

# A half-natural Vecht in 2050: what does this mean and how do we get there?

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A case study on stakeholders' visions and climate-resilient development pathways towards a half-natural Vecht

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## Abstract

Shaping climate resilient water management in a more natural way is the purpose of transforming the Vecht in a half-natural river within the coming decades. Until now, intervening within the river and connected areas is difficult caused by the set constraints and many interests involved. To realize still the desired future situation, the research project Lumbricus aims to establish climate-resilient pathways for the Vecht following a building-with-nature approach to overcome this issue. Therefore, a definition of the end situation of a half-natural Vecht is needed. Through missing out one general shared vision by stakeholders on what a half-natural river means, the following research question was constructed: *What are the key characteristics and possible envisioned routes towards a half-natural Vecht in 2050 according to stakeholders?* A combination of qualitative research methods was conducted consisting of fifteen semi-structured interviews, a stakeholder workshop and eight back-casting sessions. The semi-structured interviews resulted in four different categories of visions, based on the extent how natural the river system must become. The workshop narrowed down the different visions towards one end vision, which could be placed between the two most natural vision categories. The proposed routes constructed during the back-casting sessions led to two overarching routes which were transformed into two compressive climate-resilient development pathways. One pathway is characterized by the focus on motivation for change, the other by realizing the required space for interventions. By doing so, this researched applied for the first time a climate-resilient development pathway approach on a developed country water-management case.

**Key concepts: half-natural river, climate-resilient development pathways, building-with-nature, goal formulation, Vecht**

## Preface

This thesis is part of the Master Environmental Sciences at Wageningen University and written within the Department of Water Systems and Global Change. This department conducts solution-oriented multidisciplinary research focusing on water systems within a globally changing environment. One of the key ambitions is to “identify sustainable interventions and pathways to adapt to these futures”. This ambition comes back as well within the aim of the research project Lumbricus project to invent development pathways for the Vecht for 2050 by using building-with-nature interventions. With this thesis, I hope to provide an insight which characteristics the Vecht should contain according to stakeholders, which routes of intervention stakeholders suggest to reach a half-natural Vecht in 2050 and which overarching pathways can be constructed based on these suggested routes.

During this thesis, I was Supervised by Erik van Slobbe. A special thank you goes to you for the helpful meetings, the constructive feedback and your positive attitude. This all was essential to improve my thesis step by step which resulted in this end report. I would like to thank you for the time and energy you invested in improving my thesis. Thereafter, I like to thank Saskia Werners for her time and effort invested in reading this research and helping me with pathway related questions.

Next, I like to thank all my interviewees. Without your input, I had no results at all. Thanks for giving me your view on the topic and sharing your knowledge with me. These inspirational interviews made my thesis a lot more joyful then it would have been without it.

In addition, a special thank you goes out to my friends. You made in particular the lonely daytimes in the Leeuwenborgh Library more bearable with essential coffee breaks and sufficient distraction during free times.

Lastly, I want to thank you as a reader, for spending your time reading my research. I hope it provides you with new useful insights a half natural Vecht and how climate-resilient development pathways can be applied in water management.

Marlies van Ree

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## List of abbreviations

**KRW:** Kaderrichtlijn Water

## List of concepts

**Adaptation pathway:** Approach which consists of an optional series of implementations to fulfil future demands and aims to avoid maladaptation and lock-in effects

**Adaptive space:** Defining the conceptual space where interventions are not precluding future possibilities when dealing with uncertainty and change

**Bayous:** A river arm which was earlier connected to the river

**Building-with-nature:** an approach where the forces of nature are used in hydraulic engineering

**Bypass channel:** a side channel created among weirs to improve the connection between the different river parts.

**Catchment area:** A drainage area from where precipitation drains of into a river, lake, or reservoir

**Climate robust strategies:** strategies which work in a wide scope of plausible climate change futures and are little sensitive for uncertainty

**Climate-resilient development pathway:** pathway approach aiming to increase climate resilience and meanwhile achieving development goals

**Nature-inclusive agriculture:** A form of agriculture based on resilient food and ecosystems

**River bed:** Part of the land where the river (at certain moments during the year) flows

**Sponge functioning:** The capacity of soils to hold water during wet periods and release water during dry periods

**Vechtdal:** Region in Overijssel located around the Vecht

**Vision:** Describes a desired future situation and in broad terms how this situation will look like

**Winter bed:** Part of the river bed where the river flows (mainly) during winter

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# 1 Introduction

A brook is a type of waterbody, defined in the Oxford dictionary as “a small stream”. Brooks fulfil essential functions for ecosystems, transport substances and living organisms, and drain water towards downstream areas. At the moment, there is a trend in the Netherlands to make the previously straightened brooks more natural again. These brook restoration projects aim to improve the ecological conditions, to shape water management in the 21<sup>st</sup> century within the spectrum of climate change, and to restore cultural historic values of the brooks. The final goal is to create half-natural brooks by using geomorphological processes (Makaske & Maas, 2015). A half-natural brook is based on natural self-managing capacities but is still dependent on management and maintenance practices (Waterschappen Aa en Maas, 2011). Geomorphological processes can be defined as natural mechanisms which form water bodies among natural conditions. Constructing and stimulating these geomorphological processes in a cost-efficient and sustainable way requires sufficient knowledge on geomorphological, hydrological, aquatic and ecological processes and how these processes transform brooks towards a more natural state (Makaske & Maas, 2015).

The case of this research is the Overijsselse Vecht (henceforth the Vecht), the smallest of the big rivers the Netherlands encounters. The Vecht is one of the two pilot areas (in Dutch proeftuinen) where experiments for Lumbricus projects are conducted. Lumbricus is a research programme focusing on climate robust soil and water systems. Climate robust adaptation strategies are strategies which work well in a wide scope of plausible climate change futures and are little sensitive for uncertainty (Lempert & Schlesinger, 2000). Realizing climate robust soils and water systems is done by Lumbricus following building-with-nature principles. Building-with-nature is an approach aiming to solve issues using the forces of nature and the involved natural processes. This is done by creating the needed circumstances to stimulate these natural processes. Lumbricus works together with amongst others water authorities, knowledge institutes, businesses and farmers. Applying building-with-nature interventions into brooks is the aim of the project “Boeiende Beekdalen”, which is one of the four research topics of Lumbricus. Research for this project is conducted in the East and South of the Netherlands. Despite the fact that officially the Vecht is a river instead of a brook, this water body is still part of the Lumbricus restoration research project. However, there is spoken of river restoration instead of brook restoration within this case.

One of the current purposes of the project “Boeiende Beken” is to create development pathways. A pathway approach exists of a series of different implementation interventions aiming to avoid maladaptation and lock-in effects in a context of change and uncertainty (Bosomworth, 2015; Werners et al., 2018). In this case, pathways are created to see which combinations of building-with-nature

interventions could be implemented and in which order this should be done to transform the current canalized Vecht into a half-natural river. The timeframe chosen by Lumbricus for the sustainable development pathways is from now until 2050. The aim of these pathways is not only to outline potential ways towards a climate-robust water system for the future, but they also aim to find possible ways to transform the current river in a half-natural river. Transforming the current situation towards a new and climate robust situation is not new. However, these types of pathways are more often used in the context of developing countries aiming to improve for example livelihoods strategies and dealing with climate change.

This research focuses on the first steps in creating development pathways for the Vecht. This includes defining the goal and comparing potential routes of combined interventions proposed by stakeholders. This is done based on the following research question:

*What are the key characteristics and possible envisioned pathways towards a half-natural Vecht in 2050 according to stakeholders?*

To answer the research question, the following sub questions were established:

- How do stakeholders define a half-natural river in case of the Vecht?
- Which characteristics must be included according to stakeholders to reach their defined half-natural situation of the Vecht?
- What do stakeholders believe to be needed interventions to reach the defined goal of a half-natural Vecht?
- In which time frame and order should the preferred implementations be realised according to stakeholders?

The first step carried out in this research focuses on goal formulation. Formulating a strict definition of the end situation of a half-natural Vecht is envisioned as impossible, because of the involved uncertainties such as climate change, land use change and the working of geomorphological processes in this particular context. Nevertheless, formulating an end goal of a half-natural river more explicitly than only “a half-natural river” can be beneficial during the implementation phase. Due to defining characteristics the Vecht should contain in 2050, differences in visions on the end goal can be avoided between involved parties during the implementation phase. Furthermore, it helps to motivate why certain interventions should be implemented and others not. After defining a half-natural situation for the Vecht more specifically, potential routes of combined interventions are compared. These potential routes are proposed by stakeholders and are aiming to reach the different aspects the Vecht should contain in 2050. These proposed routes can form a basis for creating sustainable developing pathways. This study is a qualitative case study. Data for this study was collected through using semi-structured interviews, a focus group and back-casting sessions with stakeholders.

This report is composed of seven chapters. After this introduction, Chapter 2 will provide background information on the case focussing on the history, functions, future plans and involved stakeholders of the Vecht. Chapter 3 will elaborate on the concepts of pathways and goal setting used in this research. The used methodology to answer the research question will be explicated in Chapter 4. The collected results on visions of a half-natural Vecht and proposed routes are described in Chapter 5. This will be followed by a discussion in Chapter 6 and a conclusion in Chapter 7.

## 2 The Overijsselse Vecht

The Vecht is a rain-fed river flowing from Germany to the Netherlands, beginning south of Horstmar in Nordrhein Westfalen and ending in the “Zwarte Water” in Overijssel. The river has a watershed of 3785 km<sup>2</sup> and a total length of 167 km (Wolfert et al., 1996). The Dutch part of the river is called the “Overijsselse Vecht”, which has a watershed of 2035 km<sup>2</sup> and a total length of 60 km and has a drop of circa 10 m (Verdonschot & Verdonschot, 2017, Wolfert et al., 1996). From the German border until Ommen, the Vecht belongs to the water authority Vechtstromen. Downstream Ommen until the Vecht flows into the IJsselmeer belongs to the water authority Drents Overijsselse Delta (DOD). There are some significant differences in how the river looks like and which management challenges are faced between the areas of Vechtstromen and DOD. The part of the Vecht which is managed by Vechtstromen has less urban areas near the river and flanks to protect the surrounded area from the water. The part which is managed by DOD has dykes (primaire waterkering in Dutch) and has to protect the city Zwolle from flooding (3).

### 2.1 A brief history of river management of the Vecht

The Vecht has encountered multiple constructions, starting already in the 14<sup>th</sup> and 15<sup>th</sup> century with the building of dykes. From the end of the 20<sup>th</sup> century until circa the mid-21<sup>st</sup> century, three construction periods took place which regulated the Vecht more and more. 69 meanders were cut off, shortening the river from 90 km to 60 km. Multiple weirs were implemented in this time period as well, aiming to counteract erosion and manage water levels. Six of these weirs are still in place nowadays (Wolfert et al., 1996).

Until the beginning of the 21<sup>st</sup> century, Rijkswaterstaat had the management responsibility of the Vecht. Since 2005, the water authorities (waterschappen in Dutch) took over this responsibility. This was a direct result of a policy aiming to decentralise the Dutch water management system established in the year 1986. During the same period, an inverse approach of water management for the Vecht emerged aiming to transform the Vecht back into a more natural river again (Provincie Overijssel, 2004). Since 2004, projects started removing river embankment stone lining and redesigning the Vecht to improve the ecology of the river. The final goal is to change the river towards a half-natural river. An entire natural river is regarded as impossible because the Vecht is already for centuries embedded in the cultural landscape (Waterschap Vechtstromen, 2017). Several interventions were already implemented to improve the status of the natural conditions during the previous decade, such as reconnecting meanders or creating bypass channels (in Dutch nevengeulen).

## 2.2 Functions of the Vecht

Many institutes, businesses and people are directly or indirectly involved in the Vecht. This river fulfils multiple functions and has different interdependent relationships within the sectors agriculture, urban areas, nature and recreation. For agriculture, an important issue is the dependence on the water levels for cultivating crops. Both water authorities applied for years a reversed water level, with higher water levels in summer and lower water levels in winter than naturally will be. These reversed water levels were implemented to support agriculture. This increased the interdependent relationship between agriculture in the Vechtdal and the Vecht. Recently, Vechtstromen applies a uniform water level, which means that water levels in summer and winter are equivalent, which is a step closer towards natural water levels. Considering urban areas, the drainage capacity of surrounded cities is influenced by the groundwater levels of the Vecht. Nature objectives are mainly defined with the European Natura-2000 goals or the European Kaderrichtlijn Water (KRW) goals. For Natura2000, specific areas are determined to protect rare nature types and give it the opportunity to recover and improve. The KRW focuses on improving the conditions for flora and fauna and to support a balanced ecosystem (Waterschap Vechtstromen, 2017). In the field of recreation, activities like sailing, fishing and biking or walking in the surroundings of the Vecht and there is a wish to retain and expand these activities in the future. The aim is that all the above-mentioned functions of the Vecht still can be fulfilled, in one way or another, after transforming it to a half-natural river (Waterschap Vechtstromen, 2017).

## 2.3 Planning towards a half-natural Vecht

The term to reach the state of a half-natural river is set on 2050 (Wolfert et al., 2009). In the last two decades, multiple initiatives took place like the project “Ruimte voor de Vecht (in English “Space for the river”) and establishing a cross-border vision for the Vecht. The project “Ruimte voor de Vecht” was initiated, chaired and financed by the province Overijssel. When the project ended in 2018, a new core team was set up with a new governance division between the province, water authorities and involved municipalities. This core team consist of one member of the province, one member of the two waterbodies and one of the four municipalities. The same division is applied to funding where the three different stakeholder groups pay all one third (5). The cross-border vision of the Vecht established in 2009 stated that in the future water safety and drainage possibilities during high water will still be ensured. Within these set constraints, the river should evolve in a lively half-natural river, where characteristics such as water and sediment flows, meandering and erosion processes are in place (Renner et al., 2009). Additionally, studies were conducted on how a half-natural Vecht can be reached. Especially in the fields of geomorphology, hydrology and ecology research is done on potential interventions. Within these fields, options for implementation and changing conditions e.g. on the sinuosity, the space for vegetations, the functioning of the weirs and the water speed are tested

and reviewed (Waterschap Vechtstromen, 2017). In the previous two decades, the big discussion point within planning to a half-natural Vecht was the dilemma of keeping or removing the weirs. Up to now, plans to remove the weirs have failed, mainly due to the set current constraints involving water safety, agriculture and nature (Waterschap Vechtstromen, 2017). One of the current aims of Lumbricus is to establish development pathways to research what the future possibilities are to reach a half-natural Vecht in 2050 (van Slobbe, 2018). With combined knowledge from geomorphological, hydrological and ecological processes optional packages of implementations will be presented as possible pathways to take within transforming the Vecht towards a half-natural river.

## 2.4 Involved stakeholders

When aiming to transform the Vecht into a half-natural river, a wide range of stakeholders is involved. Below, the main stakeholder groups will be outlined. As mentioned previously, the two water authorities involved are Vechtstromen and DOD. Together with the province, they make the decisions which direction the Vecht should go and which interventions are implemented and which not. Furthermore, there are several municipalities which are closely located to the river. They see the potential threats the river can have, but also the benefits it can provide. Next, to these different governmental bodies, different interest groups are actively involved within the Vecht. Many farmers are a member of the Land en Tuinbouw organisatie (LTO). This organisation represents farmers, lobbies for their interests and helps farmers negotiate with third parties. The recreational sector is represented by the VNO-NCW Midden and Vechtdal Marketing. VNO-NCW Midden is an organisation aiming to create the right conditions for entrepreneurs in the region. They are strongly involved in the lobby for sailing opportunities on the Vecht. Vechtdal Marketing focuses on recreation possibilities in the Vechtdal, such as hiking and biking alongside the Vecht and fishing and sailing possibilities on the Vecht. There are several nature groups active in the Vechtdal. One of those groups is Natuur en Milieu Overijssel (in English Nature and Environment Overijssel). This organisation works together with governments, businesses and citizens. This organisation intends to make Overijssel a green and sustainable province, where people can live in a beautiful and healthy environment, now and in the future. Besides groups which have a broader focus, some stakeholders particular focus on the Vecht and the project to transform the river into a half-natural state. A broad range of scientists is involved in the research project Lumbricus. This includes scientist from natural sciences like geomorphology, hydrology and ecology, but also from social sciences like public administration. With building-with-nature principles, this research project aims to contribute towards a natural and robust water system for the future by improving the possibilities for natural processes in the water and the soil.

## 3 Conceptual framework

In this section, the key concepts used in this thesis will be discussed. These concepts are derived from adaptive management, adaptation pathway and climate-resilient development pathway literature. First, goal and objective setting within adaptive management will be outlined. This is the used approach to make the concept of a half-natural Vecht more tangible. Next, different pathway approaches will be outlined to find a fitting pathway approach suitable for reaching towards a half-natural Vecht. This approach should include both the focus on reaching a climate robust system and transforming the Vecht in a half-natural river. To find a fitting approach, different pathway approaches will be outlined. This is followed by a constructed figure of a climate resilient development pathway applicable to this case.

### 3.1 Goal and objective setting for adaptive management

Adaptive management is a management approach focussing on exploring ways to reach set objectives, predicting outcomes of possible alternative states, implementing chosen interventions, learning by doing, monitoring the results of the implemented interventions, and using the outcomes to improve natural resource management knowledge (Williams et al., 2009). Goal setting is included in one of the first steps of the adaptive management cycle and can play an important role during the rest of the cycle (Franklin et al., 2007). A clear definition of an overarching goal combined with concrete measurable objectives helps to avoid issues like conflicting decision-making processes and friction between multiple stakeholders (Susskind et al., 2012). Within adaptation management, clear goals provide directions on how to adapt when new knowledge will be obtained during the implementation process (Board & National Research Council, 2011). Furthermore, developing measurable objectives creates possibilities to assess the efficiency and effectiveness of the implementation beforehand, and monitor them afterwards (Pahl-wostl et al., 2008). According to Wintle and Lindenmayer (2008), three key elements should be included in formulating goals, constraints and performance interventions. The first one is that goals and constraints must be measurable and the spatial and temporal scale is clearly defined. Secondly, despite the uncertainties involved, the accomplishment of the goal can be stated with the requisite degree of certainty. Lastly, goals and constraints should not be established just by technicians and management professionals, but by including a broad range of stakeholders. Formulating goals and measurable objectives within an adaptive management approach include stakeholder participation to take different perspectives into account (Pahl-Wostl, 2008).

### 3.2 Goal and objective setting for adaptation pathways

Adaptation pathways is an approach applicable in a context of uncertainty and change. This approach focuses on long term adaptation objectives and aims to avoid maladaptation and lock-in effects.



Maladaptation defines decisions which preclude future options (Bosomworth, 2015). Lock-ins are situations where future actions only still can be implemented against high costs or high societal impacts (Haasnoot, 2013). Adaptation pathways consist of an optional series of implementations to fulfil future demands (Bosomworth, 2015). Within adaptation pathway literature, goal setting is mentioned in different pathway approaches as one of the first phases is pathway developing trajectory (Bosomworth, 2015; Haasnoot, 2013; Werners et al., 2018) Nevertheless, goal setting differs in meaning and importance towards the multiple ways of establishing pathways. Mainly, this depends on when and in what type of context literature was written. When adaptation pathway literature started to emerge, adaptation pathways were formed in a way that goals were little contested and seen as fixed among the adaptation timeframe. Later on, adaptation pathways were applied in more dynamic, uncertain, limiting resource circumstances where multiple decision-makers were involved (Werners, et al., not yet published). Besides this, context is an important factor resulting in different ways of developing adaptation pathways, which influences the process of setting goals. The most uncomplicated situation is a data-rich context which is relatively certain, decisions are taken centrally and there are clear and fixed goals (Wise et al., 2014). Having a data-rich context helps to define clear goals by using available knowledge, such as climate scenarios, adaptation tipping points and triggers (Werners et al., 2018). However, in many situation data is not fully available and many uncertainties are involved. These differences resulting in different ways and types of goal setting, in a range from clear set goals to abstract goals which will be developed over time during the adaptation process.

### 3.3 Adaptation pathway approaches

When looking into literature about adaptation pathways, there are multiple differences acknowledgeable about what is seen as an adaptation pathway and how it should be used. Below, four different approaches on adaptation pathway and their way of goal setting will be described.

The first outlined adaptation pathway approach is derived from Reeder and Ranger (2011). They define adaptation pathways as a route-map where implementations over time are designed as packages aiming to inspire the decision maker to think of “what if” situations. The overall aim of such a route-map is to increase flexibility over time and decreases the chance on maladaptation. For goal setting, this approach defines a much more concrete goal compared most other adaptation pathways. Within this approach, there is stated what is needed among different situations and this needs from which goals should be achieved.

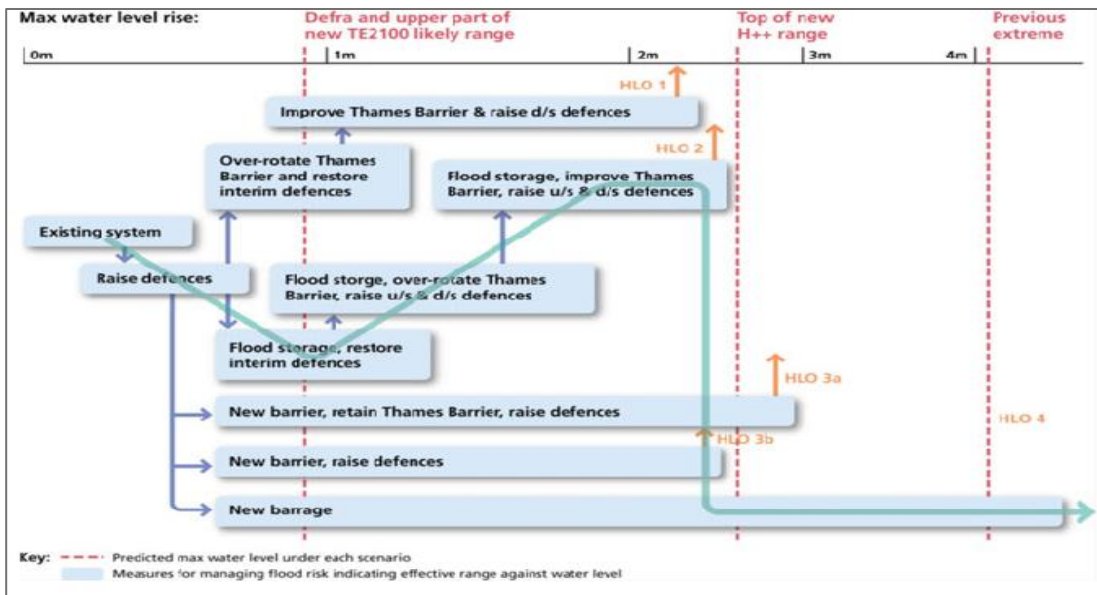


FIGURE 1 ADAPTATION PATHWAYS REEDER AND RANGE

Secondly, Haasnoot et al (2013) clarify a pathway as a metro map where each route leads to a specific destination. Here, there is a different destination where each actor can prefer a particular destination depending on e.g. implementing costs and own interests. Furthermore, there are multiple possibilities to reach each destination. Tipping points explain the moment when an action no longer meets the objectives, forcing a switch of routes to still reach the preferred destination. When a tipping point is reached is scenario dependent. Besides the metro map, Haasnoot et al. (2013) established the concept of dynamic adaptive policy pathways, which combines adaptation policymaking and adaptation pathways. Important elements of this approach are focusing on uncertainties, possible sets of actions based on alternative development over time and monitoring the system to stay on the right track to reach the objectives. In terms of goal setting, this approach defines different end goals. Each end goal can be preferred by different stakeholders, depending on their own agenda. These different end goals are resulting in different preferred routes during the adaptation process.

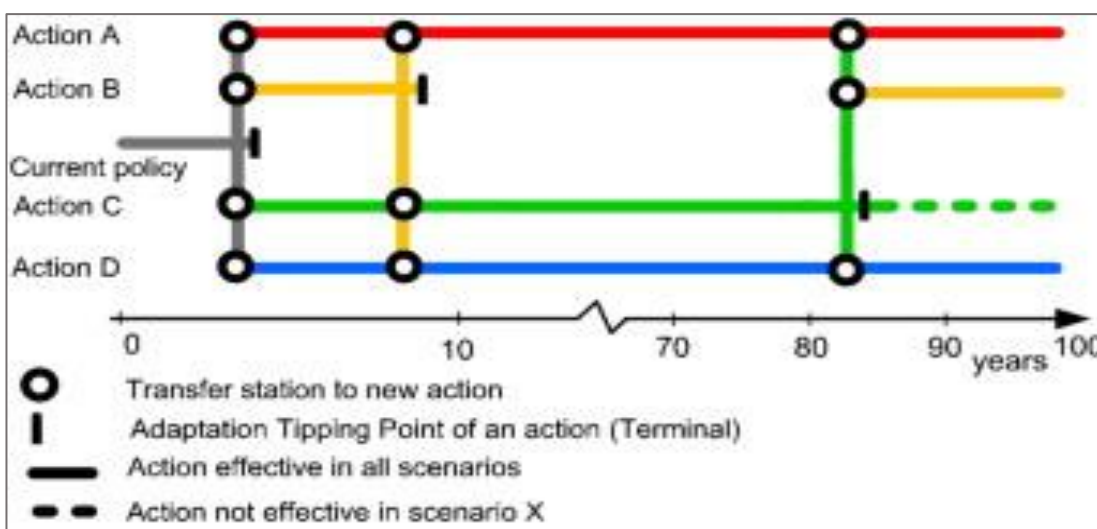


FIGURE 2 ADAPTATION PATHWAYS HAASNOOT ET AL.

Thirdly, Wise et al. (2014) frame adaptation pathways as a process where a set of implementations should be taken within the adaptive landscape, existing of the maladaptive space and the adaptive space. The aim of this approach is to make decisions in such a way to stay in the adaptive space. Through e.g. climate change and actor responses, the adaptive landscape changes over time. These changes determine whether implementations stay within the adaptive space or leads towards the maladaptive space. When looking towards goal setting, it is totally different than the approaches above. Within this approach, there is no end goal envisioned, but it is a process without a set end stage. The overall aim is to stay outside the maladaptive space, but not to change the social-ecological system in a particular way.

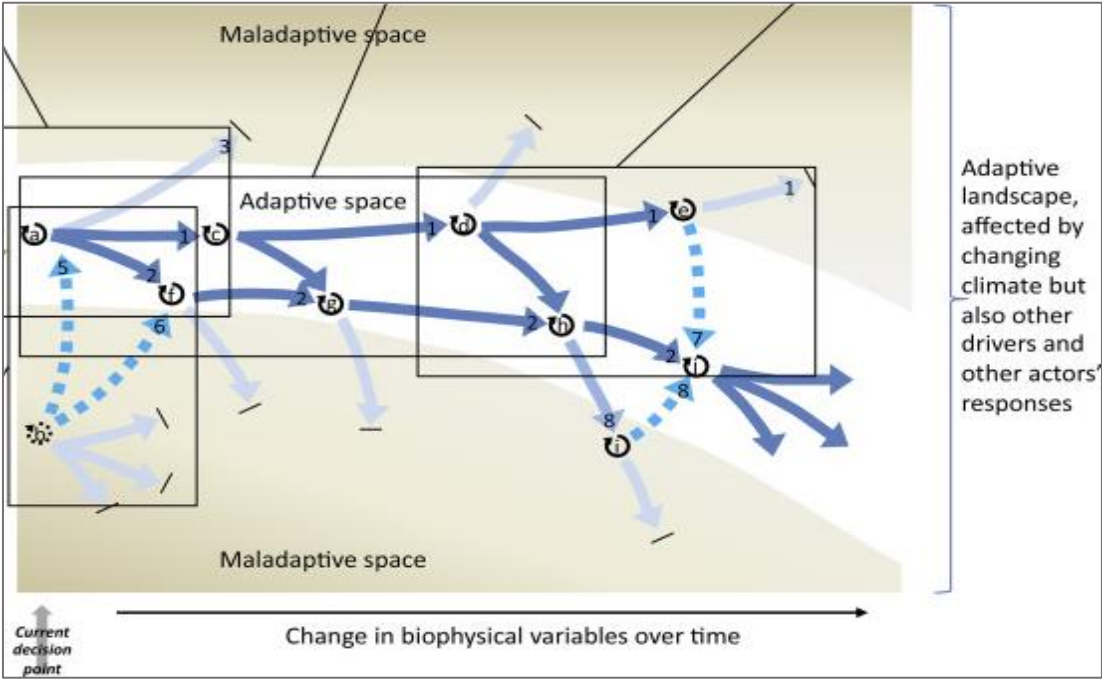


FIGURE 3 ADAPTIVE PATHWAYS WISE ET AL.

The last adaptation pathways approach discussed here is the approach of Collof et al. (2016). They describe pathways as a series of different decision points which leads to maintaining the current social-ecological stable state or changing towards another. This approach includes path-dependency and decision time frames, which are comparable to the concept of tipping points of Haasnoot et al. (2013). There is an explicit focus on the values, rules and knowledge of involved stakeholders, which determine the decisions towards implementations. Looking towards goal setting, it is also more a process defined vision of goal setting focussing on transforming the social-ecological system among stable states. In this case, the different possible end stages are defined clearly, but in what way they will be reached is depending on what decisionmakers want and are possible to do.

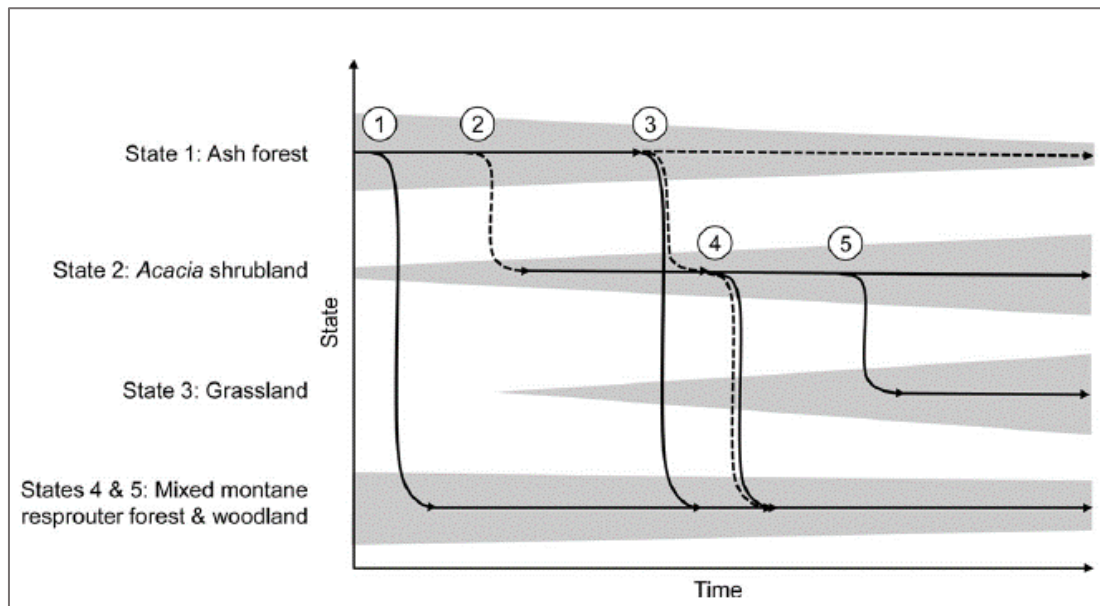
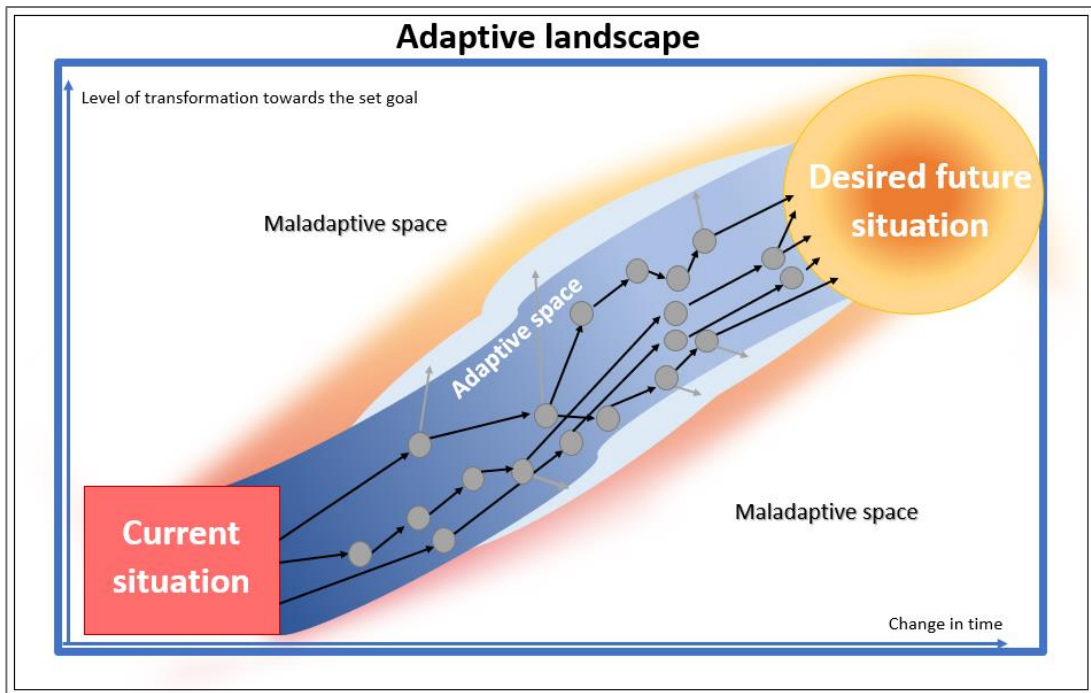


FIGURE 4 ADAPTATION PATHWAYS COLLOF ET AL.

### 3.4 Climate-resilient development pathways

Within the approaches of Wise et al. (2014) and Collof et al. (2016), changing the existing system is seen as part of a process and a necessity to deal with climate change. In climate-resilient development pathways, the existing system should be improved anyway. This type of pathways aims to increase climate resilience combined with achieving human development goals. Instead of trying to cope with climate change aiming to maintain the system, improving the current livelihood system is key (Denton et al., 2014). The concept of climate-resilient pathways is mainly used in the contexts of developing countries, taking into account the complexity of a social-ecological system, uncertainty, multi-stakeholder arenas and adaptation strategies (Butler et al., 2014). The plans for transforming the Vecht into a half-natural river fits in a certain way with this approach. Even though this project does not fit the social development element, it fits the elements of improving the current situation where interactions between climate, social and ecological systems are taken into account (Denton et al., 2014, Wolfert et al., 2009).

The established framework on the next page visualizes a climate-resilient development pathways approach including elements of an adaptation pathway approach. This framework is focused on transforming social-ecological systems from a current to a desired situation. It uses elements from the approach from Wise et al. (2014) and fits in the elements of climate-resilient development pathways (Denton et al., 2014).



**FIGURE 5 CLIMATE-RESILIENT DEVELOPING PATHWAYS**

Within this framework, there is a current situation of a particular social-ecological system that is wished to be changed into a desired future situation. The black arrows represent possible interventions and the grey dots represent the level of goal achievement on that particular moment in time. The arrows start all at the same current situation and from there possible combinations of interventions can be chosen. These combinations of interventions form different routes towards the desired future situation. How far the arrow is moving to the right signifies how long it takes to implement the intervention. How far the arrow is moving upwards signifies how much this intervention contributes to transforming the situation towards the desired future situation. Caused by involved uncertainties, the end situation cannot be concretely defined. This is why the framework accepts different end situations which all fall within the desired future. The end final arrow does not state where exactly the end situation will be, but it visualizes the prediction of this particular route of interventions to successfully transform the system towards the desired future. The possible interventions have to fall within the limits of the adaptive space and stay out of the maladaptive space within a set adaptive landscape. Over time, the adaptive space can change, for example due to climate change and can grow or decline, for example due to newly available knowledge or technological development. Focussing on staying within the adaptive space and using routes of interventions to avoid lock-ins and deal with uncertainty, this framework intends to transform a certain system to the desired future situation in a climate robust way.

## 4 Research methods

In order to answer the research question, a combination of different qualitative research methods was used. These methods consisted of semi-structural interviews, a focus group and normative back-casting sessions. For all the three carried out methods, an inductive approach was used where the collected data was interpreted and converted into explanatory conclusions. In the following sections, each method will be outlined one by one.

### 4.1 Semi-structured interviews

Fifteen semi-structured interviews were conducted aiming to collect the perceived visions (in dutch streefbeelden) of the involved stakeholders on what a half-natural Vecht is (see Appendix I for overview interviewed stakeholders). Furthermore, stakeholders were asked to identify river-related characteristics supporting their vision to make the visions more tangible. There is chosen for semi-structured interviews to provide a way to collect stakeholders' own vision and to see which aspects were named by themselves.

Each interview consisted of ten open questions which provided a predetermined direction for the interviewee (see Appendix II for interview questions). This chosen direction suggested that the Vecht will be transformed, in one way or another, into a half-natural river in 2050. The interviewees were found and selected by a snowball approach. The first interviewees were suggested by Erik van Slobbe, who is the coordinator of the Lumbricus pilar "Boeiende Beekdalen". Subsequently, during the interviews, the last question was "*which people do you suggest I should talk to when aiming to get a comprehensive view about the opinions for a half-natural Vecht?*", which provided new names of people and organisations to contact for interviews. The interviewed parties included the province Overijssel, the two involved water authorities, a municipality alongside the Vecht, a farmer interest organisation, a recreation entrepreneur, a fish management organisation, a terrain management organisation and scientists from different disciplines. Almost all interviews were done face-to-face, except for two. Long travel distances and preferences of the interviewees were the reason. At the moment there was mainly repetition during the interviews and no new names or organisations came up during the last question, data saturation was reached.

All interviews were recorded by a mobile phone device and transcribed using the online program Otranscribe. The next step conducted was coding the interviews in Atlas.ti. In random order, all interviews were coded aiming to clarify and analyse the similarities and differences between the visions of stakeholders. Different stages of coding, re-coding and clustering codes have proceeded, using Atlas.ti and Microsoft Office Excel 2016. An overview of the codes can be found in the following table. After the codes were clustered, these clustered codes were transformed into eight aspect



groups. These aspect groups will be outlined in the result chapter. Based on these eight aspect groups, differences and similarities between the stakeholder visions were analysed.

**TABLE 1 OVERVIEW USED CODES CHARACTERISTICS (IN DUTCH)**

Groepen codes	gebruikte codes	Groepen codes	gebruikte codes
Hoe ziet de landbouw eruit?	agrarisch natuurbeheer		bomen langs de rivier
	boeren betrekken bij proces		erosie en sedimentatie processen
	geen landbouw in uiterwaarden		goede bodem
	natuur inclusieve landbouw		mogelijkheid tot overstromen
	geen bemesting		natuurlijke breedte en diepte verhouding
	boeren betrekken bij proces		natuurlijke dynamiek
Hoe ziet de rivier eruit?	natuurlijke breedte en diepte verhoudingen	Welke natuurlijke aspecten ten behoeven van natuurlijke processen zijn er aanwezig?	nevengeul
	goede bodem		ongestuwed systeem
	krw-opgaven		stroming
	natura2000		structuur variatie
	meanderen		vegetatie
	mooi uitzien		vismigratie
	waterafvoer		verschillende oevervormingen
	natuurlijke dynamiek		waterpeil
	soorten		spongiteit
	verschillende oevervormingen		
Hoe ziet de recreatie eruit?	beleving	Hoe is de waterkwaliteit ?	waterkwaliteit
	mooi uitzien		Wat is de waterkwaliteit ?
	recreatie		Hoe word er omgegaan met klimaatsveranderingen?
	vaartuigen		
		Hoe is river management geregeld?	veerkrachtig systeem
			beheer naar het rijk
			beleid voor gehele stroomgebied
			Duits beleid
			systeemherstel
			toekomstig beleid
		Overige codes	Waterveiligheid

## 4.2 Workshop on goal setting

During the data collection phase of this research, a workshop was organized by Lumbricus on i.e. goal definition. The end vision for a half-natural Vecht constructed during this workshop was used to narrow down the different existing stakeholder visions to a single end vision. This end vision was taken during the back-casting sessions as the set desired situation in 2050. This was all done from a building-with-nature approach.

The workshop was the first gathering of this project aim to create development pathways for the Vecht for 2050. Nine stakeholders involved with the Vecht and/or Lumbricus came together. The group consisted of researchers from multiple disciplines and employees of the two different water authorities involved. The workshop started with a short presentation on possible existing scenarios for the province Overijssel. Next, I gave a short presentation of the results so far of my interviews as an introduction for the discussion on describing the goal of a half-natural Vecht for 2050. After the presentation, there was a brainstorm session on the principles of a half-natural Vecht in 2050. Next, the group was split up in two groups. One group elaborated on a future with weirs, the other on a future without weirs. Subsequently, a groups discussion on the two created vision took place. Lastly, a short recap was given and the ideas for the next meeting were shared. The data conducted during this workshop which is used in this research consisted of minutes made during the meeting, pictures of the written down described visions of the different stakeholders and pictures of the drawn map and sheet of the brainstorm session in groups.

### 4.3 Normative back-casting sessions

To obtain proposed pathways by stakeholders, eight normative back-casting sessions with stakeholders were conducted. The key of normative back-casting is the focus on how a predetermined future can be reached. The start of normative back-casting is the end-point and works back towards the present (Robinson, 2018). The normative back-casting sessions were executed based on how this method was used within the HI-AWARE project, described in the working report “Towards Climate-resilient Development Pathways for the Hindu Kush Himalaya” (Werners et al., 2018).

The end vision derived from the workshop was taken as the end-point of the back-casting sessions. Fifteen implementation interventions were written down on cards beforehand. These interventions were a selection of the interventions mentioned during the interviews responding the question *“What are the different interventions you know within brook and river restoration that can contribute to transforming the Vecht into a half-natural river?”* and interventions mentioned during the workshop. In addition to the pre-made intervention cards, blank cards were provided to give stakeholders the possibility to write down other possible interventions they think are important. On an A2 paper, a card “the current situation” is placed at the bottom left and a card “the Vecht in 2050” is placed on the top right. The horizontal axis is the change in time, from now till 2050. The vertical axis is the level of progress towards a half-natural Vecht. The interviewee was asked to select her or his preferable interventions and place them in order on the sheet, so a possible pathway from the current situation towards the future situation was created. Subsequently, there was asked why the stakeholder selected the chosen interventions and other interventions not. Furthermore, there was asked to explain why the stakeholder put it in a particular order. Next, the interviewee was asked to draw possible interdependencies between interventions, when an intervention should be implemented timewise and what possible lock-ins are. Thereafter, the interviewee was asked to write down on the paper what possible changes are when heavy climate change occurred or what other changes could be in the adaptive space. When changes were mentioned, the interviewee was asked if extra interventions were needed and if so to write them down on provided yellow cards and place them on the sheet (see Appendix III for questions during back-casting session).



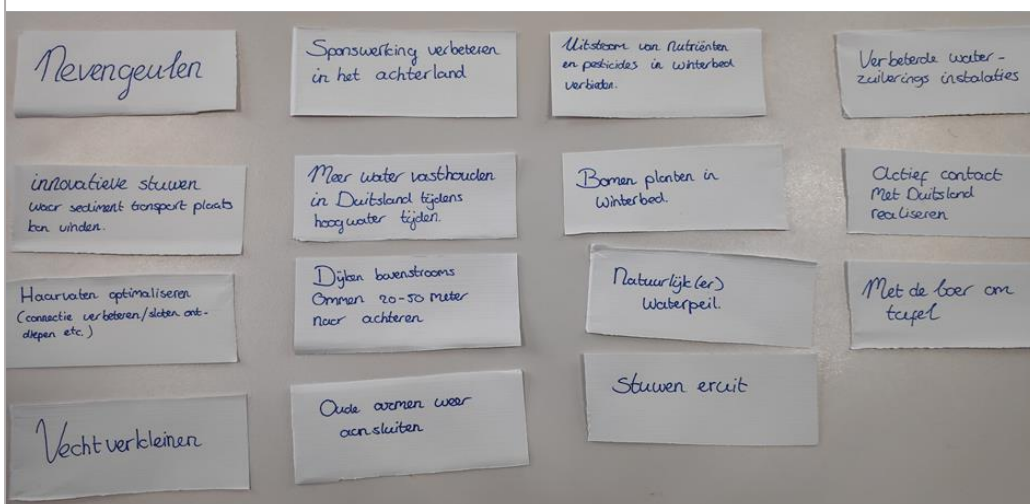
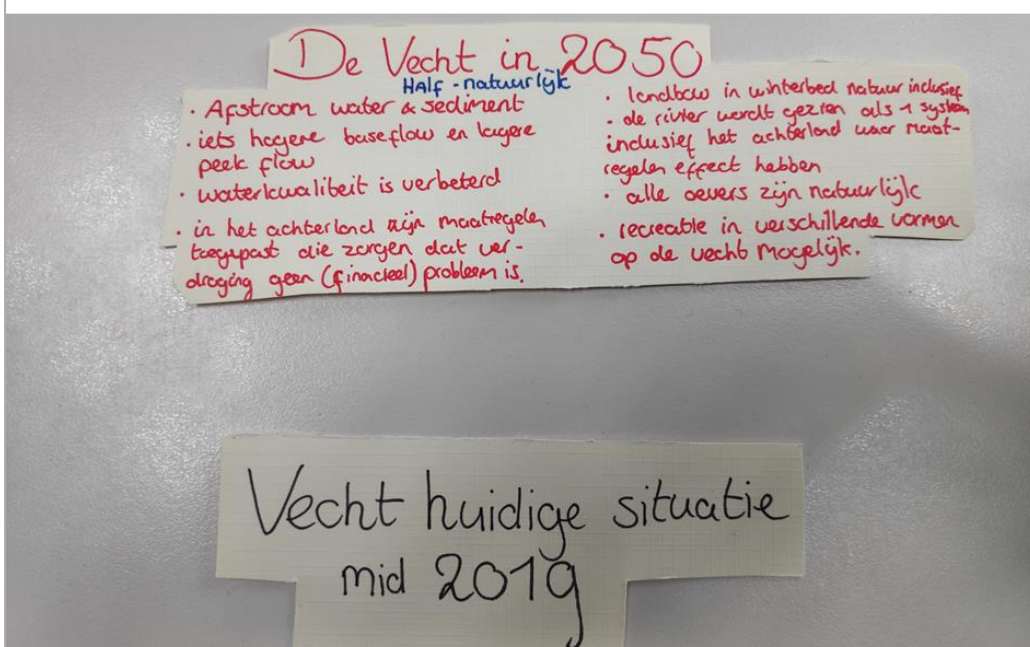


FIGURE 6 START SITUATION BACK-CASTING SESSIONS

All interviewed stakeholders were also interviewed during the semi-structural interviews. A smaller selection was made for this round because sufficient knowledge of different interventions was needed. The interviewees consisted of scientists from multiple disciplines, employees of different governmental bodies and an employee of a farmer interest organisation.

Each back-casting session resulted in one created intervention route (see Appendix IV for photos of proposed routes). The analysis afterwards was focused on the differences and similarities on chosen interventions and routes and the interdependencies of different interventions (see Appendix V for textual description back-casting sessions, in Dutch). To analyse the conducted data, all proposed routes were put in the same format using Microsoft Powerpoint (see Appendix VI for stakeholder routes transformed towards a single format). To compare interventions based on the proposed moments in time, a division was made between short-, mid-, and long-term interventions. This is visualized by the three different shades of green, shown in the figure below. Due to the number of interventions proposed which could not be visualized within a single figure, different categories of interventions were established. These categories were based on the target area of the proposed intervention (catchment areas, riverbed, river design and within the river), complemented with a category existing of overall management interventions. Afterwards, for each intervention category an overview was made on which interventions were proposed and on which moment in time these interventions were suggested. Based on that, an analysis was done comparing the suggestions of stakeholders.

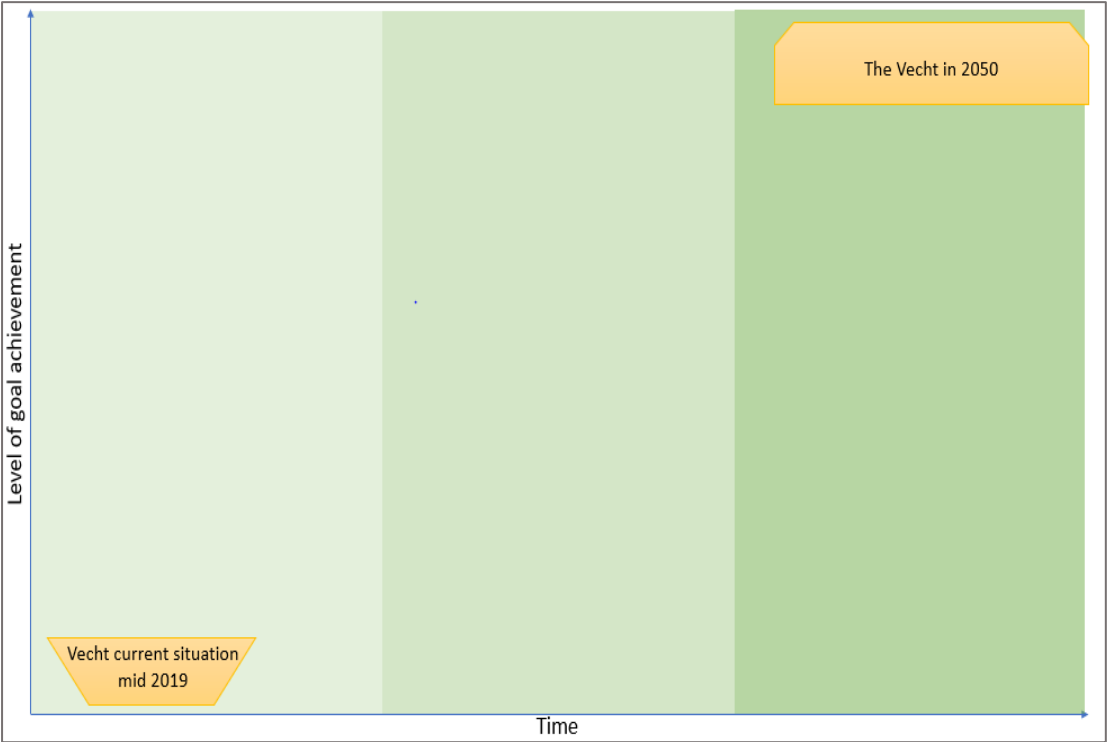


FIGURE 7 FORMAT BACK-CASTING SESSION ANALYSES, OVERVIEW INTERVENTION CATEGORIES

Subsequently, two overarching pathways were constructed based on the similarities of chosen interventions and the suggested implementations moments derived from the proposed intervention routes. To construct and visualize the overarching pathways, a route map approach was used. By applying the established climate-resilient developing pathway figure, changes in the adaptive space were outlined. These changes were derived from the back-casting sessions where each stakeholder was asked which possible future changes will affect the feasibility of the route and what can be extra done to reach the desired goal after all.

## 5 Results

This chapter outlines the results derived from the applied methods. First, the different stakeholder visions and the associated river-related characteristics on a half natural river in 2050 will be addressed. Afterwards, the construction process of the end vision during the workshop will be outlined. This is followed by a section that will describe this constructed end vision of a half-natural river. Subsequently, the proposed intervention routes resulted from back-casting sessions are discussed. Here, the focus will be on which interventions stakeholders proposed and in which moment of time these interventions should be implemented. Lastly, the focus switches to pathways. Based on the similarities derived from the proposed intervention routes, two constructed overarching pathways will be outlined. Furthermore, the foreseen possible changes within the adaptive space will be discussed using the constructed climate-resilient development pathway approach.

### 5.1 Stakeholder visions on a half-natural Vecht in 2050

Each semi-structured interview resulted in a vision description of a half-natural Vecht, as well as numerous river-related characteristics which are linked to the described vision. Comparing the different visions and linking these visions with the different characteristics generated insight into the differences in how stakeholders define a half-natural Vecht and which characteristics must be included to reach the defined situation of a half-natural Vecht in 2050. The next section will discuss, compare and categorize these different stakeholder visions. Subsequently, eight established aspect groups will be outlined based on the river-related characteristics mentioned during interviews. Thereafter, each vision category will be addressed based on the eight established aspect groups.

#### Differences in stakeholder visions

Based on the answers to the question *“What is your vision on how a half-natural Vecht should look like in 2050?”*, stakeholders were placed on a scale from visions that are comparable to the current situation towards visions in the direction of a natural system. These visions vary widely, from the vision that the current state of the river can already be perceived as half-natural, to the vision that drastic transformations are needed to reach a half-natural state. On the following page, an overview is given of the different stakeholder visions.

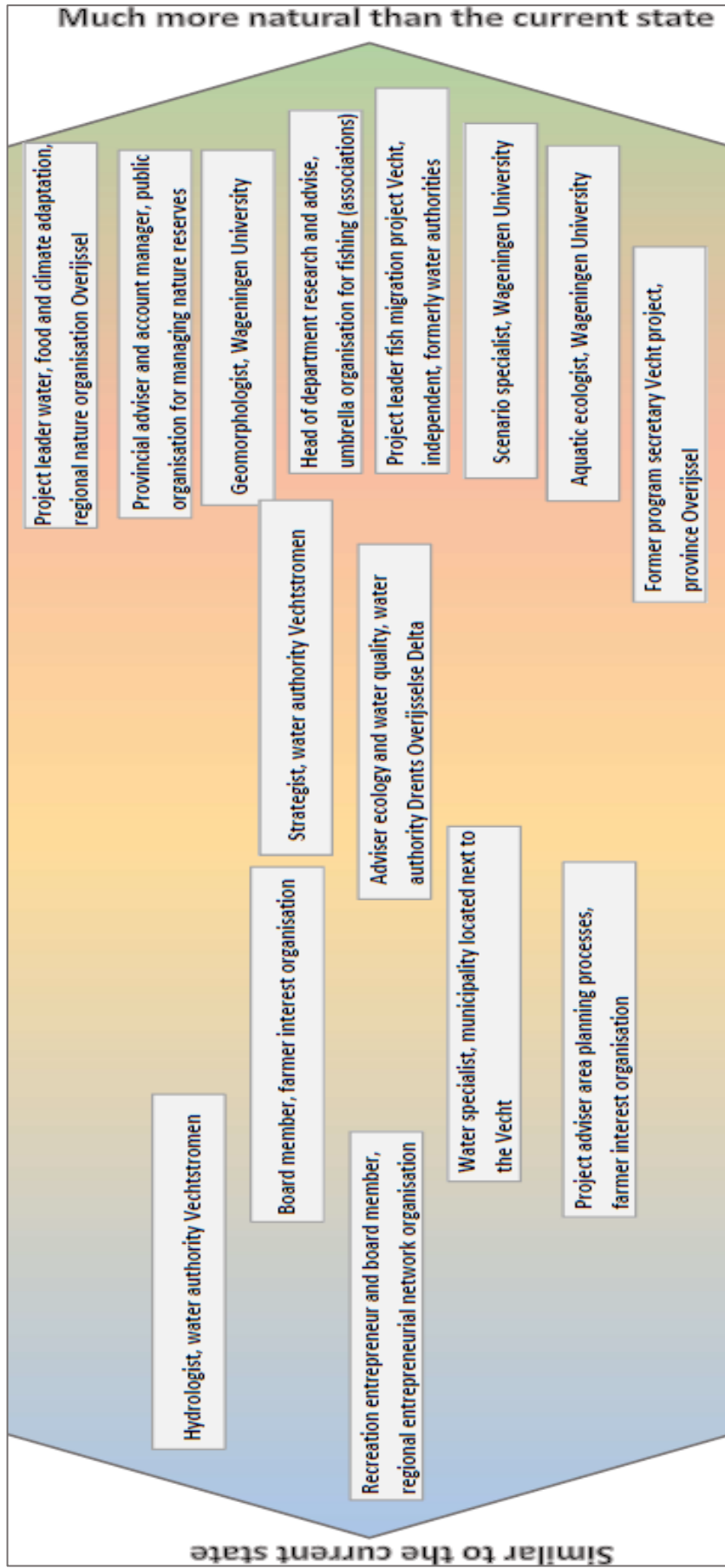


FIGURE 8 VISIONS INTERVIEWED STAKEHOLDERS

In the coming part, the key elements of each stakeholder vision are briefly described, starting with the visions closest to the current situation and ending with the visions suggesting the most natural situation. Some stakeholders describe both their desired vision as well as a vision on what probably will really happen. When this is the case, this will be mentioned explicitly.

According to a recreational entrepreneur who is also active in a regional entrepreneurial network, “the Vecht is already a half-natural lowland river”, though it could look slightly more natural (13). A hydrologist of Vechtstromen states that with the set constraints and involved parties there is no room for real change, caused by the many functions the Vecht has. This will lead to a Vecht which functions the same but looks a bit more natural (9). A board member and a project adviser of a farmer interest organisation focus both on the multiple functions the Vecht fulfils. In their vision, a half-natural Vecht in 2050 is a bit more natural, but has sufficient space for nature, agriculture and recreation (1,8). A water specialist of a municipality located near the Vecht states that the Vecht should be more natural than the current state. This includes, if technically possible, natural river banks will be created and meandering processes will be stimulated. Additionally, a half-natural Vecht in 2050 has sufficient possibilities for recreation, such as sailing possibilities which can deal with certain river depths (6). The vision of an adviser ecology and water quality of the water authority Drents Overijsselse Delta of a half-natural Vecht for 2050 is a more natural river including more variation within the river and shaped less straight and big (11). A strategist of the water authority Vechtsromen states that the river should be more natural but within the current set constraints. This means that nowadays the weirs cannot be removed, but this does not mean “that it is no option within thirty or forty years” (15). An aquatic ecologist states that because of the set constraints bypass channels are the most realistic for 2050, but personally prefers to create a more natural main channel (12). A geomorphologist and a project leader fish migration characterize the ideas of a system with bypass channels as a second best option, with the first option being the vision of the Vecht as a river without weirs (5). A director research and advice of a fish federation has a similar vision, but was also pledging for using bypass channels to create one full-length parallel system (6). According to a former program secretary of the project “Ruimte voor de Vecht” working for the province Overijssel, a half-natural Vecht should be “as natural as possible, regardless of the discussion weirs or no weirs”(3). A provincial adviser and an account manager of a nature management organisation advocate for a more natural river where nature maintains the system by itself. Furthermore, there is a system-wide approach where the river is part of a resilient and robust ecosystem in 2050 (2). The vision of a project leader water, food and climate adaptation of a nature organisation envisions almost a natural river system, without weirs, with a deeper and wider river and more variation in the river itself (14). A scenario specialist describes a half-natural river for

2050 as almost a “full natural system”, where recreative transport and weirs are eliminated from the river (10).

Based on the different visions, the stakeholders were categorized into four different categories based on to what extent the Vecht should be more natural to be a half-natural river compared to its current situation. The first category consists of the vision that a half-natural Vecht is comparable to the current state. The second category represents the vision that Vecht should be a bit more natural, to be attained through small changes in the current system. Next, the third category outlines the vision that bigger changes are needed to realize the vision of a more natural Vecht. Lastly, the fourth vision suggests big changes to realize a much more natural state.

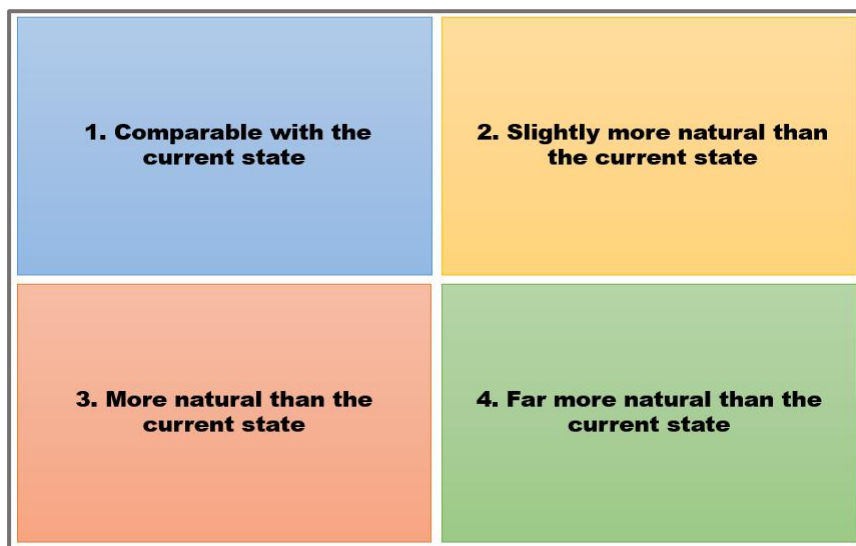










FIGURE 9 VISION CATEGORIES

#### Characteristics of a half natural river

A list of river-related characteristics was derived from the questions “*What aspects must the Vecht have to be a half-natural river from own expertise*”, “*What aspects must the Vecht meet to be a half-natural river from other involved expertise*” and “*What are minimum requirements the Vecht must meet to be a half-natural river*”. First, the various characteristics were coded in Atlas.ti. Afterwards, the codes were structured in Microsoft Excel. Thereafter, the mentioned characteristics were divided into eight aspect groups based on thematic similarities. The eight aspect groups that established were 1) land-use priority between the sectors agriculture, nature and recreation, 2) future agriculture, 3) river design, 4) future recreation, 5) eco-morphological processes, 6) water quality, 7) adaptation climate change and 8) river governance. The definition of each aspect group is outlined in the following table.

Every group exists of multiple coded characteristics, except for the group land use priorities. This group does not consist of characteristics but is based on statements of stakeholders on what this balance between agriculture, nature and recreation in the Vechtdal will be in the future. This is perceived as important, in order to understand the importance of the other categories in the overall situation of the Vecht in 2050. In the following table, the definition of each aspect group is given.

**TABLE 2 DEFINITIONS ASPECT GROUPS**

Aspect group	Definition
 Land use priorities	The division between the sectors nature, agriculture and recreation in the Vechtdal
 Future agriculture	The forms of agriculture taking place in the Vechtdal
 River design	The design of the course of the river in the Vechtdal
 Future recreation	The forms of recreation taking place in the Vechtdal
 Eco-geomorphological processes	The eco-geomorphological processes present in and around the Vecht
 Water quality	The desired level of water quality of the Vecht
 Adaptation climate change	The way the Vecht is made climate robust
 River management	The level and type of governance to manage the Vecht

The aspect groups river design and eco-morphological processes are the only two aspect categories containing overlapping characteristics. This can be explained due to the fact that the river strongly influences the conditions for eco-morphological processes. Nevertheless, there are two main reasons for dividing the involved characteristics in two different aspects groups. First, it makes it possible to explain the land use priorities more clearly. Changes in river design are mostly demanding for more land in the river bed and influence the different characteristics regarding future agriculture and recreation. The second reason is related to the scope of this research. This research is based on a building-with-nature approach, which elaborates on eco-geomorphological processes. Comparing these eco-morphological processes per vision helps to explain to what extent each vision embraces the building-with-nature approach.

The only characteristic that is not placed in one of the aspect groups is water safety. This has two reasons. First, every vision should lead to a safe river system, so it can be regarded as a fixed condition which does not contribute to outlining the differences between the visions. Secondly, there are some different views on how water safety should be handled in the Netherlands, but this is part of another discussion and will not be the scope of this research.



### Four categories: combining visions with characteristics

The characteristics derived from the interviews are describing different visions on what a half-natural Vecht will look like in 2050. In the following section, these different visions will be outlined following the eight aspect groups mentioned in the previous section. The different visions are divided into four categories, based on the similarities between the formulated visions of stakeholders. The established categories are: comparable to the current state, slightly more natural than the current state, more natural than the current state and far more natural than the current state.

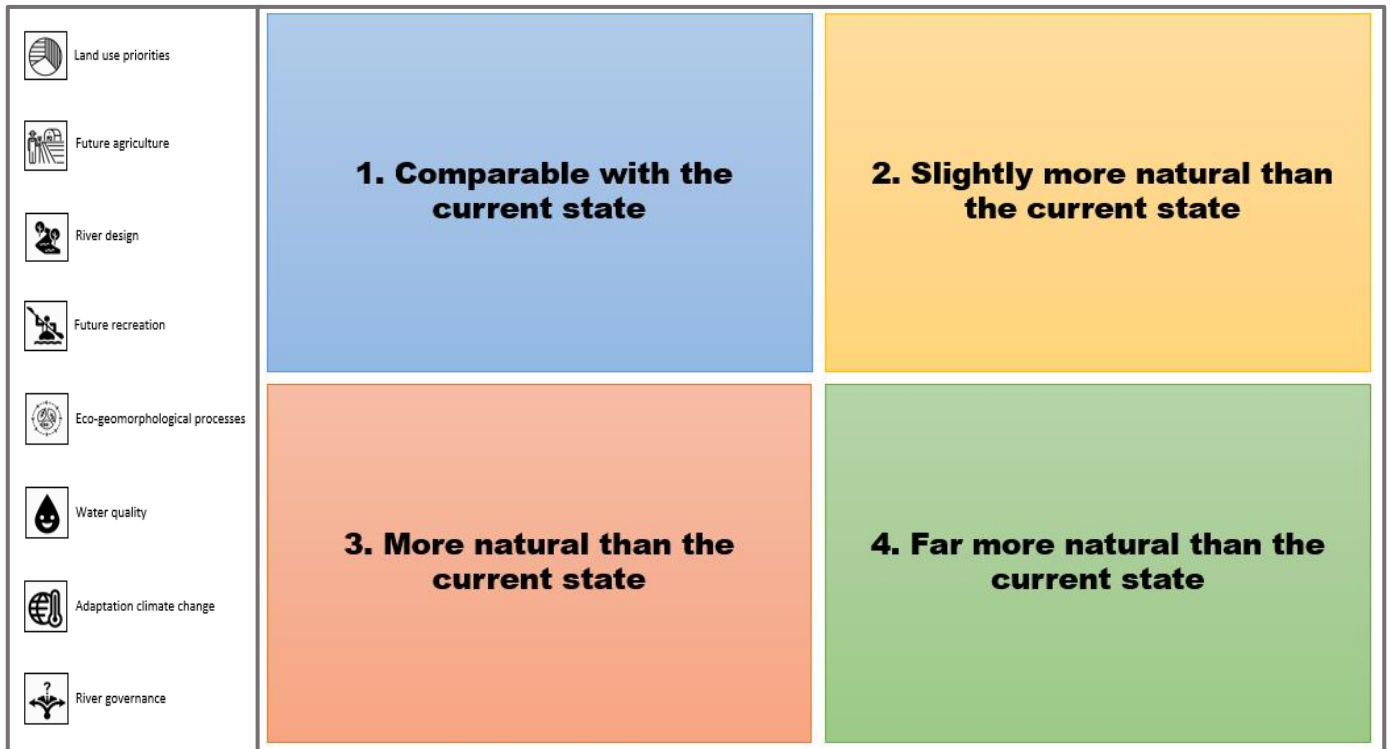


FIGURE 10 CATEGORIES WITH ASPECT GROUPS

### 1. The Vecht is already a half-natural river

According to this first vision, the current state of the Vecht can be considered as half-natural. When looking towards the year 2050, the functioning of the river remains the same, as well as the way it is used by different sectors. Nevertheless, some minor changes to improve the natural conditions could be implemented.

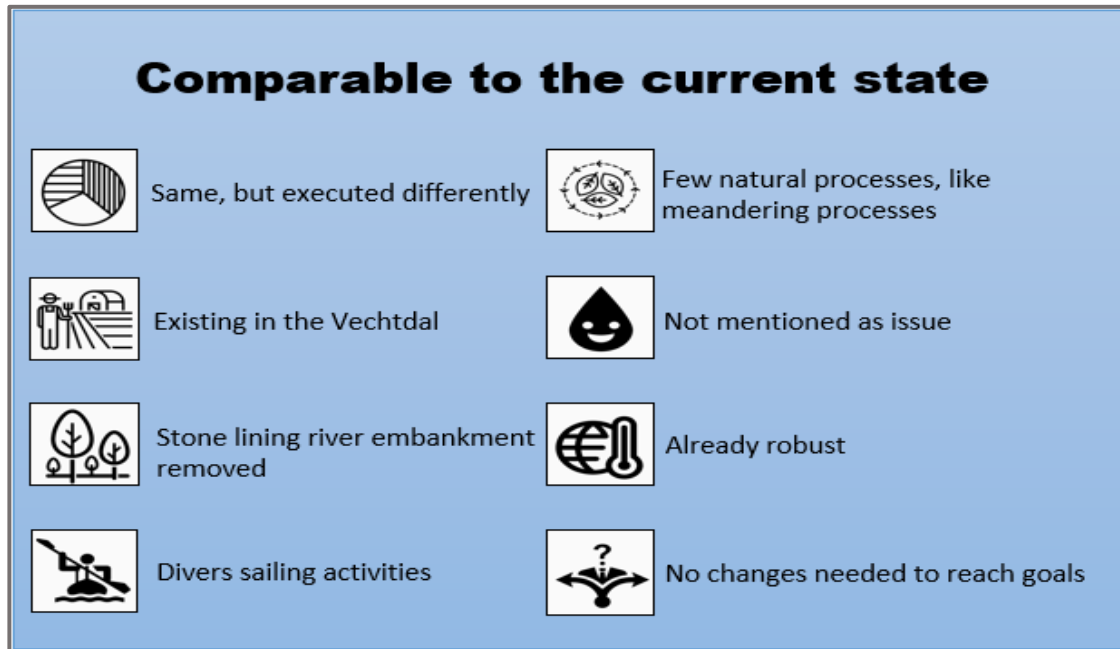


FIGURE 11 VISION CATEGORY 1

Looking from this vision, there is still place for different nature, agriculture and recreation purposes in the Vechtdal in 2050, even though the executions of these purposes have changed throughout the years. Nature is preserved during the previous decades and protected nature areas are remained protected (9). There is still agriculture possible in the Vechtdal and there are sufficient possibilities to recreate on and around the river. When looking towards sailing possibilities, the current initiated changes are realised. Recreational boats and small yachts use the implemented locks in the weirs (9, 13). Some businesses have emerged alongside the Vecht in boat rental industry. This varies from a restaurant with canoe rental possibilities to businesses where boats can be rented (with the option to spend the night on the water), to a water taxi between Hardenberg and Ommen or Hardenberg and Zwolle (13).

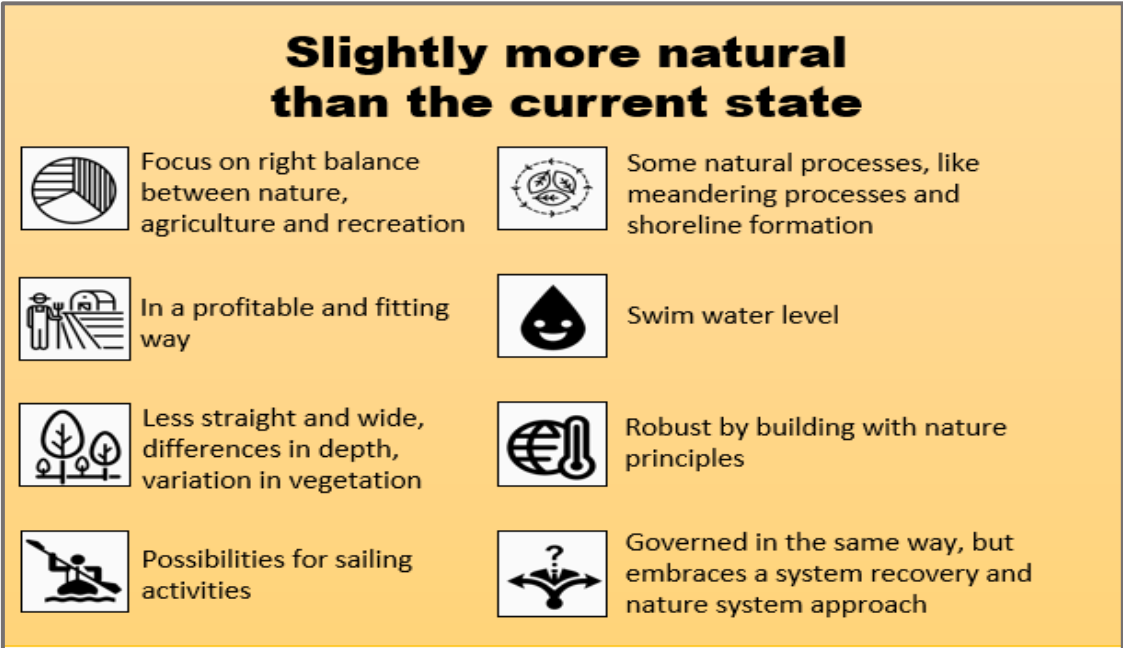
To make the river a bit more natural, the entire river embankment stone lining is removed so the river has the possibility to find its way (13). Furthermore, there is a focus on the surrounding landscape to give it a more natural look, but in a way that the functioning of the river will not be affected (9).

Adaptation interventions to climate change were not needed according to this vision, because the river is already perceived as climate robust (9).

Managing the river have mainly stayed the same. German and Dutch water authorities are consulting about cross-border issues, but the rest of the decision-making processes are taking place at the same level as before. The Dutch part of the Vecht is strongly dependent on what Germany does. Only when Germany changes its river management, Dutch water management should react to that (9).

*2. With small changes, the Vecht will be a bit more natural*

Within this vision on a half-natural Vecht for 2050, the river is made slightly more natural within different aspects. This includes changes in land use priorities, how the riverside looks like, and adaptation strategies to cope with climate change.



**FIGURE 12 VISION CATEGORY 2**

The supporters of this future vision on the Vecht put the focus on finding the right balance between nature, agriculture and recreation. In 2050, the river must be in a more natural condition while considering other sectors. There is an increased link between nature and agriculture in the form of nature-inclusive agriculture or nature conservation activities carried out by farmers. This is carried out in a way that farmers make enough money to have a profitable business (1, 8). When looking to future recreation, there are possibilities for sailing on the river the form of electric or wind-driven boats. These boats must be designed in a way that they can deal with the shallow parts in the river (6).

The river design is less straight and wide but contains more depth differences and a greater quantity and variation in vegetation. Hereby the floodplain is strongly connected to the river and there are natural differences in shoreline formation, caused by natural processes (11). Changes in river design to support nature are implemented in areas that are most promising (8).

The quality of the water is improved up to a level that it is safe for humans to swim in it. This means that the amount of nutrients, pesticides, organic pollutants and pharmaceutical residues is reduced (6).

To adapt to climate change, there is aimed for a climate robust river system. The adaptation strategies implemented are generally based on the building-with-nature approach. During peak discharges, water will be temporarily stored in retention areas (1). This will be done by designated areas for this purpose and design the landscape in a fitting way.

The river is managed in the same way as before, but from a more system recovery perspective and sees the Vechtdal as a single unit (11). Nevertheless, decisions are still made at the same level.

*3. With impactful changes, the Vecht will be more natural*

From this perspective, the river should encounter bigger changes to meet the characteristics of a half-natural Vecht. Nature get more priority and other sectors should be functioning in a more nature serving way. This aims to provide nature with more possibilities to evolve. Furthermore, the river should be managed on a river basin level, where the Vecht is seen from a system recovery perspective.

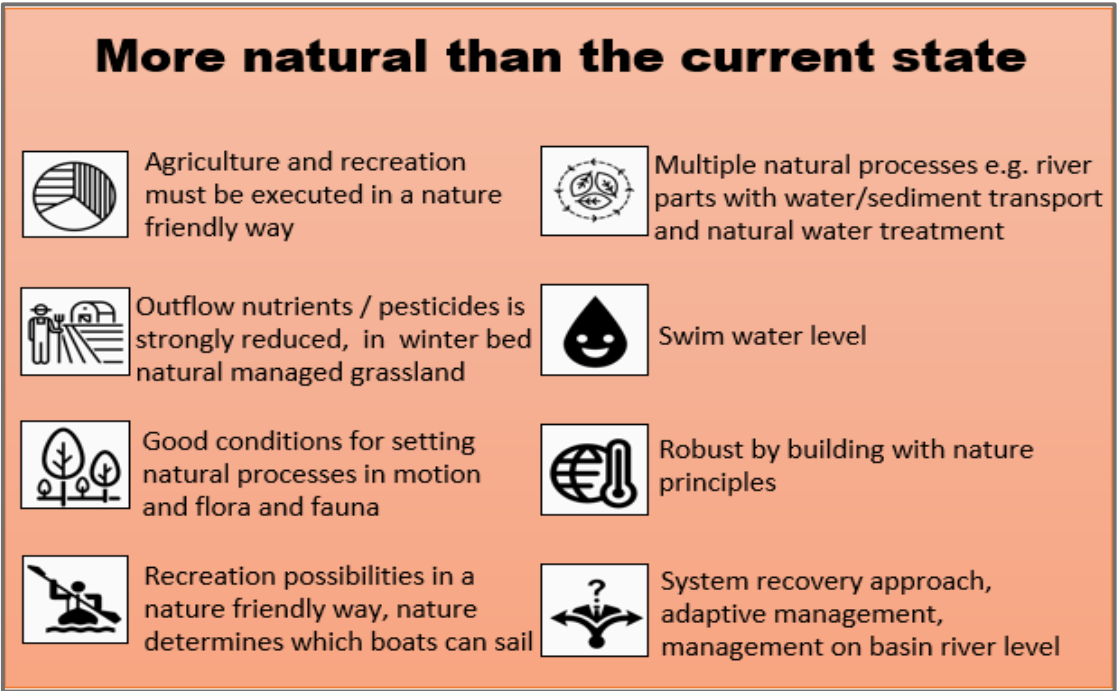


FIGURE 13 VISION CATEGORY 3

Land use priorities between nature, agriculture and recreation have switched towards a situation where nature is more prioritized. Agriculture and recreation both have changed to decline their negative impacts on nature (11).

In the case of agriculture, the outflow of nutrients and pesticides into the river has been strongly reduced (12). In the floodplains, naturally managed grasslands will be found (11). In the rest of the

area, there is a mix of extensive agriculture, organic agriculture, nature-inclusive agriculture and agricultural nature conservation (14).

In 2050, the Vecht is a river where several eco-geomorphological processes are taking place according to the building-with-nature principles. There is a natural balance in water and sediment transport, which is taking place at various spots among multiple kilometres (2, 5 and 15). This creates living conditions for different flora and fauna. There is a more natural flow dynamic with a more natural water level (11). Next, to that, the river has flooding possibilities. The realised sponge functioning in soils improves the water-holding capacity of soils during wet periods and releases water in dryer periods (12). Trees and other types of vegetation will be found at the shorelines and inside the river. This creates structure variation resulting in diversity among species and environmental conditions. Moreover, trees form a natural source for dead leaves and wood in the river. This provides food for the smallest organisms in the river and therefore forms the basis of the food chain in the river (12). There are different types of shores formed by natural processes, like more erosion processes taking place on the outside bend and more sand deposit on the inner bend of the river (11).

The water quality is improved towards a level that the Vecht is suitable as swimming water (14). This not only to improve the recreation possibilities but also meets the desired water quality level to reach the admired conditions for flora and fauna in the river and its secondary waters (12).

Climate adaptation is realized aiming to reach a climate robust river system by using building-with-nature principles. An intervention supporting this aim is improving sponge functioning and creating upstream retention areas that give the river the possibility to flood at designated areas. Furthermore, in the floodplain only types of vegetation will be found that can handle natural water levels, because of the expected dryer and extremer weather conditions (14).

Within river management, the focus is switched towards a system recovery approach and there are more partnerships on basin level (2, 11, 14). This includes collaboration with Germany, where there is looked to the possibility to implement interventions upstream in Germany to lengthen the river and to slow down the water. Furthermore, there are accurate agreements made on maximum and minimum discharge levels between Germany and the Netherlands (5, 14). Next, to that, only adaptive management will be applied, to give nature the opportunity to fix problems by itself without immediate intervention by humans. When nature cannot fix the problem, adaptive interventions can be implemented to set the right natural processes in motion anyway (5).

#### 4. With drastic changes, the Vecht will be a lot more natural

This fourth vision is described by various stakeholders to be more like a dream vision and by some as impossible within the current social-economic landscape (6). Transforming the river into a flowing river without obstacles asks for drastic change. These changes are needed within the river itself, in its surrounded areas. Realizing this river is opposing to the currently valid set constraints (11,12). Nevertheless, this vision can be valuable for the long term after 2050 or as a manner to create understanding what for potentials the Vecht has.

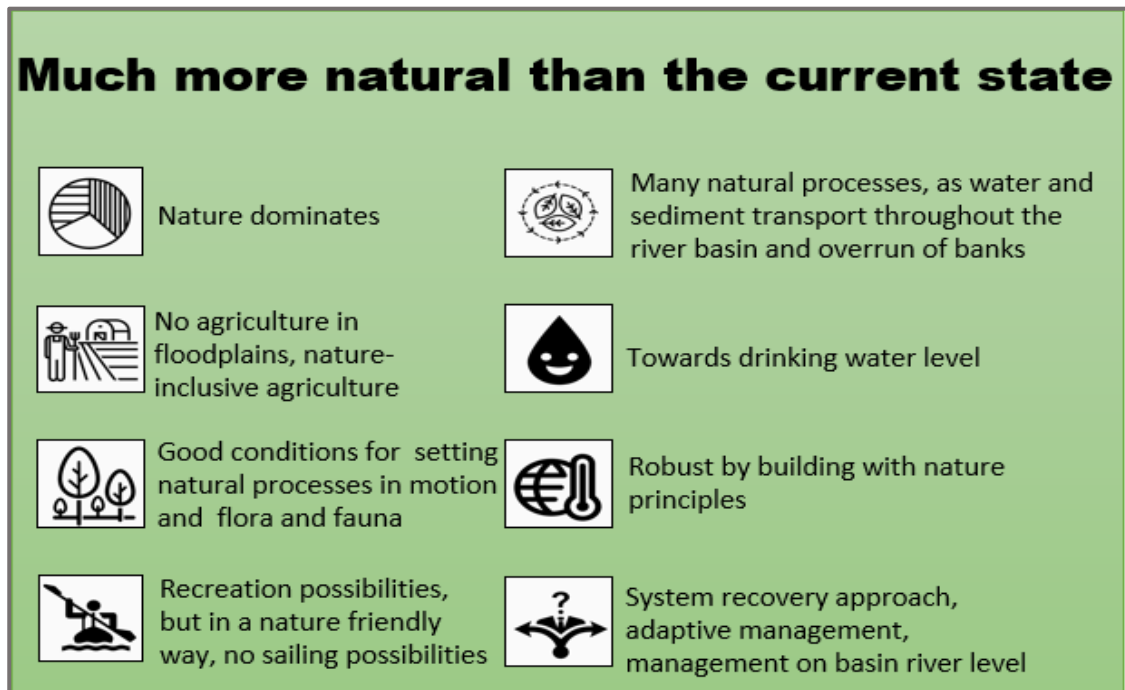


FIGURE 14 VISION CATEGORY 4

Within this vision, nature is prioritized. This is exposed in a way that traditional agricultural and recreational practices have been reduced and switched to nature-inclusive activities. This form of agriculture is less dependent on fixed water levels (11). There is no space for large-scale intensive agriculture. For recreation, the Vechtdal has no space anymore for mass tourism but focuses on particular groups who are willing to pay for the rare flora and fauna the Vecht possesses (4). A mentioned example of such a situation in Denmark, where realized restoration projects have resulted in lively small rivers and brooks (7, 14). Instead of many tourists, more exclusive and expensive forms e.g. sea trout fishing trips, are forming the recreation sector.

The Vecht itself is reshaped into a much smaller and shallower river to fulfil the demand of an almost year-round flowing river (4, 7). Free flows of water and sediment create suitable conditions to trigger natural processes (5). Furthermore, flowing water is a key condition for many flora and fauna species. Narrowing and deepening the Vecht results in a river that overruns its banks frequently, which asks for

a fitting landscape design for the river bed. These flooding processes set different natural processes in motion (12).

For water quality, there is the ambition to reach the level of drinkable water. With strict regulation on water pollution and functioning natural water treatment processes, the water quality of the Vecht will be from an extremely high level, compared to other comparable Dutch water streams (14).

The river made climate robust by applying the building-with-nature approach, where natural processes fulfil the needs to maintain the ecosystem as well as protecting humans from the water.

To achieve this, the river is managed at river basin level, so interventions can be implemented among the entire river. The morphology of the river is in order and natural processes fulfil key practises inside and alongside the river. Within catchment areas, the sponge functioning is improved to increase the water-holding capacity (5).

## 5.2 Towards a single end vision of a half-natural Vecht in 2050

To apply a resilient-development pathway approach and to be able to conduct back-casting sessions, the range of varied visions has to be narrowed down to one formulated end vision of a half-natural Vecht. For this thesis, the workshop of Lumbricus on goal setting was taken as the method to formulate this end vision. Nine stakeholders were present during the workshop. The group consisted of stakeholders from different water authorities (Vechtstromen, Drents Overijsselse Delta, Aa en Maas), scientists from different disciplines (Soil geography, geomorphology, water management and governance) and a stakeholder from a water research institute (Deltaris). In the coming section, two different future situations will be outlined. One end situation consists of a river with weirs, the other of a river without weirs. Afterwards, a section will elaborate on the final discussion of the workshop, where the two end situations are compared and combined to one final end vision.

### The situation with weirs

The first group worked out a future situation of a half-natural Vecht with weirs. Therefore, a higher base flow and a lower peak flow must be realized upstream. Sponge functioning within the catchment areas must be improved in upstream areas. This to improve the water-holding capacity to decrease the direct run of after precipitation events, resulting in lower peak flows. Another condition which must be realized is re-establishing the sediment transport. In Germany, sediment is extracted for commercial use from the river resulting in only small amounts of sediment reaching the Dutch part of the Vecht. Collaborations and agreements with Germany are needed to realize this. In the Dutch part, the traditional weirs block currently the sediment transport. To overcome this issue, innovative weirs will be placed. This type of weir has an opening at the bottom, so the sediment can pass. The new weirs should be managed in a dynamic way to enable more natural water levels. An issue with



implementing innovative weirs is that they are quite expensive. At places where the (innovative) weirs are situated, long bypass channels are created. These bypass channels realize water and sediment flows and improve the connectivity between the different parts of the river when weirs are closed. This creates possibilities for flora and fauna to evolve and migrate to other parts of the river. Additionally, to improve natural conditions in the head stream, meanders will be dug, and the river embankment stone lining will be removed (see figure 15). Transformations in agriculture can go really fast, but how this will evolve is stated as unclear. Nowadays, agriculture is strongly attached to the current fixed water levels. When agricultural transforms into more nature inclusive forms, the dependency on the current water level will decrease and creates space to imply more natural water levels.

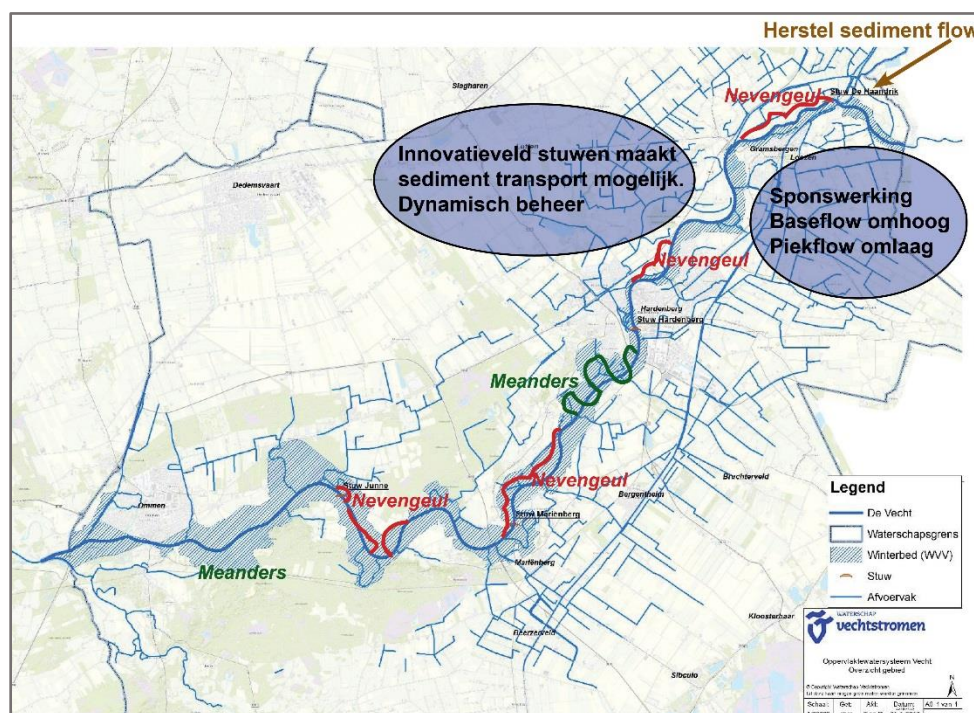


FIGURE 15 SITUATION WITH WEARS, DERIVED FROM WORKSHOP REPORT (MERKS, 2019)

### Situation without weirs

The other group worked out the vision of a half-natural Vecht in 2050 without weirs. This group started, likewise the other group, creating more water-holding capacity to lower the peak flows. This is done by improving the sponge functioning of the soils in catchment areas and by lengthening the river by digging new river bends (see figure 16). Furthermore, the river will be redesigned into a shallower river using sand supplementation. Seepage nature is not possible anymore within this situation, so this type of nature will be replaced in nature which can live under the new conditions. When transforming the current system to a half-natural system without weirs, desiccation effects in the river valley area will occur, known as lateral-connectivity. Lower groundwater levels cause losses in yields and may even make current agriculture unprofitable. Other types of agricultural systems should emerge, such as



extensive, nature-based or less groundwater depended systems to overcome these financial disadvantages. New suitable forms of making money on the affected lands can be found in the upcoming energy transition in the form of producing renewable energy using solar panels and windmills on farmer's lands. The final step for this goal description to reach half-natural Vecht is taking out the weirs. Therefore, risks must be reduced by previously mentioned interventions to a certain extent that they meet the water safety standards. Only then, the weirs will be removed.

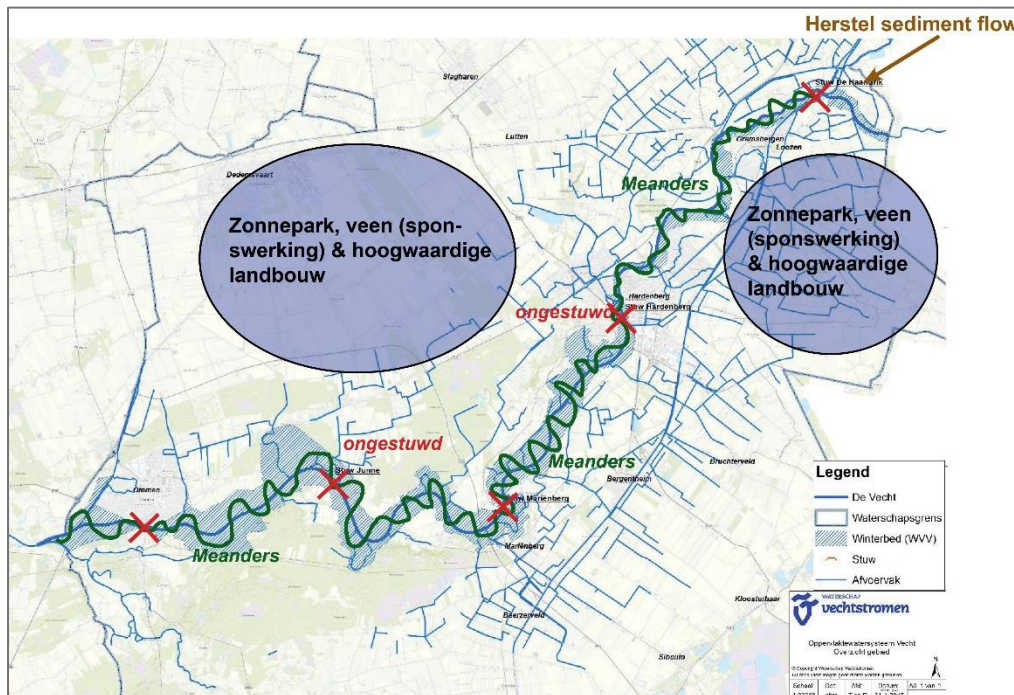


FIGURE 16 SITUATION WITHOUT WEARS DERIVED FROM WORKSHOP REPORT (MERKS, 2019)

### Combination of the two proposed visions

During the final discussion on the two different visions for a half-natural Vecht, multiple similarities came forward. The first similarity was starting with changes in the river valley area and Germany to lower the peak flows and create the right circumstances. Thereafter, both groups proposed interventions aiming to lengthen the river by creating bends meanders and in the case of the situation with weirs, bypass channels alongside the weirs. One of the stakeholders suggested seeing the described visions as two different points in time instead of two opposite end visions. This set light upon a new perspective. Both end visions on the Vecht proposed similar types and order of interventions. Furthermore, the majority of the characteristics of a half-natural river overlapped between both proposed visions. According to each vision, the Vecht in 2050 must be a river where e.g. water and sediment flow is taking place, peaks are less high and the baseflow is a bit higher, agriculture adjusts to the natural situation and has natural banks. These shared visions will form the basis for the end vision of the back-casting interviews, which will be discussed in the following subchapter. Comparing this end vision with the four different visions derived from the semi-structured interviews, the

formulated end vision of the workshop is a combination of the so-called “more natural situation” and a “much more natural situation”.

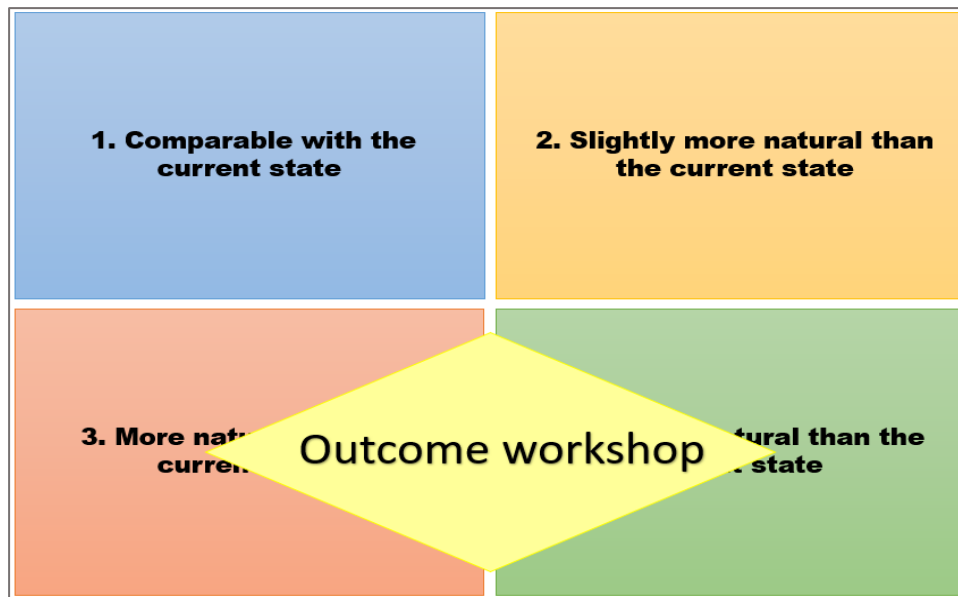
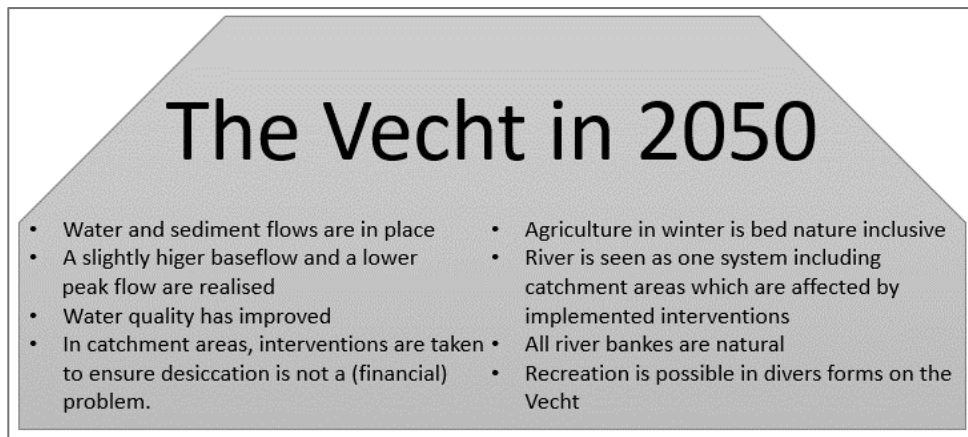


FIGURE 17 WORKSHOP END VISION COMPARED TO THE FOUR VISION CATEGORIES

### 5.3 Proposed intervention routes to a half-natural Vecht by stakeholders

In order to construct climate-resilient development pathways, stakeholders were asked to create a possible route of interventions to reach the formulated end vision derived from the Lumbricus workshop. The focus will be on the proposed routes and the chosen interventions to reach the formulated end vision. This subchapter is based on the conducted back-casting interview sessions. Each session resulted in a drawn route of interventions towards the formulated end vision (see Appendix VI). Afterwards, each route is put in the same format to make comparing possible (see Appendix VI). The aim of these routes was to find out which interventions stakeholders suggest and when stakeholders place these interventions in the time and what the order is of implemented interventions.

The following section will outline the end vision used in the back-casting interviews. Subsequently, the established categories of proposed interventions will be discussed followed by a section where the proposed routes are described. Next, the differences and similarities of the proposed interventions are outlined. Subsequently, the interdependencies between interventions and intervention categories will be discussed. The last section focuses on two potential pathways based on the similarities of the proposed intervention routes. Furthermore, it outlines the possible drivers of change of the adaptive space identified by stakeholders using the constructed climate-resilient development pathway figure.



**FIGURE 18 GOAL ASPECTS END VISION BACK-CASTING SESSIONS**

### The formulated end vision

Derived from the Lumbricus workshop, eight river-related characteristics are defined comprising the formulated end situation of the Lumbricus workshop on a half-natural Vecht in 2050. These eight characteristics are shown in the figure on the next page.

The first aspect is focusing on realizing water and sediment flows, aiming to stimulate the natural processes belonging to a lively river. The second aspect, a slightly higher base flow and lower peak flows, is aiming to create the right conditions for the futural water flow rates. A higher base flow creates more year-round water security and lowers peak flows decreasing the change of unwanted floods. Improving water quality is the third aspect, aiming to improve the current water quality towards swim-water quality to boost recreation and living conditions for flora and fauna. The fourth aspect is focusing on realizing conditions to overcome the (financial) issues of desiccation in the catchment area caused by lateral-connectivity. Interventions must be realized ensuring that changes in the river will not destroy the possibilities to make a living for inhabitants of the area. The fifth aspect is focusing on agriculture in the winter bed, which must be nature inclusive in 2050 to give nature and its natural processes the chance to develop. The sixth aspect is focussing on the management of the river. The river must be managed from a system level, including the entire area where the river affects the system. The seventh aspect is targeting the river banks, which must be all natural in 2050. The last element is focusing on recreation, which must be possible in various forms on the Vecht.

### The proposed interventions by stakeholders

As mentioned in the methodology, stakeholders got fifteen pre-made cards with interventions and a pack of unwritten cards to create a route of interventions towards the formulated end vision. In the eight conducted back-casting sessions, the total amount of placed intervention cards was 123 interventions. The proposed interventions were grouped into different categories. This because comparing these amounts of proposed interventions was considered as too complex and impossible to visualize. The categories were divided based on the target areas of the proposed interventions, complemented with a category consisting of overall management interventions. Within different categories of interventions, various governing bodies and other stakeholders are involved. The conducted categories were 1) interventions in the upstream catchment areas, 2) interventions in the river bed, 3) interventions in the river design, 4) interventions within the river and 5) interventions in overall management. Each category consists of multiple interventions used by stakeholders to create a route to the formulated end vision. The table below provides an overview of the different categories with the corresponding interventions. To clarify what are pre-made interventions and what are additional proposed interventions, the last is in italic.

**TABLE 3 CATEGORIZED PROPOSED INTERVENTIONS BY STAKEHOLDERS DURING BACK-CASTING SESSIONS**

interventions catchment areas	intervention river bed	interventions river design	interventions river	interventions overall management
Realizing active contact with Germany	Moving dikes upstream Ommen 20 to 50 meters backwards	Creating bypass channels	Implementing innovative weirs	<i>Establishing a single plan</i>
Improving sponge functioning	Planting trees in winter bed	Reconnecting bayous	Improving waste water treatment plants	<i>Consulting with nature organisations</i>
Optimizing ditches and streams	<i>Buy lands alongside the river, managing of this grounds not by farmers</i>	Narrowing the Vecht	Realizing (more) natural water levels	<i>Choosing : Preserve N2000 areas or implement KRW interventions</i>
Realizing water retain possibilities during peaks in Germany	<i>Stimulating nature inclusive, extensive, organic farming with funding and regulations</i>	<i>Digging new meanders</i>	Removing existing weirs	<i>Creating awareness and education</i>
Reducing outflow of nutrients and pesticides	<i>Creating wetlands on purchased land</i>		<i>Continuing removing stone embankment lining</i>	<i>Setting up a single knowledge team</i>
Consulting direct with the farmer	<i>Planting trees next to the river</i>		<i>Managing weirs more natural</i>	<i>Choosing: only transforming winter bed or entire river basin</i>
Setting legally binding rules for agriculture	<i>Relocating agricultural businesses outside the Vechtdal</i>			<i>Setting high water protection level</i>
	<i>Implementing natural vegetation management</i>			<i>Stimulating agriculture/energy/climate transition</i>
	<i>Changing land use winter bed</i>			

### Proposed routes by stakeholders

Within the back-casting interviews, each stakeholder proposed a route of interventions which aimed to reach the end vision derived from the Lumbricus workshop. The coming sections will outline these proposed routes, focusing on which conditions needed to be realized and which interventions can be implemented to reach these needed conditions. Seven out of the eight proposed intervention routes were including interventions among all different target area. The other proposed intervention route proposed only interventions in the target areas river bed, river design and within the river.

For the routes focussing on the entire river basin, the order of transforming the Vecht into a half-natural river had many similarities. All stakeholders started with management interventions to involve

stakeholders. This includes talking with them about the options and consequences of the future proposed interventions. At the same moment in time or a little later, the majority of the stakeholders started with interventions in the river valley area to improve the water-holding capacity of the soils to reduce the peak flows. Another way to reduce the peak flows is to lengthen the river. To do this, different interventions were proposed at different moments in time. Proposed strategies were creating bypass channels, digging meanders and reconnecting bayous. These interventions were mainly proposed at the end of the short-term and start of the mid-term. The desired river design needs more space in the river bed. This space is not available at the moment, because it is mainly used for agriculture purposes. A construction must be established to make it realizable and beneficial for farmers to change towards nature inclusive form of agriculture or relocate their businesses outside the Vechtdal. This should be realized by getting around the table with each farmer, but also implementing some legal binding rules for farming in the river bed (5, 8).

Some stakeholders state to focus on interventions aiming to result in motivation for change. This is done by creating beautiful spots with bypass channels. By showing the possibilities on a smaller scale provides potentially a stronger position to intervene on a larger scale (15). When created conditions resulting in lower peak flows, the base flow will be increased in the long term by reshaping the Vecht in a shallower river. To realize a half natural river, there was suggested to create stepwise more natural water levels. The first step will be managing water levels more natural with the current weirs. Then, and if proposed, the next step will be stowing with innovative weirs. The final step will be taken when weirs are removed, resulting in a natural water level. For improving water quality, the majority of stakeholders proposed implementing policies in both the German and Dutch catchment areas, to reduce diffuse source nutrients and pesticides inflow. Furthermore, implementing point source pollution policies were proposed, resulting in improving wastewater treatment plants. For creating more space for the river in the river bed, the biggest share of the stakeholders proposed to move dykes backwards upstream Ommen. Deadwood in the Vecht creates the wanted conditions for flora and fauna. To realize this in a natural way, all stakeholders suggested planting trees in the winter bed. Only one stakeholder created an intervention card to continue with removing the river embankment stone lining (12), but many others mentioned this during the semi-structured interviews as a right way to make the river banks natural again (11). Removing river embankment stone lining is already an ongoing process and can explain why this intervention was not mentioned in many routes explicitly. Sailing with small electric and wind-driven boats, as well as people who admire rare flora and fauna, have sufficient possibilities to recreate on and around the river. Removing the weirs will affect lateral lands through changes in groundwater levels. Different types of crops fitting within the new conditions or extensive farming practices can generate new forms of income and provides a solution to overcome the resulted

(financial) disadvantages. Another mentioned possibility was producing sustainable energy. Solar panels seemed at first good opportunity but have some long-term negative consequences. Solar panels have a durability of 25 years. After these 25 years, it takes another 25 years for soils to recover and being suitable again for growing crops (8). Nevertheless, other forms of sustainable energy seem like a potential outcome. If all previously mentioned conditions are successfully realized and it is indeed safe to remove the weirs, this was stated as the final step of realizing a half-natural Vecht.

The route intervening only in the river bed started with the choice of intervening only in the winter bed or the entire river basin. There is proposed to focus only on the river bed because applying intervention in the rest of the river valley is seen as too complex and not needed to achieve the state of a half-natural river in 2050 when no big climatic changes will occur (9). Due to time limits of the back-casting sessions, only one route was created which was focused on interventions within the river bed. To create flows of water and sediment and lowering water levels during peak flows, long bypass channels among weirs were created. By reducing nutrients and pesticides and changing land use in the winter bed, water quality improves, and agriculture transforms towards nature inclusive. There were no interventions proposed to realize a higher base flow. There was a new water safety level purposed, allowing floods in designated areas. This provides flooded soils from fertile substances and stimulates natural water treatment. Another goal aspect which not will be reached is seeing the river as one system. The focus will remain on the winter bed and not taking the whole area which is influenced by the Vecht. This route does not reach all the characteristics of the end vision, making this route a possible way to go, but does not succeed in realizing a half-natural Vecht as described in the workshop.

#### The chosen interventions and their place in time

In the coming sections, previously mentioned categories of interventions will be outlined one by one. Each section begins by comparing the different proposed interventions by stakeholders. Subsequently, the interventions will be compared based on the suggested place in time. Therefore, stakeholders were asked to put interventions on a timeline aiming to provide insight in which order interventions must be implemented and to foresee possible lock-ins. To analyse the back-casting sessions, this timeline is divided into three different terms: short-, mid-, and long-term. Stakeholders placed each intervention card on a drawn timeline from mid-2019 until 2050. This placement determined to which category the intervention belonged according to each stakeholder. Each category covers a period of approximately 10 years. Some stakeholders mentioned the deadline for the KRW interventions in 2027 as an important moment in time (11, 15), which corresponds with the ending of the short-term period. Another important moment in time is the decision point of replacing, restoring or removing the weirs, which will be around 2040(15). This corresponds to the ending of the mid-term intervention period.

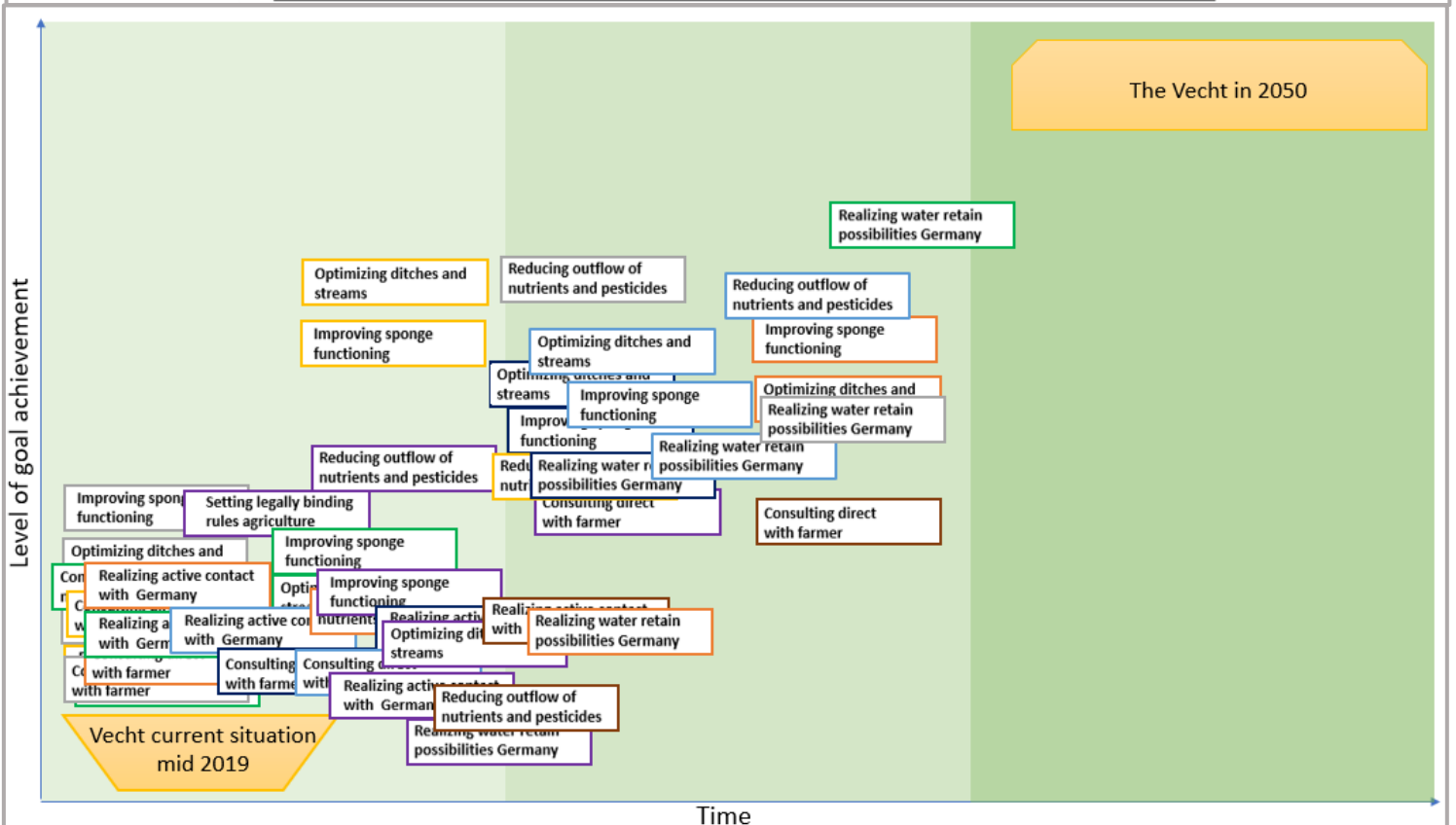


Below, each subsection will start with a table providing an overview of the suggested intervention by each stakeholder and visualisation when the interventions are proposed in time. Subsequently, the main differences and similarities will be discussed between the chosen interventions, the reason for the chosen interventions and the proposed moment in time. The colours of the interview number columns in the table correspond with the contours of the visualised interventions in time.

*Proposed interventions in the river catchment areas*

**TABLE 4 PROPOSED INTERVENTIONS IN RIVER CATCHMENT AREAS PER STAKEHOLDER**

Intervention	Interview number								
	3	4/7	5	8	9	11	12	15	
Realizing active contact with Germany	X	X	X	X	X	X	X	X	
Improving sponge functioning	X	X	X	X		X	X	X	
Optimizing ditches and streams	X	X	X	X		X	X	X	
Realizing water retain possibilities during peaks in Germany	X	X	X	X		X		X	
Reducing outflow of nutrients and pesticides	X		X	X	X	X	X	X	
Consulting direct with the farmer	X	X	X	X	X	X	X	X	
<i>Stimulating nature inclusive, extensive, organic farming with funding and regulations</i>							X		
<i>Setting legally binding rules for agriculture</i>			X						



**FIGURE 19 PROPOSED INTERVENTIONS IN RIVER CATCHMENT AREAS IN TIME**

Interventions in the river catchment area were mostly chosen from the pre-made intervention cards and complemented by some additional intervention cards. The interventions realizing active contact with Germany and consulting with the farmer were all chosen by all different stakeholders and mainly placed in the short-term period. The intervention realizing active contact with Germany is needed at the beginning of the transformation process, because later on other proposed interventions are needed to be (partly implemented) in Germany. These interventions are improving sponge functioning and optimizing ditches and streams in the German catchment areas to fulfil the demanded water-holding capacity reducing peak flows. This must be realized before intervention in other target areas can be implemented (3). Another cross-border issue which demands consultations with German water authorities is the non-existing agreement on a minimum flow rate in summer (5). Nowadays, German water authorities decide how much water they leave trough. When aiming to realize a higher base flow regulation must be put in place, especially due to the prediction that droughts in future summers will occur more frequently, (3). The last issue which demands active contact with Germany is the fact that currently, Germany extracts sediment from the river. When realizing a half-natural river, sediment flows must be in place. When Germany takes all of the sediment away before the sediment reaches the Dutch part, it disturbs the system (5). It is important to state that the German water authorities function in a different way than the Dutch water authorities. In Germany, water authorities cover much bigger areas compared to the Netherlands. The water authority governing the Vecht has also other and bigger rivers they have to manage, which results in fewer priorities on the Vecht. Next, the water authorities are much more hierarchical than in the Netherlands and do it take a long time before the right person gave permission to implement interventions. How the current contact with Germany is perceived, differs between the stakeholders. One says that there is already active contact and this should continue (11). Another says that the current contact focuses too much on transboundary bike trails and art routes, which should change towards river management issues (5).

Consulting with the farmer is the other issue suggested by all stakeholders. The aim of this intervention is to look for possible solutions so farmers can still make a living within the future river system. Most of the stakeholders proposed this intervention in the short term. There is a broad range in the proposed forms on how stakeholders suggest involving farmers. On the one hand, there is the view that farmers should actively be involved, next to other stakeholders, from the start (8). On the other hand, there is the view that there must be communication with farmers about the consequences and possibilities of the interventions, but not in a way that they have decision making power (4/7). Some stakeholders suggested additional interventions to create motivation for change in the agricultural system, by stimulating nature inclusive, extensive and organic agriculture with funding and regulation and implementing binding rules for agriculture (5, 12). Reducing the outflow of nutrients and pesticides



is an intervention almost every stakeholder agreed on as a way to improve the water quality, except one stakeholder. This stakeholder states that nutrients are not a problem for water quality, pesticides and pharmaceutical residues perhaps, but not forming a key issue in the case of the Vecht (4/7).

As already stated above as one of the interventions in Germany, sponge functioning and optimizing ditches and streams must also be primarily realized in Dutch catchment areas. These interventions are aiming to lower the peak flows because of the increased water retention capacities of the soils. Applying these interventions in the short-term or start mid-term is proposed by the biggest share of the stakeholders. Because this intervention takes a long time to apply a large amount of land, this intervention will continue almost during the whole process (3, 12).

Proposed interventions in the river bed

TABLE 5 PROPOSED INTERVENTIONS IN RIVER BED PER STAKEHOLDER

Intervention	Interview number								
	3	4/7	5	8	9	11	12	15	
Moving dykes upstream Ommen 20 to 50 meters backwards	X	X	X	X		X	X	X	
Planting trees in winter bed	X	X	X	X	X	X	X	X	
Buying lands alongside the river, managing of this grounds not by farmers		X							
Creating wetlands on purchased land							X		
Planting trees next to the river							X		
Relocating agricultural businesses outside the Vechtdal			X						
Implementing natural vegetation management			X						
Changing land use winter bed					X				

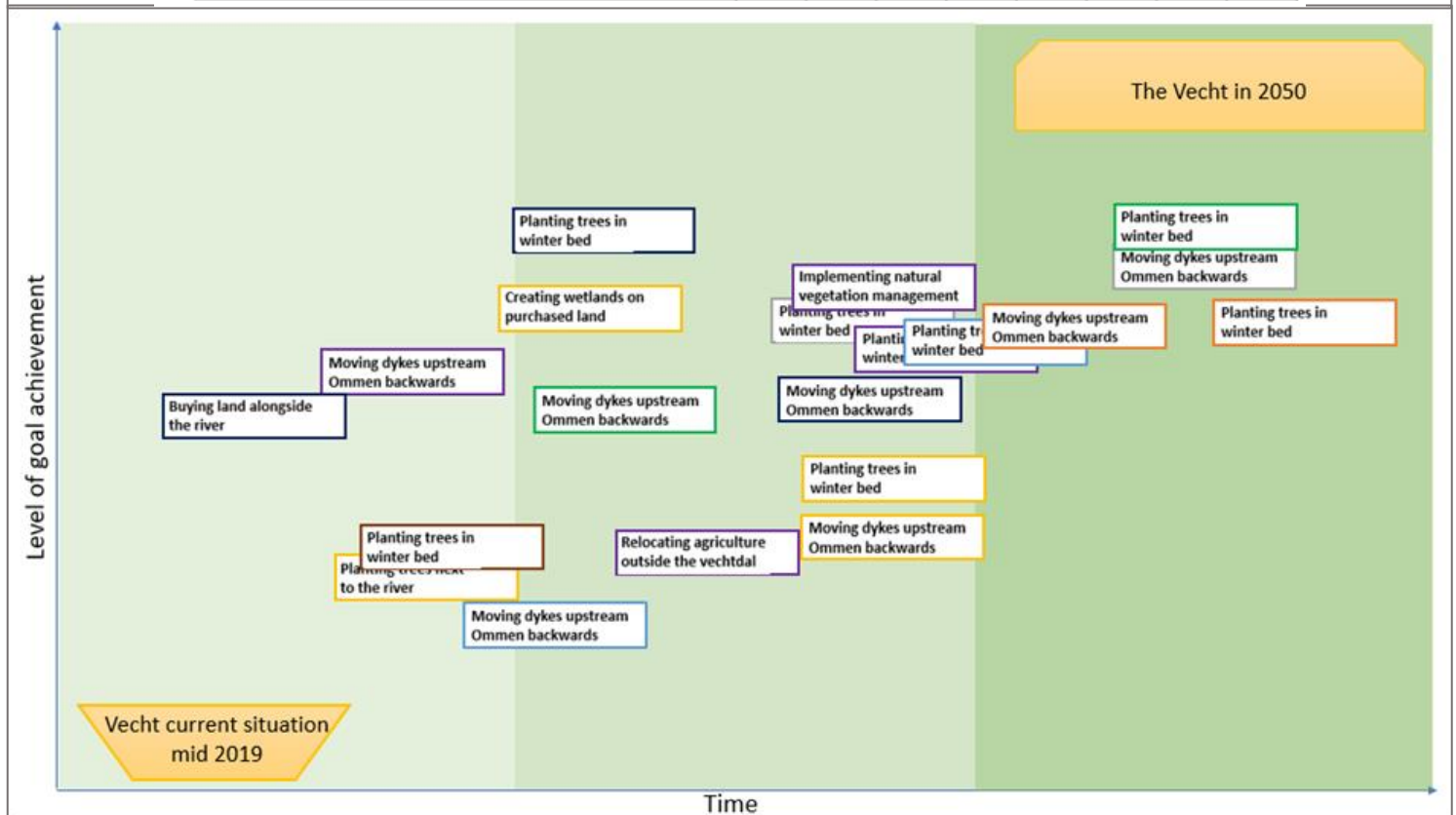


FIGURE 20 PROPOSED INTERVENTIONS IN RIVER BED IN TIME

The proposed interventions in the river bed consist of mainly self-made intervention cards and some pre-made intervention cards. Compared to the interventions in the catchment area, there is more variation when proposed interventions should be implemented. Every stakeholder has chosen for planting trees in the winter bed but disagrees when this should be done. There are two reasons given by stakeholders why they have chosen for this intervention. The first reason is to create a natural way of wood supply in the river (12). The second reason is to slow down the water during peak flows when

weirs are removed (3). A stakeholder proposing planting trees during the midterm, argues that this is needed because it takes time for the trees to grow to fulfil the task of slowing down the water when weirs are removed (3). Another stakeholder states that trees should be planted in the long term, arguing that due to safety reasons, everything else must be in place before trees can be planted (15).

The intervention to move dykes backwards upstream Ommen is chosen during seven back-casting sessions to create more space for the river (8). This intervention is also spread out over the three defined terms. A clear reason for this is not given only that this must be done to create more space for the river before the weirs are removed (12).

The intervention of creating wetlands is proposed because wetlands can retain a lot of water and release the water afterwards slowly (12). The intervention natural vegetation management aims to create natural succession and stimulates to come towards a self-supporting eco-system (5). To realize natural vegetation management, this stakeholder suggests starting earlier with projects to reorganize and relocate agriculture located close to the river to create space (5).

TABLE 6 PROPOSED INTERVENTIONS IN RIVER DESIGN PER STAKEHOLDER

Intervention	Interview number								
	3	4/7	5	8	9	11	12	15	
Creating bypass channels	X	X	X	X	X	X	X	X	
Reconnecting bayous		X		X		X		X	
Narrowing the river	X	X	X	X		X	X	X	
Digging new meanders	X	X	X						

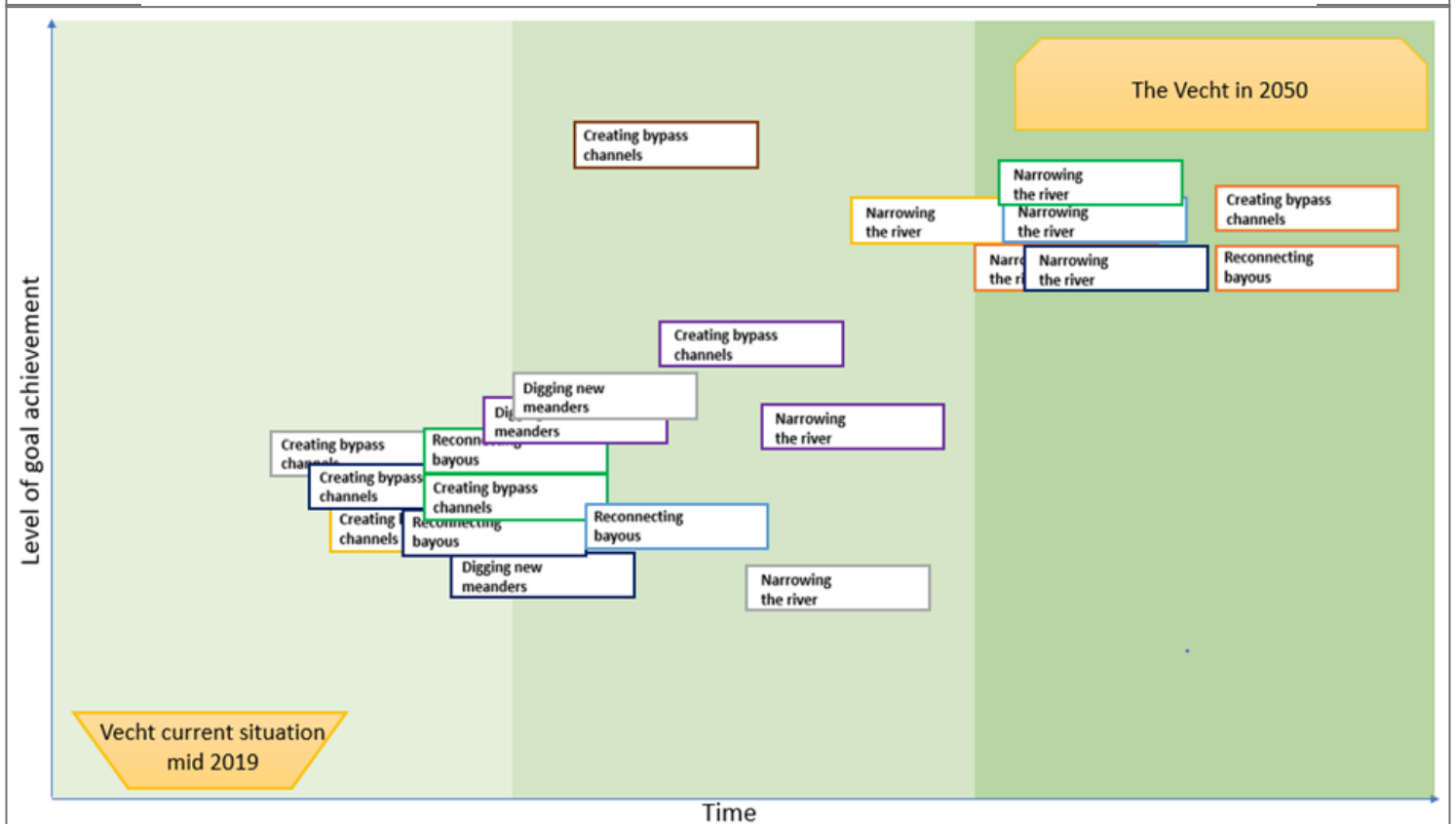


FIGURE 21 PROPOSED INTERVENTIONS IN RIVER DESIGN IN TIME

Three of the four interventions proposed to change the river design are derived from the self-made cards. The fourth additional intervention added digging new meanders. Every stakeholder has chosen to implement bypass channels, but for different purposes. One purpose of creating bypass channels could be to create ecological valuable hotspots. People can become enthusiastic about these small half-natural parts of the river which can result in motivation for change the other parts of the river as well (15). That is why this intervention is placed in the short-term or beginning of the mid-term. Another possible purpose of bypass channels is extending the river and increasing the flow capacity (5). For this reason, this stakeholder suggests this intervention later on in the intervention process. Reconnecting bayous is another way to extend the river. This intervention is chosen by half of the interviewed stakeholders, and when chosen the biggest share of the people had some remarks with it. There are two reasons for not implementing this intervention (in some of the situations). The first reason is that bayous were part of the river in the past during a different hydrological situation. This

results in a current mismatch of the needed geomorphological situation and the current hydrological situation (4/7, 12). The other reason is that valuable nature has developed over the last decades within these bayous. This nature will be lost when reconnecting the bayous (3, 5, 15). The intervention to dig new meanders is proposed as a more fitting way within the current system to extend the river (3, 4/7, 5).

Narrowing the Vecht is an intervention chosen by almost all stakeholders and all suggested one at the end of the mid-term and by the rest by in the long-term. Previous interventions leading towards improving water-holding capacity in the catchment areas and lengthening the river have lowered the water drain. From there, the Vecht can be reshaped in a shallower and when needed a broader river (12).

Proposed interventions within the river

TABLE 7 PROPOSED INTERVENTIONS WITHIN THE RIVER PER STAKEHOLDER

Intervention	Interview number							
	3	4/7	5	8	9	11	12	15
Implementing innovative weirs	X		X	X		X	X	X
Improving waste water treatment plants	X		X	X		X	X	X
Realizing (more) natural water levels	X	X	X	X		X	X	X
Removing the weirs	X	X	X	X		X	X	X
Continuing removing stone embankment lining							X	
Managing weirs more natural					X			

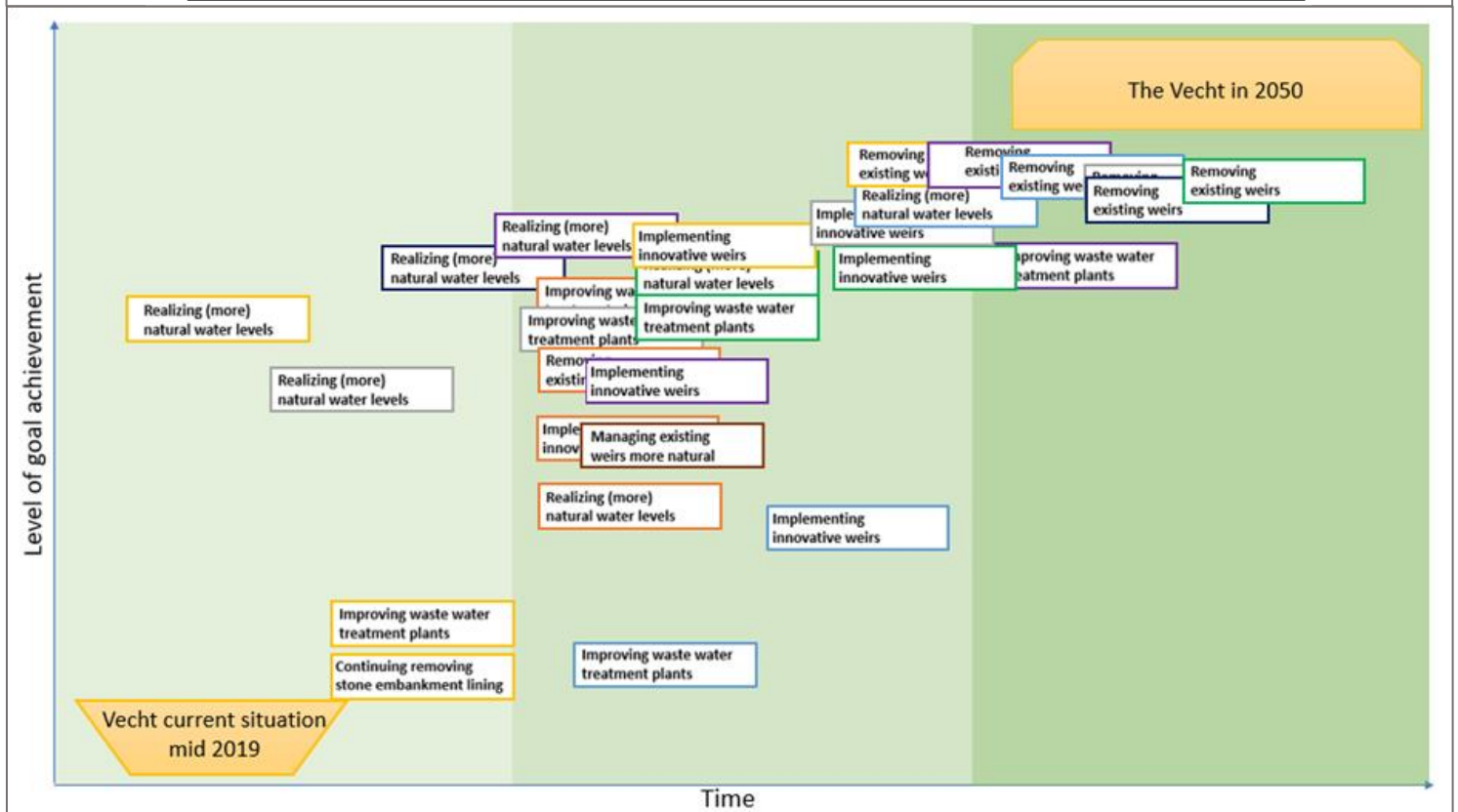


FIGURE 22 PROPOSED INTERVENTIONS WITHIN THE RIVER IN TIME

Interventions proposed within the river are mainly consisting of the pre-made intervention cards and complemented with some additional intervention. Most interventions are suggested in the mid-term and also a fair share takes place in the long-term. Almost all stakeholders suggest implementing interventions towards (more) natural water levels. The stakeholder proposing the route focusing on the river bed suggested instead of this intervention to manage the current weirs in a more natural way (9). A half-natural river system demands more natural water levels, but nowadays agriculture is still strongly dependent on these water levels. A step-wise approach to realize (more) natural water levels are recommended by different stakeholders, which means that each time when possible the water levels will be made a bit more natural (5, 12). An issue to make the water levels more natural are the

requirements to preserve Natura2000 areas, so before this can be realized, decisions about this should be made on forehand (15).

Continuing removing the river embankment stone lining is an additional mentioned intervention to realize natural river banks (12). This intervention is already an ongoing intervention, but to realize natural banks on the entire river, this intervention must be continued.

To reduce point-source water pollution, a big share of the stakeholders suggested interventions to implement wastewater treatment plants. However, to realize this national regulation must be in place at that moment to force decision-makers to implement those (3, 15)

The biggest share of the stakeholders has chosen for the intervention implementing innovative weirs. Nevertheless, several stakeholders state that this is more an optional intervention when weirs are not possible to be removed (3, 8). Some stakeholders see this intervention as a temporary solution to realize sediment transport and more natural water levels when the conditions are not ready yet to remove the weirs (5, 12). However, innovative weirs are quite expensive so removing these weirs shortly afterwards seems not realistic (15).

Almost all stakeholders have chosen for the intervention to remove the weirs. Most stakeholders argue that this intervention must be at the final moment when all other conditions are in place realized with the previously proposed interventions (3, 4/7, 5, 11, 12, 15). One stakeholder put the intervention in the mid-term, making at that moment the choice of innovative weirs or no weirs. However, a reason for this divergent choice can be due to the fact that the stakeholder stated to have lacking technical knowledge for this particular issue to give valuable advice (8).

TABLE 8 PROPOSED INTERVENTIONS IN OVERALL MANAGEMENT PER STAKEHOLDER

Intervention	Interview number							
	3	4/7	5	8	9	11	12	15
Establishing a single strategy		X						X
Consulting with nature organisations								X
Choosing: Preserve N2000 areas or implement KRW interventions						X		X
Creating awareness and education		X						
Setting up a single knowledge team		X						
Choosing: only transforming river bed or entire river basin					X			
Setting high water protection level					X			
Stimulating agriculture/energy/climate transition			X					

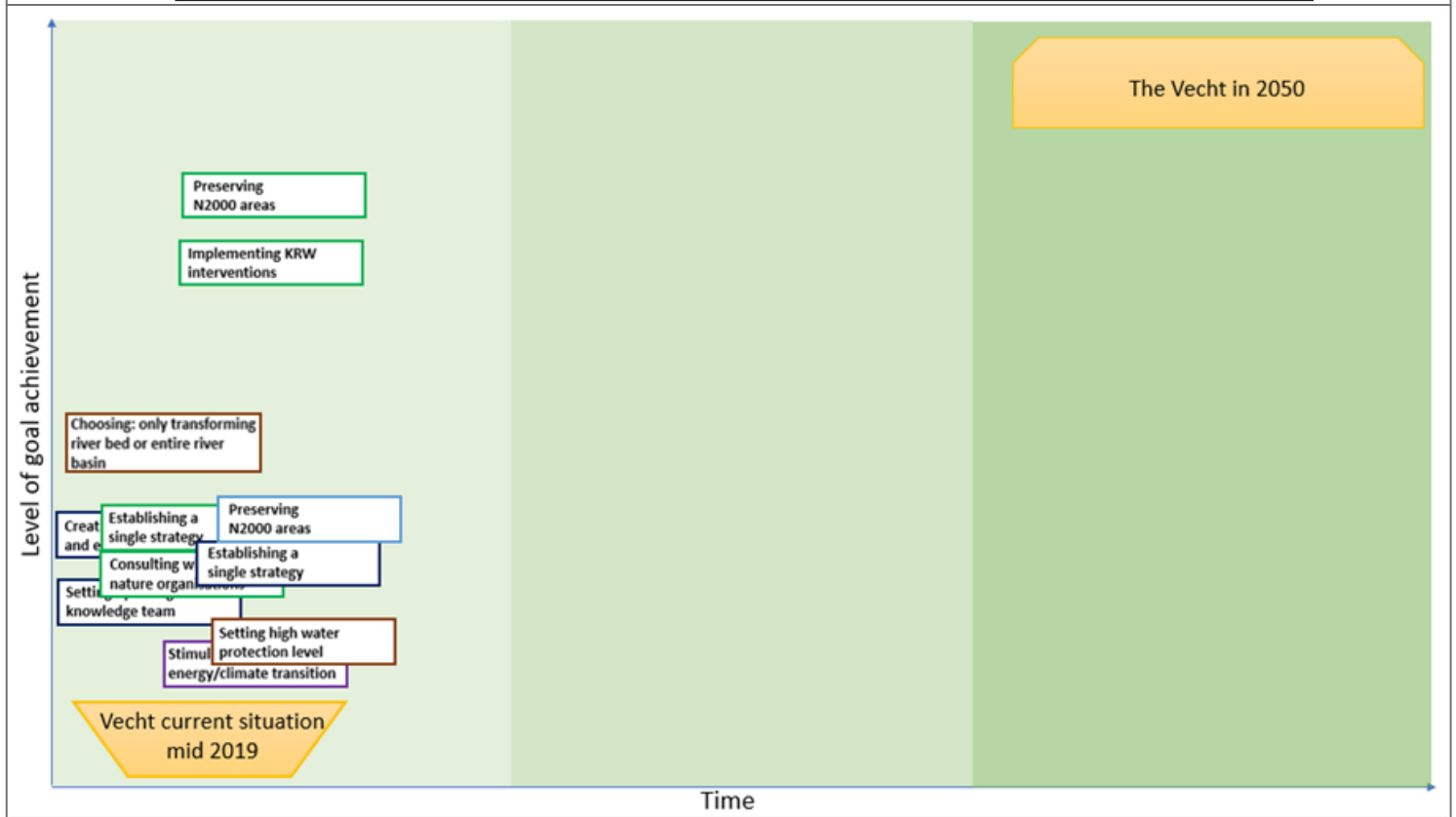


FIGURE 23 PROPOSED INTERVENTIONS IN OVERALL MANAGEMENT IN TIME

All the interventions within this category are additional interventions proposed by stakeholders themselves and are all placed in the short-term. Some interventions are focusing on key choices like only on transforming the winter bed or the entire river basin (9) and preserving Natura2000 areas or making interventions to fulfil KRW objectives. When natura2000 has to be realized anyway, e.g the intervention to realize more natural water levels, cannot be realized due to certain nature that is depended on the current water levels. That is the reason why this intervention is placed on such a high level of determining the level of goal achievement (15).



Setting up a good management strategy and creating support will create possibilities to implement interventions later on (4/7).

Other interventions are focusing on setting up a powerful management strategy who are working on realizing the different proposed interventions. These interventions are creating one plan and setting up one knowledge team (4/7, 15).

The intervention to stimulate the agriculture/energy/climate transition aims to encourage motivations for change (5). Next, consulting with nature organisations and creating awareness and education aims to create more understanding and support. Nature organisations are currently the organisations where the water authorities discuss the most with because of their ambitious goals, but this results in slowing down the entire situation. Explaining these organisations, the ambitions and plans in the long-run can maybe reduce this issue (15).

The choice of intervening only in the winter bed or in the entire river basin should be made at the beginning because it determines which interventions can be chosen and when they must be implemented in time (9). The last proposed intervention is setting a new high-water protection level. This intervention is stated as needed either way because the province withdraws from these management practices (9).

#### [Interdependencies between intervention categories and interventions](#)

This coming section will elaborate on the relations between intervention categories and interventions. During the back-casting sessions, each stakeholder was asked to draw lines between interlinked interventions with a red pen to indicate the interdependent relations between interventions. This resulted in multiple visualized interdependencies between intervention categories wherein different interventions are interlinked to each other. These interdependencies are pointing out how a certain intervention influences the possibilities for other interventions. Because of these existing interdependencies, multiple proposed interventions during the earlier implementation phases are aiming to change the current conditions to make it possible to implement later proposed interventions. A condition is meant as a needed requirement to implement a certain intervention, such as fulfilling the set safety rules or covering negative social-economic effects. This section will discuss the envisioned interdependencies of the proposed interventions. Outlining these interdependencies will start with the interventions in the long-term by stating which conditions must be in place. Next, the interventions proposed to realize this condition are outlined. Subsequently, there is reasoned backwards within the implementation process until the proposed short-term interventions.

Taking out the weirs is by multiple stakeholders proposed as the final intervention before 2050. To realize this, peak flows must be lowered to fulfil the set water safety rules and the base flow must be higher to create (almost) year-round flowing water (5). To lower the peak flows, the river should be lengthened and the water-holding capacity should be increased (5, 12). This can be done due to improving sponge functioning and optimizing ditches and streams in the catchment areas (11, 15). To higher the base flow, the river must be reshaped in a shallower river. Furthermore, active contact with Germany must be realised to establish agreements on letting through a minimum water flow rate in summer. Next, trees must be planted and grown to take over the weirs' task in a natural way to keep water longer at the same place (3, 12). To plant trees in the winter bed, peak flows must be more under control before due to water safety reasons. When this is not realised and a peak flow occurs, the young trees are not strong enough and dragged away. This is stated as unsafe within the set water safety rules (12). Before that, space must be created in the winter bed. This to implement interventions like planting trees and lengthening the river by creating bypass-channels, digging new meanders and reconnecting bayous, space must be created in the winter bed (5). Furthermore, current agricultural practises within the river bed and catchment areas must be changed to realise more natural water levels. Nowadays, these businesses are really dependent on fixed water levels to produce their crops. This needs to change before water levels can be managed in a more natural way. To create more space in the river bed and change current agricultural practises, several preliminary interventions are proposed. This includes consulting with farmers and other stakeholders, establish new regulations or create a construction to make it appealing to switch towards more nature inclusive business systems or relocate outside the Vechtdal (8). In addition, to optimize sponge functioning and ditches and streams in the upstream catchment and moving dykes backwards upstream Ommen, consulting with farmers and creating establishing constructions covering social-economic must be in place (11).

#### 5.4 Climate-resilient development pathways and possible changes in the adaptive landscape

Two different pathways have been constructed based on the similarities between the proposed intervention routes. The performed analysis outlined in the previous sub-chapter and additional data derived from the back-casting sessions (see Appendix V for textual description back-casting sessions and Appendix VI for stakeholder routes transformed) are used to realize this. Within these pathways, only proposed intervention routes are included which fulfil the eight river-related characteristics of the end vision derived from the stakeholder workshop. The route focusing on only intervening in the winter bed does not reach out to fulfil all characteristics and is excluded in the construction of the pathways. The construction of the overarching pathways is based on the choice of interventions and the suggested moment of implementing the intervention. It is important to state that not every

intervention within the different intervention routes matches exactly with the two pathways. In the case of small differences in the choice of interventions and orders, there is chosen of not creating a new pathway but pick out the choice which was suggested by most stakeholders. The section below starts with outlining the two constructed overarching climate-resilient development pathways. Subsequently, foreseen possible changes in the adaptive landscape are outlined using the constructed climate-resilient development pathway approach outlined in the conceptual framework.

#### The pathway “creating motivation for change”

The two constructed overarching pathways are both starting with setting up a management strategy, involving stakeholders and start improving conditions in catchment areas to improve the water-holding capacity. From there, the two different pathways split up. The first pathway is characterized by the focus on creating motivation for change. This follows the conviction that when more support is created, follow-up interventions are easier to implement. After starting with improving the water-holding capacity in catchment areas, creating bypass channels is proposed as the following intervention. By creating bypass channels, the positive effects of transforming the Vecht can be shown on a small-scale area. This aims to create more support than there is nowadays. When this is realised, the follow-up interventions are focussing on changing stepwise the land use in the river bed and starting with implementing ecology supporting intervention such as planting trees. Next, interventions to change the river design like lengthening the river and transforming the main channel to a shallower river will make the river ready to safely remove the weirs. Depending on how much time it costs to implement the previously mentioned interventions, implementing innovative weirs or (partly) removing weirs will be taken as the next step before 2050. When it is not possible to remove the weirs before 2050, this will be postponed and aimed to realize between 2050 and 2100. Another suggestion is to remove at least one weir when possible. The reason for doing is this is again creating motivation for change to show people that it is indeed possible and safe to create a river without weirs. This aims to create more support and less resistance to remove the other weirs later on.

#### The pathway “creating the required space for interventions”

The second pathway is characterized by the focus on creating the required space to implement big scale interventions later in the implementation process. Similar to the previous route, this route starts with setting up a management strategy, involving stakeholders and improving the water-holding capacity conditions of the soils in catchment areas. Afterwards, this route is focusing on creating space in the river bed. This is a complex task, because of the existing purposes for agriculture, inhabitants and businesses. Different strategies can be applied, such as establishing new legal rules or create beneficial arrangements to make it attractive to change current practices or relocate further away from the river. These are time and money consuming interventions. However, when space successfully

is created, implementing big scale interventions to redesign the river can be implemented at a rapid pace. When all these interventions are in place, ecology supporting interventions are implemented, e.g. planting trees and applying natural vegetation management. The last phase of implementing or removing weirs is comparable to the first route.

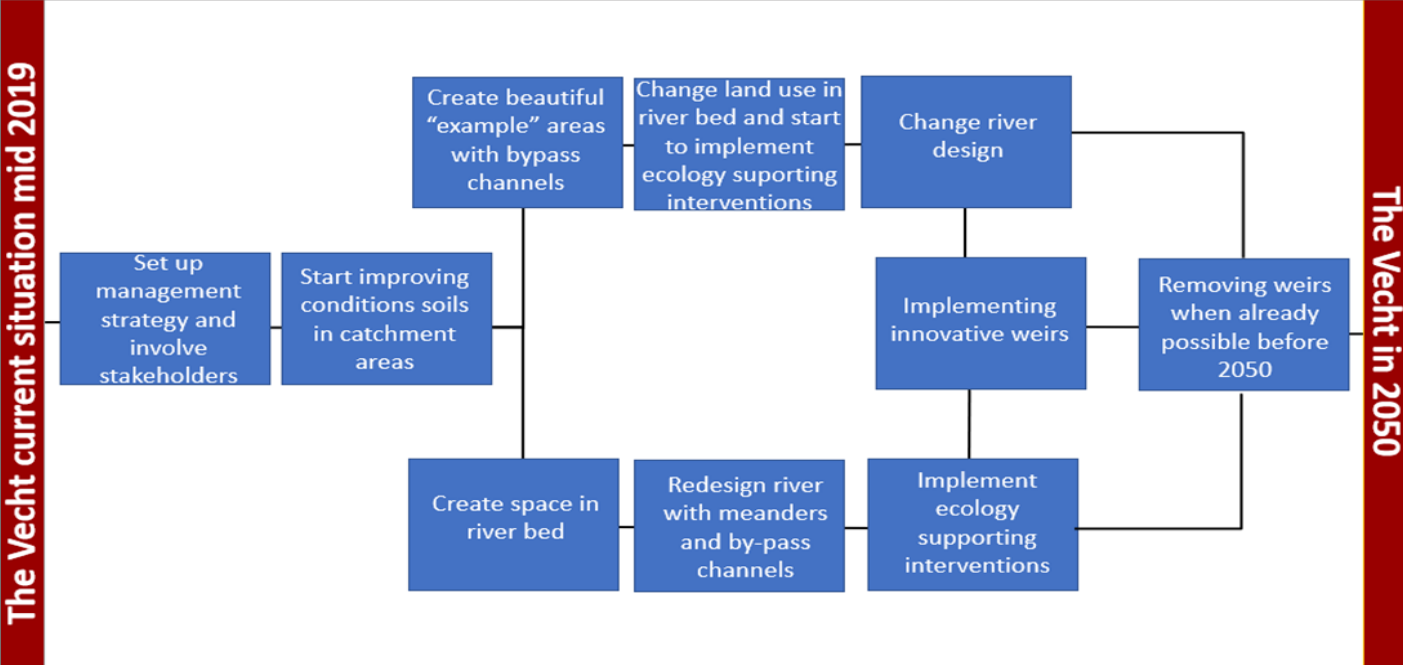


FIGURE 24 CONSTRUCTED OVERARCHING PATHWAYS HALF-NATURAL VECHT 2050

### Changes in the adaptive space

Within the back-casting sessions, stakeholders were asked which possible drivers of change can affect the adaptive space. Subsequently, there was asked which additional interventions can be implemented to still reach the desired end situation within a changed adaptive space.

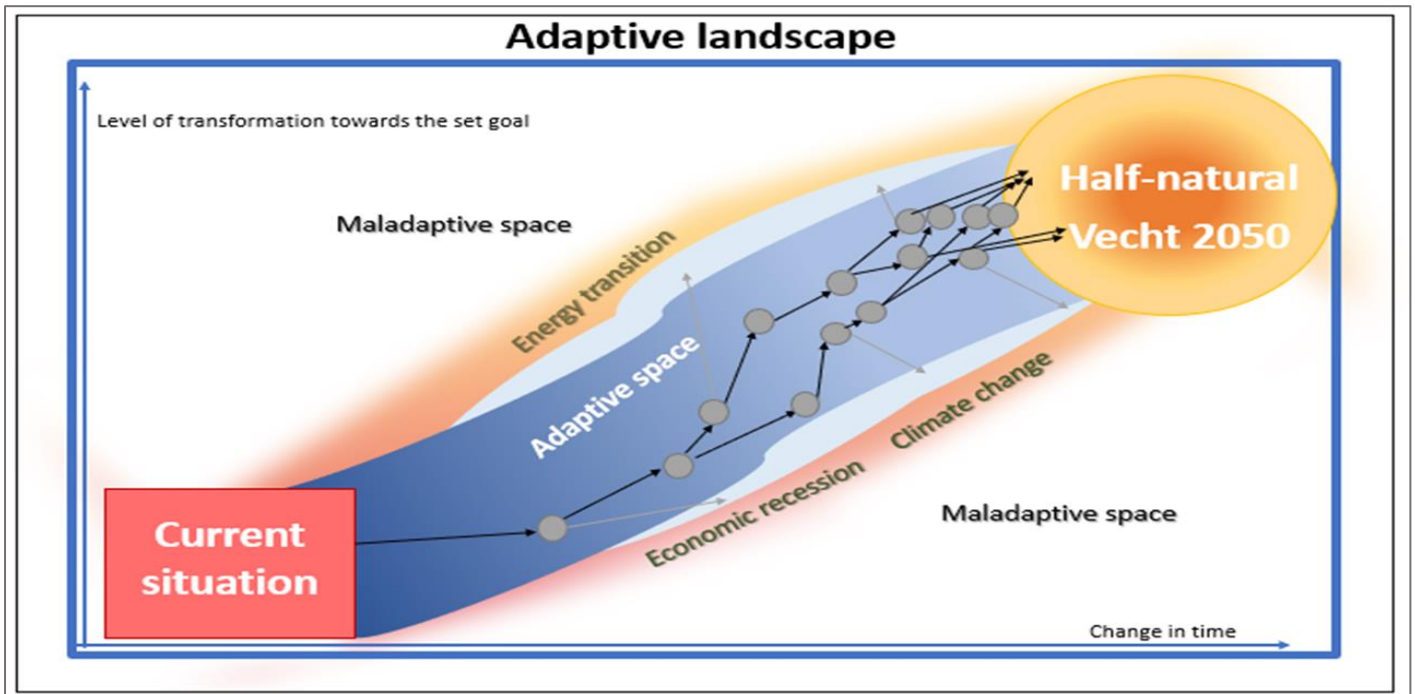


FIGURE 25 CHANGES ADAPTIVE SPACE CLIMATE-RESILIENT PATHWAYS HALF-NATURAL VECHT

Almost all stakeholders stated that climate change is a possible driver. As a likely consequence of climate change, extreme weather events can occur (12). To deal with these effects there is proposed to put more effort in interventions increasing the water-holding in catchment areas. This because it increases the water-holding capacity during precipitation events and can retain the water longer during periods of drought (5, 12). This will affect the constructed pathways in a way that more soils in catchment areas are needed to be improved to reach the new demanded conditions. These new demanded conditions must be achieved before sequential interventions can be implemented. Another proposed intervention proposed to deal with climate change effects is the change in agriculture to grow less climatic sensitive crops, which are in general less water dependent. By doing this, agriculture also becomes less dependent on the fixed water levels of the Vecht, which creates possibilities of making these water levels more. Setting up an evacuation plan, and if necessary heighten the dykes are interventions proposed which are not included in the constructed pathways (3). Establishing an evacuation plan is an intervention which can be realized without influencing other proposed interventions. Heighten the dykes is an intervention not fitting the building-with-nature approach. This intervention is only proposed to be implemented when other proposed interventions cannot sufficiently be realised and climate change creates dangerous situations concerning water safety. Lastly, changing the river design is a proposed intervention which can be implemented to counteract

the effects of climate change. This can be done by shoaling and widening the Vecht more than was planned under the current (12). This can maybe delay other proposed interventions, which decreases the chance of removing the weirs before 2050. In what way and to what extent climate will change occur, determines how the adaptive space, and consequently the constructed pathways, will be affected. Linked to climate change, the energy transition is one of the drivers that determine possibilities for reaching a half-natural Vecht in 2050. The switch towards generating renewable energy is planned to take place within the coming decades (15). Nevertheless, how this will happen is nowadays still uncertain. This makes that the adaptive space can be influenced in different ways. For example, when lands in catchment areas will be used for producing energy, it creates more possibilities to intervene in the river (5). This can speed up the implementation possibilities of interventions within the pathways. When interventions can be implemented at a fast pace, it increases the possibility to reach the needed conditions for removing the weirs before 2050. Alternatively, the energy transition can influence the adaptive space by decreasing the possibilities of intervening within the river areas. For example, this can be due to placing solar panels in the river bed. After this is done, changing the river design or setting natural processes in motion including flooding of designated areas cannot be done anymore at these places (15). This makes is more challengeable to reach the needed conditions for follow-up interventions and can slow down the implementation process. Reaching the conditions in time to remove the weirs will decline.

Lastly, having an economic recession will drastically change the adaptive space, because only money will be available for compulsory tasks and not for such a river restoration project (15). It is stated that the adaptive space will be influenced in such a way that successfully reaching the end of one of the pathways will be almost impossible.

## 6 Discussion

The aim of this study was to create a tangible vision on a half natural Vecht in 2050 and explore overarching pathways to reach this defined situation. This research was based on stakeholder visions and proposed routes of interventions towards a half natural Vecht. This chapter discusses the constructed climate-resilient pathway approach, the used methods and remarkable results. Subsequently, the theoretical and practical contributions and recommendations for future research will be outlined.

### 6.1 The constructed climate-resilient pathway approach

For this research, two different pathway approaches were combined in order to investigate how to realise a climate-robust and half-natural Vecht in 2050. As mentioned in the chapter concerning the conceptual framework, the climate-resilient development pathways approach is generally used in developing countries (Denton et al., 2014). This pathway approach is combined with an adaptation pathway approach in order to make it suitable for the case of the Vecht. The chosen adaptation pathway approach of Wise et al. (2014) focused explicitly on how interventions should be implemented with the aim to not preclude future options within a changing system. Applying the combined approach to the case of the Vecht had several advantages.

First of all, this pathway approach focused on exploring different possible ways to transform a current situation into the desired end situation. Therefore, this pathway approach focused explicitly on the order of interventions, the existing interdependencies between interventions and the possible drivers of change influencing the adaptive space. For example, the proposed interventions in catchment areas are aiming to improve the water-holding capacity. These interventions are generally suggested to start in the short-term. This is because interventions influencing the draining capacity of the Vecht, such as narrowing the Vecht or removing the weirs, can only be implemented when sufficient water can be retained. Furthermore, to fulfil the needed water-holding capacity, interventions must be implemented in a large area and realising this will take a lot of time. To achieve the desired situation in 2050, it is essential to start with these interventions soon. Additionally, changes in the adaptive space can occur for example due to changes in precipitation trends, a likely effect when climate-change occurs (Makaske & Maas, 2015). When more extreme precipitation events will take place, a larger water-holding capacity must be realised within these catchment areas. Using this pathway approach, these relations and possible effects can be identified in advance aiming to avoid maladaptation and lock-ins.

Another advantage of the pathway approach is the opportunity to provide stakeholders with new insights on the reachability of the defined end situation. Some of the river-related characteristics

included in the end vision derived from the workshop were perceived as challenging or impossible during the semi-structured interviews. During the back-casting sessions, a method which was based on the pathway approach, stakeholders were asked to create an intervention route to an end vision including the characteristics that were previously perceived as challenging. When these routes were successfully created, it may result in a growing awareness of the possibilities to make the Vecht more natural by stakeholders.

Besides its multiple advantages, some shortcomings of the approach are recognized. Firstly, the visualisation of the desired situation can be mistaken as a new stable state of the system. Despite the fact that it is visualised as a clearly defined new situation, it does not mean this desired situation is in a stable state. To be clear, it is not compulsory to aim for a stable state within the desired situation. Nevertheless, when the system is not in a stable state, supporting interventions are needed to maintain the current situation or to transform the obtained situation into a new desired situation. Another confusing element of the approach is the fact that climate change is both represented in the desired situation and a possible driver of change. This is related to the fact that the two approaches used, cover climate change in different ways. Within climate-resilient development pathways, it is seen as part of the desired end situation (Denton et al., 2014). Whereas the adaptation pathway of Wise et al. (2014) sees climate change as a possible driver for changing the adaptive space. It seems contrasting, but there is an explication for why climate change is represented in both ways. For example, extreme climate change affects the adaptive space. Where previously interventions were leading to a climate-robust system, these are not sufficient anymore in this new situation and possibly preclude future interventions. Additionally, a climate-robust system is still the desired situation and extreme climate change can make reaching the desired situation more challengeable. These differences are visualised in the figures below.

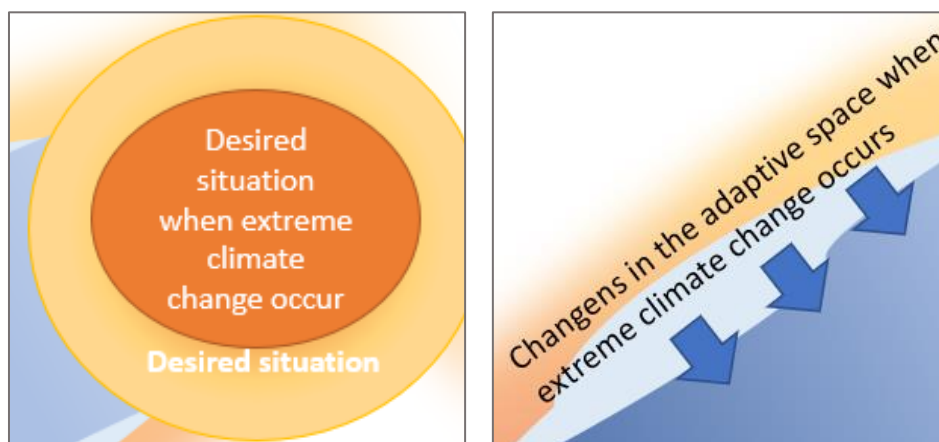


FIGURE 26 EFFECTS OF CLIMATE CHANGE ON THE DESIRED FUTURE SITUATION AND THE ADAPTIVE SPACE



In this case, there was chosen to combine the pathway approach of Wise et al. (2014) with a climate-resilient pathway approach in order to create pathways towards a chosen tangible vision within a climate-robust system. This is perceived as a useful approach for this research. For other possible research, combining other adaptation pathway approaches with a climate-resilient pathways approach can also form a powerful approach. For example, when having the research aim is to investigate climate-resilient development pathways for the Vecht without using a building-with nature approach. Instead of realizing a half-natural river, the aim can be to create a progressive high-tech system which is climate robust as well. A possible fitting approach seems to be a combination of the adaptation pathway approach of Haasnoot (2013) and a climate-resilient development pathway approach (Denton et al., 2014). Instead of the approach of Wise (2014), the approach of Haasnoot (2013) includes multiple end situations. This can create insights on the ways how to reach the different potential desired situations, such as a half-natural and high-tech system, within a single pathway approach. Nevertheless, this is an expectation. Further research must be obtained before it can be stated if these pathways can be combined towards a useful approach.

## 6.2 The applied methods

Three qualitative methods that were applied in this research were carried out in a fixed order eventually leading to the constructed climate-resilient development pathways. In this section, these methods will be discussed one by one.

The semi-structured interviews provided information on the different existing visions and associated river-related characteristics of a half-natural Vecht. There was chosen to focus explicitly on how stakeholders describe a half-natural Vecht instead of focusing on how they outline the future of the Vecht in general. The reason for this was to gain specific information on how the concept of a half-natural river in the case of the Vecht was perceived. To cover all stakeholder groups, one or two stakeholders per stakeholder group were interviewed. By selecting stakeholders to represent their group, it is possible that the outlined personal vision slightly differs from the vision of the stakeholder group in reality. To cover this issue, stakeholder visions were not generalized into stakeholder categories but kept on stakeholder level. This makes this research less usable for generalization. However, it makes the conducted results more reliable for this case of the Vecht.

The stakeholder workshop organised by Lumbricus narrowed down the existing different visions on a half-natural Vecht into a single end vision. This constructed end vision was used as the desired end situation within the back-casting session. The workshop was a useful method to bring a lot of expertise together in a single place. During the workshop, stakeholders were given the opportunity to state why they suggest a certain vision and elaborate on the underlying reasons to explain their vision. Due to this workshop, it became possible to narrow down the different stakeholder visions and to create a

single end vision. The involved stakeholders were a selected group of nine stakeholders, all related to or familiar with the Lumbricus project. Within this selected group, not all existing stakeholder parties involved were covered during the workshop. Nevertheless, there were sufficient stakeholders, for example from water authorities, who indirectly have to represent the missing stakeholder groups.

In order to collect the necessary data to construct pathways, narrow back-casting sessions were conducted. This method was experienced as useful because it provided relevant data on which interventions were proposed, the order of the proposed interventions, the interdependencies between the proposed interventions, possible changes in the adaptive space and the possible extra interventions that could be implemented when the adaptive space have changed. With this data, it was possible to construct climate-resilient development pathways. However, sufficient knowledge of technical interventions by stakeholders was needed to conduct the back-casting sessions. This resulted in the exclusion of stakeholders with particular knowledge on social-economic aspects from the back-casting sessions. A suggestion for future applications to overcome this exclusion is to conduct back-casting sessions with two or three selected stakeholders from the same stakeholder party. These selected stakeholders should be a mix of stakeholders with expertise in technical aspects and social-economic aspects. During a back-casting session, they can complement each other with knowledge of their own expertise. For this case, several stakeholders had knowledge of both the technical and the social-economic aspects. This results in inclusion of socioeconomic aspects within intervention routes and pathways, be it less explicitly than if all stakeholders would be included.

### 6.3 Critical results

As mentioned before, the end vision constructed during the stakeholder workshop could be placed between the two most natural vision categories. The reason for this is possibly the selected group of stakeholders presented during the workshop. This group consisted mainly of stakeholders supporting the more natural vision categories. It is important to be aware of that. Nevertheless, each vision was represented with at least one stakeholder. Additionally, no stakeholder mentioned this as an issue during the back-casting sessions.

One of the most surprising results of the proposed routes was that in seven out of eight back-casting sessions removing the weirs was a suggested intervention. It is important to state that many stakeholders expressly made the condition that this should only be done when if it was safe to do. Otherwise, it was suggested to postpone this intervention or implement innovative weirs. During the semi-structured interviews, this intervention was often stated as impossible or at least challenging to reach based on the current set constraints. There is no apparent reason why stakeholders changed their minds on this topic. It could possibly be related to the more natural end vision derived from the workshop. Nevertheless, removing the weirs was not one of the needed characteristics to reach the

desired future situation. Alternatively, it could be related to the different research methods applied in this thesis. The back-casting session visualized the interventions in time, whereas during the semi-structured interviews only spoken the visions, characteristics and interventions were discussed. With this visualisation, stakeholders possibly became more aware of the option to reach a situation where weirs could be removed. It could also be due to newly obtained knowledge on the possibilities of removing the weirs between the semi-structured interviews and the back-casting sessions. Maybe the stakeholder workshop or other ongoing projects focusing on the future of the Vecht could have provided new insights which changed stakeholder views in relation to removing the weirs.

Based on the proposed intervention routes by stakeholders, two overarching pathways were constructed. One pathway is focused on motivation for change, where the other is focused on creating space to do interventions. These two pathways can be linked to two different forms of governance. Preferring one type of governance above the other can explain the choice between the pathways. The pathway focusing on motivation for change can be linked to a more inclusive form of governance (Akhmouch & Clavreul, 2016). Within this pathway, the opinion of the stakeholders is key and further interventions are implemented when there is sufficient support created. The pathway focusing on creating sufficient space at first can be linked to a more traditional top-down form of governance (Akhmouch & Clavreul, 2016). Interventions are more imposing or established in a way to make it attractive for stakeholders to change their current practices. This means that stakeholders do not have to support the desired end situation but perceive established constructions as beneficial enough to change their current practices. In addition, the preferred type of governance by decision-makers can influence the choice between the pathways. This can also depend on how the trend of people's perception of nature unfolds within the coming years. When the public opinion evolves in such a way that nature is perceived as important, the pathway focusing on motivation for change could possibly be a more fitting pathway. When this trend does not occur, the pathway focusing on realizing the needed space could possibly be a better fit.

#### 6.4 Theoretical contributions

This thesis aims to contribute research on the possibilities of applying a climate-resilient development pathway approach on a water management case in a developed country. To the best of the researcher's knowledge, this is the first study to do so. However, this study focussed exclusively on the first steps of creating climate-resilient development pathways, meaning only insights on these steps could be gained. This type of pathway during this research was experienced as a useful approach within a water management case in a developed country. The reason for this is its combination of including both transforming the current situation to the desired situation and focusing on realizing a climate robust system within this pathway approach. Especially the back-casting method derived from another

application of a climate-resilient development pathway approach provided innovative insights (Werners et al., 2018). In case of the Vecht, the formulated end vision derived from the workshop was already more ambitious than most visions conducted during the semi-structured interviews. During the back-casting, stakeholders became even more ambitious by implementing interventions which were stated as impossible in the current social-ecological landscape during the semi-structured interviews. In this research, back-casting sessions as part of developing climate-resilient development pathways was perceived as an impactful method. Particularly, because it gained essential data enabling to construct the pathways and increased knowledge about the future possibilities among stakeholders.

## 6.5 Practical contributions

The practical contributions are most related to raising awareness and further establishing developing pathways for the Vecht. This research contributes to improving the awareness of the multiple existing perceptions of a half-natural Vecht by the outlined stakeholder visions and its associated river-related characteristics. This can be useful for decision makers. Resistance can occur when implementing interventions in order to reach a half-natural Vecht when stakeholders have conflicting visions on what this half-natural river included. Using this research, decision-makers could, for example explain more explicitly what they mean by ‘a half-natural Vecht’ or meet with all stakeholders to create together a clearer future desired situation. Moreover, this research can provide knowledge for further establishment of development pathways for the Vecht. The constructed pathways in this research were kept quite general but form the basis for more detailed pathways where types of intervention are scaled down to single interventions. For example, it can be downscaled to the level where the removal of each weir is a single intervention instead of seeing the weirs as one big intervention. This provides more insights on when every single intervention can be realised.

## 6.6 Future research

In the following section, suggestions will be outlined for future research. As stated above, scaling down the pathways could be useful follow-up research. Next, doing cost-benefit research of the different intervention routes could provide insights on the realizability of implementing the proposed interventions. Another possible follow-up research can be a scenario analysis on the proposed routes to see if the routes are possible within multiple plausible future scenarios. To broaden the scope on applying climate-resilient development pathway, this approach can be applied to another water management case in a developed country. Afterwards, the two or more researches can be compared and more generalized when possible. Moreover, climate-resilient development pathways can also be applied to other sectors in a developed country context. An interesting option can be the energy transition, where the desired future situation includes generating only renewable energy within a climate-resilient system.

## 7 Conclusion

This research aimed to answer the research question: *What are the key characteristics and possible envisioned pathways towards a half-natural Vecht in 2050 according to stakeholders?* This research question was formulated to create more clarity on the concept of a half-natural river in case of the Vecht and to investigate the possibilities on how to reach a half-natural Vecht in 2050.

Within this research, four different vision categories with associated river-related characteristics were established describing how a half-natural Vecht should look like in 2050. These different visions are ranging from a half-natural Vecht which is almost similar to the current state toward a half-natural Vecht which is much more natural than the current state. During the workshop on goal setting organised by the Lumbricus project, the different visions were narrowed down to a single end vision on a half-natural Vecht in 2050. This outcome could be placed between the two most natural vision categories. The river-related characteristics included in this defined end vision on a half-natural Vecht in 2050 are shown in the figure below.

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>• Water and sediment flows are in place</li><li>• A slightly higher baseflow and a lower peak flow are realised</li><li>• Water quality has improved</li><li>• In catchment areas, interventions are taken to ensure desiccation is not a (financial) problem.</li></ul> | <ul style="list-style-type: none"><li>• Agriculture in winter is bed nature inclusive</li><li>• River is seen as one system including catchment areas which are affected by implemented interventions</li><li>• All river banks are natural</li><li>• Recreation is possible in diverse forms on the Vecht</li></ul> |
|--|--|

FIGURE 27 GOAL ASPECTS END VISION BACK-CASTING SESSIONS

Subsequently, two overarching pathways were constructed to reach the defined end situation of a half-natural Vecht in 2050. Both pathways are starting with the interventions of setting up a management strategy, involving stakeholders and increasing the water-holding capacity of soils in the catchment areas. From there, the pathways split up into two different directions based on two different strategies. The first pathway is characterized by the focus on motivation for change aiming to decrease resistance and increase support for follow up interventions. The second pathway is characterized by the focus on creating the required space within the Vechtdal first and starting from there with interventions to create a half-natural river system. Both pathways end up with interventions of removing or replacing the current weirs. When all needed conditions are in place, the weirs will be removed. Following the motivation for change approach of the first pathway, maybe one weir can be removed as a role model for the other weirs later on. In case none of the weirs or not all weirs can be removed, innovative weirs are suggested to be implemented to replace the current weirs.

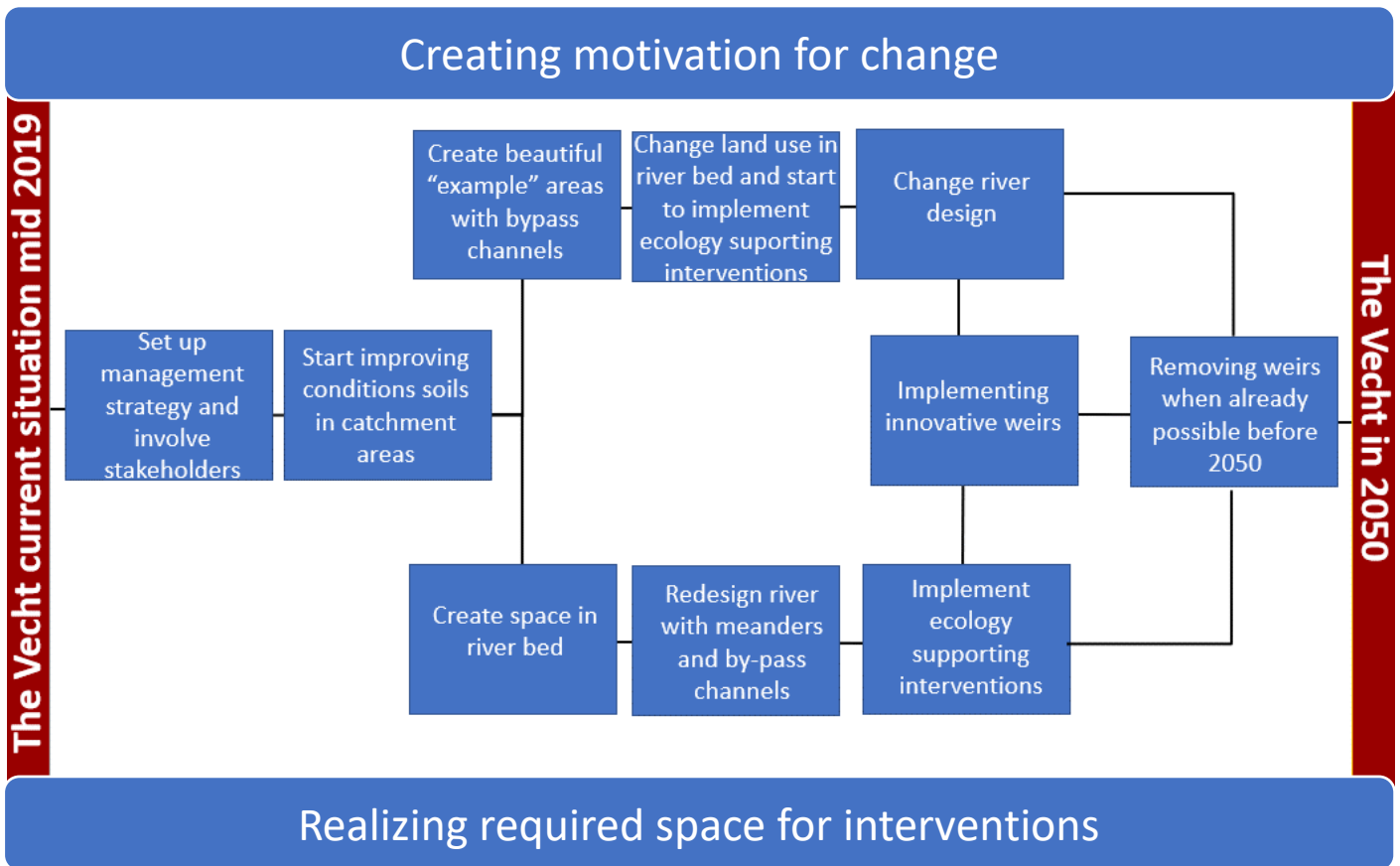


FIGURE 28 THE CONSTRUCTED OVERARCHING PATHWAYS

Several potential drivers of change were identified which can influence the adaptive space, which influences the possibilities to implement interventions. The identified drivers were climate change, the energy transition and a possible economic recession.

All in all, this research has outlined the different existing visions among stakeholders on a half-natural Vecht. Furthermore, it transformed proposed routes of interventions into two overarching pathways to envision possible ways of reaching a half-natural Vecht in 2050. Hopefully, this research provides new insights into the possibilities of how to realize a climate-resilient and half-natural Vecht in the coming decades.

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# Appendix

## Appendix I: overview interviewed stakeholders

**TABLE 9 OVERVIEW INTERVIEWED STAKEHOLDERS**

interview number	organisation	function	back-casting interview colour
1	Farmer interest organisation	Board member	x
2	Public organisation for managing nature reserves	Accountmanager	x
2	Public organisation for managing nature reserves	Provincial adviser	x
3	Province Overijssel	Former program secretary	grey
4	Independent, former water authorities	Project leader fish migration project Vecht	dark blue
5	Wageningen University and Research	Geomorphologist	purple
6	Municipality located next to the Vecht	Water specialist	x
7	Umbrella organisation for fishing (associations)	Head of department research and advise	dark blue
8	Farmer interest organisation	Project adviser area planning processes	orange
9	Water authority Vechtstromen	Hydrologist	brown
10	Wageningen University and Research	Scenario specialist	x
11	Water authority Drents Overijsselse Delta	Adviser ecology and water quality	light blue
12	Wageningen University and Research	Aquatic ecologist	yellow
13	Regional entrepreneurial network organisation	Recreation entrepreneur and board member	x
14	Regional nature organisation Overijssel	Project leader water, food and climate adaptation	x
15	Water authority Vechtstromen	Strategist	green

## Appendix II: Semi- structured interview questions Dutch/ English

### Dutch

#### **Achtergrond van de stakeholder:**

1. Wat is uw expertise/vakgebied?
  - Expertise binnen beekherstelprojecten
2. Wat is uw visie op beekherstel projecten in het algemeen?
  - Wat is het belang volgens u?
3. Wat is uw rol binnen het Lumbricus project tot nu toe?
  - Sinds wanneer bent u betrokken bij de Vecht of andere beekherstelprojecten?
  - Hoe komt uw expertise terug in het project?
4. Wat is uw rol de komende twee jaar binnen het project?

#### **Ontwikkelpaden**

5. Wat zijn uw ervaringen met het ontwerpen van ontwikkelpaden?

#### **Streefbeelden en aspecten binnen een half-natuurlijke rivier:**

6. Binnen u expertise/vakgebied, aan welke aspecten zou volgens u de Vecht moeten voldoen om een half natuurlijke rivier te zijn?
7. Als u kijkt naar andere betrokken expertises/vakgebieden, aan welke aspecten zou volgens u de Vecht moeten voldoen om een half natuurlijke rivier te worden?
8. Zou u kunnen beschrijven hoe volgens uw visie de Vecht eruit zou moeten zien in 2050? kunnen?
9. Wat zijn minimale eisen waaraan de Vecht zou moeten doen om te worden gezien als half-natuurlijke rivier?

#### **Verzamen implementatie mogelijkheden backcasting:**

10. Wat zijn verschillende implementaties binnen beekherstel die u kent om de Vecht te transformeren naar een half-natuurlijke rivier?

#### **Verzamelen namen interviews:**

11. Welke mensen zou ik volgens u nog meer kunnen benaderen om dit interview mee af te nemen die kunnen bijdragen aan een complete omschrijving van een half natuurlijke rivier?

Translated to English:

**Background information of the stakeholder:**

1. What is your field of expertise?
  - Do you have experience with brook/river restoration projects?
2. What is your vision on brook/river restoration?
  - What is according you the aim of such types of projects?
3. Are you involved with Lumbricus? So yes, what is your role within the Lumbricus project so far?
  - Since when are you involved within restoration projects of the Vecht or other restoration programmes
  - How does your field of expertise come back in the projects?
4. What is your role in the Lumbricus project for the coming two years

**Development pathways:**

5. What are your experiences with creating development pathways?

**Vision and characteristics of a half-natural river**

6. Within your field of expertise, which aspects must be realised according to you to call the Vecht a half-natural river?
7. When you look to other fields of expertises, aan welke aspecten zou volgens u de Vecht moeten voldoen om een half natuurlijke rivier te worden?
8. Could you describe how according to your vision the Vecht should look like in 2050?
9. What are the minimum requirements the Vecht should meet to be seen as a half-natural river?

**Collecting possible interventions back-casting sessions:**

10. What are the different interventions within brook/river restoration you know which can contribute to the transformation to a half-natural river?

**Collecting other people for other interviews**

11. Which people you recommend I can contact for an interview which will contribute to getting a complete description of a half-natural river?

## Appendix III: questions during back casting sessions Dutch/English

Dutch:

### **Vragen over de voorgestelde route van interventies:**

- Waarom kiest u voor deze maatregelen?
- Waarom heeft u niet voor de andere interventies gekozen van de vooraf gemaakte interventie kaarten?
- Waarom heeft u voor deze volgorde gekozen?
- Zijn maatregelen van elkaar afhankelijk, zo ja wat zijn de afhankelijkheidsrelaties? (en wilt u ze aangeven met een rode pen)

### **Vragen over de adaptive space:**

- Wat zijn mogelijke drivers voor veranderingen van de adaptive space?
- Wanneer er mogelijke drivers zijn, wat zijn extra interventies die toegepast kunnen worden om alsnog onder deze omstandigheden het gedefinieerde doel te bereiken?

Translated to English:

### **Questions about the proposed route of interventions:**

- Why have you proposed these interventions?
- Why have you not chosen for the other pre-made intervention cards?
- Why have you chosen for this particular order?
- Are interventions interdependent, so yes what are these interdependencies? (and could you draw these with a red pen)

### **Questions about the adaptive space:**

- What are the possible drivers which could change the adaptive space?
- When these possible drivers occur, what are extra interventions which could be implemented to still reach within the new circumstances the defined aim?

Appendix IV: photo's back-casting session

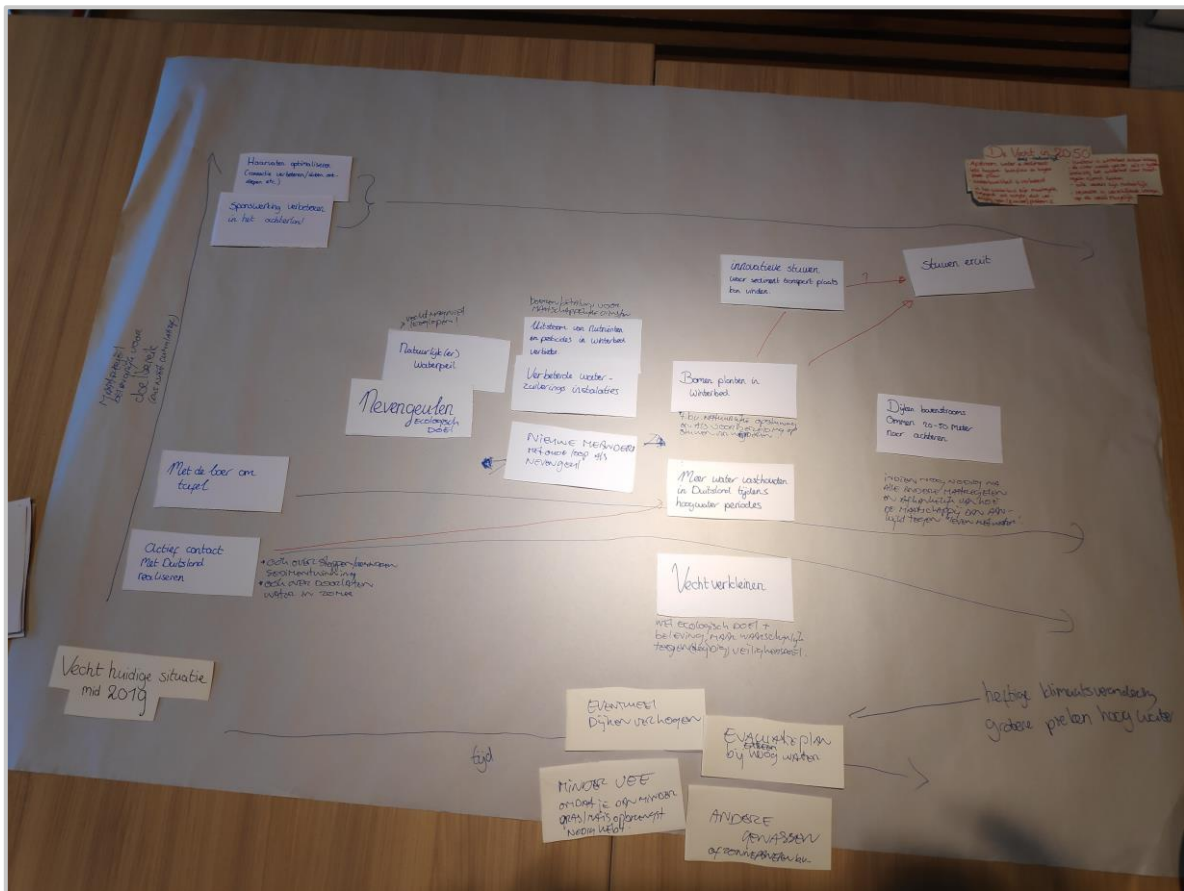


FIGURE 30 PHOTO BACK-CASTING SESSION INTERVIEWEE 3

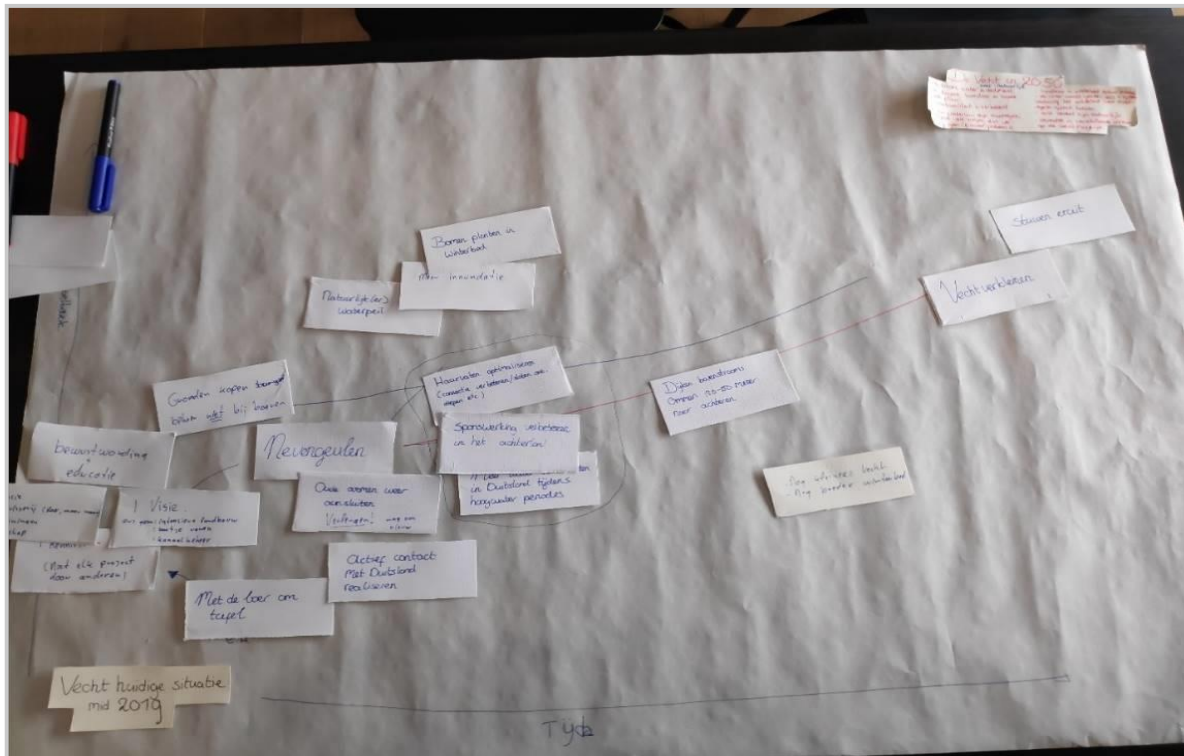


FIGURE 29 PHOTO BACK-CASTING SESSION INTERVIEWEES 4/7

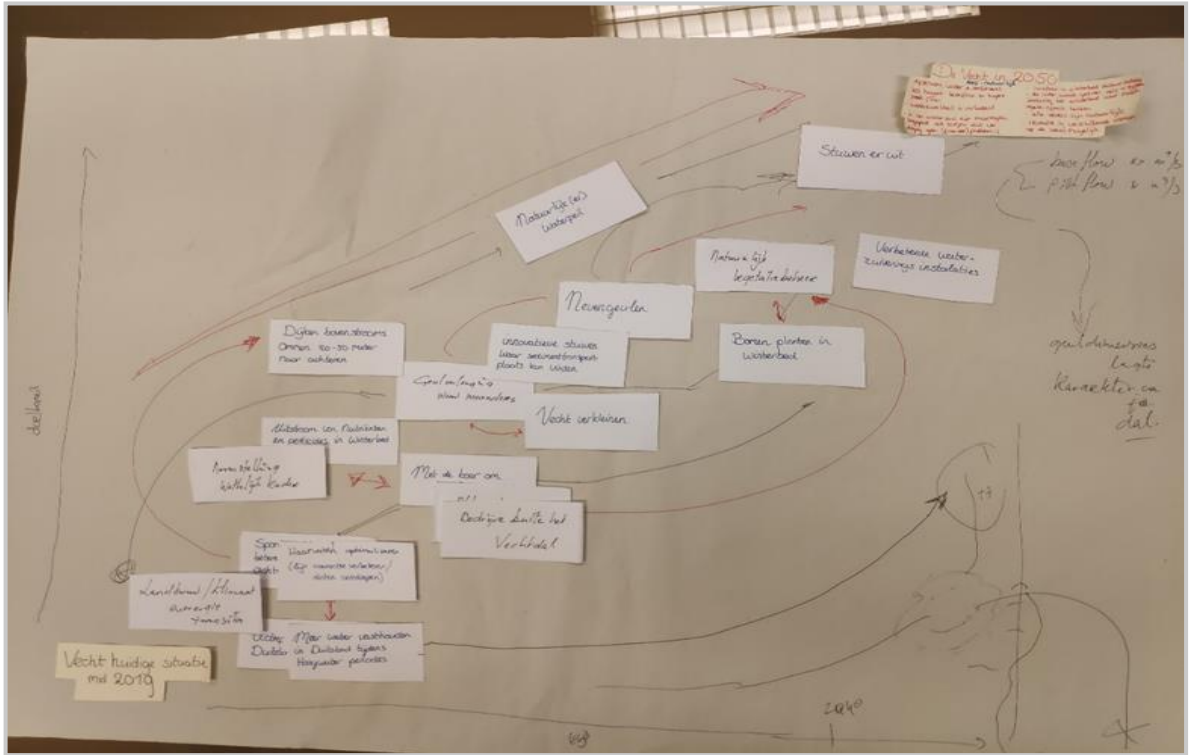


FIGURE 31 PHOTO BACK-CASTING SESSION INTERVIEWEE 5

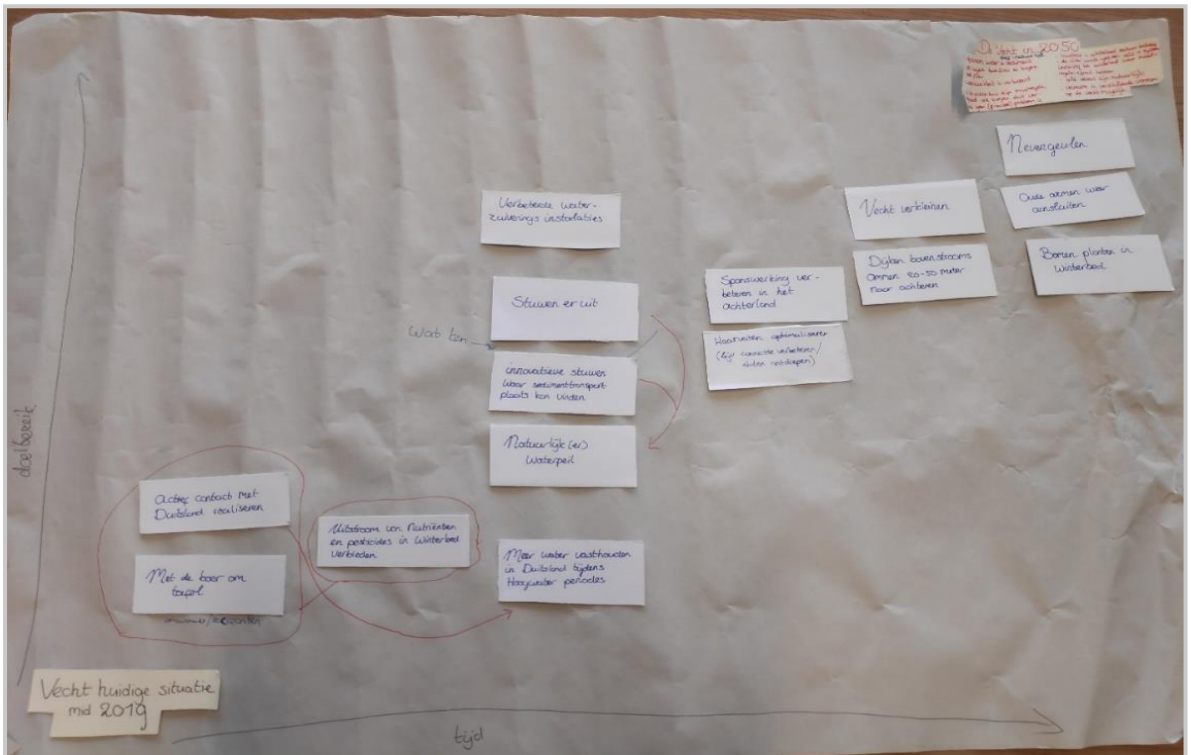


FIGURE 32 PHOTO BACK-CASTING SESSION INTERVIEWEE 8



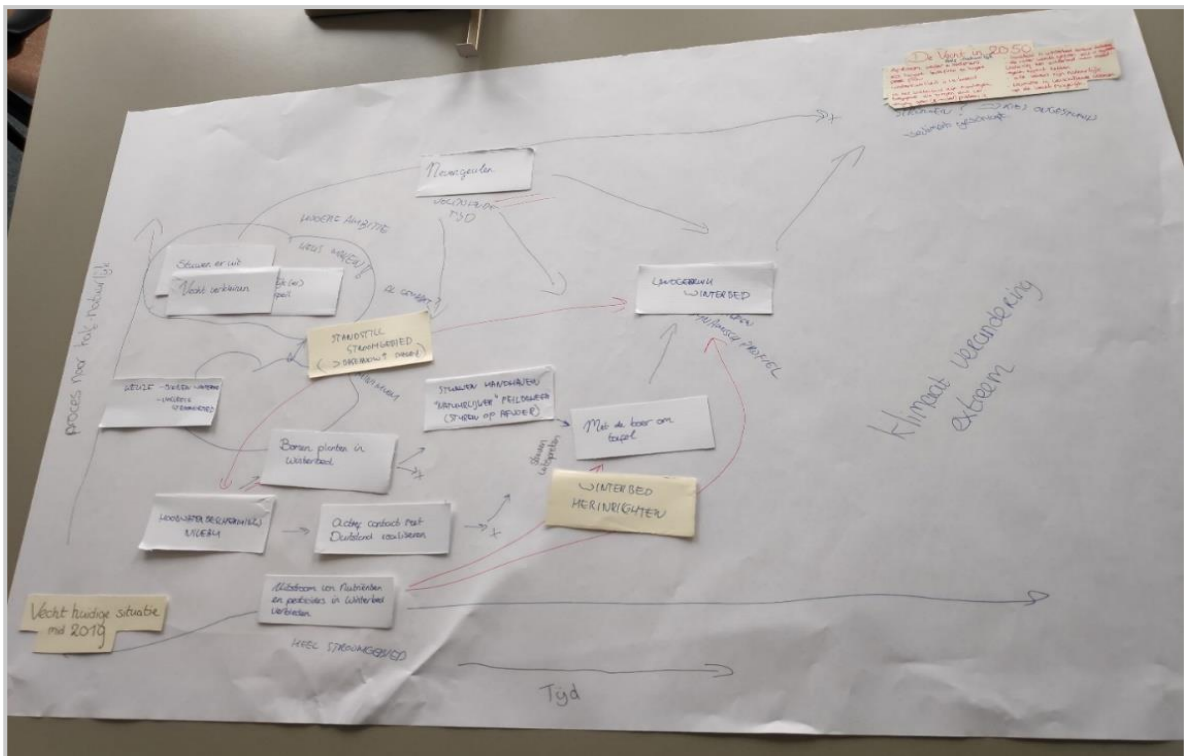


FIGURE 34 PHOTO BACK-CASTING SESSION INTERVIEWEE 9

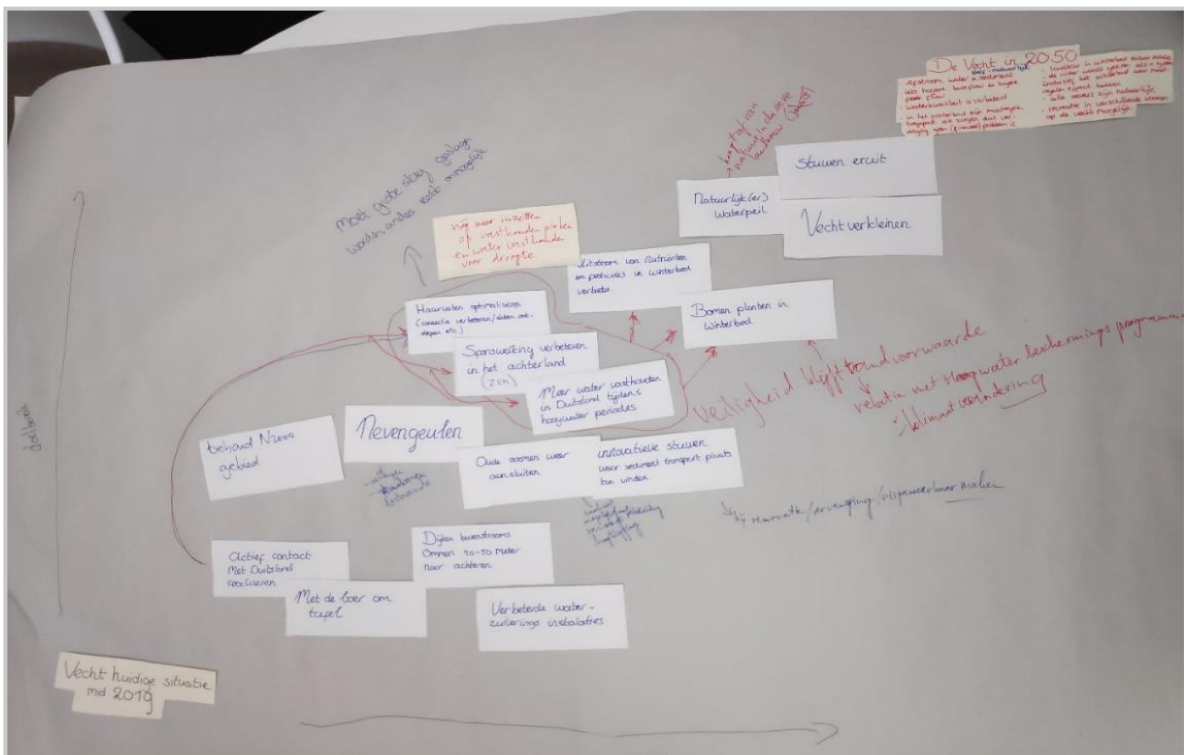


FIGURE 33 PHOTO BACK-CASTING SESSION INTERVIEWEE 11



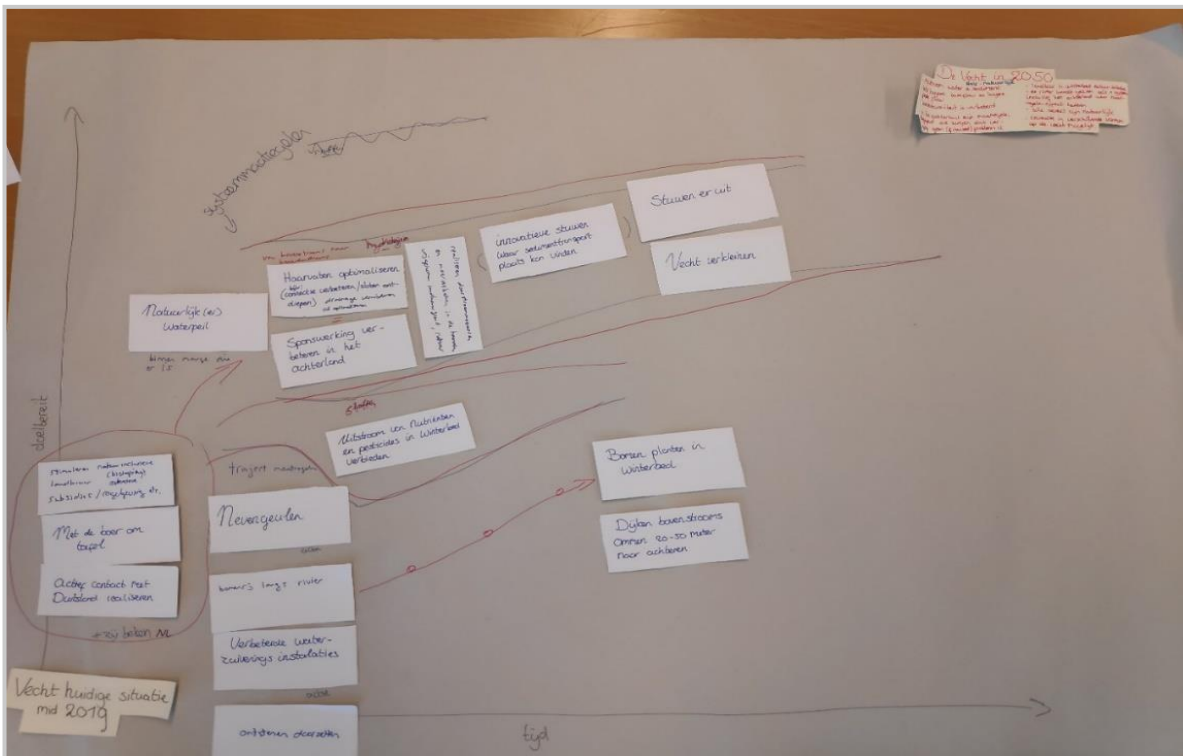


FIGURE 35 PHOTO BACK-CASTING SESSION INTERVIEWEE 12

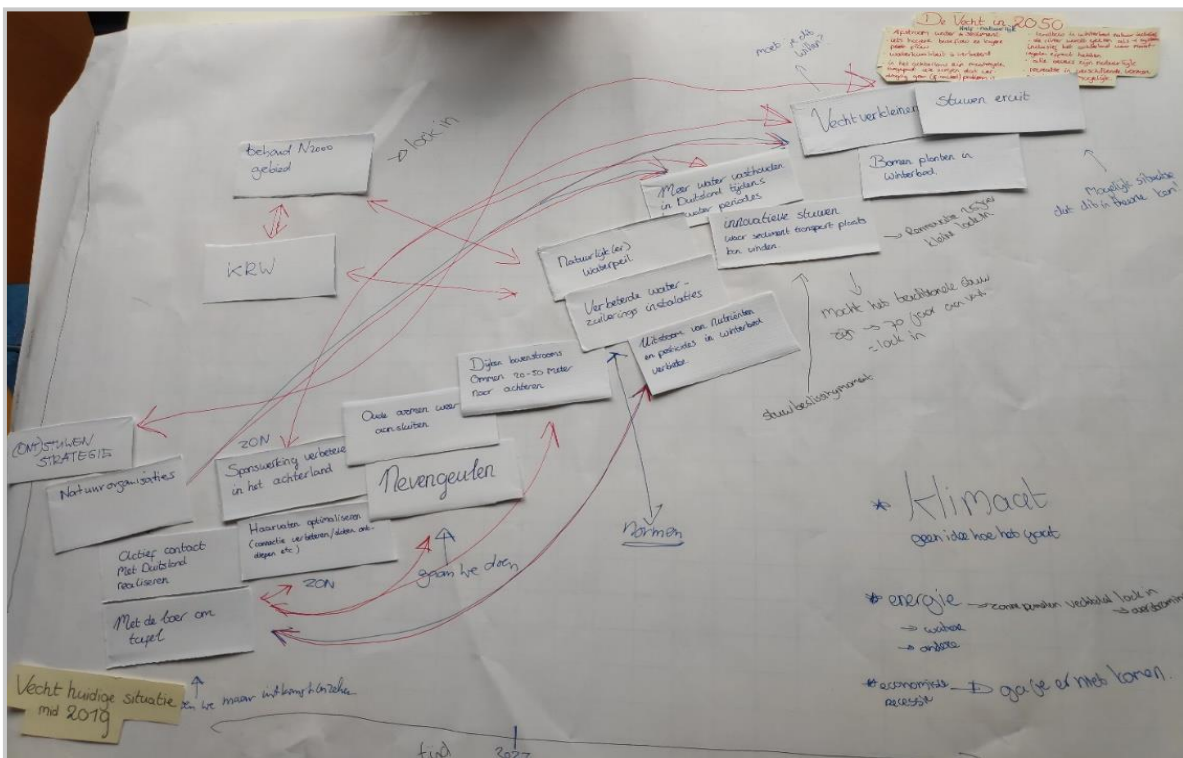


FIGURE 36 PHOTO BACK-CASTING SESSION INTERVIEWEE 15

## Appendix V: Notes back-casting sessions derived from audio recording (in Dutch)

TABLE 10 NOTES BACK-CASTING SESSIONS INTERVIEWEE 3

### Aspecten:

- Wat je bij meerde hebt is dat het de hele tijd loopt
- Spongiteit nu mee beginnen en doorlopend, haarvaten optimaliseren gaat daarmee samen
- Oude armen aansluiten bijzonder omdat het oorspronkelijke idee was en dat doen ze ook bij de Lippe in Duitsland. Hier is het idee dat de ecologische waarde van de armen die is ontstaan kan blijven bestaan wanneer niet hele armen aansluiten. Het is goedkoper dan nieuwe geulen graven dus kan je meer laten meanderen. In feite doe je het voor een hogere peakflow.
- Dijken bovenstrooms Ommen 20 -50 meter naar achter kan voor de natuurlijke rivier positief is, maar heeft nog wel een aantal andere consequenties. Het is niet aan mij om die afweging te maken. Ga er wat opmerkingen bijzetten. Je hebt oplopende flanken, met een aantal dijken wel. Dan zou het water verder naar achterlopen en wat zouden daar de kosten van zijn.
- Nevengeulen is voor mij heel erg gericht zoals de term voor het waterafvoerend vermogen
- Actief contact realiseren met Duitsland, voor waterberging. Vraag waarvoor contact nog meer mogelijk zou zijn. Marlies legt uit over de sedimentwinning.
- Nutriënten en pesticides verbieden: is daar een wet voor? Volgens leggers niet. Misschien voor KRW maar zijn doelen en geen wet
- Waterpeil gaat wel wat sneller
- Stuwen eruit achteraan
- Bomen planten in winterbed, oobos. Iets eerder omdat je ze moet aanplanten
- Verbeterde waterzuiveringsinstallaties. Zij voldoen waarschijnlijk nu aan de normen. Die moet samen met de nutriënten en pesticides.
- Vecht verkleinen, dan gaat het ene doel tegen het andere in. Dit was van oorsprong het idee, maar denk niet dat at hem gaat worden. Aan de kant de secundaire dijken hebben een lagere norm en die norm gaat er ook nog af
- Dit zijn eigenlijk allemaal dingen die gaan over half natuurlijk en niet over veiligheid. Vanuit ruimte voor de vecht sta je voor meerdere doelen. Het half natuurlijke staat dan vooral ook voor waterveiligheid. Voor het doel van het natuurlijke is dit goed. Half natuurlijk gaat dan ook over de stroming. Alleen voor de veiligheid.
- Er zijn allerlei dingen die naast elkaar kunnen/moeten. Het is ook van alle kansen moet je pakken
- Met de boer om tafel gebeurd de hele tijd. Op sommige momenten ga je wetterlijker aan de gang, maar praten moet altijd
- Haarvaten en sponswerking zijn echt heel belangrijk voor het doelbereik
- Verbetering installaties plus pesticides en nutriënten verbieden ook aardig belangrijk voor doelbereik
- Natuur-inclusieve landbouw winterbed Je hebt een periode nodig om het te regelen, dat kost tijd en de tijd wordt er steeds meer rijp voor. De laatste tijd is opeens klimaat een belangrijk issue. Niet direct daaraan gelinkt, maar biodiversiteit wordt telkens belangrijker. En steeds meer regelgeving voor boeren. Binnen GLB gemeenschappelijk landbouwbeleid Europa krijgt ook weer een vergroeningsslag de komende paar jaar. Je zou daar ook kunnen gaan voor het betalen in de uiterwaarde als boeren met een maatschappelijke dienst.
- Contact met Duitsland kan vanaf nu. Duitsland kan veel gehaald worden, maar wel belangrijk dat je je eigen boel op orde maakt en je niet daar te veel op vast pint.
- Het stukje veiligheid zit in de peakflow naar beneden

<ul style="list-style-type: none"> <li>• Nevengeulen hebben we er twee van, die met een ecologisch doel en die met een veiligheidsdoel.</li> <li>• Deze ecologische nevengeulen kunnen wel snel, zijn wat kleiner dus wat makkelijker te realiseren en werken goed voor doelbereik.</li> <li>• Nieuwe meanders helpt ook veel bij. Dat zou nog wel even duren. Dat is meer een financiële kwestie. Pijltje terug is misschien ook wel eerder. Veiligheid nevengeulen. Bij die nieuwe meanders hoe ze nu gegraven worden bij Hardenberg /Junne bijvoorbeeld, dan wordt de oude stroom, daar komt een dammetje in en is dat de nieuwe nevengeul. Ik zou daar eerder voor pleiten dan voor alleen maar nevengeulen, want dan heeft het meerdere doelen. Deze niet doen en dan meanders met oude loop als nevengeul.</li> <li>• Vecht verkleinen, mits mogelijk in verband met veiligheid.</li> <li>• Ik denk dat je overal in moet zetten. De kansen spreiden. Uiteindelijk zal niet alles lukken, maar de maatregelen die echt bijdragen aan de gezette doelen, die zal je toch wel moeten proberen.</li> <li>• Bomen planten in winterbed: die vind ik dus hieraan vast zitten ten behoeve</li> <li>• Van natuurlijke opstuwing. Met als voorbereiding met de stuwen eruit.</li> <li>• Innovatieve stuwen: dit kan ook samenhangen. We gaan ook nog even zo lijntjes trekken.</li> <li>• Of het echt die kant op moet of niet dat kan je dan zien.</li> <li>• Dit is zo'n maatregel, indien nog mogelijk doen.</li> <li>• Afhankelijk van hoe mensen dan kijken tegen omgaan met water</li> </ul>
<p><b>Afhankelijkheidsrelaties:</b></p> <ul style="list-style-type: none"> <li>• Deze twee met Duitsland (water opslag), maar ook met sediment winning</li> <li>• Sediment zou uitgezocht moeten worden, want misschien zit dat erop.</li> <li>• Op as niet cumulatief, maar doelbereik per maatregel.</li> <li>• Natuurlijker waterpeil, ik ga wel voor natuurlijker. Met name het winterpeil moet hoger en het zomerpeil kan misschien iets lager.</li> <li>• Contact met Duitsland over nieuwe afspraak over minimale debiet. We zijn gewend om meer iets te doen tegen het hoogwater dan tegen het laagwater.</li> </ul>
<p><b>Heftige klimaatsverandering:</b></p> <ul style="list-style-type: none"> <li>• Eventueel dijken omhoog bij hoog water</li> <li>• Evacuatieplan bij hoog water</li> <li>• Bij droogte minder vee in iedere situatie, minder gras en minder mais nodig. Minder vee dan kan je dat leien. En eventueel andere gewassen.</li> </ul>

TABLE 11 NOTES BACK-CASTING SESSIONS INTERVIEWEE 4/7

<p><b>Aspecten</b></p> <ul style="list-style-type: none"> <li>• Met de boer om tafel is een doorlopend proces. Ik denk dat je dit altijd moet doen, hoe wel je kunt wel met de boer om tafel maar als hij niets wilt dan schiet je niet op.</li> <li>• Dit is altijd goed. Hier kan je snel mee beginnen</li> <li>• Vecht verkleinen moet wat later, er zijn nog steeds hydrologen die het groter willen. Dit is ook een omslag van mensen</li> <li>• Sponswerking en haarvaten optimaliseren horen bij elkaar. Sponswerking hoort ook met Duitsland.</li> <li>• Natuurlijker waterpeil kan je vandaag mee beginnen. Ik denk dat mensen daar veel te druk zich over maken. Als je het peil 10 centimeter verhoogt over verlaagd, dan staat de provincie en de boeren echt niet meteen bij je op de stoep. Dat is een soort mythe die leeft.</li> <li>• Bomen in het winterbed, een hele mooie.</li> </ul>
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- Oude armen aansluiten is voor verlenging van de Vecht. Bij Junne ligt die oude arm veel te hoog, dan trekt die de hele arm leeg. Dus soms moet je nieuwe armen graven.
- Nevengeulen realistischer. Creëert ook stromend water, maar andere keuze dan echt in de rivierarmen erbij creëren. Je moet zo veel mogelijk stromend water hebben. Hoe je die puzzel oplost met die twee weet ik niet.
- *Het is ook wat is realistisch. Stuwen er nu uit kan niet, dat is niet realistisch. Dit is het ideaal*
- Het is of dit of dat
- Heel veel dingen hangen met elkaar in het verlengen. Je zult eerst moeten zorgen dat het huidige water regime past bij het systeem. Eerst in de bovenloop zou je dingen moeten doen om andere dingen ook te kunnen doen. Het is nu zoals je een wc doorspoelt, dat alles weg stroomt.
- Innovatieve stuwen niet want dat is weer een kunstingreep en daar wil je vanaf
- Met de boer om tafel moet je niet in doorslaan.
- *Er zal een extensievere manier van grondgebruik plaats gaan moeten vinden*
- *Waterzuivering is volgens mij niet het probleem. Nutriënten is niet het probleem. Pesticides en medicijnen misschien maar niet één van de belangrijkste zaken.*
- Er moet één duurzaam kernteam met macht die er helemaal inzet worden opgericht die één visie vaststelt.
- *Ik denk dat de visie deels van de provincie zou moeten komen. Waterschap is de verkeerde plek hiervoor. Die is gefocust op waterveiligheid en water aan en afvoer. Dit moet een provincie zijn, want het moet een overkoepelend verhaal zijn.*
- Ik vind dat in het kernteam provincie, sportvisserij Nederland, waterschap, Wageningen moeten zitten. Zet erbij raar en waar.
- Het water vasthouden beginnen in Duitsland
- *De vraag is of je het snel kan realiseren. Duitsland heeft een heel andere cultuur en water is anders gemanaged.*
- De Vecht zou 3 meter omhoog moeten, dat is een lang proces.
- Wanneer je nevengeulen doet, dan kies je ervoor dat je het oude systeem in stand blijft
- *Een stuw eruit halen als voorbeeld om te laten zien dat het kan.*
- *Misschien moeten we wel naar uiterwaarden afgraven, misschien moet daar eerst wel naar gekeken worden naar wat is er nodig om die hoogwaterpieken te geleiden. Dan kunnen we de angst weghalen bij andere partijen. Dan gaat verder dan dit. Ik denk dat we daar nog heel goed over moeten nadenken hoe we dat verhaal kunnen tegenhouden.*
- Gekochte gronden niet beheer naar boeren maar ooibossen laten groeien. Koop ieder jaar een half miljoen aan grond. Vanaf nu ieder jaar gronden blijven kopen.
- *In het Vechtdal maar ook in de haarvaten. Je hebt grond maar in het achterland ben je ook bezig.*
- Oude armen of verlengen.
- *We willen Meer Vecht. Dat is misschien wel wat je als titel wilt gebruiken.*
- Je kan ook zeggen we laten de oude armen bestaan, we graven nieuwen. Zolang die er maar komt. Daar begin je nu mee.
- Boer en Duitsland is proces dus altijd, maar boer niet te veel macht. Je moet ze zeker mee nemen maar ook met andere partijen.

#### **Afhankelijkheidsrelaties:**

- Alles hangt redelijk samen
- *Voor mij is afvoer het belangrijkste. Die piekafvoer. Daar zit de angst.*

**Hevige klimaatsverandering:**

- Vecht nog meer verkleinen
- Breder winterbed
- Als je vasthoudt aan building with nature principles kan je het prima
- Met kleinere Vecht met graslanden daarnaast heb je meer overstroming, maar is niet erg en alleen maar goed voor de grond

TABLE 12 NOTES BACK-CASTING SESSIONS INTERVIEWEE 5

**Maatregelen**

- Er zijn een aantal dingen die samenhangen waar je zo mee kan beginnen. Actief contact met Duitsland realiseren
- Geul verlenging, nieuwe meanders als aanpassing op het kaartje oude armen aanleggen
- Achterland op orde (haarvaten/Duitsland water vasthouden/ sponswerking) moet sowieso
- De rits volgens mij geul verleggen, nevengeulen, stuwen eruit. Als deze van tafel gaat, dan zou ik die ook van tafel halen en zou ik deze naar voren halen.
- Als je het eindbeeld hebt van stuwen eruit, dan moet je geul verlengen en nevengeulen, dan zou je hier met innovatieve stuwen en nog een Vecht verkleining. Die moet tegelijkertijd. Al eerder in de tijd de dijken op orde brengen. Deze kan je neerzetten.
- Natuurlijke successie
- Natuurlijk waterpeil
- Die boer vind ik dat alleen in een bredere context. Je moet iets te bieden hebben. Anderen zijn misschien iets positiever over de boer om tafel!
- Actief contact met Duitsland, er ligt in feite een soort van organisatie. Grensoverschrijdend Vecht Beheer. Men is daar afgeweken van de kernvraag, is de kant op gegaan van een grensoverschrijdende fietsroute en kunstroute terwijl het over water zou gaan.
- Als je het in de tijd moet zetten dan is het iets stapje voor stapje. Als je daar een lijn trekt dan heb je een hele lange curve en dan beweegt het omhoog. Het gaat parallel met de haarvaten.
- Haarvaten loopt wat steiler, omdat het Nederlandse deel gedaan kan worden, maar daarna is het deel in Duitsland ook wel belangrijker
- Eerst bovenstrooms stroomgebied op orde, nutriënten zien recht te krijgen, met dijken naar achter, tegelijk praatte met de omgeving om dingen voor elkaar te krijgen. Eerst het systeem, dan zit je met de ingrepen. In het begin zit hem in de maatregelen die relatief klein zijn. Je kan met heel veel kleine maatregelen veel doen.
- Geul verlenging is heel complex.
- Natuurlijk vegetatie beheer kan in 2040 want dat kan in 10 jaar veel bereiken
- Zelfde geldt voor armen, gaat ook snel
- Natuurlijker waterpeil kan met kleine stapjes richting natuurlijk waterpeil.
- Onderzoek naar hoeveel haarvaten/water vasthouden, hoeveel waar het moet gebeuren en dat kwantificeren.

**Maatregelen niet:**

- Oude armen zal eerst lijden tot een dip in je doelbereik omdat er dingen verloren gaan

**Afhankelijkheid relaties**

- Verschillende relaties
- Nutriënten verbieden heeft te maken met natuurlijke vegetatie
- Kwaliteit
- Ruimte

**Veranderingen**

- Landbouw transitie

TABIE 5 NOTES BACK-CASTING SESSIONS INTERVIEWEE 2

- Klimaatsverandering
  - Weer een droogte kan een impuls geven aan de droogte kant
- De vraag is wie zijn dan de spelers.

**Aspecten**

- Wel tegenstrijdige zaken in het doel. Zoals waterkwaliteit vs. recreatie in verschillende vormen. Alle oevers zijn natuurlijk vs. recreatie. Als je het als zwemwater wilt maken dan kan niet allemaal natuurlijkzijn met bijvoorbeeld strandjes.
- Het belangrijkste is met de boer om tafel. Moet niet alleen met de boer maar met iedereen die wat heeft in die omgeving. Dit kunnen ook omwonende/recreanten zijn. Je hebt te maken met een waterschap en een terrein beherende organisatie. Die moeten allemaal met elkaar om de tafel.
- Voorbeeld plan wat op tafel ligt over deel van de Vecht: er zitten 8 a 9 partijen om tafel
- Wel tegenstrijdige zaken in het doel. Zoals waterkwaliteit vs. recreatie in verschillende vormen. Alle oevers zijn natuurlijk vs. recreatie. Als je het als zwemwater wilt maken dan kan niet allemaal natuurlijkzijn met bijvoorbeeld strandjes.
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- Voorbeeld plan wat op tafel ligt over deel van de Vecht: er zitten 8 a 9 partijen om tafel
- Er wordt veel gepraat voor wat gebeurd, maar is belangrijk voor draagvlak
- De stuwen is een lastige. Als je het hebt over een half-natuurlijke rivier dan moeten er geen stuwen in.
- Peilbeheer
- Nutriënten en pesticiden belangrijke stap om de standplaats factoren goed te krijgen. Dat is door bijvoorbeeld te zorgen dat er minder nutriënten kunnen uitstromen. Hiervoor moet dan wel een harde opgaven aanzitten.
- Actief contact met Duitsland ook iets voor in het begin. De Vecht stopt niet bij Duitsland.
- Eerst met alle mensen om de tafel waar het heen moet gaan en wat er moet gebeuren
- Dit is inrichting (nevengeulen, oude armen aansluiten, bomen planten in winterbed, Vecht verkleinen, dijken naar achteren) wat naar mijn idee later komt.
- Sponswerking verbeteren in het achterland
- Je wilt wat met het peil doen, wat met de waterkwaliteit en wat met de inrichting doen.
- Kennis bij hydrologen. Als je het natuurlijk wilt maken dan zijn het zaken die bij de inrichtingsplannen worden opgenomen.
- Dit zijn echt die water ingrepen (), en daarna de omgeving daarheen aanpakken
- Je zou kunnen zeggen dit is het waterschap: die moeten waterkwaliteit en de peilverandering daaromheen.
- Dit deel doe je dit met elkaar, met een terrein beherende organisaties, gemeenten, waterschap, lto. Al deze inrichtingsstukjes die zal je daarna hebben.
- Eerst contact komen, met elkaar om de tafel en zorgen dat er voldoende draagvlak voor is.
- Dan (nutriënten en pesticides terugdringen) maatregelen zijn voor een langere tijd dus daar zal je nu al wel vast wat van kunnen zeggen.
- Kort gezegd. Je gaat met elkaar praten. Kijken naar hoe lang het duurt voordat maatregelen effect hebben. De taak van het waterschap is dan om te kijken wat heb je

nodig voor een half-natuurlijke rivier, de waterkwaliteit en regelen met Duitsland en dan kun je gaan inrichten.

- Het zorgen dat je ruimte hebt om de Vecht heen om je inrichtingsplannen te realiseren. Het kost geld om die mensen bijvoorbeeld uit te kopen. Daarvoor zal een verplichtende opgave moeten liggen.
- Belangrijkste voor een boer is blijft z'n inkomen. Het is een ondernemer. Voor de boer zal het belangrijkste zijn, wat betekend dit voor mij. Als de provincie stelt dat deze persoon schadeloos wordt gesteld gaat hij er niet op achteruit. Dan zeg ik hij zal er eigenlijk beter van worden als hij bijdraagt aan die half-natuurlijke Vecht.
- Grond opkopen wanneer boer wilt stoppen
- Mijn ervaringen is dat bottom-up beter werkt
- Blijkbaar is het heel lastig om de waterkwaliteit te verbeteren.
- Enerzijds willen ze een half natuurlijke rivier, aan de andere kant zwemwaterkwaliteit. Dan moeten er strandjes voor recreanten maar ook natuurlijke oevers. Zoveel verschillende opgaven.
- Zoveel plannen resulteert in dat je zoveel alleen maar praat.
- De vraagstukken stuw en eruit of innovatieve stuw en voor experts. Ik heb daar te weinig technische kennis van.
- Oude armen weer aansluiten
- Voorbeeld plan nieuwe meander aangelegd met een drempel voor oude stuk dat bij hoogwater het oude deel van het "kanaal" gebruikt kan worden.
- Allemaal deelprojecten zoals nu. Er moet misschien een controlegroep zijn die het project lijdt en lokaal de juiste mensen bij elkaar krijgen.
- Vraag financiering. Wie gaat het betalen? Gemeentes/ provincie? Vragen die je voorhand moet afvragen of het realistisch is.
- Kavelruil kan ook heel gunstig zijn. Als een provincie op voorhand die grond gaat opkopen.
- Enerzijds willen ze een half natuurlijke rivier, aan de andere kant zwemwaterkwaliteit. Dan moeten er strandjes voor recreanten maar ook natuurlijke oevers. Zoveel verschillende opgaven.
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#### **Afhankelijkheidsrelaties:**

- Ik heb het heel erg geclusterd
- Boeren om tafel en contact met Duitsland. Je hebt een deel Nederlandse en een deel Duitse Vecht. De projectgroep die gaat over het deel Nederlandse Vecht zal ook wel goed contact moeten hebben met de Duitse projectgroep. Als je allemaal acties uitvoert alleen in Duitsland of andersom dan heb je voor het totale systeem niet zo heel veel mogelijkheden. Als je focust op Nederland dan is praten met Nederlandse stakeholders effectiever. Wanneer Duitsland lukt heel positief, maar anders ook nog steeds dingen mogelijk



- Nutriënten en pesticiden terugdringen volgende stap na met de boer om de tafel. Dit is deel van het verbeteren van de waterkwaliteit.
- Dan heb je een natuurlijker waterpeil, een verbeterde waterkwaliteit, je hebt met de boer om tafel gezeten en je hebt voldoende ruilgebied, dan kan je aan de slag met het natuurlijker maken.
- Als je dit niet voor elkaar (water vasthouden in Duitsland, haarvaten/sponswerking), krijgt dan moet je dit niet willen (Vecht verkleinen)

#### **Veranderende omstandigheden**

- Energie transitie. Druk op landelijk gebied. Dat zijn de koppelkansen. Vanuit LTO zijn we tegen zonnepaneel velden. Er zijn heel veel argumenten waarom zonnepanelen op landbouwgrond inefficiënt zijn. De levensduur van een zonnepaneel is 25 jaar, maar daarna moet de grond 25 jaar herstellen. Dus het kost je 50 jaar. Na ons idee is landbouwgrond primair nodig voor produceren van voedsel. Je kan bijvoorbeeld niet mais in de lucht gaan verbouwen. Kijk naar daken maar niet naar de kostbare landbouwgrond. Dat is de makkelijkste en kortetermijnoplossing. Windmolens zou beter zijn, maar is voor natuurpartijen en andere partijen meer zich verstorend. Wij zeggen kijk nog eens goed naar besparing.

#### Heftige klimaatsverandering:

- Ik weet niet of dat zo is. Ik zie dat als een afbreukpunt. Dat is het lastige met die plannen
- Ik denk met de huidige maatregelen dat het alsnog moet lukken, maar je moet wel bepaalde ecosystemen of indicatiesoorten loslaten.

#### Technologische ontwikkelingen:

- Wie zegt dat er over 10 jaar niet iemand is die doorzichtige zonnepanelen uitvinden?

**TABLE 6 NOTES BACK-CASTING SESSIONS INTERVIEWEE 9**

#### **Maatregelen**

- Spongiteit en haarvaten -> moet hele stroomgebied anders geen effect (dus ook Duitsland)
- Nevengeulen zoals nu allen bypassen om stuwen heen, dan hoeven we het niet te doen als stuwen eruit
- Nog steeds discussie stuwen of niet -> dat moeten we nu wel eens gaan beslissen
- Als je meters wilt maken keuze stuwen vs. geen stuwen
- Die keuze hangt af van je streefbeeld en dat zou je nu moeten doen.
- Actief contact krijgen met Duitsland
- Ik twijfel of je haarvaten moet doen en sponswerking dat je het merkt in je Vecht net als voor Duitsland -> kost heel veel energie. Ik zet ze laag. Ik denk dat het heel veel gedoe is en heel veel kost, en of het nou alles opneemt. Daarom zeg ik als je voor half natuurlijk gaat, doe maar niet.
- Dijken verleggen: dan zou ik ze niet verleggen, maar echt weggelaten
- Je moet iets met het winterbed, kaartje landgebruik winterbed. Zolang je aardappels wilt verbouwen tot de insteek van je watergang, gaat het hem gewoon niet worden. Ik denk wel dat dat heel veel helpt
- Wanneer je dit in het winterbed kan realiseren, dan kan je ook een natuurlijker waterpeil gaan toepassen. Oude armen aansluiten
- Vecht verkleinen -> dat kan in de diepte zijn en in de breedte.
- Landgebruik winterbed
- Veiligheid -> hoogwaterbescherming. Dat moeten we sowieso al omdat de provincie z'n handen terugtrekt van de kering



- Het wordt een beetje een kip en ei verhaal
- Waterkwaliteit:
- Iets hogere baseflow: hij heeft geen baseflow. Wil je dat realiseren buiten aanvoer om. Als je zegt ik wil de half-natuurlijke Vecht dan moet je al die maatregelen toepassen
- Als je zegt we gaan het beschermingsniveau verlagen
- Natuurlijke oevers, wat moet je met een na
- Ontwikkelpad nevengeul -> om iedere geul
- Natuurlijke oevers
- Nevengeulen
- Landgebruik aanpassen
- Dat je van het omgekeerde peilbeheer afkomt
- Stuwen handhaven
- We gaan natuurlijk peilbeheer dat we stuwen op afvoer landgebruik daarop aanpassen -> het is niet superbelangrijk dus hier in de tijd
- Daarna komt je landgebruik pas
- Vecht verkleinen hoeft dan niet
- Beschermingsniveau denken we nu al over na
- Met Duitsland kan je kijken naar beschermingsniveau, maar wel veel moeite. Je kan kijken of het iets wordt, wordt het niets dan stop je er mee.
- Nevengeulen hoef je niet nu mee te beginnen, kan je in 2040 mee beginnen, maar misschien wil je dat wel eerder.

**Waarom niet gekozen voor de andere maatregelen:**

- Sponswerking/haarvaten -> heel veel moeite. Vanuit natuurlijke Vecht moet je, half natuurlijk hoeft niet. Nu houd je het een beetje smal tot het winterbed als pluspunt
- Bomen in winterbed-> als het kan doen! Lukt het niet dan niet
- Met de boer om tafel -> eerst duidelijk de keus over stuwen, hoe gaan we dan de doelen maken en concreter maken. Dan ga je met de boer om tafel. Je gaat eerst de keuze maken en dan streven uitspreken we willen peil aanpassen, dan met de boeren om tafel.
- Eerst beschermingsniveau kijken wat het wordt, moet hij om laag of omhoog, dan pas aan tafel
- Autonomoos spoor
- Aan de voorkant ook best keuzes maken, of je het binnen het winterbed doet of het hele stroomgebied. Het hele achterland is zoals het is

**Afhankelijkheidsrelaties:**

- Hoogwater gaat samen met landgebruik en boer om tafel
- Nevengeulen zijn redelijk onafhankelijk
- De volgorde is niet echt belangrijk

**Veranderingen van de adaptive space -> heftige klimaatsverandering:**

- Winterbed herinrichten
- Stand still voor je stroomgebied: dat de afvoer in de stroomgebieden mag je niet veranderen, dat je het oplost in je eigen gebied. Dan kan je zeggen ga toch nog iets verder om de base flow te veranderen.
- Dus moeten er verschijnselen zijn, eerst in het winterbed proberen mocht dat niet genoeg zijn gehele stroomgebied. Dat je eerst verkent gaat dit lukken. Die hebben ook een langere doorlooptijd nodig.
- Idealiter zou je dit willen, lukt dat niet is dat je terugval optie
- Ik kan me voorstellen dat de landbouw wel een transitie gaat plaatsvinden. Die gaan niet 180 graden de andere kant op. Dan is het de vraag ga je richting intensiever zoals het nu nog een beetje doet, of ga je natuur inclusiever
- Als je de kansen ziet in het landgebruik, dan moet je daar ook kansen pakken.

- Discussies veiligheid issue, wil je heel veilig zitten of meer leven met het water en een overstroming hoort erbij
- Kosten- en batenanalyse over dijken -> dat dijken op sommige plekken weghalen goedkoper is
- Nevengeulen zijn in principe leuke dingen, die kun je bijna altijd wel doen.

**TABLE 7 NOTES BACK-CASTING SESSIONS INTERVIEWEE 11**

**Maatregelen:**

- Stuwen eruit wanneer het hele land op orde is, natuurwaterpeil en water vasthouden in achterland
- Als je je pieken kwijt bent kan het, het ene is voorwaarde van het andere
- Natura 2000 gebieden beschermen, behoud van natuur dat je dat als voorwaarde stelt voor maatregelen. Behoud is uitgangspunt van 2000 beleid. Maar wel sowieso als voorwaarde. Dat er wel wat achteruitgang zou zijn, jawel. Niet behouden klinkt als opgeven.
- Voor 2027 KRW-deadline oeverontstening en nevengeulen
- Ik denk dat zolang je hier niet een hele grote slag hebt geslagen kan je de rest ook wel vergeten (sponswerking/haarvaten optimaliseren). We hebben een haalbaarheidsstudie laten doen naar natuurlijker peilbeheer naar ontdiepen en verbreden van het winterbed en daar kwam eigenlijk uit dat het niet mogelijk was met de mogelijkheid binnen de randvoorwaarden. Dit is heel graag wat ik allemaal is, maar of het in de realiteit gaat gebeuren en of er draagvlak voor is.
- Innovatieve stuwen weet ik niet wat de technische mogelijkheden zijn. Onze stuwen zijn Vechter Weerd en Vilsteren zijn nog niet aan vervanging toe. Voor 2050 waarschijnlijk wel ergens, maar waar weet ik niet.
- Wat wel natuurlijk zou kunnen dat uit Swimway onderzoek niet alle vissen er langs kunnen komen, dat wanneer er maatregelen worden genomen om stuwen vispasseerbaar te maken dan zou het wel kunnen. Swimway rapport komt volgend jaar.
- Deels rand voorwaardelijk. Je kunt niet de Vecht verkleinen of stuwen eruit met de huidige afvoer. In de winter dondert het water soms dan naar beneden in de zomer loopt hij leeg. De pieken kan je niet opvangen.
- Waterzuiveringsinstallaties: ontwikkelingen daarin zijn continu gaande.
- Nevengeulen: verlenging/ nieuwe nevengeulen. Je zit nu met de landbouw en de ruimte voorbij. Als je meer inclusieve landbouw zou krijgen zou hier meer ruimte voor kunnen ontstaan.
- In het verleden meanders proberen aan te sluiten, toen kwamen we erachter dat dat niet werkt. Een oude meander is gevormd toen de Vecht andere afvoer en veel meer sediment transport af. Toen is de Vecht ingebed en zijn de afvoeren veranderd. De vecht ligt veel dieper dus dan loopt de oude arm leeg. Ook natuur die er is, is waardevol dus ook daarvoor soms gekozen om hem niet aan te takken.
- Beginnen met contact met Duitsland en boeren omdat die er al zijn. Agrarische initiatieven zoals deltaplan agrarisch waterbeheer. Dus doorgaan hoe het nu loopt. Het is nu ook een initiatief om bij die meander iets met koe knuffelen te gaan doen, dus geen intensieve landbouw

**Onderlinge afhankelijkheidsrelaties:**

- Alles wat hierboven zit is een voorwaarde voor dat
- Het contact met Duitsland: het contact met Duitsland loopt al. Er is 1 keer per jaar een meeting en Vechtstromen heeft intensief contact. Zij doen eigenlijk al meer met hun achterland dan wij.

- Meer water vasthouden
- Landgebruik: bij die nevengeul Vilsteren moet een bepaald maximaal peil gehandhaafd worden.
- Veiligheid: ja dat is waar, dat is altijd voorwaarde
- Als de pieken minder wordt heb je daar misschien weer meer ruimte voor

**Klimaatsverandering:**

- Als je dat niet doet krijg je grotere pieken en langere droogteperiodes dus moet je die pieken en dalen toch verkleinen.
- Daar gebeuren wel dingen maar gaat wel langzaam. De zon. Dat kost alle moeite om goede projecten op gang te krijgen en daar financieel de middelen voor te krijgen. Als de zomers zo droog blijven kan daar wel meer draagvlak ontstaan bij de agrariërs.

**TABLE 8 NOTES BACK-CASTING SESSIONS INTERVIEWEE 12**

**Maatregelen:**

- Haarvaten, sponswerking zelfde ding. Eigenlijk is haarvaten de maatregel waardoor je sponswerking krijgt. Het heeft tijd nodig om dit voor elkaar te krijgen maar doelbereik is wel heel hoog. Opstart kan snel, maar de uitwerking duurt decennia. Dit is een systeem maatregel
- Onderscheiding tussen systeemmaatregel en trajectmaatregel
- Doorstroom door moerasbeken. Iets wat nu in Drenthe veel gebeurt. Er wordt ingezet op moeras gebieden in de kop van gebieden. Het kan veel water bergen en geeft water langzaam af.
- Drainagesystemen verwijderen of optimaliseren. Op peil gestuurde drainage kan het systeem zich aanpassen aan de hoeveelheid water
- Trajectmaatregelen minder doelbereik want die zijn kleinschaliger.
- Stoffenspoor en hydrologie spoor, allebei systeemmaatregelen
- Vecht verkleinen als volgende stap, want afvoer is niet meer zo groot dus dan is de grote bak niet meer nodig.
- De stuwen kunnen tijdens hetzelfde moment eruit.
- Veel maatregelen zijn niet één punt in de tijd maar processen.
- Stimuleren natuur inclusieve landbouw (biologisch) door middel van subsidie en regelgeving.
- Werkend van bovenstrooms naar benedenstrooms, want alles wat bovenstrooms nog slecht is werkt wat je doet beneden niet echt.
- Bovenstrooms is Duitsland en de zijbeken. Alles dus in bovenstroomse gebieden
- Beginnen bij de bronnen
- Nutriënten en pesticiden verbieden zijn aanpakken van diffuse stressors en zuiveringsinstallatie maatregel voor puntbronnen
- Hydrologisch pad heeft waterveiligheid en ecologie. Waterafvoer is veel meer gestabiliseerde. Als het water stroomt dan mitigeert dat ook door natuurlijke processen.
- Stoffen is alles wat met vies en schoon water te maken heeft, dus waterkwaliteit maar ook met recreatie.
- Een rivier zonder bomen is niet natuurlijk. Bomen planten zou nu kunnen maar men durft het niet.
- Beginnen met een rijtje bomen langs de rivier. Vanuit daar uitbreiden door de jaren heen naar meer begroeid winterbed.
- Zuivering moet je altijd doen. Kan je nu al meteen mee beginnen en heeft ook niemand dat van behalve dat het geld kost.

<ul style="list-style-type: none"> <li>• Nevengeulen kan je gewoon blijven doen. Dat kan je nu meteen doen. Voor het rivier systeem zelf voegt het op de lange termijn niet meer zoveel toe als je met de Vecht zelf bezig gaat.</li> <li>• Innovatieve stuwen is een stap tussen haakjes, wat een mogelijke tussenstap zou kunnen zijn.</li> <li>• Natuurlijker waterpeil is sowieso goed. Je marge verandert in de tijd. Je krijgt telkens in de tijd meer ruimte om het peil steeds wat natuurlijker te laten worden. Ik vind dat je met natuurlijker waterpeil moet beginnen en stap voor stap een beetje natuurlijker vanaf wanneer mogelijk.</li> <li>• Verder met ontsteden, voor de natuurlijke oevers.</li> </ul>
<p><b>Afhankelijkheidsrelaties:</b></p> <ul style="list-style-type: none"> <li>• Het hydrologie pad is allemaal afhankelijk van elkaar.</li> <li>• De bron van het pad stoffen is ook stimuleren van natuur inclusieve landbouw, met de boer om tafel en actief contact met Duitsland is hiervan de bron</li> <li>• Trajectmaatregelen (nevengeulen, bomen langs de rivier, verbeteren waterzuiveringsinstallaties kun je sowieso doen en ook mee beginnen. Boven langs de rivier heeft wel verschillende stappen door de tijd heen. Deze trajectmaatregelen zijn sowieso goed en staan ook semi los van het grote proces.</li> <li>• De dijken past hier ook in wat je maakt ruimte voor de rivier binnen het traject pad.</li> </ul>
<p><b>Waarom maatregelen niet:</b></p> <ul style="list-style-type: none"> <li>• Oude armen niet omdat de hydrologie moet passen bij de geomorfologie. Als de afvoer heel erg is veranderd heeft het geen zin om nieuwe armen aan te sluiten. Dan is het beter om een nevengeul te graven die passen bij het huidige systeem</li> <li>• Geen nieuwe meanders graven, zie daar het nut niet van.</li> </ul>
<p><b>Heftige klimaatverandering:</b></p> <ul style="list-style-type: none"> <li>- In feite zijn water vasthouden en beschaduwende mitigerende maatregelen. Bomen tegen de temperatuur en water vasthouden tegen de droogte. De sponswerking is echt een hele belangrijke voor klimaatverandering. Dan ga je droogte tegen en extreme piekafvoeren. Ook zonder klimaatverandering ook doen, want dan heb je ook piekafvoeren en ook droogte. Ik denk dat de support groter wordt om dit soort maatregelen gaan nemen omdat mensen begrijpen dat dit nodig gaat zijn. De ecologie volgt hierop. Vooral door het verkleinen van de Vecht door het verontdiepen van de Vecht, misschien verbreden waar nodig. De afvoer is kleiner dus minder ruimte is nodig.</li> </ul>

**TABLE 9 NOTES BACK-CASTING SESSIONS INTERVIEWEE 15**

<p><b>Maatregelen:</b></p> <ul style="list-style-type: none"> <li>• Stuwen leggen we ver weg</li> <li>• Duitsland contact en praten met de boer heel erg voor in het proces</li> <li>• Water vasthouden in Duitsland zou je heel snel willen maar gaat niet zo snel dus leg ik wat naar achter</li> <li>• Nevengeulen neerleggen gebeurd nu al dus die naar voren, kan vrij snel</li> <li>• Bomen in winterbed -&gt; kan pas later</li> <li>• Flexibele waterpeil kan nu al snel -&gt;</li> <li>• Haarvaten optimaliseren moet snel maar loopt lang door</li> <li>• Innovatieve stuwen erg vooraan</li> <li>• Nutriënten/pesticides uitstroom verbieden, eerst heel mooi maken met de nevengeulen, dan pas recht van spreken</li> <li>• Oude armen aansluiten kan heel snel</li> </ul>
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- Spons werking hetzelfde als haarvaten moet je nu al mee beginnen maar gaat heel lang doorlopen
- Verbeteren zuiveringsinstallatie zelfde als uitstroom -> pas recht van spreken en dan zeggen joe doe ook wat
- Die oude armen aansluiten kan je over discussiëren, zitten ook heel veel natuurwaarden in. Dat is maar de vraag of die moet. Die leg ik dwars.
- Innovatieve stuwen is er een -> als je nu een stuw hebt aangelegd/gerenoveerd doe je dat niet meer snel. We zijn nu met alle stuwen bezig en eigenlijk moet je deze discussies voeren als je gaat beslissen of je gaat renoveren of vernieuwen. Een nieuwe stuw kost 6 miljoen en renoveren 1 miljoen. Ik zou dat toch naar achteren zetten. Vanaf nu moet je goed gaan nadenken over de lange termijn. Een gerenoveerde stuw gaat 25 jaar mee. Maar je moet nu al zeggen, dat bij het volgende beslis moment wordt het toch wel een ding. Bomen planten moet je eerst alles voor elkaar hebben, omdat ik denk dat het heel lang gaat duren.
- Actieve contact met de Duitsers heb je hier heel erg voor nodig.
- Heel dingen is het hoe snel gaat het?
- Nutriënten en pesticiden terugdringen voor KRW, misschien nu al mee beginnen maar wel langere termijn
- Grens 2027
- In kader van ZON -> zoet watervoorziening Oost Nederland
- Het is nodig om de Vecht te verkleinen? Ja denk het wel. Natuurlijke stromingsdynamiek. De vraag of je het moet willen, maar als je het wilt moet het daar pas.
- De organisaties waar we de meeste discussie mee hebben zijn de groene organisaties. Ze willen veel meer en daardoor blokkeren ze de hele ontwikkeling. Het verhaal vanuit ons is dan zie dit als een eerste stap.
- Provincie focust zich op natura 2000
- Natura 2000 kan je geen natuurlijk waterpeil hebben. Daar is nu op hoger niveau een discussie aan het aanwakkeren.

#### **Afhankelijkheidsrelaties**

- Stel we komen met de Duitsers geen meter verder, dan heeft dat heel veel impact van wat er uiteindelijk hier kan. Daar heb je echt het achterland voor nodig
- Dat met de boer om tafel heeft weer met de nutriënten te maken
- Met de landbouw die heeft ook een afhankelijkheid met deze ingrepen, maar daarvoor heb je wel echt land voor nodig. Ik zeg wel dat gaan we doen, dan heb je hele lange gesprekken en compensatiegronden nodig bijvoorbeeld. Dat gaat niet 1,2,3.
- De trend gaat steeds wel meer die kant op van extensiveren in het beekdal en misschien zelfs het beekdal uit.
- Sponswerking is wat je nu moet starten maar heel erg gelinkt in wat je aan het einde kan realiseren. -> Voor Duitsland zelfde
- Waterzuiveringsinstallaties heeft heel erg met beleid te maken. Mocht in Den Haag gezegd worden de norm gaat omhoog, dan wordt er geld vooruit getrokken. Gebeurt dat niet, dan gaat het denk ik niet door.
- Stuwen aan het einde, en daar pas als het kan het eruit maken. Proberen te realiseren dat het in theorie wel kan.

#### **Klimaatsverandering:**

- Wij denken dat het klimaat de ene kant op gaat, maar het kan zo de andere kant op gaan.

#### **Energie:**

- Dat is nog niet helemaal te zien welke kant op gaat

- Wat gaan we doen qua energiebehoeften? Gaan we meer met water doen? Het zijn in ieder geval dingen die beleid heel erg gaan beïnvloeden.

Economische recessie:

- Leuk al die fratsen, maar we gaan niks investeren en beheren.
- Maar dan ga je er niet komen.

Wat voor extra maatregelen kan je toepassen?

- Het gaat met klimaat vooral om die pieken en dalen. Dan wil je flexibel blijven eigenlijk. Maar alles wat je doet, dat zijn geen regret maatregelen. Dit zou je altijd moeten doen. Verkleinen zou bijvoorbeeld een twijfelgeval zijn. Dit zijn maatregelen die wel nodig zijn.
- Dat natuurlijker peil heeft te maken met natura 2000. Als je daarop volop in blijft zetten dan ga je geen natuurlijker waterpeil doen.
- Op dit moment moeten we beide doelen KRW en natura 2000 realiseren.
- Stuwen aan zich kan een lock in zijn, je gaat een dure stuw (traditioneel) dan heb je ook een lock in. We gaan niet ingewikkeld doen, zetten een traditionele stuw neer. Dan zit je er wel 70 jaar aan vast.
- Iets mindere mate met de renovatie, kleinere lock in zit je 25 jaar aan vast.
- Je moet zo snel mogelijk gaan nadenken over een strategie over de stuwen. Misschien zijn er al wel collega's over na denken, maar dat weet ik ook niet allemaal precies. Er wordt nog per stuw gedacht denk ik. (Ont)stuwstrategie. Dit om lock in te voorkomen.
- Met de haarvaten niet rijk rekenen, want slootjes niet voor niks gegraven. Eerst was het een moerasgebied. Als je ze allemaal dicht gooit krijg je misschien weer moeras en veengebied, en dat is niet wat je wilt. Als het voor een deel lukt is het genoeg om de stuwen eruit te maken?

Appendix VI: Single format of stakeholder routes back-casting sessions

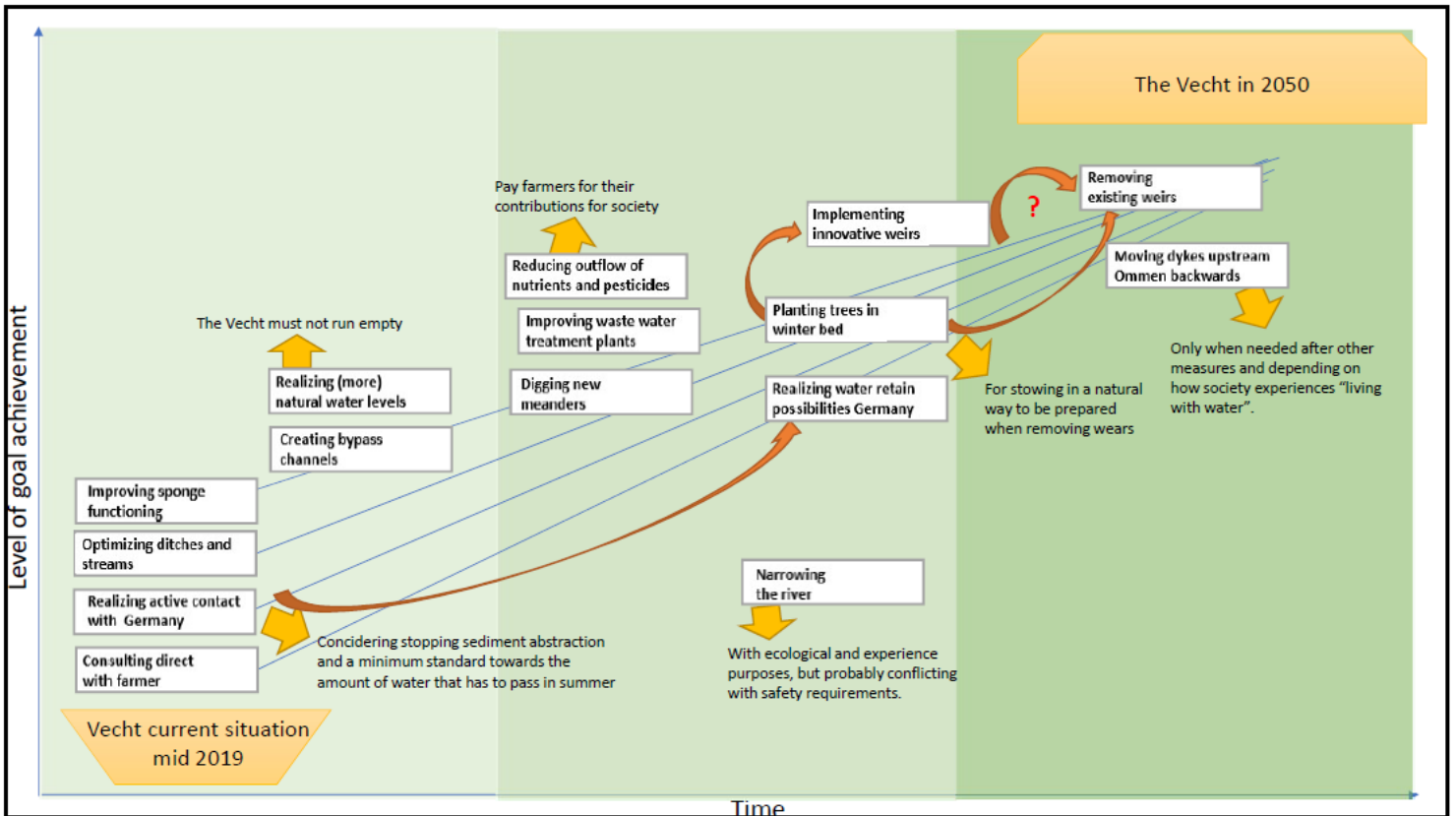


FIGURE 37 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 3

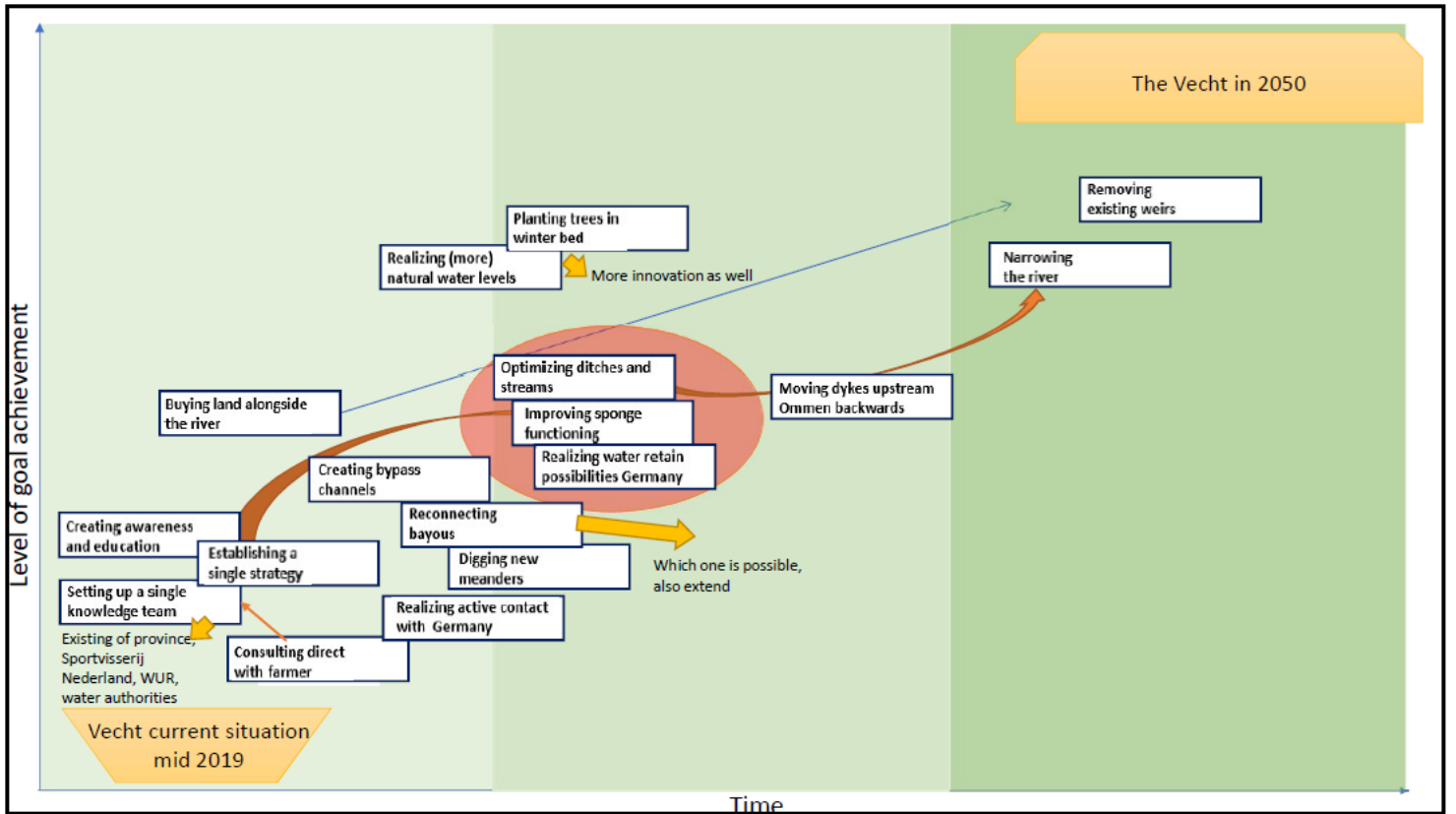


FIGURE 38 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 4/7

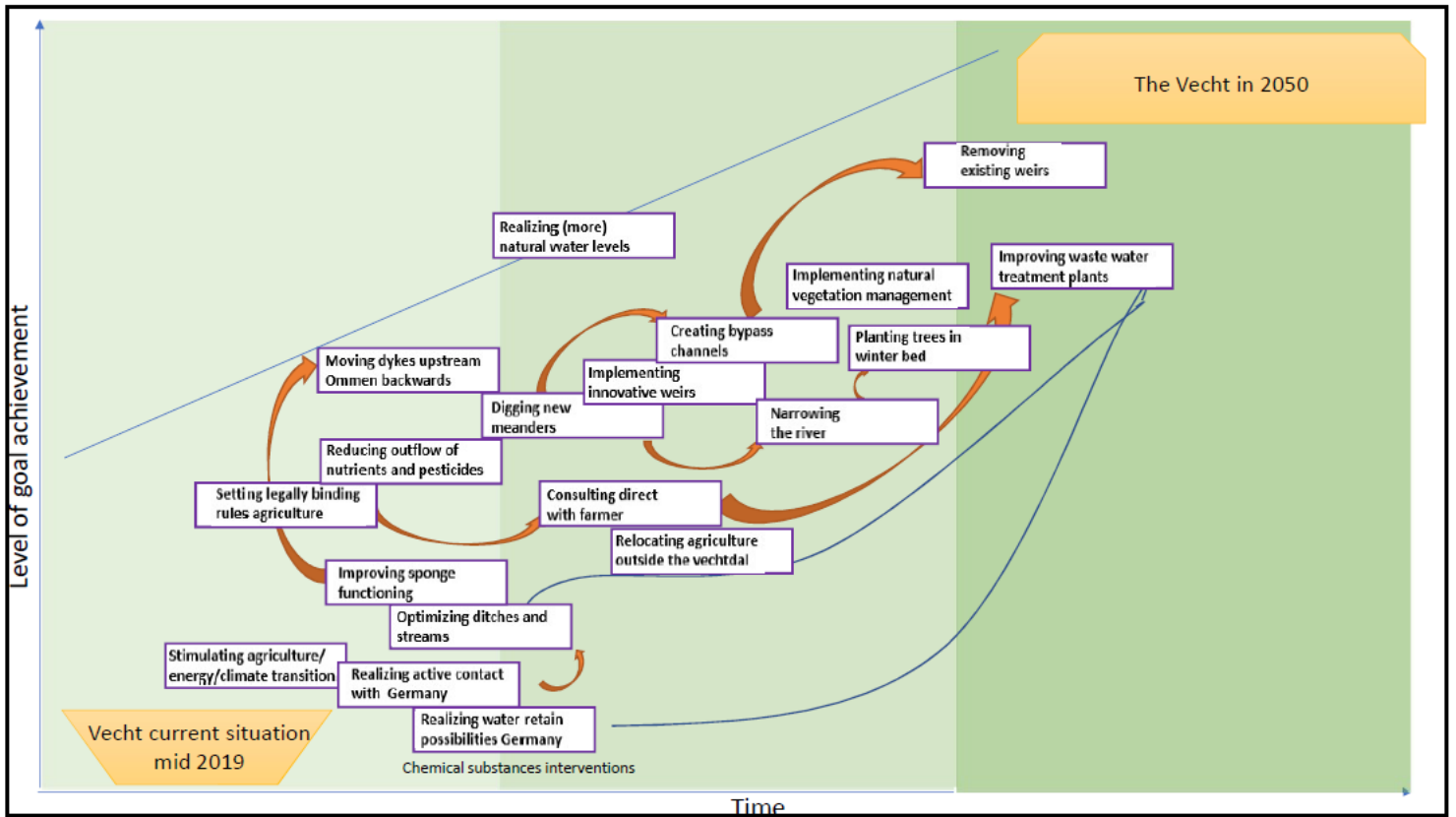


FIGURE 40 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 5

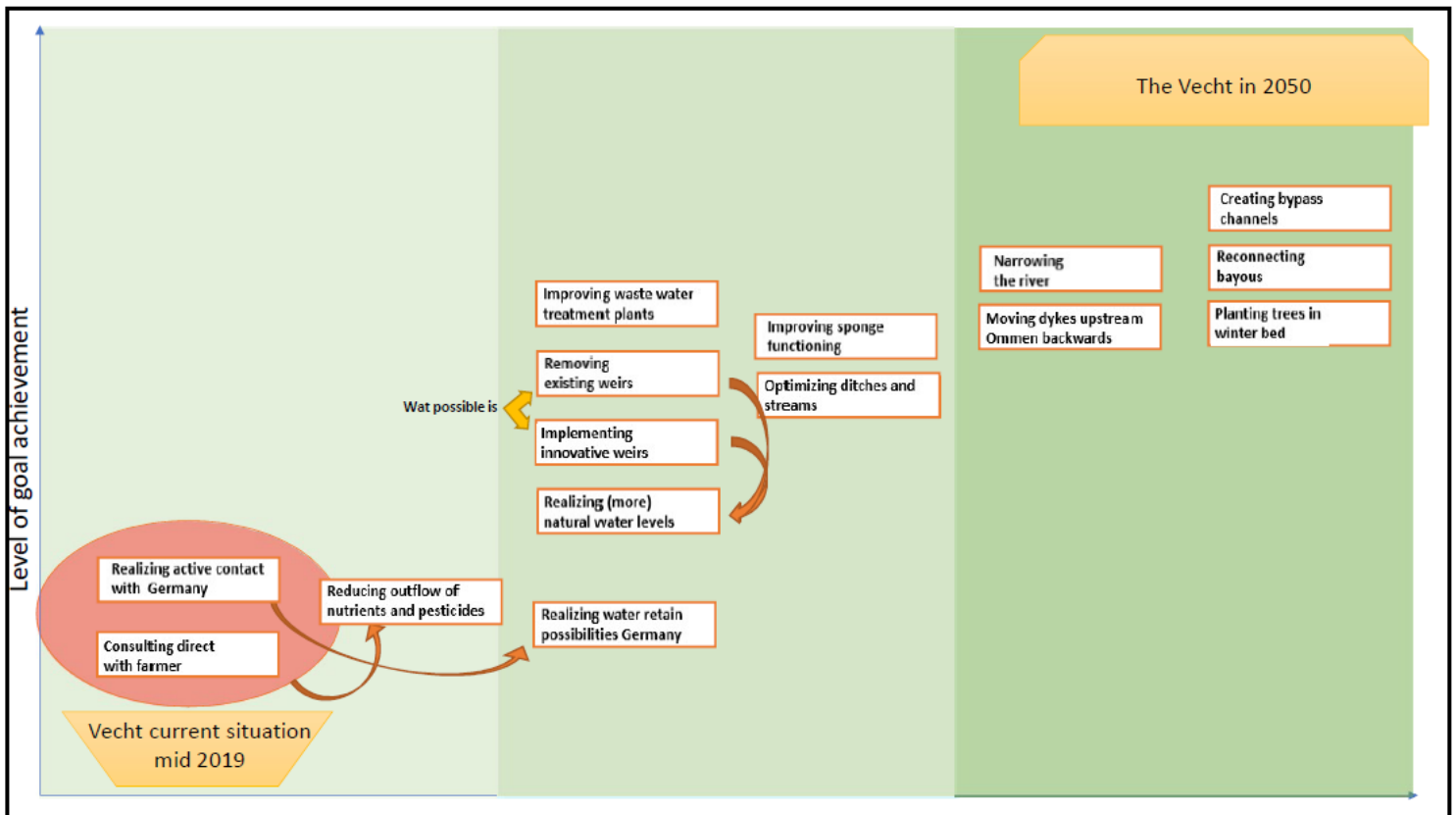


FIGURE 39 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 8



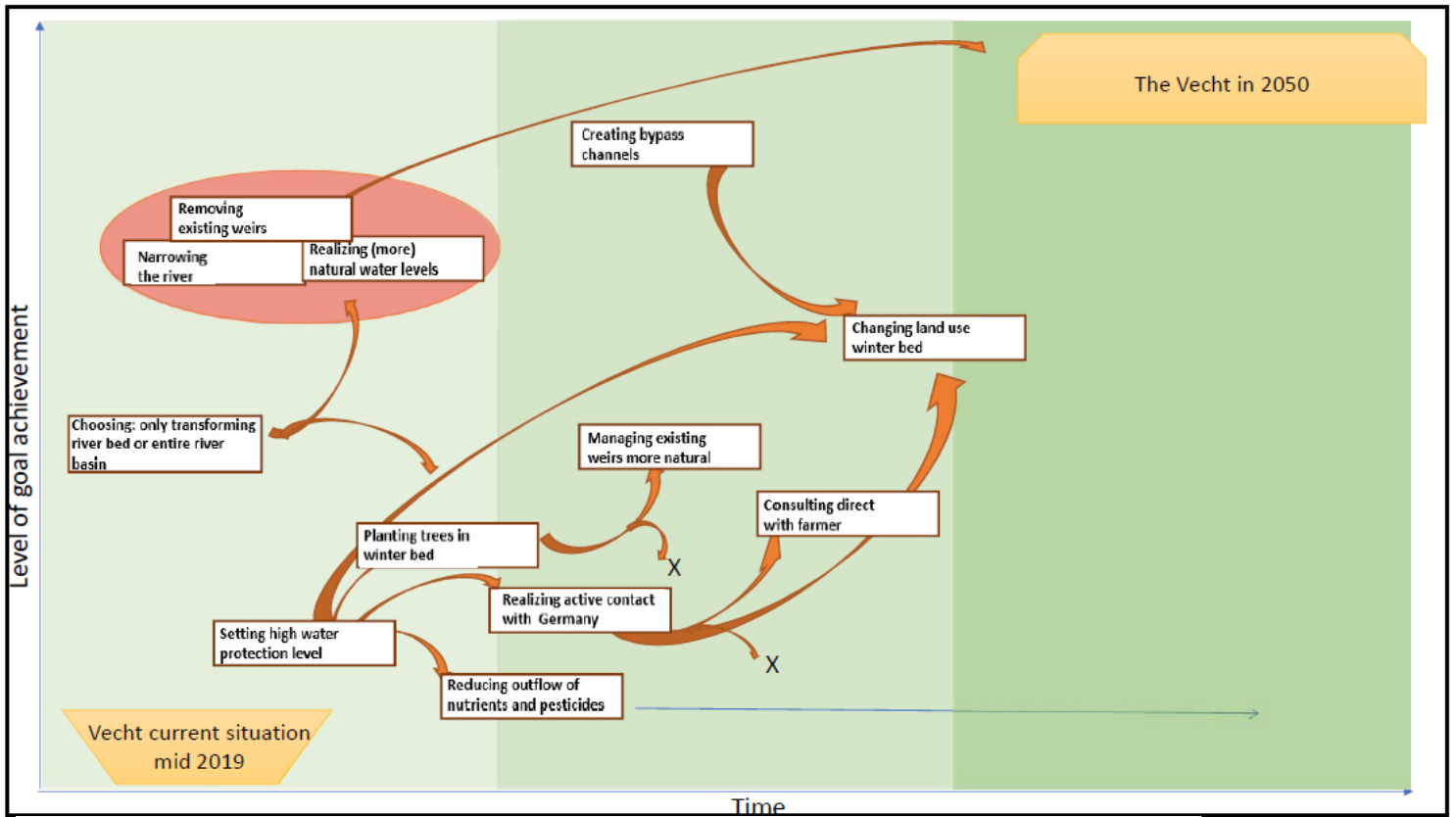


FIGURE 41 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 9

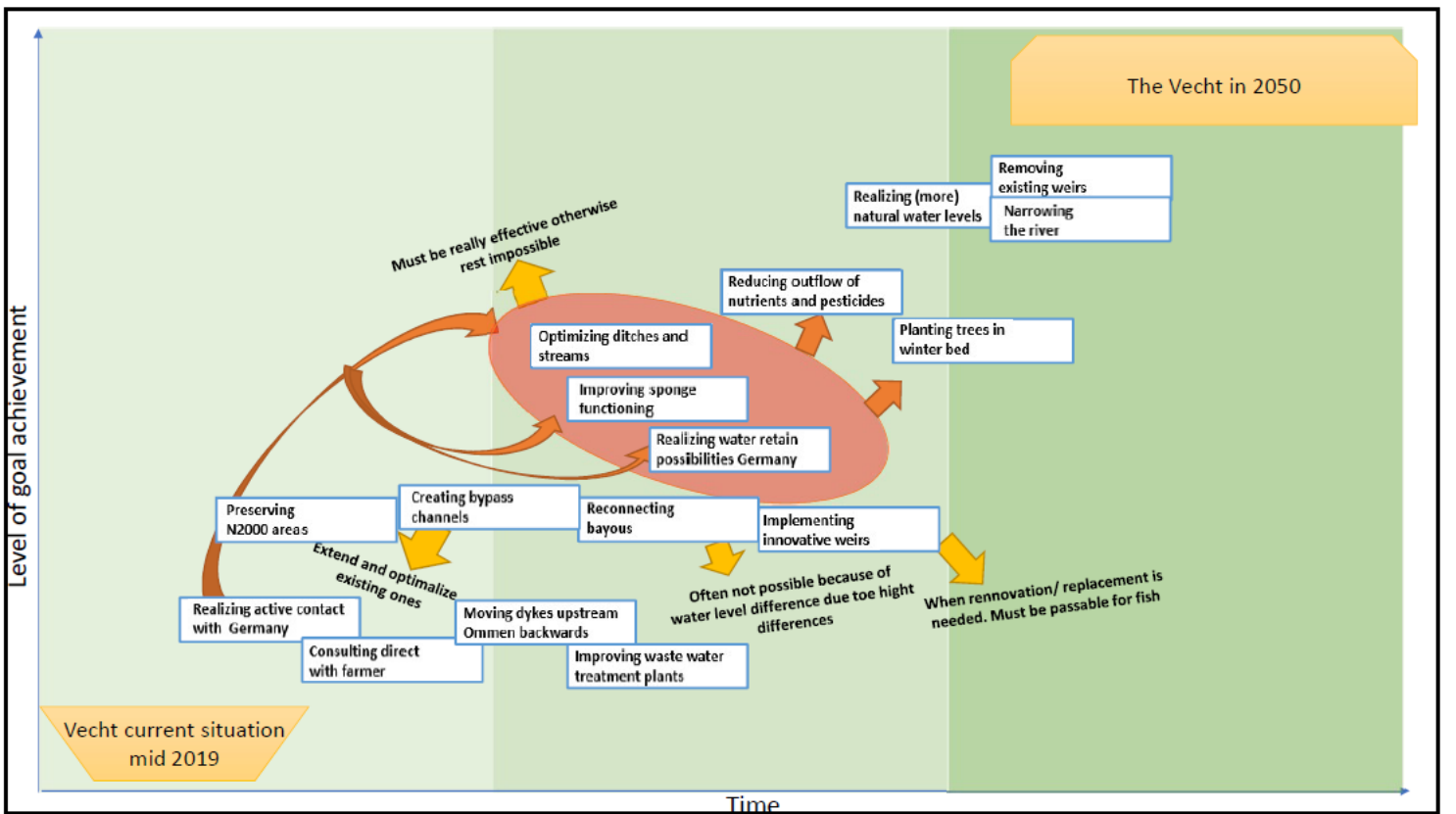


FIGURE 42 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 11

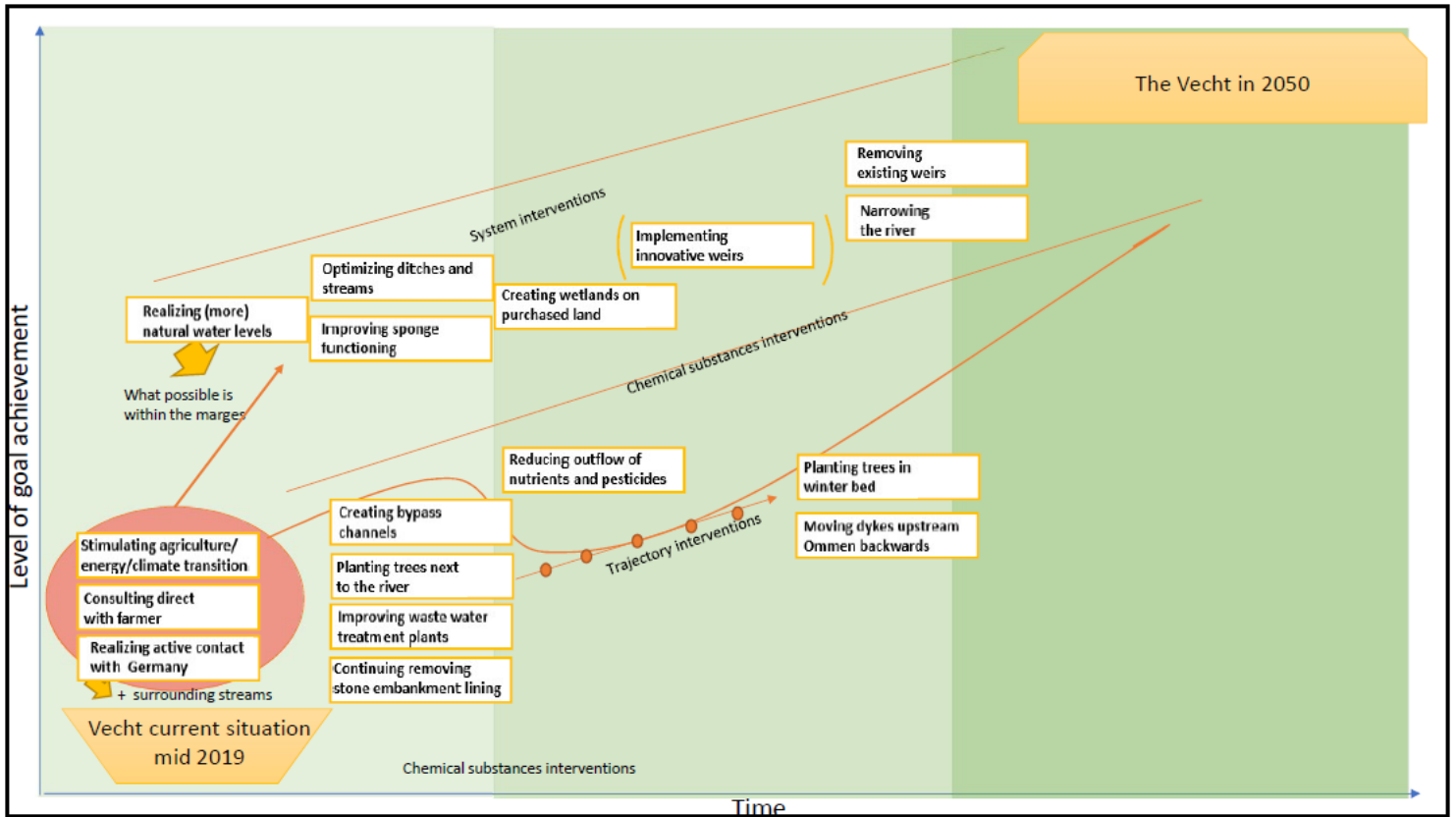


FIGURE 44 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 12

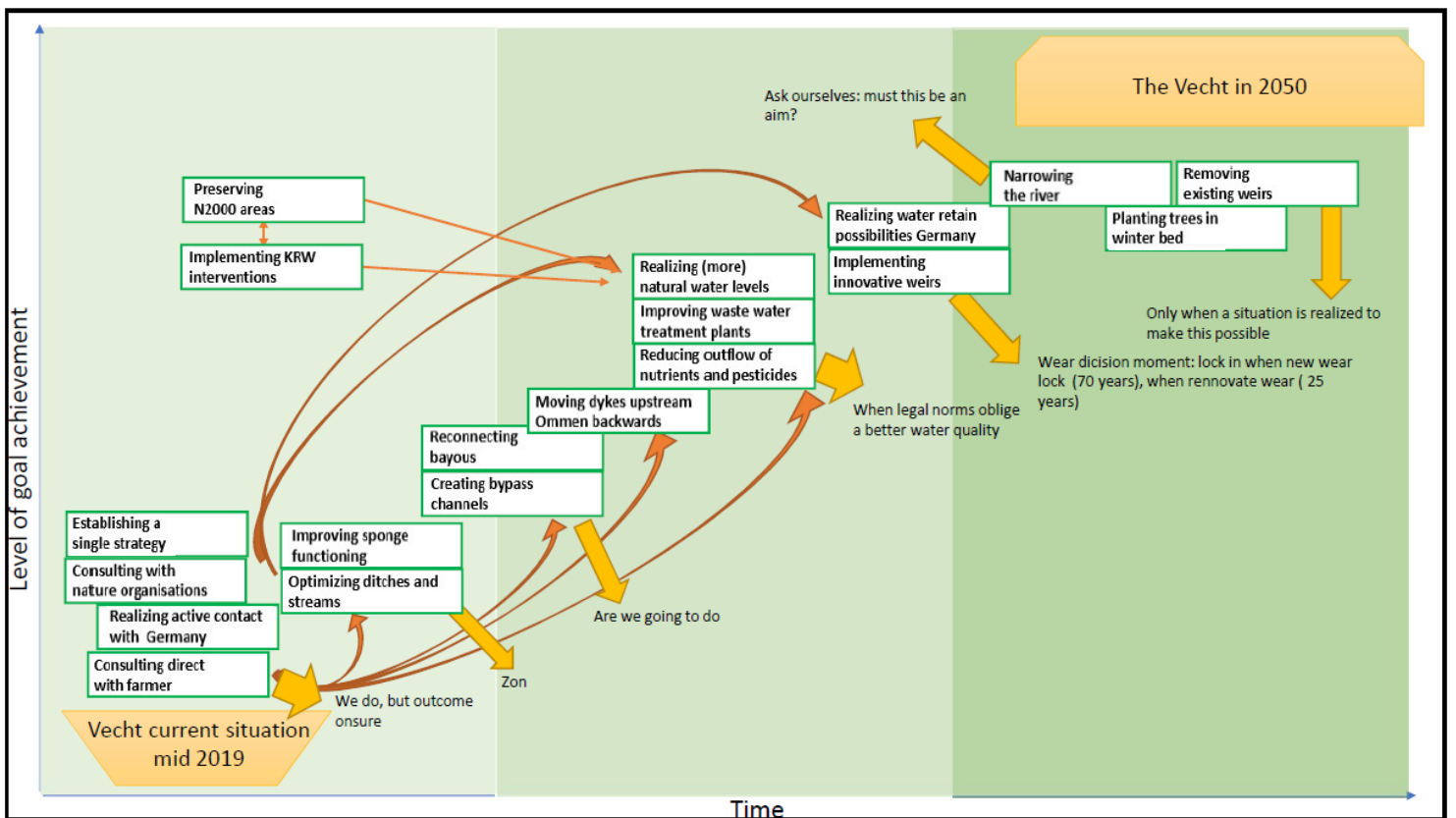


FIGURE 43 ONE FORMAT BACK-CASTING SESSION INTERVIEWEE 15