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GROWING GLASGOW

A COMMUNITY GARDEN AT THE
GOVAN GRAVING DOCKS (GLASGOW, SCOTLAND)



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This work is dedicated to my mother, the constant source of inspiration in my life.

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ABSTRACT

The presence of agriculture and housing have played an important role in the life of the human being. Many economies in some countries directly depend on their agricultural production. In Scotland, agriculture is a determining factor within the urban scale of the country - more than 75% of the land is used for agriculture and more than 15% is forested. The main concept of this thesis is to bring natural elements in the city through the architecture in an innovative way - new sustainable technologies related to organic agriculture that generated new spaces for markets, shops, galleries, etc.

The abandoned docks of Govan (the project site) allow us to think and introduce a revaluation of the public space at the waterfront in Glasgow. The dock site is considered to be "an outstanding graving dock complex without parallel in Scotland" (ReGlasgow, 2018). It was built for the Clyde Navigation Trust over a 30-year period and have been vacant since 1988. Nowadays, people in Govan wants to improve this area and what better way to do it through architecture and nature?.

The thesis proposes the recovery of the Govan Graving Docks making it safer, sustainable and more integrated. To guarantee a future for the city of tomorrow, we must think about transforming the concepts of agriculture and housing into an architectural design project.

The first concept will be the nature interpreted in the design of a vertical farming that will be able to provide new technologies for the development of the crops, both food and plants. In addition, it will be the key of a series of transformations in the area since from this concept, the other functions will simply appear.

Starting from this idea, a residential building for the citizens of Glasgow will also be developed, involving workers, farmers, students, families, etc. This, together with the building of the vertical farming will bring with it a new micro-economy, a new urban population and a new way of living in the city. To conclude with the design, the "Roof Garden" is going to encapsulate the entire project creating a connection between the two buildings. The green areas will be multiplied from ground levels upwards, attracting birds and wildlife to the roof - the rural and the urban coexist in a public space on the top. This element is also a canopy for the docks below, as Govan has inclement weather and needs more sheltered urban public spaces.

TABLE OF CONTENTS

Introduction		11
PART ONE		
THE ROLE OF AGRICULTURE IN A CITY		
	URBAN AGRICULTURE	14
	What is urban agriculture and why?	15
	The role of urban agriculture	18
	Constraints on urban agriculture development	20
	From traditional farming to urban farming	
	INTEGRATING URBAN AGRICULTURE INTO COMMUNITIES	22
	How is agriculture important to community inside the city?	24
	Community supported agriculture	25
	The impact of agriculture on the Glasgow community	
	ALLOTMENT GARDEN	26
	Contextual research	28
	The allotment in Glasgow	30
	The ideal site	31
	Allotment gardening	34
	Crops and tree species in Glasgow	
	VERTICAL FARMING	38
	The concept	39
	What can you cultivate in a vertical farm?	40
	Actual advantages of a vertical farming	46
	Principles and rules	
PART TWO		
AFFORDABLE HOUSING FOR URBAN FARMING UNDERSTANDING		
	AFFORDABLE HOUSING IN GREAT BRITAIN	52
	The concept	54
	Housing development in the cities of U.K	62
	Mass housing in the twentieth century society	
	THE IMPORTANCE OF AFFORDABLE HOUSING IN SCOTLAND	66
	Housing situation in Scotland	68
	Scottish house condition	74
	The need of more affordable homes	76
	Affordable housing in the city of Glasgow	
PART THREE		
STUDY CASES		
	SPACE AND FUNCTION	80
	Bosco Verticale in Milan, Italy	82
	Nest we grow in Hokkaido, Japan	
	NATURE & TECHNOLOGY	84
	Pasona Urban Farm in Tokyo, Japan	86
	Gardens by the Bay in Singapore	
	POST-INDUSTRIAL LANDSCAPE	88
	Parco Dora In Turin, Italy	90
	Fun Palace by Cedric Price	

PART FOUR
THE CONTEXT

THE CITY OF GLASGOW

Introduction and location	94
Weather condition	98
Urban development and spatial organization	99
The River that runs through the city: The River Clyde	100

GOVAN. POST-INDUSTRIAL CITY

Location	104
The beginnings of the city	106
Timeline: Govan historic context	108
Industry facilities and weavers society	110
Who lives in Govan? - Demographic data	116
Urban Analysis	118

PROJECT SITE: GOVAN GRAVING DOCKS

The heart of Glasgow's industrial revolution	128
An historical place for shipbuilding	130
Analysis of the area	132
Photographs of the docks	136

PART FIVE
MASTERPLAN

MASTERPLAN DEVELOPMENT

Waterfront Plan of Govan - Current situation	142
The new Govan	144
Axonometric Masterplan	146

PART SIX
DESIGN PROPOSAL

DESIGN DEVELOPMENT

Proposal objectives	150
Collage's ideas	152
Site strategies - orientation and access	154
Top View Plan	156

ARCHITECTURAL DRAWINGS

Residential building	158
Vertical farming	166
Roof Garden	174
Main Section	182

VISUALS

	184
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Conclusion	197
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Bibliographic references	198
--------------------------	-----

Electronic references	200
-----------------------	-----

INTRODUCTION

Agriculture and housing are important aspects of our daily life. It is one of the main axes on which the economy of the country develops and, in addition, it is considered a social and environmental activity. Also, agriculture has become a motivational factor to learning for people. Farmers spend time on these fields; therefore, it should be a pleasant experience where they can enjoy good infrastructure, facilities and services.

In the last decades, Great Britain has been considered one of the most productive countries in terms of agriculture. Due to the green fields and the landscapes in cities such as Scotland, the number of cutters has grown significantly and that is why it has been positive in terms of food production and quality. However, many of these fields are far from the city centres and they are very difficult to access. The question we ask ourselves in this thesis would be, what would happen if we brought the traditional farming into important cities such as Glasgow or Edinburgh?, where the climatic conditions and the fertility of the soils are the same of the fields.

The aim of this thesis is to propose an area of cultivation, housing and recreation for the inhabitants of the city of Glasgow, specifically in the abandoned docks of the Govan neighbourhood. Glasgow is a city that is constantly growing in terms of architecture so, what better way to

apply the agriculture of the countryside in the city centres through new technologies? The use of a vertical farming with the advances of the new agriculture systems such as aquaponics and greenhouses will help to define this idea.

On another hand, it is important to recognize the historical context of Glasgow and the River Clyde since it was a city that greatly influenced the first and second world wars. For example, on the Govan Graving Docks (the project site), the great ships for war were built in this place. This is why these critical factors must be analysed and then interpreted in the process design.

The thesis is going to focus on the weaker aspects of Glasgow, specifically in Govan, to propose a project that will make it a better city. It will be necessary to categorize the concepts of agriculture and housing to make clear the referent of each one and their action over the design decisions. In addition, a selection of references will be studied by extracting only functional, spatial and recovery aspects of abandoned spaces to improve the relationship between the buildings and the context. The concepts mentioned above are transformed and put into practice in the development of the design.

THE ROLE OF AGRICULTURE IN A CITY

PART ONE

URBAN AGRICULTURE

WHAT IS URBAN AGRICULTURE AND WHY?

“Urban agriculture is the practice of cultivating, processing, and distributing food in or around a village, town, or city. Urban agriculture can involve animal husbandry, aquaculture, forestry, bee-keeping, and horticulture”. (Bailkey and Nasr, 2000).

Having the concept of Bailkey and Nasr, we can understand that urban agriculture is fundamental created by the main activity of cultivating, making living things grow in some space, such as the city in particular; it is worth mention as well that along the years many extensive research on urban agriculture, and more specific community gardening, demonstrates its true potential to have a wide range of positive impacts on communities of all kinds including social, health, economic, and environmental benefits.

It can be said as well that Urban Agriculture, on a collectively frame, is an industry located within or out of the limits of a city, a town, or a metropolis; that suffers changes, meaning grows and raises, resulting on processes which bring products making possible a distribution of a diversity of these agricultural products from both plants and animals, using human, land and water resources, products, and services found in and around that urban area. Therefore urban agriculture can be practiced in gardens, rooftops, empty public land or field plots by urban residents from diverse backgrounds. Consequently the orientation and magnitude of such activities may vary from subsistence-oriented cultivation, to more recreational types of agriculture at the micro scale

frame, through small-scale semi-commercial gardeners and livestock supplies, to medium and large-scale commercial enterprises. Urban agriculture already provides a fundamental contribution to the food for the cities in many countries. Even though with the rapid growth of the urban population and the low nutritional levels of the urban most needed sectors, there is an enormous scope for increasing this source of supply.

Among the benefits of urban agriculture it can be said:

- Highly nutritious food for the poor sector of consumers, and low income generation sector.
- Efficient reuse of water and urban waste to provide water, animal fees and fertilizers for the demands of urban agriculture.
- Co-Integrating urban agriculture with urban greening programs, which can provide fuel-wood for urban residents, reduce urban pollution and temperatures, improving quality of life for all urban residents.
- Opportunity generator allowing the participation of urban residents to benefit from the implementation of urban agriculture within the broader context of urban greening programs.
- New source of supply of food to urban markets, street food, providing additional employment and income.
- Helping cities become more resilient to climate change by reducing vulnerability of urban residents, particularly the poor, diversifying urban food sources and income opportunities, preserving green open spaces and enhancing vegetative cover.

URBAN AGRICULTURE

THE ROLE OF URBAN AGRICULTURE

Urban farms are not simply farms located within cities, but rather they are unique projects that function as a link between food production and community development, whether an individual, a group of committed residents, a community-based organization, or a for-profit company, those who start and run urban farms contribute to the idiosyncrasy of urban farming inside the concept frame of the urban agriculture.

Taking about the important role that it can be given to the urban agriculture, there are three major subjects to be treated concerning among many factors such as, employment and livelihoods for the urban poor sector, food security and environmental benefits regarding climate change.

EMPLOYMENT AND LIVELIHOODS | Concerning the factor of employment and livelihoods for the urban poor sector there were made studies by Smith and others (UNDP, 1996), making an estimate that 800 million people worldwide are involved in urban agriculture, of which 200 million are full-time. *“Although production levels and turnover of individual urban producers may be small in many cases, a high number of urban producers in a city can make their overall contribution to the urban economy relevant by generating employment for many poor urban households and generating incomes equivalent or higher than the official minimum wage rate”* (Moustier and Danso, 2006). It is true and worth to be mention that in addition to either growing crops or rearing animals, urban agriculture provides other



Figure 1.1 | Could urban agriculture ensure our survival?.



Figure 1.2 | City farm.

employment opportunities, such as:

- Production and sale of processed products (meals, jams, street food, and other products)
- Production and sale of agricultural inputs, such as the production of compost or animal feed from collected organic wastes, irrigation equipment from recycled materials.

Food can often make up one of the major expenses for households, with poor households spending proportionately more of their income on food than others. Either producing one's own food or benefiting from cheaper food produced locally can really result in monetary savings and can be designated for other household expenses, such as water, medicines, rent, schooling, and clothing.

FOOD SECURITY | Generally speaking, it can be said that food security, includes food availability, as well as access to food, and the ability to use and consume this food on a safely way. The contribution of urban agriculture to food security and nutrition in cities has been the subject of many articles and research papers as well. Usually, the literature differentiates between production for the market or for home-consumption (Cole, Lee-Smith and Nasinyama, 2008). Many of these reviews seem to indicate that the direct food security purpose prevails, but that a substantial number of urban farmers also produce for the market, *"and more so in Asia and Latin America than in Africa"* (Zeza and Tasciotti, 2010).

Urban agriculture not only benefits self-producing households, but it can also increase the availability of fresh, healthy, and affordable food for a large number of urban consumers (specially the poor ones) when the food produced by urban farmers is distributed or sold locally. *“It is estimated that 15 to 20 percent of the world’s food is produced in urban areas”* (Armar-Klemesu, 2000).

ENVIRONMENTAL BENEFITS AND CLIMATE CHANGE | There are many implications concerning urban agriculture such as problems to be solve brought by the activity itself, or the implications of the context where it takes place. Recently has been increasingly mentioned for: *“the role it might play in disaster management in urban areas and the actions of cities to mitigate the effects of climate change through climate compatible city development”* (Mitchell and Maxwell, 2010). Nonetheless, is important to say that urban agriculture contributes to environmental sustainability by offering a range of potential benefits for the local environment, contemplating the re-use of wastewater and organic waste. Therefore in this perspective, urban agriculture itself can be made more sustainable and ecological, rather than using fresh water or artificial fertilizers.

In relation with climate change the urban agriculture can be understood in two main ways, there are several studies that indicate and relate urban agriculture with multiple climate benefits. Consequently it can be pointed out:

- Efficiently reducing the vulnerability of urban residents and strengthening community-based adaptation management, throughout: diversifying urban food sources, enhancing access of the urban poor to nutritious food; diversifying income opportunities of the urban poor.
- Maintaining and promoting green open spaces and enhancing vegetation cover in the city with important adaptation and mitigation benefits.

URBAN AGRICULTURE

CONSTRAINTS ON URBAN AGRICULTURE DEVELOPMENT

Among the diverse difficulties that can be present on the process of development of the urban agriculture and the urban farming activities, there are many factors which usually include a lack of knowledge about urban farming; in addition, the negative impressions of the appearance of urban farms; as well as concerns about pests, vandalism, and the safety of farm food; all these resumes to the fear that urban farms might replace other development and they are often seeing as “outsider projects”. Therefore, it is possible to categorize on a general way the many lacks that represent smalls barriers for the development of it, such as lacks of: access to land; to safe water for irrigation; to appropriate training and extension services.

ACCESS TO LAND | A major challenge to the viability of urban agriculture remains the land availability and access. Urban growth intensifies competition for land among industrial, commercial, residential and agricultural uses, especially in the borders of the cities and non-urban areas. For example, high levels of in-migration and urban growth can result in increased land prices and pressure on agricultural land, with many converting agricultural land to non-agriculture uses. Therefore, apart from availability of and access to agricultural land, it must be always in consideration the absence of secure tenure of the land. Where agriculture is practiced on public, community, or institutional land, the use of these spaces is usually not regulated and lacks legal protection for producers, leading farmers to usually not pay for the use of such lands. Consequently, insecure tenure inhibits farmers

from making investments to improve production, meaning that in order to increase security of tenure, the integration of urban agriculture into urban development and master plans, urban land use and zoning plans, are crucial.

ACCESS TO SAFE WATER FOR IRRIGATION | As it is known rainfall is not sufficient for urban agriculture in desert areas or during dry periods talking about cities in general, therefore supplementary water from other sources such as the municipal water system, or from boreholes and rivers, is always needed. In many cases, the use of untreated wastewater can reach high values where it means that the process develop without a quality control translating on the use of such polluted water, especially on vegetables that are not cooked before eating, poses potential health risks to consumers. Nonetheless, the WHO expects that “*urban agriculture, with urban wastewater as a common resource, will play a more important role in supplying food for the cities*” (WHO, 2006). The last two decades have seen a strong move towards alternative, decentralized and low-cost wastewater treatment that allows reuse of wastewater and nutrients or even includes aquaculture or agriculture as part of the wastewater treatment process.

ACCESS TO APPROPRIATE TRAINING AND EXTENSION SERVICES | Regarding this topic it is worth to mention the importance of having the right knowledge and training in order have a proper development and right function of an urban farming system; urban

agriculture is performed under specific and precise conditions that require technologies and organizational models different from those used in the rural agricultural context. Consequently, most available agricultural technologies need adaptation for use in urban condi-

tions; as well new technologies have to be developed to respond to specific urban needs, such as space-confined production methods, non-soil production technologies for use on roofs, and development of safe and economic practices for productive use of wastewater.



Figure 1.3 | Urban Farming: Feeding the future?.

URBAN AGRICULTURE

FROM TRADITIONAL FARMING TO URBAN FARMING

Regarding the transition process from traditional to urban farming, every city has its particular condition on a more general way it's possible to mention some strategies that are often present among many cases dividing the process into three main phases: gaining entry into a neighbourhood; introducing the idea for an urban farm to a neighbourhood; and finally engaging the neighbourly.

On the first phase of gaining entry, it is important to highlight that is needed to understand the neighbourhood context where it is plan to farm and build relationships within the community. While these strategies were generally discussed as useful for urban farmers who are not from the neighbourhood in which they plan to farm, it is also possible that urban farmers who planned to farm in their own neighbourhood drew upon these strategies to help garner external support for the idea for starting an urban farm. Therefore, many factors comes to the scene such as selecting an appropriate site for an urban farm taking in consideration parameters such as its slope, exposure to sunlight, and soil quality, among others.

A second consideration is how the site is currently used by the neighbourhood, avoiding sites that are actively utilized, formally or informally, for that is crucial the process of understanding the neighbourhood context and develop a plan that respects the context and goes in harmony with the communities, knowing the history and the context of the community for instance. Moving to the second phase is equally

important to gaining entry in a neighbourhood, the way in which a farm is framed as the idea is introduced to the city. With the right approach an urban farming initiative can be more than well taken by the community, always involving from the beginning the locals to make them fell part of the project, where the lack of familiarity with the project is present then it is needed to overcome the lack of familiarity about urban farming and give residents an idea of what to expect, sharing examples of existing urban farms through photos and tours might work as an strategy, in a way that presenting the idea for an urban farm be the most clear and precise as possible; meaning optimal development and growth with in a acceptance frame by the city factors, community and economy markets.

Consequently, having pass through the previous phases the third one can be the more direct one engaging the neighbourhood, community, the city itself; once an urban farm is established, ongoing efforts to engage local residents appear to positively affect community buy-in, and facilitating a fondness and respect for the farm that can increase its viability. Also creating a welcoming environment if one fundamental prerequisite to engaging neighbourhoods is creating a welcoming and inclusive atmosphere at urban farms. It is worth to mention as well that urban farmers can use a variety of strategies to involve residents on the farm, depending on their business model and the preferences of neighbourhood residents.

TRADITIONAL FARMING

VS

URBAN FARMING

80% LAND arabe land already IN USE



0% LAND. 4-8 ha land based traditional farm depending on crop

50% of crops planted are NOT HARVESTED



90% of crops planted are HARVESTED

70% GLOBAL fresh water used for soil-based farming
50-80% of which is lost to evaporation and runoff



95% LESS fresh water used for vertical farming using aquaponics method of farming

FOOD MILES

On average food travels from 1500 to 2000 miles on its way to our plate



LOCAL

Reduces the need for long distance transport decreasing the need for fossil fuel and ensuring quality

INTEGRATING URBAN AGRICULTURE INTO COMMUNITIES

HOW IS AGRICULTURE IMPORTANT TO COMMUNITY INSIDE THE CITY?

Today, agriculture is considered one of the most important economic, social and environmental activities for human beings. First, they produce a positive environmental impact by creating landscapes and maintaining biodiversity; second, it provides us natural goods in form of food or raw materials for the textile industry; and finally, they encourage the development of social and community growth within a city. The last aspect is one of the main subject of the thesis since the idea is to produce organic food locally to benefit both consumers and producers. In large cities such as the city of Glasgow, a large concentration of people practice the activity of farming in the outskirts. That is why the need to produce food necessary for daily life in the place where we live and the importance of community work to carry out this activity has arisen.

Projects that are carried out in large groups of people in productive aspects such as community agriculture can be much more viable. By generating small gardens in the backyards of homes or in the courtyards between blocks of houses to produce large quantities of food, a compatible, social and productive environmental design can be achieved.

Urban agriculture production such as family, school, community gardens, etc. can be established in different areas of the city. This small-scale agriculture has always been lived among people, whether social or individual and provides families, neighbours and related groups with

the possibility of observing and admiring natural processes (planting, growing, flowering, harvesting, conservation, etc.) every day. Being integrated into the city, promotes coexistence between users and neighbours. The garden becomes an ideal public space for the community meeting.

However, not only do they contribute to the coexistence of groups of people, but also a greater emotional and psychological well-being is successful. Healthy habits make your general health improve. When we are in contact with nature, we release stress, because of the cardiac rhythm and muscle tension decrease. People suffering from depression, anxiety disorders and high-stress levels achieve mental clarity and retention after spending time with nature.

NATURE AND WILDLIFE



- Enjoying the views on a walk
- Observing the wildlife
- Relationship with nature
- Natural and human resources

SOCIAL CONNECTION



- Gain social skills
- Increase sense of belonging
- Create collective identity
- Boost self-esteem

AGRICULTURE AND COMMUNITY



MENTAL HEALTH

- Reduce depression
- Reduce feelings of anxiety and stress
- Improve mood and self-esteem
- Scape / Retreat

INTEGRATING URBAN AGRICULTURE INTO COMMUNITIES

COMMUNITY SUPPORTED AGRICULTURE

Community-supported agriculture is an alternative socio-economic model of producing food and organizing distribution and sales, aiming to increase the quality of food and the care of the land, plants and animals. The system was born as a response to the problems of healthy nutrition and the urbanization of agricultural land in Europe in the 60s and 70s.

It is a way to support sustainability and responsible consumption. The idea is to promote eco-smart farming, local purchases, and improve the community. In addition, they have ecological farming techniques that eliminate some of the high environmental and economic costs derived from the use of pesticides and fertilizers. The energetic and environmental costs are even further reduced by aligning long-distance transport and plastic containers.

The agriculture supported by the community substitutes buyers and suppliers of the traditional market by associations of farmers and consumers who exchange products in a common and social space. In a way, consumers become producers because they finance the means of production of what they consume.



Figure 1.4 | Community Supported Agriculture in U.K.

INTEGRATING URBAN AGRICULTURE INTO COMMUNITIES

THE IMPACT OF AGRICULTURE IN THE GLASGOW COMMUNITY

Before the industrial revolution, agriculture was the main source of economic development for most European countries, although today there are many commercial options to exploit other fields of development, still many rely on it as a primary means to generate income.

In the city of Glasgow, growth in agricultural surplus has been achieved by increasing social welfare, particularly in rural areas. The standard of living of the rural masses is high because they consume a nutritious diet. If the result is positive in rural areas, why not apply them to urban areas? Technological advances allow us to “bring” traditional field agriculture to large cities.

Another important factor of agriculture in the human being is the increase in employment. Directly, agriculture provides the possibility of sustenance to farmers, salaried workers who work for days or hours, technicians and operators of machinery, among others. The development of the harvest increases the purchasing power of the farmers that will help in turn the growth of the non-agricultural sector of the country. In Glasgow, it is well known that most people depend on agriculture and it is they who must be able to afford to consume the goods produced. In different circumstances, agriculture provides employment a number of workers who, although they are not directly in the fields, depend on agriculture: scientists of agricultural branches, companies producing machinery and tools, transport companies dedicated to storage, etc.



Figure 1.5 | Leeds allotment gardeners in battle with council.

ALLOTMENT GARDEN

CONTEXTUAL RESEARCH

In the 1890s, thanks to the invention of refrigerated technology, food could be transported to all parts of the United Kingdom. However, before airplanes and ships became the key to transport and logistics, the United Kingdom was largely self-sufficient in food and depended on land.

In rural areas, people grow food in their own fields. The situation was different for those people who lived in the cities. People with high resources usually grew little food in their backyards. However, while having a private garden was a luxury, low-income people did not have this possibility.

For this reason, in the 19th century, the government gave land to low-income workers for the provision of food. These plots are known as "allotments". Today they are plots of land that are assigned to individuals or families for the cultivation and development of food for their own consumption.

According to the Act 1892 of Scotland, the legal definition of Allotments is *"a plot of land about 250 sq., within a community of other plots, tended by a lot holder singly or in partnership with others, holding the rental agreement with the Landowner. An allotment site is a land worked by the community of plot holders"* (The National Archives, 1892).



Figure 1.6 | Allotment Garden in Glasgow, Scotland.



ALLOTMENT GARDEN

THE ALLOTMENT IN GLASGOW

The allotments are distributed around the city of Glasgow. As can be seen on the map, there are more than 30 communities that carry out this activity. Most of these places belong to the Glasgow City Council but each is administered by its own committee. Assignments are rented out on a first-come, and there is no preferential regimen in practice (either the age, gender, race, cultural background, sexual orientation or religion is a limit to rent a plot). The rules are simple and those who do not comply simply must deliver the plot to be assigned to another person on the waiting list.

Normally, the plots are found in the backyards of the houses or in the courtyards but also next to public parks, private gardens, sports areas, green cemeteries, etc. Currently, there are around 1500 plots available in 22 assignment sites. However, another 1000 plots are in demand based on the number of gardeners on the waiting list.

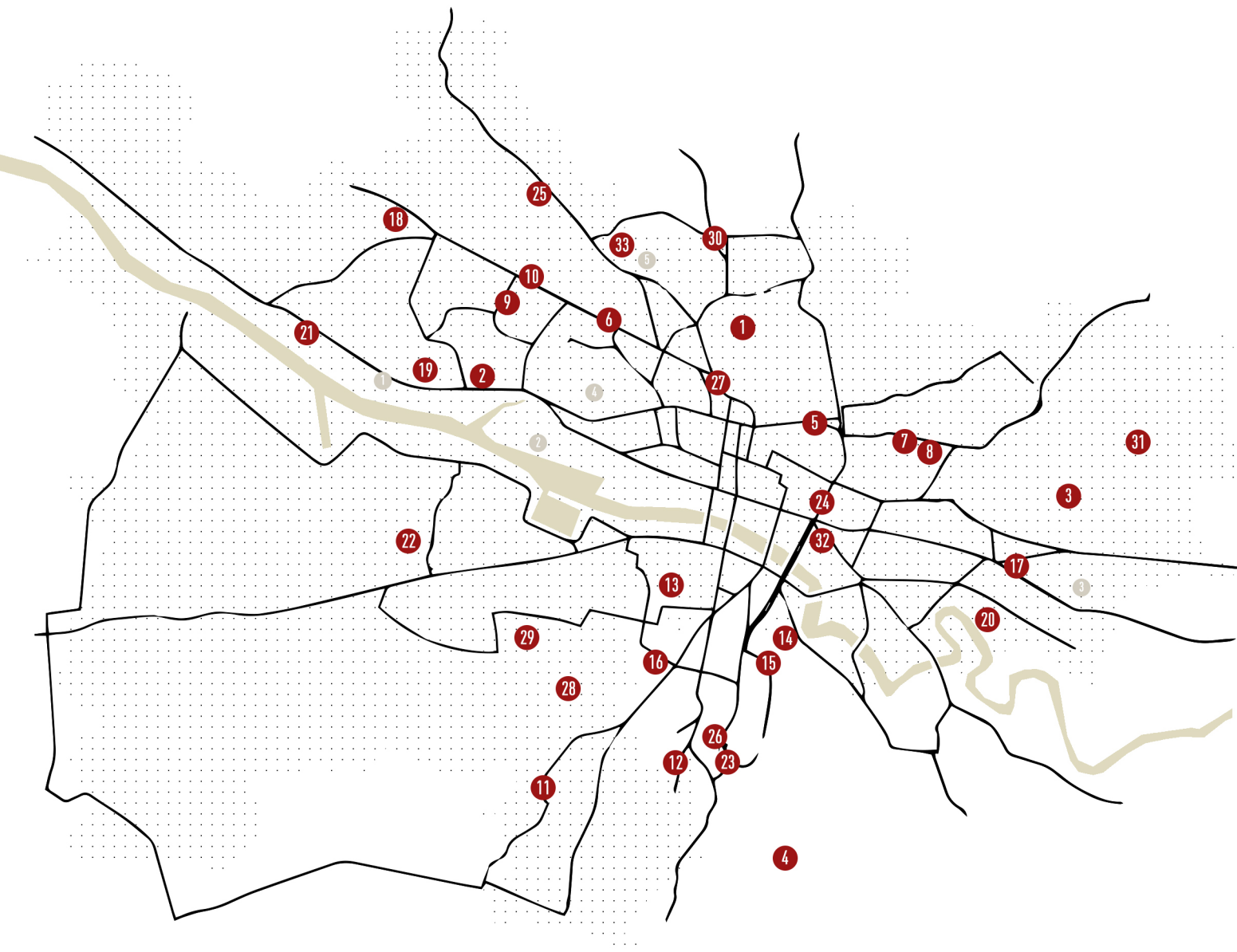
In terms of the provision of the allotments, Scotland has a low performance. It is one of the regions that offer the smallest allotments areas for residents throughout the United Kingdom. Because of this, many Scottish gardeners do not have the possibility of producing food. While in London a resident receives 1.2 m² of land, in Glasgow a resident receives only 0.52 m² of land. Glasgow City Council must work to regulate the plots standards in Scotland, providing twice a year as many of the available areas.

Allotment sites

1. Balornock Allotments
2. Beechwood Allotments
3. Budhill & Springboig Allotments
4. Croftburn Allotments
5. Germiston Allotments
6. High Carntyne Allotments
7. High Carntyne Allotments
8. Kennyhill Allotments
9. Kelvinside / Julian Avenue
10. Kelvinside / Kirklee
11. Mansewood Allotments
12. Merrylee Allotments
13. New Victoria Gardens
14. Oatlands Gate
15. Oatlands Leisure Gardens
16. Queens Park Allotments
17. Tollcross Allotments
18. Trinley Brae Allotments
19. Victoria Park Allotments
20. Westthorn Allotment
21. Yoker Allotments
22. Yoker Allotments
23. Berridale Allotments
24. Dennistoun Allotments
25. Garscube Allotment
26. Holmlea Gardens
27. Petershill Allotments
28. Sir John Stirling Maxwell Gardens
29. South Western Allotments
30. Springburn Allotments
31. Wellhouse Allotments
32. Reidvale Allotments
33. Balmore Allotments

Community projects

1. Kingway Court Growing Space
2. Yorkhill Park Growing Space
3. Gheurlertop Community Project
4. Woodland Community Garden
5. The Concette Garden



5 community growing projects

33 allotment sites

1500 allotment plots

ALLOTMENT GARDEN

THE IDEAL SITE

The allotments vary depending on where they are located: humid areas, surrounded by houses, in areas without trees, etc. The important thing about this activity is the fertility of the soil since it will be the main factor to determine the quality of the crop and how productive the result is.

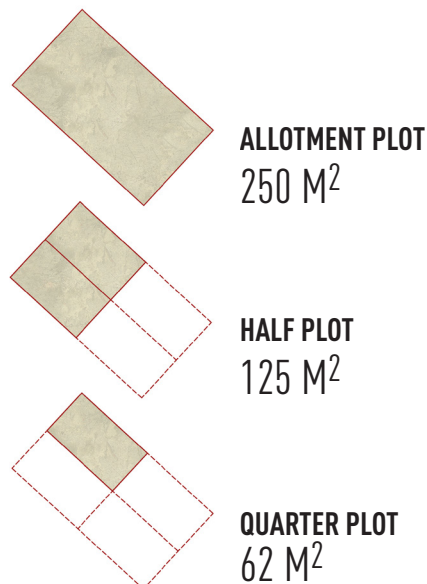
The allotments in Glasgow have different shapes: they are oblong and square, irregular and oval, large and small. In addition, they exist in different urban contexts such as social housing, close to the main transportation routes, along the railways, in industrial areas, on the edges of parks, etc. The cost of renting a full size (250m² plot) is approximately 38 Euros per year.

According to the "Allotment Site Design 2013" guide, the ideal site for an allotment must contain the following aspects:

- It should have a slight slope to the south.
- It should have a border of trees from north to east.
- A minimum of 2 meters deep.
- A minimum use of 7 years of organic food production.
- At least 2.5 acres or 1 hectare with 45 standard size plots, with land for community activities.
- Access within a short distance from the main road by car.
- They must be located near the homes.
- They must provide direct sunlight.

Additionally, according to the Scottish Act 1892, it defines allotments as plots that do not exceed one acre (4,000 m²), 40 poles (1,000 m²) and 20 poles (500 m²). However, this description does not reflect today's reality. Nowadays, allotments have a standard size of 250 m².

Increasingly, sites are starting to offer small plots of "half size" and "quarter size" plots or even starter plots for people new to gardening (SAGS, 2013). Glasgow Allotments Forum suggests that local authorities introduce and legislate a new definition of parcel allocation to meet the current needs and needs of gardeners and standardize plots throughout Scotland to facilitate management and transport (Glasgow Allotment Forum, 2018).



ALLOTMENT GARDEN

ALLOTMENT GARDENING

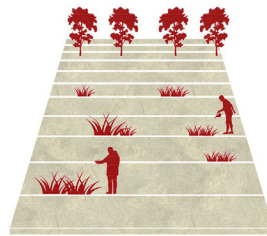
Many of the allotments are able to produce enough food to supply the weekly needs of a small family. With proper handling of food growth, families save purchases at the supermarket. In addition, fruits and locally grown vegetables are much more flavourful than supermarket shelves.

Moreover, buying fewer food products packaged inefficiently in supermarkets means less domestic waste to fill in containers. Similarly, by growing locally, you can reduce carbon footprint, which is often linked to intercontinental transport. The production of organic foods will always be healthier because they do not contain condons to make them last longer. Consumers have better control than what their families eat.

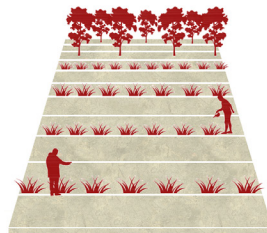
AS A PLACE OF INTEREST | For many farmers, allotments are a place of personal enrichment. Agriculture and the cultivation of plants have been a hobby for years. It is a way of entertaining. Nowadays, there are competitions during the year, which means that farmers take more care to keep their crops in good condition and commit themselves to the idea of “grow your own”. In addition, these spaces also become expansions of nature into the cities.

AS A PLACE FOR THE COMMUNITY | Many of the people who practice this activity do it because of the possibility of socializing with their neighbours. It is very possible to make friends who have the same

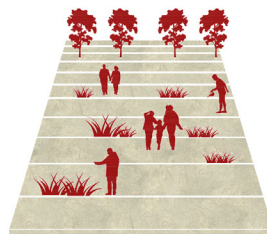
interest, the same experiences and the same knowledge about agriculture. Growing in a group makes the work more pleasant. Provide places for social interaction and give the opportunity to make friends, gain social skills, lessen isolation and loneliness, increase the sense of belonging, create a collective identity, etc.



GROWING ORGANIC FRUITS AND VEGETABLES



AREA OF INTEREST



BEING A PART OF COMMUNITY

**ALLOTMENTS ARE THE NATIONAL TOOL FOR
FOOD SELF-SUFFICIENCY, ENVIRONMEN-
TAL EDUCATION, LAND REGENERATION,
COMMUNITY COHESION AND SOCIETY'S
WELL-BEING**

GROWING FOOD



“GROWING PEOPLE”



GROWING BETTER CITIES

Allotments play an important role in the welfare and health of the inhabitants and their benefits are innumerable. They are not only a place for food growth but also a place to strengthen relationships between communities. The value of building these communities is priceless, especially in times of social stratification and discrimination. Any act of social integration must be supported and replicated. The potential of allotments in the construction of healthy communities should not be wasted and the priority of the government should be to provide land for a full investigation.

In many articles, it has been mentioned that Britain could be a more self-sufficient country of food and the awards are giving a good start for the movement. Cultivating the land, interacting with it and, above all, taking care of it should take place in all the cities of U.K. The city of Glasgow is obligated to: increase all household food self-sufficiency by 50% by 2050, provide to all citizens an outdoor fridge in for of a cultivated allotment and cultivate existing behavioural in land protection and cultivation. As future architects, we can support and help farmers in this area. Equip them with architectural ideas to increase the allotments in the urban patterns of the city. The next part of the work is going to investigate and develop potential solutions to the matter.

ALLOTMENT GARDEN

CROPS AND TREE SPECIES IN GLASGOW

WHAT CAN BE GROWN? | Although most vegetables require a lot of sun to give them, there are several species capable of providing a good income with only a little sun exposure per day. The orchards are located in places with a lot of insulation and free of any kind of shade. They receive the necessary energy for the development of flowers and fruits. The ideal garden should be located in full sunlight, facing south if possible. The vegetables that can live with fewer hours of direct light a day grow at a lower speed and develop smaller leaves and fruits. However, this is not an inconvenience.

Some of the crops that best suit the garden in Glasgow are: broccoli, artichoke, brussels sprout, cabbage spring, cabbage summer, cabbage winter, carrot, cauliflower, celeriac, celery, courgette, cucumber, rocket, kale, leek, lettuce, Onion, parsnips, radish, spinach, spring onion, squash, strawberry, swede, tomato, etc.

Some vegetables such as carrots, tomatoes, eggplant, peppers and cucumbers should have a regular and abundant watering. The humidity has to be constant. As for the lettuce, the irrigation should be moderately demanding, especially the formal heart.

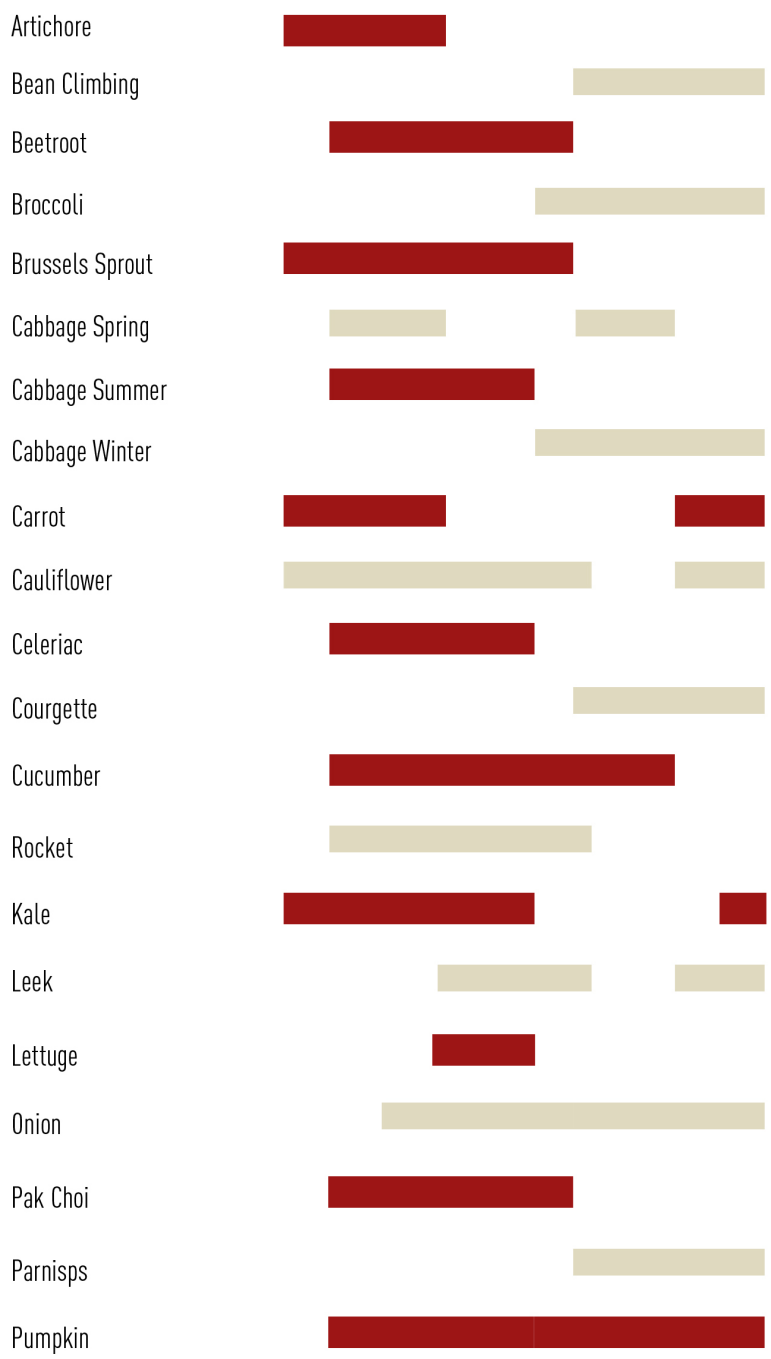
To achieve a good growth of the strawberries, the irrigation should be moderate without excessive humidity but without spending dry periods. It is advisable to add a little compost after each cycle since it is a multi-year plant.

TREE SPECIES | The trees in Glasgow are a key component in the landscape of Scotland. They not only provide colour to the life of the city but also contribute to the health of the people. They are capable of producing shade, controlling winds, reducing noise, etc. The trees that are inside the city are protected; others are capable of producing wood.

The most common autochthonous tree species in Scotland are the mountain ash, the oak and, especially, the conifers (mainly fir, pine and larch). About 15% of the country is forested. Most of the plantations were created from the 1920s, which led to the predominance of coniferous for the production of industrial wood.

The most wooded areas are found in the highlands of the south and east and are formed by birch, ferns, mosses, herbs.

Jan - Apr May - Jun Jul - Oct Nov - Dec



when to sow
when to harvest

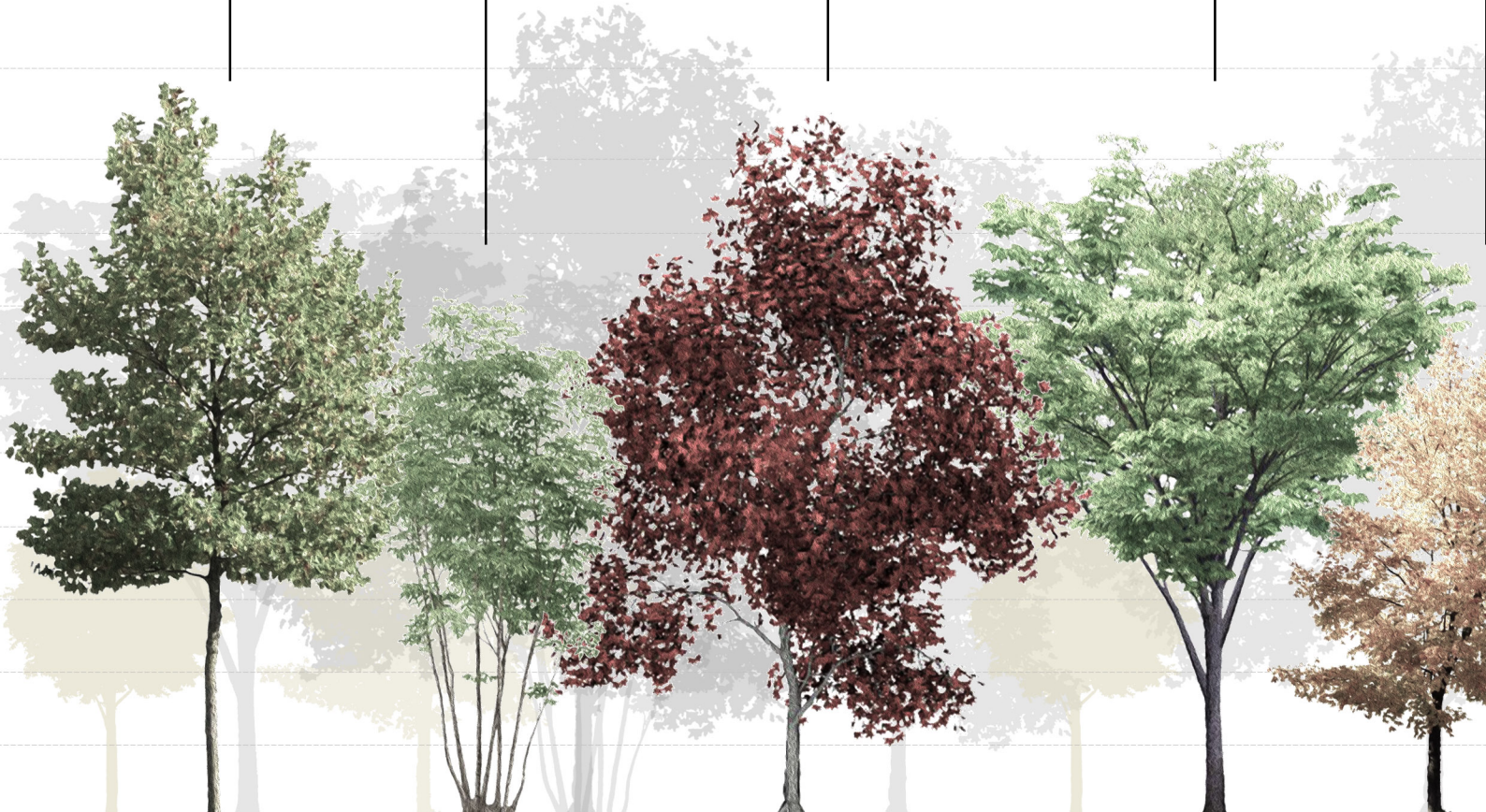
Acer campestre (field maple)
height: 8m | Good autumn colour

Corylus avellana (hazel)
height: 5m | Good on chalky soil

Crataegus laevigata (midland hawthorn)
height: 8m | Attractive berries

Malus sylvestris (crab apple)
height: 9m | Attractive fruit

Sorbus eminens



height: 6m | Large red fruit

Rhamnus frangula (alder buckthorn)

height: 5m | Attractive autumn colour and fruit

Sorbus aucuparia (rowans or mountain-ashes)

height: 10 m | Each flower is creamy white

Prunus spinosa (blackthorn)

height: 7m | Spiny tree, small purple fruit

Crataegus monogyna (hawthorn)

height: 8m | good as hedging, attractive berries



VERTICAL FARMING

THE CONCEPT

In their most complete configuration, the vertical farm consists of a complex of buildings built in close proximity to each other. They include: a building for the growth of food, management offices, one for control, a center for monitoring the overall operation of the facility, a nursery (greenhouse) for the selection and seed germination: a laboratory for quality control, a laboratory to monitor food safety, one to monitor plant diseases, an eco-educational tourism center for the general public, a green market, and finally a restaurant.

Agriculture will be housed in an adjacent but separate building without physical connection to ensure plant safety. *“The form follows the function is the main deterrent for life on earth. The environment selects the specimens that at each level better follow this golden rule of nature”*, up to the form and mode of action of the molecules of which we are made of.

The same principle must be followed when planning for ourselves. When planning a vertical farm, architects and engineers must be guided by this fundamental concept, as it is built to meet the needs of our crops and not necessarily ours.

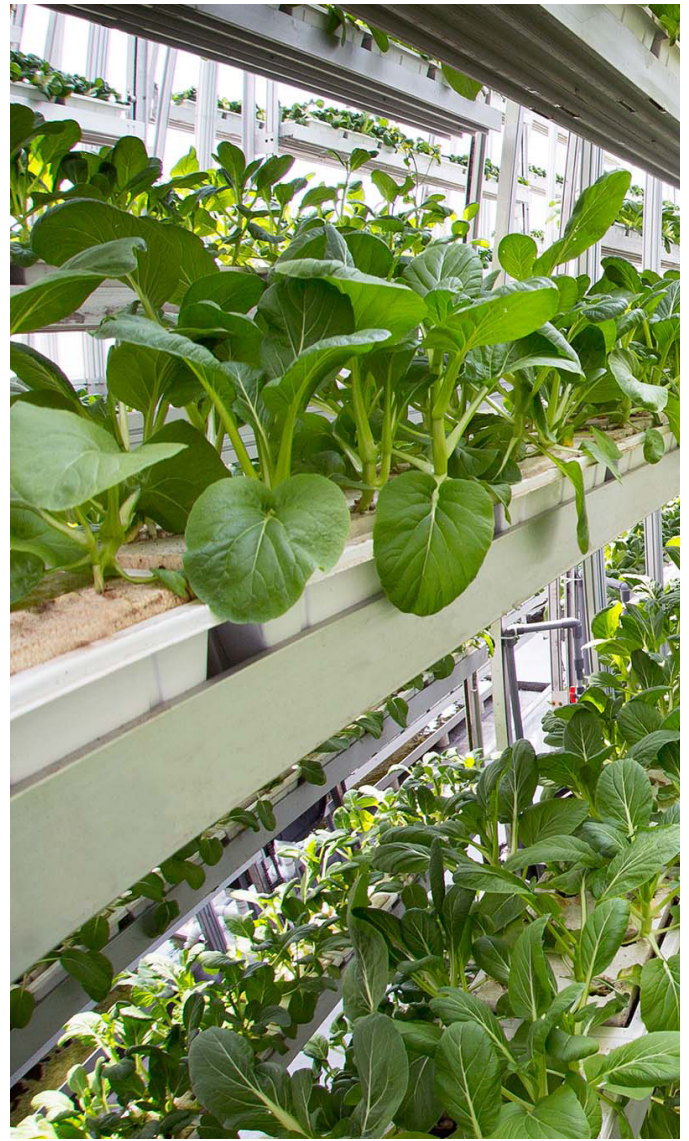


Figure 1.7 | Vertical Farming, a growing industry?.

VERTICAL FARMING

WHAT CAN YOU CULTIVATE IN A VERTICAL FARM?

The question that arises often is which crops can be grown indoors. The answer is surprising: "Virtually everything". If you visit, for example, the Kew Royal Botanic Gardens in London, the Bronx Botanical Garden in New York, or the Missouri Botanical Garden in Saint Louis you will notice that almost all types Exotic plants can be found within these structures.

The New York Botanical Gardens, for example, welcomes and takes care of the largest flower in the world, Rafflesia Arnoldi, which is quite rare and grows in isolation in the dense tropical forest of Indonesia. If horticulturists manage to grow this, then everything is possible. As for edible plants, one needs to consider different aspects before choosing which ones to grow. First, economic considerations are to be made.

Is it worth it? Can farmers sell the crop whenever it is ready and profitable? If this is so much the better since profit is the main engine behind a vertical farm. So far, many vegetables have been successfully cultivated to make money. These include tomatoes, lettuce, spinach, zucchini, green peppers and green beans.

Almost none of these crops, however, would qualify to meet the needs of a hungry city. Essential crops such as wheat, barley, millet, rice and potatoes would be more appropriate. The answer to the question whether or not it is possible to grow these plants indoors is still yes. All were grown in aquaponics. If the success of their production means

that a country that previously had to import almost all its products can now, within its borders, provide its population.

The higher revenues realized by indoor farming are driven y three factors:

1. Year round production capability.
2. Higher yield.
3. Higher retail pricing.

Leafy greens and herbs are most suitable for indoor farming because there are most economically valuable. This is because they require the least amount of energy and space. Moreover, their yield time is faster than other crops (Dirt to Dinner, 2016).



broccoli



eggplant



tomatoes



carrots



blueberries



banana



melon



strawberries

VERTICAL FARMING

ACTUAL ADVANTAGES OF A VERTICAL FARM

AGRICULTURAL PRODUCTION ALL YEAR | Since the beginning of agriculture, crops production has been linked to the seasons, even in the tropical climates. The period of the year and the weather conditions, together with the type of soil determine the yield of a specific crop in each region. The lack of production of maximum yield has traditionally been associated with adverse weather conditions that come at the end of the growth period, or are also associated with the reduced or excessive amount of rainfall.

The advantage of not having to worry about external conditions is evident to everyone. It means that for a farmer it is possible to plan the growth of each crop at anytime and anywhere. Not only is this a better, more reliable and sustainable strategy for food production, but it also allows the farmer to take advantage of seasonal market announcements that can allow a crop to be sold at a much higher price than normal.

NO DAMAGE TO CROPS DUE TO WEATHER CONDITIONS | Farmers working indoors do not have to pray for rain or the sun, or moderate temperatures, or any other element linked to the production of food crops, because they can control everything: temperature and humidity, as well as the amount of light and density of plants. In recent years, there have been catastrophic meteorological events on a global scale that have definitely changed the way food is produced. Floods, droughts, tornadoes, hail, hurricanes, cyclones and strong winds are

just some of the reasons why outdoor agriculture is a precarious occupation.

NO AGRICULTURAL UNLOADING | The agricultural discharge is essentially preventable, considering the fact that in order to maximize yields with conventional outdoor crop production; almost all plants require more water than the amount they receive from rain. This outflow in the most advanced agricultural operations is loaded with silt, fertilizers, herbicides and pesticides and usually ends up in some river on its way to the estuary. All damage caused by runoff can be prevented by moving to an indoor growing strategy. The water used to produce food inside could also be re-circulated and used over and over again, provided the nutrients are added as quickly as they are absorbed by plants grown with hydroponics.

RESTORATION OF ECOSYSTEMS | If a significant amount of agriculture were to take place within the urban landscape, the ecological footprint of the world of agriculture would be smaller. For most crops, about ten or twenty times the cultivated area that serves to grow indoors could be converted into deciduous forest outside. This is because the crops can be grown all year around and there would be no losses due to weather events. On a large scale, environmental restoration is at the top of the list of things we should have done, but most people perceive it as an unrealistic goal because of the amount of land; nowadays we need vertical farms, leaving more land available for

a near future, given the continuous increase of the human population.

NO USE OF FERTILIZERS OR HERBICIDES | The vertical farm will employ hydroponic, aquaponics and aeroponics technologies configured within a secure building. The design of the building will take into account the need to keep the animals out. Unwanted, such as insects and microbial pathogens, which in an outdoor environment are able to meet their nutritional needs. The traditional farmer must counteract this attack on crops with a variety of weapons, among, pesticides and herbicides.

Furthermore, fertilizers are essential for optimizing crop yields in depleted soils. On the contrary, the vertical farm can use pure water, in which a carefully balanced set of nutrients has been dissolved to meet the nutritional needs of the plants.

USE OF 70-95% LESS WATER | Today, traditional agriculture uses about 70% of all fresh water available on earth, and in doing so pollutes the planet, making it unusable for those living downstream. In contrast to this, hydroponic, and more recently aeroponics, crops have revolutionized the way water is used to grow plants without harmful side effects such as agricultural discharges. When these two methods are used in “closed circuits”, or autonomous, a huge amount of water is stored, up to 95% in some cases.



Figure 1.8 | Growing leafy greens in an incredibly water efficient system.

But how do these two main work systems work? Contrary to popular beliefs, plants do not need soil to support itself. What they use of the soil is a solid foundation in which they can spread their roots. In other words, the earth acts as a physical support system.

That is why plants can be found all over the world, regardless of the type of soil, as long as enough water and dissolved mineral salts are enough, and a source of organic nitrogen there are no problems. Provided that the soil type does not adversely affect the plant by being too acidic or basic, the plants can grow almost anywhere on the planet, even in the cracks of the sidewalks or on the cliffs of mountains.

The hydroponics, developed in 1937 by Dr. William Frederick Gericke, at the University of California, is the routinely used method of nurseries to obtain the seeds to germinate and sprout the roots before being transplanted into some form of soil. The avocado seed is probably the best known example of a plant that can grow to almost maturity in a glass of tap water, with nothing more added except fresh air and sunlight.

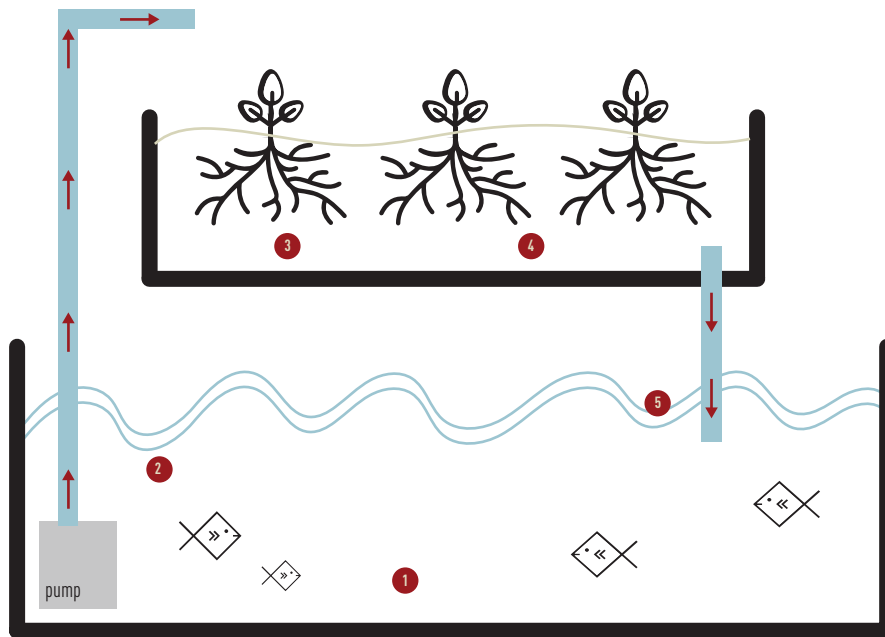
All the seedlings produce adult plants able to carry on the maintenance of the species, given the favourable climate. The creation of a hydroponic structure is largely constrained by the type of crop that one wants to produce. The configuration is in fact determined by the root system of the plant. The liquid part is slowly pumped through a special

tube, generally constructed from a plastic material such as polyvinyl chloride (or PVC), although it is not a requirement that the plastic be used. Bamboo of various diameters could also serve the purpose quite well, and since it is one of the easiest natural materials we know, bamboo would be ideally suited. Furthermore, it is very easy to grow.

Once the pipeline is set, nutrients are dissolved in water and diffused through the piping, and are electronically monitored for the concentrations of each element and organic nitrogen. The result is uniform plant growth under optimal conditions.

The **aquaponics system**, invented by Richard Stoner in 1982, is instead a bit different. In fact, there are small nozzles located under the plants that spray a nutrient-laden mist on the roots, providing them with everything they need. It is therefore possible to consume almost 70% less water than hydroponics, and without doubt it can be considered an important technique in the future phase of controlled agriculture.

The project site of this thesis is located near the River Clyde of Glasgow. For this reason, the aquaponics technique will be used, taking advantage of the water used in the docks. As mentioned above, one of the advantages of aquaponics is that water is integrated into a cycle through which it is not absorbed by the soil. The image on the right illustrates the process of this technique.



- 1 Clean water is contaminated with fish food and waste
- 2 Water containing ammonia from fish food and waste is pumped into the grow bed
- 3 Bacteria turns the ammonia first into nitrites and then nitrates
- 4 Plants absorb the nitrates as plant food
- 5 Clean water is siphoned into the fish tank with ammonia removed

DISTANCES TRAVELLED BY FOOD SIGNIFICANTLY REDUCED |

There is something reassuring in the phrase “grown up in the house”, and can be referred to any area, especially food. The local one is better because we know where it came from. The vertical farm is a concept of the neighbourhood formulated in futuristic terms, but with a very homely intent. The vertical farm will reside within the confines of the city and in doing therefore will create a sustainable local source of city production that will undoubtedly also make space for restaurants, schools, coffees and apartments. The products will be picked up as soon as they are reached, they will never be frozen or chilled.

GREATER CONTROL OF FOOD SAFETY | The vertical farm, regardless of the configuration, should be constructed in such a way as to exclude the plants of the most well-known parasitic and microbial parasitic arthropods, using the same principles that are applied to the design and construction of intensive care units for hospitals.

Barrier medicine has been successfully developed over the last hundred years, since we have become aware of pathogenic microbes and their characteristics. This approach will allow the vertical farm to operate free from pests and pathogenic organisms for the vast majority of the time. Prevention is essential.

NEW JOB OPPORTUNITIES | The event of the vertical farm will create new opportunities on many levels. The municipalities will use

them to rehabilitate urban spaces, perhaps once considered too degraded to be served by commercial properties. The areas, in which the vertical farms will grow, in turn, will attract new development, making the urban food desert an ancient memory.

New professional figures will also be created: managers, counter-parties, indoor agriculture specialists, waste energy specialists, and agricultural workers for the nursery, specialized in monitoring, collection, selection and sale. New industries associated with the development of hydroponic and aquaponic systems will grow, with sophisticated companies producing electronic tools for everything from seed nutrient monitoring in germination to crop harvesting systems.

In the last five years, Glasgow has experienced countless bad crops, caused mainly by various meteorological events such as floods and droughts. With the failure of agriculture, the urbanization rate has increased disproportionately with respect to the birth rate. Most migrants are made up of farmers and their families. What better idea to have a job in the vertical farm towards those who already know how to cultivate? The future seems to promise well for the creation of new jobs for the new vertical agriculture sector.

PURIFICATION OF GRAY WATER FOR DRINKING WATER | Every day, every city produces huge amounts of gray water derived from black water with the removal of solids. It is the responsibility of every

community to ensure that they cannot harm the environment. For the recovery of water, plants have the answer. With the roots, the plants get their nourishment by pumping water through the leaves, and then out into the atmosphere.

This process, called transpiration, allows them to take nutrients in the form of nutrients and organic nitrogen. The nutritive elements and the nitrogen remain inside the plant and become part of the new tissues, in the growing parts of the organism, while the water is continuously transpired through tiny pores in the leaves called stomata.

The reclamation of gray water could easily be achieved by exploiting this basic activity of plants within vertical farms built exclusively for this purpose. In this case the plants would not end up in someone's salad, as it would be too risky from a public health point of view. After the plants have pumped the gray water through their tissues, they can capture the transpiration water and purify it before releasing the pure H₂O contained in the atmosphere. Indoor air dehumidification is all that would be needed to recover the water we produced by eating and drinking.



365 days of production



sustainability

solar panels for temperature control in plants
water collection for humidity control in plants



control of crop production



recover the cultivation spaces to create a forest



no use of fertilizers or herbicides



new technologies

the aquaponics system to use less water



vertical farm into the city

reduce the distances



control of food safety



job opportunities

counter-parties, agriculture specialists, workers, etc



purification of gray water

VERTICAL FARMING

PRINCIPLES AND RULES

Most crop breads have a fairly wide range of tolerances regarding temperature and humidity. This will allow the indoor grower to combine a wide variety of plants and grow them in the same area if desired, as long as their roots grow at the optimum temperature for each species.

The materials used in the construction of the building will be dictated by the needs of the plants and, secondly, by the needs of those who work within the vertical farm. This does not mean that environmental conditions must become intolerable for man, rather, on the contrary. Plants and people have to live together, therefore the temperature and humidity inside the building should be very pleasant for a work environment as well as to maximize crops.

There are four main topics that designers and engineers need to include in every version of a vertical farm:

CAPTURE SUNLIGHT AND DISPERSE IT EVENLY BETWEEN CROPS

Wavelength: Designing a large, safe building for plants requires an intimate knowledge of what a plant needs and how it works as a whole, to allow maximum growth.

There are two main forms of chlorophyll: A and chlorophyll B. Both absorb light in two distinct wavelengths of the visible spectrum, blue and red (about 400 and 700 nanometres). As a result not all the energy of sunlight is needed to grow the entire crop to its maximum yield.

We can take advantage of this, in fact, for the creation of exclusive lighting for plants.

Diode light emitters (LEDs) have already been specifically designed to do so, resulting in significant energy and cost savings. In contrast, traditional light bulbs emit 95% of their energy in the form of heat (very inefficient, therefore) and the rest as a wider spectrum of light, most of which is useless for the plant.

OLED lamps, on the other hand, contain stable organic compounds that also enable the production of narrower spectra of light, saving energy and money, while continuing to provide plants with exactly what they need. In addition, OLEDs allow the design of lamps that could be made in any configuration, placing the light source at the optimal distance from the plant, regardless of the shape of the plant.

The sunlight: In areas of the world already enjoying plenty of sunlight, such as Glasgow, the sun is seen as a source of energy for crops and would be completely feasible and highly recommended.

Photovoltaic could easily provide the energy needed to run any electrical equipment, while sunlight would provide all the energy needed to grow crops. Orienting the longest façades of the vertical farm with east-west direction will allow the maximum amount of light to be captured.

Transparency: If sunlight is the main source of energy for growing crops, the vertical farm should be as transparent as possible. The designer has many options on the materials to choose from. Glass is cheap for production and durable, even though a bit fragile and heavy.

CAPTURE PASSIVE ENERGY TO PROVIDE A RELIABLE SOURCE OF ELECTRICITY | The vertical farm produces food, but evidently also produces a considerable amount of non-edible plant parts and waste. This organic material, regardless of its form, is a precious resource that begs to be reused in the system. It is good to bear in mind the fact that the term “waste” is not mentioned anywhere in the dictionary of the ecosystem. It is all part of the same natural cycle of energy recovery.

Incineration is the most practical way to proceed. A very high energy efficiency is given by biomass incinerators with devices that produce minimum levels of polluting substances, while producing heat that is transformed into electricity.

The process uses about six times less energy than it produces. The other advantage is that at the end of the day there is no waste to dispose of. The energy recovery of non-edible parts of the crop (stems, leaves, roots, etc.) makes the vertical farm and opens the way for entire cities to behave in a similar way.



Figure 1.9 | Indoor vertical farming, including technology by Urban Produce.



Figure 1.10 | Control of the plants.

USE A GOOD BARRIER FOR PLANT PROTECTION | Most outdoor crops consist of programs designed to limit the spread of pests and insects by applying pesticides or herbicides. Inside, things will be very different and much more controllable. The exclusion of unwanted visitors will be due to some fundamental elements such as the design of double doors that will allow an additional level of protection against insects and microbes.

Then, all the staff will be sterilized in various uniforms in shoes, in their hair, and will have to take a shower before changing clothes: this will minimize the risk of loss of crops due to “hitch-hiker” agents on objects such as shoes. Since the vertical farm will not need fertilizers, the risk of contaminating plants with human pathogens will be completely eliminated. This must be followed by a laboratory test routine to monitor each different area.

MAXIMIZE THE AMOUNT OF SPACE DEDICATED TO CROP GROWTH

The seeds of indoor crops: How to configure each floor depends exclusively on the selected crops. The plants are spaced at a distance similar to what you might see on a traditional terrain. Tomatoes, lettuce, spinach, green beans, peppers, zucchini, cucumbers, melons, and many others fall into the category of plants that can be grown with this methodology.

Once the construction of the vertical farm is complete, the next step

will be to buy the first materials, for example, seeds. Where to find the seeds for each crop is not a trivial matter, since there are many varieties of each crop to choose from.

The logic behind the vertical farm is to avoid the problems that there would be in outdoor cultivation. The seeds must first be decontaminated superficially, then sent to the diagnostic laboratory to check for pathogenic microbes that may be inside them, and, once certified free from disease, the seeds will be sent to the quality control test at the germination nursery.

The seeds will be evaluated for their ability to grow, and once germinated will be tested again to identify any pathogens that may have escaped the first check. The crops born will then be transferred to the growth area and located in their hydroponic plants. All crops will be constantly monitored by remote sensing systems for growth and the conditions of nutrient solutions will also need to be checked. All these important and fundamental steps to obtain safe and healthy products will create many new job opportunities for those with a green thumb.

Fresh and clear water: The water for the vertical farm will be used for growth in hydroponic and aeroponics cultures, and for people, who will work there, or for their showers and for drinking water. It could come from different sources, depending on the geographical location and the ability of the urban community to access the reuse of gray

water.

The highest quality of water is that it must be used whenever possible. Usually, this means getting water from a river, lake or tank that is then filtered before being applied to crops. The obvious advantage of controlled agriculture is the fact that it is a closed circuit system, referring to the capture of water vapour derived from transpiration using dehumidification devices on each floor. This represents a great efficient system of water use for agriculture compared to traditional methods of agricultural irrigation of open terrain.

In the closed loop system, hydroponics uses about 70% less water than traditional farming methods, while aquaponics uses 70% less water than hydroponics. In both cases, this is a substantial improvement, and for areas in countries where water is already scarce, switching to vertical agriculture is the only reasonable approach to allow more water to be made available for drinking.

Furthermore, no harmful water discharge occurs in the vertical farms. If implemented on a large scale, vertical farming would have the potential to eliminate marine pollution from agricultural discharges.

AFFORDABLE HOUSING FOR URBAN FARMING UNDERSTANDING

PART TWO

AFFORDABLE HOUSING IN THE GREAT BRITAIN

THE CONCEPT

What is affordable housing? Fundamentally, is a home that is considered accessible to all families with medium incomes. Affordable means that a person can have access to that. However, what is affordable for one person may not be affordable for another. Affordability is not a characteristic of housing – it is a relationship between housing and people (Stone, 2006, p. 153).

The disposable income of people is the main factor that determines what is affordable. An affordable house is valued through the cost generated of housing and the income that a person gets (Carswell, 2012). The costs of rent include the total cost of utilities such as gas, oil, electricity, water, etc. According to the government measures, affordable housing could not exceed 30% of an occupant's income, including rents or mortgages, property taxes, maintenance, basic services; nevertheless, the modern approach defines that affordable housing should not exceed 45% of the budget. This percentage is much higher for those who receive low income: around 40% of low-income families spend more than 45% of their income, both in the case of those who pay a mortgage and that of private sector tenants. In Croatia, Chile, Greece, Portugal, Spain, the United Kingdom and the United States, more than half of the families in the lowest quantile of income distribution spend more than 40% of their disposable income on rent (Danko as cited in Vandenbrouke, 2011). As has been pointed out in the Figure 2.1, the need of housing in Great Britain is high, specially in the big cities such as London, Manchester, Glasgow, Edinburgh, etc.

“The term, affordable housing, refers to a wide spectrum of housing types, including homeless shelters and transition housing, subsidized social housing for people with special needs, and various housing types that low- and middle-income households can rent and purchase” (Litmand, 2016).

The evolution of the affordable houses has been changing over the time. The type of housing that is built will reflect the need of people, meaning that, provides some opportunities for medium-income people who cannot afford an expensive house; it can also become an attractive place for work and cultural events in cities or simply an approach to communities interacting with each other. Some important principles that should be taken into consideration when talking about affordable housing are: context, density, size, availability, variety and community. All these variables are related to each other and are the main concepts and principles for a successful community housing.

This chapter will demonstrate the concept and importance of affordable housing in the Great Britain, specifically in the cities of Scotland.

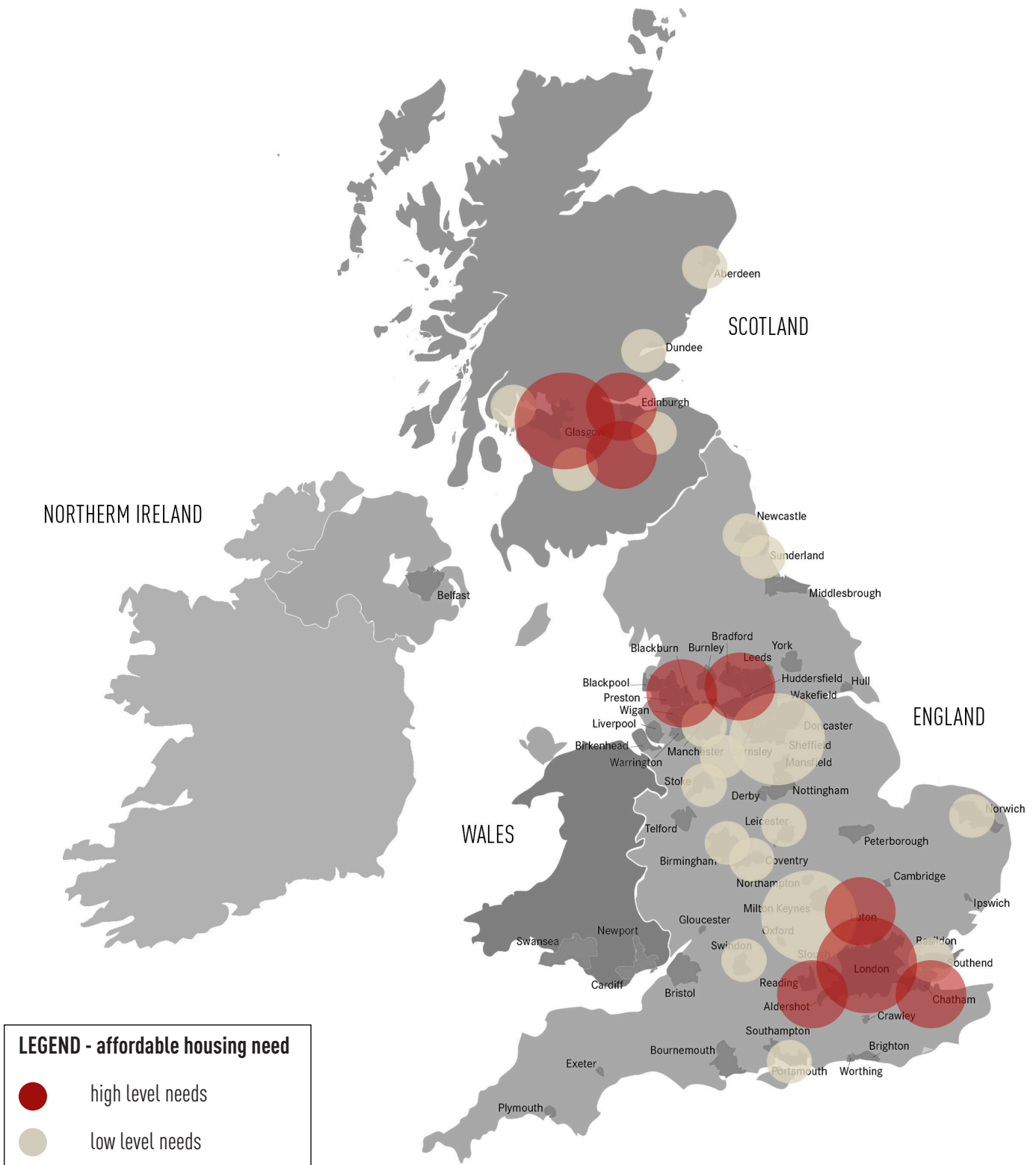


Figure 2.1 | Current affordability of housing in the Great Britain. Source: MOT Data (2013).

AFFORDABLE HOUSING IN THE GREAT BRITAIN

HOUSING DEVELOPMENT IN THE CITIES OF U.K

BEFORE HOUSING | During the years of industrialization, specifically in the nineteenth century, the cities of Britain began to expand on a large scale due to workers who came to the city in search of employment. Under the impetus of industrialization, was a decisive shift in the balance of economy from farming to manufacturing, and a parallel shift in the balance of population from country to town. The rapid growth of towns, and particulate of the industrial tons of the Midlands and North, was the most dramatic, immediate and visible social transformation of the industrial revolution, which was to have profound effects on almost every aspect of life.

As the population increased, the problems of housing conditions, mainly in the centre of the cities, were getting bigger. Within only half a century, by 1851, the decisive tilt had taken place, and more than half the English people were already town-dwellers: by then, 54 per cent of people were living in urban areas as against 46 per cent in rural (Unpopulation, 2009). Private homes in the centre city were becoming more expensive for working and middle families, therefore affordable houses were built outside the city. In the poorest areas, families could be found in squalid housing without facilities such a natural light or electricity.

Some of the worst conditions were found in London, Glasgow, Liverpool and Newcastle and as a result, there was a public health problem throughout the country because the diseases extended from work-

ing-class housing to middle-class housing.

THE NEW TOWN-DWELLERS. 1920s | Since the Industrial Revolution, the new town inhabitants were partly the results of natural increase of existing inhabitants but, more importantly, they were immigrants from the countryside. The houses grew by expansion outwards – determined by a variety of topographical, tenurial technical, economic and social considerations – and by in-filling within the existing boundaries, but not, to any great extent outside London, by building upwards. However, the houses in the Great Britain were in unfavourable conditions, without any comfort. A large number of families had to live in one or two rooms without basic services. In addition, people had to share bathrooms and kitchen facilities, therefore the lack of hygiene and overpopulation caused the spread of diseases.

At this time, the cities developed very quickly; this forced the working population to live in conditions of extreme un-healthiness, which brought with it a high mortality. Nonetheless, the State adopted a policy of non-interventionism. The first Housing Act was approved in 1919, known as the Addison Act, to improve the living conditions of people, ensuring ample space to live with water services, bathrooms and electricity (Council Housing, 2013). This marked the beginning of a long tradition of state housing that would later become municipal property.

They promoted the construction of suburban homes located on the

outskirts of the cities. They consisted of three houses for families, making no more than 12 houses per acre. *“On most estates, house was provided with a generous size garden to encourage the tenants to grow their own vegetables, to privet hedge at the front and to an apple tree at the back. The interiors varied, some having a parlour, but all had a scullery and bath”* (Council Housing, 2013). For most people, these houses exceeded the conditions of their previous marginal neighbourhoods. In addition, facilities such as libraries, schools, churches, shops, etc, were provided.

CONSTRUCTION BOOM AND INTER-WAR SLUM CLEARANCE.

1930-1940s | In the 1930s, they began to build large numbers of suburban homes that offered good services such as clean water and electricity. The reality was that only the high class could afford these new homes. As a result of that, the government started to build affordable houses for middle-low class. The priority was to build as many new houses as possible; therefore, the quantity exceeded the quality. The quality of these homes had standards of very poor spaces.

The construction of affordable housing at that time had two components. One focused on poor construction standards, as I mentioned above, with created damp draughty housing. The other centred on overcrowding which put an intolerable stain on space and facilities. According to a book by the Architect and town planner Graham Towers, in the inter-war period were two types of urban slums in Britain. Tow-

ers (2000) affirms:

(...) one was the cottages built during the earlier part of the 19th century specifically for working-class occupation. In the industrial cities of the North these were back-to-back houses. In London and some of the older cities they were terraced houses built around narrow courts. There were small cramped houses, generally two-storey. Almost invariably they were of the most basic design and poorly constructed. There were no damp courses, the walls were cracked and crumbling due to inadequate foundations and the roofs generally leaked. The other type of slum was the housing overcrowded by multiple occupation-houses or flats designed for single families but occupied by many. In large swathes of inner London there were areas of terraced housing designed and built for middle-class occupation. These were houses of three or four storeys or more, generally of quite distinguished design and comparatively well built. (p.22)

After “resolving” the development of construction throughout the country to reduce the shortage of housing for the post-war, local councils began to take into account other housing problems: slums. The Housing Act of 1930 encouraged the massive elimination of neighbourhoods, demolishing any housing of poor quality and replacing it with new construction (Council Housing, 2013). Most of these slums



Figure 2.2 | Harlem Alley in 1920.

were located in the centre of the city and were generally neglected and unhealthy areas to live.

With the demolition-construction program by the authorities, marginal neighbourhoods were replaced by apartments, mostly three to five stories high. Initially, they tried to re-host the people who were forced to leave the community because of the demolitions.

POST-WAR. 1950s | Due to the Second World War, housing construction was paralyzed. Great Britain, mainly in Scotland, suffered one of the worst housing shortages of the twentieth century due to intense bombings that destroyed thousands of homes across the country. The population in the cities grew faster and faster and the empty and abandoned spaces of the cities due to the destruction of the bombs promoted a new urban vision. In the 1950s, in Scotland began to develop high-rise housing solutions.

This concept was criticized in recent years because it was poorly constructed. Many of the apartments were built in abandoned downtown areas of the city. They began to replace the homes that were lost in the elimination of slums. Many of these houses were in the shape of blocks and seemed to be an ideal solution to the housing problem at that time.

One of the cities that suffered the greatest shortage of housing after

the Second World War was the city of Glasgow. The large number of people requiring relocation was high; therefore the construction of properties in the periphery should be carried out as quickly as possible. To try to reduce the population in the centre of the city, the government of Glasgow created four main urbanizations known as Drumchapel, Easterhouse, Pollock and Castlemilk. These new properties allowed the formation of new communities (Gibb, 1989). People from large cities began to move to peripheral areas, which resulted in a solution recognized in many areas of England. Consequently, the experiment of housing schemes outside the city of Glasgow was considered as an example of what to do and what not to do in future projects.

This brought with it a new way of life completely different from what people were used to. The apartment style had a modern design with common areas and green spaces. Each of them had a bathroom in its interior, a diverse experience since many families were used to sharing bathrooms with people who lived on the same floor. In addition, sports facilities and other activities were created to generate employment for a large number of residents. A new way of living, better than previous years.

SHELTER'S BEGINNINGS. 1960s | During the decade of 1960, new designs of affordable housing for high densities were created; most had been stamped and the majority had been found deficient. The problems of housing shortages in Great Britain, especially in the cities

of Edinburgh and Glasgow, continued to spread.

According to the Census of 1961, more than 11,000 houses in Glasgow were not able to be inhabited (Council Housing, 2013). The government focused on building high-rise housing to completely eliminate marginal neighbourhoods and reduce the list of homeless families that had accumulated in all of Scotland's cities.

With the warning about the massive scale of the housing crisis, an organization was created, known as Shelter, dedicated to getting all people to access a home. It is a national organization in which a large number of local entities are grouped to provide access to affordable housing in decent conditions. It offers projects and health centres in the cities of England and Scotland. To be more specific, Shelter Scotland was created in 1968 recognizing that the problems of housing in Scotland were equal or worse than in any other city in the United Kingdom. (Warnes, Crane, Whitehead and Fu, 2003). It provides advice, information and support to the neediest people and takes into consideration all the bad homes built by the government and the highest authorities creating new policies in order to improve the life quality of people who have no place to live or those sheltering in unworthy housing.

RIGHT TO BUY. 1970-1980s. THE END OF SOCIAL HOUSING | As I mentioned above, the United Kingdom had a shortage of housing and,



Figure 2.3 | The housing and homelessness charity after the Post-war in Scotland.

as a result, laws were enacted, such as the National Housing Plan that established the construction of public housing for social rent throughout the British territory. But this public heritage of housing was little by little going into private hands during Margaret Thatcher's Victory.

If this government was characteristic, it was because of the hatred it had towards the working class and the unions. The ex-minister of the United Kingdom, during the period 1979 to 1990, was entrusted to tertiary the economy and to dismantle factories such as fabric of motor vehicles, coal mines, among others. Its closure originated ruins for many cities and communities of the Great Britain. Of the 7 million industrial workers that existed in 1979, only 2.5 remain today. This strategy to end with the social housing communities was to offer the option to buy these homes in exchange for a few thousand free. They invoked the motto that all of Britain belonged to the middle class.

During the 1980s, an Act known as the Housing Law of 1980 was created, which gave tenants the possibility of acquiring their homes, as long as they had resided in it for more than two years. This process was called Right to Buy.

The production of houses stopped and began to decline. From this moment, the sale of homes was bought by tenants who had the ability to pay the value of the house. Nonetheless, the number of houses for the councils of London went from 840,000 in 1984 to 500,000 during

this century.

In Scotland, around 6 million people were affected by this Act, since not everyone had the ability to buy a unit. *"This has left a massive hole in the available housing stock. Fewer social homes meant longer council waiting lists, and also a reduction in the quality of housing available"* (Shelter Scotland, 2016). The housing benefits for many people were reduced, especially the new social housing. In addition, the buildings began to demonstrate structural problems, where some concrete houses had problems caused by the corrosion of the metal structure.

WELFARE REFORM. 2000s | The local councils are facing a large list of old houses and still need large investments to maintain them. Nowadays, municipal housing has become residual housing in order to help the poorest, those who do not have a home. This process goes back to the government policy of the decade of 1930, producing a regression in the housing area.

The government has obtained the necessary funds for the construction of affordable housing. However, the challenge of this thesis is to show that the way to build this type of housing in Britain, especially in Scotland, is not the most appropriate. The housing shortage has decreased and the Government has considered the most vulnerable households. It is one of the very few countries in the world where many homeless

people have a legal right to a home.

The situation in Scotland it is different. For 2003, 5 million people had an affordable housing with 2.3 million homes, 700,000 were in the social locative sector, located largely in the industrialized city of Glasgow. The number of homes built each year is greater than the number of new centres, therefore the flow did not meet the demand in those places where the new jobs are located. Nonetheless, Edinburgh shows a lack of 3000 homes, while Glasgow, former industrial centre, has a surplus of 3,500 homes, although extremely dilapidated (Shelter Scotland, 2016).

Scotland created its own Act in 1999 to improve housing policy. The main objective was to give a home to all the homeless in 2012, known as the *"2012 commitment"*. Since 2001, each municipality had to establish a "strategy to fight against poor housing conditions", which analysed local needs and set objectives. Subsequently, these local plans were consolidated throughout Scotland (Shelter Scotland, 2016). The government defined a general policy, made known from municipality to municipality, since it ensured that at least 25% of the new buildings were affordable housing.

Currently, the Scottish government continues to campaign to offer safe and flexible housing, affordable for all. According to Jason McDonald,

spokesperson for CoSLA, a structure that represents the municipalities of Scotland, considers it necessary to *"suspend the sales of social housing and direct efforts towards the problem of 22 300 empty homes for more than six months."*

To conclude, currently the housing problems in the UK remain the same as they were years ago. Apart from the incredible prices of these, thousands of people do not have access to public housing because there is no housing association for this purpose and those that are scarce. According to the president of the association Defend Council Housing, Alan Walter, *"Half of the owners of a house are in poverty"*. Undoubtedly, this process of the elimination of social housing in the United Kingdom has been linked to the destruction of the manufacturing industry and the reduction of the unions.



Figure 2.4 | Red Road Flats in Glasgow, Scotland.

AFFORDABLE HOUSING IN THE GREAT BRITAIN

MASS HOUSING IN THE TWENTIETH CENTURY SOCIETY

Affordable housing is the most widespread architectural scheme of the twentieth century. The arrival of technology and industrialized construction became an important role for the cities of Great Britain and, in turn, a stylistic principle for modern urban design.

The massive construction of affordable housing in apartment blocks became an example for many architects around the world. Britain was not far behind. In the 1930s, the tallest building in London was built. It is called Highpoint I designed by the architect Berthold Lubetkin. It was a residential building intended for the middle class and was considered one of the best examples of the principles of international architecture in London (Yorke, 1937, p.135). The American critic Henry Russel called it *"One of the finest, if not absolutely the end, middle-class housing projects in the world."*

The building has a central space known as the vestibule, which allows access to the upper floors and concentrates the circulation of the building. This vestibule is accessed by a longitudinal part of it, achieving the perspective of a deep space rather directed that extends to the bottom. *"The surface of the floor extends like the magnificent surface of a lake"* (Allan, 2002, p. 86) are words of Le Corbusier after his visit to the project in 1935. They are appreciated in the same way and arranged in its longitudinal part clean lines that make evident the perfect management of the glazed glass allowing the entrance of lighting to the enclosure, lighting that highlights the place and at the

same time provides an atmosphere of passivity and calm.

Undoubtedly, the project is part of the analysis of its social environment as a mechanism of its conception. In a conversation with Malcolm Reading, published in the article Tall Order on June 5, 1985, Lubetkin says: *"The most important contribution of the Highpoint was to demand a cultural attitude and a recognition of completely different social relationships."* The Highpoint I was considered a characteristic building of the modern movement that responded to the housing needs of the time.

Another significant affordable housing project was Alexandra Road Estate by architect Neave Brown in London. The architect was looking for an alternative to the high-rise blocks that most local authorities were building. The objective was not only to solve the housing problem, but also to establish a new type of architecture based on the interpretation of English urbanism. Brown believed that each home should have its own opening, with the front door connected to the streets that make up the city and that each apartment should have a private open space, in the form of a terrace. In addition, it conveyed an idea of community by sharing spaces between the apartments.

Alexandra Road is a complex composed of three blocks that are parallel to each other, next to one of the main railway lines in the periphery of London. In total, 520 homes were created. Each house has its own



Figure 2.5 | Alexandra Road complex. London, UK.



Figure 2.6 | Robin Hood Garden in 2013. London, England.

outdoor space, a type of garden separated from the public street. The housing units are of various types, from rooms for one person to six or seven people. Normally the bedrooms were on the ground floor and the living room and kitchen directly on these.

It is considered one of the most prominent affordable housing complexes in London and one of the most distinctive in modern times. However, there are buildings that became problematic such the Robin Hood Gardens. Maintaining the concept of the Unité d'Habitation, the architects Alison and Peter Smithson created one of the most problematic affordable buildings in the United Kingdom. This residential complex was built in a degraded area of London, covering approximately two hectares. The most interesting part of this project was the concept of the high building and the social relations with the neighbourhood. Therefore, two concrete blocks were created with 213 apartments surrounding the central green area (Stewart, 2015, p.11). Every three floors had balconies with the idea of public space to encourage interaction. In addition, it had an outdoor garden and a small artificial hill in the middle.

After over 35 years of crime and quality concerns, the decision of demolish Robin Hood Garden was made a new proposal has been chosen. Not only Robin Hood Garden has aged over time, but also all affordable housing projects built after the post-war that are now abandoned or deteriorated. In 2008, renowned architects such as Richard Rogers,

Zaha Hadid and Norman Foster made a request to save the residential complex from the demolition. According to a letter that Rogers wrote to local authorities, he describes the building as *“good, if not better, than any other modern building in Britain”*. He argues that *“rally and marked the end of the heroic period of public housing inspired by the Unité”* and that destroying it would be a mistake in the history of architecture (Stewart, 2015, p.16).

However, many people are disagreed with this idea. The Department of Culture Media and Sport said: *“The conclusion with Robin Hood Garden is that it was not a successful housing complex and consequently it was not a good example of housing design. Its design, on the contrary, turned out to be of limited architectural quality”*.

In regards to the knowledge about massing housing and the bad conditions that this bring to the country, the Trellick Tower made by the architect Erno Goldfinger is another example. The architect came to live in the apartment number 130 for two months in 1968, to demonstrate the good of living in the heights. The tower is located in London and was built in 1972. It consists of two volumes, as can be seen in the image. The largest building is for the apartments and has 31 floors; the other one is a tower with a vertical access centre to the apartment building and to some common areas.

It is also an architecture with many controversies. On the date of com-

pletion of the building, the construction of towers was being obsolete, due to social problems that were in the area. The architect asked the authorities to make a selection of the tenants but it was not accepted. The problems began few months after its inauguration, with delinquency and drugs trafficking in the common areas. Nonetheless, In the mid-1980s, some homes are sold to tenants as part of the privatization program mentioned above. With this, the owners created an association to solve the problems of delinquency. However, the building also has other problems: because it was designed during the 60's, it is not prepared to be energetically efficient.

Other projects were developed in England for medium-income residents. Among the most famous were the Churchill Gardens in London by Philip Powell and Hidalgo Moya, and the first point block in Britain, The Lawn in Harlow New Town by Federick Gibberd. However, not only in Europe there were problems of scarce affordable housing.

When the industry decided to seize humankind, it did so in a very notorious way. People went from living in humble one-story houses, in the middle of the agricultural field, to living in large affordable buildings, with more than twenty stories high, in the middle of the city. The world population consisted mostly of full-time workers, but when the steam engine arrived, labour was no longer necessary; therefore, machines replaced many jobs. This resulted in two aspects: the first overpopulation and the second unemployment.

IMPORTANCE OF AFFORDABLE HOUSING IN SCOTLAND

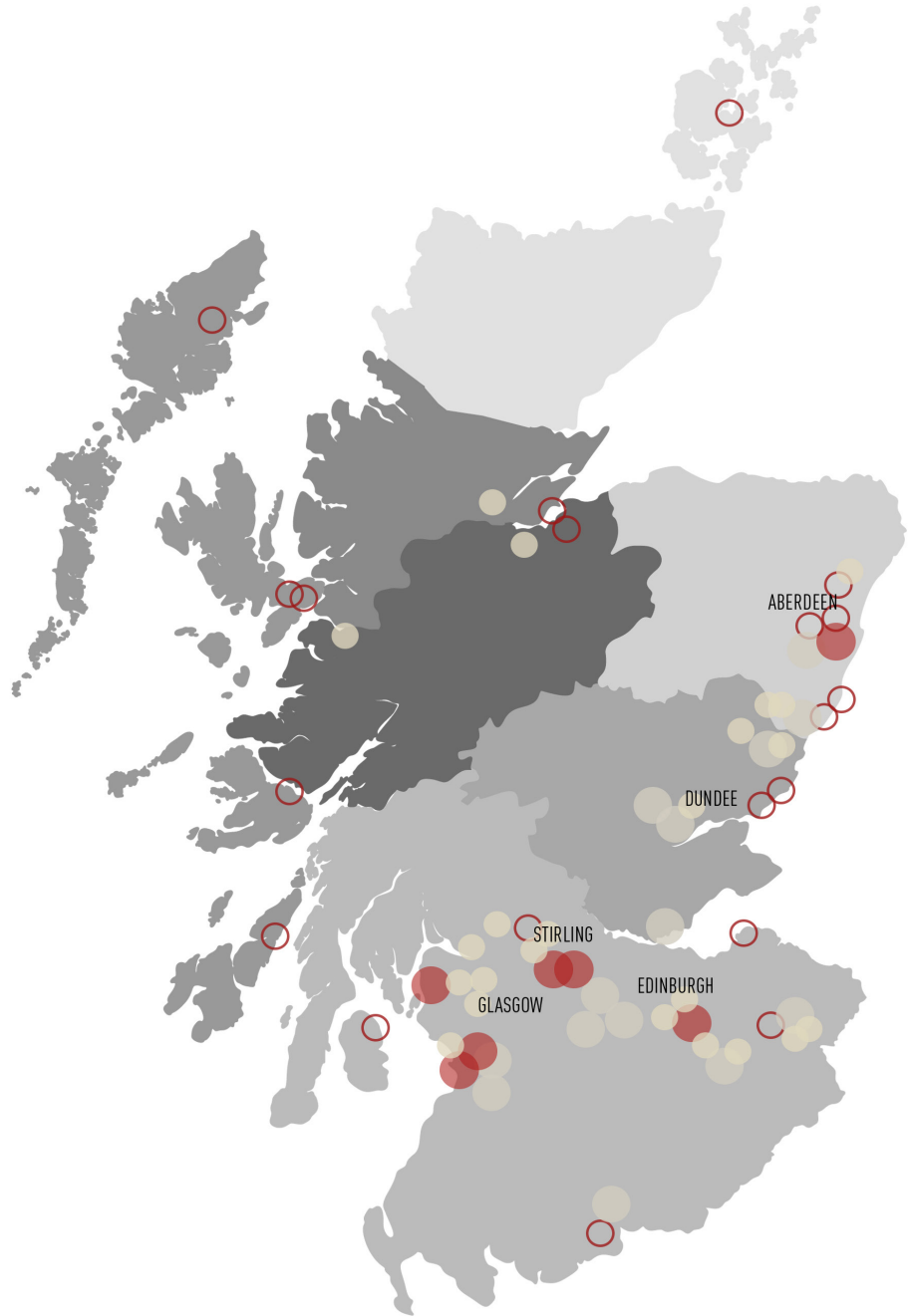
HOUSING SITUATION IN SCOTLAND

The affordable housing situation in Britain is critical, especially in Scotland's cities. Cities such as Glasgow or Edinburgh have housing and accessibility problems that affect the inhabitants: from adults who do not struggle to pay rent to little children living in small spaces without the necessary accommodations. This in turn brings long-term problems of health and marginality.

According to a report by the organization UNISON Scotland (2013), called Funding and building the homes Scotland needs, there are "approximately 1.5 million occupied homes, of which 290,000 are rented privately, 275,000 homes are rented by housing associations and 320,000 homes are rented by local authorities. In addition, there are 87,000 empty houses throughout Scotland." (p.2). As can be seen from the map, there is a diversity of building type across Scotland. Most of the houses in cities such as Glasgow, Edinburgh and Stirling are local authorities and residential while in the North East part of the country, the type of housing are more for commercial use and self-build.

The rate of construction remains low to address the problem of housing shortages, especially the shortage of social housing and affordable housing. There is a waiting list of 335,000 social housing units throughout Scotland that has not yet been taken into consideration. From this list, 71,000 homes are overcrowded and 65% of them are families with children (UNISON Scotland, 2013).

On another hand, the funding cut available for housing in Scotland is a major problem. The Scottish Government is working to identify financing opportunities, also creating projects such as Innovation and Investment Fund that serves new affordable housing in better conditions. Furthermore, funds for pensions are also investing in local housing projects. An example of this is the Strathclyde Pension Fund in Glasgow, which invests in smaller amounts on business and housing infrastructure. *"Any investment in housing from pension funds would have to provide a rate of return equivalent to that achieved by current investments. As an alternative, could be subsidized by the Scottish Government using their housing finance, stretching the budget further than commercial finance. The most straightforward investment would be in middle market housing."* (UNISON Scotland, 2013). At the moment there are 167 assassinations operating in Scotland to provide necessary housing.



LEGEND - building types

- self-build
- commercial
- residential
- local authorities

IMPORTANCE OF AFFORDABLE HOUSING IN SCOTLAND

SCOTTISH HOUSE CONDITION

Scotland is facing a crisis of shortage of affordable housing at the moment and 43% of these social housing is below the Scottish Housing Quality Standard (Powell, Dunning, Ferrari & McKee, 2015). On the following part, the conditions that cover all types of housing, whether they are property or rent of flats and houses, in the urban and rural areas of Scotland will be presented. The information acquired is thanks to the 2002 Scottish House Condition Survey (SHCS), an organization that contains the necessary information for housing development.

The SHCS shows that the typology housing in Scotland is well below the standards required for people. More than 17% of homes in Scotland are affected by humidity and condensation and 88% do not have the energy standards. In addition, there are still a fairly high percentage of people who need a home.

DAMPNESS AND CONDENSATION | Currently, a high percentage of housing and residential buildings suffer the pernicious effects of dampness, damaging construction materials, affecting the surplus value of the property and even the health of its occupants. According to the SHCS, 360,000 (17%) of the houses in Scotland are affected by humidity and condensation: 6% are humid and 11% have condensation (Shelter, 2004, p.2).

Dampness occurs in several ways; however, the most difficult to control is the dampness of condensation that occurs in walls, windows

and ceilings. It is worrisome how 360,000 homes in Scotland have dampness and condensation problems in the 21st century (Shelter, 2004, p.3). Dampness is more likely to affect public rooms than kitchens and bathrooms. By controlling this problem, it increases the durability of the home and the surplus value, as well as the materials that constitute the building. Nonetheless, the humidity levels should be between 40 and 60%.

ENERGY EFFICIENCY AND FUEL POVERTY | Not only humidity and condensation are a problem of housing in Scotland; also, there is a problem of low energy efficiency.

There are two methodologies in widespread use for calculating energy efficiency profiles: The Standard Assessment Procedure (SAP) and the National Home Energy Rating (NHER). The NHER is more commonly used in Scotland and generates an energy rating for a dwelling on a scale of 0 (poor) to 10 (excellent), based on total energy costs per square metre of floor area required to achieve a standard heating regime. According to them, 4.5 is the average score for Scottish housing energy (Shelter, 2004, p.3).

The private sector presents worse conditions than any other sector. It has an energy score of 2.65 compared to the homes in the city (4.7 points). Living in a house that does not consume energy means that people have to spend more to maintain a warm house. An average

house should not spend more than 10% of a person's income on paying for fuel for energy (Shelter, 2004, p.3). It is not acceptable for low-income families to spend a large part of their budget on heating.

The factors that impact on the number of fuel-poor households are energy efficiency, income levels and the presence of humidity. There are several organizations in Scotland that are designed to help people and make their homes warmer by installing a variety of energy saving measures.

REPAIRS AND IMPROVEMENTS | The most notorious problems in a house in Scotland are the lack of repairs. The 34% of all houses have at least one lack of large-scale repair (Shelter, 2004, p.4). Most owners have to use their own money for repairs because the government need a big amount of money to repair all the houses in Scotland that are in poor condition. The Housing Scotland Act 2007 covers the Repairing Standard, guaranteeing people a decent property. A good house must have:

- Internal and external structure including drains, gutters and pipes in good conditions.
- Structure of the property in good condition, including roof, walls, windows and doors.
- Good facilities for the supply of electricity, gas and water. The same for sanitation, heating, etc.
- A fire detector and give warnings in case of fire or suspicion.

Good design quality is essential to offer homes that truly meet challenging current performance standards and the complex needs of a community. This can bring challenges in terms of design and construction; however, they are necessary to obtain a good result in terms of quality of housing and life.

AMENITIES | As was previously discussed, Scotland has a history of homes with lack of basic services such as electricity, bath, shower or a sink. These problems are presented since the 19th century, where the families had to share the bathroom and the kitchen. This type of housing has not been resolved; therefore, attention must be paid to the new standards of the 21st century.

According to SHCS, 40,000 homes in Scotland do not have the right kitchens, as they do not have an adequate gas supply or are not connected to a public drainage system. Also, the lack of amenities is for the overpopulation. Currently, 5% of households are overcrowded where families must share spaces that were intended for two or three people (Shelter, 2004, p.5). The government of Scotland is aware of these problems and has given importance to the need to build housing that suits the different members of a community: elderly people, large families, singles, disabled people, etc. Investigations and development will continue on how the impacts of new housing can be reduced in terms of spaces and construction.



Figure 2.7 | Glasgow Slums 1969-72, Scotland.



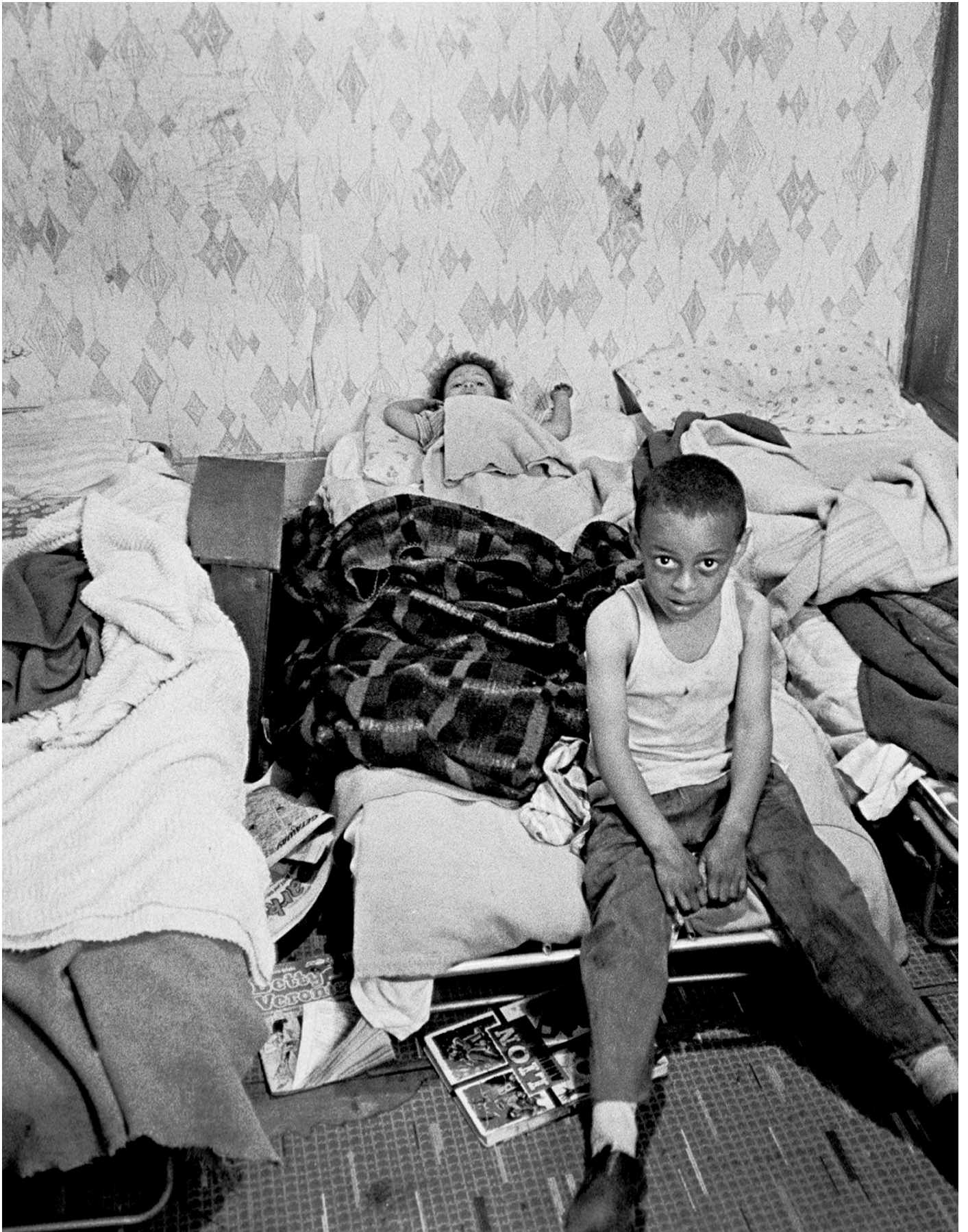


Figure 2.8 | Glasgow Slums 1969-72, Scotland.

OVERCROWDING | It refers to the relationship between the number of people in a home and the space or number of rooms available. This is the biggest problem of housing in Scotland. Given that the access to housing for people of medium- and low-income is limited, the housing facilities they occupy tend to be less appropriate than those available to people with high resources. The UK government in the distribution of housing uses a "room standard", designed in the first instance in the sixties, which seeks to prevent men and women over 10 years, not married, from sharing the same rooms (House of Commons, 2003).

At present, 5% of the total houses in Scotland are overcrowded (Shelter, 2004, p.5). It is a problem that has been accumulating since the First World War as fewer and fewer spaces are available to contain them.

From my personal view, the conditions of affordable housing in Scotland are getting worse. There have been some improvements in recent years, however, the problems related to housing are increasing. The private rental sector is the one that still has the worst conditions, suffering from condensation, humidity, energy, overcrowding, among others. Investment in housing is desperately needed: not only improve the conditions of maintenance of housing, but also the quality of life of those who inhabit it.

IMPORTANCE OF AFFORDABLE HOUSING IN SCOTLAND

THE NEED OF MORE AFFORDABLE HOMES

The crisis of the shortage and the poor conditions of affordable housing in Scotland is a problem that still continues. This is caused by the fact that the population growth of large cities increases and the number of households decreases. According to the National Records of Scotland (NRS) reveals that there is a steady increase in the number of homes in Scotland, but that the population growth is much faster. Regarding to the heritage, 72% of all Pre-1919 Homes are currently in a state of Critical Disrepair; meaning that without immediate address, they shall be beyond conservation efforts. A leading cause of this circumstance is the misdiagnosis of faults in housing stock universally and shortage of tradespeople with the appropriate skills and knowledge. Furthermore, the 38% of Scottish social housing currently falls below the Scottish Housing Quality Standard and 10% of all Scottish households are affected by damp or condensation (Shelter, 2004). As it is said before, these faults in a building are contributors to all manners of illness and put great strains on both occupants and the NHS as a result. On another hand, 33% of Scottish households are currently living in fuel poverty; a circumstance forcing them to often be faced with a choice between eating and warmth in winter. The financial implications of fuel poverty limits the ability of individuals to address their situation independently.

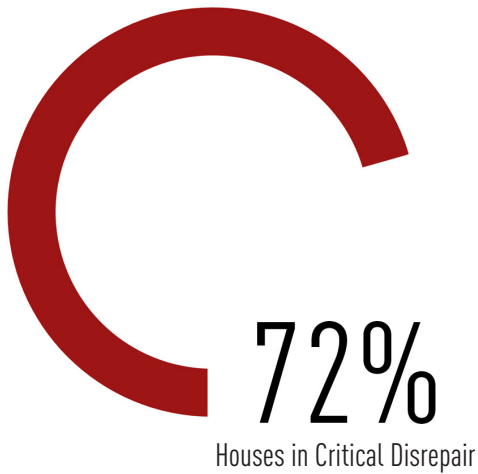
Regarding the social sector, NRS describes that in 2010, approximately 5,700 new homes were completed but in 2014 they were reduced to 3,200 (a decrease of 44%). If this continues, the housing construction

of the social sector in each year will be below average. The population of Scotland has been steadily increasing since 2014, which is why the need for housing is extremely important (Council housing, 2013). In addition, there is a huge mass of floating population that lacks a place to organize their family life. More housing is needed, especially affordable housing. Homes that are used effectively and that are built in perfect conditions; affordable for people with low and medium resources.

By investing in better quality, affordable and decent housing, the growing problems of overcrowding, the lack of facilities and housing spaces, the problems of humidity and condensation, etc. are being addressed. Despite the large number of initiatives and schemes in the last decade by the Scottish government, the construction of affordable housing implies poverty and deprivation. In Glasgow there is the largest concentration of housing in Scotland as the urban renewal projects of the 50s, 60s and 70s put an end to the slums of the city. These neighbourhoods were replaced by tall buildings that today are notorious for crime and poverty; it is impossible to enjoy the feeling of community in this type of blocks.

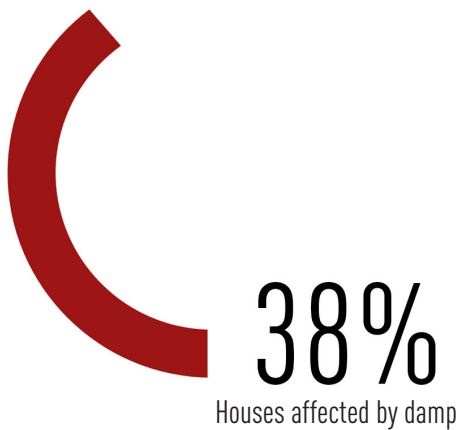
However, Scotland needs more affordable housing. Houses with attractive local environments that address health problems, insecurity, community, etc. When a home is of high quality, despite being social housing or affordable, it helps a better population growth.

HOW MANY HOUSEHOLDS LIVE IN TEMPORARY ACCOMMODATION IN SCOTLAND?



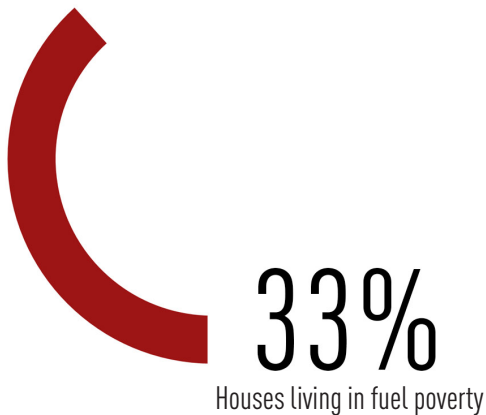
10.899

households in temporary accommodation in Scotland. 2.893 (27%) of these households were living in bed and breakfast hotels and hostels



3.426

households containing dependent children and pregnant women in temporary accommodation across Scotland. 82 (2%) of these households were living in bed and breakfast hotels and hostels



6.581

dependent children living in temporary accommodation across Scotland

IMPORTANCE OF AFFORDABLE HOUSING IN SCOTLAND

AFFORDABLE HOUSING IN THE CITY OF GLASGOW

Glasgow is an industrial city of the north of Scotland, with a rich heritage, which is currently suffering the long-term effects of the shortage of housing. Affordable housing was born to resolve the social and housing demand that have been developing since the industrial revolution. The experience, both in urban regeneration programs and in housing policies can help to define both problems. One example of the very serious concern being voiced by sections of central government about the high-density alternative being adopted by Glasgow was contained in a document called "Housing Density Report", produced within St Andrews House in 1963. In, prophetic words, it said:

Glasgow is "producing an image of itself which is regret and which we may all regret in relation to what we are attempting to achieve the Scottish economy as a whole ..." ... it would appear that no effort has been seriously made to consider whether the Glasgow housing policies are really suitable to meet the conditions of the latter half of the 20th century; There would be no pause to consider whether or not the current requirements of the population were really being met; There would be no consideration as to whether this kind of investment would stand the test of time..."

It left little doubt that the overall aims of planning viable communities and the narrower and shorter-term ones of meeting immediate housing needs were in collision within both central and local government.

There were many interests locally and nationally pressing for the high-density option. These included agricultural interests, wanting to save agricultural land, some design and planning professionals waiting more "urban" styles of development in housing layouts and last but by no means least, the proponents and manufactures of industrial building systems.

In a very synthetic way, it could be said that, despite the interventions and policies made by the government, Glasgow is still one of the cities with the living conditions of the poorest housing in Europe. The situation of affordable housing in Glasgow have two main aspects: quantitative and qualitative. People need houses, but they also need shelter houses which is adapted to geography, climate and place of work, and which provides certain standards of construction, space, hygiene and comfort in which the business of home-making can go forward effectively.

Due to the phenomenally rapid growth of population of the first half of the nineteenth century and the situation after the First World War, the stock of accommodation had to be utilized and expanded at a rate which constantly fell short of need, and which produce many ill-effects on the comfort and health of the inhabitants. As the housing situation remains unresolved, this thesis proposes a new development of affordable housing in Glasgow. In the following subjects, the study of the housing typologies and conditions will be explained in details.



Figure 2.10 | Glasgow's Red Road.

STUDY CASES

PART THREE

STUDY CASES

SPACE AND FUNCTION

BOSCO VERTICALE BY STEFANO BOERI. MILAN, ITALY (2014) |

The vertical forest of Milano is one of the best examples of design for this project. It is an architectural complex really surprising. It consists of two biological residential towers of 112 and 80 meters high designed by the architect Stefano Boeri, which collect more than 21,000 plants of a hundred different species. More than 480 people live in these towers and shelter 1,600 birds and butterflies, 5,000 shrubs, 780 trees and 1,000 perennials.

This project promotes biodiversity and shows the urban ecosystem vertically. The residents are in charge of the maintenance of the plants since most of the more than 100 species of trees and shrubs are planted around the various terraces that surround the building.

The facade changes depending on the season of the year. The plants are in constant evolution and depend on the cold, temperate or sunny climate, the colour of their leaves changes colours.

Complementing the sustainability issue, this building also has a rain-water recycling system for vegetation irrigation, as well as the integration of photovoltaic panels that provide renewable energy.

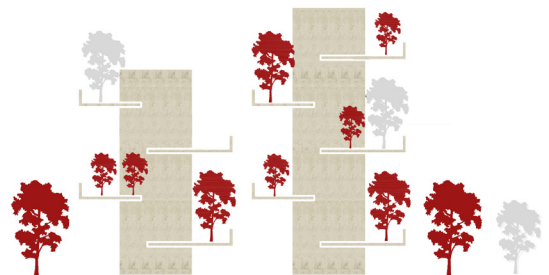
"I would like that kind of architecture could be put at the service of all," Boeri said in an interview with Efe after participating in Rome at a UN ceremony for the International Day of Forests.

The result is the creation of a kind of micro-climate that, among other things, regulates temperature and absorbs dust particles and carbon dioxide in a polluted city like Milan. Currently, the study of Italian is trying to replicate that construction in Nanjing (China), Lausanne (Switzerland), Paris and the Netherlands Utrecht and Eindhoven, the latter focused on houses for low-income people and young couples.



residential block

nature



nature integrated inside and outside the units

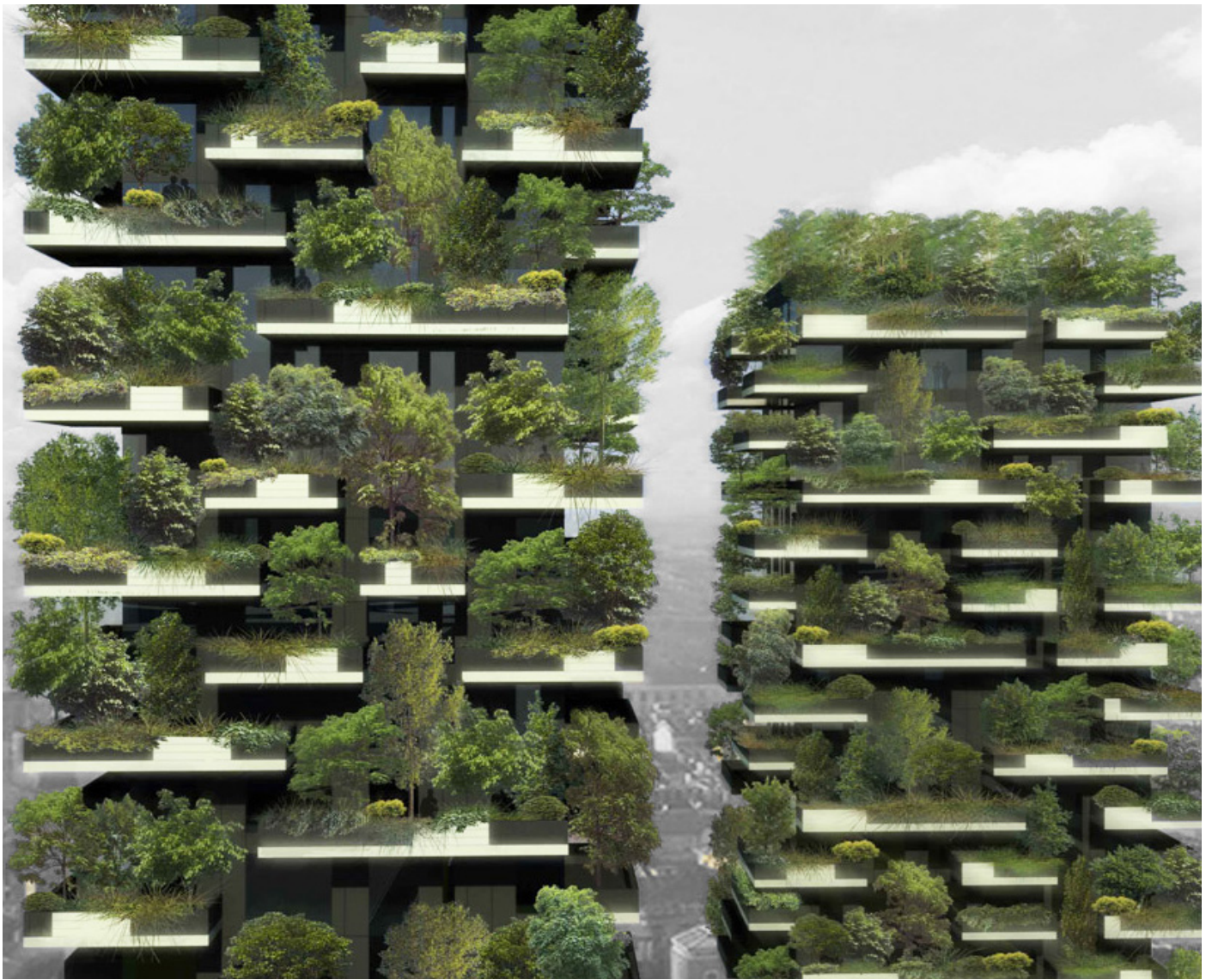


Figure 3.1 | Exterior-interior of the Cite Manifeste in France.

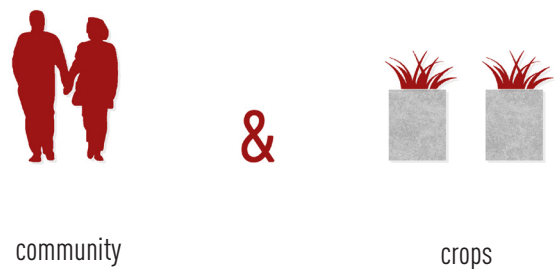
NEST WE GROW BY COLLEGE OF ENVIRONMENTAL DESIGN UC BERKELEY + KENGO KUMA & ASSOCIATES. JAPAN, HOKKAIDO

(2016) | “Nest We Grow” is a project realized by great architects and students in the city of Japan with the purpose of attracting the people of the community to prepare local foods for their consumption.

The constructive technique is one of the most important pieces of this work. It is a solid structure of wood from the USA, converted into small pieces that fit together forming large columns and beams that support the entire building. The structure mimics the vertical spatial experience of a forest in Japan and, at the same time, hang food for growth.

However, the internal spaces were the key to this project that caught my attention. With double-height designs, permanent and meeting spaces within a “cube”, they created a vertical and horizontal circulation for the enjoyment of agriculture. The community can visually and physically contemplate the food during its growth process. In the section of the figure 3.2 can be observed how the internal space of the building has a relationship with the agriculture. In addition, the use of corrugated sheets of transparent plastic in the facade and roof, allow the entry of light inside the building that creates a much warmer environment.

Within this building, a life cycle of food is generated: cultivation, harvesting, storage, cooking and eating, and composting, which restarts the cycle.



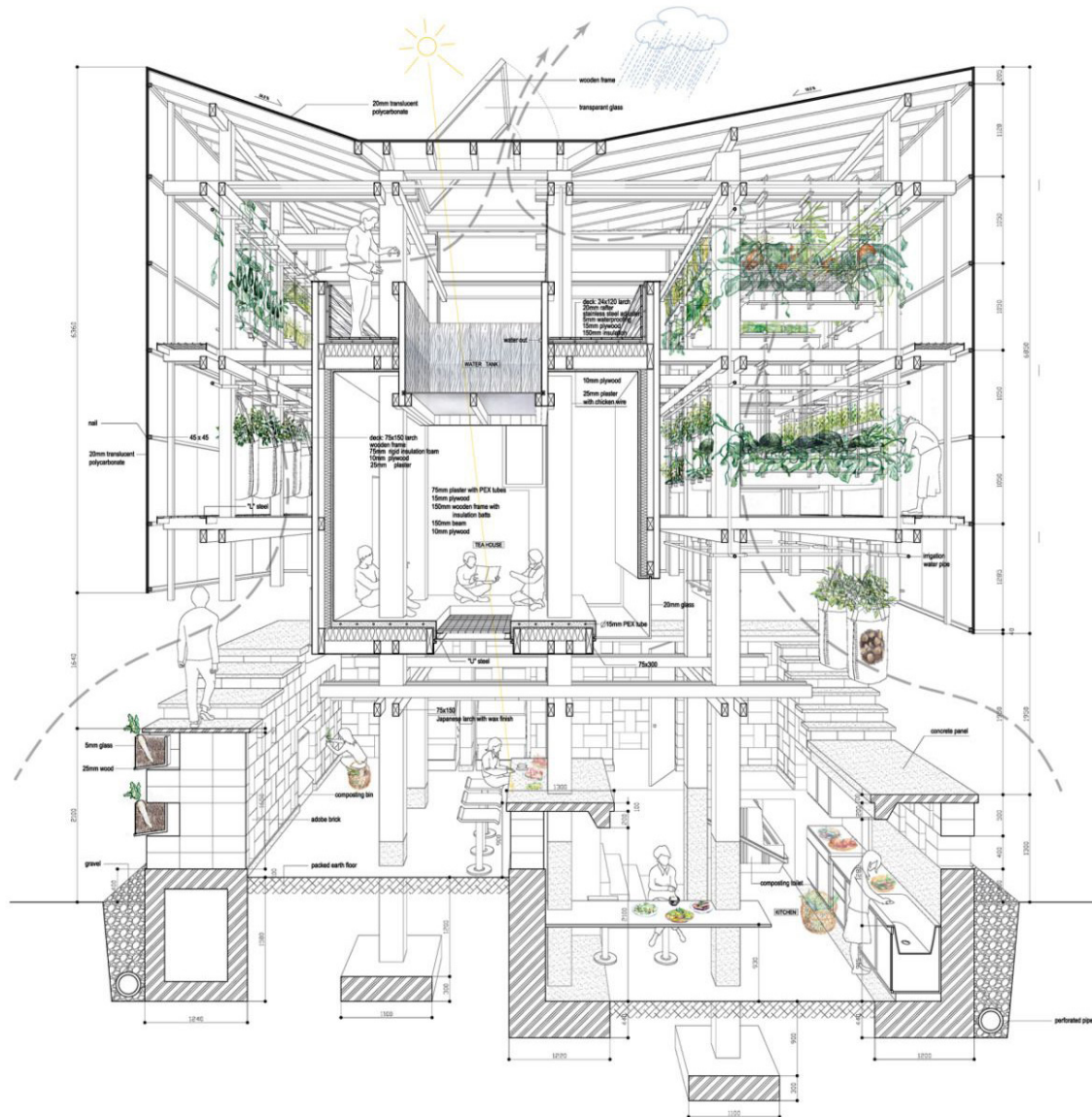


Figure 3.2 | Nest We Grow by UC Berkeley Team + Kengo Kuma & Associates.

STUDY CASES

NATURE AND TECHNOLOGY

PASONA URBAN FARM (VERTICAL FARMING) BY KONO DESIGNS.

TOKYO, JAPAN (2010) | In the center of the financial district of Tokyo, Pasona, a multinational company has contracted the Japanese architect Yoshimi Kono for the renovation of a 9-story corporate building. The design of Kono has a lush wall of green vegetation as outer skin.

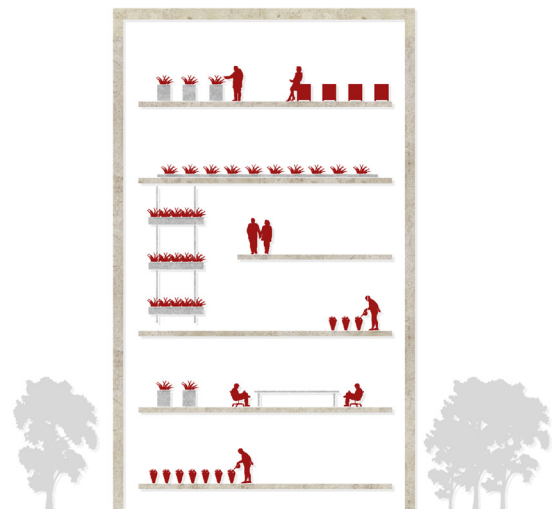
Inside the building are the urban agriculture facilities, producing more than 200 species of fruits, vegetables and rice. Most of these foods end up in a restaurant - coffee shop for the employee's consumption. The cultivation technologies are applied in this building: the hydroponic cultivation and the orchard is totally self-sufficient and sustainable.

The interesting thing about this building is how the crop mixes with the office spaces for the workers. For example, the tomatoes are suspended above the conference tables, the trees function as separators between the meeting spaces, some crops are related under the seats, etc.

"The change in the way local people think and what they talk about was always one of the long-term goals of the project" Kono told in the magazine of Dezeen. *"One way to encourage this is to not just tell urban communities about farms and plants, but to actively engage with them through both a visual intervention in their busy lifestyle and educational programs focusing on farming methods and practices that*

are common in Japan," added.

Engage with nature and generating a group of people who have an interest in this new way of life is the main objective of this design. Therefore, those in charge of maintaining the crop in constant growth are the same employees of the offices, which were guided by experts in their beginnings.



integration of work and vertical farming



Figure 3.3 | Interior spaces of the Pasona Vertical Farming.

GARDENS BY THE BAY BY GRANT ASSOCIATES + WILKINSON EYRE ARCHITECTS. SINGAPORE (2012)

Singapore's famous trees are one of the best examples to describe technology along with the nature of the future. The complex consists of 18 metal structures in the shape of trees that reach 50 meters in height. Tourists can pass between these structures thanks to the aerial walkways located at the top of the trees.

Gardens by The Bay is a botanical garden of more than 100 hectares that has diverse and varied ecosystems of our plant. The anchored structures have a variety of more than 200 species among orchids, ferns, vines, etc. They are also equipped with solar panels and rain collectors. During the day, they shade and collect the rainwater; and at night, they generate electricity to irrigate and preserve the gardens. In addition, they have a temperature generator that provides a fresh environment for visitors.

This project mixes the idea of sustainability, architecture and ecology of the future around the world. It is divided by Chinese gardens, Indian gardens, squares of palm trees, etc. Moreover, it has two macro-greenhouses that recreate the tropical rainforest with the highest artificial cataract in the world. Both spaces contain more than 220,000 hectares.

The concern for the danger of extinction of the fauna and flora of our planet have combined to design these gardens. An ambitious project totally dedicated to nature making use of technology to save energy and water.

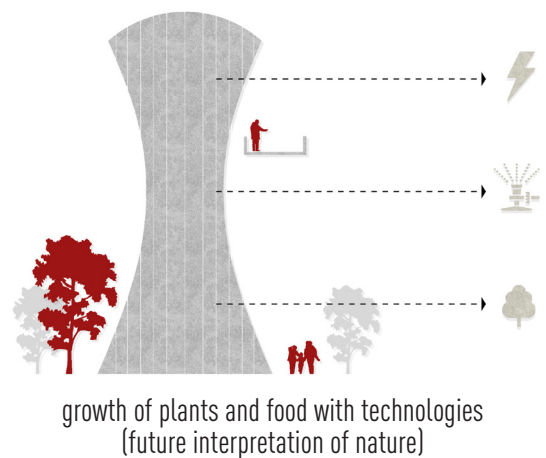




Figure 3.4 | "SuperTrees" in Singapore.

STUDY CASES

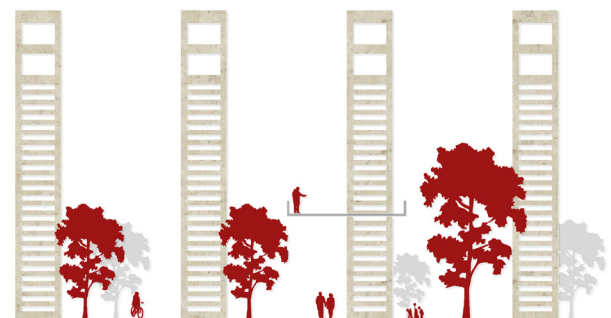
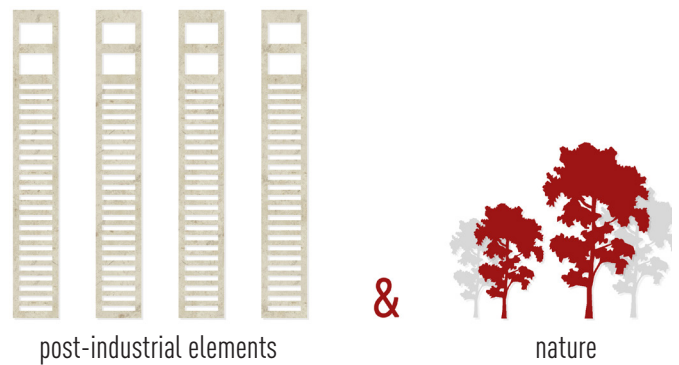
POST-INDUSTRIAL LANDSCAPE

PARCO DORA BY LATZ + PARTNER. TURIN, ITALY (2012) | An ecological problem of the twentieth century are factories and abandoned spaces. As in the case of Govan, a post-industrial city where this thesis is being developed, many places where shipbuilding was practiced are now abandoned. To talk about the recovery of post-industrial spaces, what better example than the landscape architect Peter Latz, an expert in recovering those industrial floors without hiding the past. He and his team have won numerous awards for saving industrial landscapes. Among them, Parco Dora stands out in Turin, which today has a public-green space of more than 450,000 square meters and has been recognized as one of the most important urban interventions in recent times.

The aim of the project is to combine the history of the place with architecture and green spaces. The area has five spaces that have different public functions such as temporary events, restaurants, open-air cinema, etc. The interesting fact about this project is how they preserve the structural elements of the old Vitali steelworks and how they connect the different parts of the park to each other through bridges, stairs and ramps. On the other hand, the mix of tall, low, leafy and exuberant trees and gardens of water built on concrete foundations are the symbols of transformation: green dominates on cement and on Turin.

From my personal view, historical industrialization has importance in the morphology and structure of the city. In the context, these abandoned areas take center stage that must go from being a factor of

degradation to constitute key elements for the re-qualification and modernization of the city. The idea of this thesis is not only to create a housing and agricultural space but also to maintain the historical elements of naval construction in the docks and through architecture, these elements become visible and make a memory.



preserve the memory of the place integrating nature

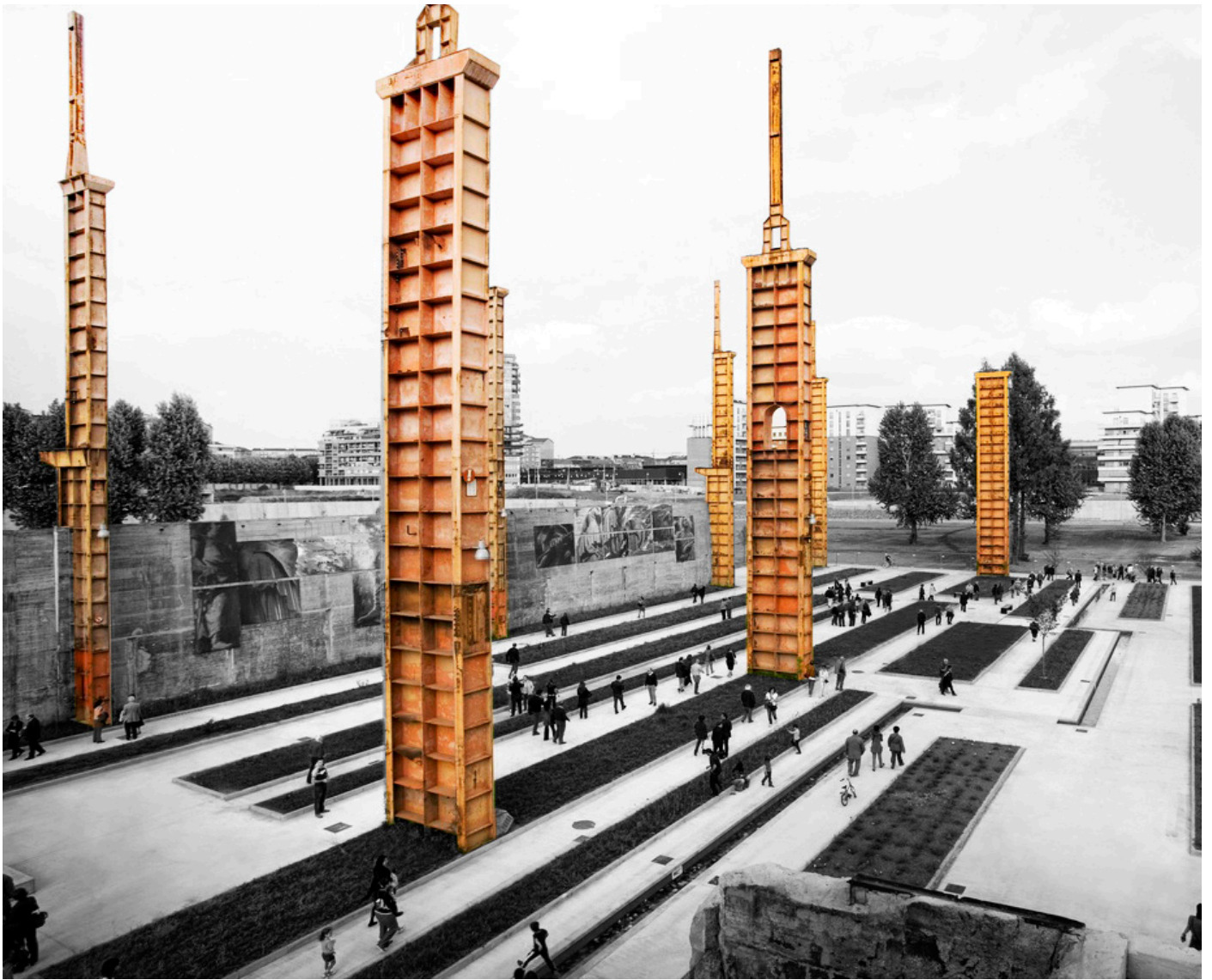


Figure 3.5 | Parco Dora in Turin, Italy.

FUN PALACE BY CEDRIC PRICE (1961) | Fun Palace was a utopian project not performed by Cedric Price in 1961 together with theatre director Joan Littlewood. This project describes Price's thinking on architecture: indeterminate architecture. Separating the architecture into two consequences, an immediate consequence that is the traditional architecture and the other one is the future consequences. Consequently, the design integrated leisure, entertainment, education, etc., able to transform and interact with users. It does not constitute a conventional building, but rather a framework structure that responds and adapts to social needs.

What most attracts my attention in this project is the adaptability and re-use of this abandoned space in an industrial area. The idea of this thesis is similar: the recovery of abandoned docks in a post-industrial city. Cedric turned this empty space into a cultural area with a system of scaffolding and mobile ramps arranged at different levels. Interactive screens, containers, suspended auditoriums, etc., all with the idea of being able to be transformed.

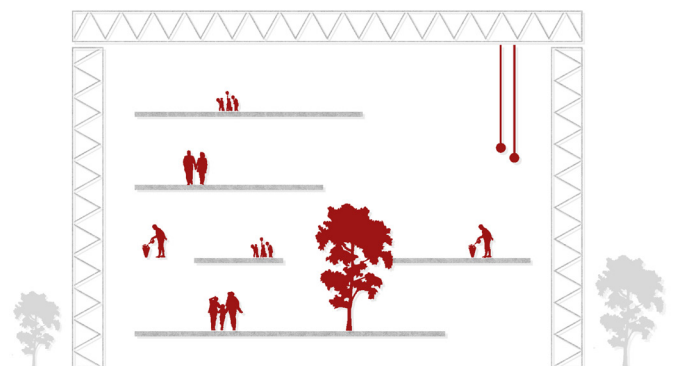
It was designed for approximately 50 thousand people, where the only fixed objects would be the steel towers as a horizontal base and everything else would be disassembled for future projects. Unfortunately, his proposal was rejected and the project was never carried out but it must be recognized that it was a work done for the pleasure of designing and dreaming. As he commented: "Design-

ing for delight and pleasure should be seldom seen to happen, and must encompass-indeed nurture-doubt, danger, mystery and magic."

Nowadays, architects such as Renzo Piano or Richard Rogers use this project as a source of inspiration for their designs. It can be said that this idea has been one of the first utopic projects that turned a cultural building into an entertainment space or park.



structure



adaptability and re-use of abandoned spaces

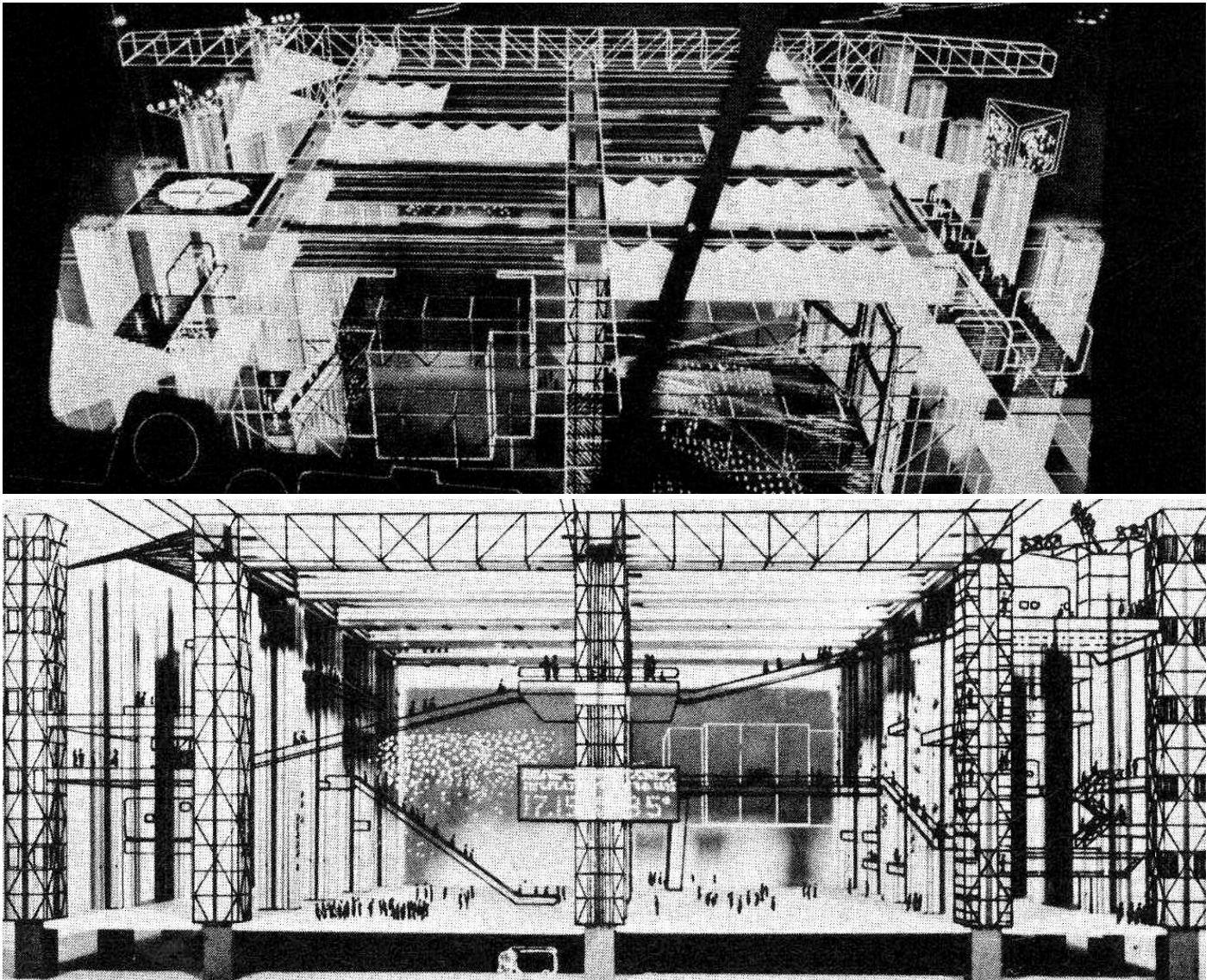


Figure 3.6 | Drawings of the Fun Palace by Cedric Price.

THE CONTEXT

PART FOUR

THE CITY OF GLASGOW

INTRODUCTION AND LOCATION

The project site presented in this thesis is developed in the city of Glasgow, more specifically in the Govan neighbourhood (as shown in the image). Before studying the urban, cultural and social analysis of the project site, it is intended to situate this neighbourhood within the global context of the city.

The city of Glasgow is the largest city in Scotland and the third in the United Kingdom after London and Birmingham. In addition, it is the second most populated metropolitan area in the United Kingdom. It is located on the banks of the Clyde River, in the lowlands of Scotland, and thanks to its location, it served as a great trading port. In 1701 a Treaty of the Union was signed on which it had the guaranteed traffic with the ports of America. From that moment, shipments of sugar, rum, tobacco and cotton helped to enrich the city even more. During the industrial revolution, the Clyde River was one of the most important world centres of shipyards, being built on about half of the steamships of Great Britain. Considering that, Glasgow became the most important and dynamic economy sector in Scotland.

After the Second World War, a population of more than one million inhabitants was reached due to massive emigration. As a consequence, it resulted in bankruptcy for most companies and industries in Glasgow and caused high levels of unemployment. To solve this problem, in 1980 a campaign of urban regeneration was applied with the idea of attracting tourism and at the same time to renew the most important industries.

Furthermore, people began to be located in new towns outside the city center and changes were made to the relative power of Scotland.

The plan worked perfectly and nowadays Glasgow is one of the main places of interest for tourists, having recovered its economic splendour. It is a cosmopolitan and bustling city and, at the same time, is the most important economic center of commerce and retail of Scotland.

Nonetheless, the truth of Glasgow is that its privileged social situation, as it is said before, presents large historical gaps that have caused the city to lose a large part of that charm it had on the pre-industrial era and during its industrialization. An example of these situations is the neighbourhood of Govan, which is an area located on the south banks of River Clyde, west of Glasgow City Centre (4.0km) that presented problems of insecurity, abandoned spaces and buildings in poor condition. Such as Govan, there are more areas in the City of Glasgow that have the same conditions. In the following subjects, the city of Glasgow will be analysed in depth, knowing from its urban development to reach the city of Govan and its condition.



SCOTLAND

WEST DUNBARTONSHIRE

EAST DUNBARTONSHIRE

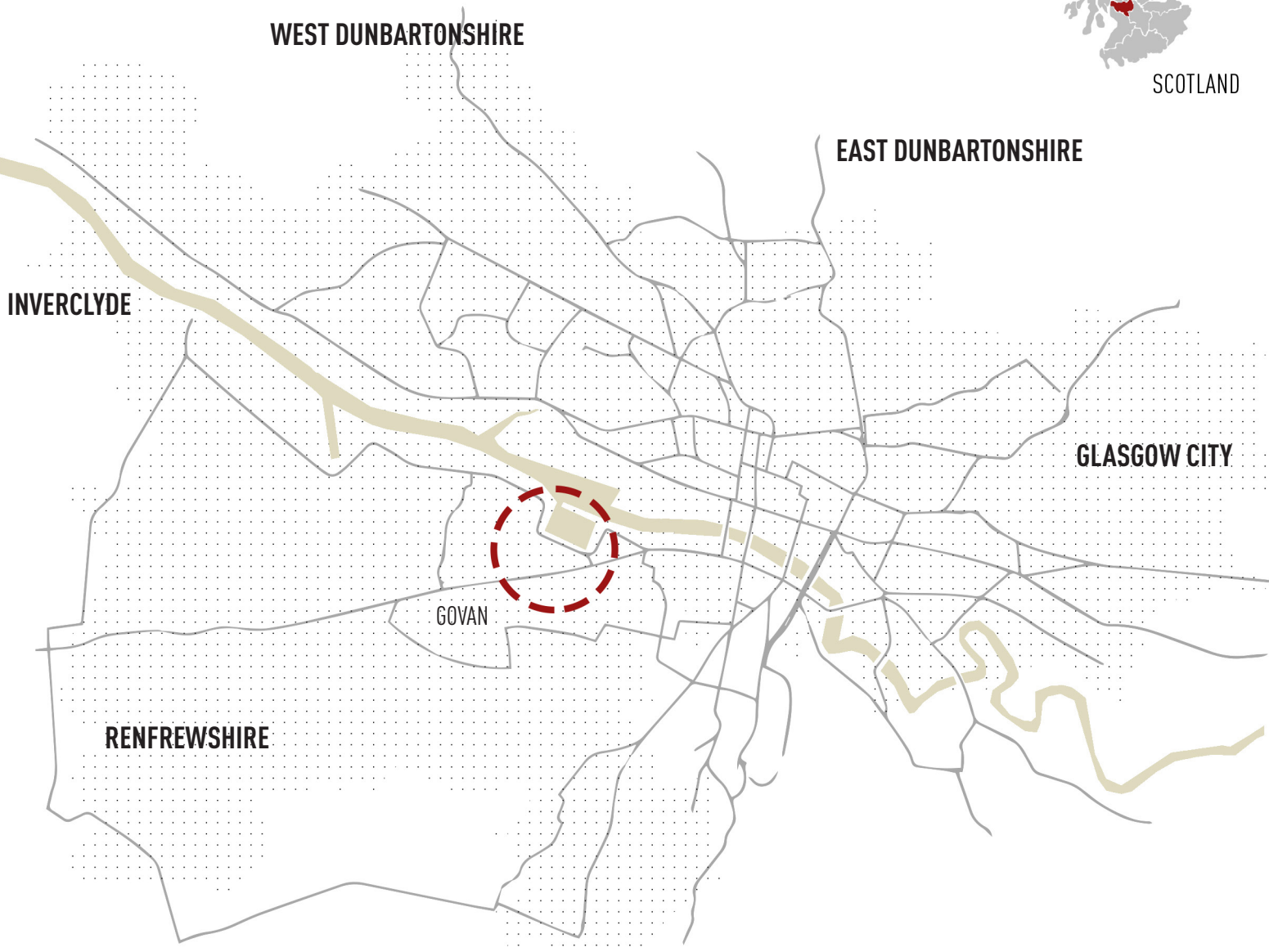
INVERCLYDE

GLASGOW CITY

GOVAN

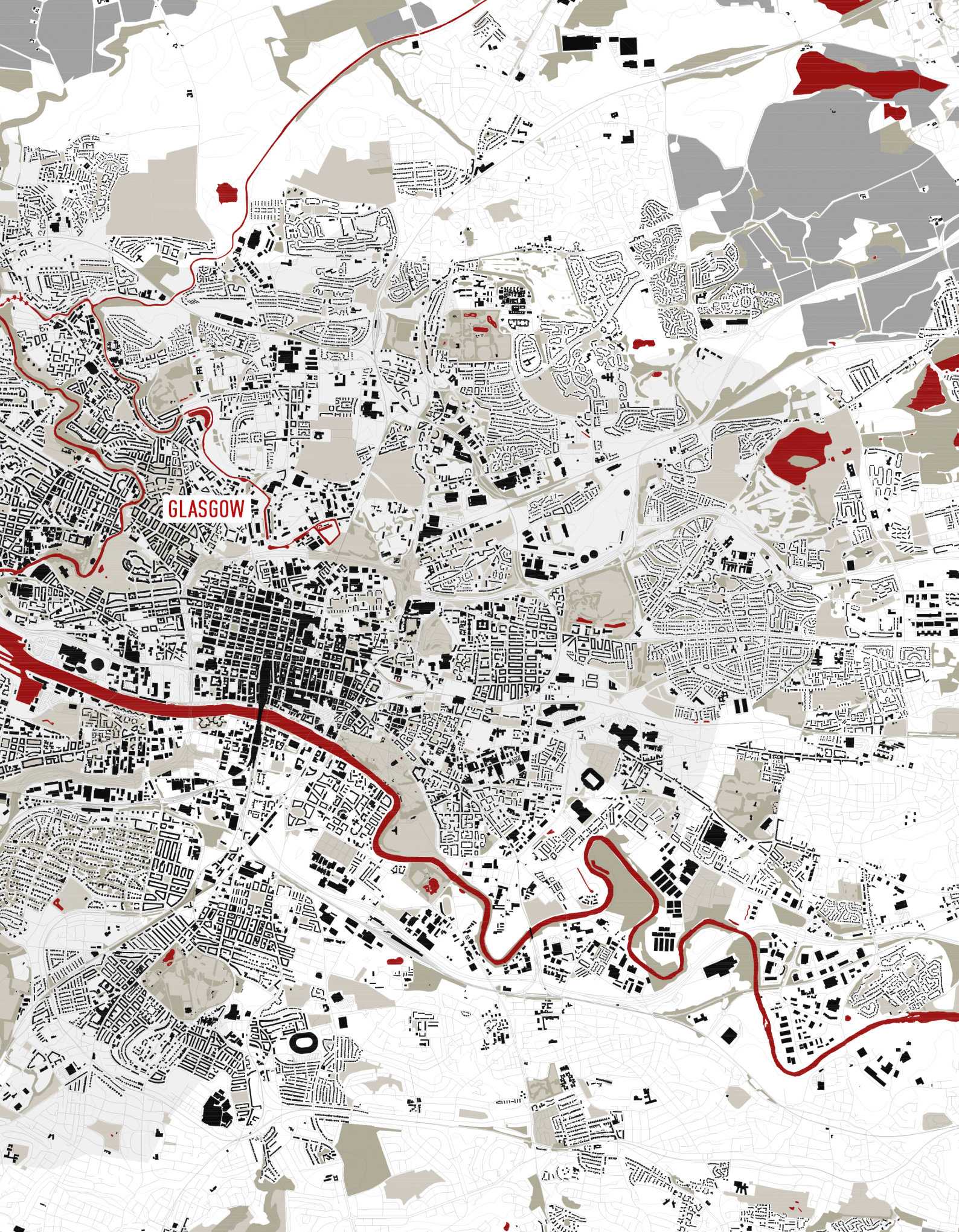
RENFREWSHIRE

EAST RENFREWSHIRE





GOVAN



GLASGOW

THE CITY OF GLASGOW

WEATHER CONDITION

The climate of Scotland is very changeable. Sometimes you can have a very hot climate and other times very cold. As the old Scottish saying goes, “there is no such thing as bad weather, only the wrong clothes”. However, the climate varies in each region and its conditions can be very different. The table below shows the weather condition in Glasgow (Clima Data Org, 2017).

The climate in Glasgow is classified as warm and temperate. There is rainfall throughout the year and even the driest month still has a lot of rain. The climate in Scotland is classified as Cfb by the Koppen-Gieger System. The annual average of precipitations is of 889 mm and its temperatures vary between 3,5 °C (38 °F) and 14,5 °C (58,5 °F).

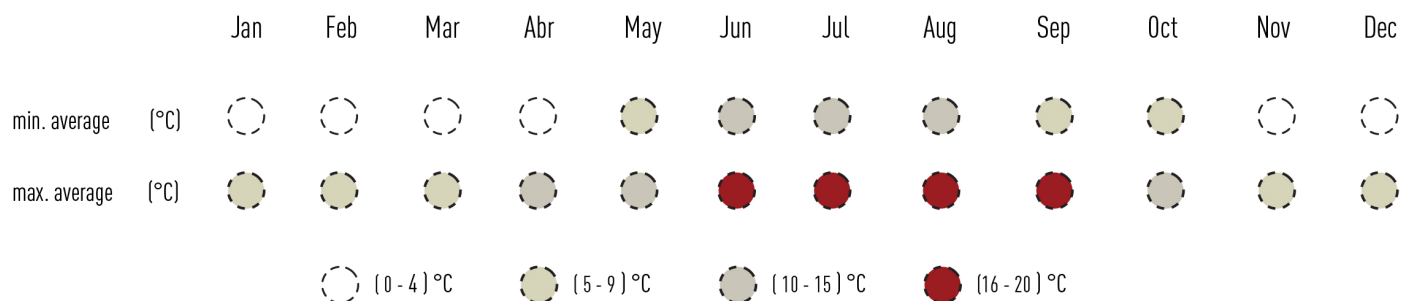
As it can be observed in the figure 3.2, the variation in the precipitation between the driest and wettest months is 66 mm. Average temperatures vary throughout the year at 11. 5 °C. Temperatures are highest on average in July, around 14.5 °C. The coldest month of the year is 3.0 °C in the middle of January.

Spring: It is the best time to visit Glasgow. Its temperatures vary between 7 °C and 13 °C during the months of March, April and May. This season sees daffodils, bluebells, cherry blossom and rhododendrons bursting into bloom.

Summer: In this station Glasgow ceases to be a dark city as there are extra hours of daylight. Temperatures range between 15 °C and 17 °C between the months of June, July and August.

Autumn: From September to November, Glasgow has temperatures between 8 °C and 14 °C. The colours are vibrant and the trees change their colour from green to fiery reds, oranges and yellows.

Winter: The weather in Glasgow during the winter can be very cold. Temperatures are usually around 5 °C during the months of December, January and February. The average number of days with snow falling in Scotland ranges from 15 to 20 days.



THE CITY OF GLASGOW

URBAN DEVELOPMENT AND SPATIAL ORGANIZATION

The global structure of the city of Glasgow can be interpreted in several ways. Due to its development of the ring system around the center, it could be said that its urban structure is radial. However, other studies claim that the urban agglomeration of Glasgow reveals a stratified structure of linear development bands to the east and west on both banks of the river, instead of a radial structure composed of a mass that departs from the city center.

Some areas with a certain spatial order are always dispersed to the great total agglomeration. The only areas with a more continuous spatial order and a more coherent urban fabric are the center of the city and the West-end area (between Merchant City and Hyndland). The areas that are separated from their spatial structure are small nuclei known as neighbourhoods and “towns”. As you can see on the map, the areas in the middle of the city are abandoned industries, railway structures or wooded areas. Due to this, the remaining areas are used to create new housing and commerce centres that favour the reintegration of communities within a continuous urban fabric. However, these areas are quite extensive and the population of Glasgow is not likely to spread drastically. It is unlikely that Glasgow has the potential level to fill all these empty areas; even if it existed, the identity of the communities and the loss of green areas would be lost. On the other hand, the area that exists between communities is formed by a transport system such as roads, cycle paths, etc. and urban systems such as gardens, public parks, recreation areas, etc.

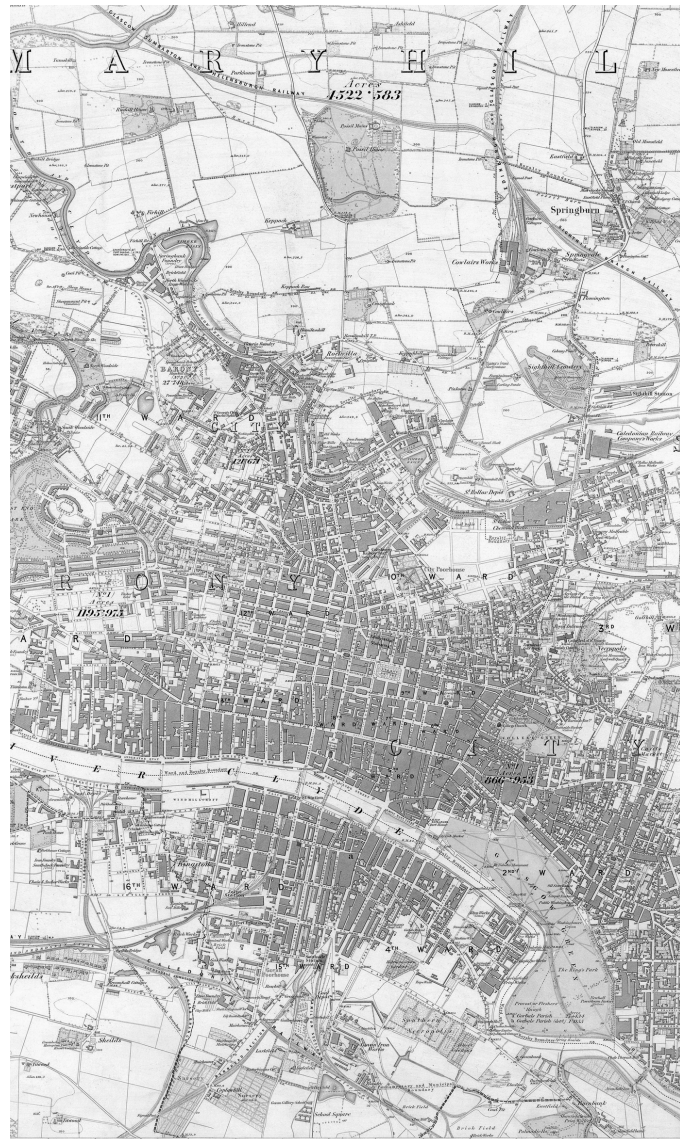


Figure 4.1 | Map of Glasgow in 1856.

THE CITY OF GLASGOW

THE RIVER THAT RUNS THROUGH THE CITY: THE RIVER CLYDE

EVOLUTION OF THE RIVER THROUGHOUT THE DECADES | The River Clyde has always been the centre of Glasgow's shipbuilding for thousands of years. It was not until the 19th century, with the arrival of the steam engine, that the naval construction became the commercial source of the city. Between 1844 and 1963, the Denny shipyard built more than 1,500 ships, including the first steam ship that crossed the canal in 1814 and the first steam ship of the turbine in 1901 (Clyde Waterfront, 2003).

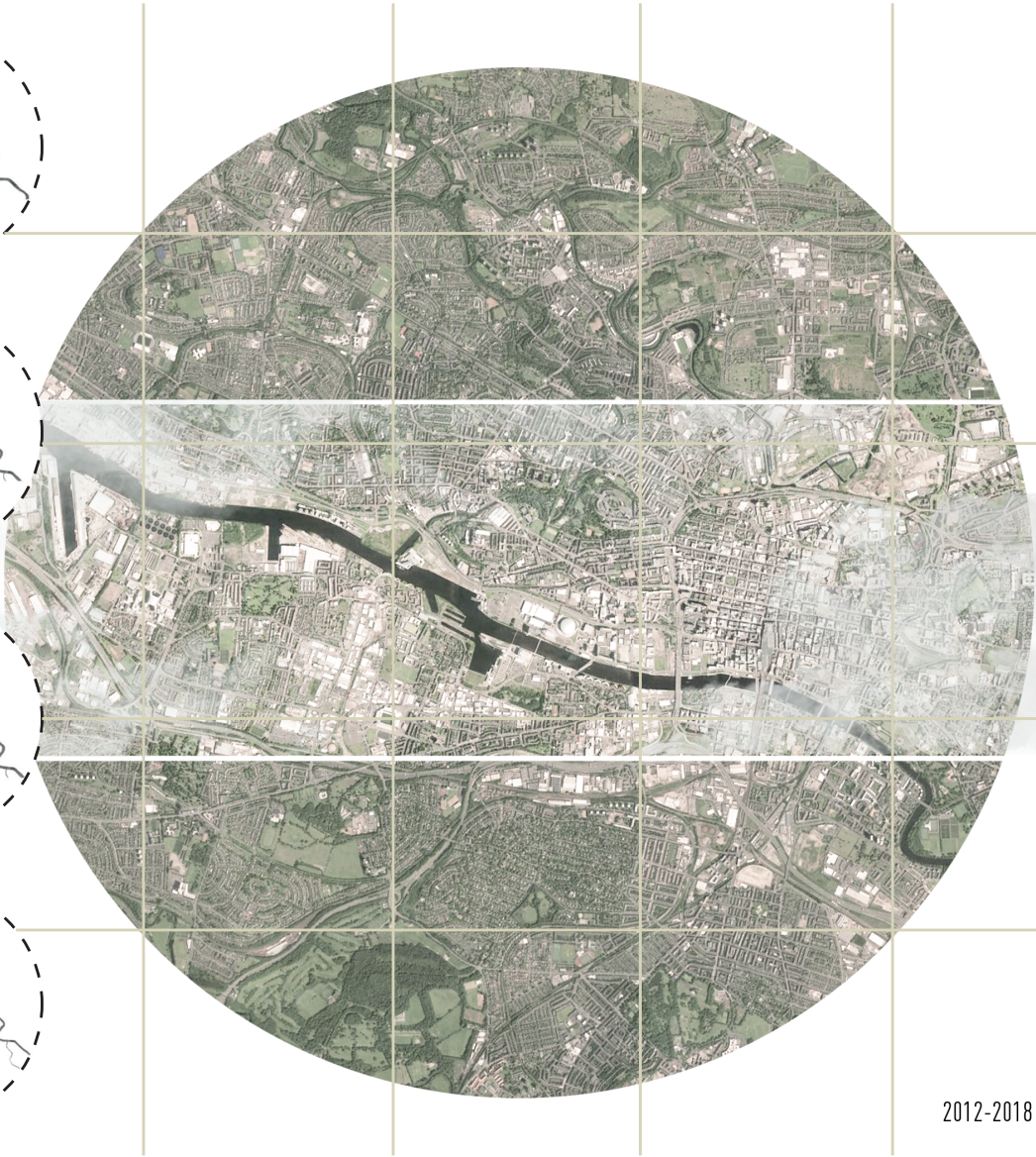
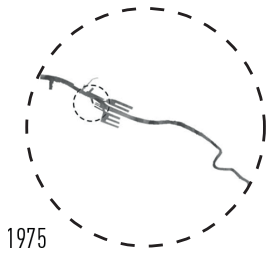
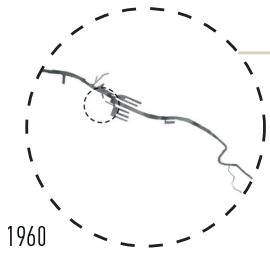
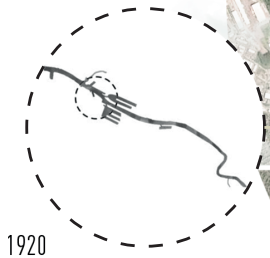
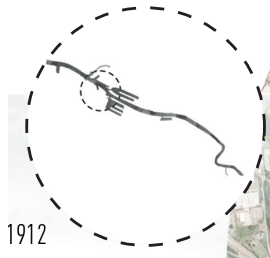
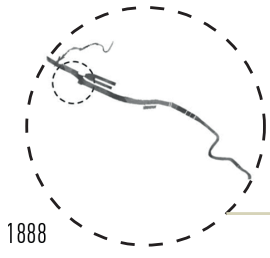
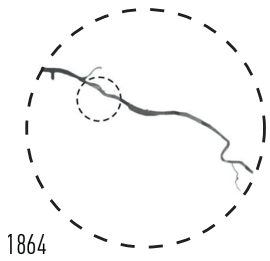
However, the heart of the shipping industry in Glasgow was in Govan. The transformation of the river began around 175 years ago, in 1838, by the naval construction of McArthur and Alexander in the old site of Doomster Hill. Two years later, Robert Napier, a Scottish engineer known as "the father of the Clyde shipbuilding", took the shipyard and turned it into a company. With the arrival of the industrial revolution, the shipyard of Napier contributed to the massive construction of the first iron ships in the world. Together with his apprentice John Elder, a marine engineer who played an important role in refining the compound engine to its most efficient form, they came to build thousands of steamboats. In 1860, Elder started his own shipyard which is known today as Fairfield Shipyard.

Among other shipyards included New Yard, Linthouse and Middelton that contain the Dry Graving Docks built between 1869 and 1898. They are three docks that were built consecutively, each of them being big-

ger to improve the need of the larger ships. In the decade of 1900, it became the largest shipbuilding area on the Clyde River and in turn the most important economic sector in Scotland, which provided work for men of all trades.

These shipyards grew in the late nineteenth century to become the main suppliers of warships to the Royal Navy, as well as developed the construction of coatings and steamboats. Furthermore, after the Second World War, the shipping industry declined and in the 1960s Fairfield collapsed. This was due for several reasons; In the first place, the War was over, so the main client did not demand the same number of orders; Secondly, bad management and stubborn trade unions fighting for better wages was creating labour problems; and, finally, the potential of commercial shipping was not recognized. In the 1980s, several attempts were made to reuse Govan's shipyards but there was no result. Now the banks of the Clyde, which were once animated, are in a bad state and unused.

The diagrams to the right illustrate the evolution of the River Clyde's form throughout the decades, demonstrating how the boom in the ship building industry led to the construction of docks, Queen's Dock and Price's Dock in Govan. The docks were a hive of activity until the 1960s when trade almost came to a complete halt. The second had three dry docks that were built for the Clyde Navigation Trust between 1869 and 1898. The first dock opened in 1875, the second larger dock in 1886



and the third and largest in 1898. Dock number three was constructed with the intention of being divided into two docks so that two ships could be serviced at the same time (Clyde Waterfront, 2003).

GEOGRAPHY OF THE RIVER | The Clyde is one of the most important rivers in Scotland. It is a set of images, power, productivity and joy. The River Clyde is located in Scotland and is 176km long. It got named by “a wise man” which once said that “*Glasgow made Clyde and Clyde made Glasgow*”. This was all said in the early 1700s.

The river is 42 km wide and 171 km long with a depth between 7.4 and 8.2 meters (Moore, 2017). It flows north-west through Glasgow to the Clyde estuary, which then flows into the Atlantic Ocean, and crosses the Clydesdale, an agricultural and orchard region known for its Clydesdale horses. Nonetheless, it is the second longest river in Scotland and the eighth longest river in the United Kingdom.

THE RIVER AS A LINK BETWEEN NORTH AND SOUTH | The River Clyde runs through the entire city of Glasgow but the communication routes located transversally along the river allow the north-south connection of the city, integrating the individual urban areas within it. The bridges act as connexion and are located strategically and in axial directions. An example of some connected areas is Govan and the center of Glasgow. Although it is an existing link, a specific spatial planning is required for this union to be more controlled.

THE WATERFRONT OF GLASGOW | The development of Glasgow has always been closely linked to the Clyde River. “*The River Clyde is a symbol of Glasgow’s past success and the city is determined that it should also be seen as a symbol of Glasgow’s future*” (John Bury, 2015). Wealth always came to Glasgow by the Clyde River. The Romans already protected it with the Antonino Wall (year 142) and, in the 16th century, its active port received ships with sugar and tobacco.

The effects of the industrial revolution brought with it the construction of land transportation (rails and trains) and maritime transport (steamships). This last one supposed an advance in the development of the docks spaces where they began to create direct connections between the river and the buildings of the city. Consequently, they began to make changes in the open spaces for the construction of parks, gardens, etc.

Currently, there is only one dock and two shipyards working. Despite the recession that has affected its traditional industries, port activity remains of great importance. Many of the industries prevailed in Glasgow and in the boundaries of the Clyde River and, as a consequence, brought the degradation of the environment: air pollution, toxic chemicals used in industrial processes polluted the river, etc. The Second World War was devastating for the city since it was from that moment when the industrial and economic sector decline on an accelerated way; the structural weaknesses of the industry that had been hidden in the full employment of the shipyards was exposed due

to all the changes generated by the new technological advances. Factories and shipyards closed, therefore they were leaving many areas of the city, especially those on the edge of the Clyde River. That is why, today, there are strategies for the regeneration of Clyde. The government of Scotland emphasizes the importance of the river in Scotland and they are working with the public sector through the Clyde Water-

front Strategic Partnership for its recovery. They established proposals in the waterfront area in order to guarantee that those who live and work near the river can benefit from the continuous regeneration of its banks. Its objective is to create a lively, accessible and safe port front for the new neighbourhoods by providing not only employment and housing, but also opportunities for tourism and leisure activities.



Figure 4.2 | The River Clyde in Glasgow, Scotland.

GOVAN. POST-INDUSTRIAL CITY

LOCATION

Govan is a district in the south-west City of Glasgow, Scotland. Located approximately 3 miles from the city center, on the south bank of the River Clyde. Govan was originally out of Glasgow but, in 1912, it was part of an extension that was made in the city. It was transformed in the 19th century due to industrialization: coal mining and shipbuilding.

For 100 years, the city was the center of shipbuilding on the Clyde. Govan had transformed and went from being a rural area, with huts and thatched roofs, to be a much more advanced city with the development of new technologies and factories. Nonetheless, after the post-war, the city lost importance; this long-term industrial decline has been one of the factors by which the city has had problems of economic, physical and social deprivation in the last decades. In addition, it brought as a consequence a series of abandoned and unoccupied lands in the city.

Despite all the challenges presented by the city and its inhabitants, Govan is a place with great potential to be intervened. It is located near the center of the city of Glasgow and is well connected by public transport. It is part of the heart of an emerging innovation district such as the University of Glasgow, Digital Media Quarter, Pacific Quay, etc. Thanks to its proximity to the river, Govan is one of the best places in terms of regeneration and one of the most interesting development opportunities in the city. Govan has the potential to re-establish a relationship between the city and the river, increasing tourism and

improving the appeal for residents and the community.

However, for several years Govan has been surrounded by abandoned areas, which provides a sense of isolation in the city. In addition, the number of roads exceeds the pedestrian roads. One of the solutions is to manage the future development of these sites by offering new housing options or using them as social and cultural spaces. Govan is an active community full of trained people who have a passionate commitment to the place and a deep knowledge of its history and tradition. Therefore, it would be ideal to promote culture and entertainment in this city.

Govan has potential for residents and local businesses. It is mainly a residential area, with an industrial interior characterized by the construction of shipyards. One of the solutions would be to start restoring its architectural heritage to offer people a better quality of life, an opportunity to live and work and to give back the identity and sense of community to the city. It must begin to be a place that represents the best of a 21st-century city, full of creativity, entertainment activities, better education, etc. It must close the chapter on poverty and crime and increase life expectancy. Govan must be a place where people can live, work, invest and visit without any problem.



clyde river

GOVAN

GOVAN. POST-INDUSTRIAL CITY

THE BEGINNINGS OF THE CITY

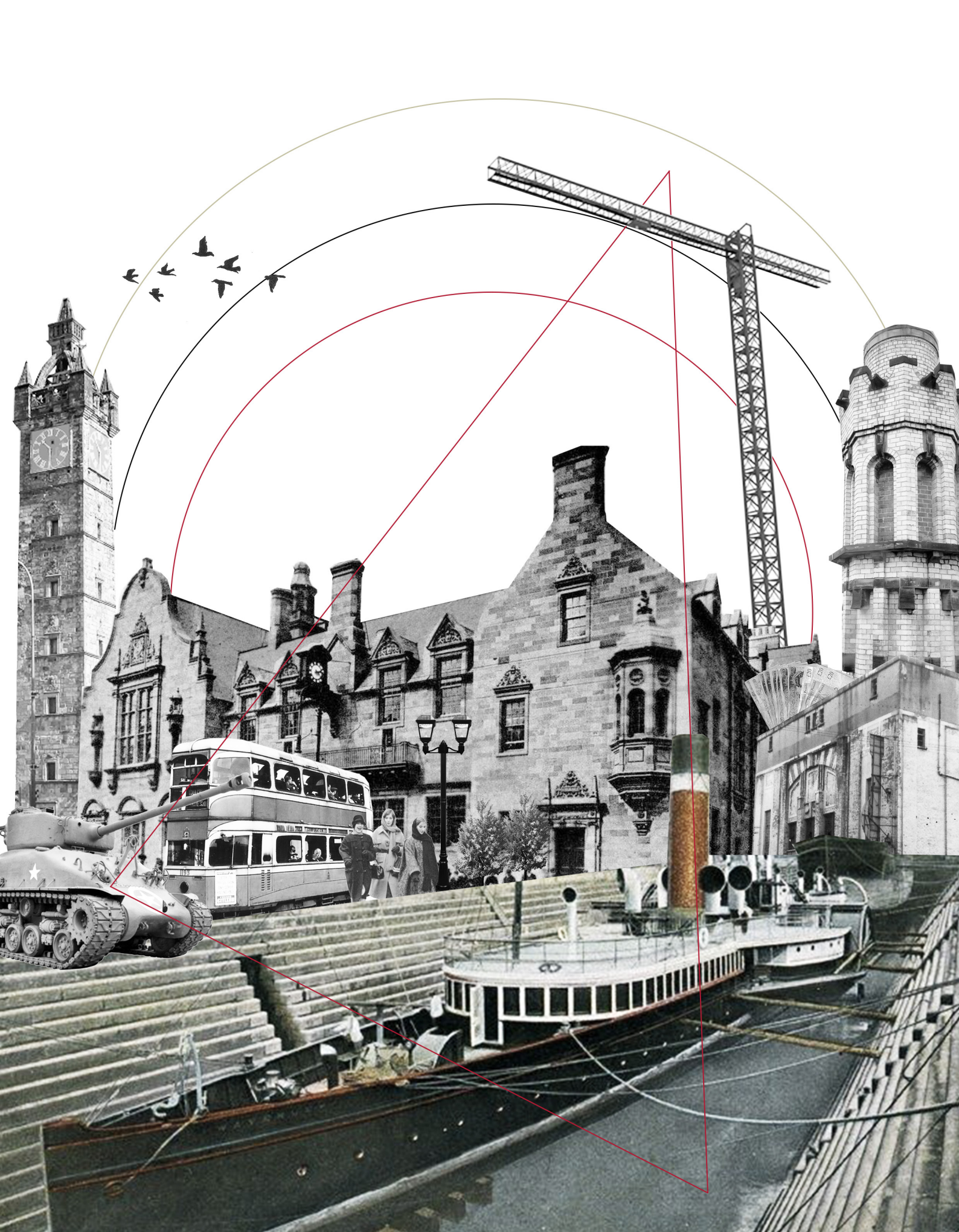
Govan during the 18th century was known for its hand-loom weaving industry and its associated skills. As a result of its success, the Govan Weavers Society was officially established in 1756. In addition, during the 18th century, particularly the 1790s, the agricultural and then the industrial revolution began, which had an effect on Govan both historical as economic.

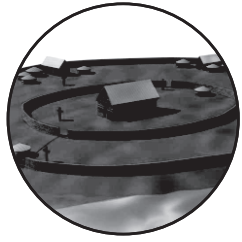
On another hand, in 1759, the Navigation Act of the Clyde River was approved due to the economic increase in America, which deepened the naval construction industry and exploited the natural resources of the Clyde river.

In 1841, Robert Napier established the Fairfield Shipyard, a shipyard that ended up being the heart of the shipping industry in Glasgow. The modern naval construction started in the Clyde River, Fair-field's docks specifically, in the mid-nineteenth century as part of the massive industrialization of Glasgow. This shipyard grew to become one of the best suppliers of the Royal Navy, which used prefabricated iron products locally on the construction of bridges, ships and factories (Clyde waterfront). The Clyde River deepened and expanded to cultivate routes for larger ships arriving from America, with the docks being carved out of the landscape. The Glasgow Graving Docks, which will be covered in further detail, were opened between 1869 and 1898 but with the impact of the economic downfall closed in 1988. In the 19th century, specifically in 1850, before the explosion of the maritime

sector, Govan's extension included little more than a series of rural residential buildings. However, at the end of the 20th century, Govan began to lose its rural aspect due to the naval construction and the invasion of industries that brought with it a large number of immigrants from both Scotland and Ireland to work as shipyards. In the year 1910, Govan became the seventh largest city in Scotland, going from having 2000 inhabitants in 1830 to 92000 in 1910. "The expansion of shipbuilding attracted workers to the area from many parts of Scotland and beyond and created a marked shortage of accommodation in the town". (Scottish Society for Industrial Archaeology, 1980, p. 2).

By the year 1930, Govan was one of the best world centres of shipbuilding. The position that lasted shortly after the Second World War, when the sector fell into its final crisis in 1960 leaving a legacy of abandoned buildings and vacant lots that devalues its true potential. In 1980, the buildings were demolished on a large scale for the construction of new industrial uses with the aim of increasing the economy of the city. However, this effect did not work out and currently, Govan is known as a working class lower class area. This area was named by the magazine "The Independent" in April 1994 as one of the worst areas of Great Britain with drug abuse as a widespread problem and unemployment up to three times the national average at the time.





500-600 A.D.

Two associated Christian burials are radiocarbon dated to the 5th and 6th centuries, making Govan the earliest known Christian site in the region. Around 565 A.D., according to historical text, the Christian missionary St. Constantine arrives in Govan and builds a small wooden church next to a sacred well and in the shadow of the ceremonial hill



1000 A.D.

The church located in the eastern hills becomes the new administrative power base of the kings of Strathclyde. The church is used for great ceremonies, meetings and pronouncements



19th century

Because of both the agricultural and industrial revolutions, there was a large population growth (2,300 – 90,000) in just 100 years by the early 19th century. Shipbuilding and immigration were two biggest factors influencing the population growth. Also, in 1826, the architect James Smith designed another church on the same existing grounds



1864

In 1864 Govan was granted burgh status. It was the fifth largest in all of Scotland

It was also in 1864 that the Fairfield Shipyard stated its development, soon to become the largest shipyard in the world



From 650 BC the King of Dumbarton wins the victory against the Scots of Dalriada, which makes him the most powerful king of the British Isles. Now the church and the Govan ceremonies are part of the British kingdom of Clyde

600-700 A.D.



In the 18th century, Govan was known for its hand-loom weaving industry. Women bleached, dyed and spun wool in many factories around the area. There was a guild of master weavers called Govan Weavers Society which was formed in 1756. In 1759 was also the year the river was deepened. This eliminated the ability from people to cross over the river

18th century



In 1841, Robert Napier took over a small shipyard in Govan, re-fitting it to build iron ships. Many warships, cargo ships and ocean liners were launched from here

1841





1875

In 1875 the first dock at the Govan Graving Docks opened



1897-1898

In 1897, Prince's Docks was completed, adding about 7 miles of new wharf to the Clyde River

In 1898, the final and largest graving dock opened at the Govan Graving Docks site



20th century

In 1912, Govan became a part of the city of Glasgow

In 1931, the king George V Dock was completed, which is the only dock currently in use today

In 1998, the Govan Graving Docks closed, still awaiting restoration



2007

In 2007, the Pacific Quay was redeveloped to house both BBC Scotland as well as Scottish Television



The second dock at the Govan Graving Docks opened

1886



In 1910, the York hill Dock was opened across from Govan, providing berths for liners coming to and from New York

1910



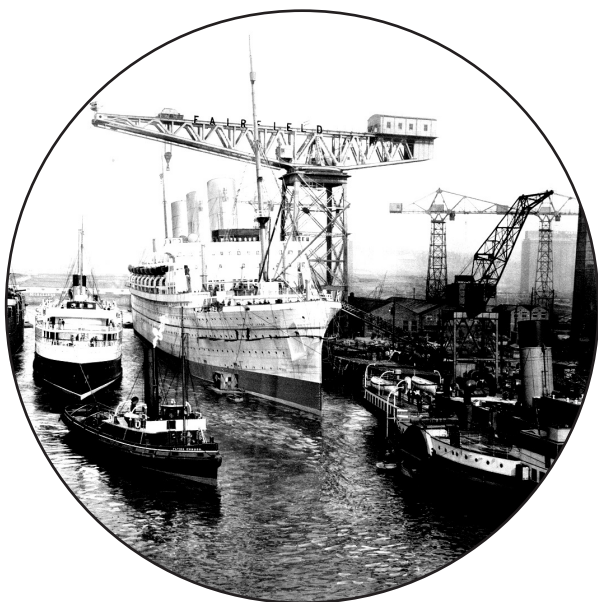
In 1864 Govan was granted burgh status. It was the fifth largest in all of Scotland. It was also in 1864 that the Fairfield Shipyard stated its development, soon to become the largest shipyard in the world

21th century



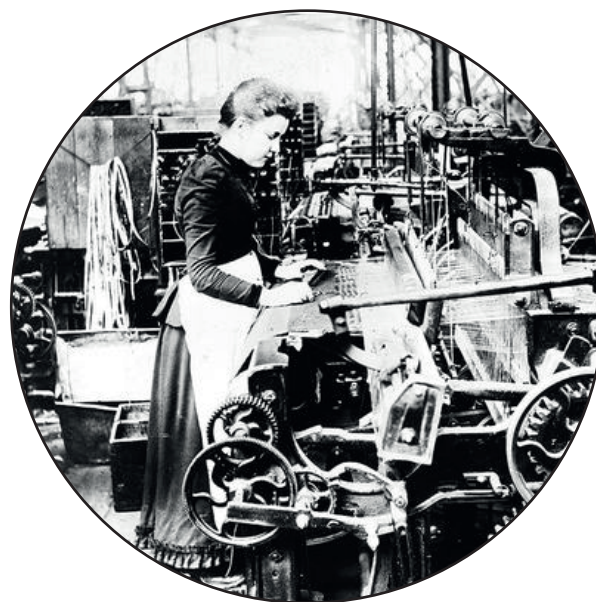
GOVAN. POST-INDUSTRIAL CITY

INDUSTRY FACILITIES AND WEAVERS SOCIETY



SHIPBUILDING

The merchants of Glasgow had their ships built in North America but it was not until 1711 that the most important shipyards were built on the Clyde River. The naval construction in the river was of fishing boats and small coastal boats. One of the most recognized shipyards was the Stobcross, where small wooden-hulled sailing vessels and steamships were built. In turn, most of the marine engines manufactured in Glasgow were installed in wooden helmets built in Port Glasgow or Greenock. Due to the success of this specialization, the shipyards began to build and establish themselves.



TEXTILE AND LEATHER

The cotton industry, together with its advanced weaving technologies and its large hand-woven textile industry, dominated the economy of Glasgow in 1830. This activity was extended until the 1870s by the fall of cotton, product of the American Civil war that took place between 1861 and 1865. New spinning mills were built in the 1870s and 1880s but these factories declined due to competition from foreign producers and the construction of the shipbuilding. During the 18th century, weaving was the basic industry of the Govan peoples. Six-storey silk mill was built in the city of Govan, which had more than 250 employed by 1839.



COAL MINING

From the 16th century coal was mined in the lands of Govan which was part of the Great Glasgow coalfield. There were pits in Gorbals, and at Ibrox, Bellahouston, Broomloan, Helen Street, Drumoyne and Craigton. During 18th and 19th centuries coal mining was a major part of the industry and thus the economy in Govan until shipbuilding took over as the main industry in the 19th century.



HAND-LOOM WEAVERS

The Handloom weaving was one of the most important industries in Glasgow during the 18th century and the surrounding communities were prosperous from this activity such as Gorbals, Calton, Anderston and Govan. John McDowell, along with his niece, were one of the first apprentices of manual loom weavers in the Calton area.



THE GOVAN FAIR PROCESSION

It was a fair that took place at the end of the 15th century in the city of Govan. In 1757 it became one of the most important events of the year thanks to the fact that the weavers of Govan revived this festival. It continued until 1881 when, with the traditional weaving trade in terminal decline and the old village swamped with newcomers seeking work in Govan's engineering and shipbuilding industries, the celebrations ended due to lack of support from the textile trade.



THE HAND-LOOM WEAVING INDUSTRY

The hand knitting industry in 1839 had more than 340 employees who worked long hours on looms in their own homes. However, with the rapid development of new technologies, the Hand-loom weaving became one of the most important industries for Glasgow in the eighteenth century, which resulted in unemployment by the hand weaving industry. From then on, these weavers continued their work until the beginning of the 20th century producing fine and delicate cloths.



GOVAN SILK WORKS

This six-storey mill was built at the western end of Govan in 1824 for Morris Pollok. It employed more than 250 workers by 1839. However, in 1973 a fire caused serious damage and the damaged section was never rebuilt. In 1901 the building was demolished to make way for an extension of the Fairfield shipyard.



HAND-LOOM WEAVERS

The recession in agriculture had a severe impact on the south-west of Scotland, which forced many people to leave the land and find work in cities such as Glasgow. Farms near the city had the ability to feed milk, meat, cheese and provender for horses, which was important for the transportation system. Regarding to fishing activity, it was much more problematic. Industrial pollution in the city of Glasgow put an end to salmon fishing in the Clyde River. Sail replaced oars and at the turn of the century was replaced by steam.



Figure 4.3 | Children play in the shadow of the idle shipyards.



GOVAN. POST-INDUSTRIAL CITY

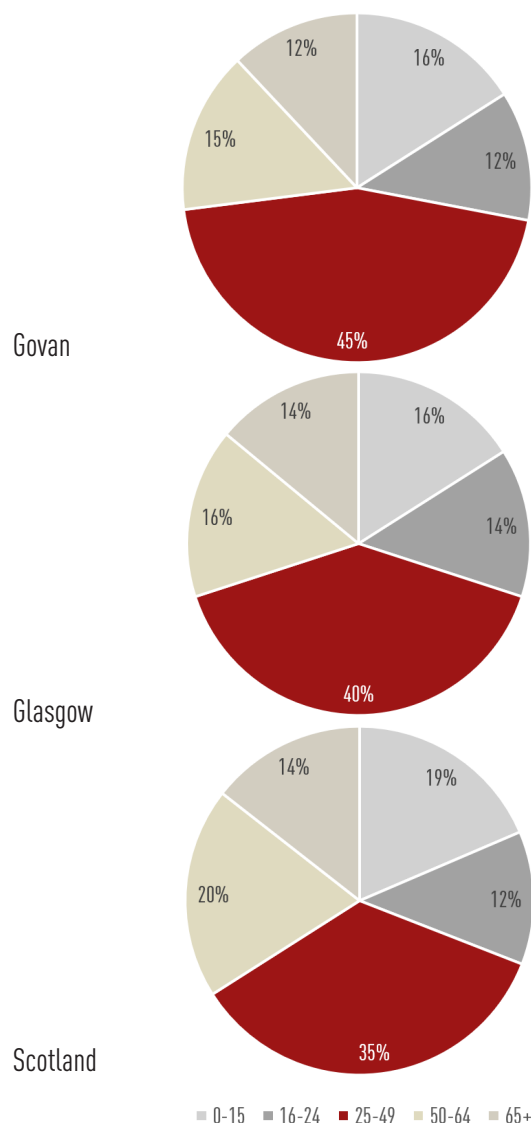
WHO LIVES IN GOVAN? - DEMOGRAPHIC DATA

POPULATION BY AGE | Govan has a total population of 5.860 (Scotland's official statistics, census 2015) with a density of 3.595/km². Slightly more women (52%) live in the area than men (48%). The table below shows a comparison between the Govan, Glasgow and Scotland population.

Govan	12,953 (2015)
Glasgow	615.070 (2016)
Scotland	5.404.700 (2016)

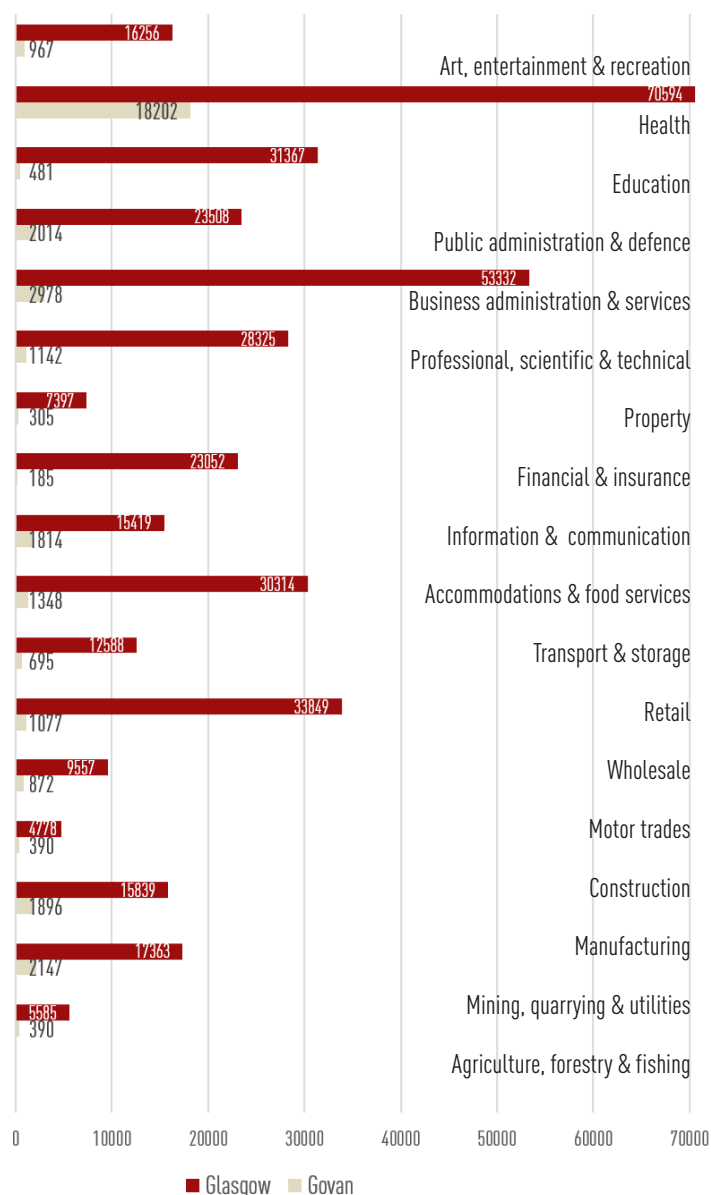
Nonetheless, the pie-chart on the right shows a population comparison between Govan, Glasgow, and Scotland according to the age of the people (source: 2011 Census Neighbourhood profiles). As can be confirmed, there is a high percentage in all cities of children and young people (0-24 years old); Govan represents 28% and Glasgow and Scotland 30%.

In turn, Govan is the city with the highest percentage of age groups from 25 to 49 years, 45% respectively, while Glasgow represents 40% and Scotland 35%. The analysis also reveals that people over 50 age represent 27% of the total population in Govan, being the lowest in comparison with Glasgow (30%) and Scotland (36%).



ECONOMIC ACTIVITY | Govan maintains its historical traditions with an economy based on production, manufacture, and construction. Two of Scotland's most important manufacturing businesses are located in Govan; In addition, it is the home of BBC Scotland and other digital media companies. Glasgow is, in general, no shortage of local jobs, but in Govan is one of the neediest communities in Scotland because as you will see below, has a high level of unemployment. There were approximately 57.000 jobs in Govan in 2008 based within the financial and business services sector (Sources: Annual Business Inquiry & ONS Mid-Year Population Estimates).

It can be clearly seen that it is necessary to generate more employment to diversify the economy and develop other professional services. There is a lack of diverse sectors such as art, entertainment, retail, accommodation, among others. The table on the right shows a comparison between the differences in types of employment in Glasgow and Govan. The total employment in Scotland is 2.443.408 while in Glasgow is 399.167 and in Govan is 36.903. Of the 18 data zones in Govan, seven are among the 5% most deprived in Scotland and six more are among the 10% most deprived. All but three are among the 20% most deprived (Glasgow City Council, 2017, p. 8). As has been seen, the health sector is the largest employer in Glasgow and Govan in general. In addition, the sector of construction, information & communication and business administration are the highest compared to the rest of the activities in Govan.



GOVAN. POST-INDUSTRIAL CITY

URBAN ANALYSIS

BUILDING TYPOLOGIES | Evidently, Govan is an industrial area, almost 50 percent of the buildings are warehouses or industrial buildings, most of them located on the southwest side of Govan. The other half percent consists of residential. As shown on the map, Govan lacks public buildings, especially leisure and entertainment areas as well as cultural activities.

These buildings respond to the main routes of access of Govan, especially those railroads that cross the city practically. The important industrial buildings that still prevail in the city are around the Fairfield Shipyard, bordering the Clyde River, which identifies the pattern of a route along the river.






With the crisis of the 70s, the problem of Glasgow and its surroundings was how to alleviate poverty and improve health without increasing the economic costs. The buildings in Govan have the worst housing conditions in Scotland. According to the city's local councillors, people living in homes that are too cold, humid or mouldy or in need of repair. In turn, there are empty and abandoned houses throughout the city.

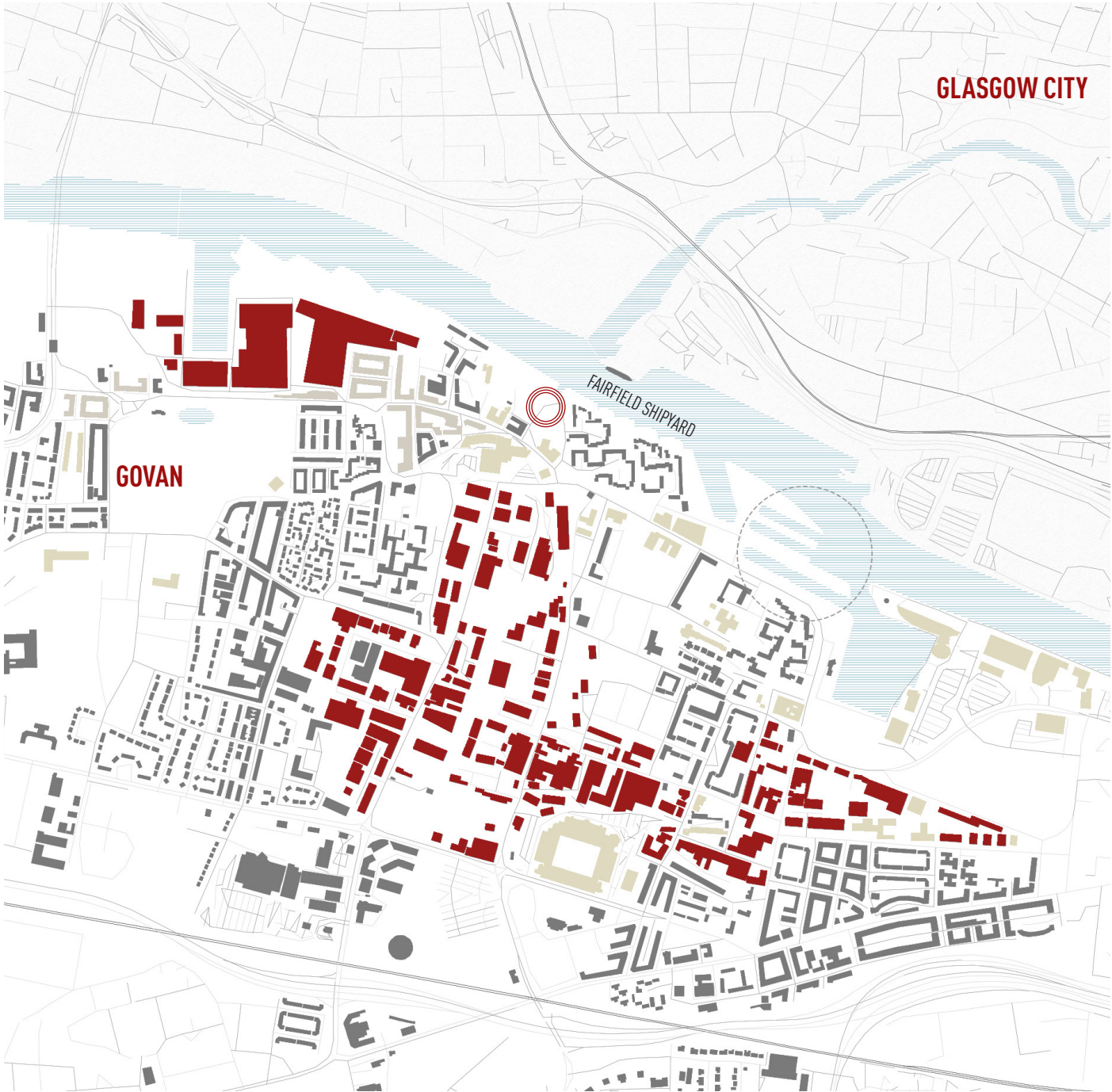
What it is also interesting about this map, is the shortage of markets. In front of the metro station (in a parking lot), Govan has one open market that works every Saturday from 10.00 am to 3.00 pm. As can be seen on the map, this is the only place where people can buy food. This is one of the reasons why this thesis proposes a market area with

food production, starting from this parking lot to the beginning of the Govan Graving Docks.

In addition, there are abandoned spaces with buildings in disrepair or empty stores in the center of the city. More than 60% of the population lives within 500 meters of an abandoned site. Previous research has shown that most of these people are of low socioeconomic level, therefore they are more vulnerable to the environmental problems that this caused due to the contaminants that nearby industries produce.

LEGEND - building typologies

-  residential
-  industrial
-  public
-  mixed-use
-  govan saturday market



GOVAN. POST-INDUSTRIAL CITY

URBAN ANALYSIS

GREEN AND FARMING AREAS (ALLOTMENTS) | As can be seen on the map, there is a lack of green areas in the city of Govan. Most of these spaces are abandoned lands, neither accessible nor used appropriately. The only accessible green spaces for people are the Elder Park, which is the main area of open space in the city. In this area, there are several public houses that occupy ground floor units of traditional housing. The buildings of the city are in bad conditions but in spite of that, you can see those buildings with high Victorian and Edwardian style of the twentieth century. Also, commercial properties include traditional commercial units on the ground floor and housing on the upper floors. There are still emblematic buildings and fine sandstone houses that define the eclectic city.

On the other hand, there are a few areas for agriculture in the city. There are only 5 community allotments scattered throughout Govan and 1 proposed, the Old Fairfield farm, which was never developed.

Before 1840, there were more than 4320 acres in crops of various types. Most of the properties had small gardens where different types of food are grown, such as potatoes and cabbages. They also had their own cows and pigs. Currently, the agricultural area is decreasing and these spaces are being replaced by residential build.



1. Linthouse Community Garden



2. Elder Farm



3. Moogety Garden



4. Riverside Community Garden



5. Vickerfield Allotments

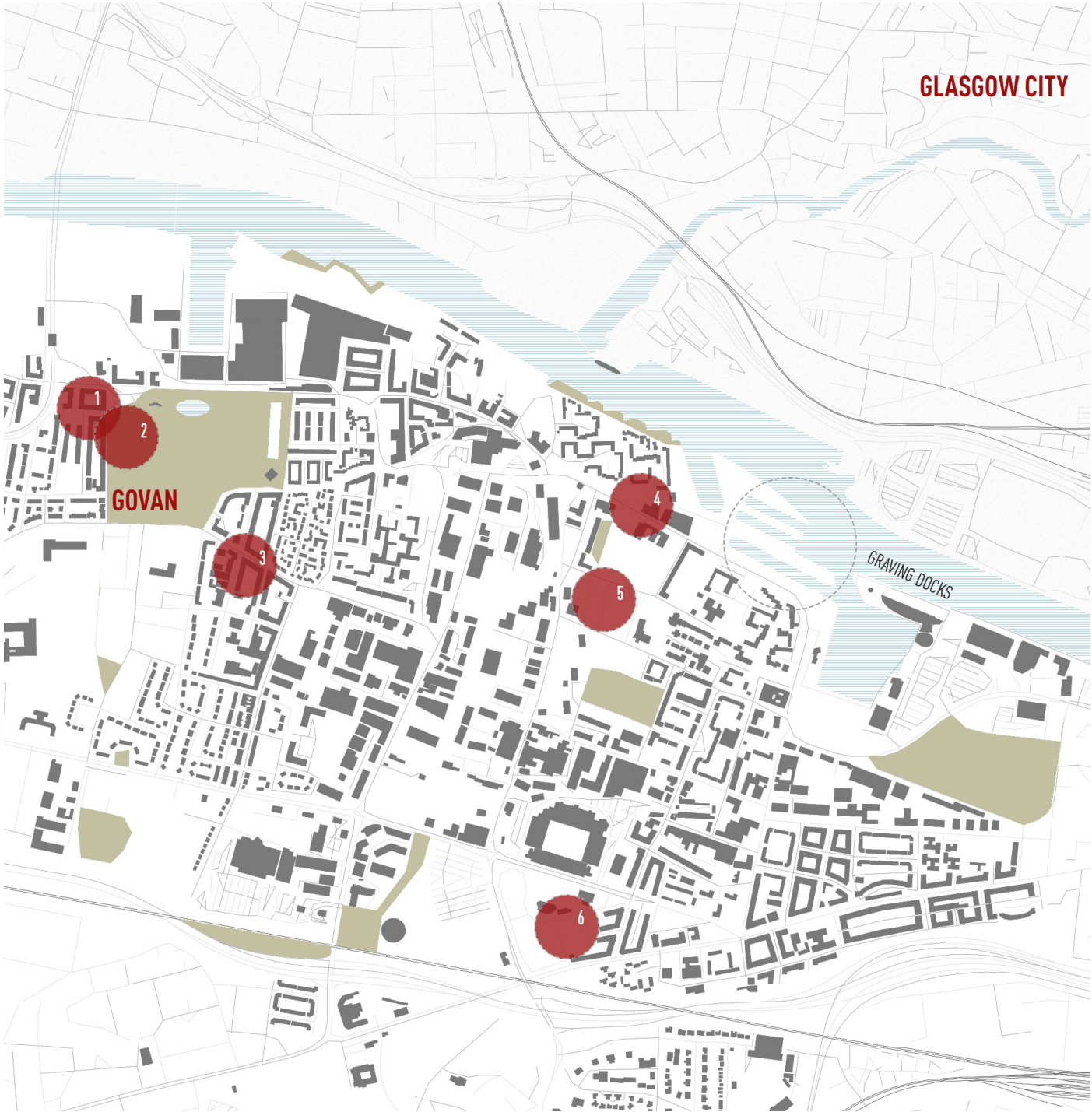


6. Ibrox Flower Field Community Garden

LEGEND - green areas and allotment gardens

 green areas

 farming areas



GLASGOW CITY

GOVAN

GRAVING DOCKS

GOVAN. POST-INDUSTRIAL CITY

URBAN ANALYSIS

ROAD NETWORK | Govan has one of the most important main roads in Scotland, the Govan Road. Across this avenue, a traditional urban landscape of Glasgow is revealed, defined by its form of century XIX. In terms of urban design, this avenue connects the east-west city marking the traditional houses on both sides of the street. As a result of this avenue and the development of its plots, Govan is recognized for its identity. This pattern shows the different phases of development that have occurred in the city since the construction of shipbuilding until today.

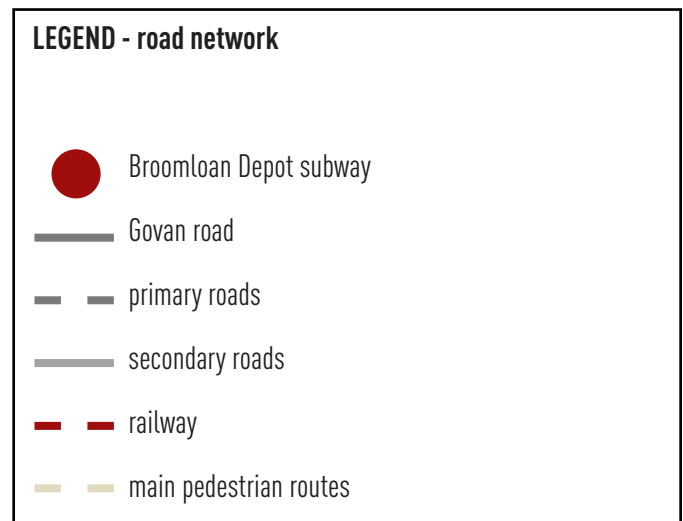
Govan Road follows its original route as seen in older maps and its smooth curve provides the central axis through the area along with the Lang-lands road to the south. Nowadays, it is the only road that goes from the eastern part of the city to the Elder Park.

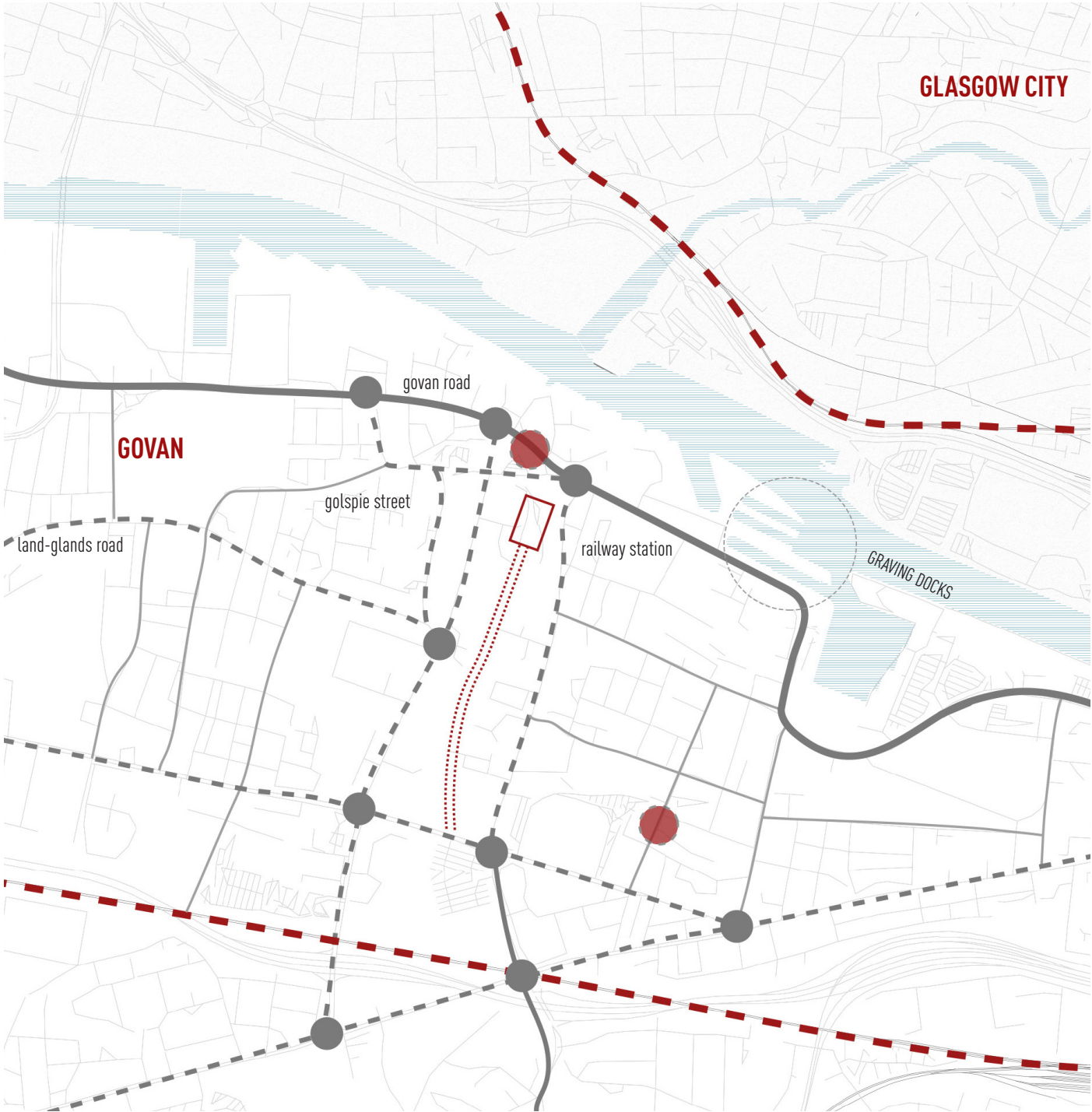
However, the flow of traffic is affected by this road, in addition to the acoustic pollution that is generated and causes problems in the residential buildings that border it. This historical pattern in the city is still evident. Although, there has been a fragmentation due to the Golspie street, that represents a physical and visual barrier that isolates the Govan center from the residential and industrial cities of the south.

It can be clearly seen that, in the middle of the city, is the Govan railway station. The station was originally part of an extension to the

Glasgow and Paisley Joint Railway. The railway located in this position causes a boundary between the north and east side of the city. The Glasgow Subway's Broom-loan Depot is near to the site of Govan station and uses part of the old tracked as a test track. Nowadays, it is abandoned.

Although the road network seems to work, pedestrian crossings are quite limited in the center of the city and along Govan Road. The current movement through Govan is a challenge for both residents and visitors.





GOVAN. POST-INDUSTRIAL CITY

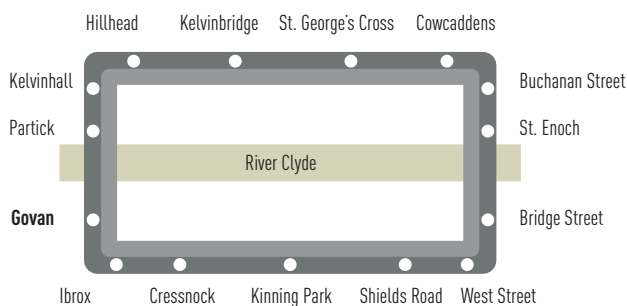
URBAN ANALYSIS

TRANSPORT ROUTES | The city of Govan is located in the circle of the Glasgow subway and the bus services are well planned.

As shown on the map, the center of Govan has good public transport connections and a variety of destinations inside and outside the city. Every two minutes there is a bus stop and the two metro stations (Govan and Ibrox) are less than 5 minutes away from each other.

These two stations link Govan with the rest of Glasgow. The Glasgow underground is not very big and crosses the Clyde river. It connects the entire network of neighbourhoods, as well as important cultural buildings such as the Transport Museum, Kelvingrove Gallery, etc.

The bus station of Govan, near the subway station, is the center of attention of both local and regional bus services that connect destinations both north and south of the river.



Subway map of Glasgow

LEGEND - transport routes

- bus routes
- bus stance
- subway stations
- 2 min walk
- 5 min walk
- 10 min wal

GLASGOW CITY



GOVAN. POST-INDUSTRIAL CITY

URBAN ANALYSIS

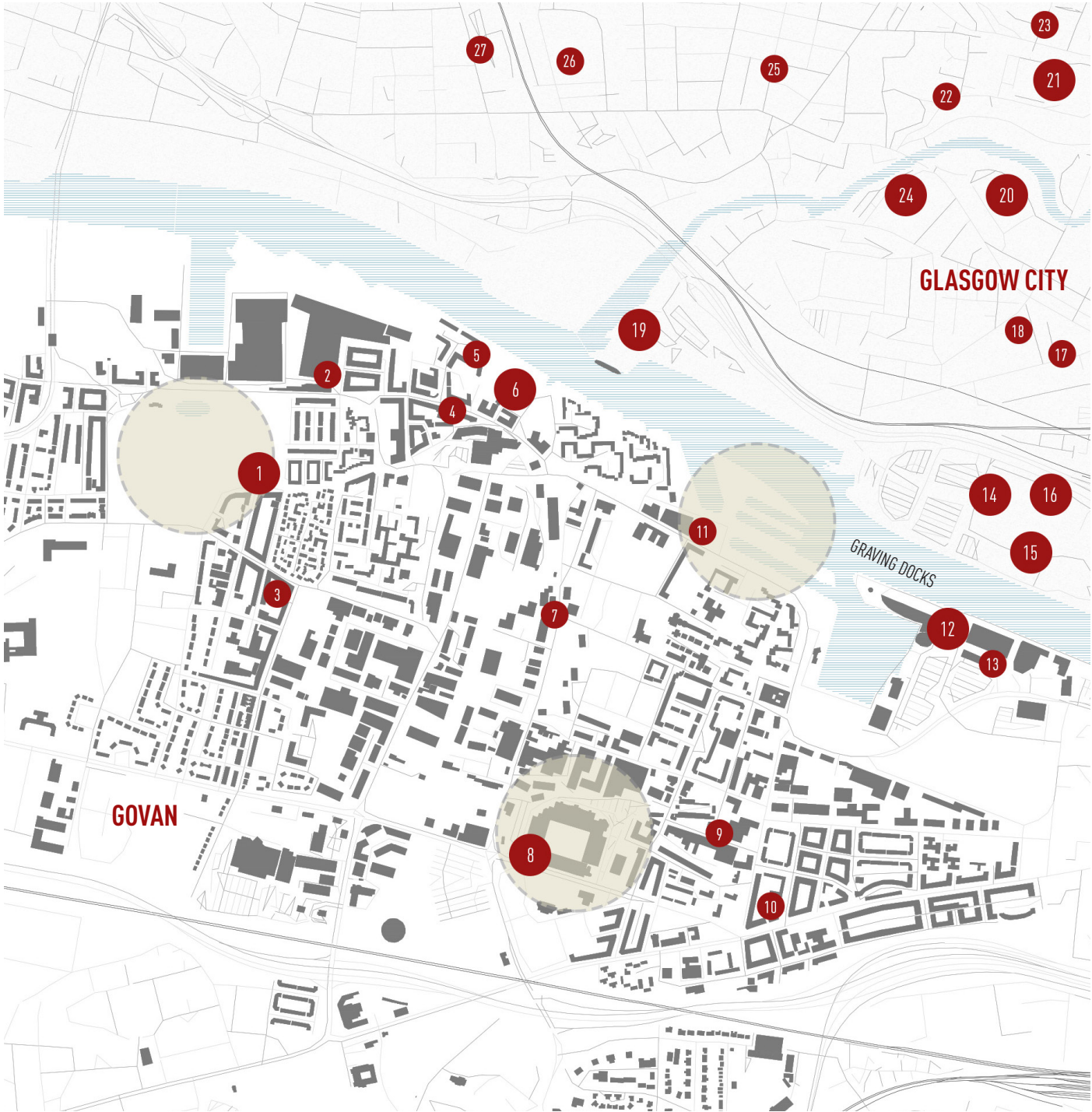
HERITAGE AND CONSERVATION AREAS | The areas of conservation are areas of architectural or historical interest, whose character or appearance is convenient to preserve or improve. Glasgow has more than 20 conservation areas arranged both in the city center and in the suburbs.

Specifically, Govan's conservation area starts in the Elder Park towards the Govan metro station, taking into consideration the historical part of the city. The area of Elder Park has great historical importance and includes a series of architectural and historical interests of the 19th century. Therefore, it is important to highlight these cultural patrimonies in the development of the project.

On another hand, in Glasgow, we can find importance museums such as Riverside Museum by the architect Zaha Hadid and The SEC Hydro by the architect Foster. From Govan, you can access these museums through Millennium Bridge or Bell's Bridge. To conclude, Govan has one important museum called the Science Museum and Cinemas, however, it is clear how there is a limited number of public and important buildings to promote culture or entertainment.

LEGEND - heritage buildings

1. Elder Park Library
2. Fairfiel Shipbuilding Museum
3. Friends of Wumenu Community Farm
4. St Antony's R.C Church
5. Govan Old Parish Chruch
6. Pier Institute
7. Revive MS Support
8. Ibrox Stadium
9. GalGael Trust
10. Ibrox Library & Learning Centre
11. Govan Graving Docks
12. Science Centre
13. BBC
14. SEC Centre
15. The SEC Hydro
16. Finnieston Crane
17. Argyle Tree
18. Kevingrove Park
19. Riverside Museum
20. Kelvingrove Art Gallery and Museum
21. University of Glasgow
22. Huntarian Art Gallery
23. Huntarian Museum
24. Football Court



PROJECT SITE: GOVAN GRAVING DOCKS

THE HEART OF GLASGOW'S INDUSTRIAL REVOLUTION

The site, selected from a number of alternatives, covers an area of 4.9 hectares at the western edge of Govan Graving Docks, Clydebrae Street, Govan.

The Govan Graving Docks is located to the west with the River Clyde and includes three docks respectively and an abandoned pump house. The place is owned by Glasgow City Council and nowadays competitions are being held to recover the area.

Being located practically on the south side of the Clyde River, this area is recognized as the heart of Glasgow's industrial revolution as the naval construction was done in the past.

Govan Graving Docks presents incredible opportunities for the realization of spaces of activities, recreation, housing, commerce, among others. It gives the possibility to connect both internal and external spaces. Being the waterfront between the river and the city, these docks offer the opportunity to make visual connections and passive environmental design strategies to improve their historical context.

In the image on the right it can be observed the relationship between Govan and Glasgow and how the Govan Graving Docks are the midpoint between these two areas. Their abandoned appearance is important to recognize the historical context that was presented there. The idea in this thesis is to create a place of recreation from an abandoned space

of an under-performing. Physical elements must be added to encourage public use and effective relationships between the area and the activities that will be carried out. In this case, the concept is to bring nature to the city through agriculture and housing, thus generating a place that has a strong sense of community, as the docks once were.

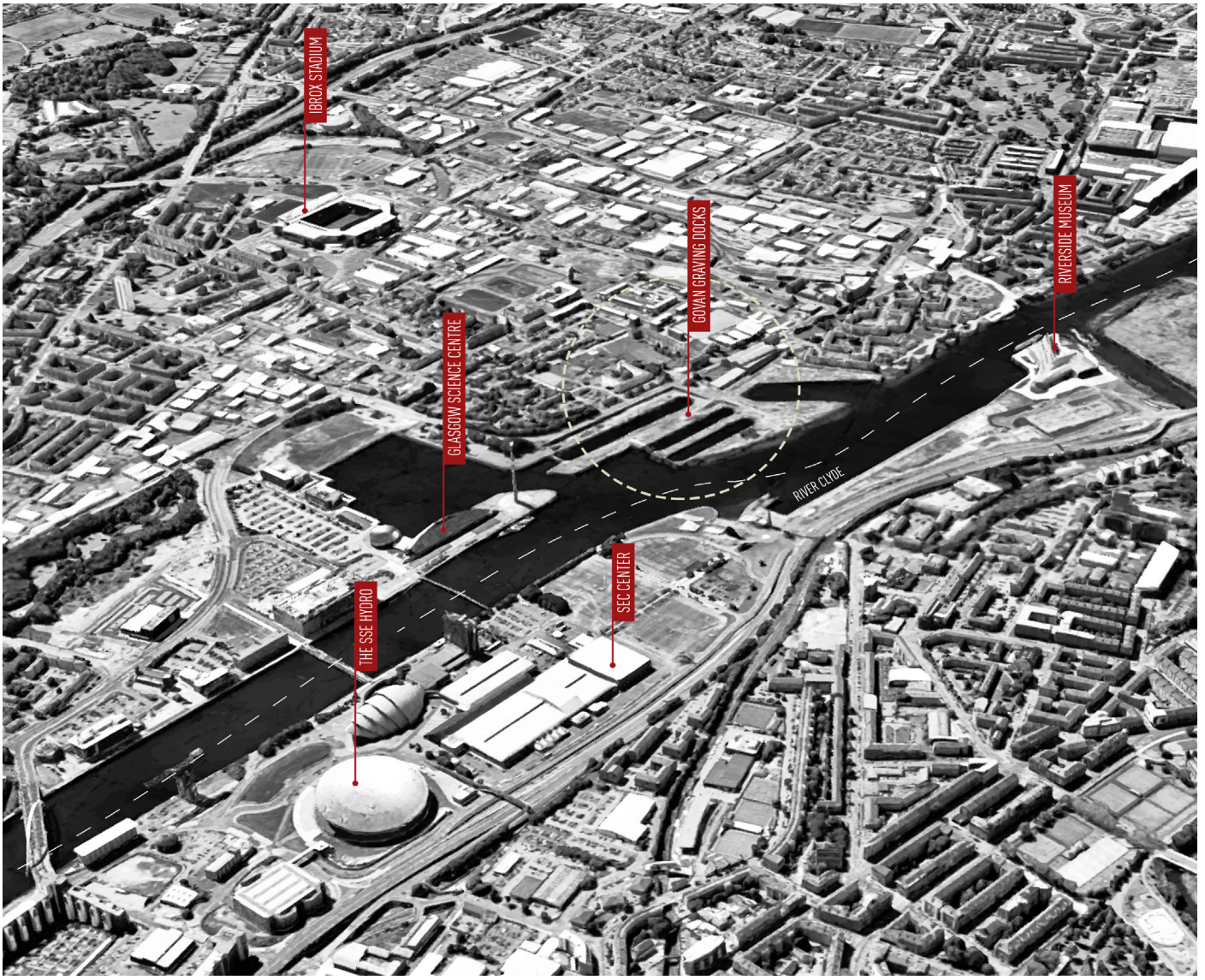


Figure 4.4 | Aerial photograph of Govan and Glasgow City.

PROJECT SITE: GOVAN GRAVING DOCKS

AN HISTORICAL PLACE FOR SHIPBUILDING

The history of the Govan Graving Docks began 175 years ago in 1838, thanks to the shipyards McArthur and Alexander, which opened a small wooden shipyard. Later, in the industrial revolution, the Scottish engineer Rober Napier buys the place to create a company of artillery. Thanks to advances in technology and the arrival of the steam engine, Napier shipyard, along with its colleague John Elder, developed the first iron ships in the world. In 1860, Elder decided to start his own business that is now known as Fairfield Shipyard. He was an important character for the city of Govan that today you can see a statue of him in Elder Park.

Between 1869 and 1898 they began to develop other docks. These include the three ports of Govan Graving Docks in which the larger ships were accommodated (for this reason each port is larger than the other). By 1900, the naval construction was the economic system of Great Britain what made the artillery the main subject for the construction of warships and steamers. At that time, the Clyde River was surrounded by naval construction areas which were the key point for the approach of the First World War.

The Glasgow waterfront was able to provide warships during the first and second world wars. However, when the second war ended, the number of orders was no longer the same and the bad management of the shipyards caused all the ports to close. For this reason, the shipbuilding industry moved to the eastern countries (Japan and South

Korea to be more specific). Thus, all the ports closed and since the 1980s they have tried to reactivate them but none has achieved it.

To conclude, it is important to mention that the shipbuilding industry in these ports covers the history of Govan, therefore it is important to keep the memory of the place even reactivating the area. The meaning affects not only Govan or Glasgow but the whole of Scotland. Glasgow came to produce a fifth of the world's ships, becoming part of the mountainous landscape of the city. The inhabitants and tourists must know the history of Govan through the architectural design that is present there.



Figure 4.5 | Govan No 3 cost £241,000 to build and was one of the largest dry docks in the country when it opened in 1897.

PROJECT SITE: GOVAN GRAVING DOCKS

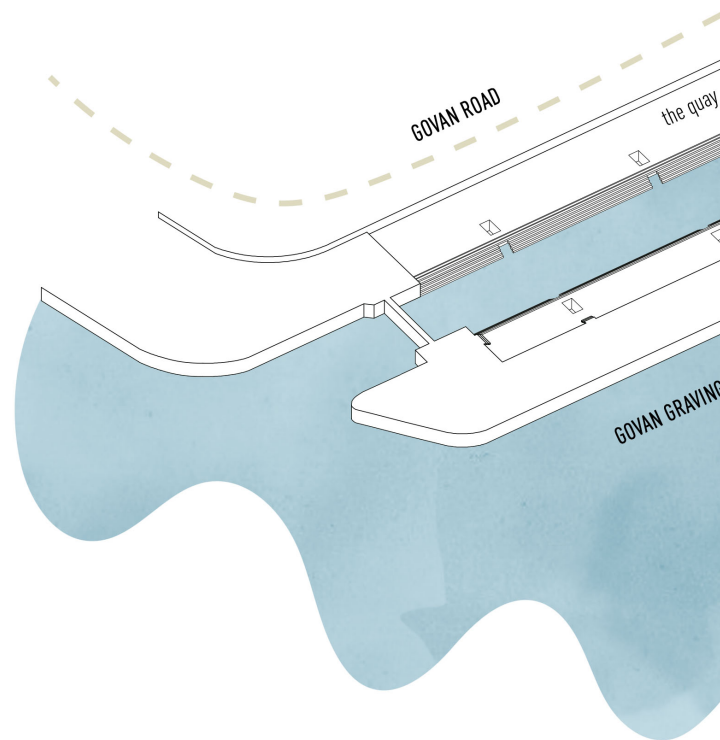
ANALYSIS OF THE AREA

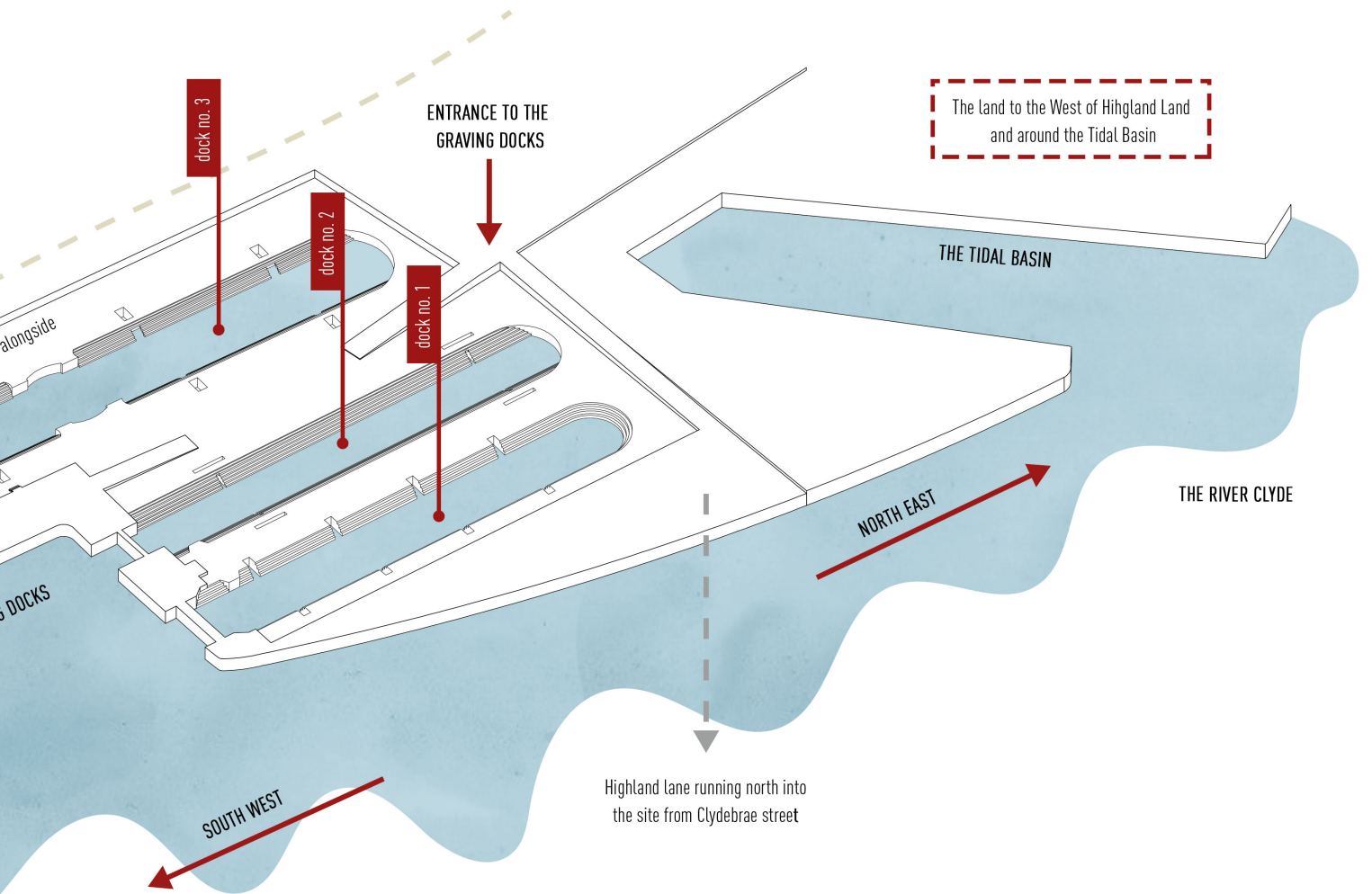
ABOUT THE DOCKS | The dock number 1 opened in 1875 and has a measure of approximately 167.64 meters long and 22 meters wide. The dock number 2 was opened in 1886 and has a measure of 175 meters long and 26 meters wide. Twelve years later, dock number 3 was opened and is 268 meters long and 26 meters wide. This dock was capable of receiving two ships and thanks to the depth, they could accommodate large ships during naval construction.

Currently, the Graving Docks have been shut for many years, creating a derelict area currently serving as a place for vandalism. This place has the potential for its restoration and that is why this thesis offers a residential and agricultural place for the inhabitants and tourists, creating a market space.

This area of the docks has a protruding piece of land that offers phenomenal views down the River Clyde and towards the city center. The docks actively bring water into the site, causing a similar link to the basin in providing a strong relation to the powers of water in this location.

Nonetheless, there are several opportunities to create links or bring the building next to the water of the Graving Docks on this site. A building located here will allow users to visit the farming and market complex.



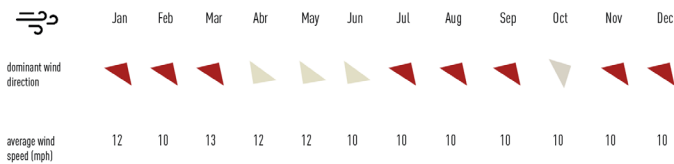


PROJECT SITE: GOVAN GRAVING DOCKS

ANALYSIS OF THE AREA

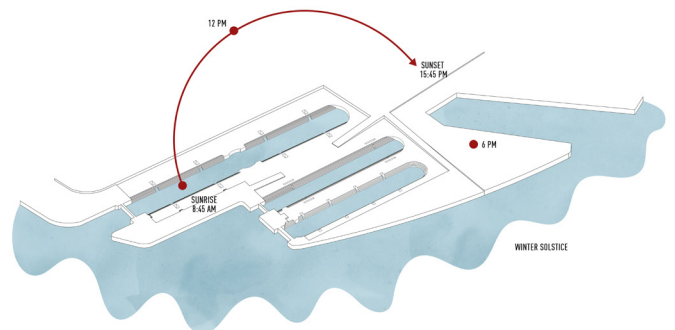
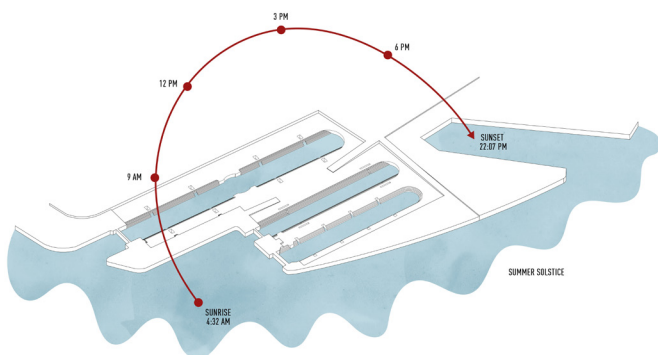
WIND | Due to the Graving Docks are exposed to the Clyde River side, knowledge of wind patterns is necessary before beginning a design proposal.

As can be seen in the table, the prevailing winds are those of the southwest. On the other hand, there is a great force of wind during the winter months, therefore the façades of the buildings, especially that of the vertical farming, have to be protected. Thanks to these analyses, the directions of the winds were taken into consideration for the design process of the residential building and vertical farming.



SUN | The route of the sun is necessary for the location of the buildings in the project. During the summer, the sun is located at 57 degrees, while in winter it has a 10-degree angle. Low light, during winter in particular, could be a problem for the growth of food in a traditional urban farming. It is for one of the reasons why it is decided to incorporate a vertical farming building since it needs artificial light for the growth of food.

The path of the sun throughout the day has a significant influence on the design. It will help in the orientation of the buildings and how protected they should be from the sun's in the façades.



KEY TEXTURE | To understand the place, it is necessary to study the different textures and elements that are around the Graving Docks. As you can see in the images, there is a set of elements, shapes and linear patterns that are evident in the docks. In addition, they are relics that still remain.

Wooden bridges are important as they act as points of links between the docks. The wooden texture portrays them almost as piers opening out into the water, a durable construction that has existed since the opening of the docks.

KEY ARTEFACTS | As mentioned above, this area served the naval construction for many years; that is why there are many relics and ancient objects around the place that have the potential to be used as tools or precedents in the process design. The most important materials are stone, wood and metal, which are currently in poor condition due to the state of the site. In addition, there are several elements that bring back memories of the activities that took place there and should not be destroyed, but appreciated in memory of the success that this area produced in Govan and Glasgow.

The stone steps of the docks and the wooden structures are fundamental to the shape of the site. The proposed buildings are on the edge of the basin, therefore the docks become a “courtyard” between the housing building and the vertical farming.

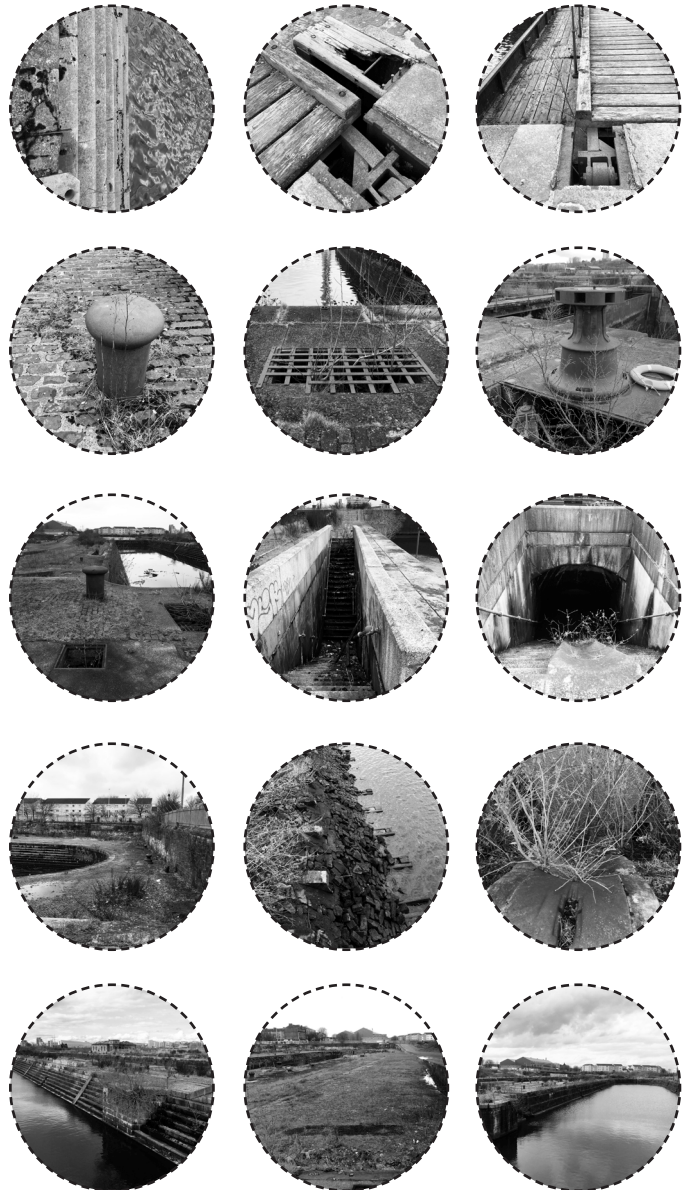




Figure 4.6 | Dock 3. Govan Graving Docks.





Figure 4.7 | Dock number 3 in the Govan Graving Docks.



Figure 4.8 | Dock number 3 in the Govan Graving Docks.

MASTERPLAN

PART FIVE

WATERFRONT OF GOVAN

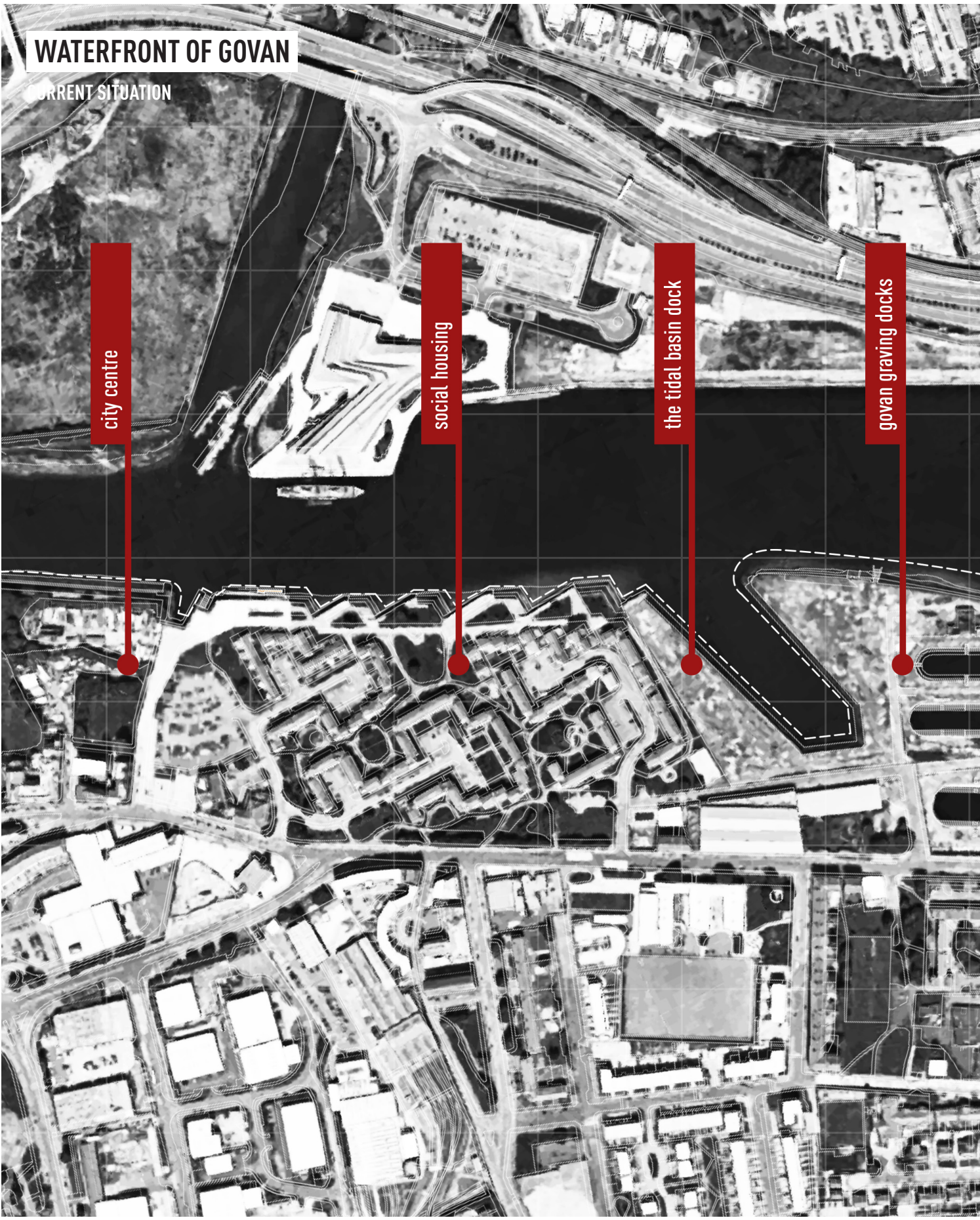
CURRENT SITUATION

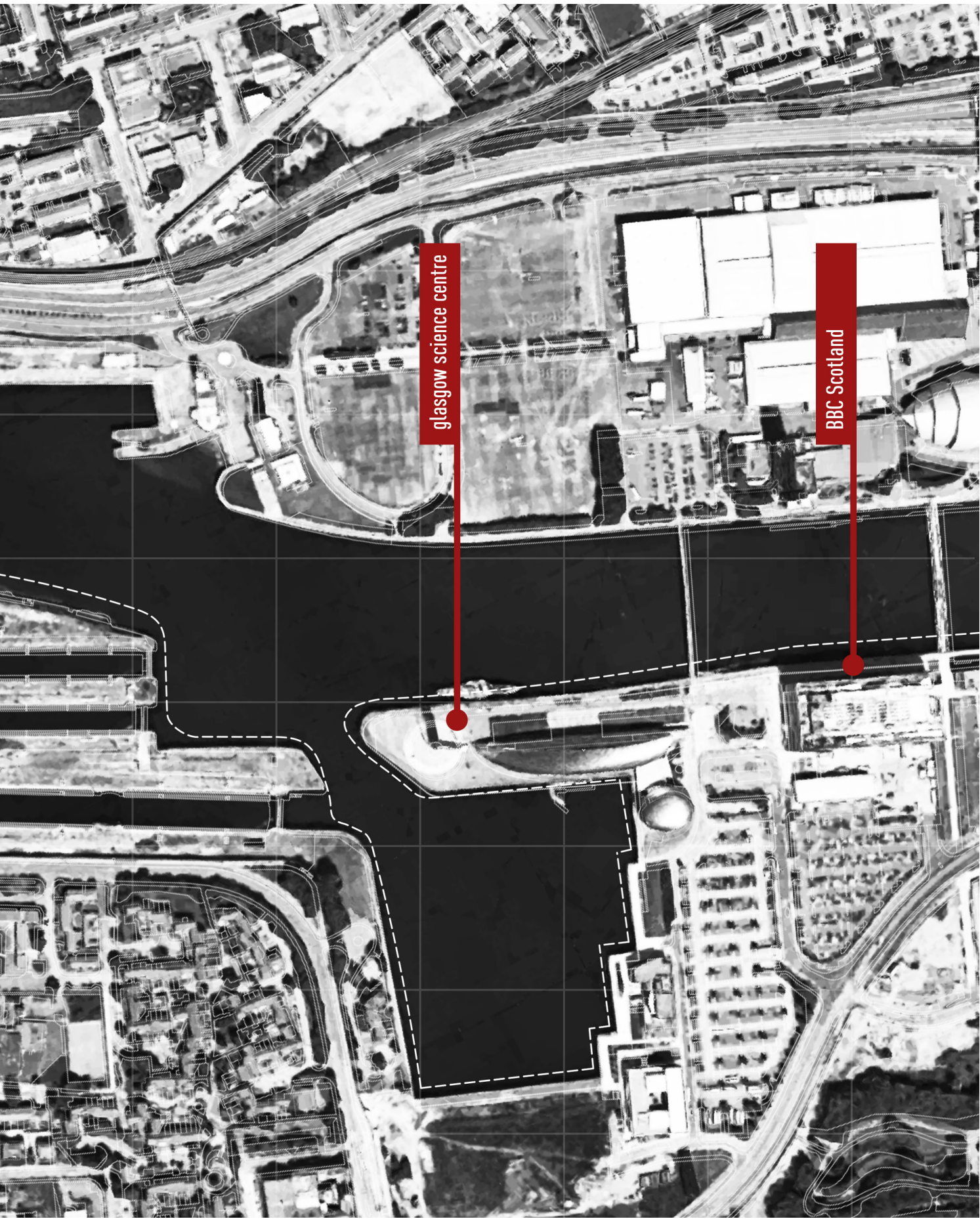
city centre

social housing

the tidal basin dock

govan graving docks





glasgow science centre

BBC Scotland

MASTERPLAN DEVELOPMENT

THE NEW CONTEXT

The city of Govan is one of the most significant, maritime industrial heritage assets in Glasgow, Scotland. It reflects in its fabric the industrial history of the River Clyde - from its apotheosis to its post-industrial nadir- and onward into derelict obscurity.

People in Govan lives with insecurity and drug problems and tourist are not interested in visiting this area despite its great history. As can be seen in the image on the top, the social housing that are in bad condition do not have a relationship with the river and the city. Both docks (The Tidal Basin and the Graving Docks) are abandoned and, in some areas, can not be accessed.

The new Masterplan proposes re-establish the area starting with the organization of spaces and new functions. Thanks to the project "Parc de la Villette" by the architect Bernard Tschumi, I was able to understand the complexity of the spaces and how to organize them. In that project, he used three independent geometric systems and superimposed on the surface of the park to design it. The first of them is the system of points, arranged in a grid of 100 meters on each side; the second is the line, composed of roads; and the third is the surface. As can be seen in the image below, the spaces of the city are organized in that way.

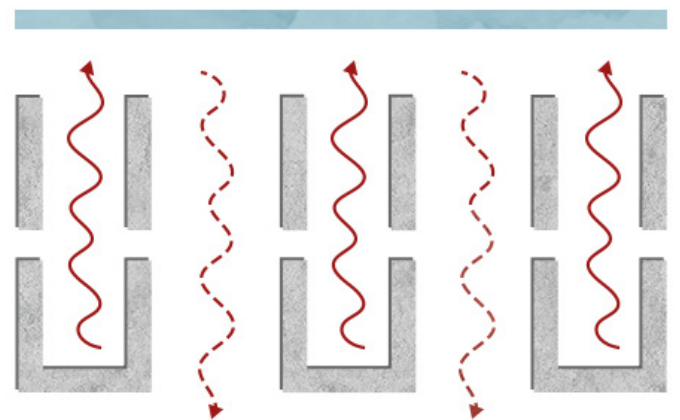


The idea of the project is to re-design housing spaces with new residential buildings and agriculture in their internal courtyards (the concept of allotments). With this, spaces for permanence, cultivation, markets, and galleries are created in the northern part of the city. Now, the new housing typologies have a relationship with the river and the city.

These new areas gave me the initial idea of the project. The concept of bring nature into the city through new technologies of agriculture producing food and vegetation for local people and tourist.

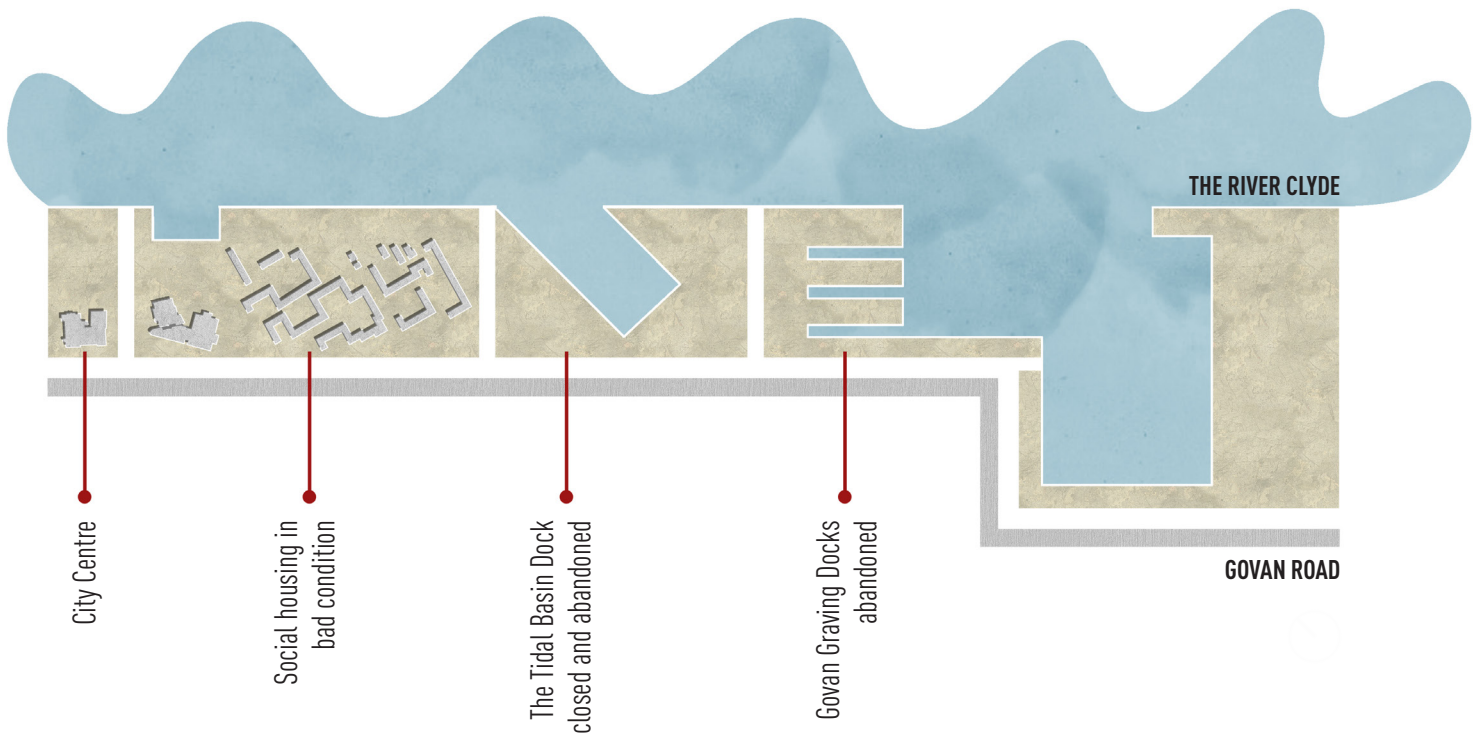
It is going to be a community where residents will be able to produce their own food and sell them in the markets and galleries near their homes. In addition, the important thing about the re-qualification of Govan is to keep the memory of the place. In the next chapter, the new project on the Graving Docks will be explained in detail.

water | the river clyde

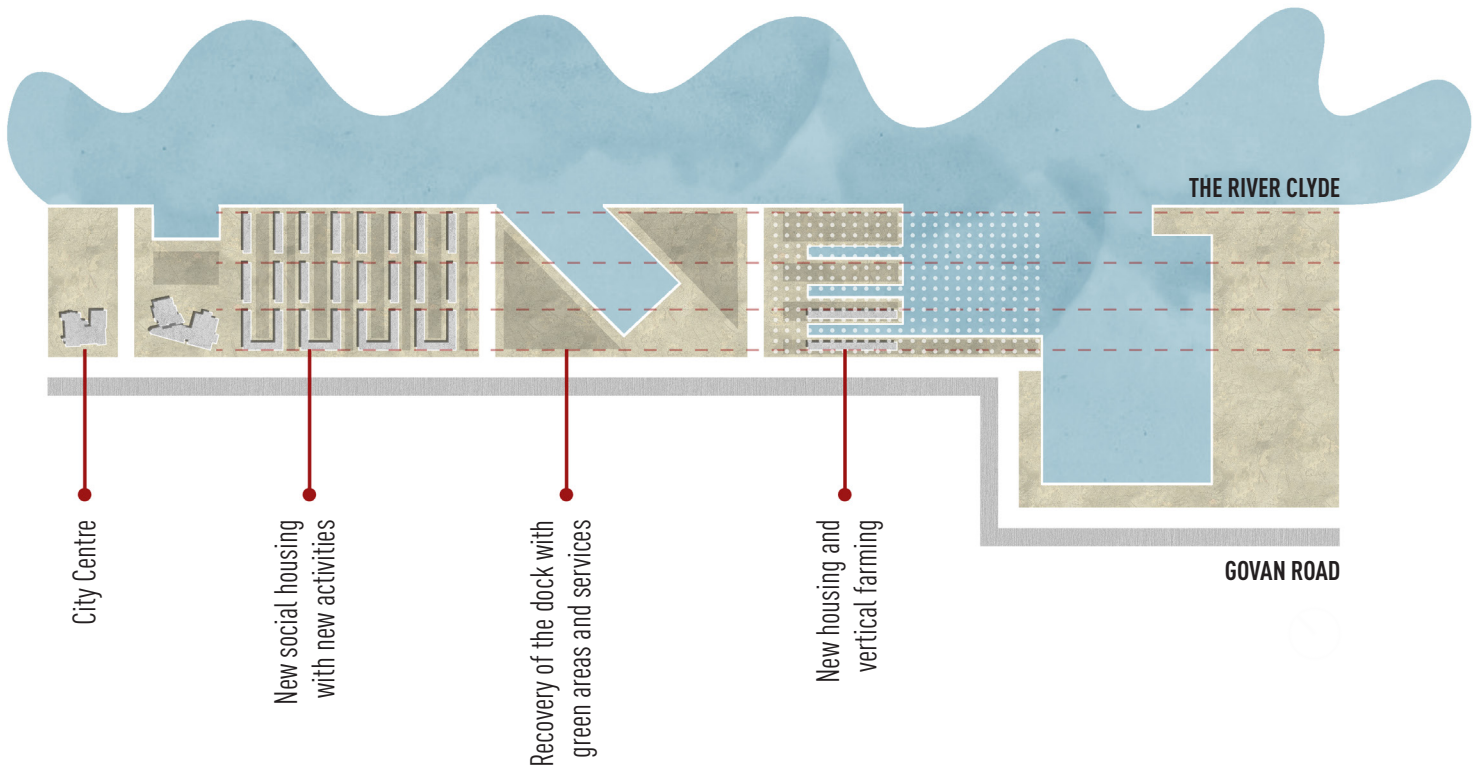


city | govan road

CURRENT SITUATION



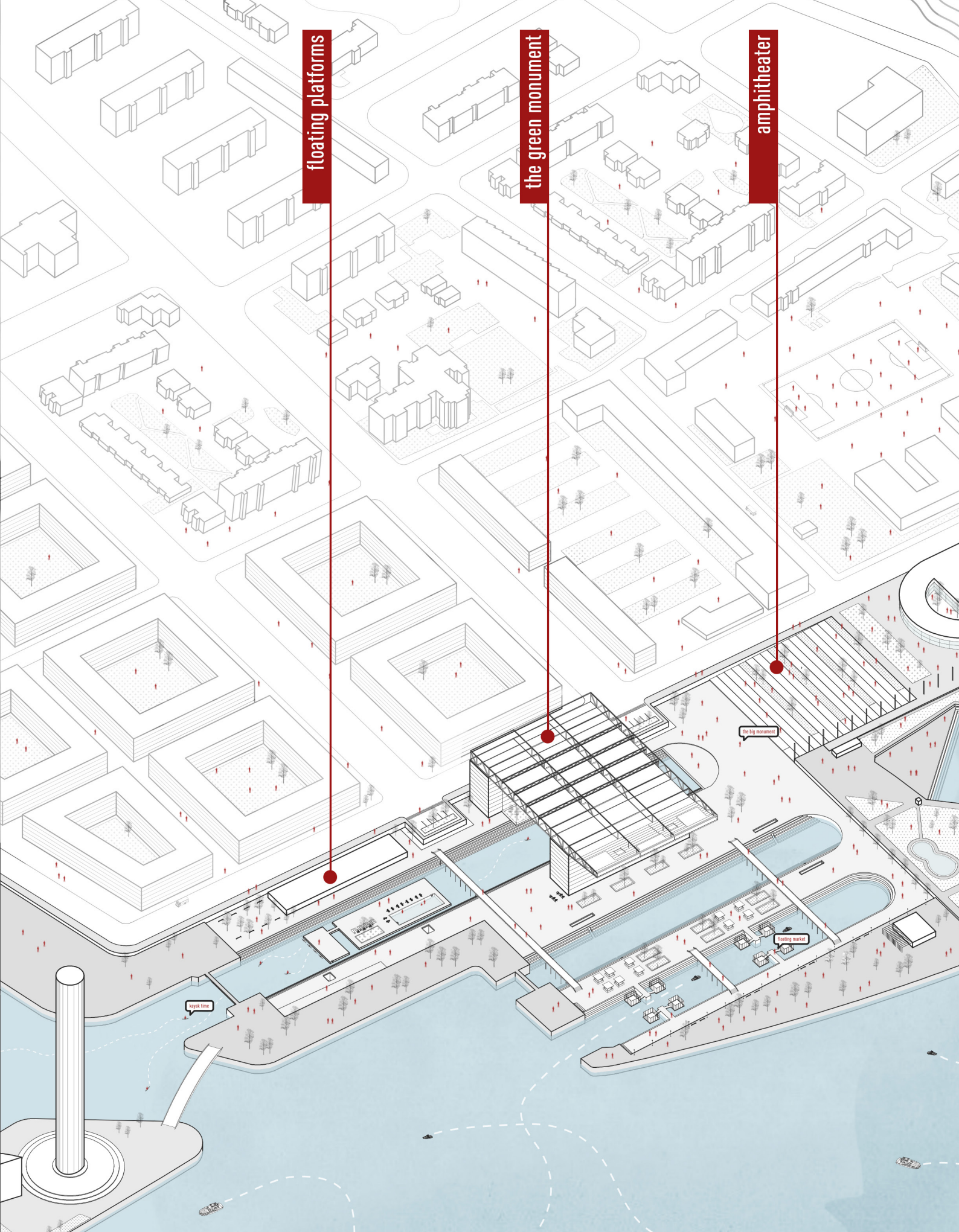
PROPOSAL

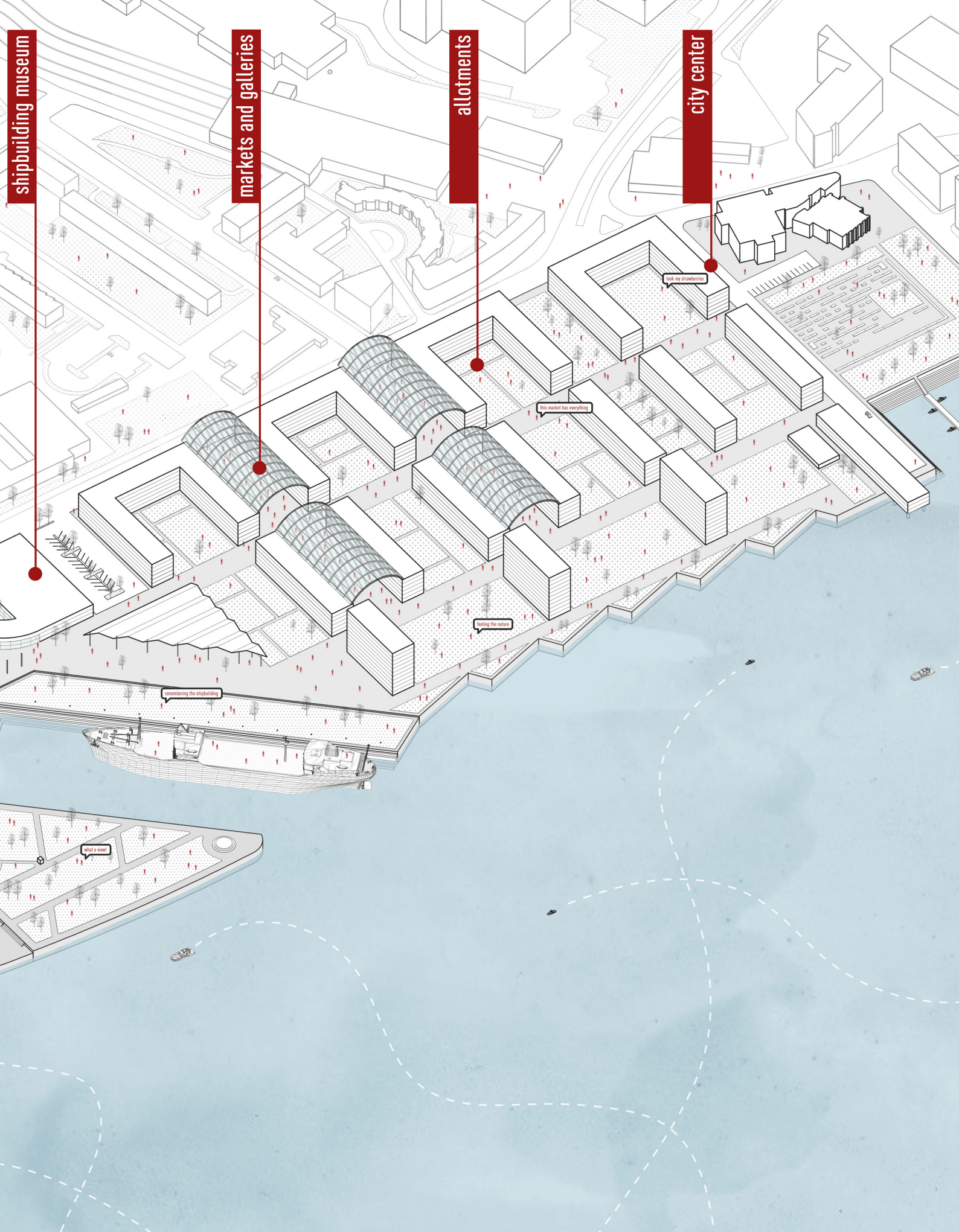


floating platforms

the green monument

amphitheater





shipbuilding museum

markets and galleries

allotments

city center

remembering the shipbuilding

what a view!

this market has everything

helping the nature

back my street

DESIGN PROPOSAL

PART SIX

DESIGN DEVELOPMENT

PROPOSAL OBJECTIVES

The abandoned docks of Govan allow us to rethink and introduce a revaluation of the public space at the Waterfront in Glasgow. Ideal place to walk along the river Clyde, with wide trails, various activities and places to rest, where the current project seeks to form a link with the context of the city.

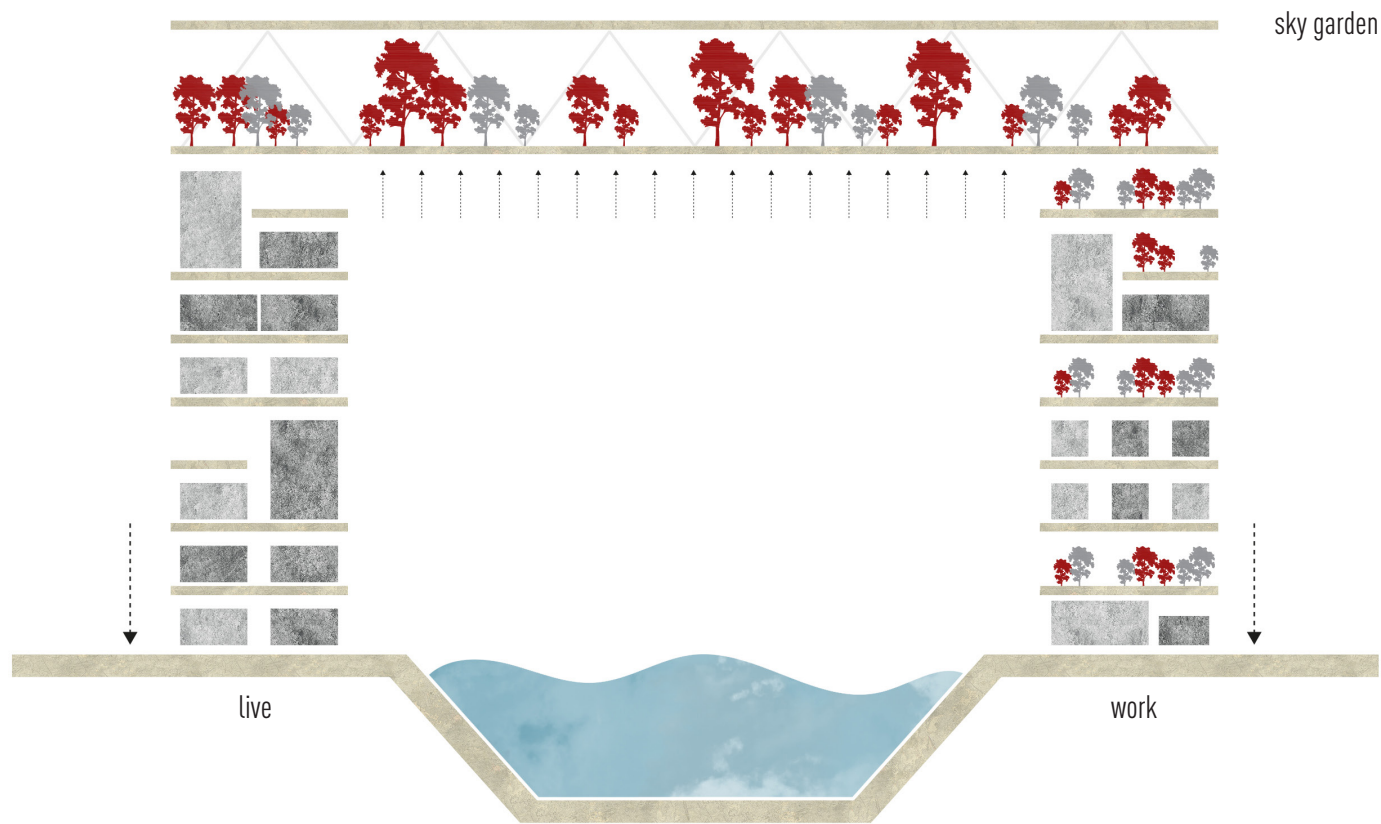
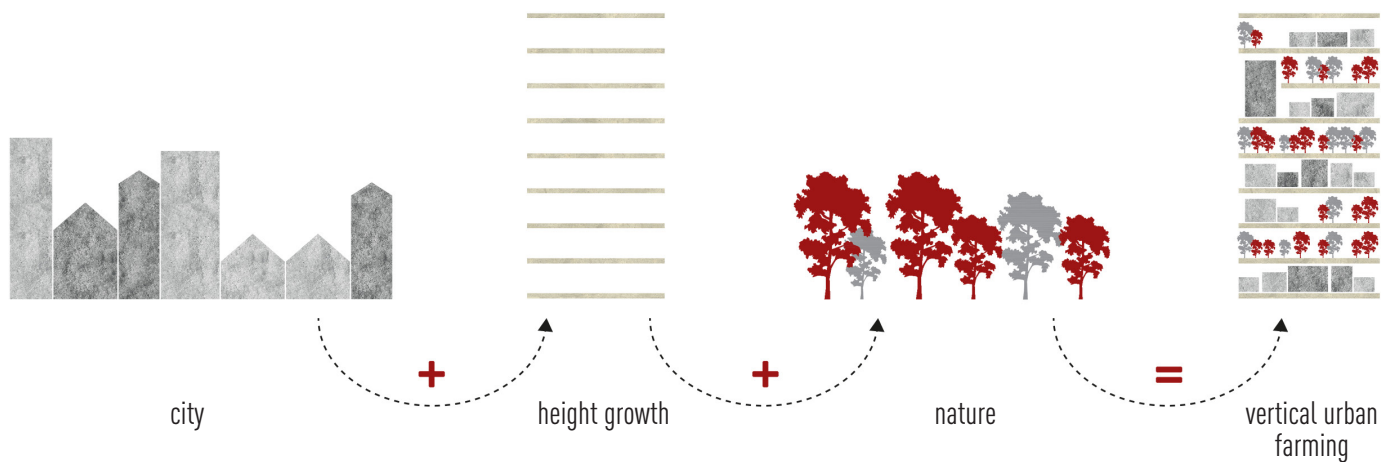
The objective of this project consists of a large monument as a center of interpretation of the landscape and vertical urban agriculture to be implanted in an intermediate point of the ports. The framework in which the project is generated is described as a search for the link between the city and the river through nature and agriculture.

As you can be seen in the image, the three basic concepts of this design are **the city, the growth in height and the nature** to be introduced in an one architectural project. In addition, understand the context of the place through physical elements and recognize space as the heart of the industrial revolution in which naval construction was practiced in the past.

The final result will be the design of a residential building on the left side (the concept in section) for the inhabitants and farmers of the area and another as a vertical farming for the production of food and plants. Both buildings connected with a green roof that not only works as a connector between them but also as an elevated public space for the development of other activities. The great monument will be a

cycle of life, work and leisure for residents, farmers and tourists where the concept of community will also be integrated.

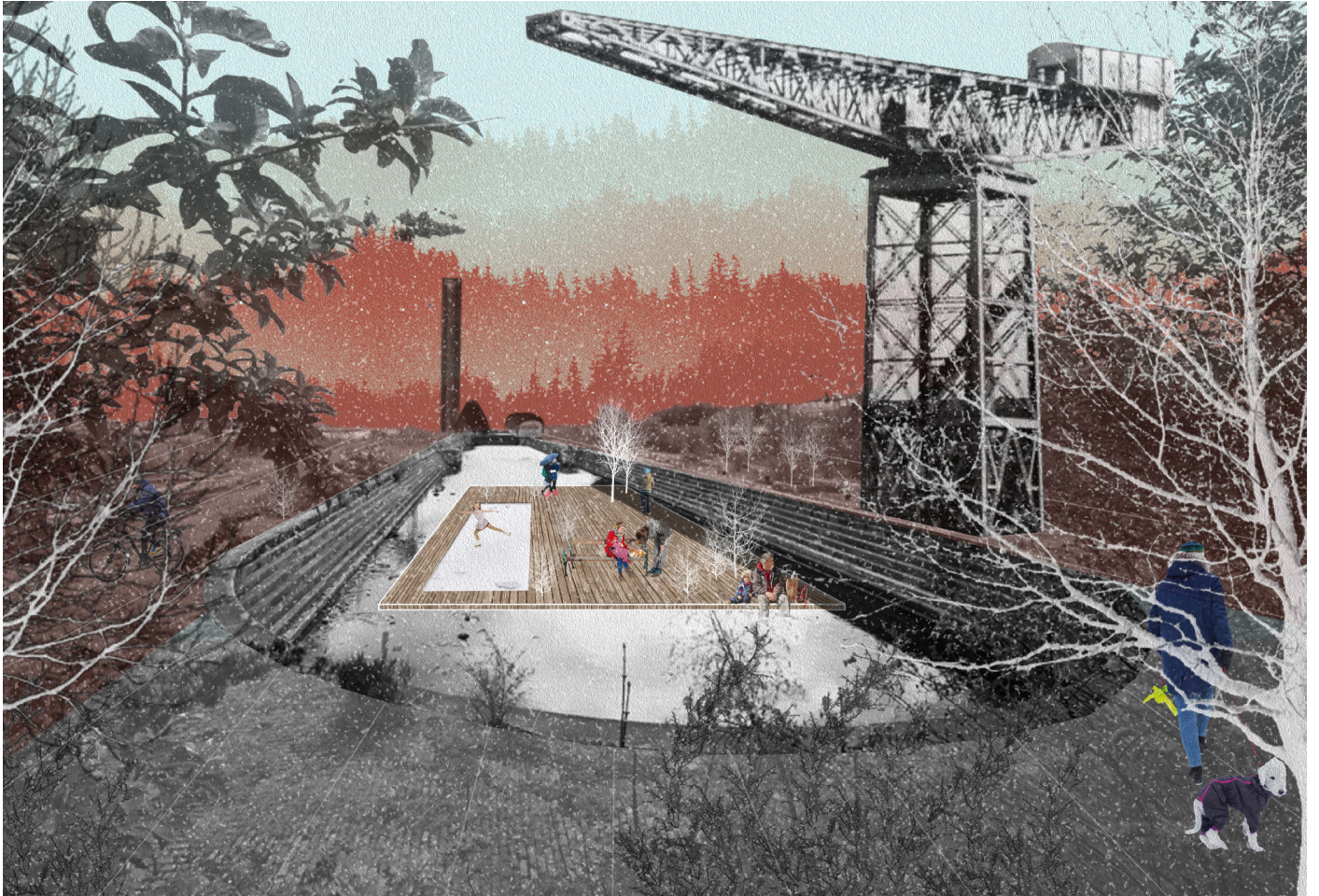
As for the conceptual visualizations on the next page, they show the definition of the new life in the Govan Graving Docks where the idea of nature is integrated to the place. Depending on the season of the year, the docks can have different uses and activities. Moreover, the interpretation of the big industrial sheds that were once there using elements such as crane towers and cantilever for their memory.



section concept



summer



winter

DESIGN DEVELOPMENT

SITE STRATEGIES - ORIENTATION AND ACCESS

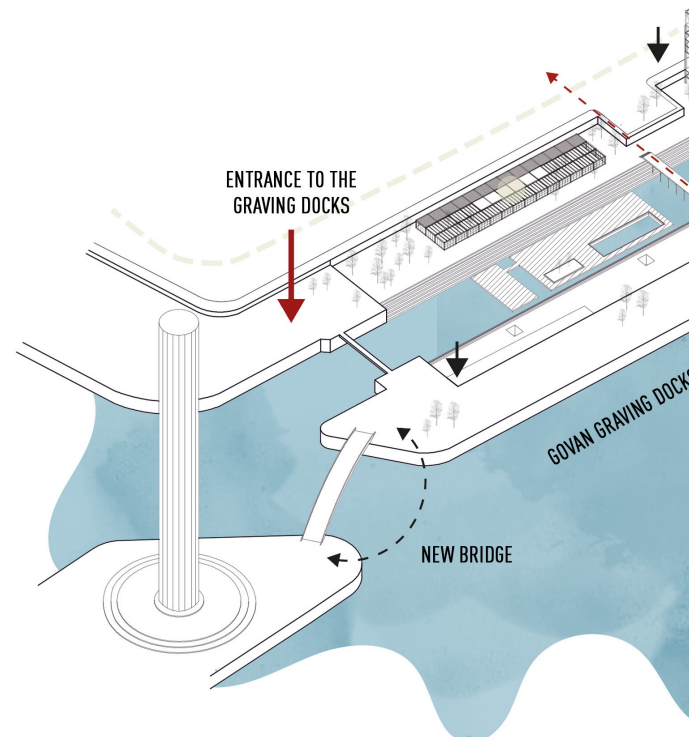
As can be seen in the image, the “great monument” is formed by a residential building, which makes a boundary between the main avenue of Govan and the docks, and a building of vertical farming. Both buildings are supported by a green roof in which various outdoor activities will take place, such as markets, coffee shops, schools for cultivation, etc.

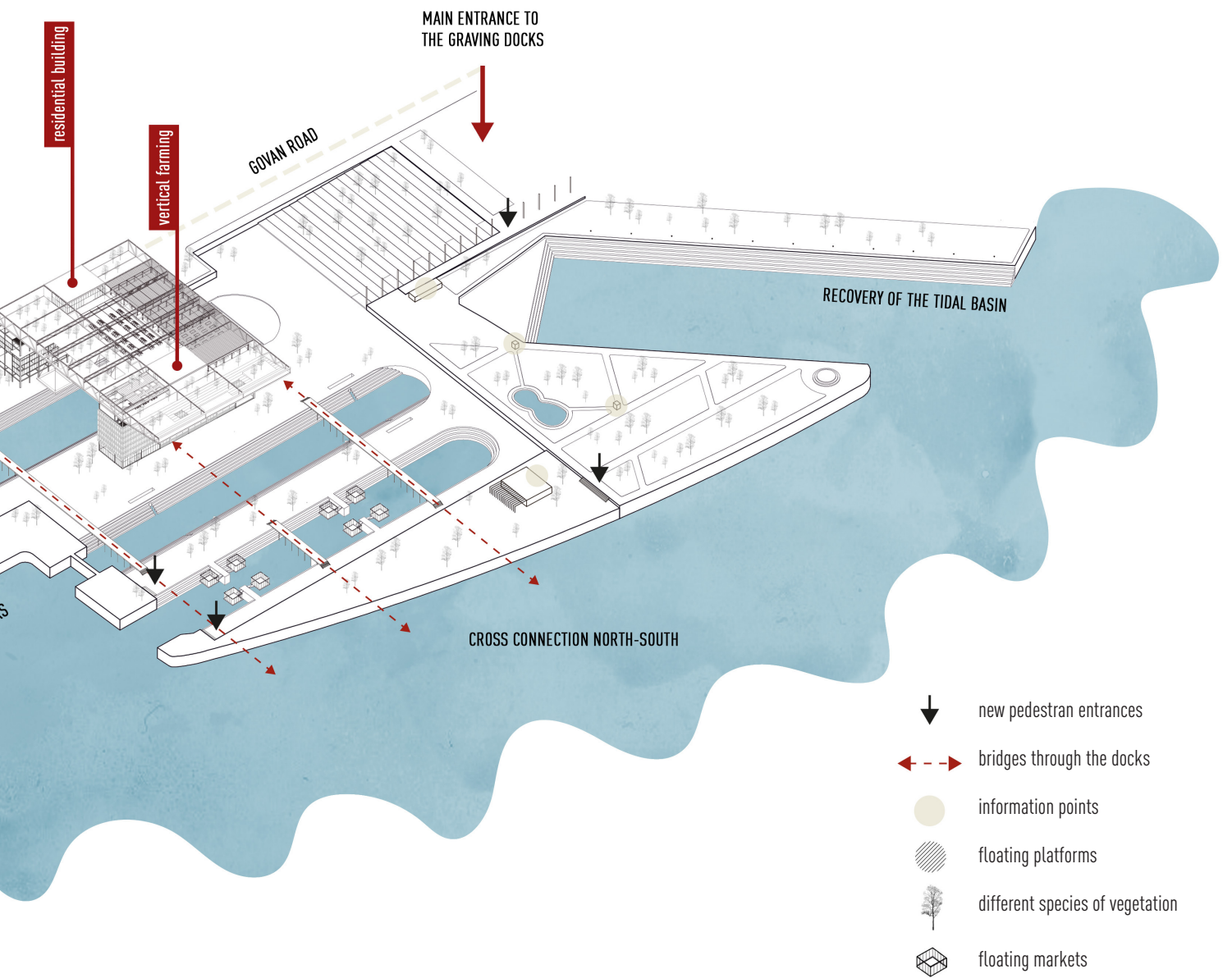
To relate the buildings with the context, the circulation and contemplation of the landscape is promoted through bridges and stairs that connect the three docks in a longitudinal and transversal way. Thus, the flow of people is much more controlled and more directed towards the main activities of the place.

The main access of the Graving Docks will be through green bleachers in which people can see the hanging gardens supported by the green roof and have a better view of the ports. In addition, the design of a bridge that will connect the city of Glasgow, specifically the Glasgow Science Centre, with the docks, inviting tourists and residents to be part of a new route aimed at the experience of life and agriculture.

However, it is also important to relate people to water. In this area, there is a huge potential to create new public spaces on water. On one hand, floating platforms have been created to sunbathe on the water and encourage people to swim in the canal again. The Club of swimming and kayak is a temporary and alternative appropriation in this project in which people could be able to enjoy the water of the

Clyde River; on the other hand, floating markets are designed to be able to transport and sell the fruits and vegetables produced in the area through fluvial roads. Consequently, sellers and buyers can move the products between the city of Glasgow and Govan through the river.

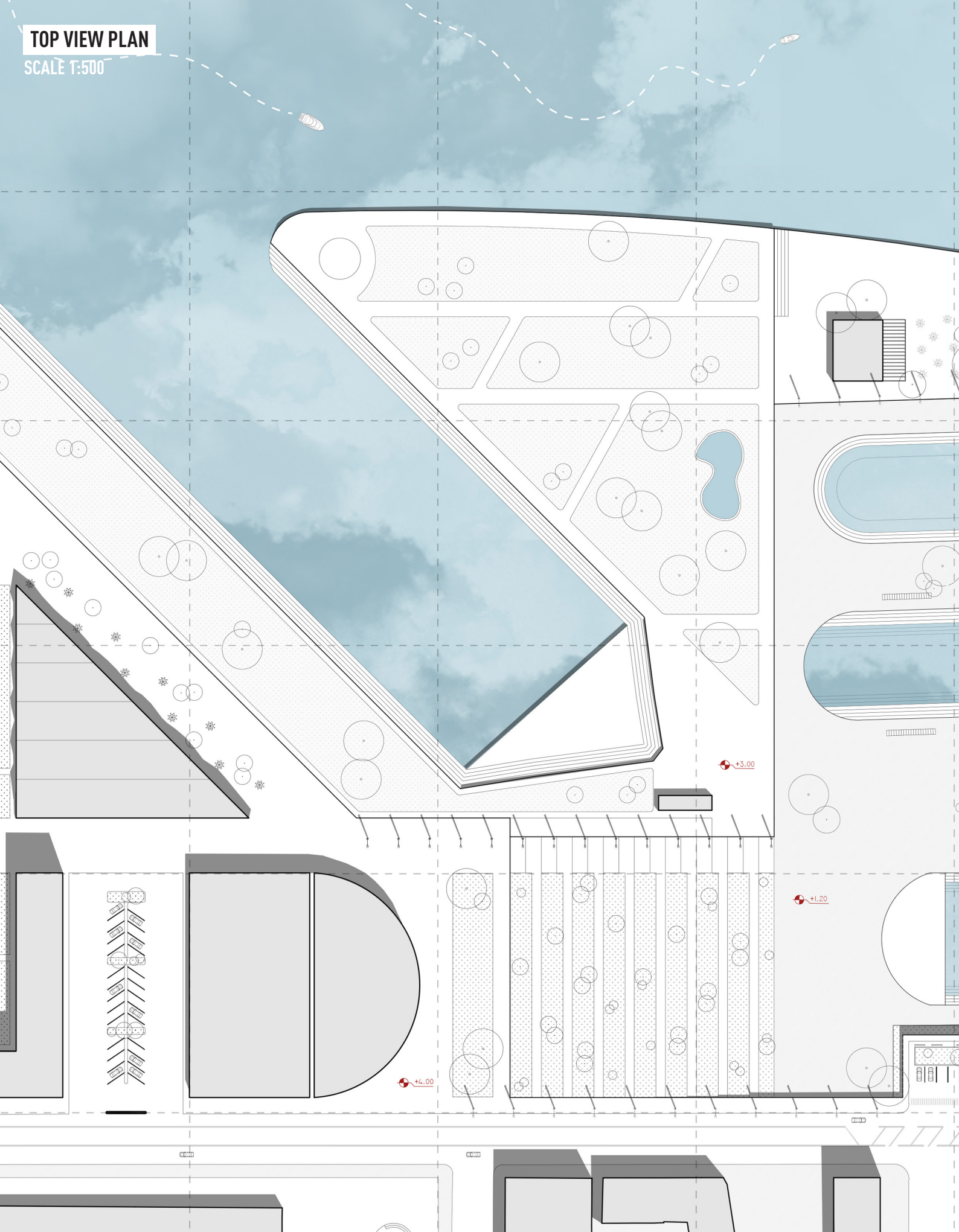


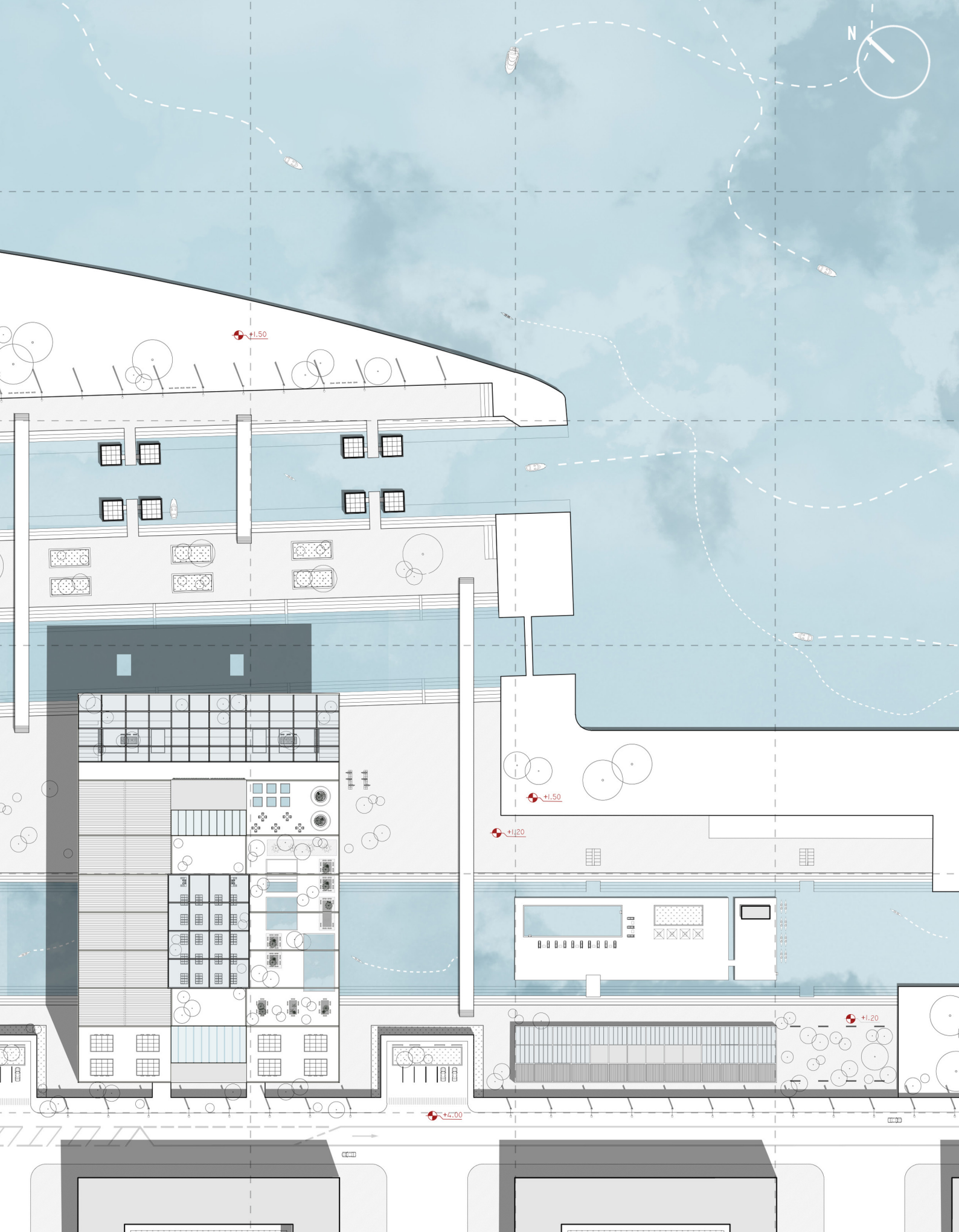


- ↓ new pedestrian entrances
- ↔ bridges through the docks
- information points
- ▨ floating platforms
- 🌳 different species of vegetation
- 📦 floating markets

TOP VIEW PLAN

SCALE 1:500



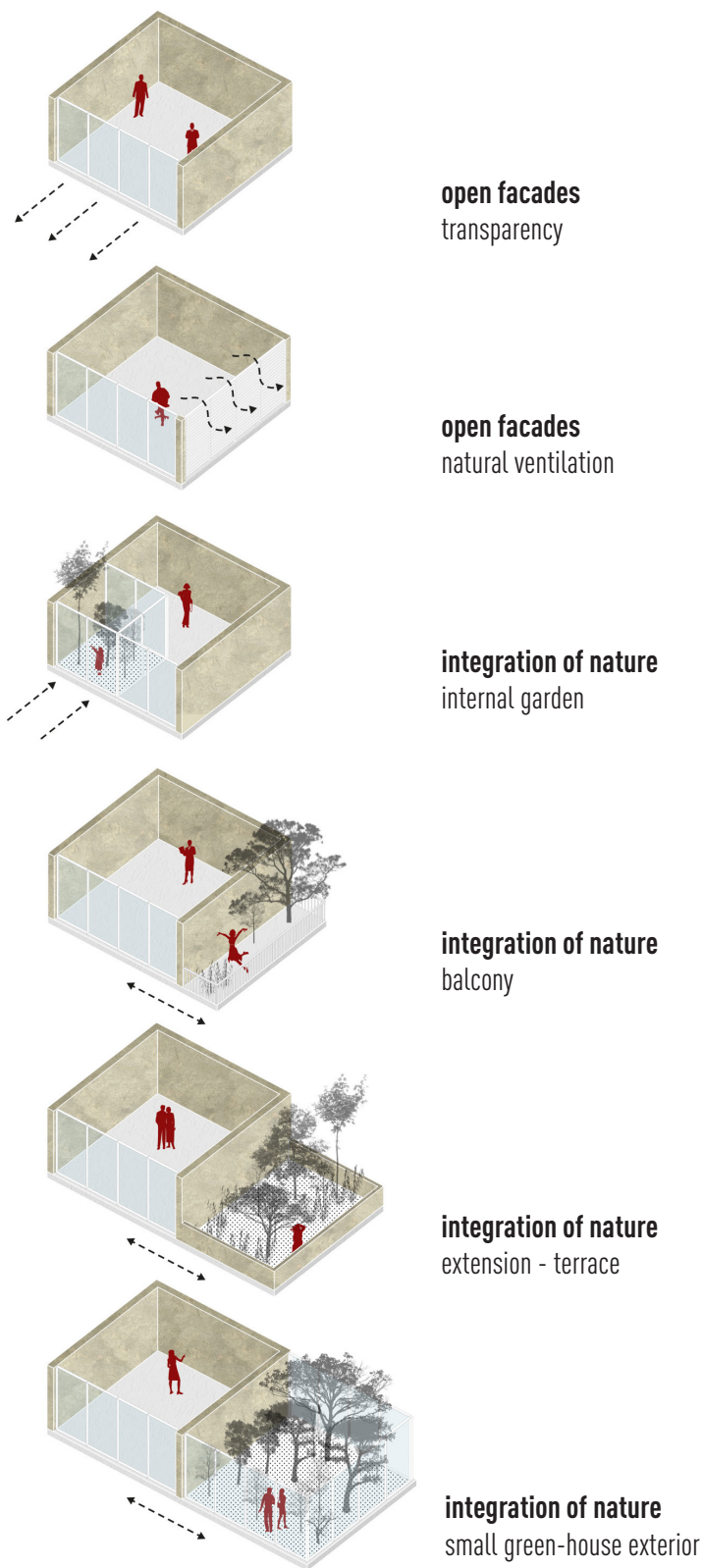


The residential building is contextually inspired by the beauty of its immediate surroundings and its objective is to respect the nature that is going to converge in the place. Bordering the main avenue of Govan and the city, the tower is characterized by its unique shape, clearly articulated with plans and carved surfaces that respond to the distribution of the apartments, the orientation of the views and the privacy of each unit.

As can be seen in the architectural plants, the fixed point of the vertical circulations occupy the perimeter of the building. The arrangement of the apartments generates different scenarios: views to the north and south of the city, the Clyde River, the distant mountains, etc. In height, it composes a full and empty game with interior spaces and diverse types of apartments that privilege the individuality over the repetition.

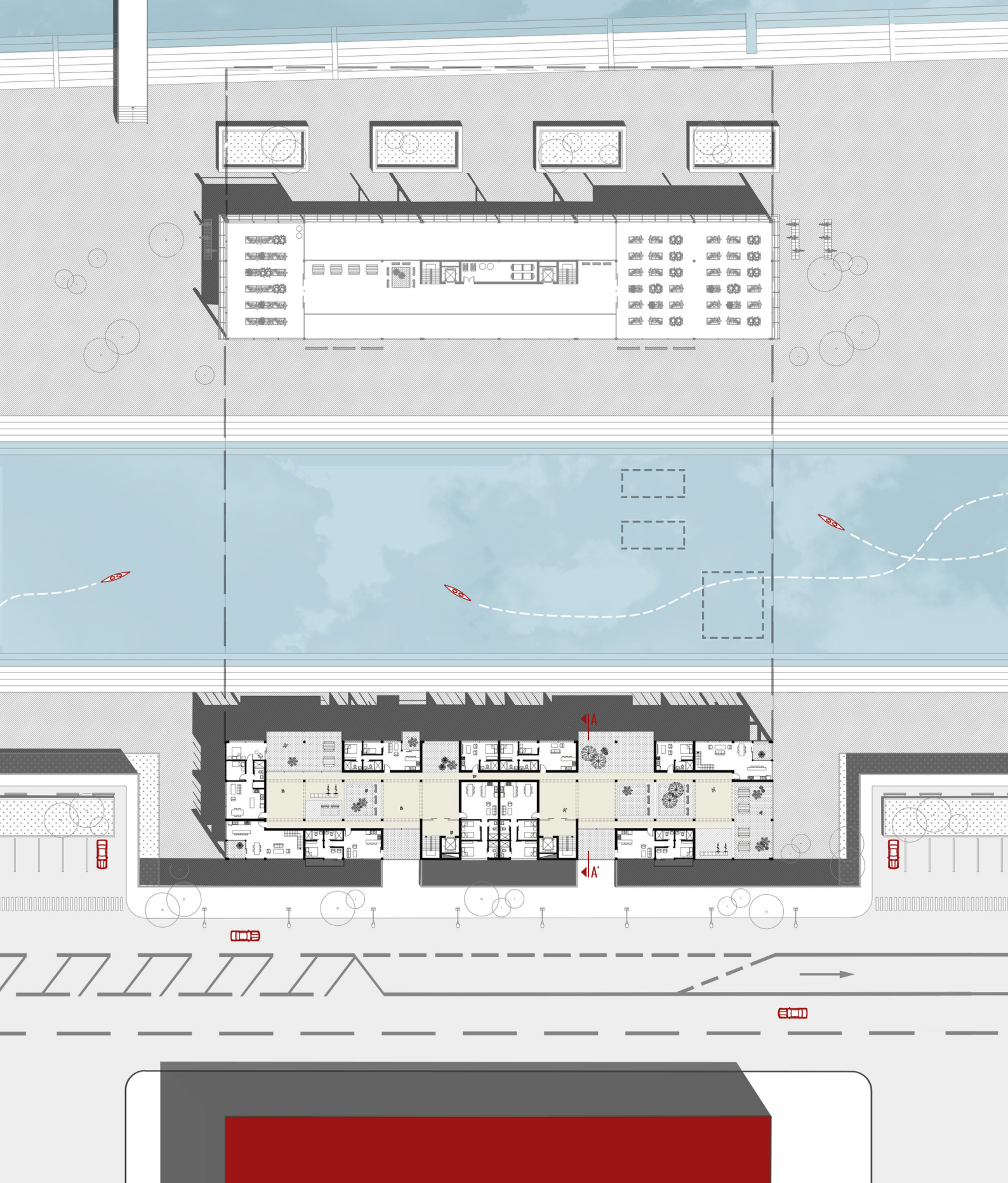
The commercial areas are located on the first and second floors. The other floors are composed of units of different apartments that allow openings and free spaces for the common use of residents. The size of the apartments reflects the need of each user. The "close" known as the corridor of the buildings become a much more dynamic area, as the distribution of the apartments and open spaces create recreational and green areas where the inhabitants will be able to make picnics, play table games, read a book, or simply observe the hanging gardens supported by the roof structure.

As for the apartments, each of them integrates in some way the concept of nature. The diagram shows how the base apartment starts to be adaptable and flexible depending on the programm that the users want to give it. Some apartments have terraces, other balconies, internal green spaces, small green-houses, etc. The idea is to integrate the elements of nature within the building, both in private and in common areas.

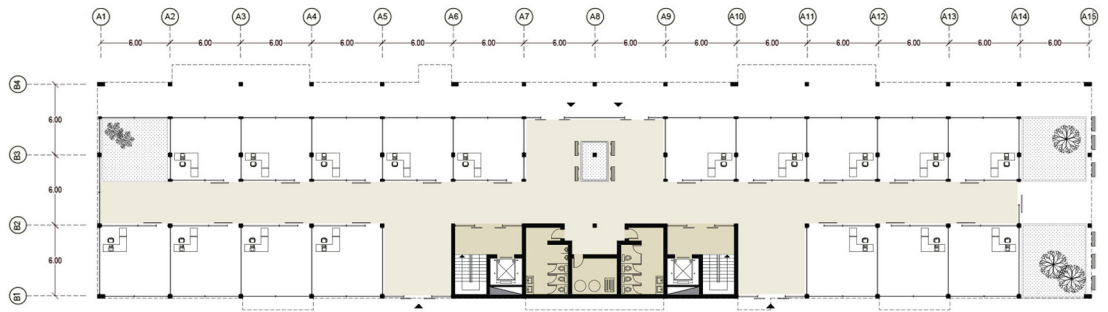


FLOOR PLAN LEVEL 2 +7.90

SCALE 1:750



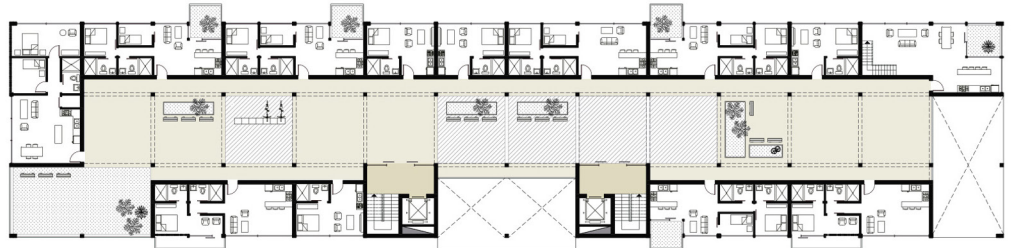
**GROUND FLOOR AND
LEVEL 1 + 0.00**



LEVEL 3 +11.35



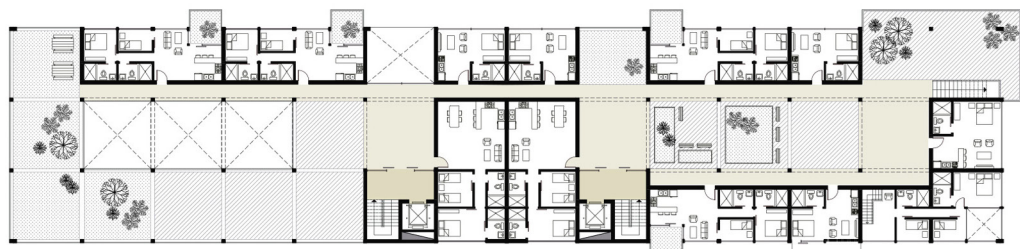
LEVEL 4 +14.80



LEVEL 5 +18.25

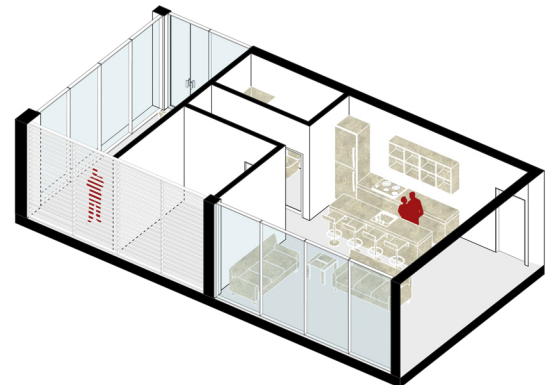
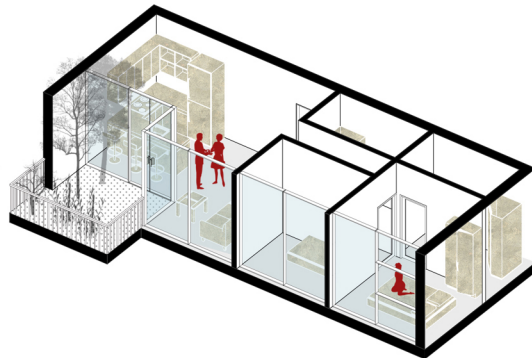
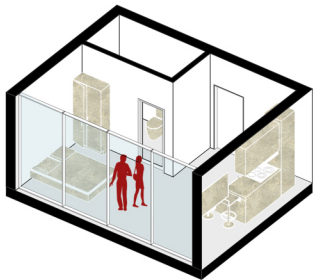
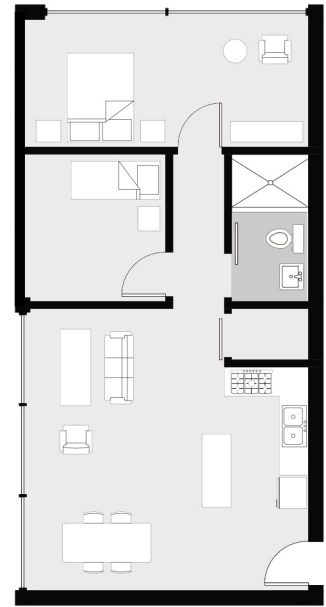
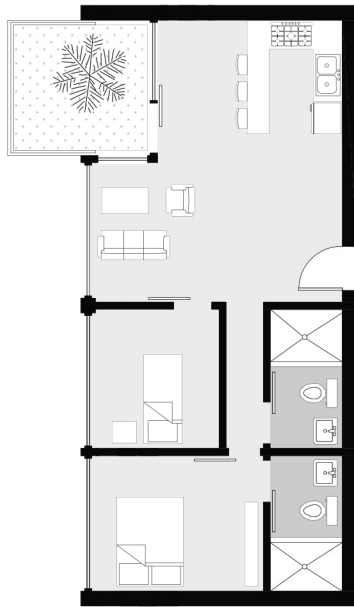
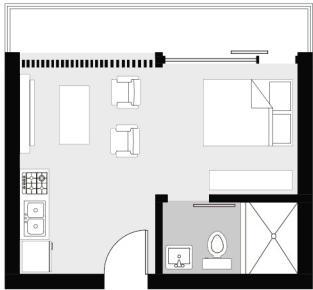
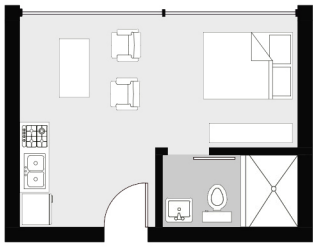


LEVEL 6 +21.70



LEVEL 7 +25.15





APARTMENT 1

32 m²



one bed | one bathroom
total units: 18 apartments

APARTMENT 2

54 m² + 8 m² balcony



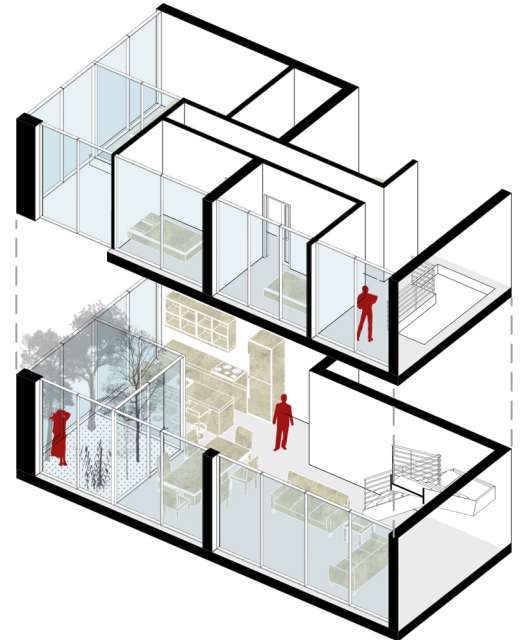
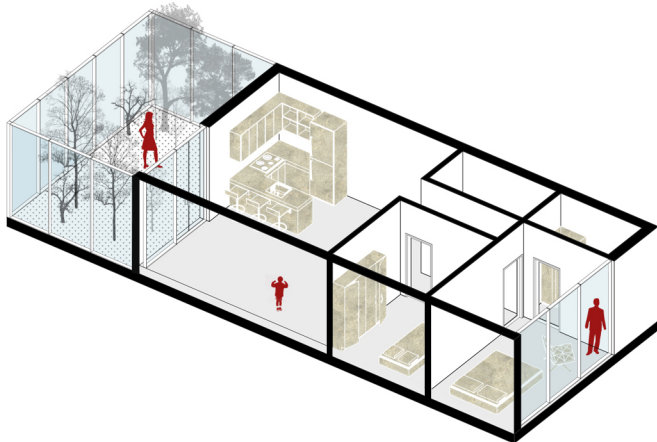
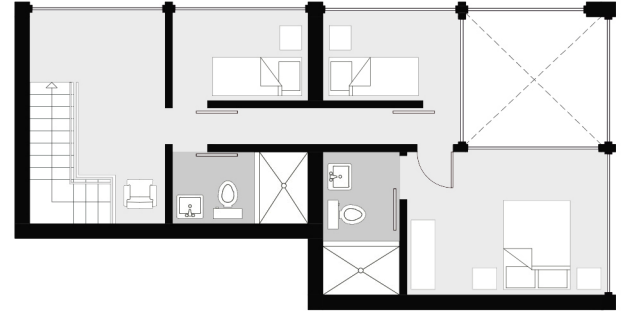
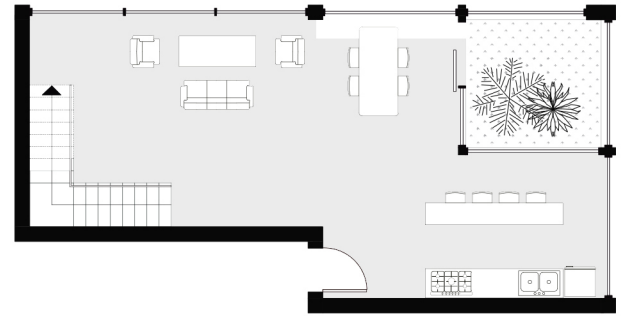
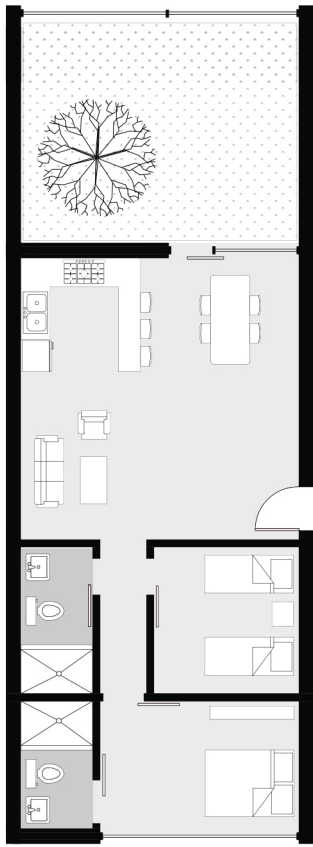
two beds | two bathrooms
total units: 28 apartments

APARTMENT 3

72 m²



two beds | one bathroom
total units: 4 apartments



APARTMENT 4

72 m² + 30 m² internal garden



three beds | two bathrooms
total units: 8 apartments

APARTMENT 5

100 m² + 8 m² internal garden



three beds | two bathrooms
total units: 4 apartments

level 8
+28.60

level 7
+25.15

level 6
+21.70

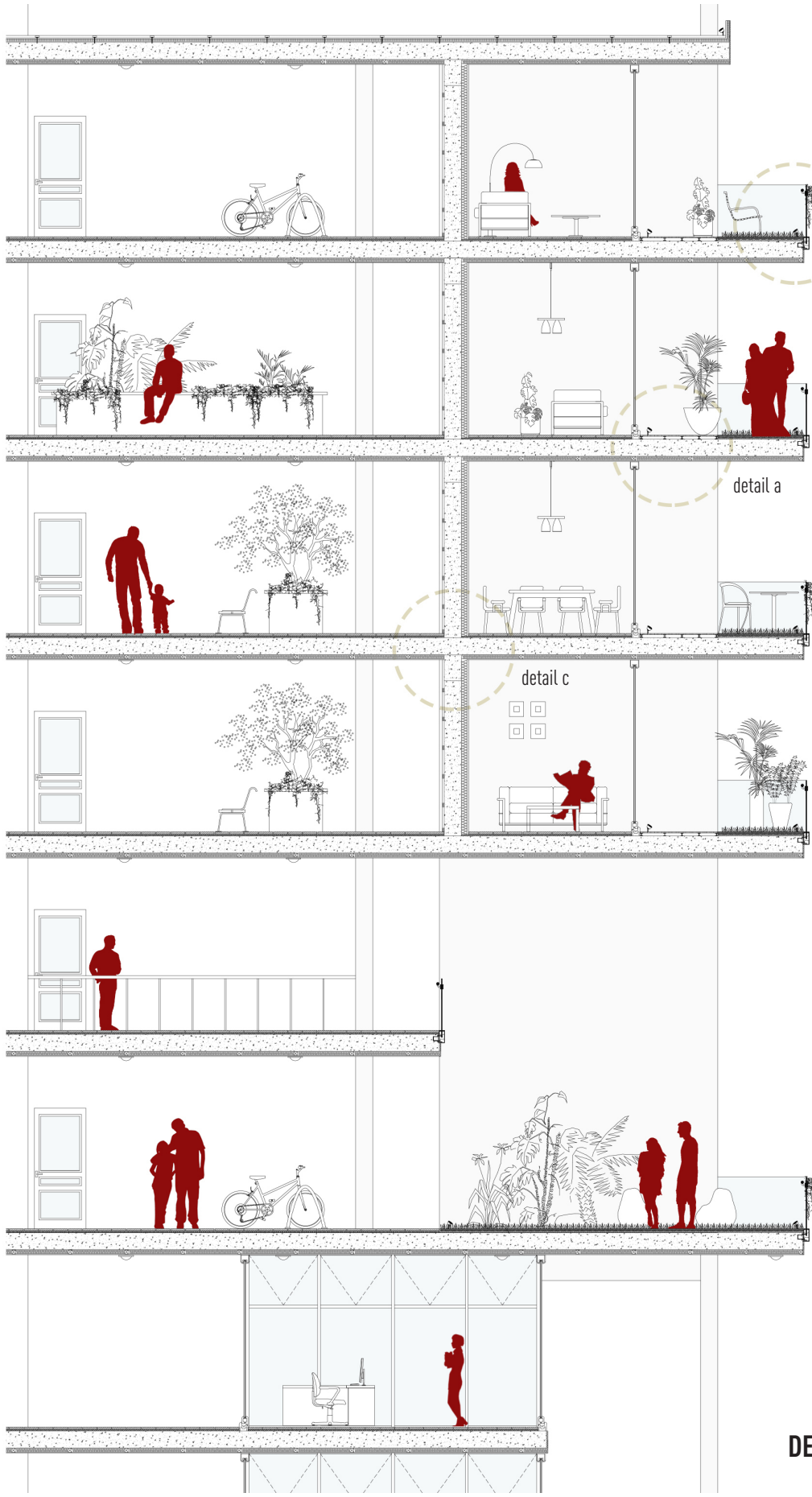
level 5
+18.25

level 4
+14.80

level 3
+11.35

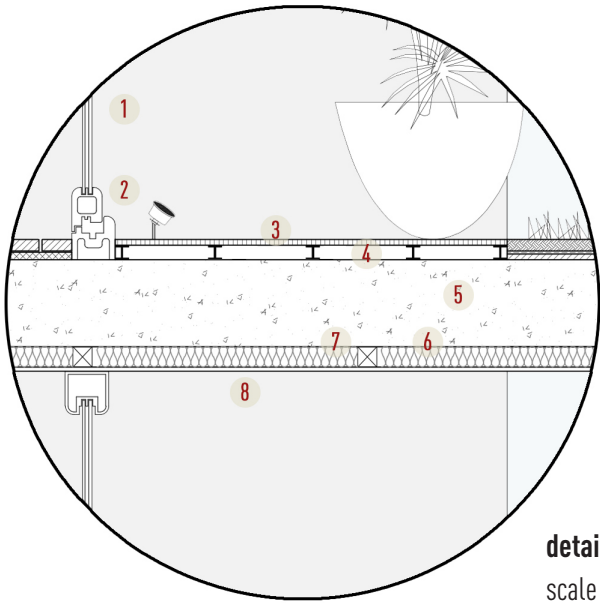
level 2
+7.90

level 1
+4.45

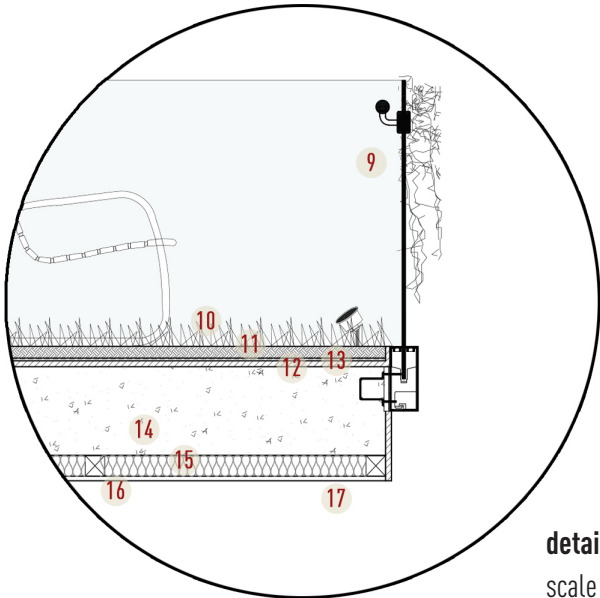


DETAIL SECTION A-A'
SCALE 1:100

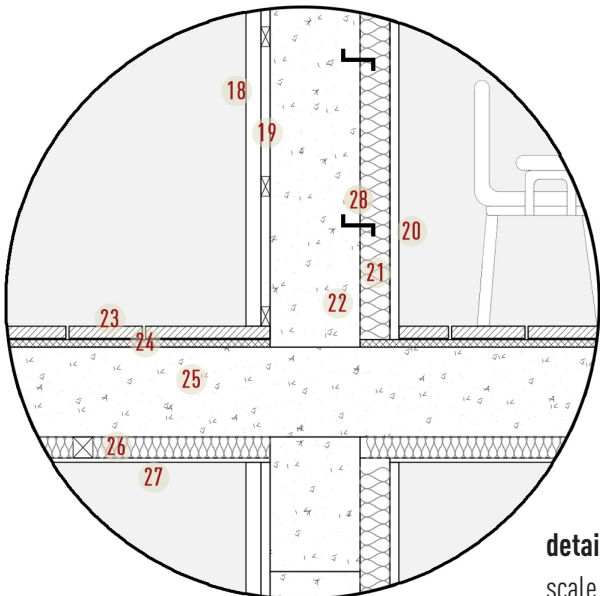
DESCRIPTION



detail a
scale 1:25



detail b
scale 1:25



detail c
scale 1:25

- 1. 120 mm thick tempered glass
- 2. Glass support (steel)
- 3. 10 mm ceramic tile or concrete
- 4. 40 mm plaster structure
- 5. 300 mm concrete slab
- 6. 50 thermal insulation
- 7. Timber structure - air slab
- 8. 10 mm plaster board
- 9. 15 mm structure tempered glass (railing)
- 10. Plantings
- 11. 20 mm soil
- 12. 10 mm moisture-retention layer
- 13. 5 mm filter fabric and reservoir layer
- 14. 300 mm concrete slab
- 15. 50 thermal insulation
- 16. Timber structure - air slab
- 17. 10 mm plaster board
- 18. 15 mm damp proof membrane
- 19. 30 mm DPM
- 20. 10 mm plaster board
- 21. 100 mm thermal insulation
- 22. 300 mm concrete
- 23. 20 mm timber floor finish
- 24. 30 mm screed
- 25. 300 mm concrete slab
- 26. 50 thermal insulation
- 27. Plaster board
- 28. Rain Screen



VERTICAL FARMING

The regeneration of Govan docks deserves more than just housing. For this reason, a vertical farming building is proposed in which the theme of agriculture and nature will become much more evident.

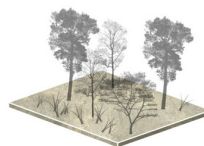
Nowadays, many of these vertical buildings function as growing machines, designed to maximize economic and with small benefits for the community. This project aims to overcome the limits of agriculture to a level of markets, vertical greenhouses and a residential community in Glasgow, Scotland.

The urban farming center pretends to be one of the most important additions to the project of regeneration in the docks and the Clyde waterfront. It is an exemplary piece of functional architecture designed to inspire a change in the lifestyle of the inhabitants and, in turn, revolutionize Glasgow, transforming it into one of the most environmentally conscious and nutritionally sustainable cities in the world.

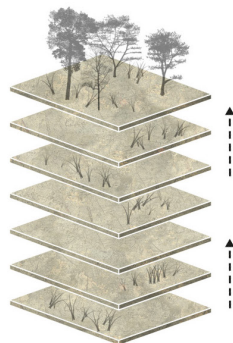
The rectangular building relies solely on natural resources and renewable energy, which is why it is totally self-sufficient. A yard produce from this vertical organic farm could feed approximately 80,000 people in a year, accounting for 14% of Glasgow's population.

As will be observed in the floor plants, each floor has enough space for the proper production of food. In some floors, the activity is the production of vegetables and fruits; in others, the growth of different types of plants. On another hand, it is the place where the hanging gardens are stored at night for their respective maintenance. This allows an addition in square meters of vertical farming horizontally for the cultivation of certain plants.

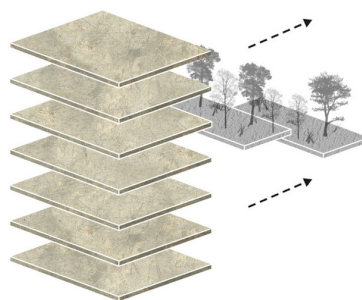
To conclude, the double facade provides a degree of protection against the wind but allows natural ventilation of some internal spaces. It is a mixture of transparent and translucent glass whose openings are able to control views, protect overheating and create a sense of privacy and comfort.



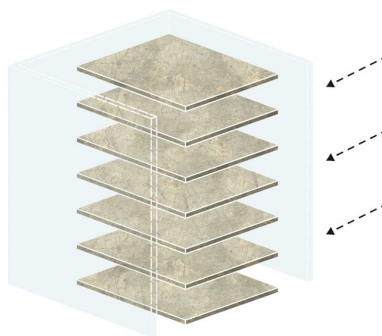
urban farming
agricultural plots in urban areas



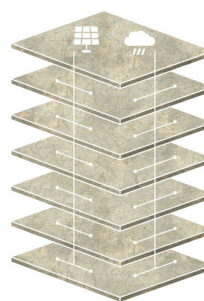
vertical farming
produced food in vertically stacked layers



outward extension
hanging gardens to increase square meters of crop outside the building



the shell
double glass facade to protect the interior

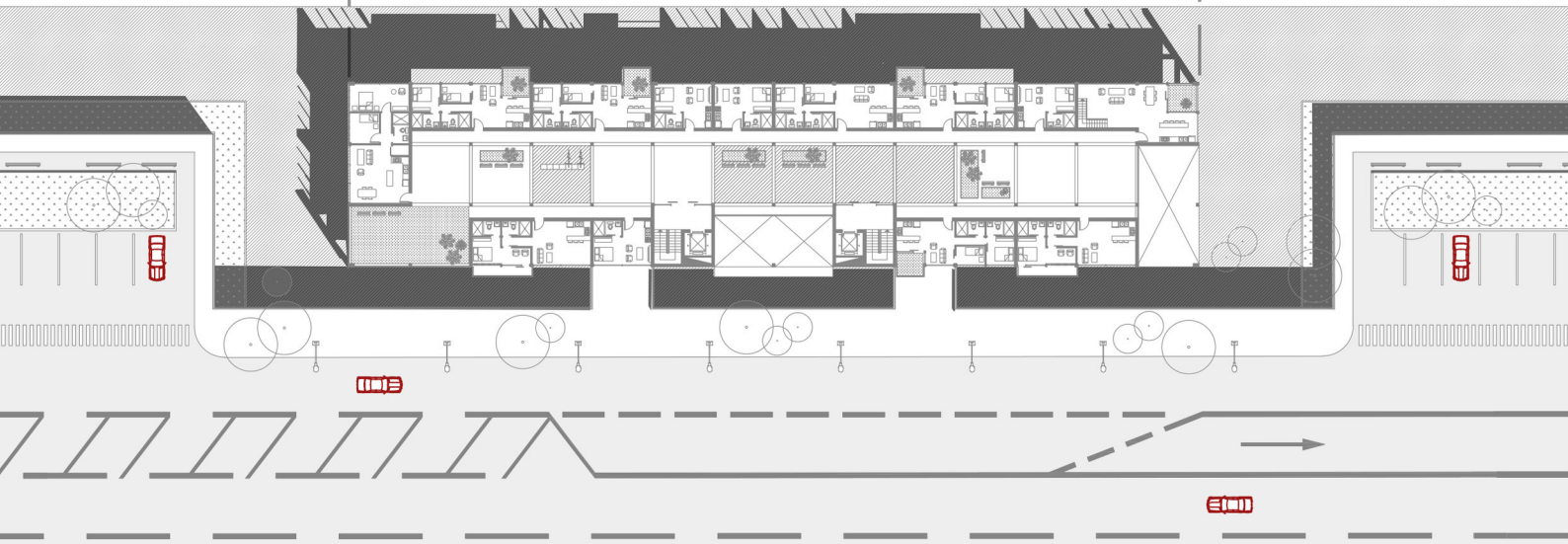
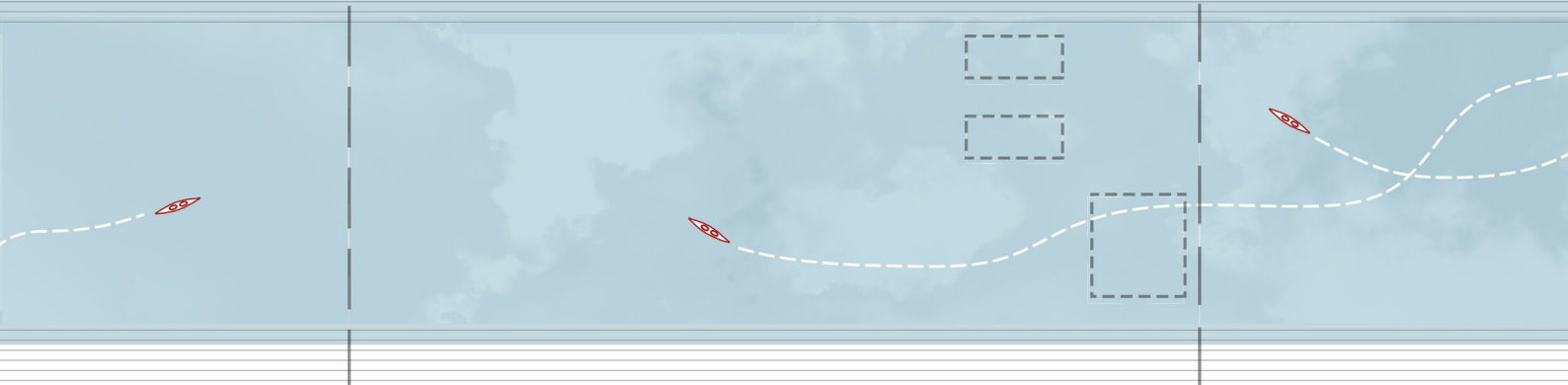
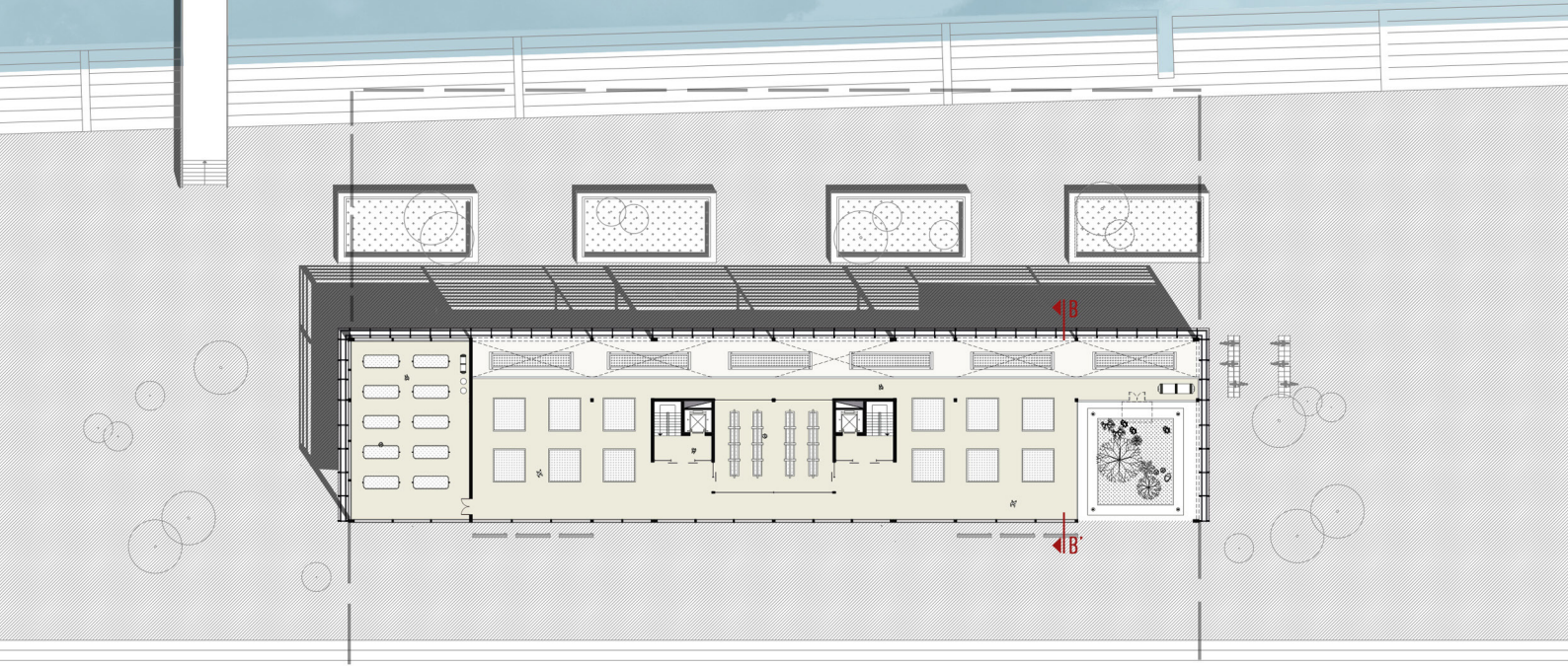


technical strategy
water collection for the crops and solar panels to produce energy for the building

VERTICAL FARMING DIAGRAM

FLOOR PLAN LEVEL 4 +14.80

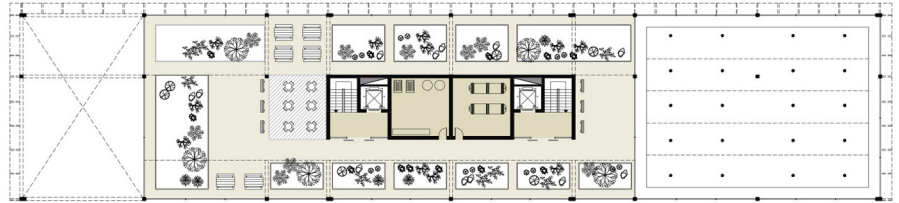
SCALE 1:750



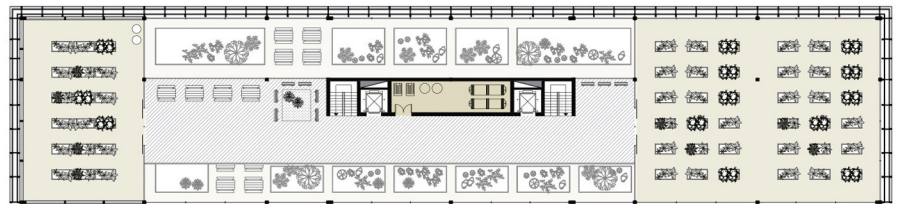
GROUND FLOOR +0.00



LEVEL 1 +4.45



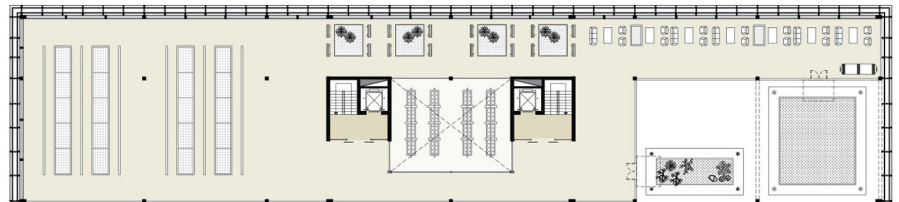
LEVEL 2 +7.90



LEVEL 3 +11.35



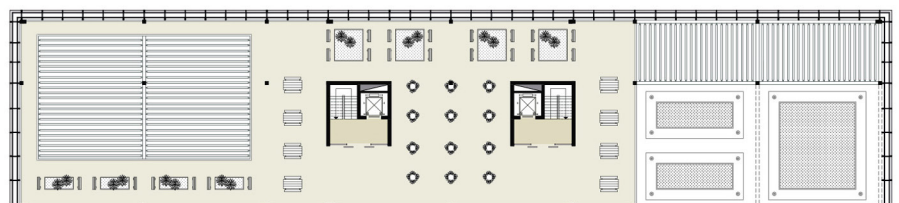
LEVEL 5 +18.25



LEVEL 6 +21.70



LEVEL 7 +25.15



LEVEL 7

LEVEL 6

LEVEL 5

LEVEL 4

LEVEL 3

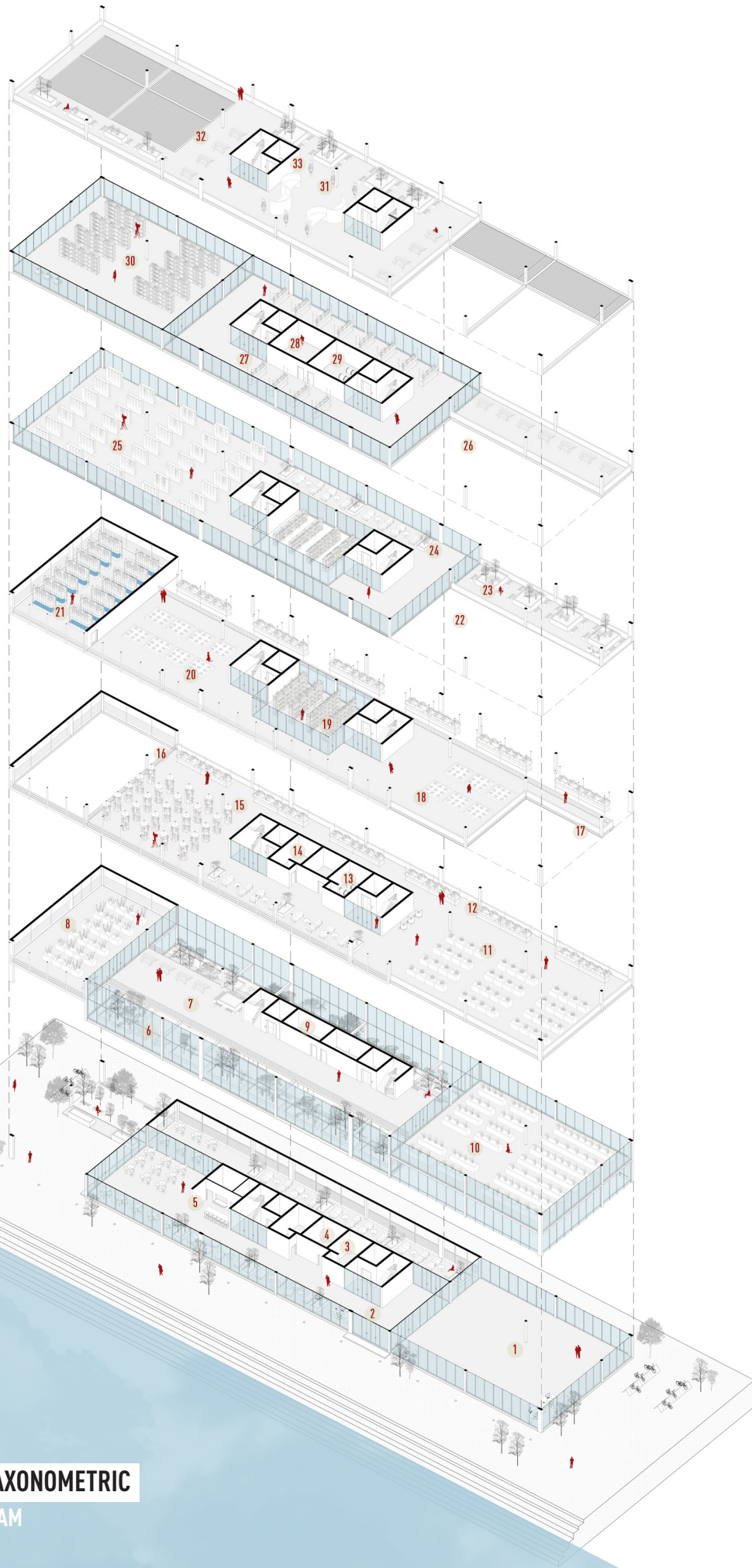
LEVEL 2

LEVEL 1

GROUND FLOOR

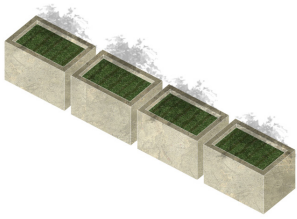
1. Flower Market
2. Reception
3. Toilets
4. Administration
5. Coffee shop and bar
6. Green House
7. Viewpoint to the greenhouse
8. Cut flower production
9. Storage
10. Cut flower production
11. Cucumbers
12. Beans and peas
13. Water pump room
14. Electrical equipments
15. Cherry tomatoes
16. Viewpoint to the seedlings
17. Hanging garden number 1
18. Red leaf lettuce
19. Sweet peppers
20. Butter-head lettuce
21. Broccoli
22. Hanging garden number 2
23. Terrace
24. Social gathering
25. Strawberries and raspberries
26. Hanging garden number 3
27. Mint and Basil
28. Storage
29. Water pump room
30. Eggplant
31. Social gathering
32. Picnic areas
33. Vertical circulation to the roof

EXPLODED AXONOMETRIC
ZONING DIAGRAM



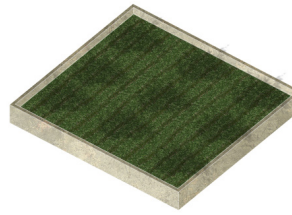
GROWING DESCRIPTION

CUCUMBERS



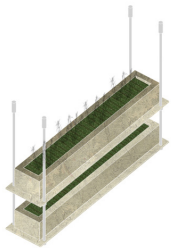
plant spacing = 2 - 5 plants / m²
growth time (weeks) = 7 - 9
temperature (°C) = 18 - 20
plant height = 20 - 200 cm
plant width = 20 - 80 cm

LETTUCE



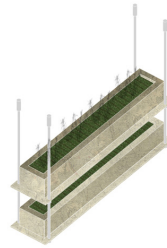
plant spacing = 20 - 25 heads / m²
growth time (weeks) = 4 - 5
temperature (°C) = 15 - 22
plant height = 20 - 30 cm
plant width = 25 - 35 cm

BEANS AND PEAS



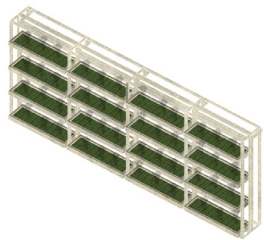
plant spacing = 10 - 12 plants / m²
growth time (weeks) = 4
temperature (°C) = 21 - 26
plant width = 60 - 80 cm

MINT AND BASIL



plant spacing = 5 - 10 plants / m²
growth time (weeks) = 3 - 4
temperature (°C) = 30
plant height = 30 - 70 cm
plant width = 30 cm

SWEET PEPPERS



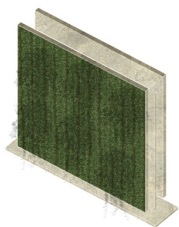
plant spacing = 3 - 4 plants / m²
growth time (weeks) = 6 - 8
temperature (°C) = 20 - 33
plant height = 30 - 90 cm
plant width = 30 - 80 cm

EGGPLANT



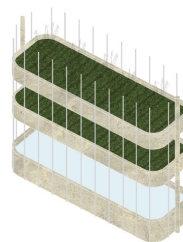
plant spacing = 3 - 5 plants / m²
growth time (weeks) = 12 - 17
temperature (°C) = 22 - 26
plant height = 60 - 120 cm
plant width = 60 - 80 cm

STRAWBERRIES



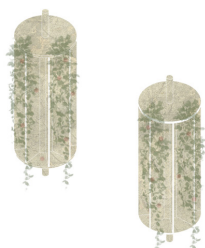
plant spacing = 3 - 4 plants / m²
growth time (weeks) = 6 - 12
temperature (°C) = 15 - 27

BROCCOLI



plant spacing = 3 - 5 plants / m²
growth time (weeks) = 8 - 12
temperature (°C) = 13 - 18
plant height = 30 - 60 cm
plant width = 30 - 60 cm

CHERRY TOMATOES



plant spacing = 3 - 5 plants / m²
growth time (weeks) = 8 - 12
temperature (°C) = 22 - 26
plant height = 60 - 180 cm
plant width = 60 - 80 cm

HANGING FLOWERS



bluebells and scots bluebells

level 7
+25.15

level 6
+21.70

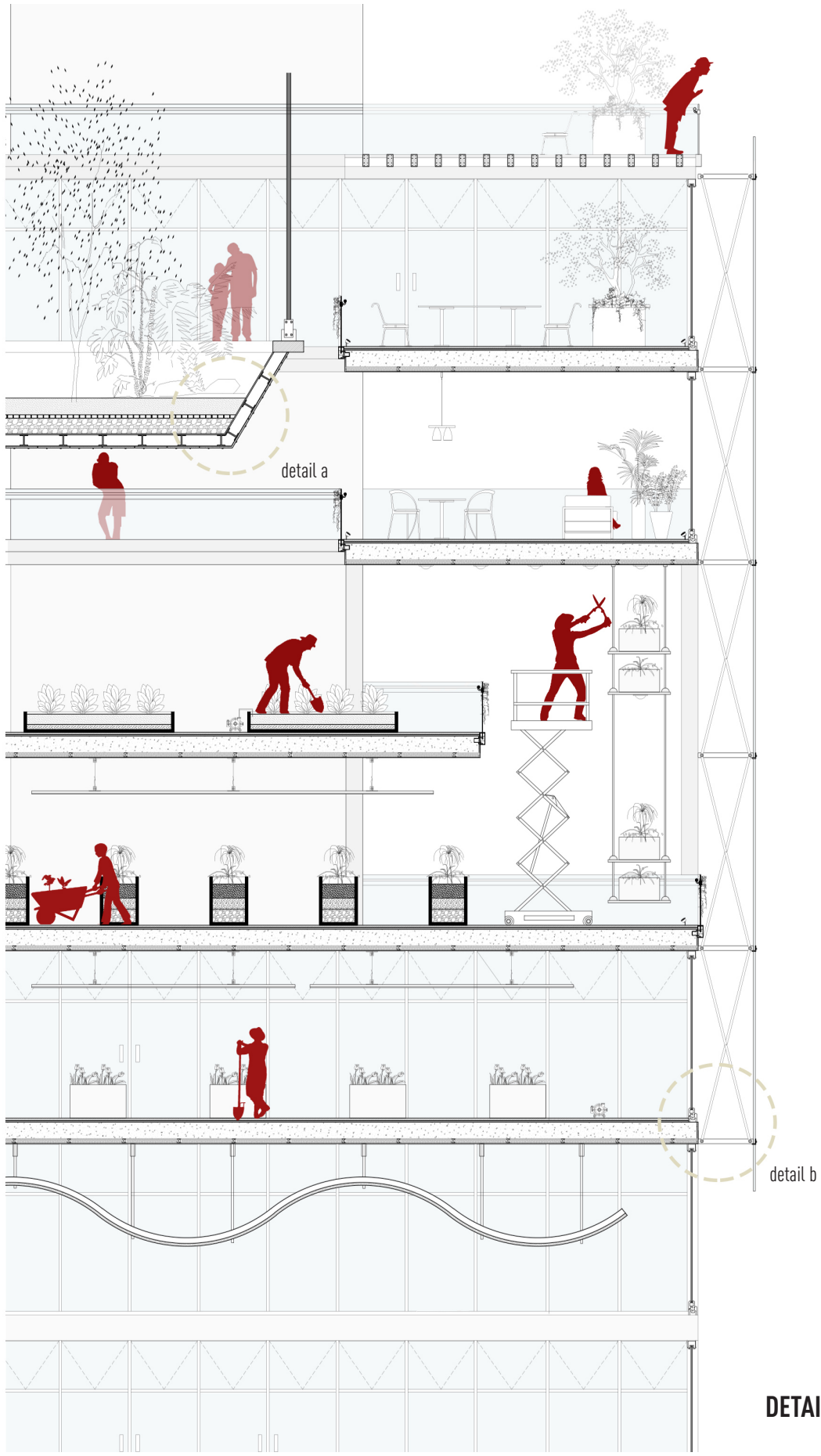
level 5
+18.25

level 4
+14.80

level 3
+11.35

level 2
+7.90

level 1
+4.45

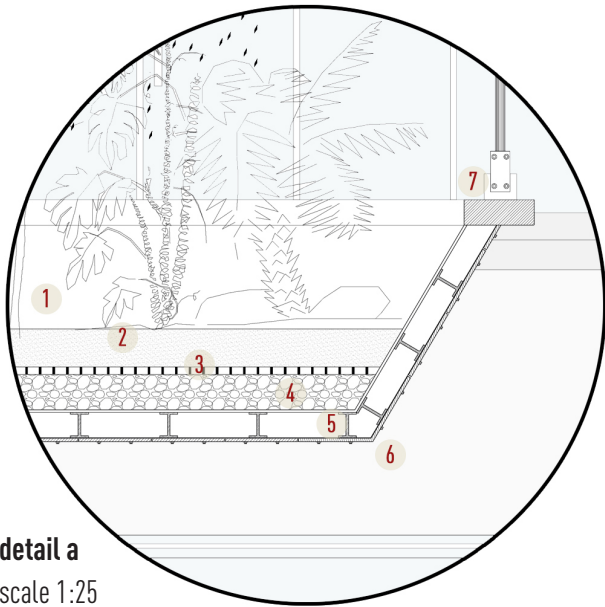


detail a

detail b

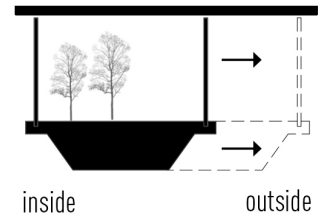
DETAIL SECTION B-B'
SCALE 1:100

HANGING GARDENS



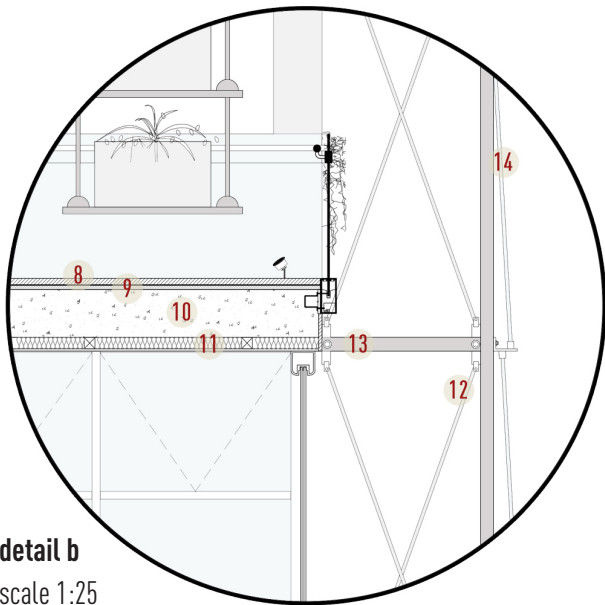
detail a
scale 1:25

1. Vegetation layer
2. Soil mix layer
3. Erosion control jute mesh
4. Drainage layer
5. Steel structure. Curb stop
6. Sheet metal protection
7. Steel rods



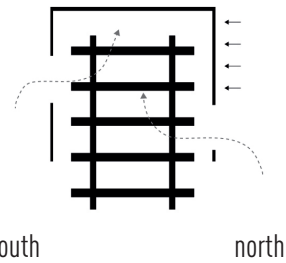
-  Three times more area to cultivate
 -  Gives each farm/domicile a direct garden right outside the dwellings
 -  During the day: above the docks
 -  During the night: inside the vertical farming
- They are working in tension but will not swing as the "tray" piece will provide cross-bracing





THE SHELL

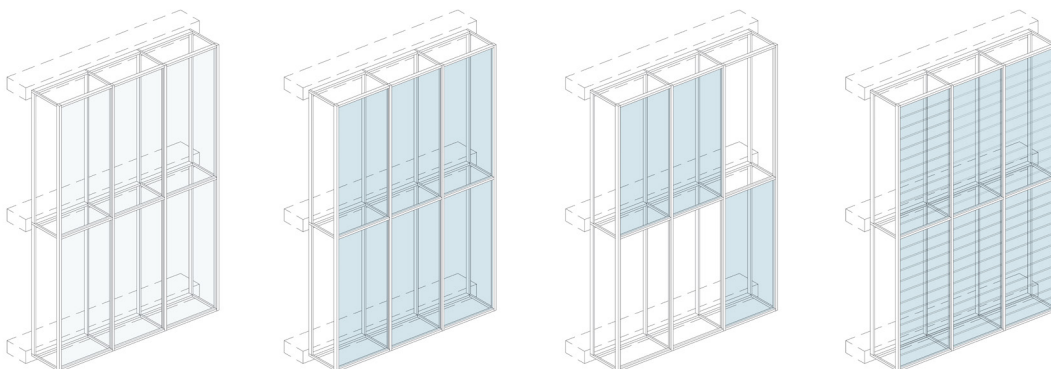


detail b
scale 1:25

8. 10 mm ceramic tile
9. 20 mm screed
10. 300 concrete slab
11. 50 mm thermal insulation
12. Steel wind braces d:10mm
13. Anodized-aluminium frame
14. Double glassed insulating glass



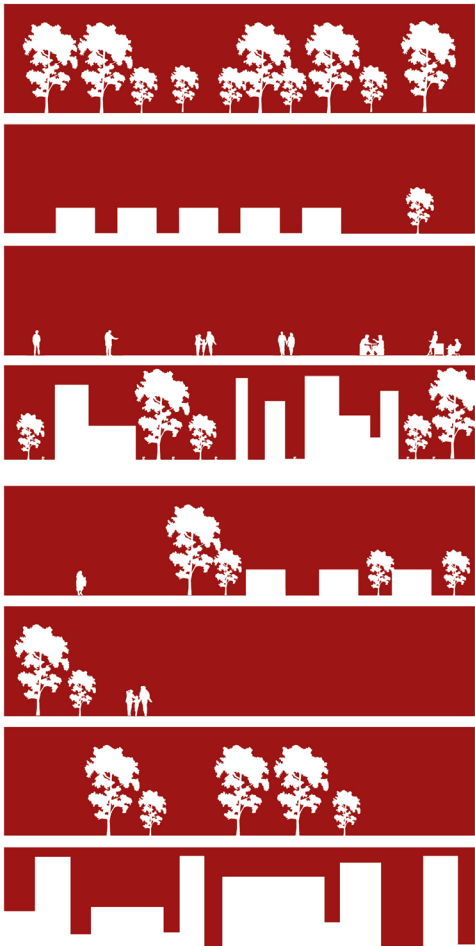
-  The glazing traps solar radiation like a greenhouse
-  Protection of the environment
-  Avoid excess heat gain in hot times
-  Minimise heat loan during cold times



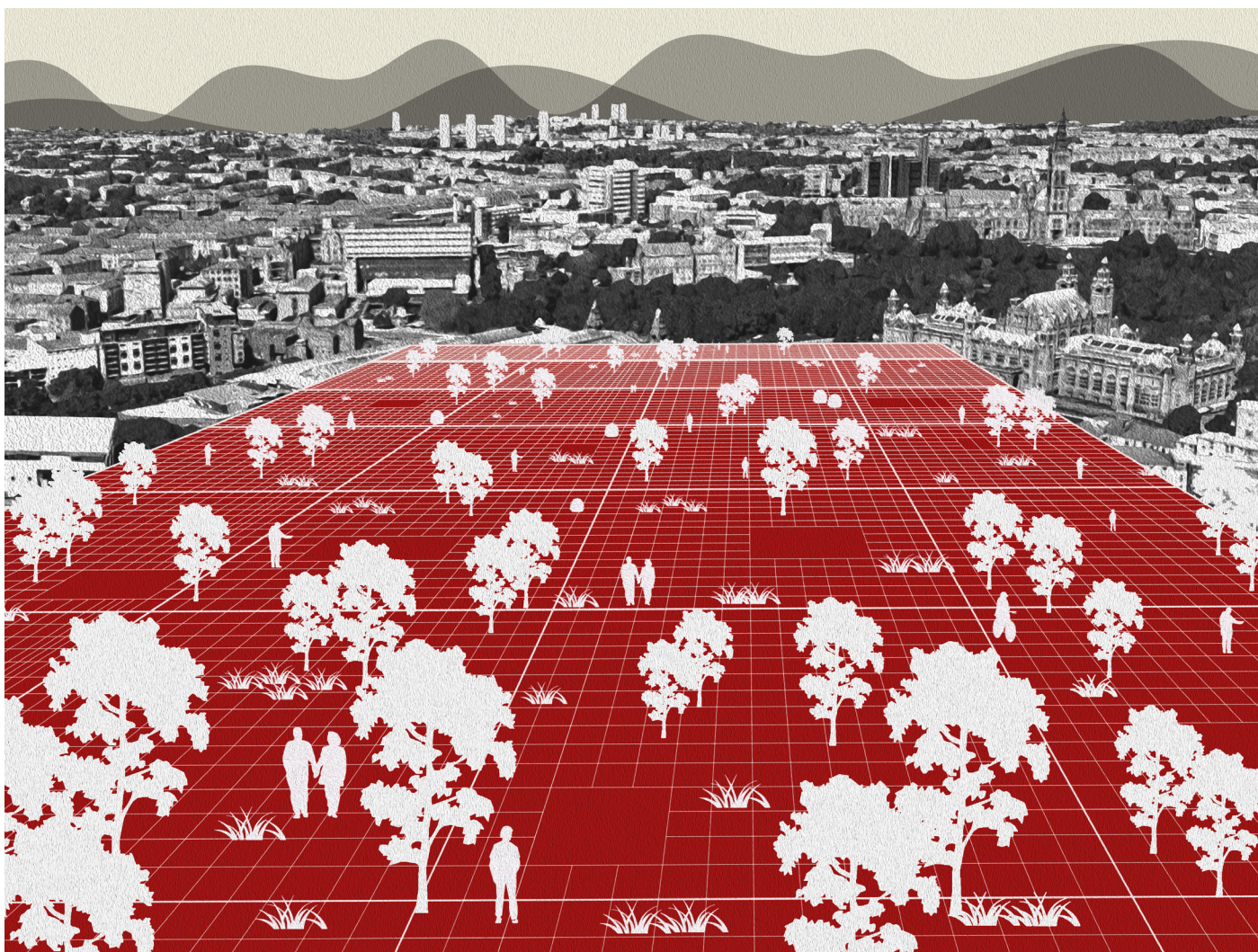
TRANSPARENCY

The transparency are key in development the facade for the building. Imagined the building as a large machine of food production with floor alteration as the moving parts within the building, exposed and expressed.

With its transparency, the program is visible within the glazed barrier forming an opaque wall along the Graving Docks.



ROOF GARDEN



The interpretation of the "Roof Garden" is the entire thesis. Is the idea of bring nature in the city through the architecture incorporating the nature elements in a new and innovative way. The parks and green spaces will be multiplied from ground levels upwards, attracting birds and wildlife to the roof. As can be observed in the collage, the roof becomes a hybrid park in which the natural and the urban coexist in a public space. For the project, specific elements found in the natural world have been picked and combined to provide an entirely artificial landscape to the city.

This space promotes public spaces in height with markets, different species of trees, green areas, etc. In addition, it is the main training center for farmers, where it will operate as an experimental organic farm in which new approaches and technologies for environmental cultivation based on efficient use of natural resources will be intro-

duced. The building is designed to promote professional training research and learning in different areas of the agriculture.

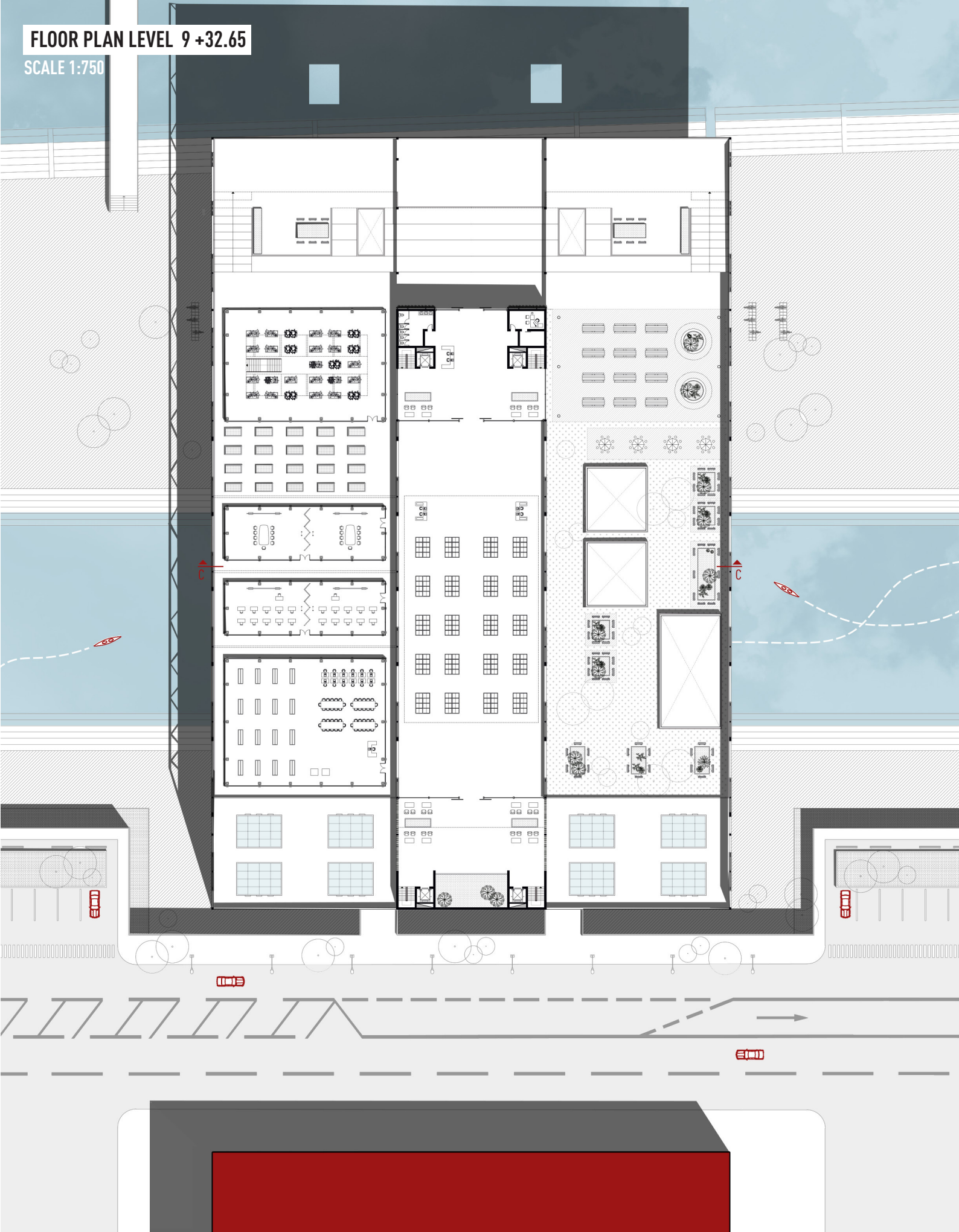
The roof has the ability to collect and filter rainwater - which is why the vertical farming works. It also technical and mechanical - the structure allow the "hanging gardens" to operate.

The shape of the roof is colossal. Is the interpretation of the big industrial sheds and cranes that were once there. The idea is to re-build the traditional industry of Glasgow with the architecture.

The "Roof Garden" is a mega structure that encapsulate the entire project - create a connection between the residential building and the vertical farming forming a great monument in the Govan Graving Docks. Whit-out it, the project makes no sense formally and logistically.

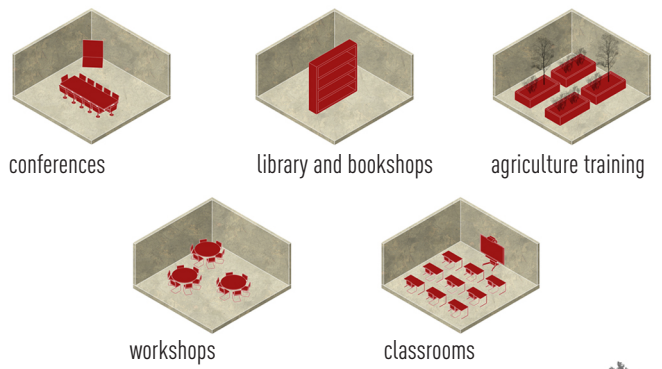
FLOOR PLAN LEVEL 9 +32.65

SCALE 1:750



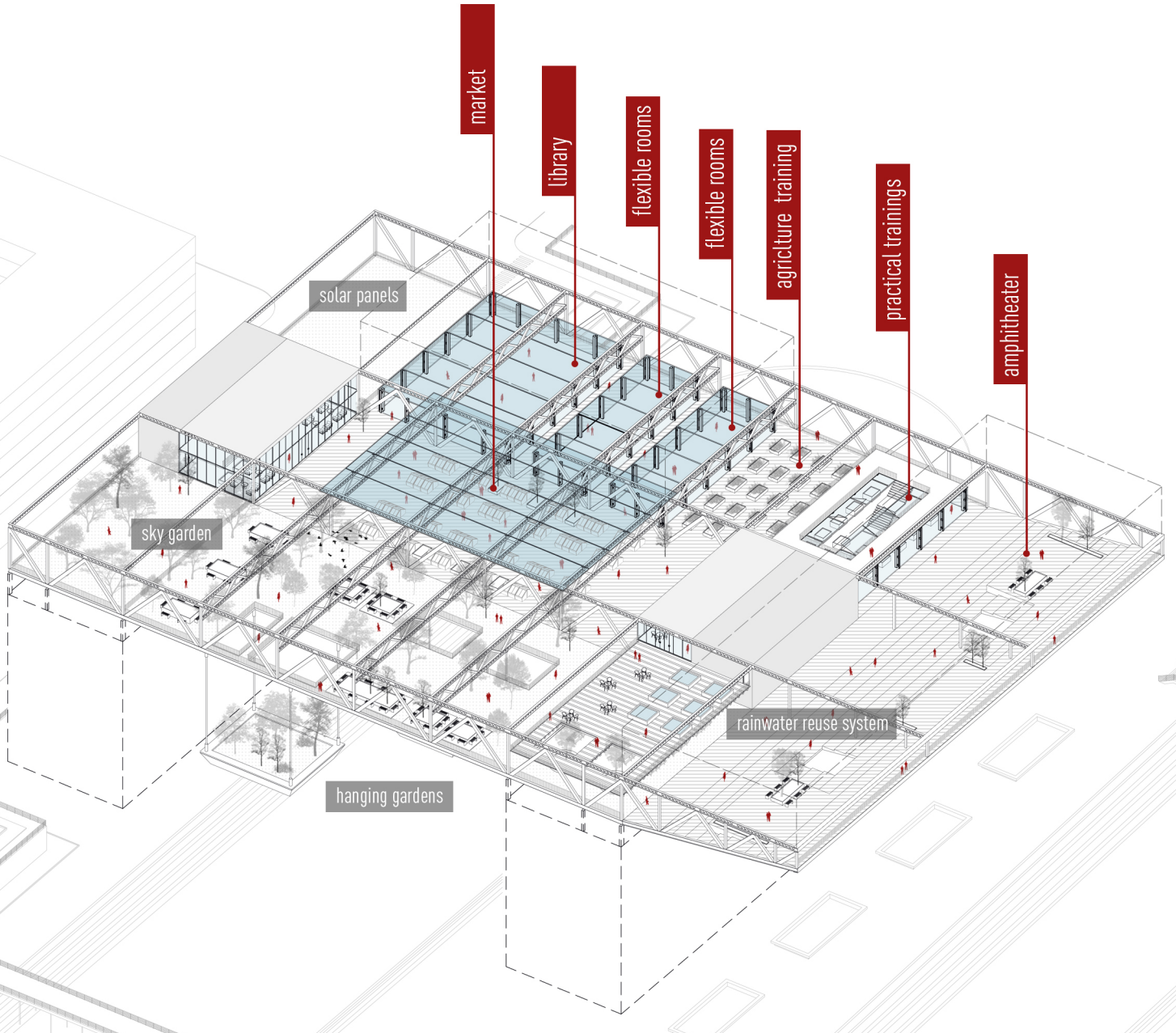
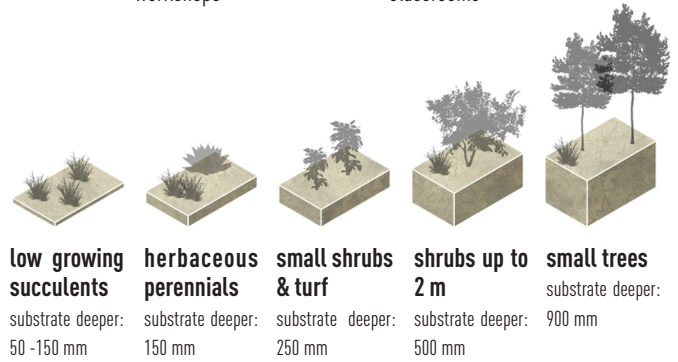
TRAINING CENTER FOR FARMERS

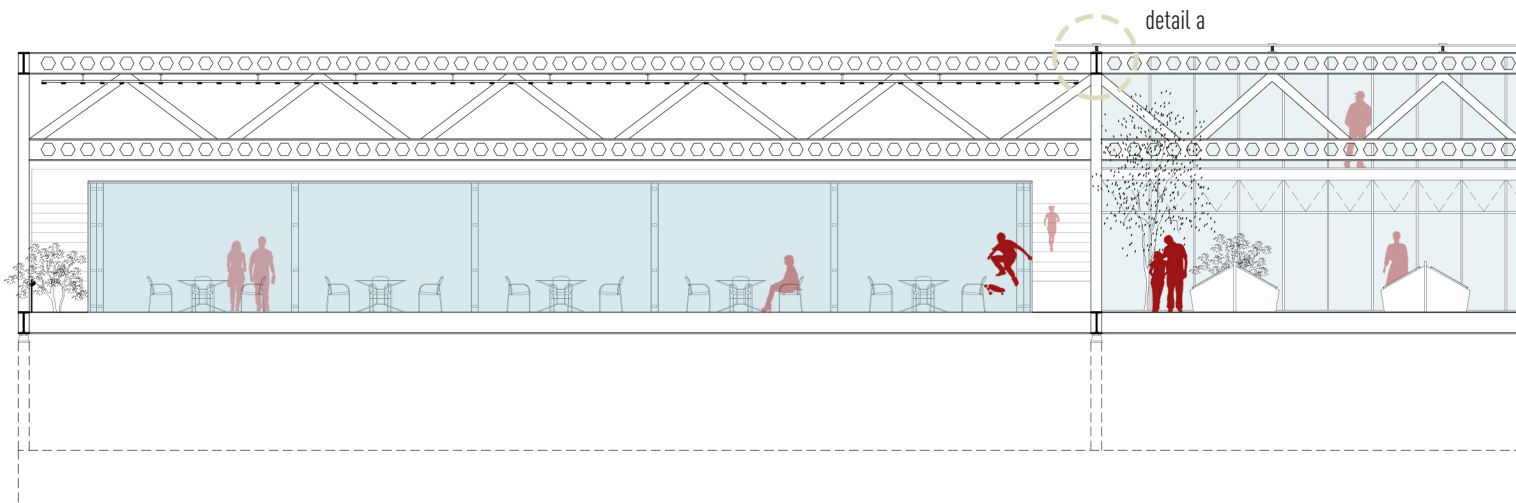
The building is designed to promote professional training, research, innovation and learning in different areas of agriculture. The roof will operate as an experimental organic farm, where new approaches and technologies for nature will be introduced. The classrooms are made of transparent polycarbonate. Its function is flexibility because they can be used for workshops, consultations, seminars, etc.



SKY GARDEN

Designed as a public park, the sky garden offers a space open to all to spend time and observe the variety of plants. Parks and green spaces will be multiplied from ground level upwards, attracting birds and wildlife to sky-gardens, tens of floors up.





STRUCTURE OF THE ROOF GARDEN

Data

$$L = 12 \text{ m}$$

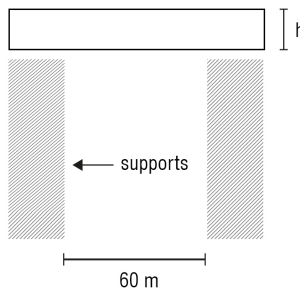
$$H = 3 \text{ m}$$

$$W = 6 \text{ m}$$

10 KN = weight of people and objects

σ = strength material = 35500 N/cm²

M = moment of inertia



Hight of the roof

$h = \text{Distance between supports} / 11$

$$h = 60 \text{ m} / 11 = 5.45 \text{ m} \approx 6.00 \text{ m}$$

Cross beams

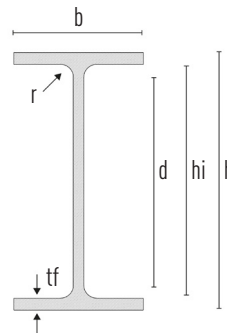
$$Q = 10 \text{ KN} / \text{m}^2 \times 6 \text{ m} = 60 \text{ KN.m}$$

$$M = Q \times L^2 / 8 = 60 \text{ KN.m} \times (12 \text{ m})^2 / 8 = 1080 \text{ KN.m}$$

$$W = M / \sigma = 1080 \text{ KN.m} \times 10^5 \text{ N.CM} / 35500 \text{ N/cm}^2$$

$$W = 3042,25 \text{ cm}^3$$

IPE = 600



IPE 600

$$h = 600 \text{ mm}$$

$$hi = 562.0 \text{ mm}$$

$$d = 514.0 \text{ mm}$$

$$b = 220 \text{ mm}$$

$$tf = 19.0 \text{ mm}$$

$$r = 24 \text{ mm}$$

$$A = 156.0 \text{ cm}^2$$

$$M = 122.5 \text{ kg/m}$$

Longitudinal beams

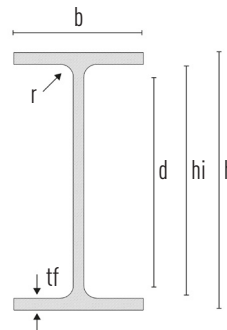
$$Q = 10 \text{ KN} / \text{m}^2 \times 3 \text{ m} = 30 \text{ KN.m}$$

$$M = Q \times L^2 / 8 = 30 \text{ KN.m} \times (12 \text{ m})^2 / 8 = 540 \text{ KN.m}$$

$$W = M / \sigma = 540 \text{ KN.m} \times 10^5 \text{ N.CM} / 35500 \text{ N/cm}^2$$

$$W = 1521.12 \text{ cm}^3$$

IPE = 500



IPE 500

$$h = 500 \text{ mm}$$

$$hi = 468.0 \text{ mm}$$

$$d = 426.0 \text{ mm}$$

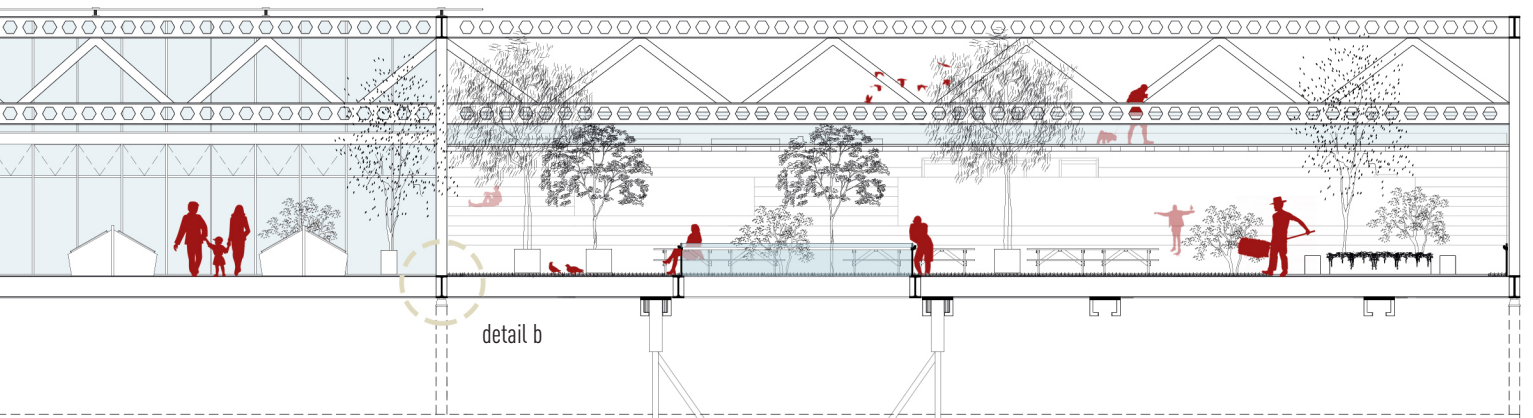
$$b = 200 \text{ mm}$$

$$tf = 16.0 \text{ mm}$$

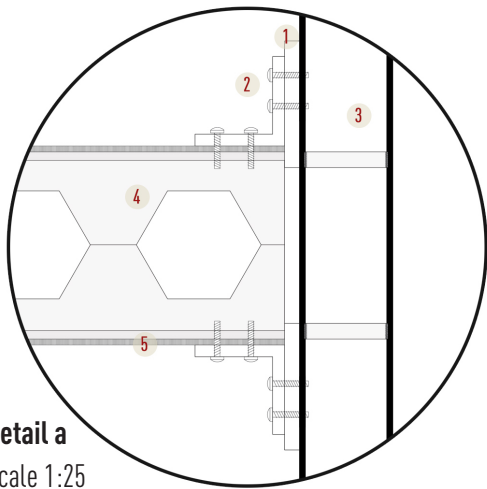
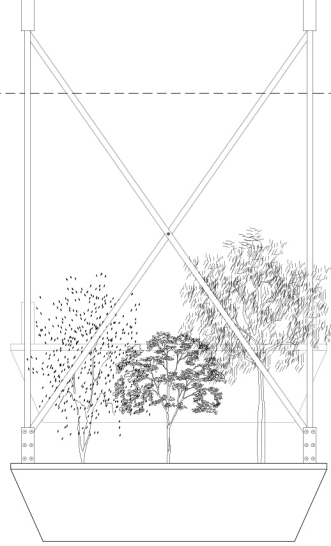
$$r = 21 \text{ mm}$$

$$A = 115.5 \text{ cm}^2$$

$$M = 90.7 \text{ kg/m}$$

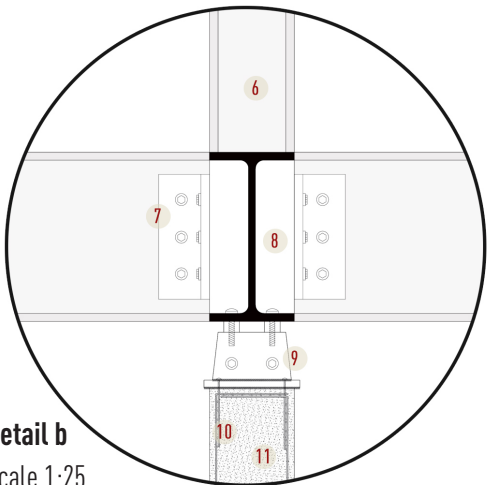


SECTION C-C'
SCALE 1:200



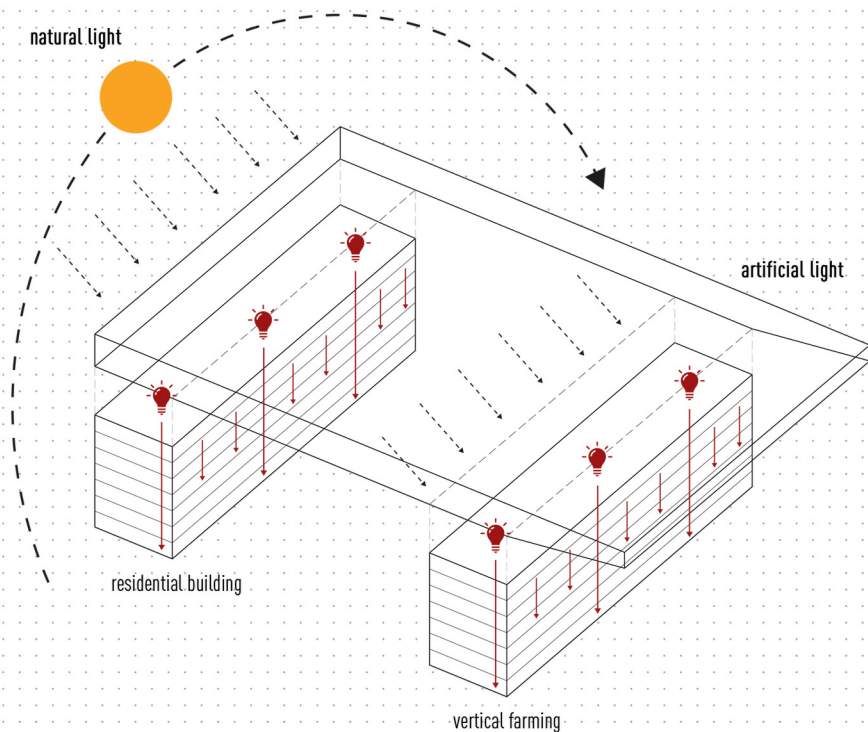
detail a
scale 1:25

- 1. Shim plate
- 2. Angle, bolt
- 3. Column 300mm
- 4. Castellated beams: hexagonal openings
- 5. Reinforcing plate



detail b
scale 1:25

- 6. Steel column 300mm
- 7. Steel plate IPE
- 8. Beam IPE 600
- 9. Base plate system
- 10. Beam reinforcement. Anchor bolts
- 11. Reinforced concrete column 300mm

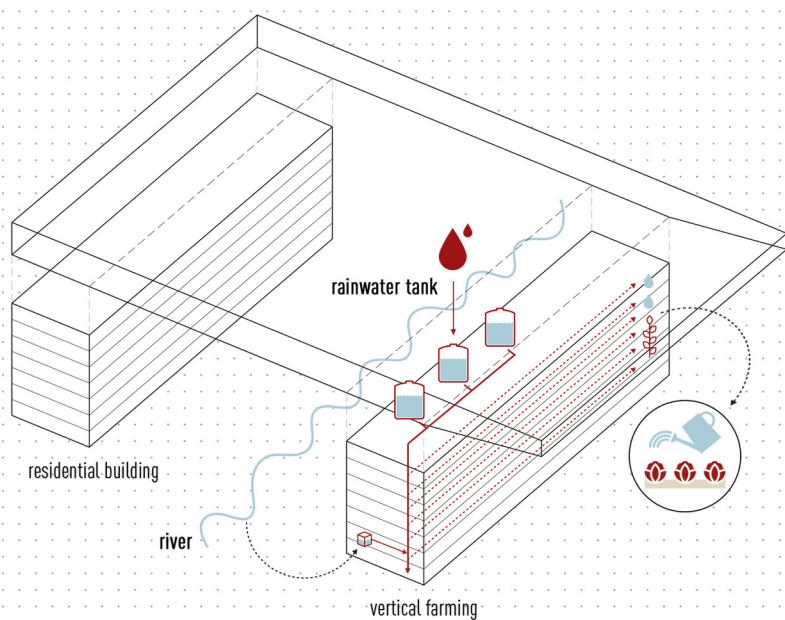


LIGHTING

The orientation of the building and the use of big windows on the sun-facing façade allow having natural light in most of the interior spaces, especially in the residential building and the garden roof. Thanks to this, maximum benefit from natural light and optimum levels of solar gain are obtained.

In the vertical farming, special artificial light is introduced on the ceiling of each crop space to allow light for the growing of the plants and food. The type of luminaries should be chosen to give an average initial circuit luminous efficacy of 65 lumen/circuit watt for the fixed lighting equipment within the building excluding track-mounted luminaries and emergency lighting.

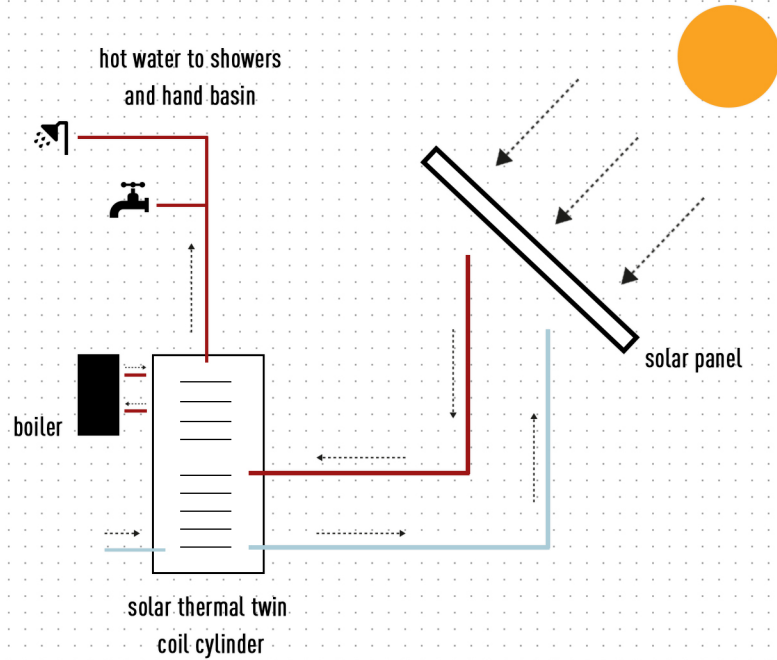
Artificial light in the vertical farming: Blue, red and far-red LED's.



RAINWATER COLLECTION AND WATER MANAGEMENT OF THE RIVER

The introduction of a rainwater collector allows re-using the rainwater to provide natural irrigating to the plants in the vertical farming. The tank is supposed to be installed on the roof garden, near the circulation system of the vertical farming. In this way, the building can be a low-cost service to the community.

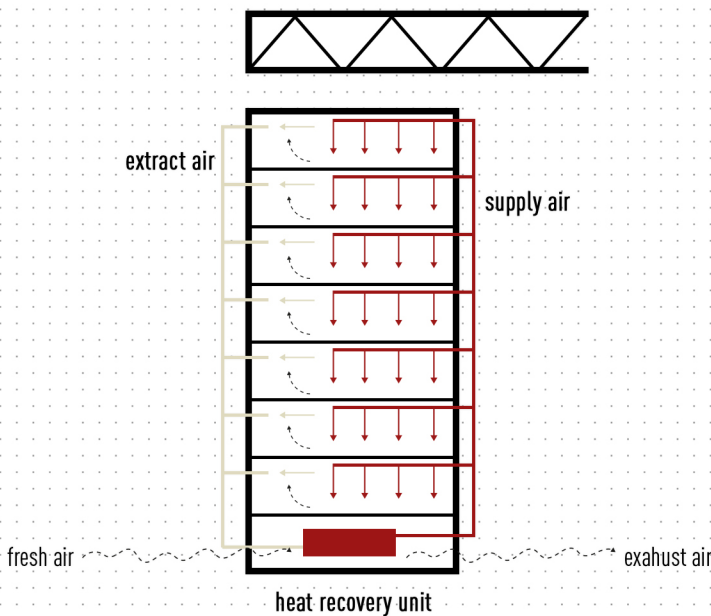
For another hand, river water is taken to be purified and stored in the vertical farming building. From the bottom to the top, the water is distributed to each floor to be used in the cultivation of food and plants.



SOLAR THERMAL | DOMESTIC HOT WATER SYSTEM

For the residential building, a solar thermal panel and a boiler system will be installed to allow water to be heated by energy from the sun. The heated water will be used in the showers and in the basin. The introduction of solar renewable heat is expected to provide sufficient capacity to meet daily hot water needs.

The building will be using free, renewable energy to heat its water, reducing its reliance conventional energy sources.



MECHANICAL VENTILATION WITH HEAT RECOVERY

The heat recovery ventilation is a system that both supplies and extracts air through a building. In this case, it offers a balanced low energy ventilation.

In the residential building, the system is used with a network of ducting which is connected to each room. From a single unit, it works by continuously extracting air from the rooms of the building and at the same time, drawing in fresh supply air from outside.

public/private spaces in the residential building
for farmers and residents of Glasgow



interior green areas



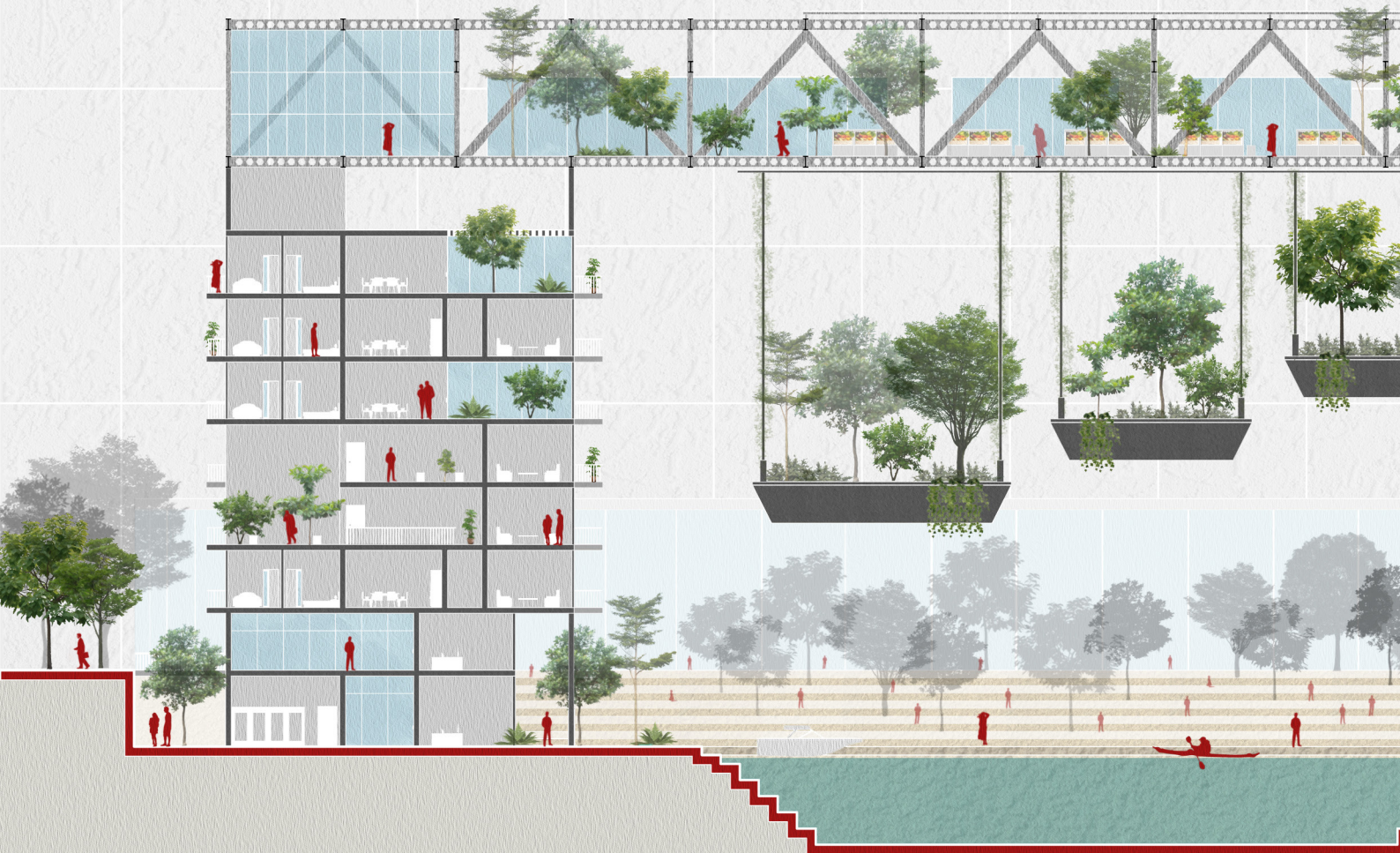
hanging gardens



sky forest and public park



markets



SECTION D-D'
SCALE 1:250

training centre for farmers



food production: fruits, vegetables and grains



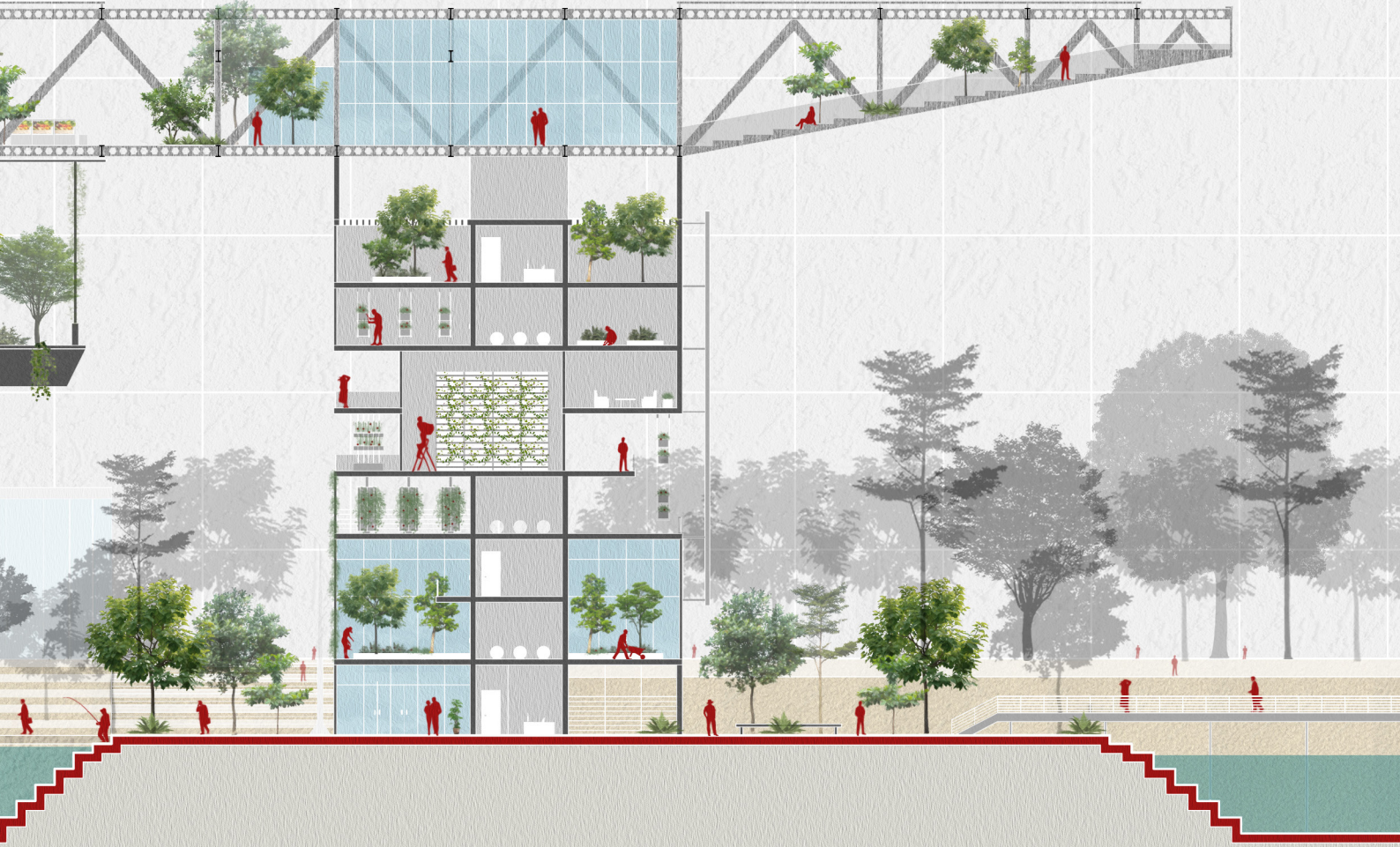
plant growth: vertical farming



solar panels and rainwater collection system



entertainment and leisure spaces





RESIDENTIAL BUILDING





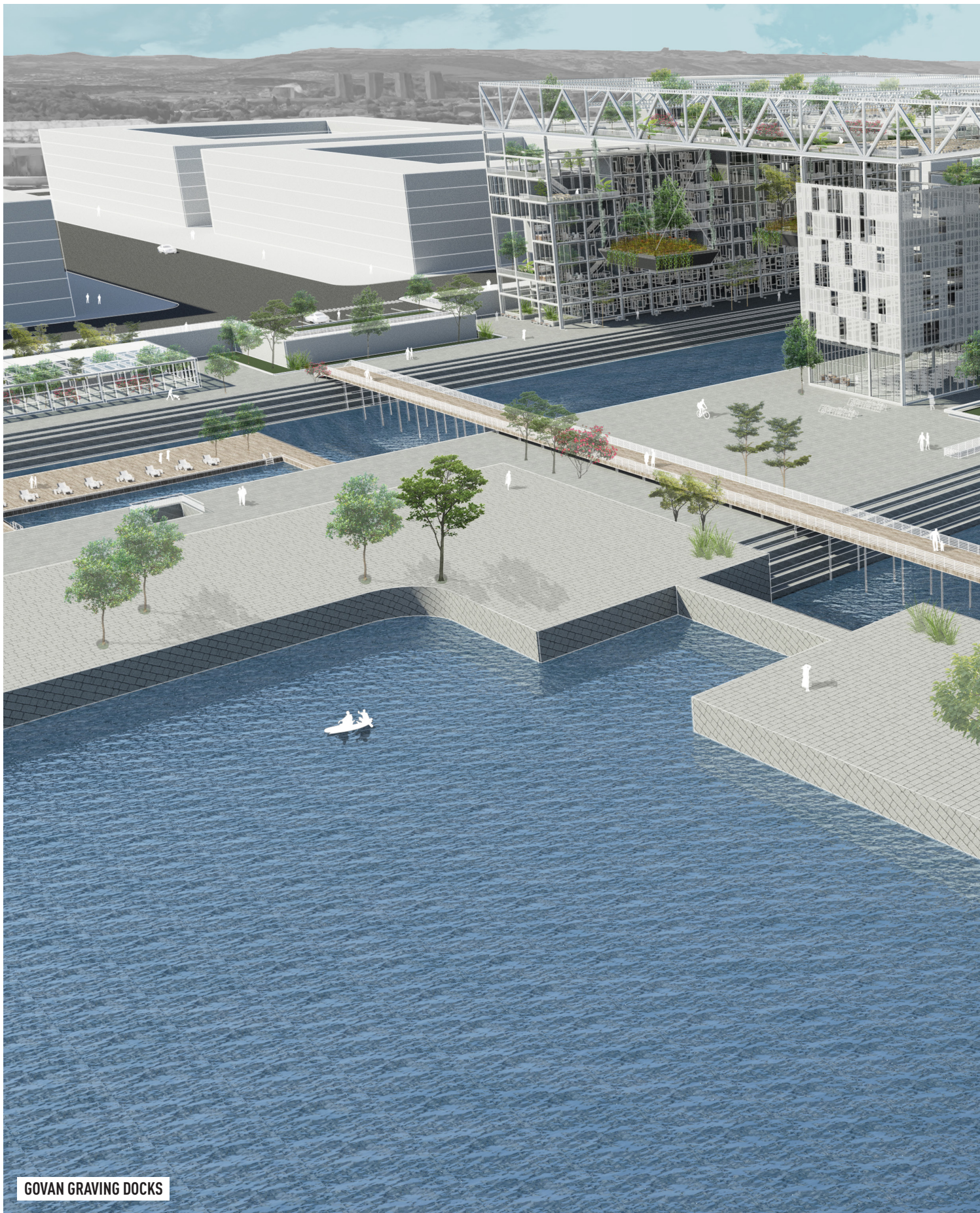
VERTICAL FARMING





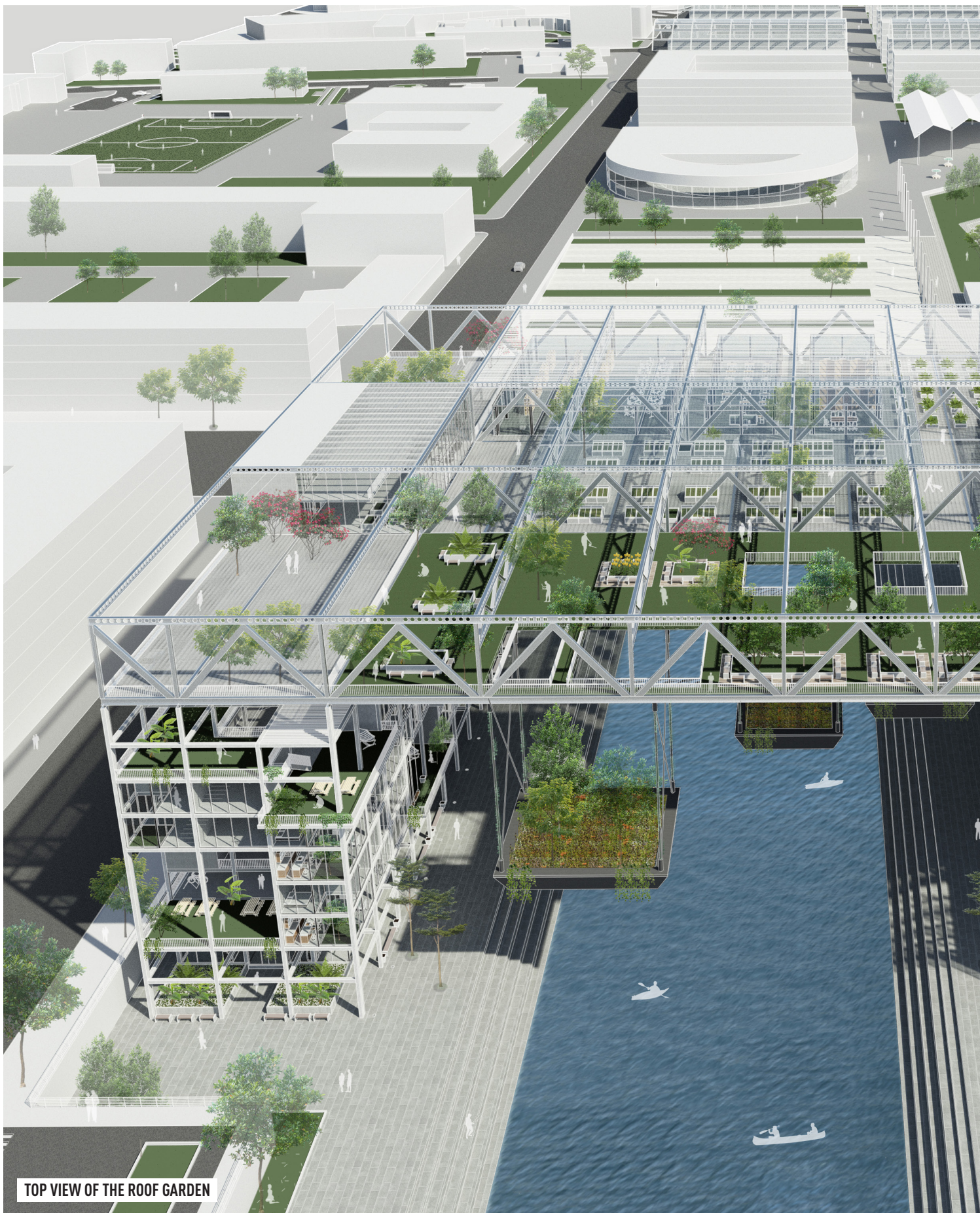
ROOF GARDEN



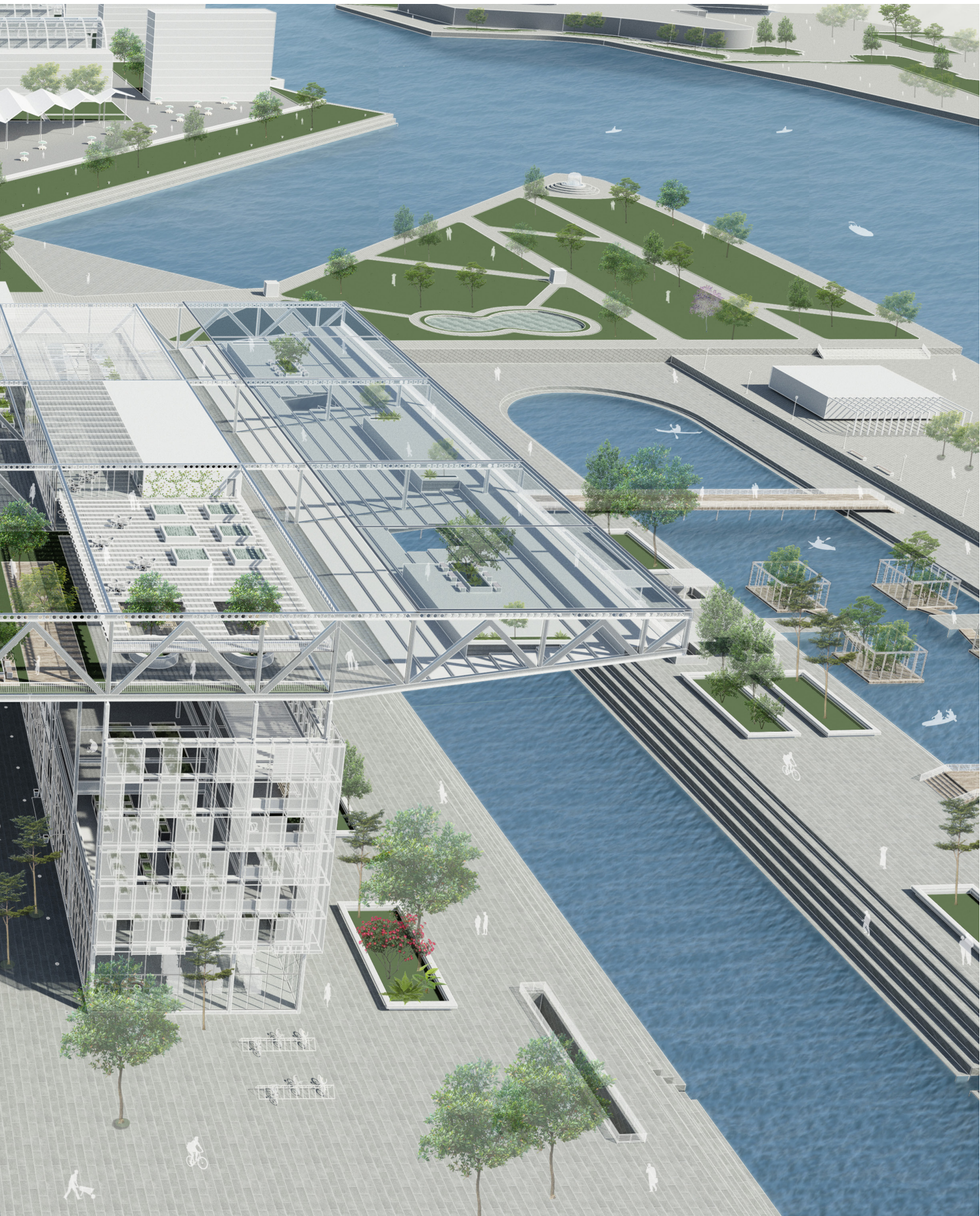


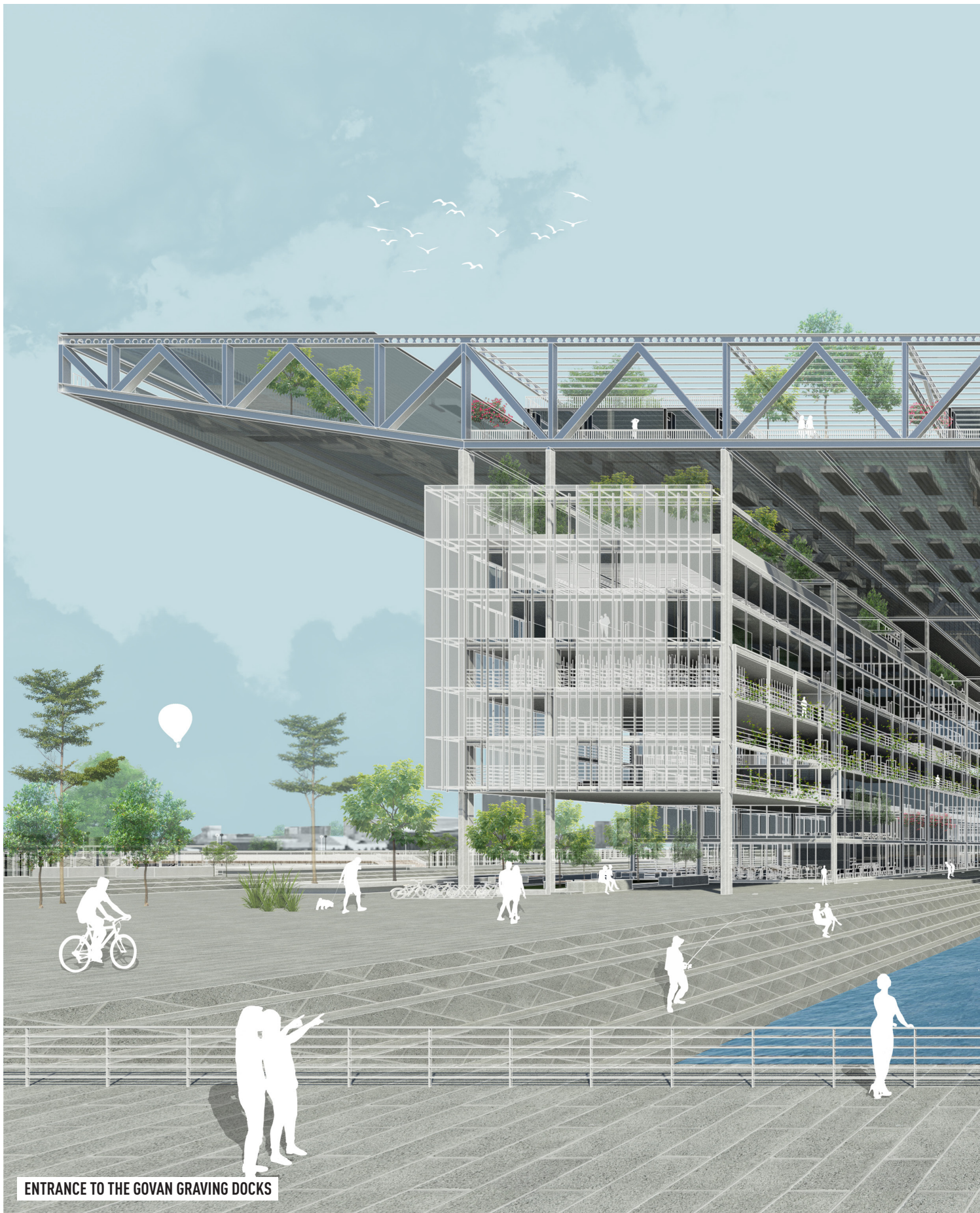
GOVAN GRAVING DOCKS



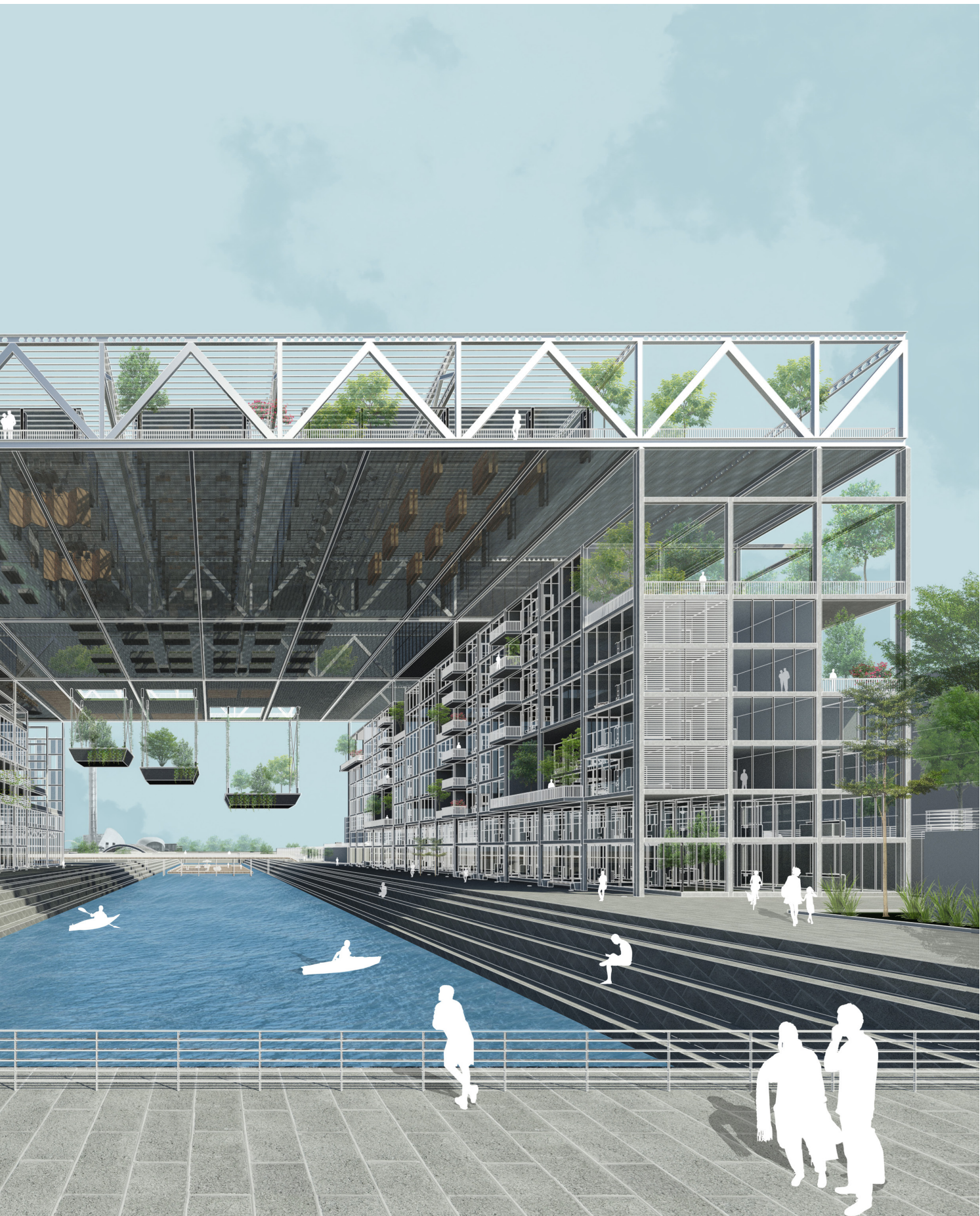


TOP VIEW OF THE ROOF GARDEN





ENTRANCE TO THE GOVAN GRAVING DOCKS



CONCLUSION

In Scotland, agriculture is a determining factor within the urban scale of the country. More than 75% of the land is used for agriculture and more than 15% is forested. This thesis examined the possibility of recovering abandoned post-industrial spaces through the concept of landscape and nature of Scotland. Extracting the strong characteristics of agriculture, we could observe in the design proposal the reflection of the cultivation of traditional fields in developed cities. Due to this, the concepts of housing and community were integrated, which in the end resulted in an area of cultivation, residential buildings, markets, recreation and leisure spaces, etc.

The result was the development of two important buildings, one dedicated to housing and the other to the production of food and plants, in the city of Glasgow, specifically in the neighbourhood of Govan. Starting with a general search on the residents, it should be found that they should be located near the work area instead of away from it. In addition, the best way to organize the internal spaces of the building was to create apartment modules for different users and thus play with the common spaces. From the balcony, people would be able to observe the building of vertical farming that is in front, the hanging gardens supported by the structure and the mountains of Scotland as a background.

Moreover, the building of vertical farming to promote the work of agriculture in the city. Designed with a simple grid and protected by

an almost invisible glass shell, this building is capable of producing foods such as vegetables, fruits, seeds, among others. In addition, it has a small two-story greenhouse for the sale also of different floral species.

However, a roof that not only serves as a connection between both spaces but also as a public area for farmers, residents and tourists. The roof also becomes an area of work and knowledge for learning agriculture with classrooms, conferences, laboratories for agriculture, etc. Became an element with special conditions of the common areas, even if it is an outdoor element as the docks or the commerce in ground floor, it acquires an individual character. Acts as an open-air collector simulating the nature and to recollect water and sunlight.

On the other hand, the structure and the shape of this roof intend to remind us of the great cranes and the naval construction that was carried out in the Govan Graving Docks. The idea is not to lose the memory of the place. In addition, to connect this great monument with the context, small bridges and floating platforms were designed between the docks. The idea is to generate a relationship between water and the people who visit or live in the place.

For future searches, I recommend relating nature with the city. As has been observed in this thesis, the proposal grants the creation of spaces where nature and the built have the same importance.

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