

Leonie Zwienink - 5245877

RE-EXPERIENCING THE ROER FRINGES

*Imagining the Roer valley through place-sensitive interventions for
experiencing the natural dynamics of the Roer river*



^ Flooded Vlodrop during the July 2021 summer floods.
From the personal archive of Mark Verschuren, 2021

RE-EXPERIENCING THE ROER FRINGES

Imagining the Roer valley through place-sensitive interventions for experiencing the Roer river

Master Thesis Urbanism - TU Delft
November '25- June '26

Leonie Zwienink [5245877]

First Supervisor: Kristel Aalbers [UR]
Second Supervisor: Inge Bobbink [LA]

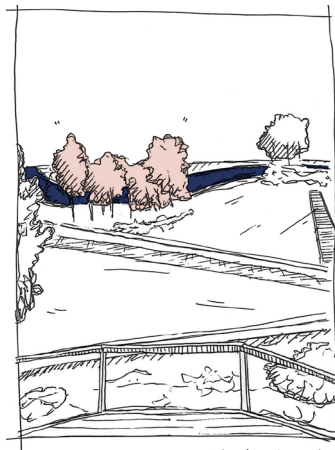
The thesis is supervised within the *Deltaic Interventions* cluster



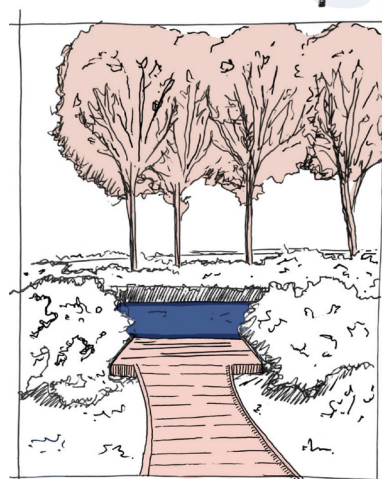
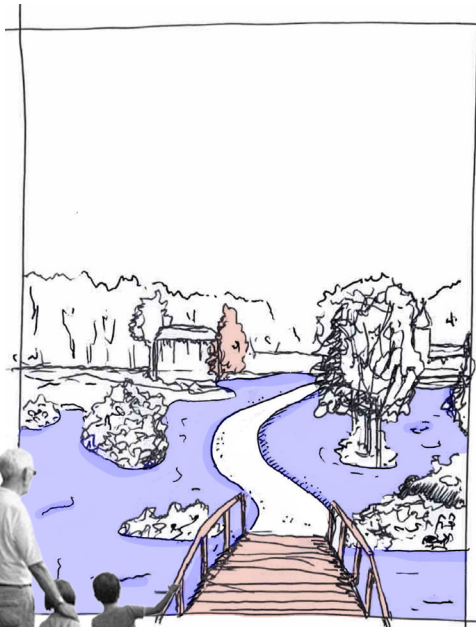
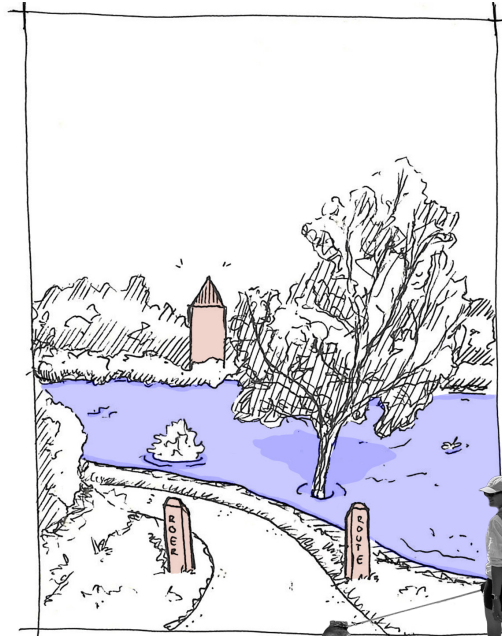
Delft University of Technology

Faculty of Architecture and the Built Environment

Unless stated otherwise, all graphics and pictures are made by the author



Herkenbosch



Sint Odiliënberg

ABSTRACT - RE-EXPERIENCING THE ROER FRINGES

The Roer Valley is increasingly confronted with hydrological extremes caused by climate change, exposing a growing imbalance between water systems, landscape structures, and settlement patterns. Historically, the Roer River and its floodplain shaped the spatial development, land use, and identity of the villages within the valley. Over time, this relationship has weakened as the expansion of the village no longer correlated with the natural functioning of the Roer. The river became a technical system to be controlled rather than an integral part of everyday life. As a result, the perceptual and spatial connection between residents and the Roer through visibility, audibility, and accessibility has largely diminished. This division is most prominent at the village fringes, where settlement meets the floodplain.

[This thesis explores how place-sensitive interventions within the village fringes of the Roer Valley can improve the experience and connection of residents with the Roer River by 2050.](#) Rather than focusing on large-scale flood prevention measures, the research explores how small-scale, site-specific interventions can strengthen the relationship between villages and the river while embracing the natural dynamics of the floodplain. Through a research-by-design methodology, the thesis combines hydrological analysis, spatial pattern analysis, and landscape interpretation to establish a framework for adaptive village-fringe design.

< Experiencing the Roer through the village fringes of Sint Odiliënberg and Herkenbosch during the regular river discharge and a T25 flood.

The study focuses on two representative village types within the Roer Valley: Sint Odiliënberg, characterised by a direct riverfront relationship, and Herkenbosch, positioned adjacent to the floodplain. By analysing seasonal hydrological conditions and the spatial logic of the villages, a set of place-sensitive intervention principles is developed within the domains of route, space, flow, and flood. These interventions are defined by three key parameters: scale, seasonality, and impact on daily life, ensuring that they remain embedded within the existing genius loci of the villages.

The thesis demonstrates that strategically placed, place-sensitive interventions can reconnect villages to the Roer River by transforming introverted settlement edges into accessible, water-oriented public spaces. The proposed interventions enhance the experiential qualities of the river, strengthen village identity, and create adaptable spaces where urban life, floodplain dynamics, and ecological processes intersect. Rather than proposing a single fixed masterplan, 'reimagining the Roer fringes' presents a transferable design approach for villages along natural meandering rivers, contributing to the discourse on water-sensitive urban design and genius loci by imagining a renewed cultural and spatial relationship between inhabitants and water systems.

Key words

Roer river, village fringe, genius loci, place-sensitive interventions, experience, flood

ACKNOWLEDGEMENTS

This graduation thesis in the field of Urbanism has been an experience of turns and takeaways that I will carry with me into my professional life to come.

Choosing the Roer river and its valley as the topic of my thesis has a special meaning to me, as half my family is from this region. Therefore, it has been such a joy to return to the area almost monthly to conduct site visits, talk to people and family from the area, and work with the (sometimes underdefined) beauty of the place.

First, I want to thank my mentors during this thesis, who not only encouraged me to follow my own line of thought but also challenged me to find my own narrative. Kristel, for believing in me and providing me with the right tools - theoretical and creative- that helped me to follow the journey that I have made during this graduation. Inge, for providing me with a critical look at our perception of the water system and challenging me to think differently.

Thank you to my family, especially Pauline and Mark, who have opened their home to me during the many field trips and supported me throughout the graduation process.

To my parents and sister, who have supported me not just along my graduation process but along my entire educational journey.

To Sjoerd, who has joined me several times to delve into the Roer valley with the drone to see the elements that would otherwise stay hidden.

And many thanks to my friends, roommates and cluster peers in the Deltaic Interventions cluster with whom I was able to share the graduation trajectory.



^ Fieldwork to the Roer river near Vlodrop with my granddad in February of 2026.

Preface - floodings of 2021

Between 13th-15th of July 2021, approximately 80-180 mm of precipitation fell in the province of Limburg in the Netherlands. Also in the Ardennes and Eifel region, an extreme amount of rain fell, resulting in high tide in the rivers and eventually in flooding in the region. This event was one of the most severe flooding events in Central Europe, resulting in damage, disruptions, and, in some cases, casualties.

The flooding of 2021 in Limburg

In two days, as much precipitation fell as twice the average precipitation estimated for the entire month. This resulted in large flow rates throughout rivers and tributaries in Germany, Belgium and the Netherlands.

In the Netherlands, the province of Limburg faced the greatest problems due to the position of the Meuse and its most overflown tributaries: the Geul, the Gelsenbeek, and the Roer. Valkenburg, a village located in the Geul catchment area, was heavily damaged by the flooding.

The flooding set a new program in motion: wacht niet op water (WRL). Within this program, the waterboard of Limburg, in collaboration with the province of Limburg, established a framework to raise awareness of high water in the province and began setting up project areas to minimise the impact of flooding in future scenarios. The program focuses on impacts guided by soil and water principles and is projected onto the sites of the rivers Geul, Gelsenbeek and Roer.

Motivation

While flooding in the Netherlands did not cause any casualties, the damage was enormous. The 2021 flooding showed that the current water management in Limburg lacks measures to minimise future nuisance.

In recent years, the main research on flooding and water management strategies in Limburg has been carried out from a civil engineering perspective. This thesis analyses the Roer Valley, one of the overflown tributaries of the Meuse, and positions the floodplain within current (humanised) systems.

By approaching flooding through the experience of the villages in the Roer valley, the natural functioning of the river becomes integrated with daily life and the identity of the Roer valley.





^ Flooded Roermond along the Meuse during the July 2021 summer floods (ANP, 2021)

TABLE OF CONTENT / GUIDE

1. CONTEXT [14]

- 1 Roer Catchment [16]
- 2 Roer as Meuse Tributary [18]
- 3 Identifying the Roer Valley [20]

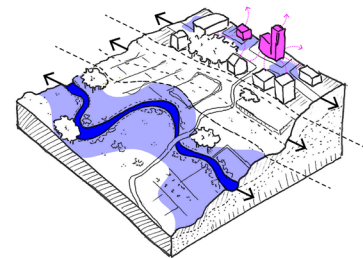
The Roer is the main tributary of the Meuse. While it is of great importance to the Dutch water system, most of its catchment area lies in Germany and Belgium. The systemic functioning of a downstream catchment area, together with the morphological context of Limburg, makes for the physical context of the Roer valley. This chapter therefore focuses on the natural and hydrological principles that form the valley and are crucial for implementing spatial interventions in the fringes.



2. PROBLEM [26]

- 1 A Critical View on the Roer Valley [28]
- 2 Problem Statement [36]
- 3 Research & Design Questions [38]
- 4 Relevance, Objective & Motivation [40]
- 5 Scope (project & hydrological) [42]

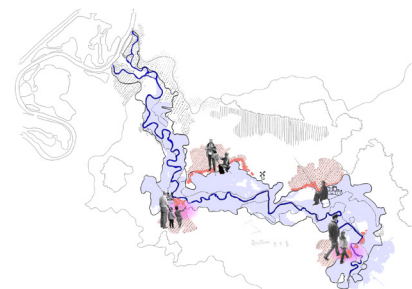
By zooming into the valley itself, the accumulation of the *valley under pressure*, a *faded water identity* and the *parallel systems* define the (spatial) problem for the Roer valley. By exploring the problems in the valley, the problem statement is formulated. Additionally, the scope and limitations of the project are stated to define the research aim and its desired outcome.



3. APPROACH [46]

- 1 Theoretical Framework [48]
- 2 Conceptual Framework [50]
- 3 Methodology [52]
- 4 Water as a Multiscalar System [56]
- 5 Defining 'experience' [58]

The theoretical and conceptual framework is presented based on the accumulated findings from the context and literature studies. A methodological framework describes the steps and methodologies used to carry out the *research by design* project.



4. RESEARCH [60]

- 0 *Analysing the systems* [62]
- 1 The intentions of the river [64]
- 2 Experiencing the river [72]
- 3 Demographics of Roerdalen [78]
- 4 Bandwidth of place-sensitive interventions [79]
- 5 Transformative design approach [80]

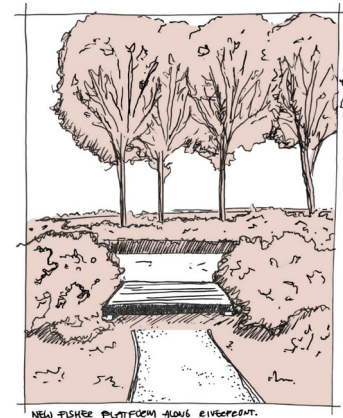
The research provides a spatial analysis of the Roer valley. Together with the analysis from the Inventory Atlas* (see additional document), design briefs for two river oriented and two floodplain-adjacent villages in the Roer valley are presented.



5. DESIGN [90]

- 1 Place-sensitive intervention principles [92]
- 2 Reimagining Sint Odiliënberg [94]
- 3 Reimagining Herkenbosch [104]
- 4 Impact of interventions [116]
- 5 Phasing the transformation [118]

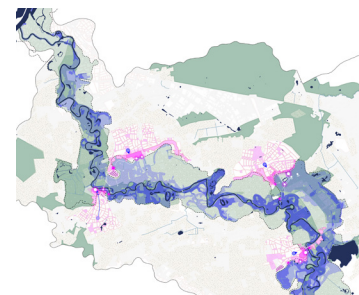
Based on the analysis, principles for river markers (place-sensitive interventions) have been formulated. These serve as the basis for projecting the transformed village fringes of Sint Odiliënberg and Herkenbosch. For each of the village fringes, a possible projection of the integration of place-sensitive interventions is shown, both in a dry and a flooding situation. Eventually, these projections are translated into the impact of the possible interventions on the Roer Valley for 2050.



6. CONCLUSION / 7. DISCUSSION [122]

- 1 Conclusion [124]
- 1 Implications & recommendations [130]
- 2 Reflection [134]

An answer is provided to the main and sub-research questions. The limitations of the project are also described, as well as a reflection on the graduation thesis and the relevance of the project for the field of urbanism.



8. APPENDIX [136]

- I. References [138]
- II. Data Management Plan [140]
- III. Inventory Atlas* [141] + [\[Inventory Atlas document\]](#)
- IV. Place-sensitive intervention principles [142]

*The Inventory Atlas of the Roer Fringes is considered as an external chapter of the thesis. Its main results are discussed in the research chapter and used to design the village fringes.

Glossary

Roer Valley

Valley: *a low area of land between hills or mountains, typically with a river or stream flowing through it.*

Although the Roer is located within the Meuse Terraces in Limburg, Dutch morphology cannot be described with hills and mountains. For the case of the Roer, there can be talked about a 'valley' because erosion created terraces in the area - ensuring that the Roer river is located in the area planned out by years of erosion.

In this thesis, the Roer Valley comprehends the *floodplain* and areas next to the valley that still exist within the *catchment* area of the Roer river.

Discharge

The volume of water flowing through a river's cross-section per unit of time, essentially measuring the river's flow rate, is typically expressed in cubic meters per second (m^3/s). Knowing the discharge of a river helps to better understand flood predictions, water management practices and the quality of surrounding ecosystems.

Flood plain

The (flat) area of land adjacent to the Roer river that periodically gets covered by water. This seasonal phenomenon occurs when the river overflows its banks due to heavy rainfall, either within the Roer catchment or upstream of it.

These lands are often fertile because sediments are carried along with the water from the river. In Limburg, people speak of *ohé*: fertile (clay) soil located next to the riverbank.

Adaptive

When space or spatial elements can adjust themselves to the current condition.

Adaptability describes the ability to be flexible across different times, seasons, and users. Being multifunctional while being bound to a set location.

Catchment

All areas of land from which water drains before flowing into the Roer river. This includes water sources/ springs in the upstream area, tributaries of smaller rivers and ditches, as well as woodlands and buildings from which water eventually drains into the river.

Fringe

Between the edge of an urban area, or in the case of the Roer valley the edge of the village, the fringe is located. It functions as the transition zone between urban zone and natural or agricultural adjacent land.

Space

The physical realm in which we operate and exist. Space is often connected to a function. This could be linked to human activity or its natural state.

Place

Space that has been or is being transformed into a destination. A place has a *meaning* for communities, ecology or water. Systems and people can benefit from its existence; it adds value to their lives or enhances their current system.

Place-sensitive interventions / markers

To intervene in the village fringes of the Roer valley, carefully selected and site-specific interventions are placed to establish a connection between the Roer river and the villages of the valley.

An elaboration on the place-sensitive interventions can be found on page 79 or Appendix IV.

Experience

The perception of spatial interventions and/or the personal connection that could be formed by these interventions. Experience is tied to senses in which the experience of a place is amplified: visibility, auditability and accessibility.



1.

< The Roer in St. Odiliënberg,
photographed in December 2025 by
author

- 1. Roer Catchment*
- 2. Roer as Meuse Tributary*
- 3. Identifying the Roer Valley*

CONTEXT

1.1 Contextualising the Roer catchment

Located in the south of the Netherlands, in the hilly parts of the country, is the Roer, a tributary of the river Maas. The river flows as a relatively small stream through the Roer Valley, eventually passing through the city of Roermond, where it merges into the larger waterbody of the Meuse. As the Roer Valley in the Netherlands is located at the end of the catchment area, water accumulates in the area in times of high discharge, resulting in flooding in the region.

The Roer in the Netherlands appears as a relatively small stream, but the river is about 165 km long and flows through Belgium, Germany and finally into the Netherlands (JCAR ATRACE, n.d.). The river springs in the High Fens of the Ardennes in Belgium. Then the water flows to the Eifel in Germany, where rainwater is collected and merged into the water system.

Within the catchment area of the Roer are a few (large-scale) elements that affect the overall water system:

Reservoirs

In the Eifel region in Germany, seven water reservoirs have been built to retain water. These reservoirs are not only made to provide regions with drinking water, but they also play a crucial role in managing the flow of the river itself. Because of the natural composition of the southern region of the catchment area, located in the Eifel, water cannot be absorbed into the ground properly. The reservoirs, therefore, prevent this water from flowing directly downstream (Asselman & van Heeringen, 2023). In periods of drought, these reservoirs help maintain the proper level of the river discharge (min. 5 m³/s).

Lignite mines

In the mid-stream of the Roer, in Germany, are lignite mines located. These open-pit mines are used to extract brown coal and can reach depths of up to 200 meters.





To prevent these mine pits from filling up with water, groundwater is extracted and pumped into the surface water system. This operation of groundwater extraction is tremendous, impacting groundwater levels in a radius of ten kilometres around these mines.

Due to environmental policy, the extraction of lignite in the German mines will reduce during the period of 2020-2030, and will eventually be closed (van der Wal et al. 2020). There are plans to fill the pits of these mines with water to create recreational water reservoirs. This also means that the groundwater extraction comes to a halt, returning the groundwater levels of the surrounding areas to their natural state.

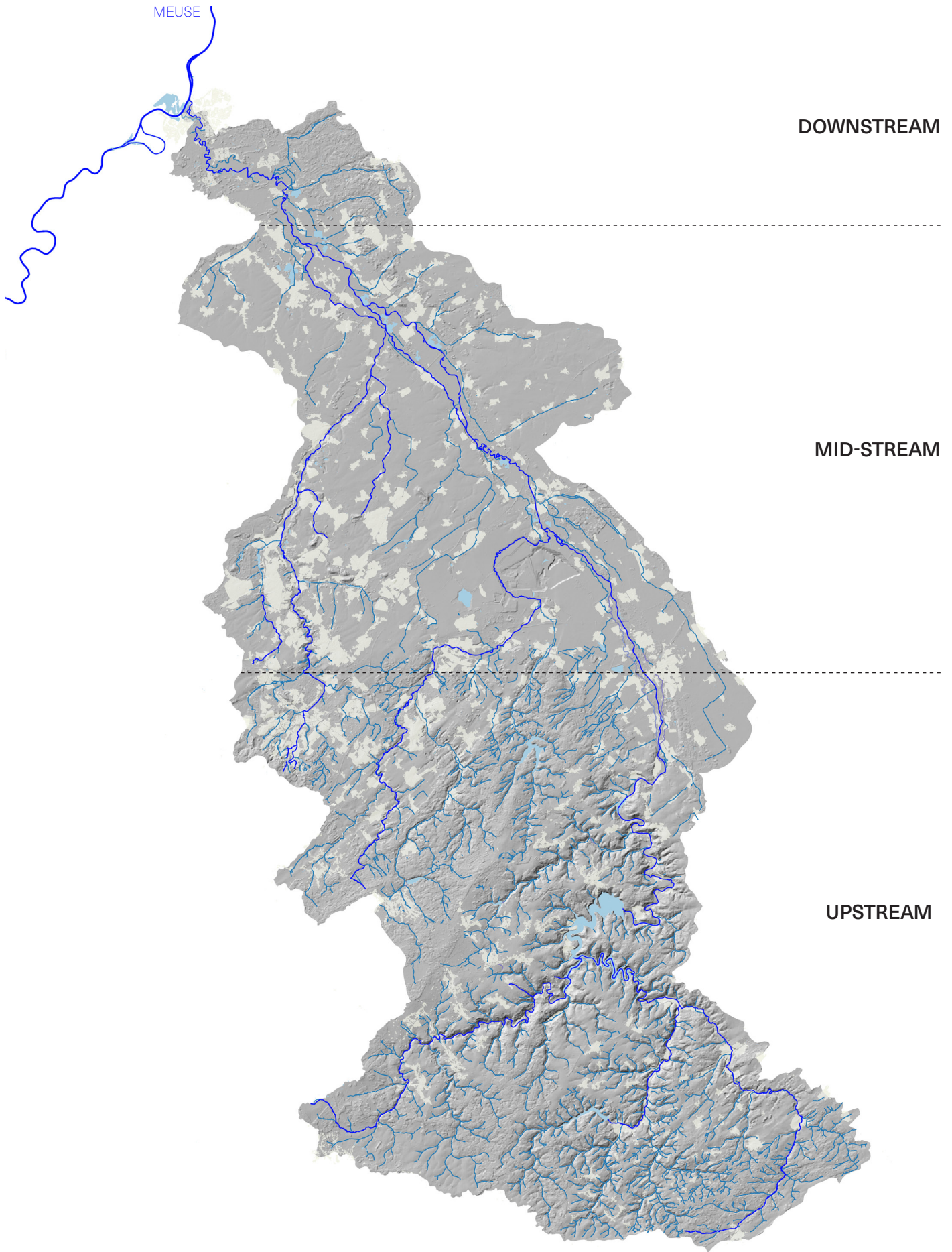
Summer '21

The flooding from 2021 occurred during the summer, which has made the event 'not a total catastrophe'. The reservoirs in the upstream catchment area were relatively empty because it was July. Had the event taken place in the winter with the same amount of precipitation, these reservoirs would have been full and not able to retain as much water. The soil in the catchment area would have been much harder, making it harder for the ground to absorb rainwater. (Asselman & van Heeringen, 2023)

For the Roer and especially the valley in the Netherlands, this would have meant that the flooding would have been more extreme. This could have led to more people being affected by the flooding of the valley.

-  Main water flow
-  Secondary water flow
-  Basin
-  Urbanised area

> The roer catchment, showcasing the main hydrological arteries and topography of the region.



0 5 10 km



1.2 The Roer as tributary

In the Netherlands, unlike the Roer in the upper parts of the catchment, the Roer appears like a small stream. In reality, the tributary is the largest contributor to the Meuse in the Netherlands and provides a consistent flow into the Meuse, especially during dry periods.

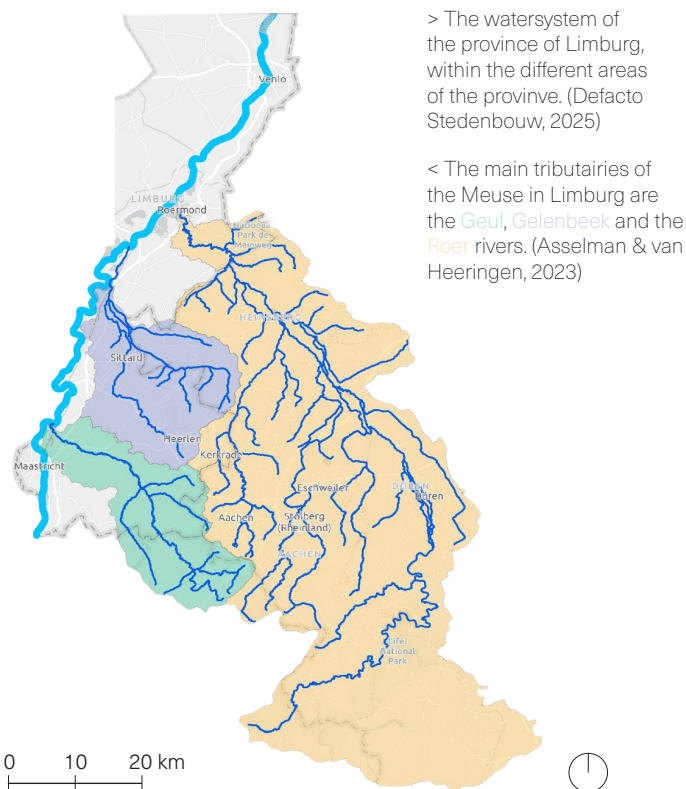
Roer in Limburg

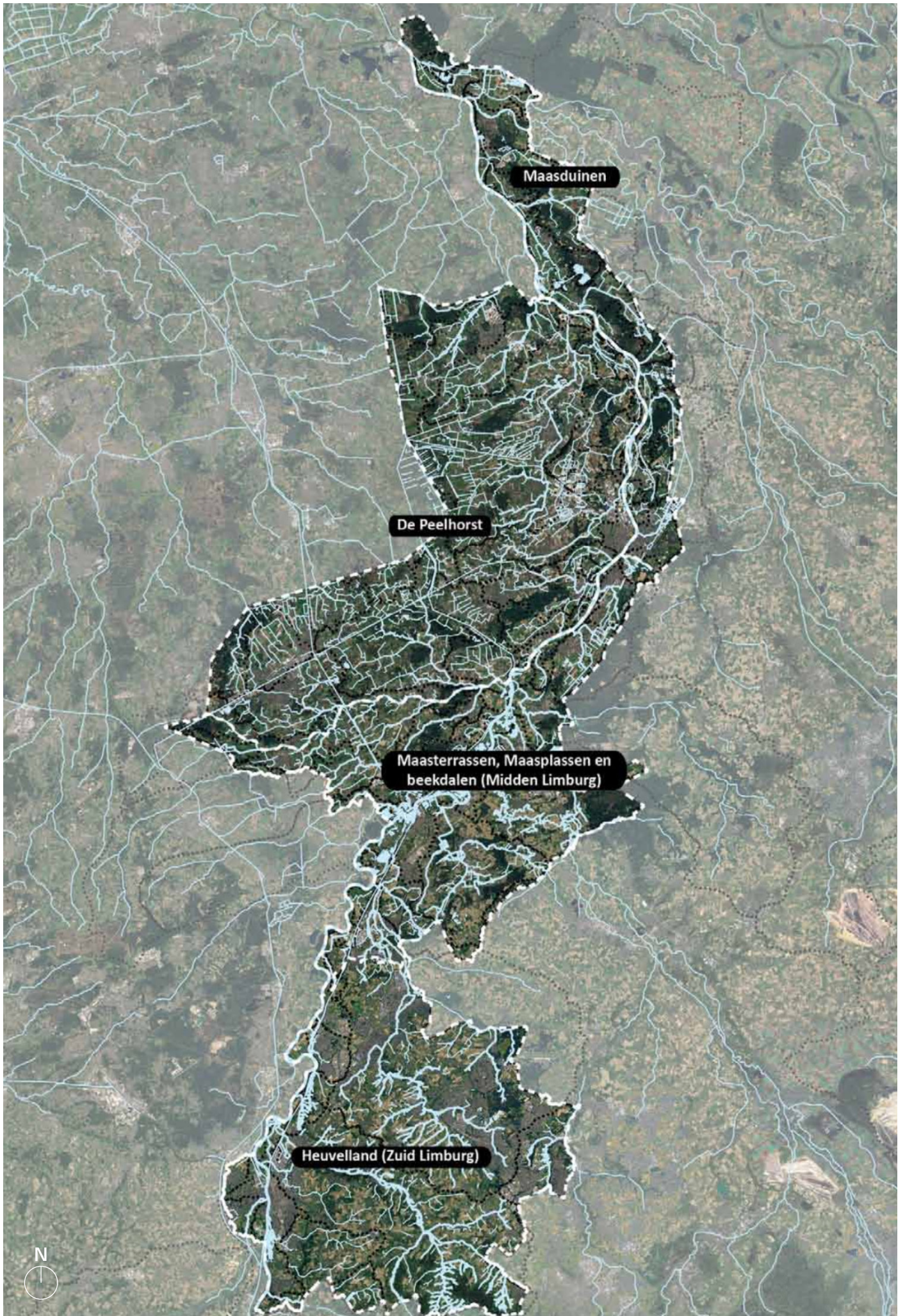
The Roer river is vital for the Meuse because of its consistent contribution to the large river. During periods of drought, the total contribution of the water that flows into the Meuse from the tributaries into the main stream lies between 12 and 16.5 percent, which makes the Roer the largest contributor of water to the Meuse out of all the tributaries throughout the Meuse catchment (Kramer, 2021). This vital position of the Roer river can be derived from examining the catchment of the Roer, as the basins higher in the catchment ensure a stable water supply throughout the year.

The crucial role of the tributary

While tributaries are crucial for the water supply of main rivers, they are often understudied or seen as less valuable than the main rivers in the Netherlands (Kramer, 2021).

This thesis therefore highlights the value of the tributary, by showcasing the natural functioning of the water and the rich context that is adjacent to the river.





1.3 Identifying the Roer valley

The Roer Valley is an unique landscape in the Netherlands, not just because of the Roer river but also because of its location within the country. It has its own unique characteristics that describes the configuration of the area. These elements can be part of the *spatial identity* of the Valley.

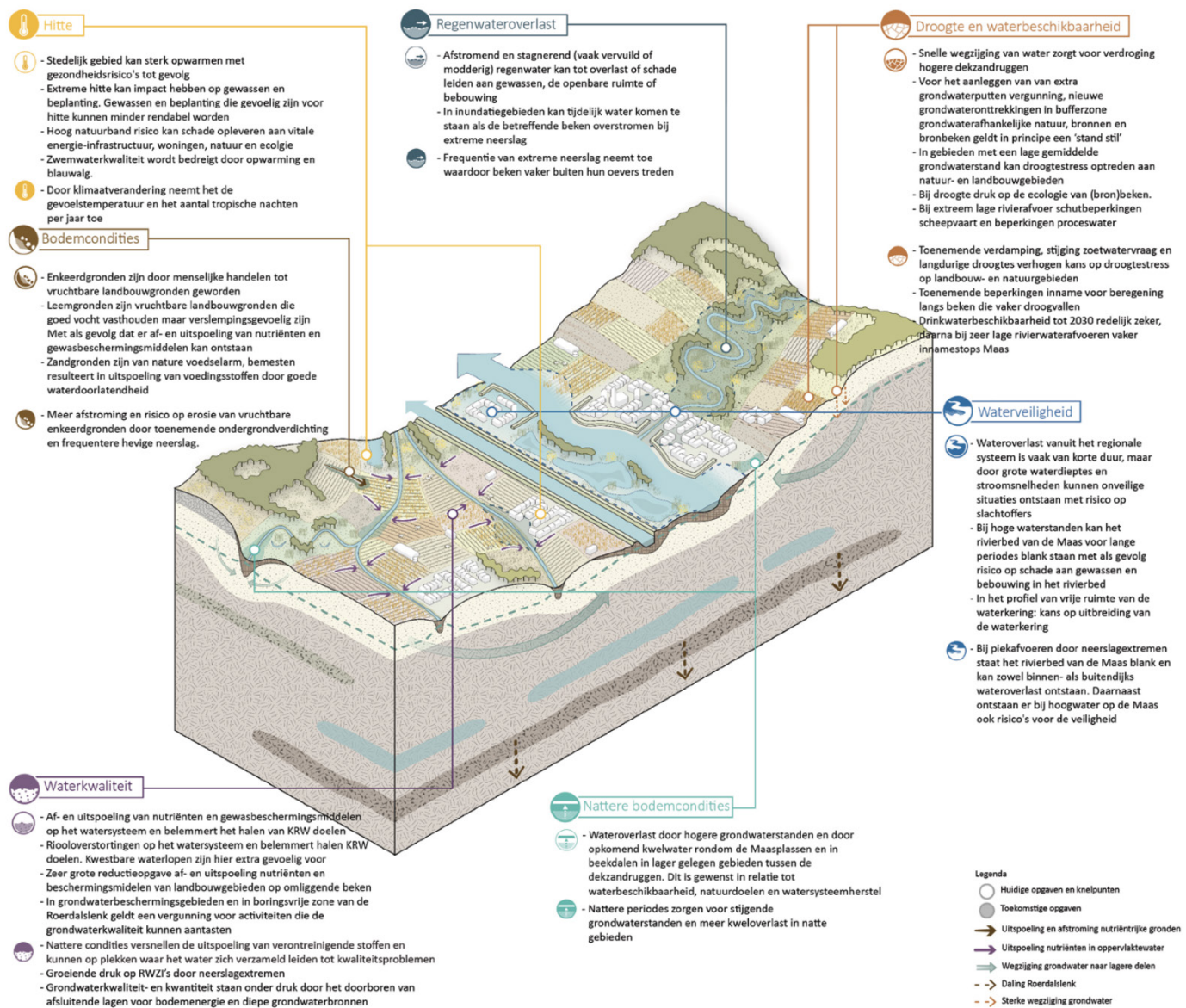
Meuse terraces

The main spatial element that defines the valley are the terraces, formed during the Pleistocene and Holocene by years of erosion and reformation of the river (Rijksdienst voor het cultureel erfgoed, 2025). While the slopes are not significant as in the more upstream areas of the Roer catchment, the height differences are very visible in the valley.

The configuration of the terraces has led to the natural settlement pattern being on the higher plateaus. This ensured the dwellings' safety from flooding while still being connected to the river.



< Visible terrace layers mark the treshold between the settlements on the higher plateaus and the floodplain.



^ Systemic overview of the buildup of the Meuse terraces and the most urgent problems that arise within the landscape (Defacto Urbanism, 2025)

Describing the identity of a region is not an easy task. For me, identity is often a part of the *feeling* of a place and can be experienced differently by each individual. Therefore, to understand the identity of the Roer valley, I am referring to the *spatial identity* of the valley.

The valley can be categorised into 3 zones: the *urban core*, the *threshold* (transition zone), and the *floodplain*. In each of these zones, the *genius loci* can be revealed: the unique character and meaning of a specific location, understood holistically through all senses, not just through sight (Norberg-Schulz, 1979).

Photographs and drawings help to explain the feeling and characteristics of the site, which is crucial to understand the identity of the Roer valley.

URBAN CORE



^ Village center of Herkenbosch (Dec '25)



^ Village center of St. Odiliënberg (Dec '25)

The urban cores project a paved urban landscape. The materiality is common throughout the area and consists mostly out of brown clinkers and brown-shaded stone houses. There are some trees in the street, but vegetation is limited. This is contrasting a lot with the naturality of the floodplain that often lies just behind a row of houses.

THRESHOLD / TRANSITION ZONE

The transition zone is formed through the height difference of the floodplain, which can be considered the border of flood plain and upper terraces. This height difference can be very subtle, as seen near Melick, but can also be very prominent in the landscape as seen near Herkenbosch. While this natural 'reshold' protects the urban areas from mayor flooding, it can also create a disconnect between the two systems of the villages and natural floodplain.



^ Visible outlines of the valley, Melick (Dec '25)



^ High difference creates clear separation between Herkenbosch and Roer floodplain (Dec '25)

FLOODPLAIN

The floodplain is mostly a Natura-2000 area with natural meadows, agricultural fields and the Roer river. Its natural feeling and open atmosphere is a stark contrast to the vastly paved urban cores. The floodplain is almost not inhabited, as the uncertain intensity of a flooding makes it unfavorable to live in.

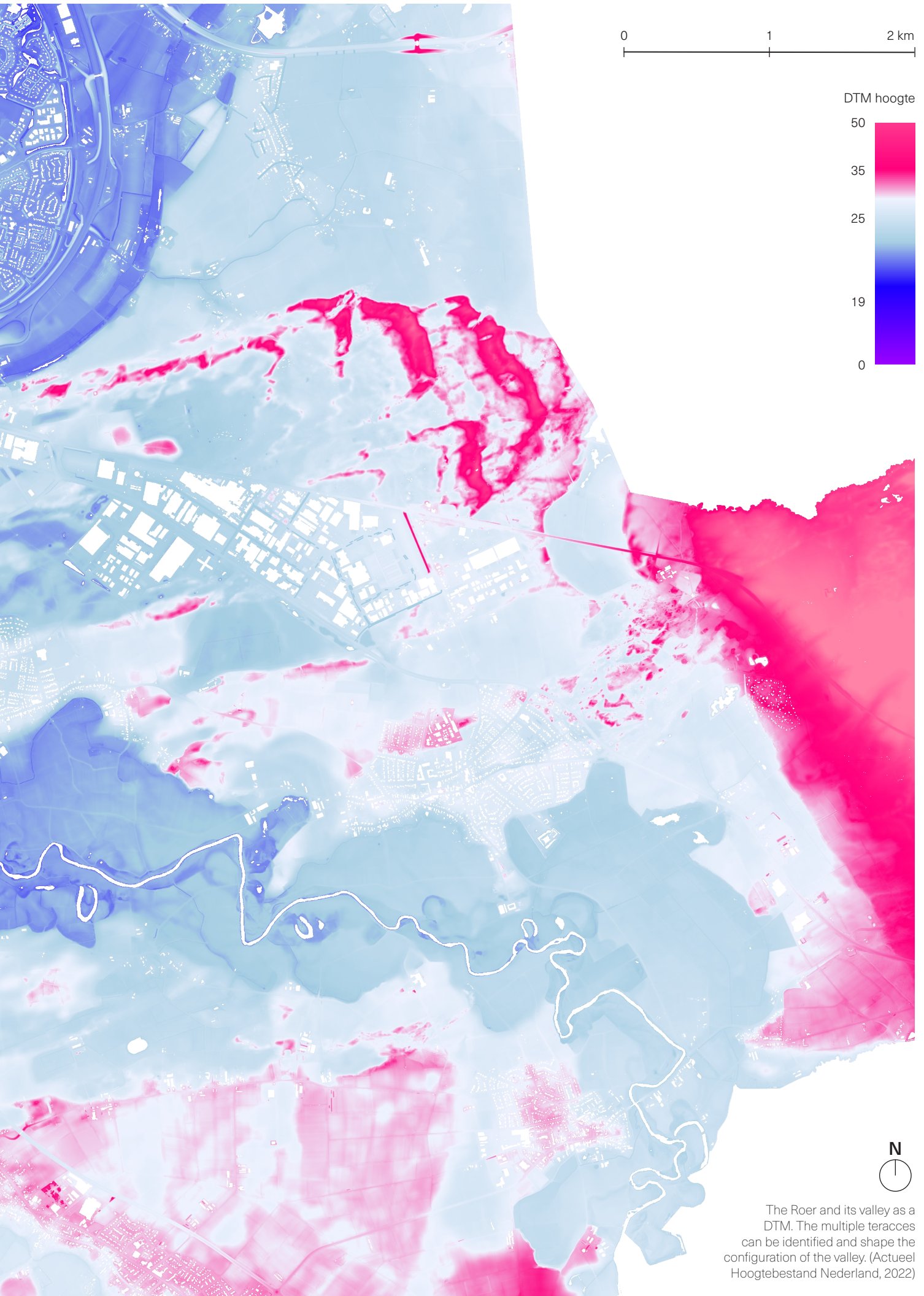


^ The Roer river near St. Odiliënberg (Dec '25)



^ Floodplain is formed by (natural) meadows and agricultural fields (Dec '25)





The Roer and its valley as a DTM. The multiple terraces can be identified and shape the configuration of the valley. (Actueel Hoogtebestand Nederland, 2022)



- 1. A Critical View on the Roer Valley*
- 2. Problem Statement*
- 3. Research & design questions*
- 4. Relevance, objective & motivation*
- 5. Scope (project & hydrological)*

PROBLEM

2.1 Roervalley: a critical view

While the embankments of the Roer floodplain in Limburg provide a natural protection from the floodings, it also creates a boundary between settlements, the water system and ecological structures. The Roer had been seen as the least impacted by the 2021 floodings in terms of impacted households in the Netherlands (Asselman & van Heeringen, 2023). However, impact (in any form) should not just be measured by the direct impact on households. A critical assessment of the Roer Valley is needed to understand its systems, configuration and eventually the experience of the Roer from the villages in the valley.

The Roer is one of the only natural meandering rivers left in the Netherlands. This results in a more natural flow of the water compared to other Dutch rivers. Next to the river, an overflow area is located, providing space for water to flow during high tide.

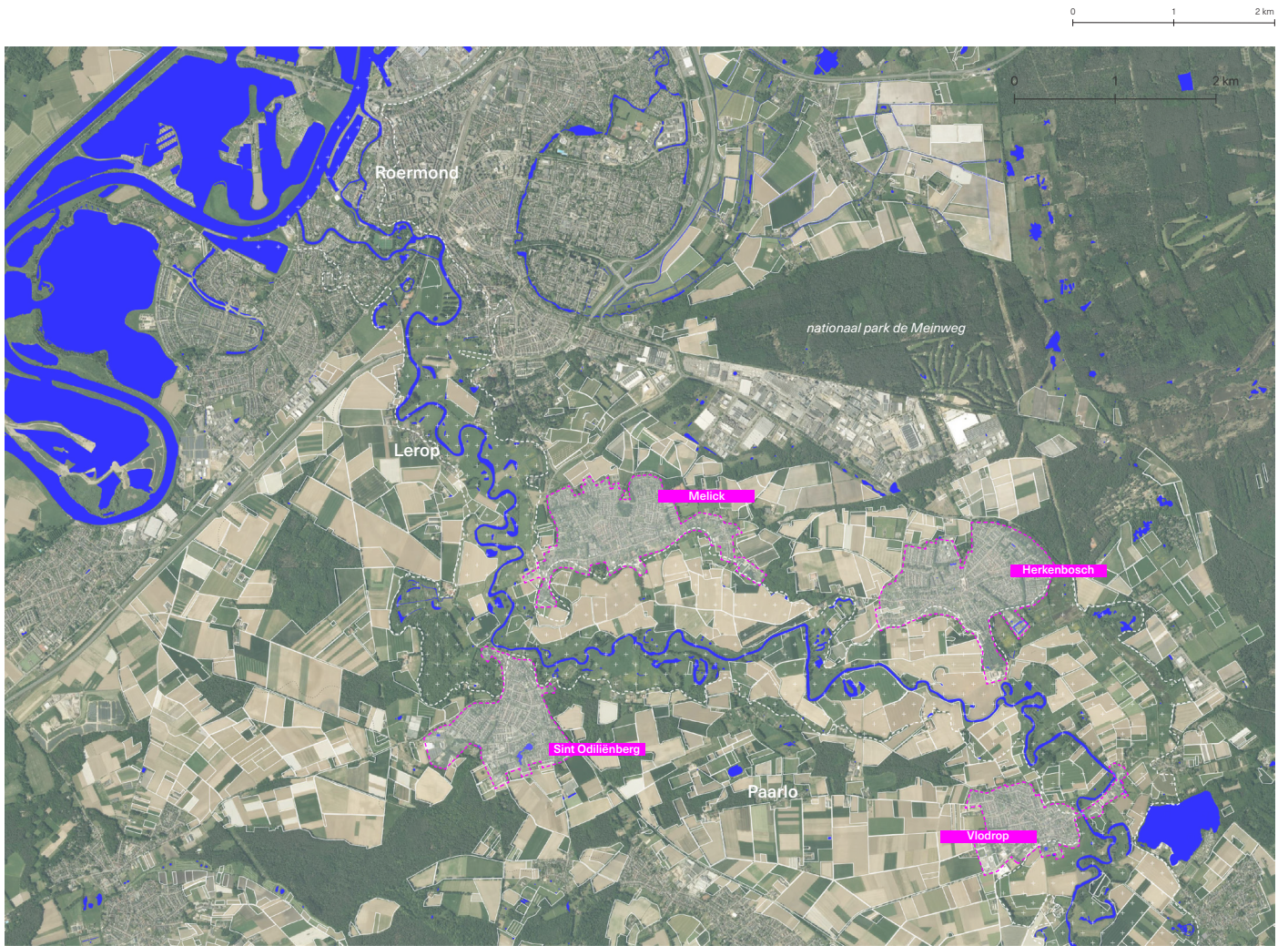
The flooding of 2021 has led the water board of Limburg to establish a new program to monitor and adjust tributaries of the Meuse to create adaptive waterways and prevent disasters. The *wacht niet op water* (WRL) program takes on the three most flooded tributaries: the Geul, the Gelsenbeek and the Roer. While the programs for the Geul and Gelsenbeek have been set up and research has started, the program for the Roer has just been established for exploration (*Wacht niet op water*, n.d.).

Given the vast catchment area and the fragile position of the mouth of the Roer into the Meuse, the Roer Valley cannot be overlooked.

Looking at the Roer valley from the perspective of the Roer river, it can be seen that the area is no longer as coherent as it once was. The urban cores do not interact with the natural processes and landscape of the river, and the floodplain is not optimally utilised. Where the area is unique in having a natural meandering river within a naturally formed terrace landscape, the urban space does not connect to it. This spatial incoherence results in a disconnection between the inhabitants and the Roer river and the natural functioning of both the river and the floodplain, due to separate functional spaces.

Re-finding this connection between settlements (urbanised areas) and the Roer and its floodplain is beneficial for both the river, the landscape, and urban life, as the systems can distribute the problems at hand.

The problems that take shape within the Roer valley can be structured into three themes: the valley under pressure, a faded water identity and parallel systems. This thematic structure of defining the problems within the area will be summarised in the problem statement, which serves as the basis for this graduation project and defines the scope going forward.



^ The spatial relationship of the villages of the Roer valley and the Roer river.



VALLEY UNDER PRESSURE [water]

Hydrological extremes

As the Roer Valley in the Netherlands is located in the downstream area of the catchment of the River, the Valley is naturally positioned in an area sensitive to water extremes. When the water is at high tide, the Valley functions as a drain of the Roer into the Meuse. In drought, the river gets provided just enough water from the upstream catchment not to dry up.

The water system flows water through the area as fast as possible. Because of the extensive agricultural land use, water cannot infiltrate the soil as much, increasing drainage during peak periods. This also affects groundwater levels, as less infiltration often results in lower levels. In (extreme) dry periods, these levels can become so low that plants cannot reach the groundwater properly, resulting in withered crops or natural areas.

Environmental impacts on the hydrological system

The Roer is a pluvial river, meaning it is primarily fed by rainfall. Because rainfall-driven events are often tied to seasons, river discharge is closely linked to them. In recent years, hydrological events have become more extreme, with both flooding and drought becoming more frequent. Rainfall comes in fewer but more intense showers, resulting in high river discharge with less time for the water to be absorbed by the soil. (KNMI, 2021)

Reliance on upstream decisions

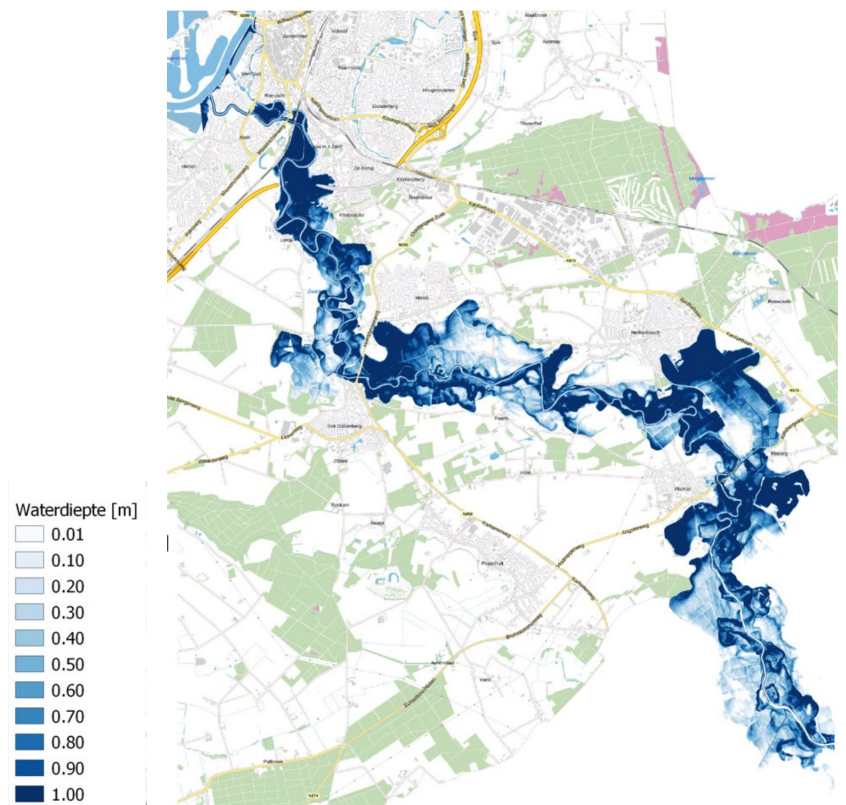
Being located in the downstream area of the Roer catchment means that, although hydrological extremes are relevant for the Valley in the Netherlands, river discharge is determined by upstream decision-making and alterations to the water system. Throughout the years, water reservoirs have been created upstream of the catchment. These reservoirs not only function as a buffer, but also ensure steady river flow during drier periods.



^ Aerial picture of floodings within the Roer floodplain in July 2021 (Het Waterschapshuis, 2022)



^ Forestfire in *National Park de Meinweg* during dry spring around Vlodrop (AV Limburg, 2025)



^ Flooded areas with water depth of July 2021 (Asselman & van Heeringen, 2023)

FADED WATER IDENTITY [place]

Within the Valley, the history of the area is clearly marked by the Roer floodplain; its depth and shape have been formed after thousands of years of flooding and repositioning of the river. This difference in elevation clearly marks the natural basin of the river. In the current conditions, the gradient manifests itself mostly as a marker of the border between natural landscape and urbanised settlements.

Cultural heritage

This naturally shaped valley has led to people settling on top of the elevated plateaus, positioned along the river and its floodplain, but high enough to keep their feet dry. While the strategic location of settlements can be logically derived from the height difference, it also had to do with the flooding of the Roer river being more extreme before the creation of basins in the upstream catchment of the Roer river. The water was less controlled, resulting in a greater portion of the floodplain being flooded. Except for a couple of dwellings, there is almost no building constructed in the natural floodplain of the Roer river.

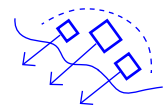
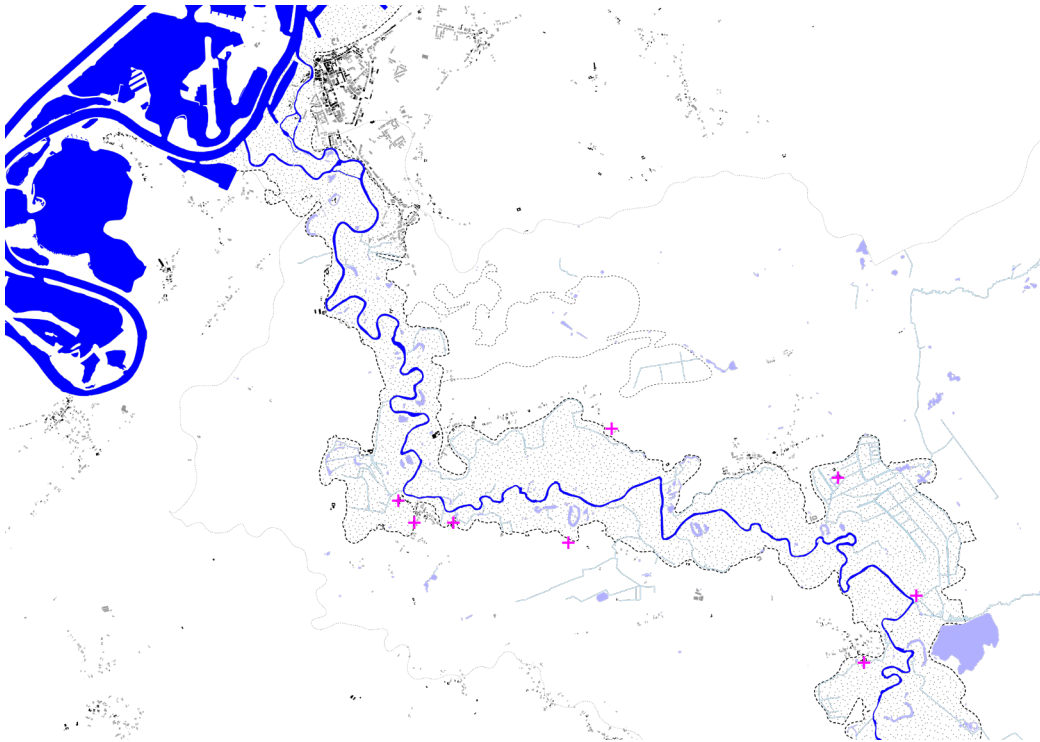
Socio-hydrological relationship

Looking at the settlement origins, these were often located at the edge of the floodplain. This expresses a connection of the inhabitants with the adjacent river landscape.

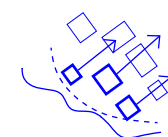
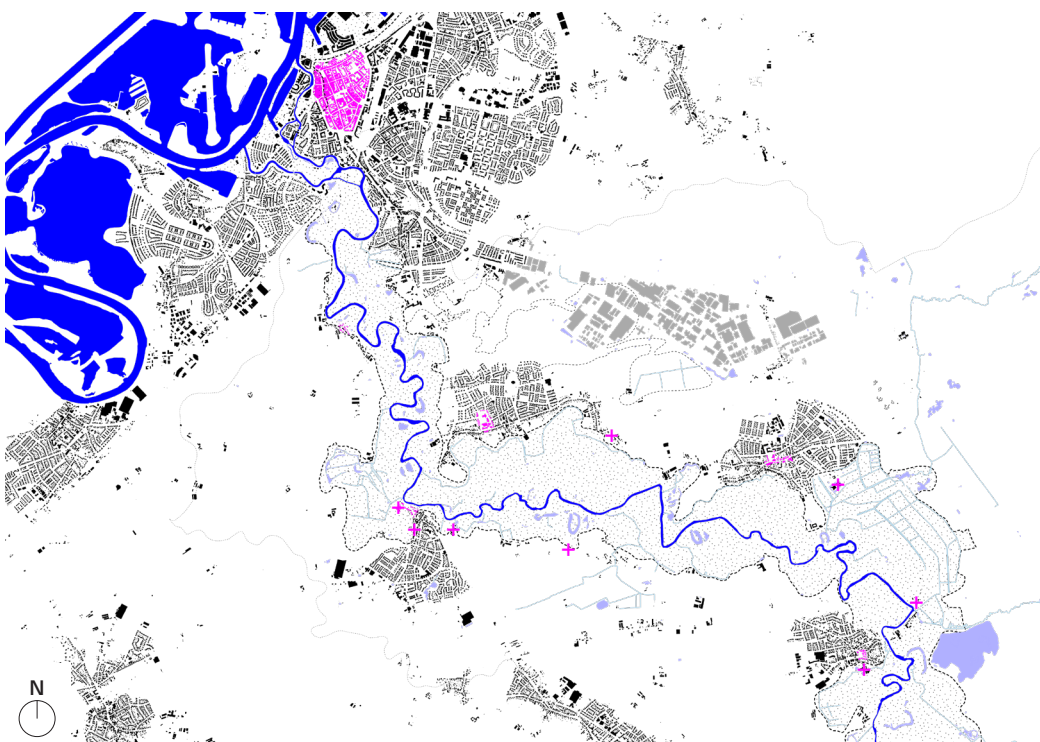
Over time, however, these settlements have expanded away from the river and its floodplain. Examining the current morphology of the settlements, the urban cores are often not connected to or responding to the floodplain.

Because the urban terrain functions and looks drastically different from the surrounding natural landscapes, a disconnection between the two zones can be seen. Living with water has made room for comfortable living within the villages with convenience at its centre. Connecting this to the *valley under pressure* and the more frequent water nuisance in the urban environments, returning to the original connection of the settlements to the river landscape can help to mitigate hydrological events.

0 1 2 km



< Dwellings and the establishment of the villages along and connected to the Roer valley before 1945. (data pdok)



< Current configuration of dwellings and the urban cores, less connected with the natural vally. (2025, data pdok)

PARALLEL SYSTEMS [space]

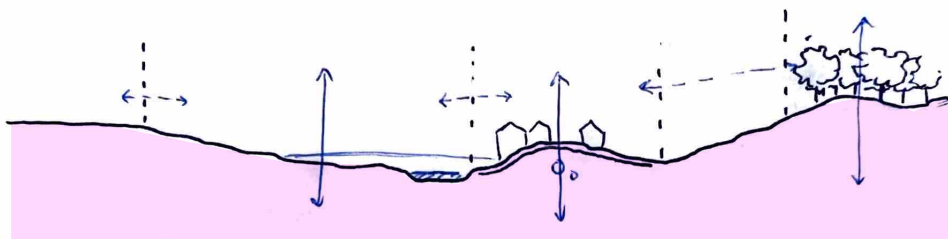
The valley is structurally categorised into the urban core, the floodplain (including the Roer river), and the transition zone between these two landscapes. Each of these areas has its own system, functioning differently from one another and addressing hydrological events, people and ecology distinctly from one another. While these systems lie next to each other and could even benefit from the assets of the other systems, they exist in parallel to each other without interacting.

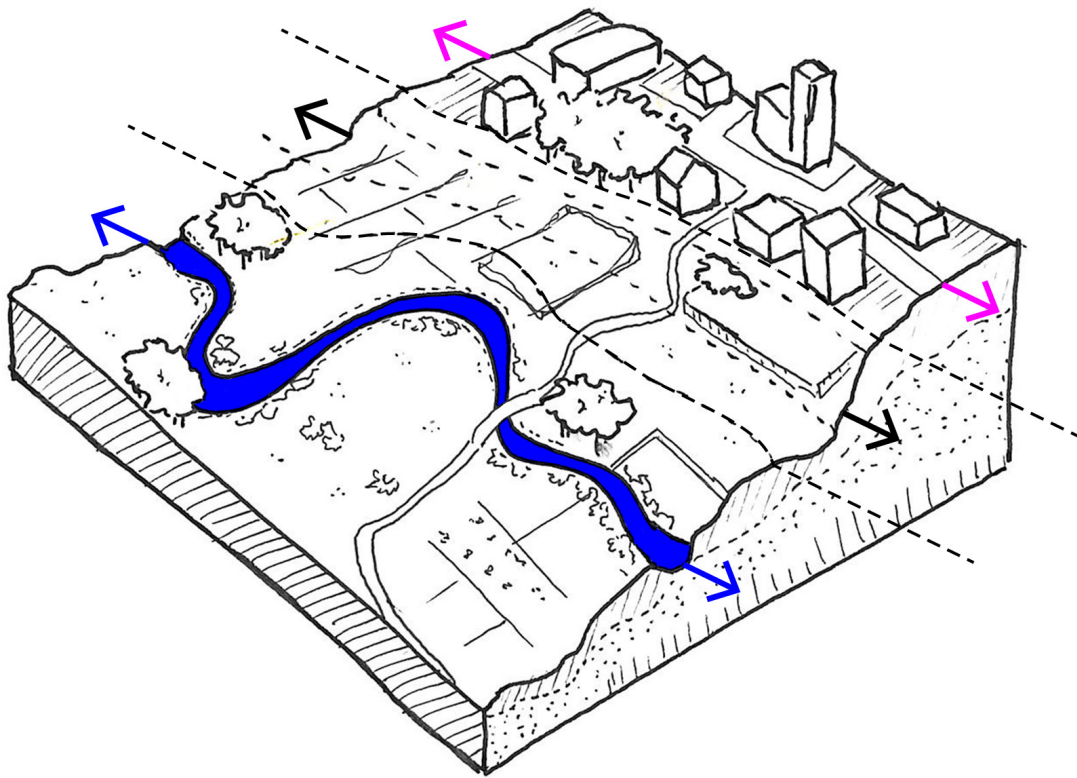
Looking at extreme precipitation or flooding events, it would be beneficial for the highly pressured zone to share its burden with its neighbouring system and vice versa. In these extreme events, the importance of natural buffers to hold, filter, and absorb water is underlined. This is more the case in urbanised cores and in the future expansion of the valley region.

Villages (the *urban core*) can benefit from the natural sponge system that comes along the *floodplain*, but the natural systems can also benefit from a better-connected system. By allowing ecological and natural systems to be more prominent in the now paved urbanised zones, the reach of ecological connection becomes enlarged.

The *transition zone* is seen as the gradient between the floodplain and the urban cores. In the current context, it manifests itself purely as a steep road, allowing people to enter the floodplain for their commute. This transition zone is not integrated into the surrounding urban cores to better accommodate interaction between the two zones.

Each zone holds a high potential to become more meaningful to the valley by adding value to its identity and accommodating the needs of the systems present in the area. When these systems are integrated, the valley has the potential to become more adaptive and structured for its systems and the people living within the Roer valley.





- Floodplain
- Transition zone
- Urban core

^ Schematic overview of the parallel functioning of the Roer valley.

2.2 Problem statement

The Roer Valley is increasingly affected by hydrological extremes, exposing a structural imbalance in the relationship between water systems, landscape, and settlement patterns. As a downstream valley, it is highly sensitive to fluctuations in river discharge and groundwater levels, while having limited influence over upstream processes. Climate change is expected to intensify these dynamics, placing additional pressure on the valley's capacity to support ecological systems, spatial continuity, and everyday life.

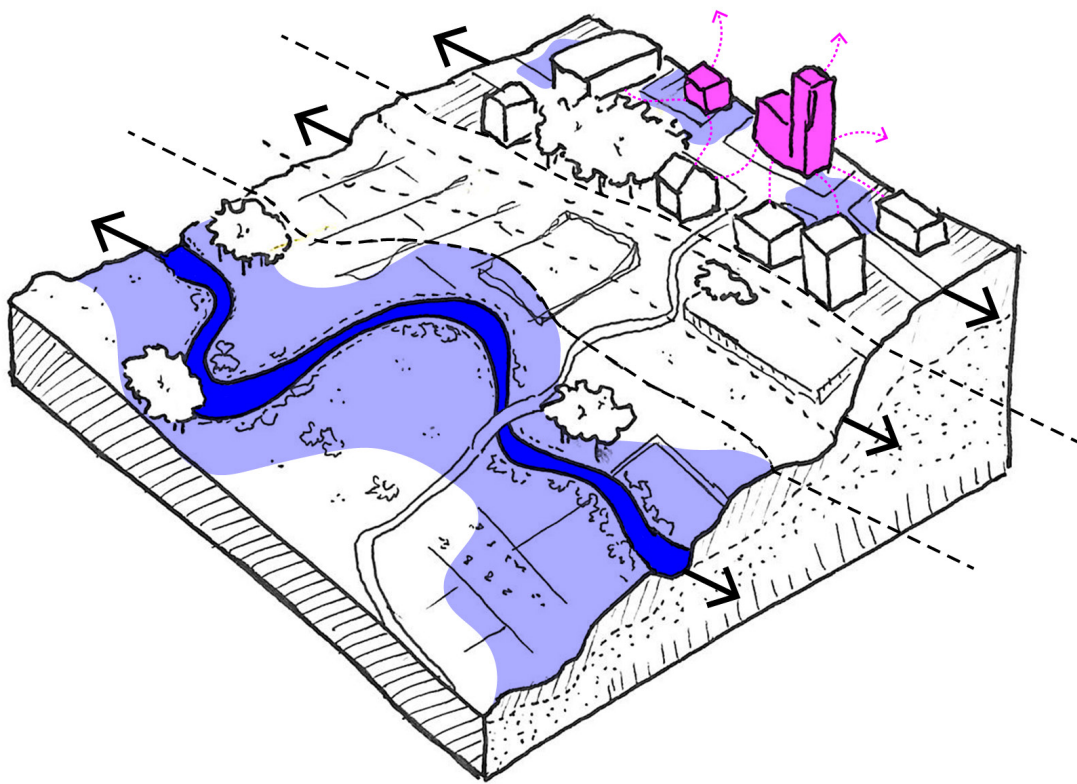
At the same time, the spatial organisation of the valley no longer reflects its underlying hydrological logic. Historically, the Roer and its floodplain structured settlement patterns, land use, and daily interactions with water. Today, this relationship has largely diminished. The river is predominantly approached as a technical system to be controlled, rather than as an integral and experiential component of the landscape. As a result, the sensory and spatial connection between residents and the river through visibility, audibility, and physical accessibility has significantly weakened.

This disconnection is reinforced by the fragmentation of the valley into parallel spatial systems. Urban areas, floodplains, and transitional zones operate largely independently, each governed by separate functional logics.

Despite their proximity, meaningful spatial and experiential relationships between these systems are limited. Particularly at the village fringes (where settlement and floodplain meet) this lack of integration becomes evident. These areas, while holding the potential to mediate between human activity and hydrological processes, remain underdefined and underutilised in both spatial and social terms.

Current responses to hydrological challenges tend to focus on large-scale or technical interventions, often overlooking the potential of smaller, site-specific spatial strategies. As a result, opportunities to strengthen the everyday experience of the river and to incrementally improve the relationship between residents and their landscape remain largely unexplored.

The absence of a design approach within the village fringes asks for a projection of (limited) spatial interventions to reconnect the village inhabitants with the Roer river. By engaging with the river through experience (sight, sound, and access), such interventions can contribute to a renewed spatial and cultural relationship between inhabitants and the river. Addressing this gap is essential for developing adaptive, village-specific strategies that not only respond to hydrological extremes, but also re-establish the river as a meaningful and lived component of the Roer Valley by 2050.



^ The Roer Valley now functions within separated systems. This is the starting point for the problem statement.

2.3 Research & design questions

Following the problem statement and the exposition of its structural elements [*valley under pressure*], [*faded water identity*], and [*parallel systems*], the main aim of this thesis is to research the impact of place-sensitive interventions within the village fringes of the Roer Valley to connect the residents to the Roer river. To guide this research, the method of *research by design* will be implemented.

The problem statement describes a need for the integration of *systems* and a connection of urbanised areas with the Roer river. Because this thesis is centered around the Roer river, water or hydrological extremes are the main driver to establish this connection.

Combining the structural elements of the problem statement, the following research question for this graduation thesis has been formulated as:

How can place-sensitive interventions within the village fringes of the Roer Valley improve the experience and connection of its residents with the Roer River by 2050?

To further research this main research question, subquestions have been formulated to support the eventual research by design outcome of this thesis.

Subquestions

- What hydrological and spatial pressures determine the relationship between the village fringes and the Roer River at different times of the year, with different seasonal hydrological impacts?
- How can (natural) hydrological processes be incorporated into the implication of place-sensitive interventions on the village fringes within the Roer Valley?
- What is the scope of a place-sensitive intervention?
- How does the implementation of a place-sensitive intervention improve the experience of the residents of the Roer river?

[parallel systems]

How can place-sensitive interventions within the **village fringes** of the Roer Valley improve the **experience** and **connection** of its residents with the Roer River by 2050?

[valley under pressure]

[faded water identity]

2.4 Roer = relevant

The role of the urban designer

While the water system of the Roer has been researched thoroughly by water engineers and geo-morphological experts. A spatial link to manifest their findings (peri-) urban areas are missing or inadequate, resulting in an incoherent relation of safety measures and spatial quality. Here, the role of an urban designer becomes relevant. The urban designer examines different systems within the Roer Valley and evaluates spatial interventions through the lens of many stakeholders/systems. With critical cartography and spatial design, peri-urban landscapes, the floodplain and other land uses can be integrated through spatial interventions. Eventually, these interventions can lead to the integration of the Roer as a structuring element within a resilient regional landscape.

Objective

The aim of this thesis is to reconnect the urbanised areas within river valleys to their surrounding natural systems. While the Roer is one of the few naturally meandering rivers left in the Netherlands, it is crucial to reconnect and profit from the surrounding natural systems that are in place, such as ecological connections and an adaptive water system.

The research serves as an exercise for the Roer valley to spatialise the often hydrological engineered perspectives of the valley into spatial implications to understand the qualities of the area. Water management practices in the Netherlands are often focused on water drainage, an approach that is not applicable to every landscape in the country. While these practices are crucial to ensure water security within the Netherlands, this results in the neglect of other systems. These (often natural) systems have to make way for human interventions, while especially natural water systems can be crucial for an adaptive landscape.

By examining the spatial qualities of the Roer Valley and understanding the missing connections, this study can provide insight into spatial interventions to make the Valley better capable of mitigating hydrological extremes. These interventions will respond to the identity of the region, but the method and eventual interventions can serve as an example for other downstream estuaries of river tributaries. It will show that reconnecting with our environment cannot just enhance hydrological resilience but can contribute to regenerating its social and ecological systems by recentring the river as the main territorial element within the area.



Personal connection

While the flooding that took place in 2021 was extreme, flooding has always been a part of the region. Throughout decades, the river would often overflow, resulting in a flooded basin. Because of the natural boundaries, the water often stayed within limits, but it had a natural synergetic system of periods of flooding and cultivation.



For generations, my family has lived in Limburg. The maiden name of my Mother, van der Beek, is common in the area, and a lot of my family members still live in the region around Roermond, mainly in the villages Vlodrop, Herkenbosch, and Montfort.

In 2021, when the rainfall became more extreme, and news of the immense precipitation in Germany became more severe, my family prepared themselves with sandbags to prevent water from entering their homes.

The result of this flooding and a flood in the 80s can be seen in the photographs taken by my family.



^ Car driving through the flooded streets of Vlodrop.
From the personal archive of the author's grandfather, estimated 1983.

^ Flooded street in Vlodrop during the floodings in 2021.
From the personal archive of Verschuren, M., 2021.

< Riding the mountainbike through the flooded streets and fields between Vlodrop en Herkenbosch.
From the personal archive of Verschuren, M., 2021.

2.5 Project scope

The Roer has a large catchment area, of which only 7% lies in the Netherlands. To change or alter the flow of water within the downstream area of the catchment to prevent flooding from occurring, interventions are needed within upstream areas. The goal of this thesis is not to prevent floods from happening, but rather to reconnect urban areas with their original relation to the natural flow of water.

This thesis analyses the water system of the (downstream) Roer catchment. The technical understanding of the water system, together with the spatial logic and history of the villages, provides a visualisation of a Roer valley that is reconnected to the water. Organisations such as the municipality of Roerdalen, the province of Limburg, WRL, or other water management committees could use this thesis as an example to rethink our relationship to water rather than over-engineer water systems that dissolve any natural relationship.

Village fringes

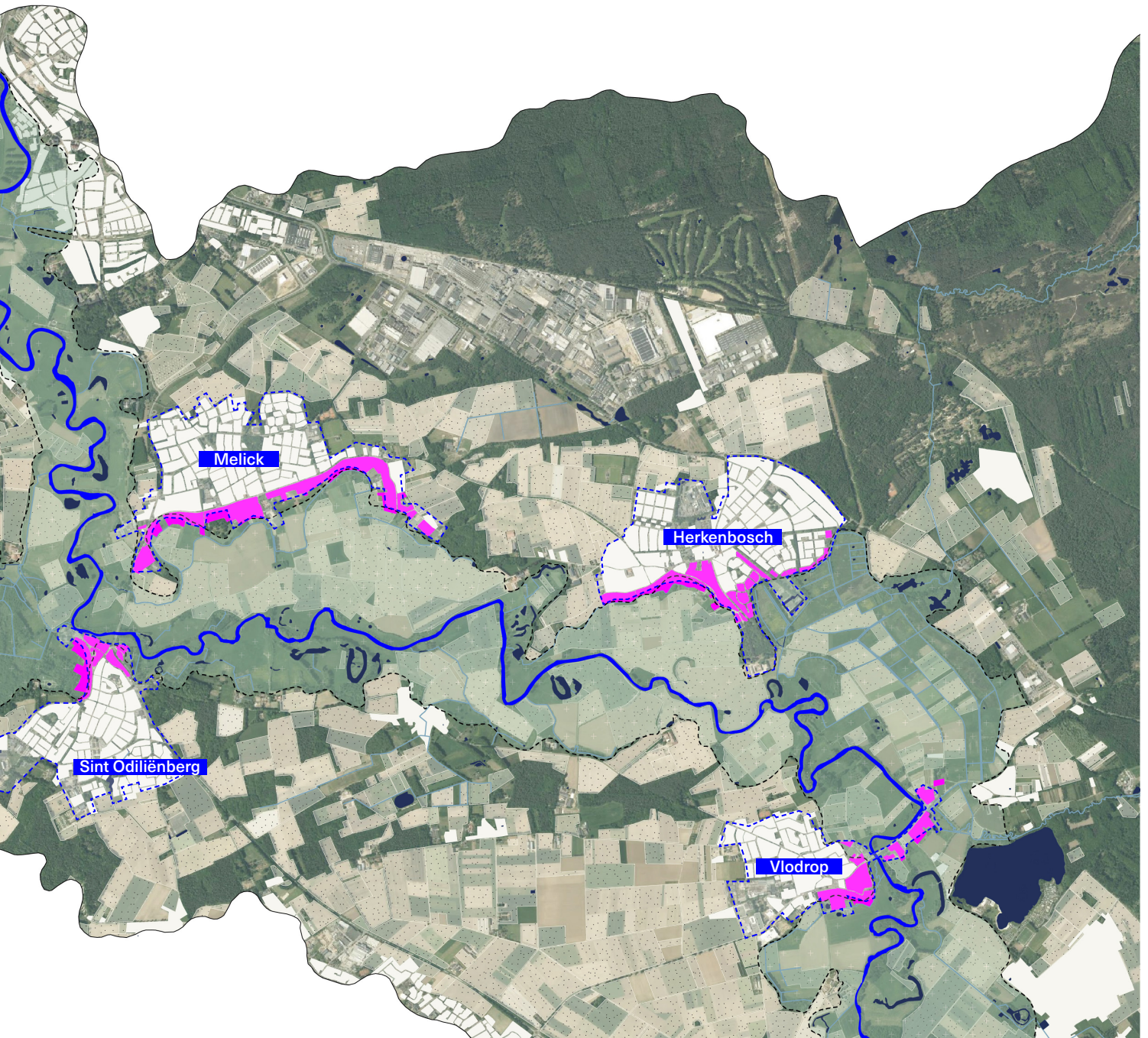
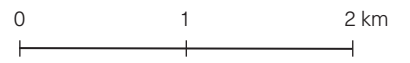
By analysing the logic of the valley between its structural elements [valley under pressure], [faded water identity], and [parallel systems], it becomes clear that the transition zone of the urbanised area to the floodplain is vital for creating a connection between the residents and the Roer river. These areas can be described as the 'village fringes': the edge of the village that also functions as the transition zone between the two spatial uses.

Each of the main villages of the Roer Valley (Melick and Herkenbosch as floodplain-adjacent villages, and Sint Odiliënberg and Vlodrop as river-oriented villages) has its unique relationship to the Roer and its floodplain through the village fringe. The fringes are visible in the pink highlights on the map.

In most of the villages, the fringe is entirely built upon. These villages have almost no connection to the natural system of the Roer river. In every village, an opening from the urban core to the river can be found. These 'openings' are vital for rebuilding the connection to the Roer. Because the Roer fringes can be considered the transition zone between the villages and their inhabitants and the Roer river, the focus of this project will lie on these spatial zones.



[^] The village fringes of the Roer valley in relation to the Roer river and floodplain.



- Surface water
- Main water flow - Roer
- Secondary water flow
- Villages focussed upon
- Village fringe
- Floodplain
- Floodplain boundary



HYDROLOGICAL SCOPE

The aim of the thesis is to reposition the Roer River as an identity carrier for living within the valley, but also to create an adaptive and integrated landscape along the Roer Valley. This last part involves the hydrological lens of the thesis.

When working with hydrological events, it is crucial to define the extent to which the extremes are considered. A different climatic event can lead to different outcomes in terms of water nuisance and water safety, which directly links to the need and possibility of areas for water retention.

Limitations

The Roer valley of this thesis is located in the downstream area of the catchment. Knowing this, it is crucial to understand that the hydrological extremes occurring through the flooding of the river cannot be resolved within the Dutch part of the Roer catchment. Especially when looking at the extreme scenario that took place in 2021, it can be determined that the shape and geography of the upstream catchment area are crucial to reduce the burden in the downstream areas.

Next to this, the aim of intervening within the Roer valley is not to prevent flooding from happening, nor to be capable of mitigating the most extreme hydrological events. This graduation project will act as a research by design project, where pluvial and fluvial floodings can be mitigated, to what extent will be determined by the possible interventions or logics applied within the spatial zones of the valley.

By addressing the Roer valley with the Roer river at its center, water becomes a more central aspect of design decisions.

[^] Floodplain becomes flooded yearly.
From the personal archive of the author's grandfather, estimated 1980.
[>] The floodplain near Vlodorp is extremely flooded in 2021 (Kuit, 2021)





3.

< Roer floodplain - transition agricultural
land use to natural floodplain
(Herkenbosch), photographed in
December 2025 by author

- 1. Theoretical framework*
- 2. Conceptual framework*
- 3. Methodology*
- 4. Water as a multiscalar system*
- 5. Defining 'experience'*

APPROACH

3.1 Theoretical framework

BEYOND SPATIALISATION

The complexity and the proposed problem statement of the Roer valley seem only spatial at first glance. Analysing the context is important, but understanding the problems at hand and placing those in the existing literature within the field of Urbanism provides guidance throughout the design process and helps to grasp certain phenomena that are in place. Therefore, the theoretical framework is formed to provide evidence and to support the arguments of the problem statement regarding the projection of the Roer valley into different zones and understanding the area within the multiple systems that are present.

The themes of water, space and experience have been touched upon in the formulation of the problem statement. Each of the themes can be referred to in literature. For water, the problem lies in *water sensitive urban design*, as it provides an understanding of the water system in the context of urbanised areas. This can also be linked to the use of 'space' in its ambiguous nature with the different seasons at the place, referring to *terrain vague*. Finally, the main aim of the thesis is to find a connection between inhabitants and the Roer while also focusing on the experience of the inhabitants during different hydrological scenarios. The theory of *genius loci* helps to understand the former water-identity of the villages and ensures that new measures in the village fringes respect the conditions they are placed into.

Water sensitive urban design [water]

Water sensitive urban design (WSUD) is an approach to understanding the context through the lens of water sensitivity. It is essentially a method for mapping and addressing water challenges, while providing multiple benefits and qualities of the context (van der Meulen et al., 2022).

For this project, WSUD becomes relevant because it can be used to reveal the implications of hydrological

extremes, while also providing possible directions of water management. This does not just entail the management of water on the surface level, but also groundwater is important to investigate, especially because this can be an indicator of areas under pressure during dry seasons. It is important to see water sensitivity not as a given condition in the status quo, but to look at characteristics of the past, present and future for outcomes of the urban design practice.

Dutch water management

While identifying space and the use of it around the Roer river is crucial for interventions within the area, it is important not to lose sight of the element of water management. The Netherlands is, after all, known for its way of dealing with water.

While this statement is true, the real definition should be 'the Dutch are known for keeping water out'. Introducing systems like the polder and boezem has made the Netherlands inhabitable. The main objective is simple: let the water flow as fast as possible. While in the coastal regions this enables polders to be cultivated and inhabited, this same management principle often does not work for the river systems in the eastern part of the country. Especially looking at Limburg, where the topography and sandy subsoil function differently from the flat, below sea level clay ground along the coast. (Brugmans, 2023)

The waterboard of Limburg already embraces this difference and advocates for planning for urban areas and water to be 'guided by water and subsoil' (Provincie Limburg, 2021). This shifts the former perspective from *pumping out water* to *ensuring water infiltrates and is used in the area*. Therefore, this thesis will embrace this new way of thinking by putting the natural flows and needs of the Roer valley first when dealing with hydrological extremes.

Terrain vague [space]

The term “terrain vague” translates as “wasteland” or “vacant land” in English. It refers to abandoned or unoccupied urban land that remains available for spontaneous use. Stanka Radovic (2014) describes: “Terrain vague thus allows for spatial uncertainty”. The term allows urban designers and architects to rethink space and the importance of not giving use to every inch within urban planning. Especially the absence of use provides us with the opportunity to think of the possibilities and allows space to transform into whatever we want it to be. Terrain vague sites are contributing to the reimagination and regeneration of space by connecting to local embodied practices, making them part of the urban commons and thus becoming part of urban public space (Kamvasinou & Iannizzotto, 2025)

Projecting this theory onto the Roer valley, terrain vague captures the beauty of making space for what is needed, in this context, space for water. In its essence, it promotes the ambiguity of space by allowing space to have multiple functions and meanings. The floodplain of the river is more than land that is flooded once in a while. It holds strong ecological qualities and forms the natural backbone of the valley. In the urbanised areas, ambiguous space can be translated to space to hold water during hydrological events, while also ensuring that it becomes part of the community as a *lived* space.

Genius loci [‘place’ & experience]

(Norberg-Schulz, 1979) argues that the purpose of (landscape) architecture is to create meaningful places by revealing the “spirit of place”: genius loci. Space derives its identity through unique natural and cultural meanings,

allowing humans to feel oriented, identified, and truly “dwell” in them. By *revealing* this identity, people foster a deeper connection to a place that transforms space into place: a spatial relation that moves beyond just the function of the area.

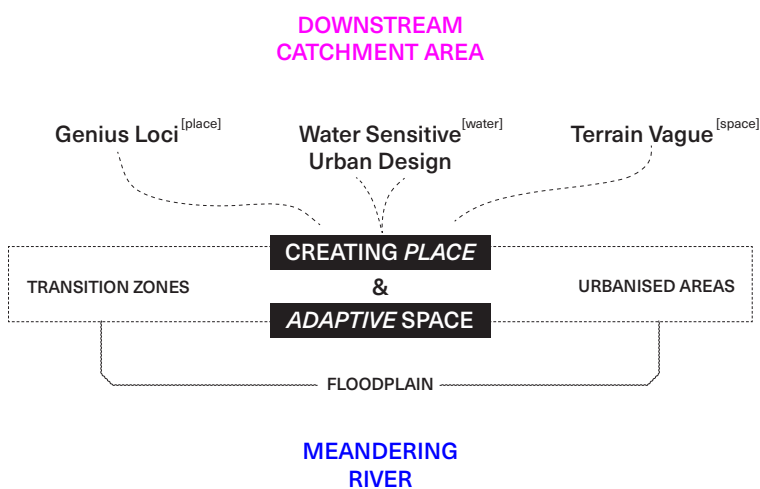
As part of the problem statement, ‘faded water identity’ is mentioned, referring to the lost socio-hydrological relations of the villages with the floodplain and Roer river. But this is also relevant for the disconnected urban cores, which often possess over historical and cultural significant buildings and spaces, but are in their current state unable to really create a good place for people to use, mainly because of the disconnection of humans and water and the monotonous nature of the cores of the villages. Therefore, understanding the significant natural and cultural meanings of places within the Roer valley could reveal the potential for all zones to transform into an integrated and meaningful landscape for people to live in.

When implementing interventions in the Roer valley, it is crucial that these (spatial) elements respect and/or better the context they are introduced into. At best, they reveal elements of the genius loci of a village or the floodplain that would otherwise stay hidden.

Revealing the (hidden) identity of the villages in the Roer valley can only be done through the insertions of *space-sensitive interventions*, ensuring that the proposed interventions do not overrule the current or historical atmosphere of the valley and its villages.

3.2 Conceptual framework

The conceptual framework links the theory to the 3 elements that make the problem statement: valley under pressure, faded water identity, and parallel systems. The goal of the research is to show how the implementation of place-sensitive interventions (markers) within the village fringes of the Roer valley helps to reconnect the inhabitants to the Roer river. The main guiding principle to achieve this goal is genius loci. Understanding the identities and relations of the villages to the Roer river through the spirit of the place creates an understanding of the valley through the elements 'water', 'space', and 'place'. As experiencing the Roer river is a central component of finding both connection and understanding the genius loci of the villages, the methods of experiencing the river become central in the project. These methods can be categorised within visibility, accessibility, and audibility. The genius loci, village fringes and implementation of place-sensitive interventions together form the conceptual framework of the project.



^ Elements of the conceptual framework.

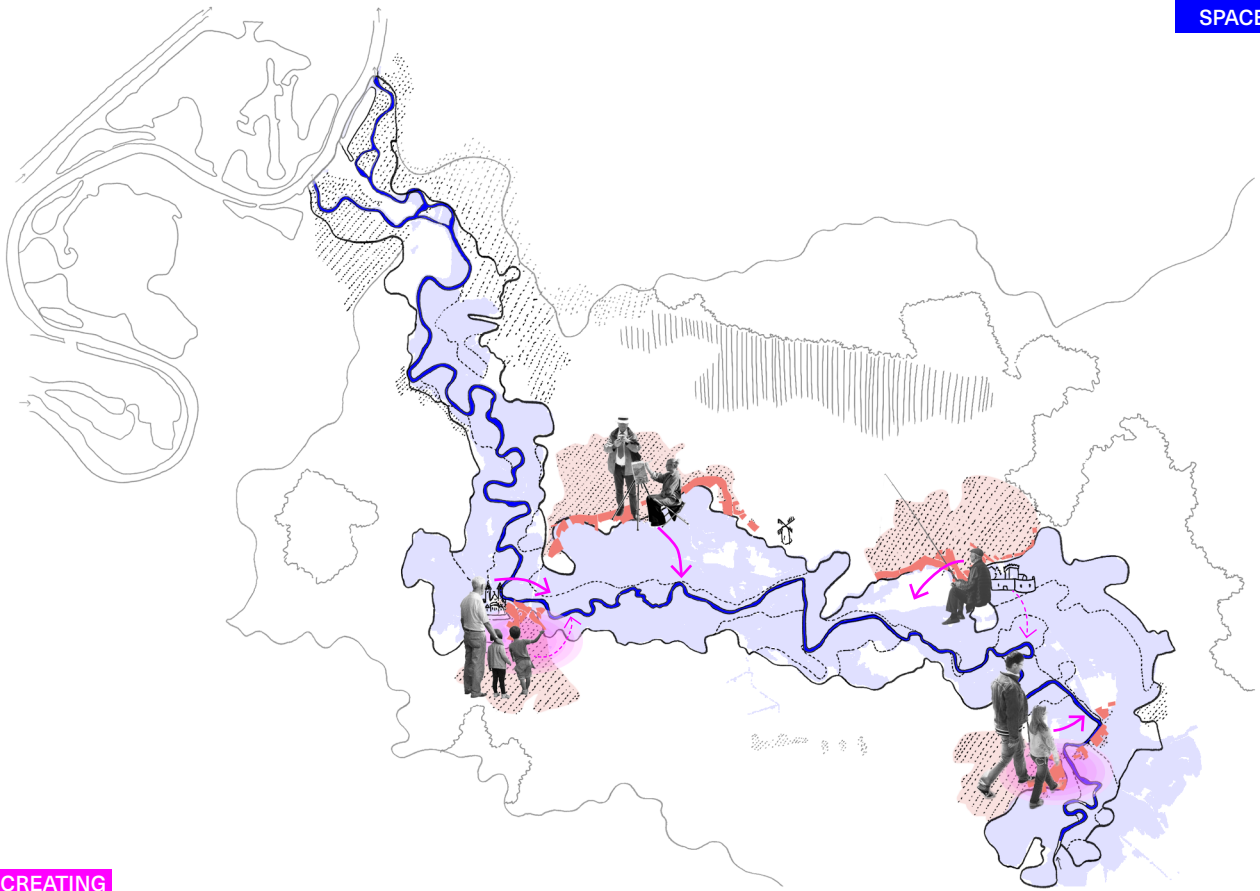
Naturally meandering river,
rainfed river,
downstream catchment area



GENIUS LOCI

WATER - SPACE - PLACE

ADAPTIVE
SPACE



CREATING
PLACE

experiencing the Roer river

- Audibility
- Visibility
- Accessibility

- Urbanised area
- Village fringe
- Floodplain

^ Conceptual framework, visualised.

3.3 Methodological framework

This thesis is performed in the field of Urbanism. The project is divided into four deadlines, each named after the A(ssessment) number. This project has therefore been phased according to these assessments. In the diagram, the different steps in each of the A(ssessment) phases are marked, together with the methods used to perform the relevant research or design.

Because the project is conducted through a *Research by Design* approach, both research and design are relevant throughout the project and are implemented together throughout the graduation trajectory.

A2 - analysing and understanding

Understanding the Roer river valley, together with the villages and their fringes, is crucial for the eventual transformative design visualisation. The first phase of the project (A2) is centred around this understanding through an analysis of the valley and its fringes. Methods for this project phase include the *understanding of* the spatial claim, the *understanding of* the natural composition of the valley and the *identification of* the hydrological extremes at place. Together with fieldwork in the Roer valley, an Inventory Atlas is created to gather findings on relevant spatial elements and to eventually formulate the design briefs for the projection of the village fringes.

This Inventory Atlas is an external chapter to this graduation report. It functions as a supporting document that is used when reading the report.

A3 - defining principles & projecting the fringes

The analysis of the Roer valley, together with the Inventory Atlas, forms the design briefs for the village fringes. This is the starting point for the possible projection of the village fringes.

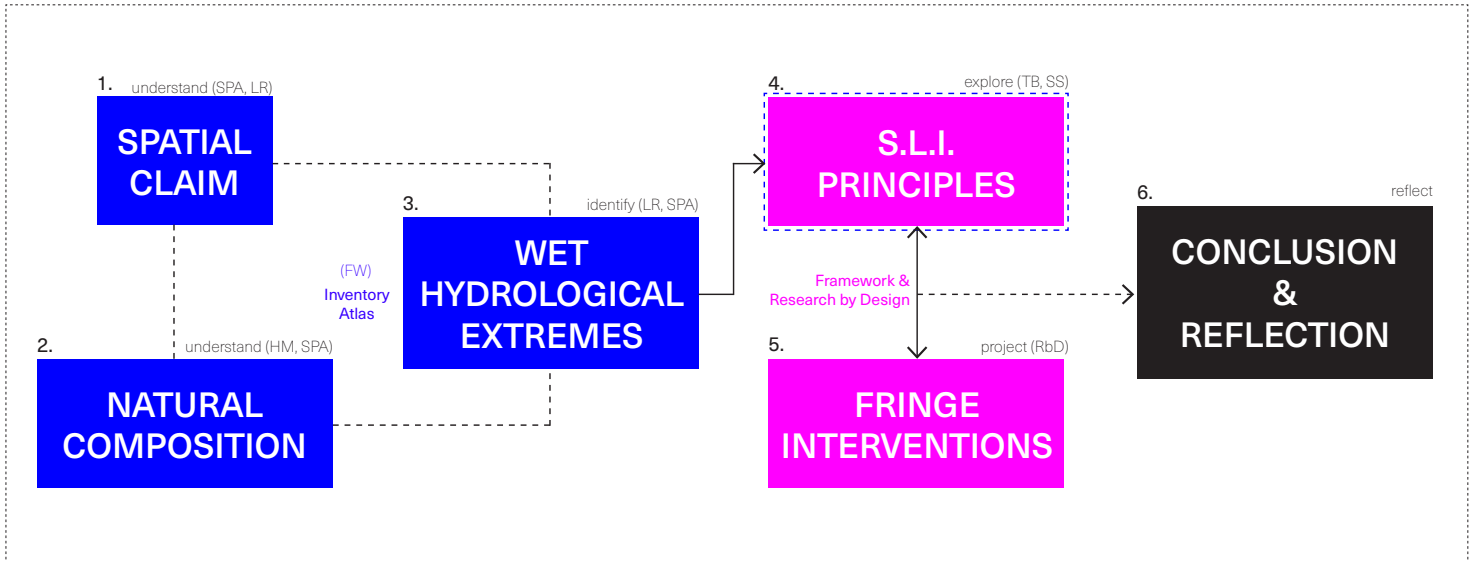
According to the established spatial 'needs' and shortcomings of the village fringes of the Roervalley, the Place-sensitive Intervention (S.L.I.) principle *framework* is created. At the same time, the interventions within two of the Roer fringes (Herkenbosch and Sint Odiliënberg) are projected. These interventions are based on the principles formulated in the S.L.I. framework. The design of the villages in this thesis is used as examples of the s.l.i. principles in different fringes within the Roer valley that connect to the river and use the hydrological cycle of the Roer in their proposal.

A3 + A4 - Concluding and reflecting on the project

The projection in this thesis is a possibility created through the analysis and principal framework of S.L.I. Elements in this thesis could be implemented differently by other (urban) designers or planners. The conclusion, therefore, answers the research questions according to the design proposal in this thesis. The *reflection* critically assesses the project and its meaning for the field of urbanism, as well as the theories used within the project.

A2 [A2] A3 A3 + A4

in the context of the Roer valley



LR - Literature review
 HM - Historical mapping
 SPA - Spatial Analysis
 FW - Fieldwork

TB - Toolbox
 SS - Scenario study
 RbD - Research by design

Methods

As each of the sub-questions has different aims to help answer the research question, different methodologies are relevant per sub-research question. In this section, each of the methodologies has been categorised into different phases of the design process. However, this does not mean that methods can sometimes be relevant for other phases of the research and design process.



Literature review - theoretical framework

Reading and analysing theory within literature. This provides evidence and ground for the project to build upon.

Because this thesis will focus on the eventual spatial implications, literature is used to form the concept and eventually reflect on the relevance of the interventions for regions similar to the Roer valley.

Policy document analysis

Policy documents are built up by governmental documents and studies done within the region that provide a constructed overview of the valley or catchment. Often these documents contain projections for the future, which can be used to steer the graduation project to certain directions.

Historical mapping

Understanding the former socio-hydraulic relationships by (re-)creating a palimpsest of the water, urban and ecological systems within the Roer Valley throughout history. Looking into history will not only grant a more complete insight of the past but can also provide an insight in the shape of the identity of the region.

Spatial analysis [cartography]

Mapping current conditions, systems and flows helps to illustrate the valley. It gives insight in the functioning of the area and provides the base for conclusions: where can certain relations be found and do implications arise? Spatial analysis does not just happen in maps, but sections and drawings also help to create a more grounded understanding of the area.

Fieldwork [photo & video]

With photo and video the current state of the Roer valley can be captured. This is crucial to understand the area and sites within the project, because not everything can be understood through desk research.

Fieldwork [sketching]

While visiting the valley, not everything can be captured by visual media. Therefore certain relations, feelings and experiences can be captured through sketching or writing down how a space is perceived. This is an subjective translation of the Roer valley but nevertheless relevant because it translates my understanding of the area into perspective, information that can be used during decisions in the *scenario study*.

External chapter: Inventory Atlas of the Roer valley

Becoming an integrated landscape and shaping the Roer as the identity -carrier of the valley is at the center of this graduation project. To answer the research question, however, it is vital to understand and identify the socio-hydrological relations, identity and functioning of the water system within the area. The atlas bundles the most important analyses and draws conclusions from the research to inform the research & design process.



EXPLORATION

Place-sensitive intervention principles [toolbox]

The intervention principles help to organise possible spatial interventions for the design process. Because this project is dealing with water and the *experience* of the river, it is crucial to create interventions that enhance the valley within multiple forms of perception. Categorising the interventions helps to implement the relevant type of intervention to achieve a better connection of the inhabitants to the Roer river.

Working with a *principle framework*, the zones and systems within the area become integrated through the eventual design. The place-sensitive interventions suggest a physical moderation within the valley, which change the spatial conditions of the valley rather than propose the addition of object in the area without a further understanding of the consequences.

Design study

With the policy document analysis and understanding of the Roer valley the base for the scenario study can be set up. Possible futures will be set out, where different elements from the spatial logics framework will be projected onto locations within the valley. These projections can then be assessed to see what does enhance the socio-hydrolic relations within the Roer valley and what elements are deteriorated by the interventions. The design presented in the thesis provides a possible overview of the impact of the placement of place-sensitive interventions in the Roer valley.

SPATIAL VISION

Research by design [answering the RQ]

To provide a vision for the question “How can place-sensitive interventions within the village fringes of the Roer Valley improve the experience and connection of its residents with the Roer River by 2050?” the research by design method delves into different scales to project spatial interventions from the *place-sensitive intervention principles* onto the area. With maps, sections and ‘experience sketches’ a palette of possibilities is created to envision a future where the Roer has become a structuring identity-carrier for living within the adaptive and integrated landscape along the Roer valley becomes visible for the timeframe of 2050.

This design will be reflected upon, to guide decision makers and designers within the province of Limburg, the waterboard of Limburg and local municipalities to rethink the relation of urbanised areas to the watersystems at hand.

3.4 Water as a multiscalar system

XL, L/M, S, XS

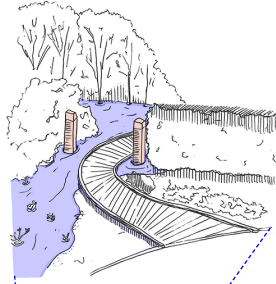
Water flows. It is a natural element that shapes landscapes, forms ecosystems and is a base for urbanisation throughout generations.

Water is not fixed and is influenced by climatic elements, shaping landscapes. Therefore, it becomes crucial to understand the multiscale nature that is involved when discussing water. From the catchment area to specific streams, the water system is connected.

This graduation project focuses on the Roer Valley in the Netherlands. Understanding the water system at multiple scales helps make more grounded choices and ensure that the implementation of interventions does not negatively impact other areas of the valley.

Flooding, however, cannot be altered and is used as provided by Asselman (2025), as the Roer valley is located in the downstream catchment area. The water system and, therefore, the influence of the flooding are dependent on upstream decision-making.

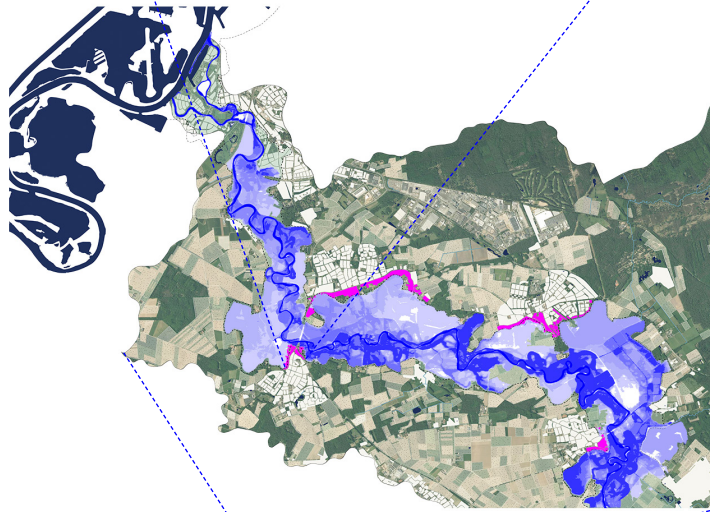
> From top to bottom:
XS - Experience of the Roer in specific location
S - Roer along village fringe
M/L - Roer valley
XL - Roer catchment



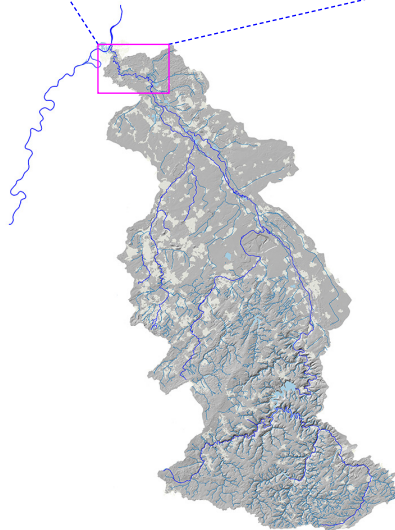
XS



S



M/L



XL

3.5 Defining ‘experience’

PERCEPTION AND EXPERIENCE

The word experience carries two meanings. The first one being “practical contact with and observation of facts or events” (Oxford University Press, n.d.). Here, experience serves as the act of doing an activity and the direct knowledge gathered from it. The other meaning of experience is “an event or occurrence which leaves an impression on someone” (Oxford University Press, n.d.), relating more to the emotional connection formed throughout an interaction. Both meanings are relevant for this thesis, with the first one linking more to the physical implications of spatial interventions and the second one relating to the personal connection that could be formed by these interventions.

To define how something could be ‘experienced’, it would only be logical to delve into the ways space, and for this thesis water, can be perceived. This can be done through human senses, such as sight or smell, but also by creating a physical connection (accessibility) to a place.

Visibility

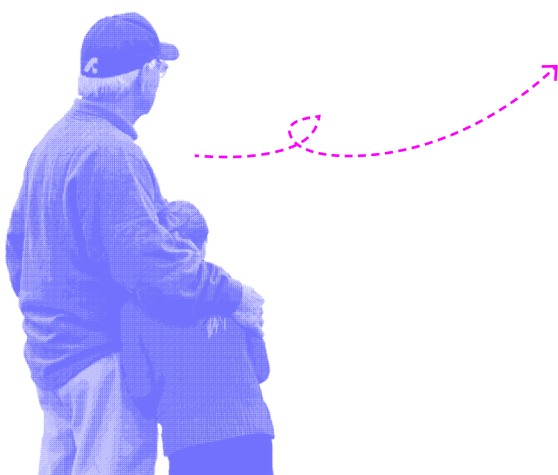
The visual connection is established by seeing the Roer river as a defining attribute. In areas close to the river, water can be seen, whereas in areas further away, it is not directly visible. The Roer has characteristic elements, such as specific vegetation, that mark the river when the water is not visible. By creating a visual connection, people become aware of the river and its presence around the valley and villages.

Audibility

The flow of water of the Roer River can be heard in a few places. This perception helps to emerge and connect to the natural side of the river. To actually hear the river, the water has to be close, making the auditable experience interesting for only a few locations of the village fringes.

Accessibility

Where sound and sight play to the direct human senses, accessibility is formed by movement and the ability to find a physical connection to a place. Having access to a place, or the lack thereof, helps define places, give them meaning, and help find a way to belong within the public space.





Hearing the flow of the Roer river



Residing along the riverfront



Following the river in the floodplain



4.

< Village fringe of Herkenbosch,
photographed in December 2025 by
author

- 1. The intentions of the river*
- 2. Experiencing the river*
- 3. Demographics of Roerdalen*
- 4. Bandwidth of place-sensitive interventions*
- 5. Transformative design approach*

Research

4.0 Analysing the systems

With the problem statement defined, it has become clear that the different systems within the valley need to be reconnected. In order to realise this, however, a spatial, demographical and systemic understanding of the valley is crucial.

Understanding an area can be done through a variety of different systems. This thesis investigates the impact of place-sensitive interventions within the village fringes of the Roer Valley to connect the residents to the Roer river.

Therefore, it is crucial to understand both the current relationship of the villages with the Roer. This has been done via the Inventory Atlas, which uses photographs and sketches from the site visits to the Roer valley.

Other systems reveal themselves upon further analysis, such as the water system, the subsoil, and the demographics of the Roer valley. Together with the theoretical framework, the understanding of the (genius loci) of the area defines the range of the place-sensitive interventions and helps to formulate the design briefs per village fringe.

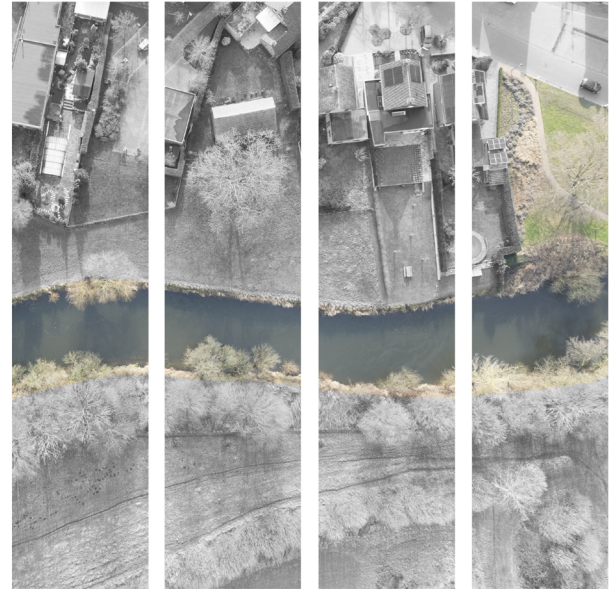


< Postcard of the floodplain of the Roer. It mainly consists out of agricultural fields and (natural) meadows. (december 2025)

INVENTORY ATLAS

The *inventory atlas: defining the fringes* serves as the analytical document to understand the context of the villages of the Roer valley. The villages Sint Odiliënberg, Herkenbosch, Melick and Vlodrop are analysed and assessed through the elements of entrances, public-private relationship, materialisation, hydrological extremes and use of space. The results from the atlas help to understand the villages and establish the eventual design brief.

The Atlas is an external chapter and should be read to understand the choices made in the thesis.



Leonie Zwienink - March-April '26

DEFINING THE FRINGES

Providing an understanding of the village fringes within the Roer Valley: an inventory

^ Cover of the Inventory Atlas.

PUBLIC-PRIVATE (Sintod)

The village centre of Sint Odiliënberg is clearly marked because of the open space around the Roer. Next to this open space, which can be considered a square, a small area of ground is formed into a park next to the river.

The public garden is small and linked to its continuation by the fence built around the houses adjacent to the park. Linking up the small gardens, it can be seen that the land that is fenced property is causing the public park land that is fenced in for the Roer valley to continue along the Roer river.

Problems
 • Boundary private area



HYDROLOGICAL EXTREMES (Melick)

The difference in height between the terrain on which Herkenbosch has been built and the Roer valley is larger than in other villages. With this difference has a negative effect on the relation between the village and river: it causes water from flooding. During extreme discharge within the Roer river, the village is not endangered.

The carls, however, has lower than the village and more into the Roer valley built. During extreme discharge, the carls will become flooded. Increasing water level prevention measures need to be carefully considered, as large-scale interventions could alter the area and disturb the historical design of the carls.

PROBLEMS & POSSIBILITIES (Vlodrop)

ADAPTIVE OPEN SPACES

Vlodrop is a river-extended village, in which the most adjacent to the Roer valley are situated in the central system and area. The design brief is therefore formulated to enhance the open space along the Roer river that use already done. For the open public space as integration of the design brief, the most adjacent to the Roer valley is a site, which cannot be removed as seen from the TPO building system. Interventions around the site are needed to create the Roer valley behind the structure together with the area of the design.

The design brief for Vlodrop is different compared to the other village design briefs, because the impact of the Roer valley is more significant. The landscape intervention also makes the impact of possible flooding, the existing relation and orientation to the Roer river should always be considered.

KEY FINDINGS:

- Village design brief in the design
- The design brief in the design is supported by the design and existing form in the public intervention in the design.
- Culture activities along the Roer river make a central intervention.

^ An exemplary export of pages of the inventory atlas.

4.1 The intentions of the river

As the only river in the Netherlands that still naturally meanders, the Roer has undergone many changes in its course. The annual flooding shaped its floodplain and valley. Understanding the morphological logic of the valley helps in assessing eventual design decisions for the village fringes.

Following the river

The river flow of the meandering Roer river has changed over the years. A natural, flowing river changes as the natural processes of sedimentation and river discharge can result in the deformation or cutting of a meander, as seen in the transformations in the images below. Over the past 200 years, the main flow of the Roer roughly remained in the same area. Flooding over the years is the main cause of changes in the meanders.

Impact of upstream reservoirs

In the 20th century, the Roer catchment underwent a shift in its natural functioning with the establishment of several basins in its catchment area. Next to serving as a drinking water supply, the catchment ensures that high water levels with a T100 probability slow down from a discharge of 300 m³/s to 60 m³/s (Homann, 2022).

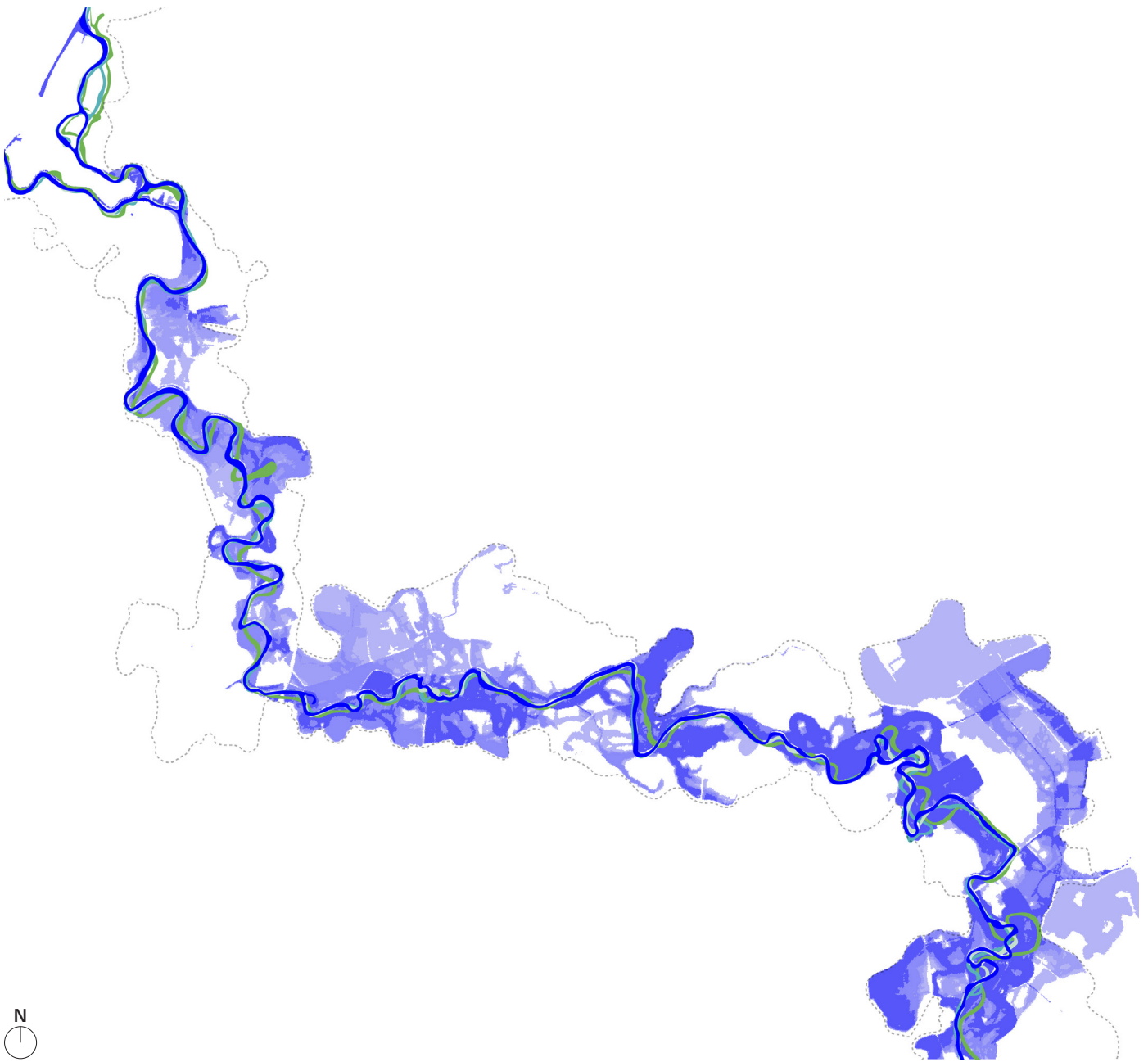
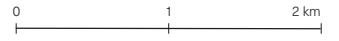
As reservoirs reduce river discharge during extreme hydrological events, the frequency and impact of flooding have decreased over time. An annual flood now occurs with a lower discharge of the Roer river than at the beginning of the 20th century.

Looking at the main morphological changes of the flow of the Roer river, the impact of the reservoirs becomes visible. The changes to the flow of the river from 1816 to 1945 are more significant than the changes between 1945 and 2025.

Predicting the flow of the Roer in the future can only be done with a certain degree of accuracy, as river discharge fluctuates. Climate change is resulting in more extreme hydrological events. Longer periods of drought or extreme rainfall could result in a different flow of the Roer river.

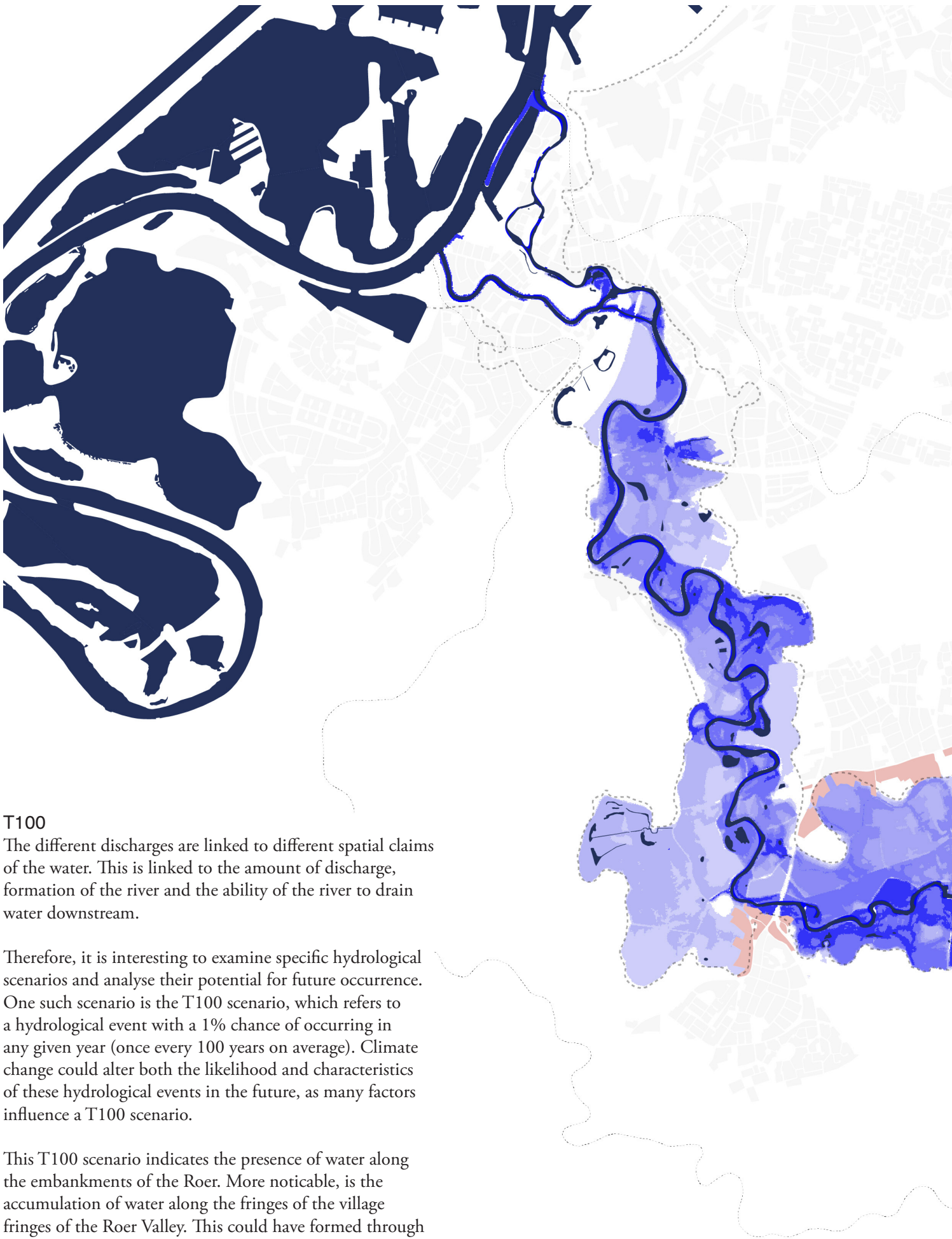


< Example of the deformation of a meander of the Roer river near Herkenbosch (Provincie Limburg, 2024)



- Flow Roer 1816
- Flow Roer 1945
- Flow Roer 1985
- Flow Roer 2025

^ Main morphological changes of the Roer River between 1816-2025 (Kadaster, n.d.) with the areas that are flooded during a T25 hydrological event (Asselman & van Heeringen, 2023).

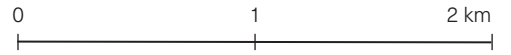


T100

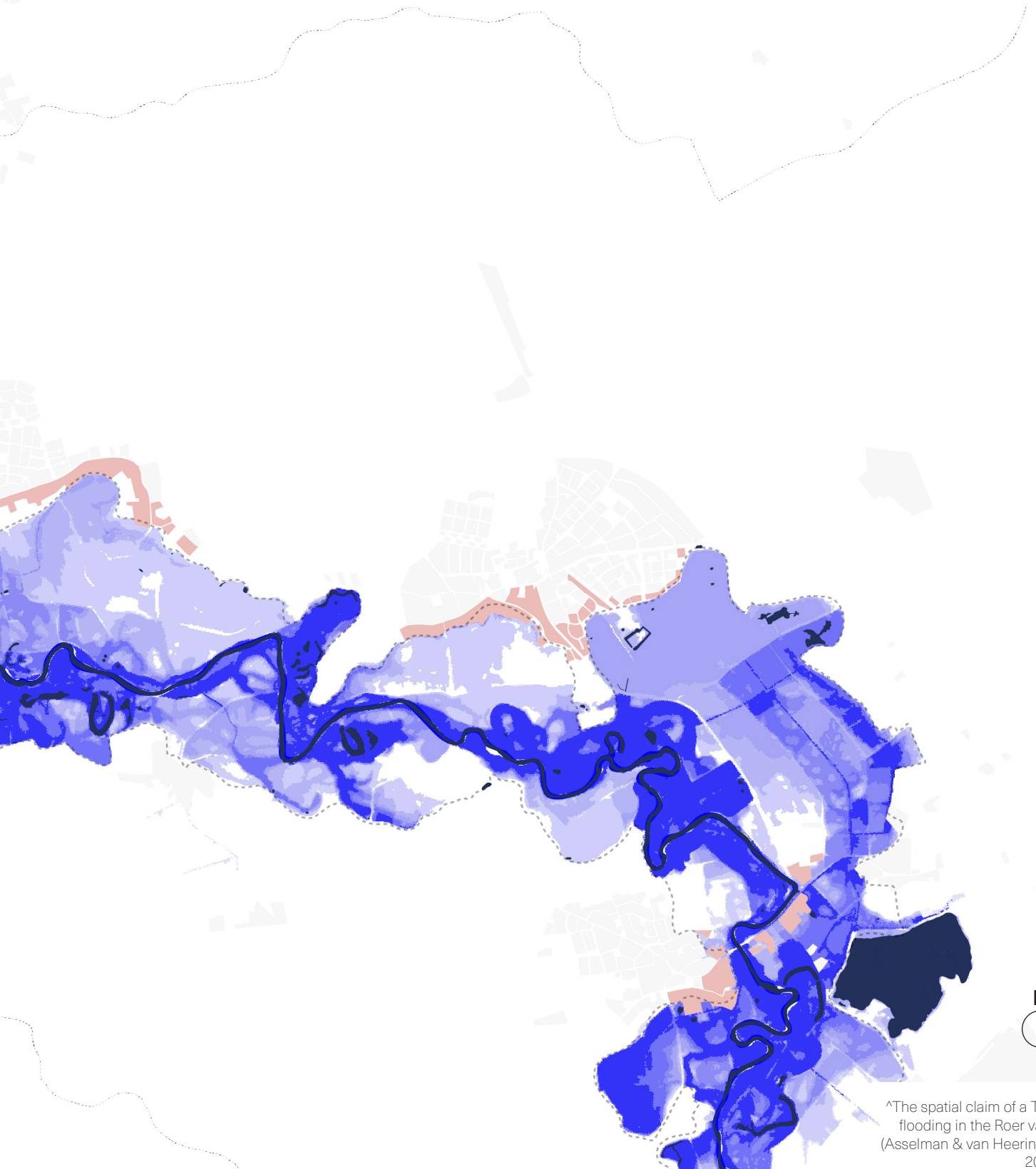
The different discharges are linked to different spatial claims of the water. This is linked to the amount of discharge, formation of the river and the ability of the river to drain water downstream.

Therefore, it is interesting to examine specific hydrological scenarios and analyse their potential for future occurrence. One such scenario is the T100 scenario, which refers to a hydrological event with a 1% chance of occurring in any given year (once every 100 years on average). Climate change could alter both the likelihood and characteristics of these hydrological events in the future, as many factors influence a T100 scenario.

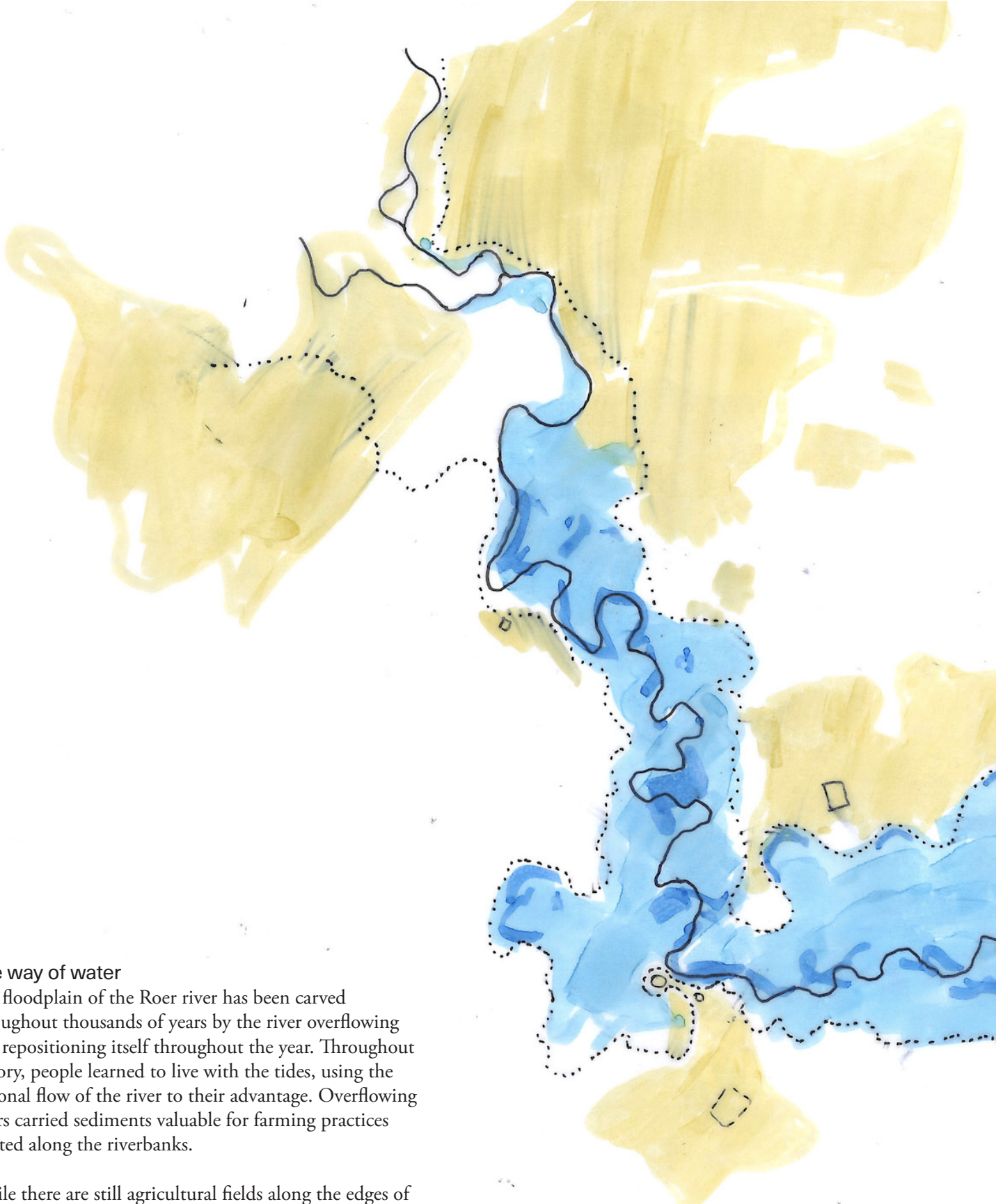
This T100 scenario indicates the presence of water along the embankments of the Roer. More noticeable, is the accumulation of water along the fringes of the village fringes of the Roer Valley. This could have formed through erosion and flooding over time, as water collected and moved along the edges of the floodplain. In a spatial design, these areas become interesting because water could be retained for a longer period along them.



- Surface water
- D 350 m³/s [T100]
- D 250 m³/s
- D 140 m³/s [T25]
- D 100 m³/s
- D 80 m³/s [annual]
- Village fringe
- Urbanised area



^The spatial claim of a T100 flooding in the Roer valley (Asselman & van Heeringen, 2023).

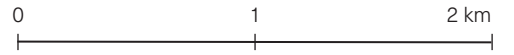


The way of water

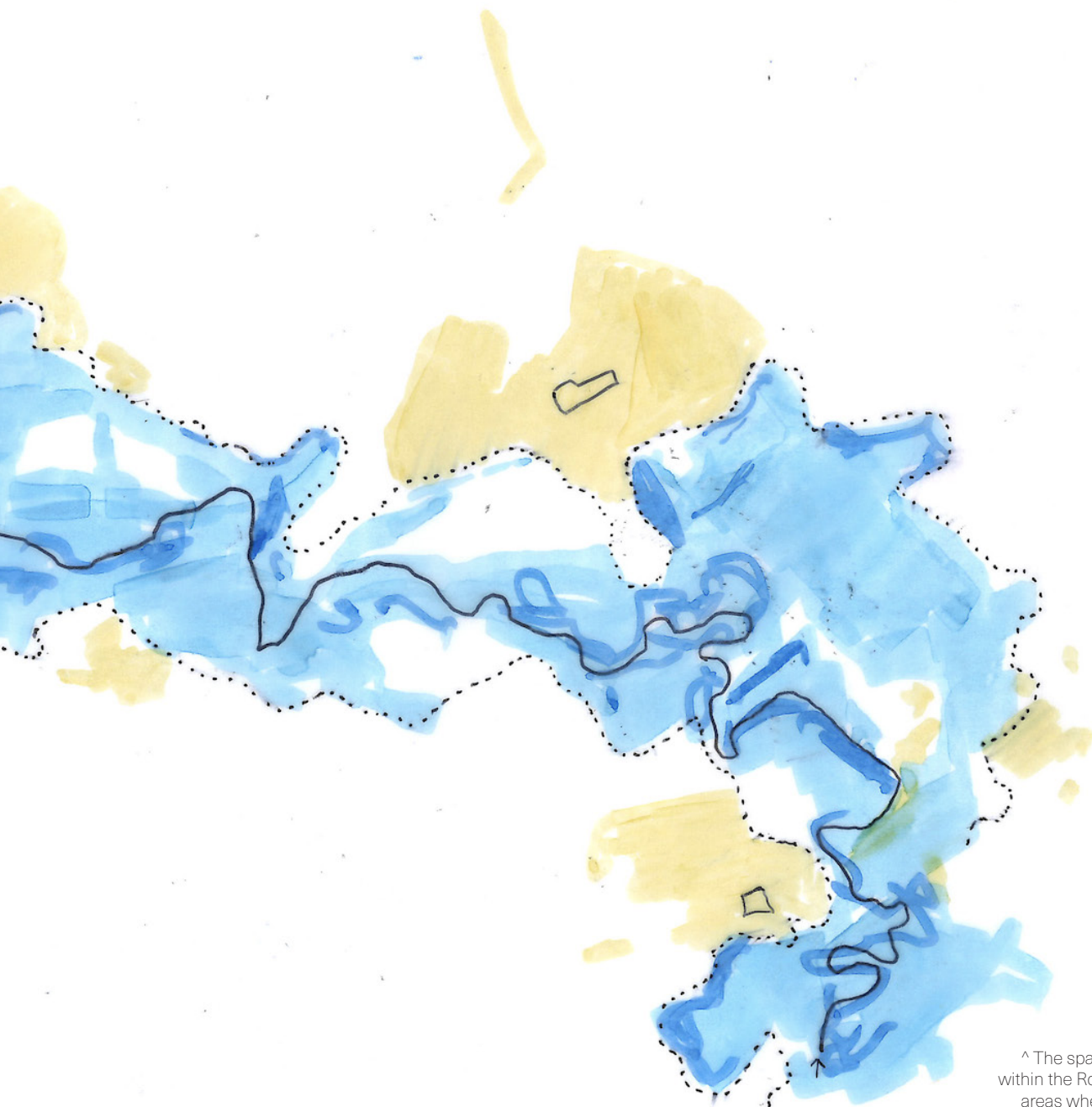
The floodplain of the Roer river has been carved throughout thousands of years by the river overflowing and repositioning itself throughout the year. Throughout history, people learned to live with the tides, using the seasonal flow of the river to their advantage. Overflowing rivers carried sediments valuable for farming practices located along the riverbanks.

While there are still agricultural fields along the edges of the Roer, the natural process of sedimentation has given way to the artificial process of fertilisation.

Settlements have always followed the natural border carved by the river. Elements showcasing the cultural heritage of the Valley, such as castles or mills, are often located at the transition zone of the river floodplain and urbanised area. This trend has been reflected in current settlement practices.



- Roer river
- Flooded area T100
- Pools of water after flooding
- Urbanised area
- ⋯ Floodplain boundary



^ The spatial claim of the water within the Roer valley, highlighting areas where water stays after a T100 flood.

SOIL CONDITIONS

A + B -The river floodplain

The floodplain and the historical position of the Roer River are derived from its soil type: Fluvial clay soils. Clay and silt-clay soils were the result of erosion and the deposition of sediments of the Roer. The soil is considered highly fertile, and a significant amount of farmland is located within these areas.

C -Sandy podzol soils

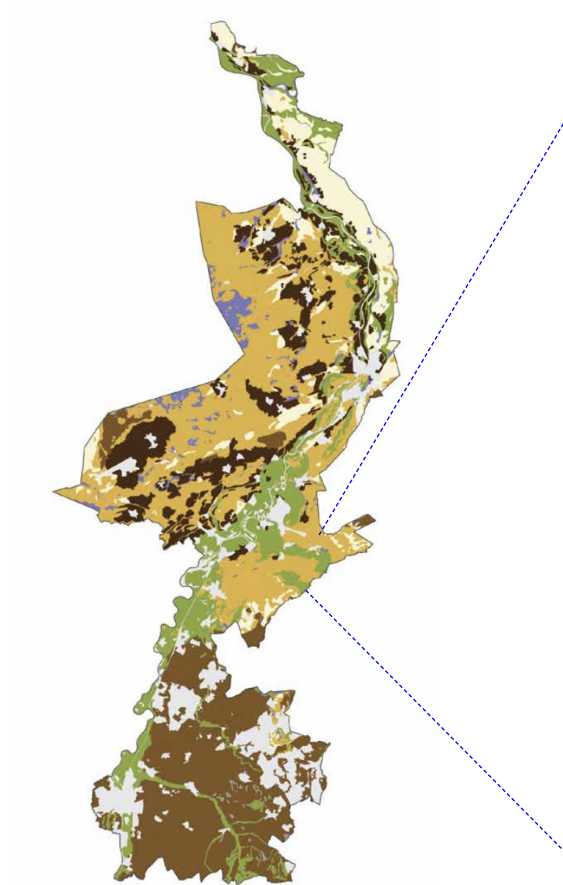
These soils contain small sand particles, making them less fertile with a high infiltration capacity. This means that during dry seasons, these areas will dry out faster than their surrounding areas, due to their infiltration capacity. During wet periods, these areas become interesting due to these same conditions. In the valley, these soil types are home to the forests and built areas.

D - Loam terraces

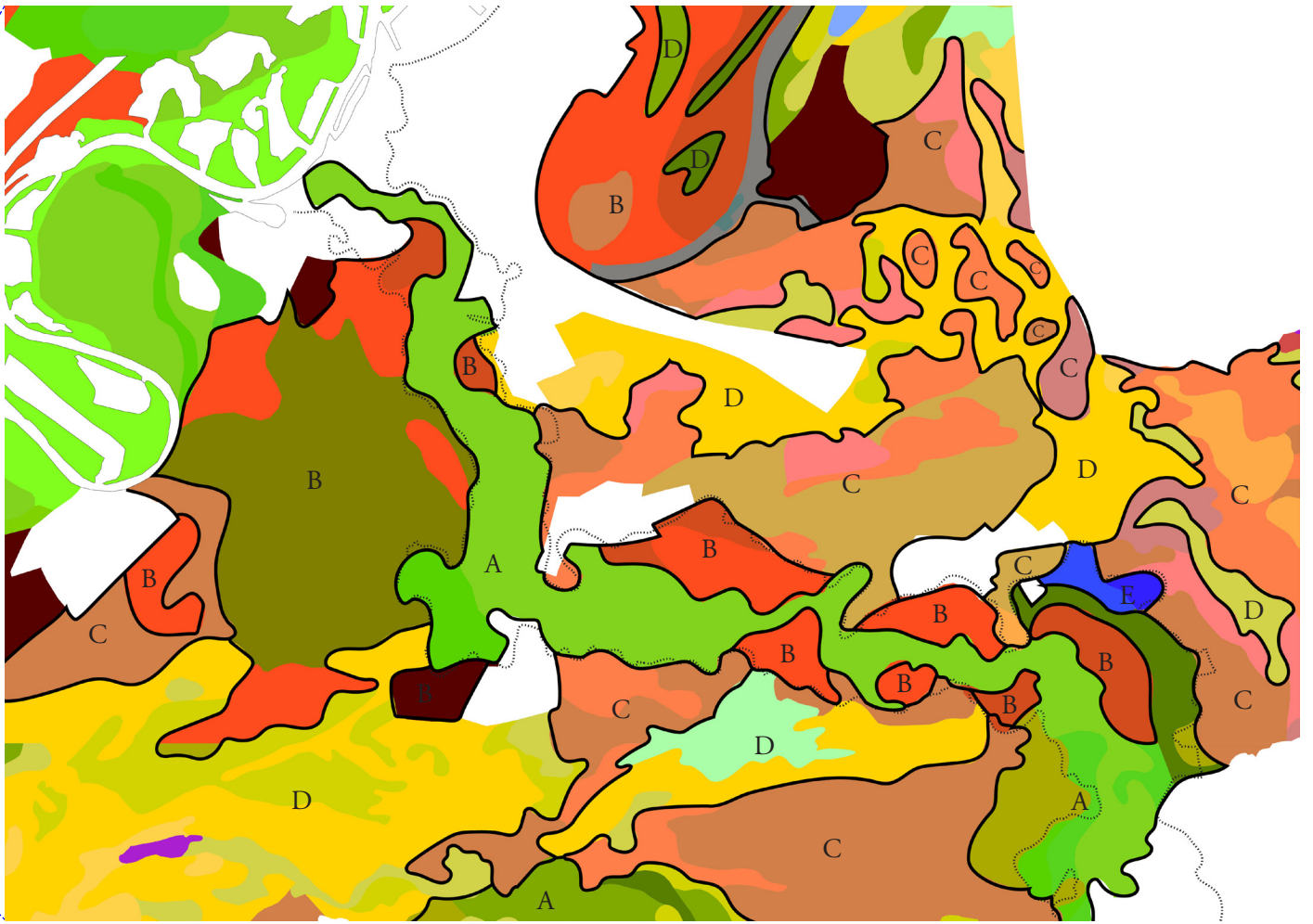
Loam soils shape the hinterlands of the Roer valley. The particle sizes of loam are bigger than sand, making the soil less prone to water infiltration than the sandy soils. During high tides, the water is therefore more likely to collect and remain standing temporarily.

Loam has multifunctional purposes, making it useful for both accommodating housing and natural areas and is also functional for farming.

Understanding the soils helps to evaluate and think of design interventions in which the soil and water systems are the main drivers for decision-making. This correlates with the vision of the province of Limburg: 'water en bodem sturend'.



^ The soilsystem of the province of Limburg (Defacto Urbanism, 2025)



^ Soil conditions of the Roer Valley
(Wageningen Environmental Research, 2024)

4.2 Experiencing the river

PERCEIVING THE ROER

The Roer river can be experienced through visibility, accessibility or audibility. While each of the different senses provides a different kind of experience and eventually connection to the Roer river, it is important to contextualise the village fringe in relation to the water first. As mentioned in the *Inventory Atlas*, two types of connection of the village to the river can be found in the Roer valley. These can be categorised as river adjacent and floodplain-oriented villages.

River adjacent villages

River adjacent villages are considered villages in which the Roer river flows along or close by the village fringe. In the Roer valley, the villages of Sint Odiliënberg and Vlodrop are adjacent to the river. There is public space directly connecting the village with the river, and the water can be seen and heard from these areas. Because the river itself directly flows along the edge of the urban areas, these villages tend to be better connected with the Roer river.

Floodplain-oriented villages

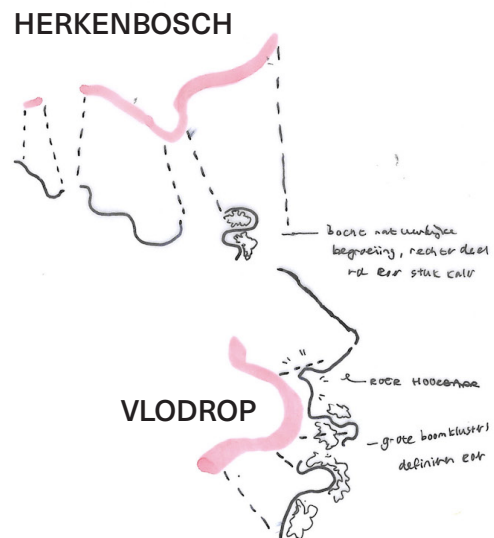
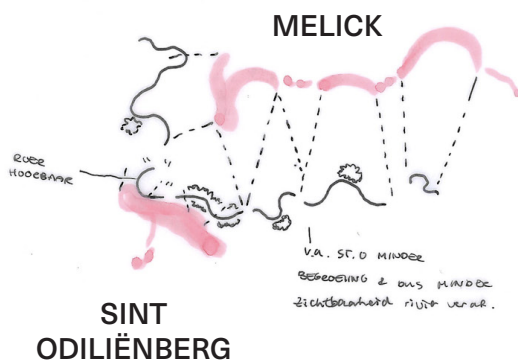
The villages of Herkenbosch and Melick are considered floodplain-oriented villages, as the Roer river does not flow

directly along the village edge. In these village fringes, the Roer river is not experienced through the perception of the flowing water, but through the markers of the Roer river that are visible from a further distance. The main markers of the Roer river are the clusters of poplars. The clusters are formed in the meanders of the Roer river. Because the floodplain is quite flat and does not contain other large vegetation, the meanders of the Roer are noticeable from a further distance.

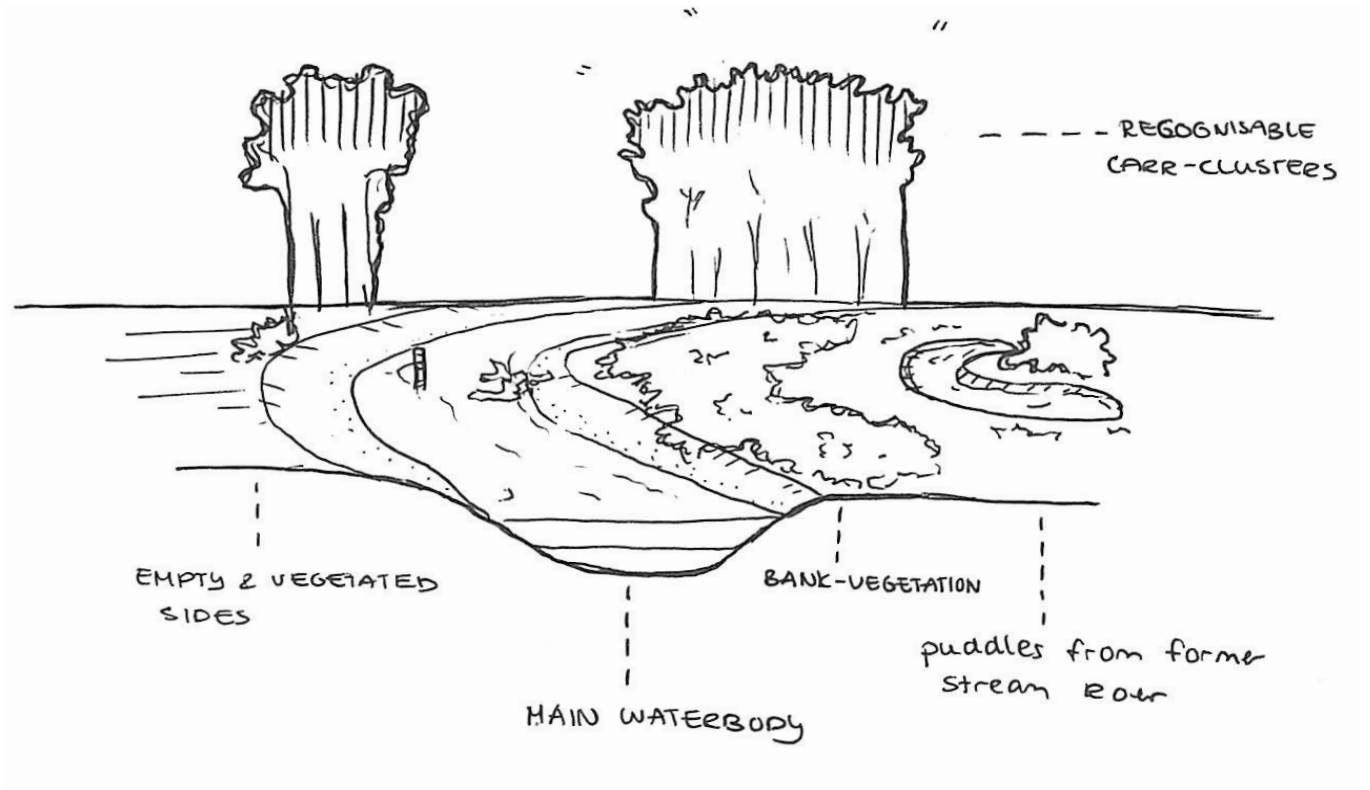
Limited perception

While the Roer river could be perceived from areas adjacent to the floodplain, not every part of the village fringe could perceive these markers. Buildings are often built on the edge of the village, blocking views. In other areas of the Roer, fewer tree clusters are present, making the river invisible from afar.

The different types of perception are crucial for the design phase of the project, in which a reconnection with the river is found through the implementation of interventions that foster the connection.



^ Sketch of the urbanised areas of the Roer valley from which the Roer can be perceived.



^ The markers of the Roer river.
 v Possibilities to experience the Roer.

Visibility



Accessibility



Audiability



GENIUS LOCI - CURRENT RELATIONSHIPS

The villages in the Roer valley resemble a typical Limburg village character: paved streets, closed-off houses, and a clearly marked village centre, often accompanied by a church.

At first glance, these villages might look very similar. The main difference between the villages is their composition and relation towards the Roer and its floodplain. From the inventory atlas (see appendix document), the two relations of the Roer are similar to the position of the public space and the orientation of the housing. In Sint Odiliënberg and Vlodrop, an important element of a public meeting place is connected to the waterfront. Melick and Herkenbosch are considered floodplain-connected villages, where their centres and orientations are not directly linked to the river. In these villages, there are cultural areas that do connect to the view of the Roer, but are underutilised in their current use.

The Nolli maps are conclusion maps from the inventory Atlas and provide an understanding of the relation of the public domain with the Roer River or the floodplain.

Inventory Atlas

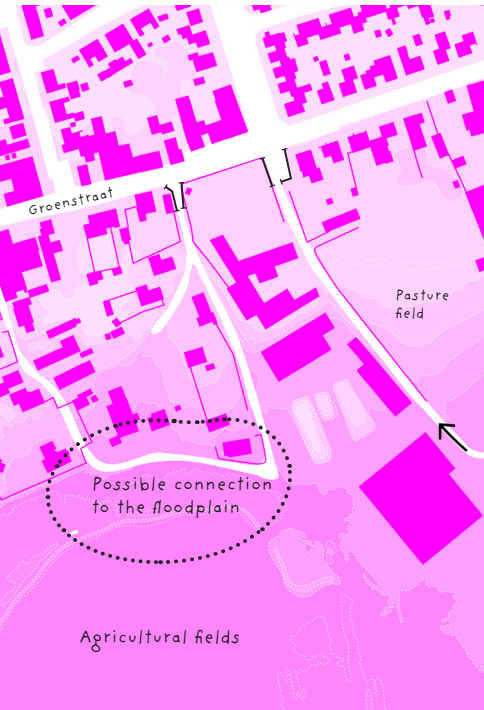
In order to get a better understanding of the villages and their relationship (or lack thereof) to the river, an inventory atlas has been created. This analysis, which has been derived from multiple site visits from December 2025 to April 2026, provides an insight into the village entrances, public-private relationship, materiality, hydrological extremes and use of space that together form an overall understanding of the relation of the villages to the Roer river.

MELICK

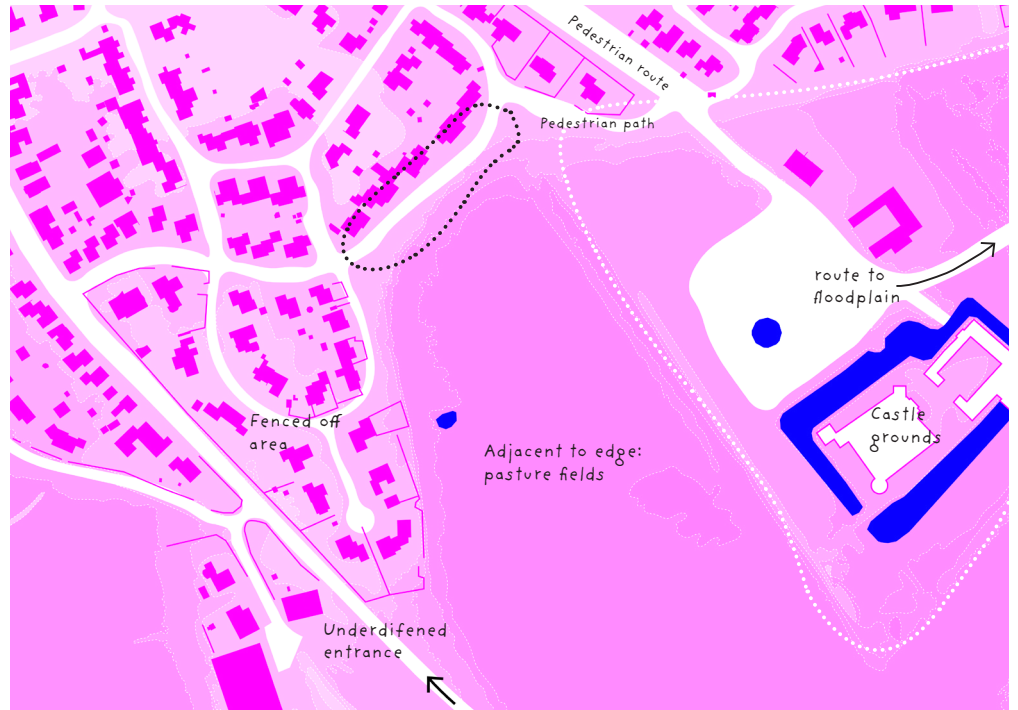


SINT ODILIËNBERG

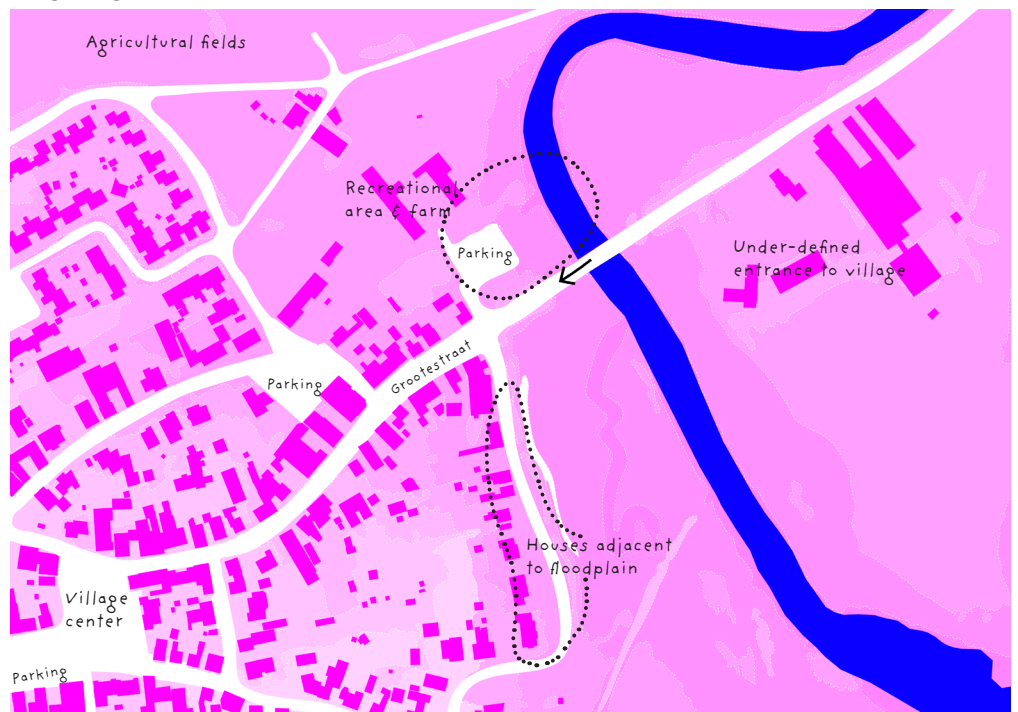




HERKENBOSCH



VLODROP



^ Nolli maps of the four villages within the Roer valley. The maps provide an insight in the relation of the public and private domain to the Roer river or floodplain.

GENIUS LOCI - SPECIES OF THE ROERVALLEY

Unique landscape

The Roer river, with its natural functioning, helps to create a landscape that is unique for the Netherlands. The Roer is a river that flows relatively fast to fast depending on the season. Next to this, the location of the Roer valley within the complex Meuse terrace layers provides a unique soil build-up, resulting in a transition from iron-rich seepage-fed hayfields to the natural river landscape (Boeren, 2022). This accumulation of specific subsurfaces results in a distinctive landscape that is the habitat for numerous species. It is of great importance that the interventions done near this landscape do not interfere with the natural system in place (Provincie Limburg, 2024).

Species in the Roer valley

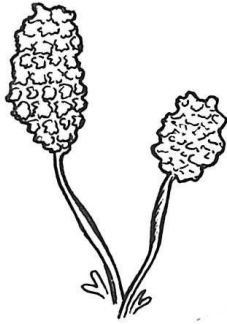
The unique (river) landscape of the Roer valley provides a habitat for a range of species, ranging from endangered dragonflies to shrubs that grow along the waterfront.

Species are part of the markers of the genius loci of the valley. The most important and meaningful species could be considered (cultural) keystone species: salient species to a people, identified by their significance in their behaviour or value to the landscape or culture (Watson, 2019).

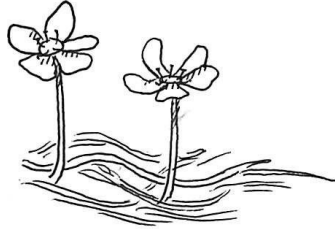
Understanding the natural systems and the species in the area is necessary to a certain extent to validate the genius loci of the Roer valley. When implementing new vegetation or creating different habitats in the proposed interventions of the village fringes, it must consider the natural conditions that shape the Roervalley. Implementing species that are not native or that are harmful to the existing functioning of the natural systems should not be incorporated within the design.

For this urbanism thesis, the use of tree species will be the main focus. Tree lines or the placement of individual trees can act as markers for the route or viewpoints that could enhance the experience and connection to the Roer river.

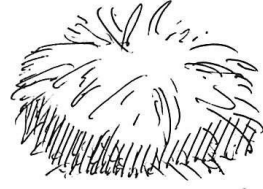
> A selective overview of the main keystone species of the Roer valley in terms of flora and fauna together with the most common trees in the area.



Grote pimpernel /
Great burnet



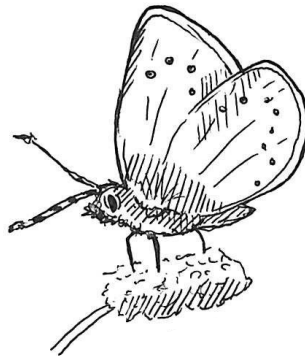
Vlottende watteranonkel /
River water-crowfoot



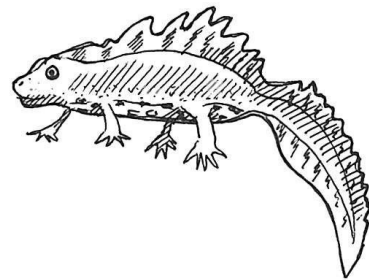
Moeras- en pluimzegge /
Greater Tussock-sedge & Lesser
Pond-sedge



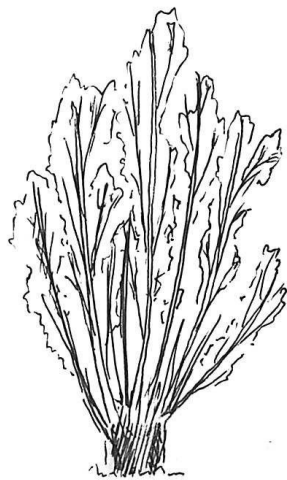
Bever /
Beaver



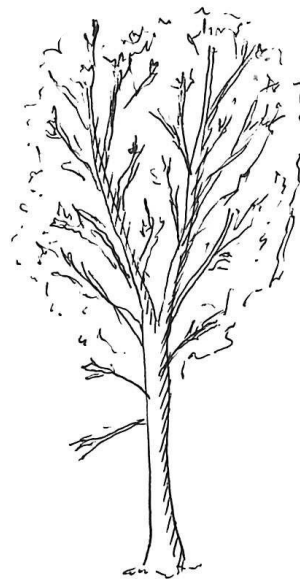
Donker Pimpernelblauwtje /
Dusky Large Blue



Kamsalamander /
Great crested newt



Wilig /
Willow



Populier /
Poplar

4.3 Demographics of Roerdalen

In the province of Limburg, the ageing of the population is an urgent topic for both the province and the municipalities within. A shift in demographics requires a reconsideration of both the housing supply and public space. The demands for public space are relevant for the design of the village fringes.

Grey pressure

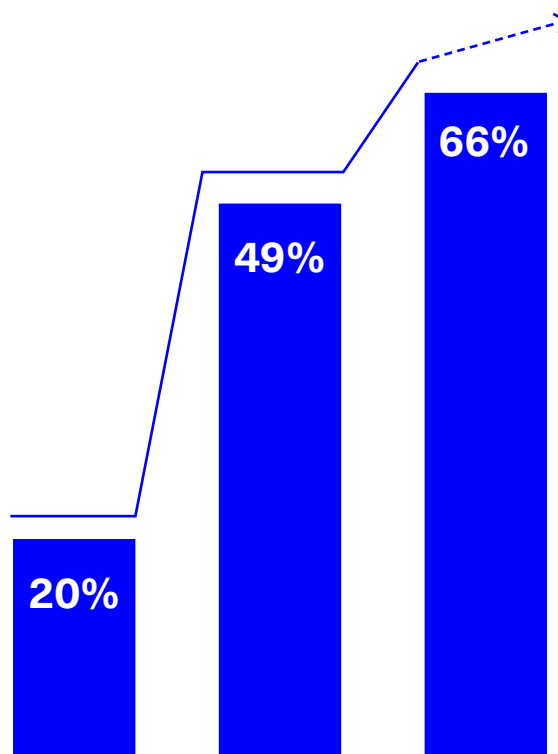
An ageing population and the consequences of this are measurable in different outcomes. For Roerdalen, it is relevant to review the grey pressure at the status quo and for the (near) future. Grey pressure projects the ratio of people who are 65+ compared to the potential working population (ages 20-64) (Central Bureau of Statistics, 2019). An increase in grey pressure is reflected in more elderly people than the potential working population. Translating this to the field of urbanism, an increase in the ageing population could mean a need for another type of housing or the spatial demands within public space.

Fringes for the changing population

Roerdalen is not the only municipality in the province of Limburg where grey pressure is a relevant theme.

The neighbouring city of Roermond also deals with an ageing population. The municipality of Roermond is one of the bigger municipalities in the province. They want to meet the ageing population within the alteration of public space. In the policy document 'spelen, bewegen en ontmoeten', the municipality addresses the ageing population by aiming to create meeting places in the public space. This is to encourage elderly people to go outside for both their health and to tackle loneliness that is more common for the ageing population (Gemeente Roermond, 2025).

These takeaways are also relevant for the municipality of Roerdalen. Because the villages within the Roer valley have a smaller population and are not located within a vastly urbanised area, the policy should not be projected in the same way as in the city of Roermond.



< 'grey pressure' is expected to increase within the next 30 years in Roerdalen (Central Bureau of Statistics, 2019)

4.4 Bandwidth of place-sensitive interventions

The interventions within the village fringes are considered 'place-sensitive interventions'. The place-sensitive interventions are introduced to ensure that the identity and the unique atmospheres of the villages of the Roer valley are respected. The bandwidth is divided into three spatial elements: *scale*, *seasonality* and *impact on daily life*.

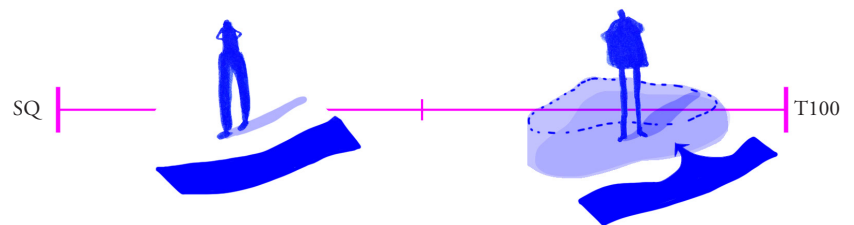
Scale

The intervention scale could range from the planting of a little vegetation [x/s] to the creation of a route that stretches to the floodplain [m/l]. Interventions larger than an [m/l] scale have too great an impact in the spatial domain and would disrupt the genius loci of the villages. Creating a connection between the villages to the Roer river should not be implemented at the cost of the historical village identities.



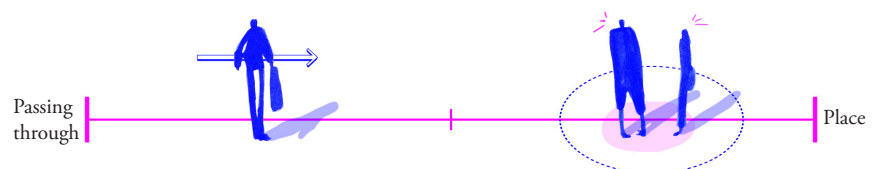
Seasonality

The seasonality of an intervention ensures that the measure adapts to the different flood possibilities. The impact of a flood, or if the area does not get flooded at all, defines the type of intervention that should be implemented.



Impact

Impact on daily life determines the possibility of an intervention to integrate within the community. The interventions should fit within the village atmosphere to be incorporated and accepted by the community.



4.5 Transformative design approach

RE-IMAGENING THE ROER VALLEY

Design briefs

While being located in a similar region, each village within the Roer valley has a unique relationship to the Roer river. Combining the findings of the analysis of the *Inventory Atlas* together with the overall understanding of the different systems within the Roer valley helps to create design briefs for each of the village fringes:

Melick - “Optimising passageways and secluded places.”

Sint Odiliënberg - “Make the Roer an integral part of public space.”

Herkenbosch - “Connecting cultural heritage with water”.

Vlodrop - “Adaptive public space while safeguarding connection.”

The design briefs are formulated to enhance the experience and connection of the residents to the Roer river and its natural functioning.

Transformative approach

The design briefs describe a possible future for the villages in 2050 that enhance the connection and experience of the village (fringes) and the Roer river. These briefs have been formulated according to the findings of the research on the systems of the Roer valley and the findings of the *Inventory Atlas*.

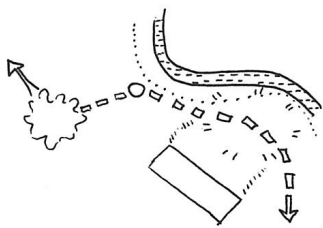
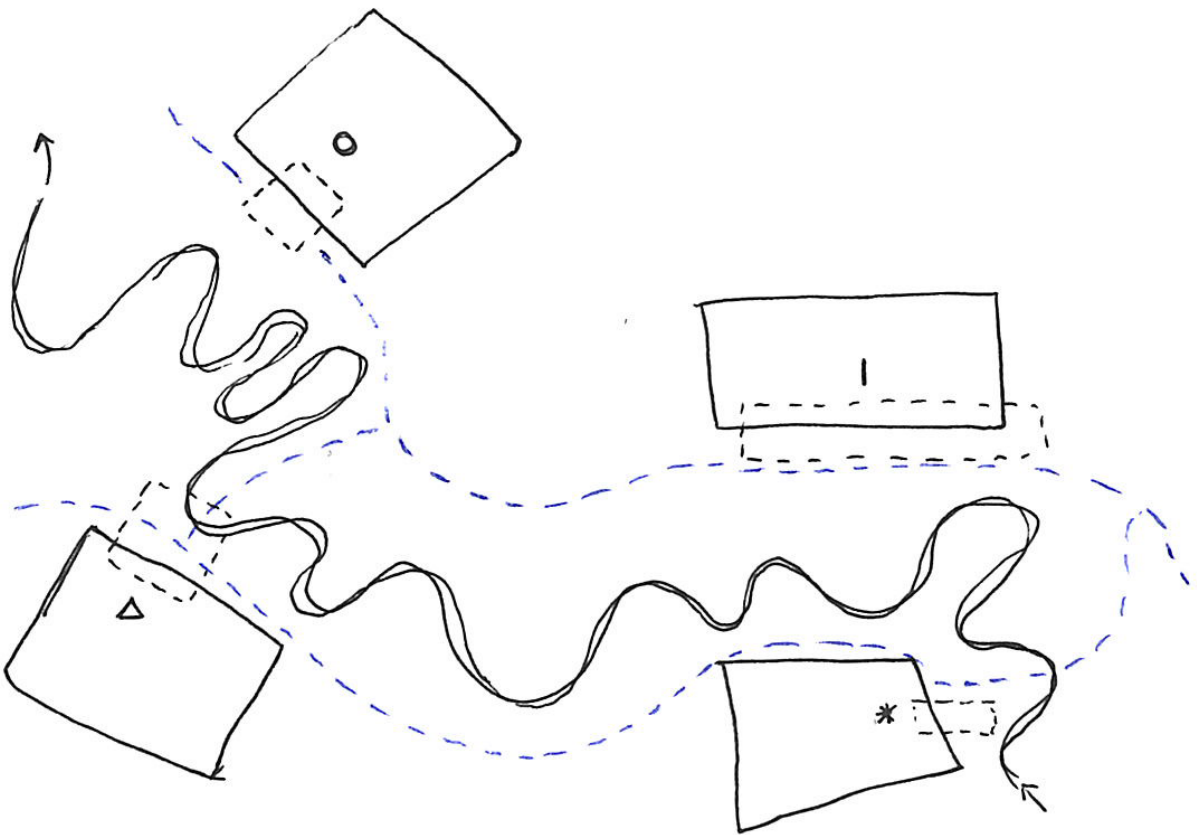
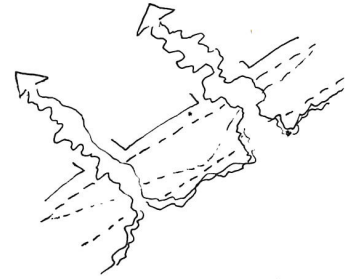
It is crucial to point out that these design briefs are not a definitive answer to foster the connection and experience of the Roer river and villages. Therefore, the briefs and further design proposals should be seen as a transformative vision rather than a fixed solution.

> sketched overview of the design briefs per village and its integration to the Roer valley.

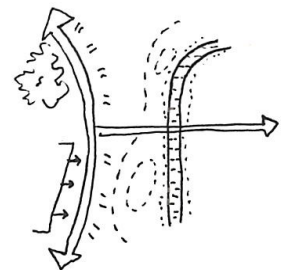
MELICK



HERKENBOSCH



SINT ODILIËNBERG



VLODROP

Sint Odiliënberg

Design brief:

MAKE THE ROER AN INTEGRAL PART OF PUBLIC SPACE

Limited interaction

The public space of the fringe of Sint Odiliënberg contains the basilica and the square that forms the public space along the basilica of Sint Odiliënberg. This public domain is partially linked to the Roer in the spatial form of a pocket park. Despite the direct geographical connection with the river and its floodplain, the river can only be experienced around this pocket park and when the bridge is crossed towards Melick.

To strengthen the connection with the Roer and the ability to physically experience the River along a longer extent of the village fringe, it is crucial to optimise the now privatised and closed-off space along the river.

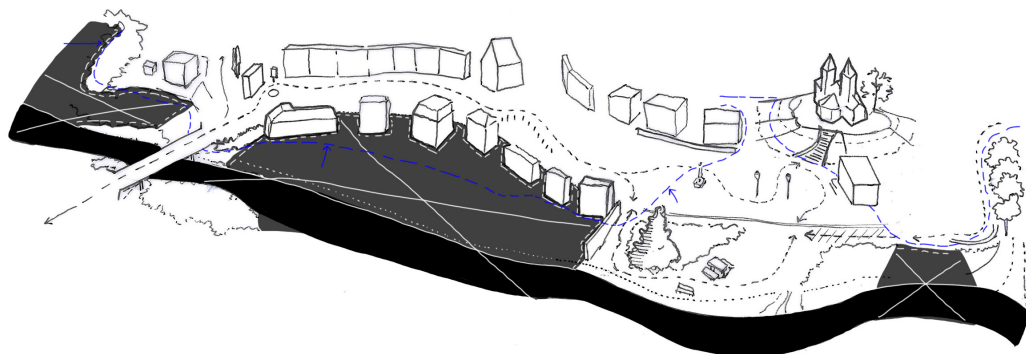
Attachment through accessibility

The largest intervention would be the opening of the privatised gardens along the riverbank. This creates an opportunity to continue the path that now connects the

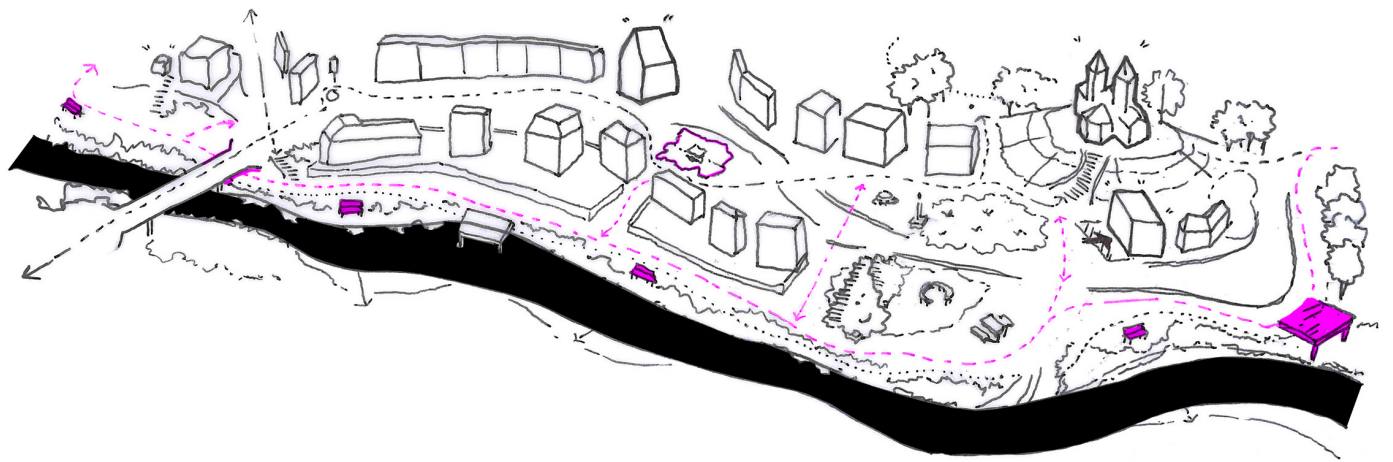
two entrances of the basilica. This route can stretch along the entire fringe of Sint Odiliënberg, connecting the forest landscape and more recent extensions of the village through the floodplain to the basilica.

The riverbanks will be transformed, as less steep embankments both improve ecological systems and the physical connection of people with the water, as the river becomes more visible. Additionally, gradual slopes create opportunities to enrich the vegetation along the river, both complementing water quality and the natural feeling of the river.

Along the established route are possibilities to integrate small placemaking elements. These could range from benches to decks for fishers and to be drawn to the water. Every element is positioned in a way that the river can be seen, heard and even smelled.






- Water level T100
- Inaccessible area
- ▨ Invisible area
- Roer
- Potential flooded dwellings



^ The village fringe of Sint Odiliënberg
reimagined, with more access along the river
and opening the space along the floodplain.

< Current perception of the village fringe in
relation to the Roer River in Sint Odiliënberg

-  Audibility
-  Visibility
-  Accessibility

Melick

Design brief:

OPTIMISING PASSAGEWAYS AND SECLUDED PLACES

Barriers

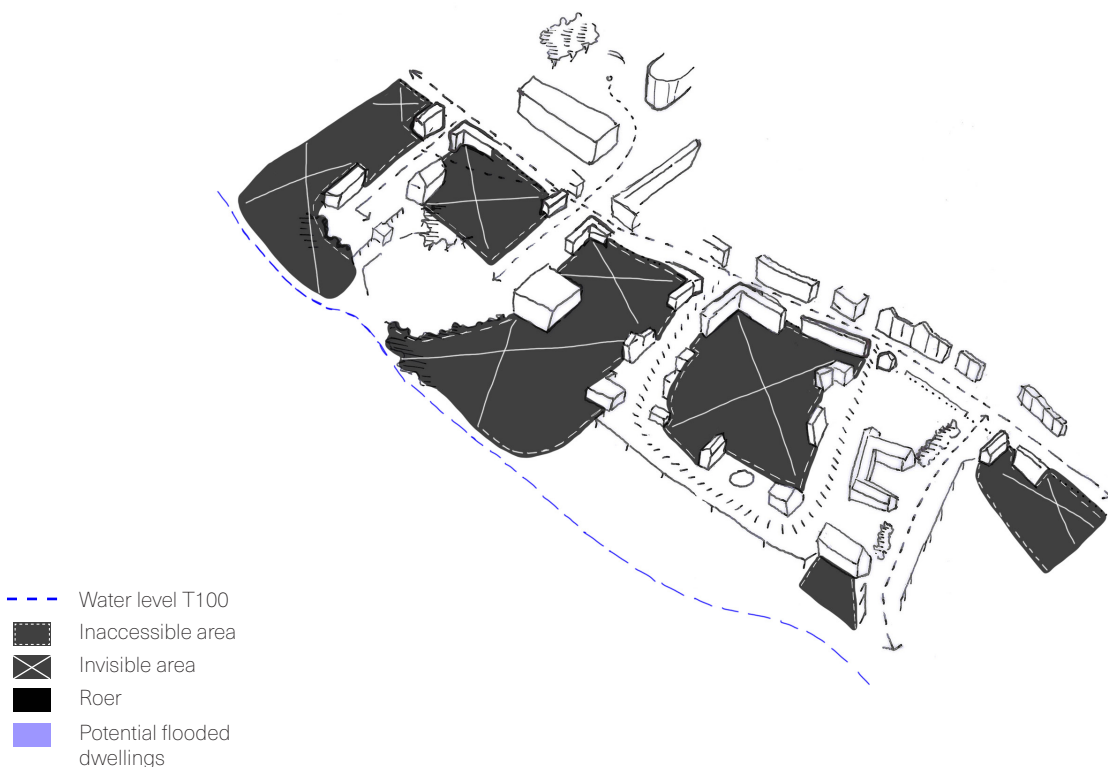
Melick has traditionally been a linear settlement. As the village expanded over time, this linear arrangement of buildings along the fringe of Melick unintentionally became the main dividing element between the village and the Roer river. The buildings block the view of the river, leaving only the houses built along the edge of the floodplain visible.

The limited sideroads that pierce through the barrier of buildings have a high potential to become passageways to the Roer River and its floodplain. The entrances to these roads are under-defined, making it unappealing for outsiders to enter these 'privatised' sideroads.

Entrances and places to stay

By transforming the sideroads into passageways, the area adjacent to the floodplain becomes more intertwined with the main road of Melick. By highlighting the entries of these sideroads, the entrances become more inviting to outsiders. Connecting the now dead-ended roads creates a connection between the different zones, making it possible to extend the accommodating space.




Along the edges of the routes, placemaking elements will be positioned. The now terrain vagues will be transformed in places by inserting place-sensitive interventions, adapting to different needs and uses of the public space. The overall route continues mostly with viewpoints to the Roer River, which is visible from the edge by the trees that define the river from a distance.





^ The village fringe of Melick reimagined, where the passageways form an extension of the village viewing over the Roer River.

< Current perception of the village fringe in relation to the Roer River in Melick

-  Audibility
-  Visibility
-  Accessibility

Herkenbosch

Design brief:

CONNECTING CULTURAL HERITAGE WITH WATER

Height as the divider

The transition between the floodplain and village is marked by a visible height difference of a couple of meters. The residential neighbourhoods are located on higher ground, while the lower-lying meadows embrace their natural landscape, which is closely connected to the neighbouring national park. Amid this transition of landscapes, the castle of Dealenbroek is located. The castle that originates from the 14th century is the main attraction of the area.

From this castle, there are a couple of roads entering the floodplain. Because of the vast vegetation, the Roer can only be seen in a couple of places, again marked by its recognisable treeline.

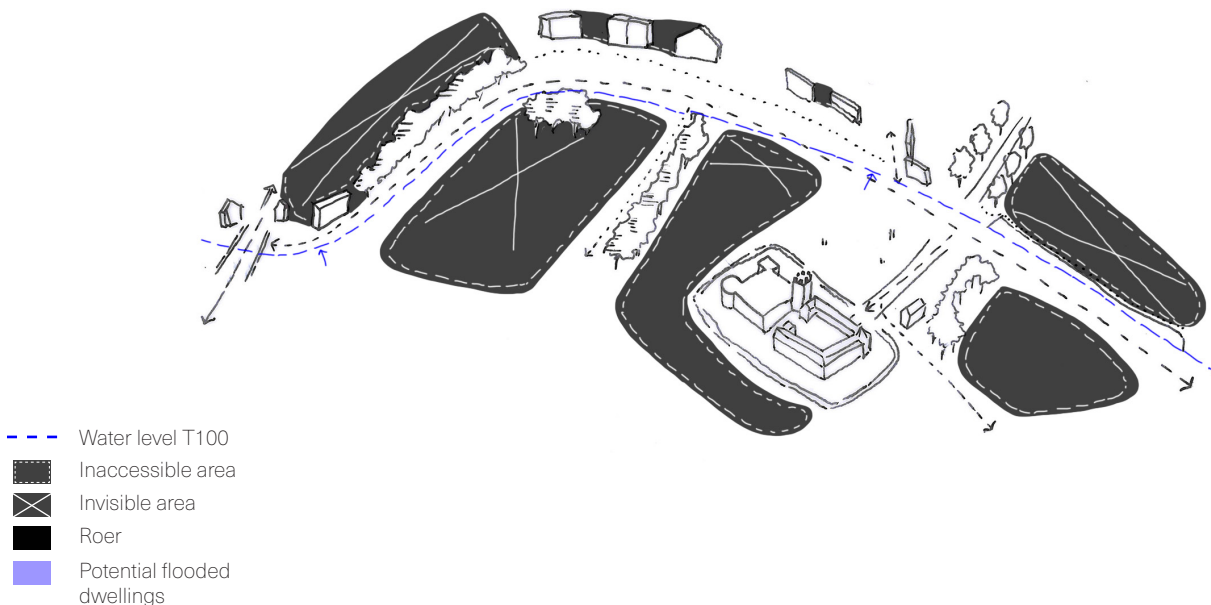
Most of the houses that are located within the fringe of Herkenbosch are not oriented towards the Roer. Many are surrounded by physical barriers such as fences or hedges which mark their private gardens, but therefore lose all sense of the surrounding nature of the Roer and its valley.

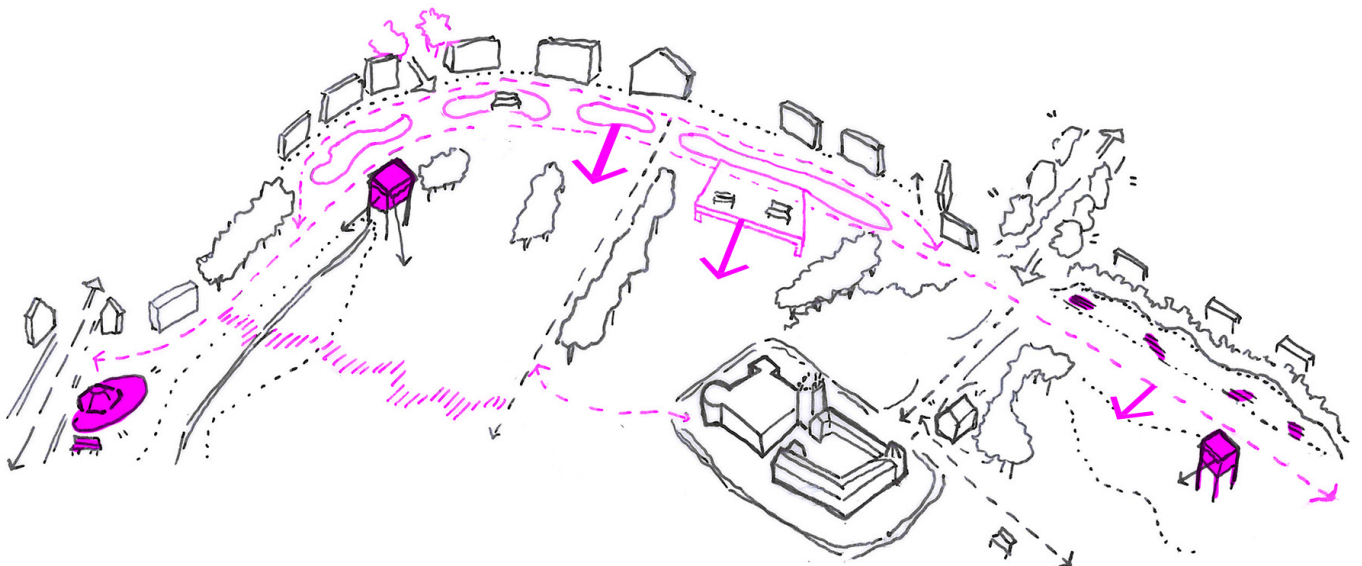
Accommodating viewpoints & connections

The first step for imagining a transformed village fringe of Herkenbosch is to create an intermediate space that bridges the gap between the street and the main road along the edge of Herkenbosch. Within these areas, places to stay will be integrated with the height differences, creating a dynamic space that overlooks the Roer River.

The wetland along the edge is part of the natural area of the Roer Valley. Accessing this is possible, but pathways need to be designed so the nature stays protected and does not get walked over. These new routes also have the possibility to accommodate placemaking elements that are visually connected with the river.




Because of the connection with the natural area of Meinweg National Park, watchtowers will be included in the terrain of the floodplain to add to the identity of the village and to accommodate the need for a visual connection with the river.

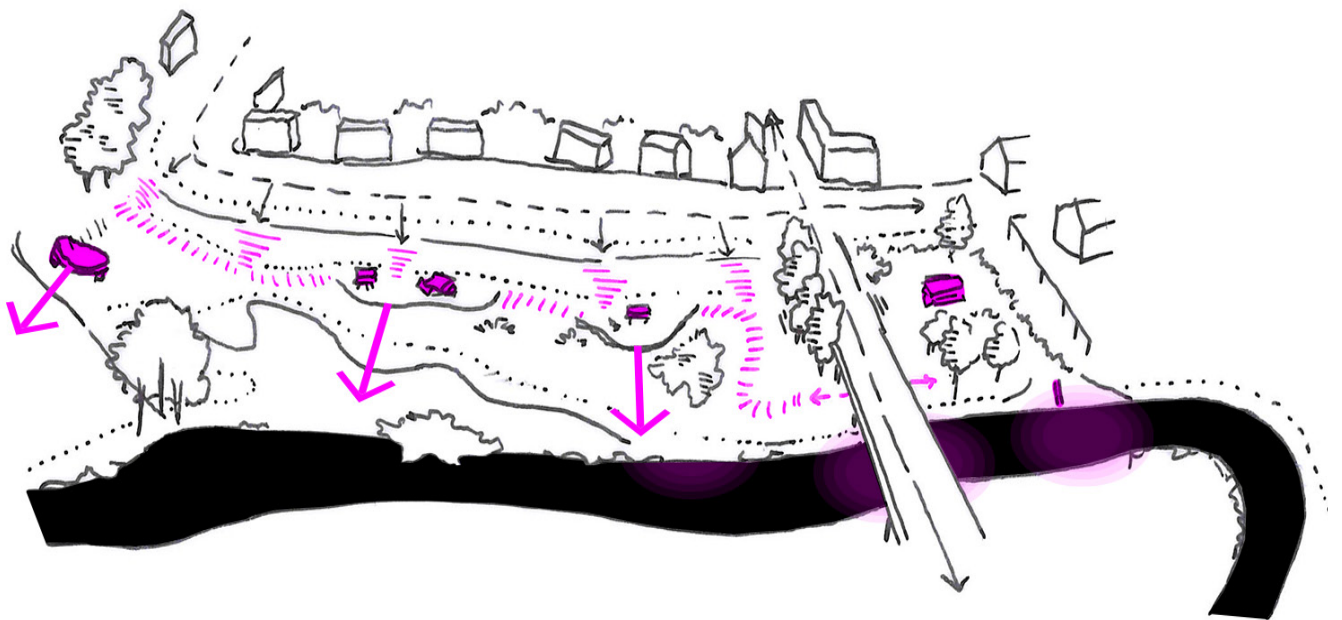




^ The village fringe of Herkenbosch reimagined. The cultural heritage of the castle forms together with the establishment of 'view-zones' a connection with the Roer River.




< Current perception of the village fringe in relation to the Roer River in Herkenbosch.

-  Audibility
-  Visibility
-  Accessibility



^ The village fringe of Vlodrop reimagined, where the elements for water protection are better integrated into the streets, opening up the adjacent floodplain to the village.

< Current perception of the village fringe in relation to the Roer River in Vlodrop.

-  Audibility
-  Visibility
-  Accessibility

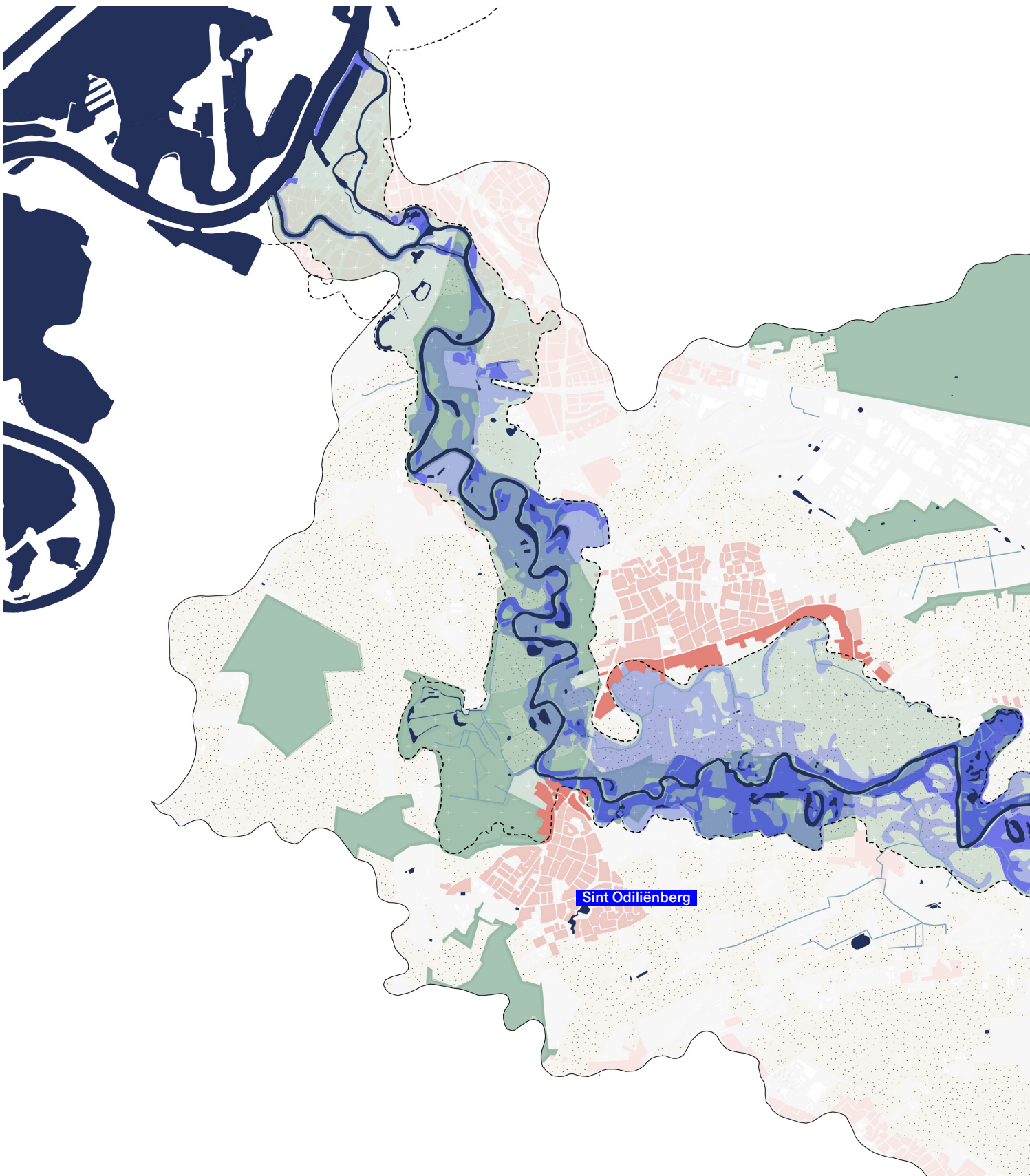


5.

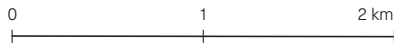
< Lookout on the Roer and the floodplain
from the village fringe of Melick,
photographed in March 2026 by author

- 1. Place-sensitive intervention principles*
- 2. Reimagining Sint Odiliënberg*
- 3. Reimagining Herkenbosch*
- 4. Impact of interventions*
- 5. Phasing the transformation*

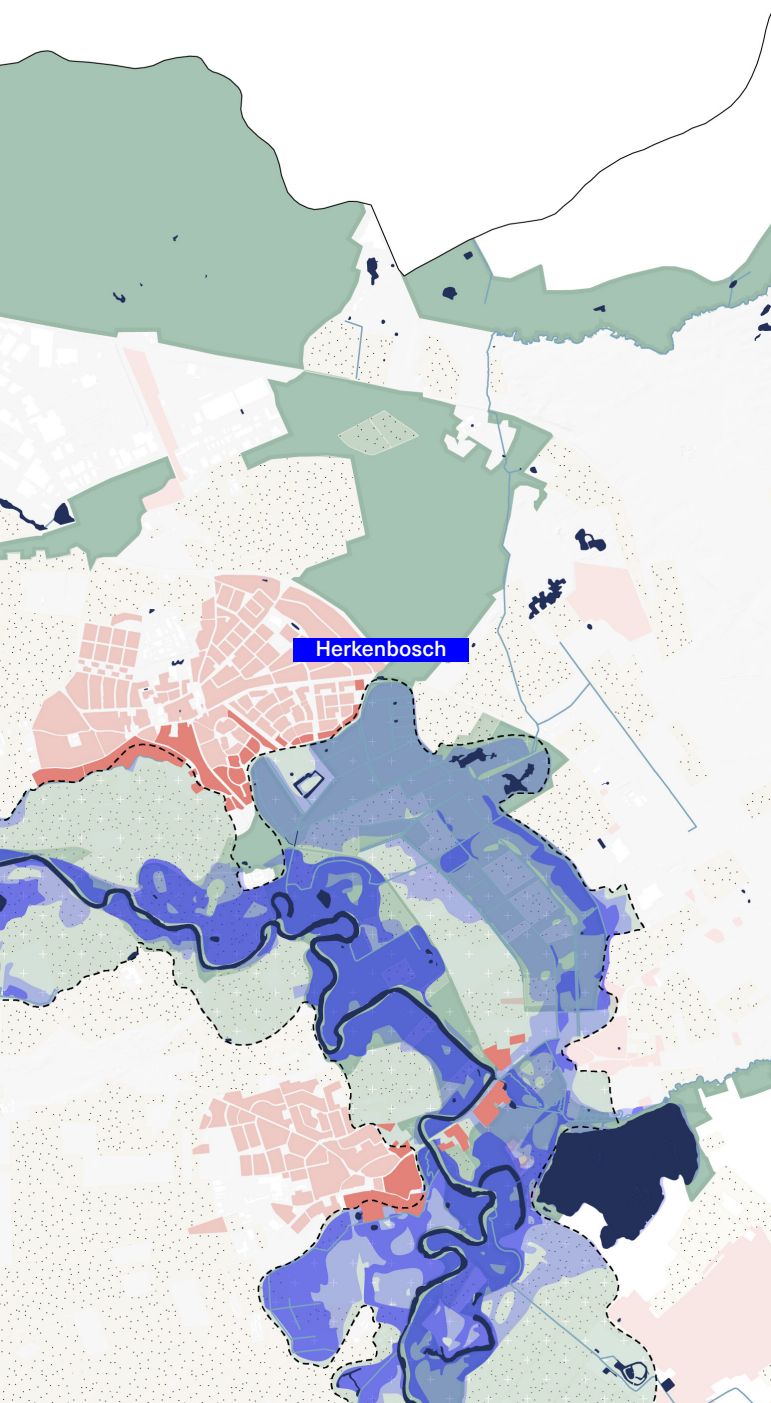
Design



^ The Roer valley and the position of the villages and their fringes.



- Main water flow
- Secondary water flow
- Urbanised area
- Village fringe
- Floodplain
- Floodable zone [T25 - D140]
- Natura2000
- Agricultural field
- Floodplain boundary
- Village with design proposal



DESIGNING THE FRINGES

Sint Odiliënberg & Herkenbosch

While all four village have their unique connection to the Roer river, two main types of connection can be generalised: villages with a direct relation to the riverfront and villages that are adjacent to the floodplain.

Because of time limitations for this graduation thesis, for each connection, one village is highlighted as the project for the place-sensitive interventions. These are Sint Odiliënberg [riverfront] and Herkenbosch [floodplain], as within each of the villages, a culturally significant building is located.

Place-sensitive intervention principles

The place-sensitive intervention principles are constructed from an understanding of the relationship between villages and the Roer River through the intervention Atlas. This results in an overview of design elements in the domains of *route*, *space*, *flow* & *flood* that can be assembled together to create a design that connects the village to the Roer river.

The overview of the place-sensitive intervention principles can be found in Appendix IV, and is visible in the design as #.



5.2 Reimagening Sint Odiliënberg

SINT ODILIËNBERG

Markers & public space

Sint Odiliënberg has been built around the basilica that was established on the mound in the northern part of the current village. Adjacent to the basilica is the main historical square of the village, which also connects the central area of the historical centre to the Roer river. This public space is the only public area where the fringe of the village connects the river with the urbanised area of the village. The only other location within the village in which the Roer river can be experienced is from the bridge that crosses the Roer river.

Limitations







As a river-oriented village within the Roer valley, Sint Odiliënberg provides limited connection between the river and its public spaces. This is mainly the result of the privatisation of the village fringe and floodplain over the years. Therefore, the design brief has been formulated as: “make the roer an integral part of public space”.

Experiencing the Roer

Opportunities in finding a connection between the inhabitants of Sint Odiliënberg with the Roer river are done through the perception of the river through its visibility and the accessibility of the floodplain. Creating access points to the now privatised floodplain and providing new visible areas of the Roer river are crucial in the reimagining of the village.



^ The spatial status quo of Sint Odiliënberg.

-  Main water flow
-  Infrastructure
-  Surface water
-  Building
-  Topographical line
-  Outline Sint Odiliënberg



- 1 Entrance Roer route - *entrance markers & elevated route* [R2, R3, R5]
- 2 Integrating bridge into route - *bridging height difference, integrating existing infrastructure* [R1, R4]
- 3 Intergenerational cluster - *proposed redevelopment*
- 4 Fishing spot - *residing along water* [S1]

SEASONAL TRANSFORMATION - 2050

Opening the floodplain

The now closed off floodplain becomes integrated within the public space by repositioning the boundary of the back garden, allowing for an access point to the area. By conducting this small intervention, the route along the river can be realised and forms the backbone for connecting Sint Odiliënberg to the Roer river.

Connecting the fringe

The Roer route connects the public space in front of the basilica to the Frymerson castle (which now serves as an event location). Midway through the route, the pathway crosses underneath the bridge. By integrating steps from the route to the elevated road, the route becomes accessible from the village entrance.

Strategically positioning trees and vegetation reveals the Roer at certain locations, creating excitement and make the route more interesting to follow further.

Experiencing the natural system

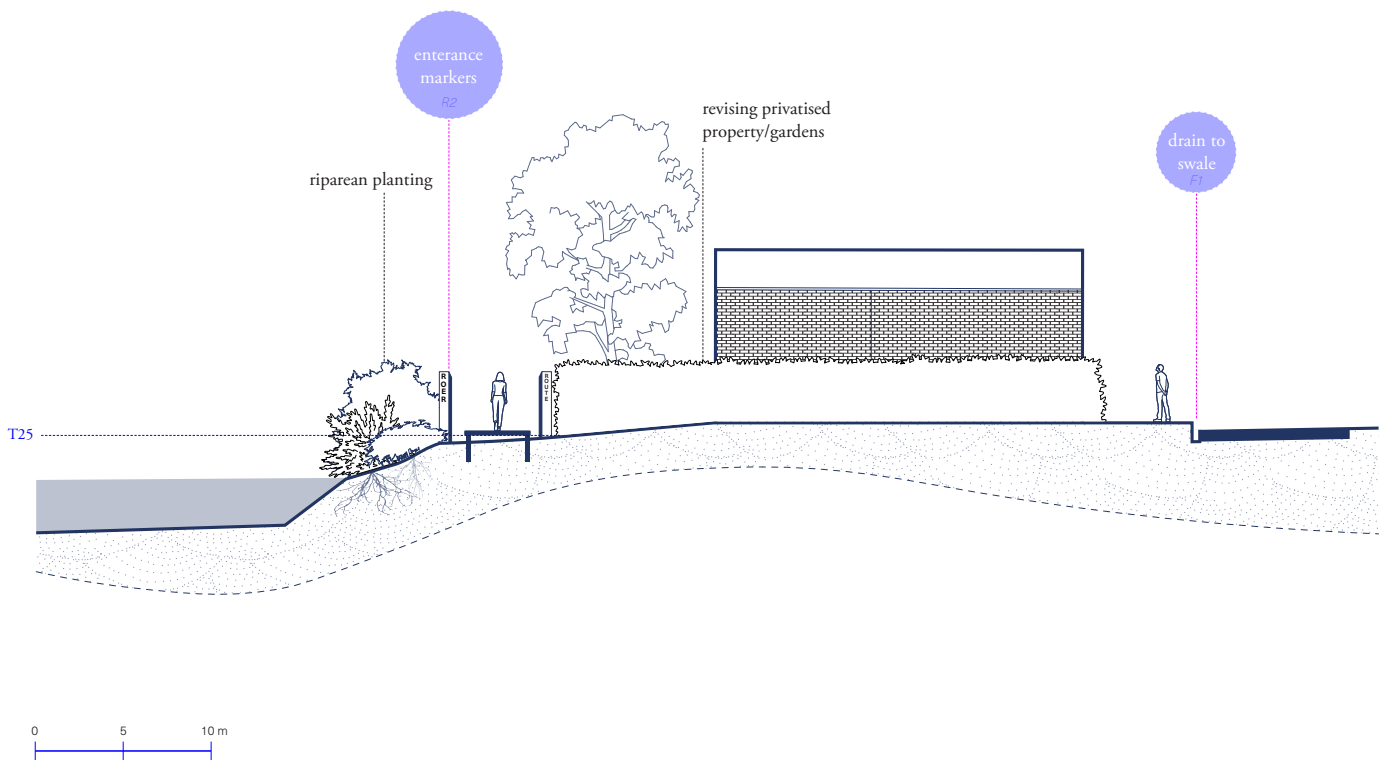
The location of Sint Odiliënberg along the Roer river allows for a yearly flooding of the floodplain. Only during an extreme scenario of flooding, some areas become inaccessible - such as the main road through the village. The projected route across the village fringe should be accessible during the annual and T25 floodings of the Roer river, to elevate the experience of the river by designing for the natural fluctuations of the water systems.

For the projection of Sint Odiliënberg, elements from the principles of the place-sensitive interventions are implemented and refined to connect to the genius loci of the village.

- Main water flow
- Infrastructure
- Surface water, including Roer
- ▭ Building
- Floodable zone [T25 - D140]
- ▭ Topographical line
- ▭ Outline Sint Odiliënberg
- Tree
- Entrance marker
- ▭ Route along fringe
- ◀ Viewpoint to river
- Location section

< Transformation of Sint Odiliënberg in 2050 in a dry (top) and wet T100 (bottom) scenario.





ENTERING THE FLOODPLAIN

The main entrance of the Roer route is positioned along the transition zone of the public space near the basilica and the floodplain. In the current situation, the floodplain is inaccessible because of the privatisation of the property and the demarcation of the area through hedges. By creating a clear entrance and fixed pathway, people can connect to the Roer river through accessibility and eventually visibility and even audibility.

Entrance markers

As described in the place-sensitive intervention principles (see Appendix IV), entrance markers point towards a new pathway or space along the floodplain that increases the

connection of the village with the river. Here, the markers showcase the entrance of the pathway along the privatised gardens.

Drains to swale & vegetation

The street edges are equipped with drains. When rainwater falls in the urban cores, it is directed to swales installed in the now mostly paved cores.

In the swales as well as the riverbanks, native planting that complements the (keystone) species of the Roer valley are planted to enhance ecological qualities and to create exciting spots to experience the river through.

^ Entering the Roer route through the opened floodplain. *Section A.*

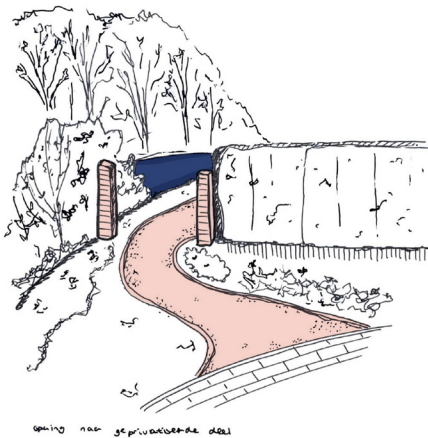
EXPERIENCING THE ROER

Revealing the river

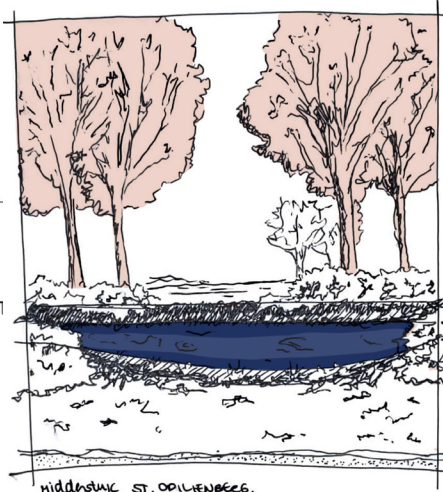
The opening of the floodplain with the Roer route leads to a new possibility of perceiving the river. The former privatised floodplain is opened up to the public. The planting of (riparian) vegetation along the riverbanks creates a more natural atmosphere around the river. By opening up certain spots along the edge, the river is visible at specific parts of the route. Having specific areas for visually perceiving the river, while being able to hear and access the river at all times, helps to create an exciting route for visitors, making it attractive to continue the route to experience different parts of the river.

During a T25, the route is still accessible. The markers of the route stick out of the water due to the strategic placement of the interventions.

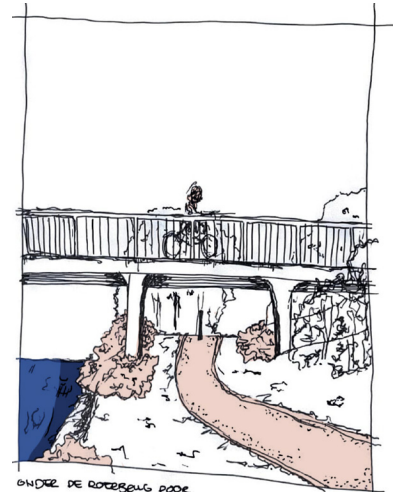
Dry situation



OPING NAAR SEPTEMBERDE DEEL

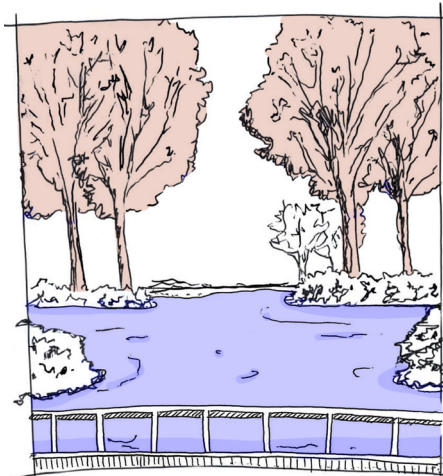
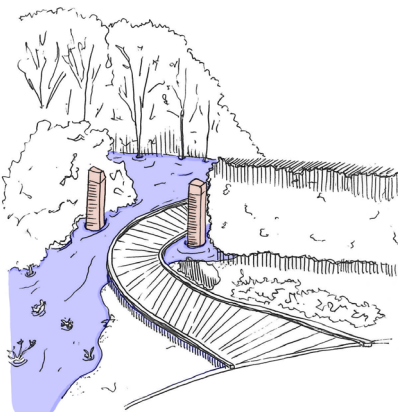


HIDDASLUK ST. ODILIEBEEK.



ONDER DE ROTTERDAM POOR

During T25 flooding



^ The entrance of the Roer route is marked with entrance markers

^ Along the Route, there are a few areas in which the Roer is visible in between the riparian vegetation.

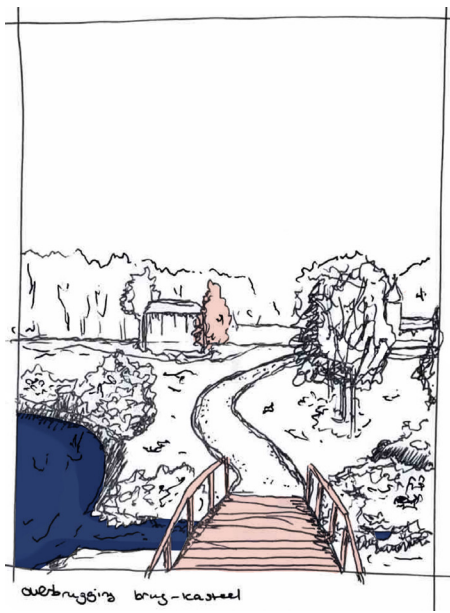
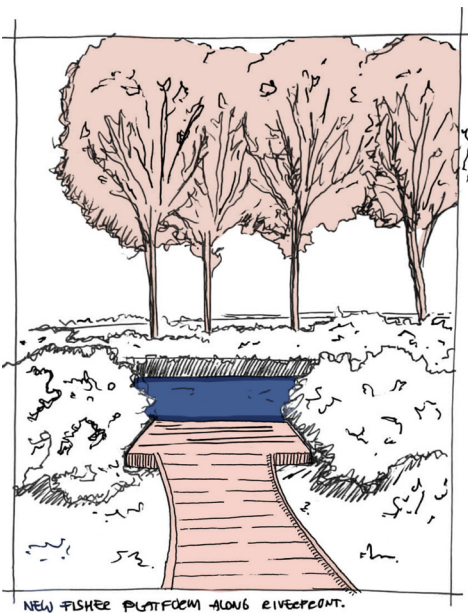
^ The route continues underneath the bridge, which becomes more incorporated with the floodplain.

EXPERIENCING THE ROER

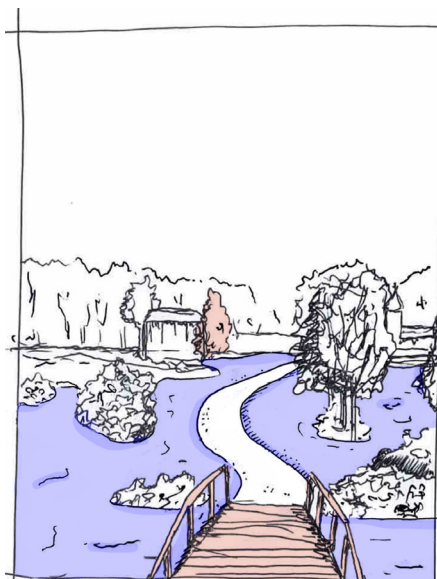
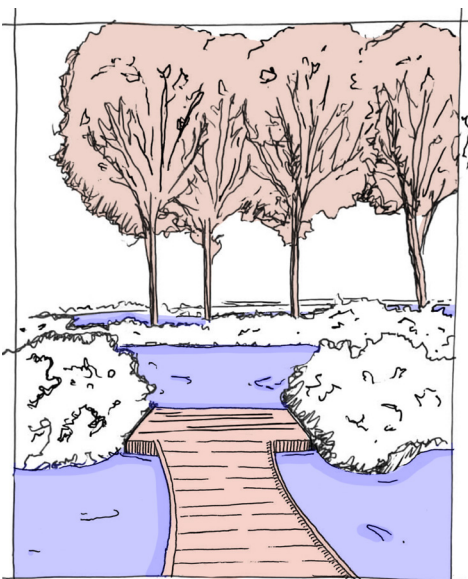
Connecting the fringe

Following the route by continuing under the bridge, a new area of the floodplain is reached. In the specific locations where the Roer is visible, the floodplain towards Melick and Herkenbosch also becomes more visible, not just connecting Sint Odiliënberg to the river but also to the other villages through the visibility over the floodplain.

The route ends near the Frymerson estate, which is located at the end of the village fringe. Following the entire route, in both the regular and wet seasons, includes the entire fringe. This ensures that most of the village is able to reconnect to the Roer river.



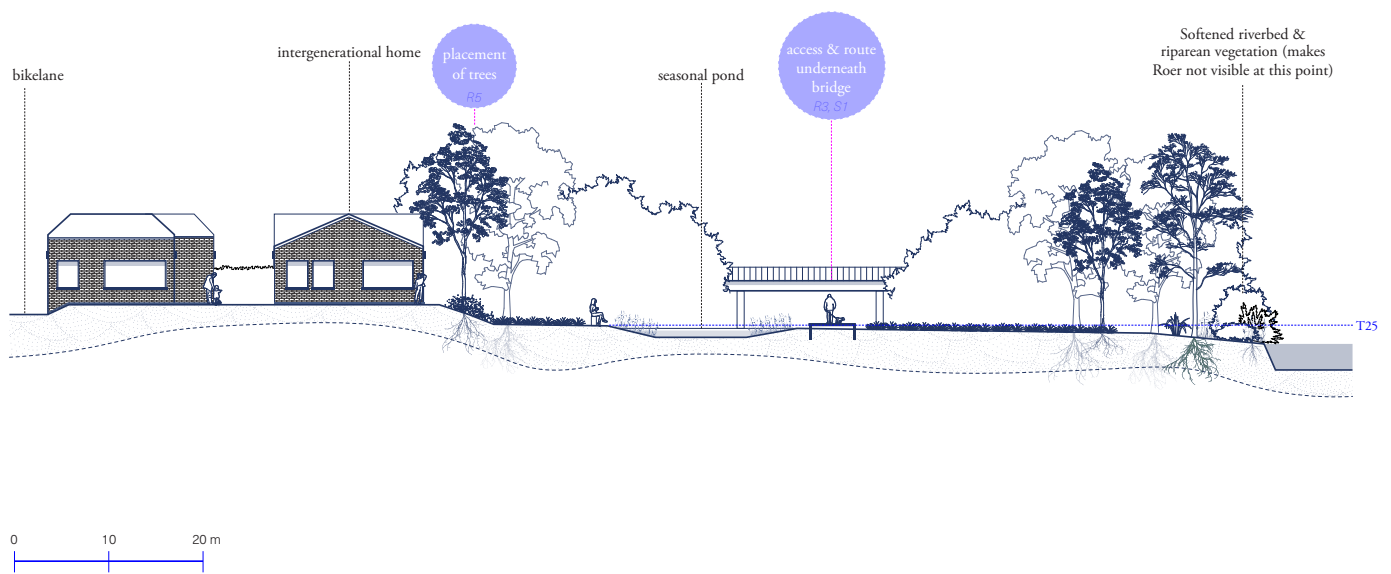
Dry situation



During T25 flooding

^ A place to reside along the river becomes the perfect spot for the fishing community of the Roer valley.

^ Following the route to back to the buildings along the village fringe.



INTERGENERATIONAL LIVING

^ Section from the intergenerational housing cluster to the Roer river. *Section B.*

Intergenerational living in the village fringe

There are limited areas in the village fringe to realise new housing. In the area shown in the section, a storage area for campers is located. This underutilises the special location of the area, which is perfectly located on the village fringe where the floodplain and the village meet.

When redeveloping this area, intergenerational houses are realised in the location. This aligns with the demographic change of the municipality and ensures the possibility for elderly people to live at home longer. The cluster of buildings is connected to the floodplain through a pathway that joins the Roer route and overlooks the river and its floodplain.

Seasonal utilization of the floodplain

The large floodplain adjacent to the new intergenerational cluster provides the perfect space where the floodplain vegetation meets the Route. By making different height levels in the floodplain, places arise that could be flooded and maintain the water for longer periods of time. These areas are referred to as seasonal ponds and provide landscape and ecosystem diversity, as well as making the Roer route more exciting.

IMPRESSION

The proposed 'Roer route' integrates the Roer with the existing public space through the accessibility of the floodplain and makes the Roer more visible along multiple locations. This impression visualises the merging of the existing public space near the basilica with the start of the Route. The soft materiality of the route connects to the robust klinkers used in the existing park, while the change of materials marks the start of the route.

During a T25 flood, most of the floodplain is submerged. Also, the connecting public space becomes partially submerged by the river. The existing brick road will be raised in areas where flooding is prominent to enable the use of the Roer route during this event.



I like to play near the waterfront when my family visits the basilica.

We like to walk along the Rour route from our intergenerational home.

ROUR

ROUTE

5.3 Reimagining Herkenbosch

- Main water flow
- Infrastructure
- Surface water
- Building
- Topographical line
- Outline Sint Odiliëberg

HERKENBOSCH

Terrace layers

The village fringe of Herkenbosch is clearly defined by the height difference between the urban core and the floodplain. Along the fringe is a sandy road that provides access to areas of the village. These entrances present as open corridors, often lined with trees and small vegetation along the pathway. Most of the houses built along the village edge do not face the floodplain, but have their garden oriented towards the natural area. The often tall fencing around private property disconnects the streets of Herkenbosch from the floodplain.

Herkenbosch is a floodplain adjacent village. The Roer river therefore, does not touch upon the fringe itself. During a T25 flood, water can reach the village fringe.

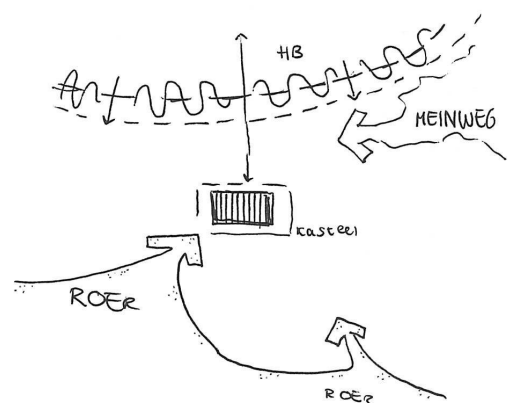
Daelenbroeck castle

In the midst of the village fringe lies the historical castle of Daelenbroeck. It is a culturally significant location for both the village and the Roer valley.

Historically, the castle was positioned next to the Roer river, but the morphological changes of the river over time repositioned the river more southwards. The castle, however, can still be linked to the hydrological heritage of the village. The design brief for Herkenbosch has been formulated as: “Connecting cultural heritage with water”.

Fusion of landscapes

Herkenbosch is positioned in the transition zone of multiple landscapes: the Roer and its floodplain, the urbanised village and the natural park de Meinweg. Combining this merging of landscapes with the visible height difference, the village fringe of Herkenbosch becomes a starting point for experiencing the Roer river at different distances and in a variety of ways to do so. From observing the river from the village fringe to perceiving the river from closer by along a projected route.



^ Schematic overview of the merge of landscapes near Herkenbosch.
> The spatial status quo of Herkenbosch.

0 75 150 m



0 150 300 m



- Main water flow
- Infrastructure
- Surface water
- Building
- Floodable zone [T25 - D140]
- Topographical line
- Outline Sint Odiliënberg
- Tree
- Entrance marker
- Flood marker
- Route along fringe
- ◀ Viewpoint to river
- - - Location section



SEASONAL TRANSFORMATION - 2050

Orienting the village to the Roer

The goal of intervening in the village fringes is to connect the inhabitants to the Roer river. As Herkenbosch has a limited area oriented towards the floodplain, emphasising the axis towards it is crucial. The 'green fingers' towards the floodplain will be planted with more plants that refer to the species of the floodplain.

Within the village fringe fragment oriented towards the floodplain, interventions are positioned to bridge the height difference between the street and the floodplain, and public furniture is placed at the end of the interventions.

Creating the route

At the end of one of the 'green fingers', the Roer route will start. The first area of the floodplain is transformed into a more wetland-like area by the application of a layer of clay. Water flowing from the village through the green fingers can accumulate in this area, marking the start of the route to the river.

Within this first area, spotters places are positioned for inhabitants to overlook the flat floodplain and make the Roer visible from the towers.

Lookout from the castle

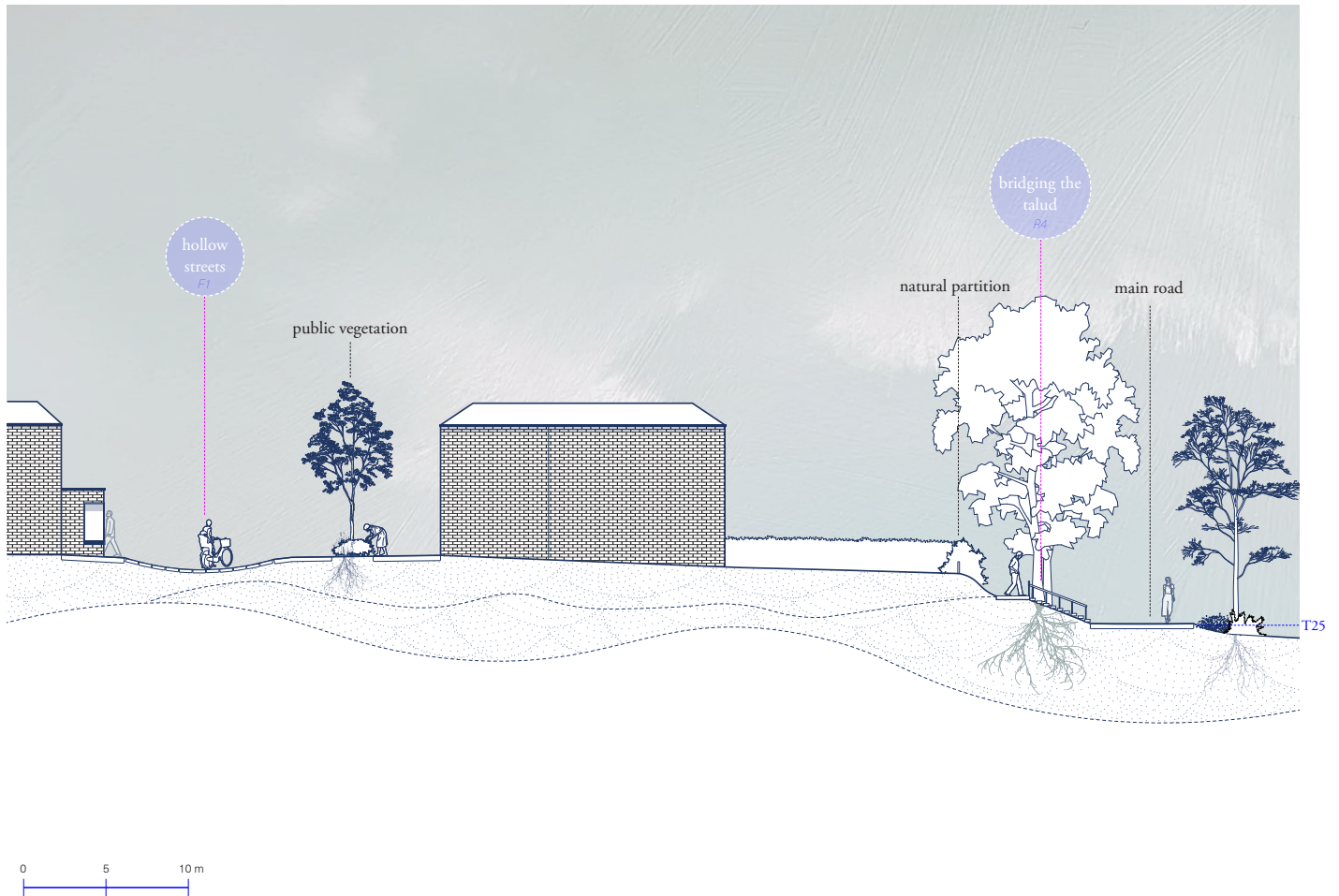
The route continues along the castle. At the corner of the castle plot, a higher-lying area is located. The lookout platform is built upon this bump to elevate the inhabitants and increase the visual overview of the river and floodplain. This lookout point could also be accessed from the main road towards the castle.

Towards the river

From the viewing platform, the pathway to the Roer is clearly marked by a line of trees. Following this road leads to a loop along the riverbank, where people can reside or take the route back to the village fringe. A side road connects the 'Roer loop' to the farm that is part of the cultural heritage of the village.

The implementation of the Roer route from the village fringe to the Roer river in Herkenbosch touches upon different ways of experiencing the river. It results in a complete perception of the river, which remains accessible and dynamic throughout its fluctuations.

- 1 Bridging the village fringe - *bridging height & lookout point* [R4, S3]
- 2 Entrance Roer route - *wet landscape & spotters place* [R3, R5, S2, S4]
- 3 Dealenbroek lookout - *lookout point* [S3]
- 4 Roer loop - *residing along water* [S1, R6]



FROM STREET TO FLOODPLAIN

^ Section of the village edge of Herkenbosch. Section X.

Streets that resemble the floodplain

The streets in the village are not linked to the floodplain in their materiality. The reimagining of Herkenbosch, therefore, starts in the streets, where roads are designed as hollow streets to collect rainwater at the surface. More intensive vegetation is added along the thresholds of the streets to resemble the natural atmosphere of the floodplain, which is only a few meters away. Implementing these elements ensures better visibility and reflection of the floodplain in the urbanised area, while providing public benefits such as natural cooling and reduced intensity on the sewage system during peak rainfall.

Utilising the terrace layers

Moving to the transition zone between the urban area and the floodplain, the height difference is very present. The height could be utilised to see further into the floodplain. Therefore, a pathway is constructed along the bump, made accessible by installing stairs. The pathway does not reach the top of the hill to ensure the privacy of the backyards of the current houses.

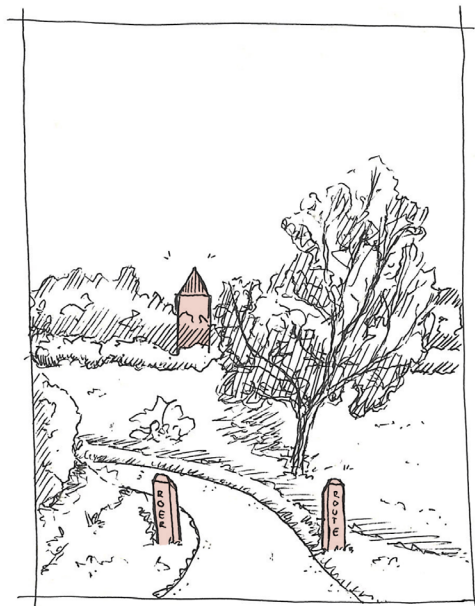
The main road of the village fringe will remain in its current materialisation (a sandy road) to emphasise the transition between the urban area and the floodplain.

EXPERIENCING THE ROER

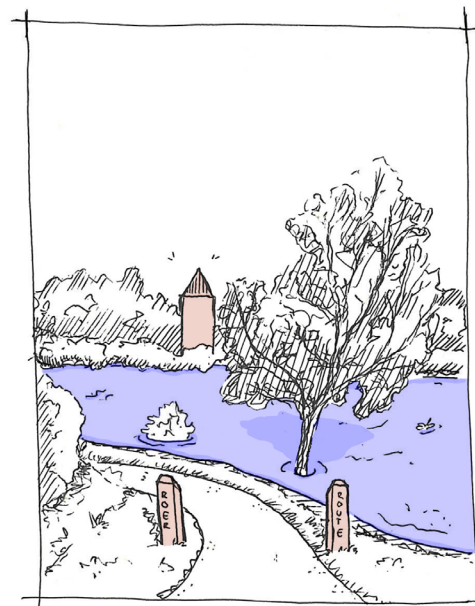
The route along the village fringe is experienced through its view of the floodplain and specific elements. The entrance from the main road of Herkenbosch is marked with the entrance markers. Rows of trees help to guide the visitor to a specific viewpoint.

During a T25 flood, the water comes close to the edge of the village, which can be safely experienced from the path along the village fringe.

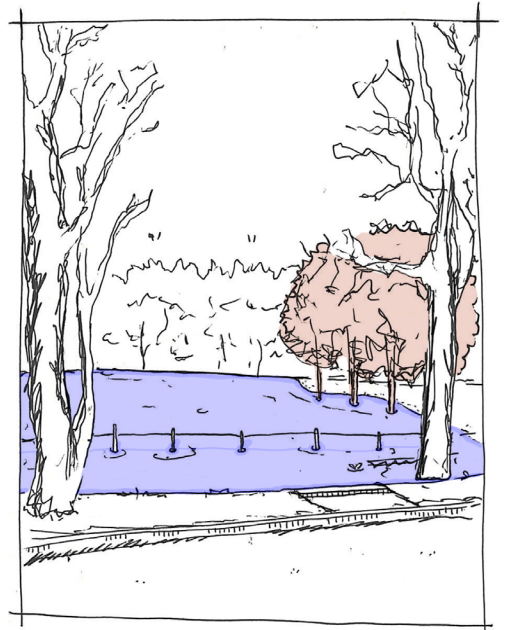
Dry situation



During T25 flooding



ENTREE ROER-ROUTE HERKENBOSCH



HERKENBOSCH : MARKERS TE ZIEN VANAF BANG

^ Looking to the castle from the entrance of the main road of Herkenbosch.

^ Perceiving the floodplain from the floodplain oriented street in Herkenbosch.

0 150 300 m



- ↔ Rainwater flow through village streets
- ➡ Rainwater flow from green finger to floodplain
- ➡ Flow of redundant water to Roer
- Location of inzoom detail
- Floodable zone [T25 - D140]



^ Water flow in Herkenbosch during precepitation, from street to floodplain.
 v Bricks stored near castle Daelenbroeck, which can be used in the redesign of the streets.

FLOW OF WATER - STREET

Collecting water on the street

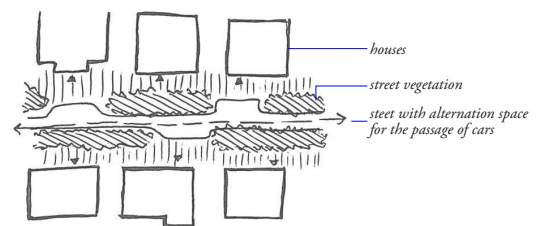
The collection of rainwater starts in the streets of Herkenbosch. In the current situation, some streets are equipped with molgoten to dispose of the rainwater. Molgoten has a drainage point every 50 meters, which means rainwater is drained to an underground disposal system.

In this proposal, hollow streets are introduced, as they enlarge the drainage capacity of the streets and can be extended over longer areas (Groenblauwe Netwerken, n.d.). Hollow streets are also common in riverside landscapes in Limburg (Rijksdienst voor het Cultureel Erfgoed, 2023), but the implementation, as drawn in the zoom-in, is a modern spinoff of the more traditional hollow roads in the countryside. The streets make the water drainage more visible, creating awareness among the inhabitants about the water system of the village and linking the drainage system to the floodplain.

The rainwater is transferred through the hollow streets to the gutters in the green fingers. Water that cannot infiltrate within the green fingers is drained to the floodplain, where wetland areas are created to accumulate the rainwater. These areas also mark the starting points of the Roer route.

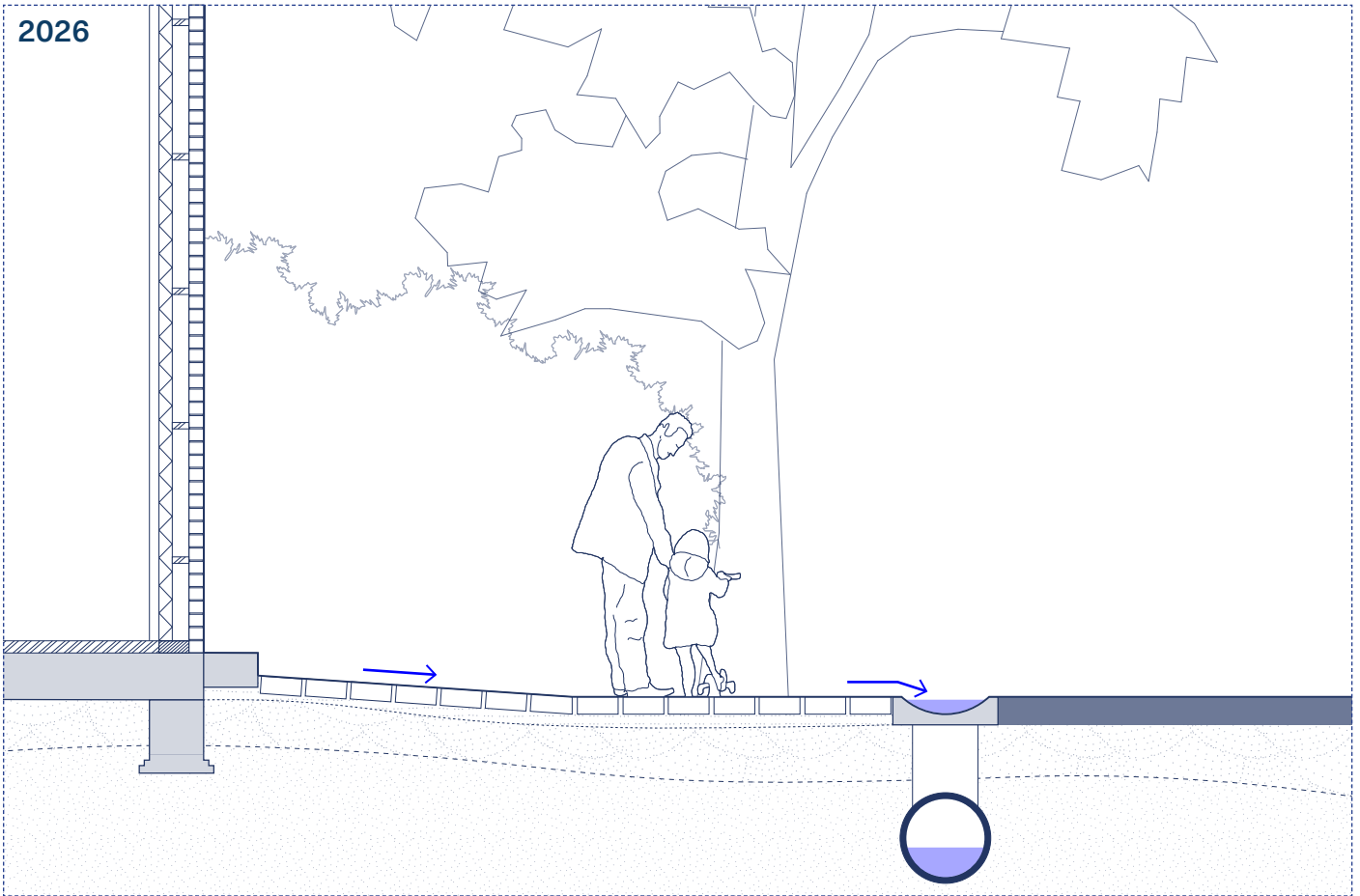
Implementation of profile

The profile as drawn for the 2030 future cannot be implemented in the entire street because of the use of cars and the inhabitants of the current profile. Realising a hollow street is possible, but in some areas, the parcel of vegetation is paved to accommodate crossing cars in the streets. In the diagram, a principle for implementing the profile is outlined. The current use of the street is still possible in the revision of the street profile.

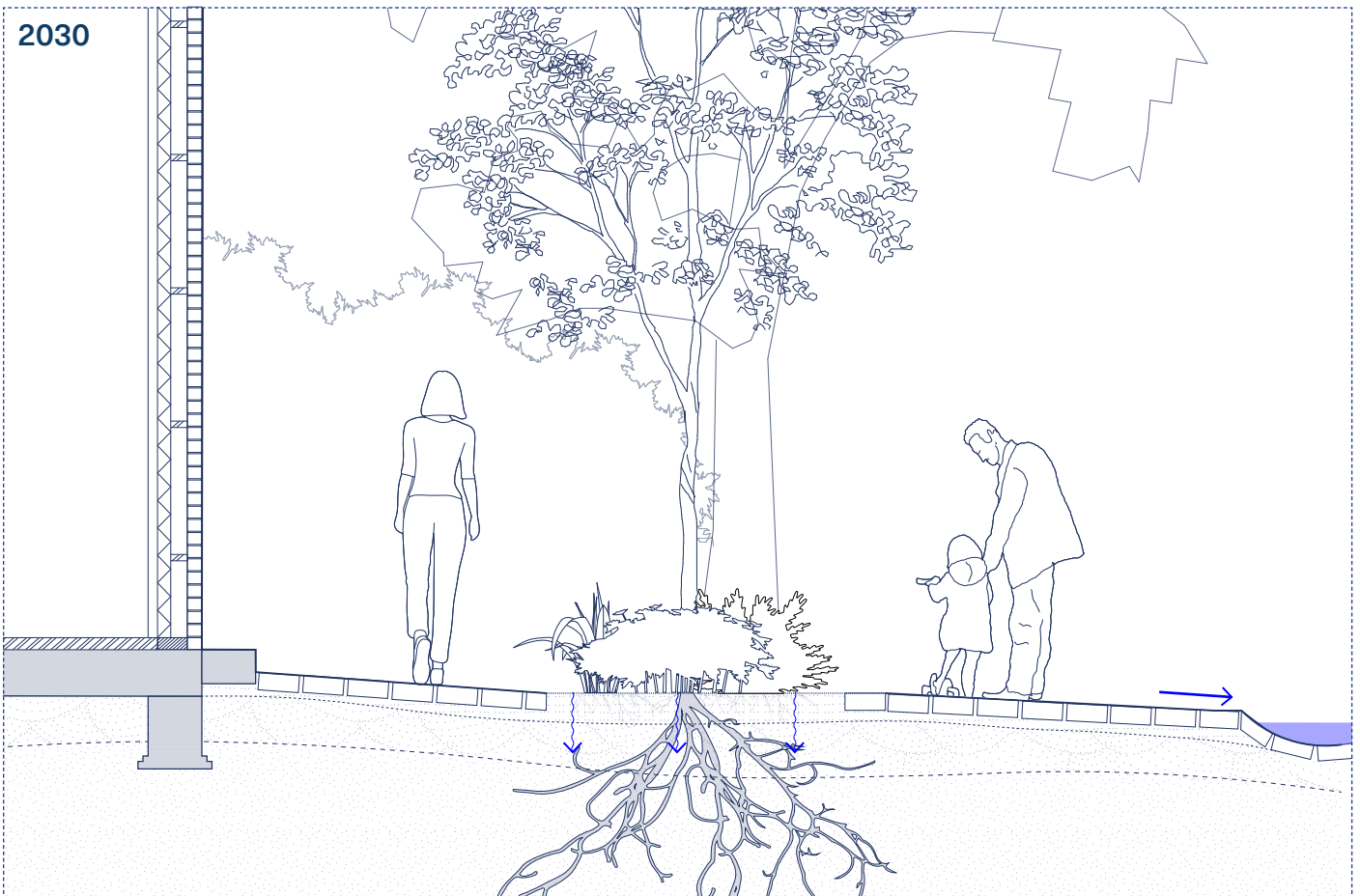


^ Diagram of the implementation of the new street profile.
 > Transformation of the street in Herkenbosch to a hollow street drainage system.

2026



2030

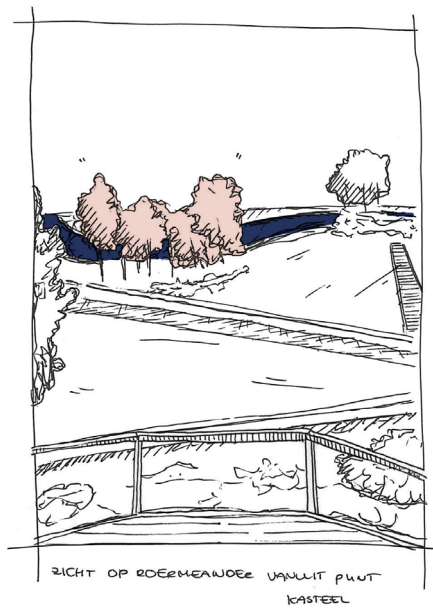
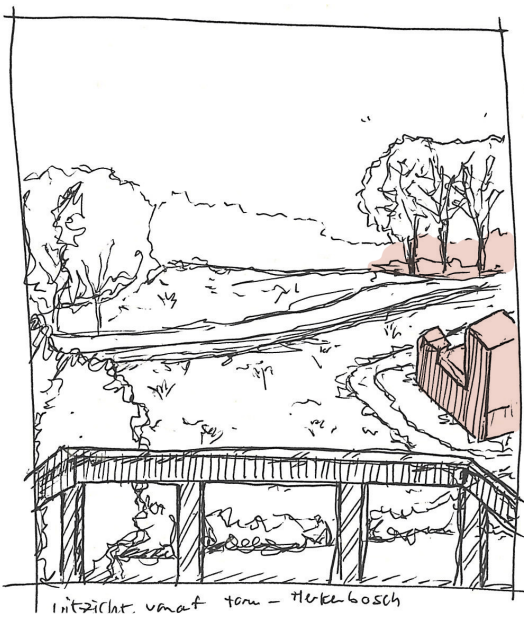


0 1 2 m

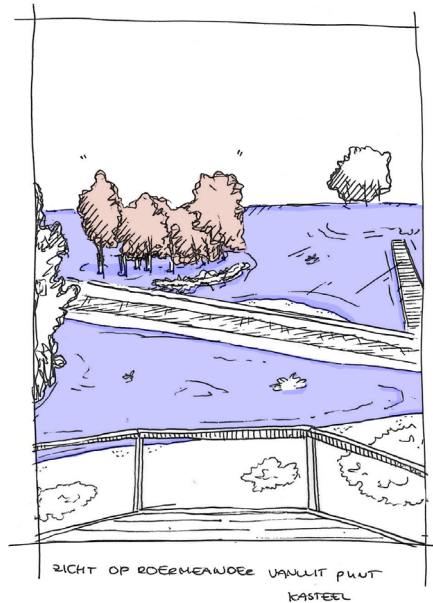
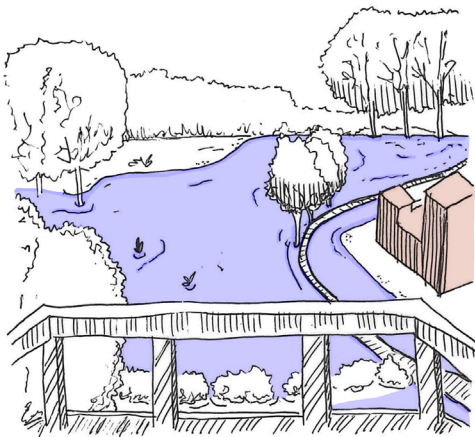
EXPERIENCING THE ROER

The Roer route immerses the visitor in the landscape of the floodplain. Through the tactical positioning of spatially limited interventions, an immersive experience of the Roer is possible.

From the spotters place, the markers of the Roer and a further overview of the floodplain are visible. By walking towards the viewing deck near the castle, the Roer itself becomes visible, together with the ending point of the route. Because the Roer route is elevated, the pathway and lookout points are accessible during a T25 flood.



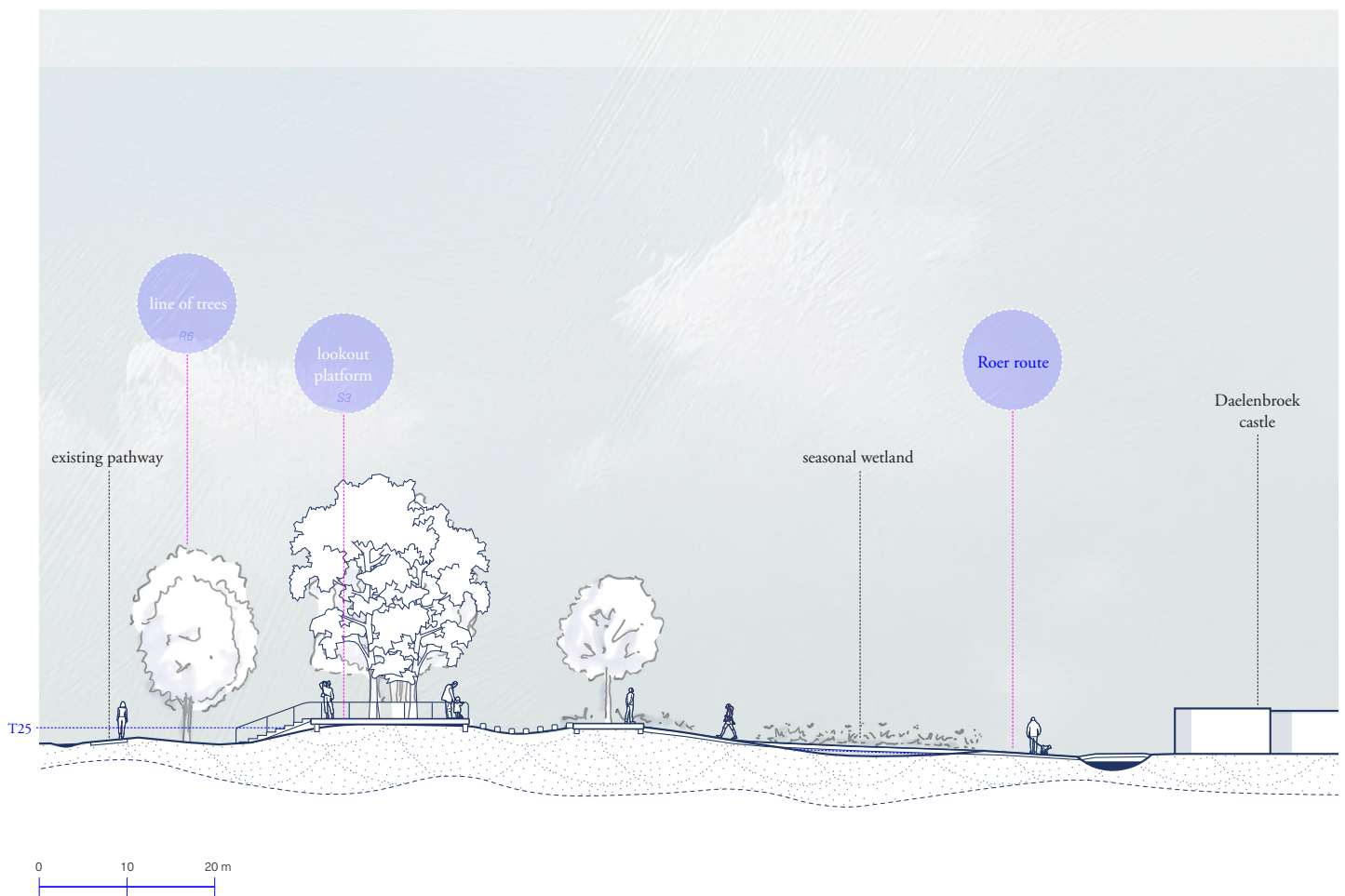
Dry situation



During T25 flooding

^ View from the spotters place / wachttower at the start of the Roer route.

^ Seeing the Roer river from the lookout deck near castle Daelenbroeck.



LOOKOUT FROM THE CASTLE

^ Section of the castle with the lookout point.
Section Y.

Optimising the landscape

The viewing platform near the Daelenbroeck castle is positioned in the middle of the Roer route. The platform is placed on the existing bump around the castle, which in the current situation blocks the view of the river from the castle grounds. Because the castle was once closely connected to the river, the viewing deck restores a connection with the river by making the river visible.

Continuing to the river

The route continues from the deck towards the river. The line of trees, which also marks the sightline to the Roer from the viewing deck, guides visitors to continue the path.

IMPRESSION

With the projection of the Roer route along the village fringe and towards the river in Herkenbosch, the Daelenbroeck Castle is positioned in the centre of the place-sensitive interventions. The main lookout place, which is strategically positioned along the edge of the castle grounds, becomes the main connecting element of Herkenbosch and the river. Here, people can experience the Roer river through visibility and accessibility, as visualised in the impression.

The accentuation of the water alongside the Roer route, together with the placement of (lines of) trees, directs the visual connection from the platform to the Roer river.

During a T25, the Roer route is accessible. The areas of the floodplain that flood during a T25 scenario are equipped with elevated walking paths, allowing the route to be used during this hydrological event.

We are able to view the Roer while taking a beautiful walk, all right next to our house!



5.4 Impact of interventions

GENIUS LOCI - REVIVED RELATIONSHIPS

During the research and analysis of the Inventory Atlas, nollie maps were made to conclude the relationship of the public domain with the Roer River or the floodplain. The reimaginings of Sint Odiliënberg and Herkenbosch give an insight into the possible alteration of the villages by the integration of place-specific interventions.

Sint Odiliënberg - connected through the floodplain

By opening up the floodplain, the imposed place-sensitive interventions integrate the existing public spaces with the Roer river. The revised Nollie map therefore accentuates this integration, in which different lookout points towards the river emerge. Over time, the existing hard boundaries of the privatised property could dissolve, creating a more intensive connection between the inhabitants along the village fringe and the Roer River.

Herkenbosch - shift of orientation

Projecting a 'Roer route' onto the village fringe and adjacent floodplain of Herkenbosch initiates a shift of the introverted village towards the river and the floodplain. This does not make the entire floodplain integrated into an accessible public space, but establishes specific locations to overlook the floodplain and the Roer. The proposed route joins the Daelenbroeck castle and stimulates movement towards the floodplain.

The revised Nollie maps are made according to the proposed implementation of place-sensitive interventions. Adjusting the interventions could result in a different spatial relationship of the village and the Roer.

SINT ODILIËNBERG



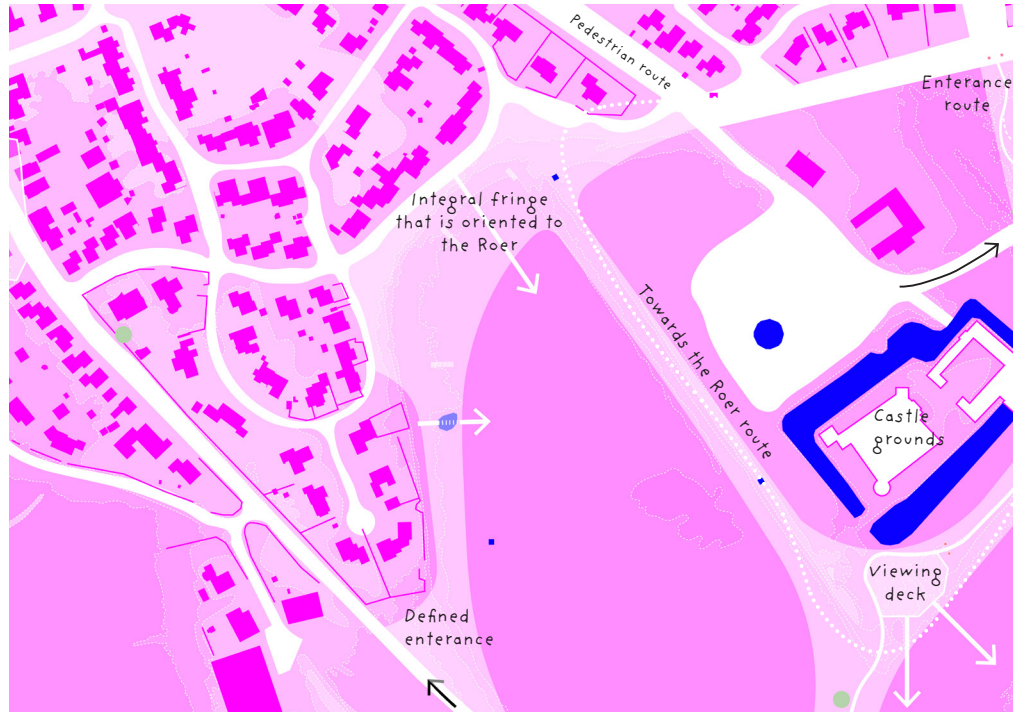
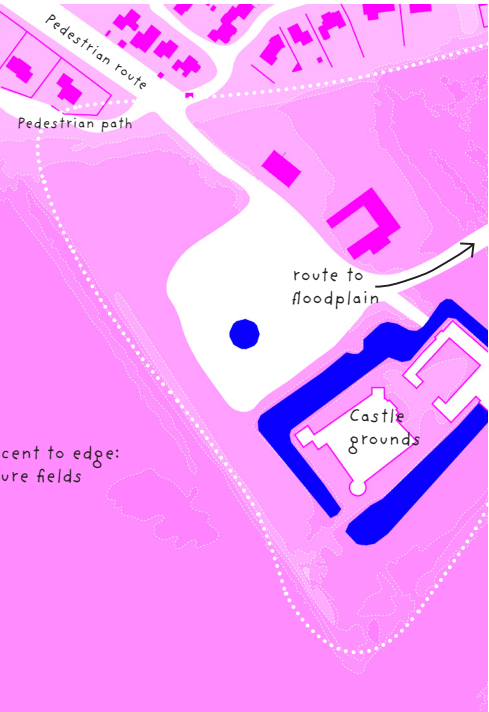
HERKENBOSCH



PROJECTED 2050



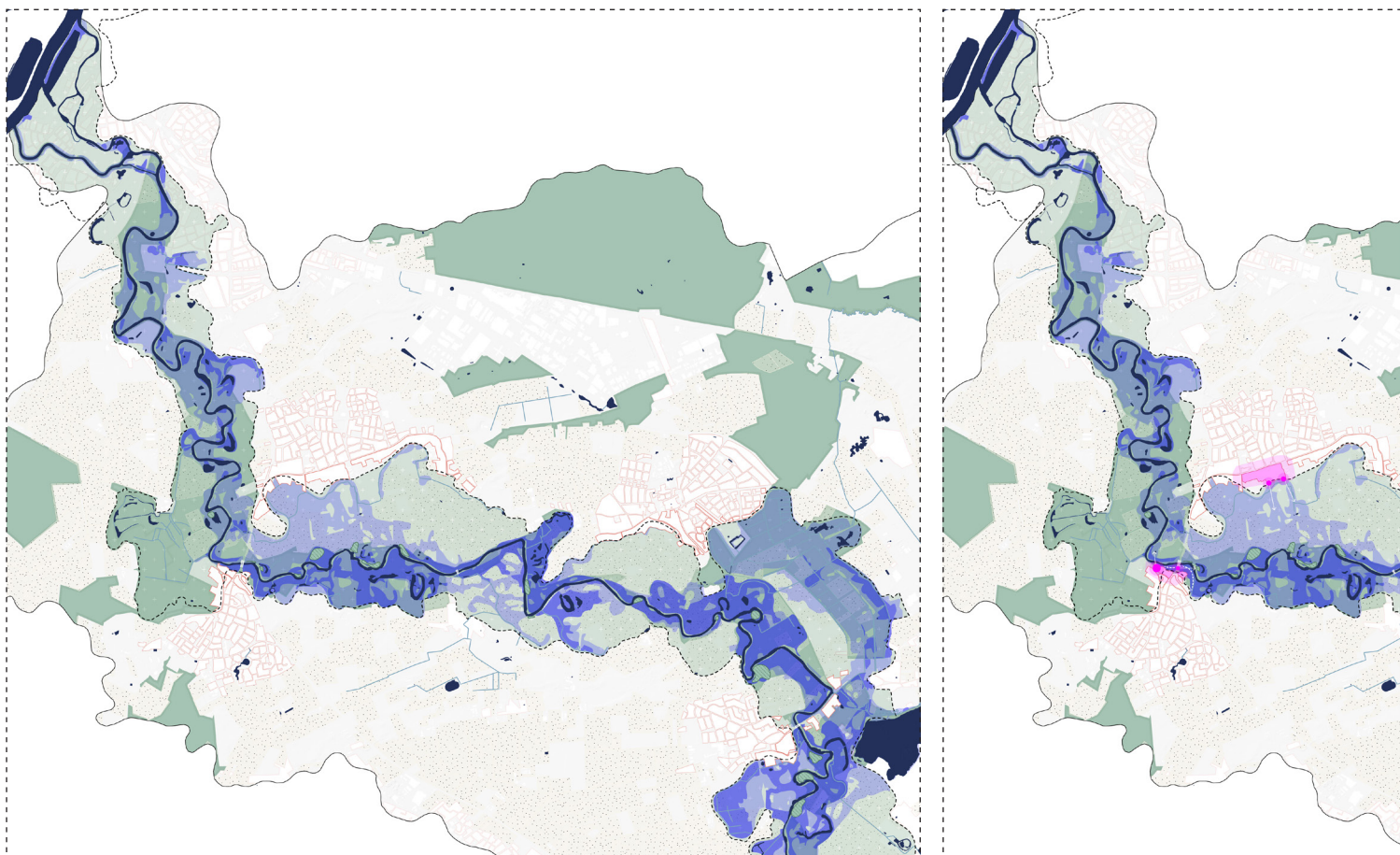
PROJECTED 2050



^ Revised nollu maps of Sint Odilienberg and Herkenbosch. The maps provide an insight in the improved relation of the public and private domain to the Roer river or floodplain.

5.5 Phasing the transformation

Status quo - 2026



IMPACT & TACTICAL URBANISM

Status quo

Starting this project involves defining the village fringes relevant to the project. In each of the four villages, there is a certain area in which the place-sensitive intervention will be implemented to foster a connection between the village and the Roer.

Starting points

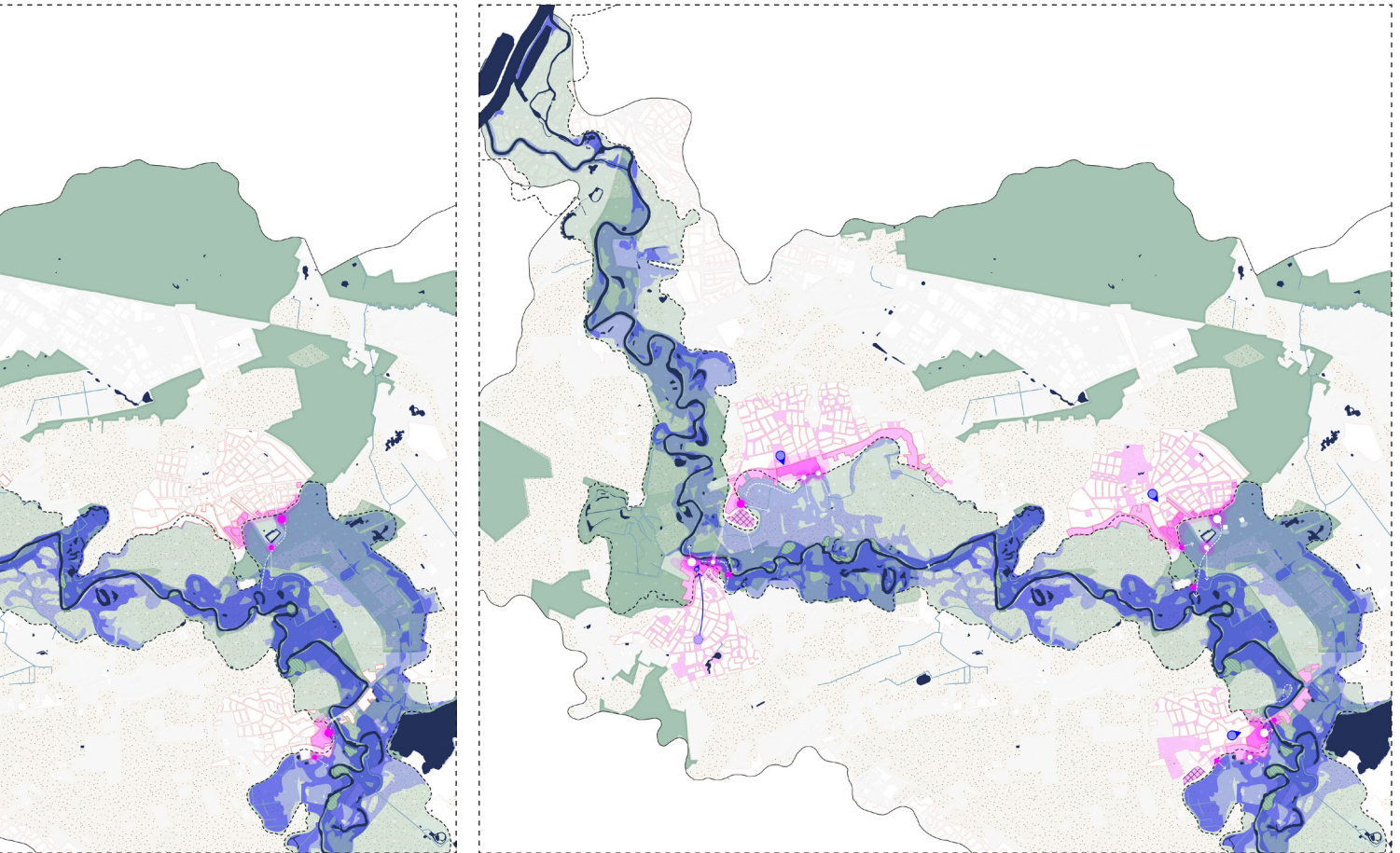
In each of the village fringes, crucial locations are pointed out that will activate the transition of the Roer valley. Initially, these interventions in each of the village fringes will 'trigger' the first connections of the village fringes with

the Roer river and its valley. Looking at the transformation of the valley in 2030, the areas of the interventions form the base to initiate a "paradigm shift" of the inhabitants towards the river. The first interventions introduce the villages to the external orientation of the village to the Roer river. The interventions therefore lift the adjacent areas of the village fringe and connect mainly the neighbouring areas better to the Roer river and its floodplain.

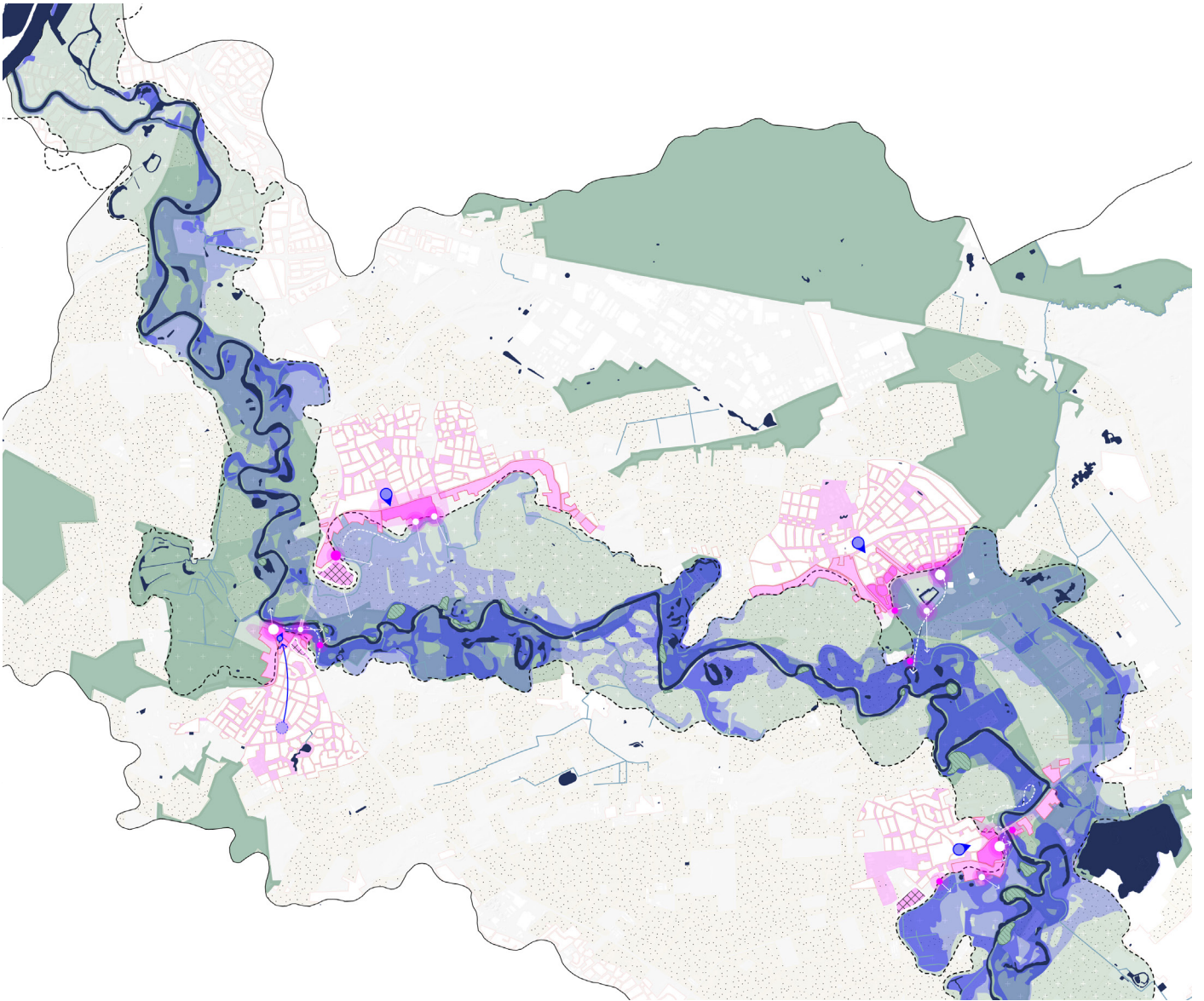
This form of an 'acupunctural positioning' of interventions, and the possibility of limited interventions to catalyse the villages beyond their fringes, is referred to as *tactical urbanism*.

2030

2050



- Main water flow
- Secondary water flow
- Floodplain
- Floodable zone [T25 - D140]
- Urbanised area
- Connecting fringes
- Integrated fringes
- Connected area
- - - Floodplain boundary
- Integrated S.L.I.
- New S.L.I.
- Village center & orientation
- Connection by accessibility
- Connection by visibility
- ⊗ Potential urban expansion



^ Transformation of the Roer valley through the application of the place-sensitive interventions in the village fringes in 2050.

TRANSFORMED ROERVALLEY IN 2050

Catalysed interventions

The strategically positioned spatially limited interventions that have been integrated in the village fringes during the period of 2026-2030 are integrated into everyday life in 2050. After 2030, new spatial interventions are integrated within the village fringes to extend the reach of the interventions or to elaborate on the already embedded interventions. They create a more integrated and connected village fringe, as the proposed Roer routes have a firmer base and exist out of a wider variety of experiences of the Roer river from the village fringes.
















Connected urban cores

Choosing the village fringes as the spatial area to initiate the connection of the villages with the Roer and return the introverted villages to the floodplain has been the basis of the project. However, only implementing the interventions in the village fringes could overlook one of the main areas of the urban cores: the village centre. Therefore, the proposed spatially limited interventions will start just in the fringes and eventually link to the village core. This is done through the implementation of a green corridor in

the public space that links the core to the village edges, or through the implementation of visible water drainage systems. Each village core will contain a spatial structure that refers to the Roer or its floodplain. Together with the created blue or green corridors, the orientation of the village core will shift to the Roer, together with the rest of the village.

A dynamic process - transformative design

The placement of place-sensitive markers is guided by a transformative design approach, with current predictions of flooding, demographics, and the spatialisation of the Roer valley in mind. The implementation of the interventions and the possible enhanced connection between the villages, their inhabitants, and the Roer River are variable. This makes the study relevant, even when the demographics of the valley and the villages change in the future. The limited interventions can be tailored to the needs of the future population and therefore, incorporated even more into the identity and genius loci of the villages of 2050.

-  Main water flow
-  Secondary water flow
-  Floodplain
-  Floodable zone [T25 - D140]
-  Urbanised area
-  Connecting fringes
-  Integrated fringes
-  Connected area
-  Floodplain boundary
-  Integrated S.L.I.
-  New S.L.I.
-  Village center & orientation
-  Connection by accessibility
-  Connection by visibility
-  Potential urban expansion



Roer



6.

1. Results & takeaways

CONCLUSION

6. Conclusion

RESULTS & TAKEAWAYS

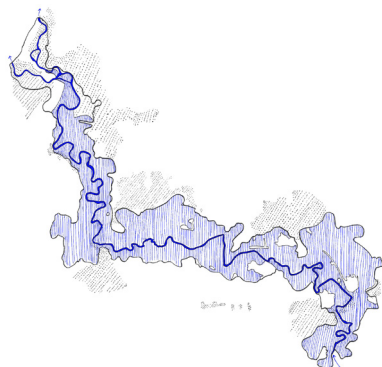
'Re-experiencing the Roer Fringes' reveals through the process of research by design that the implementation of place-sensitive interventions within the village fringes of the Roer valley creates opportunities for the villages and inhabitants to better connect to the Roer river. The thesis does not aim to project one definitive design proposal, but proposes a method to rethink the relation of the floodplain and river-bound villages to the Roer river and its natural functioning. In this way, the identities of the villages of the Roer valley are restored to their original development principles.

The research by design process furthermore proposes principles of place-sensitive interventions that could be adjusted to floodplain-oriented or river-bound villages. The overview of principles, together with the design interventions in the villages of Sint Odiliënberg and Herkenbosch, presents a method for transforming urbanised areas along (natural) meandering rivers and their floodplains in a downstream catchment, so that these areas connect better with the adjacent river. The research by design process can add to the literature of genius loci and water sensitive urban design, as the two disciplines merge to facilitate a transformation where the natural system of the river is embraced and emphasised in the village identities.

- What hydrological and spatial pressures determine the relationship between the village fringes and the Roer river at different times of the year, with different seasonal hydrological impacts?

The Roer is a rainfed river, where discharge is largely determined by seasonal and upstream precipitation. While the constructed basins in the upstream areas of the Roer catchment result in less frequent and intense flooding in the Roer valley in the Netherlands, flooding is common and part of the natural functioning of the river system.

Within the floodplain, there are almost no buildings. The flooding, as well as the geomorphological dynamics of the terrace landscape of the valley, have led to the establishment of the villages on the higher areas of the Roer terraces. This limitation has led to the villages in the Roer valley expanding throughout the years outwards of the river and floodplain area, resulting in the disconnection of the village identities and the Roer.

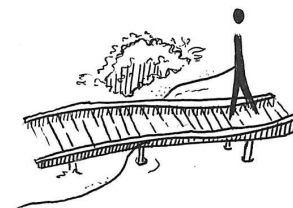


- How can (natural) hydrological processes be incorporated into the implication of place-sensitive interventions on the village fringes within the Roer Valley?

The Roer river is flooded annually. The intensity of the flood, however, differs per year, depending on the rainfall intensity and seasonal impact within upstream areas. The impact of the upstream area is seen in a change in the discharge of the river. Different discharges correspond to various spatial claims of the flooding in the Roer valley and the proximity of the water to the village fringes.

River adjacent and floodplain oriented villages have a different (direct) relation to the Roer, as the river is experienced differently in each typology.

In each of the projections of place-sensitive interventions in Sint Odiliënberg and Herkenbosch, a connection to the Roer river is established through the creation of viewpoints and a route to the water, making the river more visible and accessible. The interventions in the village fringe are near the floodplain, linking the established (re-)connection to the seasonality of the Roer river. The river can be experienced beyond its static position, as the interventions submerge inhabitants and visitors into the natural system of flooding. The interventions can be accessed and used during floods, with the possible exception of a T100 flood, as the current of the water could be too strong.



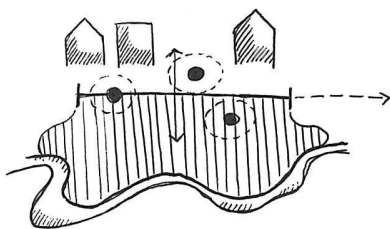
- What is the scope of a place-sensitive intervention?

Place-sensitive interventions are framed by three spatial elements: scale, seasonality and impact on daily life. The scope of the interventions ensures that the projection or integration of the elements fit within the 'genius loci' of the villages.

Determining the scale of the interventions results in a better integration of proposed elements within the existing conditions of the village fringes. This element acts as the only 'limiting' factor of the spatial interventions.

The seasonality of an intervention ensures that the measure adapts to varying flood conditions. The impact of a flood, or if the area does not get flooded at all, defines the type of intervention that should be implemented.

Impact on daily life determines the possibility of an intervention to be integrated within the community. The interventions should fit within the village atmosphere to be incorporated and accepted by the community.

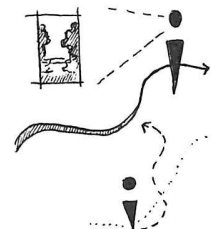


- How does the implementation of a place-sensitive intervention improve the experience of the residents of the Roer river?

The tactical placement of the place-sensitive interventions throughout the years facilitates the connection of the residents to the Roer river through visibility, accessibility, and audibility. This starts with the introduction of a few interventions in crucial locations of the village fringe between 2026 and 2030, which function as the starting point for change. After 2030, other limited interventions will be introduced to extend the reach of the interventions or to elaborate on the already embedded interventions.

With the integration of the place-sensitive interventions, the Roer can be experienced beyond its typical flow and appearance. Especially the possibility to experience the river throughout the multiple seasons, discharges and morphological alterations makes the Roer valley an interesting and dynamic place to live in.

For the inhabitants, experiencing the flood from the village fringe creates awareness of the (sometimes) unpredictable nature of the river and the importance and unique possibility of living with the water and its natural system.



How can place-sensitive interventions within the village fringes of the Roer Valley improve the experience and connection of its residents with the Roer River by 2050?

Through strategic and village-adapted placement of the place-sensitive interventions, the experience and connection of the village residents with the Roer river are sharpened. The framework provides principles of the place-sensitive interventions that, through the implementation of *route*, *space*, *flow* and *flood*, contribute to an enhanced experience of the river. Experience is defined as the visibility, accessibility, and audibility of the river and could either be perceived directly adjacent to the river or from the edge of the floodplain.

The Roer valley consists of many villages with similar appearances. Its differentialities lie in the detailing of the pavement, the orientation of the houses and the location and accessibility of public space. Understanding these systems leads to an individual design brief per village, where the principles of the place-sensitive interventions could be adapted to. Here, the location of the village, directly to the river or adjacent to the floodplain, forms the base for the design proposals.

'Re-experiencing the Roer Fringes' provides an insight into the possible adaptations of the village fringes. For the villages of Herkenbosch [floodplain oriented] and Sint Odiliënberg [river oriented], the design interventions showcase a 2050 future in which the interventions connect the public space of the villages more towards the Roer river. The interventions initiate a shift in the orientation of the villages, transforming the introverted urban spaces into external and water-oriented places. The village fringe becomes a local meeting spot where the realms of village living, the transition zone of urban and rural areas, and the natural floodplain come together. The place-sensitive interventions reflect the genius loci and provide spaces to reside in. All generations, from families with young children to elderly people who live by themselves, could make use of the new or improved public space that is created in the village fringes.

The place-sensitive interventions ensure an improved connection and experience of the Roer river by 2050, as shown in the design projections in this thesis.



7.

< Meander of the Roer near Vlodrop,
photographed in April 2026 by author.

- 1. Implications & recommendations*
- 2. Reflection*

DISCUSSION

7.1 Implications & recommendations

FEASIBILITY

The *re-experiencing of the Roer Fringes* follows a research by design in the field of Urbanism about the reconnection of villages and their adjacent river landscape. The conclusions drawn in this thesis have been informed by the analysis of villages in the Roer river valley and therefore apply in their specific context [downstream catchment area, natural meandering river, rural villages].

Base interventions

The analysis of the Roer fringes through the inventory Atlas resulted in the creation of the principles of the place-sensitive interventions. The overview touches upon multiple design aspects, each projected within the scope of *route, space, flow* or *flood*. The minimal interventions that should be applied within the village fringes are the main road materialisation, route within floodable areas, lookout points & application of street drainage system. These interventions together incorporate the now separated systems of the urban core, transition zone and floodplain. Furthermore, the interventions allow the streets of the villages to be more aware of the water system through the

design of the streets and flow paths. For both river-adjacent and floodplain-oriented villages, spatial elements allow for the experience of the Roer river through visibility (lookout point) and accessibility (route).

Impact of T100 flooding

The place-sensitive interventions are created to accommodate T25 floodings. Floodings exceeding the river discharge of a T25 flood (140 m³/s) could lead to water depths and currents that are too extreme to allow safe use of the interventions within the floodable areas. Because the interventions are designed for T25 floods, the intensity of flooding with higher discharge could also affect their quality. When extreme flooding takes place, there is a possibility that the interventions positioned in the floodplain get (partially) demolished. It is advised to consult an expert on the upkeep of public space when choosing the materials and foundation of the interventions.



< Aerial picture of floodings within the Roer floodplain in July 2021 (Het Waterschapshuis, 2022)

RECOMMENDATION

This project was made within the Urbanism graduation studio at the Technical University of Delft. If this project were to become a reality, certain aspects need to be researched or undertaken to make the project more feasible and appealing to the villages and their inhabitants.

Municipality, WRL & province

The project is relevant to multiple stakeholders responsible for the Roer valley at various scales. The municipality of Roerdalen is able to use the research and takeaways to revise its current vision of Roerdalen, in which the villages and the Roer valley are not connected and treated as separate systems. For WRL, the approach of connecting urbanised areas with the water(system) is a much-needed perspective, as otherwise highly engineered solutions for water management result in a disconnection of inhabitants and the river. The province of Limburg and other governmental institutions that make decisions around tributaries in downstream catchment areas can learn from the design approach of the thesis, in which the natural systems of the river are embraced and used to make a connection between the urban core and the river.

Co-designing the fringes

The projection of the spatial limited interventions in the different village fringes is executed according to analytical findings and fieldwork observations. From the perspective of an urban designer, these interventions are positioned according to the preferred systemic point of view. The preferences of the inhabitants are not included in the decisionmaking of the placement of the interventions. When opting for strategic interventions that enhance the experience of the inhabitants to the Roer river, it is necessary to involve the inhabitants in the process. Tuning the principles of the place-sensitive interventions to match the needs of the inhabitants, the interventions will conform better with the identity of the villages and integrate better in daily usage.

Other expertises

The projection of the village fringes in the Roer valley is done from the perspective of an urban designer. To develop a more coherent and comprehensive strategy for implementing place-sensitive interventions in the Roer valley, consultation with other experts is needed to enhance the impact of the project.

To better integrate the village fringes into the Roer valley landscape, a landscape architect or ecologist is needed to understand and eventually design for a variety of landscapes and the keystone species in the floodplain. A hydrologist or civil engineer is needed to estimate the feasibility of the proposed interventions in the floodplain during more intense floods. 'Staatsbosbeheer' or other managers of natural areas should consult about the impact of the changes to the floodplain, villages and village fringes on the larger nature system and about the upkeep of the interventions that are proposed.

Drought

Because of this, the research aims to find a connection between the villages and the river; the main focus of this research has been on the possible flooding of the Roer river. Drought, however, is becoming a more common and relevant problem in the Netherlands. The province of Limburg, especially the area around the Roer valley, is very prone to flooding due to the sandy subsoils and the lignite mines, which absorb most of the groundwater.

Because of time restrictions, drought and its implications for the Roer valley are not investigated. For future research, it is extremely important to take extreme drought also into consideration as this could influence the water storage capacity of the floodplain, the water quality and the flora and fauna in the area.

TRANSFERABILITY

Urban typology in the Roer catchment

The villages in the Roer valley can be categorised into river-oriented villages (blue) and floodplain adjacent villages (pink). These typologies can also be found upstream in the catchment area.

Elements presented in the re-experiencing of the Roer fringes could be transferred to other urban areas in the Roer valley.

However, the principles have been developed based on the analysis of the village fringes in the downstream catchment area. Therefore, the principles and design proposals cannot be transferred directly to other areas in the Roer catchment.

Downstream and midstream catchment

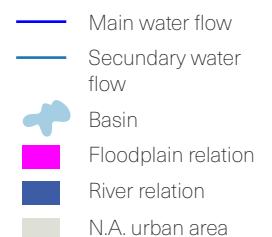
The urban areas in Germany located in the downstream and midstream area of the catchment are the most similar to the Roer valley, because of the topography and morphology that function similarly to the downstream catchment. However, as there are basins located in the midstream catchment area and the area is closer to the upstream area of the river, the water system functions differently from the Dutch Roer valley. Areas upstream of a basin could experience more intense river discharge, as seen during the 2021 flood. Limited interventions could therefore be too fragile to be positioned into the floodplain, which could result in unsafe situations for users.

Upstream catchment area

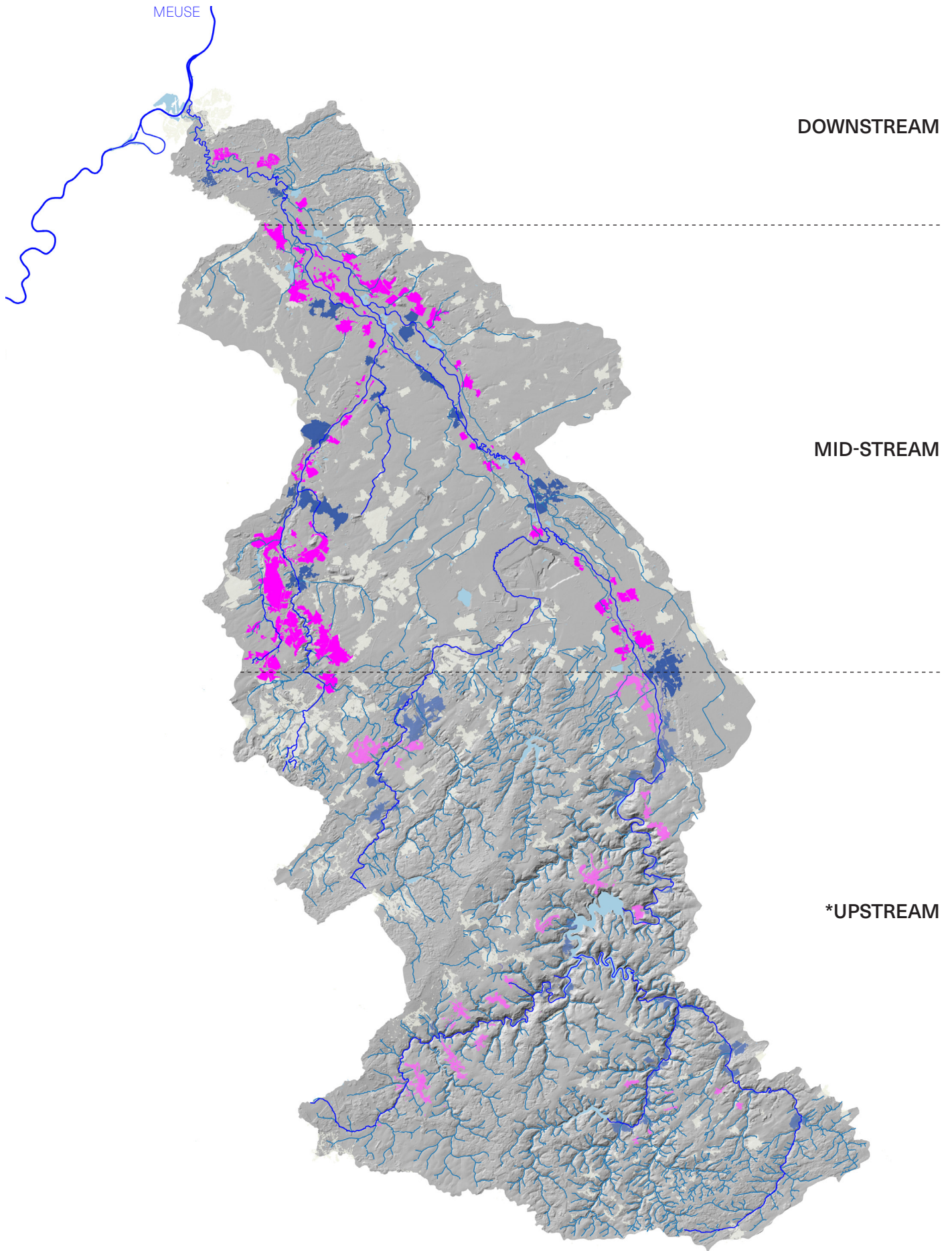
The upstream area of the Roer catchment is not similar to the Dutch Roer valley. The topography, water system, and the relationship of urban areas to the river differ from those in the downstream area of the catchment. Therefore, new research is needed to understand the systems and socio-hydrological relations of inhabitants with the Roer. When undertaking a research-by-design project, the method used in this thesis can be used to conduct a thorough analysis of the region, revealing the current relationship between the urban areas and the Roer River. This information is then used to develop place-sensitive interventions for the upstream catchment area.

Other contexts

The place-sensitive elements could be relevant for other downstream areas in the Netherlands or Europe. However, the relationship between the urbanised areas and the floodplain should be similar to that of the Roer valley. The Roer river is also a (naturally) meandering river, where flooding is part of the natural functioning of the river system. As this is a crucial aspect for the relation of the village to the river and for the integration of the place-sensitive interventions, this is a required condition for other contexts that think of implementing place-sensitive interventions in their fringes.



> The roer catchment, showcasing the main hydrological arteries and topography of the region.



0 5 10 km



7.2 Reflection

MSc URBANISM TRACK

The spatial relation between natural watersystems and the adjacent urbanised areas is central in this thesis, with the *re-experiencing of the Roer Fringes* being the central theme for the research by design. Based on a multiscalar understanding of the water system of the Roer river, the genius loci of the villages, and the spatial structure of the valley, *potential* spatial design has been developed. To execute the thesis, research and design approaches from delta urbanism, environmental justice and spatial planning were used and implemented.

The study has been conducted in the Deltaic Interventions cluster of the MSc track Urbanism. The aim of this cluster is to imagine and test possible futures for delta landscapes in which space serves as a mediator between human and environmental systems. As the Roer valley is not a definitive deltaic landscape, the conducted research is valuable for the field of Delta Urbanism for its unique approach, in which water and its natural functioning are the main components of the (re)design of an urban landscape. By addressing not only the flooding, but also the demographics, subsoil and water-centred genius loci of the villages, this thesis reveals that a water system is complexly intertwined with urban life and should be taken into consideration when developing future plans for regions in downstream catchment areas.

Throughout this thesis, a systemic approach from multiple angles is employed, reflecting the interdisciplinary nature of the graduation studio and the Urbanism Track.

RESEARCH BY URBAN DESIGN

In this thesis, research and design go hand in hand through the applied method of *research by design*.

The research began with a literature review and a spatial analysis of the Roer catchment area and the Roer valley. The literature helped understand the systems revealed during the spatial analysis, leading to new topics for research and further exploration. Eventually, the design briefs for the villages could be formulated, which were continually revised as information emerged from the spatial analysis. This ongoing process is central to a research by design approach and made both the research and design aspects of the research extremely intertwined.

Research in the field of urbanism cannot be conducted solely through literature reviews, as a spatial understanding of the site is crucial and varies for each urban designer. The spatial analysis visualised in the inventory atlas is conducted by analysing maps and data, but mostly through fieldwork. Revealing spatial connections and systems in drawings, maps, and pictures makes data that would otherwise remain hidden visible. For this project, this data was the most valuable for making design decisions, as patterns and relations of the Roer valley were revealed that were not reflected upon in other research or maps.

Therefore, the research for this project goes beyond a literature study and a data analysis, but visualises the layers of the Roer valley visible to the urban designer: *research by urban design*.

APPROACH AND ETHICS

The execution of the thesis was carried out through many exercises and methods. A project is never shaped instantly; however, the spatial analysis and frequent field trips to the Roer valley directed the framing of the project.

A main aspect of *re-experiencing the Roer Fringes* is the perception and experience of place. How space is perceived or experienced is objective. Therefore, takeaways and conclusions made during this graduation can be interpreted differently by another student or urban designer.

This project mainly focuses on water and did not execute participatory workshops with the inhabitants of the Roer valley. While there are almost no ethical constraints to this thesis, the topic of environmental justice is important to reflect upon.

Watersafety is the most important precondition for implementing any marker in the floodplain of the Roer valley. When rethinking the relationship between urban systems and water, the importance of civil water management infrastructure should never be undermined. Following the 2021 flooding, environmental justice is an urgent topic that must be addressed. Tributaries such as the Roer are still severely understudied, even though their impact was considered catastrophic in Germany and Belgium.

At the time of writing this thesis, the flooding took place 5 years ago. In a study of Klein Kranenburg et al. (2025) on behalf of WRL, interviews were conducted with people in the province of Limburg, asking whether they think flooding will occur in the next 5 years. Only 61% of the population in Midden-Limburg considered the risk of flooding very high. Even more interesting is that only 14% in Midden-Limburg thought that possible flooding would result in water nuisance on a personal level. This is considerably lower than in all other areas in the province of Limburg, underscoring the low perception of flood risk.

WRL plans to start a project in the coming years to research water safety along the Roer in the Netherlands. Especially regarding the low risk perception among the inhabitants of Midden-Limburg, the findings of this thesis can offer a fresh perspective on the possibilities in public space, where reconnecting the villages to the water system can raise awareness of flooding risks.

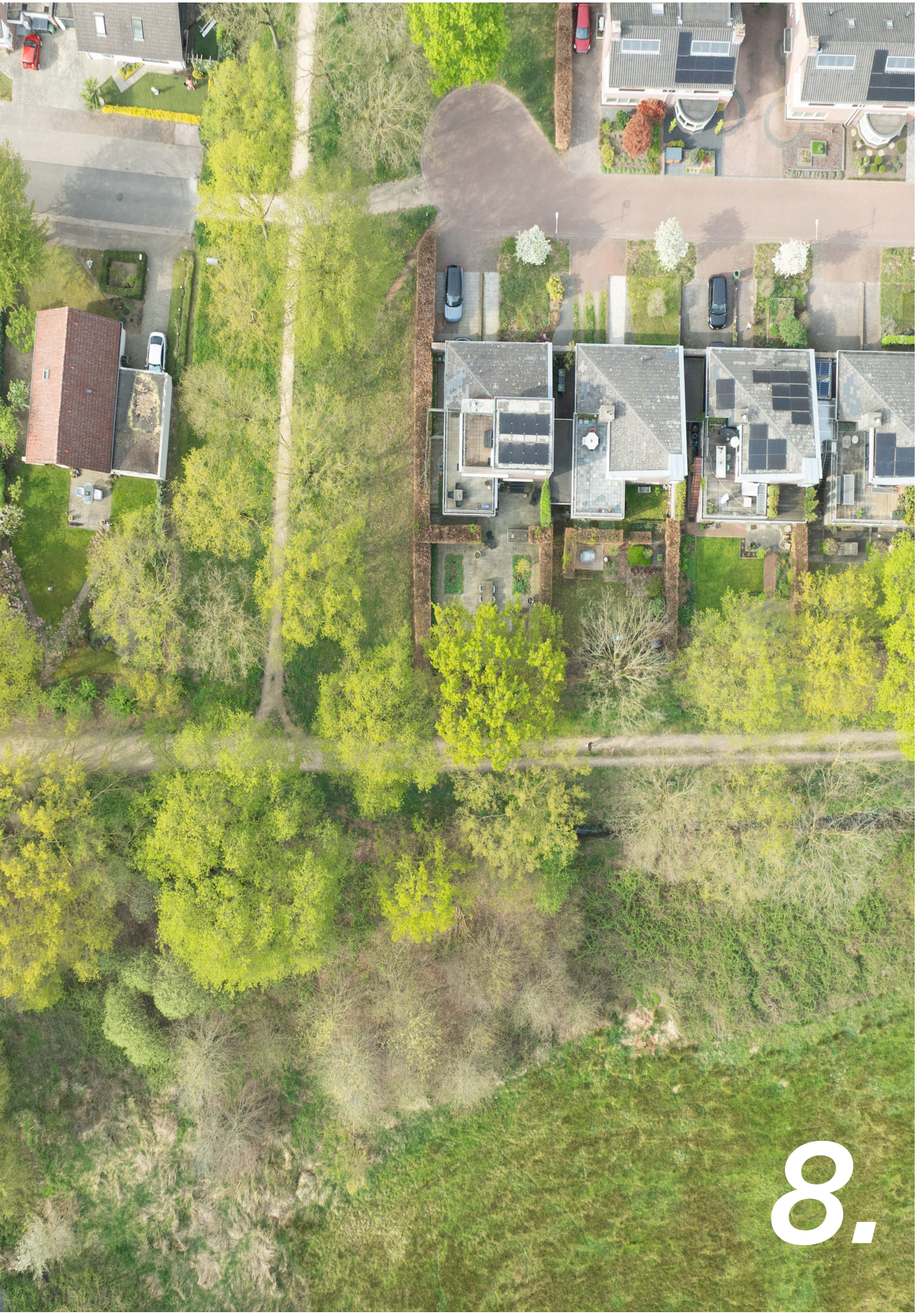
ACADEMIC & SOCIETAL VALUE

The subject of this thesis, establishing a connection between the river and the adjacent urbanised area through the experience of the river, is a unique topic. Additionally, the Roer valley is severely understudied, as it is considered a small area in the Netherlands with few inhabitants.

This is the exact reason this study is relevant: it not only highlights a research gap by combining principles of genius loci and water-sensitive urban design, but also underscores the importance of the often underutilised rural areas along a tributary. Rural areas, along with an understanding of tributaries, must be included in the creation of policies and future spatial visions.

Societal relevance - The Roer valley serves as an example of a (rural) area in the Netherlands where spatial planning and water management are seen as separate entities. A lack of spatial recognition and understanding of the natural functioning of the river has led to the development of villages in the Roer valley, disconnecting them from the river. The implementation of 'place-sensitive interventions' in the village fringes is also a call for the inhabitants to personalise and tailor the interventions to their own needs. The interventions might change the behaviour of the inhabitants, leading to the deconstruction of the large separating spatial elements and the formation of a village that is even more connected.

Scientific relevance - The Roer river is a largely understudied tributary. Especially in the field of urbanism, almost no research is conducted on the potential projection of urban fringes in relation to the fluctuating water system. The established method in this thesis, to find a connection with the water system at hand through experience, is relevant for other areas in the Roer catchment, as well as other similar downstream catchment areas. In a time when the weather is unpredictable and river systems can change at any time, it is important to adapt to future situations rather than resist them.



8.

- I. References*
- II. Data Management Plan*
- III. Inventory Atlas*
- IV. Place-sensitive intervention principles*

APPENDIX

I. LIST OF REFERENCES

LITERATURE REFERENCES

1. Actueel Hoogtebestand Nederland. (2022). *AHN4 - DTM* [Dataset].
2. Asselman, N., & van Heeringen, K.-J. (2023). *Een watersysteemanalyse—Wat leren we van het hoogwater van juli 2021?*. Deltares.
3. Boeren, J. (2022). Doelbereik Natura 2000-gebied Roerdal, Synthesedocument. Cluster Natuur en Water. Provincie Limburg, Maastricht.
4. Brugmans, G. (2023). *Down to Earth—Designing for the endgame*. Nai010 publishers.
5. Central Bureau of Statistics. (2019). 3. *Demografische ontwikkelingen*. Centraal Bureau Voor de Statistiek. <https://www.cbs.nl/nl-nl/longread/de-nederlandse-economie/2019/de-invloed-van-de-toename-van-het-aantal-gewerkte-uren-op-de-productiviteit/3-demografische-ontwikkelingen>
6. Defacto stedenbouw. (2025). *Onderlegger water & bodem Limburg*.
7. Gemeente Roermond. (2025, August 26). *Bijlage 2 Nota Spelen, Bewegen en Ontmoeten in de openbare ruimte*. Roermond. <https://roermond.bestuurlijkeinformatie.nl/Agenda/Document/08b7758d-596c-4080-a2e2-8de958b48cb9?documentId=d8feb17d-4473-4689-b70f-4b141cc69b8c&agendaltemId=e99f216f-8ca7-46e0-b1f5-78cf479162cf>
8. Groenblauwe Netwerken. (n.d.). *Holle wegen*. <https://groenblauwenetwerken.nl/measures/maatregelen-op-stedelijk-niveau/holle-wegen/>
9. Homann, C. (2022) Forecast-System for the Rur-Reservoirs. Presentation given at the International Meuse Symposium, Liege.
10. JCAR ATRACE. (n.d.). *Roer Basin*. Retrieved 27 December 2025, from <https://www.jcar-atrice.eu/en/basins/roer>
11. Kamvasinou, K., & Iannizzotto, L. S. (2025). *Bodies in the Void: Temporary practices in Terrain Vague sites*. UOU Scientific Journal, 9. <https://doi.org/10.14198/UOU.2025.9.06>
12. Klein Kranenburg, L., Wolberink, J., & Verstegen, B. (2025). *Inwonersonderzoek Waterbewustzijn en waterweerbaarheid Limburg (2025)*. Ipsos I&O. https://wacht Niet op water.nl/publish/pages/10223/ipsos_i_o_inwonersonderzoek_wrl_2025_def_9_juli.pdf
13. KNMI (2021). *Klimaat signaal '21—Hoe het klimaat in Nederland snel verandert*.
14. Kramer, N. (2021). *Lage afvoeren in de Maas—Bijdrage zijrivieren*. RIWA-Maas.
15. Norberg-Schulz, C. (1979). *Genius Loci: Towards a Phenomenology of Architecture*.
16. Oxford University Press. (n.d.). *Perceived*. In Oxford English Dictionary. Retrieved March 25, 2025.
17. Provincie Limburg. (2021, December 17). *Provenciaal waterprogramma 2022-2027*.
18. Provincie Limburg. (2024). Ontwerp-Kernrapport Natura 2000 Roerdal (150) 2024-2030. Maastricht, januari 2024.
19. Radovic, S. (2014). *On the Treshold*. In Terrain Vague (pp. 114–129). Routledge.
20. Rijksdienst voor het Cultureel Erfgoed (1). (2023, 24 augustus). Holle wegen (cultuurhistorisch beheer). [https://kennis.cultureelerfgoed.nl/index.php/Holle_wegen_\(cultuurhistorisch_beheer\)](https://kennis.cultureelerfgoed.nl/index.php/Holle_wegen_(cultuurhistorisch_beheer))
21. Rijksdienst voor het Cultureel Erfgoed (2). (2025, December 9). *Rivierterrassen van de Roer*. Retrieved January 20, 2026, from https://kennis.cultureelerfgoed.nl/index.php/Aardkundig_erfgoed/Terrassen_van_de_Roer
22. Van der Meulen, G. J., van Dorst, M. J., & Kuzniecowa Bacchin, T. (2022). *Local context sensitivity in Water Sensitive Urban Design for secondary cities*. Department of Urbanism, Faculty of Architecture and the Built Environment, Delft University of Technology, The Netherlands.
23. Van der Wal, B., Steinbusch, E., & Krikken, A. (2020). *Effecten onttrekkingen op de stijghoogten in de Roerdalslenk*. Royal Haskoning DHV.
24. Wacht niet op water. (n.d.). *Stroomgebieden*. Wacht Niet op Water. Retrieved December 8 2025. <https://wacht Niet op water.nl/wat-doet-de-overheid/stroomgebieden/>
25. Wageningen Environmental Research (2024). BRO Bodemkaart, 2024-01. <https://www.dinoloket.nl/ondergrondmodellen/kaart>. Accessed on 14-03-2026.
26. Watson, J. (2019). *Lo-TEK: design by radical indigenism*. Taschen.

REFERENCES IMAGES & GRAPHICS

1. Actueel Hoogtebestand Nederland. (2022). *AHN4 - DTM* [Dataset].
2. ANP. (2021, 17 juli). Flooded Roermond along the Meuse during the July 2021 summer floods. <https://www.volkskrant.nl/nieuws-achtergrond/het-water-rukt-op-in-roermond-maar-wij-zijn-diehards-wij-blijven~bc69c887/>
3. Asselman, N., & van Heeringen, K.-J. (2023). Een watersysteemanalyse—Wat leren we van het hoogwater van juli 2021?
4. AV Limburg. (2025, 4 augustus). Forestfire in National Park de Meinweg during dry spring around Vlodrop. <https://www.limburger.nl/regio/roerdalen/vlodrop/natuurbrand-in-nationaal-park-de-meinweg-sein-brand-meestergegeven/53441349.html>
5. Defacto stedenbouw. (2025). *Onderlegger water & bodem Limburg*.
6. Asselman, N., & van Heeringen, K.-J. (2023). *Flood maps per river discharge*. [Unpublished data]. Deltares.
7. Kadaster. (n.d.). *Topotijdreis: 200 jaar topografische kaarten*. Retrieved December, 2025, from <https://www.topotijdreis.nl/>.
8. Kuit, J. P. (2021, 16 juli). Hoogwater Vlodrop. De Limburger. <https://www.limburger.nl/regio/roerdalen/delen-van-vlodrop-herkenbosch-melick-sint-odilienberg-lerop-en-paarlo-woorden-geevacueerd/22146100.html>
9. Het Waterschapshuis. (2022, 23 februari). Geodata Hoogwater Limburg. <https://storymaps.arcgis.com/stories/7488a4903f47499a9f765a23619eb2f4>
10. Verschuren, M. (2021). *Collection of pictures from the 2021 floodings within the Roer valley*. Personal archive.

II. DMP

DATA MANAGEMENT CHECKLIST

Instruction

This checklist is relevant for all graduation projects of the Master AUBS. The form is intended to highlight common aspects of graduation projects that require particular attention with regard to planning the research and data management. Relevant information and supplementary sources regarding each question are provided below each question.

With this checklist, the faculty wants to avoid that students unexpectedly find themselves in complex and stressful situations, in which ethical or privacy matters and/or other laws and regulations become an issue. In projects involving humans, certain types of data processing increase the risks to the human participants: planning such projects requires additional evaluations and advice from university staff before ethical approval can be received and the project can begin. In the case of a graduation project, obtaining additional advice or permits may delay the project with an extra education period or semester. To avoid this, it is recommended that students set up a graduation project with a low level of risk. Therefore, all students have to check their risk, by completing this checklist before their A1.

The first section of the checklist (A) should be completed by all students, together with their supervisor, during the planning of the graduation project, before the A1. It does not need to be submitted to anyone for review or approval. Please consider questions 1 to 3 carefully in relation to the intended graduation project, and answer with 'yes' or 'no'.

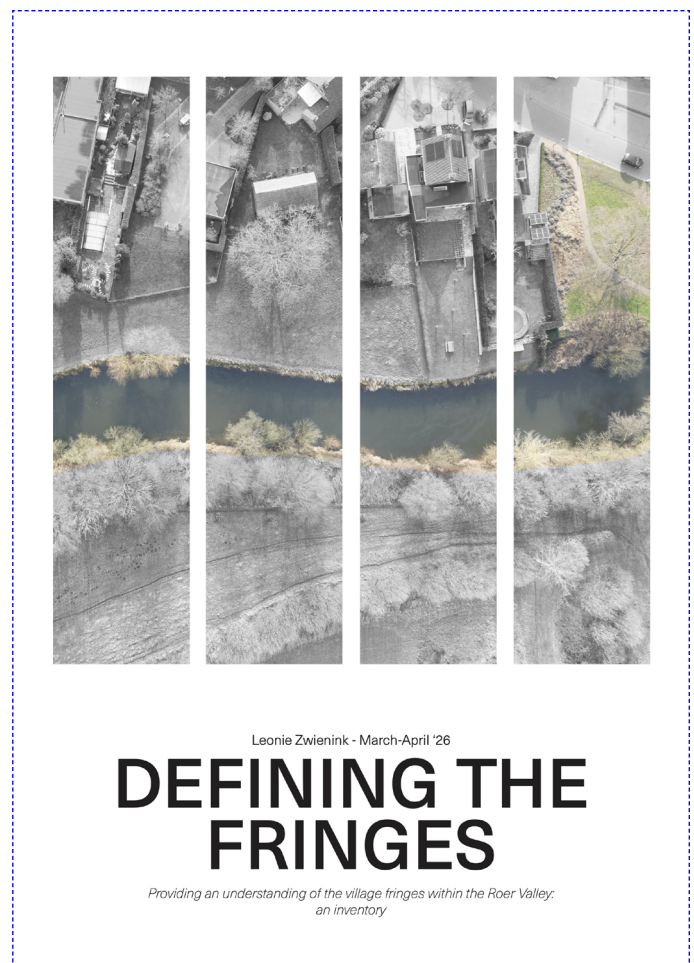
The second section of the checklist (B) should only be completed if the graduation project involves working with data from human participants. In that case, the student and their supervisor must apply for and receive ethical approval from the [Human Research Ethics Committee](#) (HREC) before the project can begin (see the paragraph 'Explanation and follow-up' after the questions). The student can submit the application to the HREC, but the supervisor is responsible for making sure that the project is compliant with relevant privacy regulations and ethical policies.

Section A. General considerations	yes	no
<p>1. Is the graduation project conducted as part of an internship (at a company), or as part of a research project at TU Delft?</p> <p>If a student's graduation project is conducted at a company or as part of a research project at the university, questions of data ownership and intellectual property rights need to be addressed in a written graduation or internship agreement before the project begins. Students and their supervisor should consult the Intellectual Property Rights of Students webpage. Additional information can also be found in the Extended Personal Research Data Workflow.</p>		✓
<p>2. Does the project involve conducting (part of) the research outside the Netherlands?</p> <p>Students who intend to travel abroad (even to other EU countries) for study, exchange, research, internship, or graduation project purposes need to follow the Travel Safety Protocol. This includes attending a mandatory Travel Safety Training Session: see the Disclaimer.</p>		✓
<p>3. Will the research involve processing data from humans, such as running a survey, conducting interviews or workshops, collecting data through social media or internet forums, or re-using existing datasets about humans provided by a third party? (If 'yes', see follow-up questions 4 to 13 in Checklist B.)</p> <p>Students who work with data from human participants must complete the next section and apply for and receive ethical approval from the Human Research Ethics Committee (HREC) before conducting the research.</p>		✓

III. INVENTORY ATLAS

ATLAS ROER VALLEY

The inventory atlas: defining the fringes serves as the analytical document to understand the context of the villages of the Roer valley and to establish the eventual design brief for Sint Odiliënberg, Herkenbosch, Melick and Vlodrop. The Atlas is assembled as an additional chapter that supports the content of the thesis. Therefore, the Atlas is not positioned in the appendix of this document but is issued an external chapter of the report.

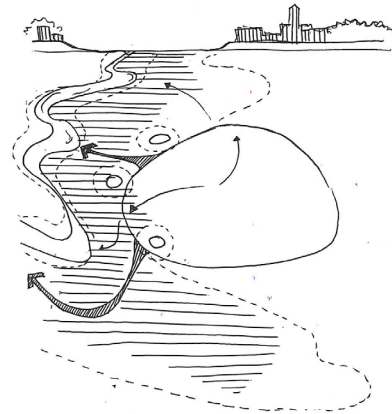


^ Cover of the Inventory Atlas.

IV. PLACE-SENSITIVE INTERVENTION PRINCIPLES

Place-sensitive intervention principles

The place-sensitive interventions principles are constructed by the understanding of the relation of villages and the Roer river through the intervention Atlas. This results in an overview of design elements in the domains of *route*, *space*, *flow* & *flood* that can be assembled together to create a design that connects the village to the Roer river.



1. ROUTE [144]

- R1 Main road - fringes [146]
- R2 Enterances [147]
- R3 Within floodable areas [148]
- R4 Bridging height difference [149]
- R5 Placement of vegetation [150]
- R6 Line of trees [151]

2. SPACE [152]

- S1 Along water [154]
- S2 Flood markers [155]
- S3 Lookout points [156]
- S4 'Spotters' place [157]

3. FLOW [158]

- F1 Street drainage system [160]
- F2 Green gutters [161]

4. FLOOD [162]

ROU TE

FACILITATING ACCESS

Pathways & roads: means to wander

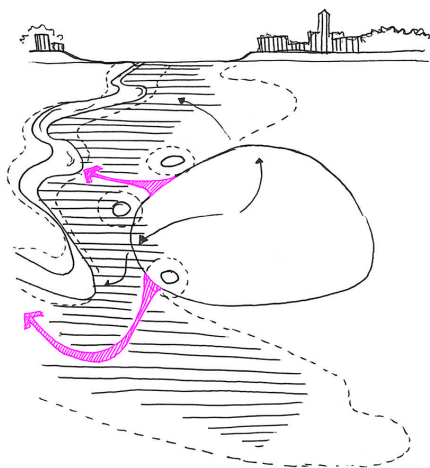
A route is a structural element that facilitates movement from one place to another. Routes could take on many forms and connect different functions to one another.

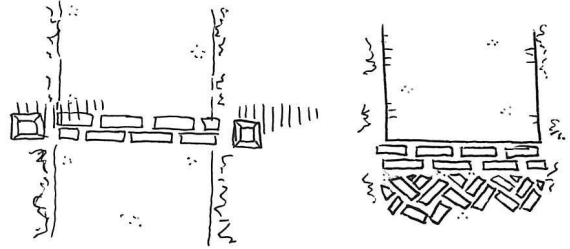
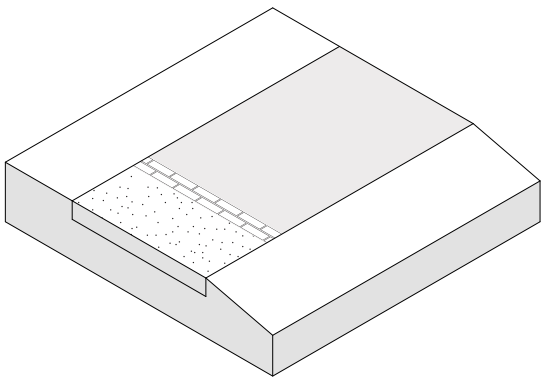
Inhabitants are able to experience and perceive the Roer mostly by means of accessibility. Through facilitating physical connection of people with the river, the Roer becomes within reach of the village. At first, the routes provide new and exciting possibilities to experience the river, the floodplain and the floodings as people have not done before within their village. Over the years, the routes integrate into daily habits, becoming part of the loops

people take to walk their dog or where families like to meet during special times of the year.

The principles of the routes give insight in the possible interventions that enhance the accessibility and awareness of the inhabitants to the Roer river.

The elements that are considered for the principles are: main roads - entrance markers - within floodable areas - bridging height difference - placement of vegetation - line of trees





MAIN ROAD - FRINGES R1

^ The principle of the addition of a brick band to the main road to amplify the transition between village, fringe & floodplain

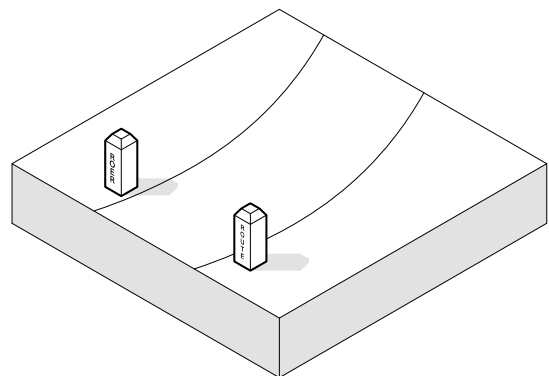
Materiality

As derived from the fringe Atlas, most of the main roads of the villages in the Roer valley are materialised with a pattern of clinkers or have been asphalted. The material of the main roads stay consistent throughout the villages and define the most prominent or most used streets.

Brick band

The main roads often connect to the proposed route. By introducing a brick band at the transition from main road to infrastructure that is connected to the Roer Route, the change in materiality forms a marker of changing functions and territory. The band is visible even when the sideroads are made out the same materials as the main roads.

Brick is used in the materiality of every village and therefore fits within the overall atmosphere of all Roer valley villages.



ENTRANCES R2

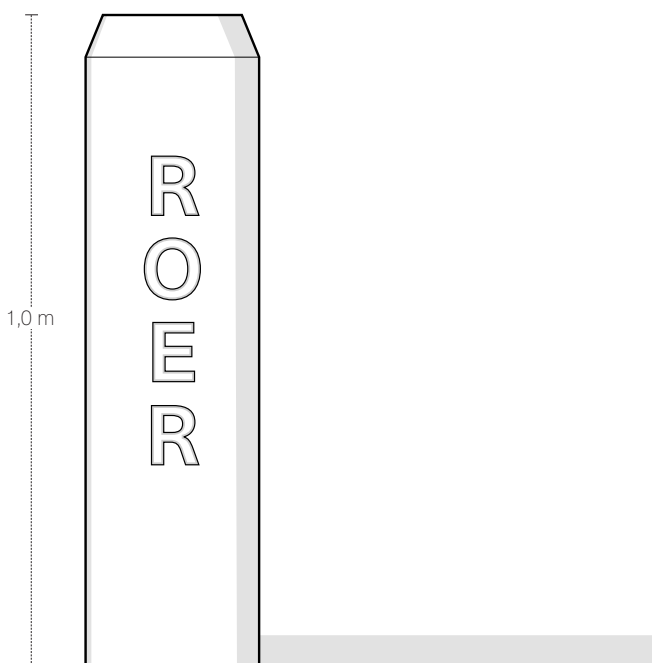
Marking the entrance

The markers of the entrances are positioned along the places of intervention within the village fringes. They reveal the routes that connect to the floodplain, create awareness of the transition of village into a floodable area or reveal the entrance that otherwise remains hidden for people outside of the Roer valley.

Its compact but recognisable appearance integrates well within the existing variety of markers within the valley. Directions for hikes or bike rides could be included within the entrance markers.

Village variation

The main principle of the entrance marker is sketched, but a differentiation of titles or height of the pole is possible per village fringe. This ensures visibility of the markers and integration of the markers in the individual villages.

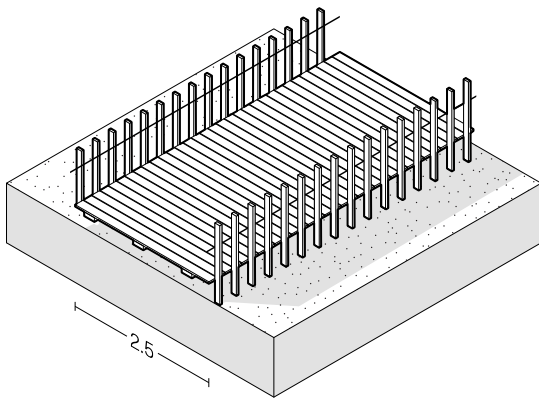


^ Principle entrance marker of the route or floodplain

WITHIN FLOODABLE AREAS R3

Walking above the water

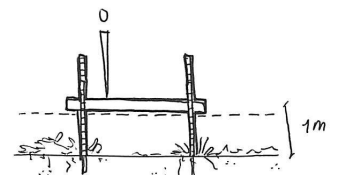
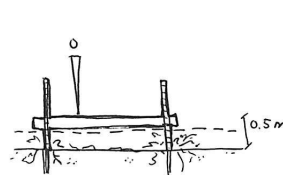
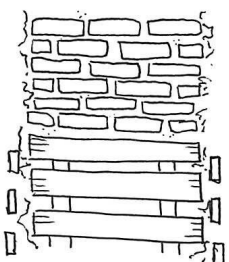
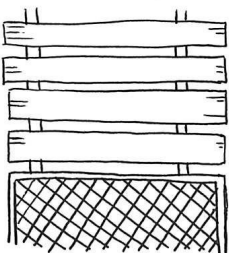
Most areas along the river are flooded yearly (see flood map on page 66). To enhance the experience and connection of the residents of the villages to the floodable and natural landscape, the route within these areas will be elevated. When entering the route during the time of a flood or shortly afterwards, the inhabitants are able to experience the natural system of the river and the flooding. During the period after the flood, certain areas remain wet, showcasing and embracing the organic and seasonal transformations of the fringe.



Materiality

Most pathways within floodable areas that flood every 1-2 years will be realised as boardwalks. Because flooding occurs more frequently in these locations, the boardwalk realises an emersive experience of the inhabitants into the floodable landscape.

The height of the boardwalk is adjusted to the possible water levels, as at different locations the waterdepth will differ during the same flooding.



^ A possible design of the elevated boardwalk within the floodable area of the village fringe.

< Material tranistions of the boardwalk to a lookout point or the main road.

BRIDGING HEIGHT DIFFERENCE

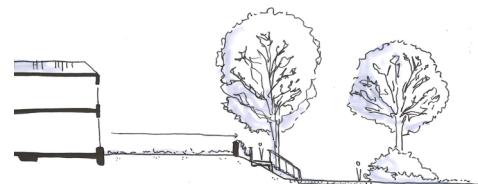
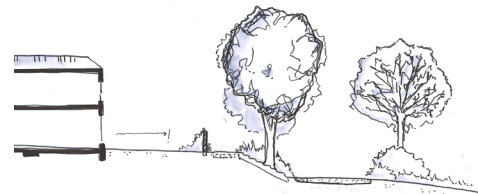
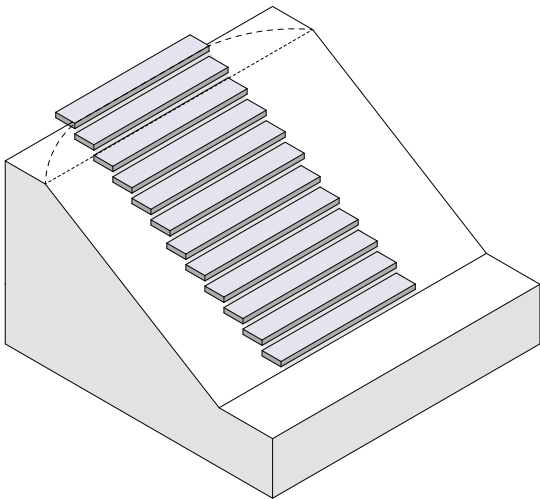
R4

The natural formation of the Roer valley with its terraces can translate to height differences within the village fringes. Each village has a different relation to the floodplain. Therefore, bridging a height difference is not applicable to every village fringe.

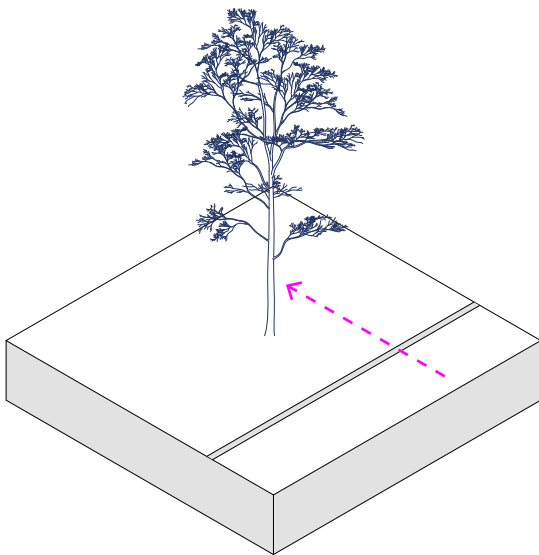
Public stairs & integrating the fringe

The differences in height often disconnect areas of the village fringes. Placing stairs or a ramp could connect roads that otherwise stay separated, or is implemented to get to an elevated point, in which the view to the Roer river is better visible.

There are many forms and ways to integrate stairs to bridge the height difference. The implemented principle should always consider its context and the materiality of the village fringe.



^ Possible projections of 'bridging the height' in a section of Herkenbosch.



PLACEMENT OF VEGETATION

R5

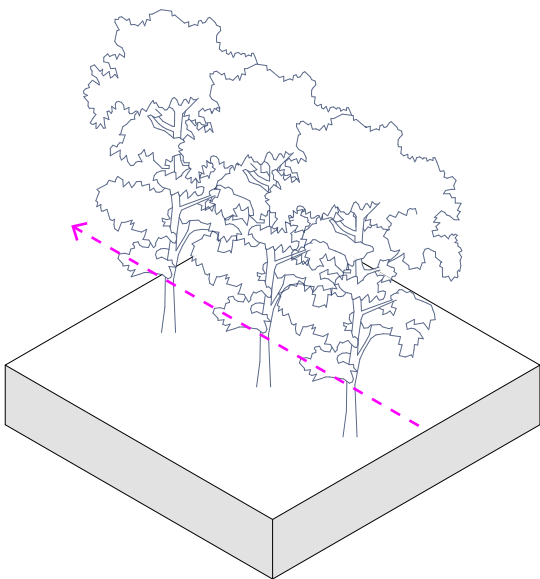
'Eyecatcher'

Strategically positioning vegetation, in the form of a singular tree, shrubs or a cluster of plants can draw attention from the village fringe to specific areas of the Roer route or the river. For visibility it functions as a point of focus. For accessibility, the implementation helps to guide to certain areas of the Roer route.

Native species

The vegetation species used in the Roer valley to mark routes or draw attention to specific areas should be considered part of the keystone species or are native to the Roer valley. This ensures integration of the design and stimulates the natural functioning of the landscape.

^ Placement of vegetation, visualisation.



LINE OF TREES R6

Sightlines

Implementing a line of trees is done to guide the visitor of the village fringe to a destination. These destination could be other elements of the route or spaces to temporarily reside in. They are positioned to strengthen an existing axis or reveal new lookouts to the Roer river.

Wayfinding

Next to increasing the visibility of the route or Roer river, the implementation of the line of trees can also be done to enhance the route itself. The floodplain of the Roer valley is mostly flat. Introducing (a line of) trees in this mostly flat area is therefore quite prominent and easy to find. The tree lines therefore also help to strengthen the route itself.

^ Line of trees, visualisation.

**ASPA
ACE**

RESIDING + VISABILITY

Lookouts & places of meaning

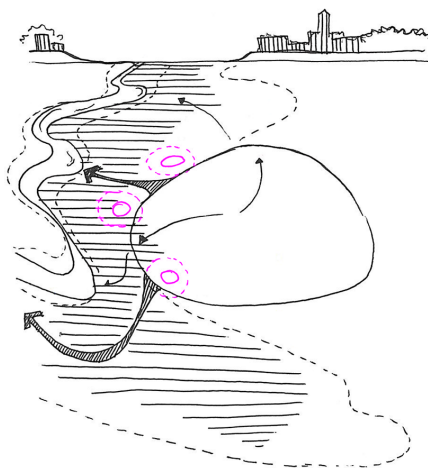
Spaces are considered open areas of land in which activity could take place. For the villages, it is interesting to design spaces that serve as places to reside. The term 'place' is especially important, as a place holds *meaning* for communities, ecology or water.

Through the integration of 'space', inhabitants are able to experience and perceive the Roer mostly by means of visibility. A difference in the visual perception of the river from the village fringe is linked to the connection of the village to the river (river oriented or adjacent to the floodplain).

As the route can be seen as the 'thread' that links different areas to each other, spaces are considered the acupuncture placemakers. They ensure connectivity of the village with the Roer by creating a visual connection and thus ensure awareness of both the river and its natural functioning.

The principles of the spaces give insight in the possible interventions that enhance the visibility and importance of the inhabitants to the Roer river.

The elements that are considered for the principles are: along water - flood markers - lookout points - 'spotters' place



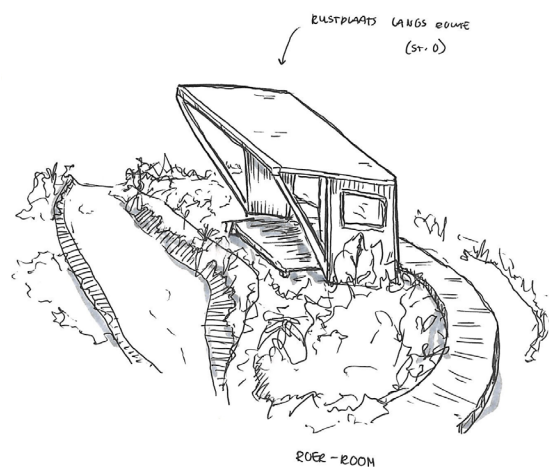
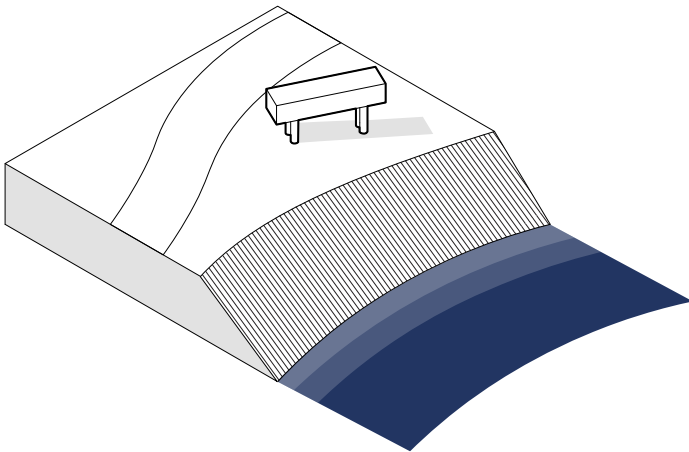
ALONG WATER S1

Residing along the river

The most direct experience of the Roer river is done through residing along its flow. Here, the river is accessed, visible and even audible. To utilize these special areas, the places are accommodated with elements to reside in. Elements such as benches, platforms or Roer-rooms can be constructed to point out the 'experience areas', but also to provide possibilities to take in the river itself.

During flood

During floods, the places along the water will remain accessible due to their connection to the (often elevated) Roer route. To accommodate this, the spaces along the river also need to be elevated. This can be realised through the implementation of decks, platforms or the strategic placement of limited interventions in areas that are not being flooded in a T25 scenario.



^ Sketch of the Roer room, a small shelter to reside in to experience the river.

FLOOD MARKERS S2

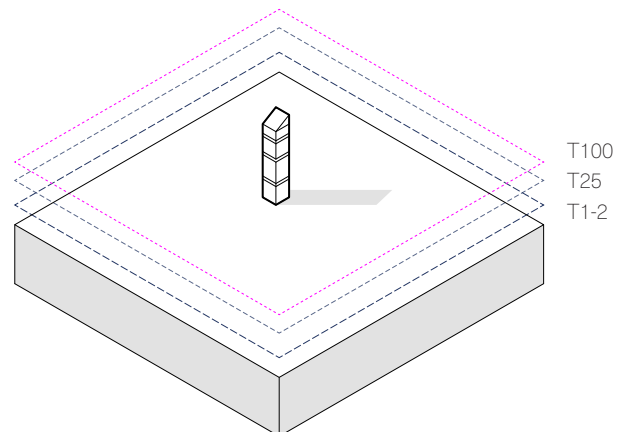
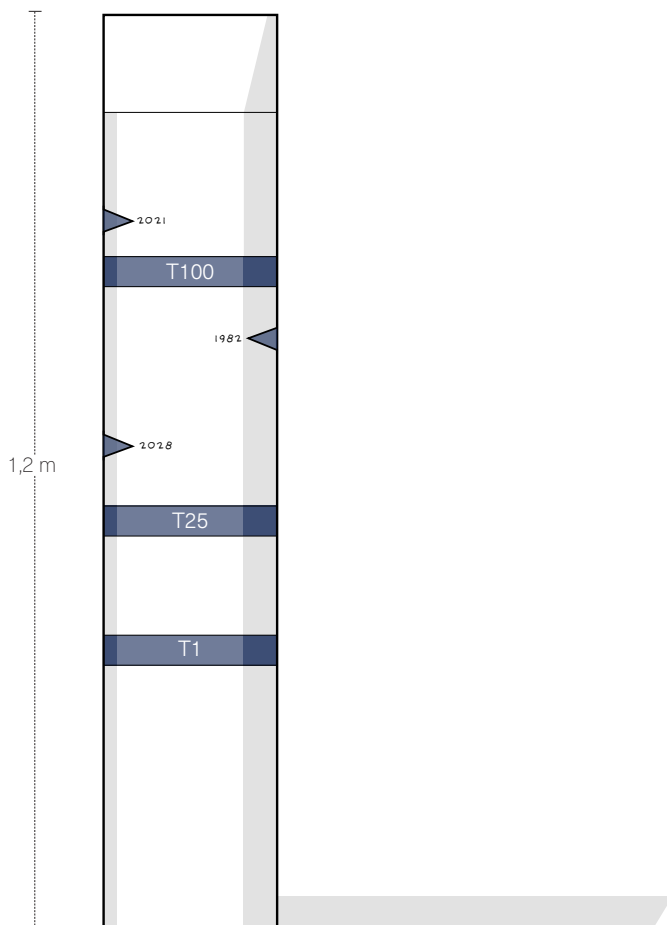
Marking the levels

Flood markers are in its essence spatial elements that showcase the possible water levels of the Roer river during different floods. Because the water levels and flood possibilities of flooding are different per village fringe and area along the fringe, each marker would be tailored to that location.

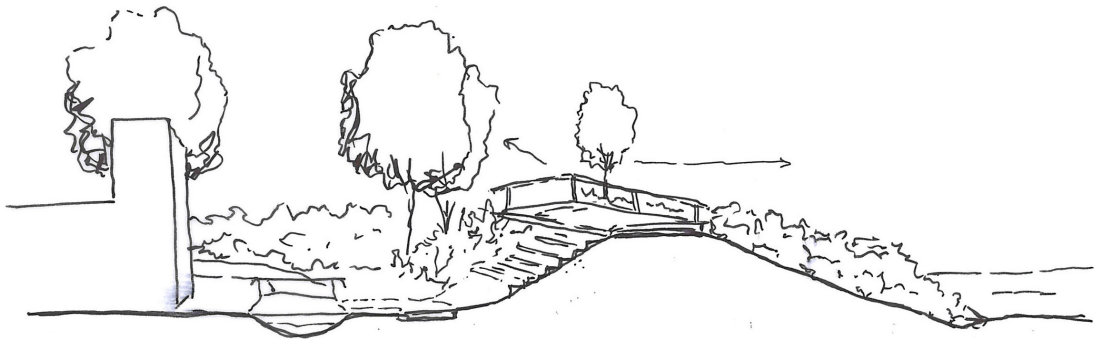
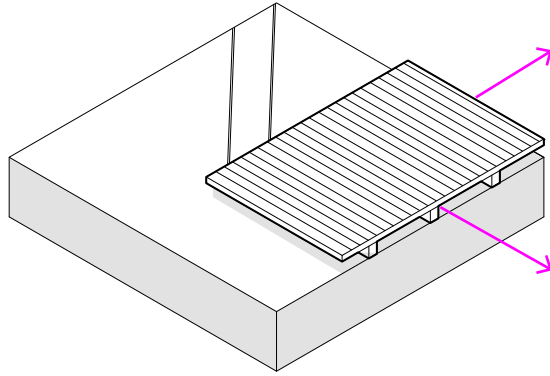
The floodlevels of a annual flood (T1), once every 25 years (T25) and once every 100 years (T100) are marked on the pole to showcase the water level per flood intensity.

Personalisation

As the markers showcase the water level of the predicted floods of T1, T25 and T100, this does not mean that each future flood has a discharge exactly correlating to a certain prediction. Therefore, the inhabitants of the villages can modify the marker by making an incision at the water level of a possible flood. This marks the dynamic system of the floodings in the Roer valley while at the same time raise awareness of the possible waterlevels along the village fringes.



^ The flood marker showcases the water level during different flood intensities.



LOOKOUT POINTS S3

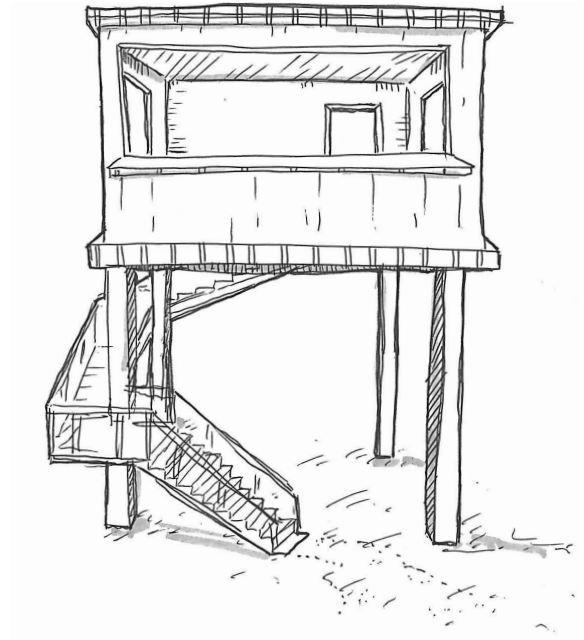
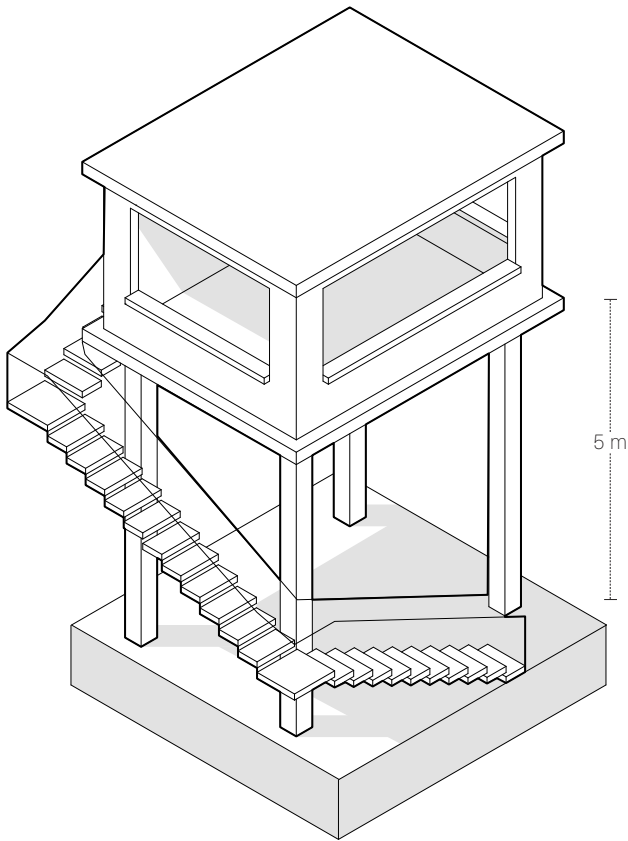
^ The lookout point could be realised as a viewing deck, as is done near the Daelenbroeck castle.

View over the valley

The lookout points along the route to the Roer or within the village fringe are oriented towards the Roer river. These areas to reside in are created to establish a visual connection to the river from the villages that are adjacent to the floodplain. Because they acquire an area higher to see the river, the spots can only be constructed in a limited number of places without disturbing the landscape of the floodplain.

Realisation & materiality

The lookout points will resemble the materiality used in the route in which the lookout is positioned. This creates a coherent and recognisable overall route and system to experience the Roer river in.



SPOTTERS PLACE S4

Lookouts from the floodplain

From some areas of the village fringe, a possible view to the Roer river could be interesting but is now hidden due to the even surface of the floodplain. In these positions, lookout huts can be placed in the floodplain that overlook the Roer. The huts are referred to as 'spotters places' that refer to (bird) watching huts.

^ Design of the 'spotters' huts around Herkenbosch.

National park de Meinweg

In the national park de Meinweg, positioned east of Herkenbosch, similar lookout huts can be found. The spotters places therefore also serve as a reference to the national park, as the natural park merges into the Natura2000 area that is positioned within the Roer valley.

**FLO
W**

REVEALING WATER MOVEMENT

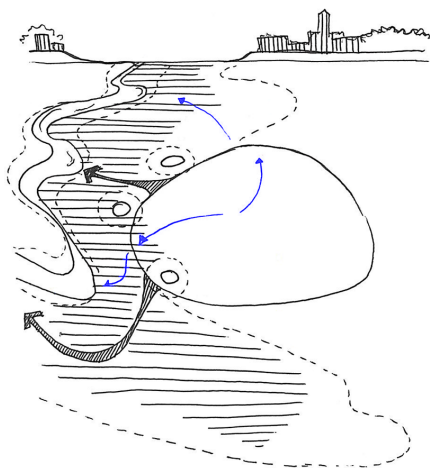
Make the water flow visible

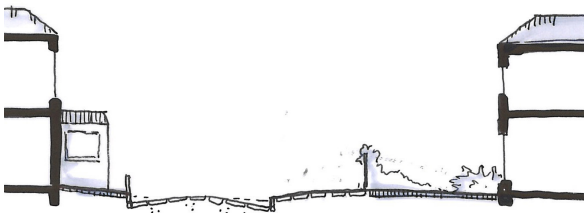
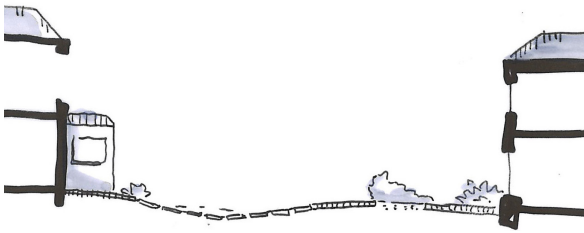
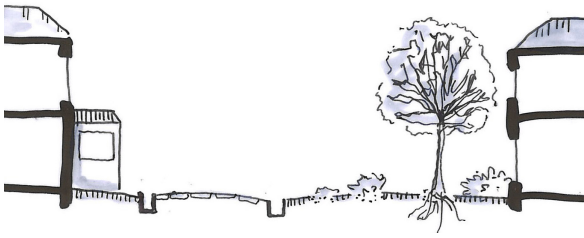
The flow of water is not always visible. By integrating design measures within the public space, the otherwise irregular flow of water (as a result of rainfall) becomes part of the streets and public realm. The form and materialisation of the flow paths may vary and each create a unique way of dealing with access water.

By integrating and visualising the water flow in the public space of the villages of the Roer valley, the inhabitants become more aware of the impact of (heavy) rainfall and the interconnection of the watersystems of the villages with the floodplain of the Roer.

Design principles for the water flow therefore ensure a connected watersystem, in its spatial form as well as through perceptual connection of the inhabitants with the water system.

The elements that are considered for the principles are:
street drainage system - green gutters



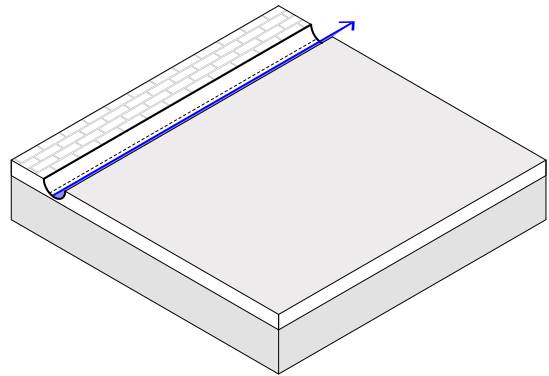


STREET DRAINAGE SYSTEM F1

Making water flow visible

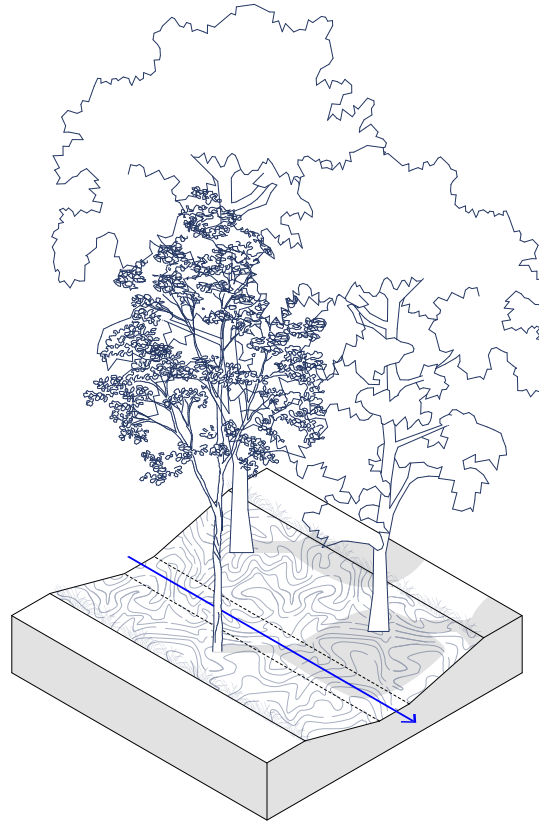
A street drainage system ensures that rainwater is drained from the street to another system that captures the excess water. In most villages, the current implementation of this system uses street gutters that drain rainwater into the sewage system.

The design of these drainage systems can be changed to make the flow of water visible in the streets of the villages in the Roer valley. Possible designs are 'molgoten', hollow streets or gutters integrated with the thresholds of pedestrian paths. The molgoten and gutters cannot span more than 50 meters without an external drainage system due to maintenance and the depth of the elements. Hollow streets can bridge longer distances without the necessity of rainwater drainage to another system.



^^ Possible implementations of a drainage system in the streets in urbanised areas.

^ Principle diagram street drainage system.

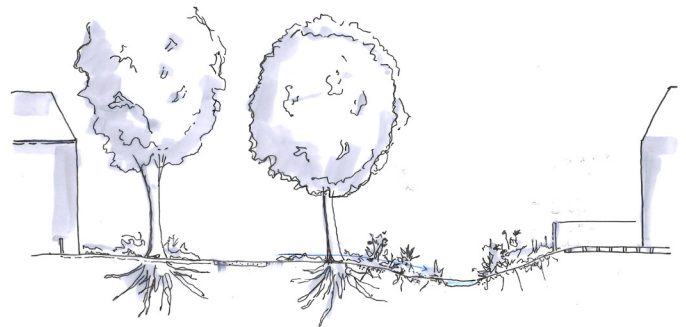


GREEN GUTTERS F2

Drainage in swales

Rainwater from urbanised areas can be directed into green gutters to stimulate local infiltration. When an extreme amount of precipitation falls in the urbanised areas of the villages, and the water cannot be infiltrated immediately, the gutters are designed to drain the redundant water to the floodplain.

The green gutters can be designed as a 'green finger' with a gutter to collect rainwater, or as a system of swales that can flood during extreme rainfall.



^ The green gutters could serve as 'green connections' or 'green fingers' into the villages

**FLO
OD**

CONNECTING TO THE NATURAL SYSTEM - DESIGN

Flooding possibilities

The principles of flood entail no direct design interventions, but act as support for the other principles to think about different possible flooding scenarios. Areas where flooding occurs yearly should be designed differently than areas where water only flows once every 100 years.

