Rotterdam floating Aquascape

creating a new connection with water

Bachelor thesis Landscape architecture
Wageningen University

Recycled islands

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Supervisors: Paul Roncken en Ramon Knoester
Coördinator: Ir. Gabriëlle Bartelse

July 2016

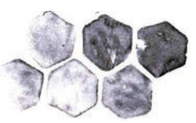

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Figure front page: Interpretation floating plastic islands, Author

Preface

This document includes the thesis 'Rotterdam aquascape, creating a new connection with water. This thesis is written as a final work of the bachelor Landscape architecture and spatial planning at Wageningen University for the specialisation Landscape architecture.

"Our current way of producing, consuming and throwing away garbage is untenable. Fortunatly more and more small scale initiatives are popping up, which show us that grabage is an unnessasary human invention and that we can find a sustainable way to provide us with our needs." (Bluecity010, 2016)

This quote of Bluecity010 talks about one of the main issues of this thesis, the human garbage disposal. I hope this thesis will inspire some people to care more about their garbage disposal and how recycling can change the way we think about this.

I want to thank Paul Roncken and Ramon Knoester for their help, creative input and support during this thesis.

Abstract

This thesis is an end work of the bachelor landscape architecture. In the thesis the link between the quays and the water in Rotterdam is researched. It tries to improve the experience of the water from the quay, by making a design using floating recycled plastic elements. The design also needs to improve the situation on the quay and make people aware of the importance of recycling. Principles derived from literature were used to make design choices.

The design links the quay and plastic recycling, through a machine which moves the plastic and water on the quay. The plastic is then stored in a container, which also makes a new place on the quay. The water falls back onto the floating island and creates in this way more interaction with the water and plastic for the people.

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Introduction

The city of Rotterdam has one of the biggest harbours in the world. The placement of the city besides the river Maas and the North sea, is one of the main reasons why the harbour is this big. However the harbour activities are moving from the city centre to the newer parts in the "Maasvlakte". This causes that the old harbours have to change their function. Already a lot of old harbour areas have been transformed to living areas or other functions. (Port of Rotterdam, 2016)

One thing that hasn't changed much are the quays. These large walls were used for docking ships and distributing the cargo. Sometimes the paved area on top of the quays was already transformed into a green area where trees were placed or grass was sown. The large height difference between the quay and the water causes the disconnection with the water. For a city like Rotterdam this connection should be more important, because the water and harbours create a lot of identity for the city. The municipality is also busy transforming the waterfront and is trying to achieve a "softer" waterfront. They planned to do this by creating several wetland parks along the river. These are already examples how to create more connection with the river. (college B&W, 2014)

Another problem in the harbour of Rotterdam is the plastic waste.

This plastic floats with the river to the ocean. In the ocean this plastic is broken down by solar reduction and eaten by small sea creatures or plankton. This will eventually create a bigger problem for the health security of the world if the plastics go into our food. (plastic soup foundation,2016)

The ocean clean-up project from Boyan Slat already raised a lot of awareness on the topic of the plastic soup in the oceans. However it's better to tackle this problem by its source. Governments are already trying to prevents plastics in our environments, but that's still not enough. A lot of plastic is going into the rivers, which brings it to the oceans. That's where the new focus of clean-up projects should be. In the rivers the plastic is still of a big size and can easily be taken from the rivers, preventing it from going into the oceans. The head of Rijkswaterstaat, Jan Hendrik Dronkers, also supports the idea to make a national plan to tackle the plastic waste in the rivers. (plastic soup foundation,2016)

The organisation Recycled park is trying to contribute to the collection and reuse of the waste plastic. Together with WHIM architects they developed a floating park made from recycled plastic from the Maas. In this way they are also helping to soften the quays. The prototype will be built in the Rijnhaven next to the already existing floating pavilion. (Recycled park,2015)

This park still has the same difficulties as the quays; How to eliminate the effect of the high quay, improve the experience of the water and show the cycle of plastic. These challenges will be the main ones which I will tackle in this thesis.

Fig 1. Effects of plastic waste

Fig 2. Changing functions for the harbour of Rotterdam

Fig 3. Impression of the floating plastic islands

Method

This chapter explains the method used in the research of this thesis. It also shows the objective and questions, location choice and a reading guide.

Objective and questions

The objective of this thesis is to improve the experience of people with the water in Rotterdam and raising more awareness for recycling. I want to achieve this by using the floating plastic elements provided by WHIM architects.

Design question: How can floating recycled plastic elements improve the experience of the water along the quays of Rotterdam and tell the importance of recycling?

Knowledge questions:

What is the current situation of the quays in Rotterdam?

How can the making process of the plastic elements raise more awareness for recycling

How can design improve the experience of the water?

These knowledge questions will be answered by studying literature and reference projects. These answers will be transformed into designing principles and used in the designing process.

Location choice

The location choice will be based on the criteria of the making process of the plastic elements. The chapter location will further explain the location choice of the location.

Method

My method for this thesis is inspired by the "Three cycle view of design science" by Hevner. He describes three design pillars and the connection between them through three cycles, creating one big process cycle. Together with the group we did the main analysis of the site and the plastic elements to ensure we got into the technical depth of the project. From this analysis everyone can find their own scientific knowledge on the specific topic they're focusing on. This together with the research of some reference projects will feed the knowledge base I need for my designing process.

Reading guide

This part explains the main structure of this thesis and introduces the subject. The chapter Rotterdam and the harbour will answer the first knowledge question. The chapter Plastic elements will answer the second question and the last question will be answerd in de chapters People and water and Reference studies. The other chapters will explain the concept, design principles, design elements and location. The last chapters will give a conclusion to the knowledge question, a critical reflection of the thesis and a reflection on the process.

Fig 4. Group analysis

Fig 5. Group analysis

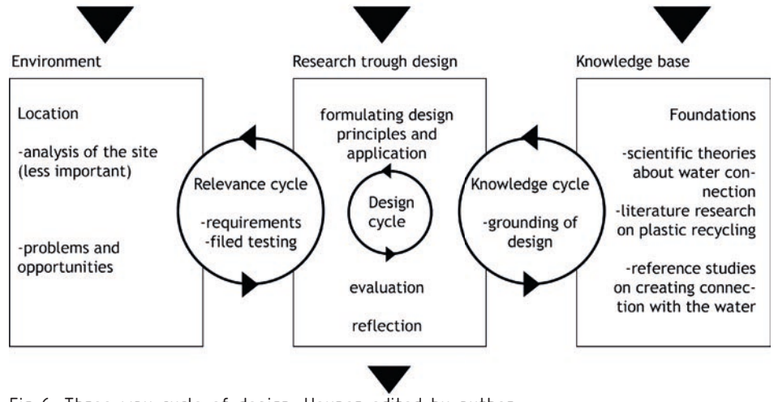


Fig 6. Three way cycle of design, Hevner edited by author

Rotterdam and the habour

In order to know the current situation of the quays in Rotterdam we have to look why they came there. There are different processes which shaped the quays and makes the quays the ways they are. The quays of Rotterdam were built as docking areas in the harbour. Many of the harbour activities have already disappeared from the city centre and more of these activities will move to the new harbour in the "Maasvlaktes". This chapter will describe the old, the current and the future situation of the quays of Rotterdam.

History of the harbour

Only from the 19th century on Rotterdam has been the main port of the Netherlands. Before this Rotterdam was still a small town on the broad of the river Rotte. The Rotte was dammed of to prevail salt water coming into the water of the Rotte. The place was used to trans-ship cargo from sea ships to river ships. The city didn't grow much during the golden age, because Amsterdam was the main harbour and also the place where most entrepreneurs were living. The harbour grew exponentially during the second half of the 19th century, because of the growth of mining and industry in the Ruhr area in Germany. This increased the transhipment in Rotterdam. Therefore engineer Pieter Caland developed a plan to make a new water way, the new Maas, through the dunes connecting the harbour to the sea. The harbours were enlarged with new docks, quays and rail ways to connect them. (entoen.nu, ?)

The harbour became the biggest harbour in Europe around the 1980ies and holds still this record. This growth came due to the refinement of oil, which is still taken place in the harbour (Port of Rotterdam, 2016)

Fig 7. Old harbour of Rotterdam

Fig 8. Old city map of Rotterdam

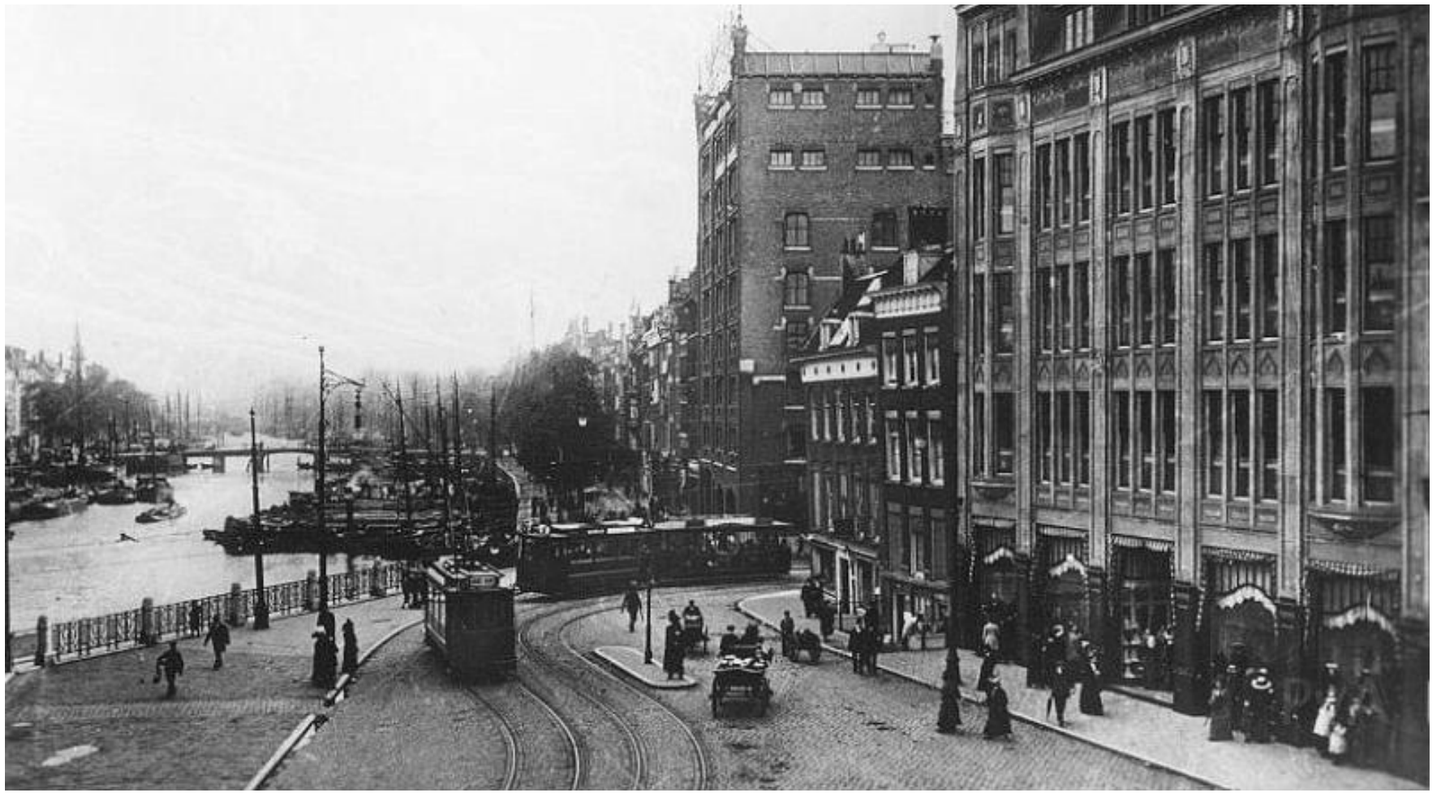


Fig 9. Old harbour of Rotterdam

Current harbour

Around the year 2000 the plans of the new 'Maasvlakte' were expected to bring new opportunities for the old 'cityports'. These old harbours inside the city centre were planned to transform into new urban environments. However these big scale plans didn't work. In 2012 it became clear that the plans were never to be realised, because of the lack of money and the scale of the plans. ''The city and the port of Rotterdam found themselves back to back, and the love for each other seemed to have faded." (Aarts et al., 2012)

Nowadays these two institutes are working together again and have found a joint development strategy. This strategy includes more realistic, organic development plans. The institutes are left with two challenges to apply their strategy. ''On the one hand, the city has to engage in new strategies to continue to take advantage of the presence of a large port. On the other hand, the port authorities have to make sure that the desired developments are politically supported by the city, although these developments mainly take place outside the perimeter of the city.'' (Aarts et al., 2012)

Both challenges can be tackled in the waterfront redevelopment areas. These areas can deliver both gain for the city and the port. "It results in two main strategic planning principles that guide the waterfront redevelopment, economic diversification and the accommodation of housing and other non-port functions." (Aarts et al., 2012)

The economic diversification of the port will attract a more diverse spectrum of investors who will both benefit the city and the port, by bringing more economical strength to the area. The accommodation of housing and other non-port functions has its roots in the 1980ies. The "Kop van Zuid'' was the first harbour which focus switched from harbour to housing and companies. By changing the function of these areas the city took over the port areas and created a patchwork of housing and harbour areas. This gives Rotterdam a unique character, but also brings difficulties like gentrification. The city ports project, which started in 2002, with its large scale projects was the successor of the 1980ies projects. The city ports project was proven insufficient when the crisis hit. More small scale projects now make their introduction in this project, which can revitalise the city port project. (Aarts et al., 2012)

The harbour activities are currently moving out of the city. This leaves the location of old industrial buildings open to new initiatives and the water vacant of any use. (Port of Rotterdam, 2016)

Fig 10. New initiatives near the Rijnhaven

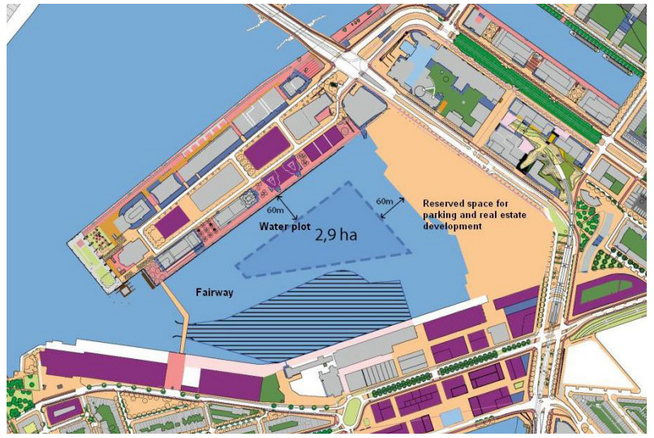


Fig 11. New initiatives near the Rijnhaven

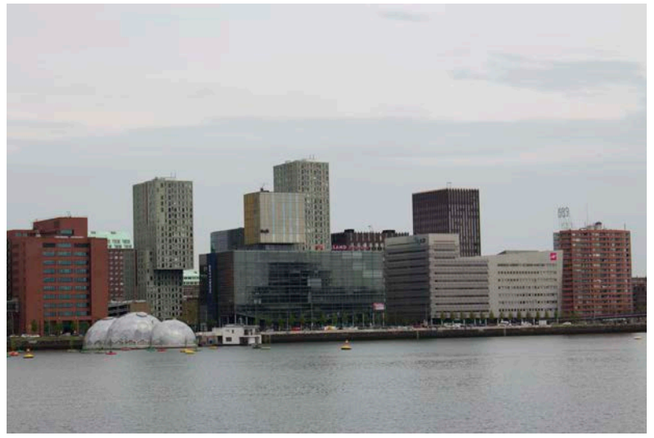


Fig 12. Floating pavalion, Rijnhaven

Future harbour

The harbour of Rotterdam has planned to maintain and strengthen their position as largest harbour in Europe. To reach this goal they wrote a vision for the Rotterdam harbour in 2030. The vision of the harbour includes the following examples; Further development of the city harbours, strengthening the relation between the harbour and the city, creating a pleasant living, working and leisure network, lowering the ecological footprint and creating a bio-based industry. (Regiegroep Port of Rotterdam, 2015) Floating communities are one of the wild cards of the city port projects and could in the future be an alternative form of waterfront redevelopment. By building on water, a distinctive urban environment is created for both residential and commercial uses. "The maritime business services industry is interested in these developments, because companies see opportunities for a distinctive business environment that contributes to their identity and image." The city and the port both see opportunities in this idea that could bring middle and high income groups into the city. The cityport projects provide a framework which allows the building of floating communities and tries to attract and facilitate initiators. (Aarts et al., 2012)

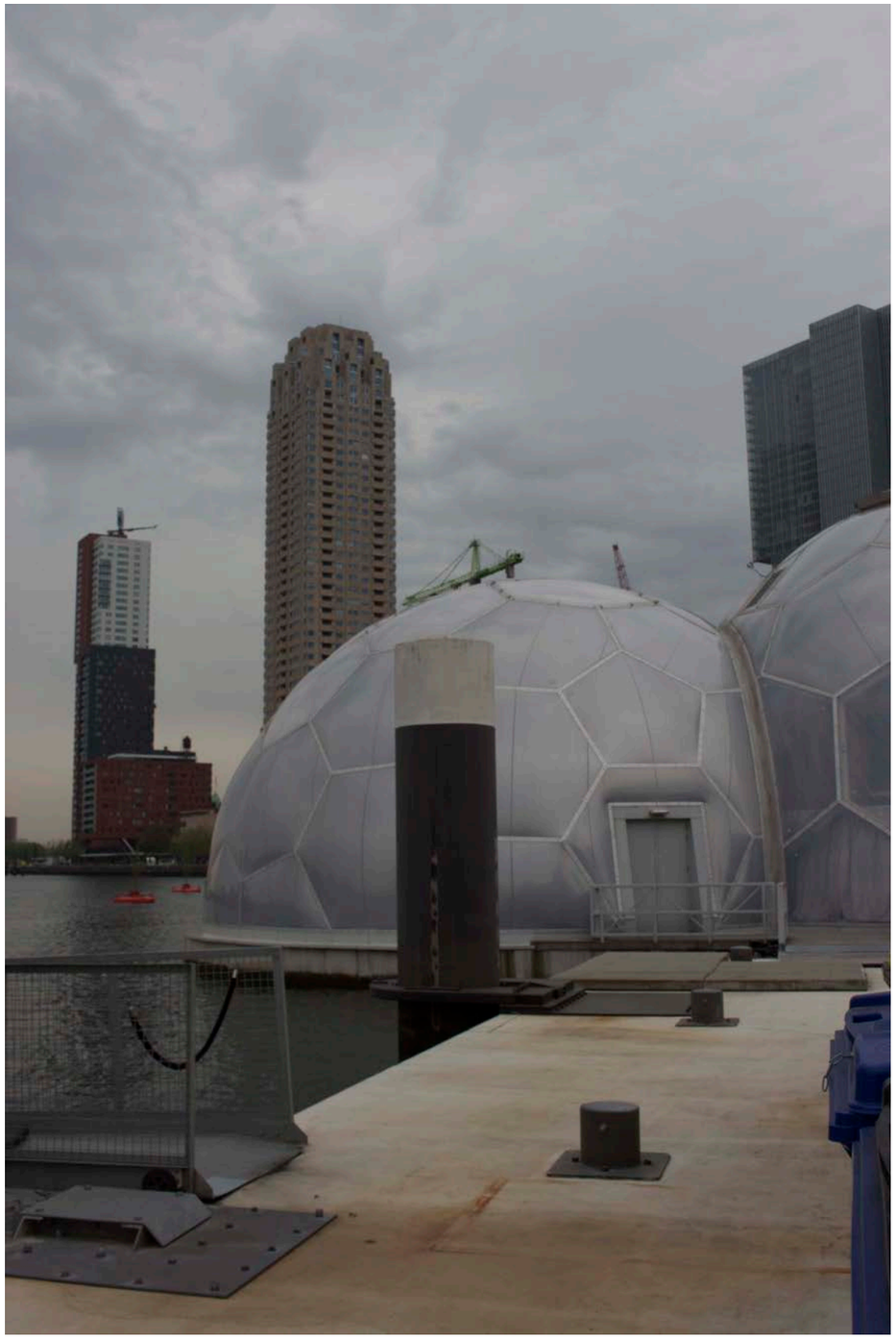


Fig 13. Floating paviion, Rijnhaven

Quay analysis

Looking at Rotterdam there are three main quay types. A double quay, a single quay and a sloped quay. The quays are made out of brick and mortar, concrete or stone. These quays have to be high enough to deal with changes up to 2 metres between high and low tide. (Rijkswaterstaat,?) They also have to deal with extreme weather and storms. They have to be sturdy and protect Rotterdam against the water. A lot of quays still have remnants of elements used for shipping. For example wooden poles to protect the quay from boats or metal bollards to secure the ship to the quay. The quays often have rails in them for a crane that could unload the cargo. To make this more easy the quays are often wide for effortless transhipment. Close to the quays are roads and warehouses, in which the goods were stored. In the old harbours like the Rijnhaven these warehouses are transformed or broken down for housing or offices. The harbour sometimes changed functions to a habour for small leisure boats. An example of one of these harbour is the "Boerengat" harbour.

Quays like the "Boompjeskade" are one of the oldest examples a quay which was made nice for leisure, beside the function of transhipment area for cargo. Already in the 17th century a double row of linden trees was placed here. The quay, trees and houses were all destroyed in the bombing during the second world war. (stadsarchief Rotterdam, ?) The quay got a couple of renovations in the 1950ies, but the most recent one redeveloped the quay into a real place for leisure activities. Instead of the annual beach more grass was sown and master planter Piet Oudolf developed a plant scheme for a part of the quay. The quay now offers a nice view on the south part of the city and a pleasant place to be. (cityguide Roterdam, ?)

Another quay in Roterdam, the "zaagmolenkade'' also got some new additions to the quay. Here next to the "Rotte" they developed a lower quay from wood for people to sit on and relax. This is an example of a second quay added to the original quay.

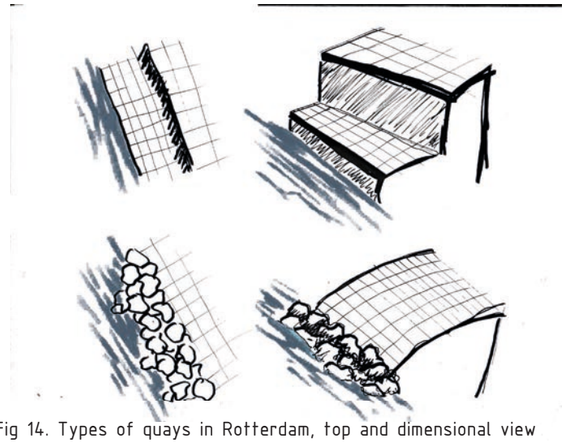


Fig 14. Types of quays in Rotterdam, top and dimensional view

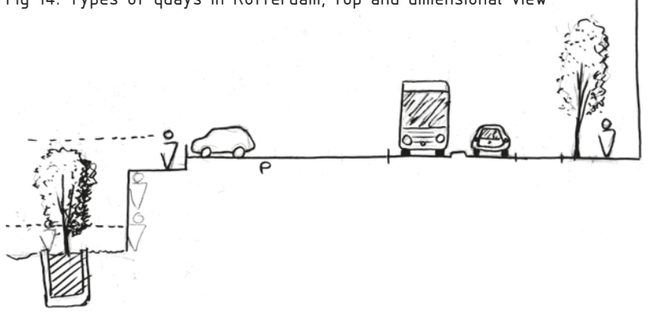


Fig 15. Quay section, Rijnhaven

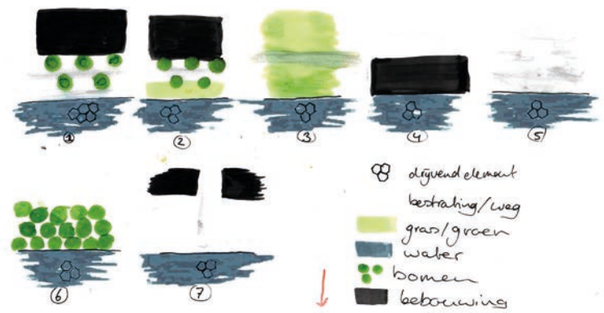


Fig 16. Possible quays

Conclusion

The quays in the harbour of Rotterdam have been shaped for the benefit of the harbour. That's why the quays are made for transhipment of cargo. Now the harbours are transforming into living areas, but the quays remain the same. This results in maintaining the identity of the place, but also causes the disconnection from the people on the quay and the water. There are lots of new initiatives for the old harbour areas, but only some are creating more connection with the water. The floating communities are an example of initiatives which create more connection with the water, by bringing life on top of the water. The floating island would fit in with the current plans for the harbour and would be a great catalyst, which could attract a lot of potential initiators for these floating communities. It could create a second quay close to the water, which large part of Rotterdam is lacking. In this way people can get closer to the water and get in contact with the water.

Fig 17. Zaagmolenkade Rotterdam

Plastic elements

WHIM architects have developed together with Delft University and Hogeschool Rotterdam the plastic elements that can form an island. This chapter describes the process of making these elements from recycled plastic and the possibilities with these elements.

Making process of the plastic elements

The plastic elements designed by WHIM architects are made from recycled plastics. For the prototypes they collected plastic by hand from locations where the plastic is piled up in the river Maas and the harbours in Rotterdam. Most of the plastics float on the surface or just below it.

Royal Haskoning DHV, ISI and SK International commissioned by SBIR made a prototype for a collector, the plastic fisher, which collects the plastic from the river in one spot. The collector is movable and collects most of the plastics. This collector can be placed best on the outer bend of the river. The collector can be emptied by hand and the plastic is put into big bags. (Recycled park, 2015)

The plastic is sorted according to material and cleaned in a special machine. This process has to take place in a factory outside Rotterdam, because the amount of plastic was too low to run through normal sorting machines. The plastic are transported to another place and melted into new sheets of plastic. These sheets are then cut to lengths and assembled in the hexagonal shapes.

These shapes are filled with Styrofoam to enhance the floating ability. This Styrofoam also gives the structure more strength, just as the ribs made from plastic.

The hexagonal shape was chosen to achieve maximal stability in the water and the sides can be assembled more easy then a round shape. (van der Eng. et al, 2015)

The sides of these prototype elements will be 1.10 m and the diagonal 2.20 m, which makes them more easy to move. The elements can be assembled with a hexagonal plate, which secures the elements together. A new park can be made from the assembled elements.

Fig 18. Visualisation plastic island, WHIM architects

Fig 19. Results from the process, WHIM architects

Possibilities of the elements

WHIM architects designed several types of plastic elements, all with different functions. They designed a path element, a tree element, a plant element, a small river element and a bench element. (Recycled park,2015) For this thesis our group first looked for alternatives for the form and size of the elements. It turned out that the provided shape was the best possibility for stability and surface, although one hexagonal is quite small on a human scale. When assembled together this shape could be more interesting and also gives opportunities of cutting the edges, making it a straight shape. It is also possible to colour the plastic in any desired colour or to colour select the plastic before melting it into new sheets. (Recycled park,2015)

These elements can make floating parks and thus create a new level for people to see the water from. The elements can be connected to the quay, but research turned out that for the life underneath the structures a space of a few meters between the quay and the island is needed. (van der Linde, 2015)

The plastic material can be used to develop different kinds of sheets and thus shapes. This offers the possibility to create more than just the hexagonal shapes.

Conclusion

The floating elements can contribute to the experience of the water, because they add a new level to the quays of Rotterdam. It is also valuable that these islands are made of recycled plastics, which are collected from the Maas. The problem with this is that the plastics that have been collected in the collector, have to be taken out by hand. This makes the process time consuming and also expensive. The process of sorting, washing and melting the plastic is also time consuming and difficult process, because of the transportation of the goods. For a design it would be best to provide a view of the process, which people can experience or do their selves. In this way they can people will get more awareness of the process behind the making of the plastic elements and the importance of recycling.

The given form of the elements provides a lot of opportunities when this form can be cut in any desirable shape. The hexagonal form then serves more as an under layer instead of a form which determines all the other forms. For a park this is more easy and will turn out as a more versatile park. Given that the plastic can be shaped in any form also provides opportunities to also create other elements from the plastic. The ability to colour the plastic also gives a spectrum of freedom within the design.

Fig 20. Visualisation of the "Plastic fisher", WHIM architects

People and water

Water is one of our main needs as humans, but it also provides us with recreational and other purposes. One of this purposes is the natural function of water. The connection between humans and nature is very important as stated by Kellert. He says that people need to feel the connection with nature in order to live. In the case of Rotterdam this is more difficult, because the city centre has lots of high rise and less green areas. The significance of the water is neglected in this way, but water is also part of the aquatic nature. (R. Kellert,2005) The design has to make the connection with water and improve the experience of it. This chapter describes the water experience of people and how to improve this in a design.

Water perception

Water is most of the time an element of any landscape or park, because it triggers our inner fascination of water. According to Herzog(1985) there are different factors that determine the preference for a type of waterscape; viewing time, spaciousness, texture, coherence, complexity, mystery and identifiability.

He tested the preference of different waterscapes by showing different pictures of waterscapes for the same length of time. All of the pictures had a different variation of the other factors. A lake for example is spacious, has less texture, a lot of coherence and identifiability, but less complexity and mystery. He concluded in his research that people are more likely to enjoy mountain waterscapes, fast streaming rivers and waterfalls. This is because of the underlying evolutionary explanation. Kaplan stated that people can already experience joy from the notion that water is nearby. This joy is probably evolved from the time when clean water was one of the main reasons to stay in an area.

This can also explain why people like the sight of a rushing river or waterfall more than a swamp, because the water of a swamp is more likely to be contaminated than fast flowing water.

The fast streaming river and waterfall are also the most capable of making sense and involving people in a place. These concepts by Kaplan and Kaplan are about the ability to find your way in an area (sense) and the raising of interest of people and keeping it (involvement). These concepts can be used in a spatial way when designing a park. (Harzog, 1985)

The perception of a landscape relies on all senses. In the article Is motion more important than sounds? The writer states that when perceiving a landscape the sound and movement are both important to perceive this landscape. The moving film without sound and the picture with sound almost was evaluated in the same way. This means that when designing a landscape both sound and motion are important, when it comes to the perception of that landscape. (Hetherington et al., 1993) For the design of the park this means that people have to see and both hear the water in order to perceive it.

Another part of the perception is a physical one. People have to be able to touch the water, mostly for children the physical contact with water is more important than a visual or mental contact. The more various the experience is, the better. (Manning,1997)

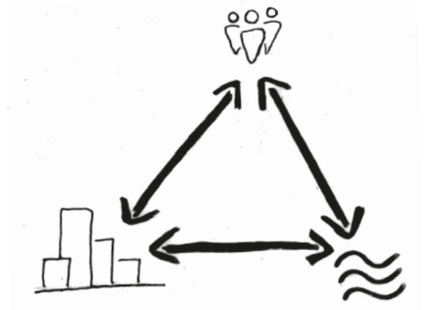
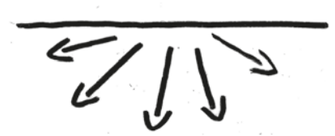
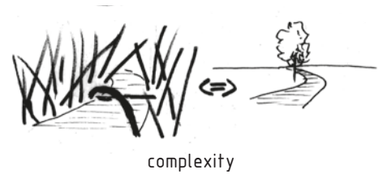
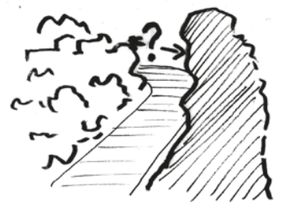


Fig 21. Ballance between water, landscape and people







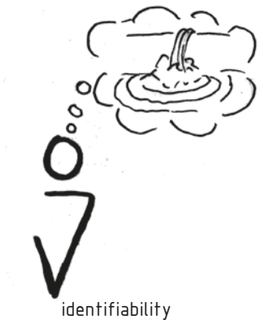


Fig 22. Factors which determine the appriciation of a waterscape

Water in design

For the design of rivers interaction between the elements water, people and landscape is needed. They have to be in balance in order to work and have interaction between one another. (Manning,1997)

For water design along rivers Manning also defines some ingredients, which can improve the water experience.

The designs along rivers have to have the following ingredients to be attractive: complexity, access, circulation systems, contact points and crossings.

These things are for rivers in cities the same as rural rivers, but cities know more human extremes and the river only reaches to the built areas. This causes a unbalance between the human, landscape and nature relation. But often nature finds its way in these urban environments in the form of little sand banks or plants emerging from the quay wall. People are in this way are also struggling to find their place along the quay. Often the path is cut off by buildings or other obstacles. This makes it impossible for people to continue their journey along the river. (Manning,1997)

The design therefore has to bring back a balance between water, people and landscape along the river Maas. The river then again provides a recreational space when it, just like nature, changes from time to time with small changes of the quay. (Manning,1997)

Ingredients

Complexity

To create an interesting design the balance between complexity and simplicty has to be right. By making a design more complex, the design gives more oppurtunities for different functions

Access

In a design people need to have acces to the river to really experience it,

Circulation systems

A design has to have acertain route. This route consists of the urge to go to the river. The viewer will try and find this route to the river, when this is not posible to reach, beacuse of foliage.

Contact zones

Contact zones are places where people can access the water. Apart from being open places in the vegetation these places give shelter and create a sense of place, because they are different and better than other places. They are places along the with gentle slopes, a firm and dry ground. Hard edges of these areas are not preferred unless the context of the place is urban.

Crossings

When designing along a river people also should have to possiblity to cross the river. Thsi derrives from to urge to seek for the unknown, the opposite of the river.

Conclusion

For a design which enhances peoples experience, the floating park has to include the following concepts; complexity, mystery and identifiability. These determine the appreciation of a water element and thus the experience of the water in a park. One of the best ways to do this is by creating a waterfall and a fast flowing river, because they include the mentioned concepts. They also both provide an audible element in a park and can therefore be better perceived. The design also has to have some of the ingredients by Manning. These ingredients (complexity, access, circulation systems, contact points and crossings) offer some design objectives for the design, which will help the water experience of people in the design.

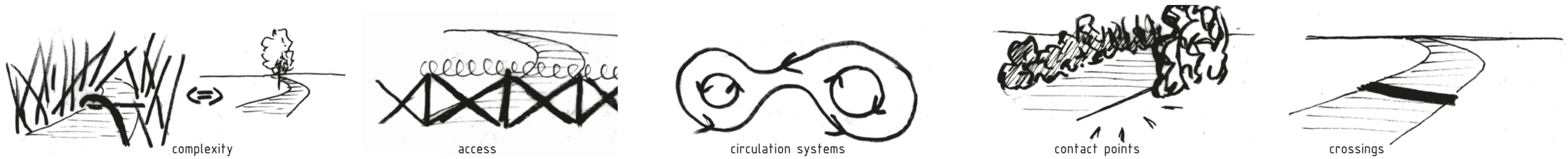


Fig 23. Ingredients which improve the water experience

Reference studies

These examples of references studies show how certain projects designed a better connection with water. I analysed the projects to see the ingredients of Manning and to see how they implemented them and looked for the factors of preference of Harzog to see how these factors were used in the design.

Mozes bridge_ Halsteren
RO&AD

This bridge was for me a great example how to use an existing place and create with a small intervention much more connection with the water. This is done by bringing the eye level of the visitor just over the water level, which enlarges the experience of the view over the water. The bridge lowers the complexity of the area and creates a way to contact the water with your hands more easily. It creates a crossing to the other side of the fortress.

Roof of Oslo Opera_Oslo
Snøhetta

This design shows the cooperation between the building and the water. The connection with the water is enlarged, because the roof of the building is made accessible and people are able to walk right from the highest point above street level to the lowest point below street level, which is also a quay. The building creates a mystery, because people are not sure what's on the other side. People can get in this way more in contact with the water.

Fig 24. Mozes bridge

Fig 25. Oslo opera

Rombeek_Enschede
Buro Sant en Co

This design is for me an example of a good reconstruction of a brook. This water wasn't always visible in the landscape, but because of this intervention it was made visible again and also made interactive for the people. This makes the complexity of the water visible and also makes the water accessible from the stepping stones. These also work as a crossing over the water of the Brook.

The Infinite Bridge_Aarhus
Gjøde & Povlsgaard Arkitekter

This single bridge shows the beauty of the original landscape and allows the visitor an unique panorama by bringing the visitor further into sea. It simple design still allows the visitor to walk a simple circulation system, which bring the visitor closer to the deep sea.

Kalvebod Waves_Copenhagen
JDS

This project allows the visitor to leave the quay and enjoy the water from different levels. The walkways are broad enough for people to stay a little while and enjoy the water. They are also made with a route within project, which allows people to walk a circle. People are able to access the water and swim in it.

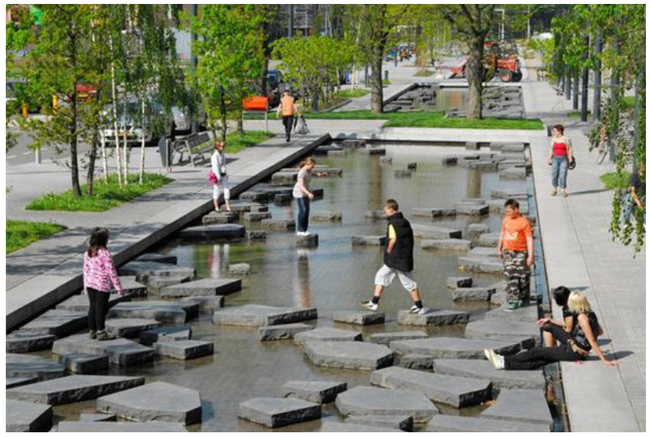


Fig 26. Roombeek

Fig 27. Infinte bridge

Fig 28. Kalvebod Waves

Sea organs_Croatia
Nikola Bašić

This project focusses on the audible part of the sea and lets visitors enjoy the sound that the waves create in the sitting elements. These sitting elements allow the visitors to access the water and when sitting on these steps the distance to the water is really small.

Grorudparken_Oslo
LINK Landskap

This project lets the water flow off the water stairs to a pond. This creates an audible effect to the water and also purifies the pond, because of the flow of water. The people that walk beside the water stairs walk on the same level as the water, which makes the water accessible.

Nansen Park_Oslo
Bjørbekk & Lindheim

This projects connects various living areas through the water. The water also offers a circulation system in the park and makes the park a place to play with water.

Conclusion

The projects mentioned all use the water in a certain way. They all use some of the ingredients by Manning and the factors of Harzog to create unique ways to experience the water. The design could use some elements of these projects to create unique ways to experience to water on a small scale.

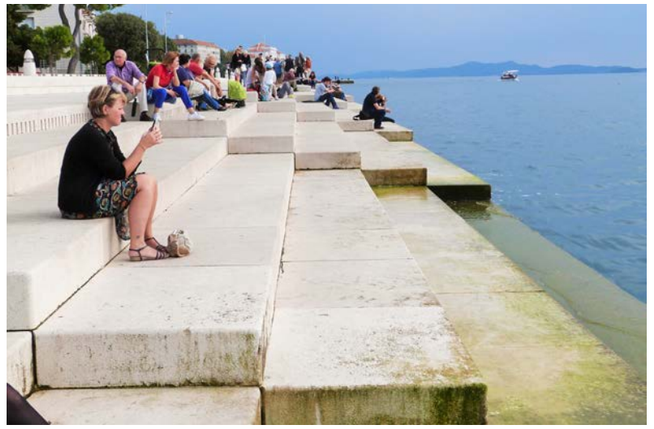


Fig 29. Sea organs

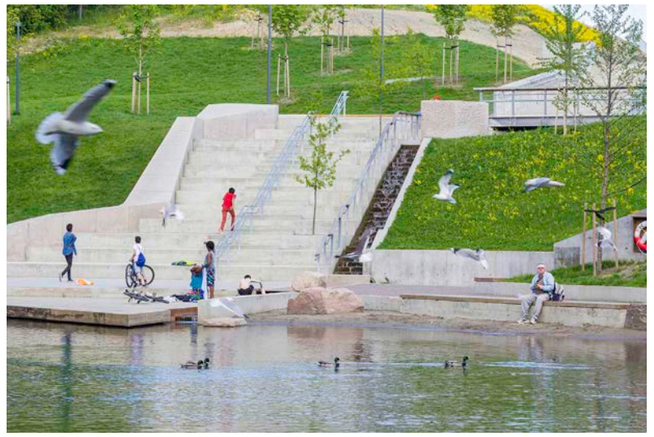


Fig 29. Grorundparken

Fig 30. Nansen park

Concept

The concept of my design is based on the two main intentions of the design.

The design has to tell the story of the plastic elements and the design has to enhance the experience of the water.

The story of the plastic elements are translated trough the two first steps of the process of making these elements. For the collection of the plastic is already a prototype of the 'plastic fisher', by combining this collector with a public park people will become more aware of the plastic in the river. I also want to combine this with the act of moving the plastic out of the collector. I chose to make a machine which people can operate to move the plastic from the collector into a structure on the quay. This machine will scoop the plastics and water and bring them on the quay. There the water and plastics will be separated and the plastics will be stored until further process.

By bringing more water on the quay people will also interact with the water. This water will then cycle on the quay and will flow into a waterfall, which will drop the water on the plastic structure again. From here the water will flow in streams back into the river, which will also create more interaction with people.

Fig 31. Concept image

key elements

From the reference studies I can derive a couple of elements, which I will use in my design for creating more experience of the water.

The water stairs from the Grorudparken in Oslo is one of these elements, it creates a waterfall on stairs, which are on the same level as the stairs the people are walking on.

The stepping stones from Roombeek park Enschede recreated an old brook flow and make it possible to cross the flow at any point.

The Oslo opera shows how a building can be incorporated in a design with water. People are able to walk on the roof, thus creating the exiting flow of being elevated from the quay and then descending to the water.

The Mozes bridge shows the effect of lowering the view. The water looks much bigger and closer by ,when your view is almost as high as the water level. The experience of the water becomes much larger when being this close to the water.

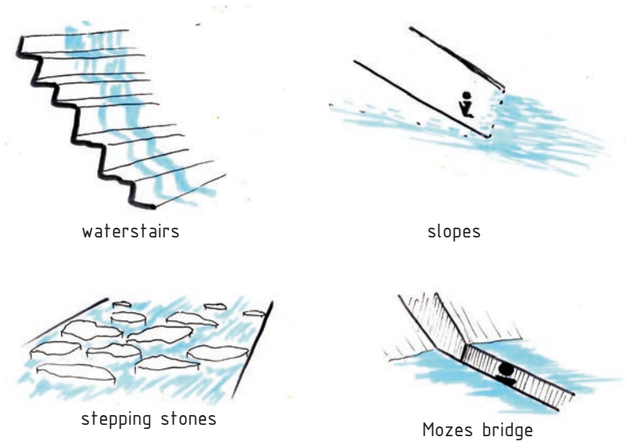


Fig 32. Key elements

Location

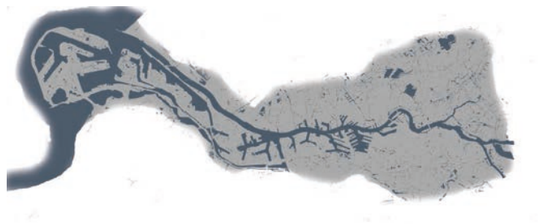


Fig 33. Area zoom

Fig 35. Proposed gathering points, WHIM architects

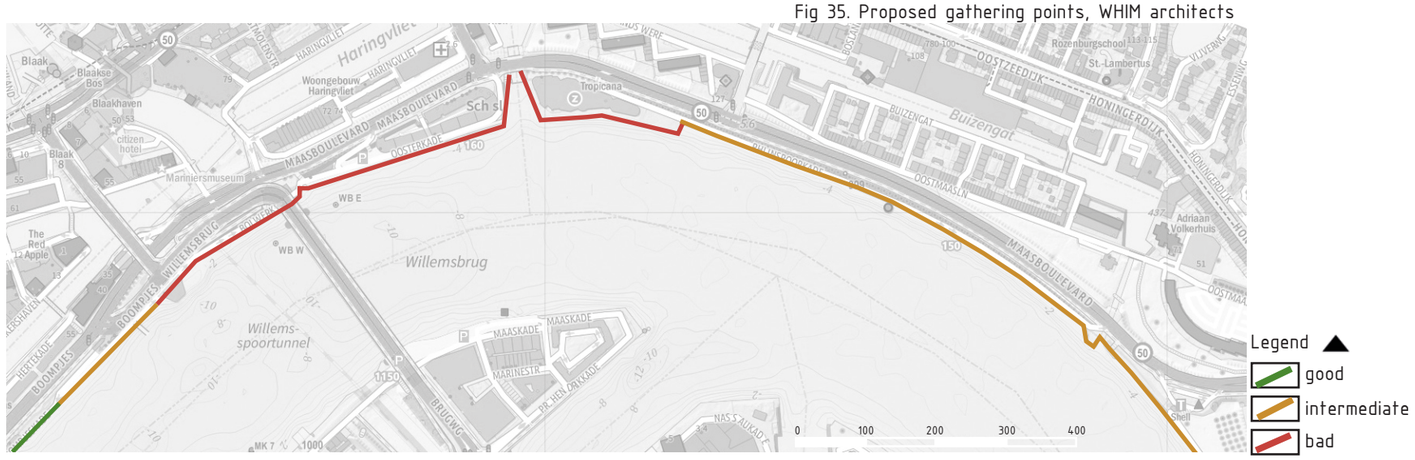


Fig 34. Water acces from the quay

The location of this project is chosen, because of the ideal location to "fish" for plastic. WHIM architects already explored some of these locations for plastic fishing. These locations are all based on the fact that the plastic travels with the water. Therefore the locations are placed along the outer bend of the river Maas.

Another factor that determined the location of my design was the accessibility of the water from the quay. Around this part along the river are the quays around 5 metres high and the water is not accessible. The width of the quay is also a lot smaller then around the 'Boompjeskade'. This makes the quay also less attractive as a place for leisure.

A last factor that determined the placement of this floating element was the location of the Tropicana. The Tropicana is an old swimming paradise, built in 1988 by Centre parks. The Tropicana was already sold in 1990, because the new owner of Centre parks thought that the Tropicana lacked an accommodation function.

In 2010 it was closed, because the owner couldn't pay the money to do necessary renovations.

After this the building stayed empty for a long time and plans were made to situate a new elderly home on the site. This was also cancelled and now new organisations are currently staying in the Tropicana. (Meersman, 2015)

Bluecity010 is the current owner of the Tropicana. they bought the building in 2015 on an auction for 1.7 million euros after the former owner Roger Lips lost all his money. Lips wanted to make the Tropicana into a city greenhouse with a restaurant, but his real estate empire collapsed and so his dreams as well.

Bluecity010 wants to make the Tropicana a new centre for innovation and small entrepreneurs. These 50 entrepreneurs are all checking how to make new products out of waste products and how their waste again can be used. This circular way of thinking calls it selves the blue economy and is an idea of scientist Gunther Pauli. Bluecity010 wants to use this way of thinking to make the Tropicana a "vibrant example of recycling, entrepreneurship, sustainability and economic activity". (van Wonderen, 2015)

The quay along the Tropicana isn't attractive at all. It feels and looks like the back of the Tropicana, including the garbage cans, cars, weeds in the pavement and broken furniture. In this way the Tropicana is a blockade that interrupts people from walking further along the quay and access the water.

Conclusion

The design of the floating elements and the way they are made fits perfectly in the way of thinking of Bluecity010 and will provide an outdoor spot, which will make it a more attractive place to be. This will also improve the accessibility of the water from the quay and will collect the most plastic before it can float into the "Boerengat" and "Haringvliet" harbours.

For my project the location is not determinative for the form of the plastic structure. The intention is that the structure is removable and could be placed at any gathering point of plastic. This will make the gathering points more special and understandable for the public. When the project is placed along the quay people will be able to access the water and experience the water more. The project therefore would also work in different countries, which have the same difficulty of reaching the water from the quay. This makes the design a non-site-specific design

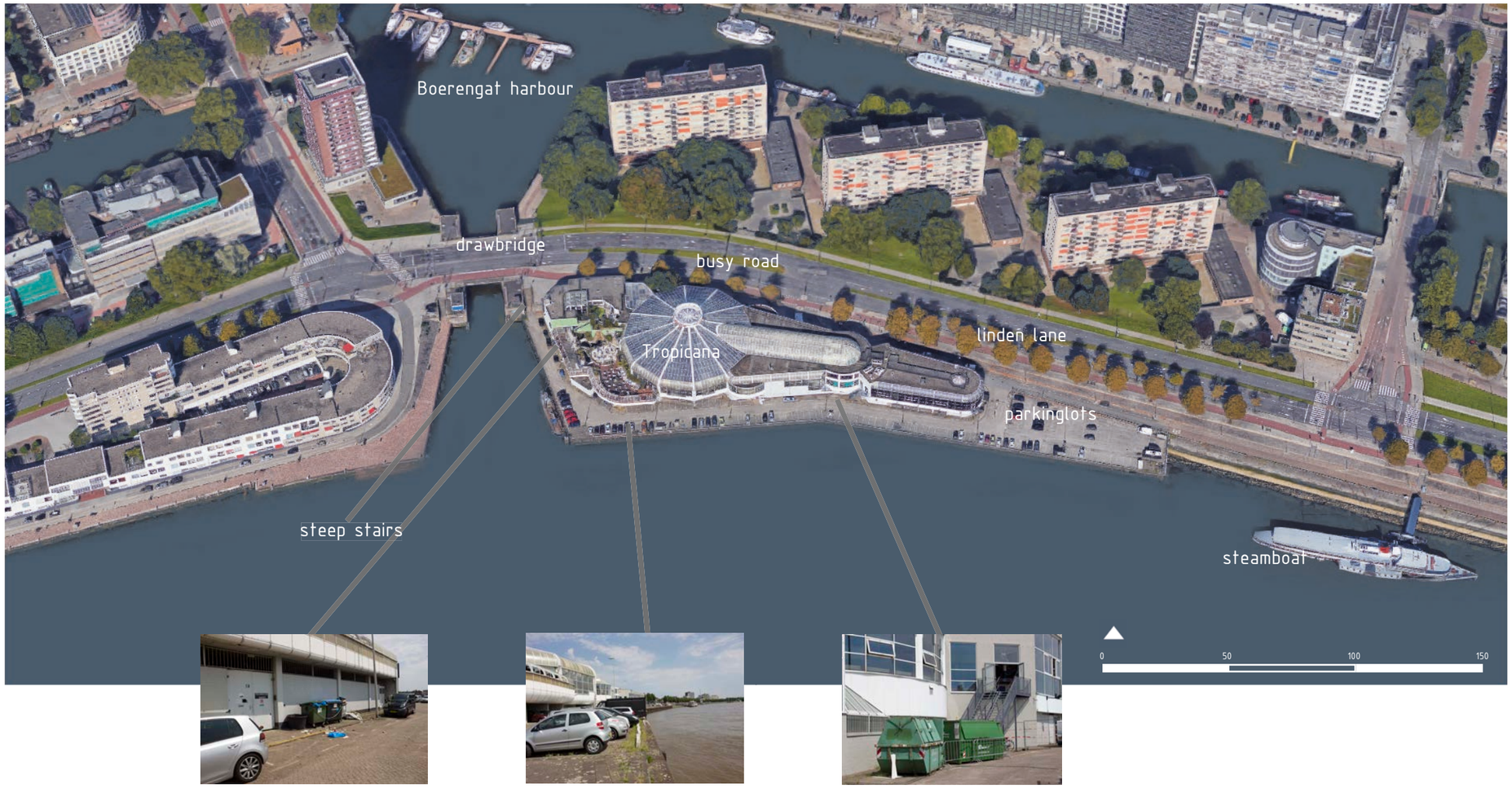


Fig 36. Quay analysis around the Tropicana

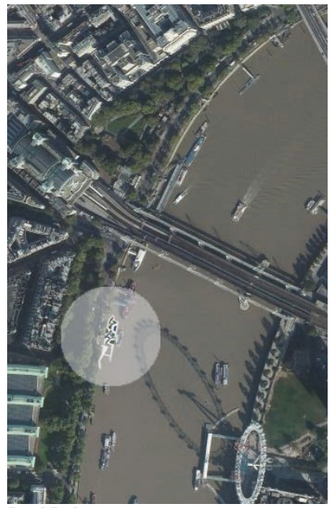


Fig 37. Project in London

Fig 38. Project in Paris

Design principles

From the factors which determine the value of a waterbody by Harzog and the ingredients by Manning, I derived a couple of design principles, which I will use in my design.

Texture

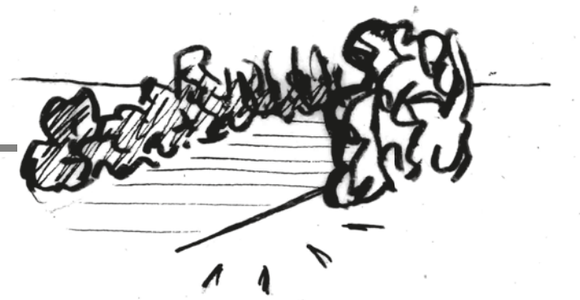
The water elements have to have a different texture from the rest of the park. This will give them a more prominent place within the park and makes them extra special. The textures of the planting and quay will be the contrasting textures.

Routing

The park has to have its own route within the park. The route to the park is the route along the quay, but in order to work the island has to have its own route. This ingredient of circulation systems by Harzorg will enhance the experience of the water.

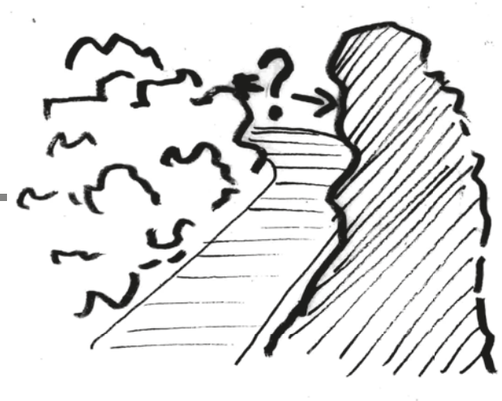
Contact points

The water has to be touchable and people need access to the water. This can be achieved in different ways on different places as long as the slope to the water is gentle and the surface dry and sturdy. The crossings also provide contact points with in the water.



Mystery

In order to develop an existing park, the concept of mystery has to apply to the park. This principle makes sure that the park isn't boring and can be overlooked in one second. This increases also time people stay in the park and thus the viewing time of the park. This will increase the appreciation of the water which is in the park. This concept also serves the factor of spaciousness, because it sometimes offers an enclosed feeling and sometimes gives the open view on the river.



Design choices

This chapter further explains the design choises and they way how the design principles were used in the desgin.

Shapes

For the design of the park I looked at the main shapes first. The plastic collector had an open rectangle shape and to connect this to the quay I made a similar shape that connects the quay and the plastic collector together. This second shape is the machine which collect the plastic from the water and the waterfall, which brings the water back to the floating structure.

The structure becomes connected in a physical and psychological way, by connecting the quay and the structure in these shapes.

People become more aware of the plastic problem, because the stairs end inside of the plastic collector making it almost impossible to miss the plastic that's piling up in the collector. In this way the way to go on the island and the way to bring the plastic up to the quay is also linked, giving the stairs a double function.

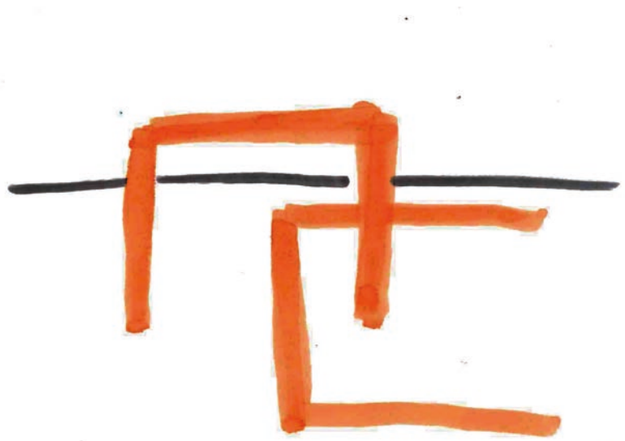


Fig 39. Forming shapes in the island

The other forming shape is the hexagonal shape of the plastic elements. For the majority of the plan the hexagonal shape is just a under layer, which doesn't determine the shape of objects. Only on places where the water is actively enjoyed the hexagonal shape becomes dominant. For example the collecting basin of the waterfall is a half hexagonal and the different tiles within this collecting basin also keep their hexagonal form.

The small streams which are created out of the flowing basin will also have a hexagonal shape, just as the stepping stones in them.

The small pool with descending slopes also has a hexagonal shape, creating a route within the plastic structure. This design choice uses the factor texture of Harzog that values the water in a design.

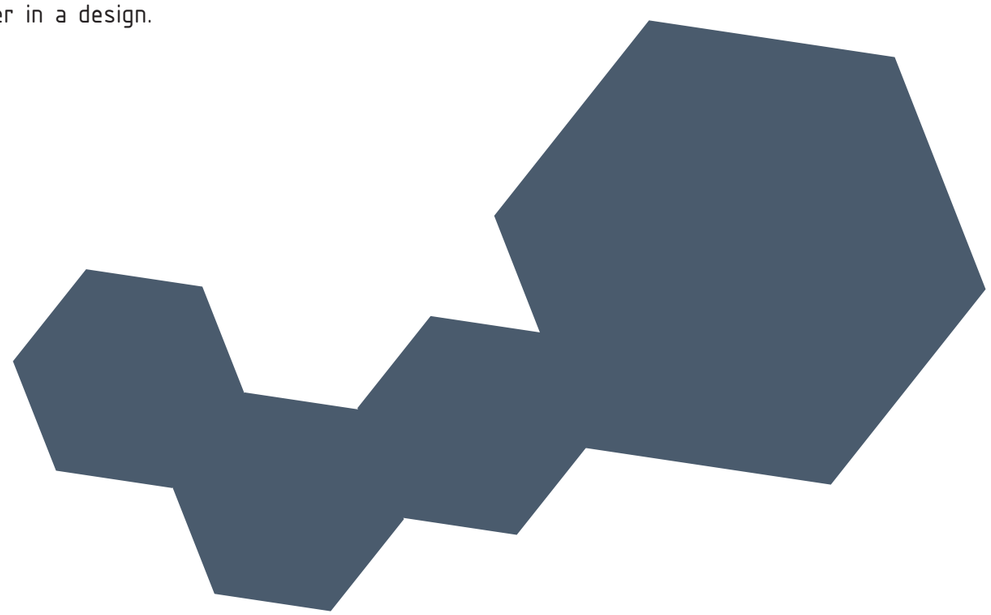


Fig 40. Forming shapes of the water

Waterfall

For the optimal appreciation of the park a waterfall is needed. For this waterfall a height difference is needed and also a flow of water. The waterfall also is the body of water which had the most identifiability. (Harzog, 1985) This waterfeature will be the main spectacle of the design, whcih will be a central poit in the design.

Spaces

For a park it's really important to have a good route, which people can walk when visiting a park. This is based on the ingredient of Manning for a good riverside design. This route is made by the entrance inside the plastic collector, the collector basin of the waterfall and the small pond. The other foliage is placed that certain spaces are created within the plastic structures. The function of the space is here determining for the form of the space. This route also creates more mystery, which gives more value to the water elements according to Harzog. For example people can't walk straight to the wheel which turns the machine.

Functionalism

The elements of the park are based on the achitectual functionalism movement. This movement claims that the construction and function should determine the look of the building. It is about the fascination of the constructing elements of the building, without the need of adding any decoration.(The editors of Encyclopaedia Britannica) For References of this movement I looked a work of Rossi and Strack

Fig 41. Atrificial waterfall, Paris

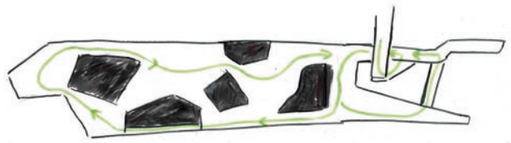


Fig 42. Routing

Fig 43 Waterfall, Rossi

Fig 44 Hall of collums, Rossi

Design elements

The floating element consists of many components which will be explained below. The components all have their own function in the bigger element and contribute to the experience of water or the recycling of plastic.

Plastic collector

The design of the plastic collector is based on the basic form of the "Plastic fisher" by WHIM architects. The plastic collector a set of two big arms, which will guide the plastic from the Maas to the end of the collector. The plastic will flow with the current into the "mouth" of the machine. At the end it can be collected with the machine. The arms are wide enough to walk on and a bridge across the arms makes it possible to cross the water. The arms are made in the same way as the hexagonal plastic elements, but they are formed into different shapes to form the arm shape. The arms will reach deep enough into the water to catch most of the plastic. The basin at the end of the collector will prevent the plastic from floating back into the river, during high tides. The arm which reaches into the river can be extended with more floatable elements to catch more plastic from the river.

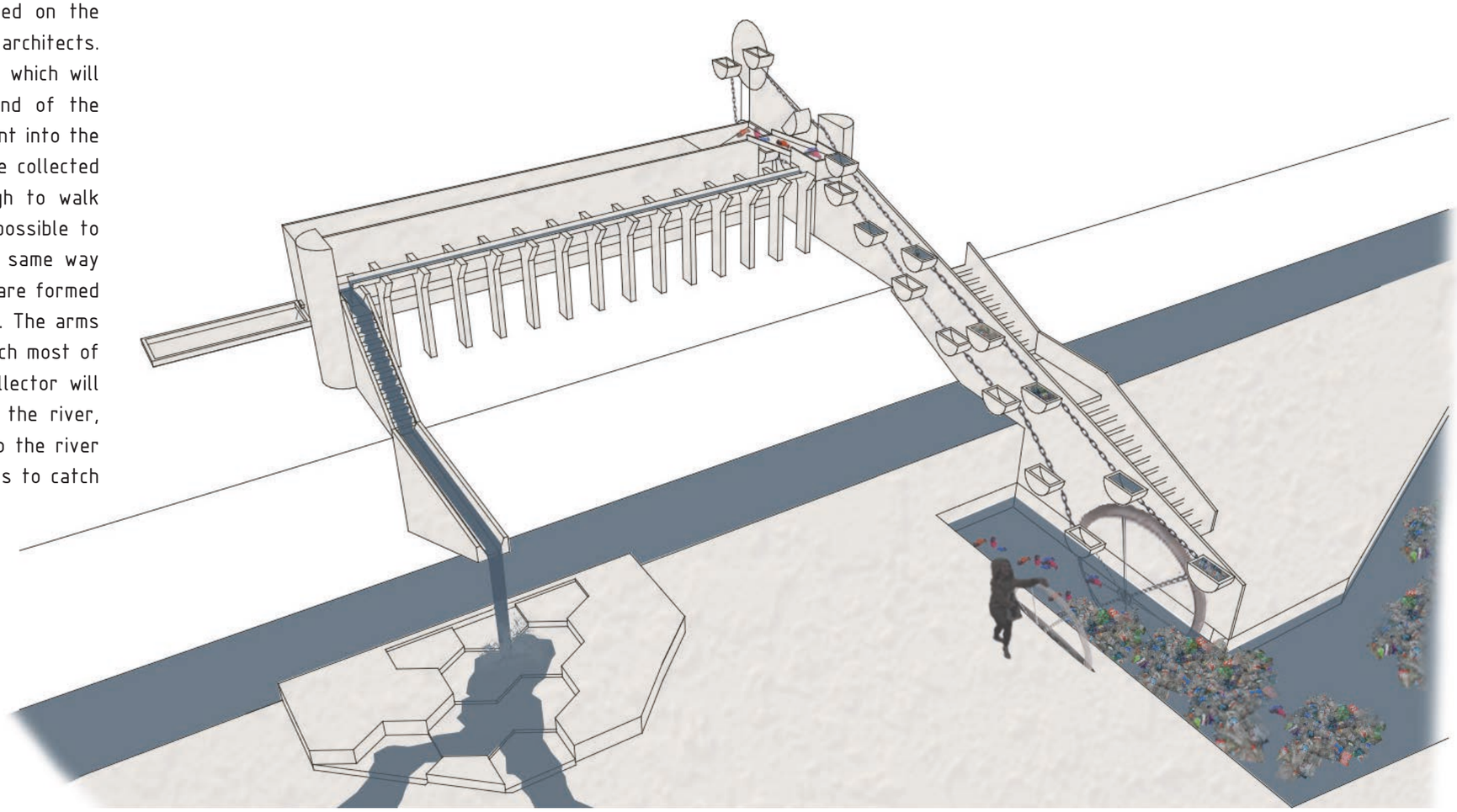


Fig 45. Plastic machine

Plastic machine

The plastic machine is the name of the device that moves the water with the plastic onto the quay. The machine consist of a series of bins, which are attached to a chain. This chain can be rotated by a wheel, which is powered by people. People can spin the wheel, which will move the bins around. The bins will scoop water and plastic from the plastic collector basin and empty them into a bin, which will separate the water from the plastic. The plastic then falls through a series of slides into a storage area. The water will be filtered in the bin and will then travel to the gutter. For the design of the plastic machine I relied on the principles of the functionalism principle and the examples of Rossi and Starck. The design of the machine also embraces this, because all elements are open and visible. The viewer will also understand the importance of plastic recycling more, when watching and participating in the plastic machine. The colour of the plastic of the island and the machine will be an off-white to enhance the functionalist principles of the design.

Plastic storage

The plastic will be stored into a big storage area, which can hold up to 70 m3 of plastic waste. This waste can still contain organic material and some water. The storage area has to be emptied more often in summer, in order to prevent a smelling rotting process. The water which is left can flow out though a small nozzle into a small raingarden. This raingarden provides a nice feature of green on the quay and will improve the view on the quay. The plastic storage also has a bench integrated to provide a nice enclosed view on the city. The container will have some windows to display the plastic. In this way people can see the plastic they just collected and get motivated to collect more. The display will also serve as a toffee cabinet, showcasing the best finds within the waste.

Fig 46. Visualisation quay

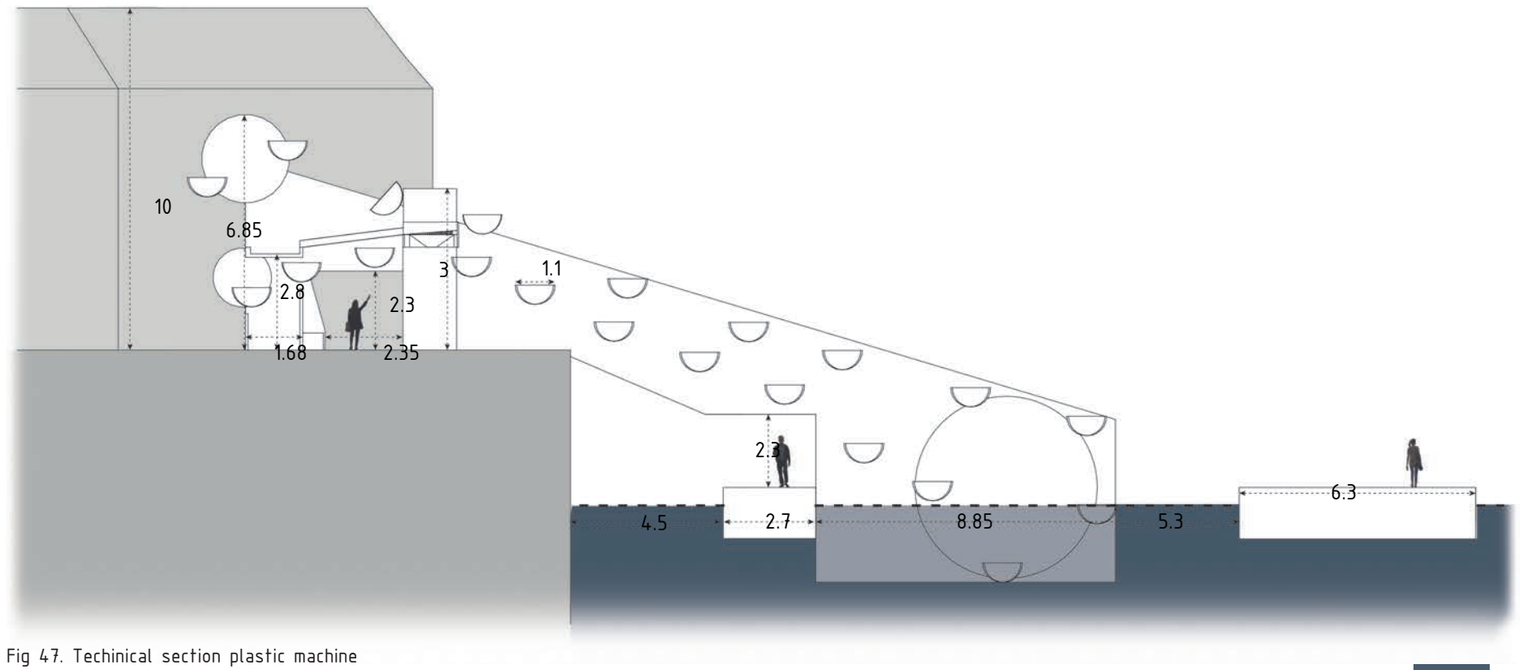


Fig 47. Techinical section plastic machine

Waterworks

The water flows through a high gutter, after the water is separated from the plastic and cleaned. The water then falls into another basin which leads the water to the water stairs. The water stairs guide the water to the waterfall, making the water audible and touchable. The water then drops a 3.6 metre from the waterfall into a water basin. This also makes the water audible and touchable, because people are able to enter the water basin, play around it and sit on it. The water then flows through a shallow river which separates the plastic island and leaves an open central space with sitting elements. People can cross this shallow river by using the stepping stones. The river leads the water back the Maas and also to the pond, completing the cycle of the water.

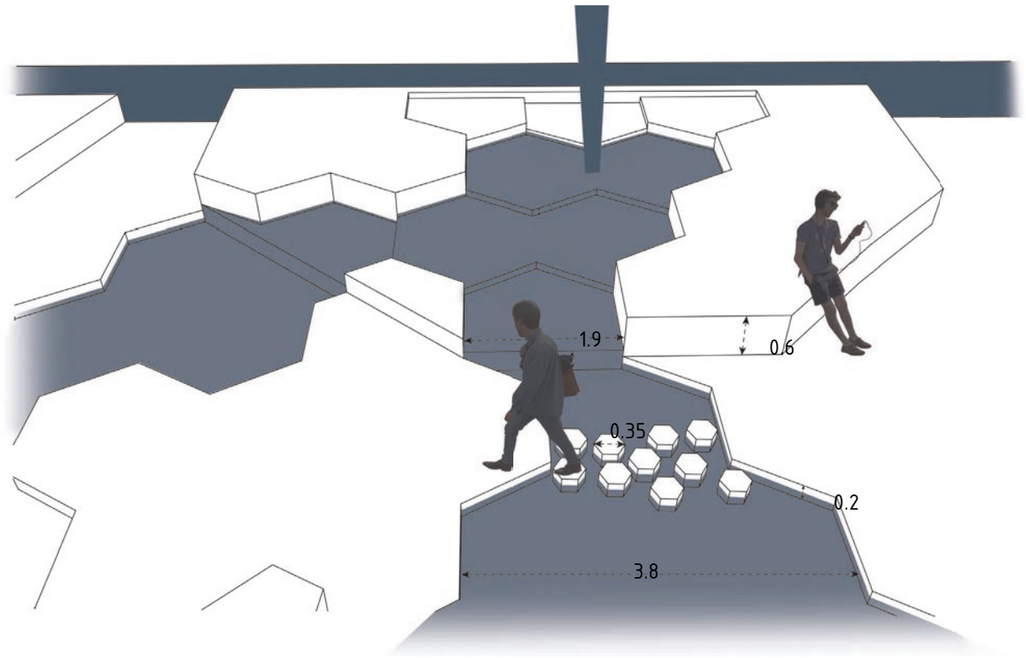


Fig 48. Technical drawing water basin

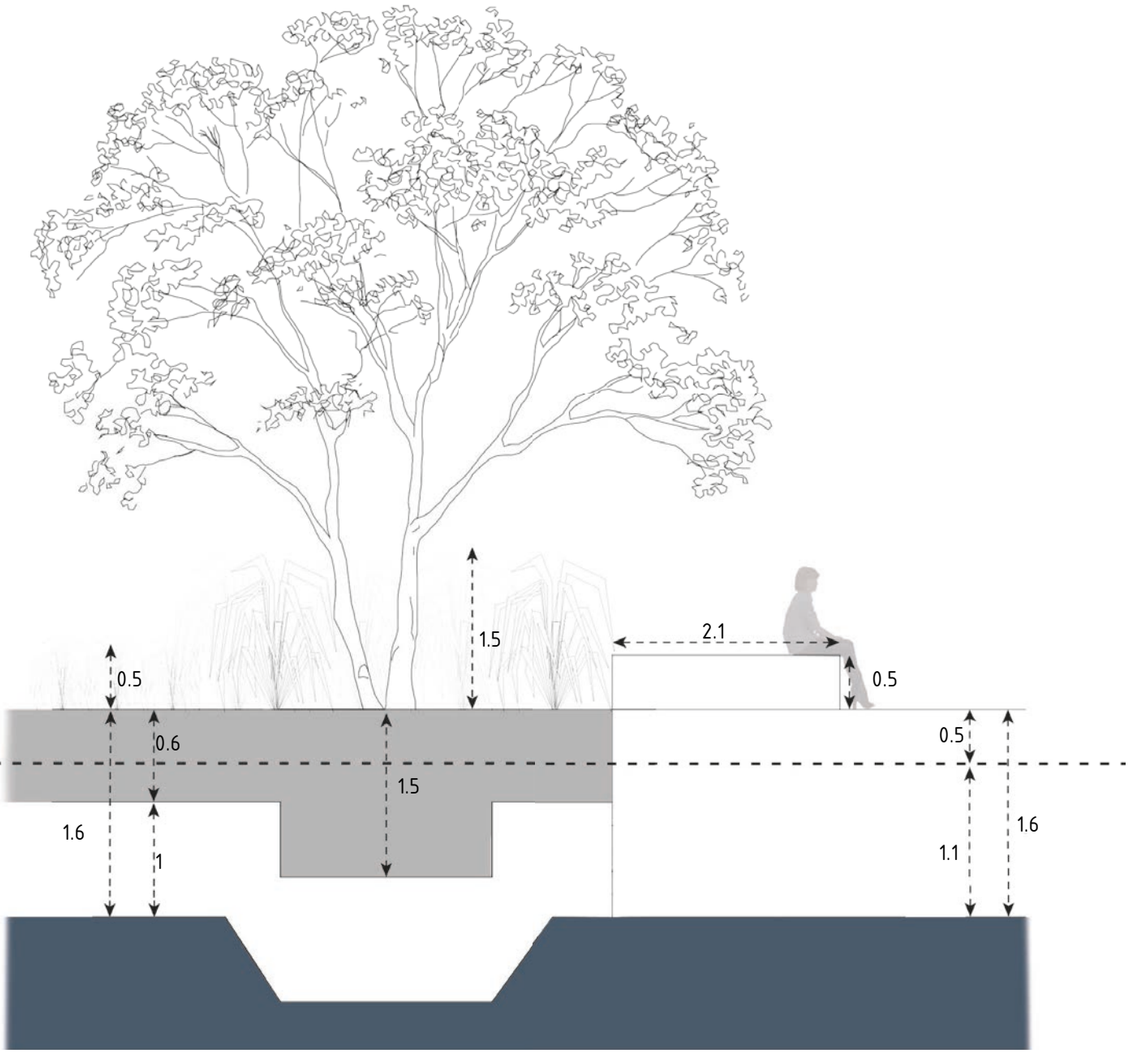


Fig 49. Technical sitting area

Fig 50. Visualisation central place, waterfall and rivers

Mozes bridge

The Mozes bridge is built according to an idea of Ro&AD. This bridge will give the viewer a new look over the water by lowering the viewing point. The water will be much closer and seem much bigger, because the viewer is standing below the water level. One thing I noticed after viewing pictures of the original Mozes bridge, is that the bridge can flood during high water. The Mozes bridge implemented in my plan can't be flooded, because the island rises with the water level. The bridge is a normal continuation of the path with on one hand the Maas and on the other a small pond with a minor slope. Because of this, People can get to the water in an easy way. The pond is in direct connection with the Maas and is one of the contact zones of the park.

Stairs

The stairs, which are used to enter the park, end directly in the plastic collector. In this way people directly get involved with the plastic in the park. The stairs are also connected to the machine. The stairs serve in this way a double function. The stairs can move over a set of rails, which enables the park to rise with the tides. The machine doesn't move with the tides to prevent difficult construction for this piece.

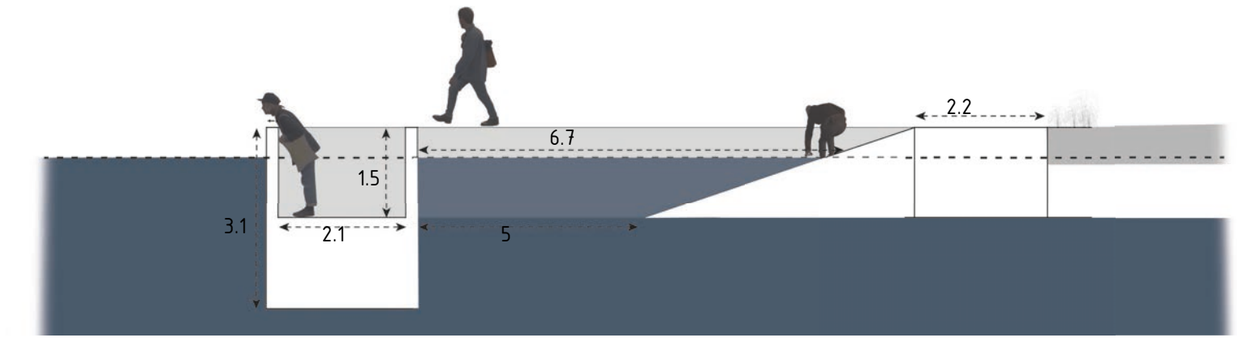


Fig 51. Techincal drawing Mozes bridge and pool

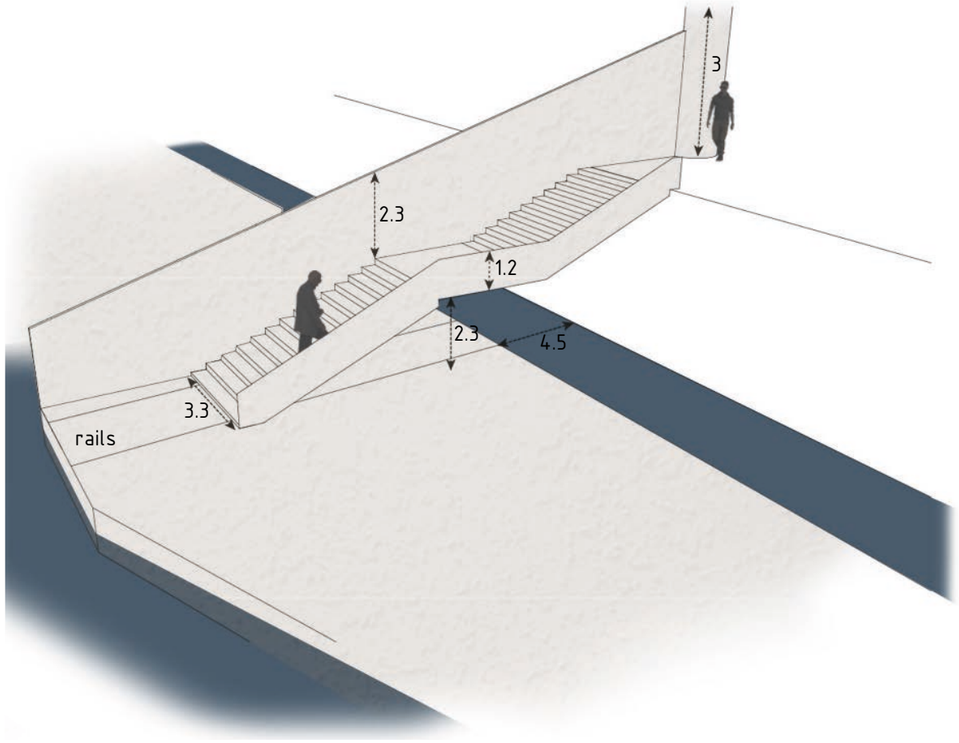


Fig 52. Techincal drawing staircase

Fig 53. Visualisation pool and Mozes bridge

Outdoor workspace map

Fig 54. Map outdoor workspace

Workspace

The workspace provides an outdoor space for the people of Bluecity010. The area can be used to work with your laptop, have small meetings or lunch. The area is because of this more enclosed from the rest of the island to have more privacy. The main route on the island also evades this place for a more quit surrounding. People should have access to WIFI and electricity in this workspace to provide a suitable environment.

These sections show the height difference on the island in comparison with the quay and the Tropicana

Fig 55. Location sections

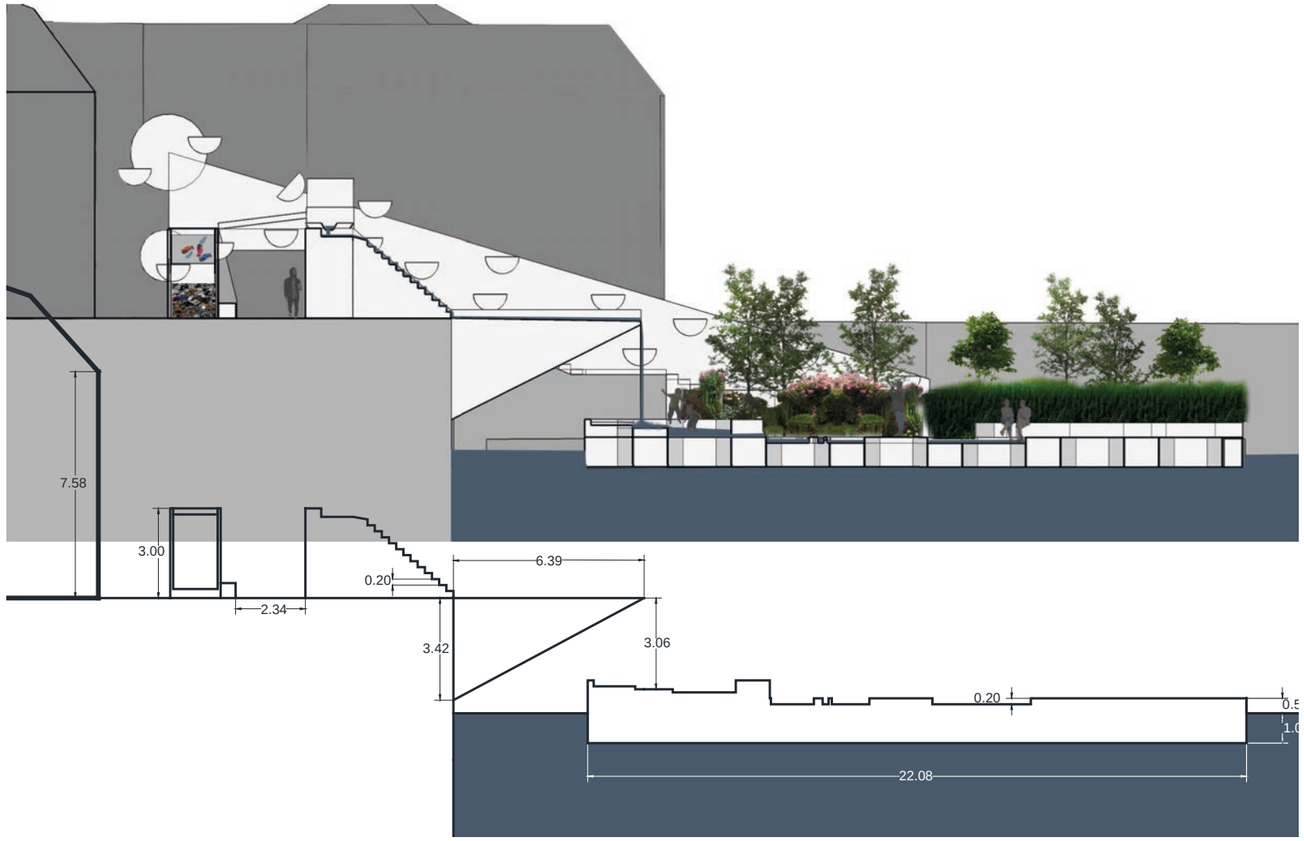


Fig 56. Section north to south

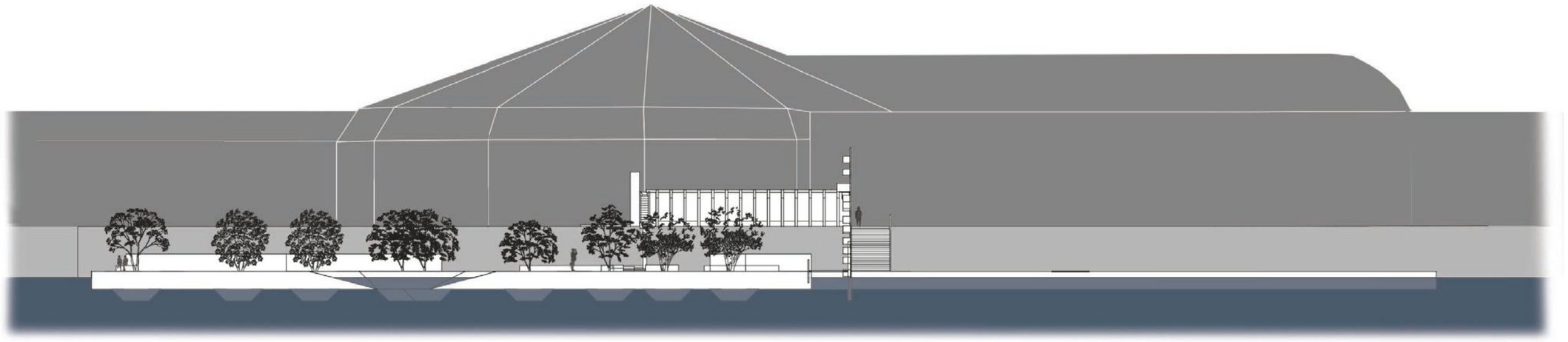


Fig 57. Section west to east

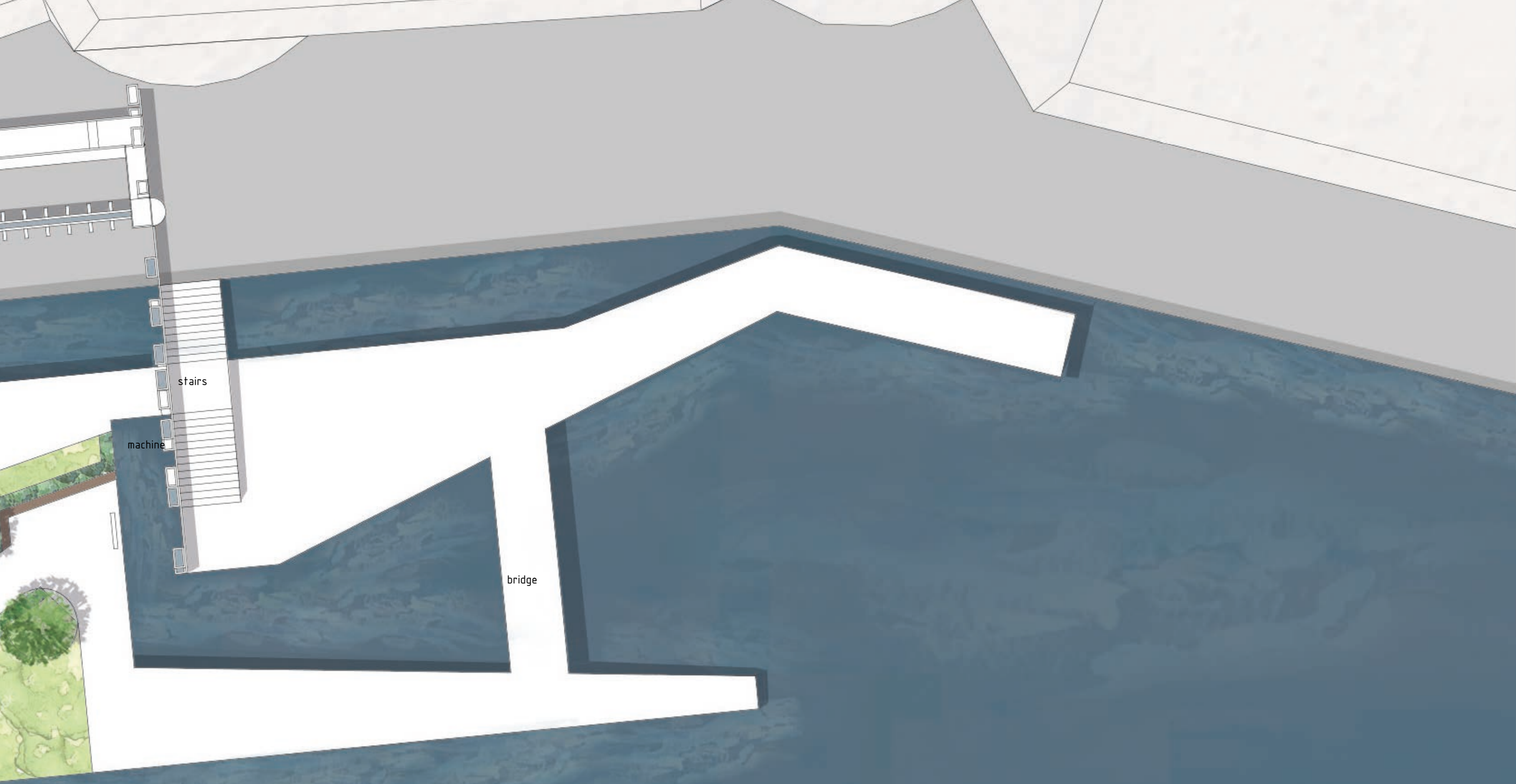
Masterplan

Legend

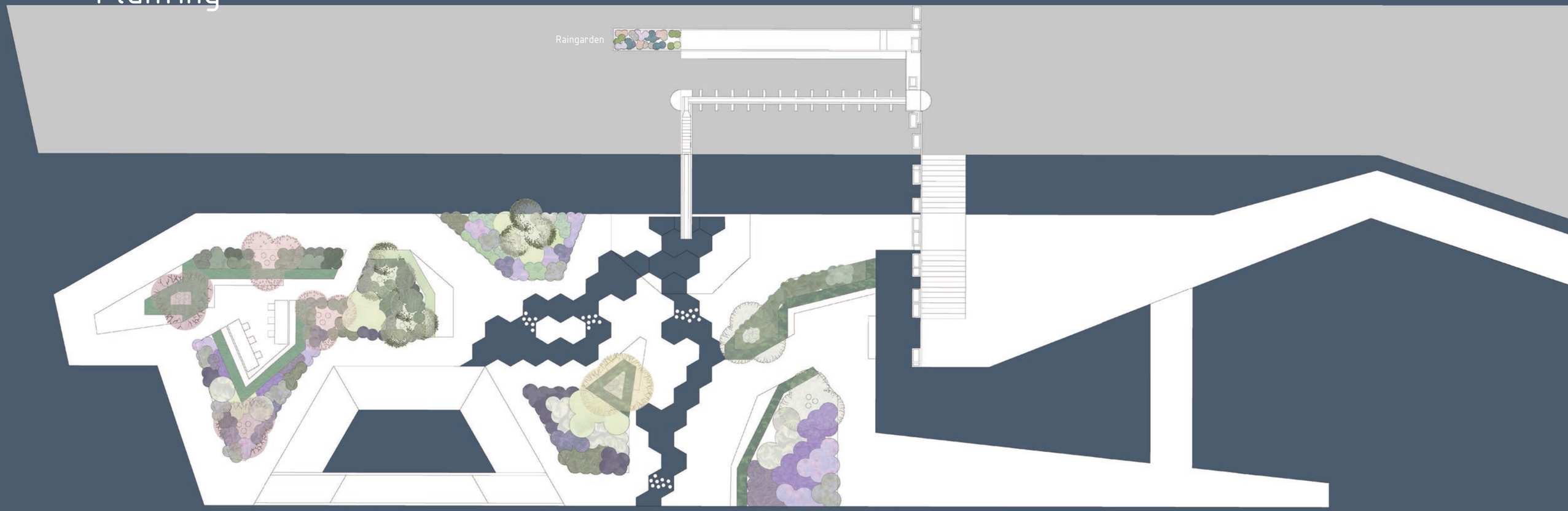
- Foliage
- Multistem tree
- Shallow river
- Water
- Sitting element

0 5 10 15 20

Fig 58. Masterplan


stairs
machine
bridge

Planting



Trees-large shrubs

- Amelanchier lamarckii
- Betula utilis 'jacquemontii'
- Gleditsia triacanthos 'skyline'
- Parrotia persica
- Rhus typhina

Perrenials-shrubs-grasses_Raingarden

- Achillea ptarmica 'perry's white'
- Baptisia australis
- Clethra alnifolia
- Crocosmia lucifer
- Iris versicolor
- Stipa tenuissima

Perrenials-shrubs-grasses_Floating structure

- Achillea millefolium 'hoffnung'
- Armeria maritima 'laucheana'
- Aster lateriflorus 'lady in black'
- Calamagrostis acutiflora 'karl foerster'
- Crambe cordifolia
- Echinacea purpurea
- Hemerocallis hybr. 'rose tapestry'
- Heuchera x brizoides 'snow white'
- Liriope muscari 'lilac beauty'
- Miscanthus sinensis 'china'
- Ophiopogon japonicus
- Panicum virgatum 'northwind'
- Pennisetum alopecuroides
- Perovskia atriplicifolia 'blue spire'
- Rosmarinus officinalis
- Sedum 'herbstfreude'
- Tellima grandiflora
- Hosta sieboldiana 'elegans'

0 10 20 30 40

Fig 59. Planting

Panicum virgatum 'Northwind'

Crambe cordifolia

Armeria maritima 'laucheana'

Fig 61. Samples of chosen plants

Planting choices

Wageningen university advised to use saline tolerant plants and trees for the planting of the plastic structure. This is because of the change of water, which is splashing against the floating structure, could fall on the leaves of plants or on the soil of the plants. Some plants can't handle any salt water on their leaves or roots which causes the plant to die. Some plants have a system which blocks the salt from their roots. And are thus more resistant to salt water. (Hop, 2008)

The plants below have a salt tolerance and are able to cope with the wind in the harbour and the Dutch weather.

Examples of these plants are:

Achillea, Armeria, Artemisia, Aster, Calamagrostis, Cortaderia, Crambe, Echinacea, Festuca, Hemerocallis, Heuchera, Hosta, Liriope, Miscanthus, Ophiopogon, Panicum, Pennisetum, Perovskia, Rosmarinus, Sedum, Solidago, Tellima, Thymus en Waldsteinia

These plants are able to survive the Dutch weather and grow under the conditions of the plastic structure, if they're watered with fresh water and provides enough sunlight.

For the trees it is best to use multiple stem trees, because the centre of gravity of this type of trees is much lower than single stem trees. This makes the island more stable. (van der Eng et al, 2015) The chosen trees are able to root in smaller spaces and are able to withstand harsh winds.

From the selection of plants I picked a range of plants and searched for the most suitable and interesting cultivars for the island. The colour scheme of the plants is white, pink, and purple. To accent the white of the plastic and the purples and pinks to provide a contrast. The plants are grouped in such a way to create an interesting colour, shape, texture and seasonal composition.

The grasses in the plan are mostly used as a backdrop for the sitting areas. They provide shelter and a more enclosed feeling.

For the raingarden I used plants, which are from different zones of the raingarden. The zones show the placement of the plant, were zone 1 is the wettest zone and zone 3 the driest zone. Some of the chosen plants have also the ability to purify the water when it infiltrates. (Danko,2006)

Fig 62. Small raingarden

Location island

Legend

- water
- floating structure
- flow of the plastic

0 100 200 300 400

Fig 63. Location design

Materials

The park is built up out of the recycled plastic, which comes from the river. The colour of the plastic used will be an off-white to contrast the quays and the water. This also means that the park has to be cleaned once in a while to keep the same effect. The path will be lightly textured to prevent people from falling when it's wet.

The surfaces of the sitting areas and tables will be covered with wood to ensure a nice dry place to sit.

The surface of the shallow river will have a three-dimensional pattern on it to enhance the movement and waves the water makes when it flows through the shallow river. This will also create more sound and movement of the river which will be more appreciated.

The park will be built from 535 plastic elements. The stairs and machine will also built from plastic. These however have to be strengthen and secured to the quay in order to keep the structure stable. It will take up to 3 months to collect the amount of plastic needed for the design. This calculation is based on the amount of plastic that is collected from the river each year, which will be around 400.000 kilograms, divided by the amount of plastic that is needed for a single element, which will be around 100 kilograms.

Fig 64. Texture shallow river

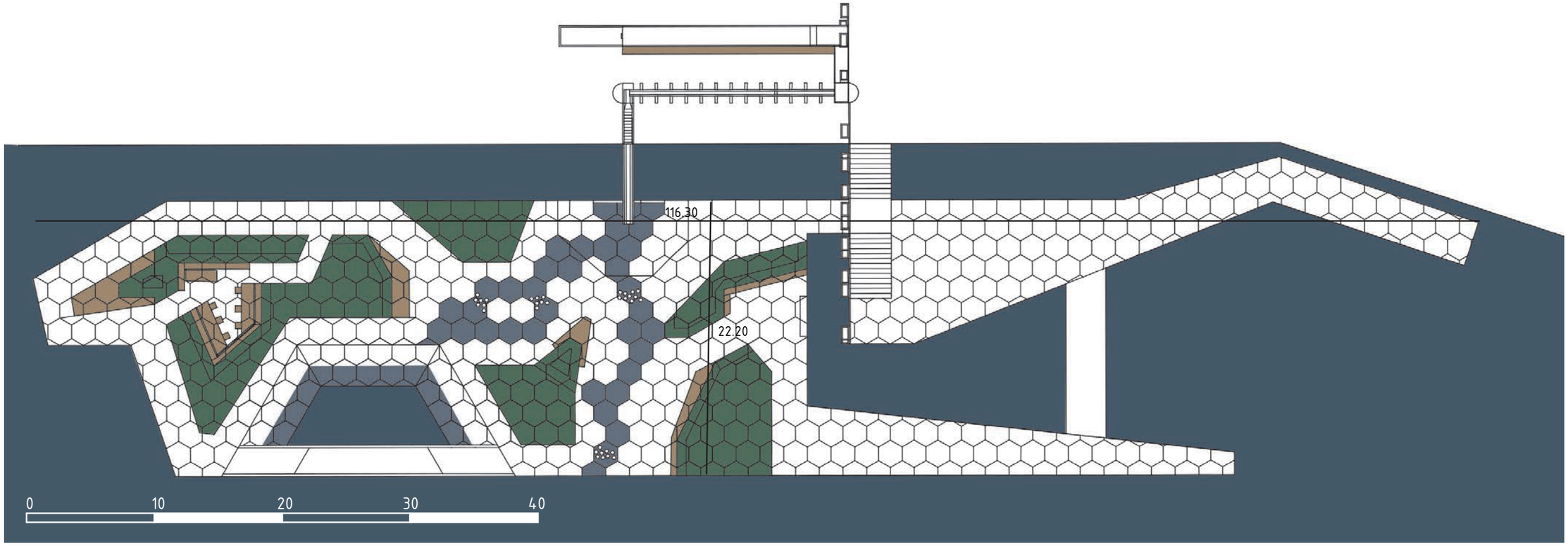


Fig 65. Map showing hexagonal elements

Conclusion and Discussion

Conclusion

The objective of this thesis was to improve the experience of people with the water in Rotterdam and raising more awareness for recycling, by using the plastic modules provided by WHIM architects. I formulated the following design question to this objective; How can floating recycled plastic elements improve the experience of the water along the quays of Rotterdam and tell the importance of recycling?

In this thesis used the ingredients given by the literature and the reference studies to create a floating structure which crosses the borers of the quay. The design was built up out of elements, which would increase the experience of the water. The design also had to help in the process of recycling the plastic. I achieved this by making a design which could collect and distribute the plastic to a central gathering place. The "waste" product from this process, water, was also used in the design again to create a cycle of water which connects the quay and the river Maas together.

By involving people into the process of recycling plastic and making it fun I tried to increase the awareness of the importance of recycling. The location also supports this message, because of the circular thinking of Bluecity010. It will offer a nice outdoor venue for the people of Bluecity010 to work, which also creates more awareness for their own cause.

The design will also partly solve the situation of the quay, by making the quay more attractive to the public. The connection with the other quays will improve by this design if people will start using the route along the quays.

The design also could be a catalyst for other plastic recycling programmes in other places or countries, because it is a non-site-specific design. The collecting of the plastic could be a starting point of new innovations and ideas for the plastic. This would work the same way for creating more experience of the water. Wherever this design is installed people would get more interaction with the water.

Discussion

This chapter gives a critical analysis of the literature and the design. The design had to improve the experience of the water along the quays in Rotterdam and show the importance of recycling. The design used the provided elements by WHIM architecture.

The design is a non-site-specific design, which also comes with its own problems. The park now has less context with the surrounding, also leaving a bit of space between the Tropicana and the plastic storage bin, which can't be used for people to walk. This space can however be filled if the Bluecity010 embraces the idea and the production or sorting of the plastic can be done inside the building.

The design now has some safety issues. For example, the big wheels that are needed to guide the cable of the water bins are open. In order for them to be safe for children they have to be closed off. Another safety problem could be the plastic paths and stairs. They could become too slippery in case of rain even with the texture of the plastic.

A third problem could be the strength of the plastic structures. These structures on the quay have to endure a lot of different factors, which I can't predict or measure. The structures might need to be secured to the ground or strengthened in order to ensure the stability and strength of the columns and the waterfall. The same is the case for the stairs. It seems logical that they would work on rails, to ensure that the island could raise with the tide, but I lack the technical knowledge to calculate the forces, which push and pull on the plastic structure.

The literature which I found about the design of water, mainly is about the design of riverbanks. I took the freedom to adapt these theories to a broader level of design and apply them to this design of a waterscape. The writer of the article implied that the same rules apply to rivers that flow through cities, which gave me more freedom to use his ingredients.

Reflection

In the proposal for this thesis I formulated the following learning objectives;

- Making a good timetable and use it
- Making a good small scale design
- Making a coherent poster, with better quality images
- Deriving design principles from theory

The first point is also my weakest in this thesis. For the proposal I made a time schedule, which could be finished. However as time progressed I found out it didn't work. For a more organised result I should have rewritten the time schedule and adapt it during the process of the thesis. This is easier said than done, because for this thesis my days for the past weeks only consisted of doing work for the thesis, also in weekends. I'm satisfied with the result, but also broken from the time it took me.

I'm satisfied about the second objective. The design of the small park and machine really challenged me to make a small scale design, which worked and suited the concept. Because the island is created on water it first was like a tabula rasa , but the principles helped me to find the right ways to deal with this.

For the thesis I really tried to bring my drawings and maps to the next level to build a more coherent poster. In my eyes I achieved this more than other studios by using the same colour of blue in the images and keeping everything simple. For the poster this was more tricky than the end presentation, but I tried to cope with this by creating a certain hierarchy. The use of Sketch-up to build my design really helped for creating a lot of images which I could use in the presentation and poster.

The design principles I derived from the literature didn't gave me enough to feed my design and come to a real design. The reference studies were a nice addition in this and they provided more elements which I could use in my design. I could see the ingredients in de reference studies, which gave me more prove that they were the right ingredients when designing with water.

The process of the thesis has been a real learning process for me. I learned that my academic writing skills still need to improve. I found out it takes me more time to find the literature I'm looking for and translate it to an understandable text, which captures the essence of the literature.

In the end I'm really satisfied with the work I delivered. I spend a lot of time in the evenings on this thesis, but in the end it was worth it. I think by challenging myself to make a small scale design, which could be implemented on multiple places, I learned a lot. This bachelor thesis is also a nice reflection of the abilities I learned in the bachelor landscape architecture and gets me excited to start the master landscape architecture.

The non-site-specific location of this project shows the versatileness of the design and shows how a small design can be a catalyst for other larger effects.

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