



# WATERFRONT DIALECTICS

ROME AND ITS  
REGION FACING  
CLIMATE CHANGE  
IMPACTS

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# Introduction

- 12 **Vulnerability and opportunity on waterfront facing climate change**  
Pedro Ressano Garcia
- 17 **Do three different waterfronts make Rome a city of water?**  
Claudia Mattogno

## Part 1. Rome Coastal System

- 23 **Rediscovering Layers and Links Between Water Landscapes and Cultural Heritage**  
Claudia Mattogno
- 27 **The 'Various Landscapes' of the Ostiense Coast Cultural and Environmental Heritage**  
Maria Grazia Turco
- 39 **The Coastal Territory of Rome Environment, Architecture, Archaeology**  
Sonia Gallico, Barbara Tetti
- 51 **The Navona Lake and the Eels of the Pantheon Architecture and Landscape for Flooding**  
Annalisa Metta

- 61 **A Trip Along the Lazio Coast**  
Giulia Luciani
- 71 **Land Consumption and Coastal Erosions in Italy.  
A Focus about the Lazio Region**  
Michele Manigrasso
- 87 **Land Consumption Along Coasts is Increasing Local  
Vulnerability. The Case of Rome and Other Six Cities**  
Francesca Assennato, Daniela Smiraglia, Chiara Giuliani,  
Alice Cavalli

## Projects results

- 99 **Roman Riviera Rome Open to the Sea**

## Part 2. Rome and the Tiber

- 109 **Interpreting the River through Kaleidoscopic Glances**  
Bruno Monardo
- 115 **Rome and the (Lost) Landscape of the Tiber**  
Maria Margarita Segarra Lagunes
- 121 **The River Between Space Symbolisation and Place  
Affordances**  
Elena Battaglini

- 127 **The Great Floods of the Tiber River in History**  
Guido Calenda, Corrado Paolo Mancini
- 133 **The Strategic Approach in Planning Water Cities. National and International Best Practices**  
Carmen Mariano
- 139 **Regenerating Cities with Blue and Green Networks. Inspirational Models and Rome Potential**  
Irene Poli
- 145 **The General Masterplan for Rome and the Key Role of the Tiber Strategic Planning Zone**  
Chiara Ravagnan
- 151 **Rethinking the Human-Water Interface for the Tiber and the City of Rome: the PS5 Flood Risk Management Plan**  
Fernando Nardi, Antonio Annis
- 161 **The Tiber River Contract: the Roman Path**  
Luna Kappler
- 169 **The Public Space Around the Tiber Realm**  
Federica Dal Falco
- 173 **The Flaminio District. Historical Plans and Urban Fabric Evolution**  
Bruno Monardo
- 181 **Landscape and Perception Values in the Urban Context of Flaminio**  
Francesca Rossi

# Projects results

187 **Through water**

193 **Let it Tiber**

## Part 3. Rome Aniene River

197 **The Aniene River and the City of Rome**  
Antonio Cappuccitti

203 **The Relationship between the Aniene River and the City of Rome. Current Status and Regeneration Scenarios**  
Antonio Cappuccitti

213 **White and Blue Water and Travertine Landscapes Along the Aniene**  
Elena Paudice

225 **Spaces and Initiatives Along the River Aniene**  
Tullia Valeria Di Giacomo

237 **The Role of Local Association in Improving the Quality of River Spaces**  
Marta Polizzi

245 **Water – and Heat – Resilient Built Environment**  
Simona Mannucci, Federica Rosso

253 **The Quality of Urban Rivers with Respect to the Contaminants of Emerging Concern**  
Camilla Di Marcantonio, Agostina Chiavola, Maria Rosaria Boni

259 **The Problem of Forgotten Peripheral Rivers and Streams in Big Cities**  
Paulina Bone

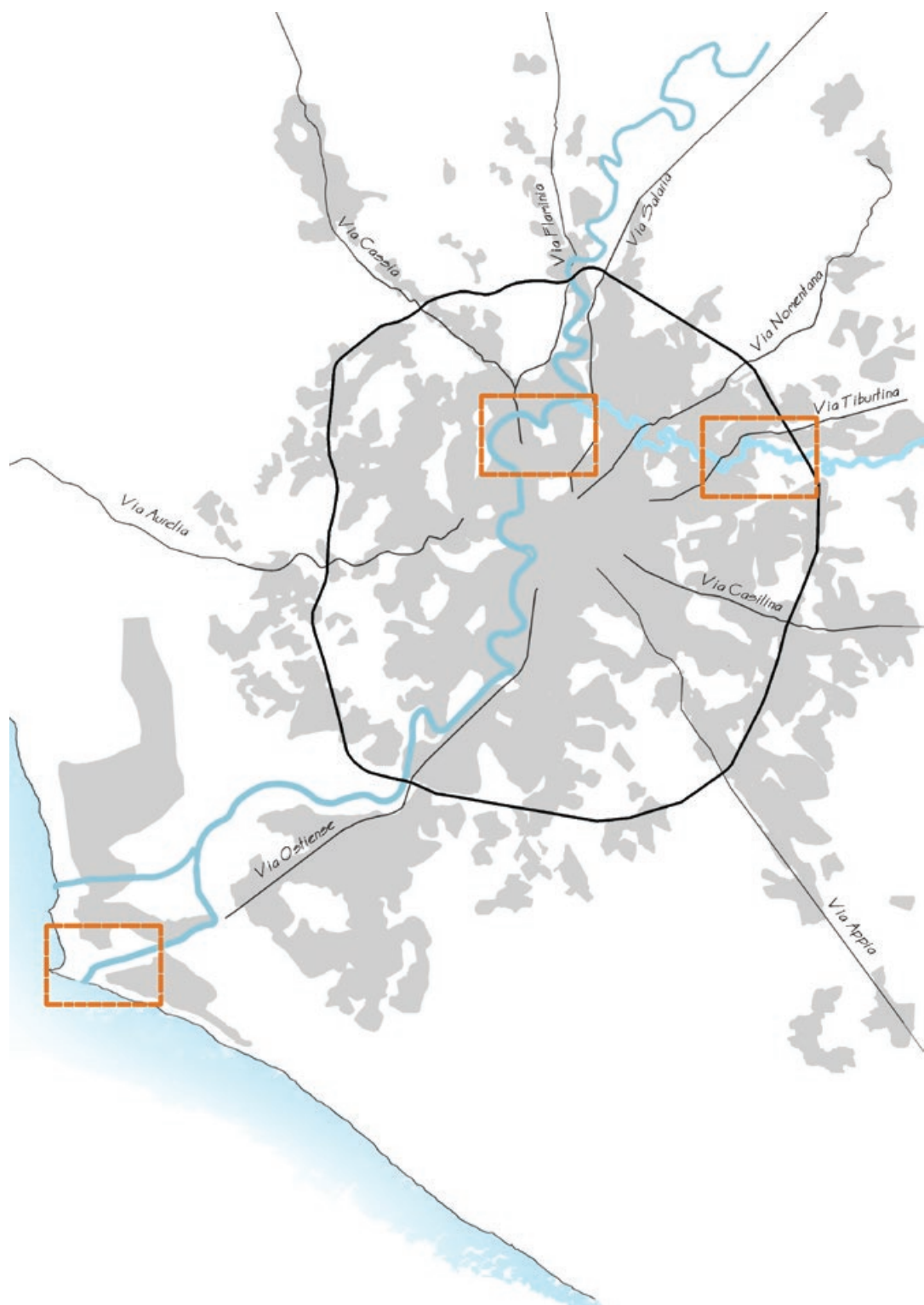
## Projects results

269 **Discovering Aniene**

277 **Permeable Widen Aniene**

## Part 4. Water as a Lifeline for Rome

289 **Urban Watering by Nature: the Romans way.  
A graphic story**  
Germaine Sanders





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# Introduction

## Vulnerability and Opportunity on Waterfront Facing Climate Changing

Waterfront Cities have been struggling with climate change, but are they more vulnerable than other cities?

In recent years the built environment settled along the shore registered major damages from natural disasters and the effects tend to have a growing impact in the next years. At present urban areas near the water are confronted with greater risks, bringing major losses, high maintenance costs and new threats for their communities, thus raising new challenges.

The SOS Climate Waterfront is a H2020 interdisciplinary project, focused on five European cities: Stockholm, Thessaloniki, Gdansk, Lisbon, and Rome facing climate new patterns. Researchers involved in the project aim to identify specific vulnerabilities and envision possible solutions for each city. The research network intends to identify the coming challenges and explore new opportunities for each city enhancing the capacity to develop solutions of resilience by benefiting from the international and interdisciplinary exposure.

The city of Rome is built over a multitude of layers spread out along large periods of time. The eternal city offers a theoretical framework for the present debate that is meaningful to exchange ideas addressing current and future societal, spatial, and environmental challenges. Though poorly equipped to adapt to climate disasters, such as heatwaves, flooding, and rising sea levels, Rome holds an outstanding repository collection of design solutions that have been tested for centuries and that are relevant today.

At present Europe is committed to decarbonize. The United Nations World Population Prospect stipulates that the quality of water services and living conditions in urban areas will decrease due to climatic extreme manifestations. The European Commission claims that the exposure to natural disasters will affect under-equipped cities and their communities thus innovative climate adaptation and mitigation solutions are needed to improve resilience.

Main vulnerabilities emerge with climate extreme manifestations thus strategies of adaptation to new patterns are being implemented. Decarbonization demands decreasing energy consumption, strategies to prevent urban islands' heat effect and the consequent emission of greenhouse gases. It also demands a greener built environment with stronger presence of vegetation and higher permeability of the soil. Impermeable surfaces in urban waterfronts contribute to flooding and pollution of surface waters.

In 2019 the Oslo Triennale discussed the topic “*Enough. The Architecture of Degrowth*” and the Lisbon 2022 Triennale focused on the topic “*Terra*”, both enhancing the importance of reclaiming the balance between humans and the natural environment. The World Congress organised by the International Society of City and Regional Planners in 2020 was dedicated to the “*Post-Oil City: Planning for Urban Green Deals*”. At present degrowth, unbuilding and return to nature are becoming increasingly present in the architectural and urban planning discourse.

Authors such as Pedro Gadanho claim that we will be dealing with the great transition imposed by the urgent need to decarbonize. In his 2022 book *Climax Architecture, how architecture must transform in the age of ecological emergency*, Gadanho argues that emergent new design is inevitable and the process of decarbonizing irreversible. Vishaan Chakrabarti in his 2013 book, *A Country of Cities*, argues that environmental degradation, unsustainable consumption, economic stagnation, rising public health costs and decreased social mobility are threatening the quality of urban life. Density and degrowth are key to enlarging open spaces for the natural environment and enhancement of biodiversity within and around the built environment.

Triennale, Biennale, world congress, authors from various countries share the same concern towards climate emergency. The question is how much change is needed and how long do we have to act. There is an agreement on the main challenges, within a common framework, though solutions are not generic, they are site-specific.

Each neighbourhood requires a delicate approach that holds the knowledge of local historic and geographic circumstances. In Rome, understanding the various scales of urban planning, landscape, architecture, and technology immediately related to water management and the result of previous strategies is required to overcome the gap. The urgent need to collect accurate data on new climatic patterns, learn about the new manifestations, and try to anticipate disasters is present among most of the authors in this book. The main question is how to predict? And to what extent preventive actions, of adaptation and mitigation, are needed?

Throughout the last century, the aim to dominate and control the natural environment has guided most of the decisions on urban waterfronts, both culturally and scientifically. In the 21<sup>st</sup> century there are new parameters to be considered, as new climate patterns challenge the existing infrastructures. Thus, major costs in infrastructure, still being built at present, represent a huge financial effort for the communities and local governmental agencies.

Outdated and unable to deal with new climatic patterns, they raise the urgent need for a new way of thinking, based on a dialogue with nature. This dialogue is dependent on the capacity to listen, observe and engage with contributions. In the first twenty years of the 21<sup>st</sup> century there are still major infrastructures being implemented that follow methodologies from the 20<sup>th</sup> century, driven by the aim to control nature instead of dealing with nature. An approach that does not acknowledge either an interdisciplinary dialogue or the capacity to negotiate and accommodate new patterns.

Some communities settled along the waterfront have been implementing solutions based on interdisciplinary discussions for centuries; there are still some heritage buildings and meaningful public spaces that hold clever solutions and a strong cultural presence along the waterfront. They offer a precious contribution to the present debate. In Rome some territories were redesigned to take benefit from the water, the waterways, maritime activities, and the possibility to moor in the city. When it comes to exploring site specific solutions for the 21<sup>st</sup> century such knowledge is relevant to improve resilience. Resilient thinking can be described as a way of strengthening the urban fabric, boosting urban life and adjusting to new demands. Urban Resilience is the capacity of the systems within a city to mitigate, adapt and grow while taking advantage of crisis or shocks.

The exchange of good practices among the five European cities, brings an added value to the debate. Each being settled on a particular landscape, has been dealing with hydrologic conditions in a unique way. Each holds an elaborated relation with the water, the landfill built over time, offering a handful of urban environments. Together, the five cover a large spectrum of approaches and paradigms. In Rome, layers of history offer theoretical concepts that lead to specific design solutions. However, when it comes to dealing with climatic extreme swings, they face similar challenges as they are unprepared. Singular historic and geographic conditions make Rome's waterfront unique, a result of a narrative of previous generations. Built upon visions to succeed natural forces, cities have domesticated the wild, managed the environment and implemented a unique cultural landscape.

Rome was initially settled over the river *Tiber*, affluent *Aniene* and a few more water streams that attracted humans to settle in the region. Buildings were implemented along a large network of waterways, layers of interventions have shaped the built environment to the present day. Throughout centuries generations of Romans have benefited from these lines of clean water taking advantage of the communities and the access to the Mediterranean Sea.

In the five cities the transformation of the territory brought more buildings, more impermeable areas and consequently higher floods that occasionally devastated the city. The city of Lisbon for instance, suffered an earthquake of 1755, affecting mainly the waterfront neighbourhoods. The deepness of devastation is well documented, built over landfill and sedimented soiled many constructions collapsed and were flooded by the subsequent high tide that reached the areas located along the river. Later in the late 19<sup>th</sup> century, the industrial port built on the river along the city, took in consideration the precedent catastrophe. New buildings had to be prepared for high tides and storms, this wisdom was included in their design. At the ground level materials covering the walls were water-resistant and designed to accommodate flooding. The knowledge of the natural disaster of the 18<sup>th</sup> century influenced the design solutions implemented in the 19<sup>th</sup> century.

In Stockholm the new neighbourhood of Hammarby Sjostad built in the early 21<sup>st</sup> century introduced permeable public spaces to drain the floods. At the scale of the built environment, most buildings have 3 to 5 floors. The density treasures energy efficiency and the public spaces keep the human scale. Most of the buildings use wooden structures.

Public spaces with vegetation, design to privilege pedestrians, soft modes of transport and the relationship with nature. The porosity of public spaces, which drain heavy rainfall and prevent flooding. All waste produced by the inhabitants is recycled in the creation of combustion.

Involvement of the community in the discussion of the program as it develops. Public participation in the development of the project and the implementation of a bottom-up strategy to influence policy decisions.

Lessons from each city offer a broad understanding of past, present, and future solutions that are specific to particular geographies and sensitive to local communities, their urban environments and the local building materials. Crossing visions offer enlightened design to overcome existing vulnerabilities.

This book, dedicated to Rome, is divided into three parts plus one. Part One, *Rome Coastal System*, presents historical approaches and dynamics in progress covering histories and current transformations along the seaside. Part Two, *Rome and the Tiber*, deals with historical perspectives, strategies and transformation programs linked to the most central areas of the city.

Part Three, *Rome Aniene River*, aims to contribute to the rediscovery of the largest tributary of the Tiber, the Aniene, too

often hidden by aggressive urbanisation within the metropolitan part.

Part Four is entirely dedicated to the expressive drawings that were elaborated during the Spring Rome workshop 2022. They clearly realise how important the empathic relationship with places is in order to fully understand their structure and potential in view of their transformation sensitive to the current conditions of climate change.

The authors listed in this book are developing their own research and come from different disciplines. They offer a sharp perception of the present debate on Rome's different waterfront, along the coastline, but also along the two major rivers, Tiber and Aniene. Articles address the role of local authorities, public and private investors; they cover a large spectrum of possibilities, the cultural identity based on historic, geographic, and societal issues addressing the city, and individuals.

It takes different approaches, environmental, social, technological, economic, cultural, each in its own way and aims to protect the Eternal city from catastrophic climate disasters. Each group presents solutions and future strategies, and some of the design proposals demand a new culture to manage and heal the territory. Decarbonization demands profound shifts in the way cities have been organised. The mobilisation of local communities towards more sustainable behaviours, the protection of biodiversity, and the integration of blue and green systems in the urban environment come across several authors.

Some design, landscape, architecture, and urban design illustrated in this book, leads to the urgent need for urban porosity and the necessity to bring nature back to the urban environment. Such an approach incorporates new perspectives to spatial planning at the scale of the city of Rome, rivers Tiber and Aniene. Emerging strategies integrate parameters to reduce energy consumption and shrink the carbon footprint. The results of the research carried out within SOS Climate Waterfront are made available on open access sources through the website of the program, shared database, and the publication of this book which will be also available online.

The aim is to share the outcomes, solutions and strategies that, in many cases, need the support and the mobilisation of civil society. It is meaningful for the research project to disseminate the results, and influence contemporary culture so that waterfront communities may evolve towards more sustainable behaviours, build responsive networks, and protect their local biodiversity.

*Pedro Ressano Garcia, Primary Coordinator of H2020-MSCA-RISE*

## Do Three Different Waterfront Make Rome a City of Water?

Rome is a very special city. Anyway, I know that every city is special...

But Rome is truly a special place where everything is superlative and lasting.

Centuries of history have so many layers and everything seems to exist even before it begins.

The traces of the past mix with the becoming, sometimes slow and in any case never hasty.

Aspirations for change appear indeterminate and are crushed by a present in which abandonment and lack of care seem to dominate.

But now, the *Eternal City* is called upon to find new declinations, although the permanence of the uses remains a constant in many spaces. The radial network of consular roads still draws the guidelines for urban development and is confirmed as the main road mobility network.

The Aurelian Walls keep their profile almost unchanged; the layout of the ancient Roman aqueducts still stands out in the Roman countryside and sometimes resurfaces even within the denser urban fabric. Contrary to the past, however, today water no longer plays an important role and often its presence is hidden by senseless landfill works. Water is no longer a resource, as it was in ancient Roman times, but more and more often it is proving to be a problem to be tackled with modest emergency solutions.

The main critical issues can be summarised in four broad categories, of which the first three pertain to environmental phenomena, while the fourth refers to spatial relationships with places.

*Coastal erosion.* The erosion is mainly concentrated near the mouth of the Tiber River between Ostia and Fiumicino, where the mainly sandy coast is subjected to natural and anthropic pressures. Winds and storms, the presence of currents, sea level rise and soil subsidence, solid supply, and flow rate of watercourses to the sea, are natural components that unfold their effects over the long term. Human interventions are responsible for important changes, a part of which dates to the remodelling of Rome, which became the capital of Italy in 1871. Such as, for example, the construction of the river embankments, the so-called "muraglioni", in the central urban area, about eight kilometres long between Ponte Margherita and Ponte Sublicio, to defend the city from the floods of the Tiber; or the riverbanks of the stretch of the Tiber towards the sea, built in the 1930s to protect the reclaimed land from flooding.

The most consistent and fast transformations, however, took place from the second half of XX<sup>th</sup> century.

The construction of residential buildings and accommodation facilities along the entire coast, the layout of new infrastructures, the development of tourist ports, have led to heavy “disorganic interferences” which have not respected the delicate balance of marine territories and have accentuated their fragility.

Added to these ones, there are a series of alterations that have modified the course of the Tiber, and therefore, the contribution of sediments, including the repeated withdrawals from the riverbed of huge inert used as construction material, the building of hydroelectric plants and dams upstream for flow regulation.

*The floods.* The hydrographic structure of Rome is characterised by a dense network of watercourses in which the two major rivers, the Tiber and the Aniene, and 12 short-length tributaries, called “fossi” are distinguished.

Only some of these watercourses are partially visible within environmental corridors, while most of them have undergone profound changes and are incorporated into sewage collectors because of intense and chaotic urban growth. As a result, the landscape suffers for discontinuous alternations of naturalistic stretches and artificial transformations. Green corridors often abandoned are cut by river alterations like fillings and covers, embankment works and captation plants, even illegal ones, which have deteriorated the entire system.

The sealing of the soil, the poor maintenance of the sewage system and the intensification of meteoric events make the city exposed to urban flooding phenomena, especially in the event of particularly intense rainfall, to which are added non-negligible risks deriving from pluvial flooding, or localised flooding caused by the difficult disposal of rainwater.

*Water crisis.* The effects of climate change, the growing use of water and the increase in water captations, the rise in temperatures combined with prolonged periods of drought, have led in recent years to a critical reduction in the availability of water resources, especially in the summer months.

The flow rates of surface water courses as well as the springs that supply the large aqueducts arriving in Rome, the most populous Italian municipality, are increasingly below the natural levels. Now they are reaching minimum values that do not guarantee the necessary water reserves.

The result is a growing difficulty in the availability of drinking water with important impacts that have repercussions not



only on civic, agricultural, and industrial uses, but also on biodiversity.

*Loss of the relationships of perception and collective enjoyment with the sea and rivers.* The transformation of the soil from a “natural” to an “artificial” use is a problem of great concern because it affects the fragmentation of the territory, the reduction of biodiversity, the alterations of the hydrogeological cycle and microclimatic modifications.

The coastline, which once represented the opening towards the Mediterranean, is today seriously compromised by kilometres of chaotic urbanisation. The predominantly tourist and residential purpose of the buildings, built above all from the 1960s onwards, completely block direct access to the sea and often also prevent its view.

In an urban context, the Tiber River is enclosed by high “muraglioni” which do not allow direct fruition near the water, but only make possible a broad monumental overview. Furthermore, access to water is practically closed upstream and downstream of the central urban area as the embankments are difficult to access. Industrial buildings and shipbuilding areas, private sports clubs, improper uses such as camps for nomad people and logistics areas, tourist and recreational facilities, alternate with residual open cultivated or uncultivated areas which effectively interrupt the ecological continuity of the river area.

Similarly, the banks of the Aniene are practically “hidden” from view and from pedestrian practicability due to a progressive and illegal privatisation which also negatively affects the quality of the water and the maintenance of the floodplain areas.

In the impossibility of dealing with the vast criticalities due to climate change, which is affecting the entire planet, we have therefore tried to summarize some more immediate problems by identifying three emblematic case studies for the Sustainable Open Solutions Climate Waterfront Workshop in Rome 2022.

The three case studies also correspond to the organization of the volume in three parts and refer to three main problems affecting the coastal area and the two river branches of the Tiber and Aniene.

The first case study is related to the coast, a long strip of sand with dunes, where elements of great environmental quality and large archaeological areas remain. These must live with chaotic urban development, with land consumption often caused by tourism and grey infrastructures, with degradation and lack of care.

Very often the sea is not visible from the hinterland or is difficult to reach. It is hidden by poor quality tourist facilities that have privatized the public use of the coast.

The main goal of the first case study is to re-establish the links between the presences of important archaeological ruins, the surrounding landscape, often disqualified, and the sea.

Green and blue infrastructures could be a good solution to systematize archaeological finds, get closer to the sea and implement landscape and hydrogeological interventions to counteract coastal erosion.

The second case study is in a dense urban space, and it relates to the Tiber River.

The construction of the embankments and the Lungotevere has changed the perception of the river, which has “moved away” from everyday life.

Some urban spaces, even very close to the river, have not been able to assume this presence as a design potential. Often, they even deny its presence...

The main objective of the second case study is to propose an urban project capable of rediscovering and structuring the urban landscape, the role of the river and, at the same time, protecting against floods.

The third case study concerns Aniene River, the hidden tributary of Tiber River. Despite having a very long history in the development of the city and its surroundings (just remember Villa d’Este in Tivoli), its presence goes completely unnoticed.

In the eastern part of the city, Aniene crosses the industrial district and is very compromised from an environmental and landscape point of view.

The main objective of the third case study is to make the Aniene River visible. We need to imagine green paths, open points of view, re-naturalize the smaller hydrographical network, and create a blue network to counteract floods and increasing rains. Climate change strongly interacts with a variety of problems deriving from urbanization, water and air pollution, biodiversity loss and degradation of land and marine ecosystems. Coastal areas as well as river edges are today among the priority places in which to tackle climate change with a design approach to create new landscapes, to reconfigure forms of naturalness, to implement the network of green and blue infrastructures to become more adaptive and resilient. That’s what our planet is calling us to do now!

*Claudia Mattogno, Sapienza University of Rome*

**Part 1.**  
**Rome Coastal System**

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**Part 4.**  
**Water as a Lifeline**  
**for Rome**

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# **Urban Watering by Nature: the Romans way**

## A graphic story

Through the eyes of someone from the low lands near the Northsea  
How to translate traditional technique & idea for future urban innovation



Re-use of public materials also in public spaces



Along the Tiber river Roma Portuense



Pipa 150/8 Tiberina



**Let the waters bring salt and sediments for citizens**

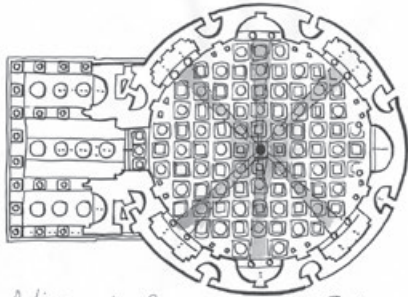
Lifeline to the eternal city of Rome are the Tiber and Aniene rivers. The city of millions from antiquity that after periods of decay, was repeatedly rebuilt with stones from the past and with the grandeur of every own time. The Tyrrhenian Sea, receiving the meandering river water closer to the current city than the sea does now<sup>1</sup>, brought salt up to Rome. Thinking of the Salinae and of the via Salaria will clarify how the value of salt was crucial to the success of settlement between the hills along the river to meet the salt and save it for sale.

Streams flowing from the mountains downwards did not only offer fresh water to the Roman citizens but the Tiber on its way to the sea has flooded the city a lot. The Romans knew how to master these situations.



1. Prof Paolo De Giromamo explains how hydraulic constructions in the Tiber are now causing erosion of the coastline because they do not allow sediment transport towards the sea.





*Antique water flooding system of the Pantheon*



*wet & low ancient historical sustainable Pantheon landscape*

The oldest squares and the Pantheon were located in the lowest parts of the city, and they were built to allow flooding water to be part of the public space. Here people gathered to honour a variety of higher powers.

Water mirrors created special elements of the ritual spaces in monuments and buildings. Or drainage points for rainwater composing a decorative pattern in the floor of, for example, the Pantheon<sup>2</sup>.

Sewerage systems existed separate from clean water supply.

Stepped stone banks of Porto di Ripetta on the Tiber did provide flexible places for trade and for water traffic.

This Baroque River harbour, facing south down the river, is now hidden under the pavement of the actual riverbank cut through by the Muraglione<sup>3</sup>.



2. Prof Guido Calenda (Roma Tre University) explains 40 inundations of Rome in 14 centuries but also asks: "what do we know?"

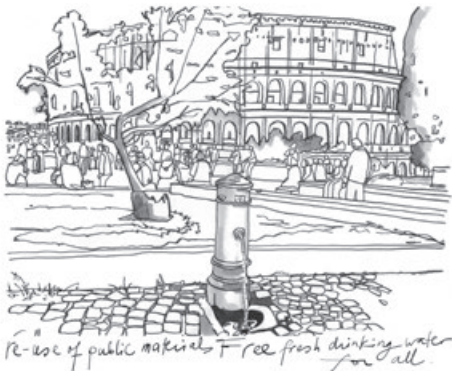
3. Prof Annalisa Metta (Roma Tre University) explains that "Rome is a city in the Tiber and not on the Tiber".



### Multifunctional fountain irrigates the Gianicolo

A marble fountain from the 17<sup>th</sup> century that was created to celebrate the reopening of an old Roman aqueduct became the source to water the Giardini including Sapienza botanical gardens at the hillside. This is just another example of never-ending playing by nature, like the Romans did, knowing that water will always find a way. Meanwhile the streaming connects places and traces of time thus creating new places and spaces to celebrate the soil as well as the water. It is the great idea of natural flow to keep life cycles going. Water to bring energy and spirit for all species to flourish. Only after the flood of 1870 the Tiber got confined<sup>4</sup> between solid high quay walls, in order to prevent future flooding of the city. Rigorous measures that are now being rethought of, with a focus on climate change. However, the question arises whether flooding is the biggest threat to future safety of the city. Although high walls do their protecting job, ultimately, they threaten the value of hospitality for people and also the preservation of the priceless culture of the eternal city. The quay walls are one kind of the defining elements of great infrastructure, as are the city walls, the roads and trails, the hills and villas and of course the Tiber and Aniene rivers.

How strict and solid do the Muraglione need to be?



4. Prof Annalisa Metta (Roma Tre University) explains that: "a caged Tiber is a river that does not exist". Prof Luna Kappler (LUISS University) explains that shared strategy is needed for a river to be a common good".



### Too hot and too dry

Thinking of the future and of climate change does raise the question how risk of flooding can be balanced out with the risk of the city of Rome falling dry and overheated. Summer is very hot now with no end and all over. In Rome you will find symbolic indication of water climate change from time ago. Fishes and boats of all size and shapes, fountains, animals and plants to remind the power of water to change and of the glory of nature. Moving around the newer parts of the city you might bump up to technical indication of climate perception. Not to increase the awareness of climate change much but to stimulate consumption of natural environments. This also could be a challenge to one's imagination. Imagine, while waiting and rushing, the value of nature...

Or to picture common places close by to go to, where would you go?

What would it look like, how must it feel, who will you meet there?

These are questions to be answered to renature the urban climate and keep Rome flexible and future proof.

