

Water as a Connector

A coherency between strategic planning design in waterfront and urban revitalization



Current Maashaven dock, Rotterdam

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"Cities seek a waterfront that is a place of public enjoyment. They want a waterfront where there is ample visual and physical public access – all day, all year - to both the water and the land. Cities also want a waterfront that serves more than one purpose :they want it to be a place to work and to live, as well as a place to play. In other words, they want a place that contributes to the quality of life in all of its aspects – economic, social, and cultural".

Remaking the Urban Waterfront, the Urban Land Institute (Seattle
Department of Planning and Design, 2012)

PREFACE

Living in Rotterdam has made me proud of the city. By experiencing a lot of various developments, I have seen that Rotterdam has progressed in 25 years which have affected the image of the city. The developments at Kop van Zuid made sure that the two parts of Rotterdam came together and made it possible for people living on the south side could travel quickly with or without public transport to the other side. Growing up in the neighborhoods Feijenoord, Heijplaat, and Camisse, I see that it's about more than just mega projects on the waterfront of Rotterdam. There are still too many neighborhoods in Rotterdam that require redevelopment and not only the post-industrial ports on the waterfront. Also, we have the global problem of climate change that can have adverse effects on the city of Rotterdam because of its position in the delta. As an urban designer and resident of my city, which I am still proud of, I see an essential task to protect and adapt Rotterdam for climate change that will also reflect on neighborhoods in decline. So my motivation comes from my city, which has besides strengths even some weakness, which needs adaptive design solutions against climate change regarding water that at the same time also result in attractive neighborhoods. Therefore, this thesis aims to find coherency in waterfront development and declining neighborhood.

AKNOWLEDGEMENT

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Also, I would like to thank my first and second mentor, Inge Bobbink and Els Bet, for their critical attitude toward this graduation thesis. Their support and guidance during tutoring have helped me refine and develop the entire project which was not easy. This process has also helped me to look at things in a certain way. I thank you both for your patience and knowledge that has shown me many new things.

Renu Ganpat
March 9, 2018

INTRODUCTION

Cities in the Netherlands have mostly traditionally developed themselves around water: often near rivers or sea, sometimes also at its intersection. Rotterdam, with one of the largest port city in the Netherlands, is an example. Rotterdam is a dynamic world port and has a century-long tradition of living with water. The tradition of protecting "against and living with water" contributed to the development of the city. The strategic location of Rotterdam in the Dutch delta brought us prosperity and growth. The city grew with their port activities. After the 20th century, the movement of the port towards the sea where the Maastvlakte aroused has left former post-industrial areas abandoned. This change in space and function has accelerated into new opportunities for Rotterdam as a city port. Rotterdam can continuously adapt to new conditions responding to economic and social changes. Thanks to its position in the delta, Rotterdam has a strong international orientation and has a large number of potential financial clusters. Because of this economy, the population number has grown in Rotterdam.

Rotterdam as a delta can also face the threat of river floods and storm surges from the seas and heavy rainfall. The City cope with a lot of heavy rain that can affect our health and environment. Due to a changing climate and changing insights concerning sustainable relations between cities and water-landscapes, new interventions will be needed to create a new urban delta-landscape. In addition to safety and better water-systems, in urban delta's there is a

need for stronger spatial identities and new cohesion of cities and their water-landscapes (delta intervention objectives). There is a requirement for Rotterdam to transform into a climate adaptive city to protect itself from floods and water damages. It is a favorite situation to live in or along water environment. Therefore, development of the water-related climate offers excellent opportunities in Rotterdam. This challenge Rotterdam in a correct way of land use planning where public and private stakeholders are involved.

New interventions that are needed to create a new urban delta-landscape are mostly planned as an individual tool that lacks in coherency of urban planning strategies in general. Van Veelen (2016) mentioned that there is a lack of research that focuses on actual processes of urban development, management, and change as an essential precondition for a successful implementation of climate adaptation strategies. There can be an integrated approach of climate adaptation in waterfront development and urban renewal. Incorporating adaptation into regular urban development processes can be explained as part of a political process to redistribute responsibilities to lower levels of authority (e.g., city level) and enlarge the role of the private sector (van Veelen, 2016). This part of the research indicate the problems of climate change, waterfront redevelopment and declining neighborhood resulting in a problem statement and a hypothesis for an enhanced integrated approach in the development of common interest between private and public stakeholders.



Kade aan Noorderland in 2013
Source: Rotterdam Climate Initiative (2013)

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1.0 PROBLEM FIELD

1.1 PROBLEM ANALYSIS

1.1.1 *Climate change in Rotterdam*

This part will explain the confrontation of threats and its vulnerability to climate change in Rotterdam. This results in climate effects that Rotterdam should consider regarding water. Because of its position and accessibility, Rotterdam is by far one of the largest port and supplier of fossil and energy sources (Meyer, Nillesen, & Zonneveld, 2011). The city has a position in the low lands between a sea with a rising sea level and rivers with increasing peak discharges (figure 1). This means water is coming from 4 ways. The position makes Rotterdam also extremely vulnerable to climate change, and it is no exaggeration to say that climate adaptation and sustainability is a matter of life and death for Rotterdam as a delta. Rotterdam is located in the delta of the Rhine and Meuse. The city has an open connection with the sea through the Nieuwe Waterweg. The city encounter with water from 4 ways (Gemeente Rotterdam et al., 2013): from the sea, the river, stormwater (rainwater) and groundwater. Because of the rapid change of climate chances of flooding and spatial damages are higher. This led to the fact that Rotterdam must take into account different scenarios of water problems due to climate change.

Rotterdam is confronted with an increasing frequency of heavy rainstorms that will lead to much more water than usual. Rotterdam as an urbanized delta has a lot of district with a lot of pavement en see challenges to retain water on the subsurface (see figure 2). During the 19th and 20th century, a lot of the original canals in the city has been filled. The amount of surface water decreased from % to less than 6% of the built-up area (Meyer et al, 2011). This led to overloaded sewage systems during heavy rainfall. Pumps were not able to pump the water from the sewage system into the open water fast enough which resulted in flooded streets (Gemeente Rotterdam, 2013).

Discharge in the Meuse will not help because the Meuse is in connection with the sea that is only rising. The combined

effect of sea level rising and increasing river discharges creates new problems for the city (Meyer et al, 2011). River discharges seemed to be the solution in the mid 1990s, but due climate change will increase with 18000 m³ per second in the future (Delta commission, 2008). The sea level was already rising by 17 cm, but due to climate change, this will speed up rapidly. According to the Delta commission (2008), the sea level will increase 130 cm by the end of this century. Although the un-embankment area adjacent to the river have been raised to 3-4 meters, they will become extremely vulnerable in the future, which one can see in figure 3 (Meyer et al, 2011). Also the urbanized area inside the dike (is 1-6 meter lower than average sea level (Meyer et al, 2011). People in Rotterdam use to drain wet peat to make it more suitable for human living and building. This led to dried peat which at a certain point began to oxidize. The result of this was shrinkage of ground (Palmboom,1987). If the future the dikes break, a large part of Rotterdam will flood.

All these effects of climate change can damage the port economy, different city structures, and environment in Rotterdam as a delta metropolitan. Delta Committee (2014) has pointed Rotterdam region as a particular case for extraordinary solutions. This is because Rotterdam is one of the cities with a chance of a high number of victims during floods. Like mentioned before, the position of Rotterdam makes it possible that water can reach the city very fast. Rotterdam and its port are also one of the cities with high potential economic damage. Rotterdam has, therefore, a significant challenge to protect its worldwide status and identity by making the city safe by climate adaptive solution.

Figure 4 illustrate the effects of climate change that Rotterdam should consider regarding water.



Figure 1: Different approaches of climate change in terms of water in Rotterdam,

Bron: Rotterdam Climate initiative

Kaart 1: Huidige locaties met waterbergingskort conform NBW (bron: Interactieve Klimaatatlas)



Kaart 1: Overstromingsbeeld buitendijks Rotterdam 2015 (bron: Deltares) met een herhalingsijd van 1 x 1.000 jaar



Kaart 2: Toekomstige locaties met waterbergingskort (bron: Interactieve Klimaatatlas)



Kaart 2: Overstromingsbeeld buitendijks Rotterdam 2100 (bron: Deltares) klimaatscenario W+ met een herhalingsijd van 1 x 1.000 jaar



Figure 2: Short of water retentions,

Source: Rotterdam Climate initiative (2013)

Figure 3: Risk of flooding 2100

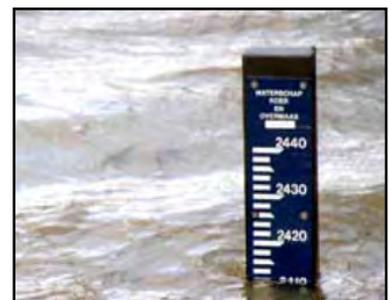
Bron: Rotterdam Climate initiative (2013)



1. Rising sea level



2. Heavy rainfall



3. High water level

Figure 4: Effects of climate change in terms of water in Rotterdam

Source: Rotterdam Climate initiative

1.1.2 Waterfront redevelopment

This part explains the history of waterfronts in Rotterdam to know the current challenge of post-industrial spaces. Moretti (2008), identify the word "waterfront" as "the urban area in direct contact with water." These areas in riverside/seaside cities usually correspond to the space occupied by port infrastructures and port activities. The industrialization leads to the relocation of manufacturing to the suburb, and port city activity had to move from the city center because of massive scale trading opportunities. Ever since the de-industrialization, cities have become more and more attractive and have been expanding rapidly ever since. However, the transitions of port cities and the industrial revolution had led to abandoned waterfront area's (Romein, 2005). These abandoned areas were seen as sites with potential and opportunities to boost the post-

industrial transformation. These waterfront redevelopments where aimed to create attractive mixed urban environments.

Rotterdam is one of the cases cities shift from industrial to service economy. This retreat from the waterfront, like Hoyle (1989) mentioned, can be illustrated in different stages, see figure 5. During the time when the port activity has shifted (figure 6), Rotterdam has developed itself in many post-industrial places (see figure 7). It has grown over the river which made possible that Rotterdam can be seen as two parts, Rotterdam center and the south of Rotterdam. Rotterdam had evolved itself around water which is seen as a power element in the city. In the late 80s, the opposite of Rotterdam center was the first place to be redeveloped

STAGE	SYMBOL ○ city ● port	PERIOD	CHARACTERISTICS
I Primitive port / city		Ancient / medieval to 19th century	Close spatial and functional association between city and port
II Expanding port / city		19th-early 20th century	Rapid commercial / industrial growth forces port to develop beyond city confines, with linear quays and break-bulk industries
III Modern industrial port / city		mid-20th century	Industrial growth (especially oil refining) and introduction of containers / ro-ro require separation / space.
IV Retreat from the waterfront		1960 s-1980 s	Changes in maritime technology induce growth of separate maritime industrial development areas
V Redevelopment of the waterfront		1970 s-1990 s	Large-scale modern port consumes large areas of land / water space, urban renewal of original core

Figure 5: Different stages in the traditional port city interface.

Source: Hoyle (1998, p.47)

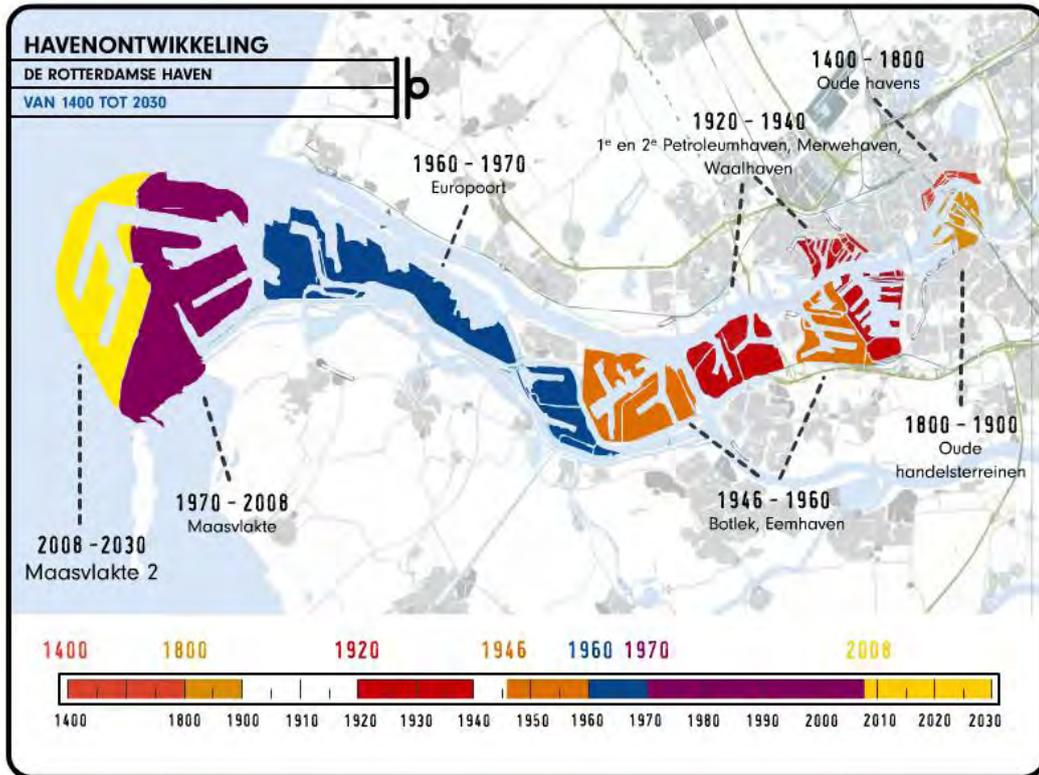


Figure 6: Development of the Rotterdam port,
 Source: Bestemmingsplan Europort en Landtong, 2013

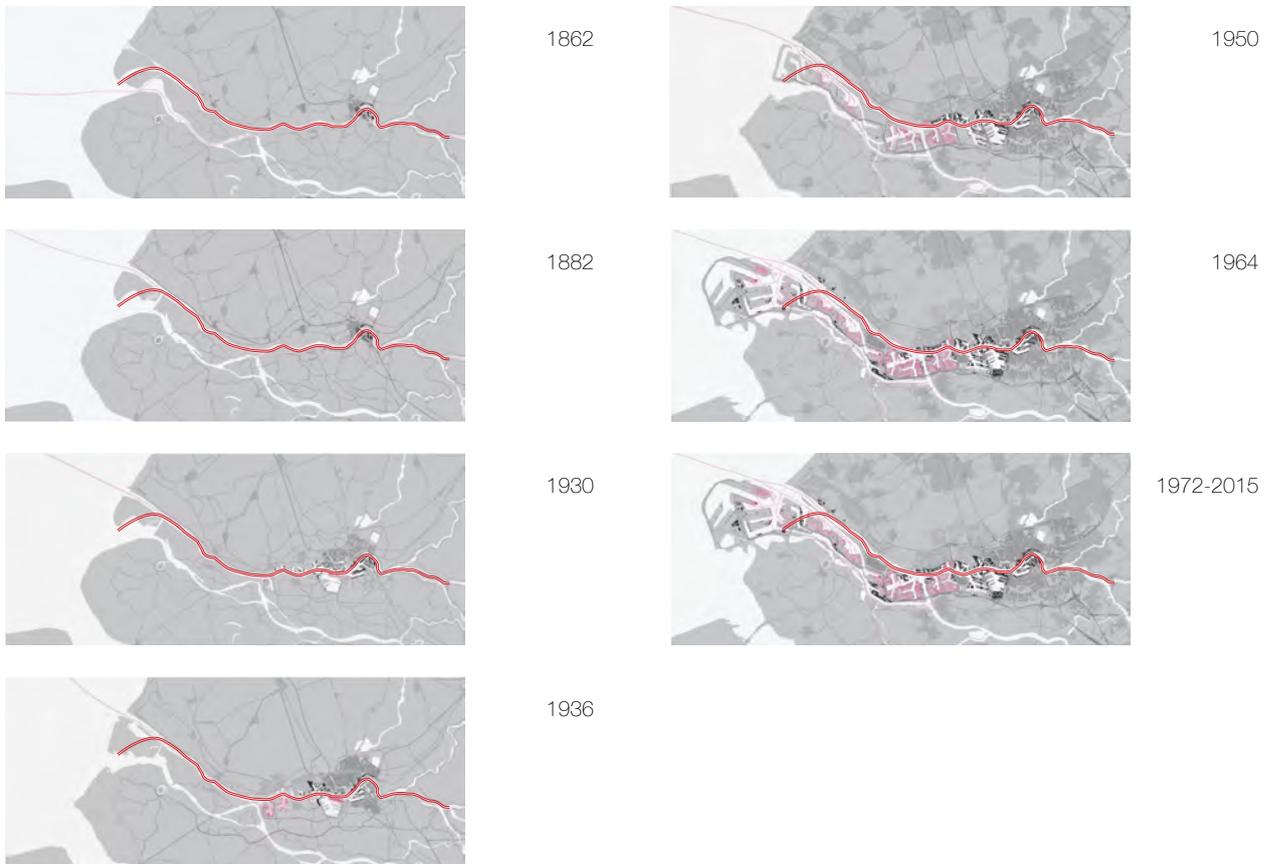


Figure 7: Development of the city Rotterdam around port,
 Source: Hein (2016)

which is now called the Kop van Zuid. The Erasmus bridge was the essential in the project and a significant development that brought the two part together. (Doucet et al, 2010). Many cities have reacted to this phenomenon with programs to regenerate the run-down areas, interpreting the post-industrial phase in a positive sense as an opportunity to revitalize the urban economy and to experiment with new objectives and create new challenges. In more recent years, urban settlements are rediscovering their water edges and rivers as a result of renewal that gives attention and awareness towards the water in general and related to the growing interest in environmental issues and the development of leisure activities. According to Doucet (2009), a lot of post-industrial development along the waterfront is mostly similar aimed at presenting a symbol of success and wealth which is often perceived to be directed towards an outside audience of tourist, investors or potential residents. After the result of researching the case of Kop van Zuid, this was not directly the case. The research concentrated on four neighborhood in Rotterdam different in higher- and lower status. The outcome of the result was that even the low-income neighborhood was satisfied and positive with the arrival of the Kop van Zuid (figure 8), even when they are not the target group. In the perception of its inhabitants the Kop van Zuid is not seen as something negative and foreign, but results do show residents in the low-income neighborhood would like to have affordable and social housing in the Kop van Zuid. Figure 9 shows the value of land-uses which is mostly focused on the high-income groups, which segregated low-income groups to deprived neighborhoods. In this case, it is not about the integration of waterfront redevelopment into the urban fabric but the equality of the content of the development.

The viewpoint of strategic planning identifies and gathers major stakeholders both public and private, but also allows for a broad

and diverse (public, economic, civil) involvement during the planning process (Albrechts, 2004). Albrechts (2004) stated that the objectives of strategic planning of today are to articulate a more coherent spatial logic for land-use regulation and a more open type of governance. At the core of this process is a democratic struggle for inclusiveness in democratic procedures as well as and for reducing or elimination unequal power structures between social groups and classes. This asks for a new approach to strategic planning (see figure 10). The Alternative that Albrechts (2004) propose is to move away from the idea of government as the mobilizer of the public sector and the provider of solutions to problems, towards a concept of governance as the capacity to realize the search for creative a territorially differentiated solutions to issues as well as the challenges for a desirable future with more different actors. In other words, planning of new waterfronts or any other redevelopment is centered on the elaboration of a mutually beneficial dialectic between top-down developments and bottom-up local uniqueness. Problems can not be solved, and challenges cannot be met by just one actor, but require the involvement of all actors equally.

Giovinazzi & Moretti (2010) suggest that participation and collaboration of several professional disciplines are required both in its planning and application. Therefore the regeneration of waterfronts is a highly complex task. Waterfronts need to be regenerated step by step so the entire city can benefit from their potentials. They are a challenge for more than one generation and need a variety of characters both in architecture, public space, and art. Public administration must give impulses on a political level to ensure that the objectives are realized independently of economic cycles or short-term interests" (Giovinazzi & Moretti, 2010).



Figure 8: View of Kop van Zuid from Rijnhaven

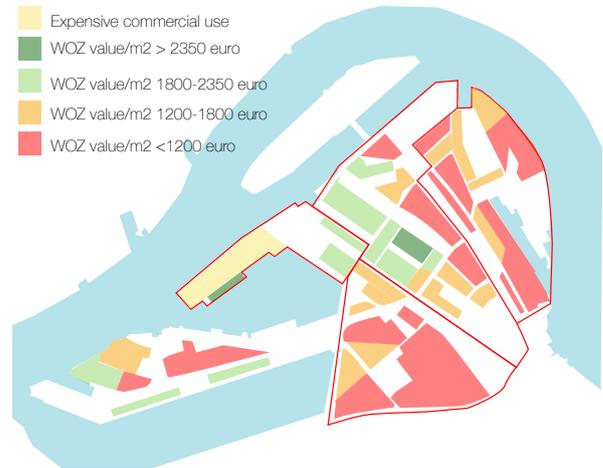


Figure 9: Land use value in the Kop van Zuid and nearing neighborhoods.

Source: By author

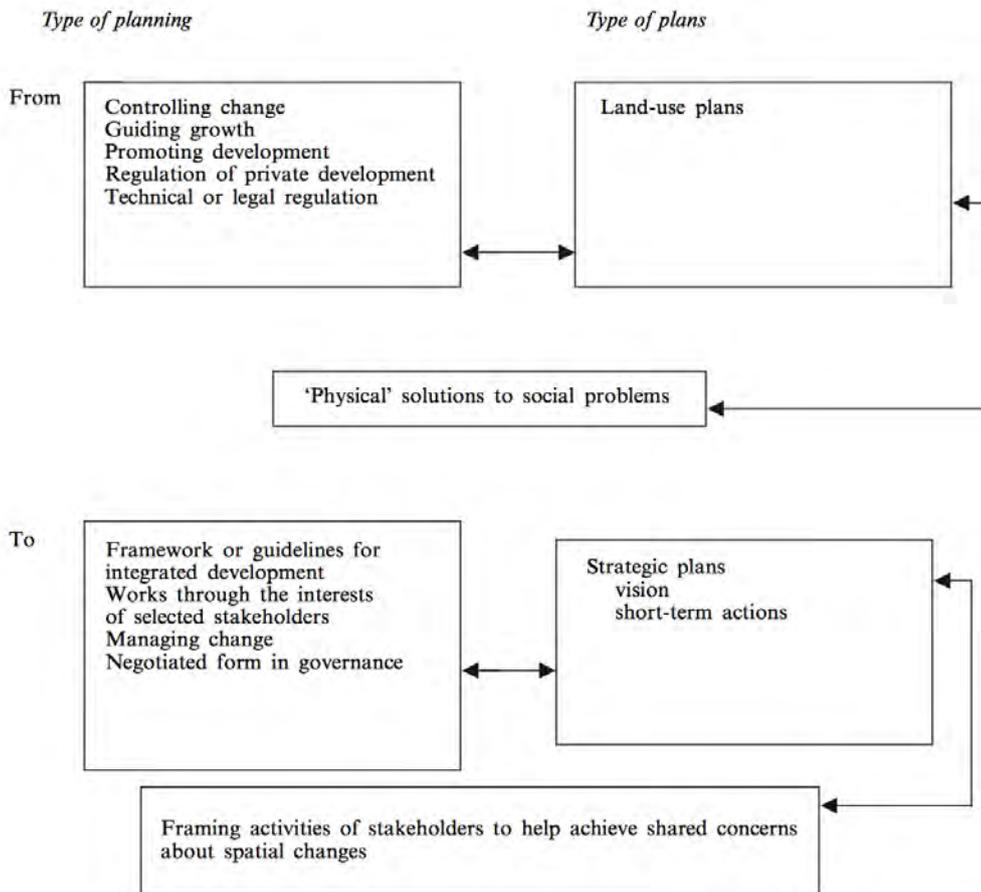


Figure 10: From traditional planning land-use to strategic planning land-use

Source: Albrechts (2004)

1.1.3 Urban decay - General Context

"Most European countries have experienced specific problems that have emerged in certain more or less well-defined parts of cities called deprived or depressed urban neighborhoods. Deprived urban neighborhoods are understood largely as spatially concentrated pockets of poverty, and their emergence is explained as a result of increasing social inequality in the cities" (Anderson, 2002). Anderson describes these neighborhoods as places which display visible physical and social problems that can disfigure the perhaps otherwise attractive urban landscape. They are often perceived by the public as places that are not inhabited or frequented by decent people – they are seen as 'places of exclusion.' These problems were initially found in the oldest urban areas with the lowest quality housing. However, in Europe, they have also emerged in newer social housing estates outside city centers (Anderson, 2002). He also stated that another cause for urban decay and deprived neighborhoods are related to social segregation. Social segregation usually tends to concentrate the low-income group in the least attractive parts of the city. Cities dominated by certain types of tenants and buildings have a high probability of deprivation and decay. So the interaction of social, economic and physical changes in the city have a crucial impact on declining neighborhood.

Also, the low-income group in these deprived neighborhoods has trouble to contribute to the physical situation. An example is a physical quality their houses, mainly when the housing estate is privately owned. This situation leads to a result with unattractive housing in the neighborhood. And of course, this points to the fact that people with a high income do not want to live here.

The areas can be seen as magnetic poles that attract poverty and social problems and repel people and economic resources in a way that influences other parts of the urban space (Anderson, 2002). Therefore the deprived neighborhoods have an impact on the vitality of the whole city. This situation repels people with high income in a way that influence other parts of the area. This situation directly results in social inequality and segregation.

1.1.4 Urban decay - In Rotterdam

In Rotterdam, nearly half of the neighborhoods have been designated as the low-income group (Stouten, 2014). These districts were drawn up by Minister Vogelaar as "empowerment areas" (Stouten, 2014) based on poor quality of the vitality, safety and socio-economic status in the city of Rotterdam. Rotterdam is mostly part of these districts (see figure 11). About one-third of the population of Rotterdam lives in these districts. Ella Vogelaar has established a 'power district' (krachtwijken) policy which target was to achieve a remarkable improvement in 40 neighborhoods in the field of living, working, learning and growing up, integration and security (Cultureel Planbureau, 2013). The Ministry of Housing, Spatial Planning and the Environment and Municipality of Rotterdam (2008) has invested a significant amount of money to upgrade these areas in Rotterdam. This amount was in total 272 million euros for the period from 2008 until 2011 (Stouten, 2014). Cultureel planbureau (2013) decided to analyze the effectiveness of the power district policy to improve the quality of life, safety and socio-economic position of the forty disadvantaged neighborhoods. The result of this was not so positive.

The result show (see figure 12):

- that there are no indications that the policy has led to a more significant increase in income or social advancement in the disadvantaged neighborhoods to the most similar neighborhoods.
- that everything considered, there are not adopting robust benefits of the policy on safety and quality of life in the neighborhood.
- Adverse effect on neighborhood participation

This report concluded that the empowered neighborhood policy did not have a distinctive impact on livability and social safety. The hardest adverse of the plan was the adverse effect of neighborhood participation. It may have helped deprived neighborhood in a sense that some residents saw things were improving in their neighborhood. On the other hand, describing a neighborhood as a disadvantage is likely to have a de-motivating effect and cause residents to see neighborhood problems in a more negative light (CPB, 2013)

Rotterdam	Rotterdam West	3014	Oude Westen
		3021	Middelland
		3022	Nieuwe Westen
		3024	Delfshaven
		3025	Bospolder
		3026	Tussendijken
		3027	Spangen
	Rotterdam Noord	3031	Rubroek
		3033	Provenierswijk
		3034	Crooswijk
		3035	Oude-Noorden
		3036	Oude-Noorden

	Bergpolder	3038	Bergpolder
	Overschie	3042	Kleinpolder
	Oud Zuid	3072	Katendrecht/Afrikaanderwijk/Kop v. Zuid
		3073	Bloemhof
		3074	Hillesluis
		3081	Tannewijk
		3082	Oud-Charlois
		3083	Camisse/Zuidplein
	Vreewijk	3075	Vreewijk
	Zuidelijke Tuinsteden	3085	Zuidwijk
		3086	Pendrecht
Schiedam	Nieuwland	3118	Buurt 62, 68

Figure 11: Overview declining cities ("priority area"),

Source: *Werk aan de wijk, een quasi-experimentele evaluatie van het krachtwijkenbeleid* by Matthieu Permentier Jeanet Kullberg Lonneke van Noije

Tabel 5.1
Samenvatting van de uitkomsten van krachtwijkenbeleid, herstructurering, verkoop en participatiebeleid (OBaZ), 2011/2012^a

	krachtwijkenbeleid	herstructurering algemeen ^b	herstructurering specifiek ^c	verkoop sociale huurwoningen	participatie-interventies (OBaZ)
veiligheid					
gerapporteerd slachtofferschap					
geweld	-	+	++	0	0
woninginbraak	+	0	0	0	0
diefstal	0	0	0	0	0
vernietiging	0	+	0	0	0
perceptie criminaliteit en overlast					
geweld	0	+	+	+	0
diefstal	0	0	0	0	0
verloedering	0	0	0	0	--
overlast jongeren	0	0	0	0	0
gevoel van onveiligheid					
algemeen	0	0	0	0	0
in de buurt	0	0	0	0	0
leefbaarheid					
sociale cohesie					
tevredenheid	0	0	0	0	0
tevredenheid woonomgeving					
vervelend in deze buurt te wonen	-	0	0	0	0
buurtontwikkeling					
buurt afgelopen jaar vooruit					
buurt gaat komend jaar vooruit	0				
buurtinzet					
inzet voor buurt (afgelopen jaar)	--				
Leefbaarometer-score (2010)					
woz-waarde	-	++	++	0	0
sociaal-economische positie					
inkomstenbron (t.o.v. potentiële beroepsbevolking)					
werkloosheidsuitkering	0				
bijstand	0				
aandeel lage inkomens (in %)	0				
aandeel sociale stijgers (in %)	0				

a ++ of -- : het effect is significant gunstig (++) of ongunstig (--) ($p < 0,05$).

+ of - : de richting van effect lijkt gunstig (+) of ongunstig (-) ($p < 0,2$ en $p > 0,05$).

0: kleinere effecten ($p > 0,2$).

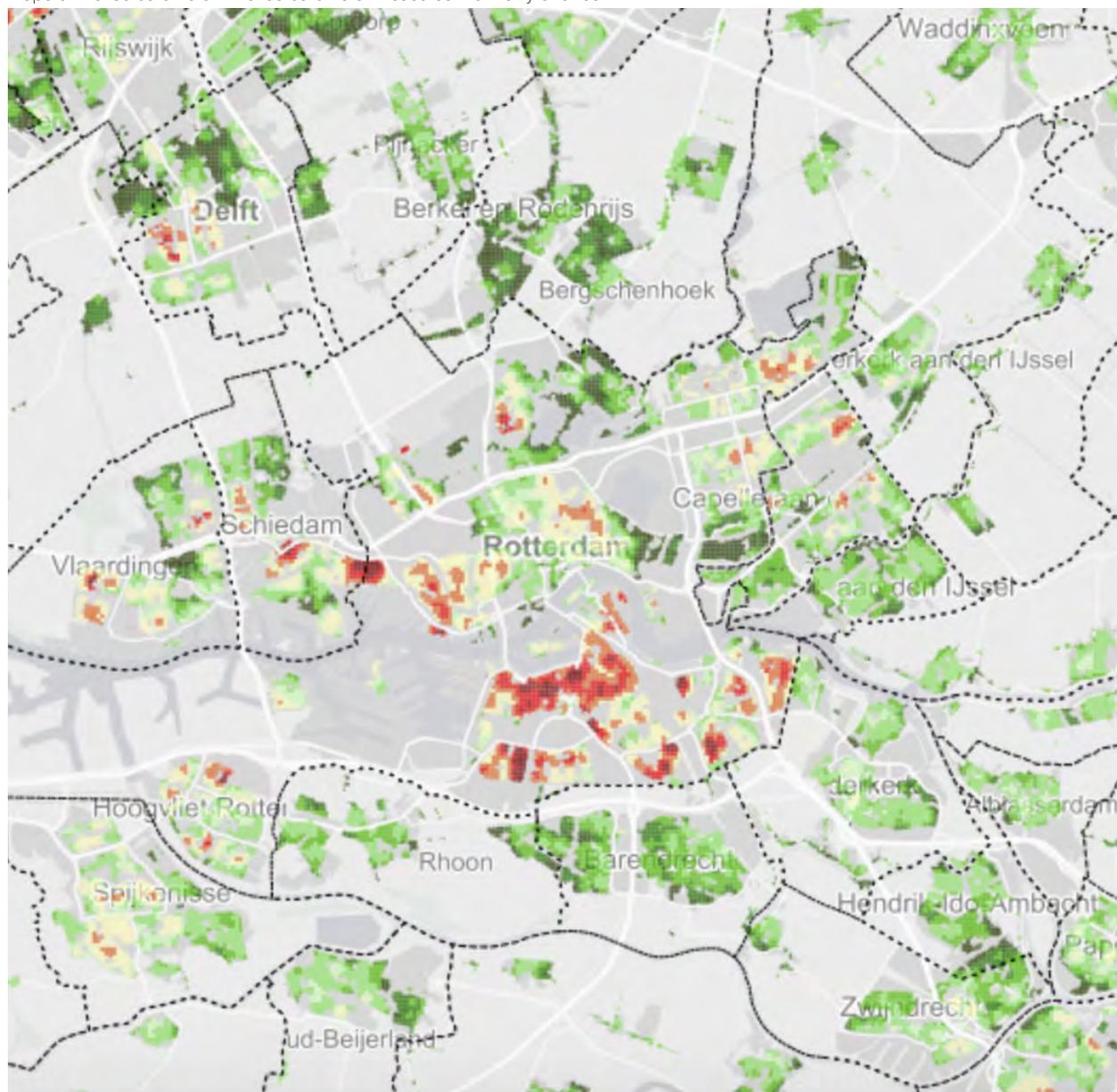
b Tussen 1 januari 2007 en 1 januari 2011 minimaal 3% van de woningen onttrokken en minimaal 100 woningen nieuw gebouwd.

c Tussen 1 januari 2007 en 1 januari 2011 minimaal 3% van de huurwoningen onttrokken en minimaal 3% van de woningvoorraad veranderd in koopwoningen.

Table 1: Summary of results from policy to empower deprived neighborhood

Source: Cultureel Planbureau (2013)

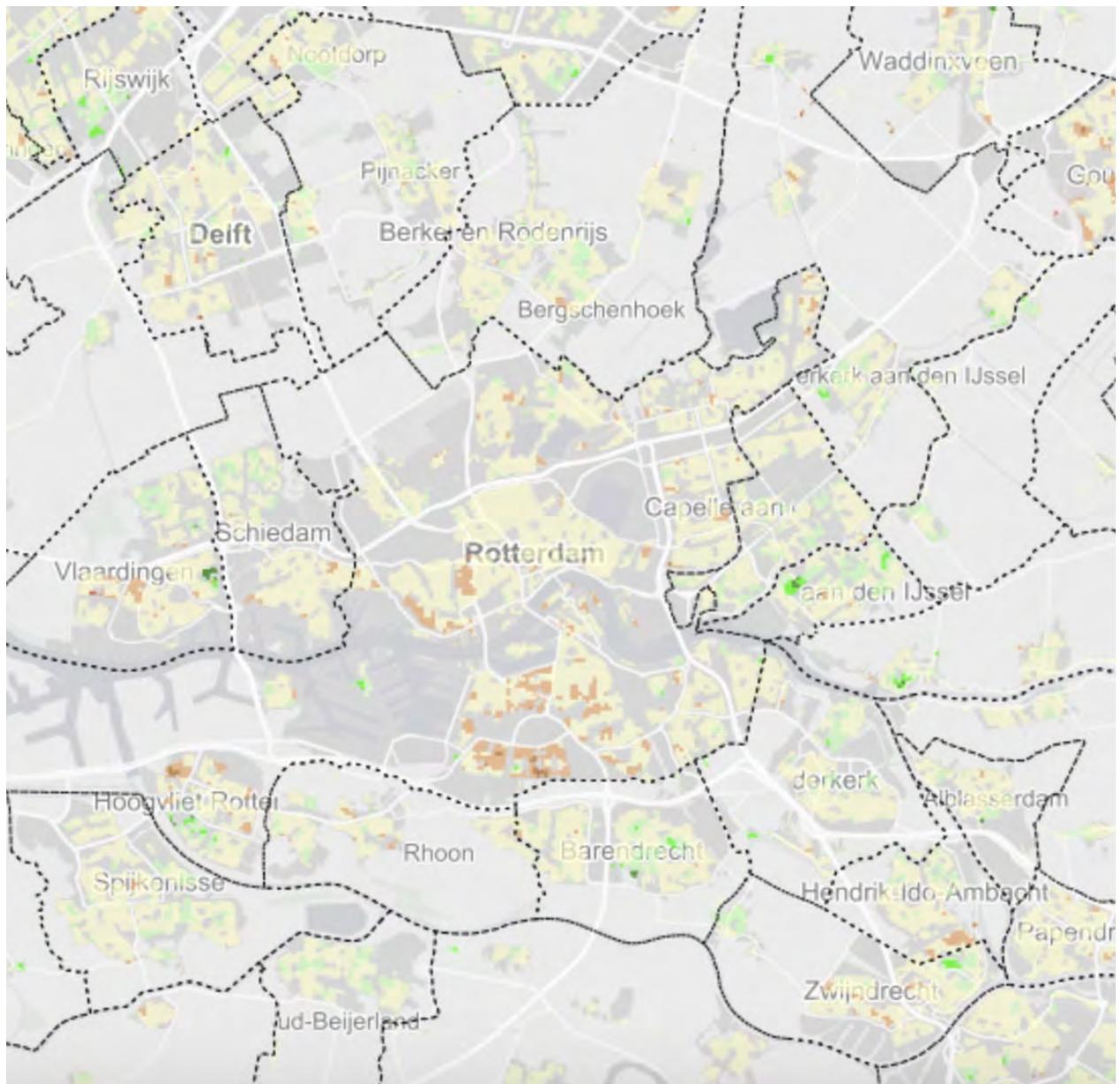
On the following pages, figure 13 -14 show that the results of the report of Cultureel Planbureau are comprehensive with the results shown in maps of the leefbarometer. The leefbarometer measures the vitality of cities.



- Zeer onvoldoende
- Ruim onvoldoende
- Onvoldoende
- Zwak
- Voldoende
- Ruim voldoende
- Goed
- Zeer goed
- Uitstekend

Figure 12: Vitality situation 2014

Bron: Leefbarometer



- Grote Achteruitgang
- Achteruitgang
- Mogelijke achteruitgang
- Geen ontwikkeling
- Mogelijke vooruitgang
- Vooruitgang
- Grote vooruitgang

Figure 13: Vitality development in 2014

Source: Leefbarometer

1.2 PROBLEM STATEMENT

Climate change regarding water is a global phenomenon which can affect the urbanized delta in a negative way. Because of the position of Rotterdam in the Rijnmond region, the Delta city is very vulnerable to water threats. Rotterdam as one of the largest port exposes itself to these vulnerabilities and economic damages. The development on the waterfront in post-industrial areas of Rotterdam gives the city its economic status and image. However, this image of a booming city is not applicable in the whole city of Rotterdam. Based on the leefbarometer, which measures the vitality in cities, shows that neighborhoods in the Rotterdam are still declining or do not even improve after secure policies from government and municipality. In the current situation of planning most stakeholders do not expand their private planning situations, which results in not well-planned land uses. Land uses are mostly not equally divided, a

reexamination of spatial planning strategy is required where different stakeholders have a common interest in the redevelopment of land uses in both waterfront and neighborhood. Therefore these processes can not be seen as an individual.

The explanation above is summarized in three main objectives this thesis will focus on:

1. We have the problem from climate change regarding water where the necessity is to make our delta climate adaptive.
2. We have the problem of recent waterfront development where strategic planning of land use is segregated between high- and low-income group.
3. We have the problem of neighborhoods in Rotterdam that are still declining due to the low-income groups.



Figure 14: Water nuances



Figure 15: Waterfront project for high income



Figure 16: Ddeprived neighborhood Tarnewijk

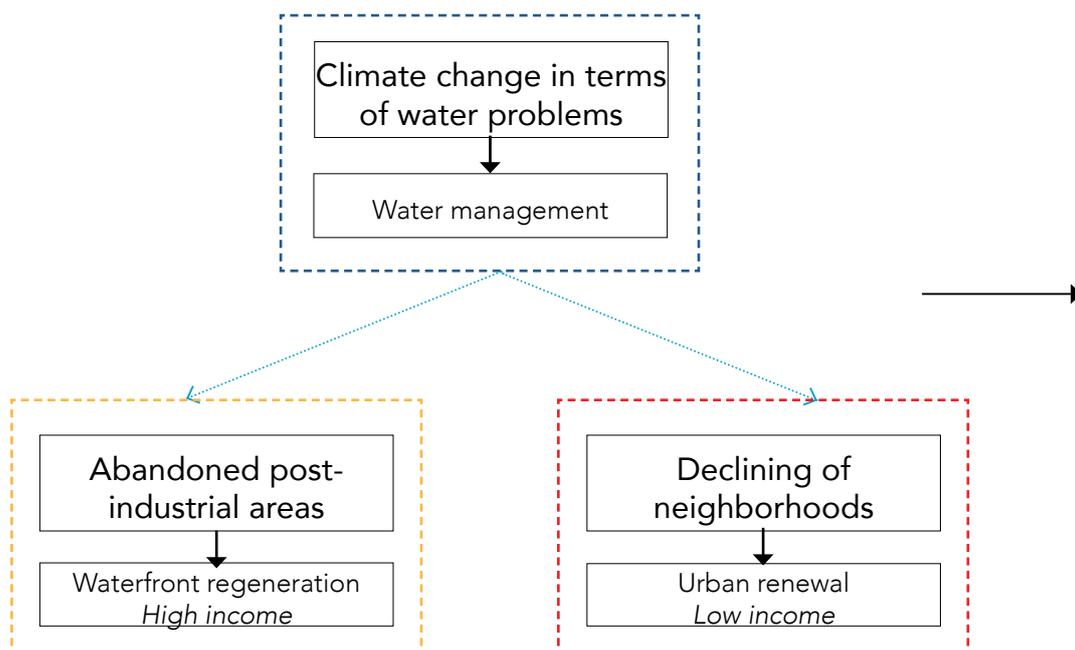


Figure 18: Current process of planning in Rotterdam

Source: By author

1.3 HYPOTHESIS

The use of water management in spatial design will create new opportunities that will enhance the socio-economic processes in both waterfront regeneration and urban renewal as a whole. This will have an effect on the future and quality of life in the city of Rotterdam.

Even though Urban Waterfront Regeneration and Urban renewal of isolated areas per say are separate processes, one should approach them from a common ground because more often than not they pose similar problems and are interdependent or related by their dependence on the same city.

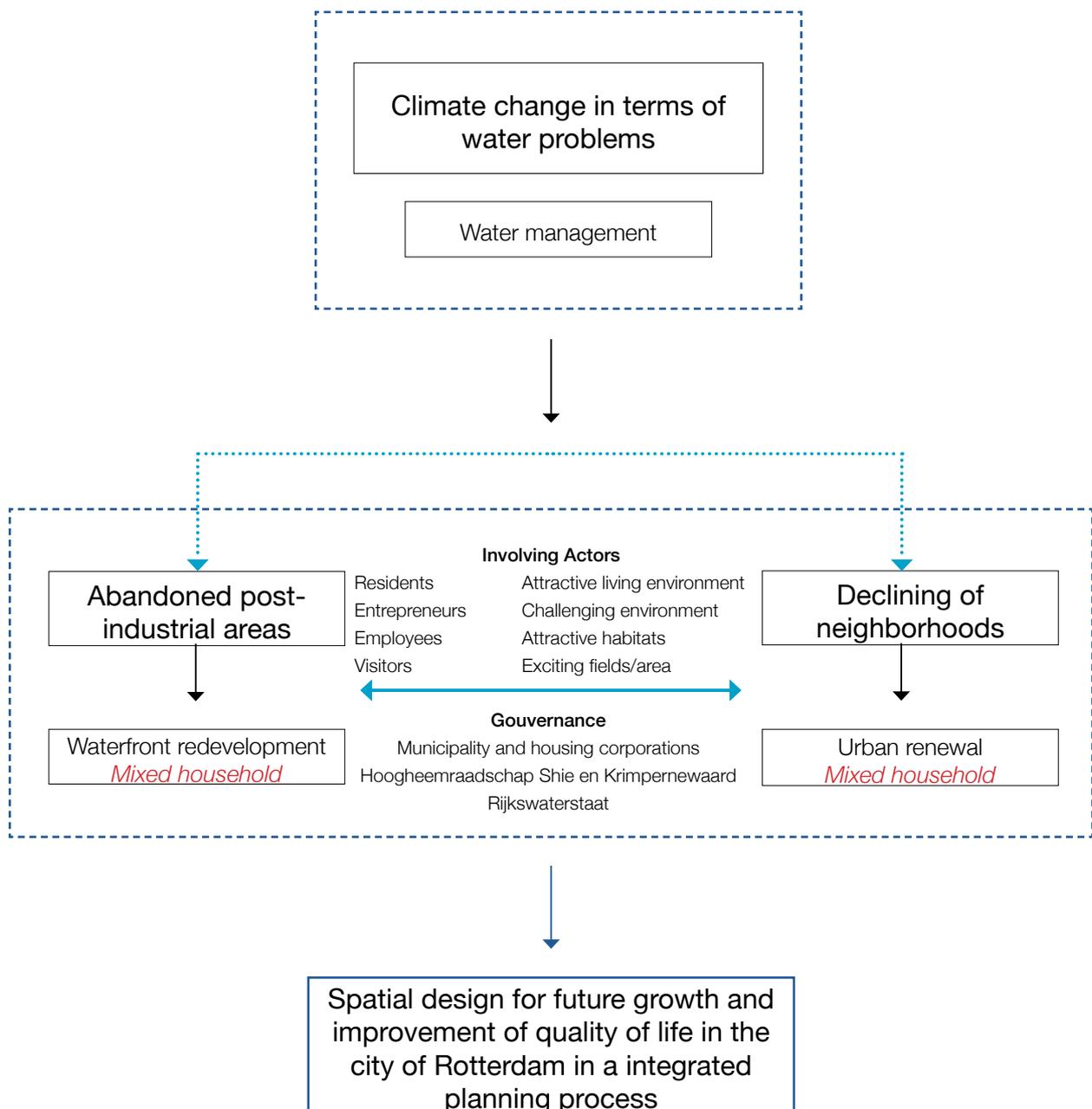


Figure 17: Wanted process of future planning in Rotterdam

Source: By Author

2.0 RESEARCH

2.1 RESEARCH QUESTION & SUBQUESTIONS

How can we use **water in spatial design** in such a way that the Rotterdam delta is **climate adaptive** and the socio-economical processes in **waterfront** and **deprived neighborhood** are enhanced as a whole for future growth and improvement of **quality of life in the city**?

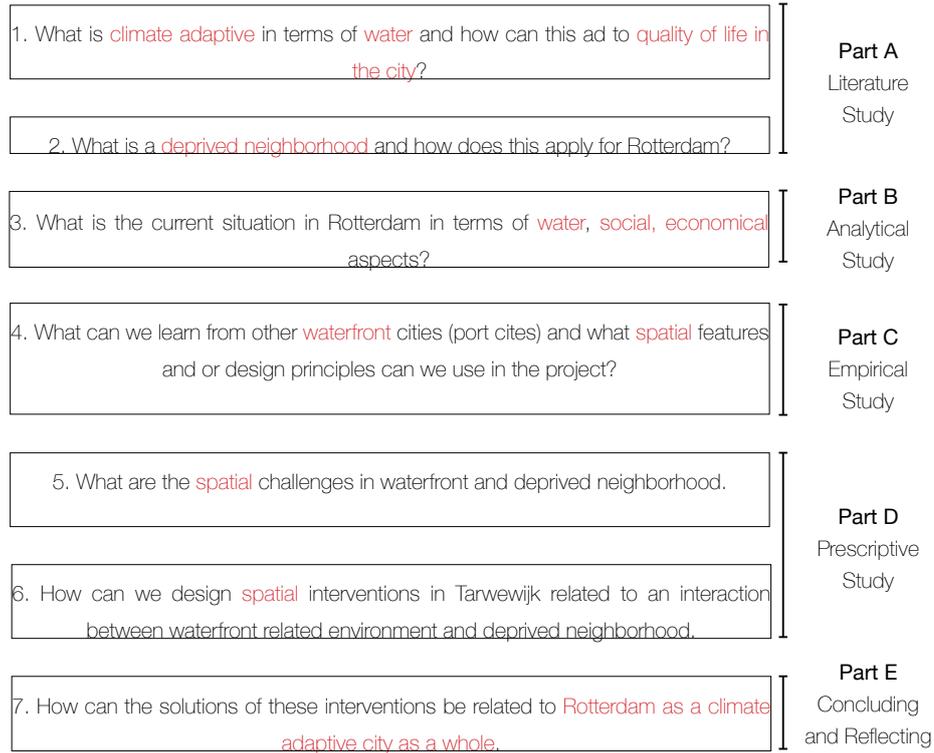


Figure 18: Thesis methodology structure

Source: By Author

2.2 METHODOLOGY

This thesis is a research by design project and aims to answer the main question:

"How can we use water in spatial design in such a way that the Rotterdam delta is climate adaptive and the socio-economical processes in waterfront and deprived neighborhood are enhanced as a whole for future growth and improvement of the quality of life in the city?"

This research can be applied in five stages: Research Clarification, Descriptive Study part I, Descriptive Study part II, Prescriptive Study and Concluding and Reflection (Blessing, T.M. & Chakrabarti, A., 2009). The relationship between each other is illustrated in figure 20.

Part A: Research Clarification - Literature study

Question one and two can be answered in the Research Clarification (RC) stage. The aim is: "to find some evidence or at least indications that support their assumptions to formulate a realistic and worthwhile research goal. They do so mainly by searching the literature for factors that influence task clarification and product success, in particular, those factors that link the two together. Based on the findings, an initial description of the existing situation is developed, as well as a description of the desired situation, to make the assumptions underlying each of the descriptions explicit" (Blessing, T.M. & Chakrabarti, A., 2009). With the outcome of this research, some criteria can be formed that support the background in this thesis. By answering question one and two will give clear insight into the definition of climate adaptive regarding water and general trends in urban renewal which can result as a theoretical backup for design strategy.

Part B - Descriptive study I - Analytical study

Sub research question three can be answered by a Descriptive study (I). The descriptive study focuses more on the influencing factors of the existing situation. "The intention is to make the description detailed enough to determine which factor(s) should be addressed to improve task clarification as effectively and efficiently as possible (Blessing, T.M. & Chakrabarti, A., 2009). The outcome

of the analytical data reveals the typical characteristics insufficiency or sufficient of spatial qualities to be enhanced the case study. The study of the current situation in question three will be done by mapping and demographics that will define three interesting districts. Analysis of the three chosen districts, which is also done by mapping, determines the exact site of study to improve regarding water that ensures the quality of space.

Part C: Descriptive study II - Empirical study

In question four, a case study will be used that define design principles that lack in Rotterdam and formulate design principles that apply to the selected case of study. The point of departure of this stage is to use the increased understanding of the existing situation to correct and elaborate on their initial description of the desired situation (Blessing, T.M. & Chakrabarti, A., 2009). This description will lead to a specific guideline on water management for climate adaptation on site that intends to improve the quality of the problem definition which is gained in the Descriptive Study I.

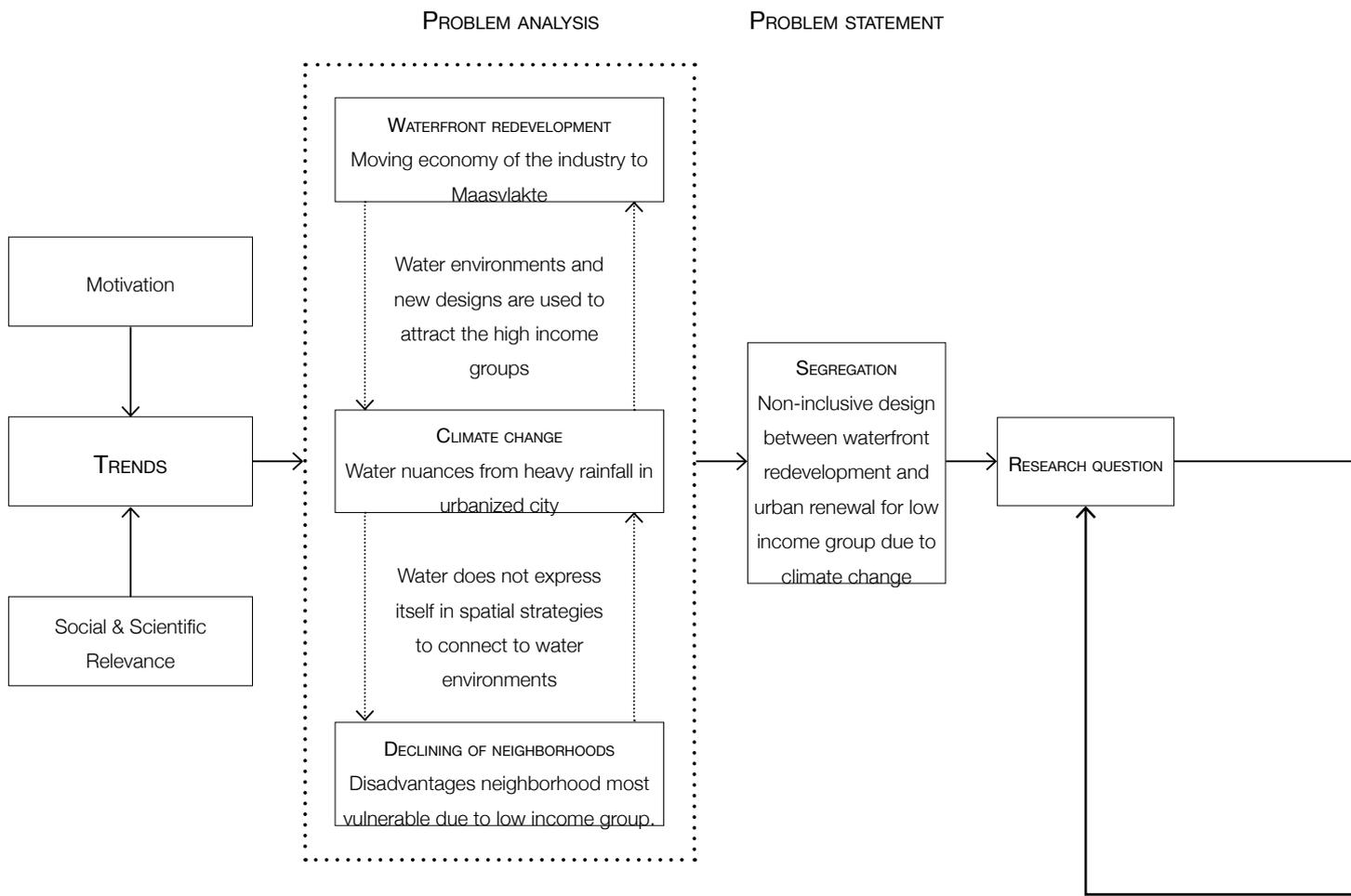
Part D: Prescriptive study - Assumption, Experience, and Synthesis

Subquestion five and six can be answered in the Prescriptive Study stage. This part investigates the impact of the support and its ability to realize the desired situation (Blessing, T.M. & Chakrabarti, A., 2009). This part questioned whether the guidelines can be used and what way to encourage and support processes as a whole for future growth and improvement of quality in life in the city. For this, different methods like scenario making, experimentation, and spatial analysis are used to define the strategies.

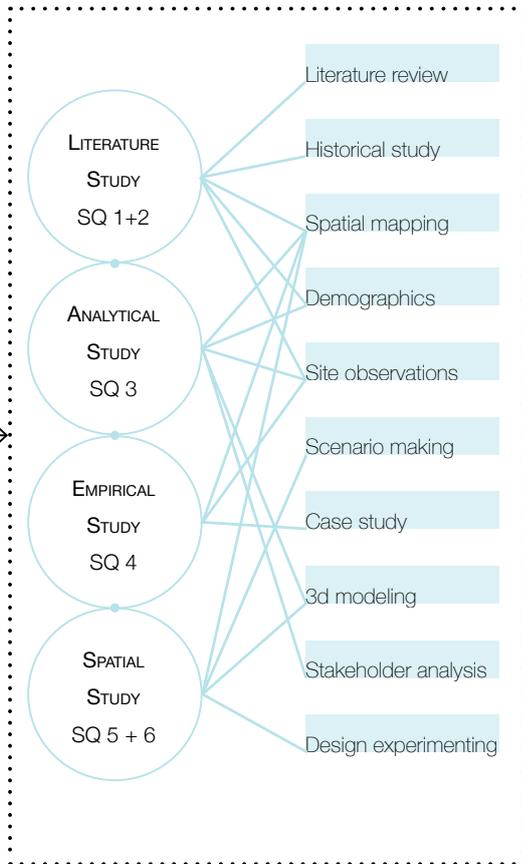
Part E - Concluding and Reflecting

The answer of sub research question seven will be a conclusion of how water can be used in spatial design to enhance the socio-economic processes of waterfront and declining neighborhood that reflects on the city of Rotterdam as a whole. These processes do not act independently from each other but are inter-scalar.

The methodology line that includes these phases is shown in figure 21.



RESEARCH BY DESIGN



HYPOTHESIS

The use of water management in spatial design will create new opportunities that will enhance the socio-economic processes in both waterfront regeneration and urban renewal as a whole. This will have an effect on the future and quality of life in the city of Rotterdam.

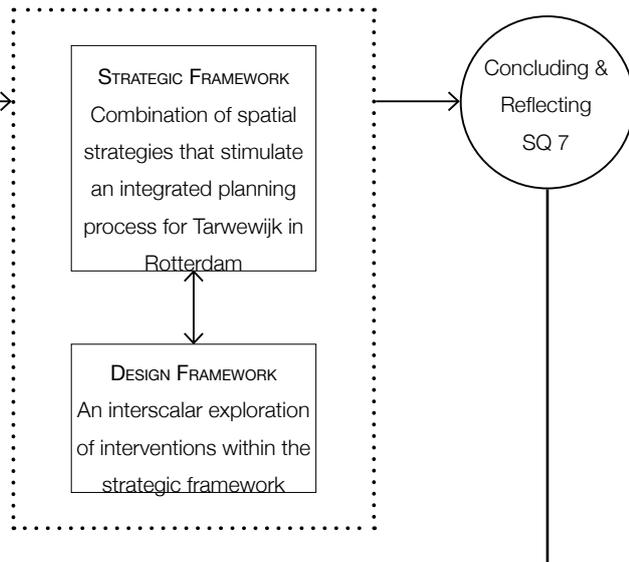


Figure 19: Methodology scheme

Source: By Author

2.3 PLANNING

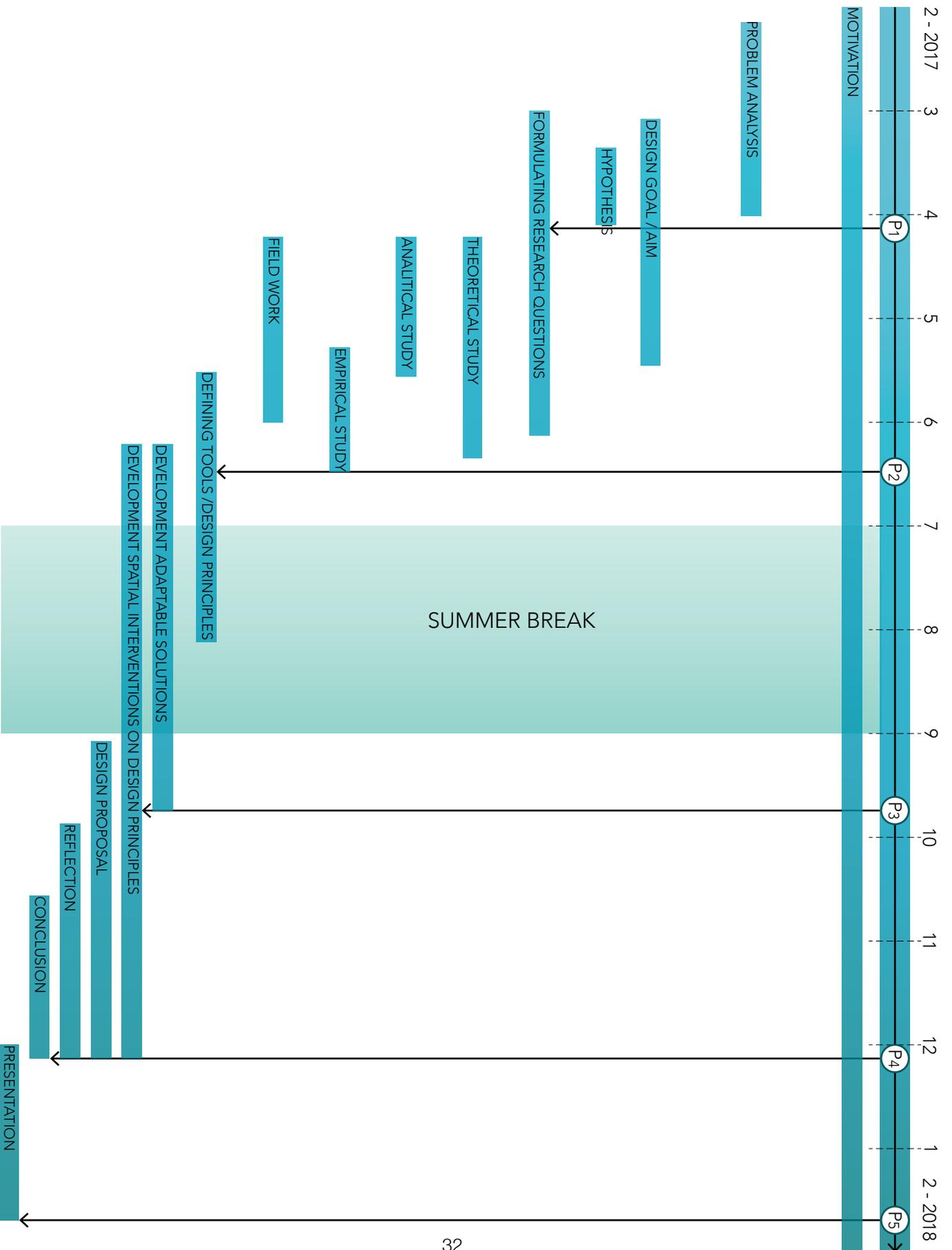


Figure 20: Time-frame process

Source: By Author

2.4 RELEVANCE

SOCIAL - The Netherlands is ranked in the top 15 of port cities with high exposure to climate change (Hanson et al., 2010) Ports and transport infrastructure are crucial elements for deltas to remain prosperous. Like Rotterdam, one of the largest port, have a position in the delta that makes the city and their related infrastructural networks vulnerable to climate change, in particular to flooding, as extreme events over the last few years have demonstrated. Figure 23 shows the number of economic damages and victims. That's why it is essential to make the built area less vulnerable.

In the historical spatial development, most strategies have not considered climate adaptive solution which now results in lacking water management for climate change. A lot of neighborhoods in Rotterdam are urbanized which cannot adapt to climate change. Requirements of climate adaptive processes in (re)development in these neighborhoods are needed. Also, these adaptive climate solutions are seen as an opportunity and strength to vitalize declining area in Rotterdam.

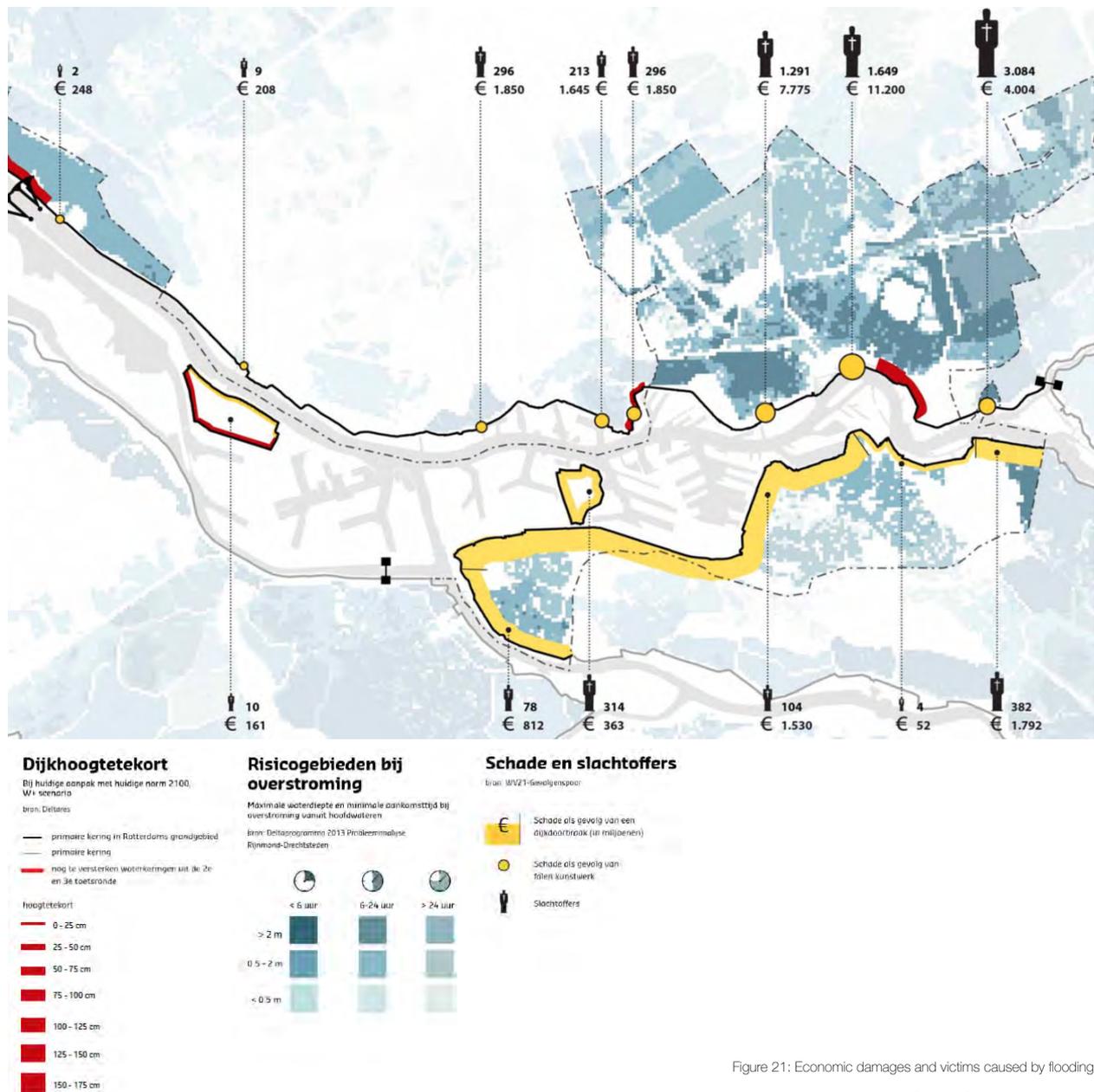


Figure 21: Economic damages and victims caused by flooding

Source: Climate initiative (2013)

SCIENTIFIC - Climate adaptation is not something new in Rotterdam, but it misses the link in coherent strategic planning in waterfront and urban renewal.

According to Groot et al. (2015), several efforts were made to co-create a common language among researchers. At the start of the project, they were using different terms to discuss similar phenomena about climate change and vulnerability. These processes do not act independently from each other. Understanding this interaction between spatial-technical adaptation and underlying social factors and mechanisms such as economic, social, institutional, political, and cultural dimensions of society are essential to 'move towards a more sustainable development path' (Pelling, 2011). Van Veelen (2016) suggest that "Spontaneous actions and planned adaptation policies may, at best, be complementary and mutually reinforcing (figure 24). However, in this case, climate adaptation is a response

of a disaster that results in spontaneous adaptation actions that may run the risk of an unequal distribution of risks and costs among society and could create adverse socio-economic impacts within different time.

Thus it is essential that we meet with an alternative where planning of urban renewal and waterfront is an integrated process by the use of environmental solutions that at the same time adapt to problems regarding water and effects the city as a whole in a positive way. This would be part of the assignment for planners and designers within the research group of Delta Urbanism. Climate adaptivity is crucial in Rotterdam to protect its economic status and image as a global port. Also, water-related solutions can act as a connector to vitalize declining neighborhoods and waterfront as an integrated process which contributes to the image of Rotterdam as a whole.

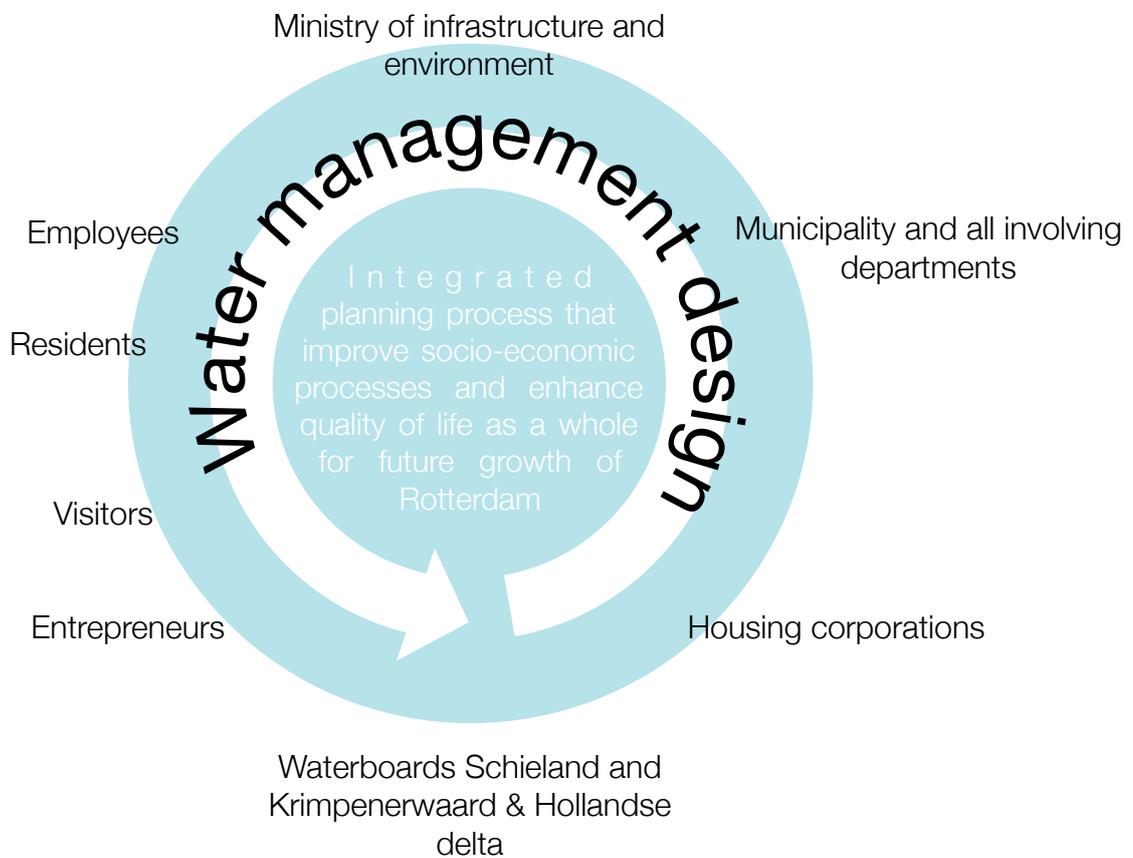


Figure 22: Complementary process of planning

Source: By author

2.5 DESIGN GOALS AND POSSIBLE OUTCOME

The goal within this project is to find a coherent process between waterfront redevelopment and urban renewal that will be able to enhance future growth in Rotterdam as a whole which in turn will strengthen the socio-economic processes and quality of life. This will also improve the identity of Rotterdam in the Randstad. To achieve this, the role of water is to be considered as an asset and power for the area. For This, the (re) design of water-related landscapes is required to create extensively used landscapes and improve social interaction, which includes all groups of income, among social groups that contribute to the quality of life.

The outcome of this thesis will be a design based on principles where attractive water management is used in an integrated strategy for both waterfront redevelopment and declining neighborhood in Rotterdam. In this outcome, water will be the focus in design that is a strength rather than a threat. Different scales will be used to develop a design strategy that takes into account urban vitality and public accessibility in a broader context. The design will hopefully create and introduce a new opportunity and policy to develop and redevelop attractive neighborhood and waterfronts as one integrated planning process with climate adaptive solutions. The outcome can contribute to current policies, for future growth and improvement of the quality of life in Rotterdam as a worldwide famous port city.

"A river is more than an amenity, it is a treasure. It offers a necessity of life that must be rationed among those who have power over it."

Justice Oliver Wendell Holmes

3.0 THEORETICAL STUDY

3.1 HISTORICAL ANALYSIS

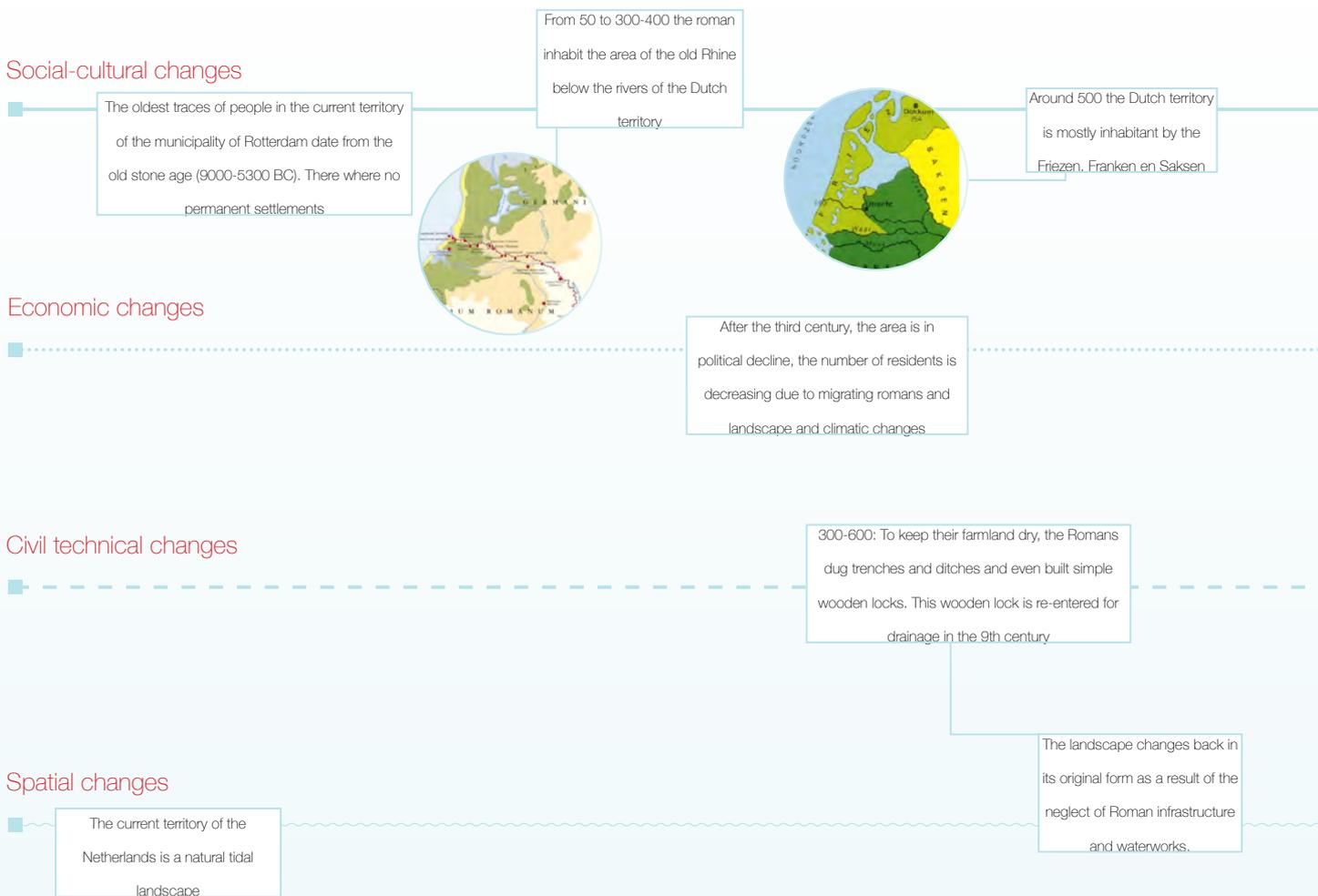
3.1. HISTORY OF WATER MANAGEMENT IN ROTTERDAM.

Rotterdam has a history evolving with water and thanks to its economy to the port and trade on the water. Water has given Rotterdam a historical and cultural significance. This meaning indicates the basis of how residents of Rotterdam have dealt with water. To understand the complex relation of Rotterdam and its river and the changing insights over time, it is essential to delve into its history of water management through the centuries. Doing so will define the current relationship with its water for future development. This part is a combined composition of the publication of Rotterdam Water City 2035 by the Municipality of Rotterdam, water board Hollandse Delta and water board of Schieland and Krimpenerwaard

and Atlas of the Dutch water town by Hooimeijer, Meyer, and Nienhuis. Also, literature from The Water project, a nineteenth-century walk through Rotterdam by Hooimeijer and Kamphuis is used as well as a Cultural-historical exploration of pre-war districts Rotterdam - South by Bet, E., Hinterthür, H and van Meijdel, L.

The timeline explain six different time periods which are: Prehistory and Middle ages, The golden century, the industrial revolution, the reconstruction, the period of crisis and new and Rotterdam and the current timeline. Each period explained by four themes: socio-cultural-administrative changes, economic changes, Civic engineering changes and spatial changes (Municipality et al., 2005)

Prehistory and middle ages -700 - 1200



3.1.1 PREHISTORY AND MIDDLE AGES 700-1600

Stone Age - Bronze Age - Iron Age

The early inhabitants of Rotterdam lived in the deltas, areas within the branching estuaries. They lived in higher and drier river dunes, also known as donks. In the course of time, these were covered by meters thick peat, which are discovered by archaeologists of the Municipality of Rotterdam (Lichtenberg, 2017). These were no permanent settlements. The high and dry places near water like the coast and levees were the ideal places for farmers. At some point the farmers could use objects made of metal, this time was known as the bronze age. Living near the water and in the dunes comes to an end because the landscape is probably too wet for farming

life. Peat has started to grow, and more and more marshlands are created. Around 800 BC parts of the marshes fall dry as a result of channels and creeks running from the sea, which make the land dry and inhabitable for people. In that period the river Rotte was also formed. The area becomes more attractive again for habitation. Especially along the banks of such rivers and on other higher parts of the marsh. The residents are mostly farmers. An archaeologist has found a lot of iron fragments in the Willemspoortunnel tracé, which indicates that there was a settlement on the lower course of the Rotte. This settlement was known as the Iron Age.

The Roman period

Until 400 the land downstream of the river Rhine was mostly inhabitable

800-900: Settlements began to take place in the eighth and ninth centuries. This happened on the river Rotte, where Rotterdam owes its name.

The cities are being constructed in higher areas (preferably by the river) because of the wet land. There was no question of water management, but rather an adaptation to the wet environment and acceptance.

1000: Due to the population growth in the 10th century there was also a greater need for agricultural land. As a result of the population increase, more workers were also available who could exploit the agricultural land.



Thanks to the invention of the iron digging machine the heavier clay and peat soils could now also be reclaimed.

1163: due to the great St. Thomas flood the water could no longer be discharged into the sea from the polders. This led to the construction of levees ('s Gravenweg, Oude dijk and Kleiweg) that connect the western dunes with eastern dry grounds.

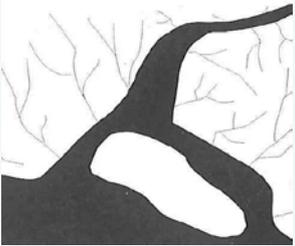
A new system of waterways was dug. The water was led to the lakes north of Leiden and further in the direction of the Spaarne and the IJ.

As a result, threats from the sea became more serious and dikes became necessary

In the 12th century levees and dams were constructed: in 1165 a dam in Crooswijk, in 1240 de Schielandse Hoge Zeedijk en in 1270 de dam in de Rotte

In the longer term, these reclamations led to the first large-scale subsidence resulting from drainage.

1160: many major storm surges occur, including the St. Thomas flood, that leads to land loss and lake complexes



by the Roman Empire. This River forms the northern border of the Roman Empire. The Romans controlled this border through forts along the Rhine which are known as limes. The current farmers came under the domination of the growing Roman Empire that led to an increasing demand for food and urban farming. To make more land suitable for agriculture and urban agriculture, people dig canals and ditches, and they build dams and locks. In the second half of the 3rd century, there comes an end to the Roman Empire because of political and economic stagnation. In this region, there are more enemy invasions, and at the same time, the landscape gets wetter. For the farmers, the existence is ambiguous, and therefore they leave. The land is now inhabited by German tribes. The northern part of the Netherlands is inhabited by the Frisians, French and Saxony.

In history just before 1100, mostly rivers and canals were present.

Because of Rotterdam's open position in the North Sea, these canals and rivers were formed by flooding.

Middle ages: reclamations and settlements

From the 8th and 9th century, against small settlements came along the small river Rotte, which creates a kind of ribbon development.

The peat and clay soils are drained which made the land suitable for urban farming, cattle breeding, and vegetable gardens. This development develops into a settlement, the agricultural and trade settlement Rotte. Because of the reclamation canals which have drained the area, the ground level decreased, which in turn resulted in flooding of lower regions. Settlements are destroyed during major floods, including Rotta.

When colonization began, the Rotterdamse delta flooded a few more times. The flooding was when the process of reclamation and diking started to form. This resulted in a system of plots.

1200 - 1600

Social-cultural changes

1255: Count William II of Holland founded the first official water board: the Hoogheemraadschap van Rijnland.

1340: Rotterdam gets her city right and the right to dig the Rotterdam schie

1572: Rotterdam receives permission from the states of Holland for expansion and fortification of the city

1588: Foundation of the Republic of the Seven provinces that form the board at country level with control over defense and foreign affairs.

Economic changes

1270: The urban development of Rotterdam starts with a market at the dam in the Rotte.

1550: The herring fishery stimulates the economy with activities such as salt trade.



1557: Due to the growth of cities there was an increasing need for fuel. To meet this need, large areas of peat area have been drained and excavated to make peat. The Grote markt was built over the canal as a hub of trade. Not only for the trade of peat, but also still fishing, textiles and beer.

Civil engineering changes

1250: Start mill dewatering for keeping the polders dry.

1350: Construction Oude Haven and the Rotterdamse Schie as shipping connection with the hinterland.



Spatial changes



1412: The City of Rotterdam expanded to the southern city fort.

1421: The St. Elisabeth flood caused dyke breakthroughs that the southern part of the Netherlands is flooded and the course of the rivers changes in such a way that the Dordrecht port is difficult to reach. The flow of the Maas loses its force, causing silting. Thanks to the sharp bend in the Maas and measures to steer the flow, Rotterdam was protected from this.

1500: The City of Rotterdam shrinks from rectangle to triangle.

1550: East development inside the city forts due to growing industry of the herring fishery.

1598: Relocation of the southern water city is expanded.

1572: Construction new southern fort, old one becomes harbour, which is now known as Blaak and Nieuwe Haven.

The origin of Rotterdam

Around 1270 the dikes of two polders are connected to each other, using a dam on the site where the Hoogstraat de Rotte now crosses. That dam served to curb the Rotte and was equipped with locks to be able to regulate the drainage. The dam was the site of the Rotterdam settlement, which developed into a market town in the 14th century, which received city rights in 1340. That led to the fortification of Rotterdam.

By the time of 1580, the northern part of Rotterdam was reclaimed entirely (Palmbloom, 1987). The southern part has a process of failure and reboot. This system of plotting can often still be found in the current pattern of streets.

In the 16th century, the canals of the city got a triangular structure between Coolsingel, Goudsesingel and the Nieuwe Maas. This

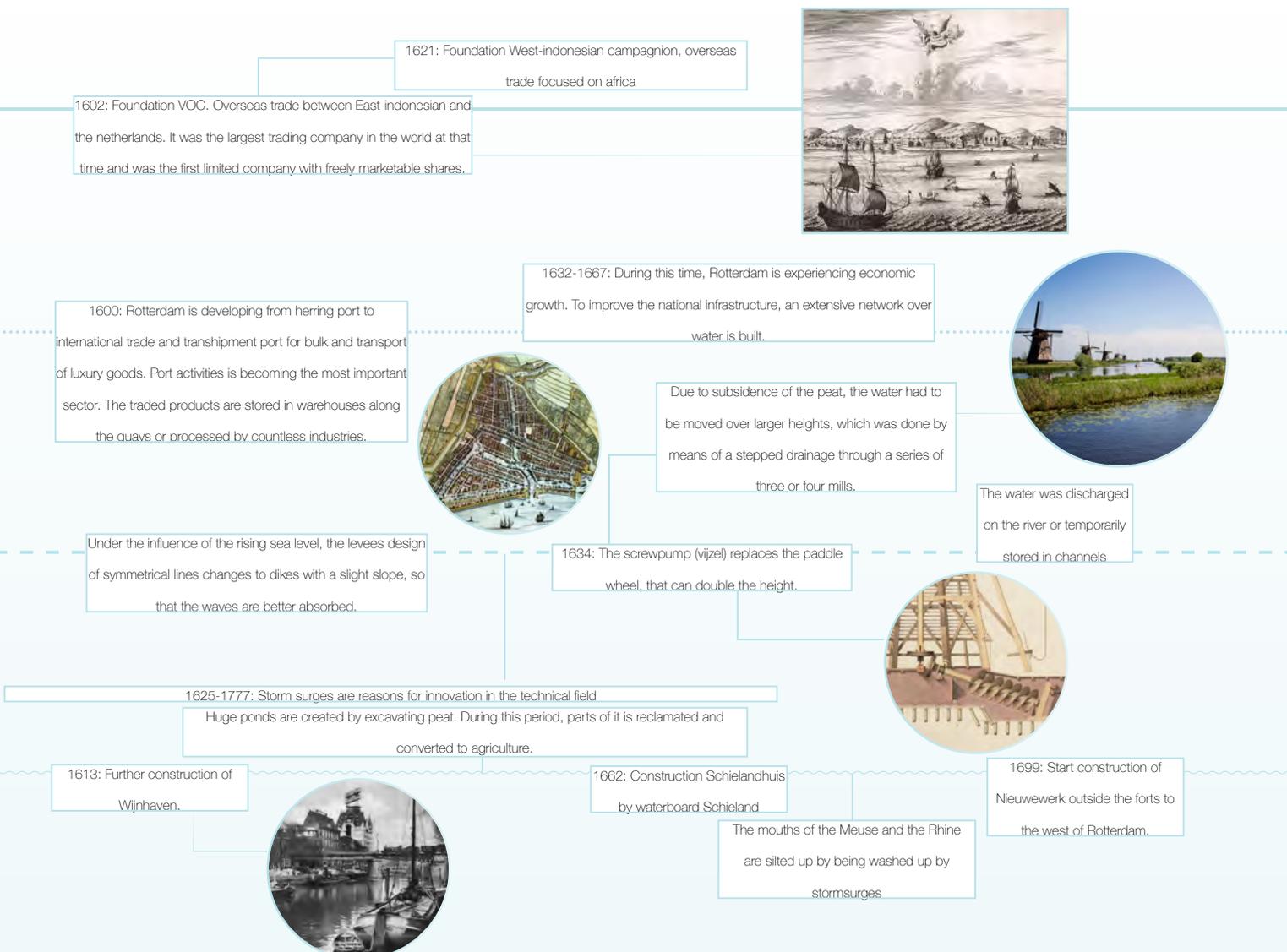
triangular structure would maintain itself during the next three centuries, even though the population continued to grow.

3.1.2 GOLDEN CENTURY 1600 -1800

The primary source of income was the transportation of good. This transportation went over the water, which made the water canals and river an essential asset for the economy of Rotterdam. This was the time when harbors, industrial sites, and docks arise, a situation rooted in external politics en economic causes.

The location of the city is favorable, but the political circumstances also play a role in Rotterdam. At the beginning of the 17th-century trading overseas gets popular and the city got new ports. Examples are the Buizengat, the Haringvliet, the Leuvehaven, the Wijnhaven, the Scheepmakershaven, the Bierhaven and the Glashaven.

Golden century 1600-1700



The ports are named after the product that was traded there. Rotterdam owes its economy here to the port and position to the sea. Rotterdam grew into a world port.

From this time on, Rotterdam experienced constant change in the spatial relationship between city and port (Meyer, 1999). Drainage of land changed the spatial landscape into one with plots. Due to drainage, peat oxidation and subsidence increased further. This resulted in subsidence of the ground level. It became increasingly difficult for the polders to discharge the extra water. In the field of engineering, people made a lot of improvement to drain water from their lands. To keep the polders dry, the existing methods based on human and animal power were no longer sufficient. The windmill offered a solution for this. The consequence of this more efficient drainage was that soil subsidence would increase further. In this time the construction of dikes was the result of the previous flooding. Later on, a mechanic screw-pump replaces the wheel

paddle in the mills so they could replace the water to higher land, which is done by stepped drainage with three to four windmills. When Thomas Newcomen introduces the design engine, it only takes little time to replace the windmills. Blijdorp was the first district to get a steam pumping station. The quantitative water management was getting better. But the vast concentration of residents and industrial growth also led to environmental problems. Against silting and the increasingly polluting water one rinses grey water with the river. At the end of the 18th century, the golden age ended by hostile raids from France. After this Rotterdam fell into economic decline.

Rotterdam knows in this period an inside dike environment and a new outside the dike environment, the Water city. This relation with the water came with panoramic views of the city, as well as from ferries crossing the river. From this time on, Rotterdam experienced constant change in the spatial relationship between city and port.

1700 - 1800

Social-cultural changes



Economic changes

Due to hostile takeover by France, there was an economic stagnation. In Rotterdam, shipbuilding remained the most important industry.



Civil engineering changes



Spatial changes



(Meyer, 1999).

3.1.3 INDUSTRIALIZATION 1800 -1945

Rotterdam sees itself as an essential position in the construction of new networks. At the beginning of the 19th century, industrialization began, which created a high demand for the large-scale application of technical inventions in production. In this time, Rotterdam started digging new canals, and harbors, but also paved roads to make land transport possible.

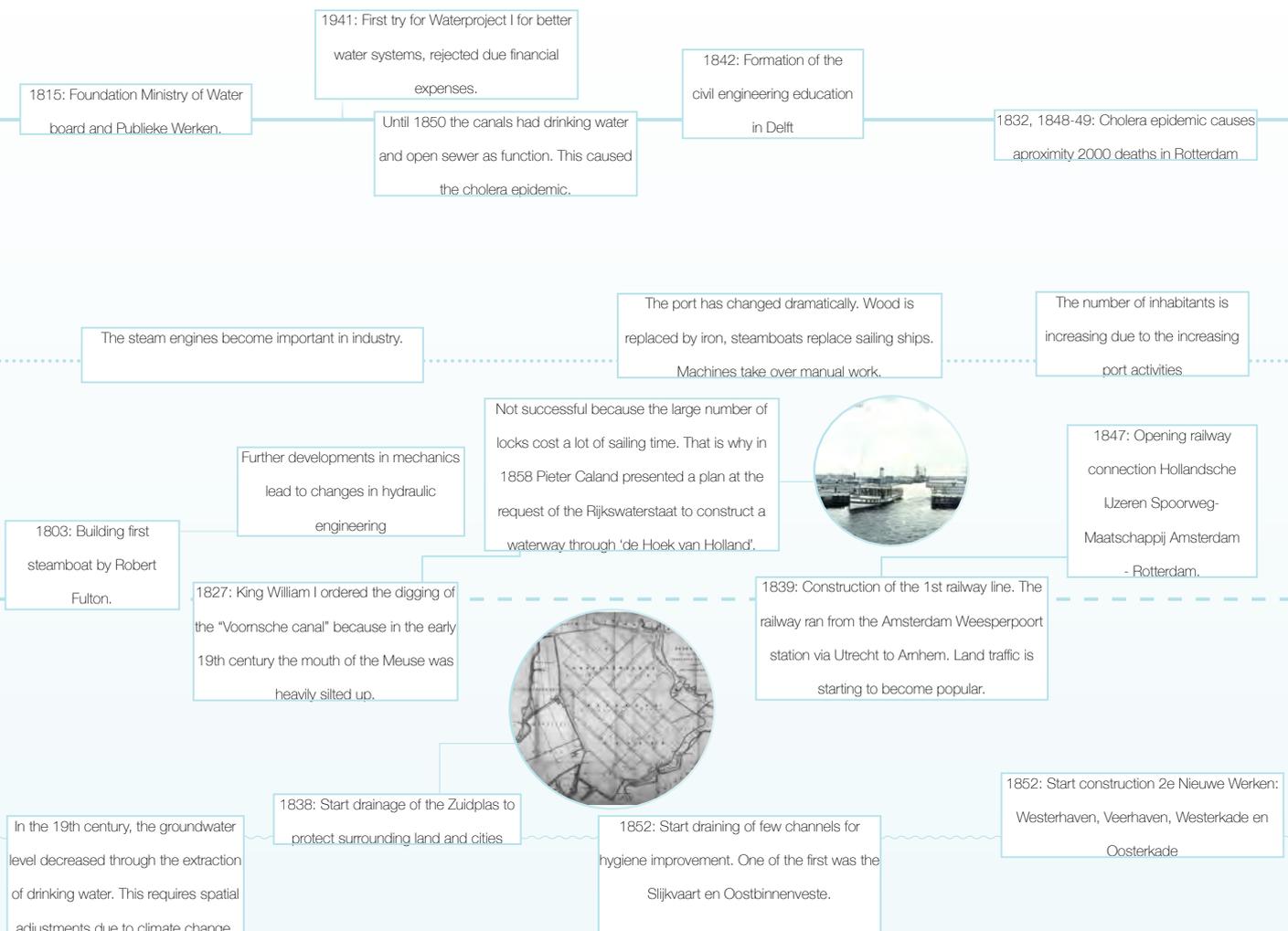
Intense efforts are made to strengthen the management of water, both qualitatively and quantitatively. The Maas becomes entirely outer dike environment for harbor and transshipment that are framed by dikes and frames. This area became higher than ground level, and the inside area's (polders) were getting lower by steam

pumps for dry land.

Water project - W.N. Rosé.

In 1841, W.N. Rosé, who was appointed city architect and director of Public Work, presented the first Water project (Hooimeijer & Kamphuis, 2001). The plan was made to prevent flooding, pollution and smells from the canals. With Scholten, who worked at the waterboard of Schie en Krimpenerwaard, he proposed to reclaim the waterways in the inner city and be replaced by sewer drainage for rain and domestic wastewater. The drinking water quality of remaining canals remained doubtful, and for this reason, a drinking water system was included in their design. The fundamental principle was to separate the rinsing of city waters with drainage system of the waterboard and allow the city to regulate its own water management. The canals with the purpose of drainage also functioned as the soft edge of the city with natural elements, the

Industrialization 1800-1850



green network around the city. The proposal was rejected due to financial costs. Also, other plans of Rosé "Eerste Nieuwe Werk" (1842), Coolpolderproject (1843) and the first Feijenoord Project (1843) were not a priority due to the growing demand for trade and shipping facilities. For this Rosé designed an iron bridge in the Water city that improves shipping over water. Rosé's previous water project plan returned to small-scale developments. After the cholera epidemic of 1853, that was a result of still neglected canals, Rosé presented his plan again as Water project II in 1854. At that time, Rotterdam consisted of three parts of water management. These are the inner city, the outer dike city that is also known as the water city, and the parts of the polders located within the municipal boundaries. Because of the differences in altitude due to subsidence in the areas outside the dikes and inside the dikes, the water situation is different in each part. The Water project existed of two independent parts, the Schie, and the

Rotte. In his new plan Rosé formulated five goals. The first three are water management related. These three concerned the objectives of Water project I. The last two are related to urban development. Here the goals are to unite useful water management with more pleasant canals presented in the plan. Therefore Rosé aimed for "a graceful walk" around the city that would make the city attractive. Adjacent to these canals lived the upper class of Rotterdam. The construction of the Water project started in 1856 and was finished in 1866. In 1858 Rosé also started with his expansion plans of Rotterdam such as the Coolpolder Plan and "Nieuwe Werken" in the west of the city and Feijenoord, on the left bank of the Maas. At that time they had to continue the principles of the water city. Meyer (1999) illustrated the water city as:

"a system of islands, intended for housing and other urban functions, surrounded by watercourses that could be used to expand the port" (p. 299)

1850 - 1900

Social-cultural changes

The cholera epidemic of 1853 was the reason to tackle pollution of drinking water.

1854: Rosé developed Waterproject II.



1863: Law for digging the Nieuwe Waterweg.

In the middle of the 19th century, urban functions are separated.

Economic changes

After 1850, the rivers are systematized under pressure from the danger of flooding. In addition to flooding, the river map also suffered from dry fall.

Explosive growth steam mills due the invention of the centrifugal pump

1868: Akte van Mannheim, the principle of freedom of navigation on the Rhine with regard to trade, thereby regulating a free and common transport market

1898: Introduction of the car mobility.

Civil engineering changes

1861: Rijkswaterstaat has steam engines to keep the rivers on the arrow. Ending of the wind mill age.

1865-1872: Construction Nieuwe Waterweg under supervision of P. Caland. The Nieuwe Waterweg is the last stretch of the connection between Rotterdam and the sea



1877: Construction Zuiderspoorlijn

1868: Municipal Drinking Water Supply Rotterdam established and in 1883 began the construction of municipal sewers under supervision of G.J. de Jongh.

1880: Introduction plan for port area with innovative transfer system led by G.J. de Jongh

Spatial changes

1854: Start construction Waterproject II, led by Rosé. This was then the first urbanisation after economic decline

1859: Start construction Singels in landscapestyle from waterproject II, by landscape architects J.D. Zocher jr and L.P. Zocher. These canals function as city walk and attractive environment for the high income.

1871: Drainage of the Binnenrotte for the construction of the rail viaduct

1885: Drainage of the Schiedamsevest and coolvest.

1898: The idea of "Cities of Tomorrow" by Ebenezer Howard penetrated the Netherlands. Initiative for the garden city to enhance industrialized district by natural elements and increase health environment.

1887-1895: Construction of Rijnhaven dock.

Nieuwe Waterweg

The construction of "Kanaal van Voorne" had to promote the passage to the sea. This was not a success because a large number of locks cost a lot of sailing time. At that point, the Nieuwe Waterweg was constructed to improve accessibility oversea. This enhanced the trading of goods.

G.J. de Jongh - Sewer drainage

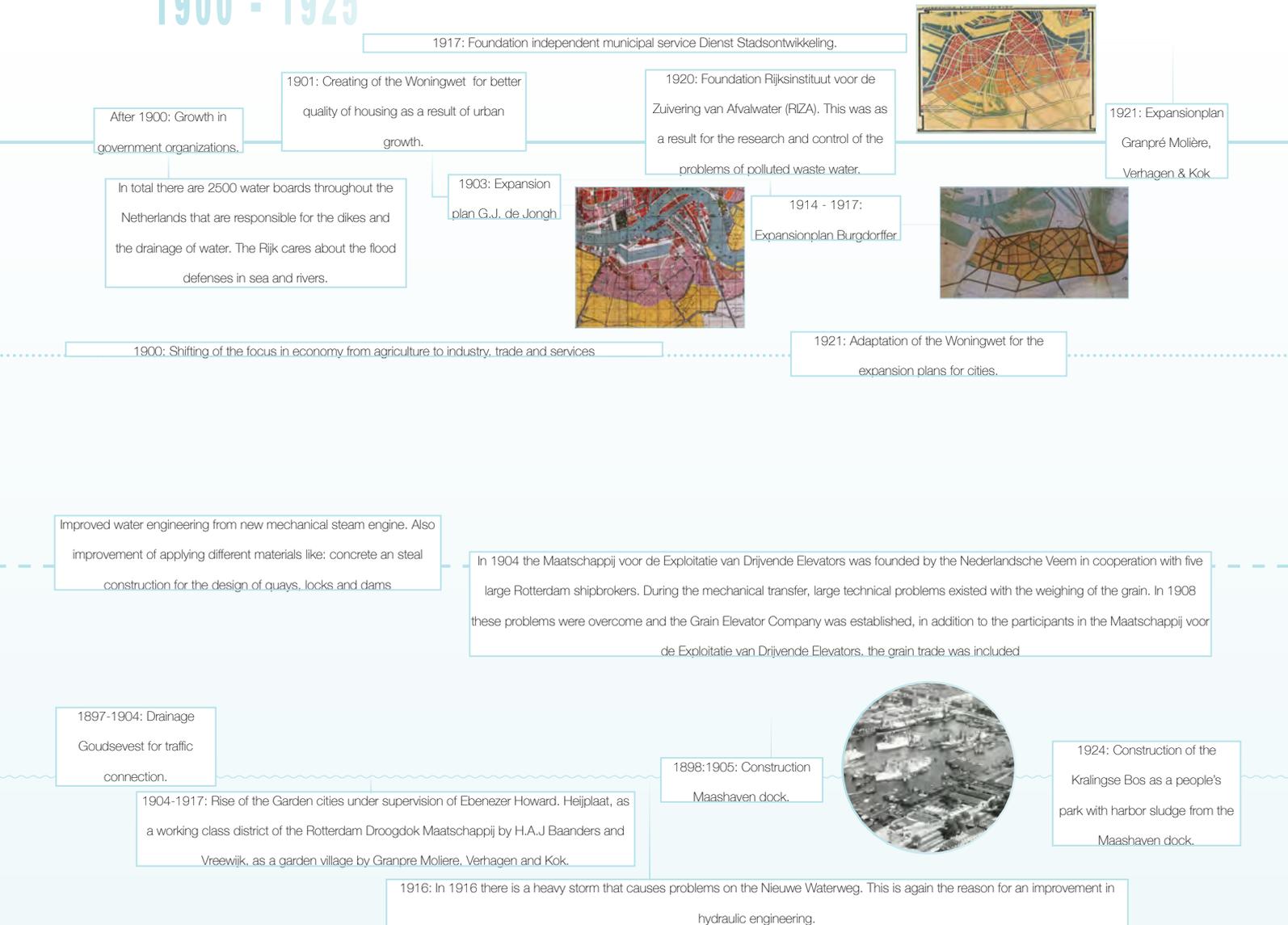
Despite the water project, the complaints of stank nuisance continued to take place. The poor condition of polder canals impeded the positive effect of flushing through the water project. In 1872 a strict separation was established between the removal of polluted water and the refreshing polder water. This was found under the direction of G.J. de Jongh, who at the time was director of civil works. After the construction of municipal drinking water systems led by van der Tak in 1868, the polluted drinking water

was also solved. The Water project of Rosé is honored because it made modern development in Rotterdam possible.

Expansion plan van der Tak & Michaëlis (1868)

Feijenoord was diked piece by piece in the 17th and 18th century. These plans for Feijenoord, designed by Rose, were based on the traditional unity between the trade quay. They did not want a railroad (southern rail trace) to fly over the Maas in the direction of the obstruction of large ships in the Maas. After a while, the railway was approved. In 1868, van der Tak and N. Th. Michaëlis designed a new plan for the expansion of Feijenoord. In 1896 this included IJsselmonde, Katendrecht, and Charlois. The project made sure polders were raised, the construction of the Noordereiland, various railway and traffic bridges like Koningsbrug and Willemsbrug.

1900 - 1925



General expansion plans G.J. de Jongh (1903)

After the death of Rose, the expansion plans came into the hands of G.J. de Jongh. But he had a different city in mind than Rose. In the plan of Rose, the port docks were modestly designed, but a new policy of public space was developed. A new network of public areas possess independent qualities than their primary function that made the city attractive. While the plan of de Jongh consisted of large port docks, namely Rijnhaven, Maashaven, and Waalhaven, these harbor docks took place on the left bank of the Maas which de Jongh visioned as a world port for Rotterdam. De Jongh believed the city needed accessibility by creating a new infrastructure of public work. Later on, he constructed more docks to improve shipment.

Expansion plan (1914-1917)

In 1910 ir. A.C. Burgdorffer succeeded G.J. de Jongh. In 1914, the expansion plan of South came forward that was designed by P. Verhagen led by Burgdorffer. The plan became independent from the port constructions unlike the plan of the Jongh. The plan focused on a centralized road pattern. The southern part of Rotterdam was mainly for workers with adapted facilities.

Expansion plan Granpré Molière, Verhagen & Kok (1921)

After the design of the Tuindorp Vreenvijk in 1920, the designers were instructed to work on the expansion plan of the left bank because of limited east-west connections in the plan of Burgdorffer. In their plan, the polder structure was ignored to built hard infrastructure over land. This resulted in long lanes from the current Maas bridges. Although this plan was never realized, it was guiding for upcoming plans.

1925 - 1950

Social-cultural changes

1926-1927 en 1937-1938: Expansion plan
Witteveen - executed



1940: In may, Rotterdam is totally bombed
by Germany.



Economic changes

1920-1940: Waalhaven en
Merwedehaven first en second
petrochemical dock.

1929: First refinery complex of
Shell in Pernis

Oil supply for the whole western part of Europe goes largely
via Rotterdam.

Introduction
reconstruction
plan C. van Traa.

Civil engineering changes

Development of a method by H.A. Lorentz
that can predict the tidal movement and is of
important meaning in research with water.

1920 - 1940: Canalisation of the Maas that improves
activities with water. It provided for the construction of
barrages, the construction of canals, and the cut-off of
Maasbochten.

1945: Completing of the
Rotte-watertrace that
forms the only connection
between the inner city
and Leuvehaven.

Spatial changes

1937-1942: Construction
Maastunnel for car mobility and slow
traffic: bicycle and pedestrians

1940: In may, Rotterdam inner city
is destroyed.

Construction inside harbour Spaanse Polder and disappearance
of inland shipping from the city

Expansion plan Witteveen (1926-1927 en 1937-1938).

1922, Burgdorffer was succeeded by H.G. de Roode. Under his direction, W.G. Witteveen was appointed as an architect. The long lanes from Granpré Mollière were primarily taken over and set up in a practically feasible plan that now presents the current structure of the southern part of Rotterdam.

In addition to the focus on water, for shipment and harbor activities, the interest also shifted in expanding the living environment on the left bank of the Maas. In most plans, the underlying landscape was mainly ignored to make mobility traffic possible. In Vreewijk, the streets are mainly built on the polder structures. The Water city, had a strong economic and industrial purpose, while land behind the dike was mostly made as a living environment. The southern part of Rotterdam became independent from the north with Zuidplein as a central point.

3.1.4 RECONSTRUCTION (1945 - 1973)

And then World War II came. The reconstruction period was characterized by the rapid recovery of facilities, growth and upscaling. In addition to infrastructural function, water also had an aesthetic value. Nationally, people focused strongly on agriculture, which resulted in the investments in water management in the polders. Harbor activities started to grow out of the city. Besides much was focused on the planning development of neighborhoods in a green environment (Vreewijk and Heijplaat).

Plan-Witteveen - The Rottetracé

After the bombing, Witteveen was given the assignment for the reconstruction of the city. He presented this on 11 December where he maintained the idea of separation between the Water city and the City center. Water had a connecting function; the Rottetracé is

Reconstruction 1950 - 1975



an example of that connection. One of his pillars in his plan was the adaptation of infrastructure to the increasing demands of traffic. Also, a link through a series of boulevards that connected essential squares and junctions with each other. Factories and homes were moved to remote locations. Because the plan offered little room for future developments, his plan was never executed except the Rottertrace. This connection also ensured the supply of materials and had therefore started construction in the war.

Basisplan C. van Traa - Venster op de rivier

His successor, C. van Traa, was commissioned to design a more modern plan. Van Traa was former secretary of Witteveen. The Basic Plan was a rigorous break with the past, with only the city triangle of Coolsingel, Goudsesingel, and Boompjes recognizable from the pre-war plan. In his plan, infrastructure was also essential.

Separating functions as much as possible, shifting the center and placing a dike construction on "de Boompjes" was also part of his plan. The Water city is now inside the dike. He built the buildings along the Rottetracé with their backs to the water because he found the water connection to small of a scale. Besides, his attention was drawn to "De Venster op de Rivier" so that the view of the river was created from the city. This was an important initiative on the relationship between city and river

Deltawerken

The flood of 1953 leads to a large-scale approach to the protection of the land against water. Many dams and storm surge barriers were made. In new districts of Rotterdam, canals and parks were created in which there is room to store water.

Economic transition Harbor 1975 - 1995

Social-cultural changes

End '70: Cultural change for the attention of environment and ecology. The idea is to manage soil and surface water.

In Rotterdam different projects like: Stroveer (J. Verhoeven, 1977-1983) en het Oude Havencomplex (Piet Blom, 1984) show the popularity of living with water.

1976: Nota Herstructurering Oude Havengebieden.

1984: Second Nota voor waterhuishouding focusses on integral system approach of water.

1985: Nota omgaan met water. Integral water management leads to new goals and challenges. Biological and ecological players become also important.

1989: Third Nota Waterhuishouding: integration of management between water quality and water quantity.

Economic changes

Moving economy: Harbour activities move westwards and post industrial sites are designated as housing locations.

'80: Economic decline results to cuts in government spending.

1982: Ending of the Holland - America trade.

1970 - 1990: Increase in car usage resulting in urbanization

Civil engineering changes

'80: Economic decline results to cuts in government spending.

Large scale improvement of purification of sewage and industrial water and the improved separate sewer system.

1995: Nota voor water: The spatial component of water must take a leading role.



Rediscovering of water as a spatial element in the city and landscape structures like the Prinselaan design.

1988: The Nota Spatial planning results to building with high density, the compact city and how to combine different functions that contribute liveliness and economic strong cities.

Spatial changes

1975: Development of the new Watercity with housing complexes and the development of Oude Haven as entertainment area.

1981: Construction Willemsbrug

1987: Redevelopment of the Kop van Zuid

Water company makes land available in kralingen for housing and moves to the brienenoord bridge.

Rotterdam derives its identity from the Maas and emphasizes it with new construction projects

In Rotterdam different projects like: Stroveer (J. Verhoeven, 1977-1983) en het Oude Havencomplex (Piet Blom, 1984) show the popularity of living with water.

3.1.5 ECONOMIC TRANSITION HARBOR 1975 - 1995

The economy is shifting to the west due to the construction of Maasvlakte I and industrial sites become interesting for redevelopment. The river is rediscovered, and the Water city seems to be coming back. Mega project of "Kop van Zuid" arose.

Water management

The attention shifts from quantity to quality of the water. During this time, various problems are being addressed such as environmental pollution, industrial processes, purification of sewer and industrial water. The water management is done with a specific alignment to the requested functions that is made possible by sophisticated technology.

Old neighborhoods and urban renewal

Urban renewal takes place in declining neighborhood. The city

grows further on the polder landscape. The unique characters of the polder landscape are acknowledged and are integrated into new neighborhoods.

In this time water is rediscovered as a spatial element in urban planning. The new policy resulted in new development along the water edges. The rivers were considered to expand the city quantitatively. A tremendous example is the project "Kop van Zuid."

New (re)developments

In this time Rotterdam has already dealt with a lot of water in the city. The relation with its water can be staged in four parts. The first stage was in the early 19th century. The then interwoven city and port related to the representation of the city that was oriented toward the water, which made the port more self-sufficient. The second relation, occurring between the 1920s and 1940s, was the attempt to transform the city into an organic entity. As third,

New (re)development 1995 - 2005



in the postwar-reconstruction age, it centered on the expanse of the river. The present stage, which is the current water systems, is the search where the river can be a new identity for its city (Meyer, 1999, p.298).

In the 90' the focus of the quantitative building on old industrial sites expanded to the opportunity to enrich the city with the redevelopment of river banks qualitatively. Later in the 21st century, the emphasis also shifted to the need for proper water management. The water boards and delta works became aware of climate change, dikes, and canalizations that led to significant problems with the discharge and storage of river water. People began to consider the water as a friend that could help to develop climate adaptive situation. The growing awareness of recurrent

flooding through high water levels leads to plans that provide more space for water. There is a demand for a more natural water system with high resilience.

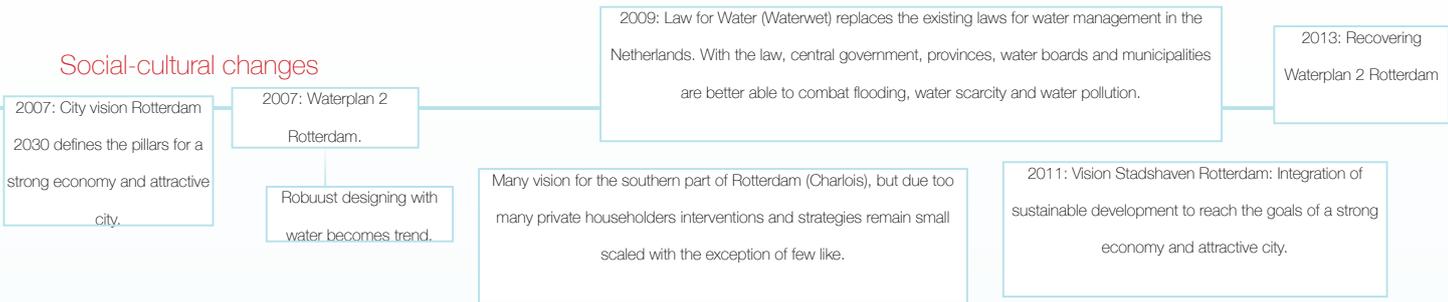
New challenges

The new uses of water in spatial intervention to achieve adaptivity in Rotterdam can restore its valuable relations with its water. Hooimeijer (2011) mentioned to backtrace situations where urban design and water management are balanced sustainably, concluding:

“The Fine Dutch Tradition expressed in the new Dutch water city can return to its roots: complex urban developments that connect different challenges in the most efficient way” (p.287).

2005 - 2015

Social-cultural changes



Economic changes



Civil engineering changes



Spatial changes



3.1.6 CURRENT TIME AND PLANS. (RECLAIM THE WATERFRONT)

In addition to describing the current trend, it is also compared with past development and plans of urban renewal and waterfront redevelopment to reinforce the goal statements of strategies.

In the past, much has been done to make industrial areas attractive again. Nevertheless, many of the developments are monotonous and for the higher income class. The developments of Kop van Zuid made a significant contribution to connecting South to North and later also involving Feijenoord with the rest of Rotterdam South. At this time, climate adaptation did not yet play a role in the redevelopment plans. In the current development plans, climate adaptation is more fitting to protect the outer dike environment for high water levels. The roof park in the Merwevierhavens is an example of connecting the Bospolder district

through the roof park to the quays. Other programs such as the River as a tidal park support the ecological value of the river. But these programs do not always support adjacent deprived areas but are focused on attractive recreational activities on the water to improve water quality. The green-blue connection of Zuiderpark with Waalhaven is a successful connection but does not contribute to the attractiveness of neighborhoods. In addition, living on the water is still aimed at target groups with a high income. In the new future plans for disadvantaged neighborhoods. Much attention is paid to make these neighborhoods attractive, but water does not express itself to spatial strategies while it can give spatial quality to the environment.

Current time and future plans



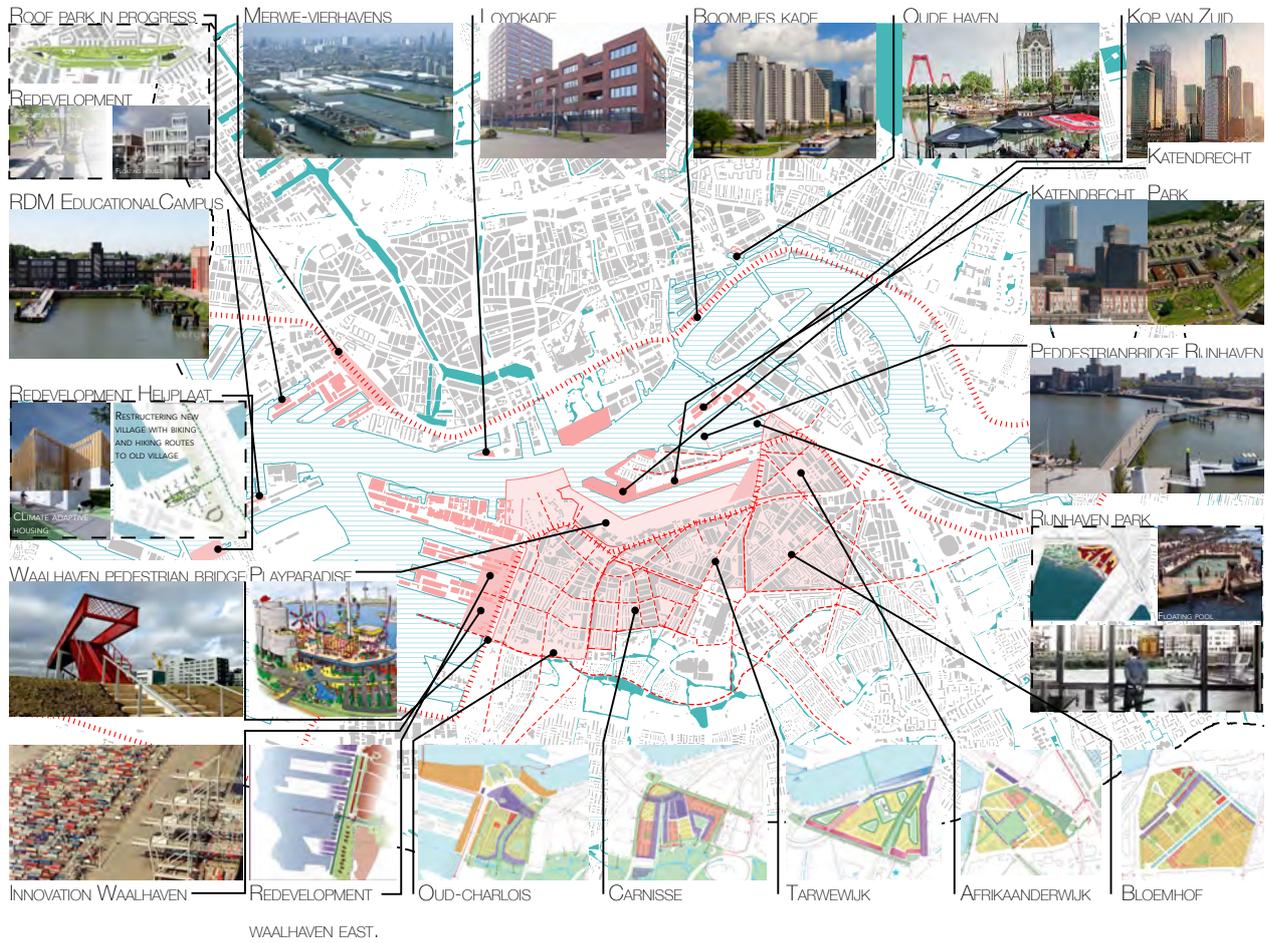
3.1.7 CONCLUSION

Based on these findings, the developments of waterfront and disadvantaged neighborhoods can be concluded as follows:

- The inside and outside dike environments seem to be two different worlds.
 - The development of high and low-income group is visibly segregated.
 - The link between the Meuse and inner water systems are not visible.
 - Attempts to connect inner dike environment with outer dike area involves green-blue connections, but do not support the disadvantaged neighborhood.
- On the level of the neighborhood, the water does not express itself into spatial strategies
- Public domain related to water should be expanded to the neighborhood instead of limited on the waterfront.

In this thesis, we look for an integrated approach of waterfront redevelopment and urban renewal through the use of water. Developments around the theme of water must provide a specific attractiveness for disadvantaged neighborhoods adjacent to the waterfront. Here we try to restore the relationship between city and river. Not as it used to be, using port activities, but as a public domain with mixed functions that strengthen the city Rotterdam as a whole to be an attractive city to live for all target groups and with a strong economy. Redevelopment of the waterfront will be coherent with urban renewal of disadvantaged neighborhoods. The inner-dike and outer-dike areas function in relation to each other instead of two different worlds.

In the following paragraphs, this thesis will highlight awareness for climate change and its importance of water in design principles as an integrated tool in blue-green measurements.



Legend

- Realized plans
 - Future plans waterfront
 - Future plans NPRZ neighborhood
- Main water system, The Maas
 - Inner water systems: canals
 - Primair dike system
- Green-bleu infrastructure
 - Street connection NPRZ neighborhoods
 - Municipality border Rotterdam

Figure 23: Comparison realized, current and future (re)development plans at waterfront and neighborhood level.

Source: By author

3.2 INTRODUCTION TO WATER SENSITIVE DESIGN

3.2.1 CLIMATE CHANGE AND WATER

The climate is changing rapidly. Regarding heavy rainfall, this means pluvial flooding of urbanized areas. Due to climate change, we have to deal with a lot of water and therefore plays an essential role in everyday life. Water sensitive design (Hoyer).

Water is an asset and can be used to create places that serve both the demands of urban drainage and urban planning (Hoyer et al., 2011). Because of this, water is crucial for the Dutch landscape. Not only the physical landscape but the cultural landscape as well. As already mentioned before, the enormous social challenges of our time are once again changing our relationship with the water. Climate adaptation requires new, smart and integrated solutions.

3.2.1 CLIMATE ADAPTATION

To be adaptive for future nuances, the current water systems have to change to face these problems. The need for climate adaptation is important. This requires more space for water retention needed. Water is going to claim the space in the city and urbanized landscape and therefore can not only be a task for water management governance, but water management should be an integrated part of the spatial design.

Meyer et al., (2015) defines "adaptability" as "the ability of a system to adjust adequately to changing conditions that were difficult to foresee or prepare for of extremely uncertain." Meaning the ability of a system to keep functioning correctly if the climate is changing. Adaptivity can be considered as a result of the properties resistance, resilience and adaptability.

3.2.2 CLIMATE ADAPTION IN URBAN AREAS

With the design of our cities, more than currently anticipated on climate change, space must be created to respond to changing circumstances while adding new quality. There is a need to look for measures that add value in our living environment. Therefore these adaptable solutions to climate change must be used in a way that they add a new spatial value in the neighborhood or city not only responding to climate change but as an integrated planning process. According to Voskamp & van de Ven (2014), urban areas are the most vulnerable places to climate change. Firstly because most of the population resides in these areas (50 % up to over 67 % by 2050), Secondly, the presence of highly concentrated buildings and pavement. Within this, increased size and socio-economic importance of cities underline the importance to improve "urban resilience." Voskamp & van de Ven defines urban resilience as:

' The ability of a system (the city) to adapt and adjust to changing internal or external processes.'

On the one hand, resilience can be enhanced by 'grey' measures, which indicates the concrete, pumping station and draining pipes etcetera. On the other hand by blue-green measurements, which make use of natural processes

3.2.3 Blue-green measurements

"Blue-green measurement is a collective term for sustainable blue and green infrastructure that utilizes underlying ecosystem functions to deliver multiple benefits. Blue-green adaptation measures are self-adaptive and produce significant co-benefits.

Therefore green infrastructure cannot be seen separate from blue infrastructure because green depends on the availability of water in times of drought and extreme heat. The main advantage of combining both blue and green measures is its multi-functional applicability to urban climate change and improving urban quality (Grant, 2010; Kazmierczak & Carter, 2010; Pötz & Bleuze, 2012; van de Ven, 2009).

3.2.4 BENEFITS OF BLUE, GREEN MEASUREMENTS REGARDING WATER

Research on improved concepts for urban flood and water management showed the benefits of blue and green adaptation measures, which aim to recover the natural water cycle in urban environments by building with nature (van de Ven, 2014).

Blue-green measures have gained attention for multiple benefits they provide in urban areas. Blue solutions benefit in particular problems related to flooding. Green solutions with vegetation improve the infiltration and buffering capacity, and provide shade and cooling by evaporation. Blue-green measures also offer recreation benefits, could be used for food production, can be an opportunity to educate on climate change adaptation and increase its awareness. According to Pötz & Bleuze (2012), the appearance of green areas and water in the city provides a more pleasant living environment. In addition Demurze, et al. (2014) mentioned that blue-green measures improve the water quality by removing suspended solids, nutrients, hydrocarbons, and heavy metals.

3.2.5 CLASSIFICATION OF ADAPTATION MEASURES REGARDING WATER

In the past decades, a lot of measures are developed to respond to water. These measurements can be classified into 5 categories,

based on the water analysis of, De Urbanisten:

- Attenuation measures: Slowing down

After a storage capacity of the measure has been exceeded, this emphasizes slowing down the runoff during heavy rainfall. These measures can store and slowly infiltrate water in the ground and most have no connection to the sewer system.

- Infiltration measures: Retain

This emphasizes the direct infiltration of water in which it is essential to create soft green spaces for these infiltration possibilities. In addition, these measures can also temporarily store water.

- Storage measures: Conserve

This emphasizes on the extra buffer capacity to store water from heavy rainfall. This adds value to its surroundings and can be reused for other purposes due to clean rainwater.

Harvesting measures: Reuse

Rainwater harvesting systems are designs in which techniques harness and make rainwater available for human consumption. These are based on water supply for multiple uses different from growing crops, domestic use, livestock watering or even industrial and commercial purposes. These measurements facilitate water retention in the soil, storage of rainfall interception.

- Transport of water: Evacuate

This indicates the systems that transport surface water with natural wastewater from rainfall. These measures are combined with above ground drainage as well as underground drainage and can also contribute to slowing down the runoff to sewer systems

The adaptation measurements that are suitable for the thesis project are illustrated in table 3.

QUALITY IN PUBLIC SPACE



ADDED VALUE & COST SAVING



INCREASE OF HOUSING VALUE



INCREASE OF PRODUCTIVITY AND QUALITY OF LIFE



INCREASE OPPORTUNITIES OF EMPLOYMENT



REDUCTION OF WATER PURIFICATION COST.



REDUCTION OF HEALTH ISSUES

Figure 24: Benefits of blue-green measurements in public space
Source: De Urbanisten

Figure 25: Added value and cost savings of blue-green measures
Source: By author

	● ATTENUATION	● INFILTRATION	● STORAGE	● HARVESTING	● TRANSPORT	COST
Private green gardens	+++	+++	0	0	0	€
Facade gardens	++	++	0	0	+	€
Green shores and riverbanks	0	++	0	0	0	€€
Rainwater retention ponds	++	0	++	+	0	€€
Parks	+	+++	0	0	0	€
Reliëf	+	++	+	0	0	€
Infiltration strips with above ground storage	+	+++	++	0	0	€
Rain barrel	0	0	+	+	0	€
Rain water tank	0	0	+++	+++	0	€
Rain water fence	0	0	++	++	0	€
Gutters	0	0	0	+	+++	€
Underground rainwater storage	0	0	+++	+++	0	€€€
Roofgarden	++	++	0	0	0	€
Permeable pavement	+	++	0	0	0	€
Water squares	+	0	+++	++	0	€€
Green roofs	+++	+++	0	0	0	€€€
Water roofs	++	0	+++	+++	0	€€
Green facade	++	++	+	+	0	€€

LEGEND:
 + Minor effect € low cost to cost neutral
 ++ Substantial effect €€ Additional cost
 +++ Large effect €€€ High cost

Table 3: Overview of blue green measures used in this research

Source: By author

SMALL SCALE

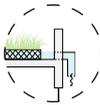
LARGE SCALE



Figure 26 Overview of scales within the blue-green measurements

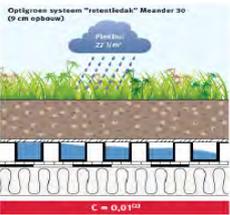
Source: By author

3.2.5 ENGINEERING OF BLUE-GREEN MEASUREMENTS



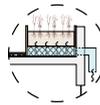
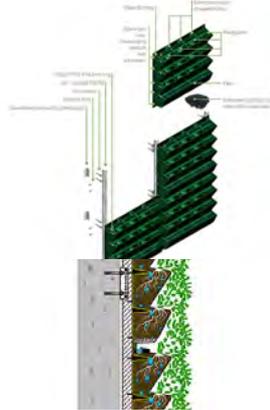
GREEN ROOFS

A green roof, also called natural roof, has a varied planting and can, therefore, retain a relatively large amount of rainwater compared to extensive green roofs. Green roofs increase the sponge function of the city. Due to direct and indirect evaporation (via plants) and water storage in the substrate layer less rainwater flows from the roof.



GREEN FAÇADE

Green façades have many advantages: they retain rainwater and evaporate it later. In addition, a green façade can contribute to the spatial quality of the façade as well as the insulation of the building. It consists of a system of hanging planters underneath each other, where the water is led from the rain pipe. Green façades are ideal for blind façades.



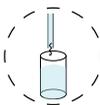
ROOF AGRICULTURE

A roof garden has all the advantages of a regular green roof: insulation, rainwater drainage, living space for insects and birds, and healthy edible products.



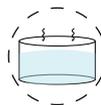
RAINWATER FENCE

A rainwater fence is a rainwater collection in the form of a fence. The rainwater fence is available in modules. As a result, the buffer capacity for rainwater can be expanded.



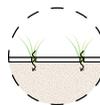
RAIN BARREL

The rain barrel is the easiest way to use rainwater. Moreover, it is a rainwater buffer facility that is easy to install at homes. The rainwater will in most cases be used for watering plants on the balcony or in the garden. Most barrels have a tap. Rain barrels come in all shapes and sizes up to 200 liters.



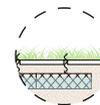
COLLECTIVE RAIN BARREL

Water tank is a larger form of a rain barrel that can be used collectively. It can buffer a larger amount of water. The water can then be used for different purposes. The water tank has a fairly large storage capacity and can store more than 1500 liters.



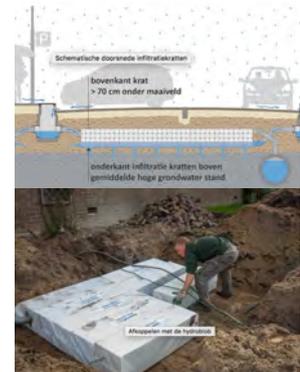
PERMEABLE PAVEMENTS

Pavement with an open joint can allow the rainwater to sink into the ground. It does not have to be drained via the sewer and the groundwater is automatically replenished. In case of rain, the clinkers contribute to reduce flooding on the streets and in the garden.



INFILTRATION CRATES

Infiltration crates are underground soil filtration facilities. These plastic crates are covered with geotextile to prevent clogging. They do not take up space above ground and have a larger storage capacity than above ground soil filtration facilities. There are infiltration crates in various sizes: for individual houses as well as facilities for whole city districts.





WATER SQUARE

By giving the rainwater a visible place in the public space, a multifunctional square is created. An additional advantage is that investments for water storage are used simultaneously for the construction of an attractive outdoor space. A water square combines water storage with other urban functions in an attractive way. The rainwater from the neighborhood is connected to the square via open drains or a rainwater sewer.



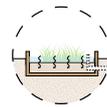
PONDS

Rainwater ponds catch rainwater temporarily and discharge it slowly. The vegetation in the pond and the green banks ensure the cleaning of the water. If the water is sufficiently clean and the soil permits it, the rainwater can infiltrate. During a rain the rainwater is stored in the pond and later drained so that there is room for the next precipitation.



FAÇADE GARDENS

By removing a row of tiles along the façade on the street side and creating a garden, the rainwater flowing from the façade can infiltrate into the ground. Façade gardens also contribute to a greener street scene. Building a façade garden has several advantages. Plants in the open ground need less water than plants in a pot. A façade garden can also be combined with an uncoupled rain pipe.



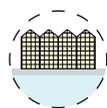
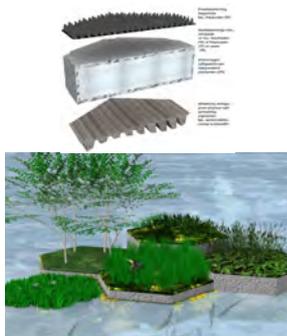
INFILTRATION STROKE

Infiltration traps or deepened fields next to paved surfaces can temporarily store rainwater run-off, allowing the water of clean hard surfaces such as roofs and cycle paths to be easily infiltrated. In addition to infiltration traps, infiltration fields are also possible. Infiltration facilities with above-ground storage can be carried out deep or shallow. In residential areas, a maximum depth of 30 cm is sufficient to ensure that children do not endanger.



FLOATING GREEN

We can permanently reuse all the plastic waste that we collect from the river. Floating green allows to improve the ecosystem in and around the river, but also provide a better living environment in the city. On the elements, a green facility can be installed. A large floating platform can be created on which, on and below, landscaping can be realized, which also have a bottom that improve the ecology of the river. Algae and plants can attach themselves.



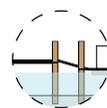
FLOATING GREENHOUSE

The floating greenhouse was developed for use in areas allocated for water retention, hereby giving these areas a multi-functional use. More areas will need to be set aside for water retention in the future. The increasing pressure on the available space makes it necessary to use this space in a multi-functional way. Floating greenhouses can also limit the loss of land value when assigning additional locations for water retention. The use of floating greenhouses can limit loss and damage from flooding



OPEN GUTTERS

A gutter is a simple above-ground drain, which fits in the garden, on the street, in parks and on squares. When used on the street, the street profile is identical to a conventional solution. The water flowing through the gutter is led to the surface water or infiltrated into the soil by means of an infiltration facility. In new situations, the road itself can be placed on a slope. In existing situations the gutter can be placed on a slope, because the gutter is becoming deeper and deeper.



FLOATING COMMUNITY

Like floating homes, districts can also be constructed on floating platforms. Not just buildings, but other urban functions as well, such as public spaces and facilities can be designed to float. Here, too, the anchoring and infrastructure connections are important factors to consider. As a rule, these are relatively expensive solutions compared with standard land-based solutions. Compared with draining or raising land, it can be a viable alternative.

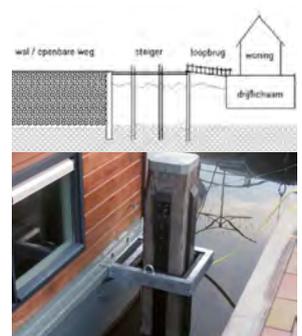


Figure 26 Overview blue-green measurements engineering

Source: By author

3.3 INTRODUCTION TO REVALUE DEPRIVED NEIGHBORHOODS

3.3.1 DEPRIVED NEIGHBORHOOD

Stouten (2014) talks about a deprived neighborhood as a 'deprived area' inhabited by low-income groups. These neighborhoods are dealing with physical, social and economic problems. In Rotterdam, nearly half of the city is designated as a deprived neighborhood (Stouten, 2014). These neighborhoods affect the quality of living and its spatial quality. The low-income groups consist of people who are mostly unemployed and don't have the self-resiliency to upgrade their home or contribute to participation for examples in the neighborhood. This can result in a socially isolated neighborhood which you can find a lot in Rotterdam like Carnisse or Tarwewijk. When people do not value their neighborhood, fewer people are interested in what happens on the streets which neglect spatial qualities that relate to the quality of life in this neighborhood. Not only the mentioned above are criteria for a deprived neighborhood, but low income can also result in little education (this is not always the case). In Rotterdam, most of the residents in the deprived neighborhood are dropouts or own a starters qualification of MBO or lower which result in unemployment of jobs with low income.

3.3.2 SEGREGATION

According to Doucet (2010) deprived neighborhoods arise due to social exclusion of low-income groups in newly developed areas. These newly developed areas are lacking in the planning of a variety of land uses. Most of them are aimed to attract high-income groups with expensive programming which the low-income groups cannot afford. This results in segregation between high and low-income groups. Differentiation of the residential environments became a new objective.

3.3.3 URBAN REGENERATION VS GENTRIFICATION

There are two strategies that involve differentiation of income groups in the living environment. One is gentrification as "the process by which buildings or residential areas improve over time, that leads to increasing house prices and an influx of wealthier residents who force out the poorer population" (Evans & Jones, 2009). Roberts (2000) defines urban regeneration as:

"Comprehensive and integrated vision and action aimed at the resolution of urban problems seeking to bring about a lasting improvement in the economic, physical, social and environmental conditions of an area that has been subjected to change" (p.17). Gentrification is mainly driven by the private sector of wealthier residents that bring economy in the neighborhood while the concept of urban regeneration is to create a living environment that maintains both high and low-income groups.

3.3.4 REHABILITATION

To support urban regeneration, Tallon (2010) suggest transforming these neighborhoods with economic 'reordering'. Meaning the focus is on enhancing property values and social transformation on spatial-economic issues regarding the development of the market value of an area and socio-cultural aspect including the upgrade of quality of life in that neighborhood and even the safety of it. This can be done in a Rehabilitation process in which rehabilitation can be seen as a step by step solution to prevent large-scale reconstruction. Instead rehabilitation: "will be a process of redefinition, which in fact roots in the exploration of the context of its origin, development and existence (Hui, 2013, p. 46). Doing this will improve the value of housing which in time can also attract the high-income groups in the neighborhood. This differs between

tenants and private owners. The housing of tenants is managed by corporations and private-owners by private individuals.

3.3.5 VALUE-ORIENTED APPROACH (MULDER EN KEI CENTRUM)

Value-oriented approaches are becoming more critical in urban processes. Besides a lot of them are different from the character. Most important, the method it is aimed to determine cost and revenues, but are limited as process tools that should be more developed (Kam, 2008,p.8). Value-oriented approaches are based on theory changes. This theory indicates a certain activity (input) that leads to results (output) which in time realize wanted effects (outcome). This project is based on the desired effects that form the foundation within the value-oriented neighborhood approach. An example of an explicit value-oriented theory is that of Mulders (2006) which is illustrated on the next page. Mulders developed principles in a model of value creation for neighborhoods. This model is on the one hand fed by high revenues as a result of investments (aimed at resident as consumer and producer) and on the other hand by lower cost as a result of investments that make neighborhoods and their residents more healthier. The relation between 'desirable' and 'healthy' is not only expressed in urban exploitation but enhance each other as well. The image of a healthy

neighborhood contributes to its desirability and so results in high property value.

3.3.6. BLUE-GREEN MEASURES IN PRIVATE AND PUBLIC INVESTMENT.

As mentioned before, deprived neighborhoods consist of affordable housing for the low-income household. This means, houses that are too small and lack of terminal comfort. It has been researched that property market values increase while investing in sustainable developments (Cerin et al., 2014). Sustainable development is described as "the need of the present generation that is met without compromising the ability of future generations to meet their own needs" (WCED,1987). This involves blue-green application in the private and public sector. The objective of affordable housing is to enhance its affordability. Integrating blue-green measures in the rehabilitation of the housing supply can reduce cost in energy bills and create higher property value (Gan et al., 2017). This leads to a better housing market in a deprived neighborhood which can tackle the attractiveness of the neighborhood as well as the living comfort of the housing. Residents profit from their investment which leads to more appreciation of neighborhood and prevents moving mobility and vacancy.

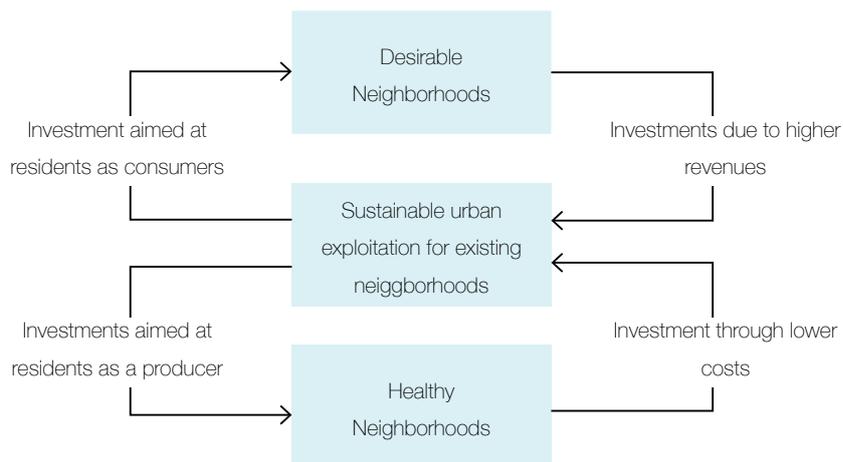


Figure 27: Value-oriented model
Source: Mulder, 2006

3.4 INTRODUCTION TO QUALITY OF LIFE

3.4.1 QUALITY OF LIFE

Ferriss (2010) stated the good society as:

“The good life flourishes in the good society, with appropriate social structure, social psychology, values, and culture patterns.”

This involves the good society norms and values, social quality, structural relationships, and other such qualities of societies.

According to Ferriss (2010), the finding of the good society is a key to the good life. Proposing that the social structure and social psychology of the good society may be found by identifying situations where good quality of life of the people predominates. This part of the theoretical framework focuses on 'social quality,' 'community and neighborhood' and 'leisure time' that approach the quality of life concept.

3.4.2 SOCIAL QUALITIES

Social quality is defined as “the extent to which citizens can participate in the social and economic life of their communities under conditions which enhance their well-being and individual potential” (attributed to W.L. Beck and others in the document The Social Quality of Europe). Ferriss (2010) distinguish four concepts of the notion of social qualities. The first is the socio-economic security, which refers to the way the essential needs of citizens concerning their daily existence are addressed by the different systems and structures responsible for welfare provisions. It is said that a certain amount of subsidies protect against poverty, unemployment and other forms of material deprivation. Secondly, Social inclusion/exclusion relates to the principle of equality and equity. This aims to provide supportive infrastructures where exclusion will be prevented, and cohesion of different groups will be improved. The third concept is social cohesion which concerns the processes that create a specific network of social groups within the neighborhood. An adequate level of social cohesion is one which enables citizens to exist as social beings. The last concepts

are empowerment, that presents the ability of the social group to participate in the social, economic and cultural processes entirely and that will develop their potentials.

3.4.3 COMMUNITY AND NEIGHBORHOOD

This implies that participation in group activities can boost the one's self-concept and lead to social cohesion.

3.4.4 LEISURE TIME

One should be able to find expressive activities as a moment of leisure. Regarding water would be fishing and other adventures on the water. According to Ferriss (2010) the admiration of nature leads to respect and satisfaction with the environment. Constant of good qualities of spaces enlarge the quality of life.

The ideal society is built upon the four pillars of the good society which are: social cohesion, inclusion, empowerment, and socio-economic security. This will improve quality of life on different levels. Good quality of public space and collective opportunities can be a factor to stimulate social cohesion. Which results in including all social groups in the participation and that in time will empower its socio-economic security.

3.4.5 BLUE-GREEN MEASUREMENTS ON QUALITY OF LIFE

Blue-green measurements can create public spaces that enable the possibilities for social qualities, community forming and leisure time to take place. Within this, it is essential that these spaces are multi-functional and non-exclusive. Meaning, the accessibility of different groups within Tarwewijk and Rotterdam needs to be highlighted. Besides blue-green measurement create an attractive environment which also aims to tackle the water nuances from heavy rainfall. Blue-green measures have therefore different purposes and characters.

3.5 CHALLENGES ROTTERDAM

3.5.1. CHALLENGES IN ROTTERDAM

Tracing back an active relation between land and water will be a challenge in creating different urban development strategies that are sensitive to water. Van der Brugge & de Graaf (2010) mentioned that one could not deny the recognition of water, which has become a crucial factor in solving urban problems like property values in affordable housing. They improve economic value and upgrade the quality of life. But also enhance the biodiversity in the city. The use of water in design is focused on the response to experienced water abundance and anticipated climate change. But visible water also has a greater need for space and challenge designers to research design in current structures.

Rotterdam that consist of three different landscape types, polder system (north), the river (Meuse) and the soft canals (south), act differently in need of water-related problems. The southern part, which is mostly paved, consist of a lot of housing that was built after the war. Most of them are made in multiple apartment blocks. This resulted in a repetition of street character in many neighborhoods. Because of the one-way traffic regulation in the neighborhood, it is also required to develop climate adaptation on the level of buildings which in time will contribute to a diverse street character that will make the street more lively in sight. In the part of the river, one should gain back its extensive uses with the water. Also, it is a challenge to enhance current water scape's that relate to social interaction and

cohesion, which in turn improve the quality of life. In all Rotterdam is challenging to use water (with or without the combination of green measures) in different ways and through different scales that identify the values of space between land and water. To achieve this, a coherency in planning strategies is required.

3.5.2 CURRENT DEBATE ON SPATIAL PLANNING, DESIGN, AND GOVERNANCE.

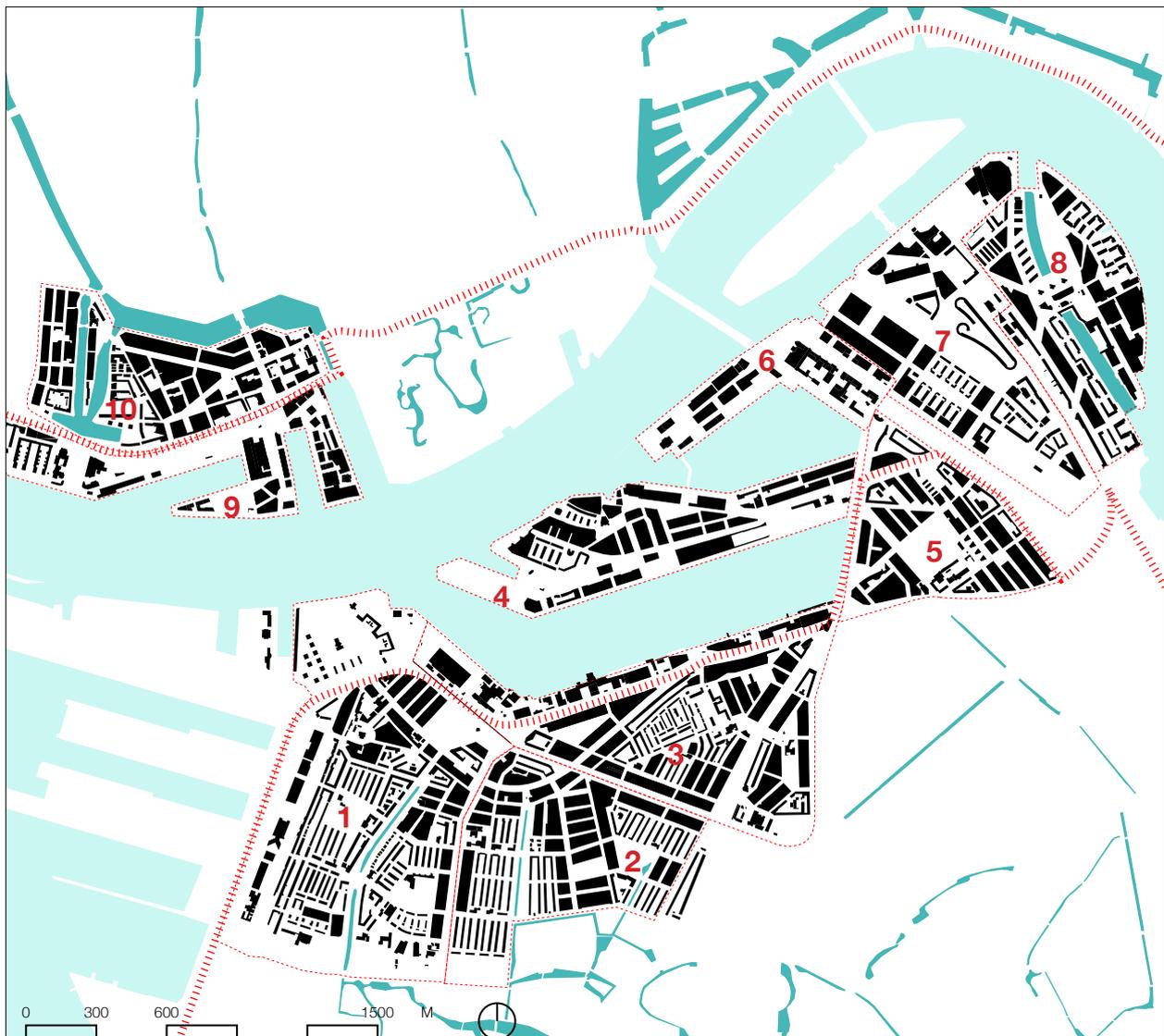
Complexed theories have given rise to a variety of new planning methods over the past decade (Meyer et al., 2015). In research, the so-called 'top-down' approach is no longer recommended. Innes (1998) laid important elements of spatial planning that is known as communicative planning, which is strongly opposed to the 'top-down' approach. Another approach refers to the 'bottom-up' approach that is known as a self-organizing city. This approach is now considered to be the fundamental driving forces that shape cities an urban regions (Meyer et al., 2015) and therefore is a primary key in the rehabilitation process. In this kind of planning methods, the main idea is having participating actors involving in the spatial planning that will be transformed into an urban design by experts and designers. In Rotterdam, it is essential to include all actors in an integrated planning process. This involves a merger of interest of these different stakeholders.

4.0 ANALYTICAL & SPATIAL STUDIES

4.1 ANALYTICAL STUDIES MEUSE

This thesis aims to find a new relationship between the waterfront and deprived neighborhoods. Also, to define the specific site in Rotterdam exciting for this new relation, this part of the thesis will first analyze ten different neighborhoods in Rotterdam near its shore and Meuse. The neighborhoods will be explained on various aspects and spatial characteristics of water, socio-economical and waterfront relations. This analytical study can be found in appendix I. The second part of this chapter is the

selection of three neighborhoods that are interesting for this thesis with the focus of water, socio-economic aspect and which show different relations with the Meuse. This results in further analysis (Appendix II) to define the specific site of interventions in the Rotterdam for this thesis. The third part is the spatial analysis of the chosen area of intervention. The last part of this chapter will analyze the potentials of water-related design in the neighborhood to express these opportunities in spatial interventions.



1. Oud-Charlois, 2. Carnisse, 3. Tarwewijk, 4. Katendrecht, 5. Afrikaanderwijk, 6. Kop van Zuid, 7. Kop van Feijenoord, 8. Feijenoord, 9. Schiemond en 10. Delfshaven.

Figure 28: Selected district in Rotterdam to be researched for project

Source: *By author*



CONCLUSION ANALYTICAL STUDY WATERFRONT

	CONNECTION TO WATERFRONT	CONNECTION INTERNAL WATER SYSTEMS	LIVENESS / MULTI-FUNCTIONAL PROFILE	LIVENESS ON THE WATER	QUALITY OF PUBLIC SPACE	PORT/WAVY/WATER
AFRIKANDERWUJK	District is adjacent to waterfront, but visual blocked a dike.	Constructed lake that functions on its own and has no other relationship with other water systems	Lake in public park in the middle of the district. Because of market and surroundings very lively. Waterfront embankment not so popular	There is a bridge over the lake to cross over, other than that no physical interaction with the water. Port has still incoming boats	Has one main public space is physical in good state, mostly looking green than recreational.	Port has still piers and founders and incoming boats. Relation of the housing area with the port is lost
CARNISSE	No relations with the waterfront	Nice inner water systems that are linear with the street structures and that gives spatial quality to the dense districts	The inner water systems have an attractive look and invites for recreational purposes. The pond in Amelandseplein has a small pier.	No interaction with waters.	Good quality of public space. Amelandseplein provides a playground	No port characters or any water relations
DELFSHAVEN	Its has a relation with the Meuse by its canals and port but physical not directly connected. Visual connection is blocked by dike	Streets are linear to the canals and well connected.	The Aelbrechtskolk and Achterhaven have a different profile than other ports in Delfshaven which provides a certain interaction	The Aelbrechtskolk provides small floating islands for recreation and enjoyments on the water	Public spaces are physical in good state. Leyboskade provides a playground	Since the Westzeedijk, Delfshaven is no longer part of the port on the Meuse. The perspective on the river is hidden by Sliemond and dike
FEUENOORD	As an island in the Meuse with great visual connections to water	Docks linear and perpendicular to streets are well accessible and directly connected to the Meuse	There is no liveliness around the ports in Feijenoord. The ports are transformed and provide little recreational purposes	No interaction with the water	Enough greenery however, the outdoor space has little quality. The green is mostly green.	The former docks contribute to a characteristic structure of a port city which function is now transformed in some pleasurable boats.
KOP VAN FEUENOORD	District is adjacent to the Meuse, great visual connections to water and skylines.	Docks linear and perpendicular to streets are well accessible and directly connected to the Meuse	There is a certain liveliness in the ports which been transformed with pleasurable boats.	Few embankments show interaction with water.	Public spaces lack in recreational purposes	The current harbor basins keep the memories of a port city alive but also strongly transformed
KOP VAN ZUID	As an island in the Meuse with great visual connections to water	No subsurface water	Public attractor for people with a lot of money. One side of the bank is used for restaurant leisure other side not so much uses	Interaction with water in big events like World Harbour Days	Has one main public space at the head of the island in good physical state on warmer days well used	The current harbor basins keep the memories of a port city alive but also strongly transformed
KATENDRECHT	As an island in the Meuse with great visual and some cases physical connections to water	No subsurface water	2e Katendrechtse port provide recreational activities and a playground not so lively	2e Katendrechtse port stimulates interaction with the water with a constructed beach.	Enough public spaces well maintained	Katendrecht has been characterized by its location between harbor areas, but has change since the arrival of Kop van zuid and bridge.
OUDE - CHARLOIS	District is adjacent to waterfront, great visual connections to water and skylines. Attractive inner water systems	Nice inner water systems that are linear with the street structures and that gives spatial quality to the dense districts	Different characters of water systems. Boegonsewiel not for recreation. Nice embankment but no so well used.	No interaction with water	Boegonsewiel is of great quality which is a great power of the area	Only at Dokhaven Park, the port and now is still, experienced through view of large port-related industry and by water view.
SCHIEMOND	District is adjacent to waterfront, great visual connections to water and skylines	No subsurface water	Not so many different profiles no so lively	No interaction with water	In all cases, the size of the green is quite modest and consists of some trees. Mainly from grass.	From the 1960s, Schiemond became unnecessary as a port. Piers are still present
TAFMEWUJK	District is adjacent to waterfront, but visual blocked by the dike.	No subsurface water	No liveliness on the waterfront because of industrial land use	No interaction with water	Enough parks and squares. However, at the level of the city, the district lacks in a coherent system of outer spaces and appearance	Here you live on the Meuse with one of the most enchanting views of the water.

Diagram 1: Conclusion relation water

Source: Ely author

Based on the conclusion diagram 1 many districts, with some exception of Delfshaven, Kop van Zuid and Kop van Feijenoord, most of them are recreational related in the sense of “walking,” “seeing” and perhaps maybe even “cycling.” It mostly lacks in the use of the specific mixed function or the purpose on the edge of the water is unclear of ‘what to do’ in such places. The water-related systems as a public space are there which give quality to the public space. But still lack in extensive use of them. This can be a the result of lack in spatial designs of quays that don’t interact with the water. Waterfront are mostly related to residential area’s which makes them mono-functional. In Tarwewijk it is also industrial related which exclude the residential part from its waterfront. Delfshaven and Kop van Feijenoord are only districts that stimulate recreation on the water. In Kop van Feijenoord one can enjoy the pleasure of restaurants and few other facilities but very limited (figure 26). In Delfshaven on the other hand one can enjoy the nature of water from a close view. Kop van Zuid appears to be the only one to be multi-functional with different uses, but are most expensive and which leisure contents and qualities are undeveloped (especially from a street-level perspective).

According to Torre (1989), people need a reason to return to water edges. Establishing those reasons will show their potential uses in a very personal way. He also mentioned that a waterfront

is alive with water-dependent activities which are the basis for an authentic and enjoyable experience (p. 37). Which lack so much in Rotterdam. This concluded to no matter how unique or exciting a waterfront development is, it will only be a success if it functions well on all levels. From local access and circulation to adequate parking capacity, to ease and comfort of pedestrian movement, to the visitor’s overall experience, all levels must meet capacity on peak activity days. Other literature (Hall, 1998) also suggest “various permutations of architectural renovations, commissioned public art programs and newly designed or renovated squares.

Overall the quality of extensive use of water-related environment with the Meuse and inner systems in all districts lack in such a way that continues liveliness in these spaces is not present. While their accessibility, except for Tarwewijk, is in most cases present, which show their potential for extensive and attractive uses by different users. Also, climate adaptivity for future threats is just not there. Since the South part of Rotterdam is mostly urbanized and paved, this is much required. The northern part has those open inner water systems in the neighborhood but lack of intensive use and or interaction with water. Since waterfront development is a complicated scheme advanced, creative and visionary planning skills are needed (Romein, 2005).



Figure 29: Top: Recreation on water in one of the channel, Down: Quay of Kop van zuid

Source: By author

CATEGORY PORT-RELATION

After the analysis, the ten districts are subdivided into three categories of port-city relations. In total, three neighborhoods

are chosen, one of each category, to further investigate which is interesting for the study of design in this thesis.

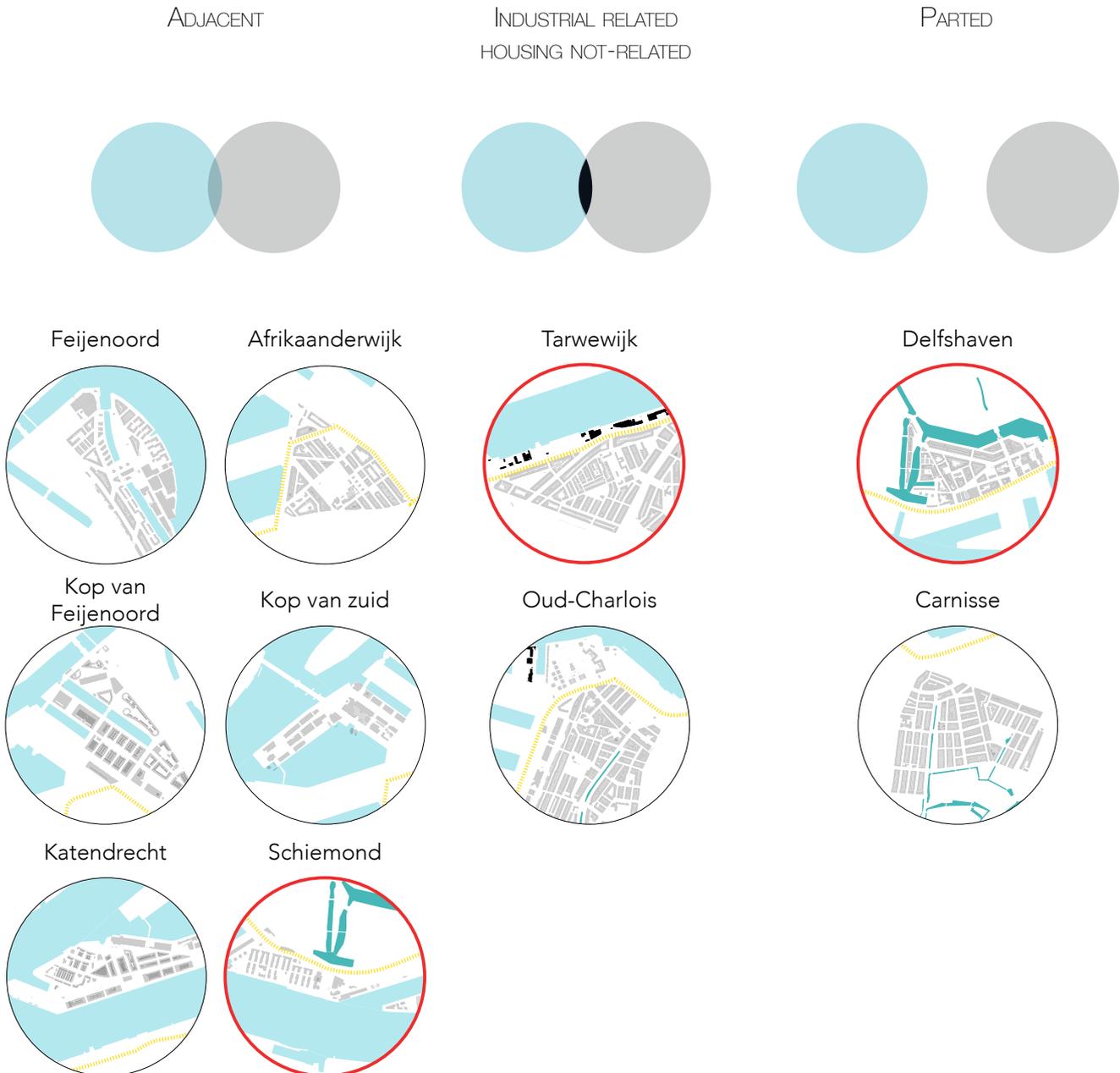


Diagram 2: Category of Port-city relations in Rotterdam

Source: By author

4.2 NEIGHBORHOOD ANALYSIS DELFSHAVEN, SCHIEMOND AND TARWEWIJK

All three neighborhood dominate in a one-man household. Besides that, the neighborhoods consist of a vulnerable target group that does not have the resilience to invest in their living environment. To define the scope of water management in the selected neighborhood, a spatial analysis will be made that will focus on the spatial features as well as the vulnerable household in the area. Also, the current policies for water, socio-economic process, and port-city will be defined on a city scale and neighborhood scale to come with certain spatial interventions in the chosen neighborhoods, where the use of water will be the main key. The chosen neighborhood to be further analyzed for possible design interventions are:

- Tarwewijk
- Schiemond
- Delfshaven

After the analysis, one neighborhood will be selected for the site of design interventions in this thesis.

These neighborhood are selected because of the lack of attention for water, socio-economic aspect and show different relations with the Meuse which also vary in the demands of water management.

Tarwewijk:

Tarwewijk is a neighborhood that is still industrial related with the waterfront. However, the current housing does not have any relations with the Meuse or inner water systems what so ever, which makes it a challenging task to provide the neighborhood with certain connectivities

Schiemond:

Schiemond is adjacent to the Meuse, but show no interaction with the water.

Delfshaven:

This neighborhood is parted from waterfront activities and the Meuse, but is interesting because of its historical identity.

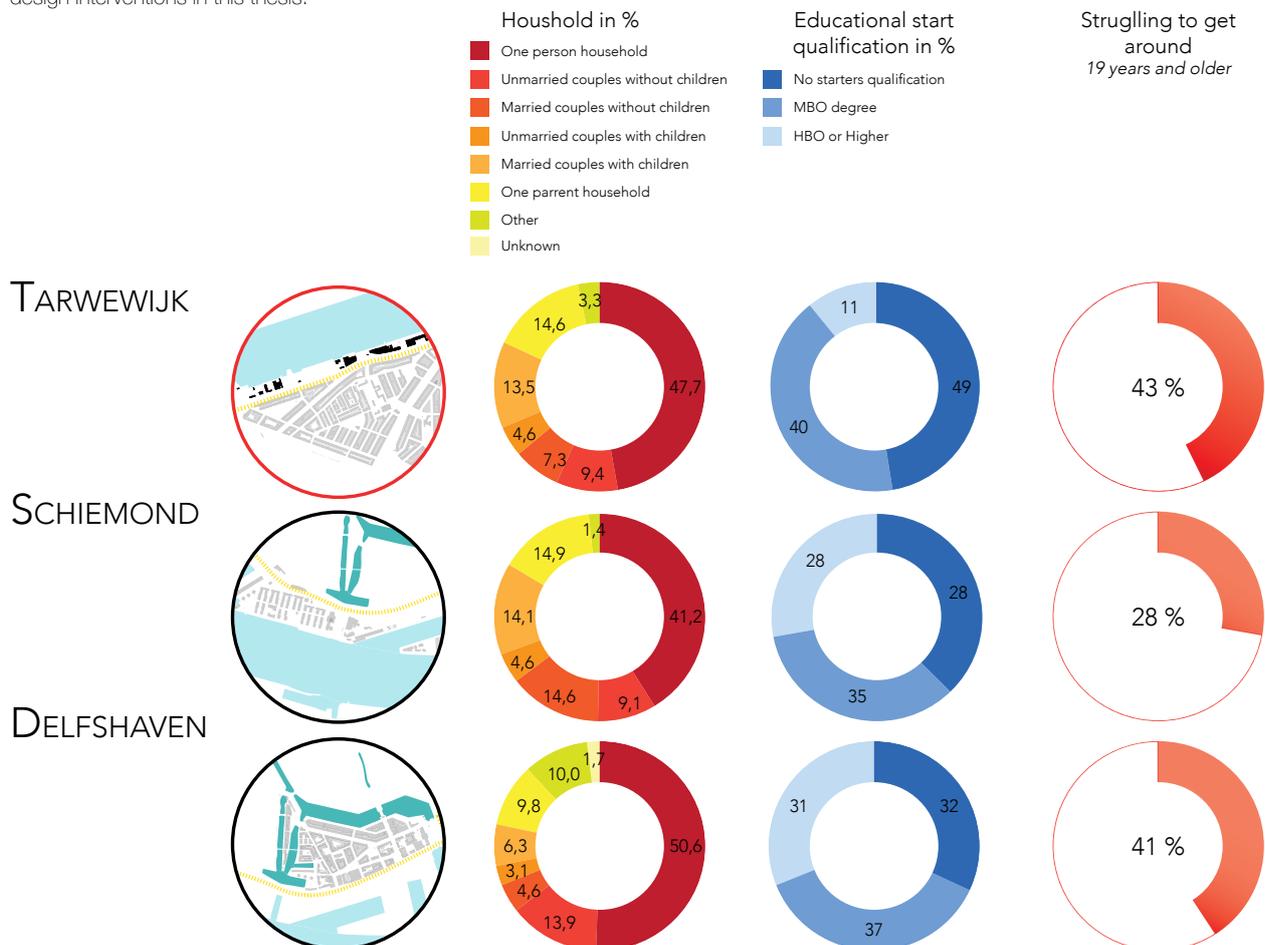


Diagram 3: Demographics Tarwewijk, Schiemond and Delfshaven

Source: By author

4.3 SOCIO-ECONOMIC DEMOGRAPHICS TARWEWIJK

4.3.1 Socio-economic demographics Tarwewijk

Because of the difficult relationship with the Maas and complexity of the neighborhood, Tarwewijk has been chosen to further investigate specific interventions. The analysis showed that Tarwewijk is known as a transition district. The so many small cheap houses do not give expanding families a chance to settle here. This also results in a high moving mobility when residents come into a situation with a higher income. In order to gain a better understanding of how we can use water to give Tarwewijk a carrying capacity, a spatial

analysis is made. This analysis leads to more insight on how water can be used in interventions and an attractive situation to make Tarwewijk attractive again. This contributes to the city Rotterdam in its whole to keep its target groups to associate the city with the river Maas, the Erasmus Bridge, the skyline of high and modern buildings, friendly people and the multicultural inhabitants of the city.

VACANCY



MOVING MOBILITY

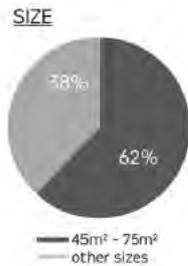


FAMILY HOUSING

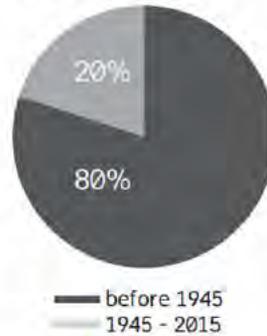


SURFACE

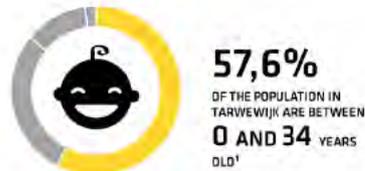




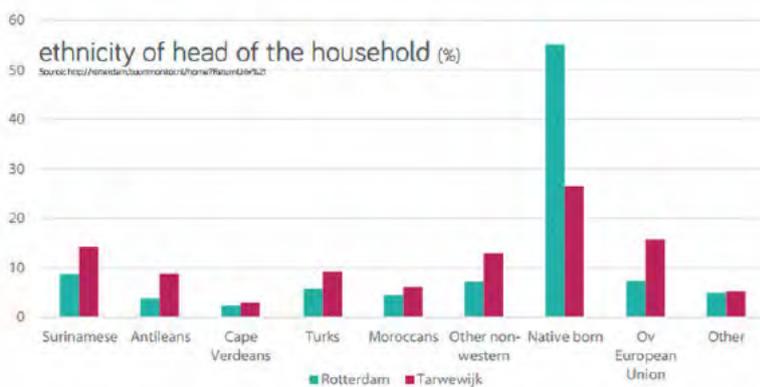
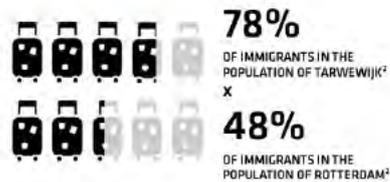
YEAR BUILT



4750
houses
dated before 1945

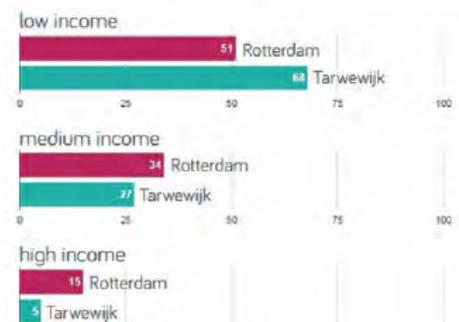


among houses
in need for renovation,
900
houses
are below standard level



household income (% standardized)

Source: <http://rotterdam.buissoninstitute.nl/home?menuid=62>



4.4 SPATIAL ANALYSIS TARWEWIJK

4.4.1 STRUCTURE



Figure 30: Underlying polder structure 1888

Source: By author

Tarwewijk is built on the polder structure for the middle-class workers in the harbor, Maashaven. The relation between waterfront and neighborhood was visible. This was because the waterfront had reasons to attract people, namely labor activities for wheat silos. Brielseleen had the purpose for goods transport and was later constructed as a dike to protect the lower lands, the neighborhoods. The expansion plan of the left southern bank was introduced to connect north and south with each other. North and south are connected using an underground tunnel, Maastunnel. Pleinweg was built to connect with the Maastunnel, and the

Mijnsheerenlaan and Dordstelaan were designed according to the concept of Grandpré Molier as green wedges through the city. The buildings at the Pleinweg have been laid out linearly to make a difference between the outside and inside areas where the building blocks in the neighborhood are again perpendicularly connected. The expansion plan meant that room for infrastructure was needed and so the polder structure was ignored during the construction of Tarwewijk. The separation between old and new can still be seen in the tissue of Tarwewijk.



Grandpré Molier

Witteveen

Figure 31: Expansion plan left southern bank

Source: Bet (2008)

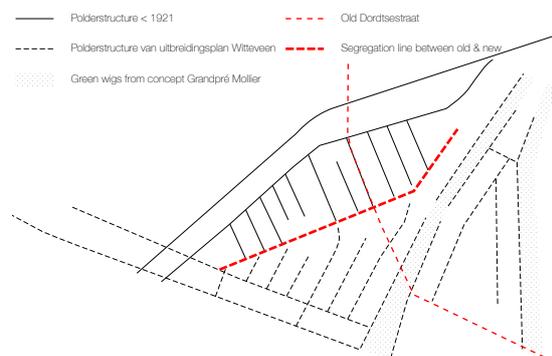


Figure 32: Street tissue old vs new

Source: By author

4.4.2 BUILT STRUCTURE

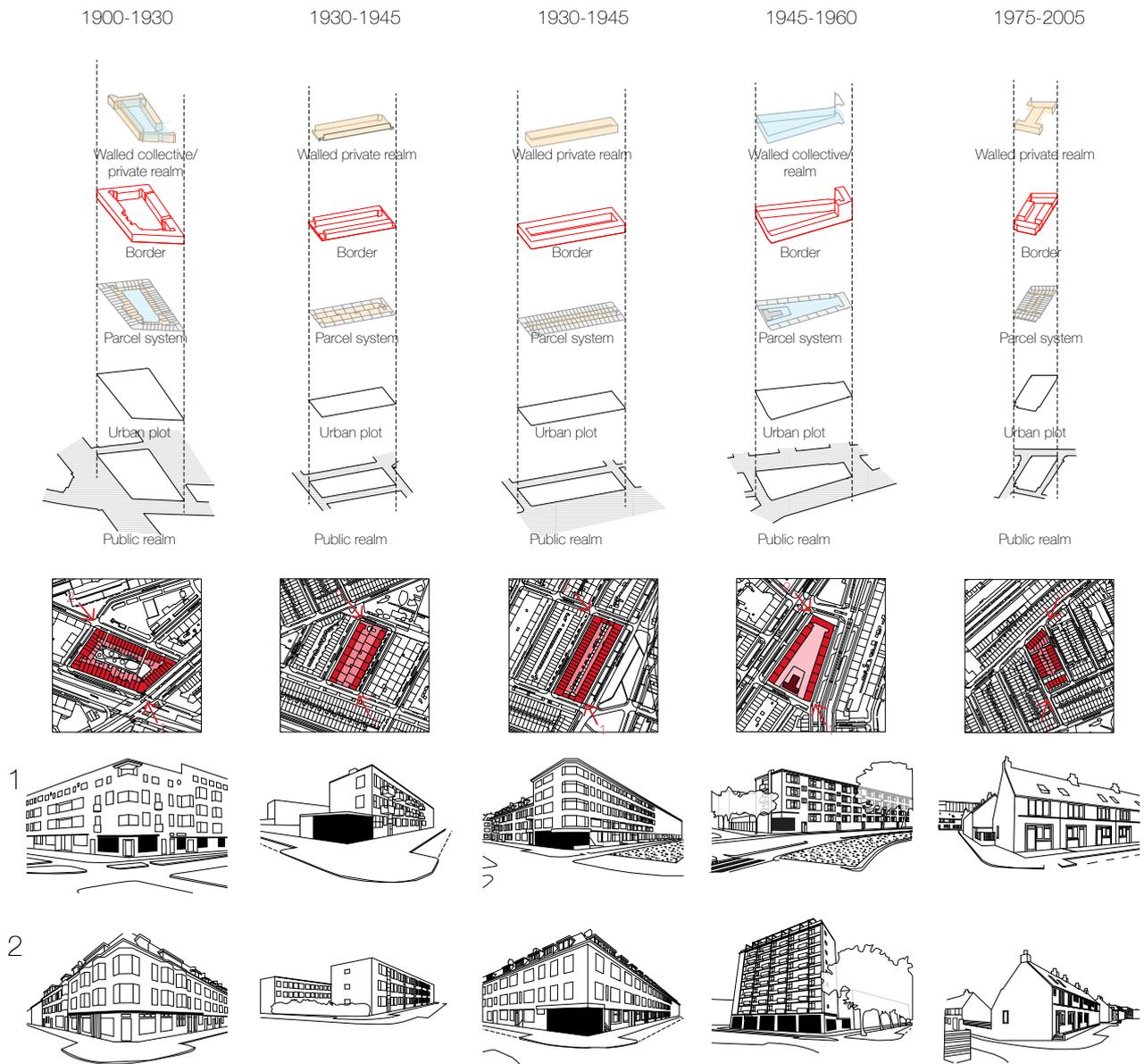
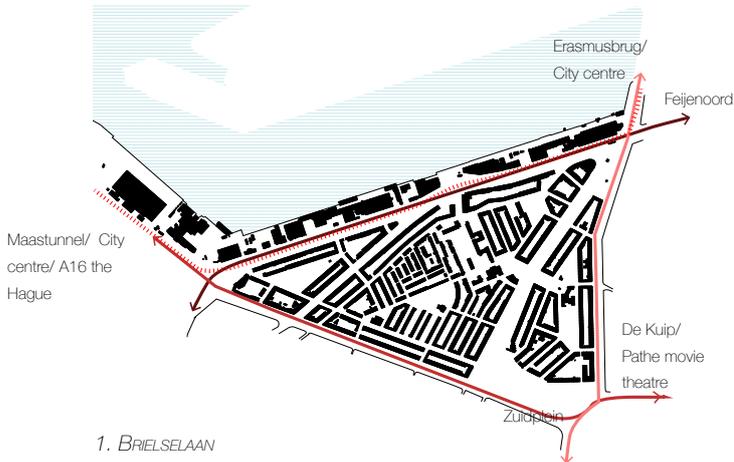


Figure 33: Built structure in different building years within Tarwewijk
Source: By author

In the illustration above it can be concluded that the built environment through time in Tarwewijk has kept introvert. Many blocks consist of private or communal spaces that are inaccessible for non-residents of that block. Besides, the building structure on edge has one or two layers extra than the building structure inside

the neighborhood. The edge structure of buildings also consists commercial activities varying from a local supermarket store to a place for the initiative "Nationaal programma Zuid." The high built structure on edge stimulates Tarwewijk to be an excellent and quiet neighborhood within a few minutes away from public functions.

4.4.3 NEIGHBORHOOD EDGES



1. BRIESELAAAN



North - South crossings



Tarwewijk is defined by three edges.

- 1: Brielselaan
Bariere between neighborhood and Maashaven
- 2: Pleinweg
Connection Maastunnel and Zuidplein
- 3: Dordtselaan
Connection Erasmusbrug and Zuidplein

The Brielselaan is bordered on the north side by the Maashaven and the southern side of the residential area. On the Brielselaan are some (former) grain companies and storage sites, such as the Meneba, the Quaker, and the Maassilo. At the moment only the Meneba and Quaker are active. Because it takes place between the district and the waterfront, it functions more like a barrier. Also, it is a busy traffic route for trucks for the industry and other cars that are still taking place. There are five crossing points for pedestrians to go to waterfront or neighborhood

East - West crossings



- The north-south connection presents some recognition points:
 - Landings (Maneba, quaker) and open spaces to know the position of the waterfront
- On the edge of the waterfront, one can experience the city skyline in layers (Katendrecht, behind Kop van Zuid).



The large Graansilo's, Meneba & Quaker, and industrial buildings determine the street scene at the Brielselaan. In some places, the dike is used for playing activities for children. Also, traffic is busy and barrier between neighborhood and waterfront.

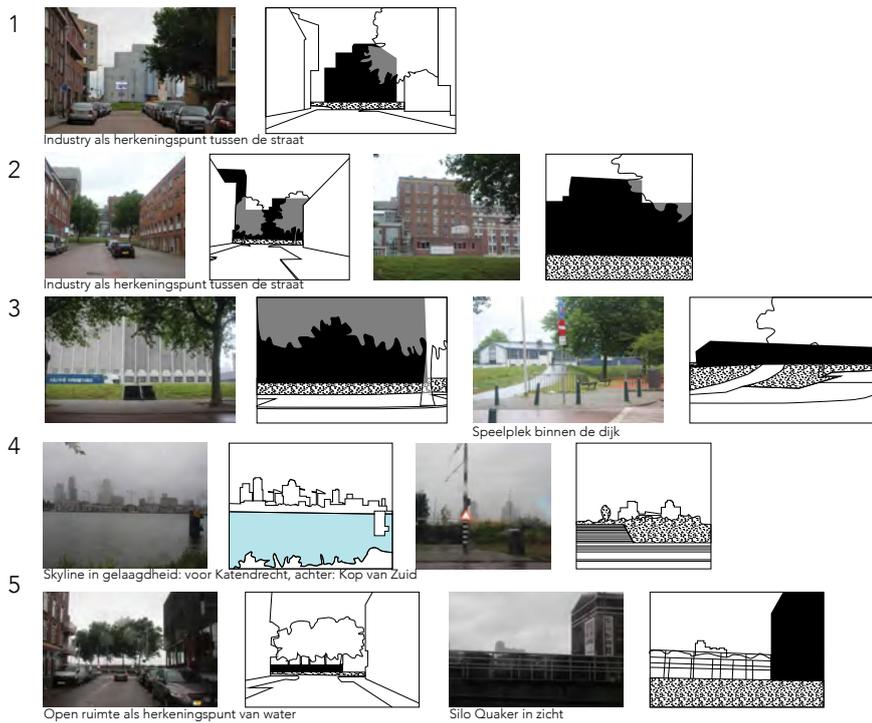


Figure 34: North - south impressions

Source: By author

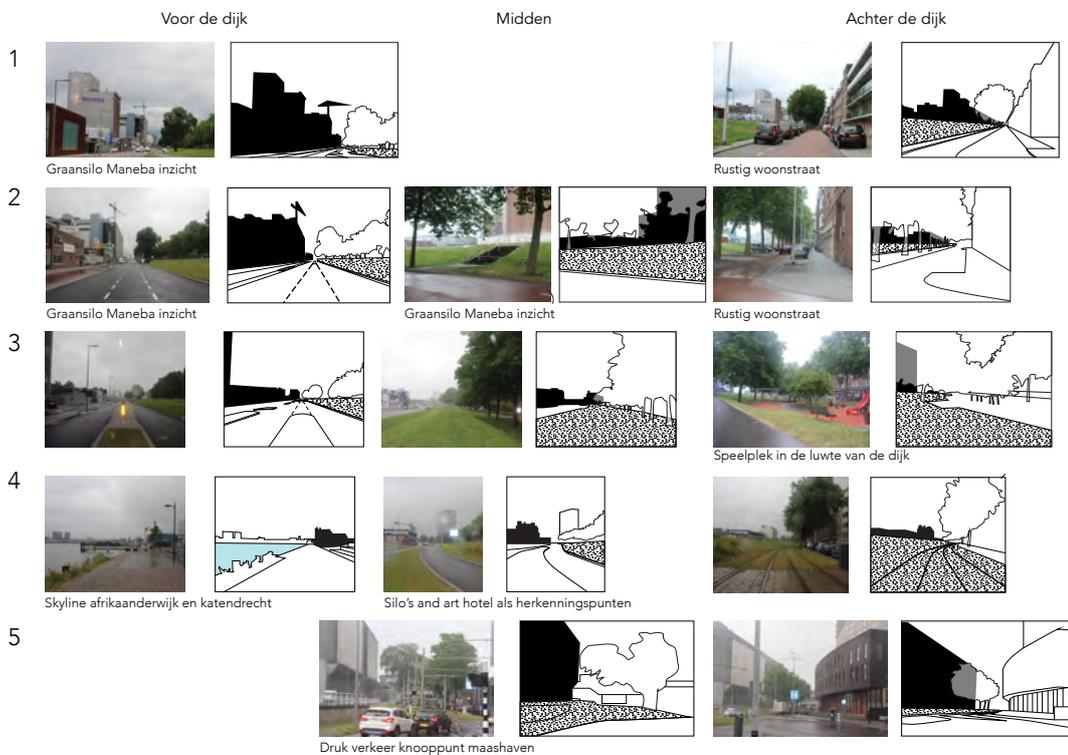
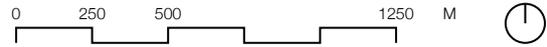


Figure 35: East - west impressions

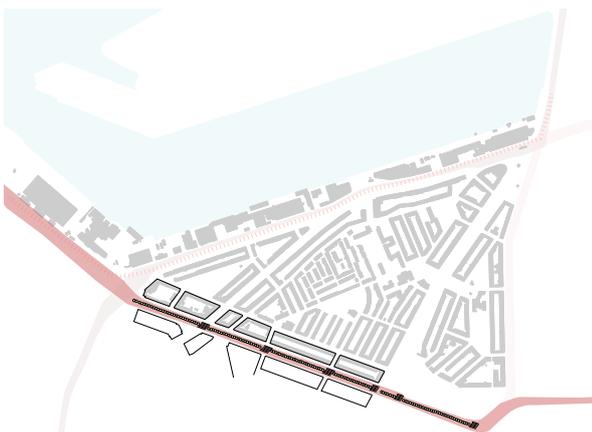
Source: By author

2. PLEINWEG



The Pleinweg is an essential traffic junction at Rotterdam-Zuid. The road connects the Maastunnelplein with the Strevelsweg at Zuidplein. It is part of the tunnel traverse. The road obtained the name for its simple reason that it combines two squares, Zuidplein and Maastunnelplein. The Pleinweg formed an essential connecting route to South from the northern part of Rotterdam. Today, the road consists of a continuous 2x2 lane for destination traffic and also functions as a separation between two districts, the Tarwewijk and Camisse.

Linear buildings



The linear building at the Pleinweg makes sure that the inside area of the neighborhood Tarwewijk is segregated for the busy traffic noise. This gives the neighborhood a more quiet environment inside by also placing the housing blocks perpendicular to this linearity and easy accessibility to other places around Tarwewijk.

Crossings



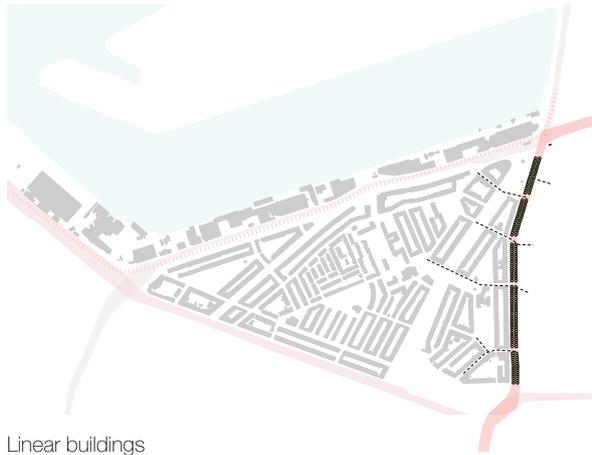
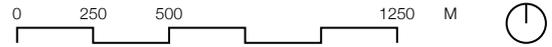
The road has five crossing points, and some differ in character. This makes Tarwewijk easy accessible for pedestrians but is mostly dominated by traffic because of the connection with the city center and the Hague.



Figure 36: Crossing impressions

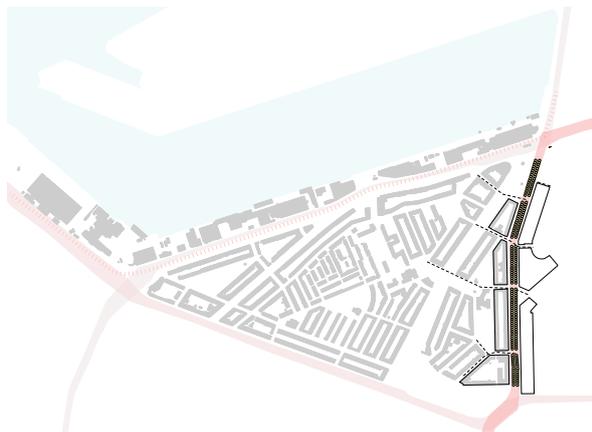
Source: By author

3. DORDTSELAAN



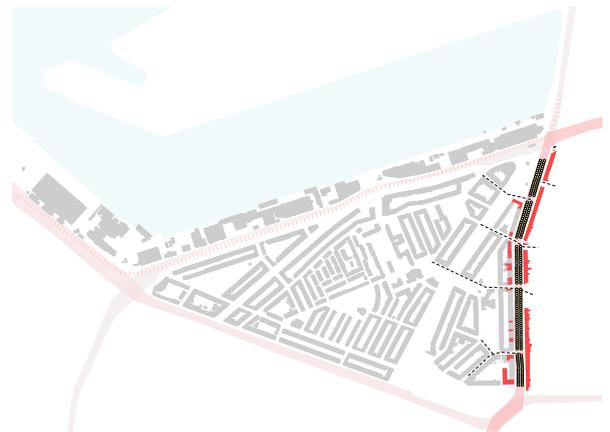
Linear buildings

The Dordtselaan connects the Zuidplein with Kop van Zuid and is also a connection to the city center via the Erasmusbridge. The road segregates the neighborhood Tarwewijk and Bloemhof. The Dordtselaan is constructed as an attractive green lane through the south of Rotterdam, but the attractiveness of this greenery does not show itself in its environment. Also, the Dordtselaan provides amenities on the level of different neighborhoods.



The Dordtselaan also has a strongly built edge that segregated the busy traffic environment from the more quiet living environment in Tarwewijk. The number of floor levels on the edge of the neighborhood is higher than the housing blocks in the neighborhood.

Crossings



The shops at the Dordtselaan are well known for its middle eastern heritage. These middle eastern shops provide foods and herbs that you may not easily find in the local store like Albert Heijn or Jumbo. On the contrary side, these streets look a lot neglected which it makes not pleasant.

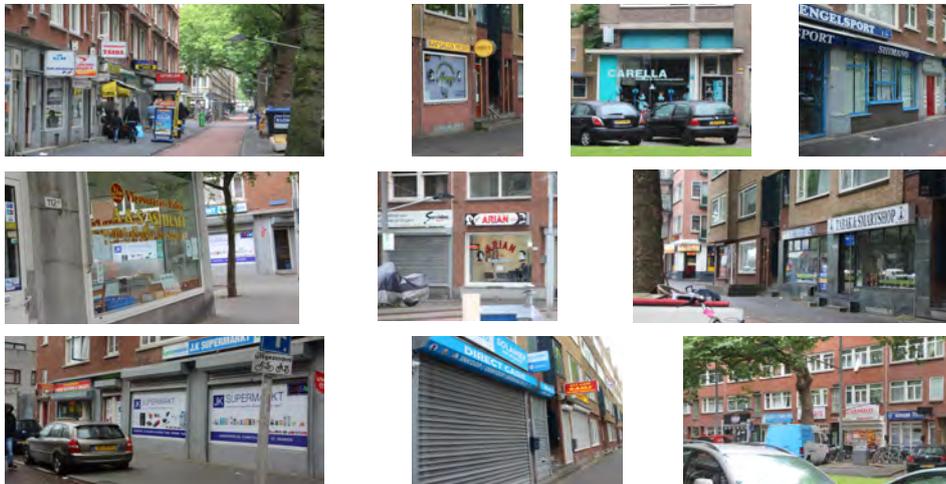
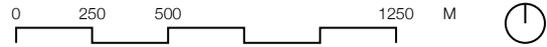


Figure 37: Shops impressions Dordtselaan

Source: By author

4.4.4 INSIDE STREETS TARWEWIJK

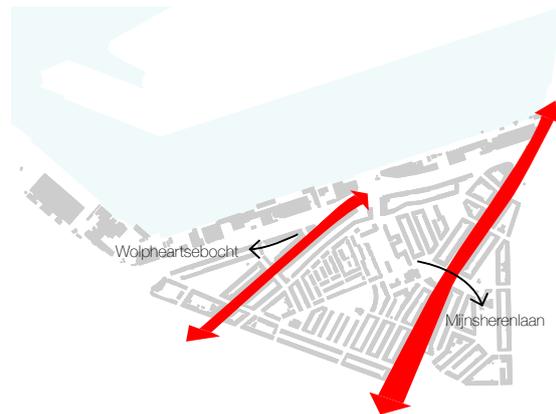


Tarwewijk has a 30 km regime. The differences in street type is visible. On the one hand the northern part before 1921 has more diversity in building types, on the other it has monotonous building types, multifamily housing, in the southern part. In addition, the street character in the southern part is diverse in appearance because of its different connections of street and built environment. Most of the street character are story of appearance.

30 km street network



Lanes



Many of the street networks on the level of the neighborhood are one-sided. The northern part shows north-south connections while the southern part is more irregular. In the middle a street, Blankenburgstraat represents the connection of both.

The Mijnsherenlaan is one of the green wigs in Tarwewijk. The Mijnsherenlaan and Wolpheartsebocht divide the neighborhood into three parts/islands.

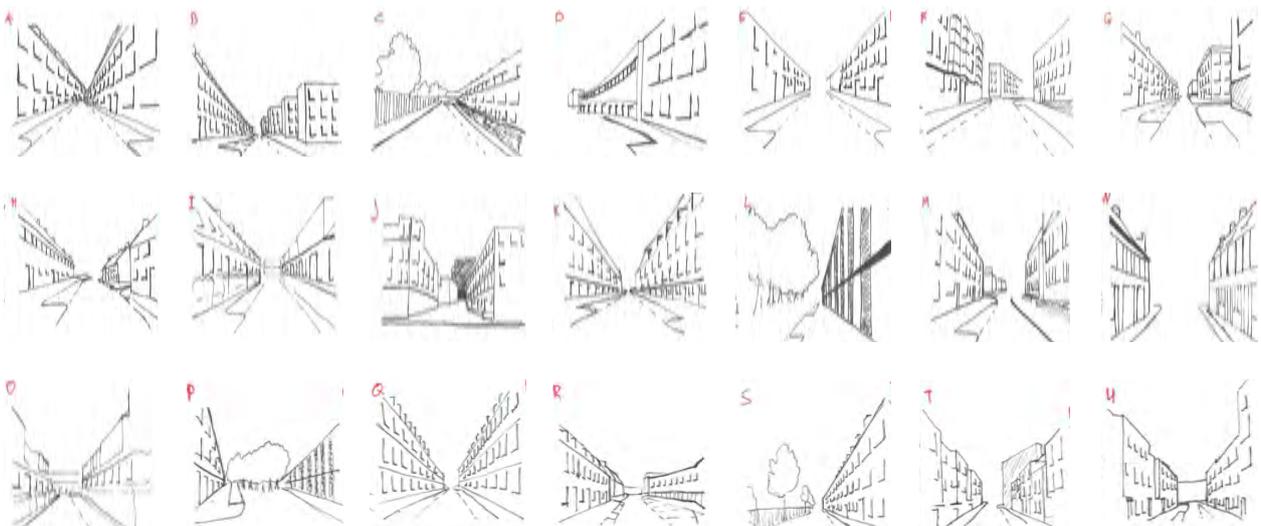


Figure 38: Street Characters

Source: By author

WIDENESS SIDEWALKS



PROGRAMS



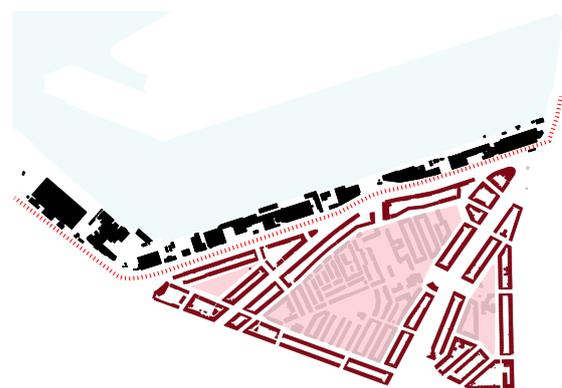
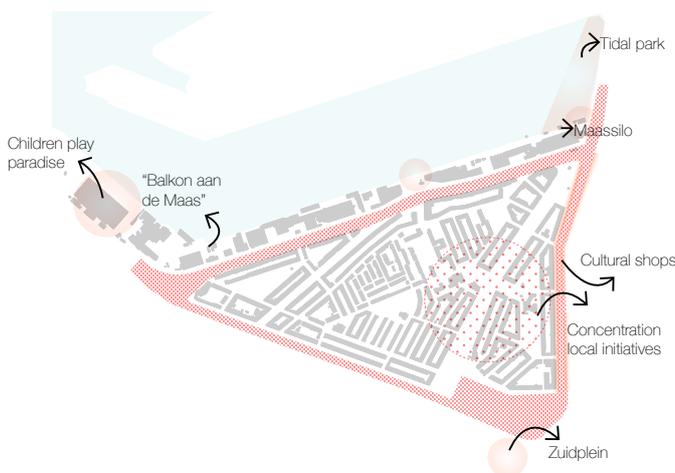
4.4.5 CONCLUSION EDGES AND STREETS



The spatial analysis of the edges en inside streets shows that Tarweijck has a hierarchy of street networks. The first one (1) is the busy traffic edges defining the Neighborhood. Secondly, the two main lanes dividing the neighborhood into three parts. And lastly, the 30 km regime street network, mostly one-sided direction. Also, the sidewalk analysis indicates the possibilities of blue-green measures on the street level. Designing with water ask for space. It is shown that specific measurements like infiltration strokes can not be applied everywhere.

- █ 1. Busy edges; Brielselaan, Pleinweg and Dordtselaan
 - █ 2. Lanes; Wolpheartsebocht and Mijnsherenlaan
 - █ 3. Streets; 30 km regime and one side traffic
- 3 islands and busy outside/ quiet inside.

Visitor flows with current developments/attractors



There is happening a lot outside the environment of Tarweijck. The different facilities and attractors make sure that the visitor flow goes around Tarweijck and not inside the neighborhood. Also, the program map shows many initiatives inside the neighborhood that aims to develop activities in Tarweijck to support its inhabitants.

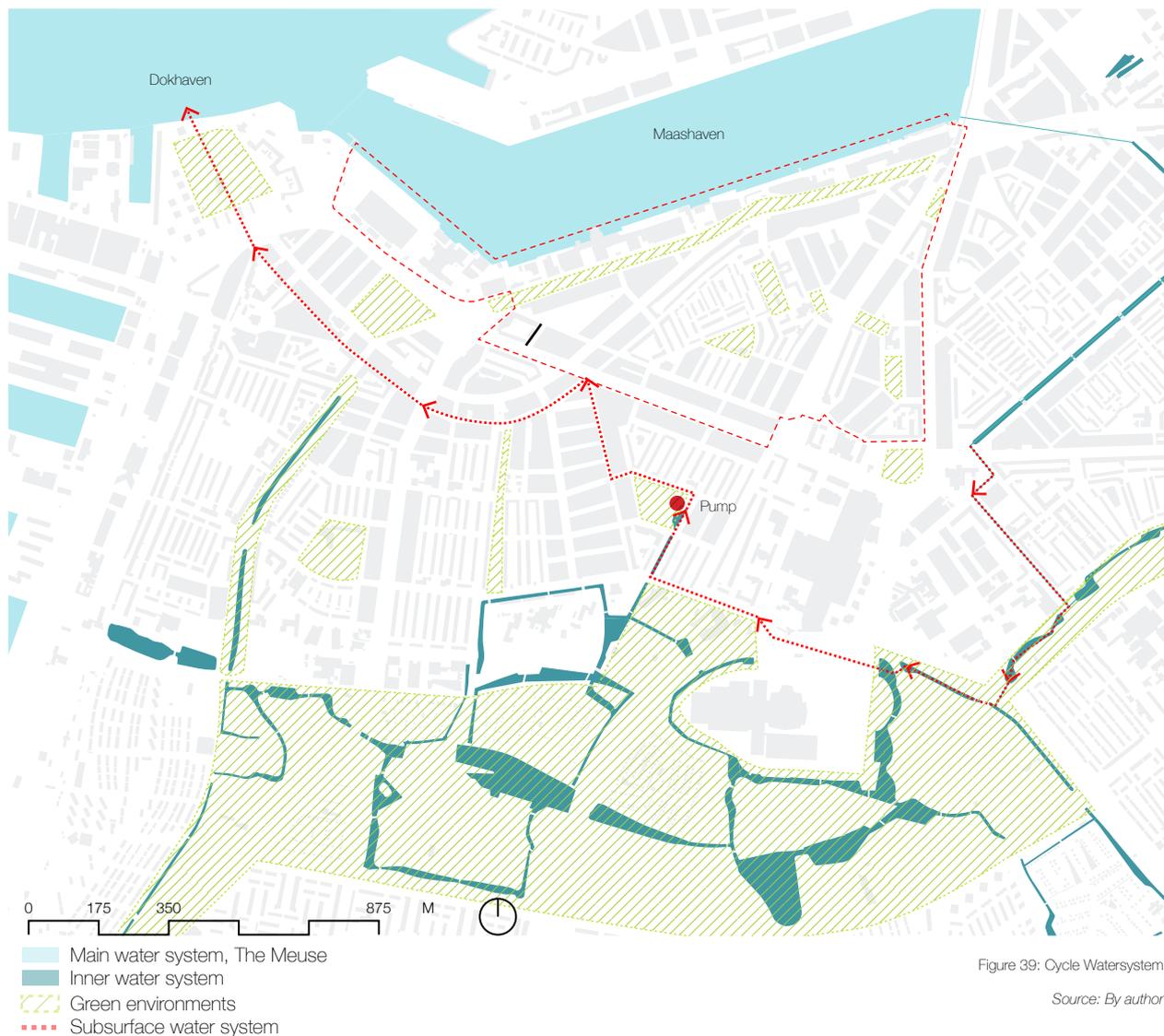
The hierarchies in street network of Tarweijck gives the neighborhood a more quiet living environment inside and busy traffic node outside, which connects to other places in Rotterdam and beyond.

4.5 WATER ANALYSIS

4.5.1 WATER SYSTEMS TARWEWIJK

This paragraph describes the spatial analysis possible inner water systems in the neighborhood and the main water system, the Meuse. Some methods of mapping are based on the analysis of

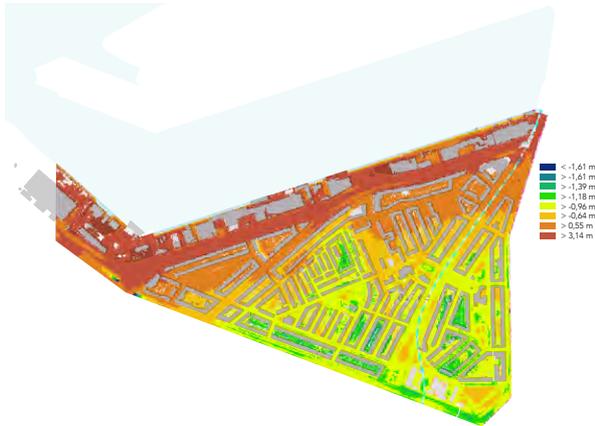
water squares from De Urbanisten, which indicates the possibilities of open water basins in the neighborhood that stimulate the goal to store 4206 m³.



The current rainwater is drained and discharged in two ways. The first way is via the paved surface to a combined drainage system of rainwater and gray wastewater that eventually is pumped using a pumping station to the Dokhaven. The second way is through the open water system around Tarwewijk itself. This lead water to the pumping station that discharges the water in the Dokhaven. Tarwewijk itself does not have any form of open water systems and

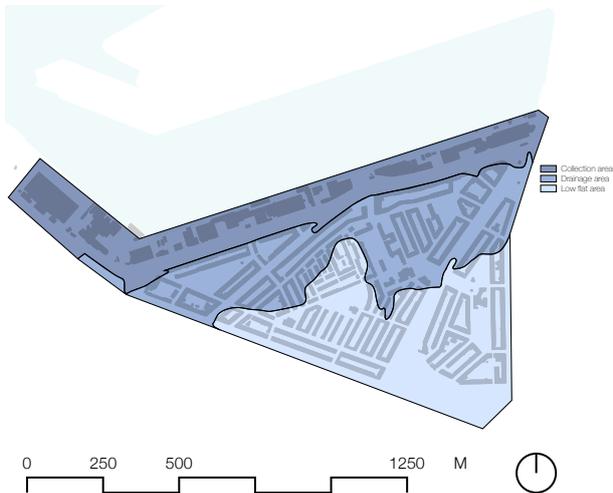
therefore is dependent on surrounding neighborhood. Rainwater is also partly infiltrated by current green surfaces. Due to climate change that leads to future water nuances in urbanized area's like Tarwewijk, the Municipality of Rotterdam and waterboard of the Hollandse Delta decided that Tarwewijk needs to store 4206 m³ in future development.

4.5.2 HEIGHT MAP



The height map shows the different height elevations in the neighborhood. It also shows the result of historical activities, the drainage of the polders, that has led to subsidence below ground level of the area behind the dikes. The difference in level between the waterfront edge and lowest point of the neighborhood is approximately three meters.

4.5.3 DRAINAGE DIRECTION



Due to elevation differences and sewage, water from rainfall flows in a specific direction. The water that hits the surface on the water edge in the northern part flows in the course of the low flat area in the neighborhood. The middle part consists of the most family housing and so also a lot of gardens that helps to infiltrate water before flowing to the low flat area. But still, a lot of water that hits the surface will be drained directly into the sewage which can result in the overflow of sewage.

4.5.4 SEWAGE



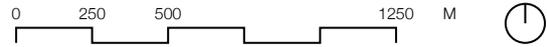
The sewage map illustrated a combined system of water from rainfall and grey waste water in the neighborhood. The Mijnsheerenlaan and edges consist of central sewage that is 900 mm thick due to wider streets.

4.5.5 WATER NUANCES



This map indicates the vulnerability of water nuances in the living environment of Tarwewijk. In case of heavy rainfall that results in the overflow of sewage, the lowest part of the neighborhood is most vulnerable to water nuances. The lowest part of the neighborhood consists of multi-family housing. Therefore, future scenario of water nuances affects the low-income group of private owners and renters. Also, the map shows possible locations for open water systems in public space that can tackle the problems of water nuances.

4.5.6 PUBLIC SPACE NEAR MAIN SEWAGE



There are a lot of public spaces in Tarwewijk, but mostly functioning more individually rather than coherent. Some of them are qualitative well maintained while others lack in attractiveness and usage. Those who are maintained are cages and semi-public, meaning that they are only accessible until a certain time. The spaces which lack in attractiveness are a challenge to come up with facilities concerning water to stimulate the use of those spaces. These spaces contribute to a certain quality of the environment and so results in the quality of life where users can socialize and educate themselves with the use of water-related design.

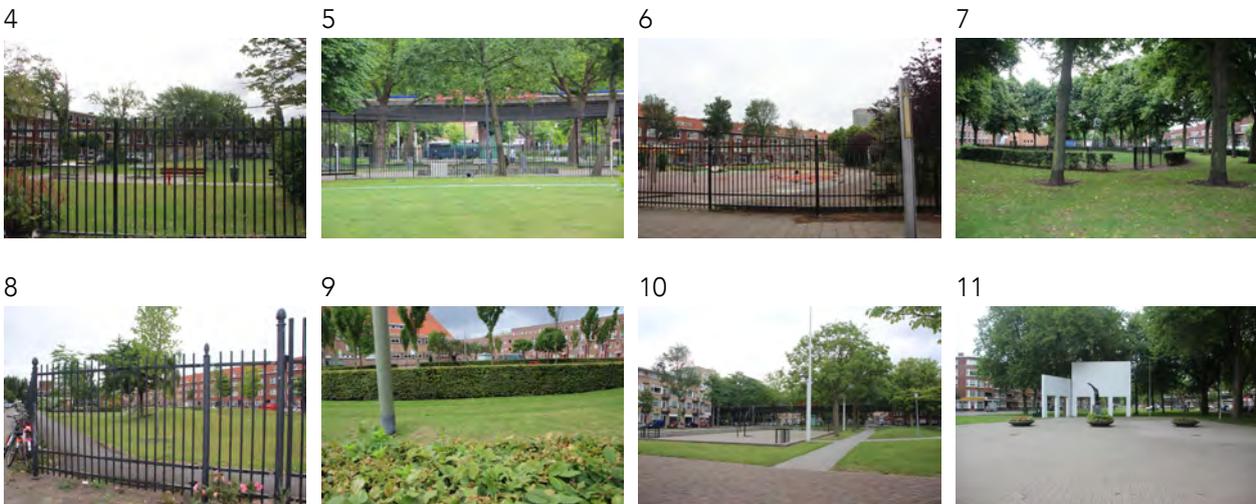


Figure 40: Impressions of current public space

Source: By author

4.5.7 POSITION TO THE MAIN WATER SYSTEM, THE MEUSE

Tarwewijk is adjacent to Maashaven, and with the moving economy to the Maasvlakte its current position at the main water system is an asset for future development. The drawing illustrates the central position within the southern part of Rotterdam and indicates that the current edges, junction, and nodes will be more important than they already are in future development. Tarwewijk should not be seen as a centrality itself within the southern part of Rotterdam.

but as a neighborhood with a soft living environment and firm edges within a few minutes away to public facilities. The quiet living environment emphasizes on the community of Tarwewijk that is not meant to be an attractor for outsiders. Tarwewijk is well connected to its surrounding in this position and stimulates programming in private and public sectors to enhance the growth opportunities in Tarwewijk.

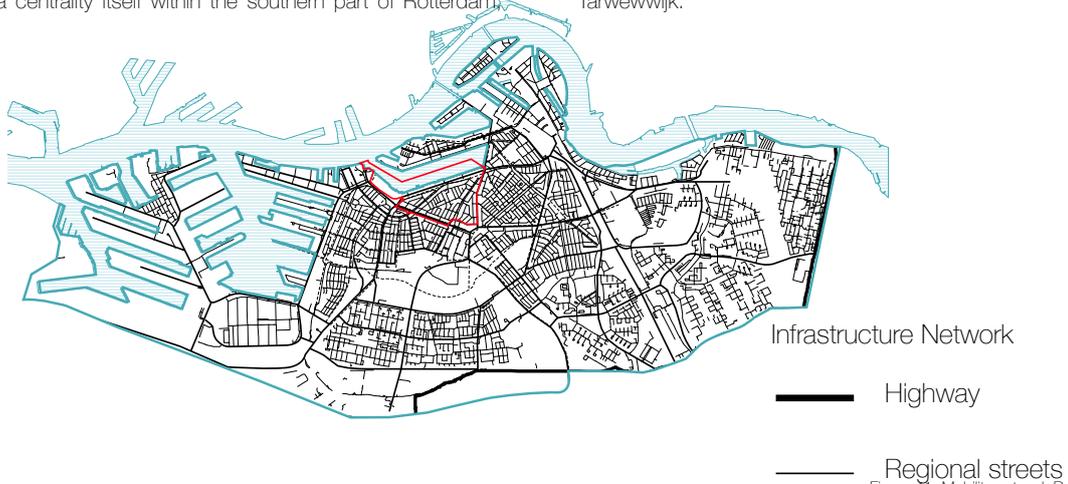


Figure 41: Mobility network Rotterdam South

Source: By author

4.5.8 OPPORTUNITIES FOR CURRENT BIKING INFRASTRUCTURE

The municipality of Rotterdam is working hard on a more social, liveable, dynamic and healthy city. This means that the use of cycles is encouraged as an alternative to short car trips in the city. The movement of industrial activities from the water edge will decrease the amount of traffic by truck drivers. This can stimulate

attractive opportunities for bicycle infrastructure that is also well connected to the whole southern part of Rotterdam and city center in the northern part as well. Also, a new network for slow traffic (cyclist and pedestrian) is also stimulated because the edges around Tarwewijk already has a lot of bikers.

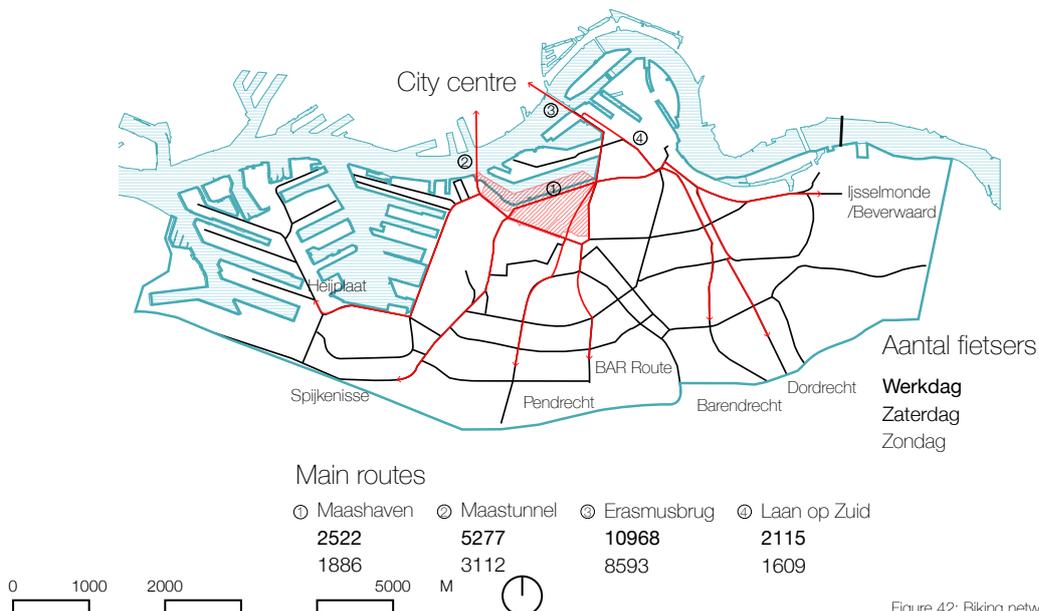


Figure 42: Biking network connected to surroundings

Source: By author

4.5.9 PUBLIC TRANSPORT OVER LAND AND WATER

The public network over land and water are well interconnected around Tarwewijk. This gives many opportunities to develop on the waterfront Maashaven. The public network over land and water is interconnected with current infrastructures of Rotterdam. Therefore, not only does development stimulate growing opportunities for Tarwewijk itself but also the accessibility for the rest of Rotterdam as a public domain for all target groups with different backgrounds.



Figure 43: Public transport network over land and water

Source: *By author*

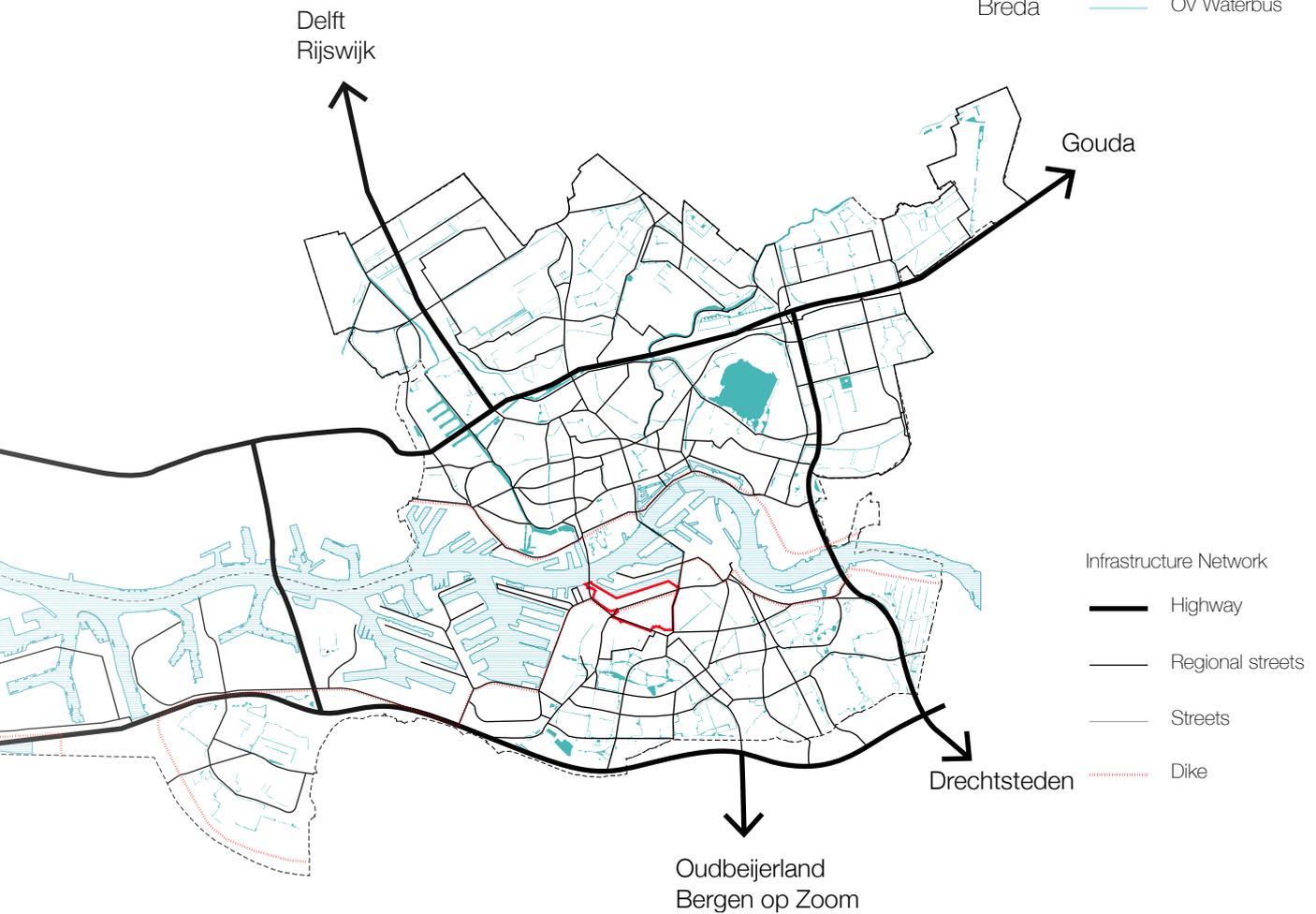
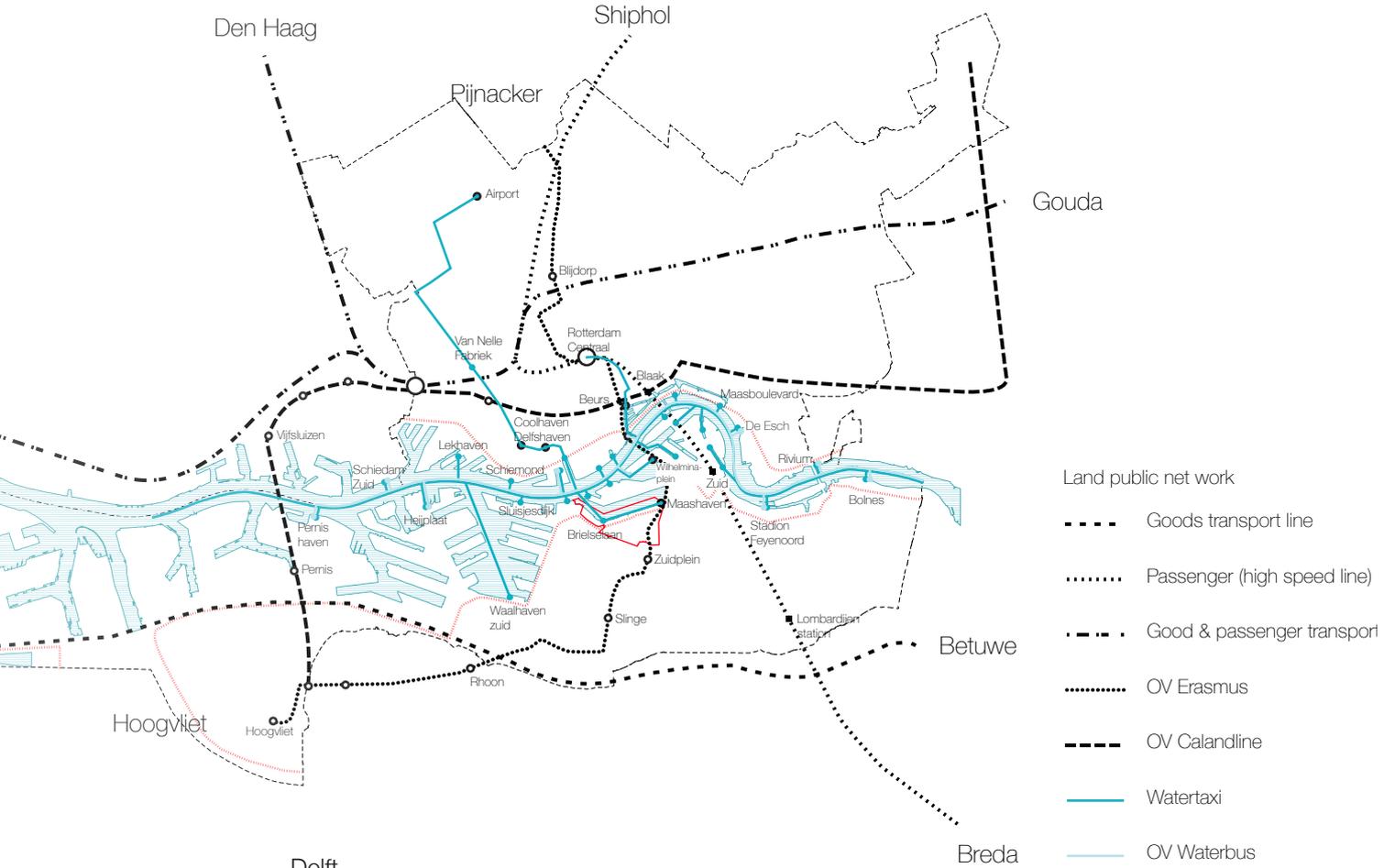
4.5.10 INTEGRATION ROTTERDAM NETWORK

The developments in Tarwewijk relates to different scales in Rotterdam and therefore stimulates Tarwewijk to be integrated into her whole system of Rotterdam instead of to be known as one of the worst neighborhoods in Rotterdam. This integration can contribute to the current policies the Municipality of Rotterdam to be an attractive city with a strong economy.



Figure 44: Network infrastructures Rotterdam

Source: *By author*



4.6 CONCLUSIONS

WATER

The water in Maashaven does not express itself spatially in Tarwewijk. After the expected departing economy of the wheat silos, the large bowl of water in the Maashaven no longer has any relation with the quay, with lines of sight as an exception. Also, the waterfront and residential area are strongly separated by the dike and the busy traffic on the Brielselaan. The high moving mobility and vacancy, caused by too small dwellings are worrying for the residential environment and the quality of life in the neighborhood. Because residents often move to other neighborhoods with larger homes, there is just no social connection with the neighborhood. This means that Tarwewijk is one of the worst districts of Rotterdam south. History has shown that water is one of the essential factors in our collective thinking and gives a common goal. Rosé used the water system of the Schie and the Rotte to create an attractive, elegant walking route around Rotterdam. Water can be used for different purposes. Water can also be used to tackle the future water nuances of the neighborhood. Can we use the large bowl of water in Maashaven, in this case, to give a certain capacity to the residential environment in Tarwewijk? There is a lot happening around the neighborhood that support developments in Tarwewijk.

The water analysis indicates different possibilities for open water systems to be expressed on the level of the neighborhood. The movements of harbor activities make it possible to reclaim the water edge as a public domain and a challenge to stimulate growing opportunities in Tarwewijk. Although there is nothing wrong with a hard quay in itself, the question can also be asked whether the mode of transition between land and water could and should not be much more vibrant. The watersides could develop into different destinations, each with its character. The current hard boundary of the water can alternate in both hard and soft bank types; the city can be enriched with diversity.

TOP LOCATION

The spatial analysis also indicates the strong position of Tarwewijk in Rotterdam. The current opportunities and challenges with water to enhance Tarwewijk relate to different scales of the neighborhood, Rotterdam south and the whole city of Rotterdam. The position of Tarwewijk is very centralized which makes the nodes; junction and edges around Tarwewijk more essential for future development. This stimulates the integration of Tarwewijk into the network of Rotterdam and contributes to an attractive city and strong economy.

Future abandoned area of post industrial spaces due to moving economy to the west of Rotterdam

Physical disruption of network between waterfront and neighborhood

Low quality of the private and public living environment in Tarwewijk

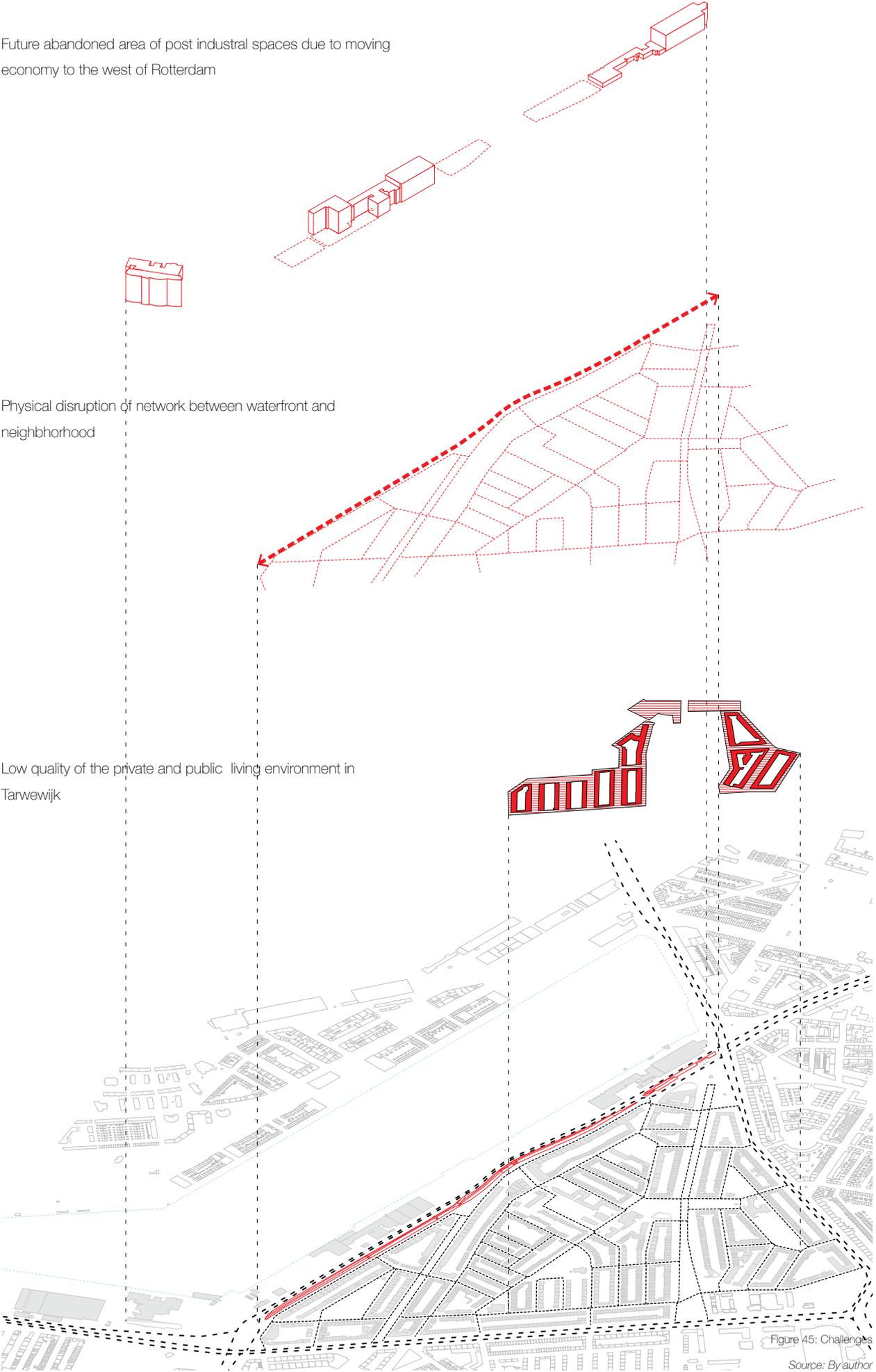


Figure 45: Challenges
Source: By author

5.0 CURRENT POLICIES AND INVOLVED STAKEHOLDERS

5.1 CURRENT POLICIES

This paragraph describes the current policies on different levels within Rotterdam in order to know how future development in

Tarwewijk could contribute to current goals and how they are complementary to visions from different stakeholders.

5.1.1 POLICIES ON CITY LEVEL

WATER ASSIGNMENT



ROTTERDAM CITY

What: The Nieuwe Maas is Rotterdam's identity bearer and represents a unique city quality. River city offers opportunities for innovative, water-based living and working environments. The expectation that the river is the inner city of Rotterdam, is becoming more concrete with the development plans for city ports.

How: Here are 9,500 to 13,500 homes. Scaffolding, pile houses and floating dwellings make the most of this dynamic environment on the water and city limits. Water also plays an important role in the infrastructure and recreation. The adapted structures have been further developed in recent years, for example for the Rhine Harbor, which makes the river quay attractive.

ROTTERDAM (NORTH)

What: Noord has an extensive water system of singles, bosoms and some big peas. The water contributes to the popularity and livability.

How: The North strategy is aimed at further development of these qualities, including new construction sites and business areas.

ROTTERDAM (SOUTH)

What: The case in Rotterdam South involves increasing social, economic, physical and cultural qualities. Water can play a role as a connecting factor between old urban areas and green gardens. This contributes to an attractive living environment. On South there is plenty of room for a new network of vessels and waterways, with many homes on the water.

How: In Rotterdam South the strategy aims to construct blue connection for additional recreational and ecological connections.

SOCIAL-ECONOMIC ASSESSMENT



What: Due to the stormy growth that the economies of Asia and Eastern Europe are taking, international competition between urban regions increases. In the vision policy of the municipality it is stated that Rotterdam in 2030 will be a clean, colorful port city at the mouth of the Meuse. The city with her recognizable skyline breathes a trade spirit and has an open and international character .

How: Building within the existing city means that Rotterdam aims at 56,000 homes. To attract more middle and high income to the city and to bind them. In the weaker neighborhoods, the restructuring and approach to the existing housing stock is central.

What: The task on the north bank focuses on further expanding the power that this area already possesses. Due to their location in the middle of the Randstad, office locations on this side of the city are already extremely successful.

How: The approach of North is based on better utilization and expansion of existing qualities: the hubs of activity and the good living environment. The neighborhoods around the city center (Delfshaven, Noord and Blijdorp) have the potential to grow into mixed urban living and working environments. development of these qualities, including new construction sites and business areas.

What: In the first decades after the war, Rotterdam South was a popular area for living and a place to live (career). That position must recover South. With the development of the Kop van Zuid and the restructuring of a large number of neighborhoods, South gained more quality and attractiveness.

How: In Rotterdam South, the focus aims on proactive private housing improvement and an intensive hot spot approach to less-favored areas.

WATERFRONT LONGTERM VISION



What: Extend the activities of the mainport from a classic port economy to a knowledge intensive economic complex that fits with the urban knowledge and services economy.

How: Sustainability is a fundamental feature in it, in all aspects: social, economic and ecological. A vital part of the intended sustainability is a climate-proof and energy-neutral development. This will provide the program with the climate objectives Of Rotterdam, respectively on the waterfront and on the energy side.

What: Merwe-Vierhavens will develop into the next twenty to thirty years new water-oriented district with 4500 to 6500 homes and a host of businesses and facilities that form part of the heart of the Clean Tech Delta.

How: Doing this with high sustainability ambitions that go hand in hand with a temporary and trend-setting use of available shores, buildings and plots whose final redevelopment is still waiting for itself development of these qualities, including new construction sites and business areas.

What: Rijn-Maashaven brings ambitions with City ports and the Clean Tech Delta near the urban audience. The Waal-Eemhaven renews and modernizes with, among other things, the fruit cluster, transshipment for container transport within Europe and bulk warehousing. At RDM-Heijplaat, the RDM terrain ensemble, garden village Heijplaat and the Quarantain Terrain which has already started.

How: Restructuring infrastructure, by increasing intensive use of space and by transporting a larger proportion of goods by inland waterway or rail.

In RDM educational institutes, technology companies and innovative manufacturing industries strengthen each other.

5.1.2 POLICIES ON TARWEWIJK

WATER ASSIGNMENT



What: Tarwewijk has enough green for water infiltration but no water systems on the subsurface. In accordance with the water policy, expansion of the paved surface must be compensated, at preference in the form of open water for retention.

How: The Hollandse Delta defined the rule that an increase of hardened surface should be compensated with 10% of that increase water surface. There is a task to realize 4.206 m³ of water storage in this area. This complies with the measure from the communal water plan to search for water storage opportunities in the district.

SOCIAL-ECONOMIC ASSESSMENT



What:

1. Improve image: remove problems in silence
2. Management en maintenances of the environment
3. Public space and accessibility

How:

1. - Improvement of residential environment and public space
- Provide transformed work-living environments
2. -Improvement of the housing quality en supply of family housing
3. - Utilize green environment and break barriers to public spaces

WATERFRONT LONGTERM VISION



What: The scale of the port, the lushness of the river and the dynamics associated with it are experienced in the industrial part of the area, but not at all with its residents.

How: The strip between Maashaven and Brielselaan can also be shaped according to these principles in the future. The area is characterized by the mix of features, excellent in this environment. Facilities and activities are interchanged with solid residential buildings with a combination of refurbished heritage. This environment is suitable for (young) small households with middle and low income, which are urban-oriented and value creativity and vitality.

5.1.3 MERGER OF INTEREST TO SUPPORT AN INTEGRATED PLANNING PROCESS

The current policies within Rotterdam indicate different interest, but they all aim for an attractive living environment and strong economy in Rotterdam. According to Hall (2009), one can not take care of business interest alone without taking care of people and planet as well. Therefore prof. Hall aims to shift individual interest into a merger of interest by different stakeholders using the model of Elkington (see figure below).

In the rehabilitation process, one can not depend on government alone to support an attractive living environment but is dependent on resident to take actions as well. Therefore this thesis aims to create a coherency between a bottom-up and top-down approach to support a merger of interest of involving stakeholders in the public and private sector. Within this, it is essential to propose a win-win situation for both public and private stakeholders. The new planning for coherency in

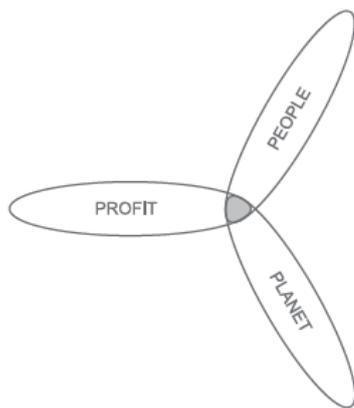


Figure 46: Merger of interest according to the Elkington model
Source: Hall, (2009)

waterfront and deprived neighborhood in the thesis can therefore also be complementary to current policies and is not a process on its own.

5.1.4 POWER/INTEREST MODEL

In order to support a common interest, an stakeholder analysis will be made by an power/interest model. The Matrix, in the figure below, is a two by two grid where the dimensions are the stakeholders interest (Brysons, 2004, p.30). This model will help how organizations can meet their mandates, fulfill their mission and create public value.

The next pages describe the possible involving stakeholders within this integrated planning process.

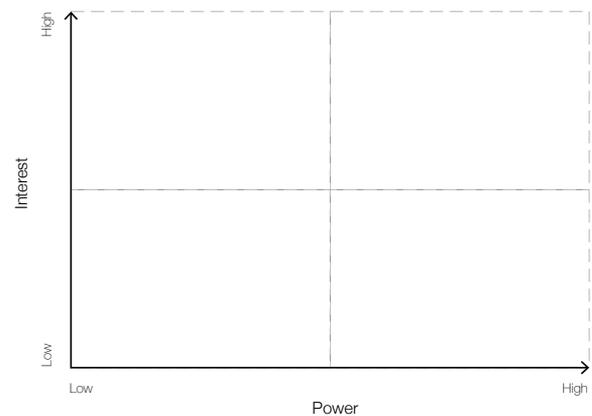


Figure X: Power vs interest grid
Source: Adapted from Bryson (2004, p. 30)

5.2 STAKEHOLDERS

This paragraph describes the involving stakeholders in the integrated planning process of Tarwewijk. In addition, they also

describe how they can be involved in strategies on different scales.

1. GOVERNANCE



Municipality

Interest:

- Building within the existing city that contributes at 56,000 homes in Rotterdam.
- Keep more middle and high income to the city and to bind them.
- The restructuring and approach in Tarwewijk to the existing housing stock.
- Improvement of residential environment and public space
- Provide transformed work-living environments



Waterboard Schieland and Krimpenerwaard

Interest:

- Create dynamic environments on the water and city limits (quay) by pile and floating constructions.
- Emphasis the important role of water in the infrastructure and recreation.
- Realize 4.206 m3 of water storage in Tarwewijk.

This complies with the measure from the communal water plan to search for water storage opportunities in the district.



Corporations

Interest:

- Increase housing comfort within Tarwewijk by energy sufficient tools that reduce energy bills
- Increase living environment for residents by adaptive measurements

2. RESIDENTS



Landowners (Protected residents)

Interest:

- Revalue housing stock for possible buyers
- Minimize energy bills without making high investments
- Remain renter by using energy sufficient tools in the rehabilitation process which increase the housing comfort.



Renters of owner occupied housing (Unprotected residents)

Interest:

- Remain living in Tarwewijk without paying to much rent
- Increase space and quality of their houses without having to make high investments
- Re-use of water reducing water bills
- Increasing of the living environment

3. LOCAL INITIATIVES



Interest:

- Increase the use and awareness of current programming and facilities in the neighborhood to enhance social structures and livability in public space.



Organization for the neighborhood and by the neighborhood". It is an important meeting point where the residents can make use of the facility and knowledge provided by their workers. (Website, face book page and local newspaper)



A community center with several activities and spaces for different groups of residents (breakfast meetings; Dutch, sports, drawing, theater & computer lessons).



An organization bounded to the Millinxparkhuis and responsible for providing clear and reliable social activities for the residents.



The Culture Workshop Tarwewijk provides shelter to residents' initiatives that have no independent place where they can meet. Partners: Women's Team Tarwewijk, Group of Media Artists.



A space which offers different entertainment clubs (cooking lessons, darts and bingo, i.e.) for the community.



A school that holds parent meetings which encompasses several subjects (advises and weekly workshops), and with music lessons for the kids, helping in their learning process and self growth.



A "home in the street" project, with young volunteer work, where the former street kids are now the eyes and ears of the neighborhood.

4. PROFESSIONALS

Designers/Ingeneers



Interest: - Contribute to climate change and a good image of the city of Rotterdam by the use of academic knowledge and water sensitive design in an integrated proces considering Waterfront, neighborhood and climate change.

Entrepreneur/Employees



Interest: - Promote ambitions among businesses in needs and create dynamic expectations of residents and entrepreneurs.

5. Public users

Rotterdammers (Residents of Rotterdam)



Interest:

- Accessibility to places with affordable programming and possibility to Interact with groups of people with different background.
- Facility to enhance social and learning skills to be functioning in society.
- Support of possibilities to exploit personal development in trainee ships.

National/ international Visitors



Interest: Environment that support dynamic activities and show the identity and architectural heritage of the harbor of Rotterdam.

6.0 WHAT IF... SCENARIO MAKING

6.1 SCENARIO MAKINGS..

For this project, the implementation of an integrated and multi-level approach is needed, serving the principles of a smart, sustainable and inclusive development that can make Tarwewijk and the whole city an attractive place to live, work, visit and invest.

The main question that is to be answered in this thesis was: How can we use water in spatial design in such a way that the Rotterdam delta is climate adaptive and the socio-economical processes in waterfront and deprived neighborhood are enhanced as a whole for future growth and improvement of the quality of life in the city?

To find out how water can be involved in the spatial environment of Tarwewijk and socio-economic values, this chapter elaborates some scenario's that is supported by the "what if...?" questions. It will elaborate the potentials of how Tarwewijk can function in the context of Rotterdam south and the city Rotterdam as a whole. By doing so, the hypothesis is testes. The hypothesis that was formulated was:

"The use of water management in spatial design will create new opportunities that will enhance the socio-economic processes in both waterfront regeneration and urban renewal as a whole. This will have an effect on the future and quality of life in the city of Rotterdam."

This experimentation shows the involvement of water that will lead to potential strategies and interventions how to enhance the living environment in Tarwewijk. To know the impact of potentials in the whole of Rotterdam, the use of the "what if.." questions will be done in different scales: neighborhood, Rotterdam South, and Rotterdam city.

The "what if.." questions that are formed to experiment are:

What if.. water plays an asset role to empower Tarwewijk as a declining neighborhood

What if. Tarwewijk is pointed out as a centrality by edges and nodes in Rotterdam South?

What if.. the inner city and Tarwewijk had the possibilities to grew to each other?

6.1.1 WHAT IF... WATER PLAYS AN ASSET ROLE TO EMPOWER TARWEWIJK AS AN DECLINING NEIGHBORHOOD

The developments at and in the Maashaven can give a specific capacity to Tarwewijk which is not possible in the neighborhood itself but offers possibilities for its residents. By investing in developments at the waterfront, the district will gain more value. To make the developments on the Maas a significant factor for the Tarwewijk, a certain interaction is expected. Also, this drawing illustrates the necessity to create clear physical connections that can take away the barrier at the Brielselaan, but also emphasizes the restructuring of the neighborhood in its current urban fabric. Also, the developments in Tarwewijk must also focus on the moving target groups within the Tarwewijk district. There is a high demand for living on the water, why not also focus on the growing income group of Tarwewijk that do not coincide with the more upper classes? This asks for a dynamic environment on and along

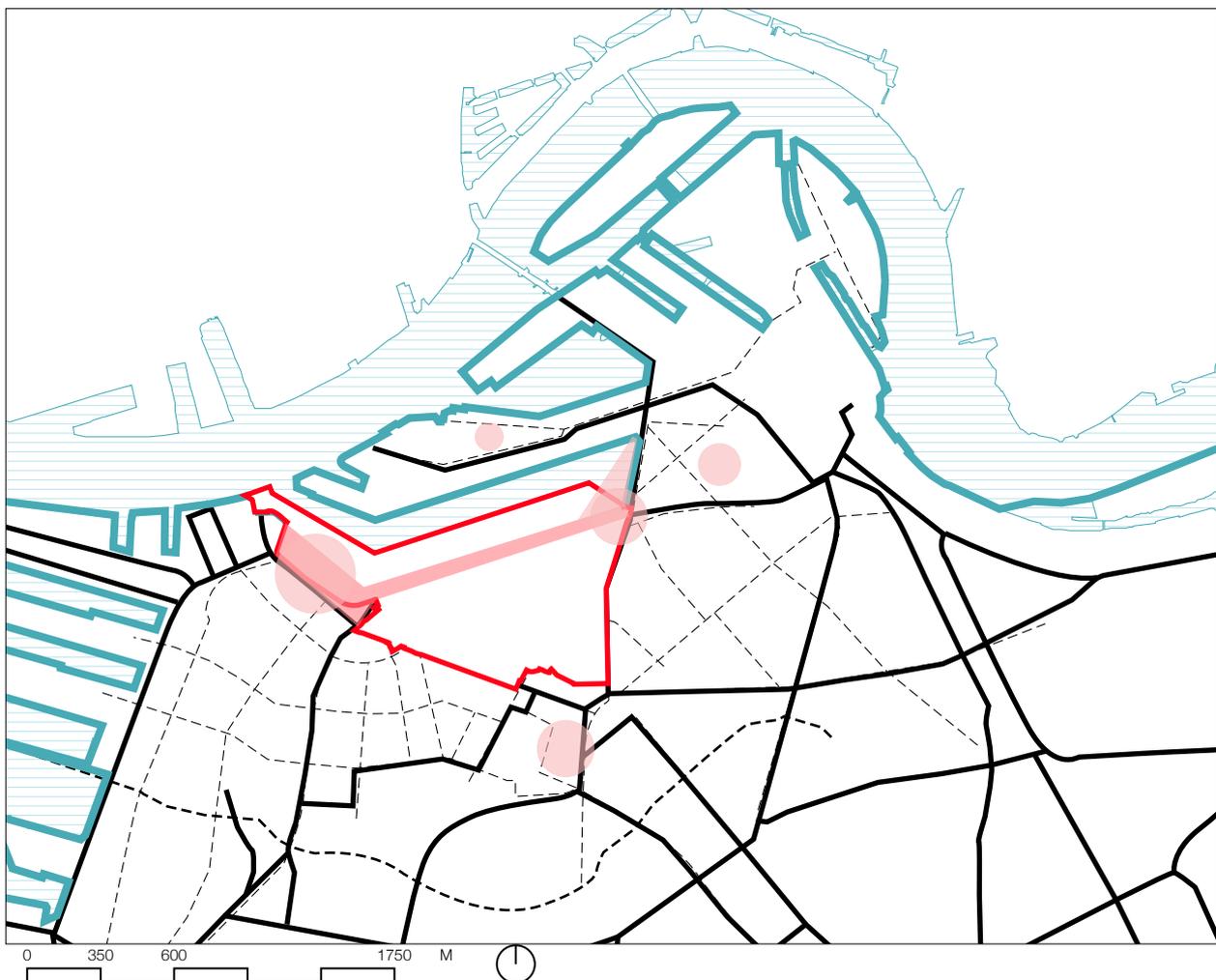
the water edge and high qualitative private and public spaces. By doing this, the possibilities are high that the moving mobility within Tarwewijk will decline and bonding with the neighborhood will increase. Tarwewijk can benefit from this restructuring of the living environment and redevelopment of the Maashaven. Literature studies (Romein, Doucet, Daamen) has shown that a thriving waterfront is focused on mixed functions and activities. The features at the waterfront must be diverse and accessible to the entire public of Rotterdam to be successful as well. Also, to empower neighborhood in decline with a lot of private owners, it is essential to use a rehabilitation process which emphasizes on the different possibilities to sustain and revalue dwellings without having to cost much and retains affordable housing.



6.1.2 WHAT IF.. TARWEWIJK IS POINTED OUT AS A CENTRALITY BY EDGES AND NODES IN ROTTERDAM SOUTH?

This question unfolds the central position of Tarwewijk in Rotterdam South as a potential. It is reminded of the situation how Rotterdam started to grow in the golden century. This was the time when water was an asset in the economy, but also different harbor activities on edge. Also, this drawing illustrated the attractiveness to live in the Tarwewijk. It is central; one can live both in a more quiet environment or on the busy edges of the district within few minutes of other facilities and places in Rotterdam South. This means investment in the living environment of the area is necessary. There

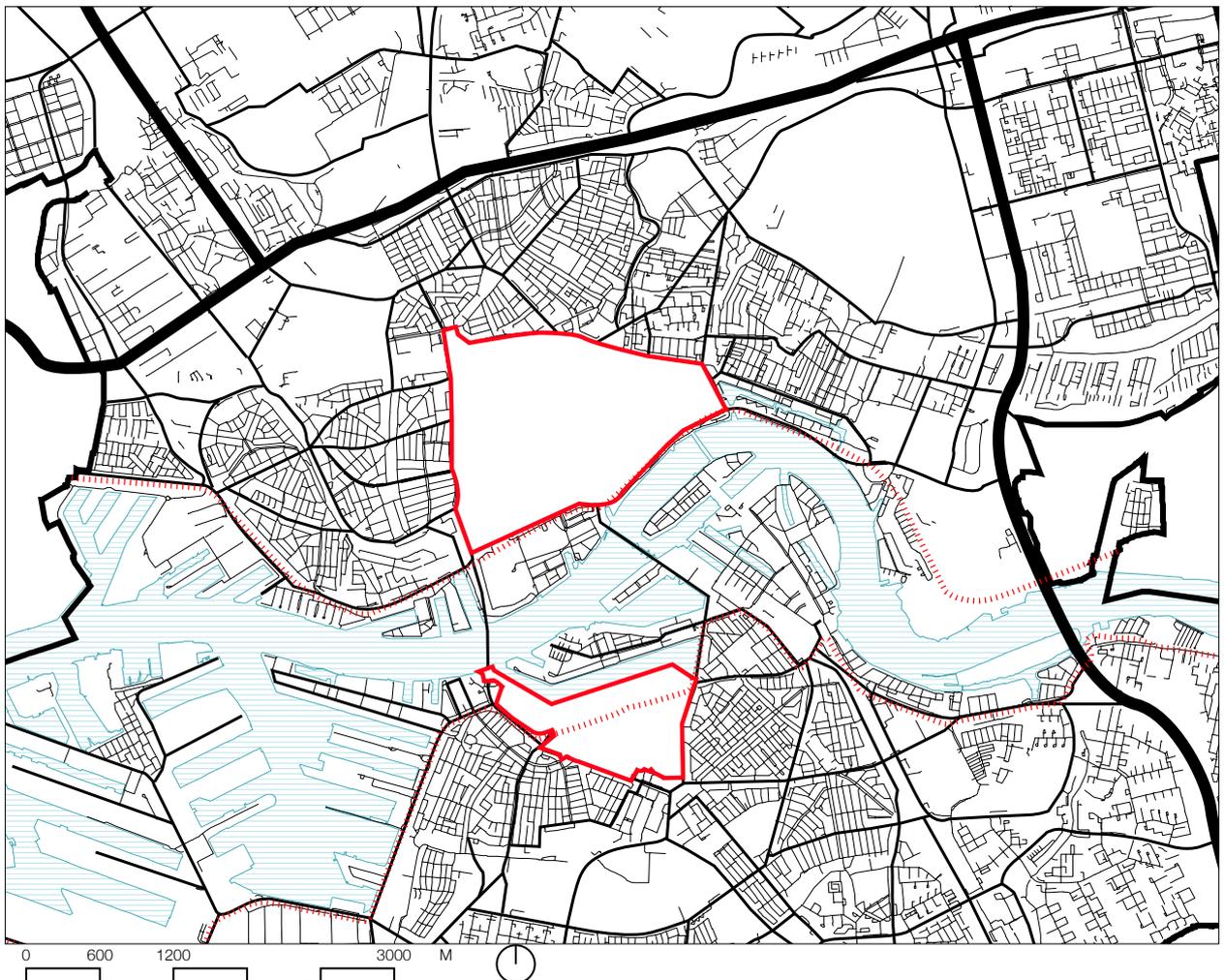
are a lot of development and renewal happening that support this development in the neighborhood. The current edges and nodes that define Tarwewijk will become essential for future developments. The developments also help to claim the water back. Not in a way that it was used to be for harbor economy, but for public enjoyment and private developments that support the growth opportunities in Rotterdam. This also encourages the southern part to grow forward from this position to enhance other disadvantage neighborhood in Oud-Charlois, the street network is already there.



6.1.3 *WHAT IF... THE INNER CITY AND TARWEWIJK HAD THE POSSIBILITIES TO GREW TO EACH OTHER?*

This question amplifies the influences of potential development in Tarwewijk as an integral design reflecting on the whole city Rotterdam. Both centers can be part of the beating heart of Rotterdam like two bosoms and the Meuse as an artery that pump life in other enclosure roads. These roads can be seen as veins in this figurative description. Meaning that Rotterdam can not live without one of them. The figure shows the essential need for linking between the two parts. The linking contribute to the current connections and enlarge the accessibility of the northern

en southern part. The collaboration between the two part are comprehensive and extend the different environments in Rotterdam as qualitative places. Both parts evolve around the Meuse. One as a mixed environment of functions, city center. The other one as a strong attractive neighborhood with a more quiet living environment within a few minutes away from active nodes and edges. This supports in claiming back the waterfront for both public en private and create different characters of the environment along this edge of the dynamic water.



6.2 FROM RESEARCH TO DESIGN STRATEGY

6.2.1 DESIGN STRATEGY

The “what if?” Scenario's through different scales has shown different potentials and has resulted in various design strategy related to a coherent design process. On the scale of the living environment of the neighborhood, the design is based on spatial restructuring in the current situation of the urban fabric. This will enhance the existing environment with water-based principles in the private and public sector that is gained from theoretical and spatial analysis. On the scale of the whole district Tarwewijk, the design is based on reconnecting residential area with the water edge. This scale also reflects on the programmatic design of the waterfront that will support growth opportunities in Tarwewijk. The

programmatic design then again also contributes on the larger scale of the city by the public involvement of different groups of people with different background. On the larger scale the three different design strategies are involved in a coherent planning process that will integrate Tarwewijk in the current network of Rotterdam as an attractive neighborhood with a strong economy in which it will maintain the identity of harbor heritage. This is all done with water playing an essential role in each one of the design strategies. The three main strategies that form this coherent planning process are:

1. Rehabilitate
2. Reconnect
3. Reactivate

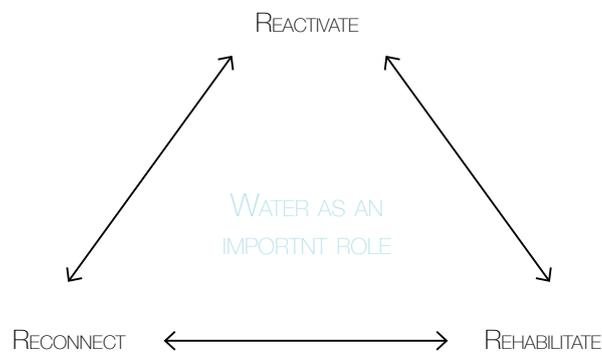


Figure 47: Coherent planning process

Source: By author

Strategy 1: Rehabilitation Through Water sensitive design

Structural based: Restructuring within the current fabric of Tarwewijk, demolishing less as possible.

Objectives

- Private:
 - Sustain low qualitative housing by making them energy sufficient
 - Re-Use of water by capture and restore water
 - Create attractive living environments and decrease moving mobility
- Public:
 - Increase awareness of climate change and requalify underused spaces
 - Increase awareness of current initiatives in the neighborhood
 - Create different possibilities for activities to occur for all residents

Strategy 2: Reconnection To main water body

Connection based: Emphasise current corridors and creating new ones to strengthen accessibility

Objective

- Integrate neighborhood with waterfront by dynamic public en private activities
- Increase accessibility to the waterfront by divers corridors

Strategy 3: Reactivation Use on & at the water

Programmatic based: Multifunctional clusters stimulating regeneration of Tarwewijk

Objective

- Stimulate growing opportunities for the residents of Tarwewijk that mainly emphasize on the low-income groups and social climbers
- Offering of facilities to uplift the socio-economic status and skills of residents of Tarwewijk
- Support of training centers for different disciplines

6.3 FROM CHALLENGES TO OPPORTUNITIES

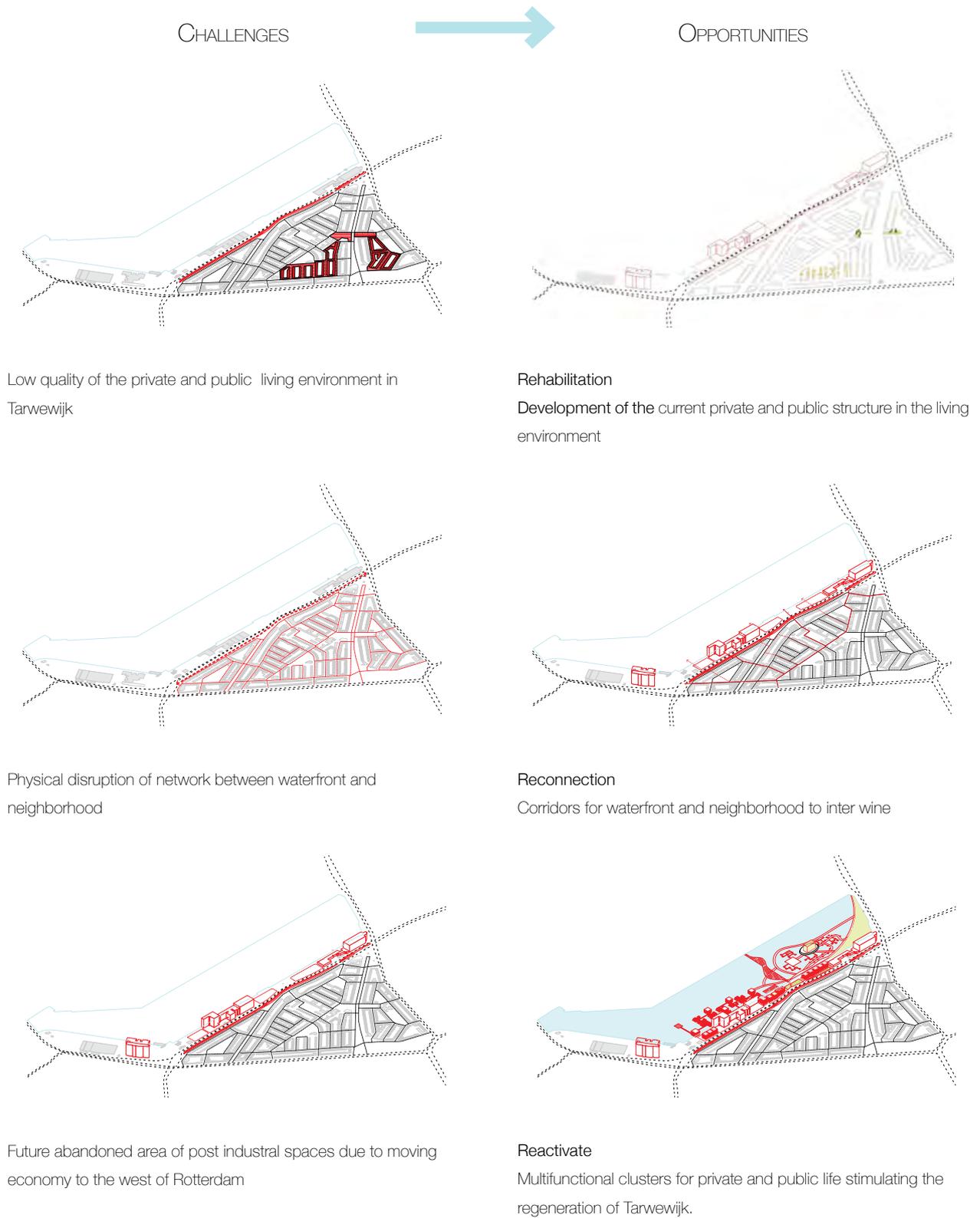


Figure 48: Challenges to opportunities

Source: By author

7.0 DESIGN

7.1 DESIGN

DESIGN

The three different strategies take part in an integrated planning process. This process can be described in four phases.

Each phase enforces the strategies in different levels and therefore are overlapping each other. The developments are attractive for the neighborhood and the living environment in each phase. The four stages can be described as following:

Phase 1: Compact neighborhood

Phase one is about keeping the soft and quiet living environment by the current high building edges and restructure within the existing urban fabric to enhance the quality of the physical living environment.

Phase 2: Accessible waterfront

This phase can start when industrial activities are slowly moving westwards from the waterfront and therefore overlaps phase one. This indicates infrastructural connection through the dike landscape and private development.

Phase 3: Integrated neighborhood

Phase three adds a new layer of mobility for slow traffic through the neighborhood and to the broader network of Rotterdam with a new bridge over water. This includes different levels of connection to new landscapes within the dike.

Phase 4: Activated River

Phase 4 evolves the area of water by extending phase 3. This includes a new community on water for public use by different income groups and private use for locals in Tarwewijk And is connected to current development. These are floating market, floating urban farming and floating housing.

Within these phases, waterfront redevelopment and neighborhood renewal become coherent and enhance Tarwewijk as a whole. The next pages describe how these phases are done and how the strategies are involved.

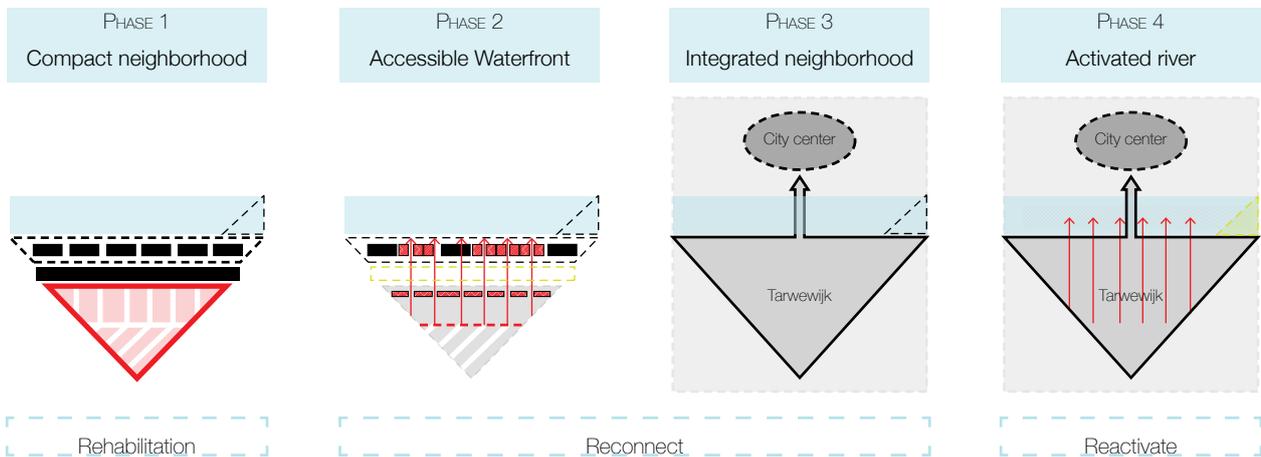


Figure 49: Process of development per phase.

Source: By author

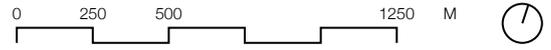


Figure 50: Phase 1: Compact neighborhood

Source: *By author*



Figure 51: Phase 2: Accessible waterfront

Source: *By author*



Figure 52: Phase 3: Integrated neighborhood

Source: *By author*



Figure 53: Phase 4: Activated river life

Source: *By author*

7.2 PHASE 1: COMPACT NEIGHBORHOOD



Figure 55: Plan of Phase 1: Compact neighborhood

Source: By author

Maintain edge structure:

This phase stimulates the edge structure of the neighborhood to be maintained. This result in the neighborhood having a soft living environment within a few minutes away from public functions and provide the opportunity for starters on the housing market to find a house for 1-2 years. These starters usually do not intent to live that long in the neighborhood, and example are the students from other cities of countries.

Rehabilitate living environment:

Also, This phase involves the rehabilitation strategy and focus on rehabilitation in the current urban fabric of the neighborhood. In the private sector, tools are provided to increase comfort and market value. In the public sector, tools are provided to increase the attractiveness of public space. This includes a new community house. This phase is a continuous process and does not have a specific end date. Within this phase an empowerment between the bottom-up and top-down approach in required. The municipality and government want an attractive living environment, but is dependent on residents due to a large private house hold. Resident are dependent on subsidies from the government in order to perform the rehabilitation process.

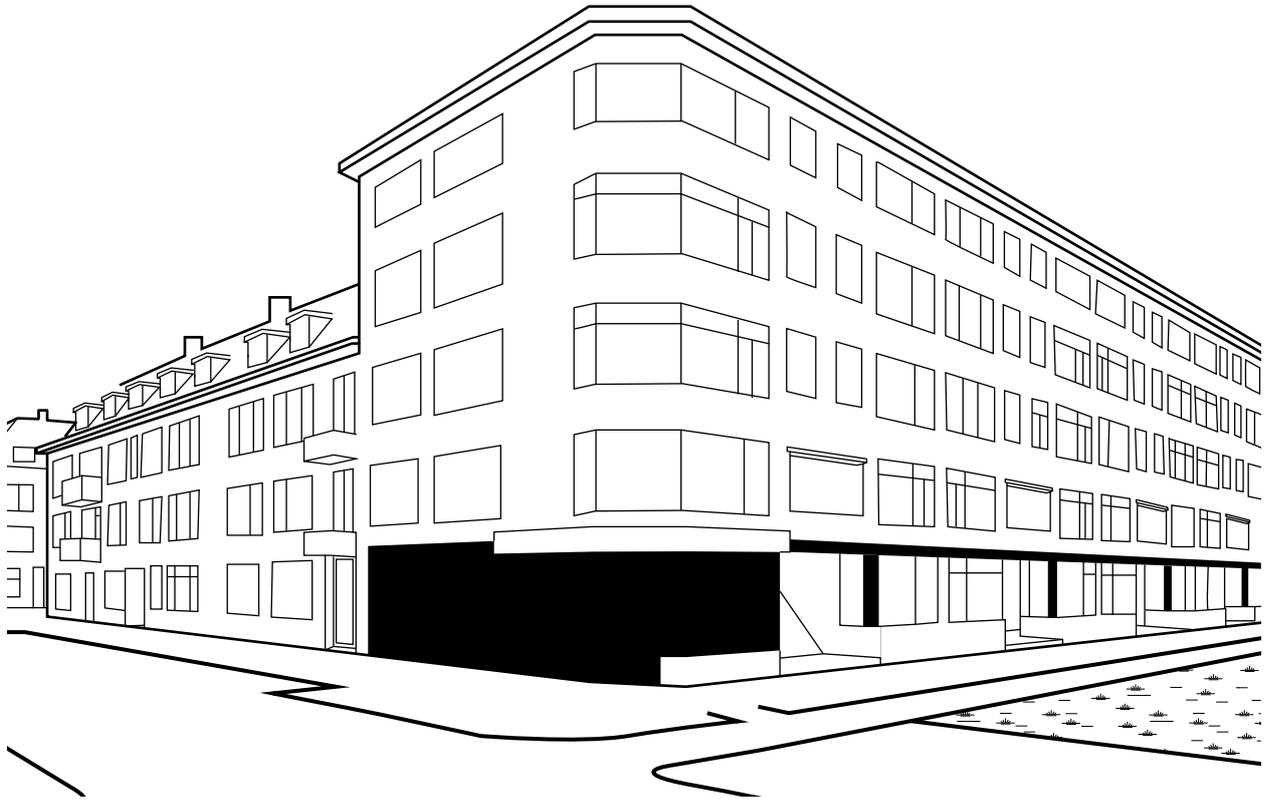


Figure 56: High edge of the compact neighborhood

Source: *By author*

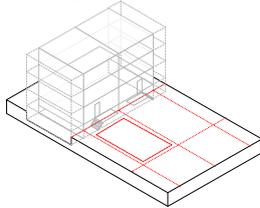
7.2.1 STRATEGY 1: *REHABILITATION* THROUGH WATER SENSITIVE DESIGN

WHAT

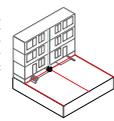
Tarwewijk is known as a transition neighborhood. When one has enough money or want to expand their families, they quickly move out of Tarwewijk. Also, the physical comfort and quality are lacking in the most privately owned housing which is 80% of the neighborhood. This causes high moving mobility in the neighborhood and no chance for social binding and or interaction. The goals are to provide opportunities which makes it attractive for private and public stakeholders to invest in the living environment of the neighborhood en reduce the moving mobility. This does not mean that housing for starters is out of the picture. To provide starters and the low-income spaces, the houses on the edges of Tarwewijk are maintained to keep the strong structure of Tarwewijk as a quiet inside neighborhood within a few minutes away from public spaces as junctions and nodes. Therefore the strategy emphasizes on restructuring Tarwewijk within the current urban fabric. The aim is to regenerate the neighborhood through water sensitive interventions that result in an attractive environment to live in. This strategy is divided into Three main intervention. One is focused on the private development in Tarwewijk, which will start in Mijnkintbuurt and is aimed to maintain the current inhabitant of Tarwewijk and decrease the moving mobility. This is done by providing different possibilities to invest in your house that increases the house comfort and is still affordable. By doing so landowners invest in their property value and renters of owner-occupied housing invest in their sufficient energy house which will save money on energy bills. The other two are focused on the use and experience of the public environment. This is done by re-qualifying the public space, which are Mijnsherenplein and Monumental square. The aim is to increase awareness of climate change, so spaces within the neighborhood are less vulnerable to heavy rainfall and make the living environment more attractive for a good quality of life. Also, the intervention also increases awareness of the current programs and facilities that are already available in Tarwewijk that offer a lot of activities that enhance residents as an individual and in social interactions. The mijnkintbuurt, Mijnsherenplein and Monumental square are chosen due to exposure to damage of heavy rainfall. Other parts of the neighborhoods can follow in time.

TOOLS

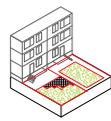
A PRIVATE



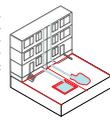
GARDEN



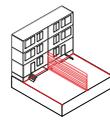
RAIN BARREL



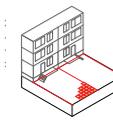
GRASS



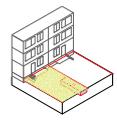
PONDS



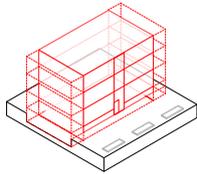
RAINWATER FENCE



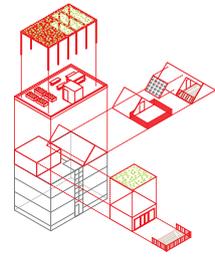
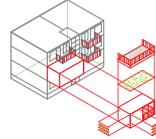
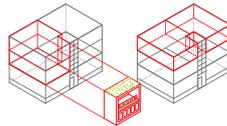
PERMEABLE PAVEMENT



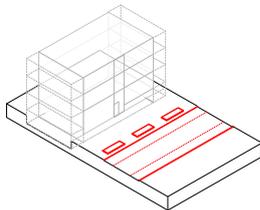
RAINWATER GRATE



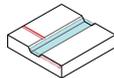
BUILDING



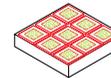
B PUBLIC



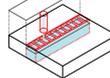
STREET



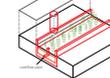
OPEN GUTTERS



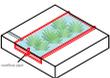
PERMEABLE PAVEMENT



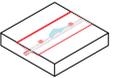
TRANSPARENT GUTTERS



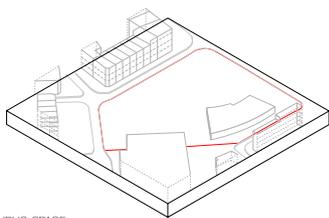
FACADE GARDENS



INFILTRATION STROKE



HOLLOW STREETS



PUBLIC SPACE



OPEN WATER CANAL



WATER SQUARE



PARKS



RELIEF



SANDY LANDSCAPE



NATURAL PONDS

Figure 57: Overview of the toolbox in the rehabilitation process.

Source: By author

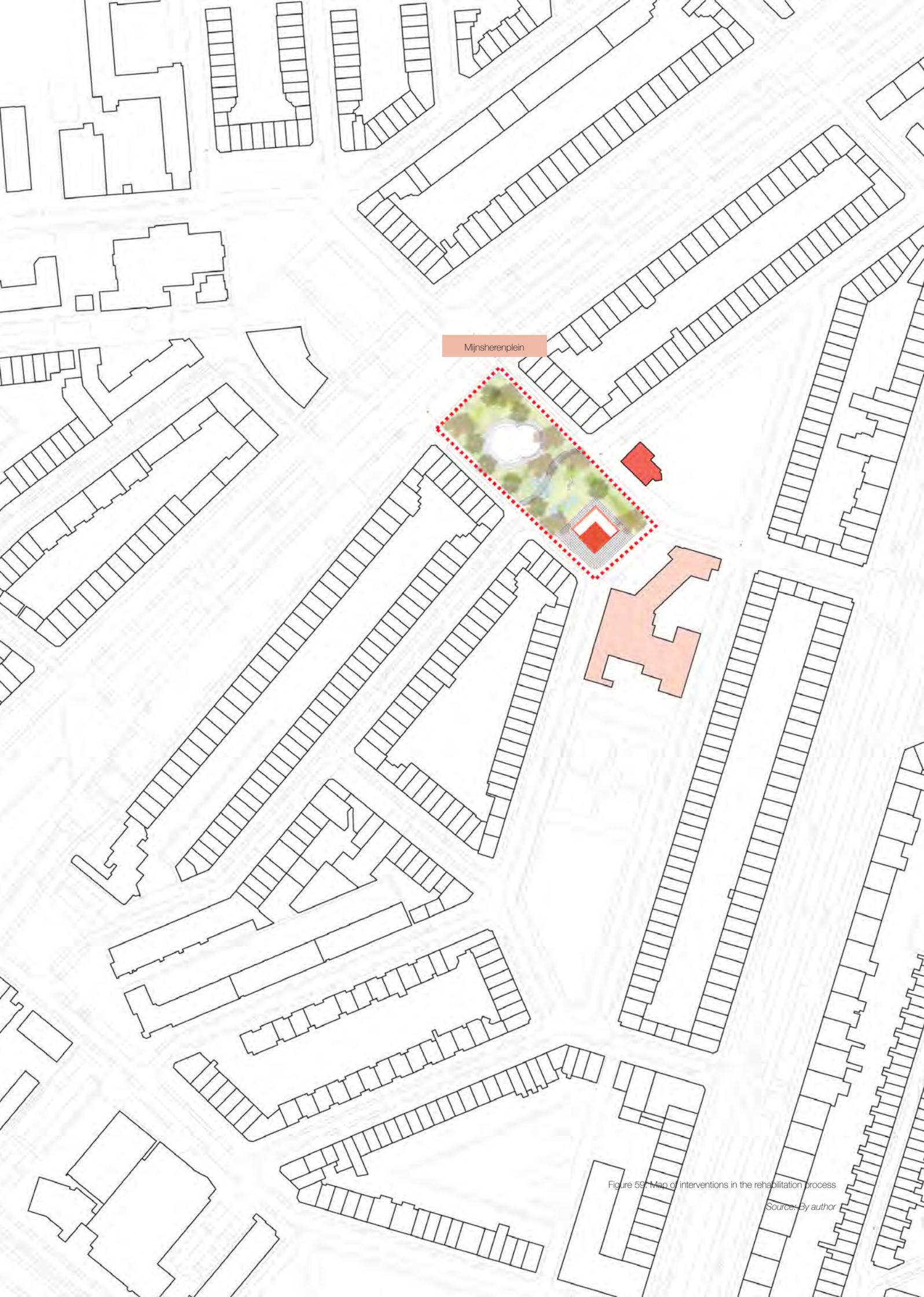


Mijnkintbuurt

Monumental square

0 20 40 125 M





Mijnsherenplein

Figure 59. Map of interventions in the rehabilitation process
Source: By author

7.2.2 MIJNKINTBUURT

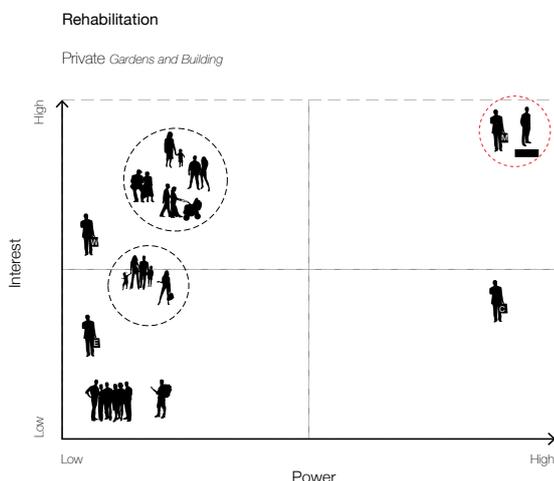
A. PRIVATE:

The goal is to maintain the social climbers in Tarwewijk by providing opportunities to create more space and sustain their dwellings. At the same time, it is stimulated to reuse water from heavy rainfall to anticipate on the effect of climate change and reduce energy cost. In order to stimulate the rehabilitation process for the low income group, municipality has to provide subsidies for the proposed tools to be carried out. The low income group are mostly situated in having not enough money and usually do not worry about climate change. But due to climate change and expected water nuances, the low income group are targeted in having damages which they may not be able to pay. Therefore, adaptation is required. The municipality can therefore propose attractive subsidies for the low income group to use the proposed tools which will save them money. Also, the living environment is enhanced and contributes to the goals of an attractive city and therefore is a win-win situation. Within the rehabilitation process we find a merger of interest between different stakeholders. For resident, it provides more housing comfort and save money for damages and high energy bills. The tools result in having an attractive neighborhood and the neighborhood will be adaptive for water nuances.

Building enhancing the housing comfort and property value

1. Expansion

This intervention provides different opportunities to extend your home to create more space and increase the quality of living comfort. This can be done by prefab systems that one can apply to the facade. Also one can also use green facades and roofs to infiltrate water from heavy rainfall. This results in less vulnerable public spaces for flooding.



2. Top-on

The intervention creates an extra floor where an opening in the slabs needs to be created. This can only be done by the top floor owners of this block. Green roofs and rainwater collection is also stimulated. The top on intervention can also be collective spaces, for example, communal gardening and or roof terraces that can be collaborated by the owner association (VE). This enhances the social opportunities of residents. Within this intervention different possibilities can be made with the private toolbox.

3. Merging

Within this intervention, two houses are being merged into one. In case of vertical merging, an opening in the slab needs to be created. With this intervention it is hard to make a profit because you will have one house for 500 - 600 euro instead of 2 houses of 400 euro each and therefore is not stimulated so often. But this can be used to decrease vacancy in the neighborhood.

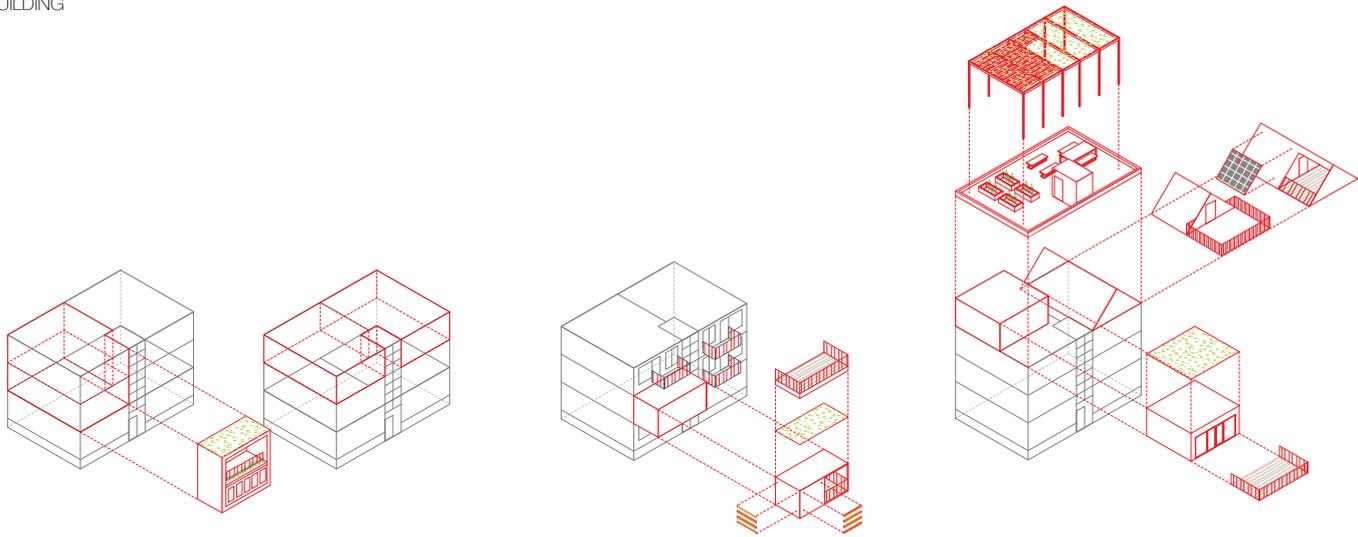
Gardens increase buffer capacity of water and reuse to sustain

Private owners and renters can apply different tools to infiltrate, capture and restore water to contribute to the effect of climate change. By doing this, one can save a lot of money by reusing water for own purposes.

Financing

The municipality already offers some subsidies to create climate proof environments. To stimulate this due to climate vulnerability, the municipality can provide subsidies for the low-income group to make your home sustainable. The high income can get subsidies as well, but 25 % less. This is because they usually can adjust.

BUILDING

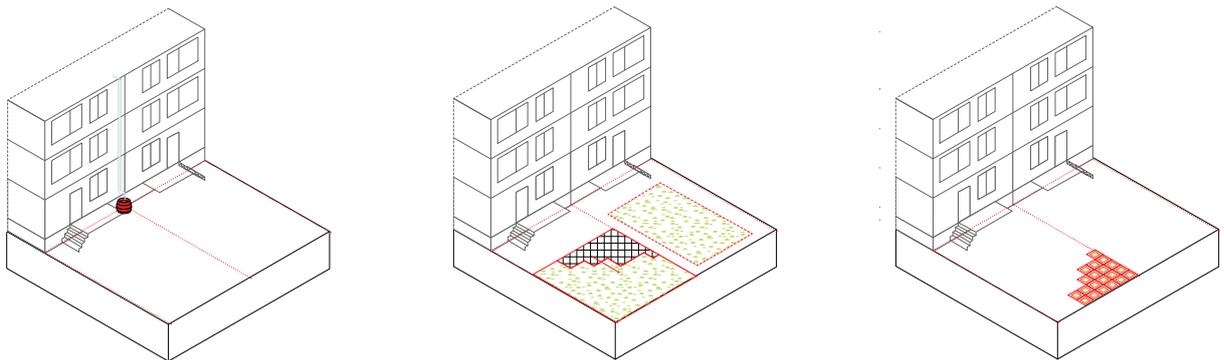


MERGING

EXPANSION

TOP-ON

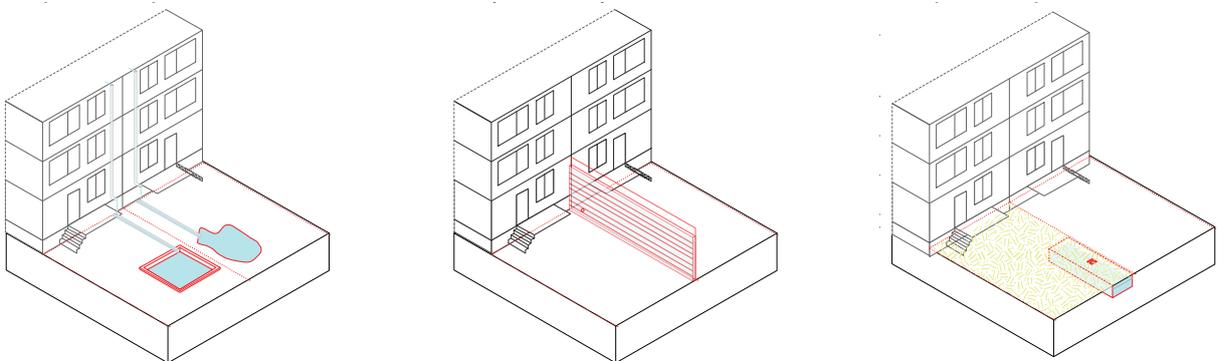
GARDEN



RAIN BARREL

GREEN GARDENS

PERMEABLE PAVEMENTS



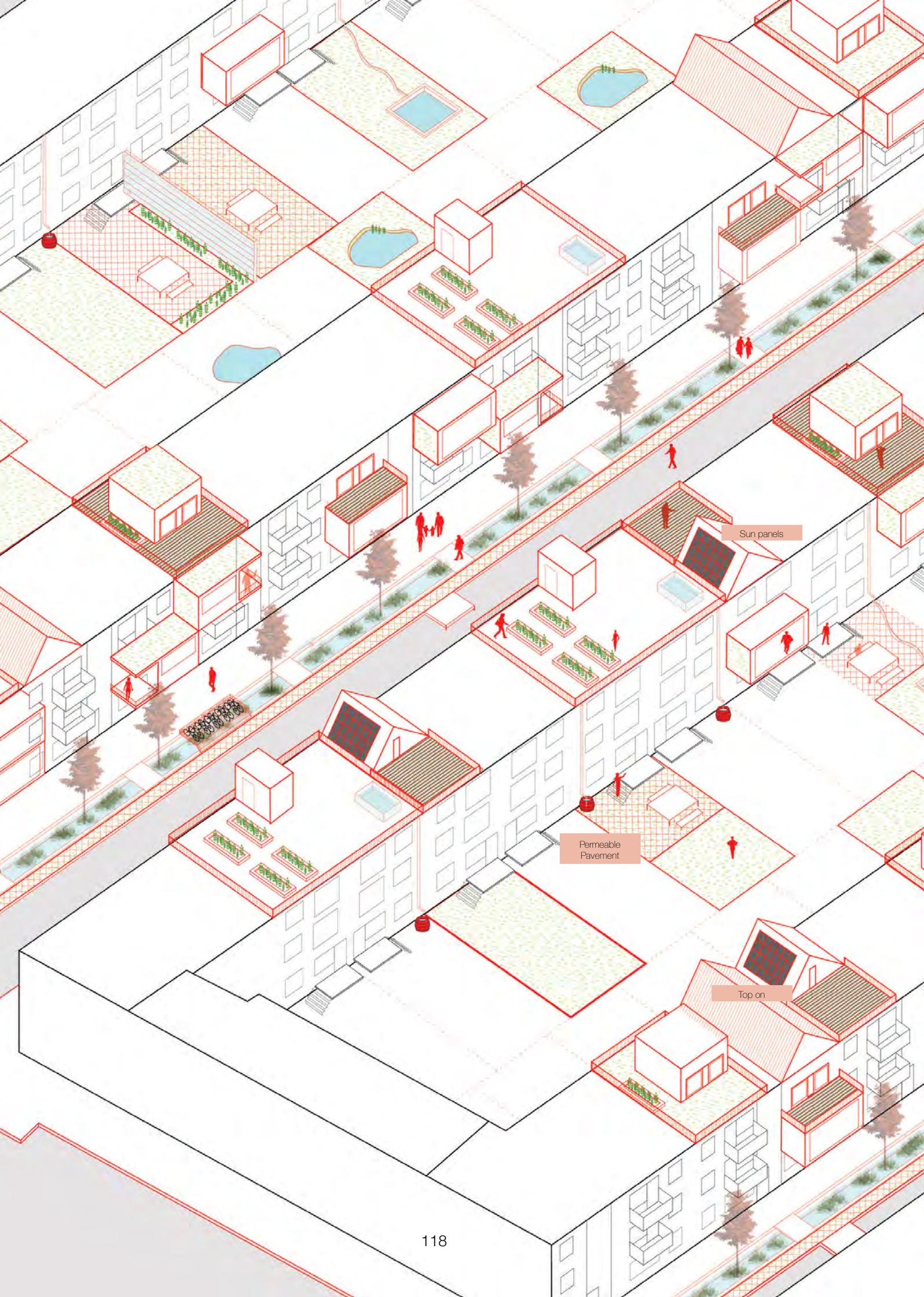
RAINWATER PONDS

RAINWATER FENCE

RAINWATER STORAGE

Figure 59: Private toolbox

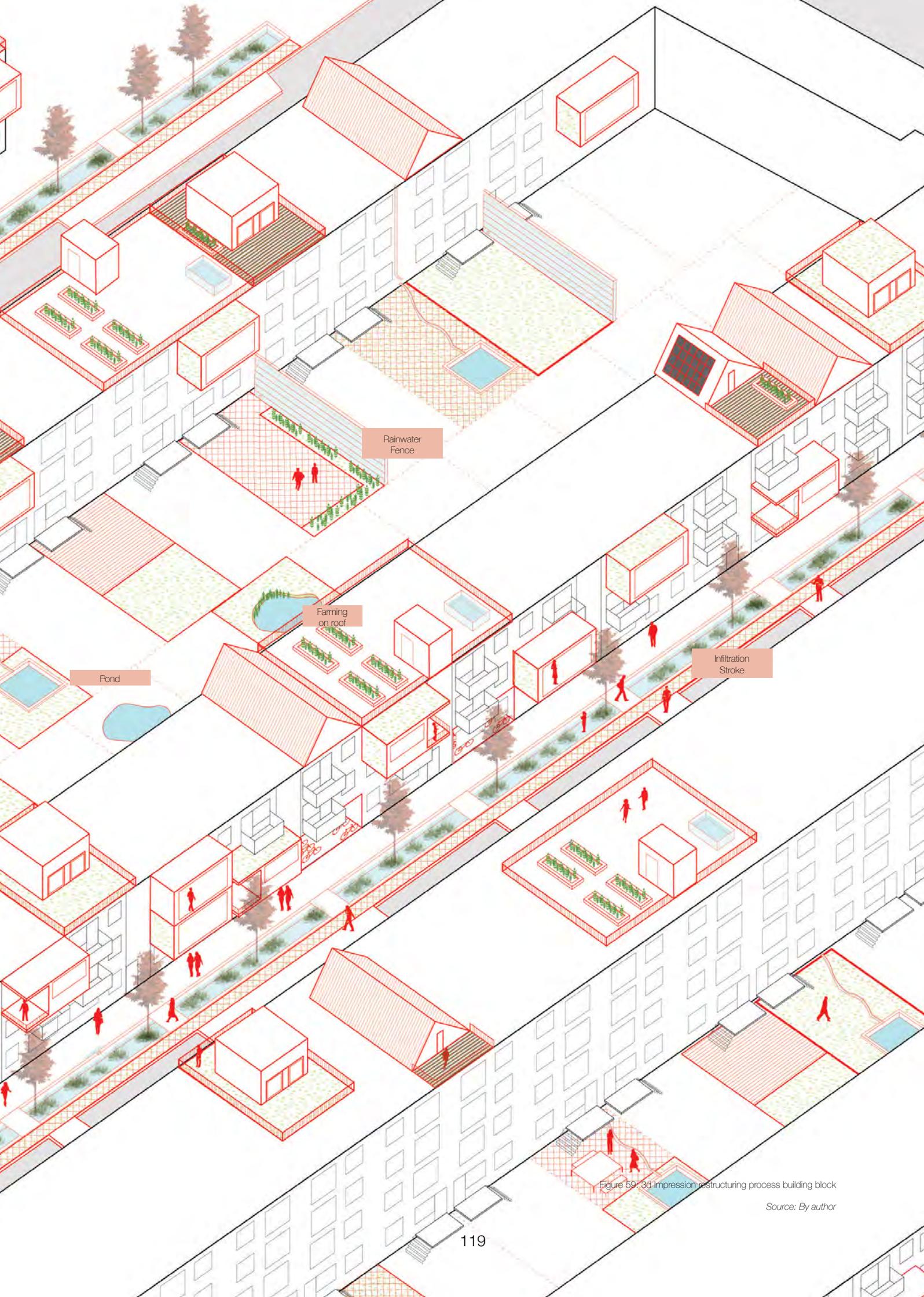
Source: By author



Sun panels

Permeable
Pavement

Top on



Rainwater Fence

Farming on roof

Pond

Infiltration Stroke

Figure 69: 3d Impression restructuring process building block

Source: By author



Figure 60: Scene rehabilitation on street level

Source: *By author*



Figure 61: Scene rehabilitation on street level
Source: By author

7.2.3 QUANTIFICATION OF THE WATER TASK

This section describes how the rehabilitation process in one block can contribute to the total water task of Tarwewijk. In this scenario, a rain rainfall of 50 mm is assumed. As a result, the following quantities will fall on the respective surfaces.

HOUSING BLOCK	:130x42 = 5460 m ²
GARDEN	:118x10 = 1180 m ²
ROOF	:5460 - 1180 = 4280

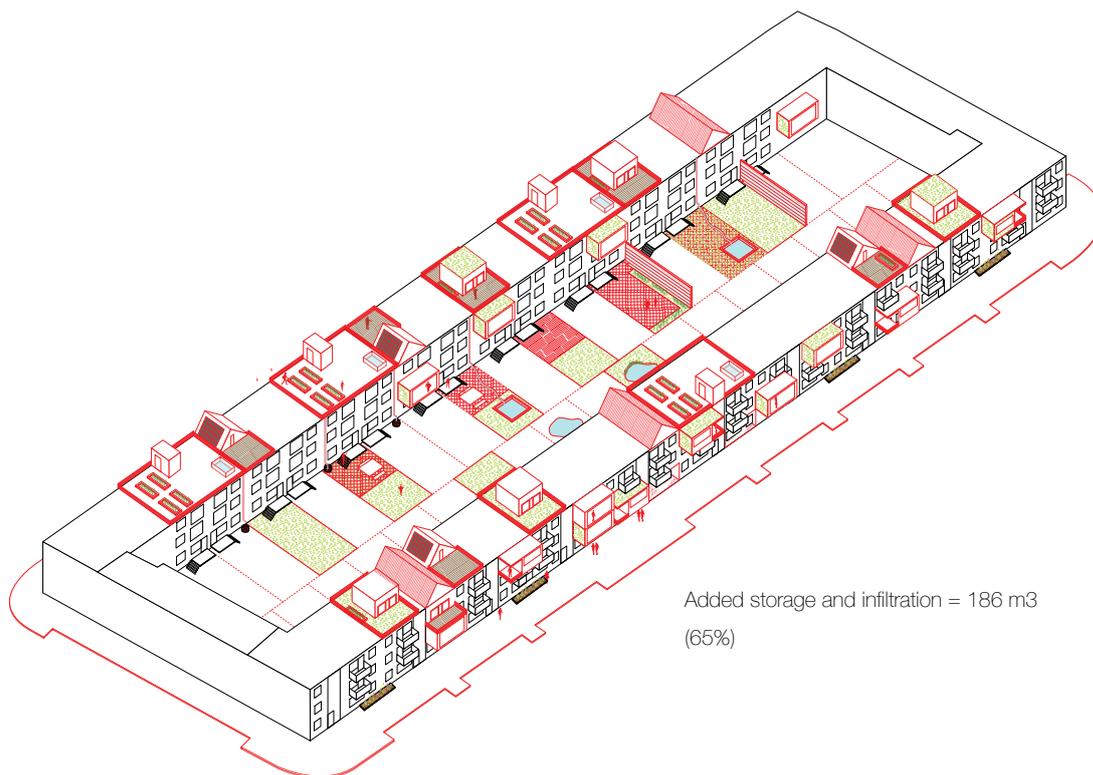
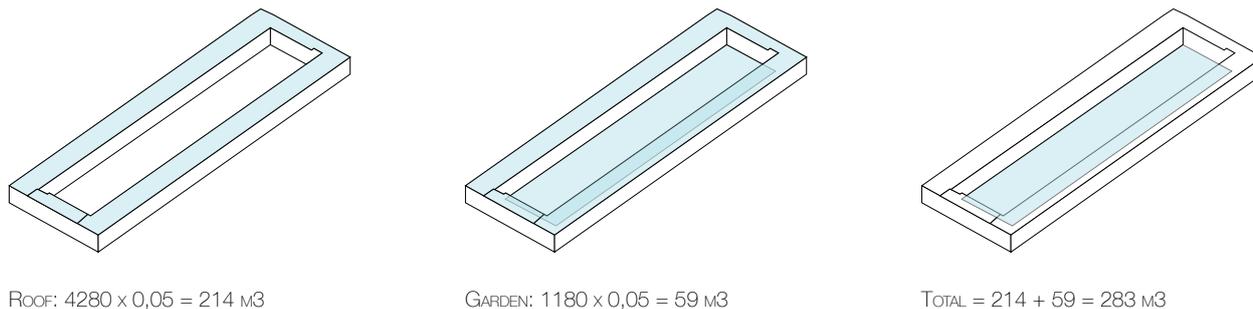


Figure 62: Quantification of the rehabilitation process in one block

Source: By author

This scenario provides 186 m³ of water storage and infiltration, Which takes care of 65 % of water from rainfall. This means that sewage has less water to drain and is decreased from clogging. Tarwewijk has a water task to store 4200 m³ of water. This block can contribute 186 m³ of water storage and infiltration. This might

not look a lot, but within this, the public tools have not been taken into account. The public tools are much easier to apply in the neighborhood because it is not dependent on residents. The proposed water squares can already store 140 m³ and 120 m³ of water.

TOOL	SURFACE (EXL) M2	STORAGE/INFILTRATION CAPACITY M3/M2	STORAGE/INFILTRATION M3	AMOUNT	TOTAL
Green roofs					
	29 M2	0,12 M3/M2	15,95 M3	3x	47,85 M3
	16 M2	0,12 M3/M2	8,8 M3	2x	17,6 M3
	10 M2	0,12 M3/M2	5,5M3	5x	27,5 M3
Roof agriculture					
	1,5 M2	0,09 M3/M2	0,14 M3	16x	2,16 M3
Water tank					
	3 M2	1,8 M3/M2	5,4 M3	4x	21,6 M3
Gardens with underground infiltration crates					
	72 M2	0,02 M3/M2	1,44 M3	2x	2,88 M3
	36 M2	0,02 M3/M2	0,72 M3	3x	2,16
Permeable pavement					
	72 M2	0,01 M3	0,72 M3	1x	0,72 M3
	36 M2	0,01 M3	0,36 M3	1x	0,36 M3
Ponds					
	9 M2	1,5 M3/M2	13,5 M3	2x	27 M3
			12 M3	2x	24 M3
Rainwater fence					
	1,5 M2	1,8 M3/M2	2,7 M3	2x	5,4 M3
Rain Barrel					
			0,15 M3	3x	0,45 M3
Facade garden					
	5 M2	0,4 M3/M2	1,6 M3	4x	6,4 M3
Total					186,08 M3

Table 4: Quantification of the added storage and infiltration capacity

Source: By author

7.2.3 MIJNSHERENPLEIN & MONUMENTAL SQUARE

B. PUBLIC

Mijnsherenplein

The goal is to increase awareness of climate change by providing public space with different adaptive solutions to decrease the vulnerability of water nuances. Water is used in different ways to stimulate this. Also, the public space offers facilities to increase the awareness of local initiatives that focus on the development of residents. This is mixed with different uses of the park which can also be educative. This result is a multi-functional space which enhances the quality of the public living environment and its usage. Therefore, water is being stored and infiltrated in this multiply used landscape.

Landscape:

The different landscape of the public space stimulates different uses by different age groups. The sandy landscape can be educative and playful. One could play on the hills landscape, but also offers space to sit and read, relax and hide in the shadows. The stepping stone in natural water pond provide the opportunities to experience water as well.

Community house:

The neighborhood offers a lot of initiatives that focus on residents, but many of the residents are not aware of them. The new community house provides space for local initiatives to exploit their

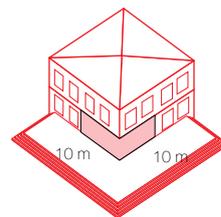
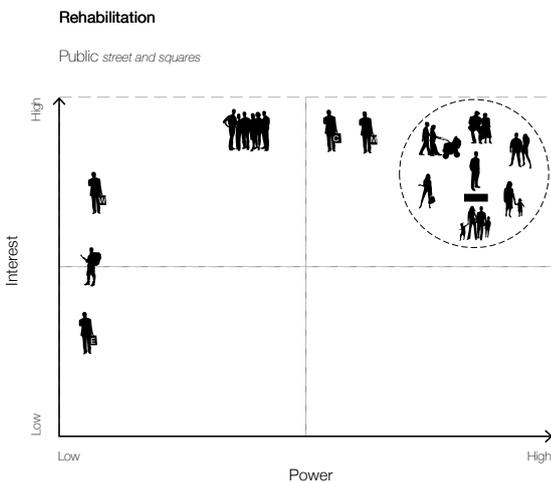
activities. Those activities can differ from workshops to promote the rehabilitation process for landowners to events and activities that contribute to social interaction in the neighborhood that enhance Tarwewijk as an active community. Current initiatives can participate in the organization of these neighborhood activities and meetings. In these meetings, it is possible to gain a certificate to sustain your house to stimulate the rehabilitation process.

Open basin:

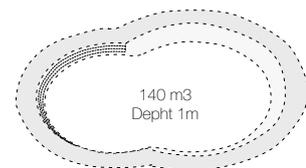
The open basin also stimulates multiple uses. In dry weathers, it can be used for skating, soccer and to sit and watch surroundings. In times of rainfall, it can store water as a water square and stimulates the experience of water that contributes to climate adaptation. In times of frost, the square could encourage ice skating. The open basins are connected to the current open water system of other neighborhoods.

Monumental square.

A monumental square is a place where The monument 'De Vallende Ruit' in Rotterdam was erected in memory of the forty men who were executed by the occupying forces on 12 March 1945 during the second world war. The monument takes place in a paved surrounding which is vulnerable to the impacts of climate change. To protect monumental heritage, the paved surrounding is transformed into an open basin which also makes the environment more pleasant and contribute to the impacts of change.

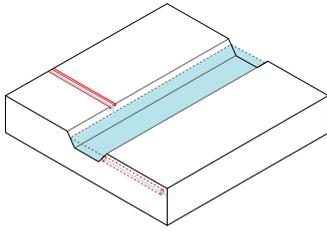


Community house

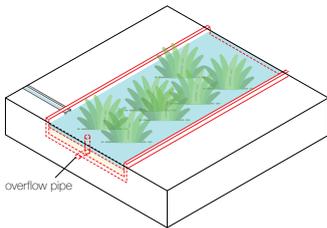


Water square

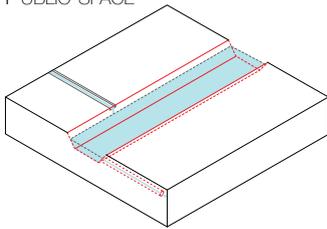
STREET



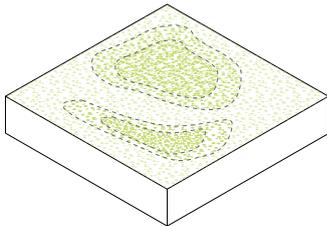
OPEN GUTTERS



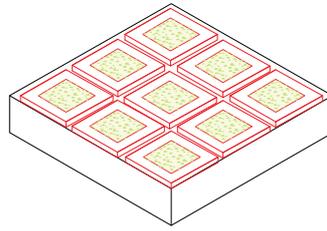
INFILTRATION STROKE
PUBLIC SPACE



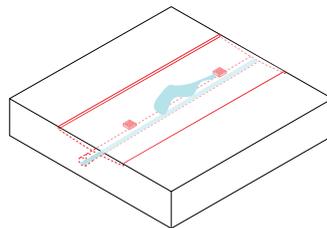
OPEN WATER CANAL



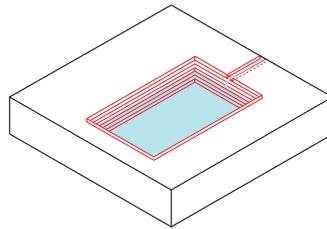
RELIEF



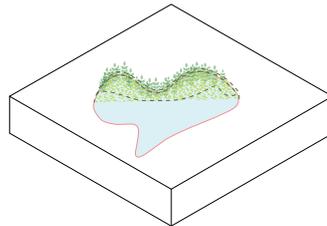
PERMEABLE PAVEMENTS



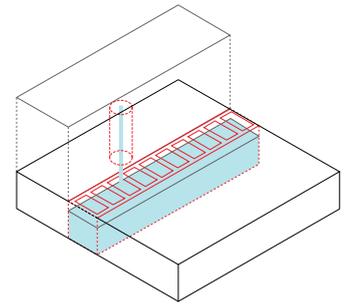
HOLLOW STREETS



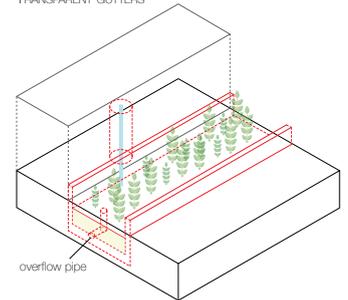
WATER SQUARE



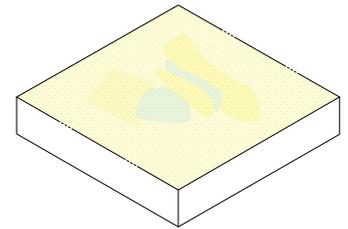
NATURAL PONDS



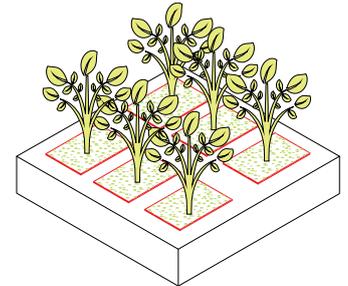
TRANSPARENT GUTTERS



FACADE GARDENS



SANDY LANDSCAPE



PARKS

Figure 63: Public toolbox

Source: *By author*

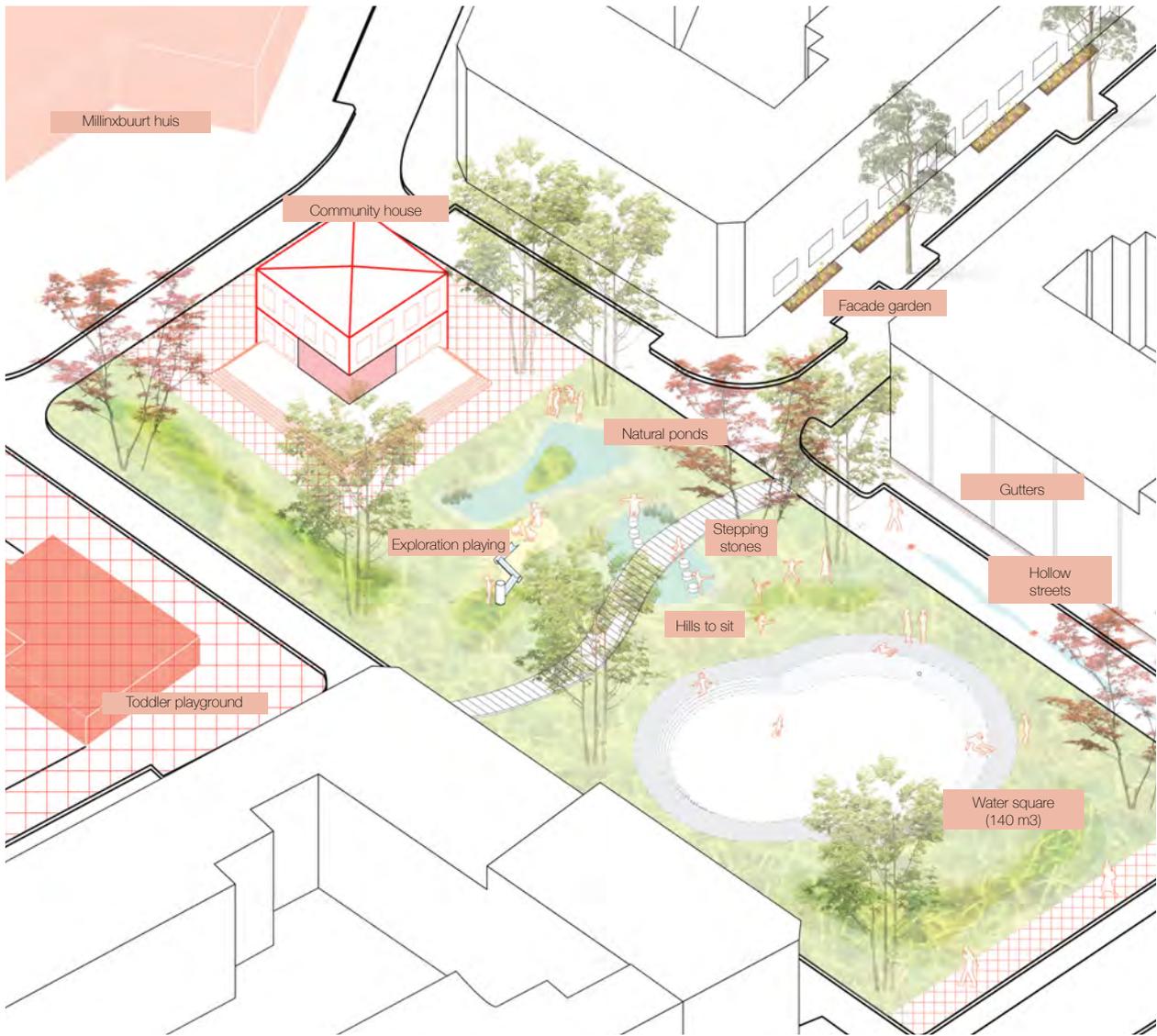


Figure 64: 3d Impression Mijnerenplein
 Source: By author

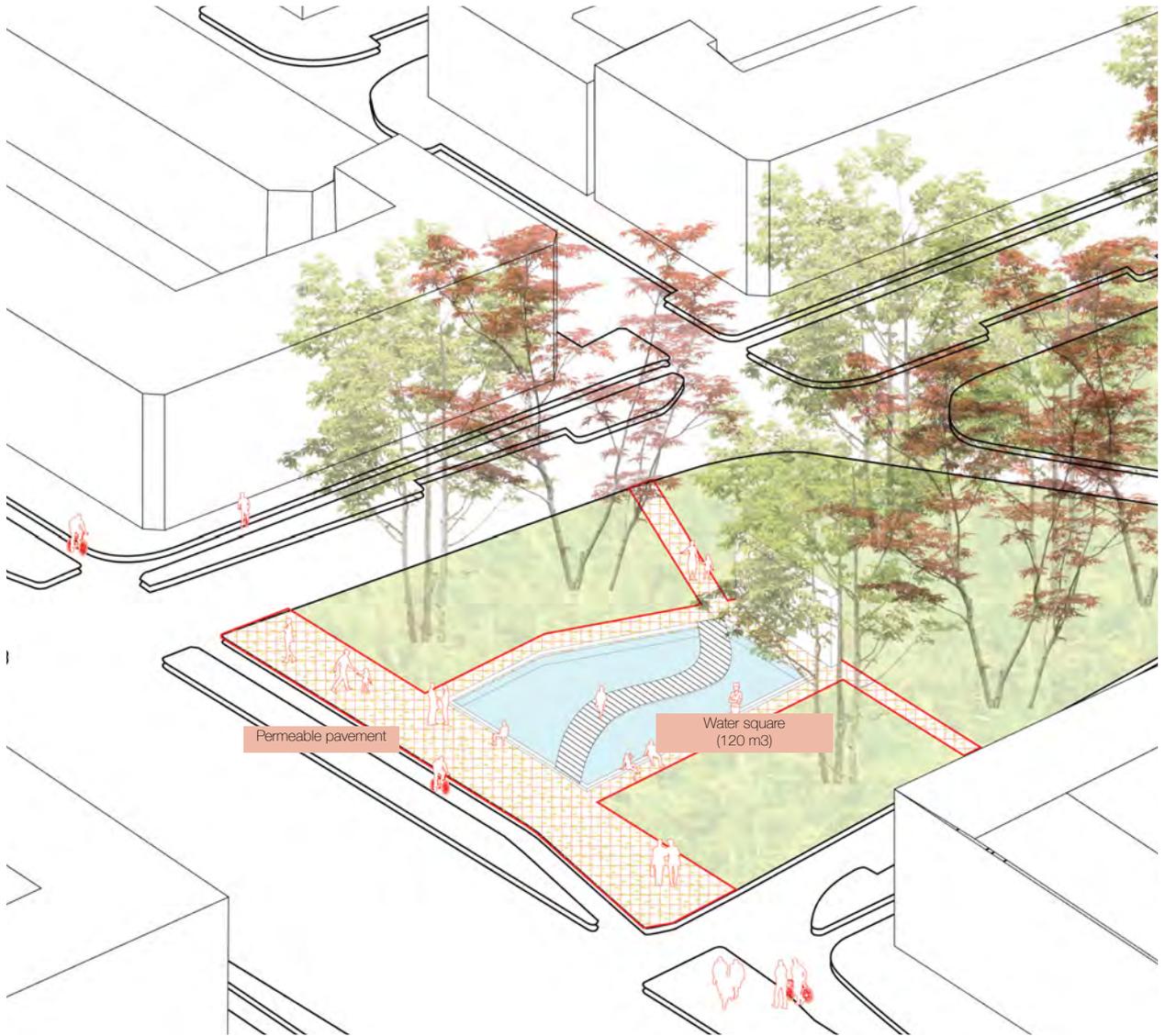


Figure 65: 3d Impression Monumental square
Source: By author

7.3 PHASE 2: ACCESSIBLE WATERFRONT



Figure 66: Plan of Phase 2: Accessible Waterfront

Source: By author

This phase can start when industrial activities are slowly moving westwards from the waterfront and therefore overlap phase one. The movements of the industry can indicate that traffic of the Brielselaan will decrease and will be attractive for slow traffic. This phase emphasize the reconnection strategy to connect the living environment with the waterfront.

Re-use Monuments:

While industrial purposes are moving, monumental heritage are maintained by reusing them for other purposes that stimulate growing opportunities in Tarwewijk and affordable function for all groups of income. Within this new elements or interventions are visible on the outside to indicate something new is happening.

Infrastructural connection through eye-catchers and private development:

The infrastructural connections are categorized in three types in order to stimulate different experiences passing them. In order to make these connections, few housing blocks are penetrated, considering the scale of the block. On the dike, new crossovers and landscape arise. For now the crossover consist of stairs but can change when more profit is made into crossing through a viaduct or maybe a bridge connection from dike. To do this some parking lots need to be removed.

New developments:

The crossover from the neighborhood will be extended to the waterfront where new developments on the shore are complementary to the connections. These provide affordable programming to stimulate growing opportunities for Tarwewijk and affordable programming for public use by all income groups.

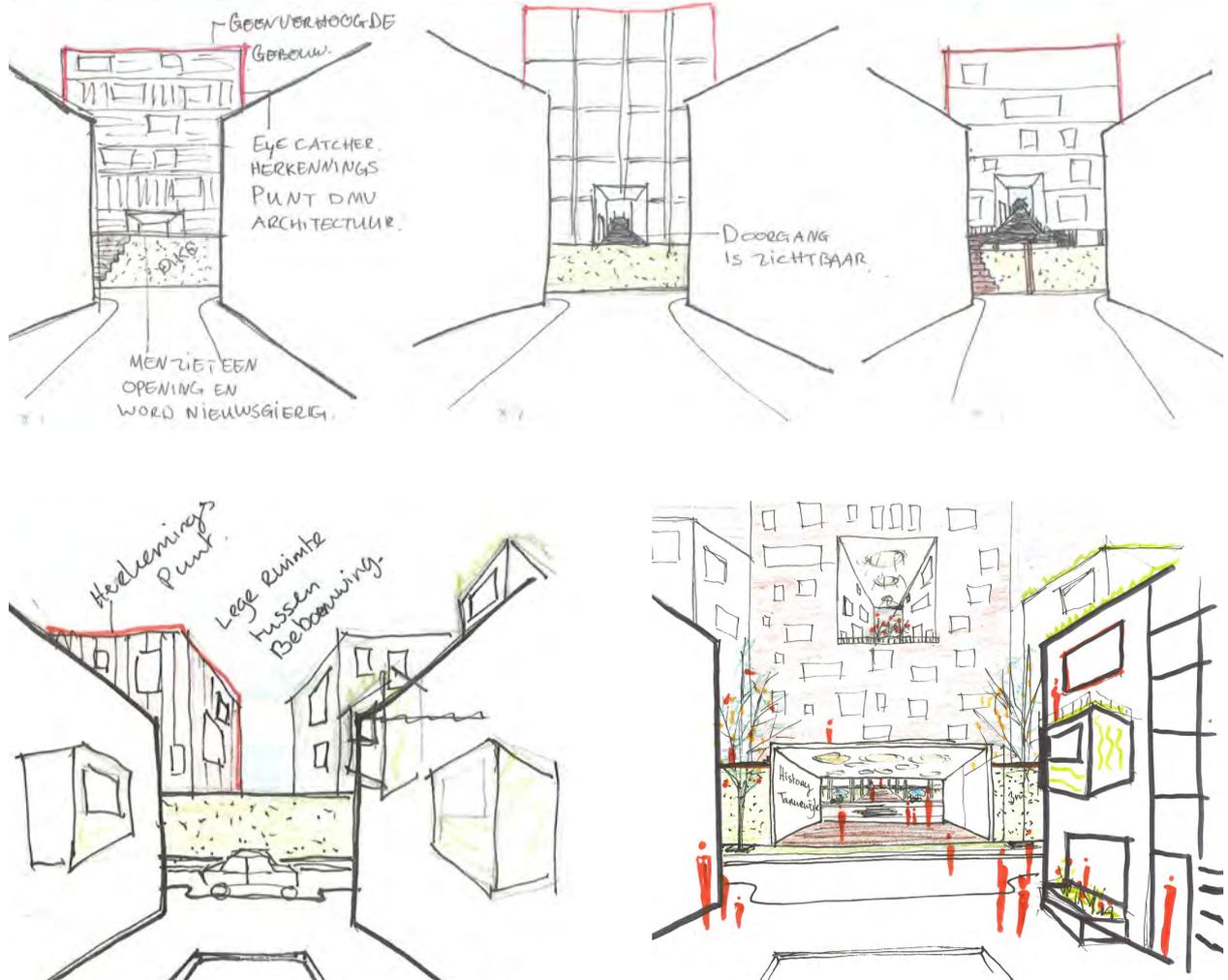


Figure 67: Examples of eye-catchers

Source: By author

7.3.1 STRATEGY 2: RECONNECT TO MAIN WATER BODY OF ROTTERDAM

WHAT

The connection-based strategy aims to reconnect the residential area with the water edge. The residential area has been developed due to harbor activities at the Maashaven and since then always had a tied relationship. With the moving economy of harbor activities to the west, Tarwewijk has the opportunity to reclaim the water edge. Therefore, this strategy emphasizes on existing and new corridors to strengthen ties with the water edge. These connection types are on the one hand in the form of corridors through the residential area and on the other landscape design over dike reflected on different scales. The types of corridors can be subdivided into three types:

- A Corridor as a heritage eye catchers
- B Corridor as architectural linking
- C Corridor through the private development of the rehabilitation process.

Corridor as a heritage eye-catcher

The corridor emphasizes on the current monumental heritage of the large silo complexes. In the redevelopment of the waterfront edge, it is essential to maintain current monumental buildings. This

is because they have always stimulated a relation with the water Maashaven.

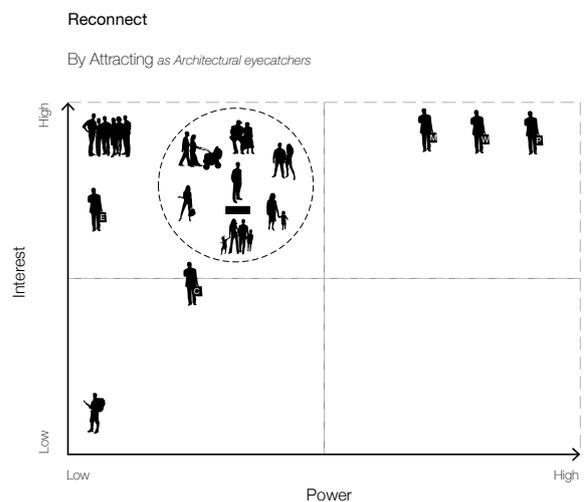
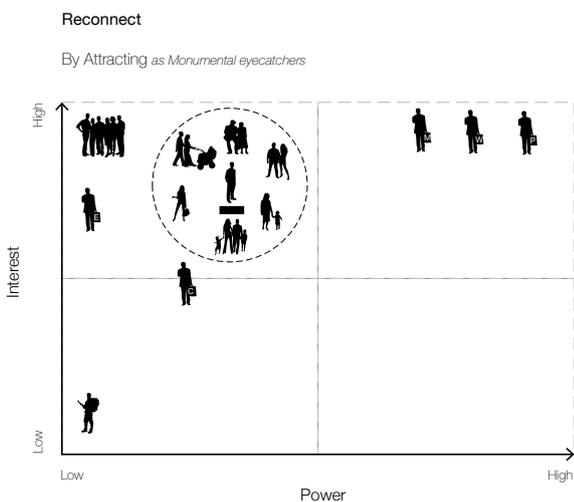
Corridor as architectural linking

This intervention emphasis on the linking of new architectural development at the water edge. The linking is made of architectural material or appearance. These can be copied as small construction development in the neighborhood. A folly is a building constructed for decoration and in this case, can be used to be associated with the class of architectural building to which it belongs to

Corridor through private development

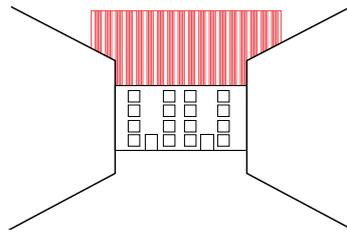
To stimulate adaptive climate solutions in the rehabilitation process, this corridor is emphasized through private new development as an example for those who are unknown with adaptive climate solutions. These developments are used to tackle the problem of water nuances and at the same time create livable environments for the neighborhood.

A fourth type can be described as a combination of the three types.

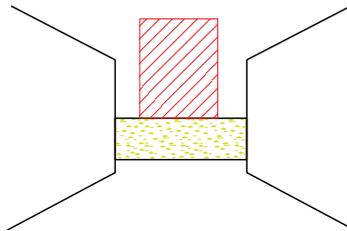


TOOLS

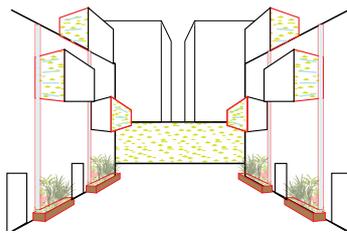
A ATTRACTING BY MONUMENTAL EYE CATCHER



B ATTRACTING AS ARCHITECTURAL EYE CATCHER



C. THROUGH PRIVATE DEVELOPMENT AS BLEU-GREEN INFRASTRUCTURE.



Reconnect

Through Private developments as green-blue infrastructure

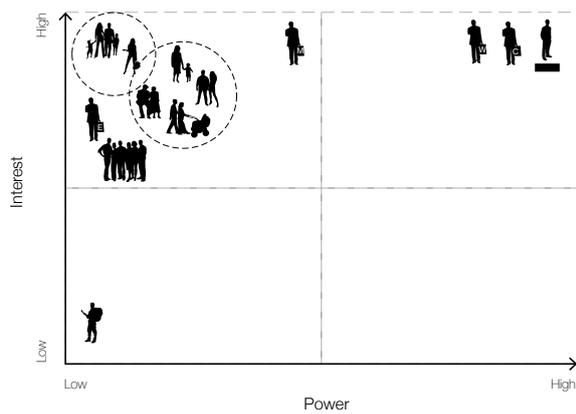


Figure 68: Reconnection toolbox

Source: By author



Figure 69: Overview different types of connections

Source: *By author*

All connections are defined from the Blankenburgstraat. This is because the two phases of development in Tarwewijk come together in this street. Meaning that the inner streets of Tarwewijk

are interconnected to the Blankenburgstraat. In addition, the individual public spaces are now interconnected by infrastructure, which results in a coherency of network.



Figure 70: Scene Monumental eye catcher

Source: *By author*



Figure 71: Scene Architectural eye catcher

Source: *By author*



Figure 72: Scene Private developments

Source: *By author*

6.3.2 PHASING CONNECTIONS

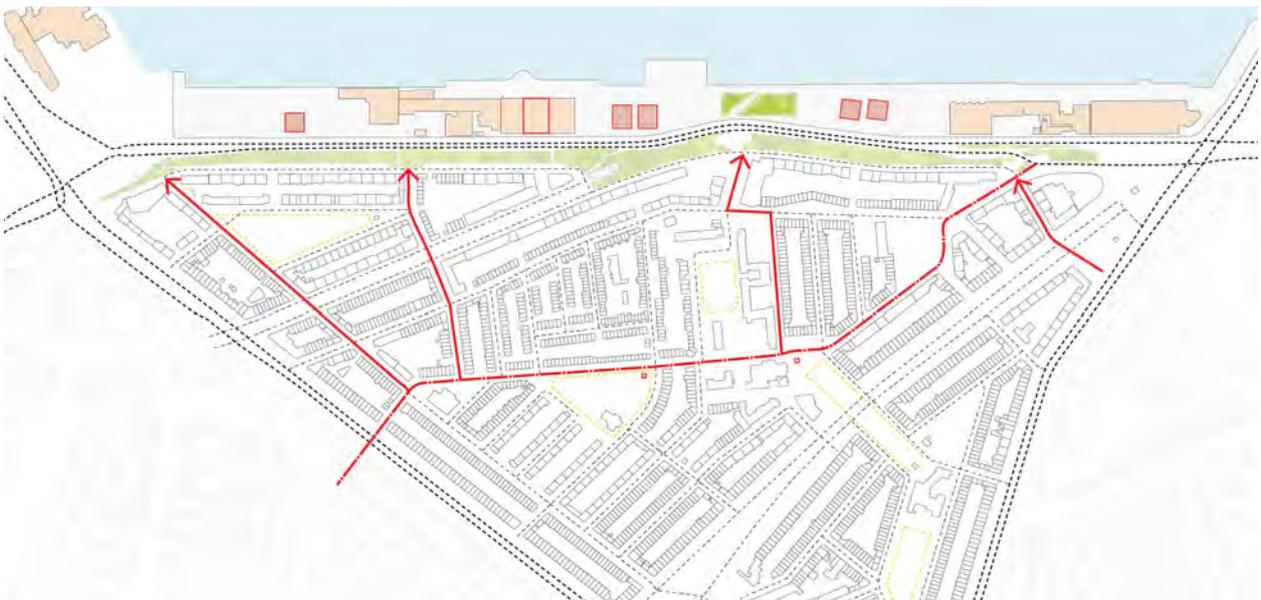


Step 1 Current connection

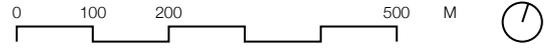


The current connections are based on current crossings over the dike. They do not relate to the waterfront edge except for one that is related to a public space along the edge with nice sight lines.

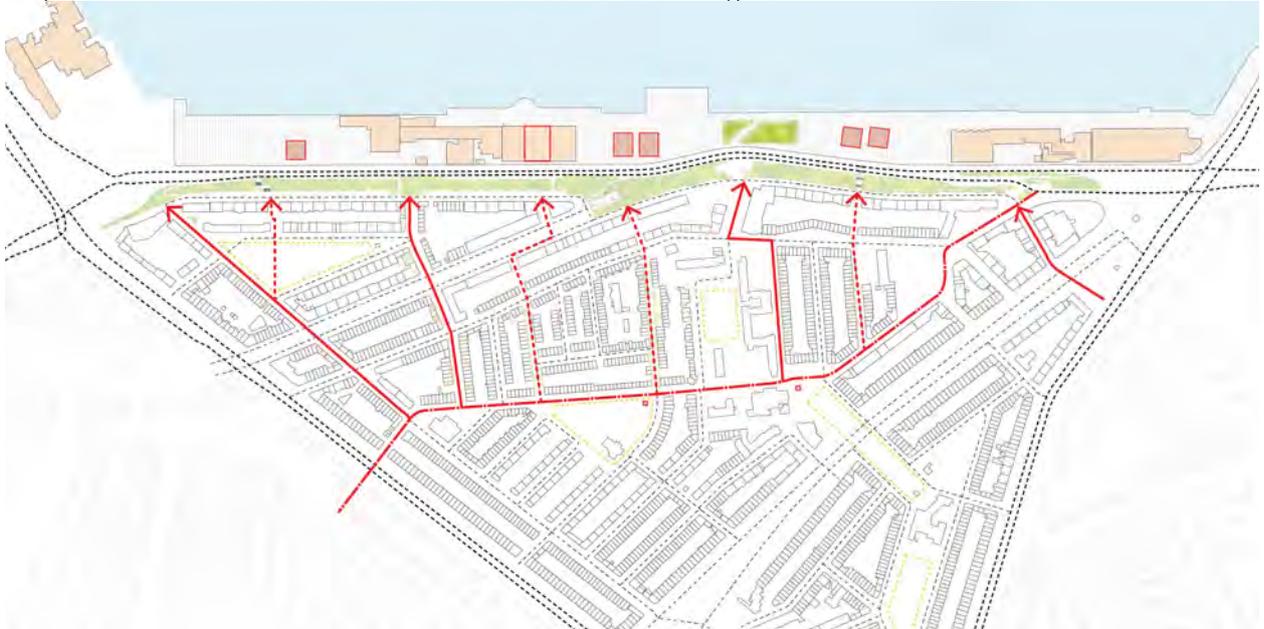
Step 2 Creating eye catchers



The First phase would be to emphasize current monumental and new architectural eye catchers. Some of the new eye catchers are aimed to improve accessibility to the waterfront which consider the scale of the block adjacent to the dike. Within these new connection some parts of the building block needs to be demolished.



Step 3 Interlock connections with attractive corridor types



Second phase is to enhance accessibility with new private development in the rehabilitation process. This will increase curiosity of pedestrians and will set an example to stimulate this further in the neighborhood. This indicates two new connection over the dike which will be elaborated in the next paragraph.

Step 4 Involving waterfront programming



Third phase emphasize on the extension of current and new connection to the water edge. New development are in line with these extentions. New development on the water edge will involve new programming to enhance growing opportunity for the neighborhood and will be discussed during strategy 3.

7.4 PHASE 3: INTEGRATED NEIGHBORHOOD



Figure 73: Plan of Phase 3: Integrated neighborhood

Source: By author

Infrastructural connection through dike landscape:

Phase three also overlaps phase two and emphasize the connections on different level which indicate the connections through the landscape of the dike. Within this, parking lots are removed in order to claim the dike landscape. To do this, 2-3 parking lots can be removed per year to have a nice landscape in the dike without being between cars. Residents of the block can park in the parking garage on the waterfront, which is only a few minutes away from their home. The first landscape as a playground in de dike is claimed for the housing block. The second playground in the dike landscape is better connected to the neighborhood and has get a new local purpose.

New bridge over Maashaven:

Within this phase a new layer of mobility for slow traffic is added by an new bridge over the Maashaven and integrate the neighborhood in the larger network of the city. The new layer of mobility add a shorter connection to and from the city center. Pedestrians and cyclist can walk and bike through and easy and quiet neighborhood without passing the busy edges and stimulate Tarwewijk to be an soft and compact neighborhood. Withing this, passers can see the rehabilitation process that can be an example for other neighborhood with low qualitative environments.

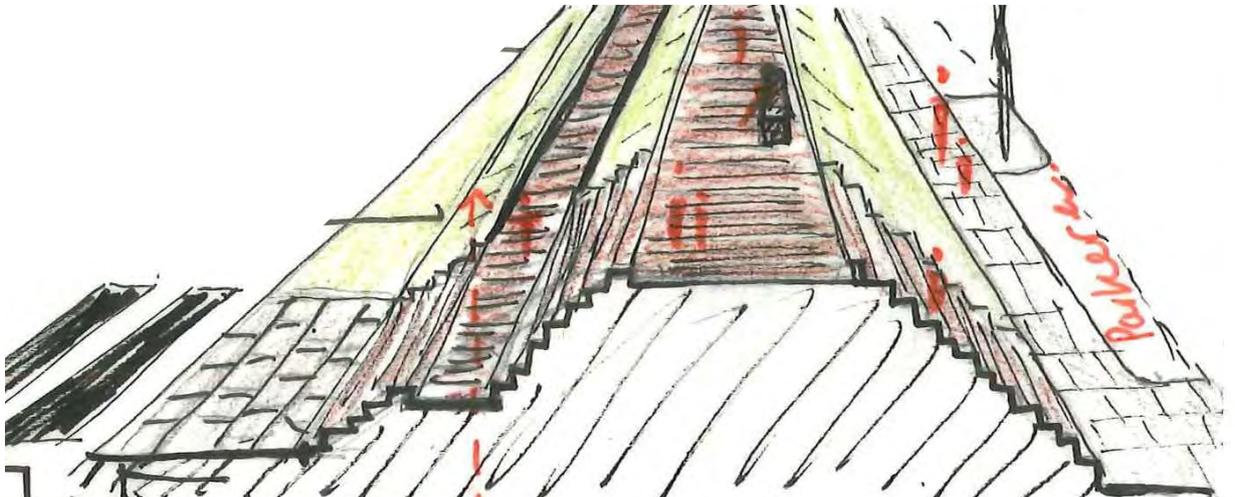
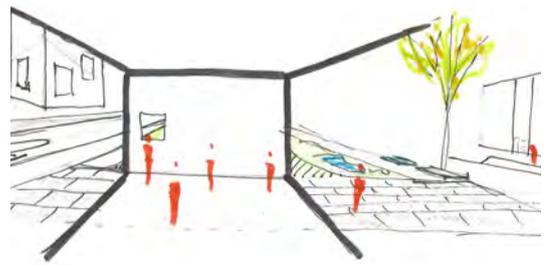
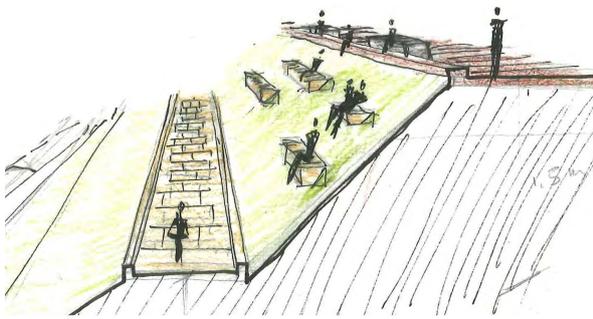
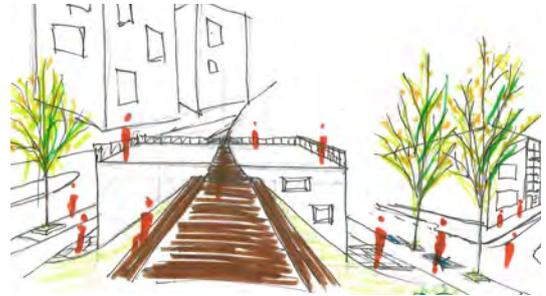


Figure 74: Possible dike landscape on the longer term

Source: By author



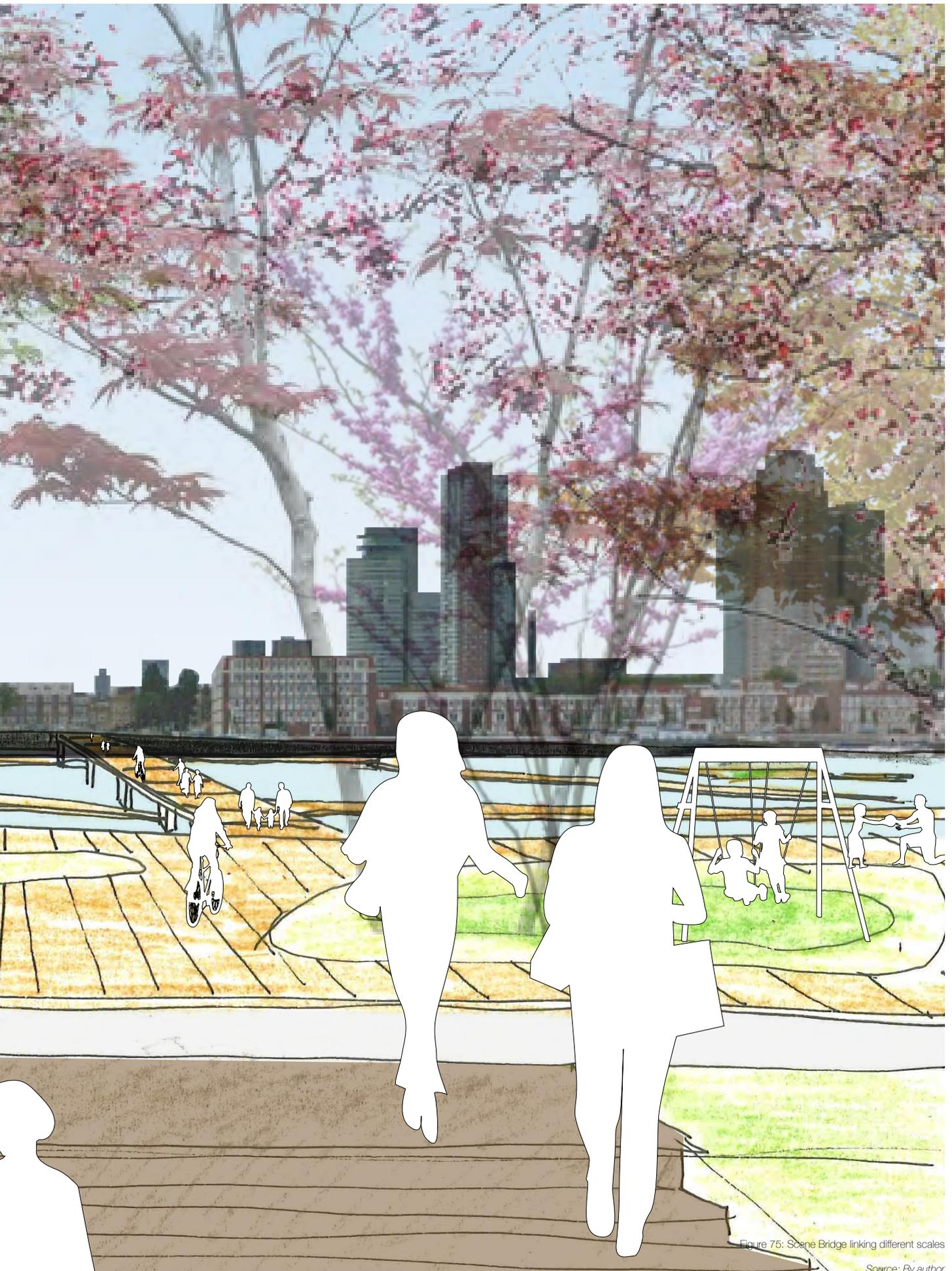


Figure 75: Scene Bridge linking different scales

Source: By author

7.4.1 CONNECTION 1



Connection one is based on Architectural linking. Within this connection a layer is added in the experience of the dike. The new playground in the dike stimulates use of the dike by residents of the building block. In addition, pedestrians are passing an active and livable environment. Therefore this contribute to quality of life.

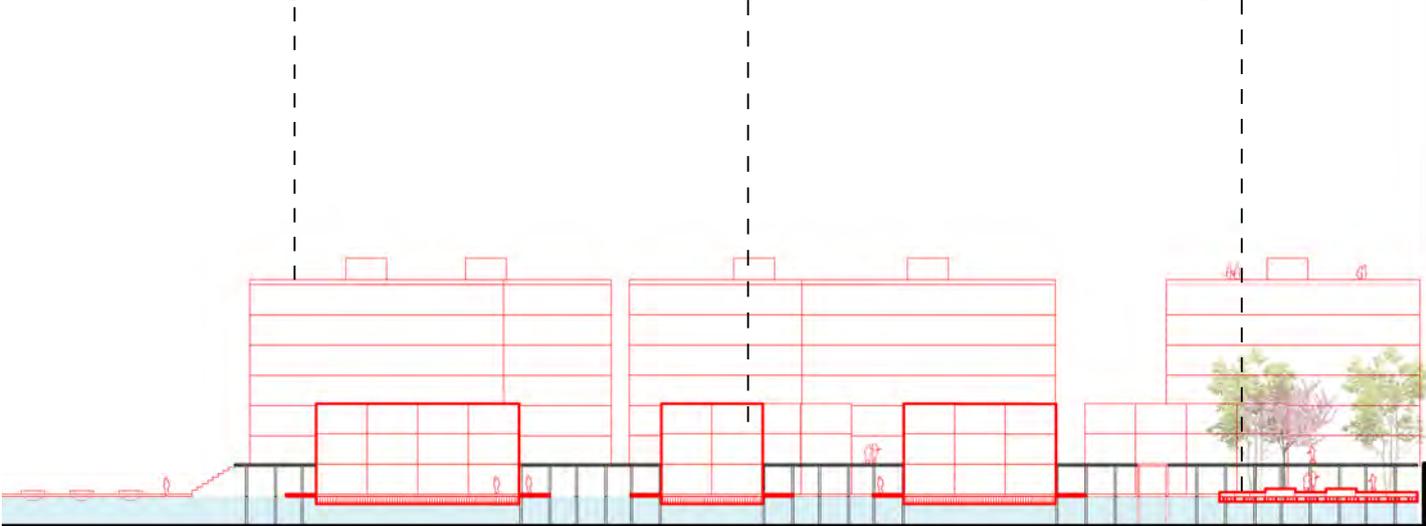
Pier construction



Floating dwelling



Floating green



7.4.2 CONNECTION 6



Connection six is based on a combination of two different types of corridors. The first one is architectural linking and the second one indicates new private development as a rehabilitation process to tackle the problems of water nuances as well. This can also set an example for other residents and stimulate curiosity for passing pedestrians to use the connection as a leader to the water edge.

Greenhouse



Urban farming on water



Floating stairs

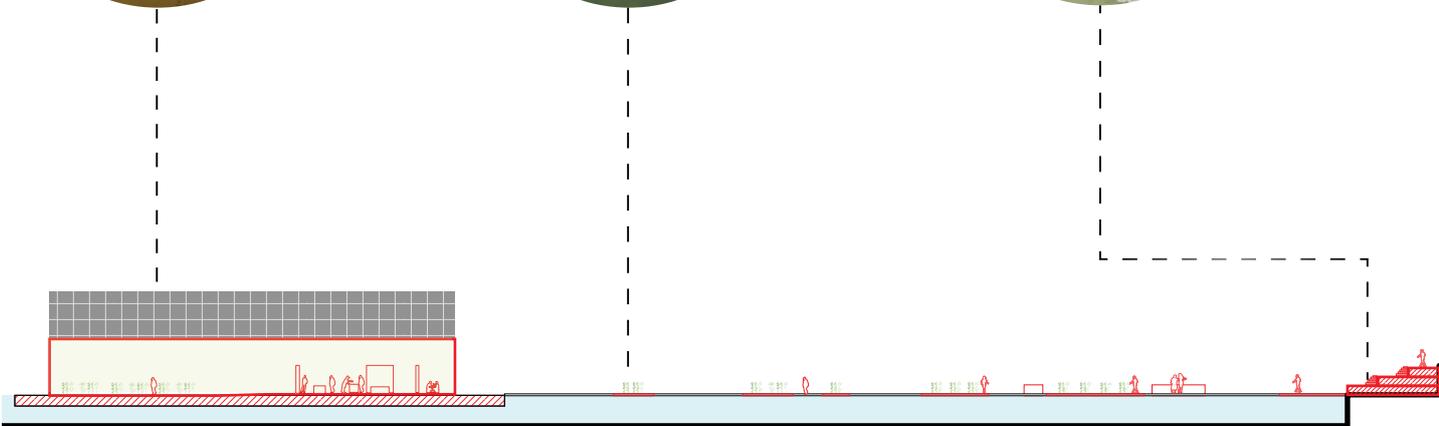
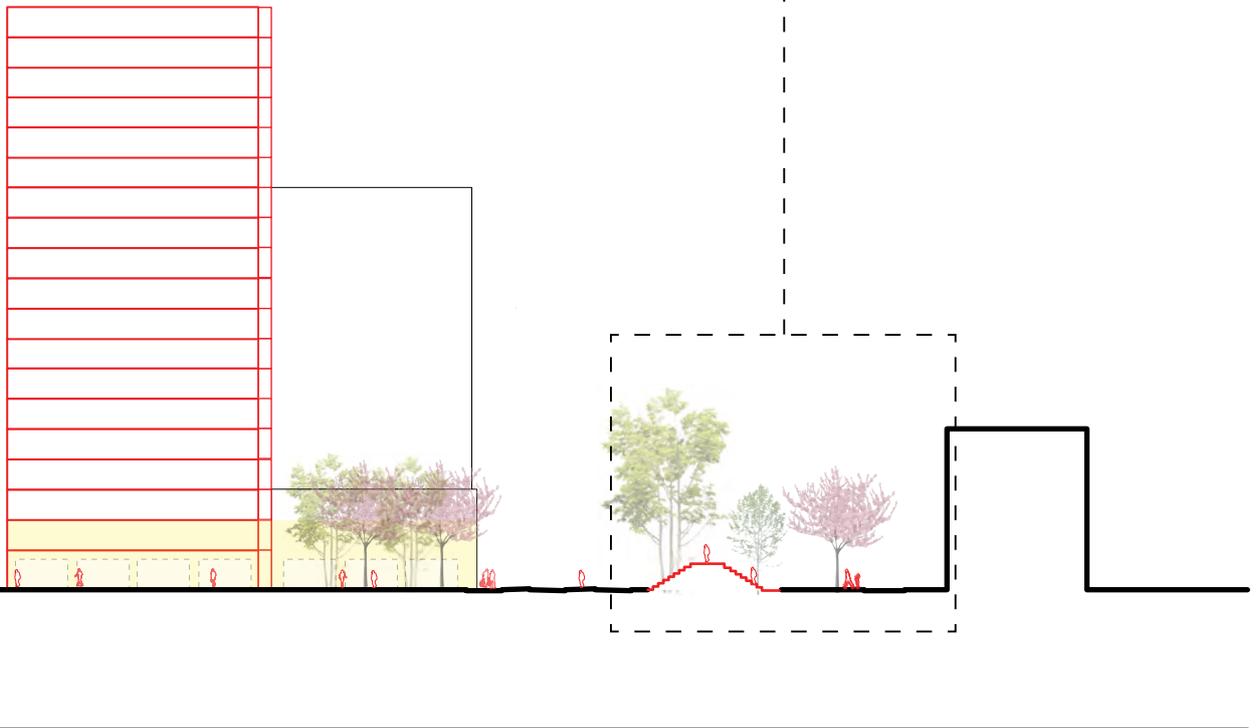




Figure 78: Impression dike landscape
 Source: By author



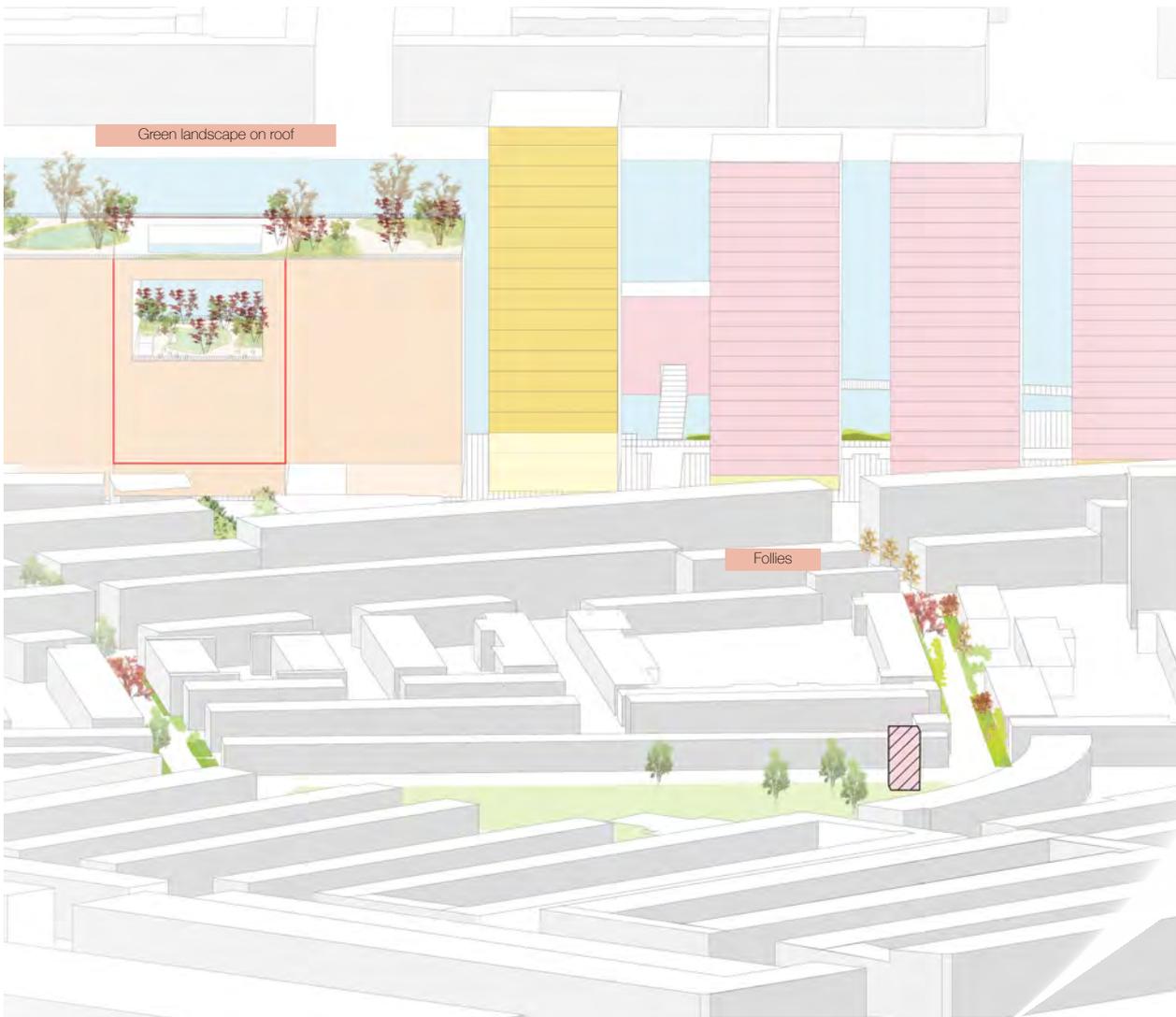


Figure 76 Bird's view perspective to waterfront

Source: By author

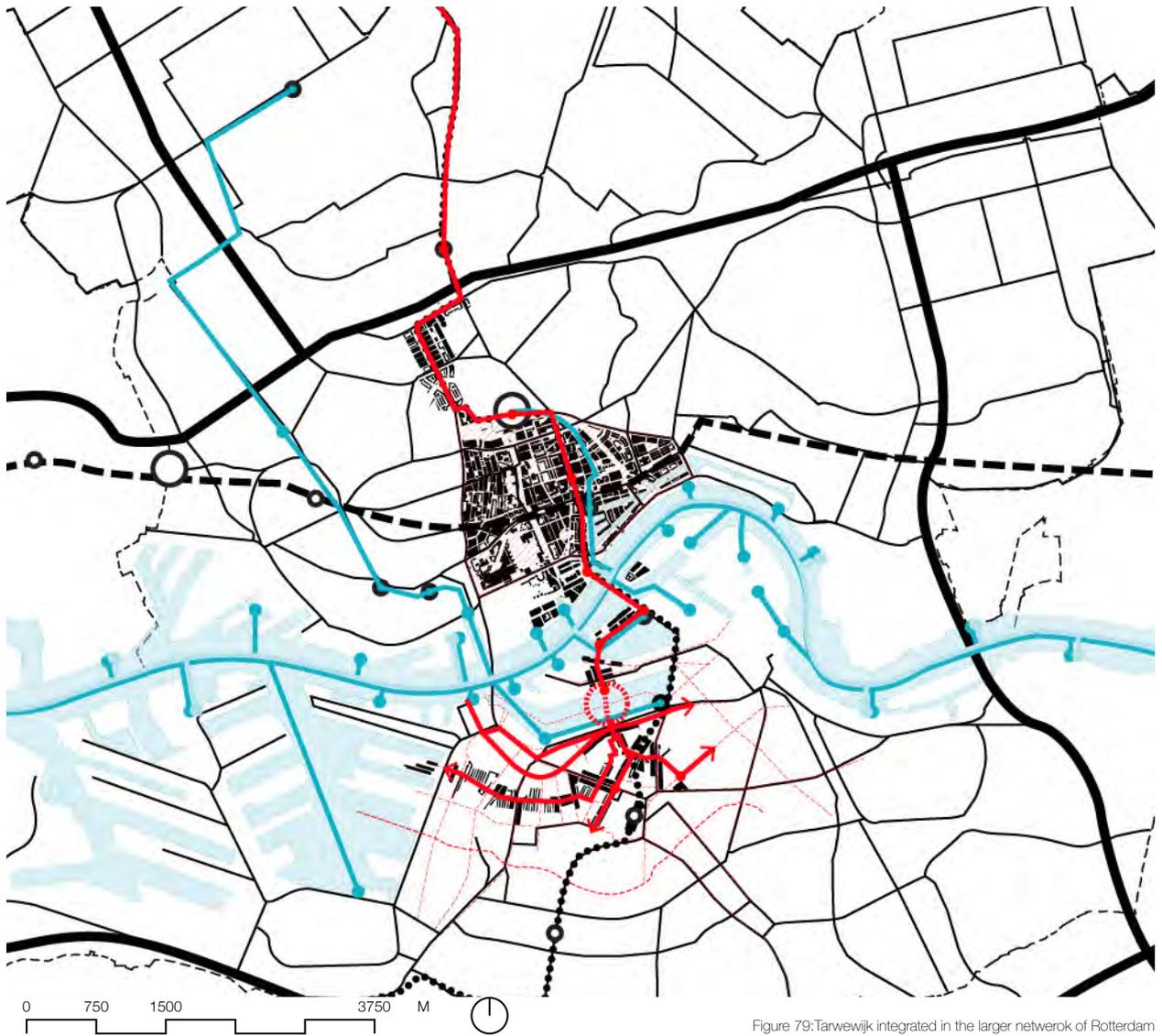


Figure 79: Tarwewijk integrated in the larger network of Rotterdam

Source: By author

7.5 PHASE 4: ACTIVATED RIVER

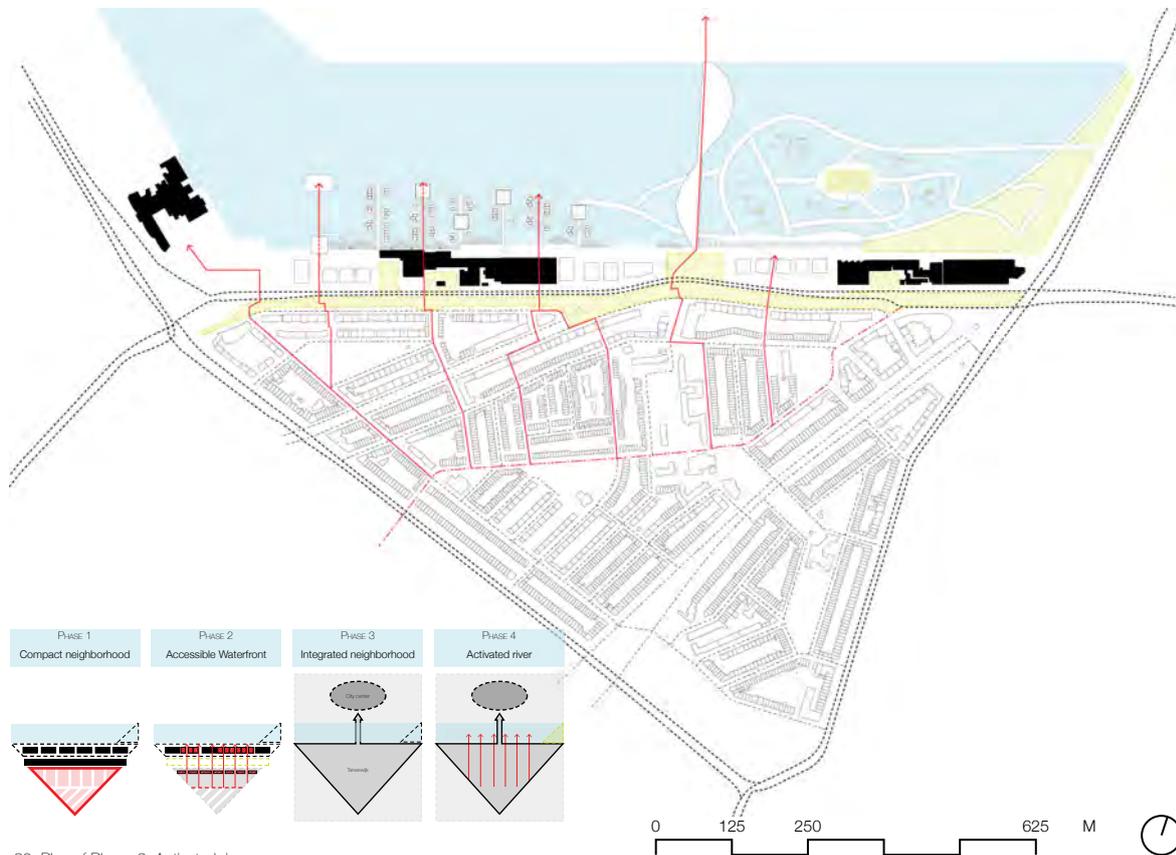


Figure 80: Plan of Phase 3: Activated river

Source: By author

Community on water:

Phase 4 evolves the area on the water by expanding the connections from phase two and three. This includes a new community on water for public use by different income groups and private use for locals in Tarnewijk And are connected to current development. This includes, floating market, Foodhall, floating urban farming en floating housing.

Transitions:

In order to vary the experience of the water edge, the transition from shore to water is varied in differentiated landscapes. This includes floating stairs, floating green, view points and extensions of the current development of the tidal park on the opposite of Afrikaanderwijk.



Figure 81: Floating market Maashaven

Source: By Author

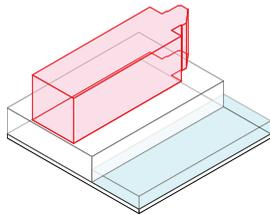
7.5.1 STRATEGY 3: *REACTIVATION* PROGRAMMATIC USE ON AND AT THE WATER

WHAT

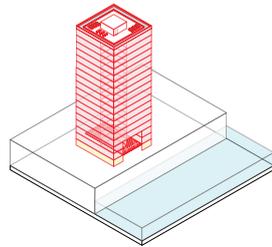
With the harbor activities moving to the Maasvlakte, Tarwewijk has the chance to reclaim the edge at the water. Past development at the waterfront has shown inappropriate planning. Most of these waterfront development use the dynamic water environment to attract high income groups with expensive housing and public programming. Socially that is irresponsible, because the low income group do not have the opportunity to use the water edge with expensive programming. This results in segregation of the high and low income group. Therefore, this strategy aims to reactivate the waterfront for two reasons. The first one is to provide private and public programming that stimulate growing opportunities for Tarwewijk as an attractive residential area. Most of the social climbers that turn into middle income groups move out of Tarwewijk as a result of small housing. They can not move into housing at the waterfront because they are simplified to expensive. Providing different programming like social and collective housing create more opportunities in housing careers for residents in Tarwewijk. By doing this, Tarwewijk can maintain people with more income that decrease its status of a declining neighborhood. The second one is to stimulate an active public use for all target groups of different background by providing a dynamic program that takes into account the experience of the large bowl of water in the Maashaven. The strategy also as a new layer of mobility for slow traffic which refer to the pedestrians and bikers. This can create a new economy in the Maashaven by different users of neighborhood and city Rotterdam. These programs also react on future climate change with adaptive solutions that anticipate on changing heights of water in the Maashaven.

Tools

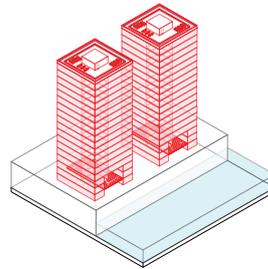
A SHORE



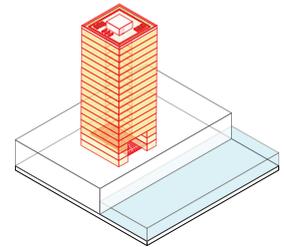
MONUMENTAL HERITAGE



MIXED DEVELOPMENT

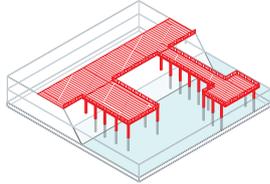


AFFORDABLE HOUSING

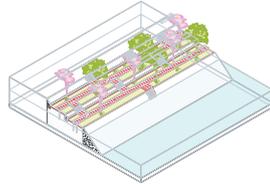


PUBLIC DEVELOPMENT

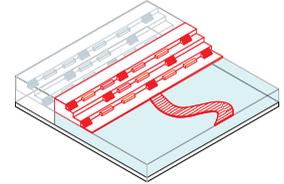
B LAND WATER TRANSITIONS



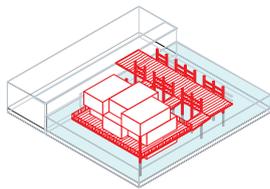
PIER VIEWPOINT



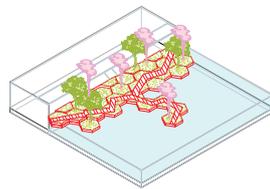
TIDAL PARK



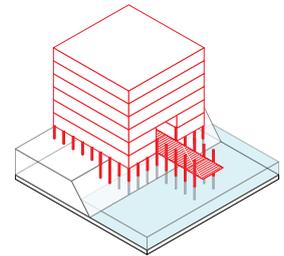
FLOATING STAIRS



FLOATING PONTONS

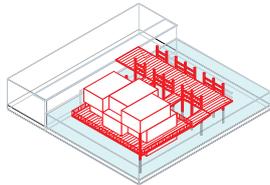


FLOATING LANDSCAPE

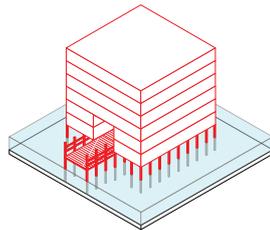


HALF PIER CONSTRUCTION

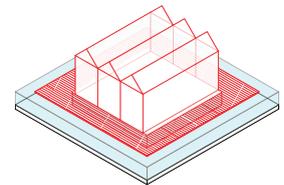
C WATER DEVELOPMENTS



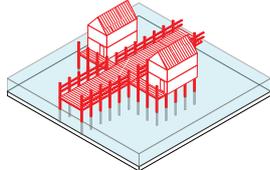
FLOATING COMMUNITY



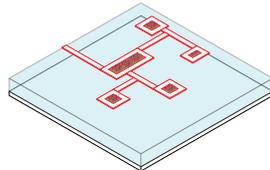
PIER CONSTRUCTION



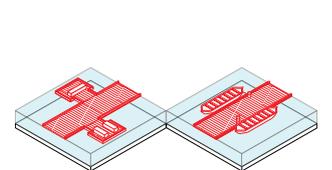
GREENHOUSE



PIER HOUSING



URBAN FARMING ON WATER

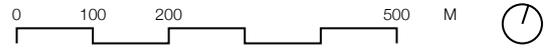


FLOATING OPEN FOOD MARKET

Figure 82: Overview of the used tools in the reactivation process

Source: By author

6.3.1 PHASING WATERFRONT

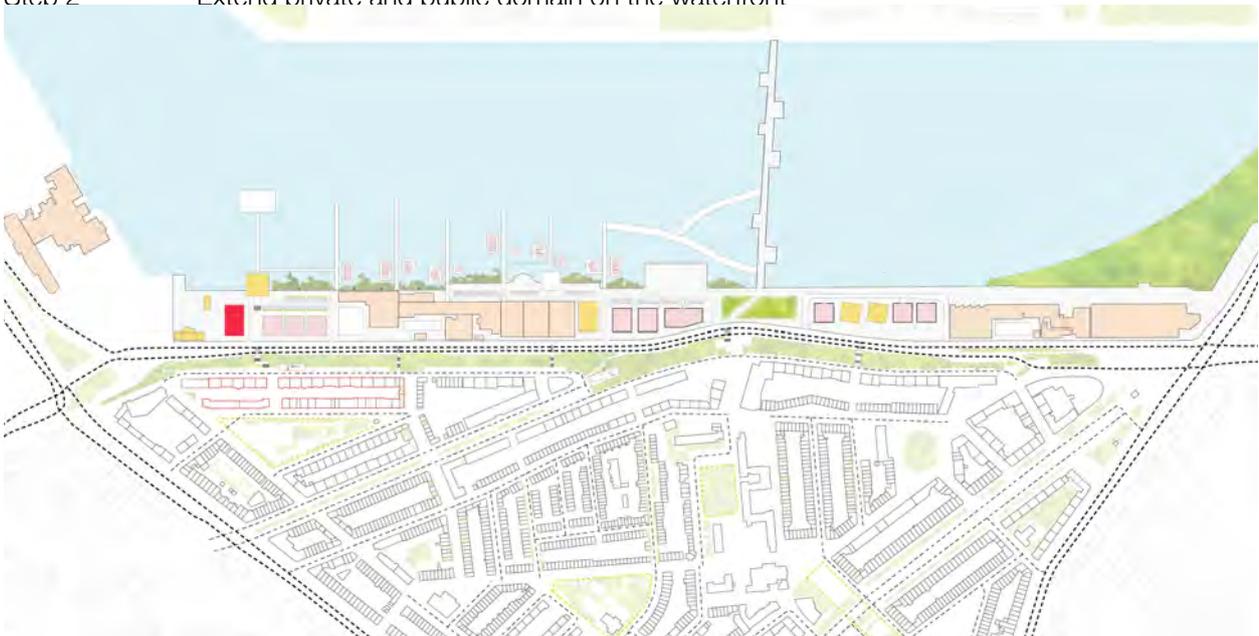


Step 1 New bridge connection

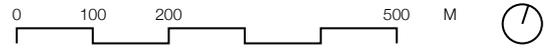


The first step is integrating neighborhood on different scale by adding a bridge to Katendrecht. Within this step a new layer of mobility is added.. This will be the first step because this happens in the current urban tissue.

Step 2 Extend private and public domain on the waterfront



When governments makes profit form developments in phase one, the profit can be used in further development to extend public and private domain.



Step 3 Extend public and private development



Public developments slowly connects to current developments like the tidal park.

Step 4 Waterfront development on the longterm



This emphasize on the full capacity of waterfront developments in the Maashaven. In this phase the new public and private economy has developed to their full potential.

6.3.1 SHORE

MONUMENTAL REUSE

The goal of monumental heritage is to maintain the identity of the harbor by reuse of the buildings. It is important that aesthetic appearance is maintained, but the function of the building will change, different from public facilities for Tarwewijk and the whole city of Rotterdam. These public functions can facilitate institutional programming to stimulate education of the low-income group.

Vocational center:

Many are immigrant from other countries who may have a diploma that is not enough for here in the Netherlands. To stimulate employment chances, this program can complement diplomae from immigrants. Also, this program facilitates also opportunities for the drop-outs that have to reach a certain age, 35-40. This also increases employment facilities for them. These vocational facilities can be subsidies by the municipality to decrease the number of drop-outs en low educated groups.

Internship:

These public functions may also facilitate internship for students in maritime technical studies to stimulate sustainability in the Waalhaven which has a lot of offshore functions. This creates an

extra layer of integration in the network of Rotterdam.

MIXED DEVELOPMENT

The mixed development provides commercial activities in the plinth, so pedestrians do not walk along empty or nonaccessible plinths. Above these commercial functions, the program can differ from private housing to public functions.

Foodhall:

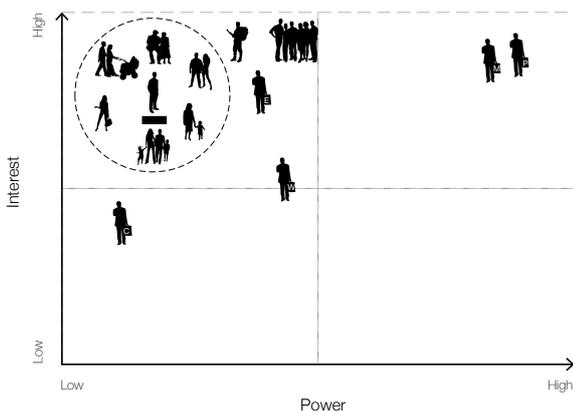
This indicates cultural food corners that stimulate the current cultural identity in Rotterdam. Food can be prepared from fresh ingredient from urban farming on water. It should be mentioned that it is not programmed with expensive food corners, but affordable for all. The foodhall takes place in the former Quaker storage.

AFFORDABLE HOUSING

The private development on the shore provides collective housing with shared facilities. This stimulates people with low income to live in affordable housing at the water edge. Because of the shared facilities, the rent will be lower by being divided by 3-4 people.

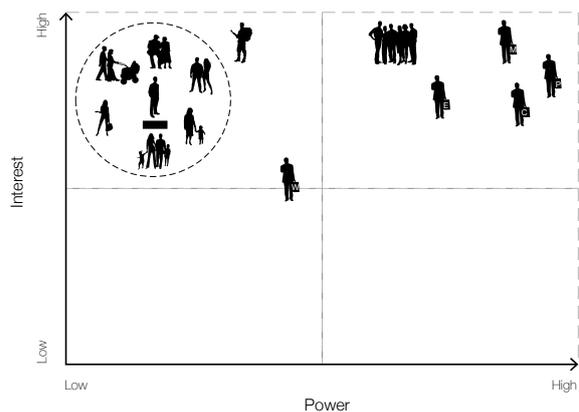
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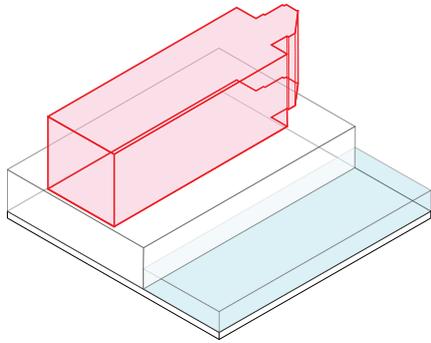
Shore by re-use of heritage



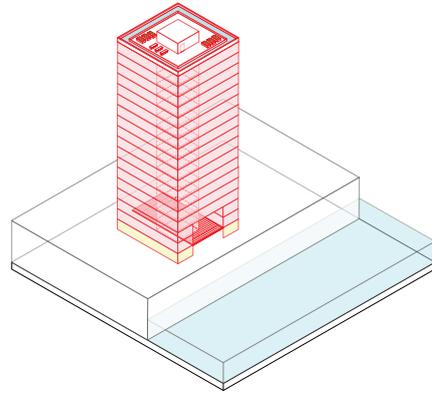
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Shore by new developments

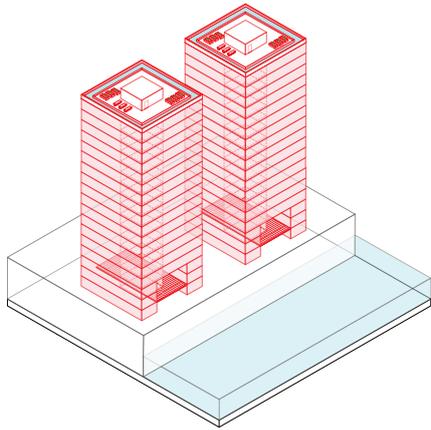




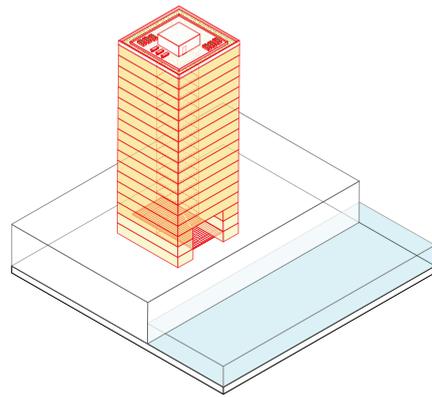
MONUMENTAL REUSE



MIXED DEVELOPMENT

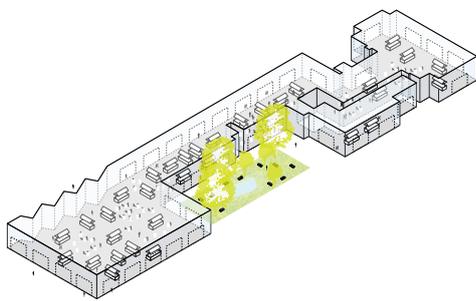


AFFORDABLE HOUSING

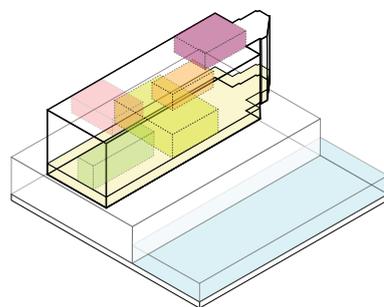


PUBLIC FACILITIES

Figure 81: Shore toolbox
Source: By author



FOODHALL IN FORMER QUAKER STORAGE



NEW PUBLIC UNITS IN FORMER MAASSILO

Figure 83: Diagrams of monumental reuse
Source: By author



Figure 84: Scene foodhall from the dike

Source: *By author*



Figure 85: Scene between buildings on new waterfront

Source: By author

6.3.2 LAND WATER TRANSITIONS

This interventions aims to create a dynamic environment at the water edge. The experience of water is divers. One can access the water in different ways, but the different edge can also create a certain biodiversity.

Pier overview:

The pier overview provide the opportunities to enjoy sight lines and public live at the water edge. One can also still view the skyline of Rotterdam which is the current asset of the water edge.

Tidal park:

The tidal park is a future development of the Maashaven and can be extended along the water embankment to be interconnected with the proposed development in this thesis on the water. This also contribute to biodiversity.

Floating houses:

The floating community provide social private housing for the low

income group. These can differ in the form of floating row houses or single housing. The floating row housing can be developed collectively to decrease cost. To stimulate diversity of income on the water, some single expensive housing will be available. These high income residents can pay more for the public space.

Floating landscape:

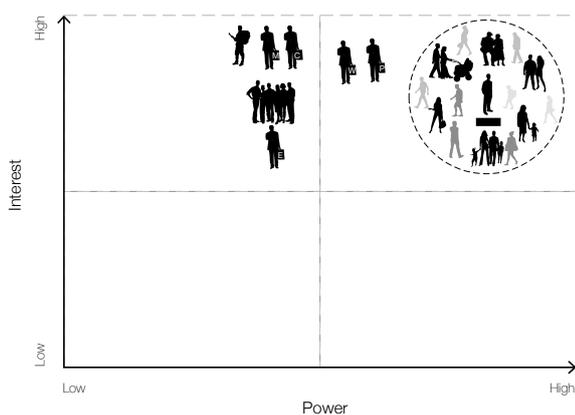
The floating landscape is made from recycled plastic from the waters. This project is already present in the Rijnhaven, which is one dock further than Maashaven. The landscape prevent to many hard edges and can be use increase biodiversity.

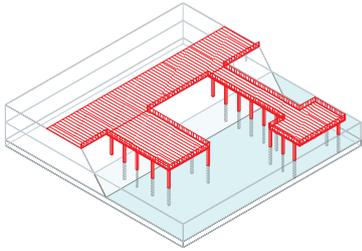
Floating stairs:

The floating stairs is also an existing project that is used in the northern part of Rotterdam. Because the edge is heavily constructed, it is not possible to reconstruct it. Therefore the floating stairs could be a good solution to increase accessibility on the water.

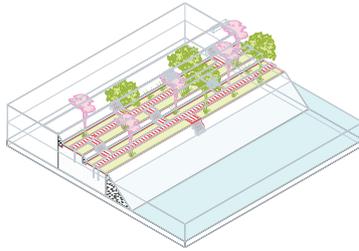
Reactivate

Land/water transition by diversify environments

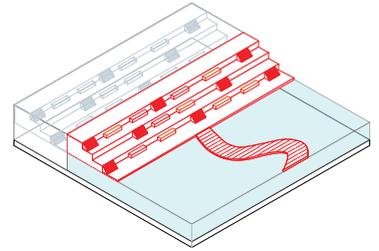




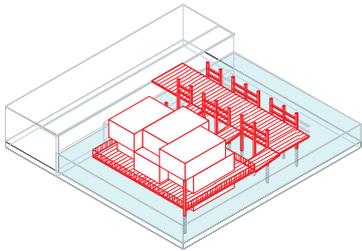
PIER VIEWPOINT



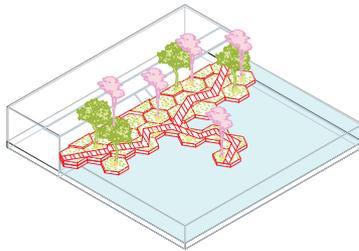
TIDAL PARK



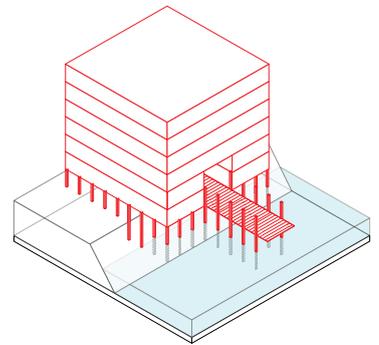
FLOATING STAIRS



FLOATING HOUSES



FLOATING LANDSCAPE



HALF PIER CONSTRUCTION

Figure 86: Transition of the water edge toolbox

Source: *By author*

6.3.3 DEVELOPMENT ON WATER

This intervention focus on the growing housing career opportunities for the residents of Tarwewijk. This will maintain middle and high-income group within Tarwewijk that will results in a changing status from the worst neighborhood to an attractive and desirable neighborhood. Also, the public use by different income groups will be a goal as well to stimulate a dynamic use of the water. The water is used to create a new economic environment that is dynamic and publicly accessible for all income groups

Floating housing:

The floating community provides social, private housing for the low-income group. These can differ in the form of floating row houses or the single housing. The floating row housing can be developed collectively to decrease cost. Also, these floating houses anticipate on the rising sea level.

Pier constructions:

These pier constructions on the water also provide collective housing with shared facilities to accommodate for the low and middle-income groups.

Pier housing:

This stimulates a diversity of housing on the water which can also stimulate entrepreneurship of resident. This result in local programming by residents.

Floating greenhouse

The greenhouse provides exhibitions of blue-green solutions for the

rehabilitation process to stimulate the tools to be carried out. This is combined with a course how to sustain your house and profit. Also, it provides learning centers how to grow your crops on water and what tools are necessary that you can also buy in their shop. This will stimulate urban farming on water. Therefore the floating greenhouse can also be transformed into a room for events. This will result in diverse programming possible on the water.

Floating market:

The crops that have been grown on water environments can be sold on the floating market. For users, it is possible to rent a floating market to sell their crops.

Floating urban farming:

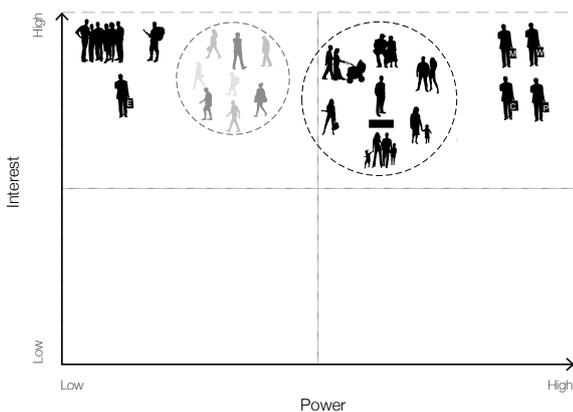
Floating farming stimulate educative farming on water which contributes to the social and healthy environment on water. Floating farming is accessible to all residents of Rotterdam. Its crops can be sold on the floating market environment. Water is used to stimulate the economy.

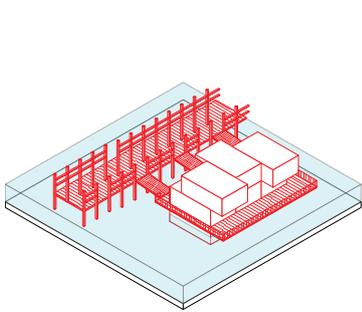
New bridge:

The new bridge ads a new layer of mobility for slow traffic, bikers and pedestrians. With the moving of the harbor activities, the truck traffic at the Brielselaan will vanish. This makes it more attractive and pleasant for pedestrians and bikers to use the Brielselaan. Therefore the new bridge stimulates an attractive connection to the city center for these slow traffickers. The new bridge also provide some pier viewpoints.

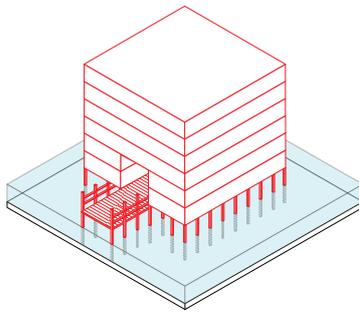
Reactivate

Use of the water by divers floating programming

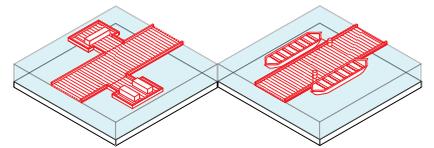




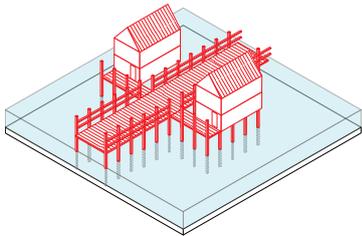
FLOATING HOUSES



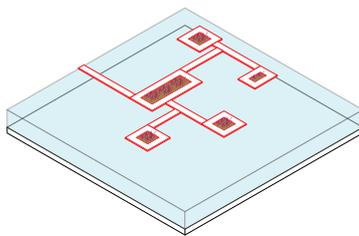
PIER CONSTRUCTION



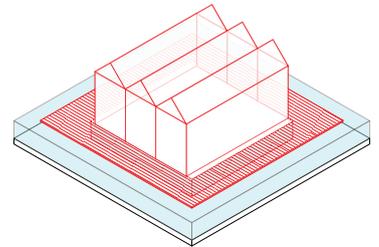
FLOATING MARKET



PIER HOUSING



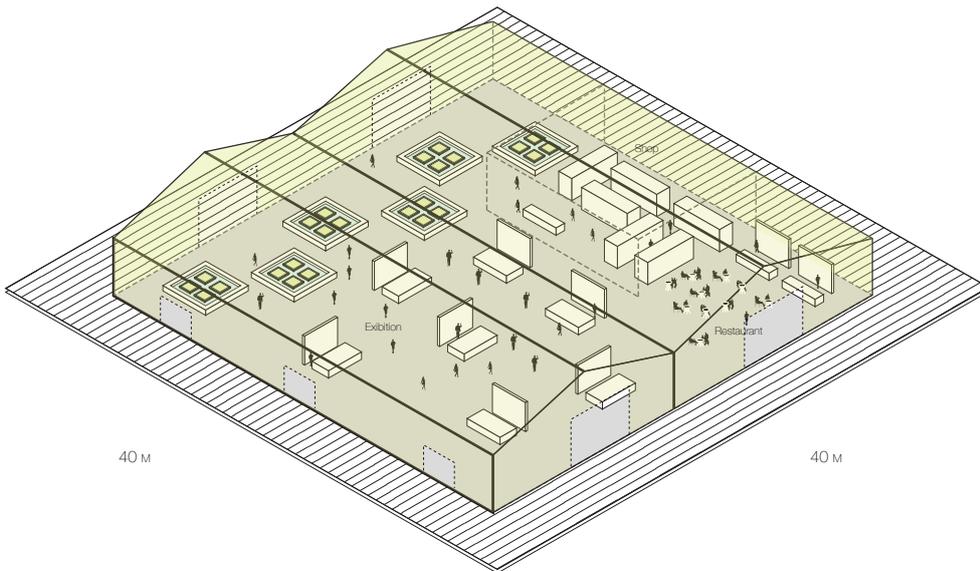
URBAN FARMING ON WATER



FLOATING GREENHOUSE

Figure 87: Developments on water toolbox

Source: By author



GREENHOUSE

Diagram 5: Possible floor plan greenhouse

Source: By author

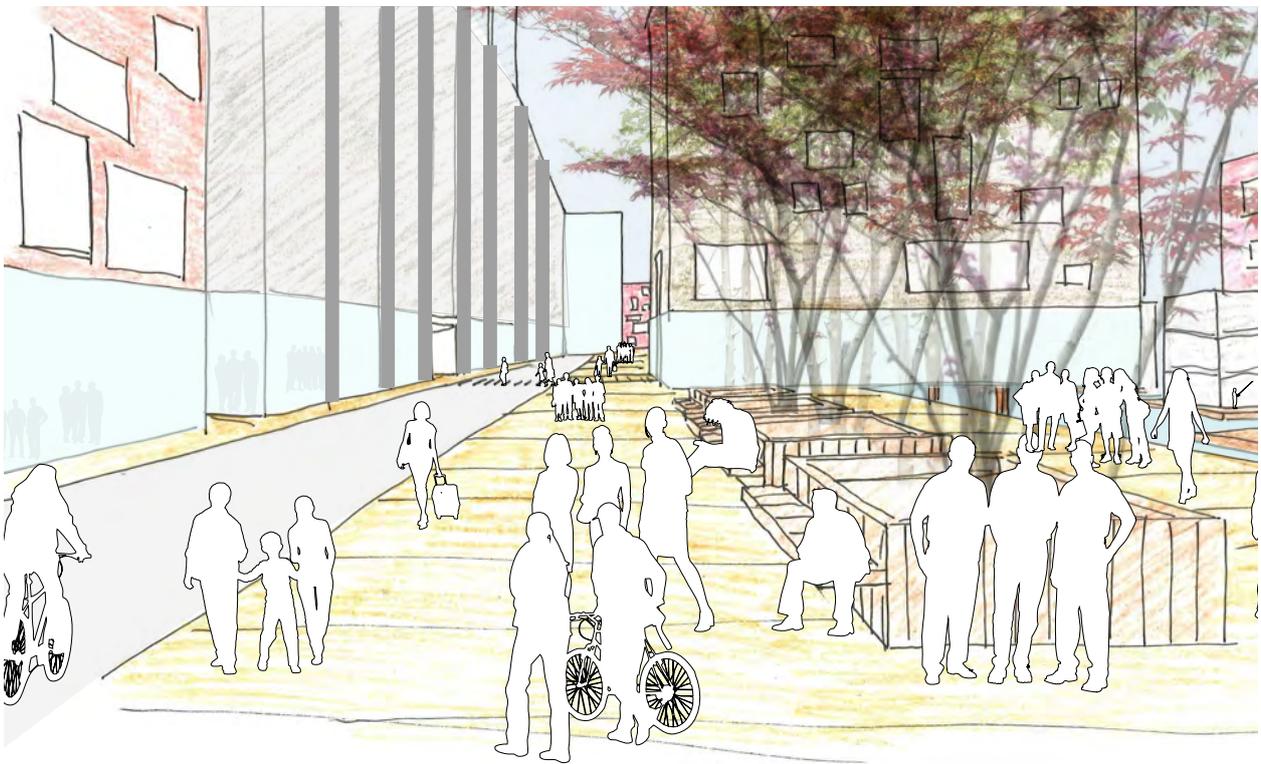


Figure 88: Scene waterfront edge

Source: *By author*



Figure 89: Scene waterfront edge

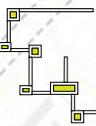
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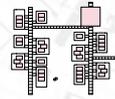
New bridge linking Tarwewijk with the city



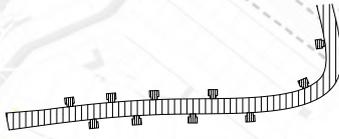
Floating Community



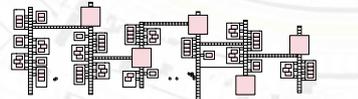
Floating farming



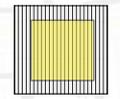
Floating market



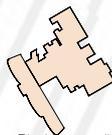
Floating pontoons & Pier constructions



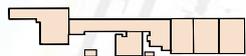
Floating greenhouse



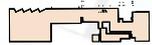
Monumental reuse



Playing paradise
(former waste factory)



Public functions, vocational center, internships
(former Maneba)



Foodhall
(former Quaker storage)



Public functions, vocational center, internships
(Maassilo)

New developments



Private and mixed development

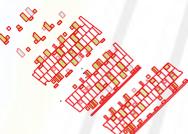


Current development

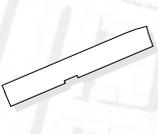


Heat water storage

Current structure neighborhood



Rehabilitation
Mijnkintbuurt



Existing urban fabric
Tarwewijk



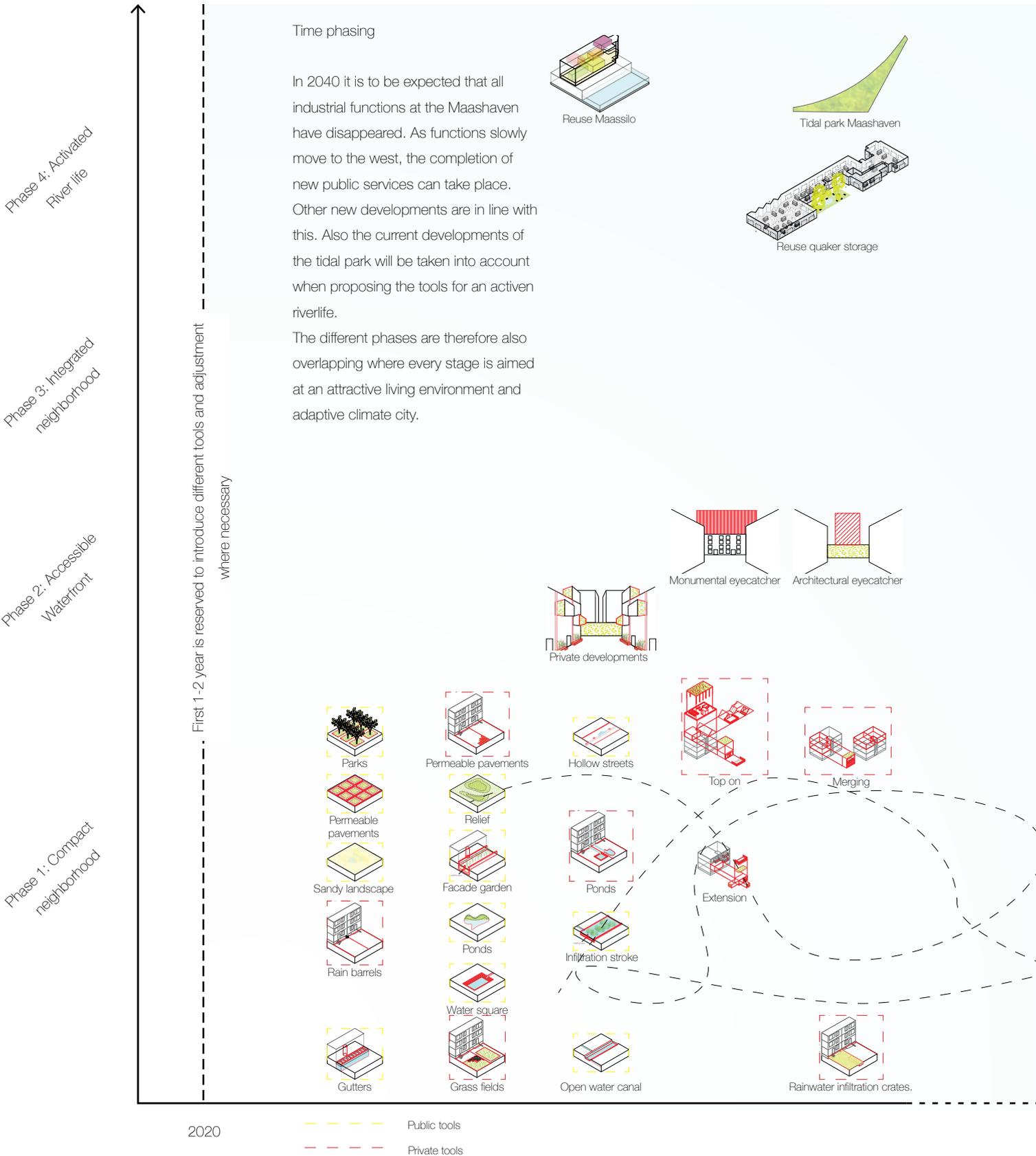
Existing urban fab
surroundings

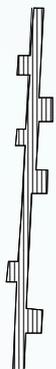




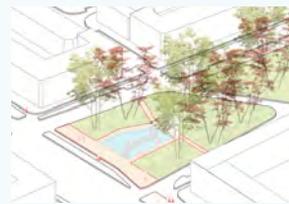
Figure 90: General masterplan
Source: By author

7.6 PLANNING





Continuous process



The tools in the rehabilitation process are implemented in the whole neighborhood where wanted, possible and necessary, resulting in an attractive area with an introvert character close to public functions.



2040

Figure 91: Possible time phasing of the interventions

Source: By author

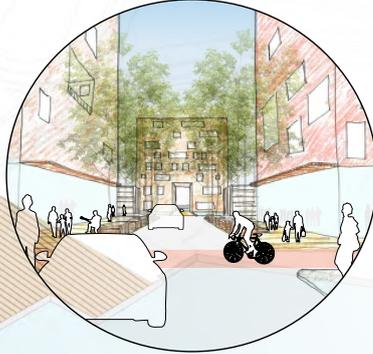
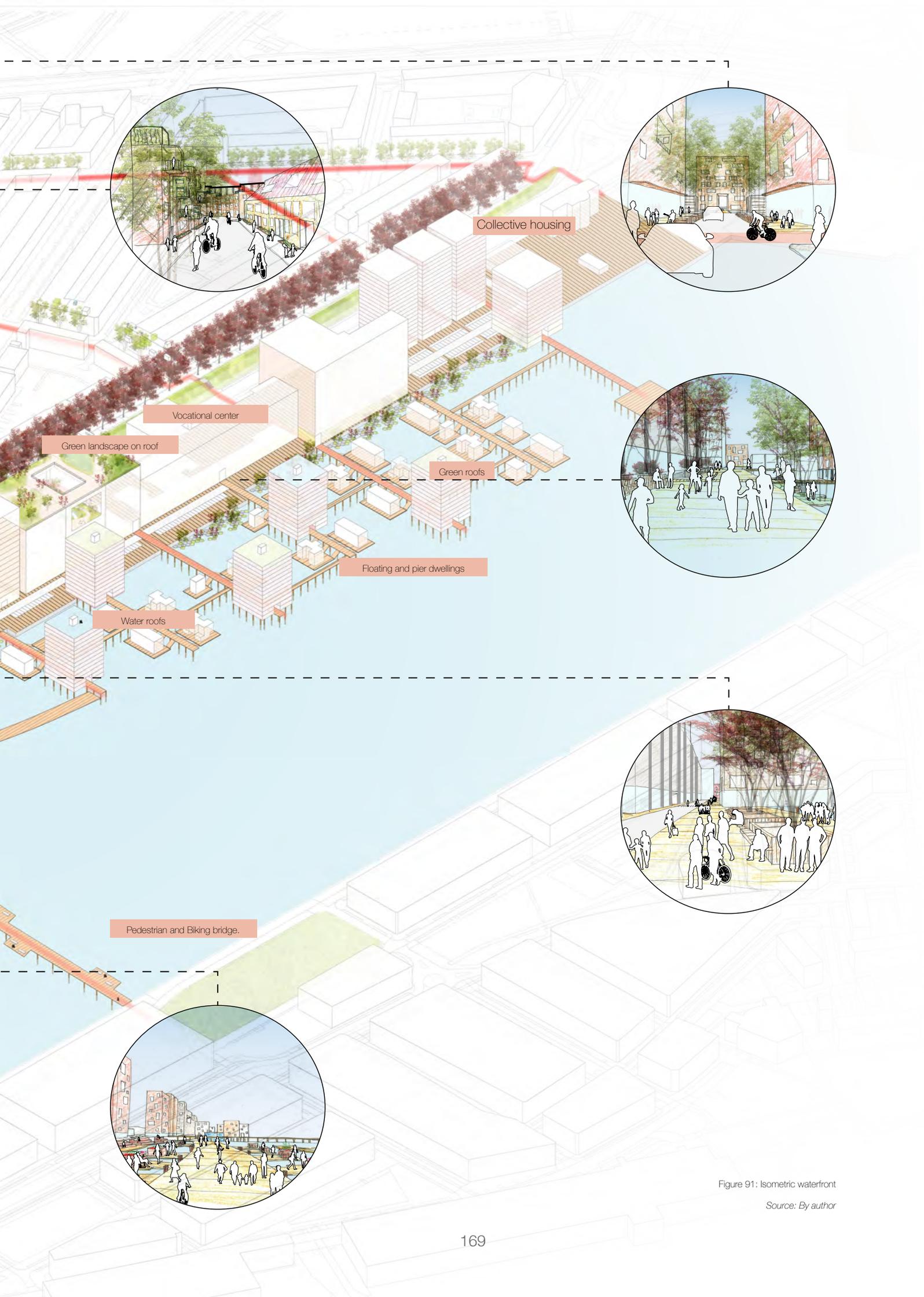


Collective housing

Public functions

Commercial functions

Greenhouse



Collective housing

Vocational center

Green landscape on roof

Green roofs

Floating and pier dwellings

Water roofs

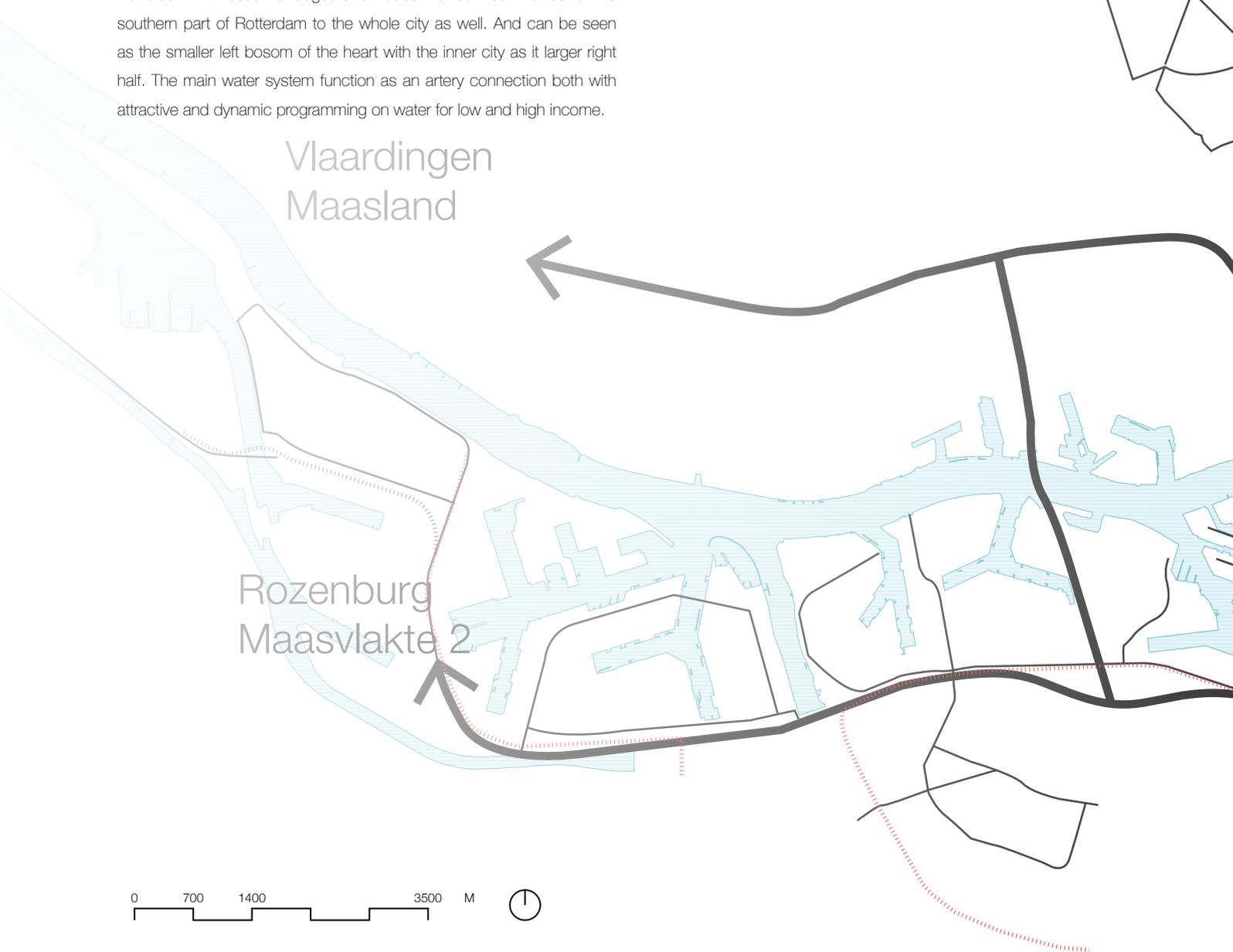
Pedestrian and Biking bridge.

Figure 91: Isometric waterfront

Source: By author

The coherent planning process within Tarwewijk has an impact on its current central position. The proposed strategy stimulate the integration of Tarwewijk in the whole network of Rotterdam. The impact influence surrounding neighborhood in the southern part of Rotterdam and is complimentary on current policies like "Pact of Zuid." Therefore, the rehabilitation process can be extended in other deprived neighborhoods: Oud-Charlois and Carnisse with the same building typology. Afrikaanderwijk and Bloemhof may not have the same building typology, but the provided public toos are applicable. These neighborhood can easily complement on the developments on the Maashaven due to their position. Metaphorical, Tarwewijk becomes part of the beating heart of Rotterdam with essential edges and nodes that connect the rest of the southern part of Rotterdam to the whole city as well. And can be seen as the smaller left bosom of the heart with the inner city as it larger right half. The main water system function as an artery connection both with attractive and dynamic programming on water for low and high income.

Delft
Rijswijk



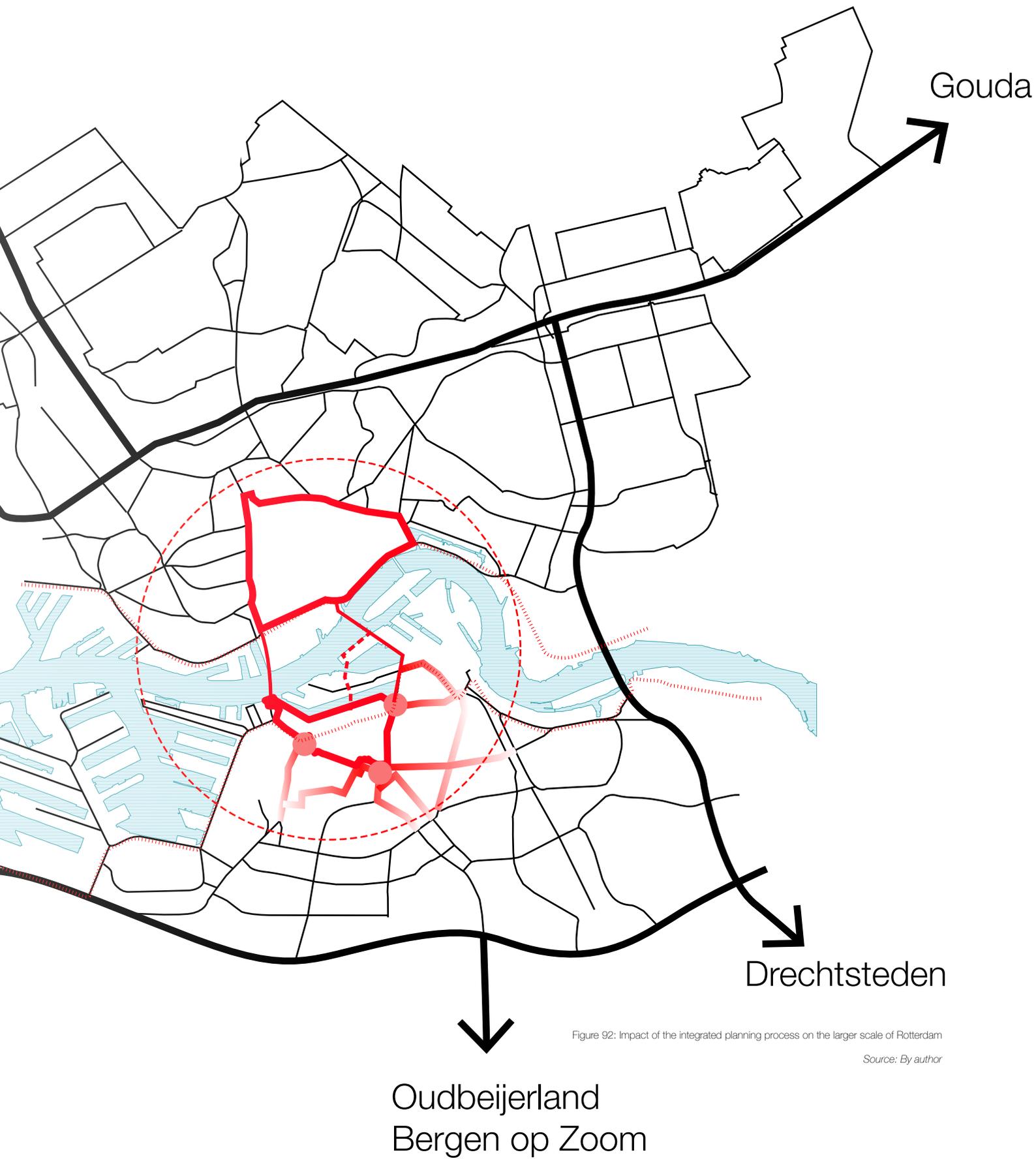


Figure 92: Impact of the integrated planning process on the larger scale of Rotterdam

Source: By author

CONCLUSION & EVALUATION

This thesis has aimed for a coherent planning process between waterfront redevelopment and urban rehabilitation in declining neighborhoods. It has been the attention to using new development at the water edge to stimulate the growing opportunities for the low-income group in declining neighborhood instead of using it to attract high-income group. The role of water has been examined throughout the thesis that aims to fill in the gap from segregation between the high and low-income group. This has defined how urban planning with the use of water can contribute to this coherency and reflect the rest of Rotterdam as a whole to enhance socio-economic challenges.

The main question that has been formed:

"How can we use water in spatial design in such a way that the Rotterdam delta is climate adaptive and the socio-economical processes in waterfront and deprived neighborhood are enhanced as a whole for future growth and improvement of the quality of life in the city?"

WATER AS A CONNECTOR

Rehabilitation through water sensitive design

Water is used in the rehabilitation process to revalue the quality of the living environment of private and public spaces in the current structure of the urban fabric. Water sensitive design also comes in combinations of green development. A large number of private landowners profit from their investment by restructuring their dwellings with blue-green solutions formed from the theoretical framework. This investment increases their property value. Also, these investments stimulate growing opportunities in Tarwewijk, due to innovative possibilities to increase surface that comes with these blue-green solutions. Public space will be less vulnerable to future water nuances in the area. This also stimulates an attractive

public space to use, that at the same time is educative and increase awareness of climate change. These public environments contribute to a certain quality of life by stimulating outdoor activities that effect health. All the interventions in the rehabilitation process related to an attractive living environment that results in a desirable neighborhood which connects residents with their living environment.

Reconnect by emphasizing relations with the waterfront

The large water environment at the edge of the neighborhood is emphasized to interconnect with its residential area. Also, water can be used in private en public developments to strengthen this interconnection. This interconnection is based on three different types. One is through new private development that related to the rehabilitation process. This development with blue-green design stimulate curiosity from pedestrian and can set an example in the rehabilitation process. The other two are bases on the monumental heritage that maintain architectural elements of the silos and new architectural eye catchers. These can be restructured by using blue-green interventions that create new elements to stimulate new relations. These silos has been there for a long time and by adding a new element can indicate something new happening. The architectural eye catchers stimulate something new is happening which will increase the curiosity of pedestrians to go to the waterfront.

A new bridge over the water also ads a new layer of mobility to the whole city for slow traffic, pedestrians, and bikers. Withing this intervention, the large bowl of water at the waterfront is used to connect residents with their waterfront. Also, the new layer of mobility provides new connections through the neighborhood. This connection is more pleasant because of its shorter length and pleasant crossing through a quiet and easy neighborhood. This stimulates Tarwewijk to maintain a compact neighborhood.

(Re)-activation programming of the waterfront with developments on and at the water.

Water can be used to stimulate affordable programming for public use by all target groups with different background and stimulate private and public development to enhance the growing opportunities of residents in Tarwewijk.

History and current developments have shown that redevelopment of the waterfront is aimed for the high-income group. This strategy proposes a new way of designing for the neighborhood. It is important to build affordable programming to enhance Tarwewijk as a declining neighborhood. With private programming as floating row houses and collective housing, it is possible for the low and middle-income group to experience a living environment at the water. This stimulates a housing career in Tarwewijk which decrease its moving mobility. Also, vocational institutes are provided to enhance the educational development of the low-income group to increase chances of employment in Rotterdam.

Other public uses on the water are aimed to stimulate use for all income groups with a different background. The water stimulates these public functions like a market hall, floating farming and green house.

The inter-scalar design strategy on different levels shows the asset and value of water which increases awareness of different users. Use of water in a coherent process between waterfront and neighborhoods has resulted in the Tarwewijk being integrated into the larger entity of Rotterdam by reclaiming back the water edge. Therefore it can be said that the main role of water is as a connector. On the scale of the neighborhood it has connected residents with their living environment. Within this scale, water has connected residential areas to its attractive waterfront with affordable programming. At the city scale, the neighborhood Tarwewijk is integrated into the larger network of Rotterdam by a bridge over water and contribute to an attractive living environment in Rotterdam.

MERGING OF INTEREST

In this new coherent planning process, one stakeholder can not play the main role but is dependent on others to be successful. Designers are limited to spatial challenges, but the involvement of other public and private stakeholders can stimulate the social and economic processes. Therefore it is needed to aim for a merger of interest approach where much as possible stakeholders can be involved to stimulate this coherent planning process.

EVALUATION

This part describes how water in spatial design reflect as a whole to Rotterdam.

The Rotterdam delta, very vulnerable to water threats. With designing with water on different levels decreases its vulnerability and stimulate and climate adaptive Rotterdam

Also, The top location of Tarwewijk within the southern part of Rotterdam has shown to be a powerful position to integrate Tarwewijk in the current network of Rotterdam and reclaim the main water body edge. The proposed inter-scalar design strategy stimulate the current edges and nodes of Tarwewijk to be more important, which related to Tarwewijk having a quieter attractive living environment within a few minutes away from public facilities. On the long-term, other neighborhoods around Tarwewijk may move with this network which extends more desirable neighborhood in Rotterdam.

Therefore this inter-scalar design does not only reflect on future water threats from heavy rainfall but to Rotterdam as a whole that enhances socio-economic status of decline neighborhood to be attractive. And so this will contribute to an attractive city for both high and low income with a strong economy that fills in the gap of segregation between the two.

REFLECTION

THE RELATIONSHIP BETWEEN RESEARCH AND DESIGN.

Research has been an essential tool during the graduation process. Since the beginning, literature research was done to obtain an initial grasp and to have a better overview about the topics climate change, declining neighborhoods and waterfront development in general, and in the location of Rotterdam, in particular.

After the trends and its problem were formulated, the main research question and sub-questions have been shaped and re-shaped as many times needed. These has resulted in the methodology framework that has corresponded in different stages of the thesis project. The Research is done as research by design. After the trends and problem have been analyzed, further research has been a continues process of interaction between the different tools that are used to do answer the main and sub-questions. The research has been done by implementing design principle on site, going back and forth between theory and practical knowledge. In the design is was needed to research how to encounter certain issues. In addition is was also needed how they were implemented in other context by doing an empirical study.

As been described, the development of this project has been a cyclical process, where a circular, rather messy, the line can be followed in the research process. In this process, a helpful tool was to do trial presentations to evaluate if the proposed strategy were

being carried on the way toward the final product. The attended steps toward the end product have in some way been experienced by failure and reboot.

THE RELATIONSHIP BETWEEN THE THEME OF THE GRADUATION LAB AND THE SUBJECT/ CASE STUDY CHOSEN BY THE STUDENT WITHIN THIS FRAMEWORK.

Living in Rotterdam and experience all its development has always made my realize that the case study of the graduation project would be in Rotterdam. Rotterdam is a dynamic world port and has a century-long tradition of living with water. The tradition of protecting "against and living with water" contributed to the development of the city. With the transitions of the port to the Maasvlakte that left a lot of post-industrial places abandoned and the topic of climate change rising, development around and with water became more important for Rotterdam. A lot of interest for waterfront redevelopment arise among planners and urban designers, however, Rotterdam also faces the problem of declining neighborhoods which mostly is excluded from waterfront redevelopment where the quality of water contributes to its lively environment. As a resident of Rotterdam, living in different parts of it, and urbanism student, I felt a personal an academic task to enhance these neighborhoods with planning that involves the low-income group as well. With the importance of climate change and many declining neighborhoods in Rotterdam, I saw an opportunity using adaptive water solution to create

a coherency between waterfront redevelopment en urban regeneration.

Due to a changing climate and changing insights concerning sustainable relations between cities and water-landscapes, new interventions will be needed to create a new urban delta-landscape. In addition to safety and better water-systems, in urban delta's there is a need for stronger spatial identities and new cohesion of cities and their water-landscapes. At this point, it became very clear that the research studio "Delta urbanism" was fit to be chosen in for the thesis to make Rotterdam climate adaptive and a coherent city between waterfront redevelopment and declining neighborhood. And due to the social and spatial challenges, Rotterdam has related to the delta interventions studio it resulted in choosing the second studio as the Urban Fabric studio. Due to infrastructural development, a lot of area in the southern part of Rotterdam is paved and therefore vulnerable to climate change. Also, most decline neighborhood in the southern part of Rotterdam consists of private ownership. Within this situation is it necessary to know one can not just demolish but is required to work in the existing urban tissue.

THE RELATIONSHIP BETWEEN THE PROJECT AND THE WIDER SOCIAL CONTEXT.

Someone once asked me how I experienced Rotterdam living there for many years. I directly told

that Rotterdam was a growing cultural city which has a lot of everything with great accessibility to public functions. This was directly tackled by the fact it has so many migrants, low quality of housing and public space. But that is not how I experienced it, while others see the southern part as something that is defined with so many declining neighborhoods due to the high amount of private housing that attract the low-income group. I have seen a lot of development in Rotterdam that contributed to a larger system of the network in Rotterdam. On the other side, strategies for the neighborhood has been too much aimed at local interventions like the policies of the Vogelaarwijken to enhance the community, while these interventions could be involved in the larger network of Rotterdam instead of isolating it from attractive environments. By using attractive environments along the water to attract only the high-income group is irresponsible and neglects growing opportunities for residents in the southern part of Rotterdam. That's why I think it is mostly important to enhance the coherency between waterfront redevelopment and urban regeneration involving all income groups and specify growing opportunities for the low-income group to change the image that the southern part of Rotterdam now has. If we do not consider increasing opportunities for the low-income group, neighborhoods will stay isolated en neglected by high moving mobility. Therefore, a coherent planning process can change the image of the city by contributing as a whole neighborhood in the larger network involving all income group.

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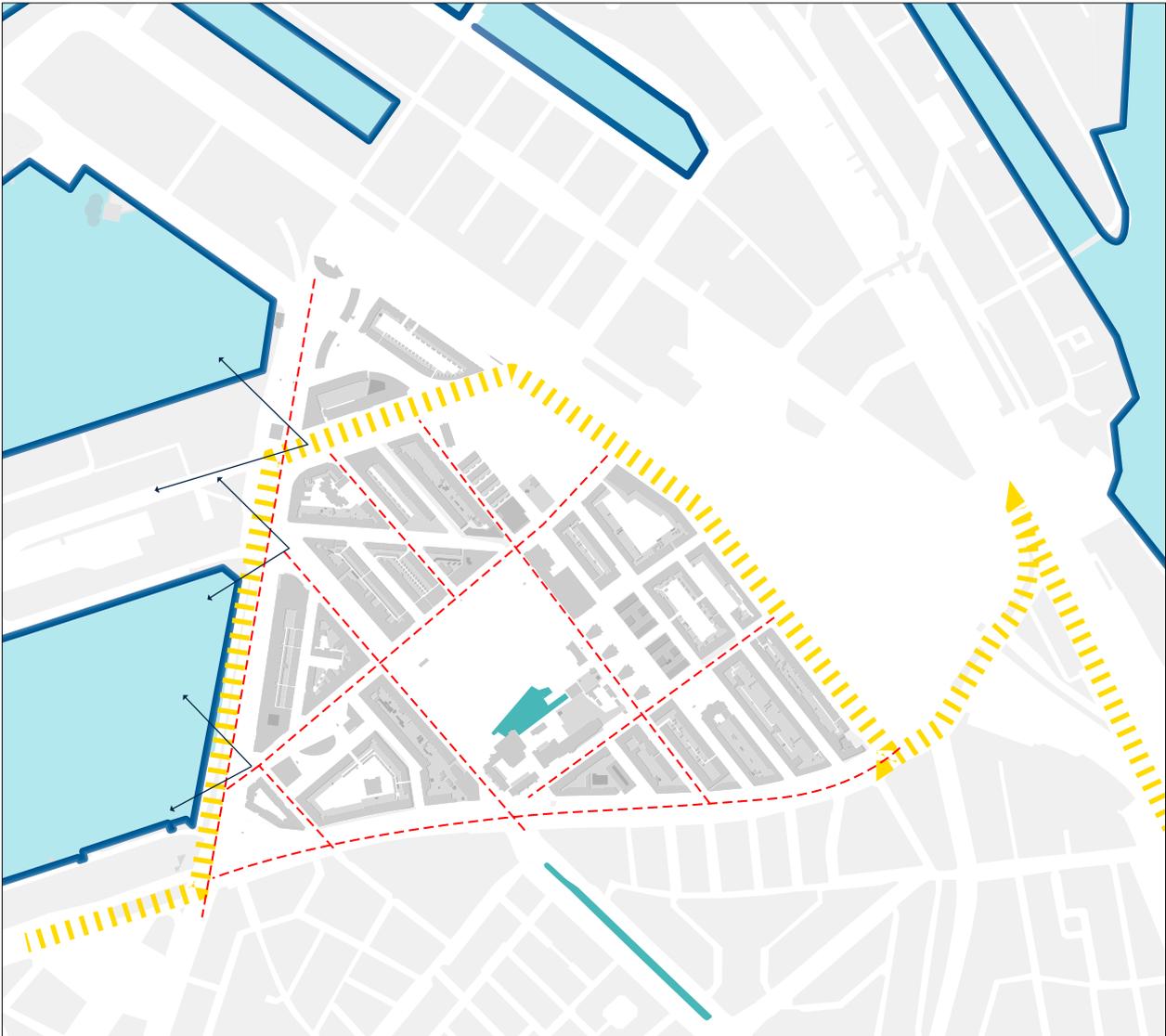
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All images, diagrams and mappings are made by the author unless otherwise is mentioned or referenced on the corresponding page.

APPENDICES

APPENDIX I

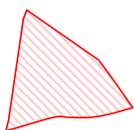
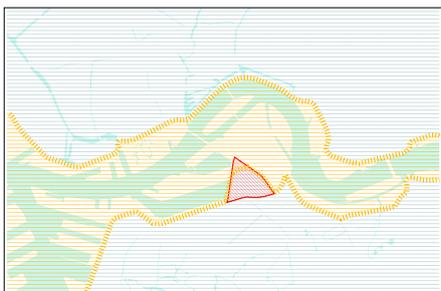
WATERFRONT ANALYSIS



LEGEND

- Maas
- District
- Inside dike
- Outside dike
- Water systems
- Dike
- Sight lines
- Fysical relation Maas
- Border district

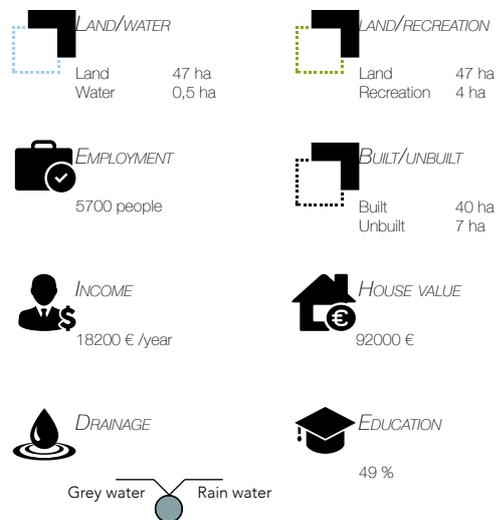
POSITION



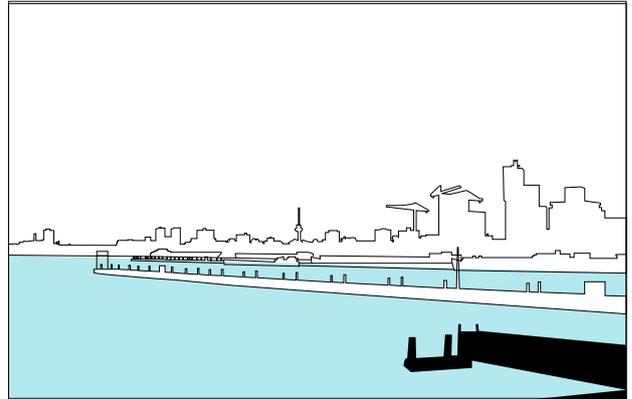
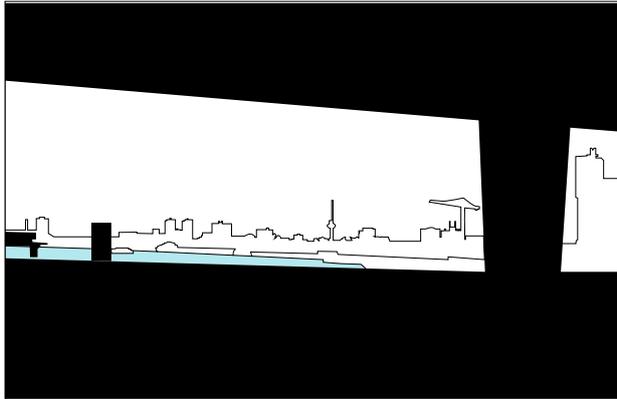
INHABITANTS

8075

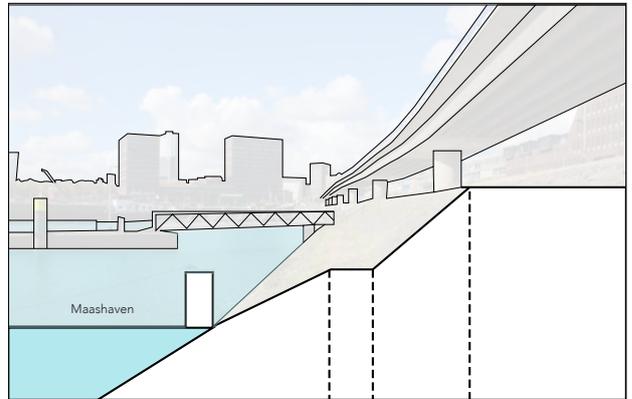
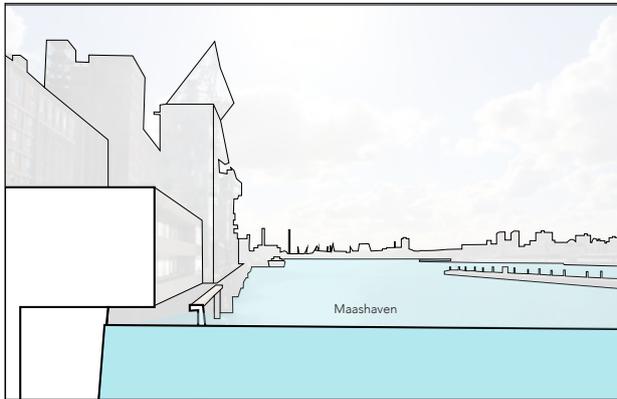
DEMOGRAPHICS



SIGHT LINES



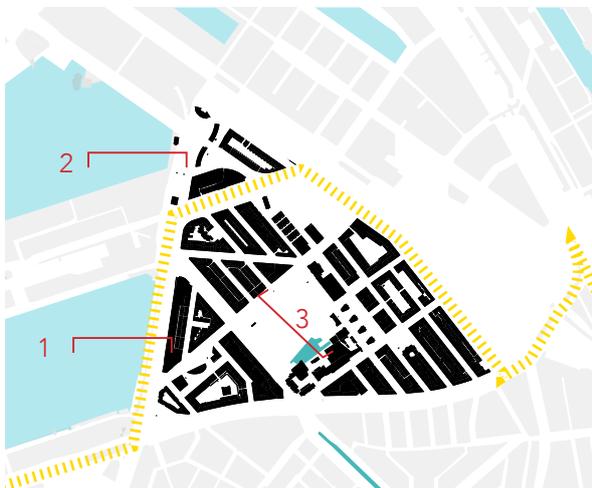
3D-SECTIONS



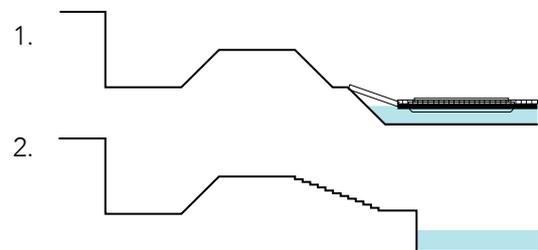
The area has little surface water in their public park in the middle of the district. This adds to a certain quality of the space but the water system functions on its own and is not part of other water systems in the area. The challenge here would be to provide more water storage in a creative way to avoid rainfall nuances but also to add an certain spatial quality in the area on a street levels.

Adjacent to the left boundary of Afrikaanderwijk are the docks Rijnhaven and Maashaven. The area has no direct accessibility to this waterfront and is blocked by the dike which you can see in section one. The waterfront provides a certain recreational purpose (section 2), but is mostly experienced in nice sight lines towards the building skyline in Katendrecht and silo's in Tarwewijk.

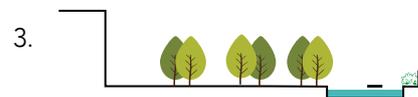
SCHEMATIC SECTION WATER SYSTEMS



DOCKS EMBANKMENTS



CONSTRUCTED LAKE

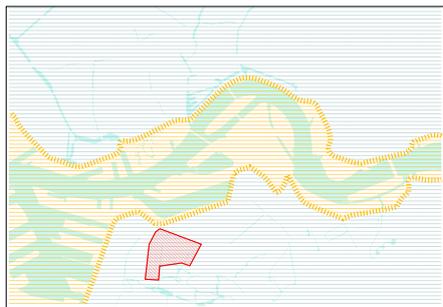




LEGEND

- Maas
- District
- Inside dike
- Outside dike
- Water systems
- Dike
- Sight lines
- Fysical relation Maas
- Border district

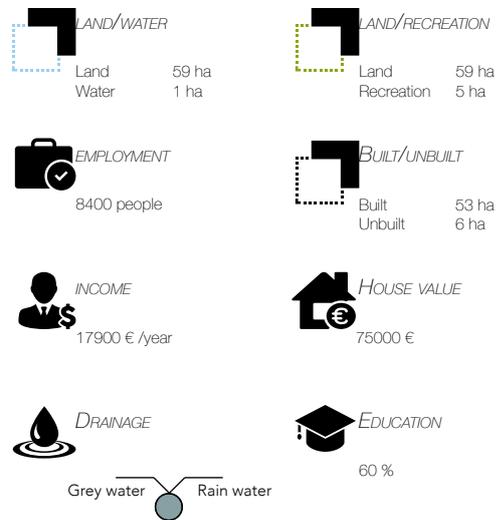
POSITION



INHABITANTS

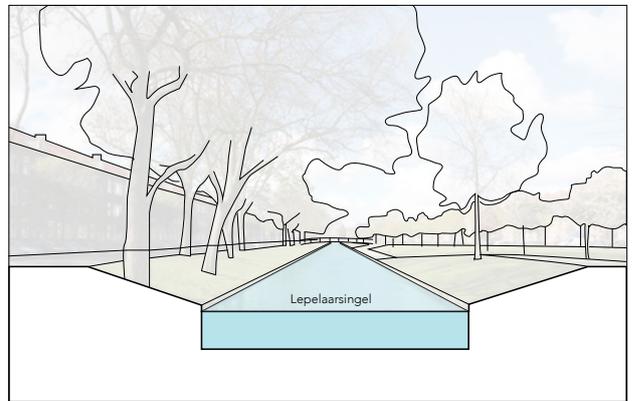
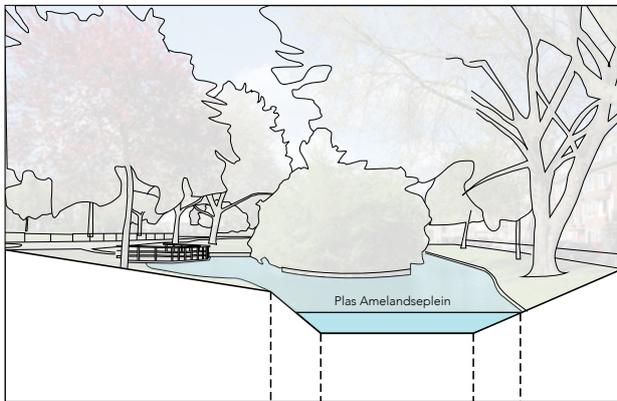
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DEMOGRAPHICS



SIGHT LINES

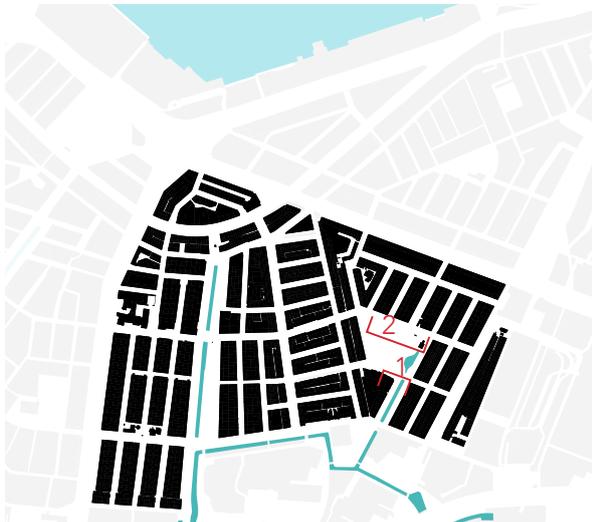
3D-SECTIONS



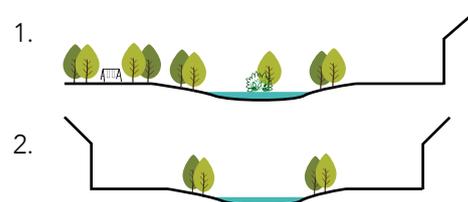
Carnisse has surface water in the form of soft canals and ponds. Compared to other streets in the area these water systems have a big impact on the spatial quality of the street and public space. The Lepelaarsingel is a beautiful single. Due to its size and design, this is a very attractive part of Carnisse. Attractive to live as well as outside space to stay in.

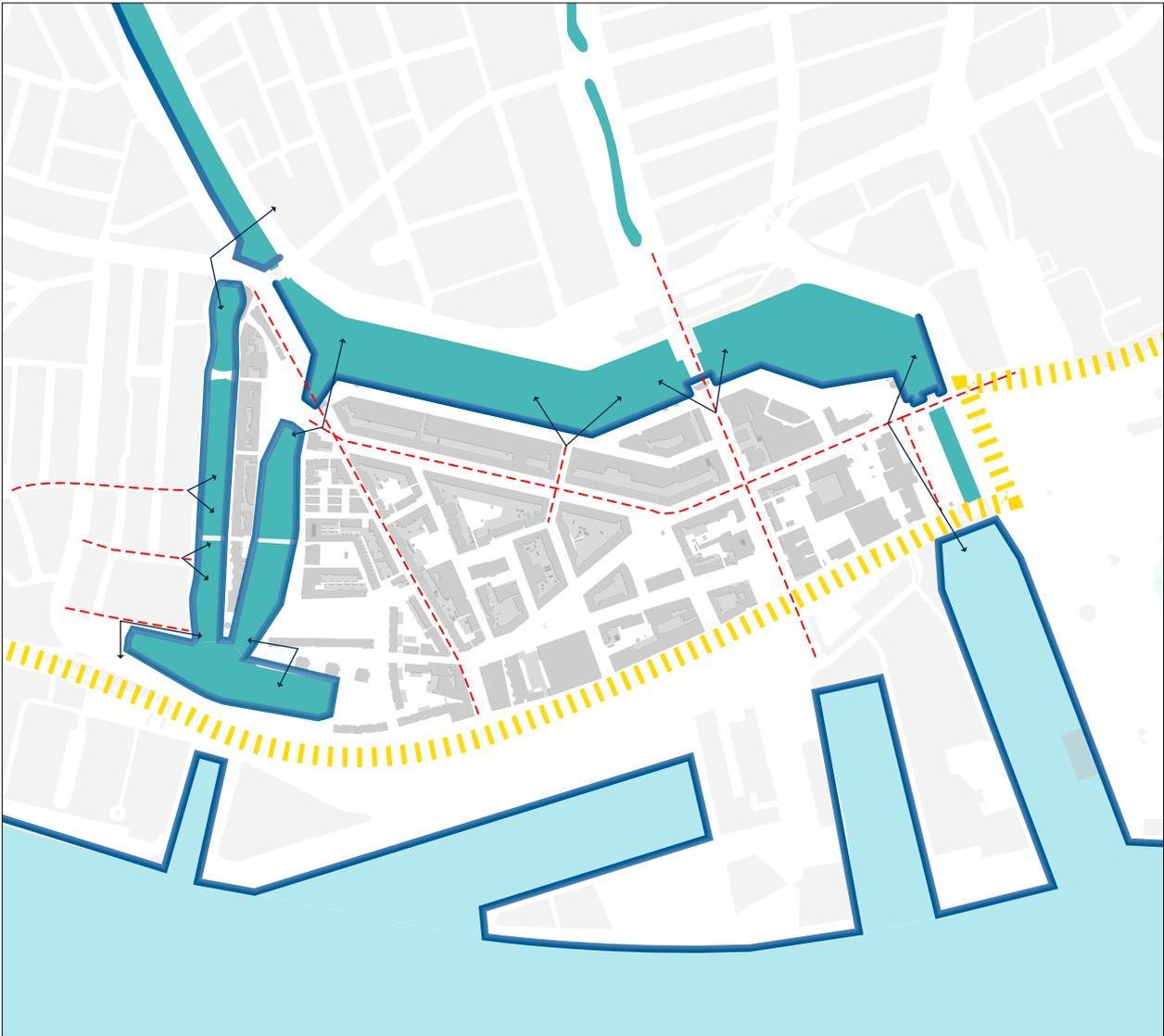
Carnisse also knows the Amelandseplein as an open space which compensates for the high urban density of the neighborhood. The water systems in Carnisse are combined with recreational purposes. Therefore, Carnisse has no relation with the Meuse.

SCHEMATIC SECTION WATER SYSTEMS



SOFT CANALS AND LAKES

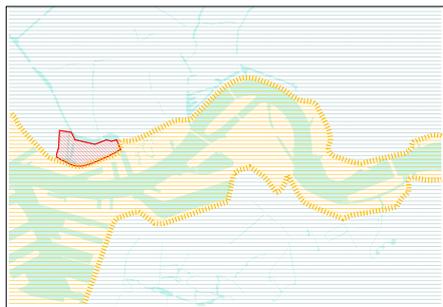




LEGEND

- Maas
- District
- Inside dike
- Outside dike
- Water systems
- Dike
- Sight lines
- Fysical relation Maas
- Border district

POSITION



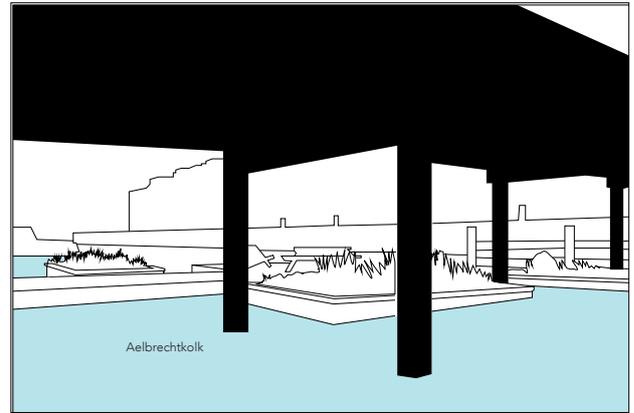
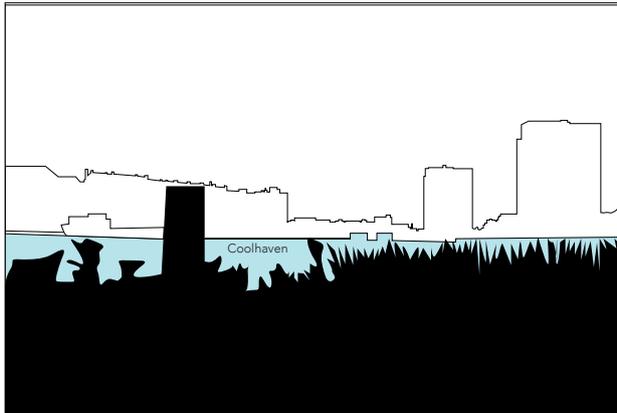
INHABITANTS

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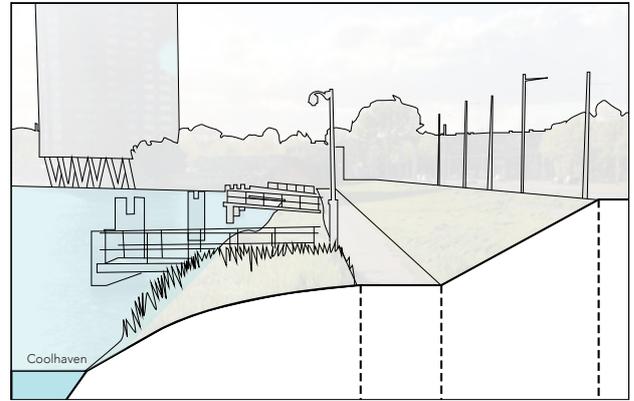
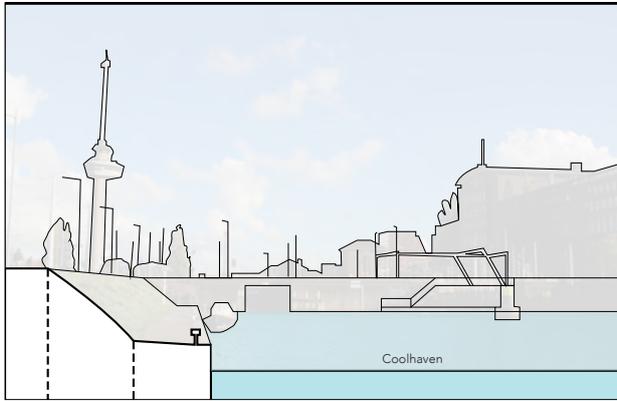
DEMOGRAPHICS

<p>LAND/WATER</p> <p>Land 55 ha Water 6 ha</p>	<p>LAND/RECREATION</p> <p>Land 55 ha Recreation 0 ha</p>
<p>EMPLOYMENT</p> <p>55500 people</p>	<p>BUILT/UNBUILT</p> <p>Built 38 ha Unbuilt 17 ha</p>
<p>INCOME</p> <p>23000 € /year</p>	<p>HOUSE VALUE</p> <p>120000 €</p>
<p>DRAINAGE</p> <p>Grey water Rain water</p>	<p>EDUCATION</p> <p>59 %</p>

SIGHT LINES



3D-SECTIONS



In the area that formerly formed the port of Delft, the water still has an image role at the edges and by the ports that is part of the area:

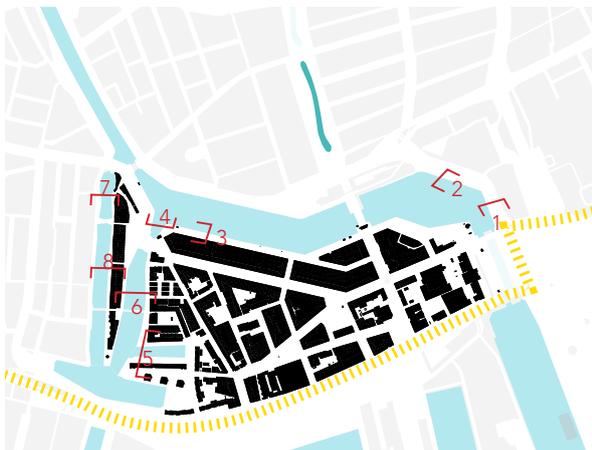
- The Coolhavenkade is in use for professional ships and ships of the Naval School;
- The Aelbrechtskolk and the front port of historic ships, south facing in modern Ships in the renewed building;
- The Middenkous for modern ships.

From the Westzeedijk there is a view of shipping on the river and

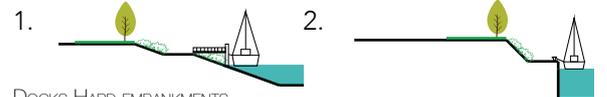
the activity of the port area.

So the water systems have an historical use of shipment. On the other hand, the water have also a spatial quality and is in some cases used for recreational uses (section 8). Although they are called harbors, the Aelbrechtskolk function as a canal like Amsterdam. The value of the perception of urban water can be described from the angles of space, culture and nature.

SCHEMATIC SECTION WATER SYSTEMS



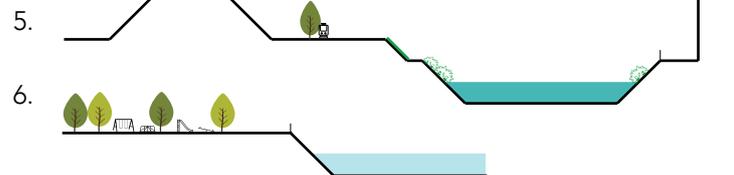
DOCKS SOFT EMBANKMENTS



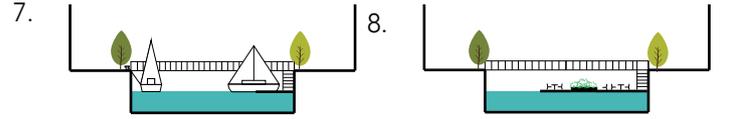
DOCKS HARD EMBANKMENTS



PARK/PUBLIC SPACE EMBANKMENTS



HARD CANALS

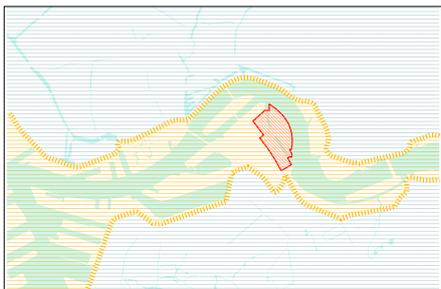




LEGEND

- Maas
- District
- Inside dike
- Outside dike
- Water systems
- Dike
- Sight lines
- Fysical relation Maas
- Border district

POSITION



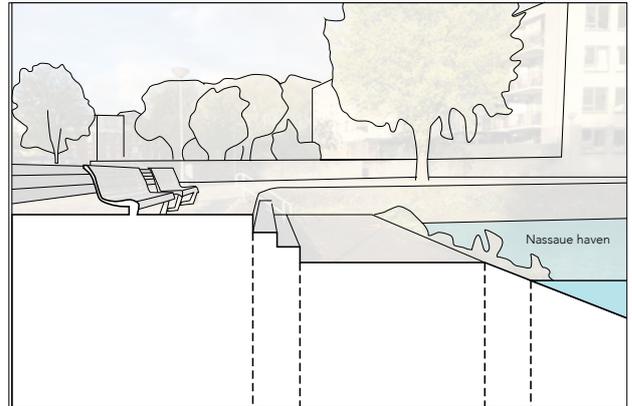
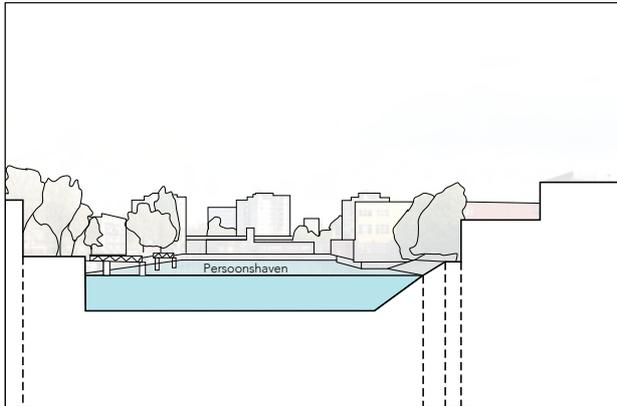
INHABITANTS

73490

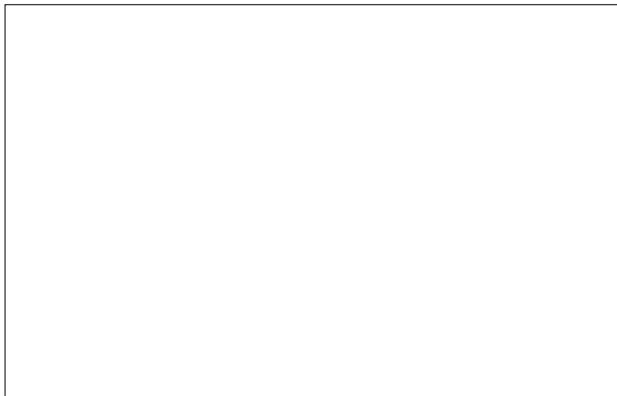
DEMOGRAPHICS

<p>LAND/WATER</p> <p>Land 100 ha Water 14 ha</p>	<p>LAND/RECREATION</p> <p>Land 100 ha Recreation 5 ha</p>
<p>EMPLOYMENT</p> <p>53300 people</p>	<p>BUILT/UNBUILT</p> <p>Built 54 ha Unbuilt 46 ha</p>
<p>INCOME</p> <p>175000 € /year</p>	<p>HOUSE VALUE</p> <p>122000 €</p>
<p>DRAINAGE</p> <p>Grey water Rain water</p>	<p>EDUCATION</p> <p>46 %</p>

SIGHT LINES



3D-SECTIONS



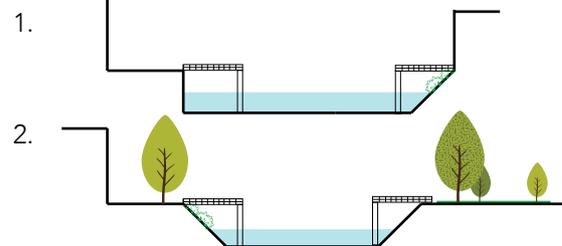
The surface water that is present in the plan area consists of the Nieuwe Maas, the Feijenoordhaven, the Nassauhaven and the Persoonshaven. These ports are in direct connection with the Nieuwe Maas. The area is characterized as an isolated location between the Nieuwe Maas and the railway from Rotterdam to Dordrecht. The many water in and along the area (the river, the

Persoonshaven and the Nassauhaven) gives Feijenoord its own character. The parks around the water systems are mostly "looking" green and do not invite people to stay. Although there are some embankments of the docks that stimulate recreational or staying purposes (section 4). Historical characters of an port are still present in the current water systems even they are not in use.

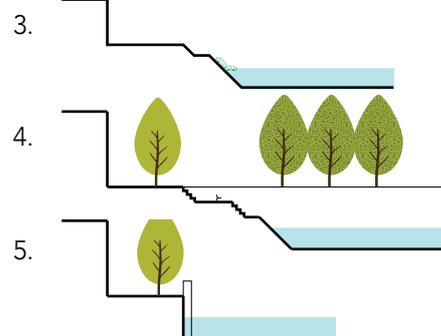
SCHEMATIC SECTION WATER SYSTEMS

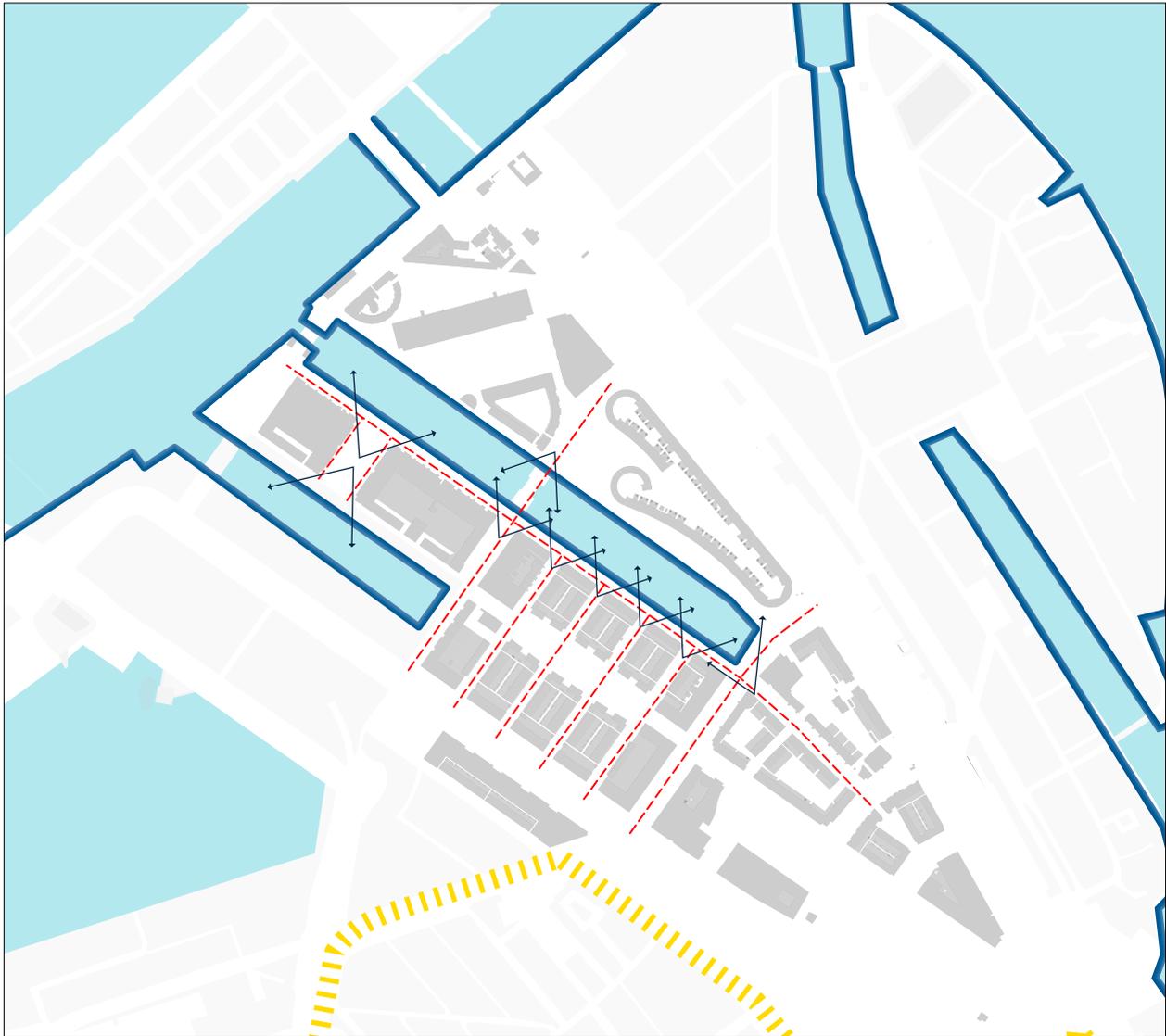


DOCKS TRANSFORMED



DOCKS EMBANKMENTS

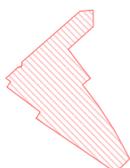
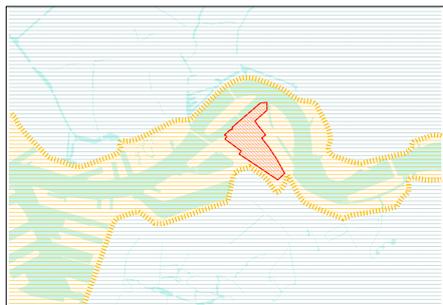




LEGEND

- Maas
- Outside dike
- Sight lines
- District
- Water systems
- Fysical relation Maas
- Inside dike
- Dike
- Border district

POSITION



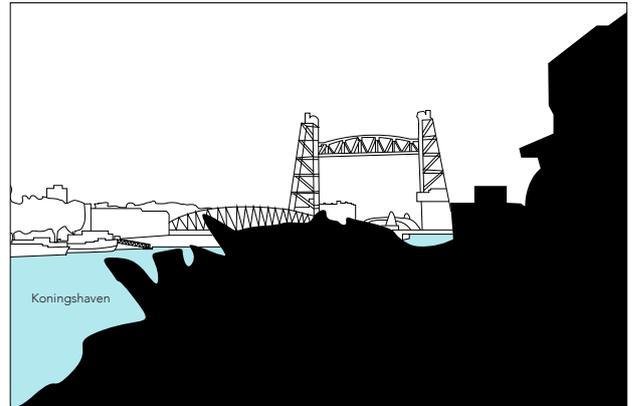
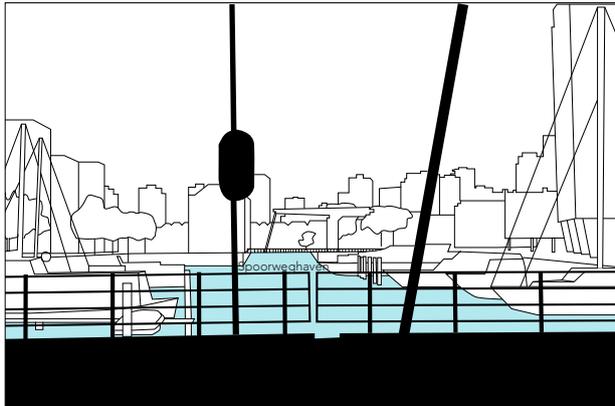
INHABITANTS

8490

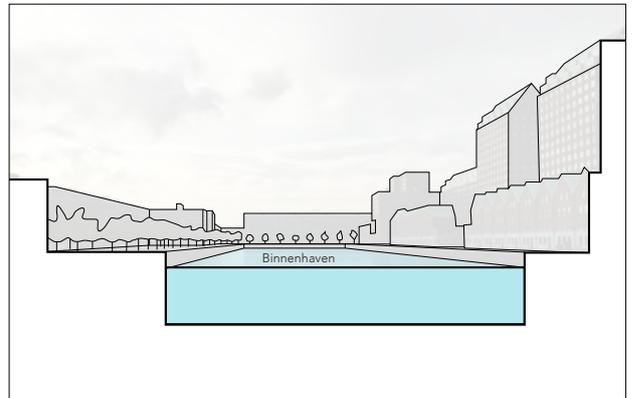
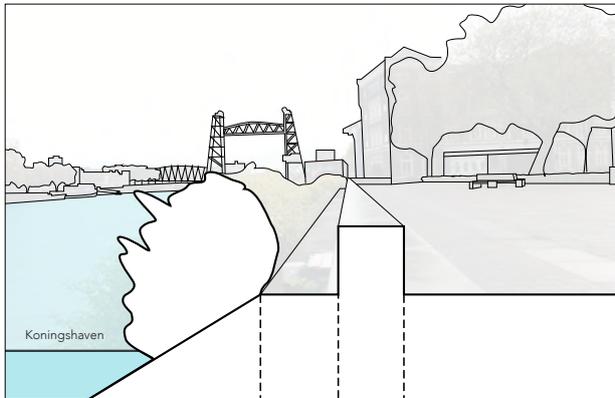
DEMOGRAPHICS

<p>LAND/WATER</p> <p>Land 150 ha Water 14 ha</p>	<p>LAND/RECREATION</p> <p>Land 150ha Recreation 5 ha</p>
<p>EMPLOYMENT</p> <p>1700 people</p>	<p>BUILT/UNBUILT</p> <p>Built 103 ha Unbuilt 47 ha</p>
<p>INCOME</p> <p>40700 € /year</p>	<p>HOUSE VALUE</p> <p>169000 €</p>
<p>DRAINAGE</p> <p>Grey water Rain water</p>	<p>EDUCATION</p> <p>67 %</p>

SIGHT LINES



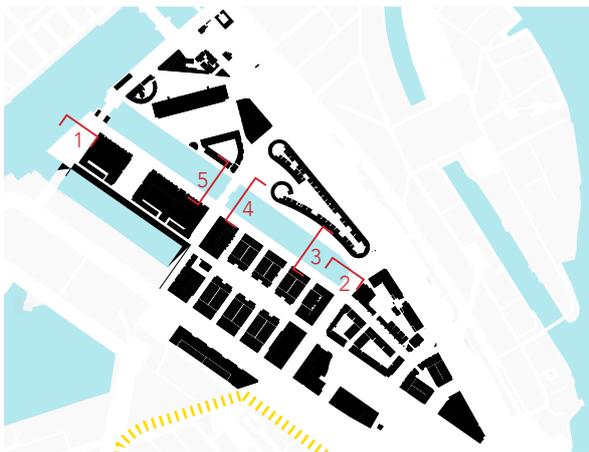
3D-SECTIONS



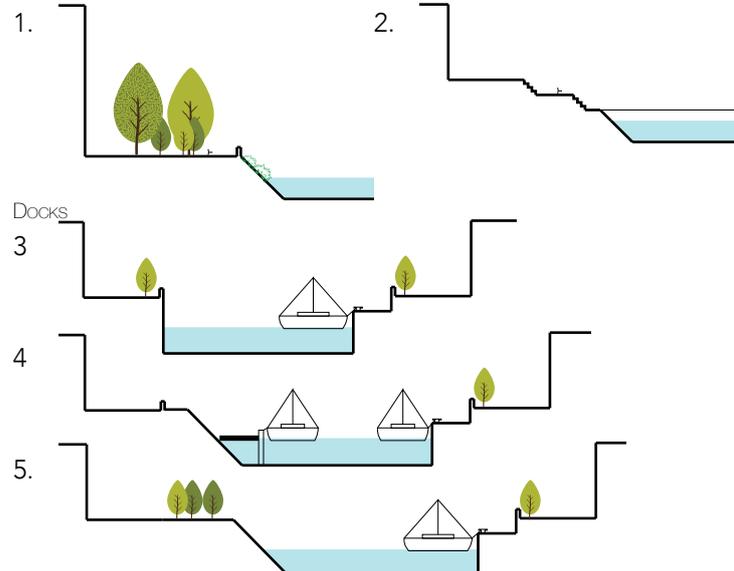
Feijenoord has a number of ports, namely the Koningshaven, the Entrepothaven, the Binnenhaven and the Spoorweghaven. These ports are also in direct connection with the New Meuse like in Feijenoord. In the Entrepothaven and the Binnenhaven are pleasure boats located (sightliness and section 3-5), which

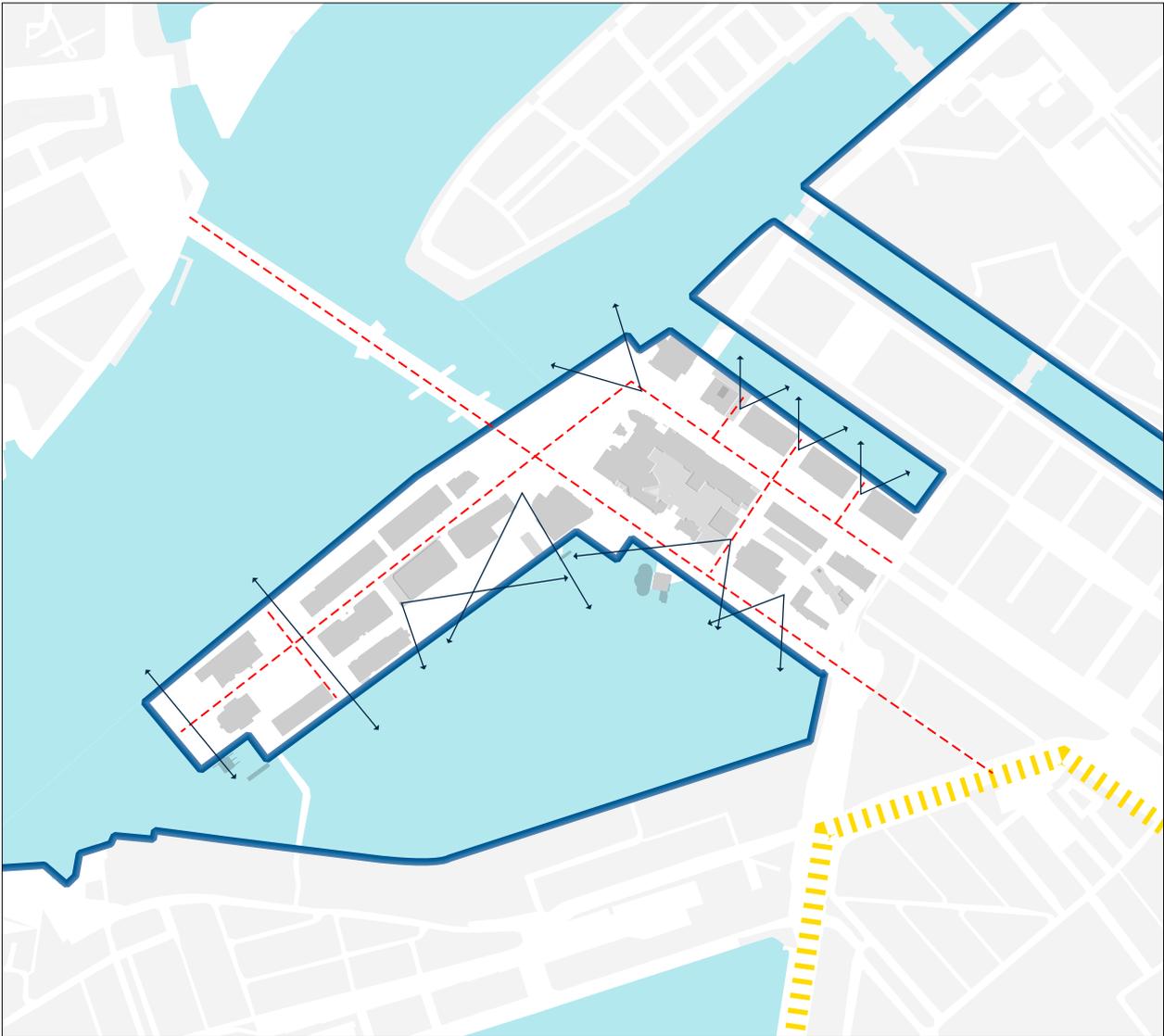
give the environment a particularly maritime character. This also invites for recreational and staying purposes on the water. The Spoorweghaven, on the other hand, is not yet used for pleasure boats, making this water a forgotten impression.

SCHEMATIC SECTION WATER SYSTEMS



RIVER EMBANKMENTS

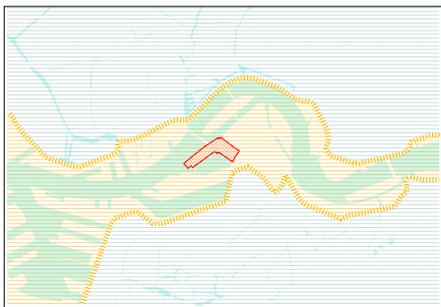




LEGEND

- Maas
- Outside dike
- Sight lines
- District
- Water systems
- Physical relation Maas
- Inside dike
- Dike
- Border district

POSITION



INHABITANTS

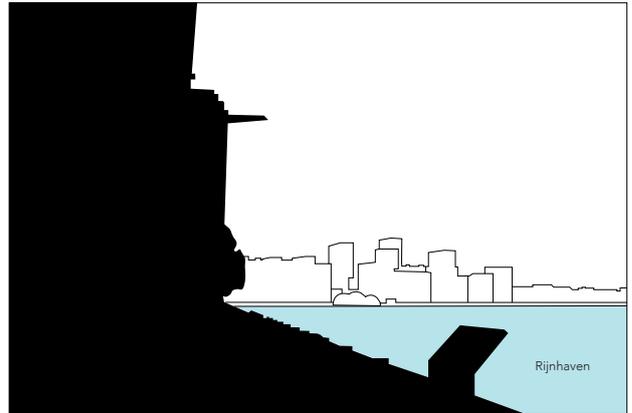
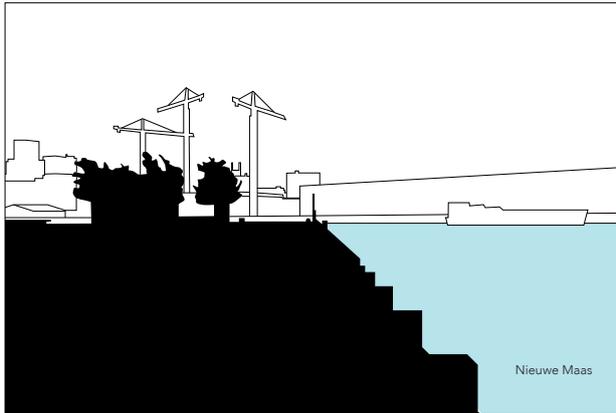


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DEMOGRAPHICS



SIGHT LINES



3D-SECTIONS

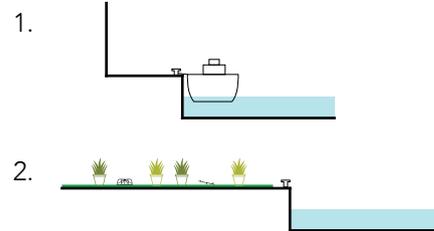
The Kop van Zuid area is an totally outside dike area and does not have any surface water but is surrounded by the Meuse. Rainfall water is immediately discharged into the water of the Meuse. The Kop van Zuid has mostly commercial functions along the embankments which attracts for leisure. However these commercial

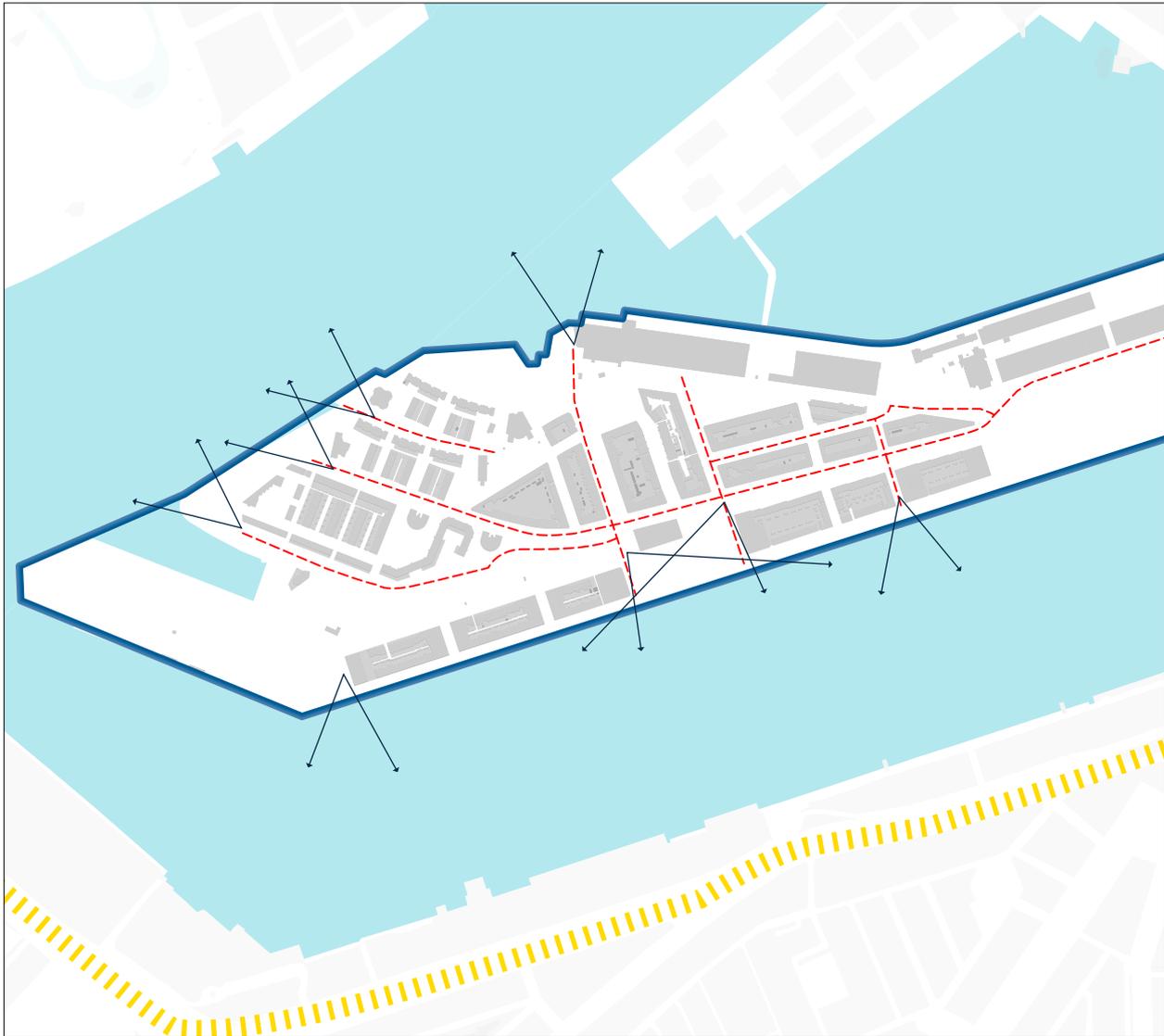
functions are quite expensive. At the head of the area near 'Hotel New York', the area provides a nice park that invites children and others for recreational purposes. The rest of the embankments is hard and does not invite for staying. It does provide beautiful sight lines that characterize Rotterdam as an port-city.

SCHEMATIC SECTION WATER SYSTEMS



RIVER EMBANKMENTS





LEGEND

- Maas
- District
- Inside dike
- Outside dike
- Water systems
- Dike
- Sight lines
- Fysical relation Maas
- Border district

POSITION



INHABITANTS

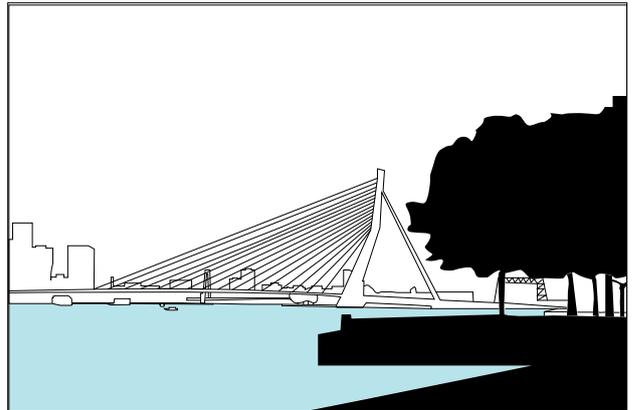
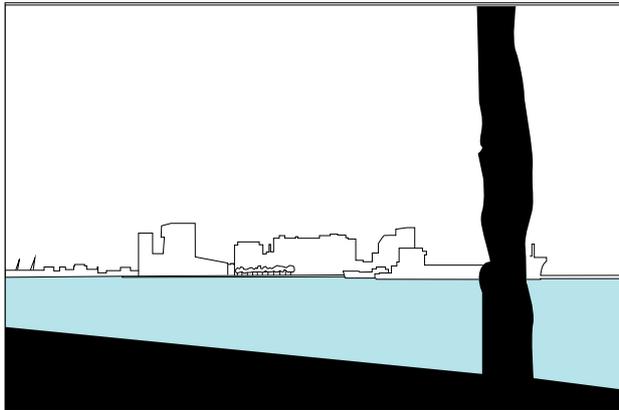


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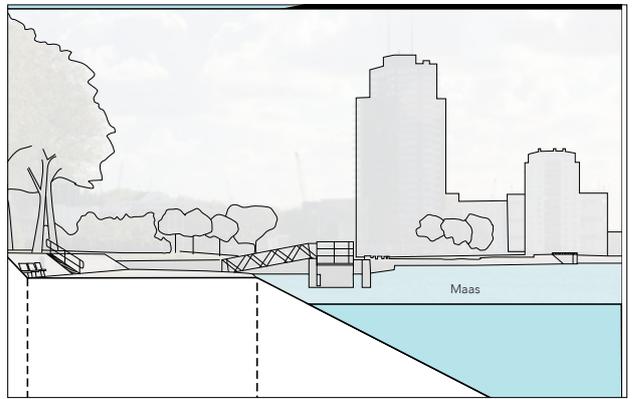
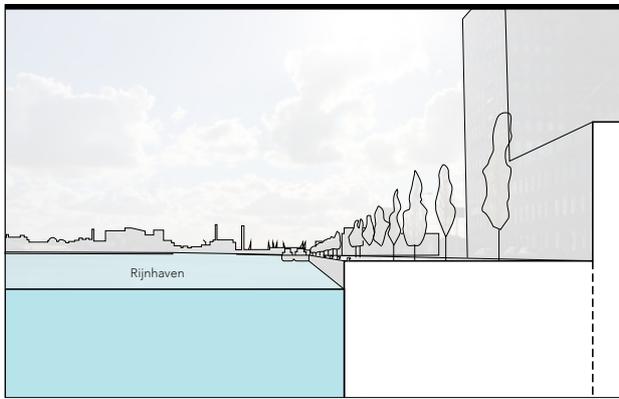
DEMOGRAPHICS



SIGHT LINES



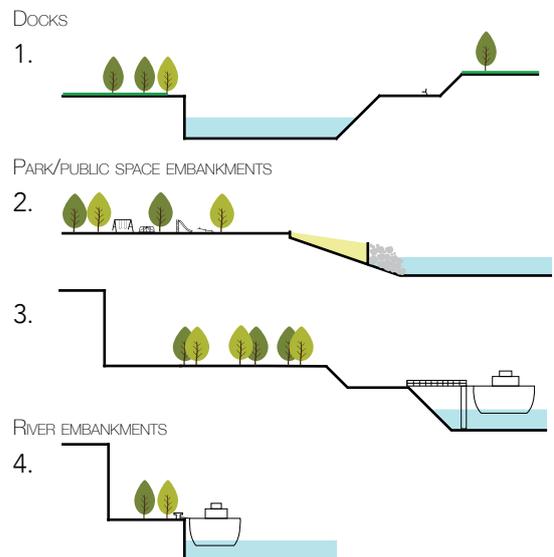
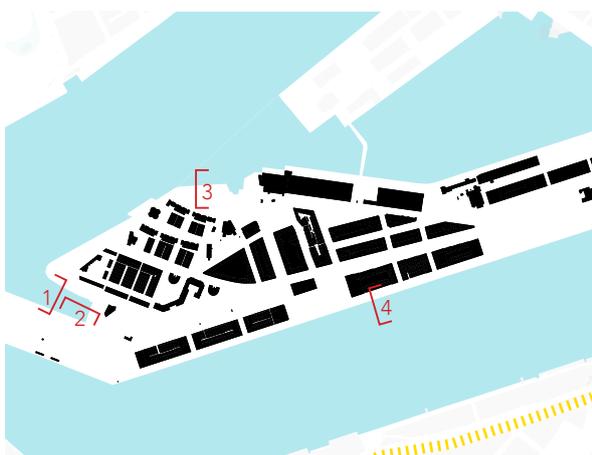
3D-SECTIONS

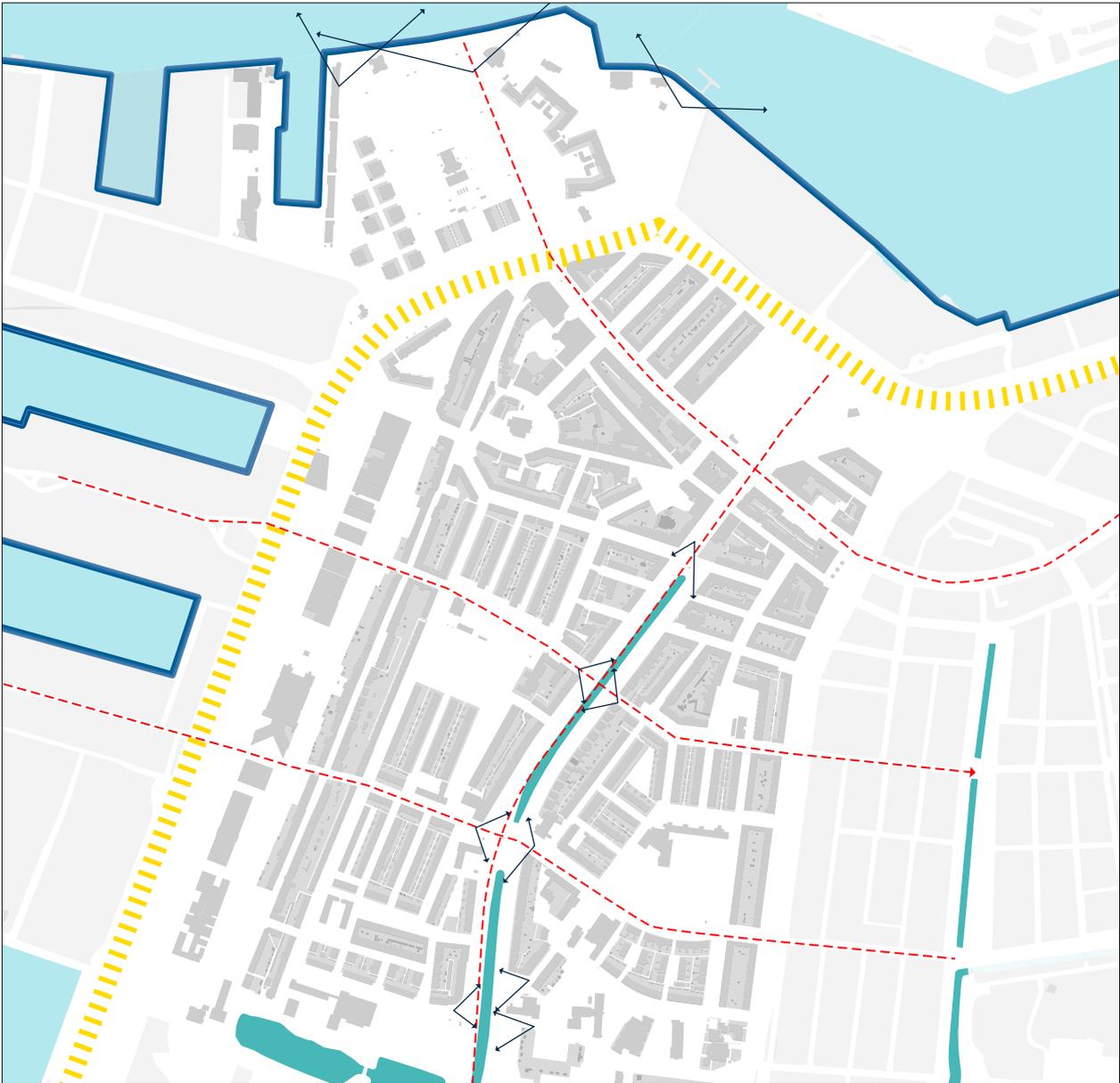


Katendrecht is bordered by the harbor docks Rijnhaven en Maashaven. The Rijn- en Maashaven are under the influences of ebb and flood. The area does not know any surface water, But show a lot of different embankments one with recreational purposes (section 2). Katendrecht is also available for the water taxi (section 3).

During new development there is no compensation obligation. However, it must be ensured that the rainwater that is in the plan area does not cause any nuisance. This means that the discharge of rainwater must be guaranteed. This can be done by constructing drainage to the Maashaven and Rijnhaven, or taking measures that can quickly infiltrate rainwater into the soil.

SCHEMATIC SECTION WATER SYSTEMS

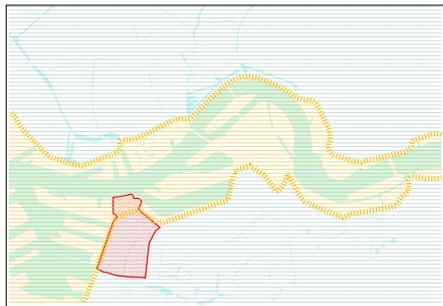




LEGEND

- Maas
- Outside dike
- Sight lines
- District
- Water systems
- Fysical relation Maas
- Inside dike
- Dike
- Border district

POSITION



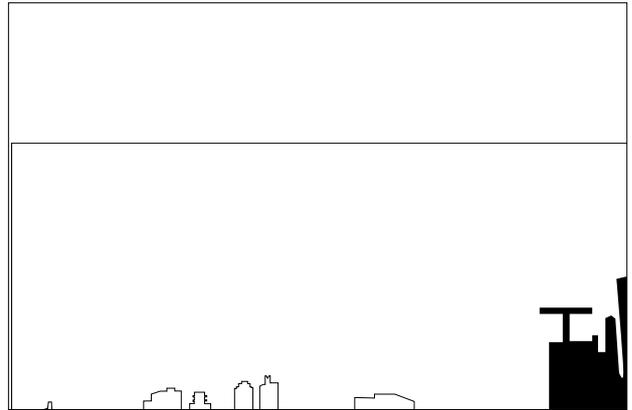
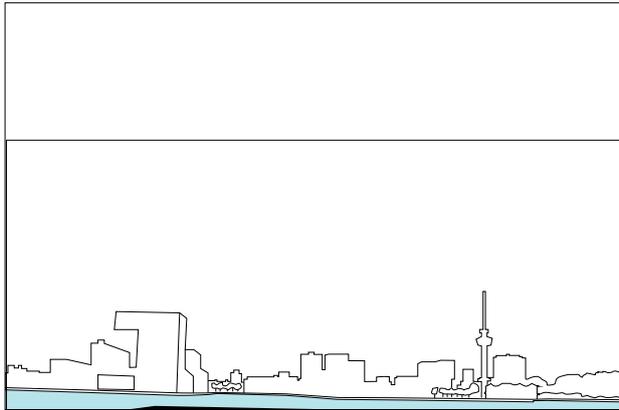
INHABITANTS

13430

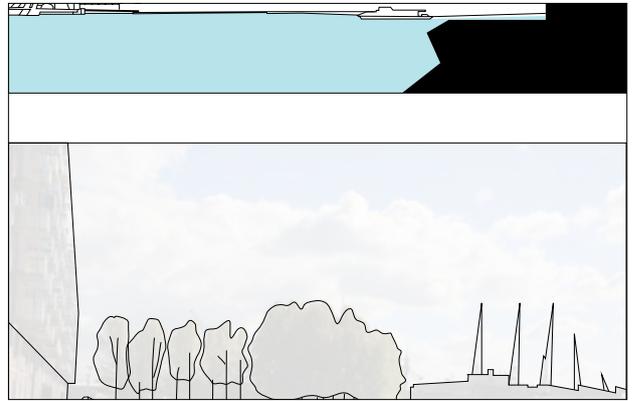
DEMOGRAPHICS



SIGHT LINES



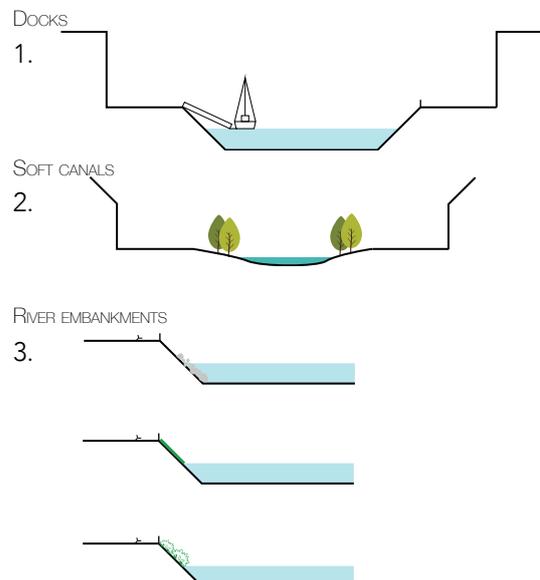
3D-SECTIONS

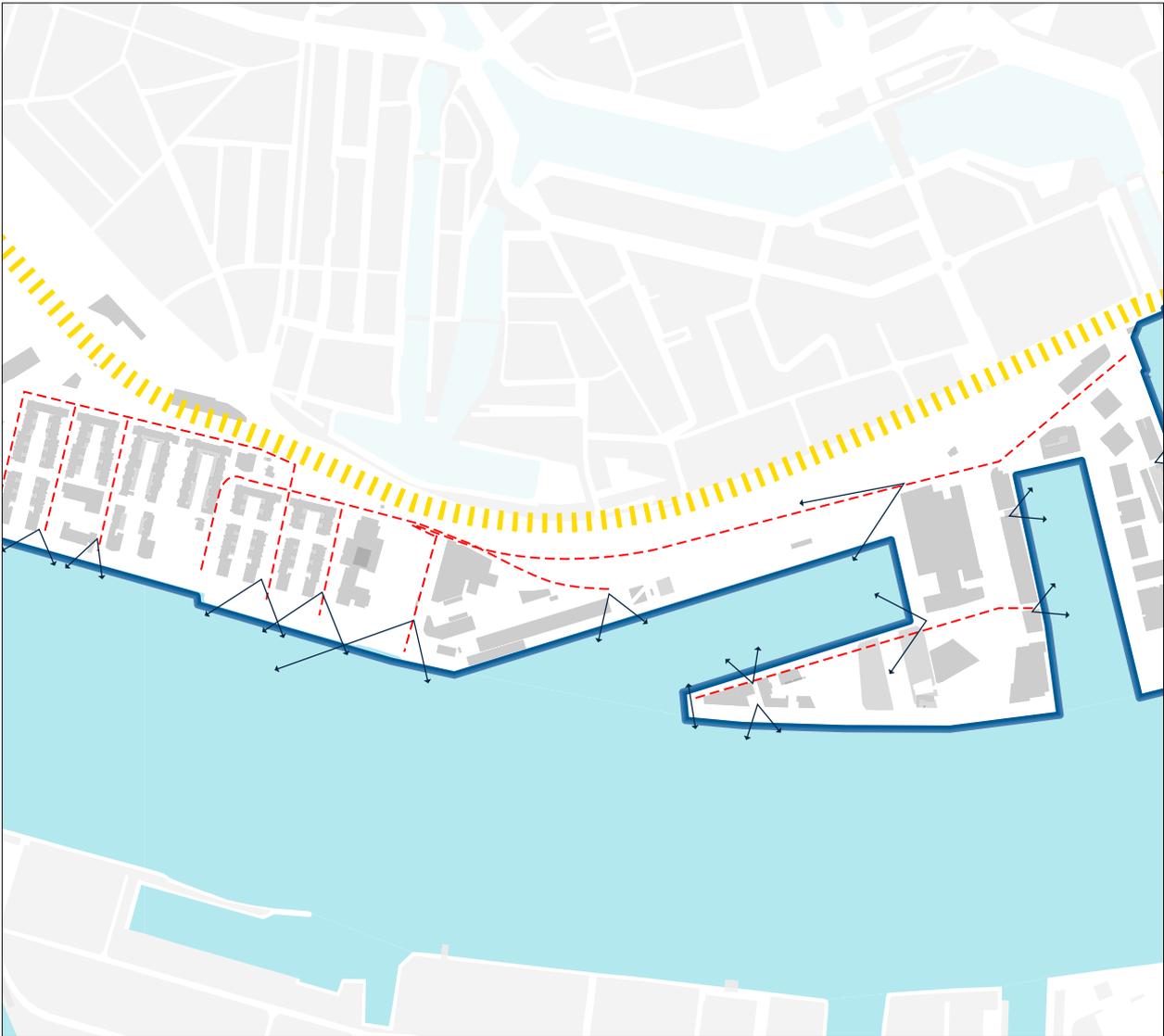


The only surface water in Old Charlois is the Boergoensevliet. The Boergoensevliet is seen as a soft canal (singel). The singels are important for the city's image. They have a great historical value and its attractive hiking and cycling routes. Often they form the transitions between the different Rotterdam neighborhoods. The Boergoensevliet is a beautiful single. Due to its size and shape, this is a whole attractive part of Oud-Charlois. Attractive to live but also

as an outside space to recreate. Restoring the singels back in their old glory will give the neighborhoods also a positive impulse. Therefore Oud Charlois is adjacent to the Meuse and have different embankment characters with a few of recreational purposes. From these embankments one can view a beautiful sky line to the other side.

SCHEMATIC SECTION WATER SYSTEMS





LEGEND

- Maas
- Outside dike
- Sight lines
- District
- Water systems
- Fysical relation Maas
- Inside dike
- Dike
- Border district

POSITION

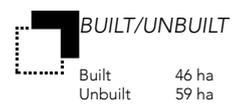


INHABITANTS

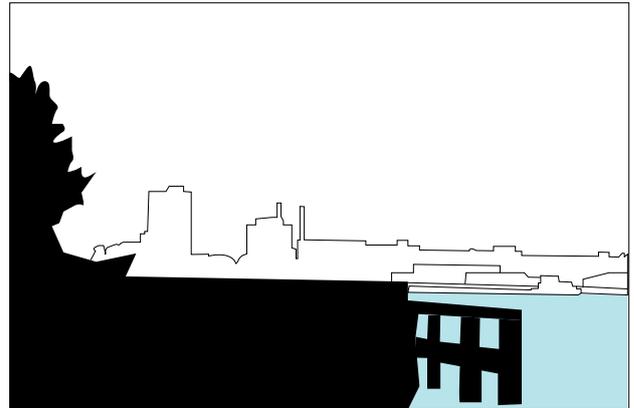
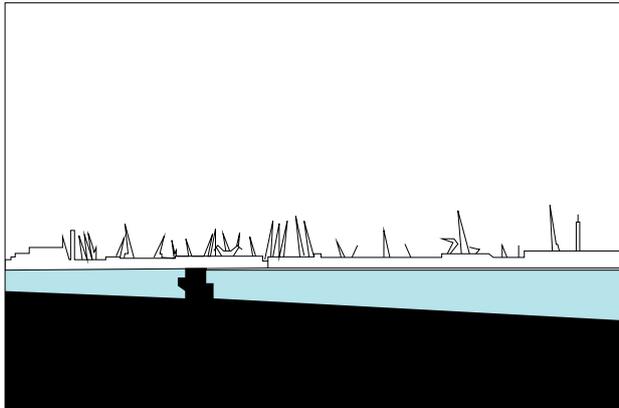


5150

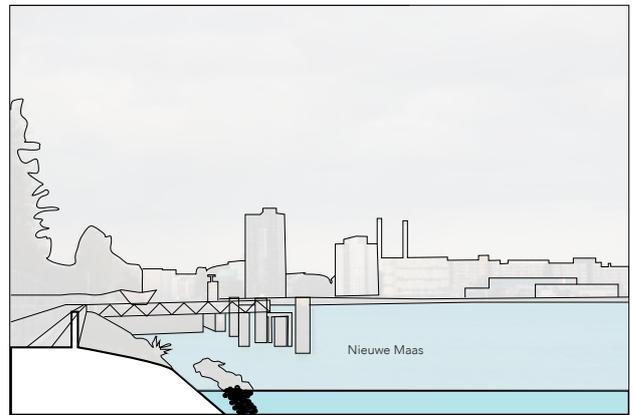
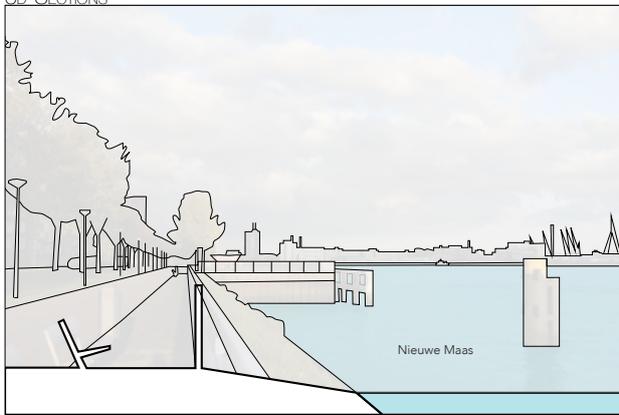
DEMOGRAPHICS



SIGHT LINES



3D-SECTIONS



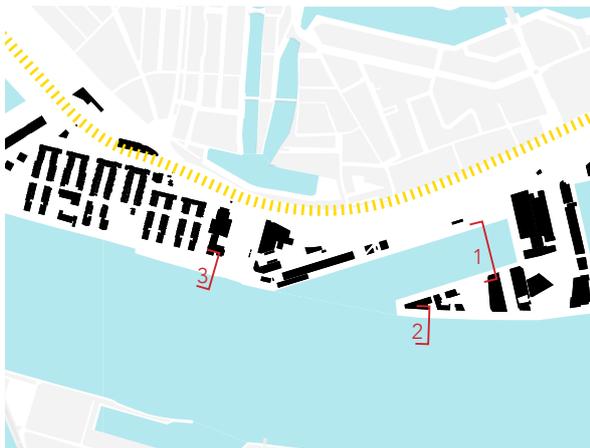
Schiemon is located on the north bank of the Meuse and was part of the port until the 1960s.

On the Corner of the Meuse, the Bartel Wilton kade, is a port building that contains a water bunker that pumped drinking water into ships. The port building also marks the end of the Bartel Wiltonkade. This quay is still sporadically used as a port for inland shipping and is now mainly serving as a large public space on the

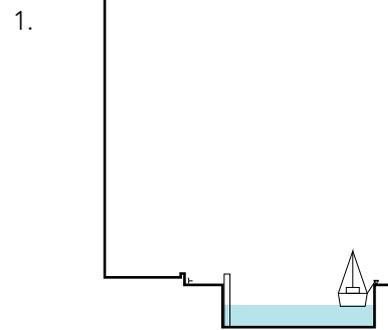
Nieuwe Maas. The view of the ports and the city is one of the great qualities of this quay.

Schiemon has a separate sewage system which drain surface rainfall immediately to the river. Due to the sea level rise and more and more irregular rainfall, Schiemon needs water storage on the subsurface. Schiemon does not have recreational embankments but provides beautiful sightlines from housing

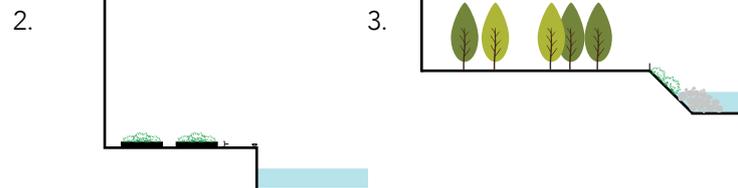
SCHEMATIC SECTION WATER SYSTEMS

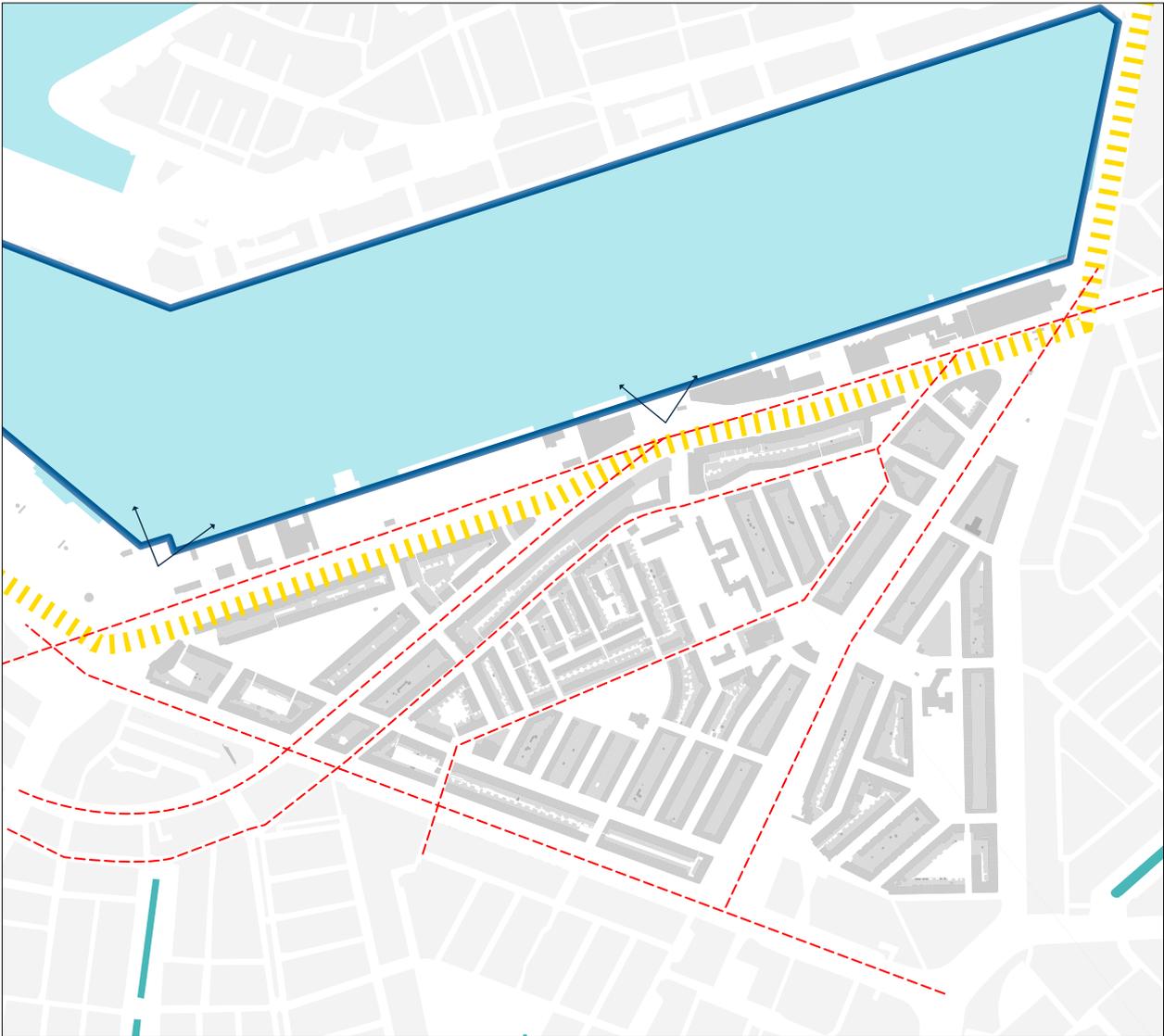


Docks



RIVER EMBANKMENTS

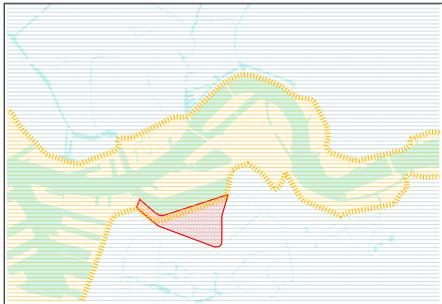




LEGEND

- Maas
- District
- Inside dike
- Outside dike
- Water systems
- Dike
- Sight lines
- Fysical relation Maas
- Border district

POSITION



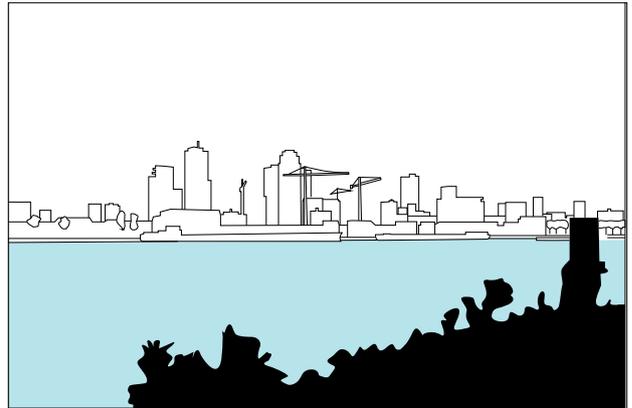
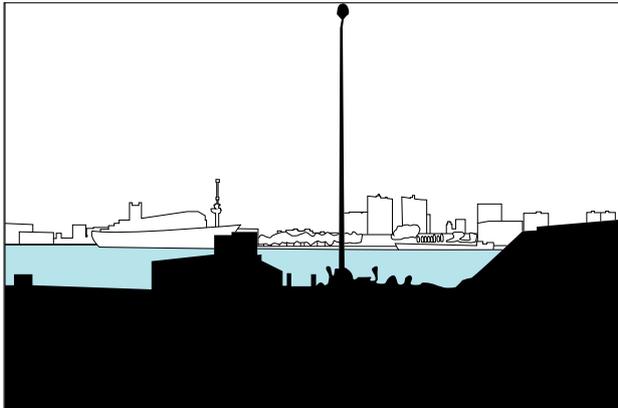
INHABITANTS

12265

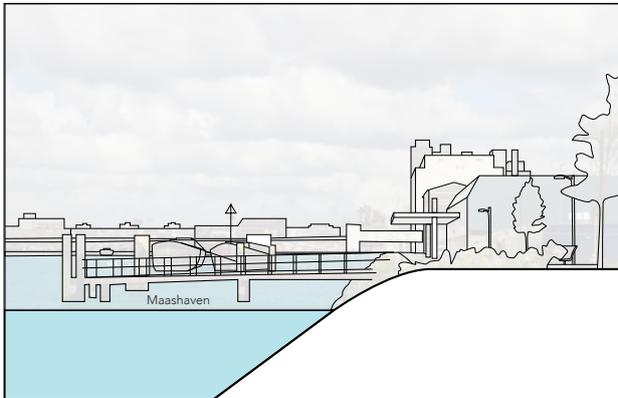
DEMOGRAPHICS

<p>LAND/WATER</p> <p>Land 114 ha Water 0 ha</p>	<p>LAND/RECREATION</p> <p>Land 114 ha Recreation 2 ha</p>
<p>EMPLOYMENT</p> <p>8800 people</p>	<p>BUILT/UNBUILT</p> <p>Built 79 ha Unbuilt 35 ha</p>
<p>INCOME</p> <p>14800 € /year</p>	<p>HOUSE VALUE</p> <p>78000 €</p>
<p>DRAINAGE</p> <p>Grey water Rain water</p>	<p>EDUCATION</p> <p>51 %</p>

SIGHT LINES



3D-SECTIONS



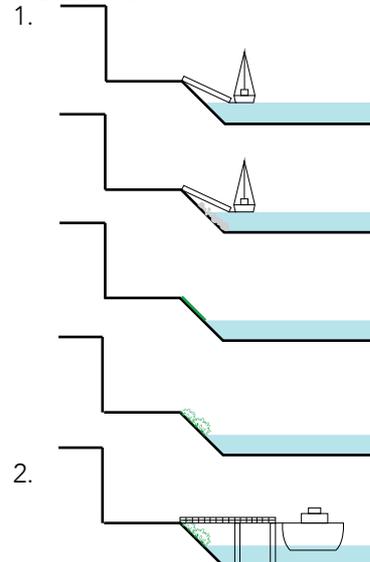
Tarwewijk is divided into an area inside the dike, which consists of mostly housing, and an area outside the dike which is used for industrial purposes. The outlying area consists of the grounds on the south side of the Maashaven and is part of the Maashaven itself. In the area there is no surface water present. In accordance with the water policy, expansion of the paved surface must be compensated, at preference in the form of open water. The

Hollandse Delta defined the rule that an increase of hardened surface should be compensated with 10% of that increase water surface. There is a task to realize 4.206 m³ of water storage in this area. This complies with the measure from the communal water plan to search for water storage opportunities in the district. The embankment does not provide recreational purposes but has also like many ports sight lines to skylines.

SCHEMATIC SECTION WATER SYSTEMS



RIVER EMBANKMENTS



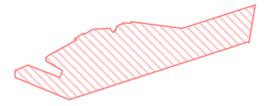
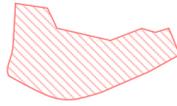
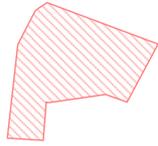
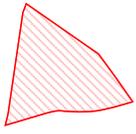
Afrikaanderwijk

Carnisse

Delfshaven

Feijenoord

Katendrecht



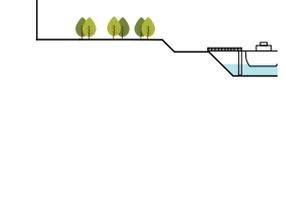
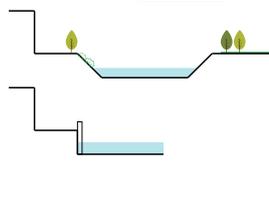
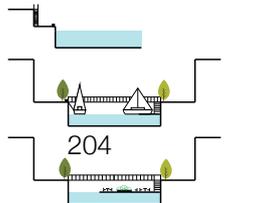
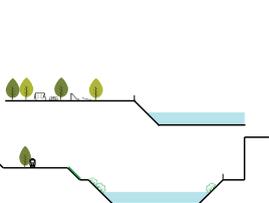
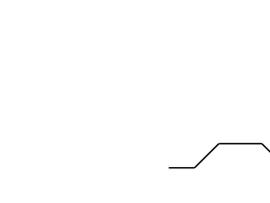
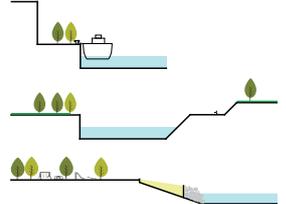
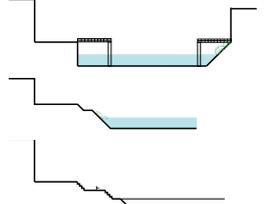
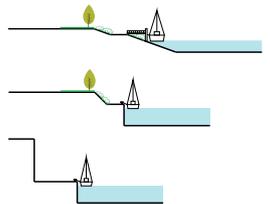
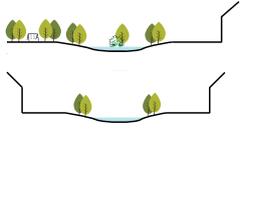
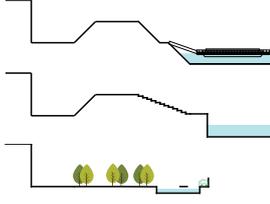
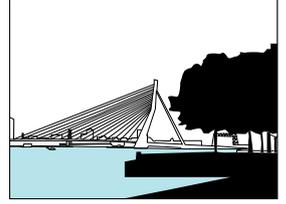
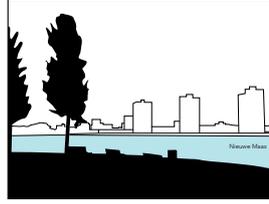
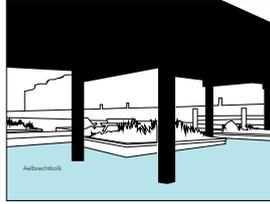
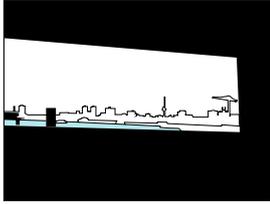
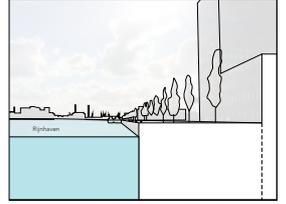
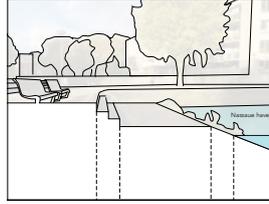
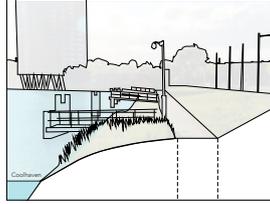
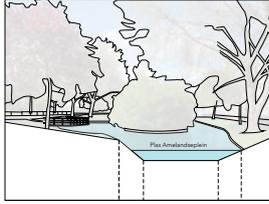
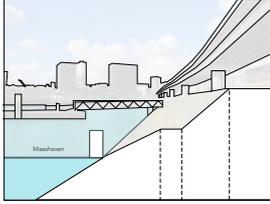
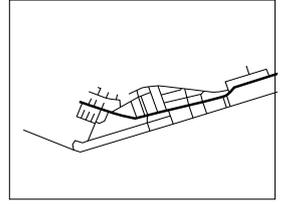
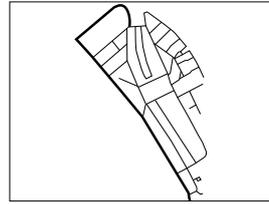
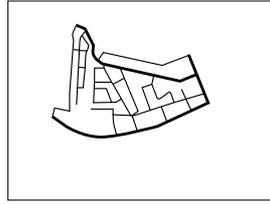
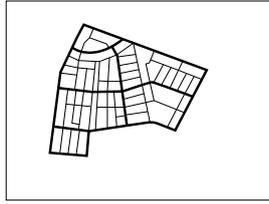
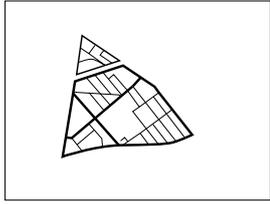
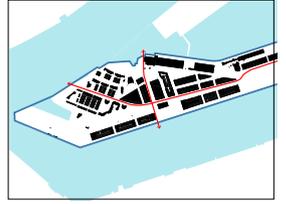
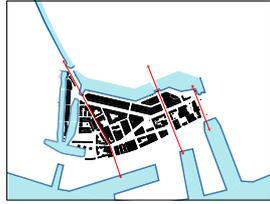
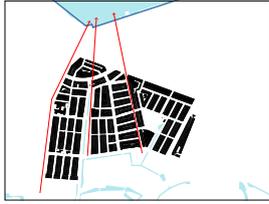
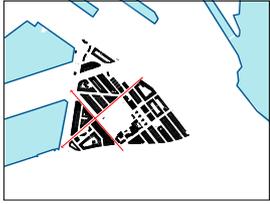
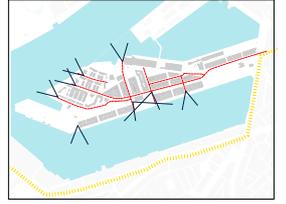
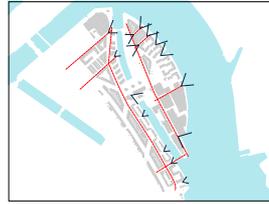
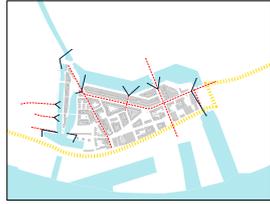
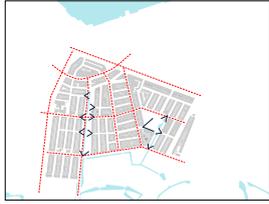
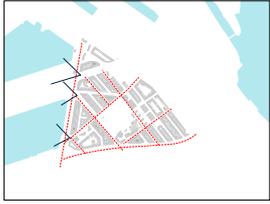
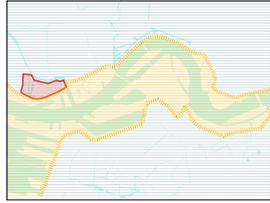
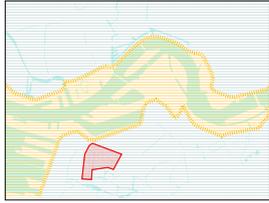
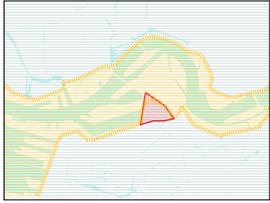
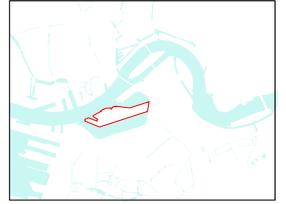
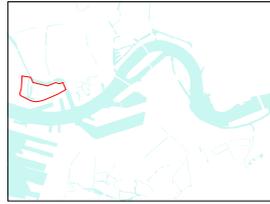
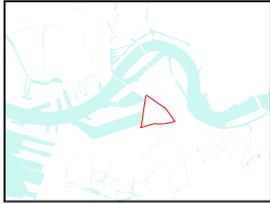
8075 Inhabitants

11225 Inhabitants

75445 Inhabitants

73490 Inhabitants

4755 Inhabitants



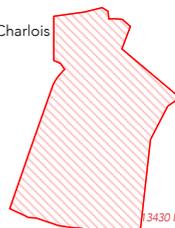
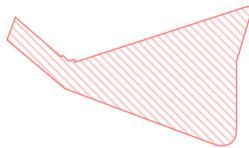
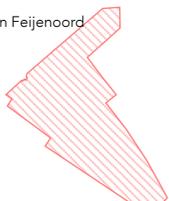
Kop van Feijenoord

Kop van Zuid

Schiemonnd

Tarwewijk

Oud Charlois



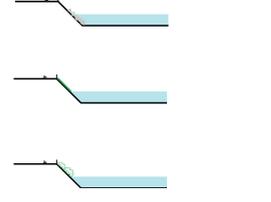
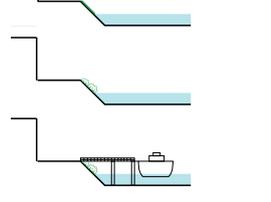
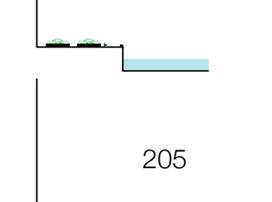
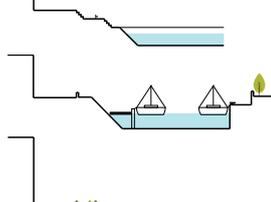
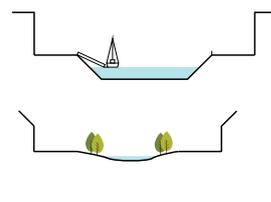
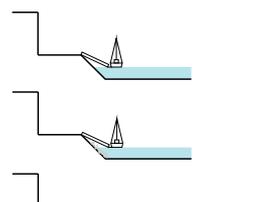
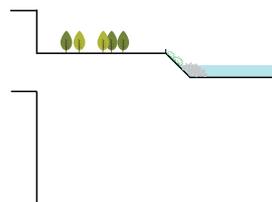
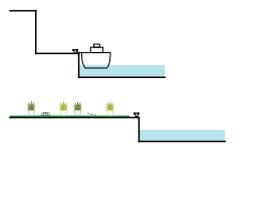
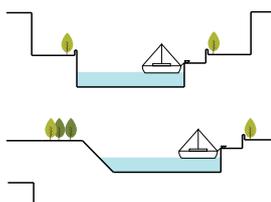
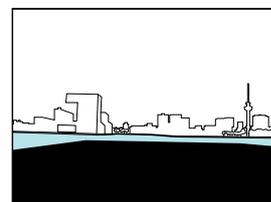
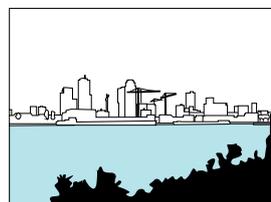
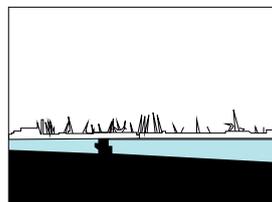
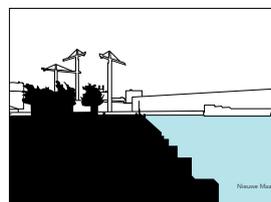
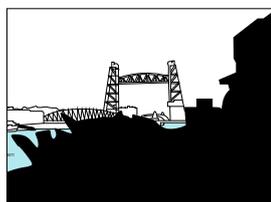
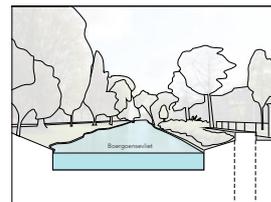
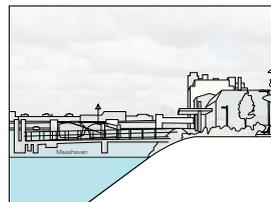
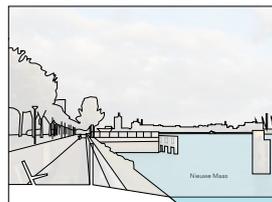
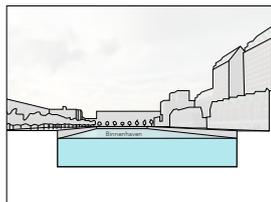
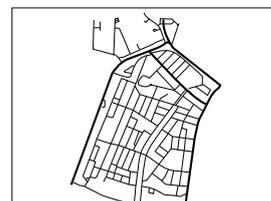
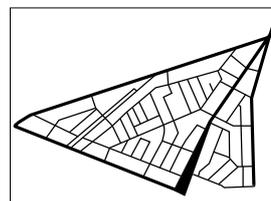
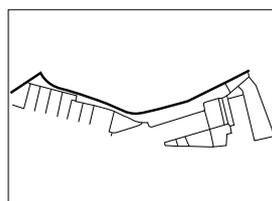
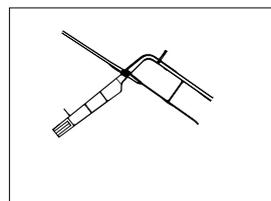
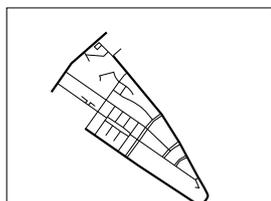
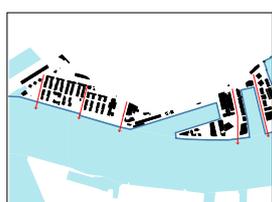
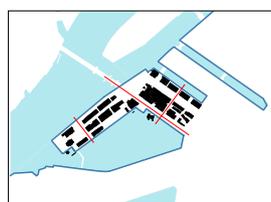
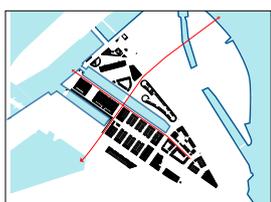
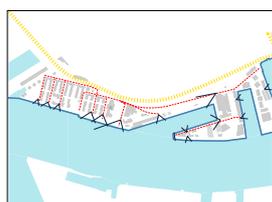
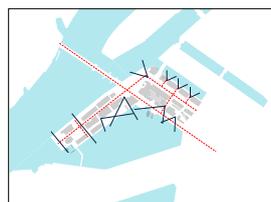
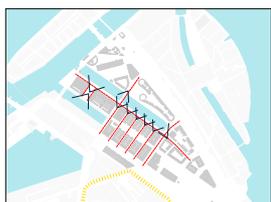
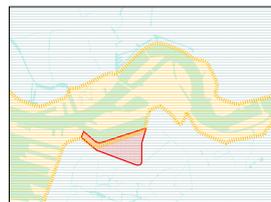
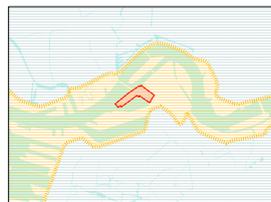
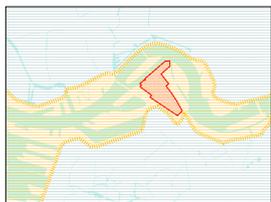
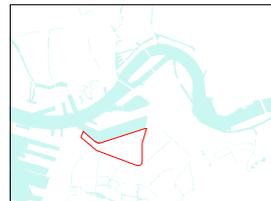
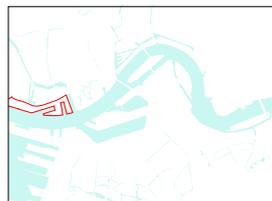
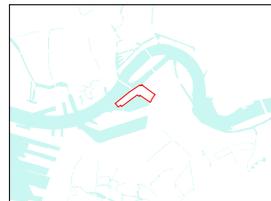
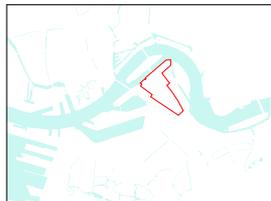
8490 Inhabitants

2235 Inhabitants

5150 Inhabitants

12265 Inhabitants

3430 Inhabitants



APPENDIX II

ANALYSIS DELFSHAVEN, SHIEDAM & TARWEWIJK

PUBLIC/PRIVATE SPACE

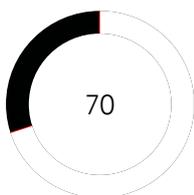
Tarweijk is a densed neighbourhood. The neighbourhood mainly contains large blocks of multi familyhousing of the same kind.



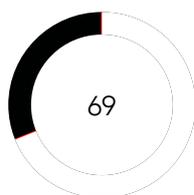
Like Tarweijk, Delfshaven is also densed in its built environment. Schiemond on the other hand is less densed. The structure of the blocks are perpendicular to the maas with streets and courtyards



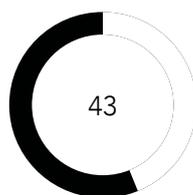
BUILT SPACE %



Tarweijk



Delfshaven



Schiemond

Private space
Public space

PUBLIC SPACE

Tarweijk has enough public space. At the urban level, mainly the lanes are important that defines the border of the area. Inside green function to much fragmented than coherent but well maintained and used.

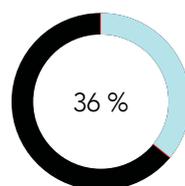


Schiemond does has more green facilities than Delfshaven, but like Tarweijk functions more fragmented than coherent. Most of the green is 'looking green'. Delfshaven lack in green environment and is mostly paved.

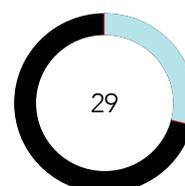


■ Unpaved public space
■ Paved public space

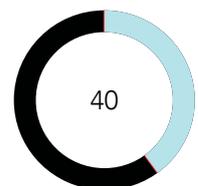
UNPAVED PUBLIC SPACE %



Tarweijk



Delfshaven



Schiemond

WOZ VALUE/M2



As a pre war neighborhood Tarwewijk has a lot of buildings out of date that do not meet the requirements of today. Because of this the housing value /m2 is very low. Tarwewijk also contains to much housing smaller than 75 m2.



On the other side of the Meuse, the average housing value is higher. Noticeable is that housing on the water have more value than housing in the inner neighborhood.

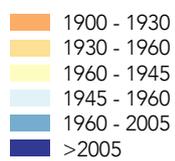


BUILDING YEAR

Like already mentioned, Tarwewijk has a lot of pre war buildings that dominated the neighborhood. First housing were adjacent to the waterfront which shows its historical port relation with the Meuse



It is clear that Delfshaven existed before Schiedam. De buildings from the '80 in Delfshaven were built in former industry area and show a deviate structure



FUNCTION



The facilities in Tarwewijk are aimed for the present residents and are concentrated on the edges of the block and area. The north edge shows its relation as a port city by its industrial uses.



Schiemond is mainly housing. Delfshaven on the other hand is a centre of facilities for nearing neighborhoods. Next to daily facilities it also facilitate cultural, bussiness en educational purposes.

- Residential
- Commercial
- Mixed use
- Industry
- School

HOUSING TYPE

The current housing supply in Tarwewijk is very monotonous. It mostly consist of multi family housing and lack in its diversity.



Also in Schiemond the housing type is dominated by multi family housing. Delfshaven knows a variety in building form with historical houses (grachtenpand). It consist of 19th century workers residents, apartments from the '20, social housing from the '50 and Schools and offices from the '80.



- Porch (portiek) appartments
- Family houses
- Top and downstairs houses
- Gallery appartement
- High rise appartement
- Grachtenpand

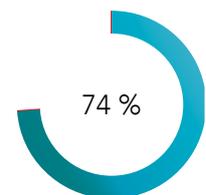
AMOUNT OF MULTIFAMILY HOUSING %



Tarwewijk



Delfshaven



Schiemond



NEIGHBORHOOD DISTURBANCE ALERT

As a pre war neighborhood Tarwewijk has a lot of buildings out of date that do not meet the requirements of today. Because of this the housing value /m2 is very low. Tarwewijk also contains to much housing smaller than 75 m2.



Delfshaven has a lot of small entrepreneurs in the centre which occasionally gives noise nuances. Any other than that it is not so bad.

- < 5 %
- > 5 % en < 25 %
- > 25 % en < 45 %
- > 45 %

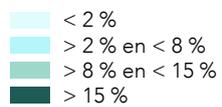
OVERCROWDING

Tarwewijk

Like Mentioned before, a lot of housing in Tarwewijk are smaller than 75 m², some even 45 m². And because of cheap housing and the dominache of multi family housing this results in family with low income moving in Tarwewijk. Delfshaven/ Schiemond



Delfshaven provide a variety in housing and its sizes which makes it less overcrowded. The housing in Schiemond are actually not that small (76 m² - 100 m²), but living at the edge of the water makes it very attractive to live.



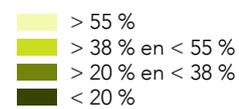
LONG STAY



The population in Tarwewijk mostly don't stay that long in the neighborhood. The neighborhood provides cheap housing as starting living carriers, but once they grow financially they will quickly move out of the area. This is simply because the houses are too small to expand their families. In the blocks built in recent years population stays longer in family housing.



In Delfshaven and Schiedamschenhoek it shows that population along water related areas stay mostly longer in the neighborhood. The new developed area in the Loydkwartier shows people stay short.



NEWCOMERS

Because of the short stay of population in Tarwewijk the area stays available for newcomers mainly with low income.



Although the duration of staying in Delfshaven is averagly longer than Tarwewijk, people like to live in Delfshaven. In This case mostly around water. You can say the water is a quality in the neighborhood to attract new target group and to keep living in the neighborhood.





PEOPLE WITH SUBSIDIES

The cheap housing in the neighborhood attract a lot of target groups with a low income. Most of the population living in Tarwewijk do not have the self resilience and rely on subsidies from the government. This makes Tarwewijk also very vulnerable.



In Delfshaven en Schiedamschenhoek most of the population also rely on subsidies. This includes people with a low income in the population. In new development in Loydkwartier the population consist mostly of people with higher income and so less people with subsidies



UNEMPLOYMENT

People with subsidies relate to being unemployed. In Tarwewijk only half of the population is in possession of a starters degree en mostly in lower education which result in low income groups.



In Delfshaven most of the people employed live along the water where the house value is more expensive than in the middle of the neighborhood. Unemployment is still a problem in both neighborhoods



TARWEWIJK

Structure

The urban structure in the south of Rotterdam follows the landscape decor of dikes and bowl-shaped polders. In Tarwewijk, the landscape structure is reflected in the construction of the building and some long lines; The double lane of the Wolphaertsbocht and the Katendrechtseijkijk and the Dordtsestraatweg.

Identity

Tarwewijk is adjacent to the Meuse, but is also strongly isolated at the same time. The character is determined by the large (traffic) structures running along or through the neighborhood such as the Pleinweg, Dordtselaan, Brielselaan and the metro line (see figure 27). These provide good connections to the inner city or the pane, but at the same time call for the association of traffic congestion and inconvenience (Program Bureau NPRZ, 2013). Around the Tarwewijk are points of interest such as the Maashaven, with the Maassilo and other significant harbor buildings, and the Zuidplein and Ahoy, but these identity factors are mainly on the scale of South meaningful and not so typical for Tarwewijk.

Mobility infrastructure

The current car infrastructure consists of main roads on a city level, with parallel roads for the access of the district. The Pleinweg (figure 28) is the most important part of the city. The Dordtselaan, part of the Wolphaertsbocht and the Brielselaan are important at city level. The parallel road along the Brielselaan has the character of a residential street, also because the dike lies between the two roads. It is not always clear how to access the neighborhood. In the neighborhood, orientation is sometimes difficult. This has to do with the monotonous straight streets that make a nod in the middle. Inside the neighborhood the traffic is mostly regulated with one way traffic, so that the central area can be kept car-clear. Because of this, Tarwewijk has a 30-km regime (Stadsontwikkeling Rotterdam, 2013).

Public space

Tarwewijk has enough available green public space, which is present in different levels. At the urban level, especially the lanes

are important: Mijnsheerenlaan (figure 29), Dordtselaan, Brielselaan and Pleinweg. Most of them have a nice green profile like Dordtselaan, but some are worn out. At the neighborhood level a number of parks and squares can be distinguished. Basically, every neighborhood has its own park or square. At the level of the district, however it miss a coherent system of outdoor spaces. This causes the outer spaces being hardly used. The presence of the many fences around the parks and squares contributes to the fragmentation.

Housing

Of the housing stock, 30% of the housing is owned by municipality or corporation and 70% is privately owned of which 28% private rented out. The living environment in Tarwewijk seems quite diverse (Program Bureau NPRZ, 2013). A garden village, a few lines of row houses, old and new forms of the closed building block, a single three-story house exist side by side. But this does not ignore the fact that the housing stock for 93% exist of monotonous multifamily houses with one floor (figure 30). Because of the housing value that is so low, Tarwewijk is characterized as a neighborhood for starters with a low income. Most of the residents living there are unemployed and living on subsidies from government. The average size of the house is 72 m² per house. In some places even houses of 45 m² exist. This also lead to the results of moving when families want to expand.

Facilities

At first sight, the Tarwewijk appears to be a residential area, but there are also a considerable amount of economic functions to be found. Mostly visible at the edges of the district. These facilities in the neighborhood are primarily aimed at the inhabitants of the Tarwewijk. In recent years, the number of stores in the neighborhood has decreased. The supply of goods in Tarwewijk is therefore no longer attractive and most stores are having a unknown existence. The neighborhood facilities, such as schools, lie in the inner area. The facilities are good and diverse. Schools, churches and nursing centers are spread throughout the district. The north edge of the neighborhood is part of industrial area Rijn/-Maashaven. This part has a large amount of industrial facilities.



Figure 27: Tarwewijk and metro rail
Source: By author



Figure 28: Pleinweg Tarwewijk
Source: By author



Figure 29: Pleinweg Tarwewijk
Source: By author



Figure 30: Street Tarwewijk
Source: By author

One can characterize Tarwewijk as a neighborhood that facilitate for starters. A lot of residents see Tarwewijk as a good place to start up, because of the cheap small housing. Although, once they are financially improved and want to expand their family, they are eager to move out of the neighborhood. Simply because Tarwewijk does not provide the space and qualitative housing for people with a higher income. Because of the most paved public space in the neighborhood, the water assignment in Tarwewijk is to provide the neighborhood with more surface water to retain storm water. This assignment to manage storm water can contribute to spatial qualities. In public spaces like parks and squares, can be

manage by several adaptable solutions. But to enhance the vitality on a street level, adaptivity on the scale of buildings is required. This is because Tarwewijk has a lot of small monotonous stony streets that not give a lot space for spatial adaptivity. This can ad to a variety of different street levels which enhance the vitality of streets and on a neighborhood level. These streets can be used to connect the waterfront with its neighborhood. These possibilities can strengthen the chance for resident to have a social connection with their neighborhood which can result in investing in private owned housing.

DELFSHAVEN

Structure

The area includes 2 sub areas. One of the sub-areas is historic Delfshaven with a small-scale structure around the voor- and achterhaven (figure 31) and (Mathenesserdijk / Havenstraat. This area originated in the Middle Ages. The second sub area is Coolhaveneiland and dates back to the beginning of the 20th century when the Coolhaven was dug and the park sluices were laid.

Identity

There are various elements that contribute to the identity of Delfshaven. Firstly, the diversity in culture history is striking. The various monuments (wind mill) and harbor basin relate back to the time how the port was created and what function it had. In addition, the building pattern in Oud Delfshaven is partly varied as a result of the traditional mixing of functions, both in scale and in appearance, although it has developed to a large extent within the historical building scale. Old Delfshaven forms a separate spatial unit with a recognizable character, one historical-spatial enclave, within the urban area of Rotterdam. Its spatial structure is primarily determined by the original outer dike mouth of the Delfshavense Schie, namely the Aelbrechtskolk and Voorhaven, and the former Hoge Schielandse Zeedijk, the dyke route.

Mobility infrastructure

The main street that is aligned to Delfshaven is the Westzeedijk. This is also the dike that protects Delfshaven from flooding from the Meuse. The internal car infrastructure in Delfshaven are mostly parallel lines from north to south and a large part of them are one way orientated.

Public space

Delfshaven lack in qualitative green public spaces (figure 32), but have a lot of surface water where nuances of storm water can be retained. This compensates the amount of paved streets. These

former docks and channels are important to the historic cityscape of Delfshaven. The semi-private zones along these water spaces are functionally not always involved with the water. The width of the channels and height of the quay play an important role in this relation (figure 33).

Housing

Delfshaven has a large variety of buildings with a historical background from the 19th century and earlier. These are the middle class workers in the 21st century, apartment buildings in the 20th century, the 1950s social housing construction and major school and office buildings, including the Rotterdamsch Lyceum, The Nursery School and the Conservatory. On the east side of the Achterhaven, recent industrial buildings have been replaced by housing construction. Other parts of the neighborhood consist of a mix of living with on the corners and edges commercial uses. People like to live along the water scape's in Delfshaven. In this part Delfshaven there are not a lot of newcomers. Residents like living at the water but the neighborhood lack in spatial interaction with water. Other than this Delfshaven also consist of the vulnerable target groups with low income.

Facilities

The centre of Delfshaven is rich in facilities. There are museums, galleries and nightlife (Historic Delfshaven), cultural facilities and a great concentration of creative activity and education. In addition to some concentrations for daily groceries the neighborhood also offers a wide range of facilities, which also attract people from outside Delfshaven.

The eastern side of Coolhaveneiland is made up of larger construction bays with many large, wide buildings. This area is characterized as 'Creative Quarter' where a blend of creative activity, creative education, knowledge institutions, service and living is positioned. The urbanization on the south side of the island, along the Westzeedijk, has a lot of services, facilities and offices due to its favorable and representative location on an excessive road.



Figure 31: Achterhaven in Delfshaven
Source: By author



Figure 32: VOC plein in Delfshaven
Source: By author



Figure 33: Achterhaven in Delfshaven
Source: By author



Figure 33: Historic mill in Delfshaven
Source: By author

Delfshaven have enough facilities, but these facilities are not fragmented rather than coherent (Stadsontwikkeling Rotterdam, 2013) Delfshaven is a historical part of Rotterdam which consist of housing and businesses. The businesses in the neighborhood are mostly small entrepreneurs that fit in the environment like galleries ect. Besides that an amount of cafeteria restaurants that ensures

noise nuances among the residents. The quality in the area are the water scapes that need to be enhanced in spatial dimensions in such a way that the residents can interact more with it than sight. As a parted district from the Meuse it also need connectivity to and from the Meuse to be a sustainable waterfront.

SCHIEMOND

Structure

The neighborhood is quite introverted by the long closed wall that is stretched on the Pelgrimsstraat. In the neighborhood, the structure of the blocks is perpendicular to the Meuse with serial streets and courtyards (figure 34). Many of these streets are accessible by openings of about two floors in the wall on the Pelgrimsstraat. Across this structure, parallel to the river is a secondary route that intersects the inner courts and the streets. This route passes through the building blocks.

Mobility infrastructure

The road structure in Schiedam consists mostly of safe roads. Only the Westzeedijk and the Pilgrimstraat are roads that are part of the urban highway network. The parking spaces in Schiedam are located along the streets. In the neighborhood are quite a lot of parking spaces for the residents living there. Cycle paths are only along main streets Westzeedijk and Pelgrimstraat. In the rest of Schiedam there are no cycling paths due to the low traffic pressure.

Public space

The green facilities in Schiedam is mainly fragmented and part of the residential area. The quay along the Meuse is the largest public space of the district where recreation is possible and quite a bit of greenery is present. This public space is more withdrawn from the inaccessible water from the Meuse. On this quay (illustration 35) some playing facilities are available. The inner areas of the residential blocks, which has also greenery public spaces, are in open connection park on the quay. Because the buildings are oriented on the public spaces, the situation creates a form of safety. The public space in the neighborhood can better be related

to water scape's.

Housing

Schiedam is mainly a residential area. The building consists mainly of social housing which are owned by housing cooperation Woonbron (Gemeente Rotterdam, 2006). The majority of the urban blocks are built in half-open blocks, which make a comb structure together. This semi-open block structure is perpendicular to the river. Through the open side towards the Meuse, the interior of the block is in open connection with the view and the river. The housing blocks are four to five layers high. On the heads of the blocks, on the river side, the relationship with the river is emphasized by residential apartments of approximate 10 layers high (figure 36). These towers have a direct and unobstructed view of the Meuse. This view is of great importance for living in the neighborhood. People like to live here because of the view which explains the low amount of newcomers and high amount of residents of long stay. And of course because of the affordable housing. The part of Loydkwartier has also nice residential towers up to 18 floors with an outstanding view to the Meuse, but these are more expensive. These provide space for people with a higher income. Although the view to the water is very valuable for residents, the accessibility is very limited.

Facilities

The facilities in Schiedam include, among other things, elementary school. The area includes childcare facilities, social-cultural work, a neighborhood banquet and a large hall. The shopping facilities in Schiedam include a supermarket and a pharmacy. These are both located on the corner of the main street, Westzeedijk and Pelgrimstraat. The facilities and residential area are clearly separated. For other facilities residents can go to new marconiplein boulevard or to Delfshaven.



Figure 31: Street between buildings in Schiemon
Source: By author



Figure 32: Schore Schiemon
Source: By author



Figure 33: Shore Schiemon
Source: By author



Figure 33: Shore Schiemon
Source: By author

Schiemon is a neighborhood that is liked for its position on the water. You can tell this by the low amount of newcomers and high amount of long stayers. The affordable social housing, which looks to be in good state, exist mostly of groups with low income of residents receiving subsidies. The relation of the district with the water is based on sightlines to the Meuse rather than a interaction. This is because the structure of the housing blocks is very

introverted from the water. The spatial dimension of the park on the quay is withdrawn from the water edge. The quay itself also function as a barrier from land to water. When water is more interacted with spatial dimension in the neighborhood, it can add more quality on street level and for the whole neighborhood. The spatial dimension between the urban blocks are wide enough that it can apply water related design.