THE CONNECTING WATERSCAPE

The case of the Maashaven in Rotterdam

Study on how inner city harbour basins can function as public space in order to stitch disassociated districts into a continuum and to re-establish the relation between city and river.

Master Thesis

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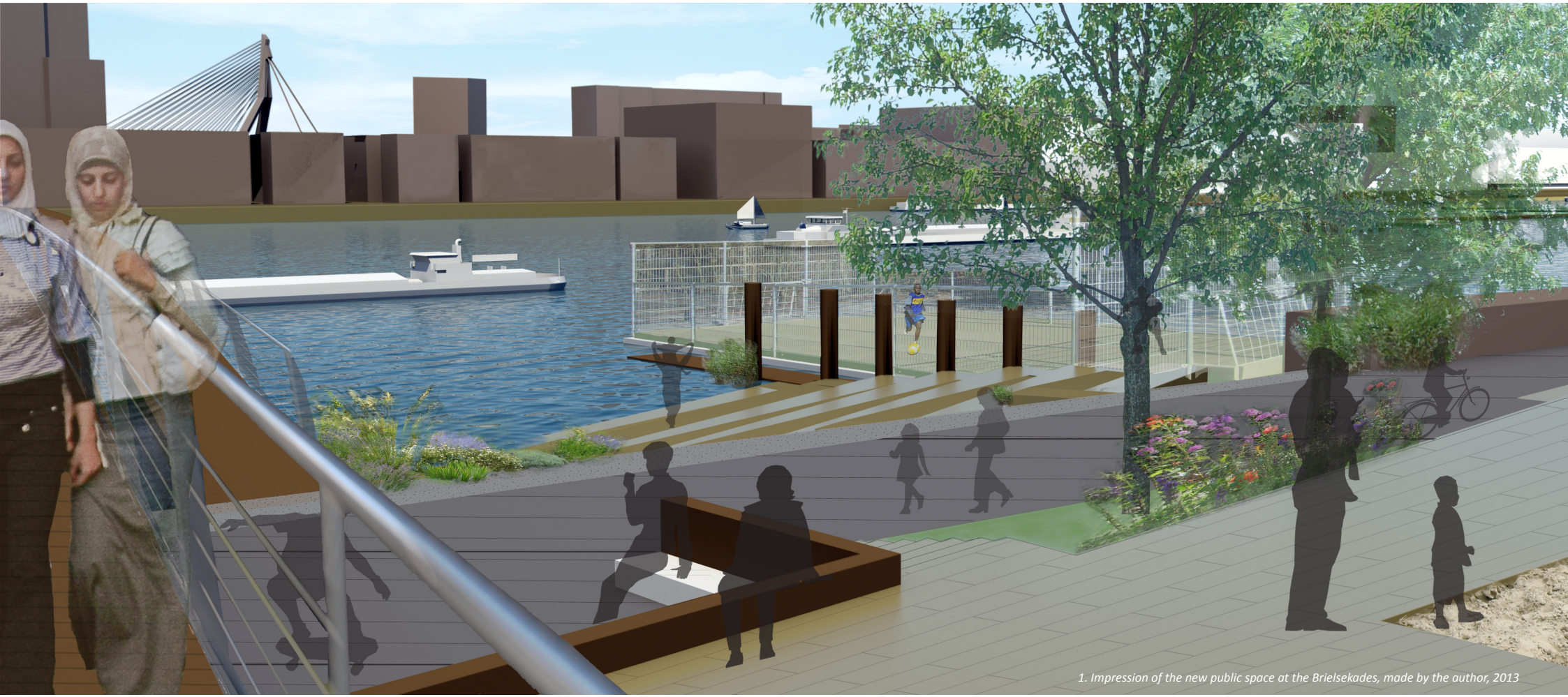
June 2013



1. Impression of the new public space at the Brielsekades, made by the author, 2013

COLOPHON

The connecting waterscape;
How inner city harbour basins can function as public space in order to stitch disassociated districts into a continuum and to re-establish the relation between city and river.

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Cover Image: Impression of one possible outcome of the redevelopment plan, made by the author, 2013.

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Abstract

The area around the Maashaven in Rotterdam South is short of larger recreational public space, which is a drawback to attract starters and young families to this socially segregated area. Like in many other Northern European cities, the harbour currently divides successful and the deprived neighbourhoods and awaits a new function now the previous industry and trade dominated relation between city and river disappears.

Therefore in this thesis it is investigated how inner city former harbour bays can function as public space in order to stitch disassociated districts into a continuum and to strengthen the relation between city and river.
This question comprises hypotheses: that water can function as public space and that creating public space is a valid strategy to reconnect disassociated districts.

Four sub-research questions are formulated. Firstly it is investigated how the relation between city and river has developed and how a design could influence this relation. Secondly, criteria for good public space in harbour areas are studied. Since the former harbour function slowly disappears, the contemporary and future spatial claims for this area are investigated at the third sub-question. As fourth question, the main varaible spatial preconditions are investigated to be able to make a design that can adapt to different future scenarios.

This thesis uses research by design on the case of the Maashaven as main method to which design research such as literature study, plan analysis, comparative study and a scenario study are supportive.
After formulating a vision on the area, an adaptive redevelopment plan is designed. Two robust interventions that could function as initiators of change in the area are further elaborated. They illustrate the meaning of the design on different scales and together cover all aspects of the scenario study and most stakeholders perspectives.

The combination of design research and research by design leads to some generic and some site specific conclusions.

Firstly, transforming a harbour basin into public space depends largely on the design of a selection of spaces at its edges. Nor the whole basin, nor all quays should be made public.
Secondly, the strategy to reconnect districts cannot only consist out of public space design but also requires a good slow traffic network, a strong identity and an appealing mix of program. In the case of the Maashaven the spatial claims of industry and inland shipping, recreation and ecology showed to be compatible and can even strengthen each other. Using inner city basins for floating neighbourhoods as the municipality proposes, is rejected mainly because of its privatising effect. On the contrary, a modest amount of floating constructions for recreational, nonpermanent use can strengthen the public character of the harbour.
Thirdly, the relation between city and river can be strengthened by making the river and inner harbours part of the daily life of people again. For Rotterdam specifically the design showed how the relation between city and river can be strengthened on neighbourhood, city and regional scale.

Extensive summary

(Continuation of the abstract)

A historical analysis executed to study the relation between city and river demonstrates how the outer dike areas were often the most vibrant and interesting areas of the city and therefore the flood defence should not be put at the very edge of the river. The current position of the flood defence, especially along the Brielselaan, is'nt optimal either. The aim should be to maintain a reasonable outer dike area where river and city come together, but to free the Brielselaan of its double barrier of heavy road and monofunctional flood defence. The functional binding to an area, like in the days the harbour provided labour, appears to be just as essential for the relation between city and river as the physical relation. A new destiny for the Maashaven should attract people to the area on a regular basis as an alternative to the lost labour intense industry.

A layer analysis on district scale exposes how the diverse layers became imbalanced by the explosive growth of the harbour in the late 19th and 20th century. This shows especially from the distorted slow traffic network and the relative isolation of neighbourhoods in between major traffic arteries. Where current flood defences and (car) traffic arteries interfere with the original morphology, lessons can be learned how to bridge or solve these discrepancies.

One of the major criteria for the success of public space is the amount of interaction as theories on public space show. This interaction can only emerge with enough visitors and a low movement speed. Rotterdam has a very well developed fast traffic network but a very low modal split for slow traffic, compared to cities known

for their successful public space network. The distorted slow traffic network should therefore be sewed together again. Theoretical research furthermore showed that the reconnection between the disassociated neighbourhoods via the harbour should be established not only physically, but also visually and psychologically in order to extend the New South Urban milieu southward and to slow down the selective migration. Due to the scale of the area and the need to facilitate interaction between people, the Maashaven should furthermore not be considered as one large public space but as an element that connects several smaller public spaces, concentrating visitors on strategic locations that embed the Maashaven better in both the city and local network. Majesty, grandeur and openness is inherent to- and part of the quality of harbours, but sometimes proved to be a pitfall for the public space of Rotterdam in the past. These public spaces should facilitate the needs of the very diverse user groups and should be connected by good quality movement space.

The inventory of current spatial claims showed that ecological recovery, heritage and inland shipping as a still active harbour characteristic, the dynamics of the river and also industry can become a vital part of

this new identity. The possible future spatial claim of a floating neighbourhood, projected by the Municipality, is rejected. Literature study showed that contemporary floating neighbourhoods privatise the water. Furthermore they are a low density (and therefore unsustainable) infill of in the future precious open space.

These backgrounds led to a vision on how the Maashaven can play a more significant role for both the city and the surrounding neighbourhoods:
Firstly the Maashaven should be better embedded in the local slow traffic network and become better visible in the already well established city scale traffic network. Secondly it should provide a new shared identity to stitch the surrounding districts together. This will be done by offering a unique program at several strategically chosen public spaces and the water that attract all desired user groups and by providing every neighbourhood with an address at the waterfront again.

The development plan proposes to transform the Maashaven into a recreational water landscape in which recreational activities and ecological recovery are closely intertwined and together create a new identity.

Three clusters embed the Maashaven on city scale: A leisure cluster of Speelstad ('Play City') and the relocated SS-Rotterdam at the Meuse-tunnel; an extension of the current Maassilo creative factory with outdoor activities and a water-transferium; and an urban beach at the Katendrechtse Pols as first place where people can really approach the water in the centre of Rotterdam.

A new bridge, high enough for most inland ships, physically reconnects the old slow traffic network between Katendrecht and the Tarwewijk. Along this reconnected slow traffic route many public spaces of importance on the neighbourhood scale are located. At the Maashaven quays two new ones will be added to this string of pearls. They will provide the two neighbourhoods with a remarkable address at the river.

The Maashaven is shallowed as far as shipping movement allows because shallowing is one of the major requirements for a recovering ecosystem and at the same time provides opportunities for recreation. The diverse activities are distributed over the area according to residents' preferences and the zones created by differences in water depth. Furthermore the middle part of a floating park forms one of the steps in the purification process of urban runoff water that would damage both recreational activities and ecological recovery. Together with floating community gardens close to the quays and more natural floating islands further away, this park forms a green oasis in the rather stoney Old South district.

The scenario study showed four major local variables with a large spatial impact: the amount of inland shipping, building activities, traffic pressure and water level rise. Especially the building activities and inland shipping are of influence on the redevelopment plan. Therefore the plan is adaptable to these two factors, which is visible in the growth model for the floating park and the alternative program in case there are no building activities. The strategic interventions are designed such that they are robust and thus can handle these two uncertain factors without structural changes.

These interventions are strategic because they are most likely to have an initiating role in the change of this area. Besides, they together cover all uncertainties from the scenario study and address all resident groups. The Katendrechtse strand is very well connected in the city scale network and will put the Maashaven on the map relatively fast. The bridge is expected to have the highest impact on district scale by reconnecting Katendrecht and the Tarwewijk with the same intended effect as the Rijnhaven bridge and on a larger scale the Erasmus bridge once did. The Brielsekades are intended as crucial on the neighbourhood scale as address at the Meuse for the Tarwewijk. Besides, despite of its plural barrier, this is practically the easiest location along the whole south side of the harbour to start the reintegration of the harbour with the older neighbourhoods.

At the Brielsekades the quays are now occupied by industry and a very poor pocket park. This strip is separated from the Tarwewijk by a busy road and a high levee. There is hardly any functional and no visual connection between the water and talks with neighbours showed how little people are aware of the precence of the Maashaven and the characteristics of the river.
The design consists out of a park and square underneath the new bridge in which the recreational preferences of the predominantly nonnative inhabitants are taken into account. A tidal clock that forms the access to a floating sports field shows the dynamics of the river without demanding people to physically enter the water like at for example the Katendrechtse strand.
A height difference of one metre and a change in materialization demarcates the division between movement and staying space and at the same time protects both the new public space and the Brielselaan behind it for more frequent flooding in the future.
The high bridge will be continued into the Tarwewijk later due to practical reasons, but is already visible from far into the Tarwewijk. An renewed crossing, an artwork and a bike path on the dike should help to improve the situation in the meantime. The way the bridge will be continued, depends on the local variables of traffic intensity, building activity and flood defence height and/

or location. These possible future situations that cannot be determined by the designer at this point in time. Therefore, different options are designed to achieve to goal of continuing the bridge further to the Tarwewijk.

The Katendrechtse Strand intervention is intended for a more mixed user group and also for visitors from the whole city, making use of its very well connected location. Here seeing and being seen plays a larger role than at the other intervention and activities enjoyed on a normal beach are translated to this urban variant. The problem of scale and openness mentioned in the backgrounds, plays an important role here. The design suggests to open up majestic sight lines to remarkable buildings. To counterbalance the extremely open, public and sometimes windy or busy quays and beach, the newly planned neighbourhood is designed such that intimate semi-private inner zones are established.

The physical relation between city and river is improved by redesigning the height differences between neighbourhood and dike and dike and waterside more subtle. The psychological relation is improved by adding functions that have to do with water on the one hand and by improving the consciousness about the waters dynamics on the other hand. This is done by adding a playing pool for small children that always remains filled as a memory of the rising and receding meuse water every six hours. This playing pond is furthermore filled with water cleaned by the floating park and some other steps. The whole cleaning system is made visible to visitors to raise the awareness about urban runoff water and does not only add clean water to the just recovering ecosystem, but also its rest products are beneficial for this ecosystem or the community gardens.

Thesis structure

In chapter one, the problem field, objectives, research questions and relevance of this thesis are introduced. In chapter two the methods and techniques to answer the research questions will be explained.

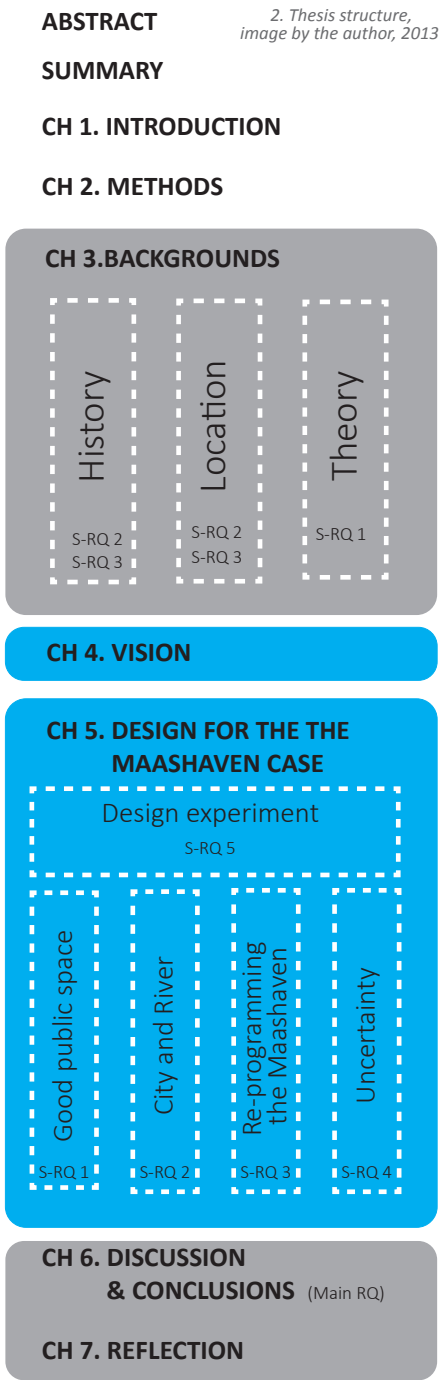
Chapter three contains both the theoretical underpinning of the thesis and gives practical background information concerning the project location and sub-research questions (S-RQ) one to four.

This forms input for the core of the thesis: chapter four and five.

Chapter four contains the vision on the Maashaven area. Chapter five shows a case study on the Maashaven. This chapter answers sub-research question five by making a design. After the short description of the design experiment, this chapter elaborates further on how the design helps to answer sub-research questions one to four.

Chapter six contains the conclusion of the whole thesis. Here the main research question will be answered and both specific and generic lessons are drawn here.

In chapter seven a short personal reflection on content and process can be found.



2. Thesis structure, image by the author, 2013

‘But at the Meuse Bridge he woke up again because the appeal of the mystical river was larger than all fatigue. He was never bored by the sight of the thousands of small lights, hanging in the air at both sides of the bridge above the black reflecting waters, the green and red eyes of the ships, these roaming houses on which people lived and moved from place to place….And at the same time the water whispered continuously around the pillars […] and a towboat chugged underneath him and farther away a heavy and melancholic moo of a ocean ship sounded through the night. And a lit train drove thundering over the railway bridge and whistled shrilly and he saw the red gleam of the open fire against the wihite plume of smoke.’

(de Jong in Meyer, 1999, p. 327)

1 Introduction

The objectives and structure of the thesis

1.1 Problem definition

1.1.1 Condensed Problem statement

In this thesis it is investigated how the redesign of the Maashaven and its quays can add to solve the following problems.

In the central part of Rotterdam South there is a lack of qualitatively good public and recreational space, which is a drawback to attract starters and young families to this socially segregated area. The harbour currently divides the successful and the deprived neighbourhoods and awaits a new function now the previous industrial and trade dominated relation between city and river disappears. However, the potential of this inner harbour is largely undervalued and under-used at the moment.

In the context of a changing urban design discipline in which uncertainty plays a larger role than ever the objective is to design a flexible redevelopment plan that can adapt to the most important local uncertainties.

1.1.2 The distorted relation between city and river

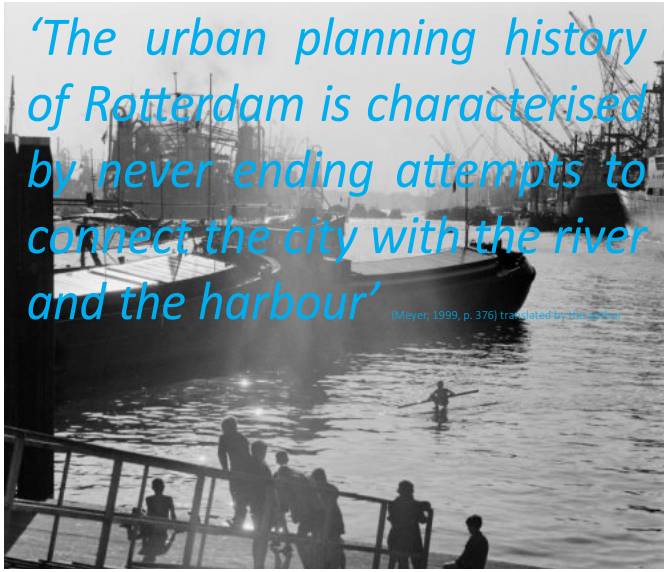
The harbour activities are currently moving away from the city centre towards the Maasvlakte, further downstream. The harbour has always been the primary identifying element for the city of Rotterdam. Not only did cranes, railroads and industrial buildings determine the visual characteristics, the harbour was part of the daily life of many residents. They worked at the piers and lived right behind the harbour in (still existing) working-class neighbourhoods. The harbours were a place of labour, welcome and good-bye and also attracted visitors who were fascinated by the hustle bustle of this economic hearth of the region as the citation on the left illustrates.

The question of what meaning these inner harbours have for the city now the harbour is practically gone, is not yet solved. Rotterdam continues to search for how to re-join the city with the water both functionally and visually. Recently regenerated harbours do not recall anything of the liveliness and attraction the former harbours possessed, as image 3 shows.

1.1.3 Social and spatial segregation in Rotterdam South

The main issues Rotterdam Old South suffers from are the high unemployment rate, the low income, the low education level and high drop-out rate of youth, integration difficulties and safety issues. It is not mainly the kind of problems that is remarkable, but merely the scale and the obstinacy on which they occur (Team Deetman/Mans, 2011).

The cause for this difficulty to change has to do with many factors. Firstly, many low-educated and often foreign people came to Rotterdam to work in the harbours. Now the industries move westward and become less labour

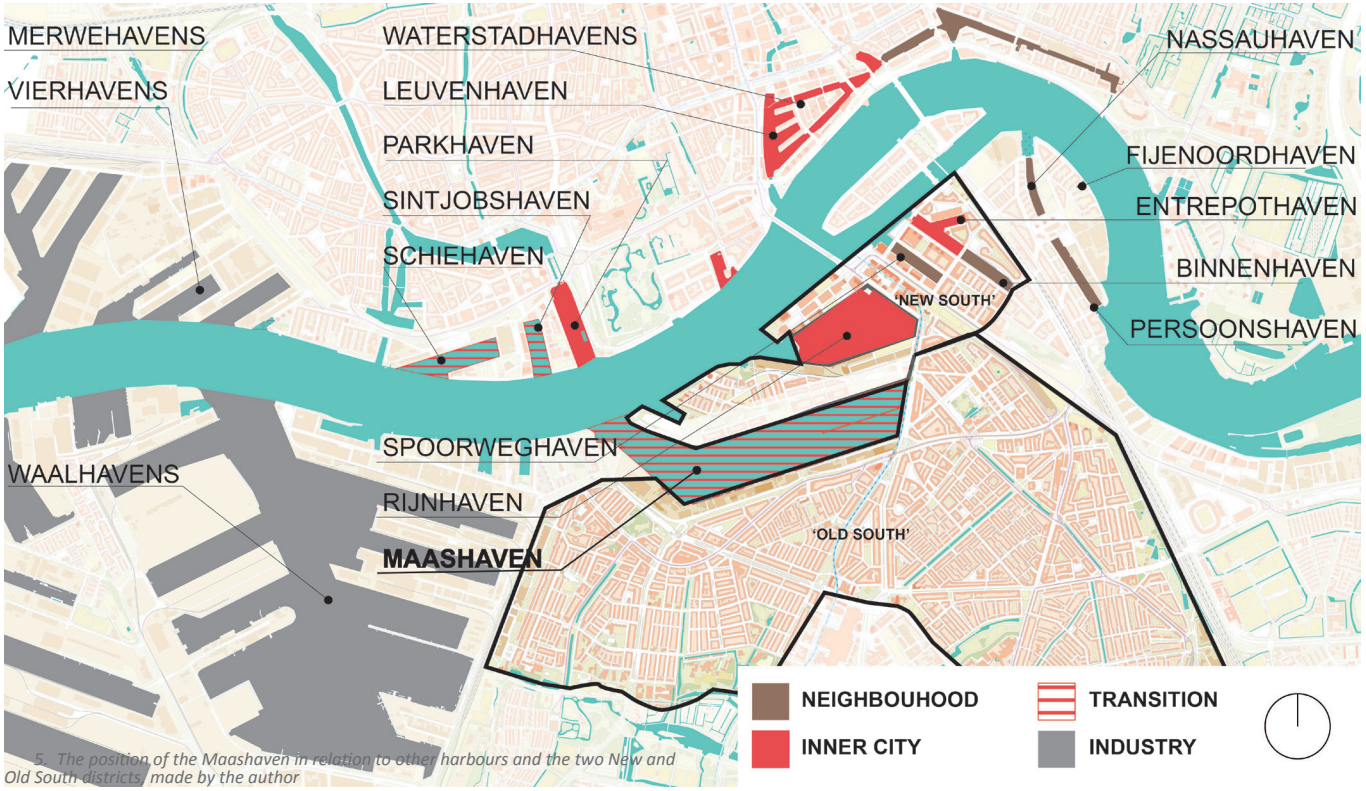


3. The Maashaven in 1955, photo by Cas Oosterhuys

4. Recently redeveloped but empty Spoorweghaven, photo by the author

intense, the availability of work is not balanced with the amount of people and their capacities.

Secondly the area seems to be stuck in a vicious circle of attracting poor, disadvantaged people because of the cheap and one sided housing stock. The problems with the housing stock are partially caused by the types of landlordship. A relatively large share of the housing stock is privately owned by rack-renters and in bad condition. People who climb on the social ladder, often move out as soon as they can afford better. This is called selective migration.
Since the establishment of the Erasmus bridge and recently the Rijnhavenbridge and the new developments at the Kop van Zuid, a new relatively rich and well reputed living and working environment is gradually growing south and westward into the old 19th and 20th century neighbourhoods. This has improved the conditions locally but also reveals the extreme social segregation more and more. The Maashaven is located exactly at the border between the new developments and the deprived neighbourhoods and currently forms a boundary that prevents the spreading of the positive impulse of the Kop van Zuid (see also figure 5)



5. The position of the Maashaven in relation to other harbours and the two New and Old South districts, made by the author

1.1.4 The lack of recreational public space in Rotterdam South

Towards 2030, Rotterdam is facing a demographic growth of 20.000 (Tillie et al., 2012) up to 44,000 (De Persgroep Digital, 2012). The municipality has expressed the wish to accommodate these people within the existing city in order to build towards a more compact, sustainable city where the ratio residents/people working in the area grows. However, with further densification, the pressure on public space will increase. Recent studies show that the livability of the city, that is strongly related to the quality of public space, becomes a more important allocation factor (Kuik and Rietveld, 2013).

Rotterdam already has difficulties competing with other large cities and the rural areas for being an attractive living environment (dS+V and OBR, 2007). Therefore qualitatively good public space where people feel at home, identify themselves with and can comfortably spend their leisure time is considered essential to stop the selective migration and to attract the desired groups of people. The total amount of public space is rather high in Rotterdam. The amount of only green public space for example already is 24% higher than in Amsterdam. Nevertheless, inhabitants evaluate the quality of public space, especially in central urban areas and the older neighbourhoods at South, generally as very low. Good quality recreational spaces are uneven spread over the city (dS+V and OBR, 2007). Concerning green public spaces, in most neighbourhoods surrounding the Maashaven the amount and quality of green is perceived as very low (Boelhouwers et al., 2011) as is shown in figure 6.

The Kop van Zuid and Old South are part of the main

densification areas (Gemeente Rotterdam, 2011b). Nevertheless, in this area there is a lack of larger, good quality recreational public spaces as is shown in figure 7.

1.2 Objectives

1.2.1 Main objective

The main objective of this thesis is to develop a flexible redevelopment plan on the future of the Maashaven as binding public space for Rotterdam South and to show possible spatial implications of this redevelopment plan by means of two strategic design interventions.

1.2.2 Secondary objectives

Two other objectives of this thesis have to do with widening the experience with design strategies for both the author and the discipline of urban designers as a whole.

Firstly this will be done by designing from the starting point of public space instead of build up area. This because public space is often considered to be one of the most important features of dense but qualitatively outstanding cities in the near future (Kuik and Rietveld, 2013). The city of Rotterdam focuses in this respect especially on the relation between green public space and densification as is shown by the recent study of TNO and the Municipality of Rotterdam 'Rotterdam –people make the inner city, densification + greenification = sustainable city' (Tillie et al., 2012).
The second way of designing explored in this thesis incorporates the use of scenarios in the design process The aim of using scenarios is to make more robust and flexible designs to deal with large uncertainties and long planning horizon inherent to the field of Urbanism.

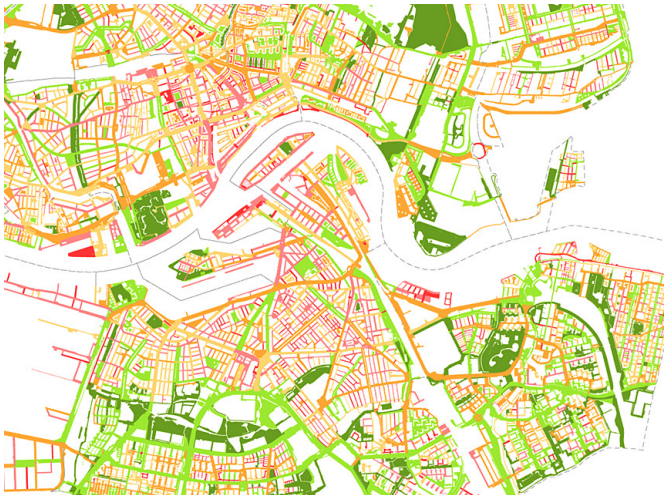
1.2.3 Products

The intended products of this graduation project are a literature study and a research by design study.

The subject of the literature study was public space in amphibious neighbourhoods. Main reason for this was the original question from the Municipality of Rotterdam to design a backbone for a floating neighbourhood. From the first site analysis and formation of the problem statement it became clear that the Maashaven should play an important role in the public space network of the city. Therefore public space in amphibious neighbourhoods was explored to see how this could be combined. However, the literature study showed that a floating neighbourhood would privatise the water such that the objective of the thesis became impossible to reach. A design of a floating neighbourhood would be unnatural here. Although the design will not consist of a floating neighbourhood anymore, many lessons from the literature review about water, publicness and public space can be used in the thesis. These findings

'On the one hand the quality of public space is a explanatory factor for the popularity of the city [.....]. On the other hand its quality becomes more and more important in the decision-making now the pressure on public space increases

(Kuik and Rietveld, 2013) p. 1) translated by the author



6. The perception of green in the public space, ranging from low (red) to high (green). Source: Report 'Trefzeker op Zuid' by Boelhouwers et al., 2011)

7. Larger recreational public spaces in Rotterdam and their reach, see also chapter 2 for the used method. Image by the author.

are supplemented by additional reading on public space throughout the research phase.

The design consist of a redevelopment plan with a scope up to 2050 for the whole Maashaven area and focuses on what role the Maashaven can play in the larger context of the city of Rotterdam. The strategic interventions show which places are most essential to transform and visualise the detailed functioning of spatial principles stated in the redevelopment plan.

1.3 Research Questions

1.3.1 Main research question

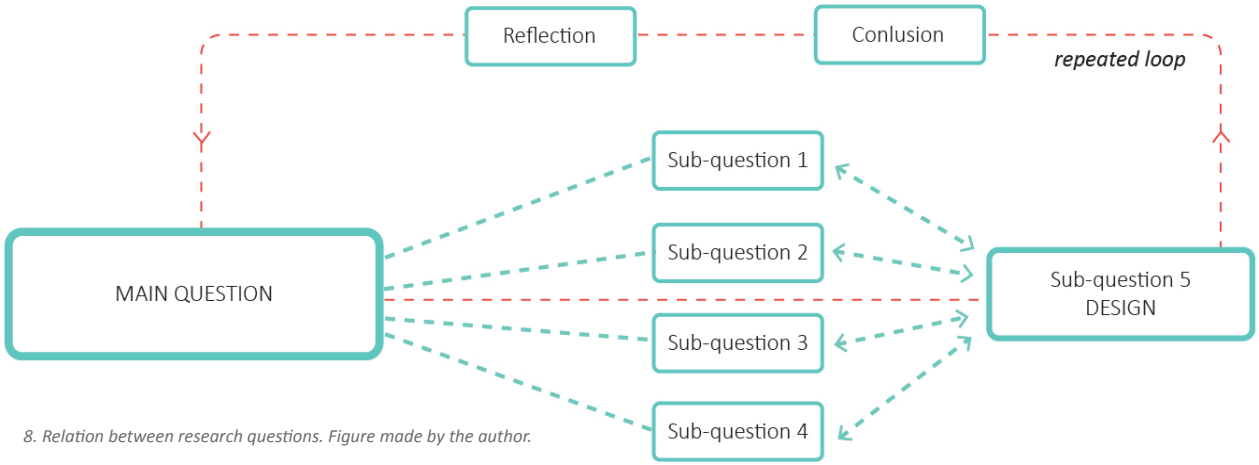
The previous context, objectives and problem statement lead to the following research question:

How can inner city former harbour basins function as public space in order to stitch disassociated districts into a continuum and to strengthen the relation between city and river?

1.3.2 Secondary research questions

The sub-research questions of this thesis are not formulated to set up a road map towards an answer in a linear way. In a linear process every sub research question provides input for the next. Instead, the sub-research questions are all dealing with an aspect of the main question, converging into a design in which found ideas are tested. Subsequently the design can provide new insights that help to better answer the sub-research questions, converging again (via conclusions and reflection) towards the main research question, as is shown in image 8.

The most important notion in both the problem statement and the research question is ***public space.*** This is a very wide and vague notion and is used in many ways. Both the term public space and the location specific properties that relate to successful public space have to be evaluated. Therefore the first sub-research question will be:



8. Relation between research questions. Figure made by the author.

1. What criteria for successful public space are important to transform the Maashaven into a binding element in the public space network of Rotterdam South?

To be able to strengthen the ***relation between city and river*** it is necessary to know how this relation developed over time and to form an opinion on how this relation should evolve in the future. Therefore the second sub-research question will be:

2. How did the relation between city and river develop over time and how can this relation be strengthened?

As shown in the definition of the problem field the loss of the clear relation between city and river is mainly caused by the changing nature of the harbour activities and its westward movement, leaving behind 'empty water'. The Municipality of Rotterdam expresses a strong desire to replace the former use and meaning with the new function of a floating neighbourhood (Gemeente Rotterdam, 2011). It should nevertheless be questioned which new functions are supporting the objective of this thesis. Therefore the third sub-research question will be:

3. What functions can and should be accommodated in the Maashaven area and does the ambition of the municipality to realise a floating neighbourhood in the Maashaven fit with the aim of the research project?

In order to propose a more flexible 'future-proof' redevelopment plan a thorough analysis of the spatial preconditions and their possible developments in the near future should be made. This leads to the fourth sub-research question:

4. What are the main spatial preconditions for the design and how to incorporate them in a robust design for an uncertain future?

The spatial design is on the one hand meant to test the above found principles spatially. On the other hand the design can lead to new insights concerning the questions posed above. This leads to the last sub-research question:

5. How could the theoretical principles derived from sub research questions one to four be translated in a strategic plan and two interventions for the Maashaven and how does this design experiment help to answer sub-research question one to four?

1.4 Relevance

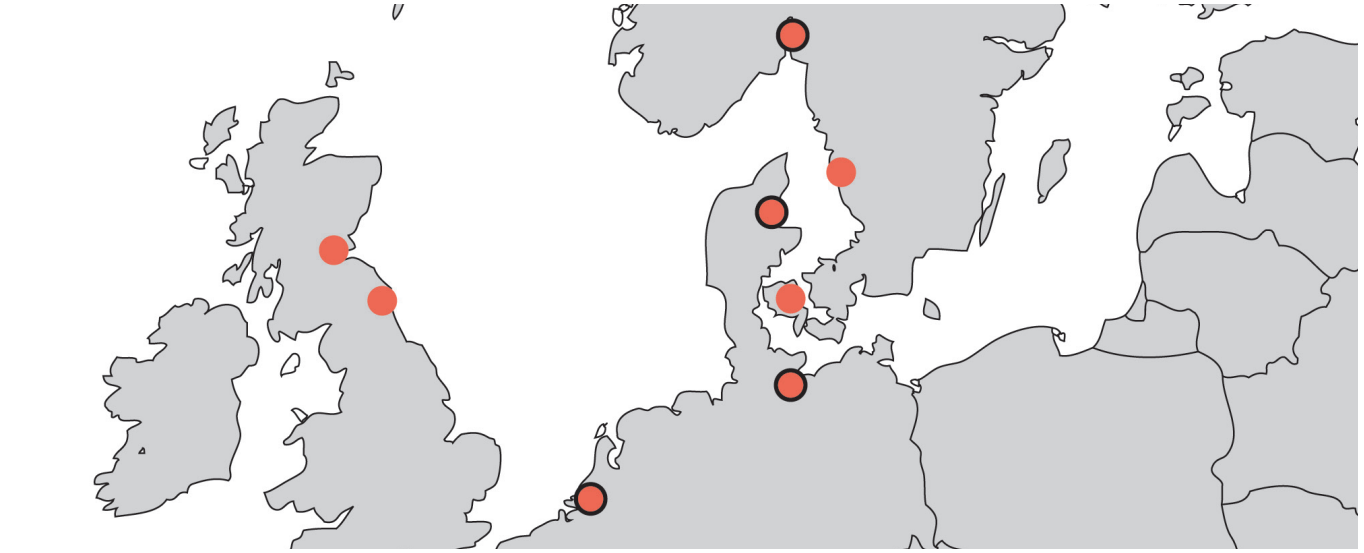
1.4.1 Academic relevance

This thesis adds to the body of knowledge about the regeneration of comparable harbour cities in Northern Europe by exploring an unconventional solution for the Maashaven and deriving lessons from it.

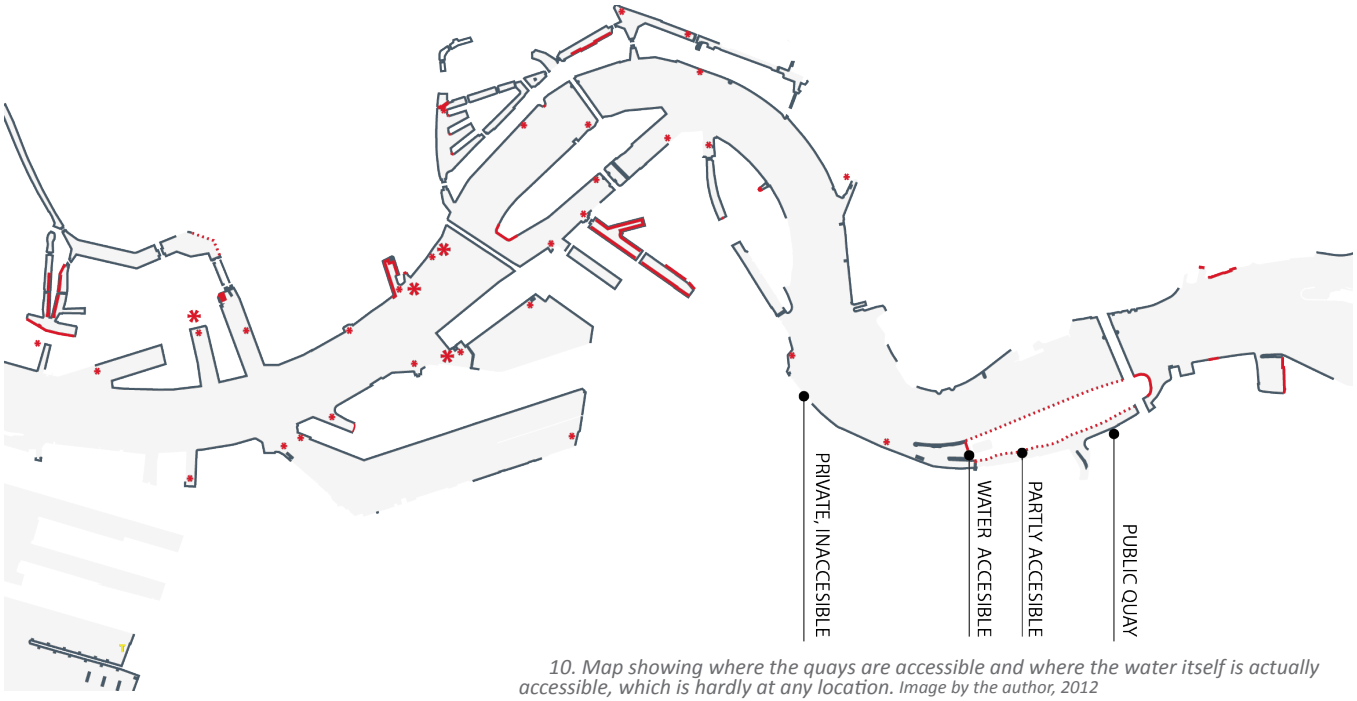
Where the harbour formerly was a gateway to the city and a vibrant community the globalization, containerization and economic changes have made the small harbours evanesce and all other harbour activity becomes concentrated at mega-ports located away from the city. Physically, these ports (fig. 9) are characterised by the central location of the freed land, an enormous amount of heritage, urban identity and the spatial separation between the densely built port areas and the city caused by heavy infrastructure and no longer accessible industrial sites (Smith and Garcia Ferrari, 2012). A social-economic similarity according to Smith et al. is the search for a more diversified economy to replace the former labour provided by the harbour to *'address the equity issues being raised by the increasing socio-economic disparities [..]'.* At the same time many countries around the North Sea display a political shift from social democracy toward more a neo liberal policy, asking for an increased role of the private sector, enhanced lately by the economic crisis.
Bruttomesso formulates the problem of the relation between city and river as the need for *'recomposition'* of the city now the binding element of the harbour has moved out.: *'giving a common unitary sense to the different parts, both physical and functional, of the waterfront'* (Bruttomesso, 2001, p. 3, in Smith and Garcia Ferrari, 2012). Cities that face these coomon problems are for example Oslo, Aalborg, Hamburg and Gateshead.

1.4.2 Societal relevance

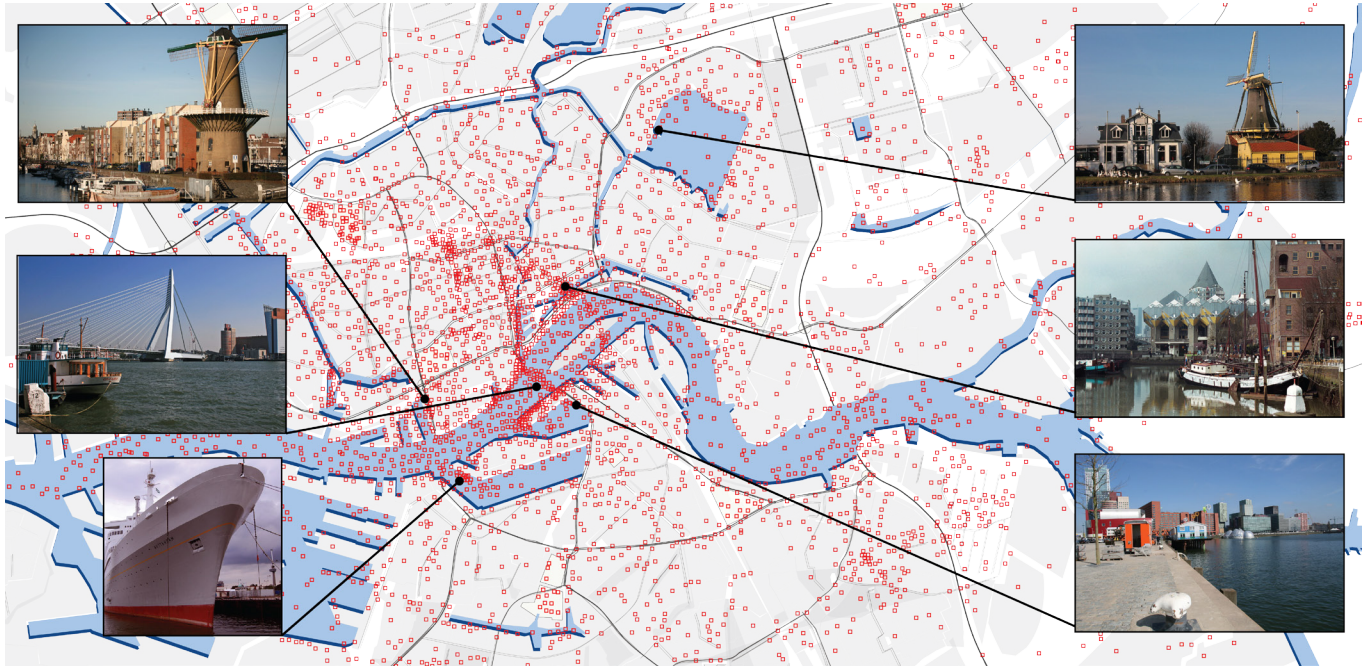
The societal relevance of this research can be primarily found in the fact that this thesis explores a new approach to improve the situation in the problematic neighbourhoods in Rotterdam South that are surrounding the Maashaven.



9. Cities that have common problems due to harbour areas at a central location between city and river. Source: Google maps, adjusted by the author.



10. Map showing where the quays are accessible and where the water itself is actually accessible, which is hardly at any location. Image by the author, 2012



11. Map indicating where the most pictures are uploaded on google maps, showing the most popular sites of Rotterdam are all concentrated on or along the water. Made by the author, 2012, based on maps.google.nl

Firstly this is done by investigating how a common public space in between two segregated districts can stitch together the two districts. Good public space *'tends to foster strong community pride and involvement, inviting improvements of existing buildings or the addition of new structures, a process which simultaneously ingrains a strong sense of community that demands exceptional landscapes'*(North, 2013, p. 13).

Secondly, with the provisions of denser cities it is important to think about new ways to increase the amount of distinctive public space in order to maintain the livability of an area.

Thirdly, this design of the Maashaven could show how the water, which is extremely important in the collective identity of the city but hardly reachable anywhere (figures 10 and 11), becomes approachable for the residents of Rotterdam.

1.4.3 Involved disciplines

Besides urban design there are overlaps with civil engineering (levees and water management), environmental studies (building with nature).

2 Methodology

Methods and techniques used to answer the research questions

2.1 The relation between research and design

The initial part of the process can be characterised as 'design research' (fig. 12). It aims at acquiring knowledge on both location specific aspects and comparative cases in order to generate knowledge that feeds the design. This evolves in 'research by design', where found principles and knowledge are spatially tested to learn what solutions are suitable for the specific case.

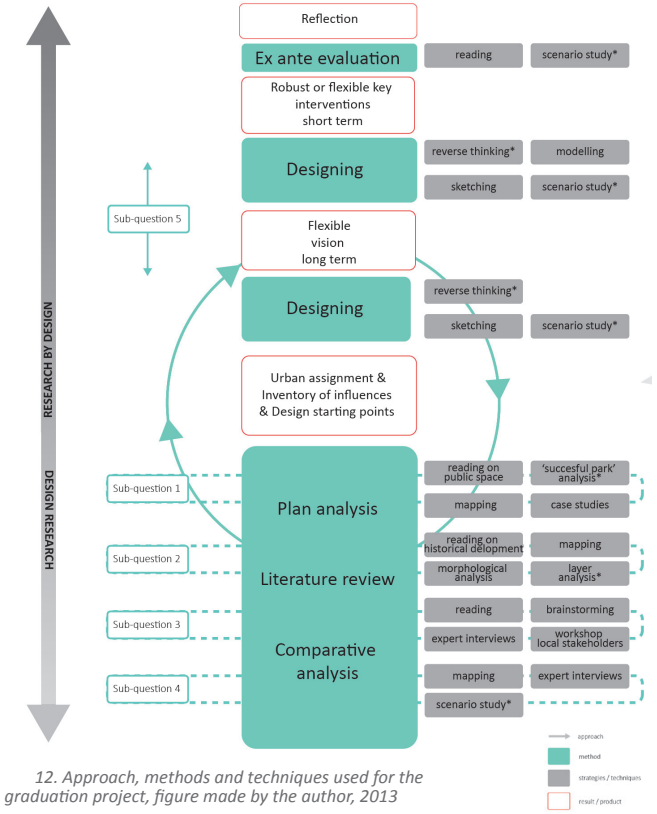
Because of -as Bobbink and Nijhuis (2012) fromulate it- *'[...] the interaction between design and research, the borderline between both is not always well defined.'*
This is expressed by the fading grey scale and the repetitive circle in the diagram, indicating that stepping back and forth between these two approaches is normal. In the first phase design related research methods like literature review, comparative analysis and plan analysis were used. This led to the formation of the urban assignment and a clear overview of local and contextual constraints.

This forms input for the second phase in which designing is the main method used to generate both case specific knowledge and general knowledge by making a strategic redevelopment plan and two more detailed key interventions to show the possible local impact of the redevelopment plan. In this thesis design is explicitly seen as a way of doing research and thus the core element of the thesis.

2.2 Design as method; acquiring knowledge by studying one case.

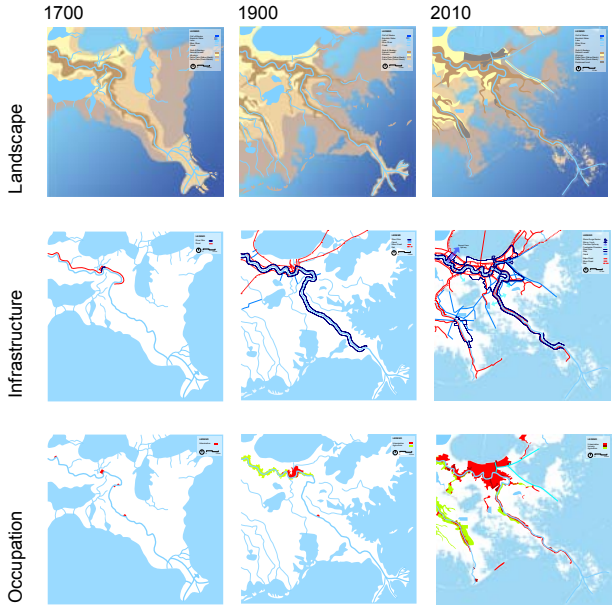
Carrying out a design for a specific case in which the context (Rotterdam South) and the object (the Maashaven) are interacting during the design process is called *study by design* (De Jong and van Duin, 2002). This type of research explores the effects of transformations in context or object. In the framework of the master thesis the design is not primarily aimed at producing a tailor-made product for the municipality of Rotterdam or to execute the design straight away. It is merely intended to acquire insight about possible futures of this area and inner harbours in dense urban areas in general. Therefore it can be called 'study' rightfully as de Jong and van der Voort (2002) argue.

This type rather practical research is called *case study* (not to be confused with comparative analysis or precedent study). Flyvbjerg (2006) explains why case studies can produce generalised and therefore scientific knowledge. One of the greatest values of a case study is the depth that can be reached by doing only one case study. This depth of study makes it possible to reveal assumptions or prejudices that are made. This thesis for example reveals for example how the desire of the municipality to design a large floating neighbourhood in the Maashaven appears to be partially based on invalid assumptions and seems to be not beneficial, if not even harmful to the area.
Case studies are also valuable research method because

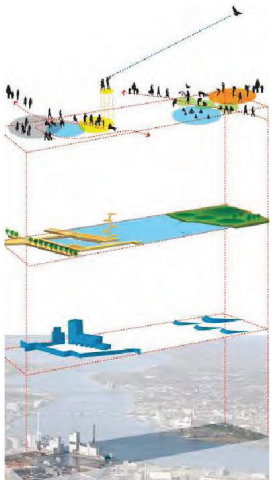


12. Approach, methods and techniques used for the graduation project, figure made by the author, 2013

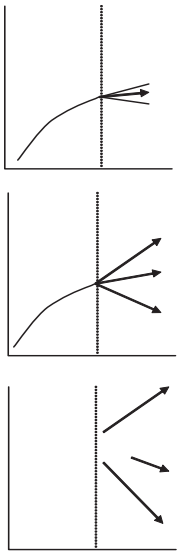
they make it possible to test a previous set hypothesis. In chapter one the hypothesis that the Maashaven can become a unifying public space is embedded in the main research question. This assumption is tested in the design.
Although the case study is site specific, some of the discoveries add to a more general body of knowledge. This is especially true when the case is comparable to other cases. On a small scale the problem of densification and demand for public space is comparable to other Rotterdam harbours, and on a bigger scale the need to find a new function for empty harbour basins with added value for the whole city, is comparable to other Northern European harbour cities that cope with the same spatial and social problems as is explained in chapter one.



13. Layer analysis of the Mississippi River Delta. Image from the Semester Booklet Delta Interventions, 2012



14. The 'reverse thinking' design method from Gehl. Source: Kibb (2009)



15. 'Prediction, Exploration, and Speculation' (original title) ; different principles for making scenarios. Lecture sheet by (Dammers, 2013)

2.3 Techniques

Four techniques from fig. 12 are further explained here.

2.3.1 Successful park analysis

The analysis technique developed by de Josselin de Jong and Mispel (2008) in their study 'Park analysis Rotterdam, success and fail factors of parks' (translated by the author) will be used in this thesis. Its relevance for the thesis is that it focuses on the way a park is embedded in its context and not so much on aspects that make a park into a park. This offers the possibility to identify strong and weak points concerning the ambition to add the Maashaven to the public space network of the city without focussing on the program and form yet. Aspects that are examined are for example reach, density of the surrounding area, unicity, mixed functions/amenities, anchorage, accessibility, routing and identity.

2.3.2 Layer analysis

The studied site is unravelled in three layers: the subsoil, the infrastructure and the occupation. These three layers differ in transformation speed. The subsoil has the slowest altering tempo and the occupation changes relatively fast. Changes are often influencing more than one layer and therefore the coherence between the three layers is shown (vertically) in relation to time (horizontally). This analysis can be carried out on both large scale as is done in figure 13 (delta), medium scale (city/region) or small scale (district). The latter scale is chosen in this thesis to make levees and structures of main ditches visible that are informative for the scale level of the design.

This technique is based on the layer approach which originates in a model constructed between 1996 and 1998 by De Hoog, Sijmons and Verschuuren (Schaick and Klaasen, 2011). This technique is part of the studio approach of Delta Interventions and helps to really understand the relation between occupation, infrastructure, and subsoil. This technique is of use for the thesis because it makes the complexity of the urban composition comprehensible and reveals in which layers problems are caused and which other layers are subject to these problems. Hence it indicates which layer(s) to address with the design to solve the detected problems.

2.3.3 Reverse thinking

This is a way of designing defined by Gehl (Kiib, 2012). The conviction that a good functioning public space is the *'grammar that hold the city together'* as Rogers formulated it (Rogers, 2010) is the underlying thought of this technique. Therefore public space is not seen as the left over space after all buildings are planned, but as starting point of the design. The first step is to define which activities and movement patterns are desirable in what part of the plan area. Secondly the kind of space and materialization that supports these activities is designed (fig.13). Only the last step is to design the building volumes the functions that best support the use of public space. By forcing oneself to think from within outdoor spaces, public space really gets priority. This way of thinking fits the objectives of the thesis because public space at and around the Maashaven must be created. The build up program is not only considered supportive but also rather unsure in these economic harsh times and ***'Although we cannot design or create life, it is possible to create an environment which invites human activities'***(Gehl Team (2007), in Kiib, 2012).

2.3.4 Scenario study

By using scenarios, a new way of designing is explored to deal with large uncertainties and long planning horizons, inherent to the field of Urbanism. Fixed master plans and large scale area development are outdated in current decennium which is characterised by the receding

governement and an economically uncertain situation. Also the Maashaven area is subject to many uncertain local factors and decisions of the governmental institutions, as is explained in § 5.8.

The aim of using scenarios is to make a more robust and adaptive design. The robustness of the design is embedded in the proposed small scale design interventions which are able to function well in a wide range of scenarios without structural changes. The adaptivity is embedded in the redevelopment plan by showing which parts should be rather adaptable without harming the strength of the redevelopment plan as a whole.

Making scenario's is not a way to list options and to pick one scenario to design for. It is a helpful tool to learn about possible futures and to discover new options besides the very first initial idea. Hulsbergen states that the driving forces or the 'critical uncertainties' on which scenarios are based should be the ones that have the highest impact on the design and at the same time the least probability (Hulsbergen and Van der Schaaf, 2002). Variables that have no impact on the design do not matter and highly predictable influences have to be taken into account in every possible design outcome anyway. Dammers (Dammers, 2013) describes different types of scenario's, ranging from predictive to very explorative (fig. 15) in which also very unlikely scenario's are taken into account like in Hulsbergens theory. He also shows that you can make scenarios using a kind of baseline trend, based on experiences of the last decades. This type of scenario is chosen in this study because for both main driving forces, there can be made reasonable assumptions based on generally accepted trends, as is explained for this case in § 5.8.2.

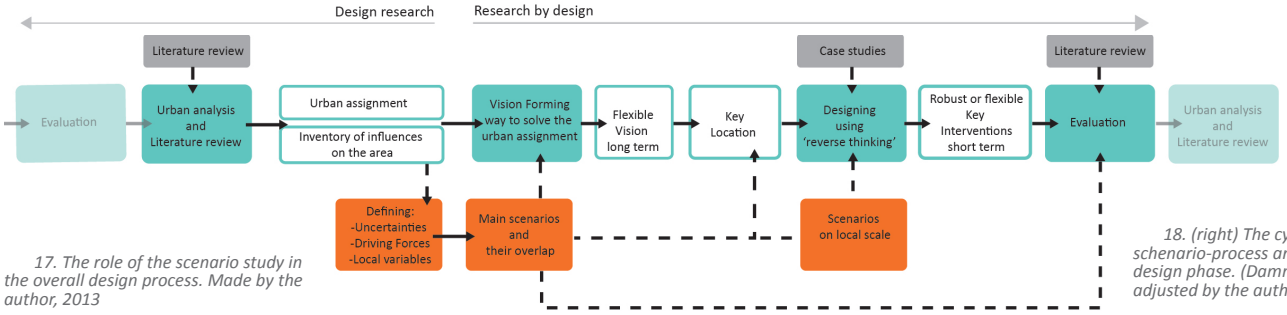
Role of scenarios during the design process

The use of scenarios becomes present during different stages of the process. Solving the urban assignment is the main goal, but the redevelopment plan and design intervention should function within different scenarios or should be flexible enough to adapt to different scenarios. The scenario at one hand feeds the design since it helps to select the most important preconditions for the design and the most important intervention locations. At the other hand scenarios are used during the design experiment as test criteria as is shown in figure 16.

Context- versus policy oriented scenarios

Dammers (Dammers 2013) distinguishes variables that are context- or policy oriented. Although all four variables are influenced somehow by the axes of the scenario graph (§ 5.8.), the first two in this study are more context oriented. The second two are policy oriented and thus depending more on governmental decisions (fig. 16). The municipality could for example decide not to facilitate more traffic along the Brielselaan but to provide another route or mode of transport. But they can not change the required flood defence height because this is influenced by climate change and the national policies.

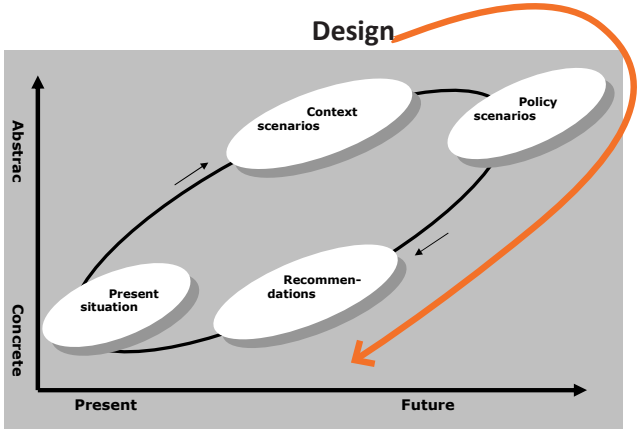
Dammers describes a scenario-process as a double cyclical process (fig.18) for both abstractness and the discussed time span. At the present moment very concrete aspects are investigated to find the main driving forces in an area. On a more abstract level and towards the end of the discussed time span the possible context-oriented scenario's are sketched (in this case what changes if the required dike height changes or when there is more real estate development). After this, we can envision how policy influences the outcome in different scenarios, or in other words, in what ways can we deal with or react to different scenarios, influencing the spatial outcome itself? Here the designing starts with showing what *could* happen. From this recommendations are brought back into the present situation by proposing interventions that will result in a convenient way to deal with different scenarios. This cycle can be repeated through time.



17. The role of the scenario study in the overall design process. Made by the author, 2013

18. (right) The cyclical schenario-process and the design phase. (Dammers, 2013) adjusted by the author, 2013

16. Context oriented versus policy oriented variables. Made by the author, 2013



Backgrounds

Theory and research supportive to the design experiment

3.1 Historical development of the relation between city and river in Rotterdam

Introduction

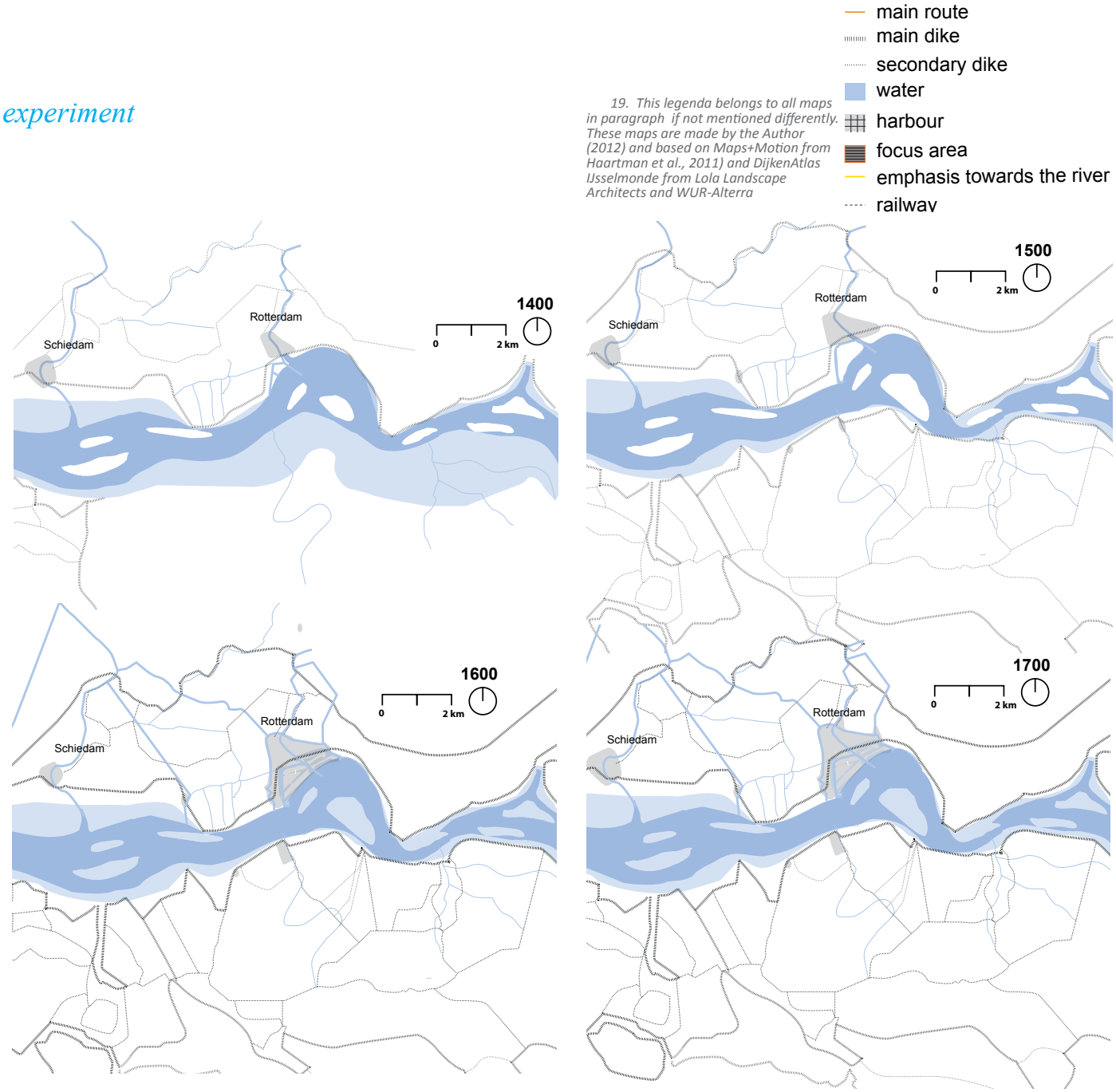
Rotterdam owes its birth and growth mainly to the river Meuse, being both an enemy and a source of life. The relation between the city and the river has changed constantly throughout history, dominated by trade and production, flood and leisure. By studying this relation throughout history lessons can be learned about how to deal with this relation in the future and to answer questions like: What relation with the river is desirable and what role does the flood defence play in this relation?

The first settlements

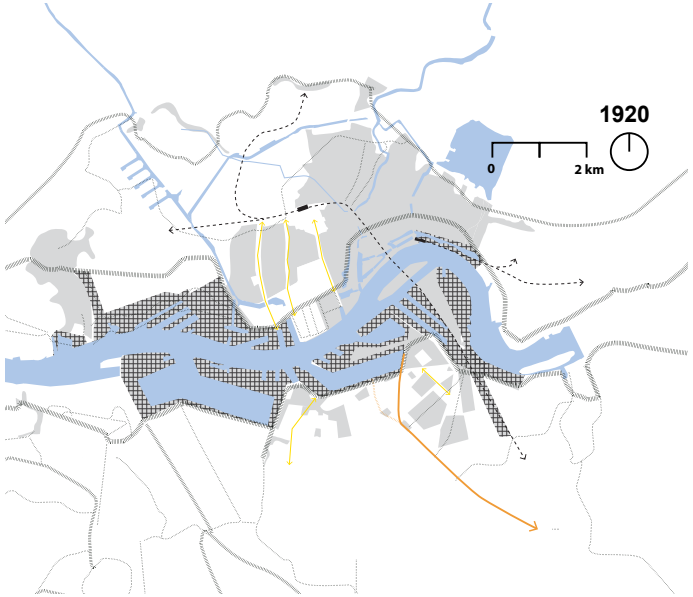
Around 1200 the first permanent settlements occurred at the location where in the end of the 13th century a 400m dam was built in the river Rotte at the transition between the creek and the river (van de Laar et al., 2004). The dike, called the 'Hoogstraat' (the high street), formed both the threshold between city and the town centre where most activity took place.

Leap over the dike

The first dike at the north banks had to protect the settlement and the land that was used for agricultural purposes. To drain these peat grounds the first small canals were dug (van de Laar et al., 2004). Main transport



19. This legenda belongs to all maps in paragraph if not mentioned differently. These maps are made by the Author (2012) and based on Maps+Motion from Haartman et al., 2011) and DijkenAtlas IJsselmonde from Lola Landscape Architects and WUR-Alterra



routes often coincided with dikes or canals. The area that is called IJsselmonde where the Maashaven is located nowadays was still under influence of the river. The area was a collection of small polders that were gained from the water, and often lost again. Here, from Poortugaal and Pernis the more permanent reclamation began from 1180 onwards (Palmboom, 1987). In 1393 also from the settlement of Katendrecht this process was initiated, from which the first dike ring is still visible in the current urban pattern. In 1373 most of the future IJsselmonde area is flooded again and thick packages of river and sea clay are put on these grounds. Only in 1580, about 300 years after the north banks of the Maas, this area was completely reclaimed (Palmboom, 1987).

In the 15th century the city grew in all directions, forming an inner and outer dike part of the city (van de Laar et al., 2004). Main source of income was the herring fishing and in other seasons the vessels were used for freight transport. In this century there was a clear distinction between city and harbour, separated by the dike. The transition between land and river was mainly functional. Here the ship building activities were located and palisades separated the harbour from the river to protect the city from enemies (Meyer, 1999). In this respect the relation was comparable to the situation right after the digging of the Rijnhaven and Maashaven (fast expansion, functional relation)

The Golden ages

In the 17th century the harbour area was a good alternative for the overcrowded and unhygienic inner city at the other side of the dike. The area became both living and working environment and its inhabitants made do with the nuisance by flooding every now and then. Especially in the golden age the atmosphere in this outer dike area became one of luxury and grandeur. The Boompjes functioned both as quay and as boulevard, giving a magnificent view over the Meuse and becoming the rich façade of Rotterdam (Meyer, 1999).

At the eve of change

In the 19th century the Boompjes was a multimodal transport hub with the new train station and the docking of international ships. Combined with the first public park, De Oude Plantage, and many representative and public functions it became the most important public space in the city. W.N. Rose supported the ideas of the 17th century water city with its formalised façade, a mixed program and a (water)network behind it. Two design principles derived from the successful public space at the old Boompjes were surplus of dimensions and the differentiation in design and materialisation (Meyer, 1999). Rose projected this on Feijenoord and implemented it at the west side of the old centre at the 'Nieuwe Werken'. Its harbour function didn't last for a long time because a big change was coming.

Modern times

Meyer describes four more consecutive phases in in the relation between the city and the river his dissertation: 1860-1920, 1920-1949, 1945-1975 and 1975-2000
1860-1920

1860-1920

Until 1850 the south side of the Meuse was rural land with some small villages and infrastructure and the polder structure were an intertwined system (Palmboom, 1987). After 1850 the first ship wharfs and factories opened at the south banks of the Meuse. In

1863 the Municipality of Rotterdam decided to develop Feijenoord and to build harbours that could host larger ships. Because of the opening of the Nieuwe Waterweg and the train connection to Rotterdam South the development speeded up. The harbour became a transit harbour. G.J. De Jongh from the municipal planning bureau was the most influential planner in this period. The first new harbours were dug east and westwards at the north side of the river. Very quickly the capacity of the newly dug harbour basins became insufficient and the Rijnhaven and Maashaven were added by 1908. That Katendrecht was sacrificed. TAt the former rural land the harbour was seen as necessary evil for the benefit of the whole city. De Jongh designed large monumental axes used for transport to and from to harbours and unlocking residential quarters. They were oriented on the new harbour basins and thus creating an indirect link via sightlines since the actual harbours became more and more an area in between the city and the river like in the 15th century. Nevertheless many people worked in this area and therefore the link between city and harbour was still strong.

1920-1949

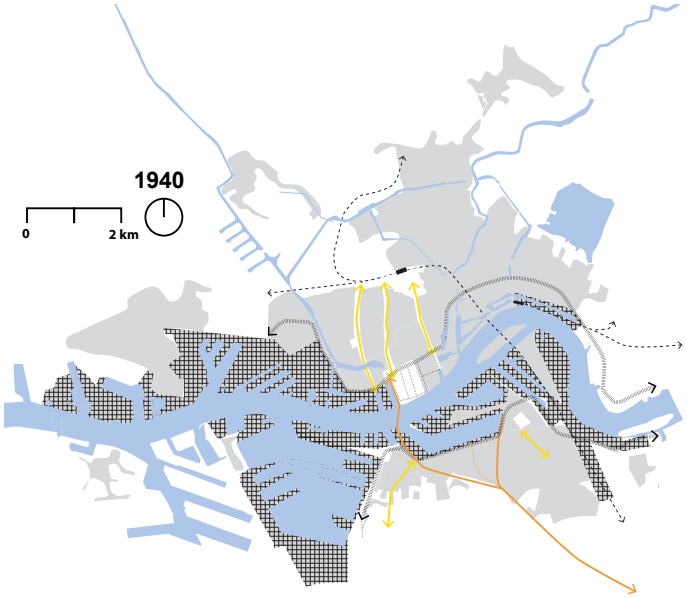
In the 1920's Backx, working at a big harbour company, plead for a more autonomous development of the harbour because of the always growing spatial demands and complexity of harbour activities and the risk of having only a transit harbour and not adding value to trespassing products. The port authority was founded for all harbour related planning and City Development (Stadsontwikkeling) was from now on concerned with designing the city, led by Witteveen. The harbour started to develop westward. Witteveen designed wide green wedges and parkways with some marvellous sights towards the mighty river. The Maastunnel had large influence on the city, making the attention shift westward and putting the Kop van Zuid in a discarded position.

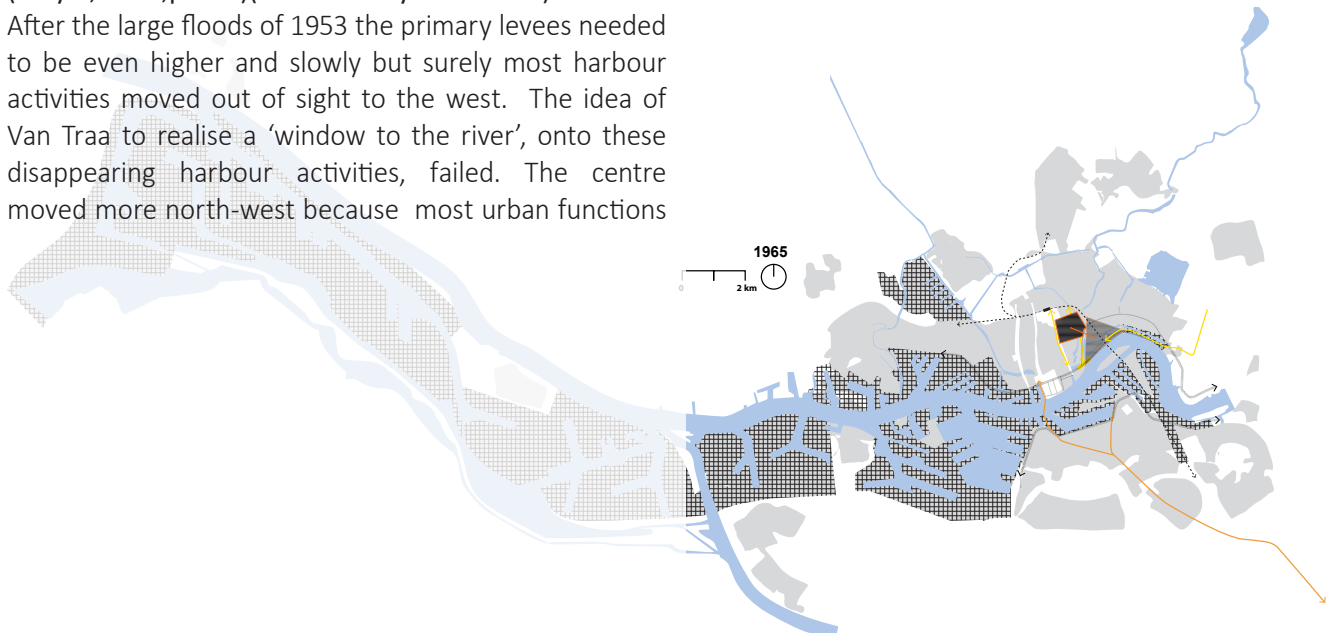
1945-1975

At the end of the war the centre of Rotterdam was bombed and Witteveen used this occasion to redesign the centre of Rotterdam and to relocate the flood defence to the former Boompjes. The main opponent of Witteveen and his successor van Traa was Kraayevanger, one of the 'captains of industry' who warned the city planners that putting the flood defence line at the edge of the river would be destructive for the relation between city and river:

'But does Rotterdam realise what one sacrifices? From the city people will hardly be able to see the river because Rotterdam will be hidden behind a fence!' (Meyer, 1999,p. 318)(translated by the author).

After the large floods of 1953 the primary levees needed to be even higher and slowly but surely most harbour activities moved out of sight to the west. The idea of Van Traa to realise a 'window to the river', onto these disappearing harbour activities, failed. The centre moved more north-west because most urban functions





didn't settle back in the old city triangle behind the high Boompjes. This also changed the contact with the river to a more distant and more symbolic one and enhanced the negative detaching effects at the Kop van Zuid. Later, many discussions and speculations about what to do with these deprived neighbourhoods made the situation even worse because nothing was done and in the meantime no one dared to invest scared of the possible teardown of major parts. The outer dike areas, in which also the Maashaven is located, were integrally heightened when they were built. Only after 1953 the flood defence line at the Brielselaan was heightened and the traffic was intensified. At the same time, less and less people worked in the outer dike areas which made both the physical and the psychological connection between neighbourhoods and the river less intense.

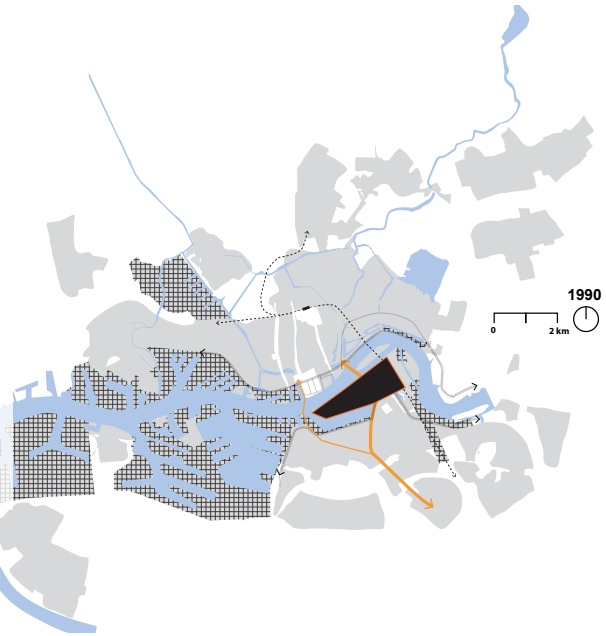
1975-2000

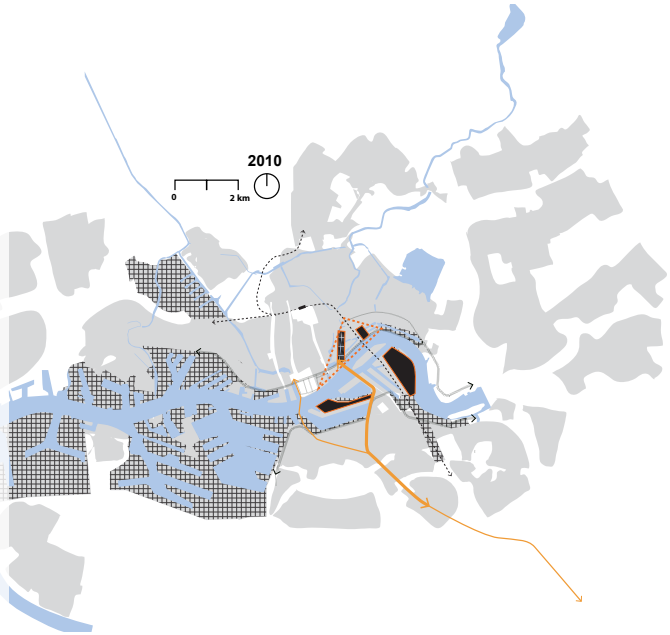
In the 1970's the left wing political majority focussed on repairing the city and the impact of the modernistic changes from just after the war. The Oude Haven and Leuvehaven were the first to be repaired in this ideology. The focus lay on housing mixed with other functions, letting go of the modernistic priorities for offices and traffic in the city centre. In the old harbour locations and the older neighbourhoods around the centre, the focus was more on the social aspects and new (mainly social housing) neighbourhoods were built, especially at Feijenoord and Katendrecht but an integral vision was lacking. Once more Rotterdam South was the appointed settling location for socioeconomic weaker groups. In 1985/7 the focus shifted to the triangle at the north shore, to turn into a cultural and touristic interesting area, which was the first real try to exploit the nearness of the river as a touristic and scenic element.

For further extensions of the centre there was a choice between moving west to the Mullerpier, and moving South to the Kop van Zuid. Chosen was to develop the Kop van Zuid as the Manhattan along the Meuse, giving the South side a façade at the river too. There was a lot of attention for historical structures and collective memory. Elements like old bridges, harbour buildings and train tracks were integrated in sight lines to strengthen the relation to the river and the harbour history. The focus shifted from the water city at the north, to the Kop van Zuid and the focal point landed at the Erasmus bridge. The Erasmus bridge formed a physical but even more important psychological link and opened in 1996. The water became the glue and the identity forming element of the now larger city centre. The public space network at the Kop van Zuid got much attention and money from the municipality, leaving the exact functions in the buildings more free.

Today

One of the most recent developments is Katendrecht, where a new strip of residential buildings is added along the Maashaven, completing the collection of different periods on this peninsula, consisting of harbour buildings, neighbourhoods from just after the digging of the harbours in 1908, additions form after the war, social housing from the 1980's and the currently finished strip of single family dwellings and apartments. Nowadays there seems to be a question again whether Rotterdam should expand at the south or north side of the river, developing the Merwe-Vierhavens or the Maashaven and Waalhaven first, but it seems clear that the extension of the urban area slowly follows the disappearing harbour.





20. The 'Boompjes' in ca. 1700 by Petrus Schenk, in Meyer, 1999

21. The 'Boompjes' currently. Source: Google maps, 2012

3.1.1 Conclusions and starting points for the design.

The outer dike areas in the city centre were often the most dynamic zones of the city and were essential for an intense contact with the river. Solutions like the redesign of the Boompjes with its higher profile and focus on traffic are regretted nowadays. With the possibilities we today have to build in outer dike areas it would be a pity to close off the inner harbours and shorten the flood defence line.

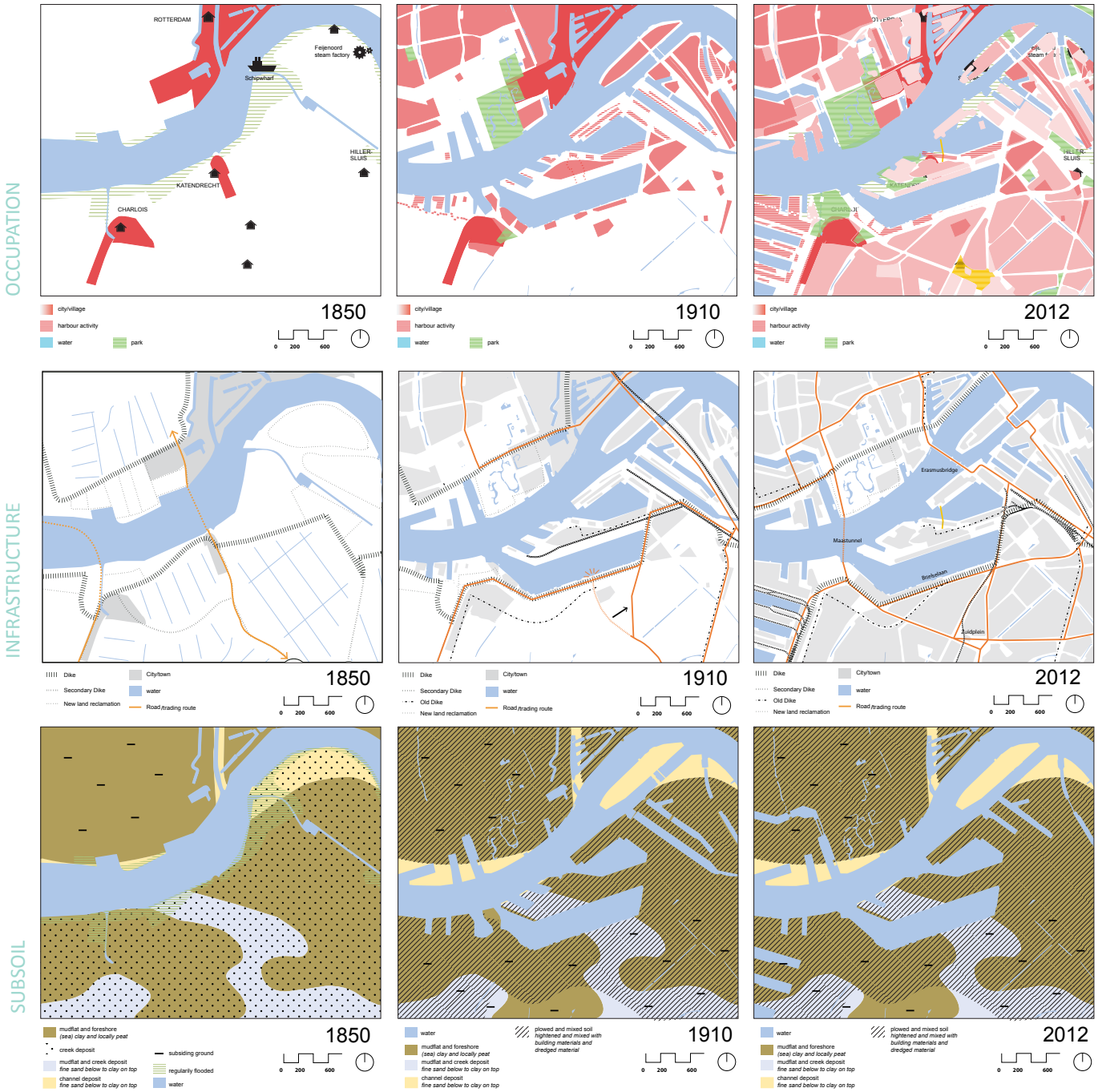
The lost connection with the river didn't only have a spatial component. Also the fact that less and less people worked in the outer dike areas made the connection to the river and its activities less intense and the industrial sites along the river only then really became a barrier. An important thing to realise when redeveloping these areas is to apply program that is accessible and interesting for people living behind the flood defence. Flood defences that contained a varied program ore were major public spaces themselves such as the old Hoogstraat, became a landmark and a connector, rather than a separating barrier.

The public space that proved to be successful and robust, as described by Meyer was a bit over dimensioned, had a layered profile and had a strong materialization and therefore could host diverse functions.

22. The Brielselaan in 1949 before the flood defence was raised.Photo Cornelis Bastiaan Vaandrager, Gemeente Archief Rotterdam

23. Cafe de Klok at the Brielselaan.Author unknown, via our-rotterdam.nl

24. The Brielselaan currently. Source: Google maps, 2012



25. Overview of the layer analysis of the Maashaven area. Images made by the author, 2012

3.2 Context and morphology of Rotterdam South

3.2.1 Morphology: The layer analysis

In figure 25 the coherence between subsoil, infrastructure and occupation is shown in a 3x3 layer analysis. On the following pages every layer is explained more in detail as supplement to § This analysis is followed by a conclusion about the influence of the different layers on the plan area.

Subsoil

The subsoil of Rotterdam is influenced by both river and sea. As can be seen in § and figure 26 the southern part of Rotterdam is diked later than the northern part. This has influenced the composition of the subsoil. Before the Iron Age the landscape was mainly swampy peat, until the tidal influence of the sea increased so new gully were formed and the peat was de-watered a bit (van de Laar et al., 2004). By floods of both the river and the sea sand was deposited on the peat. This process was stopped when in the thirteenth century the first dikes were constructed north of the Meuse (Palmboom, 1987). In combination with the drainage and the cultivation of the peat to make the area suitable for agriculture, the process of subsidence started. The dikes around IJsselmonde, the southern part or Rotterdam were finished in 1580. The pattern of the polders here started from the dike rings and the distances between the ditches was wider because the subsoil contained more clay than on the north banks. The next big change to the subsoil was made when the harbours were dug in the beginning of the 20th century. The material dug out of the new harbours was used to heighten the outer dike areas (Klerk et al., 2008). This was often polluted and

mixed with building materials and coals. Also after the Second World War debris was used in the harbours to fill up old basins or heighten some grounds, but no good traceable record was found of this.

Occupation

Around 1200 Katendrecht is mentioned for the first time but only from 1393 onwards this was diked land (Palmboom, 1987). The first houses were built at Katendrecht because it was the point where traders from Dordecht had to cross the river towards Rotterdam. While Rotterdam was growing quickly, Charlois and Katendrecht grew only very modestly as agricultural villages. In 1850 the first signs of changes become visible. Shipwharfs and some factories opened at the south banks of the Meuse. In 1863 the Municipality of Rotterdam decided to develop Feijenoord and to build harbours that could host larger ships. With the train connection to Rotterdam the development speeded up enormously. The first inhabitants of this area were harbour workers, fitted in between the harbour infrastructure. That Katendrecht was sacrificed for the Rijn- and Maashaven by 1908 was not considered a very big problem because the village was poor and full of rumouring labourers. The growth of the harbour attracted many people from other regions and to host all of them Vreewijk was one of the first garden/towns planned for the working class in the south (van de Laar et al., 2004), designed by J.M. Granpré Molière and Verhagen. The new neighbourhood of Katendrecht was built directly after the Maashaven was finished. For the further expansion of Rotterdam South, Witteveen drew a plan in 1920. This plan envisioned Rotterdam South as a compact and independent city with its own facilities clustered around the current Zuidplein, that could grow from 75.000 to 300.000 inhabitants. The plan was never executed and the city grew more dispersed to be able to host more harbour activities, but the Zuidplein is still recognisable as intended centre.

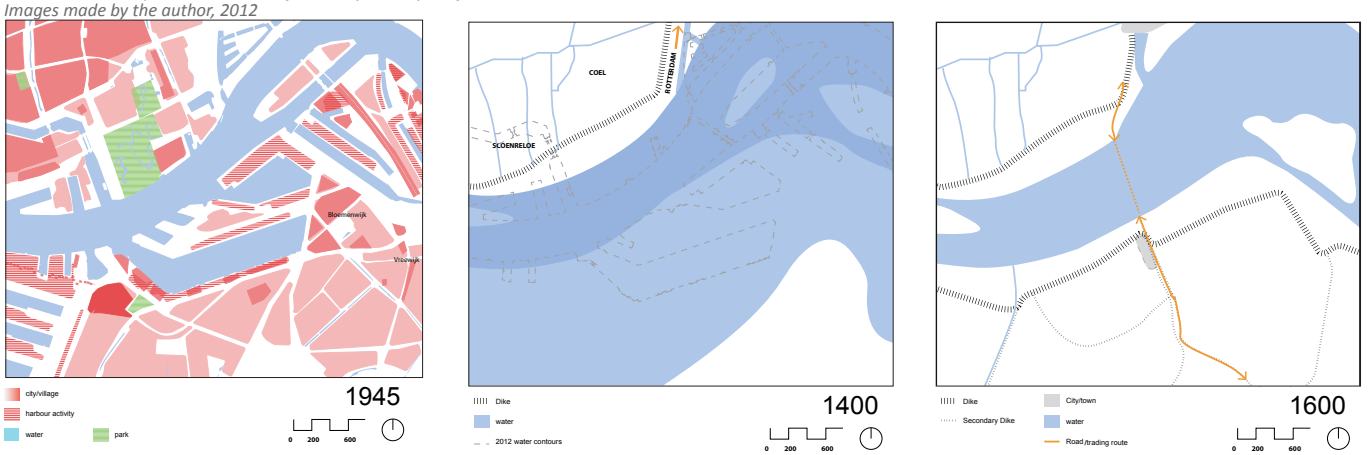
The Second World War had an indirect effect on South. Less dwellings were rebuild in the city centre and combined with the already large demand for dwelling from before the war, Rotterdam South expanded fast. Influenced by the neighbourhood-ideology every neighbourhood was separated from the others by a green area and the large Zuiderpark was constructed as central green park for Rotterdam South in 1952.

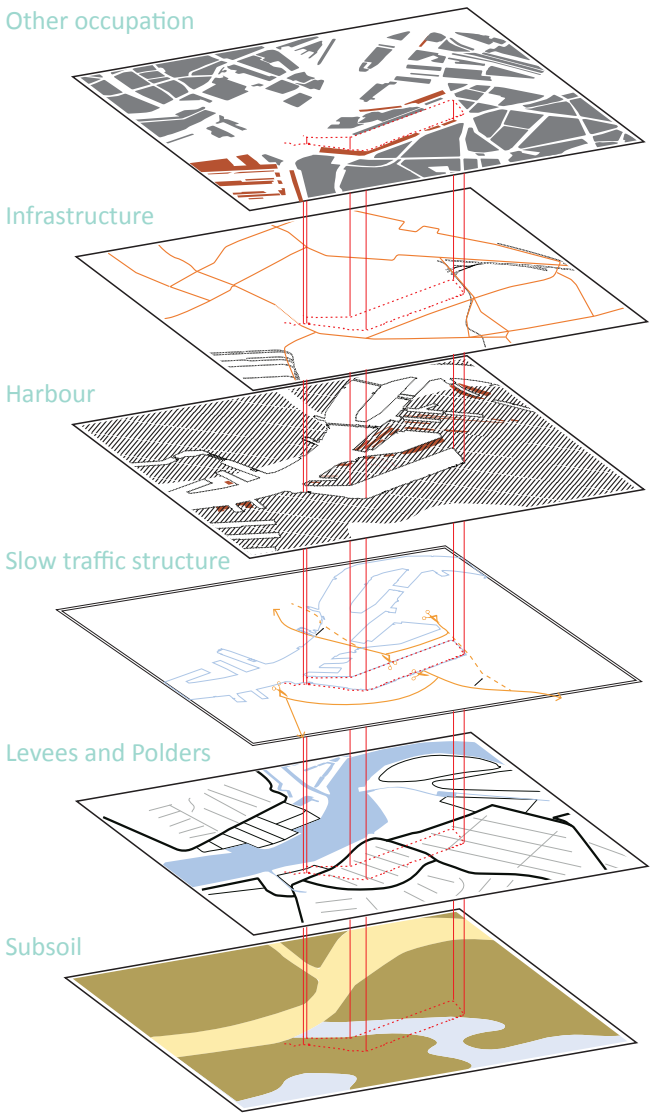
In 2012 becomes visible how the harbour activities slowly move westwards. The Kop van Zuid developments started in the 90's with a plan of Riet Bakker and Teun Kolhaas and with the Erasmusbridge the first attempt to better connect North and South was made. Slowly these developments spread westwards, following the trace of the former harbours. Together with the regeneration of pre- and post-war neighbourhoods that until now didn't had priority, this will be the biggest change in Rotterdam South for the coming decennia (Team Deetman/Mans, 2011). Studies to better connect the harbour piers with the area behind the dike and studies for new north-south connections over the Meuse are executed right now, including possible floating developments in the Rijn- and Maashaven (Gemeente Rotterdam, 2011).

Infrastructure

The development of infrastructure of dikes and polders was largely explained in § . On IJsselmonde the Dordtsestraatweg is the oldest connection to Dordrecht, already existing before the polders were made. Katendrecht was the point where this trading route crossed the river towards Rotterdam. The 1850 map shows how in the outer dike areas new small polders were reclaimed where clay was deposited on the foreland.

26. Additional periods illustrative for the layer analysis of the Maashaven area. Images made by the author, 2012





27. Sequence of how the different layer have influenced each other, with the occupation as 'infill' totally on top. Image made by the author, 2012

With the digging of the new Rijn- and Maashaven the old pattern was completely interrupted. Harbour infrastructure now dominated IJsselmonde. Whereas the old dike pattern formed the natural basis for all transport routes for centuries, the rail tracks and roads only sometimes followed the old polder structure and the primary dike was relocated. The old Dordtsestraatweg was cut off and shifted to the east. Already before the First World War there were plans for an extra bridge to connect Fijenoord and central Rotterdam to accommodate for the increasing amount of traffic but this Erasmus bridge would only be build in 1996. In the plan form Witteveen for the Rotterdam South the former Dordtsestraatwg via Zuidplein to the Maastunnel (opened in 1942) was very important (van de Laar et al., 2004). This was, together with the Brielselaan along the primary dike, the most important east-west connection to give access to the harbours. This dominated the structure of South until the ring road around Rotterdam was completed with the Van Brienenoord bridge and the Benelux tunnel, another gigantic infrastructural creation that was, once again, overpowering all other structures. Typically for Rotterdam is the separation of traffic flows and the dominating character of the roads. They cut through older patterns and divide the city into an "agglomeration of isles"(Palmboom, 1987). At the south side of the Maashaven the combination of the primary dike and the Brielselaan has become an enormous infrastructural barrier between the Tarwewijk residential area and the river. At Katendrecht and in the Tarwewijk there are still old levees, but without clear function or use.

3.2.2 Synthesis Layer analysis

Until the arrival of the harbour on the south banks of the Meuse, the areas identity was formed by the subsoil and and cultivation of it by humans. Roads and water-safety infrastructure coincided harmoniously.

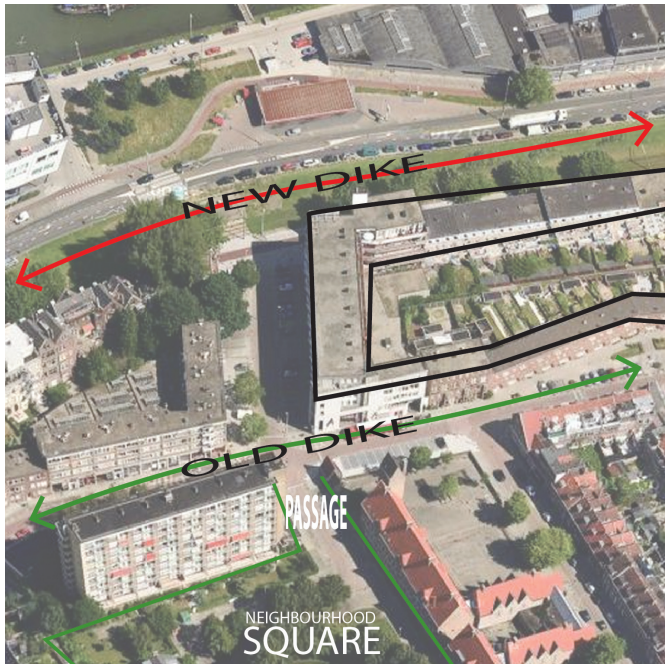
When the harbour took over around 1900 a big shift can be seen in the influences of different layers. The relatively harmonious pattern was broken. Both climate influences and subsoil were controlled by brutal force and machines. Infrastructure followed directly after and the occupation by other functions like housing only took what was left. This created an "agglomeration of isles", as Palmboom called them. Nevertheless, since the harbour is the most recognisable structuring element in this part of Rotterdam, we shouldn't try to erase these traces like the harbour in its turn broke up the typical polder structure around 1900.

Large roads and bridges with their far views are nowadays part of the identity of Rotterdam and should not be ignored or erased, although they made deep scars in the city pattern. Changes in this layer usually are occurring with quite a slow pace of about 50-100 years (Schaick and Klaasen, 2011). These large gestures also have their charm, just like the harbours. The contemporary task for governement and planners is respectively to invest in and to redesign the small scale infrastructure now. In this way we could attempt to sew Rotterdam together again by means of the slow traffic and public space network. It is time to repair and intertwine layers, bringing into peace the disconnected systems of subsoil, infrastructure and occupation again.

3.2.3 Morphological reference points today

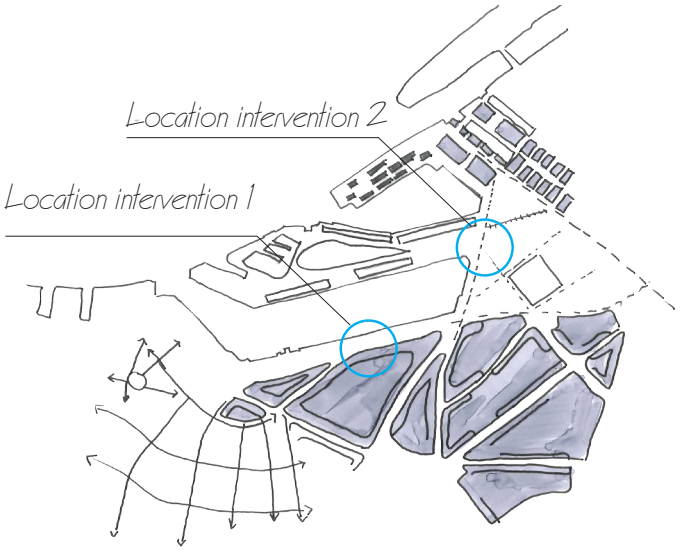
When looking more closely to the buildings and remnants of older levees, some interesting things can be remarked. Every neighbourhood has its own structure, varying from a network structure at Charlois, a collection of different types at Katendrecht to an isle structure at the Tarwewijk (Meijel et al., 2008). These isles usually have a double edge which makes the transfer between the more quiet inner area towards the main lanes. At the location of intervention 1 this is still the case. However, the main lane has become a rather hidden street behind the new flood defence and the busy Brielselaan. Another interesting thing can be learned from this location when looking at old maps. The transition onto the old dikes -that were actively used for both traffic and publicfunctions- was usually made via the typical structure of having a public neighbourhood square and a smaller passage onto the dike. Nevertheless the new monofunctional dike does not coincide with the old one anymore and the sophistication of the transition is lost.

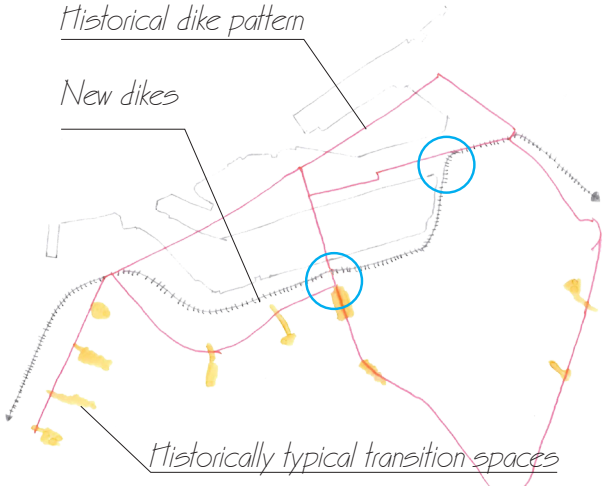
At the location of the second intervention another phenomenum can be seen. On one side of the street the transformation between the low polder and the levee is guided by the building, while at the other side a rather abrupt border has emerged now the quay in which the modern flood defence is integrated is considerably higher than the original street level. This again is an example of how unscrupulously new flood defences were forced upon the existing structure. These observations are used while designing the interventions (see chapter 5)



Location intervention 1

Location intervention 2





28. (left) Sketches showing the typical neighbourhood structure, historical dike pattern, historical transition zones and current primary dike, Images by the author, based on Meijel et al, 2008.

29. (top) Photos of the intervention locations showing typical morphological observations, images via google.com, adjusted by the author, 2013

public space

ecology

business and industry

(floating) dwellings

30. Four spatial claims, images adjusted by the author, original image sources consecutive: landezine.com, POSAD Spatial Strategies, Photo by the author, ecoboat.com

3.3 Current spatial claims and ambitions

Today, after most harbour activities have moved out, there are several spatial claims projected on the Maashaven and its quays:

1. Large scale floating dwelling and some other real estate developments at Katendrecht by the municipality and private investors (Gemeente Rotterdam, 2011);
2. Businesses, Industry and inland shipping by current users;
3. Ecological improvement by the municipality, Rijkswaterstaat and institutions like the WNF (L.Koetsier, 2012);
4. Public use and leisure as ambition by the author.

There are two other spatial claims that are especially important for the Brielselaan and surroundings. Here a possible change is traffic pressure and a change of flood defence height (see Appendix B) and location might alter the profile of this area completely.

3.3.1 Spatial claim 1: Floating neighbourhood in the Maashaven

The municipality of Rotterdam sees floating dwelling as a way to densify the city in the future and to offer unique living milieus in order to attract more prosperous people to settle in Rotterdam (dS+V and OBR, 2007). The first single floating building was located at the Rijnhaven, hosting an information centre and conference space. At the moment the first small experiment with multiple dwellings is started at the Nassauhaven, where about 14 dwellings are projected. The Maashaven is one of the locations considered suitable for large scale dwelling if the time is ready. In preparation for this the municipality is already directing for the outplacement of the current 106 mooring places for inland ships in 2025 (Meinster and Persie, 2012).

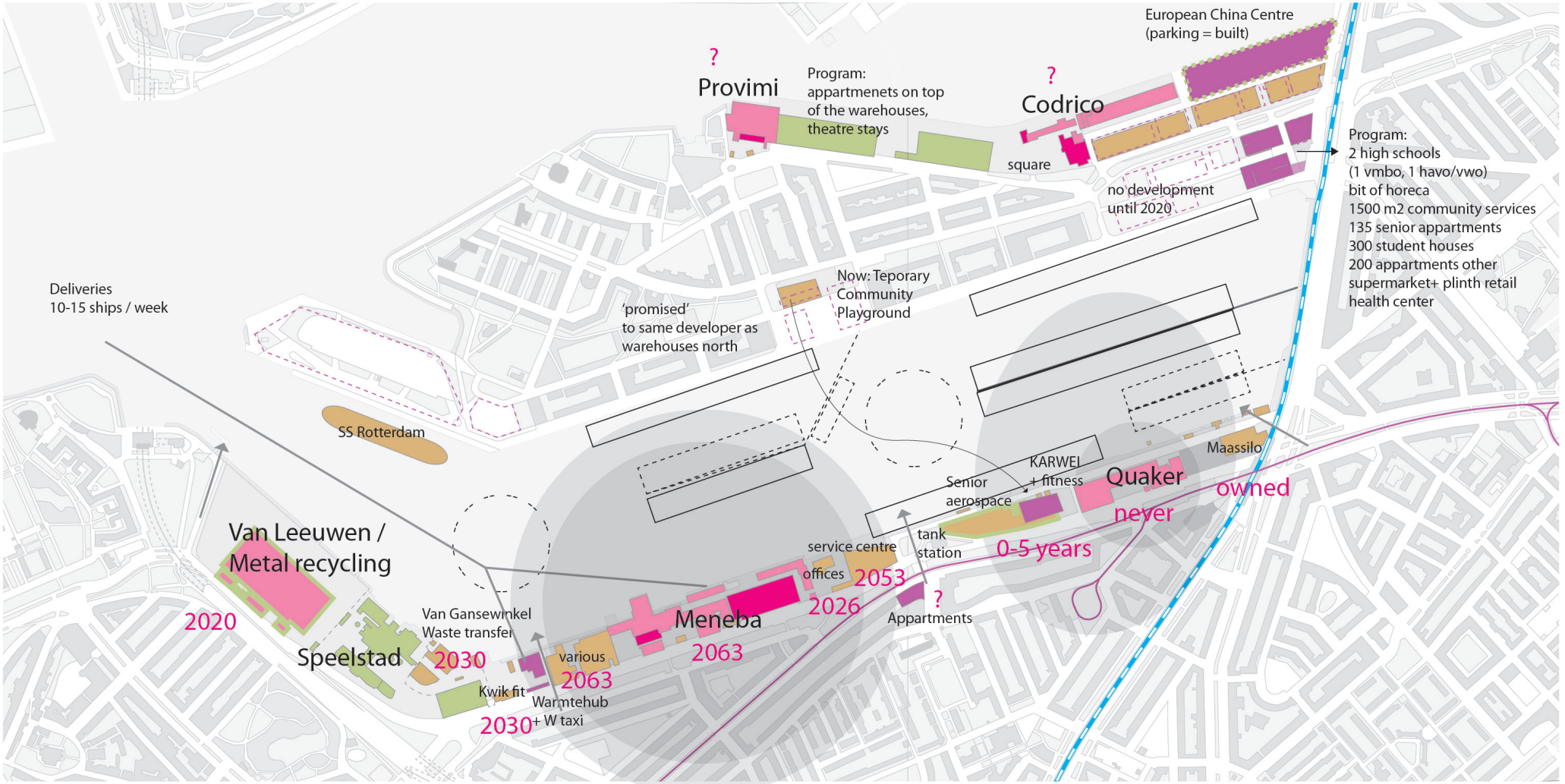
However, this whish is in tense relation with the openness of the water as a quality and identity giving element for the city as a whole (Verheijen, 2008). By analysing the role of public space in amphibious neighbourhoods by means of a literature review (See Appendix A) , it was concluded that floating neighbourhoods as employed in current practice tend to privatise the water surface. Therefore large scale dwelling of the current Dutch fashion in the Maashaven is rejected. Designing other types of amphibious neighbourhoods more suitable for the use of water as public space is considered to be beyond the scope of this thesis.

Other real estate developments

At Katendrecht many developments have taken place in the last decennium. Due to the economical crisis the (re) development has come to a hold. There are still many locations available for development, as is shown in figure 31.

3.3.2 Spatial Claim 2: Businesses, Industry and inland shipping

The Maashaven is one of the last harbours in the inner city with a function for inland shipping. This is very much appreciated by the current inhabitants because of the dynamic character. On the other hand the presence of inland shipping forms a drawback for other possible functions and some ecological improvements of the site. Whether this waiting location for about 106 ships is maintained in its current form and whether the deliveries to companies at the Brielselaan continue via shipping,



31. Image showing the site specific conditions such as the future available building grounds, existing building plans and expiry dates of leasehold contracts, mooring sites of the inland ships, existing companies with their nuisance, still active shipping routes towards companies at the Brielselaan and required turning circles for the ships. Made by the author, 2012

- transformation
- new (initiated)
- current active, nuisance
- current active, no nuissance
- buildable, not initiated, long term
- inland shipping currently in use
- inland shipping optional (108 in total)
- turning radius inland ships
- current access to quays
- 2020 — year leasehold contract ends
- noise radius
- smell radius

33. The intertidal transition zones between sweet and salt water are located in and around the urban area of Rotterdam.Image from (Geest et al., 2012)

32. Range of measures on differens scale levels which can be used to create a richer ecological system. Images from Koetsier, 2012

is very determining for the future of the Maashaven. There are plans by the municipality to out place the waiting ships in two steps towards 2025 to make room for a floating neighbourhood. Nevertheless the harbour authorities have a strong saying in this process and recently all kinds of facilities for these ships are installed. For more information about the inland ships in the Maashaven, see also Appendix C.

Along the Brielselaan there are still many businesses located, of which some cause smell and noise nuisance. The (re)development of former industrial plots is possible when land lease contracts end. This can happen parallel to or -more likely- after developments at Katendrecht. One of the current projects along the Brielselaan is Speelstad Rotterdam, which is expected to have a big influence on the area in terms of branding and the establishment of other related functions, but also on traffic nuisance. Other developments in this strip largely depend on (demography) and the economic situation.

3.3.3 Spatial claim 3: Ecological value of the Maashaven

The Maashaven as stepping stone

Since the last decennium there is more attention for the ecological recovery of the New Meuse and the New Waterway. This is caused by pressure from amongst others organisations like the WNF but also the new water regulations like the KRW (Kader Richtlijn Water) which all surface water has to meet in 2015 to provide enough clean and safe surface water.

In the last century many infrastructural works have been carried out in this area to facilitate the growing and changing harbour. This has led to a decrease in ecological value of the traditionally rich waters (Rijkswaterstaat Dienst Zuid-Holland, 2008). This area is important because of its intertidal character and gradually changing sweet-brackish-salt transition (fig. 33). Migratory fish are often used as a metaphor to measure how well the ecological system functions. In former days this estuarine system was very important for fishes like salmon, sea trout, smelt and stickleback. Main cause for the lack of migratory fishes is the ongoing deepening of the waterways and harbour basins, and the hardening of quays and shores (Koetsier, 2012). If the targeted fish species return in larger amounts to these rather urbanised waters, it is a sign that the whole ecosystem recovers. The creation of so called 'stepping stones' along the river can help to provide migratory fish a safe and peaceful place to rest and eat on their journey up- or downstream.

The municipality of Rotterdam argues for the creation of these stepping stones in the urban area of Rotterdam and tries connect other than only ecological benefits to these stepping stones via Eco-Dynamic Design (EDO). This implies the damping of waves, stabilisation of shores, cleaner water, recreational value and raising property value via greenification and a more attractive living environment (Geest et al., 2012).

At the moment the Maashaven is about 8 metres deep and most of its quays are straight and hard which minimises the intertidal surface. Shallowing inner harbours is considered one of the most important measures to create stepping stones now the harbour activities move out (Koetsier, 2012). Considering the current use of the Maashaven this would mean the

harbour could be shallowed up to at least 4 different depths: 4,65m for loaded inland ships, 2,65m for empty inland ships (Koetsier, 2012), 1,5 m for water busses and 0,7m for water taxi's. Re-designing the zoning of the Maashaven could offer even more possibilities. This shallowing does not only provide ecological value, but saves about 7,5 euro per m3 transport costs for the soil dug out for example from the main channel that would otherwise have to be transported elsewhere.

Besides this shallowing other measures on different scales shown in figure 32 are known to improve the ecological value.

3.3.4 Spatial claim 4: Public use and Leisure for whom?

One of the objectives of this thesis was to use the public space at and around the Maashaven to unite the disassociated neighbourhoods around it. To be able to attract all user groups in the area to the Maashaven it is necessary to know what these groups desire in terms of attractive program and public space, as was stated in the literature study on good public space.

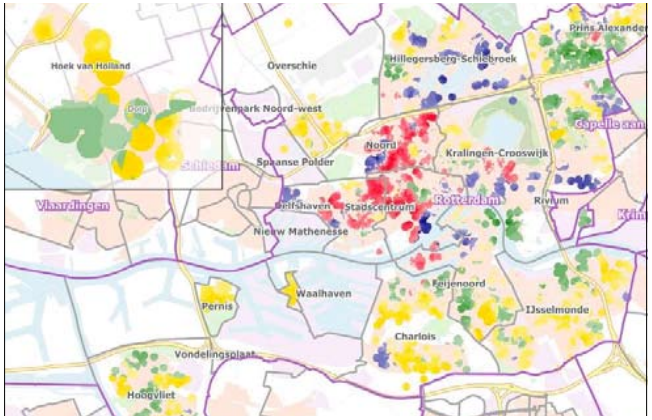
When defining user groups with the same characteristics a certain generalisation always occurs. Lately the 'lifestyle' method of Smart Agent is often used to describe potential user groups and in most publications about public space and leisure activities, this method is used. There are basically three user groups for the Maashaven area.

1. Current residents Kop van Zuid and Katendrecht

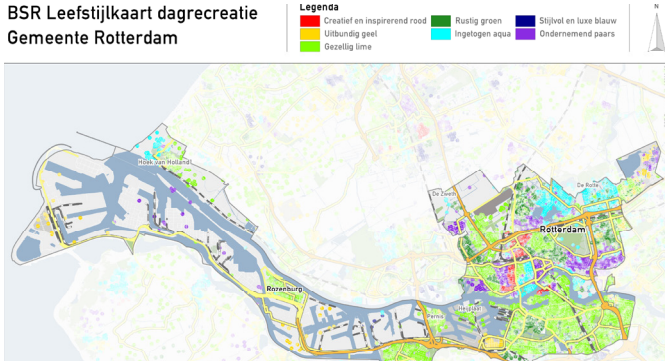
In this area mainly higher educated young urban professionals and young families live, characterised by a 'blue' and 'red' lifestyle (according to the typologies from Smart Agent) (dS+V, 2009) or 'cosy lime', 'dynamic purple' and 'creative inspiring red' (van der Wilt, 2012). The blue preferences are mainly sporting and walking and the park typology of 'Het Park' is very popular among this group. The red desires are globally the same as the desires described in the category 'desired residents' below. The dynamic purple people are relatively rich, like going to museums, theatres, restaurants and cinemas. The creative inspiring red group likes going out, sitting at terraces in summer, going to festivals and organised attractions, walking and doing sports. The 'cosy lime' group is the largest group in Rotterdam and likes shopping and going to the cinema the most.

2. Desired residents

Firstly, these are people that are currently moving away from the southern neighbourhoods as soon as they start earning enough to go somewhere better (Dudok et al., 2009). Often this has to do with people who manage to finish (higher) education and start to work. There is a group of students that live here cheap during their study and move away directly after. This group of desired residents live usually alone or in young couples and have specific questions for public space close to their house, which preferably gives them the opportunity to start something for themselves at home or close by in an atelier like setting. Their lifestyle is individualistic and they prefer a highly urban environment where in the public space they can meet people, relax on a bench, picknick, play different sports, go to bars, restaurants, festivals. For these people the public space close by should be able to function as their backyard (dS+V, 2009) and they are looking for more busy, new and thrilling recreational activities and are sensitive for trends and 'places to be'.



34. 'Lifestyle map' of Rotterdam. Source: dS+V, 2009, Groenonderzoek 2008



35. 'Lifestyle map' specifically for dayrecreation Rotterdam. Source: Van der Wilt, 2012, Centre for Research and Statistics (COS)

A second desired group are the city-families ('stadsgezinnen'). This is only about 12% of the total amount of families but a growing group that is attracted by projects as ***stadstuinen*** and ***landtong*** at the Kop van Zuid (Jager, 2012). Their wishes in short are: good or special education (Dudok et al., 2009), safe places to play for children (own garden or semi-collective inner courts) , easy access to sports , horeca, culture and exotic shopping, safe public space for older kids.

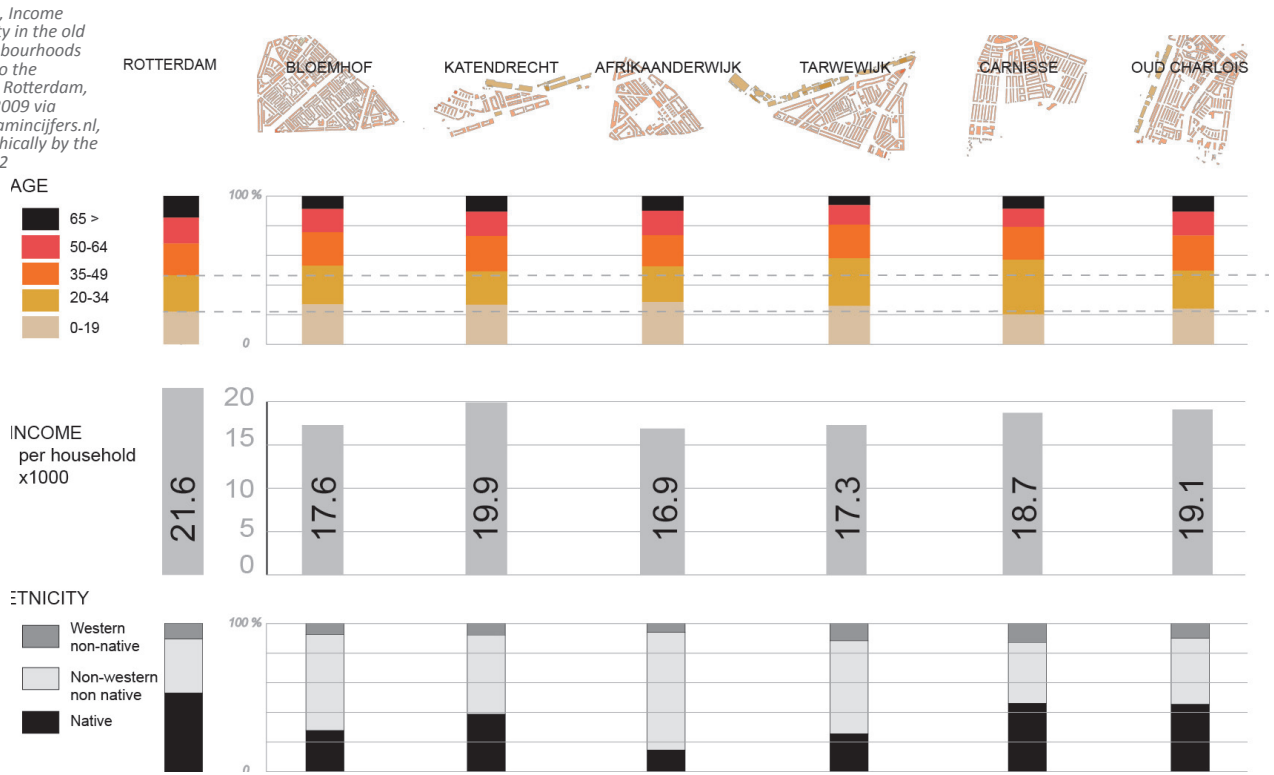
Both these groups can be considered as part of the higher and middle class, which strongly prefer lively environments that have a strong identity, either historically or culturally (Boelhouwers et al., 2011).

3. Current residents older neighbourhoods

In these neighbourhoods the 'green' group (dS+V, 2009, de Vries and Dujardin, 2012) and 'cosy lime' is most present. The green group is quite introvert and uses parks mostly for walking and enjoying nature. The 'cosy lime' group is the largest group in Rotterdam and likes shopping and going to the cinema the most. These two types give less of an idea what kind of functions they possibly desire in the Maashaven.

Compared to Rotterdam as a whole, a very large part of the Inhabitants of the old neighbourhoods at the South side of the Maashaven is non-native, as figure 36 shows, and the amount of young people is remarkably high (Dudok et al., 2009 and fig 36). It is very difficult to find concrete indications on leisure activities and desires concerning the public space, but while reading about it the following becomes apparent:

36. Age, Income and Ethnicity in the old south neighbourhoods compared to the average for Rotterdam, data from 2009 via ww.rotterdamincijfers.nl, edited graphically by the author, 2012



Migrants seem to visit recreational landscapes such as beaches and parks at distance (outside the city) significantly less than autochtones. On the contrary they go for a walk, go shopping or go for a coffee or dinner somewhere close by more often compared to autochtones. This difference is thought to be caused by the higher practical and financial threshold for migrants to leave the city (Jocovi, 2000).

Young migrants in the old neighbourhoods have relatively less leisure time to spend compared to native young people in Rotterdam and they spend less time on cultural activities. Some exceptions on this are their relatively higher participation in dancing and singing classes and their higher amount of visits to local cultural centres. Other activities that attract relatively many young migrants are markets, festivals and live-performances (Vries and Dujardin, 2012). This correlates with the recommendations of a survey about leisure activities for Turkish and Moroccan young people in Rotterdam (Keune et al., 2002) which advises to provide help via organisations like the successful TOS (Thuis Op Straat, 'At home on the street') to organise small festivals and neighbourhood activities. Another useful recommendation is that there should be activities provided which make people feel responsible for the public space. The role of social organisations and schools is very important for participation of migrant people in public activities (Spierings et al., 2009) because membership of private sport or cultural organisations is far less than among western people.

When looking at the differences in park visits, research from the municipality shows that migrants and young people visit parks more often and that they stay longer in one park. Western people use parks relatively often to walk their dogs and appreciate cafés and restaurants close by, and non-western people use parks more to sport or to let their children play and appreciate organised activities more (Dun and Vries, 2010). Young migrants at Rotterdam South especially miss chill-out sports and sports facilities, and migrant women are often dependant on neighbourhood parks for their social contacts where they can gather in small groups while they watch their children play (Bolt and van Kempen, 2002).

Some general notions that become visible while reading about leisure and demands concerning public space are the fact that migrant people are less attracted by promenading 'to see and to be seen' than autochtone people and that the second and third generation starts to resemble the autochthon population more and more in terms of leisure activities and demands in public space.

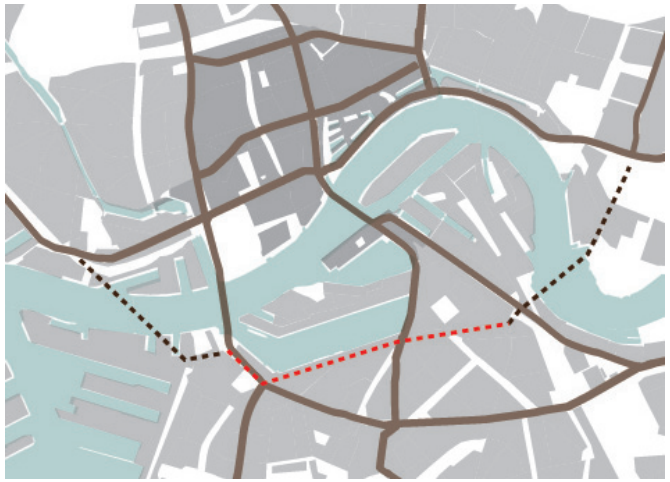
3.3.5 Spatial claims on the Brielselaan

Traffic

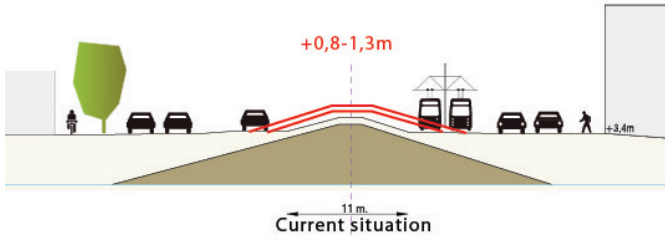
There are already several plans for new city bridges to connect the north and south of Rotterdam better. Two locations which are often nominated are the link between the Sluisjeskade and the Vierhavens and the connection between the Putselaan and Kralingen. If one of these two or even both of them are realised in the future the pressure on the Brielselaan will increase because it will become part of a more regional route network.

Flood defence height and location

The effects of climate change on this area are explained in appendix B. In short, the necessary heightening of the flood defence up to 2100 will be 0,8 m up to 1,3 m. Besides, the outer dike area becomes more and more vulnerable for flooding, requiring adaptation on the long term. The location of the flood defence depends on the possibility to maintain the current buildings safe, the ease with which they can be relocated, the financial situation of the municipality and the objectives of the design. In this research there is a strong preference to maintain a large outer dike area for the cites dynamics and relation with the river (see also strategic intervention 1).



37. Possible locations for third or fourth city bridge. Image by the author



38. Impact of the required increase of dikeheight. Image based on a drwaing by The Urbanisten, 2010, adjusted by the author, 2012.

3.3.6 Conclusions spatial claims

A large scale floating neighbourhood is considered inappropriate for the Maashaven because it privatises the water and decreases the contrast between built and unbuilt in Rotterdam.

Industry and inland shipping will have to be incorporated in the redevelopment plan for the Maashaven for the coming decades and the redevelopment plan should strive to combine this with creating a recreational landscape in which ecological recovery is taken into account. It does not only bring ecological benefits, but also improves the living environment and can have recreational opportunities. This could be done by means of shallowing the harbour and other small scale additional measures.

The user group of residents that should be attracted to this area has largely an overlapping set of desires with the existing residents at Katendrecht and the Kop van Zuid. The existing residents of the older neighbourhoods have some specifically different needs. This becomes mainly visible in the relatively young population and the fact that after school or community organisations are crucial for participation in (outdoor) activities, the different attitude towards 'seeing and being seen' and the role of women and small children.

Special attention should be paid to the plural barrier of the Brielselaan which is under thread of traffic intensification and water safety measures that can increase the barrier working.

3.4 Theory on good public space

As theoretical basis to answer sub-research question one, three elements are important. First of all: what is public space and what makes it successful? Secondly, one of the objectives of the thesis is to use the Maashaven as binding element. How can public spaces become binding elements in the city? Thirdly but maybe most important, are there any specific design criteria for public space in harbour areas?

39. Brancoplein (above) as good functioning neighbourhood public space and Schouwburgplein (below) as well functioning city scale public space. Images via maps. google.com

3.4.1 Definition and function of public space

The main functions of a public space network are described by Carmona et al. (2010, p.83): *'As well as providing access to and displaying the 'public face' of private property, the public space facilitates and accommodates the overlapping realms of 'movement space' and 'social space'.* Social space is where interaction between residents takes place, where they trade, share thoughts or relax in presence of others. The modern movement has often been accused of tearing apart movement space and social space. Since the end of the 19th and beginning of the 20th century a new large scale 'traffic machine' as Palmboom (1987) calls it, has made an enormous growth possible for Rotterdam and embedded the city excellently in the national and European network. Nevertheless, the consequence is a ripped apart slow traffic network and a disconnection of social and movement space. Gehl, who has investigated the public space in the city centre of Rotterdam (Gehl, 2007) concludes that a better intertwined and prioritised slow traffic network could drastically enhance the quality of the public space network.

In addition to its function, public space is often characterised by its accessibility: *'Public space relates to all those arts of the built and natural environment where the public have free access. [……] It includes the interfaces with key internal and private spaces to which the public normally has free access'* (Carmona et al., 2010, p. 137). Accessibility includes -besides the physical aspect- also visual accessibility and symbolic accessibility (Carmona et al., 2010). Visual access means being able to examine a space before entering it. Symbolic accessibility has to do with feeling welcome somewhere; for example chique shops might exclude poor people. When physical accessibility is not optimal, the other two types of accessibility can help to improve the situation enormously. One positive point in this respect is that waterfronts are often seen as neutral area where everyone feels welcome, as Breen and Rigby (1994) observe in their comparison of 75 waterfronts.

3.4.2 Contrast and transition between public and private space

Public space exists because of its contrast with private space. This does not mean it is a black and white relationship. The private property is often separated from the public sphere via several small and sophisticated steps, creating an in between area that functions as a buffer (Meyer et al., 2009). Looking at the complete public space network, there also is stratification recognisable among public spaces. Local neighbourhood squares like the newly renovated Brancoplein in the Old West part of Rotterdam are less anonymous and used by less diverse user groups than city squares like the Schouwburgplein. Nevertheless they are both successful on their own scale (fig.39).

This diversification in public spaces adds to the success of a city district (Gadet, 2011). Gadet observes the popularity of neighbourhoods that have small and peaceful squares where children can play and where larger public spaces and streets that are part of the city network just around the corner. These seem to be especially popular amongst young families and starters, the user groups that should be attracted to this area, explained in § 3.3.4 For Rotterdam this is a critical point since Rotterdam has a lot of public space per inhabitant, but is criticized by Gehl for the over dimensioning and the lack of differentiation. The *'pitfall of contemporary architecture and planning'* has led him to use the reverse

thinking method in his design for the harbour area of Aalborg: *'Every developer wants life and a high density of people, which often results in an even greater density. But the contemporary architectural answer to greater density is frequently bigger volumes and larger spaces, resulting in lack of human scale environment and this, inevitably, in lack of people and life. Nothing happens because nothing happens because nothing happens….'* (Gehl in Kiib, 2012, p.123).

Also to embed a space in peoples 'mental map', scale is very important. Soledad Garcia Ferrari et al. (2012) evaluate the success of waterfront developments on different scale levels too. They use the terms macro (national, international), meso (regional, city) and micro (neighbourhood to building) scale place making. Successful waterfront spaces are well embedded on all levels and they are able to adapt to changes on all scales. To achieve this it is very important to know how user groups relate to the space, thus to know their interests and demands according to the waterfront area that is transformed.

3.4.3 What makes public space successful?

An urban designer cannot design the success of a place, they can only create 'place potential' as Carmona calls it (Carmona et al., 2010, p.107). In a more concrete sense this means that you facilitate and stimulate the happening of a diverse activities in the outdoor space. Gehl (2006) described three types of activities:

- Necessary activities like going to school or work and walking a dog.
- Optional activities, like sitting in the sun, going for a small walk and eating lunch outside.
- Social activities, like meeting people, spontaneous encounters, watching others etcetera.

Gehl's theory is that necessary activities always occur and are often related with the existence of slow traffic routes. By designing a place in an attractive way optional activities are enhanced and only if both necessary activities and optional activities are present, social activities will develop.

Gehl especially values the time people spend in a specific place and evaluates spaces according to their 'liveliness'. He argues that not the amount of people passing by makes a space well used, but the fact that a space seduces people to stay a bit longer or to slow down their walking or cycling speed. This makes that less people can provide the same amount of liveliness for a space. Only when people linger and slow down, social activities can emerge from optional or necessary activities. Cities that are highly valued for their public life often have a large modal split for slow traffic as figure 40 shows. Rotterdam, in comparison has an extreme large modal split for motor vehicles.

To give designers a help in creating spaces that are well used and successful, Gehl has defined twelve concrete design tools based on the themes protection, invitation and delight, summarised in figure 41.

To evaluate or design spaces how they are embedded in their context on meso and micro level criteria as reachability, density and anchorage are important. In this thesis the analysis technique of de Josselin de Jong (de Josselin de Jong and Mispel, 2008) is used to examine this in the current situation (see also § 2.3.1. and § 5.5.1)

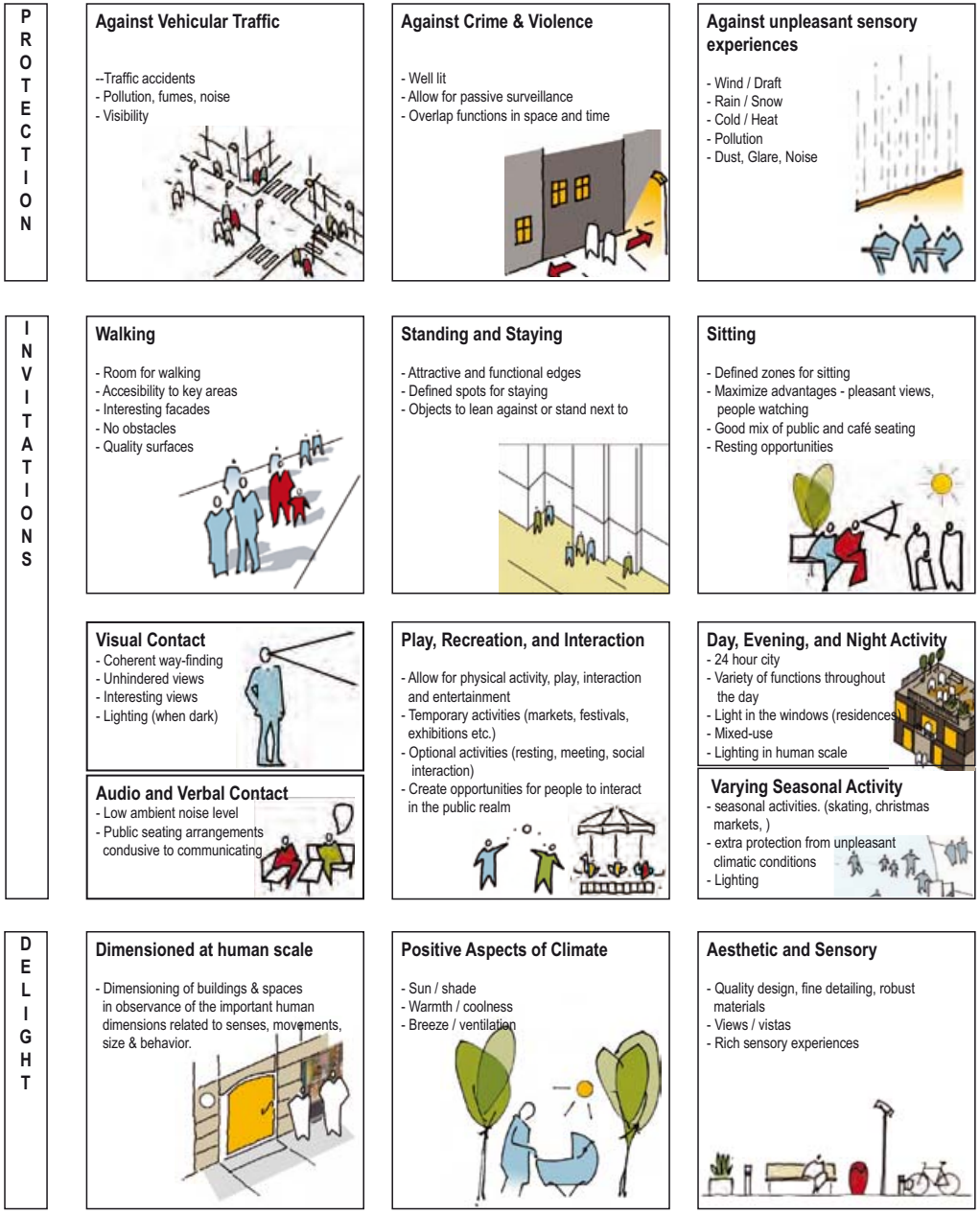
3.4.4 Specific criteria for harbour environments

The surplus of scale discussed in § 3.4.2 is inherent to waterfronts which are public spaces characterised by their one-sided openness and their linearity which invites people to move along the edge (Fisher et al., 2004). Many planners consider this linearity as dull. However this linearity is one of the core qualities as well. *'City after city has made the mistake of building confectionary embellishments at the waters edge that compete with the power and the majesty of the waterfront'* (Fisher et al., 2004, p.63). The water becomes a visual extension of the public space and benefits especially at urban inner harbours from a strong edge on the land side that frames the space (Zandbelt et al., 2005). To prevent people to get lost in space, designers should facilitate movement along the water lines but concentrate other stationary activities in a limited amount of spaces to reach a density of people that makes the space attractive for even more people in analogy of Gehl's theory.

Fisher further emphasizes that waterfronts that do not consider the shoreline as a border but feature both interesting land and water use, are the most successful. She also observes how the water often fulfils the function

City	walking	cycling	public transport	motor vehicle
Amsterdam	4%	38%	30%	28%
Rotterdam	5%	14%	25%	56%
Stockholm	15%	7%	43%	33%

40. Modal split in different cities, data from Urban Audit and Eurostat, 2009



41. Criteria for good public space from Gehl. Source: Gehl, J. 2007. Public Spaces - Public Life, Rotterdam

of ever moving landscape or stage, a quality that is not exploited when only static functions are assigned. She therefore sees it as the most important task of the designer to show these dynamics and temporal changes and to emphasize the sometimes extreme sensory experiences waterfronts bring about.

From Gehl's twelve criteria for good public space the comfort and protection criteria deserve extra attention in harbour areas because of the harsh weather. At the same time this extreme sensory experiences, as Fisher calls them, are also a quality of these areas. Ferrari and Fraser (2012) regard the differentiation of public spaces from large and open to very small, protected and semi-private as very positive in their case study of Sluseholmen, Sweden. For the spaces where people are concentrated for stationary activities opportunities to stand/stay and to sit, to play, talk and to watch others should be given extra attention.

Public space, especially in harbour areas, is considered as the very first thing that should be planned and secured since private investors can cause a lot of damage to both the physical and symbolic accessibility (Zandbelt et al., 2005 , Beyer Reigstad, 2012). Reigstadt even suggests holding back private investors completely until the public space is secured, which he illustrates with the example of Kalvebod Brygge, Copenhagen where the water is only used to greater honour and glory of company buildings (fig.42). Sight like these are not unfamiliar for Rotterdam.

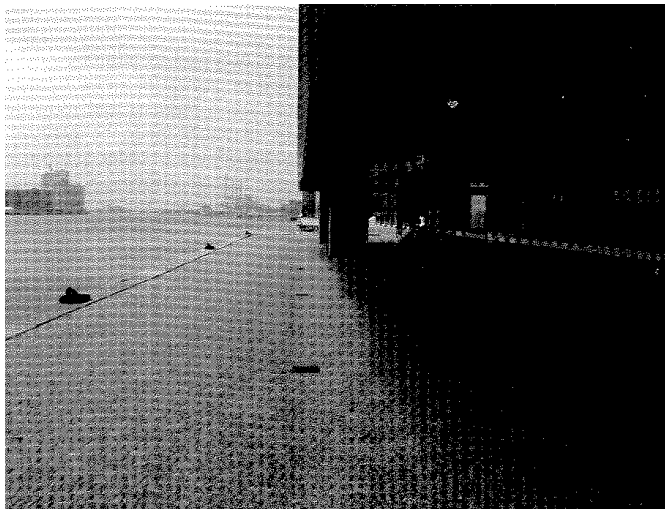
3.4.5 Public space as binding element: the social dimension.

One of the objectives of the thesis is to use the Maashaven and its quays as a binding public space to

reconnect or re-join the now segregated districts in Rotterdam South. This makes the social component of public space very important. Nevertheless social aspects in relation to social segregation are very intangible and hard to design. Some interesting ideas of experts on public space are summarised below.

The way neighbourhoods are often planned as separate entities enhances social segregation in cities (Carmona et al., 2010). The Tarwewijk could be seen as an example of such an 'entity', caused by the way workers neighbourhoods were planned in left over spaces in between infrastructure and because of its relatively heavy double edges (see § 3.2.3). When different neighbourhoods overlap (J. Jacobs in Carmona et al., 2010, p 118) or are sharing the same inter-neighbourhood space this isolation is less.

North describes in her book how transforming derelict, obsolete and former industrial sites into public space can *'stitch formerly disassociated and inaccessible districts into a continuum, often promoting a better functioning of the city as a whole, while maintaining and reinforcing the unique characteristics of each community'* (North, 2013, p. 17). She observes how *'Lands with previous uses, before at the urban edge but now or soon surrounded by density, can be repurposed as parks with the general result of gentrifying their communities'* (North, 2013, p. 104). She emphasises the power that a unique space can have to the sense of belonging of people and how different groups of people are able to connect their identity to it. To make public space really part of the social transformation issue she points out several aspects designers can make use of.



42. Quays used for the promotion of the building only, at Kalvebod Brugge, Copenhagen, Source: S. Reigstad in (Reigstad, 2012)

First of all it is important that public spaces appeals to the targeted user groups and answer to their specific needs. By involving people with both the designing, making and maintaining of a place they appropriate an area. Besides, it is of importance that public spaces are able to change or develop with the changing neighbourhoods. Good public spaces are initiating change by providing a new link or entrance and are functioning as allocation factor to attract new investors. In other periods they follow changes in their context. She calls these public spaces ´operative landscapes´. Water with floating functions is pre-eminent suitable to accommodate changes.

Last but not least she explains how the perceptibility of older layers from history and natural processes can add to the 'rootedness' of a place in the district, but also to the binding people feel with their living environment.

3.4.6 Lessons to design good public space

The criteria below are listed in three categories to show where they apply to (most) and in which part of the thesis they can be tested best. All criteria are included in the design, although some are more implicitly used than others, like no. 4 of the Design Interventions criteria.

Further Design Research

1. Explore the specific need of targeted user groups.

Vision and redevelopment plan

1. Focus on reconnecting the slow traffic network.
2. Stimulate overlap of uses and be selective in creating places to stay in order to concentrate people, but connect them well via well designed movement space.
3. Pay attention to the meaning of spaces on different scale levels and design them according to this.

Design Interventions

1. Make the dynamics and nature of the river visible.
2. Respect the characteristic linearity of the quays but program both water and land.
3. Do not only to focus on physical accessibility but also on visual accessibility. For the Brielsekades this especially applies since the flood defence stays a physical barrier that only can be made easier.
4. Design the neutral terrain of the Maashaven as an element that people from different neighbourhoods feel attached to by using historical layers and natural processes.
5. Design places to stay with the 12 quality criteria in mind.

4 Vision

Based on the backgrounds described in chapter 3, a set of starting points for the design can be formulated.

4.1 From backgrounds to vision

The historical analysis demonstrates how the outer dike areas were often the most vibrant and interesting areas of the city and therefore the flood defence should not be put at the very edge of the river. The current position of the flood defence, especially along the Brielselaan, is'nt optimal either. The aim should be to maintain a reasonable outer dike area where river and city come together, but to free the Brielselaan of it double barrier. The functional binding to an area, like in the days the harbour provided labour, showed to be just as essential for the relation between city and river as the physical relation. A new destiny for the Maashaven should attract people to the area on a regular basis as an alternative to the lost labour intense industry.

A layer analysis on district scale exposes how the diverse layers became imbalanced by the explosive growth of the harbour in the late 19th and 20th century. This shows especially from the distorted slow traffic network and the isolation of neighbourhoods between traffic arteries. Where current flood defences and (car) traffic arteries interfere with the original morphology, lessons can be learned how to bridge or solve these discrepancies.

One of the major criteria for the success of public space is the amount of interaction as theories on public space show. This interaction can only emerge with enough visitors and a low movement speed. Rotterdam has a very well developed fast traffic network but a very low modal split for slow traffic, compared to cities known for their successful public space network. The distorted slow traffic network should therefore be sewed together again. Theoretical research furthermore showed that the reconnection between the disassociated neighbourhoods via the harbour should be established not only physically, but also visually and psychologically in order to extend the New South Urban milieu southward and to slow down the selective migration. Due to the scale of the area and the need to facilitate interaction between people, the Maashaven should furthermore not be considered as one large public space but as an element that connects several smaller public spaces, concentrating visitors on strategic locations that embed the Maashaven better in both the city and local network. These public spaces should be connected by good quality movement space and facilitate the needs of the diverse user groups. Majesty, grandeur and openness is inherent to- and part of the quality of harbours, but sometimes proved to be a pitfall for the public space of Rotterdam before.

The inventory of current spatial claims showed that ecological recovery, heritage and inland shipping as a still active harbour characteristic, the dynamics of the river and also industry can become a vital part of this new identity. The possible future spatial claim of a floating neighbourhood, projected by the Municipality, is renounced. Literature study showed that contemporary floating neighbourhoods privatise the water. Furthermore they are a low density (and therefore unsustainable) infill of in the future precious open space.

4.2 Vision

Considering the information above, the Maashaven can play a more significant role for both the city and the surrounding neighbourhoods when:

1. it is better embedded in the traffic networks on two scales by means of:
    - A better integration in the slow traffic and public space network on the neighbourhood and district scale. The connection of the two historically traceable but still important routes is essential to spread the successful centre milieu further southward.
    - A better visibility in the regional network. The locations do already exist along the centre ring, but the (public) spaces and program which can be found all along the rest of the inner city ring, are still lacking here.
2. a strong identity is created to stitch the surrounding districts together by means of:
    - Transforming the Maashaven into a unique recreational landscape which program and public spaces attract all desired user groups.
    - Providing every neighbourhood again with an adress at the waterfront.

In this way neighbourhoods can exploit the new common identity of the 'Waterscape' besides only **being stigmatised by their current reputation**

5 The design experiment

Sub- RQ 5: How could the theoretical principles derived from sub research questions one to four be translated in a strategic plan and two interventions for the Maashaven and how does this design experiment help to answer sub-research question one to four?

5.1 Outline of chapter 5

This chapter answers sub-research question five by translating theoretical principles derived from chapter 3 and 4 into a design. At first, the design experiment (the redevelopment plan and the two interventions) will be described briefly.

Secondly, the other four sub-research questions will be discussed in relation to the design. These paragraphs show design related analysis and details about the design that help to answer sub-research questions one to four. In these explicative paragraphs is also shown how the lessons of chapter 3, theoretical backgrounds, are taken into account in the design. Every paragraph deals with one sub-research question and concludes with answering the question.

Chapter 6 contains the conclusion of the whole thesis. Here the main research question will be answered and both specific and generic lessons are summarised here.

43. Impression of one possible outcome of the redevelopment plan, made by the author, 2013

5.2 Redevelopment plan

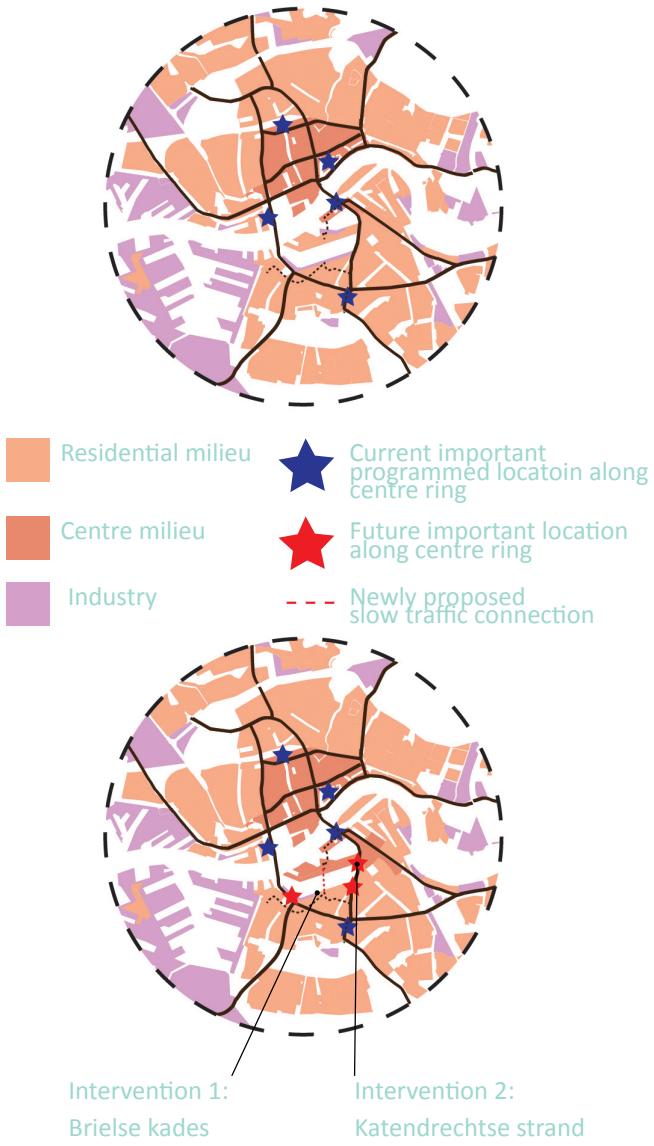
The new role of the Maashaven in Rotterdam South

5.2.1 Objectives in the urban context

Since the establishment of the Erasmus bridge, Rijnhaven bridge and the regeneration of neighbourhoods at Feijenoord and Katendrech, the spreading of the so called centre-milieu (dS+V and OBR, 2007) has come to a hold at Katendrecht. The Maashaven forms the edge between successful and more deprived Rotterdam South. By proposing another bridge and a unique and attractive program, the spreading of this centre milieu southward gets a new impulse, making the maashaven a binding instead of a separating element in the city.

Furthermore, the Maashaven touches at the inner centre ring but does not have any program that makes the area noticeable at this ring, although the visual triggers are already there in the form of majestic industrial buildings. The redevelopment plan tries to embed the Maashaven better in the whole city by creating important locations along this city ring.

Last but not least the redevelopment plan shows how the Maashaven can get an new purpose as recreational landscape in which ecological recovery and industry are integrated, instead of ending up as empty water basins as many other already regenerated harbour areas in Rotterdam.



44. Position of the project locations in the city network. Top: existing situation in which the location is not part of the Centre milieu. Below: desired situation with an extended central milieu in southern direction and a reconnected slow traffic network. Images by the author, 2012

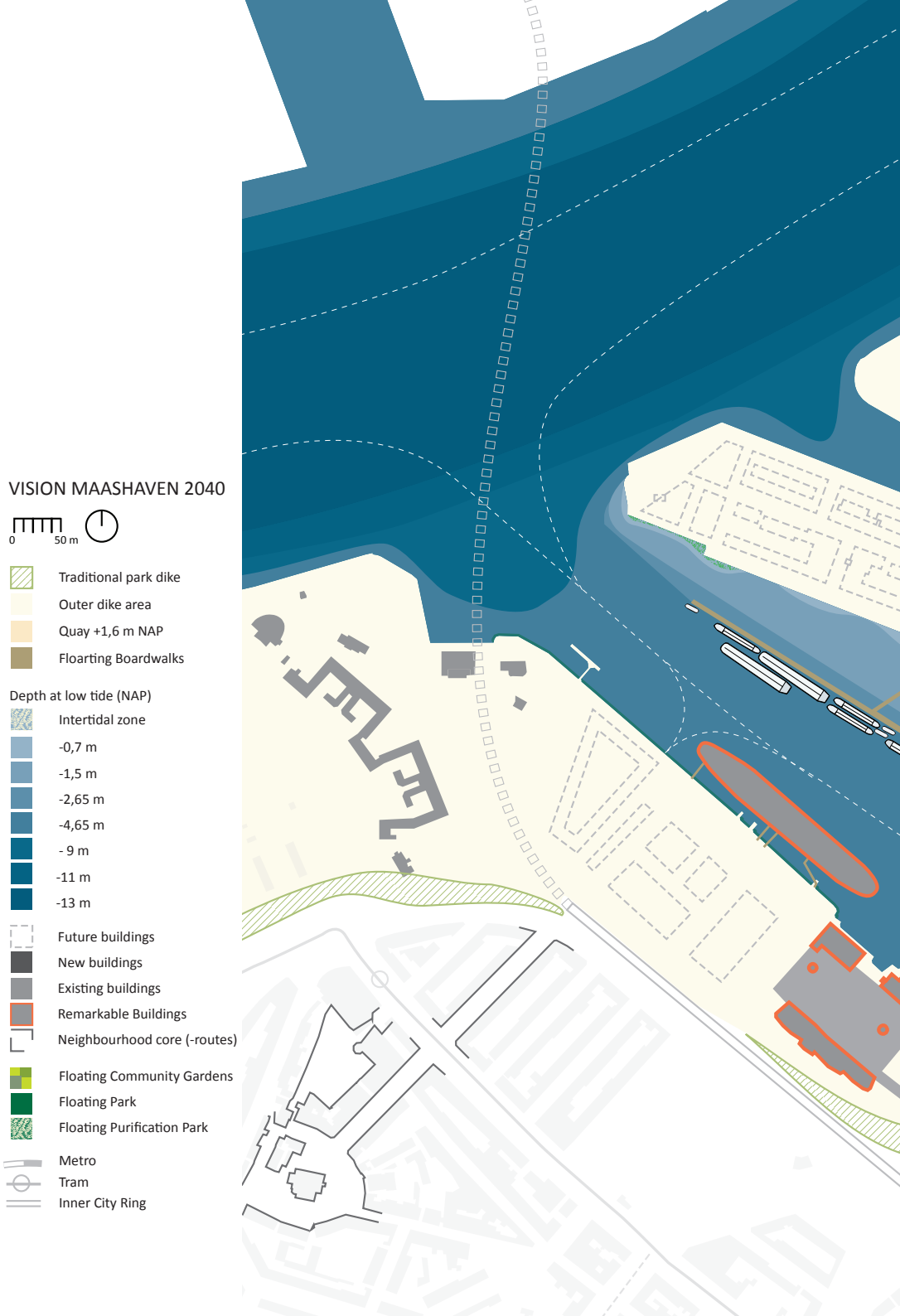
45. Current situation, Image by the author, 2013

5.2.2 The Maashaven as modern city park

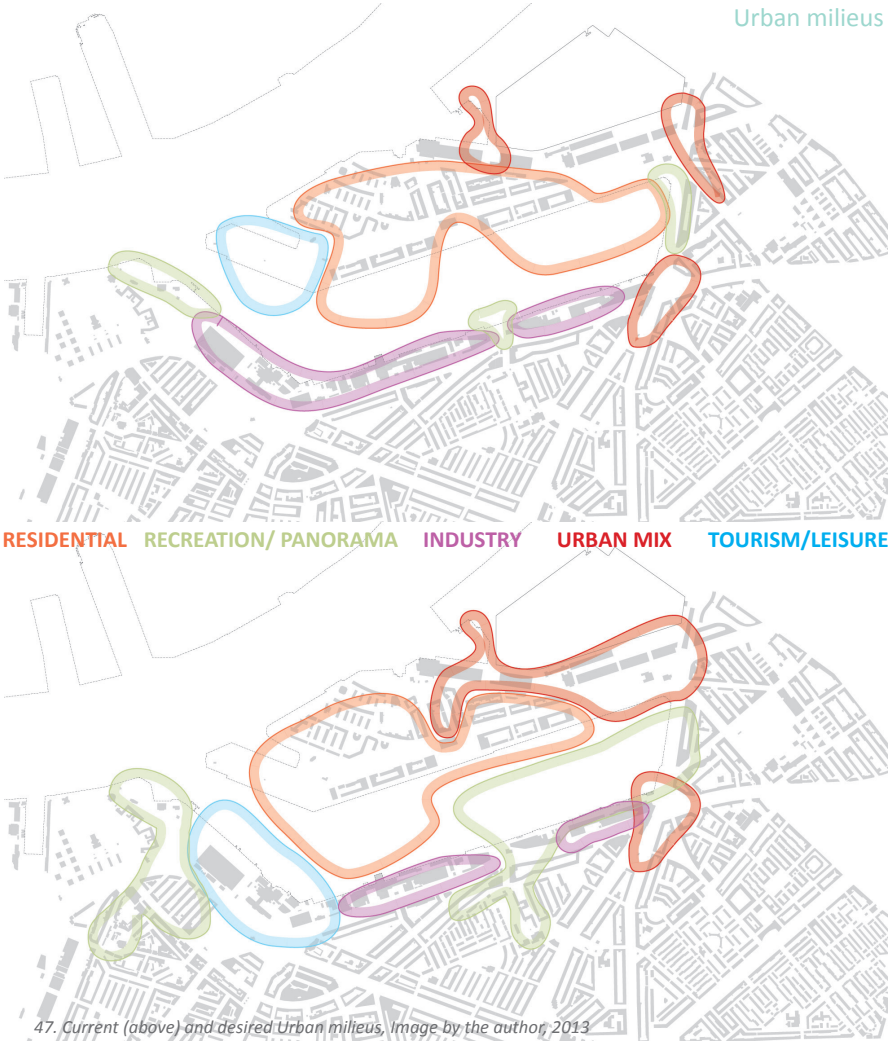
Departing from the now 8 to 9 metre deep basin, the Maashaven is shallowed in steps to make ecological recovery possible in its characteristic straight demarcation. Hereby a diverse recreational landscape emerges in which the inland shipping community can maintain its most central waiting location.

Where inland ships leave, the Maashaven is used for boating and recreative functions that attract both neighbours and people from the rest of the city. In this way the Maashaven earns a place in peoples daily life again. Floating community gardens and helophyte filters, permanent isles and some more natural floating isles form a varied park which is interesting for both people and animals.

A new slow traffic bridge provides the essential physical connection between Katendrecht and the Tarwewijk and is high enough for most ships. This is also a place to stay and have a wide view 'from inside out'. From this point you can see diverse new public spaces at the edge of every neighbourhood where people can get to, in- and onto the water, giving every neighbourhood it's own address at the river. They are interconnected by simple quays. At the background you see alternately housing, active- and regenerated industrial buildings. Every other time you come back, you discover something new has been built, slowly filling in the whole urban decor of this blue-green oasis.
There are two new water-busstops at Speelstad and at the Maassilo. Also the connections to the metro stations and tramline are improved so people from all over Rotterdam can easily visit the area by public transport.
The map on the right shows how the Maashaven could look in 2040. Other variants are discussed in § 5.8.7 to show the adaptability of the redevelopment plan.



46. Redevelopment plan map, Image by the author, 2013

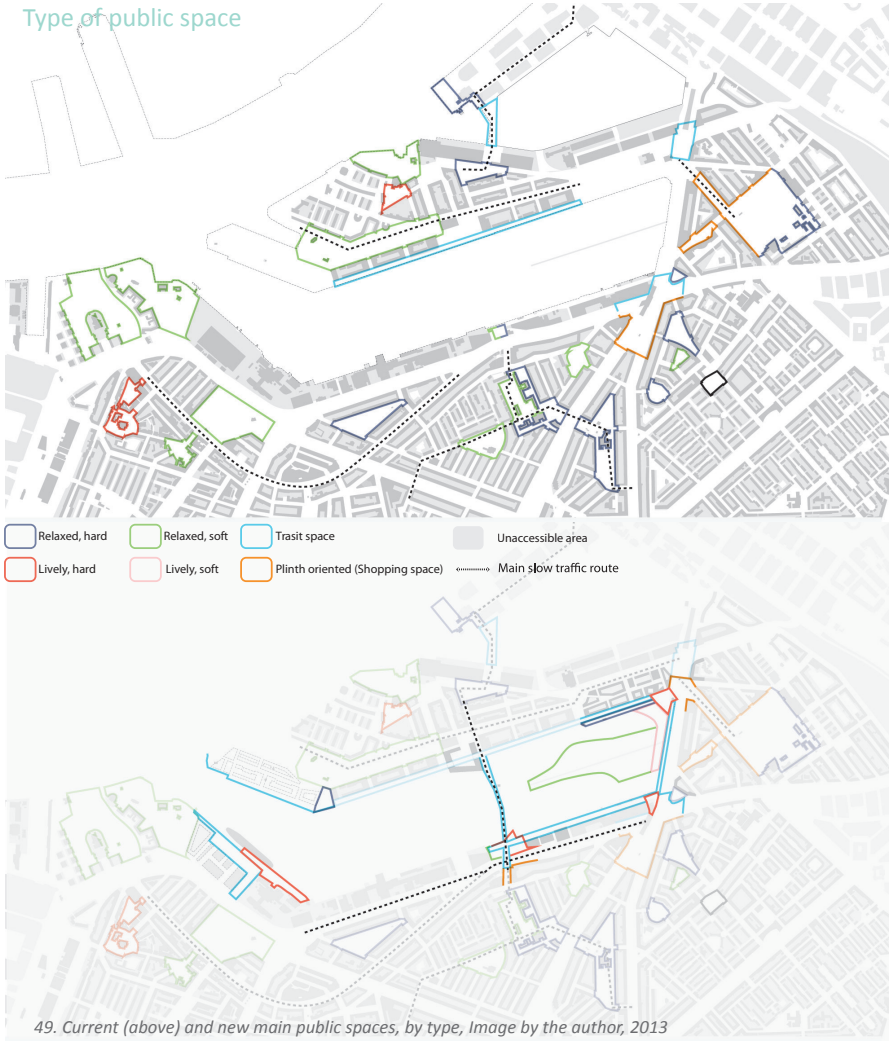


47. Current (above) and desired Urban milieus, Image by the author, 2013

48. Current (above) and new activities, Image by the author, 2013

Clear structures become visible from image 49 and 50 of where clusters of program and activities are located. Along the Maashaven Eastside there are some supra local activities but generally both program and activities are concentrated in the neighbourhoods and not so much at the Maashaven, and different urban milieus are rather separated.

The new activities and supporting program are proposed to pull the existing urban milieus over the Maashaven and to attract the three different user groups analysed in § 3.3.4 to this area. The inland shipping community is considered as part of the residential milieu here. With the relocation of the SS-Rotterdam next to Speelstad and the Pirate Wharf at the south west, a better reachable regional cluster theme park(s) and hotels is created, freeing the remote point of Katendrecht. Activities at the Katendrechtse Pols (like sunbathing, horeca, water sports etc.) are still more oriented on the existing user groups at Katendrecht and the activities at the south side are more focussed at the existing residents in the older neighbourhoods (like walking, gardening, playing, meeting friends and football). Nevertheless, by making all activities visible and reachable for different groups, the Maashaven becomes an area that unites both sides instead of separating them. Emphasizing the historical



49. Current (above) and new main public spaces, by type, Image by the author, 2013

50. Current (above) and new program, Image by the author, 2013

and natural layers in the harbourscape will provide a shared identity and common ground for the diverse activities.

While focussing on local use in the middle part of the maashaven, at the corners there is the opportunity to locate functions and spaces that embed the maashaven better in the city as a whole and that are well reachable by public transport and car.

Because the change of tides, river nature and the runoff water treatment are made visible, many educational possibilities all around the Maashaven arise. Some special activities like wreck diving and canoeing exploit the changed nature of the Maashaven to the maximum.

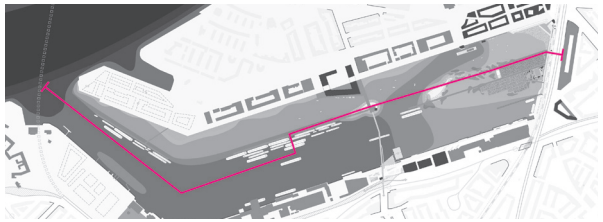
Although there are only a few completely new public spaces, they are all interconnected by transit space of a more basic quality that already can be found at the quays of Katendrecht.

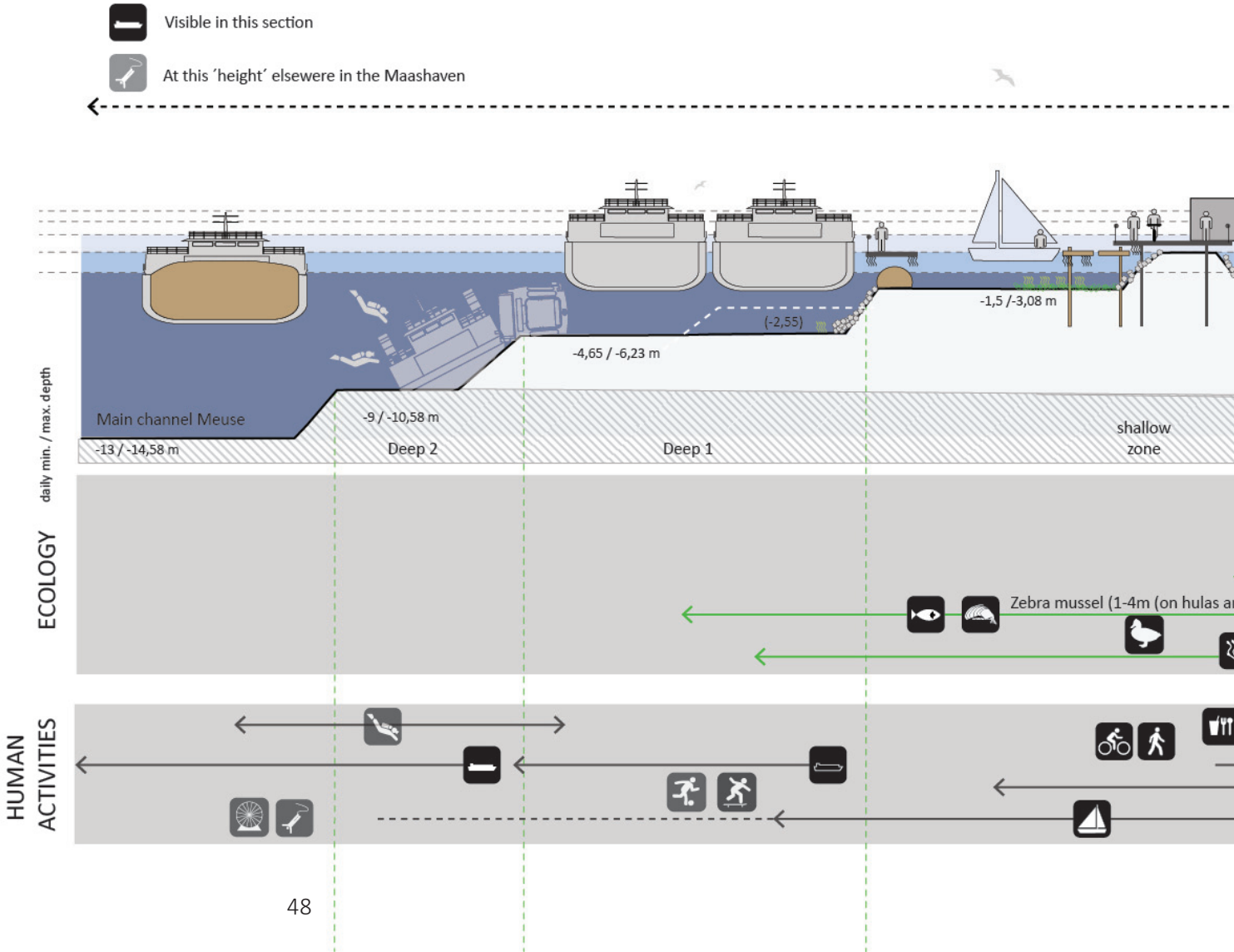
A floating neighbourhood was rejected but diverse floating functions for temporary stay are projected in the maashaven, like a greenhouse, a swimming pool, a Cruyf-court and some bungalows. A big advantage is that most of these functions are already available and only have to be transported here.

5.2.3 How the harbour welcomes nature and recreation

As is shown in the (schematic) section on the right there are several depths created in the harbour, depending on the kind of ships that needs to go through. Few loaded inland ships for Meneba for example need 4,65m while water taxi's need only 0,7m. Because of the shallowing, sunlight reaches the bottom better and the whirling water calms down. This makes that dust and dirt settles faster and makes it possible for water plants to grow, which calms the water even more and provides an attractive environment for fishes. By providing different surfaces, more diversity is reached. Old wrecks or stoney grounds are interesting for zebra mussels that filter the water from dust and small fishes like to hide here. Also mooring poles or floating isles fitted out with nylon hulas provide good living environments for shellfish, who attract all kind of birds on their turn. Although intertidal zones and also rough quays have a very harsh climate they host some unique plants and animals, as well as the floating helophyte filters (see also § 5.7.3). These filters and the wadi system at the new built neighbourhood clean the urban runoff water such that it doesn't harm the recovering ecosystem. This filthy surface water is now discharged at the remote part of the harbour seen from the relatively clean main flow of the Meuse, where the waterhub (a transferium) is planned. The cleaned water can be used for the playing pond and theoretically the water can get so clean in the future that swimming becomes an option here.

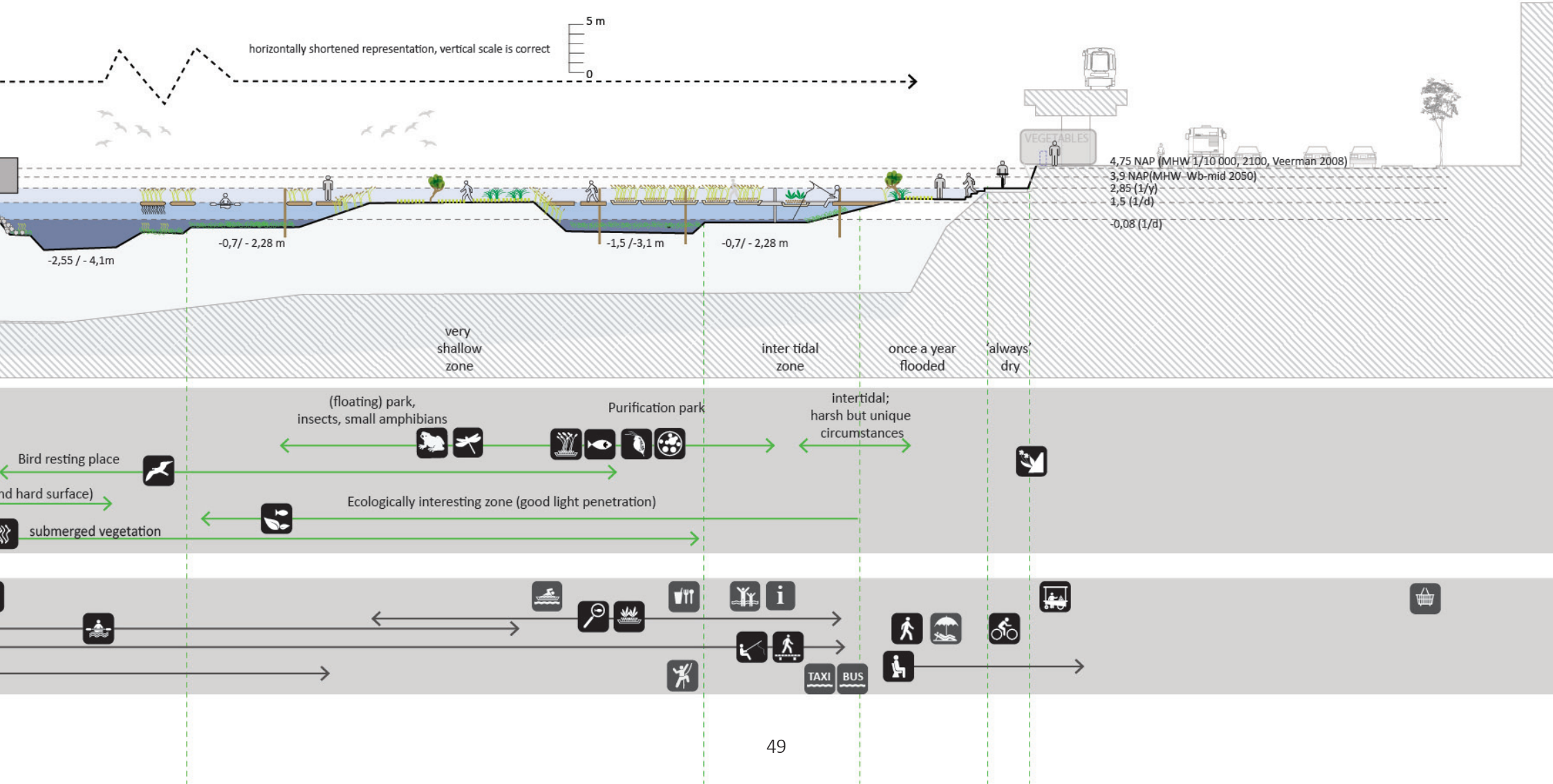
Different depths are not only interesting for animals and plants, but can accommodate different kinds of recreation. Besides the changing looks of the harbour above water and the possibilities for experiencing new nature above water, the deeper part are for example interesting for a diving school or sailing club. Many sailing boats can go all the way up to a depth of 1,5m and in the very shallow zone people can explore the floating park by canoe. The sloping banks make the tide become visible and via a walk and an augmented reality App schoolchildren and visitors can learn about the ecosystem and the urban water system (see also intervention 2).



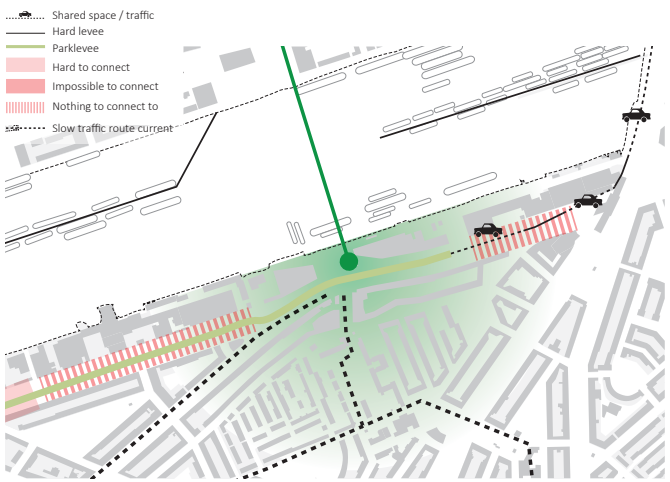


All this sounds like a very extreme intervention. Nevertheless it has a lot of benefits. Most of them are soft and indirectly paying off via the improvement of the living environment but for example by using soil that is available in the Rotterdam region about 20 million euro could be saved and invested in the essential new bridge (based on Koetsier, 2012) and although the characteristic hard quays will be preserved, the additional soil will stabilise them, saving maintenance costs.

51. Schematic section showing the new depths of the Maashaven in relation to ecological and recreational chances. Image by the author, 2013



52. All desired connections to the Maashaven on the long term. Image by the author, 2013



53. The Brielse Kades as best connection point. Image by the author, 2013

54. Anchorage of the Katendrechtse strand intervention (Reachable within three turns, defining the width of peoples mental map according to de Josselin de Jong, 2008). Image by the author, 2013

5.2.4 Why the two strategic interventions

When looking at concentrations in public life and anchorage, there are many locations that should be better connected to the Maashaven on the long term (figure 52). Nevertheless two strategic interventions are chosen to develop first because they can give a positive impulse to the area on short term.

At the Brielsekades the bridge will connect the Tarwewijk to Katendrecht, bringing the two separate districts closer together, and supplying new visitors to this place from both sides of the harbour. Earlier bridges like the Rijnhavenbridge showed the importance of this physical connection. The Brielsekades intervention becomes the visage of the Tarwewijk and is the starting point for people to discover the area. From here the Tarwewijk can get an impulse to climb on the socioeconomic ladder. The reason why the bridge connects here is twofold. On the one hand this point has historically always been the place where a very important route towards the south has been (see also chapter 3) and where still is an important slow traffic route for the Tarwewijk. On the other hand, all other locations along the south side are much harder to connect because of heavy infrastructure or a lack of 'destination' on the Maashaven side of the Brielselaan (figure 53).
The Katendrechtse Strand, intervention two, is a place that can position the maashaven quickly on the mental map of the whole city because it is very well anchored in the city network. It is at the same time one of the locations that has the potential to develop first and where the shallowing of the Maashaven becomes visible soon, looking at the scenario study (§ 5.8).

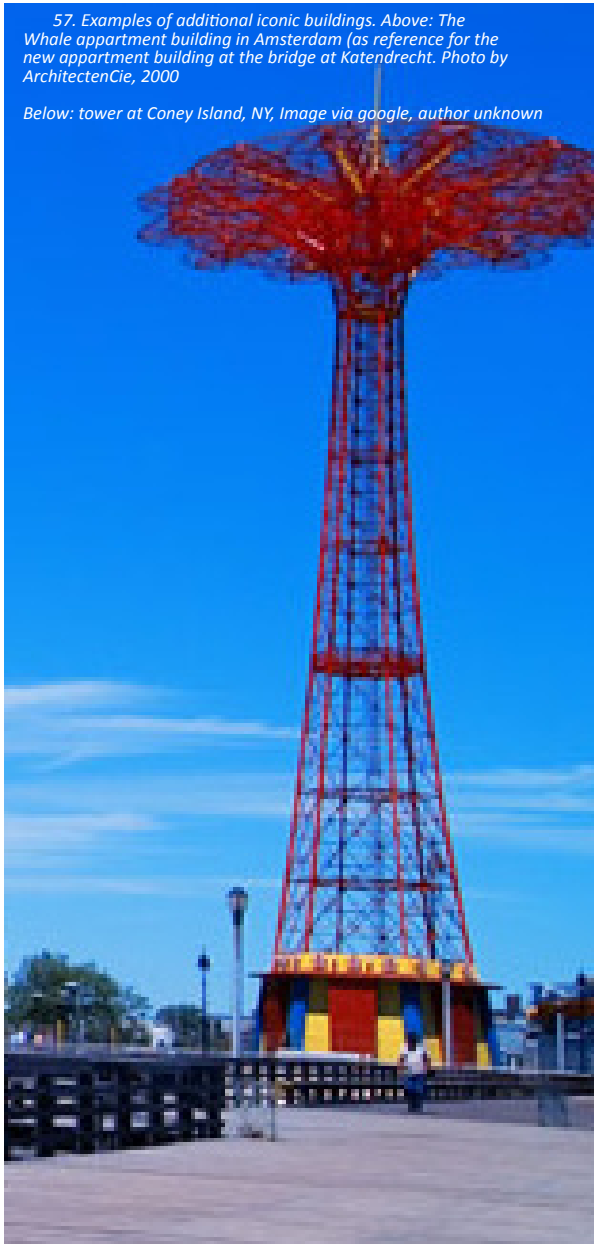
Additionally, these two locations can show how to design for very different user groups and together they cover all local variables of the scenario study.

55. Examples of floating gardens of different scales using the system of the DrijvendeTuinen organisation. Images via drijvendetuinen.nl, 2012

56. Examples of reusing industrial remains. Above: Landschaftspark Duisburg Nord, image via landezine.nl Below: using old barrels for gardening. Impressions by Erika Richmond and Peggy Pei-Chi Chi, 2012, via inhabitat.com

57. Examples of additional iconic buildings. Above: The Whale appartment building in Amsterdam (as reference for the new appartment building at the bridge at Katendrecht. Photo by ArchitectenCie, 2000

Below: tower at Coney Island, NY, Image via google, author unknown



5.3 Brielsekades

Strategic intervention 1

5.3.1 Ambitions

This design intervention investigates how four ambitions can be realised:

- The brielsekades should become a meaningful place on the neighbourhood scale where Katendrecht and the Tarwewijk get connected via a bridge in order to bring both urban milieus closer to each other physically.
- Secondly the Tarwewijk should get a new adress at the Maashaven here. The design investigates how to deal with the plural barrier of the Brielselaan to better connect to the Maashaven, both physically and psychologically.
- Thirdly , this intervention should make residents aware of the dynamics and nature of the river again and should take into account how the influence of sea level rise affects the redesign of outer dike areas and the flood defence in urban areas.
- Finally, the Brielselaan should become a pleasant lane again in the far future. Although this is a long term ambition, the intervention should be designed such that this becomes both favourable and possible.

58. Impression of the new public space at the Brielsekades, made by the author, 2013

"Daddy, is this the sea?"

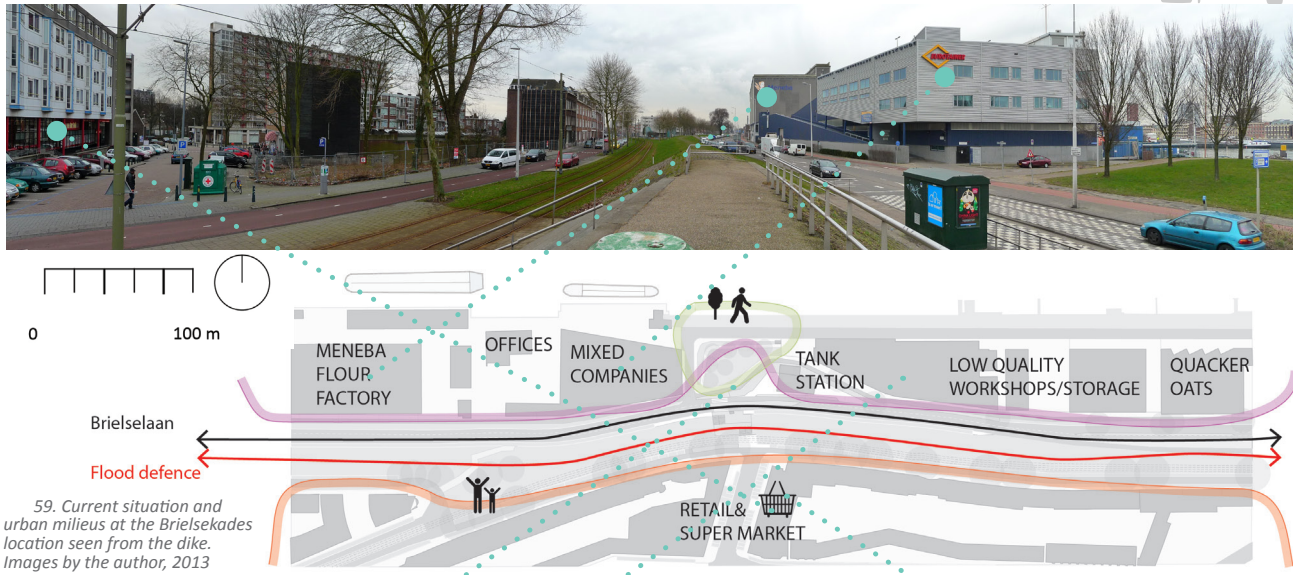
"First of all, please put something on the dike! You can´t even cycle there now..... From there on you'll see the water naturally"

"This workshop brings me at the quay for the first time in my 32 year stay in Charlois...."

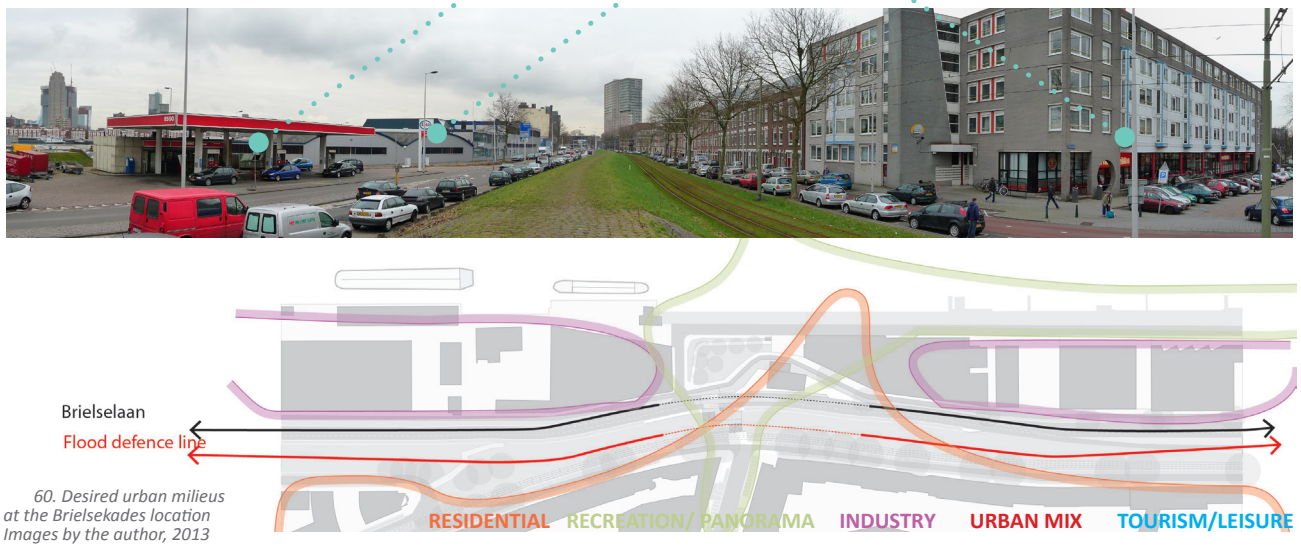
5.3.2 Urban context and position in the redevelopment plan

This project location is of importance to better embed the Maashaven in the city on the neighbourhood scale as is shown in § 5.2.1 and therefore mainly has to do with neighbourhood users and local traffic.

At the moment the Brielselaan and the industrially used strip in between the Brielselaan and the Maashaven disconnects the Tarwewijk from the water side, which is in birds flight only one hundred metres away, but psychologically far more as shows from the pictures on the right and the reactions below of residents at the workshop meeting 'Flour, yeast and water' at Meneba, one of the large factories.

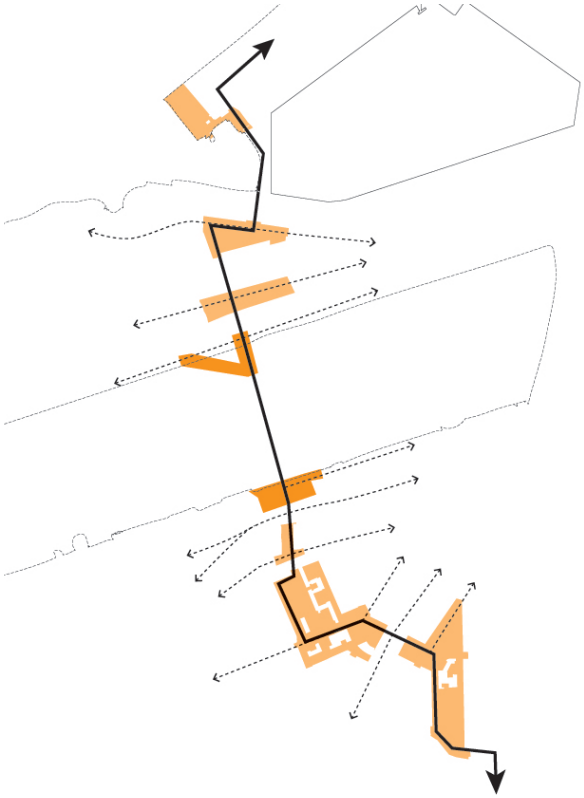


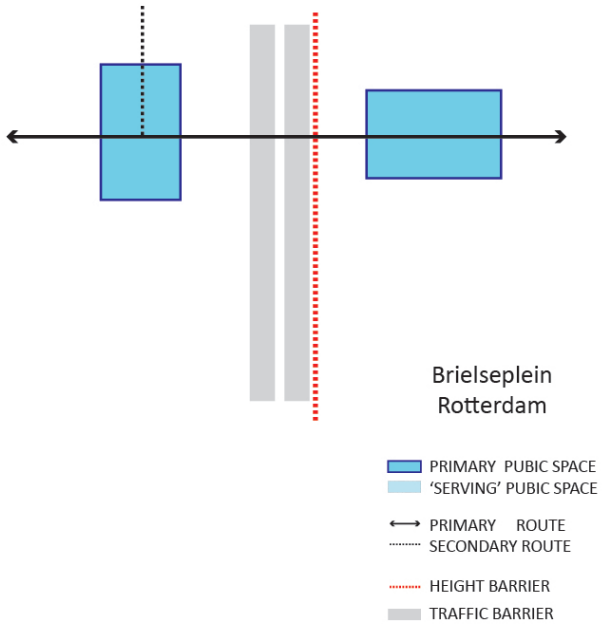
59. Current situation and urban milieus at the Brielsekades location seen from the dike. Images by the author, 2013



60. Desired urban milieus at the Brielsekades location Images by the author, 2013

61. (above) Reactions of residents of Charlois and the Tarwewijk at the Workshop 'Mee, Gist en Water' organised by Vitibucks Architects on 19/03/2013 about the future of the Maashaven Quays. Images by the author, 2013





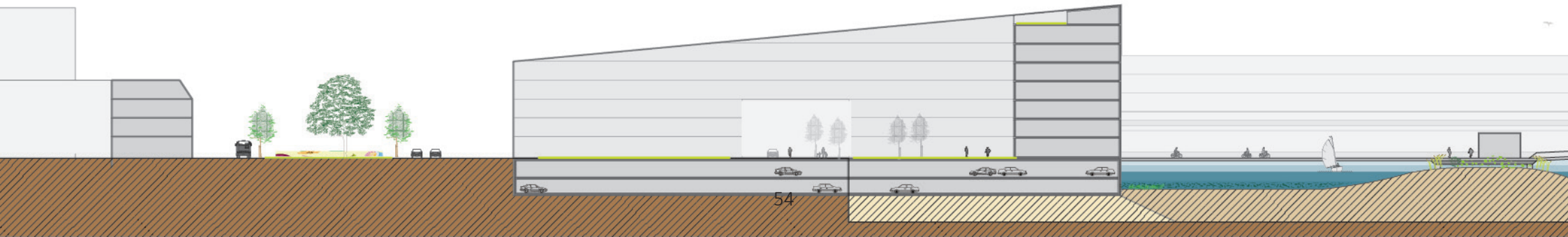
62. Conclusions of the comparative study about hierarchy of spaces and routes at locations with multiple barriers(see paragraph 3.2.3). Images by the author, 2013

63. Section over the Maashaven from the new apartment block at Katendrecht to the Brielsekades intervention. View towards the Maashaven Oostzijde. Image by the author, 2013

By doing a comparative analysis (§ 5.5.2) on public spaces that are designed on or close by plural barriers (height, traffic), it was discovered that the new public space at the Brielsekades is best treated as an independent public space and should not be united with the existing shopping area at the edge of the Tarwewijk. Hence bridging the barriers with a new public space itself isn't necessary as long as the route continues as smooth as possible. The route to connect The Kop van Zuid with the Tarwewijk thus gets priority. Along this route several locally important public spaces with local facilities form the point where people leave the route towards their homes or vice versa. The route becomes a bundle of local slow traffic. The new square at the Maashaven becomes both a destination in itself where people from the Tarwewijk should be attracted to and a place where people leave the main route to continue along the quays or over the flood defence. By well designing this place people cycling or walking over the main route will be tempted to stay or return on another day.

5.3.3 The Bridge as essential link

The bridge is of utmost importance because it is the only direct physical connection between Katendrecht and the Tarwewijk and rejoins two pieces of slow traffic network already stemming from the 16th century. Constructing a bridge instead of only using less accessible solutions like water busses going once an hour at night or a ferry boat should make the threshold for users as low as



possible. The bridge itself is not designed in detail, but the section below shows the main principles in relation to the complete profile of the redesigned Maashaven. Its free height at low tide is 7,6 m (7,3 in 2050, Wb21-mid, see also figure 67) which is high enough for the waterbusses. At high tide the free height is 6m (5,8m in 2050) which is high enough for most recreational ships, water taxi's and some smaller water busses. Although the 'Rijnvaarthoogte' (common height Rhine bridges) is 9,1m, many of the currently present inland ships are by far not that high, which would make the bridge fit in when inland ships are still present. Predictions show moreover that the percentage of smaller inland ships (with less depth and a height above water of about 4,2 m) become more numerous in the future because of the effects of climate change upstream (de Vries, 2006). For bigger ships an movable part is provided which makes sure that the possible future waterhub at the Maassilo is not obstructed.

Both neighbourhoods get an new address at the Maashaven. At the faster developing Katendrecht side this could be in the form of build up program containing mainly apartments, partially moved into the harbour as a landmark and welcoming gesture. At the slower developing side of the Tarwewijk this is a park-like square with supportive facilities targeted at the residents of the Tarwewijk.

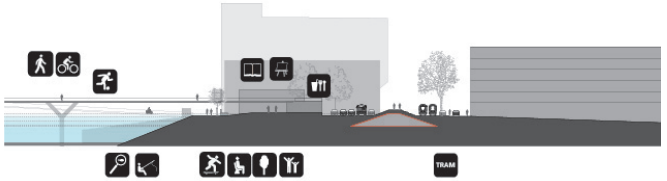
5.3.4 The design is not the final result

The design could be phase two of five (more extensively described in § 5.8.9). It contains the most important robust elements in order to realise the objectives and can be executed relatively in dependant of local variables.

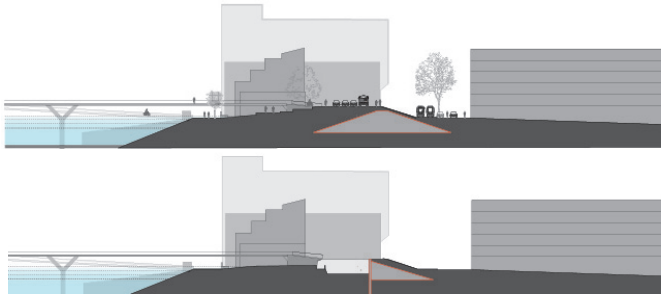
- **Phase 1:** The first phase consists of temporary use in order to make people familiar with the place and to bridge the first period in which the harbour will be shallowed and the necessary preparations are made. A new cycle path on the dike, an improved crossing, a skate park in empty storehouses and a work of art which is visible from far away at the outer side of the dike are part of it.
- **Phase 2:** The design, see next pages.
- **Phase 3:** The next very important step after the here shown intervention is the connection on height towards the Tarwewijk, completing the full route in a smooth way. This last step is only possible after approximately 2026 because of leasehold contracts of the surrounding plots. The intervention is planned as soon as possible because it will function as an initiator for change in the area. Both in the first and second phase considerable improvements are made in respect to the crossability of the barriers, safeguarding the ambition to improve the connection between the Tarwewijk and the Maashaven.

The phases are shown schematically on the right.

T = 0-5, Phase 1

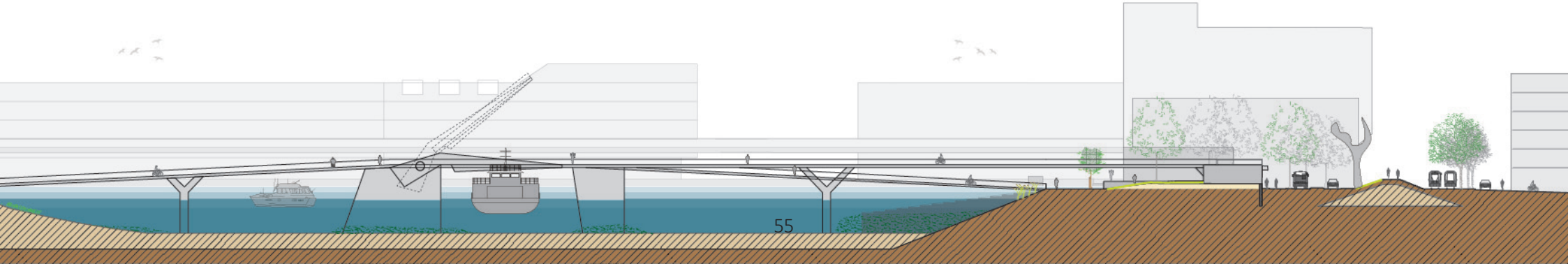


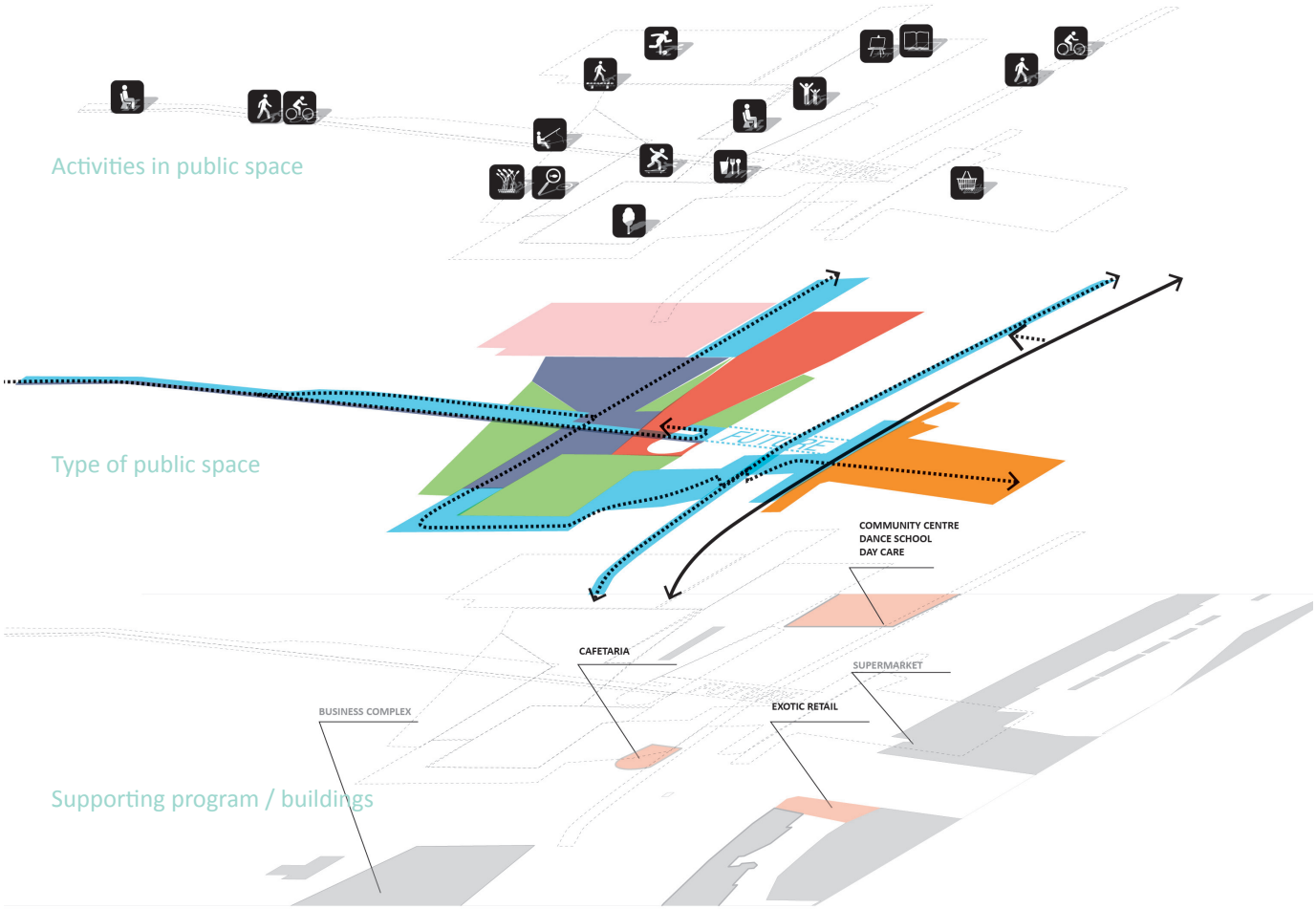
T = 5-10, Phase 2 (see also next pages)



T > 2026 , Phase 3, (Two options, depending on the state of the new flood defence)

64. Schematic sections showing phase 1 to 3. For more phases and extensive explanation, see § 5.8.9) Images by the author, 2013





Relaxed, hard
Relaxed, soft
Trasit space
Lively, hard
Lively, soft
Plinth oriented (Shopping space)
Existing route (slow traffic)
New route (slow traffic)

INITIATED/ EXISTING PROGRAM ELSEWERE

NEW PROGRAM

65. How the design is build: activities, most suitable type of public space and program/buildings which support the desired use. Made by the author, 2013

66. (Right) Overview map of the Brielsekades in phase 2. Made by the author, 2013

5.3.5 Design: Activities, Spaces, Program and buildings

In the current situation the public space is very poor and there are no attractive functions for residents of the Tarwewijk but a few benches placed on a small mound, also called 'the balcony'. The panorama potential of this place seems to be reckoned but very much under exploited.

To create successful and lively public space both a pleasant space where people feel comfortable to stay and functions that attract or 'provide' visitors are important as the theoretical research showed. From the research on demands of the current residents it seems promising to facilitate a park setting because residents from the Tarwewijk like to go to parks for picknicks, walks, meeting people or watching their children play. At the same time the amount of green public space is perceived insufficient and of generally low quality (Meinster and Persie, 2012) and the mobility towards recreational spaces in general but especially for children of migrant groups to go to further located parks is relatively low (Boelhouwers et al., 2011).

Facilitated activities are first of all walking, picnics, kids' play and meeting people. These activities are supported by an urban park which is not wild and natural but neath and tidy. This park starts at the main entrance from the Tarwewijk at the west and transforms into a square towards the east, connected by a small cafeteria terrace at the bridge. Surfaces in between the main walking paths are filled in with both soft (grass,flowers) and hard material (playing grounds, terrace). Besides a few benches, the edges of these surfaces provide additional space to sit, watch and talk. The square at the east side

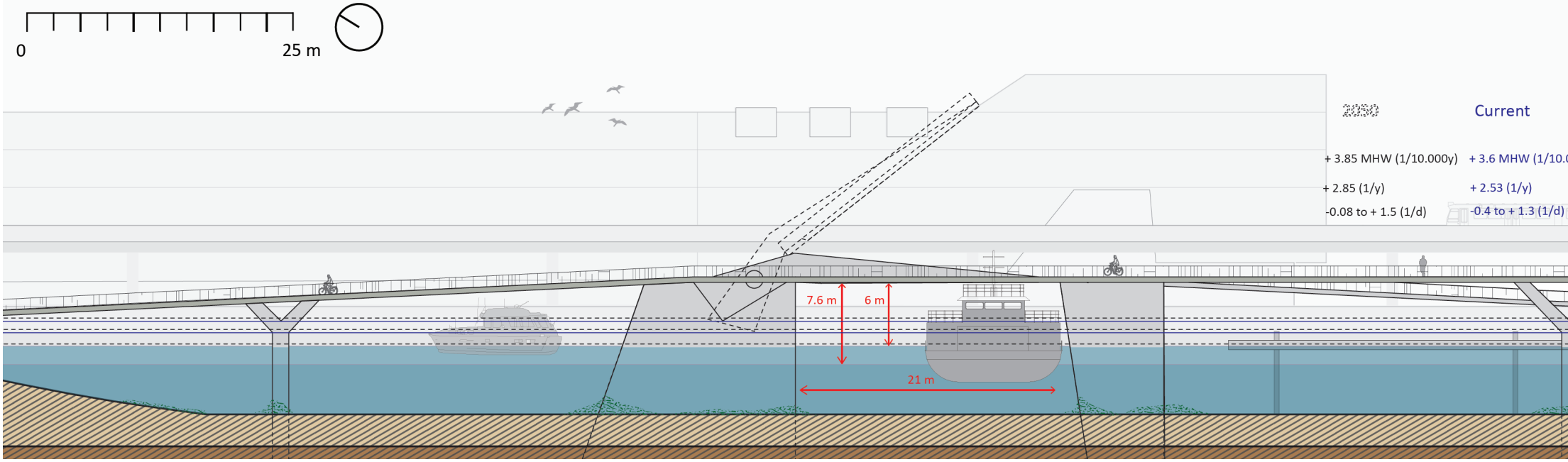

0
50 m
TRAM
Walking
Cycling
Sitting
Sports
Skatboarding
Childrens play
Walking close to water
Water nature
Nature education
Fishing
Park visit
Eating / drinking
TRAM
New tram stop
Shopping
Workshops
Evening education

also functions as the forecourt of the new community centre. To attract the relatively large group of youngsters in these neighbourhoods, this centre where (after)school related activities, adult education or dancing classes can be held is proposed. These kind of organisations are the bridge to the wider society to a larger extend than for young people at the other side of the Maashaven as showed from research.

Along the water, the rather raw materialised road along the entire quay continues as transit space. It widens under the bridge where benches and skate attributes facilitate young people hanging about.

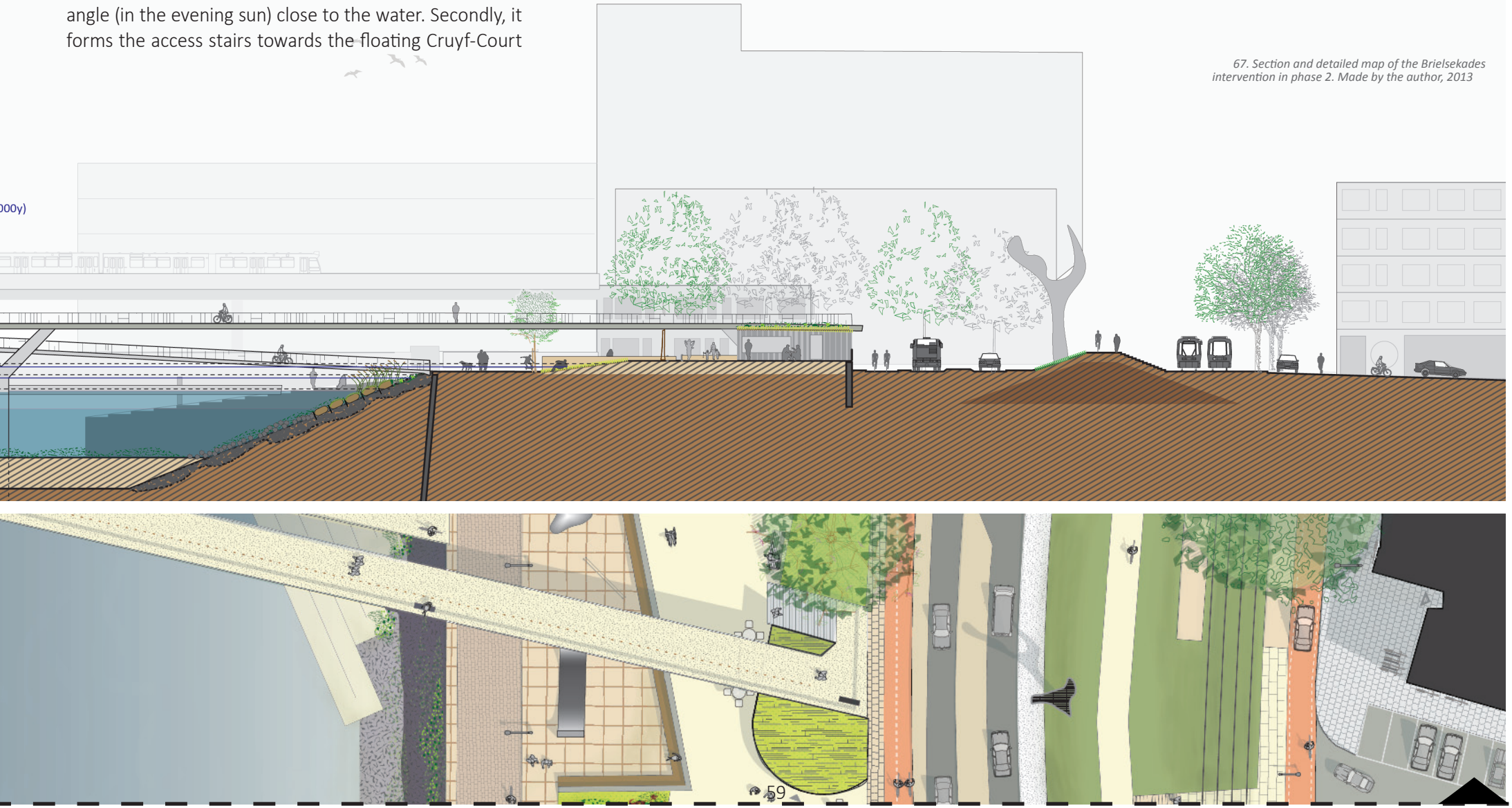
The shore itself is more roughly green and together with the road and some overgrown former harbour attributes this forms the prelude towards the Maassilo quays in the east which have the potential to adopt an atmosphere like the Emscher Landschafspark in Duisburg Nord.

The relation with water of residents of the older neighbourhoods probably differs from people at the Kop van Zuid. Not only do migrant people swim and navigate less on the water, they are also less aware of its nature and dynamics, as the reactions in § 5.3.2 shows.

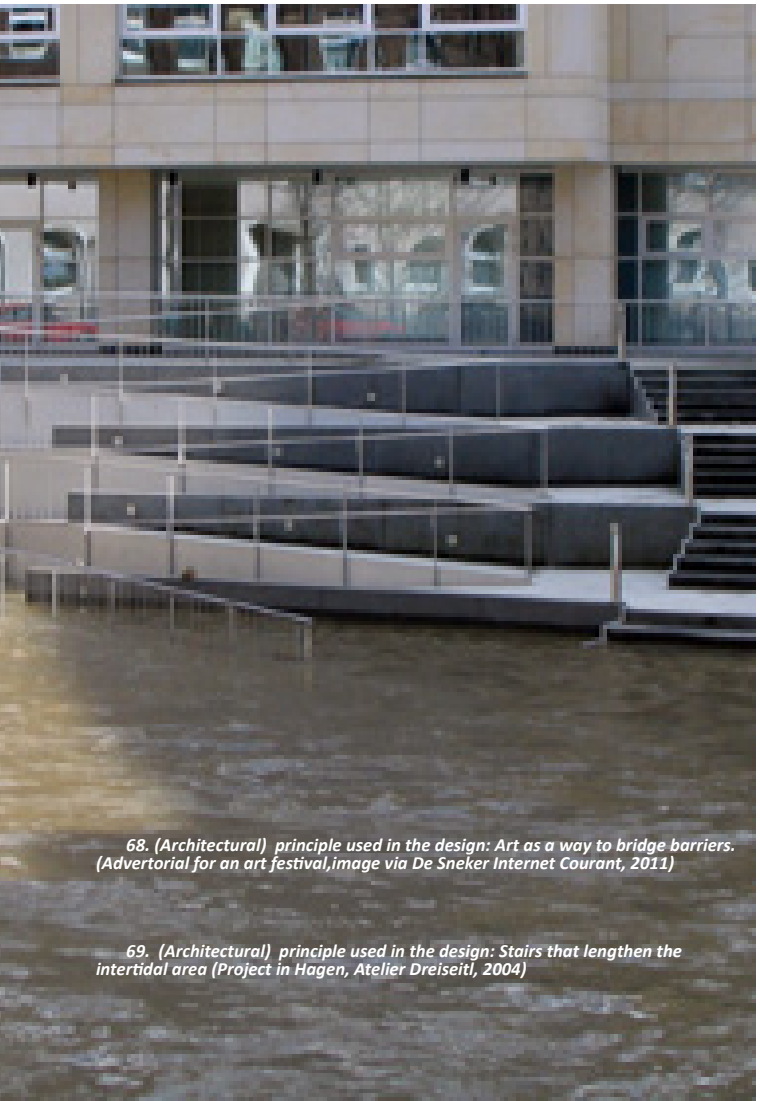


To show people these dynamics, a structure in front of the original quay is proposed on which the intertidal area is outstretched. By lenghtening this surface from about 1 to 460m, the 'speed' of the tide becomes visible with about 1.3m/minute. Besides being a kind of natural clock, the structure provides sitting space at a different angle (in the evening sun) close to the water. Secondly, it forms the access stairs towards the floating Cruyf-Court next to the community centre. At every time of day, this pontoon can be accessed form another point along the stairs, once more emphasizing the waters' dynamics.

This floating sports function is drawn here as a floating Cruyf-Court, but could also be connected to for example a future sailing school as one of the residents of the Tarwewijk (Eric Dullaert, met at the previous mentioned workshop) wants to set up after the successful yearly sailing matches at the Maashaven.



67. Section and detailed map of the Brielsekades intervention in phase 2. Made by the author, 2013



68. (Architectural) principle used in the design: Art as a way to bridge barriers. (Advertorial for an art festival,image via De Sneker Internet Courant, 2011)

69. (Architectural) principle used in the design: Stairs that lengthen the intertidal area (Project in Hagen, Atelier Dreiseitl, 2004)

70. The reuse of industrial remnants at Houtan Park by Turenscape, in 2009. Image via landezine.com, 2012)

71. Fast way of greening the quays by using Soil Bags ®. can also be attached to racks on stone. Image via greensoilbag.com

5.3.6 Water safety

The quays of the Brielsekades are only 3.2 metres above NAP, which means that their flooding frequence already is once per 500 years. This will further increase to about once per 25 years in 2050 (van Veelen, 2012) at the lowest climate scenario used in this thesis. All new property developed in outer dike areas should be flood proof up to events happening 1/1000 years. By raising all ground floors of new property towards 4.2m NAP this is secured. This heightening of the ground level is also done at the more delicate part of the new public space, while the rough materialization of the lower part of the quay can handle more frequent flooding. The extra height brings back the feeling of having a 'balcony' at the harbour like in the present situation.

The rise of this ground level at the neighbouring properties could, if the economic situation allows it, be made by for example half sunken parking garages that in a later stage can be part of the flood defence when it shifts from the Brielselaan into the buildings. By slowly raising a strip of the quay to 4.2m NAP, the Brielselaan will be protected against too frequent flooding both in its current state and in case of the future option that the road is lowered after 2026 (see also §5.8.9).

5.4 Katendrechtse strand

Strategic intervention 2

5.4.1 Ambitions

- This intervention should postion the Maashaven on the city scale public space network and extends this public space network towards and onto the water.
- This design demonstrates how a new relation between the city and the river can emerge by bringing its citizens in closer contact with the water and raise awareness about water processes in he city.
- An adress at the river for both the Afrikaanderwijk as the Katendrechtse Pols can be created here.

The inner harbour will accommodate the function of recreational landscape as substitution for the former industrial use, bringing people back to the harbour again on daily or weekly basis. Rainwater purification and other measures to enhance ecological recovery of the river Meuse are integrated in- and of added value for the recreational landscape. The historical and contemporary spatial qualities of the area are enhanced to provide a shared identity for the surrounding neighbourhoods and the intervention is able to cope with changes in amount of building developments, climate change and inland shipping in the area.

73. Impression of the Katendrechtse strand. Made by the author, 2013

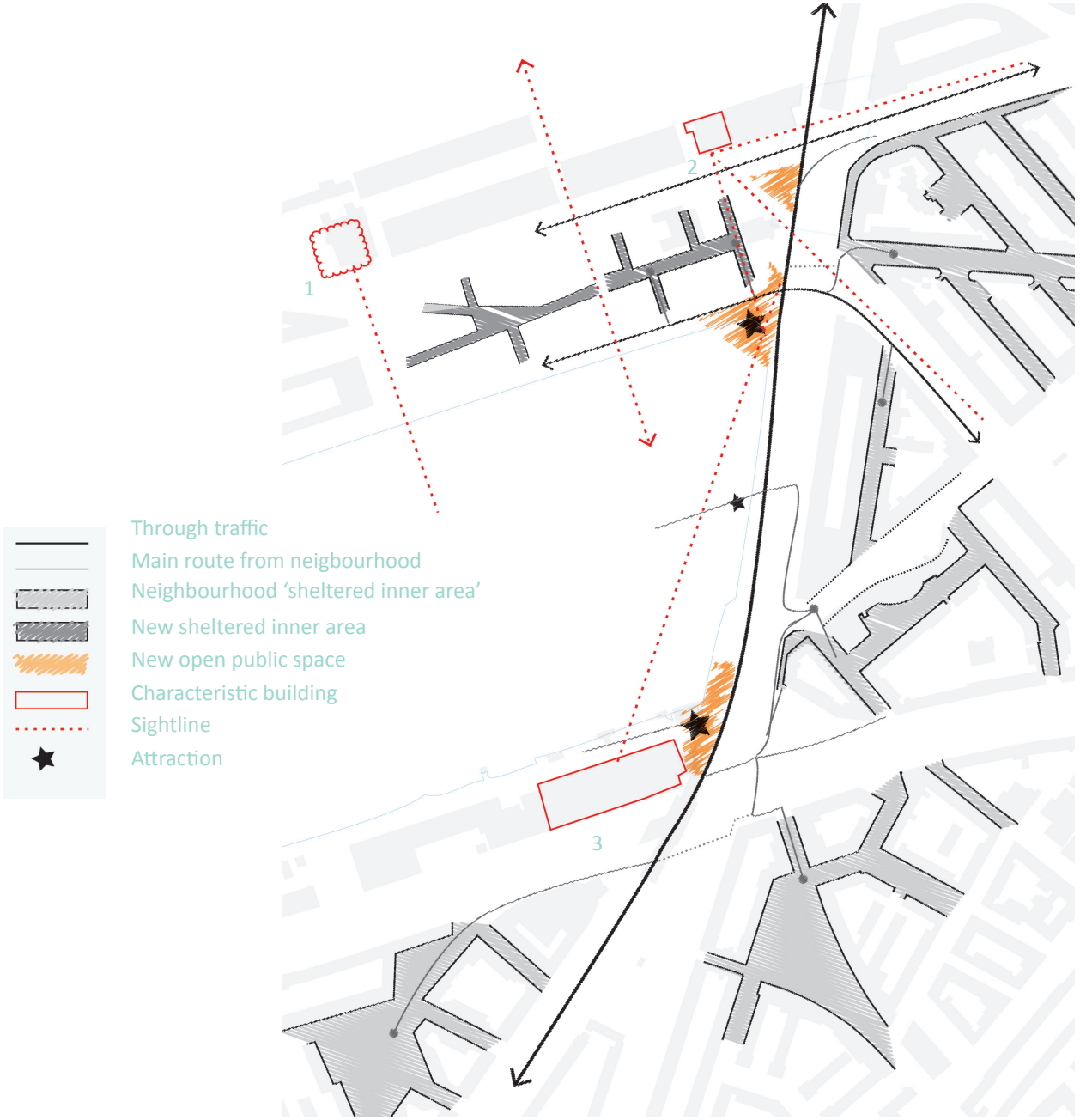
72. Example of an intertidal river beach at De Esch, Rotterdam. Photo by Sasch via skyscrapercity.com, date unknown.

74. Top: Existing activities in the public space, existing program and dominating milieus. Bottom: desired milieus. Images by the author, 2013

5.4.2 Urban context and position in the redevelopment plan

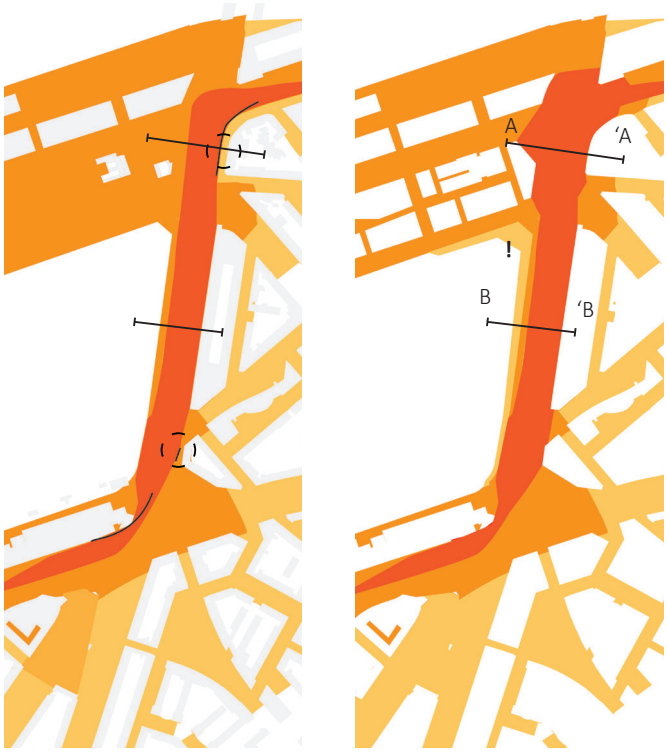
The project location is situated on the so called centre ring of Rotterdam (see § 5.2.1) . Along this ring there are several points of interest of importance for the whole city, like the Wilhelminapier and Het Park with the Euromast. This location has the potential to also grow into a remarkable point, attracting both neighbours and a broader public. At the moment the rather vacant site is surrounded by predominantly residential areas, but both the metro station Rijnhaven and the popular market area of the Afrikaanderplein are close by. Also the newly equipped Brede Hilledijk with its new connection over the railway towards Parkstad unlocks a potentially large group of users in the future.

In order to attract more diverse user groups and stimulate encounter between these groups the existing milieus should reach out towards and over the Maashaven, with special attention to the more urban milieu that has to pursue others than neighbours to visit the area, and the recreational/leisure milieu which provides a peaceful walk, ride or boat trip on short distance form this urban milieu.



75. Left: Characteristic buildings (1) Codrico building (photo by Charles E.P. Vermeulen), (2) Santos building (photo via Architectuurinrotterdam.com), (3) Maassilo (photo by the author)

76. Map showing the desired relations with the surrounding neighbourhoods. Made by the author, 2013



77. Perceived height maps before and after. The two circles show the location where the problem of section A occurs. Made by the author, 2013

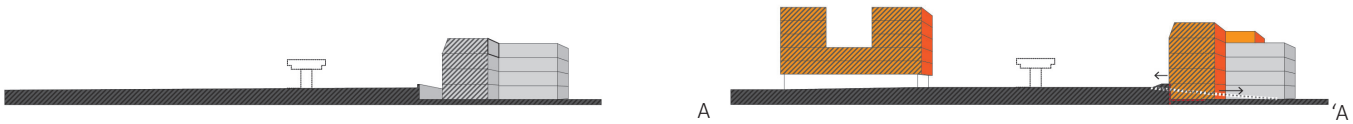
5.4.3 Relation with the surrounding neighbourhoods

Image 76 on the previous page shows how the future relation to the surrounding neighbourhoods is envisioned.

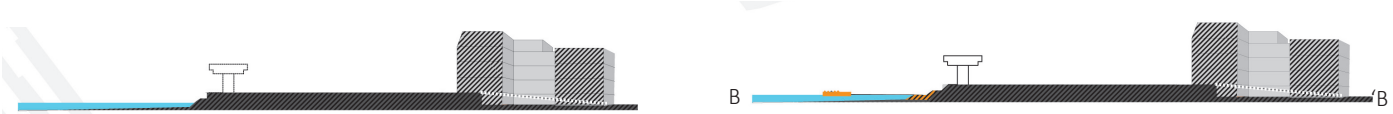
Characteristic for neighbourhoods at this area of Rotterdam is that they can be seen as isles within a network of roads and rails. Often they possess a more quit residential inner areas and more formal edges along the main roads. Disadvantage is that connections between neighbourhoods and functions on the other side of the main roads are often not so well developed or distorted by later extensions of roads or levees. The design aims to continue the quality of inner areas and more formal edges onto the pier of Katendrecht, but to ensure the good connection between these inner wolds and formal streets. This inner world adds another quality because of its shelter in contrast to the very public, open and sometimes windy quays surrounding the area. This feeling is enhanced by blocking off sight lines into the neighbourhood by alternating streets and shifting facades. Only the rhythm of sight lines at about every 170m that are important for the identity of the area are kept open, featuring beautiful industrial buildings or a see through towards the Manhattan at the Meuse at the Wilhelminapier.

At several points new public spaces are envisioned. The most northern one will be part of a more formal entry to the pier of Katendrecht, whilst the southern two (see image 76) are opening up to the harbour and offering place for attractive program.

To improve the relation between neighbourhoods, the axis of the city ring and the Maashaven at the other side, a few adaptations are proposed. This relation was distorted by the heightening of the dike and caused very abrupt gaps to emerge between the higher road and the lower neighbourhoods (see section A), and the quay became hardly reachable anymore (section B). The first adaptation concerns this quay. By improving the walkability of the orange level along the water (image 77) and by adding another lower level closer to the water, a new attractive route is proposed that connects the new public spaces shown at the previous page. The second adaptation restores the connection between the neighbourhoods and main road by continuing the higher level up to the facade and bridging the height difference in the secondary streets and the buildings themselves. This last adaptation resembles to the way these height differences were solved in early times (§ 3.2).

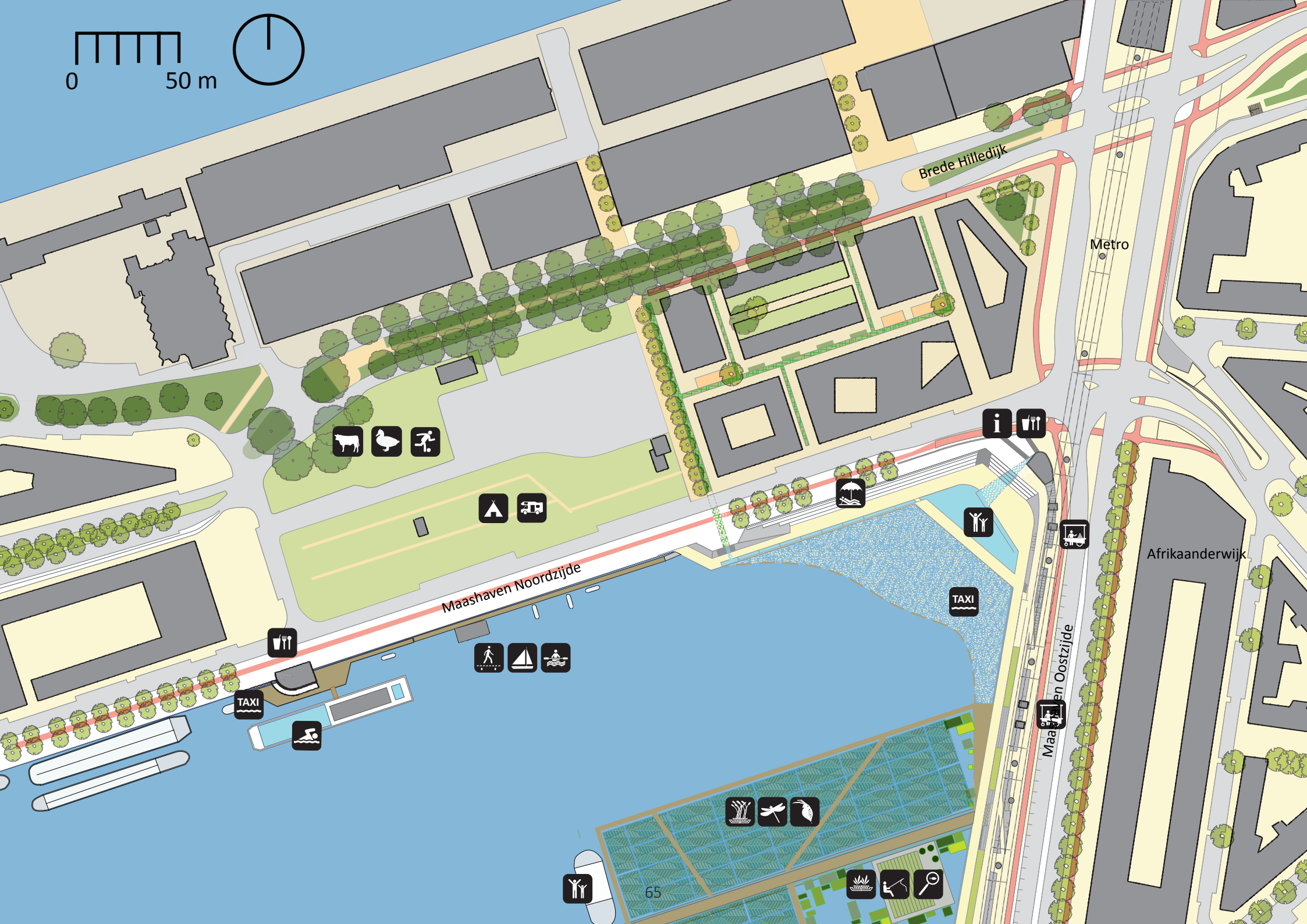


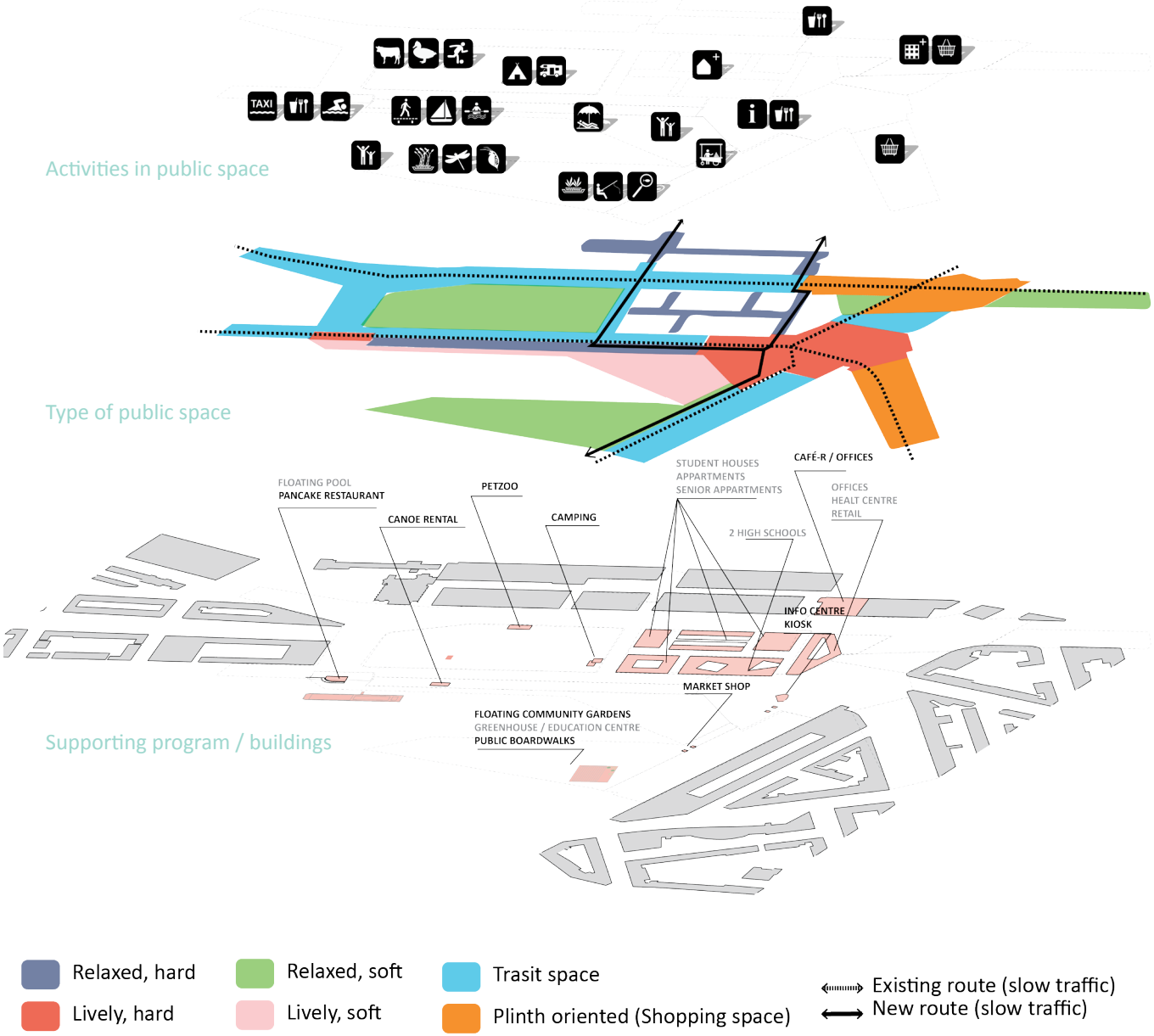
78. Section A before and after, showing the distorted relation and the new relation between neighbourhoods and the city ring. Made by the author, 2013



79. Section B before and after, showing the distorted relation and the new relation between neighbourhoods and the waterside. Made by the author, 2013

80. (right) Plan showing one of the possible results at the Katendrechtse Strand intervention. Made by the author, 2013


0
50 m
Brede Hilledijk
Metro
Afrikaanderwijk
Maashaven Noordzijde
Maashaven Oostzijde
TAXI
TAXI
65



81. How the design is build: activities, most suitable type of public space and program/ buildings which support the desired use. Made by the author, 2013

5.4.4 Activities, spaces and program in the design

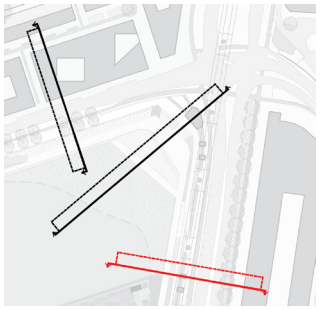
The plan is set up using the 'Reverse thinking' method of Gehl (see also chapter 2). On the previous page one of the possible results after implementing the intervention is shown. On the left activities, types of spaces, supporting program and buildings are shown which all together built the design. On the next few pages three sections show these spaces more in detail. The potential of the now rather quiet quays and the water should be unlocked. Therefore a range of activities is accommodated by the design to make these activities more likely to happen.

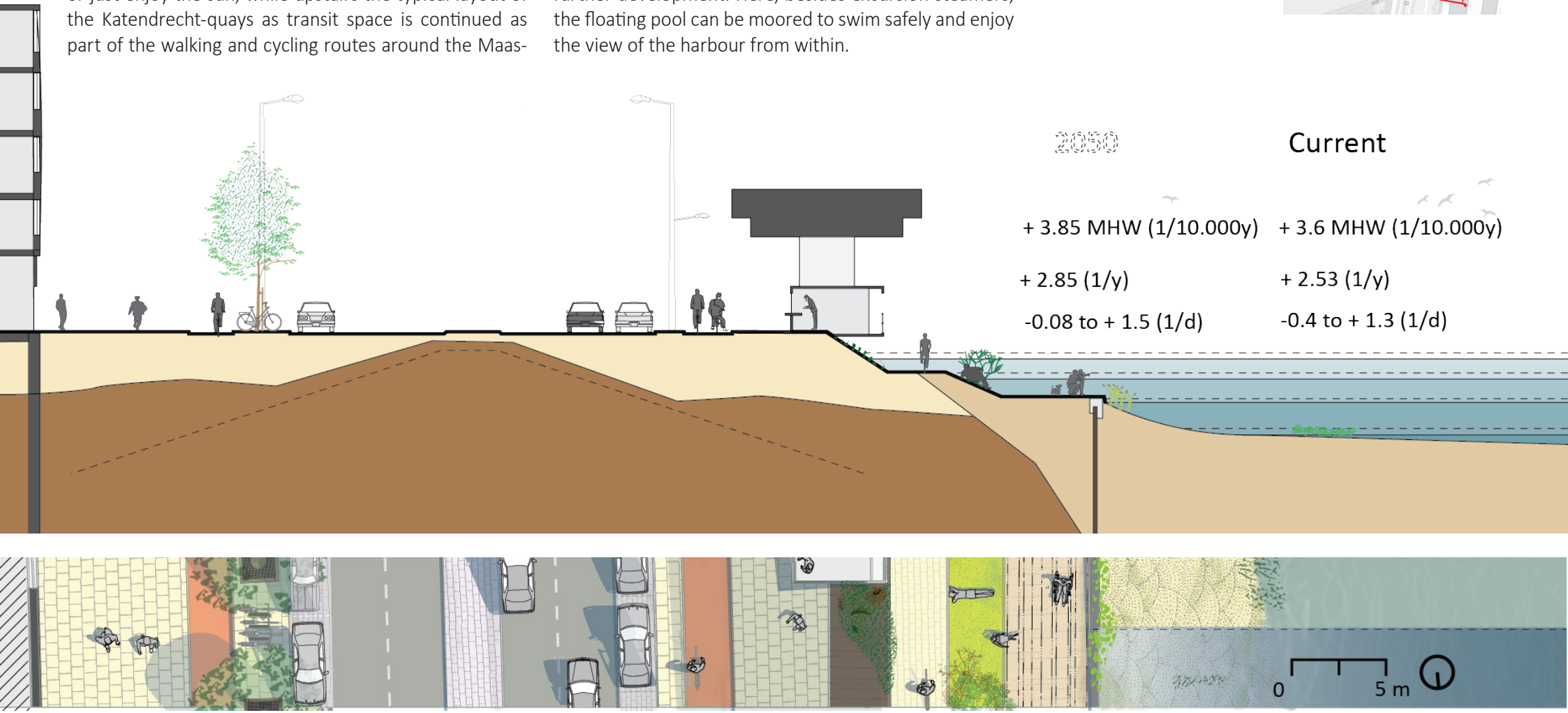
In the very corner of the Maashaven a city beach is created to make use of the ideal position with regard to sunshine and reachability to attract people to stay or to promenade along the urban beach. In contrast to the design intervention at the Brielskades, seeing and being seen, lunch meetings and socialising for the blue and red lifestyles (see also chapter 3) is facilitated here. This landscape largely exists of robust paved material. Via ramps and stairs the different levels are connected. During the day the playing pond offers children a chance to be in the water under close supervision of their parents since the Maashaven itself won't be suitable for swimming in the coming decade yet. At high tide the Maaswater is close to this pond and when the water backs down a muddy beach becomes visible. The pond remains filled as a memory of the receding water. At the most central point, visible from all sides, the 'Maasys' kiosk is located where ice creams and snacks can be purchased. It is also featuring an information point about the history, future and water system of the area. This is the starting point for the Layar(an augmented reality app)-guided tour through the area. From this point the water, cleaned in the floating park, flows down to the

small pond, and after this further down to enter the Maashaven together with the filtered water from the new neighbourhood. More about the water system can be found in §5.7.3.

Further to the left the large steps continue along the quay and offer a bit more peaceful place to sit, talk, read or just enjoy the sun, while upstairs the typical layout of the Katendrecht-quays as transit space is continued as part of the walking and cycling routes around the Maas- and Rijnhaven. Close to the water a series of floating wooden boardwalks offer access to a canoe rental shop and mooring places for small recreational boats. These boardwalks end at the terrace of the 'Bakboord' pancake restaurant. This restaurant is easily accessible from both the neighbourhoods and the petting zoo and campsite. These two temporary occupy the plot that is waiting for further development. Here, besides excursion steamers, the floating pool can be moored to swim safely and enjoy the view of the harbour from within.

82. Section and detailed plan fragment at the Maashaven Oostzijde showing the three levels and the current and future water heights. Made by the author, 2013

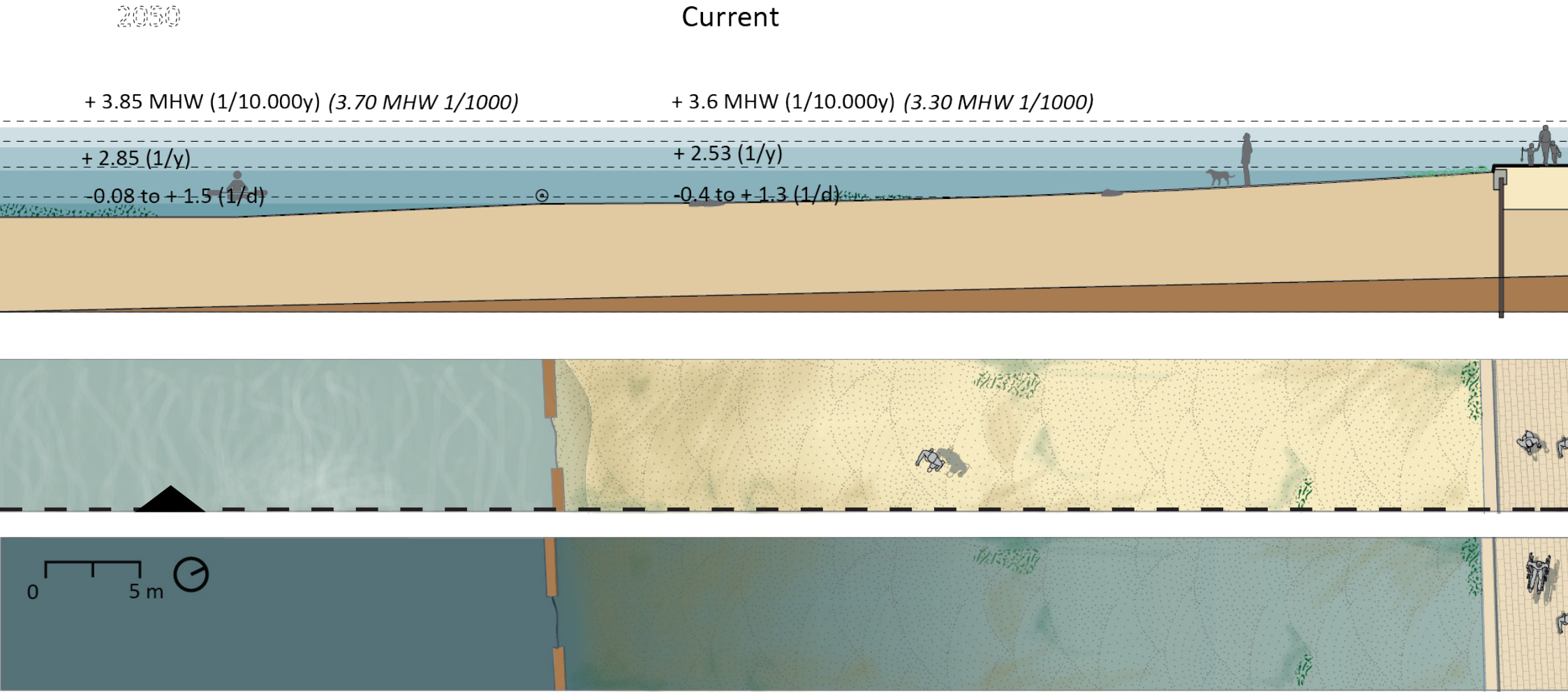




When leaving the central square towards the Maashaven Eastside and the Maassilo, the path at the level of the Maashaven Noordzijde continues as paved walking and cycling lane towards the Brielsekades whilst the lower square converges into a path which gives access to the floating park and the floating community gardens. In the future this could be the access leading to the more natural extensions of the park where several floating bungalows can be hired to stay one or two nights at the hearth of the Maashaven.

On this lower level one can touch the water at high tide and there are wooden platforms for quiet fishing. Between the two levels a grass ramp provides space to lie down. At the locations where all levels are connected, stairs are extended with larger steps to gather.

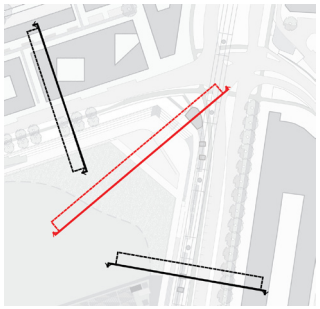
At the upper level, underneath the metro, overhanging stalls for locally grown products or arts and crafts can be established as the community gardens and the greenhouse grow bigger and get well known. The floating park and the vegetation along the lower level will provide some protection on windy days.

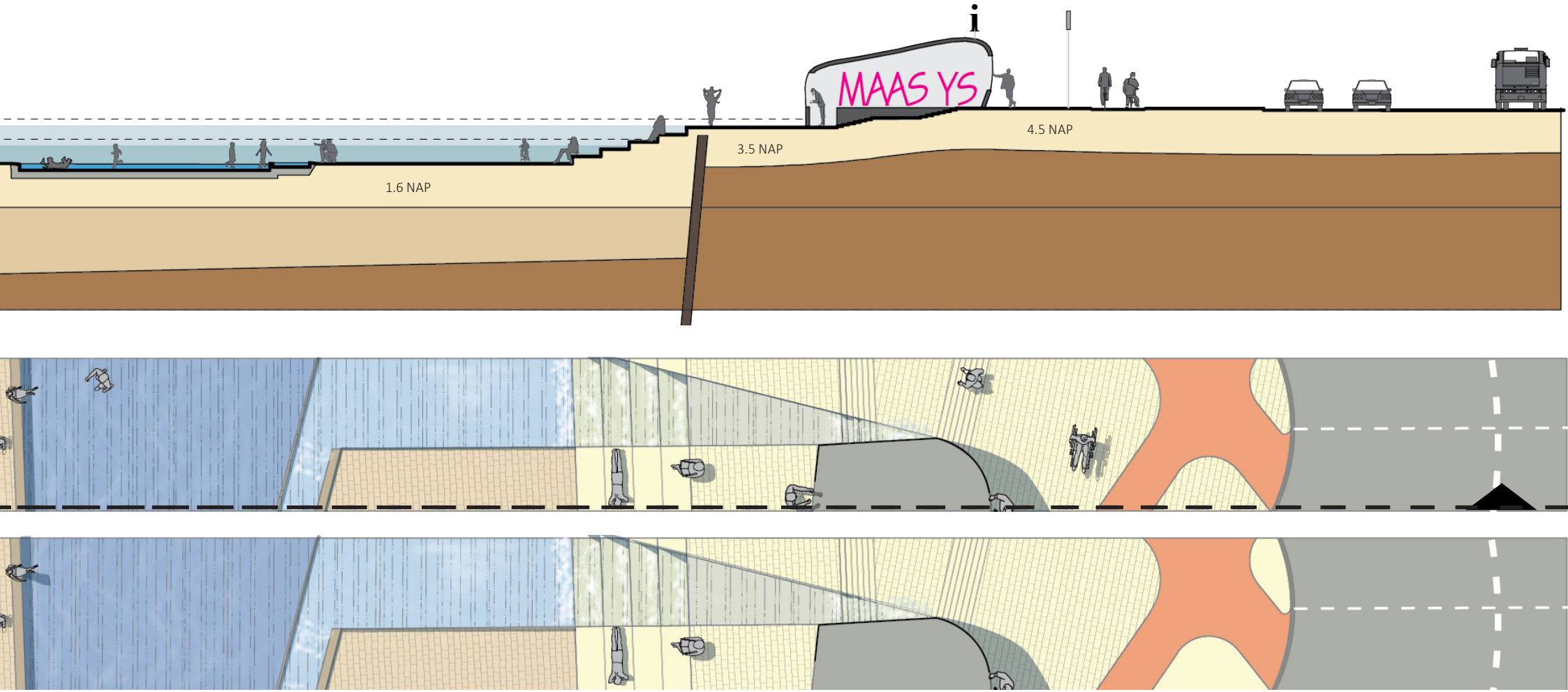


The program for the first blocks of the new neighbourhood is already initiated by the municipality, although its masterplan has another configuration in which the difference in publicness and scale between neighbourhood spaces and public space along the quay are not so differentiated as is proposed by this design.

The floating pool and floating greenhouse already exist elsewhere and could be town in or constructed anew. These functions are very welcome in the Maashaven, opposed to the floating neighbourhood discussed in chapter 3 because they do not privatise the water but are open for a wide range of people to get acquainted with the harbour and the river.

83. Section and detailed plan fragment at low and high tide at the Katendrechtse Strand, showing the three levels, the kiosk, the playing pond, the beach and future water heights. Made by the author, 2013





5.4.5 The educative water treatment system

The system

The purification system aims at creating added value for both humans and the ecological recovery of the Maashaven.

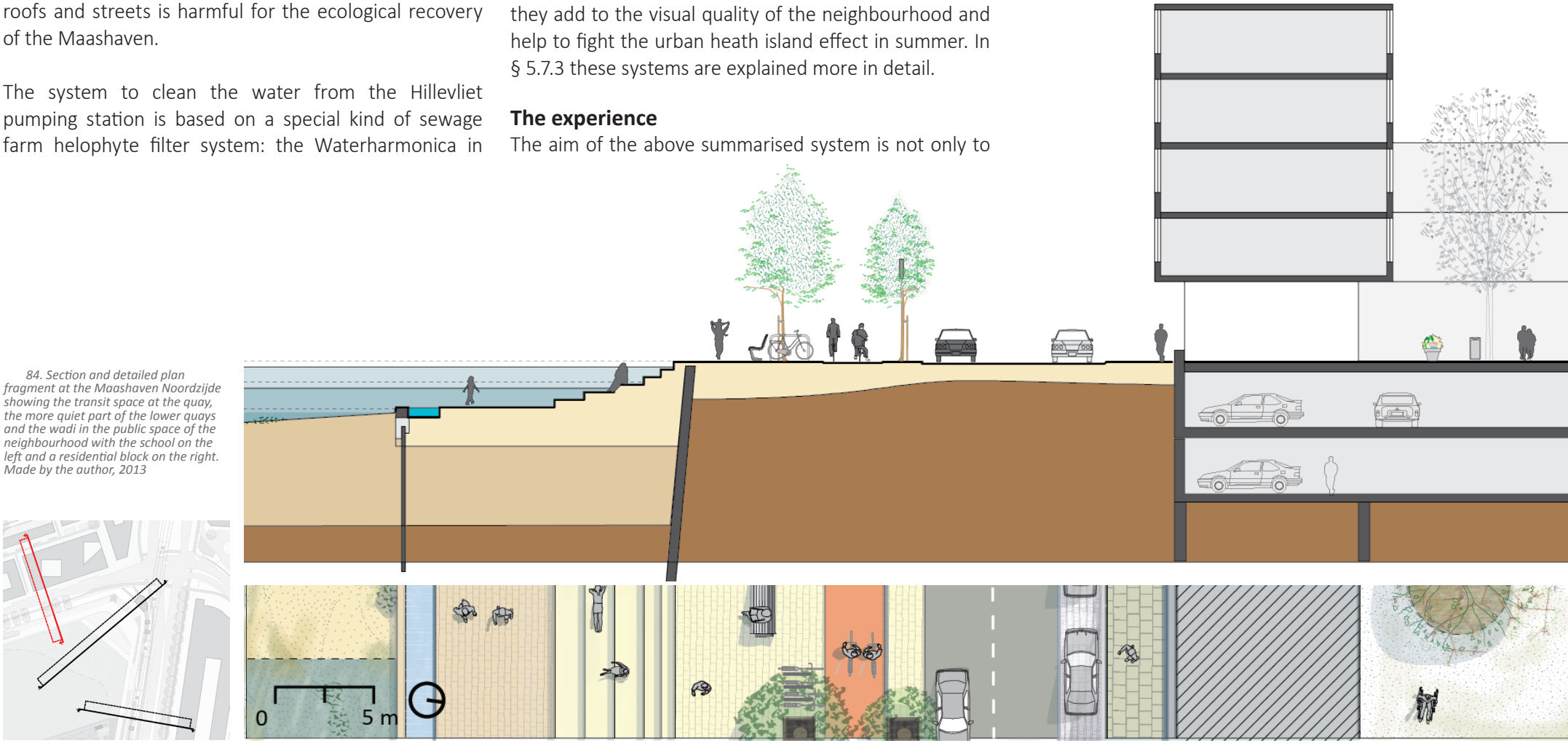
On a normal day about 540 to 1080 m3 of polluted rainwater is pumped into the Maashaven (Rienks, 2013) and this might become more as soon as the new Parkstad developments are finished. This water from roofs and streets is harmful for the ecological recovery of the Maashaven.

The system to clean the water from the Hillevliet pumping station is based on a special kind of sewage farm helophyte filter system: the Waterharmonica in which the traditional helophyte filter is extended with a basin to grow water flees. After the water is filtered from large particles underneath the waterhub platform, a bit of it can be used for watering plants in the floating greenhouse where the nutrients are a welcome content. Its outflow enters the purification system again. After all the treatment steps the water streams down from the information point to fill the playing pond and after this via small cascades towards the harbour. For the runoff water from the new neighbourhood, wadi's are used because they add to the visual quality of the neighbourhood and help to fight the urban heath island effect in summer. In § 5.7.3 these systems are explained more in detail.

The experience

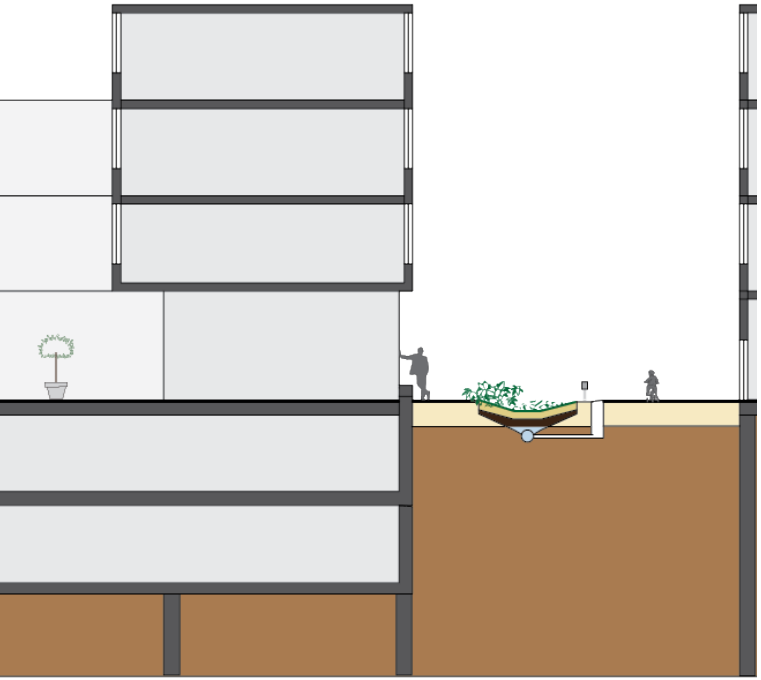
The aim of the above summarised system is not only to improve ecological conditions. It also adds recreational and educational value through the floating park with its unique plans and animals and the green wadi's make people more aware of water cycles in their environment. In this way, both surface water and the river become part of peoples realm of thoughts.

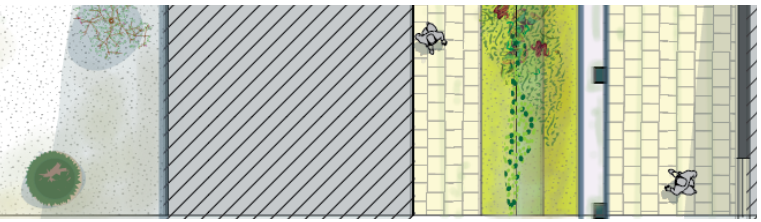
Besides offering people the possibility to experience parts of the system (floating park, greenhouse, wadis) for recreational purposes or confronting them with



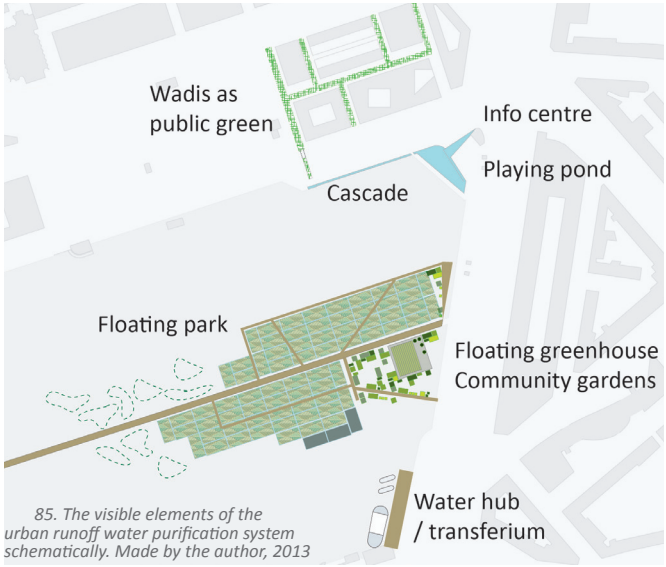
84. Section and detailed plan fragment at the Maashaven Noordzijde showing the transit space at the quay, the more quiet part of the lower quays and the wadi in the public space of the neighbourhood with the school on the left and a residential block on the right. Made by the author, 2013

water flows (the playing pond, wadis, cascades), a new type of media called augmented reality can be used to make a walk through the area even more interesting. This route can already be initiated in the first phase of the design, featuring historical information, touristic attractions in and around the harbour or insight in Rotterdam's Stadshavens Project. The first tests with this interactive system in relation to water education prooved to be succesful in the WATERgraafsmeer project (WATERgraafsmeer, 2011).

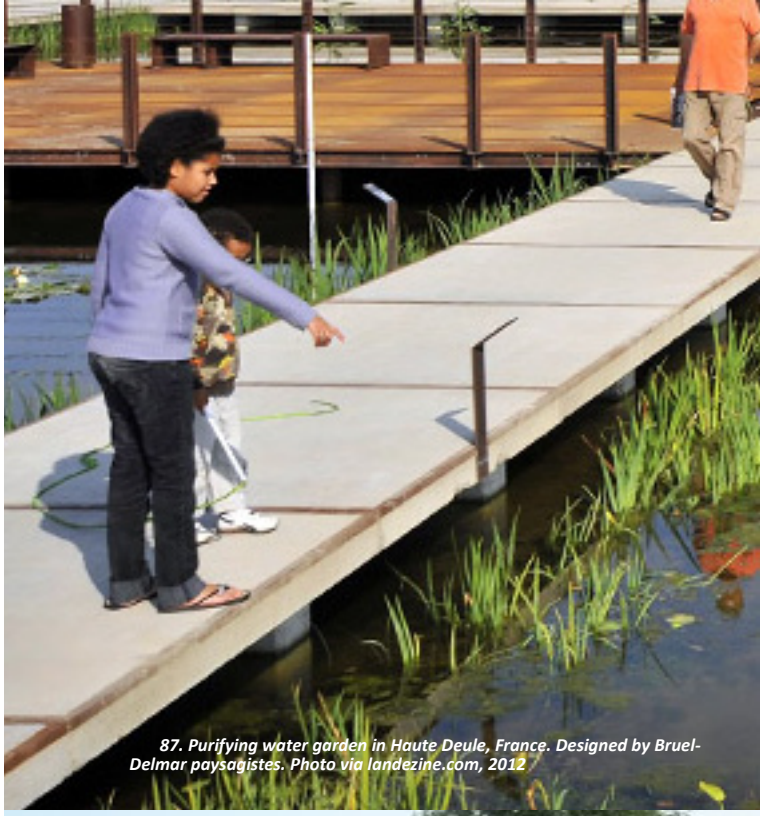




86. Impression of the Layar-Guided tour, using augmented reality to inform people. Made by the author, 2013



85. The visible elements of the urban runoff water purification system schematically. Made by the author, 2013



87. Purifying water garden in Haute Deule, France. Designed by Bruel-Delmar paysagistes. Photo via landezine.com, 2012

88. Playing pond at the Westergasfabriek park, Amsterdam. Designed by West 8. Photo by MrtnPS, via panoramio.com, date unknown

. . . . . and how does this design experiment help to answer sub-research question one to four?

5.5 Good public space

Sub- RQ 1 in the design: How is the Maashaven embedded in the current public space network and how does the design improve this?

This section shows the analysis of the current public space network and the position of the Maashaven in this network which has lead to the proposed changes in the design. Secondly, a comparative analysis on cases dealing with the same problems as the Brielsekades is shown. This case study has provided insight on how the basic hierarchy and sequence of spaces at the Brielsekades should be designed.

5.5.1 Strengths and weaknesses of the position of the Maashaven in the current public space network

To get grip on the question how to make the Maashaven well integrated in the public space network and to learn what criteria are important for this, the method of evaluating city parks of de Josselin de Jong was used (see §2.3.1). It is based on 8 criteria that are most valuable for the success and failing of parks (de Josselin de Jong and Mispel, 2008):

Given criteria:
- Reach
- Density of the surrounding area

Possible to change by designing:
- Unicity
- Mixed functions / amenities
- Anchorage
- Accessibility
- Routing
- Identity

These criteria show an overlap with the more general criteria that are discussed in chapter 3 of this thesis.

Reach

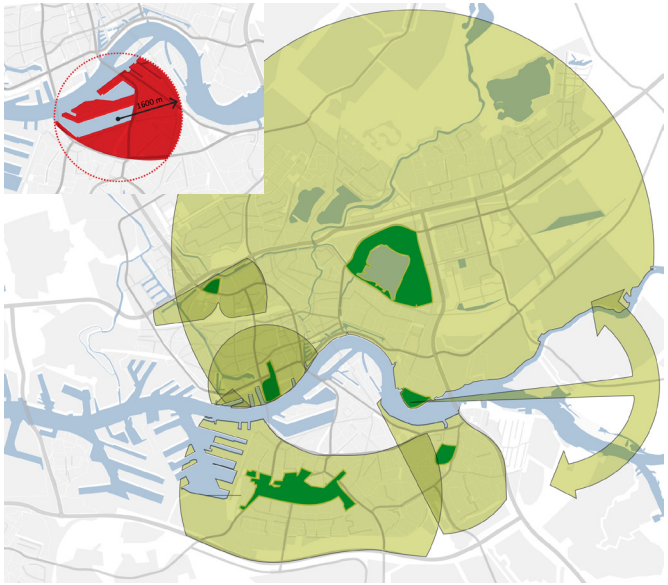
The ***reach*** is defined as a radius around the park which depends solely on its size, minus the area that is behind borders that are unlikely to be crossed. Examples of borders mentioned by de Josselin de Jong are highways, urban freeways and the river Meuse. Assuming that between half and the entire surface of the Maashaven becomes recreational public space, the reach would be comparable to a city district park ('stadsdeelpark', defined as 20-75 ha). This would cover most of the targeted area which means that the Maashaven could serve a large part of the Old and new Neighbourhoods at Rotterdam South.

Density

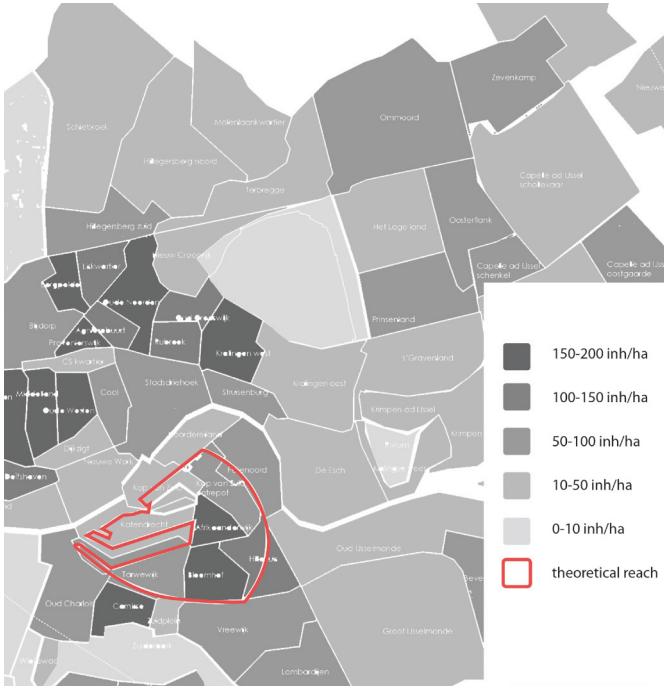
The higher the ***density*** of potential visitors is, the better. Image 90 shows the average density of the neighbourhoods. The exact amount of people within the reach is not calculated, but the map shows that most of the surrounding neighbourhoods have a rather high density and this density will only increase when projects like 'the Rotterdam' or the new neighbourhood at the Katendrechtse Pols are finished.

Unicity

With the term ***unicity*** is meant to show how much concurrency a park is experiencing form other, comparable parks. To do this, parks that are of the same category or higher categories are drawn on the map, all with, in the case of a park of the size of half of the Maashaven, a circle of 1600 metres (fig.91). Again, the exact numbers are not calculated due to a lack of exact data, but the effect is very clear: there is basically no

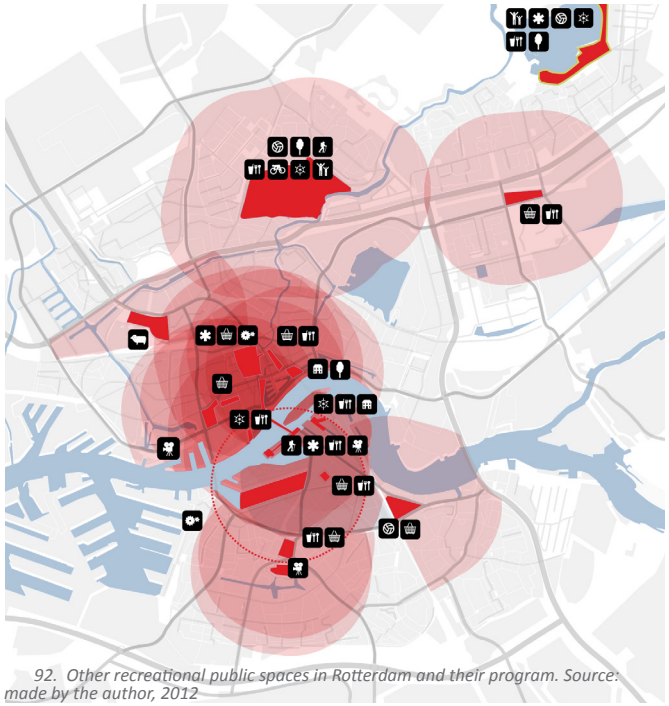


89. The Maashaven as public space, covering a large part of the Kop van Zuid and the larger parks with their reach. Image by the author, 2012



90. The potential reach of the Maashaven on a density map. Image based on de Josselin de Jong, 2008, adjusted by the author

91. Parks surrounding the Maashaven area and their program. Source: made by the author, 2012



92. Other recreational public spaces in Rotterdam and their program. Source: made by the author, 2012

overlap. To investigate what kind of other functions could be combined with the Maashaven park the concurrency of other recreational spaces is mapped in the same way. The same radius is used, although that is a very rough assumption since the recreational spaces differ a lot in shape and clearness of their boundaries and in what amenities and recreational possibilities they offer. Based on this analysis the choice for the main program was made, as explained in § 5.7.4.

Mixed Functions

The mixture of functions within 600m makes a place lively during the day because different people use the park in their daily rhythm. This varies from people walking their dogs in the early morning and late evening, going to and returning from work during rush hours, working in the area, having lunch, playing during the break or free afternoon, baby sitting or shopping during the day and going out in the evenings. When looking at the map, it shows that the surrounding areas are largely residential

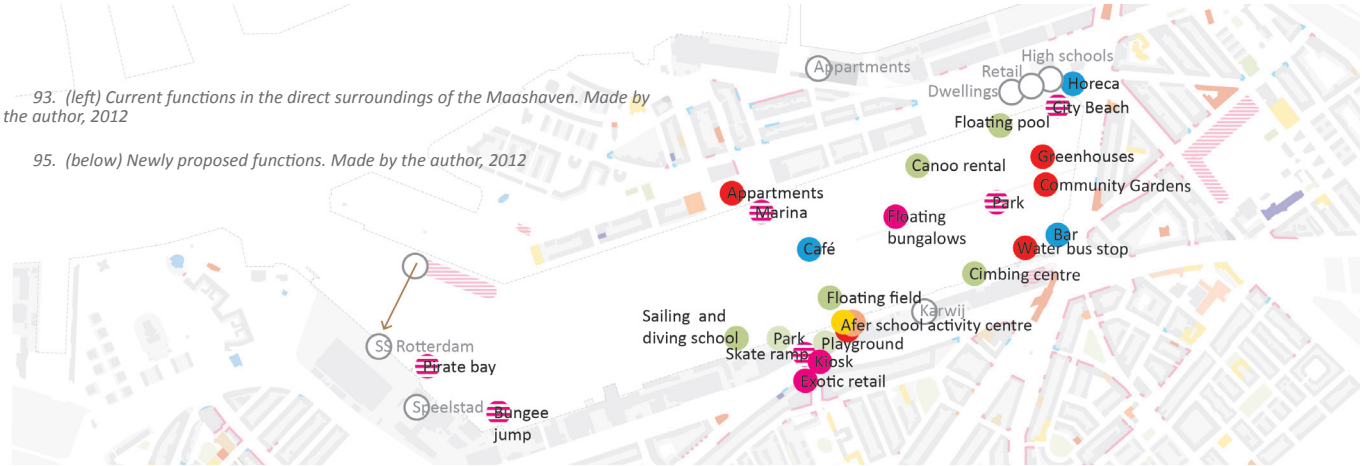
and that offices are located in the North mainly. There are some people working at the Brielselaan and the edges of the Waalhaven, but these are less labour intense businesses. There are several shopping area's close by, but always hidden behind the first line of buildings, seen from the Maashaven. In the neighbourhoods there are relatively many schools and health facilities.

In the current situation the main user group would be residents and towards the harbour mouth more tourists or day recreation might be expected especially when the new Speelstad opens around 2015. When redeveloping the industrial strip along the Brielselaan, it is important to aim for a mixed program. To increase the liveliness and the diversity of potential visitors of the area the connections to the shopping area's and schools are optimised in the design and the amount of people spending their days working in the area should be increased, just like the amount of bars/restaurants close by. In the redevelopment plan, there are some new dwellings and schools proposed (partially already planned, shown as grey circles in the image below) but also a mix of recreational functions is added that are used throughout the day and have peak uses in weekends. These functions can attract people even if the socioeconomic situation is such that more offices and apartments will not be built.

Anchorage

The Anchorage is analysed by the three-step method. Every line directly touching or leading to the surface of the Maashaven is part of the first step. Every side street of the first line belongs to the second step, and so on. It is investigated that the places reachable within this network belong to the 'mental map' of people (Jong and Mispel, 2008). The better a place is anchored, the more people have it on their mental map.

In the image on the right it is visible that the Maashaven is quite well connected to the north and south-east and less to the south-west and north-east. The peninsulas Katendrecht and Wilhelminapier are quite directly connected, and so is the Afrikaanderwijk. An important thing to notice is that a lot of first line connections are via the main roads, which means that the anchorage is very car oriented and for slow traffic the anchorage might be even less. The zoomed image shows the situation at the Brielselaan. Because of the double nature of this road and



93. (left) Current functions in the direct surroundings of the Maashaven. Made by the author, 2012

95. (below) Newly proposed functions. Made by the author, 2012

96. Anchorage of the Maashaven. Image made by the author, 2012

94. Zoomed anchorage of the Maashaven.in the current situation and in a possible new situation. Images made by the author, 2012

the few cross connections, the edge of the Tarwewijk is already coloured yellow, while it is quite nearby. Because of this the cores of Charlois and Tarwewijk are not very well connected within three steps. When you combine this with the bad visibility and the height differences and heavy roads that have to be crossed, the situation, especially on the south is worse than drawn here. At the third zoom possible new connections are drawn, showing the impact on the Tarwewijk and Charlois. One proposed connections is designed in detail in intervention one, the rest is only suggested in the redevelopment plan.

Accessibility

For the accessibility, small city parks and public spaces in general are dependent on slow transport such as walking and cycling, and public transport. For the different transport nodes different walking distances are used (bus, tram, metro: 500m , train 800m (Gehl, 2007 , Jong and Mispel, 2008). Also the amount of accesses to the area are compared to the contour length of the area. Besides this visual blockage by viaducts, buildings, dense greenery and levees are influencing the ease with which people find the area.

As shown on image 97 the coverage by public transport is quite good. There are two spots where a possible improvement could be made to better connect the Maashaven, of which the most western one will be covered by the relocation of tramline 2 to the Waalhaven Oostzijde (Gemeente Rotterdam, 2011). Another way to attract more visitors form the city centre is to add a waterbus-stop at the SS-Rotterdam and at the Maasslio. The water taxi stops are not taken into account here because this is still a rather elitist mode of transport.
There are no real access points to the water, as there are hardly any in Rotterdam in general (see also § 1.4). The only places where you can access a pier or a boat taxi are at the Maashaven Oostzijde and the Ponserpad, but these are not commonly used and semiprivate. Based on the 3-step analysis and the accessibility analysis new points of access to the water and two new tram stops are proposed in the redevelopment plan.

Routes

De Josselin de Jong sees routes that cross a park as a positive contribution to the liveliness of the park. People use these routes to get from one neighbourhood or to another or from a neighbourhood to a specific function in the park without visiting the park as a whole. At the moment these routes are very minimal since there are nearly no routes through the harbour itself and many quays are difficult to reach. In the design this is enhanced by locating more functions in the harbour itself, building a bridges right in the middle and designing amphibious jetties and planking (see fig. 100).

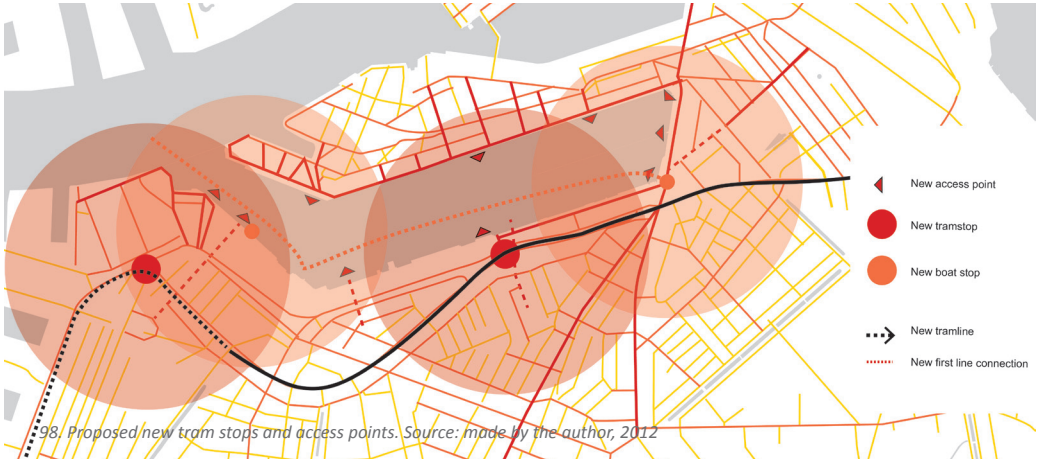
Identity

This is probably the quality factor with the widest scope. These 5 elements are judged by de Josselin de Jong:

1. ***Clarity:*** The amount of difference between 'park' and urban area. Overflowing makes it less clear.
2. ***Singularity:*** How much the parts are different than elsewhere: special functions/meanings.
3. ***Personal Binding:*** Whether the park is liked my many groups or only few.
4. ***Readability:*** The method of Kevin Linch (derived from general urban patterns, not specifically parks) containing of an analysis of Paths, Edges, Sectors, Junctions and Orientation Points.
5. ***Attractiveness:*** Consisting of cultural identity and program

In figure 102 the Maashaven is judged on these aspects. The Maashaven scores relatively badly. Negative things

97. The public transport coverage and points where the Maashaven can be accessed. Source: made by the author, 2012



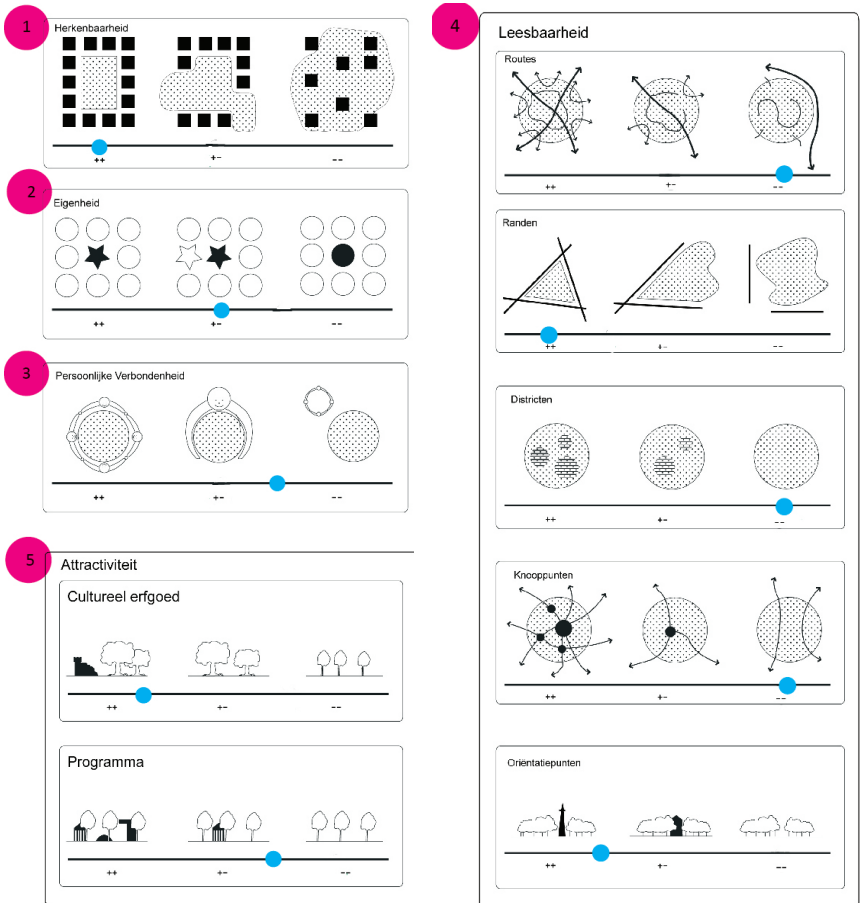
98. Proposed new tram stops and access points. Source: made by the author, 2012

which the redevelopment plan tries to improve:

- The lack of program
- The low personal binding because only people form Katendrecht and the inland shippers feel attached to this area now. Some of the inhabitants from the older neighbourhoods only came for the first time to the Maashaven quays when they were invited to the workshop 'Meel, Gist en Water' organised by Vitibucks on 19-03-2013.
- The bad readability. There are hardly any routes, no visual differentiation in sections and hardly any focal points.

Positive things that the redevelopment plan exploits are:

- The clarity of the area. The difference between urban area and the Maashaven is already strong and with the envisioned densification it will grow only stronger.
- There are several buildings listed as monuments, and the Maashaven is part of the collective memory of Rotterdam.
- The edges are very clearly defined.
- There are several orientation points such as the SS Rotterdam, the Maassilo, Meneba, the metro viaduct, the former waste treatment plant, the Santos building and the Maashaven tunnel entrance.

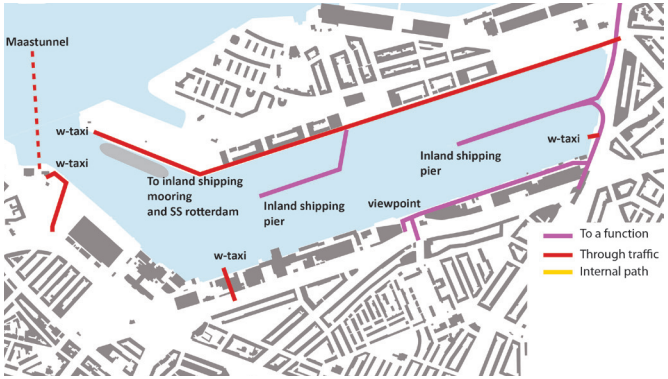


102. *Judgement of Identity-criteria. Source: adjusted by the author, originally from De Josselin de Jong, 2008*

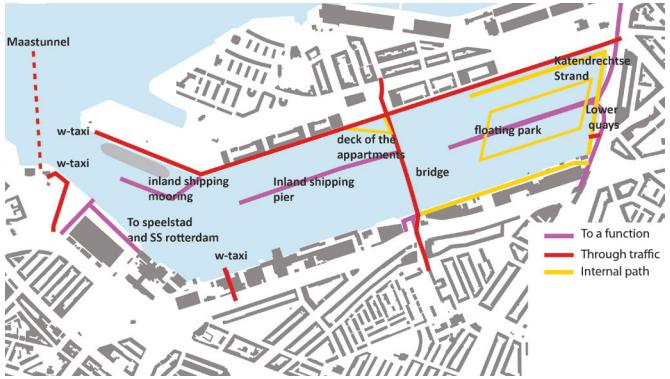
104. *The Viaduct and the Maassilo. Source: by the author, 2012*

105. *Former waste treating plant. Source: by the author, 2012*

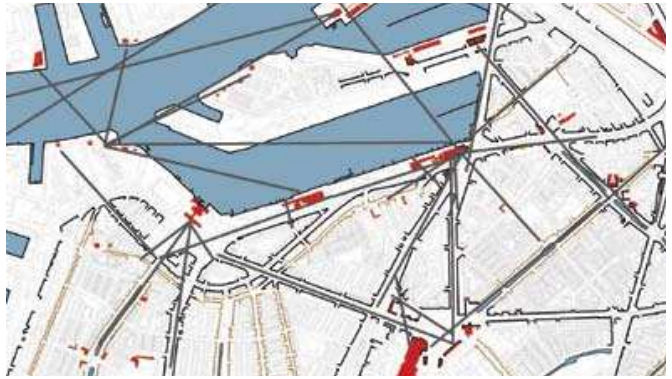
103. *SS Rotterdam. Source: by the author, 2012*



99. *Existing routes to and around the Maashaven. Image made by the author, 2013*



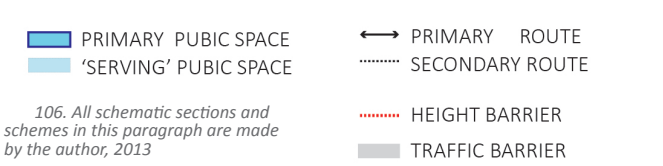
100. *Proposed routes to and around the Maashaven. Image made by the author, 2013*



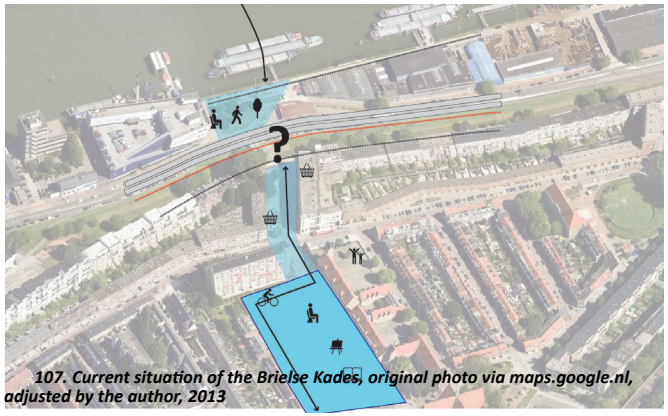
101. *Sightlines and orientation points. Source: Vanmeijel et al. , 2008, Cultuur Historische Verkenning Vooroorlogse wijken*

5.5.2 Comparative study on bridging plural barriers by routes and and public spaces.

When designing at the Brielse Kades some questions arose. There already is some public life at the edge of the Tarwewijk, but this is now practically all happening behind the plural barrier of the road and the dike. The question arises wether this existing public space (which practically is just a street ending in a neighbourhood square) should be connected literally to the regenerated public space at the quay. Could it become one large public space? Should the public space be used to bridge the barriers? Or isn't the public space as a surface the most important, but is it more the route that connects the two? How should the barriers be tackled, since both traffic and a flood defence will stay at least the coming decades. In order to answer these questions five other situations with similar problems have been studied to find out how routes, public spaces and height and traffic barriers relate to each other and in what hierarchy. Some cases might be of another scale, but it the goal is to find general principles.



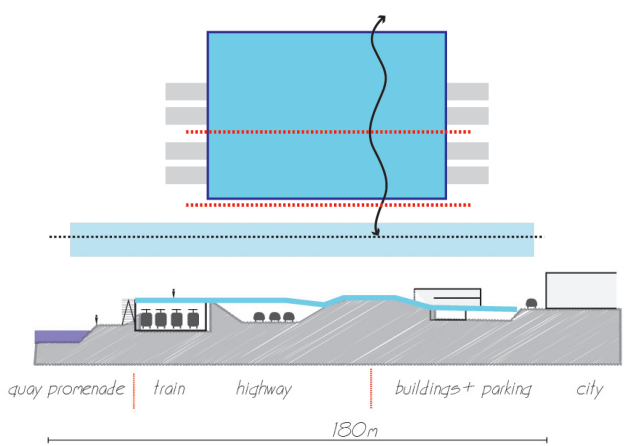
106. All schematic sections and schemes in this paragraph are made by the author, 2013



107. Current situation of the Brielse Kades, original photo via maps.google.nl, adjusted by the author, 2013

Olympic Sculpture Park, Seattle

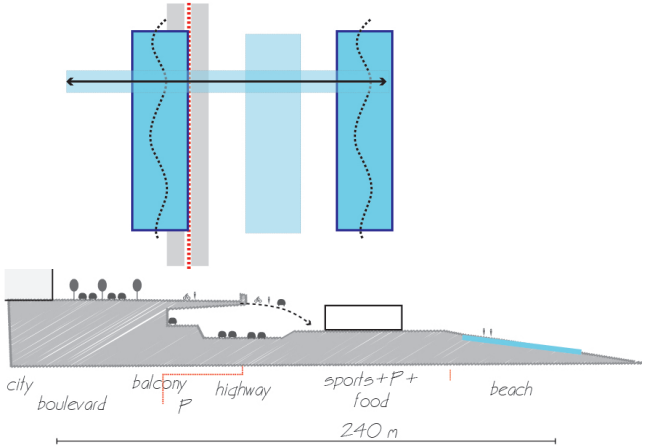
In this case the public space is a sort of snake folded over the diverse barriers. Although it doesn't cover them completely and there are only some crossing possibilities, it makes the impression to be one continuous space that works like a lid on top of the infrastructure. This happens because of its strong forms, unified materialization and sharp lines. This public space carries the main slow traffic route from the city towards the quays and public space and main route become one thing.



108. Olympic sculpture Pak Seattle, design by Weissmqn/fredi, 2007, via http://www.weissmanfredi.com

Ronda del Littoral, Barcelona

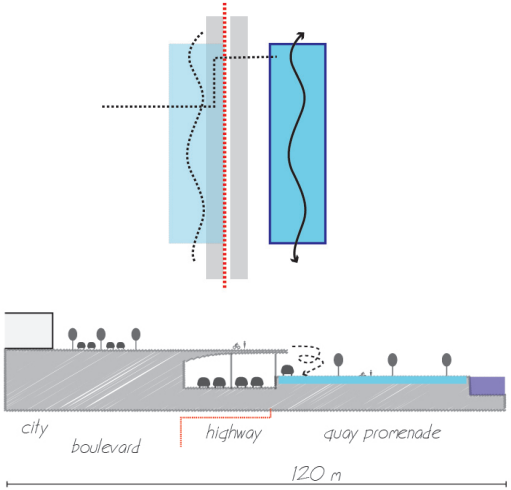
Here the different barriers ares spread out. The main slow traffic route between city and beach does not coincide with the main public spaces, but only crosses and connects them. Slow traffic along the main route is combined with some car traffic but is made as easy and smooth as possible. The two main public spaces are linear and facilitating both through fare and static activities. The height difference is used to create a balcony and to provide a view over the bay, hiding the highway and giving the serving public space in the middle less visual attention. The rather intense traffic at the boulevard is broken down in steps which makes it physically and psychologically easier to cross.



109. Rotonda del litoral, Barcelona, author unknown, via google.com

Mol da Fusta, Barcelona

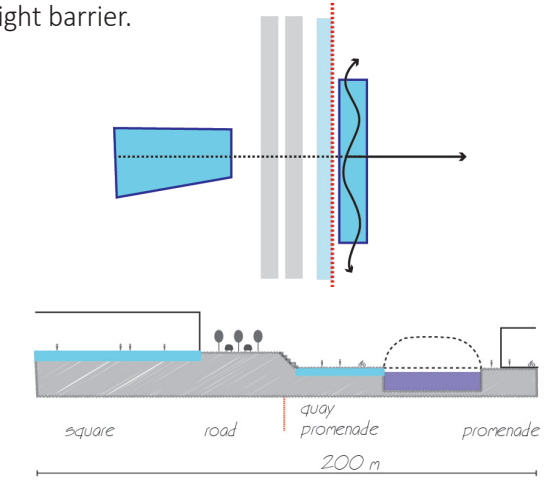
Here the balcony principle is similar to the Ronda del Littoral but more condensed. Nevertheless the balcony itself is more a sober materialised serving space while the lower public space is the main space for through fare and static activities and also materialised as such. The connection between the levels has less priority than in the Ronda del Littoral, is more difficult to take and is located outside of the main axes. Nevertheless to catch attention it is painted in red.



110. Mol da Fusta, Barcelona, Sigit Kusumawijaya, via http://sigitkusumawijaya.blogspot.nl

Magdenburger Hafen, Hamburg

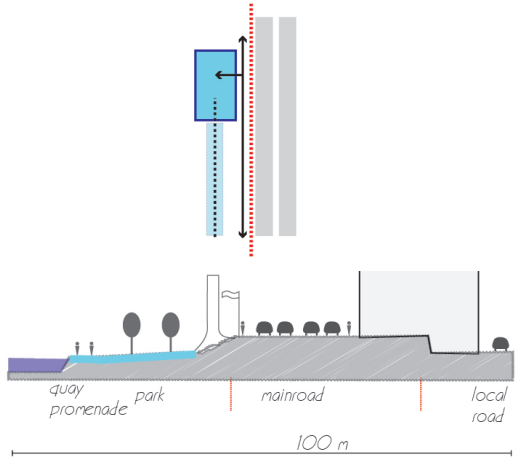
Before there were cars going over the bridge and straight up towards the road. Now the height difference is made more abrupt and the relation between the higher and lower level changed. The lower quays became more important and from the main route over the bridge the main pedestrian directions go left and right and people stay longer at the lower level close to the water. The square at the opposite side of the road is a completely different, more enclosed space, only connected via a secondary route via stairs and a road crossing. The stairs are made quite monumental to try to upgrade the secondary direction a bit to invite people to cross the height barrier.



111. Magdenburger Hafen, Hambug, HafenCity Hamburg GmbH, via hafencity.com

Leuvenhoofd, Rotterdam

Here the height difference is crossed by stairs on one side and by a large building on the other. The building separates more than it connects. The Leuvenhoofd square/park is the primary public space at the end of a long quay and is not very well connected to the rest of the city because it is not possible to cross the road here. It is a destination in itself and it is hardly possible to get here accidentally. In that respect it is positive that it is visible from many (outer dike) areas as one of the few green places at the water side. Trees, a monuments and poles make it also a bit more visible from the inner dike area.



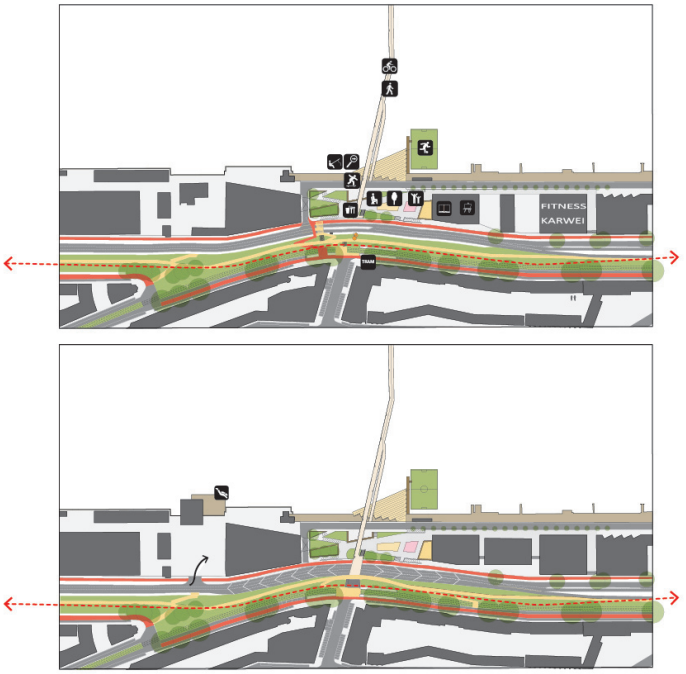
112. Leuvenhoofd in Rotterdam, designed by Piet Oudolf, www.oudolf.com

The main purpose of the bridge was to connect Katendrecht and the Tarwewijk and to join two loose ends of an already existing slow traffic route. If you look along this new projected slow traffic route, there are all sorts of different and unique neighbourhood public spaces that are thread together by the route. From these small public space other, smaller routes go into the neighbourhoods.

To optimise the connection the route should thus get priority here, and not connect Katendrecht with the quays on the opposite side only, but in first place with the area behind the dike. This should be made as easy a possible as in the Rotonda del Littoral case. The balcony solution of the Mol da Fusta would also be working here, as long as the bridge would directly attach to the higher level. Nevertheless, a real balcony should go all the way up to the buildings and into the neighbourhood to prevent a second barrier to arise. This solution is not chosen because it would be an enormous investment and would mean the replacement of many current shops and houses.

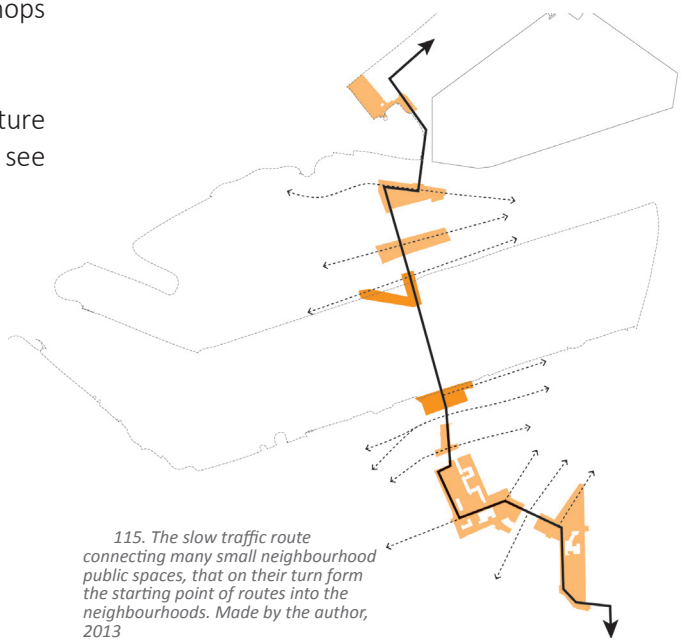
By keeping the bridge at the same height as the future flood defence, people walking or cycling on it can see (until after 2026) and later go directly into the Tarwewijk or left and right along the Brielselaan over the ridge of the dike. The Brielsekade square now already is and stays a separate public space with its own character, and becomes one of the beads on the main thread.

The square itself is well visible and reachable from the bridge and functions as starting point to continue your way along the quays. Going straight is nevertheless easier and going down to continue along the quays really is a decision.
To make the new Brielsekades visible and attractive for residents from the Tarwewijk, visual elements like at the Leuvehoofd can be used. Besides the bridge itself, this could be artwork or trees in an earlier stage. Also when designing stairs or ramps with a little more ardour, as is done at the Magdenburger Hafen, people might more easily take a look what's on the other side. Besides these design elements, attractive program would help to pursue people to take a look at the others side.

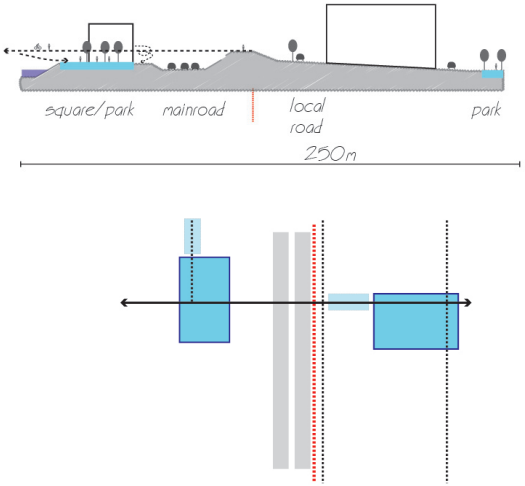


113. Schematic representation of the new design before and after the connection of the bridge towards the Tawewijk. Made by the author, 2013

114. The slow traffic route in the wider Rotterdam context. Made by the author, 2013



115. The slow traffic route connecting many small neighbourhood public spaces, that on their turn form the starting point of routes into the neighbourhoods. Made by the author, 2013



116. The new design represented with the same legend units as the comparative analysis on the last pages. Made by the author, 2013

5.5.3 Conclusions on sub-research question 1: Good public space

What criteria for successful public space are important to transform the Maashaven into a binding element in the public space network of Rotterdam South?

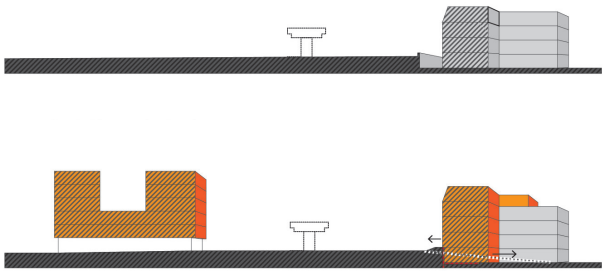
It is important to improve and to create new accesses to the quays and to provide a few strategically situated public spaces along these routes were people want to slow down or deliberately go to. The design improves the anchorage of the Maashaven in the city- and neighbourhood network by new routes and strengthens the psychological accessibility by using sight lines and landmarks. For identity building, natural processes and (industrial)heritage are exploited and together with some new functions that are attractive for different user groups like community gardens, personal attachment of people to this area is stimulated.

Two small public spaces are designed in detail at the edge of water and land. Nevertheless more abstract suggestions are done in the design about the type movement spaces and openness and enclosure of other public spaces as was found important from the theoretical backgrounds. The contrast between public spaces inside the new neighbourhood at Katendrecht and the modesty sized but open and unenclosed Katendrechtse Strand shows for example the importance of scale and concentration of people in the redesign of the visually very large Maashaven.

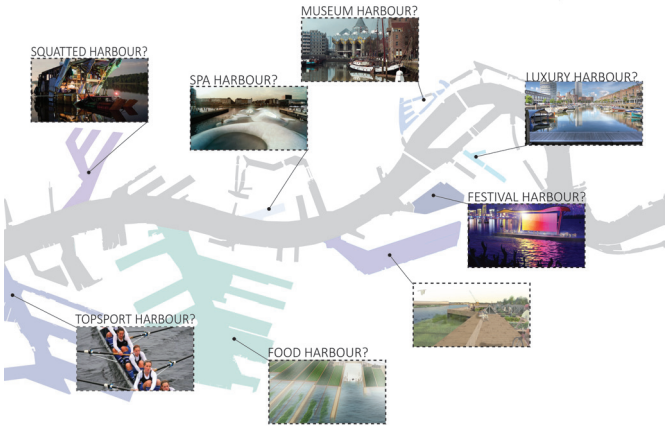
On the smallest scale spaces were created where people can comfortably stay while enjoying the positive aspects of climate. These spaces, and the way in which the dynamics and nature of the river is shown is inspired by the preferences of the main target groups. Although spaces reach out to water, the characteristic linearity of the quays and the wholeness of the basin are not violated.

5.6 City and River

Sub- RQ 2 in the design: How does the design change the relation between city and river?



117. Section A before and after, showing how to repair the distorted relation and the new relation between neighbourhoods and the city ring. Part of intervention 2. Made by the author, 2012



118. Possible new functions for diverse harbours. Made by the author, 2012

5.6.1 The river seen from within the city

To show how the design alters the relation between city and river the analogy of micro, meso and macro scale of Soledad Garcia Ferrari et al. (2012) from the theory chapter is used.

On micro scale, handling on building and neighbourhood level, the design focuses on repairing the city in the first place. This practically means removing barriers, restoring and enhancing sight lines and improving accessibility, such that the harbour and the river become better integrated in peoples 'mental map'. The Brielsekades intervention especially shows how the design tries to improve accessibility, both physically and psychologically. At the Katendrechtse strand reparations the urban fabric such that the flood defence is becomes better integrated are proposed (fig. 117), and special attention is paid to sightliness and landmarks.

The nonphysical part of place making on the micro scale comprises the mix of recreational functions for different user groups. By offering all existing and desired residents the possibility to use the Maashaven and its quays on daily or weekly basis, it becomes part of their daily life again like it was when the majority of the people worked here. In those days they were depending on it for both financial but also social reasons. The area won't be able to offer employment on such a large scale again, but absolutely creates some new business opportunities.

The relation on meso scale also has to do with the functionality of the harbour basin. On the city or regional scale the Maashaven could become known for its unique leisure programme. At the mouth of the harbour this is done by Speelstad, SS-Rotterdam and Pirate Wharf that are clustered together at the Maastunnel entrance and are visible from far. At the other side, along the Maashaven Oostzijde the first urban floating park can be a strong branding image and thus get a wider meaning than only being a local green space.

Of course not every harbour in Rotterdam should feature a leisure program and a floating park. This was considered appropriate here because it caters to the local difficulties. Nevertheless the idea of assigning a new function with value for the city to every harbour can be extracted from this. Instead of being known as coal harbour, fruit processing harbour, wood harbour or grain and flour harbour new functions should be found that can be linked to an identity and a place on peoples mental map. Besides park/leisure harbour a high tech food harbour, festival harbour, museum harbour or top sport harbour are imaginable (fig. 118).
Aspects that are considered as very important in this redevelopment plan are the ecological recovery of inner harbours and the literally and psychologically aerating and de-stressing contrast these open basins offer in the further densifying city. In this respect the river and the inner harbours should become the vital lungs of the Rotterdam agglomeration and the potential

of the river as a diverse and dynamic landscape is very underestimated.

On the macro scale this design stresses mainly the importance of ecological recovery. By applying the found ideas in more inner harbours it could change the Rotterdam agglomeration from bottleneck into a fully functioning link of the ecological system of the delta. The lung function mentioned before could also add to the competitiveness of Rotterdam compared to other cities and the more rural sites, where many families and middle class couples flee to now.

5.6.2 The city seen from the river

The redevelopment plan suggests that more and more (public) transport will take place over water in the future. When this happens not only every harbour should be distinctive for the inhabitants and visitors of Rotterdam, but neighbourhoods and resident groups can also express themselves more towards the river. With all those inner harbours, Rotterdam possesses an enormous stretch of embankments can be used as advertisement space (within certain planing regulations). Being located at or close by the river gives the opportunity to create a public visage and to attract customers and visitors. This goes for the two interventions designed in this thesis, but also for companies such as Speelstad, who can not only create a recognisable corporate image but also use the river for the largest part of their visitors flow, avoiding congestion or expansion of the current car based infrastructure.

119. The river as the lung of the densifying city. Made by the author, 2013

5.6.3 Conclusions on sub-research question 2: City and River

How did the relation between city and river develop over time and how can this relation be strengthened?

The most vibrant part of the city shifted from on top of the dike to the outer dike area in the golden ages. In the industrial age the harbours and the river were a place of labour for all inhabitants but slowly industry became less labour intense and started to move westward, leaving behind closed off and rather passive areas. The isolation became even stronger because of the intensification of car traffic arteries and the flood defence heightening after 1953. This made the workers neighbourhoods physically and psychologically disconnected from the river. Since the '90s a slow reclamation started but failed to bring back the vibrancy to the harbours.

The design changes the relation on micro, meso and macro scale. This is done by respectively:

- Solving barriers and repairing the urban fabric, improving accessibility and making people familiar with the nature of the river (micro);
- Providing a new unique function that makes that neighbours and citizens have a reason to go here in their daily or weekly pattern again and proposing a new role for the river as open and green lung for the densifying city (meso).
- Using the river and its basins as positive allocation factor in the combat for middle and higher class residents and taking away the ecological bottleneck in the complete system of the delta (maro).

In addition the design suggests to use the river more actively as approaching route and to see the city more from the river by giving every neighbourhood an adress at the riverside.

5.7 Re-programming the Maashaven

Sub- RQ 3 in the design: How does the design deal with the different spatial claims?

120. IJburg, Amsterdam. Source: Palmbout Urban Landscapes,derrived form lecture History and Theory TU Delft, 2010

121. Stadstuinen, Rotterdam. Source: Jacco van Giessen via www.jacco.org

122. Floating footbal pitch, Darling Harbour, Sidney. Source: www.whatson.cityofsydney.nsw.gov.au

5.7.1 Spatial claim 1: Analysing the objectives behind floating neighbourhoods and possibilities to incorporate other floating structures into the design

Objectives behind floating neighbourhoods

The main reasons for living on the water, according to Nillesen and Singelenberg (2011) are the tranquillity and beautiful vistas from the consumer's viewpoint and the possibility of combining water storage and dwellings for developers. This last argument is less valid in the urban context of the Maashaven where the body of water already exists and vacant building sites are available in the direct surrounding. This is in contrast with more rural polder locations which are under pressure of urbanisation and extra water storage like in the Zuidplaspolder. These locations allay better that the Maashaven with the conclusions form the 'SEV Consumer survey living on water' (Goetgeluk et al., 2011) which shows that the main user group interested in floating dwellings prefers to live in a suburban or rural setting. Trying to attract this type of dwellers with semi-suburban floating neighbourhoods in the city centre of Rotterdam seems therefore to be forced.

The qualities of having wide vista's, the experience of open space, seeing movement and the play of light on the water is also present in land-based dwellings close to a body of water without actually 'consuming' it for private use. The demand for living next to the water becomes apparent in the popularity of new neighbourhoods as IJburg in Amsterdam Stadstuinen in Rotterdam. They attract urban starters and 'urban families' (Jager, 2012) who are strongly desired by the municipality in order to gentrify the area around the Maashaven (dS+V and OBR, 2007). In this respect it is better to not fill the former harbour basins with floating dwellings but to exploit the quays and the contrast between open and build up space to the maximum.

Inland ships as floating community

There currently are 106 mooring places for inland ships at the Maashaven (see appendix C). These inland ships cause some noise nuisance but the general experience of the neighbours is positive. The always changing configuration of ships causes a dynamic and interesting sight. The inhabitants argue that the ships are the very first form of floating dwellings and that they are characteristic for the area. The shippers themselves are afraid to be moved away from the city centre and its facilities step by step.

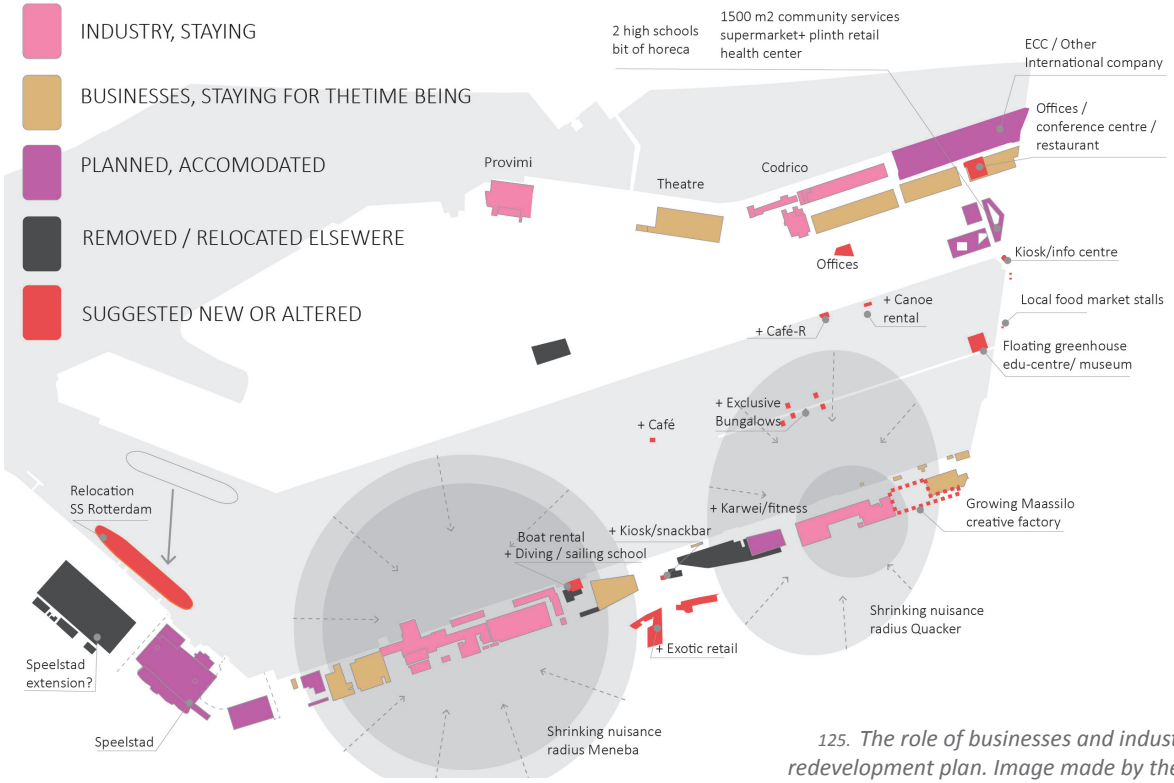
Other floating functions

The above mentioned reasons for not filling the Maashaven with floating dwellings does not mean there cannot be any floating function located in the Maashaven. If the publicness, water transport related dynamics, openness and experience of the body of water as large surface are maintained, some floating buildings can even enhance the publicness of the inner harbour and invite different user groups to meet and mix in this area. In the design, a floating greenhouse, swimming pool and football field offer visitors and local residents another perspective on the harbour and the surrounding city. A few floating bungalows or hotel suites located in the more quiet part of the floating park also attract

people to the area . As long as the length of stay is limited and the visitors are diverse, these floating buildings do no privatise but rather advertise it among the public. Besides, the floating bungalows can also be part of the bsiness model.

5.7.2 Spatial Claim 2: Businesses and Industry

There are some factories that will stay in the area because they have very long or even endless contracts such as Meneba, Codrico, Provimi and Quacker. Every year the safety and nuisance regulations are sharpened and large improvements already have been made. Nevertheless, the municipality should work together with these companies to reduce nuisance further such that when the economic situation improves, redevelopment of the quays next to these companies is possible. Besides negative effects, these companies also provide jobs. There are some other existing businesses that are kept in place as long as they function well and provide a bit of liveliness to the quays, such as the business centre next to the Brielsekades intervention. For businesses as the creative factory in the Maassilo and in the near future Speelstad, the possibility to grow further are foreseen in the design and they can attract new user groups and new residents to the area. The inferior businesses like low quality metalworking will be relocated to other harbour areas that develop later because they hardly add quality to the area and these are the locations that could be developed first. In the redevelopment plan there are no very large new businesses or industries suggested, but merely smaller retail or commercial activities because in the current market there already are a lot of problems with the larger scale investments such as the European China Centre (EEC). Besides, the proposed new activities should be as much as possible linked to people from the neighbourhood and local entrepreneurs. Historical or new qualities brought by the new redevelopment plan could be an impulse for these new businesses. Examples are the beautiful Santos building, the better reachability of the retail at the Tarwewijk or the scenic location of some floating bungalows.



125. The role of businesses and industry proposed in the redevelopment plan. Image made by the author, 2012

123. Badeschiff, Berlin. Source: Arena Berlin via www.arena-berlin.de

124. Floating Greenhouse, Naaldwijk. Source: Dura Vermeer B.V. via www.promise.klimaatvoorruimte.nl

5.7.3 Spatial Claim 3: Ecological recovery

Pitfalls for the ecological recovery of the Maashaven

There are two possible pitfalls that could be in the way of the ecological development of the Maashaven. One of them is the pumping station at the Maashaven Oostzijde which pumps about 540-1080m3 polluted rainwater into the Maashaven every day (Rienks, 2013), but has a maximum capacity of about 50m3/min. (72000m3/day) for peak discharges (Plender, 2010). The average daily disposal might even grow larger if the Parkstad developments in the catchment area of this pumping station are finished because it increases the paved area. Also the planned developments on Katendrecht will increase the runoff rainwater that flows towards the Maashaven. Rainwater itself is relatively clean, but as soon as it runs off roofs and streets before it enters the surface water system, it collects pollution. 'Ecologically unhealthy' contents are larger waste particles, nutrients like nitrogen (N) and phosphorus (P), metals and all kinds of bacteria like E-coli (Kampf and Boomen, 2013).

This problem was discovered in one of the earlier graduation projects on this area by Plender (2010). He designed a purification system to clean the water in order to be able to use it via an inlet at the Brielselaan, for the Zuiderpark area again. The need to create a clean inlet stream of water has expired with the construction of the Blue Connection(Blauwe Verbinding) which will provide the Zuiderpark area with clean water from the polder district south of Rotterdam. Nevertheless, still the constant stream of polluted water entering the Maashaven in the least dynamic part of the harbour is negative for the ecological recovery.

A second drawback would be the movement of inland ships, their engines and wastewater in this harbour.

Expert meetings on water/ecology issues

To get better grip on the seriousness of the problems, possible solutions and helpful technologies that are adding to both the ecological and recreational value, experts were interviewed.

These interviews led to some practical conclusions:

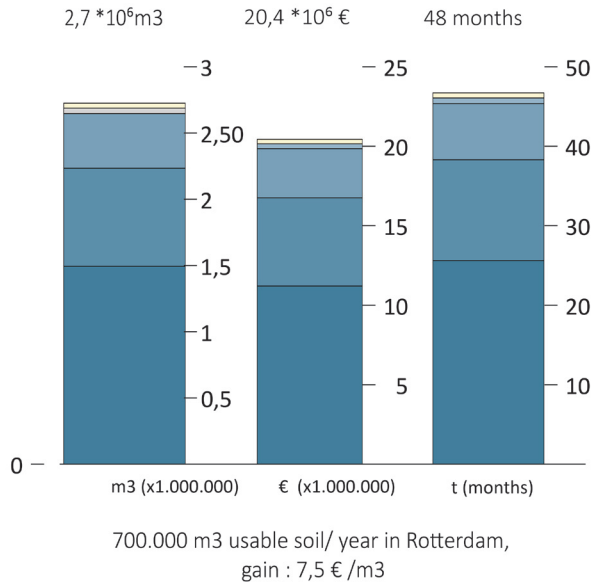
- Inland shipping can coexist with ecological developments as long as enough distance is kept or a kind of peaceful corridor is created.
- Swimming in the Meuse harbour isn't yet possible due to regulations and responsibilities of the authorities for public health. This is mainly due to the bacteria like E-Coli from animal faecal in urban runoff water. Swimming water is not tested on phosphorous, nitrogen or heavy metals. Natural purification systems like helophyte filters show better and better results on also decreasing concentrations of these dangerous bacteria and the Waterharmonica system is especially known for this.
- Ponds of maximum 30 centimetres deep like applied at the Westergasfabriek park in Amsterdam are possible under current regulations.
- For new urban neighbourhoods, wadi filter systems become more and more common, which do not burden the sewage system or surface water system so much.
- The size of traditional helophyte filter systems can be drastically declined if a deposit basin and water flee treatment basins are added to the system. Urban examples are already available. The necessary size for rainwater purification in this area is about 1-3 hectares.

- Nutrient rich water is often perfect for agriculture or aquaculture because normally horticulturists have to add these relatively valuable nutrients to irrigation water themselves.
- Shallowing is until now only done up to a base-depth of about 4,65 metres, but could be more extreme depending on the kind of ships that need to make use of the basin. This shallowing is usually carried out in layers.
- The return of the salmon and trout are very ambitious. Smaller and less demanding types like the twait shad (‘flint’) are more realistic and are at the basis of food chains for other animals like larger fish and birds.

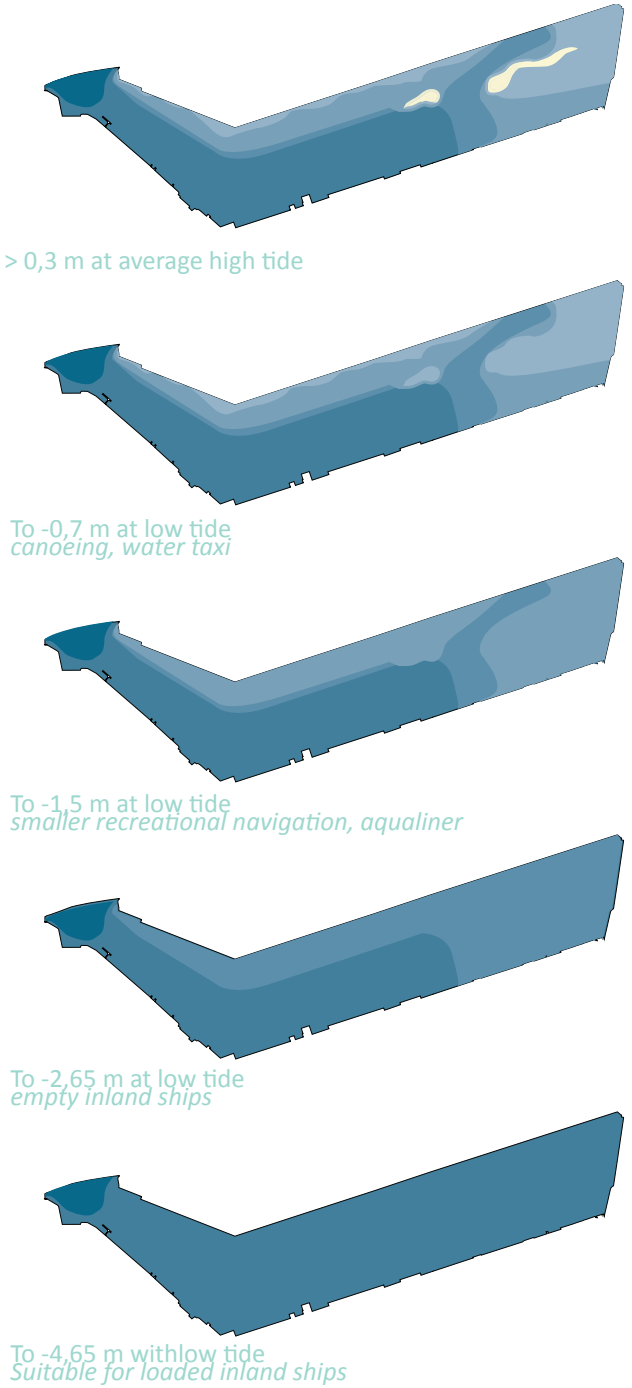
A more detailed report on these meetings can be found in appendix D.

Shallowing the Maashaven in steps

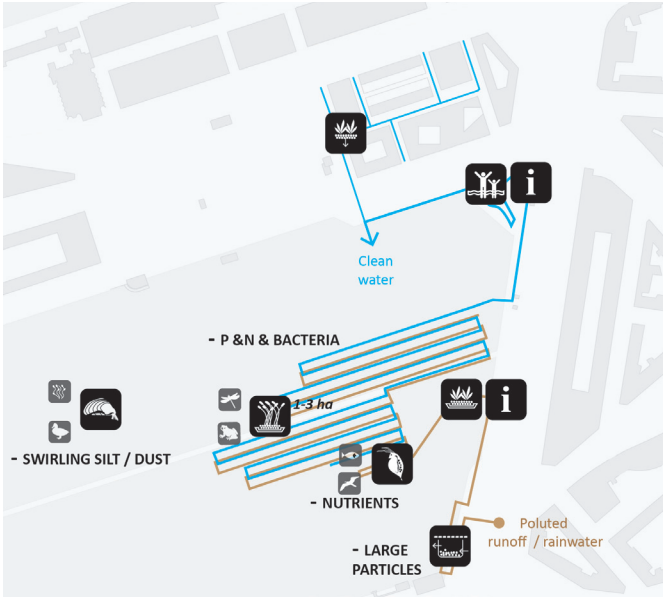
In the redevelopment plan large differences in depth are proposed. This shallowing is not carried out all at once, because per year only about 700.000 m3 usable soil becomes available, depending on the amount of building and dredging activities in the area (Sundermeijer, 2013). Per m3 the costs saved for transportation and storage are about 7,5 € (Koetsier, 2012). In the diagrams on the right is shown which steps are made, how long this would take and how much money could be saved that could be invested in the new bridge. These are all very rough estimations. If executed this would have to be verified by experts. As a comparison, the Rijnhaven bridge costs about 10 million euro (Weg, 2013).



126. Estimation of the amount of soil needed, amount of money saved, en the amount of months at least required, Image by the author, 2013



127. (Right) different steps in the shallowing of the harbour and type of ships in line with this depth. Image by the author, 2013



Steps in the water system

- Zebra Mussel
- Wadi system
- Greenhouse
- Helophyte filter
- Water flea
- Deposit basin
- Playing pond
- Info point

Side benefits

- Fish like shad, smelt, stickle
- Diverse birds
- Insects
- Small amfibian
- Water plants
- Diverse duck species

128. Working principle of the complete water system proposed in this design. Figure by the author, 2013

The helophyte filter and the wadi system

Since much effort is done to stimulate the ecological recovery, it would be a pity to dump filthy runoff water directly into the most shallow part of the harbour where it would do most harm. Therefore two systems are selected to clean this water.

Waterharmonica

The Waterharmonica. In this system the traditional helophyte filter is extended with a basin to grow water flees. This system is chosen because it produces not only clean water but also water flees that are attractive food for diverse fish species that are wanted to come to the harbour. Besides, because of its settlement basin, water flee treatment step and the composition of the flow beds, it is relatively compact and this makes it possible to reduce the in 2010 proposed system by Plender for the maashaven form 17 ha to 1-3 ha (Boogaard, 2013). In regard to swimming water, this system showed very good results in filtering out the most harmful bacteria (Kampf and van den Boomen, 2013).

First the water flow is lead through a basin underneath the new water hub where large particles and silt sink. Secondly the nutritious water is pumped through a basin where water flees feed themselves with algae formed in the nutrient rich water. Water flees have to be harvested every now and then, but are not harmful for humans. The water flees also eat bacteria like the E-coli bacteria (Kampf and Boomen, 2013). The pre-filtered water is lead through a floating helophyte filter of the flow-bed principle in which the water is cleaned while it flows horizontally through a layered bed on which reed grows. This system is relatively expensive but it can be best built on floating isles, and with addition of a lavastone bed it is relatively efficient (Plender, 2010). The helophyte filter removes further nutrients, bacteria and metals. Besides purifying water, helophyte filters attract small amphibian and insects and they can form an attractive recreational landscape featuring plants like meadowsweet, cat's-tail and types of lilies. The water at the end of this chain is nutrient-poor and free of bacteria that are harmful for both human and fish and could be used to fill the playing pond. If the retention time is around 3 days, result that can meet the low concentrations necessary for outdoor swimming water (Kampf and van den Boomen, 2013).

Between the deposit basin and the helophyte filter, the floating greenhouse becomes part of the system, because the nutritious water can be very well used for growing plants.

With the current regulation it is not yet possible to declare Meuse water suitable for swimming, even if the quality improves a lot (Ouboter, 2013). For playing ponds up to 30cm deep like applied at the Westergasfabriek Park in Amsterdam regulations are less strict. Nevertheless a future in which public bathing facilities like they were present up to far into the 20th century for harbour workers (Gemeentewerken Rotterdam, year unknown) return to Rotterdam would be a nice goal on the horizon.

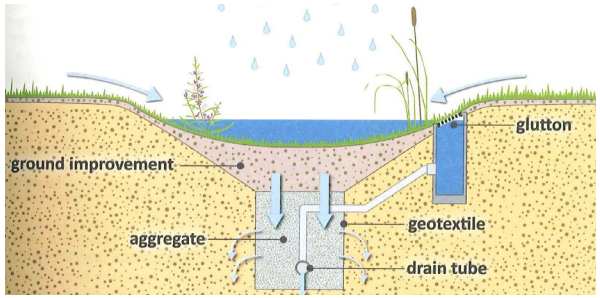
Even more improvement of water quality in the harbour can be achieved by providing hard substrate to grow zebra mussels under the water level. These mussels filter the water from swirling silt and dust, which make it easier for water plants to grow. These mussels and the water plants are on their turn food for rare types of ducks and fishes (Rijkswaterstaat Dienst Zuid-Holland, 2008).

The Wadi system

For the filtering of the runoff water from the new neighbourhood, a wadi system is chosen (fig. 129) because it is a visible way of collecting and purifying water throughout a neighbourhood. It can be executed in long and relatively narrow stretches which makes it usable in streets. The total the surface should be approximately 5% of the runoff surface of roofs and streets (Rombout et al., 2007). The wadi's in this neighbourhood can provide the public greenery as is shown in image 129 and in figure 84.

Three types of floating isles

In the design there are three different floating isles proposed: the floating community gardens, the floating helophyte filters and the floating wetlands. The floating helophyte filters should be based on a stable and secure basis that can carry a relatively high load. Therefore the industrially fabricated Flexbase system is proposed that makes use of large polystyrene blocks with a coating or cloth covering and is used as foundation for floating (green)houses, cultivation floors and bird-isles (Roël, 2013). For the community gardens isles from 'Drijvende Tuinen' are proposed, which also have a polystyrene basis, but these are cheaper and can be made in cooperation with residents (see for examples image 55). The more natural islands further away from shore that do not have to carry humans can be made out of peat or coconut mats with soil and vegetation on top. These can be slowly degrading with time and are rather cheap.



129. Working principle of a wadi (top) and example of an urban wadi. Both from the book 'Urban Green and Blue Grids' by Potz and Bleuzé opMAAT, 2012, p 90-93

130. (right) Example of a helophyte filter in an urban environment at the Erasmurgracht in Amsterdam, designed by opMAAT. Image via opMaat.info

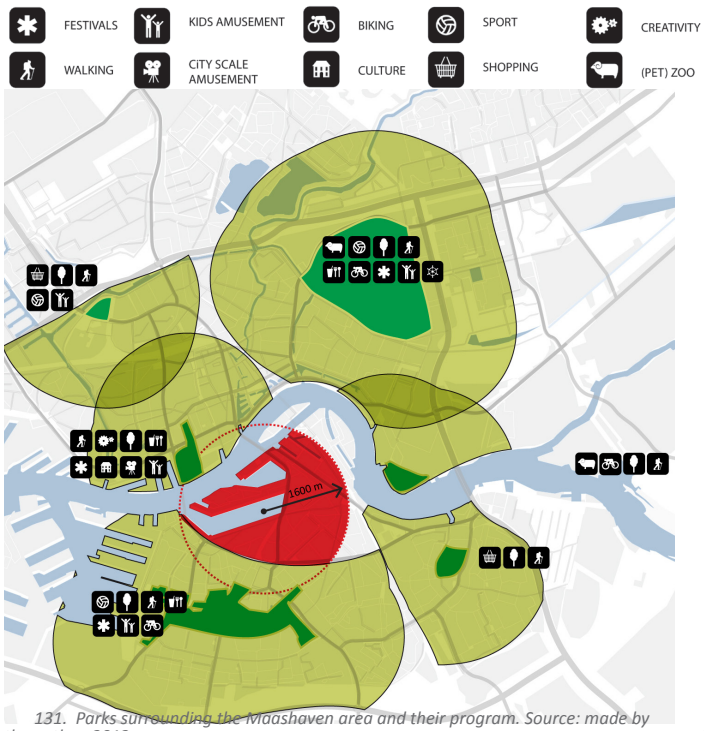
5.7.4 Spatial claim 4: Public use and Leisure

The Maashaven should be attractive for both residents from the surrounding neighbourhoods as well as for people from the rest of Rotterdam.

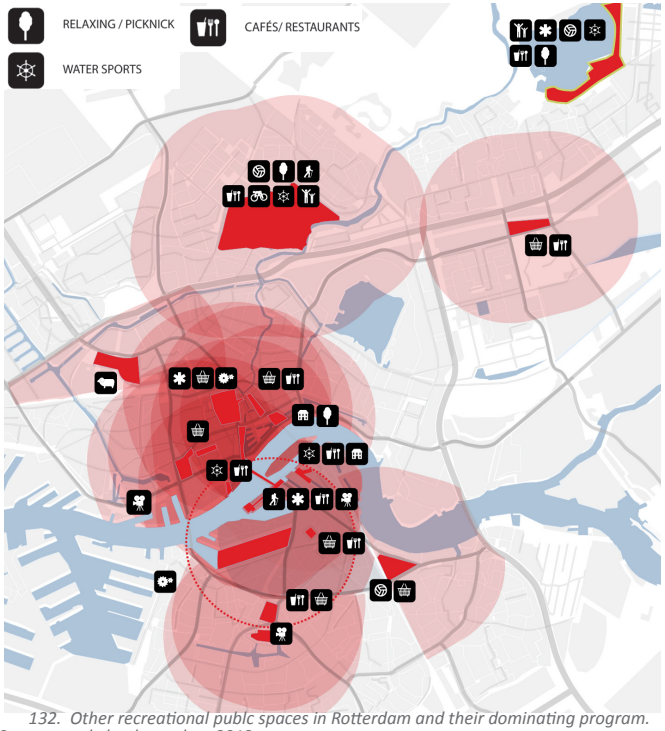
A unique program for the Maashaven in Rotterdam as a whole

In figure 131 and 132 most leisure functions in the surrounding parks and other larger public spaces are pointed out. It shows that in the direct surrounding for example shopping and festival terrains are already present. This makes these functions less suitable for the Maashaven, unless they specifically connected with unique aspects of the Maashaven or target a niche market. Spaces to relax and to pick nick which are known on city scale, like the Kralingse Plas, are not yet very present in the surrounding of the Maashaven, and neither are sports, kids amusement, creative functions and petting zoos. Also amusement on city scale could be very well possible here. Nevertheless the concrete plans to create a kind of amusement park (Speelstad) at the former waste treatment company close to the Maastunnel, will facilitate this on an organised basis, leaving only possibilities for small scale playing facilities. Functions that are more or less omnipresent but have a lower reach and thus can coexist more easily are cafes and restaurants, walking and cycling. A special remark has to be made about water sports. Although there are several places where people can moor their recreational boat (Veerhaven and Entrepothaven), the capacity is restricted and there are no sailing, diving or canoeing schools or boat rental places near by at Rotterdam South.

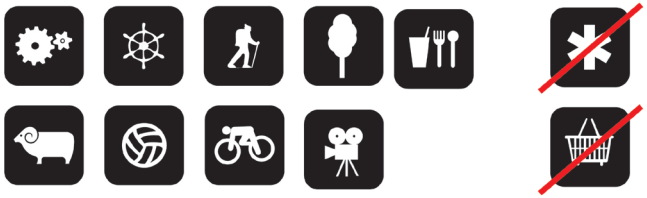
The Maashaven could thus be unique on city scale by offering a park-like landscape strongly connected with the water, having places to sit and picnic, offering possibilities to practice water sports other than only mooring a recreational boat, sports and kids amusement. Although shopping is not very attractive here, people who go shopping at for example the Afrikaandermarket could be attracted to lengthen their stay in the area by offering them a place to sit and enjoy the weather and views. These functions could be supported by relatively omnipresent functions as cafés and restaurants and good walking and cycling routes.



131. Parks surrounding the Maashaven area and their program. Source: made by the author, 2012



132. Other recreational public spaces in Rotterdam and their dominating program. Source: made by the author, 2012



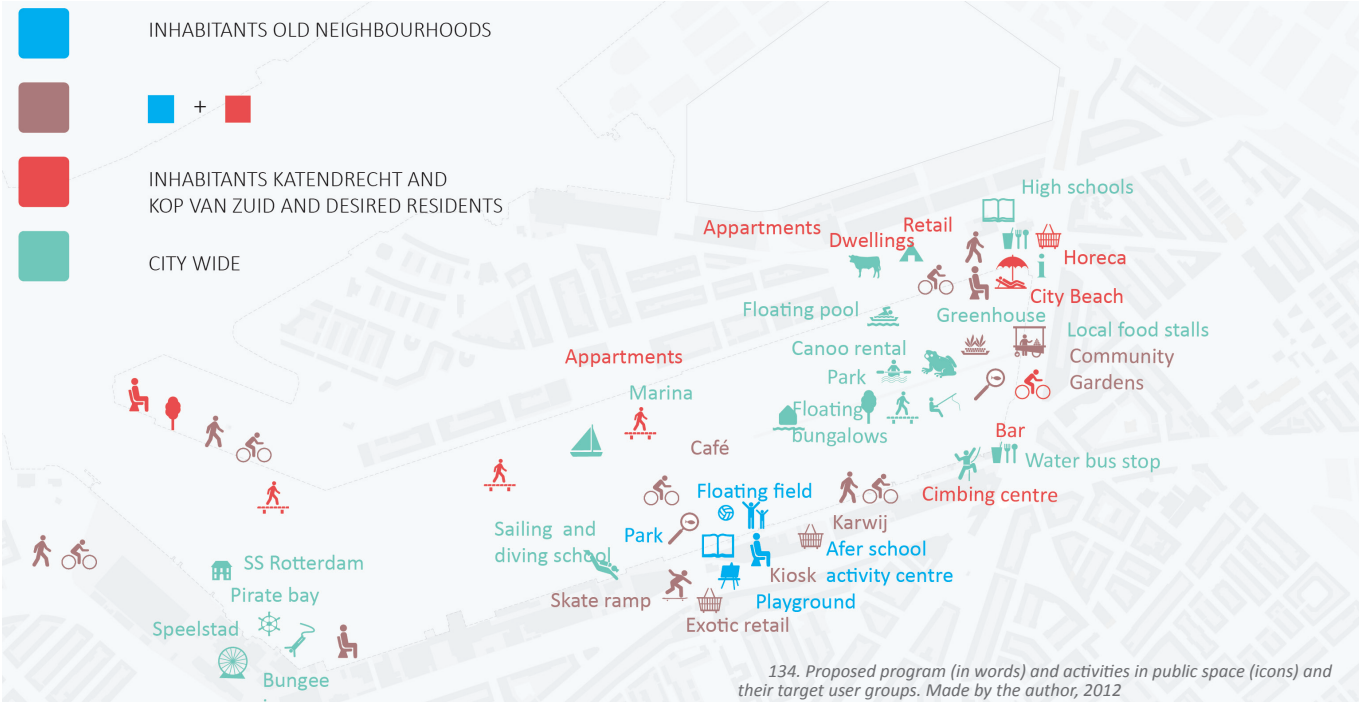
133. Possible functions derrived from analysing the surrounding public spaces. Source: made by the author, 2012

Programming the Maashaven for the neighbourhood scale

In chapter 3 there are three groups of residents defined and analysed concerning their preferences for leisure and recreational activities: current inhabitants of Katendrecht and the Kop van Zuid, current residents of the old neighbourhoods south of the Maashaven, and residents that should be attracted. Most new program and how it relates to the user groups is already explained in the redevelopment plan or one of the strategic interventions. Figure 134 shows in addition the complete proposed new program, activities in public space and the target groups.

Also in the spatial design of the public space certain user group specific things are taken into account. A few examples are given below:

- The Katendrechtse Strand is designed more as an arena, or stage facilitating promenading, sunbathing and watching other people. The public space at the Brielsekades also has sitting facilities, both on edges and benches but many of these are directed towards the kids playgrounds and give small groups of mothers the opportunity to sit together and talk while their children play.
- At the Katendrechtse strand there are more facilities to really touch the water or to step into a boat and at the Brielsekades the water is reached via solid and stable stairs and swimming and boating has less priority since people living close by might have less affinity with water related activities.
- The greenery at the Katendrechtse strand side is kept relatively rough and natural which forms a contrast with the new and tidy buildings and public space here. At the Brielsekades the greenery is more tidy and framed, since one of the main complaints about the rest of the greenery in the neighbourhoods is that it is neglected and meaningless and perceived as unsafe (Boelhouwers et al., 2011).
- At the Maassilo functions that attract young and creative people who organise themselves in the public space like a bar and a climbing wall are planned, while at the Brielsekades a community centre where after school activities are organised should attract migrant children who are often dependant on these organisations for social activities.



134. Proposed program (in words) and activities in public space (icons) and their target user groups. Made by the author, 2012

5.7.5 Conclusions on sub-research question 3: Reprogramming the Maashaven

What functions can and should be accommodated in the Maashaven area? Does the ambition of the municipality to realise a floating neighbourhood in the Maashaven fit with the aim of the research project?

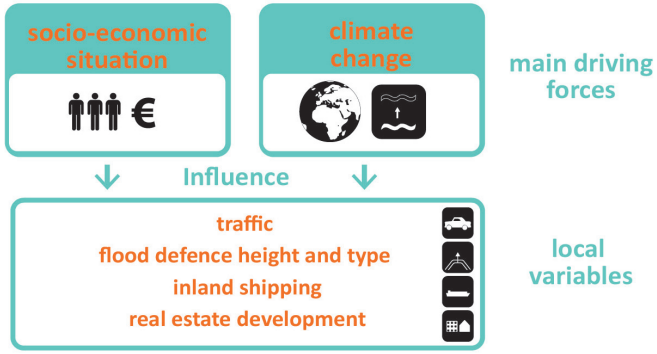
The analysis of other recreational spaces in the surroundings of the Maashaven showed that to be distinctive the Maashaven should feature a park-like landscape that is strongly connected with the water, places to sit and picnic, possibilities to practice water sports other than only mooring a recreational boat, 'normal' sports and kids amusement. To attract all desired user groups the detailed new program was selected and located based on their user group specific and overlapping demands.

The design showed that some industrial use on the quays and inland shipping on the water can be combined with the above mentioned leisure and recreational program. Ecological recovery by shallowing the harbour and applying urban runoff water treatment systems on land and water can be combined with the other spatial claims and even enhances the recreational value and living conditions.

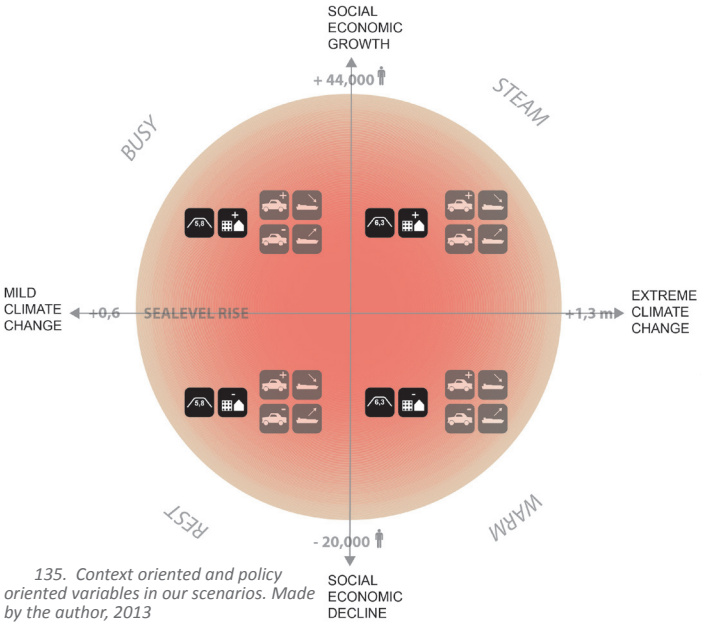
A floating neighbourhood is not suitable for the Maashaven because it privatises the water and therefore takes away the possibility to connect the two disassociated districts. Secondly, it violates the desired contrast between the open landscape and densifying city. Nevertheless, other floating functions that are for temporary use have a very positive effect because they help to make more people acquainted with the harbour.

5.8 Uncertainty

Sub- RQ 4 in the design: How does the design deal with an uncertain future?



136. Main determining aspects and main local variables. Made by the author, 2013



135. Context oriented and policy oriented variables in our scenarios. Made by the author, 2013

5.8.1 All uncertainties in the area

From the urban analysis it showed that here are many factors of influence on the possible development of the Maashaven and its quays:

- The need to realise new housing, leisure and office program.
- The needed height and width of the flood defence.
- The amount of nuisance caused by flooding in the outer dike areas
- The ease with which current companies (big and small) can be relocated.
- The role of the municipality
- Wether the area develops organically or via project development
- The presence or outplacement of the inland ships.
- The amount of traffic that makes use of the Brielselaan.
- The possibilities to improve the ecological value of the Maashaven.
- The possibilities to realise a multifunctional flood defence.

5.8.2 Main driving forces

The main two driving forces in the area which influence all above mentioned factors more or less, are put on the axis of the scenario graph.

On the vertical axis social economic growth and decline is indicated, represented by the amount of extra inhabitants expected for the city of Rotterdam. In nearly all previsions Rotterdam will be growing further. The numbers of +20.000 (Tillie et al., 2012) and +44.000 (De Persgroep Digital, 2012) are shown as reference points. The other extreme (shrinkage) is put on the axis too.

On the horizontal axis two expected sea level rises in 2100 are used. The influence of higher river discharges is also incorporated in the MHW levels (Normative High Water levels) used to quantify the water levels at the site. The expectations about sea level rise are chosen because Wb21-mid (sea level rise of 0,6m in 2100) represents the lowest, and Veerman 2008 (sea level rise of 1,3 m in 2100) the highest generally accepted climate scenario. The Wb21-mid scenario is currently most used by Rijkswaterstaat (Helpdesk Water, 2012) and the Veerman 2008 scenario is often used by the Delta Program as extreme value.

5.8.3 Local variables with the highest spatial impact

The influences with the highest spatial impact in the area are the presence of inland shipping, the amount of traffic on the Brielselaan, the height of the future dike, and the amount of new real estate that can be developed in and around the Maashaven. The spatial claims of these local influences are explained in chapter 3.

5.8.4 Towards a usable set of scenarios

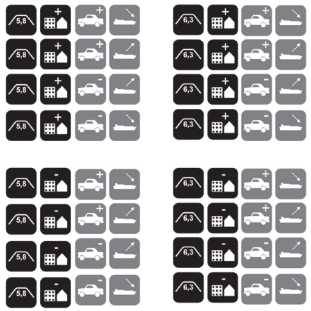
In the scenario graph in figure 135 is shown how the two context dependant variables described in chapter 2 change per quadrant. The policy dependant variables are indicated all in every quadrant. This creates theoretically 16 possible combinations of variables, as is shown in figure 137. Nevertheless, this can be brought down to 6 essentially different scenarios in two steps, which can be used to design with.

(1)

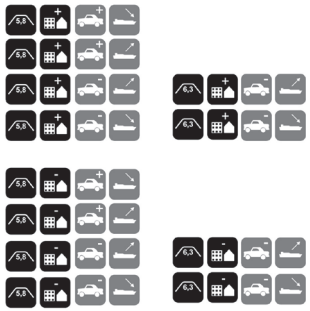
When the traffic pressure goes up or stays the same, it doesn't matter how much the necessary dike heightening needs to be, it would in both ways mean that in all scenarios the traffic has to share space with de dike in the economically low dynamic scenario or that a 'dike in building' becomes an option in economically high dynamic scenario. This is due to the fact that the current narrowest section is already used to the maximum, as is shown in figure 141.

(2)

Among the 12 scenarios that are left, there are scenarios that only differ on the aspect of inland shipping. This is not very much related to the Brielselaan profile. Thus another 6 can be eliminated in order to simplify as long as while designing, both inland shipping options are kept in mind for the bigger picture. See also figures 138 to . These 6 scenarios are schematically drawn in figure 144. Next to the schemes possible sections are drawn to show the differences these scenarios might imply.

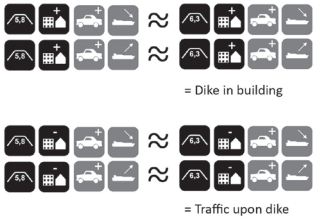


137. 16 possible scenarios.



138. 12 scenarios.

139. Scenarios that only differ on inland shipping.



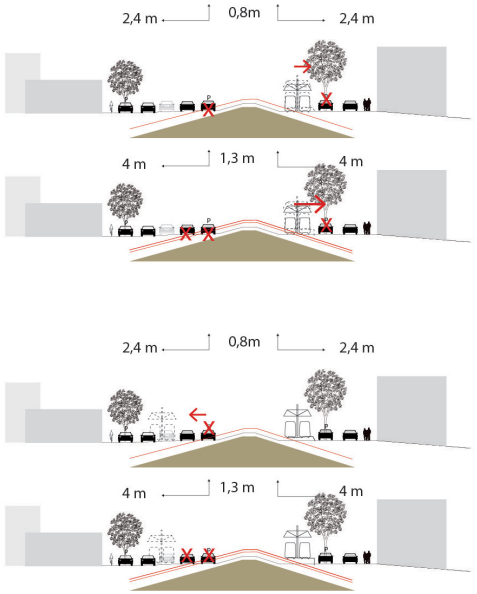
140. When traffic goes up or stays the same, the effects on the brielselaan profile are comparable.

Current or upscaling

With both new dike heighs and the same traffic or more, keeping traffic next to the dike would mean unacceptable profiles in which trees and parking strips would have to disappear

Downscaling (central reservation removed)

With less trafic the traffic can be accomodated in a similar profile as currently. The tram would have to move to the left side (requiring an extra crossing over the dike later on) or be placed on a higher basis.



141. The narrowest section of the Brielselaan. Made by the author, 2013

A flood barrier in building / tunnel

B downscalen
current profile / flood barrier
in building / tunnel

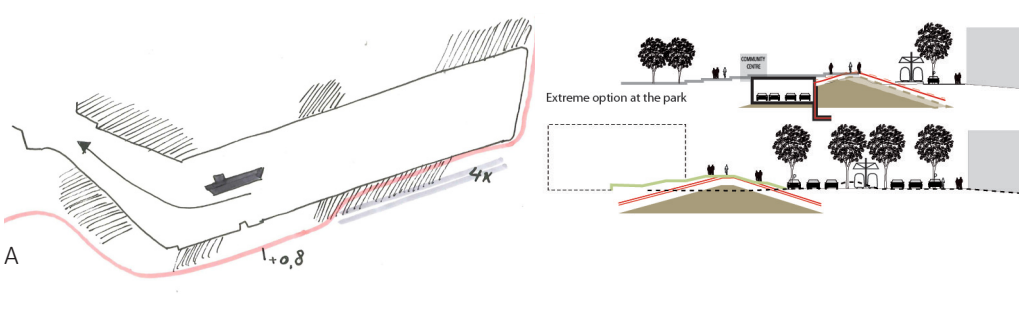
C traffic on dike

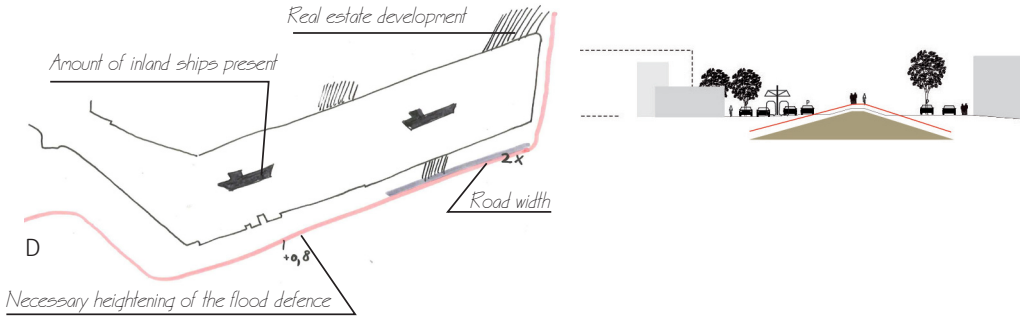
D downscalen
current profile

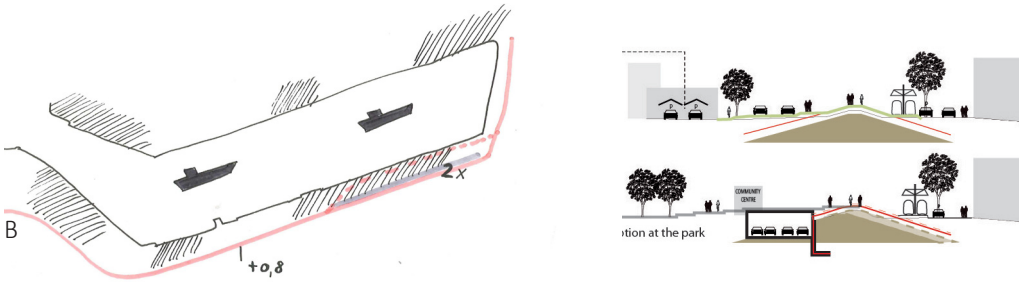
E downscalen
current profile / flood barrier
in building / tunnel

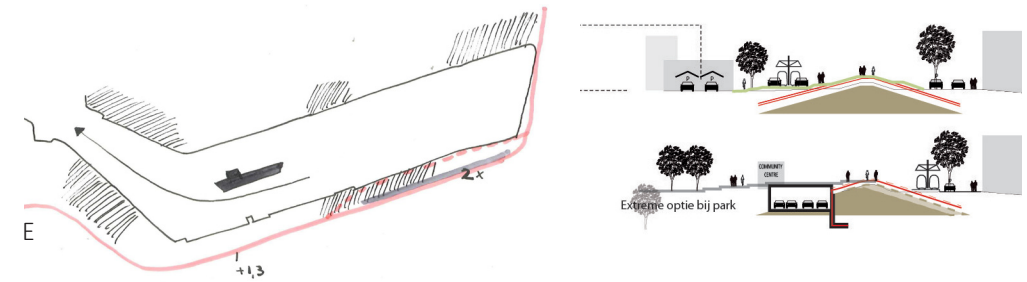
F downscalen
traffic on dike

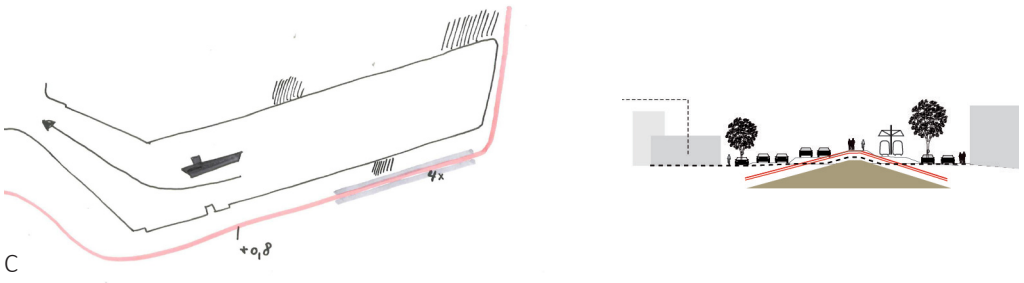
142. The six essentially different scenarios schematicalky drawn and some possible sections to show the different consequences on the Brielselaan. Made by the author, 2013

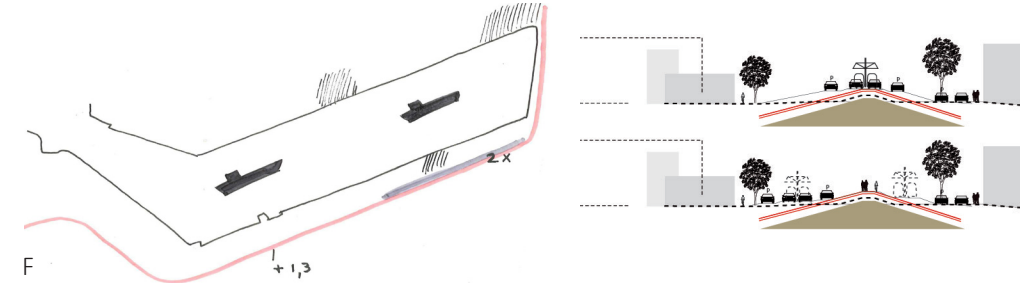












5.8.5 The overlap model

If the different scenario's are put in overlay, a map like in figure 143 can be created. In this map the darker areas are more likely to develop because they occur in more than one scenario.

From the analysis it showed that there are several locations essential for the urban assignment (see also § 5.2.4, Redevelopment plan). The two locations for the design interventions were chosen because they are both important for the urban assignment and these two together offer the possibility to show most aspects of the redevelopment plan in detail. At the same time they are different from each other concerning the scenario study.

The location at the Maashaven Oostzijde (Intervention Katendrechtse strand) is one of the first and most sure to develop, as shows from the overlap model. It is also the location where a possible shallowing of the Maashaven becomes tangible first and therefore a showcase how to use the water differently and how to reinvent the relation between river and city.

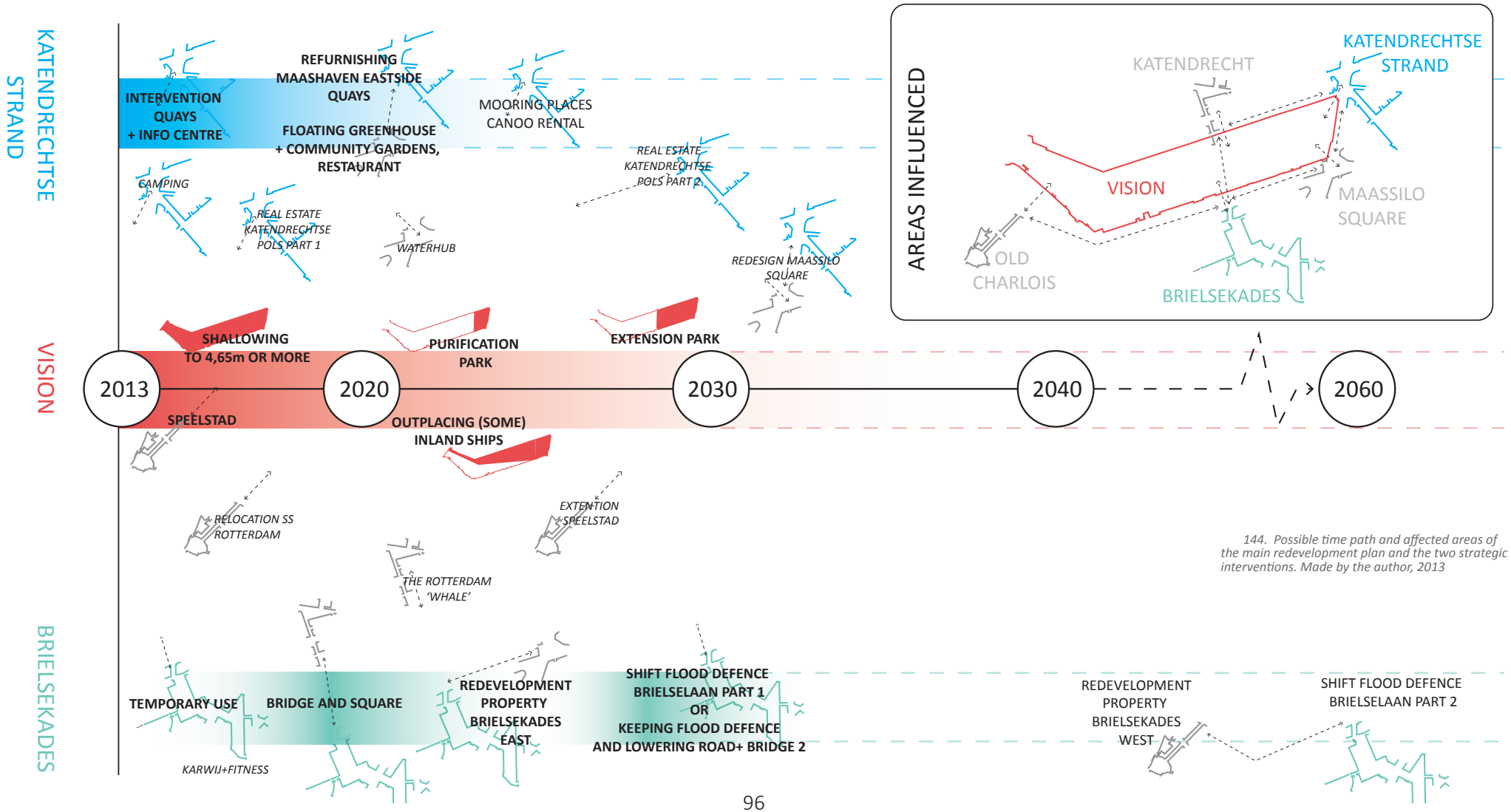
The location at the Brielselaan is the most important one from the urban assignment and it is the location where it is both necessary and possible to redesign the Brielselaan profile. Here the local influence of traffic , the real estate market and the necessary flood defence adaptation can be showed.

143. Image showing the overlap of the scenarios concerning inland shipping and shallowing, and real estate (re)development . Also the areas with priority from the urban assignment are shown in pink. Made by the author, 2013

5.8.6 Adaptability and robustness in the design

After the design has been carried out it appears to be merely the redevelopment plan that is adaptable. The design interventions both have robust elements in them and they are both designed as a developments model that could be slowed down or altered along the way without making structural changes in the original robust intervention. The robust elements are implemented at different moments in time because of local conditions. A possible time path is drawn in the figure below to show how the events foreseen in the area coincide. Per event the affected areas are pointed out. Nevertheless, the core aspects of the interventions can be carried out independently.

In the Brielsekades intervention two robust interventions are planned. One is the making of the bridge and square after probably 5-10 years. As is explained in § 5.3.3 the bridge is designed such that it can coexist with inland shipping. Another robust intervention concerns the connection between this bridge and the Tarwewijk at height over the flood defence, only possible after



144. Possible time path and affected areas of the main redevelopment plan and the two strategic interventions. Made by the author, 2013

a crucial freeing of land in 2026 and its exact shape depends on the state of the local variables at that time. The rest of the proposed aspects of the design are rather flexible.

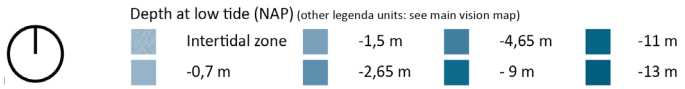
At the Katendrechtse strand the robust part of the design is planned right away because it will serve as the activation of this area. This intervention is robust because it can function in all scenarios. The rest of the design could develop fast or slow or change, depending on which scenario becomes reality.

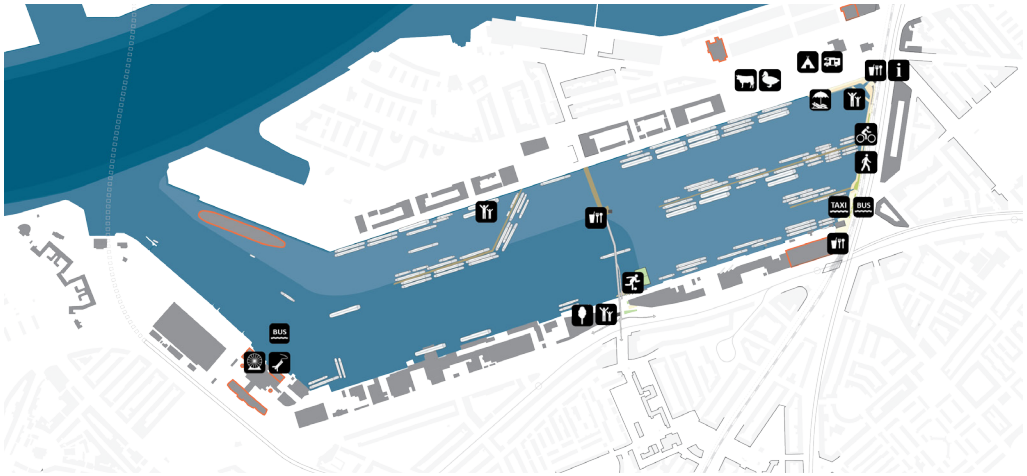
5.8.7 The adaptable redevelopment plan

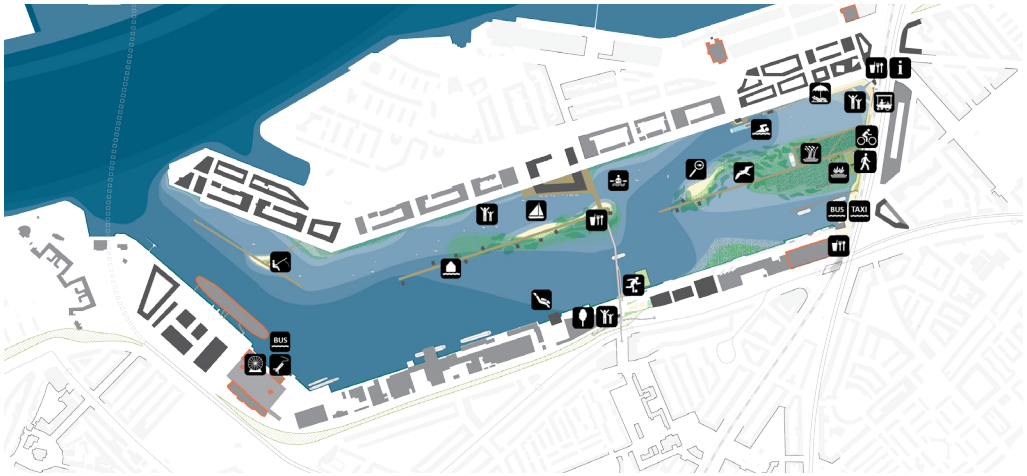
The redevelopment plan for the Maashaven is an adaptable model, in which the local influences of inland shipping and social economic growth are most visible.

Theoretically it is possible that with no or declining socioeconomic growth there will be no (re)development of building plots on the quays and on the water. In this case the temporary interventions that are proposed in the plans for the Brielsekades and Katendrechtse strand will get a more permanent character.
It is also imaginable that the municipality decides not to relocate the inland ships because there is no pressure to develop any functions on the water or the lobby of the harbour authority to keep these mooring places turns out to be too strong. When all or most of the inland ships stay in the area, the bridge and the main parts of the proposed strategic interventions can still be developed, and the Maashaven will be added to the public space network of the city mainly via its connections towards the maashaven and the interventions on the edge of water and land. The planned shallowing of the harbour will then be limited to 2,65m where empty- or 4,65 m where fully loaded ships go.
The two extreme images between which the redevelopment plan will develop are shown on the right. The detailed redevelopment plan drawing shown in the beginning of this chapter is located somewhere in between these extremes . This is an arbitrary choice based on the conviction that the presence of inland ships (and their crew) in the harbour and the presence of some businesses and factories and flexible used terrains adds to the character and identity of the area. Urban planners of today should strive toward functional mix and diversity as much as reasonably can be achieved without harming individual and collective interest too much.

145. Two extremes for the main redevelopment plan: in times of low socioeconomic development and prolonged inland shipping (above) and in times of high socioeconomic development and outplaced inland shipping. Made by the author, 2013







5.8.8 Uncertainty at the Katendrechtse strand

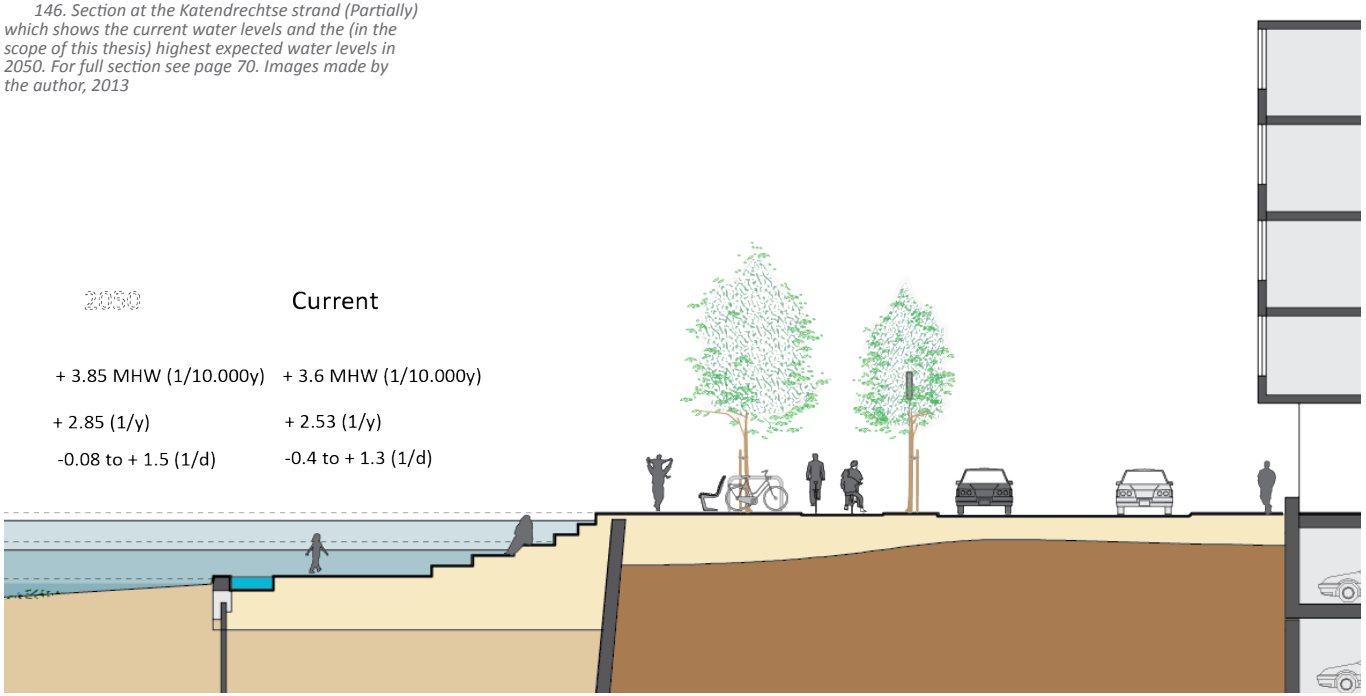
From the scenario study there are three local factors important at this site: water level rise, social economic growth, inland shipping.

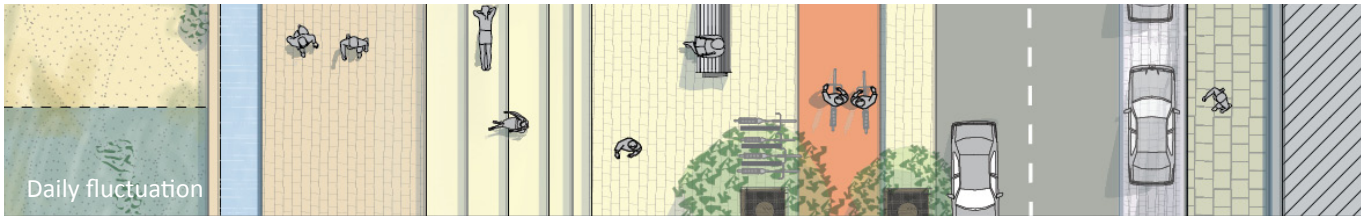
In the images on page 99 it is shown how the intervention can still work when inland shipping (partially) stays or if the social economic growth stays low in the coming decades. In that case the vacant plot can be more permanently used for as campsite or festival terrain and the floating park takes over what space is left empty by the inland ships.

The new interventions are designed such that they can accommodate changing water levels up to 2050 (shown by the dotted lines). See for the full overview of used expectations appendix B. Up to 80 cm most buildings can easily be made dry proof (van Veelen, 2012) and with new buildings a chance of damage of less than about 1/1000 is accepted, while with existing buildings this is even 1/100. Up to 2050 only the lowest parts of Katendrecht (3,5m NAP) the MHW (Normative High Water levels) in the Veerman 2008 scenario is about 20 cm higher than the current lowest point of quays, and in 2100 the MHW could be up to 70 cm higher in case of a 1/1000 flood event (HelpdeskWater, 2012). Since water levels with a chance of occurrence of 1/1000 or more are only exceeding the height of the current quays towards 2100 by 70 centimetres, the water safety at Katendrecht can largely be provided on building scale, as long as the furnishing of the public space can resist more frequent flooding. If this is not the case because climate changes faster than the models used in this study or accepted damage risks change, a solution with an additional low flood defence wall (permanent or movable) can be implemented between 2050 and 2100.

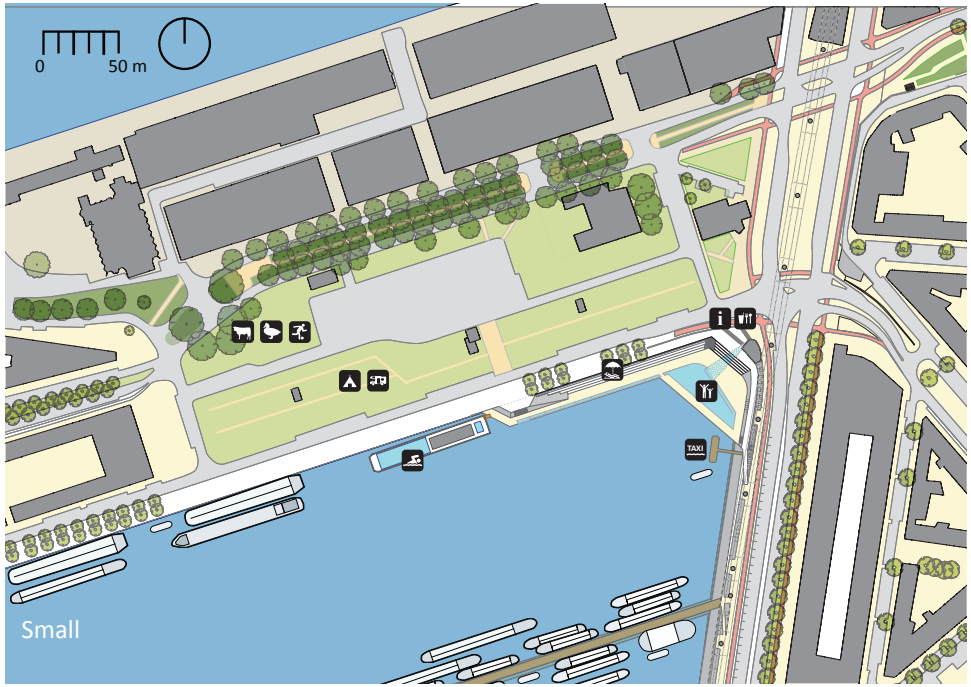
The primary levee at the Maashaven Eastside should be raised with 0,8 up to 1,3m towards 2100, like at the Brielselaan strategic intervention is shown more elaborated. Spatial implications of this change are not explored in this intervention, because there is more space to implement the necessary changes at this location, contrary to the Brielselaan intervention. Possibilities show already from section A on page 64. The height of the second floor here approximately matches the future needed dike height at this location.

146. Section at the Katendrechtse strand (Partially) which shows the current water levels and the (in the scope of this thesis) highest expected water levels in 2050. For full section see page 70. Images made by the author, 2013





147. (right) Diverse possibilities for the future of the Katendrechtse Strand area, in which all the main robust intervention functions well. Images made by the author, 2013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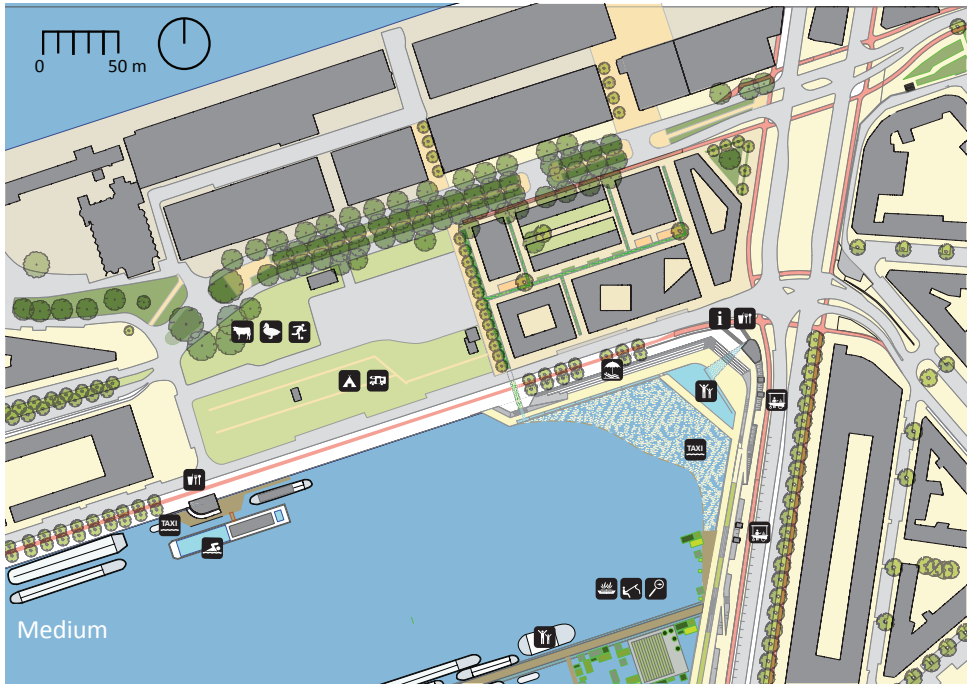
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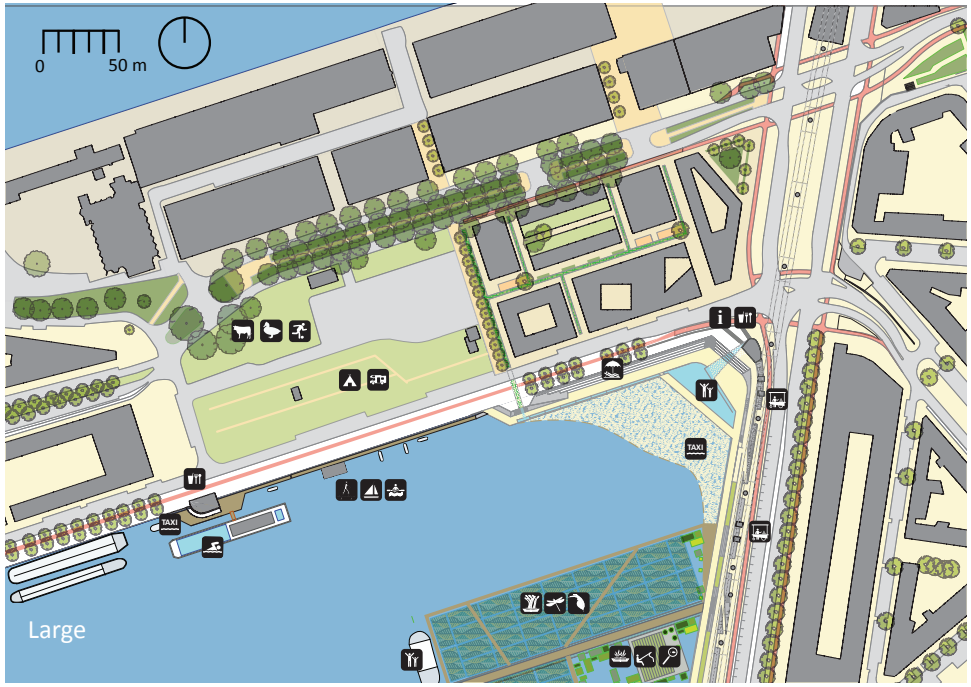
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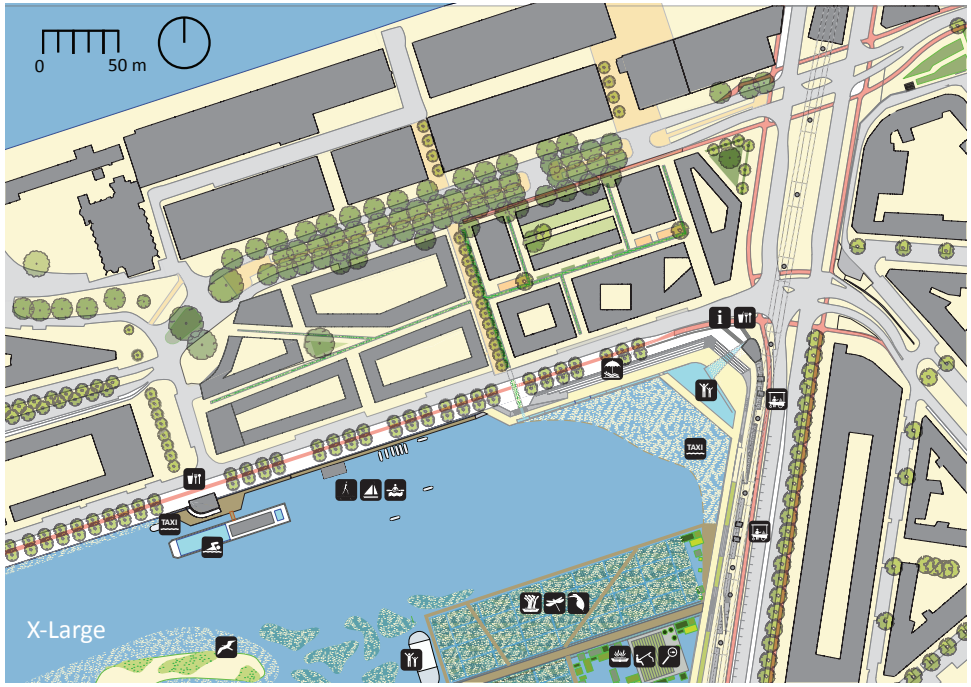
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Possible futures

The design shown in §5.4 is only one possible outcome. Depending on the development of the three most important local factors of the scenario study, the design might evolve differently. On the left the least and most extreme possibility is shown, as well as two combinations of local variables. The inland ships and the floating park are claiming the same space and the more the inland ships recede, the bigger the park can grow. Nevertheless, even with the current occupation the edges of the park, the floating greenhouse and the community gardens could already be developed like the Medium situation shows, safeguarding the main objectives of the design. Besides the possibilities drawn here, there are numerous other possibilities.

S: Minimal development

Here the temporary use of the vacant plots by a city campsite, petting zoo or for festival purposes (like the Rotterdam Dunya festival) gets a mor permanent character. The core of the intervention will be realised as soon as possible to provide people visiting these temporary activities, existing shops and the Afrikaandermarket a place to sit down and enjoy the views. Neighbour kids can play in the water safely here and people who go for a ride or walk can buy a coffee or iceream while getting information about the history and future of this area. The pond will be filled with clean tap water. The intervention can co-exist with the inland ships and water taxi stop, forming a diverse and characteristic view.

M: Hesitant development

The quays of the Maashaven Eastside are refurnished as soon as the area is used intenser. People will now be able to easily make a round trip via these quays and the new bridge connecting the Tarwewijk and Katendrecht. The more the harbour is shallowed, the more inland ships move towards the western part of the harbour, leaving space for the floating greenhouse/educational centre and slowly but surely the floating gardens really start to form a community, attracting caring residents on a daily to weekly basis. At Katendrecht the first part of the new neighbourhood is completed and the pancake restaurant opens its doors to welcome residents, people who camp at the other side of the road or people who are on their way around the harbour. From here a few times per day a small boat trip over the Meuse can be made, with an optional stop at the SS-Rotterdam or Speelstad.

L: (Design, see also page 65)

Wether the shallowing is complete or not, the floating purification isles extend the community gardens into a complete floating park. This will be the first one on this scale known in the Netherlands and people from all over Rotterdam and further can see here how rainwater from the Afrikaanderwijk and Parkstad is filtered such that it doesn't harm the recovering ecological system of the inner harbours. The playing pond can now be filled by locally purified water that flows down from the information point at the Kiosk At the Katendrechtse quays between Bakboord and the urban beach, a canoe rental service has found a nice location to rent out canoes to people who want to explore the floating park from another viewpoint. On nice summer days small sailing- and recreational boats come and go from this point, while close to the Maassilo at the other side of the Maashaven the waterhub has developed a strong position in the transport network over water.

XL: Maximum development

The floating park can be extended even more with more natural floating constructions and at some places the harbour is so shallow that the bottom becomes permanently visible above water. Local entreopreneurs have created peaceful places to stay over night in one of the 10 to 15 floating bungalows. All empty plots at Katendrecht are finished and most of the industrial buildings at the Rijnhaven side have found a new use. The campsite has moved to a new location at the other side of the Maashaven close to the picturesque centre of Old Chalois, but via the Maashaven bridge it is only 5 minutes by bike.

5.8.9 Uncertainty at the Brielsekades

Brielselaan on the long term

Before the flood defence was built, the Brielselaan was a shady lane with only a very minimal mound where shops and houses had their entrances (image 149). Nowadays it is transformed into a plural barrier. One of the main causes for this is the higher flood defence, that separates both traffic and people. The goal on the very long term is to free the Brielselaan from the flood defence and to transform this subordinated road into a dignified lane where house owners and businesses want to have their frond door at. The ideal situation would be to have the flood defence integrated in the buildings along the Maashaven, so both a wide Brielselaan is made possible, and an outer dike strip remains where people can get close to- and live with the water.

The area east of the intervention becomes available first (see for all leasehold contracts chapter 3), and the design office of the Urbanisten already has made a study on how the flood defence could be integrated in the current buildings of the Maassilo and Quaker (de Urbanisten, 2010) that have practically endless leasehold contracts. The plots west of the intervention will be in use until at least 2053 or 2063. The flood defence could thus first be integrated at the eastern part of the Brielselaan. This makes a switch of the flood defence at the location of the intervention necessary.

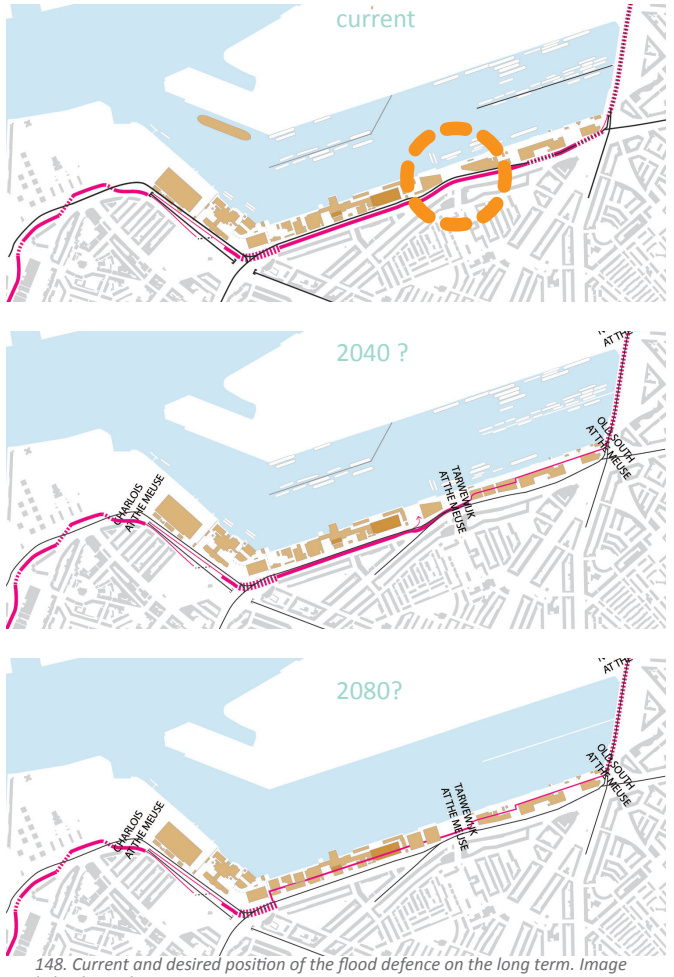
Uncertainty

The relocation of a flood defence in an urban area is nevertheless a very difficult task because it concerns a lot of money and different stakeholders. Therefore, in the design of the Brielsekades it is not taken for granted if or when the flood defence is relocated.

At this location the local factors traffic, real estate development and flood defence height, used in the scenario study, are of influence. The speed and ease with which the industrial strip is redeveloped, depending on social-economic growth, determines if the flood defence can be integrated or not. Secondly, when for example both traffic pressure goes up and the flood defence needs to be heightened to the extreme variant, this is not possible in the current profile (see also figure 141).

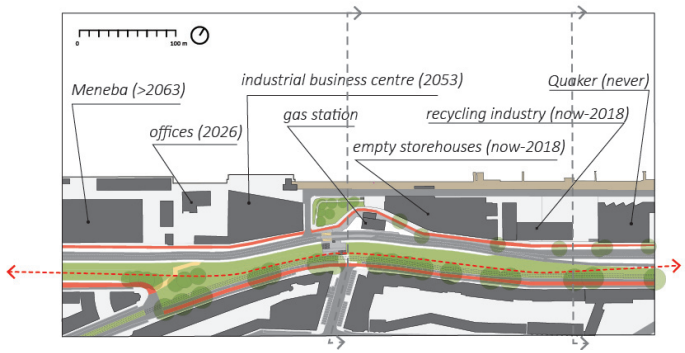
The intervention of the Brielsekades is designed such that it can be executed within the variation of these factors. The first two phases of the design are relatively independent of these local factors and are taking into account current developments such as the planned Karwei shop with integrated fitness centre. Especially in the fourth phase in which the slow traffic route over the bridge is connected to the Tarwewijk at height, the state of the local factors is determining the way this step can be made. The phasing is explained on the next few pages and is followed by a short explanation of how the design reacts to the six different scenarios.

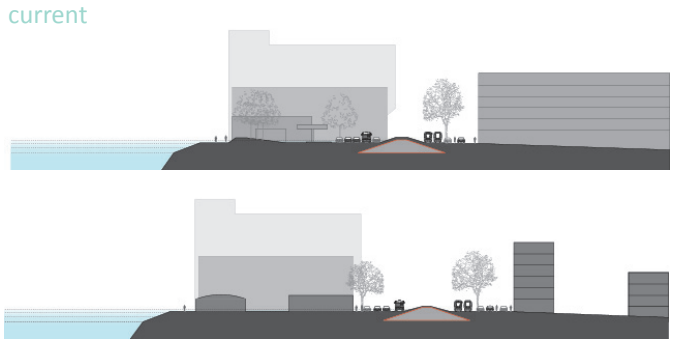
149. The Brielselaan in 1949, Photo via Gemeentearchief Rotterdam

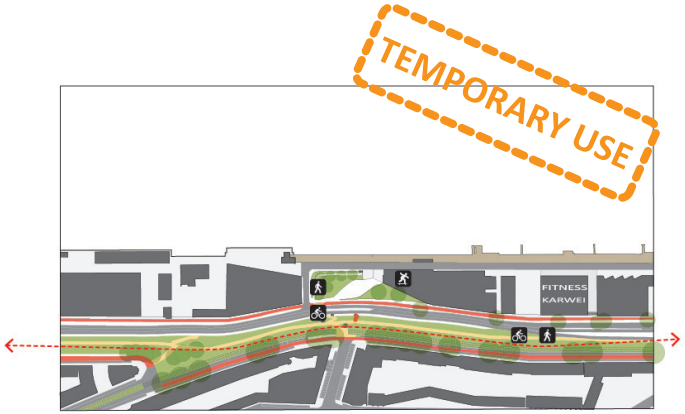


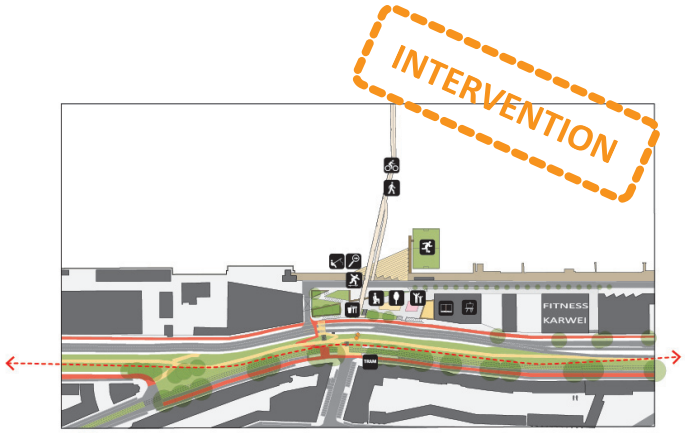
148. Current and desired position of the flood defence on the long term. Image made by the author, 2013

150. (left) Current profile of the Brielselaan. Image via maps.google.com, 2013









Phasing

In the current situation a tank station and some empty storehouses are occupying the plot and there is some very small greenery in between the tank station and the business complex on the left.

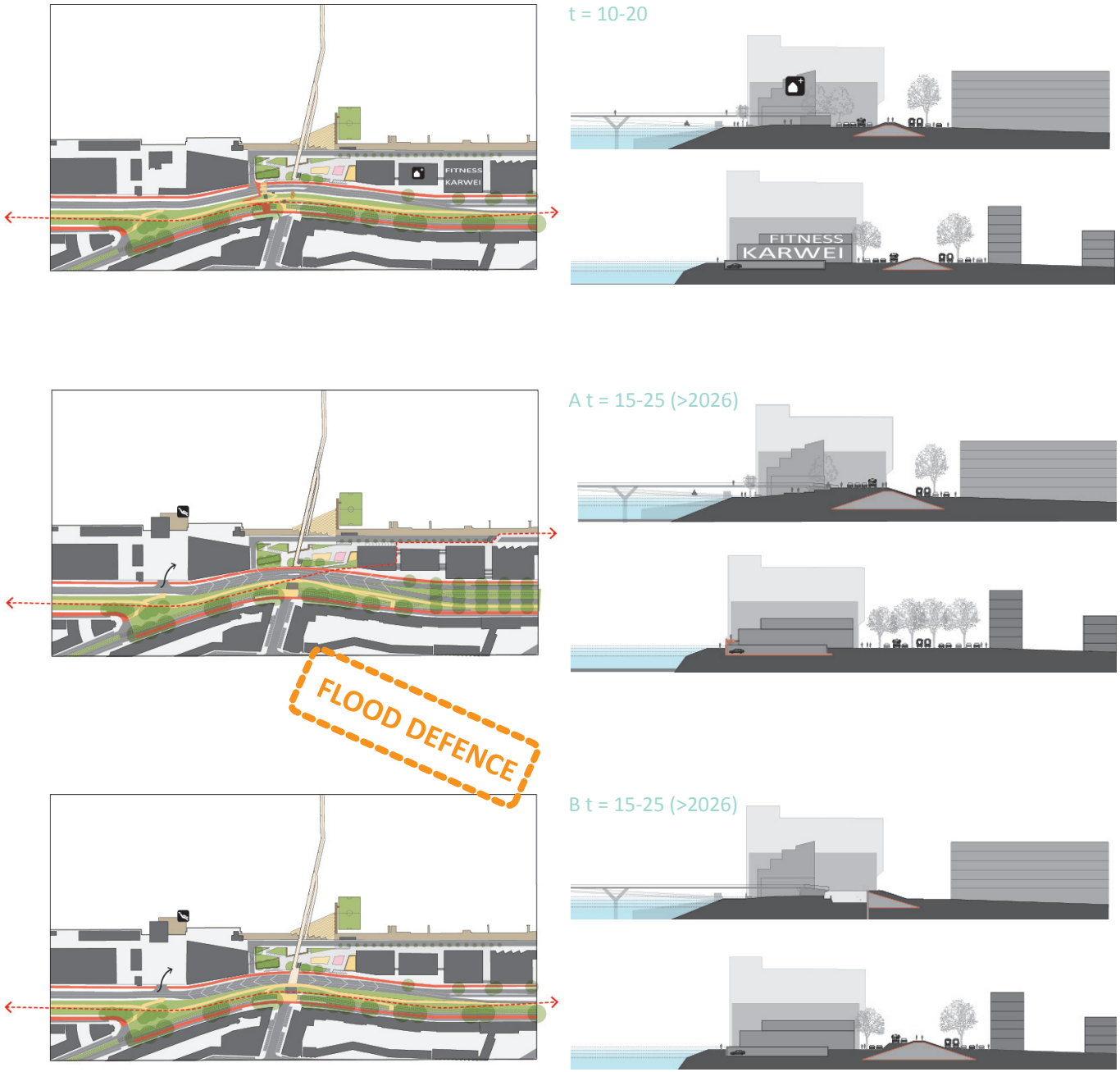
As soon as the tank station can be bought out the transformation can start. The first phase of about 5 years contains mainly measures that have to do with place-making. A skate park is accommodated in the empty sheds and has its entrance at the existing park. A work of (preferably local) art is placed on the outer side of the dike to attract people to this 'other' side of the dike. To make this easier, the crossing of both the road and over the dike is improved and a foot and cycle path is laid out on top of the dike as residents already plea for since years. Already from the establishment of the Karwei onward, all new buildings should be constructed such that they later on can become part of the 'built' flood defence and such that their ground floors remain free of damage in case of flooding with a occurrence of 1/1000 years. By building a half sunken parking garage that lifts the ground floor with one metre, this could be done.

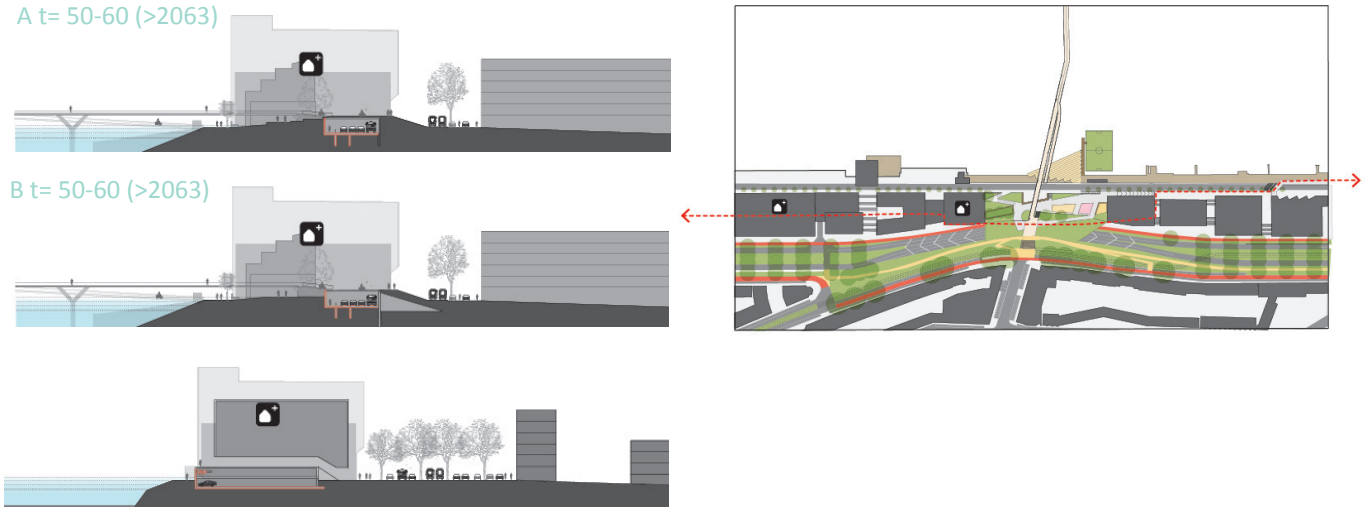
After 5 to 10 years the main intervention including the new bridge is built, supported with some of the money saved by shallowing the Maashaven. The bridge is high enough for most recreational traffic and lower water busses and inland ships. Both the community centre and the more delicately furnished part of the public space are raised with one metre to 4.2m. NAP as well so they become part of the threshold that protects the Brielselaan against raising water levels. If nothing is done, the Brielselaan will have a chance of flooding of

about 1/25 (Wb21-Mid scenario) up to 1/5 (Veerman 2008 scenario) (van Veelen 2012).
The bridge cannot yet be continued towards the other side of the flood defence into the Tarwewijk because the height above the Brielselaan should be at least 4.5 to 5 metres. When lowering the road enough to achieve this, the main entrance and deliveries entrance of the business complex west of the intervention becomes unreachable. So until another entrance can be made at the plot of the western neighbours this connection has to wait and in this period up to 2026 the strip east of the intervention can be developed further with for example extra apartments, which are now via the bridge very well connected to the Kop van Zuid .

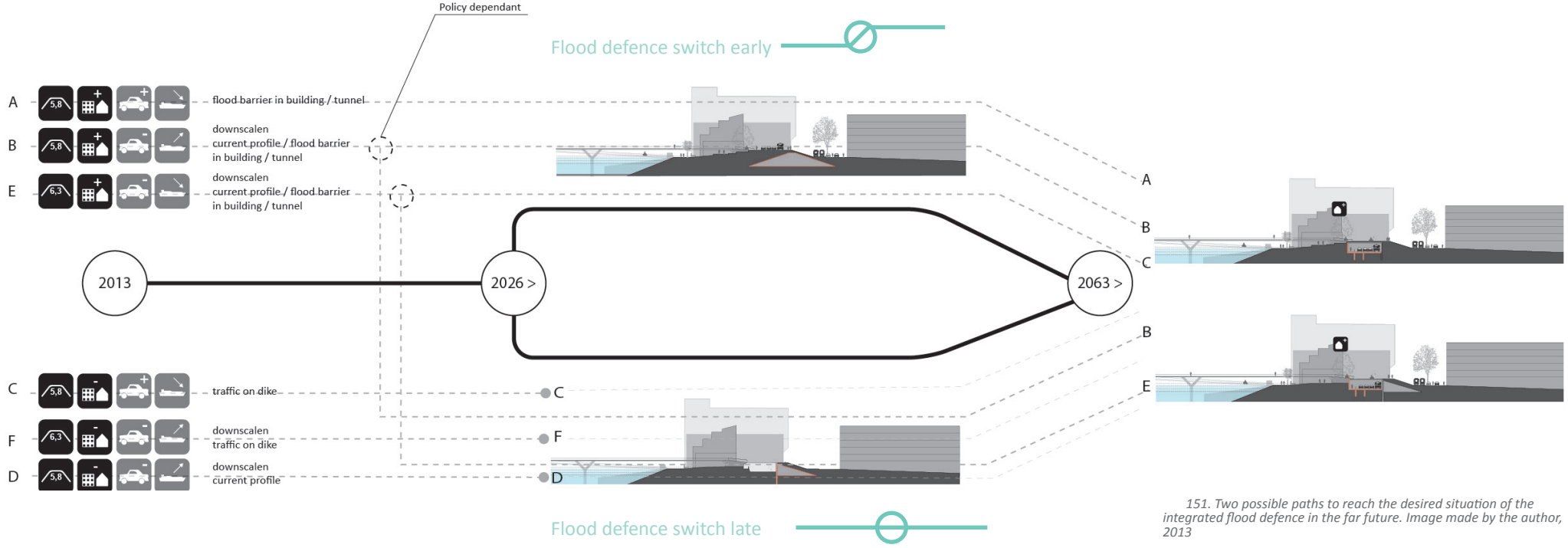
After the entrance to the business complex can be made on the other side, the next important step for the intervention can be made. If the integration of the flood defence at the eastern side has succeeded, the flood defence at the brielselaan can be taken away here, and the flood defence line has to switch from its old profile on the west to the new location on the east side. Therefore the road will be elevated on top of the shifting flood defence to the height of the bridge (section A on the left). The continuous slow traffic route and the switch of the flood defence line are combined here.

If the integration of the flood defence into the buildings has not succeeded yet, the flood defence will have to be raised in its current profile. At the location of the intervention this can be a flood wall construction to safe space. To be able to make the slow traffic connection to the Tarwewijk, the road is lowered a bit. The lowered road will be protected against frequent flooding by the threshold of +4.2 m NAP.





In the very far future, when also the western industrial strip has transformed and has integrated the flood defence, the whole Brielselaan can be freed of the flood defence. The traffic can still go underneath the slow traffic route. Either in the existing lowered road (in case of option B before) of which the old flood wall becomes part of the tunnel or in a new tunnel if option A was executed before.



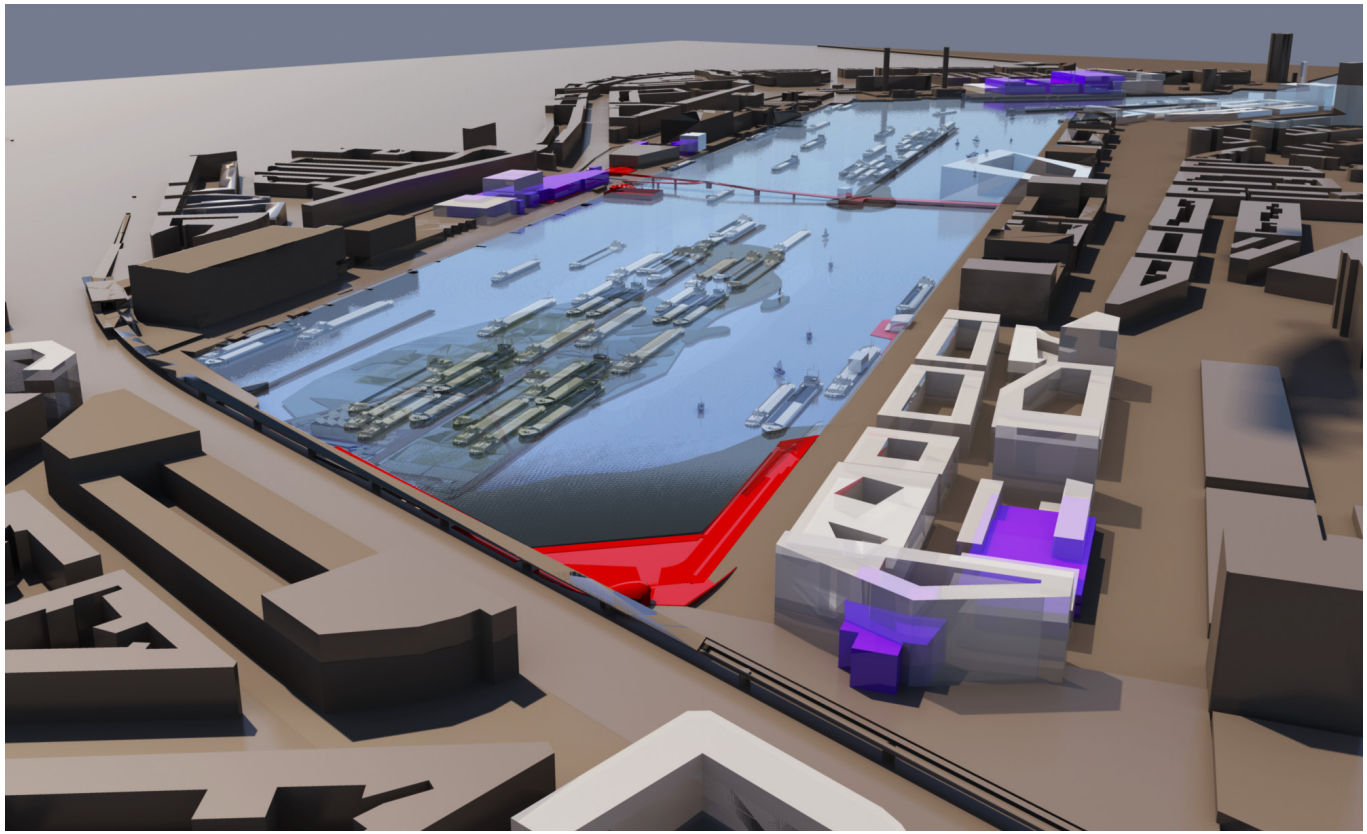
151. Two possible paths to reach the desired situation of the integrated flood defence in the far future. Image made by the author, 2013

Scenarios

Figure 151 summarises the two possible paths toward the very far future goal of integrating the whole flood defence into the built up strip. When there is a lot of animo to redevelop the eastern strip, the upper path can be chosen in which the flood defence gets integrated soon. Wether this is done in scenario B and E is merely a policy choice, because when it is decided to down scale the brielselaan, the current profile can also be maintained.

At scenario C, F and D with low economic development, it is highly possible that the flood defence will never be moved. In the case of down scaling the road and low climate change the dike could be raised in the current profile. With more traffic and/or high climate change, traffic and flood defence will have to share space.

152. Impression of robust elements (red), and adaptive plan components (white buildings, floating park and inland ships). The purple buildings are the existing buiodngs. Image by the author, 2013.



5.8.10 Conclusions on sub-research question 4: Uncertainty

What are the main spatial preconditions for the design and how to incorporate them in a robust design for an uncertain future?

Inland shipping, real estate development, traffic pressure and flood defence height are the main spatial preconditions that are uncertain and they are influenced by the socioeconomic situation and the amount of climate change.

The redevelopment plan is adaptive concerning the real estate development, the amount of inland shipping and the traffic pressure.

Concerning the flood defence height, a robust height of both redesigned outer dike areas and flood defence is implemented in the interventions because spatial consequences didn't differ too much between the lowest and highest scenario and designing an adaptable solution would increase both costs and nuisance enormously. Only at the Katendrechtse strand some uncertainty is kept by leaving open the possibility to place low flood walls in the future. Concerning the location of the flood defence the design steers towards locating the flood defence inside the built up strip along the Brielselaan in the far future to free the Brielselaan from its main barrier and to keep a considerable outer dike area where people can live with the water. Nevertheless the design leaves room for the possibility that the flood defence is not moved.

The bridge which is essential for the spreading of the positive developments at Katendrecht and Kop van Zuid was designed in a robust way such that it can be implemented in any scenario.

. . . . . so what do we learn ?

6 Discussion and conclusions

What generic and specific conclusions can be drawn from this research?

As conclusions of section 5.5 to 5.8, sub-research questions one to four were answered. This chapter answers the main research question and reflects on it.

The main research question contained two hypotheses, namely that public space design can be used as a strategy to reconnect neighbourhoods and that the water of a harbour basin could be public space. The effectiveness of this strategy and the legitimacy of these hypotheses are discussed at point two and three.

This chapter is concluded by some site specific lessons and recommendations for the Maashaven case.

6.1 Generic lessons

The answer to the main question contains four generic aspects and will be summarised below.

HOW CAN
INNER CITY FORMER HARBOUR BASINS (1)

FUNCTION AS PUBLIC SPACE (2)

IN ORDER TO
STITCH DISASSOCIATED DISTRICTS INTO A CONTINUUM (3)

AND TO STRENGTHEN THE
RELATION BETWEEN CITY AND RIVER (4)
?

1. **Contemporary floating neighbourhoods are not desirable in dense inner cities**.
   They privatise the water and therefore do not match with the aim of adding inner harbours to the public space network. These neighbourhoods are a low density infill of precious open space, since sustainable and efficient cities are rather dense and need contrast between open and built up space.
   The arguments to build floating neighbourhoods suit rural areas better and the ambitions behind floating neighbourhoods can be reached by other solutions as well. Only if the city does not need the water to be visually open or public to maintain its living quality and the density of floating neighbourhoods increases remarkably, they could become an option for urban environments.

2. **Transforming a harbour basin into public space depends on the design of a selection of spaces at its edges.**
   Edges are essential for the access to-, the encounter with- and the experience of the complete body of water as being public. Neither the whole body of water nor the whole quay length should be redesigned as public space. The spaces to redesign should be strategically chosen and redesigned with special attention for scale. Only then people will be concentrated and encounter and exchange is stimulated.

3. **Reconnecting districts by public space requires good slow traffic connections, a strong identity and an appealing mix of program**.
   The hypotheses that creating public space could reconnect neighbourhoods originated from the fact that the area lacked larger good quality recreational spaces and literature showed how former industrial sites that are transformed into public space can bring neighbourhoods nearer.
   This thesis showed that well designed public space is indeed very important to bring people together. Nevertheless, a widespread and well interconnected slow traffic network appeared -especially in former harbour areas- of determining importance for the success of these public spaces. Good public space in itself cannot exist in isolation. Looking back, it can therefore be concluded that the focus of the strategy has been altered from public space only towards the interplay between slow traffic and a select amount of public spaces.
   Secondly, offering an attractive program for different groups is important to activate the site, to create a shared interest and to make people appropriate the site. Enhancing historical elements and natural processes can be part of the shared identity that helps to achieve this.

4. **The relation between city and river can be strengthened by making the river and inner harbours part of the daily life of people again**.
   The presence of the river should become a natural part of peoples lives by making the river and harbour areas better accessible and part of the daily movement pattern. Secondly, it is essential to find a new function that attracts people on a daily or weekly basis.

Taking into account the main uncertainties in an area shows the bandwidth where the urban designer can operate in and makes main preconditions and priorities more clear.

6.2 Case specific conclusions

Water as public space

--> Making the Maashaven part of the public space network depends mainly on a better connectivity and the public space design of a few strategic locations, a better knowledge and understanding of the area and its dynamics and the kind of functions that are located in the water and at the quays.

Better accesses to the Maashaven are proposed at both endings of the bridge on neighbourhood scale. At the Katendrechtse Strand, the Maassilo and Speelstad/SS-Rotterdam improved connections are proposed to better embed the Maashaven on city and regional scale.
The dynamics of the river are made visible by lengthening the intertidal zone. At the Katendrechtse Strand this is done in a semi-natural way by creating a beach. At the Brielsekades this is done in a cultivated way by folding together an intertidal stretch of 460 metre into stairs that give an ever changing access to a floating Cruyf Court and at the same time function as tidal clock. Not all the water is directly accessible but besides at the two interventions, a stratified floating park, scaffolding, canoeing, boating possibilities and the new bridge make being at the water possible. The floating neighbourhood, proposed by the municipality, is rejected. Nevertheless, there are enough possibilities for floating recreational functions that enhance the public character of the harbour.

Ecology and Leisure

--> The design experiment shows that ecology, leisure functions and inland shipping can go together in one area.

By shallowing the harbour as far as the diverse ship movements allow, ecological recovery is started. Further measures like greening basalt quays, creating shallow zones and providing artificial reefs are beneficial for new activities as fishing or diving. The floating park is not only a welcome addition to the relatively stoney living environment in the neighbourhoods surrounding the harbour, but also helps to purify urban runoff water, provides a new living environment for amphibians and birds and binds people to the area via the new floating community gardens. The water cleaning process is made visible by using the cleaned water in a playing pond and providing a Layar-guided tour through the area. In this way education and awareness raising are exploited as positive additional product.

Connecting New and Old South

--> Stitching together Old and New South depends partially on the establishment of the bridge and partially on the creation of a shared identity and functionality.

The bridge will connect the torn apart slow traffic network and improve the nearness of the older neighbourhoods. It unlocks their qualities for residents of the New South neighbourhoods and makes the old neighbourhoods a more attractive location for starters and social climbers. This connection should be as effective and easy as possible and not depend on time schedules and ticket prices.
To realise a unique character where all user groups can identify with, the dynamics of the river and historical elements are exploited. Secondly the leisure program should attract all user groups. New functions that bring people to the area on a repetitive basis such as community gardens, sports facilities or a community centre are valuable in this.

City and River

--> The relation between Rotterdam and the river can be strengthened on micro, meso and macro scale.

On micro scale the discrepancy between the old morphology and the heavy infrastructures of the 20th century can be repaired and the awareness of the nature of the river can be increased.
On meso scale new functions and identities should be found for each inner harbour that can replace the former labour function and brings back the harbours in peoples daily system. The river and inner harbours together can form the green lung for the further densifying city.
On macro scale the river should be used as positive allocation factor in the combat for middle and higher class residents in the Randstad and the ecological bottleneck in the complete system of the delta should be taken away.

Uncertainty

--> Some robust interventions are necessary to initiate change in the area, but the largest part of the Maashaven can develop in a very adaptive way.

The redevelopment plan is largely adaptive to developments of inland shipping, real estate (re) development and traffic pressure. The bridge and the interventions are in essence robust to make sure the main objectives are reached. The design intervention of the Brielselaan is nevertheless adaptive to the future location of the flood defence. The height of the flood defence and the (re)developed outer dike areas's are dimensioned in a robust way because the spatial implications of the lowest and highest scenarios wouldn't be different enough to choose for a more complicated and less cost effective solution.

6.3 Recommendations

For further research

- There should be more research on the spatial side of public space and recreation for diverse user groups. Many social and functional aspects are covered, but concrete spatial implications are not very well documented.
- When flood risk and water safety interests are concerned with the (re)development of private property, very complex situations arise. Further research on how to smartly integrate water safety in private developments could improve the quality of the city at the edge of water and land enormously since in the coming decades both investments for the water safety and redevelopments of large stretches are at hand.
- More extensive research should be done on how regulations and responsibilities could be changed such that pioneering and pilot projects in the harbours are made easier. This could become one of the big strengths of Rotterdam. During the research for this thesis many objections for safety and public health were raised in such a way that many possibilities for change are smothered without really comparing the risks to the benefits.
- More research should be done on runoff and waste water treatment in urban areas. Most available knowledge is based on rural experiences.

For the municipality

- Reconsider floating neighbourhoods in inner city harbours. Many objectives behind these plans can be realised in a way that is more beneficial for the city as a whole.
- Take ecology in account more often, not only because it improves the living environment but can also have financial benefits.
- Use scenario thinking more often in the design process because it does not only help to prevent blue print masterplans but also forces designers to get the main preconditions clear.
- Focus on sewing the slow traffic network together and on creating public space in times of economic crisis. Planning and designing public space in an early stage can function as initiator and prevent the ‘waste’ of essential public spaces as soon as the economy starts to recover.
- Embrace the water and do not fortify the city for the very small chance of extreme events. Cherish your outer dike areas to stimulate the resurrection of a vibrant water city. Small scale interventions on building scale often provide good alternatives for large scale flood defence lines directly at the water line. Steer towards multifunctional flood defences where possible.

. . . . . looking back . . .

7 Reflection

7.1 The design in relation to the objectives

The main objective of this thesis is to develop a flexible redevelopment plan on the future of the Maashaven as binding public space for Rotterdam South. Besides, the main research question contained the hypothesis that water could be public space and therefore a more hidden objective was to test whether this really is the case.

The design deals with spatial aspects and it is plausible that the proposed interventions reduce the spatial segregation. The improvements concerning the social binding are nevertheless impossible to proof. This makes that the decline of social segregation as a result of this design is an assumption based on experiences at other locations.

The hypothesis that water can be public space was indeed investigated and led to the conclusion that the water does not necessarily needs to be physically accessible everywhere to be perceived as public space and that it is merely the edges between water and land and the use of the water that determine its public or private character.

7.2 The relation between research and design

Looking back, it can be concluded that part of the research was used to determine the exact assignment. The initial assignment, given by the municipality of Rotterdam, was to design a backbone for a floating neighbourhood, but the study of public space in amphibious neighbourhoods and the first steps in the urban analysis led to the conclusion that this was not desirable. After this decision, research and design became intertwined quickly. Doing research by design parallel to more specific literature and site study helped to narrow down the research. By designing, it was possible to test whether ideas could have a spatial implication and if yes, which. If the designing was kept for later in the process the scope of the research, which is already quite broad, would have been impossible to handle.

7.3 The relation with the studio thematic (Delta Interventions) and methods

This project had a relatively small scope compared with many other studio participants and knowledge provided by the studio specific lectures was used less directly. On the other hand the information provided by the studio meetings helped to determine the impact of climate change on the local scale for which understanding the context of the delta is necessary. Also the scenario thinking was stimulated by the studio. Here scenarios on the scale of the delta were often used to explain aspects of this complex system. This provided the trigger to see if scenario thinking could also be used on the smaller scale.

The graduation project could also have been carried out at the urban regeneration studio. Nevertheless the Delta Interventions studio has the tendency to be very concrete and in the urban regeneration studio the pitfall would have been to focus more on only the social, less tangible side of urbanism. Starting from the topic of water in the urban context, more concrete spatial questions were answered.

From the studio the use of the layer analysis and comparative analysis were stimulated very much. These techniques were used in this thesis too. Mapping, another emphasized technique by the studio, was used less extensively. During the process it was sometimes difficult to find a good balance between methods and techniques. Especially the scenario study was sometimes close to becoming a dogmatic method instead of a technique supportive to the main method: research by design. If scenario thinking is used as a technique to sharpen the design and to get the main preconditions clear, it has much more value for the final product. If this would have been clear from the beginning onwards, much time could have been saved.

7.4 The relation between the academics and practice

This research has been carried out at the urban planning department of the municipality of Rotterdam and the Stadshavens Innovatiekas at the Innovation Dock at the RDM Campus.

Aspects that are more emphasised in practice are the feasibility, the financial and legal implications and the

diversity of stakeholders. This has made the design richer but also might have restrained its innovative character a bit.

More elemental questions were asked form the academic viewpoint, which led for example to the reconsideration of a floating neighbourhood in this and other urban inner harbours. Also the question whether water can be public space and if yes, in what way, is a more academic question. The thesis has not provided a practical yes or no as answer to this question. It has rather nuanced the question further and investigated elements that contribute to good public space in harbour areas.

A positive aspect of doing an academic research project at a practical institution is that it has led to a redevelopment plan that questions rooted ideas and sketches another (in practical sense extreme) future, but bases this future perspective on realistic and current preconditions.

Another advantage of doing a project at the municipality is that working multidisciplinary and using knowledge of other fields of practice is relatively easy. Experts on other fields of practice are very approachable. This makes ideas on for example costs of a bridge or the feasibility of creating swimming water easy to verify.

The influence of the Stadshavens Innovatiekas is very visible in the plan because the seeds for incorporating ecological recovery were planted there. By working there one day a week I became inspired and my knowledge on sustainable development in the Rotterdam region was extended. I wholeheartedly recommend that graduating students from different departments within the municipality get in touch with the 'Innovatiekas' on a regular basis to enrich their thesis. Besides, also for regular employees it would create surplus value if the sustainable and innovative ideas produced and collected here are actively integrated in design and policy.

7.5 Social context

This project has showed how living conditions in Rotterdam South could be improved and how spatial segregation, one of the aspects contributing to social segregation, could be decreased. It will always be important to fight the existing problems in the older neighbourhoods from within these neighbourhoods. Nevertheless, since it is merely the scale of the problems that make them unique as the Pact op Zuid main report observes (Team Deetman/Mans, 2011), fighting these problems 'from outside' by stimulating the spreading of successful developments towards these neighbourhoods could help enormously, as the improvements on Katendrecht and Feijenoord have shown in the last decades.

Furthermore this project shows how the river could be exploited differently for the city of Rotterdam as a whole.

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Appendix A: Literature review paper

Public space in amphibious neighbourhoods

The relation between public space and water in amphibious communities to investigate possible application of amphibious neighbourhoods in Dutch inner city regenerated harbour bays.

Course AR3U022, Theory of Urbanism
MSc Urbanism, Delft University of Technology

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11th Graduation Lab Urbanism Conference

Abstract – Nowadays harbour activities move out of the city centre and the basins left behind are considered possible building grounds for amphibious neighbourhoods. Concurrently, the water surface has the potential to function as newly gained public space for the more and more dense city.

In this paper it is investigated how and to what extend public space is embodied in European and Asian amphibious communities, in order to find design principles that integrate inner city harbour basins in the public space network of the city. A brief review of Carmona et al. (2010) and Gehl (in Beyer Reigstad, 2012) on the notion of public space is followed by the main body of the paper which deals with literature on the urban form of European and Asian amphibious communities by respectively Singelenberg and Nillesen (2011), and Jumsai (2008) and Leblanc and Brand (2011).

The paper concludes that the overlap of functions on the water is essential to create successful public space, but currently lacking in most Dutch examples. Therefore a more extensive research on new types of amphibious neighbourhoods is recommended before applying them in Dutch inner city harbours. In relation to the thesis on designing the Maashaven in Rotterdam as public space, some practical recommendations will be given.

Key words – Amphibious housing, water urbanism, regeneration, urban harbour bays, public space, Rotterdam.

1 Introduction

Formerly, harbour basins were located in the core of the city. Harbour activities now slowly move outward due to technological changes (Meyer et al., 2012), leaving enormous centralised surfaces ready for development. These outer-dike areas are characterised by the risk of flooding and their separation from the inner dike areas. With the effects of climate change building typologies that can deal with changes in water level - called amphibious typologies- become relevant (Pols and Kempen, 2007). Amongst others, the municipality of Rotterdam expresses the strong desire to use inner city harbour bays for densification by floating neighbourhoods (Gemeente Rotterdam, 2011). However, this whish can be in tense relation with the openness of the water as a quality and identity giving element for the city as a whole (Verheijen, 2008). To be really beneficial for the city as a whole the public space in these water based neighbourhoods should contribute to the public space network of the city since public space is the grammar that holds the city together (Rogers, 2010).

To be able to assess public space in amphibious neighbourhoods, the general notion of public space will be studied briefly, as described by, amongst others, Carmona et al (2010). More specific criteria in relation to regenerated harbour bays are given by Gehl (in Beyer Reigstad, 2012). The overlapping of transportation and staying space, the presence of both necessary and optional and the threshold area (Meyer et al., 2009) between private and public appear to be very important factors in the design of public space.

Relevant literature on amphibious building typologies can roughly be divided into two categories: The European and Asian approach. In the Netherlands there are many examples of amphibious neighbourhoods (Nillesen and Singelenberg, 2011). They either emanate from the houseboats with their flexible, individualistic imago (Hooimeijer et al., 2007), or from land based suburban settlements which are nearly literally transferred on to the water (Verheijen, 2008). The solutions are robust but the relation with the water is still rather static compared to the second category.

Secondly, there are studies on Asian organically grown amphibious communities. Leblanc and Brand (2011) studied the different governance types in the Dutch and an Asian situation, which determine the structure of amphibious neighbourhoods. Villages such as Tha Khanon or Ban Li in Thailand are almost naturally changing with the tide and they utilize both the wet and dry periods to the maximum (Jumsai, 2008). In these examples water becomes really part of the public space network.

This literature review is part of the theoretical underpinning of the graduation project. The recommendations will be linked to its main research question: *How can the water surface of inner city harbour bays, such as the Maashaven in Rotterdam, become an integral part of the city's public space when both the shores and the water are under pressure to become urbanised?* Studies on the Maashaven in Rotterdam showed that the Maashaven has potential to serve as public space for the city (Kokhuis, 2013). This literature review helps to get grip on what makes water function as public space and whether amphibious neighbourhoods could be part of the redevelopment of the Maashaven.

2 What is Public Space?

The functions of a public space network are described by Carmona et al. (2010): *'As well as providing access to and displaying the 'public face' of private property, the public space facilitates and accommodates the overlapping realms of 'movement space' and 'social space'* '(p.83). Social space can be interpreted as the space where interaction between residents takes place, where they trade, share thoughts or relax in presence of others.

From the quotation above the border between public and private space seems very important, and especially in amphibious neighbourhoods this is a precarious subject because of the open character of water.

The private property is often separated from the public sphere via several small and sophisticated steps, creating an in between area that functions as a buffer (Meyer et al., 2009).

Besides by its function, public space is often characterised by its accessibility: '*Public space relates to all those arts of the built and natural environment where the public have free access. [……] It includes the interfaces with key internal and private spaces to which the public normally has free access*' (Carmona et al., 2010)(p.137).

This does not automatically mean that all accessible space really functions as public space. Many modernistic examples showed that when 'movement space' is disconnected from 'social space', or if basic requirements such as safety, comfort, accessibility, legibility and familiarity (Carmona et al., 2010) are not met, the public character of those spaces decreases enormously.

Whereas Carmona describes public space very abstract and theoretical, the Danish author and designer Gehl is known for his concrete theories on public space. Besides, he has applied his theories on several, mainly northern European harbour developments. For the design of the harbour district of Aalborg the method of '*reverse thinking*' was used (Kiib, 2012). This implies planning the desired public life and its activities first, followed by the supporting public space. Only in the last stage the building volumes and walls are defined such that they utmost support these activities.

To define what good public space is Gehl uses 12 main criteria, shown in figure 1 (Beyer Reigstad, 2012). Especially in harbour areas the protection and comfort criteria are important because of the often harsher climate. The challenge, according to Gehl, is '*to provide good-quality public spaces that invite optional activities during week days*' (Beyer Reigstad, 2012) (p.148). The minimum necessary predictable activities such as home-work traffic and dog walking, will always take place with or without good public space design. The more optional use of public space is stimulated by good design, the more likely it is that the place becomes a destination for other people as well (Beyer Reigstad, 2012).

Public space is not an easy thing to describe and good public space depends on many factors as has been shown above. Nevertheless, there are some key components that can be assessed in the following paragraphs, such as the overlapping of activities and the presence of necessary and optional activities. Not only the public space itself, but also the threshold-world in between private and public is very important for good functioning public space.

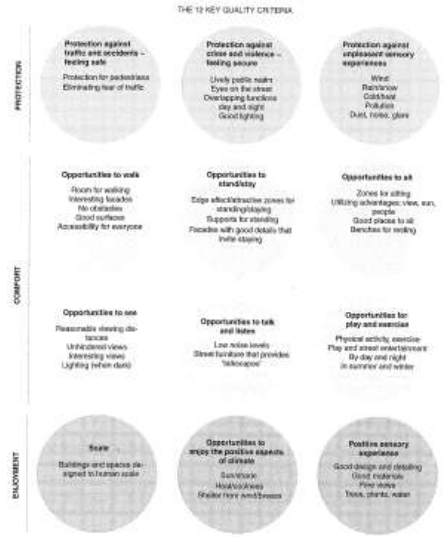

Figure 1: Twelve quality criteria to evaluate city space.
Source: Gehl et al, 2006, in(Beyer Reigstad, 2012)

3 Public space in European water based developments

The main reasons for living on the water according to Nillesen and Singelenberg (2011) are the tranquillity and beautiful vistas from the consumer's viewpoint and the possibility of combining water storage and dwellings for developers. Besides listing examples of amphibious housing they elaborate on different types of water bodies where amphibious housing could take place, water dwelling typologies, basic urban principles and patterns.

Water dwellings in the Netherlands initially originate from merchants living on their vessel in 1650. The more modern example of houseboats became more popular after World War 1 and 2, when gigantic housing shortages drew people towards the water in search of a place to live on improvised houses on former inland navigation ships (Hooimeijer et al., 2007). Whereas new water dwelling typologies in the late 1990's arose in rural settings the houseboat is practically the only typology found in denser urban areas, due to regulations.

Nillissen and Singelenberg name three typologies of water based typologies: floating houses, amphibious houses and pole dwellings. The way public space is designed in amphibious neighbourhoods depends largely on the layout of the neighbourhood, imposed by the principles of accessibility and the vistas (Nillesen and Singelenberg, 2011). The space used for accessibility is often the only public space in the Western examples and the threshold between public and private is thin.

The first access type, the jetty, often has a private character because it is narrow, dead ended and doesn´t host any secondary functions. People have their private spaces on the other side of the house, oriented towards the water. In Stijgereiland in Amsterdam for example, a lot of effort is done to orient all houses such that they have a clear view over the peaceful water (Van Ballegooijen et al., 2012). This makes the water a kind of inaccessible extension of the private sphere and a buffer between houses. In Sausalito Bay, California, jetties are marked by a porch and because regulations are less strict than in Holland, people tend to appropriate the jetties with placing benches, plants and bikes. Here the jetty has the atmosphere of an inner street, serving a more social function for the neighbourhood. Nevertheless, the ease with which outsiders enter the area is lower because you feel like intruding into some different world as Rijcken describes it in his travel report (Rijcken, 2007).

The spit is a wider, land based variant of the jetty. Parking and roads are often situated on the spit, and in some cases public spaces such as a playground or BBQ terraces are added at the end of the spits to encourage people to walk up and down. The threshold world between private and public is thicker here since houses often have a small garden or a parking place in front of their house. Again, like in the jetty typology, private terraces are usually oriented towards the water.

The bank principle is comparable to the spit, but the strip of land in front of the houses is more public since it usually hosts a continuous route. Here, the threshold between public and private is enlarged, and the private terraces are still oriented towards the water.

The typology of isles is not very common. The isle has a more private character and the water a more public character because it often hosts activities such as (recreational) shipping, fishing or traffic to and from the isle.

From the overview above it seems that in most western examples the water is a quite passive component of the neighbourhood. The water functions as a buffer

and a quiet and peaceful vista. The water could hardly be called public space because it is only used for recreational boating. Public space as in conventional neighbourhoods is only there where it coincidences with the access principles (see also figure 2) Still, its proportions are minimal and they often have a private feeling. Nearly all examples listed by Nillisen and Singelenberg are from a more rural context. For denser urban areas where public space is of large importance 'Living on water can be in tense relation with the openness of the water which is considered a major quality for living in Rotterdam.' (Verheijen, 2008). Verheijen of the municipality of Rotterdam clearly sees a lack of knowledge on designing amphibious neighbourhoods in which too many traditional land based principles are used and only the public space is left out to show some patches of water.

Examples better integrated water in are the canals of Venice, where the main traffic network runs over water, and land based public spaces are very well connected to the water network. An interesting and hope giving sketch of one of the main advocates of an amphibious future for the Netherlands, Koen Olthuis, is shown below in figure 3. It shows an elementary difference with the examples discussed above. Here the water substitutes the space that is provided by the public space and street network in conventional city patterns (Olthuis and Keuning, 2010)

Figure 2: Ground plan with access via jetties for the floating neighbourhood of Stijgereiland, Amsterdam.
Source: Architectuurproducties bv, in Ballegooijen, H. Van, Namen, T. Van, et al. (eds.) (2012),p.10

Figure 3: Study by Waterstudio for a floating city near Malé in the Maledives. Transport takes place mainly over water.
Source: Olthuis and Kempen(2010), p.292

4 Public space in Asian water based communities

The resemblances between water based neighbourhoods in Europe and Asia are mostly visual or technical. Functional principles of public space and the relation with the water are essentially different. Jumsai shows how Asian water based communities live with the water instead of above the water, and Leblanc and Brand try to grasp the origin of the differences between a Dutch and an Asian example by analysing the interrelation between the governance structure and the physical structure of the neighbourhood.

Jumsai distinguishes two types of amphibious urbanism, namely *hydraulic* and *aquatic*. An example of the hydraulic type is the extremely controlled Dutch system with its dikes, pumps and pipes. Aquatic towns as Jumsai calls them are more the type of towns associated with amphibious urbanism, as meant by the author. *'In contrast to their hydraulic counterparts, they exist with, and not against, the forces of nature'* (Jumsai, 2008)(p.34) Although floating and pole settlements were to be found in Europe before -Venice emerged as a pole town-, they are more common in Asia. Jumsai opens his essay with the observation that amphibious urbanism has become strange to us, since the colonial land based urbanism has set the norm in many countries were amphibious urbanism was widespread.

A Thai pole town lost to this rigorous modern adaptation is Bang Li. The houses were separated in two levels, with a rather flexible infill of shops and services on the ground floor as is shown on picture 1. As soon as the seasonal flood would approach, all activities moved up a level. All houses were interconnected by walkways and traffic changed easily from busses on the road to ships and rafts. Public life just moved upwards and the water became an integral part of it. Nowadays the whole ground floor has been filled with sand, destroying the amphibious character.

This example of Bang Li shows parallels to both modern pole houses in Holland such as the pole dwellings at Stijgereiland and second level approach of for example Hamburg Hafencity, discussed by Pols and Kempen (2007). Nevertheless, both modern examples seem to lack the real amphibious character of adaptation. The access and public space for the Dutch pole dwellings does not change with a rising water level. This does change for the Hamburg Hafencity since all (slow) traffic moves up a level in case of extreme high tide. Nevertheless the ground floor is just closed off hermetically in case of a flood, and the risen water surface is not used for traffic or other public activities. Besides, the possibility to close off the ground floor, instead of letting it flood, influences the character of the public space in dry periods enormously, creating large closed surfaces and a stony character.

Image 1: Two storey amphibious houses in Bang Li.
Source: Urban Aquatics, Jumsai(2008) p.37

Leblanc and Brand dive deeper in the reasons why amphibious communities originated in their particular form. They compare the urban form of the Dutch example of Terwijde with the Brunei Kampong Siraja Muda. Le Brand observes that the water in the Dutch examples is often used as separator and to protect the private sphere, instead of connector.´*The potential of these waterways, as new public realm is obviated by the close surveillance of narrow waterways by overlooking housing and intrusive private decks´*(Leblanc and Brand, 2011)(p.28)

According to Leblanc and Brand the difference between Asian and European examples are mainly due to the (lack of) planning system.

Whereas public spaces in the Dutch example are very inflexible and set out by governmental institutions, public space in the Brunei example grew gradually. The public space in the Dutch example functions as a constraint where the Brunei example shows how public space adopts to the needs of the community.

Siraja Muda grew gradually around the houses of key ancestors, forming the start of their community. All front porches of the pole dwellings are nowadays linked by footpaths and verandas that are part of the public space, as shown in figure 4. Every house is accessible on its back by boats. Before the 1970's the houses were only linked by small bridges and the major transport and trade took place via water. Trespassing through neighbouring private spaces was allowed for for example small children. The rules for both private and public space are directed by economy, traditional community rules and kinship, and not by governmental legislations like in the case of Terwijde.

Figure 4: Map of Siraja Muda showing the organically developed communities, interconnected by paths only since the 1970's.
Source: Leblanc and Brand (2011), p.29

As drawing a conclusion from the examples above, it can be stated that Asian amphibious communities the water surface isn't only seen as thread and visual quality. Asian amphibious communities are -or were - more living with the water than above it. They seem to be more flexible in adjusting their daily routine and accessibility principles according to the water level and they do not depend on only dry or wet access. They have in common that the water surface is used for transport and trade. Terraces or walkways often function as intermediate space between the very public and large water surface and the private house.

5 Conclusions

This literature review aimed to discuss how public space is embodied in existing amphibious neighbourhoods and to what extend the water in these neighbourhoods can be considered as public space. This study was executed in order to learn how the water surface of inner city regenerated harbour bays could be better integrated in the public space network of the city. After investigating the general notion of public space, literature on amphibious communities in respectively Europe and Asia was studied. From this literature review, several conclusions can be drawn.

Firstly, from the theories on public space and the examples transport, commercial activities and leisure functions on the water surface appear to be essential to make the water really part of the public space network of the city. Without those overlapping functions the water serves more as a separator than as a connecting element, which is nowadays the case in most Dutch amphibious neighbourhoods.

The lack of these overlapping functions is caused by two main reasons.
The more public character of the water in the Asian examples partially has to do with the more frequent and extreme rising and falling of the water level which forces communities to adopt their ways of living. Extreme water levels only occur relatively seldom in the Dutch examples, and therefore do not force the Dutch yet to change their land-based principles of access, orientation and private versus public sphere.

The clinging to a traditional kind of neighbourhood design might be another drawback in changing the water into real public space. Usually, the traditional front door is linked to the public streets on the shore, but now disconnected by a long stretch of piers and jetties, functioning as an out of proportion threshold world. It becomes an in between space that hardly serves any (semi-)public function, which it does in several Asian examples. The private back side of the Dutch amphibious house is oriented towards the water and makes the water a kind of untouchable element that extends the private sphere.

To better integrate the water surface of amphibious neighbourhoods into the public space network of the city we should thus find new neighbourhood configurations and use the water for the overlapping functions of amongst others access, transport and leisure as is schematically shown in figure 5. It requires a change of attitude not to consider the fluctuating water only as a dangerous element, but to really live with it like in the Asian examples, treating it as a vital and integrated element in the urban fabric.

6 Recommendations for the graduation project

The current Dutch possibilities of building on water are conflicting with the aim of adding the Maashaven to the public space network of Rotterdam. They are not suitable for the inner city harbours since they privatise the water and do not add anything but extra dwellings to the city. An extensive research, which goes beyond the scope of the thesis, should be carried out to find other configurations that make amphibious dwellings in inner cities a good option that does not privatise the water.

Parallel research on the specific case chosen for the thesis, the Maashaven, shows the need for a large surface of public recreational space such as a district park (Kokhuis, 2013). Although current types of amphibious dwellings do not fit in this picture, the literature review teaches us something about transforming the water into public space. It implies giving it several overlapping functions such as transport, leisure, trade etcetera and the design of steps from land to water should be done very carefully such that the public space on land and water are part of one system. The need to create overlapping functions will be taken into account in the conceptual phase of the thesis, whereas Gehl's criteria and design method will be used when redesigning the water and its shores more detailed in a later stage.

Finally, the review showed that one should not design for a single water level, but taken into account the frequency of changing water levels. In the case of the Maashaven the daily difference is about one and a half to two metres and the chance that the level in which the water is higher than the quays becomes one in five years in 2100 (Kokhuis, 2012). The design should thus be able to facilitate continuous use when the level of the water rises and falls about two metres, whereas a high tide occurring once every 5 years should be accommodated but not dominating the whole design of the public space.

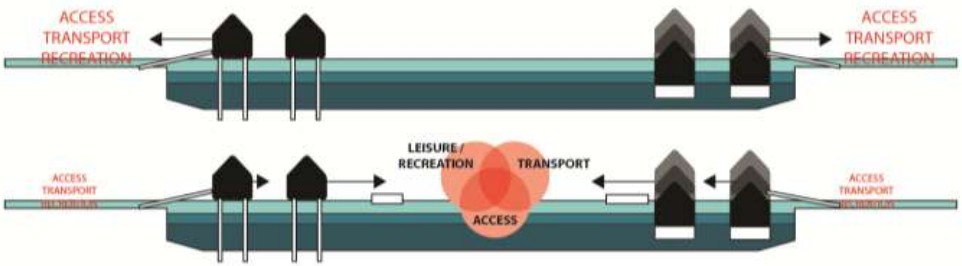

Figure 5: Schematic representation of recommended adaptations to make the water in amphibious neighbourhoods better integrated in the public space network of the city. Source: made by the author, 2012

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Appendix B: Local impact of climate change

The Rijnmond-Drechtsteden area: Towards a closable open system via the current strategy.

In June 2012, the Delta Program 2013 was presented in parliament. Both on national and regional scale possible development strategies are being investigated in order to decide in 2015 on which water-safety strategy is implemented. The Delta Program Rijnmond Drechsteden (DPRMDS) focusses on the region of which Rotterdam is part. They use four climate scenarios which differ from each other concerning to what extend the effects of climate change occur and how the demographics of the Netherlands change.

After testing the first set of development strategies, two of the strategies are put aside: the completely opening up of the Haringvliet, and the construction of a ring of permanently closed dams around the Drechtsteden area (Rijnmond-Drechtsteden, 2012). Another conclusion is that the region in which the Maashaven is situated is able to maintain its required safety level within the current strategy, meaning the local heightening of the dikes. Nevertheless this does mean that outer dike areas such as Katendrecht and the Brielsekades need to develop in a flood-proof way, taking the higher water levels into account.

153. Areas were outer dike measurements (dotted), optimisation of the current strategy (salmon) and further investigation of new strategies (orange) is applicable. black lines indicate dike-rings.
(Deltaprogramma Rijnmond Drechtsteden and RWS, 2012)

On short and medium-term (2020 and 2050) this ideally means that all spatial interventions in Rotterdam should be linked to the reinforcement of the dikes.
On the long term (2050-2100 and further) more measurements need to be taken. The Maeslant storm surge barrier will most probably be improved several times up to 2100 to lower the risk that it won't close from 1/100 to 1/200 or even 1/10.000. Around 2100 the whole barrier needs to be replaced.

In the DPRMDS a ring of closable open dams is discussed to be able to close off Rotterdam and Dordrecht in case of high water discharges in combination with storm tide. I this way the water mass would be guided around the major economic centres. This is not feasible on short term because of the high costs and the high chance of failure of the system as a whole (in which each barrier increases the risk of failure for the whole system). Nevertheless, with even higher river discharges and technical improvements on the reliability of the barriers, this strategy can become realistic in the future. Another possibility for the future is the complete closure of the Nieuwe Waterweg (with ship locks), on the current location of the Maeslant storm surge barrier or further inland to decrease the effect on navigation. Whenever in the future the sweet water assignment becomes more important (currently the water safety assignment in combination with economic interests dominates the choice of strategies), this option can help to provide enough sweet water for the inlets upstream. Nevertheless, for nature this strategy is disastrous.
In the most extreme generally accepted climate scenario the sea level rises with 1,3 metres in 2100. In Rotterdam some outer dike areas are currently on +3,2 m NAP. To protect these outer dike areas this means that the Maeslant barrier would have to close up to 30 times a year in 2100 at when the closing threshold of +3 NAP is reached (Meyer et al., 2012). This is unacceptable for navigation and harbour activities. Without adjustments to the outer dike areas the water level can't raise more without causing nuisance.

Based on these considerations the followings starting points are chosen for the thesis:

- Roughly climate scenario Warm up to Steam
- Short and long term (< 2050-2100): Continuing the current strategy (enforcing dikes in combination with regeneration of urban areas). Starting adaptation of the outer dike areas to make sure the Maeslant barrier won't have to close too often in the future.
- On the long and very long term (2100 >): The replacement of the Measlant storm surge barrier further land inward so ships from sea can enter the harbour further without barriers. On the long run, when technical feasibility increases and the occurring climate change is better predictable, this

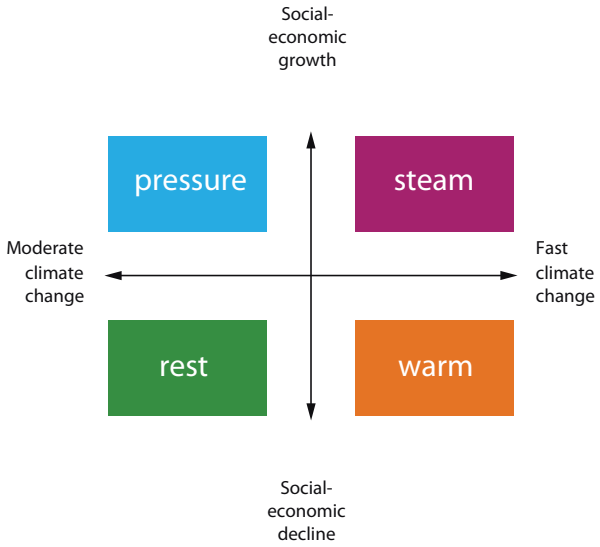
is combinable with the closable open system (Staff Delta Program Commissioner, 2012) of river dams.

- The scope of the thesis will mainly be <2050 for all variables, but concerning the water-assignment outlooks towards 2100 will be made, in order to take no-regret measures to deal with this relatively slowly changing variable. This also corresponds better with available data which usually uses the 2100 scope too.

How do the studied scenarios differ?

All possible development strategies are taking the climate scenarios' 'Warm' or 'Steam' as starting point. Both imply a sea level raise of 85 to 130 centimetres, an increase of precipitation in winter up to 28% and a decline a of precipitation in summer up to -38%. Scenario Warm predicts a similar amount of inhabitants for the Netherlands as a whole until 2050, and a decline to twelve million in 2100. Steam predicts an augmentation to twenty million in 2050 and to twenty-four million in 2100(Staf deltacommissaris, 2012).

The main difference between these two scenarios is the amount of possible causalities in case of a disastrous flood. Secondly they imply a different amount of pressure that cities will experience to develop urban functions in outer dike areas or to densify even more in high-impact areas.



154. Scenario graph used by the Delta Program. translated, based on Deltaprogramma Rijnmond Drechtsteden, 2012

155. The dike and the outer dike area's in the plan area. Made by the author, 2013

Impact of climate change on the Maashaven scale

In the Maashaven area there are two aspects that have to be taken into account concerning climate change.

1. The dike along the Brielselaan and Maashaven Oostzeide.
2. The outer dike areas of the Brielsekades and Katendrecht.

In figure 156 and 157, the data from 2 climate scenarios is shown. These are the minimum and maximum used in the scenario study for this thesis (see also § 5.8). They are chosen because Wb21-mid (sea level rise of 0.6m in 2100) represents the lowest, and Veerman 2008 (sea level rise of 1.3 m in 2100) the highest generally accepted climate scenario. The Wb21-mid scenario is currently most used by Rijkswaterstaat (Helpdesk Water, 2012). At the moment this area within dike ring 17 has an official accepted risk of 1/4,000. Concerning the economic value that still increases it would be logical to also raise the safety level to 1/10,000 just as at the other side of the Meuse and like the rest of the Randstad.

In the study of The Urbanisten (De Urbanisten et al., 2010) it is explained how the height of the dike is calculated. The necessary dike height is an accumulation of the MHW (Normative High Tide), plus an extra dike table height of 0,5m supplement en gulf supplement of 1m. In the table the MHW is increased with 1,5 m to get the necessary dike height.
The current dike height differs along the Brielselaan. In this study the location at the Brielselaan number 55 is taken as starting point because this location is critical for the design. Here the current dike height is 5 m. (Actueel Hoogtebestand Nederland, 2012), (De Urbanisten et al., 2010). According to the data below this already is 10 cm too low if you want to ensure a safety level of 1 / 10,000. The next test round will be carried out in 2014. If this dike is tested on the safety standard of 1 / 4,000 it will still be approved just safe since the necessary dike height MHW 3.44 (van Veelen, 2012) + 1,5 = 4,94m. Towards 2050 nevertheless also with this lower safety level the dike should be heightened.

(1) The flood defence

These data show that the necessary dike heightening varies from +/- 0,4 metres in 2050 up to 0,8 to 1,25 metres in 2100. In the study of The Urbanisten even a necessary dike height of 7,6 is used because they use the safety standard for a 100 times safer dike (not 1/10.000 but 1/1.000.000, practically completely safe). This would mean a heightening of even 2,6 metres. Adopting this safety level is not considered realistic regarding the

156. (left) The different waterlevels according to the two used climate scenarios and the chance of occurence , made by the author, 2013, based on van Veelen, 2012 and Helpdesk Water, 2012

157. (right) The water depth on the quays and the necessary dike height in the two climate scenarios, made by the author, 2013, based on van Veelen, 2012 and Helpdesk Water, 2012

	2012	2050		2100	
	current	WB mid	Veerman	WB mid	Veerman
Water Levels 1 / 100	3,11	3,55	3,50	3,95	3,69
Water Levels 1 / 1,000	3,30	3,70	3,65	4,10	4,21
Water Levels 1 / 10,000 (MHW)	3,60	3,90	3,85	4,30	4,75

Quays Katendrecht 3,5-3,9m Source: Helpdesk water, 2012
Quays Brielselaan: 3,2m Source: van Veelen, 2012

timespan	**2012**	**2050**	**2100**
WB21 mid sea level rise	**0,00**	**0,35**	**0,60**
water depth on quays Brielselaan 1 / 100		0,35	0,75
water depth on quays Brielselaan 1 / 1000	0,10	0,50	0,90
water depth on quays Katendrecht 1 / 100		0,05	0,45
water depth on quays Katendrecht 1/1000		0,20	0,60
MHW (1 / 10,000)	3,60	3,90	4,30
neccesary dike height	5,10	5,40	5,80
current dike height (assumption)	5,00		

Veerman sea level rise	**0,00**		**1,30**
water depth on quays Brielselaan 1 / 100		0,30	0,49
water depth on quays Brielselaan 1 / 1000	0,10	0,45	1,01
water depth on quays Katendrecht 1 / 100		0,00	0,19
water depth on quays Katendrecht 1/1000		0,15	0,71
MHW	3,60	3,85	4,75
neccesary dike height	5,10	5,35	6,25
current dike height (assumption)	5,00		

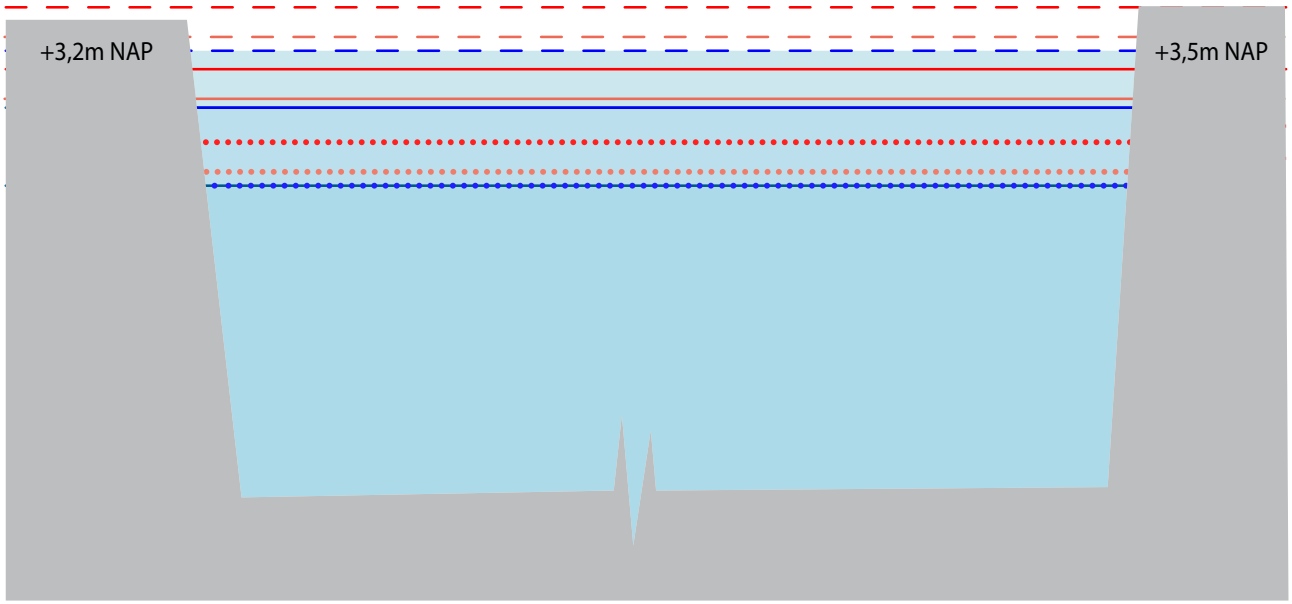
current political viewpoint and economic situation.

The outer dike areas

In existing outer dike areas a risk on damage of 1/ 100 is accepted, whereas with new developments in outer dike areas this is 1/1,1000 (van Veelen, 2012).

Van Veelen shows in his study how existing buildings can be made flood proof rather easily up to about 80cm of water. Above this water level, more structural measures have to be taken, like raising the ground levels or implementing a fixed or movable flood wall. For both the Brielsekades and Katendrecht the data on the right show that existing buildings can be adopted such that they can be maintained up to 2100 since a 1/100 event will not likely cause higher water levels on the quays than 0,75m. Nevertheless, all newly built property along the Brielsekades should be made flood-proof up to 0,9- 1,01 m to guarantee absence of damage in a 1/1,000 event in 2100. Also the depth of inundation of infrastructure like the Brielselaan should be considered. 30cm Of water (both scenarios 1/ 100 in 2050) will already cause a lot of nuisance and congestion.

Not only the data explained above is important. Maybe even more important for the outer dike interventions is the daily fluctuation and the highest water level that occurs approximately once a year. These are the changes in water level people experience and recognise. The interventions are designed with the current water levels as a starting point and robust up to at least 2050 where it concerns public space. Where new buildings or very large investments are concerned like at the Brielsekades, also the very log term up to 2100 is taken into account. These water levels are shown in figure 158.



158. Daily fluctuation and yearly maximum of the water level in the current situation, with the WB-21 Mid scenario in 2050 (then the highest) and the Veerman scenario in 2100. Made by the author, 2013, based on van Veelen, 2012 and Helpdesk Water, 2012

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Appendix C: Inland navigation

The Maashaven currently functions as waiting harbour for inland navigation. In the structure vision for the Stadshavens the municipality takes a different standpoint concerning the inland ships. The fact that inland shipping enhances the dynamics of the area is seen as positive but at the same time question marks are posed at combining the waiting function for inland shippers and floating dwellings as is foreseen here (Gemeente Rotterdam, 2011). The ships are already removed from the Rijnhaven, the showcase harbour for the Stadshavens project. The mooring possibilities are guaranteed at least up to 2020. After 2020 the amount of mooring places in Rotterdam as a whole will be guaranteed, but the location may differ, depending on the plans for the Maashaven and the need for mooring places.

Recently large investments are made to provide electricity at the quays of the Maashaven. This makes the noisy and contaminating diesel generators superfluous. The amount environmental certificates shippers need to stay in the inner city of Rotterdam grows steadily. All those investments are made to enhance the synthesis between the developments at Katendrecht and the inland shipping in the urban context. The Maashaven can accommodate 106 ships (Luijendijk, 2013). The Havenbedrijf (harbour company) plans to remove 75 ships to another location before 2020, followed by the other 75 before 2025 to make the transition to other floating functions possible (Meinster and Persie, 2012). In the transition phase a combination of inland ships and floating functions is envisioned. This causes several conditions to rise. When inland shipping is combined with other forms of lighter (recreational) shipping the maximum speed is reduced to 0,15 m/sec and collision protection is required under or above water (Meinster and Persie, 2012).

Both the shippers and the inhabitants of Katendrecht are against the plans to remove the ships from the Maashaven (Schuttevaer.nl, 2010). The inhabitants argue that the ships are the very first form of floating dwellings and that they are characteristic for the area. The shippers themselves are afraid to be moved away from the city centre and its facilities step by step

Concerning the ecological recovery of the inner harbours, fully loaded inland ships need a depth of about 4,65 m, while empty ships only need a water depth of 2,65 m. The latter accounts for the largest part of the inland ships in the Maashaven, and is much better for ecology (Koetsier, 2012). With floating functions it is a general rule to keep 2 meters of open water between the floating body and the ground. For the future in which extremer droughts are envisioned upstream, the bureau for inland shipping predicts that smaller ships with a fully loaded depth of max. 3m and a 'kruiplijnhoogte' (height after lowering the radar etc.) of 4,2m become more popular again (de Vries, 2006). This is positive for further integration of inland ships in urban areas because they require both less high bridges and less deep water.

An employee of Quacker confirmed that their transport only takes place via road, and that they are not anymore using inland ships for transport of their goods. This makes the first part of the harbour free of necessary deeply loaded ships. Meneba requires about 7-15 deliveries per ship per week, and the waste treatment company and a Ship Repairing company together up to 3 per week (Rus, 2012). These routes are shown in image 31.

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Appendix D: Expert meetings

Dick Sundermeijer
Ingenieursbureau Rotterdam, Technical Project manager Rijnhaven

The shallowing of a harbour is always done up to certain basic level. For extra height differences you should work with for example Geotubes to create stable edges of higher levels. If you place them already before you have the sand ready, silt will gather behind the tube already because of the tides. Per year about 700.000 cubic metre of usable sand becomes available, fluctuating according to the amount of building activities. When designing for species, only take a few main groups as an example and don't go too much in detail outside of your own discipline.

When you want to clean the incoming urban runoff water to make water that is in contact with the whole Meuse swimmable you should keep a few things in mind:

- Check the composition of the Meuse water. If this is as filthy as the urban runoff water, your cleaning is not effective.
- You could aslo think of dams to lead away the filthy water from the recreative area.
- Check how much the inland ships are polluting as well.

Olaf Velthuijsen
Urban Ecologist, Municipality of Rotterdam, author of 'De zalm en steur terug in de Rijnhaven Ecologische verkenning, randvoorwaarden en advies' (2010)

When improving the ecological situation one should not aim at getting back the salmon or sturgeon back. These are species very useful as a horizon goal or for communication purposes, but smaller species at the basis of ecological recovery such as the Twait Shad are both easier to facilitate and they support many other species. For ecological recovery mainly the intertidal and shallow areas are of most importance. These zones are harsh but unique.

Inland shipping can go together with ecological recovery, as other research shows. Lately also in the main channel of the Meuse which is very intensely used, more and more species are found again. Nevertheless the quieter the water, the better. You could think of a kind of corridor idea at the areas that you envision to shallow the most. Separate these areas not only above water, but also below, for example with Geotubes.

Contents like P en N are the most harmful for ecological recovery because the cause too nutritious water where for example algae grow easily.

To explore the possibilities of swimming in open water, you should consult a water expert to see the testing criteria

Erik Trouwborst
Consultant water and spatial transformations, Municipality of Rotterdam

When assessing water on its suitability to be used for swimming, only bacteria are tested, like the E-coli. These come from human and animal faecal matter in urban runoff water. If you want to create swimming water you can better create an isolated, smaller pond which is easier to control with small pumps and is less subject to large fluctuations in rainwater/urban runoff water. With a large flow of clean water you could improve the quality of the open water a bit but the amount of incoming water with the tide is still rather large in comparison.

Something interesting might be that the Meuse should meet the new, stricter requirements of the KRW (Kader Richtlijn Water) in 2015. Also for this new requirements more and more runoff water should be cleaned. If you have ecological recovery as a goal, especially the remote parts of the harbours where the cleaning influence of the tide is the least are vulnerable for pollution. You could also decide to relocate the polluting pumping station to another location. This will nevertheless be an expensive operation.

Consult the experts of Waternet in Amsterdam about their work on helophyte filters in relation to swimming water.

Maarten Ouboter

Water specialist at Waternet Amsterdam, expert on urban water quality, fighting for swimming in urban water in the future.

In Amsterdam the idea of creating swimmable canals is a horizon goal to trigger people. The canals proved to be clean enough to swim during the benefit swimming marathon last year that people could do on their own risk. Nevertheless the Municipality cannot guarantee this quality throughout the year yet and therefore can't approve swimming. They are now testing all the urban overflows now, to get an indication where the first swimming locations in urban context might be located. The problem in relation to swimming water is mainly the bacteria and hazardous objects such as rusty bikes. Be clear on which contents are harmful for what: ecological recovery or human activities such as swimming.

For swimmable water you should totally disconnect urban runoff water from the pond or clean it in an appropriate way. A disinfecting kind of natural water treatment is the 'stekelbaarsjesproject' (stickleback project (waterharmonica) of Ruud Kampf at Texel. Soon this kind of filter will be set up as a pilot project in Amstelveen.

Floris Boogaard

Consultant drainage and water management at Tauw bv, lector spatial transformations Hanzehogeschool Groningen, Phd researcher at TU Delft Civil engineering on sustainable urban drainage systems (SUDS), expert on 'building with nature'.

When you add a deposit tank to your filter system, and choose a more advanced helophyte system, it can become more compact and you can reduce the size to about one to three hectares. A deposit tank also makes the rest of the system easier to clean.

Look at the reference projects of the Erasmusgracht and Westergasfabriek park in Amsterdam. At the Westergasfabriek, which is a closed system because of its polluted soil, swimming wasn't possible too. Here a pond of 30cm deep was created for children because up to 30cm 'swimming' basins are subject to less strict regulations.
When you are talking about floating gardens and greenhouses the *drijvendetuinen.com* project is a nice example of low cost gardens which have an ecological and educational purpose. Besides, for greenhouses nutrient rich water is very desirable. If you can locate them at the beginning of your cleaning chain, they can use these 'bad' nutrients. Also the water that is cleaned from the largest particles can already quite fast be used for flushing toilets. Another educational addition could be an augmented reality- walk as is done at the WATERgraafsmeer project.

Gauke Weg

Senior plan economist, Municipality of Rotterdam

For an exploitable floating neighbourhood you should have a large amount of houses. For example the relatively shallow Nassauhaven is not yet exploitable with 48 houses because of the polluted soil which should be covered or taken away. Covering here would result in too shallow water.

An interesting aspect concerning density and contrast is that for example the Rijnhaven has allowed the high density on the Wilhelminapier, which has an FSI of approximately 2,5. When programming the water with dwellings or other buildings, this might become problematic when looking at regulations (without speaking about desired qualities).

Some financial indications:

- The openable Rijnhavenbridge has cost about 10 million euro. This could be 10% less if not openable. (Maashaven is twice as wide, red.)
- A new quay with the current depth costs about 20,000 euro per linear metre. Less deep is less expensive, and if the quays have to be reinforced anyways (as in the Rijnahven case) you can combine budgets.
- Think about the openable part of the bridge: the wider the more expensive.

- Try to earn at least 1/3 of your money (by selling ground or shallowing the harbour) before starting the project.
- Not creating enough parking spaces 'kills' a lot of nice projects. Combine functions that demand parking or share parking lots/garages for dwellings (at night) and recreational functions (day).

?

Frans den Adel
Advisor hydraulic engineering Municipality of Rotterdam, plan economist.

Some more budget estimations:

- A deep quay (before shallowing) costs 20,000 euro per linear metre, a shallow one 'only' 12,000 euro.
- Take 650 euro per m2 for nicer floating boardwalks that are stabilised by poles and have a residential function (high safety requirements). Very cheap polystyrene ones cost half as much.
- If you build a concrete stair like construction against the existing quays it will cost about 2,000 euro per m2.
- A fixed boardwalk (towards the bridge) will cost about 1,500 euro per m2.
- The bridge can even be another 10% cheaper is the opening is only 10 metres (only for recreational boating).
- Only at the Wilhelminapier there are already a few hundred parking places in short. If realising the 'whale' like building at the Katedrecht side of the bridge, you can use the money of the sale of ground (and water) for the bigger project, and let the developer take care of the parking and the building. If this is (partially) realised in the water, you 'only' have to dam and fill the pit.
- When relocating a dike that has to be altered or heightened in anyway because of non-safety motives, you can only count on a very minimal contribution from Rijkswaterstaat, similar to or even less than the costs of a simple and cheap dike reinforcement.

159. Yearly average of the contents of the water pumped into the Maashaven by the Hillevliet pumping station (data via Waterschap Hollandse Delta,Riens, 2013) and of the Meuse at Brienenoord (data from Helpdesk Water, 2013). The data show high concentrations of P, BZV5a and CHLFa and low oxigen and very low visibility for the water from the pumping station. Bacetra concentrations are not tested.

	Components	BZV5a	CHLFa	Cl	N	O2	O2	P	Zicht
		mg/l	ug/l	mg/l	mg/l	%	mg/l	mg/l	m
Yearly Average from:									
Pumping station		3,208	23,417	88,5	2,133	80,667	8,617	0,277	0,325
Meuse		1,424	9,595	129,9	2,657	92,55	9,1283	0,08567	0,7417

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Gemeente Rotterdam

URBANISM

Delta Interventions

The connecting waterscape

Master Thesis

Karlijn Kokhuis