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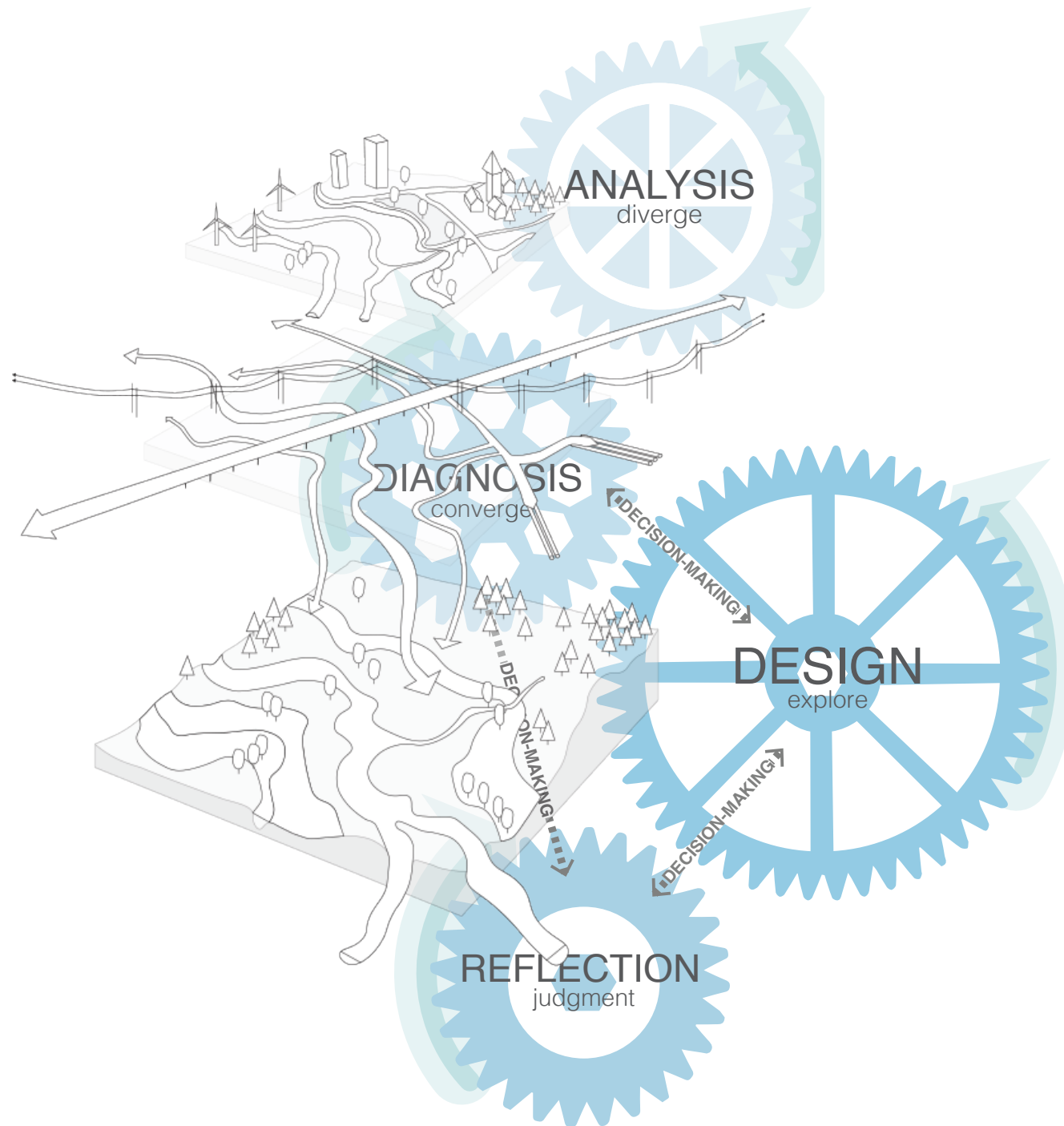
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# DESIGN ORIENTED APPROACH DELTA PROGRAMMA

*Version 1.0*

*April 2026*



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commissioned by the Delta Programme:  
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Conceptualization:  
Redesigning Deltas Collectief



TU Delft, Delta Urbanism, Deltares  
Defacto, Vista, Arcadis, De Urbanisten,  
FABRICations, Bosch Slabbers, Tauw  
LOLA (LOst LANDscapes),  
Royal Haskoning DHV  
ZUS [Zones Urbaines Sensibles],  
Flux landscape architecture, Sweco  
Studio Hartzema, Feddes-Olthof,  
Witteveen & Bos

***With design, you can  
bring the future forward.***

Co Verdaas

***Designing is inventing.***

Lodewijk van Nieuwenhuijze

***We need many plans to  
arrive at a good plan.***

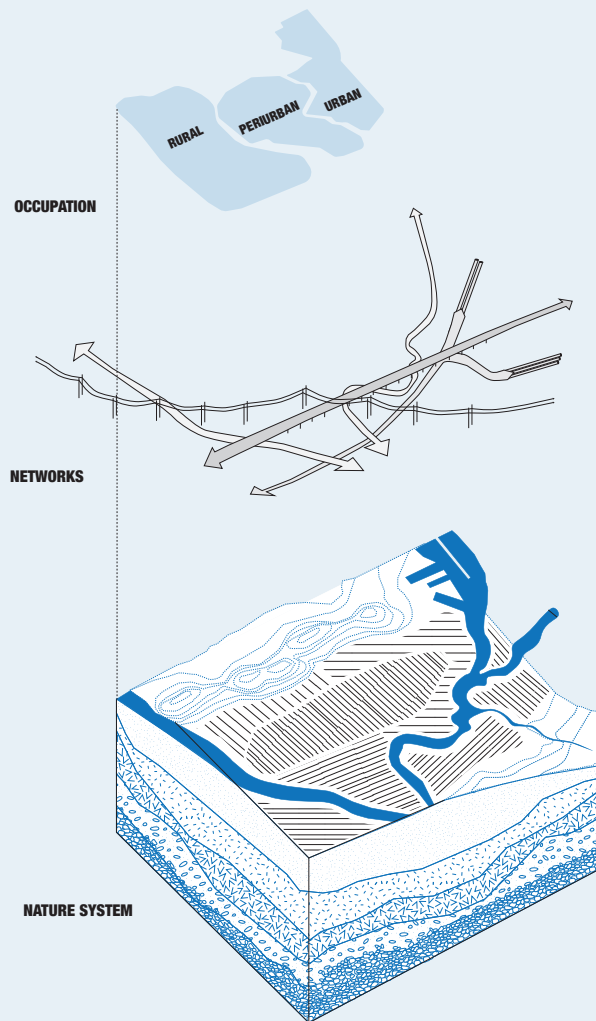
Dirk Sijmons H+N+S

# Introduction

The Design-Oriented Approach was commissioned by the Delta Programme to support the area-based sub-areas of the Delta Programme. Through research by design, the collaborating parties can span boundaries and unite different disciplinary perspectives. Connecting insights from the delta management with those of the spatial planning world is urgent in light of climate change.

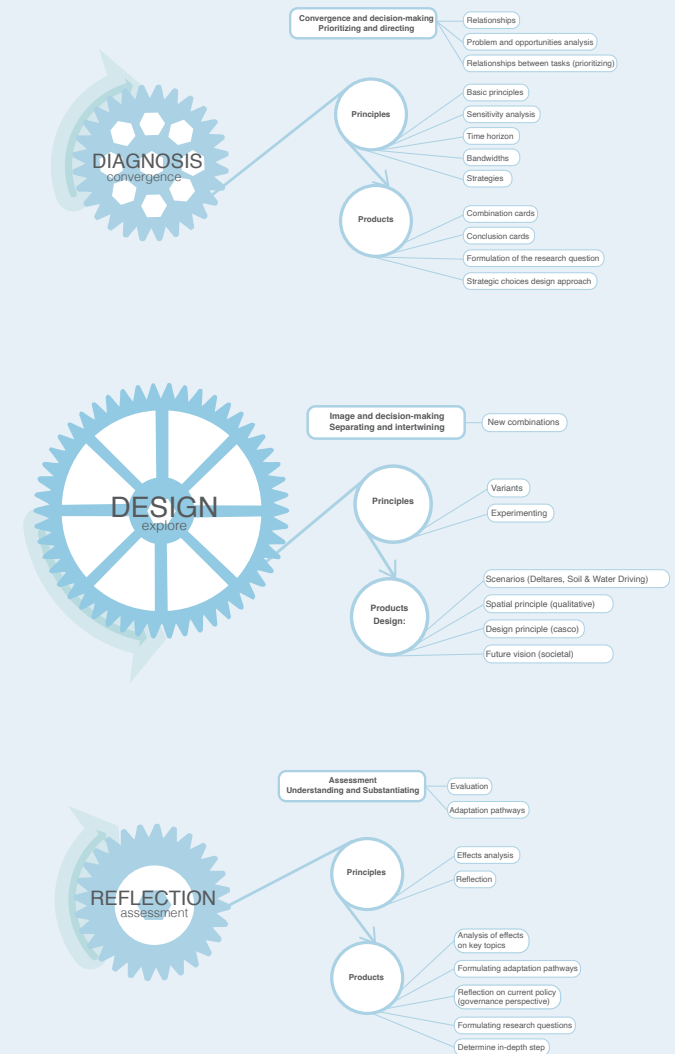
The Netherlands is organized down to the square centimeter by spatial planning, and the water system is controlled and managed. This is now under pressure due to changes in the hydrological system; how do we transform the fully regulated spatial and water system towards a sustainable future?

Research by design is a method for exploring an uncertain future. Designing leads to images of possible futures based on observation, learning from references, and experimentation. Designing is observing, mapping out main lines, facts, and coherence, interpreting these, and distilling or adding meaning. Designing is experimenting by analyzing, creating variants, and testing them. This is a collective process in which knowledge from different disciplines is brought together and in which spatial and temporal scales can be connected.



Design-oriented research is a method for investigating an uncertain future. Designing involves observing and experimenting by analyzing, creating variants, and testing them. This is a collective process in which knowledge from various disciplines is brought together and in which spatial and temporal scales can be connected. In the spatial domain, Research by Design is an essential part of exploring ways to visualize and understand spatial challenges and solutions. In the world of delta management, models and graphs are common. In participatory processes between these two worlds, Research by Design is enriching because it can visualize and connect different languages.

This Research by Design approach provides insight into the design process and how it can be used for research purposes. After preparation, the design process can be explained in four steps: analysis, diagnosis, design, and reflection. These steps influence each other iteratively; it may always be necessary or desirable to take a step back in the process due to outcomes and new insights. For each step, the goal is defined along with associated activities, followed by the principles that are important for that step. The products resulting from each step are listed below. The final design is an important vehicle for getting everyone behind a plan, but the outcomes of a broad design process are knowledge development and the keys to new futures.



# Key message

The world around us is changing, and although we see, and know, more and more about climate change, its unpredictability creates a great deal of uncertainty. The measures we traditionally take to protect ourselves against water are coming under pressure due to rising sea levels, land subsidence, changing patterns in (more intensive) rain and no rain (drought). Adapting to the effects of climate change has been high on the agenda since the near-floods of the 1990s. Shaping our country for a safe and bright future must be done while embracing many uncertainties.

To anticipate uncertainties, the Delta Programme applies a reassessment to delta decisions and regional strategies every six years. This provides the opportunity to investigate whether course corrections are necessary, based on new insights and developments. In a previous Delta Programme reassessment, it was noted that a stronger connection needs to be established between water challenges and spatial planning. In the second Delta Programme reassessment, design-based research has been deployed as a way to deal with the uncertainties of the future and to investigate how we can innovate traditional measures by incorporating spatial developments into delta management. Research by Design is an approach in which design is used to develop research knowledge. Design is not

aimed at creating a spatial plan, but at learning from various possibilities in the future. Designing for a future-proof spatial order of the Netherlands must be done from the perspective of both the water and soil systems and the preconditions of spatial planning. In this context, research by design serves as the means to better connect the challenges of the Delta Programme and spatial planning through interdisciplinary design.

The Delta Programme Research by Design Approach aims to support research in the various regions of the Netherlands and to better link them together. The national strategy must respond to regional and local characteristics, so linking the national scale with other scale levels is very important. At the same time, local scales must also be related to one another on the larger scale of the main and regional water systems. Connected to this is the importance of adopting a comparable timescale, regarding the horizon and assumptions used. The streamlining of space and time can be achieved through Research by Design. It also offers the opportunity to connect the 'push' of climate change (the need to adapt) with the 'pull' of an appealing future perspective (adaptation also has other benefits). It provides the possibility to disregard existing preconditions, which may currently constitute a blockage, and to look at the system with a fresh perspective.

This allows new possibilities to be explored, after which it can be determined whether these can be incorporated over time.

The Delta Programme Research by Design Approach supports how the Delta Programme can utilize Research by Design in the area-specific sub-areas, partly to ensure they connect and overlap. In spatial planning, connecting and aligning between different scales happens naturally; it is important that the water system is also incorporated into this as a matter of course. Connecting scale levels in time and space is a way to capitalize on opportunities that lie in the future and are uncertain.

Within the Delta Programme as well as in a broader societal context, much is in development and the pressure is high. There is a need for consistency (addability), broad support, scientific quality, and the connection of the lower scales within a national strategy. This requires a balance between room for customization to anticipate the significant differences between regional programs and consistency at the national scale (the same Delta scenarios, the same planning horizon, the same starting points for design workshops, etc.).

# Research by Design

The Delta Programme Research by Design Approach version 1.0 was developed as a basis for the application of Research by Design within the Delta Programme. It forms a starting point for connecting challenges, disciplines, and scale levels in time and space in order to connect opportunities and to continue developing towards the future through learning and experimentation.

The Research by Design Approach is based on steps and elements that are self-evident in design processes. Designing does not merely lead to an enticing perspective in a convincing image; it is

based on knowledge, skills, references, experimentation, and vision (Elise van Dooren, TUD). Designing is already a form of research, but with the goal of arriving at a final solution.

The aim of Research by Design is to learn. Bringing together knowledge and references is the first step. However, later in the process, it may become apparent that further analysis is required. Based on existing knowledge and knowledge of the dynamics in an area, a diagnosis is made to determine exactly what the challenge is. Based on new insights and a learning-based develop-

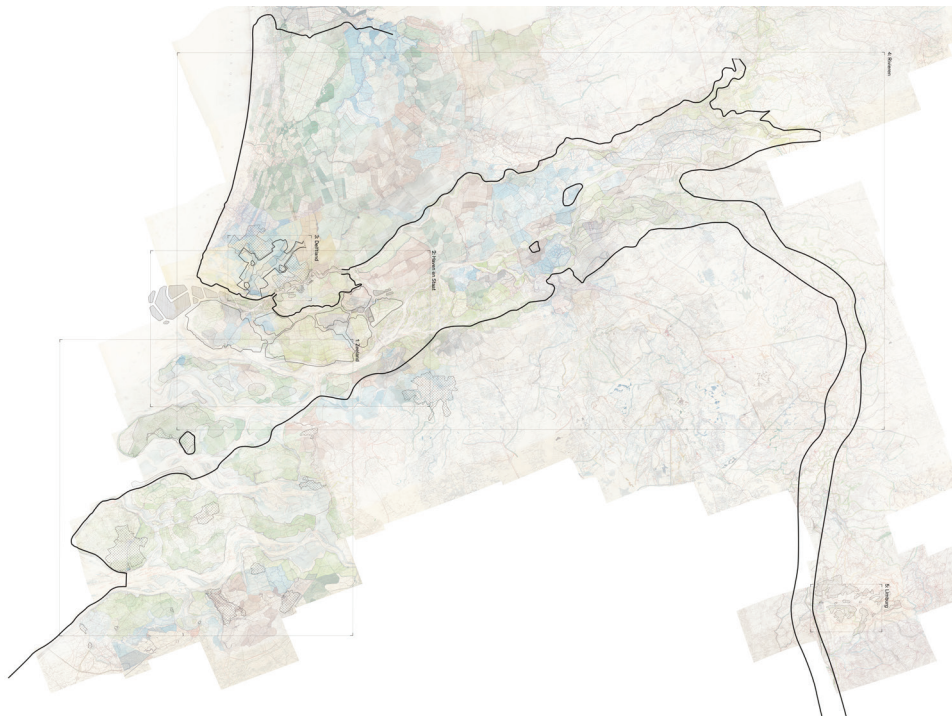
ment approach, the Delta Programme Research by Design Approach focuses on learning-based development and application.

This is an important critical step and significantly different from what is customary in the workflow of engineers who isolate and solve a problem: in spatial planning, you are specifically looking for all interests and bringing together opportunities and bottlenecks. Based on the diagnosis, the design goal or vision for the future is formulated, from which various (forms of) design experiments are carried out.

The outcomes may lead to further analysis or an adjustment of the diagnosis. Perhaps even to an adjustment of the objective; this could, for example, be the outcome of the final step (reflection on the results) with regard to existing policy or the realism of a transition approach.

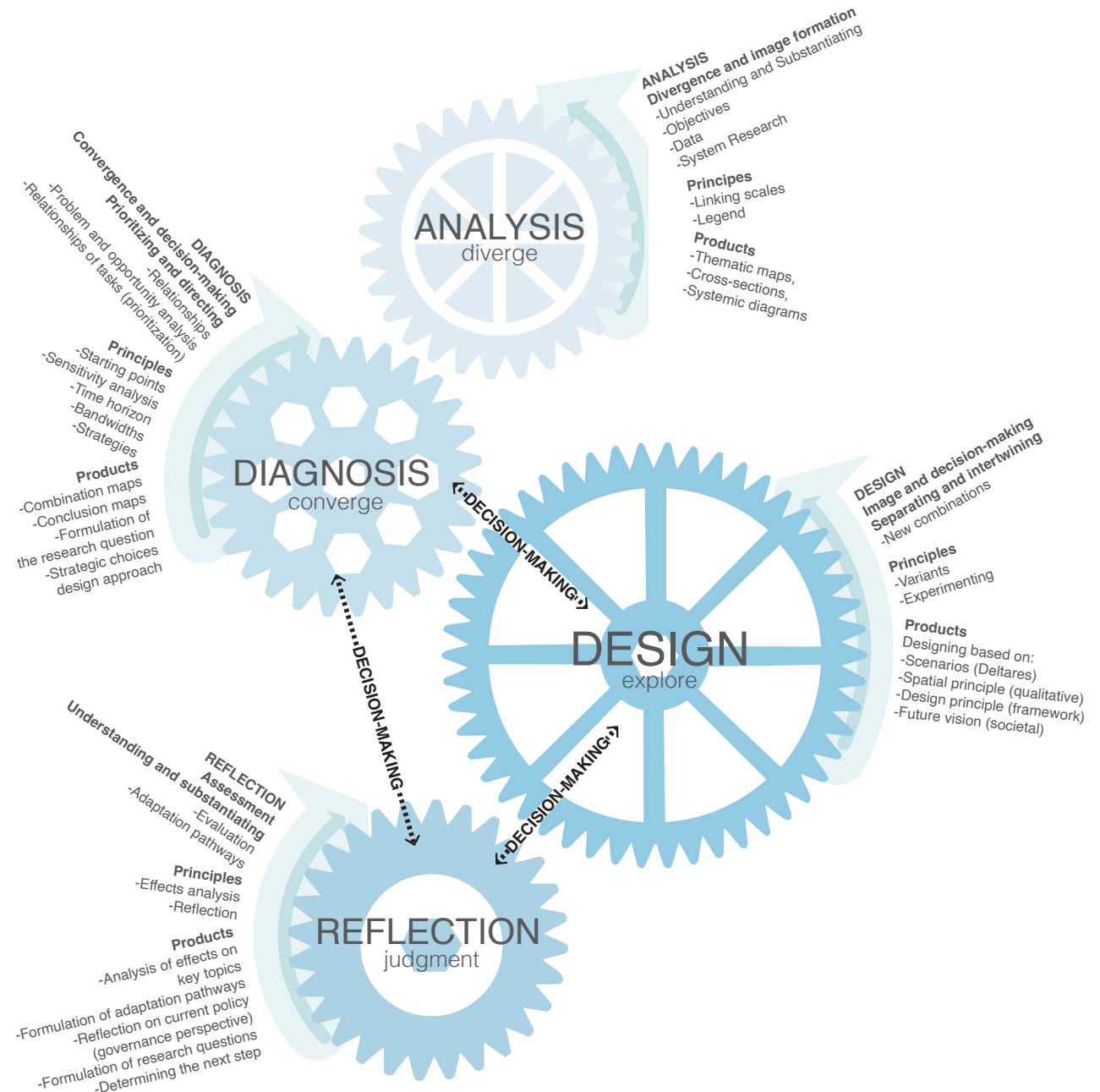
In the design approach diagram, alongside the preparation, the four steps (analysis, diagnosis, design, and reflection) are elaborated as a mechanism, because they influence each other iteratively; it may be necessary to take a step back in the process. For each step, the goal is defined along with associated activities, followed by the principles relevant to that step. The products resulting from each step are listed at the bottom.

**Result of Research by Design *Redesigning Deltas* project, an example of how five sub-areas add up to a regional strategy.**



In this explanation of the Research by Design Approach, three projects differing in scale and approach have been selected per step for illustrative purposes. The first project is Accelerated Sea Level Rise Central Holland, by Defacto Stedenbouw (2023). This exploration aims to study the impact of long-term solutions in the water system on land use. The second project is Rotterdam from a port city to a port archipelago + sponge watercity (Urbanisten, Lola, Royal Haskoning DHV), part of the Redesigning Deltas design study (2022) and subsequently submitted by De Urbanisten and Deltares to the EO Wijers Prize Competition (2023). This project assumes the extreme scenario where the sea level in the year 2100 is three meters higher than it is now and posits a high delta dike as a hypothesis. The third project is National Productive Park Delfland (Zus, Flux and Sweco), part of the Redesigning Deltas design study (2022) and subsequently developed by ZUS and Flux into Delfland Sweet/Salt 2100 (2024) with Deltares and the Delfland Water Board.

The hypothesis is that the relationship between city and countryside must change significantly under the influence of major transitions in the water system. The research focused on variants of a new relationship, both in a spatial and a systematic sense (flows).





# Preparation and organization

The Research by Design Approach begins with creating the right conditions:

- Formulating a clear objective,
- Determining the process steps to be followed,
- Determining the scales at which work is carried out,
- Determining the appropriate data and organizing the data,
- Involving the right actors and determining their roles,
- Planning the necessary meetings with a clear agenda.

Establishing the goal of design research also gives direction to the design-oriented approach.

The goal may be to better understand the challenges in the area, or to explore different solution directions or strategies. It may also be that the design approach is used as a means to formulate a vision, or to break free from a stalled process.

An important consequence of the objective is framing the research area and establishing the relationships with surrounding areas and the higher scale. Design research works across scales, and there are at least two scales at which work is carried out: the scale of the research area and the regional scale in which it is situated. When making decisions, it will always be necessary to look back

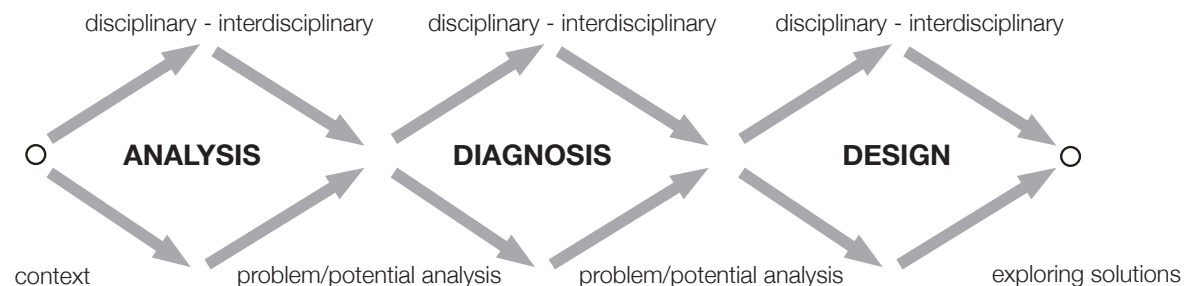
and forth between the two scales. What effect does one scale have on the other (higher or lower) scale?

Depending on the objective and the chosen research area, it is determined which actors are of importance; a multidisciplinary team is needed to make the preparations and guide the process. The design discipline must be well represented in this team, preferably with at least two designers. These could be an urban designer and a landscape architect, but also two from the same discipline; designers can also differ considerably in their specialities. One designer may work more conceptually, while others may work more pragmatically. Subsequently, outside this core team, other actors who may represent the socio-cultural distinctiveness of an area or task can be invited to contribute ideas.

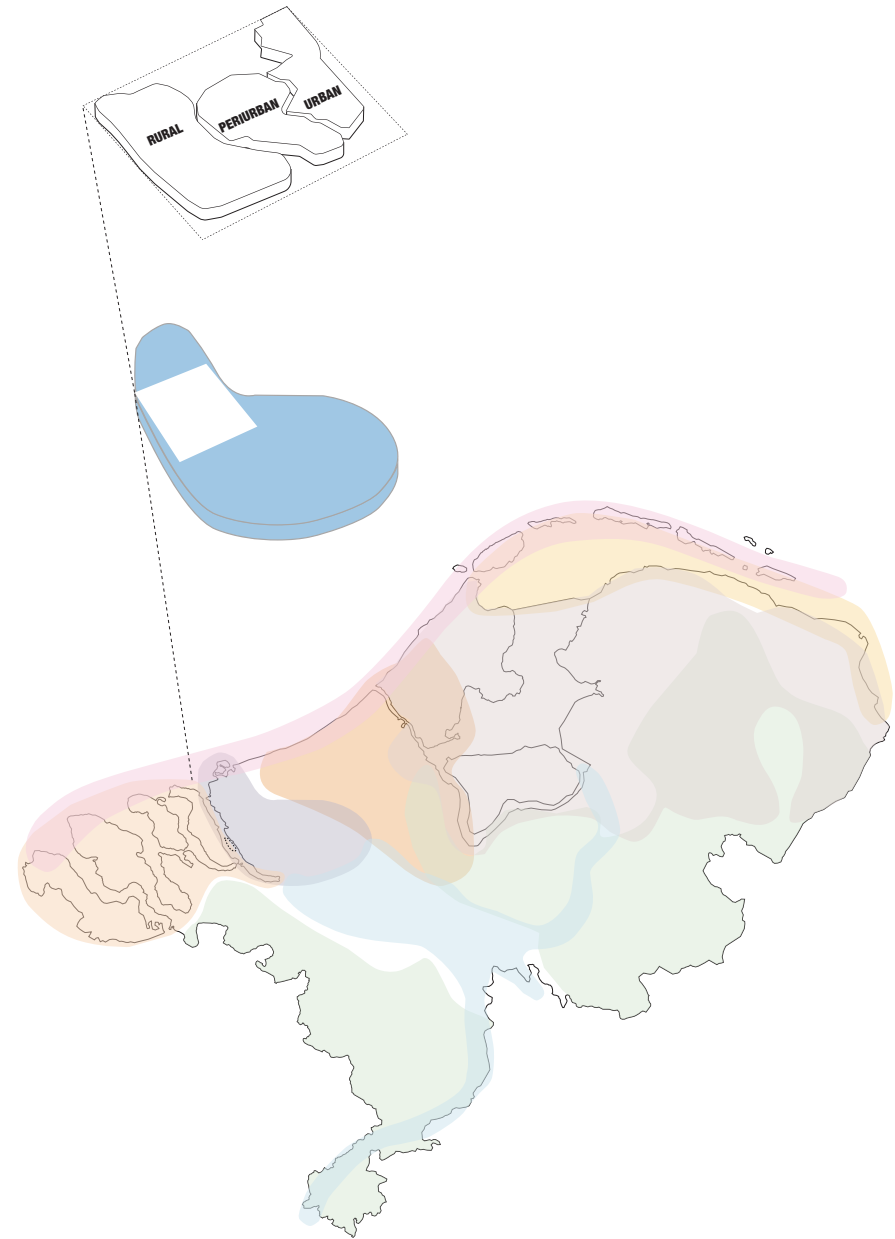
In addition to the objective of the design research,

it is good to formulate shared goals with the team again. This allows problem analyses and agendas from different disciplines to be combined, making it clear exactly what is considered the task and what the expectations are. Subsequently, it is necessary to organize a working session with all involved disciplines for each step, to work from a low to a high level of detail, to switch between steps and scales, and to identify, make manageable, and utilize spatial quality during the process.

Design research is an interdisciplinary design process that does not unfold automatically; the fact that work involves different disciplines must be consciously and actively acknowledged. This means that at every step, there must also be a shift between disciplinary and interdisciplinary approaches in the development of knowledge. For the analysis and diagnosis phase, this means ensuring that the level of detail of the knowledge remains for every disciplines: some disciplines



possess very detailed information (for example, figures regarding the water system) that does not resonate with less detailed information (spatial ambitions for the area); this creates an imbalance that impacts the research. It is common practice in spatial planning to work from generic to specific, and this also impacts the level of detail of the data. In every step, bringing together disciplinary to interdisciplinary knowledge is necessary in the active form of a work session. In this work session, it is important to systematically discuss the data from the disciplines and establish relationships.



**Base layer: Determining the correct scales & correct cross-sections, a water system per scale (diagram)**



## Ordering of data:

### 1. Urban-landscape (human)

People  
Metabolism (local scale)  
Buildings  
Public Space (local scale)  
(Vital) Infrastructure (local scale)  
Soil/Subsurface (local scale)

### 2. Functional Landscape (human)

Surface type  
Function

### 3. Infra-landscape (human)

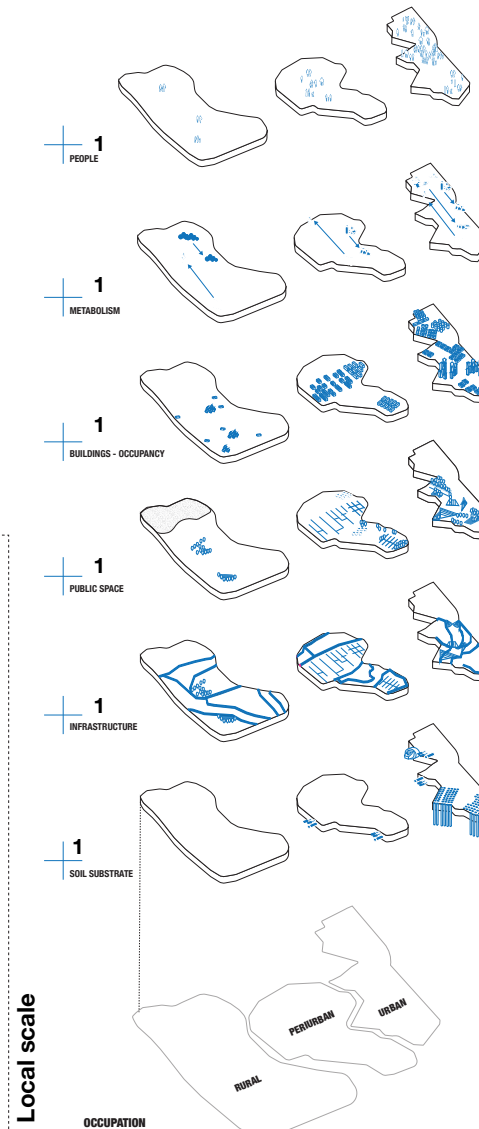
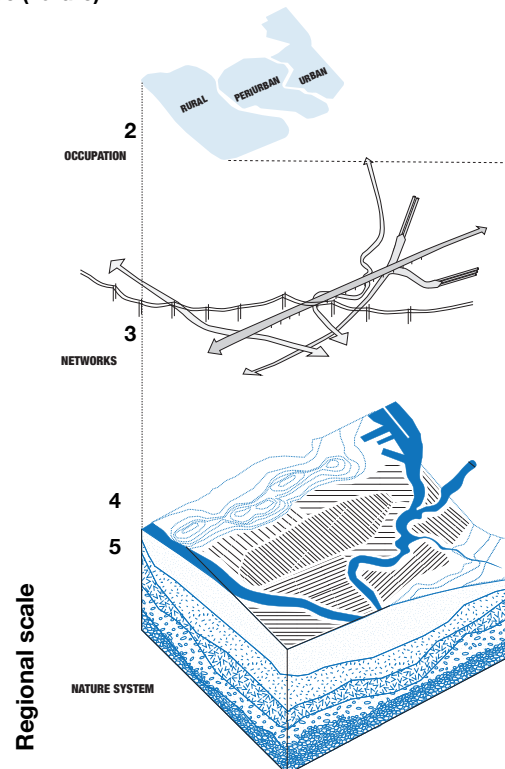
Utilities (energy, data, water, waste)  
Mobility (roads, rail)

### 4. Cultural landscape (hybrid)

Historical landscape  
Water  
Dikes

### 5. Nature Landscape (nature)

Geology  
Soil  
Groundwater  
Topography  
Ecology



# Analysis:

After establishing the right conditions for Research by Design, the first phase of analysis begins, in which a broad observation is made from a shared starting point: Diverging.

This step also determines the perception of the area based on an understanding of the situation in the research area and the substantiation of the choices made on that basis. Based on the research objective established during the preparation phase, it is important to create a plan regarding which analyses will be performed and which data is required for the systems research. Principles that must be applied in this step are the purposeful linking of scales and the determination of the necessary legend: which information is of importance.

In urban design, the organization of data to translate it into integrated information from various specialists is structured into layers. This Research by Design Approach is based on the Layer Approach of Maurits de Hoog, Dirk Sijmons, and San Verschuuren. In *\*Herontwerp van het Laagland\** (1998), they identify three layers: substratum, networks, and occupation. Because research is conducted at (at least) two scales and the delta system needs to be clearly highlighted, two layers have been added to the 3 layers of the Layer Approach. For the local scale, the occupation layer is more detailed and is called urban landscape, while for the higher scale it is named Functional Landscape to emphasize land use.

# Divergence and perception, understanding and substantiation

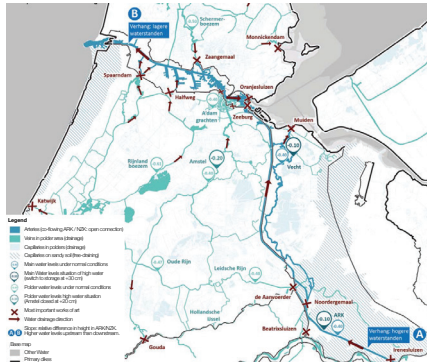
Because the Dutch water system is a hybrid of the natural system and added water infrastructure, it has been designated as Cultural Landscape.

To organize the data, we use these five layers: Urban Landscape (human and more specific for the lower scale), Functional Landscape (human), Infrastructure Landscape (human), Cultural Landscape (hybrid), and Nature Landscape (nature). The table lists the specific sets of data per layer. In each layer, there is an economic, ecological, and social component that may be important to add depending on the research area and the objective. Furthermore, it is important to determine the relevance of data per scale; we recommend the following sources: PBL Atlas of the Region (<https://themasites.pbl.nl/atlas-regio/>), the Landscape Soil Map from Wageningen University & Research (<https://bodemdata.nl/>), and the Climate Impact Atlas (<https://www.klimaateffectatlas.nl/nl/>). The more different studies use the same sources, the easier it is to link them together. In this context, we distinguish between static and dynamic data: static data describe the spatial system, whereas dynamic data describe the pressure exerted on this system. This distinction is important because the dynamic data also play a role in the diagnosis.

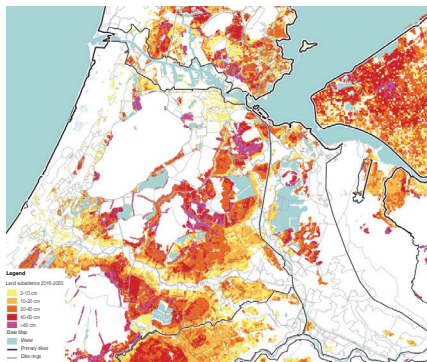
The various specialists will collect the necessary data and translate it into information (with a good legend) by, for example, creating a good map, cross-section, and diagram, as illustrated with the example projects. This material can be discussed in a working session to determine whether there is enough available and what diagnosis will be applied.

| Data type/ sources<br>PBL, WUR, KEA    | Static data                                                                                                      | Dynamic data                                                                                                                                 |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Urban landscape (human)</b>      |                                                                                                                  |                                                                                                                                              |
| People                                 | Demographics                                                                                                     | Climate change (heat)<br>Impact (heat stress, vulnerabilities)                                                                               |
| Metabolism (local scale)               |                                                                                                                  |                                                                                                                                              |
| Buildings                              | Bouwjaar,<br>Bebouwingsdichtheid (FSI),<br>Funciemenging (MXI),<br>Erfgoed<br>Base map (neighborhood typology)   | Impact (pile rot)                                                                                                                            |
| Public space (local scale)             | Base map (tree, greenery, water)                                                                                 | Climate change (heat and water)<br>Physical consequences (water, heat, land subsidence)                                                      |
| Infrastructure (local scale)           | Ontsluitings-kwaliteit Openbaar Vervoer en snelweg,                                                              |                                                                                                                                              |
| Soil/subsurface (local scale)          | Geological values (provinces)<br>Base map (grey)<br>Soil profiles,<br>Base map (soil)                            | Physical consequences (soil subsidence, groundwater)<br>Impact (soil compaction, opportunities for infiltration)                             |
| <b>2. Usage Landscape (human)</b>      |                                                                                                                  |                                                                                                                                              |
| Surface type                           |                                                                                                                  |                                                                                                                                              |
| Function                               | Land use 2015, Mixed-use (MXI),<br>New functions<br>Base map (land use)                                          |                                                                                                                                              |
| <b>3. Infra-landscape (human)</b>      |                                                                                                                  |                                                                                                                                              |
| Utilities (energy, data, water, waste) | Wind energy, heat networks and heat sources                                                                      |                                                                                                                                              |
| Mobility (roads, rails)                | Main roads, railways, metro lines and stations                                                                   |                                                                                                                                              |
| <b>4. Cultural landscape (hybrid)</b>  |                                                                                                                  |                                                                                                                                              |
| Historical landscape                   |                                                                                                                  | Histland (RCE)                                                                                                                               |
| Water                                  | Watersysteem en afwateringsgebieden 2021 Vaarwegen, Ecologische waterkwaliteit, Verzilting oppervlaktewater      | Flood risks, waterlogging, drought, heat<br>Climate change (nuisance, drought, flooding)<br>Physical consequences Impact                     |
| Dikes                                  | Location and standards of primary flood defences                                                                 |                                                                                                                                              |
| <b>5. Nature Landscape (nature)</b>    |                                                                                                                  |                                                                                                                                              |
| Geology                                | Geomorphological map of the Netherlands (1:50.000) Base map (geomorphology)                                      |                                                                                                                                              |
| Soil                                   | Soil map (BRO)<br>Soil profiles, Base map (soil)                                                                 | Land subsidence 2020-2050<br>Physical consequences (land subsidence)                                                                         |
| Groundwater                            | Seepage and infiltration (current)<br>Groundwater protection of drinking water sources<br>Base map (groundwater) | Climate change<br>Physical consequences (groundwater)                                                                                        |
| Topography                             | Elevation map AHN3                                                                                               |                                                                                                                                              |
| Ecology                                | Landscape Typology (RCE)<br>Base map (natural system)<br>Theme map (natural system)                              | Ecological system under pressure,<br>Critical nitrogen deposition in nature reserves<br>Base map (opportunities for natural climate buffers) |

# Analysis examples



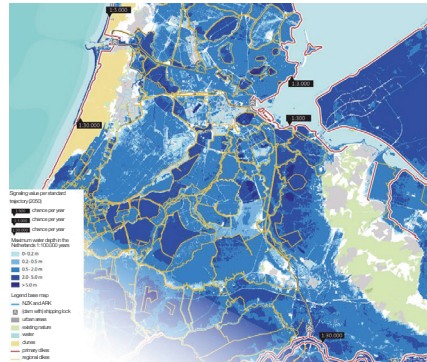
Water system ARK /NZK catchment area  
(data: Water boards HDSR, AGV, Rijnland, HHNK,  
Map: Defacto stedenbouw)



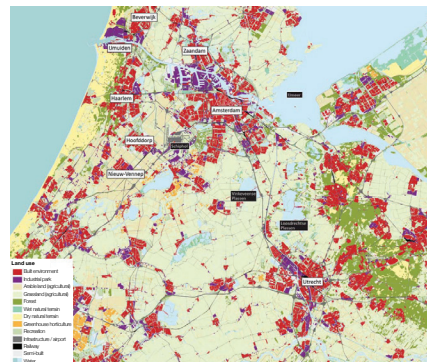
Land subsidence opportunities map (2016-2050) (data: National Climate Impact Atlas, Map: Defacto stedenbouw)

## Accelerated sea level rise, Centraal Holland

Impact of long-term solutions on land use  
Defacto Stedenbouw, 2023

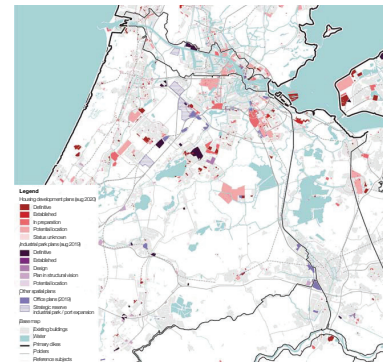


Maximum flood depth and flood defence standards in Central Holland (data: LIWO, Map: defacto stedenbouw)



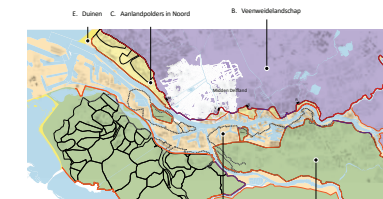
Land use (data: PBL, Map: Defacto stedenbouw)

The result of the analysis phase is five maps: the water system, flood risk and land subsidence, land use, and spatial plans. It is a regional study, which means that the data is also less precise in detail. The system has been mapped out in broad outlines.

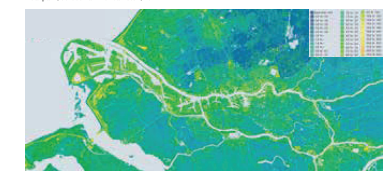


Spatial plans (data: Nieuwe kaart van Nederland; College van Rijksadviseurs, Provincie Zuid-Holland and RIGO, 2021; Map: Defacto stedenbouw)

In this analysis, the regional scale has been mapped for m  
An important analysis for thinking about the future is learn  
The historical analysis shows how the landscape was brow  
as an indication of how we could also let it go again.



Global division of main landscape typologies. Berno Stroodman Framework River as a Tidal park, Stroodman + Urbanisten, 2012



Height map of the Rotterdam region (Source: AHN)



Geological map of the Rotterdam region (Source: De Bosatlas van ondergronds Nederland)



Historical map (1820) + Current main dike system



1570: small-scale land reclamation



1850: Maasmond largely reclaimed



1940: onshore polders, canal polders



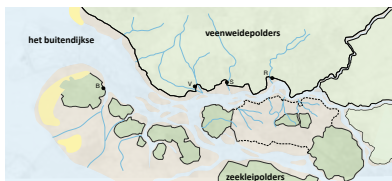
2008: expansion of the port with Maasvlakte and Hartelssluis

## Rotterdam Waterstad 2100

De Urbanisten, Royal Haskoning DHV  
Redesigning Deltas 2023



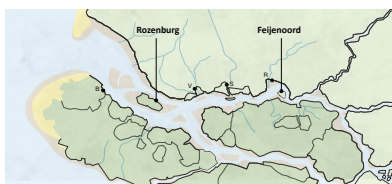
many different topics.  
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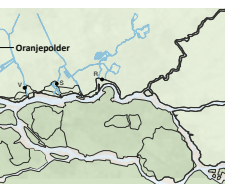
1380: continuous Meerdijk in the north / marine clay polders (polders ring) in the south



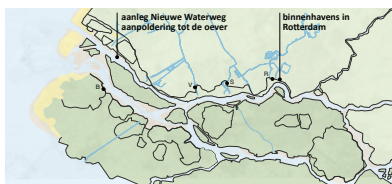
on, varying influence of sea and river



1690: small-scale land reclamation, varying influence of sea and river



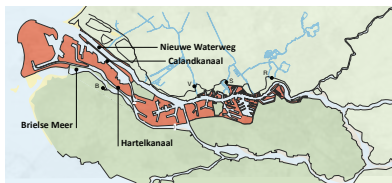
hed, varying influence of sea and river



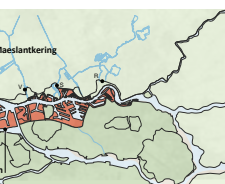
1890: construction of new waterway (1872), small eel polders, harbors



ports



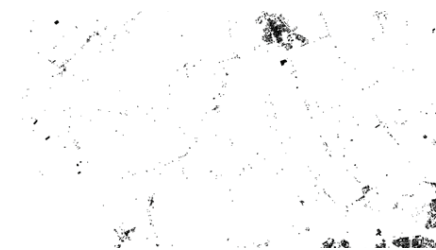
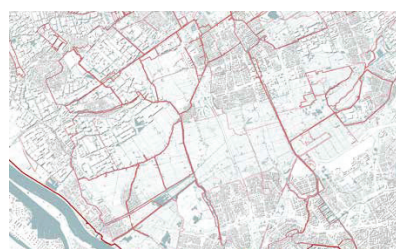
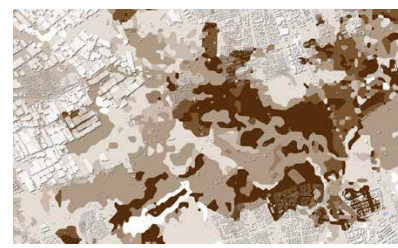
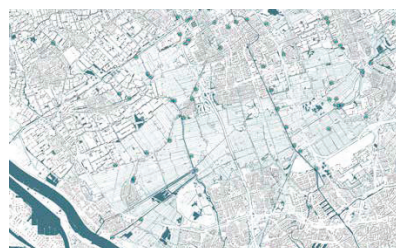
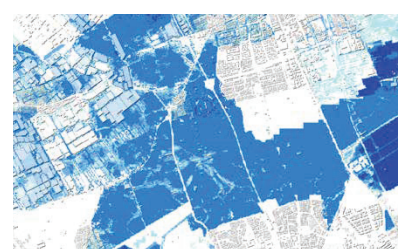
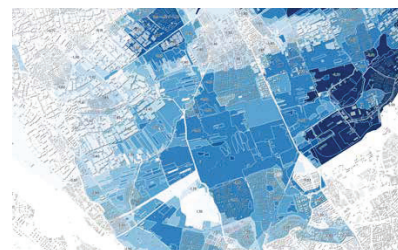
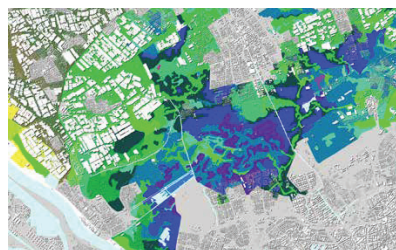
1971: completion of Europoort/Caland-/Hartel canal, damming of the Brielse Maas



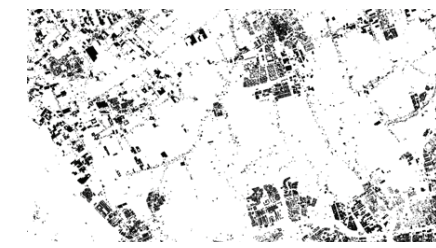
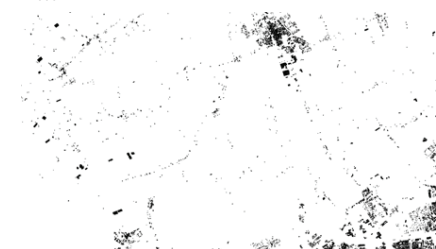
Maasvlakte 1, Hartelsluizen, Maeslantkering



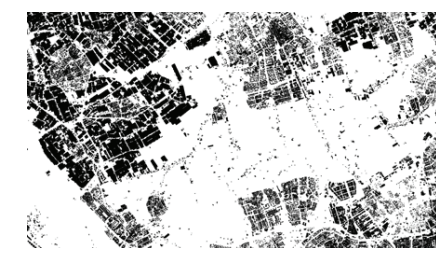
2015: port expansion with Maasvlakte 2



1900



1980



### Delfland zoet/zout

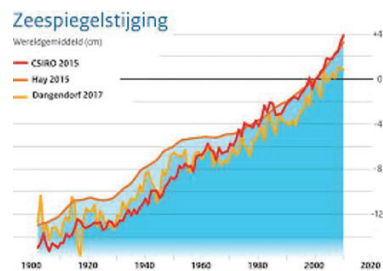
ZUS [Zones Urbaines Sensibles], Flux, Sweco  
Redesigning Deltas 2024

The analysis of the South Holland landscape as an example for the entire region, in which the historical relationship between city and surrounding countryside and the water system is mapped out.

# Diagnosis:

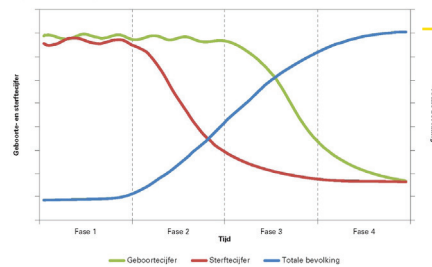


Four scenarios for climate change in the Netherlands around 2100

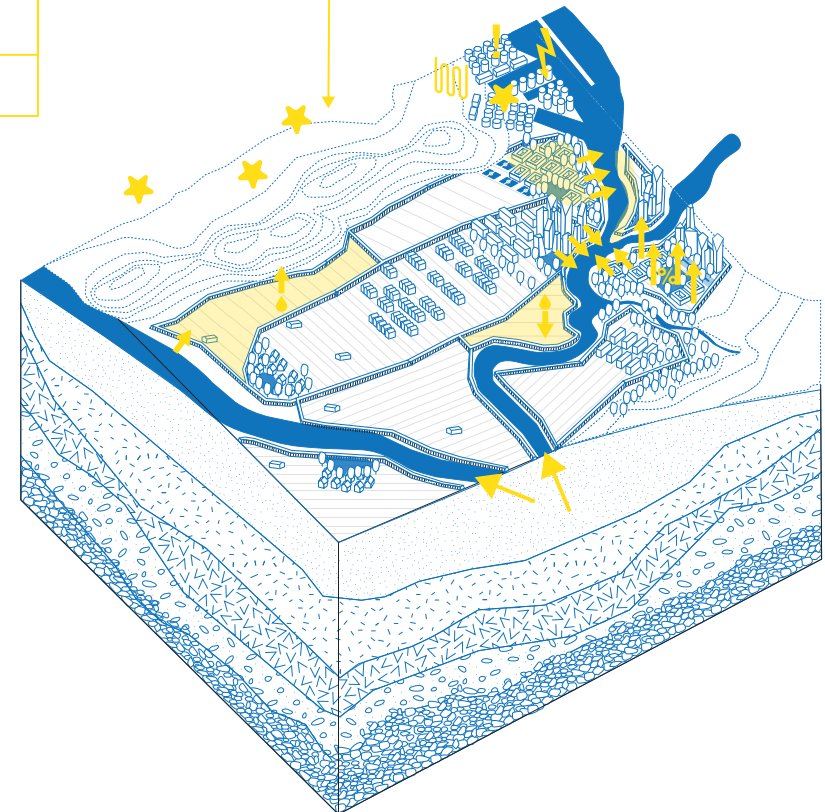


Sea level rise monitoring

Figuur 1. Het demografische transitie model



Demographic transition model





# Convergence and decision-making, prioritizing and directing

In the diagnosis phase, conclusions are drawn from the analysis phase by establishing relationships between the various topics and projecting the dynamics onto them. This allows opportunities and bottlenecks to be identified and determines which spectrum of challenges will be addressed in the research. In this step, example projects can also be reviewed for reference. In this way, solution directions that have already been tested are included in the research. The diagnosis provides the basis for setting priorities and considering these as guiding principles for the direction of the design phase. The convergence of the analyses is achieved by creating combination maps; combining topics that might form a synergy or, conversely, conflict with each other yields insights that can be incorporated into a conclusion map. In this way, the definition of opportunities and problems comes together, and a more focused research question can be formulated. This question will then determine the strategic choices of the design-oriented research.

## Various diagnoses

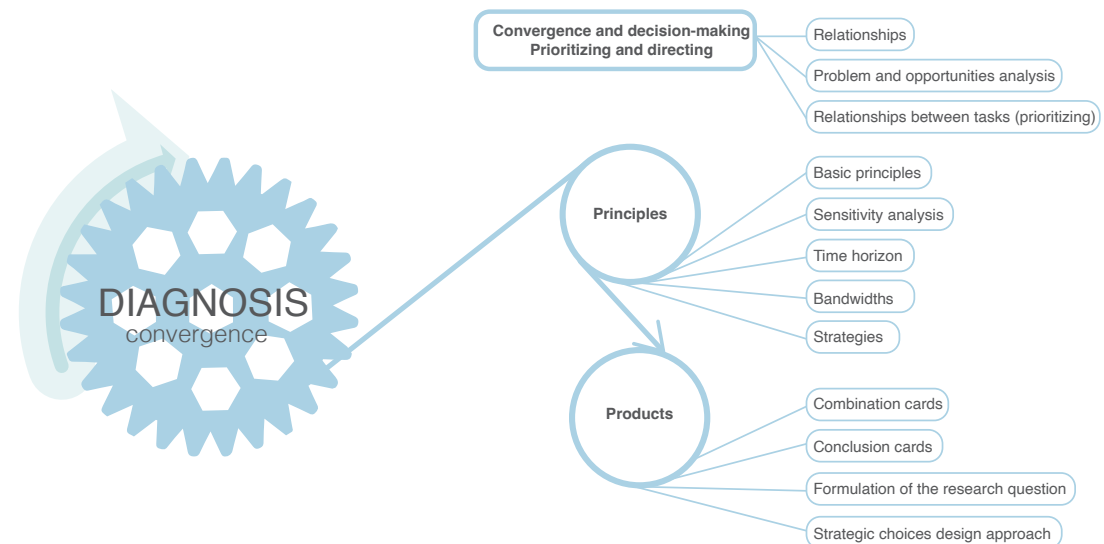
1) Combination maps per specific topic and the challenges, exploring boundaries and tipping points (moments when the current situation is no longer sustainable) or exploring opportunities (how much quality the current situation has to offer the future). An example of the Accelerated Sea Level Rise Central Holland project by Defacto Stedenbouw (2023) are maps of the impact of the changing water

system on topics such as urbanization, vitality and recreation, economy, energy (transition) and infrastructure, ecology and nature, and agriculture.

2) Combination maps of various topics to explore the spatial demand.

3) System analyses of, for example, the water system and a 3-meter sea level rise in a cross-section and diagram. In Rotterdam Waterstad 2100 by the team De Urbanisten and Deltares (2023), cross-sections were used to clarify the hydrological situation in 2100, making the problem very clear. In the Delfland Sweet/Salt project, this was elaborated with a series of drawings illustrating the historical development of the water system in relation to a cross-section with a quantitative diagnosis.

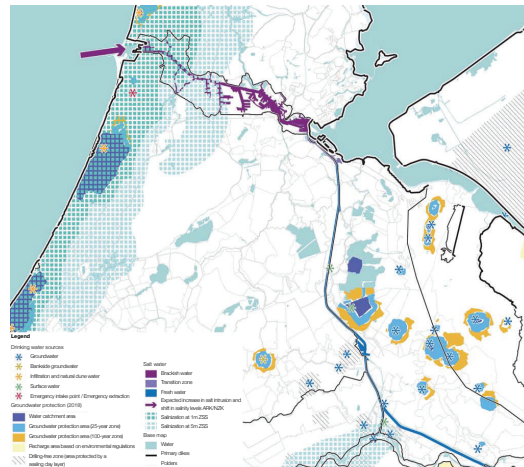
The diagnosis is carried out with the entire core team and all involved disciplines during a working session; the diagnoses regarding opportunities and bottlenecks per knowledge area are then linked together, and choices are made regarding which boundary conditions will be used in the subsequent design phase. The principles applied here are: (re) formulating the baselines, establishing a time horizon and bandwidths for the research based on the sensitivity analysis, and selecting the strategy for the design phase.



# Diagnosis examples



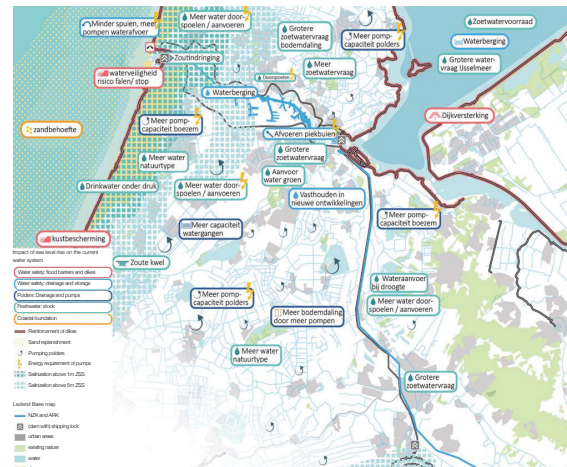
In the diagnostic phase, the expected and planned investments, and the potential impact of climate and salinization were identified as starting points for positioning the solution directions in the design phase.



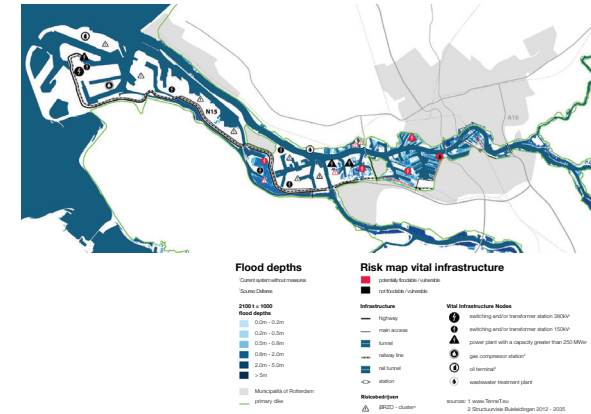
Potential salinization due to rising sea levels and existing drinking water catchment areas (data Atlas of the Region (PBL, 2020), Waternet, Deltares; map: Defacto stedenbouw)

## Accelerated sea level rise, Centraal Holland

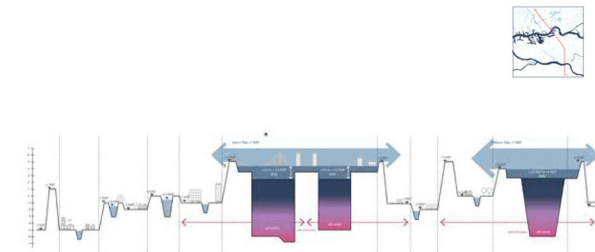
Impact of long-term solutions on land use  
Defacto Stedenbouw, 2023



Potential impact of climate change (sea level rise and changes in precipitation patterns) on the water system (data: water system analysis ARK/NZK area HKV; Deltares; map: Defacto stedenbouw)



Flood risk bottleneck analysis.

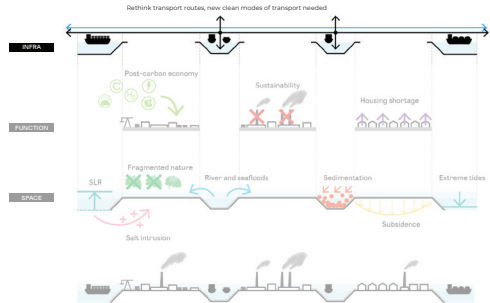
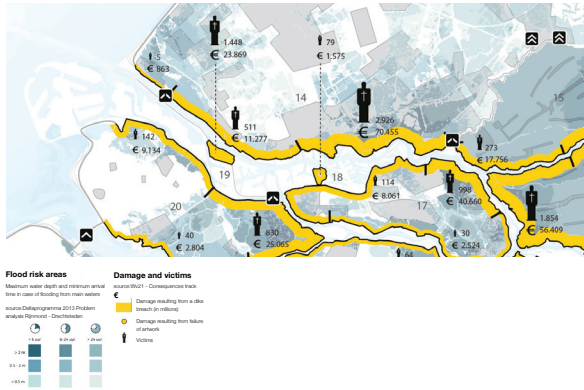


The problem of a 3-meter sea level rise in the city.

## Rotterdam Waterstad 2100

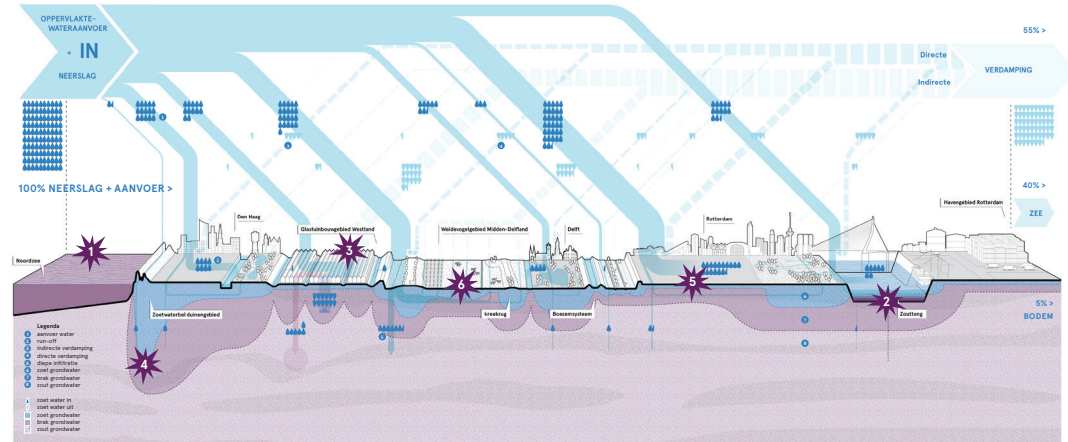
De Urbanisten, Royal Haskoning DHV  
Redesigning Deltas 2023



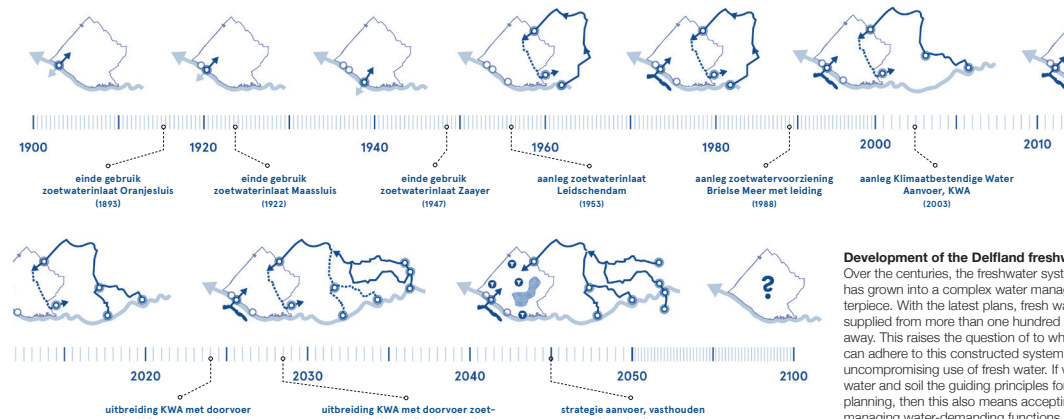


Diagnosis of the remaining bottlenecks.

The diagnosis utilized cross-sections to clarify the problem of the 3-meter sea level rise. Together with a bottleneck analysis, this served as the starting point for separating the approaches to the port (LOLA) and the city (Urbanisten) and assigning different spatial strategies to them.



Diagnosis of the current water balance for the Delfland Water Board. The interrelationship between the above-ground and underground water systems has been illustrated in the cross-section. Water distribution (run-off, infiltration, indirect and direct evaporation) varies by land use type and soil type. In total, approximately 40% of the fresh water is transported to the sea, 55% leaves the system through (in)direct evaporation, and only 5% infiltrates into the soil. Climate change poses challenges across the board. 1. Sea level rise = increased salinization pressure. 2. Long periods of drought = low river flow = increased salt intrusion. 3. Presence/increase in greenhouse horticulture = reduced rainwater infiltration = reduced counter-pressure from saline seepage. 4. Increased urbanization = greater demand for drinking water. 5. Paved surfaces = reduced infiltration. 6. Salinization = threat to current agriculture and nature.



**Development of the Delfland freshwater system.**  
Over the centuries, the freshwater system for Delfland has grown into a complex water management masterpiece. With the latest plans, fresh water is being supplied from more than one hundred kilometers away. This raises the question of to what extent we can adhere to this constructed system and to the uncompromising use of fresh water. If we truly make water and soil the guiding principles for our spatial planning, then this also means accepting salinization, managing water-demanding functions, and simplifying and making the freshwater system more robust in the future.

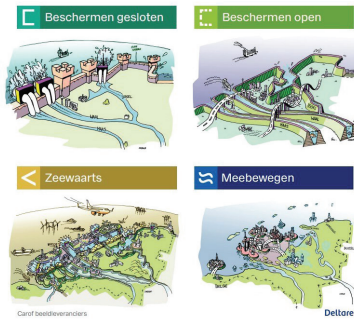
### Delfland zoet/zout

ZUS [Zones Urbaines Sensibles], Flux, Sweco  
Redesigning Deltas 2024

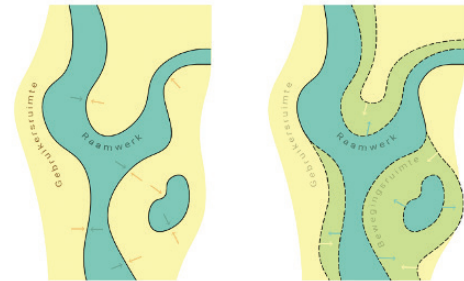
The diagnosis outlines the water balance moving between the above-ground and underground systems. Additionally, the development of the freshwater system has been mapped out to understand its current state and where it might be headed.



PBL scenarios (1)



Solution directions van Deltares (2)



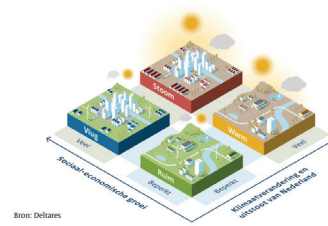
Casco Concept (3)



Spatial principle of rewetting in Plan B by Lola (3)



Spatial principle of raising by ZUS in NL2200 (3)

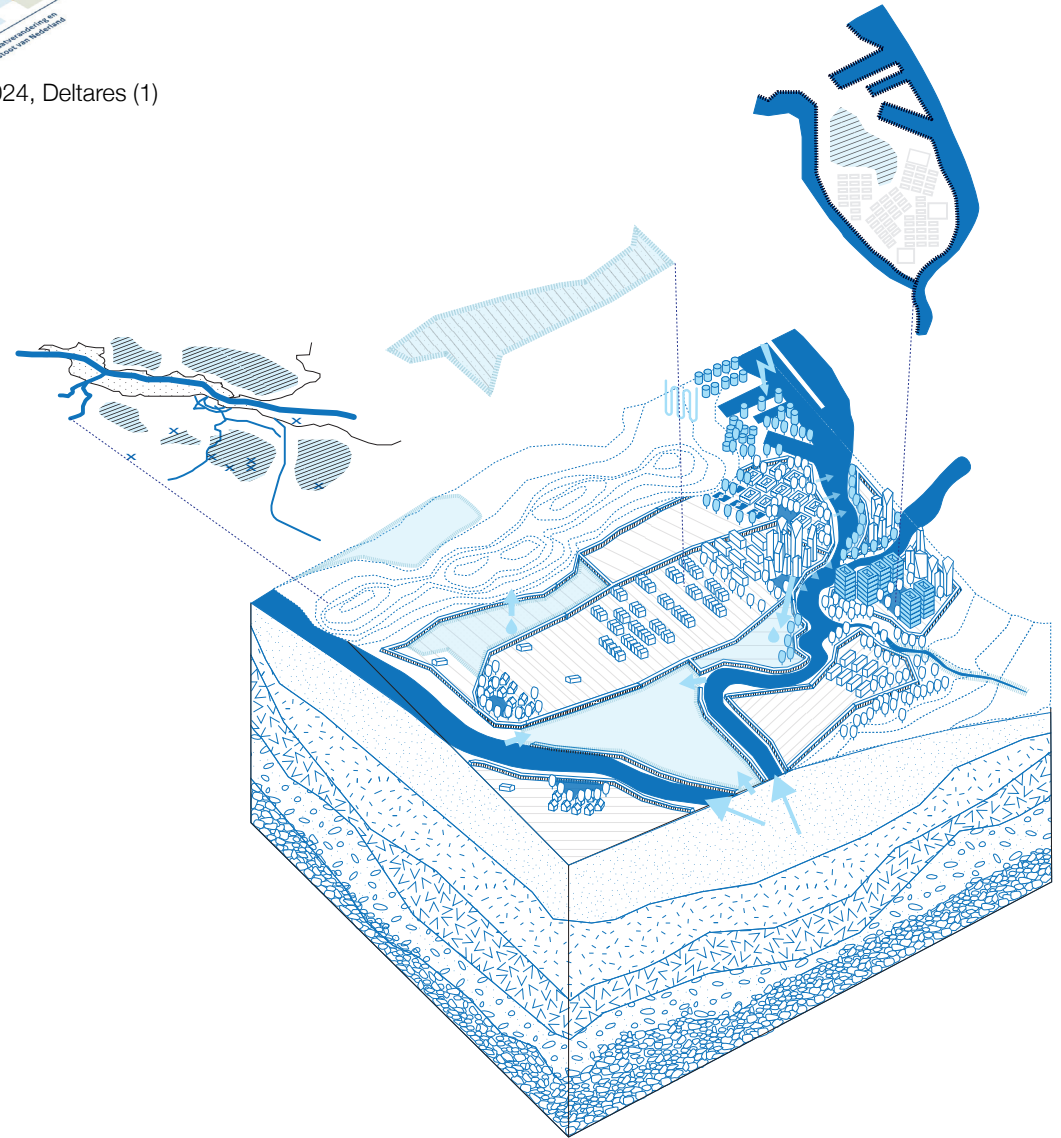


New Delta scenarios 2024, Deltares (1)



NL2120, WUR (4)

# Design:



# Image and decision-making, separating and intertwining

The strategic choices made during the diagnosis phase determine the approach in the design phase. Designing can be implemented in various ways to support decision-making and visualization. During the analysis phase, the aspect of observing the design process brought to light the main lines, facts, coherence, interpretation, and meaning. In the diagnosis phase, conclusions were drawn, references examined, and the lines laid out for the design phase: the starting points, the time horizon, the bandwidths, and the strategy. Designing is experimenting by analyzing, creating new combinations and variants, and testing them.

Different design strategies can be followed, designing from:

1) Spatially shaping scenarios for the future in which numerical, computational facts are used, such as the PBL and the Deltares Delta scenarios (see left page).

2) Elaborating on a (qualitative) spatial principle, as Defacto has done, for example, with the strategies or solution directions of Deltares: seaward, adapting, and protection open/closed, and the scenarios in the Fresh/Salt project by Flux and ZUS.

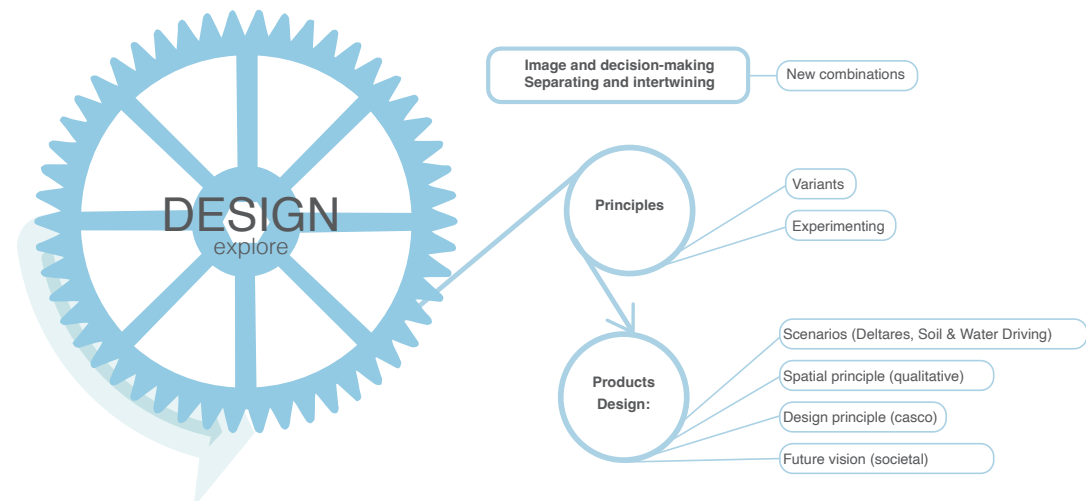
3) Design principles, such as the Casco concept, which act as specific guiding models to steer

design decisions, such as the application of a spatial principle of rewetting in Plan B by Lola and a spatial principle of raising by ZUS in NL2200 (see left page), as well as the super dike in the Rotterdam Waterstad 2100 project by the team De Urbanisten and Deltares (next page).

4) Designing a future vision (societal) that visualizes foresight in conjunction with linguistic, analytical, and creative expression of renewal in the future. For example, a plan such as NL2100, which proposes an entirely green delta.

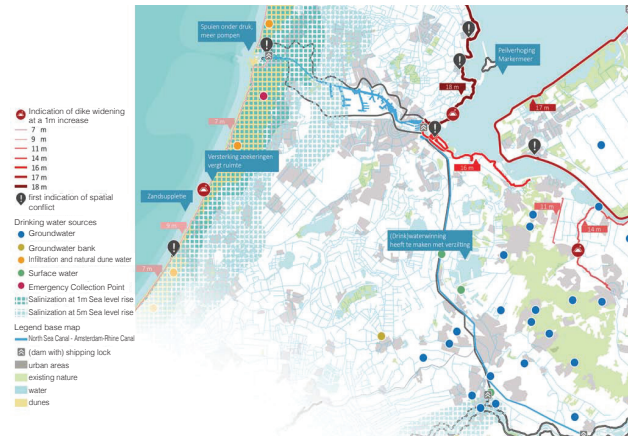
The interdisciplinary design, as described earlier, starts with a first step involving disciplinary ideas

that are subsequently combined into integrated solutions based on the established preconditions in the diagnosis phase. This step is also taken in an active working session. The participating disciplines prepare the necessary knowledge and ideas (references, strategies, and solutions) and present these, preferably within disciplines, initially one-on-one, in a charrette format (conducting the discussion in several rounds), and subsequently in a plenary session. The result is a vision, a strategy, and spatial designs for the area, supported by cross-sections and diagrams. These often align with the analysis and diagnostic drawings; in any case, they are at the same two scales and have a comparable legend.

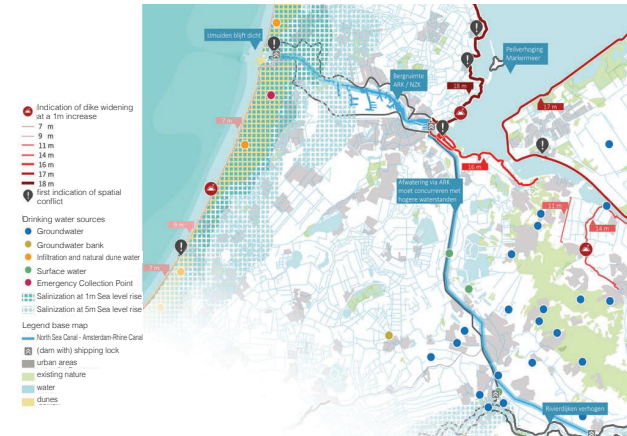




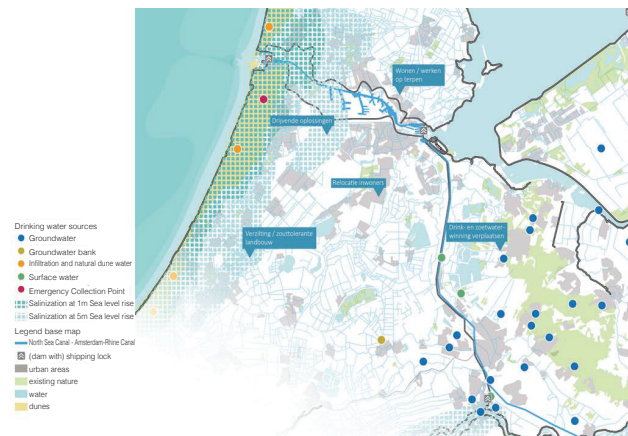
# Design examples



Potential spatial development under "protecting-closed" in Central Holland (data: Deltares, map Defacto stedenbouw)



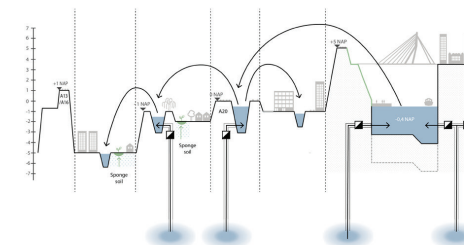
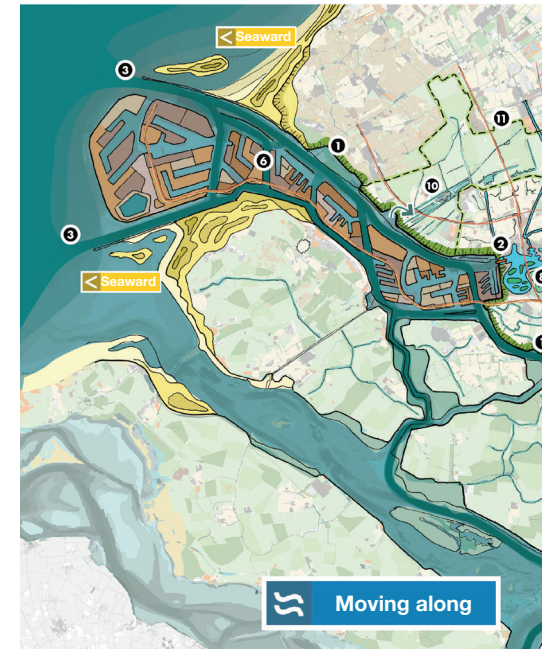
Potential spatial development under "protecting-open" in Central Holland (data: Deltares, map Defacto stedenbouw)



Potential spatial development under "moving along" in Central Holland (data: Deltares, map Defacto stedenbouw)

## Accelerated sea level rise, Centraal Holland

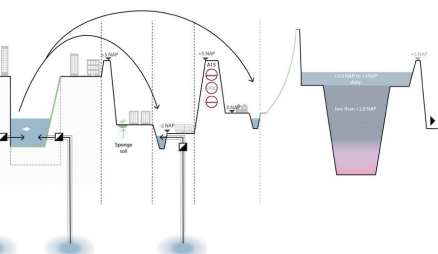
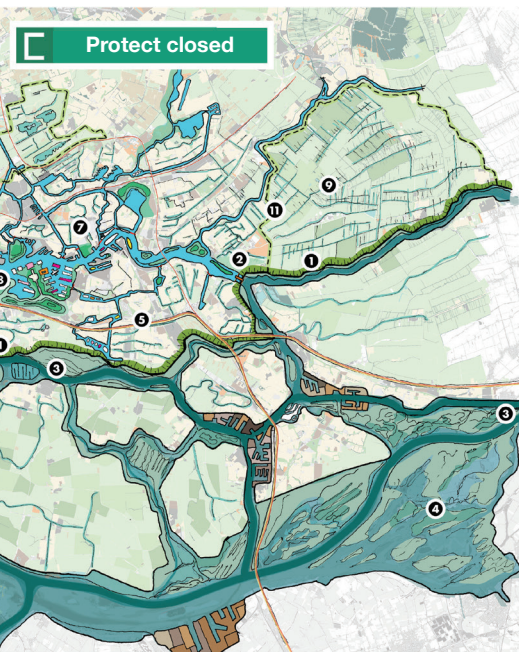
Impact of long-term solutions on land use  
Defacto Stedenbouw, 2023



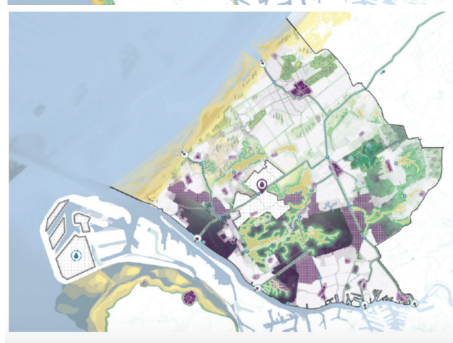
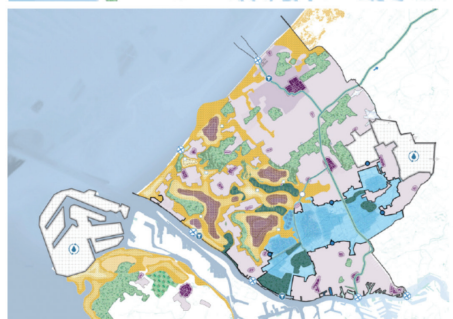
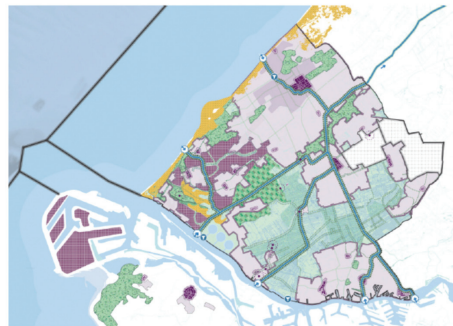
## Rotterdam Waterstad 2100

De Urbanisten, Royal Haskoning DHV  
Redesigning Deltas 2023





The design research led to a proposal in which the various solution strategies of Deltares (protect closed, seaward, and adaptive) have been applied in relation to each other within the region. For the city, an extension of dike ring 14 has been proposed, which represents a significant transformation of the Rotterdam water system. This is substantiated in a cross-section.



**Delfland zoet/zout**  
ZUS [Zones Urbaines Sensibles], Flux, Sweco  
Redesigning Deltas 2024

### Scenario 1: Makeable Delfland.

We continue on the same path and further expand the freshwater system by constructing a large freshwater basin off the coast. This prevents saline seepage, peat meadow areas retain their current function, and urbanization can take place without restrictions from the water system.

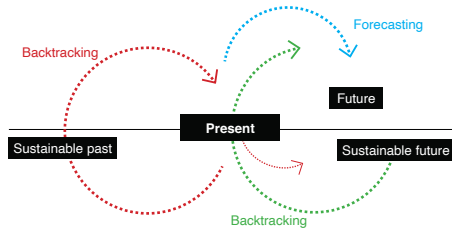
### Scenario 2: Delfland<sup>tm</sup> water machine.

We view Delfland as an independent 'water machine' and adapt the landscape so that the available water is used as efficiently as possible. No water is admitted from the Meuse or Rijnland; instead, it is designed as a large freshwater basin. Subsequently, this water is pumped onto new dune landscapes to infiltrate slowly, causing new freshwater lenses to form. New urbanization takes place on these inland dune landscapes.

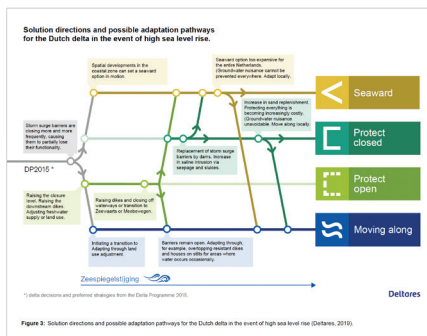
### Scenario 3: Delf-delta-land

We assume the quality of the existing water and soil system. Land use adapts to the variation between fresh and wet winters, and dry and saline summers. This results in unique delta nature along the river zone and seasonal shifts within agriculture. At the same time, a zone with little (soil) life emerges due to extreme seasonal fluctuations. We see opportunities for urbanization in this zone.

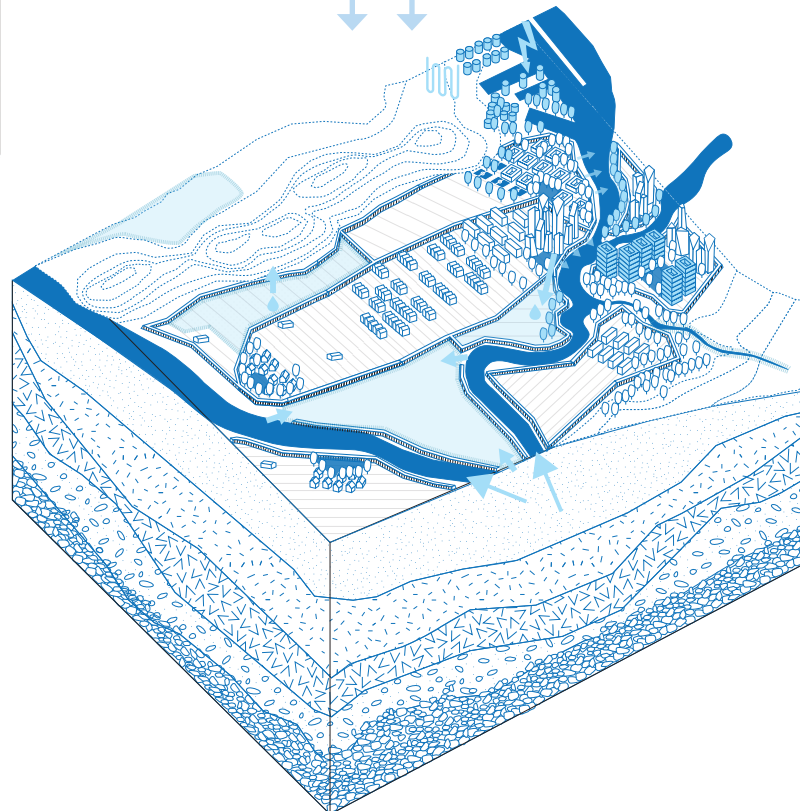
# Reflection:



Backcasting method



Formulating adaptation pathways



## ⑧ Time and design journey

A total experience of the future. When you truly want to find a solution, you must empathize as much as possible. By making it relatable, you can better understand the challenge and begin designing for the future.

- Verveeld en Verward / Dorine Baars, Jonas Martens



## ⑪ Transition thinking

With this method, you gain insight into transitions using the X-curve. This X-curve shows the build-up of the new system with the upward line and the dismantling of the existing system with the downward line.

- Drift + EUR (Erasmus Universiteit Rotterdam) / Derk Loorbach



## ⑥ Reframing

The 'Reframing' method helps address the question of how we, as a society, can and want to shape our future. Stories play an important role in this.

- TU Delft en Reframing Studio / Femke de Boer



## ⑩ Future matrix

The future matrix helps to structure long-term thinking using four columns and to reason backward to what needs to be done now.

- College van Rijksadviseurs / Jannemarie de Jonge, Paul Kersten, Saskia Naafs e.a.



Handleiding Toekomst Denken  
(Manual on Future Thinking) CRA, 2023

# Assessment, understanding, and substantiation

The phase of reflection and judgment is an explicit part of the design process; it is iterative. Reflection is on the original objective of the research and evaluating whether it has achieved what was originally intended. This can guide the design process. Once this has been completed satisfactorily, this phase contributes to understanding and substantiating future decision-making by, for example, developing adaptation pathways during this phase.

Reflection on the results of the design research can take various forms, specifically tailored to the original objective.

1) Analysis of effects on key topics, as demonstrated by the Accelerated Sea Level Rise Central Holland project by Defacto Stedenbouw (2023).

2) Formulating adaptation pathways, as was done in the Rotterdam Waterstad 2100 project by De Urbanisten and Deltares (2023).

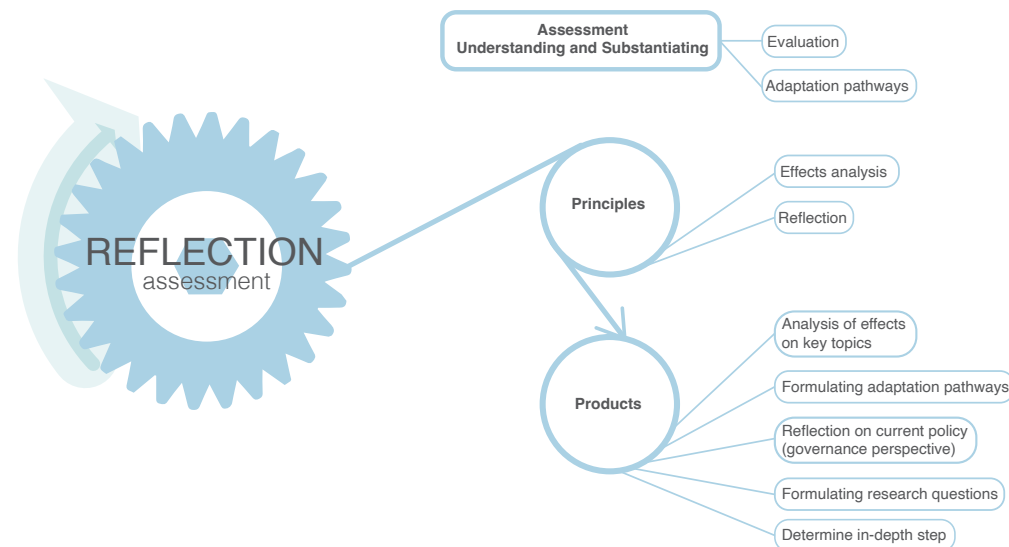
3) The method of backcasting: connecting forecasting and foresight design strategies can be translated back in time into steps that are realistic.

4) Reflection on current policy (governance perspective) Rotterdam Water City 2100, De Urbanisten and Deltares (2023)

5) Formulating new research questions: which new insights requiring new research are important

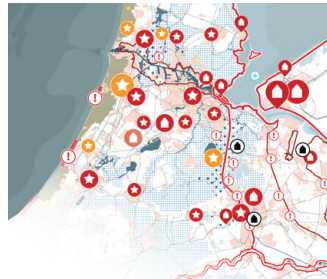
to investigate further? For example, with other stakeholders, on a different scale.

6) Determining the next step in depth: on which aspects can the chosen path be further developed?

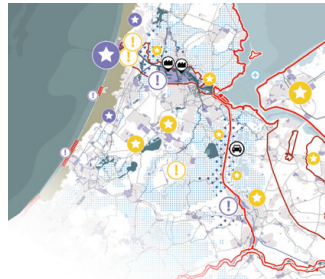




# Reflection examples



Impact of Urbanization, Vitality and Tourism



Impact on Economy, Energy and Mobility



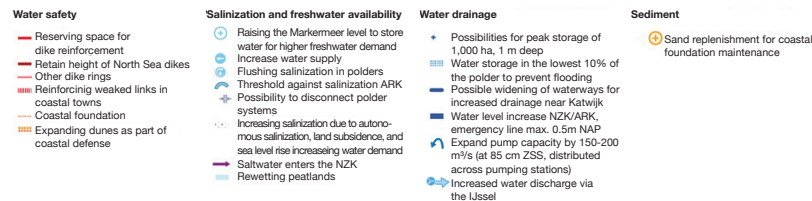
Impact Ecology



Impact on agriculture

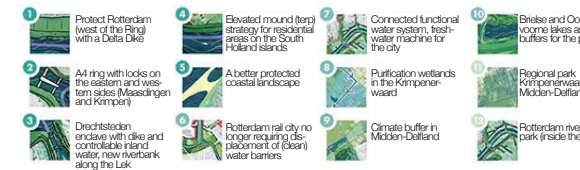


In the reflection, all three solution directions were examined in terms of their impact on urbanization, vitality & tourism, economy, energy & mobility, ecology, and agriculture. This is an example of adapting.



## Accelerated sea level rise, Centraal Holland

Impact of long-term solutions on land use  
Defacto Stedenbouw, 2023

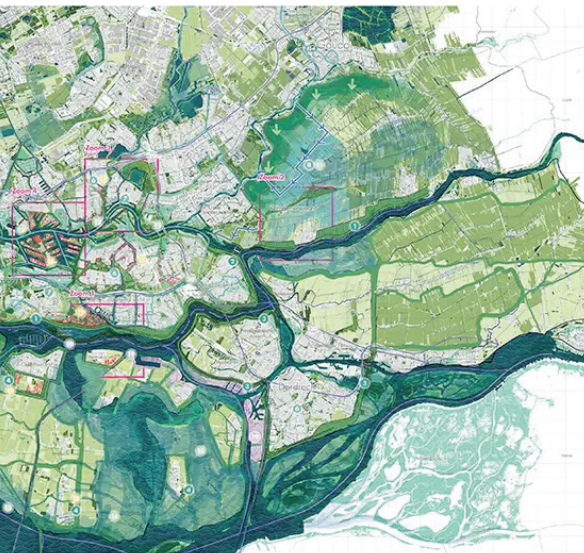


The proposal by Lola, Urbanisten, and RHDHV was submitted to the competition and provided with a follow-up. This follow-up is a reflection on the proposal, which is provided with turning points & adaptation pathways and is usually approached sectorally, one-dimensionally from the perspective of the following approach (following water), and this could now be approached from a multi-perspective examines implementation and scaling up, tra

## Rotterdam Waterstad 2100

De Urbanisten, Royal Haskoning DHV  
Redesigning Deltas 2023



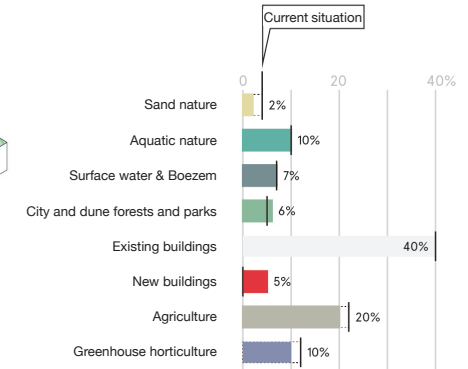
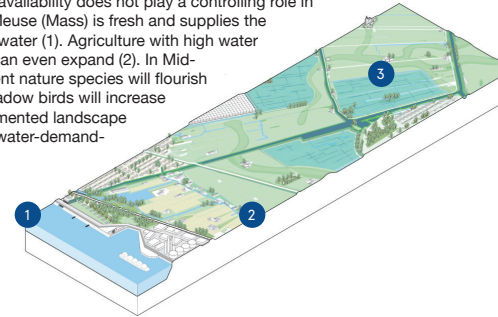


- 1. More dynamic living with water, with greater room for ecological gradients on the South Holland islands
- 2. New water-oriented housing typologies along the new dike/marsh
- 3. Wet agriculture on the South Holland islands
- 4. New urban harbor on the Oude IJ
- 5. Living along a better connected recreational water network
- 6. Expansion of residential areas on elevated mounds on the South Holland islands
- 7. Relocation of inland port activities to a new high-port route
- 8. New safe transport routes by water and land
- 9. A floating seaward port expansion
- 10. Gradual elevation of outer-dike functional port areas

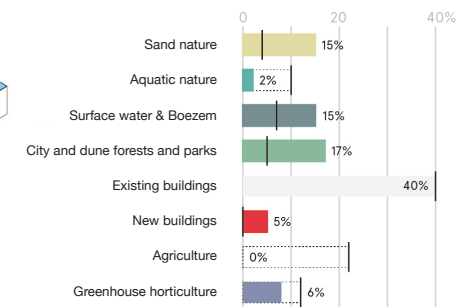
mitted by Urbanisten and Deltares to the EO Wijers committee. This is primarily a reflection phase in which the spatial proposal and a governance perspective is included. The former is from the perspective of the water system, and with a model-follower connected to the spatial perspective. The governance perspective focuses on transformation, societal feasibility, and steering.

### Scenario 1: Constructible Delfland 2100

In this scenario, water availability does not play a controlling role in spatial planning. The Meuse (Mass) is fresh and supplies the polders with sufficient water (1). Agriculture with high water demand remains and can even expand (2). In Midden-Delfland, the current nature species will flourish and the habitat for meadow birds will increase (3). The result is a fragmented landscape with a mix of different water-demanding functions.



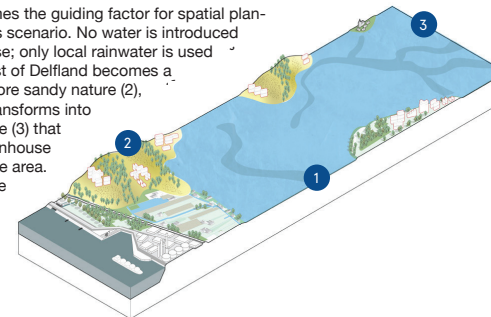
Land use ratio Delfland scenario 1



Land use ratio Delfland scenario 2

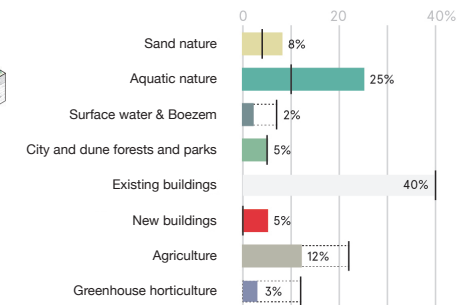
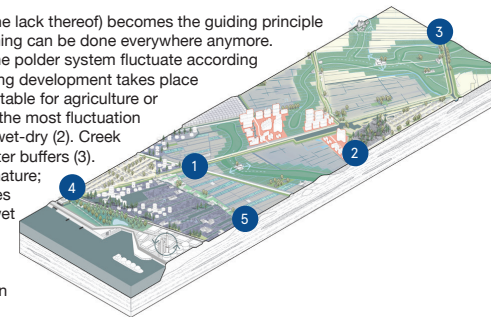
### Scenario 2: Delfland™ water machine 2100.

Water availability becomes the guiding factor for spatial planning and land use in this scenario. No water is introduced from the salinizing Meuse; only local rainwater is used as a source (1). The west of Delfland becomes a dune metropolis with more sandy nature (2), and Midden-Delfland transforms into one large freshwater lake (3) that acts as a buffer for greenhouse horticulture and the dune area. The result is a landscape with hard boundaries between functions.



### Scenario 3: Delf-delta-land 2100

Water availability (and the lack thereof) becomes the guiding principle for land use; not everything can be done everywhere anymore. Salt concentrations in the polder system fluctuate according to the season (1). Housing development takes place where the soil is less suitable for agriculture or nature, in the zone with the most fluctuation between fresh-salt and wet-dry (2). Creek ridges serve as local water buffers (3). There is more room for nature; nature development takes place in the saline and wet zone along the river (4). Agricultural adaptation with freshwater crops in winter and saline crops in summer (5).

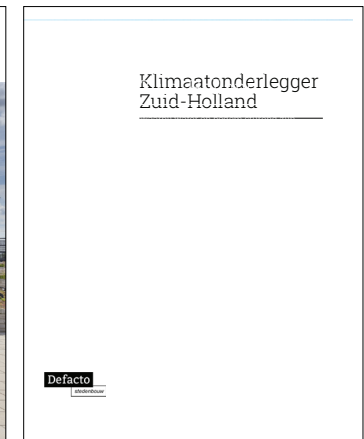
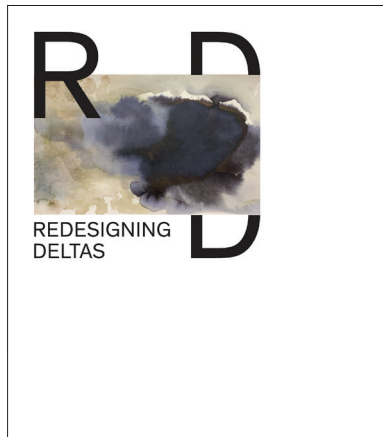


Land use ratio Delfland scenario 3

### Delfland zoet/zout

ZUS [Zones Urbaines Sensibles], Flux, Sweco  
Redesigning Deltas 2024

# References and examples







# Colophon

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TU Delft, Delta Urbanism, Deltares  
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## Bibliography

- De Bruin, D., Hamhuis, D., van Nieuwenhuijze, L., Overmars, W., Sijmons, D., Vera, F. (1987). Ooievaar. De toekomst van het rivierengebied. Ministerie van Verkeer en Waterstaat.
- Deltares, BoschSlabbers en Sweco (2021), Op water-basis: grenzen aan de maakbaarheid van ons water-en bodemsysteem. Delft: BoschSlabbers & Sweco.
- Deltares (2024) Deltascenario's voor Nederland: Wateropgaven in 2050 en 2100 : Nationaal Deltaprogramma.
- H+N+S Landschapsarchitecten (2023) De Lagenbenadering, het Lagen model, en het casco concept, reflecties op drie instrumenten in het herontwerpen van de Nederlandse delta 01-03-2023.
- Hoog de, M., Sijmons, D. & Verschuuren, S. (1998) Laagland. HMD (Het Metropolitane Debat) Herontwerp: Amsterdam.
- Sijmons, D. F. (1991). 'Het casco-concept: een benaderingswijze voor de landschapsplanning', Informatie-en Kenniscentrum/NBLF, vol. 24, 1991.
- Van den Boomen, T., E. Frijters, S. Van Assen, and M. Broekman, red. 2017. Stedelijke vraagstukken, veerkrachtige oplossingen: Ontwerpend onderzoek voor de toekomst van stedelijke regio's. Illustration by Catalogtree, Arnhem. Amsterdam: Trancity Valiz.
- Van Dooren, E., Boshuizen, H., Van Merrienboer, J.G., Asselbergs, T., Van Dorst M. (2013). 'Making explicit in design education: generic elements in the design process', International Journal of Technology and Design Education, vol. 24, no. 1, 2013, pp. 53-71.
- Verheijen Marco (Stedebouw & Architectuur Blog Doorontwikkeling van de lagenbenadering (31 march 2021).

## Websites

- PBL Atlas van de regio  
<https://themasites.pbl.nl/atlas-regio>
- Landschappelijke Bodemkaart van Wageningen University & Research  
<https://bodemdata.nl>
- Klimaateffectatlas  
[www.klimaateffectatlas.nl](http://www.klimaateffectatlas.nl)
- KNMI Klimaatscenario's  
[www.knmi.nl/kennis-en-datacentrum/achtergrond/knmi-23-klimaatscenario-s](http://www.knmi.nl/kennis-en-datacentrum/achtergrond/knmi-23-klimaatscenario-s)
- PBL scenarios  
[www.pbl.nl/publicaties/vier-scenarios-voor-de-inrichting-van-nederland-in-2050](http://www.pbl.nl/publicaties/vier-scenarios-voor-de-inrichting-van-nederland-in-2050)
- NL2120  
<https://www.wur.nl/nl/onderzoek-resultaten/dossiers/dossier/nederland-in-2120.htm>
- CPB Langetermijnverkenningen  
[www.cpb.nl/langetermijnverkenning](http://www.cpb.nl/langetermijnverkenning)
- Deltares, ruimtelijke oplossingsrichtingen voor zeespiegelstijging  
[www.deltares.nl/expertise/onze-expertises/zeespiegelstijging](http://www.deltares.nl/expertise/onze-expertises/zeespiegelstijging)
- Versnelde zeespiegelstijging Centraal Holland Deltaprogramma van Defacto Stedenbouw (2023)  
[www.deltaprogramma.nl](http://www.deltaprogramma.nl) · 2021/04/22
- Eo Wijers - CRA (2023)  
<https://eowijers.nl/prijsvraag-2022-2023>
- Handleiding Toekomst Denken  
[www.collegevanrijksadviseurs.nl/adviezen-publicaties/publicatie/2023/12/07/handleiding-toekomstdenken](http://www.collegevanrijksadviseurs.nl/adviezen-publicaties/publicatie/2023/12/07/handleiding-toekomstdenken)
- Redesigning Deltas  
<http://deltaurbanism.org/redesigning-deltas>



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