

LIVING WITH THE WASTE

Creating a better life image by constructing decentralized waste management in Kampung Kranggan, Semarang

Xuan Liu

Landscape Architecture MSc 2020
Delft University of Technology

LIVING WITH THE WASTE

Creating a better life image by constructing
decentralized waste management in Kampung
Kranggan, Semarang

Xuan Liu

Landscape Architecture
Faculty of Architecture and Built Environment
liuxuan-lx@hotmail.com

July, 2020

Delft University of Technology
with the guidance of

Frits van Loon

First Mentor
Chair of Landscape Architecture

Machiel van Dorst

Second Mentor
Department of Urbanism



ACKNOWLEDGEMENT

This project would not have been possible without the support of many brilliant people in the past year.

I would like to thank my mentors, Frits van Loon and Machiel van Dorst, for their constant inspiration and stimulation. The knowledge they share with me throughout the process is invaluable not only for this project but also for the later professional career.

I also would like to thank the Shared Heritage Lab for organizing the amazing field trip to Indonesia as well as the ITB group. Your generous sharing and help during the site visiting and local communications give the project more insights.

Last but not the least, I'm very grateful for my family, who also support the decision I made. Also my friends from home and delft for encouraging me along this journey. It's a unique graduation journey given the pandemic, everyone suffers from it meanwhile starts to appreciate more for what we have and what's around. I wish you all the best, and we'll soon meet again in real life.

CONTENT

Chapter1 Introduction

- 1.1 Motivation*
- 1.2 Fascination*
- 1.3 Semarang Background*
- 1.4 Observation*
- 1.5 Problem Statement*
- 1.6 Research Question*
- 1.7 Relevance*

Chapter2 Methodology

- 2.1 Theoretical Background*
- 2.2 Methodology Framework*

Chapter3 Analysis

- 3.1 Current Green & Blue Structure*
- 3.2 Existing Waste Management*
- 3.3 Future Waste Management Possibilities*
- 3.4 Site choice*
- 3.5 Kampung Kranggan*
- 3.6 Analysis*
- 3.7 Summary*

Chapter4 Precedent Study

- 4.1 MAKOKO Urban Design Toolbox*
- 4.2 Weishanhu Park*
- 4.3 UP+S Rain Garden*

Chapter5 Design Strategies

- 5.1 Green & Blue Structure Vision*
- 5.2 Proposed Waste Flow*
- 5.3 Design Strategy*
- 5.4 Design Iteration*

Chapter6 Design Implementation

- 6.1 Masterplan*
- 6.2 Overall System*
- 6.3 Detailed Design*

Chapter7 Conclusion&Reflection

- 7.1 Conclusion*
- 7.2 Reflection*

References

ABSTRACT

Waste has always been with humans, and its amount will increase drastically, along with rapid urbanization and globalization. Improperly treated waste causes problems such as water pollution and disease, impedes living quality. Developing countries suffer more because of their hysteretic economic and social development. Landfill, as the predominant waste dealing measure, struggles to handle the current situation due to the gap between the waste amount and the land it requires. How to establish decentralized waste management should be examined to adapt to the inevitable future of living with waste.

Semarang is the fifth big city in Indonesia, also the capital of Central Java Province. Its unplanned city expansion since the last century fails to equip the city with effective waste infrastructure and leaves no space for people and nature to interwave. Consequently, it creates an unhygienic and unattractive environment and undermines the living quality.

This project looks at Kampung Kranggan as the test site in the light of its commercial importance, strategic location, and rich culture. The design explores how waste flows can be integrated into daily life activities and empower the locals in building their living environment. Landscape interventions help to contribute to a healthy environment and, more importantly, create social and economic impacts, meanwhile become the starting point of mindset and behavior change about waste.

Keywords: decentralized waste management; urban metabolism; Indonesia Kampung; sustainability; landscape intervention

CHAPTER 1

INTRODUCTION

- 1.1 Motivation*
- 1.2 Fascination*
- 1.3 Semarang Background*
- 1.4 Observation*
- 1.5 Problem Statement*
- 1.6 Research Question*
- 1.7 Relevance*

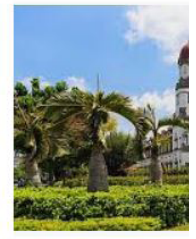
Semarang on Internet



Hotels Semarang - goedkoop overnachten met Ag...
agoda.com



Star Hotel Semarang, Semarang - Boek e...
agoda.com



Holiday Inn Express
ihg.com



Hotel Ciputra Semarang, Indonesia - B...
booking.com



semarang - Liberal Dictionary
liberaldictionary.com



Book Amaris Pemuda ...
agoda.com

Source: Google Image 'Semarang'

1.1 Motivation

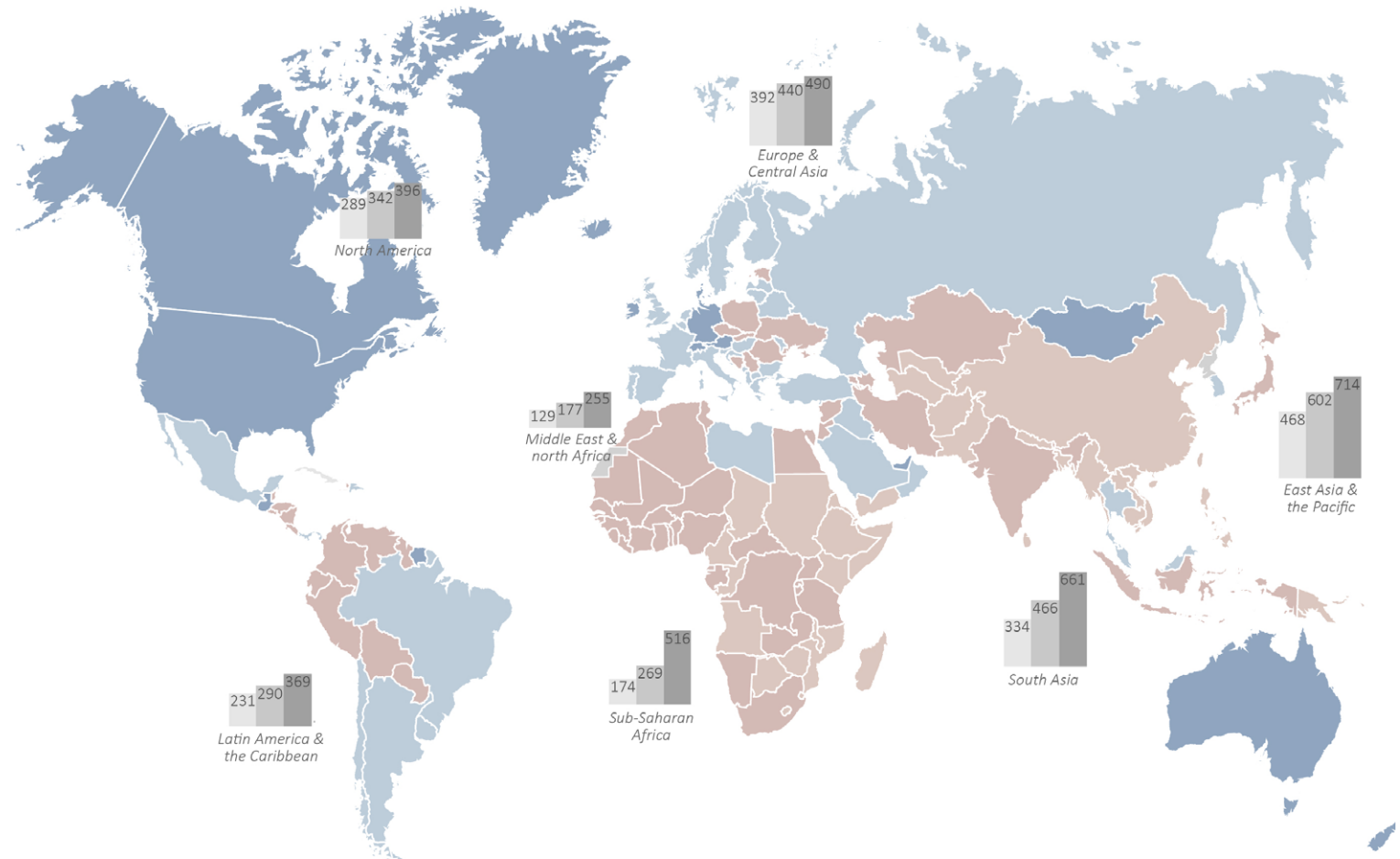
Last November, I joined the shared heritage lab and went to Indonesia for the site visit. Before going, I googled some images of Semarang city, they all look nice and tidy. Also, I made some desk analysis of the city, so I know what to expect on-site. However, when I actually got there, the 'unphotoshopped' Semarang shocked me. The waste presents everywhere throughout the city, in the drainage, in the river, on the streets. It diminishes the environmental quality, also the heritage values of the city. Thus, the onsite experience triggered my eagerness to deal with the waste issue through landscape architectural interventions.



Global waste generation will increase 70% by 2050

In the World Bank report 'What a waste 2.0', it states that the global waste could increase 70% if the current condition goes on. Among all the regions, East Asia and Pacific produce the largest amount of waste, the estimated number in 2050 is 714 million tonnes per year. However, the future indicated by these data is not only about the waste, considering the impact it has on other aspects, like the economy, society, and environment, etc. Thus, it is inevitable for the human to learn how to deal with the waste properly and live with it. A new picture is needed for waste management towards a brighter future.

Globally, 44% of the waste is food waste, paper and plastic also account for a large proportion, 17%, and 12% respectively. These materials are all recyclable and can be reused in daily life. Currently, over half of the waste is dumped in an open area or ended up in a landfill, only 7.7% are recycled, that is to say, there's a huge potential that lies in these wastes that most people are not aware of yet.



Data source: What a waste 2.0, 2018

Waste in Indonesia

The annual waste production increases together with the population in the past decade, the number in 2018 reaches 693×10^5 ton with an expected increase to 150,000 tons per day by 2025 (World Bank, 2018). However, only a little part of the waste is treated properly. The waste much influences the country in several aspects.

Waste & Space

Recent news indicates in Semarang city the daily waste production is way over the capacity of the 46 hectares landfill. Soon the landfill will be no longer able to function normally. Apart from the waste ends up in a landfill, the rest is scattered on the street, in the water, etc.. It squeezes the precious public spaces and reduces their quality as well.

Waste & Water

The waterways are the open sewages in the country. Citizens throw everything into the water. The waste clogs in the water further pollute water and curbs the water treatment. These polluted water finally goes to the Java sea, contaminates the world hydrological cycle too.

Waste & Health Condition

The adverse waste effects sanitation then extends to the health condition, which is the most relevant factor in daily life. The word 'sanitation' refers to the maintenance of hygienic conditions, through services such as garbage collection and wastewater disposal (World Health Organization, 2018). Poor sanitation and hygiene cause **50,000** deaths annually in Indonesia (World Bank, 2012). Back in 2001, infant mortality reached 121 per 1000 while the average number in other similar developing countries is 59, and a high proportion of deaths was associated with sanitation-related disease. By increasing access to sanitation facilities from **35%** to **61%**, the infant mortality reduces **68%** from 1990-2015 (USAID, 2015), which adds a solid demonstration of the connection between waste and health condition.

Semarang City Waste Production 1,200 Tons per Day, 46 hectares of Jatibarang Landfill will be Full

Friday, April 5, 2019 15:38

Eggs in Indonesia have been found to contain dangerous concentrations of chemicals – and the poison comes from the world's plastic waste

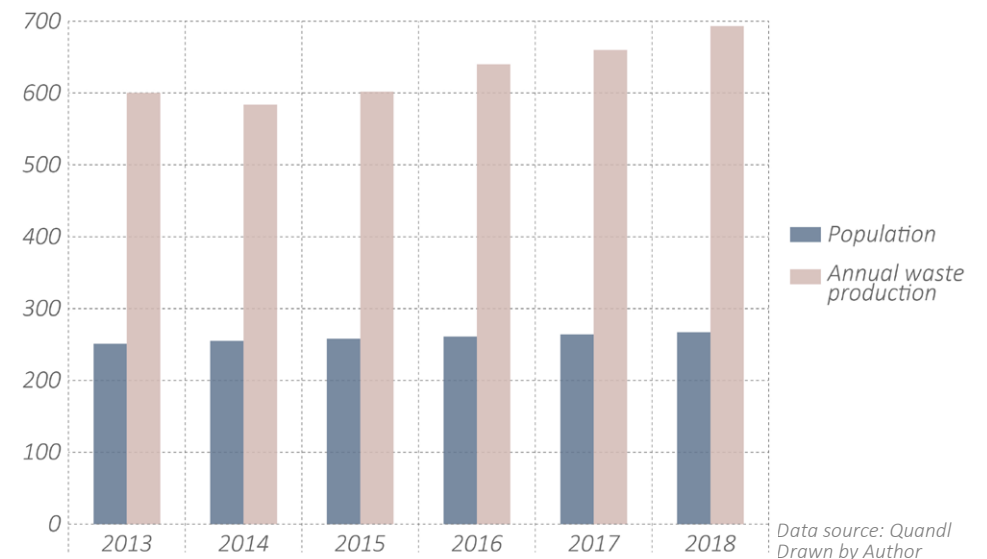
Jessica Lin

November 19, 2019

BY CRISTINA TUSER | NOV 13, 2019



LIQUOR WASTE POLLUTION IN INDONESIA DISRUPTS WATER TREATMENT



1.2 Fascination

There's no such thing as waste



Source: Google

The definition of waste is unwanted or unusable materials (Wikipedia, 2019). We, as humans, are the ones who decide the values of materials. Thus, waste is a concept only created by us. But, such an idea doesn't exist in nature. In the natural cycle, everything is usable materials, and they are always in the circular cycle, even the waste in our perception.

However, the notion of waste in human society is always related to dirt, and it represents something ugly and smelly, which doesn't fit our expectations for a proper, decent life. The shame and fear of waste make us push it as far as we could by building its facilities invisible, inaccessible (Engler, 2004).

We fight our waste in every way we could, but somehow it can find its way back to us all the time, maybe now it's time to make peace with them. Places for waste are needed for circulating rejected items and materials (Lynch, 1990). By bringing them closer to our lives, transforming those unpleasant spots into a public garden, create places for education, or points of connection to the environment by decentralized facilities through landscape architectural interventions.

1.3 Semarang Background

■ **373.70 km²**
total municipal area

■ **1,288,084**
inhabitants

■ **1200 tons**
daily waste production

■ **1**
landfill

■ **67%**
covered by waste services

■ **64.57%**
handled waste

SUMATERA

KALIMANTAN

Jakarta

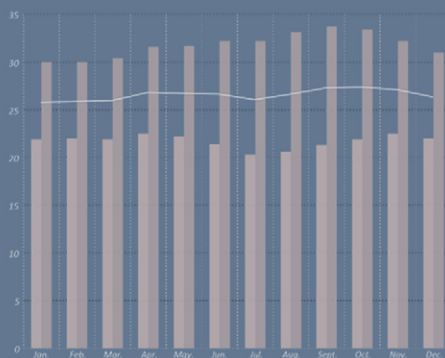
SEMARANG

Surabaya

Yogyakarta

INDONESIA

JAVA ISLAND



Temperature
Source: climate-data.org

Semarang is situated on Java Island, and it is the capital and the largest city of the Central Java Province. The city has 1288085 inhabitants, 424628 households, with a total area of 373.7 km². The only landfill is located at the southwest of Semarang. However, the daily waste production is 1200 tons, which exceeds the capacity of the landfill.

1.3 Semarang Background

Semarang is the capital city of Central Java Province, the fifth big city in Indonesia, also one of the most heavily populated cities in the country. Semarang becomes the main port since the first river port built along the Semarang River in 1406 due to its strategic location. Different groups of people, the Portuguese, Chinese, and Dutch, come to settle here and share the prosperity of the city, which endows the city with different cultures. At that time, Semarang is the trading center of Java Island.

Later on, the establishments of the transportation infrastructure and two floodways change the city. Semarang River loses its function as the transportation route, and citizens start to bath, wash in it. Meanwhile, the kampung develops in the city without proper infrastructure. Its poor sanitary and living condition leads to the breakouts of disease such as cholera and malaria.

In the process of urbanization, Semarang encounters population growth as a result of economic development. The increase in population triggers higher waste generation. Gradually, it becomes the largest waste producer in

Central Java Province. People leave their waste everywhere. It clogs the waterways causing water pollution and river siltation, degrades the capacity of urban drainage, piles up on the streets emitting an unpleasant smell, furthermore affects on society and economy.

The halo of Semarang city accumulated along history is fading away. People here suffer from the way they act, and the whole city is turning into a trash dump which obstructs its own development.

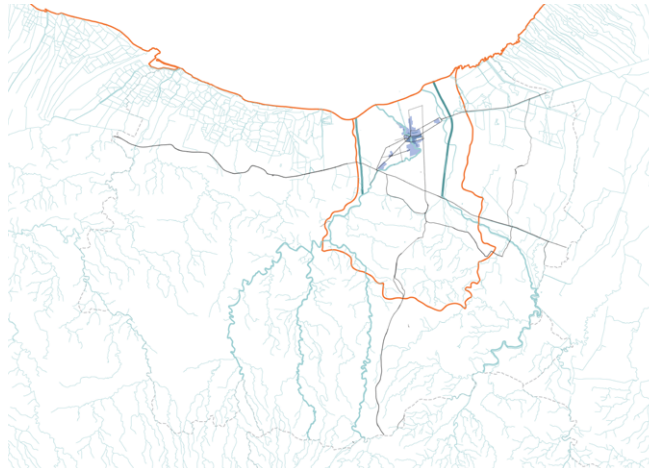
Semarang city



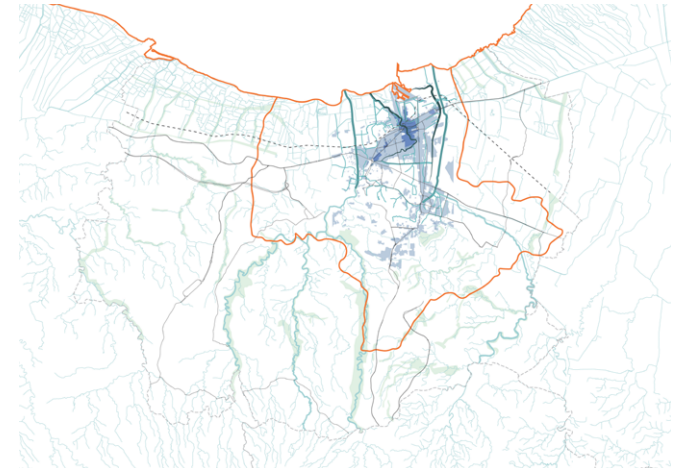
1.3.1 Urban morphology



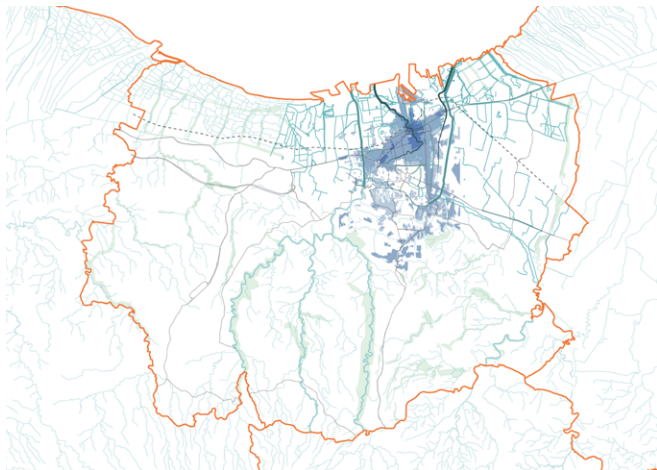
1719



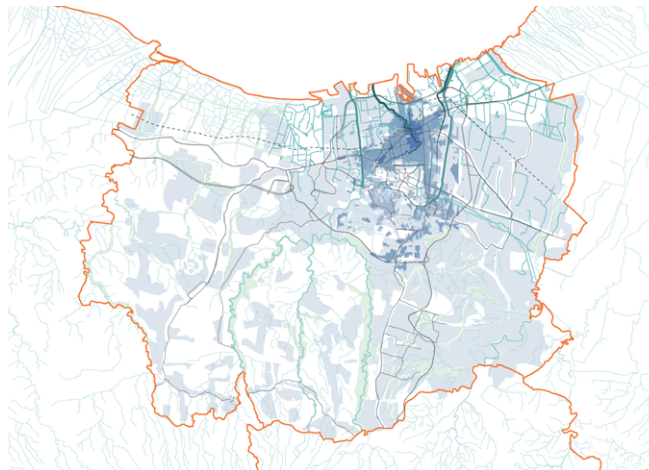
1824



1917



1946



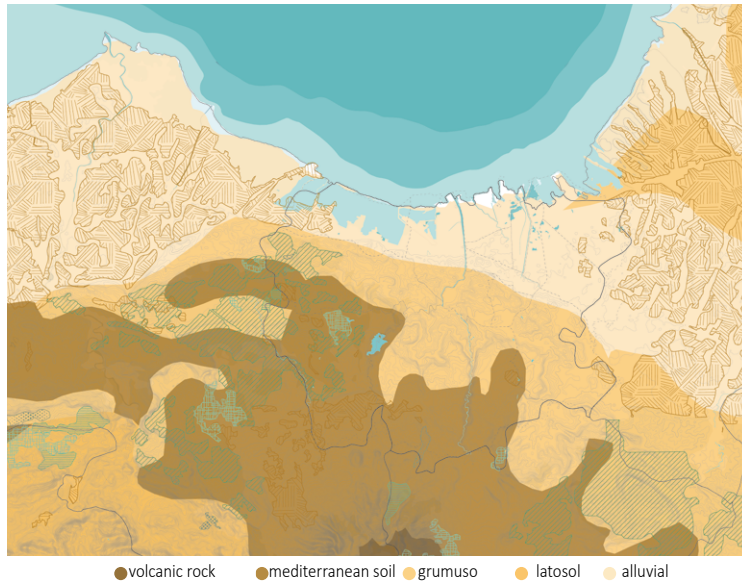
2019

- 1719:
Dutch settlements dominate the urban fabric, and also attracts several ethnic groups to settle nearby.
- 1824:
To deal with flooding, the West and East waterways are built. The city grows rapidly because of the establishment of the Daendels Road.
- 1917:
Semarang grows towards the hinterland. The Dutch government initiates drainage development due to the serious disease like cholera caused by flooding.
- 1946:
Few documentation of the city planning can be found because of the war. Semarang city keeps expanding towards the mountain area.
- 2019:
Semarang city expands horizontally. unorganized expansion causes many problems.

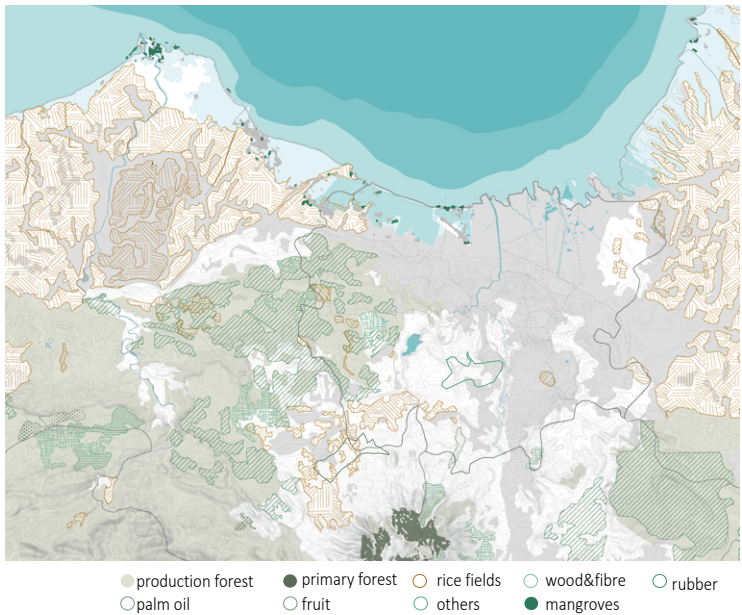
Source: Shared heritage lab collaborating drawings

1.3.2 Landscape Structure

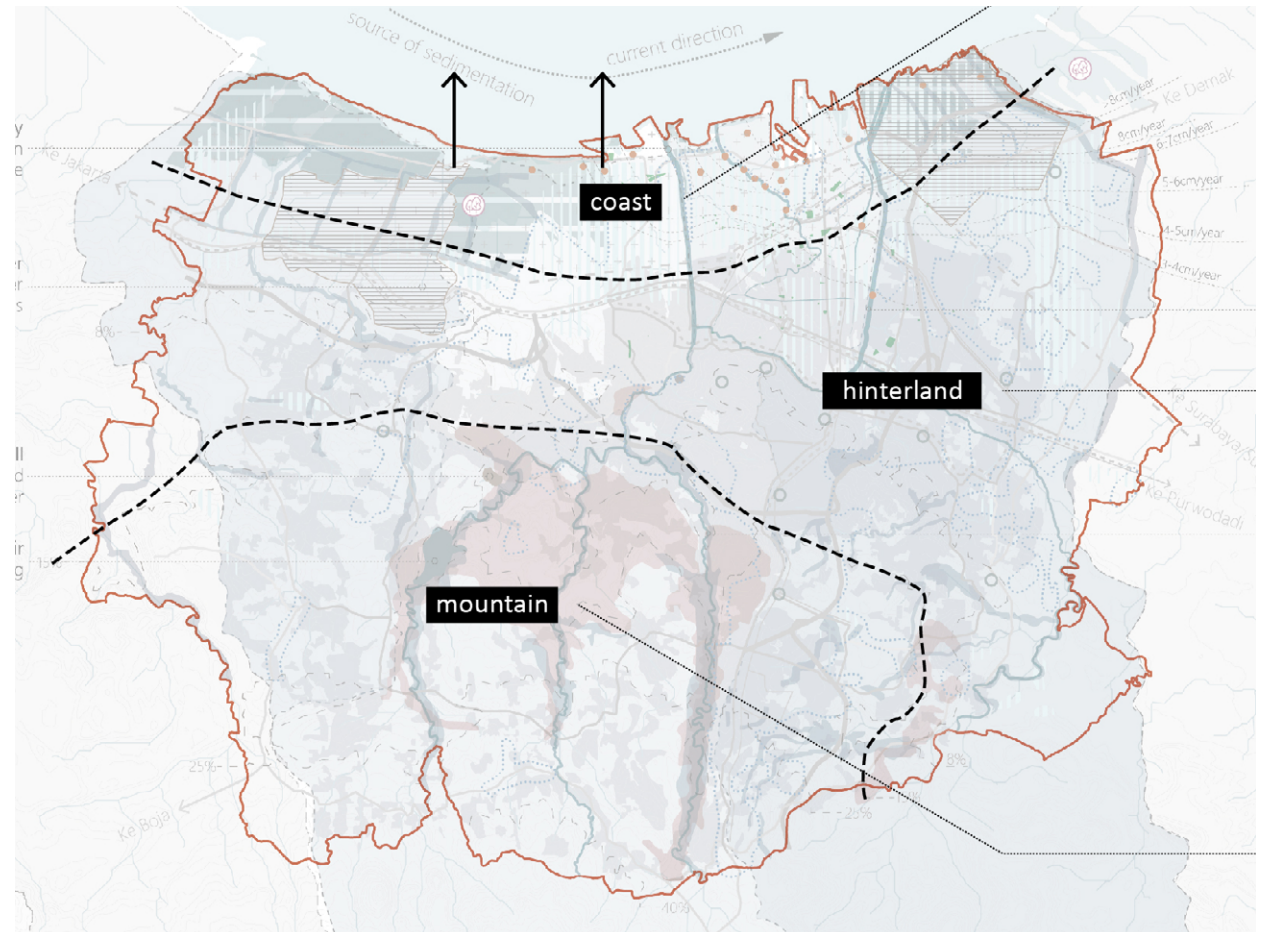
Soil Map



Plantation Map

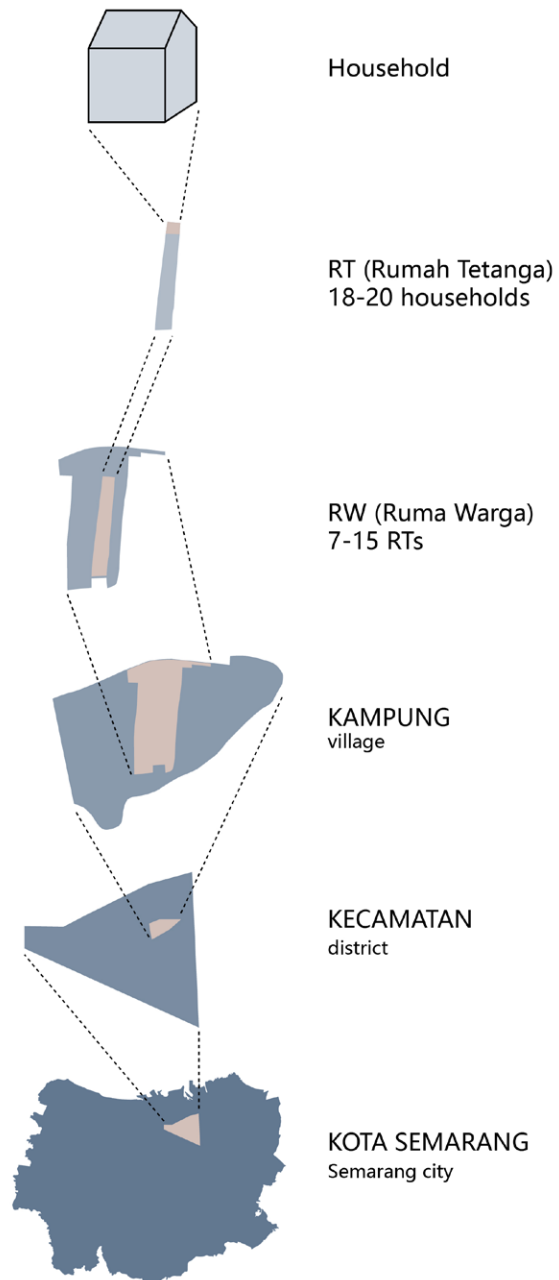


City Structure



The tectonic plate movements bring fertile soil to the city where various plantation can flourish. It also causes active volcano movements then form the topography of Semarang. Overall, the city is formed by the mountain, the hinterland, and the coast. Another effect of the tectonic plate movements is the whole island is tilting into the Java Sea. Semarang is also facing other issues such as groundwater extraction, waste and water pollution.

1.3.1 Social structure



Indonesian cities have several subdivisions. The first level is the city (Kota), the second level is the district, and the third level is the village, so-called kampung. Kampung is an indigenous, closed, and self-built settlements, it usually is considered as an informal settlement because of its unplanned development.

Kampung is further divided into several communities (Rukun Warga, RW) and neighborhoods (Rukun Tetangga, RT). RW and RT are not administrative. They're organizations help to manage the kampung. Both the head of RW and RT are elected by the residents. Commonly, a RW has 7-15 RTs. Every 2 or 3 months, the head of each RW will meet and communicate with the information they collected from each RT, then report to the superior organization. A RT typically contains 18-20 households. The average size of a household is about four people. The head of each RT holds a meeting monthly with the residents to discuss daily issues, like water, waste. Residents' opinions matter to the ultimate decision making.

Indonesian society is organized from bottom to top, so people are strongly connected to their neighborhood and community. With this social structure, they have the power to make a change to their own kampung.

1.3.2 Gotong Royong & Thematic Kampung



Source: Gotong Royong:Cooperation; steemit.com

Gotong Royong, which means mutual assistance or collective work, is one of the crucial characters in Indonesian culture and society (Bowen, 1986). It emphasizes the individual responsibility toward the community and influence every aspect of society, such as the social structure. Under Gotong Royong culture, in a community, one help each other with agricultural, constructional, and other situations for free, in turns, others will offer their support when needed. Thus, Gotong Royong spawned a strong community bond. In the development of a kampung or a RW, residents have the power to make decisions and develop the village as a whole.

Thematic kampung is a proposal initiated by Semarang government based on Gotong Royong culture. It aims to enhance the local living environment and stimulate its economy with greater local participation. It proposes one kampung could have one theme and use it as an attraction for tourists. By now, there are some successful thematic kampung cases established in the city, such as the aquaponics kampung and batik kampung. These examples shed light on the encouraging outcome of this proposal.

THEMATIC KAMPUNG AND « GOTONG-ROYONG » CULTURE AS THE BACKBONE OF SUSTAINABLE DEVELOPMENT



GOVERNANCE DEMOCRACY PROMOTION LOCAL
INSTITUTIONAL PARTICIPATION HUMAN RIGHTS
ARTS CULTURAL TECHNOLOGY SUSTAINABLE

Source: www.semarangkota.go.id

1.4 Observation

1.4.1 Interview



Paper Shop Owner

- Pecinan resident
- Age: 73

1. Does Pecinan area change a lot since you live here?

Not really

2. Are the residents here today also mostly Chinese?

Yes, but more and more people are leaving Pecinan because the environment is getting dirty. Some people will sell their house when they move out, some just abandon the building.

3. Was Kali Semarang dirty when you were young?

No, the river was pretty clean at that time. Now the condition is getting worse every year.

4. Do you go to the waterfront or any other places in Pecinan in your free time?

No, I usually don't go to the waterfront. I would go to the parks outside Pecinan, I also go to the temple if there's an event.

5. What's the current measures about waste?

Every two or three houses share a trash bin, we put the daily waste into it, then supposedly a waste collector should come and collect every two days. But the waste collector usually doesn't show up on time, then the trash will pile up on the streets.



Restaurant Owner

- Pecinan resident
- Age: 76

1. How long have you been running the restaurant?

Over 20 years.

2. Does Gang Baru change all these years?

It doesn't change that much. This street has been the market street since at least 50 years ago.

3. What's the current measures about waste?

Every household collects their waste in the trash bin on the streets, then a waste collector comes to pick the waste up. Same for the market.

4. Do you think the waste management work well?

Not really. The residents and visitors sometimes just throw garbage on the streets. Street vendors are even worse, they leave waste everywhere if the manager from RT doesn't pay attention.

5. Does this have an impact on your business or daily life?

Absolutely. Fewer people come to Gang Baru because of the unpleasant street, so I make less money.

6. What are your hopes in the future for Gang Baru?

I hope the street can be cleaner, and the next manager of RT can really take responsibility.

1.4.1 Interview



Drinking Water Refill Store Owner

- Bandarharjo resident

1.How long have you lived here?

I've been living here for 25 years since 1995.

2.Why do you choose to live here?

I choose to join my wife as she is from here.

3.What do you do on a daily basis?

I run this store of refilling drinking water from the mountain.

4.Where is the gathering place?

Mainly in our terraces, or probably on the side of the road

5.Do you know where the grey water goes?

Yeah just to the sewer on the streets.

6.What's the current measures about waste?

Well, every two days a guy comes to take up the trashes in front of our houses. But, that's it.

7.What are your hopes in the future for this place?

I just hope that water around here would not be polluted, and that there would be no future problems related to the water access nor flooding.



Casual Worker

- Bandarharjo resident

1.How long have you lived here?

I have been living here all my life.

2.Why do you choose to live here?

I have all my families here and sufficient source of income around.

3.What do you do on a daily basis?

I go look for money here and there; sometimes by pulling becak rides, construction work, or fishing in the sea.

4.Where is the gathering place?

Just in our houses. Although we have a bigger gathering place near the fish factory, just for an official and bigger events though.

5.Do you know where the grey water goes?

Well just on the sewage outside?

6.What's the current measures about waste?

I only know a guy will come and pick up the garbage on the streets.

7.What are your hopes in the future for this place?

I think what the people need here the most are some help with regards to fundings, especially on the sinking houses.

1.4.2 Insufficient waste management



poor waste infrastructure

The city spares most of its public spaces to transportation infrastructure. Limited spaces are used for waste infrastructure, such as waste collection and recycle. As a result, waste presents itself everywhere in the city, and an overfull trash bin becomes the typical city image.

Moreover, the waste management network does not serve the whole city. The waste service network covers only 67% of the sub-districts of Semarang, and it merely handles 64.57% of the total waste (Miladan, 2016). Additionally, it mainly tackles with waste collection and transportation. Most of the waste ends up in the only landfill, which almost reaches its maximum capacity due to the increasing waste generation. Wastewater all goes into Kali Semarang ultimately. Thoughts about reuse and recycle are not included in the current system.

limited local participation

Although the interviews reveal that some residents have the awareness of the environment, when it comes to waste management, they only know their waste will be picked up, then the whole waste dealing process has nothing to do with them. It is to say, the current waste management fails to include citizens as much as possible to strengthen their understanding of the city waste cycle, and the consequences can happen from their misaction in this cycle.

unhygienic environment

Insufficient waste management further leads to other issues such as water pollution, drainage clog, and so on, then extend to the public health condition. The unhygienic environment obstructs the city's future prosperity.



1.4.3 Lack of green space

During the rapid and unorganized urbanization, rare attention is paid to the green space in Semarang city, especially in the hinterland and coastal area. As a result, the city develops into a grey environment in which the land is occupied by compact dwellings, leave no space for waste, nature and people to breathe.

However, according to a WHO report on urban green space in 2017 the urban green space is highly required in a healthy living environment. The benefits of green space can be concluded in environmental and social aspects. In this report, it also states that the urban green space an individual possess vary from 9-50 m² in different countries. Unfortunately, Semarang fails to reach the minimum number(WHO, 2017).

1)environmental aspect: urban green spaces can substitute grey infrastructure, create a more lively and inviting environment. Also, it adds aesthetic value to the surroundings and helps to increase people's appreciation of nature. Ecologically, green spaces provide habitat for flora and fauna, promotes biodiversity and microclimate. Some large green spaces can function as a stepping stone in a larger ecosystem.

2)social aspect: green spaces have impacts on human health both physically and mentally. It assists in reducing illness and stress, building a safer living condition and creating a sense of belonging.



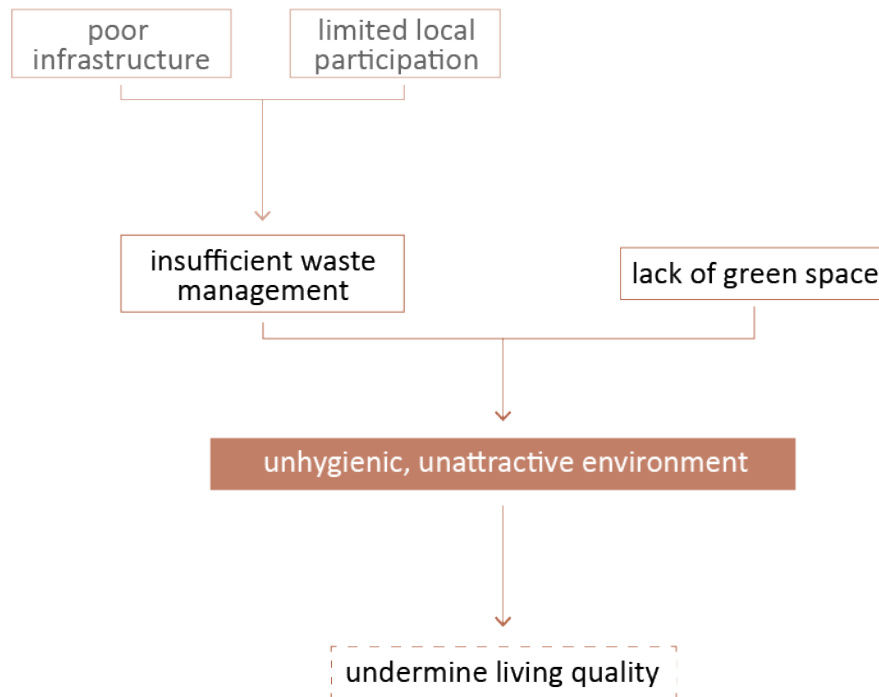
1.4.4 Poor living quality

The waste all around the city influences Semarang economically and socially, and reduces people's living quality. Nevertheless, people choose not to take this issue in mind. Waste is only waste to them, the way to deal with it is to keep it out of sight, out of mind. Waste has been distanced and repressed, yet it shapes our lives and landscapes (Engler, 2004).

However, the connection between living quality and waste is blurry to the citizens at the moment.



1.5 Problem Statement

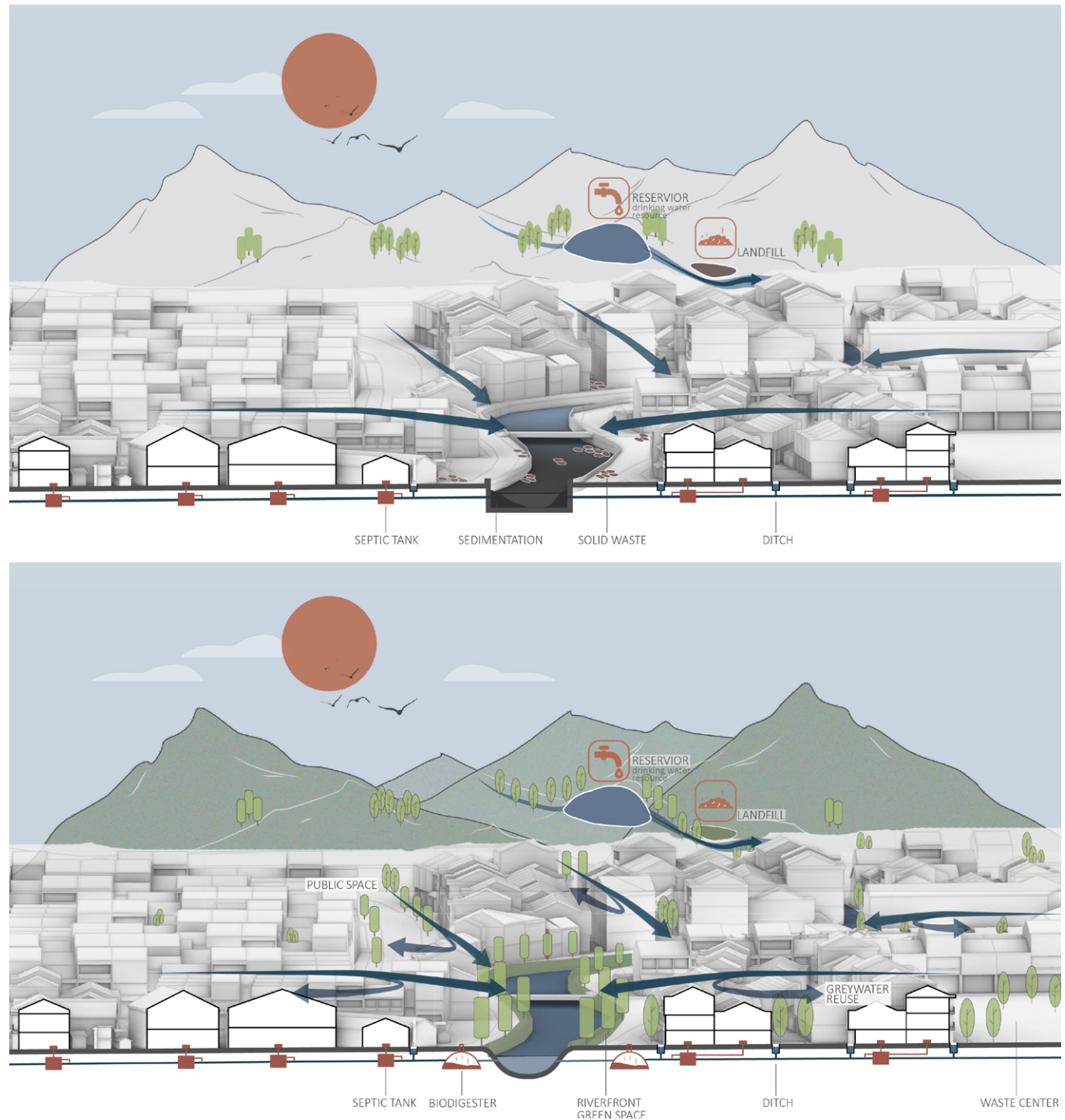


Insufficient waste management and lack of green space leads to an **unhygienic and unattractive environment**, disconnect people and their living environment, further undermines the living quality.

1.5 Research Objective

Waste has been with humankind since the very beginning. Corresponding to massive urban sprawl happens all over the world, water generation keeps growing rapidly as well. For now, the most common method to deal with waste is landfill which requires a big area to build and meanwhile contaminates soil and water. However, in the coming future, where waste generation will increase by over 50%, the land can no longer handle all the waste in landfills. Alternatives to deal with waste is in need.

The objective is to create a healthy environment by conducting decentralized waste management. The new waste flow is proposed on the grounds of the natural and cultural context. The spatial intervention is considered in a dense kampung at a strategic location in Semarang city. The design explores solutions that tackles with waste, meanwhile provides economic and social benefits to create a better life image for the locals.



***How can landscape architectural
interventions create a healthy environment
by reconstructing waste management?***

- *What is the existing waste management and environment it creates?*
- *What are the possibilities for future waste management?*
- *What are the principles and strategies to reconstruct a decentralized waste management to create a clean, inviting environment?*
- *How to translate these principles and strategies into a spatial design?*

1.7 Relevance

Academic relevance

As stated in the fascination, waste will become a significant issue in the future and invade every aspect of our daily life. Especially in the global south, the radical change from the agriculture society to urban society brings in rapid urbanization in which waste infrastructure is not properly considered. Moreover, there is little literature and cases found in the landscape architecture field are dealing with this topic spatially. More spatial solutions in terms of waste are needed in our realm.

The project focuses on how to translate waste management into physical spaces in a highly densed city context. By improving waste management, it can change people's attitude towards waste and enhance the living quality. It has referential value to cities with similar context.

Social relevance

Indonesia is known for its community based social structure. The graduation project proposes a decentralized waste management based on this social structure. Citizens' participation is an essential element in the proposed waste flow. The design also intends to integrate different stakeholders, strengthen societal interactions, create new job opportunities, etc.. It helps to create a better and more sustainable life image for the city.

CHAPTER 2

METHODOLOGY

- 2.1 Theoretical Background*
- 2.2 Methodology Framework*

2.1 Theoretical Background

Healthy Environment

Environment is the vessel that contains all lives on the Earth. Unfortunately, due to massive development of cities, grey infrastructure dominates nature. Urgent and severe environmental challenges rise, to name a few, global warming, pandemic, and sanitation condition. For the benefits of all species share the same planet, for ourselves and the later generations, a sustainable way of development should be seriously considered, a healthy environment is in need.

Health, as defined by The World Health Organization(WHO), is "a state of complete physical, mental, and social well-being, not just the absence of disease or infirmity" (WHO, 2001). A healthy environment should ensure basic human rights, for instance, physical and mental health, water, sanitation and green space (WHO, 2016). Sustainable cities and communities provide an integral urban metabolism for both people and nature to coexist.



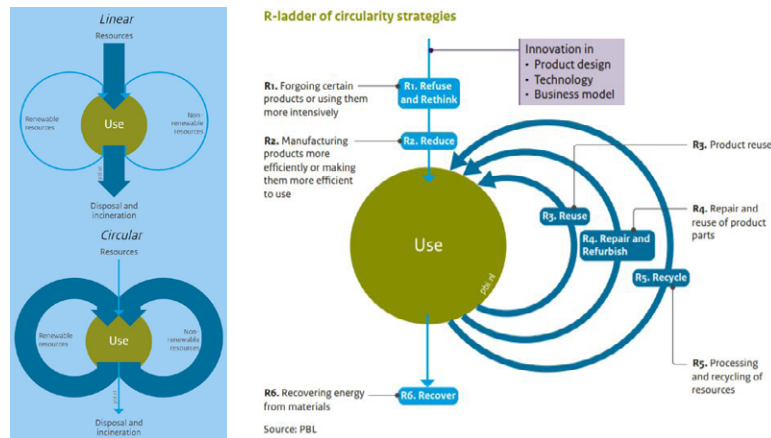
Source: Healthy environment, healthy people (UNEP,2016)

2.1 Theoretical Background

Circular Economy

Circular Economy is originally a concept in the economic realm. It tries to make the most use of resources in the production chains by recycling (PBL, 2017). It is an alternative of the traditional linear economy where materials are discarded after a single usage. The circular strategies include rethink, reduce, reuse, repair, recycle, and recover, varying from a new mindset towards resources to actions that can extend resources' life span. Under this notion, materials are utilized with less environmental contamination.

In terms of waste management, it provides a new cycle for waste production, consumption, collection, and regeneration. In this closing loop, the conventional idea of waste as unusable materials is developing towards a more sustainable direction. Moreover, adjustment of the waste cycle also has an impact socially and economically.



Source: Opportunities for a circular economy (PBL, 2017)

Ecopolis

The term 'ecopolis' comes from two words, one is 'eco', which refers to ecology, the other is 'polis', refers to a self-governing city-state from the ancient Greek (Downton, 2008). It implies the people should take care of the ecosystem or the environment to maintain the balance between nature and culture. It includes both biotic and abiotic components to create livable habitat, also the notion from cradle to cradle and circular economy where materials are all seen as resources.

In Tjallingii's discussion about ecopolis, he brings up a threefold strategy framework. The framework includes the responsible city, the living city and the participating city. Each of them highlights different issues and objectives. The ideal ecopolis city will form when the three perspectives find the dynamic balance.

The Responsible City argues the environmental problems occur because of the careless maintain of flows. Hence, it addresses four principles, economical in use, reuse, renewable or infinite resources, and responsibility for quantity and quality of flows. The Living City indicates the attention to maintain the environment is equally vital as the making of it. Not only the inhabitat for human needs to be maintained, but the living ecosystem around us. Use of local natural and cultural potential, spatial structure for 'flow management', health and a differentiated human habitat, and habitats, corridors and stepping stones for plants and animals are the guiding principles for this strategy. Lastly, The Participating City features the involvement of people in the process of creating and maintaining the environment. Many problems nowadays, for example, waste and water issues, are related to people's engagement. This strategy has four principles, creating conditions for the operation of the market, creating conditions for cooperation, visible ecological relationships, enforcement.

2.1 Theoretical Background

An integrative approach

Engler discusses several waste landscape design frameworks in his book designing America's waste landscapes. These frameworks are developed in the different period and reflect on the changing notion about waste. The camouflage approach and utilitarian approach from the modern period, aims at masking the waste site from its past. In postmodernism period, the waste site is either transformed into a recreational place or kept as a museum to spread knowledge about waste to people. In these periods, waste is still being pushed away from daily life, the spaces for waste like landfill and dumping site are mostly located at the margin of a city.

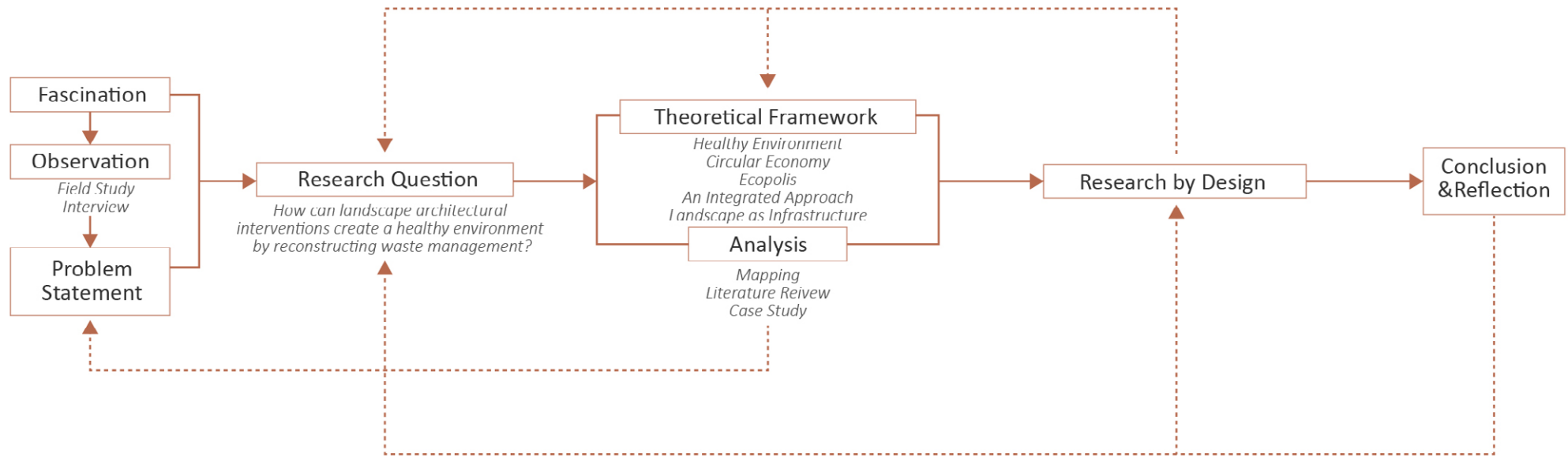
However, in the supermodernist time, attitude towards waste start to change. In the sustainable approach, waste is seen as a valuable resource, and the design is keen to combine waste disposal and recreation functions. In the integrative approach, it combines elements from other approaches and explores the dynamic balance between nature and culture (Engler, 2004). It looks at the potential of waste facilities functionally and aesthetically, also other aspects from a broader context, for instance, ecology, economy and social agendas. By bringing the waste facilities into daily life and presenting them visible equally, the approach emphasizes on the characteristic of a waste site and community participation. It intends to create a healthy environment.

Landscape as infrastructure

Urban Landscape Infrastructure is a landscape intervention perspective in which regards infrastructure system as a crucial element to organize and influence a city's development (Nijhuis & Jauslin, 2015). It dwells on the urgent need for multifunctional and sustainable infrastructure system globally and points out the connections between different layers can be made during this process.

The theory seeks to a multipurpose infrastructure network in the future, which covers not only natural elements such as water, vegetation, but also human interventions. Urban Landscape Infrastructure has a stronger relationship with ecology and social aspects compared to the traditional infrastructure. By shaping the landscape as the carrier of infrastructure, it contributes to moving towards a more sustainable environment.

2.2 Methodology Framework



Research methods

Mapping

Mapping is a crucial method for designers to understand the development of a place and the driven forces behind it. By using the method of layering, it reveals the hidden relationship between different elements. In addition, mapping also is a mean of designing, a way of searching for potential solutions.

Literature review

It is a sufficient tool to gain knowledge related to the design topic and can help designers build up their own theory structure. It's also a powerful tool to gather all kinds of information about the site, such as history, climate, and building development. The paper related to waste offers new insight into why we should alter our notion about it and how to build up the future waste landscape.

Case study

By analyzing precedent cases in a similar context, it provides sound knowledge and principles that might be helpful for the ongoing project. In this sense, it can be regarded as the base of future design.

Field study

Site visiting is an essential step for designers to check information and data collected through desk analysis. More importantly, it directly reveals the differences between maps and reality, which might strengthen or weaken one's argument. For instance, after visiting the site, I realize the waste problem is more severe than water issues, this fact I observed onsite alter the design.

Interview

Interviews are used as a qualitative research approach to gain understandings of human behaviours and develop the basis for further research and design decision making. Talking to local people gives new insights on how does the city organized from a user's perspective, and facts cannot be gained only through observations. For example, the interviews I made with local residents reveal the inefficiency of current waste management and how waste influence their daily life.

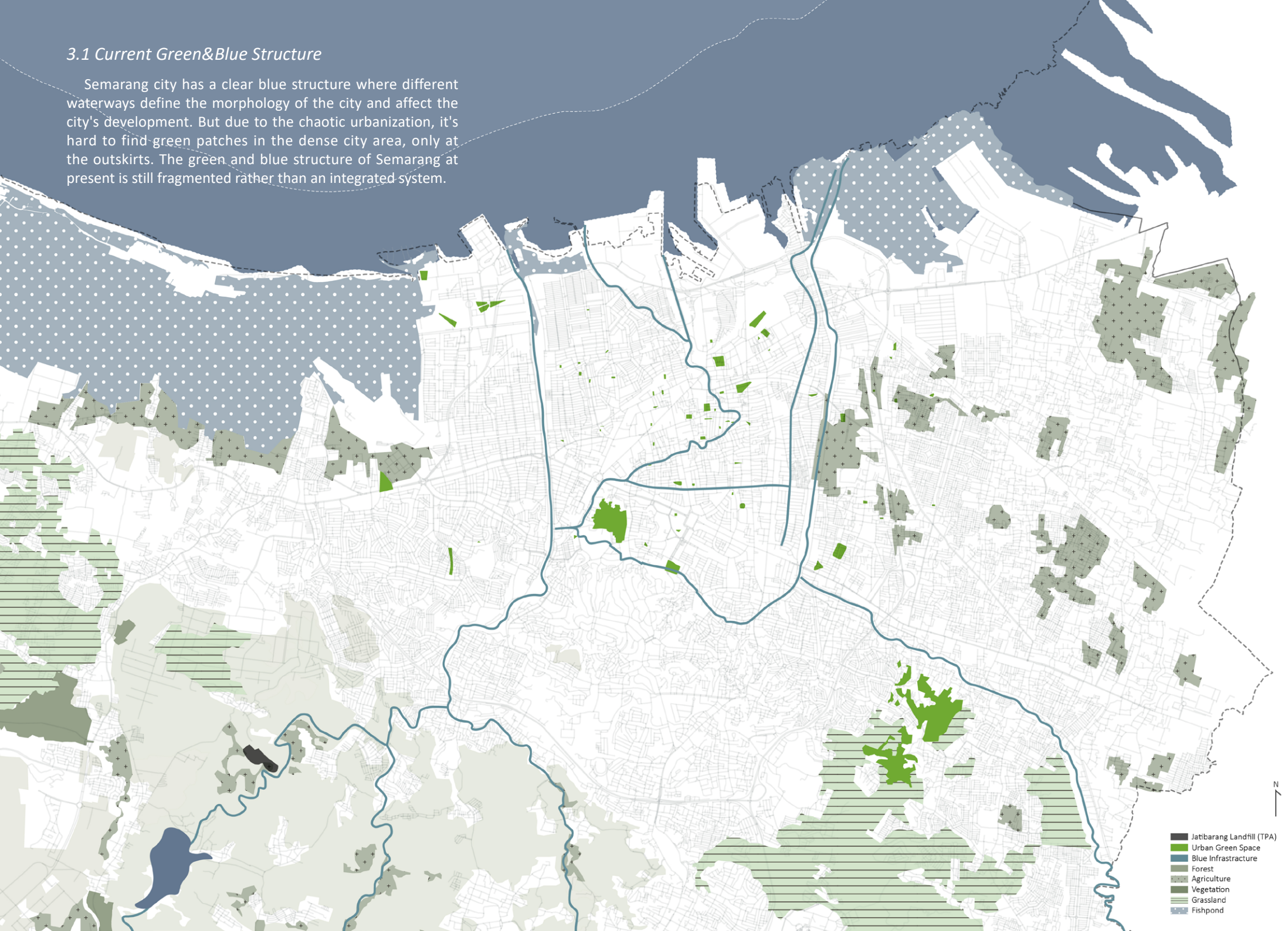
CHAPTER 3

ANALYSIS

- 3.1 Current Green & Blue Structure*
- 3.2 Existing Waste Management*
- 3.3 Future Waste Management Possibilities*
- 3.4 Site choice*
- 3.5 Kampung Kranggan*
- 3.6 Analysis*
- 3.7 Summary*

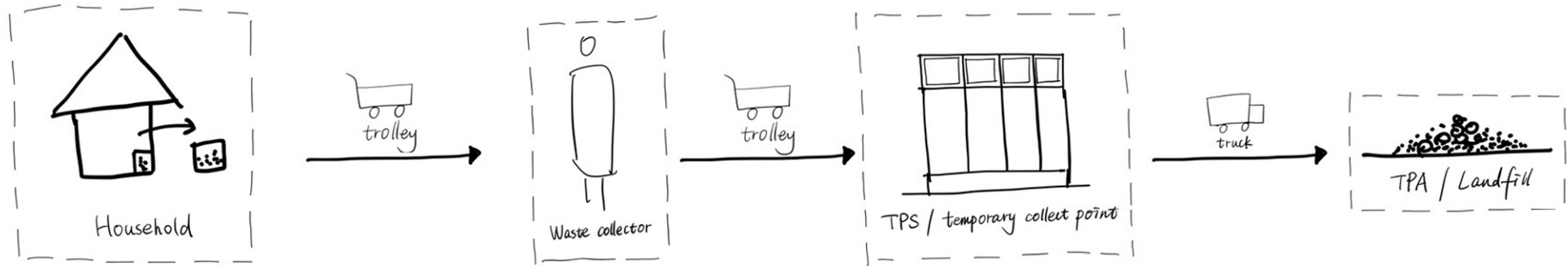
3.1 Current Green&Blue Structure

Semarang city has a clear blue structure where different waterways define the morphology of the city and affect the city's development. But due to the chaotic urbanization, it's hard to find green patches in the dense city area, only at the outskirts. The green and blue structure of Semarang at present is still fragmented rather than an integrated system.



3.2 Existing Waste Management

ideal solid waste management



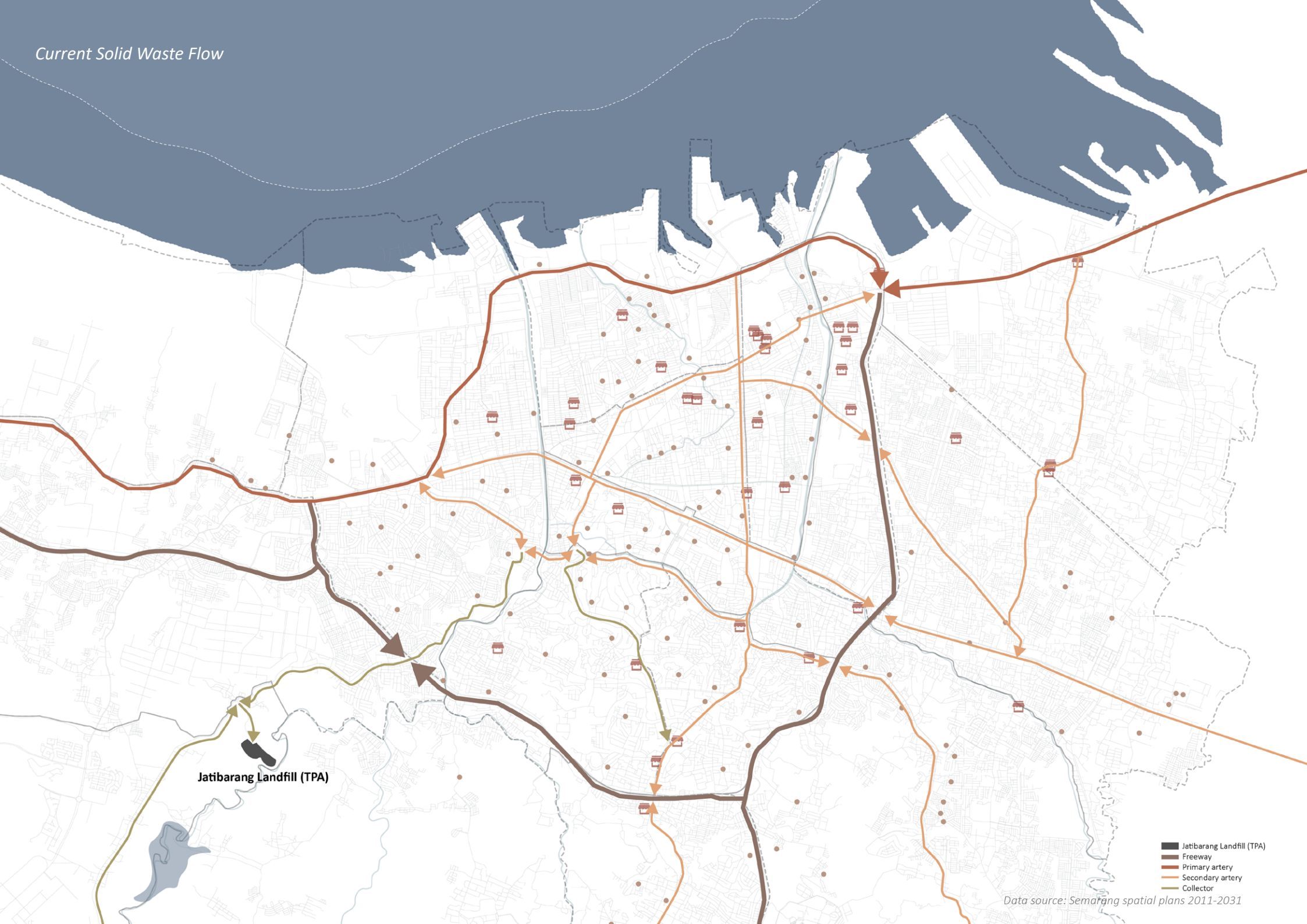
household

kampung

city



Current Solid Waste Flow



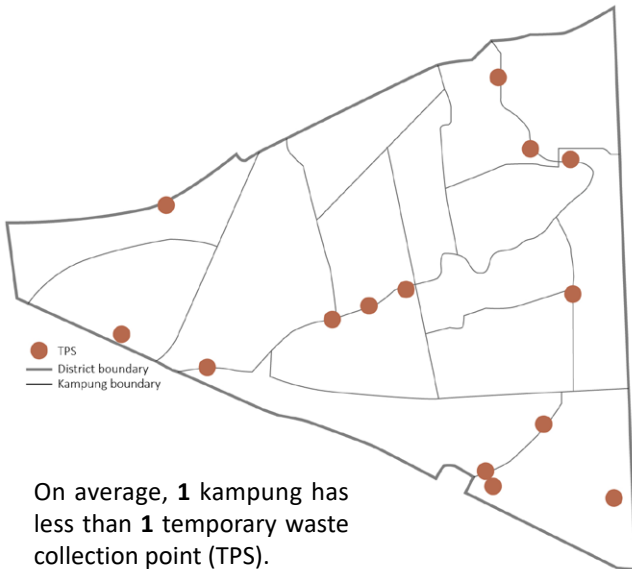
Jatibarang Landfill (TPA)

- Jatibarang Landfill (TPA)
- Freeway
- Primary artery
- Secondary artery
- Collector

Data source: Semarang spatial plans 2011-2031

3.2 Existing Waste Management reality

Waste infrastructure



household



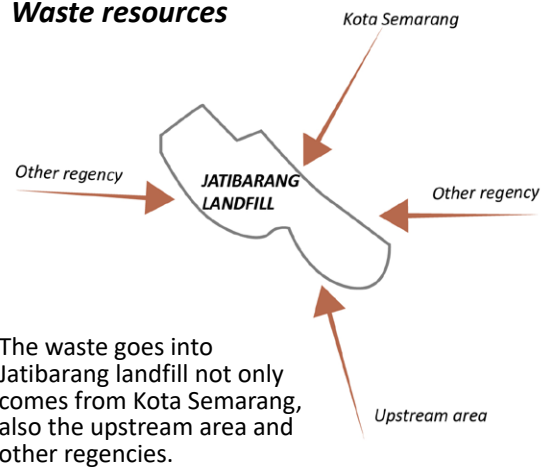
trolley



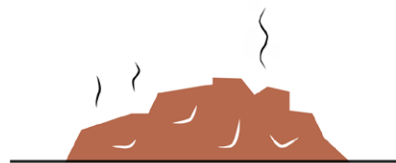
TPS



Waste resources

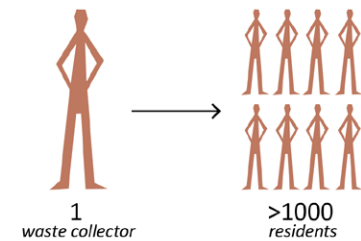


Landfill capacity



The total amount of waste transferred to Jaribarang is **1200**tons per day, while the 46-hectare landfill's capacity is only **400**tons per day.

Service coverage



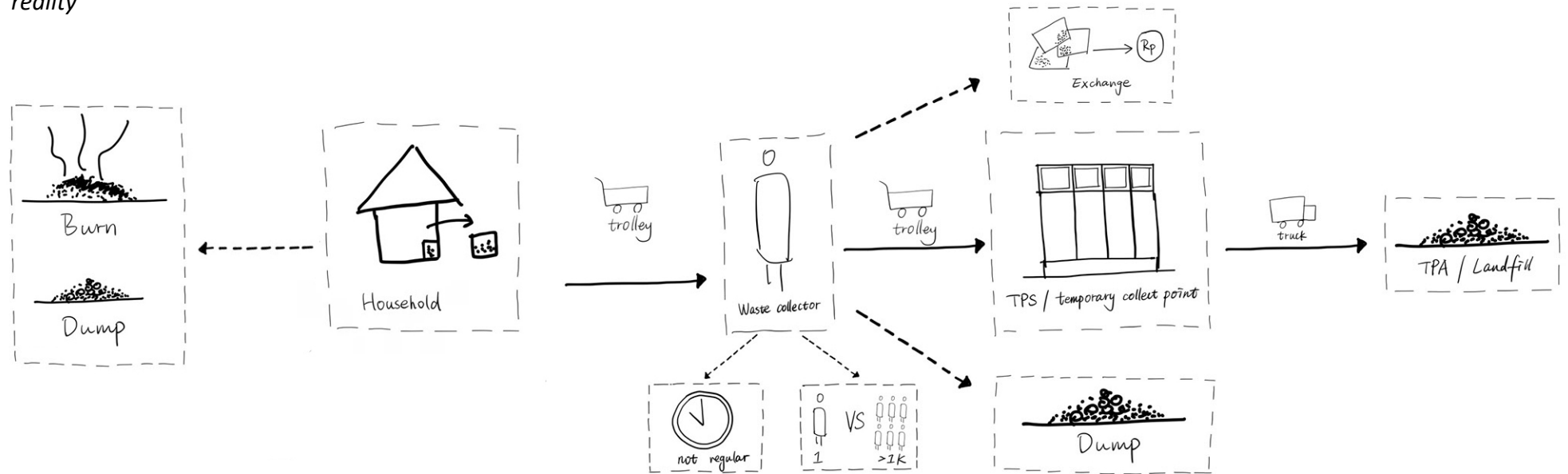
1 waste collector serves over **1000** residents.

Implementation



Waste collectors usually do not show up on time. Moreover, sometimes they dump the waste in a random open space.

3.2 Existing Waste Management reality



household

kampung

city



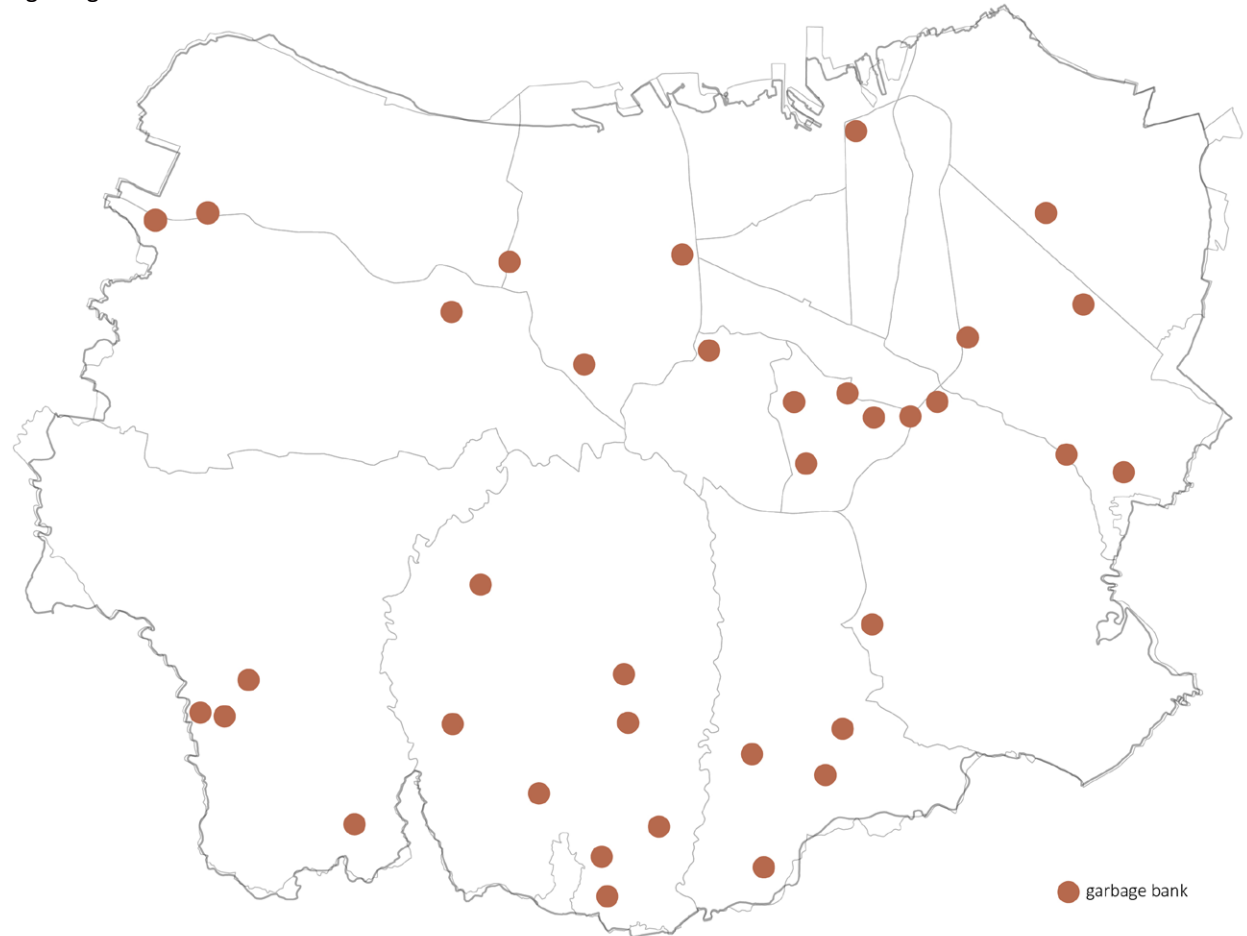
3.2 Existing Waste Management

- garbage bank proposal

Garbage bank is a proposal initiated to deal with non-organic waste in Semarang city. Residents can deposit their non-organic waste then withdraw some recycled useful items in a garbage bank. However, now only small numbers of garbage bank exist and mainly spread in the upper city. Moreover, other limitations are gradually emerging, and the exchange system turns out ineffective.

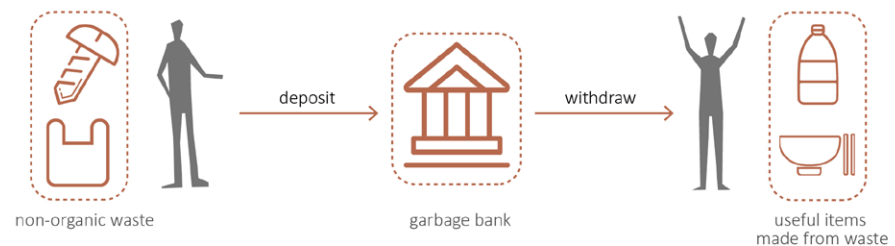
Firstly, the garbage bank requires an actual building, while many kampungs do not have enough funds for it. Secondly, the system only provides the exchange process, which is not enough to arouse the resident's interest in this proposal. At last, it is hard to manage the garbage bank because of unstable salary.

garbage bank location

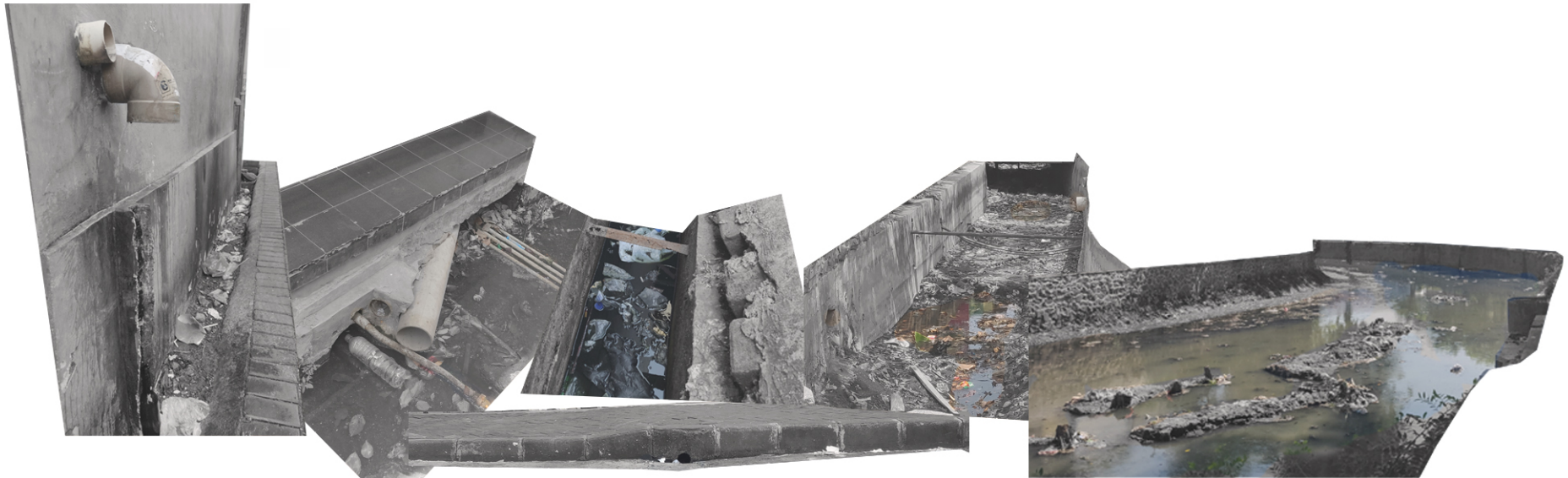
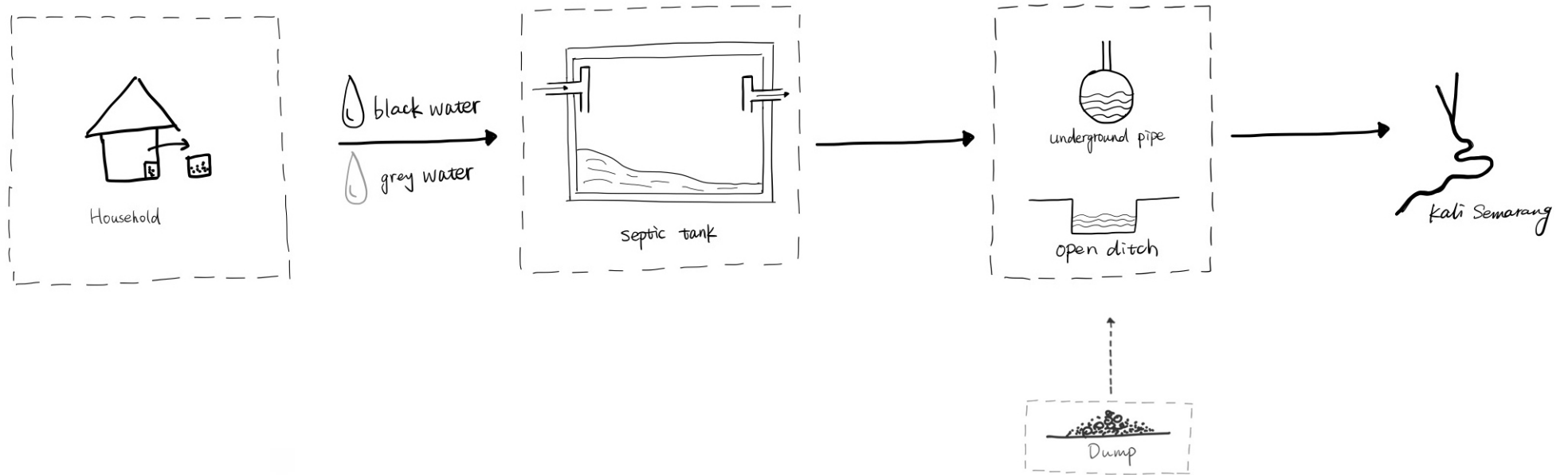


Data source: Study of Waste Bank's Condition in Semarang City, 2019

garbage bank process

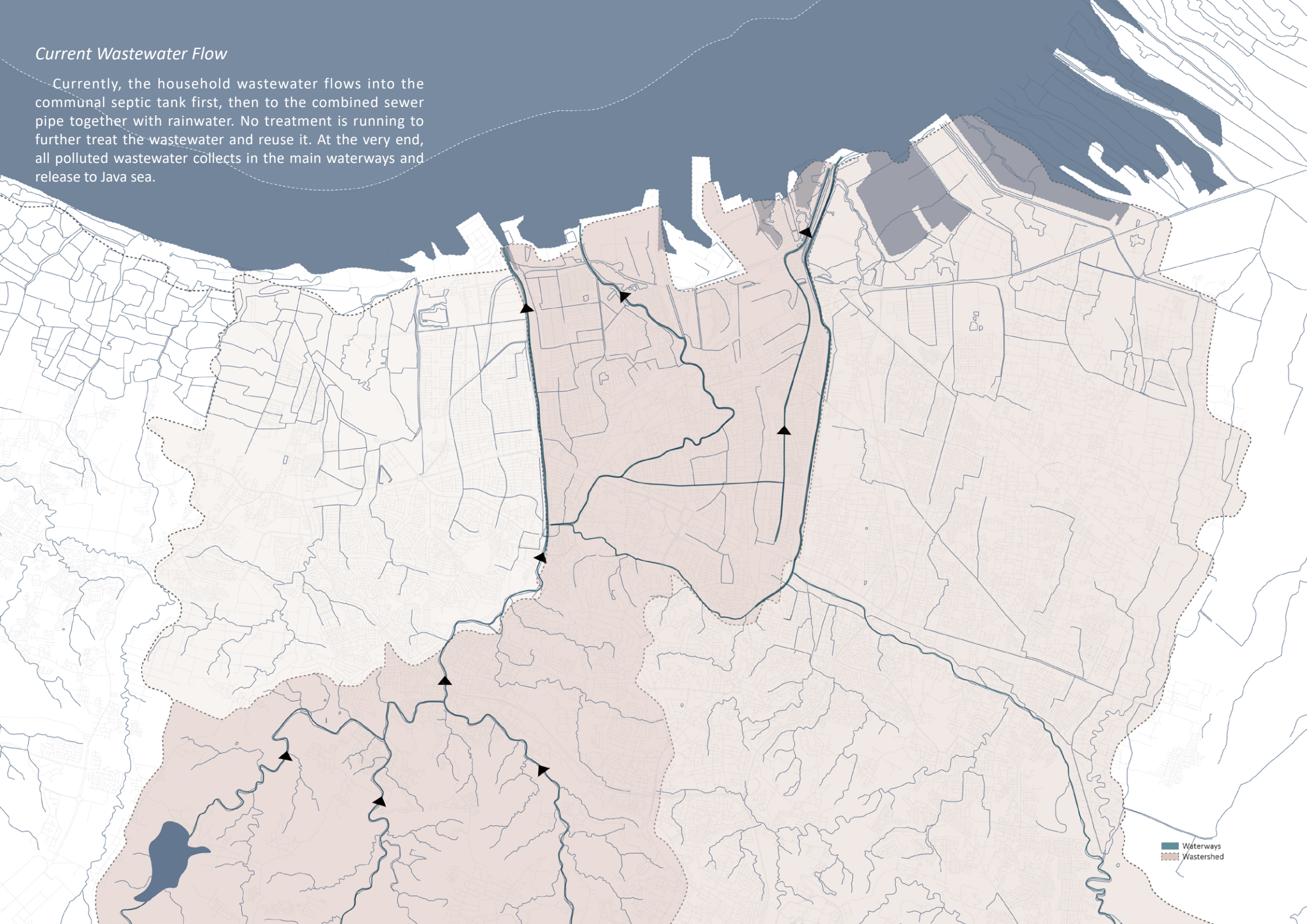


3.2 Existing Waste Management wastewater management



Current Wastewater Flow

Currently, the household wastewater flows into the communal septic tank first, then to the combined sewer pipe together with rainwater. No treatment is running to further treat the wastewater and reuse it. At the very end, all polluted wastewater collects in the main waterways and release to Java sea.



3.3 Future Waste Management Possibilities

Centralized



Push out the waste

The waste is pushed out from the house and the city as soon as possible. Since it becomes invisible to people, the current mindset of waste is formed.



Loss in transit

Due to the hot weather in Indonesia, the waste should be processed without delay, especially organic waste. At the moment, the waste rots in the long transit to Jatibarang landfill.



Large space

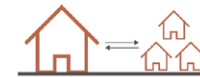
Large landfill space is required to contain the huge amount of waste generated in the city.

Decentralized



New mindset

By operating the waste cycle within the community, it becomes more aware to the residents. Also, the concomitant benefits economically and materially will change their attitude towards



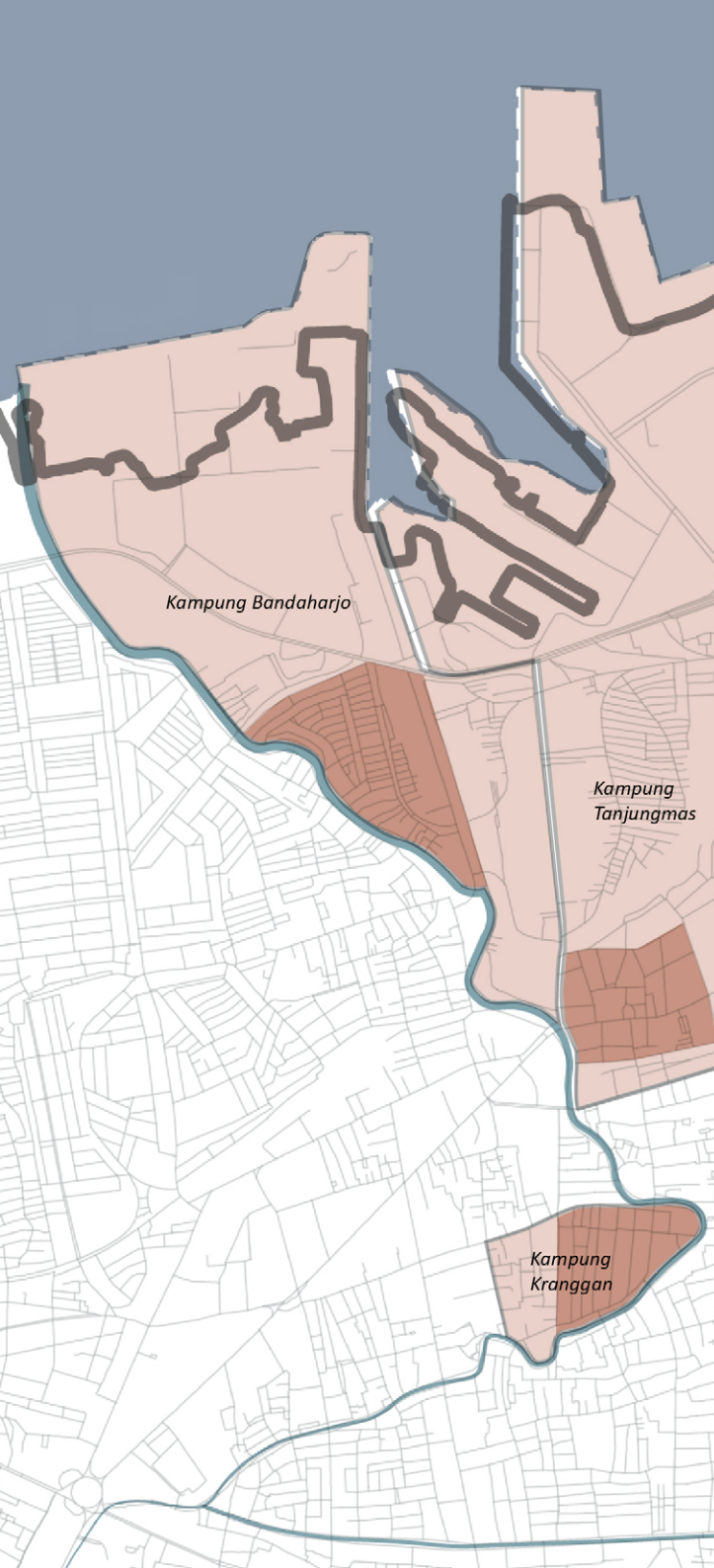
Strengthen community bond

Decentralized waste management takes advantage of the current social structure, meanwhile tries to reinforce the bond.



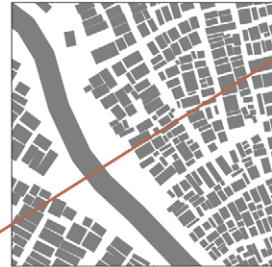
Small space

Small waste spaces scatter around the community, so residents have easy access to these public spaces.



3.4 Site Choice

Kampung Bandaharjo

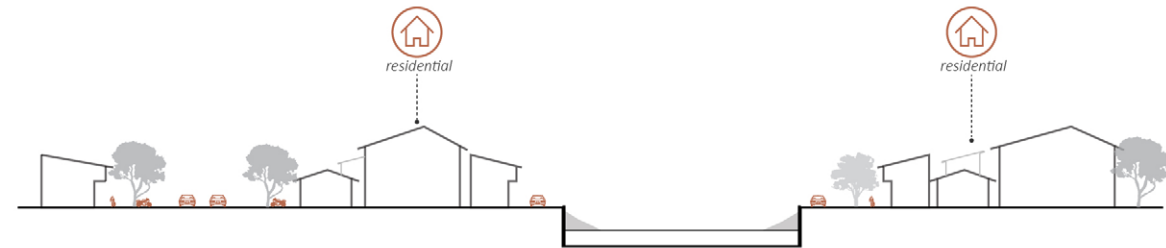


Sections 1:2000

Current waste situation



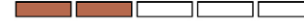
Impact of waste



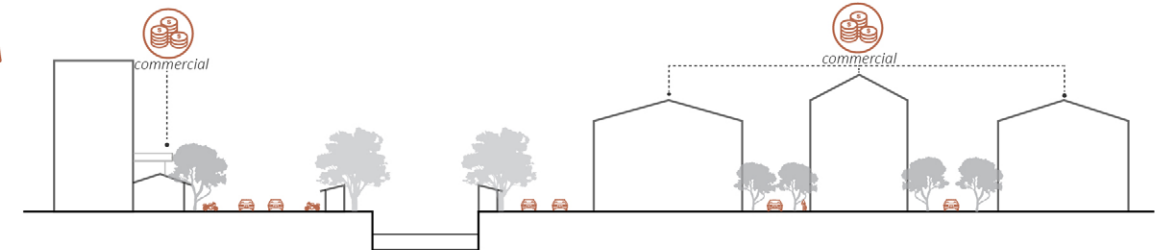
Kampung Tanjungmas



Current waste situation



Impact of waste



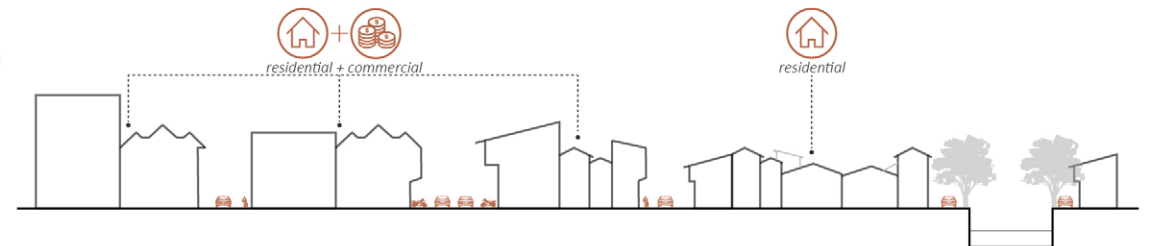
Kampung Kranggan



Current waste situation

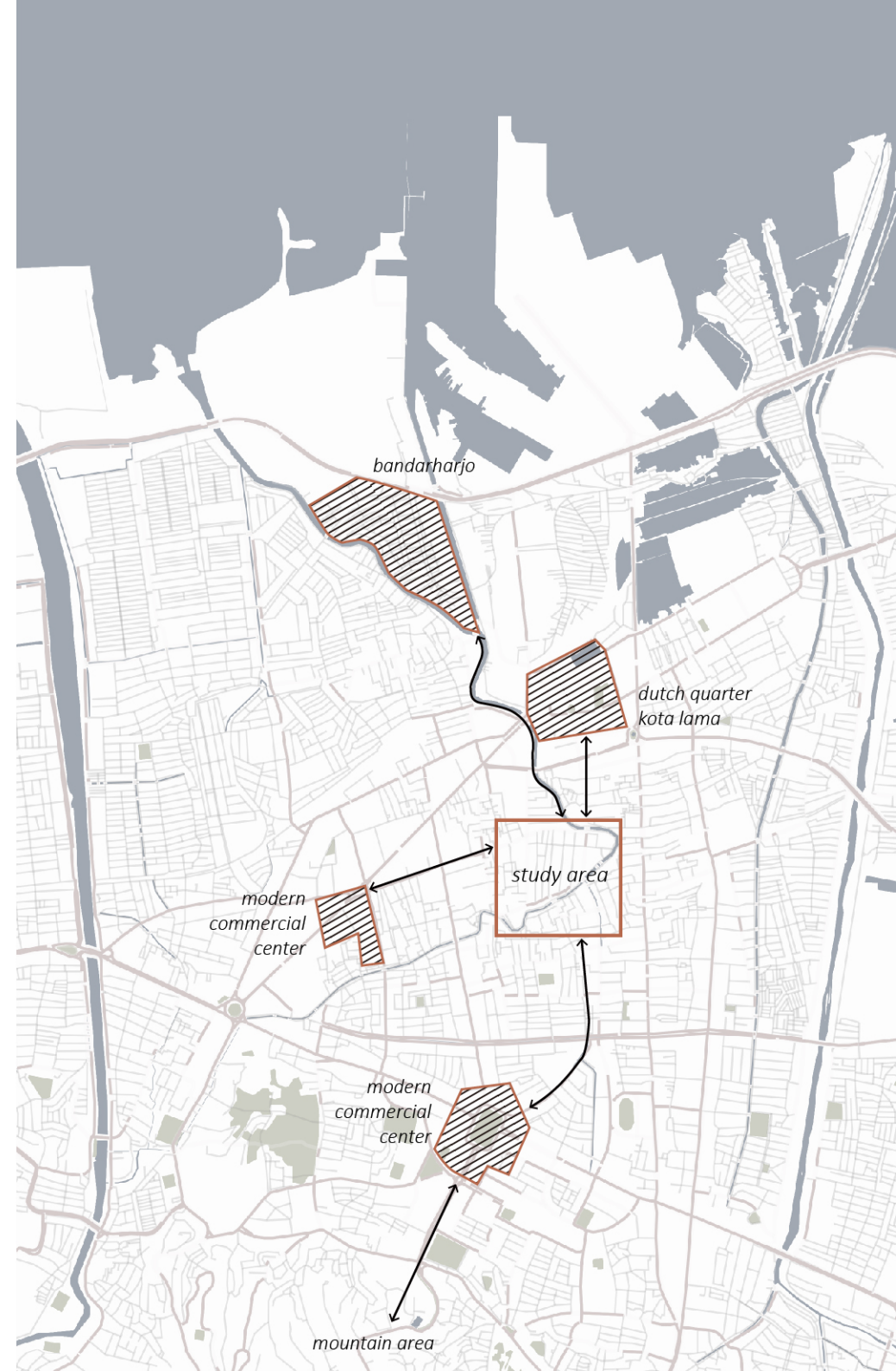


Impact of waste

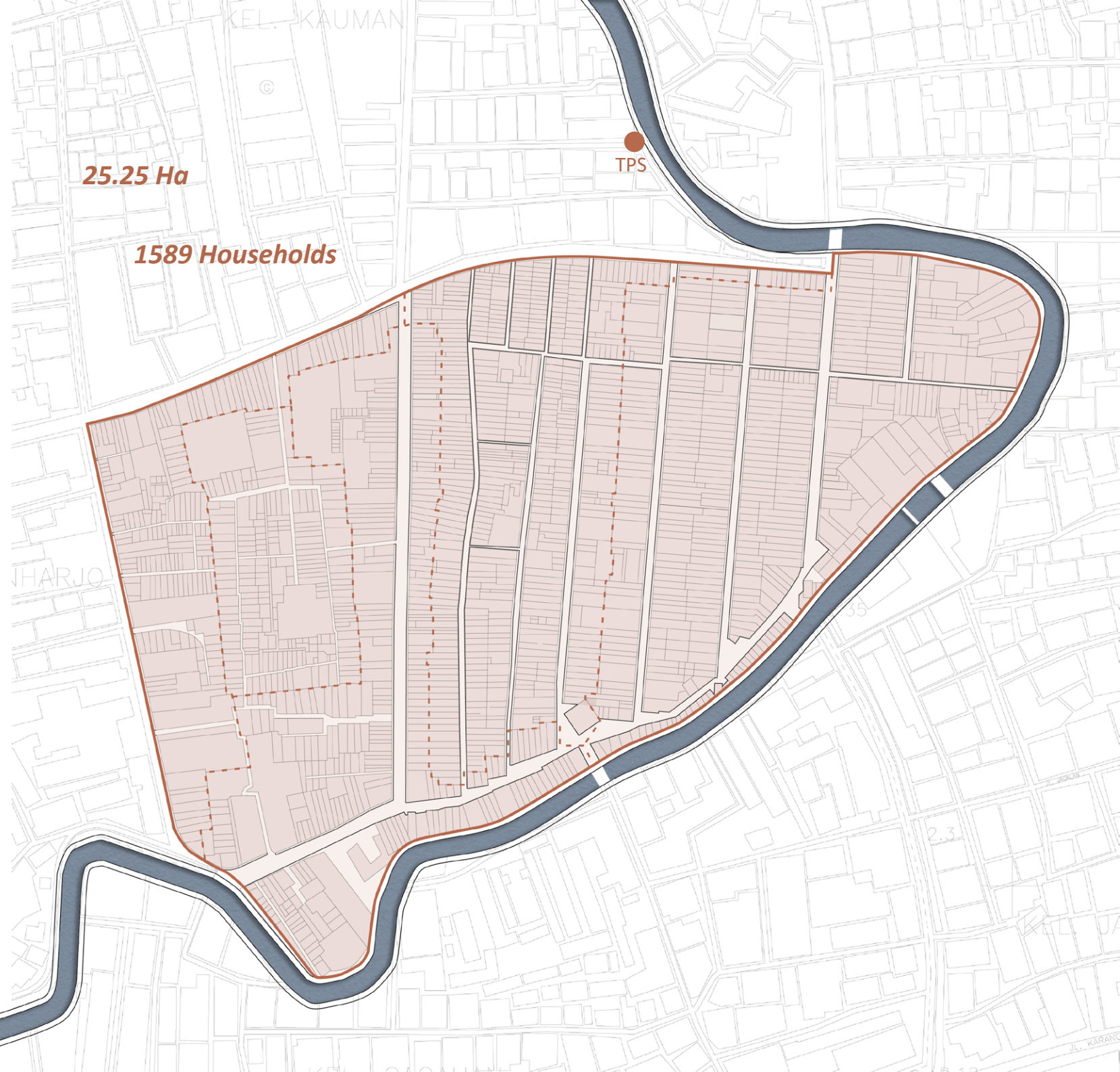


3.4 Site Choice - Kampung Kranggan

Kampung Kranggan is chosen to implement decentralized waste management. It is located at a strategic location along the Semarang river with easy access to both the coastal area and the mountain area. Kampung Kranggan is famous for trading but also suffers from the waste generated from it. More waste is generated here compared to other areas due to its both commercial and residential function. Also, the waste problem has a more considerable economic influence in this kampung.



Kampung Kranggan is located in north Semarang, and the Semarang river defines its eastern boundary. The area of Kampung Kranggan is 25.25Ha, and it accommodates 6078 residents, 1589 households. The kampung is further divided into five RWs. RW3 and 4 are known as Pecinan, the Chinatown, the trading center of the city long ago. Most of the streets in this kampung are narrow. The enclosure space delivers a strong sense of intimate, environmentally and mentally. Not so many vegetations are found in this kampung, which makes strolling less bearable under the hot weather. Here, waste is visible everywhere, on the street, in the open ditch, and also in the river. The main composition of waste is organic, plastic, and paper, mostly comes from the household and market. Typically, trash bins stand on the streets, but most of them are in bad condition. The nearest TPS is outside the kampung, and its capacity can't fit the waste. The waste keeps growing and taking over the kampung.

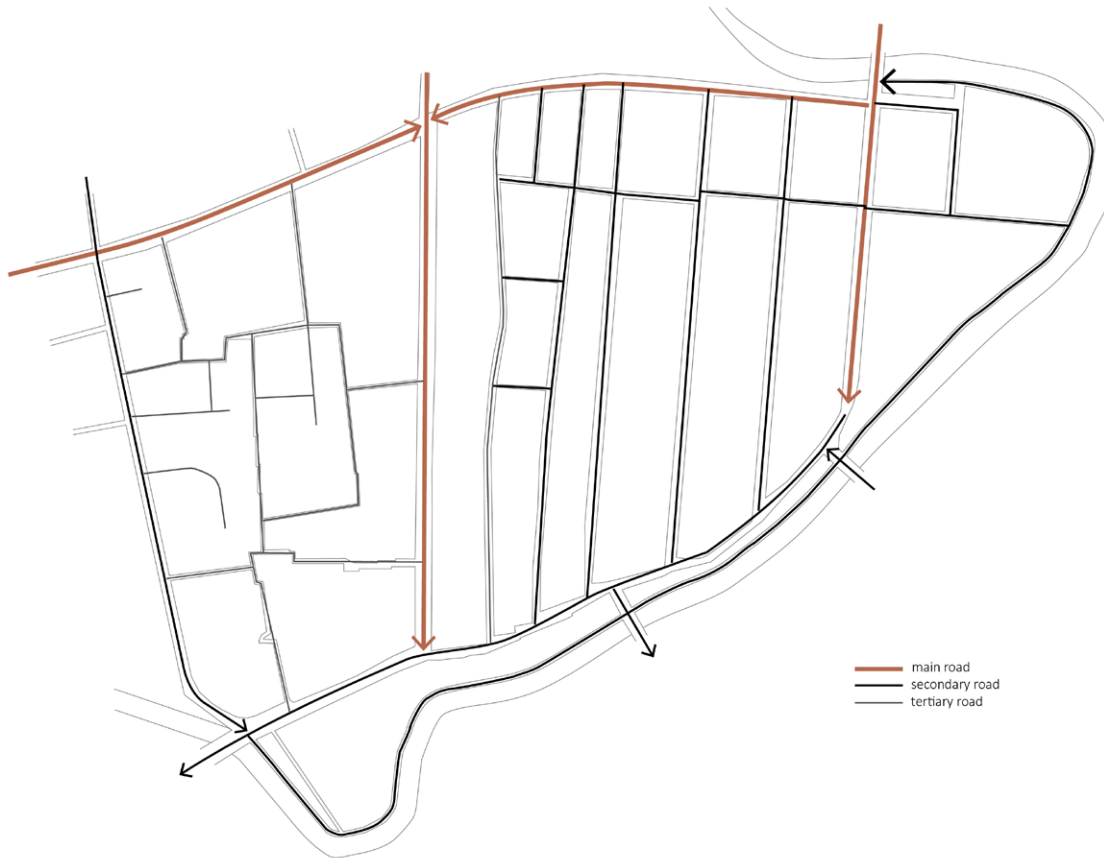


3.5 Kampung Kranggan



Source: Shared heritage lab

3.6 Analysis - Accessibility



Kampung Kranggan is well connected to other city areas. Main roads and most of the secondary roads are one-way roads. However, the traffic within this kampung is not in good order due to the chaotic parking.

Moreover, the existing road network is designed for cars, so the space for the pedestrian is inadequate. Also, because there is no boundary between pedestrian and car lane, it is not safe to walk freely in this area.

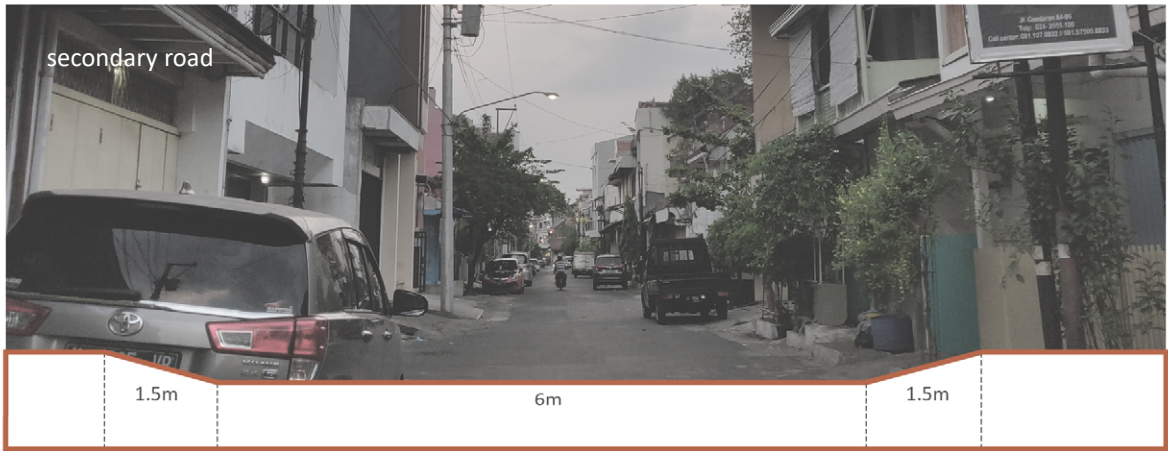
The long, rational streets is another key feature in Kampung Kranggan. But when it comes to waste collection and transportation, the continuous street pattern is not in favor.

3.6 Analysis - Street Profile



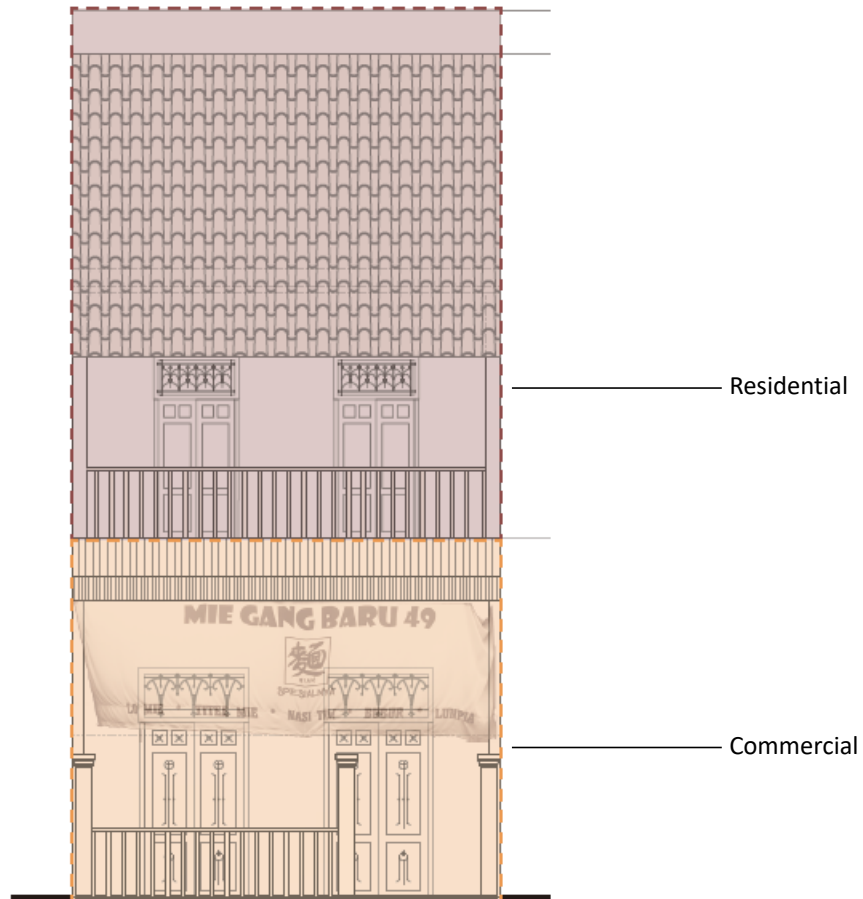
Street profile in Kampung Kranggan is composed of three types. The main road is 12 meters wide, the secondary road is 9 meters wide, and the tertiary road is 4 meters wide.

From the onsite observation, more activities happen on the main road, for instance, the famous night market, which is more crowded and noisy compared to other roads.



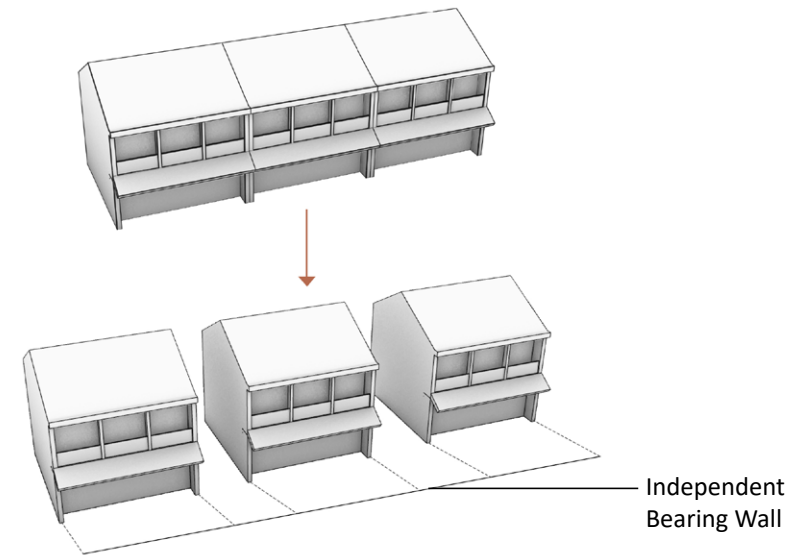
3.6 Analysis - Building Typology

Shophouse



Source: Li, J., 2020

The shophouse is the dominant building typology in Kampung Kranggan. It is usually two or three stories. The ground floor is used for commercial activities, and the upper floors are for residential purposes. Though building materials might vary due to different cultural contexts, the function stays the same. Each shophouse has its independent bearing walls.



Street Facade



Source: Li, J., 2020

3.6 Analysis - Building Condition & Heritage Value



Buildings in Kampung Kranggan are mostly in moderate condition. Some at Gang Baru are in bad condition. Overall, there is a lack of maintenance on buildings out of limited economic condition. Some buildings in this kampung have high heritage value.



Source: A tale of three cultures: Semarang inner city development, 2016

3.6 Analysis - Temples



There are several temples in Kampung Kranggag, and they represent the unique culture in Chinatown. The red color stands out from the surroundings and catch people's eyes easily. Temples are usually located at the end of the road to bring peace and guard the street. Religious activities happen on a daily basis within these temples. Big temples, like Kong Tik Soe, are used as public space for holding gatherings and celebrations. Regardless of the size, each temple has an open space at the front where people can meet and talk.

1. Siu Hok Bio



2. Tek Hay Bio



3. Ling Hok Bio



4. Tong Pek Bio



5. Hoo Hok Bio

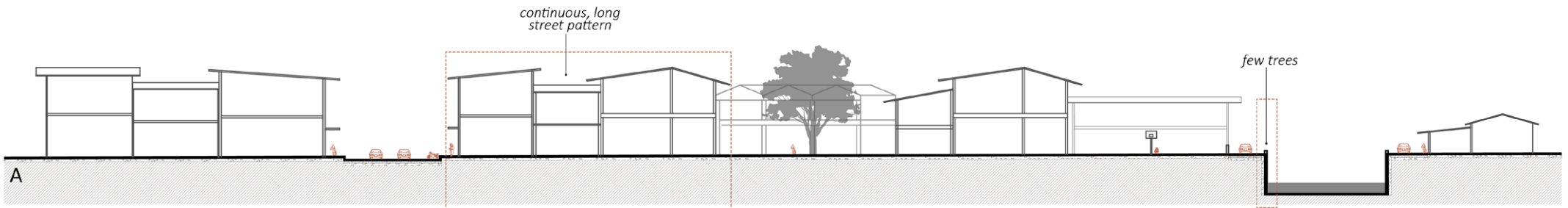
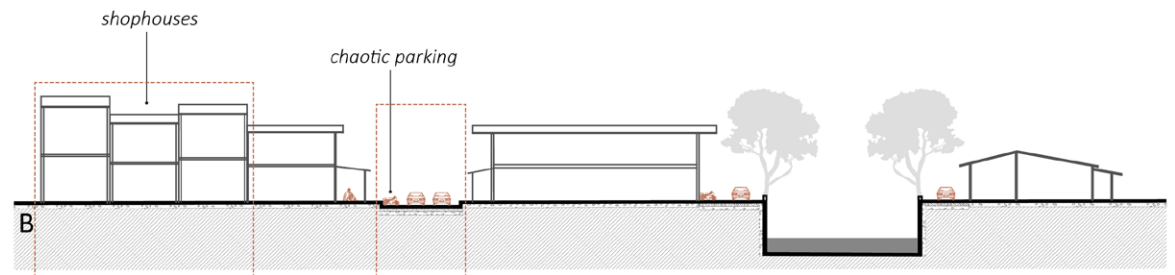
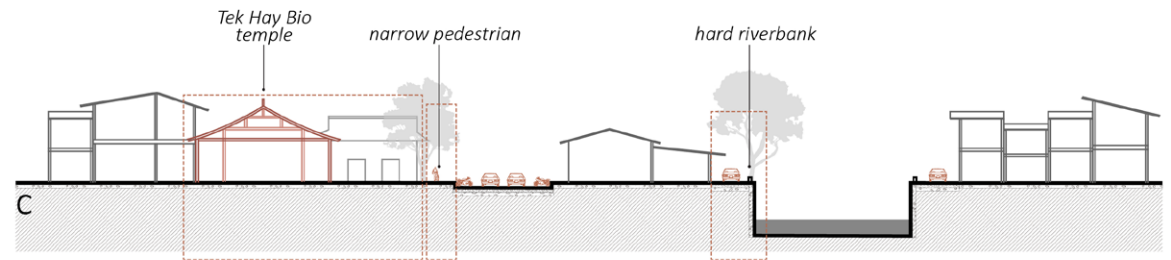
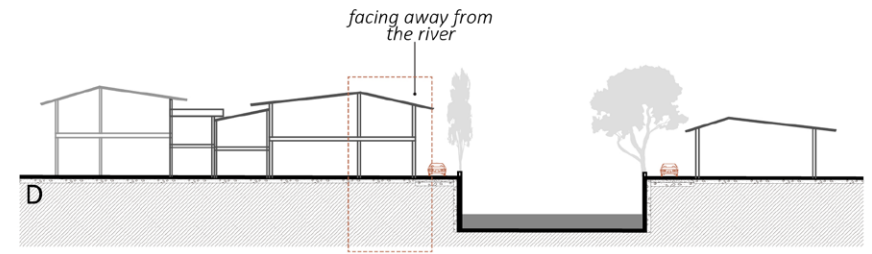
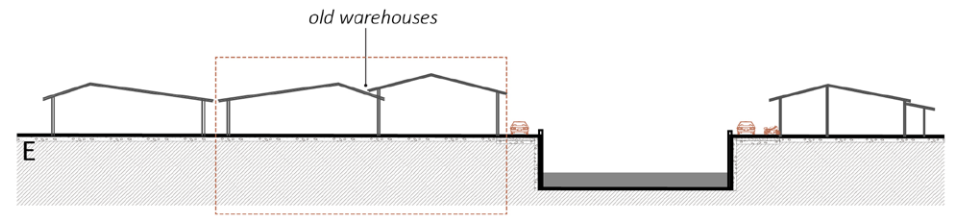
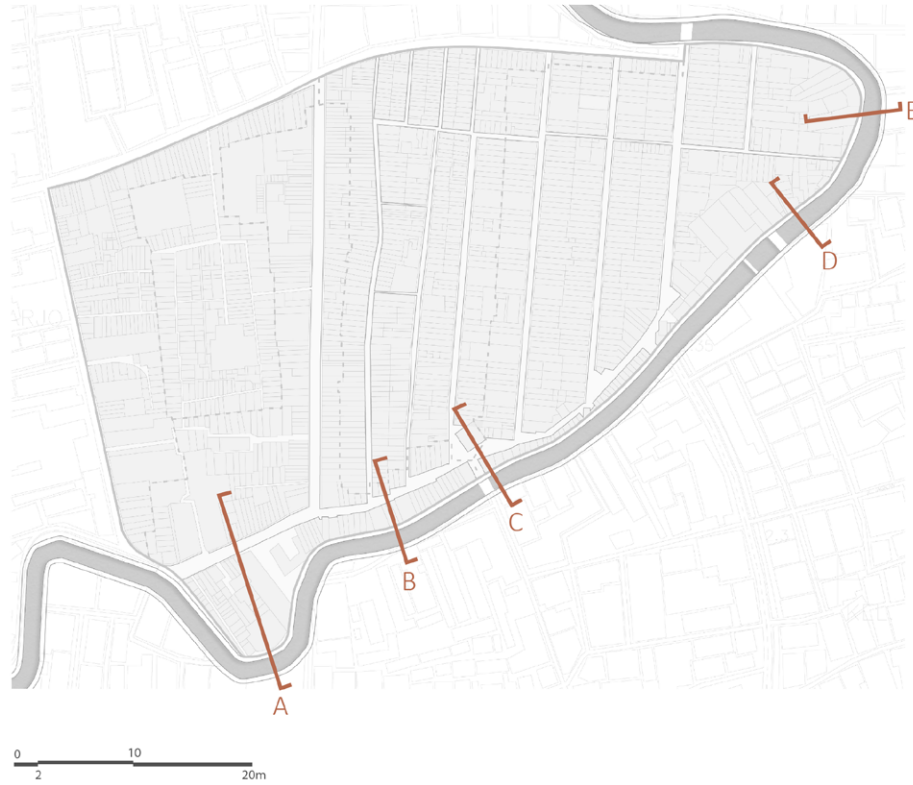


6. Kong Tik Soe



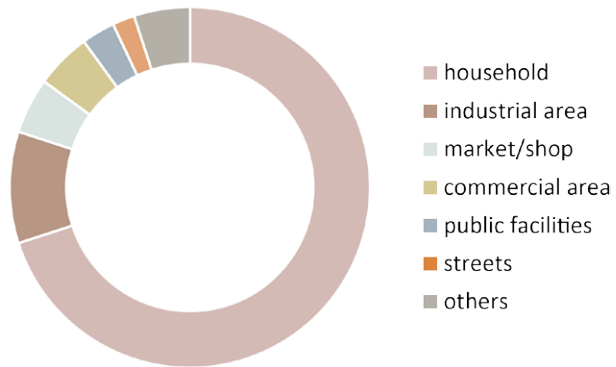
Source: photo 2-5, taken by author
photo 1,6, google street view

3.6 Analysis - Riverfront Typology



3.6 Analysis - Solid Waste

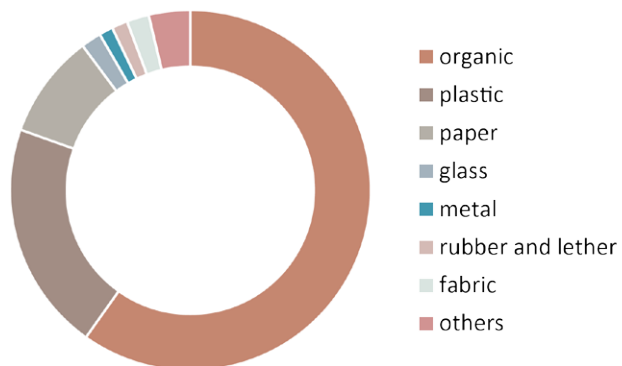
waste sources



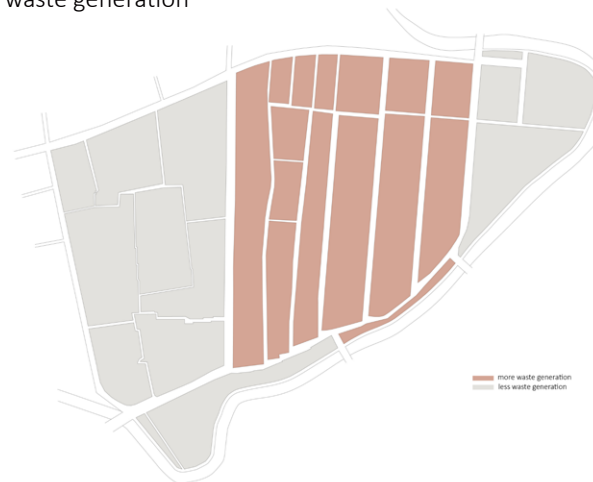
land use



waste composition



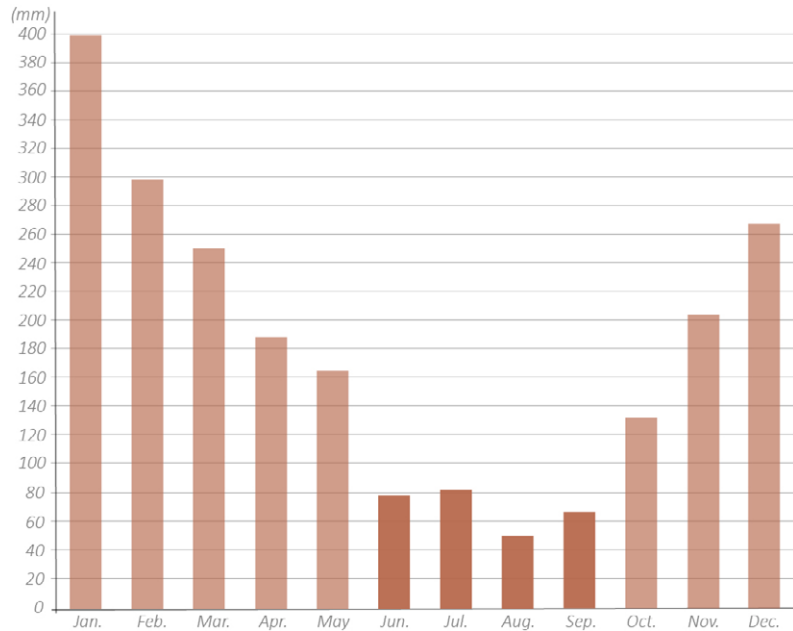
waste generation



Households produce the largest amount of waste in everyday life. compare to other activities. The waste is mainly made of organic and plastic. In Kampung Kranggan, the generation of organic and plastic waste is even higher because of its commercial feature. So the solid waste solution targets these two categories of waste. Other waste will be collected and processed in other specialized waste management kampungs.

3.6 Analysis - Liquid Waste Water Level

Semarang annual rainfall

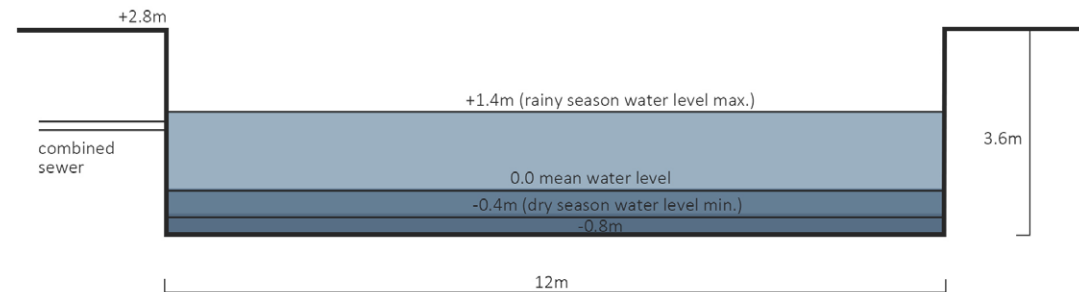


The tropical climate in Semarang leads to significant differences in rainfall throughout a year. The annual average rainfall is 2182mm ('Semarang Climate', 2019). The rainy season is from October to May, and the dry season is from June to September.

The section of Semarang river flows through Pecinan is about 12 meters wide. The depth of the hard riverbank is 3.6 meters. Since no solid data is found about the water level in Semarang river during different seasons, an estimation is made based on information from news, onsite photos, and interviews. After the normalization of Semarang river in 1980, Pecinan no longer suffers from severe flooding. However, during heavy rainfall, drainage overflow may occur.



Water Level Estimation



Water levels near Semarang at its source are also **less than half** of normal and water shortages have become severe with even rivers drying up. **news from Sept. 2019 (dry season)**

三宝垄东、西区防洪运河沉积物令人忧虑

【本报讯】三宝垄市东、西区防洪运河的沉积物确实令人忧虑，因此民众希望当地市府尽快清理那些沉积物。据悉，东区防洪运河自2010年后就没再清理过。那些沉积物形成岛状，导致运河狭窄，水流不畅通，尤其是河

岸一带出现非法的违章屋及了橡胶棚，但民众没用到。他们当前最需要的是快餐、它食品等。最近雨季直下倾盆大雨，东区防洪运河的河床水泛滥，水位半米高，但民众还未来清理，民众很无奈。当地民众是担心，利用沙袋在经常出现河水泛滥的

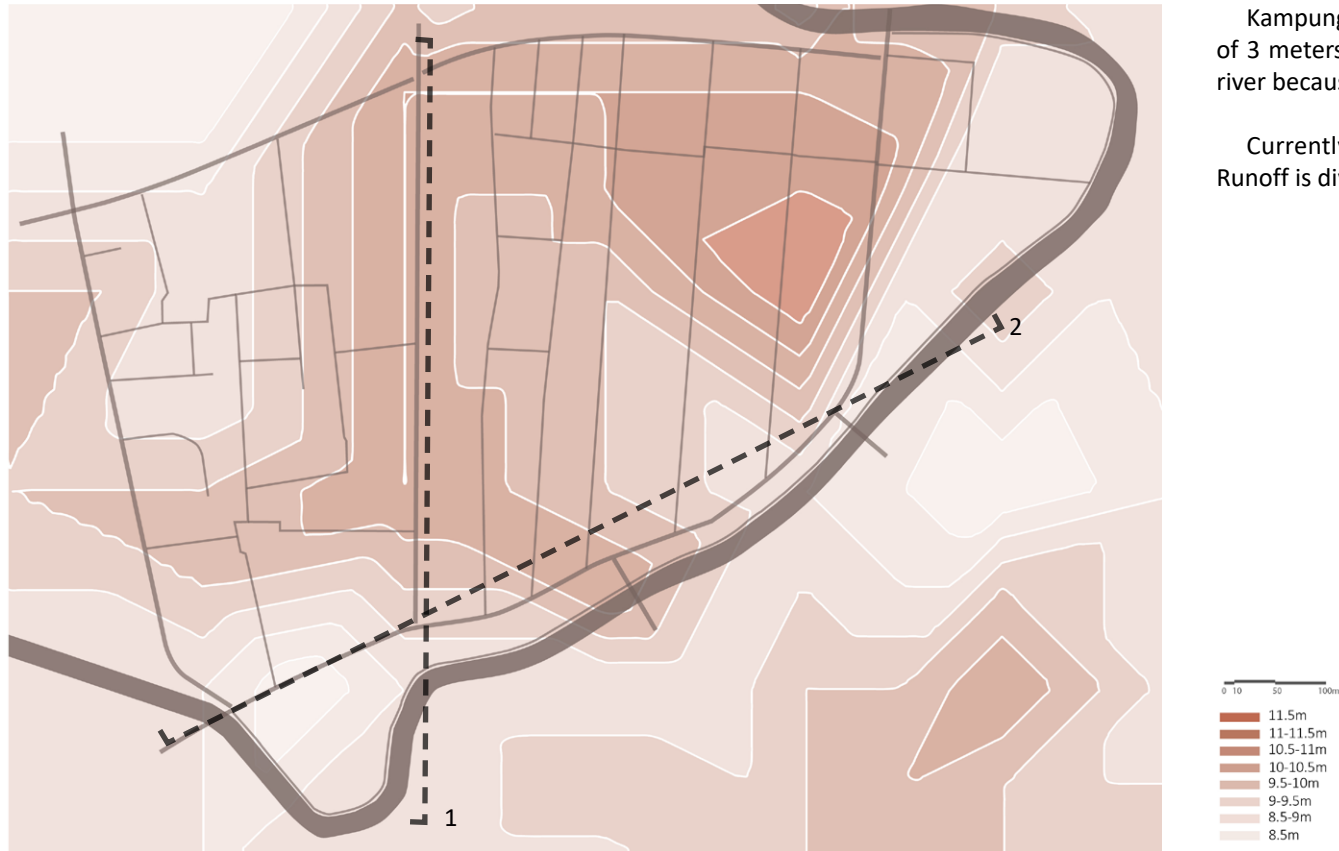
每次长期的雨季一定出现水灾，跑到村民居住区。尤其是三宝垄市如果蒙雨连续约2个小时下个不停，近日在西区防洪运河的Simongan河堤水势高涨，加速河流的水流湍急流入海中，几乎淹没Taman Pleset的小岛。(ing)

the water on the street is more than half meters high

news from Feb., 2015 (rainy season) indicates the drainage overflow

Source:
semarang annual rainfall, en.climate-data.org
author's own photos
floodings in semarang, guojiribao.com
covering climate now, www.asahi.com

3.6 Analysis - Liquid Waste Topography



Kampung Kranggan has a flat topography with a subtle height difference of 3 meters. As shown in the sections, the water will flow into Semarang river because of the natural topography.

Currently, no rainwater harvesting measures are running in this area. Runoff is diverted to combined sewer directly without any treatment.



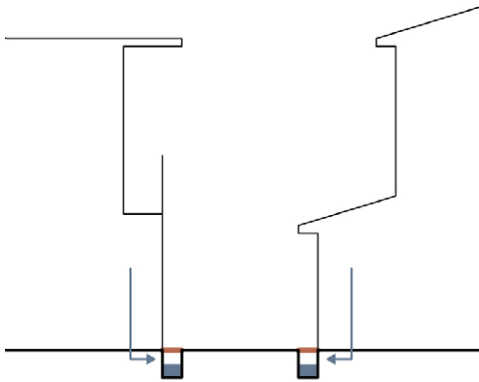
Section 1



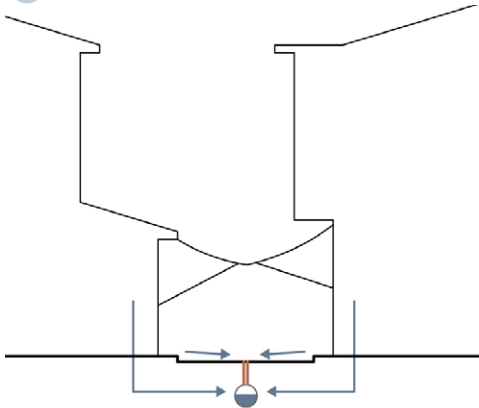
Section 2

3.6 Analysis - Liquid Waste Combined Sewer

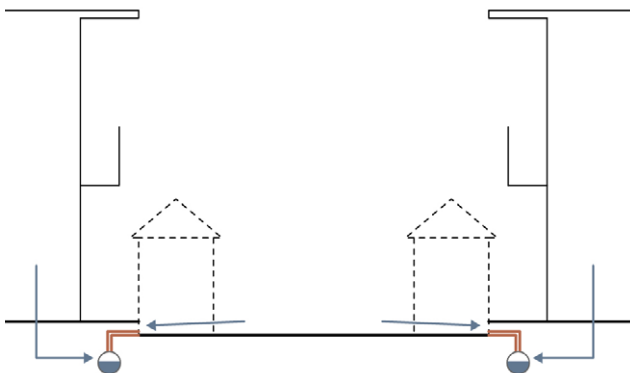
● Typology 1



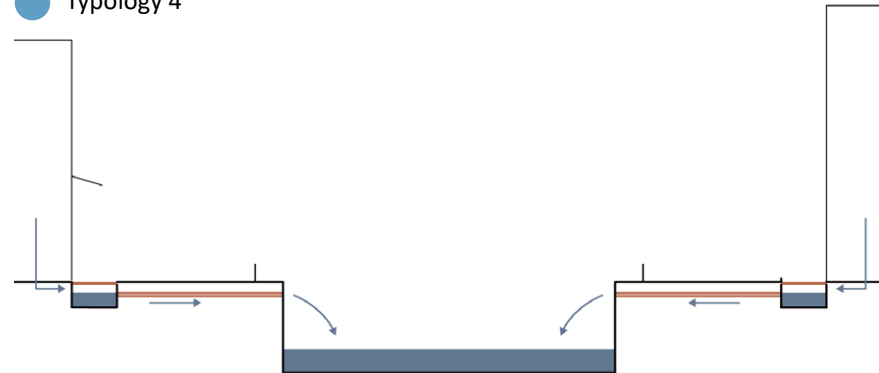
● Typology 2



● Typology 3



● Typology 4



Kampung Kranggan now has four typologies of drainage, all installed underground. Black and grey water go into the drainage together and finally flow into Semarang river without any treatment. The gutters are usually covered by stone to keep the filthy wastewater invisible.

3.6 Analysis - Liquid Waste Combined Sewer

● Typology 1



● Typology 2



● Typology 3



● Typology 4

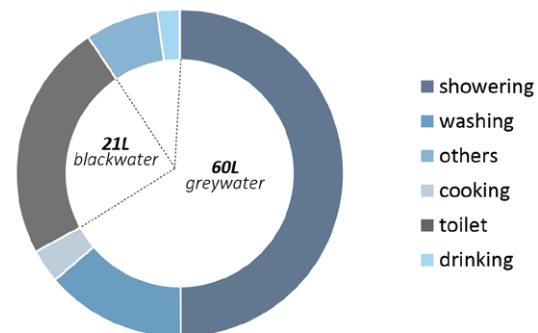


3.6 Analysis - Liquid Waste P-DAM Pipe Network



PDAM, Perusahaan Daerah Air Minum, is the water service carrier in Semarang. By now, the water service coverage of Semarang is only 60%, and the water is not drinkable. According to surveys, every household uses the tap water mostly for washing and bathing, and they boil the water before drinking and cooking (Whittington, D., Davis, J., Miarsono, H., & Pollard, R., 2000). Kampung Kranggan is covered by the piped water network. The main water supply pipes locate underneath two main roads through the kampung.

wastewater generation (L/p/day)



Data source:
Up: Semarang spatial plans 2011-2031
Bottom: Fuchs, A., & Tillie, N., & Smit, M. (2019)

3.6 Analysis - Green Space

Existing Green Space & Trees



Green space is scarce in Semarang, especially in Kampung Kranggan due to its very condensed built environment. Existing green spaces are formed after plants invade abandoned buildings or vacant spaces. None of them can be used as an open space for daily activities.

Narrow streets can't provide enough space for plantations, so the kampung doesn't have lots of large trees. The common tree species are Banyan tree, Magnolia, and Robinia. Though lack of large trees, residents tend to make their streets more lively and greener by putting potted plantations in front of their houses.



3.6 Analysis - Green Space

Empty Space & Abandoned/Broken Buildings



Kampung Kranggan is a neighborhood with a rich history and culture. It contains indigenous Javanese settlement and Chinese style shophouses, which have outstanding heritage value. However, due to the discrepancy between urbanization and economic development, many buildings have not been appropriately maintained. Their bricks and tiles are broken, eventually lose the function as dwellings, being abandoned by the owners.

All the empty spaces within Kampung Kranggan are small and have impervious surface. The majority of them don't hold any kind of activities at present.

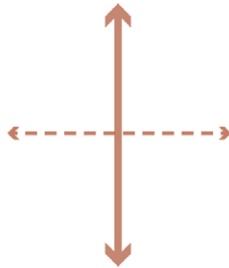


3.7 Summary

dense urban tissue



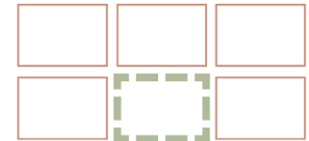
*weak West to
East connection*



*insufficient waste
management*



*lack of high
quality green space*



CHAPTER 4

PRECEDENT STUDY

4.1 MAKOKO Urban Design Toolbox

4.2 Weishanhu Wetland Park

4.3 UP+S RAIN GARDEN

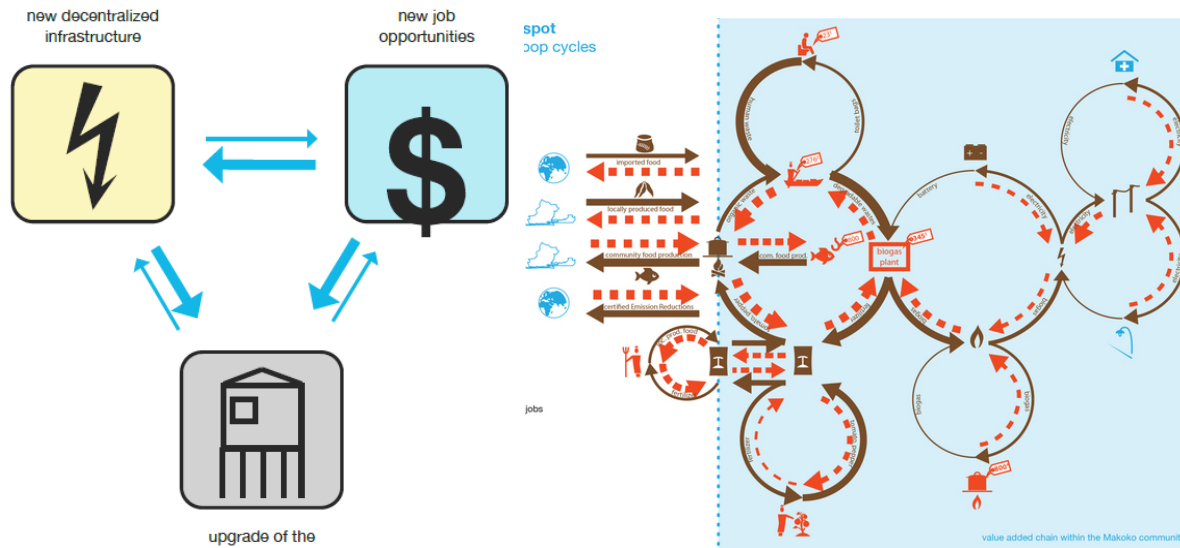
4.1 MAKOKO Urban Design Toolbox



Project Location: Lagos State, Nigeria
Designer: Fabulous Studio
Year: 2014

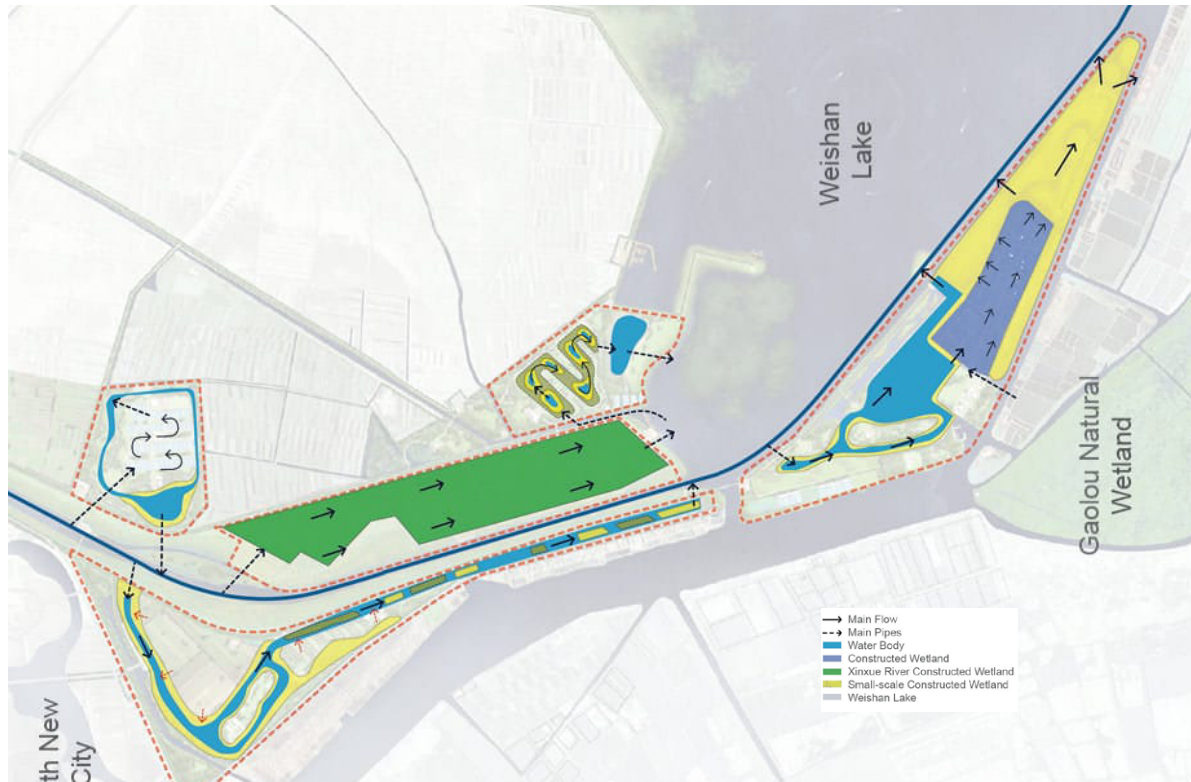
When it comes to decentralized management, community participation is one of the crucial factors. Makoko urban design brings up a comprehensive system for solid waste management and involves residents to the largest extent. It creates new decentralized infrastructure, meanwhile generates new job opportunities, and the excess profits will support residents to upgrade their neighborhood.

New infrastructure is scattered within the whole neighborhood as hotspots to ensure residents have easy access to them. Waste is collected and transfer to these hotspots by boat. Organic waste will be processed in a biodigester, then convert into biogas and fertilizer to support daily activities such as washing and planting. Solid waste is further processed, subsequently sold to recycle companies. There will be a good demand for workers and craftsmanship for waste picking, sorting, and crushing in these hotspots. Makoko urban plan brings up design solutions from a socio-economic perspective, creates profound impacts than mere landscape. It sets out an example of integral and sustainable community development.



Source: *Urban Design Makoko* (Aro, 2015)

4.2 Weishan Wetland Park



Project Location: Jining, Shandong Province, China

Designer: Aecom

Year: 2008

This project is proposed to rehabilitate the declining water quality due to the poor performance of agriculture and aquaculture. It combines waterway improvement, ecological protection, habitat restoration, and tourism development, reaches a balance between nature and social development.

The project creates various habitats such as forest, farmland, and wetlands to optimize the riparian ecosystem and increase and enhance biodiversity. Constructed wetland is introduced to purify the polluted water. It does not only has a strong purification capacity, but also high aesthetic values. The polluted water first runs through constructed wetland, then stores in water bodies, excess water will flow into weishan lake. By highlighting the local landscape elements and cultural characters, the design adapts to the context and interactive with residents successfully.



Source: <https://www.gooood.cn/weishan-wetland-park-by-aecom.htm>

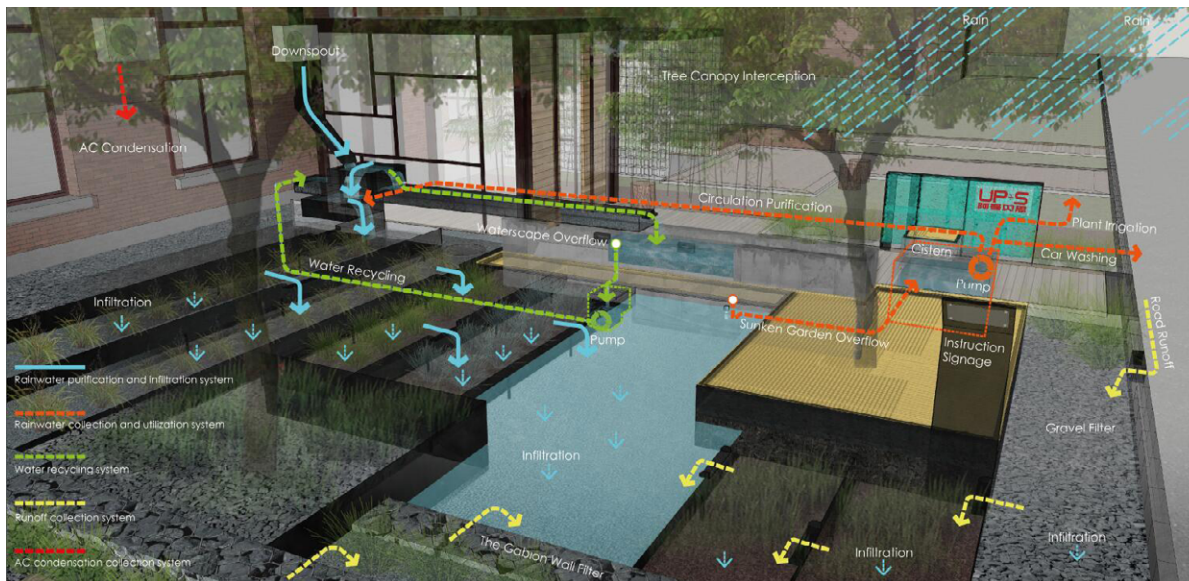
4.3 UP+S Rain Garden



Project Location: Beijing, China
Designer: U.P.SPACE
Year: 2015

Floodings occur more often during the rainy season as a consequence of massive impervious surfaces. Within compact urban tissues, it's hard to build large green infrastructure. Micro interventions like rain garden is preferable harvest, purify, and store rainwater .

In this project, rainwater flows through cascading purification terrace before storing in the central water pond. To contain more water and prepare for potential heavy rainfall, a underground cistern is equipped. Local plantations with effective purify ability have been chosen. Besides functional strategies, landscape experience is another focus in the design. Local recycled materials are used to enhance the sense of belonging. A bright-colored permeable platform invites everyone to stay and enjoy the beauty of rain.



Source: <http://ups2006.com/zh/projects/241>

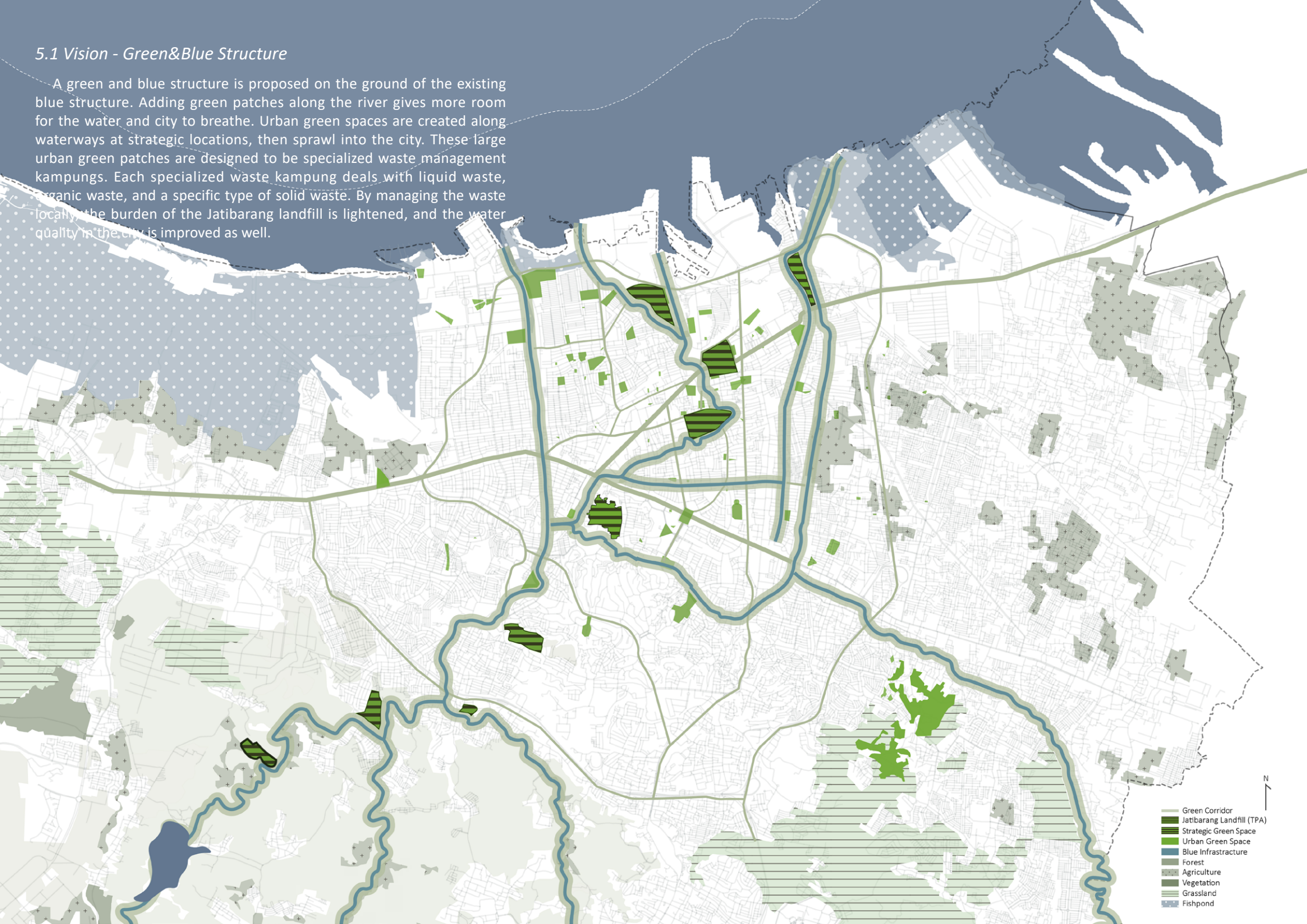
CHAPTER 5

DESIGN STRATEGIES

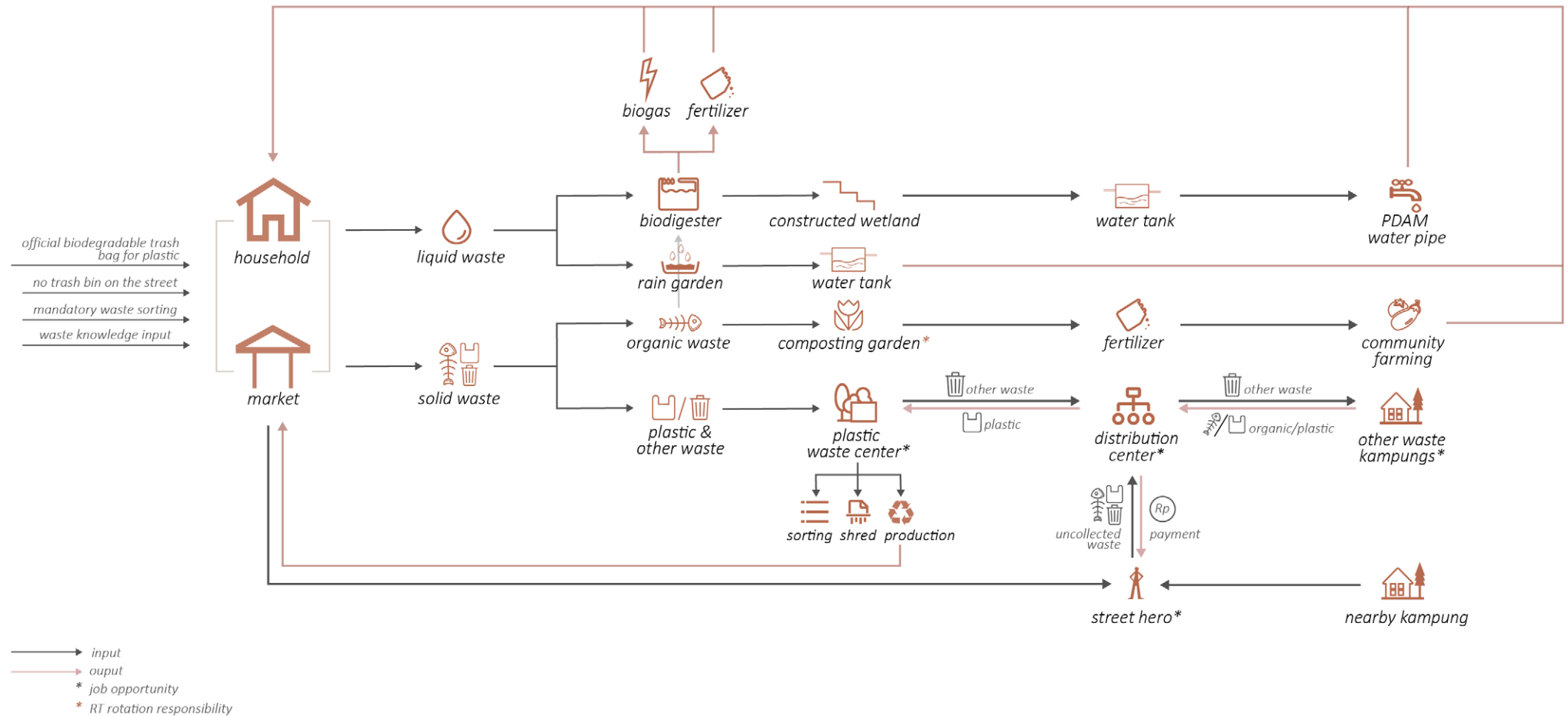
- 5.1 Green & Blue Structure Vision*
- 5.2 Proposed Waste Flow*
- 5.3 Design Strategy*
- 5.4 Design Iteration*

5.1 Vision - Green&Blue Structure

A green and blue structure is proposed on the ground of the existing blue structure. Adding green patches along the river gives more room for the water and city to breathe. Urban green spaces are created along waterways at strategic locations, then sprawl into the city. These large urban green patches are designed to be specialized waste management kampungs. Each specialized waste kampung deals with liquid waste, organic waste, and a specific type of solid waste. By managing the waste locally, the burden of the Jatibarang landfill is lightened, and the water quality in the city is improved as well.

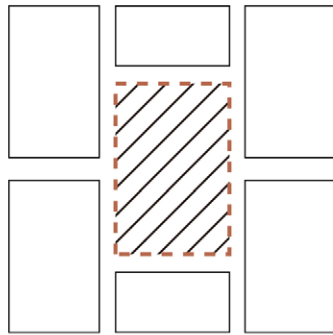


5.2 Proposed waste flow



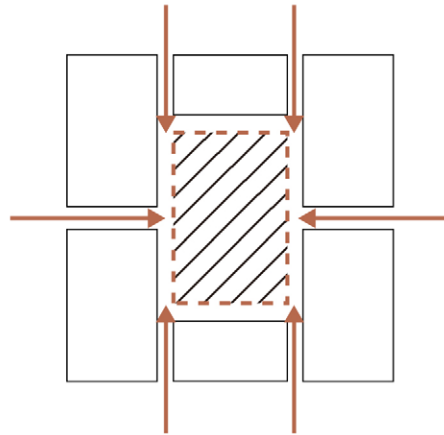
The proposed waste flow considers waste as precious resources, aims to maximize their value by upcycling. Waste centers and composting gardens are scattered within the kampung to ensure its good access. The solid waste is collected and processed in different specialized waste management kampung. Waste centers create job opportunities and bring economic development to the community. The liquid waste is treated via biodigester and constructed wetland then be reused again. Other beneficial products such as biogas and fertilizer are produced in the process too. The decentralized method empowers the locals as the main actor in the new system, meanwhile, it also includes different stakeholders to cooperate and contribute.

PROVIDE



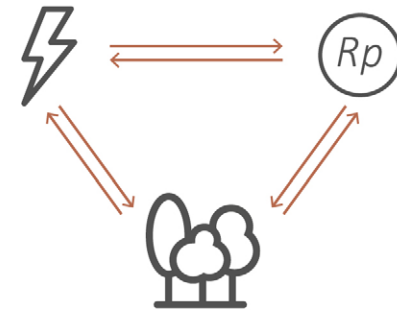
Provide space for
waste management

CONNECT



Connect people with waste
infrastructure

INTEGRATE



Establish new waste flow and
healthy environment

5.4 Design Iteration

[0] Current



[1] Provide - placemaking

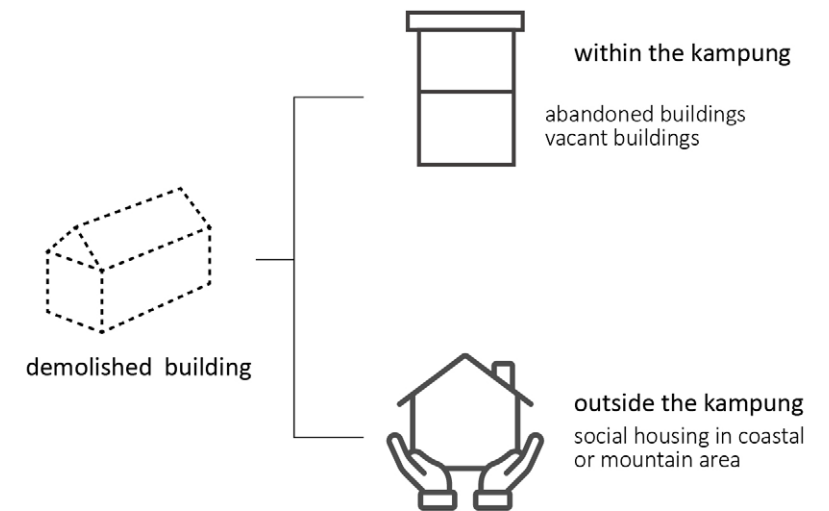


5.4 Design Iteration

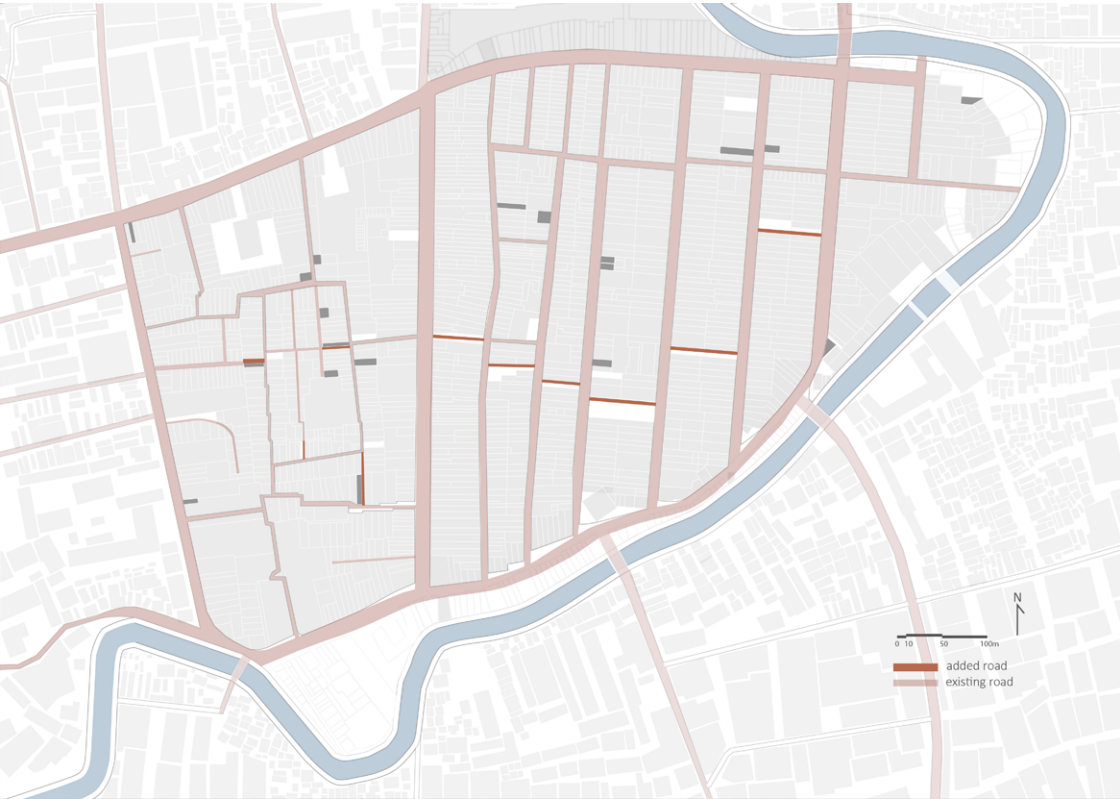
[1] Provide - relocate



[1] Provide - relocate strategy



[2] Connect

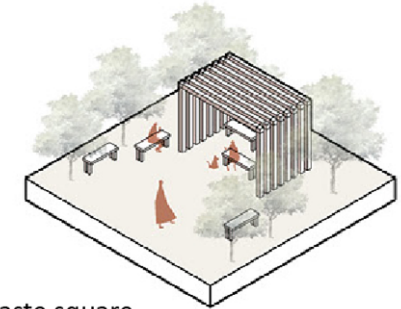
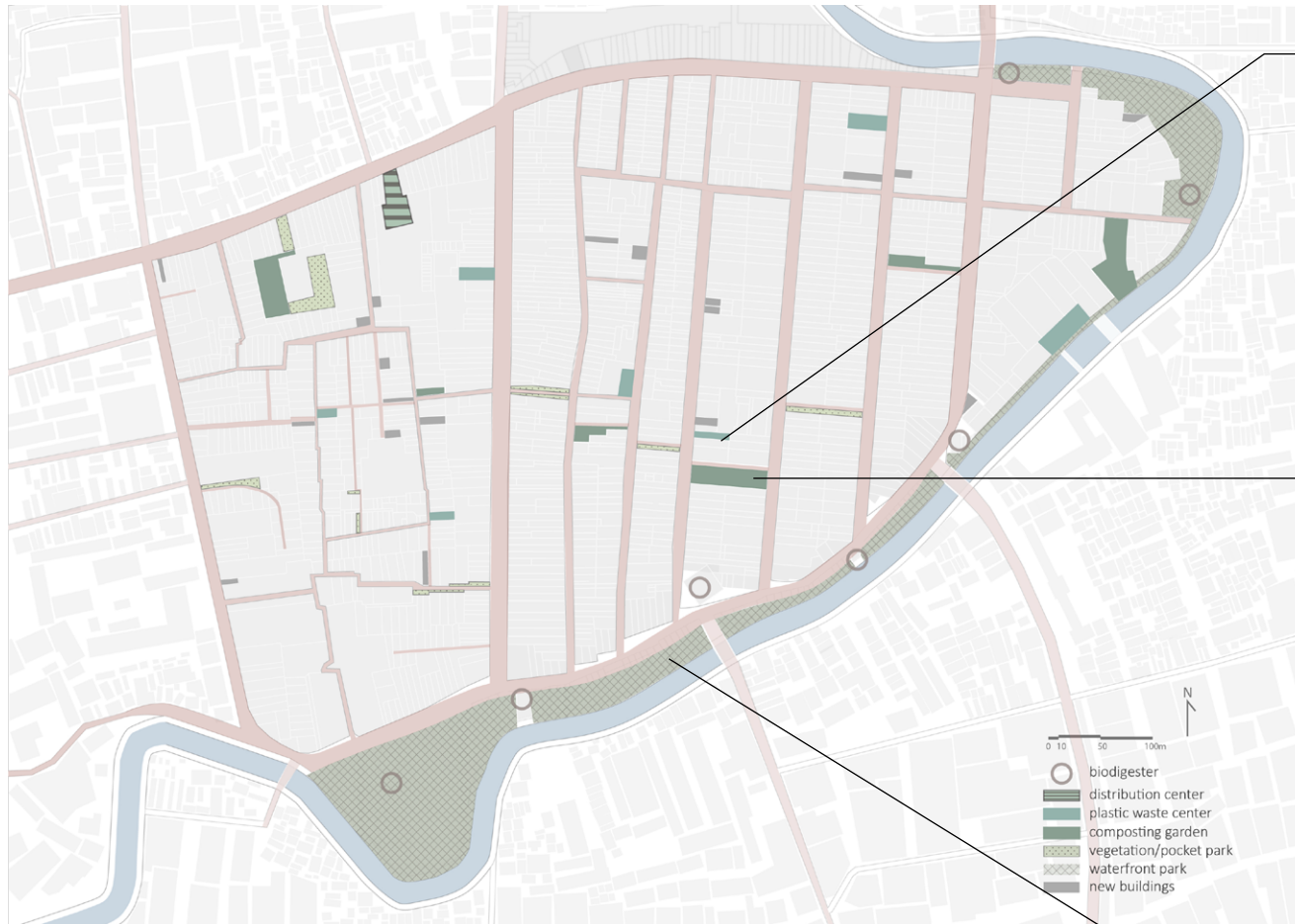


[3] Integrate

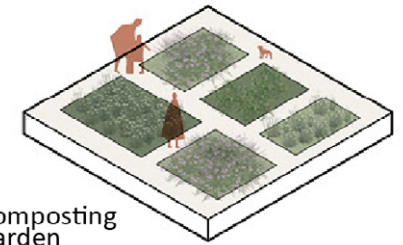


5.4 Design Iteration

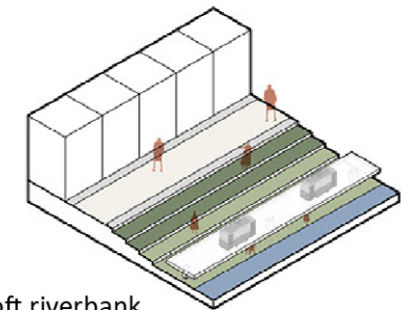
[3] Integrate



● waste square



● composting garden



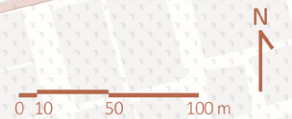
● soft riverbank

CHAPTER 6

DESIGN IMPLEMENTATION

- 6.1 Masterplan*
- 6.2 Overall System*
- 6.3 Detailed Design*

6.1 Masterplan



- 1. temple
- 2. composting garden
- 3. waste distribution center
- 4. plastic waste center
- 5. kampung square
- 6. water terrace
- 7. wetland park

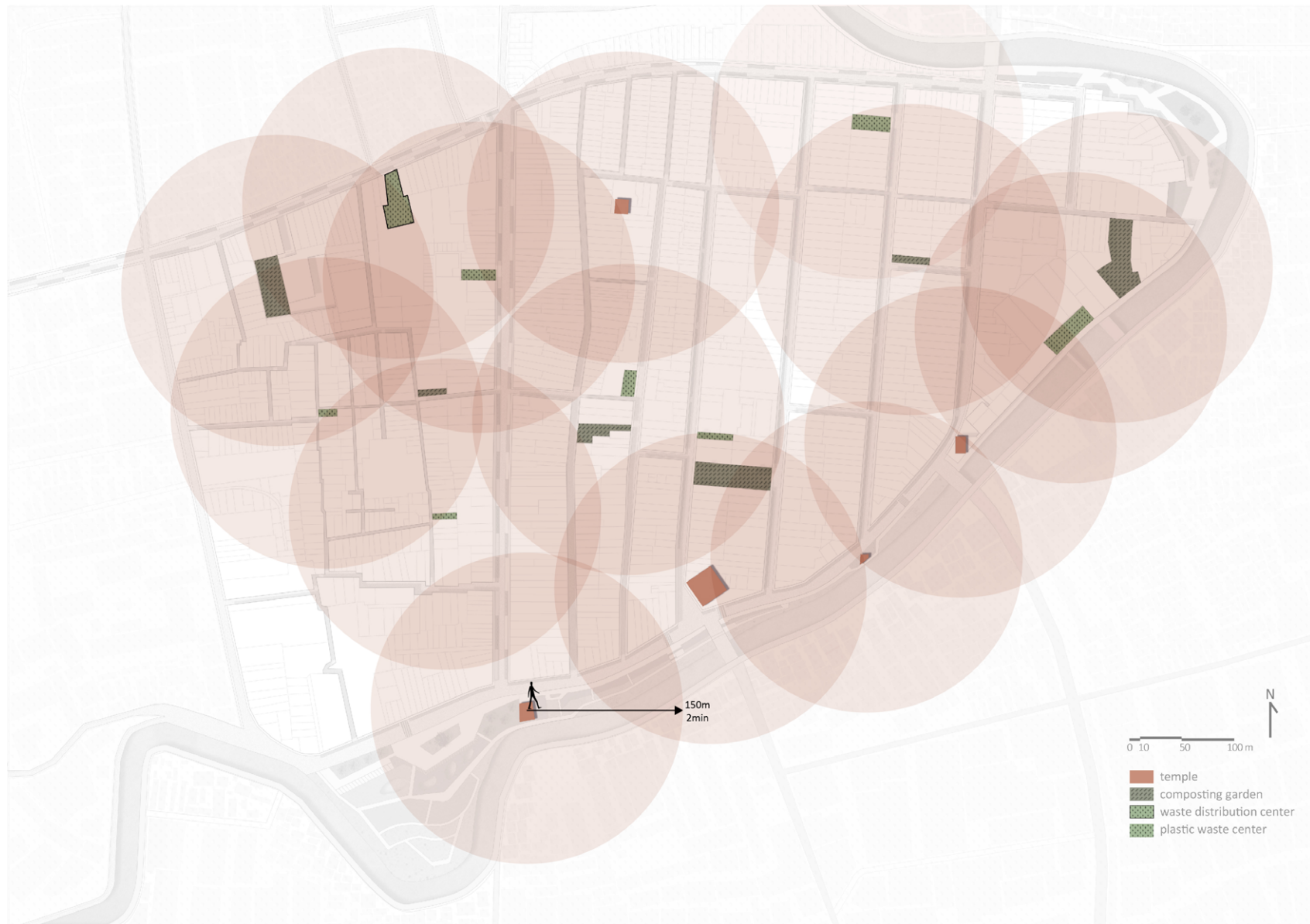
6.2 Overall System

Solid Waste



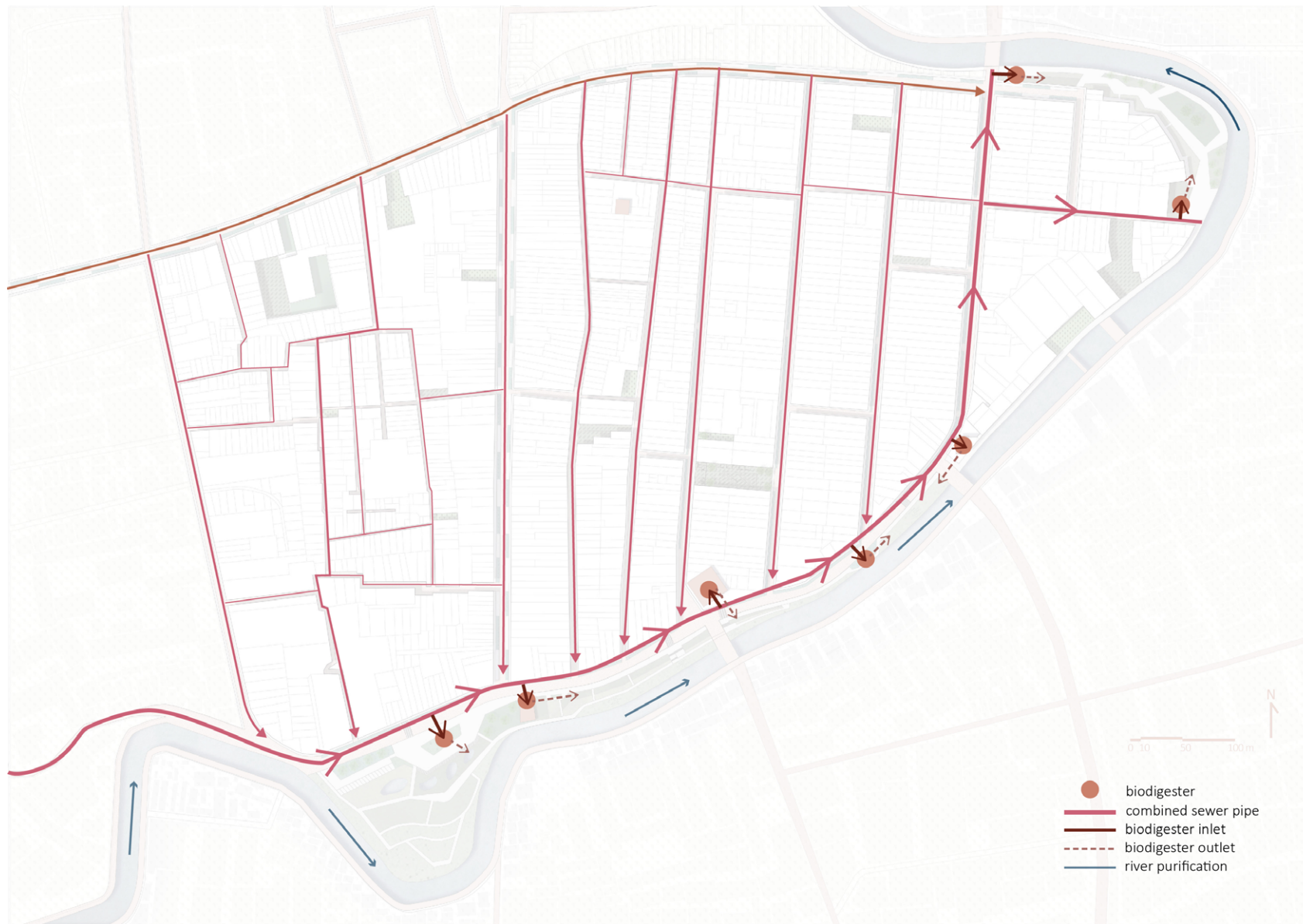
6.2 Overall System

Solid Waste Infrastructure Access



6.2 Overall System

Liquid Waste - Household Wastewater



6.2 Overall System

Liquid Waste - Rainwater



6.2 Overall System

Street Typology - Main Road

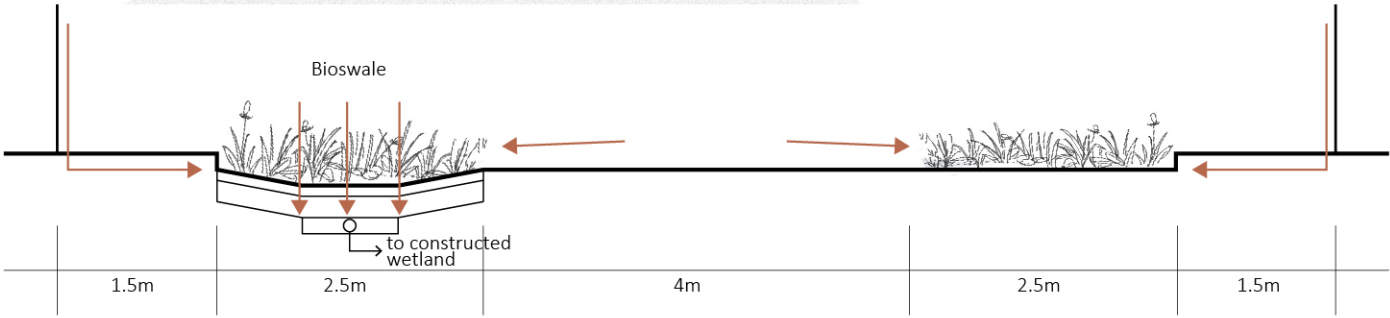
Before



red brick



grey brick



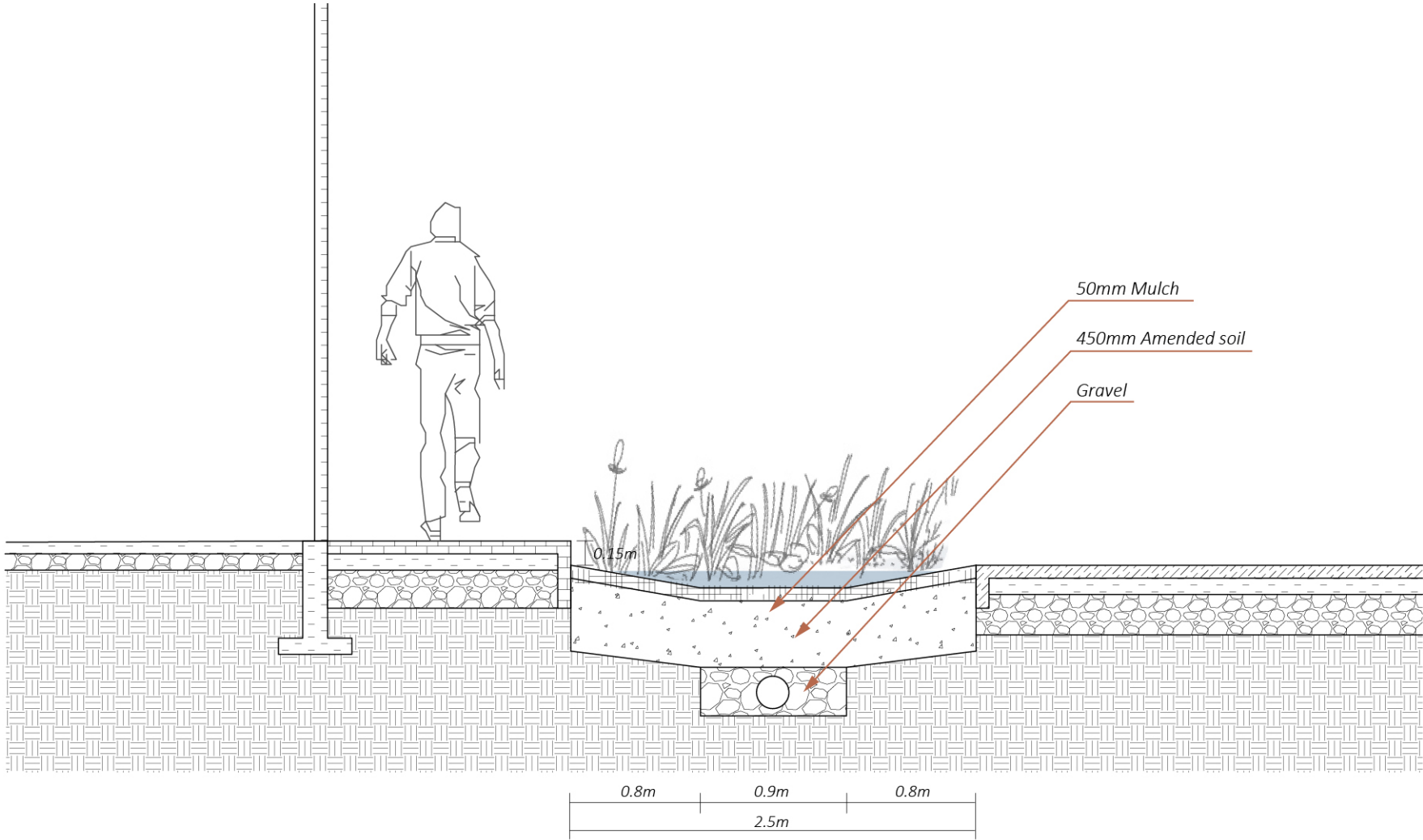
6.2 Overall System

Street Typology - Main Road



6.2 Overall System

Bioswale Section - 1:100



6.2 Overall System

Street Typology - Secondary Road

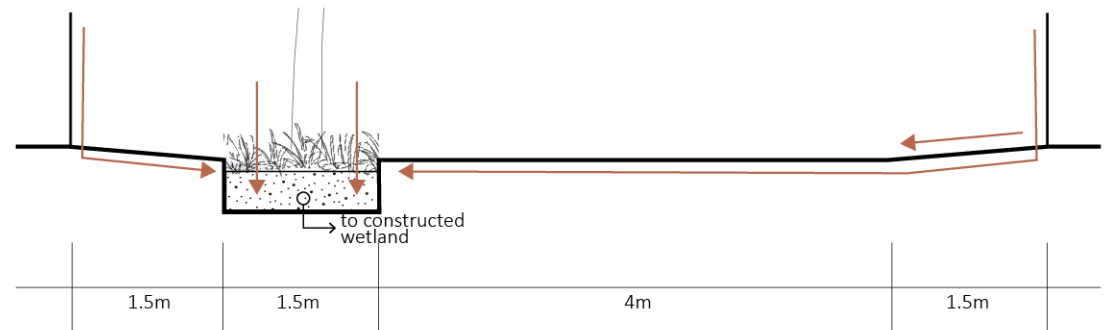
Before



asphalt



grass brick



6.2 Overall System

Street Typology - Tertiary Road

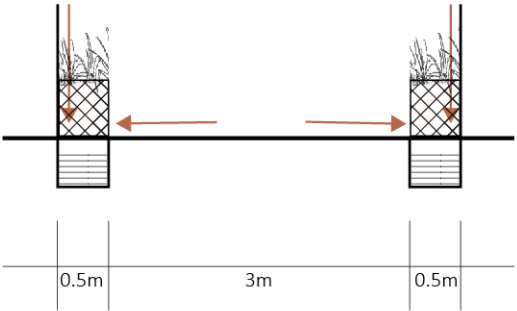
Before



asphalt



grass brick



6.2 Overall System

Green Space



6.3 Detailed Design



Plastic Waste Center

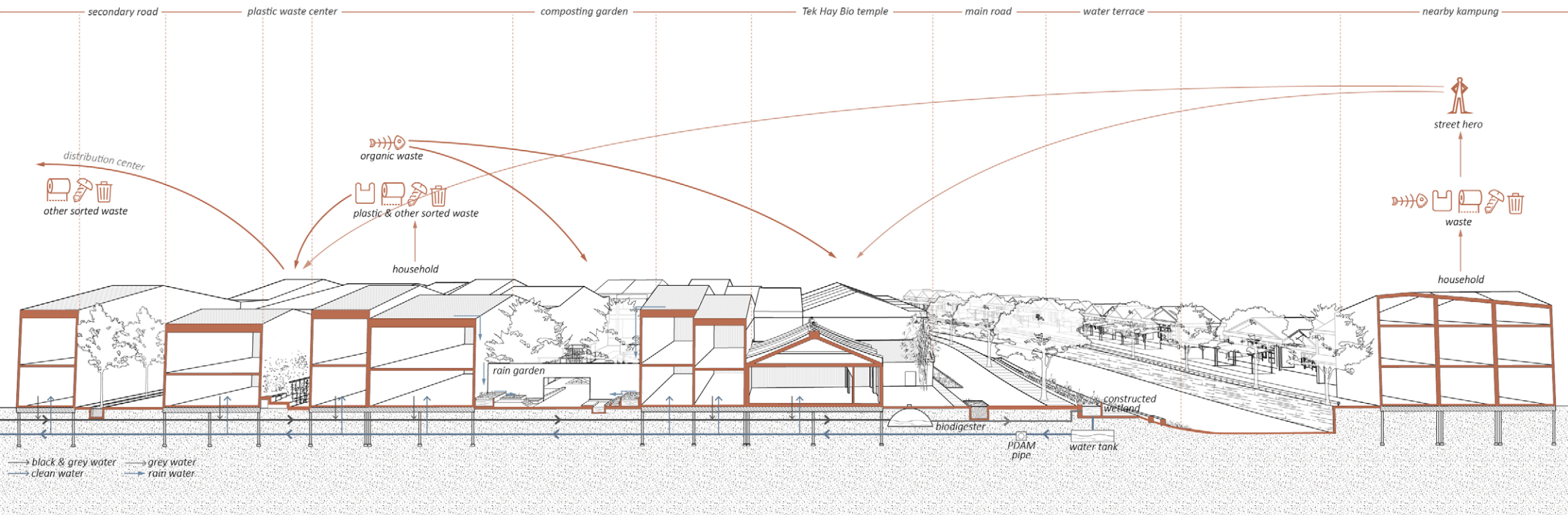
Composting Garden

Temple

Water Terrace

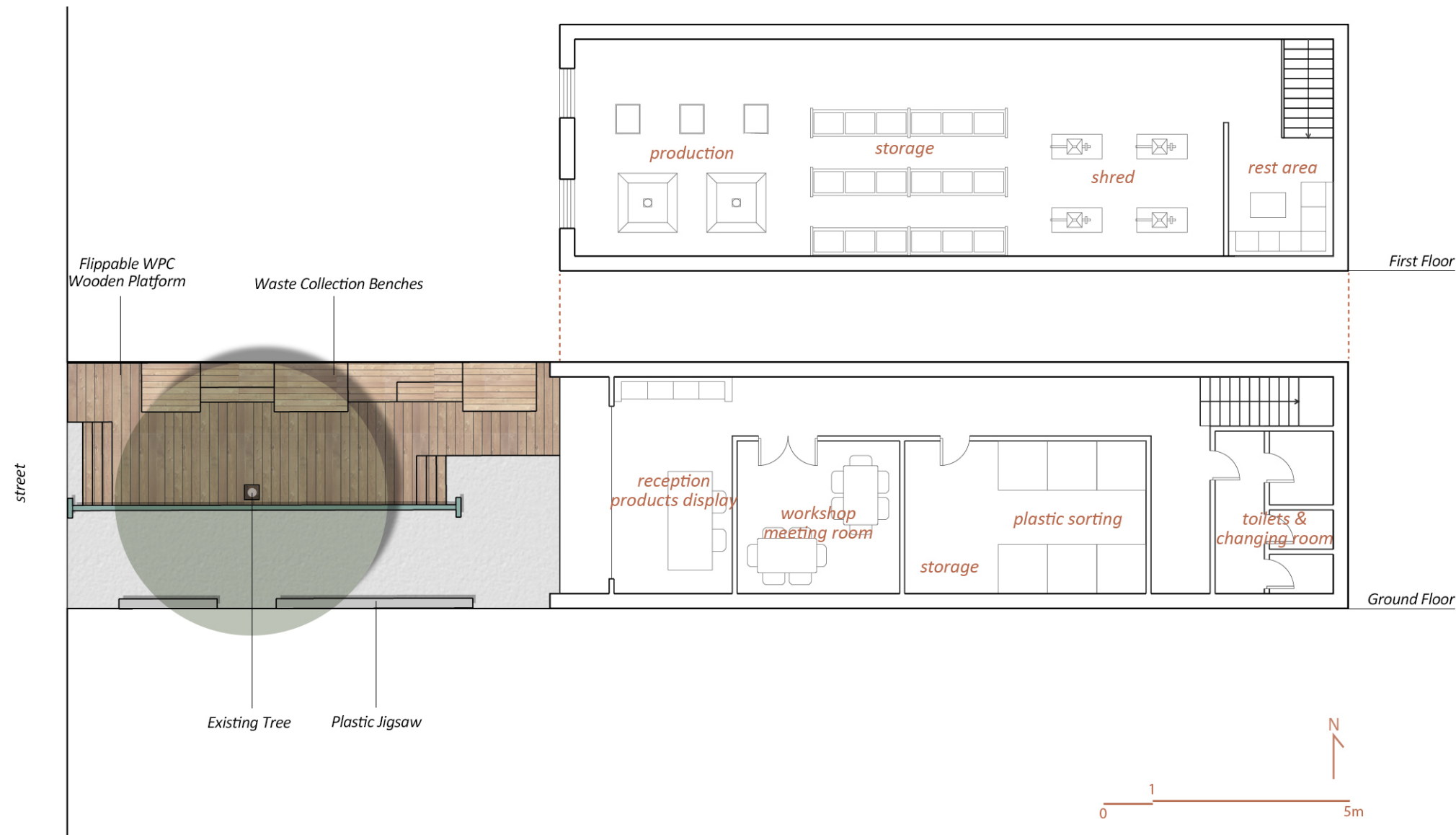


6.3 Detailed Design



6.3.1 Plastic Waste Center

The plastic waste center is where the residents drop their sorted waste and meet their neighbors. Spaces for plastic processing are offered here, also workshops and group meetings to enrich residents' knowledge about waste sorting and recycling. The building inherits the Chinese shophouse typology but uses recycled materials as much as possible.



6.3.1 Plastic Waste Center



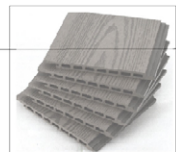
WPC platform

existing tree

plastic jigsaw

6.3.1 Plastic Waste Center

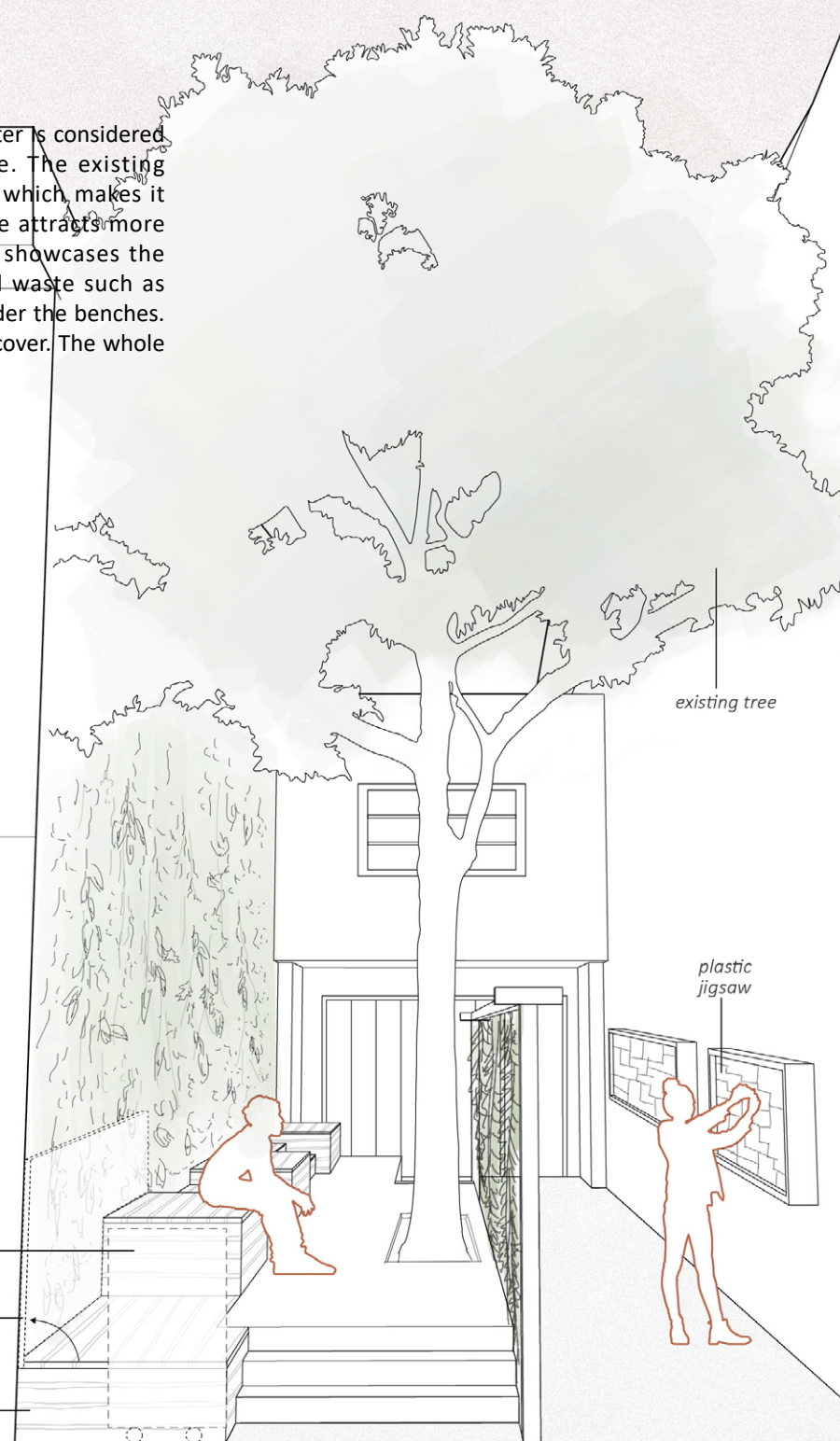
The open space in front of the waste center is considered for meeting people and collecting waste. The existing tree covered the space under its shading, which makes it a pleasant place to be. Plastic jigsaw game attracts more residents to enjoy this place, meanwhile showcases the outcome of waste recycling. Other sorted waste such as paper, metal, is collected in the trash bin under the benches. It can be taken out easily with the flippable cover. The whole platform is made of wood plastic composite.



waste collection

flippable cover

WPC
wooden platform



existing tree

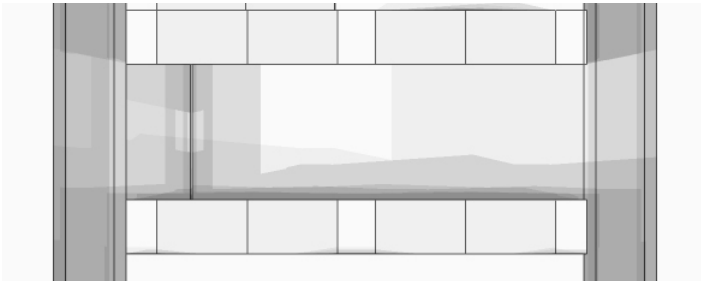
plastic
jigsaw



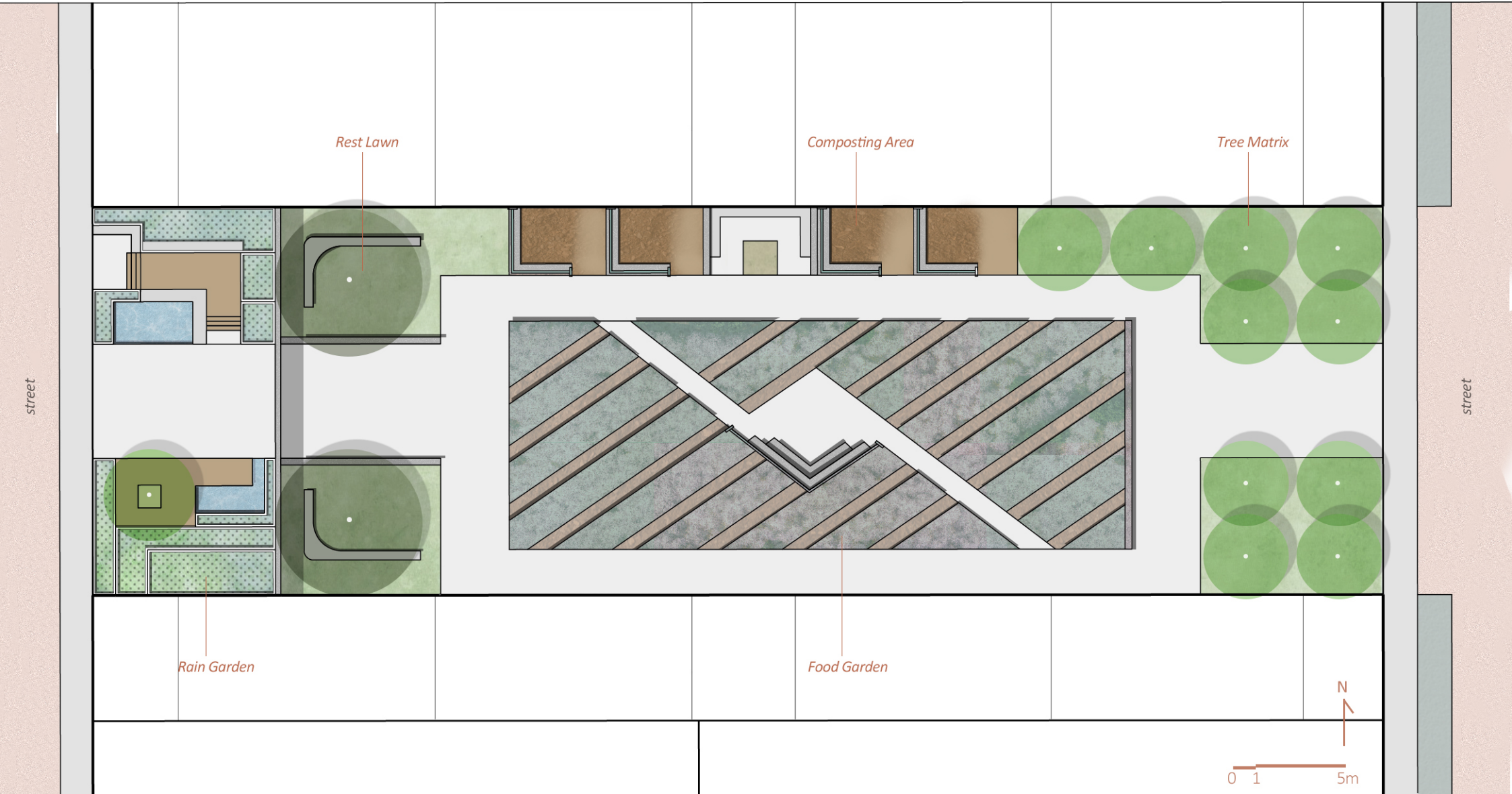
6.3.2 Composting Garden

The composting garden is composed of a rain garden, food garden, and the composting area. It provides space for people to meet and take care of their environment together and showcase the outcome directly. To well maintain the composting garden, RTs will take responsibility in turns.

sunshine analysis



Plan

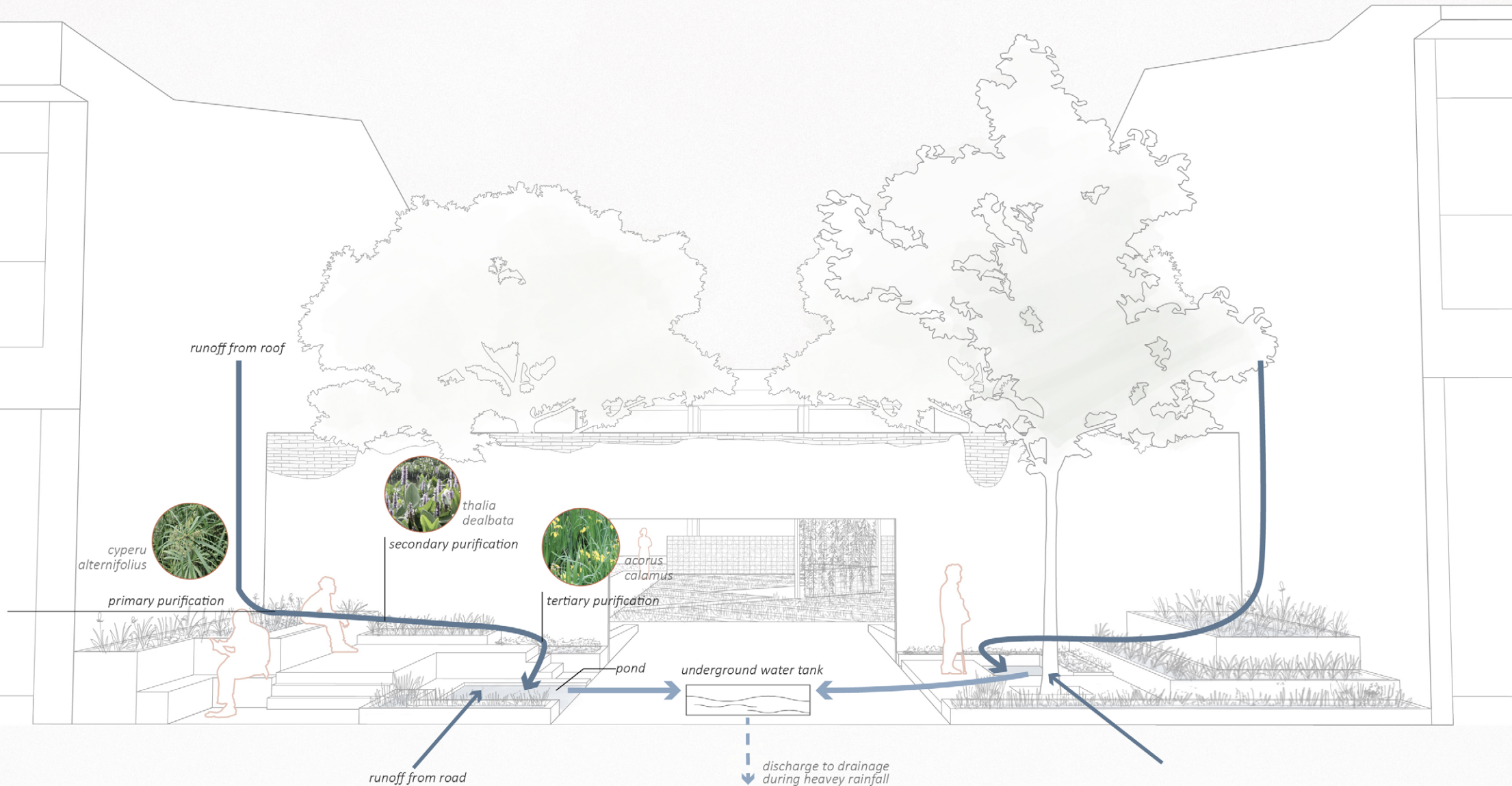


6.3.2 Composting Garden - rain garden

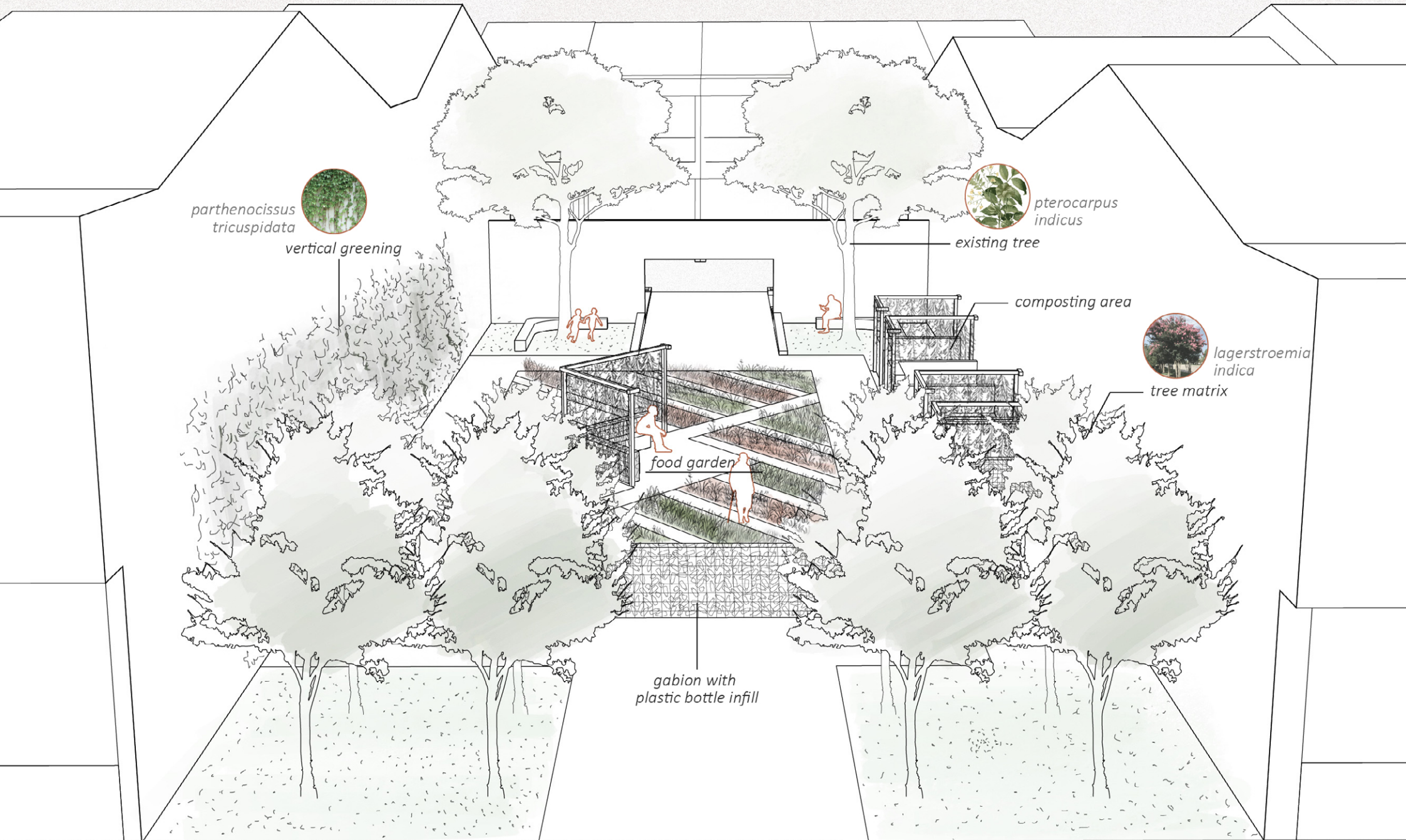


6.3.2 Composting Garden - rain garden

The rain garden is for rainwater harvesting, treatment, and storage, also for people to sit and talk to their social distancing friend. This open space gives a welcoming atmosphere to people, and together with the existing, it helps strengthen the entrance of the composting garden.



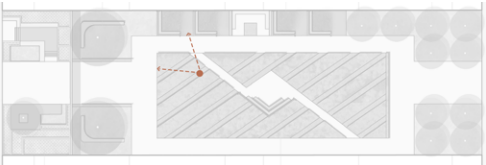
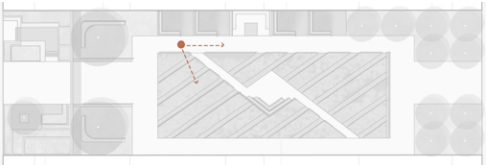
6.3.2 Composting Garden



6.3.2 Composting Garden

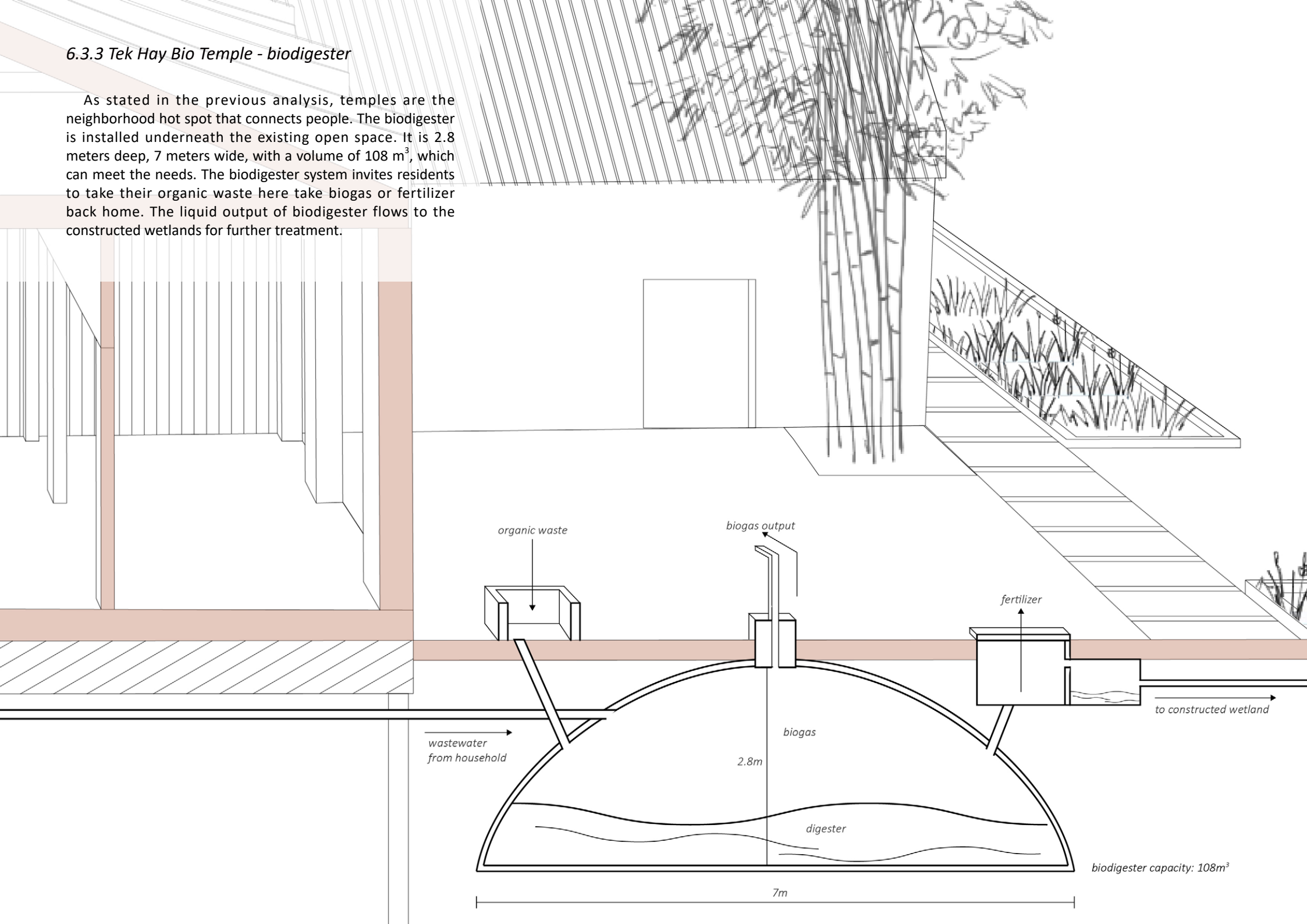


6.3.2 Composting Garden



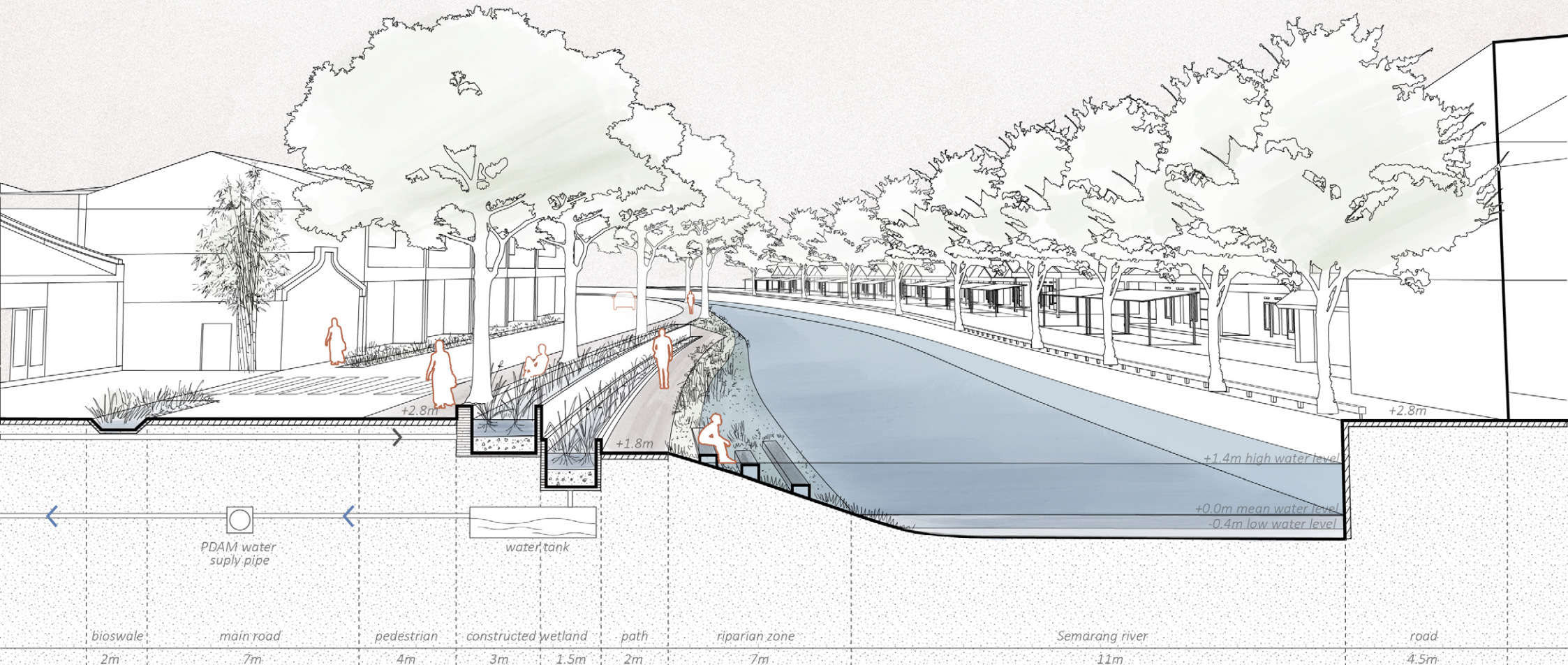
6.3.3 Tek Hay Bio Temple - biodigester

As stated in the previous analysis, temples are the neighborhood hot spot that connects people. The biodigester is installed underneath the existing open space. It is 2.8 meters deep, 7 meters wide, with a volume of 108 m³, which can meet the needs. The biodigester system invites residents to take their organic waste here take biogas or fertilizer back home. The liquid output of biodigester flows to the constructed wetlands for further treatment.

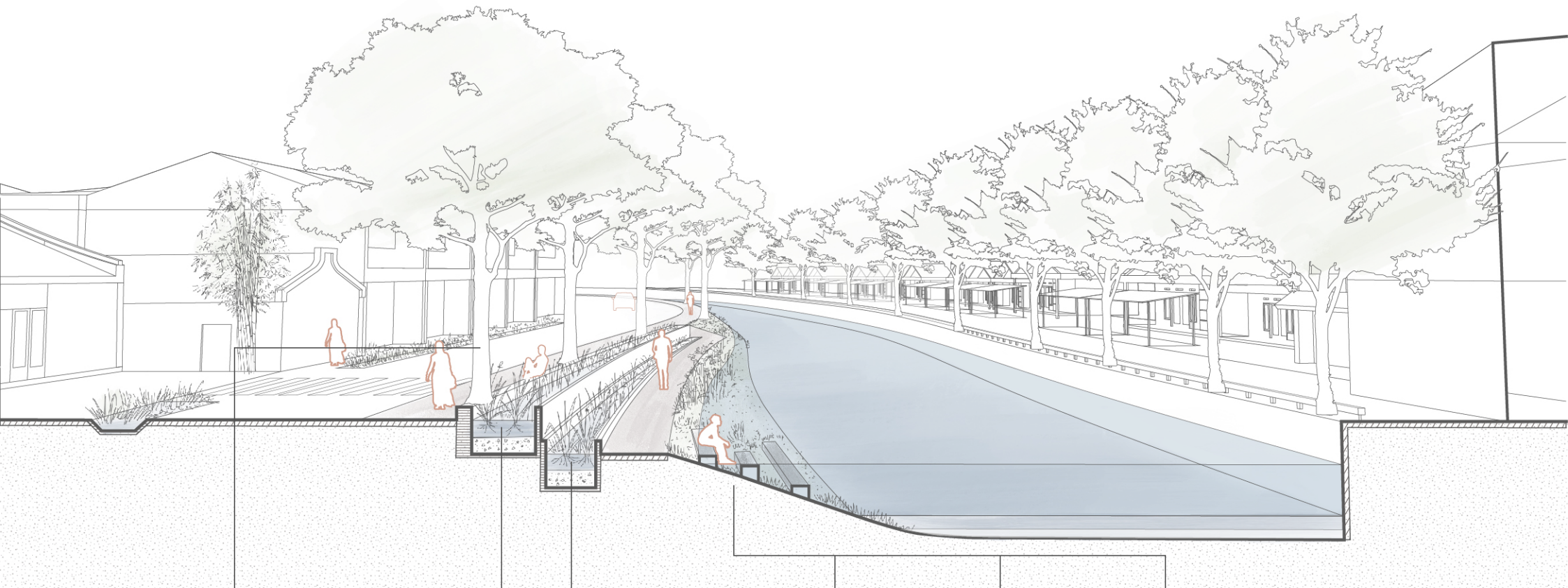


6.3.4 Water Terrace

The water terrace is equipped with constructed wetlands to treat the effluent from biodigester. The treated water is stored in the underground water tank to prevent pollution from the poor quality underground water and river overflow during heavy rainfall. The water tank is connected to the PDAM water supply pipe to transfer water back to the households. The soft riverbank gives more room for the river and nature to thrive.



6.3.4 Water Terrace
Planting Scheme



magnolia grandiflora



lythrum salicaria L.



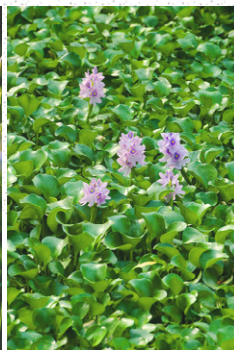
sagittaria trifolia



vetiveria zizanioides



iris tectorum



eichhornia crassipes

6.3.4 Water Terrace

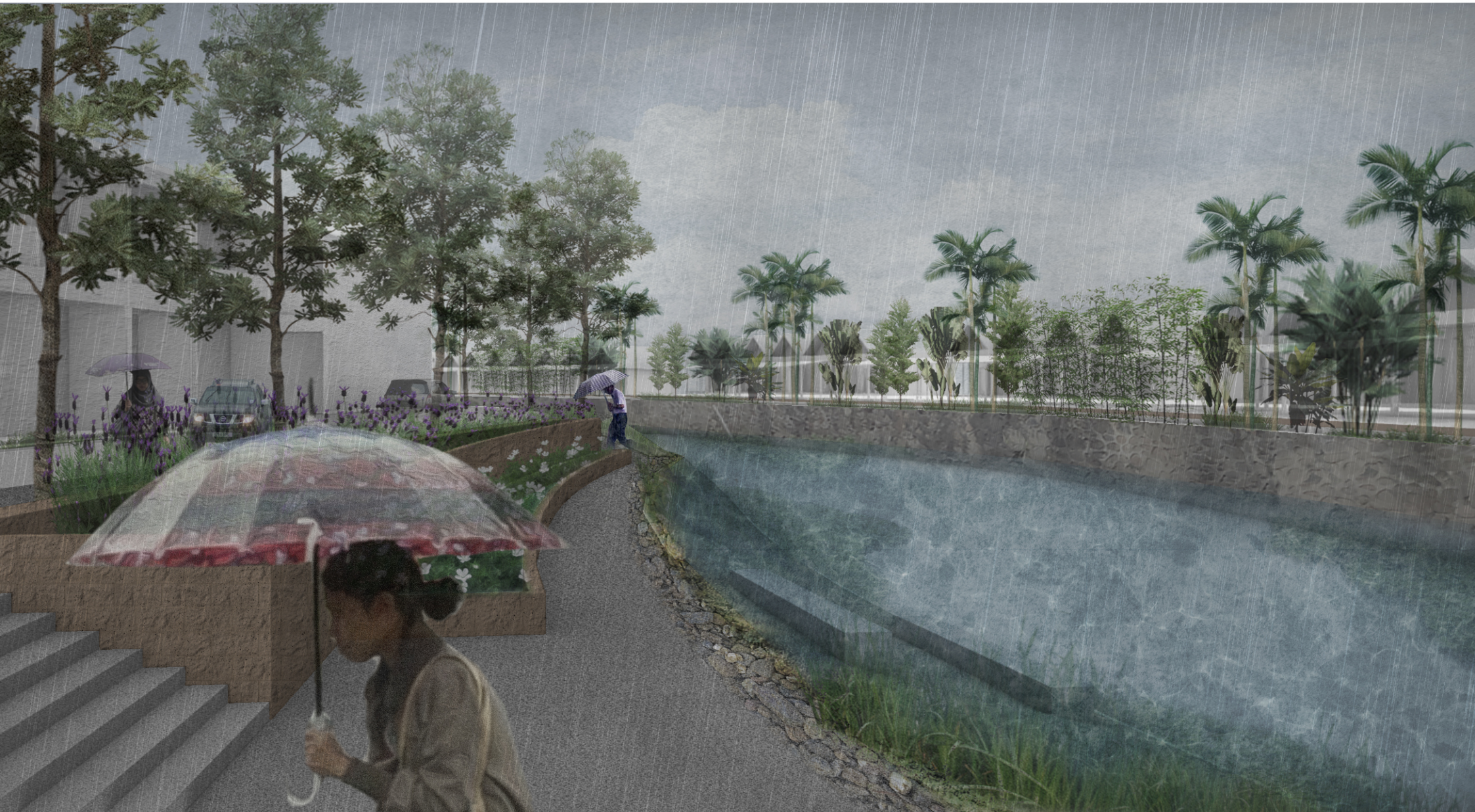


constructed wetland

permeable pavement

soft riverbank

6.3.4 Water Terrace



6.4 Phasing



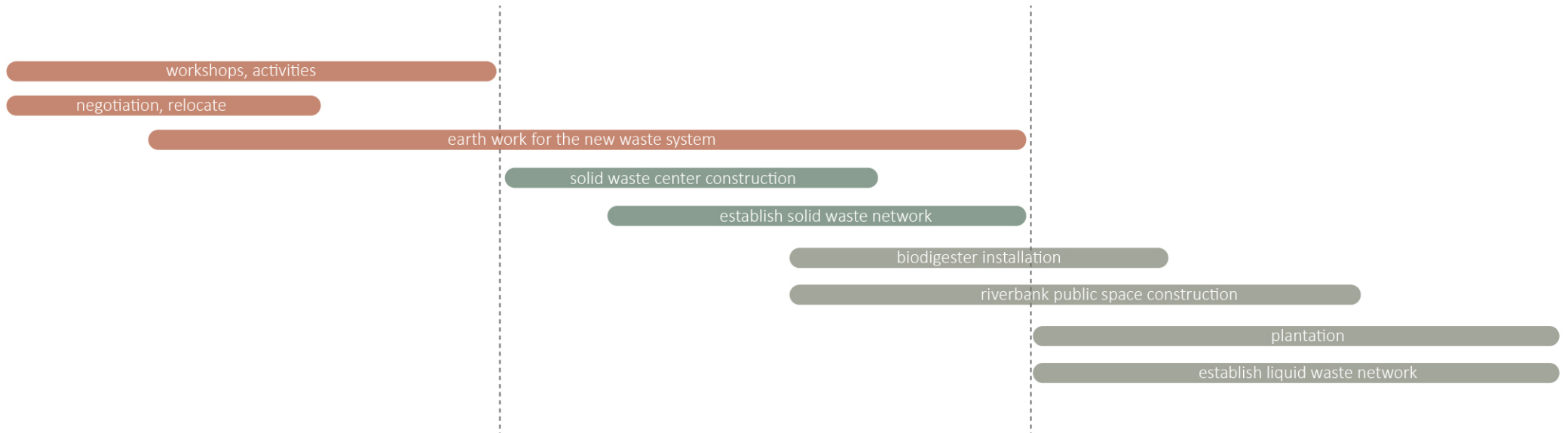
Stage 1 (1-3 years)
placemaking & knowledge broadcasting



Stage 2 (3-5 years)
fulfill solid waste network



Stage 3 (3-5 years)
fulfill liquid waste network



CHAPTER 7

REFLECTION

7.1 Conclusion

7.2 Reflection

7.1 Conclusion

Research question: *how can landscape architectural interventions create a healthy environment by reconstructing waste management?*

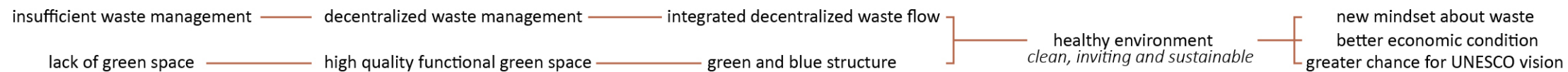
Problem Fields

Proposal

Landscape Intervention

Design Outcome

Influence



The project discusses the possibility of constructing decentralized waste management in Kampung Kranggan, a dense village in Semarang, Indonesia. Semarang city has been coping with water-related issues since the last century, but not enough the attention is given to the waste problem. Thus, the waste infrastructure is not well organized and maintained, and residents don't care about waste collection and recycling. These two main factors make the current waste management insufficient. In parallel to the waste issue, there is also a conspicuous shortage of green spaces within the city, which hinders outdoor activities and biodiversity.

The design strategies do not only delve into the local scale to reconstruct waste management but also the potential to develop a green and blue structure on the city scale. The solution helps to create a healthy environment, but more importantly, the new waste flow blends into people's daily life, which would gradually change their mindset about waste. Therefore, Kampung Kranggan, as the most busy and dense neighborhood in Semarang, is chosen for further research. Since Kampung Kranggan functions as a commercial center and famous for its market, it directly connects to the waste flow. However, the current waste flow is linear and lack of local participation, it is unsustainable in the long run.

Based on the existing situation, several theories and cases focus on waste recycle, and people's participation is studied and adapted in the Indonesian context. A bottom-up approach is highly valued since it involves people in the new waste flow to the largest extend. It is a great way of learning and understanding the benefits of waste while making and maintaining the spaces themselves. The bottom-up approach is possible in this case because of Indonesia's featured social structure and culture.

Place-making is crucial since there are barely spaces that can be used to improve waste infrastructure for realizing the decentralized waste management in Kampung Kranggan. That is why a few houses are demolished due to its building quality and location. For solid waste, scattered waste centers and composting gardens within the kampung make sure every resident has easy access to them. With public spaces these centers offer, residents are more likely to stay after dumping their waste at the designated spots so that they would be active social places in the future. For liquid waste, biodigester and constructed wetland are introduced to improve the existing linear flow. Biodigesters will be installed along the waterfront as the first wastewater treatment with other beneficial outcomes such as biogas and fertilizer. The existing septic tanks will be a supplementary system at the beginning then gradually replaced by the biodigesters. Constructed wetlands integrated with public spaces are secondary wastewater treatment. The treated water would be reused by the kampung again and stored at a safe elevation to prevent polluted water intrusion during the rainy season.

These strategies are replicable within the city in several kampungs. With these specialized waste management kampungs processing different kinds of waste specifically, together with the green spaces they generate while reconstructing waste management, they serve as the backbone of the new green and blue structure.

This project could be achieved by residents as the main actor with the help of the local government and NGO organizations financially and technically. Because this project falls into the governmental proposal of 'thematic kampung', it is more likely to be supported by the government. When the intervention expands to several waste management kampungs in the city, it would have a remarkable impact on the city's healthy and sustainable development.

7.2 Reflection

Research and design

Research and design are two crucial processes throughout the design process. At whatever stage in this project, research and design turn out to be inseparable and collaborative. During the analysis stage, research through several ways like mapping, literature review, and site visiting, helps to obtain local knowledge and reveal the driven force behind it. Also, it leads to a more precise research question and design goal. On the other hand, the design is fulfilled by the research as a basis and frame from the city scale to the neighborhood scale.

Flowscape and the project

The Flowscapes Studio is the graduation studio of the MSc Landscape Architecture. It discusses the approach 'landscape as infrastructure' and emphasizes the idea that landscape is a living system in which different metabolic flows interweave. As landscape architects, we are dealing with dynamic flows, processes, and time instead of static objects. In my graduation project, the current flows lead to a vicious cycle and decrease living quality.

The project chooses to address the waste flow, at the same time, create an impact on other metabolic flows. By manipulating the waste flow, the design facilitates the local economy and creates functional spaces for waste, people, and nature.

Research method and approach

The project targets decentralized waste management construction that contributes to a healthy environment. Desk analysis of the general information about the city is done to help define problem fields. Site visiting exposes more aspects in Semarang city and offers the chance to communicate with local people, which gives insights from another perspective. The research and site visiting narrow down the design topic and stimulate the decision of constructing decentralized waste management. Specific analysis of the current waste management reveals the poor waste infrastructure and limited local participation in the ongoing system are the reasons behind the insufficient centralized waste management.

Further on, theories and cases in terms of waste landscape and decentralized waste system are studied. There are plenty of studies done on these topics, explaining how to set up decentralized waste management in which different stakeholders involve, or how to make affordable household infrastructure. However, these solutions are very generic and lack spatial translations of the context.

This project attempts to fill in the gap between the generic solutions and the particular challenges on a neighborhood scale. Thus, to make solid strategies, the local context plays a determining role in the design process. By respecting the existing structure, a design can be accepted and maintained by the people in the long run.

7.2 Reflection

Reflect on the wider world

Waste has been there since human comes into being. Improperly treated waste damages public health, economy, and ecology in countries all over the world, especially developing countries without efficient waste infrastructures. However, as global waste generation increase is an inevitable fact, the relationship between waste and human should be altered to pursue an auspicious and sustainable future. The project is set out to explore and present the possibility of making peace with the waste and utilizing it as new resources to facilitate the economy, furthermore, establish a new mindset about waste. The project follows the local government's proposal of thematic kampungs, makes use of the unique Indonesian social structure and culture to realize decentralized waste management in a dense neighborhood. Design principles and strategies can be translated within Semarang city by adapting the local context.

The most important thing that can be taken out from this project is the beauty or qualities lie behind the landscape. Landscape is conventionally regarded as the beautiful surface with functional spaces that serve people and nature. As a matter of fact, landscape goes beyond the landscape itself and touches a broader range such as economy, lifestyle, and culture, it is the vessel of these hidden driven force. At this point, landscape architects should be more conscious about the possible effects on different aspects while designing. Good landscape designs can blend in the context naturally and become part of the users' daily life, or even the starting point of behavior change.

Ethical issues and dilemmas in placemaking

The project proposes an alternative way of living with waste in order to create a healthy living environment. A promising future lies in the city. However, to reach that future, the conflict between sacrifice some people's benefits for the greater good and restrict its development by only using existing limited resources and space should be carefully assessed. This dilemma touches upon a profound underlying cultural aspect. As a matter of fact, Indonesian tend to live together with their familiar neighbors. Moreover, Kampung Kranggan includes the Chinatown in Semarang, the tendency of living with the same ethnic group is even stronger due to historical factors. Thus, finding the balance between the newly implemented design and the traditions is the key to ensuring the kampung will develop and last as a healthy living environment. Since the project respects both the government's proposal and the social structure and the benefits can be seen spatially and economically in a relatively short term, it becomes much easier to convince the government and local people to participate in the implementation.

REFERENCES

Aro, I. (2015). *Urban Design Makoko digital version*. Retrieved from <https://www.slideshare.net/IsmailaAro/urban-design-makoko-digital-version>

Bowen, J. R. (1986). *On the political construction of tradition: Gotong Royong in Indonesia*. The Journal of Asian Studies, 45(3), 545-561.

Corten, J., & Dun, P. (2016). *A tale of three cultures: Semarang inner city development*.

Dengan Rahmat Tuhan Yang Maha Esa. (2011). *Rencana Tata Ruang Wilayah Kota Semarang Tahun 2011-2031 (Semarang Spatial Plan 2011-2031)*.

Downton, P. F. (2008). *Ecopolis: Architecture and cities for a changing climate (Vol. 1)*. Springer Science & Business Media.

Engler, M., & Center for American Places. (2004). *Designing America's waste landscapes (Center books on contemporary landscape design)*. Baltimore: J. Hopkins University Press.

Fuchs, A., & Tillie, N., & Smit, M. (2019). *Developing a decentralized and integrated water management System for Neighborhood Communities within Indonesia's informal urban Settlements Sub-theme: Informal Solutions for Sustainable Development*.

Hadiwidodo, M., Samadikun, B. P., & Arinasandi, D. (2019). *Study of Waste Bank's Condition in Semarang City*. In E3S Web of Conferences (Vol. 125, p. 07010). EDP Sciences.

Jackson, R. J., & Kochtitzky, C. (2001). *Creating a healthy environment. The Impact of the Built Environment on Public Health*. Washington, DC: Sprawl Watch Clearinghouse.

Joko, T., & Yunita, N. (2016). *Survey of Drinking Water and Sanitation in Local Government Semarang, Salatiga, Kendal and Pekalongan District*. International Samanm Journal of Finance and Accounting, 4(1).

Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). *What a waste 2.0: a global snapshot of solid waste management to 2050*. World Bank Publications.

Lynch, K. (1990). *Wasting away*. Random House (NY).

Miladan, N. (2016). *Communities' contributions to urban resilience process: a case study of Semarang city (Indonesia) toward coastal hydrological risk*. Université Paris-Est, NNT : 2016PESC1010ff.

Nijhuis, S., & Jauslin, D. (2015). *Urban landscape infrastructures. Designing operative landscape structures for the built environment*. Research in Urbanism Series, 3, 13-34.

PBL (2017). *Opportunities for a circular economy*. PBL Netherlands Environmental Assessment Agency, Retrieved from <https://themasites.pbl.nl/circular-economy/>

Semarang Climate. (2019). Retrieved from <https://en.climate-data.org/asia/indonesia/central-java/>

semarang-3122/

Tjallingii, S. P. (1995). *Strategies for ecologically sound urban development*. Ecopolis. Leiden: Backhuys Publishers, 44-53.

United Nations Environment Programme. (2016). *Healthy environment, healthy people*. Retrieved from <https://wedocs.unep.org/bitstream/handle/20.500.11822/17602/K1602727%20INF%205%20Eng.pdf?sequence=1&isAllowed=y>

USAID. (2015). *USAID Indonesia Urban Water Sanitation and Hygiene Annual Progress Report 5: October 2014 - September 2015*.

UP+S RAIN GARDEN. (2015). Retrieved from <http://ups2006.com/zh/projects/241>

Waste. (2019). In *Wikipedia, the free encyclopedia*. Retrieved from <https://en.wikipedia.org/wiki/Waste>

Weishanhu Wetland Park. (2008). Retrieved from <https://www.goood.cn/weishan-wetland-park-by-aecom.htm>

Whittington, D., Davis, J., Miarsono, H., & Pollard, R. (2000). *Designing a "neighborhood deal" for urban sewers: a case study of Semarang, Indonesia*. Journal of Planning Education and Research, 19(3), 297-308.

World Bank. (2018). *Indonesia Marine Debris Hotspot*. Retrieved from [http://documents.worldbank.org/curated/en/983771527663689822/pdf/126686-29-5-2018-14-18-6-SynthesisReportFullReportAPRI](http://documents.worldbank.org/curated/en/983771527663689822/pdf/126686-29-5-2018-14-18-6-SynthesisReportFullReportAPRI%20FINAL.pdf)

World Health Organization. (2001). Definition of health [Online]. Available: <http://www.who.int/aboutwho/en/definition.html>.

World Health Organization. (2010). *Urban planning, environment and health: from evidence to policy action*. Urban planning, environment and health: from evidence to policy action.

World Health Organization. (2017). *Urban green space interventions and health: a review of impacts and effectiveness*. WHO: Geneva, Switzerland.

Zapata Campos, M., & Hall, C. (2013). *Organising waste in the city : International perspectives on narratives and practices*. Bristol etc.: PP, Policy Press.