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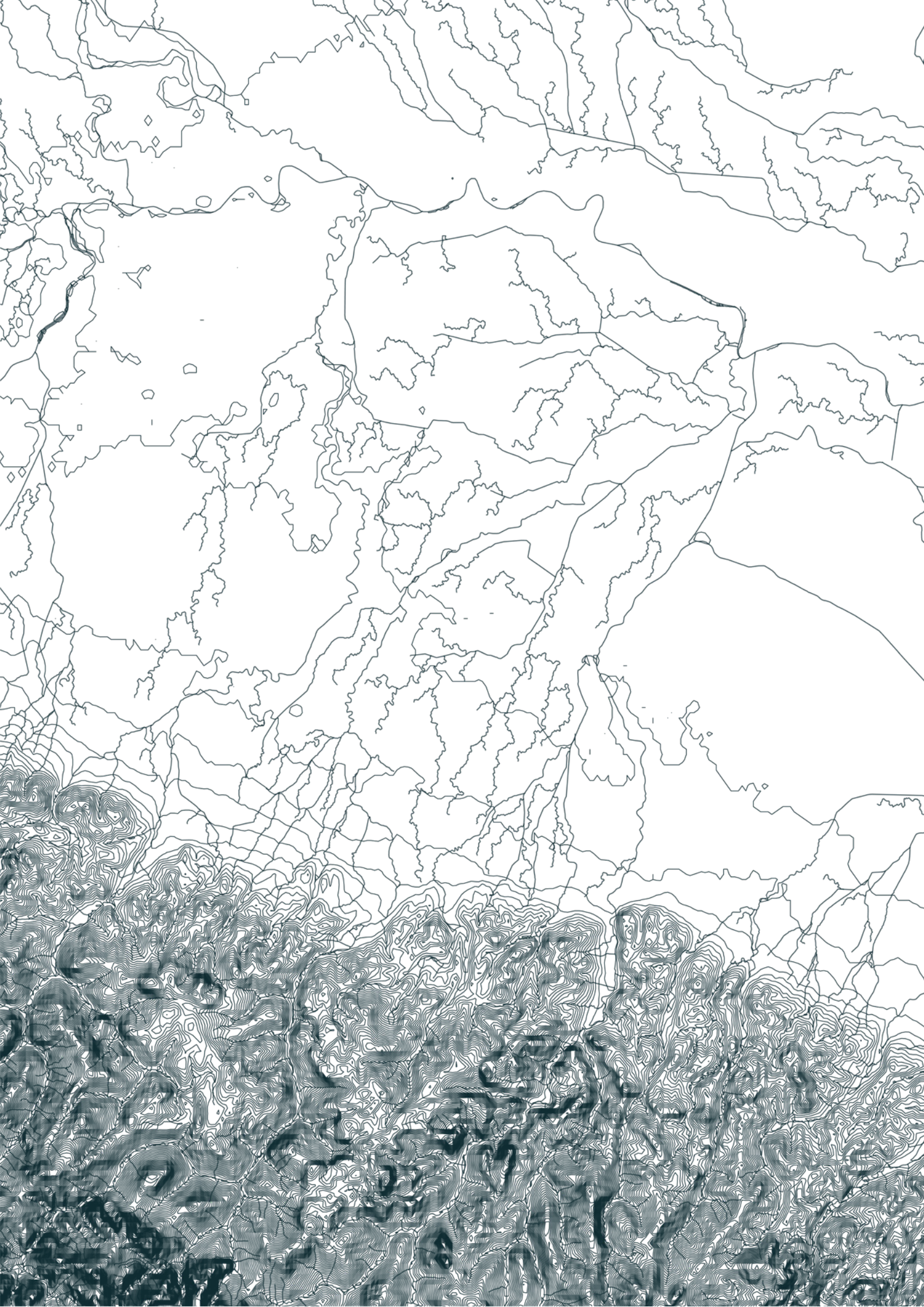

To all who want to reconnect to the essence of life ***water***

Living Waters

"Water Heritage as a transformative approach to a reintegrated dynamic water-sensitive reality in the Emilia-Romagna region's southeastern Po and Reno territory."

P5 Report

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Thesis Project *Living Waters*

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ABSTRACT

This project investigates the challenge of water in the Anthropocene. Due to the accelerating human-induced climate crisis and human actions such as damming, over-extraction, and irrigation practices, the hydrological cycle has been altered, causing an increase in the intensity and frequency of its extremes: severe floods and prolonged droughts. In this Anthropogenic epoch, the world has become heavily globalized and urbanized, leading to critical territories that are exhausted, disconnected, and vulnerable as they are densely built with fixed, impermeable materials and structures. These artificial landscapes cause the detachment of the natural systems from human environments, threatening society's existence.

Additionally, there is the intangible water challenge of social alienation from water identity: the loss of society's (ancient) connection with water as an integral part of their way of living. These tangible and intangible water-related challenges are increasingly occurring in the territory of Emilia-Romagna, located within the Po Valley in Northern Italy. This transformation has turned a once wild, dynamic, and rich watery landscape into a humanized, artificial one, resulting in a sinking delta challenged by both sea and riverine floods. Therefore, this introduces the focus area of this thesis project.

There is an urgency to address these challenges by raising awareness and designing solutions for the changing water-related conditions of territories, systems, space, environments, processes, and human behavior. As natural water catastrophes increasingly and interscalarly threaten human daily life, this project argues for a transformative approach to living with water's uncertainty and dynamics. It aims to answer the research question 'How to interscalarly design a water-sensitive reality on the human dimensions of daily life in the Northern Italian southeastern Emilia-Romagna region for flood and drought protection while reintegrating water heritage as a way of living?'

The project focuses on Emilia-Romagna using the methods 'non-linear interscalar design' and 'using water heritage as a transformative approach'. Additional methods include 'critical discourse analysis', 'literature review', 'historical analysis', 'critical mapping of spatial systems,' and 'fieldwork'.

Spatial analysis and fieldwork show that Emilia-Romagna's territory is densely urbanized, with 47% intensive agricultural land, and has lost its natural historical landscape due to land reclamation. The longue durée captures the (historical) transformation from ancient flood-dynamic settlements to completely canalized agricultural land, constantly threatened by floods from the Reno basin and Apennine rivers. Literature reviews reveal the changing societal position of water, from a worshipped living deity and landscape of care to an inconvenient object removed from the daily living environment by the introduction of the car, reflected in urban design and planning. They provide a framework for a healthy watershed by spreading, slowing, collecting, and infiltrating water in up- and downstream landscapes and providing room for the river to restore the natural balance through the various scales. This historical transformation and water identity form the water heritage used as the foundation of the design.

To conclude, the interscalar landscape-urban design uses water heritage, formulated by ancient structures and societal values, to restore the territory through water. Based on the concept of 'water storage along various landscapes' and guided by the Santerno River as the main connecting territorial element, Room for the River interventions, along with the interplay of artificial and natural water management through a territorial water reservoir system, demonstrate a possible interscalar framework. This framework contributes to flood and drought protection while increasing spatial quality and improving daily life. A transformative way of living with water in urban, peri-urban, and rural environments is proposed. This approach allows inhabitants to reconnect with their water identity, restore water's position within society, and raise awareness of the crucial essence of water in providing life in various ways. This is highlighted by the water-sensitive small-scale urban design in the village of Sant'Agata sul Santerno, featuring a water storage square. This interscalar design reintroduces water as a cultural landscape where natural water dynamics freely roam within an artificial framework, ensuring water safety and reframing human daily life.

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ACKNOWLEDGEMENTS

This thesis process has been an incredible journey. Not only was I able to explore my fascinations with water and combine it with designing, but I also discovered a deeper understanding of what water means for society and life. I have gained a lot of knowledge and developed myself in many aspects, some even surprising. My interests and passion for the field or Urbanism will continue to grow and I am curious to what the future will bring.

I want to express my gratitude towards my mentors who guided me through this process and pushed me further than I thought I could or would go. My first mentor, Francesca Rizzetto, supported me tremendously by sharing her knowledge and experience of Italian culture, enriching my thesis project. Her dedication to always be reachable and present throughout the entire year provided me with a strong safety net for this entire process and confidence. But most importantly, I am grateful for the personal developments I achieved as a designer under her guidance, resulting in a design outcome I desired to have and of. Your dedication as a mentor is truly admirable.

My second mentor, Eric Luiten, broadened my horizon with his expertise in landscape architecture for my project and pushed me to do more than I initially intended. I appreciate your critical approach and feedback, which constantly allowed me to improve my project and the designer in me. Even as a second mentor, you have been constantly present during this graduation year and I admire your guidance as a teacher.

I would like to dedicate a part of the acknowledgement to Prof. dr.ing. Carola Hein for inspiring and fueling my passion, interests, and graduation topic of how to live with water while including the perspective of water heritage. Exploring this topic throughout this year has been a great pleasure, and I aim to continue this exploration in my career and life.

During my fieldwork, I am grateful to Caterina Capucci and Andrea Baldini for taking their time to enbroading my knowledge of Italian culture and landscape. They allowed me to gain insight into their personal lives regarding culture, tradition, and the impacts of floods and droughts, which enriched and strenghtened my project. As this was an important part of my thesis project, I will be forever greatfull for their time, passion, and dedication.

I also would like to thank my parents for their unconditional support during my study years, and care during my graduation year. I would not have been able to do this master study without them. Visiting the Emilia-Romagna region for the thesis with my mother was an incredible and special experience to share with her. During this year, my father has been a great support to share his knowledge and help me develop as a designer.

Additionally, I thank Quinten Rook for his dedicated, unconditional support, time, and care during my graduation year. Hours of discussion and reflection helped me gather my thoughts and to improve my project. I am also grateful to Bo Meekel for constantly supporting and helping me to continue with my project.

Finally, I would like to thank the Transitional Territories studio for allowing me to approach this thesis in a way that brought deeper meaning to the project, explore unfamiliar theories, and develop myself as a researcher and designer, strengthening my passion for water. Specifically, I would like to thank my fellow urbanism students and dear friends Vera Vince, Kirthan Shekar, and Merel Garritsen for their constant support and help during this year. You have made my year unforgettable and I am looking forward to continuing our friendship after graduation!

CONTENTS

INTRODUCING LIVING WATERS

WATER, THE SOUL OF THE EARTH AND ARCHITECT OF NATURE

Water is all around us. It is in the air, in the soil, in almost all elements in our surroundings. The world is shaped by water in its various forms, providing the possibility of life. An essence of one of the most questioned, debated on, fought for, and precious gifts humans have: life. So how come we all fight for our (common) lives but forget the essence that allows us to breathe and exist - the forgotten element of water?

That we have forgotten this essence is evident, as water is one of the greatest challenges humans face nowadays. It threatens human existence and shifts the natural equilibrium to a state of distress. This essence and shift that sparked my interest in water, slowly turning into a fascination, which makes sense as I am a Dutchwoman constantly surrounded by water. But foremost, water is the soul of the earth and the architect of nature. So complexly designed, it connects every piece of life, yet is hidden in forgotten stories and memories that make us disconnect.

Thus, water is the essence of life and death? It is clear that there is a story to retell.

Looking back at how water was constructed in life, interestingly, water is a prominent subject in biblical scriptures, a protagonist, symbolizing life (rebirth through baptism) and death (the Great Flood, a cultural reset). Similar themes appear in Greek mythical stories about Zeus and Hercules. It is woven into language, stories, and poetry. Iceland has 90 words for snow and in Arabic, there is an expression for 'the talk of the sea, the water lore': kapesani lemetau. The Dutch poet Marsman (1941) wrote about the Memories of Holland, describing the Dutch waterscapes and how he almost identified with this landscape. Science has explained much about the unexplainable of hydrology, revealing geological phenomena and the foundational mechanisms providing life. But there is still much more to learn!

Therefore, this thesis, or perhaps a personal manifesto, addresses the rapid changes in the world from ancient to modern times, defined by technology and advanced knowledge, yet constantly surrounded by water. This process has led to a disconnection between human and natural environments, a lack of understanding, and a reluctance to identify with water. In the past, water was part of life and understood as a crucial element providing life – interweaving social, religious, and political life. Water was culture, community, and a way of living. "How To Read Water (clues & patterns from puddles to the sea)," a book by Tristan Gooley (2017), is an incredible contribution that explains the various ways water warns, talks, and provides, simply by reading its clues and understanding its mechanisms, characteristics, and processes. It tells the story of how past societies lived with water. They listened to its signs that predicted weather and soil conditions, created a foundation for an advanced navigation technology purely based on its features, and provided awareness of its benefits by taking care of and allowing its existence.

Now, we have destroyed many aspects of it, if not even more: pollution by microplastics and harmful substances, dying sea life and ecologies, facing extreme floods and droughts due to its imbalanced state, and so on. Much needs to be done, and this thesis aims to contribute within its limits, as there is an urgent need for action and change. This thesis aims to explore and discover the deeper meaning of water in various spheres of life (social, cultural, economic, political, and environmental) to restore water from being an object to being a subject again. As an essence of life, water is an identity. So what is this water identity? What better way to explore this than in the region of Emilia-Romagna situated in Northern Italy, characterized by the Po River, its Delta, and the Apennine Rivers? A region rich in water history, heritage, and territories, including historical cities such as Bologna, Ferrara, and Ravenna, which rose from the existence of water and connected Italy to the world. But also a region, the size of the Netherlands, similar to the Dutch context as they are both sinking, reclaimed, artificial Deltas, facing similar threats, and cultures surrounded by water. Could they learn from one another?

The region is both threatened and structured by water, facing extreme floods and droughts due to the altered hydrology, while being attacked from two sides: rising sea levels and mountainous river discharge. The Po Plain is subsiding due to human activities such as mineral extraction and intensive agricultural irrigation practices. As this territory is strongly urbanized, originating from the Roman Times, the adaptability to these changing water dynamics is limited. The territory's fixed structures, including crucial cultural heritage, are threatened to be lost by the increasing force of water, ironically as it rose from the water.

But how do we cope with this increasing threat from the climate crisis in a world that is statically defined and structured, on which deeply rooted economic systems, cultural identity, and life depend? Changing the traditional ways will be a challenge as (traditional) culture is one of the most valued aspects of Italian identity. But they seem to have forgotten that water is an integral part of their identity.

As questioned at the start, water represents the interplay between life and death, and this relation will continue to exist due to its dynamics, as history shows. However, the balance has shifted. There is more destruction than water provides life. So, what have we lost, and what needs to

be reintegrated in this modern context? How did we cope and harmonize with water in the past, and what changed to make us detach its value? A systematic change in our existence is needed, which is deeply rooted in Anthropogenic processes and modern systems that are not easily altered. But where did it bring us to think something is impossible? The Dutch created the Netherlands, just as the Italians did in Northern Italy. Let's turn the impossible into the possible, but this time learning from the past and adopting a transformative approach to living with water. Starting with landscape urban design, as design is a tool used for constructing life - and is that not what we need water for - life?

A paradigm shift where water as an object returns to water as a living entity.

Living
Waters

2

PROBLEM STATEMENT

THE CHALLENGE OF WATER IN THE ANTHROPOCENE

This thesis investigates the challenge of water in the Anthropocene and examines the Anthropogenic way of living, in which human actions altered nature to a disrupted equilibrium. This has left the world in a critical and vulnerable state, slowly transitioning toward an irreversible turning point in the accelerating process of the human-induced climate crisis (Magnason, 2021). This way of living has detached natural systems from human environments, resulting in an artificial landscape - a disconnected (societal) 'residue' of the past. The problems arising from this altered, modernized world are numerous and complex. Water as a way of life, one of the greatest challenges humans face (Mauter, 2018), is the focus of this research project.

The water challenges in the Emilia-Romagna region of Northern Italy, the focus area of this thesis, are both tangible and intangible, resulting from the human-induced climate crisis and human actions altering the hydrological cycle.

Tangible Water Challenges
Framed by the Northern Apennine rivers and the Adriatic Sea, the territory is threatened by extreme floods due to rising sea levels and riverine peak discharges from extreme precipitation, along with prolonged droughts from lack of precipitation. Additionally, climate warming and saltwater inundation cause soil erosion and alter the aquatic and coastal ecosystems, affecting Italian culture and tradition (Montgomery, 2007).

Human actions further threaten the area. Over-extraction of water (and mineral) resources by mining and irrigation practices, along with urban structures and heavy infrastructure, cause the region to become a sinking valley as the soil subsides, increasing the flood risk. Historical land reclamation, deforestation practices, and the abundance of impermeable materials, combined with the construction of artificial, static dykes, canals, drainage systems, rivers, and infrastructure, have resulted in a bare, imbalanced landscape that doesn't leave space for water dynamics to be slowed down, collected, and infiltrated to recharge groundwater levels. This declines water security due to a lack of water storage for flood and drought relief and causes landslides as soil destabilizes (Millison, 2023).
The region is densely urbanized, housing one-third of the Italian population, and functions as productive agricultural land, with 90% of the territory being rural and 47% used for agriculture (European Commission, 2019; Pistocchi, 2015). It is a crucial food source regionally, nationally, and globally, and with a considerable water footprint, agriculture relies heavily on natural and artificial water systems. The dominance of artificial structures causes the territory to be extremely vulnerable to these risks (Bocchiola, Nana, & Soncini; 2013).

Intangible Water Challenges
Additionally, there is the intangible water challenge of social alienation from water identity: the loss of society's (ancient) connection with water as an integral part of their way of living as human values have been altered – values that have faded and been lost. As culture and tradition are crucial for the Italian identity, proposed changes in land uses and transformative approaches can be met with resistance.

Addressing the Challenges
Facing these tangible and intangible water challenges requires rethinking and reevaluating water as a way of living, as it also concerns the culture and identity of the region. There is an urgency to act upon and propose solutions to tackle these challenges as the irreversible turning point of the climate crisis is nearing its fatal state. This disconnected natural and societal state demands looking beyond solutions for the tangible threats of floods and droughts, proposing a transformative approach to living with water in a world of increasing uncertainty and unpredictability that integrates and adjusts postmodern human processes. It requires raising awareness of the altered hydrological cycle, a complex interscalar system that threatens human daily life on all scales and through diverse landscapes connected by river structures. Additionally, reintegrating the water heritage of the territory to reintroduce (and retell the story of) water and its essential, harmonious role in society is necessary to propose that transformative way of living. This allows the possibility to propose a healthy future by shaping new conditions while continuing on the inherited territory.

Therefore, this thesis aims to answer the research question '*How to interscalarily design a water-sensitive reality on the human dimensions of daily life in the Northern Italian southeastern Emilia-Romagna region for flood and drought protection while reintegrating water heritage as a way of living?*'

On the next page, a map illustrates the critical water-related conditions of the territory of Emilia-Romagna, highlighting the high flood risk areas, although the entire valley is vulnerable to flood inundation.

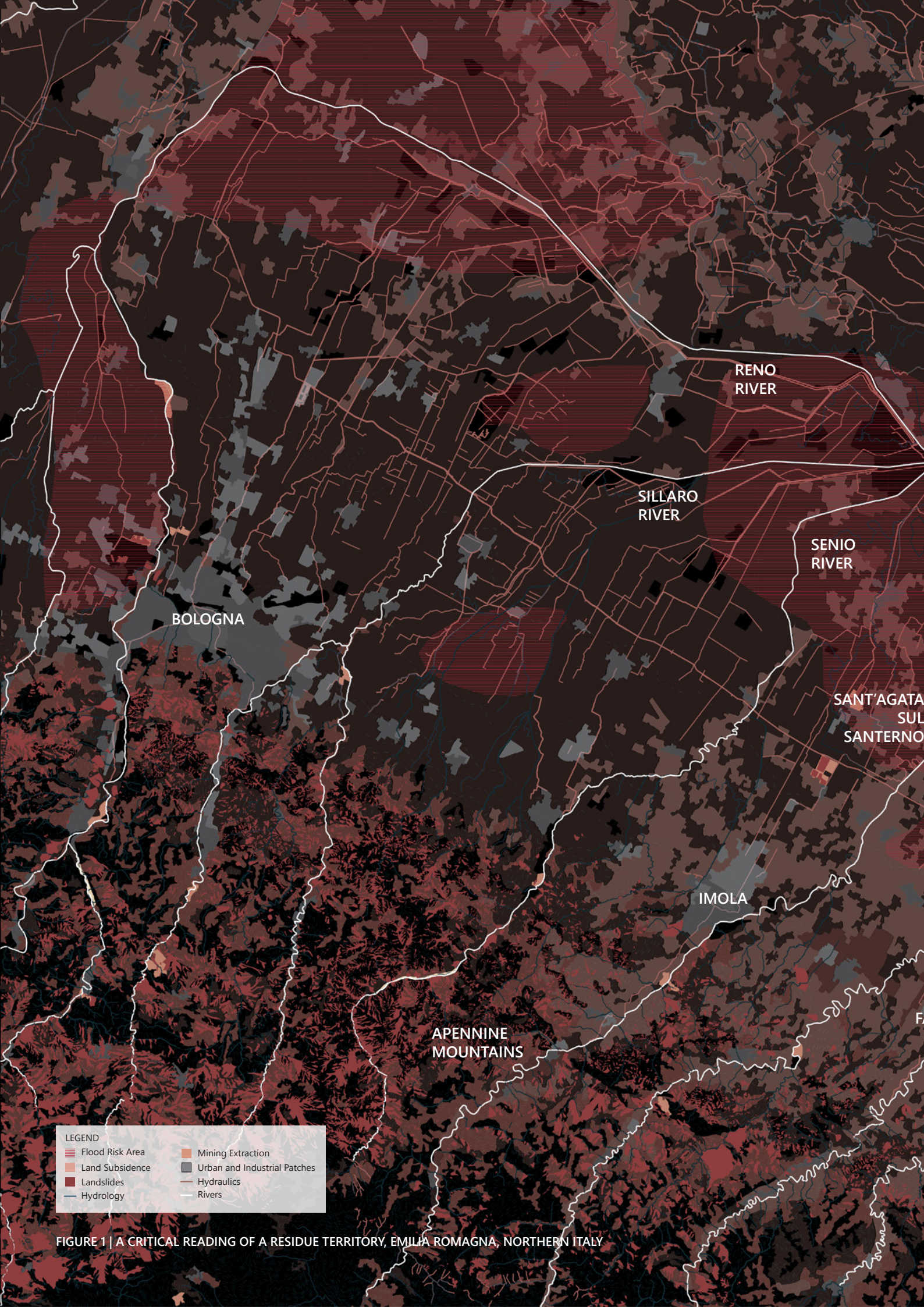
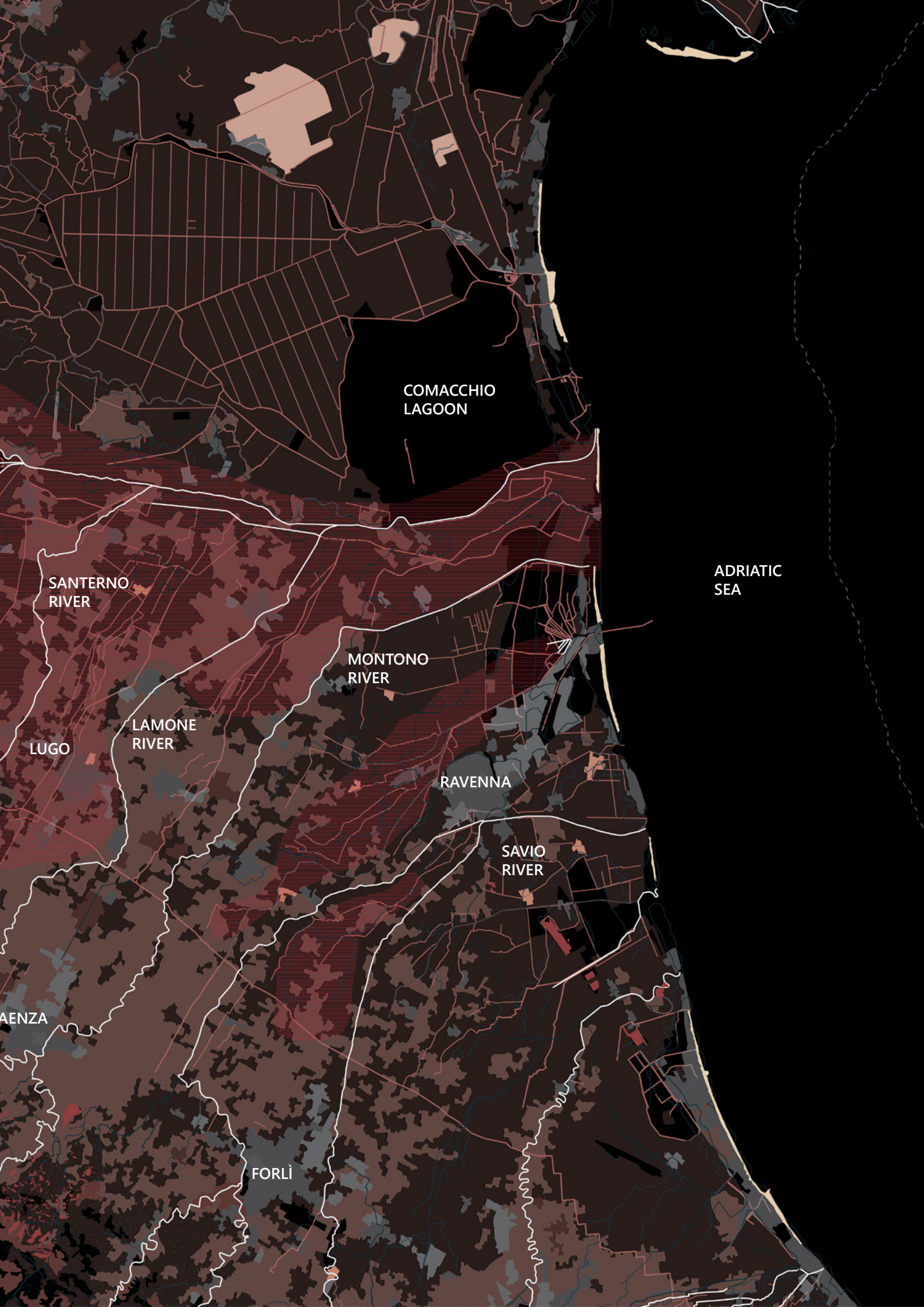


FIGURE 1 | A CRITICAL READING OF A RESIDUE TERRITORY, EMILIA ROMAGNA, NORTHERN ITALY


COMACCHIO
LAGOON
ADRIATIC
SEA
SANTERNO
RIVER
MONTONO
RIVER
LAMONE
RIVER
LUGO
RAVENNA
SAVIO
RIVER
AENZA
FORLÌ

2.1 RESEARCH QUESTIONS

HOW TO LIVE WITH WATER ?

The project began with the general question:

'How to live with water in a world of uncertain conditions and unpredictable change?'

This question arose as we increasingly face water-based climate crisis-related challenges in a world where natural and human environments are disconnected. Given that water is integral in our daily lives and essential to all beings, the question evolved into a more specific inquiry:

'How to live with water in our daily lives amidst uncertain conditions and unpredictable change?'

Water is a complex cycle interconnected through all scales, but how can we manage it on a smaller scale? What role does water play in our living environment as we address these water-related challenges? What does this mean for humans? What implications does this have for humans? Thus, how can we design in a water-sensitive manner? In which sensitivity must encompass resilience to the extremes of the hydrological cycle and recognize waters significance as part of human life, a societal construct. This project addresses both the tangible and intangible aspects of water.

With the aim of proposing a transformative way of living while learning from the past, as we continue on an altered landscape with its history, culture, and conditions, the project will use water heritage as a tool for reintegrating and proposing a new way of living with water. Thus, the final research question is:

'How to interscalarily design a water-sensitive reality on the human dimensions of daily life in the Northern Italian southeastern Emilia-Romagna region for flood and drought protection while reintegrating water heritage as a way of living?'

To answer the stated research question, it is necessary to define sub-research questions that form the basis of the project's structure. These questions will be addressed through a literature review, critical mapping of spatial systems (Longue Durée and Dutch Layer Approach), and fieldwork, using a research-by-design approach.

The first sub-research question has already been addressed as part of the problem statement, allowing us to define the site selection of this thesis project: the southeastern part of the Emilia-Romagna region. Namely:

S.RQ1: "What is the main flood and drought risk area in the region of the Po Valley?"

As the research questions state, the project aims to tackle both tangible and intangible water-related challenges. It addresses the tangible threats of floods and droughts, aiming to provide water safety and security (water resilience or sensitivity). With the problem statement and the site selection defined, the next step is to identify where these challenges are occurring and what elements and conditions define the critical territory of Emilia-Romagna. This is crucial as this is the default layer of the territory is not bare land. Thus,

S.RQ2: " What (systematic) elements and conditions formulate the critical territory of southeastern Emilia-Romagna, and how are these composed?"

The following step is to analyze the second part of the research question, which aims to reintegrate water heritage as a way of living. As society has lost its connection with and awareness of its water identity, tangible and intangible water heritage will be tools to reintroduce them to their (ancient) water identity. The next sub-question therefore is:

S.RQ3: "What is the tangible and intangible water heritage of the area?"

For this question, two methods are used to identify the two layers of water heritage. Firstly, the spatial analysis of the Longue Durée captures the territorial transformation due to human actions regarding hydraulic works and water management to define the tangible water heritage. Secondly, a literature review on the intangible water heritage explains the position and meaning of water in ancient societies.

S.RQ3.1: "What is the Longue Durée of Emilia-Romagna's territory?"
S.RQ3.2: "What was the position of water in ancient societies in the region of Emilia-Romagna and how did it construct life?"

As this concludes the necessary research and analysis part of the project, the following sub-questions are defined for the design part:

S.RQ4: "How to raise awareness on the urgency of a transformative approach to living with water by reconnecting with the lost water identity?"

S.RQ5: "How to interscalarily design a water-sensitive urban design on the human dimensions of daily life in the southeastern part of Emilia-Romagna?"

S.RQ6: "What (Dutch) reference project can support and inspire the interscalar water-sensitive urban design?"

2.2 RESEARCH HYPOTHESIS

A NEW WAY OF LIVING

The hypothesis of this project is that water will be allowed to flow more freely in the future. While current water management is characterized by technology, intervention, and control, future water management will focus on nature-based solutions, allowing for the free dynamics of water. Control will not be entirely abandoned. It will support existing water structures rooted in control, gradually transitioning into a world where and through time, this will transition into a world that is slowly restored and in which control can be let go. In this future, water will become an increasingly visible part of both physical structures and daily life. There will be a new way of living with water.

I see a future with wetlands surrounding urban structures and even connecting within the urban structures. A future where water management simultaneously means nature-based solutions, as the example of 'room for the river. Human-scale interventions such as water squares where social life gathers and people are not afraid to make their feet wet as the water will dynamically flood the urban, peri-urban, and rural territory. There will be more understanding and restoration of the connection with water through which a life in balance with water will be created. The landscapes will be more similar to the ancient water landscapes in which biodiversity, animal, and human life flourished, however, it will be in the context of modern society. The floodscapes will be brought back into our existence and provide an opportunity for our Earth, which is neglacted and increasingly destroyed, to heal.

2.3 DESIRED OUTCOMES

A WATER-SENSITIVE FUTURE

The overarching desired outcome is a water-resilient future in the southeastern part of Emilia-Romagna, which is the most critical and vulnerable area of the Po Valley. This will be visualized through an interscalar, water-sensitive, small-scale urban design intervention in public spaces across urban, peri-urban, and rural territories. This approach aims to provide a visualization and imagination of a potential short-term solution for a healthy way of living with water, while offering a framework for long-term adaptability to the changing dynamics and conditions of the territory. The objective is to restore ancient, sacred water landscapes to reconnect, raise awareness, provide safety, and enhance spatial quality for inhabitants. This shift involves changing the perspective from fearing water to living with water by reintegrating water into society.

Figure 2 displays the relation between (sub)research questions, intended methods, and desired outcomes for a precise overview of the deliverables that collectively achieve the aim of this thesis project on water resilience.

	Sub-Research Questions	Intended Methods	Intended Outcomes
Design Intervention	RQ | *'How to design a water-sensitive reality on the human urban scale in the Emilia-Romagna region for flood and drought protection while reintegrating water heritage as a way of living?'*	Non-Linear Research By Design	*Short-term Water-Sensitive Urban Design on the human scale integrated in a long-term Interscalar Design through which a transformative approach of 'living with water' is introduced that is adaptable and flexible to uncertain conditions and unpredictble (future) changes*
Theory/Analysis	S.RQ1 | *'What is the longue durée of this region's territory?'*	cricital discourse analysis urban data mining palimpsest (historical analysis): literature review + critical cartography	*Longue Durée: understanding of the historical transformation of the territory*
	S.RQ2 | *'What is the area's water heritage?'*	summarising outcomes S.RQ1 literature review	*Defined Water Identity*
	S.RQ3 | *'By what (systematic) spatial elements is the contemporary territory of the Po Plain and region of Emilia-Romagna constructed and how are these composed?"*	urban data mining critical mapping spatial systems literature review	*Element Catalogue*
	S.RQ4 | *'What is the main flood and drought risk area in the region of Emilia-Romagna?'*	urban data mining literature review	*Project Framing*
Design Analysis	S.RQ5 | *'What is a water-sensitive (urban) design?*	literature review analysis reference projects	*Definition Water-Sensitive Urban Design*
	S.RQ6 | *'What are the similarities and differences between the Dutch and Italian (Delta) water territory and what can be learned from Dutch practices?'*	literature review interviews	*Planning Principles*
	S.RQ7 | *'What are reference projects that can support and inspire the design of this thesis project?'*	analysis reference projects	*Frame of Reference*
	S.RQ8 | *'How to raise awareness on the urgence of implementation of a transformative design approach? And the (lost) water identity?'*	literature review interviews	*Participation Plan*

FIGURE 2 | (SUB)QUESTIONS, INTENDED METHODS, *AND INTENDED OUTCOMES*

3

METHODOLOGY STATEMENT

This chapter describes the research process through which finally the research question is answered. The main aim is to ensure transparency and clearness of the process that supports the (scientific) findings and explanation of what techniques and tools are utilized and why, visualized through frameworks.

Before the various frameworks are presented, a brief recap of the statement of the research problem, as explained in Chapter 2, is provided. Water is one of the greatest challenges humans are currently facing. The Anthropogenic way of living caused a state of climate crisis, altering the hydrological cycle whereby contemporary societies need to cope with its extremes: flood risk and long periods of drought. In the region of Emilia-Romagna, flood risk is caused by rising sea levels, increased riverine discharge due to more extreme precipitation, and land subsidence. Land subsidence is caused due to human actions such as (mineral and) water extraction for irrigation practices and human-induced pressures on the soil of urban structures, heavy construction, and infrastructure. The region of Emilia-Romagna provides a home for one-third of the Italian population, consists of many important cultural heritage structures (providing income through tourism), and is an important food source both nationally and internationally as the main land-use of the region is defined by agriculture. Due to the increased risk of (salt)water inundation, agricultural and other land uses are threatened by soil erosion and (soil) salinization, damaging the territory and altering the aquatic and coastal ecosystems and thus affecting the cultural and traditional food chain. There is also an intangible layer in the problem statement, as due to the Anthropogenic ways of living, there is a social alienation towards the intangible heritage of the water identity, which concerns (forgotten) water-based religious, spiritual, and social practices and rituals. For these reasons, the area is in a vulnerable and critical condition and is in urgent need of a transformative approach towards a water-resilient future.

3.1 PROJECT FRAMEWORK

To answer the stated research question a project framework has been designed to explain how the project accomplishes the preferred outcome(s) (stated in *Chapter 2*).

To simplify, the framework is divided into four project 'stages': design of the project, project intervention(s), post-project, and shift in paradigm, along the perspectives of conditions, project, and proposition. In the framework, the three perspectives are colored to emphasize the different layers. The project layer (white) explains the different stages, and how this is constructed, of the project. The conditions layer (top grey) emphasizes the conditions that the current design stage has to cope with, regarding water. Lastly, the proposition layer (bottom grey) explains the aim of the project in specific design stages with specific conditions (Figure 3).

The project starts with the design of the project. After the research question (stated in the introduction of this chapter) is formulated the approach of research by design is utilized, through which there is a constant exchange and interaction between an analytic system approach and exploration of non-linear interscalar designing. In Chapter 3.2 the Methodological Framework explains the specific methods and steps taken that support this approach. As a result, the current situation has been identified through which the required planning principles (Chapter 4) based on this current situation are proposed as the foundation for the vision of the project intervention(s) in the next stage. These planning principles have to work with the intangible and tangible elements that are currently not connected and cooperative. The conditions of this stage is a state of static uncertainty as the world is composed of static structures such as urban settlements, industrial constructions, infrastructure, and private land uses, in an environment that is threatened by uncertainty through a changing climate (environment) projected by extreme periods of drought and floods that this static world has to cope with. In the next stage, the project intervention, the conditions are in a state of transition from static to dynamic certainty as the introduced project intervention has to take into account and cope with the existing static conditions but simultaneously, implement a transformative strategic vision (proposition layer) that argues for water-resilience, a concept working with the dynamics of water. In this transformative vision intangible and tangible elements are (re)connected and (re)integrated. The project intervention(s) is an interscalar design that is firstly a small-scale water-sensitive urban design. However, this is within a strategic design on the macro- and meso-scale, connecting the scales. Implementation of several, smart small-scale water-sensitive designs in various territories provides an opportunity to impact the larger region, composed of various territories (coastal, (agricultural) in between-hinterland, urban, and mountainous). It is important to emphasize the fact that the first motivation for this project was the wandering of how a nearby future would look like if a transformative approach were implemented to deal with the tangible and intangible water challenges. Thus, regarding a human-scale design that has an immediate impact and copes with the current conditions of a changing reality of water dynamics. But as already stated, simultaneously, there needs to be a design that incorporates the long-term vision consisting of an open-end that allows for adaptivity and flexibility for uncertainty. Therefore, the interscalar design is of great importance.

Moving to the post-project stage is characterized by a process of restoration & rehabilitation through the (human-made) design interventions that support and nature-based solutions that allow nature to heal itself. In the period up to 2050 major systemic changes will happen in various aspects such as 'the carbon neutral' and 'clean energy transitions' and global warming will be at a 1-1,5 degree increase (source). Therefore, this is the turning point of 'restoration & rehabilitation' to a period with a focus on rehabilitation, restoring Earth's health, and the systematic functioning of humans on how they perceive water, which will be reflected through the long-term impacts of the project intervention(s). The conditions and proposition will still be in a state of transformation and transition. In the year 2100, an (currently) estimated sea level rise of 1 to 2 meters will be measured.

From this point on, life with water will drastically change. However, this will not be a sudden change as this project proposed a slow transition towards a new water reality through adaptive and flexible designs. Therefore, from this moment, the transformative strategic vision will be transitioned into a state of transformation. This will be characterized by a shift in the paradigm of how to live with water in which intangible and tangible elements are (re)connected and (re)integrated, but are also interdependently related and functioning (proposition layer). The conditions will be dealing with water dynamics and uncertainty (as we do not know what the future holds for us), to which the interventions can adapt. The project will be supporting and ensuring (within its limits) a state of restored water equilibrium after a period of restoration and rehabilitation.

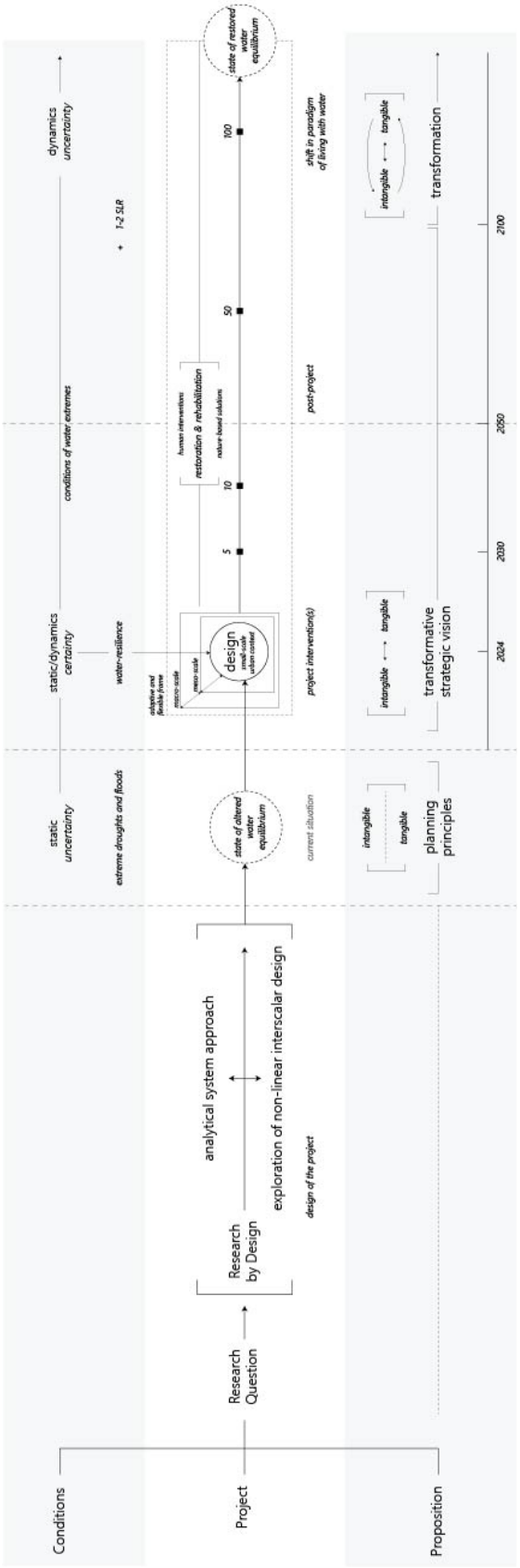


FIGURE 3 | PROJECT FRAMEWORK

3.2 METHODOLOGICAL FRAMEWORK

To provide a better understanding of the stage of the design of the project, as abstractly explained in the previous paragraph, the methodological framework is featured (Figure 4). In this framework, the utilized methods are visualized and their (inter)relations, are explained through three phases: exploration through (theoretical and analytical) research & critical mapping, and non-linear interscalar design through the approach of research by design (phase 1). P2 marks the 'end' of this phase by presenting the sub-conclusions and design outcomes of this research by design and providing the construction of this project through the Methodology, as explained in this chapter.

The second phase is defined by field work as the project location, the southeastern part of the region of Emilia-Romagna in the Po Valley, Northern Italy, is visited. This method is utilized as it is a crucial way to understand the complex Po Plain territory and Italian culture, which cannot only be understood and researched through digital sources. Through this way, the tangible and intangible water identity (and its heritage) that varies through each part of the region, could be identified and understood. While visiting, (analytic) research through various methods will be executed (figure 3) and summarized in the second stage of sub-conclusions, defining the 'end' of phase 2.

Then lastly, phase 3 is entirely focused on the method of research by design as the main design phase had started. It is important to acknowledge that this design phase is non-linear and simultaneously interscalar. As design is explored, evidence-based research has accompanied this phase that continued to formulate the scientific base of the design.

Methods
As the framework illustrates, various methods have been used that construct this design process. Therefore, an explanation is provided to explain what methods are used, what they entail, and why they are used.

Phase 1
Critical Discourse Analysis
This method is used for the theoretical approach of this thesis project, partly provided by the Studio Transitional Territories itself, to construct the knowledge foundation on which the project will be built. It provides the (theoretical) understanding of the phenomena behind the problem field and explores a deeper layer of awareness as 'what one generally refers to as the truth' (Giseke et al., 2021; p. 64).

Literature Review
A literature review is used to demonstrate the understanding of the knowledge that has been gathered in the context of the topic of the thesis. It answers theoretical sub-research questions related to the research question and provides an overview of the critical discourse analysis. It is a critical reflection to formulate the definition of key concepts and understanding of the knowledge referred to as the truth.

Urban Data Mining
This method describes the exploration through research and analysis of existing datasets to discover and extract useful data and conclusions to be able to understand the problem field and project context. It is used to uncover hidden layers of data that only through this method can see the light. During this thesis, the main dataset that has been used is through GIS.

Palimpsest (historical analysis)
This method is also referred to as a 'longue durée': the historical study and analysis of the problem field and project context. This is used to uncover and discover the (hidden) historical structures and systems that structure and frame the contemporary territory and social construct. This method aims to create an understanding of historical phenomena and their relation to the transition and transformation of the territory by defining key events and elements that explain this evolution. This covers the social, political, geological, environmental, and economic layers of society.

Viewing the Urban through an Ethnographic Lens
This method includes the study of social constructs and thus the study of cultures, based on a theoretical approach. The aim is to understand the genius loci. This method can be under-divided into the sub-methods observation, language, storytelling and myths, note-taking (writing and visualization), interviewing, focus aspects, and (digital) documentation.

Critical Mapping Spatial Systems
This method aims to unveil existing structures, spatial knowledge, and power relations through new connections and (inter)relations, which will be mapped visually. It is a matter of selecting spatial structures by dividing them, adding new layers, and superimposing them to reveal this 'new reality' in spatial complexity.

Interscalar Design
This method is used to design through scales (macro, meso, and micro), which will be executed in a non-linear way.

Analyzing (and visualizing) actors
When (key) actors are defined through analysis of the problem field and project context they are visualized to provide a clear understanding for the audience. It is a way of researching, discovering, and concluding the findings.

Phase 2

Fieldwork

This method aims to collect data by physically exploring and analyzing people, cultures, and natural environments. This is used to not limit a project to digital and theoretical gathered data but to provide an opportunity to understand spatial contexts on a deeper level in 'wild' everyday surroundings instead of semi-controlled environments (Field Work, z.d.). Sub-methods that will be used are photography, videography, interviewing, and observation.

Analyzing 'pictures'

Picturing is a way of constructing social behavior, physical objects and elements, and relations to tell a story. It is a way of visualizing reality differently while focusing on a certain perspective. By analyzing these 'pictures' linkages are unveiled. Pictures can be photographs, images, movies, visualizations, paintings, drawings, reference projects, and collages.

Diagrammatic sketching

Through conceptualization and simplification, key conclusions and findings are visualized for the audience. These are often conceptualizations of complex spatial structures, relations, observations, and flows which can be of tangible or intangible character.

Phase 3

Research by Design (also executed in phases 1 and 2)

This is an approach that uses design as an explorative and research method to communicate knowledge. The design is used to understand the effect of design decisions to reflect on and adapt. For this method, the method of designing with conceptual models can be utilized. This method visualizes the design explorations in a three-dimensional, physical manner that enriches the research by not limiting it to two-dimensional explorations. There are four types: conceptual models, working models, structural models, and presentational models (Giseke et al., 2021).

Producing and reducing complexity

These are two broad approaches to simplify complexity and embrace complexity. 1) bases city development on a few simple, universal spatial rules (reduces complexity) and 2) takes a participative, collaborative approach to city development (produces complexity).

Intervening through system thinking

The main argument for the importance of this method is that wicked problems (problem fields) cannot be approached in isolation as each problem occurs in a system of complexity. Methods such as narrating through system thinking uncover the various layers to create an understanding and afterward superimpose it to bring it back to its complexity. This argues for a holistic approach to produce a realistic solution. 'There are some general guidelines: problem definition, analyzing the urban-natural complex as a system, circular instead of linear design-thinking (long-term), and transdisciplinary/cooperative approaches' (Giseke et al., 2021; p. 175).

Curating evolutionary landscapes

'It proposes an open-ended, process-oriented approach to deal "with the problem of determinacy versus indeterminacy, the integration of time in design, and systemic openness for changes in the design environment ' (Giseke et al., 2021; p. 236). This method ensures the evolution and transitions of landscapes (systems) to be adaptive to (future) uncertainty regarding climate change and/or changes in social constructions.

Visualizing possible future 'scenarios'

This design method visualizes a possible future scenario of a hypothetical character. It is a way of visualizing short and/or long-term scenario developments in a complex system reality as a certain future framed in a blueprint will not result in an adaptive and/or resilient future. Therefore this scenario is utilized, to ensure open-mindedness without fixed limits.

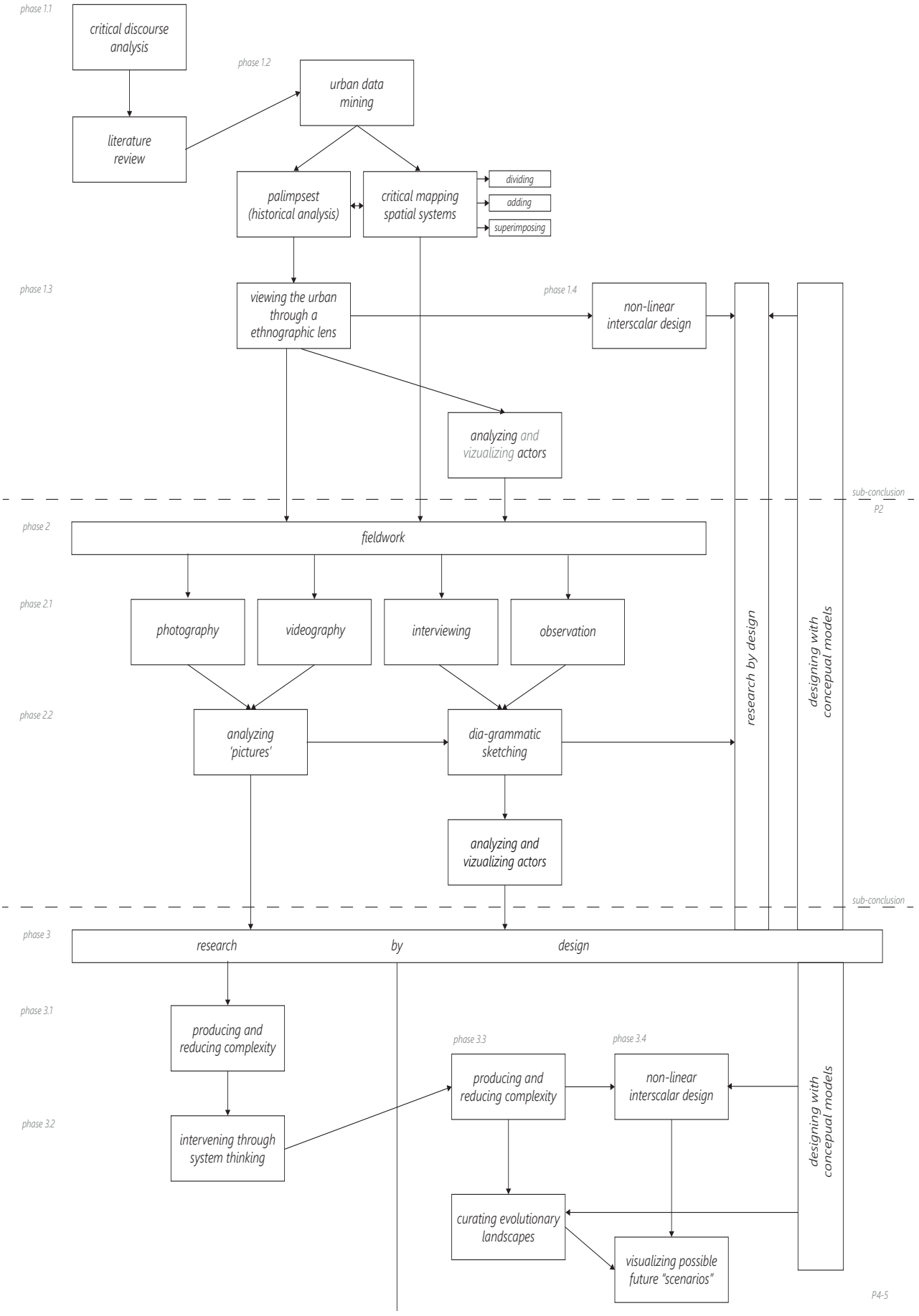


FIGURE 4 | METHODOLOGICAL FRAMEWORK

3 THEORETICAL FRAMEWORK

In the theoretical framework, key concepts are defined to formulate the problem statement and research question. Foundational existing theories are discussed, and their relations provide the theoretical underpinning of this thesis project (Bracken, 2023). The theoretical framework is divided into separate elements: paradox, paradigm (shift), subjects, concepts, theory, and disciplines, and visualizes their relations (Figure 5).

The paradox of this thesis is between hydro-engineered landscapes and hydro-variability. Due to the hydro-variability, which includes flood and drought hazards, hydro-engineered landscapes (human interventions) were created to minimize the impacts of these variabilities. However, the conditions of these engineered landscapes can actually increase the impacts of the hydro-variability, resulting in a paradoxal outcome.

Therefore, a paradigm shift is required. Currently, the paradigm involves human actions aimed at introducing, maintaining, and supporting a state of static certainty in an altered water equilibrium through a national and regional strategy of control (Malatesta, 2013). This transformation requires a paradigm shift towards living with water (both abundance and scarcity) in tangible and intangible ways, moving towards a state of dynamic uncertainty by which the water equilibrium will be restored.

The subjects that support this proposed paradigm shift are humanized landscape, territorial longue durée, water identity, and floodscapes. Except from territorial longue durée, which will be explained in Chapter 4: Spatial Analysis, these subjects will be further explained in this chapter.

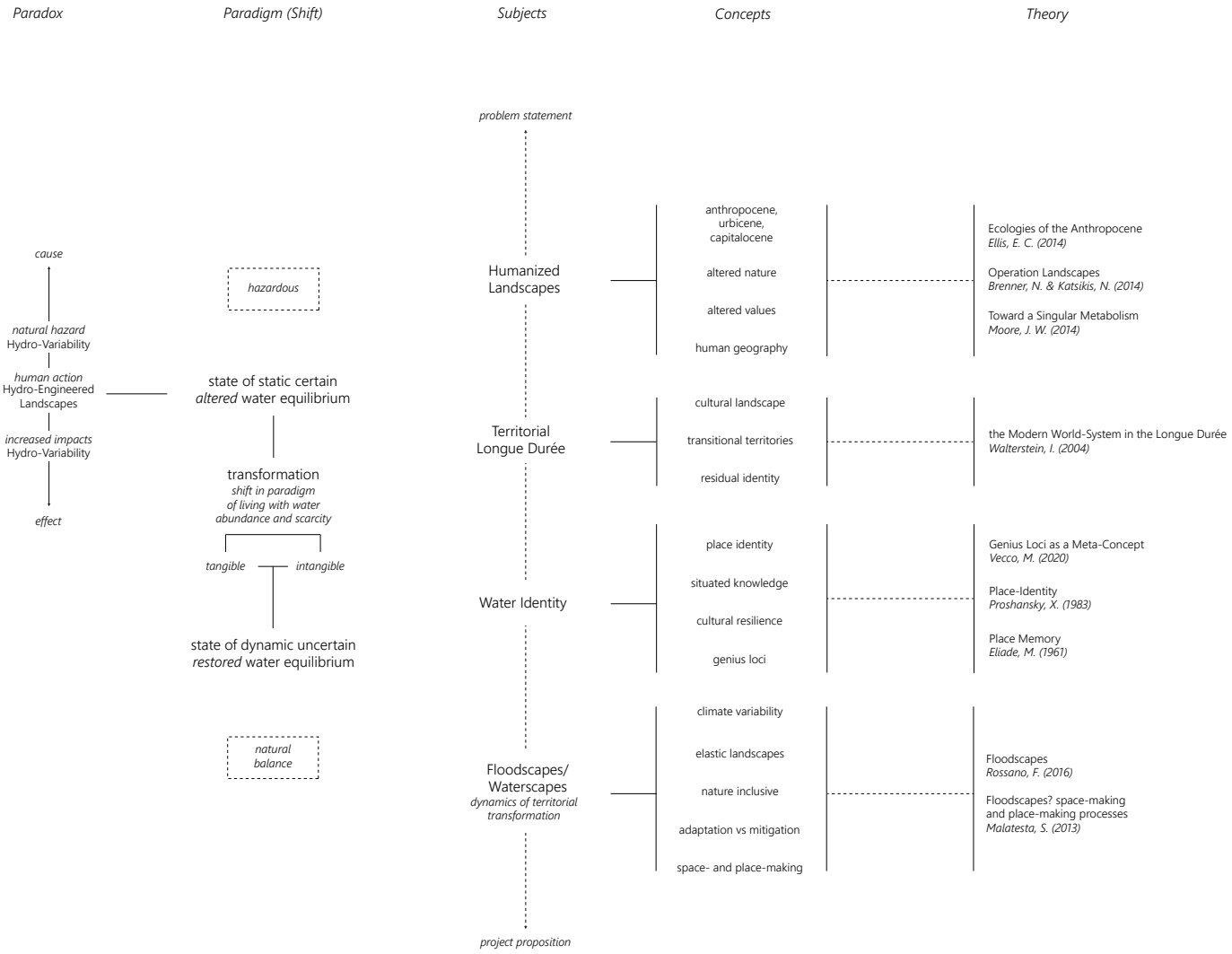


FIGURE 5 | METHODOLOGICAL FRAMEWORK

Humanized Landscape

The current state of the Earth's natural systems and processes is shifting drastically due to global warming, the climate crisis, rapid urbanization, population growth, and socio-technological innovations. This marks a new geological epoch, the Anthropocene (Magnason, 2021). The Anthropocene defines and introduces a new period in which nature has been altered by human activities, causing irreversible impacts on its ecosystems and landscapes. Though the alteration of nature by humankind to adapt it to their needs has been done for centuries, as historical records and heritage show, the scale, scope, and speed of this alterating now exceed natural limits, marking an unprecedented moment in human history and introducing humankind as a global force.

This transformation involves a global environment of commodity production and exchange, fundamentally changing the relationship between humans and the Earth's natural realm. This change aims to ensure the required proportions of nature and its benefits for global economies and societies, causing severe pressure and irreversible destabilization. In the area of this thesis, the southeastern part of the Emilia-Romagna region, destabilization is caused by sea level rise, increased pressure on river discharge, and sinking of the delta due to soil subsidence, all driven by human-induced alterations.

Acknowledging both the contemporary state of the Earth and the processes of the Anthropocene, the Capitalocene, and Urbicene paradigms - which explain that the Anthropocene results from capitalistic processes involving the relation between capital, power, and nature and consider planetary urbanization as a geographical result of the anthropogenic processes (and thus capitalistic processes) - provides a deeper understanding of how this state has been produced. This understanding encompasses the various complexities and spheres that occur and are simultaneously intertwined and disconnected, guiding further investigation of processes related to the thesis problem statement.

Brenner and Katsikis (2014) describe how the processes of the Anthropocene, and thus Capitalocene and Urbicene, have led to the neglect of the hinterlands. In the 1950s , this created a perception of non-city spaces as irrelevant background spaces compared to cities, understanding urbanization as cityisation (city-centric urbanization) and separated from 'supporting' hinterlands: 'non-city landscapes' and 'sacrificial zones'. However, the counterpoint of Metabolic Urbanization shifted this perception towards seeing urbanization as a metabolic process, acknowledging the interrelation between cities and hinterlands. Cities are provided by and rely on hinterlands, the 'non-city spaces', and both co-evolve and co-produce due to their interdependencies. This understanding of co-evolving and co-producing shifts the perception of the separation between hinterlands and cities to metabolic urbanization of multiscalar citylandscapes, connecting from local to global levels.

Nowadays, globalization in the Capitalocene has transformed the contiguous city-hinterland connection to distanciation of this relation, producing hinterlands of hinterlands through global commodity production and exchange. The Capitalocene shifted from formal to real subsumption, exhausting natural land with more capital for more capital to sustain its maximum productivity. This causes metabolic rifts and cycles of creative destruction as social and ecological metabolic processes become disconnected, destabilizing, and exhausting the ecological surplus of the hinterlands and their ecosystems (Moore, 2014).

For this thesis, this challenges to perceive the area not only as a regional entity with integrated local processes but also as a strategic point in a global web of production and exchange. In this web, 'borders' fade to prevent cycles of creative destruction fuelled by the Capitalistic distanciation. Importantly, it explores how to design with this evolutionary process of creative destruction in operational landscapes, transitioning into nature-sensitive processes without exhausting ecological surplus and acknowledging hinterlands as part of urbanization.

In this geological epoch of planetary urbanization processes and intensified global connectivity, it is hard to imagine a world beyond human, more-than-human landscapes and spaces. Whereas in the past humans and nature were perceived as two independent systems, they are now critically intertwined in a complex relationship (Malateseta, 2013). As humans have altered nature in the Anthropocene, a result of Capitalist processes, production landscapes arisen. However, nature is not produced and exists outside humanity, causing an epistemic rift between nature and society. The Po basin and coastal territory of its delta are operational landscapes that are fully capitalized. The rapid expansion of urbanization, infrastructures, large

constructions, agricultural irrigation processes, and extraction of resources is pressuring soil stabilization, causing land subsidence and increasing flood risk besides sea level rise and increased river discharge.

Therefore, there is a great need to grasp the more-than-human world to transform the imbalance of the natural world into an adaptive system of humans-in-nature. As we are beyond the frontier conditions in the Po Valley and are entering the end stage of exhaustion, we need a transformative approach to prevent the chain of closing frontier landscapes and the final exhaustion of the ecological surplus of nature. This calls for a softer impact on nature, demanding unproduced landscapes while 'giving back to nature' to recharge this ecological surplus. However, the contradiction lies in the dependency on intensifying the primary production system as urbanization and population growth rapidly increase.

This thesis needs to explore how to cope with these Capitalistic developments through green sustainable urbanization and social-ecological justice. It aims to meet societal demands while restoring and adapting natural space to human-induced risks such as flood risk, soil subsidence, soil degradation, drought, and salinization, while providing space for nature to simply be unproduced. The goal is to shift the perception of humans-and-nature to humans-in-nature (again).

As previously explored in the theoretical discussions on the Anthropocene, Urbicene, Capitalocene, altered nature by altered values, and human geography, the contemporary state of the Earth is a critical, complex interplay of the human and natural systems. Each is altered by the other, continuously impacting the other. Therefore, this thesis defines this process as the *Humanized Landscape*, explaining the processes that have produced the paradigm of nowadays society and Earth's state and what transformative shift is required to heal the damages done.

Water Identity

At the core of identity is the concept of genius loci and its relation to place. Many philosophers and scholars from various disciplines have contemplated the concept of genius loci, crafting definition of this profound relation. Vecco (2019) proposes a paradigm shift, viewing genius loci as a meta-concept - a holistic approach that positions genius loci as a core element of place-making through analysis and suggesting relations of many concepts of genius loci over time.

Debates on the theory of genius loci were executed by ancient philosophers such as Democritus, Plato, and Aristotle and provided the base for philosophers that followed. But why do all these discussions on genius loci, which in its mythical origin in ancient Roman times referred to as a protective 'genius', occur (source)? Or a dwelling god, regarding the space where the god was (spiritually) situated? A great explanation could be the undeniable strong connection to the concept of identity, a spirit, and is this not eventually what human life is about? Who we are, were, and can be or could have been?

Vecco (2019) brings to light many definitions, from Lukermann (1964) who argues place is a result of experience to Norberg-Schulz (1980-1985) who critically, but strongly captured the definition of genius loci. He defines the common identity that connects communities and individuals in society. It is composed of the environmental character, with its tangible features of 'the essence of place', and the intangible features of character or atmosphere that is in constant transition due to seasonal alterations. 'The character is based on geographical, historical, cultural, architectural, economic, and social coherence' (Vecco, 2019; p. 4) and its interaction and therefore is part of a holistic entity. This explains the complexity of the 'identity' or 'essence of place' as it thus is both tangible and intangible, something we cannot grasp physically.

Saussure states that place is a signifier, connecting the memorial mind of humans to a place, with the place serving as a reminder of the memory it holds. This relates to Eliade's (1961) theory on place memory, suggesting that genius loci in the intangible sphere is more than just the essence of place but also resides in the memorized mind of humans, whether individual or collective.

There is an aspect of uniqueness connected to genius loci, as each place has different cultures interacting with its environment, transforming it into a cultural artifact carved into the landscape. Thus, genius loci can be divided into two elements: the 'natural environment' (tangible) and the complex 'human cultural environment' (intangible) (Hu, 2001). Sack (2003) debates the complexity of this concept, arguing that place is foundational for meaning and society (social, cultural, and natural), rather than being a result of their interrelation.

Hillmann (2004) contends that 'places are emotional and identities, having a soul. Our task is to discover it, just as we would get to know other humans' (Vecco, 2019; p.5). This intangible emotional layer, often referred to as a soul or a spirit, underscores the importance of understanding the relation between place and genius loci, which is crucial to our existence. Discovering this soul refers to the human cultural environment, which forms the identity.

The concept of place involves the processes of anthroposiation of landscapes and territorialization, which produce the identity of place and genius loci, in both tangible and intangible ways. Place is not static, it is in constant self-reproduction of temporal 'dominances' shaped by human processes, integrating the aspect of space-time. This frames the genius loci as a place as living testimonies of landscapes of culture and nature. (Magnaghi, 2000; 2006). Places are constantly shifting, transitioning articulations through time.

As the meto-concept defines, 'the identity of a place is a multidimensional construct of the natural, social, the empirical, and the cultural' (Vecco, 2019; p. 10), articulating the holistic aspect of this concept. It summarizes the three main factors of the tangible material layer, the intangible experience of place memory of which place is a signifier, and the interrelation of the continuous processes of the natural environment and human cultural environment framed by values in space-time.

Why is this meta-concept that suggests a paradigm shift to a holistic, interrelational concept of genius loci and place, approached? It is important to understand the living environments and cultural landscapes of places as the spirit of place does not exist without human construction. Why? As it is a necessary condition for human life to understand this, the essence of place, identity, spirit, a being in both tangible and intangible meaning. Because if not, genius loci are threatened to be lost. 'Protecting and conserving

the genius loci does not mean copying ancient models, but highlighting the identity of the place and interpreting it in a new way' (Vecco, 2019; p. 11). Only in this way (non-linear rethinking-protecting-transmitting place and its genius loci), living traditions, collective memories, and transmissibility can be preserved.

For this thesis, this perspective ensures the cultural resilience of places, both tangible and intangible, which is fundamental for the sustainable development of humanity. The core of the problem statement addresses tangible water challenges, but it also emphasizes the intangible factor of social alienation from water identity. Understanding the theoretical foundation of identity, rooted in the interrelation of genius loci and space (both tangible and intangible) and framed by the values in space-time constructed by the continuous processes of the natural environment and human cultural environment, is crucial to understanding how this social alienation developed. The loss of genius loci occured when human processes dominated the natural environment, erasing its memory and spirit. Water was part of the place and with that, the genius loci, the spirit. Modern land reclamation and water control further alienated people from their water identity, destabilizing cultural resilience.

The definition states: *'Water Identity refers to the intrinsic connection between water and the cultural, historical, and environmental character of a place. It encompasses both tangible aspects, like physical landscapes shaped by water, and intangible aspects, such as the cultural and social meanings attributed to water through human interaction and memory.*

Rediscovering water identity is crucial for sustainable human development and a water-(cultural)-resilient future.

Floodscapes

The terminology of 'floodscapes' is defined based on personal assumptions supported by scientific literature for. The current strategies for flood hazards are controlled strategies that result in an impact-effect paradox, as explained in the introduction of this paragraph. Therefore a new paradigm is needed - a shift from controlled landscape approaches to flexible approaches that allow space for the complexity of natural system dynamics, particularly regarding water (Magnason, 2021; Rossano, 2016; Malatesta, 2013).

Rossano (2016) discusses how ancient philosophers such as Xenophanes, Herodotus, Aristotle, and Theophrastus were fascinated by the hydrological mechanism, as water was intensely intertwined with art, science, and theology. In each domain, water has continuously been a protagonist. The Great Flood, also 'Noah's Flood' in biblical scripture, was foundational for destruction and clean beginnings (a cultural reset). Greek Mythology spoke of similar floods as it was a tool for Hercules to conquer the Mynians and punishment from Zeus to human mankind. In the 6th century, Xenophanes theorized the alternation of water levels through discoveries of fossilized sea animals in the terrestrial territories. Aristotle supported this with the theory of universally cyclical flood. Theophrastus introduced the theory of climate variability, defining this hydro-cyclical-fluctuation theory. During the Enlightenment, the discipline of Geology emerged, introducing new perspectives on Earth's natural phenomena.

With the introduction of Geology and centuries of theory development on hydrology and the phenomenon of floods, humans evolved an understanding of the Earth's history and its complex systems. Understanding that these elements are a constant of transition, of dynamics, and that floods are part of the landscape. Ancient cultures illustrate how they coped with these flood mechanisms and built their even primitive settlements on floodplains, such as the Italian Terramaras and Dutch Frisian terps (Rossano, 2016)(Cremaschi, et al., 2016). They understood that water is a fertilizer of soil, providing sediment alluvials on which agriculture could blossom when the water retreated (Malatesta, 2013). In Rassona's (2016) he defines these landscapes on which these populations functioned as pre-industrial floodplains in which humans made the natural system work with their human system.

Then, as explained in the subject of *humanized landscapes*, with the introduction of modern times decentralized adaptive communities were replaced by societies with urban-centered individualization as capitalistic economic growth overpowered the wild sublime (Rossana, 2016). In essence, humankind evolved, in their mind, to be an overpowering nature through an egocentric perspective and started the controlling hydraulic works of river canalization and land reclamation as a result of flood hazards. This underlies an interesting theory in flood hazard science as a shift has been introduced that can be reflected through Dennis J. Parker's (2000) description of the concept of (flood) hazard. Flood *hazards* are only 'hazardous' when human systems are affected by the hazard phenomenon. In ancient times, before this human (re)action on the flood hazards, populations were adaptive as they were cooperative and in balance with the flood *mechanisms* which were not perceived as *hazards*.

Therefore, for this thesis, the theoretical terminology of *floodscapes* is introduced as it explains a paradigm shift on the ways ancient and modern humans live(d) with water and captures an adaptive, nature-inclusive landscape of elastic nature. As the climate is changing and floods (and droughts) will increase, there is a call for design strategies that can cope with the uncertainty of the future while coping with water challenges that are faced now. This concerns strategies that are elastic, provide elastic landscapes, and are nature-inclusive, thus working with the dynamics of the complexities of nature's system. It requires a certain flexibility that can adapt. At the same time, it can mitigate the impact of the flood or drought occurring as can be taught by ancient practices of Frisian terps that systematically mitigated the impacts of the floods and natural wetlands, which constructed the ancient wetlands before they were reclaimed, which can absorb and release water to adapt to seasonal (and thus climatic) variations (Rossana, 2016)(Piovan, Filippini, & Hodgson, 2019). Simultaneously, the floodscape will not be 'lost space' as multifunctionality will be at its core, and, different from ancient times, there does not have to be a 'waiting time' for when the water retreats.

However, the Earth was not as densified, inhabited, and structured in ancient times and even modern times as it is now, and within this floodscape, certain conditions and elements need to be considered. It is not the same type of floodscape as the pre-industrial floodplains. This concerns not just urbanized areas, industrial construction, and

infrastructure, but also social-economic domains such as economic growth, social identity, and culture. Malatesta (2013) argues that flood hazards were crucially integrated in space- and place-making processes. The article explores '*the dialect between institutional control over space (space-making) and the meaning local communities give to places (affected by floods) (place-making)*' (Malatesta, 2013; p. 3). Thus, he refers to the terminology of floodscape as the interplay between space-making, different layers of material & physical transformations, land-use planning & control strategies, and modified spaces due to stigmatization of fear, and place-making, the social actors' interpretations of these control strategies, processes as a result of flood hazards.

To conclude, the definition of floodscape for this thesis project is as follows:

'*A landscape based on interaction and coping with the constant state of territorial transformations by the fluctual dynamics of flood mechanisms. It is elastic and adaptive in the short- and long-term through nature-inclusivity, incorporating the interplay of flood-based space- and place-making processes while considering the Anthropogenic structuralization of the modern post-industrial floodplains*.'

3.4 CONCEPTUAL FRAMEWORK

As the theoretical underpinning is framed and key concepts are identified and explained, this chapter will explain how these concepts are interrelated through the Conceptual Framework (Figure 6).

This framework illustrates what is expected to be discovered through this research, answering the research question '*How to design a water-sensitive reality on the human urban scale in the Emilia-Romagna region for flood and drought protection while reintegrating water heritage as a way of living?*' Therefore, this thesis aims to develop a design for a water-sensitive Anthropocene, a transformative way of living with water. The main concept variables of the research are mapped through a relational system based on a cause-and-effect relationship.

As the problem field and statement have explained, the *Anthropocene* is a new geological epoch in which human activities have altered nature, causing irreversible destabilization of its ecosystems and landscapes. The concepts of the *Capitalocene* and the *Urbicene* re-positions this thesis with a deeper understanding of how this Anthropogenic 'state' has been produced. The Anthropocene is a result of capitalistic processes (with a relation between capital, power, and nature) and considers planetary urbanization as a geographical result of the Anthropogenic processes (and thus capitalistic processes).

As a result of this state, two main indicators have affected the region of Emilia-Romagna. The tangible factor of the *climate crisis* illustrates the contemporary state of the Earth as a result of the Anthropocene which has *altered the hydrological cycle*, impacting the Earth with the extremes of long periods of drought and flood risks. At the same time, there is an intangible layer of s*ocial alienation towards the water identity* of the region as there is a *lack of social awareness* of the past water-related relationships the ancient Emilia-Romagna society had deeply rooted in their culture.

Therefore, the framework relates the concept of the *human framing of water* in the Anthropocene, as the *longue durée (historical analysis)* revealed the change of the cultural water relations which illustrates a society that is living with water to society in a state of control of water. This residual water identity is the *water heritage* of the region, which describes the *water identity and culture* of the region of what it was and what it currently is. This water identity is both tangible, physical structures, and intangible, cultural practices, traditions, and rituals. Therefore, the water identity/culture is related to the social alienation towards the water identity as the current state of the water culture is a social alienation, a total shift of how it was in past generations.

As the framework illustrates, the problem statement ends with the statement of social alienation towards water identity through a lack of social awareness of this identity and the extremes of the altered hydrological cycles caused by the climate crisis which threatens the regions with flood risks and long periods of drought. The aim is to design *climate resilience* for the region of Emilia-Romagna as it is impacted by climate change. However, within this climate-resilient design, the *social & economic values* of the currently existing society and its culture that require it to remain and environmental values that enable climate resilience need to be defined. Values are also necessary to be able to raise awareness of the lost connection with the water identity of the region.

Climate resilience requires a climate-sensitive design as it is a climate-responsive design and within this thesis, the focal point is a *water-sensitive design*, due to the challenges of the extremes of the altered hydrological cycle. As the output of this thesis will be a design on the small scale in the urban territory to reflect on how to live with water in human daily life, the design solution will be explored through water-sensitive urban design while being integrated into the meso- and macro-scale as this project will be an inter-scalar design. With this design the analysis and research frame will close and the design solution will be a *transformative approach to living with water in a water-sensitive Anthropocene*.

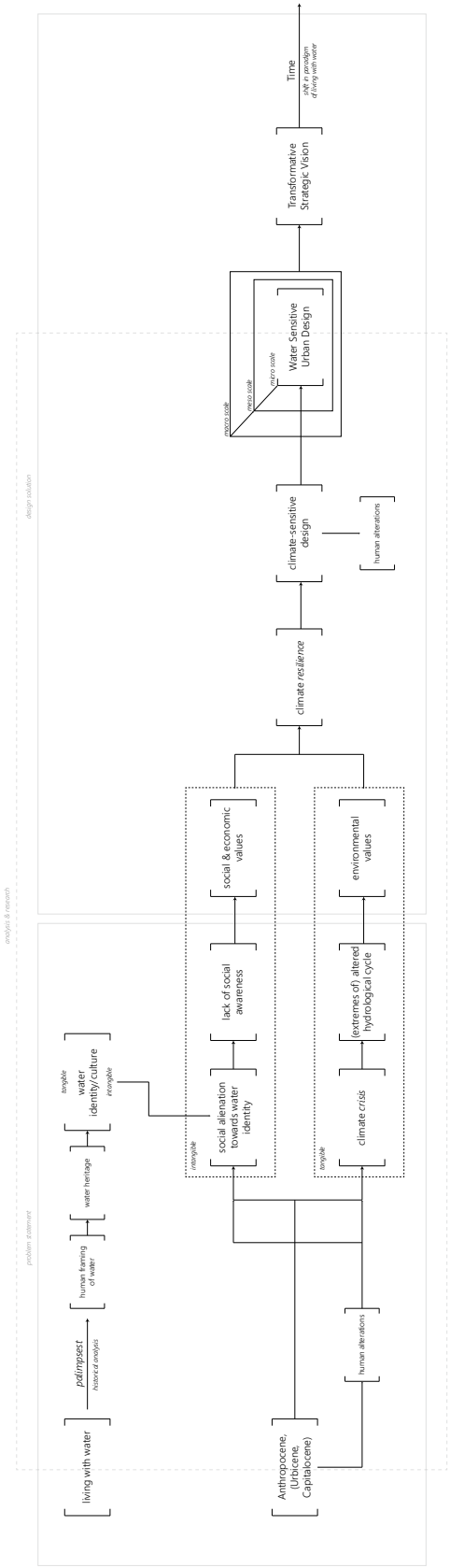


FIGURE 6 | CONCEPTUAL FRAMEWORK

Notions

During the first phase of the thesis, *notions* were introduced to frame the project. As notions are a conception about something, it is a general conception of something known, experienced, or imagined ("Notion", 2024). The difference between the concept variables and the notions is that the notions reflect the general conception and are positioned within the conceptual framework to highlight where these notions are defined and to relate the theoretical exploration and background to the project. The concept variables are specified and defined as key variables of the thesis and are context-related.

The first notions '*altered value & residual identity*' and '*altered nature*', which are described in Chapter 4 (intensives), are related to the concept of human alterations. It explains the consequence of the altered nature, which has altered the values rooted in society as a result of the Anthropocene. This also has affected and resulted in the residual identity of the area, the 'leftover'. Both relate to the altered (water) identity of the area, which is explained by the palimpsest. These altered values have caused social alienation towards this water identity which is the residual identity. It shows the traces of historical phenomena both tangible and intangible of how the Earth is altered by the human forces conquering the water, transforming fear into a sense of disrespect towards nature as water lost its meaning in society, at least what it once was, leaving water as an empty body of nothing without meaning. As altered value & residual identity are related to the social alienation towards the water identity, the intangible layer, the notion of altered nature is related to the climate crisis, the tangible layer. In the 'simplified' conceptual framework the climate crisis is related to the extremes of the altered hydrological cycle. In this version, the climate crisis is related to a more specific division of the notions of *scarcity,* related to the scarcity of water and thus the long periods of drought that target the region of Emilia-Romagna. On the other hand, the climate crisis relates to the notion of *abundance* (of water), and thus the increasing flood risk of the region that threatens multiple layers of society.

The notion of *zones* is connected to the water heritage and water identity/culture. The palimpsest explains the shaping of the residual identity, which is also partly the water heritage. This water heritage is one of the key elements of the water identity and culture of the region. However, there is not one identity or culture. There can be spoken of the 'Italian culture', but within this culture, there are various, rich identities and cultures depending on regions and thus zones. Therefore, the notion of zones (Chapter 4) is introduced. Zones allow us to unravel the incomprehensive systems' complexity and to be aware of the plurality of objectives. In this way, it allows a way to understand patches of place, and thus patches of identity, which diver immensely in already 'just' the Northern region of Italy and the region of Emilia-Romagna within. This is further explained within the framework as the zones are thus the (cultural) regions, which can be divided into mountainous territory, agricultural hinterland territory, urban territory, and coastal territory.

Then the notion of *limits*. This notion is introduced before the concept and aim of climate resilience as there will be limits to what extent climate resilience can be reached which will influence the outcome. There are tangible limits such as climate change, the hydrological extremes of weather conditions, floodings, and periods of droughts, and the internal configuration of water that is changing due to climate change such as salinization and acidification which is impacting and limiting life with and in water bodies. These together greatly impact the various layers of society, environmental, social, and economic. But also, the terrestrial composition of which the limits are infrastructure, heavy industry, and urban structures which are static, demanding, and non-flexible. These need to be considered during the design of climate resilience as they will restrict it. And then there is the intangible limit of the (Italian) culture, which is determined by traditional practices that are rooted in the culture and close by heart whereby it has this emotional layer and economic profits based on cultural practices of production that allow a specific way of living and comfort that humans challenge with to change or submit.

The notions of *grounds & rare earth*, and, again, zones. The grounds and rare earths are connected to zones, as the tapestry of the ground defines the various grounds and rare earths within the zones. Water is strongly intertwined and interdependent with soil, and therefore climate- and water-sensitive design requires the introduction of the notion of grounds & rare earths. An awareness and understanding of this interrelation and the functioning of the soil is crucial to be able to design climate-sensitive. Various areas of society, such as agriculture and landscape (restoration), are dependent on soil types, threatened (rare) soil, and benefits that are provided by the variety of soil.

Lastly, the notion of *impermanence* which touches upon a state of temporariness and transitoriness. This notion is placed in the design phase of the project as it is crucial to ensure a state of transitoriness with the proposed transformative approach. Due to future uncertainty caused by altered natural systems, the design essence is required to be adaptive to be able to 'work with the complex dynamics and systems of nature'. Thus, the design will not be a blueprint but rather a flexible, open-ended proposition working with impermanence.

4

SPATIAL ANALYSIS

A TERRITORIAL EXPLORATION - PAST AND PRESENT

The Spatial Analysis consists of four parts. Firstly, the mandatory studio intensive and Urban Geography intensive. Secondly, the Longue Durée, which explains the historical transformation of the territory. Thirdly, the analysis of the dominant, critical elements in the territory and how these elements are composed and relate to each other through the Dutch Layer Approach. Lastly, a stakeholder analysis to frames the direct and indirect stakeholders impacted by the current conditions and proposed alternative future.

4.1 INTENSIVE TRANSITIONAL TERRITORIES

SEMENTIC FIGURES

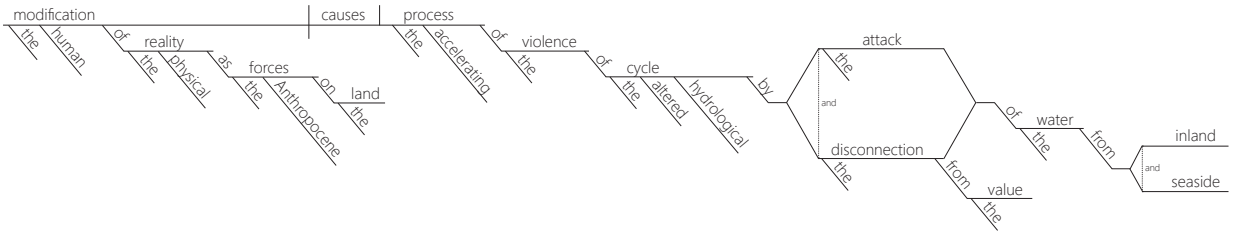
Altered Nature

General Definition - The altered nature is a contemporary imbalanced system of processes, disconnected from the essence of life through the human modification of the physical phenomenon of interdependent elements, materials, and beyond human and human life on the Anthropocene (human, terrestrial, and aquatic Earth), causing the estranged, distant, and unfamiliar perception of 'nature' in this changing, artificial reality.

The accelerating process of the violence of ecological degradation goes beyond the boundaries of the landscape, which is exploited and hunted by humans through their unfulfilling avidity, with human-engineered ecological catastrophic events resulting in crumbling ruins of a once-existing valued and pure complexity in balance.

Project - The human modification of the physical reality as Anthropocene forces on land causes the accelerating process of violence of the altered hydrological cycle by the attack of water from both inland and seaside and the disconnection from the value of water. The sea and rivers are contemporary imbalanced systems of processes as a result of the human-engineered climate crisis and in the region of the Northern Adriatic Sea, the sea level rising and pressure on river discharge are the main projections of this. The altered land experiences flooding and drought in exponential extreme situations which stresses the boundaries of the static urban fabric and the existence and survival of the trans-scalar ecological and human systems. The perception of the boundary of land and sea defines the division of their separation as if they are self-functioning bodies, however, this should be undefined and porosated to create an understanding and awareness of the interrelation of the sea and land. The extensive urbanization of the Northern Adriatic coastal territory is (historically) stimulated by its water-embraced geographical location, geomorphology, and geopolitical pathways and opened up opportunities that embedded the historical richness in its urban fabric. In this past water-embraced reality, the inhabitants perceived water as a valued and integrated element in a large, complex system in which water provided life and the territory provided life for water. The tangible heritage of the static urban fabric needs to be conserved but lacks the flexibility to transform with the altered processes of water and limits life for water. The unrecognized and forgotten intangible heritage of the value of water is a result of the feared and disconnected planning practices of human-engineered interventions that protect from but do not coexist with water.

Action/Position - The disconnection from this physical and sociological water reality should be transformed into an integrated planning system that acknowledges and embraces the urgency for space for the dynamics of water and transformative ways of living with these dynamics. The inhabitants need to live and cope with the water as a cultural value that is integrated into everyday life and a transformation of perception in their minds in which they are part of this nature. The lost sociocultural identity should be disclosed and reintegrated with the strong physical identity of the urban fabric to embrace the essence of life with water through the learnings of past cultural water practices.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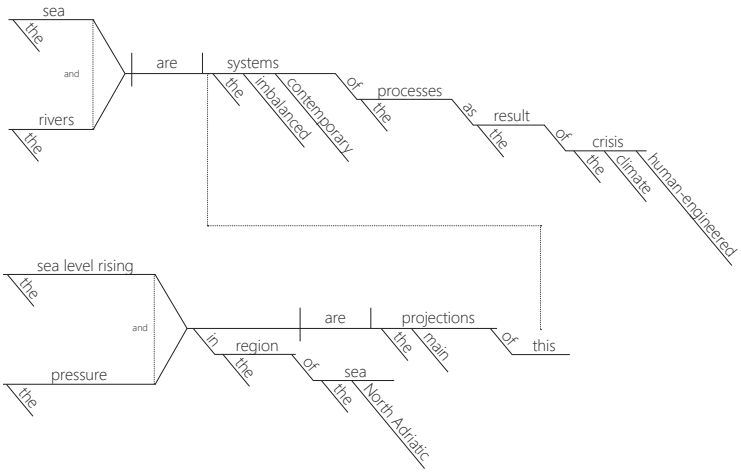
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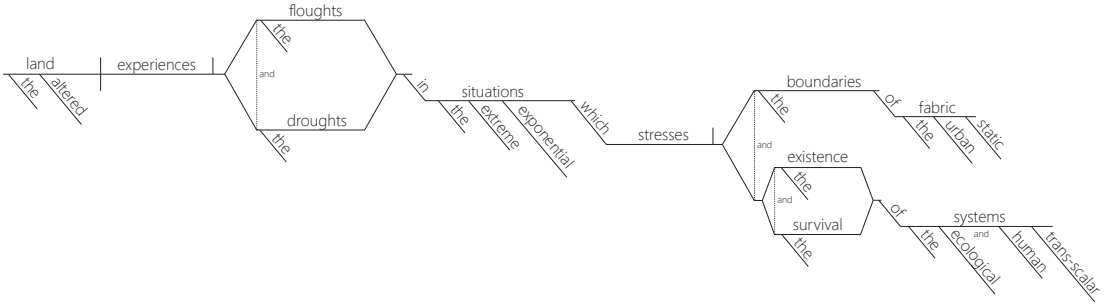
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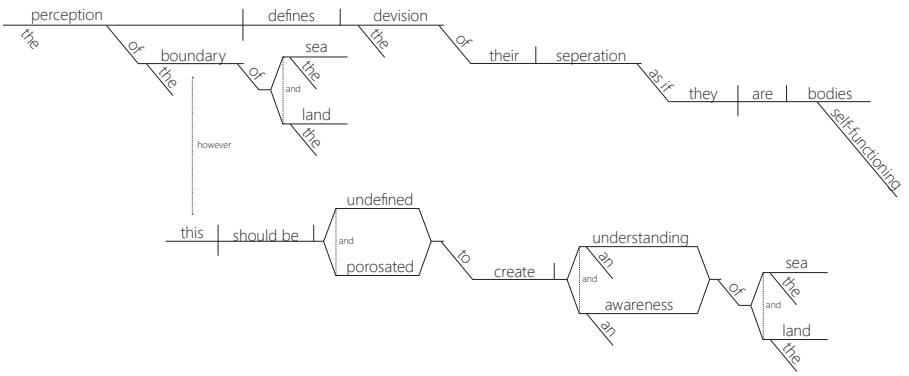
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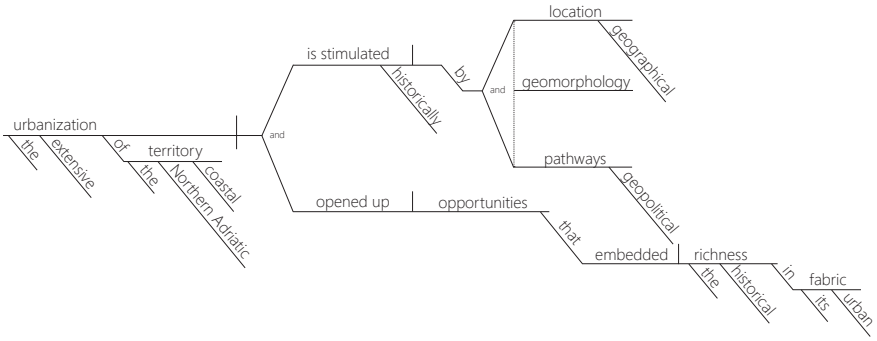
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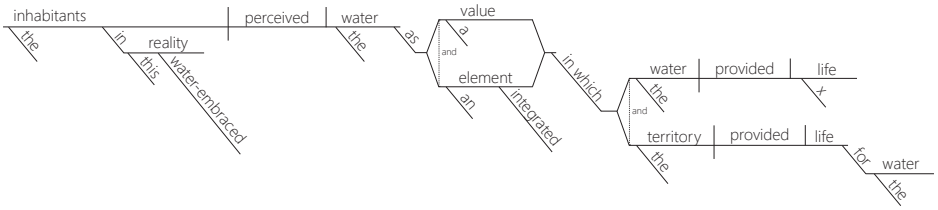
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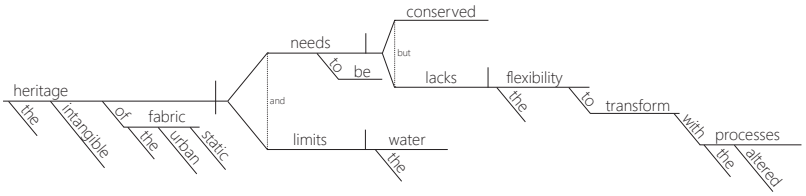
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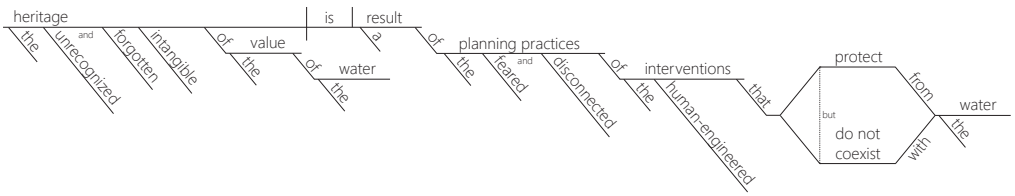
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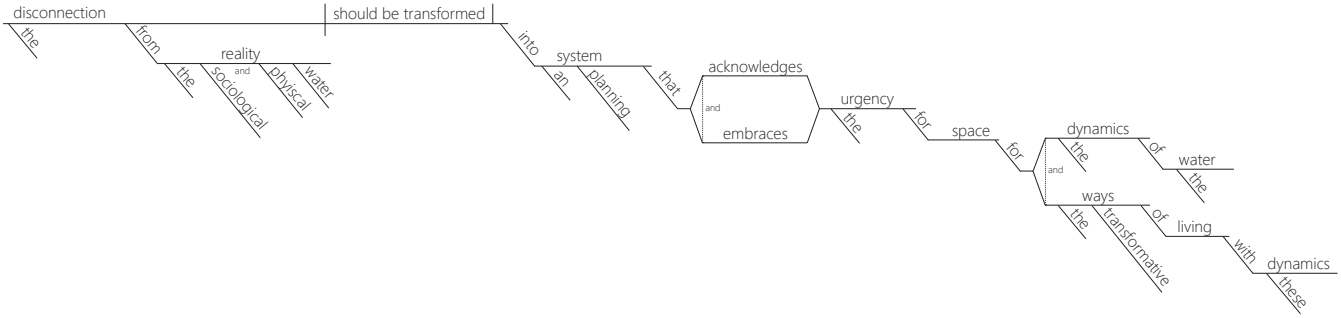
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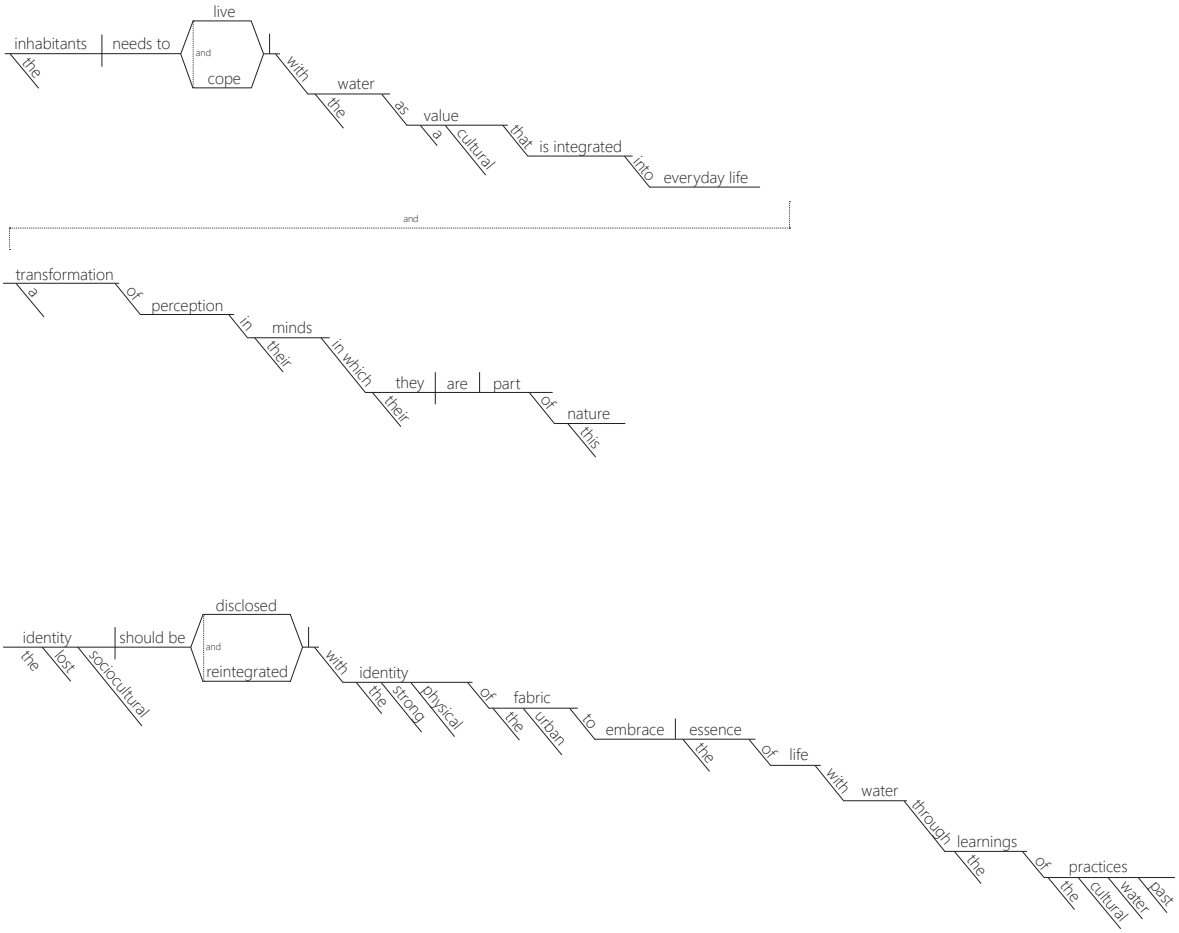
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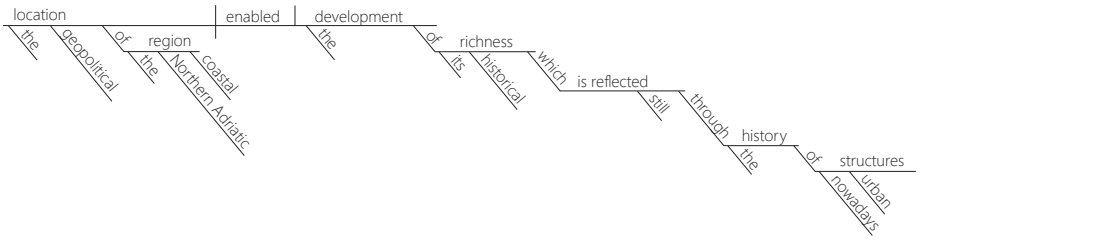
Altered Value & Residual Identity

General Definition - As the planet is changing through the Anthropocene forces, the alignment of natural cycles and people's values requires changing paradigms. This transformability concerns socio-environmental approaches of robust planning with uncertainties at multiple levels and the recognition of cultural value as this allows for full human flourishing. The stability and resilience of the earth system and human well-being dynamically coexist and are in contact with continuous change. At the same time, it is not about returning to a prior state, because social and natural systems evolve and co-evolve together over time, but about evolutionary resilience to an adaptive altered state as an altered value. During this evolving process, the residual identity is a voicing of these altered values and transforms the global scale to the local as these impacts on identities are manifested at particular localities. It is what remains after the geographical, geopolitical, and geomorphological transformative processes of the natural and human systems.

Project - TThe geopolitical location of the Northern Adriatic coastal region enabled the development of its historical richness which is still reflected through the heritage of nowadays urban structures. The residual identity of this region is formulated by the cultural heritage of earlier civilization processes and the tangible implications of tourism, industry, infrastructure, and port structures of the modern altered Anthropocene landscape, including both terrestrial and maritime zones. These economic structures are mainly structured to profit from and exhaust the values and opportunities that the landscape freely provides but break the natural cycles by prioritizing economic profits instead of coexisting with the socio-ecological terrestrial and maritime processes.
As a result, the whole region experiences losses of socio-ecological value through the pressure and violence of tourism and polluting industries, fixed infrastructure, and overwhelming maritime forces on the geomorphology of this region. Water is perceived as a distant resource that provides for people's values but not as an integrated element of people's values and everyday life. The focus should shift to coexistence with and not separation by protection from water. This value loss contributes to the need for a transformative planning approach for revolutionary resilience.

Action/Position - This call for a transformative planning approach to evolutionary resilience protects the natural and human structures from rising water levels. The climate crisis alters the geography and the geomorphology of this Northern Adriatic coastal region and threatens these static structures through accelerating flooding risks caused by sea level rising and pressure on river discharge. Through altered values of planning that acknowledge dealing with the altered and residual realities under continuous change and uncertainties and water as an element of daily life urban planning and the need for an identity shift towards perceiving water as a value, the resilience of water-related risks will be transformative, evolutionary, and robust. This forces the scale of this planning from global levels towards the various localities that should be considered separately and integrated into the altered reality.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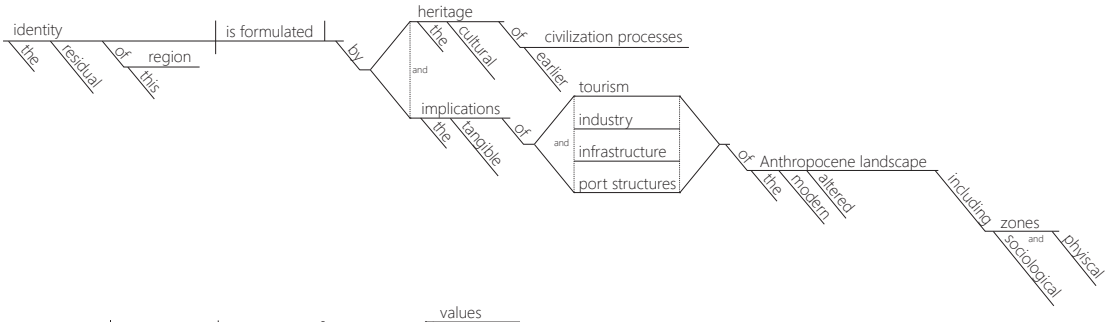
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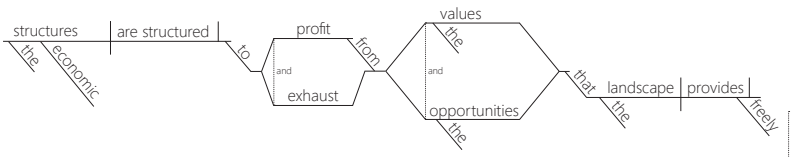
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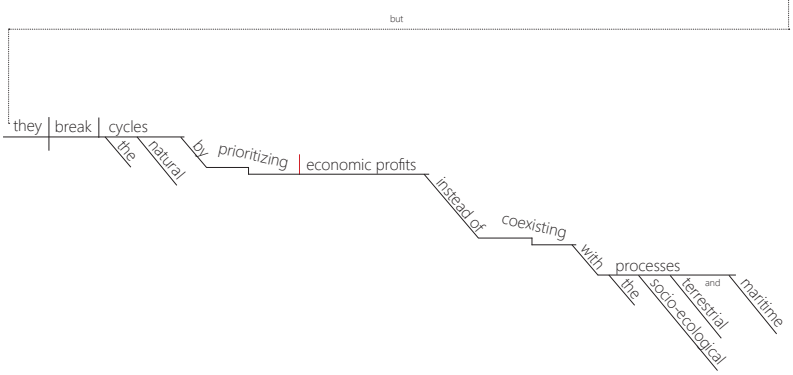
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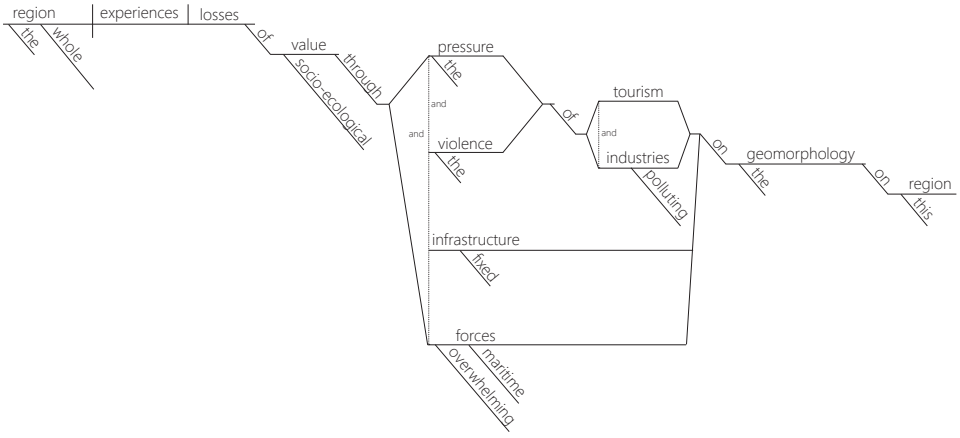
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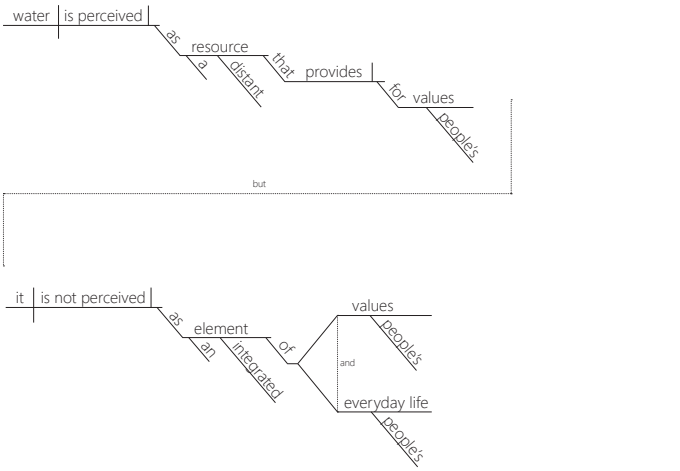
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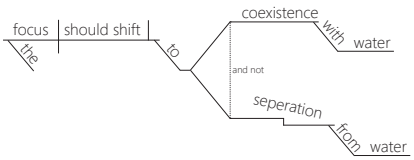
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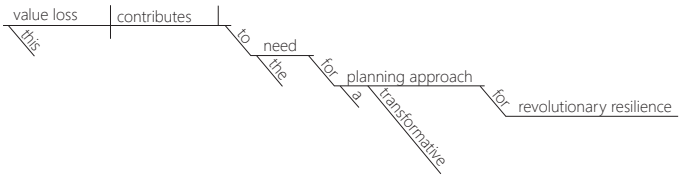
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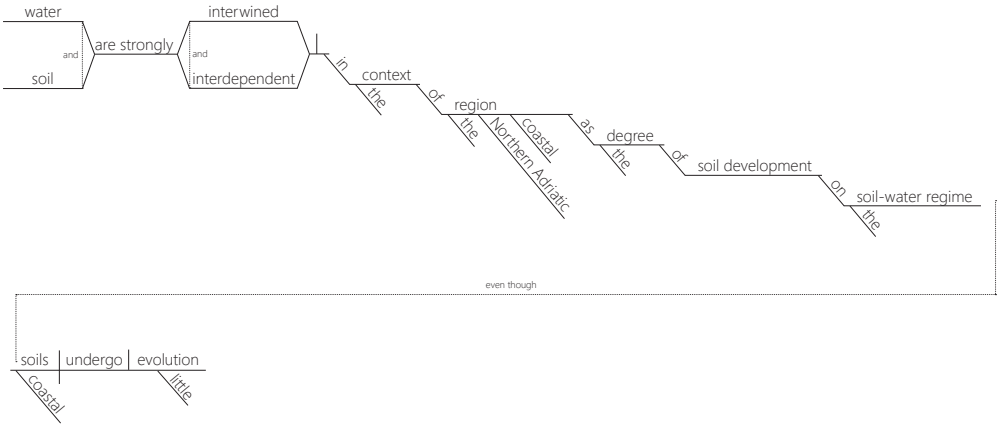
Grounds (processes) & Rare Earth (resource and social implication)

General Definition - Grounds define the upper soil layer that is enriched by processes that provide life for vegetation and therefore is a crucial ecological element in the processes of the natural and human cycle. However, the tapestry of the ground, which is the governance of the ground, and its value are defined by what its function does for humankind and not by what its function does for the biosphere for life in the natural cycle. Besides grounds quantities as a resource that supports needs, its quality and performance should be acknowledged and valued. Because the social implications and extraction of grounds and climate change alter the soil dynamics, impacting the ecosystem services and human activities. However, landscape configuration and its associated hydrological characteristics affect the morphological, physical, and chemical evolution of soil profiles as well, which determine the life of the natural vegetation.

Project - Importantly in the context of the Northern Adriatic coastal region, water and soil are strongly intertwined and interdependent as the degree of soil development depends on the soil water regime, even though coastal soils undergo little evolution. Human-induced pressures through landscape alternation such as sand and water extraction, terrain levelling, tourism enhancing, and land use changing modify soil development and can cause critical environmental conditions. In this area, the coastal landscape is defined by wetlands, lagoons, and deltas which are low-lying areas that cause the area to be vulnerable to climate-change-induced sea-level rising. This causes soil subsidence, inundation, flooding of land, ground and soil salinization, soil contamination, erosion, coastline regression, altering of the morpho-ecological setting of the territory, and inversion of discharge direction. The Po River Delta is especially vulnerable to inundation due to sea-level rising as it has been affected by natural and anthropic subsidence through water and soil extraction, but the areas of Venice and Triëste experience frequent storm surges flooding due to local subsidence.

Action/Position - As human-induced pressures through landscape alternation and climate change impact threaten the ecosystem services of the Northern Adriatic coastal region, the health of the grounds should be a starting point of spatial planning. Planning with grounds requires awareness and acknowledging the traces and dynamics of its soil and how to plan with this knowledge instead of using it for its function for humankind. It provides the opportunity to plan in a timeframe that is unpredictable as its dynamic processes adjust and coexist with unpredictable, continuous changing conditions.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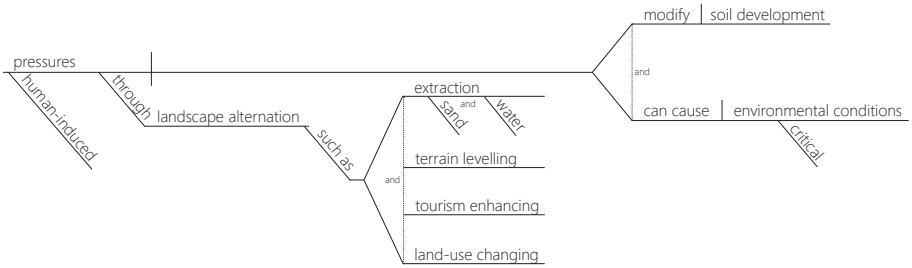
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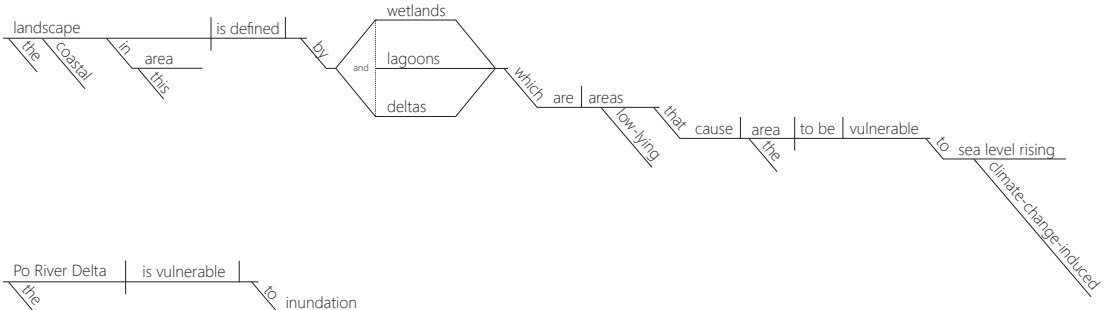
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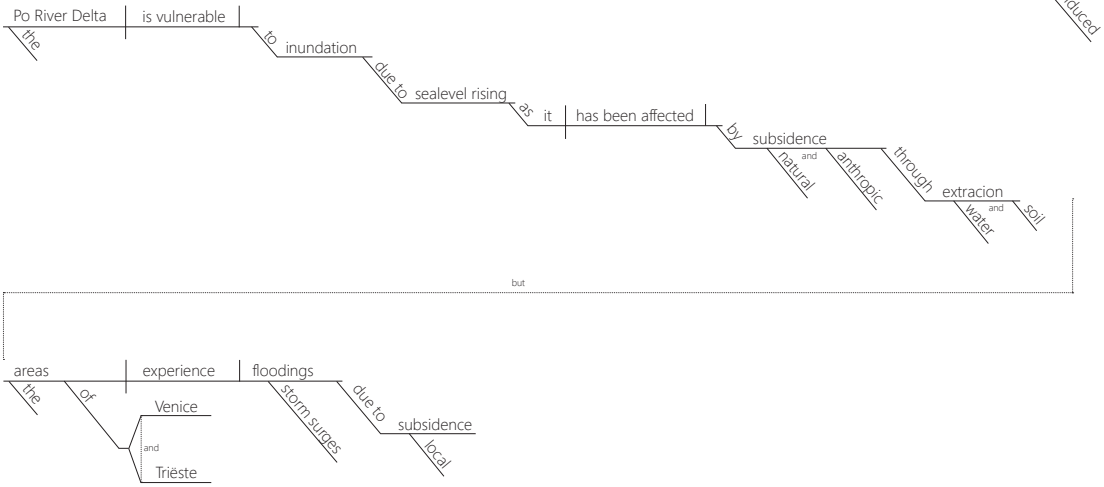
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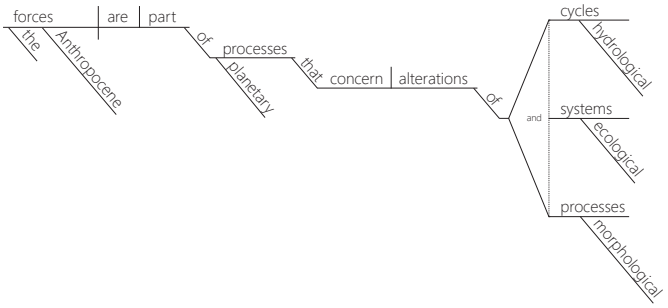
Zones (situated knowledge against the (more-than-human) Anthropocene)

General Definition - Zonifying the uncomprehensive system's complexity of the Anthropocene altered by humans as the new forces of nature, allows us to acknowledge and be aware of the plurality of objectivities. This place-based truth reveals partial perspectives of the planetary processes of the more-than-human Anthropocene. The understanding requires versions of situated, visceral encounters within the new encounters with the human forcer in the Anthropocene to embrace small-scale truths of the current versions of the future. It embraces place in its physical and unphysical form as patches to imagine learnings of intimate conjunctions of ecologies and social forces for future understanding.

Project - IThe Anthropocene forces are part of planetary processes that concern alterations of hydrological cycles, ecological systems, and morphological processes. The overwhelming too-muchness of these planetary more-than-human Anthropocene forces can be elucidated by understanding the situated knowledge and perceptions of the localities of the Northern Adriatic Sea region, concerning Ravenna in the Po Delta, the Venice lagoon, and Gulf of Triëste. These partial perspectives cover the more-than-human forces of the Anthropocene, which are the consequences for the local terrestrial and maritime ecologies, water body systems, soil processes, micro-lives, animal habitats and livelihoods, and the place-based Anthropocene histories' processes and materializations and aim to find intimate conjunctions of these social, environmental, and economic forces to understand the current versions of the future.

Action/Position - The patches of this zonifying go beyond its physical space and also focus on virtual space and understanding patches of place to find its situated truth. The virtual space of patches allows an understanding that goes beyond physical limits. It provides the opportunity to map the plurality of objectivities to visualize the partial perspectives and create imaginative water-sensitive realities through design and art with scenario-making. The patches of place encompass the understanding of situated, individual places that also go beyond human perspectives.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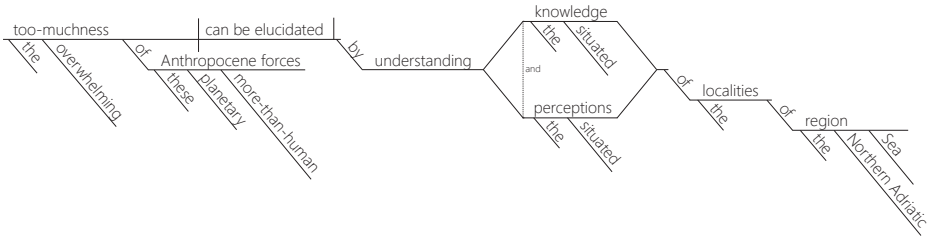
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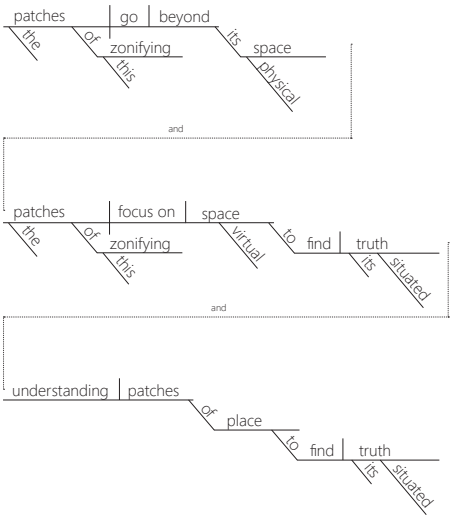
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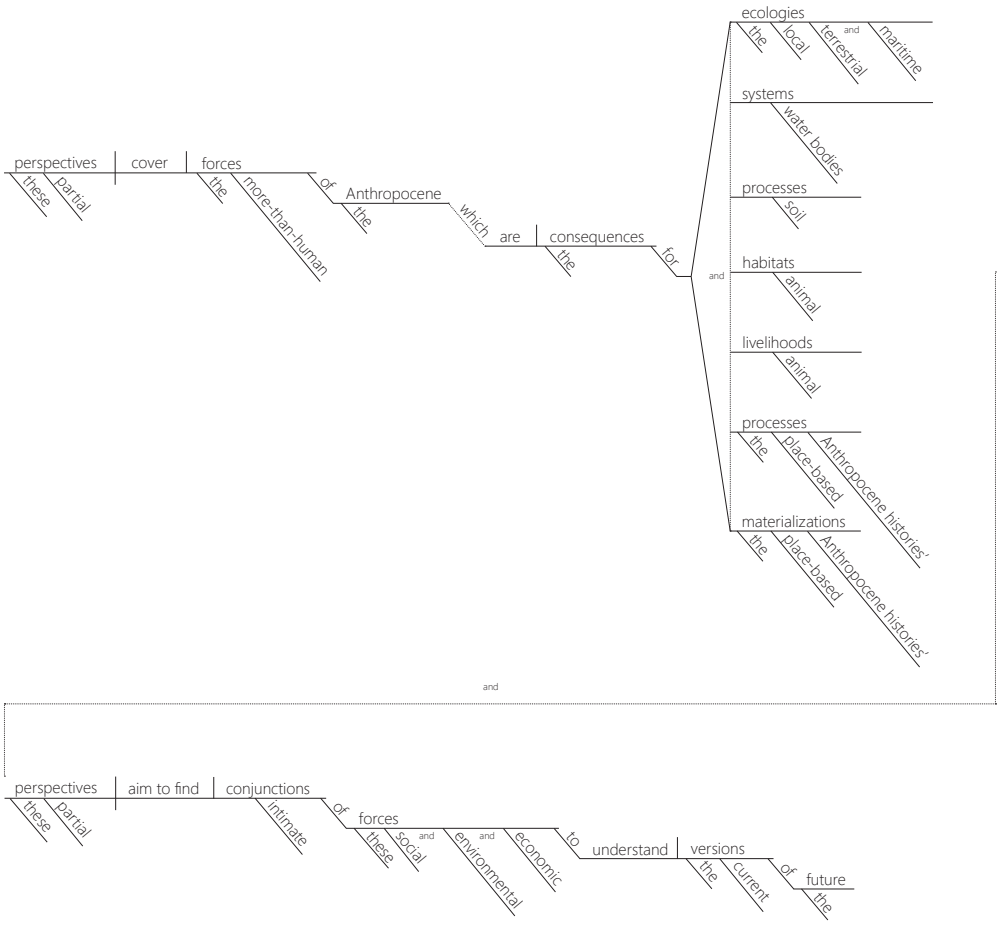
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INTENSIVE TRANSITIONAL TERRITORIES

DRAWINGS

The Northern Adriatic coastal region is famous for its rich water-embraced cultural-historical identity, geographical closeness to and geomorphological integration with the hydrological cycle. The geopolitical location of the Northern Adriatic coastal region allowed the development of its historical richness through past civilizations, which is still reflected in the physical heritage of contemporary urban structures. The historical cities of Ravenna and Venice seem to be a projection of this harmonious life with water, however, the climate crisis-induced forces illustrate the region's disconnection to and imbalance of its water identity.

This thesis aims to address the accelerating violence of the altered hydrological cycle related to the (more-than-human) Anthropocene in the dynamics of the vulnerable Delta del Po landscape, shaped by wetlands, coastal lagoons, and the Po basin. Its violence is bilateral as on the one hand pressure arises from sea level rising from the Adriatic Sea and the inland river discharge of the delta. On the other hand, human-induced pressures through landscape alternation such as sand and water extraction, terrain levelling, extensive urbanization, tourism enhancement, and land use change modify and cause critical environmental conditions for the low-lying Delta del Po. These critical conditions are projected through soil subsidence, inundation, flooding of land, periods of drought, extreme weather circumstances, ground and soil salinization, soil contamination, erosion, coastline regression, altering of the morpho-ecological setting of the territory, and inversion of discharge direction. This has great consequences for the local terrestrial and maritime ecologies, water body systems, soil processes, micro-lives, animal habitats and livelihoods, the liveability of the (social) human living environment, and the place-based Anthropocene historical processes and materializations.

Although it seems that water is a pellucid tangible presence, there is also an intangible challenge related to the water identity of this region. It concerns a disconnected and forgotten social perception of water. In the Anthropocene, water is perceived as a distant resource that provides for people's values but not as an integrated element of people's values in everyday life. Past civilizations embraced and celebrated water as an essential of life through rituals, religions, and cultural practices and by this, coexisted with its physical reality. The lost sociocultural identity should be disclosed and reintegrated with the strong physical identity of the urban fabric to embrace the essence of life with water. Therefore, this thesis voices the urgent question of how to live with water under continuous change and uncertainties through transformative resilient planning that acknowledges the urgency for space for the dynamics of water and transformative ways of living with its dynamics through traditional knowledge of local cultures of water practices, while preserving its static and physical heritage in the future Anthropocene.
This project seeks to explore designing with the dynamics of the Delta del Po for water management regarding floodings and periods of droughts on the human scale of everyday life through the porosity of the land-water interface. This forces the scale from regional planning towards small-scale design of various localities and touches on a realistic component of scenario-based designing.

Composition
The Northern Adriatic Coastal Region

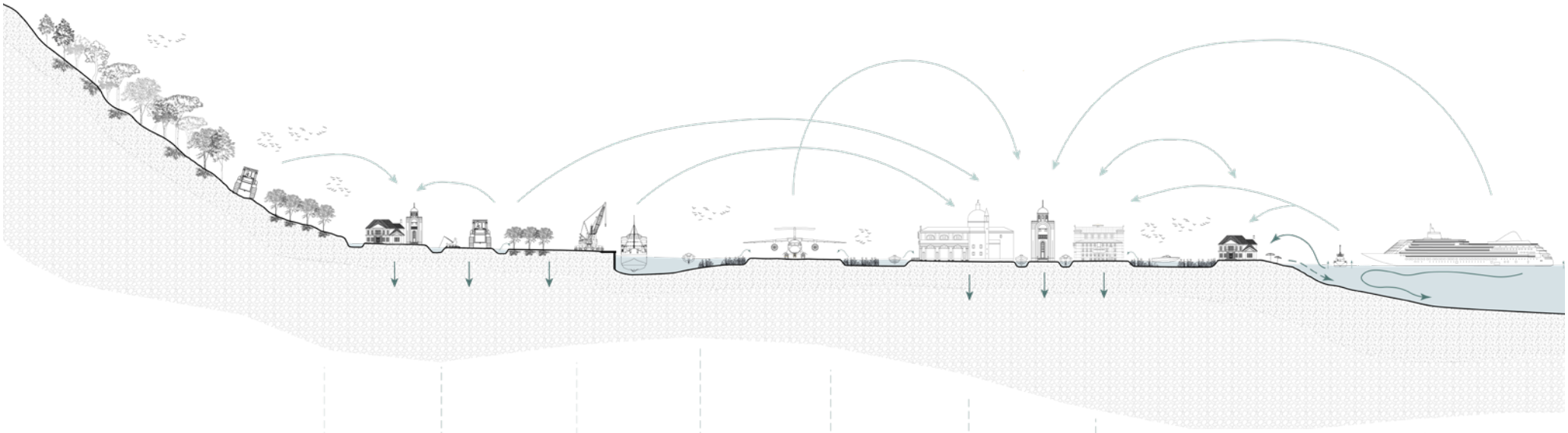
This composition illustrates the main natural components of the Nothern Adriatic Sea. The topography emphasizes on its dynamic structure as there are both the mountains and lower-lying coast territories. The land-water interface consists of coastal lagoons, salt marshes, and beaches. This dynamic coastal territory includes the historical cities of Ravenna, Venice, and Trieste, and allows space for various agriculture. It devides the sea from the hinterland that is occupied by irrigated agriculture.

- Sea Current
- Historical Cities
- River inputs
- River structure
- Northern Adriatic Sea

Alteration/Interactions

The alteration of and interactions with water processes in physical urban structures.

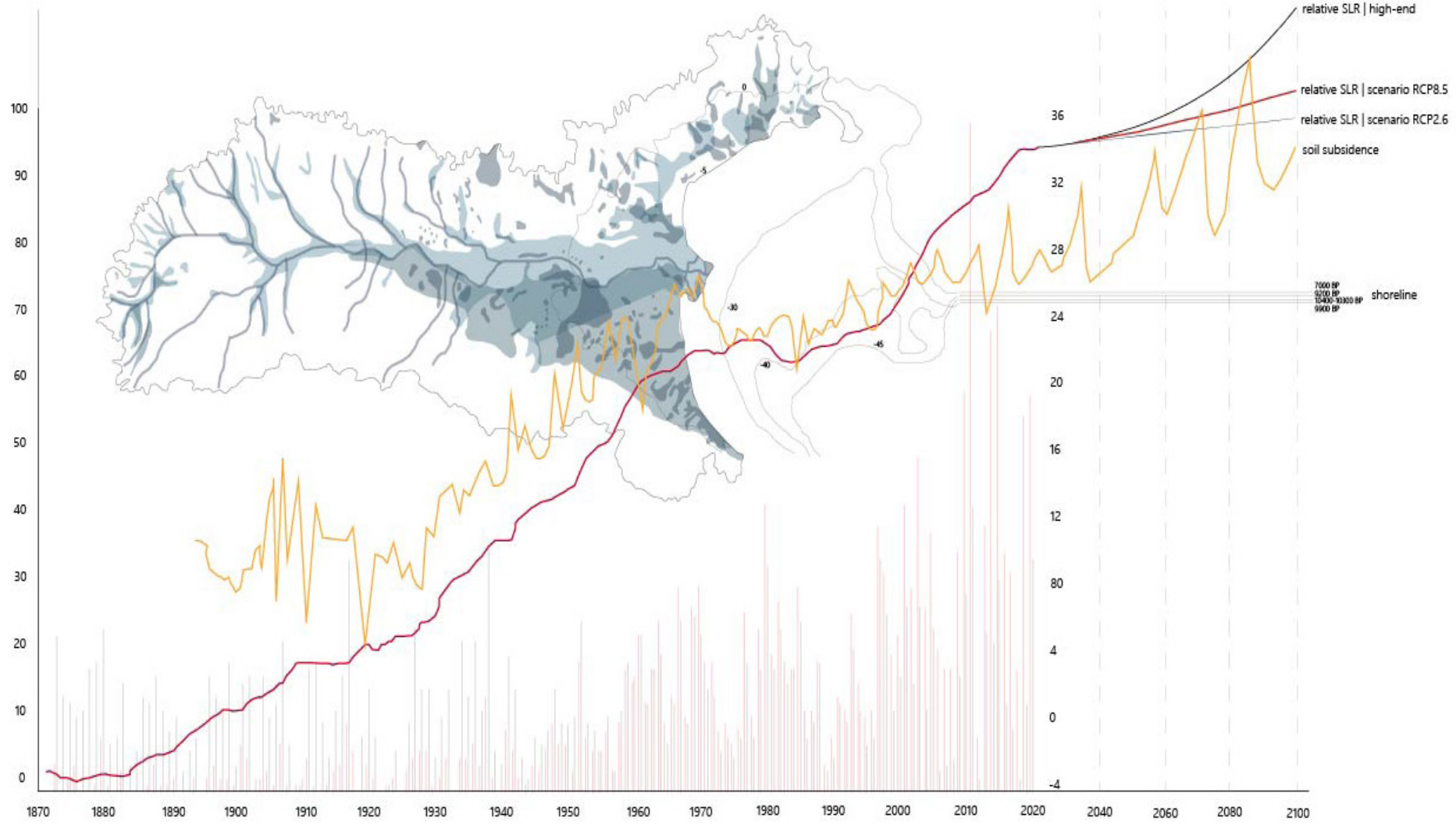
This section illustrates the physical and cultural relations with water in daily life. This concerns over-tourism, agriculture, port industires, leisure activities, and environmental impacts.



Mountain agriculture and vineyards	Rural villages	Hinterland agriculture and vineyards	Port	Tourism	Water-related leisure activities	Historical city cores	Coastal wetlands and lagoons	Coastal development	fishing industry	Marine tourism
	flooding risk by pressure on river discharge,	Irrigation causing land subisdence	water pollution	overtourism	Inland wetland erosion and loss of biodiversity by water activities	flooding risk by sea level rising, pressure on river discharge, and land subsidence	Coastal wetland erosion and loss of biodiversity by water activities salinization	Coastal erosion		overtourism

Limits
The critical conditions of floodings, soil subsidence,
and erosioin

This spatial-temporal diagram illustres the flood risks due
to sea level rising and subisdence.


relative SLR | high-end
relative SLR | scenario RCP8.5
relative SLR | scenario RCP2.6
soil subsidence
shoreline
7000 BP
9200 BP
10400-10300 BP
9900 BP
0
-5
-30
-45
-40
100
90
80
70
60
50
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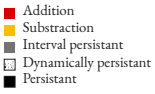
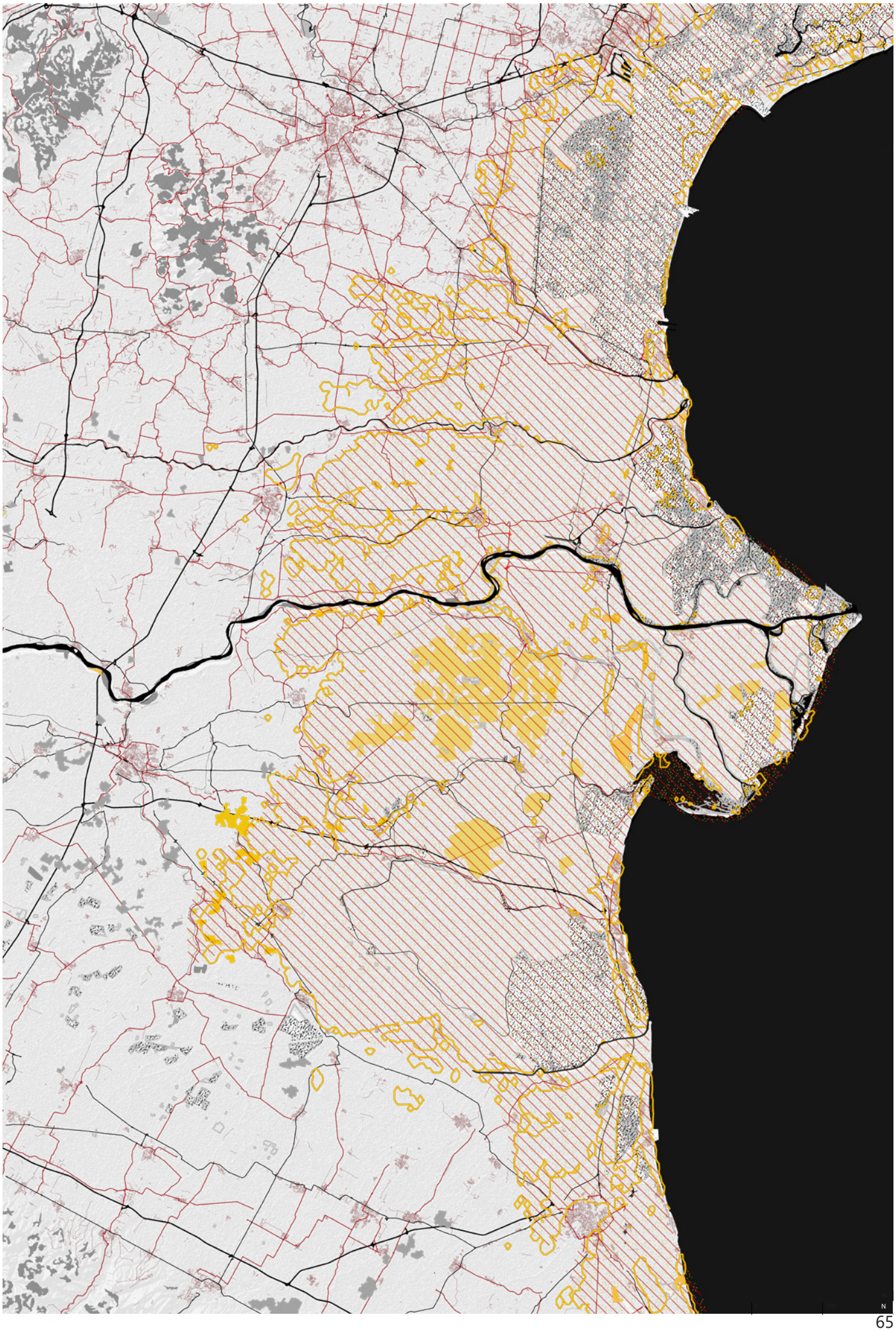
Palimpsest
The in-between dynamic coastal territory

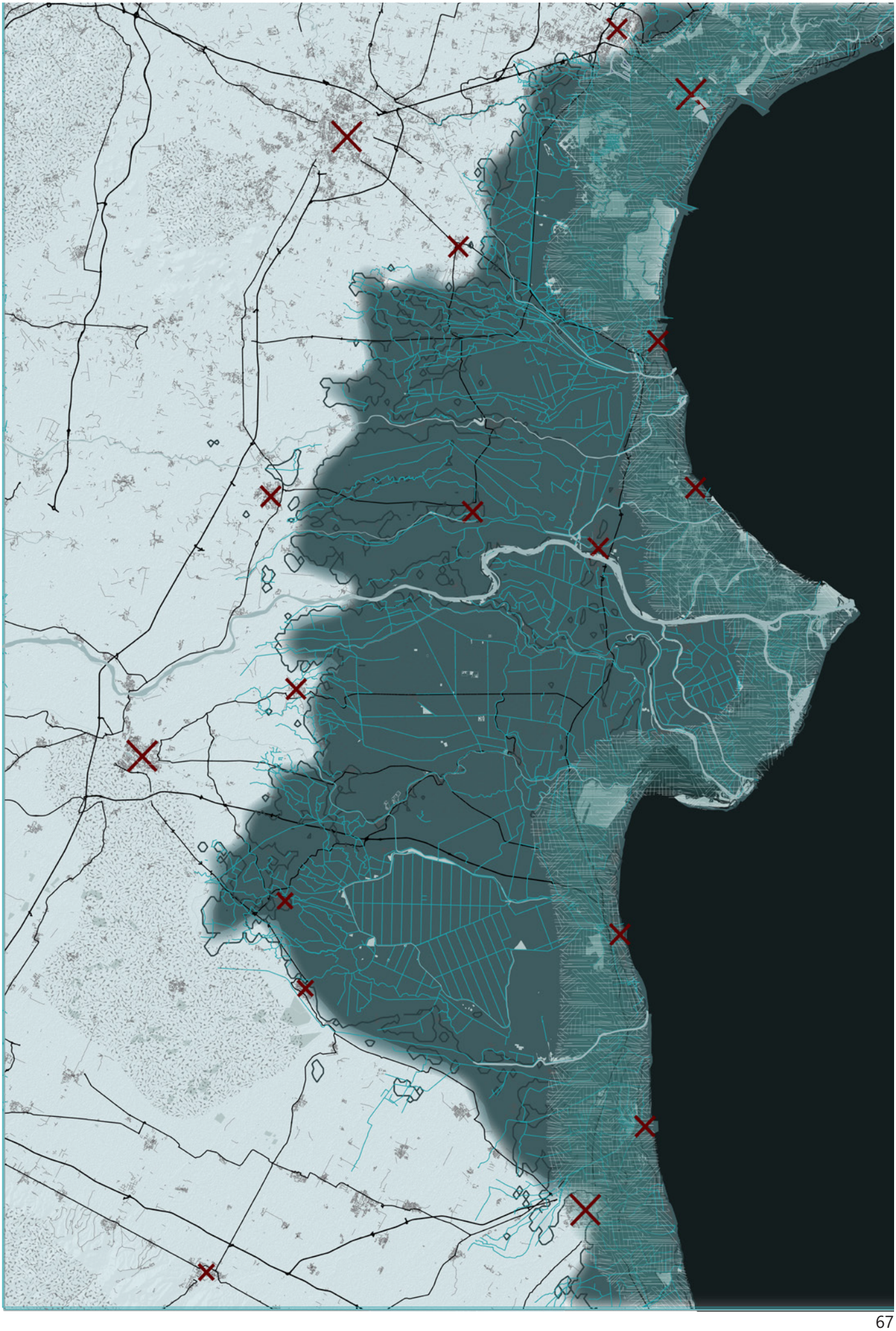


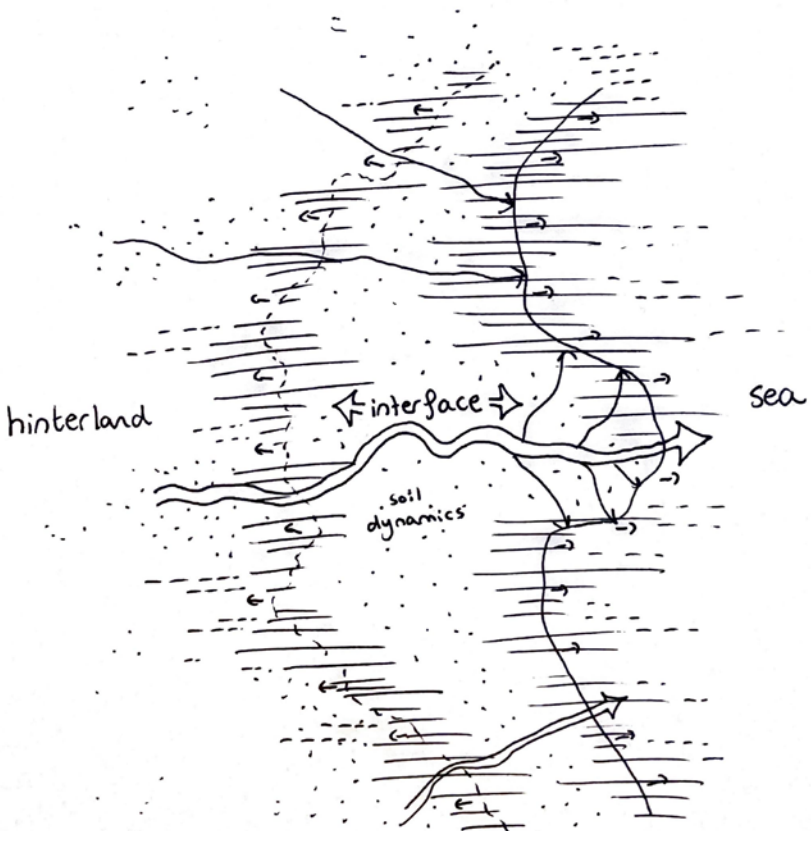


Transposition - Continuity
Towards the water paradox

The continuity illustrates the impacts of water on the composition. The dynamic coastal territory will flood firstly, while wetlands will be lost due to salinization and inundation. The static historical cores will be damaged and agriculture will erode. The hinterland will flood in the next stage and threaten the cultivated land.

- Damaged Heritage
- Coastline
- Waterways
- Infrastructure
- Erosion of agricultural practices
- Continuous subsidence by irrigated agriculture
- Seasonal Flooding Stage 2/Drought | hinterland
- Coastal wetlands degradation
- Flooding stage 1 | vulnerable coastal territory
- Northern Adriatic Sea



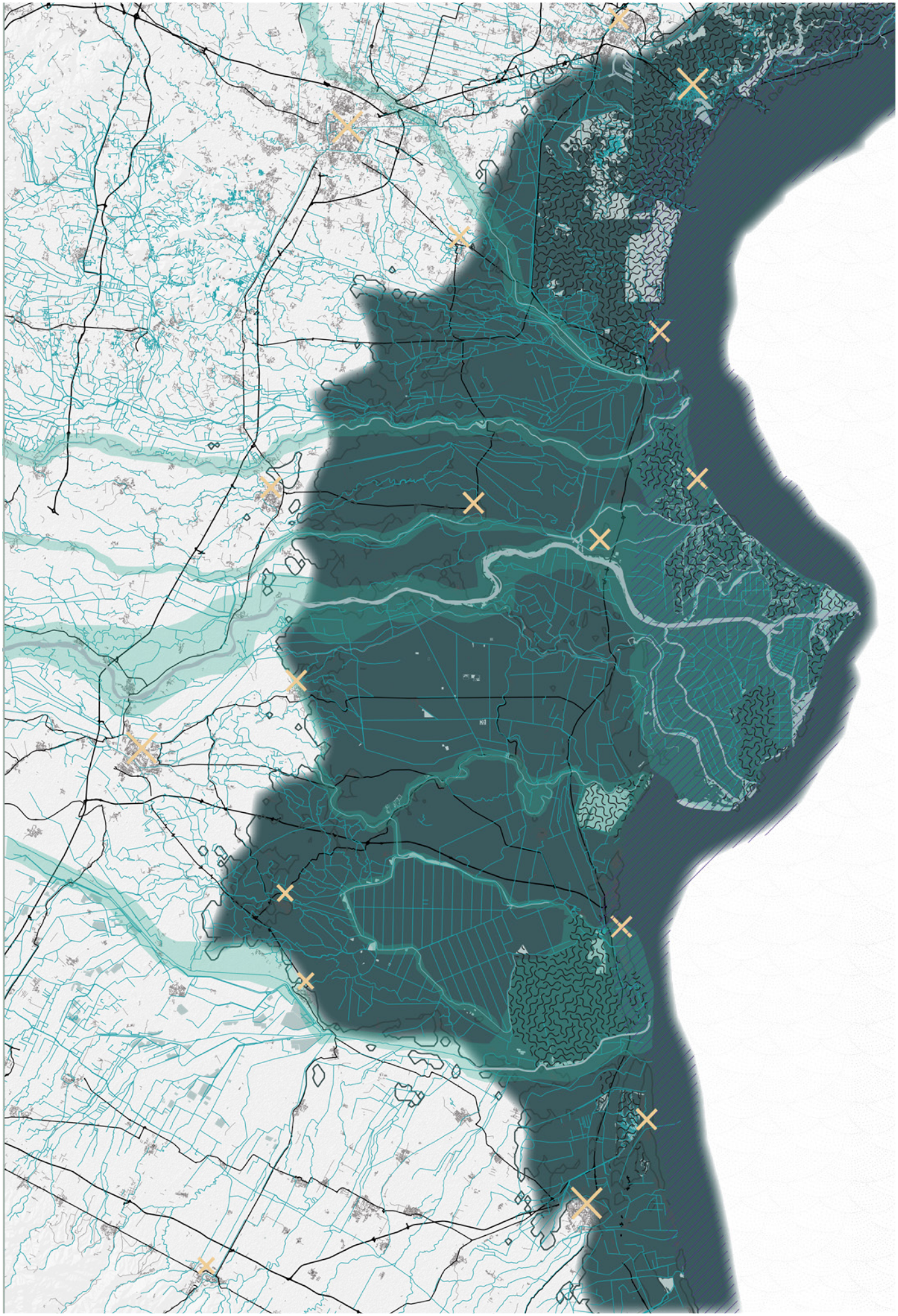


Transposition - New Order

A water-sensitive future

In the water-sensitive future the land-water interface will be dynamic and porous. A diverse waterlandscape will arise, while historical cores adapt to this new reality with water. Agriculture requires new types of management and systems. The river has room to flow with its dynamics and wetland structures ensure buffers for periods of drought.

- water-sensitive heritage
- Porosity of land-water interface
- Waterways
- Infrastructure
- Coastal wetlands
- Adaptive territory
- Water-integrated Agricultutal Hinterland
- Dynamic coastal territory
- Northern Adriatic Sea



4 INTENSIVE GEO 1

URBAN GEOGRAPHY

Thesis Summary

The Northern Adriatic region is renowned for its rich water-embraced cultural-historical identity, geographical procimity to and geomorphological integration with, the hydrological cycle. Its historical richness is still reflected in the physical heritage of contemporary urban structures. The historical cities such as Ravenna seem to be a projection of this harmonious life with water, however, the climate crisis-induced forces illustrate the region's disconnection to its water identity. This thesis aims to address the accelerating violence of the altered hydrological cycle related to the (more-than-human) Anthropocene in the dynamics of the vulnerable Po basin and delta. Its violence is bilateral as pressure arises from sea level rising and the inland river discharge. On the other hand, human-induced pressures through landscape alternation modify and cause critical environmental conditions for the low-lying delta. This has great consequences for the local terrestrial and maritime ecologies, water body systems, soil processes, micro-lives, animal habitats and livelihoods, the liveability of the (social) human living environment, and the place-based Anthropocene historical processes and materializations. Although it seems that water is a pellucid tangible presence, there is also an intangible challenge. The lost sociocultural identity that coexisted with water should be disclosed and reintegrated with the physical identity of the urban fabric to embrace water. Therefore, this thesis voices the urgent question of how to live with water under continuous change and uncertainties through resilient planning that acknowledges the need for space for the dynamics of water and transformative ways of living with its dynamics. This should be achived through traditional knowledge of local cultures of water practices while preserving its static and physical heritage in the future Anthropocene.

Anthropocene, Urbicene, Capitalocene

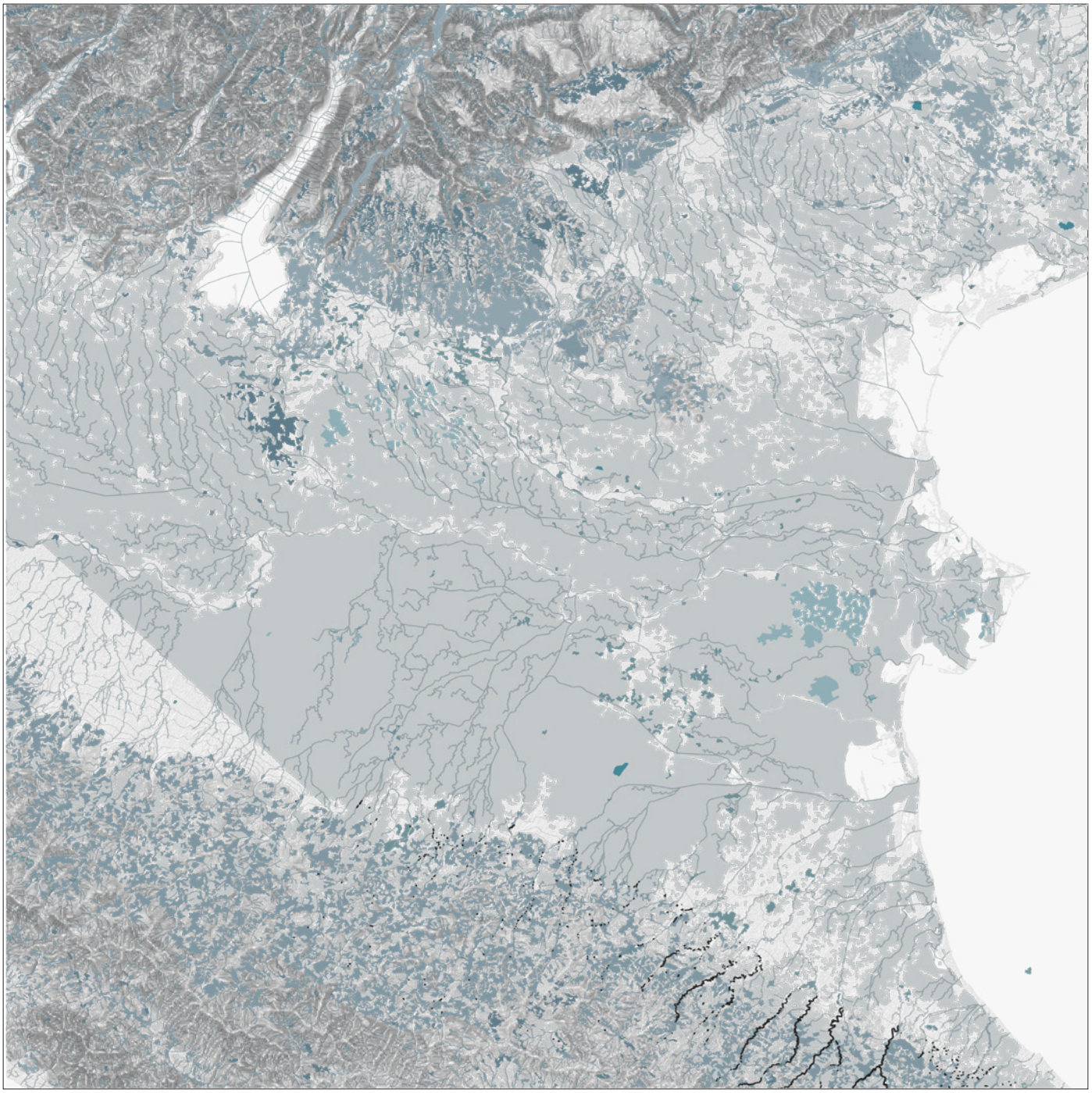
The current state of the Earth's natural systems and processes is shifting drastically due to global warming, the climate crisis, rapid urbanization and population growth, and socio-technological innovations. This marks a new geological epoch, the Anthropocene. The Anthropocene defines and introduces a new time period in which nature has been altered by human activities, causing irreversible impacts on its ecosystems and landscapes. Though the alternation of nature by humankind to adapt it to their needs has been done for centuries as historical records and heritage show us, the scale, scope, and speed of this alternating process going beyond natural limits is unknown to human history and introduces humankind as a global force. It concerns a transforming global environment of commodity production and exchange, formulating a fundamental change in the relationship between humans and the Earth's natural realm to ensure the required proportions of nature and its benefits for these global economies and societies causing severe pressure and irreversible destabilization. In the area of my thesis, the east-southern part of the coastal Po basin Emilia-Romagna, the destabilization of the territory is caused by sea level rising, increased pressure on river discharge, and sinking of the delta due to soil subsidence, due to human-induced alternations. Acknowledging both the contemporary 'state' of the Earth as processes of the Anthropocene and the Capitalocene and Urbicene paradigms which explain that the Anthropocene is a result of capitalistic processes (with relations between capital, power, and nature) and consider planetary urbanization as a geographical result of the anthropogenic processes (and thus capitalistic processes), repositions my thesis with a deeper understanding of how this 'state' has been produced, the various complexities and spheres that occur and are simultaneously intertwined and disconnected, and how to further investigate processes related to my thesis problem statement.

More-than-City Urbanization

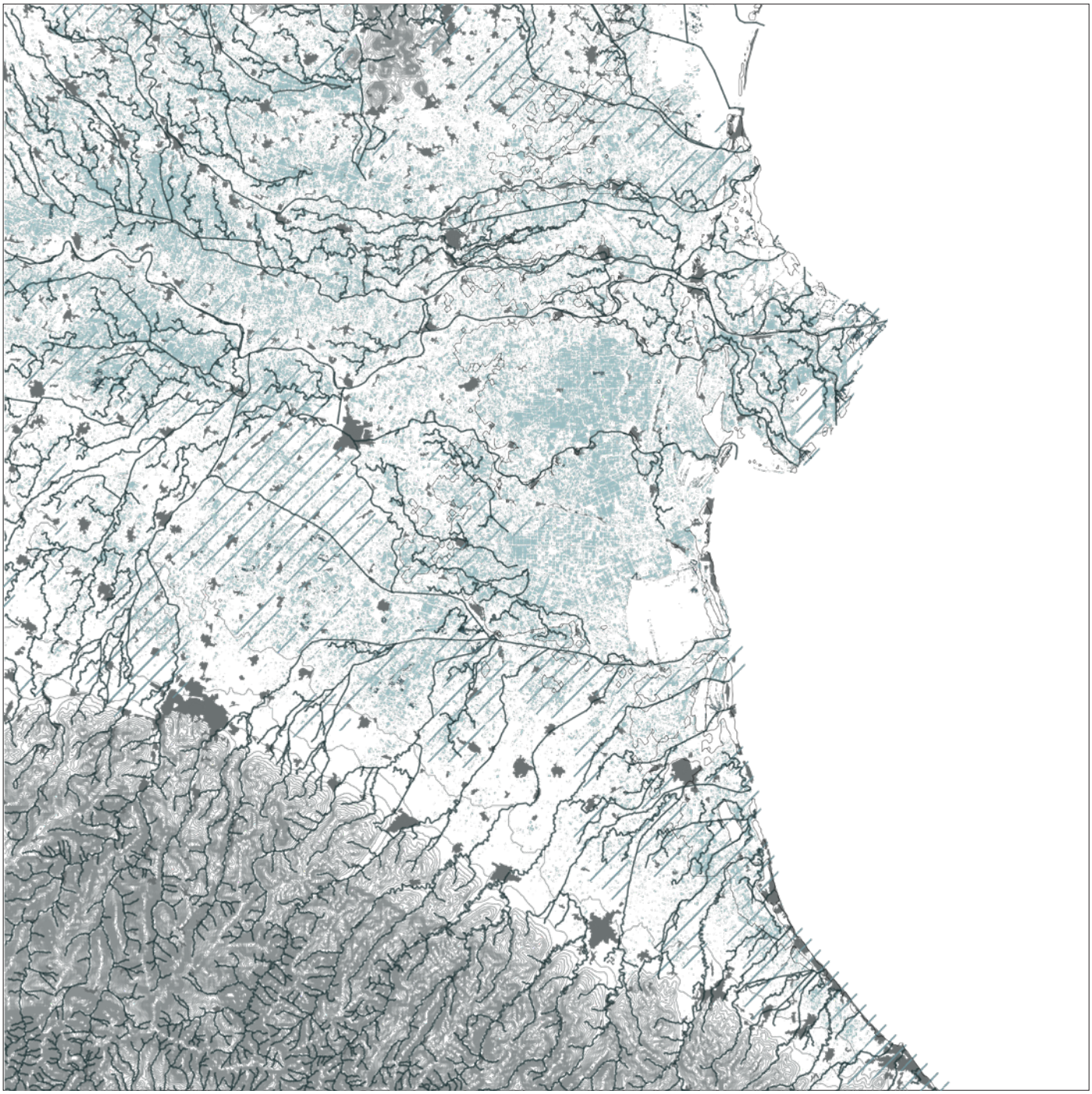
The processes of the Anthropocene, and thus Capitalocene and Urbicene as explained above, have resulted in neglection of the hinterlands. In the 1950s it created a perception of non-city spaces as irrelevant background spaces compared to cities, understanding the process of urbanization as cityisation (city-centric urbanization), separated from 'supporting' hinterlands: 'non-city landscapes' and 'sacrificial zones'. However, the counterpoint of Metabolic Urbanization shifted this perception towards urbanization as a metabolic process, acknowledging the interrelation between cities and hinterlands as cities are provided by and rely on hinterlands, the 'non-city spaces', as they co-evolve and co-produce due to their interdependencies. This understanding of co-evolving and co-producing shifts the perception of the separation between hinterlands and cities to metabolic urbanization of multiscalar citylandscapes connecting from local to global levels. Nowadays globalization in the Capitalocene, transformed the contiguous city-hinterland connection to distanciation of the city-hinterland relation as it produces hinterlands of hinterlands through global commodity production and exchange. The Capitalocene shifted from formal to real subsumption, exhausting natural land with more capital for more capital to sustain its maximum productivity. This causes metabolic rifts and cycles of creative destruction as social and ecological metabolic processes become disconnected and destabilize and exhaust the ecological surplus of the hinterlands and their ecosystems. For my thesis, this challenges me to perceive the area as not only a regional entity with integrated local processes but also as a strategic point in a global web of production and exchange in which 'borders' are faded to prevent cycles of creative destruction, fuelled by the Capitalistic distanciation. And importantly, how to design with this evolutionary process of creative destruction in operational landscapes, something we cannot escape but should transition into nature-sensitive processes without exhausting ecological surplus and acknowledgment of 'hinterlands' as part of urbanization.

More-than-Human Urbanization

In this geological epoch of planetary urbanization processes and intensified global connectivity it is hard to imagine a world beyond human, more-than-human landscapes and spaces. As humans have altered nature in the Anthropocene, the result of Capitalist processes, production landscapes arose. However, nature is not produced and exists 'outside' of humanity. This has caused the epistemic rift between nature and society. The Po basin and coastal territory of its delta are operational landscapes that are fully capitalized. The rapid expansion of urbanization, infrastructures, large constructions, agricultural irrigation processes, and extraction of resources in the soil are pressuring the stabilization of the soil, causing land subsidence as an additional driver of flood risk, besides sea level rising and increased pressure on river discharge. Therefore, there is a great need to get a grasp of the more-than-human world to acknowledge and transform the imbalance of the natural world into an adaptive system of humans-in-nature. As we are beyond the frontier conditions in the Po Valley and are entering the end stage of exhaustion, we need a transformative approach to prevent the chain of closing frontier landscapes to prevent final exhaustion of the unpaid work of the ecological surplus of nature. It calls for a softer impact on nature which demands unproduced landscapes while 'giving back to nature' to recharge this ecological surplus. However, its contradiction lies in the dependency on the intensification of the primary production system as urbanization and population growth rapidly increase. My thesis needs to explore how to cope with these Capitalistic developments through green sustainable urbanization and social-ecological justice, to meet the demands of society while restoring and adapting natural space to its human-induced risks such as flood risk, soil subsidence, soil degradation, drought, and salinization while providing space for nature to simply be unproduced. To shift the perception of humans-and-nature to humans-in-nature (again).



Agricultural sub-citylandscape in relation to the Po riverbasin valley



Flood risks in relation to wet areas urbanization

Highest flood risk areas
Permanently wet areas
Temporary wet areas
Urban structures

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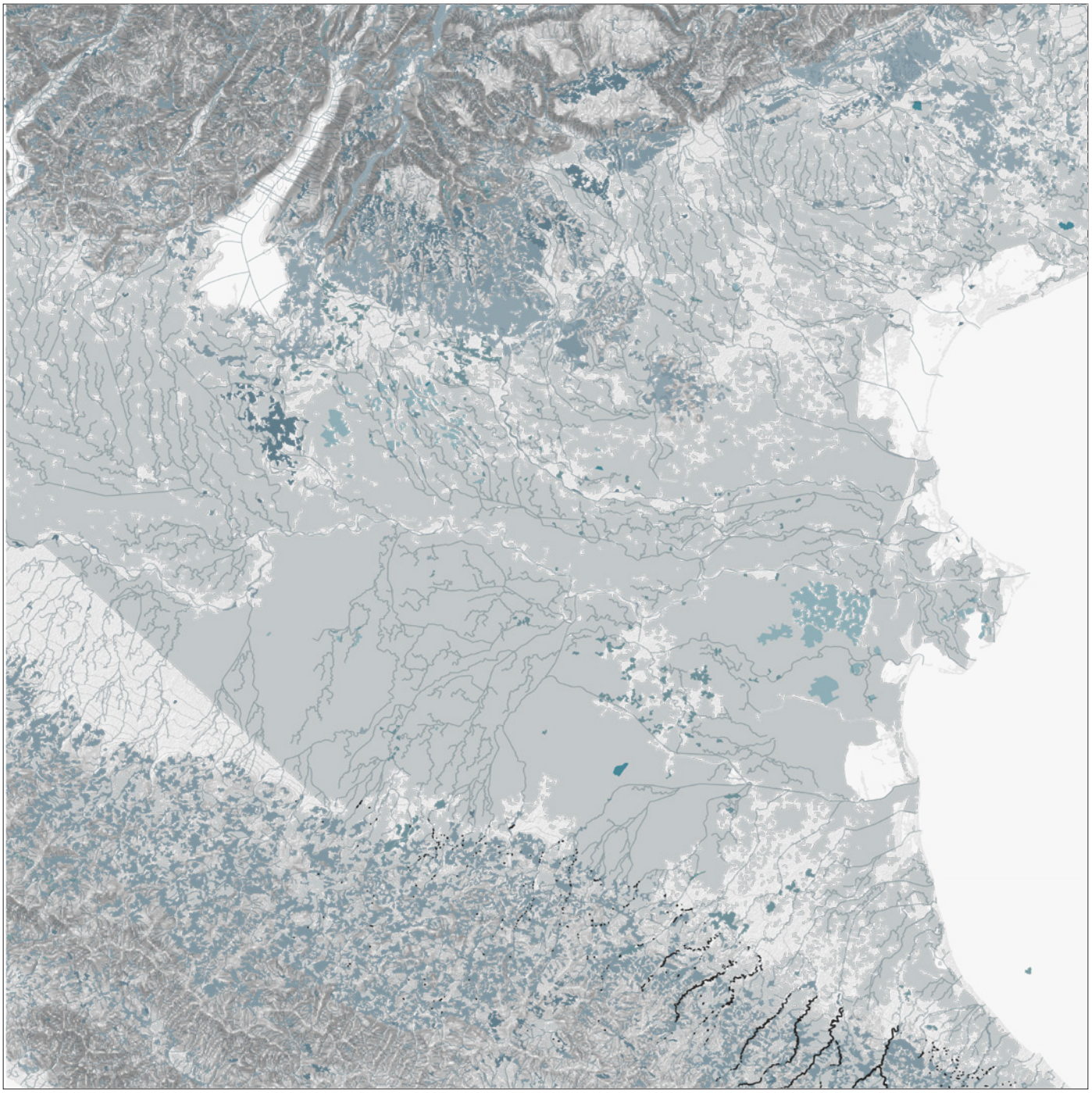
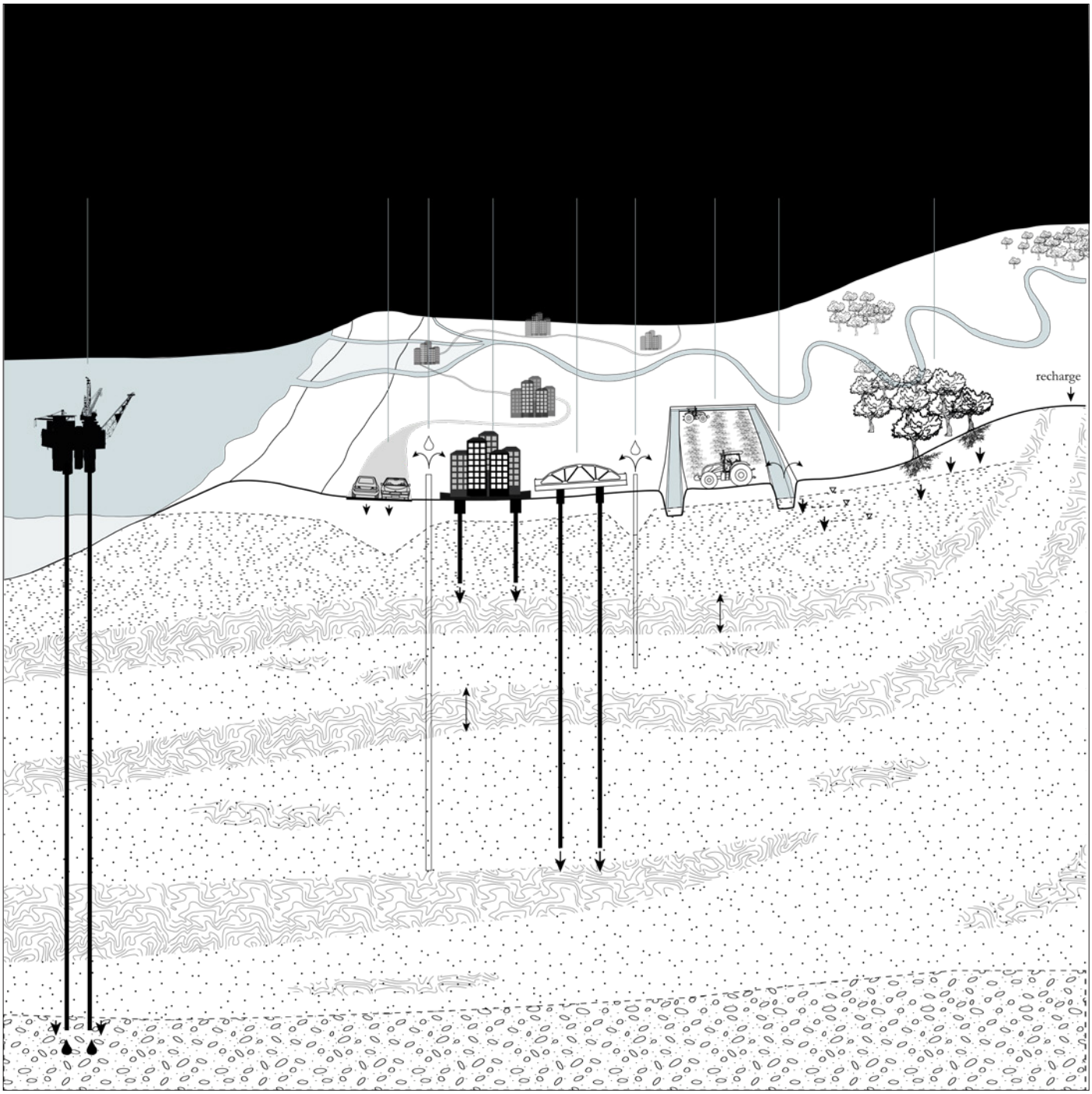


Agricultural sub-citylandscape in relation to the Po riverbasin valley

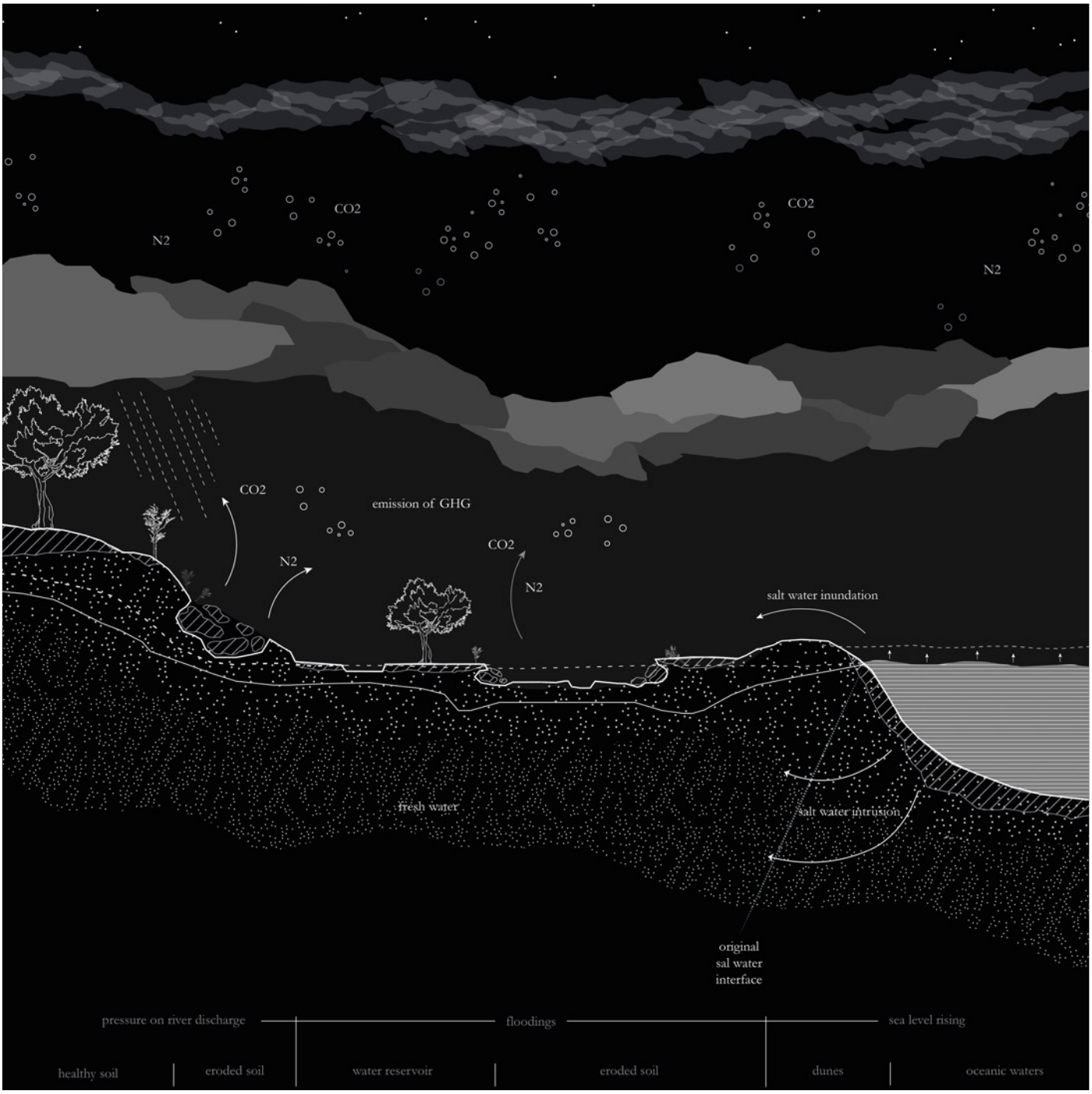
- Pastures
- Olive groves
- Vineyards
- agriculture
- Fruit trees
- Rice fields
- Permanently irrigated land
- Non-irrigated agriculture
- Riverbank Agriculture

1:1.500.000



Human Drivers of Land Subsidence

- pressure
- Compaction
- Groundwater level
- Unconfined Aquifer
- Aquitard (sily, silty clay, clay)
- Confined Aquifer (impermeable layer)
- Bed Rock
- Top Soil



Soil Degradation due to Climate Change and Human Drivers

4.2 LONGUE DURÉE

A HISTORICAL TERRITORIAL TRANSFORMATION

As is described in the Chapter 'Theoretical Framework,' the Longue Durée (the long term) involves a study of historical exploration to define, discover, and uncover the influences on the physical territory over time. This approach is crucial for the region of Emilia-Romagna, located in the Po Valley territory, including the Po delta, a natural mechanism characterized by its water dynamics, continuously transitioning the territory and expanding into the Adriatic Sea. Since water is the essence of life and urban settlements and societies have flourished where there was water accessibility, the Po river and the hydrological system of this area have always been of great importance. As we have discovered, water represents both life and death, so how did the Po River, regarding these topics, shape the territory?

During this exploration, nine critical periods have been defined as the main indicators of change on the Po river and its territory. The conclusion of the historical, territorial transformations due to human actions is provided in Figure 7 on the right page, while Figure 8 offers an overview of the most crucial political moments and specific human actions that allowed these transformations to occur.

0 | Formation of the Po Plain (1 million years ago) During the Cretaceous and Pliocene (130-2 million years ago), the Alps and its valleys were formed by glacier movement. In a period after the Pliocene, the formation of the Apennines occurred due to tectonic activity (Conti, et al., 2000). As water levels were up to 120 meters higher, the Po Valley was fully submerged as it could have been named 'the Alpine Gulf ' (Figure 6 / 0). Water began to retreat again, lowering to 100 meters beneath the current sea level. During this time, the Veneto rivers were tributaries of the Po River flowing into the Adriatic Sea at a further coastline. Around 10.000 years ago, the current territory was shaped by the rivers (EVOLUZIONE DEL TERRITORIO e DELLA FASCIA COSTIERA - Consorzio di Bonifica Pianura di Ferrara, z.d.). As in the interglacial period the glaciers formed moraines, and the sediments of morainic deposits were now transported by the rivers to the plain, where it was left behind in the order of gravel, sand, lime, and clay (Geological Aspects, z.d.)(Cremaschi, et al., 2015). Rivers periodically changed their course while freely using their dynamic characteristics, by which the different deposits were caused to be mixed and laid upon one another. As a result, this constructed an alluvial layer (alluvial means deposits transported by riverine floods) in which aquifers were formed, a saturated water storage body formed by permeable sediment. Uphill is a steeper slope where more coarse gravel material is disposed whereby rivers lose their velocity. This is the aquifer recharge area due to high soil permeability and fast groundwater velocity. Downhill, in the plain, the aquifers are more vulnerable as groundwater velocity decreases and soil is quite impermeable. In between these areas is the resurgence belt where aquifers surface the ground levels. This is a moment when unconfined aquifers are overfilled as underground water in permeable territory flows to impermeable terrain downhill (Museo Geologico G. Cortesi, z.d.). With this information, the origin of the formation of the Po Valley is provided to better understand the natural processes that went before the historical alterations of human mankind to its contemporary form.

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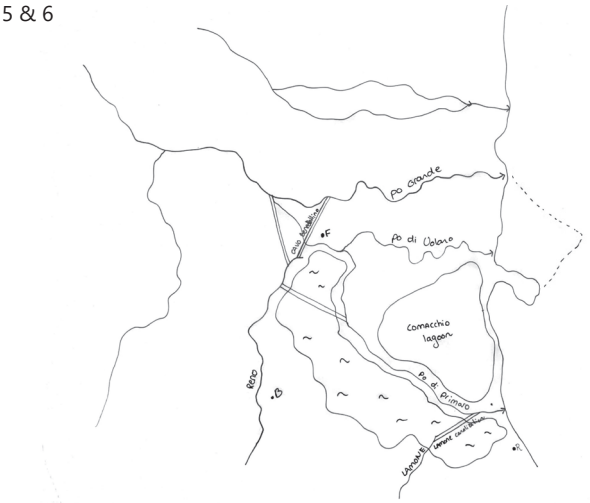

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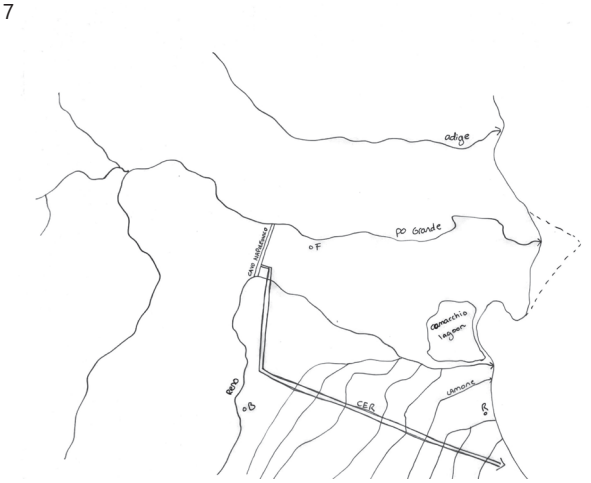

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FIGURE 7 | LONGUE DURÉE

1 | Bronze Age, the Terramare Civilization (1650-12th century BC)

In this period, the Terramare civilization is quite the protagonist in the region of Emilia-Romagna. The civilization was advanced and intelligent as they first (1150-1450 BC) had small village settlements up to 3 hectares built on adaptive pole housing for flood protection in the river and swampish territory. Within a decade, bigger villages developed which were up to 10+ hectares as mass colonization of the Hungarians on the Po Plein occurred due to political factors (Figure 6 / 1) (The Terramare Culture and the Bronze Age Collapse, 2021). At this time, the Po River, Reno River, and wetlandscape were a result of Alp and Appennine sediments transportation, and the coastline was moved towards the East, forming dunes. The Po River had two main branches, named the Po of Adria and the Po of Ferrara (Consorzio di Bonifica Delta del Po & Paganin, z.d.). The villages were built on reclaimed land surrounded by embankments and ditches. On the surrounding hinterlands, they had their agricultural system, based on cereal farming, herding, and metallurgy. Interestingly, the Terramara were an important component in a complex international maritime and amber trade system, being located at a very strategic central point between Nordic societies and the Eastern Mediterranean. Unfortunately, this advanced civilization, after flourishing for 500 years, came to an abrupt end due to a mass extinction. A climate crisis caused extreme droughts and cold periods, resulting in resource scarcity due to environmental overexploitation whereby 120.000 inhabitants had to be relocated to be able to survive (Sabatini, et al., 2018).

2 | Iron Aze, Padanian Etruria (10th-6th century BC)

In this time urbanization is prominent and human developments have become more dominant. The Etruscans, an ancient civilization inhabited in the Mid-Western part of Italy emerged from the Bronze Age, expanded their territory to the Po plain due to its fertile characteristics, and formed a Dodecapolis (league of 12 cities) (Italian Peninsula, 1000 B.C.-1.A.D. Heilbrunn Timeline of Art History. The Metropolitan Museum of Art, 2000). The first phase of this civilization which dominated Northern and central Italy is called the (Proto-)Villanovans and flourished due to their economic system based on trade and manufacturing of bronze and iron, connected to their still strategic trade system. They first lived in small hut-villages and were based around a warrior-farming society, but developed due to the economic flourishing of a society of elites and wealth (penn.museum, z.d.)

As this society flourished, urban developments happened simultaneously and as international trade was foundational for this economic success, port developments arose. The famous ports of Atri (or Hatria) (between the river Adige and the ancient Po mouth, nowadays *Adria*) and Spina (South of the ancient Po mouth) were constructed and connected the region to the world. These urban developments were possible due to the Etruscans' knowledge of hydrology and hydraulics as they continued the land drainage as their ancestors had done. On the reclaimed lands, the Etruscans introduced the irrigation technique by which low-lying settlements were able to be built as a network of drainage channels in the wetlandscape was implemented and problematic stream embankments were strengthened (Ferronato, et al., 2014). The Po was regulated to prevent the ports from silting up for which a drainage system was constructed and the river at Spina was strengthened with artificial river branches and canals to prevent annual floods (ETRUSCAN ENGINEERING & AGRICULTURAL ACHIEVEMENTS, 2007). These cross-connections constructed the various lagoons (Seven Seas) in a complex hydraulic system. These water systems were also used by the public and for agricultural purposes. Due to the silt deposits the coastline moved eastward (Consorzio di Bonifica Delta del Po & Paganin, z.d.). Not until recently the remains of the ancient port of Spina were discovered near the Comacchio lagoon by illegal traders of fishermen who found remains in the waters.

3 | Roman Empire, Via Aemilia (1268-183/150 BC)

Roman colonization occurred in the Po Valley as they conquered the Etruscan civilization. Similar to their ancestors, they colonized here for the same reason, fertile land. This was urgently needed as Roman societies expanded rapidly. Even though the Etruscans altered the natural landscape, the Po Valley still was composed of marshland and wetlands (Consorzio di Bonifica Delta del Po & Paganin, z.d.). Introduced by the Romans, a new period of advancement arrived with the construction of a new infrastructure system characterized by the road Via Aemilia in the Po Valley (Figure 6 / 3). This infrastructure system connected the whole of the Italian Peninsula to its core, Rome. The Via Aemilia was completed in 268 BC at the border of the Apennine mountain range on top of an ancient foundation of a road system (connecting Piacencia to Rimini), along which new colonizations thrived such as Bologna, Rimini, Modena, Reggio Emilia, and Parma (Campedelli, 2023). They were also functioning as military trespassing borders due to their geographical location. These new colonies were constructed by a Roman system, the centuriation works (figure X). This system consisted of agricultural plots in an orthogonal grid divided by various settlers who individually took care of their plots (Tesfamikael, 2017). As the Po Valley was a marshland, increased land reclamation and reforestation works provided land for the construction of this agricultural grid (Ferronato, et al., 2014). However, this reclaimed land was still often threatened by floods (Brandolini & Cremaschi, 2018). In 89 BC Ravenna was also under the control of the Romans and the military harbor of Classe (ancient port of Ravenna) was a very important maritime component. At this time Ravenna was an archipelago of lagoons built on pile housing (Fondazione Parco Archeologico Di Classe, 2022).

4 | The Medieval Age, Fall of Roman Empire and Ferrara (2th century AD - 476 AD)

In this time period, the Roman Empire fell. As Romans tried to reclaimed land (successfully), with their fall the Po Valley was again threatened by floods from the rivers from the Apennines (Curtis & Campopiano, 2014). The territory drastically turned into a swamp basin as irrigation systems were not maintained and a colder climate caused the Po river to waterlog (Brandolini & Cremaschi, 2018). In this time, the Po river with its two branches (Po di Primaro and Po di Volano) was situated south of Ferrara, a newly born city foundation. Ferrara has a Byzantine Castrum (castrum bizantino di Ferrara), a military and trade camp during the early Roman period, as its historical core. Ferrera is an interesting geologically situated city as it is formed by the functioning of the river Po and formulating the start of (its) Po delta, resulting in its miraculous cultural landscape full of rich history (Unesco World Heritage Centre, z.d.). However, due to the Ficarolo's break (rotti di ficarolo) the embankment of the Po river broke through near the city of Ferrara and transformed the course of the Po river towards the North, bringing life to a new river course, the Po Grande (Po di Venezia). As a result, the Po di Primaro, which was the main river, had a reduced inflow of water and affected the economic flourishing of the city of Ferrara. A long period of devastating floods was the result as Apennine rivers transported sediment to the Po di Primaro (later Reno).

5 | The Medieval Age, 'Flumen Raffanarie' canalization (1504-1570 AD)

One of these Apennine rivers is the Lamone river, separately from the Po di Primaro flowing into the Adriatic Sea, north from Ravenna (Figure 6 / 5 & 6). As the territory of the Po di Primaro basin (former waterbed of the Reno river) was continuously threatened by the floods that occurred due to this wild hydrological system and for economic purposes, the Lamone river canalization took place in 1504 AD (Ferronato, et al., 2014). This was one of the first hydraulic successes as the Lamone river now was connected to the Po di Primaro. In this time, Ferrara developed into a flourishing city under the power of the dynasty 'House of Este', just as Modena and Reggio (Unesco World Heritage Centre, z.d.). During the 10th and 13th century AD, the Medieval Warm Period climate provided conditions for European civilizations to develop and, instructed and stimulated by private owners and monasteries, land increasingly was drained. During the 14th and 15th century complex urban developments were designed and executed in the city of Ferrara, marking it as the first Renaissance city to do so (Unesco World Heritage Centre, z.d.). During the 15th-16th century AD, the Renaissance, large-scale land reclamation (the Bonifica Bentivoglio drainage system) happened, stimulated by the Este family, which continued far into the Modern times as we know it now, when the last wetlands were drained, creating a artificial landscape (Brandolini & Cremaschi, 2018)). However, at the end of the 16th century all rivers flowing from the Apennines to the Po di Primaro again flooded the area, recreating the ancient swamp landscapes on the previously colonized and cultivated lands (Ferronato, et al., 2014).

6 | Modern Age, Cavo Benedettino: Reno canalization (1750 AD)

During history one river was framed as the most problematic. The Reno river. In the past the Reno river, as many other Apennine rivers, was not naturally connected to the Po Grande and therefore shaped the swamp landscape of the Reno basin territory by frequent flooding (Figure 6 / 5 & 6). Due to these floods and "due to political reasons, the Reno canalization was not realized until 1750 AD" (Ferronato, et al., p. 765) where this man-made canal connected the Reno river to the ancient bed of the Po di Primaro. However, due to lack of maintenance the canal silted up. Several attempts during history were made to continue the construction of the Cavo Benedettino, but each time it ended up in the same way as the first try in 1750 AD.

7 | Modern Age, Cavo Napoleonico and Canale Emiliano Romagnola (1807 AD- 1980 AD)

Finally, in the time of Napoleon, the construction of Cavo Napoleonico in 1807 AD appeared to be the work of the impossible. With this construction, the Reno River reached the Po Grande through a 18-km long artificial canal starting near Cento, a city near Ferrara (Figure 6 / 7). Up until nowadays, this canal secures water safety from riverine floods and allows major land reclamation works to alter the Po basin territory. For this, a hydraulic system of 150 km of canals was dug. 'In 1925 AD, after the foundation of the Consorzio di Bonifica Renana, the setting of the actual drainage network of the Reno plain was established thanks to Ing. Pietro Pasini' (Ferronato, et al., p. 767). The hydraulic works of the region expanded after Napoleon's canal which is stated as one of the most important hydraulic interventions done during history. Additionally, a different hydraulic work is crucial to the water management of the region of Emilia Romagna. The Canale Emiliano Romagnola, constructed in 1970, concerns a canal of 165 km in the region from Bologna to Ravenna. The initial motive for the canal was an irrigation system for agricultural land, as the region is highly dependent on these productive lands (Ricci, 2014). The idea originated in 1863, but it took more than 100 years to finalize it, while during this time major adjustments to the project had been applied to fit the current state of society. It slowly became a multifunctional complex water system for agricultural, industrial, civil, productive, environmental, and touristic use. The canal provides clean drinking water for the region and is the only source during the summer. Seven lifting plants are used to accommodate the canal through the territory, and with this, the introduction and development of the modern, artificial hydraulic water works have been identified and introduced the new period:

The Anthropocene, the artificial landscape

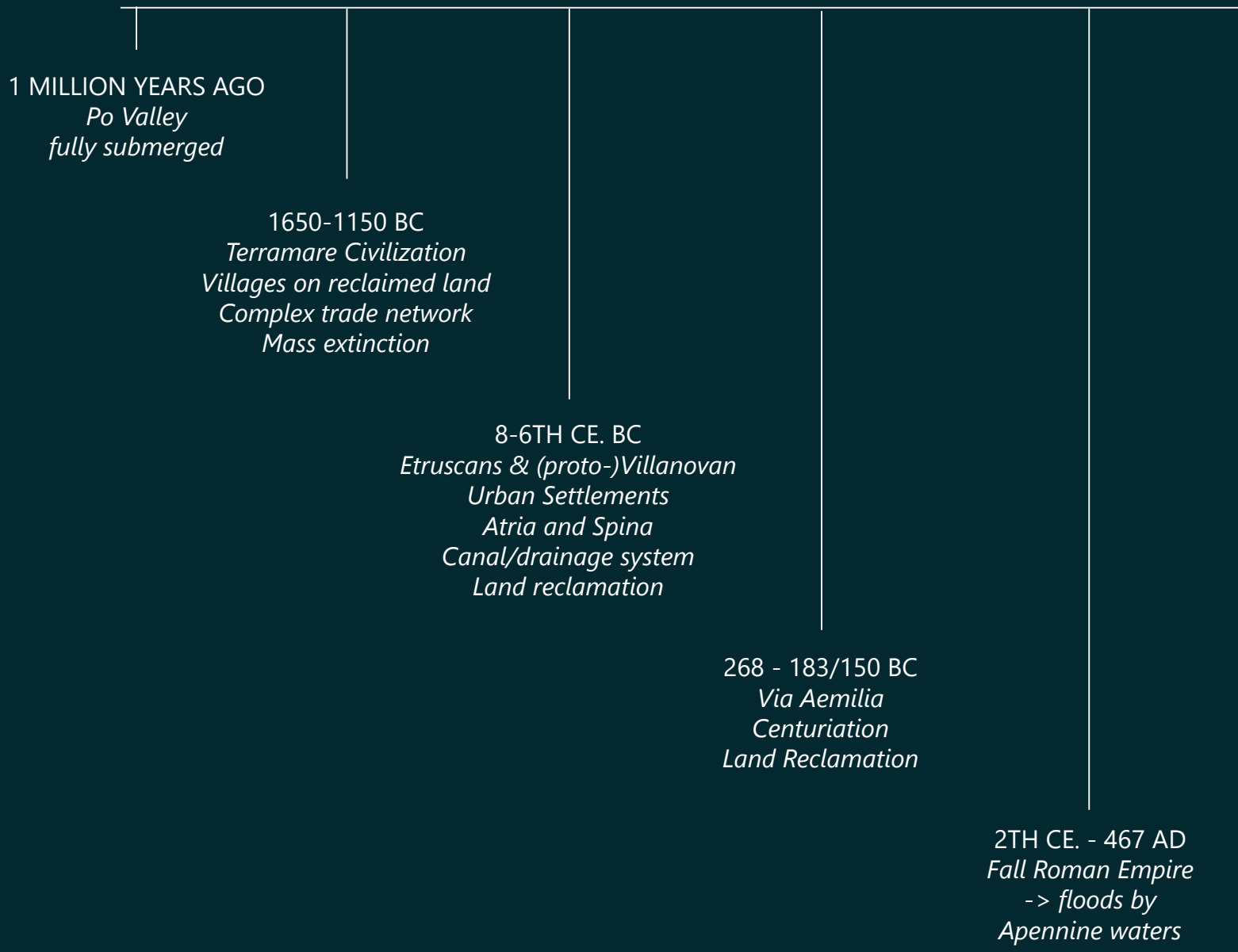


FIGURE 8 | OVERVIEW HISTORICAL HUMAN ACTIONS FOUNDATIONAL FOR TERRITORIAL TRANSFORMATION

1152-1192 AD
Ficarolo's Break
-> Po Grande North of Ferrara

1504 AD
Lamone River canalization
-> silted

1740 AD
Cavo Benedittino
-> silted

1807 AD
Cavo Napoleonico
-> succes!

19TH/20TH CE.
drainage network of Reno Plain

4.3 THE DUTCH LAYER APPROACH

FRAMING THE CONTEMPORARY CONDITIONS

The Dutch Layer Approach has been used to structure the spatial analysis of the southeastern area of the Emilia-Romagna region. The following layers are explored: territory (water and natural), infrastructure, urban and industrial fabric, and agriculture and hydraulic system.

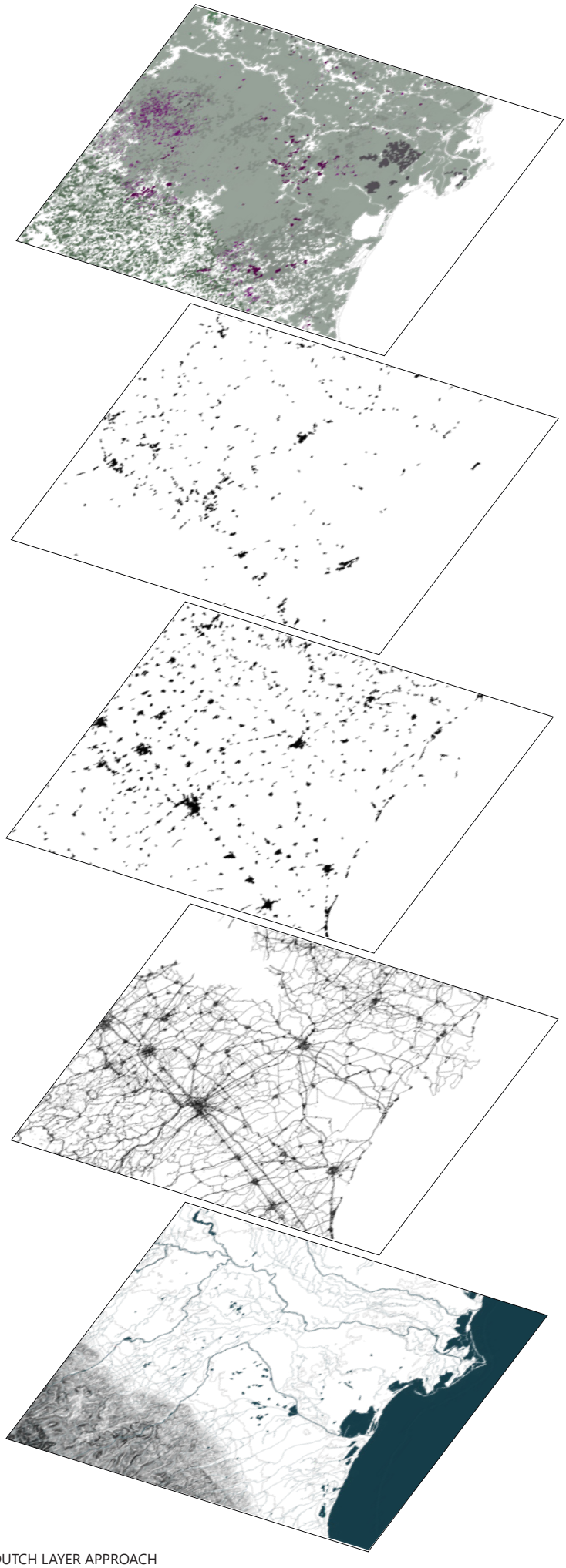


FIGURE 9 | DUTCH LAYER APPROACH

TERRITORY | WATER

As water is the subject in this thesis, in the layer of the natural territory water is separated from the other elements. The longue durée has provided an overview of the human influences on the natural territory with a specific focus on the hydrological system. On this part, the history of the Po territory and especially the southeastern part of the Po territory, in which the rivers originate from the Apennines, is defined as, historically and contemporary, the most risk area regarding flooding. The Reno River specifically is highlighter as problematic, as not until Napoleon implemented the Cavo Napoleonico floods were drastically threatening the existence of this part of Emilia-Romagna. Now the longue durée provided the historical overview, the third sub-research question will be answered through critical mapping and critical cartography:

By what (systematic spatial elements is the contemporary territory of the region of Emilia-Romagna constructed and how are these composed?

Thus, first, the (natural) hydrological system: water. There are three prominents 'main rivers', as history showed us: the Adige River (North of the Po), the Po River flowing into its delta, and the Reno River (south of the Po) flowing along the Comacchio lagoon. From these main rivers, various tributaries articulate the territory. In this selected territory, all the rivers originate from the Apennine mountains, with the exception of the Po River which (also) originates from the Alps.

Surface water is scarce in the territory, as can be seen on the map. Interestingly, the surface water that is situated in this territory, is mainly along the coastline and a few sprawled dots of waterbodies in the territory, close to where multiple tributaries connect the Reno River. The riverine discharge pressure is higher as these rivers join here together. Comparing this to the flood risk map of one of the most recent, devastating, floods that occurred in 2023 in this region (Figure 10) and the flood hazard classification map (Figure 11), it can be concluded that this part of the river system is most vulnerable and threatened by the impacts of increased river discharge (as it did through history) causing extreme flood risks. The flood hazard classification map even illustrates that this territory is labeled and framed as classification H3, the highest classification.

Both maps illustrate the increased risk at the area where two rivers connect to the Reno (Idice River and Sillaro River), impacting a large part of the territory surrounding these rivers. But also along the two other rivers connecting to the Reno River more towards the Adriatic Sea, namely the Saterno River and Senio River. And lastly, the Rivers of Lamone and cross-rivers of Montone and Ronco, which mouth flows into the Adriatic Sea individually, experiences high flood hazard in the surrounding territory. For all the rivers, the flood hazard increases towards the lowest part of the plain, where they meet other rivers and come together. Map 1 illustrates similar conclusions, focussing on the Rivers basins south of the Po, the Reno-Lamone-Montone&Ronco territory.

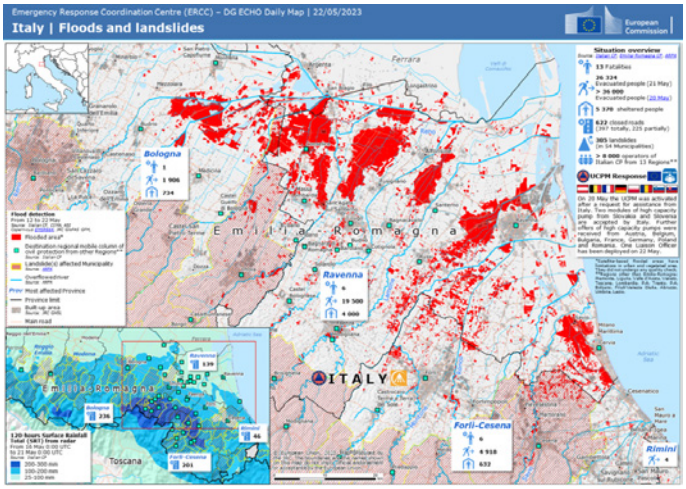


FIGURE 10 | FLOODS AND LANDSLIDES. (ERCC, 2023)

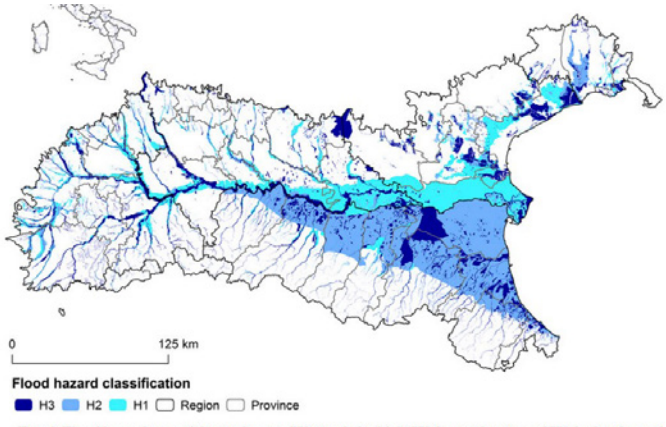


FIG. 3. Flood hazard map of the study area; H3 stands for high, H2 for moderate, and H1 for low hazard probability. Top left picture shows the flood hazard map for the whole Italian territory. Own elaboration from ISPRA (2015) and Trigila et al. (2015).

FIGURE 11 | FLOOD HAZARD. (Roder, et al., 2017)

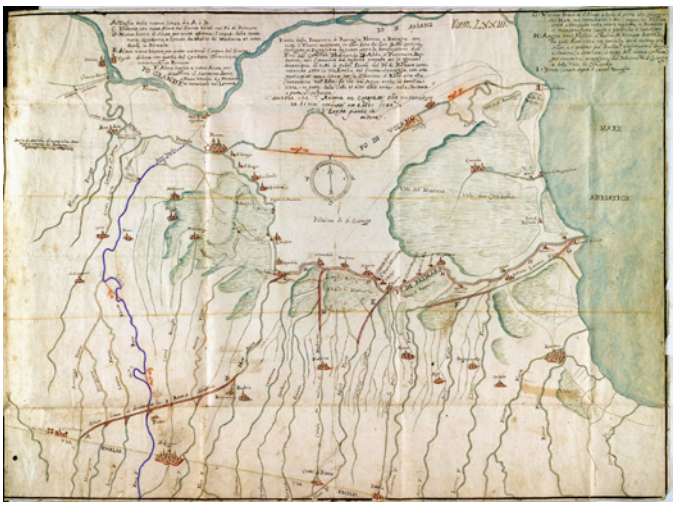


FIGURE 12 | HISTORICAL MAP RENO TERRITORY. (unife universitá di ferrara, z.d.)

FIGURE 13 | HYDROLOGICAL SYSTEM

FIGURE 14 | HISTORICAL MAP MARSH LANDSCAPE PO DELTA.
(unife universitá di ferrara, z.d.)

FIGURE 15 | HYDROLOGICAL SYSTEM

FIGURE 16 | HISTORICAL MAP MARSH LANDSCAPE PO DELTA.
(unife universitá di ferrara, z.d.)

FIGURE 17 | HYDROLOGICAL SYSTEM

The longue durée analysis presented the fact that almost every hectare of wetland has been reclaimed, as can be seen in Figure 9 compared to Figure 10. As stated before, most of the large water bodies are situated along the coastline and small dots are sprawled through the territory. Comparing this to the maps in Figures 24 and 25, this is what is left of the historical cultural wetlandscape. The map shows that the natural Po Delta consists of more than half of the existing water bodies (including wetlands). Then the Comacchio lagoon, which has been there through history, still exists. The surrounding coastal territory has some bigger 'spots' of water, compared to the inland 'spots'. However, how are these water bodies categorized? To indicate what the 'wetlandscape leftover' is, the catalog of the various water categories is visualized in Figures 18-23. In the same order, the water is categorized as a total overview, coastal lagoons, salt marshes, salines, inland marshes, and water bodies.

Another finding, while overlaying the 'natural reserve' on the water bodies, it appears that a big part of them are protected areas. The Po Delta (Parco del Delta del Po), is the area where two rivers connect to the Reno (Parco Regionale del Delta del Po (Valli di Argenta)). Except for the Comacchio lagoon and water bodies south of this lagoon along the coast.

TERRITORY | NATURAL ENVIRONMENT

In addition to the water layer, the territory also consists of other natural elements such as forests, beaches, and grasslands. This is displayed in Figures 26 and 27, where Figure 27 provides the same map but with the addition of the topography layers (mountains and coastal). The displayed natural areas are mainly formed by the different types of forestry and beaches along the coast. In yellow the natural grasslands are visualized, which mainly are situated in the mountain range. Along the coast the coniferous and mixed forests are situated, in the mountain range mainly broad-leaved forests, and along the Po River and in the mountains transitional woodland-shrub.

Conclusion

These analyses have shown that the formation of the hydrological systems, compared to the flood hazard and risks maps, explains where the main risk areas are as water accumulates due to cross-over areas and geomorphology of the rivers, as the flood risk areas are located in the lower plain where the river velocity decreases due to the decreased slope of the territory.

Furthermore, the 'leftovers' of the intensive land reclamation works are located along the coast, and small spots of water bodies sprawled on the inner territory. Compared to historical maps, water was given more room as land reclamations were not fully executed along the whole territory. Life was surrounded by water, however, the territory was still threatened by floods. Forests and grasslands are mainly located in mountains, along the Po River, and the coast which can also be explained by the land reclamation works. In ancient times, the territory was covered by wetlands and forests, but this is what is left over.

More than half of the wetlands are part of natural reserve areas, which concludes that to preserve this historical cultural landscape the land-use of 'protection' has to be given to the water bodies to provide its value. Otherwise, other land uses such as agriculture and urbanization are prioritized, due to the Anthropogenic way of living. Water on its own does not have value in this ancient water territory.

FIGURE 18 | WATER LANDSCAPE

FIGURE 19 | COASTAL LAGOONS

FIGURE 20 | SALT MARSHES

FIGURE 21 | SALINES

FIGURE 22 | INLAND MARSHES

FIGURE 23 | WATER BODIES

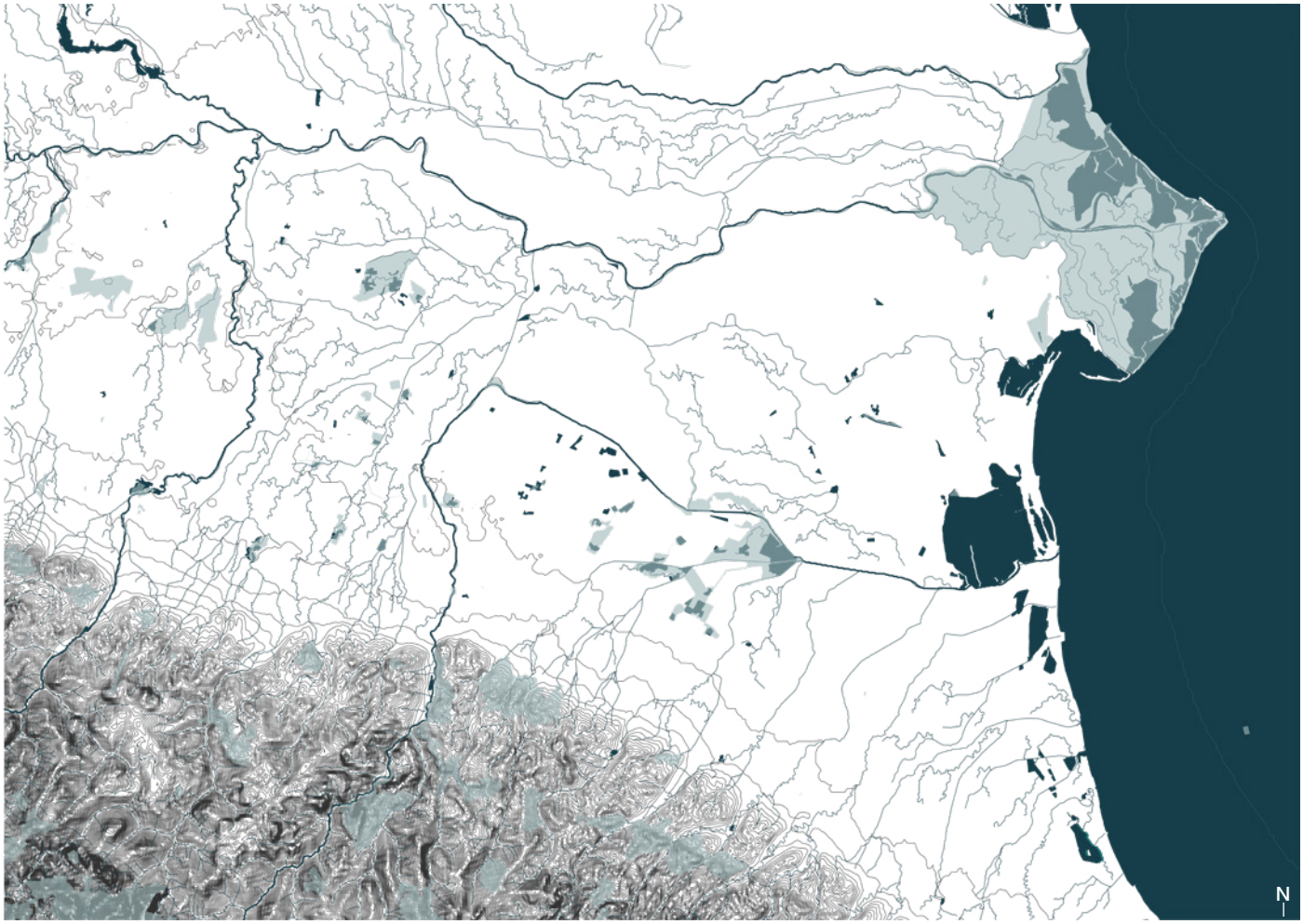


FIGURE 24 | *existing water bodies with the nature reserve areas overlayed*

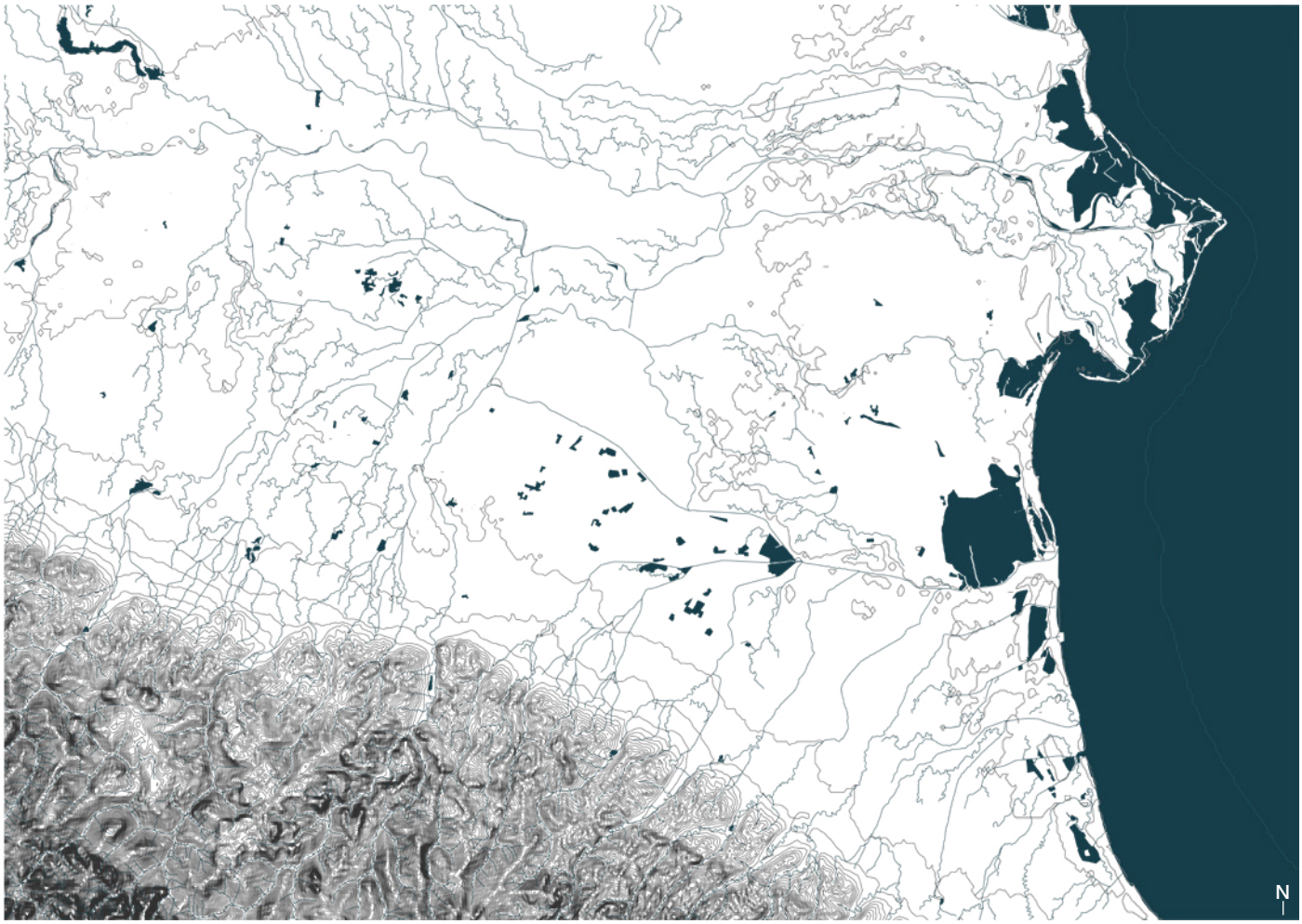


FIGURE 25 | *contemporary situation water bodies*

FIGURE 26 | *contemporary situation with natural territory (forest, grassland, and beach)*

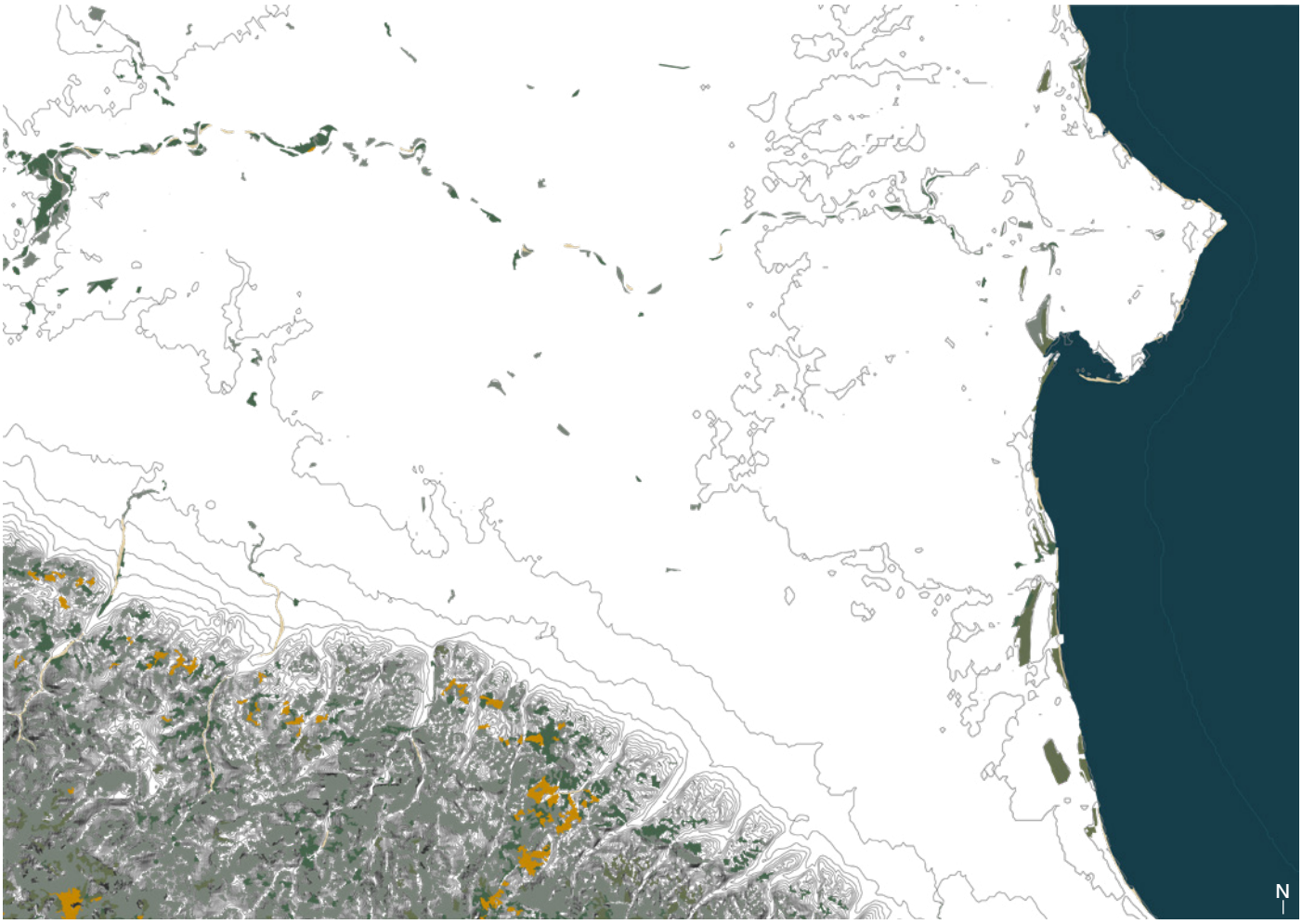


FIGURE 27 | *contemporary situation with natural territory and topography*


N

INFRASTRUCTURE

The next layer of the system approach is the infrastructure and therefore this element will be explored, analyzed, and mapped to provide an understanding of how this element structures the territory of the southeastern part of the Emilia-Romagna region. As this region is rapidly urbanizing and consists of important agricultural and industrial lands, this requires supportive infrastructure. But also coasts (and the inner territory) are entirely developed for tourism. Figure 25 shows how the whole region is entirely connected and accessible by roads, sparing almost no land. But what is the foundational structure of the territory? How is it framed?

The longue durée discovered that the Via Aemilia, connecting the region of Emilia-Romagna from the west to the coast on the east, was constructed during Roman times and was part of an important network that connected the whole of the Italian Peninsula. To this day, this connection (yellow) still consists (Figure 26), as a dominant, linear dividing, marking, and structuring the territory. However, it is not in its ancient form, but on top of this structure, the same connection has been kept alive. As in Roman times colonization arose along this infrastructure line, this road goes straight through the cities. Parallel to the Via Aemilia, with the introduction of the car, the highway A45 was constructed. These large-scale connections mark the border of the mountains and the Po Plain, as it already did in ancient times.

In Figures 27-30 an overview of the various layers of the territory are mapped. The first map illustrates the highways, in the next map the primary layer is added, the following the secondary road system is added, and lastly, the tertiary road layer. It is interesting to see that the main connections (highways) are harshly structured and figuratively are cutting the territory, as the primary roads are somewhat following the territory but also consist of this harsh character. The highways connect strategic points in the territory: Ravenna, Bologna, and Ravenna, along the Comacchio lagoon, and further into the territory. Whereas the primary connections connect the territory in between and along the coast, already more specifically accentuating the locations of the bigger cities. Except for Bologna, which is already accentuated with the highway, accentuating its strategic location within the infrastructural system (of Via Aemilia).

When adding the secondary road layer, the main structure of the centuriation system from ancient Roman times is visible. An interesting contrast to the road structure that now appears south of the Via Aemilia in the mountain territory, where the road patches are more organic and follows the territorial morphology. The suggestions of the locations of cities in the territory are also more emphasized now, as the inner circle of Ravenna appears

And then lastly, the tertiary layer illustrates the more precise agricultural plot system of infrastructure, and the cores of urban settlements are more defined now.

Conclusion

To conclude the most important findings of this analysis, the following is stated. The territory is entirely developed for agricultural, industrial, and touristic purposes and to connect the cities and urban settlements. The infrastructure still reflects the Roman foundation of the strong linear connection of the Via Aemilia and the centuriation system of agricultural plots. On an abstract level, the infrastructure connects the most important acupunctures, which are the cities, the coast, the mountains, and the lagoons.

Figure 25 | *infrastructure*

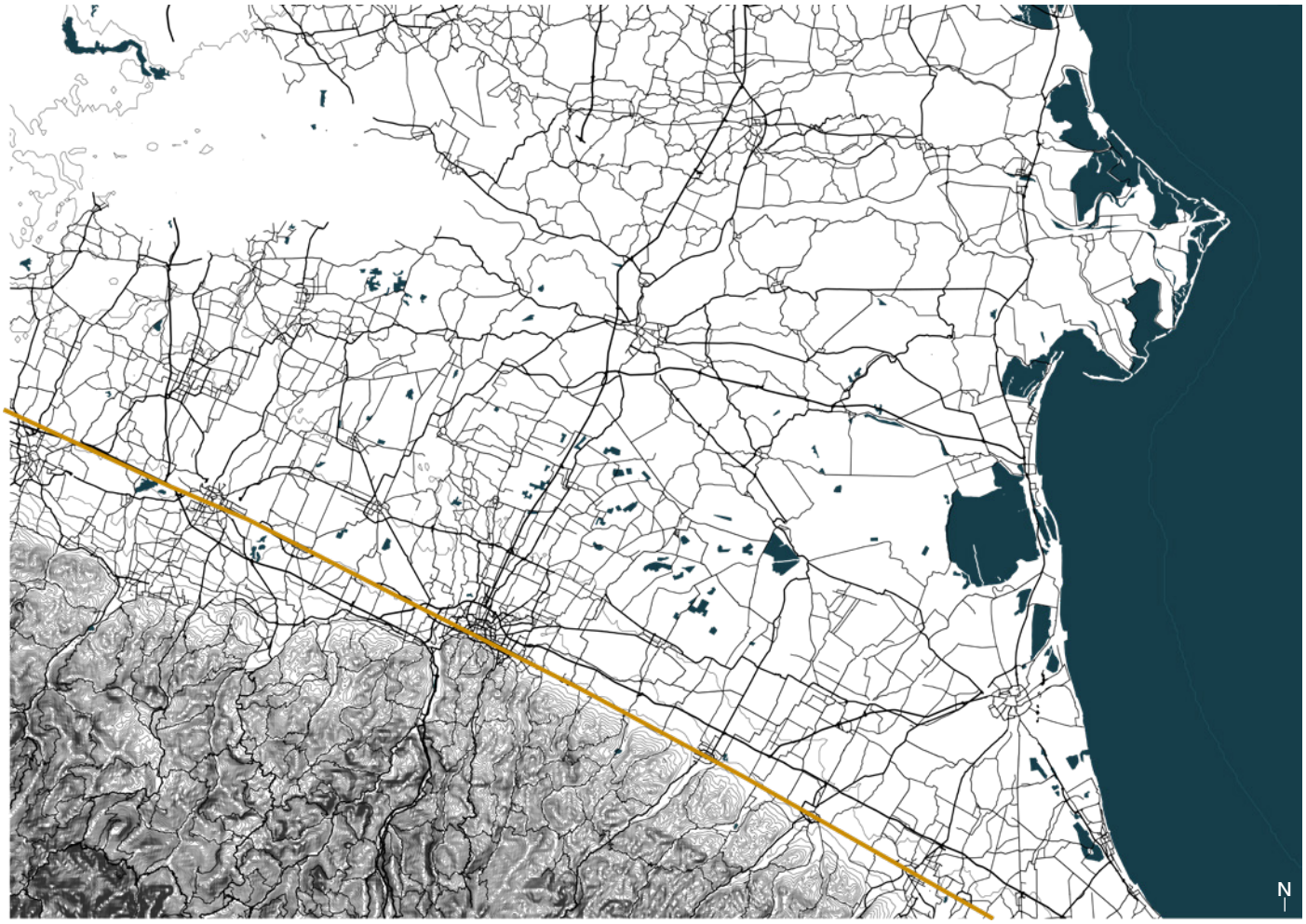
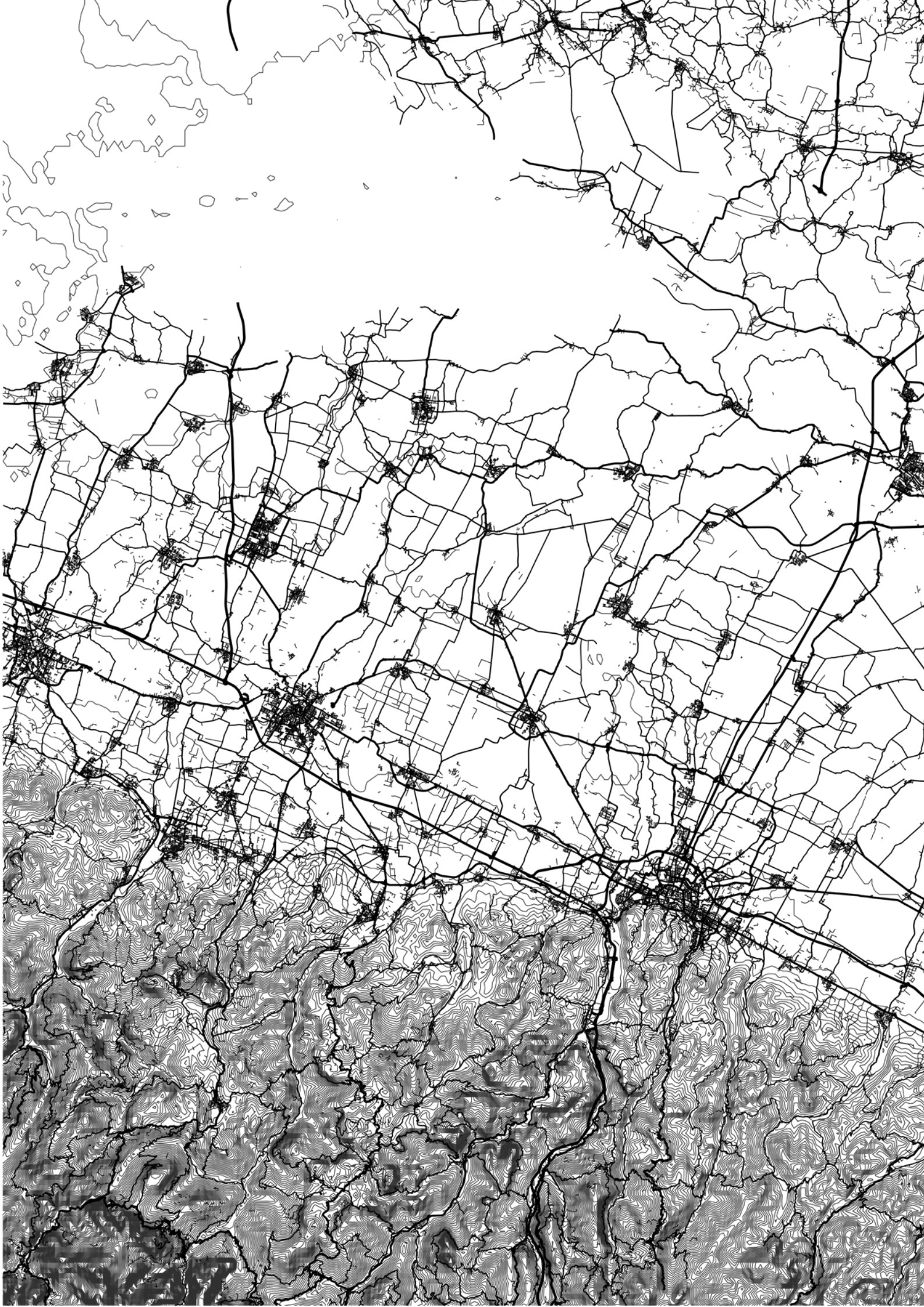


Figure 26 | *Via Aemilia*




N

URBAN FABRIC AND INDUSTRY

Just as the previous chapter on infrastructure and the longue durée has uncovered, the territory of the Po Plain and its region of Emilia-Romagna is entirely urbanized, which is still rapidly expanding. The area is decentralized as the composition of the urban fabric is sprawled along the territory, just as Figure X shows for the southeastern part of the region of Emilia-Romagna.
For the urbanization processes in this region, infrastructure was a core element that stimulated the birth of new colonizations and cities. Figure 31 displays the urban territory, however, the infrastructural connections, especially the main infrastructure, are visible through the composition of the urban fabric. There is still another element that is crucial for the arising of urban settlements, as explained before, the element of water. This (ancient) water territory consists of a rich river structure that originates from the Alps and the Apennines. Even though the cities (also) arose along the Via Aemilia, each area is connected to one of the Alpine rivers that flows towards the coastline and the Po River. It is interesting to compare three big cities in this region, Ravenna, Bologna, and Ferrara, as they arose along different territorial conditions even though they are in the same area (Figure 32).

First, Ferrara. Just as many other cities in this territory, the urban fabric consists of a Roman core: a Byzantine Castrum (military camps/defense works) (Figure 33). These Castra of ancient Rome had different sizes and provided protection and housing for 1000 to 7000 soldiers, their families, and horses, and were rectangular often surrounded by a ditch and mound (Oxford Reference). The Castrum Bizantino di Ferrara arose as the Byzantine trade along the Adige and Po Rivers had to be safeguarded. It was situated on the left bank of the Po River when the Po separated into its two branches. Hereby, the soldiers had control over the two access points from the Adriatic Sea, connected to the Po Delta (Uggeri, 1974). Water was thus crucial for the trade and defense conditions on which the city of Ferrara arose. After this, the city started to develop but during the Medieval, the city flourished as the city walls expanded during the Medieval expansion of the city when the Este family provided wealth and economic growth (Unesco World Heritage Convention, z.d.). During the Renaissance, the city developed a complex urban plan, marking it as the first Renaissance city to do so. Ferrara was a cultural center as it flourished in various domains: cultural, social, economic, and political (Scafuri & Unesco World Heritage Site, z.d.).

Then, Ravenna. In ancient Roman times, Ravenna was the naval base of Rome's Eastern Fleet. The geological position of Ravenna along the coast and with its lagoon, as Ravenna originally was constructed on a coastal archipelago, marked this area as a tragic point for a military and trade basis. The ancient port of Ravenna in 89 BC Classis, arose therefore for its strategic position which connected the region with its hinterland and Rome internationally to Northern societies and the Mediterranean. The village was built on wooden poles on islands in a lagoon developed through time and kept its strategic importance as it was the biggest military base in the Adriatic region (Deliyannis, 2010). From the year 0, when emperor Augustus Caesar reigned, the wetlands were drained, land reclaimed, and were artificial canal systems constructed for the navigation of the fleet. In 402 AD, Emperor Honorius located his court in Ravenna, marking the city as the capital of the Western Roman Empire. After the Romans, the city developed more until the port of Classis silted up and the city lost its economic importance. In 1952 the city of Ravenna was a new port and industrial opportunities were discovered, whereafter a rapid industrial-port-based fabric arose (Ravenna History, z.d.) (Figure 34).

Lastly, Bologna. Bologna finds its origin in the Etruscan time (6th century BC), named Felsina. During Roman times, the name of the city was changed to Bononia and its colonization arose along the Via Aemilia. The city flourished over the centuries and constantly kept its importance culturally, socially, politically, and economically and is nowadays the capital of the Emilia Romagna Region (Bologna: Art and History - University of Bologna, z.d.). The city of Bologna also has a Byzantine Castrum core, accentuated with a grid structure, but is also structured with a second urban feature, called the porticoes (Figure 35). This is a 62 km long multifunctional structure of porticos that arose in the 1100s when the development of the University of Bologna was in urgent need of new urban spaces (Bologna Italy, 2018).

Thus, the arising of the cities is based on the conditions of infrastructure and water structures. Closely related to the urban fabric is the development of industrial land use. Figure 36 shows the map of the urban fabric with its surrounding industrial fabric. The largest industry patches are nearby big cities (Ravenna, Ferrara, Bologna, and (in cities) along the Via Aemilia. Comparing the bigger cities, it is interesting to see that Ravenna, in the coastal area, has an industrial territory larger than the urban fabric of the city, as the most recent development of the city was dependent on industrial opportunities. Most of the heavy industry is situated along the Via Aemilia and the bigger cities (Eurostat, 2004). Ravenna is a chemical and port-industrial district focussed on the shipping industry, petrochemical sectors, energy production, and waste treatment services the discovery of Terra gas field (Eni Rewind, z.d.; Emas Ravenna, z.d.), Bologna marks as the area for engineering, electromechanical and metals, food industry, and automotive industry, and Ferrara has a focus on chemicals and plastics as it is a petrochemical hub (Regione Emilia-Romagna, 2022). In the in-between territory, it is mainly focused on productive industries (shoe and leather industry, ceramics, etc.) also accompanying the agricultural sector. This industrial-urban structure is connected to the (artificial) water system as the water supply is crucial for the existence of these areas.

Conclusion

To conclude, the urban fabric is decentralized and sprawled along the territory. Water and infrastructure are the main conditions for the arising of the cities and connecting the cities, which all find their origin in Byzantine times. Ferrara, Ravenna, and Bologna are all connected to water and infrastructure, but in various forms, as they are situated in different territories with their territorial conditions and characteristics. Bologna (infrastructural) hinterland, Ferrara riverine landscape and Po delta, and Ravenna a

FIGURE 27 | *urban fabric*

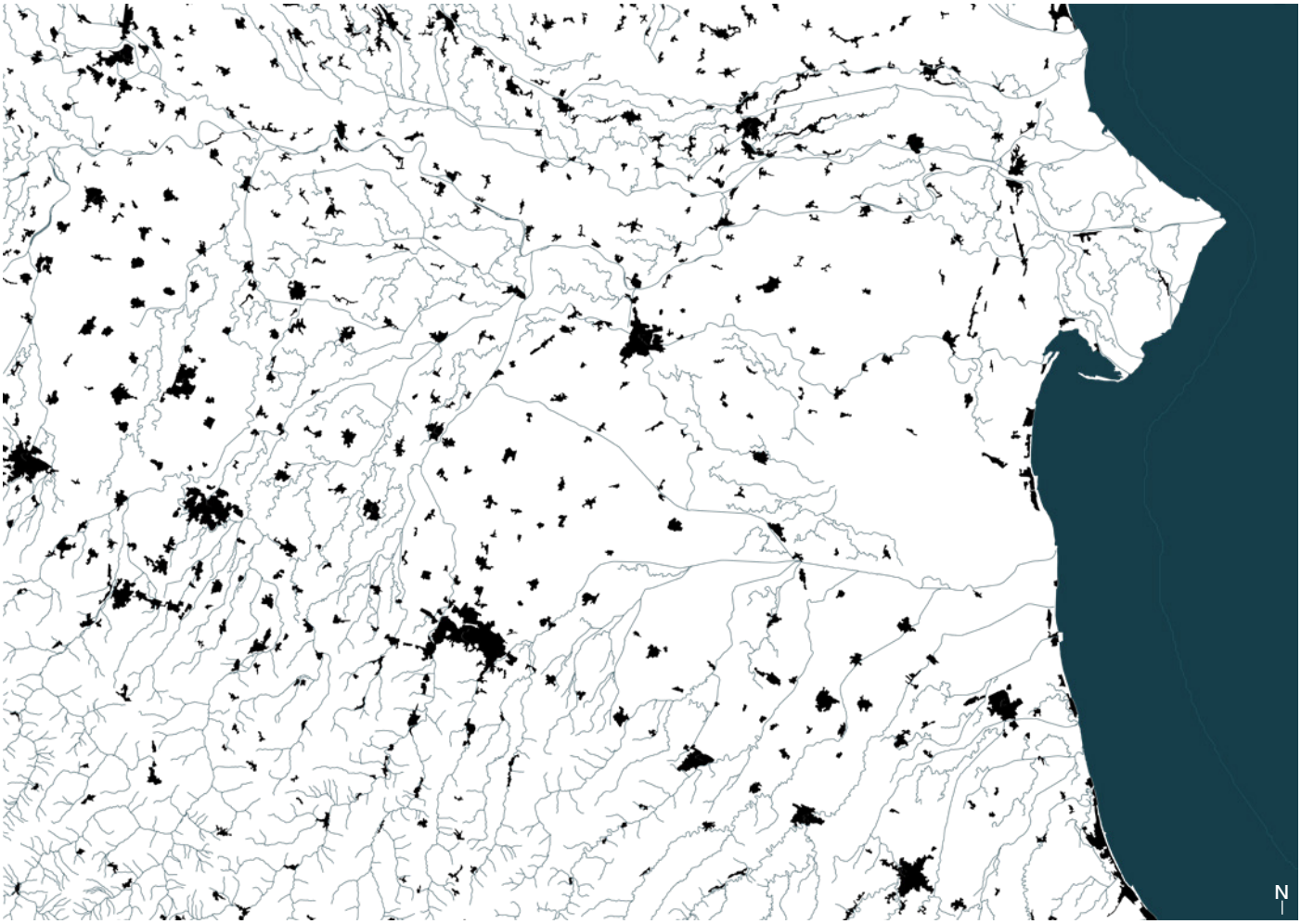


FIGURE 28 | *urban fabric in hydrological system*

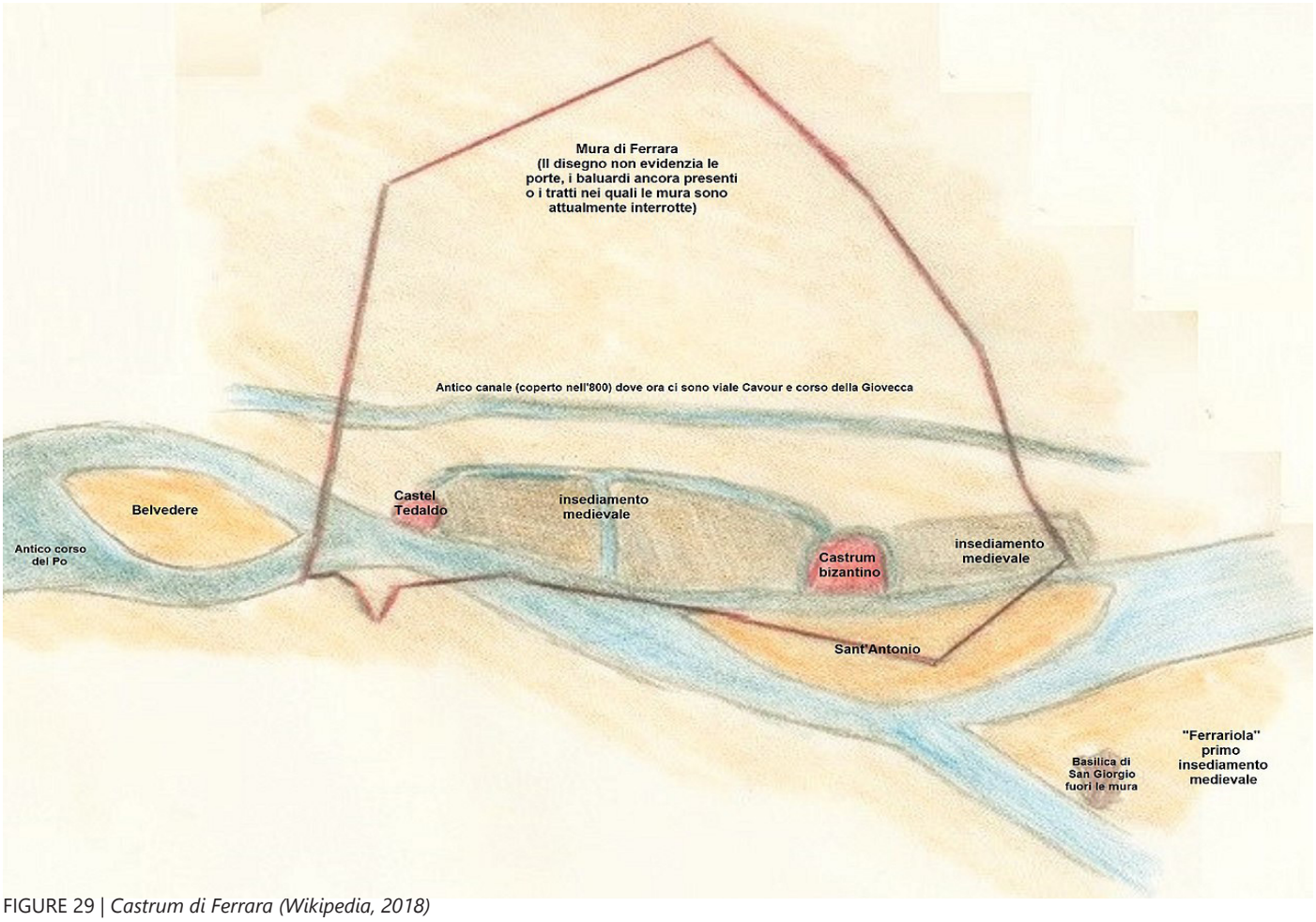


FIGURE 29 | *Castrum di Ferrara (Wikipedia, 2018)*

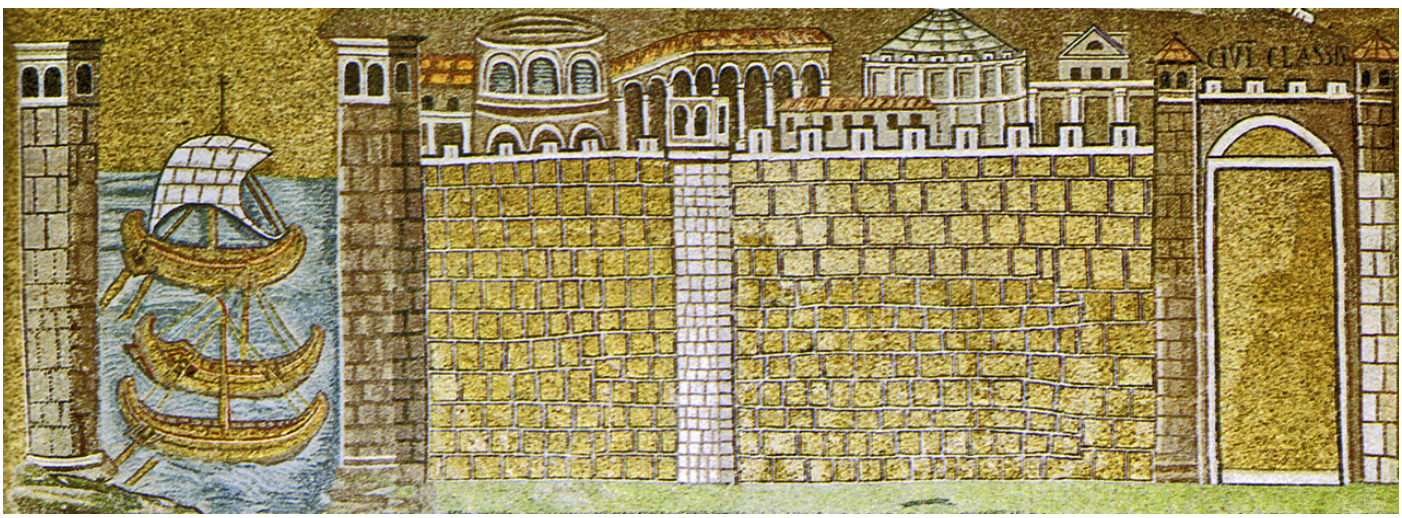


FIGURE 30 | *mosaic of classe, ancient port of ravenna (basilica of sant'apollinare nuovo). (On the Mosaics Road, 2018)*

FIGURE 31 | *the porticoes of bologna. (Unesco)*

coastal port territory.

The industry is closely connected to the urban fabric and also sprawled along the territory. The heavy industries are intensely situated along the Via Aemilia and the bigger cities, whereas the inner territory is characterized by smaller, productive industries.

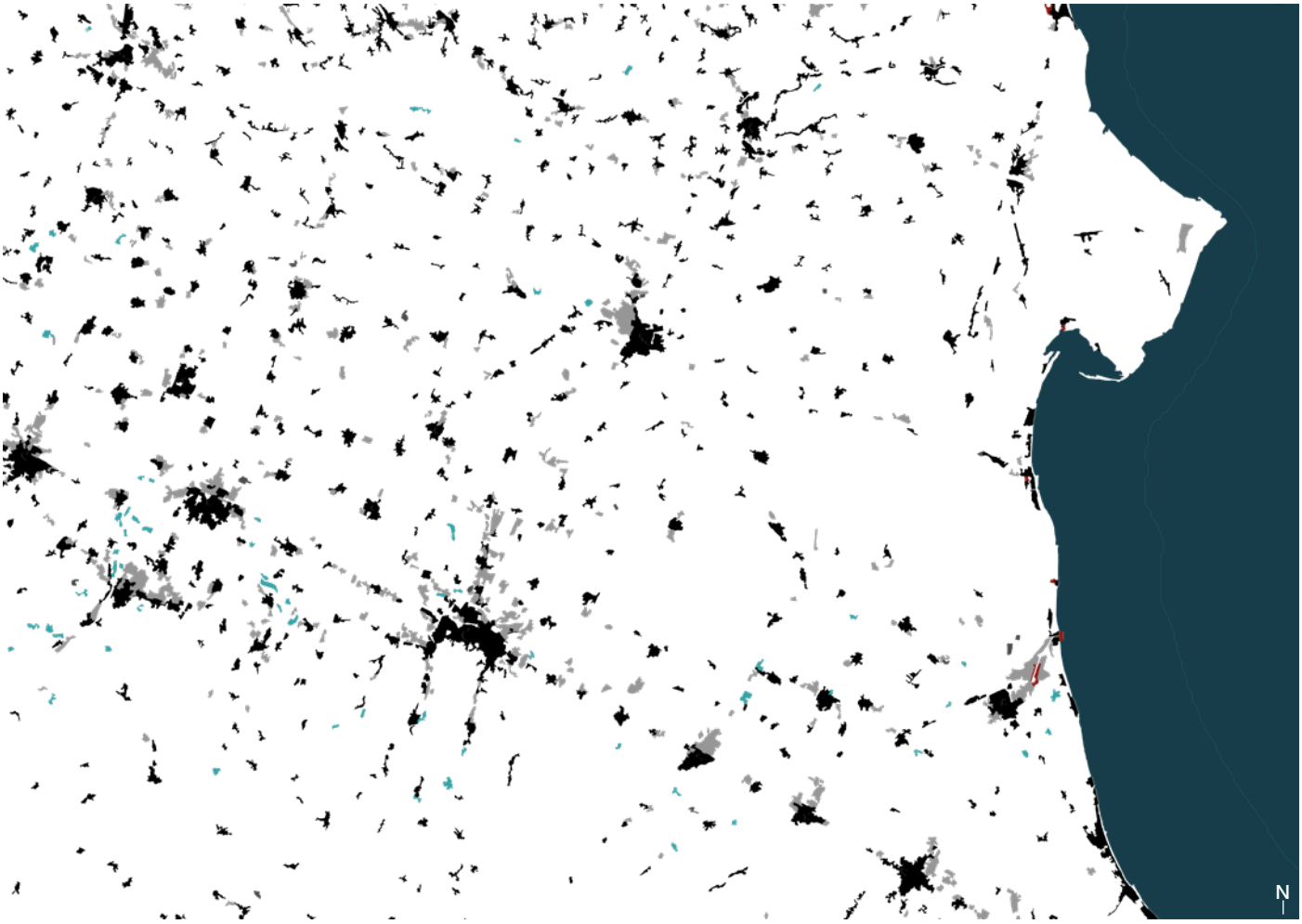


FIGURE 32 | *urban vs. industiral fabric*

FIGURE 33 | *industrial fabric*

AGRICULTURE & HYDRAULIC SYSTEM

The Po Plain has always been an attractive target for many civilizations as it consists of a crucial characteristic for the existence of a society, fertile soil and accessibility to water. Agriculture has been present throughout the whole history of the region and only intensified more in Medieval and Modern times. Habitation and agricultural practices were possible and (increasingly) expanded due to the (advanced) techniques of land reclamation that the inhabitants controlled, introducing the artificial canal and drainage systems to secure water supply, navigation, and flood management. Accompanied by this, the control of the rivers through canalization and (strengthened) embankment arose. The start of the artificial landscape in the Anthropocene. Thus, how is agriculture and its supportive hydraulic system composed in the southeastern territory of the region of Emilia-Romagna?

Figure 38 illustrates the fact that the region of Emilia-Romagna (and the entire Po Valley) is productive agricultural land. This explains why the territory is an important food source for both regional, national, and international populations. Emilia-Romagna consists of more than 1 million hectares of agricultural land of which 75% of the farming practices are high & medium intensity as modern techniques allow the expansion of the production of fertile lands. Of all the arable land, 79% is for arable cropping, 10% for meadows and permanent grassland, and 11% for permanent crops (European Commission, z.d.). In the north of the region, irrigation is easier, therefore the agricultural production is mainly focused on corn, soybeans, and rice. In the area, 1,2 million livestock is produced and one-third of the farmers utilize irrigated land. The main crops are cereals, fruit, vegetables, and grapes (vineyards). Figure 39 illustrates where the various agricultural productions are situated in the territory. The most intense fishing area is the Comacchio Lagoon, as history shows (Aledo, z.d.).
Agriculture is an important aspect of the identity of the area as it is framed by famous food such as the Parmigiano Reggiano cheese (from Parma and Reggio Emilia), Aceto Balsamico Tradizionale di Modena, Parma ham, and Grana Padano cheese, and other local products (Regione Emilia-Romagna, 2018). These products are also important for international export.
As stated before, the hydraulic system is crucial for the existence of agricultural lands. An intense, complex system of canals and drainage structured the land and transformed the ancient marshy wetlands into dry agricultural lands. Figure 40 illustrates the structure of the hydraulic system in the territory and one canal marking the territory is crucial for the existence of this region. The Canale Emiliano Romagnola (CER), supplies clear drinking water to the region of Emilia-Romagna through 165 km of canals (highlighted in yellow in figure 41) (Rossi, 2011). During summer this is the only source of clean drinking water. The plan for this canal originates back to 1939, but only in the 1980s was it constructed. The initial plan for the canal only had irrigation purposes for the agriculture sectors. But as it took more than 100 years to execute the plan, it was developed and expanded to a complex, multifunctional system for water supply, agricultural, industrial, civil (flood management), navigation, and touristic usage (Rodríguez, et al., 2020). The canal runs through the whole territory and is supported by seven lifting plants to accommodate its relief and a mobile river dam at the mouth of Reno.
Another crucial canal is the Cavo Napoleonico, which connects the Reno River to the Po River. The longue durée illustrated the importance of this canal, introduced by Napoleon, as it prevented floods that continuously threatened the territory. This canal is connected to the CER and provides the foundational frame of the hydraulic system of the region, which is supported by drainage canals that connect the inner territory with its urban, agricultural, and industrial fabric (StorieDiPianura, 2024; Mazzini, et al., 2006).

Conclusion

The Po Valley and the region of Emilia-Romagna are strongly dependent on the intense agricultural lands and productions, supported by the complex, multifunctional hydraulic system. Agriculture is important on economic terms, but also significantly important for the identity of the region which is defined by the local food production. This hydraulic system is crucial for its existence as it allows the lands of this region to stay dry while supplying clean water to the inhabitants and productive uses. The frame of the hydraulic works is constructed by larger canals and these are supported by smaller drainage canals that secure the transportation of water towards the inner territory.

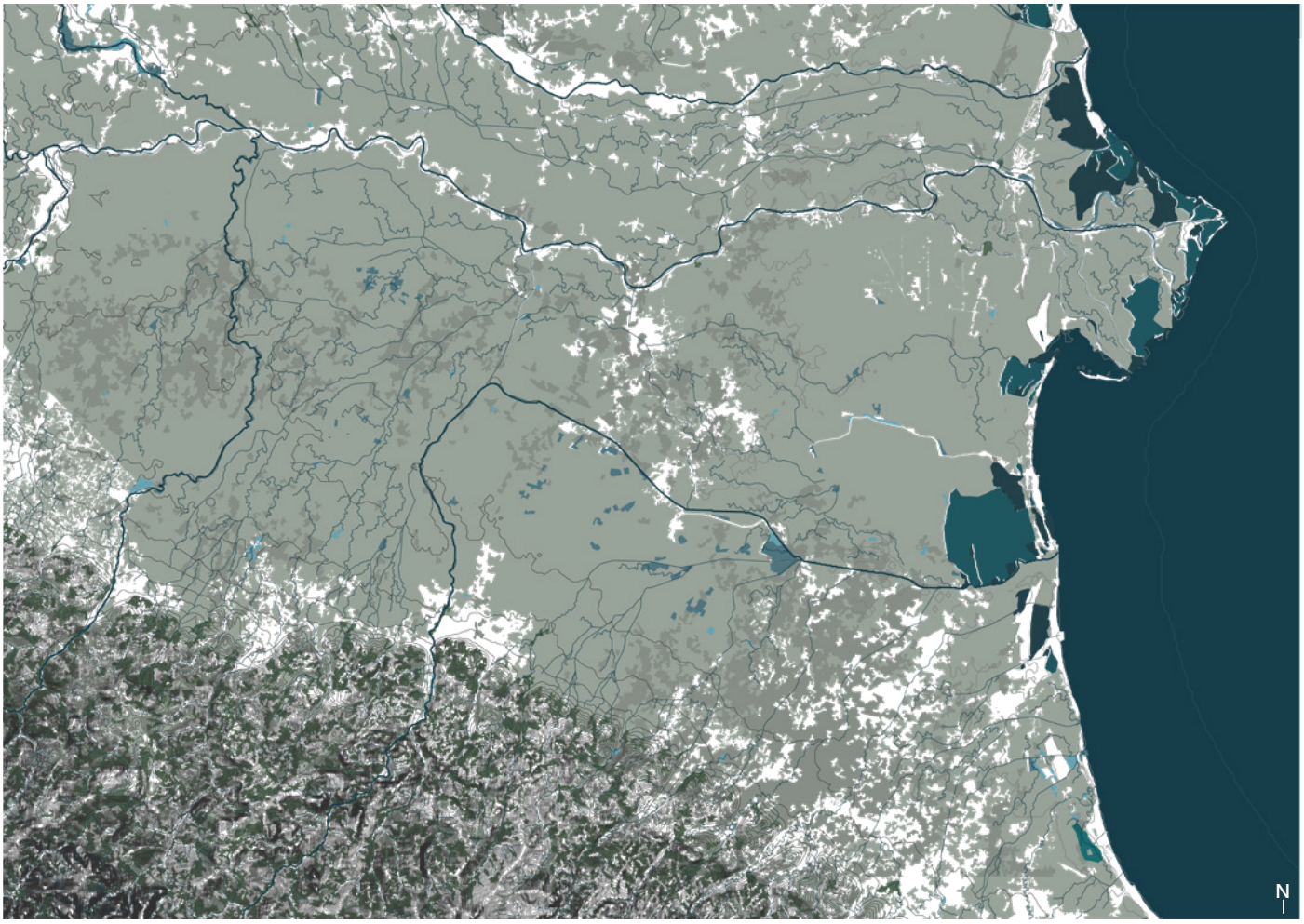


FIGURE 34 | *agriculture landscape vs. hydrological system*

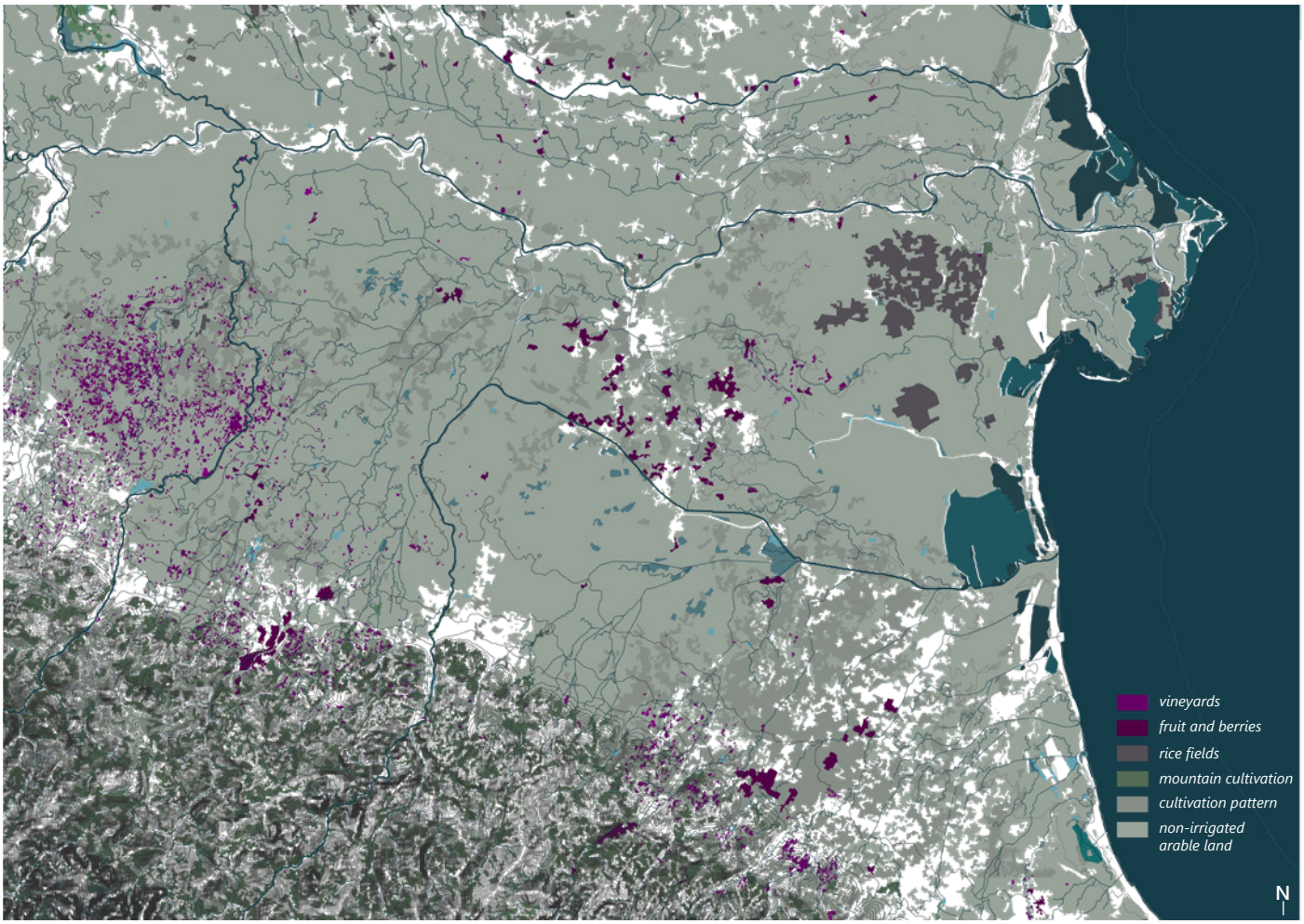


FIGURE 35 | *various types of agriculture*

CANALE EMILIANO ROMAGNA

THE ONLY WATER SUPPLY THROUGH EMILIA-ROMAGNOLA'S REGION

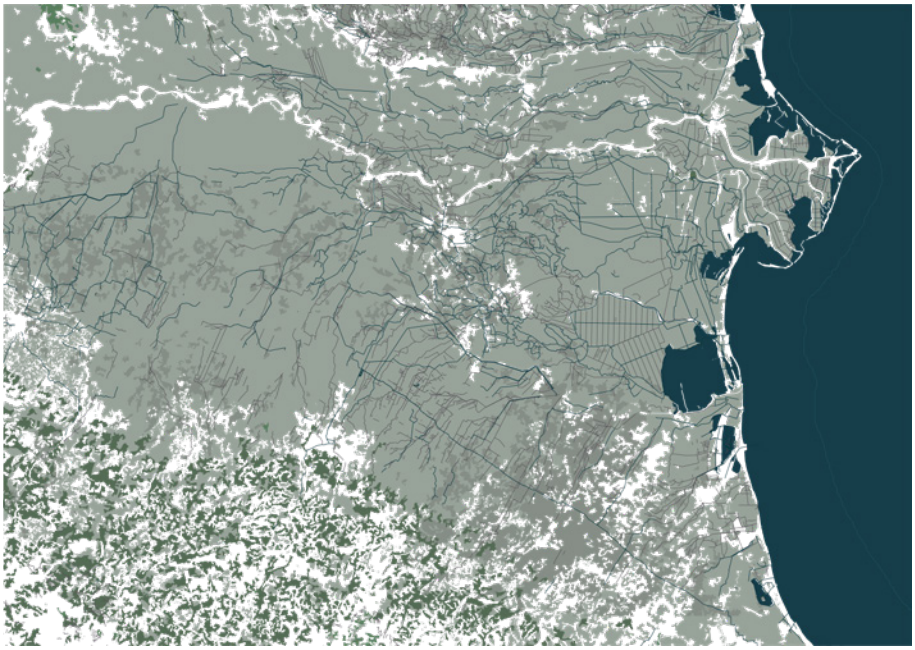


FIGURE 36 | AGRICULTURAL LAND AND HYDRAULIC SYSTEM

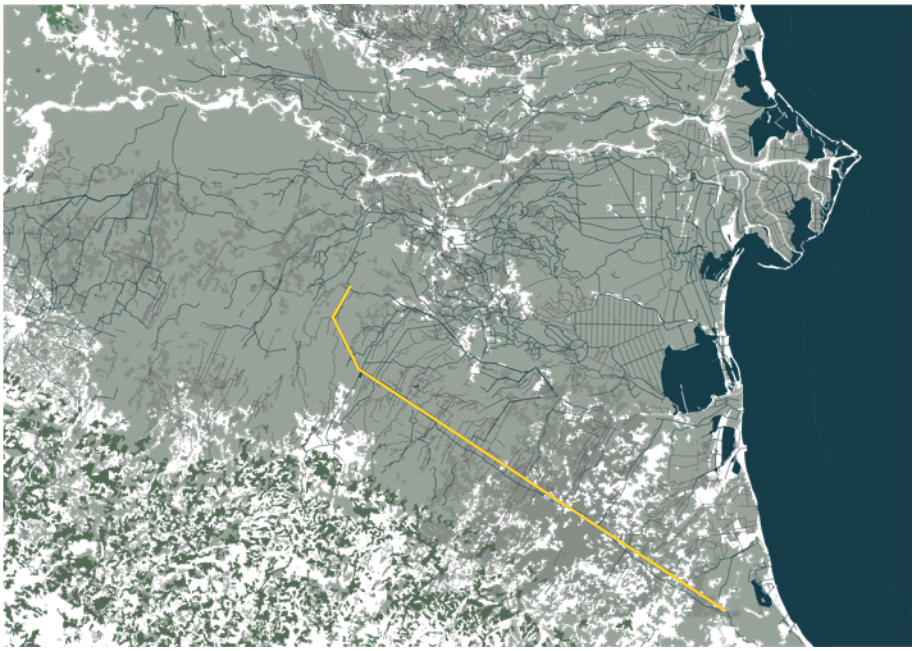
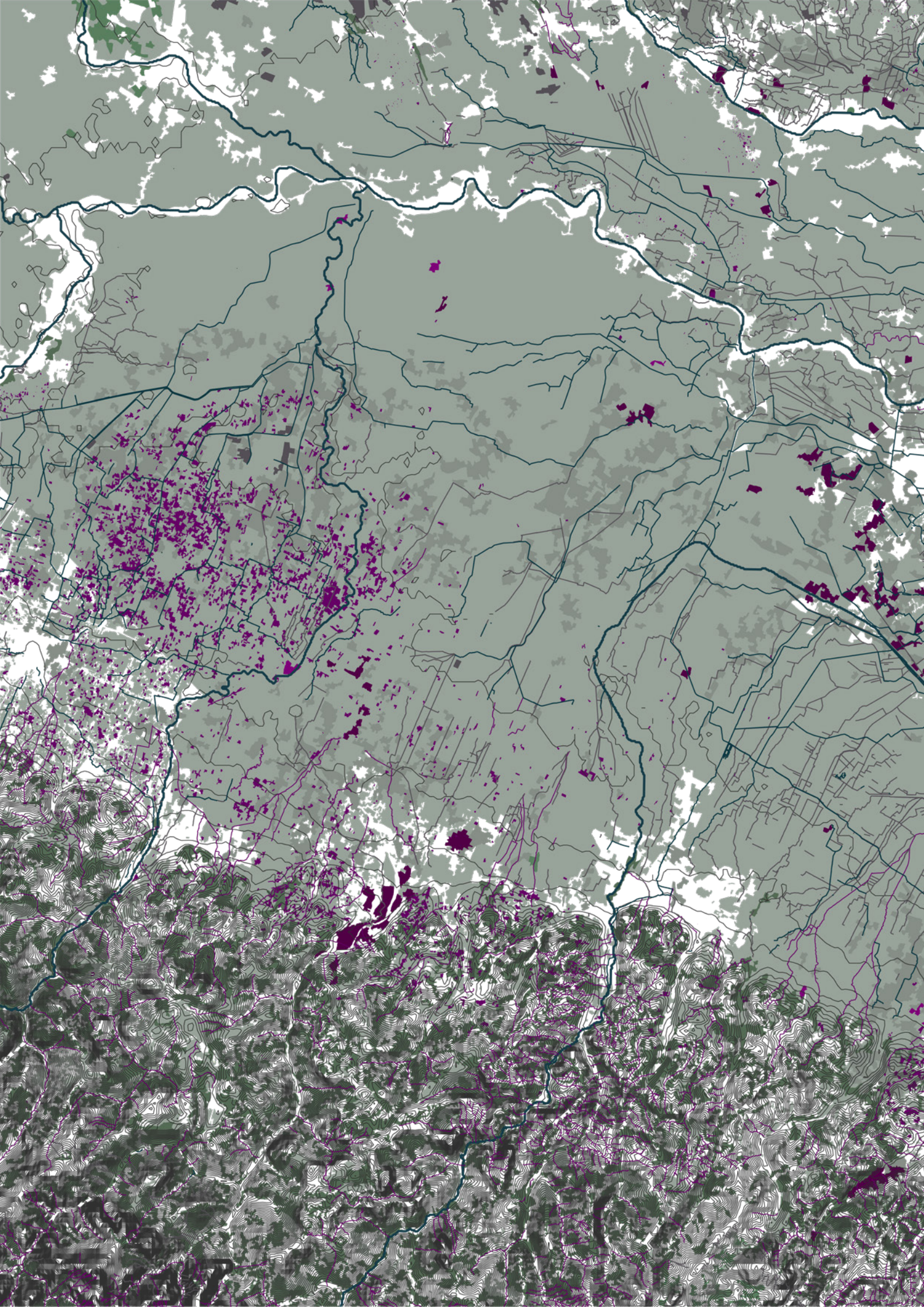
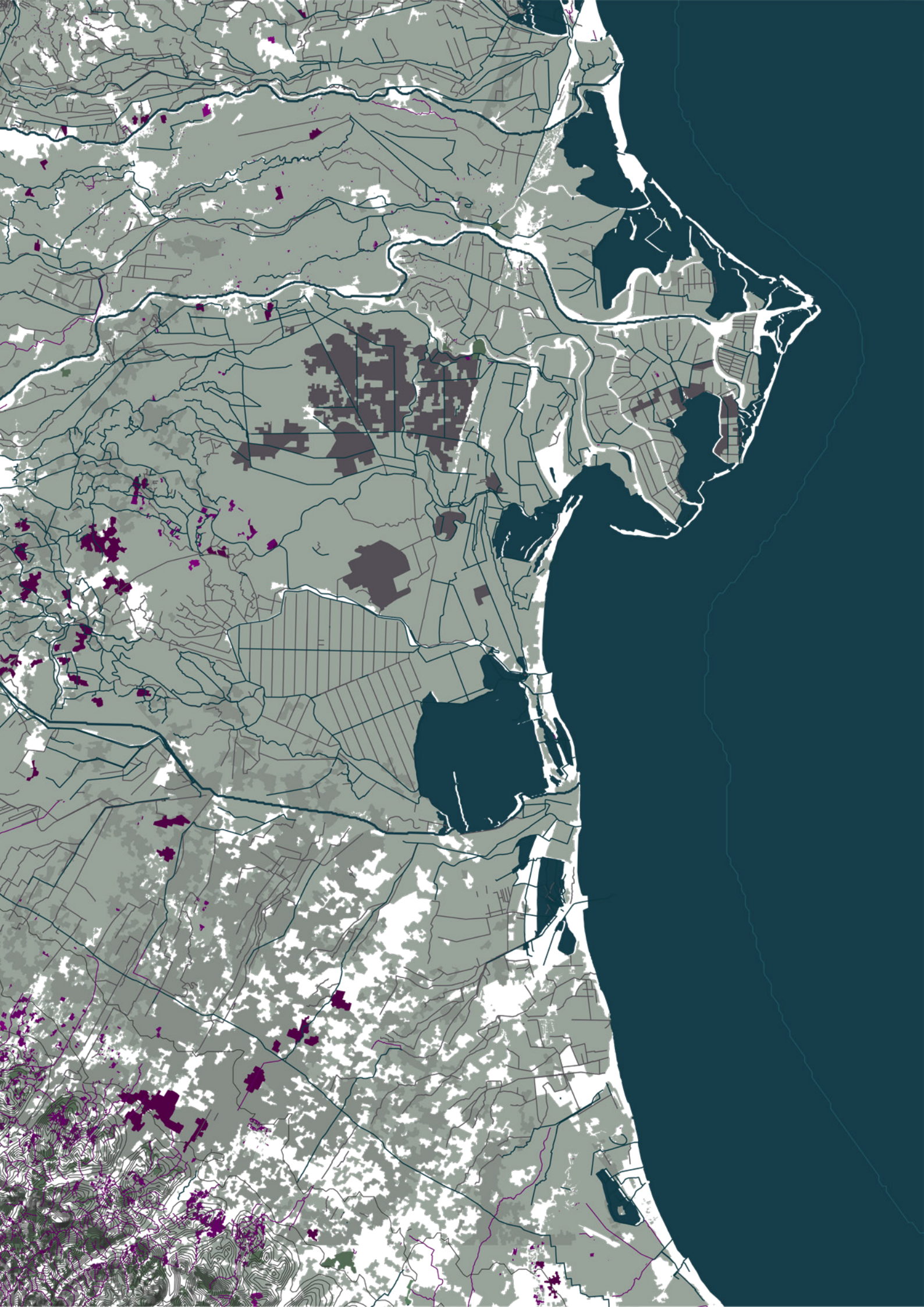


FIGURE 37 | CANALE EMILIANO ROMAGNOLA (CER)

FIGURE 38 | HYDRAULIC SYSTEM: CANALS, DRAINAGE, AND STREAMS





4.4 STAKEHOLDER ANALYSIS

WHO - HOW - WHY

As Figure 39 shows, many stakeholders are involved in the design process. The stakeholders are categorized as 'direct' - those directly connected to the current critical conditions and proposed design interventions - and 'indirect' - those involved but not heavily impacted by proposed changes. They are also divided into four groups: public sector, private sector, environmental, and civil society. Each stakeholder is connected to various scales (S-M-L-XL) to identify the scales of impact.

The most prominent stakeholders are water and local farmers. This thesis proposes that water be reintroduced as a subject and defined as a main actor, given its central role in the region's challenges. The aim is to make water a harmoniously present protagonist within the territory and public spaces, reducing its destructive nature. Representatives of water are the various NGO's standing for similar values and rights water consists of. This conflicts with the agricultural dominance of the territory, which is part of the region's cultural identity and traditions, adding an emotional layer to the design process.

Stakeholders often resist change. However, as agricultural current methods are destructive imbalanced with nature, causing water challenges, compromises are necessary to mitigate its negative environmental impacts. Upstream farms will be more heavily impacted initially, as restoring the water territory's health involves recharging aquifers through mountain water storage. Therefore, farmers must change their ways. In the long-term, sustainable agricultural methods will benefit farmers by providing healthy conditions for continuous farming. Without action, the possibility of traditional farming will decline in the future.

Downstream farming will also need to adapt to transformative practices. Considering farmers' values and spatial claims, a new transformative way of living with water must be proposed, allowing space for water taken by agricultural practices. This does not eliminate farmers; coexistence and cooperation are possible through sustainable agriculture practices like agroforestry, permaculture, and aquaculture.
These changes affect food production and export, a significant income source for Italy. This issue impacts small-scale farmers but large-scale stakeholders, including provincial and national government, farmer associations, and the European Commission regarding trade.

It is important that actors at various scales are aware of why these alternative ways of living are proposed, as stakeholders often do not understand the vital impacts of imbalanced water processes resulting from agricultural practices. Flood impacts are frequently attributed to a lack of maintenance rather than climate change. While this is not incorrect, long-term systematic changes are needed to ensure a safe and secure future where agriculture remains viable. If current practices continue, traditional farming will no longer be possible.

Awareness campaigns on climate impacts, alternative sustainable agriculture, and a clear vision of long-term benefits are crucial. Governance must provide financial support to stimulate change, ensuring that farmers do not suffer a decline in quality of life through financial losses.

Local citizens are also important stakeholders. Proposing an alternative way of living with water in their daily lives can be met with hesitation, as they are accustomed to traditional ways. Water-sensitive design should ensure increased spatial quality while providing water safety. Participation is crucial to include values, wishes, and spatial claims, making citizens feel involved in the transformation of their territory. As water has been part of their identity, it should continue to be so to ensure cooperation.

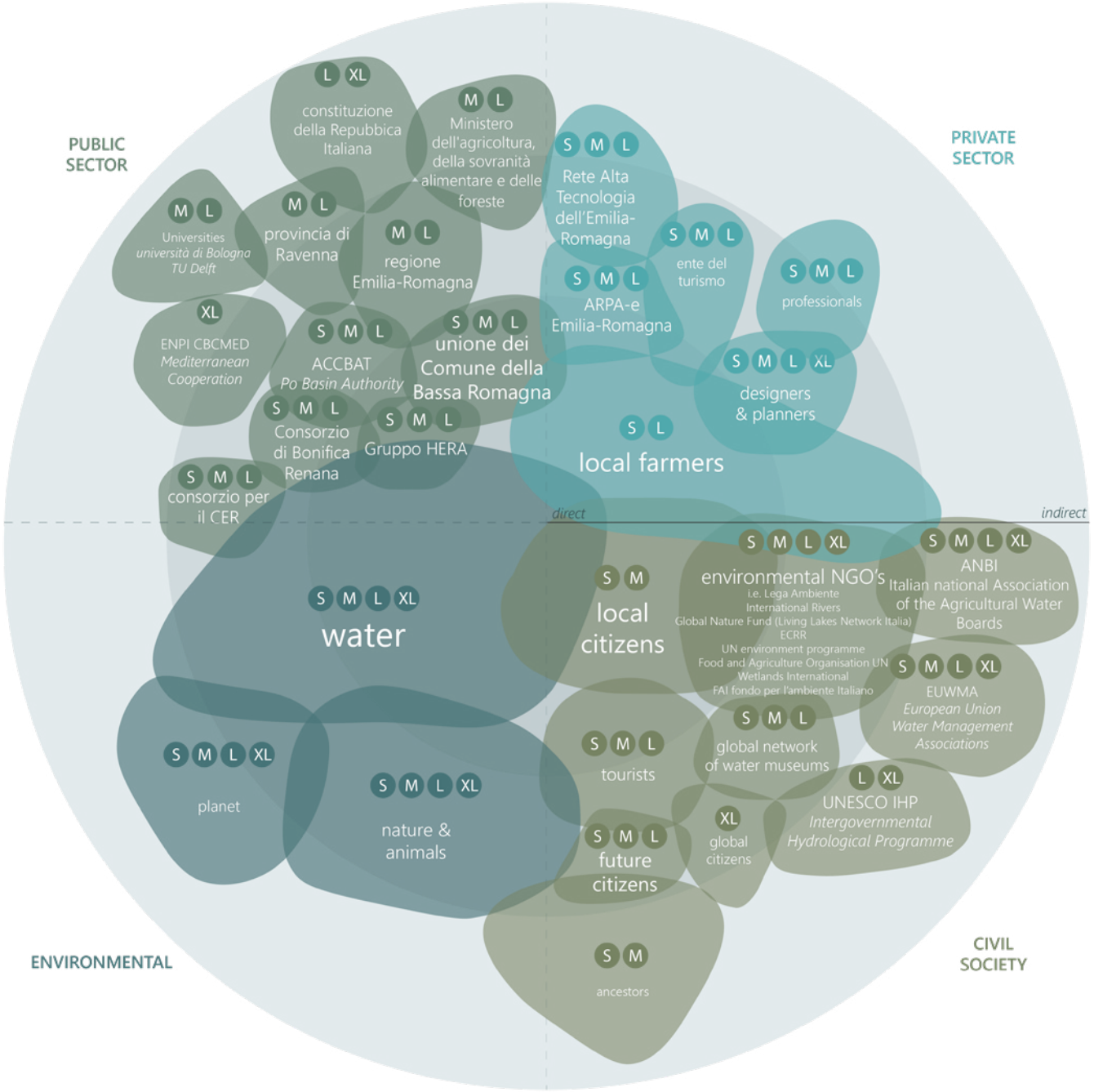


FIGURE 39 | STAKEHOLDER ANALYSIS

45 CONCLUSIONS ANALYSIS

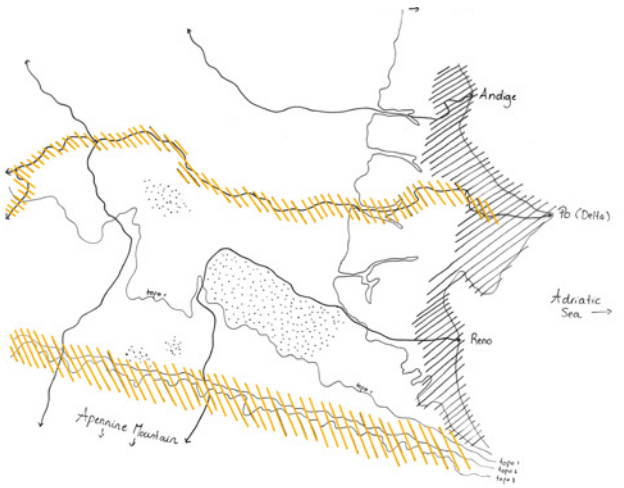


FIGURE 40 | *conclusion territory - 'leftover'*

FIGURE 41 | *conclusion territory - floodrisk*

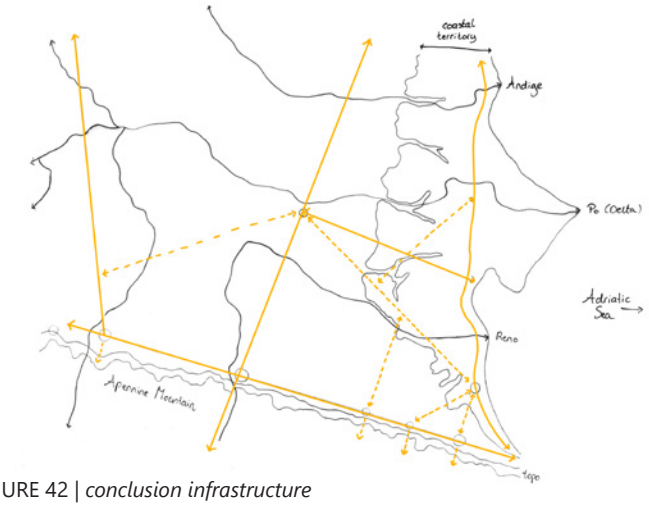


FIGURE 42 | *conclusion infrastructure*

Territory - 'residue'
These analyses have shown that the formation of the hydrological systems, compared to the flood hazard and risks maps, explains where the main risk areas are as water accumulates due to cross-over areas and geomorphology of the rivers, as the flood risk areas are located in the lower plain where the river velocity decreases due to the decreased slope of the territory.

Furthermore, the 'leftovers' of the intensive land reclamation works are located along the coast, and small spots of water bodies sprawled on the inner territory. Compared to historical maps, water was given more room as land reclamations were not fully executed along the whole territory. Life was surrounded by water, however, the territory was still threatened by floods. Forests and grasslands are mainly located in mountains, along the Po River, and the coast which can also be explained by the land reclamation works. In ancient times, the territory was covered by wetlands and forests, but this is what is left over.

Territory - Floodrisk
More than half of the wetlands are part of natural reserve areas, which concludes that to preserve this historical cultural landscape the land-use of 'protection' has to be given to the water bodies to provide its value. Otherwise, other land uses such as agriculture and urbanization are prioritized, due to the Anthropogenic way of living. Water on its own does not have value in this ancient water territory.

Infrastructure
To conclude the most important findings of this analysis, the following is stated. The territory is entirely developed for agricultural, industrial, and touristic purposes and to connect the cities and urban settlements. The infrastructure still reflects the Roman foundation of the strong linear connection of the Via Aemilia and the centuriation system of agricultural plots. On an abstract level, the infrastructure connects the most important acupunctures, which are the cities, the coast, the mountains, and the lagoons.

FIGURE 43 | *conclusion urban - 'origin along water- and infrastructure*

Urban origin
To conclude, the urban fabric is decentralized and sprawled along the territory. Water and infrastructure are the main conditions for the arising of the cities and connecting the cities, which all find their origin in Byzantine times. Ferrara, Ravenna, and Bologna are all connected to water and infrastructure, but in various forms, as they are situated in different territories with their territorial conditions and characteristics. Bologna (infrastructural) hinterland, Ferrara riverine landscape and Po delta, and Ravenna a coastal port territory.

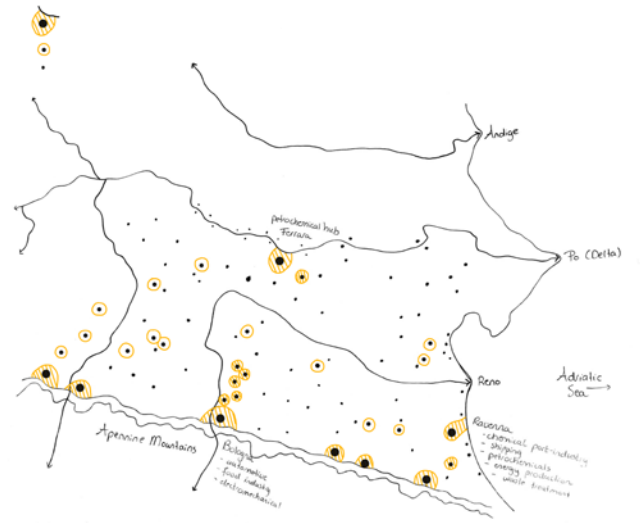


FIGURE 44 | *conclusion urban vs. industry*

Urban vs. Industry
The industry is closely connected to the urban fabric and also sprawled along the territory. The heavy industries are intensely situated along the Via Aemilia and the bigger cities, whereas the inner territory is characterized by smaller, productive industries.

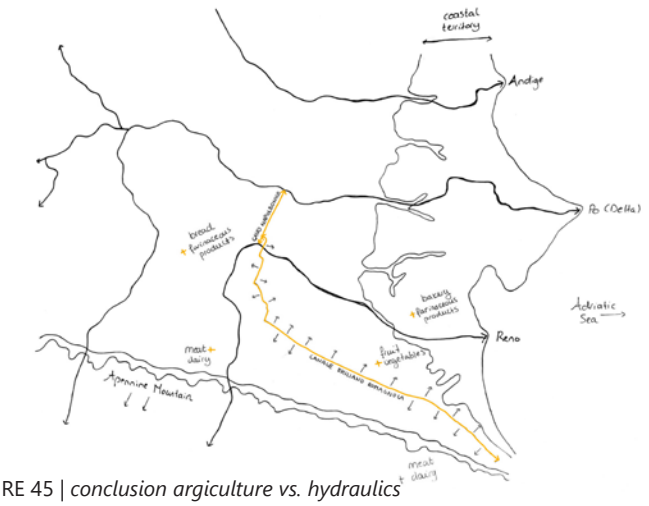


FIGURE 45 | *conclusion argiculture vs. hydraulics*

Agriculture vs. Hydraulics
The Po Valley and the region of Emilia-Romagna are strongly dependent on the intense agricultural lands and productions, supported by the complex, multifunctional hydraulic system. Agriculture is important on economic terms, but also significantly important for the identity of the region which is defined by the local food production. This hydraulic system is crucial for its existence as it allows the lands of this region to stay dry while supplying clean water to the inhabitants and productive uses. The frame of the hydraulic works is constructed by larger canals and these are supported by smaller drainage canals that secure the transportation of water towards the inner territory.

5

EXPLORING THE REGION OF EMILIA-ROMAGNA

FIELDWORK | CRITICAL CONDITIONS - TERRITORIES - CULTURE

As a continuation of the spatial analysis and territorial exploration of historical and critical conditions, structures, and elements, the method of fieldwork has been applied to broaden the types of data to include personal experience. Since culture and identity are crucial aspects of this thesis project, visiting the region is essential to gain first-hand knowledge which, digitally, is (impossible) to gather.

To structure the fieldwork, main goals had been set to focus the exploration. First and foremost, the main goal was to gain a better understanding of the water heritage of the territory, both tangible and intangible. Based on the Longue Durée and Dutch Layer Approach, important structures such as the Canale Emiliano Romagnola (CER), the Via Aemilia, and river structures were identified. A specific focus was placed on the Santerno River, as it is connected to the village Sant'Agata sul Santerno, where the water-sensitive urban design of this project will be implemented. The aim was to identify the flood impact, both tangible and intangible, Italian culture, various public spheres (urban, peri-urban, and rural), and diverse land uses.

To explore the different landscapes of the territory (coast, plan, and mountain), the entire stretch of the Santerno River was documented, as the river is a connecting element crucial for the large-scale design, which is related to the small-scale. As the territory is a residue landscape, it was important to visualize and understand what this landscape has 'lost' and how human interventions such as the CER, other canals, and canalized rivers structure this landscape. Leftover traces of rivers and other structures were followed, explored, and critical areas were visited.

Regarding culture and identity, casual interviews with inhabitants, especially in Sant'Agata sul Santerno, provided insights of personal experiences with the flood and drought impacts, daily life routines such as the importance of the car, and an indication of the importance of food and agriculture for the Italian identity.

It was interesting to experience the deep connection Italians have with their surroundings, while simultaneously observing that a certain historical connection with water has been lost, as it was often perceived as unimportant or something profitable. This fieldwork developed a personal connection with the territory and region, enriching the understanding, drive, and cruciality for this project.

The following pages display the summary of interviews conducted and a selection of photos, organized by themes, that summarize the fieldwork experience.

FIELDWORK

The car is very important for us, we use it for everthing. I would like to see a more green square as it needs an upgrade, however, parking space is very important.

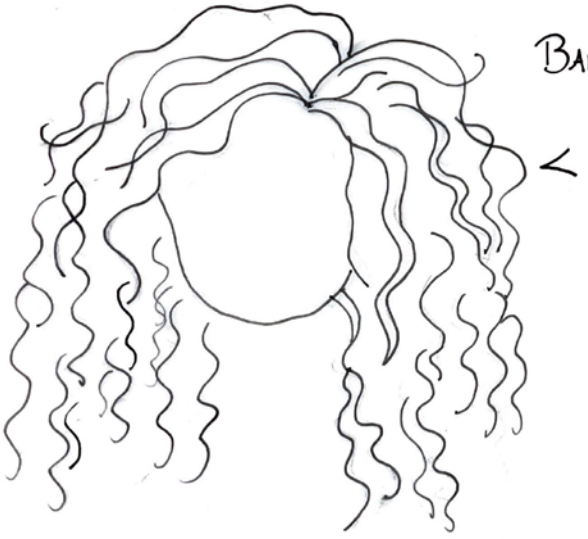
Catarina Sant'Agata sul Santerno

I saw the water slowly coming in and I thought it would be just a little bit, but then the water rose up to 2 meters and pushed my front door All the way into the garden. The house is destroyed, the kitchen is gone and we live upstairs. Pigs were screaming while they drowned and dead animals flooded in the water. The wate stayed 2-3 days, the mud up to 2-3 weeks. It was very traumatic, I still talk to someone and the sound of water triggers me. My dogs were so scared.

The dyke broke near the railway due to accumulation of branches and roots by which the pressure got to high. It is not per se climate change that caused this, but lack of maintainance! We got 2000 € from the government, but renovating the kitchen is only 10.000 € ... It changed our lives.

PHOTO: CATERINA CAPUCCI

PHOTO: CATERINA CAPUCCI



Barbara, Lugo

The city of Lugo has also been challenged by the flood risks. Water levels came up to 1 m. damaging a lot of my furniture and interior, walls.. I am still renovating, but it is really expensive. The water came from the Senio River, however, water levels increased up to 2 m. in Sant'Agata due to the Santerno River. Also the floods in Faenza were catastrophic.. and Riolo Thorme!

PHOTO: CATERINA CAPUCCI

ANDREA, Argenta

People have lost the connection with water and the awareness of nature's working. I think that that is concerning as they do not understand why certain phenomena are happening.

" Climate change is more up North, not happening here in Italy ".

Argenta has been spared from floods due to flood plains nearby. however, Conselice did not have these plains and was fully flooded. Streams are silting up and we are digging them out as this is less costly.

Agriculture is very important and tradition, farmers are not very welcoming to new types of agriculture.

PHOTO: CATERINA CAPUCCI

Sant'Agata sul Santerno

The water was everywhere, very devastating. You can see it everywhere, streets, walls, trees, a lot has been damaged. Even a year later we are still renovating.

The dyke broke and the water came up to 2 meters. There was so much mud.

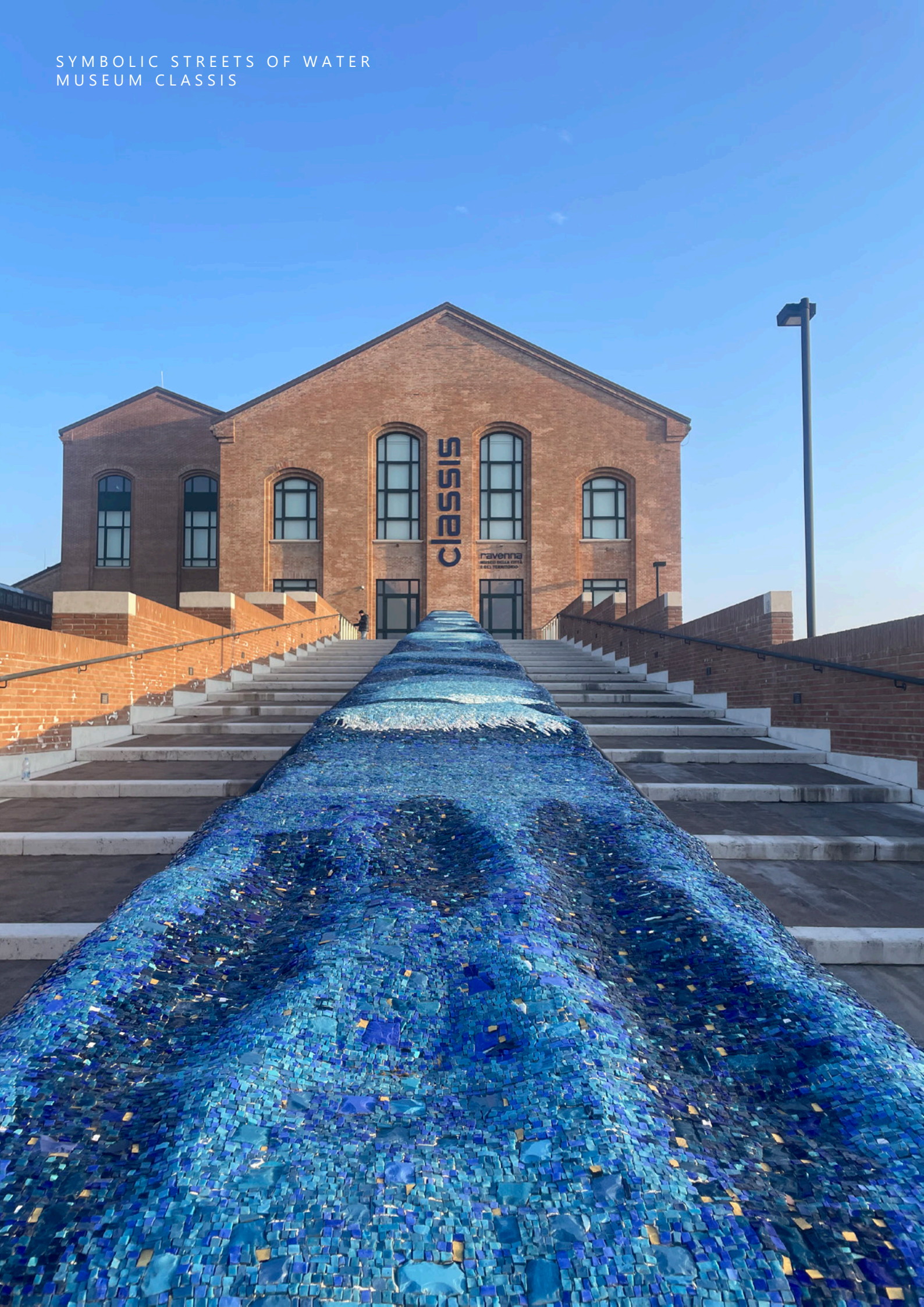
The car is very important. The square needs an upgrade, especially after the floods. The library is gone, the pharmacy just opened. a green square would be nice but we need parking spots.

THE HIDDEN CANALS OF THE CITY OF WATER, BOLOGNA
AN ARTIFICIAL URBAN WATER SUPPLY


CANALI DI BOLOGNA
CANALE DI RENO
Canaletta Ghisiliera
Canaletta delle Lame
Canale Navile
Canale Molino - Aposa
Canale Cavaticcio
Canale di Reno
Canale delle Moline
Tu sei qui
Bologna
Condotto Fiaccacollo
Chiusa di Casalecchio
Canale di Savena
Chiusa di San Ruffillo
Scopri di più sulla rete dei canali
tel 051 6493527 | info@canalidibologna.it | www.canalidibologna.it

MOSAIC & THE CULTURAL ASPECT OF WATER IN A COASTAL TERRITORY

SYMBOLIC STREETS OF WATER
MUSEUM CLASSIS



SYMBOLIC STREETS OF WATER
RECLAIMED CANAL (RIGHT)


A RESIDUE OF THE ANCIENT WATERY TERRITORY
RARE PIECE OF FOREST

A RESIDUE OF THE ANCIENT WATERY TERRITORY
ANCIENT RIVERBED FIUME SANTERNO

A RESIDUE OF THE ANCIENT WATERY TERRITORY

THE ARTIFICIAL LANDSCAPE OF EMILIA-ROMAGNA
CANALE EMILIANO ROMAGNOLA

THE ARTIFICIAL LANDSCAPE OF EMILIA-ROMAGNA
DAMMING OF THE APENNINE FIUME SANTERNO

THE ARTIFICIAL LANDSCAPE OF EMILIA-ROMAGNA
ARTIFICIAL MOUNTAINOUS AGRICULTURAL WATER RESERVOIRS

THE ARTIFICIAL LANDSCAPE OF EMILIA-ROMAGNA
INFRASTRUCTURED RENO RIVER

THE ARTIFICIAL LANDSCAPE OF EMILIA-ROMAGNA
HYDRAULIC WORKS

THE PO DELTA LANDSCAPE
A RECONSTRUCTION OF ANCIENT DELTA CIVILIZATIONS

COASTAL ACTIVITIES
CAPANNI DA PESCA

THE COASTAL TOWN COMACCHIO
MORNING FOGG


GIOACCHINO BACHETO

FLOOD DESTRUCTION SANT'AGATA SUL SANTERNO
PHOTOS: CATERINA CAPUCCI

AFTERMATH OF THE FLOODING SANT'AGATA SUL SANTERNO
TRACES OF THE MUD LEVELS

FLOOD DESTRUCTION SANT'AGATA SUL SANTERNO
PHOTOS: CATERINA CAPUCCI


IV novembre

6

IN MEMORY OF WATER

UNA STORIA DI ACQUA - TERRE -SPIRITO

Previous analysis showed the physical transformation of the territory due to human actions and natural phenomena (longue durée), resulting in the contemporary elements that structure the artificial landscape of the region of Emilia-Romagna (Dutch layer-approach). This forms the tangible water heritage of the region. However, a part is still missing. This project addresses not only the tangible water-related challenges that originate partly from these physical transformations of the territory but also the intangible water-related challenge of the social alienation towards the water identity.

The main question arising from this statement is, *what was/is this water identity in the territory of Emilia-Romagna?* What did water mean in ancient societies, and what has changed to bring us to our current state of disconnection, disharmonization, and objectification of the natural realm, specifically water? This answer is crucial to formulate the intangible water heritage, which is constructed by the water identity and history of the cultural territory, and to understanding why this disconnection with the water identity exists in our current society. What exactly have we lost? We can't mourn something that we are not aware of.

Interestingly, a broad body of knowledge is dedicated to understanding the meaning of water in ancient civilizations: from the prehistoric to Celtic times, through the Roman Period, up to modern ages. It appears that the worship of water (*hydrolatory*) is not easy to grasp as it is complex, syncretic over time, and versatile, consisting of local variations across a large territory (Gerrard, 2022).

Before diving into the meaning of water, first a short history lesson on the ancient civilizations that roamed the territories of the Northern Italian low plain (*Italian: Pianura Padana*). Figure 47 provides an overview of the timeline of all the civilizations that succeeded one another in this region from the Neolithic period through the material ages to modern times. This begins with the overarching common ancestor Proto-Indo-European, of the Indo-European language family around 4500 BCE (Renfrew, 1989). This family is divided into seven language groups that are spoken up to today: Armenian, Indo-Iranian, Celtic, Greek, Italic, Balto-Slavic, and Germanic (Figure 46) (Fortson, 2011).

Focussing on the territory of Emilia-Romagna, the (proto-) Celtic and native Italic groups characterize the common origin of this region. Understanding this construction of its origin, the timeline provides an overview of which cultures formed these two language groups (as we have to keep in mind that Italy originates from a mixture of various cultural influences). The blue boxes highlight the cultures of these (proto-) Celtic and Italic groups that inhabited this specific area, Northern Italy. Wild warriors eventually made way for a modern type of humankind through processes of chaotic power changes, successions, and transformations that finally brought us to its current state, the Kingdom of Italy. The appendix provides an overview of maps illustrating how these civilizations were situated throughout the territory.

Thus, now that we know the origin lies in the Celtic and Italic groups, we can identify where to search for the meaning of water in what societies. *How was water constructed in these societies?*

Literature tells us that religion was a crucial part of the survival of these ancient civilizations and it was not necessarily separate from their daily life (Edlund-Berry, 2006). It was intertwined. Their religious identities were strongly connected through the convergence of ritual, community, and place (Irvin, 2022). Water was a crucial element within this relationship. It is common sense, knowing that in prehistoric times, the territory of "Italy," especially the swampy, marshy Northern Italian low plain, was characterized by watery landscapes (Lundock, 2022). Springs, streams, rivers, natural and man-made pools, and lakes were familiar territorial features and often elements of veneration.

This veneration manifested itself in the personification of these water bodies, and around the Adriatic, these river deities were mainly male, although deities could also be female (Šašel-Kos, 2000). All ancient religions, therefore, were polytheistic (Fortson, 2011). Interestingly, '*living waters*' were specifically marked as sacred, emphasizing the dynamics of the moving water living in the landscape (Endlund-Berry, 2006). This resulted in a culture based on sacred geography (Irvin, 2022).

The living character of water was more than just the gravitational mechanism making it flow; it included the steam from warm temperatures, the sound of bubbly water, the freshness of cold temperatures, the smell of minerals within the water, the tranquility of its reflection, and sweet or salty features. These characteristics had specific symbolic value and triggered an unusual sensory emotional response (Misic, 2022), invoking a divine, spiritual experience that could only be explained by the presence of higher powers (Architessica, 2013). It was a way to grasp the unexplainable natural phenomena and mechanisms.

Water often symbolized 'purification', 'fertility', and 'healing', playing a vital role in rituals at watery sanctuaries and sacred sites (Cousins, 2022; Misic, 2022; Lundock, 2022). Springs, specifically, were considered sacred and often marked devine spots at roads, river crossings, and mountain passes (Glinister, 2006; Livi, 2006; Šašel-Kos, 2000). These spring deities, often called Nymphs, guided the location of cult settlements due to geological marks (Livi, 2006). However, springs did not always correspond with healing deities (Cousins, 2022). Different deities were worshiped along various water bodies (Coombe, 2022).

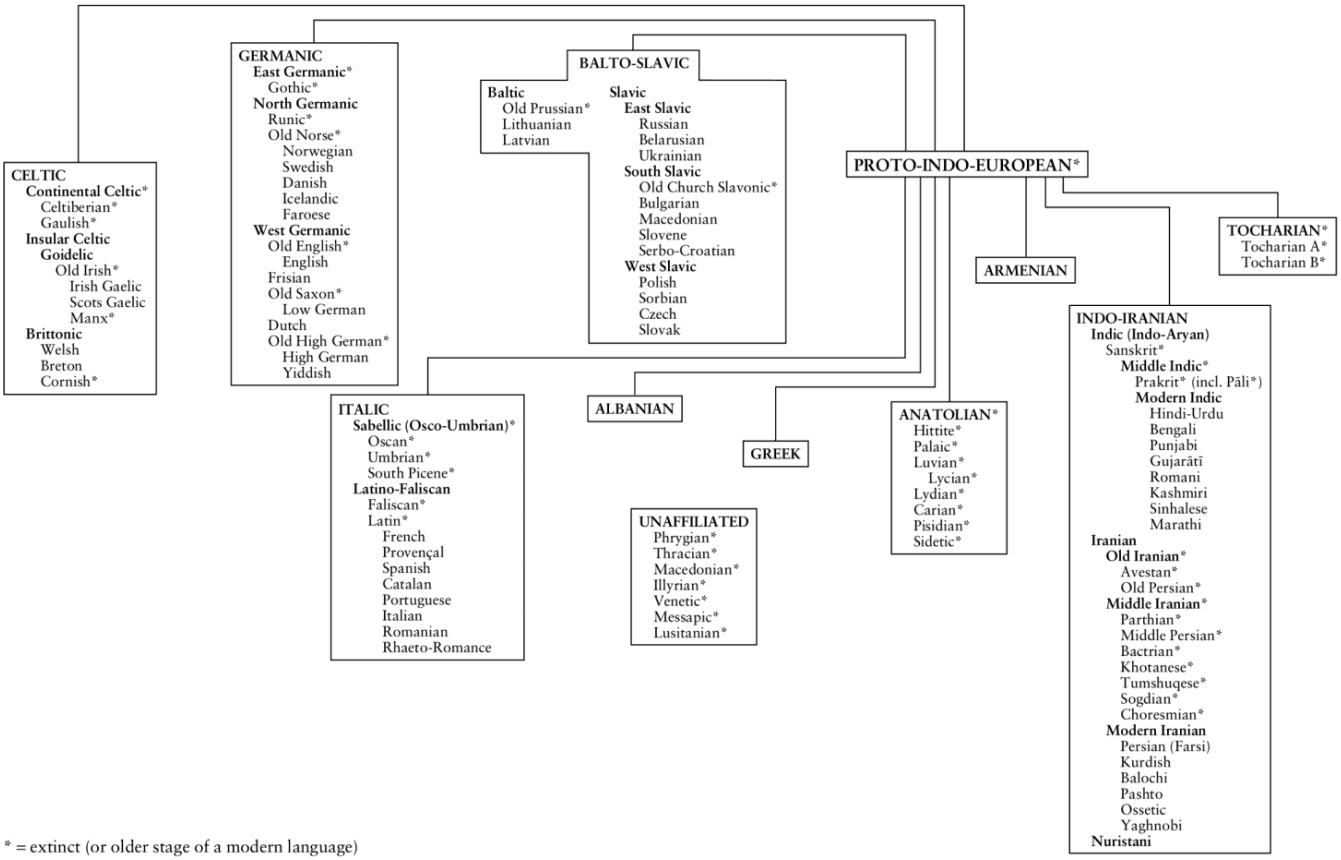


FIGURE 45 | INDO-EUROPEAN FAMILY TREE. (Fortson, 2011).

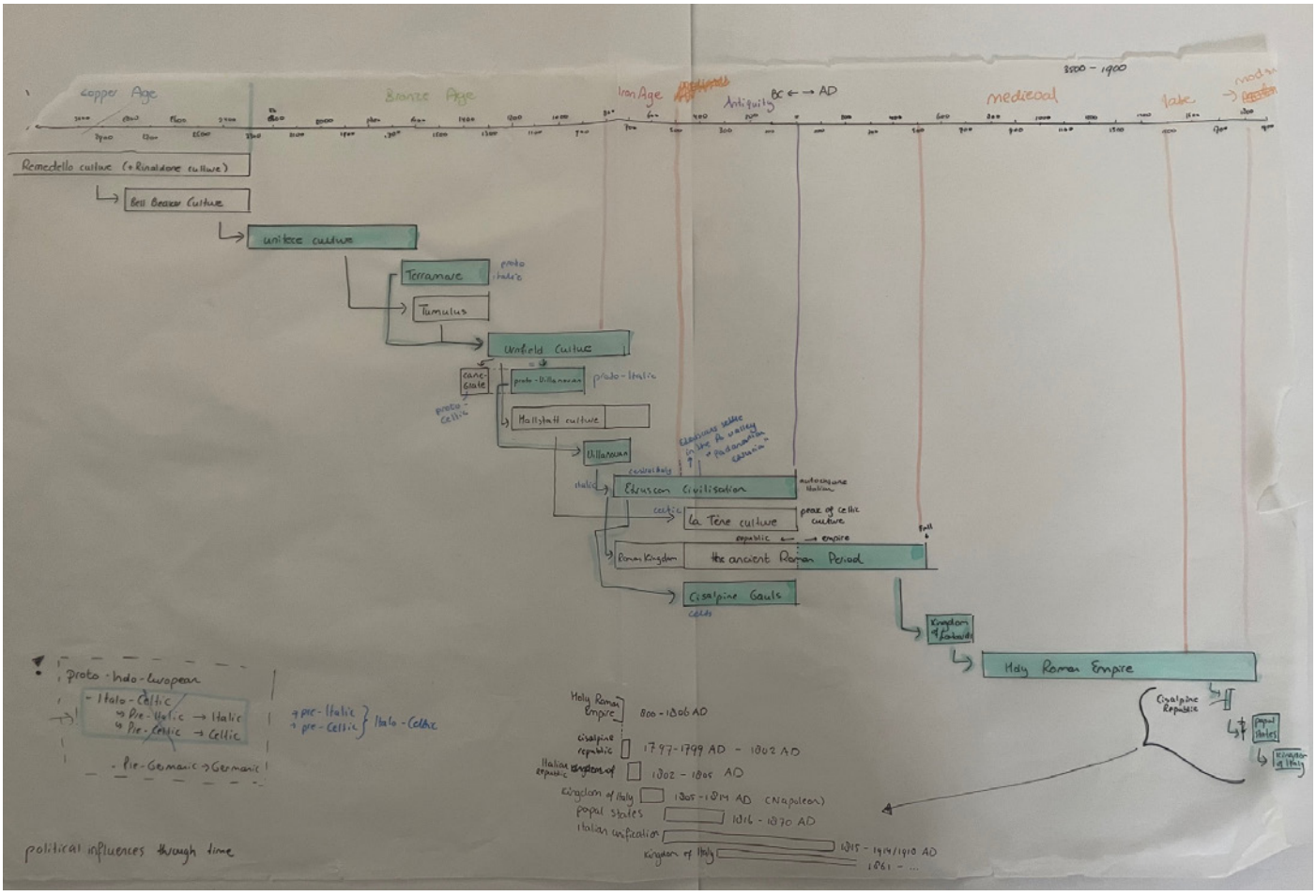


FIGURE 45 | CELTIC AND ITALIC CIVILIZATIONS IN NORTHERN ITALY (BLUE BOXES)

Neptunus and Salcia personified sweet spring waters. Neptune was the protector of water and symbolized traffic and trade along rivers. Venus, Asklepios, Apollo, Isis, and Serapis were healing deities (Misic, 2022; Šašel-Kos, 2000). Hot springs with sulfur had their own deities, such as the Italic Mefitis, Goddess of healing sulfur waters and purification. These springs, including iron and alum waters, were known as 'medicinal springs' for their healing properties. Roman spa and bathing complexes were (therefore) popular for their religious and healing values. Marica was associated with standing bodies of water, both inland or coastal (Livi, 2006).

Each water body had its specific deity, worshiped through local rituals and practices. While the details varied, water remained central to social and spiritual life. Local implications led to different feasts and festivals for these deities from prehistoric times to Christianity (Misic, 2022). Sacred sites ranged from individual rituals to common, monumental sanctuaries.

Ritual sites transitioned through doctrinal and imagistic mode (Misic, 2022). The doctrinal involved routine, repetitive practices led by priests or priestesses, with low emotional arousal which made it more inclusive. The imagistic mode was adaptable, visually exchanging knowledge, stimulating higher emotional arousal, involving an individual approach to religion, through shared community-based rituals (Endlund-Berry, 2006). This inclusivity made sanctuaries accessible to everyone, regardless of status, gender, cult, or ancestry (Irvin, 2022).

Given the strong hydrology, water was integral to both the daily life and religious practices of these ancient cutures. Sanctuaries and sacred sites (*locus religiosus*) were often located in watery landscapes, reflecting the strong relation between ritual, community, and place within the religion (Livi, 2006; Cousins, 2022). Water served as a bridge between the natural and divine, acting as a spiritual passage for interaction between deities and mortals (Irvin, 2022; Šašel-Kos 2000). This made water significantly sacred and valuable to these cultures.

Water was also crucial in everyday life, as evidenced by deposits found in these sacred sites. These deposits included statues, terracotta, figurines, weaponry, and even human remains, indicating sacrificial rituals involving 'specialized' everyday objects (Livi, 2006). Offerings ranged from sprinkling merchant goods for blessed sales to depositing animal remains for fertile soils and coins along sacred routes for protection. These acts of relinquishment were exchanges for blessings, healings, and forgiveness, creating an emotional bond with the water deity (Misic, 2022). In that sense, it was a pragmatic interaction as in exchange for an offer a reward or favor was prayed for (Cousins, 2022). Votive deposits, made without requesting favors, were also common (Glinister, 2022).

Irvin (2022) and Coombe (2022) describe the relationship between water deposits and liminality (in Pre-Roman Gaul), noting that water often defined boundaries. Sacred sites served as foundational markers for cult communities before urban settlement, with rituals performed there establishing these abstract boundaries (not the site itself) (Irvin, 2022). Cults often developed near sacred watery deposits and rivers, which facilitated trade and communication, connecting land, community, and location (Livi, 2006).

Wells were essential to daily life locus, specifically social interactions (Gerrard, 2022). They provided freshwater, supporting life and requiring physical labor, which increased their appreciation and attached value to water. Located based on groundwater accessibility, wells were often central settlements, providing spaces for social gatherings and being integral to the rhythm of daily activities like cooking, cleaning, and drinking. Some wells also held spiritual significance as passages to the divine world, defined as a 'holy well', and were connected to sacred springs, serving as important landmarks for travelers in the in-between territories (Livi, 2006).

Back to the Terramare culture, an (proto-)Italic culture situated specifically in the Po Plain in Northern Italy (Figure 45), recently in this area an artificial pool has been excavated, which is the construction of an elevated pool used for ritual practices as no drainage system was connected to it, eliminating the possibility of irrigation or other water supply uses (Gershon, 2021). This pool symbolizes the presence and meaning of water in not only a functional way but also a spiritual way (due to deposit findings in the pool). This suggests that water was integrated into and had significance for the cultural-social life of this civilization, already 3400 years ago during the Bronze Age. As the longue durée has shown, this culture started as small pole-house sub-quadrangular settlements of 2 hectares on reclaimed land within a moat structure banked to protect from water and connected to existing river structures (Cardarelli, 2009). In their hinterlands, through an artificial canal and drainage system, agricultural fields were irrigated (Cremaschi, et al., 2018). Therefore water was a primary source of their economy. This developed into 20 hectares of bigger settlements sprawled along the territory of an advanced culture that consisted of intelligent water managers and cleverly made use of the resources the fertile land surrounding them provided (Cardarelli, 2009). Therefore this culture could be referred to as a 'hydrological community' (Bellintani & Saracino, 2015). Even though being an advanced culture, the society collapsed as a result of climatic change and over-exploitation of water and woody resources, leaving the territory bare and in a vulnerable state (Cremaschi, et al., 2006). Cremaschi et al. (2018) relate the functioning and collapse of the Terramare culture as a lesson that could be learned from the current climate crisis. This caused a huge migration and relocation to other regions of the world, leaving this territory for centuries, and allowing nature to restore its imbalanced state.

The shift continues. The territory was left alone to recover until the Etruscans, a funerary cult and successors of the Urnfield Culture and Villanovan, established Padanania Etruria. This culture had a polytheistic religion centered around water deities, but with the Romans' arrival, these natural sacred places underwent significant transformations, altering how water was structured and positioned within society (Livi, 2006).

The Romans, intrigued by the Etruscan culture (and other pre-Roman populations) and their religious practices, studied Etruscan knowledge while burying their sanctuaries under urban structures (Glinister, 2006; Harvey, 2006; Šašel-Kos, 2000; Turfa, 2006). Although Romans merged their religion with Etruscan elements, they emphasized logical explanations over Etruscan devotion to divinities (Edlund-Berry, 2006). The Etruscans arose in the

Early Iron Age, but all material cults came to an end with the Roman rise (Livi, 2006). Influenced by Greek culture, water remained the essence of their society, additionally to being merged with the traces of ancient rituals and social practices around water that was there before the Romans, water was the soul of Roman civilization (Architessica, 2013).

The evolution of these watery sacred sites was shaped by the defining role of spatial organization. Romans began to value water as both sacred and ornamental, symbolizing power and wealth. Natural 'open-air' sites that were slightly accentuated for ritual use and provided habitat for the natural dynamics of water, evolved into engineered, urbanized religious structures (Misic, 2022; Irvin, 2022). These spaces retained their original values of 'healing', 'fertility', and 'purification', but also became venues for recreation and physical pleasure. During this process of showcasing power and recreation, the Romans sculpted natural waters to their needs, replacing natural watery landscapes with stone and concrete structures that controlled the 'living' waters (Cousins, 2022).

Reflecting on the core position of water in their society, it was not surprising that they had advanced knowledge of hydrology, hydraulics, and hydrogeology (Gerrard, 2022). Despite this advanced knowledge, the ritual purpose of water was subtly altered (Cousins, 2022). Water remained central in urban environments, primarily for ornamental use but always involving religious themes, as seen in urban water features (Glinister, 2006). Natural sanctuaries for Nymphs evolved into architectural monuments like Nymphaea, and aqueducts were used in sacrificial rituals, maintaining a connection between religion and their advanced technology (Misic, 2022). However, the privatization of previously accessible nature to these water structures emphasized elitist control of water (Glinister, 2006).

The importance of water was deeply rooted in Roman culture, even as its purpose changed (Livi, 2006). During the Renaissance, there was a reconnection with these water roots in built structures. However, with the introduction of the car in the previous century, water was pushed out of the environment, seen as an unwelcome guest instead of a necessity of life (Architessica, 2013). The city of Bologna is a prime example.

TThe way water was integrated into ancient societies and their value systems simultaneously shaped the tangible world of these societies. The tangible world did not exist without the intangible social construction and vice versa. Literature shows the development of water from landscapes of care and functional uses in social life to a symbol of power and wealth, utilized ornamentally for its beauty. Water transformed from natural springs to structured, engineered spectacles like bathing complexes, forums, altars, nymphaea, and aqueducts. Their use even continued from these Celtic-originating Roman (Greek-influenced) structures into Christianity, coexisting with polytheistic religions characterized by syncretic divinities and rituals (Misic, 2022). Later, churches wiped away most of these Celtic-Italic ritual spaces,yet water remained a religious element (Šašel-Kos, 2000).

This interplay between tangible and intangible constructions of water was foundational for colonization and urbanization of territories where these ancient civilizations flourished, particularly in the region of Emilia-Romagna, Northern Italy. Cities such as Bologna demonstrate how artificial structures brought water to colonies lacking natural resources, transforming them into thriving centers of life and economy. Ferrara, a military passage on the Po River, used water for defense, influencing its urban layout. Coastal settlements like Ravenna, Spina, and Classis became port cities, facilitating global trade connections with both the Mediterranean and Northern Europe. There are many examples of water's importance in everyday life, emphasizing its crucial role in these civilizations.

Water had great significance in ancient societies. However, by arrogantly positioning humankind above this natural element and pushing it out of the environment, water lost its value and (common) understanding: social alienation from our water identity. This shift explains the lack of awareness and misunderstanding of (catastrophic) natural phenomena, and the polarization over how to address them. There is a lack of respect towards its systems as they have the intelligence, knowledge, and capability to 'know better' and 'overpower and dominate nature'. While religion explains the unexplainable aspects of the natural world including water, intertwining it with human life, today's society often overlooks water's complex life-sustaining features from macro- to micro-climates. Through time humankind developed the answers to these mysteries, but the arrogance of control and power made the elements lose their value. Something which is actually in our roots through cultures such as the Terramare or Roman Empire, making history repeat itself. History shows we have consistently done this. We constructed a world in which we seem to think we do not need water, as it is an inconvenient object. *But why?*

Our neglect and arrogance towards the forgotten element of water has led to its disharmonized nature as we forgot to take care of it, now striking back against our fixed societies with no place for its existence. Have we forgotten the essence of water? A divine element providing life, the essence of our existence. We have forgotten to take care of it and now the consequences are pushed with much more force in our face. This neglect has led to increasingly catastrophic events as water reclaims its space that it lost to live in. Restricting its dynamic, spirited, lively character. It is in our blood, our existence, and our ancestors, a carrier of ancient memories forgotten by the attempt to tame it, bringing it slowly to its destruction and who knows, perhaps death. As we know, it is both the provider of life and death.

We must ask ourselves: 'In Memory Water: of all that once was, is, and (never) will be'?

Even though we understand the answers to the 'mysteries of water', we must recognize the 'simple' fact of the existence of these complex systems - whether designed by a God, deities, or just nature itself - is something divine. We need to use this knowledge to preserve this divine element and transform its destruction into a harmonious way of living, free from fear and have control in a more dynamic way. By cooperating and coexisting with water and recognizing its spirit, as ancient civilizations did, we can achieve this - but we must have the desire to see it.

We need to remember water.

ALL WATER HAS A PERFECT MEMORY AND IS FOREVER TRYING TO GET BACK TO WHERE IT WAS.

- Toni Morrison

7

THE INTERSCALAR DESIGN

"ALLOW ME TO REINTRODUCE, WATER'

As introduced at the start of the report, this project proposes a transformative way of living with water using urban design as a tool, focusing on the southeastern Emilia-Romagna region. Previous chapters explained how this 'watery' territory transformed over time, detailing the influences that caused the territory's critical conditions, the civilizations that crossed and inhabited the soils, and how their religions, dedicated to water, shaped its geography and social life. Human actions, driven by technology, power, and arrogance, formed an artificial residual landscape, altering how humankind interacts with natural elements, specifically water. This has brought us to an epoch of climate crisis, disconnection, and forgotten memories of water.

It was a construction of life where tangible elements are undeniably intertwined with the intangible, necessitating change for current society. By reintroducing the forgotten memory of water and its significance to our ancestors through design, a first step is set towards healing of the natural world and humankind.

The focus area of this design is the southeastern area of the region of Emilia-Romagna in Northern Italy. Early analysis guided the design towards the village of Sant'Agata sul Santerno, situated along the Saterno River (Italian: Fiume Santerno). This project aims to address both the tangible water-related challenges (heavy precipitation, floods, and droughts) and intangible water-related challenges (social alienation towards the water identity), focussing on the human dimension. Unfortunately, Sant'Agata and the Santerno River (unfortunately) face all these challenges (Figure 46). Numerous new articles (Figure 47), analysis, and fieldwork highlight the increasing impacts of water in this region, flooding the entire town up to two meters high, drastically affecting human, animal, and natural life. Additionally, this territory has a rich water history dating back to the Neolithic time period, Terramare culture, Romans, and Napoleon (see Longue Durée, chapter 4.2 and In Memory of Water, chapter 5). A history largely unknown, aside from visible structures dating from the Roman Times, but completely lost of value in the ancient connection with water.

This tangible and intangible water heritage will be used as a method to construct a new way of living through an interscalar design, connecting various scales through water's complex systems. To heal this water territory and its inhabitants, a new framework must be provided atop the existing conditions, addressing water-related challenges across different scales while reintroducing water in the territory. The final goal is to design a transformed future for daily life on Sant'Agata sul Santerno's main square, Piazza Umberto I.

But how to do this?

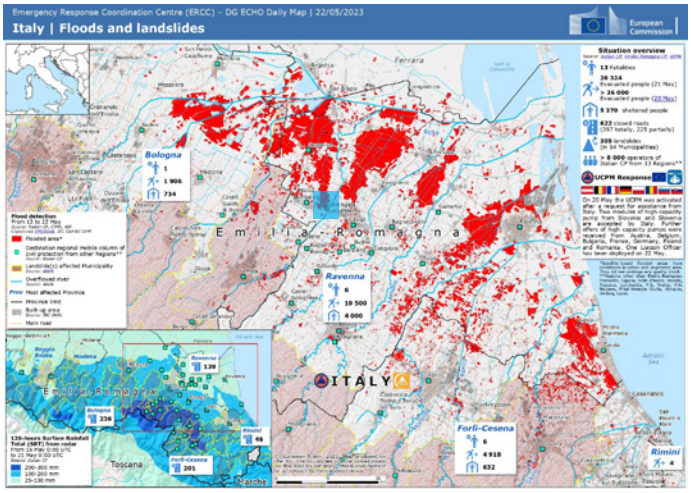


FIGURE 46 | SANT'AGATA FLOODS (BLUE BOX). (ERCC, 2023)

KEVIN CARBONI CLIMATE CRISIS 31.10.2023

The weather alert is back in Northern Italy: cloudbursts, flooding and landslides

In less than 24 hours, 25 extreme events occurred. Rivers flooded in Lombardy and Emilia Romagna. The northern area of Milan paralysed by flooding. Versilia was hit by a whirlwind. Trains and roads under special observation

A rider in Milan with water up to his ankles due to torrential rains that hit the city VASILE MIHAI-ANTONIO/GETTY IMAGES

Italy's worst floo 100 years – in pic

Devastating floods in Emilia-Romagna region ha several dead and thousands homeless after torre rains triggered landslides and caused rivers to b their banks

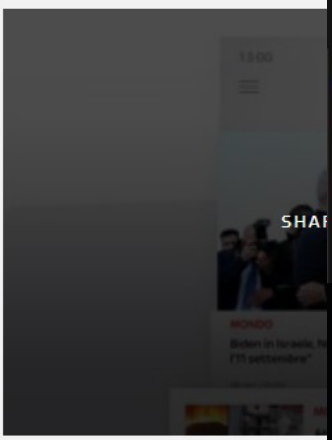
Thu 18 May 2023 20.11 CEST

CHRONICLE

Bad weather, orange alert issued in Emilia-Romagna, Liguria and Tuscany

18 Oct 2023 - 15:51

©IPA/Frame



It is the area of the Emilian Apennines, due to hydrogeological criticality, that is specifically included in the alert issued by the civil protection from midnight today to tomorrow. In particular, the reliefs of Piacenza, Parmigiano, Modena and Reggiano are affected. The same situation also applies to Liguria and Tuscany

FIGURE 47 | NEWS ITEMS SHOWING INCREASED FLOOD AND DROUGHT IMPACTS IN EMILIA-ROMAGNA REGION.

ANSA English / General News

Navigate

Drought sends Emilia Romagna canal into level of pre-alert

In 2022 the CER entered pre-alert stage in June

ROME, 12 April 2023, 15:13

Redazione ANSA

Drought has already pushed the level of water in the Emiliano-Romagnolo Canal (CER) to below the safety level of 3.25 m above sea level, two months earlier than in 2022.

Share

Musica June

PHOTO

From drought to century's worst floods: Emilia-Romagna disaster lays bare Italy's climate vulnerabilities

Calamity is latest in series resulting from 'dangerous mix of Italy's fragility, increase in extreme weather events'

Giovanni Legorano | 24.05.2023 - Update : 31.05.2023

World

Top Vatican, Iranian diplomats discuss situation in Gaza

Israel freezes tax revenues for Palestinian Authority

Israel's Netanyahu seeks to salvage damaged ge with religious rences, says Israeli

ding for tures

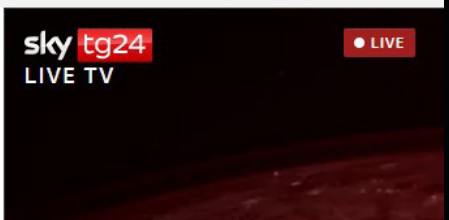
ve left ential urst

CHRONICLE

Bad weather in Emilia-Romagna, a bridge collapsed in Fornovo (Parma). VIDEO

30 Oct 2023 - 14:33

Difficult situation on the Emilian Apennines due to bad weather. This morning in Fornovo, the flood of the Sporzana stream, a tributary of the Taro river, carried away one of the pylons of a bridge that then collapsed. The road was literally swept away by the force of the same stream, swollen by the rains



7.1 VISION & PLANNING PRINCIPLES

A GUIDE TO THE DESIGN APPROACH

VISION OF *LIVING WATERS*
This thesis envisions a (possible) future in which water resilience is prominent and a part of daily life. Water resilience in each of its aspects: the physicality such as resilience to extreme drought and floods, but also the intangible resilience of a common understanding and identity based around water as the subject of daily life, is the overall aim. The aim is to capture and reintegrate the lost (resilient) ancient water identity in the contemporary context, through design. To connect people with water through physical designs that stimulate and support the internal connection with water that is part of daily life in the 'simple' daily habits and actions. To change the perception of water as an object without value as a subject with value as it is the essence of life.

For this, a couple of planning principles built the foundation to provide the conditions that are required to allow such a future to exist. In Figure 48 this is visualized, however, this would be the ideal situation, tackling all the challenges through all kinds of interventions (including policies, etc.). Figure 49 shows the selected planning principles with their design interventions that formulate the foundation of this interscalar design project.

1 | Restoring and reintegrating the (connection with) water identity through intangible and tangible water heritage by

1.1 Restoration of and bringing rivers back to life.
Over time, humans have altered nature by controlling and limiting the water and its hydraulic system to allow land on reclaimed land. However, this was at the expense of the rivers' natural life. Therefore it is of great importance these rivers are brought back to life, allowing their dynamics to flow around 'freely' as a healthy river is supposed to do, through restoration and rehabilitation developments. Interventions that support this planning principle include the nature-based solution of 'room for the river' which simultaneously demands governance as interdisciplinary, inter-scalar, and cooperative participation is required.

1.2 Restoration of the coastal and in-between 'Reno' territory cultural landscape.
As explained, the focus area has been altered by humans through land reclamation as floods constantly have threatened the existence of the region. However, before this land reclamation the territory was structured by the dynamics of a delta landscape with flourishing life on wetlands, (coastal) lagoons, and dominating forests (in water environments). As almost 90% of the wetlands have been destroyed in the Po Plain, this water identity of the territory has been lost. To connect with this water identity, characterized by a nature-balanced ecosystem of various water bodies, the restoration of these territories is required, to bring back a water life that has been known by past generations that allow healthy nature to exist. Supporting interventions for this restoration principle include a reforestation program, as most of the forests have been cut down, restoration of wetlands, increasing of the (water) biodiversity, and as a result, the increased possibility of wild fisheries.

1.3 Raising awareness on living with water and connecting to it.
As the restoration of a water identity requires more than tangible, physical interventions, it is of great importance to raise awareness with the inhabitants of the region to be able to let them internally reconnect to this identity. For this education is crucial, governance is required, and participation programs that include inhabitants in the restoration developments. In this way, it allows them to gain knowledge and a deeper understanding of what this water identity is and why it is of great importance.

1.4 Integrated water buffer- and storage- system of existing urban settlements through small-scale designs.
As a large part of the territory consists of paved spaces formed by urban settlements, these spaces are required to contribute to the large-scale potential of water resilience. This asks for small-scale designs that are part of an integrated system which can be designed as flood squares, water-absorbing infrastructure, and natural channelization designs. At the essence, these designs allow water to come in. These designs require a new way of living with water in a future that lives with higher levels of water. Therefore, it is important to raise awareness of this new type of living with water to ensure inhabitants are comfortable in their living environment. This will be a complex process of education, participation, and governance strategies. At the same time, we have to deal with the existing world of the tangible (water) heritage consisting of (historical) structures, housing, industrial constructions, and farms that cannot be swept underneath the water. Thus, smart water defense structures such as dyke structures and nature-based buffers need to be implemented to protect the existing territory to allow today's life to continue and preserve its heritage.

2 | Integrating buffer zones for 'wet' and 'dry' periods by

2.1 Integrating space that allows room for (peak discharge of) water through
the integration of existing and new flood plains ('room for the river') and
2.2 Increasing water accessibility in periods of drought.
The region faces water challenges as the hydrological cycle has been altered and weather conditions become more

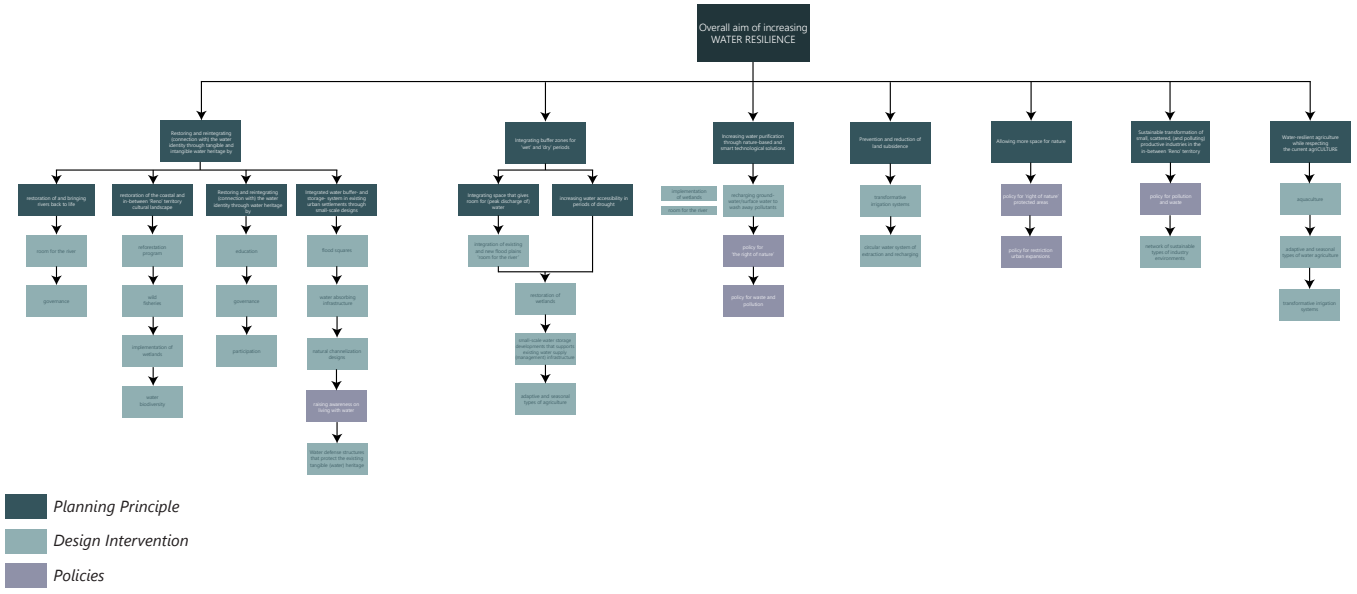


FIGURE 48 | *Planning Principles and Design Interventions*

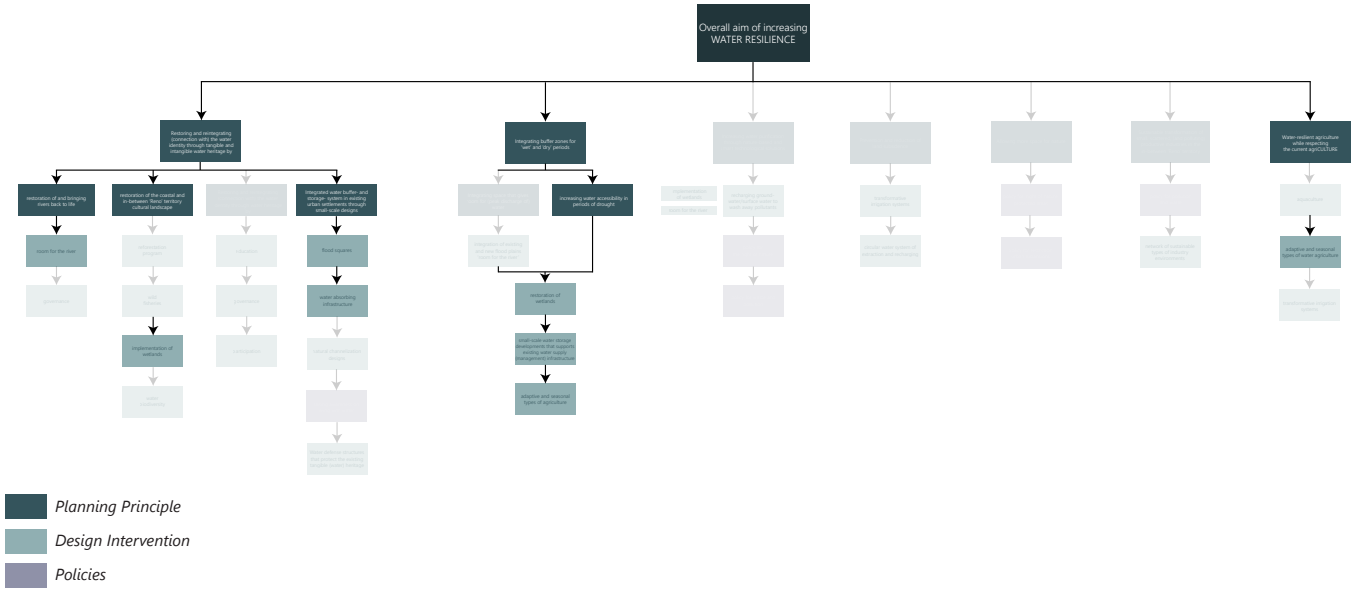
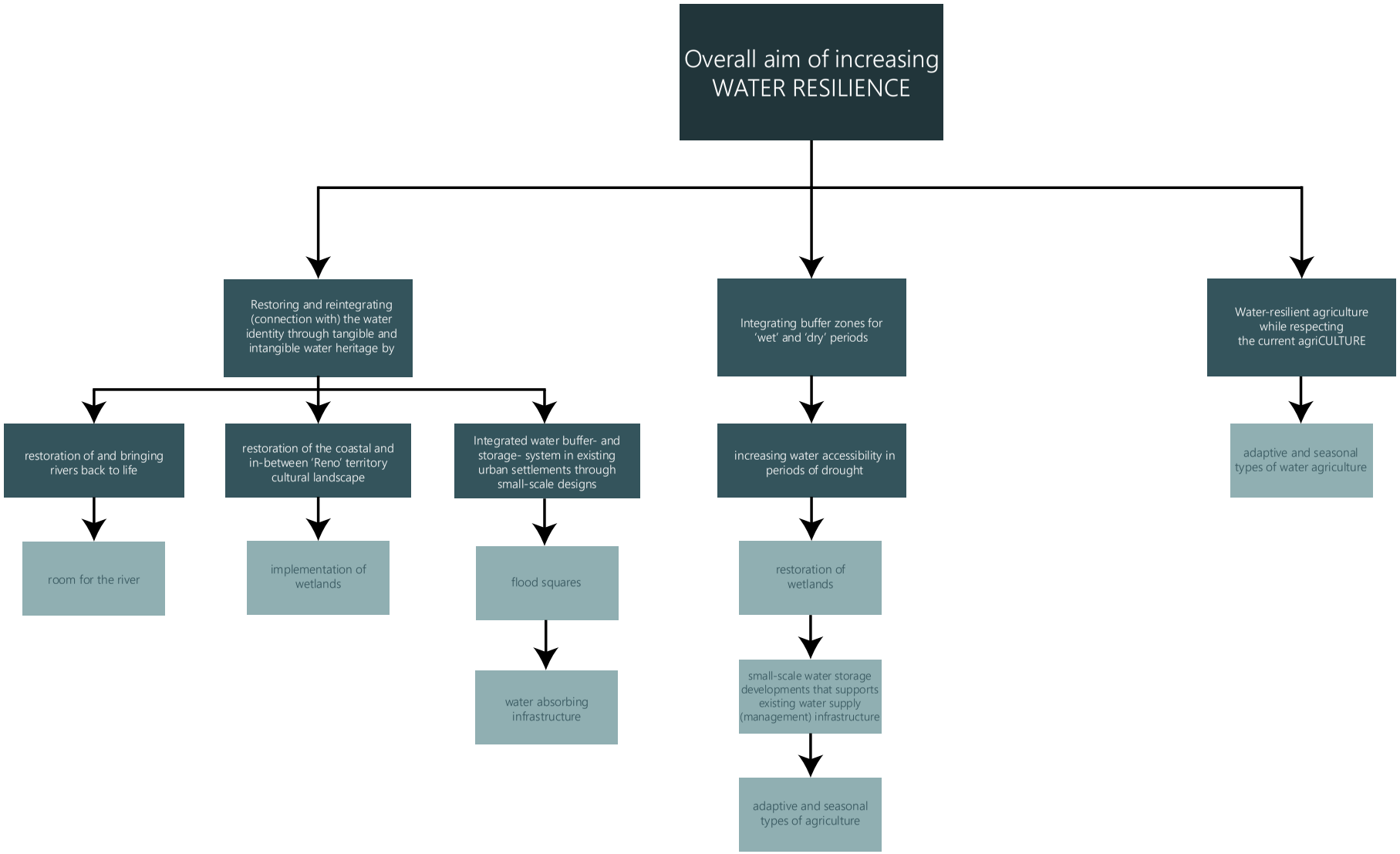


FIGURE 49 | *Selected Principles and Design interventions*

FIGURE 50 | SELECTED PRINCIPLES AND DESIGN INTERVENTIONS



extreme each year. Therefore, the region is threatened by increased flood risks due to land subsidence, increased riverine discharge and sea level rising, and long periods of drought. Therefore, buffer zones are of great urgency to capture and store water in periods of high discharge to prevent floods and to have access to water in dry periods when water is scarce. They work as sponges as they absorb and release water in the right periods. For this, again, the restoration of wetlands can be applied as these natural elements function as sponges, delivering many other benefits such as increased biodiversity, attraction of rare species, free water purification system, etc. Additionally, a small-scale water storage system that supports the existing water supply (management) infrastructure. While connecting small-scale storage developments an impact will be made on the larger scale, allowing a higher success rate. This can be done by recharging aquifers and designing natural and artificial storage spaces. Lastly, adaptive agriculture that is based on seasonal agriculture can be implemented. This type of agriculture allows wet periods as it functions during pre-flood, flood, and post-flood periods, based on the different seasons. This allows for more room for water while conserving the existing land use.

3 | Increasing water purification through nature-based and smart technological solutions.

Due to the excessive use of fertilizers on agricultural land and agriculture itself, the surface water and water bodies are immensely polluted with nitrogen. Irrigation systems somewhat wash away pollutants from the water bodies, but finally end up in the downstream areas of the delta, accumulating in specific areas. This harms the natural environment and ecology of the territory. Therefore, water purification is required. Groundwater, surface water, and aquifers can be recharged by the restoration of wetlands, integration of existing and new flood plains ('room for the river'), and water storage areas. As wetlands naturally function as water purifications these nature-based solutions provide an opportunity to clean water. Flood plains allow the natural water dynamics to clean the land when water retreats after it has flooded an area, carrying the pollutants with it. At the same time, it provides a new, restored, and fertile piece of land. Additionally to these nature-based solutions, smart technological solutions such as water storage areas are needed to provide enough water to recharge water bodies.
Furthermore, policies are required to reduce waste and pollution of water bodies, and policies for 'the right of nature' ensure humans are obligated to respect nature and take care of it.

4 | Prevention and reduction of land subsidence.
To ensure water resilience, the risks of floods need to be understood. As explained there are multiple causes for the increased risks due to climate-change-induced factors (sea level rising and peak riverine discharges) and human-induced factors (extraction of water resources for irrigation systems). This planning principle focuses thus on the human-induced factor of land subsidence, which is an unstainable use of a water resource. Therefore, this thesis argues for a transformative irrigation system for which sustainable water use is required. In addition, there needs to be a circular water system of extraction and recharging to prevent compaction in the soil which causes land subsidence.

5 | Allowing more space for nature.
The region of Emilia-Romagna is one of the most densified areas of the Po Valley and (almost) entirely structured by (artificial) elements such as infrastructure, heavy constructions, industrial patches, and agricultural areas. As history shows, nature has made room for human alternations and developments, and slowly conquered (almost) the entire territory. To design a water-resilient future, there has to be more room for nature, and thus water to be allowed to roam freely (within certain restrictions to protect built areas and cultural heritage, and new, restored natural structures to flourish and blossom on the territory. For this planning principle governance through policies is required to ensure that there will be restrictions on urban expansion, as sources show that the territory is the victim of rapidly increasing urban expansion in the upcoming years and decades (source). Simultaneously, policies for 'the right for nature' through for example protected natural areas are crucial as in contemporary society an area needs to be given value for humans to be aware and see its value (Magnason, 2021).

6 | Sustainable transformation of small, scattered, (and polluting) productive industries in the in-between 'Reno' territory.
The Po Valley and the region of Emilia-Romagna are both characterized by industrial economies. Along the Via Aemilia and in big cities such as Ravenna and Ferrara most of the heavy industries are located. As this is part of the international trade system and ensures large amounts of income for the inhabitants of the area, these heavy industrial areas are difficult to transform as many are dependent on this and these large structures are difficult to remove. This will need a systematic approach, something this thesis will not approach. However, in the in-between 'Reno' territory industry is structured as small scattered productive areas that are 'easier' to transform as they leave less of a mark behind on the territory. Therefore this thesis argues to focus on these areas and integrate sustainable policies that put restrictions on pollution and waste and encourage sustainable pollution and waste management. The second intervention will be a network of sustainable types of industrial environments that are connected and support one another on a large scale to ensure impact in the whole region and not only locally.

7 | Water-resilient agriculture while respecting the current agriCULTURE.
As stated before, the region of Emilia-Romagna is greatly characterized by agriculture, with an emphasis on 'culture'. It is more than just a profession, it is a way of living and an identity. Identity is everything to the Italian culture, as many probably already know, and food is one of their holy grails. Food is their essence, as 'you are what you eat' (Francesca, 2024). Great examples are the famous pasta Bolognese, Parma ham, and the king of all cheeses: Parmigiano Reggiano. It is, therefore, crucial to ensure the existence and respect of the generational-passed down agriCULTURE.
However, we unfortunately live in a period of climate crisis and there is a need for a paradigm shift. Water is starting

to fight back and is trying to take back the rains that have been taken away with the start of the land reclamations. As the paintings of the Romantic Period tried to capture on canvas: nature cannot be dominated by humans as its power is all over (figure X). And this is happening again with the rising sea levels and extreme weather conditions that will not wait for life. Agriculture can also play its part by introducing aquaculture, which will increase with the restoration of the cultural landscape of wetlands and more waterbodies. This can be introduced as a (partly) alternative to the current agricultural system. It is important to state the fact that the transition into new types of agriculture will be slow to allow farmers to get used to the idea and not have to take drastic acute actions. This will be designed by different stages of transitions and subsidies will stimulate farmers to transform their practices. At the same time, adaptive seasonal agriculture will be introduced that functions on the dynamics of water, which is based on pre-flood, flood, and post-flood cultivation. And lastly, to allow farmers to stay working in the same system, a transformative irrigation system will be introduced. In this way, irrigation agriculture will be more sustainable.

Design Proposition

The overview of all the planning principles and design interventions is a framework that provides all the interventions and is based on the outcomes of the problem statement, longue durée, and spatial analysis. It provides an overview of what should be done to design a possible water-resilient future. However, to frame the design proposition more precisely, a selection is visualized in Figure 50.

As explained at the beginning of this report, the motivation of this project started with the question of how a specific small-scale design intervention in an urban context should be designed to cope with water, thus a water-resilient urban design, as the territory is threatened by both extreme flood and drought risk. What would a design like look that would be implemented in the near future, but could be part of an integrated water-resilient large-scale system that can adapt and cope with rising water levels in 50, 100, or 200 years?

Then the design proposition. The final design will be on the micro-scale representing human daily life in a public space. However, this small-scale design intervention will be part of an integrated large-scale system of various small-scale designs sprawled through the territory of the selected focus area, the southeastern part of the region of Emilia-Romagna as this area is at most risk for floods and threatened by long periods of drought. As the region can be divided into several territories, the public spaces will differ from urban, and peri-urban to rural. Therefore the small-scale designs will be of various natures.

Along with the overall aim of water resilience, in its tangible and intangible context, there are three overarching planning principles selected:

1 Restoring and reintegrating the (connection with) the water identity through tangible and intangible water heritage by

- Restoration of and bringing rivers back to life with the intervention of 'room for the river'.

- Restoration of the coastal and in-between 'Reno' territory cultural landscape with the intervention of wetlands restoration and implementation.

- Integrated water buffer- and storage-system in existing urban settlements through small-scale designs with the interventions of flood squares and water absorbing infrastructure.

2 Integrating buffer zones for 'wet' and 'dry' periods by increasing water accessibility in periods of drought with the intervention of the restoration of wetlands, small-scale water storage developments that support existing water supply (management) infrastructure, and adaptive and seasonal types of agriculture.

And lastly, 3 water-resilient agriculture while respecting the current agriCULTURE by the intervention of adaptive and seasonal types of water agriculture.

The idea is, that the area will be resilient against the water-related challenges, articulating the increased threatening of floods and periods of drought while a new way of living with water will be introduced that restores and reintegrates the tangible and intangible water heritage. What I mean by that is, these interventions will physically provide water resilience as various storage interventions will be designed as wetland restoration (rural), water-absorbing infrastructure, and flood squares (peri-urban and urban) on the small-scale. However, these designs are part of a large-scale system. Larger scale interventions will be interventions as 'room for the river' to provide more space for water and adaptive and seasonal types of water agriculture that provides an alternative for the contemporary type of agriculture that slowly destroys the current landscape and does not provide water-resilience.

All these interventions provide the reconnecting with the intangible water heritage as through these designs water heritage is brought to life again by restoring the (principles of) the historical cultural landscape, as described in the longue durée (Figure 52). In the past, water had more space and rivers could let their dynamics move freely around the territory, therefore floodplains were part of nature on which humans adapted that seasonal agriculture, and wetlands occupied the whole territory. Reshaping this understanding of the water dynamics and the benefits that it provides us, instead of perceiving it as a change that is against our society, reconnects us with the essence of what water can mean for society and provides a more balanced way of living with water. It reconnects us with who we were in the past adapted to the modern context. These interventions will bring back a rich landscape that has not been here in a long time, rich of biodiversity, trees, and a natural balance that restores the landscape to a more resilient and sustainable state.

The small-scale water storage and buffer designs also provide an understanding of the intangible water heritage and reconnects humans who use these interventions in

daily life with the essence of water, which is providing life. Flood squares store water physically, but is also a place where people gather, socialize, and where people live with the water as it provides life in a social context. Water absorbing infrastructure provides a reconnection with water as infrastructure is part of human daily life. Nowadays infrastructure is constructed as a border from water while in these interventions infrastructure will be supported by water and vice versa. It will provide, again, modern human life but in balance with the water dynamics, mechanisms, and understanding just as it did in the past where humas navigated by water. In the large-scale wetland restoration areas there can be recreational, multifunctional areas where people can physically reconnect with the cultural landscape as it was in ancient times.

The aim is to create water-resilience through the various scales by design to reconnect humans with their water identity and heritage which they lost nowadays as the essence of life slowly faded by the anthropogenic way of living, which is water.

7.2 FOCUS AREA & RIVER ANALYSIS

THE COMPOSITION OF RIVERS AND THEIR SURROUNDINGS

To frame the focus area more precisely, three rivers within the main flood risk area, frequently mentioned during fieldwork as the causes of major floods, were selected for exploration: the Santerno River, Senio River, and Lamone River. These rivers run from the southern Apennine mountain range to the plain, connecting to the Reno River (Santerno and Senio) and the Adriatic Sea (Lamone). While the main territorial exploration and analysis has been conducted on a larger scale to understand the entire region, the analyses of these rivers provide a more focused view. This allows for the identification of specific elements and structures that will inform the design, as they represent the existing conditions on the territory.

Starting with the Santerno River, followed by the Senio River, and ending with the Lamone River, each river has been divided into four topics of analysis: waterways, roads, natural landscape, and agriculture. This approach helps identify the main land uses and provides a clear overview of how these elements are structured. The analysis of these rivers led to similar conclusions, as the structural elements are similarly constructed along them.

The waterways are more natural upstream, while the low plain landscape is structured by artificial canals, canalized rivers, and drainage systems. Smaller villages with industrial units are situated along the rivers in the mountains, with larger cities located along the mountain border to the plain and sprawling further through the territory. The Canale Emiliano Romagnola (CER) splits two urban strips, with denser urban areas south of the CER and smaller cities and villages, with industrial units, north of the structure. The infrastructure is denser in the low plain compared to the mountainous area. The Via Aemilia intersects the larger cities along the mountain border.

The natural environment, consisting of forests, natural grasslands, vegetated areas, and few (if any) water bodies, is mainly found upstream. In the plain, almost all natural features have been reclaimed, cut down, or destroyed. Lastly, agriculture dominates the territory. The analysis categorizes agriculture with significant areas of natural vegetation, mining extraction sites, and fruit trees & berry plantations. Pastures and olive groves are also present, but to a small extent. These general findings are summarized in the analysis summary maps of the three rivers, following the detailed analysis maps of each river.

FIGURE 51 | SANTERNO WATERWAYS

FIGURE 52 | SANTERNO INFRASTRUCTURE

FIGURE 53 | SANTERNO NATURE

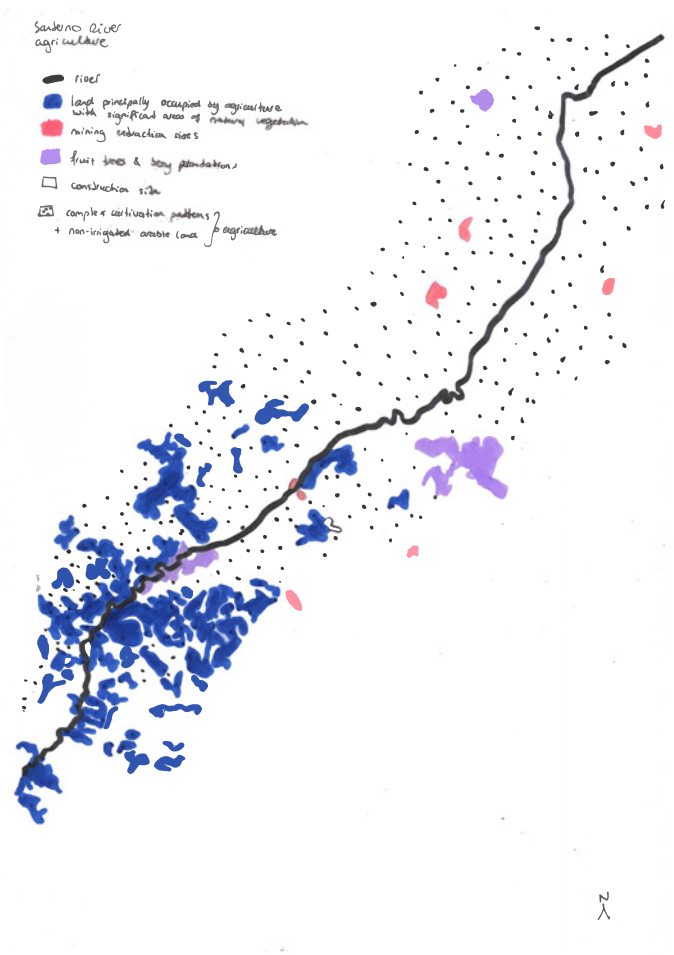


FIGURE 54 | SANTERNO AGRICULTURE

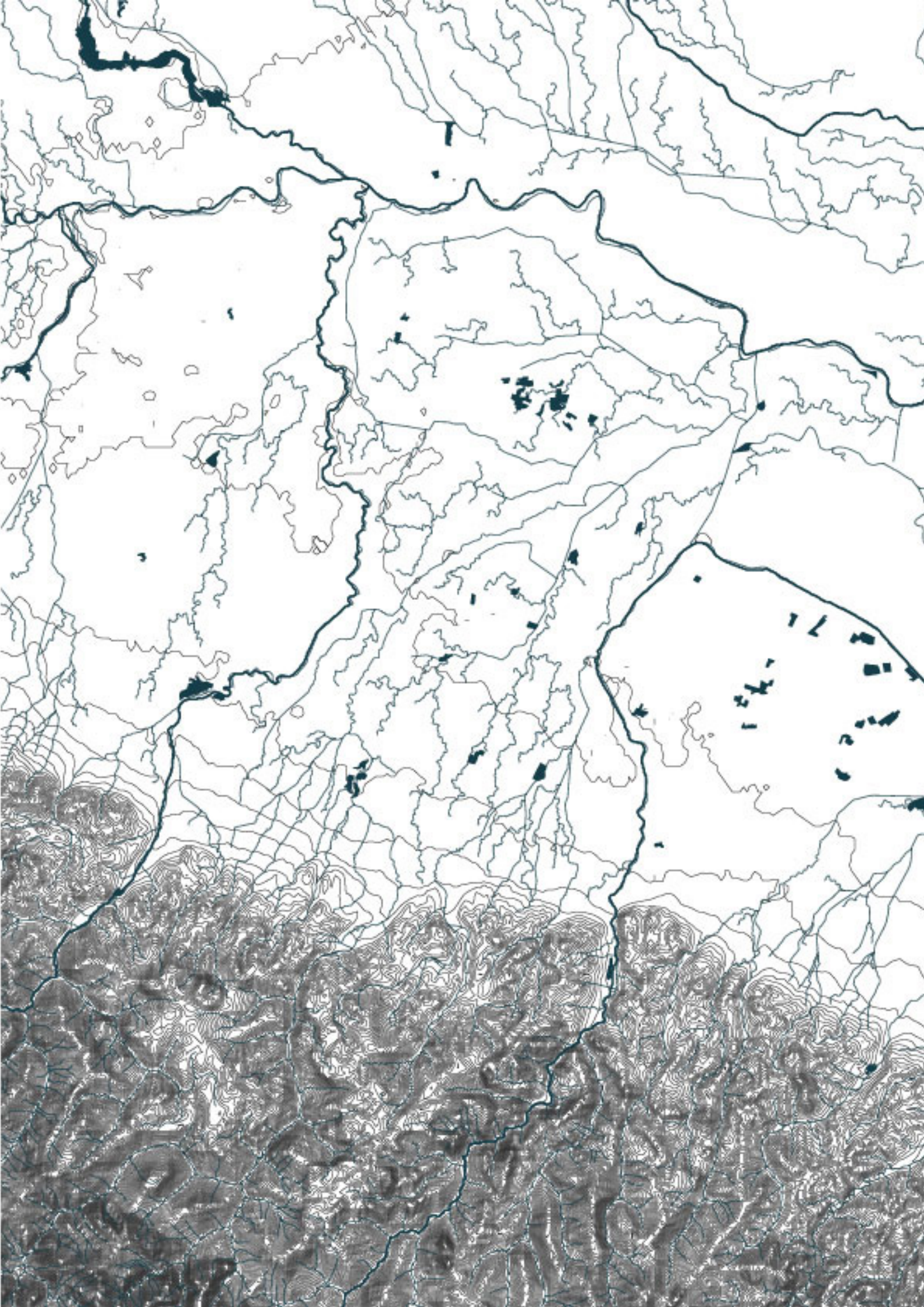


FIGURE 55 | RIVER ANALYSIS


Santerno
Senio
Lamone

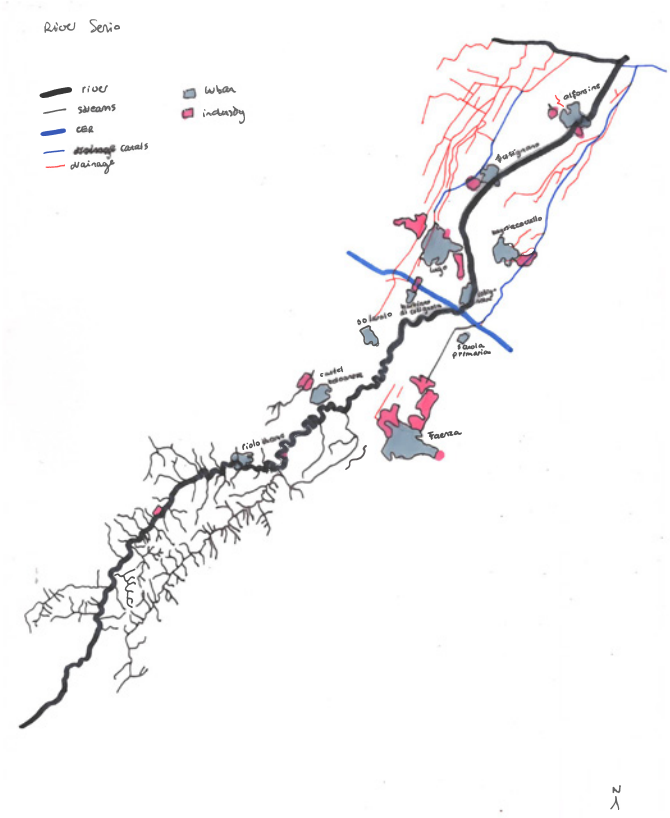


FIGURE 56 | SENIO WATERWAYS

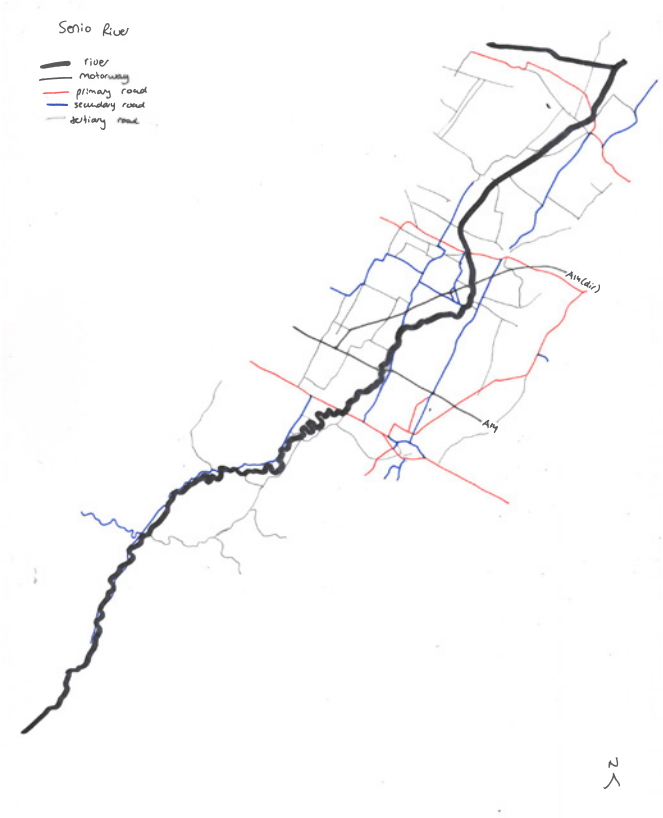


FIGURE 57 | SENIO INFRASTRUCTURE

FIGURE 58 | SENIO NATURE

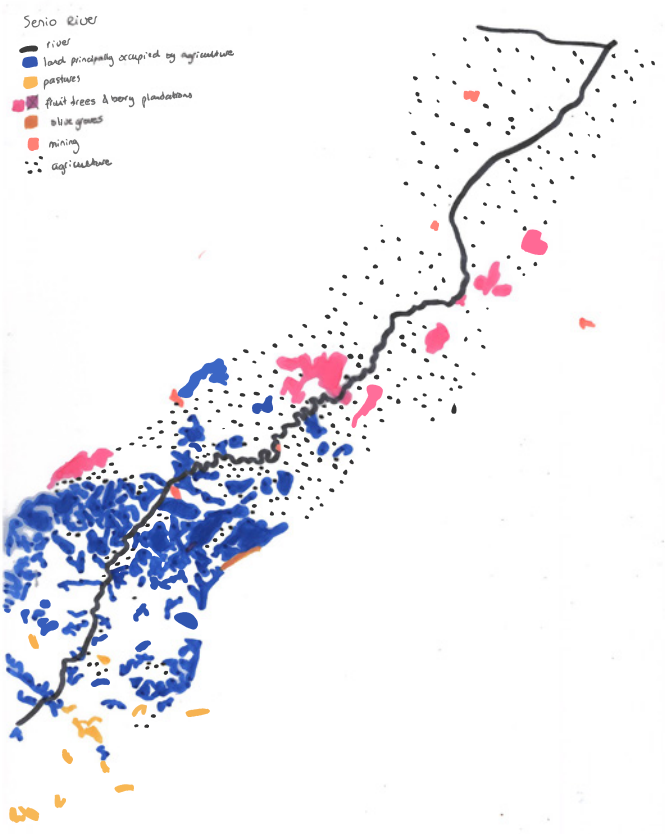


FIGURE 59 | SENIO AGRICULTURE

FIGURE 60 | LAMONE WATERWAYS

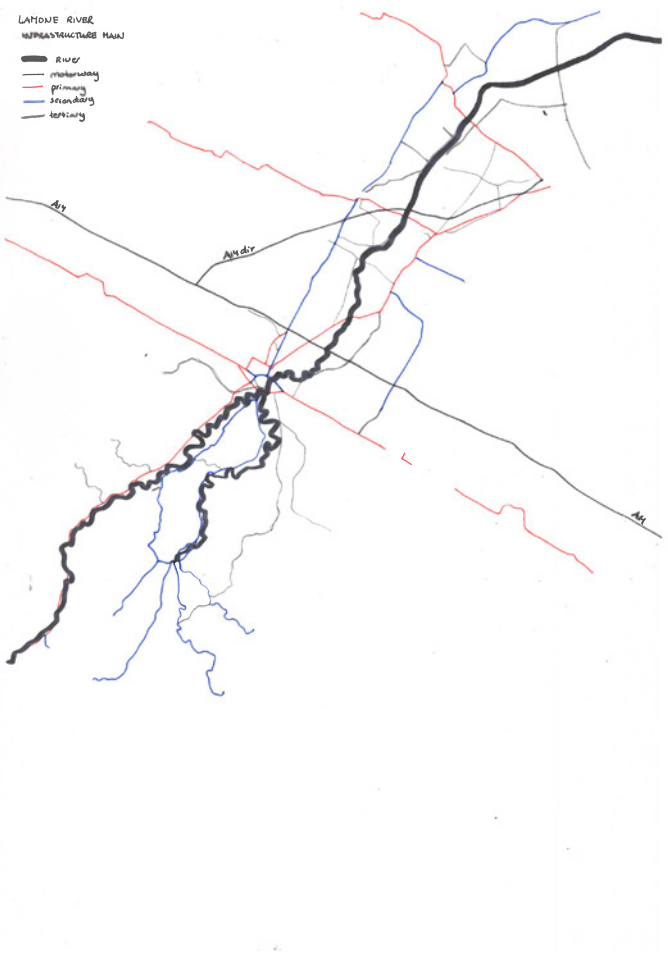


Figure 61 | LAMONE INFRASTRUCTURE

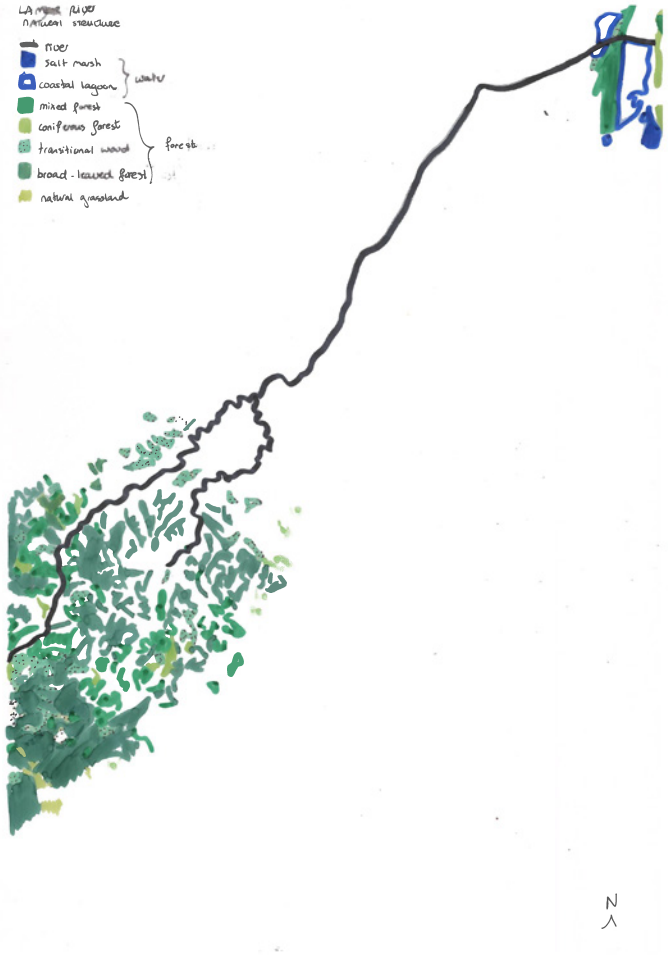


FIGURE 62 | LAMONE NATURE

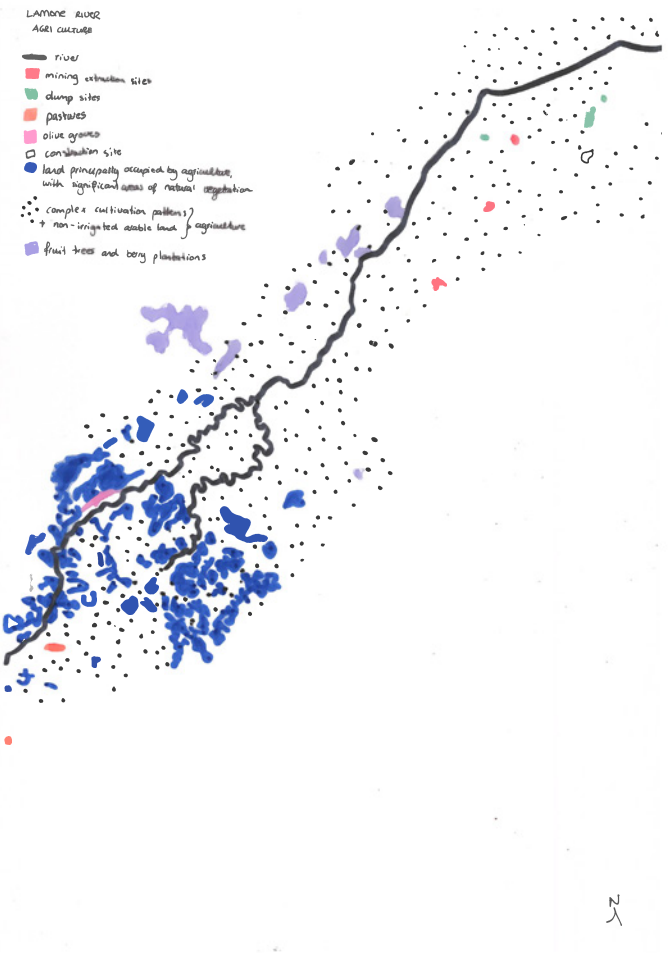


FIGURE 63 | LAMONE AGRICULTURE

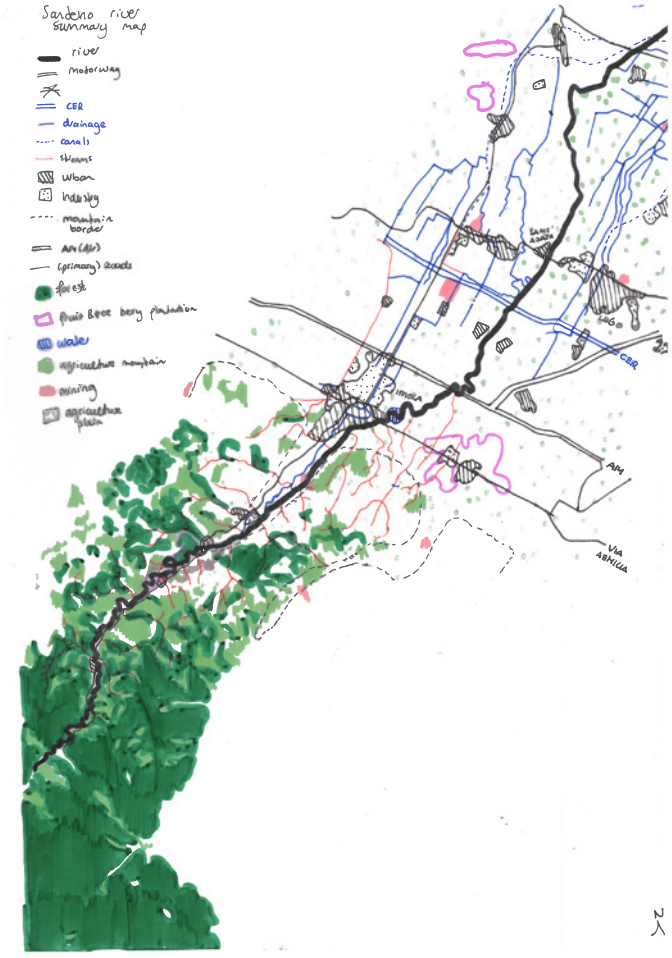


FIGURE 64 | SUMMARY MAP SANTERNO RIVER

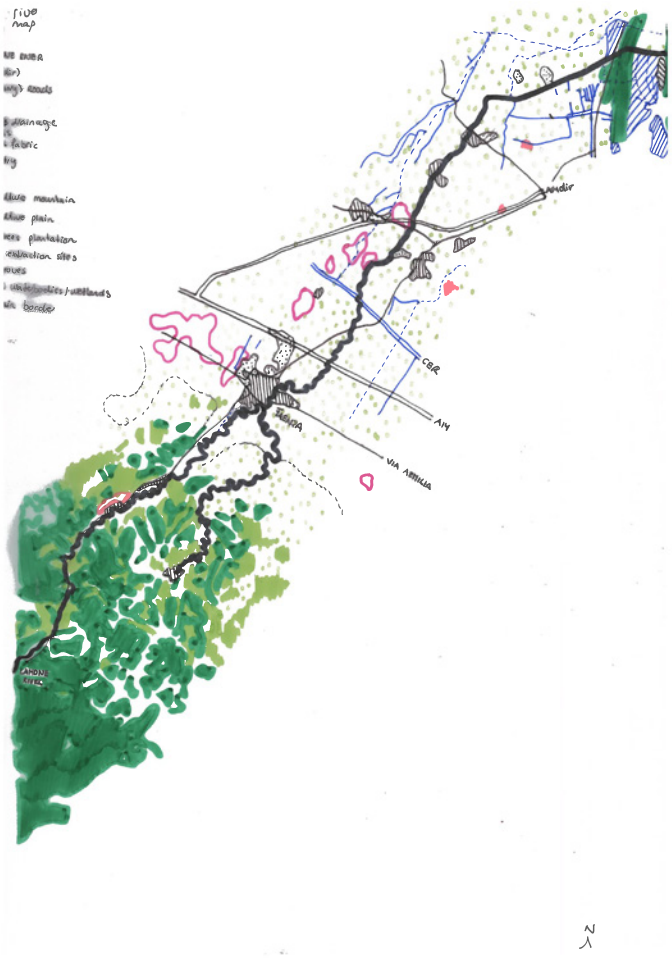


FIGURE 65 | SUMMARY MAP LAMONE RIVER

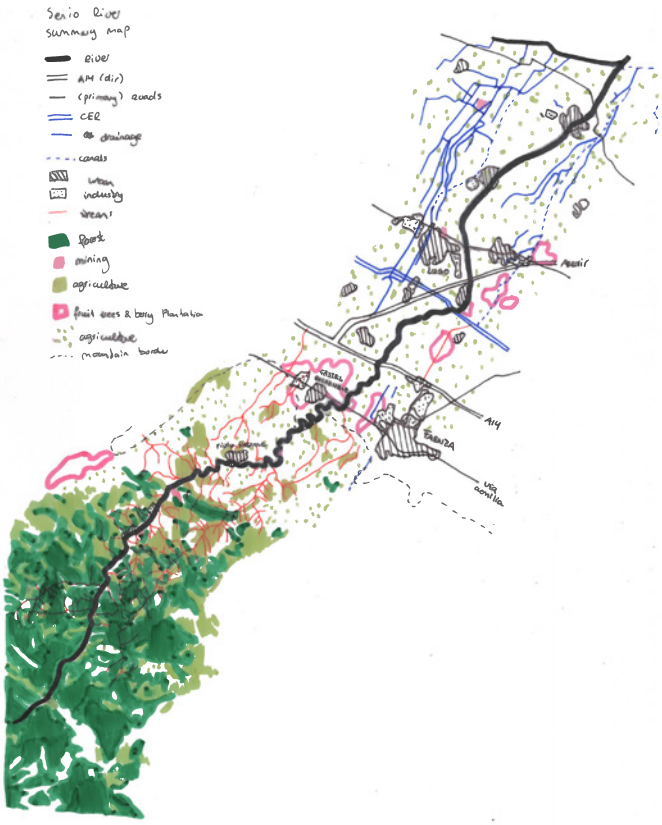


FIGURE 66 | SUMMARY MAP SENIO RIVER

To design across scales and ultimately create a small-scale design in the Village of Sant'Agata, the design will zoom in on Santerno River. The next chapter will explore the history of this river and the small town, providing a better understanding of their interrelation and connection with the territory, from past to present.

7.3 SANT'AGATA SUL SANTERNO

A HISTORY OF ROMAN URBANIZATION AND WATER CHALLENGES

The village of Sant'Agata sul Santerno, located on the left bank of the Santerno RIver, has a rich history. The town emerged during the Byzantine Era (Roman period) on a strategic location as a castrum, a military fort that was part of a defense line from Ferrara to the Via Aemilia. Soldiers lived in these camps with their families and livestock when they were not engaged in military activities. The castrum had a specific layout with four gates at the end of four main axes crossing each other in the middle. Castra were quadrangular shaped and varied in size. These forts were surrounded by a deep, protective moat (in Latin: fossa). This castrum core now forms the town center.

This fort was part of a Roman Grid that laid out across the entire territory, a centuriation system consisting of agricultural plots (centuria) measuring 710 meters on each side. This system was basically a Roman land surveying, with the Via Aemilia (the main Roman route constructed along the mountain border) serving as the maximus decumanus, the reference point of the centuriation system (Ufficio Turismo dell'Unione dei Comuni della Bassa Romagna, 2021). Figure 70 shows how the Roman grid is still visible in this territory. The main axes of the fort and the grid itself connected the military base to other bases, as all cities started as castra colonizations, even those constructed on older settlements. Figure 67 provides a reconstructive overview of the ancient Roman castrum of Sant'Agata sul Santerno. Tracing the outlines of the castrum reveals the typical measurements of 160 x 160 meters. Its main square, Piazza Umberto, was once the moat surrounding the castrum, later drained as the castrum transformed. The single gate of this castle still stands next t the square, serving as the entrance from Via Rome, which still has its clock. Interestingly, the moat transformed from a public square in the center of the village to a parking lot in recent times as towards the introduction of the car water was pushed out of the living environment, reflecting the lost connection with water as social gatherings spaces and its relation with water have been replaced.

It is not surprising that this ancient core was a military fort, as it was constructed along the Santerno River (in Latin: Vatrenus), an important navigation route in Roman times. The river was part of a network connecting the city of Imola along the mountain border to the Reno River (ancient Po Riverbed) and a Roman port in the Comacchio lagoon (coastal lagoon), linking Etruria and Spina (coastal harbors) (Figure 72) (Soldati & Marchetti, 2017; Comune di Sant'Agata sul Santerno, 2019). At that time, the landscape, although starting to be reclaimed, was dominated by marshes, wild rivers, but also canals. The Santerno River was dynamic, meandering freely through the territory, with wide bends that slowed down the water. During high water levels from heavy rainfall, the river would flood the surrounding territory, a common occurrence with Apennine rivers as part of an unstable hydrographic system.

As we know, the Santerno nowadays is not as free as it was before. But, interestingly, a part of its natural form can be traced back within the existing (reclaimed) territory. The Google Earth view (Figure 75) illustrates the ancient riverbed of the Santerno River south of the town. Figure x displays the map of how this river runs along the old castrum base of the village. The wide bends of the river are visible here.

Many colonizations arose along these unstable river structures, and these civilizations were often threatened by the floods. After a devastating flood, the river was canalized between 1885 and 1888, with a 2.5-kilometer canal ('halyard') with raised banks to prevent the water from slowing down, resulting in its current structure (Figure 74). This significant human intervention altered the natural territory. The free movement of the river controlled, expected to solve the water challenges, however, as recent events have shown, this is far from the reality.

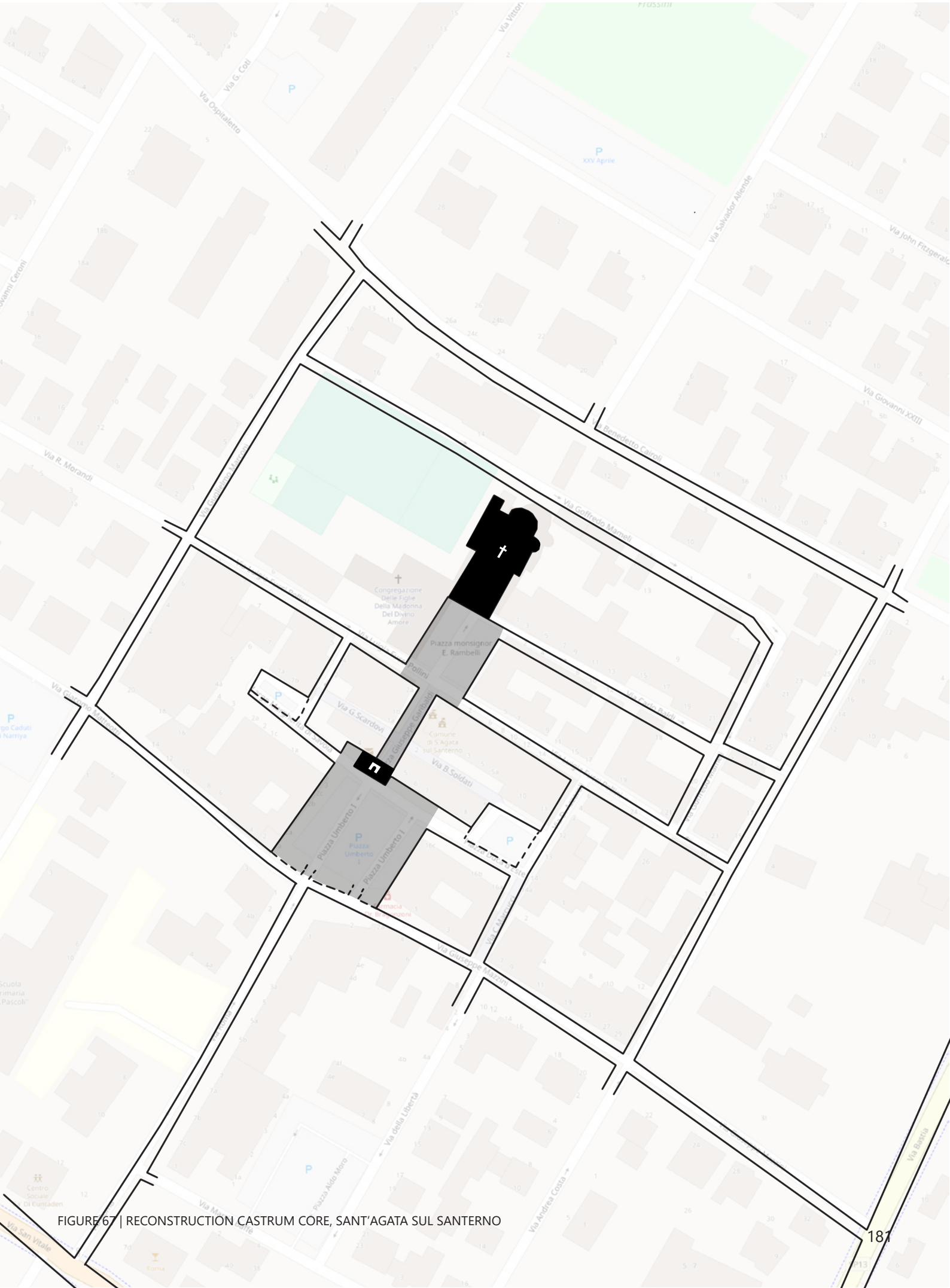


FIGURE 67 | RECONSTRUCTION CASTRUM CORE, SANT'AGATA SUL SANTERNO

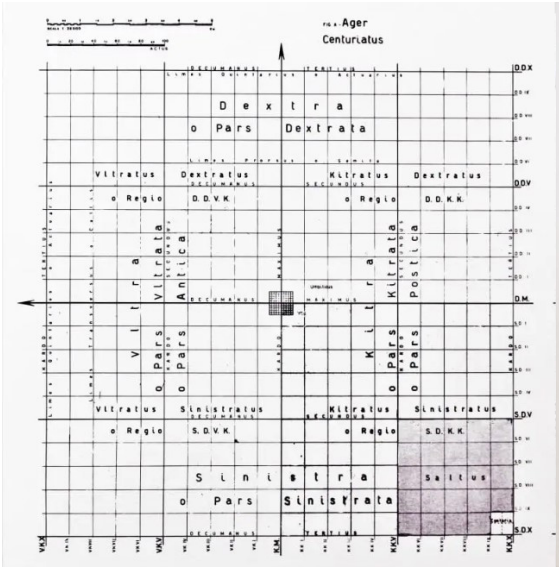


FIGURE 68 | AGER CENTURIATUS (Tesfamikael, 2020)

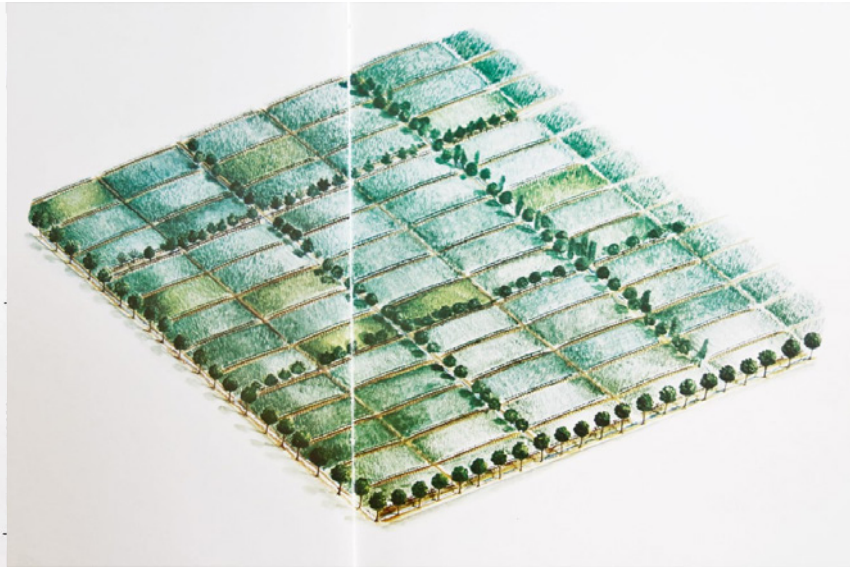


FIGURE 69 | IMPRESSION CENTURIA AGRICULTURAL PLOT (Tesfamikael, 2020)

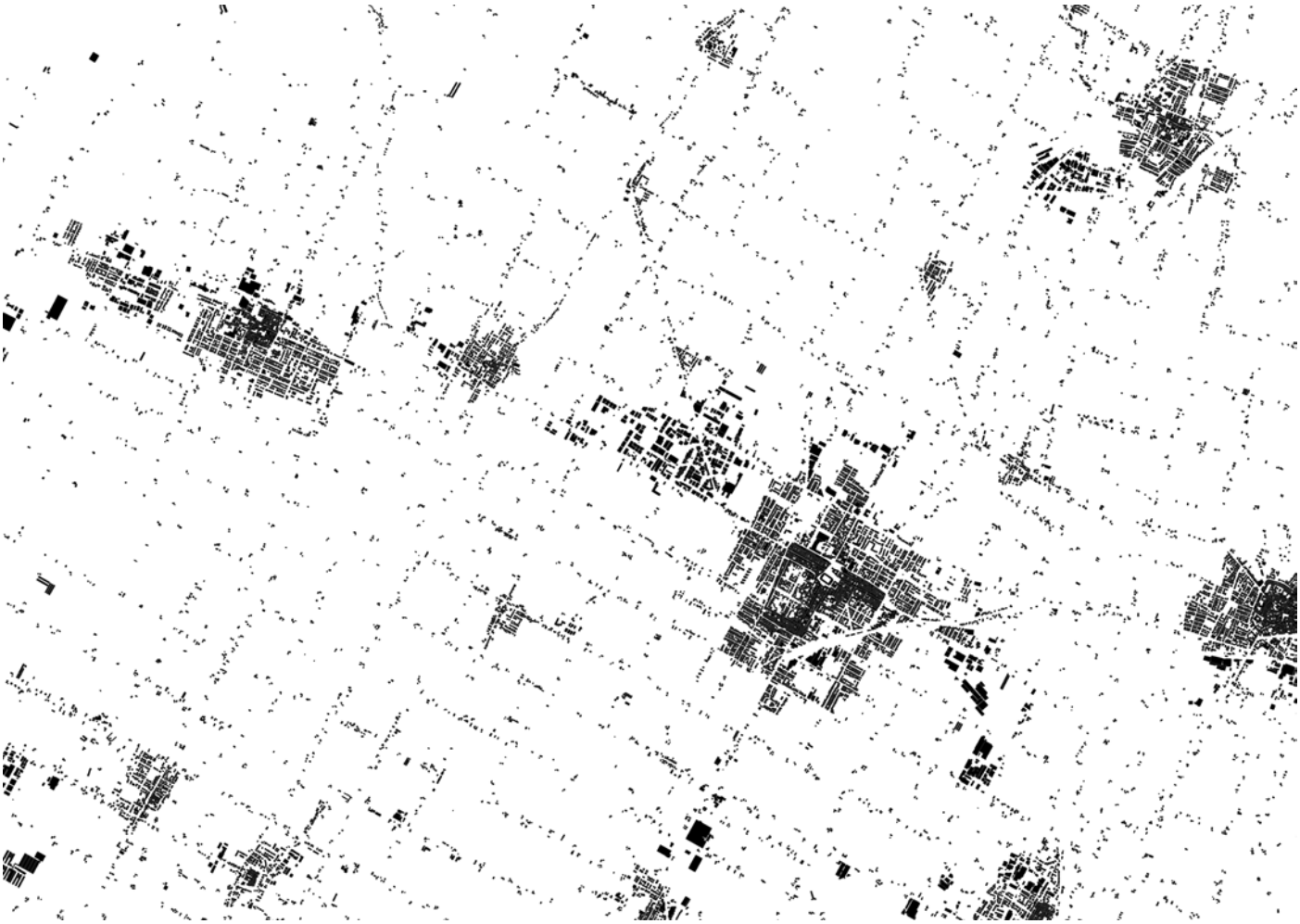


FIGURE 70 | BUILDING LAYER TRACING THE EVIDENCE OF THE ANCIENT ROMAN CENTURIATION GRID

FIGURE 71 | TRANSFORMATION SPATIAL USE MAIN SQUARE PIAZZA UMBERTO, SANT'AGATA SUL SANTERNO

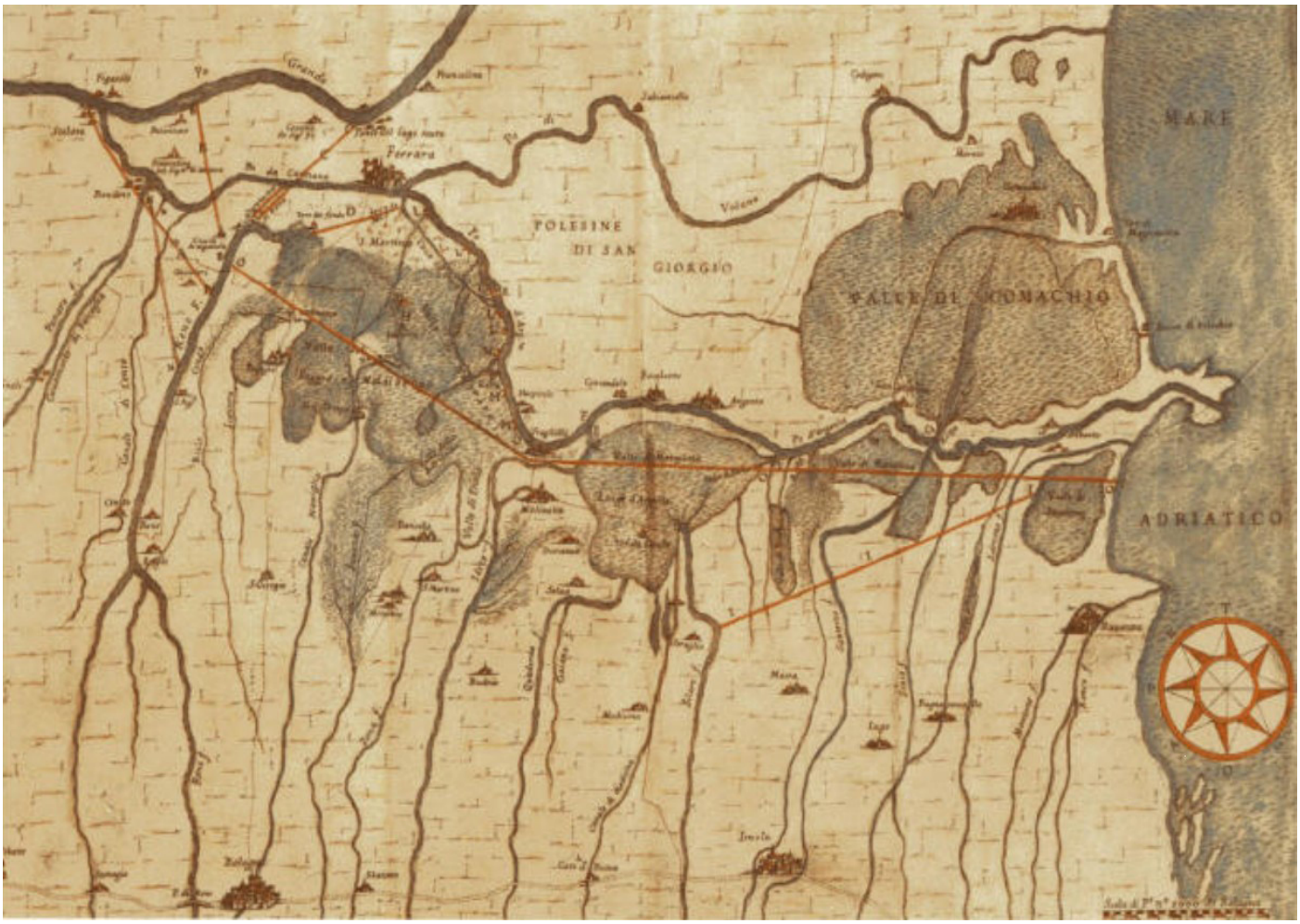


FIGURE 72 | MAP OF APENINNE RIVER COURSES ILLUSTRATING SANTERNO AS NAVIGATION ROUTE FROM IMOLA TO COMACCHIO LAGOON (C. Saccenti, 1651)

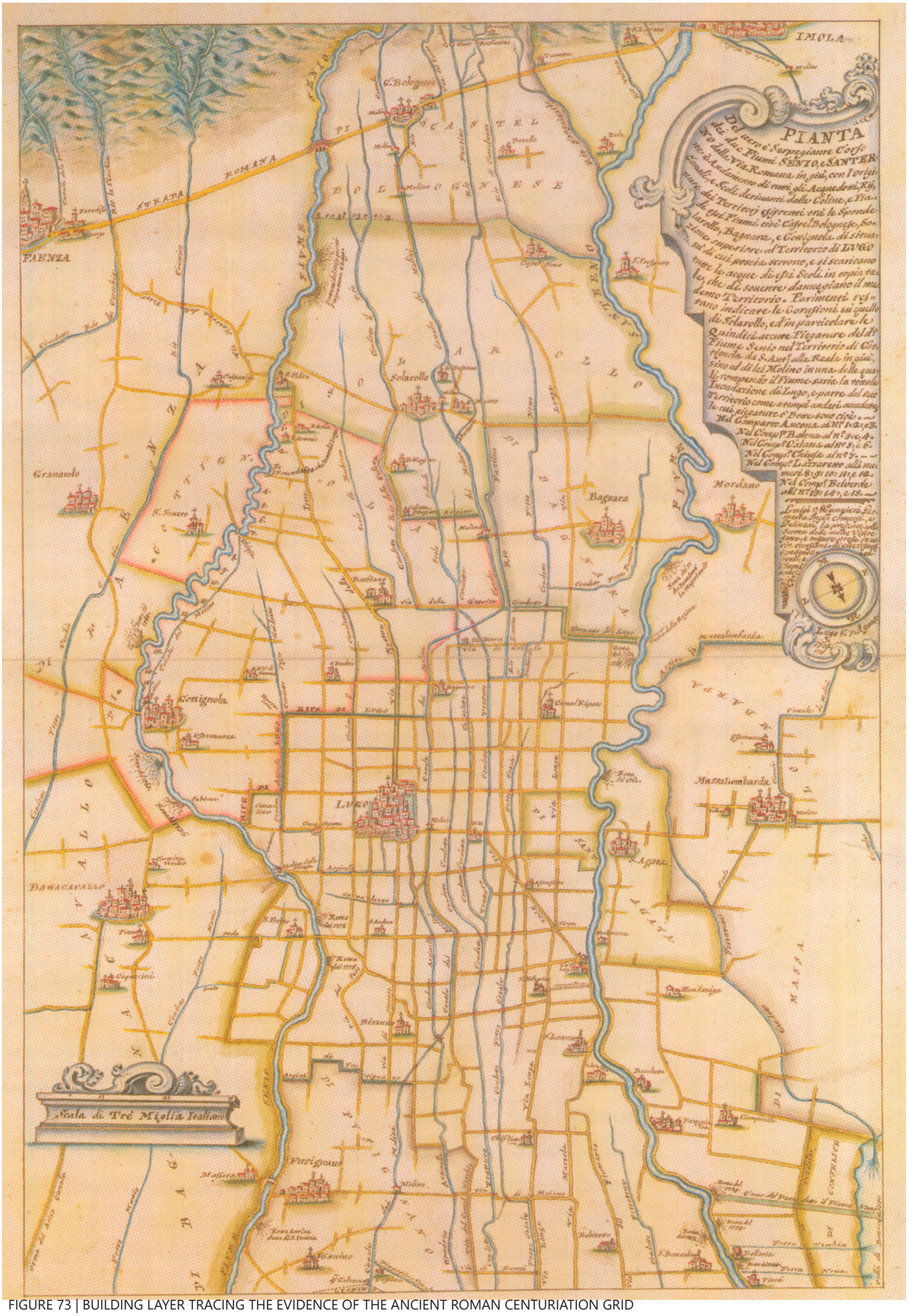


FIGURE 73 | BUILDING LAYER TRACING THE EVIDENCE OF THE ANCIENT ROMAN CENTURIATION GRID
(Ufficio TUrismo dell'Unione dei Comuni della Bassa Romagna, 2021)

FIGURE 74 | RECONSTRUCTION ANCIENT RIVER MEANDERING IN RELATION TO ROMAN CASTRUM

FIGURE 75 | AERIAL VIEW LANDSCAPE TRACES ANCIENT RIVER MEANDERING SANTERNO RIVER (QGIS, 2024)

7.4 HEALING WATER WITH WATER

A FRAMEWORK FOR A HEALTHY WATERSHED

This chapter describes the conceptual framework of 'healing water with water' to restore a healthy watershed. It is based on the taechings of Andrew Millers (2023), a permaculture teacher and practicer who claims water is at the base for sustainable agricutlure. Therefore, he explored and teaches on the water systems and how to improve it health.

For this framework, he describes a landscape as the hat, belt, and shoes and it is all about collecting, slowing down, and infiltrating water. All to recharge aquifers, increase water levels, and rehydrate the soils to ensure water accessibility and natural flourishment of ecosystems. Figure 76 illustrates a sketch of this concept.

Based on this framework the concept of this project arose 'water storage along the various landscapes'. Water will be reintrocued along the various landscapes and will need the posibility to be collected and stored. In that way, water accessibility is present during dry and wet periods.
explanation text which illustrates the theory behind the framework for the territory and concept of 'water storage along various landscapes' from upstream to downstream

At the same time, it argues for the health of rivers and the fact that trees also make water. Rivers need to more freely as they are based around a dynamic equilibrium. Therefore they need room and connot be constricted. Their health is important and depended on the soil health, which also stores water, and therefore riverbank and streambank restoration is crucial. It is all about river and stream revitalization: bringing them back to life.
For this, trees and vegetation are a crucial element. The roots strenghten the soil and simulteneously store water within the soil.

The same principle is important for the 'hat'. At the top of the mountains, trees need to be implemented to capture water and increase water infiltration into the soil to recharge the perched aquifer.
Then in the 'belt', water that runs of needs to be slowed down and stored. In that way more water can be infiltrated to restore groundwater levels and ensure long-term water accessibility. Which restores the health of ecosystems and watersheds. Agriculture can be used together with this water storage.
Lastly, the shoes. The runof water than reached the valley of the mountain ranges, can be captured in water reservoirs and ponds that can be combined with agricultural use. It is important to implement sustainable agricultural such as permaculture and agroforestry, to keep allowing nature to flourish and be brought back to health.

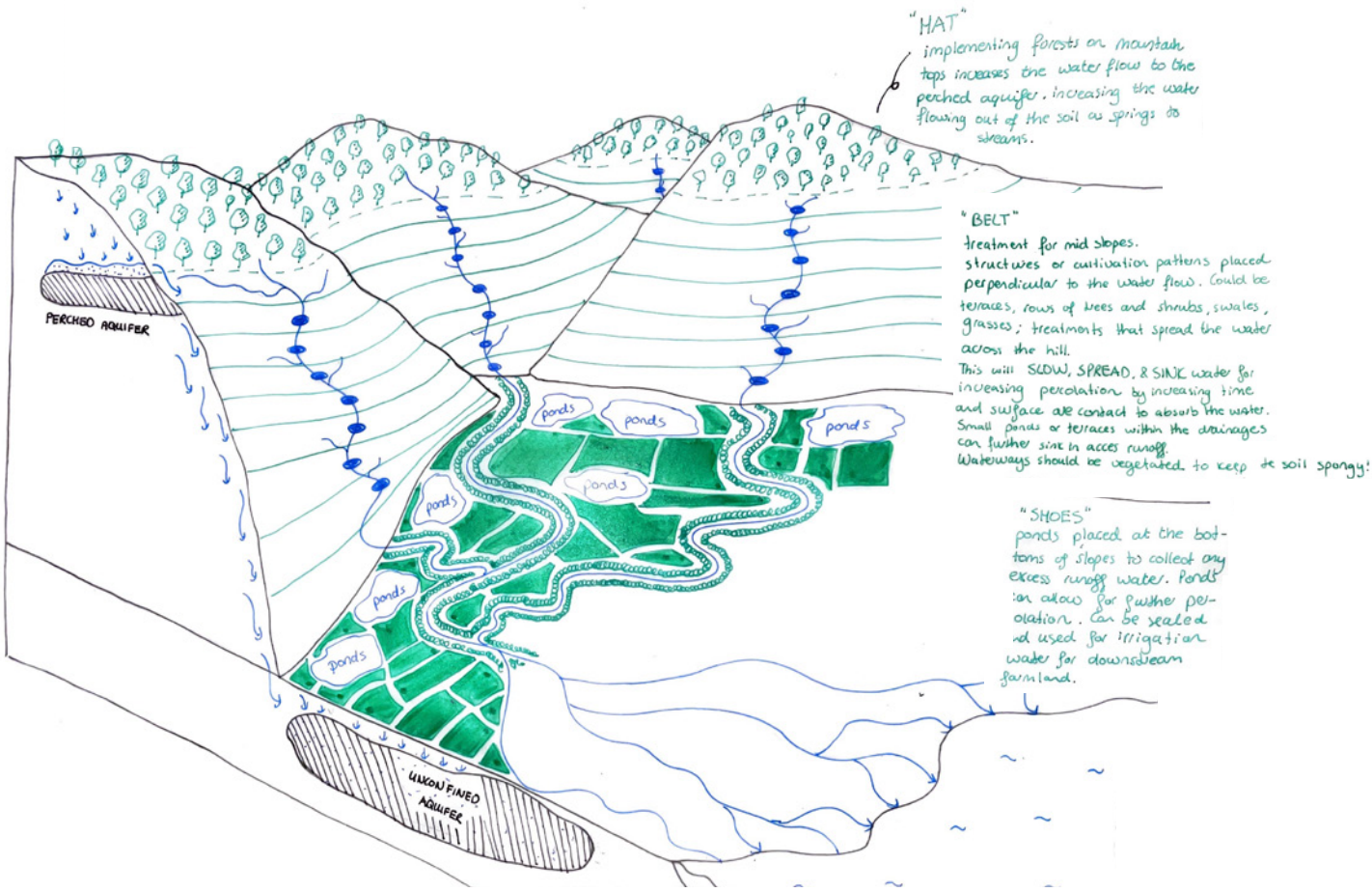


FIGURE 76 | CONCEPT OF 'A HEALTHY WATER SHED' - THE HAT, BELT, AND SHOES PRINCIPLES. (Andrew Millison, 2023).

7.5 THE INTERSCALAR DESIGN

DIVERSE WATER STORAGE ALONG THE RIVER

As the previous chapter described, the concept of the healthy watershed (and planning principles) has shaped the framework for the territory on how to restore the natural watershed system, based on collecting, storing, and infiltrating water. It explained abstractly how the territory can be divided into the hat, belt, and shoes and how in various ways the water can be slowed down, multi-used, and recharge the groundwater levels and on the bigger scale, aquifers (Andrew, 2022). The clear aim is to recharge and rehydrate the soil and with that the environment through the scales, from micro-climate to large-scale watershed systems, to create flexibility for water stress during long periods of drought and peak discharges.

As the problem statement has explained (chapter 2), the territory is challenged by both tangible and intangible water challenges and sub-challenges. The water extremes of long periods of drought and flood risks due to peak river discharges and sea level rising are increasingly threatening the region. During dry periods the main water resource is the Canale Emiliano Romagnola (CER) and rivers are drying up as groundwater levels are too low due to non-recharged aquifers and over-extraction of water resources and irrigation practices. This causes the soil to subside which increases the flood risk from both the extreme river discharges and sea level rising. Water flows as fast as possible from the river to the sea due to impermeable services and drainage systems that will not allow water to slow, spread, and infiltrate to relieve the peak discharge stress. As well as soil subsidence threatens the territory's existence because of rising sea levels that in the future will flood the whole territory if it continues to happen. This makes the area extremely vulnerable. As these are the tangible water challenges, there is also the intangible water challenge of the social alienation towards the water identity of the territory and region.

Therefore the main concept of this proposition is the concept of water storage along the various landscapes. Each landscape (mountainous, low plain (with its river landscape), and coast) interacts differently with water and therefore demands a diverse strategy of water storage. Historical analysis, especially of the intangible water heritage, shows the undeniable convergence of ritual, community, and place and how water connected them. Nowadays, it is all detached and dissociated. This concept of water storage along these various landscapes, of which the essential element, main connector, and provider of life is water, provides the opportunity through design to return the socio-cultural watery landscapes that function as 'sacred' or 'spirited' landscapes. Allowing humans to interact with and profit from these landscapes, in a harmonious way, within a modern context with Anthropogenic processes and practices, while providing room for the watery landscapes themselves.

From Analysis to Strategy

As the composition of the natural and artificial landscape of the territory along the Santerno has been identified, the next step is to explore the opportunities for and potential of the concept of water storage. There are clear areas of urbanization which are structured in horizontal strokes along the Via Aemilia (mountain border) and north of the CER (low plain). The in-between territory is characterized by agricultural plots and (densely) sprawled urban and industrial patches connected by a dense infrastructural system of primary, secondary, tertiary, and residential roads (based on the Roman centuriation system of the agricultural plots). From the mountain border, the Fiume Santerno transforms into a more prominent territorial element constructed by heavy dykes as the landscape slowly flattens towards the Adriatic Sea compared to its mountainous layout where the Santerno elegantly flows in the valley of the mountain ranges next to it. Interestingly, the mountainous river is characterized by various concrete dams that interfere with the flow velocity and a few bridges cross the river at quite some distance from one another. This also impacts the sediment flow to the downstream territory, increasing flood risk and silting up of streams. Alongside the river, a few water reservoirs are constructed which are mainly for private agricultural use, and one or two reservoirs for public use, which are secluded by fences. Furthermore, some forests exist in the area and the main land use, again, is formulated by agriculture. An interesting water sub-challenge that appeared during the analysis of the mountain territory is that the mountains are heavily threatened by landslides, caused by soil instability due to deforestation and intensive agricultural use. However, important to notice, is the fact that these landslides are historically phenomena as in the past landslides have happened here (source). However, the current conditions increase the threat of this challenge. Figure X shows the landslide risk map of the area and how these are characterized. Figure X provides a photographic overview of the elements along Fiume Santerno gathered during fieldwork.

This analysis clearly illustrates the disbalance of the natural water system and calls upon a strategy that restores and strengthens the watershed to a healthy one and demands a more sustainable and connected land use and human interaction with it.

Abstractly, figure 78 (strategy map Fiume Santerno) provides an insight into how water storage could interact with the landscapes to reduce the water challenges it is facing, using the planning principles, hat-belt-shoe concept, and water heritage as the foundation.

In the mountain, it is of great importance that the existing water reservoirs are embraced, expanded, and improved into a multi-functional connected system that both perma-

nently stores water and naturally collects water to infiltrate into the soil. As 'a healthy watershed' explained, recharging groundwater and aquifers is crucial in the hat of the territory to collect, slow down, and spread water as much as possible before it runs downstream. This interconnected system provides in this way an opportunity for water to be collected during heavy precipitation to prevent floods and store water which can be used in drier periods, for both agricultural irrigation and slow infiltration to rehydrate the soil. By making this structure multi-functional, by allowing agriculture and recreational land uses, the spatial quality increases, and room is provided for the various spatial claims. It is crucial that these practices are sustainable and will be managed sustainably (resilient agriculture). Good examples are the concept of permaculture (based around water) and agroforestry systems (Millison, 2022; Jose, 2009). Secondly, river and stream (bank) restoration is crucial to prevent bank erosion and allow ecosystems to flourish that protect the water structures, and restore habitats. More room should be provided for the river to allow relief during peak discharges and concrete dams can be transformed into lower threshold dams with floodplains to restore the sediment flow from up to downstream and provide natural fertile land. Lastly, an afforestation and reforestation program should be implemented to provide soil stabilization to prevent landslides, increase water storage in both trees and soil and restore their drought-flood cycle (Trees Make Water). Automatically, trees and vegetation purify water from pollutants which causes at the start of the hydrological cycle, clean water will enter the system, preventing water pollution.

Now the hat has been formulated with fitting strategy interventions, the following 'area' is the belt. Here it is important to slow down and capture water that flows both on top of the and below ground to increase the infiltration into the soil and keep it moisturized. Cultivation patterns can be applied perpendicular to the water stream through terrace and pond systems in combination with vegetation buffer zones.

These hat and belt strategies provide room for water, slow it down, collect, and let water infiltrate. In this way, peak discharges can be relieved and flood risks are prevented in the pressure area on the mountain belt where various historically important cities are located along the Via Aemilia. In this case, Imola.

This pressure point characterizes the transition into the shoe area. Here the river transforms into a dyke-protected water structure which is both prominent and vulnerable. The river changes from a meandering element into an artificial, straight canalized structure. The river changes from a naturally branched river-stream system to an artificial landscape of canal and drainage systems with even less room for the river. It crosses the CER and ends at the pressure point where it connects with the Reno River. As water heritage is the driving force of this project, these water-related structural elements (dykes, canals, drainage systems, agricultural irrigation patterns) will be integrated into the solution. It is important to find a balance between conserving these water heritage elements and implementing a restoration of the natural, historical landscape which is part of the water heritage to provide a transformative approach in which living with water will be achieved in various ways while reconnecting with the water identity of the territory. Therefore, the concept of water storage will be implemented along the artificial drainage and irrigation systems and improve the functioning of the CER to expand water resource accessibility. For the shoe area, excess runoff water must be slowed down, stored, and locally infiltrated. Therefore various types of water reservoirs, ponds, and wetlands will be implemented along these drainage and irrigation structures to have an additional security of water during dry and wet periods. At the same time, the canalized river will be revitalized and transformed into a meandering river to again slow down the water flow. Room for the river interventions will be implemented such as floodplains, side channels, secondary channels, and dyke relocation. As water is the essence of life and life is structured by working ecosystems, naturalization of the river and artificial landscape is crucial. Therefore again, river bank restoration will be implemented, as well as naturalization of ditches, and riparian buffers to both ensure reforestation programs, purify soil and water from (agricultural) pollutants), and prevent flood risks due to soil stabilization.

Lastly, an overall network of small-scale urban water storage designs will provide a large-scale impact in the urban public space alongside the peri-urban and rural public spaces.

Territories and Zoom Ins

As the concept of this design is water storage along the various landscapes, the Santerno River has been divided into the Mountain Territory and the Plain Territory as both approach the water storage differently. These zoomed-in territories provide a more specific overview of how the strategy (explained above) is displayed in these two landscape-based maps. In the mountainous landscape, a more clear division can be presented of the existing forests and the potential for the reforestation program (on top of the agricultural land use). Which does not mean 'instead of agricultural use' (only at specific parts) but 'integrated into the agricultural use'. The plain territory allows the strategy to be more specified on the potential areas of river revitalization and 'room for the river'-interventions. The water storage reservoirs in the urban and rural areas will be along the two arrows, connecting both realms through water through the various scales. Finally, the river crosses the Reno River which causes a pressure point. As peak discharges here gather from two bigger rivers, areas for flood relief are crucial to prevent floods. Therefore, also room for the Reno River has been provided, and just like the natural park on the left of this area, a natural park will be implemented that can be combined with agricultural, but mainly functions for the water stress relieve during peak discharges and provides space for wetlands and watery landscapes, with vegetation, as a protection layer in the landscape. This is visualized in the maps on the following pages.

The map below illustrates the zoning sketch of the plain territory, which identifies the various ways water storage interacts with the existing elements and conditions within this territory. This is foundational for the 'strategy map Fiume Santerno, plain territory' map.

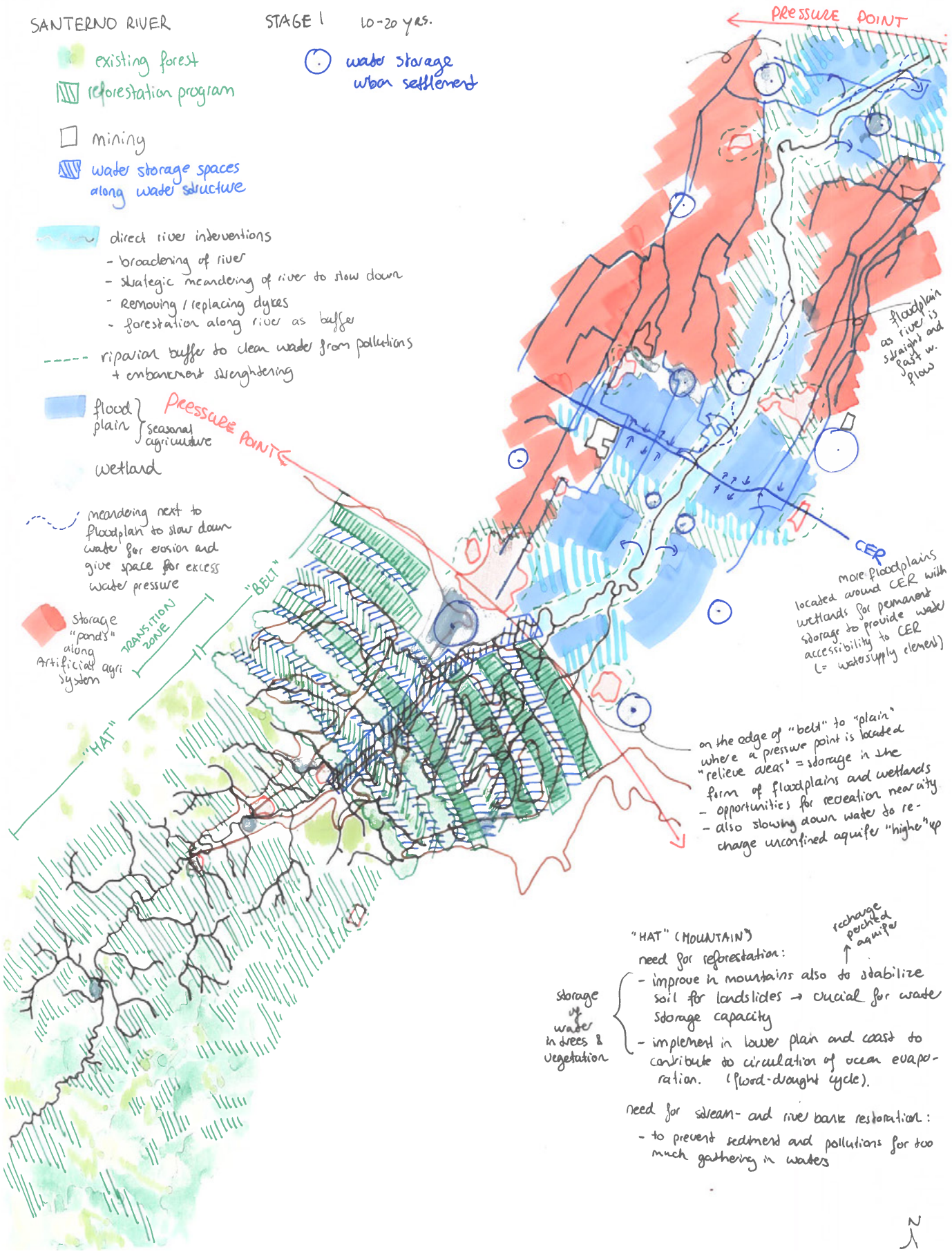


FIGURE 78 | *strategy map Fiume Santerno*

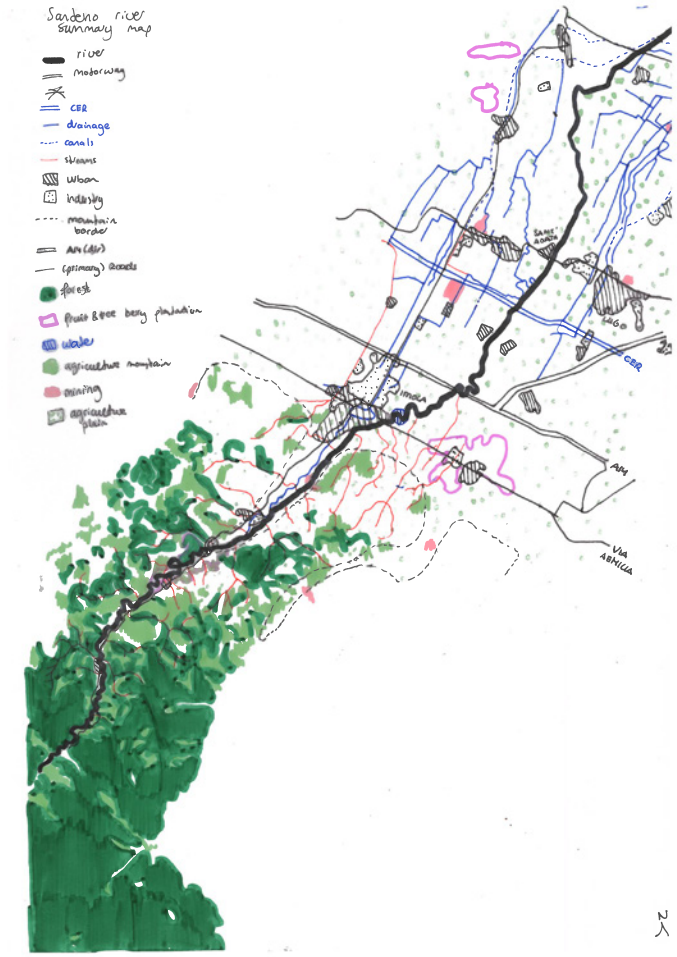


FIGURE 79 | *sketch 'summary map'*

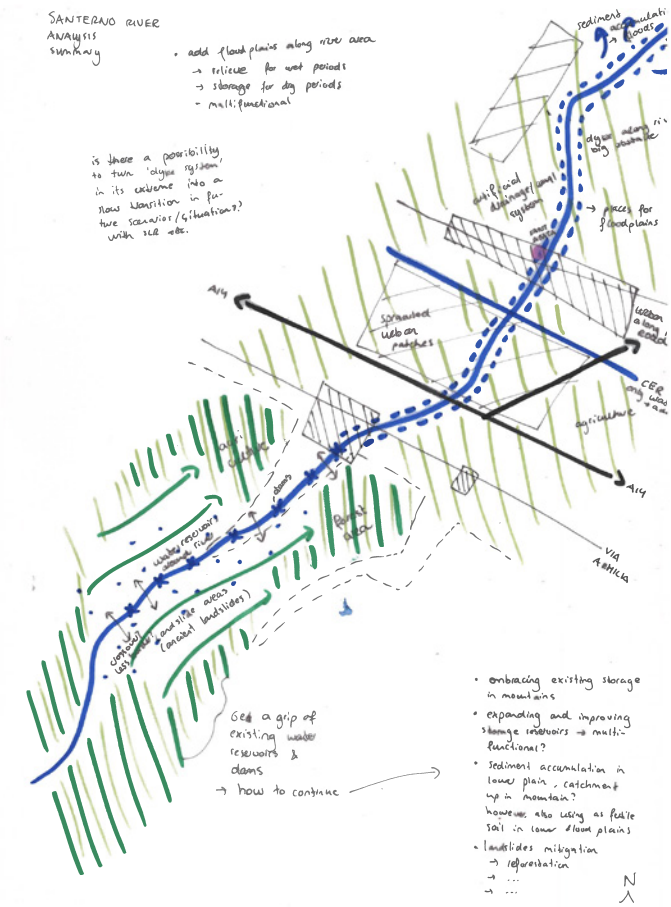


FIGURE 80 | *sketch 'summary map snalysis'*

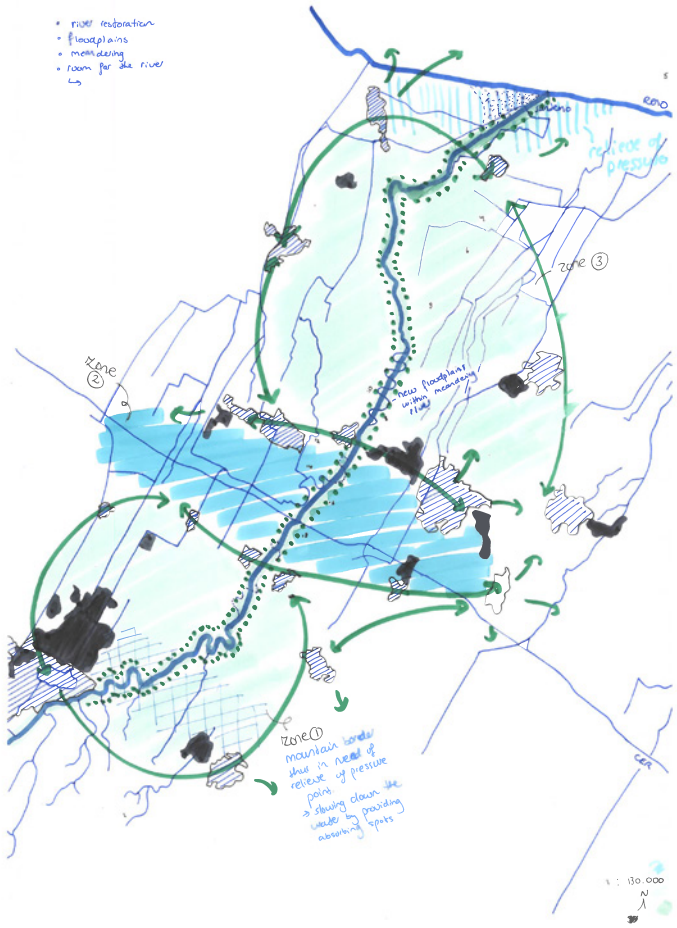


FIGURE 77 | ABSTRACT WATER STORAGE ZONING MAP, *PLAIN TERRITORY*

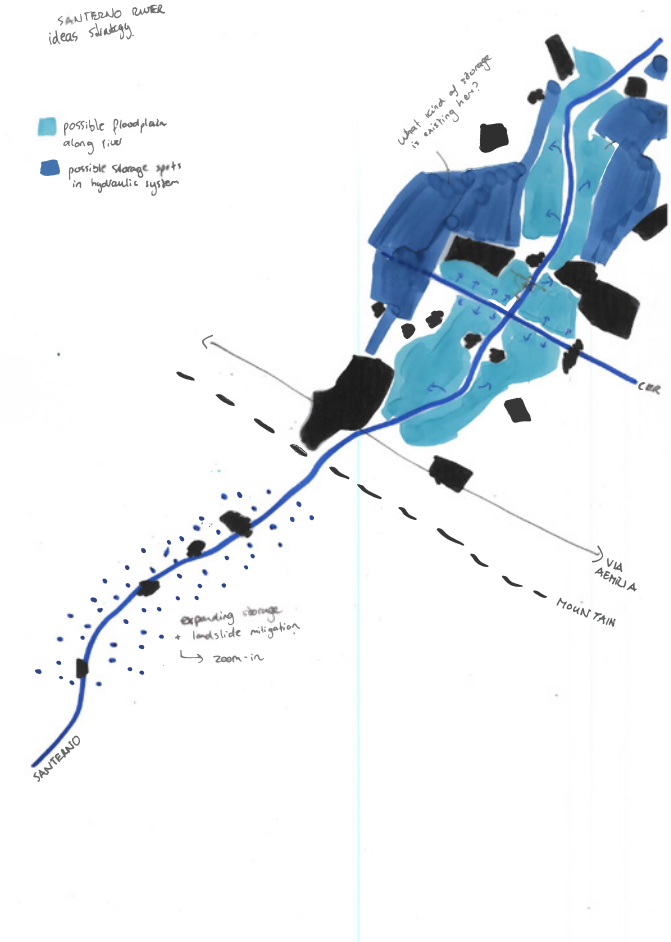


FIGURE 81 | *sketch 'spaces of opportunity'*

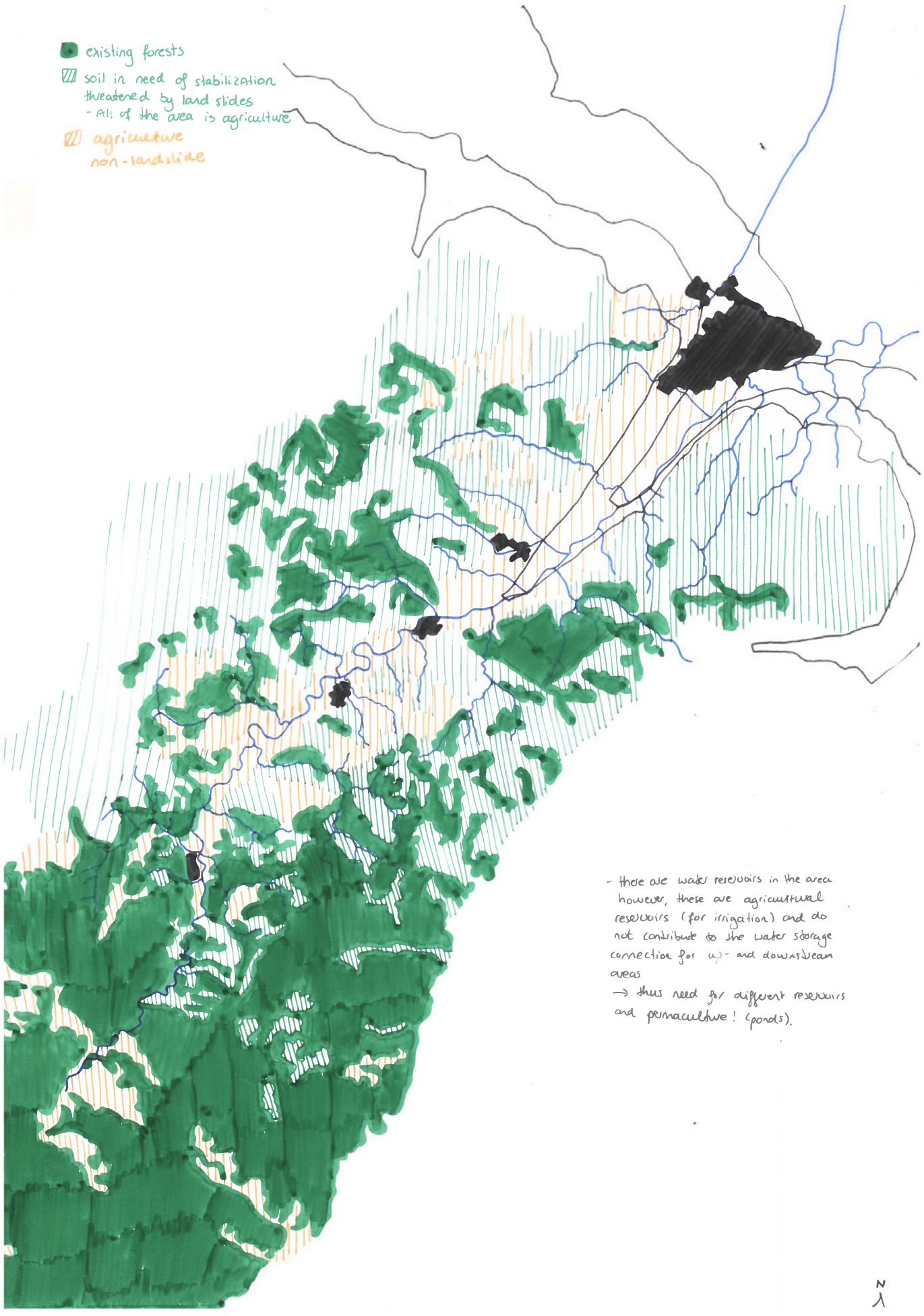


FIGURE 82 | STRATEGY MAP FIUME SANTERNO, *MOUNTAIN TERRITORY*

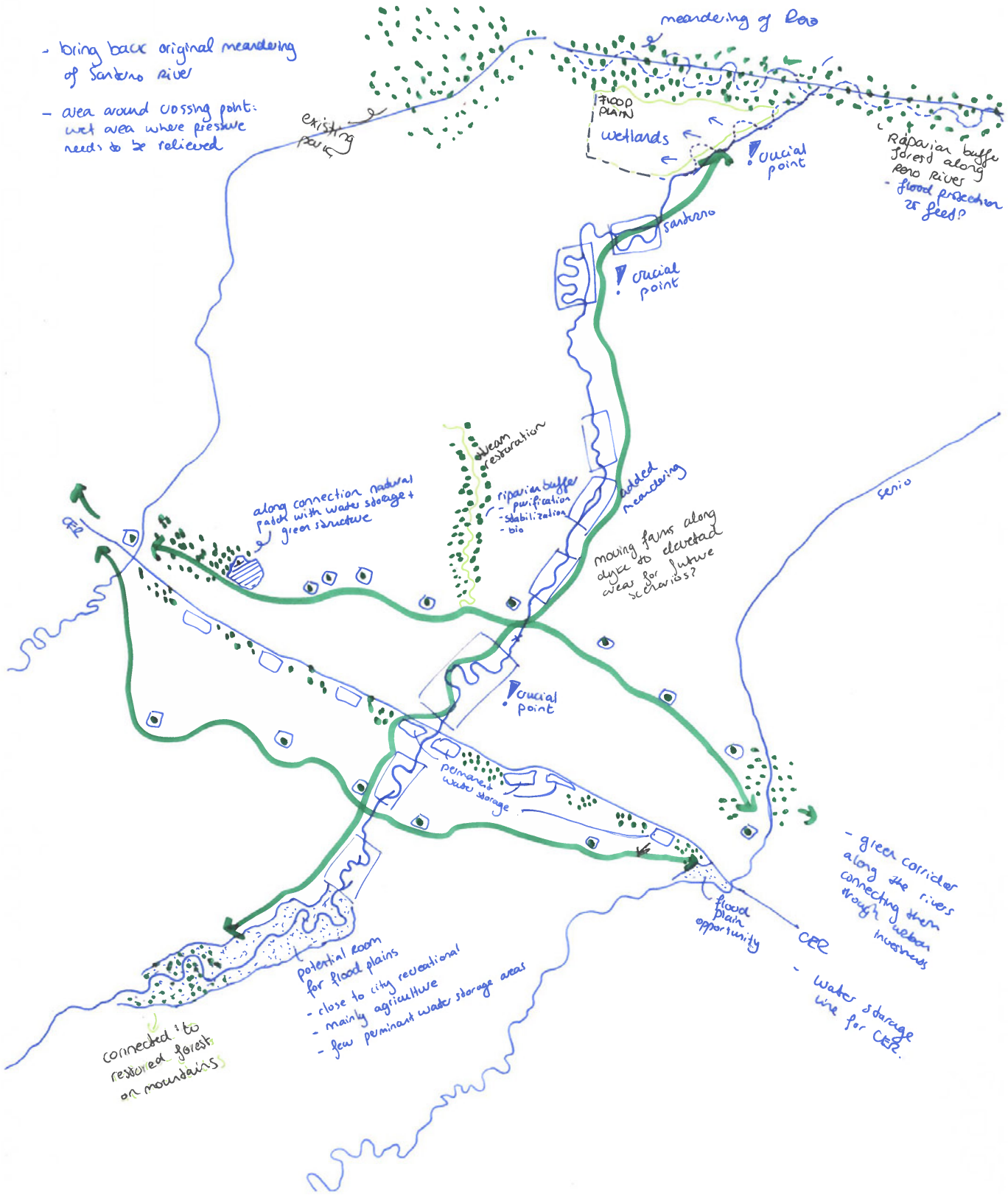


FIGURE 83 | STRATEGY MAP FIUME STANERNO, *PLAIN TERITORY*

IL TERRITORIO DEL FIUME SANTERNO

'HEALING WATER WITH WATER'

UNA STORIA DI ACQUA - TERRE - SPIRITO

RENO RIVER

LAVEZZOLA

VOLTANA

SANTERNO RIVER

ZOOM IN RIVER JUNCTION RENO - SANTERNO

ZOOM IN SANT'AGATA SUL SANTERNO

SANT'AGATA SUL SANTERNO

LUGO

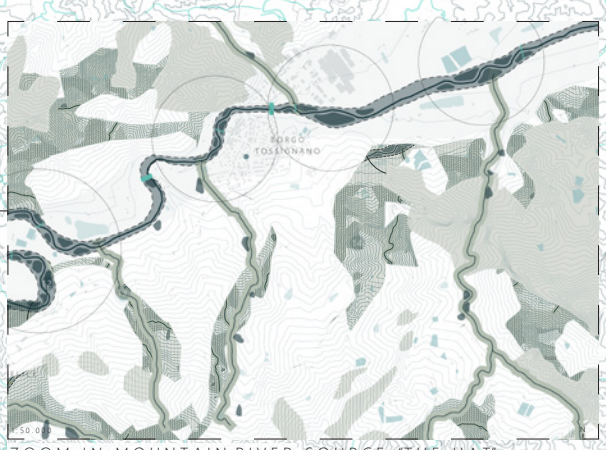
CANALE EMILIANO ROMAGNOLA

IMOLA

CASTEL BOLOGNESE

VIA AEMILIA

BORGO TOSSIGNANO



ZOOM IN MOUNTAIN RIVER SOURCE "THE HAT"

1:90.000

N

FIGURE 84 | ZOOM INS ALONG SANTERNO RIVER

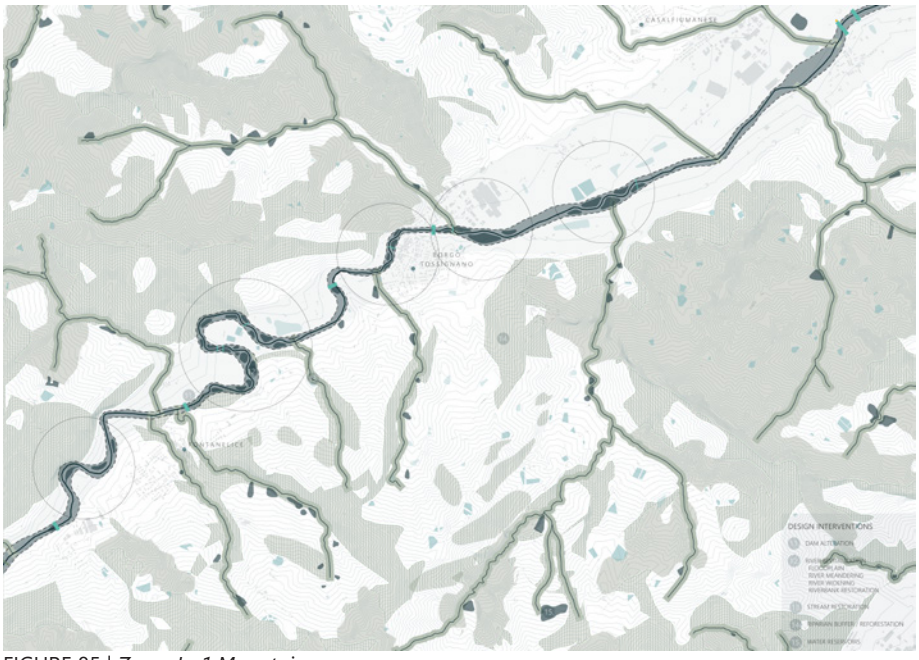


FIGURE 85 | *Zoom In 1 Mountain*

FIGURE 86 | *Zoom In 2 Sant'Agata (low plain)*

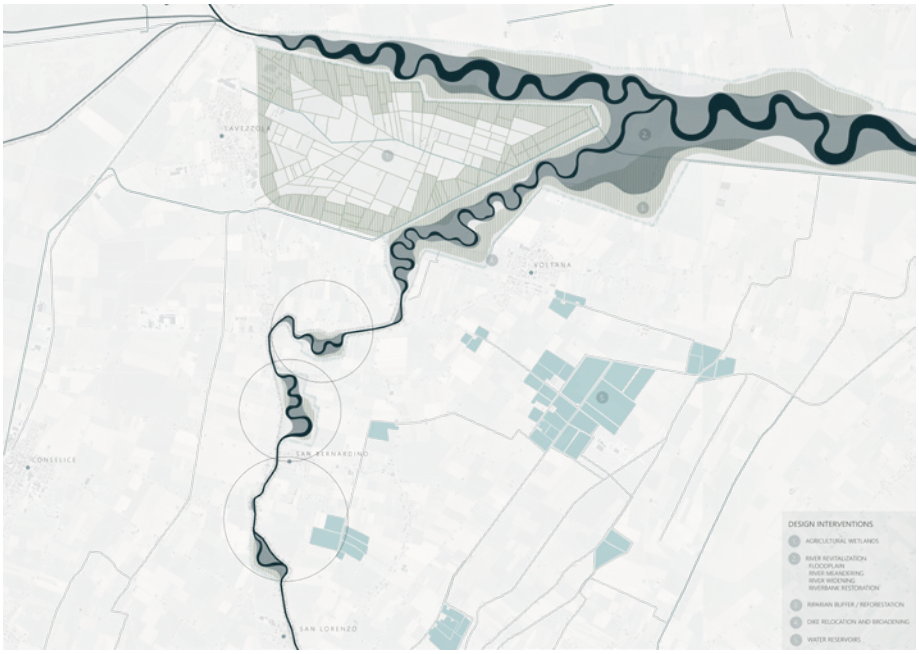


FIGURE 87 | *Zoom In 3 river cross-over*

FIGURE 88 | *zoom in mountain strategy map* 1:50.000


CASALFIUMANESE
14.
15.
DESIGN INTERVENTIONS
11. DAM ALTERATION
12. RIVER REVITALIZATION
FLOODPLAIN
RIVER MEANDERING
RIVER WIDENING
RIVERBANK RESTORATION
13. STREAM RESTORATION
14. RIPARIAN BUFFER / REFORESTATION
15. WATER RESERVOIRS

Zoom Ins

As the concept is focused on 'water storage', these scales do not specifically approach the water storage spaces and designs. Therefore, four zoom-ins have been approached to clarify on an even smaller scale (1:50.000) how these water storage designs respond to the various landscapes. Figure x 'zoom-ins along the Fiume Santerno' illustrates where these zoom-ins are situated along the Santerno River. Zoom-in 1 approaches the mountain territory, zoom-in 2 the plain territory around Sant'Agata (the small-scale design) connected to the bigger city Lugo on the right, and finally zoom-in 3 at the crossover of the Santerno and Reno River. In the first instance, another zoom-in was placed along the mountain border where the city of Imola crosses the Via Aemilia. However, this zoom-in has not been selected to further develop as the interventions will be similar to both the upstream and downstream zoom-ins, and the focus is not put on designing water storage for the bigger urban spaces. More important is the focus on the mountain zoom-in, as this design secures the water stress in the zoom-in of Imola as the Imola zoom-in mainly articulates a pressure point in the territory. All over the territory, along the mountain border, cities are attacked by water stress due to flash floods and peak discharges of the river as water cannot be collected, slowed down, and infiltrated in the mountain landscapes. Therefore, fixing this challenge more upstream will provide better future conditions for this mountain-border zone and its important cities constructed along it. Zoom in 3 is also a pressure point, but here the design is important to approach as two big rivers cross and therefore specific conditions need to be designed. Eventually, zoom-in 2 will even be more zoomed-in to be able to design water storage on the human scale in the village of Sant'Agata. The three zoom-ins can be seen on the follwoing page.

ZOOM IN 1 | APENNINE SANTERNO RIVER

This zoom-in will not be zooming in further than this scale as the main strategy is presented on a larger scale. The main principle here is collecting as much water as possible, slowing the water down, and let-ting it infiltrate to rehydrate the soil, especially on the larger scale to recharge the aquifers and restore the health of the water start. At least its starting point.

How was this approached? Based on the characteristics of this landscape type and base maps conduct-ed from QGIS, an overlaid system of data provided the locations of the water reservoirs. For this, the base maps 'flow accumulations', 'flow connectivity', 'slope', and 'google earth' have been used. The first map provides an overview of where (in white) water accumulates and how these flows are connected. The bigger the white patch, the more water gathers. A clear indicator can be seen where the river runs, as more flat land is located here, and water gathers here to be transported towards the downstream areas. Then the second map, the flow connectivity. This map illustrates the paths water flows and how these paths are connected. This explains the water paths when it rains and where the water comes from as it accumulates (map 1). Then the third map presents the slope of the territory as the black color illustrates flat pieces of land and the white color the steepest slopes. The slope is closely connected to the first two maps as it explains, through the geography, why the flow connectivity runs as it does and why water accumulates at certain points. Based on these three maps a 'suitable water reservoir' area has been iden-tified, which has been implemented along these flow connections, and (especially) placed at locations where water (heavily) accumulates. Then the Google Earth map allowed the design to shape these reser-voirs to the existing agricultural plots and geography. In the map both the existing (dark blue) and added reservoirs (lighter blue) have been visualized. A more zoomed-in version of this map provides a better view of how this is constructed. As can be seen, sometimes reservoirs are located away from the existing streams. These reservoirs are 'second order' reservoirs, as the first order is located along the streams, which ensure water accessibility and a greater impact along the whole territory. These reservoirs are therefore connected with canal systems to be able to let the water flow from one reservoir to the other and connect them. To visualize this within the design, these reservoirs are designed more artificially, while the first order reservoirs are more naturally designed.

Furthermore, the zoom-in focuses on the river running through the landscape. In the river many dams are constructed, often no higher than 3-4 meters and more often only up to 1-2 meters. These higher dams are kept for this strategy as they slow down the water, however, at the locations of the lower dams, these dams are displaced by threshold dams. Additionally to these dams, the river will be natural-ized as it will meander more, and flood plain - reservoir areas have been constructed along these dam structures. Which were not there and will store more water for peak discharges. To realize this, the river zone will be (slightly) broadened to allow nature to flourish and allow room for the dynamics of the wa-ter. The river banks will be naturalized and stabilized by adding vegetation and forestry. This prevents bank erosion and allows ecosystems to flourish, which are crucial to the success and health of water systems. The higher, existing dams will provide the opportunity for cross-overs, as not many are located along the river, to soften the 'border' function of the river.

Alongside the reservoir strategy, a reforestation program will be added to decrease the landslide risk by stabilizing the soil, but also increasing (as the Healing Water with Water chapter has taught us) the water absorption in the soil as trees and vegetation are useful in helping elements for this principle. They are crucial for the ecosystems, environment, and entire workings of the hydrological cycle. The map shows in dark green patches the existing forest and with the lighter green patches the added forests. This is also based on the slope map to position this strategy mainly along the steeper areas where the location of water reservoirs is not suitable. However, the reforestation program can also be added to these water reservoir areas as it provides opportunities for agriculture through agroforest, as earlier already has been explained. Permaculture is a perfect alternative for a transformative way of agriculture that perfectly fits within a watery and forestry landscape. However, there is still room for 'traditional' agriculture that al-ready exists there. As this design mainly focuses on the short-term not everything will have to change, however, the provided framework will allow long-term flourishment to ensure a better, healthy natural system in an uncertain future. By allowing this strategy to flourish, the natural wa-

tery landscape will develop into this 'sacred geography' the past civilizations were relating to. Springs will arise (who knows even Nymphs), streams will develop into flourishing elements of the ecosystems, wetlands will make an appearance again, and the river landscape will slowly meander back into its natural form. Through this, the water heritage will be reintroduced through the landscape and restored and new opportunities of recreation (and its experience with the natural watery landscape) will increase the spatial quality of hu-man life and their interactions.

On the left page a section has been provided that provides an overview of all the reservoirs through the mountainous territory. It shows the connection of trees, water reservoirs, streams, agriculture, human interaction, and the river strategies.

On the following page, zoom ins of this section are presented to highlight these human interactions with the (restored) watery landscape.

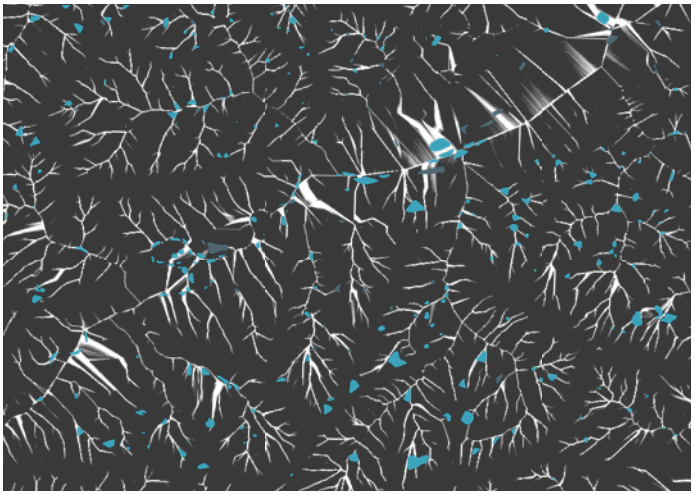


FIGURE 89 | flow accumulation vs. existing & new reservoirs

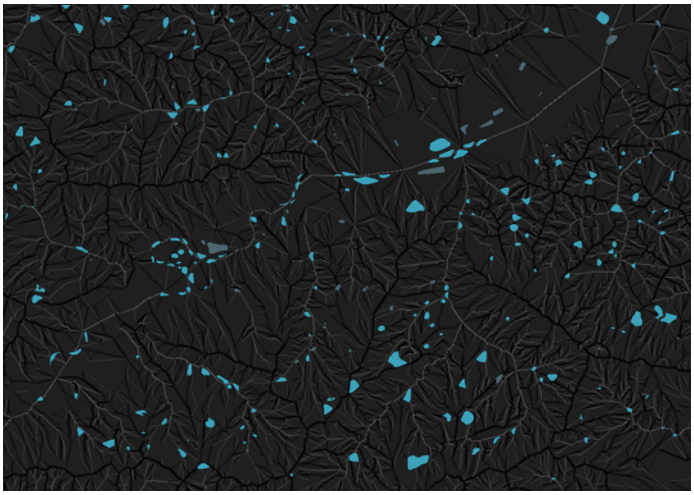


FIGURE 90 | *flow connectivity vs. existing & new reser-*

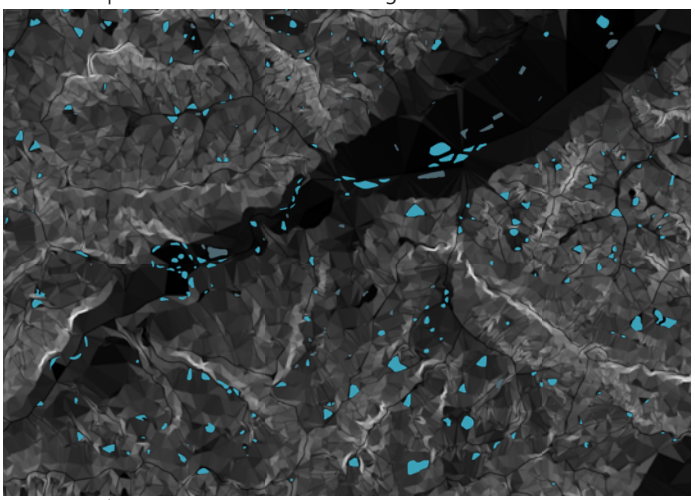


FIGURE 91 | *slope vs. existing and new reservoirs*

FIGURE 92 | *existing agricultural plots vs. existing & new reservoirs*

ZOOM IN SECTION INTERACTION WITH WATER - NATURAL RESERVOIR

ZOOM IN SECTION INTERACTION WITH WATER - AGROFOR

ZOOM IN SECTION INTERACTION WITH WATER - RIVER REVITALIZATION, FLOOD RESERVOIRS, AND AGRICULTURAL RIVERBANK USE

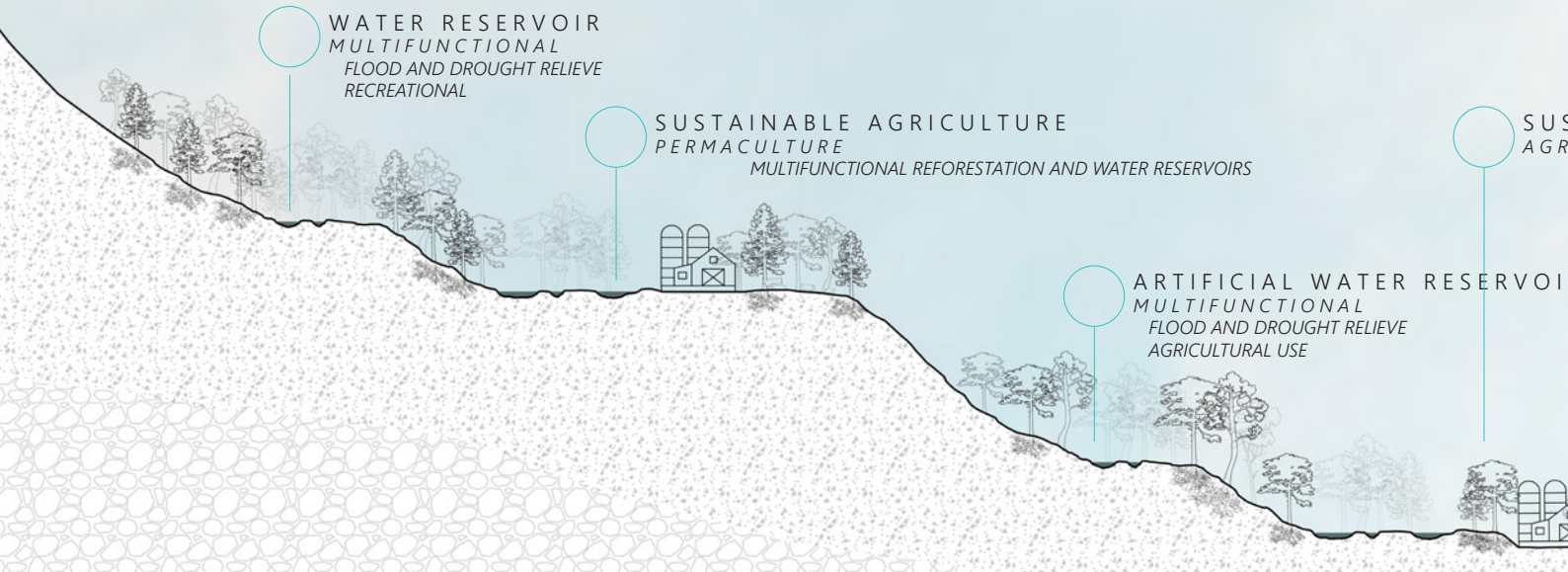


FIGURE 94 | SECTION APENNINE SANTERNO | HUMAN INTERACTION AND SPATIAL QUALITY

RESTRY

ZOOM IN SECTION INTERACTION WITH WATER - PERMACULTURE

STAINABLE AGRICULTURE
OFORESTRY
MULTIFUNCTIONAL REFORESTATION

RS

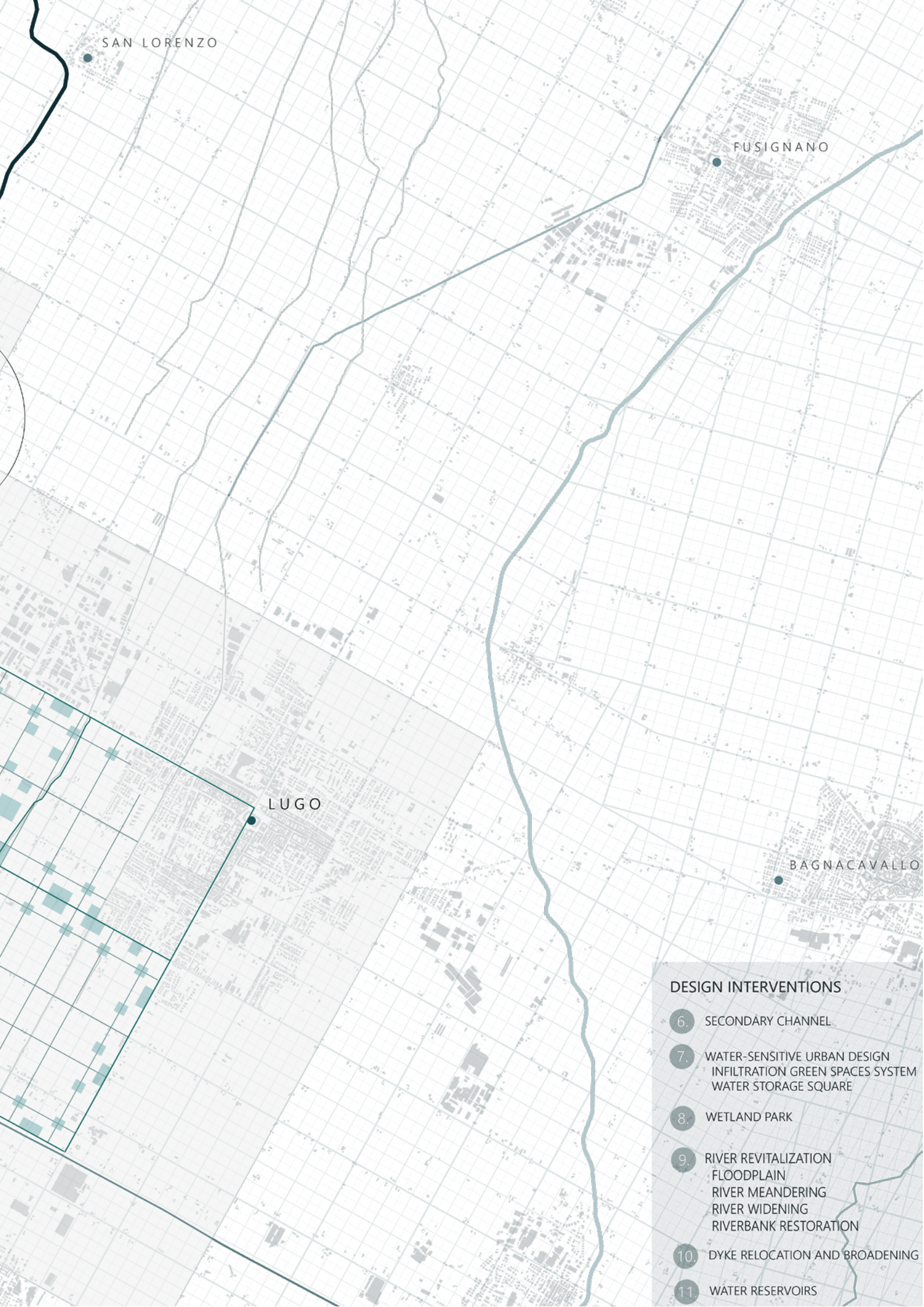
WATER RESERVOIR
MULTIFUNCTIONAL
FLOOD AND DROUGHT RELIEVE
DRINKWATER SUPPLY

REFORESTATION
SOIL STABILIZATION
PREVENTION LANDSLIDES
INCREASED INFILTRATION

FLOOD RESERVOIRS
ROOM FOR THE RIVER

RIVER REVITALIZATION
RESTORING ANCIENT RIVER
RIVERBANK RESTORATION
RIVER MEANDERING
STREAMBANK RESTORATION

FIGURE 99 | ZOOM IN SANT'AGATA SUL SANTERNO STRATEGY MAP 1:50.000


SAN LORENZO
FUSIGNANO
LUGO
BAGNACAVALLO
DESIGN INTERVENTIONS
6. SECONDARY CHANNEL
7. WATER-SENSITIVE URBAN DESIGN
INFILTRATION GREEN SPACES SYSTEM
WATER STORAGE SQUARE
8. WETLAND PARK
9. RIVER REVITALIZATION
FLOODPLAIN
RIVER MEANDERING
RIVER WIDENING
RIVERBANK RESTORATION
10. DYKE RELOCATION AND BROADENING
11. WATER RESERVOIRS

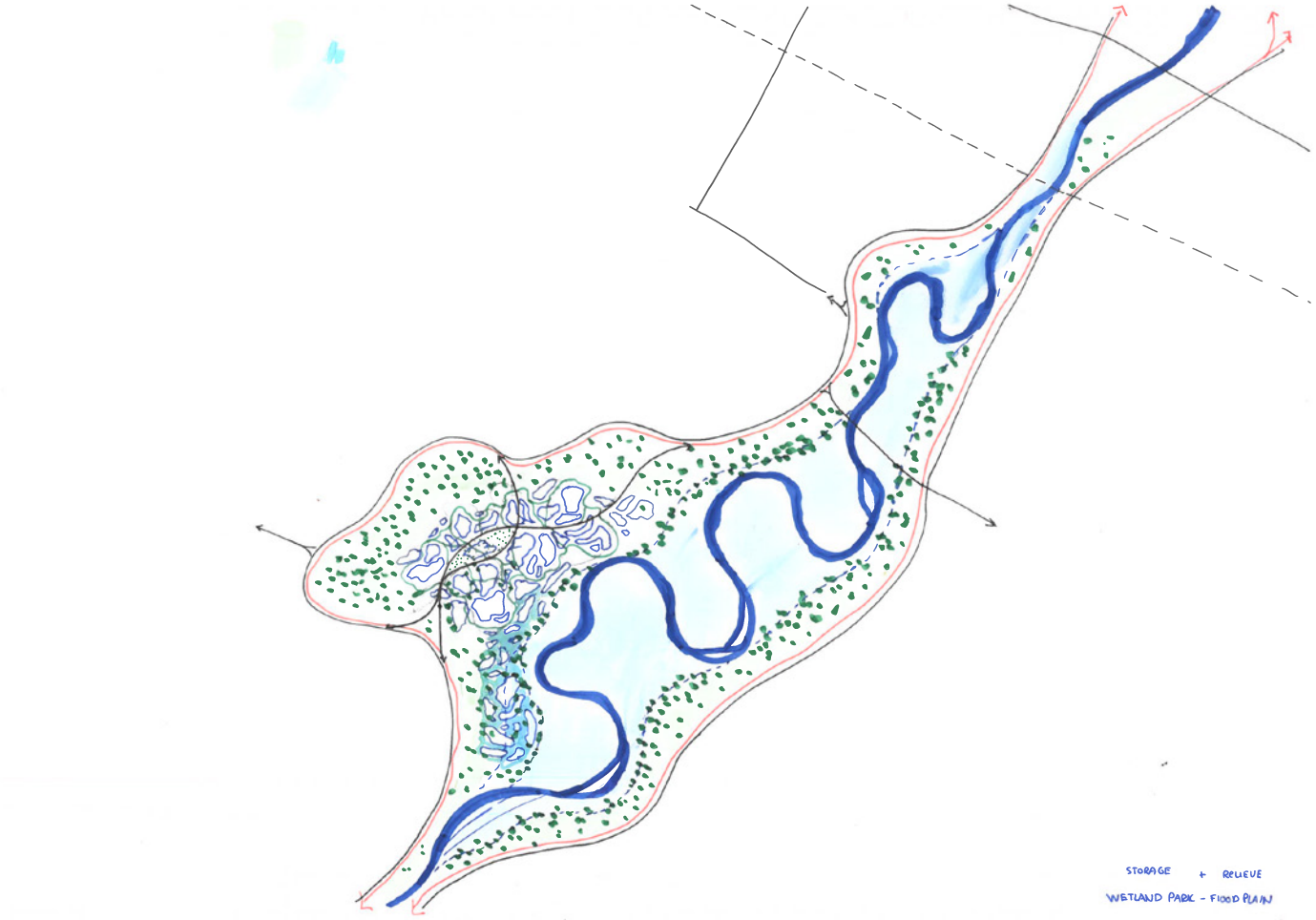


FIGURE 104 | sketch design *floodplain and wetland park with connecting routes into the hinterlands*

FIGURE 100 | *sketch room for the river interventions Santerno River*

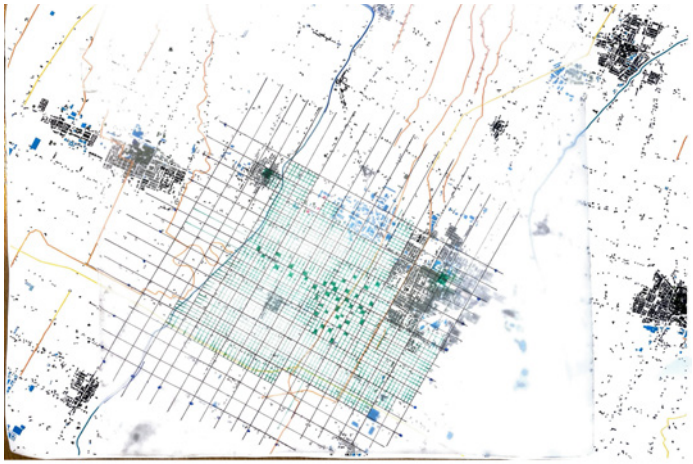


FIGURE 101 | sketch *scenario 1 - grid squares as base for water supply*

FIGURE 102 | sketch *scenario 2 - grid lines as base for*

ZOOM IN SANT'AGATA SUL SANTERNO

Then we continue to the zoom-in of Sant'Agata sul Santerno within the plain territory. The first prominent characteristic of the territory is the Santerno River. And what is interesting, as the history of Sant'Agata sul Santerno showed in Chapter 7.3, the river has been drastically altered into a canalized system, losing its natural features due to historical flood risks threatening the area. Recent floodings illustrate that history repeats itself and that the canalized structures, to control water, lost their control. Fieldwork provided insight into the fact that lack of maintenance of these dyke systems and accumulation of branches, roots, silt, and mud put pressure on the dyke, on the point where the railway crosses the river (south of Sant'Agata), with the dyke losing this battle. As a result, the whole town flooded with water rising to two meters, leaving destructive traces behind. This project therefore approaches this challenge with the principle of 'healing water with water'. Dykes will be relocated, moved further away from one another instead of directly along the river, creating room for the river and flood plains. South of Sant'Agata a big floodplain area is introduced which will be designed as a more natural part of the territory. Therefore, the area will be given back to nature. On the left side of the river, a wetland park will be realized for the flourishment of ecosystems and nature, natural water storage, and possibilities for human interaction. This human interaction will however only be focused on this wetland park and not on the river itself. The intervention of meandering will allow the river to transform back into its natural state. In this way, peak discharges have enough room to relieve the water stress and water will be slowed down through the meandering of the river. As the floodplain crosses the road connecting Sant'Agata and the city of Lugo (on the right) a different room for the river intervention will be realized. Here, as the space is accessible for the intervention (limited by existing structures and housing), a secondary channel will be designed. The entrance point of the channel will also be a threshold, to let the main flow of water be directed through the river and not the channel. This part will be more designed as the river was not naturally structured like this, historically, but in this way, more room for water is provided. Again, bike and pedestrian routes will enrich the design intervention and allow humans to interact with the new watery landscape. These interventions are an example of the interplay between existing structures, 'hard' infrastructure, and nature-based solutions that allow for a transformative way of living.

To connect these smaller scale interventions within the bigger scale, as the design is an interscalar design, the room for the river interventions are connected through a bike route, connecting the historical cores of Sant'Agata and Lugo, through the existing territorial structures such as the centuriation plots, ancient roman roads, canals, and existing river. Along these marking territorial structures, a system of water reservoirs will rehydrate the hinterland in-between territory as this design does not only focus on the rivers. Following the existing Roman Grid and dividing it into smaller sections (as the Romans did as well), a system of rectangular reservoirs is implemented. These reservoirs function as rain collectors and permanent storage for irrigation practices (in periods of drought) to prevent soil subsidence and decrease the flood risk of the plain territory. These reservoirs can be multifunctional as they could support agriculture through fish ponds and reservoirs in combination with crop production. They can also be combined with livestock. This is a prime example of permaculture. As this scenario of sprawled water reservoirs of different sizes within the Roman grid, can be quite labor-intensive to implement and with that costly, an alternative of connected water streams that provide the agricultural lands of water is presented. In this way, two interpretations of the Roman grid as a base for this water supply for the territory are explored. Water supply for this area is crucial as (mainly during dry periods) the CER is the only water supply source of the whole Emilia-Romagna region, which makes the territory vulnerable. This strategy decreases the vulnerability and provides additional water supplies. The CER will not be altered as it will function as a 'backup' for when the territory does not provide enough water to allow the inhabitants to continue their daily life.

Additionally, to these interventions, the main drainage and canal structures will be naturalized as vegetation along the banks is important for (micro)ecosystems. Riparian zones will be connected on the outer sides of these agricultural lands, to filter the groundwater from pollutants before it ends up in the bigger water bodies, transporting it through the territory. These riparian buffers are also functioning as flood prevention when they are of a size of 25 feet and can be easily combined with livestock.

This all in visualized in the 'zoom in Sant'Agata sul Santerno map' and additional drawings on the same page.

Furthermore, this design is supported by more zoomed-in designs of the floodplain and secondary channel interventions. In these maps, the connections of this bike route, connecting the territory, already clearly show the connection with the town Sant'Agata on a smaller scale, all the way down to its historical core, the Byzantine Castrum. Sections of these interventions have been provided to allow a different perspective on these interventions and, again, illustrate the human interactions with these water-based interventions. The visitors of these territories, with their new reality framed around water, are guided through a historical landscape brought back to life. It raises awareness of how water provides life and what it does to nature and even humans themselves. The playful territory can be experienced through different scales, all via the human dimensions, while fulfilling a bigger purpose of rehydrating the landscape and restoring its historical value, reconnecting the inhabitants with the watery landscape as part of their daily/weekly life.

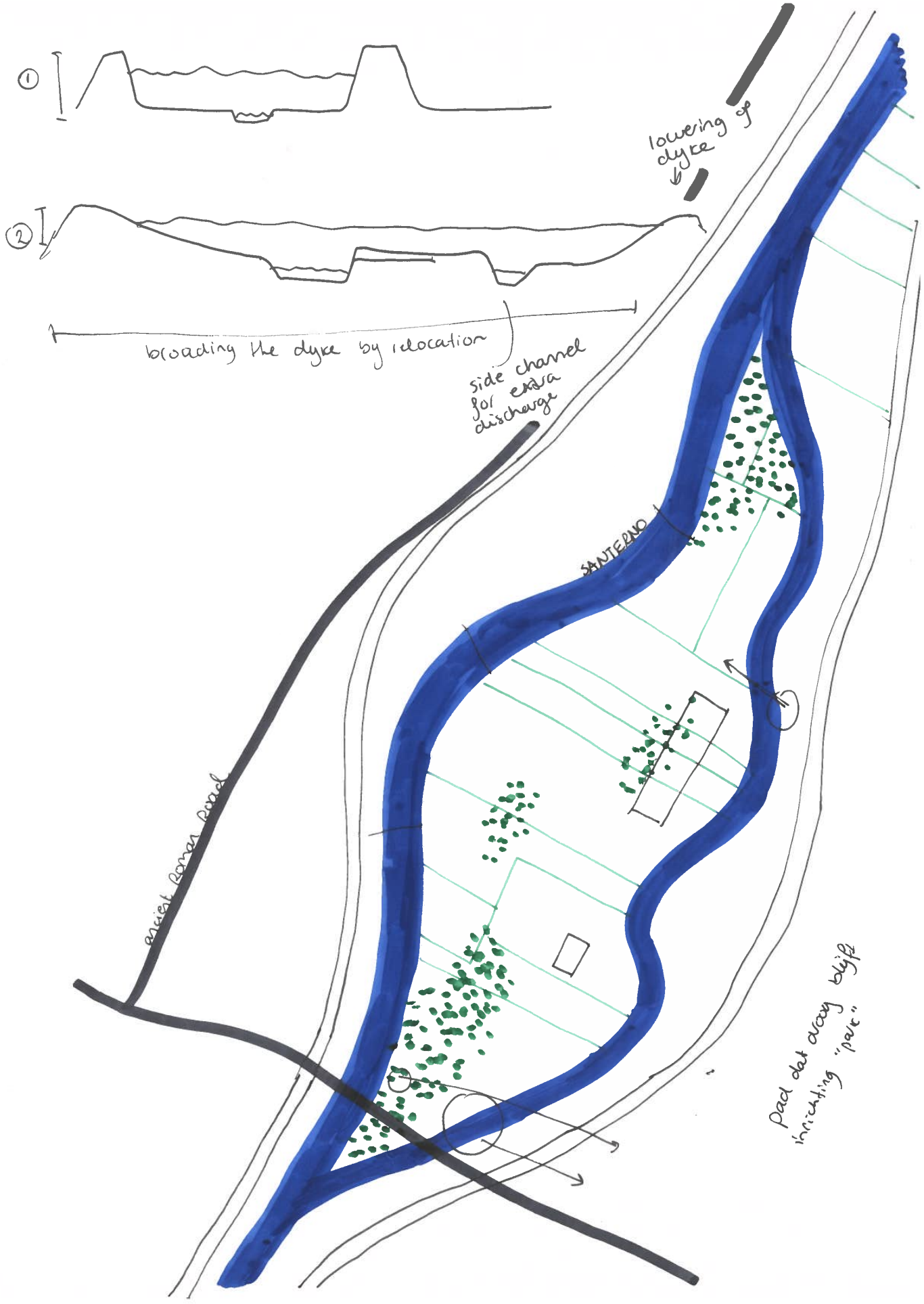


FIGURE 111 | SKETCH DESIGN SECONDARY CHANNEL

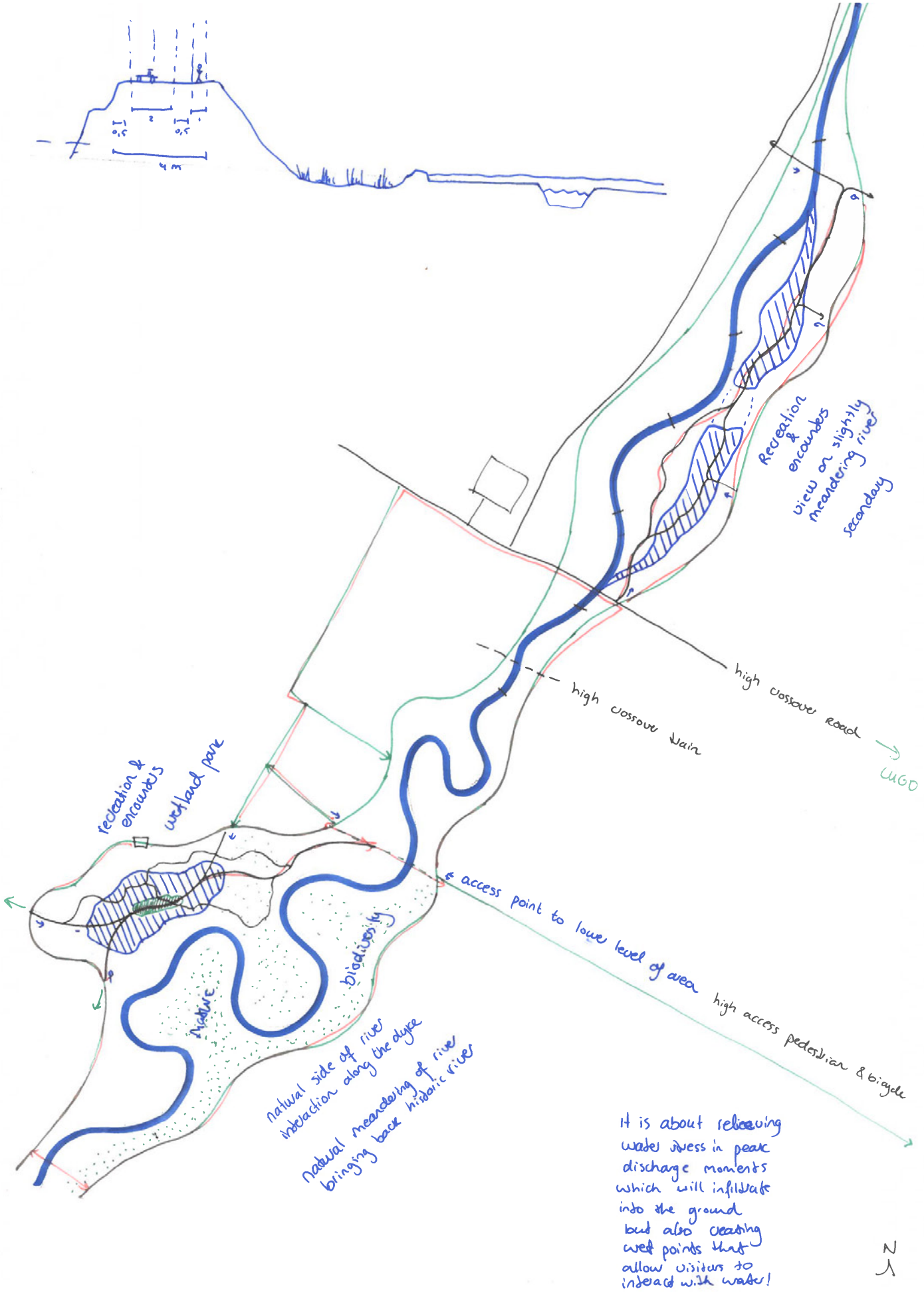


FIGURE 103 | sketch r*oom for the river interventions (floodplain with wetland park south of Sant'Agata and secondary channel North)*

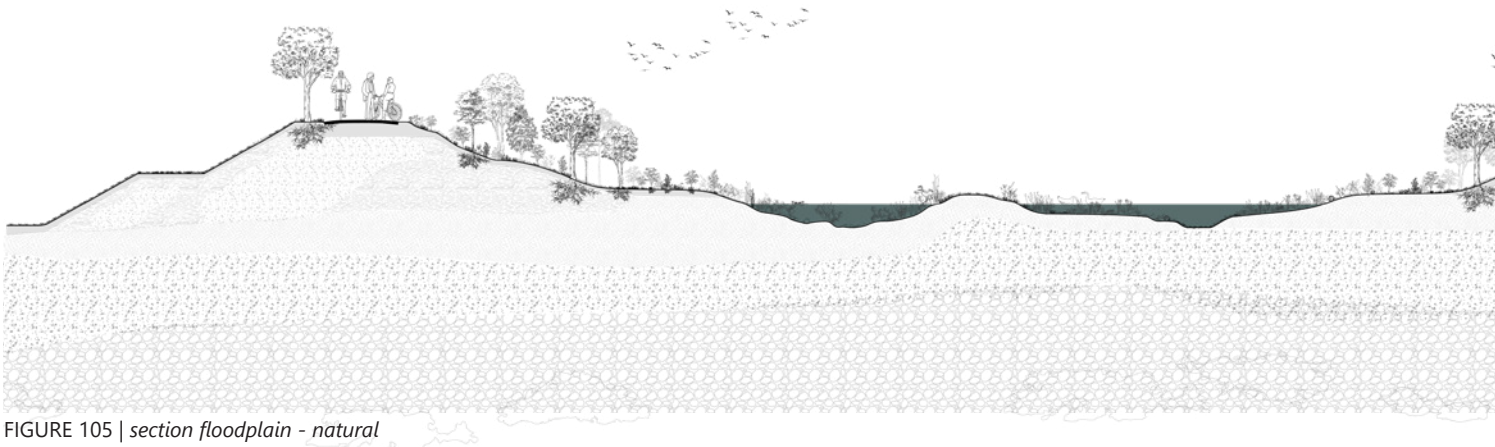


FIGURE 105 | *section floodplain - natural*

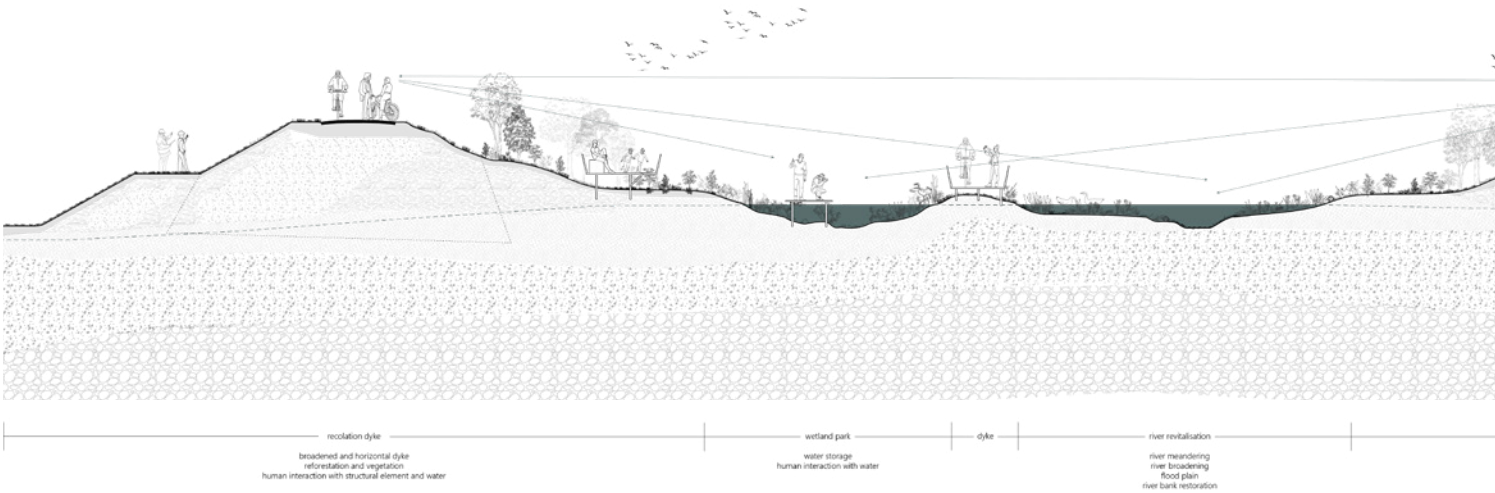


FIGURE 106 | *section floodplain - human interaction*

Especially at the parts where floodplains are created, the dykes will transform. Not only will they be relocated, but they will also be broadened to allow vegetation (except for its structural core) to flourish on its sides, naturalizing the environment and allowing the river to stabilize its banks. The sections show the interaction between humans and the watery landscapes. The wetland and river are separated by a small dyke to prevent inundation of this system, which would be destructive.

On the page below zoom ins of these sections have been provided to emphasize the illustration of human interaction with the watery landscapes.

The sketch with various dykes illustrates the various options of dyke constructions that could be implemented, but in this case, the section shows just one.

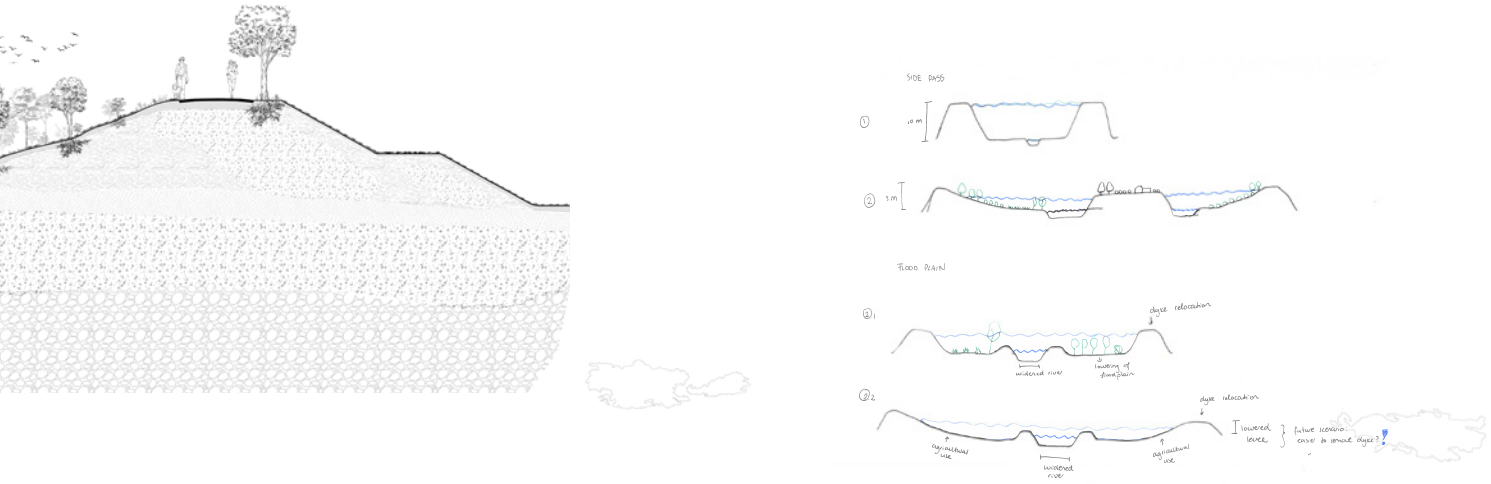
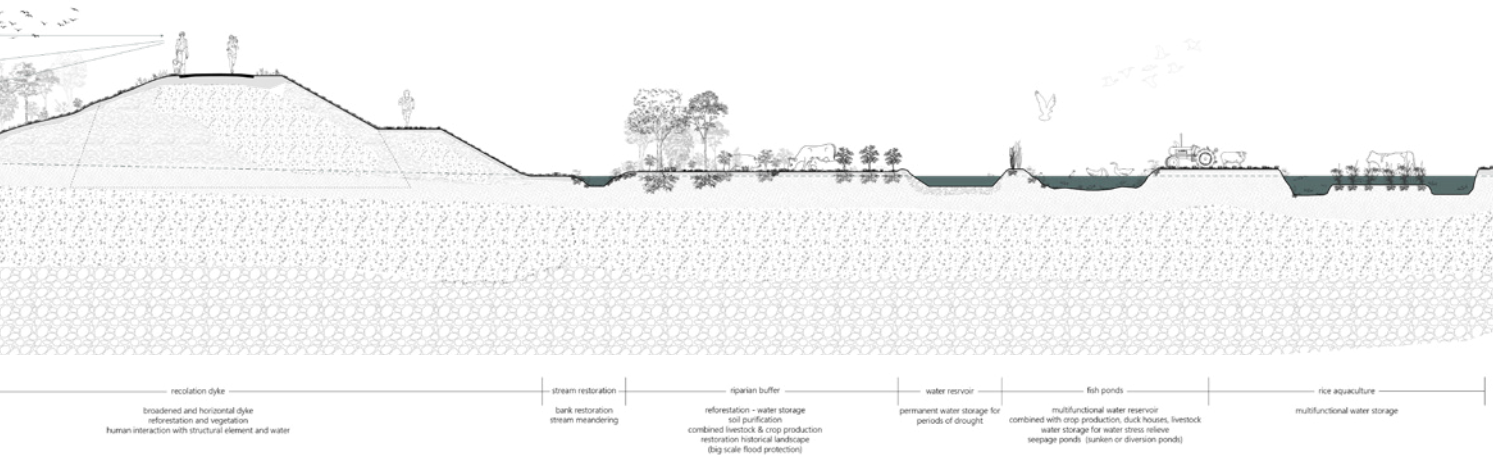


FIGURE 107 | *sketch various options dyke sections*



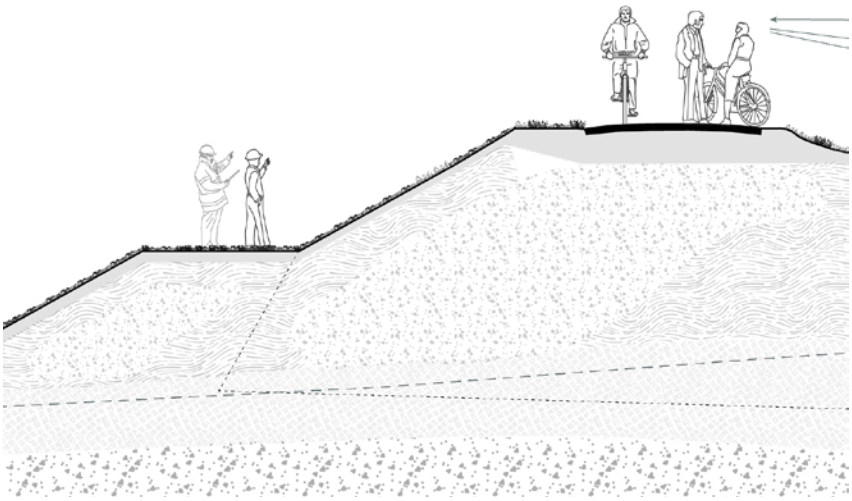


FIGURE 108 | *human interaction - maintainance and bike route*

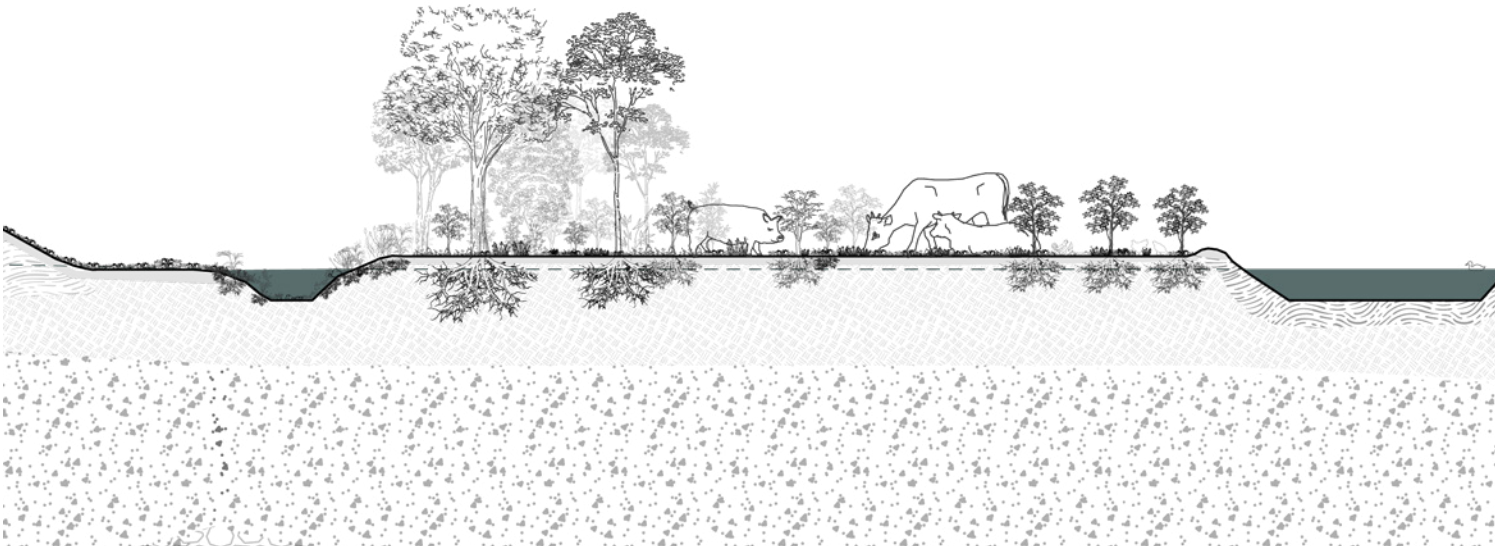


FIGURE 110 | *human interaction - stream restoration, riparian buffer, and (multifunctional) water-based agriculture*

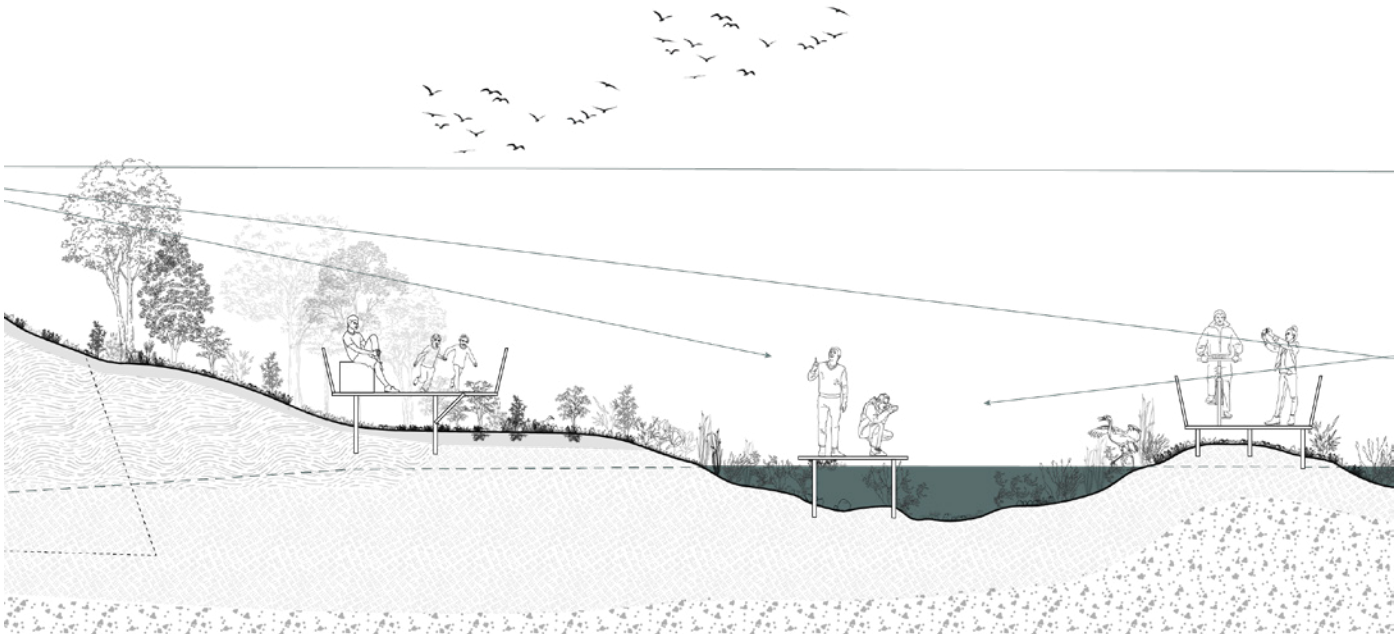


FIGURE 109 | *human interaction - wetland park*

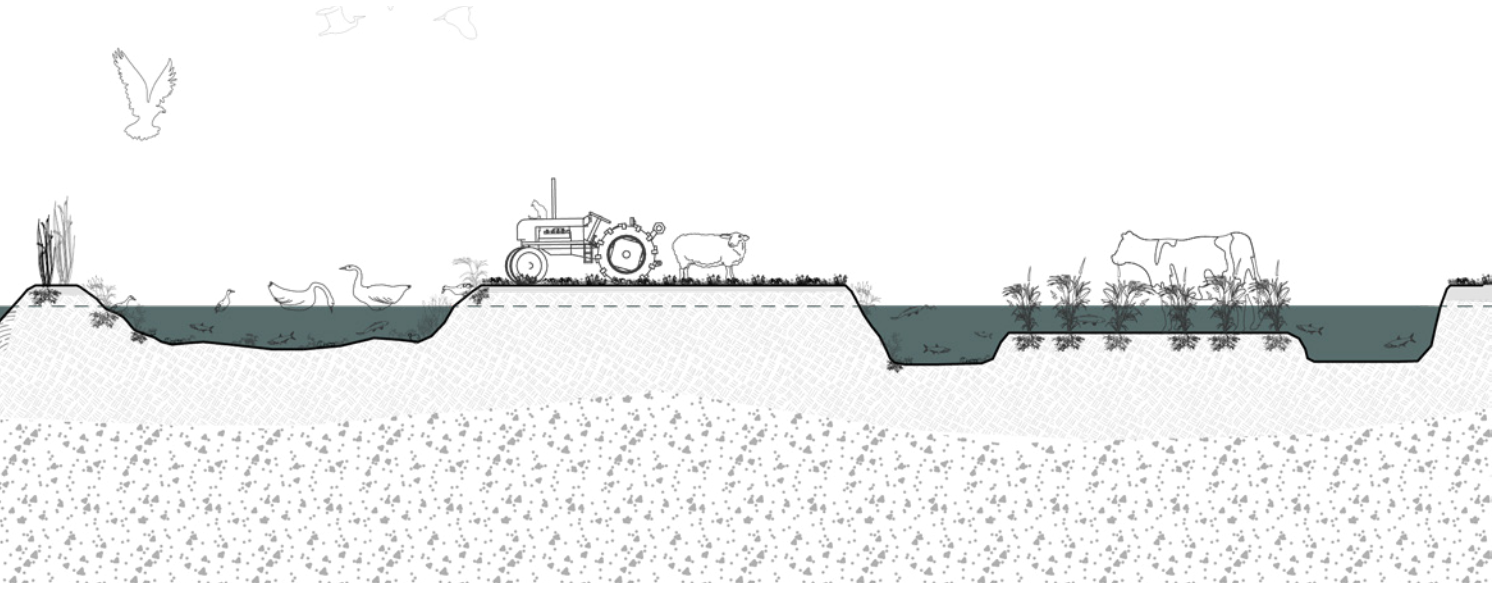
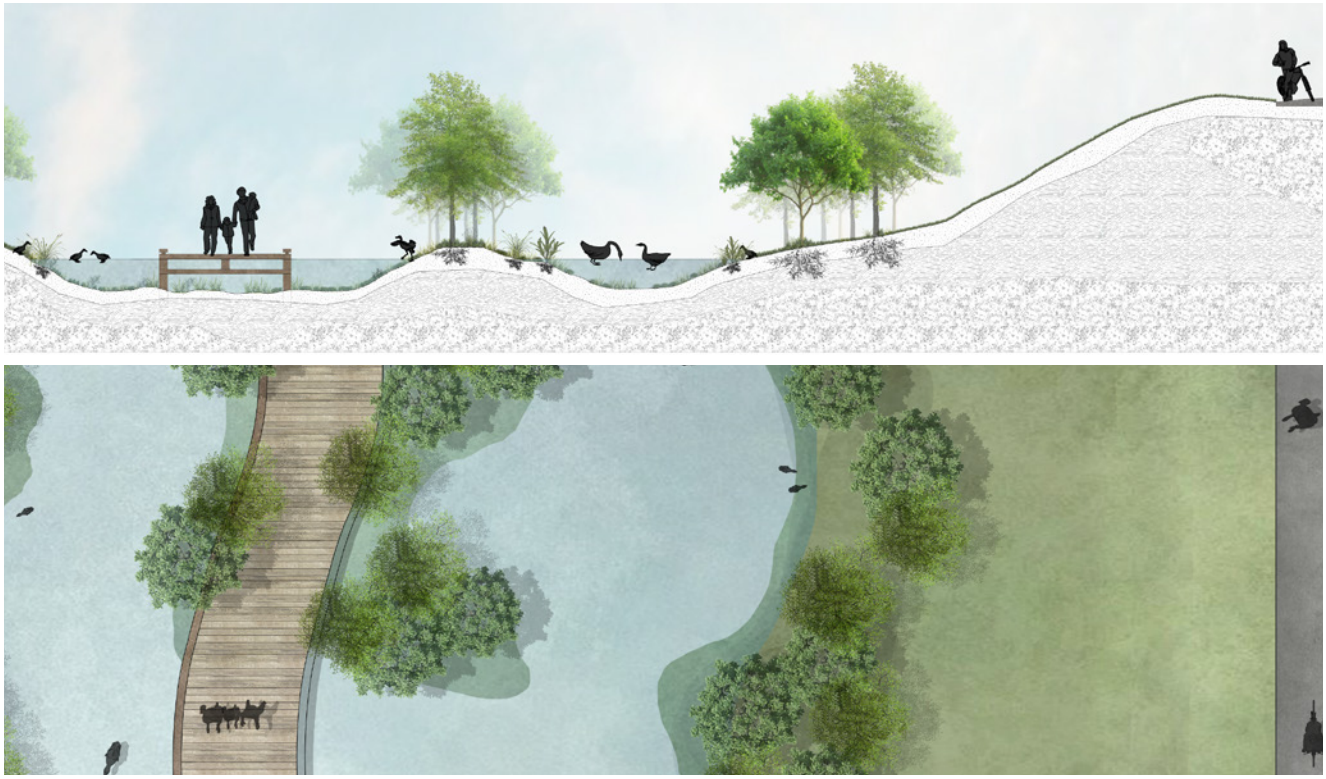
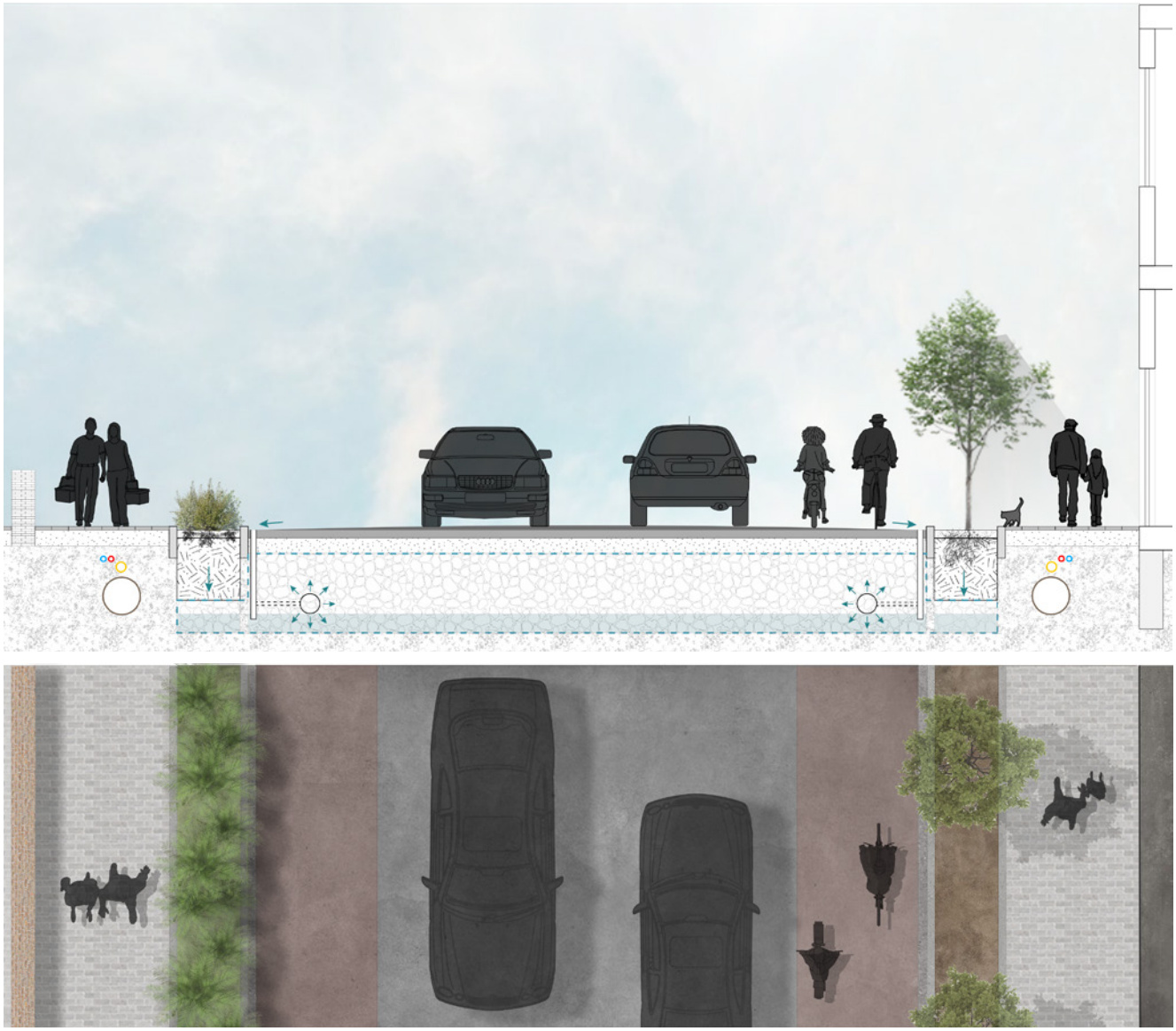


FIGURE 112 | PLAN VILLAGE STRATEGY 1:8.000


URBAN PARK
NATURAL INFILTRATION
BERTO
RAGE SQUARE
URBAN PARK
NATURAL INFILTRATION
URBAN WETLAND PARK
NATURAL WATER STORAGE
CHANNEL PARK
NATURAL INFILTRATION
SECONDARY CHANNEL
NATURAL WATER STORAGE
FLOODPLAIN SANTERNO
NATURAL WATER STORAGE
VIA BASTIA
ND
TRATION
URBAN PARK
NATURAL INFILTRATION
VIA SAN VITALE
ROMAN CASTRUM
URBAN WATER STORAGE DESIGN
TREE INFILTRATION SYSTEM
N

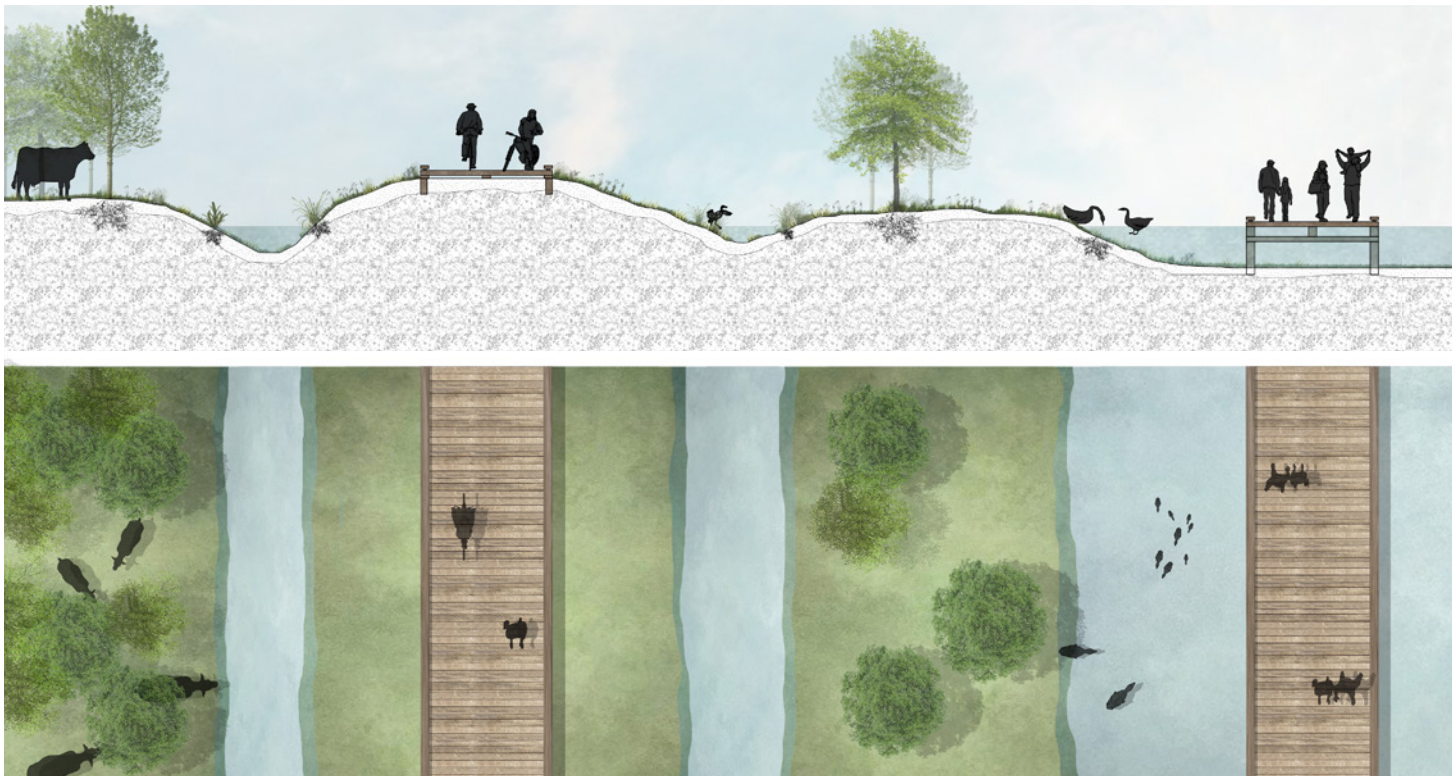


SECTION AND PLAN INTERACTION WITH WATER - WETLANDPARK STILL WATERS 1:150



SECTION AND PLAN INTERACTION WITH WATER - URBAN WATER STORAGE VIA ROME 1:100

FIGURE 113 | SECTIONS BIKE ROUTE - INTERACTION WATER INTERVENTIONS



SECTION AND PLAN INTERACTION WITH WATER - RURAL WATER STORAGE RESERVOIRS 1:100

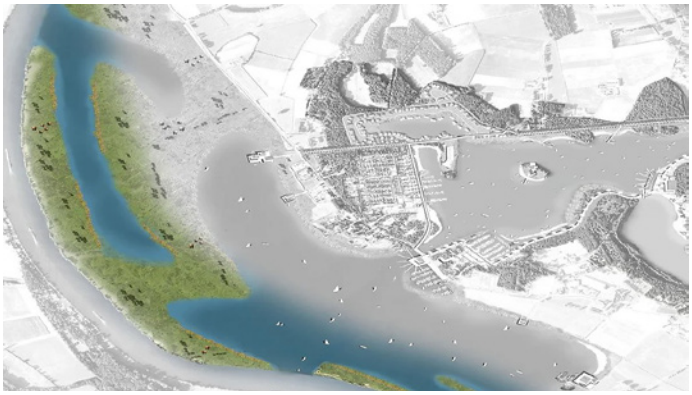
SECTION AND PLAN INTERACTION WITH WATER - URBAN WATER STORAGE VIA BASTIA 1:100

Meanderende Maas River - Netherlands
(River Meandering)
https://www.h2owaternetwerk.nl/h2o-actueel/meanderende-maas-dijkversterking-en-nieuwe-landschap

Meanderende Berkel River - Almen-Zutphen, Netherlands
(River Meandering)
https://deberkel.info/beleef-de-berkel-almen-zutphen/

Meanderende (Beneden) Regge River, Netherlands
(River Meandering
https://maasparkwell.wixsite.com/maasparkwell/hoogwatergeul

Ijsseldelta Zuid - Netherlands
(Bypass)
https://www.tauw.nl/projecten/natuurinclusief-ontwerp-ijsseldelta-zuid.html



Hoogwatergeul Well-IJen - Netherlands
(Secondary Channel)
https://maasparkwell.wixsite.com/maasparkwell/hoogwatergeul

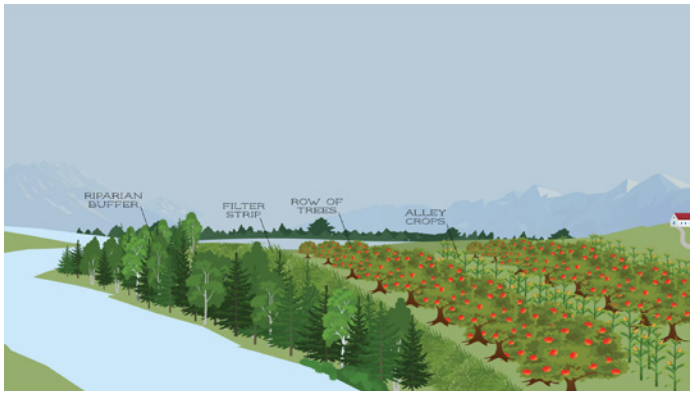
Project Kreetsand / Elbe Dykepark - Hamburg
(FloodPlain)
https://www.internationale-bauausstellung-hamburg.de/en/projects/elbe-islands-dyke-park/pilot-project-kreetsand/projekt/pilot-project-kreetsand.html

Qunli Stormwater Wetland Park Turenscape - Haerbin, China
(Wetland Park)
https://www.archdaily.com/446025/qunli-stormwater-wetland-park-turenscape

JINGRUI - by LAURENT
(Wetland Park)
https://mooool.com/en/vital-house-by-laurent.html

Lakeside Forest - Yudao Landscape Design
(Wetland Park)

https://mooool.com/xinglong-lake-lakeside-woods-library-by-yudao-landscape-design.html

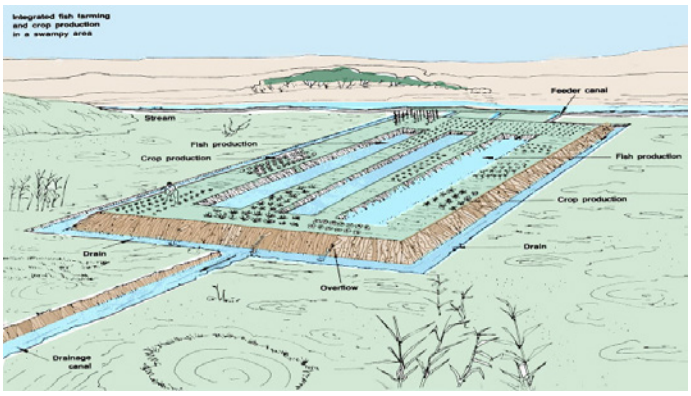


Riparian Buffer

https://snohomishcd.org/blog/2018/7/16/a-closer-look-at-working-buffers

Zhoukou Shahewan Wetland Park - Beijing Sunshine Landscape Co.

https://worldlandscapearchitect.com/zhoukou-shahewan-wetland-park-zhoukou-henan-china-beijing-sunshine-landscape-co/?v=3a1ed7090bfa



Fish Ponds
(in combination with various agriculture)

https://www.fao.org/fishery/docs/CDrom/FAO_Training/FAO_Training/General/x6708e/x6708e01.htm

Cal Poly Pomona Lanscape Architecture student water farm Aquaponics - Silverlake Reservoira

https://i.pinimg.com/originals/65/67/7d/65677d2ae218807ffbe7b21658c0838d.jpg

Dyke construction

https://v-web002.deltares.nl/sterktenoodmaatregelen/index.php/Definities

Roman Bath
(Square Design & Res)

https://i.pinimg.com/originals/8a/47/d4/8a47d44893414669ee1a9d8a0a2dff33.jpg

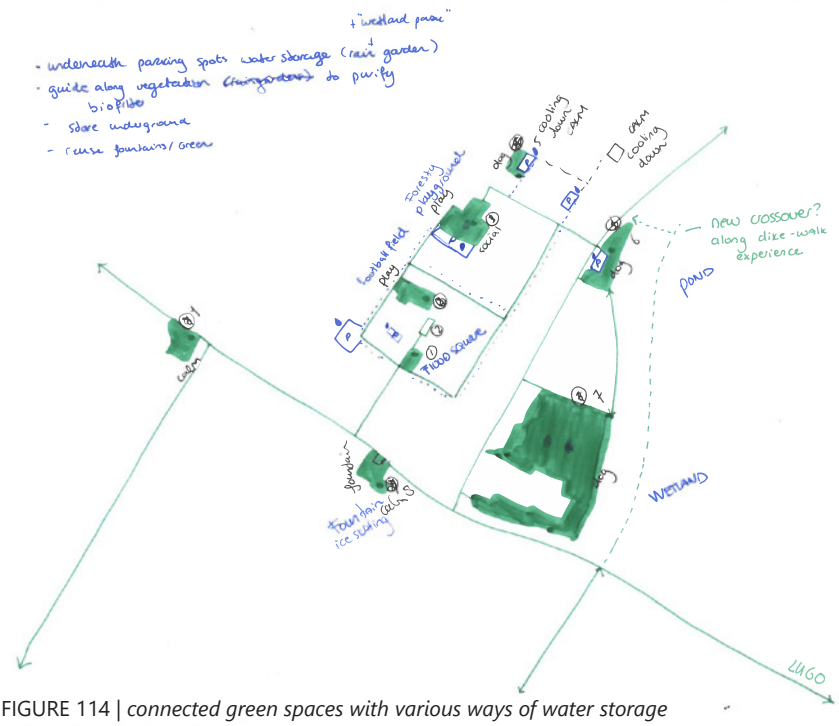


FIGURE 114 | *connected green spaces with various ways of water storage*

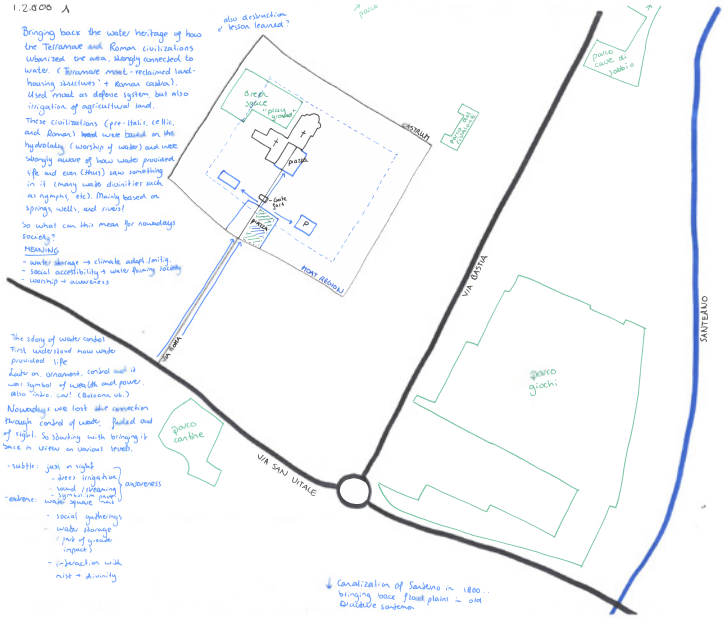


FIGURE 115 | *explanation of concept village within water storage story*

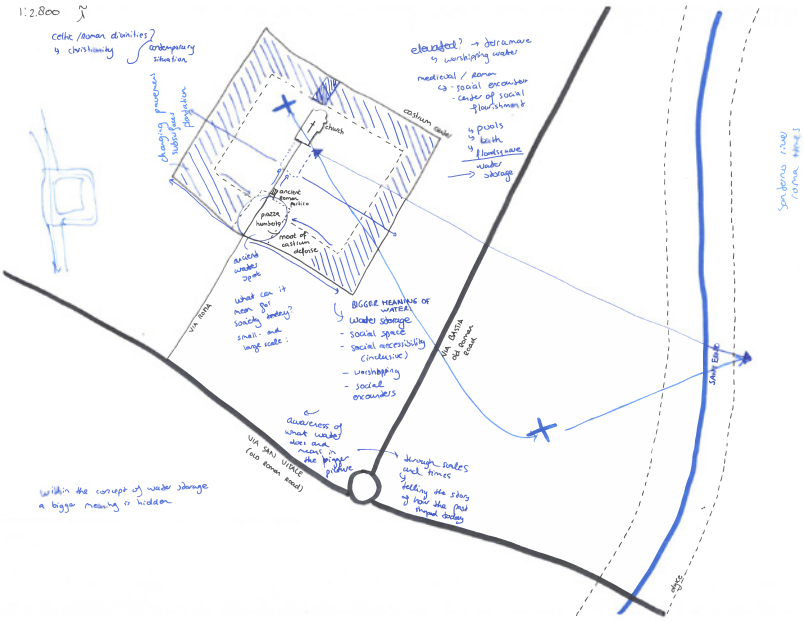


FIGURE 116 | *explanation of concept village within water storage story*

Then we zoom in further towards the town of Sant'Agata. This territorial route, connecting the various water interventions through this new watery landscape, continues within this town. The route connects the various green spaces which on their own fulfil a water storage function. Varying from fountain park to a mini wetlands park, forestry park, plain grass fields, to a water square at the center of the historical castrum. These parks are located along the ancient Roman roads Via San Vitale and Via Bastia. This place was of great importance in the past, functioning as a military fort surrounded by a moat structure, and later on, Christian influence changed this to a fortress/castle. Therefore the design of the village will be a guide through time, letting the visitors and inhabitants experience this timeline through water elements and interventions. The main structures of this castrum core will visualized with trees that are connected through an irrigation system. (Illustrated in the sections) these permeable interventions will allow water to slowly infiltrate into the ground, irrigating the vegetation. In places where trees cannot be located, rain gardens will function in the same way. Supportive sewage systems will, in a fast way, collect the water underground, transporting it to a common water storage square which will provide the village with water during dry periods. This will not be the main water supply, but an additional one, introducing a circular use of water resources. Placing these elements in the interior of this village, letting the inhabitants variously interact with them, raises awareness and reintroduces water in their daily lives. Behind this water storage concept, a deeper meaning is hidden, reconnecting the inhabitants (in a subtle way) with their ancestors, history, and water identity.

The design guides use the main square, Piazza Humberto, which is located on the moat structure of the Byzantine castrum. It is connected to another square, next to the Christian church, which is mainly used for ceremonial activities. Nowadays the main square of the town is functioning as a parking lot. As the water heritage of this region showed, water was also part of social life. It supported socialization, festivities, and connection. It was often a central point of settlements, for example, wells. This idea will be reintroduced by the design of the main square, providing a place for the inhabitants to gather, interact, socialize, and enjoy life through the element of water.

The sections on this page provide an overview of all the human interactions with the water interventions and elements throughout the village and the territory.

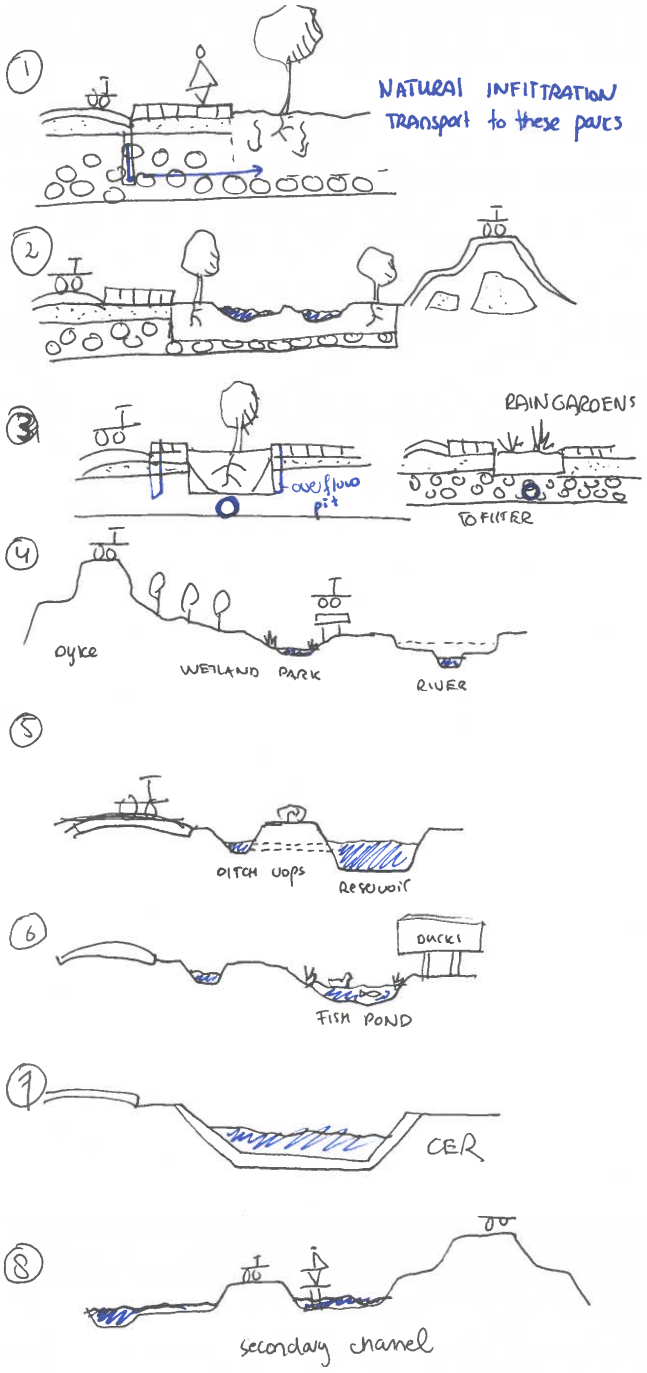


FIGURE 117 | *overview sections human interaction with water along territory*

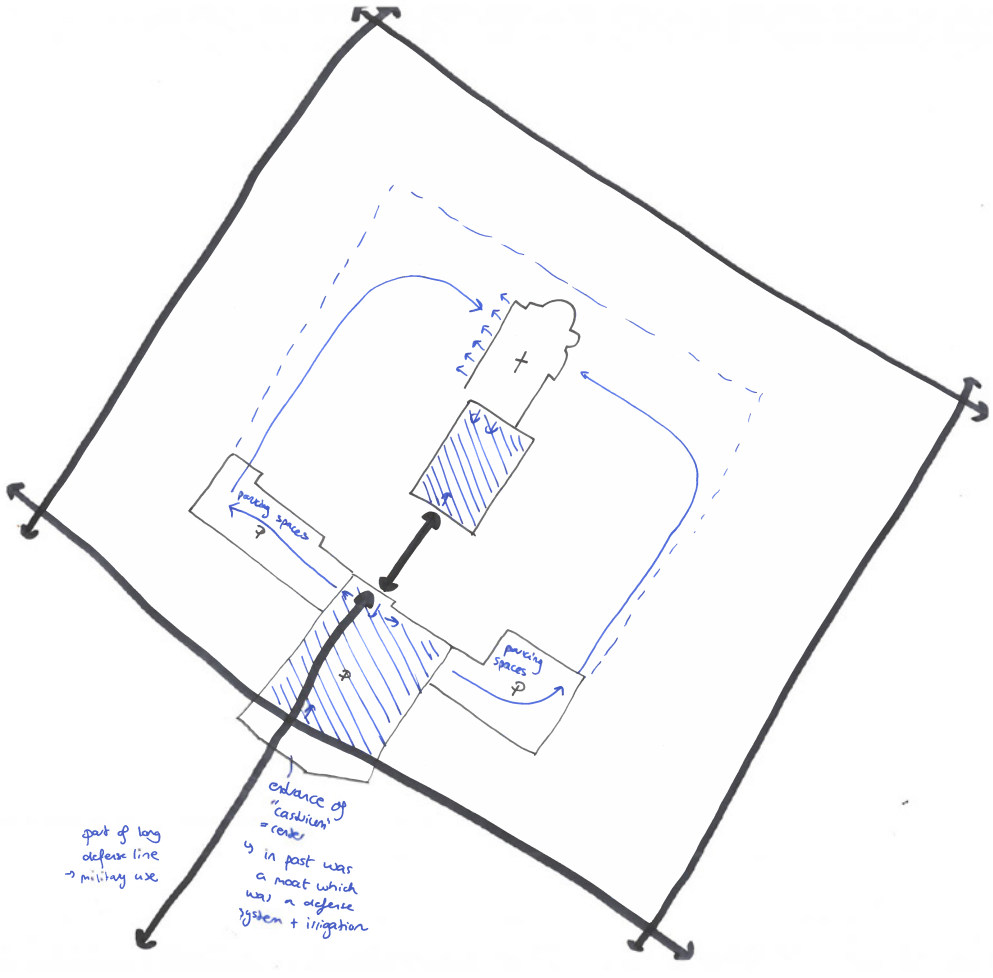


FIGURE 118 | *zoom in to the castrum, relation Piazza Humberto and ceremonial 'church' square*

GIGURE 119 | *zoom in to the castrum, relation Piazza Humberto and ceremonial 'church' square, ideas of intervention*

Piazza Humberto, a water square

We have arrived at the smallest scale of this interscalar design of the region of Emilia-Romagna. *How will water heritage (the history and identity of water, in this region) guide the design of this small-scale square within an urban context to a transformative way of living with water?*

How to design this within the human dimensions? The concept of this square design starts with the longing to let the inhabitants reconnect with this water's history and identity, bringing it back into the living environment as part of their daily, social lives. Instead of being an unwanted object pushed out of the territory, being a welcome element structuring the tangible and intangible realms of human life. But how, through design?

The references on the following page illustrate physical structures, mainly from the Roman Period as these were more prominent during this time, but also one from the Terramare's. Each of these references tells a story of how social life was structured around water. It is a view from a social gathering of entertainment, looking down on it (Theater in Milos), or a flooded Roman theatre in which the seatings are guided towards a water object, it now being the subject, the protagonist (Theater in Butrinti). Or the famous Colosseum which they apparently flooded so now and then to replay naval battles and the ancient Terramaren pool that was constructed, and elevated, for ritual offerings, connecting water with a deeper meaning within society as religion and social life were closely intertwined. Or fountains (and wells) that were both functional and ornamental, as they provided water to drink and pleased the eyes of the spectators. Or, and lastly, a nymphaeum which was dedicated to Nymph deities, water divinities, through a tangible structure in which water (obviously) played the leading role. For all of these examples, water was leading for its construction in the physical sense, but also of importance for religious and social life (which were one). It was part of the 'rhythms of life'. And this is what the water square reintroduces through design as earlier on, it already has been stated that the tangible and intangible connection with water, was closely related and intertwined.

On the same page, the conceptual drawings of the design illustrate the process of how these various elements (elevated platforms, an encirclement of spectators guiding the visitor to a central point on which social gatherings occur, surrounded by natural elements (trees and vegetation) in which a calm environment is created to rest. An interplay between a resting part and an active part. On page X the definite plan of the water square (scale 1:300) is visualized. The parking lot is transformed into a social square in which water through various ways is collected and stored. But also slowed down. The square is surrounded by vegetation as a protective structure that encloses the space. Along the road, these vegetation elements have been heightened, up to a meter, with a brick wall to ensure the safety of its composition. The square is separated into two sides, divided by the ancient connection Via Rome that north of the square through the ancient gate connects with the ceremonial 'church' square. On the left it functions more as a resting place within a calm environment of dense vegetation patches, allowing space for trees to flourish. Within the bigger green patches, a system of seating spaces has been designed, to emphasize this intimate environment. On the right side, a more active functioning has been located. The square is on the same level, except for the inner circle. In this way, the square can be used for social gatherings, the market, and other activities. As the green patches along the road are heightened, the dynamic seating platforms are elevated, imitating the theatre-like setting of spectators on a stage, also functioning as stairs for children to play on. In this way, these seating constructions, allows inhabitants to watch the activities happening on the square. In the center of the square, a focus point has been designed, insinuating this sacred core, referred from a sacred well or nymphaeum. In the middle green patch, a fountain has been constructed, and a tree, as a symbol for these sacred elements that are strongly connected also within the larger scale systems and characteristic for the whole design through the scales. This is done, under the circle with a different pavement the water storage construction is located. The inner circle of the square is descending with 15 centimeters, to allow rain water to be collected and be present in the everyday life of the inhabitants. This hints at the transformative way of living with water, in every scale, introducing a way of living with water where water has shifted from this destructive, feared element to an integrated element of beauty, calmness, and understanding. The miniature water storage symbolizes the water storage underneath the pavement.

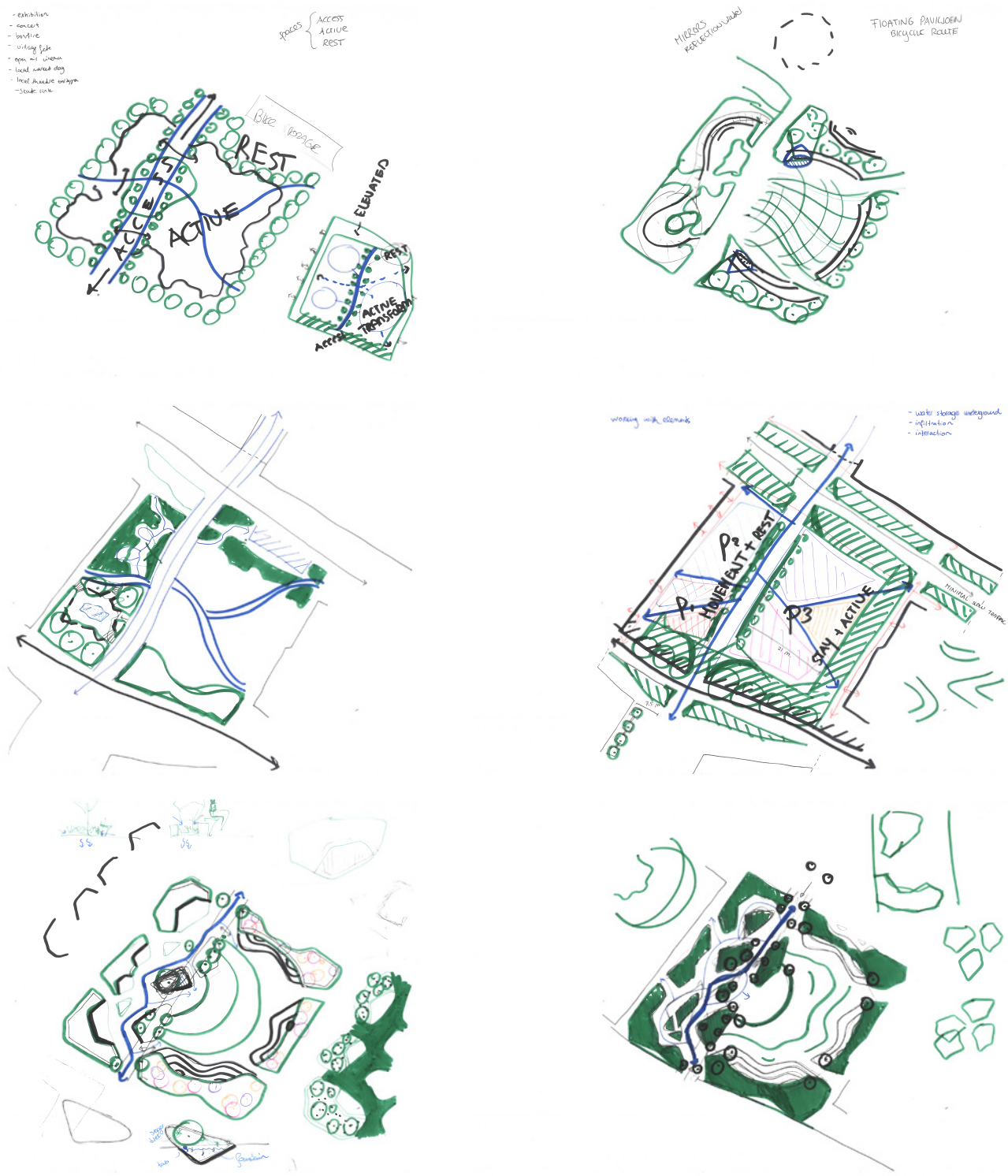


FIGURE 120 | *conceptual process of water square design*

Ancient Roman Theater, Milos
(Square Design)
https://www.miloshospitality.gr/news/ancient-roman-theater-of-milos

Colosseum with naumachiae (choreographed naval battles)
(Design Square)
https://medium.com/everything-antiquity/brennen-was-here-30e0c8d7bea5

Fountain
(Square Design)
https://i.pinimg.com/originals/47/bf/f2/47bff286417f3680db31253c604dea8b.jpg
https://ap.rdcpix.com/3462319599/8abac8c3386a6d78d553d478ac07b78d4l-m10xd-w1020_h770_q80.jpg

Religious Rituals Middle Bronze Age Artificial Pool, Northern Italy
(Square Design)
https://www.smithsonianmag.com/smart-news/3400-year-old-artificial-pool-italy-may-have-hosted-religious-rituals-180978148/

Farnesian Nymphaeum in Roman Forum
(Design Square)
https://madainproject.com/list_of_roman_nymphaea

Flooded Ancient Roman Theater Butrinti
(Design Square)
https://www.nottingham.ac.uk/humanities/departments/classics-and-archaeology/research/research-projects/current-projects/butrint-project.aspx

Figure 56 | *references used for the conceptual design of the water square*

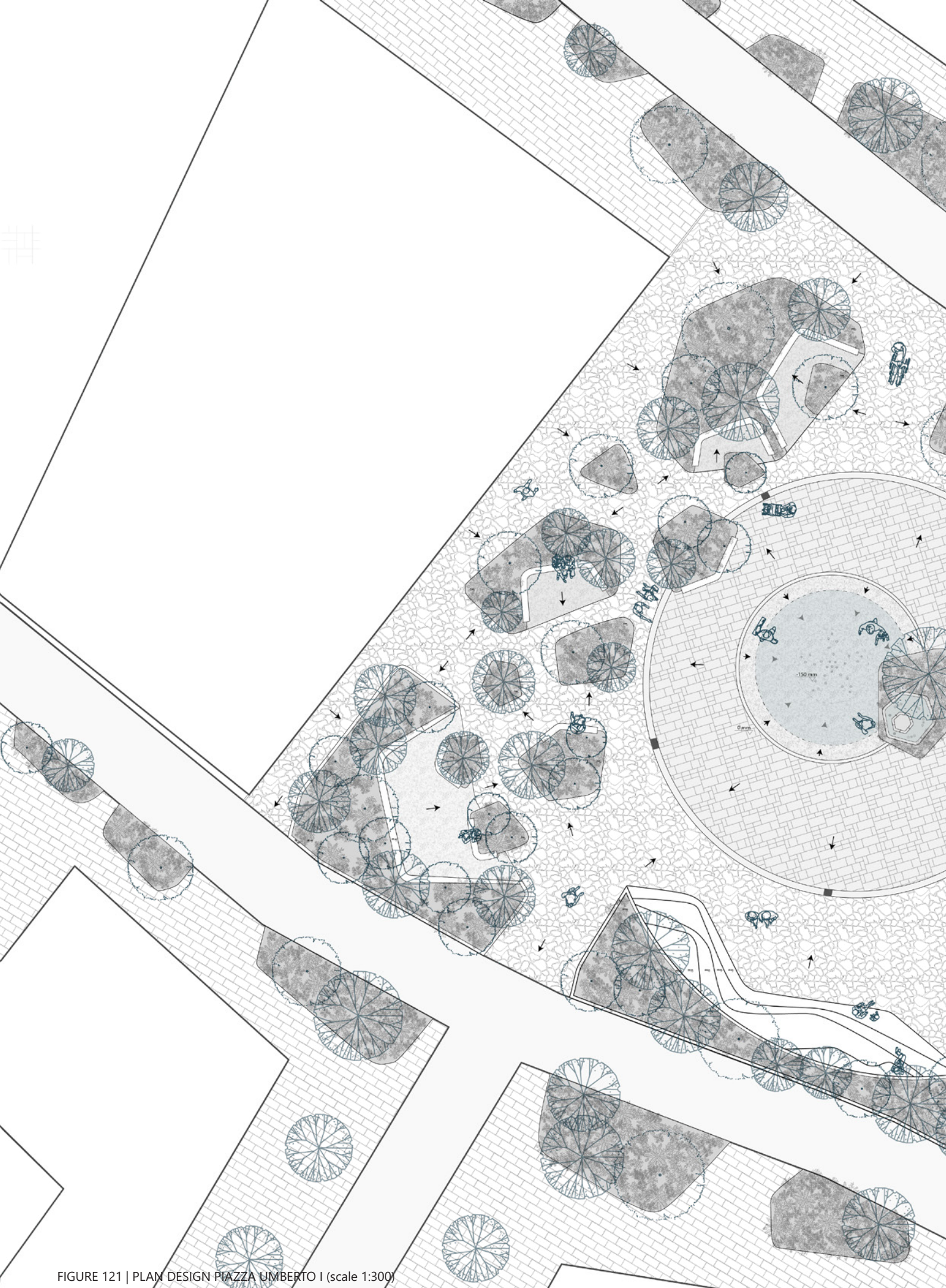
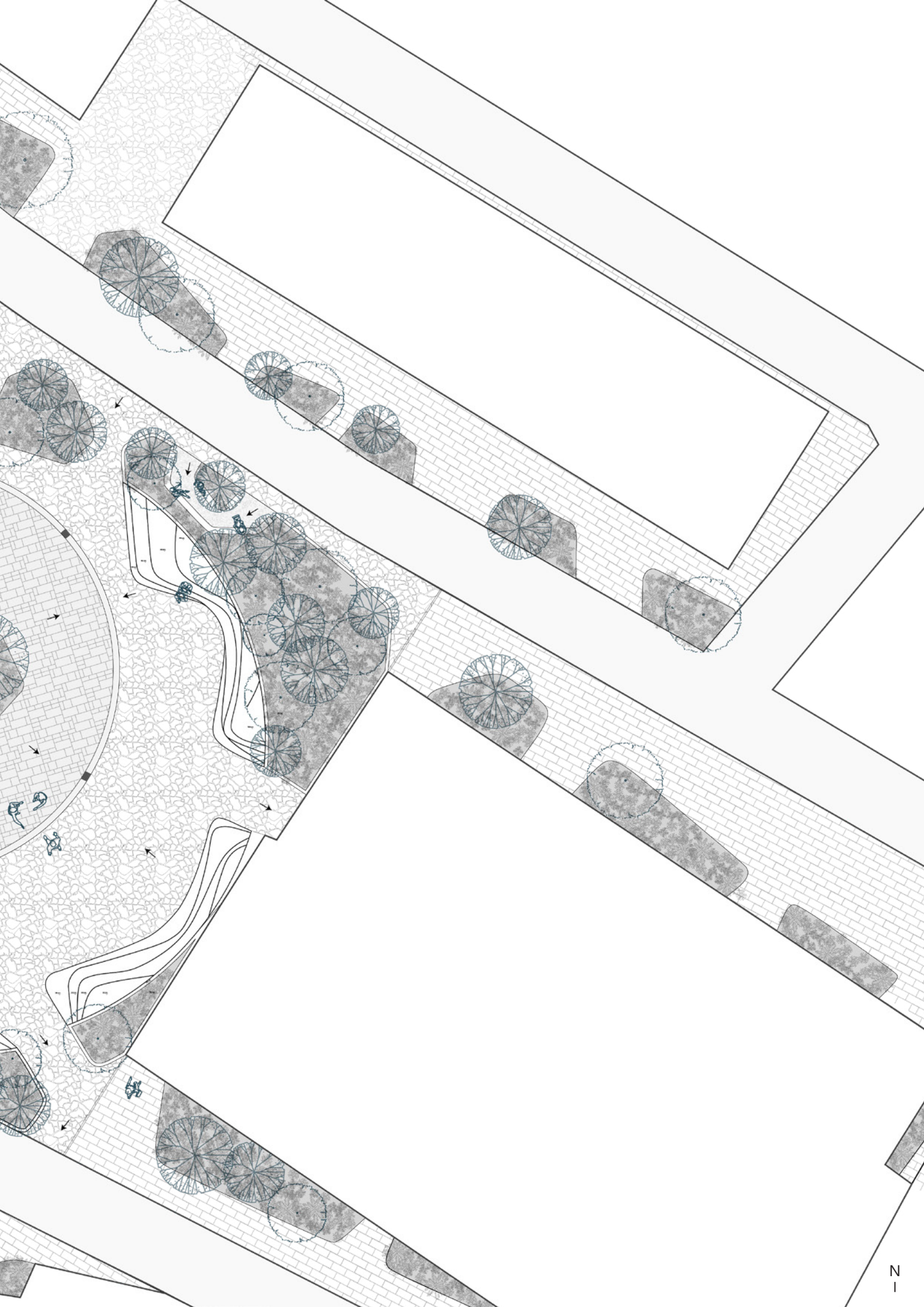


FIGURE 121 | PLAN DESIGN PIAZZA UMBERTO I (scale 1:300)


N

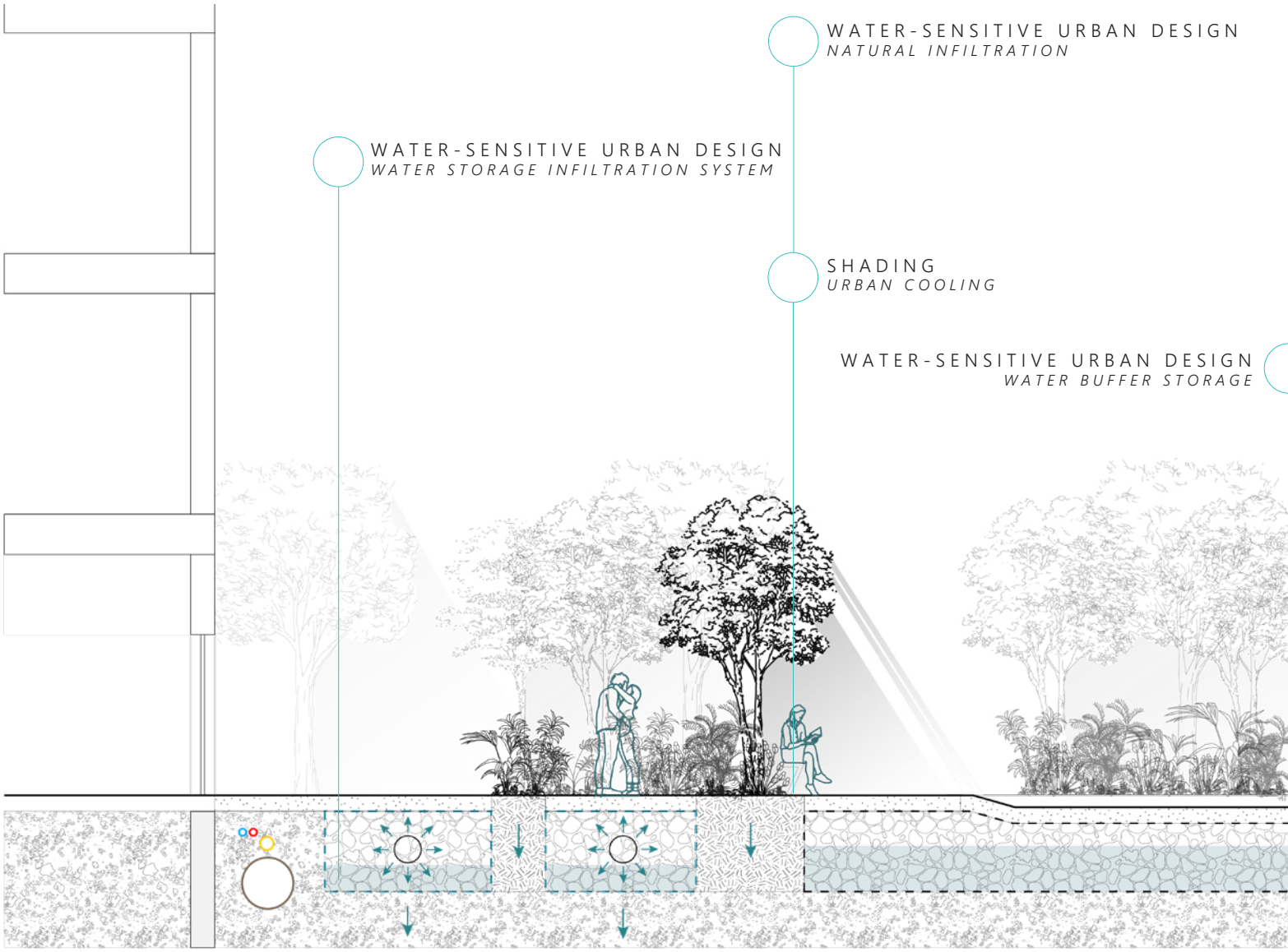
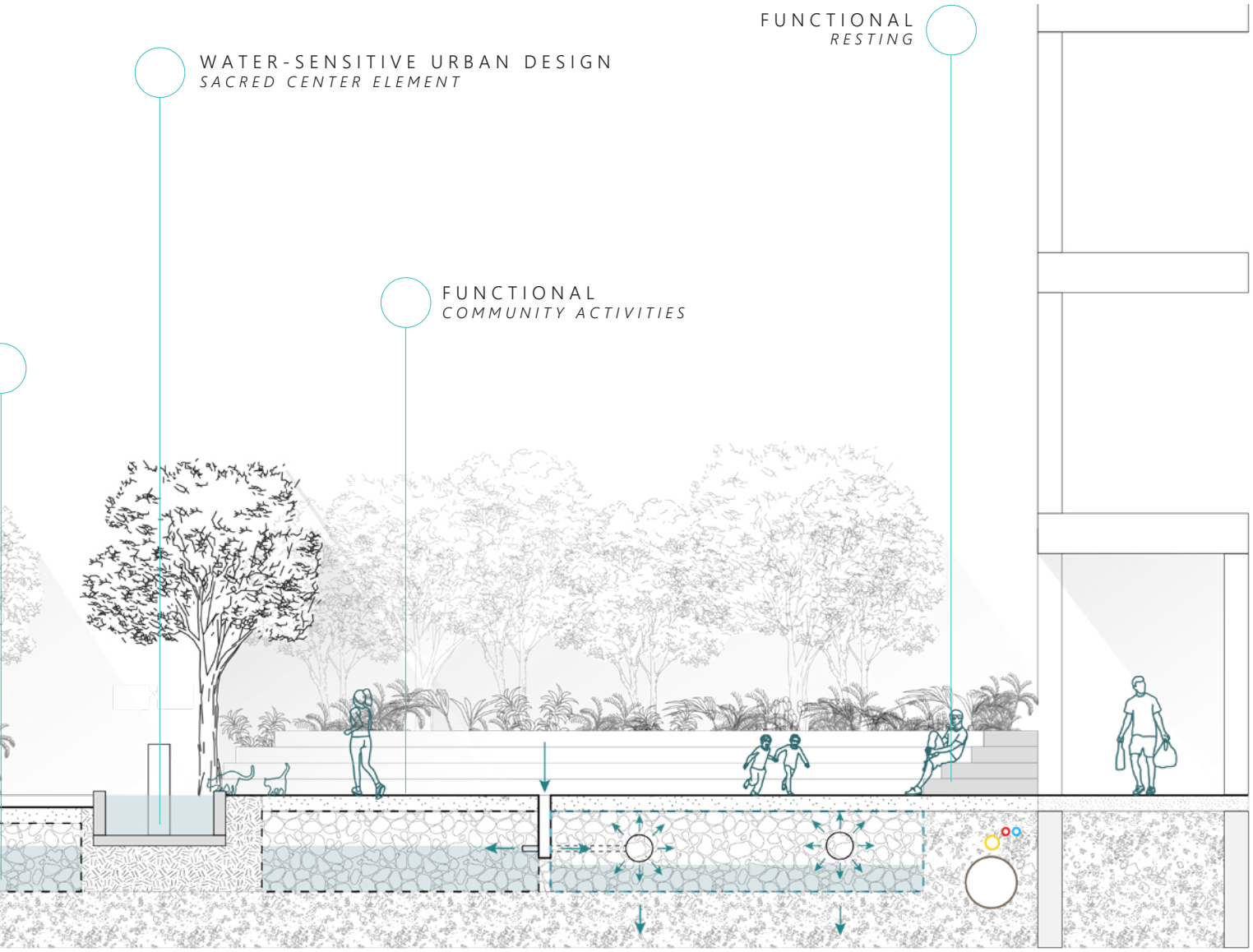


FIGURE 122 | SECTION PIAZZA UMBERTO I - DESIGN PRINCIPLES AND SPATIAL QUALITY


FUNCTIONAL
RESTING
WATER-SENSITIVE URBAN DESIGN
SACRED CENTER ELEMENT
FUNCTIONAL
COMMUNITY ACTIVITIES

1:200

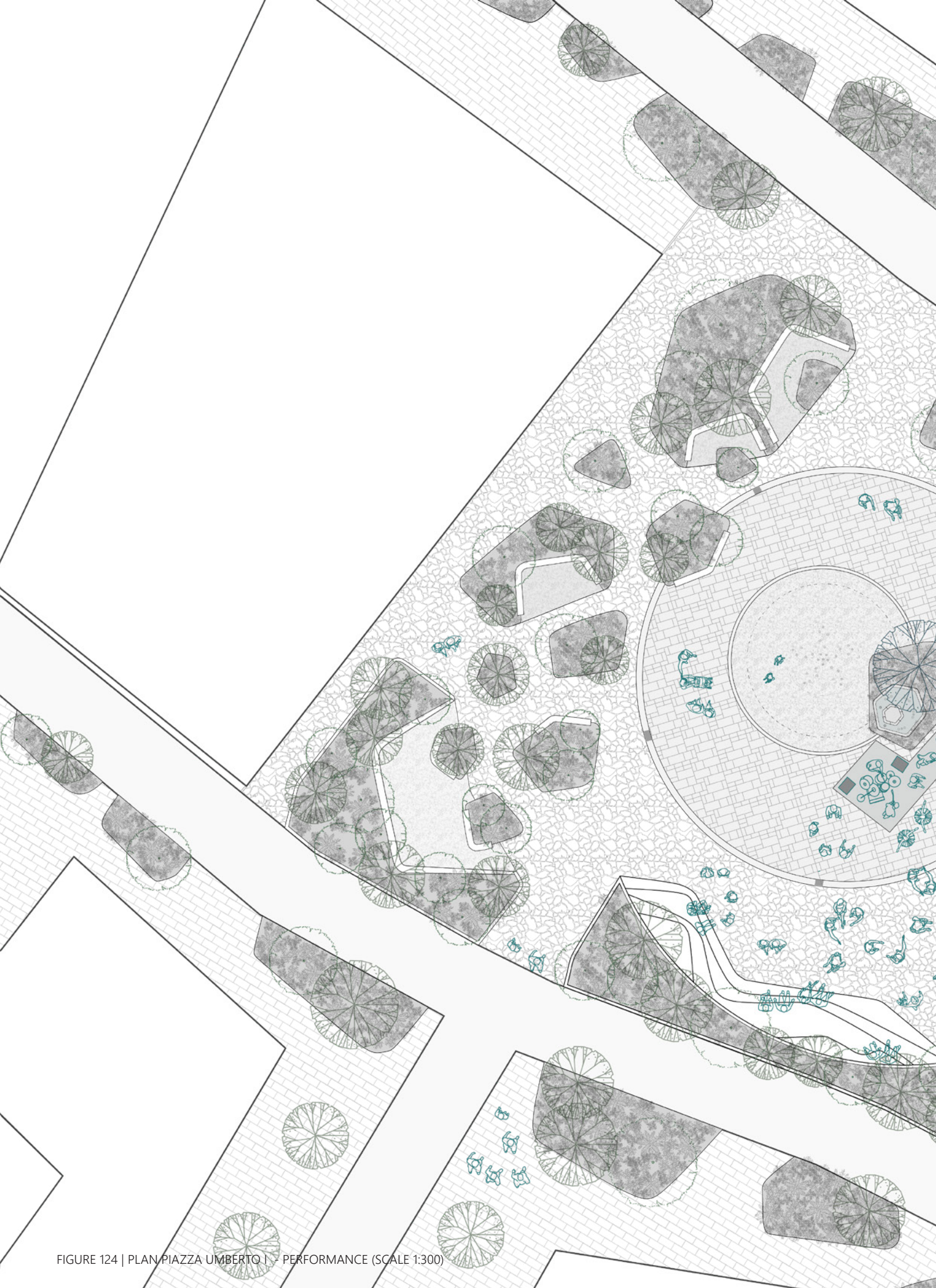
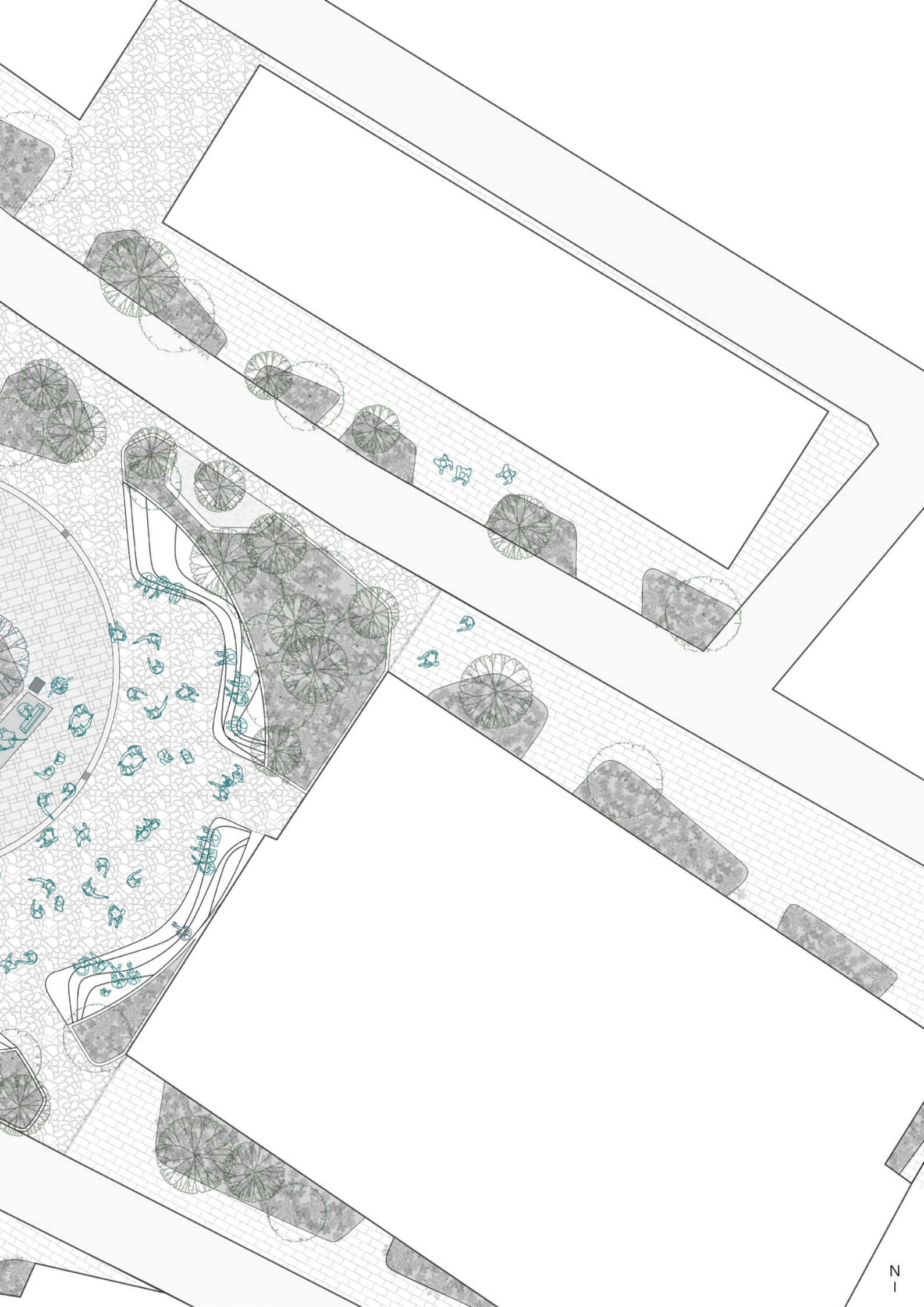


FIGURE 124 | PLAN PIAZZA UMBERTO I - PERFORMANCE (SCALE 1:300)


N

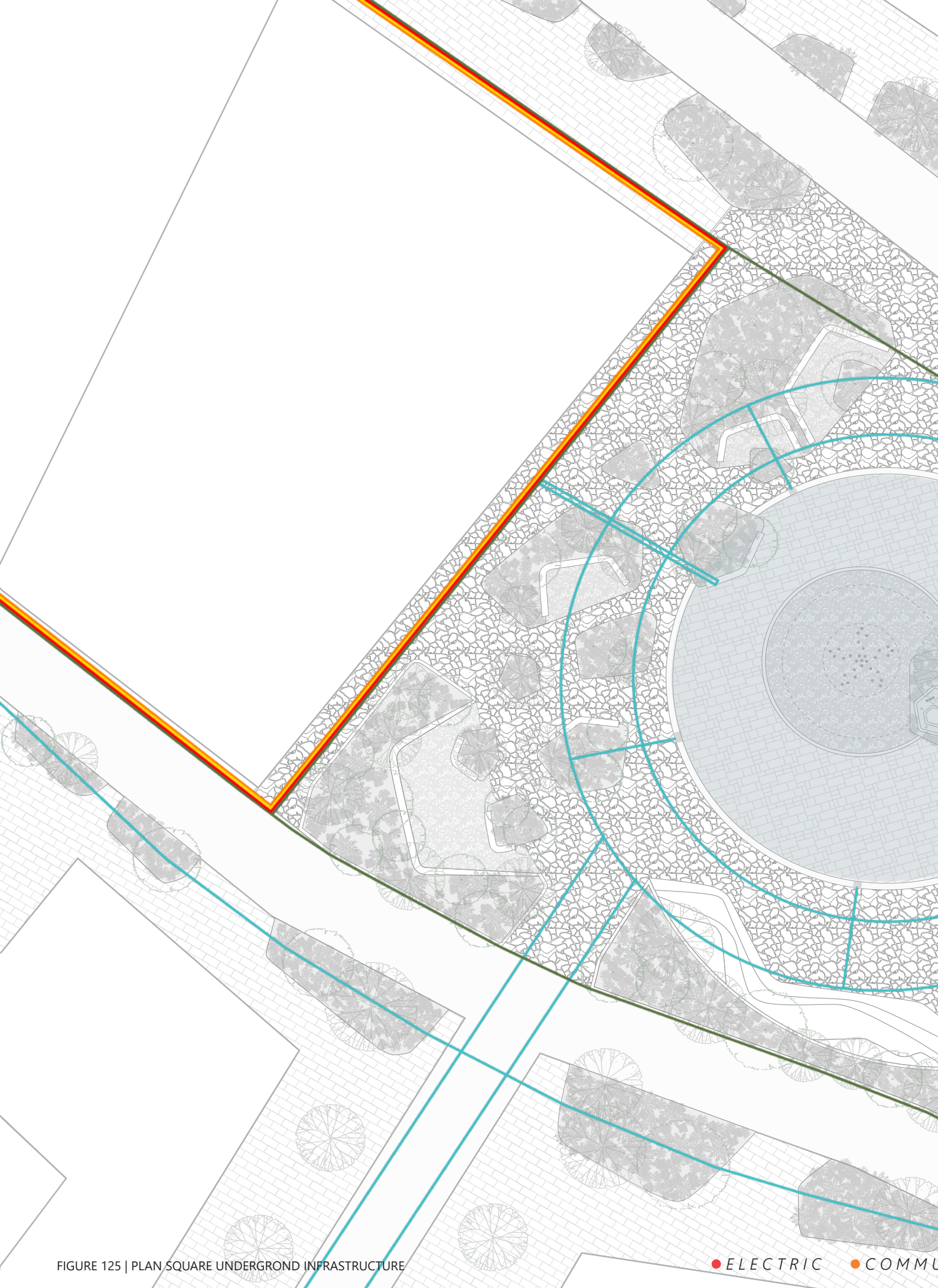
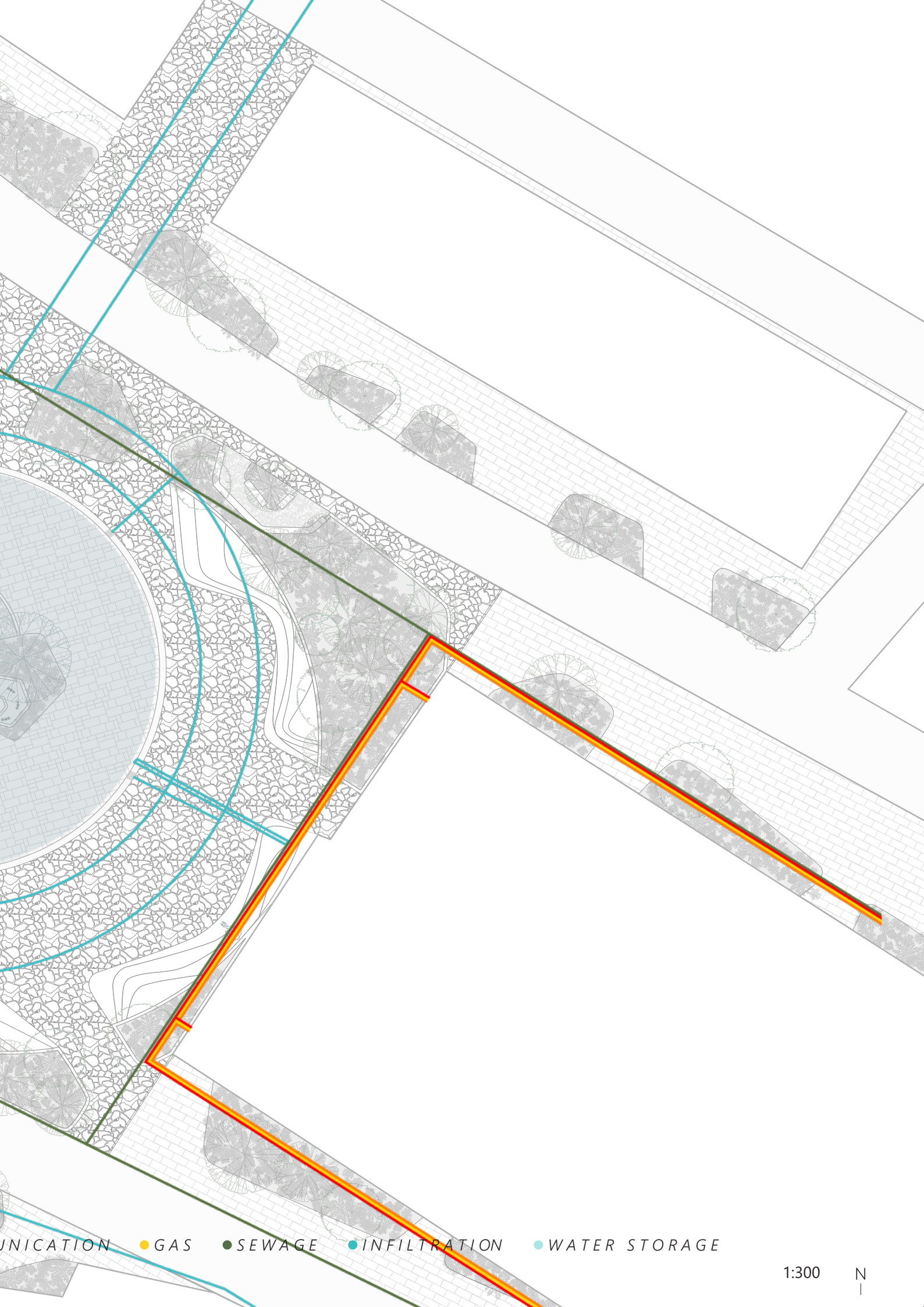


FIGURE 125 | PLAN SQUARE UNDERGROND INFRASTRUCTURE


UNICATION
GAS
SEWAGE
INFILTRATION
WATER STORAGE
1:300
N

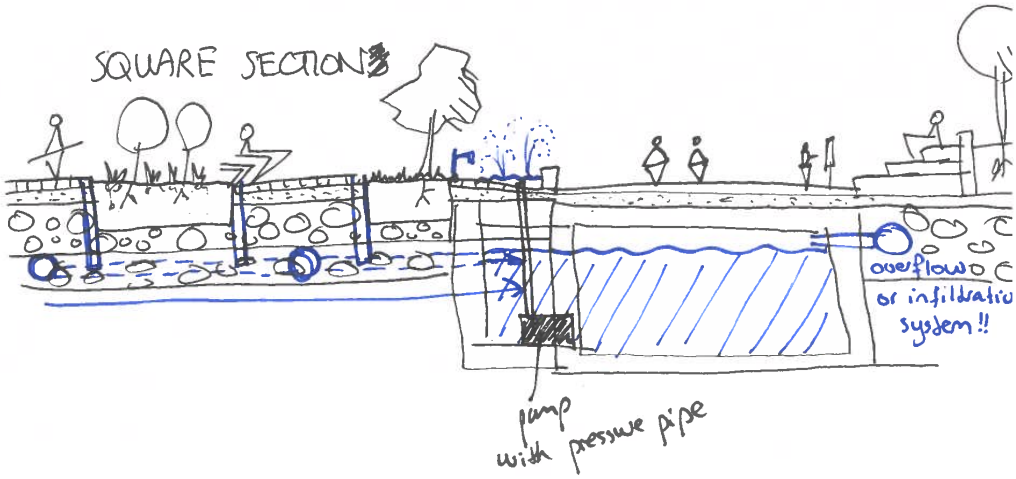


FIGURE 126 | SKETCH SECTION WATER STORAGE SQUARE

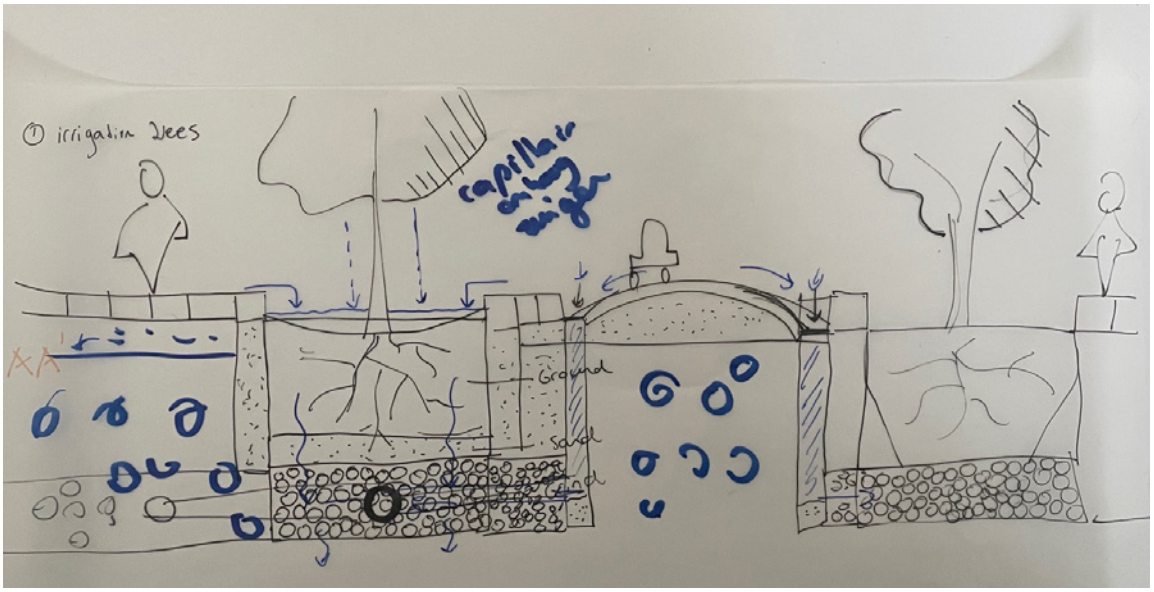


FIGURE 127 | SKETCH IRRIGATION IRRIGATION SYSTEM

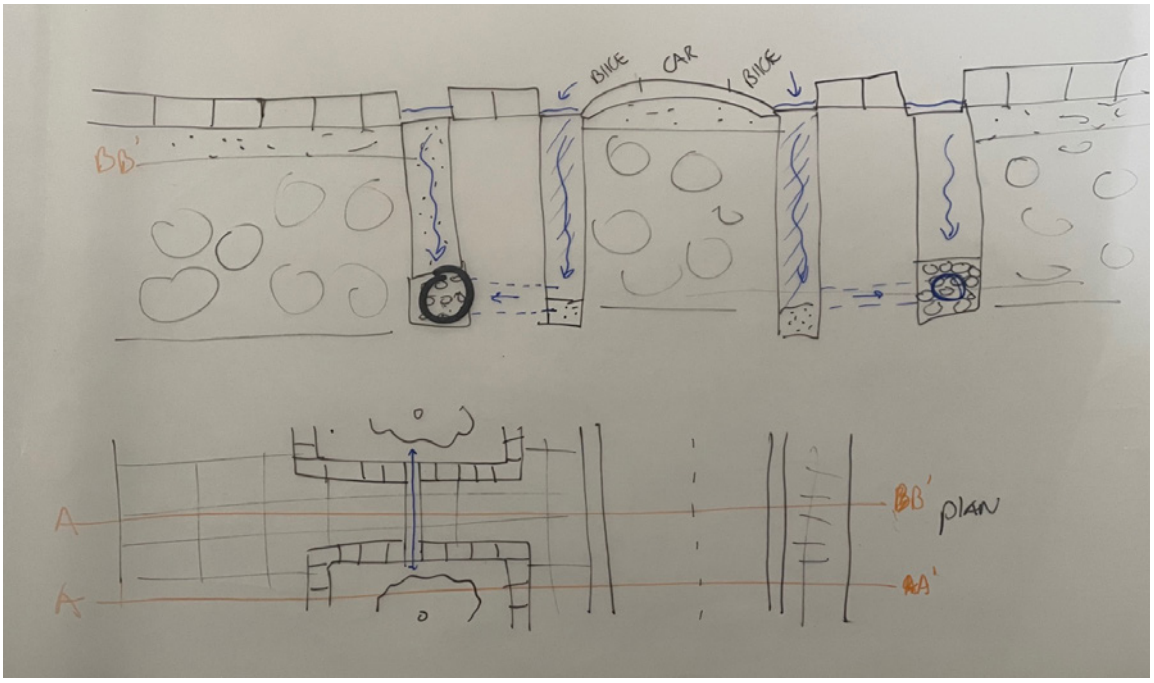


FIGURE 128 | SKETCH SECTION IRRIGATION SYSTEM

The water square is thus also functional as it stores water under the square. The sections explain this part better. The idea is based on both slow ways of infiltration and fast ways. A natural water infiltration system is introduced by opening up the pavements and constructing trees and rain gardens. They gather water during moments of precipitation and will slowly infiltrate them into the soil. However, during peak moments this will not be enough, and therefore a gutter connected to a drainage system (which is constructed underneath the pavement, not the natural areas) will allow the water to be gathered in storage spaces or infiltrate other areas.

In the square, also sprinkles are constructed that will not allow still-standing water to prevent mosquitoes. Also, mist construction is designed within the green patches to allow inhabitants to cool down during periods of heat, which is supported by the construction of trees (done in a way to imitate a mini forest) and creates a shady, pleasant environment. The water storage unit underneath the pavement is connected to the drainage systems and stores water. On one side of the unit, an overflow pipeline is constructed for extreme moments when the unit will be filled. This water can then be transported to the river, sewage, or infiltrate into other areas through infiltration pipelines.

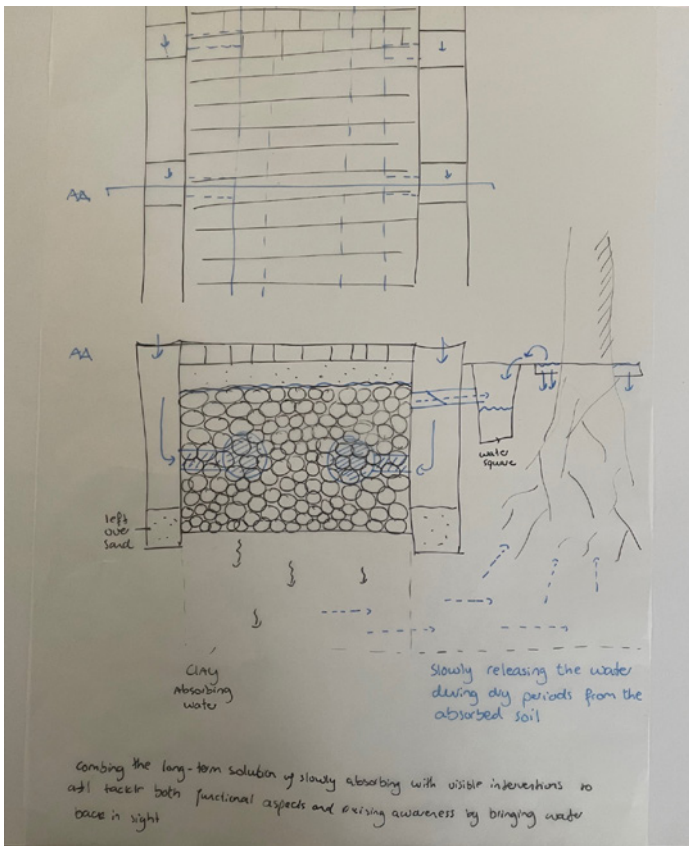


FIGURE 129 | SECTION INFILTRATION PRINCIPLE

The main design principles of the square are formulated by: water, functional, routes, and shading. The square has to be water-sensitive with the supporting elements illustrated in the plan and sections. It connects to the water heritage (tangible and intangible) and the larger scales through water. The square is functional as it can be used for social activities. The concept of the design is based on connecting routes (Via Rome to the ancient gate) and crossing routes, connecting the square entirely. Shading is important for moments of heat, which occur often in Italy and for long periods, increasing the spatial quality and cooling down the environment, decreasing the urban heat island effect.

Veolia Headquarters, Aubervilliers

https://i.pinimg.com/originals/0a/40/5f/0a405fb6ce5d4bb97ac4f78130b6aef2.jpg

Tree Irrigation System

Västra Hamnen, Malmö, Sweden
(Square Design)

https://nicholasdykstraobservations.com/wp-content/uploads/2014/11/img_20141105_220031.jpg?w=1305

Gallery of A Floating Pavilion, Archdaily, Slovenia
(Square Design)

https://i.pinimg.com/originals/94/2c/36/942c36fd6ee69aa9c8a51d2a1542f2c5.jpg

Gallery of Freedom Square - 501 architects
(Square Design, Seating)

https://www.archdaily.com/989597/freedom-square-501-architects/6331fb417120022fb99e27d9-freedom-square-501-architects-photo

Changsha Longfor CHunjiang Licheng District, Guangzhou S.P.I. Design Co., Ltdmist
(Square Design, Mist)

https://mooool.com/en/changsha-longfor-%C2%B7-chunjiang-licheng-district-by-guangzhou-s-p-i-design-co-ltd.html

Stora Torget Barkarbysten White Arkitekter
(Square Design)

https://i.pinimg.com/originals/cb/2a/a1/cb2aa14792514 8ff1ccb0d710b08eda4.jpg

Botanical Garden Brazilian Modern: The living art of Roberto Burle Marx, New York
(Square Design)

https://i.pinimg.com/originals/4a/ee/58/4aee584a1ee4a524f1f8ba17e6d2b3d9.jpg

Exhibition Space
(Square Design)

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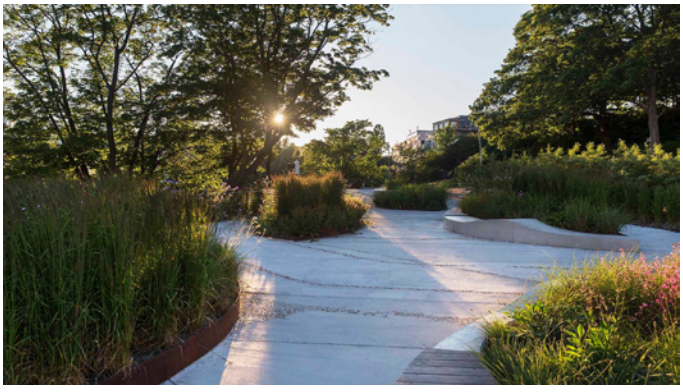
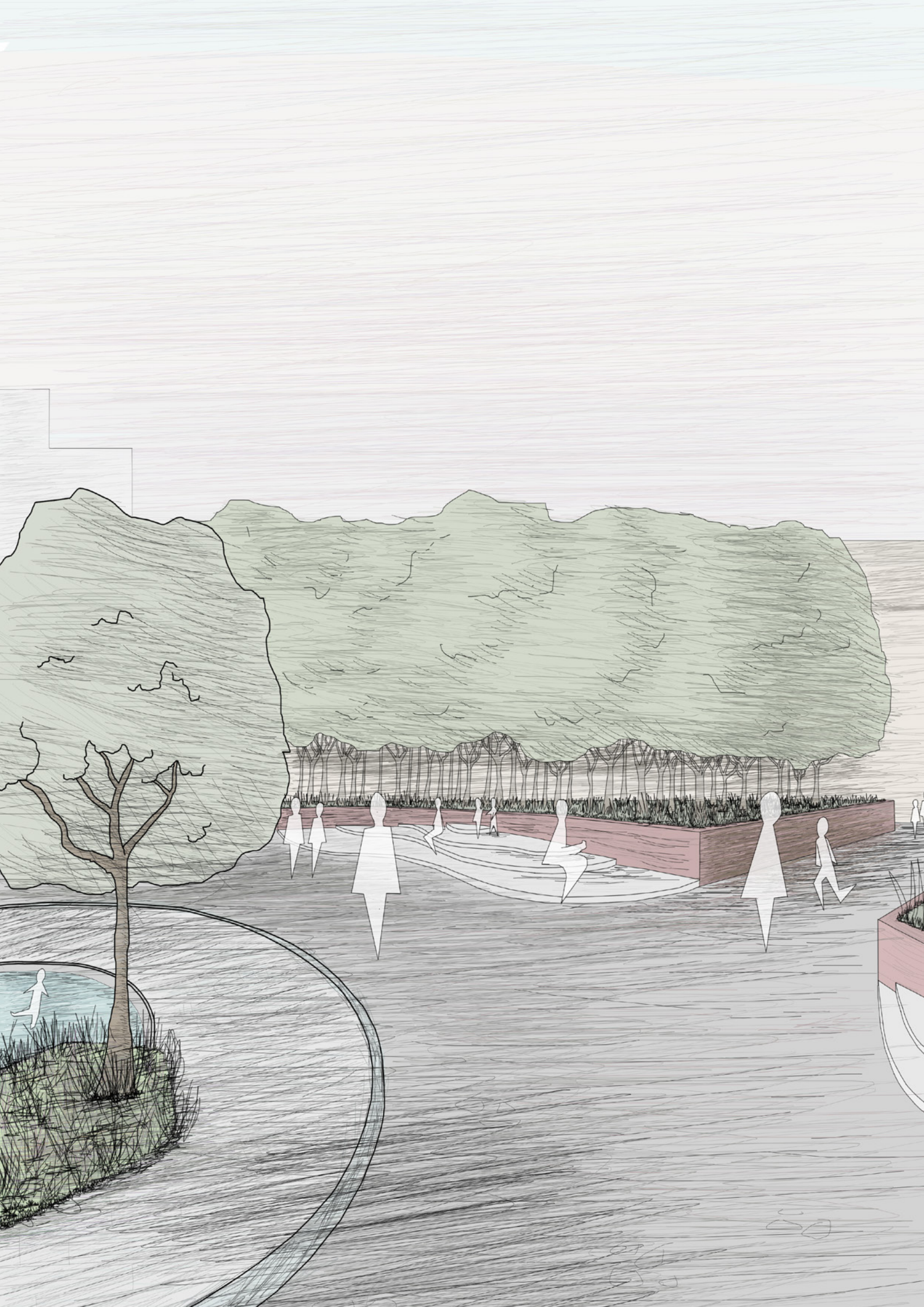
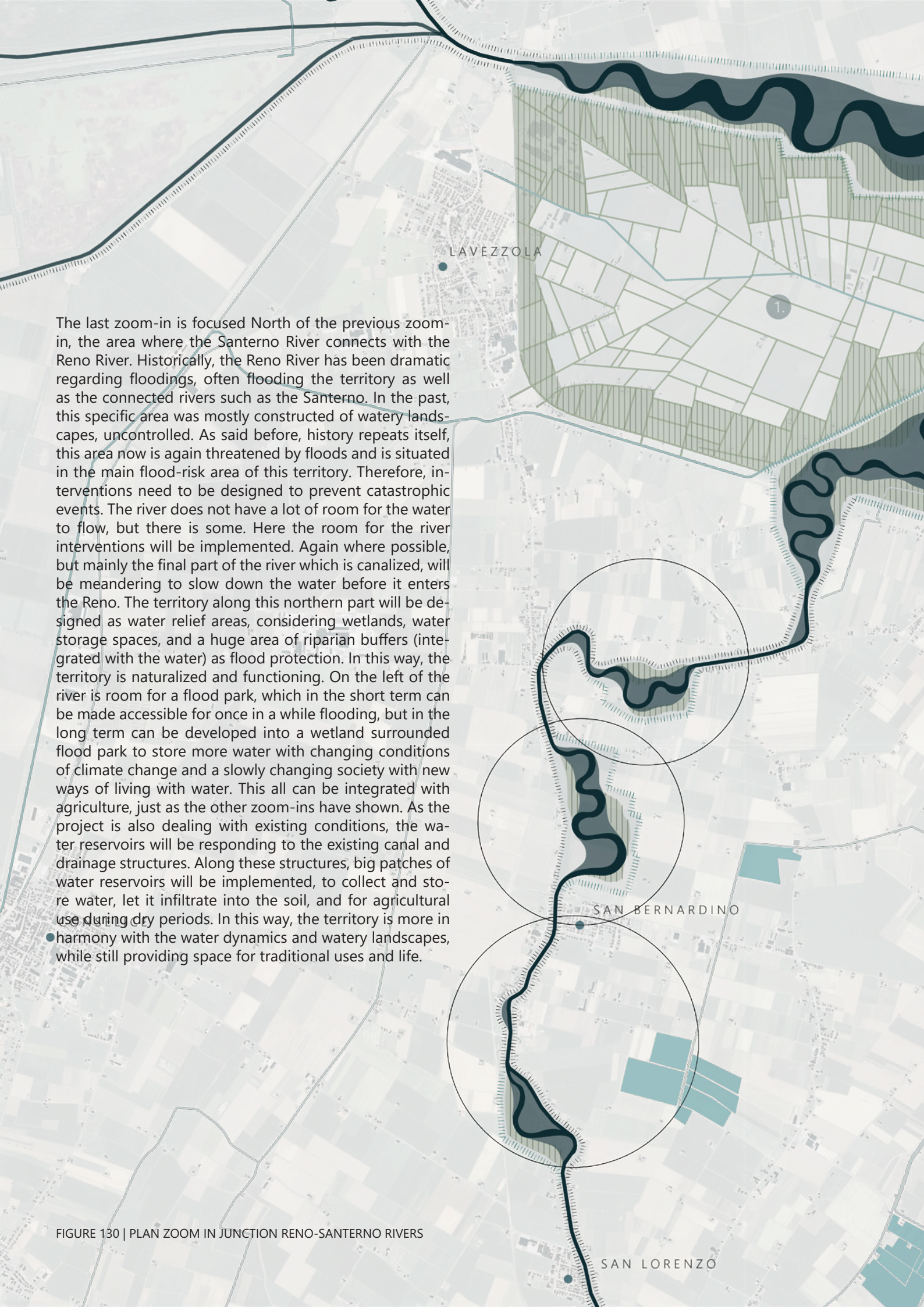


Anders Franzen, AJ Landskap, Sweden Stockholm - Photo: Kasper Dudzik
(Square Design, Sphere Impression)

https://landezine.com/anders-franzen/

Figure 56 | *references square design*



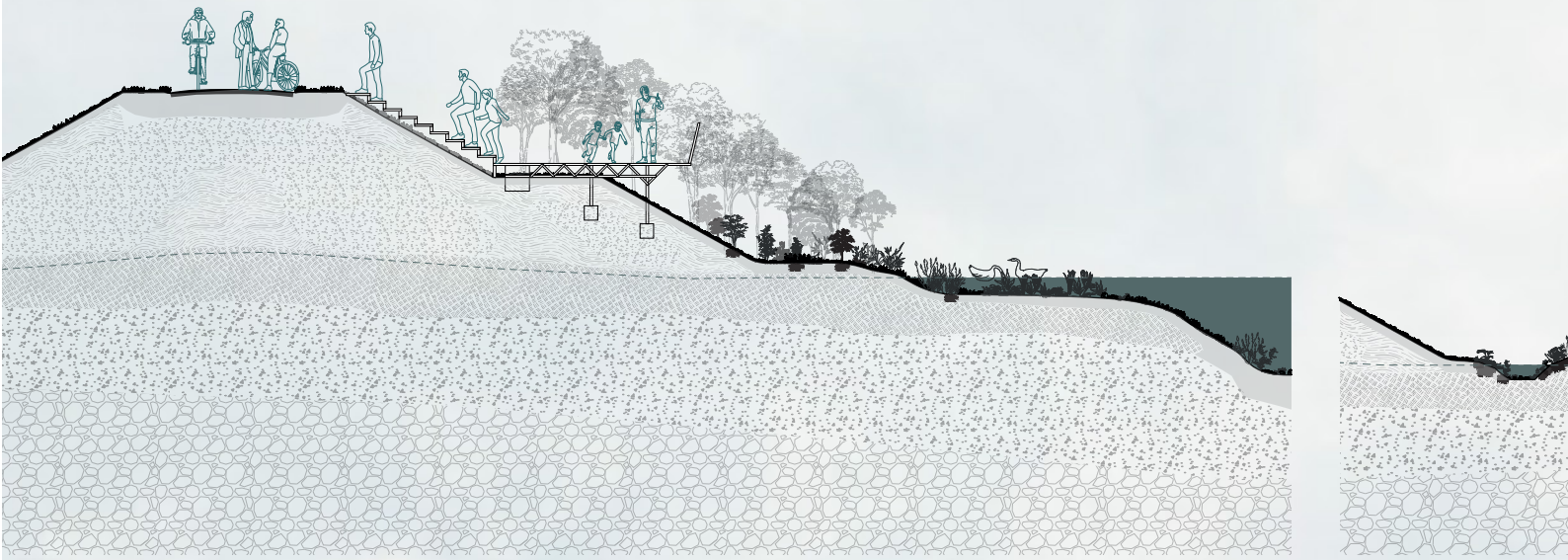


The last zoom-in is focused North of the previous zoom-in, the area where the Santerno River connects with the Reno River. Historically, the Reno River has been dramatic regarding floodings, often flooding the territory as well as the connected rivers such as the Santerno. In the past, this specific area was mostly constructed of watery landscapes, uncontrolled. As said before, history repeats itself, this area now is again threatened by floods and is situated in the main flood-risk area of this territory. Therefore, interventions need to be designed to prevent catastrophic events. The river does not have a lot of room for the water to flow, but there is some. Here the room for the river interventions will be implemented. Again where possible, but mainly the final part of the river which is canalized, will be meandering to slow down the water before it enters the Reno. The territory along this northern part will be designed as water relief areas, considering wetlands, water storage spaces, and a huge area of riparian buffers (integrated with the water) as flood protection. In this way, the territory is naturalized and functioning. On the left of the river is room for a flood park, which in the short term can be made accessible for once in a while flooding, but in the long term can be developed into a wetland surrounded flood park to store more water with changing conditions of climate change and a slowly changing society with new ways of living with water. This all can be integrated with agriculture, just as the other zoom-ins have shown. As the project is also dealing with existing conditions, the water reservoirs will be responding to the existing canal and drainage structures. Along these structures, big patches of water reservoirs will be implemented, to collect and store water, let it infiltrate into the soil, and for agricultural use during dry periods. In this way, the territory is more in harmony with the water dynamics and watery landscapes, while still providing space for traditional uses and life.

FIGURE 130 | PLAN ZOOM IN JUNCTION RENO-SANTERNO RIVERS

DESIGN INTERVENTIONS

1. AGRICULTURAL WETLANDS
2. RIVER REVITALIZATION
   - FLOODPLAIN
   - RIVER MEANDERING
   - RIVER WIDENING
   - RIVERBANK RESTORATION
3. RIPARIAN BUFFER / REFORESTATION
4. DIKE RELOCATION AND BROADENING
5. WATER RESERVOIRS



ZOOM IN SECTION INTERACTION WITH WATER - DYKE WATCH POINT ON RIVER SANTERNO

ZOOM IN SECTION

BIKE ROUTE ALONG BROADENED DYKE STRUCTURE

INCREASING SPATIAL QUALITY BY

MULTIFUNCTIONAL USE OF SPATIAL ELEMENTS: SAFETY, LEISURE, FLORA AND FAUNA, FLOOD AND DROUGHT RELIEVE

RAISING AWARENESS THROUGH INTERACTION WITH RESTORED WATER(-BASED) AND RIVER LANDSCAPES

INCREASING HARMONIOUS INTEPRLAY BETWEEN NATURAL INTERVENTIONS AND HARD INFRASTRUCTURE

VIEWPOINT ALONG REGIONAL BIKE ROUTE

INCREASING SPATIAL QUALITY BY

ALLOWING CLOSE INTERACTION WITH WATER INTERVENTIONS

RIPARIAN BUFFER

INCREASING SPATIAL QUAL

FLOOD PROTECTION

ECOSYSTEM FLOURISHMENT

SOIL AND WATER PURIFICATION

RIVER REVITALIZATION

RIVERBANK RESTORATION

RIVER MEANDERING

FLOODPLAIN

ROOM FOR THE RIVER

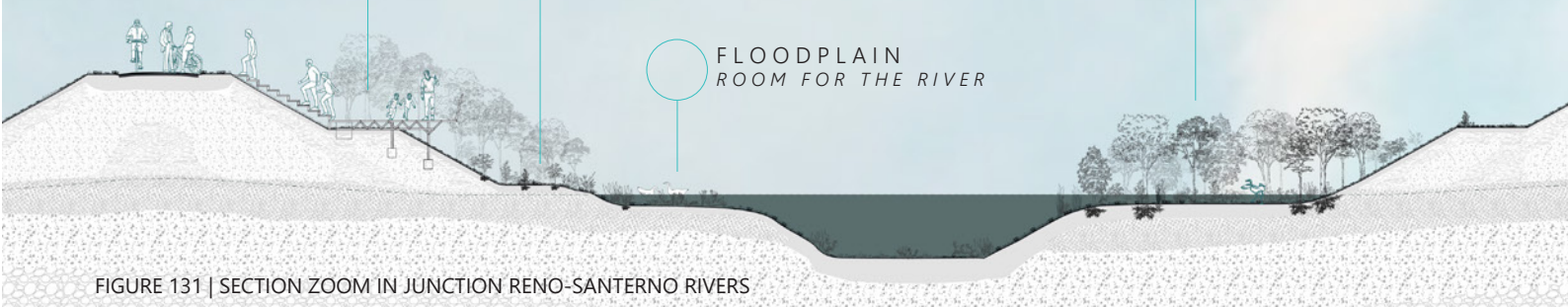
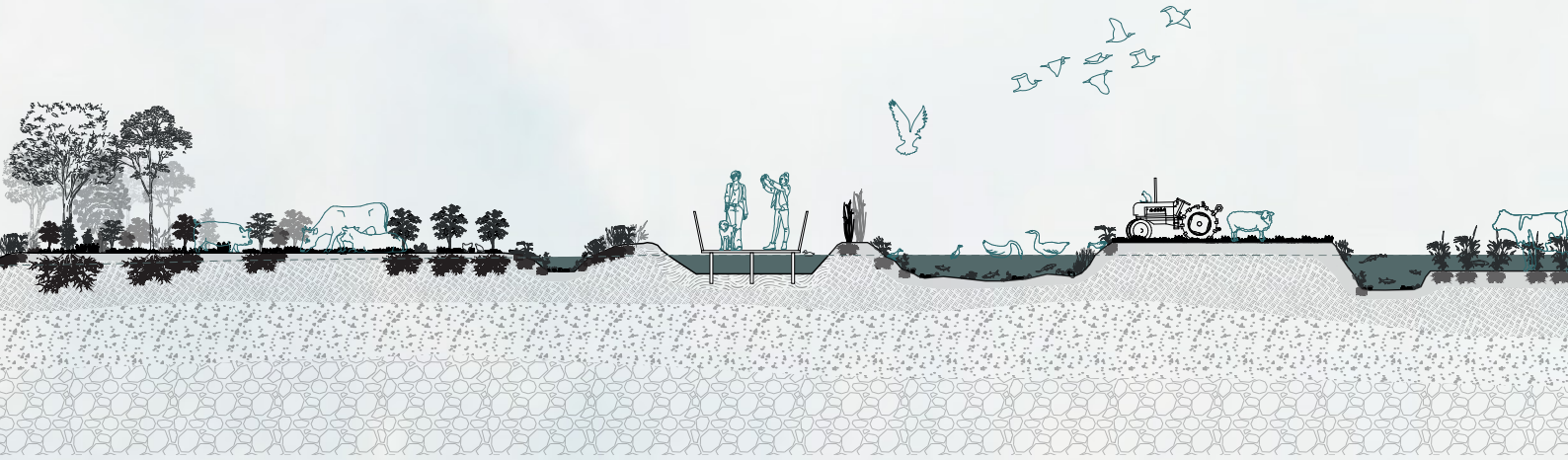


FIGURE 131 | SECTION ZOOM IN JUNCTION RENO-SANTERNO RIVERS



INTERACTION WITH WATER - RECREATIONAL AND AGRICULTURAL USE OF WATER RESERVOIRS

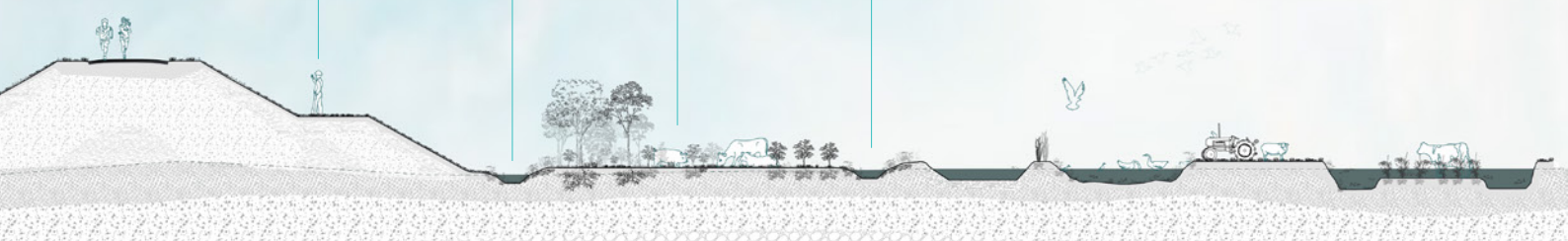
INCREASING WATER SAFETY
REINFORCED DYKE SYSTEM
PREVENTION OF DYKE FAILURE
ALLOWS FOR LEISURE AND MAINTAINANCE

STREAM RESTORATION
STRENGHTENING SOIL
PREVENTION OF BANK EROSION
ALLOWS FOR ECOSYSTEM FLOURISHMENT
INTERCEPT GROUNDWATER SEEPAGE

RIPARIAN BUFFER
INCREASING SPATIAL QUALITY BY
ECOSYSTEM FLOURISHMENT
SOIL AND WATER PURIFICATION
MULTIFUNCTIONAL USE: AGRICULTURE

ITY BY

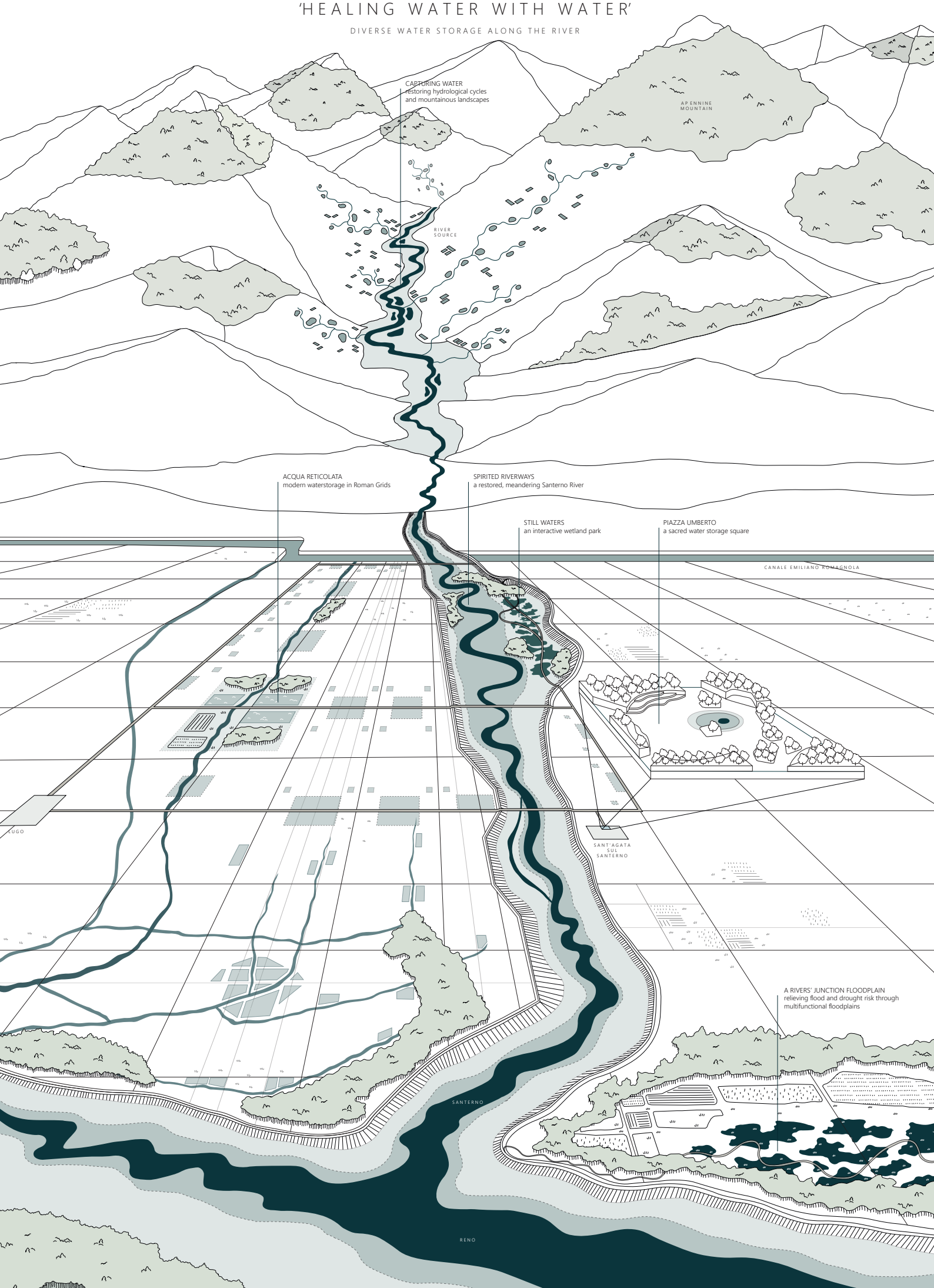
WATER RESERVOIRS
ALONG STREAMS, CANALS, AND DRAINAGE
FLOOD AND DROUGHT RELIEVE
ECOSYSTEM FLOURISHMENT
MULTIFUNCTIONAL USE: AGRICULTURE

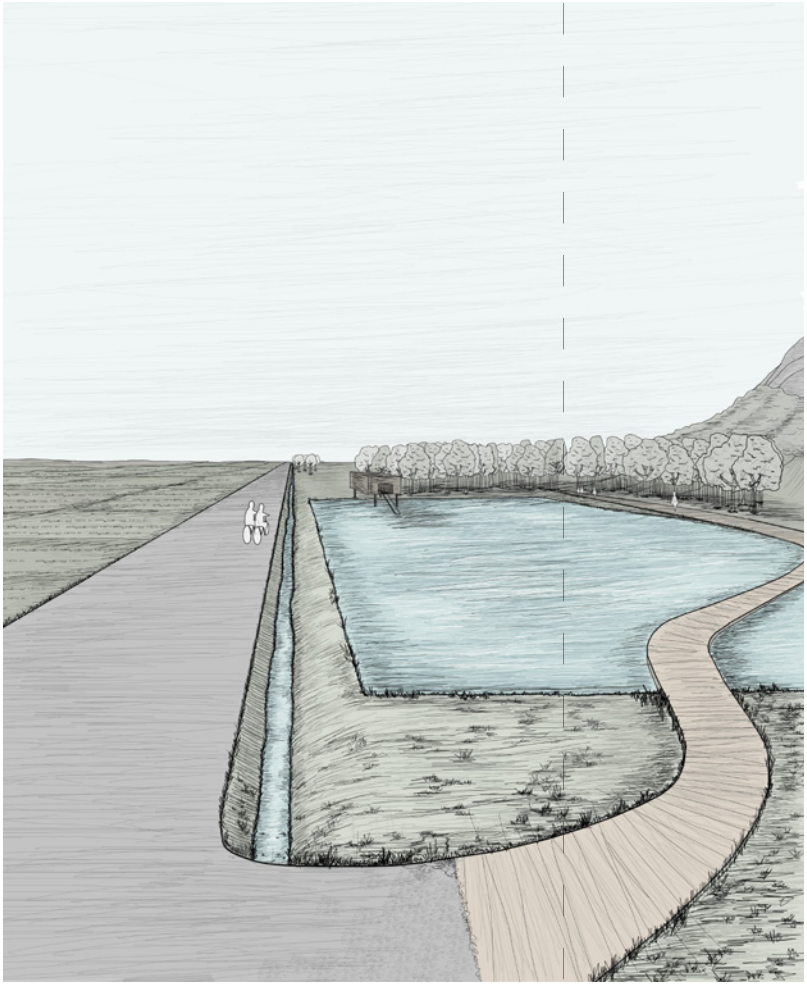


IL TERRITORIO DEL FIUME SANTERNO

'HEALING WATER WITH WATER'

DIVERSE WATER STORAGE ALONG THE RIVER





MULTIFUNCTIONAL WATER RESERVOIRS
(LEFT) PLAIN | (RIGHT) MOUNTAIN

FIUME SANTERNO AND
WETLANDPARK STILL WATERS

FIGURE 132 | IMPRESSIONS LIVING WATERS

CONCLUSION STATEMENT

"I REMEMBER WATER"

This project began with a quest to find answers on how to live with water in a future marked by uncertainty and unpredictable change. Specifically, it aims to determine how the southeastern region of Emilia-Romagna, facing floods, droughts, and other water-related challenges due to Anthropogenic processes, can adapt to these changes. Although this region is rich in water heritage, much of it has been forgotten. The goal is to restore this lost connection with water and propose a new way of living that ensures safety from hydrological extremes. More specifically, it seeks to answer the research question 'How to interscalarily design a water-sensitive reality on the human dimensions of daily life in the Northern Italian southeastern Emilia-Romagna region for flood and drought protection while reintegrating water heritage as a way of living?'

Water Heritage and Conditions of the Critical Territory
Firstly, extensive analysis and research were conducted on the territory itself. The problem statement defined why this area is critical, justifying the need to design a better alternative for the future. The research identified the systematic elements and conditions that compose this critical territory. Critical mapping of spatial systems and fieldwork were conducted, using the Dutch Layer Approach, which divides the analysis into territory – water, territory – natural, infrastructure, urbanization and industry, and agriculture and hydraulics. Simultaneously, the Longue Durée revealed how these current conditions emerged from historical territorial transformation due to human actions.

The Dutch Layer Approach concluded that the territory is a residual territory of its original natural state – a rich, watery river and delta landscape. This landscape can be subtly traced along the mountains, river structures, and coastline, as land has been reclaimed since the Bronze Age, including deforestation and resource over-extraction. Historically threatened by floods, the main risk area is around the Reno River basin and connected Apennine Rivers to the Po River and its delta. Over time, excessive infrastructure fueled colonization and urbanization processes and along water structures (rivers, coast, delta), leading to large cities and hinterlands of productive agricultural land full of traditions and artificial structures to ensure its water supply. Surrounding these big cities are big industrial clusters and the entire territory is built with hydraulic elements like canalized rivers, canals, dykes, dams, drainage systems, sluices, and pumping stations to reenact the disconnected natural hydrological system. The main water supply of the entire Emilia-Romagna region is the Canale Emiliano Romagnola, making the territory extremely vulnerable to water security issues. The result: an artificial landscape.
The Longue Durée identified key moments of intervention in the hydrological cycle to (primarily) prevent floods. Civilizations in the Po Valley reclaimed land for habitation, demonstrating intelligent water management that transformed natural systems into artificial ones, fueling economic growth and international trade as transportation was depending on water structures. With the Roman era came the centuriation system, structuring land for colonies, infrastructure, and agriculture. Despite attempts to control floods, with a period of success due to Napoleon's Cavo Napoleonico in 1807, modern challenges have re-emerged due to these artificial systems limiting natural dynamics and the increasing climate crisis.

The existing conditions and tangible water heritage of the territory have been defined. Theoretical research through literature reviews explains how water's position in (ancient) societies transformed, leading to social alienation from water identity and describing the intangible water heritage. History shows how societal transformations toward water identity dismantled the interrelation of religion and daily life, where water was central. This intangible construction of water closely relates to the tangible urban structures of life and vice versa. Over time, logic and power replaced spirituality, and modern advancements pushed water out of the living environments, severing its historical roots.
Water, once perceived as something divine, a spirit, and worshiped, transformed from natural water bodies of veneration into symbolic objects of wealth and power with a slightly spiritual meaning. While water remained in the living environment, societies began to control it by confining it within artificial structures. A result of the unravelled mysteries of water, stripping it of its 'divine' nature. With the introduction of the car in modern times, water was further pushed out of the living environment as an unwanted guest, causing society to forget its roots and the essence of its life-given properties.

The Design
This project aims to introduce a transformative way of living with water. On one hand, it proposes flood and drought safety through a water storage framework that restores the ancient water landscape of the territory, allowing room for the dynamics of water. On the other hand, it seeks to restore the ancient understanding and connection with water, integrating it into social construction as the tangible and intangible are closely intertwined.

The analysis showed that the main flood risk area is the Reno River basin and the connecting Apennine rivers, providing the site selection of the design. The interscalar design focuses on the region of Emilia-Romagna, within this flood risk area, with a final focus on the human dimensions and small scale. It proposes an alternative way of living with water, answering to the questions: how does this affect human life, changing the perception of water, and

fostering interaction with it? What does water mean for humankind and vice versa? The water storage square in Sant'Agata sul Santerno, the small-scale design location, illustrates living with water, focusing on short-term changes, providing water safety and sustainable water use, enhancing spatial quality, and promoting social and cultural interaction with water in the historical town center.

Simultaneously, this is integrated into a large-scale design and system based on recharging the entire territory through the scales, as water is multi- and inter-scalar. To restore the region's healthy watershed, water should be reintroduced throughout the territory, responding to its diverse landscapes. Alongside short-term solutions for daily life, a framework of 'water storage' is presented on the existing territory, allowing adaptability for future uncertain changes. This ensures safety while allowing water to flourish naturally.

We must start caring again, reintroducing water into our living environments in ways that respect and understand its existence and dynamics. Life with water is magnificent and incredibly complex. Understanding how water works, lives, roams the earth and provides life for all species should inspire awe. Water needs to be introduced into our daily lives, as it has always done in the past. We have become unfamiliar with its benefits and its essence. Currently, water management is left to the government and institutions, alienating us from the connection that exists with water. We need a personal relationship with water, an understanding of care, and a realization of its importance. Water is so much more than we realize. It is a memory that we have lost but can remember. Water lives inside of us and it is all around us. This design is a way to see its potential for life and restore the disconnection between human and natural life.

Living Waters.

Whoever believes in me, as the scripture has said,
rivers of living water will flow from within them.

- John 7:38

9

REFLECTING LIVING WATERS

PROCESS - DESIGN - VALUE - LANDSCAPE URBANISM

What is the relation between your graduation project topic, your master's track, and your master's program?

This graduation project aimed to understand, frame, and address the water-related challenges society currently faces as the accelerating climate crisis moves from an indistinct background position to a more dominant presence. These increasing water-related impacts, defined by the extremes of the altered hydrological cycle - drought and floods caused by human actions - leave a catastrophic footprint and threaten human existence.

Urbanism concerns the human influences and interactions with the (interscalar) public and/or common space. Therefore, it also copes with the impacts of the climate crisis, touching upon both theoretical understanding and practical approaches to the changing conditions of territories, systems, spaces, environments, processes, and behaviors. There is an urgent need to design approaches that formulate conditions and frameworks that provide both spaces for water while addressing these challenges. Additionally, there is a need to raise awareness about why these challenges occur, how they occur, and what happens with or without action on these challenges. In today's globalized, urbanized, and intensified society, detaching natural and human systems and environments (the Anthropogenic epoch), the urgency of awareness arises from the fact that natural catastrophes automatically threaten human spaces. The fixed tangible realm is disharmonized and provides no space for natural elements such as water. Huma behavior often lacks awareness of the understanding of these processes.

For both understanding and intervening, framing the water-related challenges and their impact on the existing (territorial, systematic, spatial, and environmental) conditions through scales, and assessing the spatial quality is of great importance. Therefore, this graduation project has provided a theoretical and practical understanding of the water-related challenges, framed these challenges based on the context of the Northern Italian region of Emilia-Romagna, and intervened in the current conditions through an interscalar design to provide a transformative approach to how to live with water (Figure 133).

How would you describe the relation and dominance of the domains of landscape architecture and urbanism in your project?

Being part of the graduation studio Transitional Territories, as its name suggests, allows the project to reach beyond traditional urban borders, as the urban territory is interconnected with the landscape domain. Urbanism, at its core, serves to take care of the public space within human territories. These spaces are in constant transition through

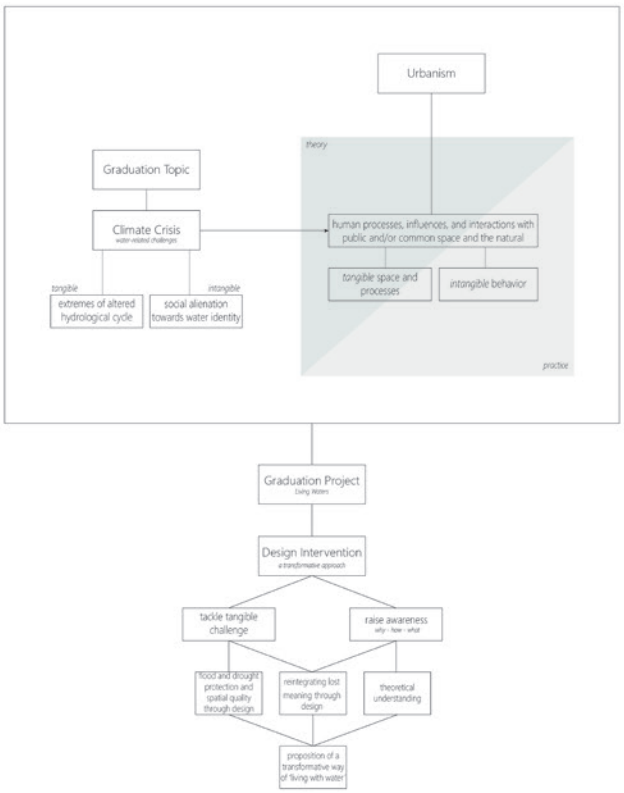


FIGURE 133 | *Graduation Topic, Urbanism, and Graduation Project*

past and future times as human actions alter their (natural) state. Accordingly, this is not limited to the urban sphere but also integrates the peri-urban and rural spheres. Life is a complex construct of natural, human, and in-between processes, cycles, and systems.

Even though the world has been intensively urbanized, it does not encompass the entire planet. There is always an interplay between the natural and human realms and all that is in between. In essence, everything that existed before was untamed nature in which humans harmoniously roamed the earth, forming the foundation of all urban structures. Therefore, urbanism cannot be limited to arranging objects and buildings but should extend into its supporting landscape processes. Pushing the natural landscape out of the service of care brought us to a destructive state of climate crisis in a strongly imbalanced, disharmonized world. To be able to turn the tide, this project therefore focuses on the interplay and reliance of the two domains, combined as one serves the other, in human territories through landscape urbanism.

What approaches and methods did you use and did they work?

To reach and ensure the aim of this project two methods have been used: non-linear interscalar design 'designing through scales' and using water heritage as a transformative approach to understand, frame, and intervene in water-related challenges (in the region of Emilia-Romagna) (Figure 134).
The water-related challenges are tangible and intangible. There are physical impacts that frame the water challenge (droughts and floods), but also the intangible challenge of the social alienation towards the water identity. For the tangible challenges, the non-linear interscalar aspect of this project provided an understanding of the natural systematic processes of the hydrological cycle (hydrology), how this is displayed in its macro-scale (global cycle, environmental systems), meso-scale (river basins through the mountainous to the coastal landscapes with its various land use), and micro-scale (micro-environments, local urban and rural conditions), and how these scales correspond with one another. The intangible challenge is less easy to grasp and therefore, the exploration, definition, and understanding of the water heritage of the territory was crucial and leading to the definite proposed design interventions. As it regards the social alienation towards the water identity, defining a lost societal connection with water, water heritage has been used to identify human alternations of the natural hydrological cycle within the territory and allowed for a deeper understanding of human behavior explained through the Anthropocene that transformed (ancient) harmonized ways of living with water into controlling and fighting water while pushing it out of the living environment. The project proposes an alternative, transformative 'way of living' with water and therefore, these two approaches (interscalarity and water heritage) are crucial and leading.

The approach did work, however, the process was messy. The constant switching through scales while taking research and design steps provided a lot of information at the same time, and therefore, many moments of reflection were necessary to comprehend the entire picture and this time was not always available. This required me to occasionally work with a level of confusion or uncertainty, which made the process demanding and puzzling, but also intriguing and interesting. Eventually, these two methods came together and provided the desired outcome of understanding. It made me (re)realize that messiness simultaneously occurs with complex topics, projects, and specifically within the research and design process itself.

How did your research influence your design/recommendations and how did the design/recommendations influence your research?

The process of research and design is interdependent. The first stage of the process mainly consisted of research, framing an understanding of the 'background' processes that provided the 'foreground' territorial conditions and this was reflected through an abstract, imaginary design. Fortunately, due to the interscalarity (also) in the research process, it guided me early on to my exact (small-scale) design location. In some aspects, this straightened out

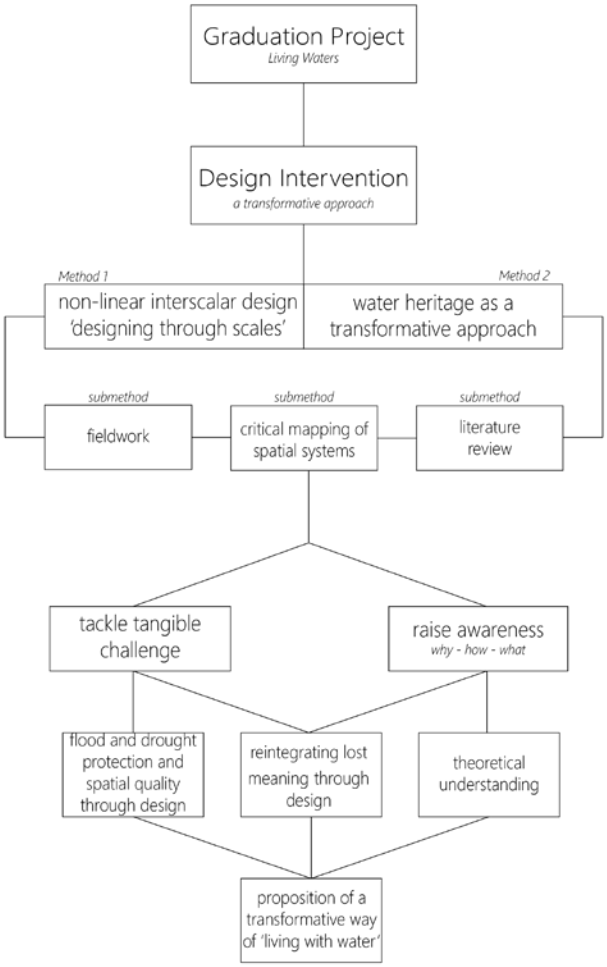


FIGURE 134 | *Relation Methods and Design*

confusion and made it easier to focus research and design on the big scale to the small and vice versa. Simultaneously, this design focus area provided a direction of research that guided me to the focus areas of all scales, connecting the narrative. It helped narrow the research and enabled me to be more context-specific, even in the various scales. However, as the process was messy as explained before, the follow-up feedback indicated that the reasoning for the design, based on the research, should be more enriched and argued as the steps that had been taken were rough and quickly put together. They could be more sensitive and critical. This design recommendation therefore brought me back to the research and allowed me to enhance and make it more coherent.

As design became more dominant during the process, feedback transitioned increasingly toward the design aspect of the process instead of the research/narrative. At this point, the research and analysis were already quite specific. During this period, I experienced a block/hindrance in my creative design process that I am aware of happening more often in the transition process from analysis to (concrete) design. The feedback provided by my mentor guided me through analyzing a river structure, defining the various elements that are constructed along it, to areas of intervention. On its own, this specified the required research to be able to set the following steps. It functioned as a push in the back to the right direction. Additional feedback taught me to search for more structural elements in the territory on various scales to reason and lead my design. This helped me to structure the design.
Finally, as this project designs a transformative way of

living with water through various scales, the feedback recommendation of accentuating the human experience (small scale) in all scales helped improve the design and narrative, and focus the research on the aspects that should be detailed and precise.

How do you assess the value of your way of working (your approach, your used methods, used methodology)?

As explained before, the process was sometimes experienced as quite messy and confusing. Even though this is part of the design process in general, during these times it was with more difficult to value this approach and the used methods highly. In these moments it came down to trusting the process and continuing, however, motivation to continue was more tricky and limiting the process in some ways. With the (preliminary) results of the research and design process visible now I will value these methods highly. Especially with the supportive methods of fieldwork, historical analysis, and critical mapping of spatial systems the methodology was enriched and provided various, critical, interesting research outputs. The most surprising and outstanding method was the fieldwork which clarified the project even more than expected, gathering also a better cultural understanding besides experiencing the territorial elements in person. What could have elevated this process and increased the value of this approach are more moments of sub-conclusions to clarify confusion and uncertainty. These written sub-conclusions force you to reflect and knit together loose ends which are causing the messiness.

How do you assess the academic and societal value, scope, and implication of your graduation project, including ethical aspects?

I framed and intended this graduation project to be knowledge for a broader audience than just the academic world. It is of great value to the academic sphere as it contributes to the understanding, framing, and possible coping of water-related challenges in a transformative way in a context-specific and abstract manner. This project aimed to visualize a near future that copes with these challenges in a more harmonious way of living with water. It highlights and raises awareness of the interconnectedness of human behavior, history, identity, landscapes, and natural systems and processes in territories. In this way, it is an addition to a broader body of knowledge in which existing knowledge has been gathered and used to argue for interscalar design interventions that also imagine in this near future a long-term framework that provides conditions that will restore the health of the natural hydrological systems and its connected processes. This project is also an example of and argues that design is more than a tangible intervention that functions as a solution and increases spatial quality. It touches upon an intangible sphere of human behavior and living quality. By reflecting on the past that constructed the current situation through design interventions, lessons can be learned, or lost knowledge can be re-introduced to construct a healthier, functioning, and strongly connected future of natural and human processes. It argues that design was constructed through an intangible understanding, connection, and valuing of the natural domain that illustrates the deeper meaning of awareness of the being and working of the world's processes that provide harmony in the way of living (with water) as it did in the past. Simultaneously, design can construct and stimulate this awareness by providing the conditions and elements and allowing space for this deeper understanding and meaning in human behavior. It is of great value for the academic world to connect this tangible and intangible layer of design and understanding.
At the same time, this project also has societal relevance as the academic world is familiar with the urgency of action regarding the water-related challenges, consists of an understanding of the causes and consequences of these challenges, and the long-term impact of sacrifices, transformative approaches, and change. Society is less aware and educated on these matters and therefore, as it touches upon its constructed behavior often described as 'familiar tradition', this project aims to reach this target audience as well. Change will only happen if conditions provide opportunities for cooperation, participation, and an understanding of long-term (and short-term) visions. Sometimes a long-term vision requires the relocation, transformation, or removal of spatial claims which is, without awareness and knowledge, difficult to understand and cope with in the short term. At the same time, the project touches upon human history, digging up lost connections, behavior, and a being of our ancestors which is society's right to know. Therefore, the societal awareness of these complex topics this graduation project approaches is crucial for future success and impact.

How do you assess the value of the transferability of your project results?

As this project concerns various scales, including the bigger scales, it automatically brings complexity along. Especially in a region where cultural identity is strongly intertwined with (all) human processes. Design cannot simply be produced and realized, it also requires policy-making, participation processes, cooperation, funding, and financing. It requires in-depth research of the context-specific conditions that decide the rate of success or failure of the design interventions and this has to be done in a large territory. Especially raising awareness among the inhabitants of the territory and the effort of convincing is a tricky aspect that will not be without difficulty. However, besides these complexities that will automatically come along with these large-scale projects, the transferability of the project is there. Reference projects (in the same climatic conditions) in countries like Switzerland, Germany, and the Netherlands show the success of the design interventions proposed in this project to restore a healthy watershed, such as river revitalization, stream bank stabilization, flood plains, etc. There is a gap in knowledge on the long-term impacts as these projects have not been realized long enough, but they argue that up until now the interventions work. These Nature- and Ecosystem-Based Approaches are often less costly as natural solutions require less maintenance than hard infrastructure and production and realization are less costly as hard infrastructure such as dams or canals.
Especially the transferability of the small-scale design is

there as the main input and condition of the water square design was to create an as much as realistic project as possible. Not only using digital data, but the fieldwork visit provided me insights on both technical and social aspects, enriching the design.

Which learning goals did you set at the start of the graduation project to stimulate your development and did you achieve these goals?

At the start of the project, the first learning goal I set was to design a detailed small-scale design regarding the concept of a water-sensitive urban design to visualize living with water in the near future in everyday life in an urban context. Especially in this scale, the learning goal specifically reached out toward the technical sites as the aim was to understand the technical water management of water to a great extent while being sensitive to the natural hydrological processes. Simultaneously, a learning goal was to gain more knowledge on the natural hydrological system and its workings and the hydraulics of the territory. With the latter, the technical aspects come back again as it intrigues me and I lacked knowledge in that department. To a great extent, I have reached these goals, however, as I am not a hydraulic engineer or water manager there is a lot of room for improvement in understanding the detailed knowledge of the technicality of the elements of water management. This mainly regards the larger scale interventions such as the precise construction of dykes, dams, etc. The technical detailing of the small scale did meet the requirements of the learning goal and broader knowledge has been gained on how to (technically) design water-sensitive in an urban context. I did gain lots of knowledge on the natural processes of the hydrological cycle and a deeper understanding of what, how, and why certain human behaviors caused the disconnection and disbalance of the hydrological cycle besides the climate crisis.

Reflecting on the design products, what would enrich and improve this project?

The main concept as a response to the problem statement that this graduation project is based on is 'water storage through the various landscapes'. As the focus area is a larger territory consisting of various landscapes (mountainous, river landscape, plain/low land, the urban, and coast) this requires different approaches to water storage with different impacts on different stakeholders. As research and design both guided me to a specific focus area, which is also required from the studio, it eliminates other areas of design. 'You cannot design it all.' Therefore, the design is focused along one river (Fiume Santerno) which mainly connects the mountainous, low plain, and river landscape all of which a zoom-in design has been produced. To enrich the project, a zoom-in of the coastal area which requires a various approach to water storage could be explored and designed. Especially as there is a living delta in this coastal area. Secondly, an improvement to this project would be small-scale designs of every landscape type to visualize the various (daily or weekly) human interactions with water in not only an urban context, but also peri-urban, and rural. Lastly, it would have been interesting to test the large-scale conditions and framework that have been designed on different rivers in the territory to connect a bigger area.

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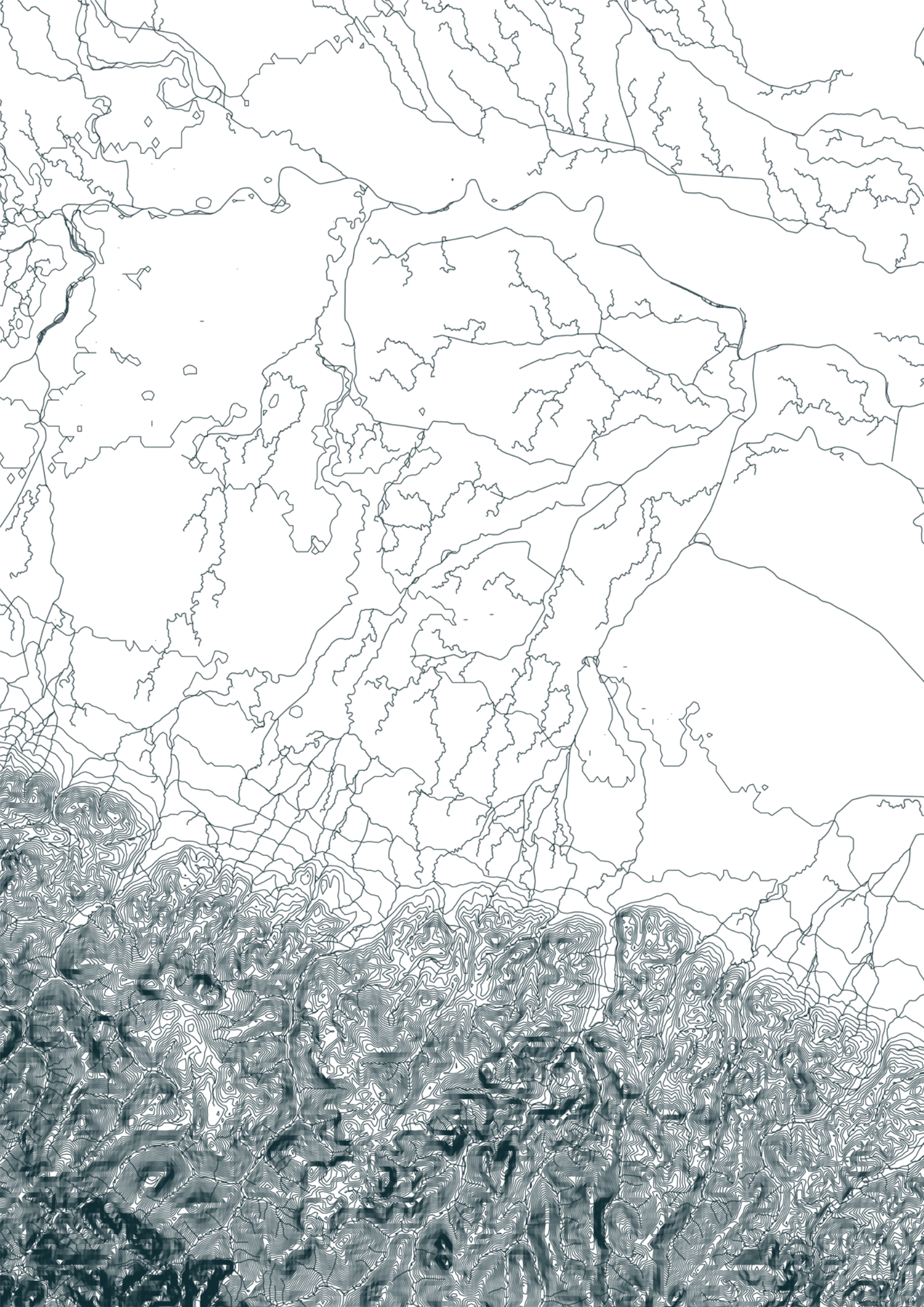


I remember ***water***

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Kim Schneider
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