

POLITECNICO
MILANO 1863

CITY EXTENSION

Activation and Recombination

Milano, Italy

Author: Mengmeng Wang, Zhuoying Jia
Supervisor: Prof. Stefano Stabilini

Sustainable Architecture and Landscape Design
Master Thesis
12.2023

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ABSTRACT

This thesis focuses on the role of urban analysis at different scales in urban renewal, which ultimately has an impact on site and detail design. The site is located in an urban abandoned site in Milan, Italy, surrounded by various functional areas and crossed by two water systems. Therefore, the focus of the design will be to make full use of the surrounding environment of the site to activate this area.

In the analysis at the city level, the urban ecosystem and road system were analyzed from the three scales of **Macro Scale**, **Meso Scale** and **Micro Scale**, and combined with the guidance of relevant policy documents (*PTM*, *PGT2030*, etc.) and **SDGs**, finally determined activation design of abandoned urban spaces.

Starting from the introduction of urban roads, the design continues the urban texture and connects the diverse functional areas around the site. Urban farming and the renovation of abandoned building have also become the starting point for urban activation and recombination.

In the architectural design, the combination of **Block Topology** is also used, so that a single form can eventually be combined into a variety of spaces.



01 POLICY DOCUMENTS & URBAN ANALYSIS - MACRO SCALE

Policy Documents Analysis
Transportation System
Urban Natural System & Areas of Urban Renewal

Agricultural areas of landscape importance
 Areas of landscape relevance
 Routes of historical and landscape interest

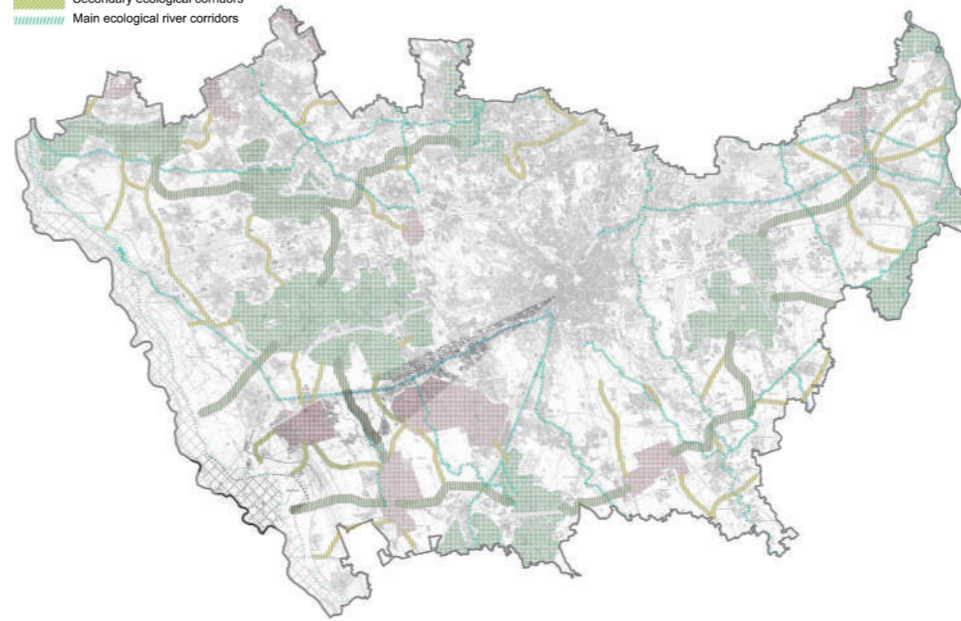


areas of prevailing historical and cultural value

This figure shows that the historical and landscape interest routes are mainly along the canal. Landscape areas and agricultural areas are less distributed in the northwest and more in the northeast and southwest.

The site axis contains many historical and landscape interest routes. And the landscape areas and agricultural area are distributed along the canal. So it has good historical and landscape value.

Primary ganglia
 Secondary ganglia
 Primary ecological corridors
 Secondary ecological corridors
 Main ecological river corridors

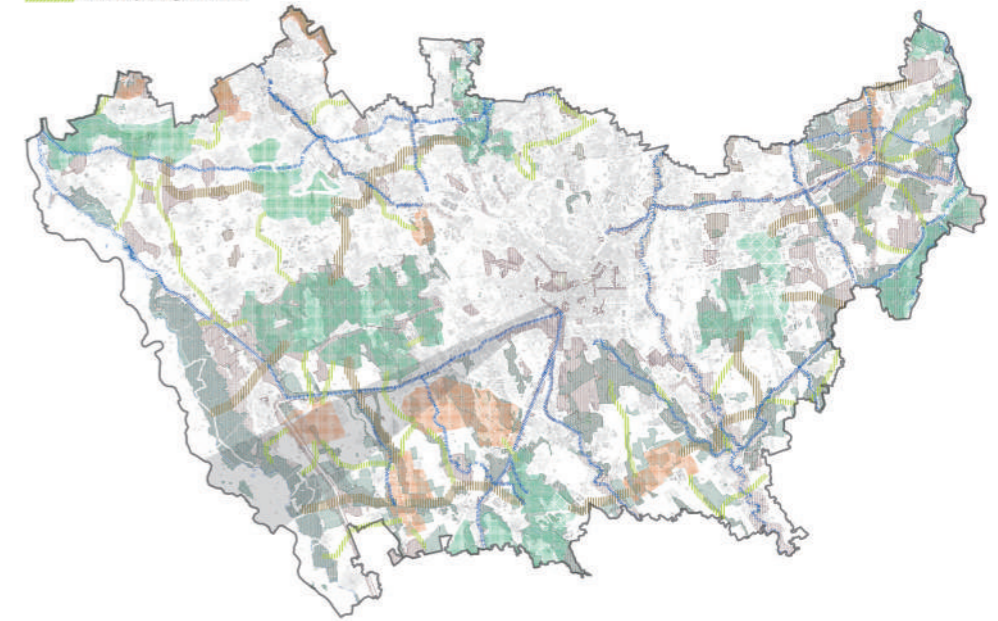


elements of the urban ecological network

This map is mainly from PTM document. The primary ganglia are scattered around Milan, forming the largest primary ganglia in the West. The secondary ganglia are mainly distributed in the south, and each ganglia is connected by ecological corridors.

Within this axis, there are mainly secondary ganglia and secondary ecological corridors, and the secondary ecological corridors span the canal.

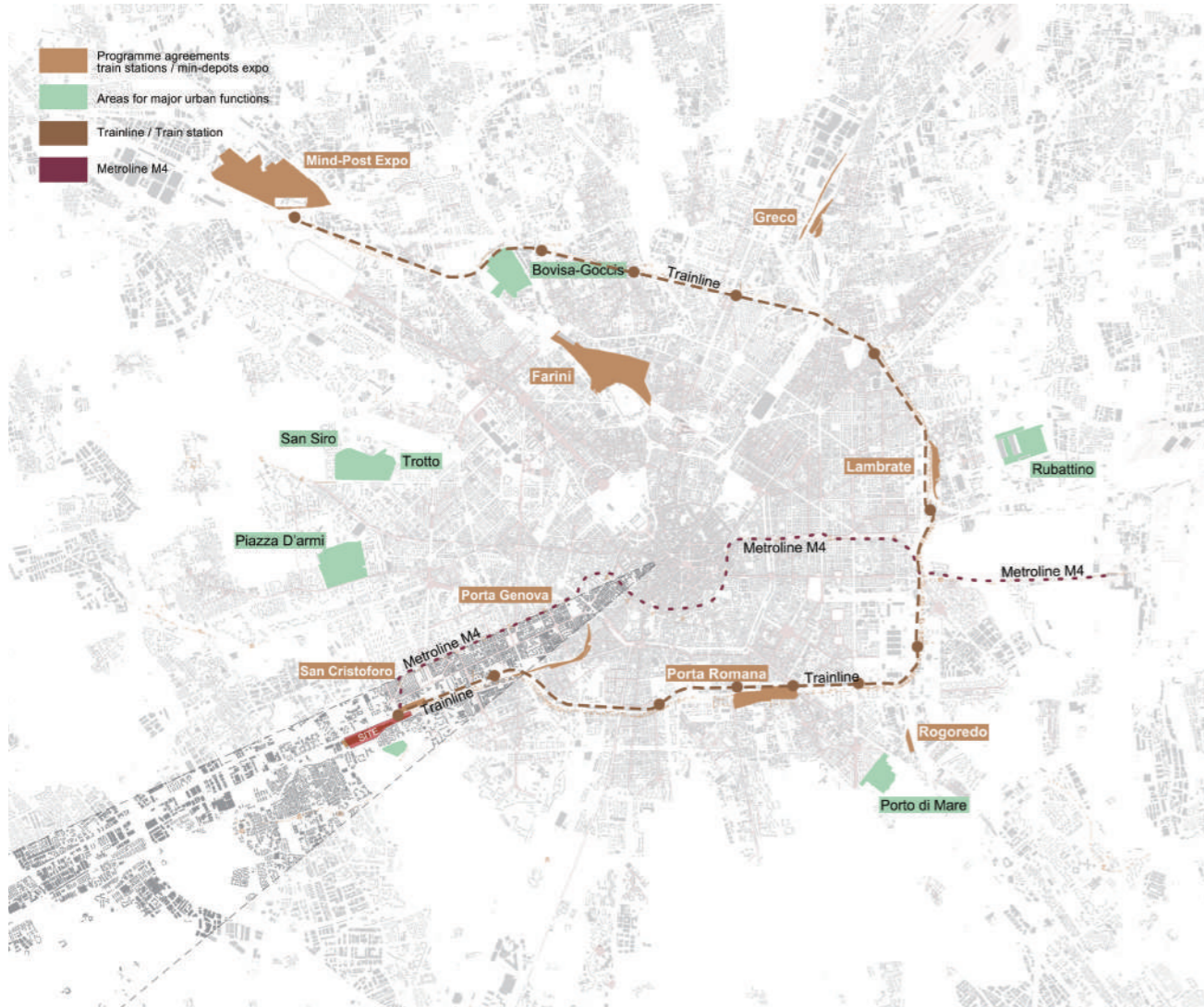
Primary ganglia
 Secondary ganglia
 Primary ecological corridors
 Secondary ecological corridors
 Main ecological river corridors
 Agricultural areas of landscape
 Areas of landscape relevance



synthesis map

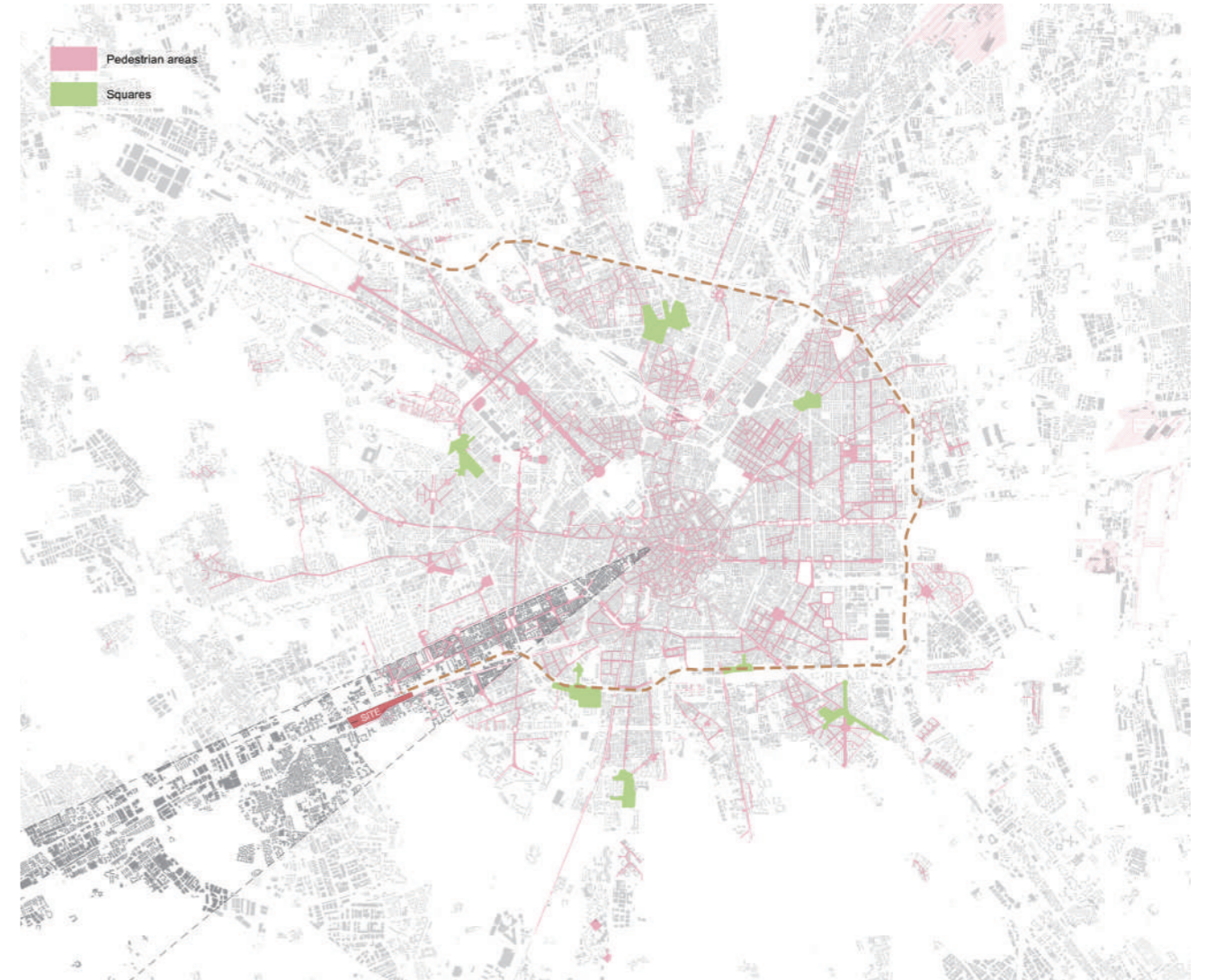
Generally speaking, there are abundant ecological networks in this axis. But it lacks vertical ecological corridor. And there is a lack of connectivity among ecological corridors.

TRANSPORTATION SYSTEM



railway and metro lines

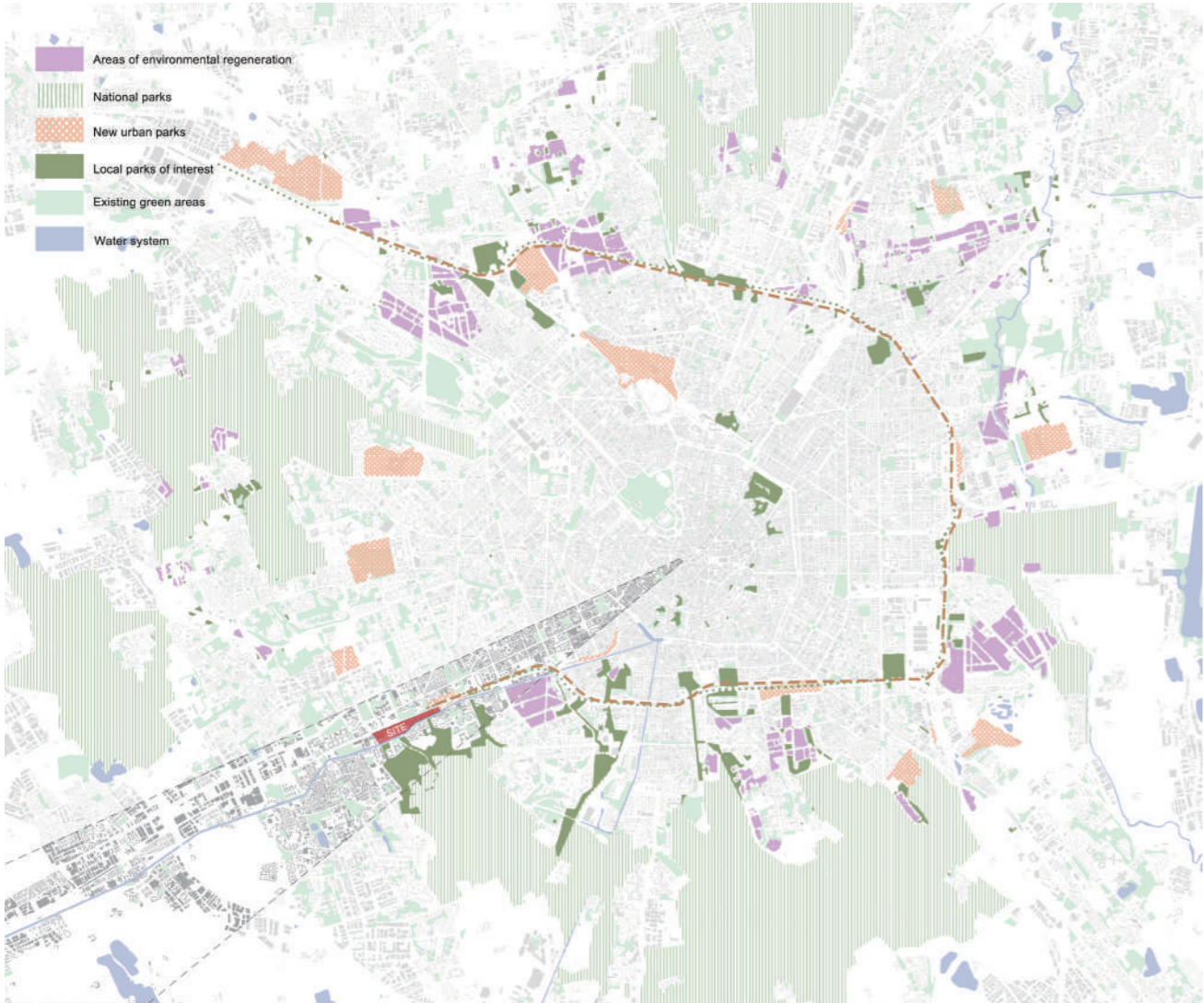
The 13 railway stations connect the main landscape area in the city and focus on our site. This is the intersection of the planned Metro Line 4 and one of the 13 railway stations, it will have a lot of potential people here.



pedestrian system

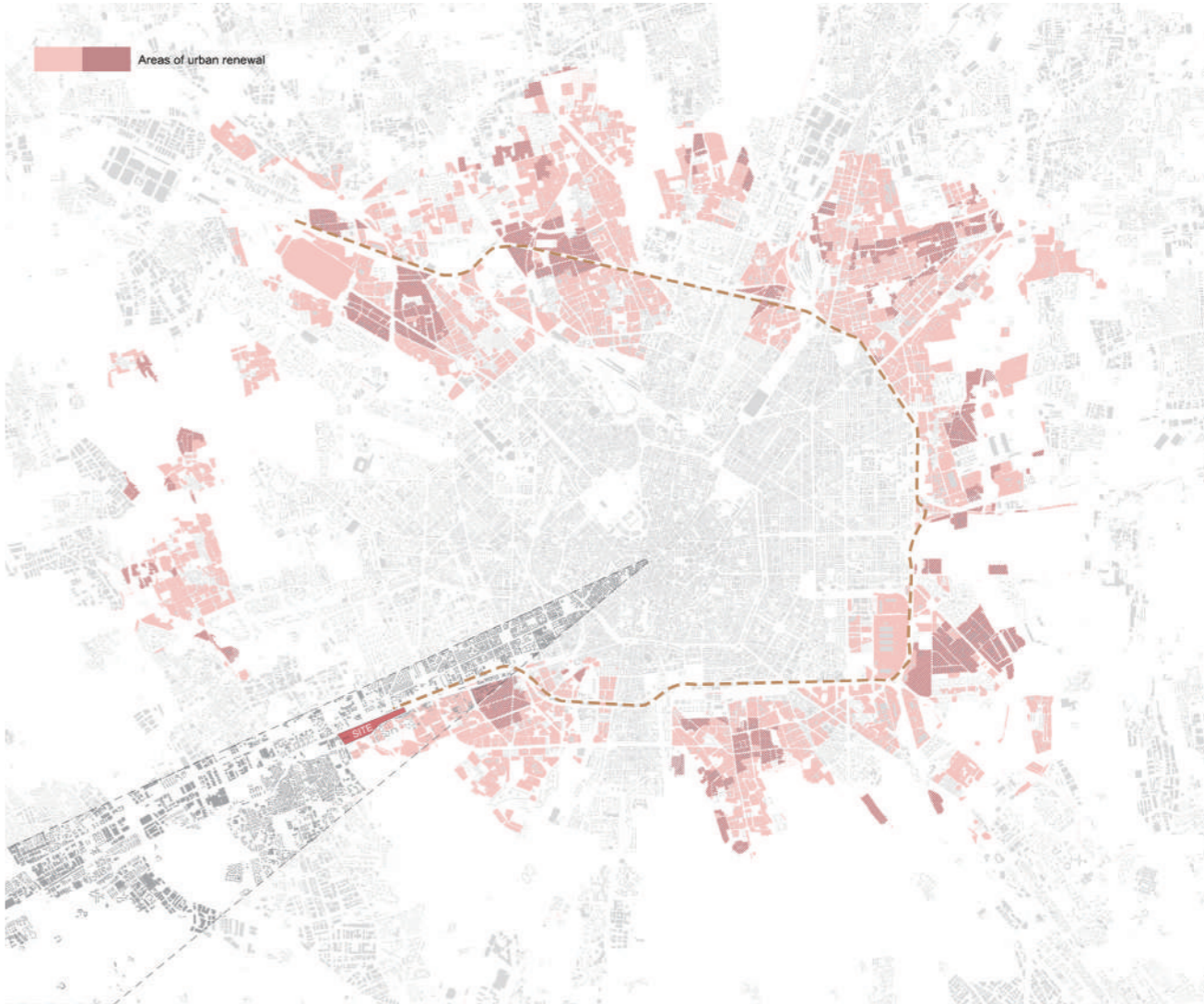
The figure shows that the pedestrian are concentrated in the city center, and the location of the site happens to be the main pedestrian break, that is, the site should become a hub connecting the city and the suburbs.

URBAN NATURAL SYSTEM & AREAS OF URBAN RENEWAL



urban natural system

This Milan's natural systems are mainly from PGT2023, distributed along the railway lines and are concentrated on the outskirts of the city. There are a large area of local parks of interest on the south side of the design site, and there are also water systems passing through. This is the future plan, so it reflects the strong ecological value of the site.



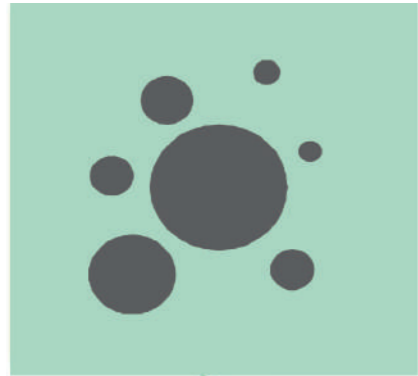
areas of urban renewal

The urban renewal area is still distributed along the railway, and has a large area around the site. Combined with the previous analysis, it can be concluded that this area needs to be renewed.



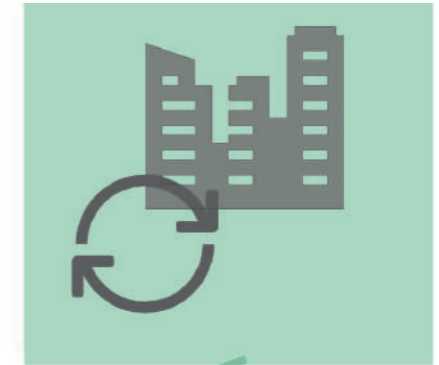
02 URBAN CHALLENGES - SDGS - ES

Urban Challenges
Sustainable Development Goals
Ecosystem Services



WATER MANAGEMENT

Improvement of water system related to naviglio grande and its uses. Effectively managing ground and surface water resources for domestic, agricultural, commercial, industrial recreational and ecological uses .

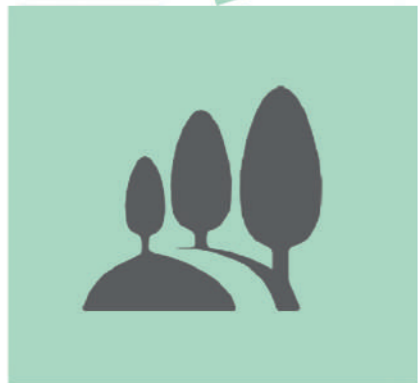


URBAN UPGRADING

The axis consists of a number of abandoned and low quality areas along the canal and in between the railway line and canal. The challenge is to regenerate these areas to define new relationships between them and the city.



CHALLENGES



INTEGRATION OF AGRICULTURAL LANDSCAPES

Preserving and incorporating the agricultural heritage of Parco Agricolo SUD into the city



ECOLOGICAL CONNECTIVITY

Connection of the fragmented ecological areas into a continuous system from urban core of the city to rural areas and also across the existing ecological corridor .

SUSTAINABLE DEVELOPMENT GOALS



GOOD HEALTH AND WELL-BEING

Ensure healthy lives and promote well-being for all at all ages



CLEAN WATER AND SANITATION

Ensure availability and sustainable management of water and sanitation for all



INDUSTRY, INNOVATION AND INFRASTRUCTURE

Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation



SUSTAINABLE CITIES AND COMMUNITIES

Make cities and human settlements inclusive, safe, resilient and sustainable



CLIMATE ACTION

Take urgent action to combat climate change and its impacts



LIFE ON LAND

Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

SELECTED SDGS / SUB TARGETS



Sub targets 3.6



By 2020, halve the number of global deaths and injuries from road traffic accidents

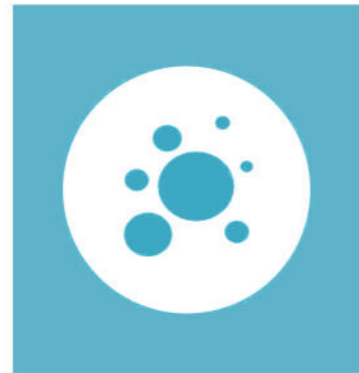
Sub targets 3.9



By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination



Sub targets 6.9



By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies



Sub targets 9.1



Develop quality, reliable, sustainable and resilient infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all



Sub targets 11.2



Provide access to safe, affordable, accessible and sustainable transport systems for all

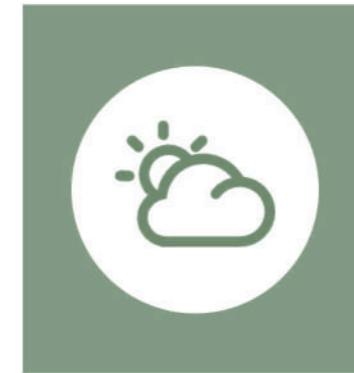
Sub targets 11.7



Provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities



Sub targets 13.1



Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters



Sub targets 15.1



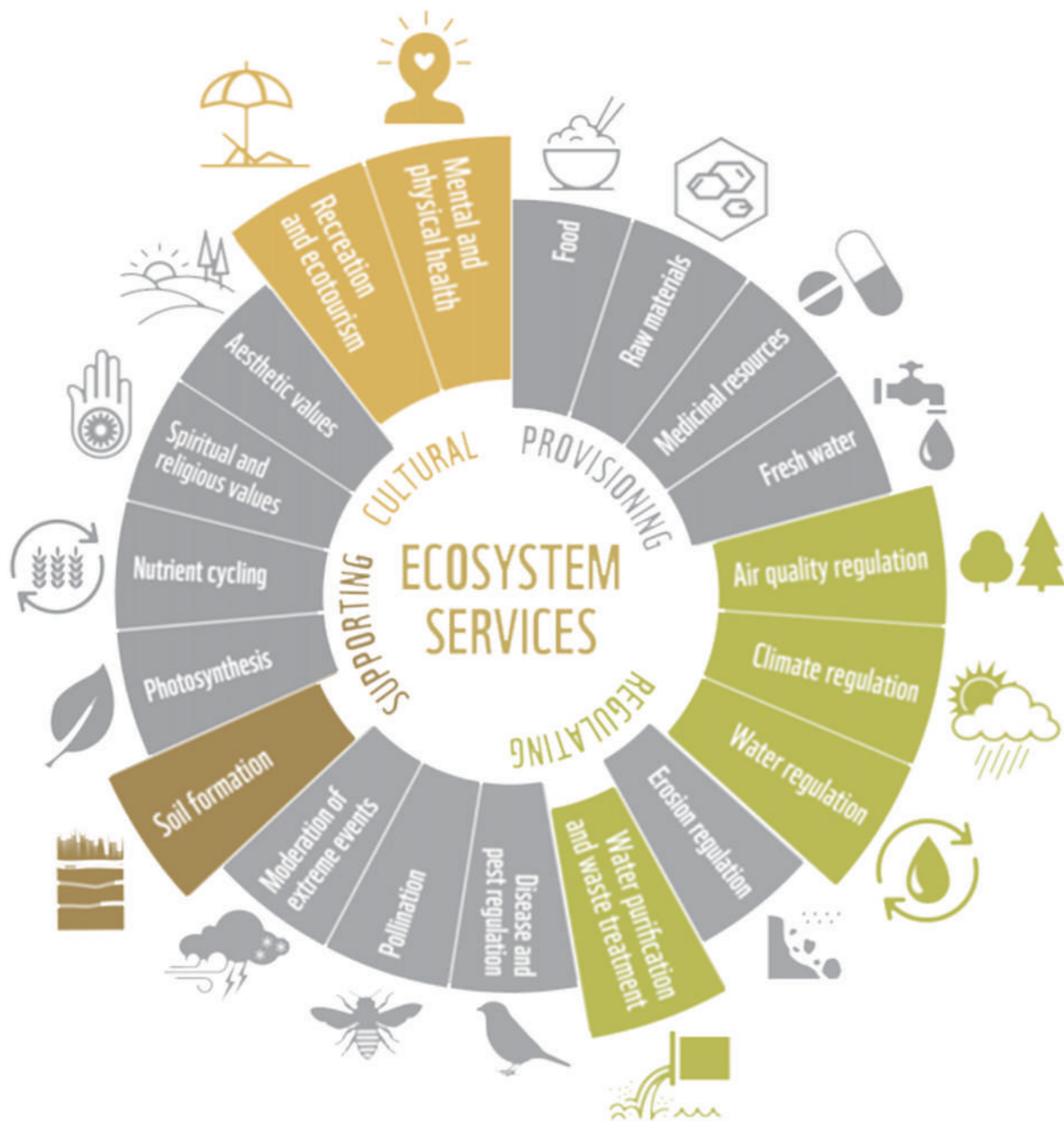
Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services

Sub targets 15.5



Reduce the degradation of natural habitats, halt the loss of biodiversity

ECOSYSTEM SERVICES



CULTURAL SERVICES
Mental and physical health



CULTURAL SERVICES
Recreation and ecotourism



REGULATING SERVICES
Air quality regulation



REGULATING SERVICES
Climate regulation



REGULATING SERVICES
Water regulation



REGULATING SERVICES
Water purification and waste treatment



SUPPORTING SERVICES
Soil formation

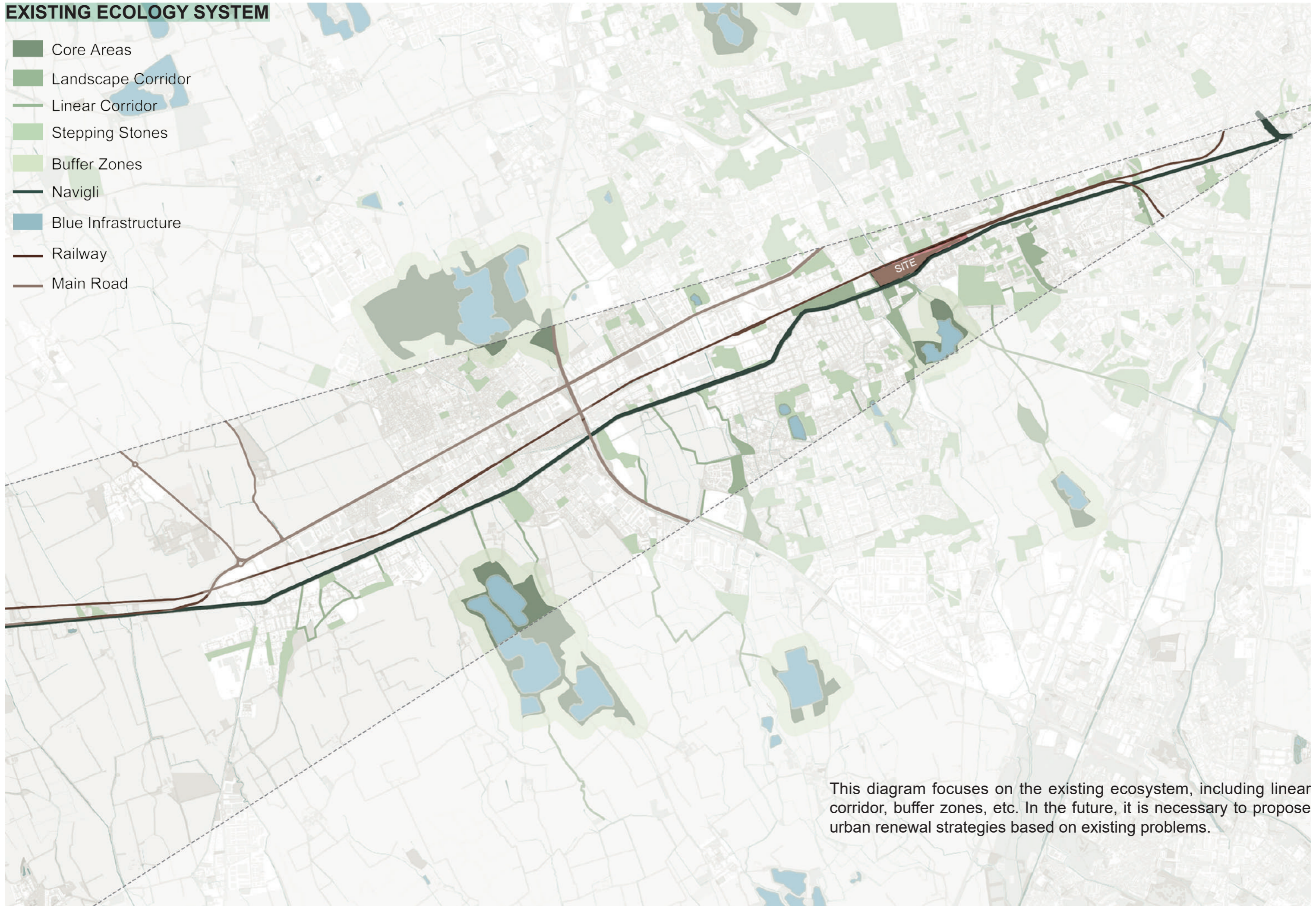


03 URBAN ANALYSIS - MESO SCALE

Existing Ecology System
Green Infrastructure Strategy
Challenge Map
Nature - Based Solutions

EXISTING ECOLOGY SYSTEM

- Core Areas
- Landscape Corridor
- Linear Corridor
- Stepping Stones
- Buffer Zones
- Navigli
- Blue Infrastructure
- Railway
- Main Road



This diagram focuses on the existing ecosystem, including linear corridor, buffer zones, etc. In the future, it is necessary to propose urban renewal strategies based on existing problems.

GREEN INFRASTRUCTURE STRATEGY

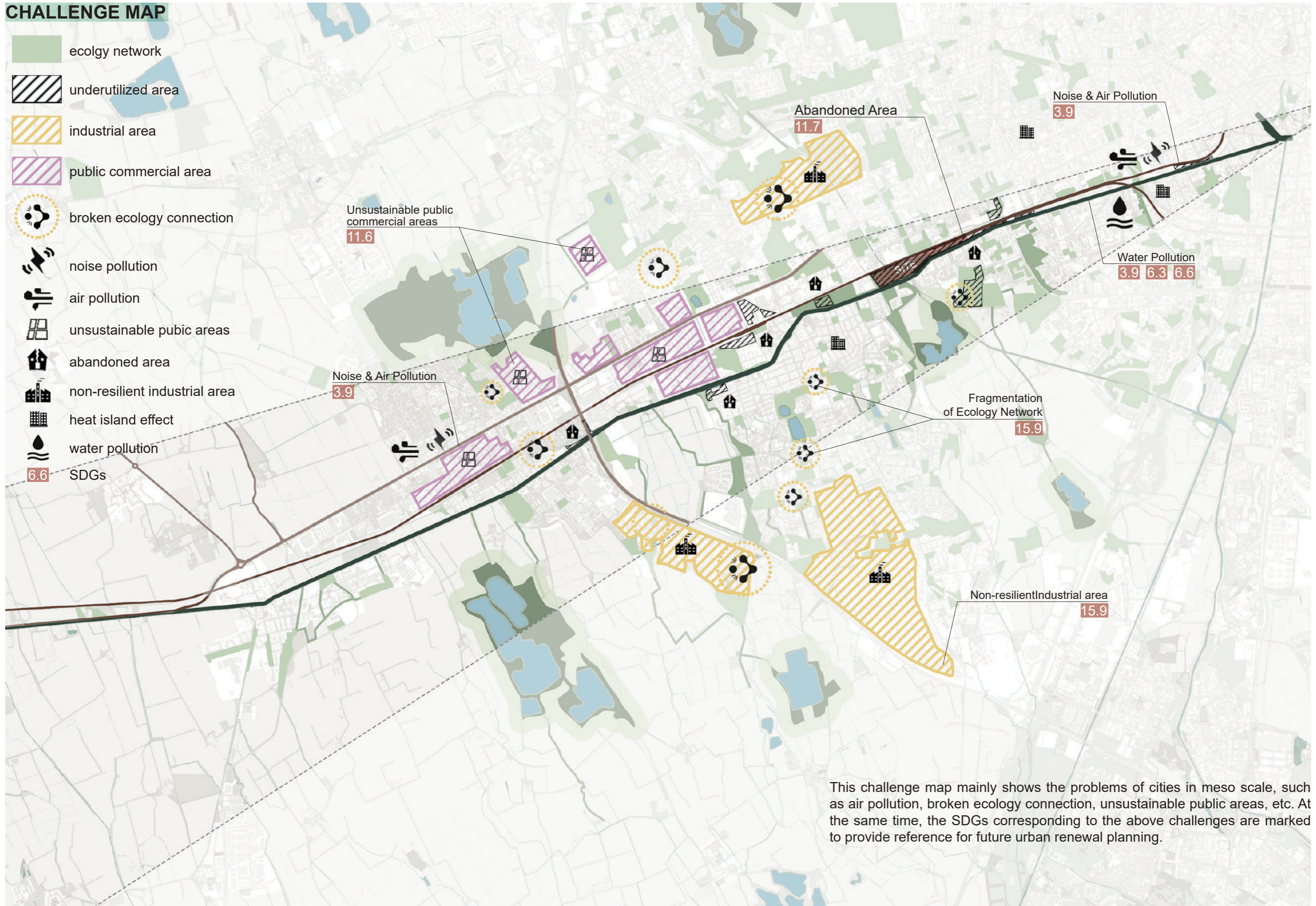
- Core Areas
- Landscape Corridor
- Linear Corridor
- Stepping Stones
- Navigli
- Blue Infrastructure
- Proposed Landscape Corridor
- Proposed Stepping Stones
- Proposed Landscape Bridge
- Railway
- Main Road



Green infrastructure strategy is the main update content of the city proposed for the existing ecology system, including proposed landscape bridge, proposed stepping stones, etc., and it is a guide for design from a larger urban scale.

CHALLENGE MAP

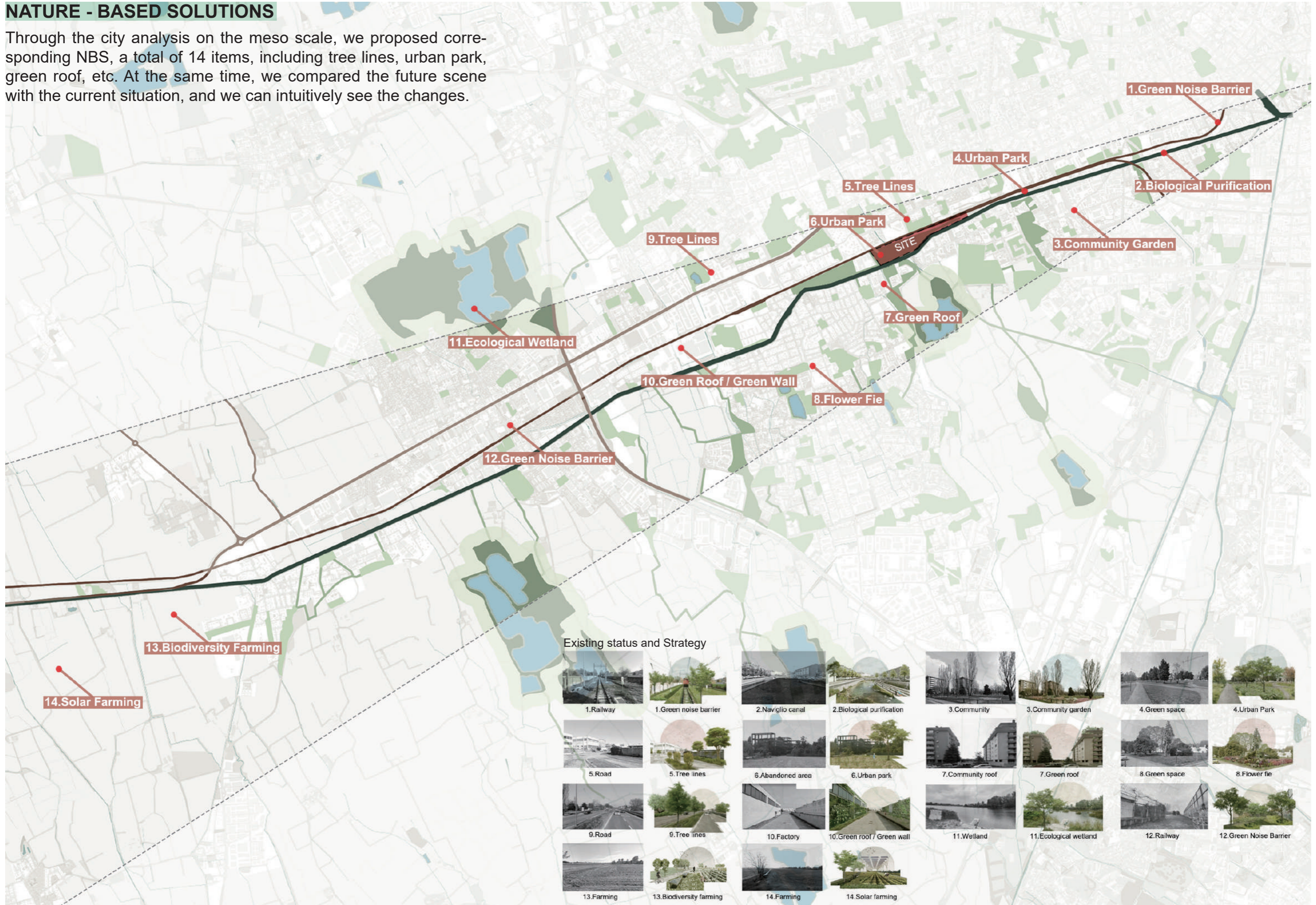
-  ecology network
-  underutilized area
-  industrial area
-  public commercial area
-  broken ecology connection
-  noise pollution
-  air pollution
-  unsustainable public areas
-  abandoned area
-  non-resilient industrial area
-  heat island effect
-  water pollution
-  SDGs



This challenge map mainly shows the problems of cities in meso scale, such as air pollution, broken ecology connection, unsustainable public areas, etc. At the same time, the SDGs corresponding to the above challenges are marked to provide reference for future urban renewal planning.

NATURE - BASED SOLUTIONS

Through the city analysis on the meso scale, we proposed corresponding NBS, a total of 14 items, including tree lines, urban park, green roof, etc. At the same time, we compared the future scene with the current situation, and we can intuitively see the changes.

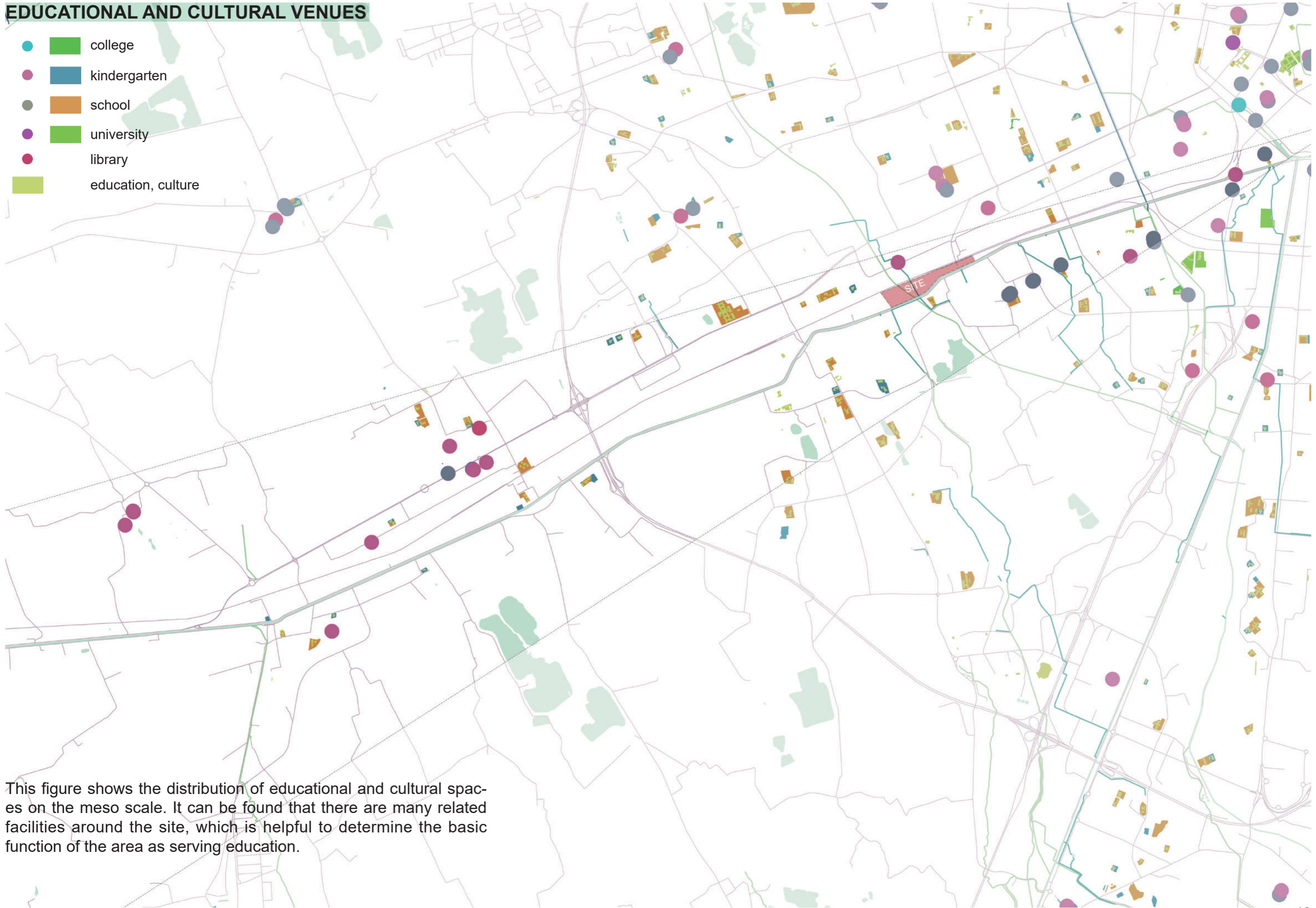


Existing status and Strategy



EDUCATIONAL AND CULTURAL VENUES

- college
- kindergarten
- school
- university
- library
- education, culture



This figure shows the distribution of educational and cultural spaces on the meso scale. It can be found that there are many related facilities around the site, which is helpful to determine the basic function of the area as serving education.



04 URBAN ANALYSIS - MICRO SCALE

Boundary Map / Accessibility Map
Functional Area Around the Site
Challenge Map
SWOT Analysis

BOUNDARY MAP / ACCESSIBILITY MAP



boundray map

Although there are many road systems around the area, such as railways, highways, and roads along the river, it is difficult to enter the site, making the site isolated as an "isolated island".

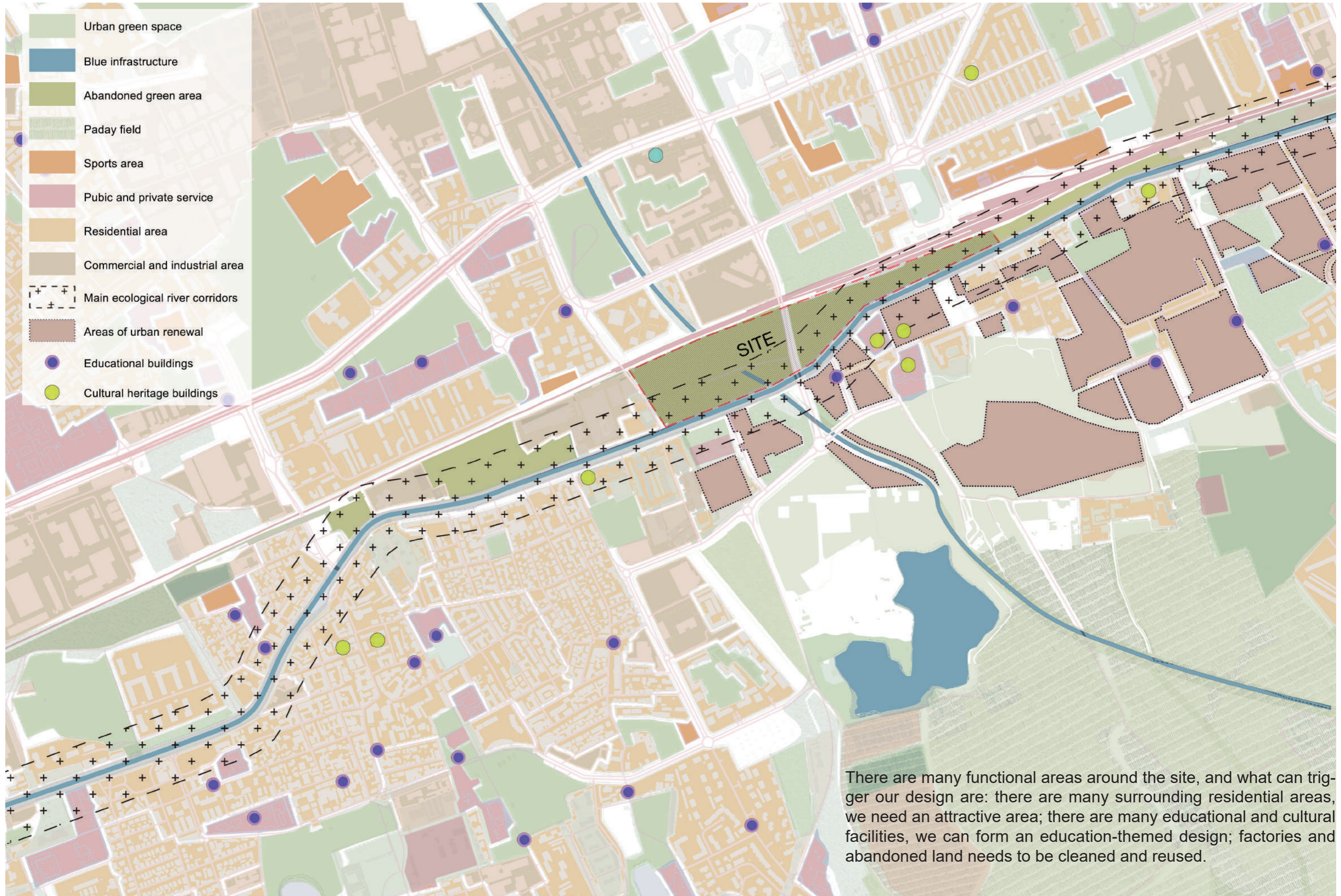
Therefore, in the future design, urban roads need to be introduced into the site to form a complete road system.



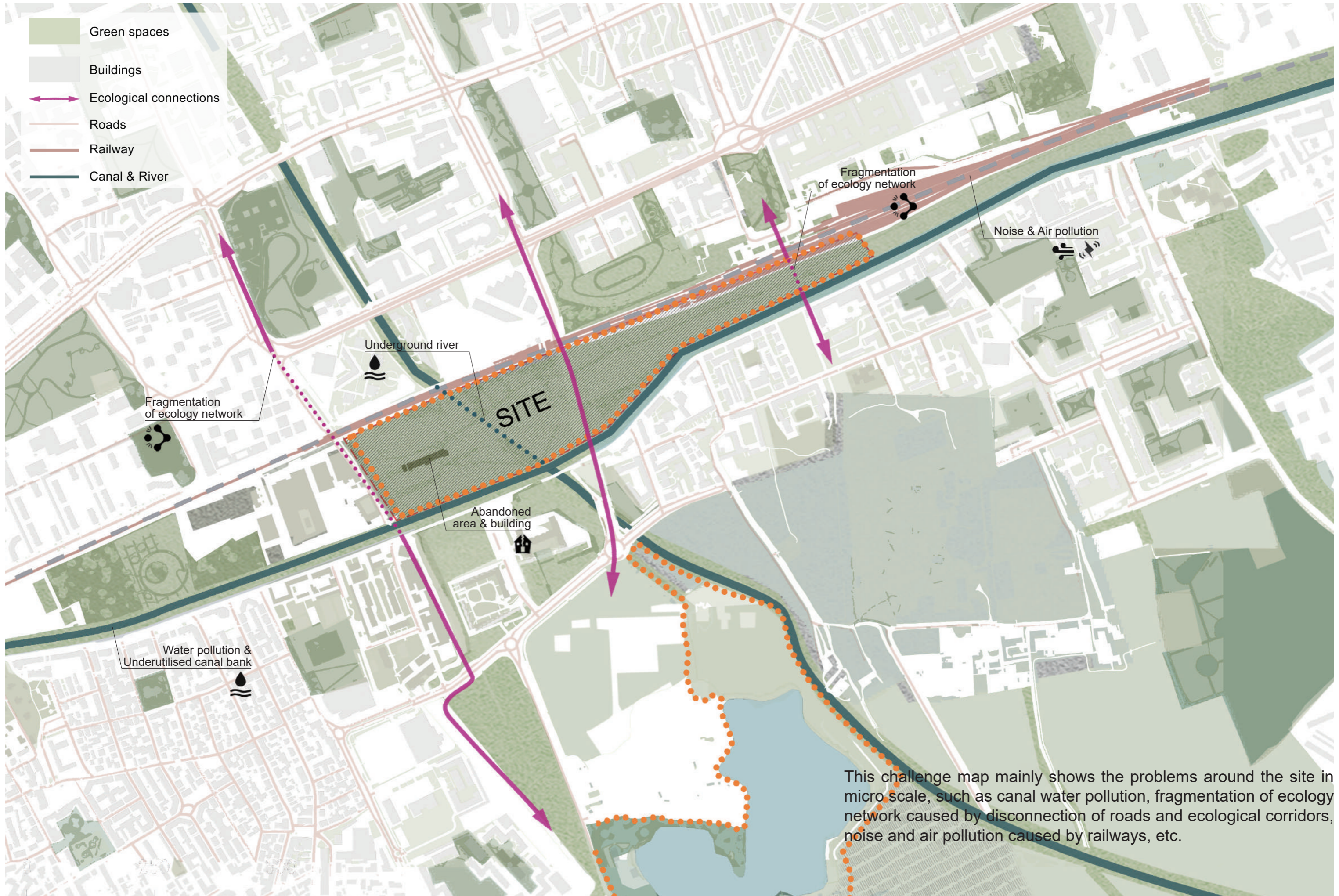
accessibility map

There are only two existing road systems that can be used by people: one is an underground passage on the left side of the site, which connects the residential area on the north side and has a strong connection; however, the other requires people to enter the site via a viaduct, but the entrance and exit of the viaduct is far from the site and very unsafe, so the road may be removed in the future.

FUNCTIONAL AREA AROUND THE SITE



CHALLENGE MAP



This challenge map mainly shows the problems around the site in micro scale, such as canal water pollution, fragmentation of ecology network caused by disconnection of roads and ecological corridors, noise and air pollution caused by railways, etc.

SWOT ANALYSIS

S

STRENGTHS

- Good water system, two canals intersect in the site
- Green areas spread across the area
- The site is surrounded by cultural and educational functions

W

WEAKNESSES

- ↔ Presence of Highway and Railway lines
- Connection between existing overpass and site
- Noise and air pollution created close to the highway and railway
- Water pollution of the Naviglio
- Isolated abandoned buildings

O

OPPORTUNITIES

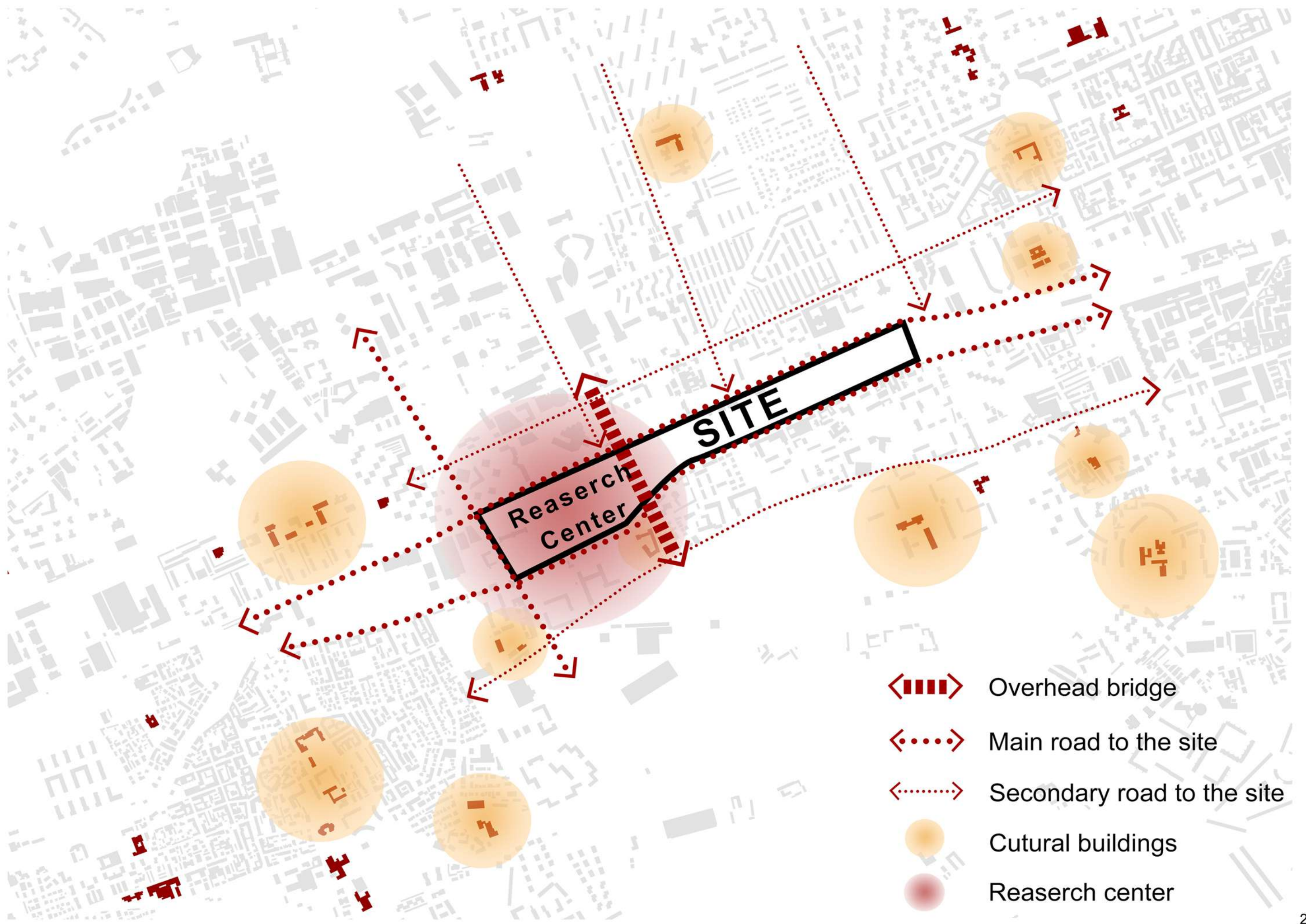
- Abundant green systems on the north and south sides of the site
- Spread residential areas
- Blue areas around the area






T

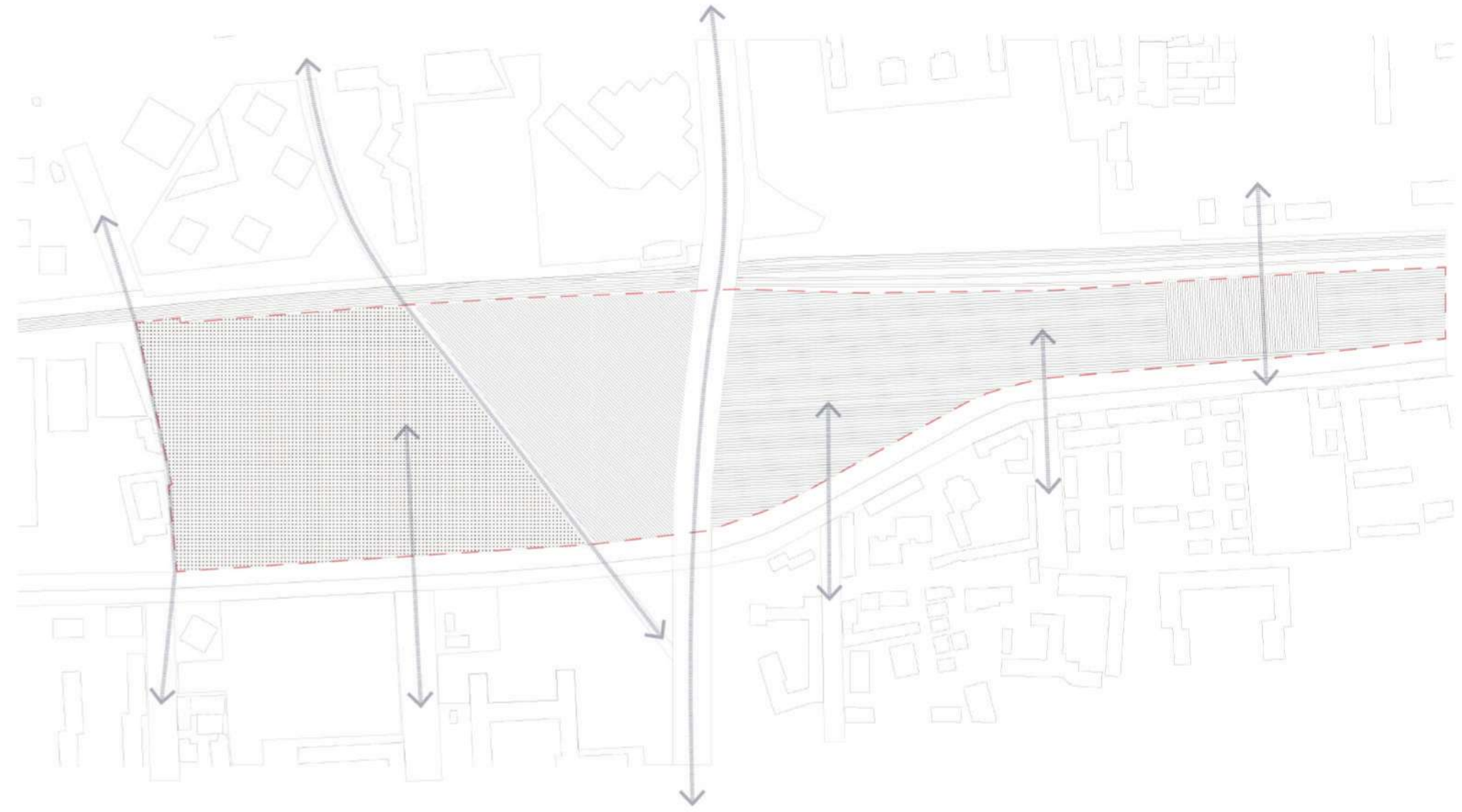
THREATS

- ↔ Fragmentation due to the railway and highway
- ↔ Pedestrian access across the Naviglio is less
- Industrial area



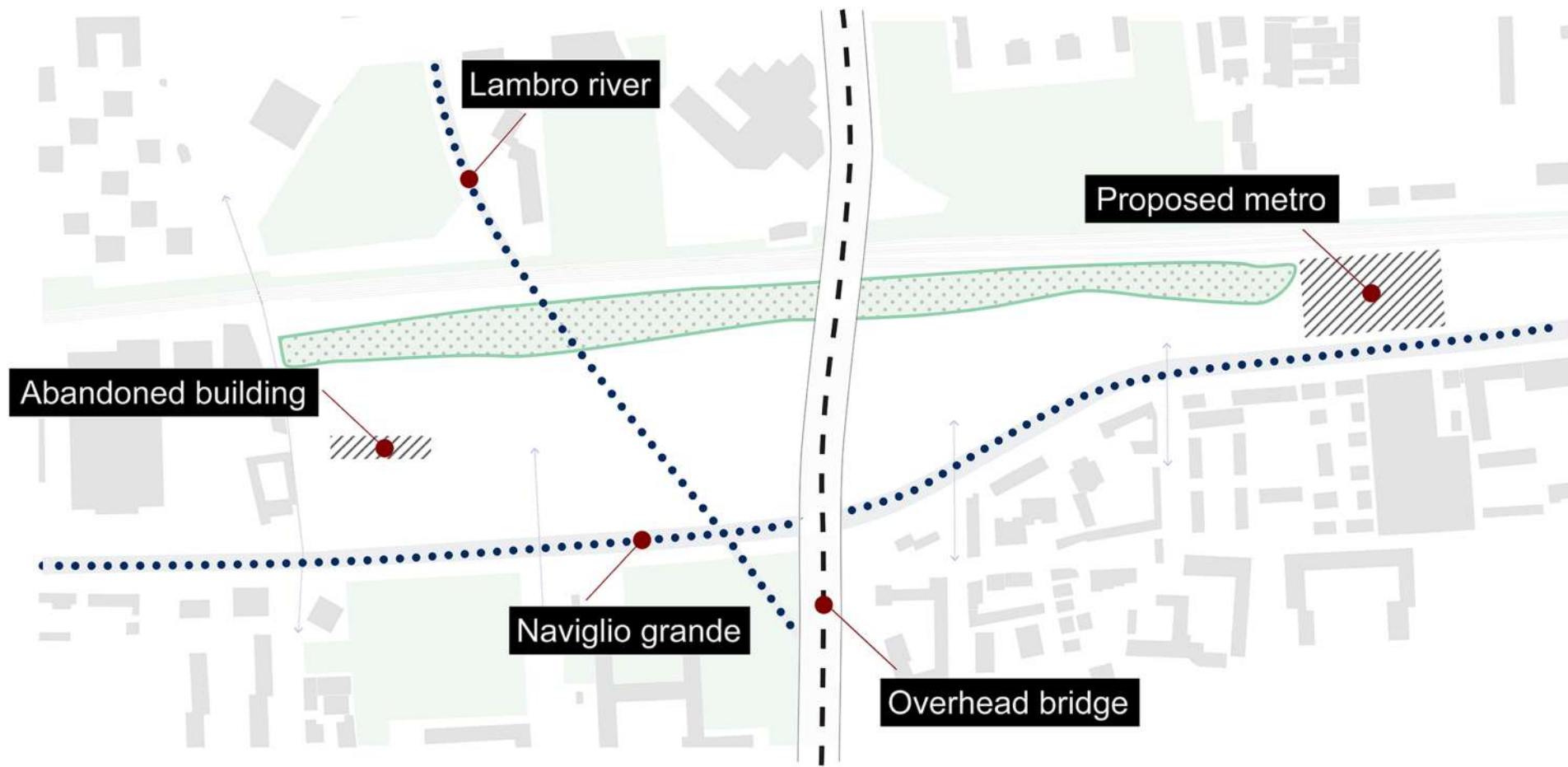


-  Overhead bridge
-  Main road to the site
-  Secondary road to the site
-  Cultural buildings
-  Reaserch center

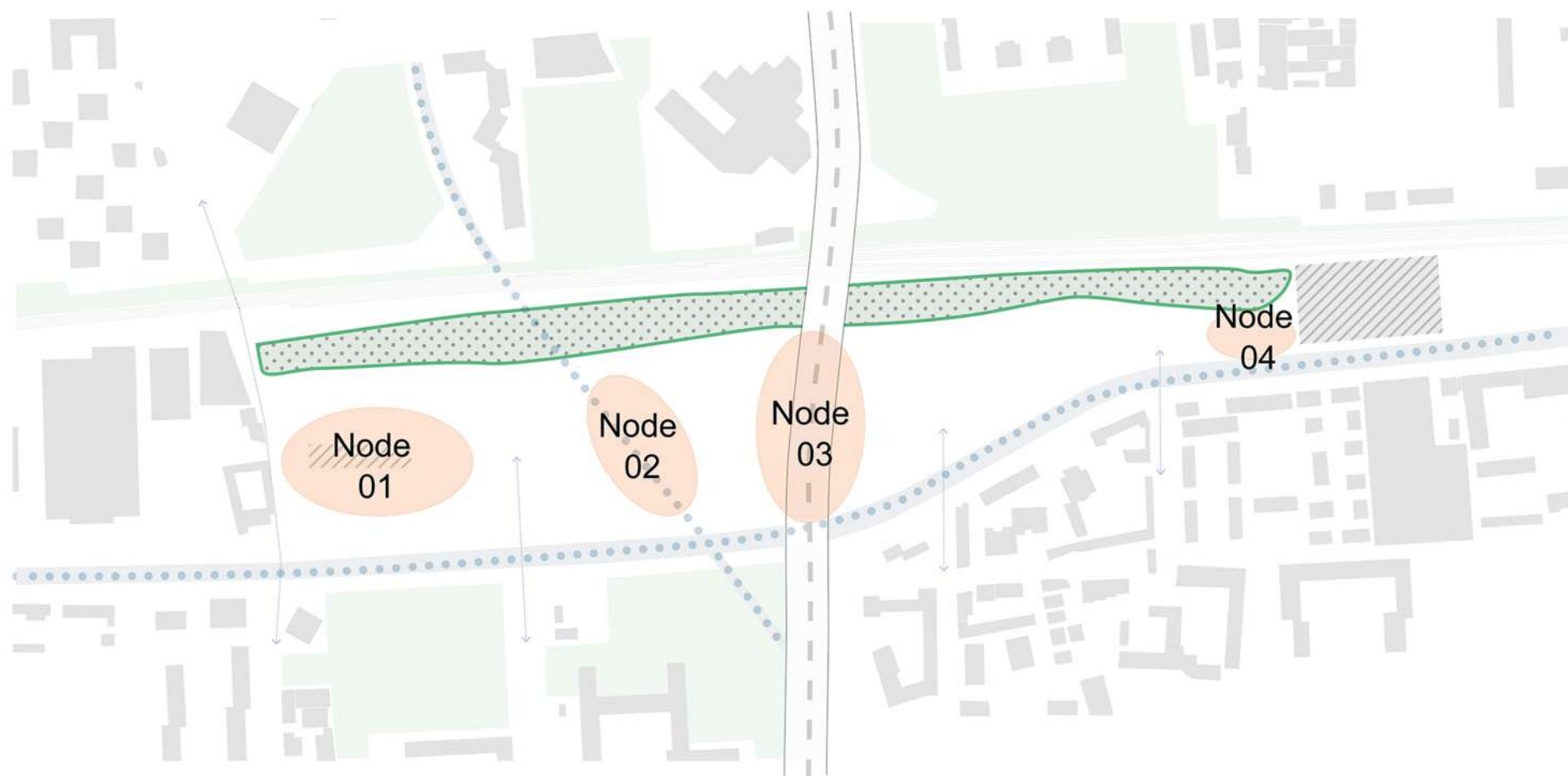


05 DESIGN STRATEGY

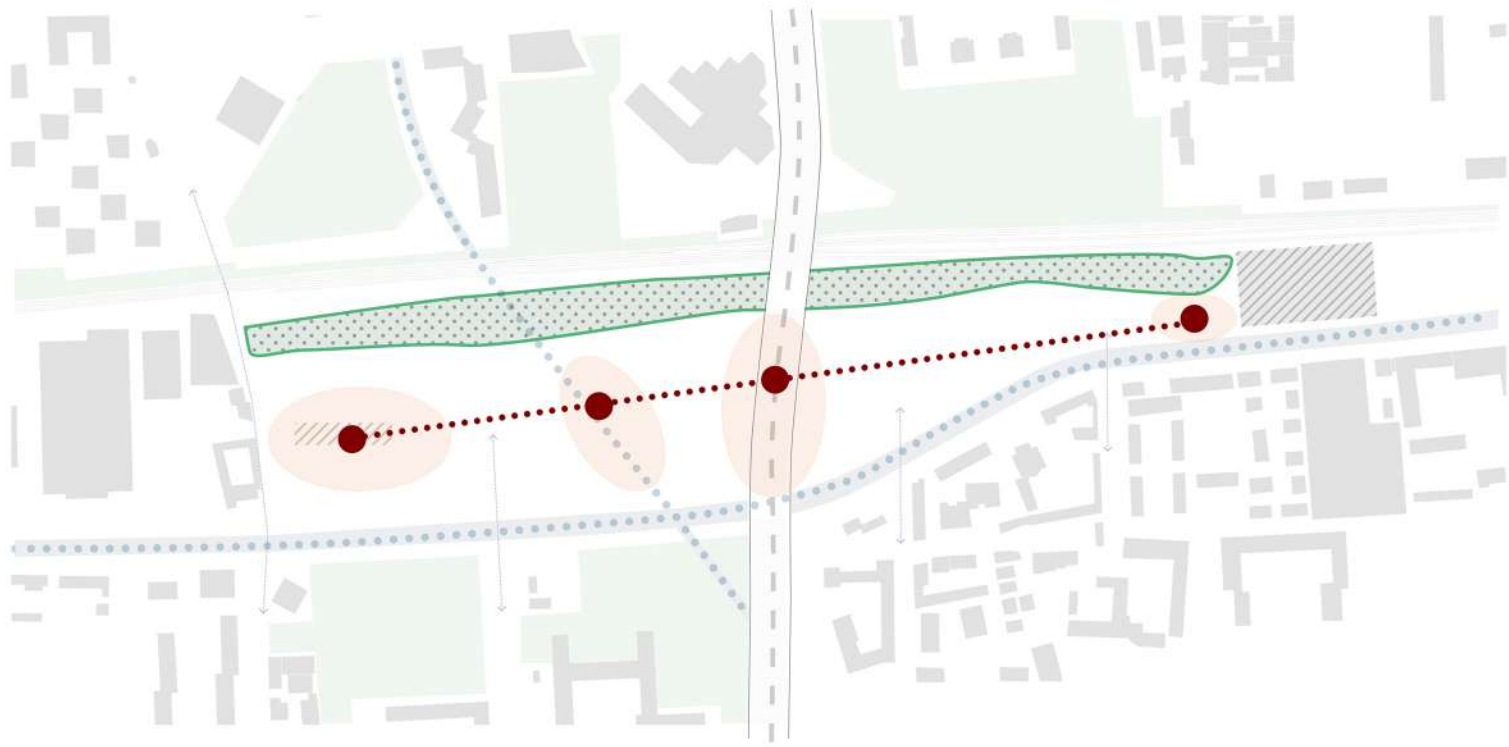
Urban Fabric Extension
Site Design - Functional Division



Identify important elements in the site.



Set up four focal landscape nodes spaces based on elements in the site.



Identify the shortest path among the four focal landscape nodes.



Extend the city texture to the site.



The main walkway.



The secondary walkway.

SITE DESIGN - FUNCTIONAL DIVISION



functional area of the site

According to the shape of the main road, the "grid" method is used to divide the site into more detailed functional divisions based on the three main functional areas.

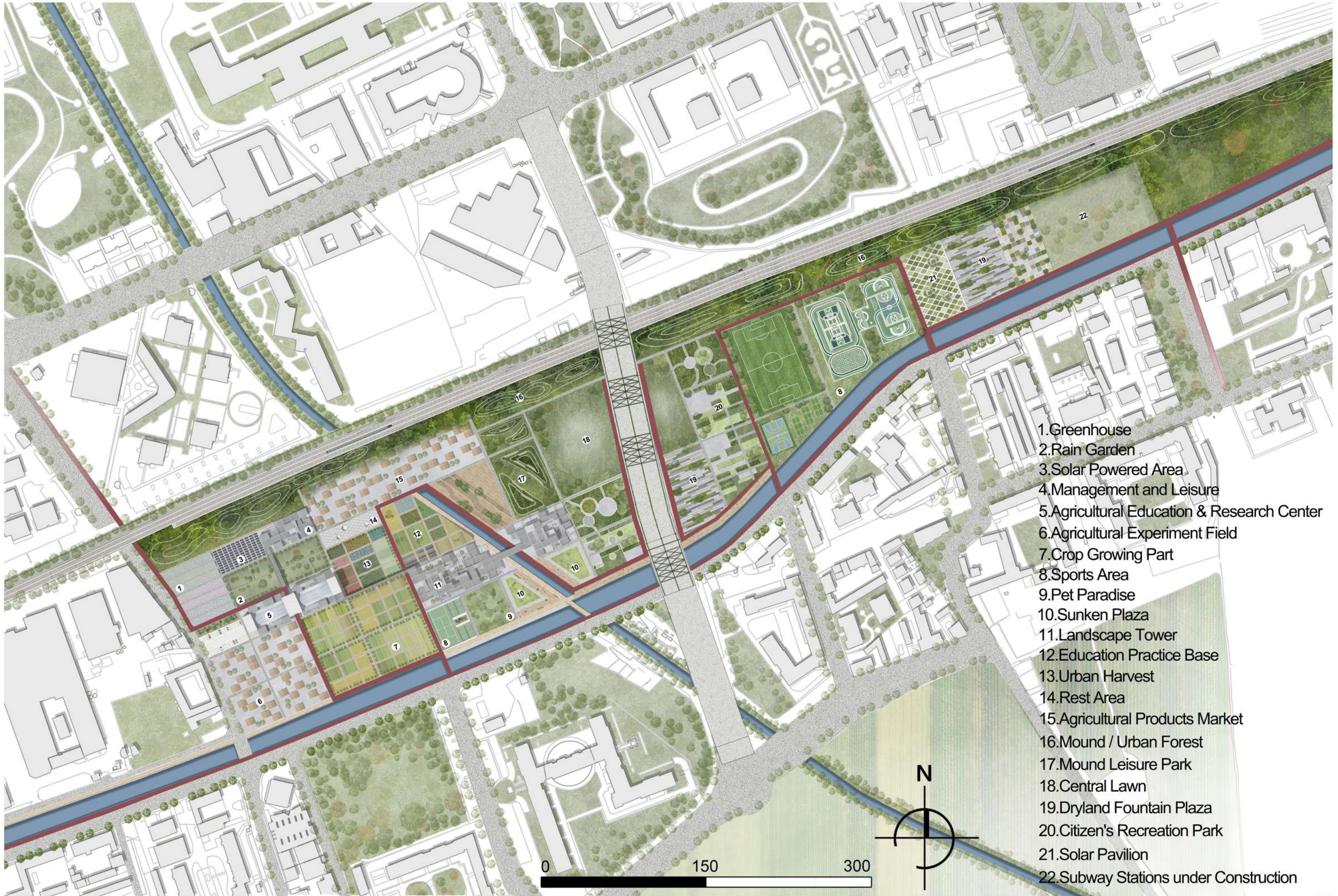
For example, there will be a research center (reconstruction of abandoned buildings), an agricultural experiment area, etc. in the urban farming area; there will be a canal activity area in the waterfront park area; there will be children playground, sports area, etc. in the urban park area. Because there are railway lines on the north side of the site, mound is used for occlusion.



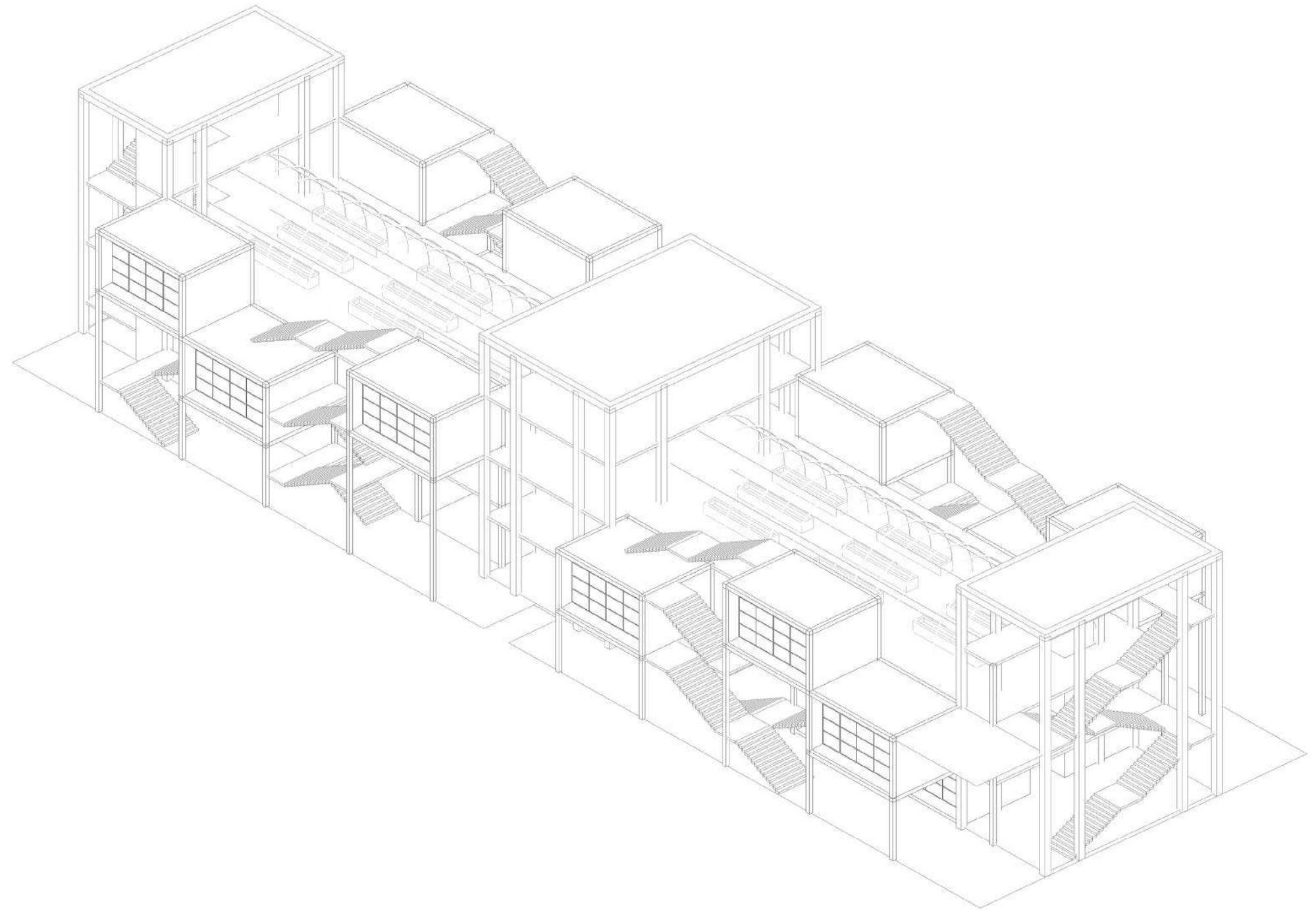
06 MASTERPLAN & DESIGN ELEMENTS

Masterplan
Site Node Design
Site Section
Mound Detail
Scenario

MASTERPLAN



- 1.Greenhouse
- 2.Rain Garden
- 3.Solar Powered Area
- 4.Management and Leisure
- 5.Agricultural Education & Research Center
- 6.Agricultural Experiment Field
- 7.Crop Growing Part
- 8.Sports Area
- 9.Pet Paradise
- 10.Sunken Plaza
- 11.Landscape Tower
- 12.Education Practice Base
- 13.Urban Harvest
- 14.Rest Area
- 15.Agricultural Products Market
- 16.Mound / Urban Forest
- 17.Mound Leisure Park
- 18.Central Lawn
- 19.Dryland Fountain Plaza
- 20.Citizen's Recreation Park
- 21.Solar Pavilion
- 22.Subway Stations under Construction



07 FOCAL AREA1 - AGRICULTURAL EDUCATION & RESEARCH CENTER

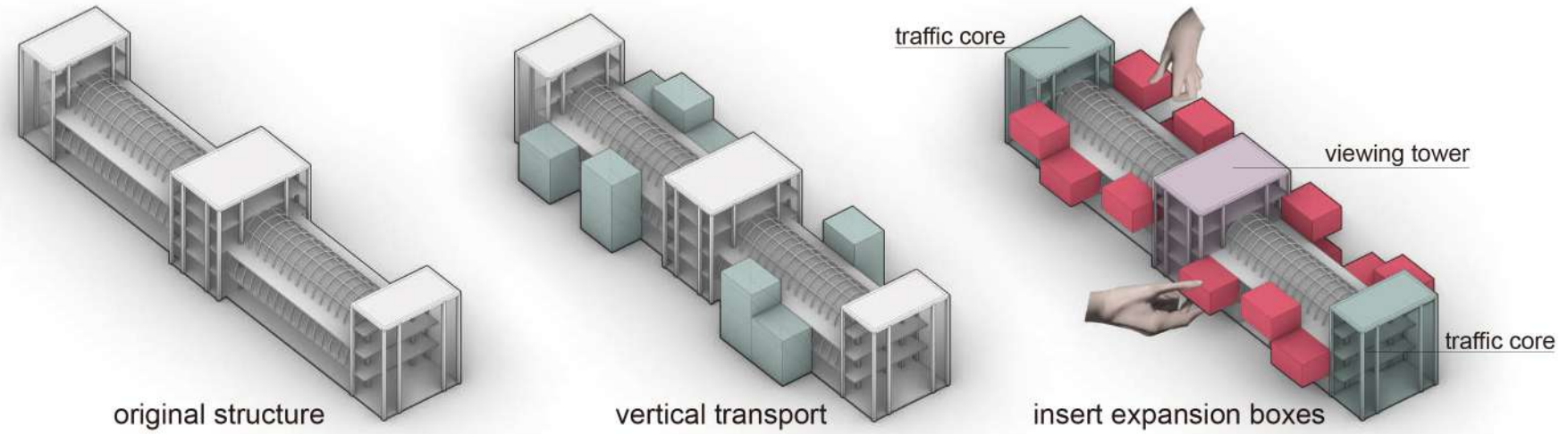
Building Renovation Shape Analysis
Architectural Plan and Section
Exploded Diagram
Architectural Detail
Scenario

Through field trip, we found the abandoned building frame as shown in the right picture, so we decided to keep the building.

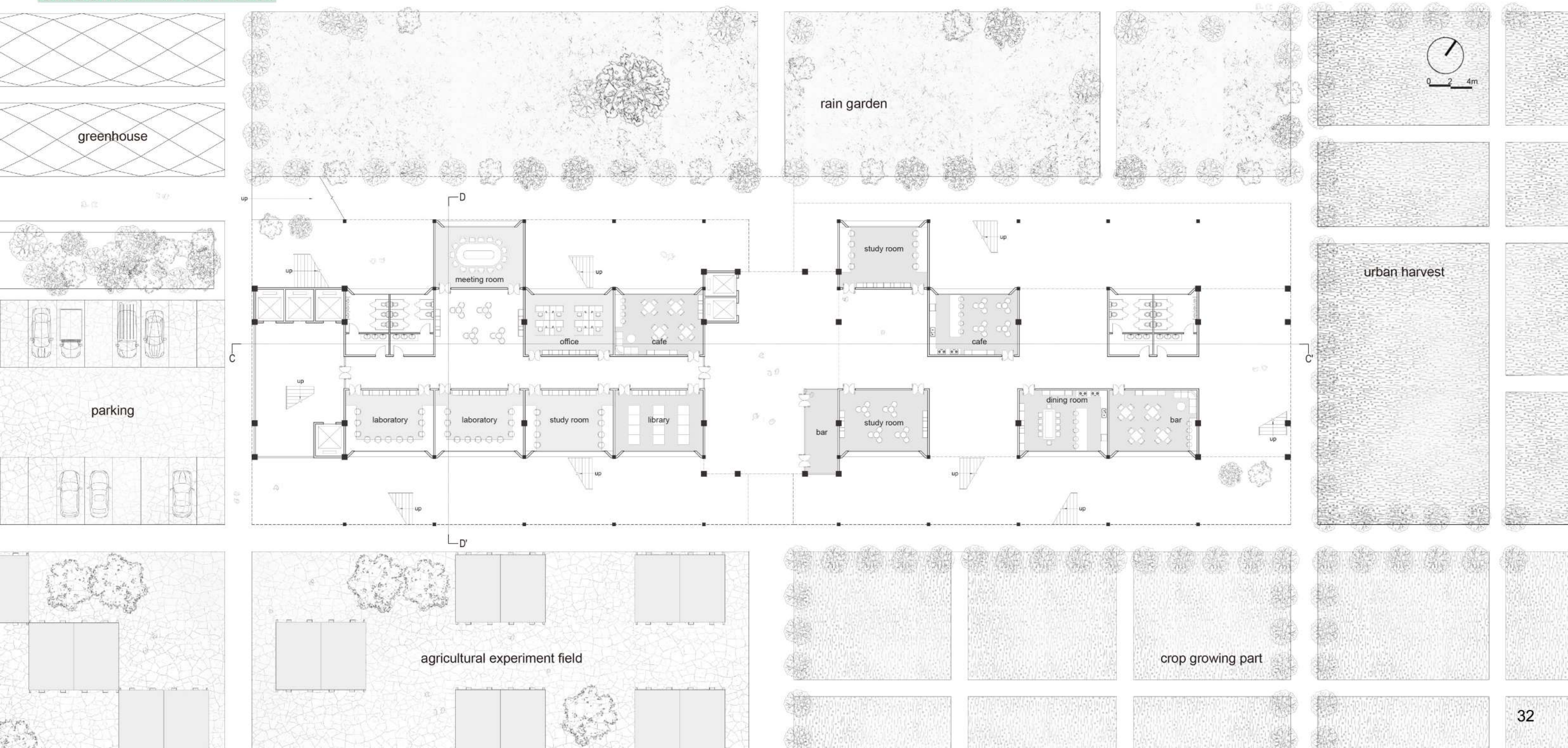
The original structural frame is made of concrete. In order to ensure the sturdiness of the original structure, we choose to use steel as the material for the transformation. In the space design, the original space structure has not been changed, but the "towers" at both ends of the original building have been given traffic cores, the "tower" in the middle has become a viewing platform; the architectural space in the middle of the three towers is divided by the basic form of square.

The ground and first floors of the building are distributed with research, education and leisure spaces such as laboratories, libraries, bars, and cafés, while the second floor is mainly an indoor greenhouse, providing a practical place for agricultural education and research.

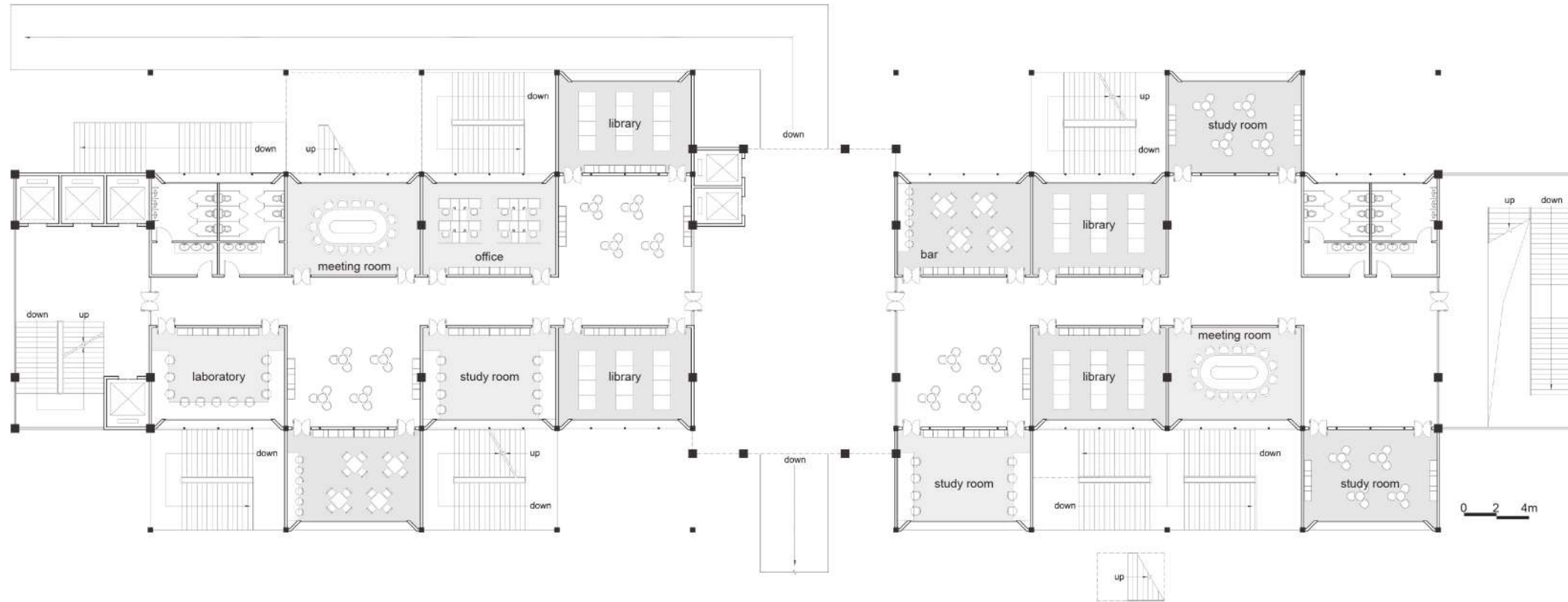
SHAPE ANALYSIS



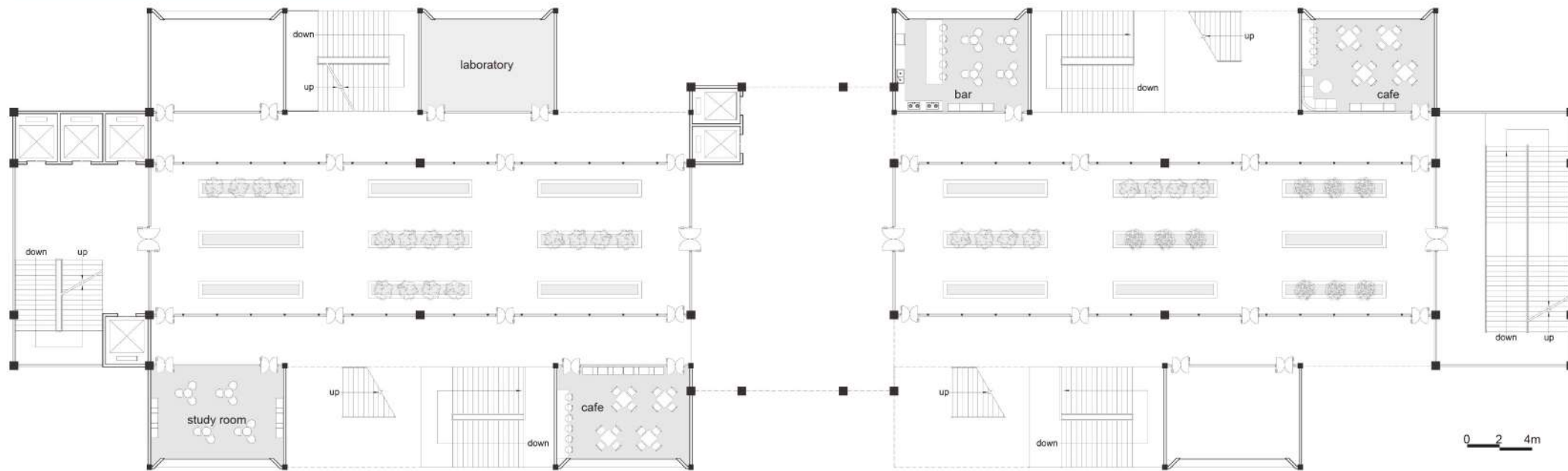
GROUND FLOOR PLAN



FIRST FLOOR PLAN



SECOND FLOOR PLAN

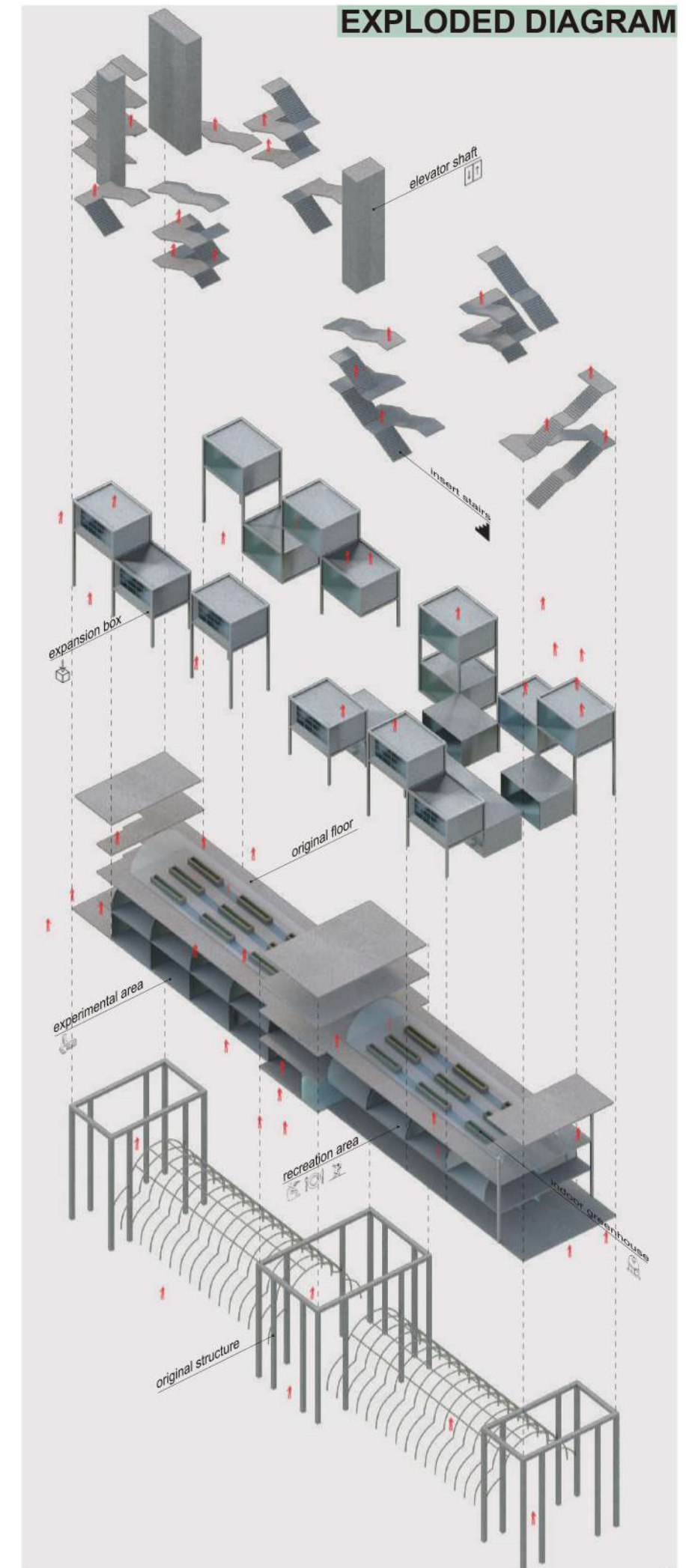


The front of the building is mainly an agricultural experiment field, which is convenient for researchers to operate experiments; the left is the parking lot, which is connected to the main road of the city; the rear is the greenhouse and rain garden; the right is the picking area.

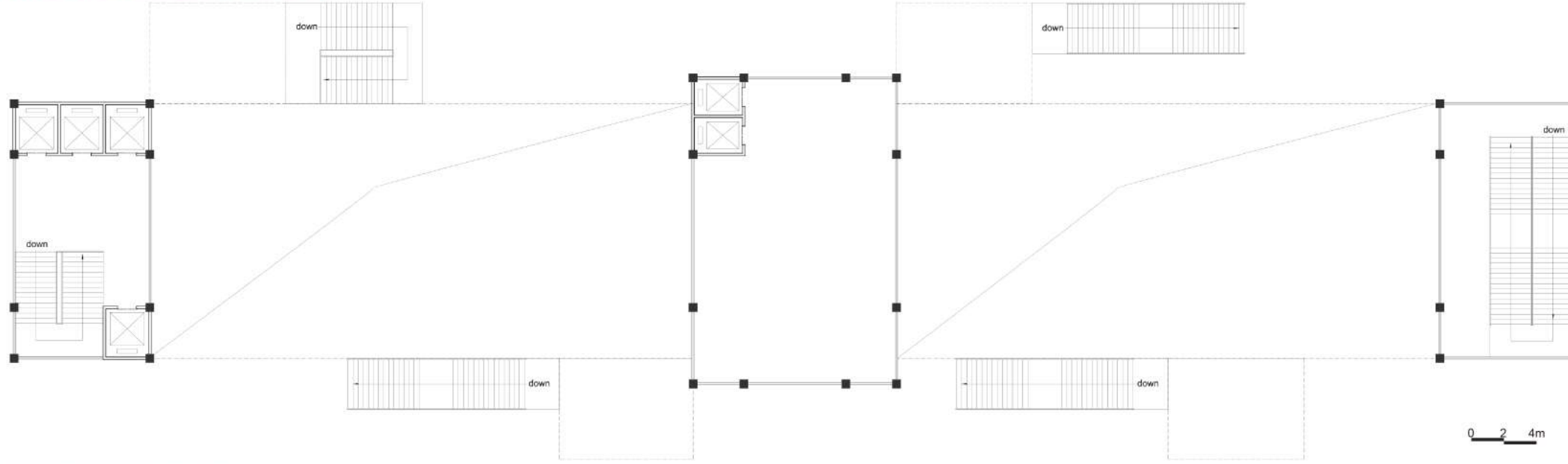
In the layout of the building, the left side of the building is defined as a "private space", which mainly includes research, learning and office spaces; the right side of the building is designed as a public space, including study rooms, bars, cafés, etc., because the right side is closer to the outdoor farming area, so it also provides a place for people to rest and communicate.

The extended boxes on the building's facade are connected by a variety of stairs, ensuring that the building can be accessed from everywhere, so people can not only enter the building through the traffic cores on both sides, but also reach the interior of the building through the outdoor stairs; the steel structure also ensures the firmness of the external boxes.

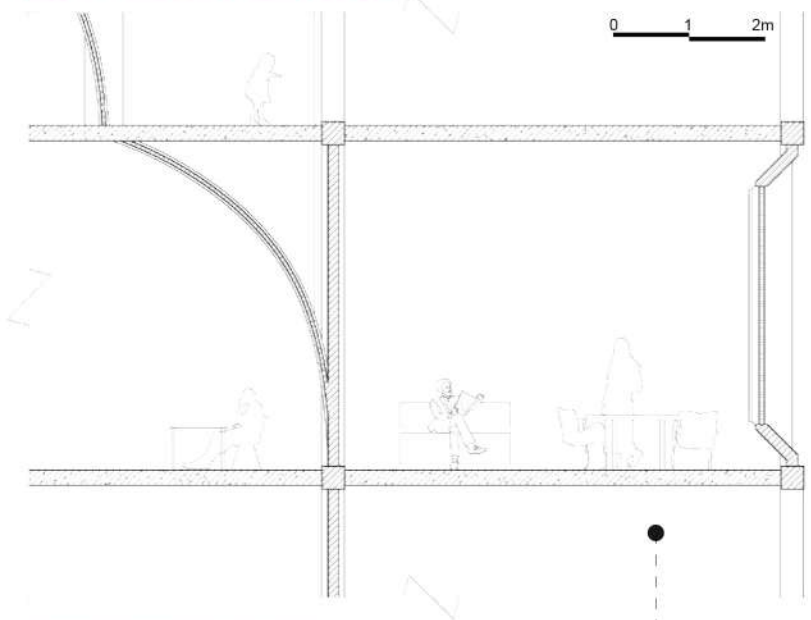
EXPLODED DIAGRAM



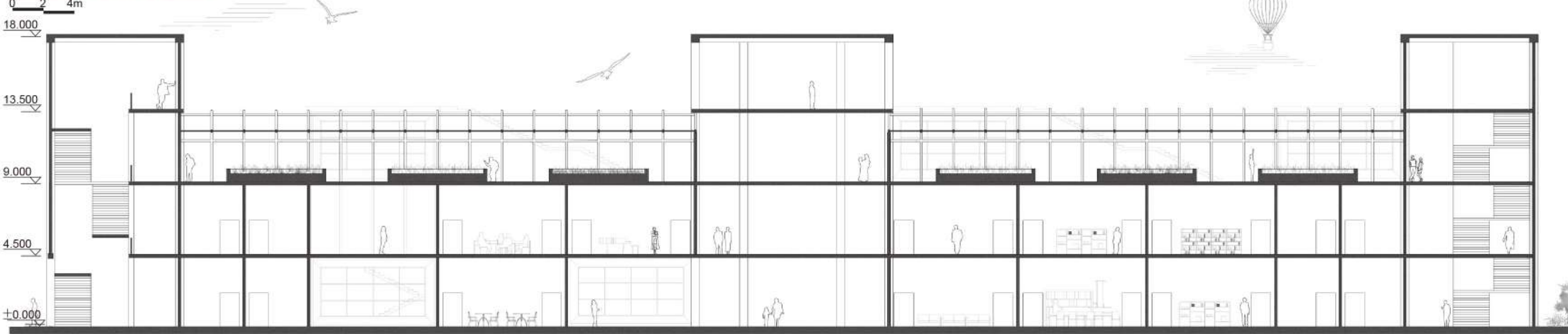
THIRD FLOOR PLAN



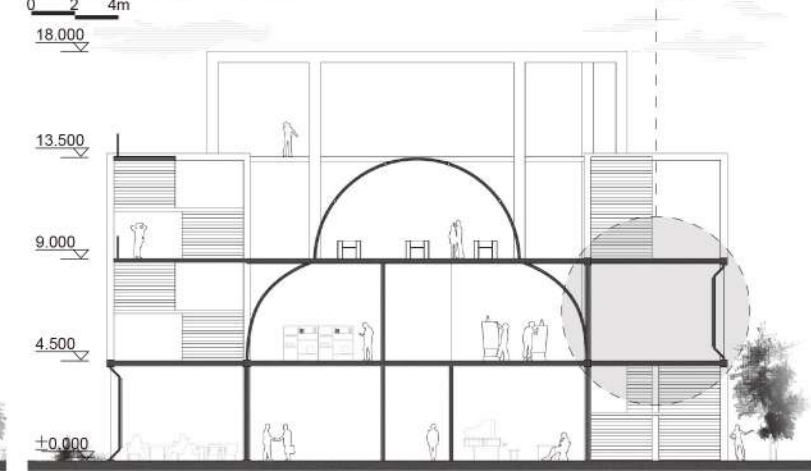
DETAIL DIAGRAM



SECTION C-C'



SECTION D-D'

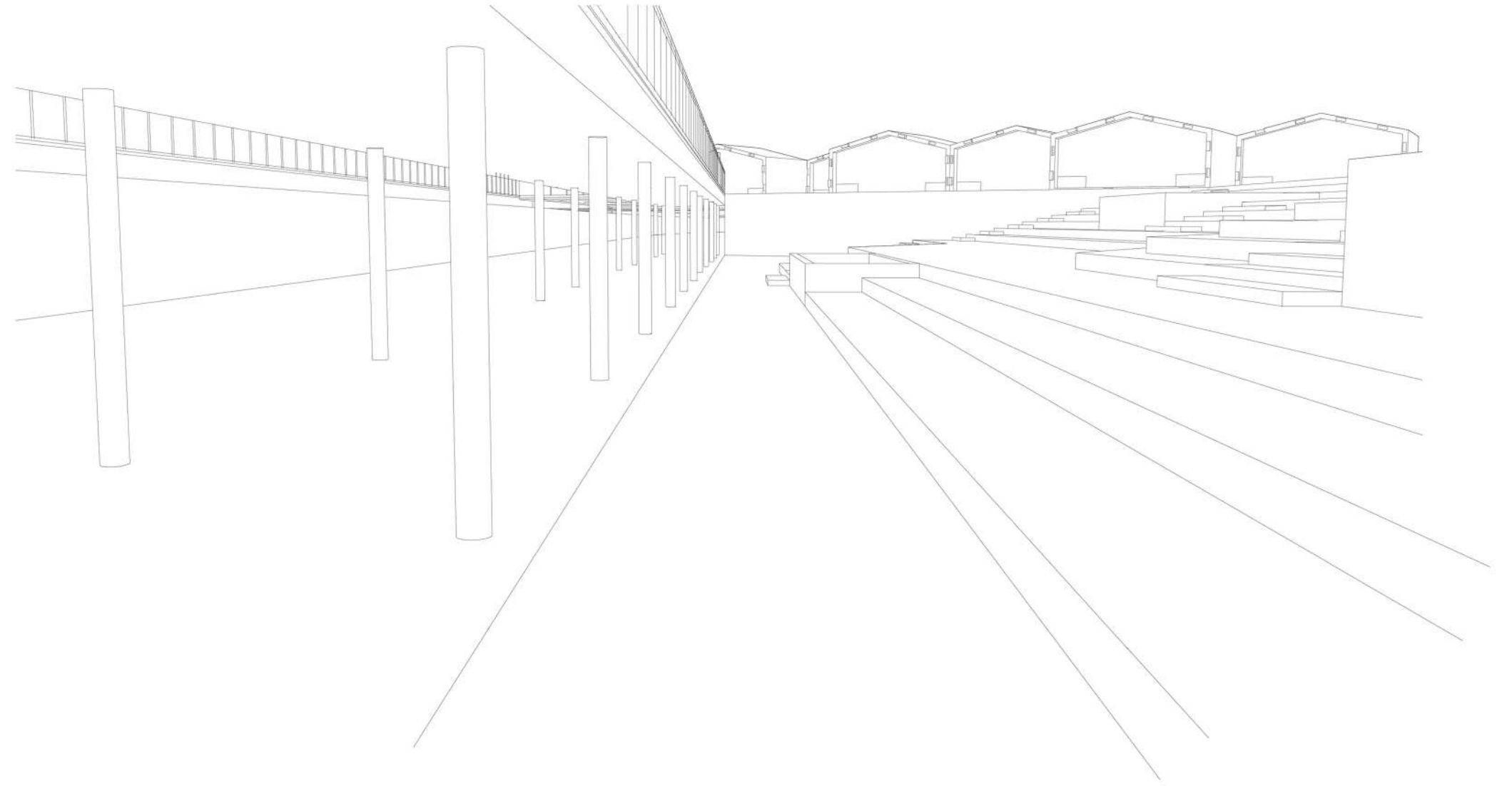


SCENARIO 3



SCENARIO 4

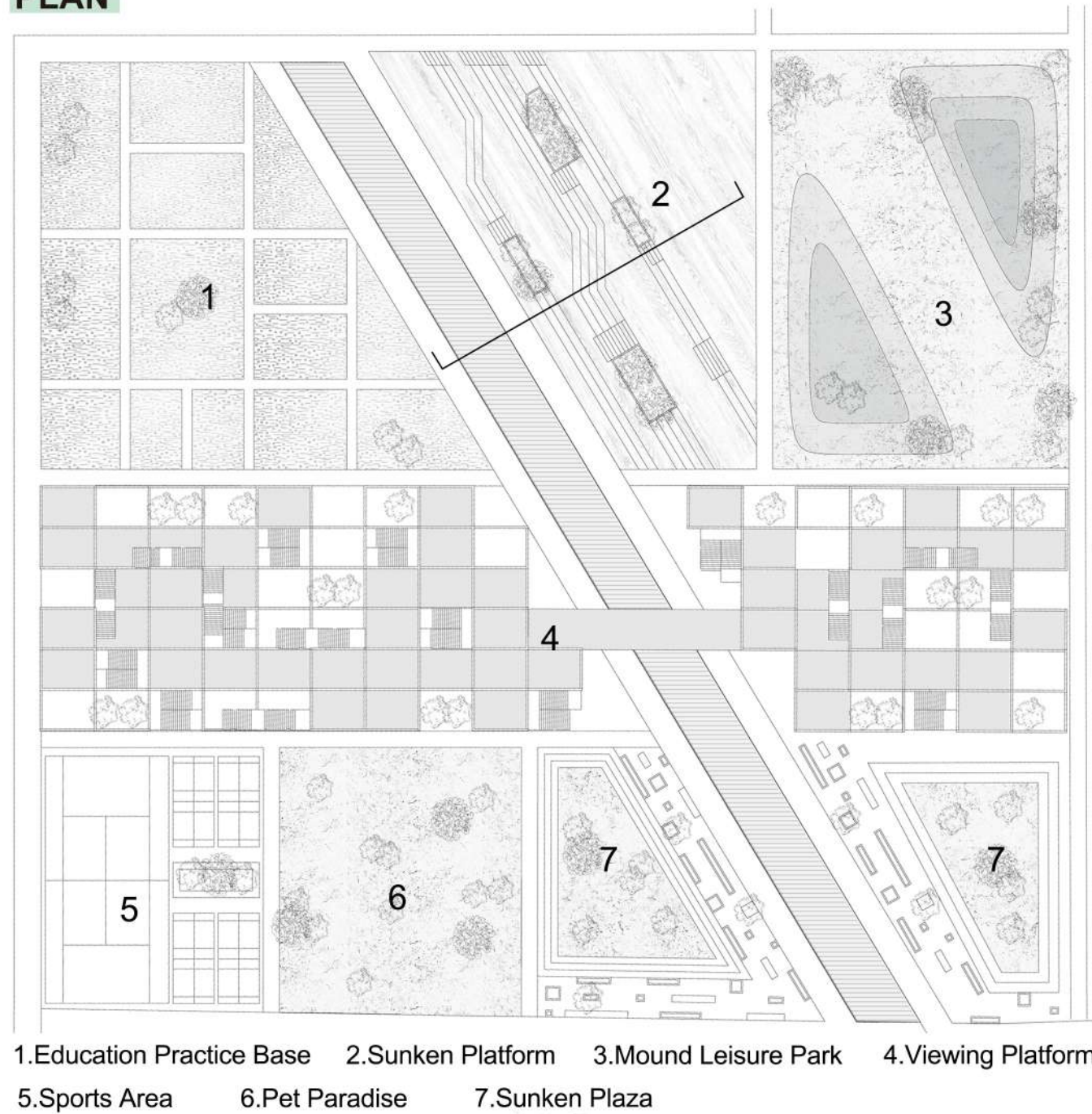




08 FOCAL AREA2 - RIVERFRONT SPACE

Plan and Section
Scenario

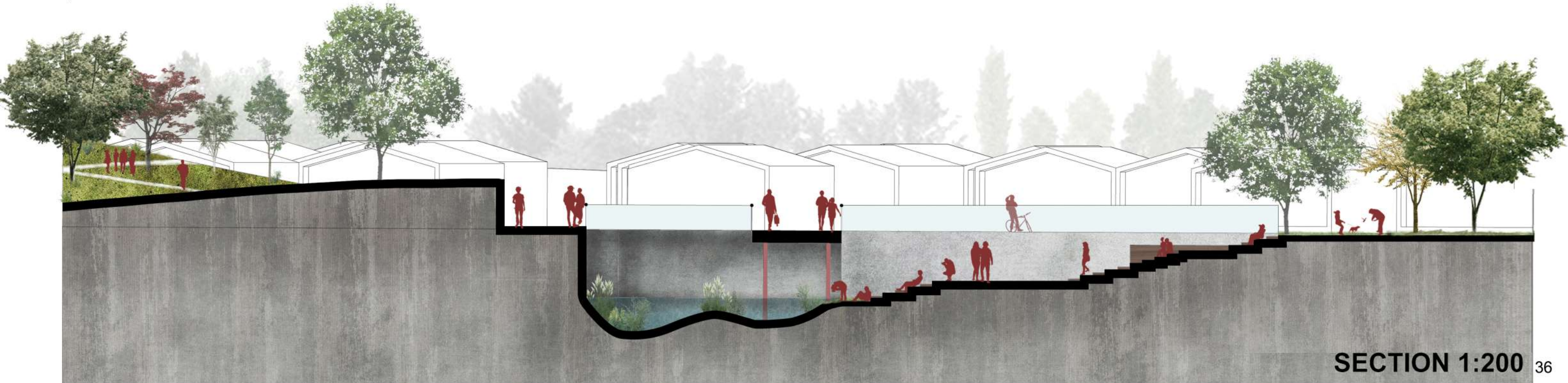
PLAN

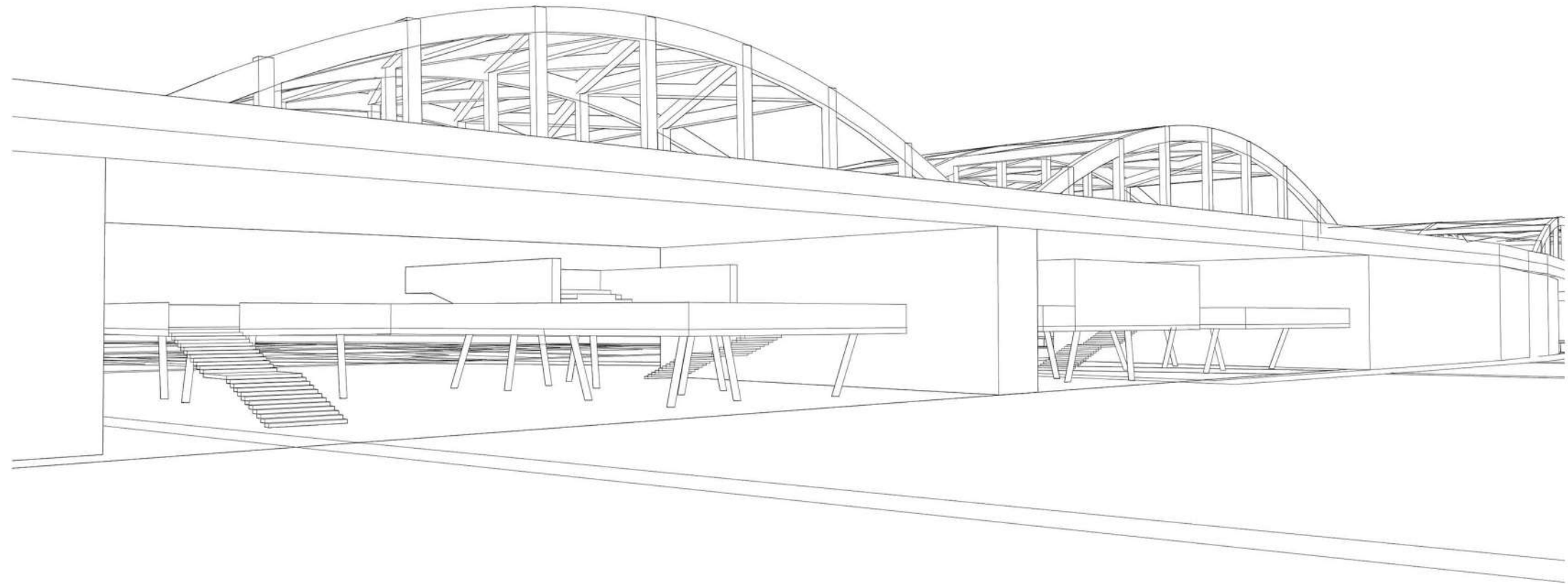


We designed the sunken waterfront level platform where the red path passes over the platform as a bridge. We think this space is interesting, it gives people a space to do down and rest, at the same time, it also allows people to get close to the river, the wall along the river can be used as a projection wall, and in the summer the sunken platform can become an open-air theater.

Secondly, we also extended the viewing platform to the east side of the Nambulo River, which serves two purposes; firstly, it unifies our two design proposals. Secondly, the different heights of the platforms also allow the people on the east side to have such a space to enjoy the two rivers.

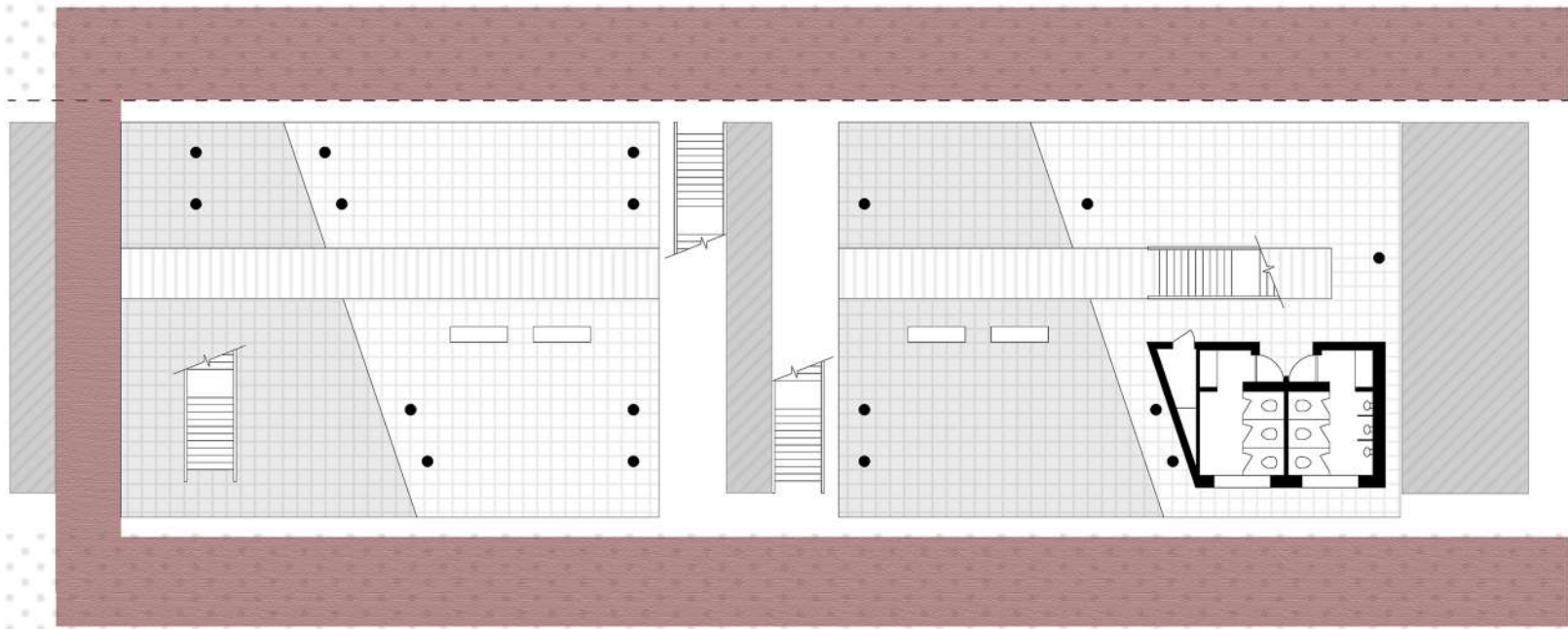
SCENARIO



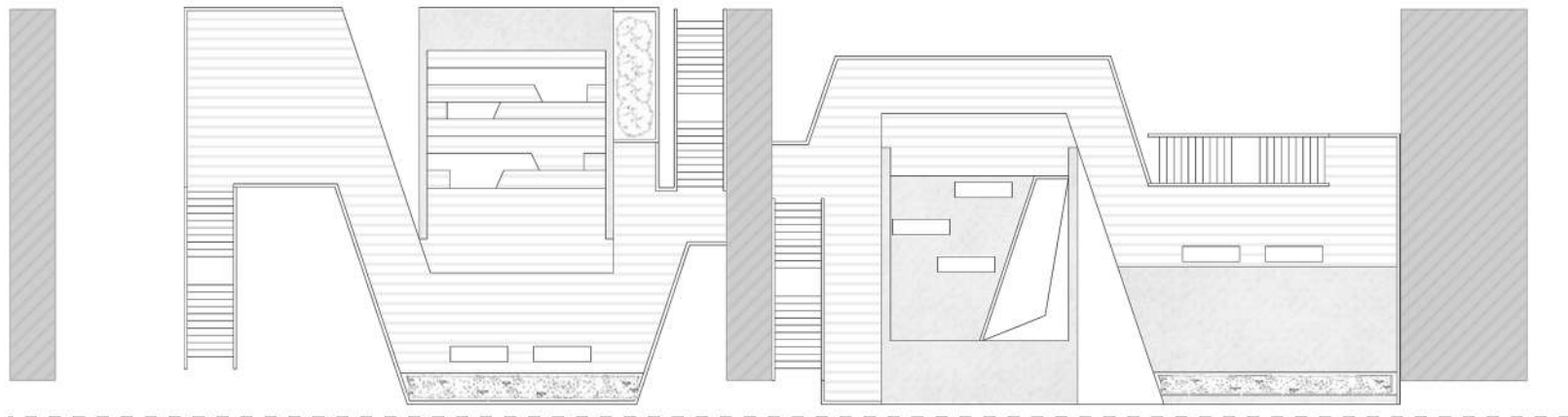


09 FOCAL AREA3 - UNDER THE OVERHEAD BRIDGR

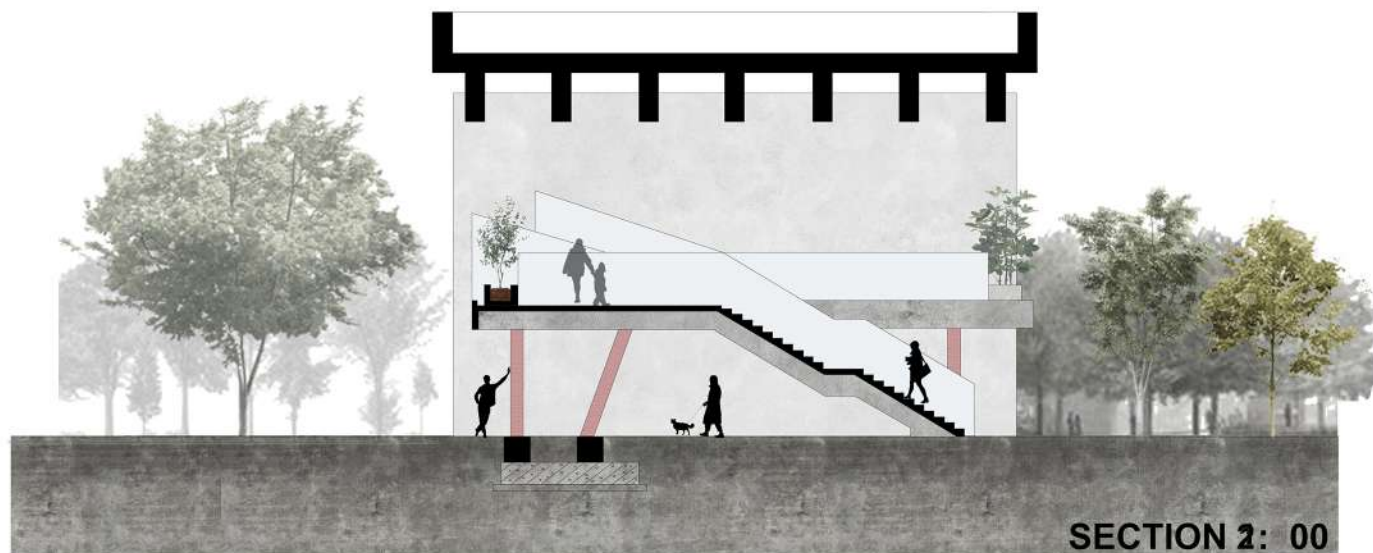
Plan and Section
Scenario



1F PLAN 1:200



2F PLAN 1:200



SECTION 2: 00

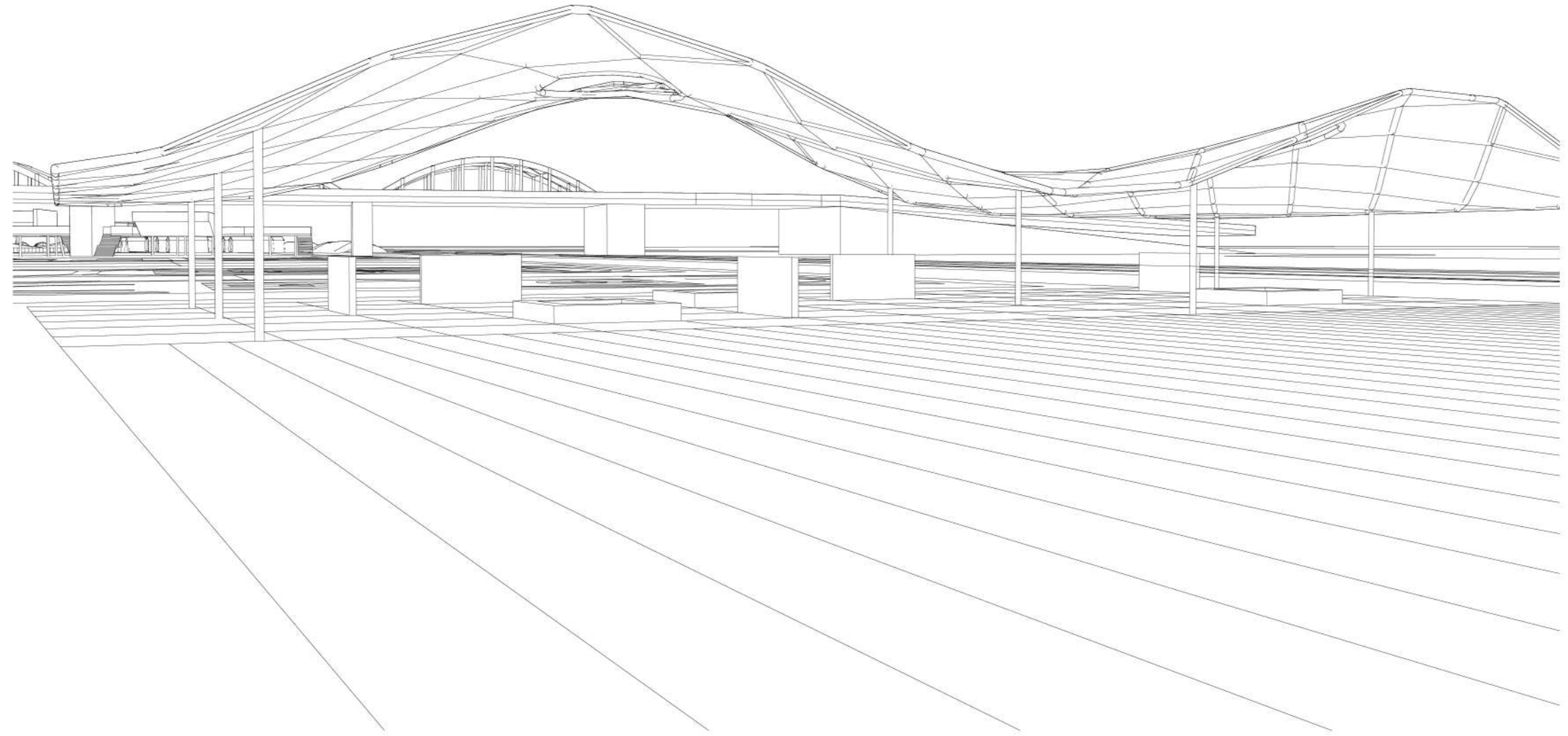
Through our site research, we found that the height of the bridge is 9M, providing us with the possibility of making a second floor space. Since the bridge is in the center of the site, dividing the site into west and east sides, it is extremely important to connect the two sides with an interesting under-bridge space. We designed an interesting bridge in the space under the bridge where people can do various activities.

At the same time, in order to show the difference between the structure of the original pillars and the newly designed bridge, and to make the space interesting, we designed the pillars as inclined pillars, so that people can also lean on the pillars and take a rest. A toilet was also designed under the bridge for people to use.

SCENARIO



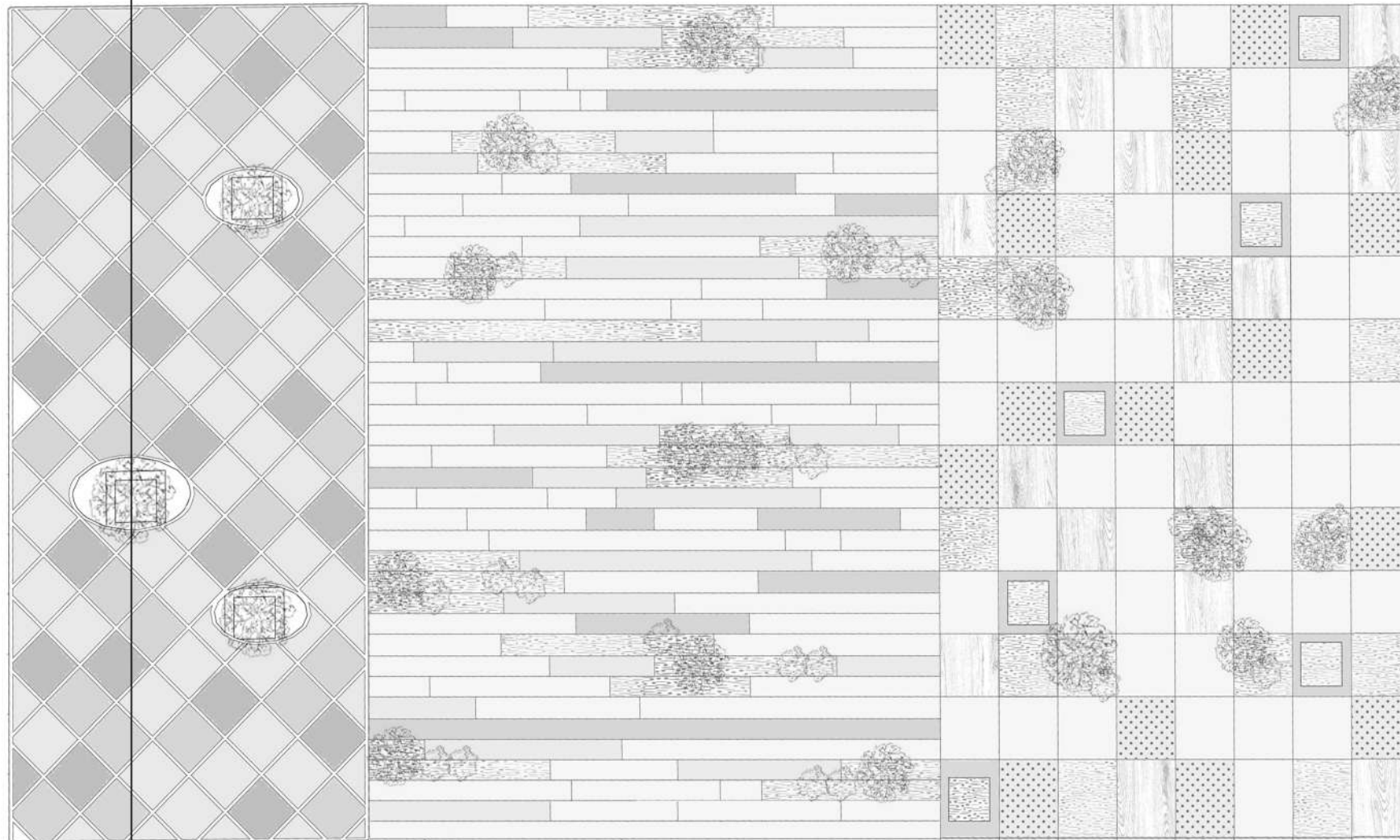
SECTION 1:200 38



10 FOCAL AREA4 - METRO STATION PLAZA

Plan and Section
Scenario

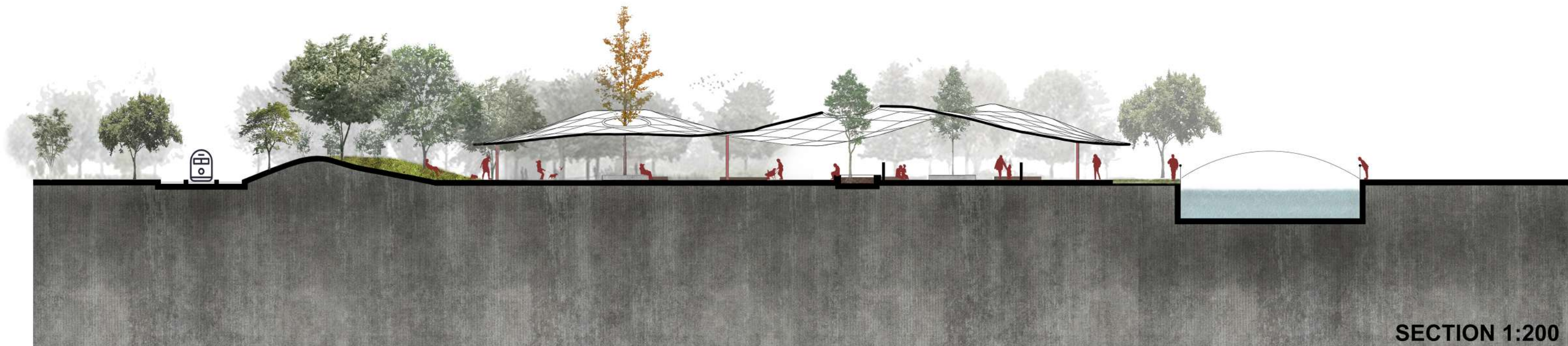
PLAN



The fourth node is the design of the square outside the subway station, which gathers people from the subway and train stations within the site. People first pass through a pixelated space designed for the site, which is composed of tree pools, rest seats, and wooden paving. After passing through this interesting space, people will enter a striped water treading space, and finally enter the site through a solar pavilion space.

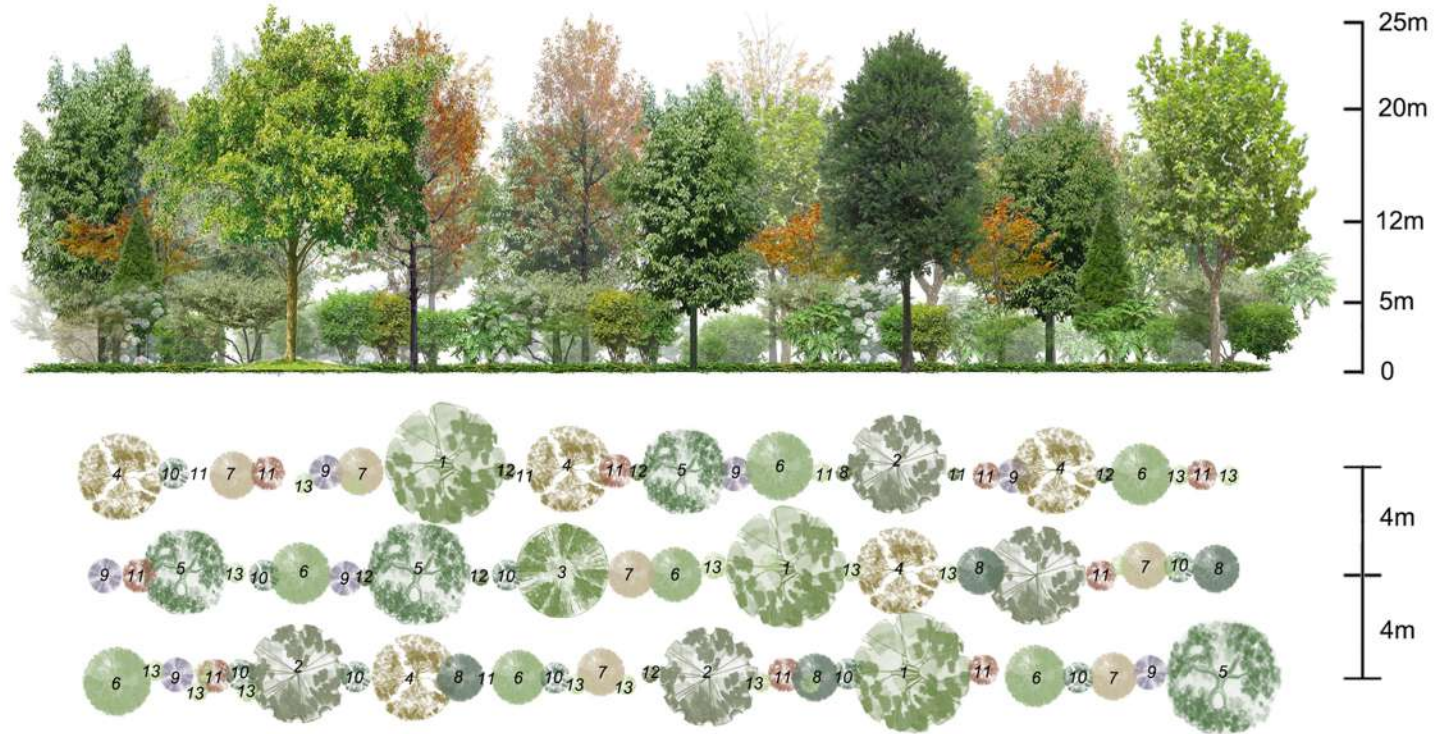
Solar pavilions not only provide a cool resting place for people, but also provide energy for the use of electricity within the site, truly achieving sustainable architectural and landscape design. Connected to the square and the space under the bridge is a sports venue used by citizens.

SCENARIO



SECTION 1:200

Mesophilic urban forest composition



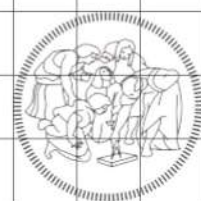
- | TREES | STUMP TREES | SHRUBS |
|----------------------------------|-------------------------------|----------------------------------|
| 1 <i>Quercus robur</i> 20% | 7 <i>Carpinus betulus</i> 15% | 9 <i>Viburnum lantana</i> 15% |
| 2 <i>Morus alba</i> 10% | 8 <i>Acer campestre</i> 15% | 10 <i>Euonimus europaeus</i> 25% |
| 3 <i>Platanus acerifolia</i> 15% | | 11 <i>Corylus avellana</i> 25% |
| 4 <i>Prunus avium</i> 5% | | 12 <i>Viburnum opulus</i> 20% |
| 5 <i>Populus nigra</i> 5% | | 13 <i>Crataegus monogyna</i> 15% |
| 6 <i>Acer platanoides</i> 15% | | |

Filter hedge to watercourse - riparian buffer zone



- | TREES | SHRUBS |
|------------------------------|------------------------------|
| 1 <i>salix alba</i> 40% | 3 <i>Frangula alnus</i> 40% |
| 2 <i>Alnus glutinosa</i> 60% | 4 <i>Viburnum opulus</i> 25% |
| | 5 <i>Salix cinerea</i> 35% |

Politecnico di Milano
Piacenza, Italy
12.2023



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