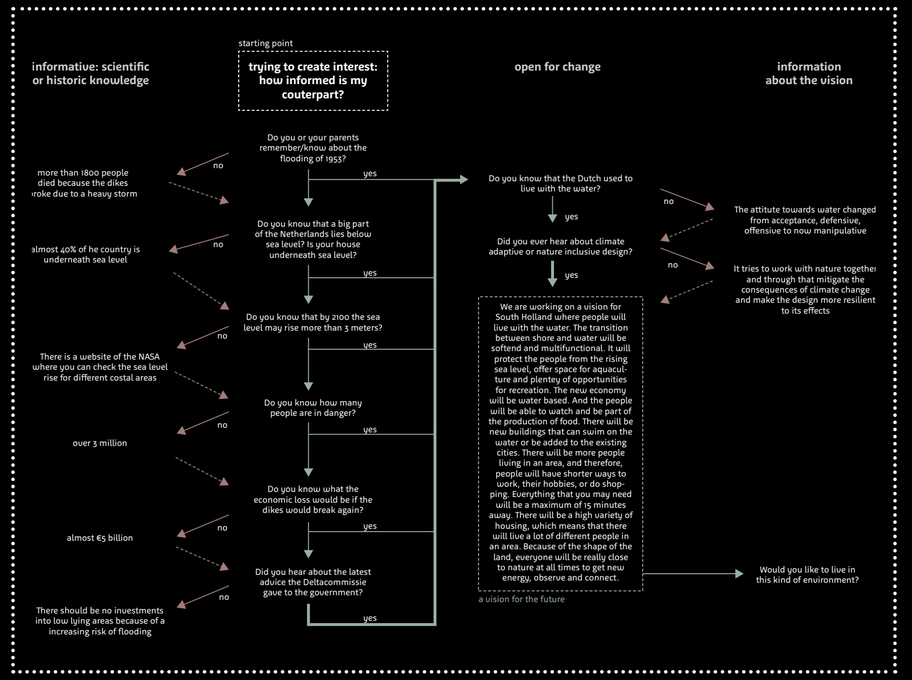
stakeholder participation

As shown before, the private stakeholders will cause several conflicts in the future. Therefore, it is important to include them, like other more powerful stakeholders, to come to a design that includes the needs of all stakeholders. Since citizen involvement on a regional scale takes too much time, the focus concerning citizens lies on a smaller scale like a neighbourhood. These smaller interventions will eventually have an impact on the regional decisions made by higher public organisations.

Stakeholder participation starts with making people aware of everything that is and will be going on. A constant tool that can be used is education. Therefore, not only classical education for pupils is considered, but also possibilities for adults where they can re-educate due to the changing economy. Additionally, a game has been designed for this report to start with accessible awareness shaping. This game is explained in chapter 4.3. Stakeholder participation is, however, also a complex undertaking that should be done at several levels in the stakeholder system. In this project, two stakeholder participation strategies are happening at the same time. As an example of an agreement tool, a draft manifesto has been written, as well as a conversation guide created as a communication tool.

Firstly, an awareness tool based on education and communication. Secondly, a policy is invented to unite powerful stakeholders to follow a long term strategy. In the light of deep uncertainty, the strategic goal may change over time but the core agreements will stay the same. These agreements will be created in a collective participatory process that is open for everyone and indispensable for some, such as the powerful stakeholders of the civil and private sectors. The manifesto is meant as a guide for the future. People may change but the overall ambition will stay the same. Furthermore, the collective effort will be a starting point to create a network for partnerships. Those are especially important for making the Netherlands adaptive to the effects of climate change.

The second strategy involves a communication tool. It shall offer basic information and questions with which to create awareness for the issue at hand, create openness for change and for sparking interest in taking part in the shaping process. The tool shall be used in daily life by ordinary citizens.



88 | Communication guide to spark openness for change, see appendix for larger image

manifesto

agreements for a water based future

I We believe that we shall embrace deep uncertainty. This shall not dampen our aspiration for action. On the contrary, it shall set us free and enable us to create an adaptable ecology, economy, and culture: a collective that shall grow and change together. Worshipping the commons, protecting the rights of living organisms and creating a future for everyone to thrive in balance with each other. We will accept nature as our guiding principle, opening new opportunities and stopping our greed for more. We believe that we must work with nature rather than against it. It will guide us while shaping our new environment and set boundaries we shall not overstep.

II We will accept nature as our guiding principle, opening new opportunities and stopping our greed for more. We believe that we must work with nature rather than against it. It will guide us while shaping our new environment and set boundaries we shall not overstep. We aim to create balance with the natural environment and regenerate the ecosystems from the anthropocentric influences of the past decades. This means that we shall not strive for economic growth but for thriving within the planetary boundaries.

regenerative adaptible

III By following the laws of nature, we will create equality for every human and non-human that enters the terrain we pledge to take care of. Whether they are thundering or silent, all inhabitants shall have a right to equal education and therefore be able and encouraged to take part in the decisions and developments that touch them.

IV We believe that the strongest concepts will develop out of the heritage of our culture and land. We pledge to be sensitive to what is already there and has been there. To everything tangible but also to what is invisible. This can only be seen by learning about and with the people and the land we are working with.

V We believe that we must see this endeavour as a cathedral project. It will take multiple generations to be finished and multiple generations will benefit from it. In this sense, it is not about creating short term rewards but about aiming for harvests for generations yet to come.

visionary sensible inclusive

89 | Manifesto created by the stakeholders in a participatory process

the game of values

As a third method, to inform stakeholders regarding the project, a card game was created with the different types of strategies (actions or policies) related to the main values. Each one of the five values (adaptive, regenerative, sensitive, visionary, and inclusive) is defined by a colour. Each deck of value cards is then divided into the five main themes related to the project: coastal areas, agriculture transition, mobility, harbour areas, and living with water. Each theme is composed of three cards and each strategy has its own symbol and title.

In addition, each set of value cards has three general actions that can be linked to all of the five main themes and three policy cards. Therefore each value set has twenty-one cards in total.

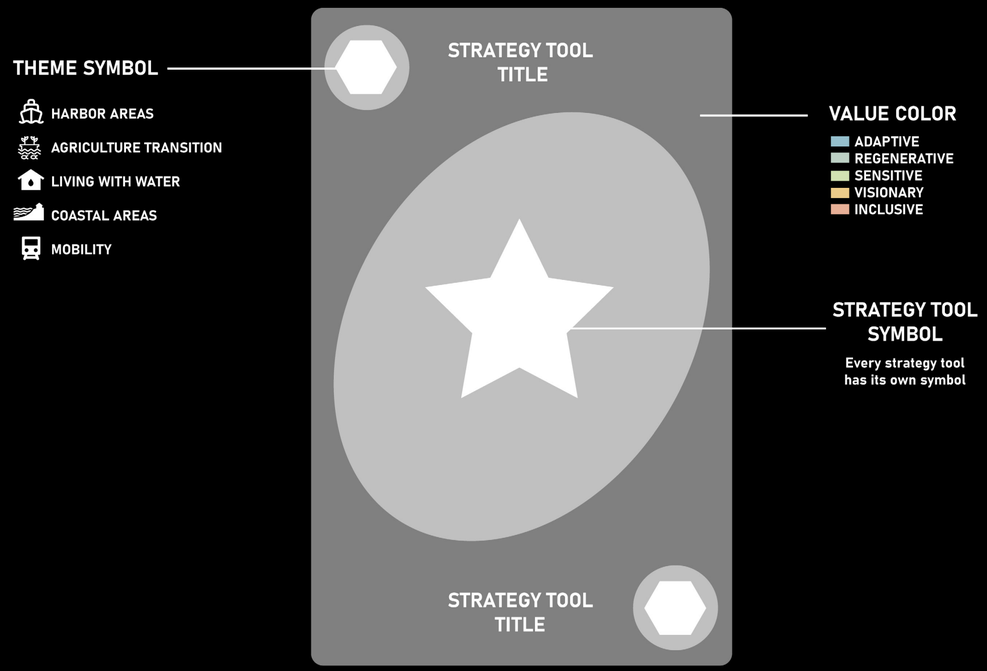
The main objective of the game is to create awareness about the different types of actions and policies related to the project and show how these strategies can be collected and linked to each other due to their values or main themes.

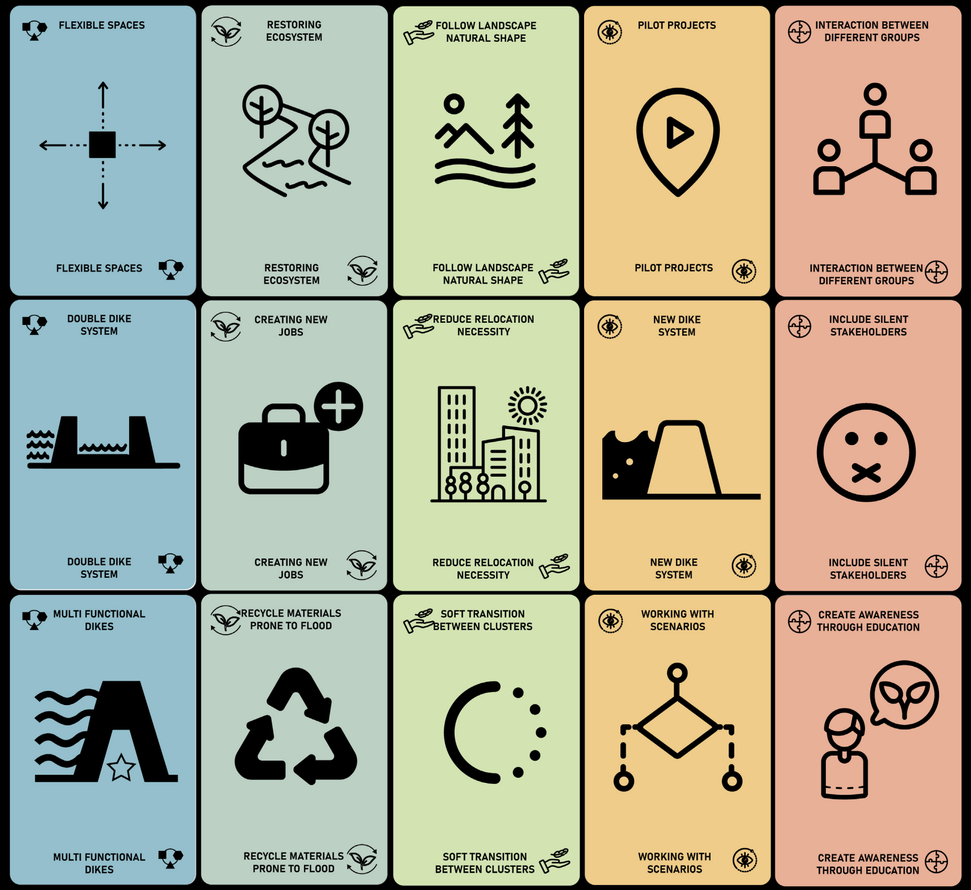
The card game also makes the project more appealing to citizens, and accessible to all the different social groups and ages. It creates awareness between children and the new generation, which will surely be part of the long-term vision of the project. It is supposed to be an inclusive but informative tool. On the back of each card there should be a description of the action or policy. A version of the game to be printed and cut out can be found in the appendix.

Objectives: Collect five cards of the same theme but different values or five cards of different themes but the same value. The game is intended to be played by at least three players.

How to play:

1. Each player starts with five random cards that are not supposed to be seen by the other players. A pile of the remaining cards will be faced down and placed in the middle.
2. On each turn, players will collect a card from the pile and receive a card from the player on its right and decide on one card to discard, and pass that card to the player on his left. That will allow players to decide on one theme or value and collect cards that are related to their own personal strategy.
3. If a player receives or collects from the pile a policy card, his strategy is speeded up and the player can collect two cards from the pile in the next round, increasing his chance of collecting all the needed cards
4. If a player has a value card that can be used for all of the different themes, it can be used as a wild card and substitute one of the needed theme cards for a specific value. A player can only use one policy card in his final collection to win.
5. The first player to collect a complete set of five theme or value cards has to face down his collection of cards. The other player will do the same. The last player to do so will lose this turn.
6. The winner is the player who creates a collection of three different strategies (therefore the player who wins three rounds first), composed of actions and one stimulator policy.





91 | General cards

Value: General

The general value cards are cards that cover all of the different themes that create the different sets. The adaptive value means flexible spaces, double dike systems, and multi-functional dikes. For the regenerative value, the cards illustrate restoring the ecosystem, creating new jobs, and recycling materials prone to flood. For the sensitive value, the cards are to follow landscape's natural shape, reduce relocation necessity and create a soft transition between the different clusters. The visionary general cards are pilot projects, a new dike system, and working with scenarios. Finally, the inclusive value general cards illustrate the interaction between different groups, the inclusion of silent stakeholders, and create awareness through education.

Value: Adaptive

The adaptive set of cards in this game shows the actions related to the adaptive aspect of the project. For the coastal areas, this value is illustrated by the open soil in the buffer zones, the drinking water stored in the dunes, and the mobility system inside of the dunes. For agricultural transition, the cards illustrate the adaptation of greenhouses into housing, the adaptation of current crops into aquaculture, and the education of agriculture producers on aquaculture. For mobility, the cards are about the car routes that are adapted to become public transport, the mobility system inside of the dikes, and the connections that can be adapted to the different clusters. For harbour areas, the cards show the adaptable mixed-use, the public waterfront adapted to public space, and floating harbours. Finally, for living with the water, the cards are about flood adaptable buildings, floodable emergency areas and a flloodable emergency route.

92 | Cards with adaptive value

93 | Cards with regenerative value

Value: Regenerative

The regenerative value card set presents the actions that offer a possibility of renovation. When it comes to coastal protection, it touches upon the use of dunes growth and new vegetation to regenerate protection. For the agricultural transition, the set illustrates different types of aquaculture practices, both on a small and big scale, and the productive buffer zone between the dikes. Regarding mobility, the set illustrates the reuse of infrastructure prone to flood and an efficient connection between current and new urban areas. For harbour areas, the set shows the transformation of waste into clean energy, the productive public waterfronts, and the circularity of industrial production. For living with the water, the set illustrates the relocation of nature, the requalification of urban areas, and sustainable water management.

Value: Sensitive

The sensitive card set is related to the sensitiveness of the project towards society, ecology, and economy. In coastal areas, it is linked to the environmental protection of the dunes and their fauna and flora, but also to the use of these spaces as a leisure areas. On agricultural transition, it is linked to the maintenance of rural production in certain areas, the open soil from greenhouses, and the sensitive relocation of agricultural areas. For mobility, the card set includes the maintenance of existing routes, and following existing rivers and height differences. Regarding harbour areas, the card set illustrates harbour basins' densification and shift into public spaces and the de-pollution of the soil in industrial areas. Lastly, on living with the water matter, the cards present the keep of existing buildings, the sensitive relocation of citizens, and the protection of cultural heritage

94 | Cards with sensitive value

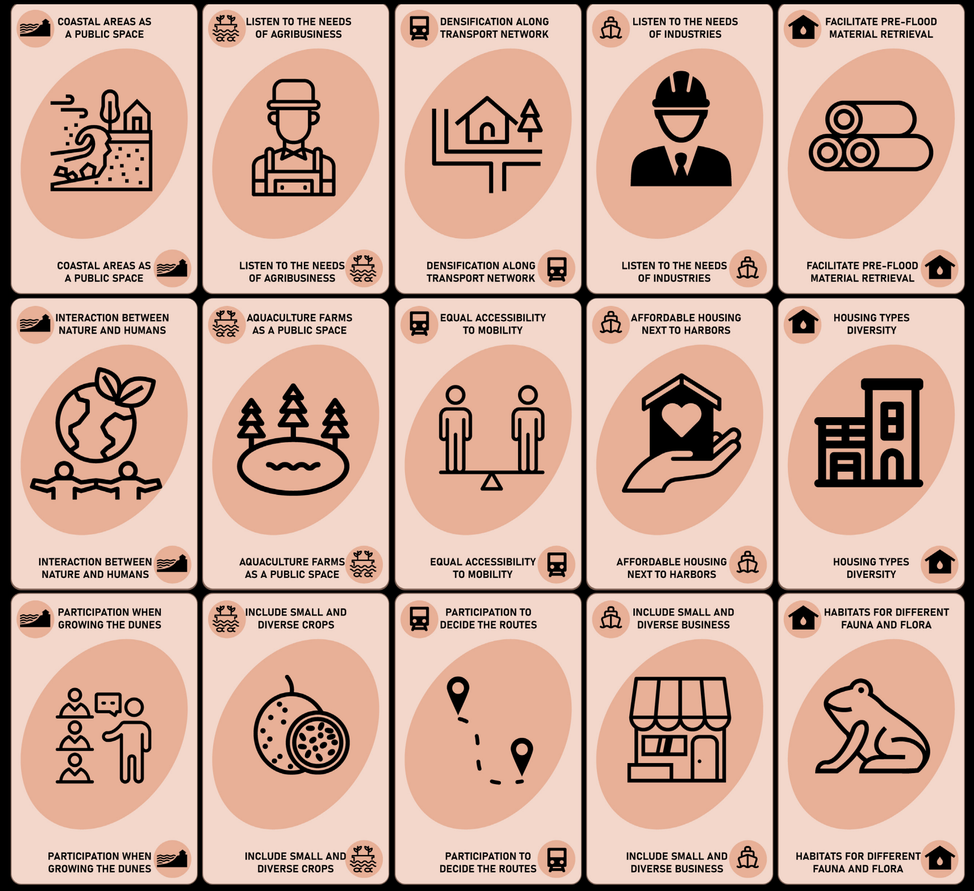
95 | Cards with visionary value

Value: Visionary

The visionary card deck illustrates actions related to the visionary aspect of the project, actions related to the future function of the dunes for coastal areas, such as the new infrastructure underneath and the use of them as a natural barrier. When it comes to agricultural transitions, the cards illustrate the circularity of aquaponic production and the innovative aspect of large-scale and marine aquaponics. The mobility theme is illustrated in technological and water-based solutions for public transport while. The harbor areas cards are linked to the new functions and mixed-use of current and new ports and the introduction of new industries. Finally, living with water is illustrated in leftover spaces for densification, new lifestyles, and the densification on the water.

Value: Inclusive

The inclusive value cards present the actions that are supposed to promote spatial justice. For coastal areas that means the use of these spaces as a public spaces, the promotion of the interaction between humans and nature, and the participative process when it comes to dunes growth. For the agricultural transition, it means to include agriculture producers' opinions during the transition, to make the aquaculture production spaces also public and leisure spaces, and to include small and diverse types of crops during the transition. For mobility, it means densification along with the transport network, equal access to mobility, and participation to decide public transport routes. For harbour areas, it means listening to the needs of industrial workers, creating affordable houses while densifying the harbour and to include small and diverse businesses in the mixed-use areas along the harbours. Finally, for living with the water, the cards show that inclusiveness means facilitating pre-flood material retrieval, promoting housing types diversity, and habitats for different fauna and flora.



96 | Cards with inclusive value

4.4 tools and policies

Now that we have the first stakeholders on board using the manifesto, the communication tool, and the card game, it is time to see where to proceed and how to achieve the goals that have been set in the conceptual framework.

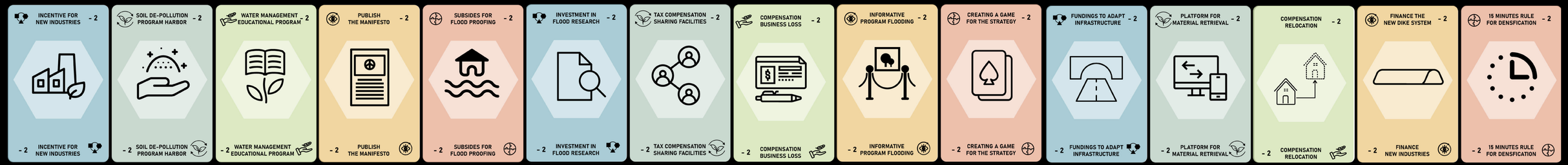
Education is used to realise a shift in certain areas. Schools and institutes play an important role. From Wageningen University, Delft University of Technology and Leiden University, a new collaborative institute will emerge that conducts its research and then helps schools and higher education to build educational programmes. This will first be led by the agriculture school located in Delft and fed by the ecological and economic input of the other institutes. One of these programs will teach farmers how to change their way of agriculture into a water-based version. Apart from the new aquaculture institute, there will be a program educating everyone about the flooding. “Environmental matters” will be a standard course given at elementary and secondary schools. This way the first step towards awareness is taken.

Synergy is boosted by mixed-used areas and clusters, forcing stakeholders to work together. This can be achieved on several levels. On a smaller scale, every municipality must follow a certain number of rules when making new strategies and zoning plans for their cities. An example of a rule would be to have at least 40% of floor space dedicated for economic use, following the recommendations of the UN-Habitat (2015). Another way of using synergy as a tool is to focus on the corporation of different companies. Following the stakeholder analysis, future synergies can be encouraged and future collisions can be turned into tactical co-operations. For example, Staatsbosbeheer (the national nature management) and housing corporations could be put together early in the process, to find out how they can help each other build greener environments instead of fighting over noise nuisance. This can be achieved by stakeholder analysis and involvement on, again, several levels.

Nature cannot regenerate itself. Regeneration is therefore in its way a goal and a tool in one. To achieve regenerative ecology, economy, and culture, different things are needed. In the transition phase, all the materials that are being deconstructed and retreived from the area that gets flooded, are free to use. An online platform will be designed to intellegently collect, store, retrofit, redistribute, remanufacture and reuse all the materials. There are already several corporations doing this. This is explained in chapter 4.1. In the strategy, these sort of corporations are being merged and nationalised. In ecology, it is important to always have nature being able to sustain itself as a priority. Natural processes are preferred over man-made systems that require annual renewal. To achieve this, Staasbosbeheer will be given a more important role in developing spatial strategies and will be involved in every main plan by the municipality. Landscape structures form a base. The economy will begin being regenerative by starting with pilot projects. This way it becomes visible how nature and the economy react. For example, starting with a small aquaculture industry project will show how certain things work, before implementing it on the regional scale. Additionally, by giving each industry in the region a certain identity, the system will sustain itself. One cannot fail because it is needed by the other. With every development, the identity of the cluster must have a focus point. For example, Utrecht has connectivity to the rest of the country as its main role in the polycentric region. With every development, this focus point is kept in mind. This way the region is regenerative.

The five principles the UN-Habitat recommends, help make the culture also regenerative. The principles help the city become more compact and integrated. This means that they will be less reliant on others, making it more regenerative. The earlier mentioned 40% economic use tool could for example help with this or setting a minimum of 15.000 people per square kilometre density and always less than 15 minutes from a public transport station as a rule for new densification. This way the ecology, economy and culture are all regenerative, making the region adaptive for the future.

All these policies cost a lot of money for the government. This is justifiable, because no money is lost on the terrible consequences of a flood, as seen in chapter 4.1. Investing now is also a good choice, because an adaptive economy is also a much more efficient economy, and therefore saves money. Finally, at the beginning of the project, money is earned with taxes on CO_2. T`his gives the government a good start and sets the mental shift in motion.



97 | Policy cards

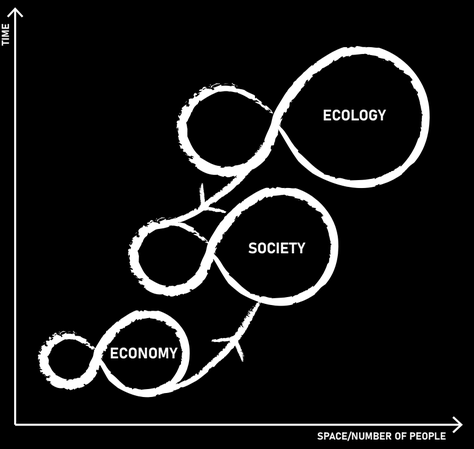
4.5 phasing
adapting the adaptive cycle

The model of the adaptive cycle was derived from the comparative study of ecosystems and it is meant to be a tool for thought. This model claims that two additional functions are needed while studying different systems, release and reorganisation, in addition to the ones traditionally used, exploitation and conservation. These four phases are connected by a front loop and a back loop that passes through all the phases. In the project, these phases were adapted and renamed, based on the adaptive cycle applied to social systems, published in the Ecology and Society journal in 2015 (Fath, B. D., et al., 2015). Stages in this cycle are similar to ecological stages, from new growth to status quo, to confusion, and innovation.

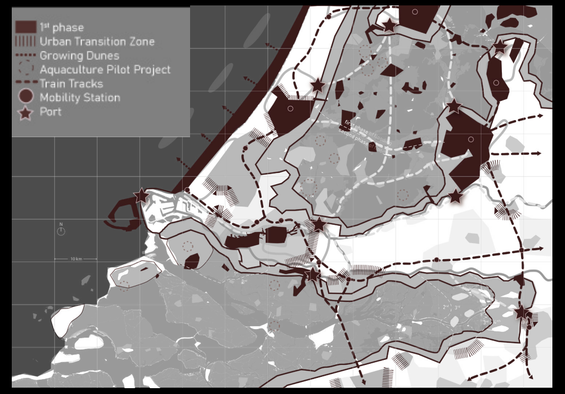
In the cycle loops, and during brief moments, new recombinations are tested after long periods of capital accumulation and storage. Even though this window of experimentation is brief, it can trigger instabilities in the status quo. On a system of interconnected adaptive cycles, larger and slower adaptive cycles provide the memory of the past to allow the recovery of smaller and faster adaptive cycles.

A system with a hierarchy of adaptive cycles represents a panarchy. The hierarchy of the panarchy in this project is defined by time and space. The different adaptive cycles used to understand this social system, and later to create a timeline for the project, are composed of ecology, society and economy.

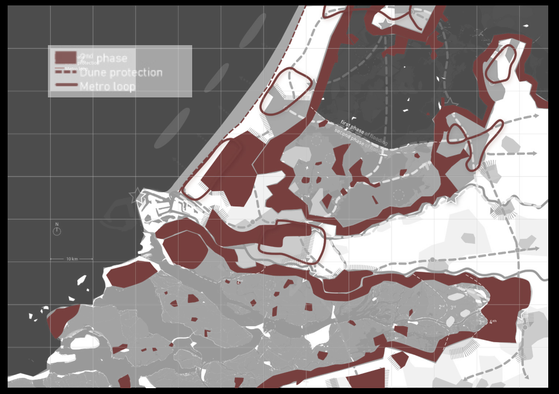
Ecology is on the top of this hierarchy, being the largest and slowest one to adapt, followed by society and economy. This hierarchy is based on the values and goals of the project and therefore is only an adaptation of the adaptive cycle and panarchy model.



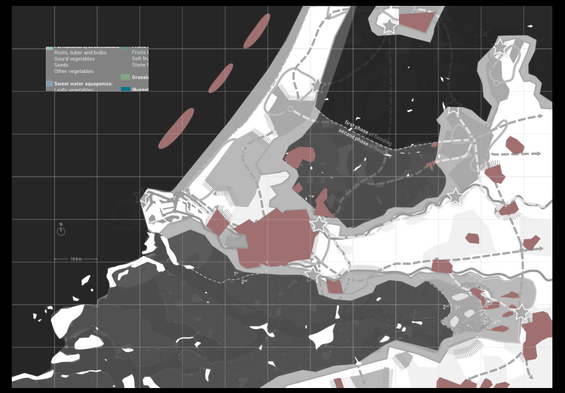
98 | Adaptive cycle of the project



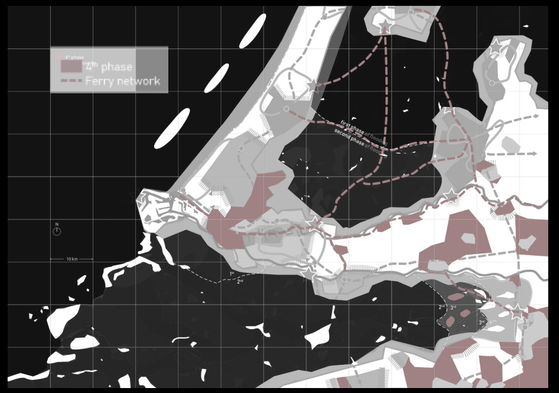
99 | First phase



100 | Second phase



101| Third phase



102 | Fourth phase

SLR: 0 m
DIKES CLOSED

SLR: 0.5-3 m
DIKES OPENED

SLR: 3 m
FLOOD COMPLETED

ECONOMY

STATUS QUO

- Educate about new water based economy
- Finance (new) water based companies
- Start densifying harbour areas

Pilot projects

MILESTONE:
Pilot projects succeed

CONFUSION

- Build new infrastructure
- Stop and displace production in some areas
- Retrieve materials and relocate cities

MILESTONE:
New urban areas fully built

INNOVATION

- Monetary compensation and incentives for the economical shift to water based
- New and small water based companies appear
- Merge production locations

NEW GROWTH

- Growth of new companies
- Investments in the new economy

STATUS QUO

SOCIETY

STATUS QUO

- Publish the manifesto
- Sign the manifesto
- Increase awareness about sea level rise

MILESTONE:
Manifesto signed

MILESTONE:
Population convinced

CONFUSION

- Relocate people
- Attract people for the secured area

MILESTONE:
Population fully relocatec

INNOVATION

- New lifestyle
- New research possibilities

NEW GROWTH

- Example for other nations prone to flooding

STATUS QUO

ECOLOGY

CONFUSION

- Strength dunes
- Fill up harbour basins

Stop pumping water

Grow natural dikes and vegetation

Grow green belt (buffer zone between dikes)

MILESTONE:
New dike structure ready

MILESTONE:
Green belt ready

INNOVATION

- Regenerate natural landscape
- New species of fauna and flora

NEW GROWTH

STATUS QUO

103 | Project timeline

spatial timeline

The project touches upon different major themes, namely ecology, economy, and society. The order in which each theme's different phases occur is understood to follow the adaptive cycle theory for social systems (Fath, et al., 2015) looping from status quo to confusion, to innovation, to new growth to come back in the loop to status quo.

Actions and policies trigger new phases in each one of the cycles, and all three different themes try to reconquer a new status quo through the project. A few milestones can be highlighted, such as the publication of the manifesto that triggers confusion and the new urban infrastructure and relocation that triggers innovation.

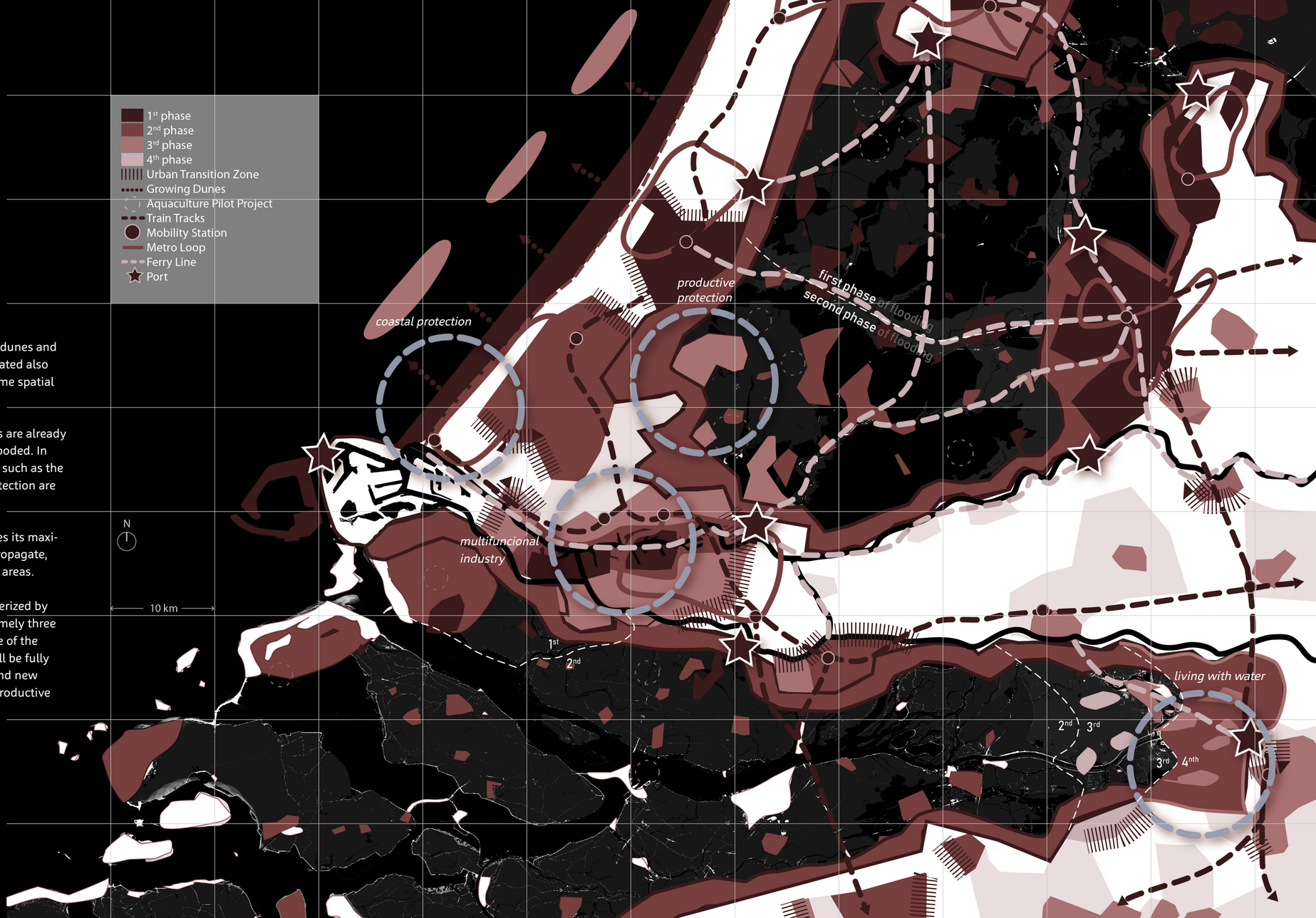
This timeline can become spatial and the different main actions and policies that were first shown in the general timeline can be subdivided into four phases, linked to the water level in each stage of the project.

In the first phase, the dikes are still closed and the new infrastructure, such as train tracks and mobility stations, can be mapped. In addition, the strengthening of the dunes and the urban areas that must be relocated also belong to the first phase and become spatial on the map.

During the second phase, the dikes are already opened and a part of the land is flooded. In this phase, the new infrastructure, such as the metro loop, and the new dune protection are done and activated.

In the third phase, the flood reaches its maximum area and the cities start to propagate, densifying the surrounding empty areas.

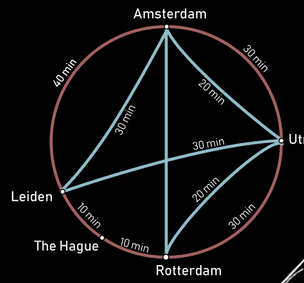
Finally, the fourth phase is characterized by the final deepness of the flood, namely three metres above sea level. By the time of the fourth phase, the ferry network will be fully completed and both the original and new urban areas will be connected to productive and leisure areas.



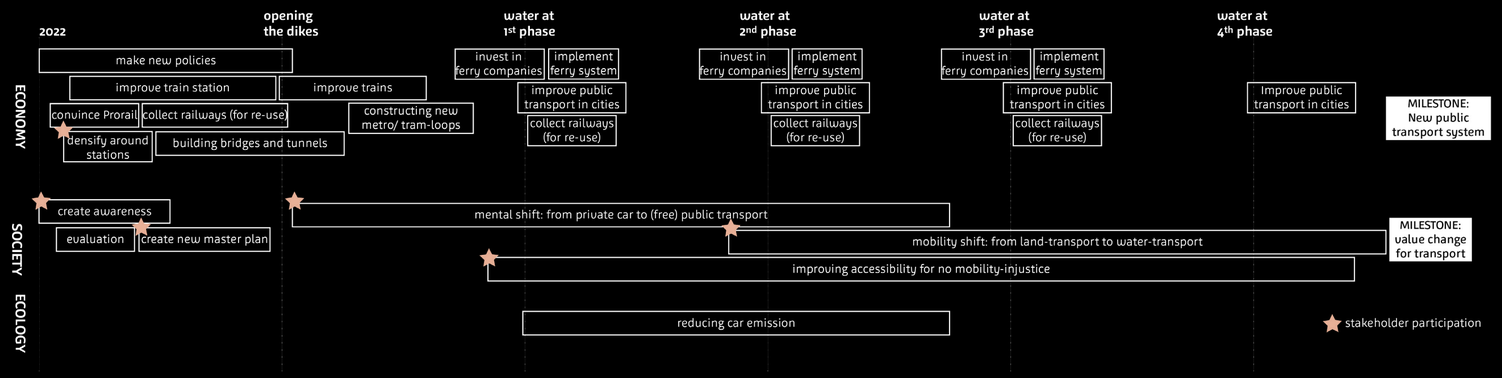
4.6 strategic projects
a new transport system

The first key project for achieving the vision is the mobility network. This can and needs to happen in an early stage because it will boost every other development. Before opening the dikes, the current railway system needs to be improved and made ready for the water. This means firstly dismantling everything that will be flooded, and using it to build up the new metro loops in the urban areas. Secondly, the stations need to be prepared to connect to metro and ferry systems. Thirdly, some parts of the current railways will be tunnelled, protecting them from flooding but also giving space to water.

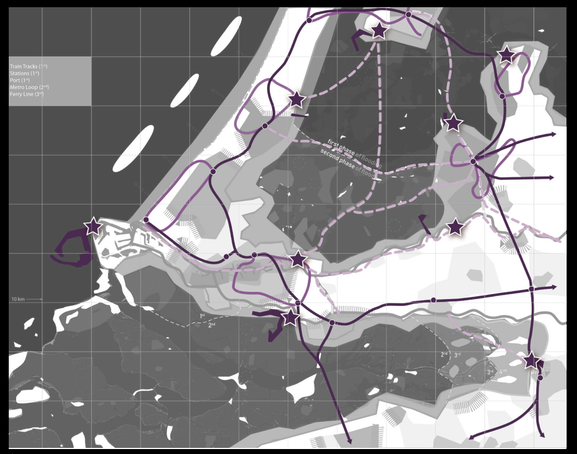
There are several incentives to make public transport the most attractive transport system. An important step is making public transport free. One of these is making it free for users. This will be realised by giving NS more financial options and making a deal. Another incentive is improving the quality of the trains and metros, meaning they will be faster and more comfortable than a car. Lastly, every densification of housing will demand a new public transport station. A house cannot be farther away from a station than a 15-minute walk. When the water has arrived everywhere, the high-speed ferry can be implemented.



105 | Impression new Leiden mobility hub (author's own)
106 | Connection distances (diagram)
107 | Analysis of guiding spatial structures



108 | Timeline



109 | Spatial timeline

This all can and needs to happen in an early stage because it will boost every other development. Before opening the dikes, the current railway system needs to be improved and made ready for the water.

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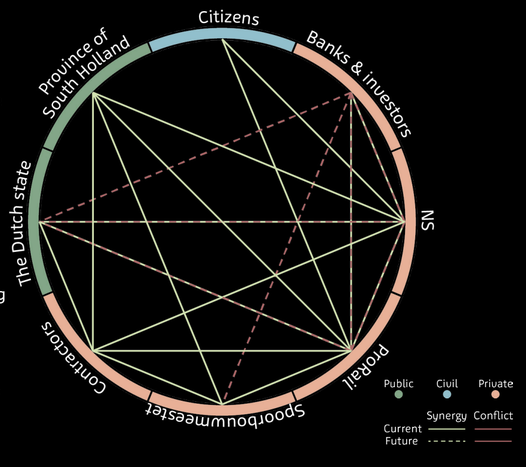
In Fjellstrand, a shipyard next to Oslo, Norway, a high speed electric ferry is being implemented this year, as well as Sydney, Australia.



110 | Involved stakeholders

111 | Plan for the new mobility system

coastal protection

One of the weakest points in the current defence system is the coastal dike protection in the south of Den Haag and north of Hoek van Holland. In proposed floodings, this is often the first place for the dikes to break. Therefore, it is essential to strengthening the dunes in this area. The strategy starts with expanding the zandmotor project (Rijkswaterstaat, 2021) further along the coast. In a second step, at the same time as the mobility system described in the project before is extended in this region, a train line is implemented in the dunes to strengthen them further. This way the existing dunes are on both sides additionally supported, naturally at one side and engineered on the other. As a third implementation artificial islands will be constructed. This diminishes the effects of erosion at the shoreline.

The beach area will not only be a defence but will also create a new habitat for diverse flora and fauna and recreational facilities like new surfing spots. Furthermore, the area will be an important place for education. People can learn about the natural environment and its processes. The educational aspect is also a very important element in the urbanised area.

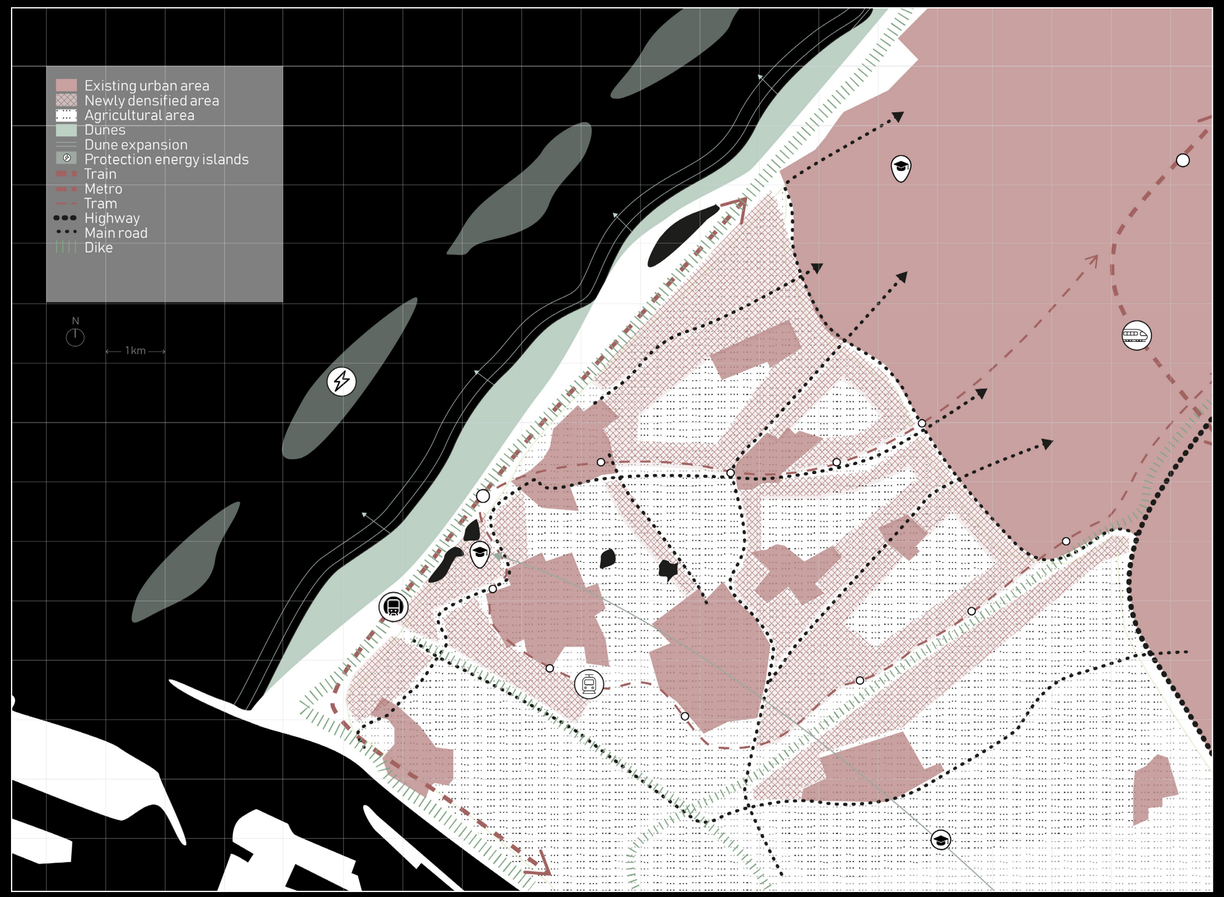
112 | Impression coastal protection (author's own)

113 | Analysis of guiding spatial structures

114 | Impression of new permaculture education areas

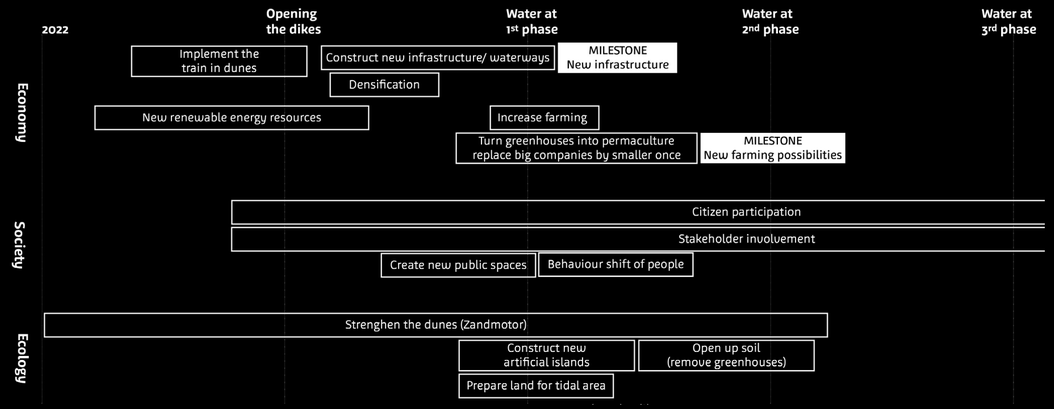
A change of land use from former greenhouses to open soil permaculture offers necessities and opportunities to learn about this form of agriculture. Also, the change from big-scale production to a more local, small scale and communal practice asks for new knowledge. The area's close connection to Universities in Delft and Den Haag and the new train line along the coast makes this place a great location to test, experiment and learn from each other. Water research is especially important here because salt and sweet water are already here before the dike will be opened. This makes the place an ideal spot for investigating the new water-based economy.

What makes the place special from the densification point of view is its in-between location. Den Haag, with its high density and agricultural area. Therefore this strategic project is an example of the buffer zones between urban and agriculture. The formerly scattered urban settlements will slowly grow together along with the main networks. This process will be encouraged by the new metro ring connecting the villages with the bigger mobility network. As in all projects, one main guideline is to shape the new land and borders with the existing landscape morphology.

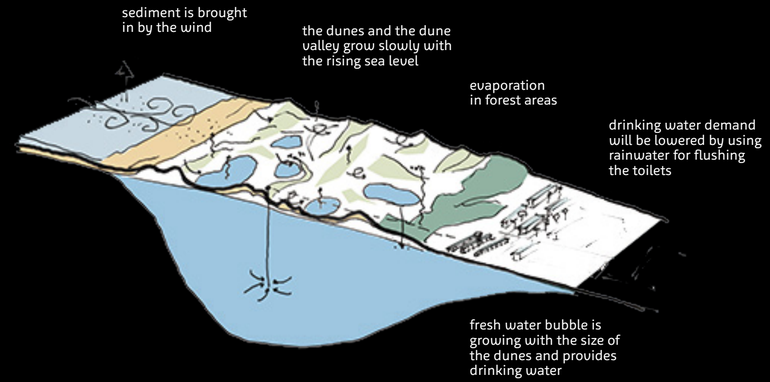


115 | Plan for the new mobility system

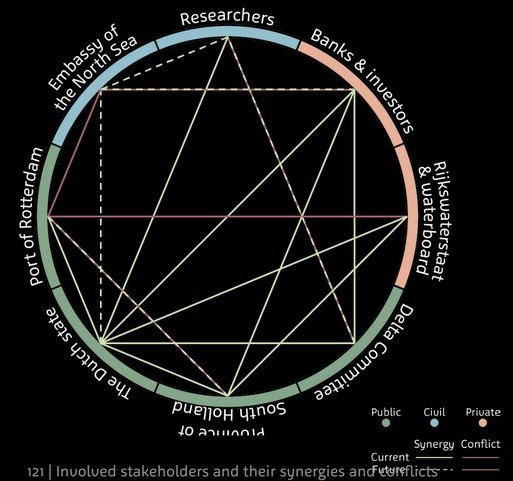
117 | Economic flows



118 | Timeline



119 | Functioning of the dunes (author's own, based on LAMA landscape architects)



121 | Involved stakeholders and their synergies and conflicts

120 | Coastal protection (author's own, based on LAMA landscape architects)

productive protection

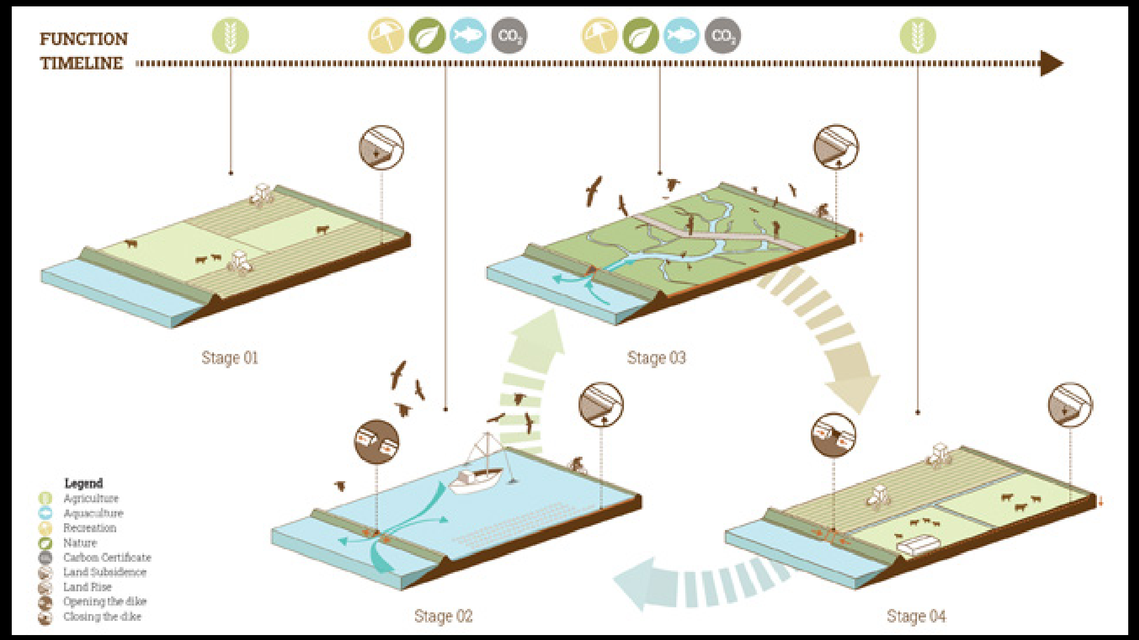
The third key location illustrates a solution to one of the biggest challenges in the project: the transition from inland agriculture to aquaculture. The area is located close to Zoetermeer, in one of the lowest parts of South Holland, reaching eight metres below sea level. Not only the cities in the studied area are most likely to disappear in case of flooding, but a high extent of agricultural areas will be lost, due to the agricultural vocation of the land.

The challenges of this specific location illustrate the challenges found in a great part of the project area, such as the relocation of cities and agriculture, but with the gravity of being at such a low height compared to the sea level. The patch of eight metres deep and the dikes nearby create the possibility to introduce a new dike system around this hole that will be surely filled by water. This allows the pilot project to also exemplify elements that could be found in the buffer productive zones, such as aquaculture production.

Therefore the main goal of the pilot project in this key location is to transition from inland agriculture to aquaponics through a pilot project located inside the productive green belt.

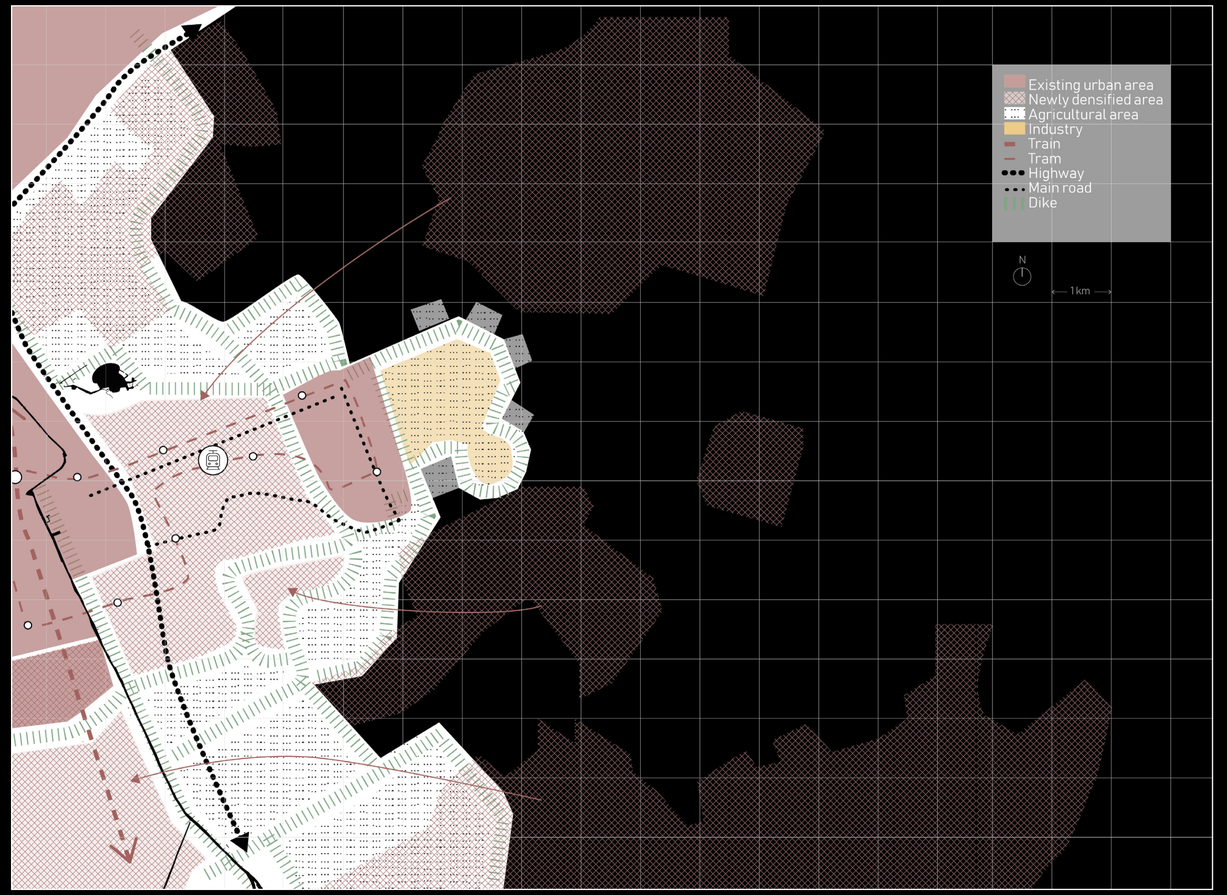
122 | Impression protection belt (author's own)

123 | Analysis of guiding spatial structures



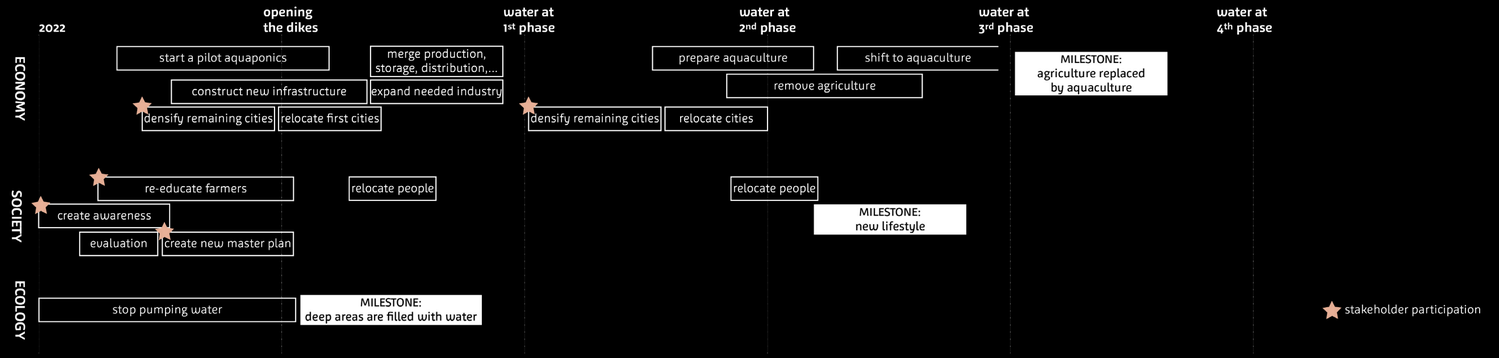
124 | Double dike system (Defacto, 2021)

To achieve this, an educational program regarding aquaculture will be necessary. This will be particularly important to convince and educate rural producers about the productive transition. Small-scale aquaponics systems can be financed by the government on current agricultural locations and incentives could be given to companies that are already producing or improving aquaponics on a bigger scale. The deepness of the hole makes the area ideal for a pilot aquaponics pond, where agricultural products that are already produced in the area can be produced also aquaponically. This pilot project can be built inside of the new dike system. Once the dikes are open, the pilot project will be easily integrated and expanded into the bigger pond area that will be rapidly filled with water.

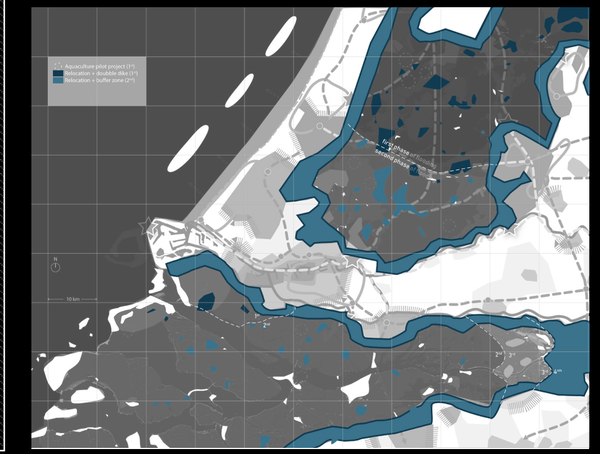


126 | Plan for the new mobility system

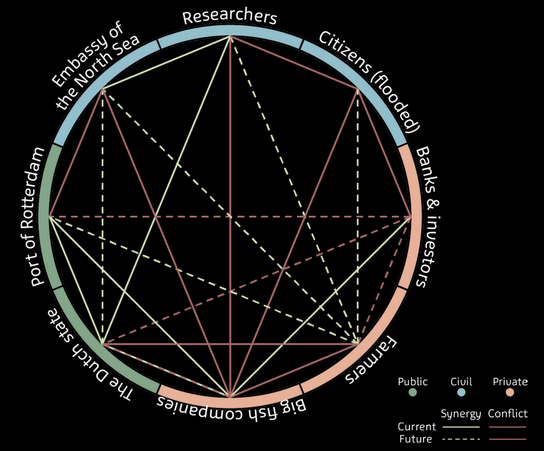
127 | Economic flows



128 | Timeline



129 | Spatial timeline

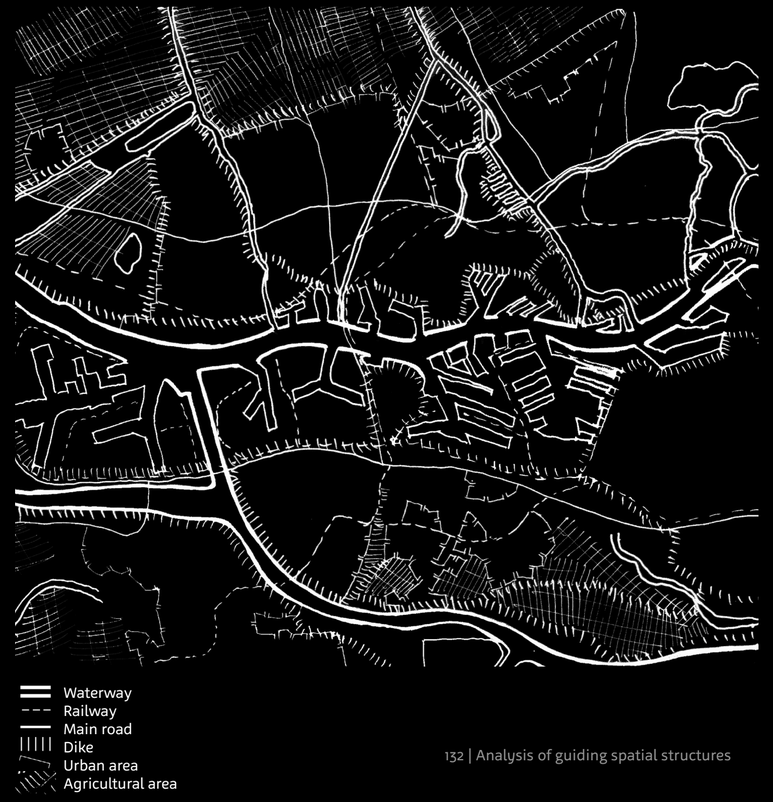


130 | Involved stakeholders and their synergies and conflicts

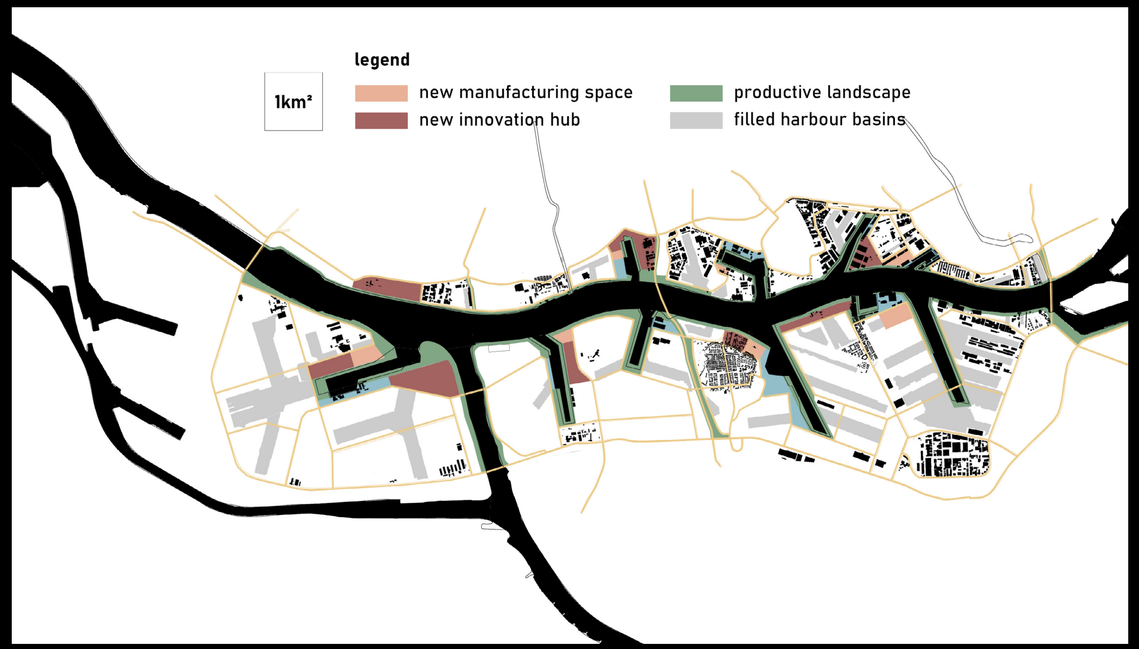
multifunctional industry

When the sea level continues to rise to 3 metres, the area that is now the port of Rotterdam will be the last safe area in the province of South Holland. Although not all the population and resources are planned to be transferred to the port area, the densification and urbanisation of the port will be an important strategy for dealing with the future climate crisis. The port along the Nieuwe Maas River will be divided into industrial and urbanised areas according to the patch analysis.
The pilot project includes the Rotterdam Makers District and the area to the west of it where the chemical and logistics industries are currently located. And there are 3 key actions: firstly, for the landscape, part of the harbour basins will be filled up for densification, and with reference to the case of Sunqiao Urban Agricultural District in Shanghai, others will be converted into a productive landscape; then, for the infrastructure, the current freight railways will be converted into railways for public transport, and the area covered by water transport will be expanded, with new road systems being constructed; thirdly, with regard to the disposal of current buildings, five types are preserved that can be utilised: the first type is about services

131 | Impression multifunctional harbor area (author's own, based on Sasaki „Sunqiao urban agricultural district" and Mei architecten „Fenix I")



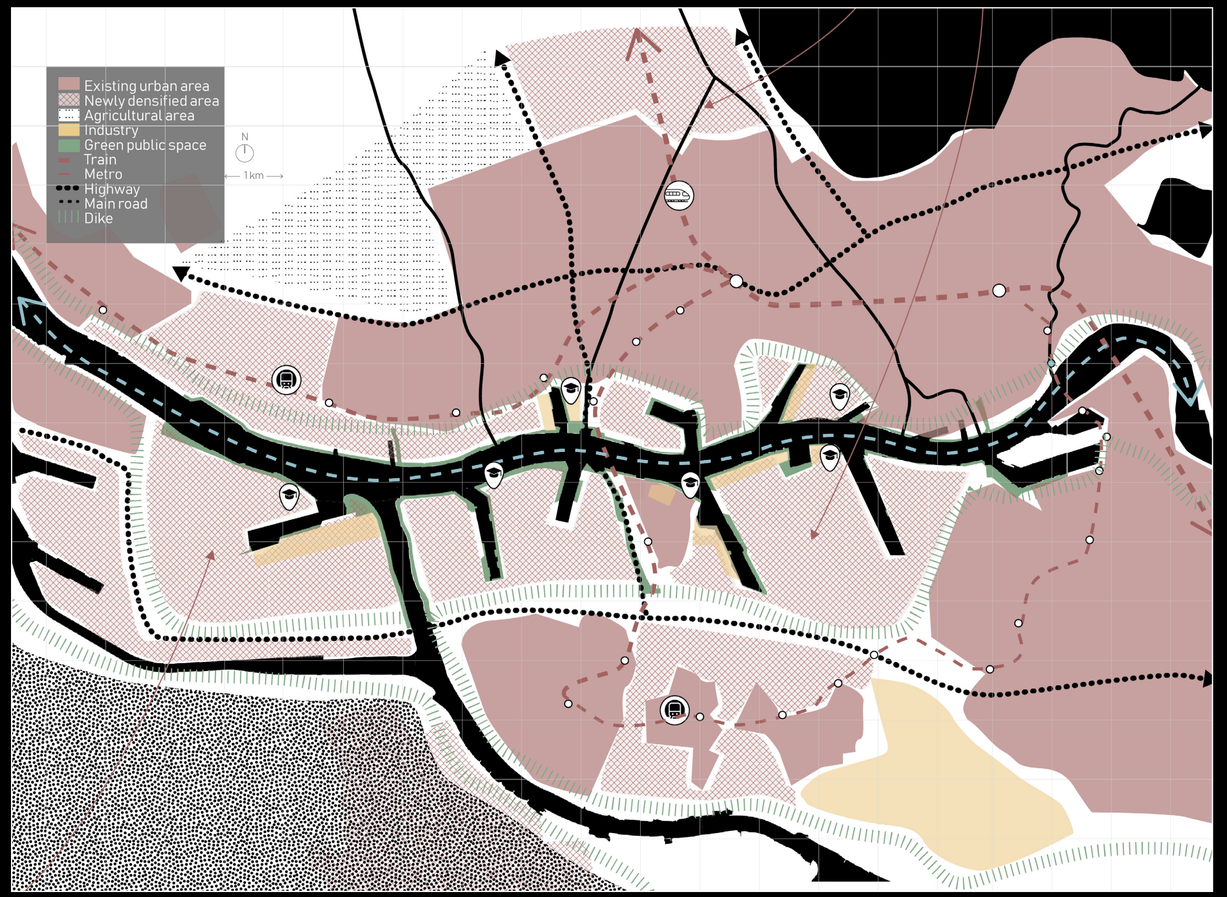
132 | Analysis of guiding spatial structures



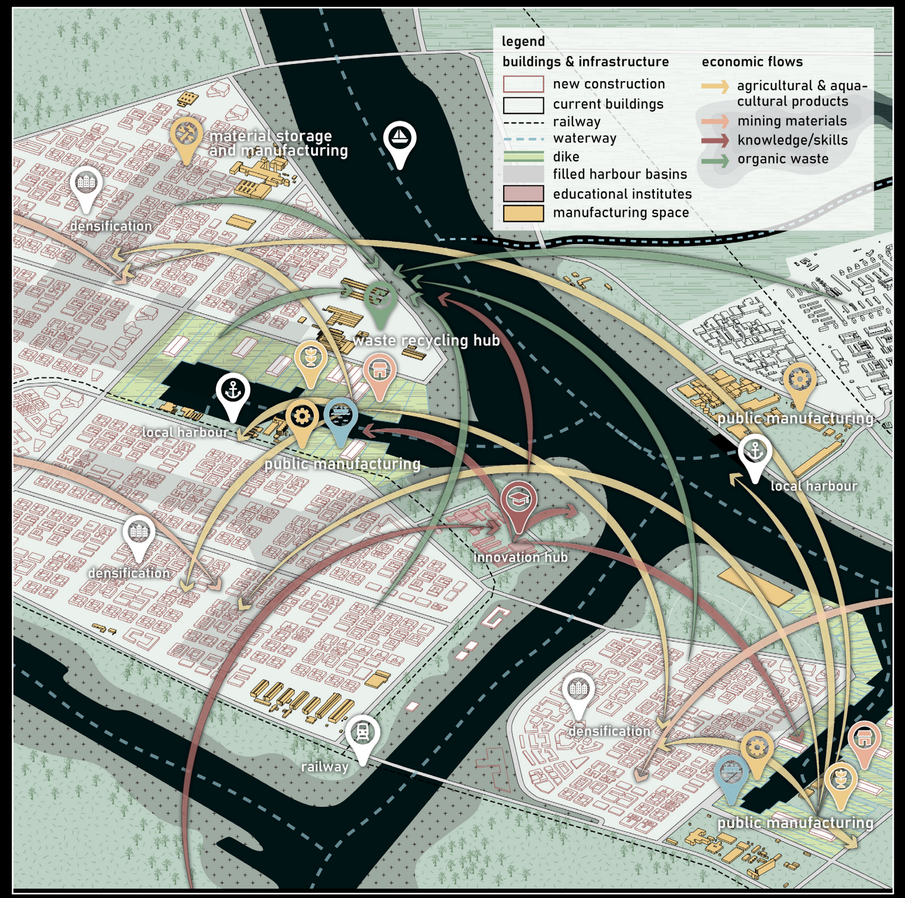
133 | The multifunctional belt

such as taxation and financial consultation, which can still operate during the transition period; the second type is related to the construction industry that temporarily serve the densification of the port and also deal with the mining materials; the third one is about waste disposal to merge the energy transition facilities for waste recycling and clean energy production; the fourth type is educational institutions or skills training centres which are mainly located in the Rotterdam Makers District and are playing an important role in the economic transformation; the last one is large-scale, structurally sound warehouses where the internal space can be divided to accommodate more small-scale companies.

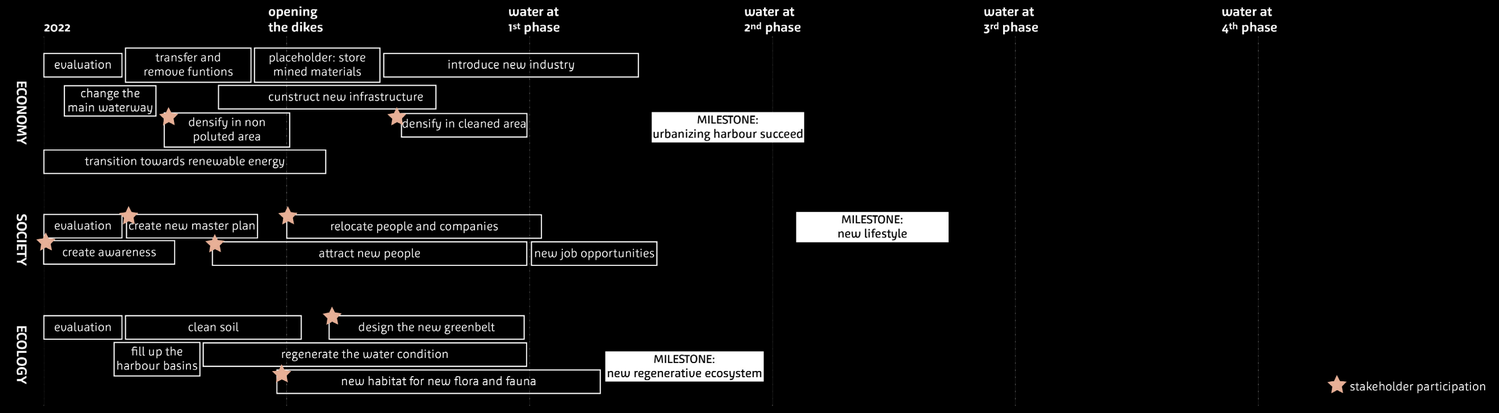
Through a preparatory process of industrial transfer, land-use change, and soil decontamination, the pilot area will be transformed from a purely heavy industrial area into a new mixed-use urban centre. The preserved harbour basins will become a new urban agricultural development and also provide recreational services. And smaller distribution centres, light processing industries, and emerging innovation hubs will surround them. Also, the two sides of the Nieuwe Maas River are connected as a whole by roads and waterways.



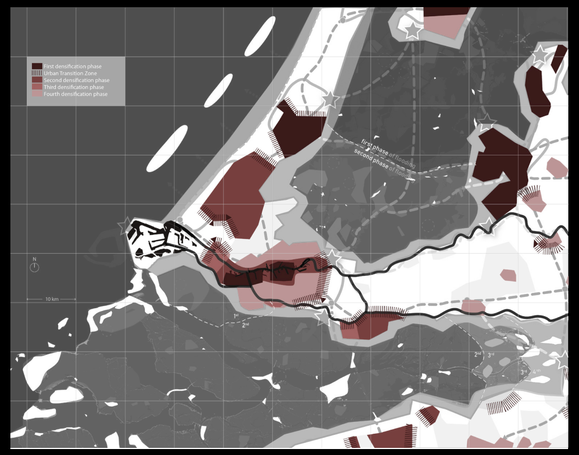
134 | Plan for the new harbor are with multifunctional belt and education centres



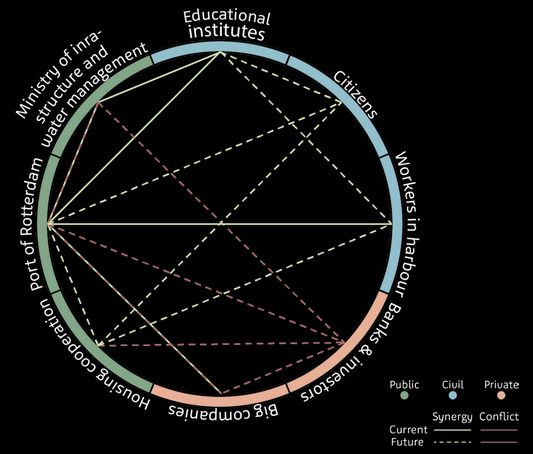
135 | Economic flows



136 | Timeline



137 | Spatial timeline



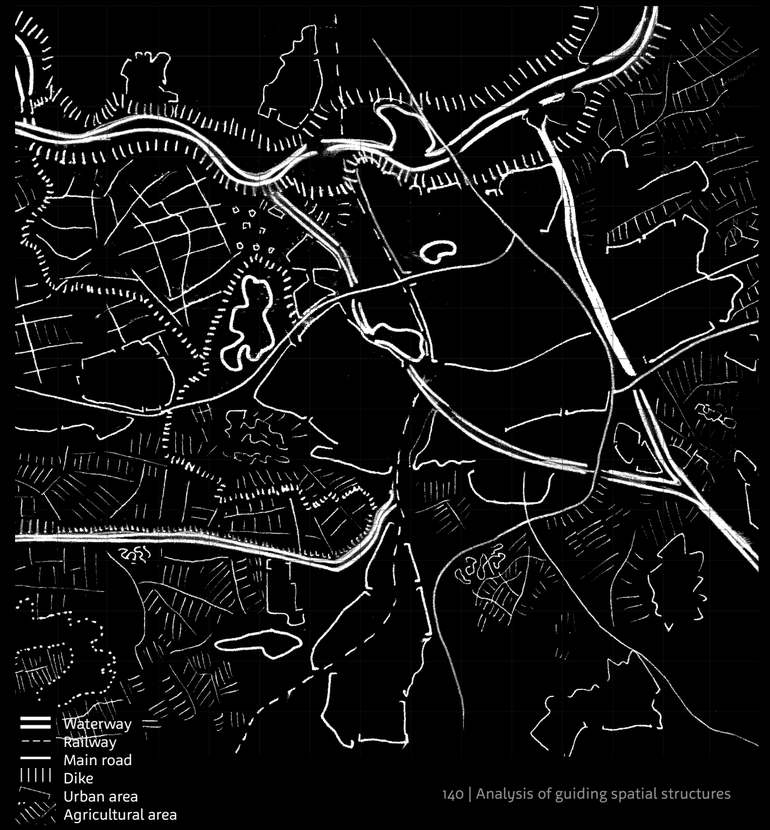
138 | Involved stakeholders and their synergies and conflicts

living with water

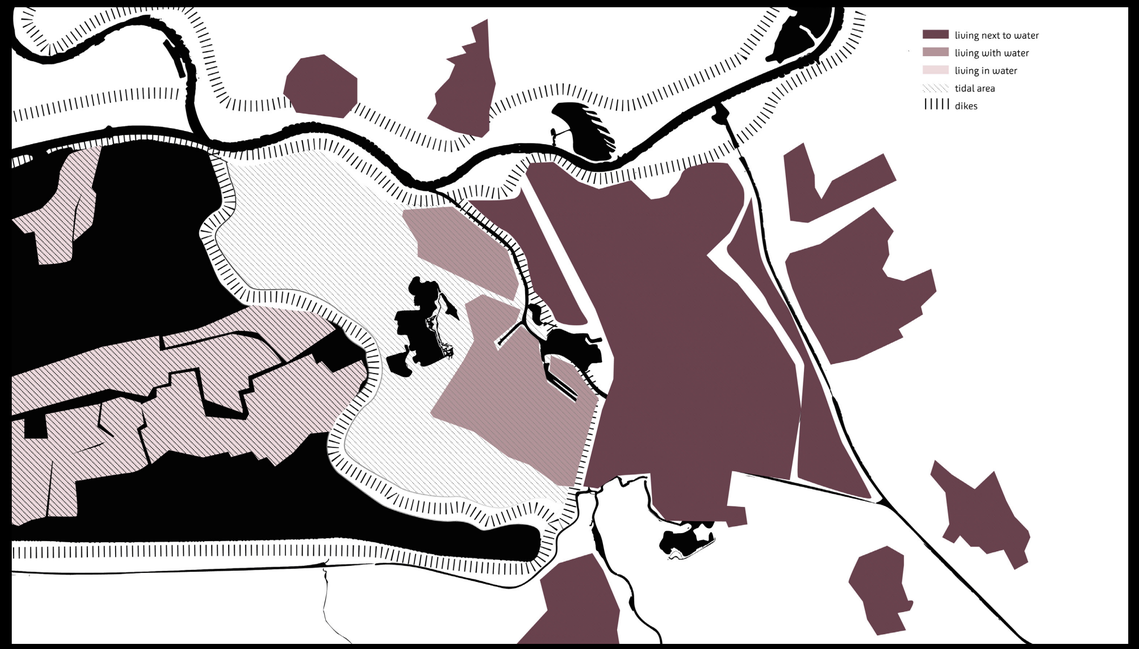
The pilot project in Den Bosch is the last pilot project to be developed. In phase 4 the water will reach Den Bosch, a city that has not been in touch with water yet and is now turning into a small new urbanised port. The city will be divided into three different areas defined by the appearance of water. The main strategic action of this project is the adaptability of the buildings according to different water management approaches (flooded area, tidal area, prepared for emergencies area) based on existing landscape structures (height, dikes and rivers). This leads to residents living in, with or next to water.

Living in water: To keep as many local residents as possible, the buildings that are about to be flooded will be built up, causing the first two metres (that is approximately how high the water will get) to be water-resistant and people living on the higher levels. However, this is only possible for brick and concrete buildings since the wood will start to rot. Densifying in this flooded area will be done by building floating houses that are secured to their position by anchor points.

139 | Impression of the new coastal city Den Bosch (author's own)



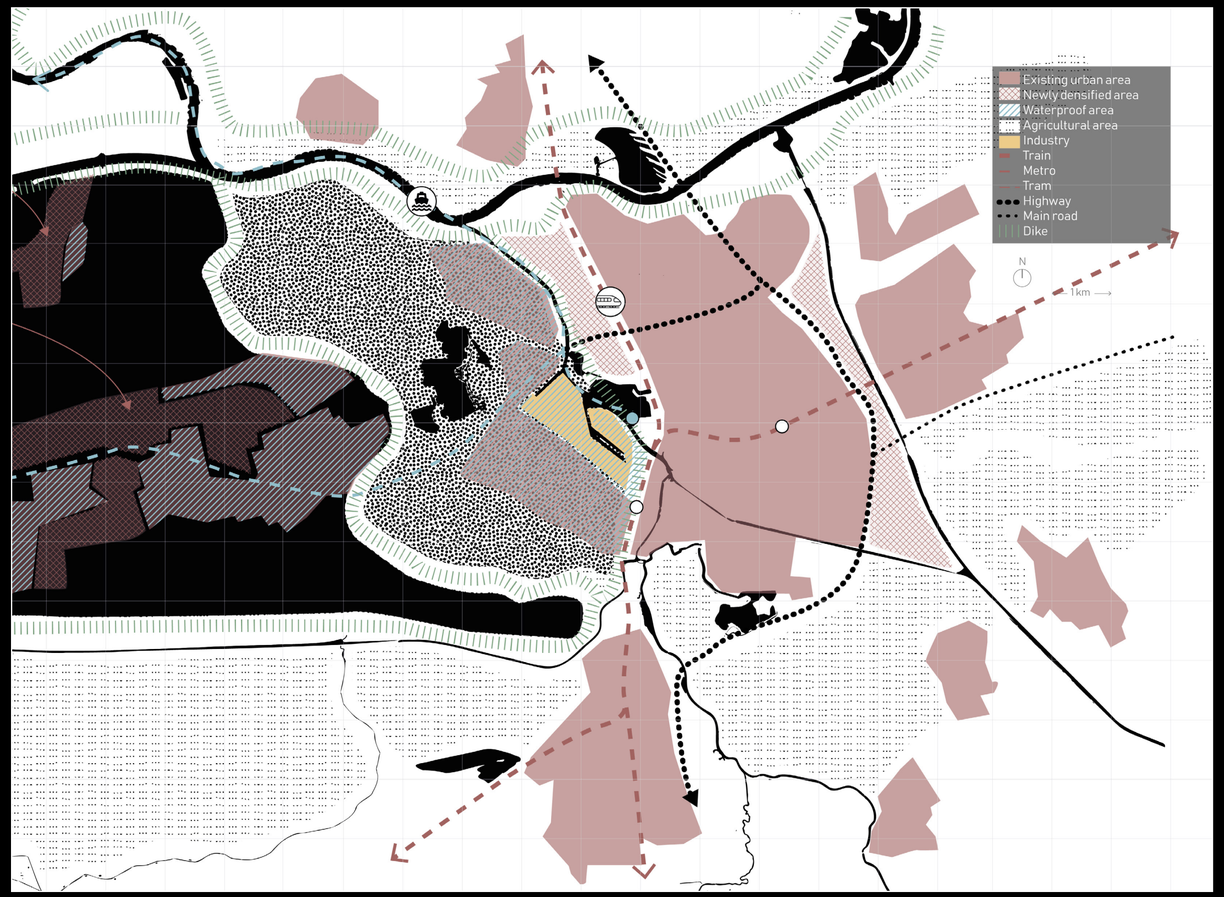
140 | Analysis of guiding spatial structures



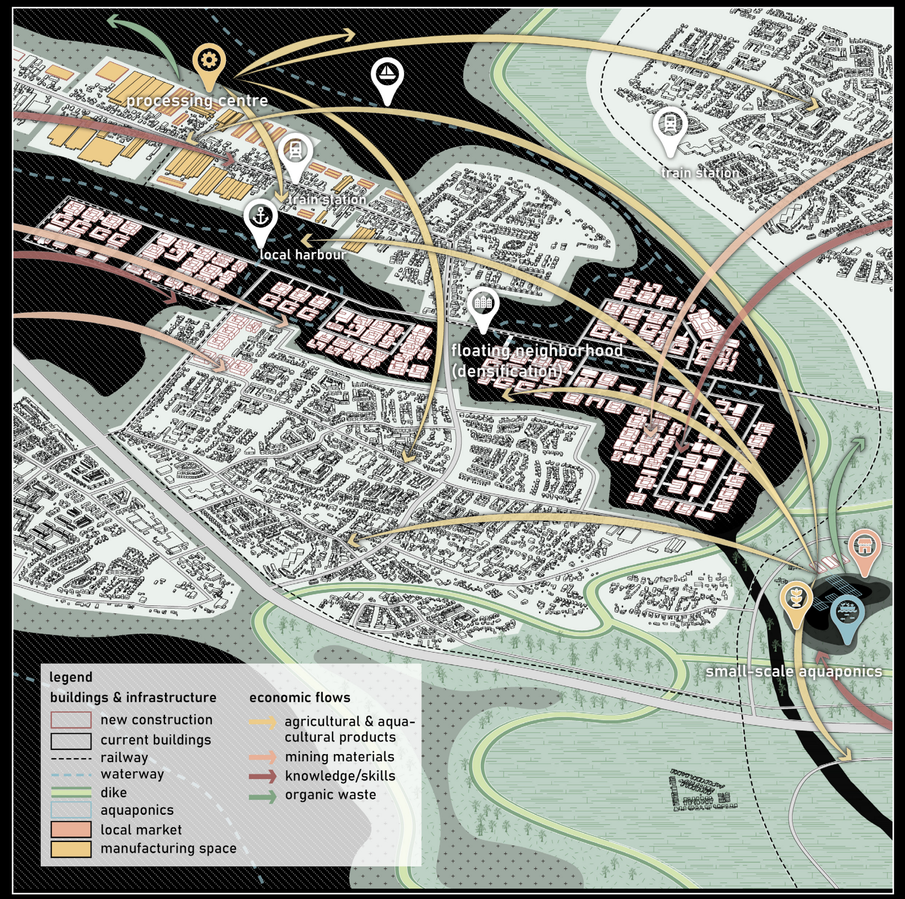
141 | Ways of living with the water

Living with water: This area is constructed to be adaptable to the tides. This tidal area is separated from the permanently flooded area by the main dike. During flow times the water can go over the dike into the prepared tidal area. Buildings there will be constructed in a way that they are either always above the water level (like building up buildings or buildings on stilts) or they are movable with the water (floating buildings). The wood-constructed buildings will be used for mining materials for other purposes. The permanent change in water level leaves new possibilities for aquaculture production. Since we want to make the loops of the circular economy smaller, we provided Den Bosch with a new floating processing centre. This is not only a pilot project for the floating industry, it also shows that living near the (clean) industry will be no problem in the future.

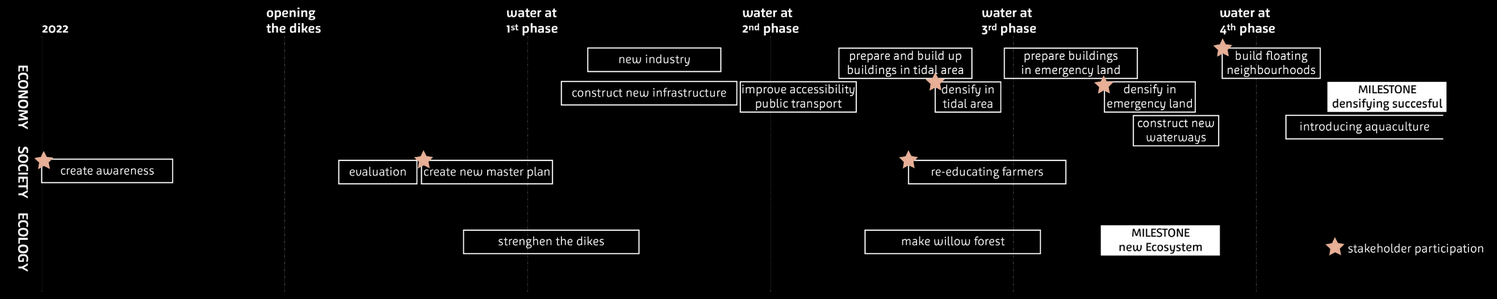
Living next to the water: a new dike structure will secure the historic inner city of Den Bosch from further flooding. However, since this is a new harbour city the buildings and the citizens must be prepared for floods caused by, rare but heavy, storms. This can be done by providing stronger water-proof doors. A project like this is already designed by Posad Maxwan. This urbanism studio design The Grote Rug, a floating and selfsufficient city.



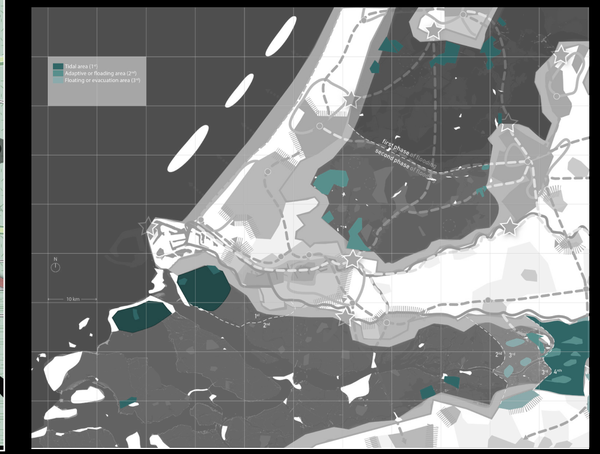
142 | Plan for Den Bosch



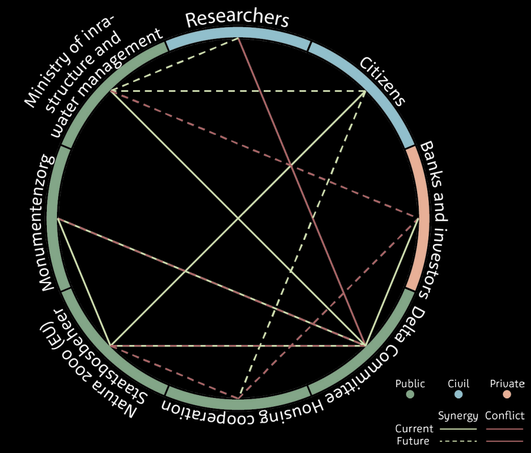
143 | Economic flows



144 | Timeline



145 | Spatial timeline



146 | Involved stakeholders and their synergies and conflicts

network of projects

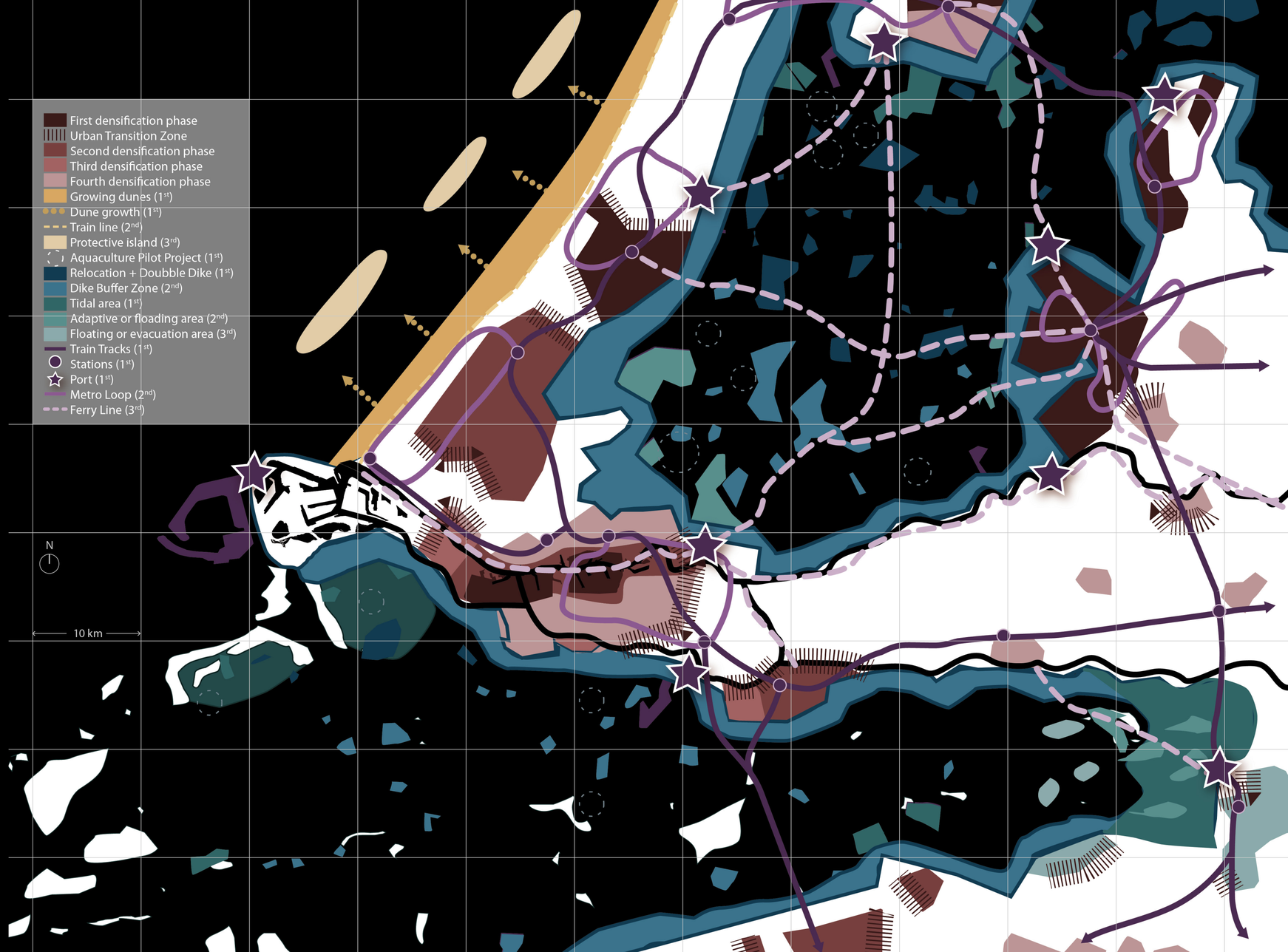
Even though the projects were presented individually, they are examples of strategies that can be located all over the Netherlands. These are nested in a complex network that follows the spatial timeline presented before.

The different themes can be used to ordinate the timeline, subdividing it into the key strategies thematics. Living with water can be linked to the urban densification aspect of the project through the different phases presented in the spatial timeline and to the urban transition zones during the first phase.

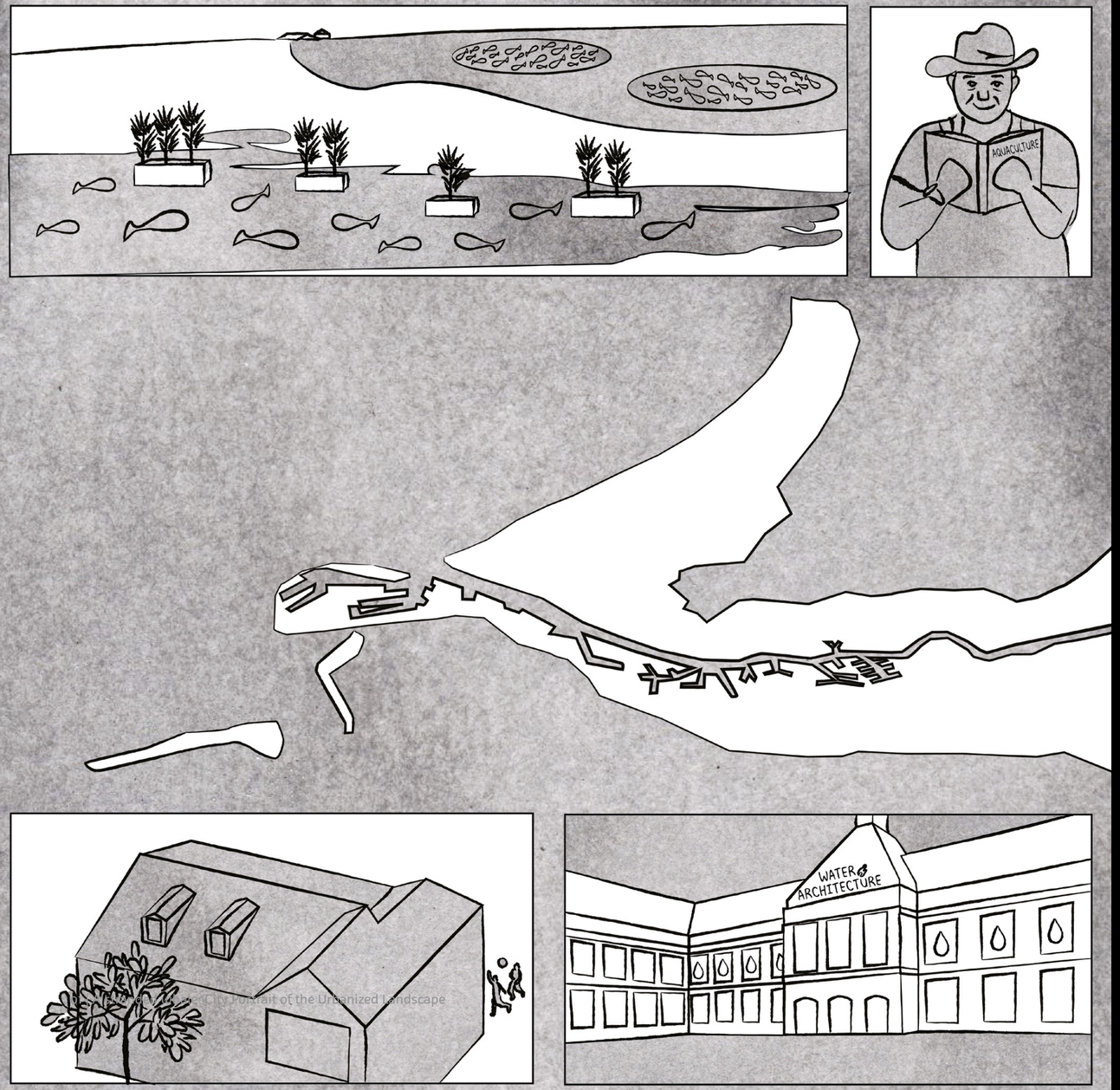
Coastal protection is linked to the growth of the dunes during the timeline's first phase, the train line construction during the second phase, and the protective island development during the third phase.

The productive protection is linked to the pilot aquaculture projects and the double dike construction and tidal areas during the first phase, the growth of the dike's buffer zone, and the adaptive flooded area during the second phase.

Finally, the new mobility system can be linked to the adaptations and construction of train tracks, mobility stations, and ports during the first phase, the new metro loop during the second phase, and the ferry line during the fourth phase.



147 | Network of projects in relation to time



05 discussion

“To listen to and tell a rush of stories is a method. And why not make the strong claim and call it a science, an addition to knowledge? Its research object is contaminated diversity; its unit of analysis is the indeterminate encounter. To learn anything we must revitalize arts of noticing and include ethnography and natural history.“
Anna L. Tsing (2015, p. 75-78)

5.1 conclusion

The consequences of climate change are a major challenge for delta environments. The way in which the South-Holland delta is currently organised is not ready for the consequences this will entail. This project aimed to find a solution to the question “How can South Holland’s economy and culture adapt to the inevitable consequences of flooding by following a circular approach?”

An important issue to mention here is that there is not a perfect solution. The idea of adaptability is to be ready for every possible future, making it impossible to propose one spatial layout in which the circular economy works fluently. The project proposes to use the concept of circularity to make the transition toward this adaptive future and regenerative economy that acts in synergy with the natural environment. Circularity is used to diminish economic, ecologic, and cultural loss.

The project proposes to make use of the fact that the region lies below sea level. This will mean that a large part of the province will be flooded. The large shift that will need to happen, can be used to also shift to an adaptable future. The answers to the sub-questions lead to the answer to the main research question.

Firstly, “Which strategy can help with creating the mental shift that needs to happen?” is answered with education. Education will be the main tool, formally and informally. Courses in schools will teach children about climate change, new institutes will help farmers learn about new ways of agriculture, and programs throughout the city in public buildings will help people imagine and gain knowledge about their future. An important tool here is an awareness game, specially produced for this change. This aims to give people knowledge so that they can contribute to the conversation.

The second sub-question was “How can synergies be reached on all levels of the region?”. The key concept here is that synergies happen at different scales, working within the scale and supporting other scales. Mixed-use areas are implemented in different layers. On the regional scale, every cluster has its own identity which allows the region to work as one system. Within each cluster, there is always a port with certain industries, and an urban, agricultural, and natural area. By scattering the port throughout the region, people are not only brought to the port area like in Rotterdam, but the port is also brought to the people. This creates synergies on several levels. Within the different areas, there are also smaller synergetic loops happening. Aquaponics creates a clear synergy between fish and plants, the belt around the dry land functions as a protection as well as a production area, and mixed-used areas in cities force stakeholders to work together. To achieve cooperation on all these scales, a manifesto is created. It will function as a guide and a contract for the uncertain future, stating some agreements will stay the same.

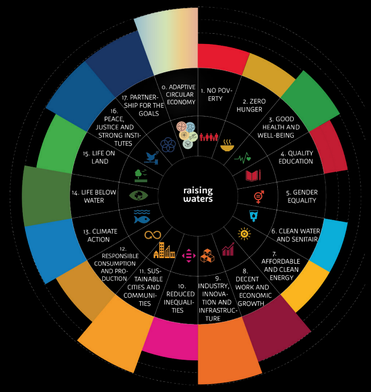
Lastly, regeneration is answering the question “How can the landscape inform a new spatial development?”. Regeneration is created to achieve the best adaptability possible. An example of the circular transition in this theme is mining all the materials from the flooded area and using them to build up new urbanised areas and public transport systems. Also, by changing the glasshouses into permacultural areas, agriculture is made regenerative, making the region adaptive. The whole region is made regenerative by giving each cluster an identity. The synergy that is created helps the region be regenerative. Every cluster adds something to the system, making it impossible to have one fail. All the clusters share the same benefits and burdens because they rely on each other. Connections within the clusters themselves also regenerate every part of the area, making it at the same time more socially just.

5.2 discussion
SDG‘s

Global warming is not only affecting all of us, now and in the future, it is also caused by all of us. Hence, we must solve this problem together. In the chapter about stakeholder participation, we already described how different stakeholders can contribute to a new urban and circular future. However, we are not the only ones who think about social relevance while thinking about climate change, global warming, and sustainability. The UN created 17 Sustainable Development Goals (SDG) in 2016 (United Nations, 2018) and in 2019 the EU established the European Green Deal where everybody engages in tackling climate change (Rocco, 2021).

In short, the goal of the Department of Economic and Social Affairs (UNDESA) was to set up goals to put an “end [to] all forms of poverty, fight inequalities and tackle climate change while ensuring that no one is left behind” (United Nations, 2018). This resulted in the 17 goals of the Sustainable Development Goals. They defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” To achieve these goals, it is of high importance that the three interconnected core elements, environmental protection, social inclusion, and economic growth create a common synergy (United Nations, 2018). A critique on this could be that economic growth is not a goal, but more a consequence of the total sustainable and just transition towards a better future. Since these three elements are also strongly represented in our project, we wanted to illustrate how well this project scores on the 17 SDGs. However, it is worth mentioning that these rankings are based on our perception and are not scientifically underpinned. In image X you can see that ‘Raising Waters’ scores high on the economy goals (goals 7, 8, 9, 11, 12, and 17) and those about the ecology (goals 13, 14, and 15). However, the social goals (1, 2, 3, 4, 5, 6, 10, and 16) are not well represented. These goals are rated lower since they are more long-term effects of our strategy but are not immediately visible through our main strategic actions. For example, we did not design a gender-equal vision, but we will make sure that there is no gender gap in 2100 anymore due to the mental shift the society will undergo. Besides the rating of the goals for our overall project, the same ranking is done for the individual key projects (see appendix). The trend of high scores in economy and ecology is also visible here.

The European Green Deal is a social sustainable policy, approved in 2020, that aims for goals like zero pollution, affordable secure energy, smarter transport, and high-quality food. The policy is a reaction to the several systems that are falling apart due to “exploitation, destruction of natural habitats and climate change” (United Nations, 2018, p. 92). It is a social contract between the EU and the European citizens (European Commission, 2019). Our project contributes to reaching



149 | SDG‘s in the project

these goals by creating new renewable energy sources, free public transport and a local water-based (food) economy.

As described, this project could be an example of a new urban development that suits different goals and policies of higher nations. However, on a smaller scale, it is important to mention that the success of a project like this depends on the contribution of the entire society. The boat can only sail with everybody on deck. Hence, it is important to start as soon as possible by creating awareness of the urgency of our future scenario, but also the potential to show people that if we are in this together, we can create a bright, sustainable, and just future.

ethical issues

The moving of a million people is an important ethical issue. Not only because of the financial losses but also because of the mental loss. People are born and raised in the area we bluntly say that gets flooded. It can trigger emotions, as we already have seen at our mid-term presentation and in conversations we had with colleagues. It asks a lot of people to leave behind everything. In history, we have seen this happening before, but it is sadly enough always triggered by disaster. We hope that we have shown that there are alternatives.

While writing this report, we may have been too generalising when talking about people. An important recommendation would be to do more in-depth citizen participation with people who will be affected by the project.
We talked about previous floods or other disasters. We understand that that also can raise a lot of emotions because people have experienced these kinds of things. Especially with the indescribable disasters going on in Ukraine right now, we understand that we may have triggered emotions. We do think it is important to show those horrible things do not need to happen before a societal change happens. If you have anything that you would like to talk to us about, feel free to contact us through the Urbanism department of the TU Delft.

dependencies and relevance

A large dependency of this project lies in the sea-level rise. The strategy is structured around the level of the water; different phases are structured around where the water reaches. Steps that need to be taken therefore rely on how fast mankind can slow down the global warming that is causing the sea level to rise. Sadly, we can be sure of the sea level to rise at least 0,95m in 2150, in case of a 2,4˚C warming (IISD Earth Negotiations Bulletin, 2022; NASA Sea Level Change Portal, n.d.). Also, the project works already with the current sea level. When the dikes are opened, a large part of the region will be flooded, as explained in the chapter about rising water.

The project is relevant for a lot of other areas. Policy transfer is a tricky thing to do, but when translated in a sufficient way, it can be useful (Dąbrowski, 2022). There are several areas that, when translated to their own context, can use parts of the project.

- Delta areas, above sea level and below sea level, can use the approach of working with the soil types and water specific for delta areas. Aquaculture can be implemented as part of the economy.
- Coastal areas, more broadly than delta areas, can also use the water-based approach. Aquaculture can again play a big role. When there are dunes, the area can use the coastal protection strategy from this project.
- Port areas can use the approach of merging several functions together, as well as scattering the port around the region, making every city dependent on others to boost the regional economy. Also, the mixed-use strategy of densifying the port can be used in a lot of other ports.
- Polycentric regions can have a look at the mobility network, mainly as a tool to achieve socio-spatial justice. The strategy of creating similar clusters of functions, but making sure every cluster has its own identity, could also work in other regions.
- Municipalities and provinces can learn from the visionary way of thinking. The nature-based approach can help their regions be adaptive for the future.

academic relevance

There has already been a lot of research done on how society can adapt to climate change. Just this week, the IPCC published a report stating the urgency to change political and societal behaviour is larger than ever (NOS, April 4 2022). If governments would keep on doing what they do now, the earth will have a warming of 3,2˚C by 2100. The article states that ["Innovation and behaviour are also discussed. Heleen de Coninck of Eindhoven University of Technology: „New in this report is that it outlines the possibilities to prevent the most serious climate change: possibilities in behavioural change, political action, innovation and international cooperation, for example in the field of financing and investments."] (NOS, April 4 2022, translated by authors). Fortunately, this is what this project proposes and also what is seen in published research. More and more research is being done at the economic and spatial consequences of climate change and proposing different ways of dealing with the sea-level rise. This shows that the shift is already beginning to happen. With this project, we aimed to show an example of how different research projects can be put together to investigate the consequences. Of course, there are a few limitations. One of them is time.

For further research, we would recommend several things:

- Do more in-depth research on people, by quantative research but also qualitative;
- Get more in detail with calculations;
- Do more detailed design of key projects by including the actual stakeholders for input;
- Make a financial timeline and get in detail with budget, then improve or change policies;
- Expand the game by explaining the cards, testing it more and improving it.

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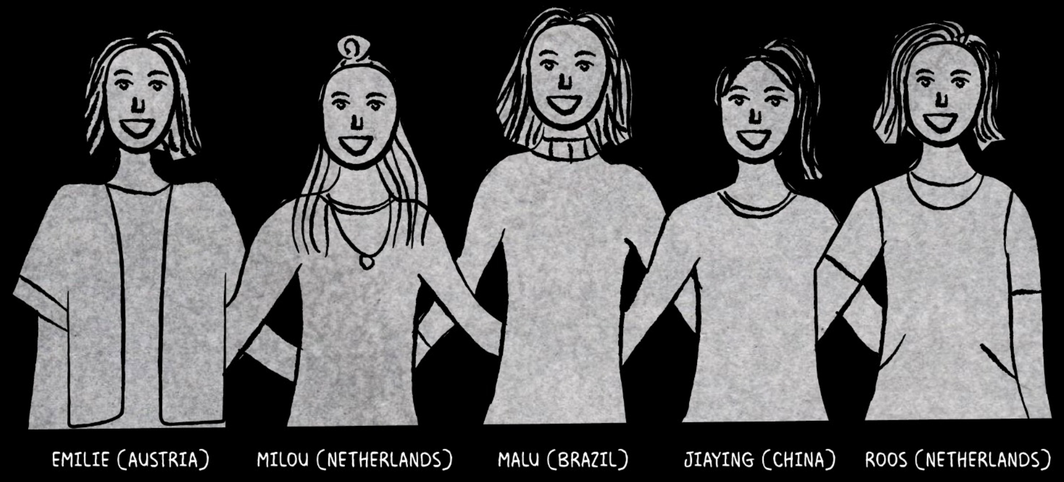
7.1 personal reflections



Milou Mulder

This course suits the way I have been experiencing the master for so far really well: research by design, design by research, dare to experiment and make sure to take enough time to dig into the things you are really passionate about.
The first week I was a little insecure about the skills I could contribute to the group since I felt like I was the least experienced in the urban field because others did a more urban-focused Bachelor's or did an internship. The new context of the three-meter sea-level rise also contributed to the insecurity. However, I wanted to use this opportunity to learn from my peers, their knowledge and their experience. The different points of view on things due to cultural differences were also very interesting.
The success factor of this project is based on many things. For a start de course itself. Even tho the regional scale was challenging at first, the SDS and Capita Selecta lectures, as well as those from the methodology course, helped a lot. They provided us with new useful inputs and other inspiring perspectives for our project. Especially those about the social aspects, like the Social Justice, the SDG and the lecture about ethics really got my attention. The group gave me the freedom to explore more about this which I really appreciated.
This leads to another, large factor why this project was such a success: our group spirit. Our team consists of five very strong personalities who balance each out very well. We trusted each other which allowed diving into themes we were passionate about. Since we were five, we were able to divide the tasks according to our interests. This led to the fact that we, most of the time, were doing things we enjoyed and had fun with. The good spirit helped us be motivated and work harder.
Especially at the beginning, I felt like we had to give 200% since the land we based our vision on first had to be shaped. However, these strong personalities also lead to many discussions. You had to be sure about the things you were proposing, so I think we also gained a lot of communication skills. Besides that, the long discussion made sure that all decisions were well thought out and based on a lot of research. This makes our vision very strong and research-based.

Coming back to the individual personalities, my groupmates can confirm that my first description of myself during the first tutoring was very correct: I have many organising skills. A structured miro board and a large pile of sketches allowed the group to explore all options without losing the overview. However, at some point, I felt like being busy organising thoughts did not give me enough space for designing. After acknowledging this, I pushed myself to be more committed to the designing part, which turned out very well. Also here the great team spirit was encouraging me to step out of my comfort zone and use this safe environment we created for each other, to explore different techniques.
Overall this group project was a big success and I am proud of us all for how great we performed and developed our design.

Emilie Stecher

Sometimes we have to step out of our comfort-zone to see what we are used to from a new perspective. That was what we did in our regional design project. By challenging the status quo in a playful way, we imagined a future that at first sight seems very unrealistic. But what in the beginning seemed like crazy idea became over the term of the quarter more real than ever. Through experimentation and supported by research, inspirational sessions by our tutors and the lecture series, we more and more realized that what we were working on was something very urgent. Imagining how the Netherlands could react to sea-level rise, a threat that questions the attitude of the country and puts its existence at risk like nothing before, was extremely challenging. Every time we presented our vision people either spoke up in rejection or were fascinated by its complexity. I think the most important thing for us was to not get lost in the intangibility. In this respect it was very helpful that we were making such a fantastic team. Everyone was on board. We all had different levels of expertise and passion, and maybe especially because of that, we were discussing and sketching a lot to learn from each other and convey what we were thinking. Sometimes it was difficult to find the right tools and concepts. Especially in those times the theories we learned at the capita selecta series, like using the R-ladder to evaluate our performance, helped us to understand the complexity at hands. I would like to highlight the lecture about the circular port economy by Karel van den Berghe because we retrospectively took quite some of his conceptions. When we were discussing the different future approaches towards water or land based urbanisation, we took the differentiation of specialization and optimization as a base to create a framework. This was one of the most important realizations in our project development. Furthermore, the thought about a change from land development to network development was very helpful. With this we created polycentric clusters, a decentralized port system and a mobility network that is the driver for spatial justice. This also links to the notion of territorial metabolism, which for us was very important since we were looking at the ecosystem as a whole, to create a regenerative landscape. In general the notion of urban political ecology is very close to our perception of regional planning. Like Dirk Sijmons (2018) describes, we have to look at the whole artifacts. We won't find the solutions only in the built up areas, but have to look at ecosystem services and nature based solutions to get a grip on what it needs to create liveable cities. This was very important for our design process. All in all it was extremely interesting to investigate with five brains on an issue that is just starting to get attention. Especially in the regional scale it has not been touched too many times, if ever. We spend our time together trying to create the basis for a new Dutch landscape, economy and culture that might inspire more planners, decision makers and fellow students to think out of the box and imagine something new — and possibly even spark change.

Maria Luisa Tarozzo Kawasaki

I started this quarter knowing that it could have been a challenge for me since I am not used to the regional scale and to economic studies. However, against the odds, this quarter has been one of the most stimulating projects I ever participated in.
Multiple factors played a role in this. First of all, we started our project with a very fascinating theme for me: the flood in the Netherlands linked to sea-level rise. The group embraced the theme, even if it was a challenging one, and I think that the commitment to the research from all of the group members was extremely important to our project.
The group where I ended up was another very important factor. All of my groupmates were very passionate and collaborative. Discussing the project felt like talking to friends. I also believed that we were very efficient when it came to dividing tasks. We always made sure that the person assigned to the task was the best one for it (and the one who would have had more fun doing it). That allowed each one of us to study in-depth subjects that we were more curious about. I learned so much about aquaponic production and how to calculate the economic loss. I allowed myself to get into research rabbit holes and had so much fun while doing it. It was also always fun to come back with the results from our personal research and learn from it with the group.
In addition, the group always showed to be very sensitive and empathetic. We always knew when we needed to take a break or solve personal matters. This attitude always made me feel comfortable and motivated to work even more. I had to fly to Italy in the last week before the deadline to spend a few days with my parents that live in Brazil and even though I was feeling guilty about it, my groupmates never made me feel bad about it. My gratitude for them made me want to work even harder once I was back.
Finally, this quarter has been the most organized so far. The methodology course was very helpful to the project but not only. Concepts such as communicative planning and how to write an abstract proved to be useful also in other aspects of my academic life. I also enjoyed the fact that we had a lecture regarding ethics in urbanism, a topic that I find very important but never learned about before this course.
The tutors of our studio, Marcin and Birgit, followed us from the very beginning. The feedbacks were always extremely helpful and I could tell that both of them wanted to see our project improving until the very end. The paper recommended by the tutors and the concepts I learned from it, like the adaptive cycle to mention one, are theories that I will surely reuse in the future.
Overall I am very happy with the results of this quarter. I know that our project could have been so much more if we had time. I think we could have detailed concepts that unfortunately can appear to be superficial in the report. We couldn't really solve the problem of how to convince people about our project, maybe because, after all of our readings, this project seems to be more and more obvious. However I know that we did what we could have done, with our limitations of time and knowledge.
I hope next quarter can be as fun as this one and I wish the same to all of my groupmates and colleagues.

Roos te Velde

The Research and Design studio on Spatial Strategies for the Global Metropolis, together with the Methodology course was my first course in the master of urbanism. This made several things come to light particularly strongly. Firstly, it was a liberation to finally have discussions in my studies about the future of the society and planet. The bachelor's architecture at the TU Delft was for me still very much based on outdated principles. It gave me an important base of knowledge, but it was lacking a focus on sustainability, in my opinion. In this project, sustainability was the main driver. The word sustainability does not even do justice to the complexity and grandeur of the task we are facing. What also was specifically liberating to me is the fact that there are so many nationalities together. It pulled me out of my bubble and forced me to look at the country I have been leaving in for over two decades in a new light.

The course, being my first one in the master's, made me quite insecure about my skills and abilities. The feedback halfway through the course showed that my group members also got this feeling. They told me not to worry, which helped in build some confidence. They also said that I should take time to experiment with things I was not sure about, like visual design maps or using QGis. It was nice to have the time to do this and I learned a lot from my group mates concerning this. Another thing that stood out was the fact that my group thought I was good at drawing conclusions from chaotic discussions, but I could also get a bit too strong in this and overrule some opinions of others. After this feedback, I tried to pay more attention to this and asked whether everyone agreed with certain conclusions I drew.

The group dynamic brought a strong visionary thinking atmosphere. The whole course was like a grounded playground; there was space to fantasise and be optimistic about the future, while also using evidence to argue. For this, the interaction between the two coursed really helped. On a more personal note, I also had a great time. The group dynamics worked well together. During personal family issues, everyone was supportive and gave me the space and backup I needed. The visionary aspect of our project always made us very enthusiastic and cheerful, which helped to stay motivated.

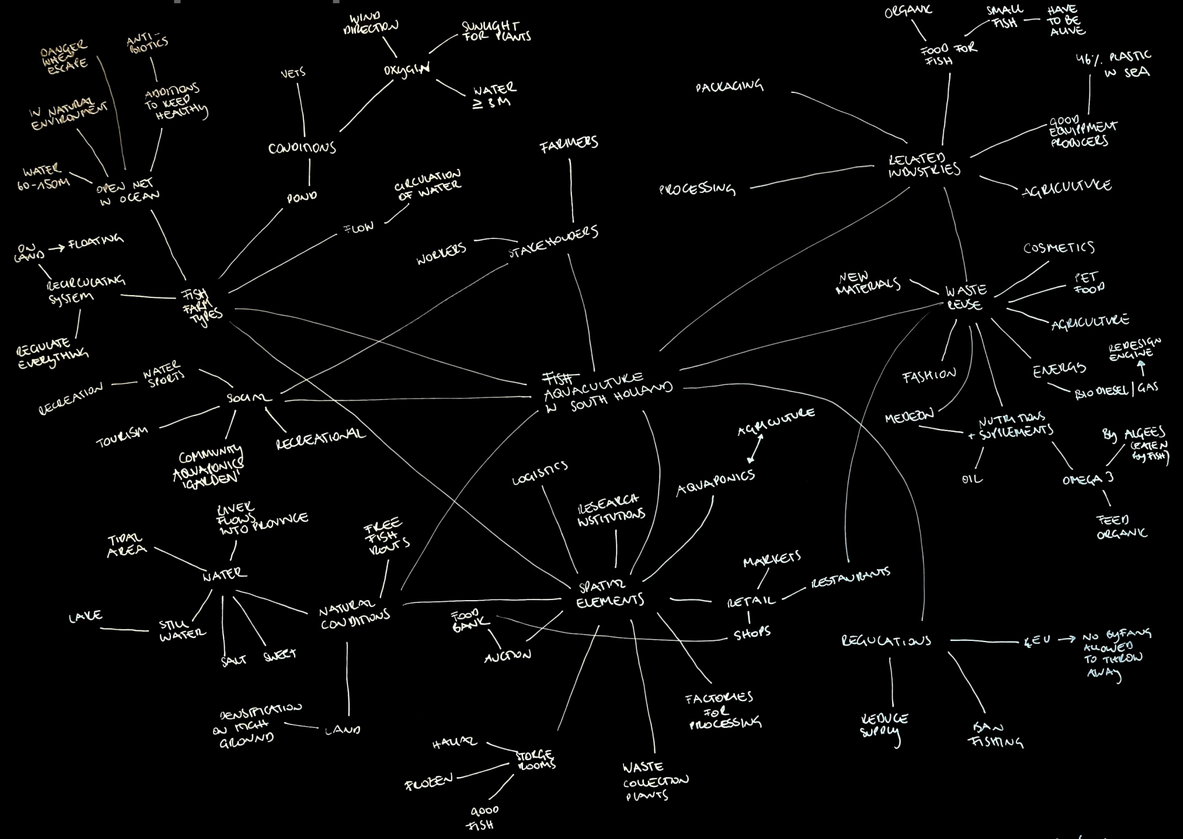
Lastly, it was crazy to see how difficult it was to convince friends and colleagues of our project, especially Dutch friends. I had to show several news articles and scientific reports to persuade them into thinking differently and be more open to alternative ways of dealing with the water. This helped sharpen the arguments in our project.

Jiaying Wu

This course was a huge challenge for me from the start: I have studied architecture and urban planning during my undergraduate studies and have also worked in urban design for 1 year afterward. I am familiar enough with operating on a spatial level, but I know that urbanism is much more than that. The circular economy is a word that is both new and not new to me. I have been exposed to so many different topics of sustainable development, both in China and in the Netherlands. But this course required me to gain an in-depth understanding of the Dutch policy and social context in related areas, which was difficult. But during the first week, a series of lectures really helped me, especially Alex's presentation on the circular economy and the series of helpful learning videos he provided. I was also very interested in 'oil spaces-exploring the global petroleumscape '(edited by Carola Hein, 2022) Carola Hein talked about (although our group didn't end up choosing the energy category).
Another thing that was challenging for me was working in groups. I understand the great importance of group work and was keen to make new friends and learn more from them in the learning process. But perhaps I am shy at times as the only Chinese person in the group (with a very different cultural background to my European peers) (this was also reflected in my mid-term group assessment). But the other four members of our group were really helpful and encouraging, which gradually made me open up and enjoy more and more the process of learning together collaboratively and enjoying the discussions and debates. In addition, the two tutors in our group have also been very helpful to me. They always listened patiently to me express my ideas and also gave us recognition for our milestones from time to time.
Coming back to the course, I am really proud that the direction we have chosen to stick to is not limited to one sector, but uses sea-level rise as an urgency, starting with landscape change, scenario exploration, and using circularity as an approach to explore how to minimise economic loss, cultural shift and regeneration of the food industry(as this industry will be greatly affected, for example by the loss of a lot of farmland) in this sustainable transition. This is a very ambitious subject and there are many things that could continue to be studied in-depth, such as how to adjust the criteria for decision making in time for the transition period, how to involve all stakeholders in cooperation, how to recycle and use building and infrastructure materials from flooded areas, how to explore localised, more efficient and flexible production models for agriculture and aquaculture in a context of reduced surface area and increased water area, etc.
We have had a lot of difficulty in convincing people. Because although our project will generate a lot of discussions, from what we've said to others, most people are not going to take defensive measures now because of the scenarios that will happen in 2100. The limited time available for the course did not allow us to gather and present the evidence in more detail and discuss it with a variety of people, but I believe this is a good start and a plan that looks at the long term. I think it's already involved in practice because the first step in trying to make that circular and sustainable transition is to realise the potential of education to facilitate discussion and reflection on relevant topics.

7.2 other images

Mind map conceptual framework



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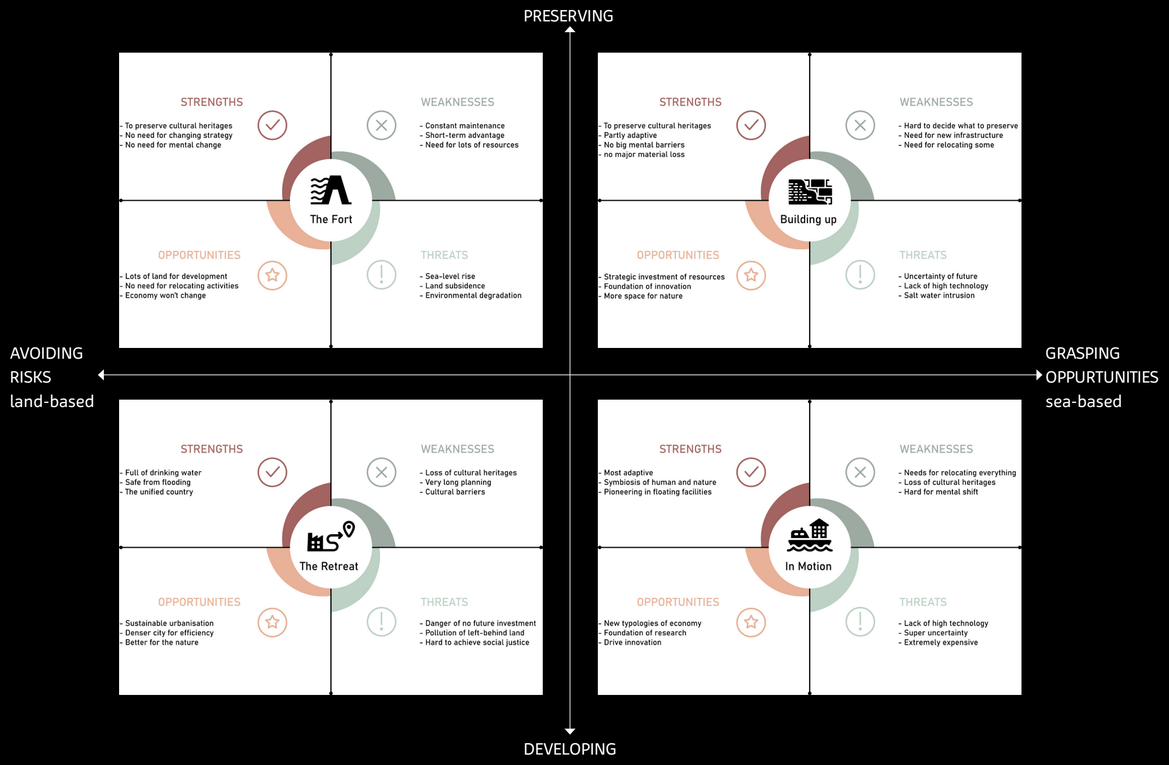
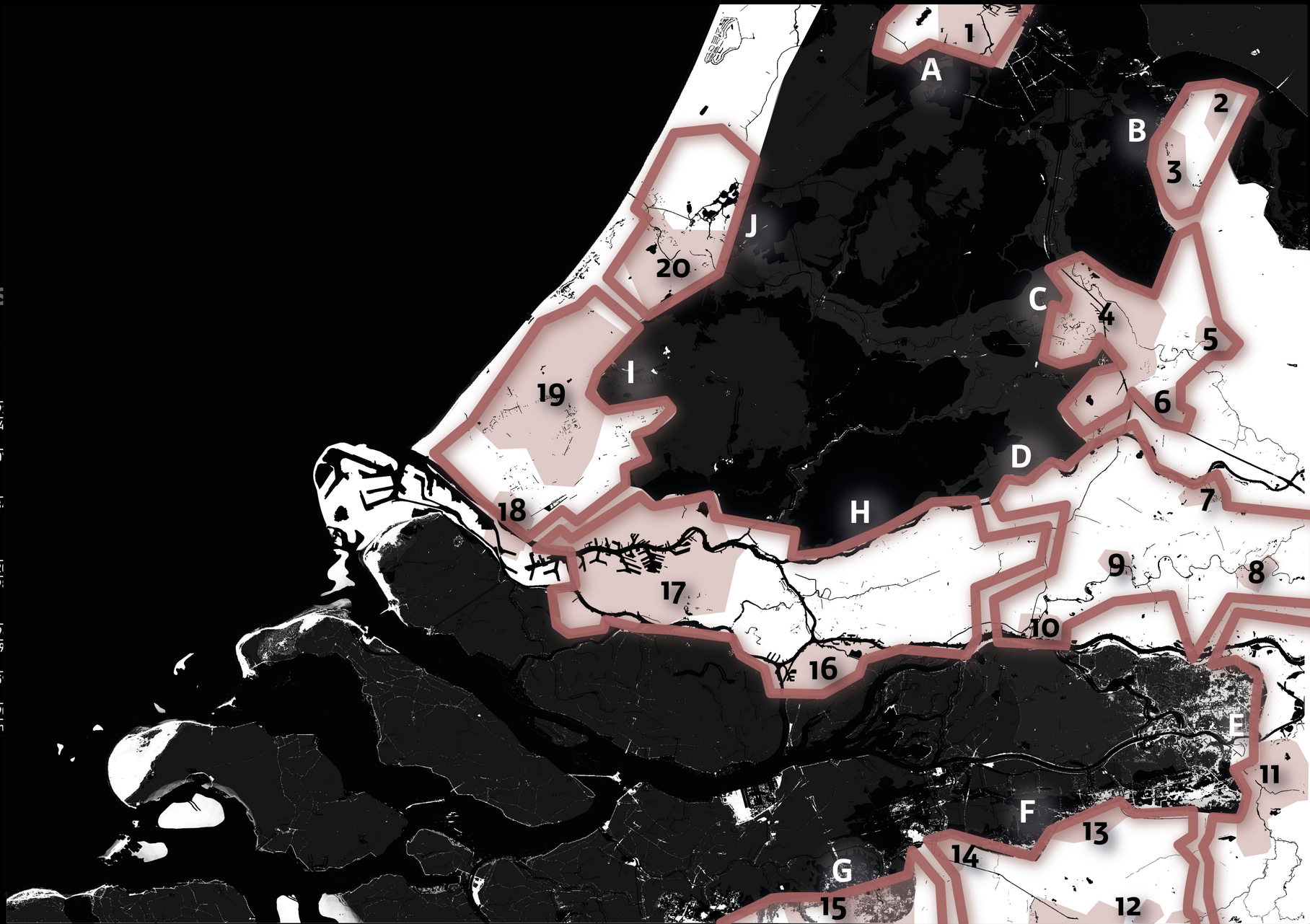
SWOT-analysis scenario's



calculation - relocating residents

	current city	cluster	size of city in km²	% of total km² cities	sum km²/ cluster	sum%/ cluster	%(cluster) * tot. Residents assigned residents based on size
		-	km²	%	km²	%	
1	Amsterdam	A	44,54	4,95%	44,54	4,9537%	199.9
2	Huizen		10,00	1,11%	44,43	4,94142%	199.4
3	Hilversum		34,43	3,83%			
4	Utrecht	C	129,16	14,37%	155,07	17,25%	696.0
5	Zeist		12,34	1,37%			
6	Houten		13,57	1,51%			
7	Culemborg	D	9,08	1,01%	37,17	4,13%	166.8
8	Tiel		8,46	0,94%			
9	Leerdam		6,45	0,72%			
10	Gorinchem		13,18	1,47%			
11	Den Bosch	E	50,84	5,65%	50,84	5,65%	228.2
12	Tilburg	F	25,03	2,78%	51,46	5,72%	230.9
13	Waalwijk		17,13	1,91%			
14	Oosterhout		9,30	1,03%			
15	Breda	G	35,86	3,99%	35,86	3,99%	160.9
16	Dordrecht	H	44,07	4,90%	240,60	26,76%	1.079.9
17	Rotterdam		196,53	21,86%			
18	Delft	I	22,22	2,47%	170,34	18,94%	764.5
19	Den Haag		148,12	16,47%			
20	Leiden	J	68,82	7,65%	68,82	7,65%	308.9
total			899,13 km²			100,00%	308.909 residen



calculations - new density

	r = residents;	km²;	r/km² = residents / km²			
# RESIDENTS	**NL**		**SH**		**%**	
ATM	17.608.239	r	3.656.135	r	20,76%	
2050	18.527.200	r	4.198.700	r	22,66%	542.565
2100	20.000.000	r	4.600.000	r	23,00%	401.300

	in plan		**to add**		**total relocate**	
ATM	2.625.455	r	-		1.030.680	r
2050	-		542.565	r	1.573.245	r
2100	-		401.300	r	1.974.545	r
			943.865			

KM²		
Urban area	2.974	km²
New urban area	2.698	km²
total	5.672	km²

	DENSITY (res. / km²)		# res		km²	
Rotterdam	2.995	r/km²	651.631	r	32,41	km²
Oude Westen	16.509	r/km²	9350	r	0,57	km²
UN Principles	15.000	r/km²				

res. Pos. With dens.	**Urban area**		**New urban area**		**total**	
Rotterdam	8.907.130	r	8.080.211	r	16.987.341	r
Oude Westen	49.097.766	r	44.539.631	r	93.637.397	r
UN Habitats	44.610.000	r	40.468.500	r	85.078.500	r

km² needed 2050			**% of Urban area**	**% of new Urban area**	**% of tot.**
dens. of Rotterdam	1.402	km²	47%	52%	25%
dens. of Oude Westen	254	km²	9%	9%	4%
dens. UN Habitats	280	km²	9%	10%	5%

km² needed 2100			**% of Urban area**	**% of new Urban area**	**% of tot.**
dens. of Rotterdam	1535,89	km²	52%	57%	27%
dens. of Oude Westen	278,64	km²	9%	10%	5%
dens. UN Habitats	307	km²	10%	11%	5%

SOURCES

SOURCES	**NL**	**SH**	**%**
ATM	(CBS, 2022)	QGIS	#VALUE!
2050	(CBS, 2019)	(CBS, 2019)	#VALUE!
2100	(CBS, 2022)	#VALUE!	23,00%

SOURCES	**in plan**	**to add**	**total relocate**
ATM	QGIS	-	#VALUE!
2050		- #VALUE!	#VALUE!
2100		- #VALUE!	#VALUE!

SOURCES

Urban area	QGIS
New urban area	QGIS
total	#VALUE!

SOURCES	**DENSITY (res.**	# res	km²
Rotterdam	(*KadastraleKaart*, n.d.)		.
Oude Westen	(Wetenswaardigheden, cijfers en statistieken over Oude Westen, n.d.)		.
UN Principls	UN-Habitat (2014)		

SOURCES	**Urban area**	**New urban are**	**total**
Rotterdam	#VALUE!	#VALUE!	#VALUE!
Oude Westen	#VALUE!	#VALUE!	#VALUE!

km² needed	**2050**	**% of Urban are**	**% of new l**	**% of tot.**
dens. of Rotterdam	#VALUE!	#VALUE!	#VALUE!	#VALUE!
dens. of Oude Westen	#VALUE!	#VALUE!	#VALUE!	#VALUE!

km² needed	**2100**	**% of Urban are**	**% of new l**	**% of tot.**
dens. of Rotterdam	#VALUE!	#VALUE!	#VALUE!	#VALUE!
dens. of Oude Westen	#VALUE!	#VALUE!	#VALUE!	#VALUE!

agriculture and aquaponics

Monday, 21 February 2022 21:24

Types of crops	**Sweet acquaponics**	**Marine Aquaponics**
Potatoes	BAD (cost eff)	BAD (cost eff)
Strawberries	GOOD	?
Amaryls	GOOD	?
Apples	BAD (trees)	BAD (trees)
Asparagus	AVERAGE	?
Beets	GOOD	GOOD
Cauliflower	GOOD	?
Beans	AVERAGE (NH)	GOOD
Chrysantemum	BAD (pH)	BAD (pH)
Peas (green/yellow)	AVERAGE (NH)	GOOD
Festuliolum	AVERAGE	?
Barley	GOOD	GOOD
Grassland	GOOD	?
Leafy crops general	GOOD	?
Palms	BAD (trees)	BAD (trees)
Pears	BAD (trees)	BAD (trees)
Peony	BAD	BAD
Pumpkin	BAD (heavy)	BAD (heavy)
Flowers general	AVERAGE (NH)	?
Leek	AVERAGE	?
Plums	BAD (trees)	BAD (trees)
Rhubarb	BAD (cost eff)	BAD (cost eff)
Radish	GOOD	?
Cherries	AVERAGE	?
Cucumbers	GOOD (NH)	?
Lilies	AVERAGE (NH)	?
Maize	BAD (weight)	BAD (weight)
Other small fruits (berries)	AVERAGE	?

data comparisation - COROP area's

	Nederland	Zuid Holland	Den Haag	Groene hart
Bevolking				
total	17475415	3726050	887863	337798
	100%	21%	5%	2%
< 20	21,4	22	22,6	22,5
20 - 25	6,3	6,6	6,1	5,7
25 - 45	24,9	26,3	27,8	24,2
45 - 65	27,6	26,7	26,6	27,6
> 65	19,8	18,5	17	20
	100	100,1	100,1	100
married	45,2	43,8	39,8	50,4
divorced	9,3	9,9	11	8,6
migration background	24,6	33,6	46,9	19
inhabitants per km2	519	1380	3529	715
Households				
1 person	38,5	40,1	43,6	32,8
without kids	29	26,8	23,8	31,5
with kids	32,5	33,1	32,5	35,7
average houshole size	2,14	2,13	2,07	2,28
Migration				
balance	6,2	6,7	11,8	1,9
growth (2020)	7,3	9,5	13,2	9
Living				
increase houses per 1000	9,4	9,9	9,8	12,6
privately owned	57,1	51,9	47,2	63,5
value (2000)	80	77	77	88
value (2020)	270	262	281	267

	Nederland	Zuid Holland	Den Haag	Groene hart
Education				
finished school	190908	38947	8787	3932
finished MBO	154500	31217	6475	2996
finished HBO	67403	12601	3052	1094
finished WO	42532	10124	1731	342
Jobs				
agriculture, woods, fishery	1%	2%	1%	3%
energy, manufacutring	14%	12%	5%	15%
commercial services	51%	51%	48%	52%
non commercial services	34%	36%	47%	30%
Income				
average income	€ 45.400,00	€ 45.300,00	€ 45.000,00	€ 48.500,00
standardised	€ 31.400,00	€ 31.500,00	€ 31.800,00	€ 32.900,00
Social safety				
benefit total	4875300	914860	216250	80950
benefit below AOW age	1419360	294680	80690	20140
benefit above AOW age	3455600	620190	135560	60810
below AOW, relative	29%	32%	37%	25%
Mobility				
cars	503	438	408	477
Proximity facilities				
doctor within 3 km	8,5	12,5	21,7	5,2
hospital within 20 km	4,4	8	10,3	3,9
childs day care within 3km	0,6	0,5	0,4	0,6
primary school within 3km	10,9	16,1	27,6	8,7
secondary school within 5kr	6,3	10,6	16,1	4,3
secondary school within 5kr	4,2	6,4	11	2,4
supermarket (km)	0,9	0,7	0,6	0,8
supermarket (within 3 km)	11,5	16	26,7	6,4
horeca within 3 km	67,9	86	164,7	23,8
library (km)	2	1,5	1,3	2
train station (km)	5,1	5,3	3,1	4,6

interview with Hans, 14 February 2022 February

Hans has been working for the voedselbank (foodbank) for 2,5 yeas.

Can you describe what the voedselbank (foodbank) is?
The foodbank is an organization that provides poor families with food. With 'poor' families we mean families who have less than 50€ to spend every week on food, clothes, education, leisure and things like that.

What is happening at this location of the foodbank?
The foodbank where we are right now, in Rotterdam, is a distribution centre for 3.000 families. We have two sections here: one for the families in Rotterdam and one for other cities nearby. There are also several pick-up points in Rotterdam and even some shops. The shops are especially nice in the winter because then the families can choose which vegetables they would like. Not everybody likes brussels sprouts or sauerkraut for example.

How do get all the food?
The crates we give to the families mainly consist of dry food and canned food since these are easier to store than fresh products like bread, fruits and vegetables. Most of the things we get are leftovers from supermarkets or directly products from the distribution centres. Some of the fruits are travelling from all over the world, just to get to the Netherlands and then they are 'not good enough for the supermarkets. If they had not given the fresh products to us, they would have been thrown away. It is such a waste since these products are still perfectly edible.

Do you produce any waste?
Our main waste is plastic that is needed for the transport of goods. Yet, we have not found another way to reduce this. We also have some waste from the fresh products we get. But instead of throwing the bad apples away, we give them to the cows of the floating farm close by. Of all cows, they are the most spoiled ones!

With the new plans the municipality has, do you think that the foodbank can stay at this location?
Yes, eventually we have to be relocated. The municipality has big plans for a new residential area here. However, since the soil is polluted, we have to move even earlier so they can clean the soil.

Determination of categories' values
(source: Ranneft, M. W., 2020)

Commercial use
"To determine the damages to commercial enterprises, HIS-SSM of Deltares in combination with the global depth damage functions of Huizinga, Meol, and Szewczyk (2017) is used. This registration is publicly accessible. The category is divided into different subcategories of which the most important are: Hostility services, Offices, Health, Industry, Education, and Retail. As stated before the average damage to these commercial enterprises is valued on the area that is damaged by the flood. The value will be represented by the x, and y coordinates of the authority. This could slightly differ from the x, and y coordinates of the actual location. To reduce the amount of different used categories commercial use is a combination of the categories industry and office. Due to the fact that the detail of the land use map is smaller, a factor of 0,3 Huizinga et al. (2017) is needed for commercial use to translate from the area of the business itself to the commercially used area. The value per squared meter is estimated at euro 443."

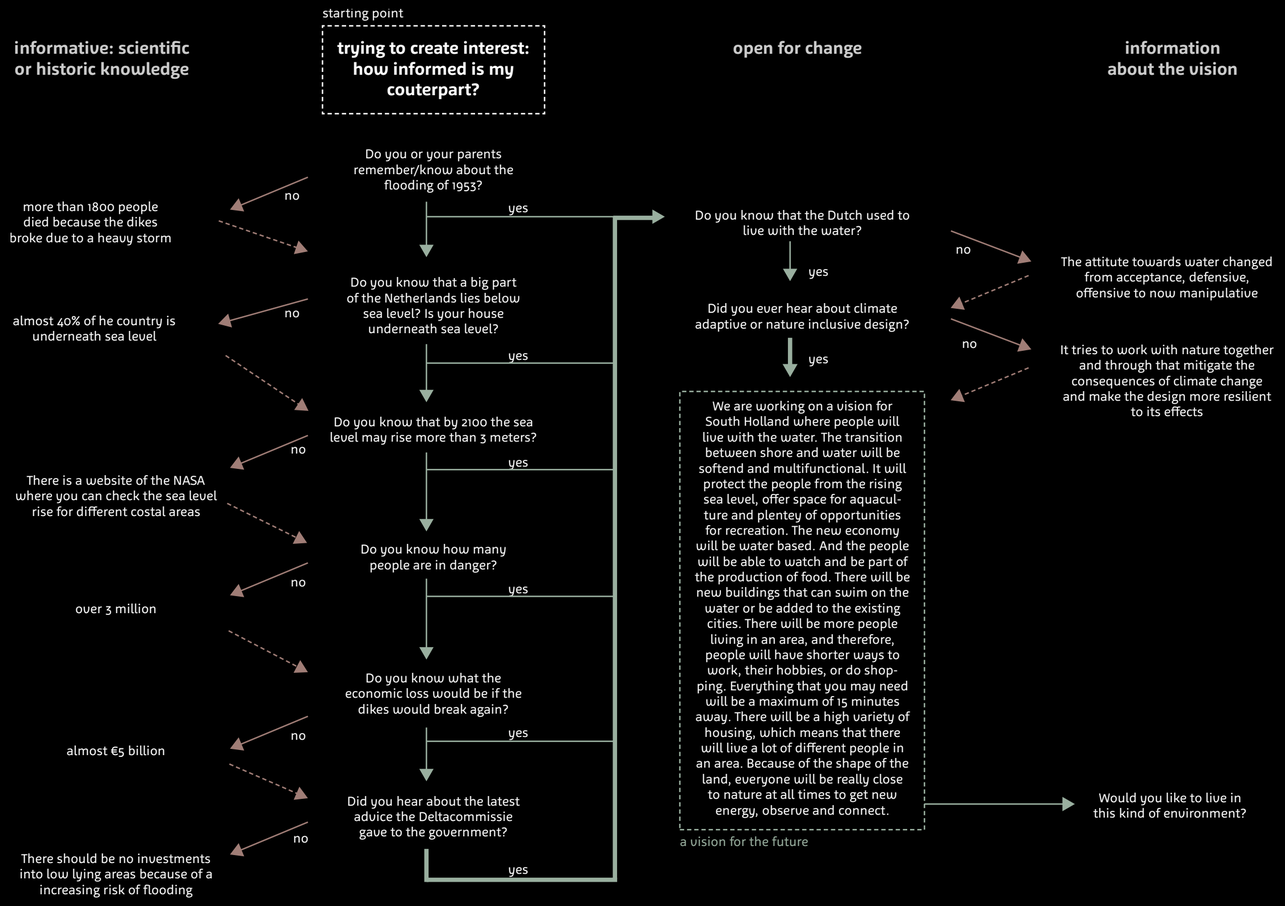
Residential area
"The damage to residential areas, just as for the commercial area, is based on the HISSSM. In reality, there are different forms of residential areas. People might live above stores or there could be multiple addresses in one building. This distinction is based on 2 separate residential situations. The first is single-family housing. This includes farms, bungalows, and other possibilities. The second is apartments. Consists of ground-floor apartments, first-floor apartments, and second or higher floor apartments. To determine the damage to household effects each apartment is granted the value of its own contents. Due to the fact that the detail of the land use map is smaller, a factor of 0,2 is needed for the residential area to translate from the area of houses itself to a residential area including gardens and pavements,(Huizinga et al., 2017). The value per square meter is estimated at 212 €."

Infrastructure
"For this category the Nationaal Wegen Bestand Wegen(NWBW) is used,(Documenten :: Nationaal Wegenbestand, n.d.). In the NWBW the different roadways are divided into three categories. The sections highway and motorway are especially distinguished and the other roads are combined in the third category. This is based on a topographical map of top10nl,(TOPNL Basis Registratie Topografie- PDOK, n.d.). The distinction is based on the responsible authority. The highway is the responsibility of the nation. The motorways are the responsibility of the province and the other roads are maintained by the municipality and the regional water authorities. To reduce the number of use categories all these subcategories are combined and valued at one price per squared meter. This estimation is valued at 109 € in 2020.

As mentioned before are these subcategories are combined into a single category railroad which is estimated to be worth 353 € per square meter in 2020.
The airport is determined based on the CBS land use map. Its value is estimated to be 155 € per square meter in 2020."

Agriculture, recreation, and greenhouses
"The green categories are based on the CBS land use map that is created in 2008 and regularly updated. The value of these area categories is dependent on seasonal influences. Nevertheless to estimate the value they have been set to a fixed value. The distinction between agriculture and greenhouses is based on the fact that the values of the categories varied too much to combine. The values for agriculture are estimated at 2 € per square meter while the greenhouse category is estimated at 52 € per square meter. To price recreation, an estimation of 108 € is made. This estimation is based mostly on the value of sports."

communication tool



some useful definitions

resilience means that in case of a disaster the system will not be in shock or be destroyed. Because it is adaptive it will be able to withstand the pressure and stay healty and safe.

manifesto

agreements for a water based future

I We believe that we shall embrace deep uncertainty. This shall not dampen our aspiration for action. On the contrary, it shall set us free and enable us to create an adaptable ecology, economy, and culture: a collective that shall grow and change together. Worshipping the commons, protecting the rights of living organisms and creating a future for everyone to thrive in balance with each other. We will accept nature as our guiding principle, opening new opportunities and stopping our greed for more. We believe that we must work with nature rather than against it. It will guide us while shaping our new environment and set boundaries we shall not overstep.

adaptible

II We will accept nature as our guiding principle, opening new opportunities and stopping our greed for more. We believe that we must work with nature rather than against it. It will guide us while shaping our new environment and set boundaries we shall not overstep. We aim to create balance with the natural environment and regenerate the ecosystems from the anthropocentric influences of the past decades. This means that we shall not strive for economic growth but for thriving within the planetary boundaries.

regenerative

III By following the laws of nature, we will create equality for every human and non-human that enters the terrain we pledge to take care of. Whether they are thundering or silent, all inhabitants shall have a right to equal education and therefore be able and encouraged to take part in the decisions and developments that touch them.

inclusive

IV We believe that the strongest concepts will develop out of the heritage of our culture and land. We pledge to be sensitive to what is already there and has been there. To everything tangible but also to what is invisible. This can only be seen by learning about and with the people and the land we are working with.

sensible

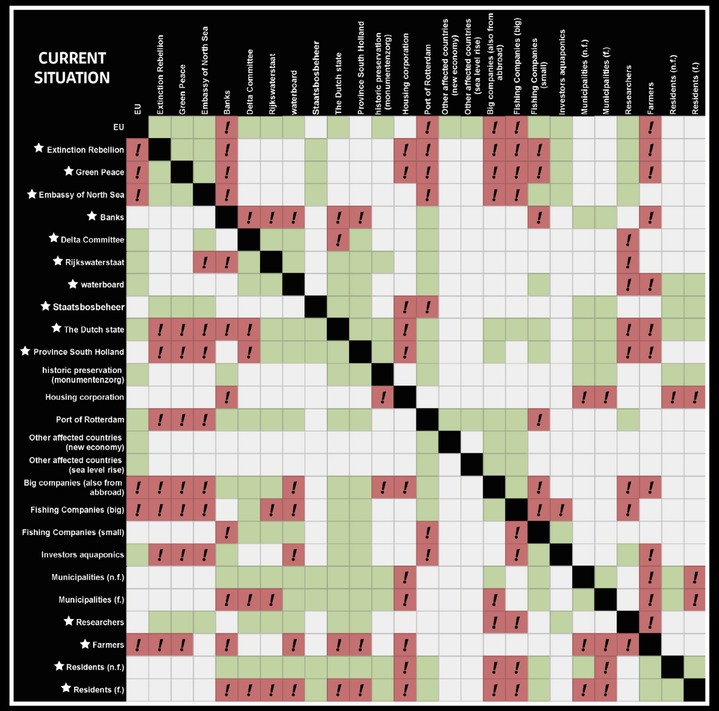
V We believe that we must see this endeavour as a cathedral project. It will take multiple generations to be finished and multiple generations will benefit from it. In this sense, it is not about creating short term rewards but about aiming for harvests for generations yet to come.

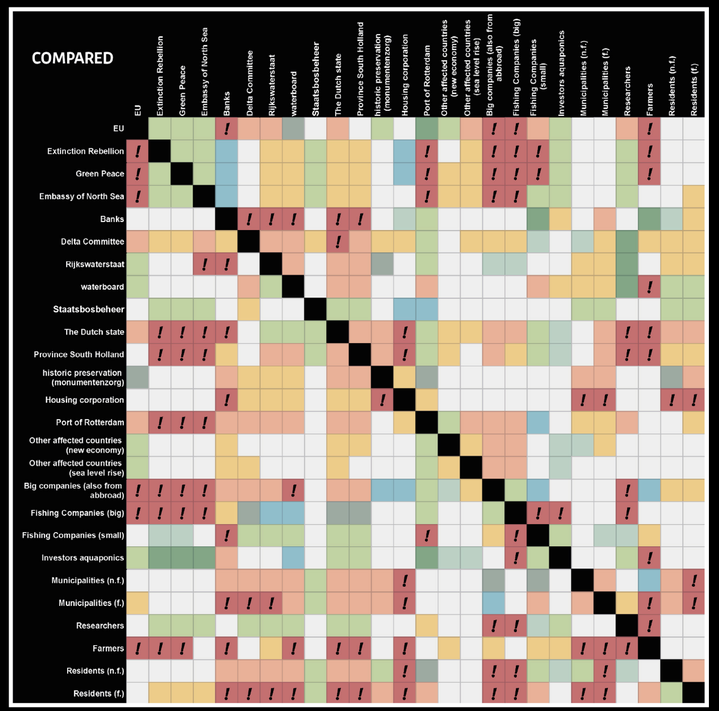
visionary

stakeholder relationships

	currrent position	current power	future position	future power	sector	Importancy	timeline (start)	timeline (end)
EU	Fence Sitter	Producting	Fence Sitter	Producting	Public	4,5	All	All
Extinction Rebellion	Proponent	Blocking	Proponent	Producting	Civil	2	Beginning	Middle
Green Peace	Proponent	Blocking	Proponent	Producting	Civil	2	Beginning	Middle
Embassy of North Sea	Proponent	diffuse	Proponent	Producting	Public	2	Beginning	Middle
Banks	Opponent	Blocking	Opponent	Blocking	Private	5	All	All
Delta Committee	Proponent	Producting	Proponent	Producting	Public	5	All	All
Rijkswaterstaat	Opponent	Producting	Fence Sitter	Producting	Public	5	All	All
waterboard	Opponent	Blocking	Fence Sitter	Producting	Public	5	All	All
Staatsbosbeheer	Opponent	Producting	Fence Sitter	Producting	Public	5	All	All
The Dutch state	Fence Sitter	Producting	Fence Sitter	Producting	Public	5	All	All
Province South Holland	Fence Sitter	Producting	Fence Sitter	Producting	Public	5	All	All
historic preservation (monumentenzorg)	Opponent	Blocking	Opponent	Blocking	Public	4	All	All
Housing corporation	Proponent	Producting	Fence Sitter	Producting	Private	4,5	Beginning	End
Port of Rotterdam	Fence Sitter	Producting	Proponent	Blocking	Public	5	All	All
Other affected countries (new economy)	Fence Sitter	diffuse	Fence Sitter	diffuse	Public	3	Middle	End
Other affected countries (sea level rise)	Proponent	diffuse	Proponent	diffuse	Public	2	Middle	End
Big companies (also from abbroad)	Opponent	Blocking	Opponent	Blocking	Private	4	All	All
Fishing Companies (big)	Opponent	Blocking	Opponent	Blocking	Private	5	All	All
Fishing Companies (small)	Opponent	Blocking	Proponent	Producting	Private	2	Middle	End
Investors aquaponics	Proponent	diffuse	Proponent	diffuse	Private	2,5	End	End
Municipalities (n.f.)	Proponent	Producting	Proponent	Producting	Public	5	All	All
Municipalities (f.)	Opponent	Blocking	Opponent	Blocking	Public	5	All	All
Researchers	Proponent	Producting	Proponent	Producting	Civil	3	Beginning	Middle
Farmers	Opponent	Blocking	Proponent	Producting	Private	5	Middle	End
Residents (n.f.)	Opponent	Blocking	Proponent	Producting	Private	5	Middle	End
Residents (f.)	Opponent	Blocking	Opponent	Blocking	Private	5	All	All

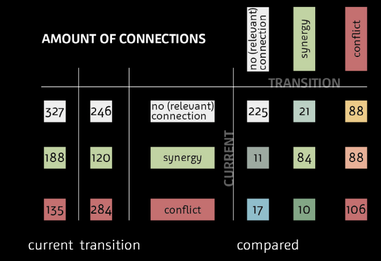
stakeholder relationships





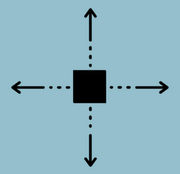
As mentioned before, a new regional design involves many stakeholders. The 26 most important stakeholders for this project are shown in these diagrams. The stakeholders used previously are marked with a white star. They are more than the used 12, since some of them are combined into one stakeholder (like the nature activists) Similar to the circle diagram in the chapter about the stakeholders, these matrices show the connection (synergy or conflict) between different stakeholders in the current situation, as well as during the transition zone. The matrices should be read as “is [stakeholder on the left] in a conflict or a synergy with [stakeholder on the top]?” Thereby it is important to know that the connection is always from the point of view of the stakeholder on the left. There is no matrix for the final future situation due to the goal of a complete synergy between all stakeholders.

Comparing the current situation to the transition zone, it shows clearly that many connections (27% to be exact) are turning into a conflict. The other way round, there are only 10 connections (1,54%) that turn from ‘conflict’ to ‘synergy’.
The high amount of current conflicts that stay the same way in the transition (16,3%) zone is alarming. This outcome can be used in future design proposals and there should be extra emphasis on participatory interventions among these stakeholders. More than one-third of the connections are not exciting or are not relevant for this project (50,3% of the current connections and 37,8% in the transition zone). This is not something negative, but it could be interesting to have a closer look at how these connections can get important and that they might even strengthen the vision.



card game - *cut me!*

FLEXIBLE SPACES



FLEXIBLE SPACES

RESTORING ECOSYSTEM

RESTORING ECOSYSTEM

FOLLOW LANDSCAPE NATURAL SHAPE

FOLLOW LANDSCAPE NATURAL SHAPE

PILOT PROJECTS

PILOT PROJECTS

INTERACTION BETWEEN DIFFERENT GROUPS

INTERACTION BETWEEN DIFFERENT GROUPS

DOUBLE DIKE SYSTEM

DOUBLE DIKE SYSTEM

CREATING NEW JOBS

CREATING NEW JOBS

REDUCE RELOCATION NECESSITY

REDUCE RELOCATION NECESSITY

NEW DIKE SYSTEM

NEW DIKE SYSTEM

INCLUDE SILENT STAKEHOLDERS

INCLUDE SILENT STAKEHOLDERS

MULTI FUNCTIONAL DIKES

MULTI FUNCTIONAL DIKES

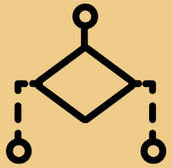
RECYCLE MATERIALS PRONE TO FLOOD

RECYCLE MATERIALS PRONE TO FLOOD

SOFT TRANSITION BETWEEN CLUSTERS

SOFT TRANSITION BETWEEN CLUSTERS

WORKING WITH SCENARIOS



WORKING WITH SCENARIOS

CREATE AWARENESS THROUGH EDUCATION

CREATE AWARENESS THROUGH EDUCATION

INCENTIVE FOR NEW INDUSTRIES - 2

- 2 INCENTIVE FOR NEW INDUSTRIES

SOIL DE-POLLUTION PROGRAM HARBOR - 2

- 2 SOIL DE-POLLUTION PROGRAM HARBOR

WATER MANAGEMENT EDUCATIONAL PROGRAM - 2

- 2 WATER MANAGEMENT EDUCATIONAL PROGRAM

PUBLISH THE MANIFESTO - 2

- 2 PUBLISH THE MANIFESTO

SUBSIDES FOR FLOOD PROOFING - 2

- 2 SUBSIDES FOR FLOOD PROOFING

INVESTMENT IN FLOOD RESEARCH - 2

- 2 INVESTMENT IN FLOOD RESEARCH

TAX COMPENSATION SHARING FACILITIES - 2

- 2 TAX COMPENSATION SHARING FACILITIES

COMPENSATION BUSINESS LOSS - 2

- 2 COMPENSATION BUSINESS LOSS

INFORMATIVE PROGRAM FLOODING - 2

- 2 INFORMATIVE PROGRAM FLOODING

CREATING A GAME FOR THE STRATEGY - 2

- 2 CREATING A GAME FOR THE STRATEGY

FUNDINGS TO ADAPT INFRASTRUCTURE - 2

- 2 FUNDINGS TO ADAPT INFRASTRUCTURE

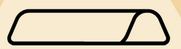
PLATFORM FOR MATERIAL RETRIEVAL - 2

- 2 PLATFORM FOR MATERIAL RETRIEVAL

COMPENSATION RELOCATION - 2

- 2 COMPENSATION RELOCATION

FINANCE THE NEW DIKE SYSTEM - 2



- 2 FINANCE NEW INDUSTRIES

15 MINUTES RULE FOR DENSFICATION - 2

- 2 15 MINUTES RULE FOR DENSFICATION

OPEN SOIL BUFFER ZONE

OPEN SOIL BUFFER ZONE

GREENHOUSE BECOME HOUSING

GREENHOUSE BECOME HOUSING

CAR ROUTES BECOME PUBLIC TRANSPORT

CAR ROUTES BECOME PUBLIC TRANSPORT

MIXED USE

MIXED USE

FLOOD ADAPTABLE BUILDINGS

FLOOD ADAPTABLE BUILDINGS

DRINKING WATER RESERVE DUNES

DRINKING WATER RESERVE DUNES

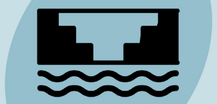
ADAPT CROPS TO AQUACULTURE

ADAPT CROPS TO AQUACULTURE

MOBILITY INSIDE THE DIKES

MOBILITY INSIDE THE DIKES

PUBLIC WATERFRONT BUFFER ZONE



PUBLIC WATERFRONT BUFFER ZONE

FLOODABLE EMERGENCY AREAS

FLOODABLE EMERGENCY AREAS

MOBILITY INSIDE THE DUNES

MOBILITY INSIDE THE DUNES

EDUCATE ABOUT AQUACULTURE

EDUCATE ABOUT AQUACULTURE

CONNECT CLUSTERS

CONNECT CLUSTERS

FLOATING HARBORS

FLOATING HARBORS

FLOOD EMERGENCY ROUTE

FLOOD EMERGENCY ROUTE

DUNES GROWTH AS FLOOD PROTECTION

DUNES GROWTH AS FLOOD PROTECTION

BIG SCALE AQUACULTURE

BIG SCALE AQUACULTURE

RECYCLE INFRASTRUCTURE PRONE TO FLOOD

RECYCLE INFRASTRUCTURE PRONE TO FLOOD

WASTE BECOME CLEAN ENERGY

WASTE BECOME CLEAN ENERGY

RELOCATE NATURE

RELOCATE NATURE

WILLOW FOREST AS FLOOD PROTECTION

WILLOW FOREST AS FLOOD PROTECTION

PRODUCTIVE POLDER BUFFER ZONE

PRODUCTIVE POLDER BUFFER ZONE

EFFICIENT PUBLIC TRANSPORT

EFFICIENT PUBLIC TRANSPORT

PRODUCTIVE PUBLIC WATERFRONT

PRODUCTIVE PUBLIC WATERFRONT

RE-QUALIFICATION OF URBAN AREAS

RE-QUALIFICATION OF URBAN AREAS

DRIVER OF COASTAL MAINTANANCE

DRIVER OF COASTAL MAINTANANCE

SMALL SCALE AQUACULTURE

BIG SCALE AQUACULTURE

NEW CONNECTIONS BETWEEN CITIES

NEW CONNECTIONS BETWEEN CITIES

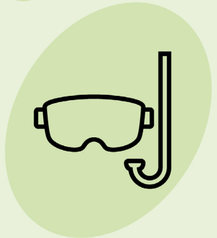
PROXIMITY BETWEEN PRODUCTION AND LOGISTICS

PROXIMITY BETWEEN PRODUCTION AND LOGISTICS

SUSTAINABLE WATER MANAGEMENT

SUSTAINABLE WATER MANAGEMENT

COASTAL AREA AS A LEISURE ZONE



COASTAL AREAS AS A LEISURE ZONE

KEEP CURRENT LAND USE

KEEP CURRENT LAND USE

KEEP EXHISTING ROUTES

KEEP EXHISTING ROUTES

HARBOR BASINS DENSIFICATION

HARBOR BASIN DENSIFICATION

KEEP EXHISTING BUILDINGS

KEEP EXHISTING BUILDINGS

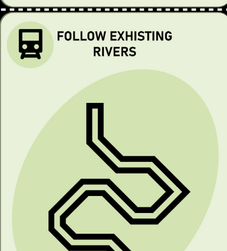
PROTECT COASTAL FAUNA AND FLORA

PROTECT COASTAL FAUNA AND FLORA

OPEN SOIL FROM EX GREENHOUSES

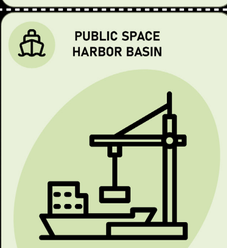
OPEN SOIL FROM EX GREENHOUSES

FOLLOW EXHISTING RIVERS



FOLLOW EXHISTING RIVERS

PUBLIC SPACE HARBOR BASIN



PUBLIC SPACE HARBOR BASIN

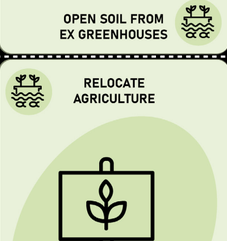
RELOCATE ALL CITIZENS

RELOCATE ALL CITIZENS

PROTECT DUNES

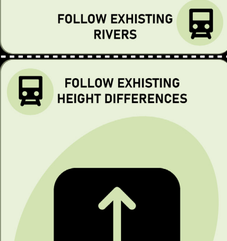
PROTECT DUNES

RELOCATE AGRICULTURE



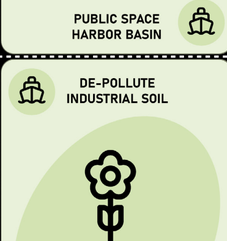
RELOCATE AGRICULTURE

FOLLOW EXHISTING HEIGHT DIFFERENCES



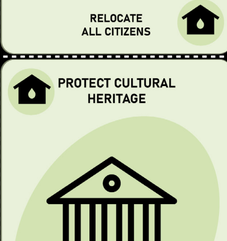
FOLLOW EXHISTING HEIGHT DIFFERENCES

DE-POLLUTE INDUSTRIAL SOIL



DE-POLLUTE INDUSTRIAL SOIL

PROTECT CULTURAL HERITAGE



PROTECT CULTURAL HERITAGE

DUNES CONNECTED BY INFRASTRUCTURE

DUNES CONNECTED BY INFRASTRUCTURE

SUPPORT LARGE SCALE AQUACULTURE BUSINESS

SUPPORT LARGE SCALE AQUACULTURE BUSINESS

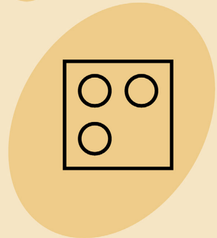
HIGH SPEED TRANSPORT BETWEEN CITIES

HIGH SPEED TRANSPORT BETWEEN CITIES

CREATE A NEW PORT SYSTEM

CREATE A NEW PORT SYSTEM

EMPTY SPACE FOR POTENTIAL DENSIFICATION



EMPTY SPACE FOR POTENTIAL DENSIFICATION

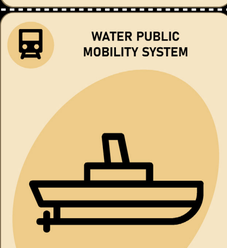
FOLLOW THE NATURAL TIME OF DUNES

FOLLOW THE NATURAL TIME OF DUNES

SALT WATER AQUAPONICS

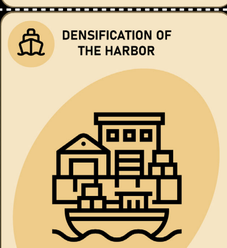
SALT WATER AQUAPONICS

WATER PUBLIC MOBILITY SYSTEM



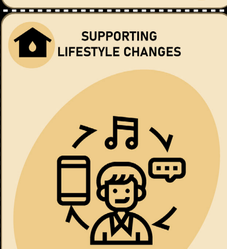
WATER PUBLIC MOBILITY SYSTEM

DENSIFICATION OF THE HARBOR



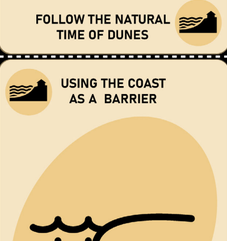
DENSIFICATION OF THE HARBOR

SUPPORTING LIFESTYLE CHANGES



SUPPORTING LIFESTYLE CHANGES

USING THE COAST AS A BARRIER

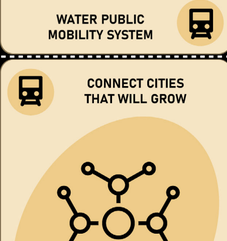


USING THE COAST AS A NATURAL BARRIER

PROXIMITY PRODUCTION AND SELLING POINTS

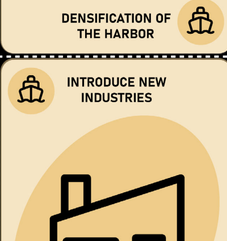
PROXIMITY PRODUCTION AND SELLING POINTS

CONNECT CITIES THAT WILL GROW



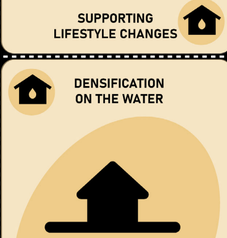
CONNECT CITIES THAT WILL GROW

INTRODUCE NEW INDUSTRIES



INTRODUCE NEW INDUSTRIES

DENSIFICATION ON THE WATER



DENSIFICATION ON THE WATER

COASTAL AREAS AS A PUBLIC SPACE

COASTAL AREAS AS A PUBLIC SPACE

LISTEN TO THE NEEDS OF AGRIBUSINESS

LISTEN TO THE NEEDS OF AGRIBUSINESS

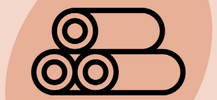
DENSIFICATION ALONG TRANSPORT NETWORK

DENSIFICATION ALONG TRANSPORT NETWORK

LISTEN TO THE NEEDS OF INDUSTRIES

LISTEN TO THE NEEDS OF INDUSTRIES

FACILITATE PRE-FLOOD MATERIAL RETRIEVAL



FACILITATE PRE-FLOOD MATERIAL RETRIEVAL

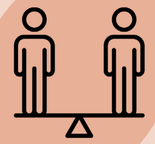
INTERACTION BETWEEN NATURE AND HUMANS

INTERACTION BETWEEN NATURE AND HUMANS

AQUACULTURE FARMS AS A PUBLIC SPACE

AQUACULTURE FARMS AS A PUBLIC SPACE

EQUAL ACCESSIBILITY TO MOBILITY



EQUAL ACCESSIBILITY TO MOBILITY

AFFORDABLE HOUSING NEXT TO HARBORS

AFFORDABLE HOUSING NEXT TO HARBORS

HOUSING TYPES DIVERSITY

HOUSING TYPES DIVERSITY

PARTICIPATION WHEN GROWING THE DUNES

PARTICIPATION WHEN GROWING THE DUNES

INCLUDE SMALL AND DIVERSE CROPS

INCLUDE SMALL AND DIVERSE CROPS

PARTICIPATION TO DECIDE THE ROUTES

PARTICIPATION TO DECIDE THE ROUTES

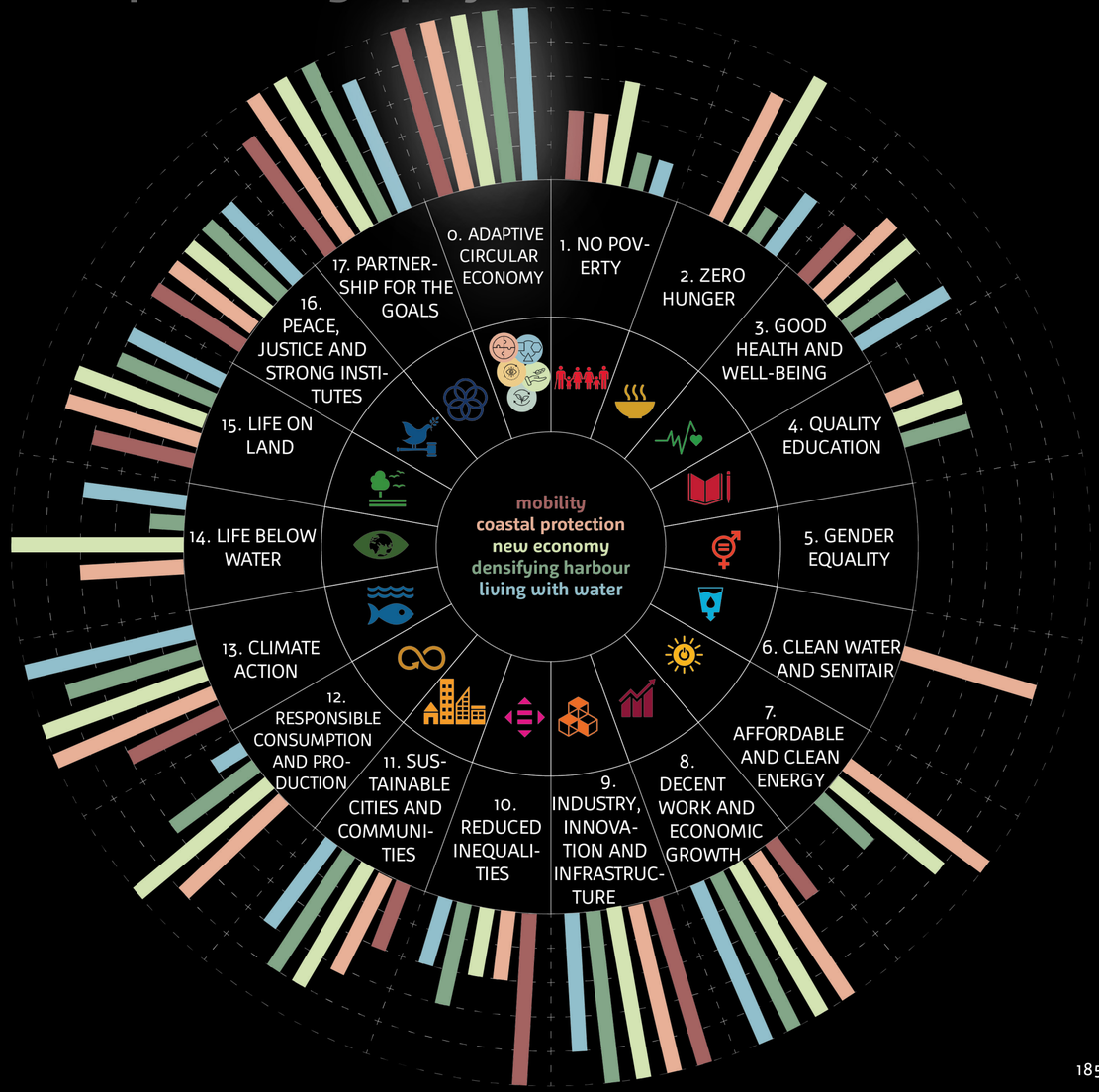
INCLUDE SMALL AND DIVERSE BUSINESS

INCLUDE SMALL AND DIVERSE BUSINESS

HABITATS FOR DIFFERENT FAUNA AND FLORA

HABITATS FOR DIFFERENT FAUNA AND FLORA

SDGs per strategic project



timeline strategic projects