

RIVERCITY flowing right ->

**AquaFo(A)rming a new center of production
in the borders of Gothenburg and Partille**

Acknowledgements

I would like to thank

My supervisor Andreas Olsson, for his valuable guidance and productive meetings, his sharp advice and interest on the project, throughout the semester.

The team of SUDes for supporting diversity, offering me the opportunity to be part of a program, with people of so many different professional and educational backgrounds.

Finally, Effie Stamopoulou for the endless support, motivation, help, advice and for always showing me a different perspective.

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January 2017



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ABSTRACT

Sweden has the reputation of being one of the most sustainable and innovative countries in the world, when it comes to environment-related technology. However, the ecological footprint rates indicate, that Swedes are currently living lifestyles that would require the equivalent of four Earth-like planets to sustain. Most carbon footprint emissions are closely connected to household activities, with transport and food accounting for more than 60% of total consumption. At the same time, Sweden is reliant to other countries for about 50% of her food imports. With an interconnected global economy, a population rising and a rapid urban growth, Sweden has to act as a leading example, minimize the risks and respond sufficiently to future challenges.

Gothenburg is the 2nd largest urban center and the country's biggest port that handles most import and export operations. The city is expected to double in size by 2035! The thesis suggests a new center of production in the borders of Gothenburg and Partile municipality. The location chosen on a strategic axis highlights the role of public transport and the importance of regional cooperation. The proposed system incorporates sustainability into all aspects, bringing household in the first place and using already known technologies (waste management) combined with aquaponics, it responds to a crucial issue, food production. The thesis seeks to bring sustainability on a new level, suggesting that the use of technologies can form the actual urban design.

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INTRODUCTION

Aims and Objectives

Sweden has the reputation of being one of the most sustainable and innovative countries in the world, however, the country ranks among the world's top 15 polluters for its citizens ecological footprint. How are these two contradictory statements related? Which are the elements that build up Sweden's sustainable profile and what are the main sources of the country's consumption footprint? Most importantly, how are they related to urban design?

Urban sprawl, population growth, environmental pollution, food and energy sufficiency are some of the most crucial challenges that urban designers have to face in the coming years. Any suggested solutions should take everything into account and try to respond to as many issues as possible. Sweden is deliberately chosen as a case study to show, that there are things we can learn from sustainably developed countries, things that can be improved and opportunities that should be investigated and tested.

Starting from a global perspective and scaling down to a site specific proposal, the thesis seeks to emphasize the interconnected relations and their importance to any future urban development. More specifically, the project tries to suggest new tools and alternatives to monocentric development, use of new technologies for environmental consideration, as well as to refine the roles of the different parties –citizens, municipalities, countries- when it comes to implementation of sustainability principles.

Toolbox and Methods

The thesis is divided into 4 chapters:

-Chapter 1 – the research

The first chapter provides research background on a global and national perspective. Sweden is one of the most sustainable and innovative countries in the world, but has a large consumption footprint based mainly on food and transport needs. At the same time agriculture activities are limited and the country relies to other countries for more than 50% of her food sufficiency. Sweden needs to find alternatives to food production, and aquaponics systems are one of the most recent and effective new technologies to do so. The analysis presents the various types of aquaponics systems, the potential growing plants as well as their benefits compared to traditional farming.

-Chapter 2 – the region and the site

Moving down to the regional scale the chapter explains Gothenburg's strategic location to national transactions. Being the second largest center of Sweden the region is expected to double in size by 2035. The thesis questions the municipality's existing plans on further enhancing the existing center and suggests an alternative development on a strategic axis. A specific area on the axis is chosen as the site for the detailed design and the prototype for the new proposed system. Finally the chapter includes an analysis of the ex-

isting site describing its main qualities and characteristics, as well as its future role for the region.

-Chapter 3 – the project

In chapter three the suggested site development is presented step by step to the overall masterplan. More specifically, the toolbox and methods used to define the new design, the separate layers and elements of the proposal, the different typologies of built structures and open spaces, the infrastructure and how they work together. Moreover, in order to have a better understanding of the new area the project focuses in two key areas, presenting analytical plans and sections, perspective views and 3d illustrations that show the special qualities and the atmosphere and feeling of the new proposed center.

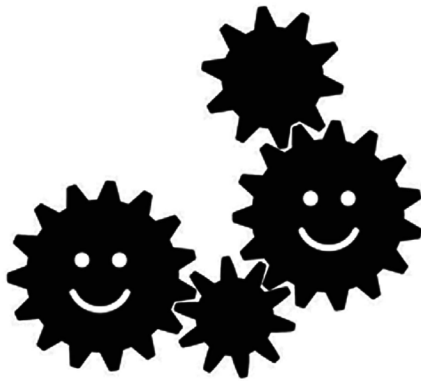
-Chapter 4 – the conclusions

Finally the last chapter presents the possibilities of the new area and how much the system can support, in terms of housing and job opportunities, production and energy efficiency as well as its contribution to the regional context of Gothenburg. The thesis is concluded with some further thoughts on urban sustainability and future prospective.

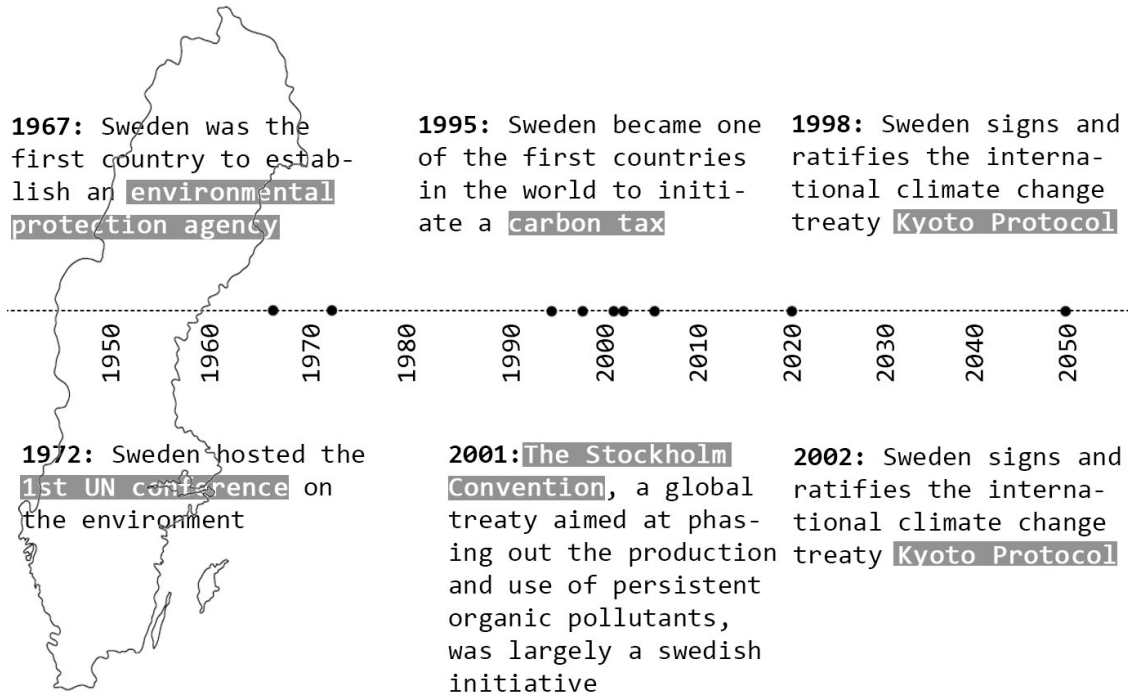
the research



Sustainable Sweden...



1. HISTORICAL FACTS



1.1 Sustainable Sweden

a. Historical Facts

Sweden first attempts to sustainability started in the 1960s and 1970s. After noticing a decrease of natural resources the country invested in long-term environment consideration and challenged the global status once and for all. Here are some of the most important facts regarding Sweden's sustainable profile:

1967: Sweden was the first nation to establish an environmental protection agency.

1972: It hosted the first UN conference on the environment, which led to the creation of the United

Nations Environment Program (UNEP).

2001: The Stockholm Convention (2001), was another important Swedish initiative. The treaty aimed at reducing persistent organic pollutants during the production.

1998 and 2002: Sweden signed and ratified the Kyoto Protocol twice, a global treaty focused on climate change.

Waste management, energy efficiency and sustainable urban planning have made Sweden a leading example to environment related technologies and a powerful inspiration on climate change efforts (Sweden tackles climate change, 2017, www.sweden.se).

2. CITIZENS ENGAGEMENT

b. Citizens engagement

The country's sustainable profile derives significantly from a public that is aware of climate change, engaged in environmental issues, and always focuses on further improvement. The Standard Eurobarometer survey, held in 2015, reveals that one out of five Swedes consider climate change and environment as an important issue, compared with only 6 per cent of citizens at EU level.

Although, Sweden ranks amongst the first places on many international sustainability indices, the country always strives to take the next step, increase the efforts and set new goals. (Sweden tackles climate change, 2017, www.sweden.se).

c. Roadmap 2050

The goals set by the government focus on reducing greenhouse gas emissions, increasing energy efficiency and turning into greener technologies and means of transportation.

Sweden is committed under Roadmap 2050. The program set by the EU, aims at an 80 per cent reduction in GHG emissions by 2050 for all EU, compared to 1990 levels. Sweden's goal is to reduce GHG emissions by 40 per cent by 2020, compared to 1990 levels and to have a vehicle fleet completely rid of fossil fuels by 2030 (Sweden tackles climate change, 2017, www.sweden.se). Sweden has made a progressive headway and is close to reaching that goal due to political incentives and government initiatives.



26% of Swedes

note environment and climate change as a main concern, compared with

vs...

6% per cent at **EU** level

Recent estimations are even more optimistic for the further future, finding that Sweden will be able to achieve the goal of 80 per cent reduction, by 2050. In order for that to be realized, more measures need to be taken regarding, not only the heavy industries and large organizations, but also households and individuals consumption behavior. International solidarity is key to implementation, knowledge distribution and general motivation.

3. ROADMAP 2050



VS...



Sweden's goals:
reduce GHG emissions
compared with 1990 by
40% by the year 2020

have a vehicle fleet
completely **rid of**
fossil fuels by 2030

no net GHG emissions
by the year 2050

EU goals:
reduce GHG emissions
by at least **80%** below
1990 levels for all
of EU.

d. Energy efficiency

Sweden is a leading example when it comes to energy efficiency. 52 per cent of the country's energy production comes from renewable sources. 95 per cent of this comes from hydropower and the rest from wind, solar and biofuels energy. At the same time 99 per cent of Sweden's waste is recycled and only 1 per cent is going to landfill. 50 per cent of the waste is recycled and 50 per cent of it is incinerated. Energy efficiency has been a high priority for Sweden. By 2020 the government

goal is to make energy use 20 per cent more effective compared to 2008.

To achieve that the country introduced several interconnected moves. In 2005, power intensive industries were offered tax reliefs, in order to implement energy-effective policies. Moreover, information on how to save energy is widely available to citizens throughout the country. Each municipality - there are 290 in total- has an advisor to whom people can turn for guidance on topics such as replacing windows, using low-energy lights applying different heating systems etc. (Sweden tackles climate change, 2017, www.sweden.se).

4. ENERGY EFFICIENCY



52%
of Sweden's energy
production comes from
renewable sources



99%
of Sweden's waste is recycled
50% of it is recycled and
50% incinerated



95%
of this comes from **hy-**
dropower. The rest
comes from **wind, solar**
and **biofuels** energy



1%
of Sweden's waste
is going to **lanfill**

e. Research and innovation

Taking sustainability seriously, Sweden invests to environment-related technology. Expenditure on R&D (research and development) represented 3.3 per cent of GDP in 2013, which is the fourth highest percentage in the OECD (Organization for Economic Co-operation and Development).

Investments in environmental R&D have resulted to a number of sustainable solutions and made Sweden a forerunner for several clean energy technologies, including biofuels, smart grids and carbon capture and storage. As a result, the country has continuously ranked among the top five positions in Global Cleantech Innovation Index for the last years, being the second most innovative country in the world, after Switzerland, in 2016.

Finally, there is a significant amount of sustainability and environmental protection related organizations, such as the Swedish environmental protection agency, the Stockholm's resilience center, Vinnova, the Swedish energy agency etc. (Sweden tackles climate change, 2017, www.sweden.se).

VINNOVA

A government agency set up to develop Sweden's innovation capacity for sustainable growth (SEK 2.7 billion/year)

THE SWEDISH ENERGY AGENCY

A government agency that works for the use of renewable energy, improved technologies, a smarter end-use of energy, etc.

STOCKHOLM'S RESILIENCE CENTER

International center for research into governance of social-ecological systems

5. RESEARCH AND INNOVATION



Expenditure on **R&D** (research and development) represented 3.3% of GDP in 2013, the **fourth highest percentage** in the OECD.



World's most innovative countries

Based on 2016 Global Innovation Index

1. Switzerland
2. Sweden
3. United Kindom
4. United States
5. Finland
6. Singapore
7. Ireland
8. Denmark
9. Netherlands
10. Germany

6. HAMMARBY SJÖSTAD, STOCKHOLM, SWEDEN



Former industrial area **Hammarby Sjöstad, Stockholm** turns into a sustainable neighbourhood from smart electric grids to public transport, bike friendliness and waste management.

e. Urban design

Sweden has been an inspire to sustainable city planning with a number of built examples to prove it.

Stockholm

One area first turned into a sustainable urban planning example was Hammarby, Stockholm, in the mid-1990s. Different technologies and initiatives from smart electric grids to public transport, bike friendliness and waste management, were implemented to the former industrial site, celebrating sustainability in all levels (Sweden tackles climate change, 2017, www.sweden.se).

7. VÄSTRA HAMNEN MALMÖ, SWEDEN



västra hamnen, malmö is a carbon-neutral neighbourhood, uses water management and wind powered systems for thermal energy needs of buildings, throughout the year.

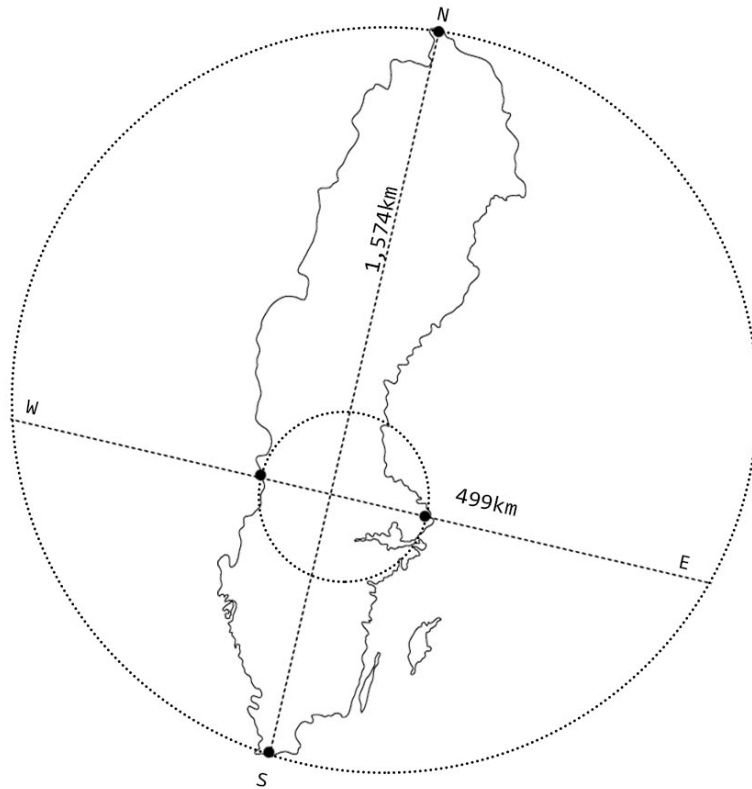
Malmö

A similar area called Västra hamnen (Western Harbour) in Malmö was regenerated in 2001. The former deteriorating site was turned into a carbon-neutral neighborhood, incorporating different techniques and sustainability systems. An aquifer thermal energy storage system uses collected water for thermal needs of households during the year. The chilled water is used for cooling purposes during summer and pumped up with wind energy for heating purposes during winter. These are only some of the most important facts and examples demonstrating Sweden's sustainability achievements and engagement (Sweden tackles climate change, 2017, www.sweden.se)

Un-Sustainable Sweden...



8. SIZE AND CLIMATE



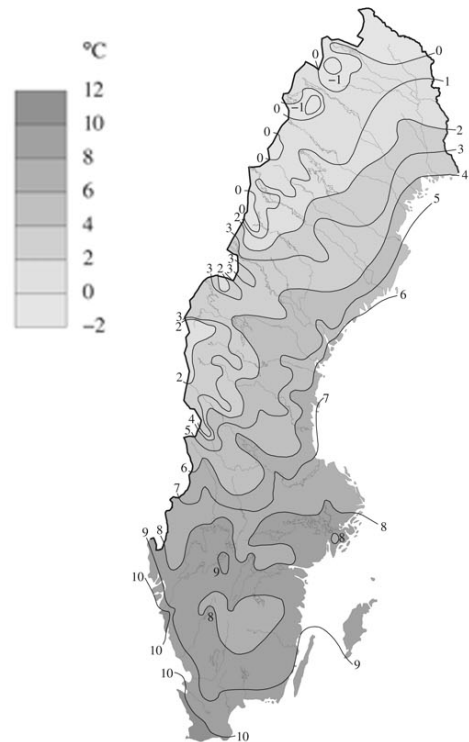
3rd largest country in EU (450,295km)

Longest distances:

1,574 kilometers (978 miles) from north to south, **499 kilometers** (310 miles) from east to west

Land boundaries:

2,205 kilometers (1,370 miles) total boundary length



Average Temperatures

Sweden's climate and topography conditions are restrictive for agriculture purposes

9. AGRICULTURE IN SWEDEN



56% forrest

7% of swedish **land is cultivat-**
ed, mostly in southern plains, where
growing season is **100 days longer**
than Norland



-3.5%
arable land has decreased
since 2000



mineral fertilizers and plant
protection products have yielded
larger harvests, **BUT**
have also caused environmental
hazard

1.2 Un-Sustainable Sweden

a. Climate and Topography

Sweden is quite a large country! At, approximately, 450 square kilometers (449,964 km²) Sweden is the 3rd largest country in the European Union by area, the 4th-largest country entirely in Europe, and the largest in Northern Europe.

Most of Sweden has a temperate climate, with largely four distinct seasons and mild temperatures throughout the year. The country can be divided into three climate zones: the southernmost part has an oceanic climate, the central part has a humid continental climate and the northernmost part has a subarctic climate. Sweden is much warmer and drier than other places at similar latitude, mainly because of the combination of the Gulf Stream and the general west wind drift.

However, because of its high latitude and large size the length of daylight varies greatly from north to south. Due to different soils and different climate zones, most part of land are more suitable for forestry instead of agriculture. In fact 56 per cent of the land is dedicated to forestry, 1.5 per cent to pasture and only 7 per cent of it is used for farming. Most of this is in the southern plains, where growing season is 100 days longer than Norland. As an inevitable process, arable land is continuously decreasing, specifically with a 3.5 per cent decrease since 2000. At the same time mineral fertilizers and plant protection products have yielded larger harvest, but have also caused increasing environmental hazards (www.scb.se, 2017).

b. Ecological footprint - Food and transport

The size, the climate and the topography of the country indicate the need for transportation and import of food products. Indeed, looking at Sweden's consumption footprint we get a revealing picture of the above sentence. 61 per cent of total consumption footprint refers to food and transport needs, while 39 per cent to the rest of consumption including goods, accommodation and services. In fact food holds the first position causing 32% of consumption footprint, leaving the second place to transport needs that are responsible for 29% of consumption footprint (WWF, 2016).

Emission of carbon dioxide and other greenhouse gases is one of the foremost global environment problems causing climate change today. Since Sweden accounts for less than 0.2 per cent of total global emissions, the country could easily have gone unnoticed in the climate debate (Sweden tackles climate change, 2017, www.sweden.se).

However, the ecological footprint results per country, are far from encouraging and definitely not to be gone unnoticed. The recently published Living Planet Report, produced by the WWF (World Wildlife Fund) -one of the largest scientific studies looking at humans impact on Earth- lists Sweden among the world's top ten polluters, together with well known polluters such as the USA, Canada or Middle East oil producing countries. The report suggests that Swedes are currently living lifestyles that would require the equivalent of four Earths-like planets to sustain. According to the study, Sweden consumes the equivalent of 6.5

10. FOOD TRANSPORTATION



Need for **transportation**
and **import** of food products

global hectares per capita, (for perspective, nearby Germany consumes 5.3, Tanzania consumes 1.3, and the USA consumes 8.2), when the available biocapacity per person based on our planet resources is only 1.7 global hectares! (Sweden's consumption footprint among the worst, 2016, www.thelocal.se).

A nation's total Ecological Footprint, includes the area needed to produce the materials a country consumes, and the area needed to absorb its carbon dioxide emissions. The ecological footprint per capita is a nation's total Ecological Footprint divided by the total population of the nation (www.footprintnetwork.org). That is to say, that the small percentage Sweden holds in total global emissions is only based on the country's low density of population and not on the consumption behavior itself.

Although someone would assume that the vehicles industries, as a big part of Sweden's economy, are mainly responsible for the consumption footprint that is not totally accurate, today. Thanks

11. CONSUMPTION FOOTPRINT

32% Food



29% Transport



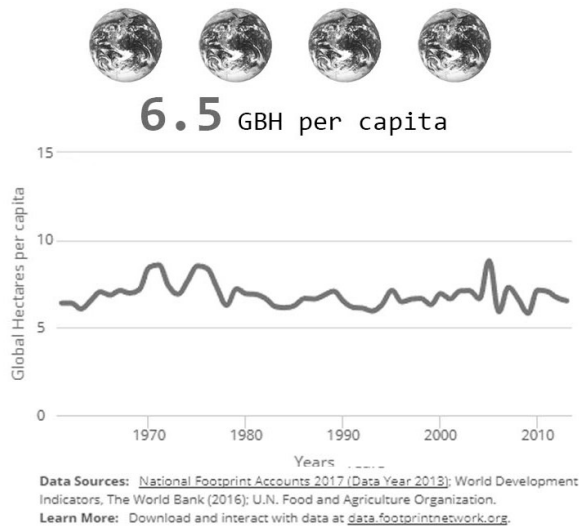
18% Goods 12% Accomodation 9%

both to developments in the economy and to political incentives (such as tax reliefs or long-term planning), industries implemented low emissions regulations and see environmental adaptation as an economic opportunity. It is the very consumers themselves that have to change their habits.

c. Population rising

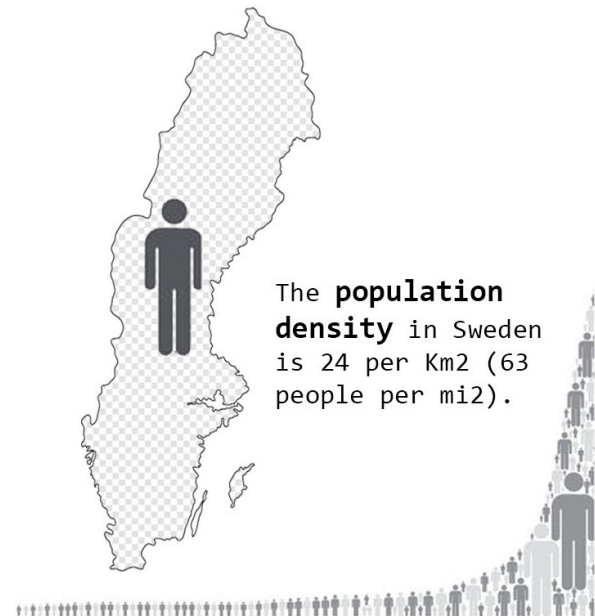
As any other country Sweden is expecting a growth of urban population in the next few years. By 2050 two thirds of the world's population will live in cities, according to the UN. Climate change and growth of population are real challenges that we must face in the future, and Sweden could inspire, in sustainability solutions. However, being part of a globalized economy, it is important to minimize the effect of interconnected relations and reliance to external factors.

12. ECOLOGICAL FOOTPRINT



The Ecological Footprint per capita is a nation's total Ecological Footprint divided by the total population of the nation. **The available biocapacity per person based on our planet resources, which is currently 1.7 global hectares.**

13. RISE OF POPULATION



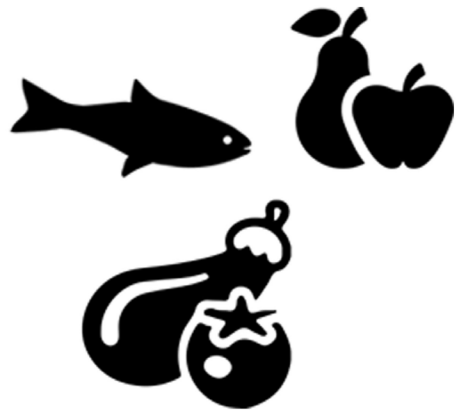
10.000.000 people in 2017

85.4% urban population

12.800.000 people in 2060

92.7% urban population

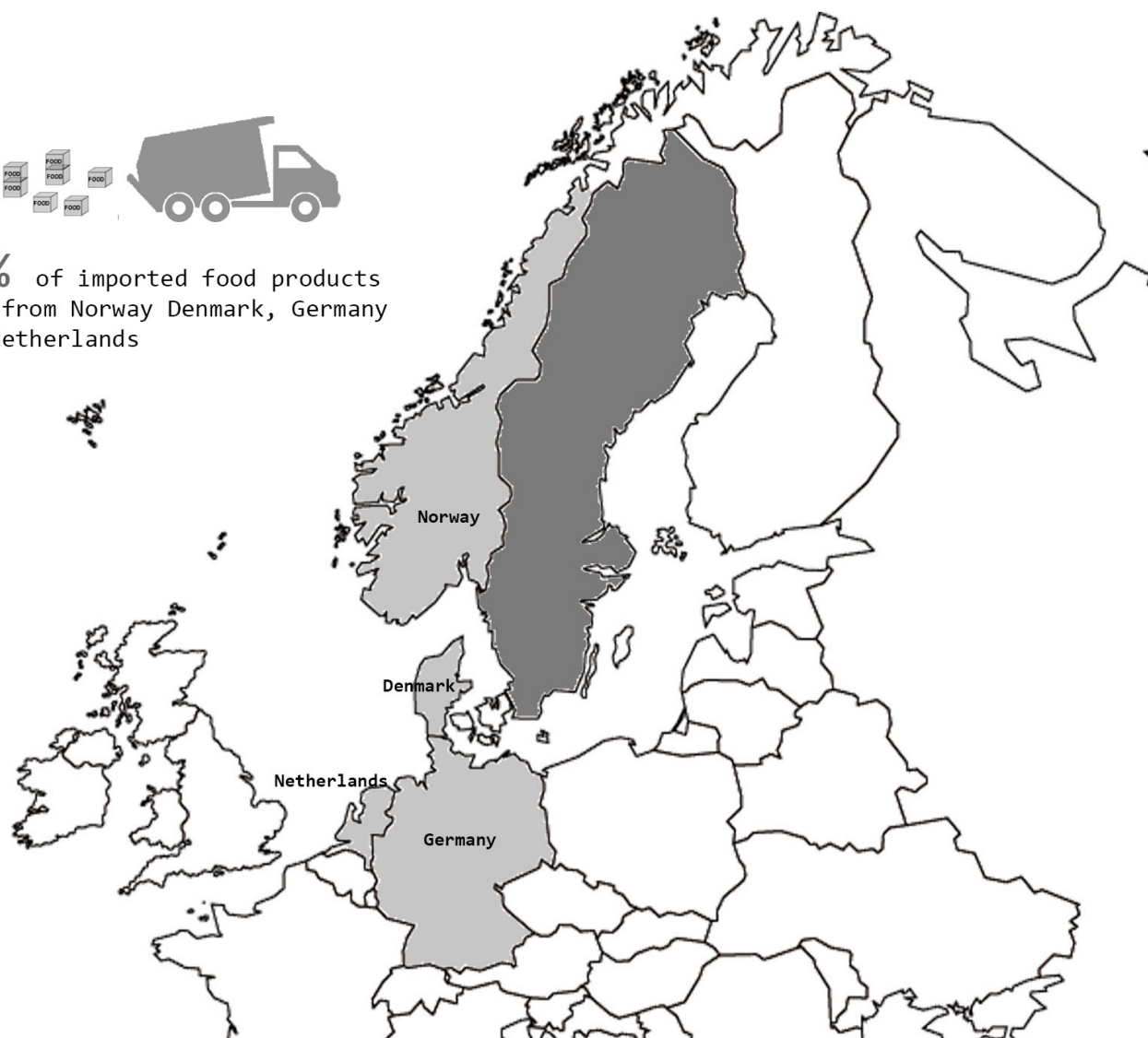
Food Imports...



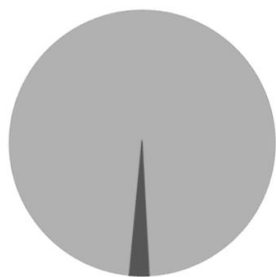
14. MAIN COUNTRIES OF FOOD IMPORTS



65% of imported food products come from Norway, Denmark, Germany and Netherlands



15. GDP AND AGRICULTURE IN SWEDEN



2%

of swedish GDP is
based on agriculture

1.3 Food imports

Only 2 per cent of Swedish GDP is based on agriculture. Sweden has a total degree of self-sufficiency of 45-50 per cent in food products (mainly meat, dairy products and cereals), meaning that 50-55 per cent is imported. Sweden imports almost twice as much food products as it exports.

As stated in the Market Report Food, published by Chamber Trade Sweden, 2015, the primary food imports are: 1) food that is not at all produced in the country (ex. Citrus fruits, nuts, green coffee, tea, cocoa, spices and wine) and 2) products which are produced during a part of the year (fish and seafood products, fresh vegetables and fresh fruits, sauce and dressings, ready to eat meals, certain canned, frozen and dried food, animal feed etc.). In fact "...Ranked by product groups, the two largest categories are fish and seafood products (24%) and fruit & vegetables (17%), whether fresh or processed. Other impor-

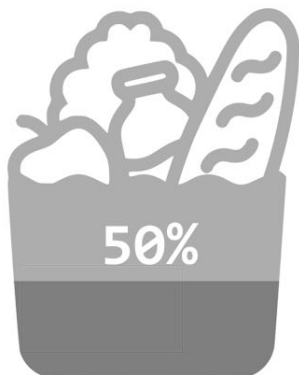
16. IMPORTS vs EXPORTS



Sweden imports almost **twice** as
much food products as it exports.

tant product groups are meat products and beverages, as well as cheese, chocolate and sugar confectionery, green coffee, oils & fats, and animal feed. Even though the market for meat products mainly is supplied by domestic production, it has in just a few years become the third largest import product group". About 70% of all food imports are normally imported from the European continent, while four countries account for about half of the total import value: Denmark, the Netherlands, Norway, and Germany. Gothenburg is the main gate of transactions to Sweden and generally to Scandinavia (Chamber Trade Sweden, 2016).

17. MAIN FOOD IMPORTS



Sweden has a total degree of self-sufficiency of **45-50%** in food products.
Sweden has to import **50-55%** of the food.



Sweden imports food that is not at all produced in the country or products which are produced during only part of the year.



24%
fish and seafood products

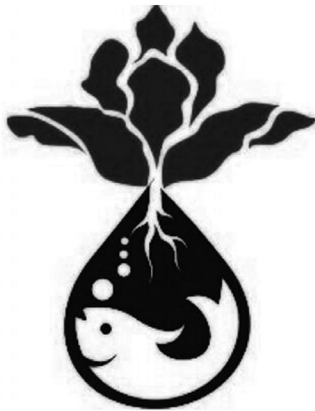


17%
fruit & vegetables
wether fresh or processed



3rd
meat and meat products

Aquaponics...



1.4 Aquaponics

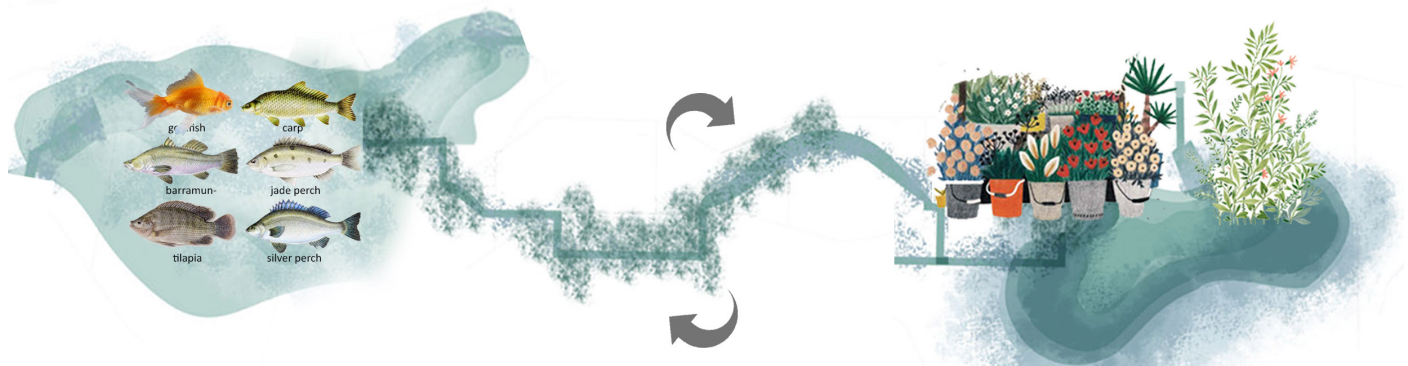
A new way for food production

a. How it works

Aquaponics is an alternative to traditional farming, a closed non-segregated system, which combines aquaculture (raising fish) and hydroponics (growing of plants without soil - in sand, gravel, or liquid). The waste of the aquatic animals becomes fertilizer for the plants and the plants in return naturally filter the water for the fish.

The aquatic effluent accumulated in the water tanks in high concentrations becomes toxic for the animals, but contains essential nutrients for the plants growth. The combination of the two systems is significantly more effective, when compared to either one of them separately, or to traditional agriculture. The benefits eliminate some of the most important drawbacks, such as water consumption, growth speed, topography and climate reliance, production variety throughout the year etc. (www.backyardaquaponics.com).

18. HOW THE AQUAPONICS WORK



FISH

The fish waste becomes fertilizer for the plants

- Deep water culture
- Media-based aquaponics
- Nutrient Film Technique (NFT)
- Vertical Aquaponics

PLANTS

plants in return naturally filter the water for the fish

- fruits and vegetables
- flowers
- tree plants
- biofuel plants

19. DEEP WATER CULTURE AQUAPONICS



20. MEDIA BASED AQUAPONICS



b.Types of growing systems

Depending on water circulation, plants arrangement and fish densities, there are 4 primary types of aquaponics widely in use today:

Deep water culture

(DWC) A raft is used as the base for the plants above a tank filled with fish effluent water. The plants are placed in holes on the foam raft surface and have their roots fully floating in the nutrient-rich water. This method is considered as one of the simplest, because it provides fast growing with low maintenance and is more effective for green salads plants and large scale commercial use (www.backyardaquaponics.com).

Media-based aquaponics

Media based aquaponics is the opposite of deep water culture. The plants roots are anchored to some kind of media instead of floating freely in the water. There are different types of media used, such as expanded clay pellets, shale, or gravel. This technique is more suitable for large fruiting varieties and requires a longer growing period for the plants to mature. Consequently, this system can be better used for hobby or house purposes, rather than commercial large-scale production. One important benefit is that media breaks down the solid waste and eliminates the need for additional buffering filter (www.backyardaquaponics.com).

21. VERTICAL AQUAPONICS



Vertical Aquaponics

Vertical aquaponics is one of the most efficient ways of aquaponics growing systems, in terms of cost, productivity and labor. Plants are placed in tower systems, such as the AquaVertica shown in the picture, ensuring large yield quantities by using the minimum possible space. This method requires a sufficient structure system that can carry the plants and ensure adequate light from top to bottom. Therefore, is more appropriate for leafy green, strawberries and other crops that do not need big support. The arrangement of plants in towers simplifies the labor procedure and it's convenient for maintenance (www.backyardaquaponics.com).

22. NUTRIENT FILM TECHNIQUE (NTF)



Nutrient Film Technique (NTF)

In NTF plants are placed in horizontal pipes, while their roots freely float and absorb the water circulating inside the gutters. This method is also space effective, because growing pipes can be hanged from ceilings in different heights, offering larger production quantities. It can better work with plants that require little support, instead of heavy-roots invasive plants (www.theaquaponicsource.com).

SEASONAL PLANTING GUIDE

23.

Winter

NH: December, January, February SH: June, July, August

Asparagus
Beetroot
Broccoli
Brussels Sprouts
Cabbage
Cauliflower

Endive
Horseradish
Kale
Kohlrabi
Lettuce
Onions

Parsley
Parsnips
Peas
Radish
Rhubarb
Shallots

Spinach
Swiss Chard
Turnips



24.

Spring

NH: March, April, May SH: September, October, November

Artichoke
Beans
Cantaloupe
Carrots
Collards
Corn
Cucumber
Eggplant

Garlic
Herbs
Kale
Kohlrabi
Leeks
Lettuce
Melons
Mustard Greens

Okra
Onions
Parsley
Parsnips
Peanuts
Potatoes
Pumpkins
Radish

Spinach
Squash
Strawberries
Swiss Chard
Turnips
Tomatoes
Watermelon
Zucchini



25.

Summer

NH: June, July, August

SH: December, January, February

Beans
Chard
Corn
Garlic

Herbs
Lettuce
Mustard Greens
Onions

Okra
Peppers/Capsicum
Spinach
Radish

Squash
Tomatoes



26.

Autumn/Fall

NH: September, October, November

SH: March, April, May

Beetroot
Bok Choy
Broccoli
Brussels Sprouts
Cabbage
Carrots

Cauliflower
Celery
Endive
Garlic
Kale
Kohlrabi

Lettuce
Mustard
Onions
Parsley
Peas
Radish

Spinach
Sugar Peas
Swiss Chard
Turnips



c.Plants that can be grown in various aquaponics

Different types of plants can grow in different types of aquaponics, depending on maturity and stocking density of the fish and plants. These factors influence the concentration of the fish effluent, and subsequently the quantity of nutrients that are made available to the plants roots.

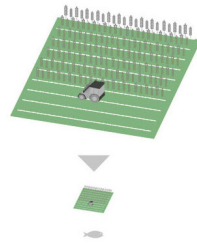
One can grow almost any kind of plant in aquaponics system either for personal or commercial use, as long as they use the appropriate type and ensure a continuous production. Not all plants should be cutout at the same time, due to the need for nutrients to be absorbed and water to be filtered for the fish to survive. Moreover, although different systems can achieve almost any plant production is difficult to combine all of them at once. The various systems require different space capacity, multiple temperature and light conditions, little or much maintenance, are less or more expensive. It is important to clarify whether the goal is personal use, profitable production or research purposes.

Some of the most common plants grown in aquaponics include: 1) Salad varieties and home used plants such as cucumbers, shallots, lettuce, tomatoes, chiles, capsicum, red salad onions, and snow peas, 2) green leaf plants and herbs such as watercress, basil, coriander, parsley, lemongrass, and sage, 3) vegetables, such as beans, cauliflower, cabbage, carrots, broccoli, bell peppers and eggplant as well as 4) high nutrients and space demands fruit trees. (www.backyardaquaponics.com).

d.Aquaponics benefits vs Traditional farming

As presented in a relevant research project called *Regen Village*, by Effekt architects, Copenhagen, 2016, aquaponics systems accumulate significant benefits, when compared to traditional farming. As stated in their published diagrams an excessive amount of land and water is used for agriculture purposes all over the planet. The numbers are revealing for the environmental impact farming causes to natural resources. Deforestation, clean water shortage and loss of biodiversity are only some of the factors contributing to climate change. At the same time, consumption of products causes an additional footprint to the farming itself. Not only a significant amount of food is wasted every year, but the transportation needs increase the GHG emissions. Current urban challenges such as population growth and bigger demand for food are calling for food alternatives and smarter solutions

Aquaponics seem to eliminate most of the drawbacks mentioned above. Using aquaponics systems we can decrease both land and water use producing significantly more food in shorter time, compared to traditional farming. Not only the food is 100 per cent organic, but a great variety of products can be achieved regardless geography or climate conditions. This means that aquaponics eliminate the need for transportation and thus the total ecological footprint caused by traditional agriculture. (Effekt architects, 2016, *Regen Village*, www.oeffekt.dk)



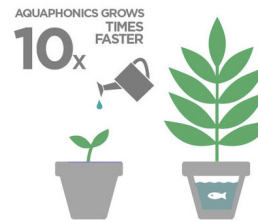
Using aquaponic farming systems we can decrease land use by **98%**



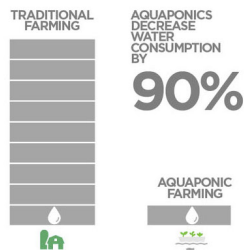
...freeing up space for biodiversity and permaculture



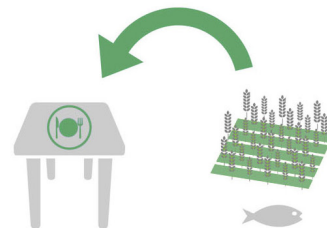
Aquaponics facilitates a more efficient and a **100%** organic production



Aquaponics have the capacity to increase yield **tenfold** compared to terrestrial farming-**in the exact footprint**



At the same time decreasing water consumption by **90%**



... and eliminating transportation by enabling farm-to-table

...vs TRADITIONAL FARMING



42% of Earth's land surface area is used for farmland



Farming is the single and most powerful driver of deforestation and loss of biodiversity



One third or **1.3 billion** tons of the world food is wasted every year...



On average vegetables travel **2.400km** from farm to consumer, causing an extra **12%** emissions prior to consumption



...the equivalent of the size of Africa AND South America combined

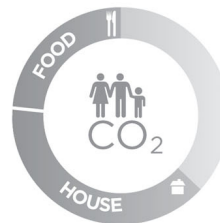


70% of global water consumption is used for farming, causing rivers and lakes to dry up

1 IN 7 PEOPLE IN THE WORLD SUFFERS FROM HUNGER



One in seven or **842 million** people are starving. This makes hunger and malnourishment the single greatest threat to health worldwide



Meanwhile, 66% of our environmental impact is directly related to home activities, consumption of energy and food ingestion

the region and the site



Gothenburg...



2.1 Gothenburg

a. The port as a strategic location

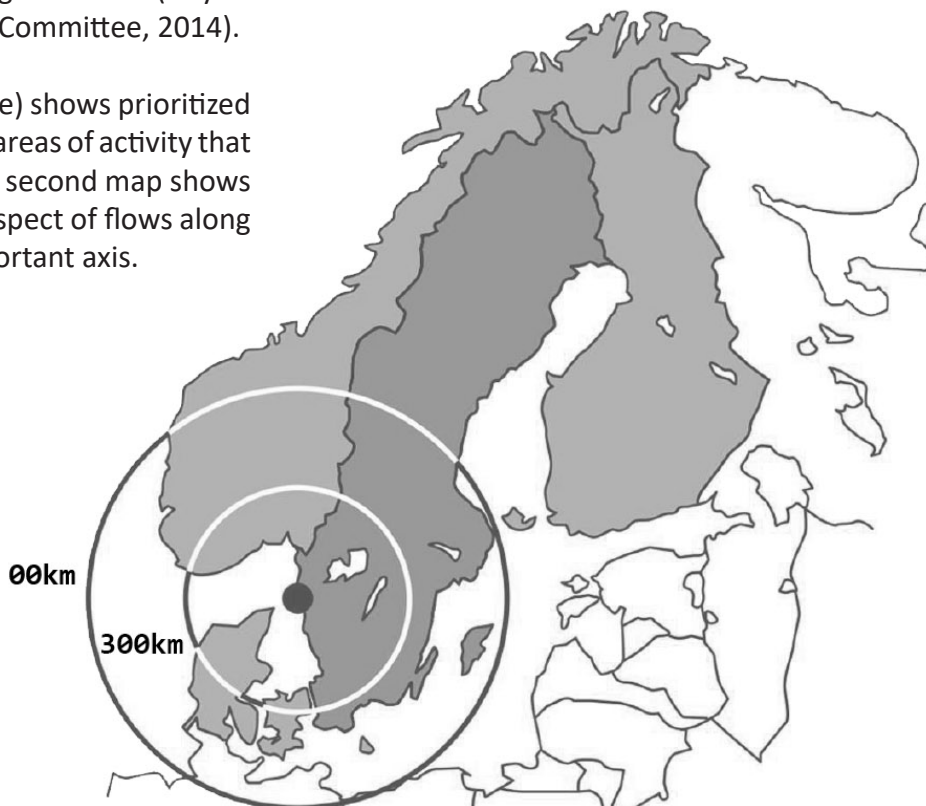
Gothenburg is the main gate of transactions to Sweden and generally to Scandinavia. Half of the industrial capacity in Scandinavia is located within 300km radius of Gothenburg- if the radius is extended to 500km, it includes 70 per cent of Scandinavia's industrial capacity. There has been a big discussion about a high speed train what will connect Copenhagen, Stockholm and Oslo through Gothenburg. This is due to the fact that Gothenburg is in a very strategic location (City of Gothenburg, Urban Transport Committee, 2014).

The first map (next page) shows prioritized main routes for goods and the areas of activity that generate most transports. The second map shows approximate proportions in respect of flows along corridors. So this is a very important axis.

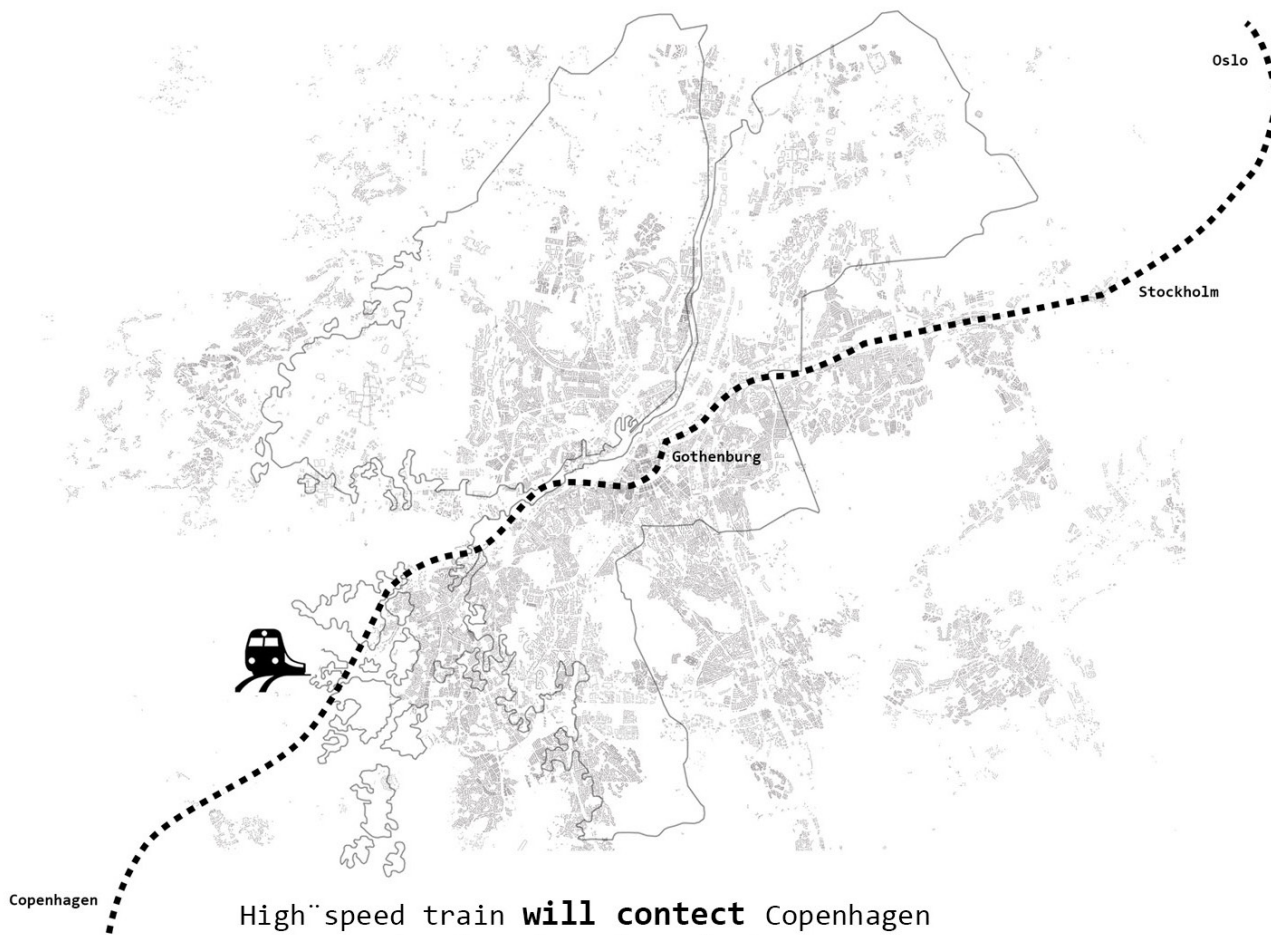
28. INDUSTRIAL CAPACITY

50% of the industrial capacity in Scandinavia is located within **300km** of Gothenburg

70% of the industrial capacity in Scandinavia is located within **500km** of Gothenburg

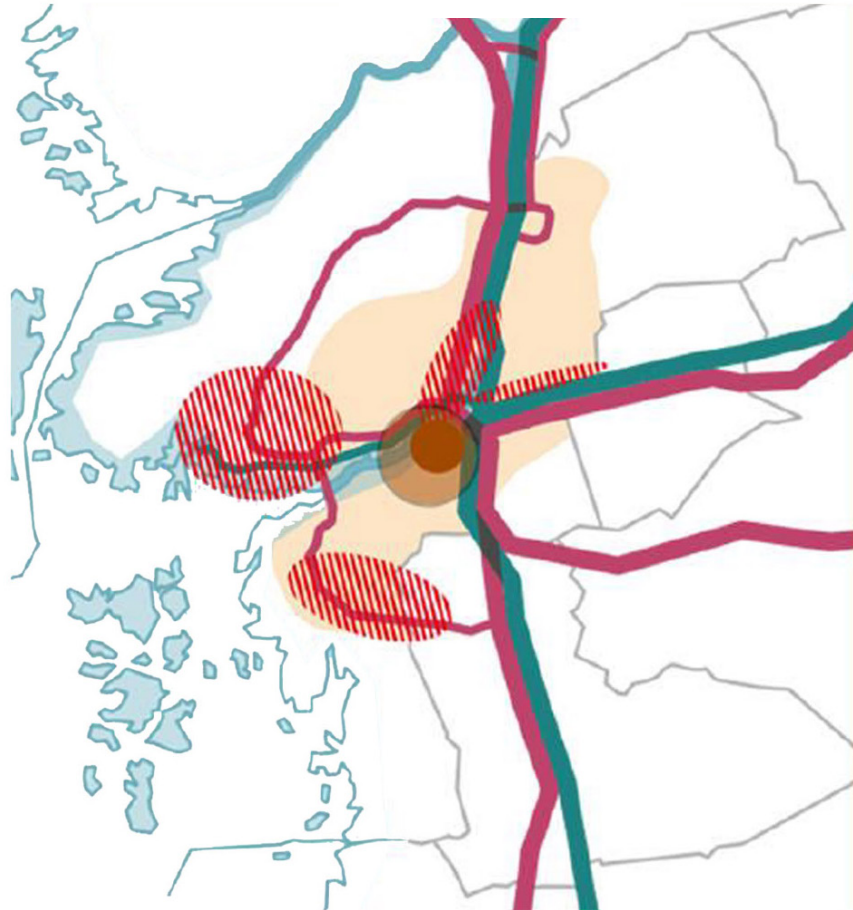


29. FUTURE HIGH SPEED TRAIN



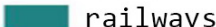


High speed train **will connect** Copenhagen and Oslo, through Gothenburg

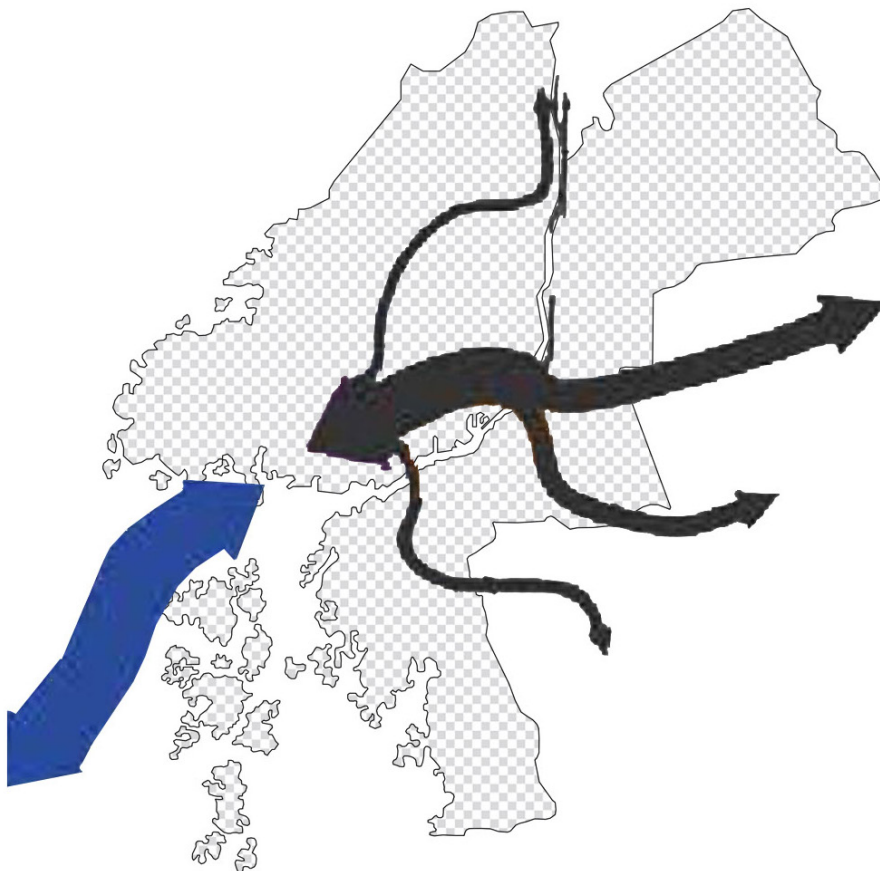
30. MAIN ROUTES FOR GOODS



the image shows prioritised **main routes for goods** and the areas of activity that generate most transports

-  goods generating or goods consuming activities
-  roads
-  railways

31. TRANSPORT OF GOODS



transport of goods to the port by road, and
approximate **proportions** in respect of **flows** of
trucks along corridors

 on sea  by land

b.Rivercity 2035 - Regional Plan

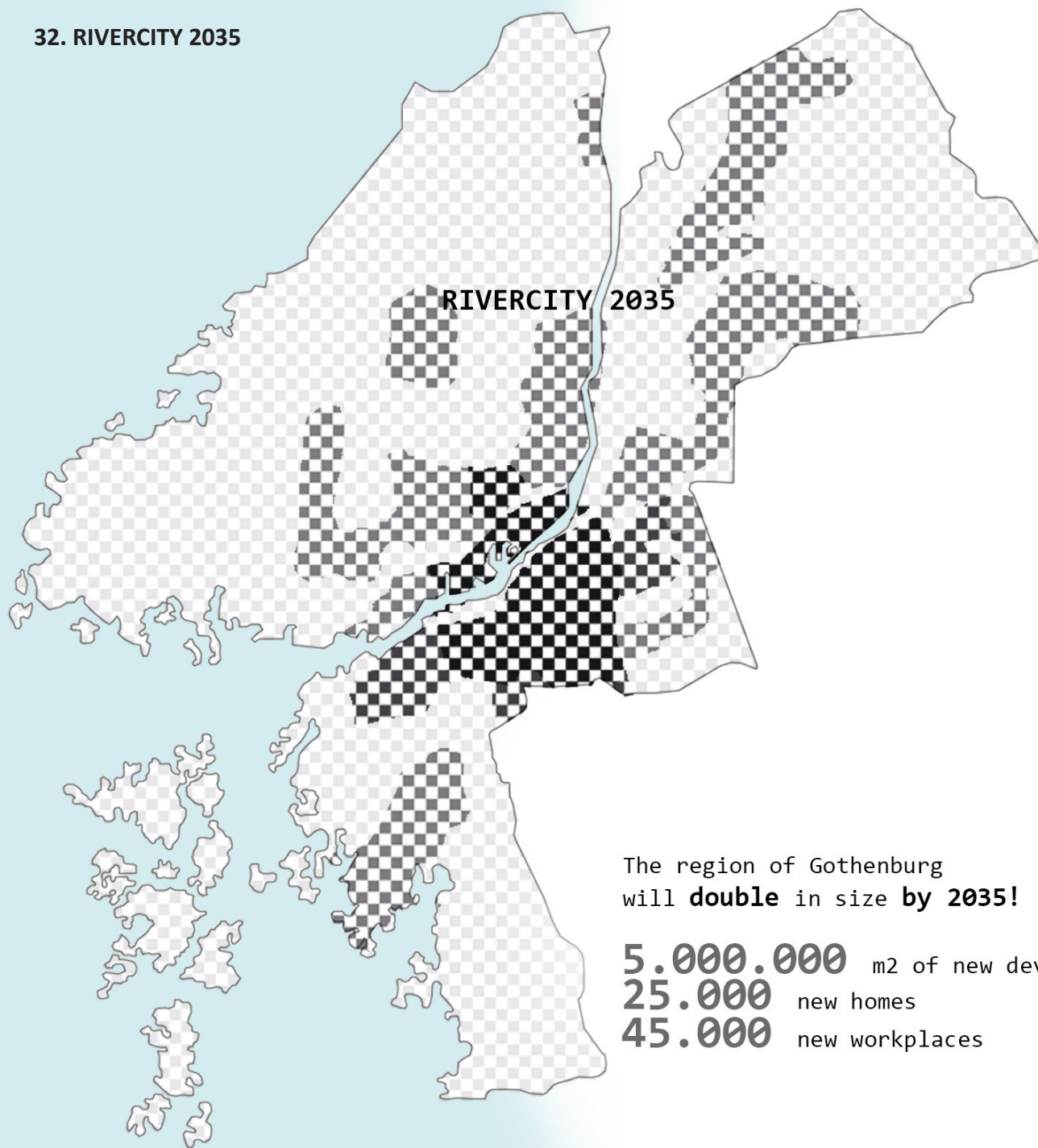
Gothenburg is the second largest city in Sweden and one of the biggest urban centers who will have to deal with the upcoming challenges. The city is expected to double in size by 2035!

Five million m² of new development, 25.000 new homes and 45.000 new workplaces are already introduced as part of the regional development plan, called Rivercity 2035. The plan focuses on the center of Gothenburg and spreads outwards to the region. The primary goal is to densify what already exists and what is already well connected.

The vision has three main strategies – Connect the city, Embrace the water and Reinforce the center. The proposed development is spanning on both sides of the river. By 2030, 10 new areas will be built according to detailed plans that the city has decided. On a second phase, other areas in the region have been marked as potential nodes and might be strengthened in the future. However, there are no detailed plans for those yet (City of Gothenburg, Planning and Building Authority, 2014).

At the same time a lot of thoughts have been made on the natural elements surrounding the city, the existing transport infrastructure and their relation to the urban fabric. These elements reveal that the city is focused on the center, while infrastructure intersects the surrounding landscape splitting the urban development in several parts. Gothenburg 's goal is to preserve these green and blue stripes, connect them with each other and “bring” them to the center (City of Gothenburg, Park and Nature Committee, 2014).

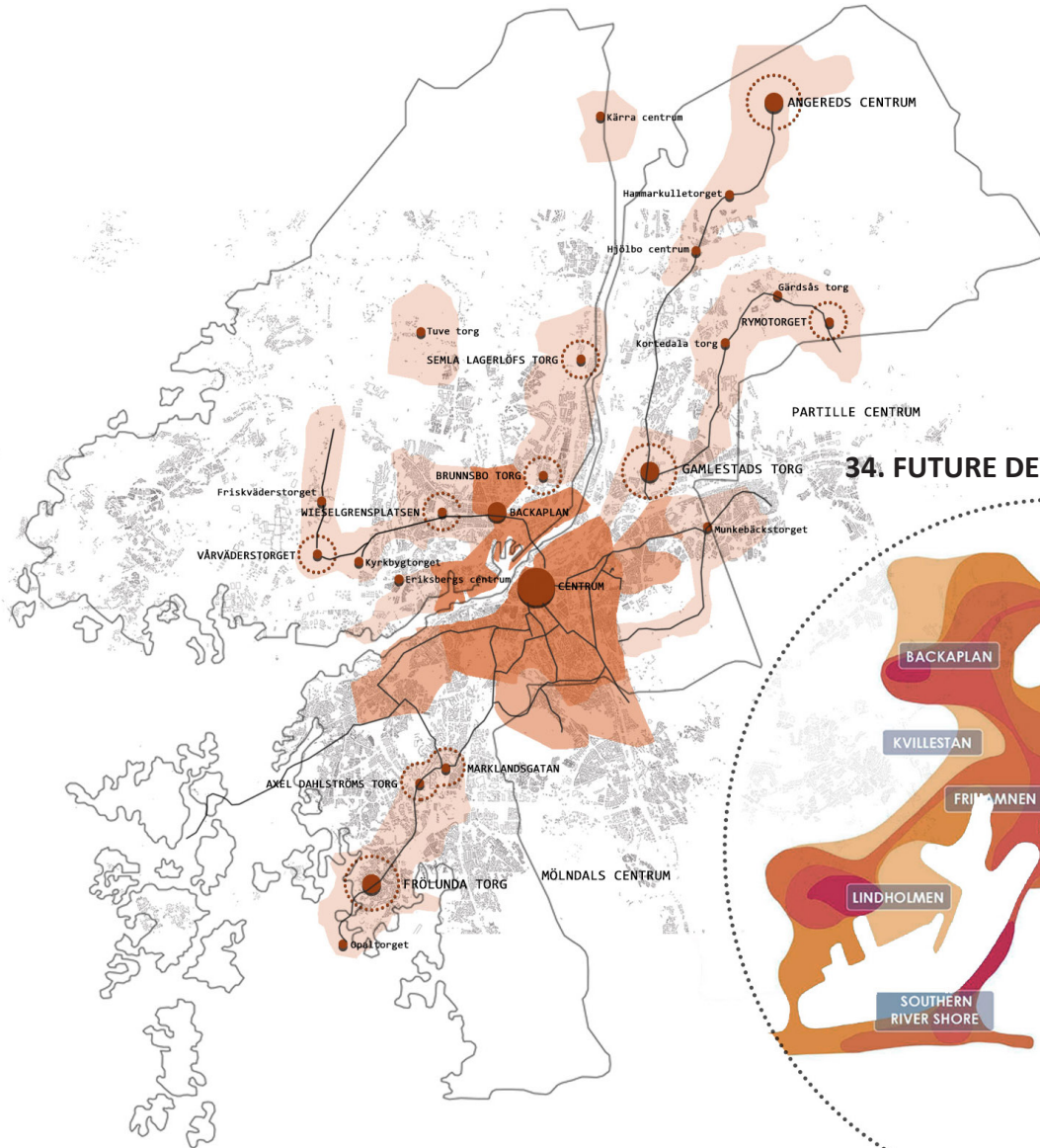
32. RIVERCITY 2035



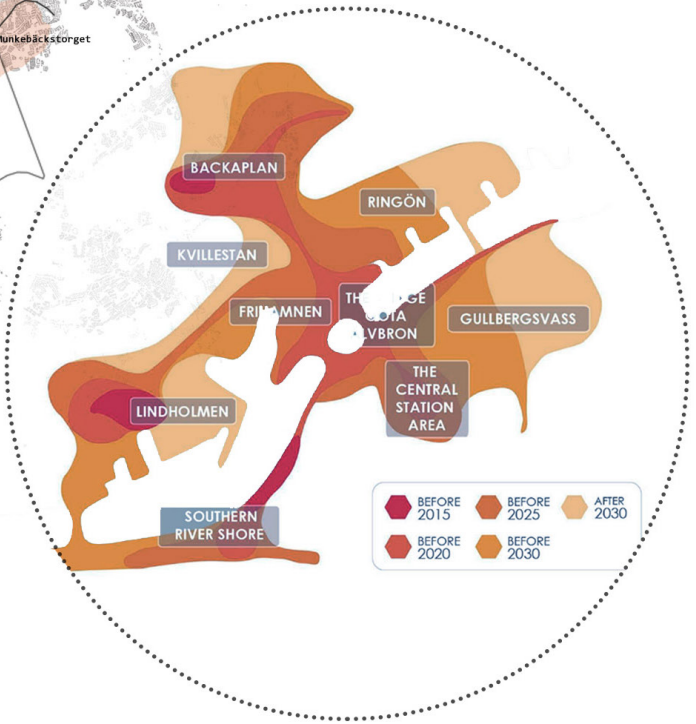
The region of Gothenburg
will **double** in size **by 2035!**

5.000.000 m² of new development
25.000 new homes
45.000 new workplaces

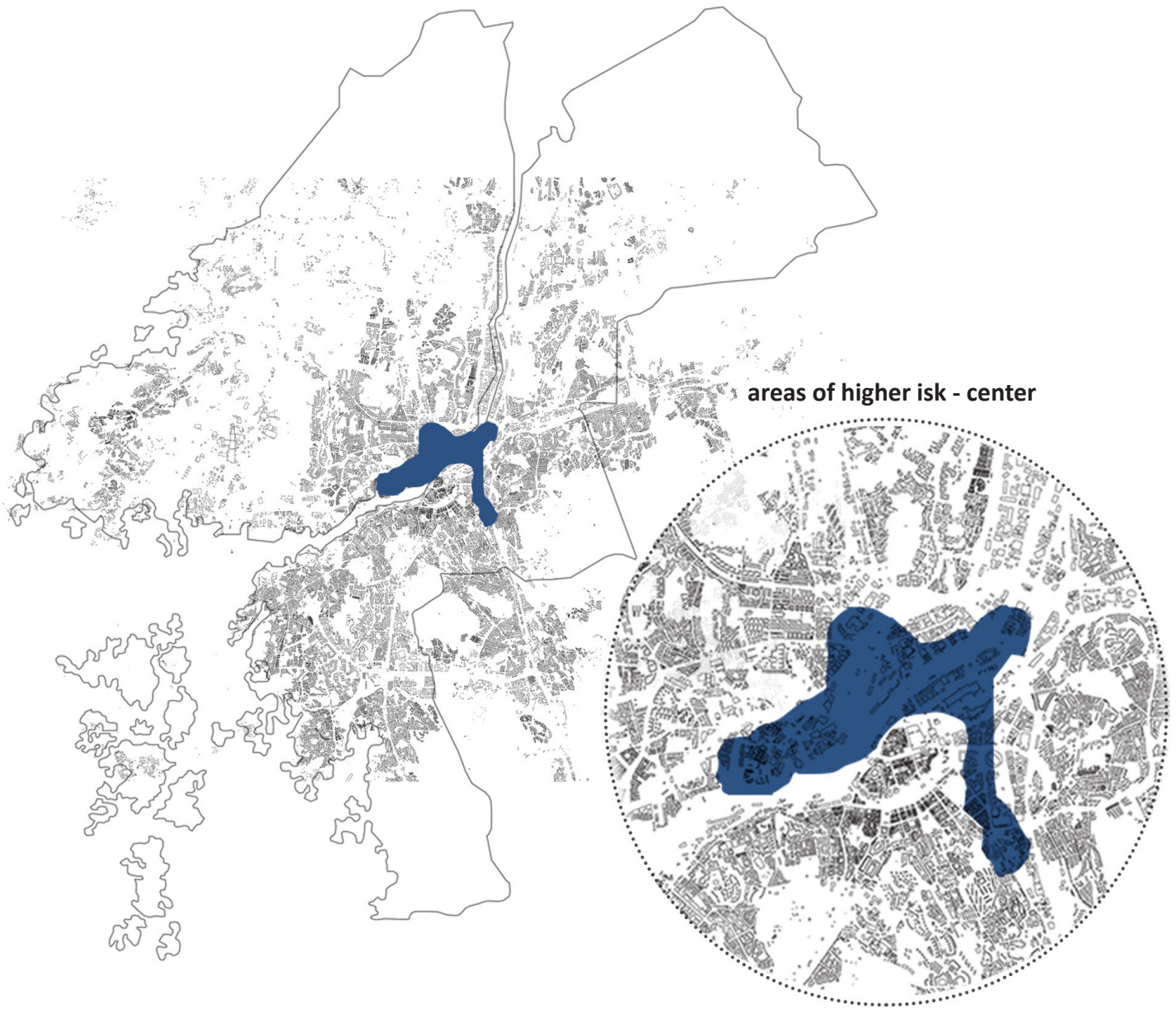
33. REGIONAL DEVELOPMENT PLAN



34. FUTURE DEVELOPMENT AREAS



35. AREAS IN RISK OF FLOODING



36. FUTURE AREAS OF DEVELOPMENT

1 THE SOUTHERN RIVER SHORE

The Southern river shore will be brought closer to the water through the quarters of Skeppsbron, Masthuggskajen and Stigberget. The Järntorget/Järnvågen hub will be the midpoint and link up the area. It will be complemented by a mixed range of commercial activities and uses. There will be further study of how the busy urban highway of Oskarsleden can be redesigned into an urban street.

2 THE CITY WITHIN THE MOAT

We should safeguard the mixed commercial activities and uses in the city within the moat and the rich range of events and pursuits. The Nordstan quarter will be developed towards Lilla Bommen and the Central Station area.

3 LINDHOLMEN

The Lindholmen quarter has an important role to play as a centre for the knowledge economy with collaboration within the media, the arts and academia. This role will be reinforced by building on existing clusters. Work and education in the area will be improved, but it will also be complemented by new homes. Lindholmen will be developed as a hub and will in time link Stigberget on the Southern shore to Hisingen through a public transport link.

4 RAMBERGET

The green area of Ramberget is of considerable value to the urban environment and will be better integrated into the rest of the city.

5 KVILLESTAN

The commercial activities in Kvillestaden will be safeguarded alongside the character of the residential area. The area will be linked to the Frihamnen and Backaplan quarters. How Lundbyleden and the port railway line will be directed underground will be the subject of further study.

6 BACKAPLAN

Backaplan will link the rest of Lundby to the Frihamnen and Brunnsbo quarters. The area will be developed as a dense mixed use hub. Retailing will continue to be developed. Backaplan will form part of the urban axis that will be created across the river to the Central Station area.

7 FRIHAMNEN

If the inner city is to expand across the river and link up the Kvillestaden, Backaplan, Lindholmen and Ringön quarters, Frihamnen will be strategically important. The area will be a hub comprising new workplaces, socially mixed housing and good public transport. The development will be dense and contain a mix of uses.

The Kvillebacken river will be channelled through Frihamnen to form a 'green corridor'. No freight ferries will be permitted here. The area will be linked to the city within the moat by means of a new bridge for pedestrians and cyclists between Frihamnen and the extension of Östra Hamngatan and Avenyn.

8 RINGÖN

At Ringön, various businesses currently exist side by side. This diversity will be utilised and reinforced. The area will be developed under its own power at the same time that scope will be created for industry – enterprises that are at the leading edge as well as enterprises that are more conventional. The range between the new enterprises at Frihamnen and the existing enterprises at Ringön is an important contributing factor in the development process. There will be old and new, expensive and less expensive. Alternative forms of housing, such as houseboats, will be accommodated at Ringön.

9 THE CENTRAL STATION AREA

The Southern river shore will be brought closer to the water through the quarters of Skeppsbron, Masthuggskajen and Stigberget. The Järntorget/Järnvågen hub will be the midpoint and link up the area. It will be complemented by a mixed range of commercial activities and uses.

There will be further study of how the busy urban highway of Oskarsleden can be redesigned into an urban street.

10 GULLBERGSSVASS

The Gullbergsvass quarter will be reinforced with a mix of uses, which both builds on the local qualities of the neighbourhood as well as a new, large park. The area will be integrated more effectively with the water through new walking paths along the river. There will be further study of how the busy urban highway of Märten Krakowgatan can be redesigned into an urban street.

11 THE RIVER

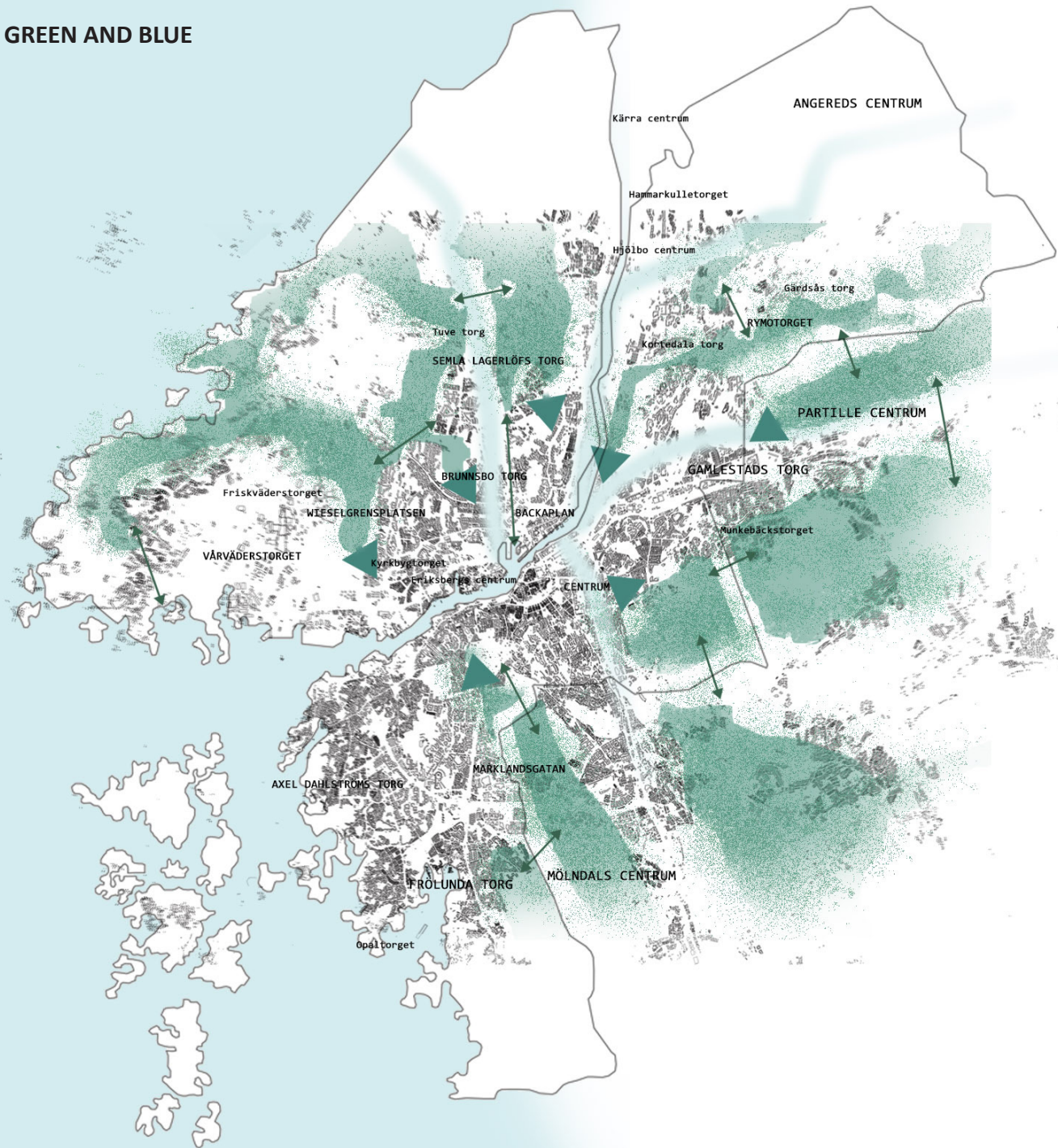
We will have a living river space with smallscale and large-scale boat and ferry traffic. Continuous paths for walking and cycling will be established along both banks of the river. Squares and activities on both sides of the water will attract people down to the water and link the city across the river.

12 RIVERCITY 2021

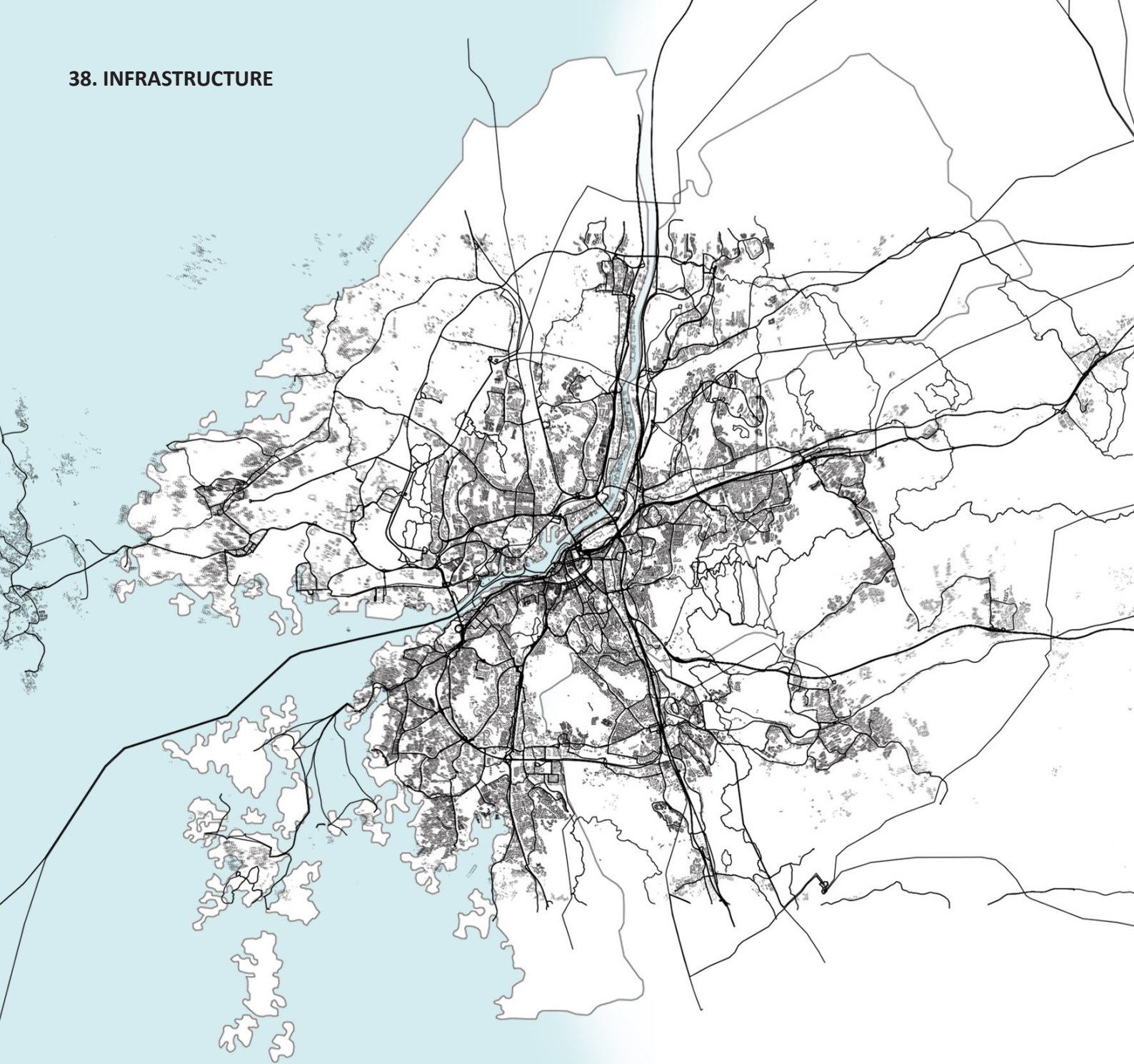
We will capitalise on our strengths in the lead up to the Jubilee by developing the first stage of RiverCity 2021. The area will comprise parts of Frihamnen and Ringön. Key issues for RiverCity 2021 will be to show how housing, workplaces and services can be integrated into a modern inner-city environment and which connect the city across the river. A Jubilee Park will be created on the waterfront of Frihamnen and Ringön.



37. GREEN AND BLUE



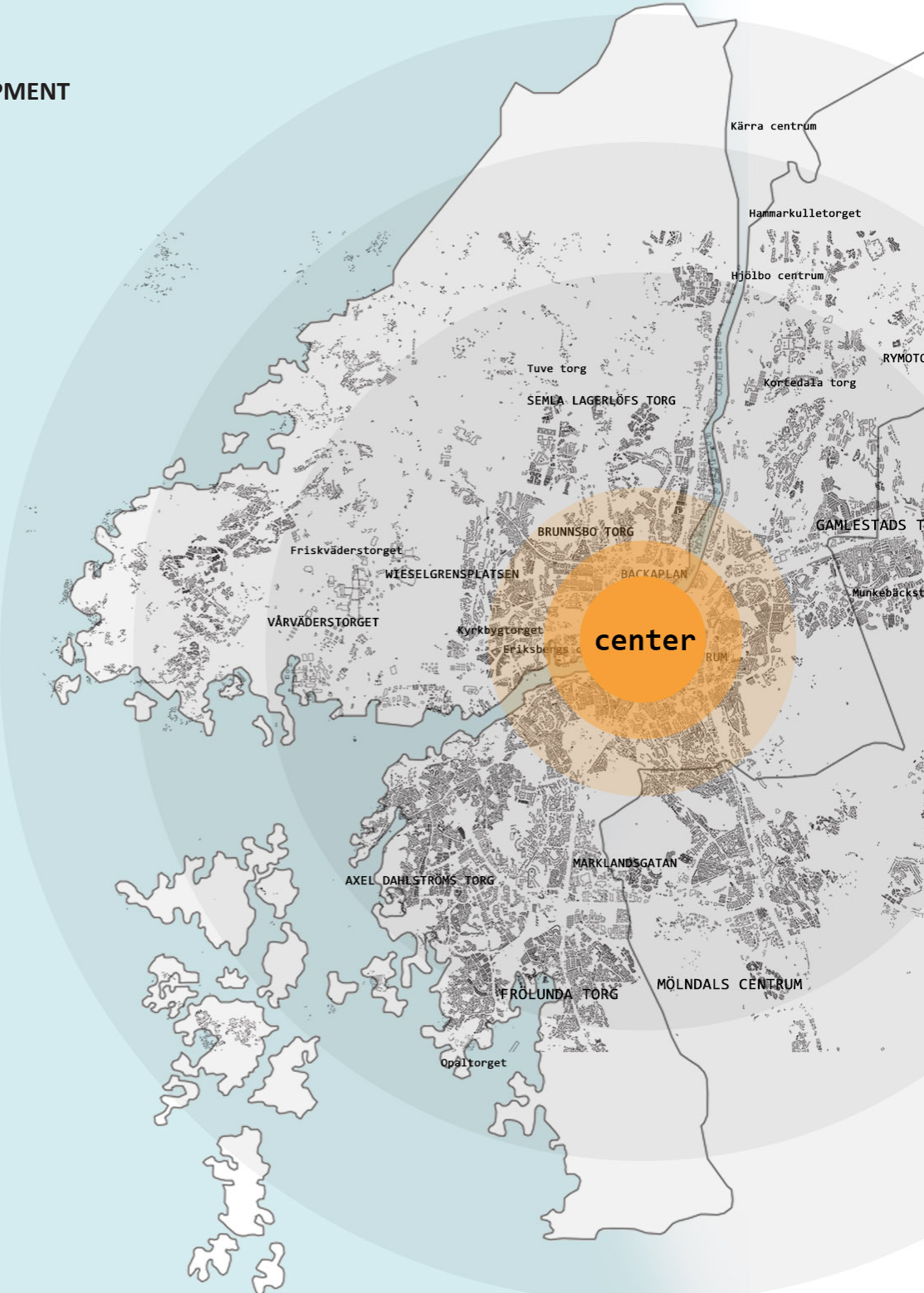
38. INFRASTRUCTURE



Regional Strategy...



39. MONOCENTRIC DEVELOPMENT





We must be able to
formulate new questions

inclusion
attractive
people

seclusion
affordable
space

2.2 Regional strategy

a.Questioning Rivericity 2035

-When focusing on a more dynamic, denser and larger center how can we avoid an isolation of the periphery and the non-center?

-Living close to the water creates attractive high quality spaces, but can it be affordable and accessible to everyone (social segregation)?

-How is the proposed densification -responding to the global population rising- related to Swedish lifestyle and existing population density? Is it reasonable to suggest the double ratio of density population in just 15 years?

-Last but not least, do the new plans respond sufficiently to crucial environmental challenges, such as the sea level rise?

b.Alternative regional strategy

In this thesis project I want to suggest that the development can take place in several interconnected nodes, rather than in only one big center. In the proposed system the public transport infrastructure is of high priority.

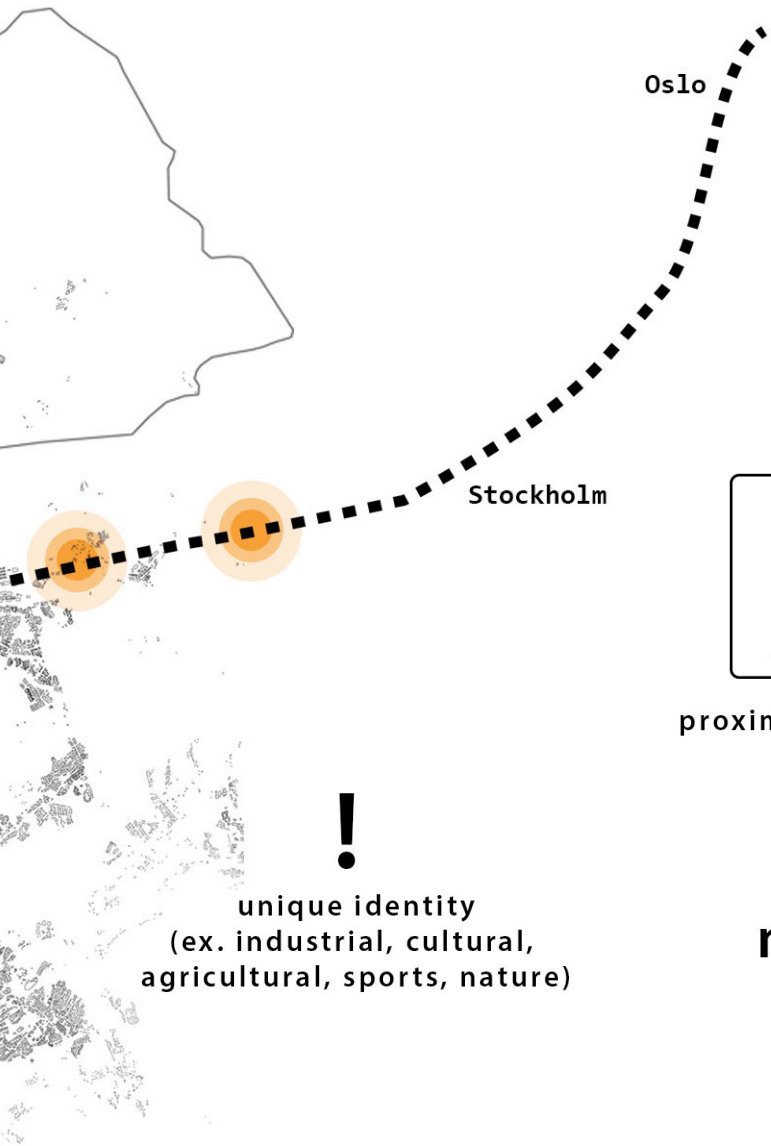
The chosen area of expansion is the strategic west to east axis, that connects Gothenburg with Stockholm. The proposed urban fabric extends in 5 nodes along the axis. The public infrastructure is used as the glue element for the new urban fabric, but also for the surrounding landscape.

Each one of the proposed nodes has the following characteristics: a proximity to a station, a unique identity and role/purpose, is both urban and natural, can operate independently but is substantial part of the system.

40. ALTERNATIVE DEVELOPMENT



41. NODES CHARACTERISTICS



proximity to station



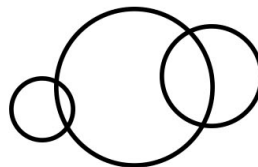
unique identity
(ex. industrial, cultural,
agricultural, sports, nature)

node

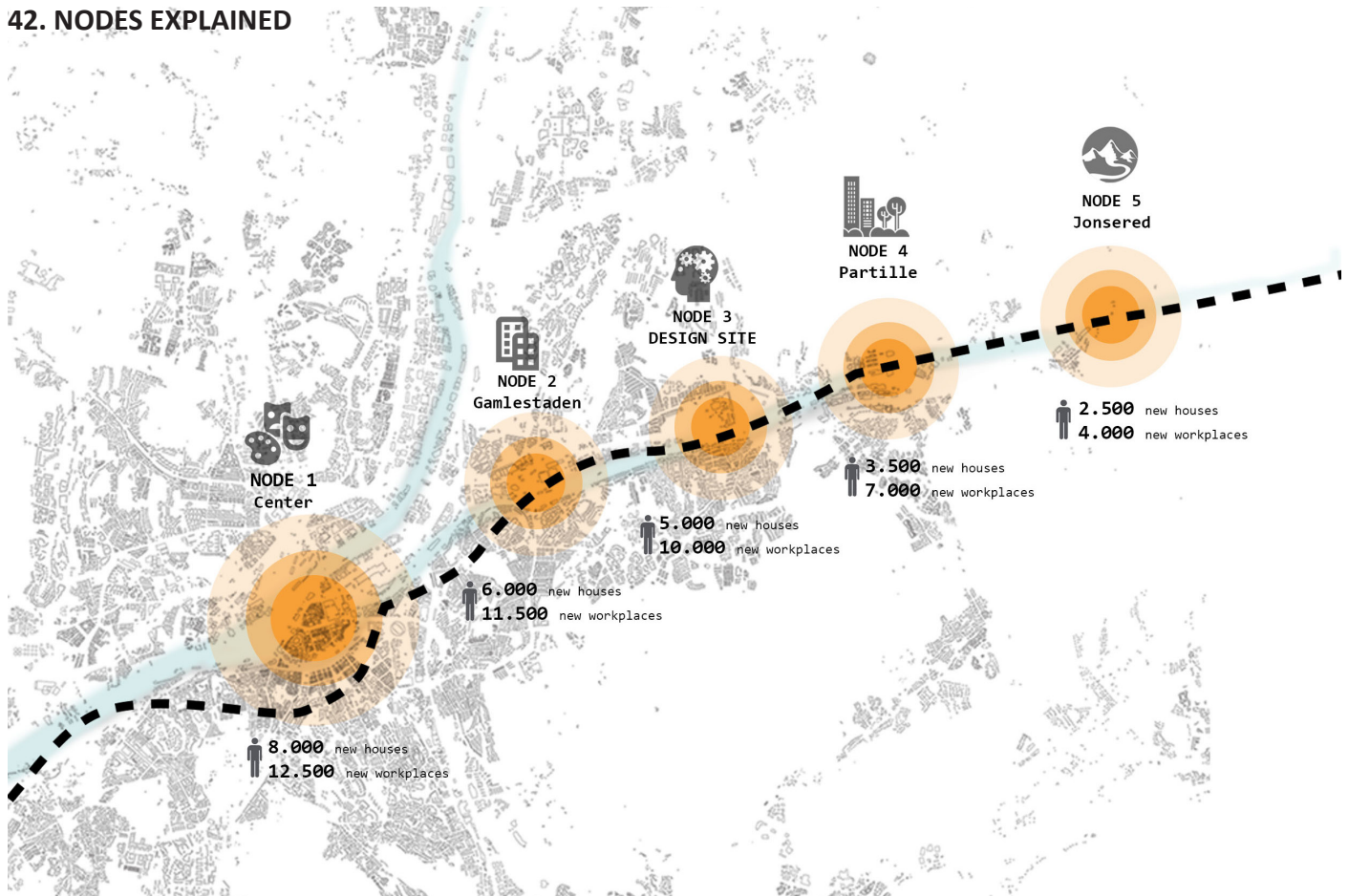


urban + natural

is independent but part of the system



42. NODES EXPLAINED



Node1: the existing center is densified and highlighted as the cultural core of the region. The area through the port's operations, is the main link to internal and external transportations and communications.

Node2: the old city (Gamlestaden) is regenerated, densified and turned into an important administration node. Office buildings and services, and a new larger station release the congestion from node 1.

Node 3: the former industrial area is turned into a research and innovation node incorporating all aspects of sustainability.

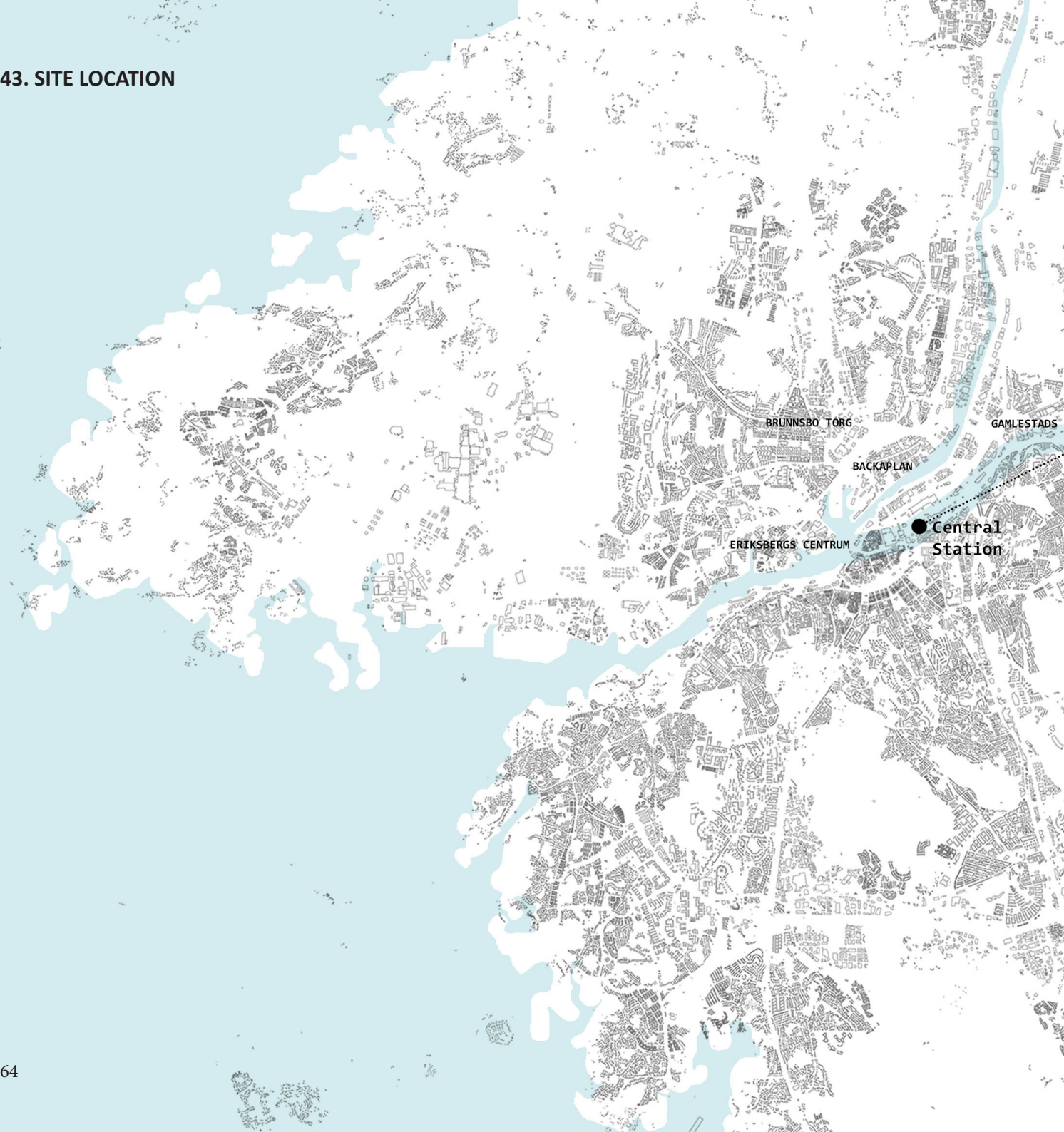
Node4: Partille municipality is densified with housing, workplaces and public spaces, acquiring an equal role the other nodes.

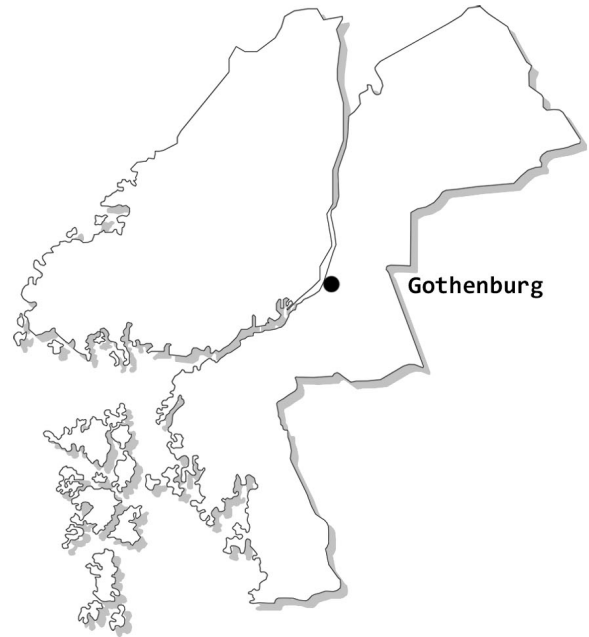
Node5: Jonsered is transformed into a nature-driven node, where landscape qualities are highlighted and offer opportunities for new development and growth.

The site...



43. SITE LOCATION





2.3 The site

a. Location and pictures

The site is approximately 7km away from Gothenburg's central station and is located just on the borders of Gothenburg and Partille municipality, suggesting, that any future development requires a regional cooperation.

The site is surrounded by three green hills-areas on both sides and lies right next to river blablaba. It is also next to the railway, with the closest station to be Partille (1.5km away). We can identify 3 distinct areas.

Area 1 - the industrial

The site itself has a really industrial character. Most of it is filled with car related business and production facilities. Large scale buildings, container workshop facilities, numerous parking spaces, storage and packing containers etc. Some part of it, contains wood manufacturing businesses and buildings with similar architectural qualities. On the western part there is a residential area, which is currently inaccessible. Finally, there are some old brick buildings used mainly as production facilities and one museum.

RESIDENTIAL AREA

LUSH GREEN

IN

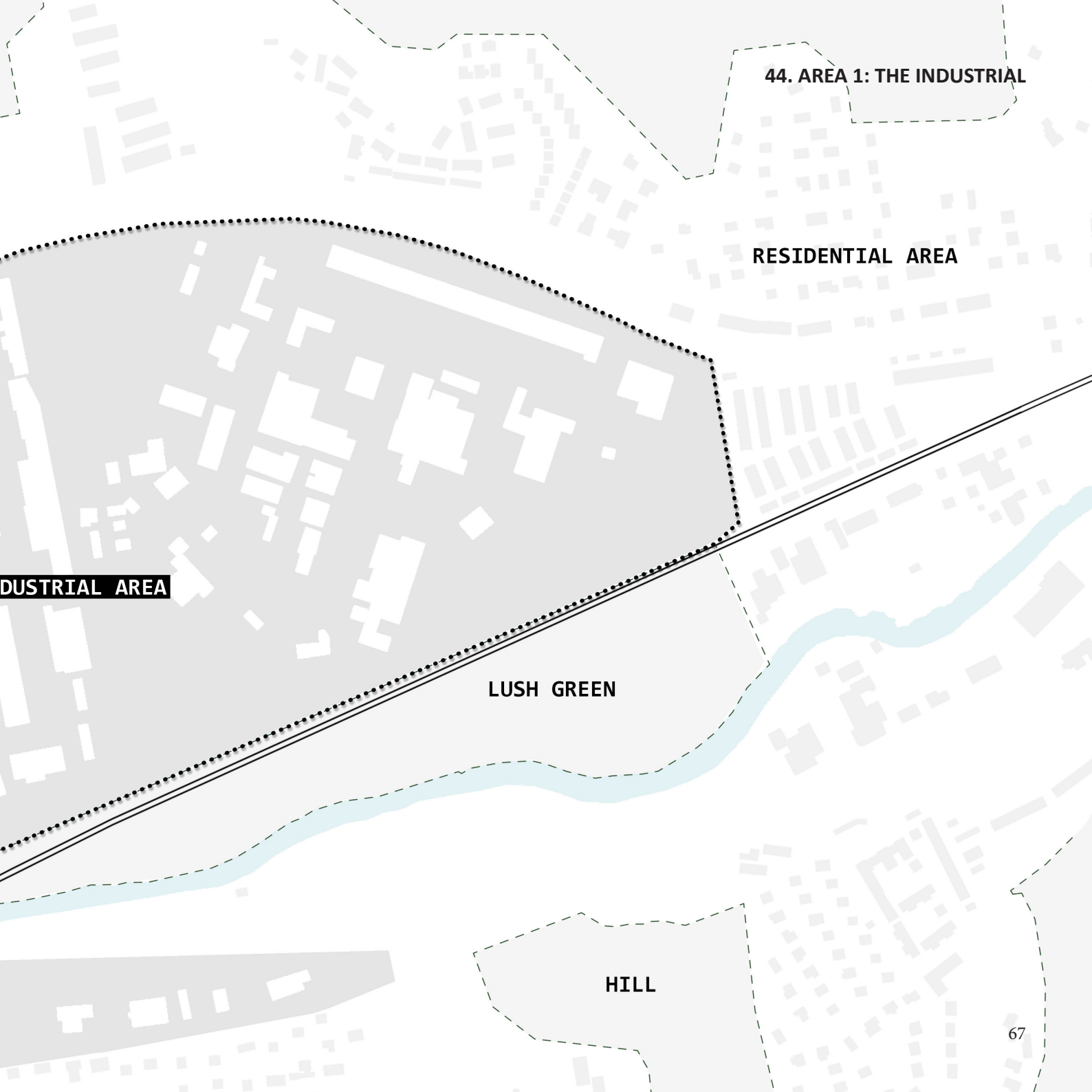
44. AREA 1: THE INDUSTRIAL

RESIDENTIAL AREA

INDUSTRIAL AREA

LUSH GREEN

HILL



45. INDUSTRIAL FACILITIES



47. INDUSTRIAL FACILITIES



46. STACKED OLD CARS FOR RECYCLING



48. WASTE STATION



49. PARKING SPACES



51. INDUSTRIAL FACILITIES



50. PRESERVED BUILDINGS



52. INDUSTRIAL FACILITIES



Area 2 - the natural

Just right next to the industrial site, there is a totally different area, filled with lush green and even some small paths next to the river that people are actually using to walk and run. Once entering that part, someone feels totally disconnected from the industrial content and the noise, regardless the proximity.

RESIDENTIAL AREA

LUSH GREEN

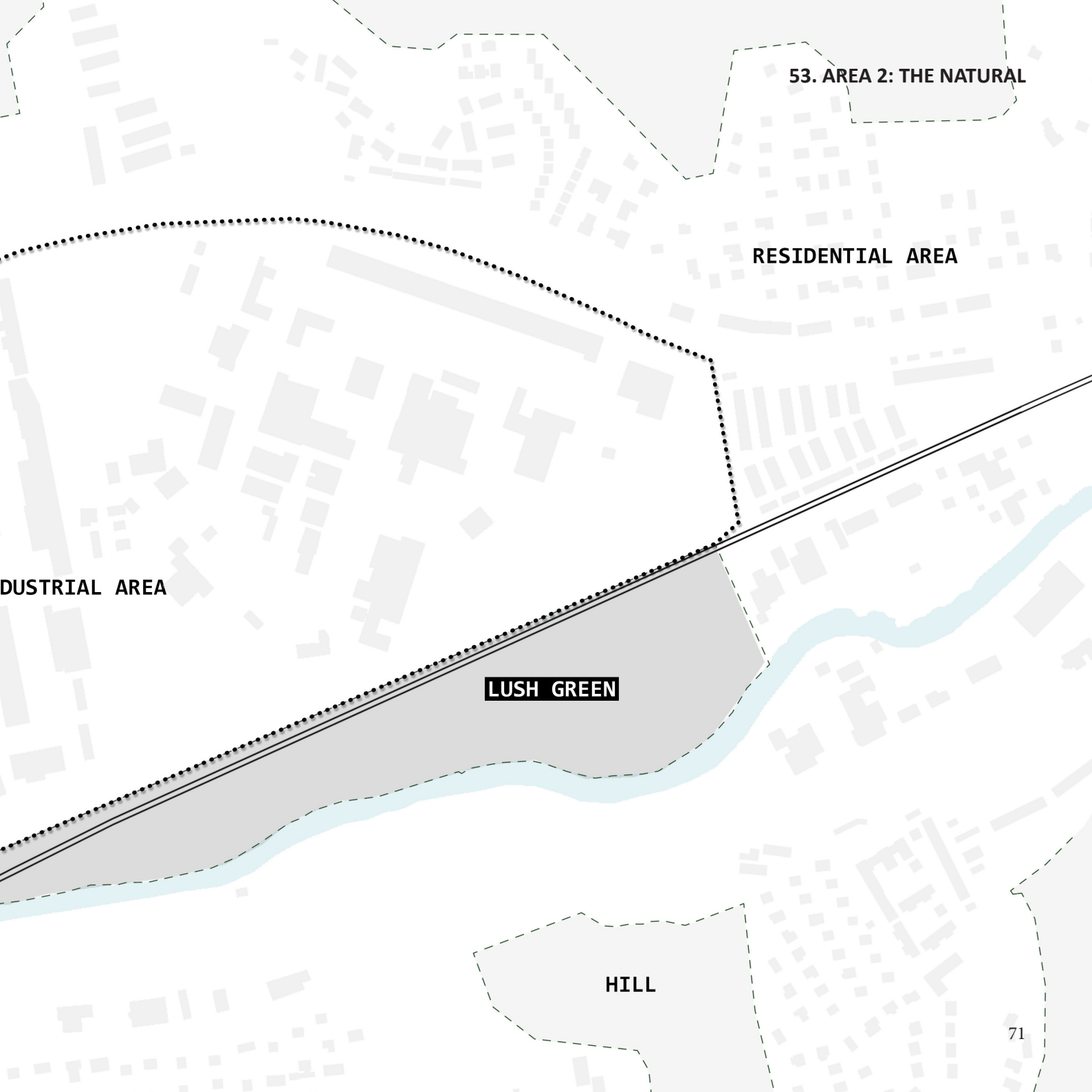
53. AREA 2: THE NATURAL

RESIDENTIAL AREA

INDUSTRIAL AREA

LUSH GREEN

HILL



54. PATHS MADE BY PEOPLE



56. LUSH GREEN



55. NATURE DIVERSITY



57. RECREATIONAL PATHS



58. THE OLD RAILWAY



60. THE RIVER



59. THE CONNECTING BRIDGE



61. RECREATIONAL PATHS



Area 3 - the residential

Finally, the surrounding area is a total residential area, with 1-2 stories family houses, colorful traditional villas and neighborhood facilities (grocery, school, kindergarden, etc).

RESIDENTIAL AREA



LUSH GREEN

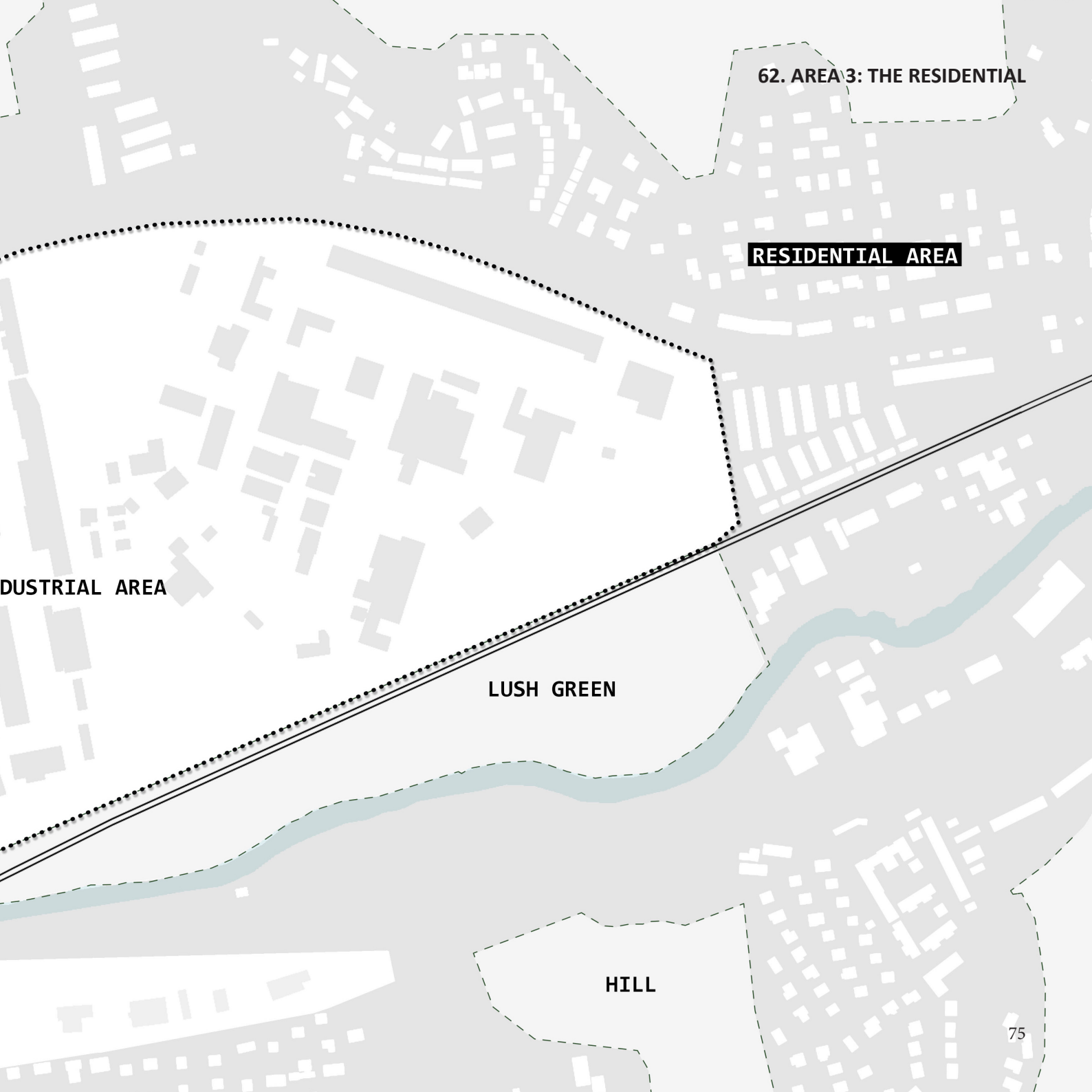
62. AREA 3: THE RESIDENTIAL

RESIDENTIAL AREA

INDUSTRIAL AREA

LUSH GREEN

HILL



63. 2-STORIES HOUSES



65. OIL STATION



64. LOW CAR TRAFFIC



66. GREEN AREAS



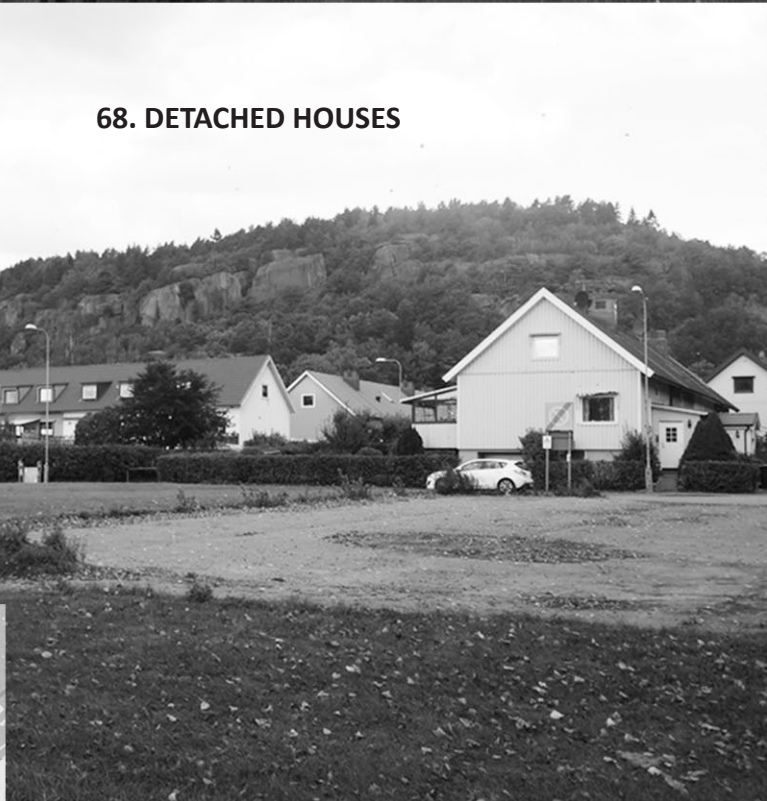
67. DETACHED HOUSES



69. DETACHED HOUSES



68. DETACHED HOUSES



70. DETACHED HOUSES



b.Characteristics

некоммерческий average,
Billverksstad
Auto repair,
etc

71. EXISTING FUNCTIONS



large scale

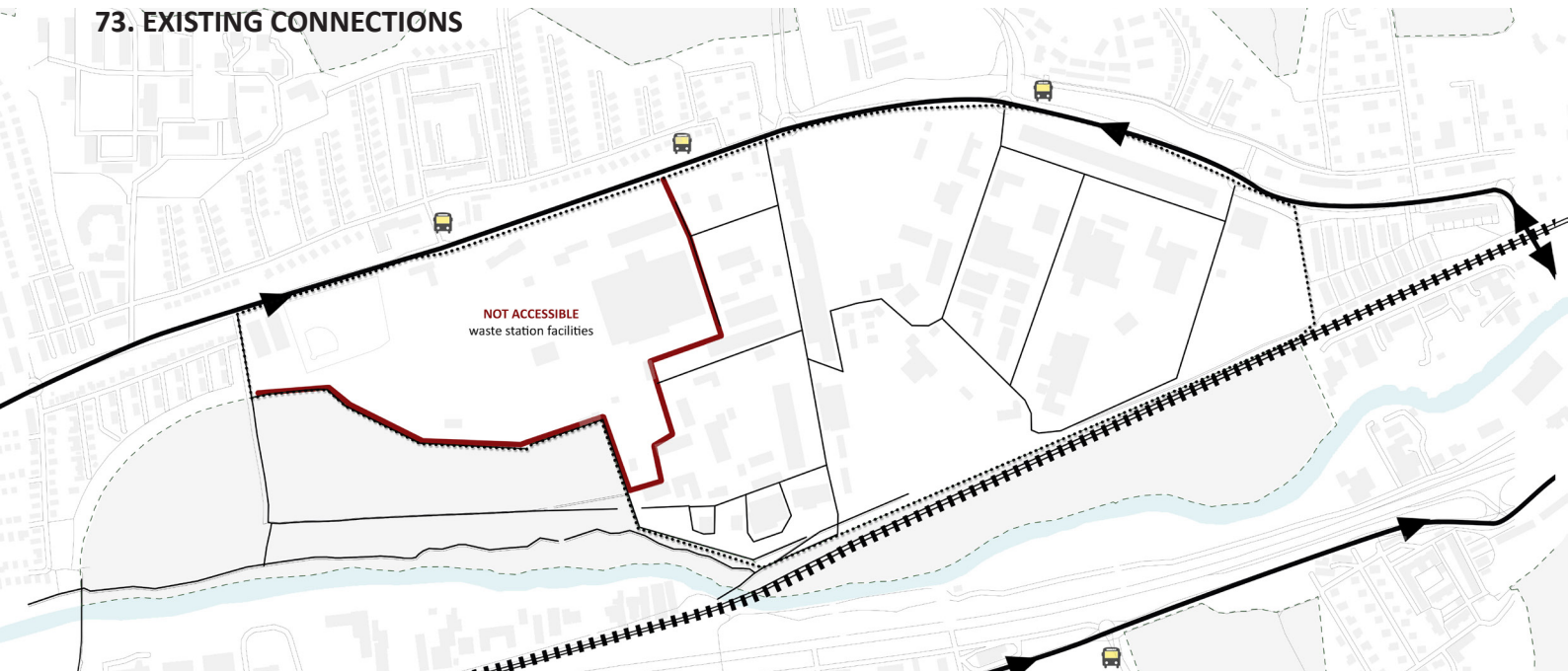
small scale

medium scale

72. MAIN BUILDING SCALES



73. EXISTING CONNECTIONS



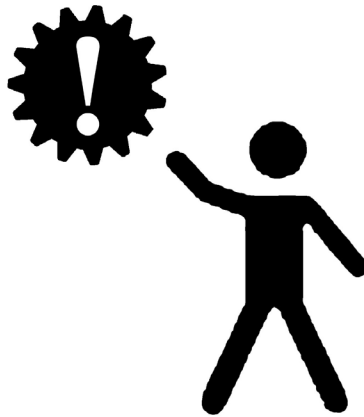
74. GREEN AND BLUE



the project



Design principles...

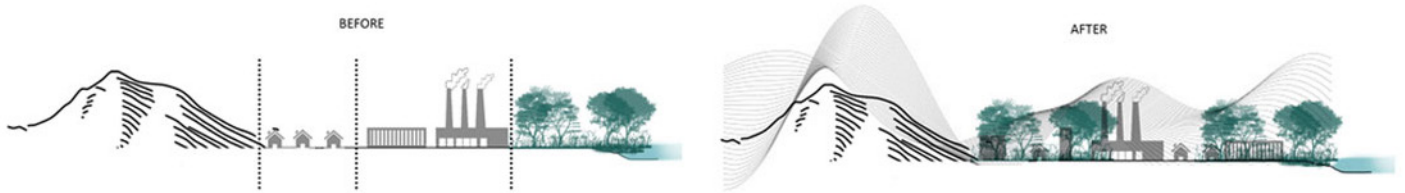


3.1 Design principles

- 1) Create a continuity in the different space qualities from nature, residential, industrial.
- 2) Create a bigger diversity in both scale and functions
- 3) Suggest cross connection with the other side and more internal connection for the site
- 4) Keep the industrial character but refine its purpose
- 5) Highlight the existing qualities, green and blue, family residential character, recycling technology

75. DESIGN PRINCIPLES

1 natural vs urban



2

BEFORE



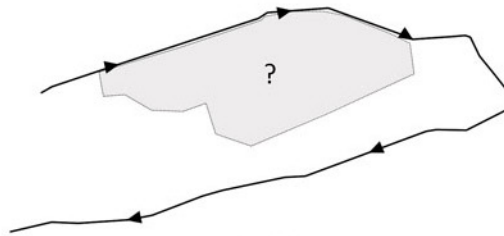
refine production

AFTER



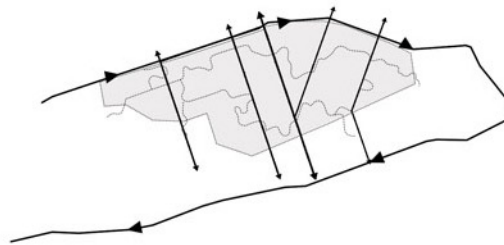
3

BEFORE



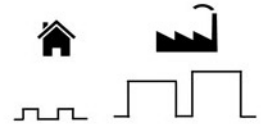
connect

AFTER



4

BEFORE



scale and functions

AFTER

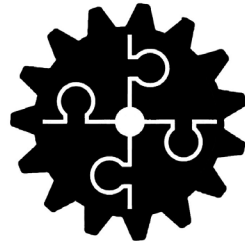


5

highlight existing qualities



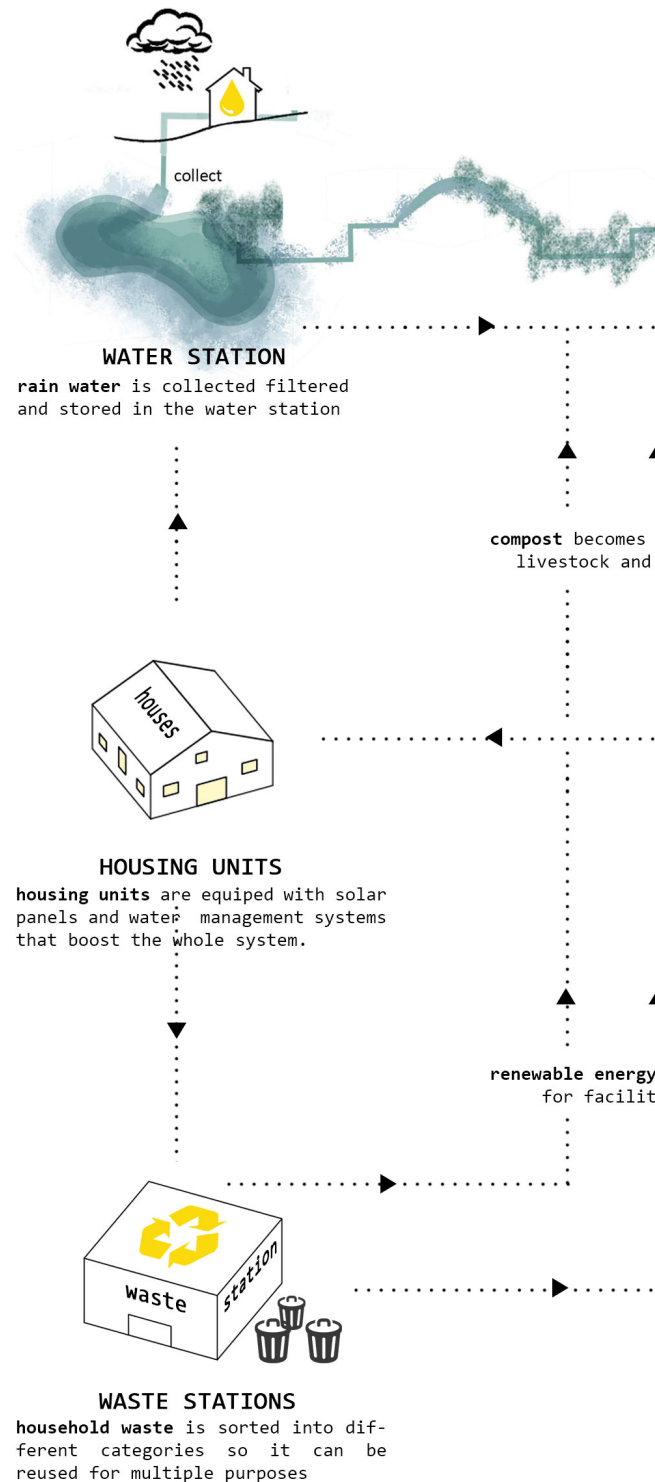
Piece by piece to the overall project...



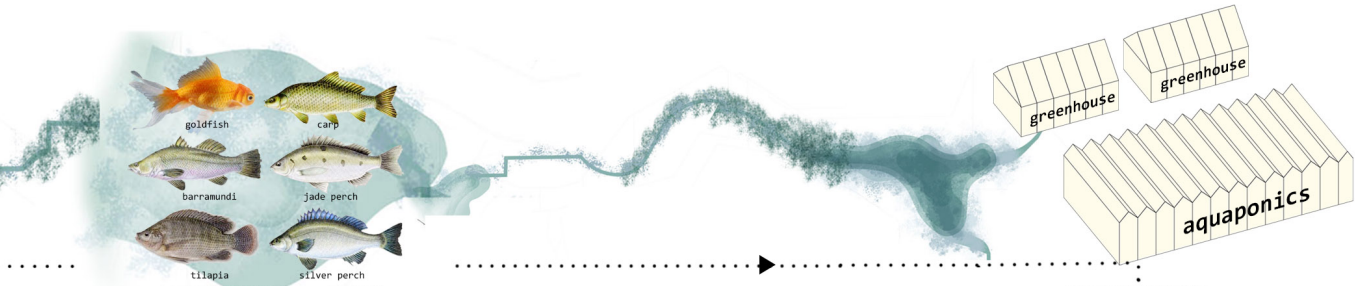
3.2. Piece by piece to the overall project

a. How the system works

In the propose system, rainwater is collected from buildings and public spaces network and is directed to the water station. The collected water is filtered and then distributed to the fish facilities. The waste from the fish becomes fertilizer for the plants. The food and plant products are collected stored and then distributed and used by the community, or the region of Gothenburg. At the same time, household waste is sent to biogas facilities and turned into electricity. The produced energy is stored and then distributed to the rest of the site and surrounding area.



76. HOW THE SYSTEM WORKS



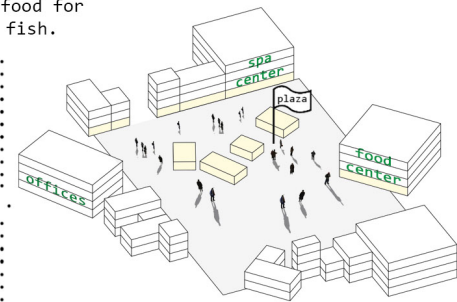
LIVESTOCK - FISH

The waste from the fish becomes fertilizer for the plants

PRODUCTION

aquaponics + greenhouses produce food and therapeutic plants for the community and the regional area

food for fish.



DISTRIBUTION

products are distributed within the settlement. Surplus production is distributed to the region



food



therapeutic plants

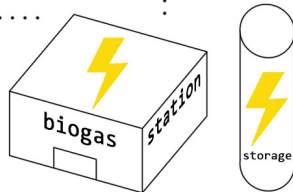


flowers



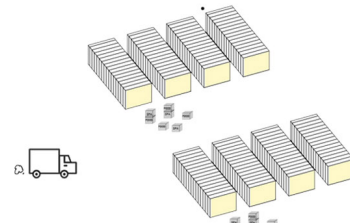
renewable energy plants

is used
ies



ENERGY STATIONS

bio-waste that is not compostable is used in the biogas facilities and turned into electricity for the houses and the production needs



STORAGE

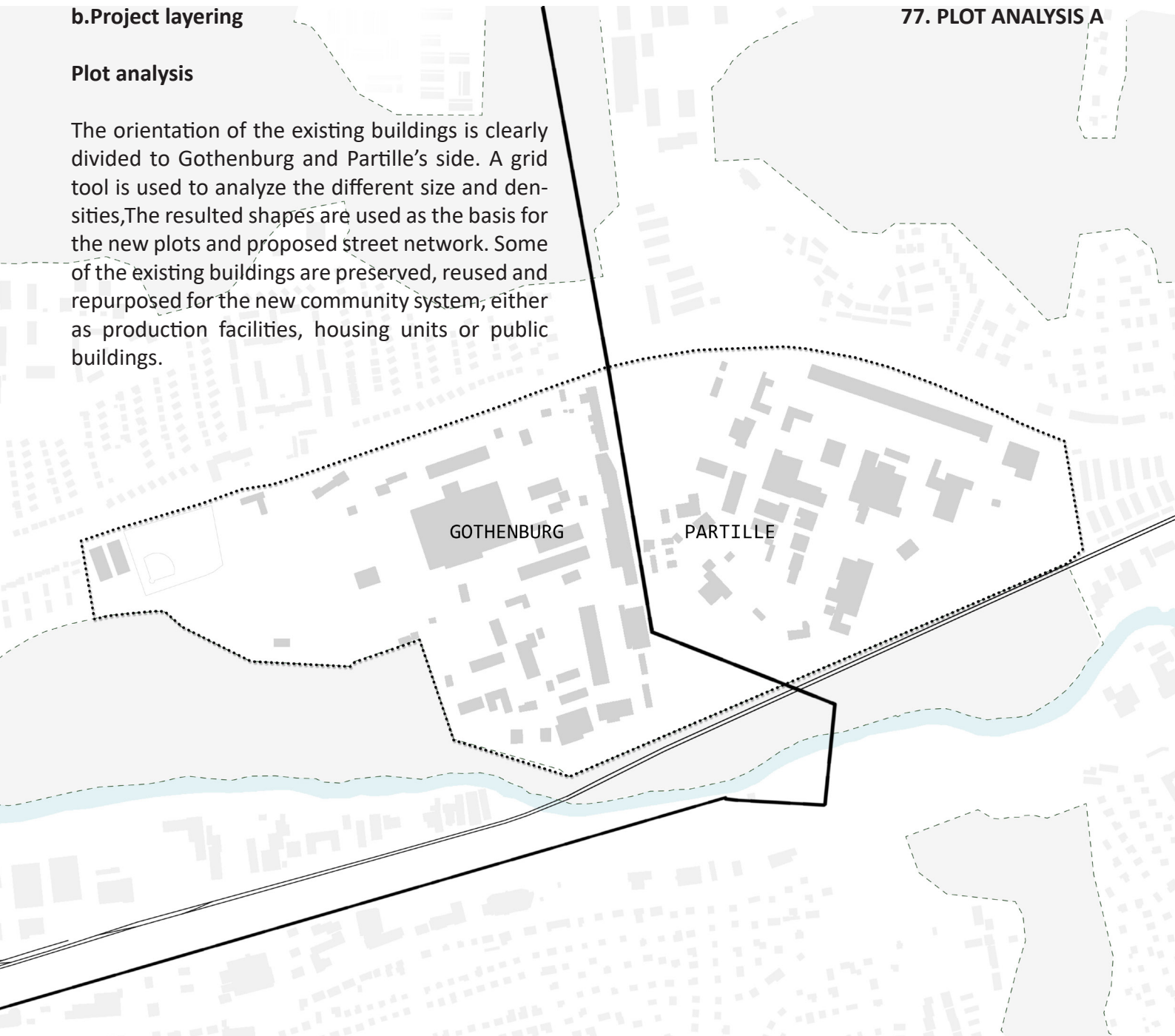
products are collected, packaged and stored ready to be used or distributed

b. Project layering

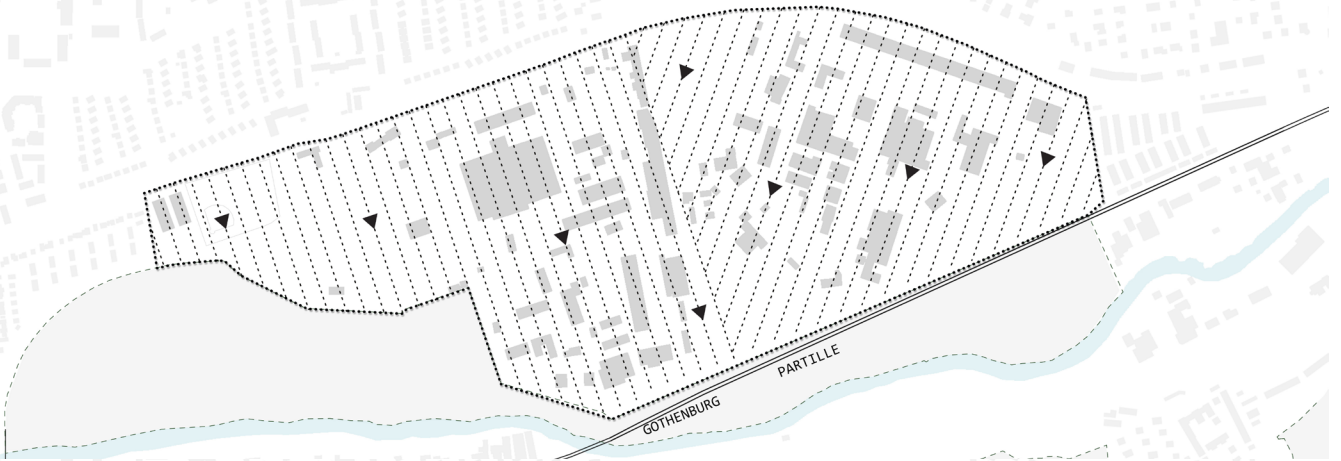
77. PLOT ANALYSIS A

Plot analysis

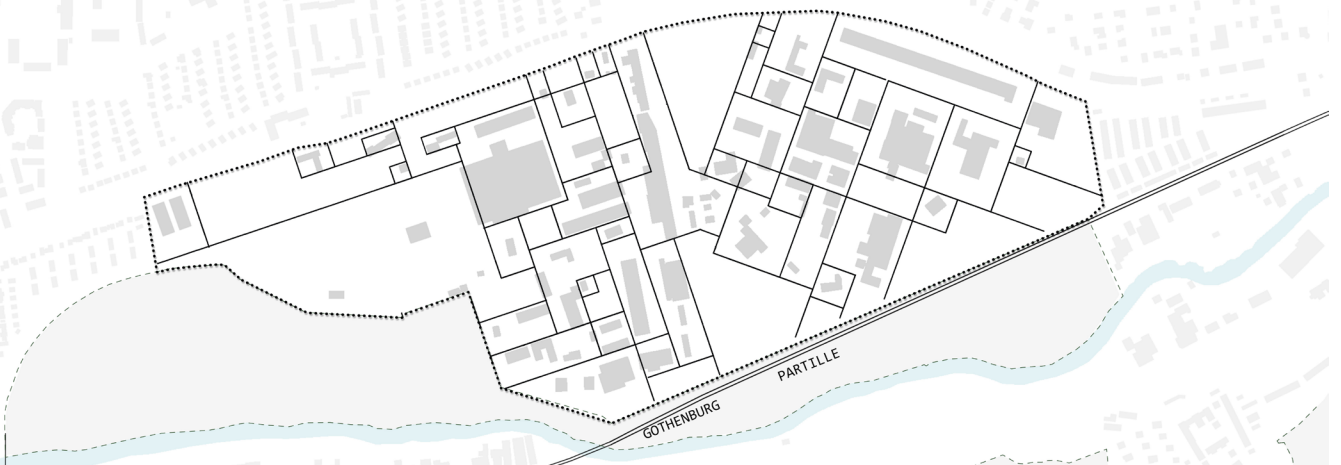
The orientation of the existing buildings is clearly divided to Gothenburg and Partille's side. A grid tool is used to analyze the different size and densities. The resulted shapes are used as the basis for the new plots and proposed street network. Some of the existing buildings are preserved, reused and repurposed for the new community system, either as production facilities, housing units or public buildings.



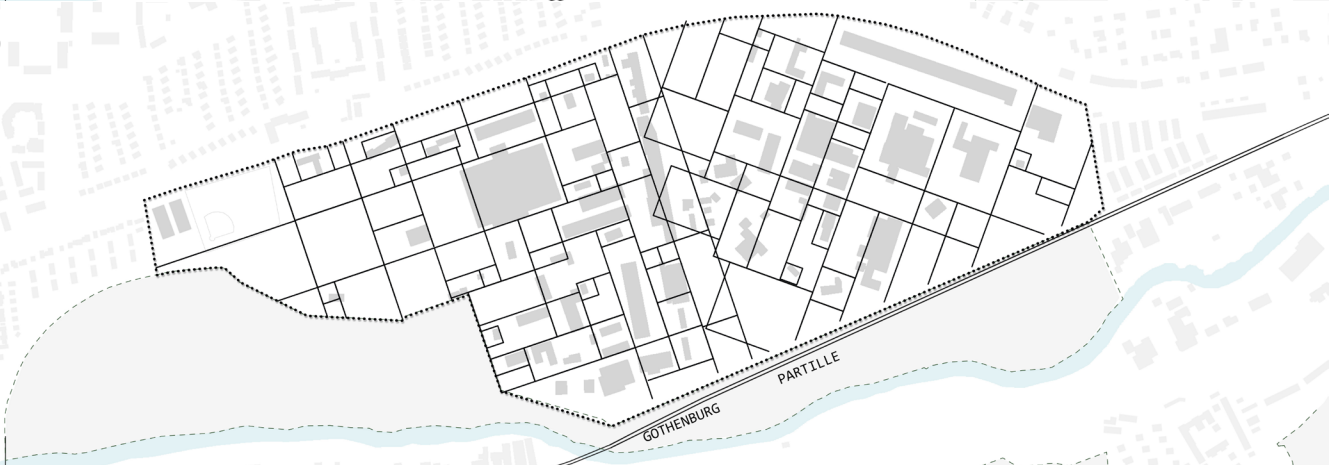
78. B



79. C



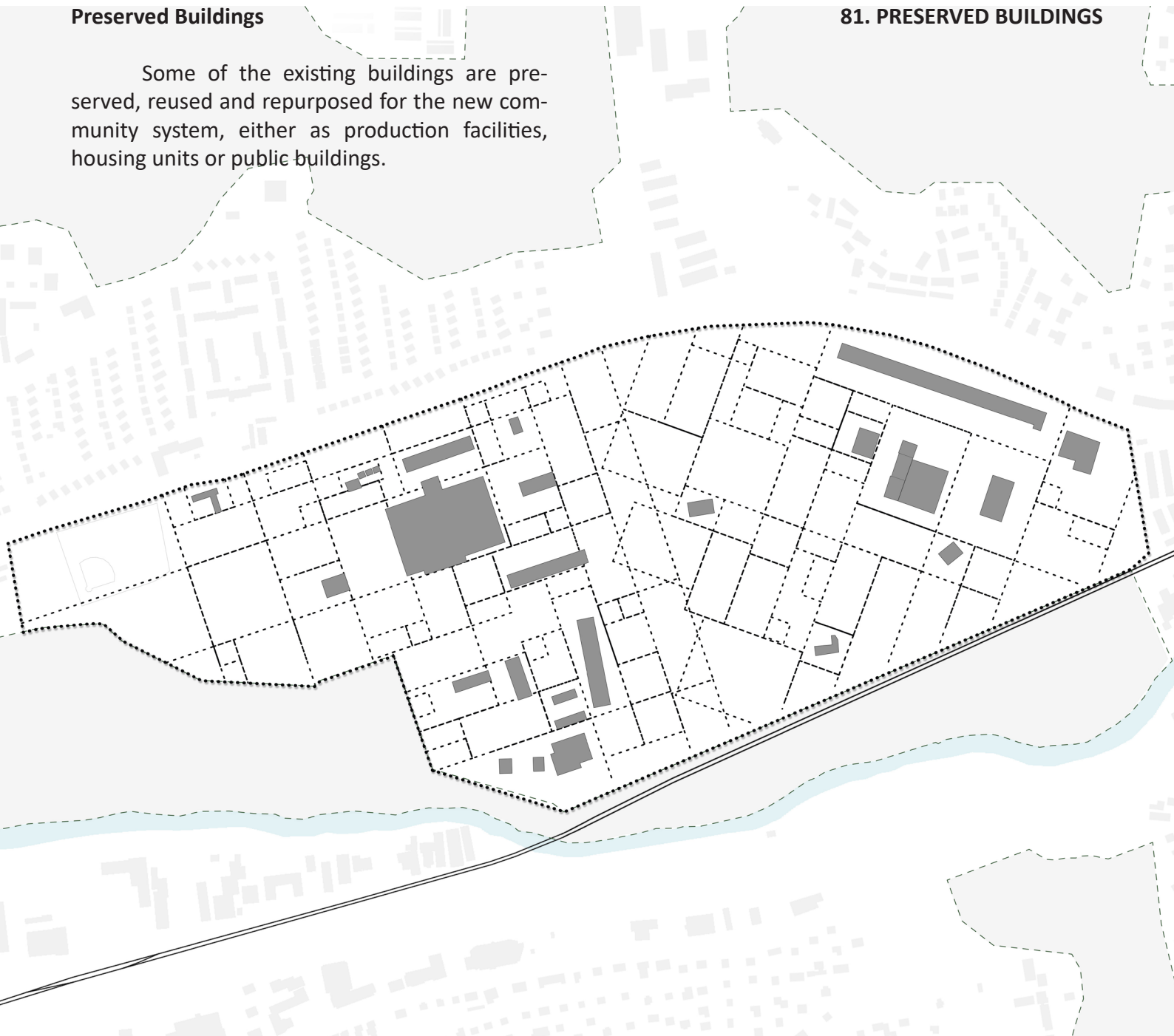
80. D



Preserved Buildings

Some of the existing buildings are preserved, reused and repurposed for the new community system, either as production facilities, housing units or public buildings.

81. PRESERVED BUILDINGS



82. OPERATING FACILITIES



Operating Facilities

The main operation facilities are placed to the periphery of the site. Two waste stations collect all the waste from the site and surrounding area, while the water station is placed on the lower point of the site close to the river. Energy storage towers are distributed along the area and act as landmarks and symbolic structures for the site.

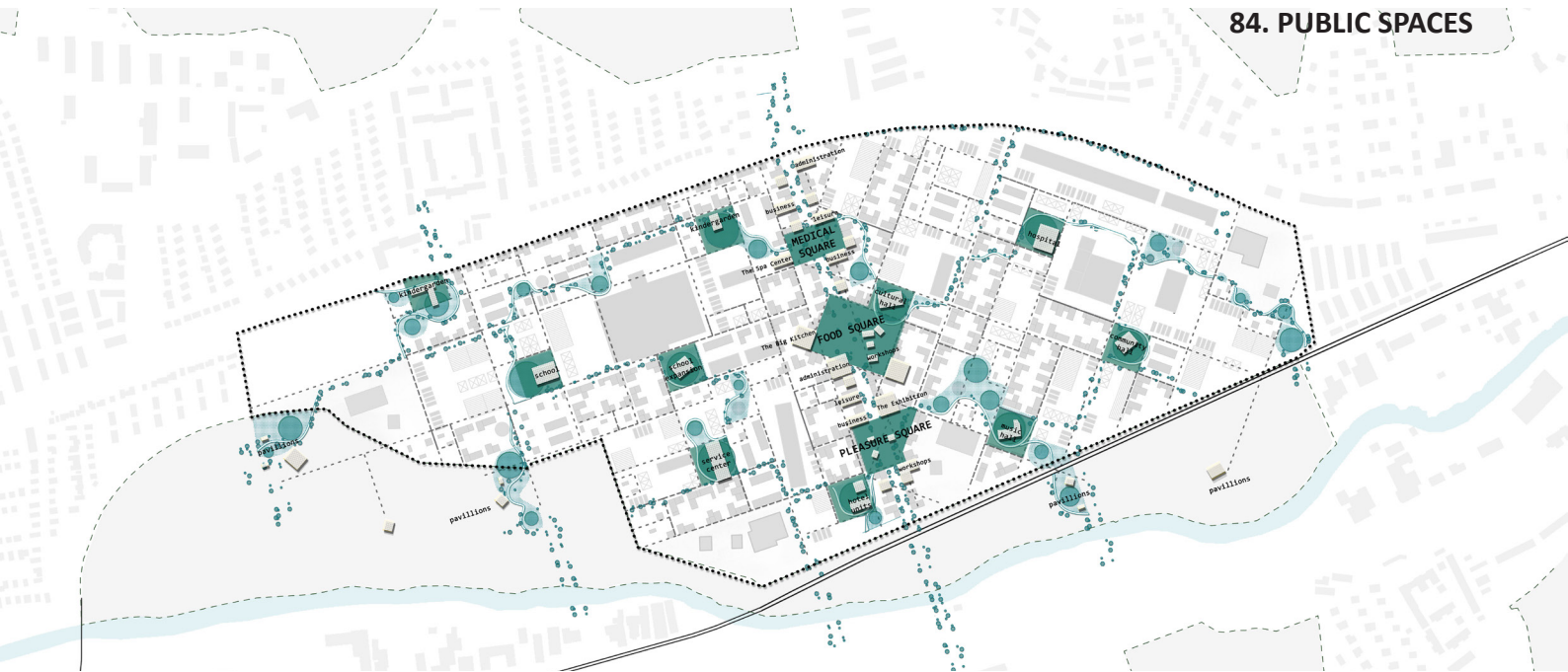


Layering

83. PRODUCTION UNITS



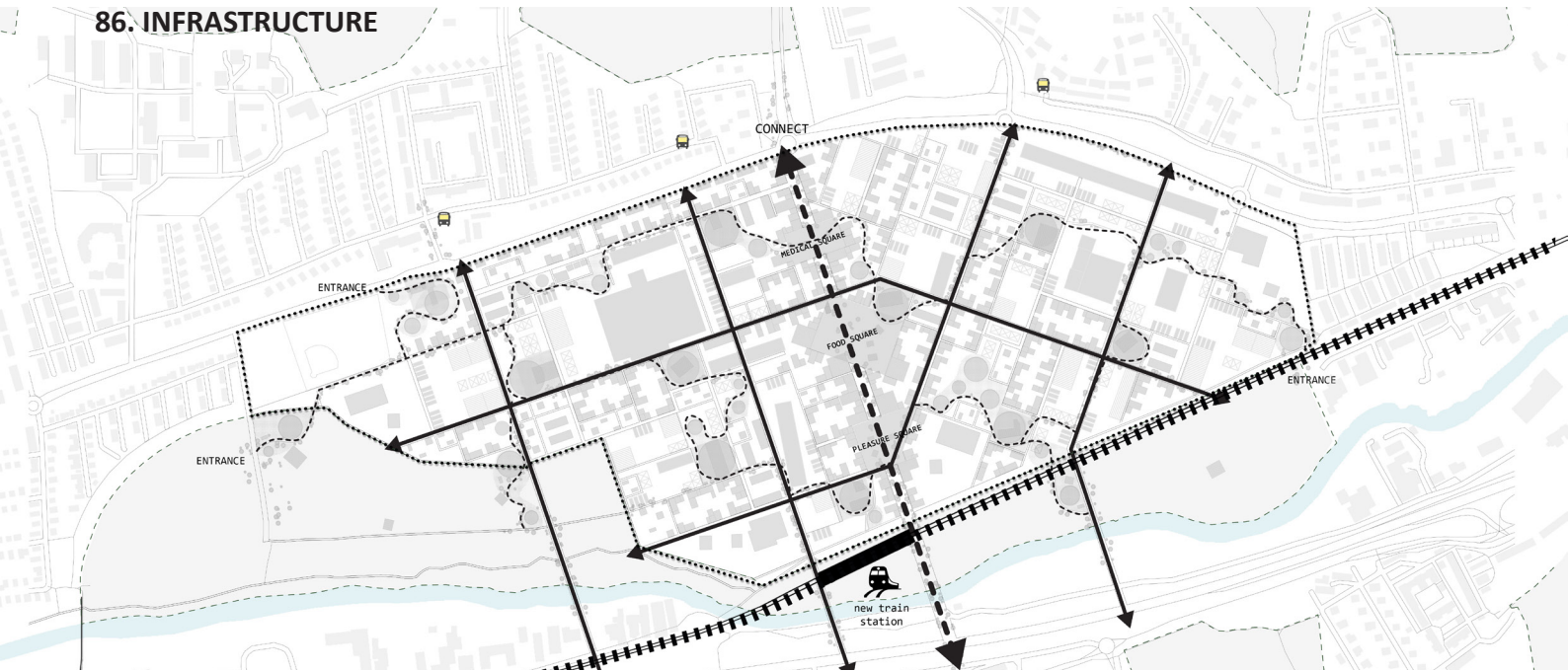
84. PUBLIC SPACES



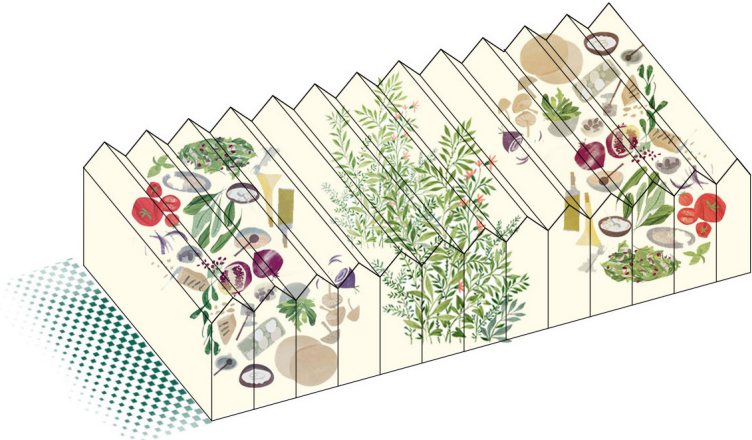
85. LIVING UNITS



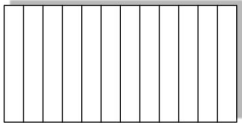
86. INFRASTRUCTURE



aquaponics



aquaponics provide vertical production of **food and therapeutic plants** for the center and the extended area



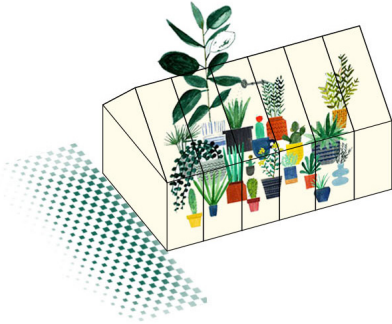
Production units - Typologies

The **bigger plots** are used for **production purposes**, ensuring adequate space for operations, distributions and transportations.

The facilities **produce** fresh fruits and vegetables, therapeutic plants and flowers. A small part of them is used for research purposes, for bigger tree plants of higher demands or plants for biofues energy.

87. PRODUCTION UNTIS - TYPOLOGIES

greenhouses

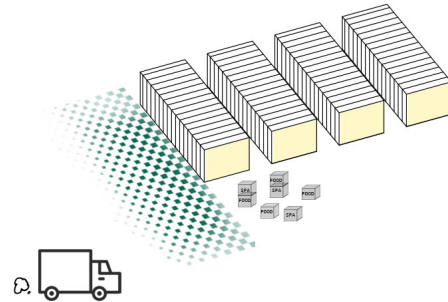


greenhouses provide a variety of plants production **regardless climate or geographic** conditions



There are four **types of production units**:
a) the big-volume preserved buildings, which are turned into closed aquaponics facilities, of deep water or media-based growing system b) the transparent aquaponic facilities, which provide vertical or NTF growing system production, c) the greenhouses, which produce a variety of plants

storage



storage facilities throughout the site keep the products **safe and ready for distribution**



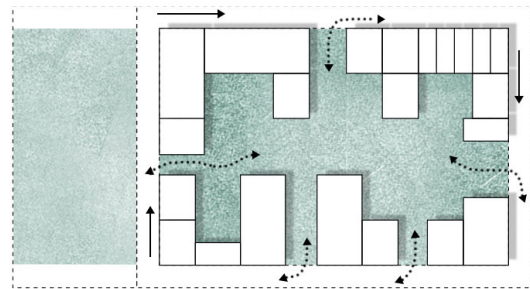
regardless climate or geography conditions and d) the storage facilities throughout the site, which keep the products safe and ready for distribution.



courtyards



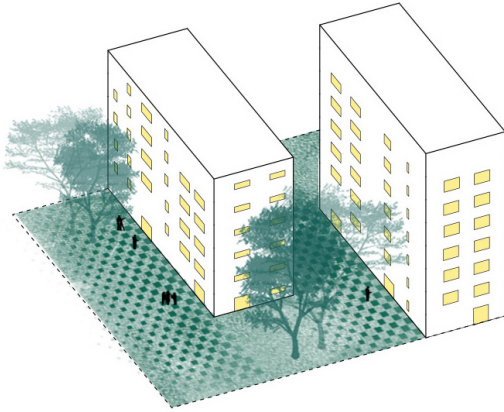
multiple plot sizes allow different investments and diversity in built structures



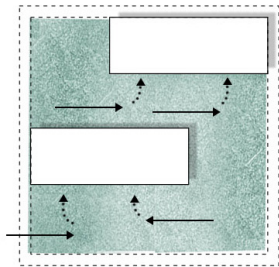
Living units - Typologies

The smaller plots are used for housing development. The buildings differ in scale, density and arrangement in order to attract mixed groups of residents and to create friction in the living space.

block apartments

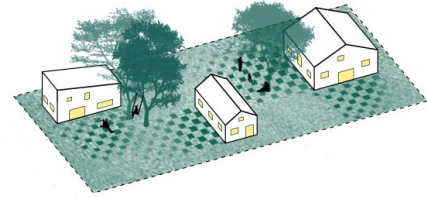


block apartments offer **affordable housing** to different groups or **rental space** for professional use

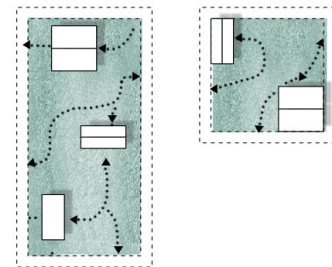


Depending on the size there are three different **types of housing units**: a) the courtyards, multiple plot sizes allow different investments and diversity in built structures, courtyards are permeable from different sides and have the potential to be densified even more in the future b) block apartments, offer affordable housing to different

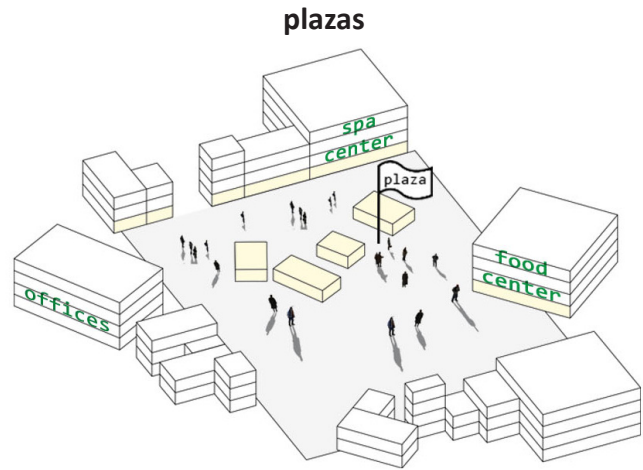
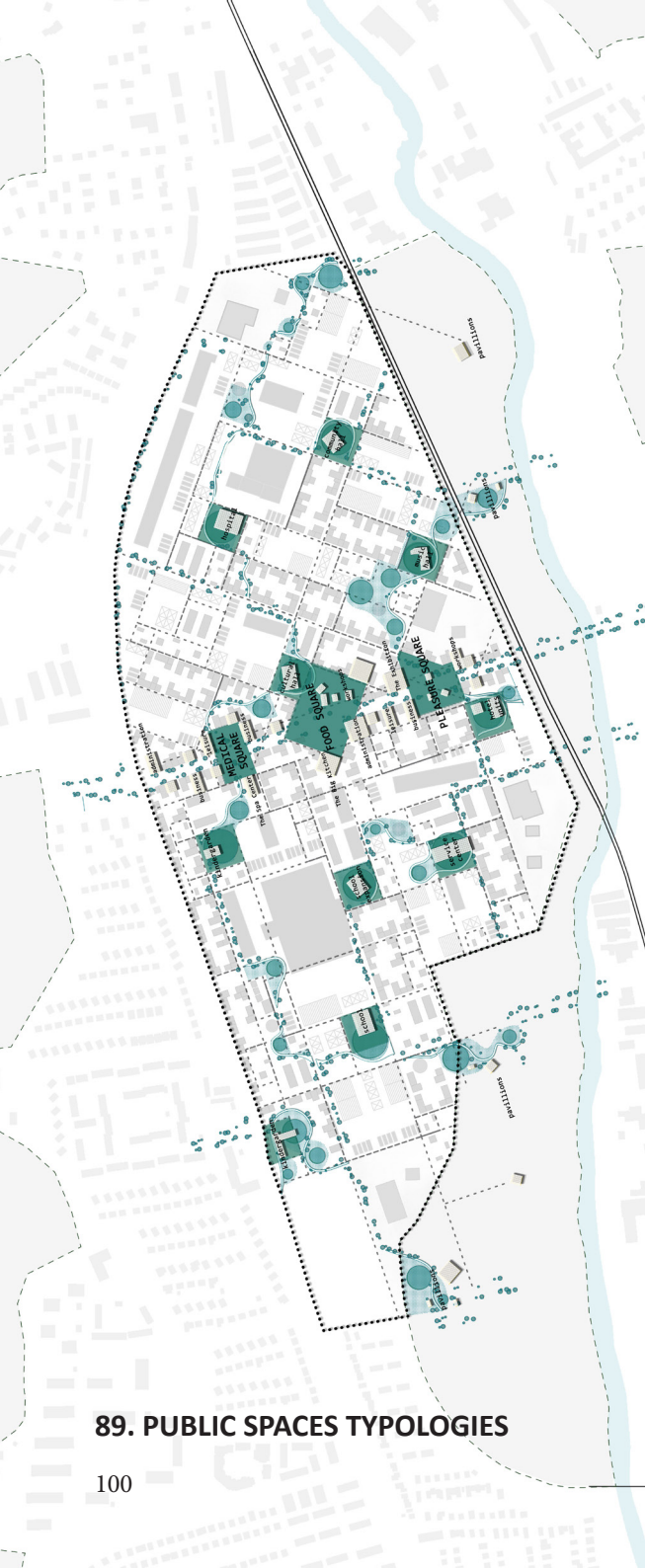
detached houses



detached houses allow a great level of **personalization** to families, couples or individuals



groups or rental space to professionals, they are taller than the other buildings up to 6 floors high and c) detached houses, which allow a great level of personalization to families, couples or individuals and have private gardens that define the movement in the space.



3 main plazas each one with different character offer places to meet enjoy and be informed, celebrating the unique qualities of the site

FOOD SQUARE

MEDICAL SQUARE

PLEASURE SQUARE

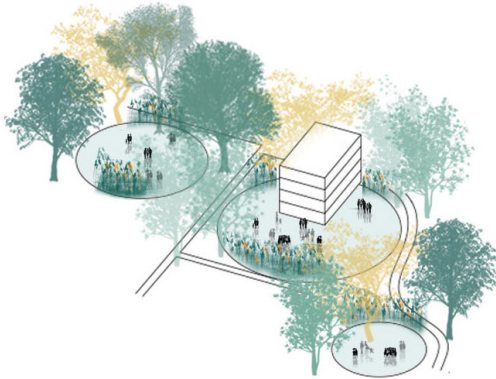


Public spaces - Typologies

The areas where housing and production meets, as well as the middle axis where the municipalities meet, are turned into the main public spaces.

The middle stripe becomes the main public axis, **the core of the new area that connects the two municipalities as well as the other side of the river.** 3 large squares each one with different character and purpose, create the stripes con-

gardens



Gardens along the public spaces create as a **water management network** throughout the site

PURIFY

BIODIVERSITY

RECREATION

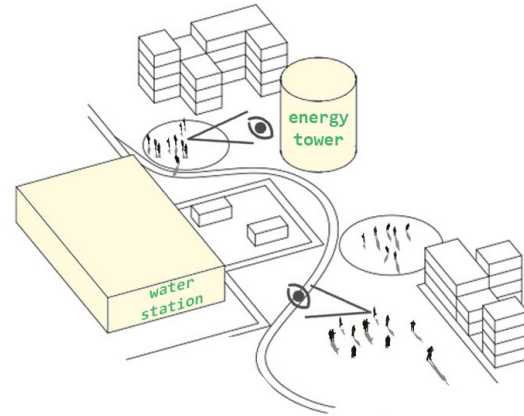
DELAY



tinuity for residents and visitors. Around the site smaller public spaces host activities and buildings mainly related to the community, such as school, kindergarden, community hall, service center etc.

The public spaces are further enriched with seasonal gardens, that spread out the to the existing lush green area, with few pavilions and light constructions that merge with the nature. These spaces are ment for relaxation and observation, but also for better orientation and connection to the river.

operating facilities



operating facilities stand throughout the site as **landmarks** representing the thew informational and innovative society

WASTE STATION

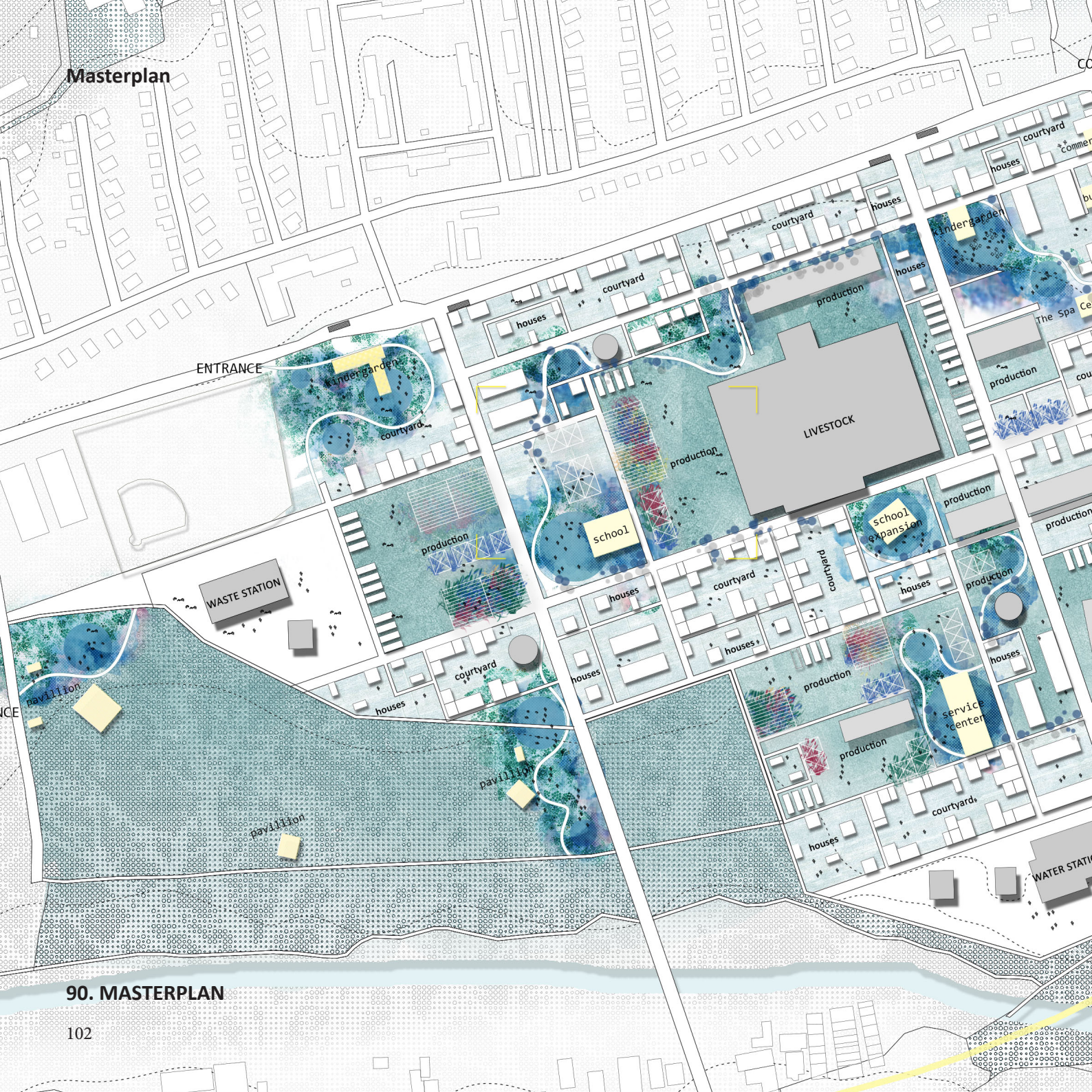
WATER STATION

ENERGY STATION



There are **three main types** of public spaces: a) the plazas which host different buildings and activities from food and beverage, leisure, bussiness and admiistraiton commerce and housing fuctions b) the gardens which create a storm water management network and offer space for relaxation observation or gathering activities and a changing nature experience during the year and c) the operation facilities which act as landmarks and symbolic structures for the site showcasing the used technology.

Masterplan

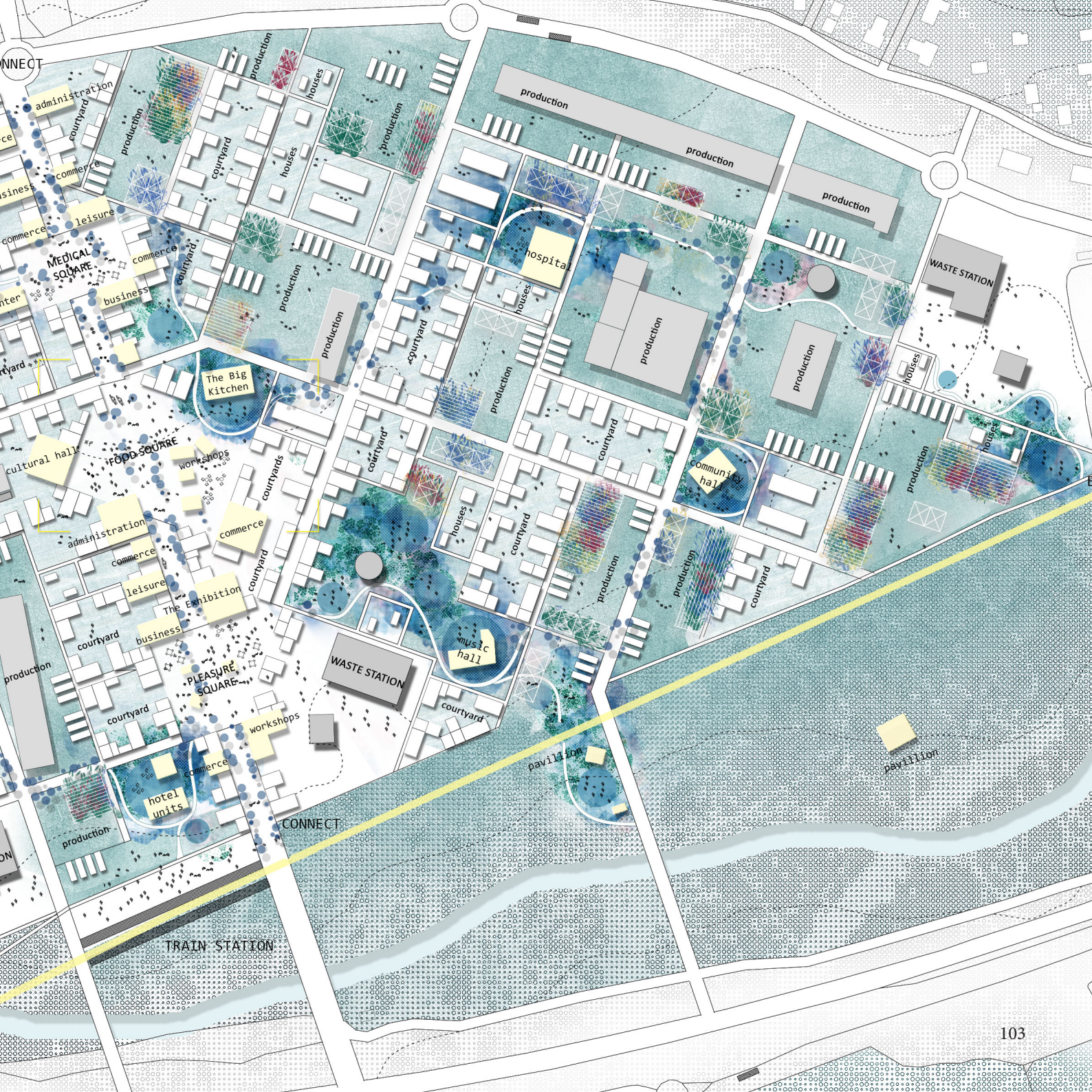


ENTRANCE

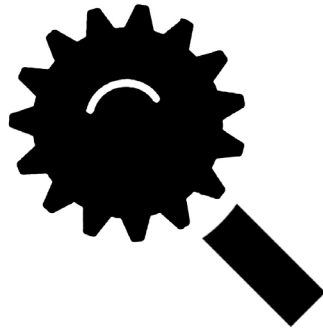
WASTE STATION

LIVESTOCK

90. MASTERPLAN



Zoom in closer...



3.3 Zoom in closer

a.The new area

Living and production merge into one inseparable entity. Housing units boost the system with waste and rainwater collection, while operating facilities transform it to energy and clean water for the production needs. The final food products or plants are redistributed back to the community or the region to consume and export. Mixed functions, scales and space qualities create friction and diversity for residents and visitors. The public spaces best demonstrate the site's unique identity and create business opportunities for tourists and research initiatives.

Starting from south to north, someone can reach the site from the new train station, enter the main public stripe, and find the pleasure square, the food square and the medical square up to the north side. Different buildings and activities offer a lively urban realm, from a large spa center, treatment and cosmetic stores, food...





... restaurants and kitchen labs, grocery stores, flower exhibition hall and workshop pavilion, as well as a series of other public facilities, such as business or commerce, leisure and services, all create a lively space for all to share, enjoy and be informed.

For those who live in the area or have the time to experience more of it, the secondary organic route offers an inner site to the actual life of the community. Seasonal gardens create a unique nature experience that continuously changes during the year, while passing over the school and kindergarden facilities, or the community hall and service center reaching the public stripe again and continue to the other smaller public spaces.

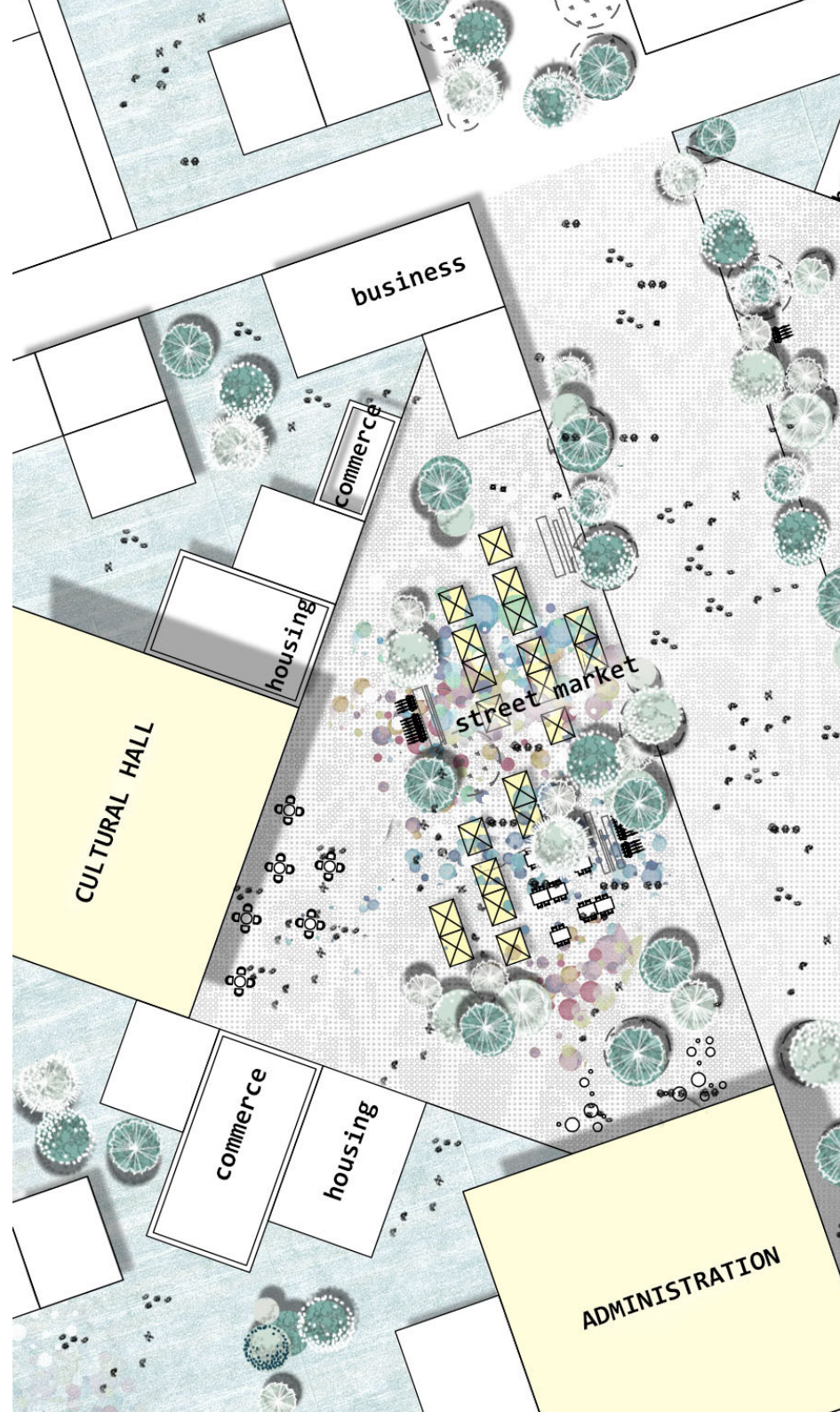
The new area becomes an autonomous center for the region of Gothenburg



92. INSIDE THE PRODUCTION



93. ZOOM IN AREA 1 -->
THE FOOD SQUARE





buisiness

housing

housing

commerce

THE BIG KITCHEN

housing

housing

workshops

sitting
meeting

barbecue

barbecue

meeting

housing

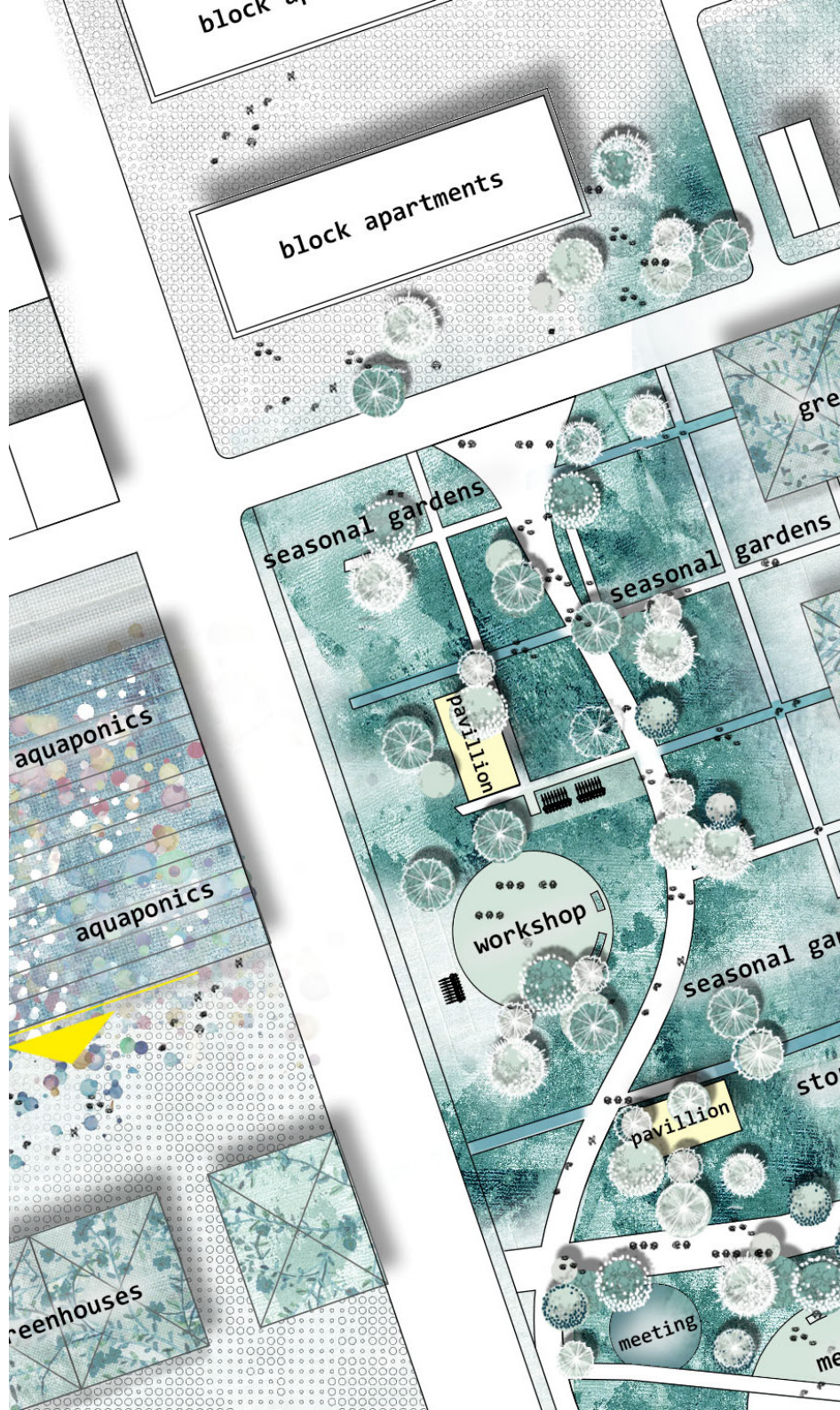
leisure

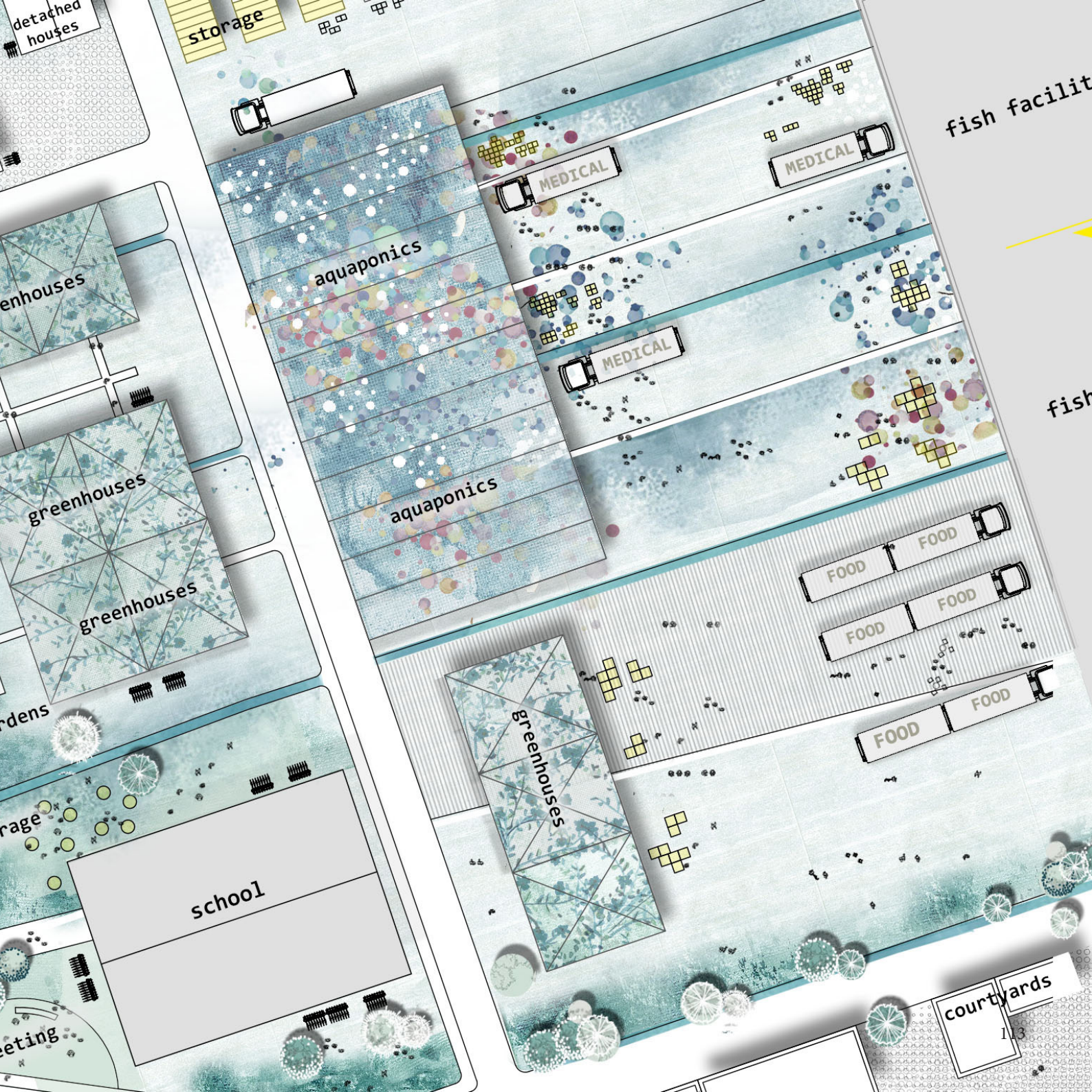
barbecue

pavillions

SHOPPING CENTER

94. ZOOM IN AREA 2 -->
THE PRODUCTION





detached houses

storage

greenhouses

aquaponics

MEDICAL

MEDICAL

fish facility

greenhouses

aquaponics

MEDICAL

fish

greenhouses

FOOD

FOOD

gardens

greenhouses

FOOD

FOOD

storage

school

courtyards

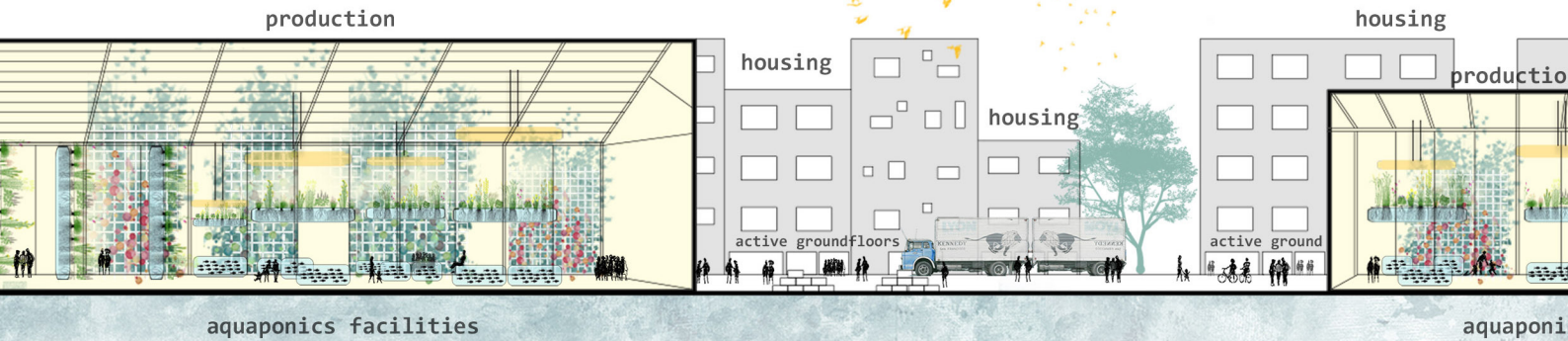
meeting

13

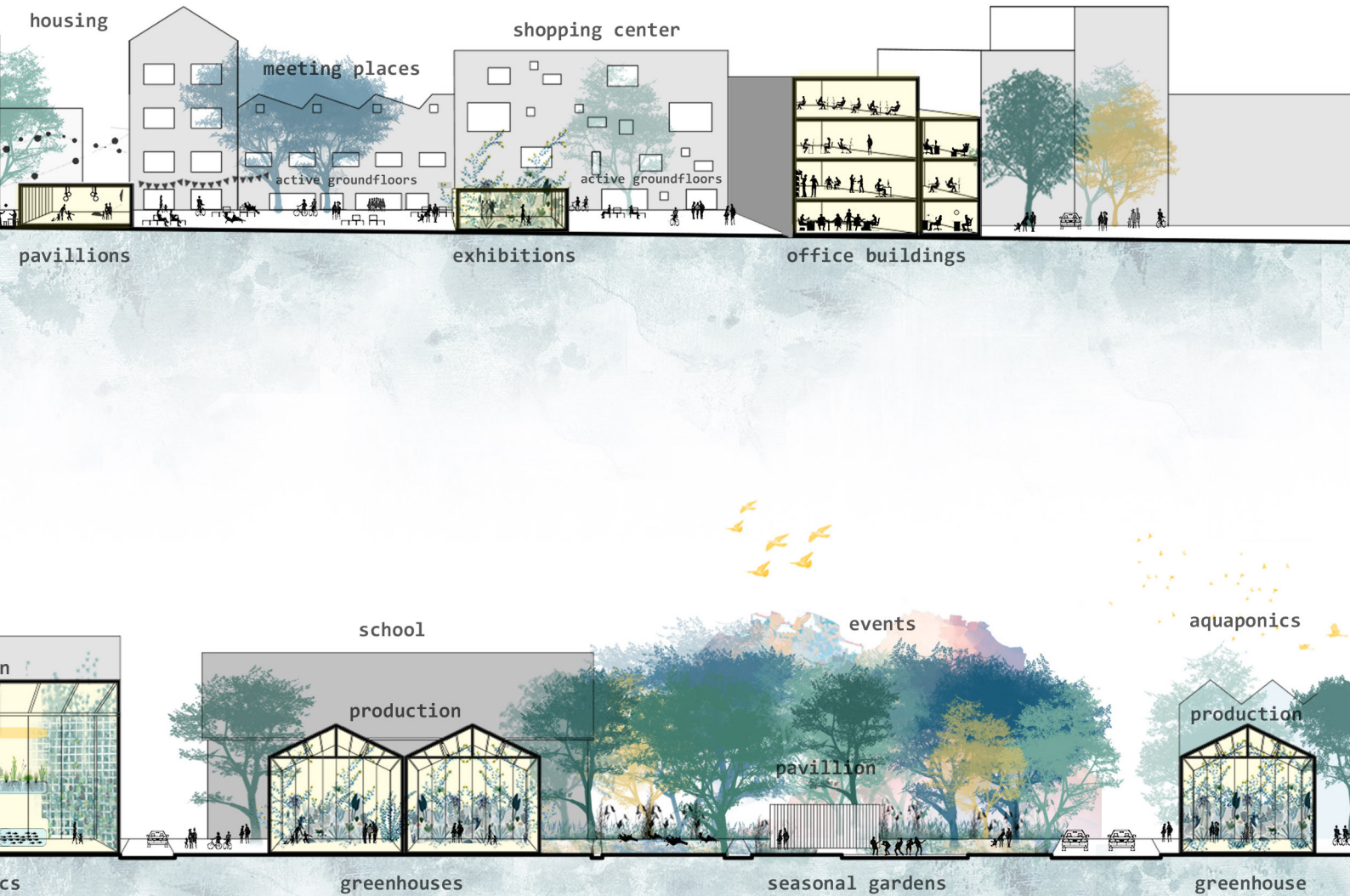
95. SECTION AREA 1 --> THE FOOD SQUARE



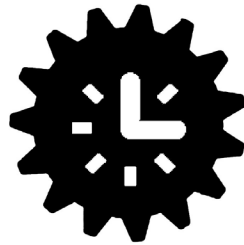
96. SECTION AREA 2 --> THE PRODUCTION



FOOD SQUARE



Timeline...



3.4 Timeline

2018

phase 1 2018: preserve and renovate existing structures and start building the operating facilities (water station, energy stations, waste station)

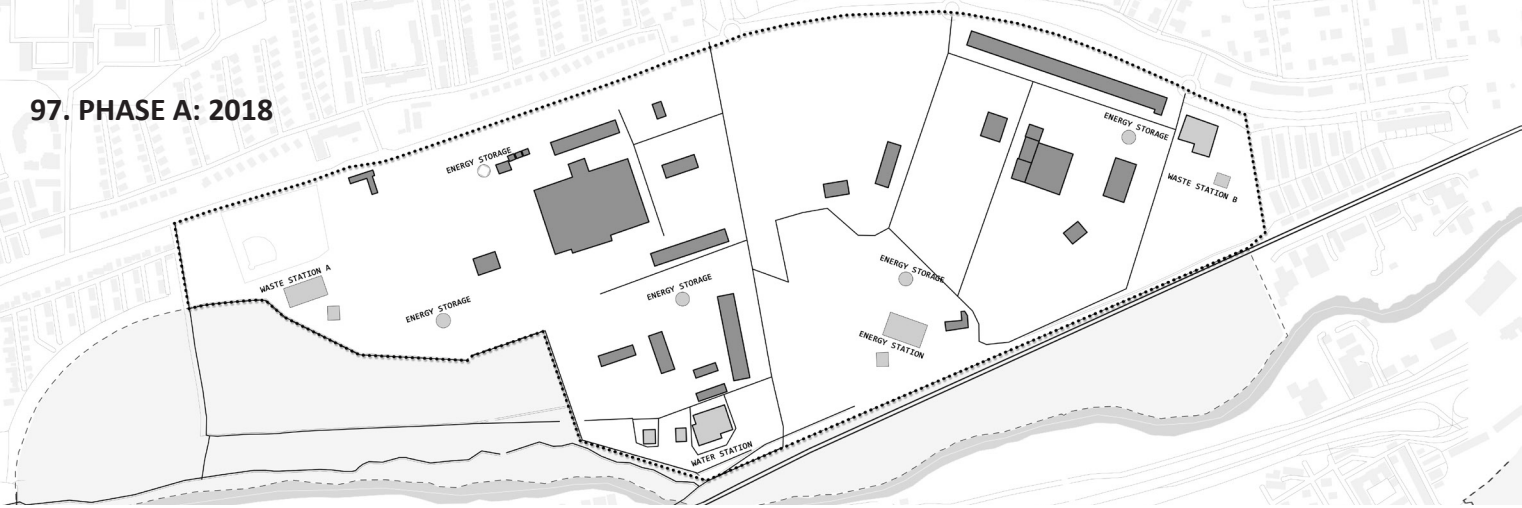
2025

phase 2 2025: create new connections and the new train station - introduce public nodes and start densifying around them

2035

phase 3 2035: densify even more – attract more people to come, live, work, invest or visit the new center

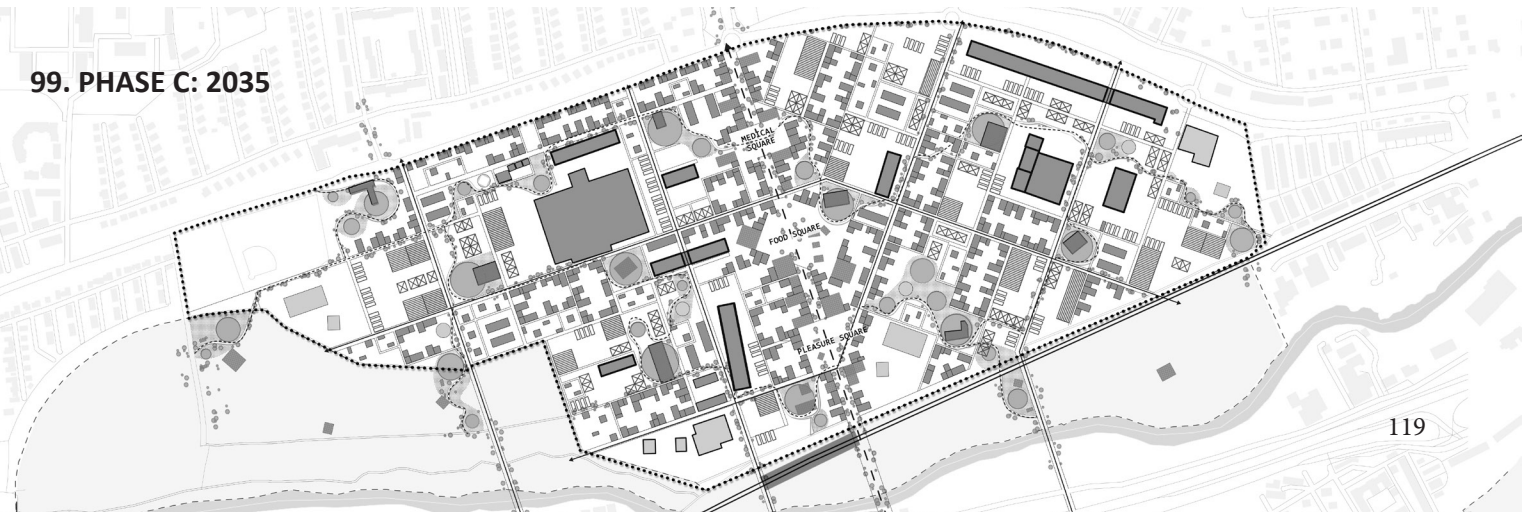
97. PHASE A: 2018



98. PHASE B: 2025



99. PHASE C: 2035



conclusions

IV

4.1 Conclusions

a. How much can the new system support

The new system can accommodate up to 17.000 people and generate up to 30.000 new workplaces. It can produce enough food and energy for the needs of the community and the regional area, and create business, tourism, research and innovation opportunities, attracting multiple groups of people.

b. Further thinking

Future urban challenges are now present more than ever. While countries like Sweden may not be in a crucial condition or face emergency issues, they still need to minimize the risks of an interconnected global economy. Most importantly though, their privileged position indicates their responsibility to act as leading examples, providing solutions and alternatives. Highly developed countries can and should invest in sustainability, as they are equally responsible for the causes.

There are and there should be a lot of different approaches to sustainably city planning and new technologies are only one of them. While many people are skeptical, there is the need of spreading the information and knowledge, demonstrate the exiting new opportunities and benefits and use the new systems as a tool towards essential issues such as environmental threads. This thesis projects suggests that urban design should not only incorporate new technologies, but can actually be formed and shaped by them.

It also aims to emphasize, that the concept of sustainability is not only related to careful design and smart technology systems, but rather on a combination of the above with an individual and public awareness, involvement and implementation. The mix of living working and enjoying is important for all separate units to realize themselves as part of a bigger entity. Households, working places, public spaces, neighborhoods, cities, regions and countries are all interconnected living organisms and should operate like that.

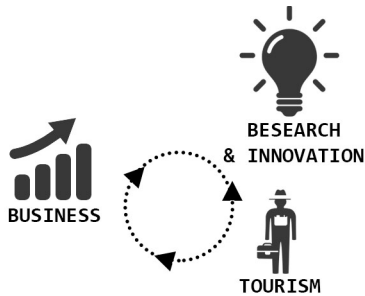
Monocentric development is probably not the only solution to future planning and sticking only on what already exists is maybe not the only sustainable way to go. We must be able to formulate new questions, but most importantly we should dare to suggest new answers.

ure planning and sticking only on what already exists is maybe not the only sustainable way to go. We must be able to formulate new questions, but most importantly we should dare to suggest new answers.

100. HOW MUCH THE NEW SYSTEM SUPPORTS



can accommodate up to 17.000 people in 2035 including families, couples or individuals



can create business, tourism, research and innovation opportunities, attracting multiple groups of people



can produce enough food for the community and depending on the aquaponics used export to other the region



can generate up to 30.000 new jobs



can produce more than 0.9TWh of energy through waste management facilities, solar panels and water recycling systems

101. AERIAL VIEW OF THE COMMUNITY





housing

ENERGY STORAGE

housing

production

housing

MEDICAL SQUARE

FOOD SQUARE

housing

production

production

ENERGY STORAGE

housing

production

housing

housing

production

production

production

housing

production

production

ENERGY STORAGE

WASTE STATION

production

4.3 Presentation - Model



102. FINAL PRESENTATION BOARDS



Jury

Peter Siöström
Harrison Fraker
Jenny B Osuldsen
Andreas Olsson

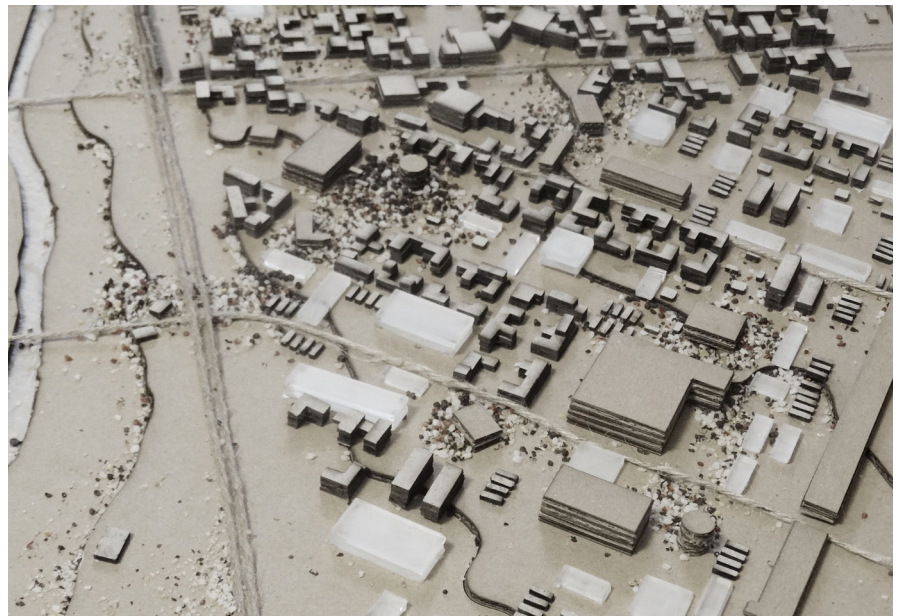
Final posters

3 x (1189x1480mm) mat paper

Materials used

Sand paper
Black pepper
Tracing paper
Brown thread
Grey cartboard 2mm
Brown cartboard 1.5mm
Transparent Plexiglass 3mm

103. MODEL ZOOM IN



104. MODEL TOP VIEW



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14. Main countries of food imports
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18. How the aquaponics work
19. Deep water culture aquaponics, link to picture: <http://www.foodforfreedom.review/wp-content/uploads/s-l1000.jpg>
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29. Future high speed train

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31. Transport of goods, Source: City of Gothenburg, Urban Transport Committee (2014), Gothenburg 2035 transport strategy for a close-knit city, February, page 56

32. Rivercity 2035

33. Regional development plan

34. Future development areas – center, Source: City of Gothenburg, City Council (2012), Rivercity Gothenburg vision, October, page 39

35. Areas in risk of flooding

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37. Green and Blue, Gothenburg region

38. Infrastructure, Gothenburg region

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