



KVILLEPIREN PURIFYING PARK

– Exploring phytotechnology in site-specific landscape design

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Abstract

In this master's thesis I examine how phytotechnology can be used in a site-specific design at Kvillepiren. The pier was built in the river Göta Älv, to be one of Gothenburg's ports. Today, the harbours have moved and the area where the Kvillepiren is part of a major urban development project. Like other older port areas, there are challenges in developing Kvillepiren.

There is an on-going debate about sustainable landscape architecture where aesthetics is highlighted as an important, often neglected aspect to work with to create experiences that lead to understanding and concern for the environment. In this project the site-specific environmental problem of contaminated soil is dealt with by using phytotechnology, an ecotechnology where plants are used to cleanse the soil at Kvillepiren. Working with theories of aesthetics and site-specifics serves as a contrast to phytotechnology in order to develop the Kvillepiren into a park with experience values. The work uses theory and methods from authors Andrea Kahn, Carol Burns on site specificity. Theories of aesthetics and sustainability are mainly addressed by Elizabeth Meyer's texts. Basic facts are presented in this thesis on phytotechnology, as well as time aspects and educational aspects of the technique with facts mainly from Kate Kennen and Niel Kirkwood. During the project, several field visits were made to well-known projects in Europe that are using phytotechnology in an urban context. These visits have provided inspiration, knowledge and design tools to use for the design at Kvillepiren.

In the case study section, the design proposal builds up to be a result of the methods I use to understand and read Kvillepiren as well as from tools found during field visits. The method and the theory part provide ways to anticipate and read Kvillepiren and its context. The technical nature of phytotechnology has challenged me to focus on site-specific values and aesthetics as important aspects of a versatile design. To capture aspects such as atmosphere, relationships and dynamics in the river landscape, the traveling transect method has been reversed, developed by Lisa Diedrich and Ginni Lee. I walked a line, documented and after the travel, worked with the gained material to crystallize site-specifics of Frihamnen. The site-specifics were used for design editing of the Kvillepiren and processed using tools found in field trips. The project is based on theories of site-specificity, aesthetics in relation to sustainability and the technical solution phytotechnology, which uses plants and biological systems to clean land. The design editing in this project has generated a park with phytotechnology that also contains educational aspects and creates awareness for local environment as well as for sustainability on a more global level.

In the concluding part, I reflect and discuss the methods used, the results, the possible future development and the application of the proposal. The design proposal, Purifying park of Kvillepiren is a result of a personal design process using known methods and theories. The proposal should be read as a comment in the debate on the development of Gothenburg's port areas but the opportunity to be developed, realized and then reformed and developed again.

Sammanfattning

Det här mastersarbetet undersöker jag hur fytoteknologi kan användas i en platsspecifik design på Kvillepiren. Piren byggdes i Göta älv för att vara en del av är en av Göteborgs hamn. Idag har hamnarna flyttat och området där Kvillepiren är en del i ett stort stadsutvecklingsprojekt. Precis som för andra äldre hamnområden finns flertalet utmaningar i att utveckla dessa områden.

Det pågår en debatt om hållbar landskapsarkitektur där estetik lyfts fram som en viktig, ofta försummad aspekt att arbeta med för att skapa upplevelser som leder till förståelse och omsorg för miljön. I detta projekt hanteras det platsspecifika miljöproblemet med förorenad jord med fytoteknologi, en ekoteknik där växter används för att rengöra marken vid Kvillepiren. Att arbeta med teorier om estetik och platsspecifika funktioner fungerar som en kontrast till fytoteknik för att utveckla Kvillepiren till en park med upplevelsevärden. Verket använder teori och metoder av författare Andrea Kahn, Carol Burns på webbplatsens specificitet. Teorier om estetik och hållbarhet behandlas huvudsakligen av Elizabeth Meyers texter. Grundläggande fakta presenteras i denna avhandling om fytoteknik samt tids- och pedagogiska aspekter av tekniken med fakta främst från Kate Kennen och Niel Kirkwood. Under projektet har flera fältbesök genomförts till kända projekt i Europa som använder fytoteknik i urbana sammanhang. Dessa besök har gett inspiration, kunskap och designverktyg att använda för designen av Kvillepiren.

I fallstudiedelen byggs designförslaget upp och blir ett resultat av de metoder jag använt mig av för att förstå och läsa av Kvillepiren samt av designverktyg jag fått med mig från fältbesöken. Metod- och teoridelen ger vägar till att förstå och läsa av Kvillepiren och dess kontext. Fytoteknikens tekniska natur har utmanat mig att fokusera på plats-specifika världen och estetik som viktiga aspekter av en mångsidig design. För att fånga aspekter så som atmosfär, relationer och dynamik i hamnlandskapet har metoden traveling transect ändvands, utvecklad av Lisa Diedrich och Gini Lee. Jag gick en linje längst med älven, dokumenterade och arbetade efteråt med det förvärvade materialet för att kristallisera platsspecifika för Frihamnen. Till design editing (sv. designredigering) av Kvillepiren användes sedan dessa platsspecifika värden och bearbetas med hjälp av verktyg funna i fältresor. Projektet bygger på teorier kring platsspecificitet, estetik i relation till hållbarhet samt den tekniska lösningen fytoteknologi som använder sig av växter och biologiska system för att rena mark. Designredigeringen i detta projekt har genererat en park med fytoteknik som också innehåller utbildningsaspekter och skapar omtanke för den lokala miljön och för hållbarhet på en mer global nivå.

I den avslutande delen reflekteras och diskuterar jag kring använda metoder, resultat, möjlig framtida utveckling och applicering av förslaget. Designen förslaget, Purifying park of Kvillepiren är ett resultat av en personlig designprocess där kända metoder och teorier används. Förslaget bör ses som en kommentar i debatten kring utveckling av Göteborgs hamnområden men möjlighet att utvecklas, realiseras för att sedan omformas och utvecklas igen.

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1. INTRODUCTION

URBANIZATION AND POLLUTIONS

The urbanization is a global phenomenon, with more people already living in urban areas than in rural areas. In 2018, 55 % of the world's population lived in urban areas, compared to 30 % in 1950. The future projection for 2050 is that 68 % of the world's population is going to be urbanized (United Nations, 2018). The economic growth over the last decades has had consequential impacts on ecosystems, climate, land-use and human (United Nations, 2017, p. 6). Anthropogenic activities such as growing population, industrialization and neglect of the environment have resulted in soil pollutions among other things. Soil pollution is one of today's major environmental hazards. It is mainly caused by chemicals used in or produced as by-products in industry, local or imported waste including wastewater, chemicals from agriculture and petrol-derived products (Eugenio, McLaughlin, & Pennock, 2018, pp. 7-8). Soil pollution has a large negative ecological impact, causing danger to human health and negative economic effects. It degrades major ecosystem services and reduces food safety by affecting the health of plants and by making crops poisonous to eat. Direct risks to human health arise from contamination by minerals such as arsenic, lead, cadmium from organic chemicals, and pharmaceuticals (Eugenio, McLaughlin, & Pennock, 2018, pp. VI-VII). In United Nations' "2030 Agenda for Sustainable Development", there are several targets in reducing soil contamination and other pollutions (United Nations, 2017, p. 8). According to the UN, a pollution-free planet is imperative and eliminating pollution and contaminations would be an insurance for future generations of humans, healthy wildlife and ecosystems (United Nations, 2017, p. 70).

A pollution-free environment is one of Sweden's 2020 environmental goals. There are six clarifications of this goal. One clarification has directly to do with contaminated areas. They should be remediated so that they no longer can harm human health or the environment. Another clarification has to do with knowledge of and education about the effects of chemical substances on the environment and human health. Knowledge about pollutions and risk assessment should be distributed and available for good risk assessments and preventive actions. The goal is not predicted to be reached by 2020. One indicator is the sanitation of polluted areas. Today 83000 sites are estimated to be polluted in Sweden. 2373 areas have been cleaned so far and 2534 areas are in the process of remediation. The most polluted areas and/or the areas with highest danger to human health, and areas with development plans, are generally primary sanitated (Naturvårdsverket, 2018).

TRANSFORMATION OF HARBOR AREAS

The current global urbanization together with a reduced demand of harbour areas and industry within the cities is driving major development projects and transformations of harbours in European cities. Old harbours are often turned into office complexes, luxury housing, shopping centers and similar facilities. The transformation of the special leftovers from late 19th – and 20th industry is a main task for contemporary urban planning (Diedrich L. , Translating Harboursapes Site-specific Design Approaches in Contemporary European Harbour Transformation, 2013). The cities

of Europe are acknowledging these post-industrial areas, especially with urban design of waterfronts. However, Lisa Diedrich and Ellen Brage are concerned that the site-specifics of these places are not explicitly addressed in the debates on urban development. There is an interest among planners and architects of elaborating new answers on issues regarding these areas, especially in projects in projects that transform rather than redesign. Working with site-specifics and a more transformational approach in developing harbour areas supports a cultural climate that value heterogeneous, complex and multi-layered sites. It has potential in resource-saving as well as in promoting ecological and economic sustainable solutions (Diedrich & Braae, 2012).

Transformation of harbour areas have a potential to create new sustainable development areas within the city. There is an ongoing debate about sustainable landscape architecture and the role of aesthetics. Sustainability is often seen through the lens of the three components, ecological, social and economic. In the field of landscape architecture, aesthetics can be seen as the fourth component in sustainable design. In Elizabeth Meyer's manifesto, she makes a claim for the capacity of landscape architecture to create sustainable culture compared to the general concepts of sustainable development, ecological design or conservation biology. Landscape architecture plays an important part in sustainable development and working with aesthetics is crucial. The sustainable aesthetics must not just perform ecological. To gain full effect it also needs to perform socially and culturally. It works as magnifying glasses, making us more able to appreciate the context (Meyer, 2008, pp. 15-19).

BROWNFIELDS AND SANITATION

Old harbour areas with development potential are often so-called brown-fields. Brownfields are land areas which have previously been used for industry and they are often of contentious type, culturally, ecologically, politically and aesthetically. Due to their industrial history they are often heavily polluted, and the remediation techniques are often very costly, preventing clean-up and development of the sites. Traditional sanitation methods are energy intensive, expensive and sometimes moves the environmental problem to another location. There is a need for a wide range of cost-effective solutions to clean up contaminations in soil and water so that they can be transformed into healthy environments to develop. In Sweden as well as other countries, the urbanization trend is on-going with a need for more housing within the cities. There is an ambition to make cities more environmentally sustainable and effective and avoid sprawl. Larger cities, like Gothenburg, need new housing and therefore, the cities are built denser. The place for exploitation is often a former industrial site and/or a harbour area. There is a need for sanitation in many of the areas with densification potential (Boverket 2016, 7).

PHYTOTECHNOLOGY AS A SANITATION METHOD

Phytotechnology is a plant-based method using natural processes within the plants to remediate contaminants in soil, water and air. The method is an eco-technology, based on ecological principles, considering the natural systems as an integral component of societal and human interventions. There is a comprehensive opportunity in using plant-based sanitation on contaminated lands, and the method is integral to landscape architecture and site design. An important aspect of using phytotechnology compared to other more traditional methods is the time aspect. The method uses plants and can generate an aesthetically pleasing area with recreational and park values. A temporary design using phytotechnology can therefore give site values during the purifying process (Kennen & Kirkwood, 2015, pp. 5-9).

KVILLEPIREN FUTURE DEVELOPMENT

Sweden has an ambition to make cities more environmentally sustainable and effective and avoid sprawl. In the same time the cities need more housing due to urbanization and demographic changes. The place for city development and exploitation is often a brownfield such as a former industrial site and/or a harbour area. There is a need for sanitation in many of the areas with densification potential. (Boverket 2016, 7). Like other old harbours in Europe, Gothenburg harbour areas are under development. Kvillepiren, part of Frihamnen, a central old harbour, is one of these development areas in Gothenburg. At Kvillepiren temporary housing is planned (Göteborgs Stad, u.d.). MARELD landscape architects together with el balto landscape architects were chosen in a competition, started

by the municipality of Gothenburg, to develop the Jubilee park, one of contemporary Gothenburg's largest park projects situated in Frihamnen. It is built in different stages. Now with the "Play and learn park" as a start. Kvillepiren is part of the Jubilee park project with no detailed designs made so far (Allik, 2019).

The soil at Kvillepiren is polluted, mostly with Polycyclic aromatic hydrocarbons (PAH) but also with arsenic, barium and lead. Several measurement values exceed the threshold of developing land as housing area. The threshold values are set by the Swedish environmental protection agency (Forsman & Holm, 2016). The temporary housings planned at Kvillepiren is postponing the need for sanitation of the area to a future development when more permanent building structures is built. In this project I make a proposal for a purifying park cleansing the soil with the plant-based remediation method of Phytotechnology. Phytotechnology is generally seen as a technical solution. In this project I want to investigate the aesthetical aspects of the method and the role of the landscape architect in using the method.

GOALS AND AIM

The main goal of the project is to generate a site-specific design at Kvillepiren, using the eco-technology phytotechnology. In contrast to the technical aspects of phytotechnology, I will focus on sensory qualities and site specifics during the design process to generate a sustainable park with strong human-nature relationships that generates concern and awareness for the environment. The project aims to show how phytotechnology can be used in a landscape design with soft values such as personal experience, aesthetics and pedagogics in focus during the design process. An underlying goal with the project is to contribute with knowledge about sustainable design and the role of aesthetics in designing with phytotechnology. The knowledge gained from the work in understanding and reading the site of Kvillepiren, together with literature and reference places, will come together in a site editing “Kvillepiren Purifying park”. The aim of the project is also to deepen the debate regarding Kvillepiren and other polluted post-harbour areas by bringing new visions regarding the process of purification and what the site can be during the process. The project is also a personal learning- and design experience that will give me insights on how to work as a landscape architect with sustainable design, that includes sensory qualities and aesthetics.

RESEARCH QUESTIONS

- **How can a site-specific sustainable design at Kvillepiren be made so that the area functions as a park during the cleaning process of phytoremediation?**

During the design process the following question will help in maintaining a focus on sustainability and sensory qualities to the park.

- **Can a park, during the cleaning process of phytotechnology, highlight natural processes and the cleaning processes of the plants with experiences so that visitors are educated in environmental awareness?**

2. THEORY AND METHOD

PROJECT FRAME

The project 'Kvillepiren Purifying Park' is a design proposal using phytotechnology to clean up the contaminated soil at Kvillepiren at the same time as educating people in sustainability and creating awareness through experiences of natural processes and aesthetics.

The literature study is primary focused on harbour development, phytotechnology, sustainable landscape design, aesthetics and sustainability, and site-specifics. These topics are researched in literature with contemporary authors and presented in the theoretical and method part of the thesis.

Field visits have been made to reference projects in Amsterdam, Netherlands, Fredericia, Denmark, and Berlin and Duisburg, Germany. The field visits have given inspiration to the design at Kvillepiren and knowledge about how phytotechnology can be used in a design process for a landscape architect. At every reference place design-tools has been found that later in the project is used in developing the design editing of Kvillepiren. The field visits also contributed knowledge that the literature lacks about designing with phytotechnology in an urban context with soft values.

The link between the method of phytotechnology and sustainable landscape design is a focus in this project, investigated in the case study. There, Kvillepiren is understood by analyzing and searching for information about Kvillepiren and its context and relation to the river and connected land areas. The method "traveling transect" is used in the site reading of Kvillepiren to capture site-specifics in the river landscape of Frihamnen. The site-specifics of Frihamnen is the base for the design

editing of Kvillepiren. The understanding and reading of the site, together with design tools from the field visits lead to the editing of Kvillepiren which also is the design proposal. Literature, field visits as well as the case study, with the design proposal are discussed in the final discussion/reflection part.

The project frame is visualized on the next page.

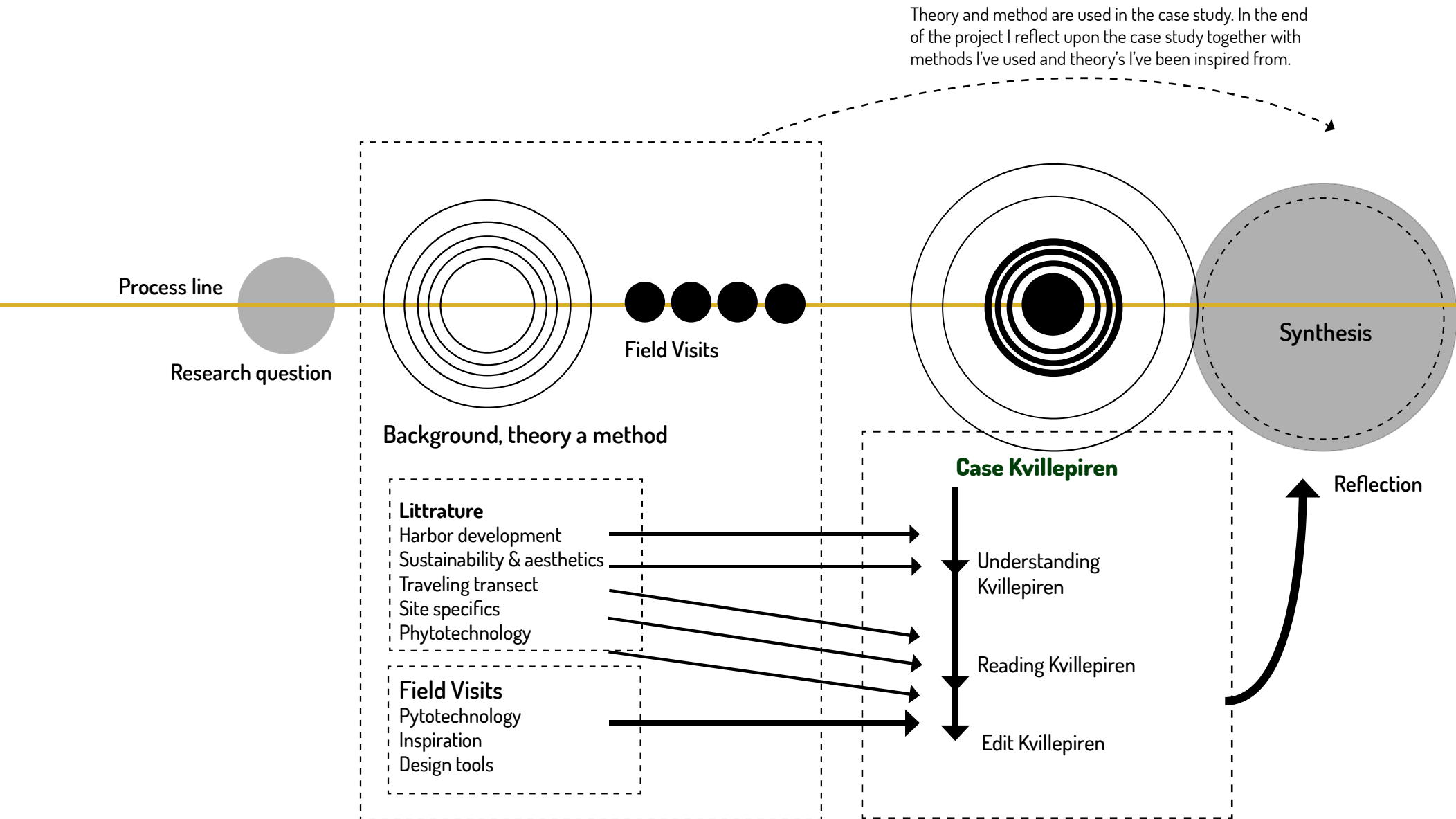


Figure 1. Research design figure explaining the work process.

Literature study

Knowledge, information and methods for the case study at Kvillepiren are obtained through the literature study. Primary focus for readings in this project has been on site specifics, harbour development, phytotechnology, sustainable landscape design and sustainable aesthetics. The topics for the project are researched through literature with contemporary authors. Literature has also been used for the field trips to gain understanding for the reference projects. The history and development options of Kvillepiren and Frihamnen have been investigated to gain understanding about the site and its surrounding landscape. Important literature sources for the theoretical readings on sustainable landscape architecture have been Elizabeth Meyer's Manifest Sustaining Beauty together with other publications of hers. The writings of Andrea Kahn and Carol Burns have contributed with knowledge about site specifics as well as site reading and site editing. Lisa Diedrich's writings about harbour transformation have been used to get an understanding of contemporary harbour development projects. Lisa Diedrich together with Ginni Lee have also developed the traveling transect method used in this project to grasp site specifics of Kvillepiren and its relation to the surrounding harbour areas of Gothenburg.

Field visits

During the project, I have visited four different projects in Europe that use phytotechnology in an urban context. The visits were made openly to understand how other projects deal with pollution and use phytotechnology in public areas. These projects gave me inspiration and knowledge on how to apply phytotechnology at Kvillepiren as well as for other aspects

of the design. The projects visited are all well-known and generally highly appreciated projects that combine phytotechnology and public use of the areas. They were chosen after research and in dialogue with my supervisor Lisa Diedrich. The projects visited are the cleansing park *de Ceuvvel* in Amsterdam, Netherlands, *Natures New Order* in Fredericia, Denmark, *Floating University* in Berlin and *Landschaft park Nord* in Duisburg, Germany. The presentation of the projects is mainly based on my own experiences in these sites, but also on information from interviews and in publications. At each site I have found relevant design tools that are used together with site-specifics at Frihamnen for the design at Kvillepiren.

Case study

The case study consists of three parts: the Understanding of Kvillepiren, the Reading of Kvillepiren and the Editing of Kvillepiren, which also is the design proposal. To generate an understanding of the project site information of Kvillepiren, the historical and geotechnical information of Frihamnen is of importance together with contemporary development plans for the area. When reading the site, personal experiences of the site and of the surrounding harbour landscape is gathered using the method of traveling transect. The site editing part of the case study is a result from the use of literature, the field visits, and the understanding and reading of Kvillepiren. The design generates a design proposal for Kvillepiren, which has a focus on generating rich experiences for the visitors and creating awareness for the local environment.

Limitations

This project is made as an examination project in landscape architecture. Therefore, there has been limitations in time aspects and restrictions in presenting the project in an academically acceptable way. The design process has hence, been free and a personal learning and design process.

In the research and the design process of the project, I focus on aspects within the field of landscape architecture. Therefore, I don't go deep into technical aspects of phytotechnology. Except for phytotechnology, the project consists of other subjects such as site-specifics, harbour development, aesthetics, and sustainable design. Because of the larger number of related subjects, none of them are investigated deeply. Instead, the relations between these aspects, and how they can co-exist is of special interest to this project. I investigate aspects of phytotechnology that enable a temporary design at Kvillepiren that has the capacity to effect, evolve and invite people to the temporary park. Phytoremediation as just a way of cleaning the soil is not of interest in this project.

The reference places visited during the field trip are mostly urban areas with an industrial heritage, polluted and cleaned with phytoremediation. They also work as public areas, inviting people to see and learn about the process of cleaning the soil and experience the historical heritage of the site. Areas that only involve the process of cleaning the soil without inviting people, have not been of interest to this project. The field visits have been chosen with guidance from my supervisor Lisa Diedrich.

The case study will be the result of my work with literature readings, field visits, site understanding, site reading and site editing. The design MARELD landscape architects have done together with atelier le balto landscape architects is the basis of predicting the development connected to Kvillepiren. My design relates to these companies' design but is free in the way it is made, without restrictions or demands to follow these plans. In this project I will not focus on other people's experiences or thoughts of Kvillepiren, instead I use my own experiences as a base for the site reading and the development of the site editing of Kvillepiren.

SITE AS DYNAMIC AND RELATIONAL

“Site is best viewed from points in between” (Burns & Kahn, 2005)

The existing site matters, when designing physical environments. The design at Kvillepiren is located at a specific site with site-specifics. In the design work of a site it is important to understand the relationships between project and locale. Phytotechnology is a method affected by specific site conditions but there are also other aspects of the site to consider for the design which requires site thinking and site reading. Andrea Kahn and Carol J. Burns’s concept of reading a site is used when exploring Kvillepiren and its surroundings.

A site is in popular language often referred to as the ground where something takes place with clear given boundaries. In design projects, site is often seen as piece of land a designer gets from a client to shape. During the design process the designers focus, and interest often goes outside these boundaries towards also looking at larger systems and the designers’ own influence on the site and beyond. Kahn and Burns created the concept of the dynamic relational construct to define site. In their description of sites, sites are defined in relation to each other according to forces working at, and in-between them. Each built project creates forces within the own area but also influences systems and modifies patterns that both reach beyond the site and operates within it. During design process site thinking should construct and comprehend relational conditions between the designer and the site, because design does not simply operate at one restricted place. In a design process the designer engages in a dialog and an interaction with the site. Therefore, Burns and Kahn claim the site as a relational construct

deriving from exchanges between the real and the representational. In site thinking the site provides a situation that guides the designer to knowledge embedded within ways of engaging and understanding the world.

- Area of control – e.g. proper harbor transformation area
- Area of influence – e.g. catchment, coast, water table, climatic zone
- Area of effect – e.g. district, city, metropolitan region

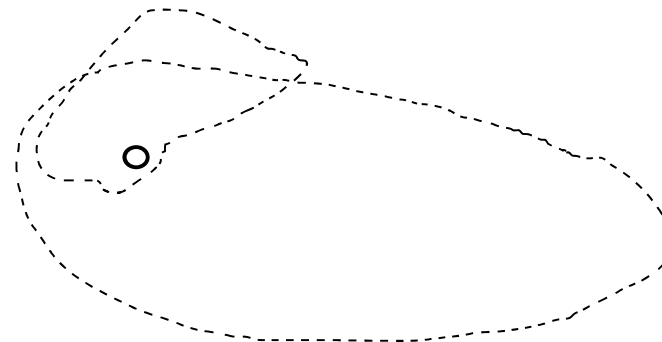


Figure 2. Picture made after Lisa Diedrich (2005) drawing over site as more than topical invention.

Through time, site can be conceived as three areas. The first is the area of control. This one is obvious and easy to trace between property lines. The second one is the area of influence, which encompasses forces that act on a plot without needing to be bound to it. The third district area is the area of effect, which is the land impacted by the design. These areas exist simultaneously, overlapping and affecting each other by physical and nonphysical forces that designers are a part of effecting (Burns & Kahn, 2005, p. xii). Lisa Diedrich uses Burns and Kahn's definition of site in her work on European harbour areas and their development. In the context of harbour transformation Diedrich defines the area of control as the proper project area, while the area of influence goes beyond the project area such as a coastline, a climate zone or a water table. The area of influence also comprehends larger zones like a city, a district or a whole metropolitan region (Diedrich L. B., 2011).

According to Braae, Diedrich and Lee, designers often address sites from a material and static point of view, as empty places to host new design inventions. With this approach, the designer often overlooks much of what exists, especially ephemeral site properties such as relationships, dynamics, and atmospheres. There are however contemporary tendencies towards more site-specific designs and an increased ecological awareness in landscape architecture and planning. This drives a focus towards relational properties in understanding ecological systems and atmospheric site-properties leading to a greater aesthetic understanding (Braae, Diedrich, & Lee, 2013, pp. 4-5). The American scholar Elizabeth Meyer examines site thinking of landscape architects of the pre- and post-modern eras. Meyer

notice site-reading and site editing as central concepts in differentiating the landscape architecture profession from architecture, horticulture and engineering. Instead of seeing sites as empty canvases they are seen as existing situations full of material and non-material conditions. Meyer also writes about the personal process and effect of reading and editing a site where the landscape architects use their personal experiences in the design processes (Meyer, 2005, pp. 93-121).

"Sites are found as well as intervened. New directions for site practice might look less at new tools for how to read sites, and more at finding spaces within which to imagine site. For those spaces might be as much between disciplines as they are between surfaces, membranes, and operations" (Meyer, 2005, p. 121).

AESTHETICS AND SUSTAINABILITY

In times of environmental hazards and crisis, environmentalists are conceptualizing nature as the realm we all belong to, that hosts us, comprising all life including humans as one form. Anthropocene as the epoch we live in, synthesizes humans' great impact on earth, its geology and ecosystems with often deeply troubling results. To face these impacts, concepts of sustainability decentering humans is an effort, in making the relationship between nature and humans more balanced in order to turn the development around (Vicenzotti & De Block, 2018, p. 150). Ideas on sustainability, ecology and aesthetics have been scrutinized over centuries. Many scholars from various disciplines, including architects, landscape architects, philosophers, histo-

rians, geographers, and ecologists, have developed aesthetic theories often related to ecology. Questions regarding aesthetics and sustainability often revolve around the relationship between nature and culture or humans and the non-human. Eighteenth-century aesthetic theory conceptualized and separated stronger than before nature and culture, science and arts. Landscape architecture, which is an interdisciplinary profession, very much involved in future physical development face the challenge of bridging the domains (Notteboom & van Hellemond, 2018).

Elizabeth Meyer's manifest "Sustaining beauty, the performance of appearance, a manifesto in three parts" defends beauty and makes a claim for it within the discussion about sustainable landscape design. Together with her following text "Beyond 'Sustaining Beauty'" Meyer advocates sustainable design using the sensible and aesthetics (Meyer, 2008) (Meyer, 2015). For historical landscape architects during the nineteenth century, like Fredrick Law Olmsted, the experience and appearance of the landscape was important. The landscape was seen as civilization and culture as much as a bio-physical environment. Meyer criticise contemporary practice of sustainable landscape architecture and design for its lack of regard for appearance, and beauty. Instead it stands on the pillars of ecology, social equity and economy. These pillars are in relation to each other but not to aesthetics (Meyer, 2008).

As well as among other people, the view of sustainability differs within landscape architecture and among landscape architects. Meyer divides landscape architects into groups according to the different ways they think

about and deals with sustainability. According to her, the largest group mainly relay on eco-technologies. This group ask themselves how ecological processes can be constructed and search for the best ways to technically construct raingarden, paving roads and reuse construction waste. These aspects are of great importance in sustainable projects but, according to Meyer, not enough. Landscape architects are not engineers or restoration ecologists and should instead embrace the designer's role (Meyer, 2008). In her manifesto, she makes a claim for the capacity landscape architecture has in creating sustainable culture compared to the general concept of sustainable development, ecological design or conservation biology. Landscape architecture needs new language as well as new techniques to conceptualize sustainable landscapes. Through hybridisation terms, connecting already existing concepts related to both ecology and culture, landscape architecture has potential to open up for new concepts between categories that today divide aspects of design process. These hybridisation terms can connect urban and wild, aesthetic and ethic, beauty and disturbance, aesthetics and sustainability.

EXPERIENCE OF SITES

Meyer draws on the writings of pragmatists and philosophers as well as architects to understand aesthetics as an experience, not a surface appearance or a form of language. When designing site and working with aesthetics, the personal sensory experience is of importance. Designers need to use their perception and cognition in order to create an exchange between the sensing

body and the world. She argues that landscapes need to provoke those who experience it through aesthetic experiences and re-entering people's minds to generate change in mindset towards more sustainable thinking and behaviour. What is needed are landscapes that provoke those who experience them to become more aware and care enough to make changes. Design can change society by altering people's consciousness to help in the work of changing priorities and values. The site specifics are important in creating aesthetics in a sustainable landscape design because sustainable aesthetics or beauty, is site-specific, not generic. It works as magnifying glasses, making us more able to appreciate the context. The site may be strange and surreal but site specifics in the environment can be important regardless if the site is productive, toxic, regenerative or resilient. It can be an abandoned brownfield, a forest or a park. Sustainable aesthetics will highlight processes and create hyper-nature but will not simulate the place as it is. The design will emerge from the context but differs from it (Meyer, 2008, pp. 15-19). In Meyer's Manifesto she mostly refers to the experience and importance of beauty in sustainable landscape architecture. In her later text "Beyond sustaining beauty", Elizabeth change from using the word beauty, to instead use the term aesthetics, which comprises more of sensory experiences, and environmental perceptions of the landscapes, compared to beauty. In perception theory the personal experience of aesthetics is often in focus, but aesthetics is even more than a personal experience. Singular experiences create collectively new ways of thinking about and living in the environment, creating sustainable cultures (Meyer, 2015).

"The experience of designed landscape can be a spatial practice of noticing, wandering and wondering in, and caring about the environment. The experience of landscape can be a mode of learning and inculcating values" (Meyer, 2008, p. 20).

The personal experiences are important both in the site reading of the landscape and in the site editing for Kvillepiren. The method of traveling transect is used in this project to capture dynamics, atmospheres and relations in Kvillepiren. The method is inspired by writer and explorer Alexander von Humboldt's trans-areal travelling, mapping and his trans-versal collecting of information. It has been developed by Lisa Diedrich and Gini Lee to be a tool to capture, map and express qualities such as dynamics, atmospheres and relations. The Travelling Transect consists of a transect travel, a cartographic diary and the tableau physique. It was developed in the water landscapes of the Canary Islands where a group of researchers were seeking abstract qualities of the place such as dynamics, relationships and atmospheres. Within the method of traveling transect the concept of serendipity is central. It involves findings that you have not been searching for. The method is a way of exploring with openness, creating circumstances that can lead to these findings. In the text "Trans-areal excursions into landscapes of fragility and endurance", Diedrich and Lee places traveling transect within the discussion about sustainable design and the role of aesthetics. (Diedrich & Lee, 2019, pp. 1-2). In their description of Meyer's writings, they fit the traveling transect method within the aesthetic design scope. Theory and practice of landscape architecture should recognize the relationship between people and place which exchanges emotions, energies and agency.

IDENTIFICATION WITH- OR DISTANCE TO THE ENVIRONMENT

Greet De Block and Vera Vicenzotti 2018 discuss nature-culture relations and landscape architecture and argue for environmental aesthetics that contain distance between the subject and the object and the sublime experience of the landscape. Space is needed between the subject and the object so that the beholder can critically reflect on the relation of human and non-human. Block and Vicenzotti agree with Meyer on the importance of putting aesthetics back on the landscape agenda. However, they are concerned that contemporary debates fixating on aesthetics that is linking humans to the environment and natural processes run the risk of further depoliticizing design. This might jeopardize the distance between the rational and the sensible in the experience of design, making people less engaged and critical (Vicenzotti & De Block, *The effects of affect. A plea for distance between the human and non-human*, 2018).

*“If we take the quality of distance as key to the aesthetic experience, we might rebalance current trends in social theory and ecological landscape design moving towards organicist reasoning considering society as a socioecological system ruled by such ‘natural’ laws as co-evolution and self-regulation” (Vicenzotti & De Block, *The effects of affect. A plea for distance between the human and non-human*, 2018).*

De Block and Vicenzotti talk about both distance and the sublime. Instead of normalized practices such as care, concern and empathy, the sublime is about engaging with dissent, disruption and the political. In opposition to theories of affect with no distance between human and environment, the sublime experience has the potential to generate critical thinking and political action. The postmodern sublime does not claim to comprehend

nature’s power or size. It avoids both dystopian and utopian images of nature, questioning instead the very idea of nature and the human-nature relationship (Vicenzotti & De Block, *The nature of post-human landscape design*, 2018).

In Meyer’s writings she draws connections between aesthetics and ethics when describing who identification with the environment can create awareness towards the environment. Marc Tribe (2018) question these connections and writes instead about the importance in seeing definiteness between these two categories to be able to generate designs that are both ethical and aesthetical. According to Tribe, concepts of aesthetics and ethics reside in different camps and stand at a distance from each other. He takes the simple example of invasive species that can have strong aesthetic values for the beholder but is not ethical to plant for environmental reasons. To think that all designs with high level of environmental protection don’t need to be pleasing for humans either. The separation of aesthetics from ethics is therefore important, to be able to make well evaluated choices regarding both ethics and aesthetics (Treib, 2018).

PHYTOTECHNOLOGY

Phytotechnology is a plant-based method that can be used to sanitize soil from pollutants. It is a relatively cheap method with environmental benefits compared with traditional methods. The method is rarely used within cities and in public places. The method is presented in this thesis to describe how it could be used in the development of Kvillepiren. It has potential in generating a purifying park in post-industrial and harbour areas where the soil is polluted. In this chapter the basics of phytotechnology is presented as well as the time aspects and the educational possibilities with the method. The concept of phytoremediation or phytotechnology has been used frequently since the 1990's. But there has been a longer history of using plants and natural elements in design to clean soil, water and air from pollutants. The method of using plants to cleanse the soil with plants has aesthetical constraints that a landscape architect can work with.

Figure 3. Phytotechnology in a coastal landscape.

PHYTOTECHNOLOGY

Plants have been used by humans to alter the environment for at least a millennium. Broad definitions of phytotechnology include all plantings that enhance the environmental goals. In this thesis the term is used more specifically as a set of techniques or technology connected with environmental cleanup. The term phytoremediation is commonly used when describing the degradation and/or removal of contaminants on a polluted site or from a specific group of plants. Today phytotechnology is a term used to include more techniques mastering natural processes for a cleaner environment:

“Phytotechnology is the use of vegetation to remediate, contain or prevent contaminants in soils, sediments and groundwater, and/or add nutrients, porosity and organic matter. It is also a set of planning, engineering and design tools and cultural practices that can assist landscape architects, site designers, engineers and environmental planners in working on current and future individual sites, the urban fabric and regional landscapes (Kennen & Kirkwood, 2015, p. 3).

In this thesis both phytoremediation and phytotechnology are used to be able to be specific regarding the phytoremediation process and to be able to include a wider view of the field of knowledge that is connected to the term “phytotechnology”. (Kennen & Kirkwood, 2015, p. 3).

In the 1970’s researchers began to systematically study the relationship between pollutants and plants, especially plants and metals. Phytotechnology or remediation using plants was formally established and named

in the 1980’s. The techniques and the terms quickly profiled as researchers learned more about different processes in the plants and the soil. In the 1990’s the main techniques still used today were named and companies started to patent techniques. Many greenhouse and lab experiments were published during this time. (Kennen & Kirkwood, 2015, pp. XXV,11). Phytotechnology has been used successfully on different sorts of sites, including industrial and municipal landfills, agricultural fields, military bases, gas stations, mining sites and residential sites. The method has been studied in the field as well as in labs, showing good results in treating different sorts of contaminants (Ware, 2018, p. 10).

Why Phytotechnology?

Methods used to remove contaminants from sites can be divided into in situ, on site and *ex situ*, off site. The traditional methods of cleaning soils at brownfields often involve *ex situ* excavation of the soil and disposal to landfill or covering and capping it with concrete and clay. The remediation process can also involve soil washing in situ or sometimes *ex situ*. The groundwater then often needs to be encapsulated and treated so that it does not spread pollutants during the cleaning process. These common methods are expensive, energy intensive and often move the problem to another location or postpone it for the future instead of dealing with it once and for all (Kennen & Kirkwood, 2015). Anthony Randazo, who gave the technical definition of *ex situ* and *in situ* 1999, argues that conventional ways of cleaning landscapes often are as aggressive to the environment as the industrial site that first produced the contaminants (Randazo 1999, p. 1). Kennen and Kirkwood are today of a similar opinion.

According to them traditional the methods of digging contaminants for deposit or treating them *ex situ* is expensive and these methods has no special design potential compared to phytotechnic which experience values during the sanitation time. The traditional methods often destroy microenvironments and soils, leaving them unsuitable for agricultural and/or horticultural use (Kennen & Kirkwood, 2015, p. 6). Phyto-techniques are often in situ processes and therefore often more cost effective and environmentally friendly, without transportation of toxic soil or use of chemicals in the cleaning process (Smith, 2015). The cost of using phytotechnology can be as little as 3% of traditional clean-up methods according to Kennen and Kirkwood. These numbers are however hard to predict because the

process depends much on on-site specific qualities such as contaminants, soil condition, time and weather. In some cases, the plants can be harvested and used to generate energy or to extract heavy metals from the soil which can then be used, generating economic products (Kennen & Kirkwood, 2015, pp. 6-8).

The method of phytotechnology works slowly, but during the process of using plants in environmental clean-up, the plants can create aesthetically pleasing sites and give other values. The plants improve air quality, mitigate further spread of contaminants, generates ecological processes and contribute to increased biodiversity in the area (Ware, 2018, pp. 11-12). Kennen and Kirkwood presents many advantages and opportunities with using phytotechnology compared to traditional clean-up methods. According to them the public acceptance for phytotechnology is high, especially if it is located close to residential areas. For the landscape architect, phytotechnology can be a starting point for the design at industrial sites integrated in vegetation and landform strategies. There are also ancillary benefits of using the technology such as community use, community involvement and education and recreation. With a close community use, the areas can be used as outdoor classrooms and experiences for students, and other visitors. They can also be living experiments that educate residents about post-industrial lands, the history, pollutants and show how sustainable ecosystems can be created with help of cleansing plants (Kennen & Kirkwood, 2015, p. 8).

How it works

Phytoremediation is a solar-driven technique which uses plants to clean up contaminated soils. There are several phytotechniques working in different ways, all involving plants (Cunningham, Berti, & Huang, 1995). A variety of plants are employed in the remediation process, some more effective than others. The plants should be specially selected depending on the contaminants and the location of the plants and the site-specific conditions (Smith, 2015). As in all planting designs, plants used in phytotechnology plantings require sunlight, oxygen, water, nutrients and somewhere to grow. Site-specific conditions such as the texture of the soil, salinity, Ph value, light, wind and pollutant concentrations must be within the limits of the chosen plant's tolerance levels. (Cunningham, Berti, & Huang, 1995).

When choosing a method for remediation, the first step is to determine if the pollutants are organic or inorganic. Organic compounds are systems put together that can often be degraded with phytotechnology. The plant mechanism breaks them down into less toxic components, binding them into plant tissue and/or releasing them to the atmosphere. With organic compounds there is no need to harvest the plants. Inorganic pollutions are elements or compounds that occur naturally such as lead and arsenic. Combustion of fuels, industrial production and other human activities release toxic inorganic pollutants in the environment. Inorganic elements and compounds cannot be degraded and destroyed, but in some cases, they can be extracted by plants. To remediate the site the plants then need to be harvested. In general, there has been more success in treating soils with organic pollutions compared to soils containing inorganic elements (Kennen & Kirkwood, 2015, pp. 32-43).

Different plant mechanisms

The plants can clean up and remediate contaminated sites in many ways. They act as filters and metabolise or accumulate toxins. This can be done in or above ground. A plant can often perform several processes and treat multiple toxins at the same time. The microbiological organisms around the roots (rhizosphere), in the soil allow transportation of chemicals from soil into the plant (Ware, 2018, pp. 8-10). Of the different mechanisms in phytotechnology, the best-case scenarios are phytodegradation and rhizodegradation. These systems degrade the contaminants in the soil without the need of harvesting the plants. They can be used on organic components. The rest of the mechanisms work on organic and inorganic pollutants (Kennen & Kirkwood, 2015, p. 34). The following list describes different phytotechnology mechanisms.

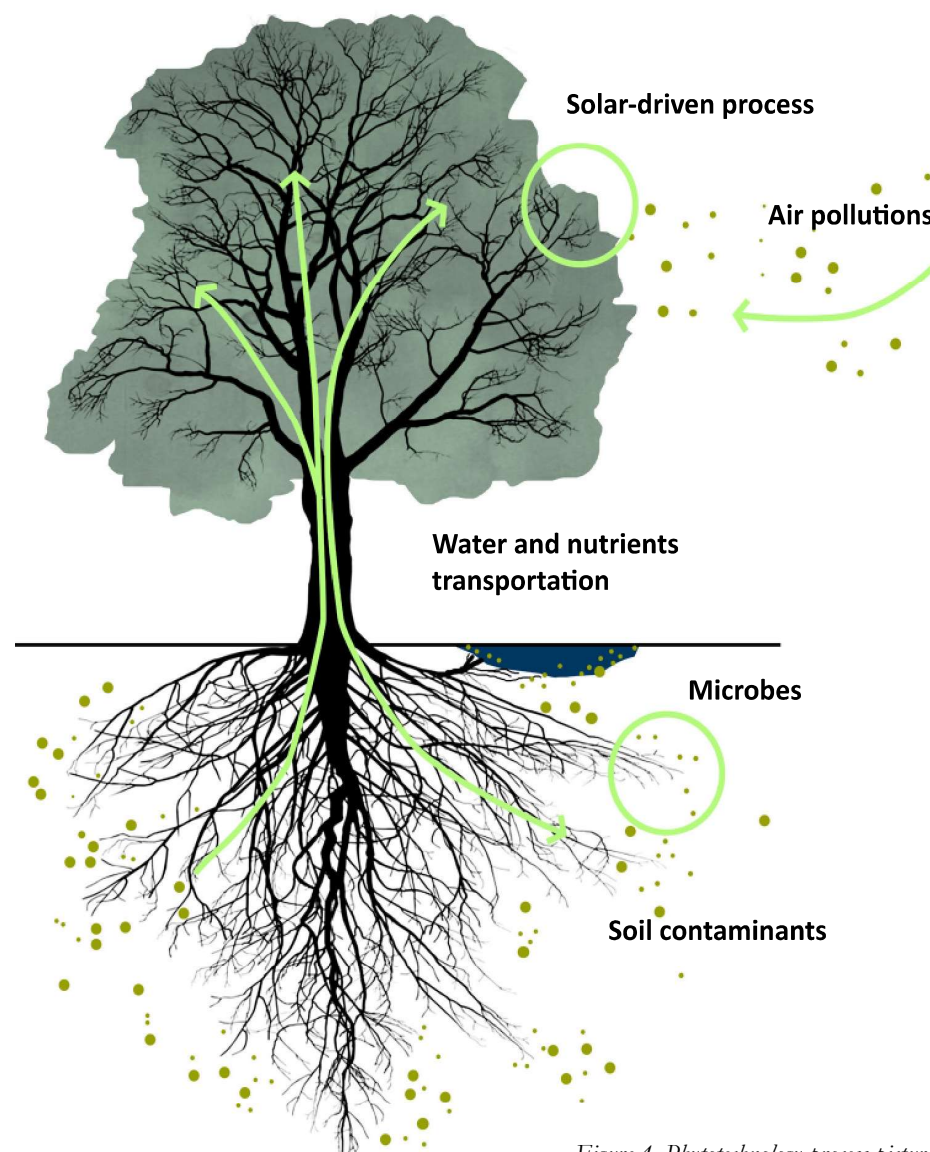


Figure 4. Phytotechnology process picture.

Phytodegradation

During *phytodegradation* the contaminant is taken up by the plant and broken down to smaller parts. These parts, so called metabolites, are in most cases non-toxic. The metabolites are then used in the growth process of the plant. The process occurs during photosynthesis and/or by internal enzymes and or microorganisms.

Rhizodegradation

In the process of *rhizodegradation* microbes in the soil destroy contaminants, but the plant is still a critical part of the process. The plants release sugars and create a good environment for the microbes to thrive in. The plant helps the process by increasing the number of microorganisms and encourage the life of especially good sorts of microbe-degrading communities.

Phytovolatilization

Elements and components occur as solid, liquid and gas form. During the process of *phytovolatilization* contaminants are taken up by the plant, which transpires them to the atmosphere as gas. The release of gas is usually slow enough, so that the air quality doesn't get impacted in a harmful way.

Phytometabolism

In the process of phytometabolism, nutrients (inorganic such as N, P, K) needed by plants are taken up, and used as building blocks, for photosynthesis and biomass. Once the organic contaminants have been broken down through *phytodegradation*, the metabolites left from the process can be used through phytometabolism.

Phytoextraction

In the process of *phytoextraction*, the plants take up and accumulate contaminants from the soil. When dealing with organic compounds the mechanism can be coupled with phytodegradation that destroys the compounds in question. Inorganic components are not destroyed. Instead, the plants need to be harvested and taken care of *ex situ*.

Phytohydraulics

In the process of plants absorbing water, they can collect contaminants within the water during the process of *phytohydraulics*. The forces can be so strong that groundwater can change direction and go towards the plant instead spreading with water's other movements.

Phytostabilization

During *phytostabilization*, the plant holds the contaminant in place. The vegetation can physically cover the contamination and may also bind the contaminants by releasing phytochemicals into the soil, making them less bioavailable.

Rhizofiltration

Contaminants are filtered from water with plant roots during *rhizofiltration*. The sites that uses rhizofiltration can be constructed wetlands and storm-water filters. During the process, contaminants are stored at the binding-site by plants adding oxygen and organic matter.

(Kennen & Kirkwood, 2015, pp. 34-41)

Time Aspects

The process of cleaning the soil with phytoremediation often takes long time, often generating projects of 5-50 years depending on several aspects. Time aspects of phytotechnology can be a dealbreaker when planning and deciding to use phytotechnology or not (Kennen & Kirkwood, 2015). The cleaning of polluted land is often made when there already are developed plans to build on the land or use it in other ways. This often leads to projects with very tight timeframes where the use of phytoremediation does not fit. The issue of contaminated soil and/or groundwater is often raised late in the process, leading to ineffective and expensive projects (Naturårdsverket, 2006).

A time frame for cleaning the soil with phytotechnology is hard to predict. Still, there are some general aspects to consider when estimating the time.

- The type of contaminants and their concentration in the soil
 - The depth and size of the contaminated area
 - Type of plants used and their growing time
 - Climate and growing season at the site
 - Other plant growing conditions such as damages by weather, pests and animals
- (UPA, 2012)

Kennen and Kirkwood present ways of speeding up the process of phytotechnology. Using plants that are especially fast in taking up contaminants, so called hyperaccumulators, is one way. The adding of fertilizers in the soil may also speed up the process of degrading chemicals. Some studies have shown improved results by adding nutrients, but it is important to have in mind that the fertilizers can affect plant succession and the type of plants growing in the area. It is important that both plants and microbes thrive in their living environment for best result, therefore plant selection and choices in possible adding of nutrients crucial in the process. (Kennen & Kirkwood, 2015, pp. 67-70).

But the long timespan of phytoremediation comes with the opportunity of creating temporal designs. The plant communities can change and grow during the period and create a site with changing landscape experiences (Sleegers, 2010). Landscapes are temporal by their nature, with dynamic systems and ecological relationships. In Diana Balmori's book "A Landscape Manifesto" she describes different types of temporal landscapes. Some are more temporal than others and temporal in different ways. Some have to do with cyclical systems such as the changes during the year and others have more to do with a linear decay of materials over time. The movement of the landscape is also an important aspect of temporality according to Balmori. Temporal landscapes have time as an important design factor and starting point. They have specific qualities such as being fun, fast and full of life according to Balmori (Balmori, 2010). In Meyers manifest *Sustaining Beauty*, she talks about the temporal aspects connected to beauty within the landscape. She claims that sustainable beauty is dynamic instead of static.

Landscape architecture has the capacity to design with time and temporal aspects more than other related fields. It arrests, delays and intensifies time by highlighting ecological processes and creating wonder for natural ecologies and urban cultures according to Meyer. More than other related fields such as architecture or sculpture, landscape architecture works with the medium of time. The beauty of landscapes can lie in the changes and rhythms of nature and biological process are important to take to account in the design process (Meyer, 2008).

“Not only do we move through landscape, the landscape moves, changes, grows, declines. Beauty is ephemeral; it can be a fleeting event, captured once a year in the mix of a specific light angle, a particular slope of the ground, and a short-lived drop of a carpet of brilliant yellow leaves. Or it can be created by the long processes of stump and log decay, and of regeneration in a forest garden” (Meyer, 2008).

Hamdi, a pioneer in participatory aspects in architecture and planning writes about effects of small changes in the city, often temporal, and the big effects they can have in his book *Small Change* 2010. In order to do something big, to think and act globally, you need to start with something small that counts. According to Hamdi we need to recognize the communities of spontaneous and temporal places. The relationship between place and identity can be strong and a catalyzer in creating community, sometimes strong feelings of ownership over the place. Community development is often seen as a positive development but there is also a risk of communal and spatial exclusion if the site is been appropriated strongly by the community (Hamdi, 2004, pp. xi,70).

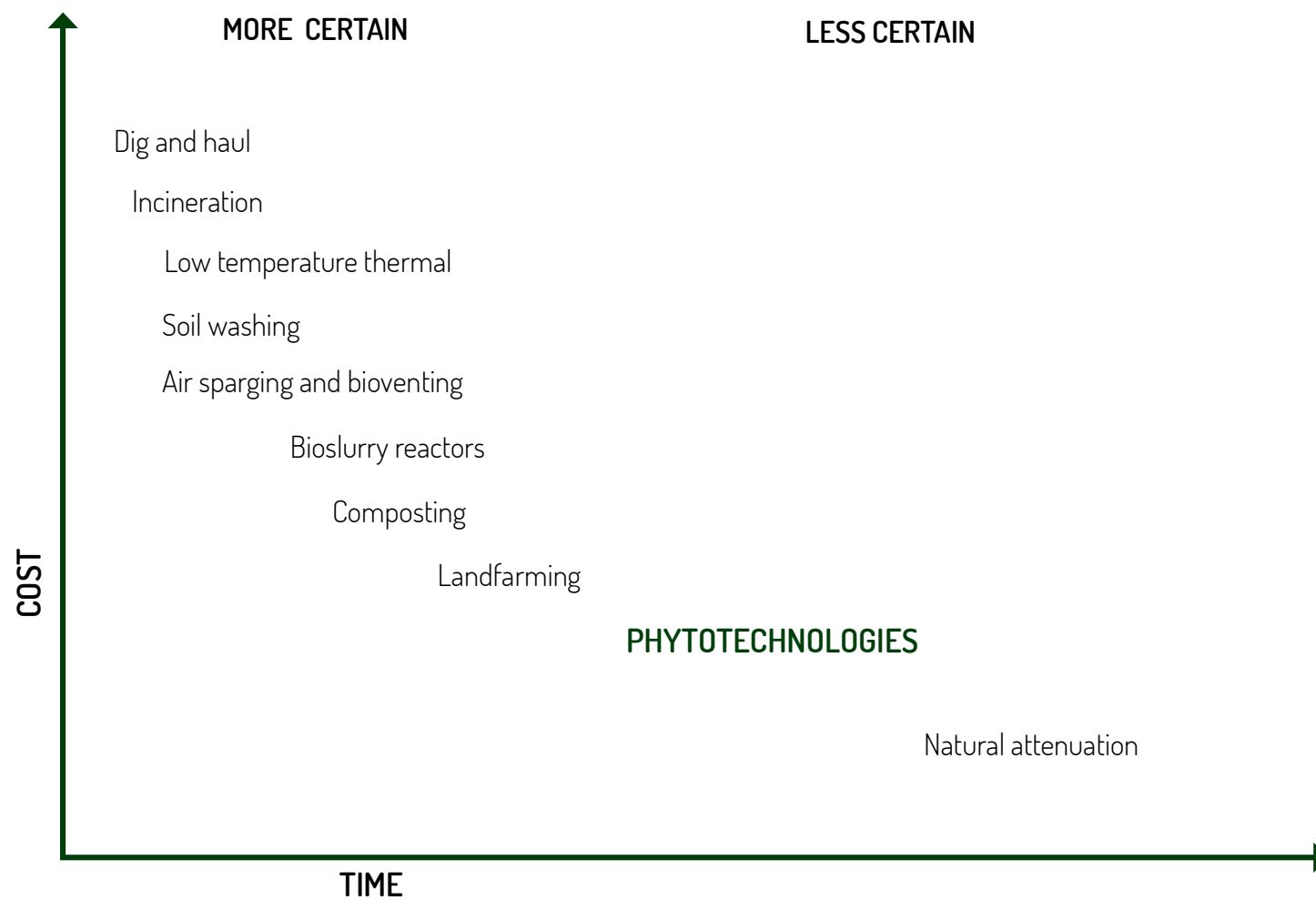


Figure 5. Cost benefits vs Treatment Time
(Graphic redrawn from Kennen Kirkwood (2015)).

Education and care

Kennen and Kirkwood present the educational use of phytotechnology as a potential benefit of a design with phytoremediation. The sites can according to them be closely linked to related communities and pedagogic work such as outdoor classrooms for local students at different levels. They can educate residents about dangers of post-industrial lands, with pollutants in soil and groundwater and how nature and natural systems can help in restoring these landscapes (Kennen & Kirkwood, 2015, p. 8).

Both ecocentrism and anthropocentrism can be associated with working on preserving a healthy environment. The reason why differs. A person with a more anthropogenic world view has concerns related to human welfare whereas ecocentrism takes into account all sorts of life and systems within it. Sharob Doty and Ellen Weir, 2016 did a survey about social acceptability for phytoremediation in parks with industrial history and contaminations. They compared results in acceptability with risk perception and if the person had an anthropocentric or ecocentric world view. The analysed result showed that there was a strong correlation between having an ecocentric world view and acceptability for phytoremediation. There was also some correlation between risk perception of danger in the park due to contaminants and positive attitude towards phytoremediation in the park. Most people did not know that the park was contaminated. Generally, there was a positive attitude towards cleaning the soil with phytotechnology (Wier & Doty, 2016, pp. 1030-1034). When working with creating communal support and acceptance for project with phytoremediation it could be effective to work on effecting people's worldview towards more ecocentrism, instead of an anthropocentrism. Doty and Wier therefore

argue that it would be valuable to highlight environmental benefits rather than just the benefits human health problems when working with communicating aims of using phytoremediation in landscape projects. (Wier & Doty, 2016).

Meyer's arguments connect with Doty and Weirs' findings about how people feel about designs with phytoremediation connected to their view on their anthropocentric or ecocentric world view. According to Meyer, landscape architects should design for environmental experiences that can affect people. Aesthetics in landscape design can have the role of making people attached to, learn about, feel responsibility for and in the end care for the environment. It involves environmental experiences and re-centering people's consciousness from an egocentric (anthropocentric) world view to a more biological world view (ecocentric) (Meyer, 2015, pp. 31-32).

Beautiful sustainable landscape design involves the design of experiences as much as the design of form and the design of ecosystems. These experiences are vehicles for connecting with, and caring for, the world around us (Meyer, 2008, p. 18).

FIELD TRIPS

I have done field visits to different reference projects in Europe that use phytoremediation to find inspiration and learn about how phytoremediation can be used in public places. Some of the reference projects have a focus on handling post-industrial sites and their industrial heritage while others focus more on education in sustainability and highlighting natural processes on site. As mentioned, designing with phytotechnology within the urban fabric is unusual. The use of reference places is therefore important in making a convincing design for Kvillepiren with phytotechnology, showing that it has been done in other places and how it works in a public area. In May 2019, I therefore visited the projects, purifying park *de Ceuvel* in Amsterdam Netherlands, the project *Natures New Order* in Fredericia, Denmark, *Landschaft park Nord* in Duisburg, Germany, and in September 2018 I visited the project *Floating University* in Berlin, Germany. The field visits included personal experiences at the sites together with interviews, spontaneous talks, photographing and e-mail conversations as well as written information about the sites, the design and the use of phytoremediation. They are all presented with a main description, how the site uses phytotechnology and with design tools. In all sites visited, I found relevant design tools that can be applicated at Kvillepiren. The design tools are aspects that I have found to be of special interest and importance to bring onto the design at Kvillepiren.

Figure 6. Photo from de Ceuvel Amsterdam 2019.

DE CEUVEL

Amsterdam Netherlands

- DELVA Landscape Architects

De Ceuvel is a polluted and abandoned site located in one of the ports of Amsterdam. In 2012 the economy of Amsterdam was not strong enough to afford traditional sanitation methods, so the municipality arranged a competition for a temporary design instead. DELVA landscape architecture and urbanism together with Space and Matter, Metabolic Label, Space & Matter and Studio Valkenier won a design competition resulting in the temporal project *de Ceuvel*. Their proposal, “*Purifying Park De Ceuvel*” uses phytotechnology to clean the soil and water. It is also a place that is built on the circular use of energy and recourses (DELVA, 2019). For example, energy is harvested with sun panels, feces are collected and composted at the site and material for building structures comes mainly from reused materials (Mense, 2019). The park is a place for environmental innovation and research, where different professionals and residents are working together with sustainability issues mainly connected to ecology, energy and material use. There is a focus on innovation and education and different workshops, tours and written information on site educate visitors in understanding different ecological systems and sustainable work on site (DELVA, 2019).

“Soil and water purification, education, biomass production, innovation, research, ecology, art and culture come together at this new breeding ground. We see it as a park for intensive knowledge development (DELVA, 2019).”

De Ceuvel attracts all sorts of people, but mostly people with creative professions that are interested in sustainable development and alternative ways of living. It is five years left until the contracts expires and people have started to care about the place, both people that are active participants working at *de Ceuvel* and visitors. There are people from the community engaged in dialog with the municipality about how the development should progress in the area. The general opinion from the community is that the development process should be slow and with participation from locals and bottom-up co-creation (Mense, 2019).

Phytotechnology combined with design and aesthetics

During my visits at *de Ceuve*, it was clear that the method of using phytotechnology had influenced the design at the park, with lush freely growing vegetation, special plantings and elevated walking paths for accessibility. The elevated path protects people from the poisonous soil and leaves the plants safe to do their job of cleaning the soil, without human destruction. This path took me through the whole area, with had houseboats put on land, trees and other types of vegetation, information boards and close contact to the canal. The walk separated me from the vegetation, in some way creating distance in the relation between me and the plants. At the same time, I got a better view of the process of phytoremediation without interrupting it. The walk was interesting with different environmental experiences such as mixed vegetation of larger trees, perennials, grasses and bushes and openings and views connecting the park with the water. Most of the plantings had a wild character but some were more controlled, like the flowering plantings close to the café. During the walk I also got a lot of written information about the area and the work on ecological sustainability from the information boards. At certain locations there were seating where located I stopped to sit down and enjoy the area in a calm fashion. The area is temporary with buildings and materials can easily be removed from the site. The building structures looked homemade and in some ways the area was a bit messy but that also gave me an experience of being part of a process of community building where not everything is polished and finished. I met up with Barend Mense worker at DELVA Landscape architects. He explained how they have worked with the project and how phytotechnology has been used. DELVA worked together with other professionals. The design of the site is built on the planting of hyper-

accumulation plants. The choice of plants was made by researchers from a University in Amsterdam. It has been important to cooperate with other professionals within the project because many parts within phytotechnology go beyond the landscape architects' profession. But the landscape architects at DELVA had some opinions and some saying in the choice and composition of the plants.

"The plants were mainly selected by the scientists. But the landscape architects at DELVA has done some aesthetic chooses. They choose plants that had more aesthetic qualities such as flowering. Larger trees are old that was left on site. The site looks very beautiful some periods of the year but in others the plants does not perform aesthetically. That's something we could work more with (Mense, 2019)"

After some discussion about what aesthetic could be in the discourse of sustainable design using phytoremediation Barend said,

"I mean it is messy, not so much order with the plants but it also fits the site and its atmosphere. It is a temporary site with a lot of co-creating and self-built structures. The composition of the plants is in its own way site specific. But it would be good to continue the work with the vegetation towards more aesthetics during the whole year (Mense, 2019).



Figure 7. Elevated footbridges from de Ceuvel Amsterdam 2019.



Figure 8. Water purifying vegetation from de Ceuvel Amsterdam 2019.

Design tools

Just like Kvillepiren in Gothenburg, *de Ceuvl* used to be a polluted and abandoned site, located in one of the old harbours of Amsterdam. The two sites have many similarities regarding water, history and development plans in the surrounding area. *De Ceuvl* as a place for innovation and education is inspiring. Similar educational frames can be developed at Kvillepiren.

- Elevated footbridges**

Separation from contaminated soil by elevated footbridges.

- Information Boards**

The information boards give information about the site, phytoremediation and sustainability work at the site.

- Larger trees preserved on site**

There are aesthetic values in preserving already large trees on site and the use of flowering plants for phytoremediation.



Figure 9. Elevated footbridges and boats on land from *de Ceuvl* Amsterdam 2019.

Figure 10. Outdoor seatings from *de Ceuvl* Amsterdam 2019.

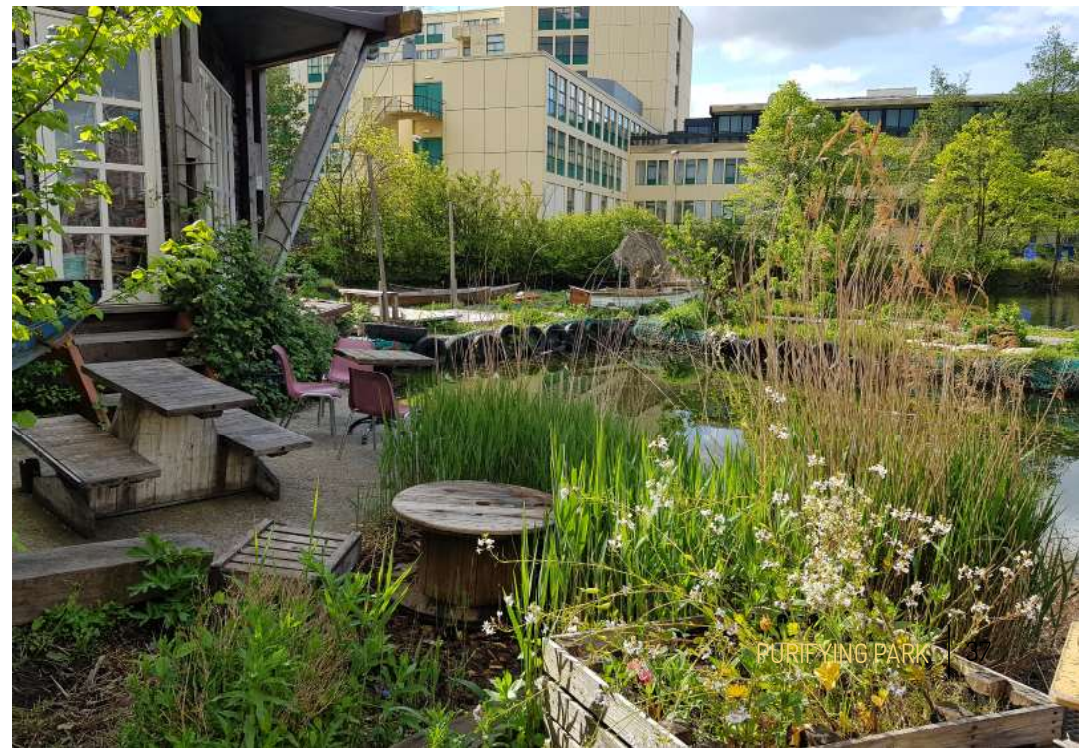




Figure 11. De Ceuvel Amsterdam 2019.

LANDSCHAFTPARK NORD

Duisburg Germany

- Latz + Partner

Landschaftspark Nord in Duisburg is a former industry that produced coal and steel from 1901 to 1985. The park is part of a larger industrial heritage area in Germany where *Landschaftspark Nord* is an important node. The site is a park, monument and museum at the same time. In the park, visitors can explore the industrial remains, gardens, meadows, water landscapes, and nature which are reclaiming terrain from industry. In 1989 an idea for a natural and man-made landscape with an industrial stamp was created by Peter Latz and Partner. He had an idea of working with and preserving the existing features and developing the landscape around it. He wanted the industry to be left as a monument while creating a park that invites nature, in order to create a closer relationship between the man-made industry and nature (*Landschaftspark Duisburg Nord*, 2019).

“Our new conceptions must design landscape along with both accepted and disturbing elements, both harmonious and interrupting ones. The result is a metamorphosis of landscape without destroying existing features, an archetypal dialogue between the tame and the wild. The image of nature can be made of the “untouched” and the “built”. (Latz and Partner, 2019) “

Figure 12. View from tower in Landschaftspark Duisburg 2019.





Figure 13-14. Landschaftspark Duisburg 2019.

Spontaneous Phytotechnology and industrial heritage

Parts of the area at *Landschaftspark* are polluted by industry. The contaminated soil is left at the site, remediated by spontaneous phytotechnology and/or storage in existing bunkers (Latz + Partner, 2019). Different parts of the park are managed in different ways, depending on the pollutions. Some parts are fenced off with more intense vegetation that are cut down every 10 years. Most of the park is opened for visitors (Anneliese Latz, 2019).

During my field visit I wandered in the park, experiencing the interplay between the industrial heritage and ecological restoration. The park has mixed vegetation with wild natural-looking areas, park plantings and more strict garden plantings. Some parts were fenced in, because of toxic soil and/or other dangers connected to the sites' industrial history. Natural processes were highlighted in the park, especially by water floating through streams, pipes and collected in water basins. The park felt inviting and accessible with a lot of walkways, social areas and activities for visitors such as climbing walls, playground and informational boards. At the Blast Furnace Park visitors can climb many stairs to get to the top of a high industrial structure. After climbing the stairs, I got a great overview of the park with its different parts creating an interest for the landscape and the surroundings.

There was a strong impression of industrial heritage on site generated in relation to the contrasting vegetation, giving an experience of the conflict between nature and the industrial landscape. The site plays in many ways on the image between our anthropogenic world and the possible more ecological future and/or past.

Design tools

Landschaftspark in Duisburg Nord is a large area compared to Kvillepiren. The park has a lot of man-made elements left from the old industry, used in the creation of a park full of experiences. Despite differences in size and historical context, there are relevant design choices to be inspired by. The relationship between man-made and the wilder nature creates tensions and interest for the site and the human-nature relation. The view spot gives a good overview of the area and connects it to the surroundings.

•View spot

The view from the old coal and steel industry building gave a strong experience of the site and a good overview of the area and the surroundings.

•Industrial remains

The historical heritage of the site was preserved by leaving industrial buildings and features untouched.

•Wild and cultivated Plantings

The plantings were both of wild character and in the form of cultivated gardens



Figure 15-16. Landschaftspark Duisburg 2019.

FLOATING UNIVERSITY Berlin Germany – RaumlaborBerlin architects

Floating university is a project conducted during the summer season of 2018 in Berlin, led by the architect office Raumlaborberlin. It is a learning site and an offshore campus for examining cities in transformation. The site was shaped in a rainwater retention basin near Tempelhofer Feld (Tempelhof Field). The project explored contemporary, resilient forms of urban transformation. Students and their teachers, together with artists, local experts, architects, and visitors have collaborated in building a campus and an outdoor urban laboratory. The sight has been a learning space where workshops have been held, and natural processes and human use of water and filtration demonstrated. Transdisciplinary research tried to deal with the following question of urban practices:

“How can cities cope with risks, strains and chances of global warming, the shortage of resources, superdiversity and hyper-accelerated development nowadays? Which tools do we need to live and work well and in a resource-efficient manner in the future” (Raumlaborberlin, 2018)

The project Floating university was a temporary project. During the visit I talked to Louise Nguyen who works at Raumlaborberlin and discussed the engagement of the locals in the project. Louise told me that people already feel responsibility for and ownership of the site and that many people have ideas about how to make the project more permanent (Nguyen, 2018). During the summer of 2019 the project is running again with special learning programs for creating awareness for the environment, so called “climate care”. The project is still using the water basin as a meeting point and a place for understanding natural systems within the city and generate learning experiences and awareness for the environment (Floating University Berlin, 2019).



Figure 17. Floating University Berlin 2018.



Figure 18. Water basin - Floating University Berlin 2018.



Figure 19. Purifying water tower - Floating University Berlin 2018.

Phytotechnology design and aesthetics

During my visit to the *Floating University* in Berlin I got closer to water, its different forms and water processes within the city. The basin was muddy, and a lot of algae were growing in it at the time of my visit. Still the basin was beautiful and access to this kind of more rough, urban body of water was a new experience for me. The site invited me to experience water with all my senses and understand the purifying processes on site. The water could have its own life in the basin and was present at its own terms. Fluctuating, making the surface go high or low, clear and dirty, warm and cold. The water was made accessible in many ways. There were two towers that provided a great view over the area: the entrance tower with plantings and the water-tower in the middle of the basin. The filtration of water through plantings in the water tower was the phytotechnology implemented at the site. The whole system is made so that people will understand where the water comes from and how the cleaning of it functions. The design is simple, leaving the water to express itself. The materials and structures at the site were made by simple materials. The scaffolding elements, wooden footbridges, other elements and materials on site are easy to disassemble and moved from the site. This strengthens the feeling of temporality on site.

Design tools

Water is an important aspect when working with visualizing natural processes. The connection to water as well as the understanding of natural processes connected to water could be also be important aspects for the design at Kvillepiren. Water can also be cleaned during the processes.

•Movable objects and materials

The area has temporal design with objects that are easy to build up as well as take apart and move from site.

•Water tower

The water tower showed the process of cleansing water in an educative way. It also gave a good overview of the area.

•Participatory activities on site

The project included participatory building, workshops and the possibility for visitors to connect the social life and human interaction to the physical form and natural processes.

NEW ORDER OF NATURE

Fredericia Denmark

- SLA Architects

New order of Nature is a project that part of the urban development project FredericiaC in one of the disused harbours in Fredericia, Denmark. It is designed by the design studio SLA and transforms a 14-hectare area into a temporary recreation landscape (SLA, u.d.). The design work started in 2009 and was implemented in 2012. The project deals with the inter-phase of development and void land and is built on the idea of “process urbanism”. This means that areas develop one step at a time with adjustments and adaptations during the process. The new public space is therefore temporary and adaptable to desires from the community and changes in the development schedule. Simple structures have been built together from simple materials, creating a social area in the park. The park also has a larger fenced area with phytoremediation trees. By the quay movable wagons are placed with trees cleaning soil. In the book *On the move*, the authors present the project and raise the question about the temporal landscape and what happens when it is taken away.

“At the same time, if people learn to love a landscape and then it is taken away, what does that mean? Better to love it and lose it or to never love - or have - it at all? (Diedrich, Bridger, Hendriks, & Moll, 2015, p. 125)”

Figure 20. Fredericia 2019.





Figure 21-23. Photos Fredericia 2019.

Phytotechnology combined with design and aesthetics

During my visit to the project *New order of Nature* in Fredericia, I experienced the temporary harbour park and saw the phytoremediation tree plantings. I walked along the water by community gardens, playgrounds, sport fields, open grass fields and by the harbour area where people were fishing. In a more secluded part of the area I found the plantings for the phytotechnology process which used a mix of different sorts of trees. The phytoremediation was separated from the public area by fences. The fence created a distance to the process, but also an understanding of the dangers of contaminated soil. The park also had community gardening, play spaces, open grass fields, trees and container buildings for commercial activities, Airbnb housing and community facilities. A lot of people were using the site for different activities such as fishing, playing at the playground, walking and preparing surf lessons.

Design tools

The project *New order of Nature* in Fredericia uses temporary design to remediate the soil by phytoremediation. The main remediation site is fenced in and people are protected from and constrained to take part of the process. At the same time, large areas of contaminated soil have the chance to be remediated effectively without human disturbance. The temporality of the site is visual with simple materials and movable features. This can help people in the emotional understanding of the place as transformational.

•Different species for phytoremediation

Test area with different species remediating the contaminated soil.

•Temporary design

The project activates the area before more permanent development plants is made physical.

•Fenced phytoremediation area

The fenced phytoremediation area creates a distance to the contaminated soil and the phytotechnology process.

3. CASE - KVILLEPIREN



Figure 24. Photo Kvillepiren 2018.

UNDERSTANDING KVILLEPIREN

Kvillepiren is situated in Frihamnen, which is an important part of the urban development project Nya Älvsstaden. The project aims to extend the city centre of Gothenburg over the river and connect to the island Hisingen. Historically, Frihamnen has been an important harbour and development node in Gothenburg. The area still has historical remains and savings from important stages of the emergence of Gothenburg as an industry and harbour city. The landmass Kvillepiren and other parts of Frihamnen are man-made, built up by material from the construction of the ports and from other leftover materials from industry and buildings (Forsman & Holm, 2016).

History of Frihamnen

Gothenburg was developed as a trading and shipping city and has historically been the most important port city in the Nordic region. Frihamnen together with Lundbykajen and Ringön are the only parts of Gothenburg's inner harbour which have preserved some of its traditional character and are thus an important part of Gothenburg's cityscape as a historic harbour and industrial city. After the city's fortifications were demolished in the beginning of the 19th century, the city had new opportunities for expansion and began to develop south and east, with new possibilities for the harbour in the river Göta Älv. Interplaying urban building patterns from different periods have created the land masses and landforms of today's Frihamnen. Some important milestones in the expansion of the area have the redrawing of Kvillebäcken which created a straighter stream and rebuilding of the Hisingsvassen in 1850, the inauguration of the Frihamnen in 1925, the road

network for Ringön in 1950 and the construction of Lundbyhamnen and Kvillepiren in the 1960's. After the 1960's the development of Frihamnen at Kvillepiren as an industrial harbour pier did not go as planned and most of Kvillepiren was abandoned. After the harbour crisis in Gothenburg of the 1980s, the idea of Gothenburg as an event city was developed, and the site was later used and known mostly as a venue for concerts and other events. Frihamnen was used until 2000 after which the role as trading place no longer was important due to Sweden's entry in the EU (Göteborgs Stad, 2014, pp. 2,5,6,14,16).



Figure 25. Map over Gothenburg with Kvillepiren which has a central location in the city.



Figure 26. Aerial photo over the harbor area Frihamnen from 1920 before Kvilepiren was built. Taken from SWECO Rapport 2016.



Figure 27. Aerial photo over the harbor area Frihamnen from 1960s. Kvilepiren is built, before Kvilepiren was built. Taken from City of Gothenburg 2013.

Contemporary Development at Frihamnen

Kvillepiren and Frihamnen are a part of Älvsstaden, one of the biggest urban development projects of the Nordic region. In the project 9000 housings are planned, and 15000 people are estimated to work in the area. The area is planned to be built in different phases. A major project in the area is the Jubileumsparken which also is an elaborative project to test innovative ways of developing the area. Parts of the park are planned to be finished in 2021, to celebrate Gothenburg's 400th birthday. There are already activities at the site, before the park is finished, such as urban farming, a sauna, pool, café and bar, water play area and much more. MARELD landscape architects together with atelier le balto landscape architects were chosen after a competition to develop Jubileumsparken. The companies are working together to develop the park step by step. One example is the play and learn park (Allik, 2019). The Sienna prize, a prestigious Swedish landscape architecture award, was won 2018 by the municipality of Gothenburg for their work with Jubileumsparken. The award was given for the process of transforming the site and involving the residents (Sveriges Arkitekter, 2019). In 2019 temporary houses are planned to be built at Kvillepiren (Älvstaden, u.d.) There is a great need for new housing in Gothenburg and the temporary housing project is part of the city's strategies of activating sites immediately instead of waiting on permanent building structures. The temporary housing will activate the site before the surrounding area gets its more permanent structures and a strong connection to Jubileumsparken. The temporary houses at Kvillepiren are given temporary contracts that can be extended 5 years at a time for a maximum of 15 years (Göteborgs Stad, u.d.).

Kvillepiren is directly adjacent to the river Göta Älv, which is classified in the highest protection class since the valley is of national interest for nature conservation and outdoor recreation. Göta Älv's river mouth is also a Natura 2000 site. Due to that the area are planned with development of housing, the area should be regarded as highly sensitive (Forsman & Holm, 2016). The regulations for temporary building permissions are hence less strict than for permanent ones. The process is faster and less demands needs to be fulfilled to obtain the building permission. But the houses need to be movable and the ground needs to be restorable after the permission ends. In the year of 2017 the Swedish government introduced a new temporary law that made it easier to obtain building permissions for temporary housing. This law is valid until 2023. An article in the newspaper ETC covers the environmental aspects of temporary building permissions. The Swedish government has stated that temporary housing has no long-term environmental effects. However, the company Evidens have criticised this statement in a report from 2015. According to their analyses, temporary housing is not cheaper or faster to build. They also showed that the environmental impact can be high and therefore a bad investment when considering environmental perspectives. The houses at Kvillepiren are planned with environmental concerns in focus, such as low energy and water consumption (Hansing, 2019). A particular problem with Frihamnen and the development in the area is that there are several complex risk factors that need to be handled within the urban plans. There is a risk of flooding due to rising sea levels from the river Göta Älv and from stormwater. The area is also surrounded by high-traffic roads with high noise levels. The geological conditions are special because the history expanded artificially after the 1800 on marshland. The area is also polluted from industries and harbour use (Boverket, 2017).

Pollutions at Kvillepiren

Commissioned by Göteborgs Frihamns AB, Sweco has conducted a general environmental technical survey within the area of Frihamnen with focus on the area of Kvillepiren where temporary housing is planned. The survey shows that parts of the ground at Kvillepiren are polluted, mostly with Polycyclic aromatic hydrocarbons (PAH) but also with arsenic, barium and lead. 10 of 17 samples show levels of pollutants that are too high for using the land as ordinary housing areas. The analysis from Sweco is as a brief assessment done with spot-checks. The area investigated in the report is nearly 65000 m² with only 17 testing spots. This is a relatively low sampling density. Therefore, it is possible that there are other pollutants and/or other concentrations at other locations on the site than Sweco described in their report. The unpredictability is especially uncertain for Kvillepiren where the character of the filling materials differ much (Forsman & Holm, 2016). For the project area at the south tip of Kvillepiren, the report from Sweco mostly shows pollutants by PHA, the pollutant generally treated in this project. The tests also show some other pollutants such as different metals. Due to the brief assessment which gives insufficient knowledge for planning of detailed phytoremediation, with risk of unpredicted pollutions at other locations at the pier, this project only deals with concepts of plantations that could be used for phytoremediation.

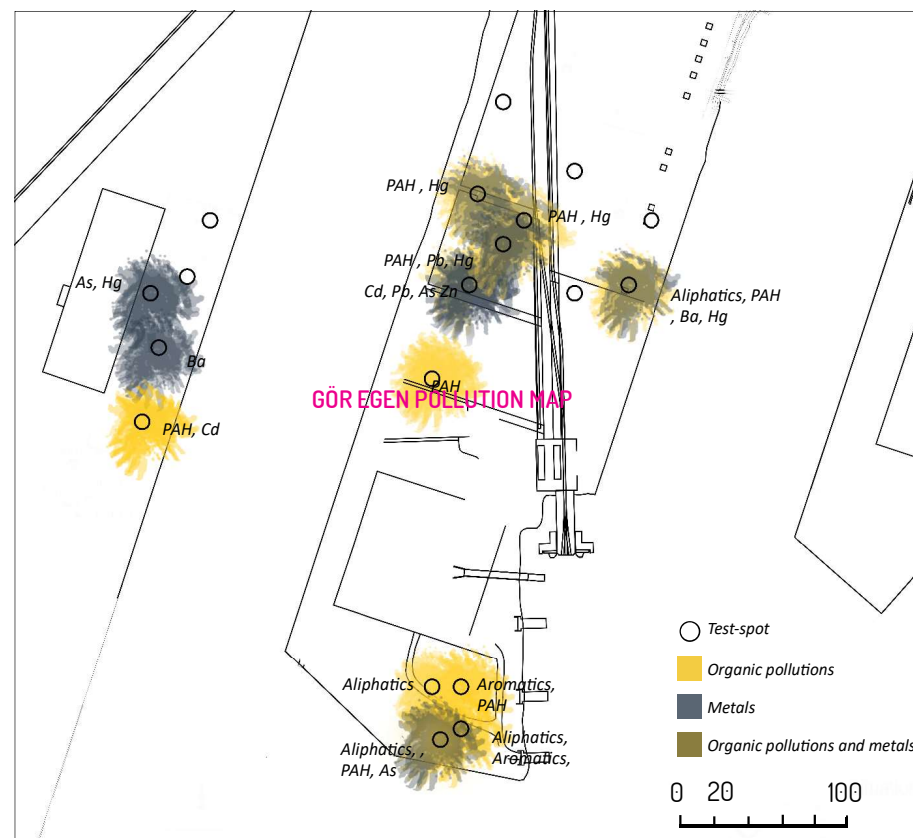


Figure 28. Pollution map over Kvillepiren. Made with information from Forsman & Holm 2016.

SITE READING OF KVILLEPIREN

Situating Kvillepiren

In this project, the area of control is where the site-specific design proposal is made. The borders for the project have been determined after a process of understanding and reading the site with its context and relation to neighboring areas. The borders of the design are mainly restricted by the waterline, which is the main limit for Kvillepiren as a land mass, together with the planned housing area on the pier. These borders can change during the development of Frihamnen and after predicted future sea level rise or extreme weather due to climate change. They can also change due to other future conditions that are hard to predict. Because of the temporality of the design and a limited time frame, the rise in sea level or other future conditions are not of special interest in the set time frame. The area of control is strongly influenced by the rest of the development in Frihamnen, the rest of Gothenburg harbour development areas, the river Göta älv as well as by global conditions like climatic factors such as, wind, water, trading and traveling. The historical use of the site as well as Gothenburg as a harbour city also strongly influence Kvillepiren with historical remains, polluted soil and a deserted atmosphere from the disused harbour. Historically, this area has been important for trading and has had impact globally. The area is today secluded and fenced in, waiting for development. Kvillepiren is part of the larger development projects in Gothenburg and affects the development with Jubileumsparken as an important evolving social and cultural meeting place in the social life of Gothenburg. Kvillepiren is part of the river landscape in Gothenburg and affects the river landscape as well as the adjacent area of Frihamnen.

A design editing at Kvillepiren can affect and change the river landscape, clean the soil, and create awareness about pollutions, sanitation and sustainable development. This can be a catalyzer for sustainable development in the area and spread knowledge and inspiration in developing other areas. Working with site-specific environmental problems with phyto-technology in the area can have the capacity to impact people's thoughts on sustainable development, pollution and ecology and generate awareness. The pedagogic aspects of the new park on the site include the history of Gothenburg as a harbour city. Development in the area will create impact in land use as well as about how people think about soil and pollution issues. After the sanitation time it will be possible to develop other ways of using the area and the effect and impact will change.

Area of control

Tip of Kvillepiren

Area of effect

Gothenburg city center

River landscape

Pollutions

Development plans

The world with traveling and trading

Area of influence

Climate conditions

Weather

Pollution

Soil condition

Geography

Harbor and industrial history

The areas that are effecting and influenced by Kvillepiren goes far outside the actual area of control in the project



Figure 29. Kvillepiren Area of control, influence and effect.

Traveling the Line

Lindholmen – Kvillepiren – Ringön

On a day in January 2019, a landscape method for reading the river landscape of Gothenburg was used, inspired by an exploratory expedition called the Traveling Transect. It was made with open mind, to grasp the site properties and its relations to the surrounding areas. The aim was to have experiences that would guide the design on Kvillepiren. The method helped me in the design process to free myself of a narrow fixation on phyto-technology and technical information, so that I could focus on aesthetic qualities, site specifics and relations to the surrounding harbour landscape instead. It also helped me in understanding the context where the area of control was situated in a larger geographical area of impact and effect related to the Gothenburg river landscape. The strong harbour and water connection of Kvillepiren together with the development by the river in central parts of Hisingen made me curious to zoom out and imagine the line along the water that passes the pier. Along the river, Gothenburg's city view appears and the relationship between the various areas passed along the line is related to these with strong visual connection. Gothenburg is rapidly developing on Hisingen by the river Göta Älv. This development takes place in stages where Frihamnen is under current development. The relationship between Lindholmen, Frihamnen and Ringön is interesting because they all have a harbour and industrial history and are all areas at different development stages going from industrial harbour areas to something else. The line to travel was adapted during travel due to barriers in the form of water, fences and roads. Stops and detours were made at particularly interesting places.

Established methods within landscape architecture practice were used during the travel, such as sketching, photographing, sampling, and taking notes. I documented the walk and had a special focus on the connection to the river Göta Älv, soil/ground cover and vegetation. I stopped to document when I found something interesting and/or when the environment changed. During the travel I used a simple printed map and drew on the map where I walked and stopped for documentation. This helped me to understand and remember the special relation between different findings from the walk when processing the material in studio. The travel is divided into three sequences according to geographical location by the river with different characteristics, atmospheres and at developing stages. The sequences are 1. Lindholmen, 2 Kvillepiren and 3. Ringön. These areas are in strong relation to each other, connected by the river. On Kvillepiren I stopped more frequently and did more documentations and reflections compared to the rest of the travel. During my travel I tried to be opened to find what I wasn't expecting. An openness for serendipity helped in investigating the questions raised during the walk and adding new information. After the walk, the material was taken care of, analyzed and developed in studio and later helped design editing of Kvillepiren. In this thesis the post-travel material is presented. The developers of the method, Diedrich and Lee use a tableau physique, also used by Humboldt, to capture and express experiences and findings on site (Diedrich & Lee, 'Transareal excursions into landscapes of fragility and endurance: a contemporary interpretation of Alexander von Humboldt's mobile science, 2019'). In the end of the site reading my own version on a tableau physique is presented where I present pictures and the main conclusions from the walk in a linear diagram form.

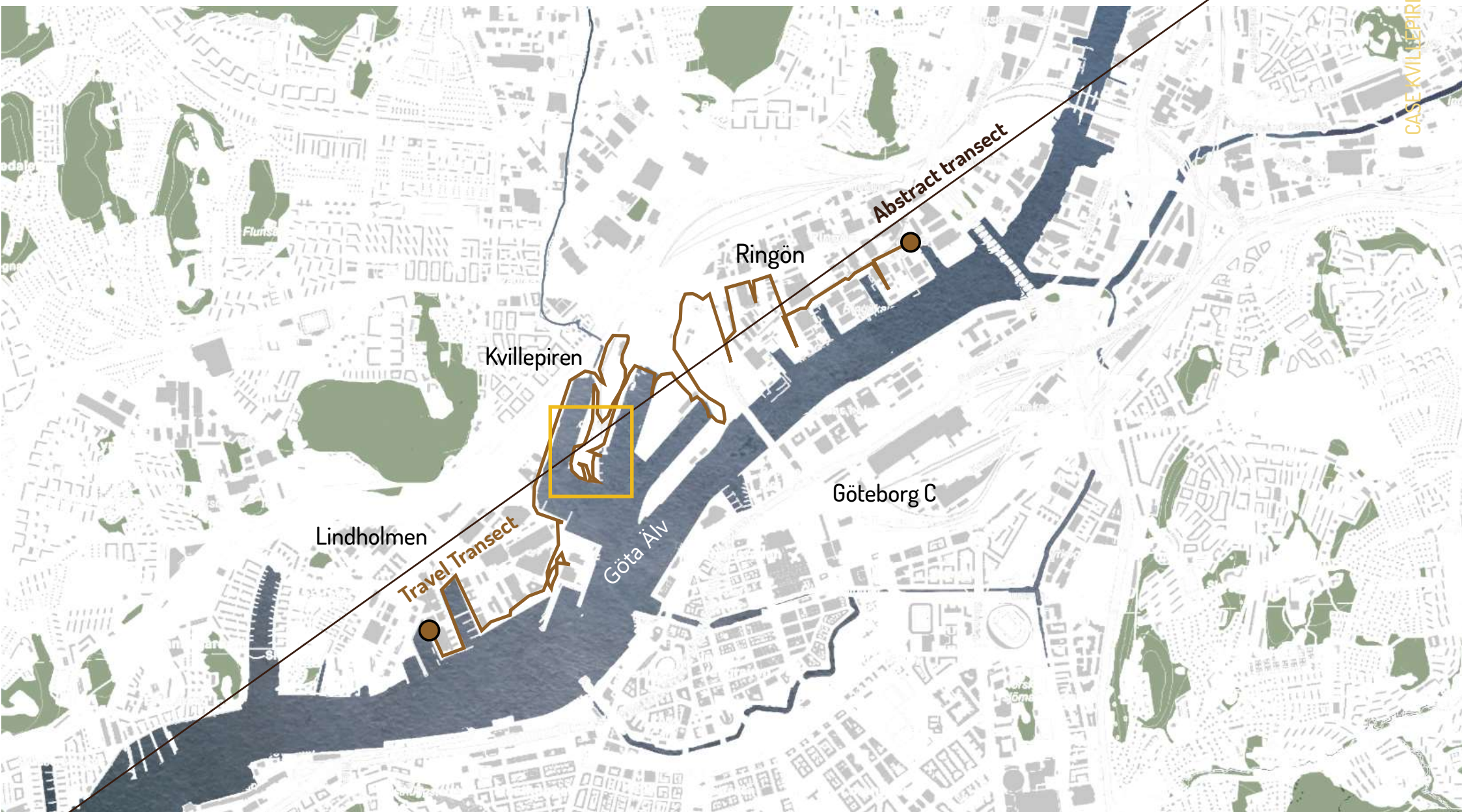


Figure 30. Traveling the line of Lindholmen - Kvillepiren - Ringön.

0 200m 1km

LINDHOLMEN

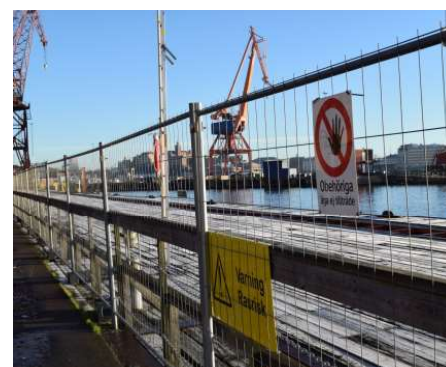
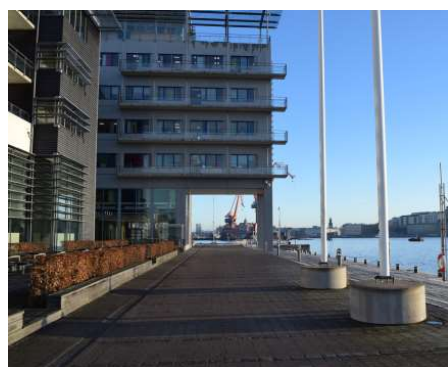


Figure 31,32,33,34. Photos Lindholmen 2019.

KVILLEPIREN

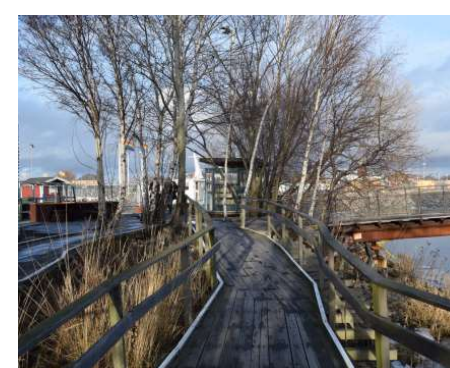


Figure 35,36,37,38. Photos Kvillepiren/ Frihammen Jubilee park 2019.

RINGÖN



Figure 39,40,41,42. Photos Ringön 2019.

Sequence 1. Lindholmen

- A hard-surfaced developed area

The first sequence of the traveling transect walk was made from the communal traffic boat stop of Lindholmen to Lundbystrandhall industrial/harbour area, where Kvillepiren first is visible. I walked the harbour walk that follows the river closely for the most part of Lindholmen. In the last section of this part I passed an industrial area where I needed to walk through fences and got lost for a short while. Most of the walk experience was clean and ordered, safe from traffic and relaxing, with the waterline leading the way. The area had a safe, calm and ordered atmosphere which made me a bit restless. The architecture at Lindholmen is relatively large-scale and monotonous with some individual houses having more character in colour and form. This made me feel more invited to pass by than inspired to stay. Some historical remains have been saved from when the area was a harbour, like cranes that have become monuments over old times. The art features at Lindholmen look expensive and melt into the architecture of the same style and age. Pretty much the whole walk was on hard surface ground with only a small area of nature-based soft-surfaced connection to water. This area was fenced with no seating's and clearly not designed or planned for inviting people to stay and enjoy the site. I asked myself if this soft-surface meeting with the water is still to be developed or if it is planned. During the walk I had a great view over the city of Gothenburg over the river. I felt a strong connection to the river during the walk but also asked myself where water in other forms was? Water can take so many forms: in vegetation, dripping, evaporation, transportation and so on. The hard meeting with the waterline at Lindholmen doesn't have the capacity to show these other forms or other natural processes in the area.

Today much of Lindholmen is dominated by companies, and education and science institutions. Lindholmen is under current development, planning to grow, especially by more housing. ÅF's report *Analys av grönytor och parkmark på Lindholmen Göteborgs Stad* from 2017 states that there is a lack of green areas and parks of size and quality at Lindholmen. In the most part of Lindholmen there is more than 300 meters to a park from housing areas. The connection to parks in the surroundings such as the park area Ramberget is weak. Future scenarios with more houses together with new green areas still has a lack of greenery in areas on Lindholmen. Goals made by the municipality of Gothenburg regarding ecological and social sustainability is therefore not predictable to be reached within the area (ÅF Infrastructure AB, 2017).

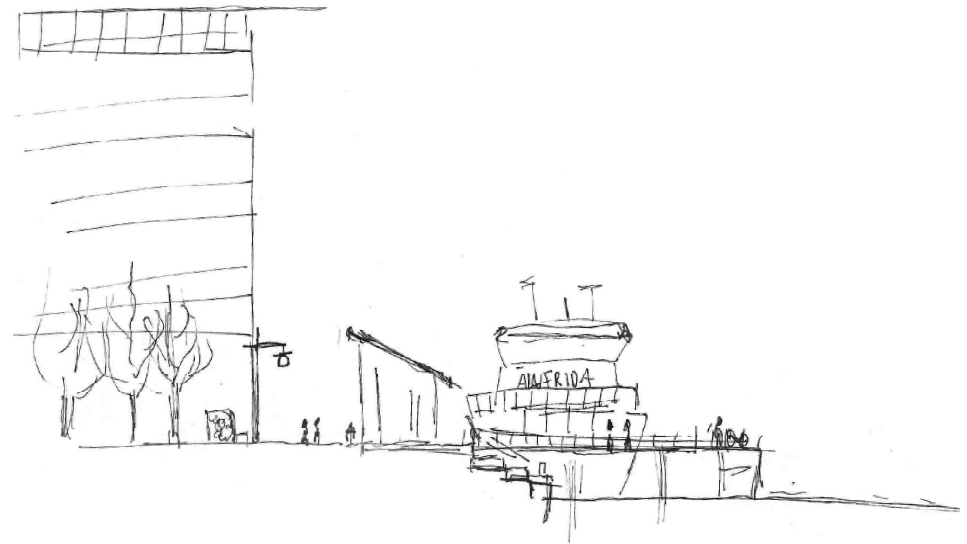
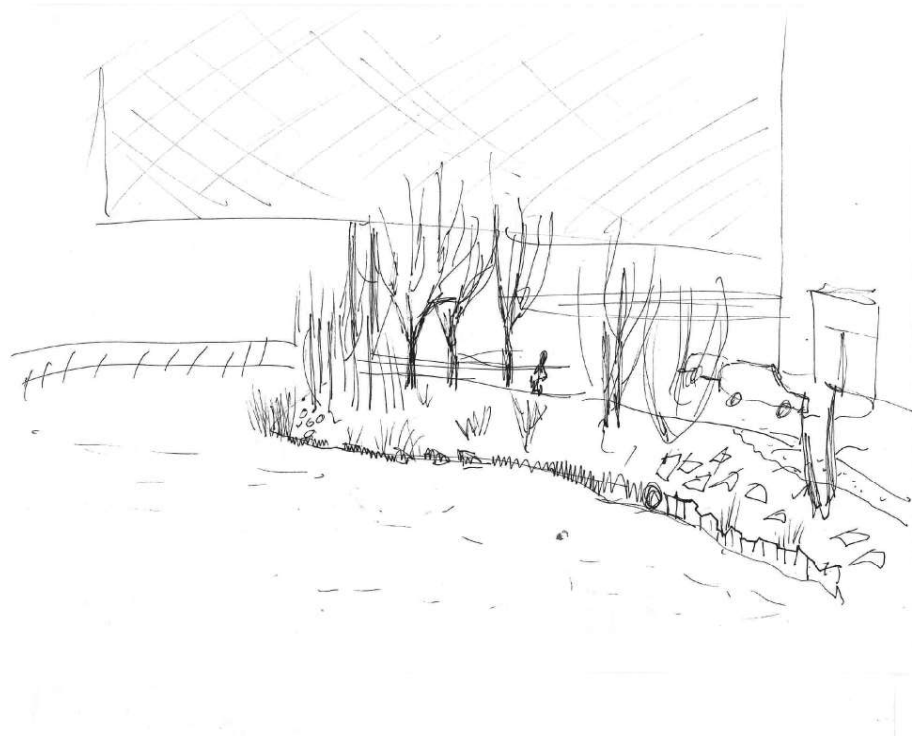


Figure 43,44. Sketches Lindbolmen 2019.



SOFT COASTLINE



HARD COASTLINE

CASE KVILLEPIREN

Figure 45,46. Photos soft coastline and hard coastline 2019.



Figure 47. Photo Lindholmen 2019.

Sequence 2. Kvillepiren

– A hidden escape with post-industrial vegetation

Kvillepiren is visible after walking past the sports hall, Lundbystrandhall in the very north-east of the first part of the walk. When standing by the industrial/harbour site close by Lundbystrandhall, I got an view across the water of the most central parts of Gothenburg. From this viewpoint, Kvillepiren looked like a lively green island in the hard surfaced, grey city fabric. I continued to follow the water, passing Kanalhuset, a Swedish television building. The path I walked felt like an abandoned quay, with Kanalhuset as the only contemporary exploitation of the area. I passed an old, rusty crane and a larger old sailing boat by the quay, that were historical remains and objects with character. These objects said something about the historical use of the site and explained the form of the waterline, man-made and hard-surfaced to fit the harbour and industrial use. When reaching Kvillepiren the whole area was fenced off. To reach Kvillepiren I walked in by Jubileumsparken's main entrance to the sauna and the public bath. After getting past several fences, I passed Strandparken, a part of Jubileumsparken and the communal bathing site at Jubileumsparken to reach the project area at Kvillepiren. Jubileumsparken is under development and this development is done step by step, involving the residents of Gothenburg. It has an atmosphere that supports community building created by social activities and co-creating activities. The park has and movable and temporary objects which supports the understanding of the site as transformative.

Kvillepiren is totally man-made, built from old construction materials and fillings. On the ground there are stones, bricks, concrete and various sorts of debris. Despite the harsh soil conditions, different plants are estab-

lished on the site and some humus has been formed. The area has several historical remains. A spectacular loading bridge is of special interest to me. It reaches up toward the sky, creating a symbolic path to nowhere. On the bridge there is a better view and connection to the rest of the city. The exploitation phase of Kvillepiren is already physical in the form of a newly build walkways going through and crossing the pier.

The pier has a vegetative border to the water. At the end of the pier, which is the site for the site editing, there is a lot of vegetation growing freely. There are smaller trees, bushes and grass. The primary vegetation found on site is pillar, birch, roses, willow, reeds, different grasses and flowers. From the appearance and species of the site's vegetation, I draw the conclusions that most of the vegetation have spread to the site naturally, without human gardening or planting. I tried to walk over the whole area, but it was hard due to bad accessibility, with little or no good walking paths and brushy vegetation at some parts. The site is desolate, but with some trace of human interaction and presence. A campfire has been built and used, people have left trash and the walking paths have been used. Someone or some people have marked the site with graffiti. The word "love" is written all over the place. On large objects, like smaller houses, there are small objects like trash pieces, with different colours. This art gives a meaning to the site and gives a comforting atmosphere. Despite the fencing and the abandoned feeling of the area, people are using the site and care enough for it to draw art on it.





OLD OBJECTS AND FEATURES WITH THE
WORD "KÄRLEK" (LOVE) WRITTEN

Figure 51. Photo Krillepiren 2018.

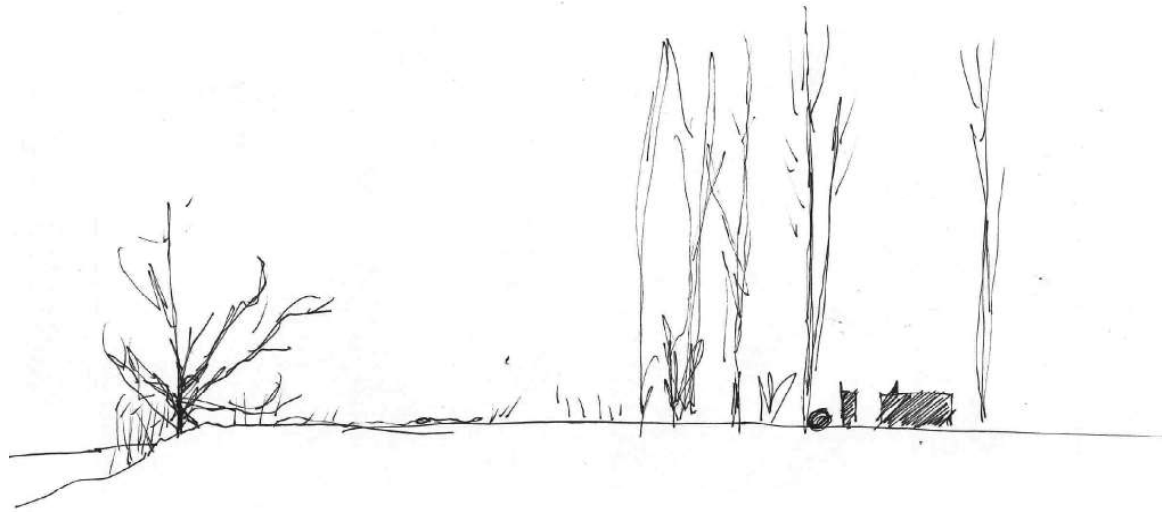


Figure 52. Sketch from Kvillepiren 2019.

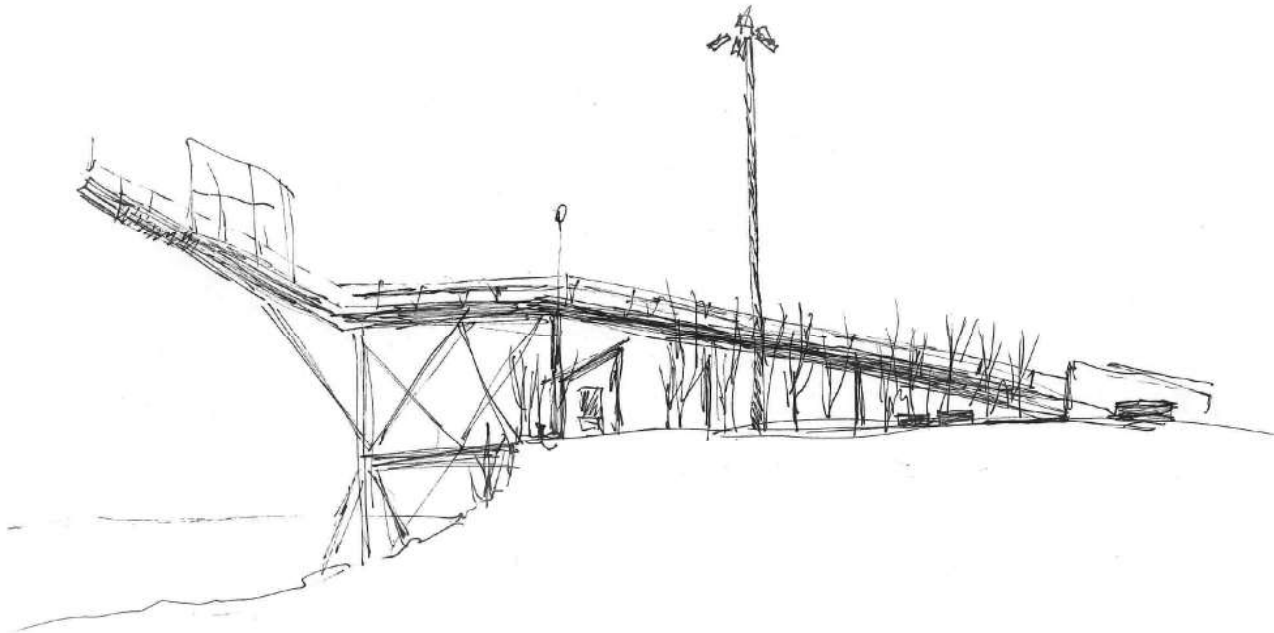


Figure 53. Old loading bridge. Sketch from Kvillepiren 2019.

Sequence 3. Ringön

– Art creating an atmosphere of care

It was hard to continue the walk from Kvillepiren further northeast towards Ringön, due to lack of accessibility, with fenced-off industry/harbour areas and large roads as barriers. During my walk at Ringön I followed streets, like labyrinths, thinking they would lead me to the river or to other areas made for public use. Sometimes the roads led me to the river but sometimes I got lost in the area and felt trapped in between industries. The areas I reached with contact with the river were two small pocket parks with boats, trees and art. These areas were the only urban commons I found at Ringön except for the roads. Ringön is an industry/harbour area but there are also creative communities, art studios and clubs there and other activities going on. There is a lot of urban art at Ringön with more simple and playful expressions compared to the art at Lindholmen. The art at Ringön looks cheaper and more informal with graffiti, homemade sculptures and smaller farming plots. The art is well integrated in the architecture, with colours, form and size relating to the existing architecture, giving the area a more inviting atmosphere. In contrast to the fences and industries, which could create a hostile environment, the art at Ringön said something about human creativity and playfulness that creates awareness in developing the area. This care come from a wider group of people than traditional developing projects.

There are approximately 800 businesses at Ringön. In many ways it is an industrial harbour area with different industrial companies fencing in their plots. But Ringön is developing with different studios, art festivals and creative activities creating a special local atmosphere. There is a project and group called “Saltet på Ringön”. This group wants the development

of Ringön to be different from Lindholmen, Frihamnen and other development projects in Gothenburg. The future of Ringön is uncertain but the aim is to let the process to be slower and more organic compared to other harbour development projects (Saltet på Ringön, u.d.). In short term the development will highlight the qualities of the site, both for new companies and the qualities that connect people to the river in the area. The new bridge that will be built in connection to the area, will affect the present housing structure. Since 2012 the city of Gothenburg has worked together with companies, property owners and other actors in the site in the development of the area (Göteborgs stad, 2019).



Figure 54. Sketch shoreline at one of Ringöns pocket-parks 2019.



FENCED AREA



OPENED AREA

Figure 55,56. Photos opened and closed areas at Ringön 2019.



ART WELL INTEGRATED IN THE ARCHITECTURE



ART HIDING BARRIERS AND FENCES

Figure 57,58. Photos of Graffiti at Ringön 2019.

Findings from traveling transect

– Frihamnens site-specifics

In the context of the whole walk from Lindholmen to Ringön and after working with the material gained from the traveling transect, there are findings in form of site-specifics at Frihamnen that say something about its dynamics, atmosphere and relationships to the surrounding harbour landscape. The relationship between Lindholmen, Kvillepiren and Ringön was strongly affected and disturbed by physical barriers such as fences, industry and larger roads. The areas also have differences in atmosphere, architecture, function and use, which also differentiate the areas from each other. The tip of Kvillepiren is a deserted piece of land, compared to Lindholmen and Ringön. Its atmosphere is calm, and time has been standing still since it was used as a harbour. Vegetation has slowly taken over the place, creating a nature area of post-industrial plants that endure hard conditions. There are several dynamics working on the river landscape, connected to Gothenburg as a historical harbour city and contemporary development plans for the city. The development at Jubileumsparken and the rest of the river area is on-going but not at the tip of Kvillepiren where the phytoremediation design is going to be drawn. The development is hence growing closer and Kvillepiren will be affected by neighbouring development in the short term. The seclusion and detachment Kvillepiren have from the rest of the city give the site a special atmosphere of disconnection to the city. Because of this seclusion the site has a special ability to be a place for relaxation and contemplation that can connect people to the environment and give them an understanding for the history and development in the area.

Industrial history

Kvillepiren, Lindholmen and Ringön have remains from the historical use of trading, shipping and from being an industrial harbour area. At Kvillepiren the actual landform is a man-made historical remnant. History can also be read on site by looking at different historical objects such as mooring bollards and bridges, the soil and pollutions in the soil. Because Kvillepiren has been a relatively secluded piece of land for several decades, plants have had the chance to grow freely, creating a special sort of wild post-industrial vegetation. There are traces of few people with occupying and caring for the site by making fireplaces and creating art in form of graffiti. Kvillepiren's existing atmosphere, relations and dynamics are valuable and, in many ways, unique in the river landscape of Gothenburg which is often densely developed or still used for industry. These site-specific values are important to take care of in the developing of the area. With the existing conditions as a base the area can develop as a refuge in the city fabric with post-industrial vegetation. In addition to the existing site-specifics, the area needs to develop, to make the site into a purifying, inviting and educative park that considers the history of the place. .

Post-industrial vegetation

In relation to the existing development plans in Frihamnen, already densely developed Lindholmen, developing parts of Kvillepiren to park area can be important in generating public space for recreation in the central river landscape of Hisingen. Kvillepiren possesses a diverse vegetation with a wild character that was not found elsewhere during the walk. Plants have had the chance to grow freely, creating a special sort of wild post-industrial

vegetation. That the sites are man-made, has created special post-industrial site conditions. Plants have established there despite harsh conditions concerning soil, wind and salt. Because of these conditions many of the trees and bushes have grown slowly and developed individual characteristics. This vegetation is found in direct connection to the river, creating a soft riverfront and meeting between land and water with high biological values for wildlife and recreational values for humans. The area is not accessible today but has large potential to be an important lush park with direct connection to water by a soft riverfront. Giving the citizens a spot in connection to vegetation and water, reflection on the development of the city and visions for the future. When creating a park at Kvillepiren larger trees can be retained, creating a park with thriving vegetation. Due to the temporality of the park newly planted trees will not have time to grow large and the old ones are therefore of special importance.

Access to the river

The different areas along the river function in relationship with each other. This relationship is very much related to the public's connection to the river and it could be even stronger with better access to the waterscape. During the walk the access to and the relationship to the river differed but during most parts of the walk it was possible to walk close to and get an overview of the river and the city skyline with Gothenburg's central parts. Accessing the river landscape was most problematic at Ringön, where fences, industry and lack of guidance made it hard to reach and follow the river. At Lindholmen, which mostly has a hard-surfaced meeting

with the water, it was possible to walk by the river for the most part but with little possibility to understand the biological interaction with land, due to the hard-surfaced meeting with water. On Kvillepiren, which has a vegetative border with the river, this meeting was more interesting. This relation between land and river creates biotopes for wildlife and provides visitors experiences and an understanding for the rivers in connection to land. The different areas' site-specific values could be better shared and create a harbour rich of experiences if the areas were better connected by the river. A long harbour walk, where the connection to the river is in focus from Lindholmen to Ringön could create this connection and give the residents of Gothenburg a better connection to the river landscape at Hisingen. The land meeting with the water is also of importance.

Barriers on land

During my travel from Lindholmen to Ringön by the river, I met several obstacles and barriers. Lindholmen has relatively good accessibility compared to Kvillepiren and Ringön. At some passages and in some places during the walk, I felt unwelcome and had a hard time finding my way through the area. Especially Ringön had places where I felt captured in-between fences with a lack of guidance where to walk and where to find my way. At the same time, parts of Ringön with art, made me feel more welcome, fascinated and safe. The project area for the site editing, the tip of Kvillepiren, is currently not accessible for the public due to building fences. This area also lacks clear paths and if someone were to reach the area despite the fences, the site doesn't provide directions how to move in the

area. Large areas of Frihamnen will be under construction for many years creating delimited building areas and fences that will certainly create poorer accessibility in the local area. This makes the accessibility in the park areas even more important to work with during the site editing of Kvillepiren. The inaccessibility during my walk had to do with bad walkability due to physical barriers, bad navigation due to unclear directions where to walk and a feeling of unsafety due to different reasons in the build environment. When developing Kvillepiren into an accessible public park it is important to design and work with these three aspects of access. With experience and inspiration from Ringön, art can be used to generate a safer and inviting atmosphere in an otherwise university/ industrial area. It is important that this art interact with the existing architecture on site.

Atmosphere of care

On Ringön, I experienced a special atmosphere that is characterized by the current creative development of the area. This development is driven by people with creative professions, and artistic and social activities in the area. Art mostly in the form of graffiti decorates the industrial environment, well adapted to the architecture, colour and form of Ringön. The art and the care people put into the site-specific art shows regard for the place's history, present and responsibility and commitment to take part of Ringöns development. At Lindholmen the art was of another character, creating another type of atmosphere. This art relates more to the newly developed architecture and has the same luxury character as many traditional harbour development areas with low connection to historical

site-specific values. The atmosphere of Kvillepiren is characterized by being more abandoned and secluded than both Ringön and Lindholmen. Yet there is art at the pier that shows a similar atmosphere of care that is seen on Ringön. During my travel I felt that I experienced an escape from the city when I reached Kvillepiren, where the atmosphere was calm, and I had time and space to relax and contemplate. The pier has strong visual connections to the city with its amazing skyline, which creates an interesting contrast to the city. In contrast to its surroundings, Kvillepiren with its special post-industrial vegetation and soft connection to the river has potential in developing towards being an recreational environment with strong connection to water and vegetation. People could reconnect and identify with the post-industrial nature, gaining understanding of plant mechanisms and water processes within the city. Other parts of Jubileumsparken that are being developed with co-operative activities. This way of developing the park gives it a special aesthetic. It creates a sense of creative atmosphere while also leaving room for thoughts about future development. The temporary design at Kvillepiren should interact with the form and aesthetics of Jubileumsparken and be built in a similar way for the residents to feel involved in the process and contribute in creating the character of the place's. The ecological processes of cleaning the soil with phytoremediation could involve people and educate them in a pedagogic way, making people be aware and care for the environment. Working with site-specifics when developing the area has a potential to create experiences that create an atmosphere of awareness and a fascination for Kvillepiren, Gothenburg harbour landscape and the environment in general.

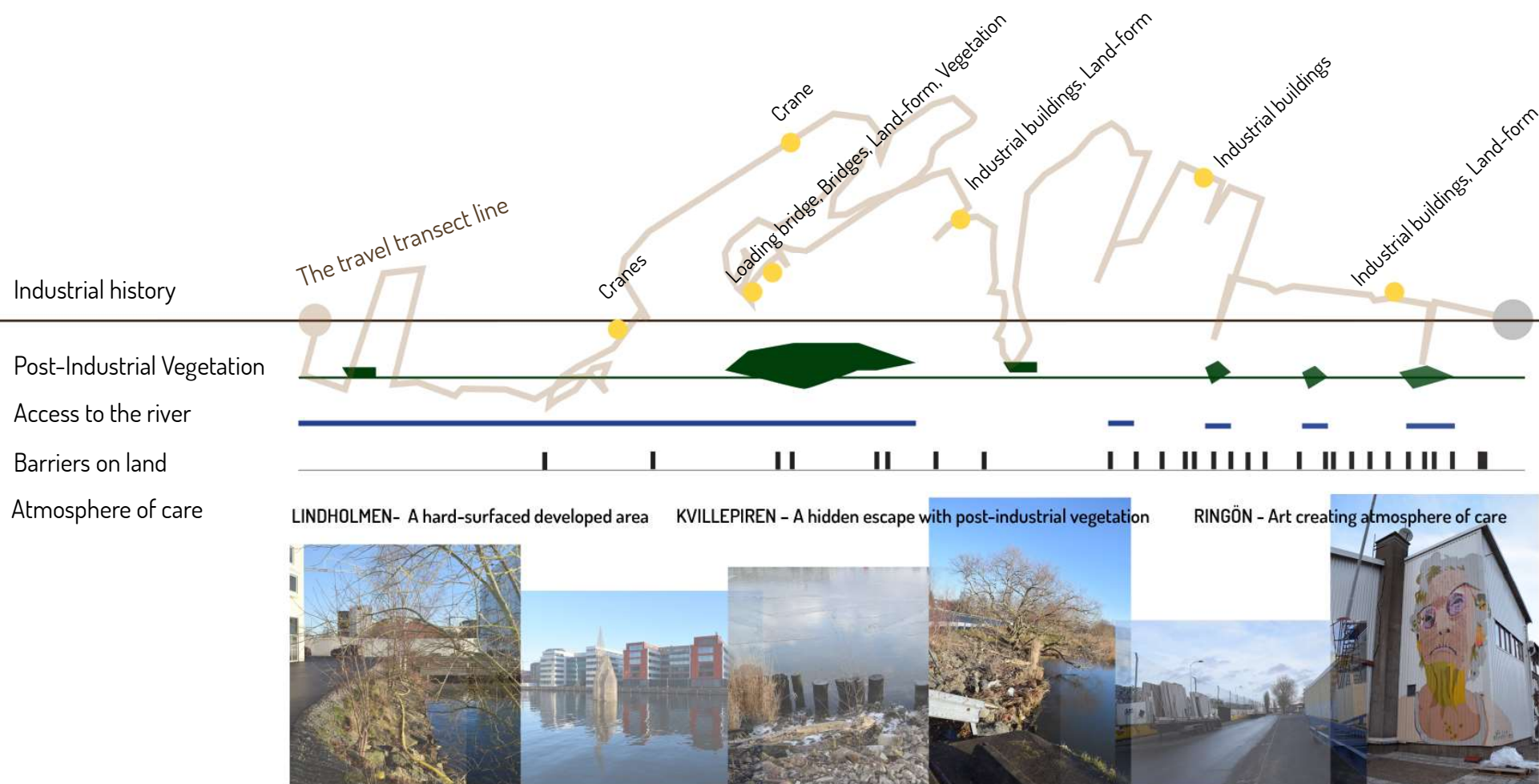


Figure 59. The tableau physique is a concluding illustration made from the findings of the walk at Lindholmen, Kvillepiren and Ringön.

KVILLEPIREN SITE EDITING

- PURIFYING PARK

The development of Frihamnen and Jubileumsparken are complex projects, with several actors involved in building the park in different parts and in different phases. Kvillepiren site editing – Purifying Park contributes one alternative design for the tip of Kvillepiren, a part of Jubileumsparken in Gothenburg. The design proposal would create a temporal green oasis, with a caring atmosphere, generating environmental awareness, in the otherwise busy development areas of Frihamnen. In the park, people would learn about sustainable development, soil pollution, soil sanitation through phytotechnology, biological processes and experience lush vegetation in the middle of Gothenburg city. The park has an experimental component with the use of phytotechnology for remediate the soil. Residents as well as interested foreign visitors and tourists are invited to experience the park and learn about the process of cleaning with plants and to reflect upon environmentally sustainable development in general.

From the traveling transect conducted in this project, site-specifics of Frihamnen has been specified and used together with design tools from field trips in the process of the editing of Kvillepiren. The site editing synthesizes the project in form, color and function by using generators of space as site-editing principles. Findings from the site reading conclusions like INDUSTRIAL HISTORY, POST-INDUSTRIAL VEGETATION, ACCESS TO THE RIVER, BARRIERS ON LAND and ATMOSPHERE OF CARE are processed and turned into site editing principles used in the design process for Kvillepiren Purifying Park. The principles are called PRESERVING MATERIALS, CLEANSING WITH PLANTS, APPROPRIATING SPACE and CREATING AWARENESS.

The design process has been a result of methods used in the project as well as a result of my personal background and the work with sketching for finding function and form for the park.

SITE ACTORS AT FRIHAMNEN

There are several actors involved in the planning of and designing for development at Frihamnen. MARELD landscape architects have a main responsibility for organizing the design at large parts of Jubileumsparken and to work closely with the municipality of Gothenburg and other firms involved in the project. The redrawn map in figure 59 shows plans made for Frihamnen and Jubileumsparken as of January 2019. These plans are under continuous elaboration. Changes in the plans are affected by political decisions, economics, different findings on site and during participatory processes. Jubileumsparken is developed in parts, with some parts already realized such as the shoreline park, the sauna, the pool and other functions that are movable within the area until more permanent plans are made. It has been important during the process to activate the area before a more permanent design is realized.

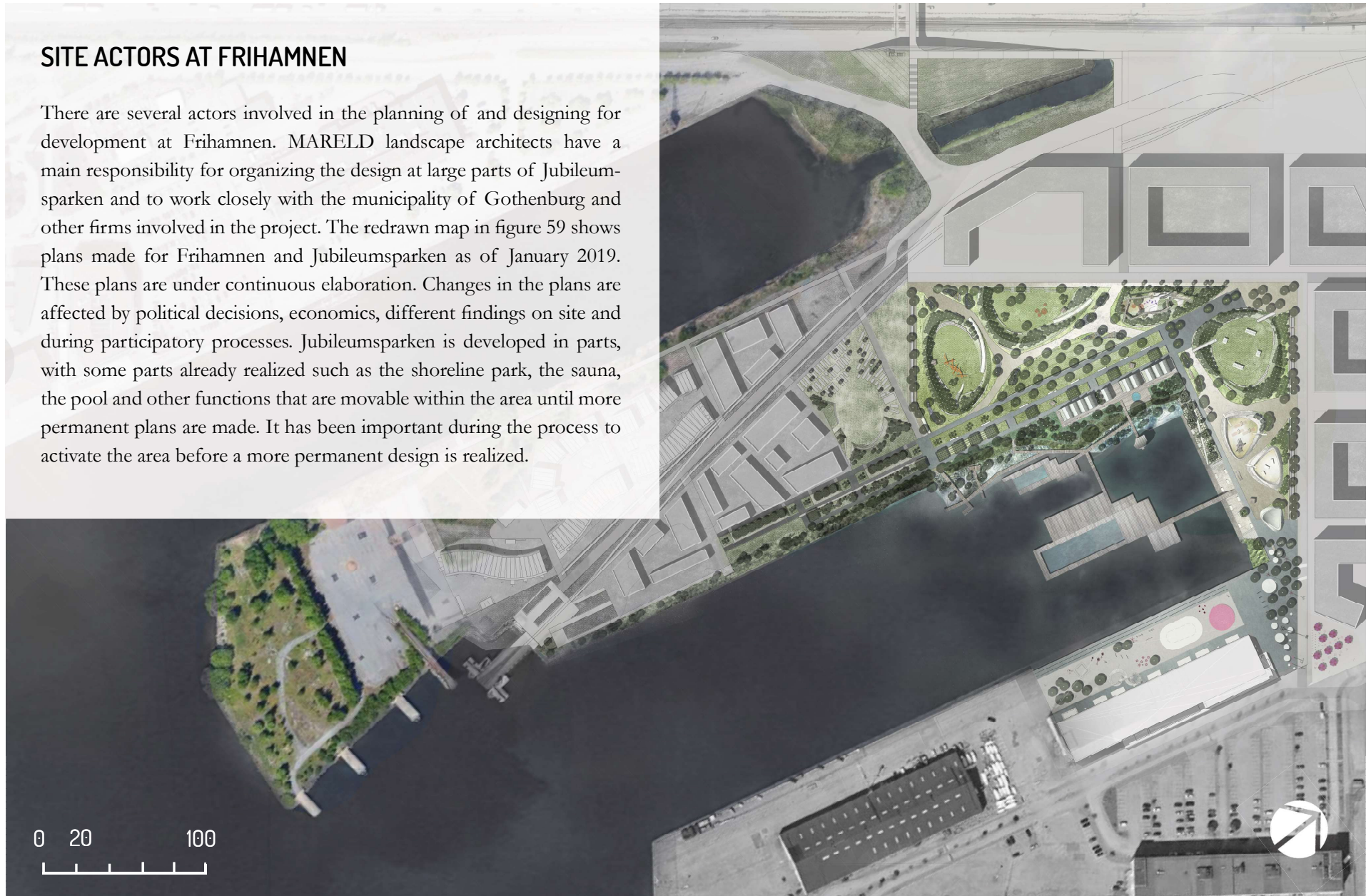


Figure 60. Redrawn from MARELD and atelier le balto plan (2019).



Figure 61. Site actors in Frihammen.

TARGET POINTS AT FRIHAMNEN

During the process of planning and designing Jubileumsparken there are several target points and functions within the area that are planned or already realized. Objects and activities are made movable and smaller prototypes are made of for example the pool in the area. The design at Kvillepiren purifying park should relate to the planned design in the rest of Frihamnen, in form and with complementing functions.

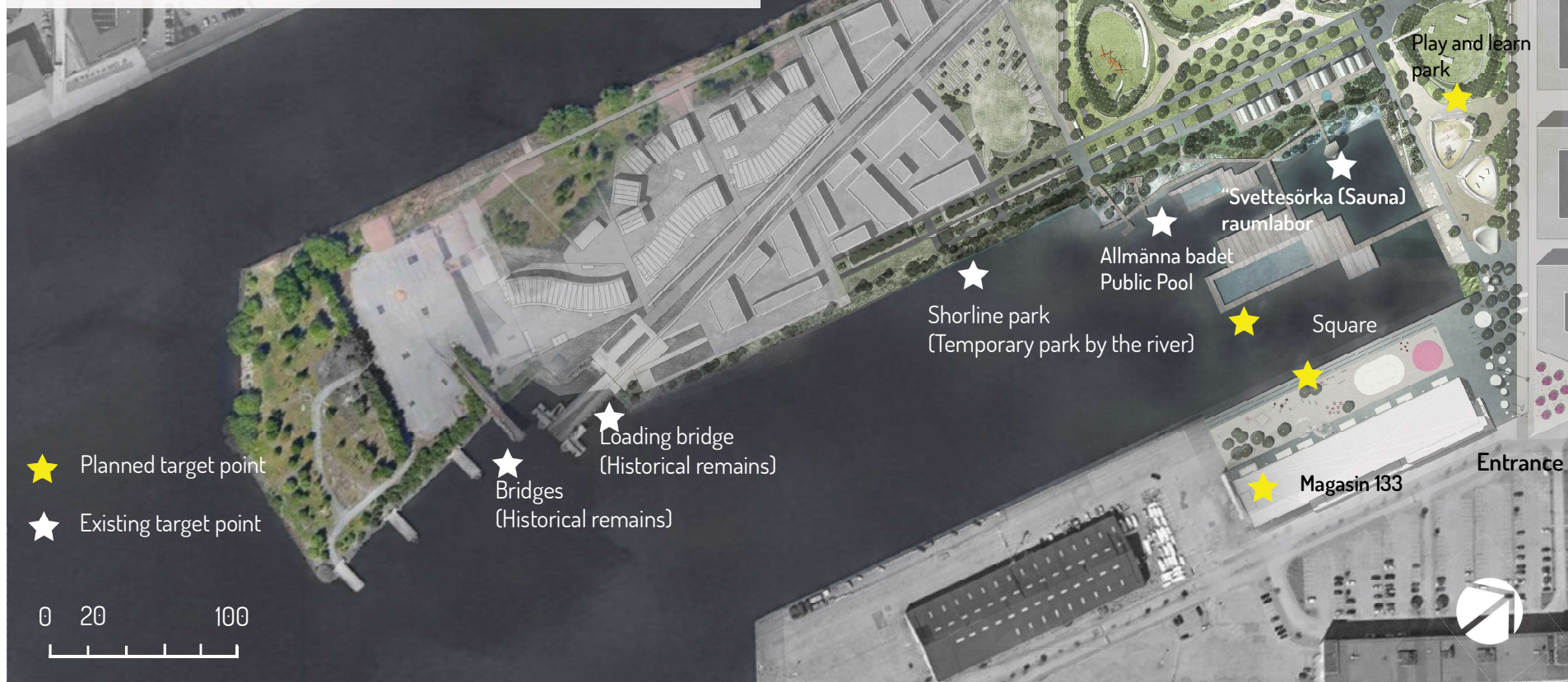


Figure 62. Access and target points in Frihamnen.

FROM READING TO EDITING - SYNTHESIS DIAGRAM

DESIGN TOOLS (FIELD TRIP RESULTS)

LARGE TREES PRESERVED ON SITE (De Ceuvel)
INDUSTRIAL REMAINS (Landshaftpark)

LARGE TREES PRESERVED ON SITE (De Ceuvel)
DIFFERENT SPICES FOR THE PHYTOTECHNOLOGY
(New order of Nature)
WILD AND CULTIVATED PLANTINGS (Landshaftpark)

ELEVATED FOOTBRIDGES (De Ceuvel)
VIEW SPOT (Landshaftpark)
FENCED PHYTOTECHNOLOGY AREA (New order of Nature)
VIEW SPOT (Landshaftpark)
WATER TOWER (Floating university)

PARTICIPATORY ACTIVITIES ON SITE
(De Ceuvel, Floating University)
INFORMATION SIGNS (De Ceuvel, Landshaftpark,)
MOVABLE OBJECTS AND MATERIALS (Floating university)
WATER TOWER (Floating university)
FENCED PHYTOTECHNOLOGY AREA (New order of Nature)

FINDINGS FROM TRAVELING TRANSECT (FRIHAMNENS SITE SPECIFICS)

+ INDUSTRIAL HISTORY

+ POST-INDUSTRIAL VEGETATION

+ ACCESS TO THE RIVER

+ BARRIERS ON LAND

+ ATMOSPHERE OF CARE

SITE EDITING PRINCIPLES (GENERATORS OF SPECIFIC SPACES)

PRESERVING MATERIALS

CLEANSING WITH PLANTS

APPROPRIATING SPACE

CREATING AWARENESS

PRESERVING MATERIALS

The already existing materials of Kvillepiren and Frihamnen constitute the base of the design editing of Kvillepiren. Frihamnen is under great change due to development of the area. The site-specific values of Kvillepiren are therefore important to preserve in order to maintain a relation to and an understanding for the site's history. Materials such as larger trees, proximity to the river, the private and calm atmosphere should be preserved as well as the soil cleaned by plants.

CLEANSING WITH PLANTS

Plants suitable for phytotechnology, with a special ability to absorb and break down pollutants are planted in the park to clean the soil. Different plants and plant compositions are used to create diverse park experiences. Fast-growing tolerant trees are planted such as *Betula*, *Salix* and *Populus*, as well as different kinds of grass and perennials.

APPROPRIATING SPACE

The space at Kvillepiren is appropriated for visitors, so that they can interact with, and learn about the natural processes on site. The park is made accessible through elevated walking paths in wood. On the tracks, the visitor is led through phytotechnology plantings in close contact with the river with several viewpoints. The larger asphalt site retains its open flexible character but is broken up with plantings.

CREATING AWARENESS

In addition to the spontaneous understanding and learning about natural processes at the site, pedagogic elements are added in the form of information boards, information hubs as well as activities such as workshops in sustainability, community gardening and guided tours. The aim is to create a special atmosphere of awareness making the site into a catalyst for a greater awareness of the environmental responsibility in daily life and of global environmental conditions.

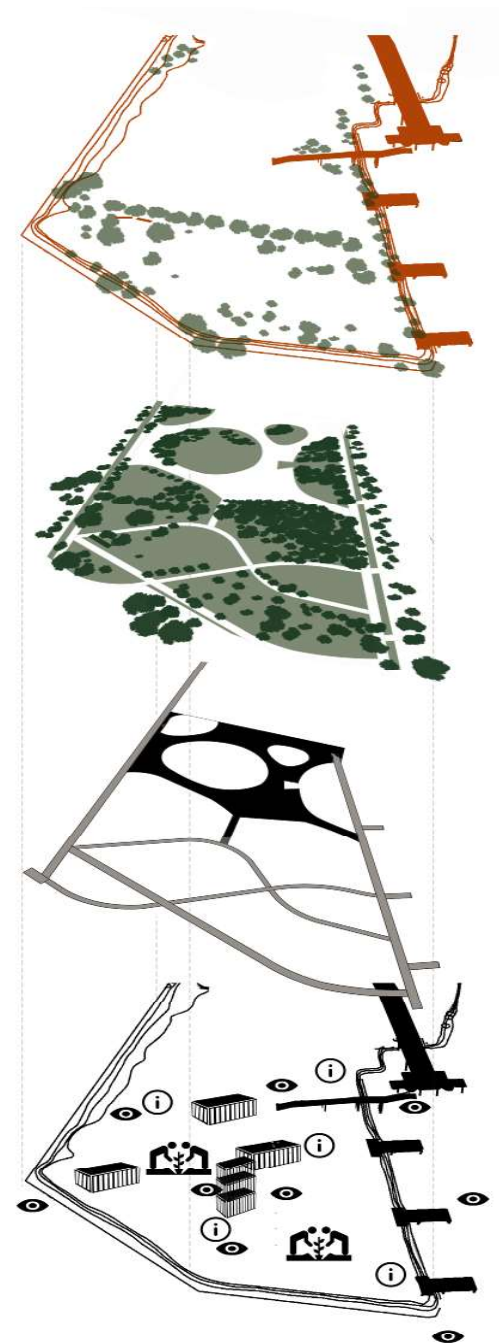


Figure 63. Site editing principles at Kvillepiren.

PRESERVING MATERIALS

In times of great change in Frihamnen, the existing materials are important to preserve and work with within the site editing of Kvillepiren. **Preserving these existing materials will straighten the human connection the environment and ensure the sites relationship to the history of the area after the development.** Special objects like bridges and larger trees are preserved as well as the graffiti paintings and the existing soil and debris building up the landform. The preserved materials are part of Kvillepiren site-specifics. Preserving them will help to develop new functions and meaning together with the other space generators developing the site. The polluted soil is a problem and a site-specific environmental hazard that is dealt with on site.

That the site is polluted, is not visible today but the editing of Kvillepiren, with plants to clean, and creation of awareness, the contaminated soil is highlighted as a site-specific aspect of the site. The existing calm atmosphere of the site and its post-industrial heritage are used to create contrasts and develop a strong caring atmosphere for the environment, which is possible due to the site's history and function in the harbour of Gothenburg's old harbour-scape together with development of phytotechnology cleansing away pollutions in the soil. Taking responsibility for the history and developing the area from the problems we humans has created on site. The atmosphere from the post-industrial vegetation as well as the feeling of getting away is preserved by using the existing features on site and giving visitors space and time to walk in the area and experience the secluded piece of land.

Preserved on site

Bridges

Loading bridge

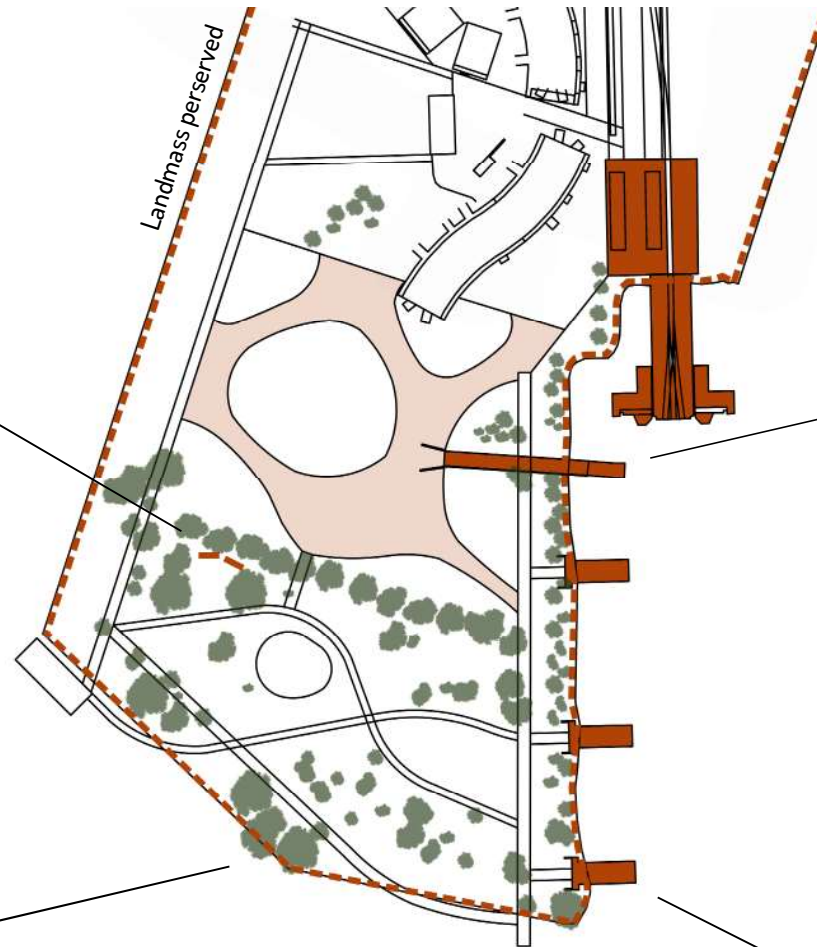
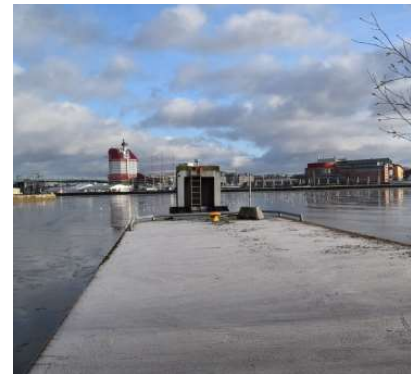
Old trees

Soil with pollutions

The landform

Asphalt

Graffiti



0 10 50



Figure 64. Preserving Materials at Kvillespiren.
In red on the map.

CLEANSING WITH PLANTS

The vegetation at Kvillepiren has a purpose by cleaning the soil, but also by creating park values such as aesthetics. Plants are planted in different plant compositions to give visitors a varied park experience, which generates an interesting park with wild character and a calm atmosphere creating awareness for the environment. The mixed vegetation creates different biotopes that are good for biodiversity and wildlife and enriches the nature experience for the visitor. The added plants on site are selected to suit the special site conditions, like weather and temperature, as well as for being able to cleanse specific contaminants in the soil. When looking for plants to use at Kvillepiren, Kennen and Kirkwood's book *Phyto - Principles and resources for site remediation and landscape design* (2015) is used. The plants used are of durable species, such as birch, Salix and poplar, grasses and perennials known to absorb and break down the pollution created by Polycyclic aromatic hydrocarbon (PAH) which is the main pollutant found at Kvillepiren. In parts of the pier polluted by heavy metals, dense plantings of Poplar ssp., Salix ssp. or Helianthus annuus are used. These plantings need to be harvested to get rid of the contaminant from site because metals are elements that can be absorbed but destroyed by the plants. The mixed vegetation and plantings give variation in space, shape and colour to the site. Most of the existing larger trees that grow on site are preserved. The older trees generate great biological values and aesthetic values with their post-industrial character. Because the design of the Purifying Park of Kvillepiren is temporary, no other trees will have time to grow old and have the character of an old tree. **In contrast to traditional phytoremediation plantings, in Purifying park the plantations are made varied to give a rich experience in place.** To speed up the process of phytotechnology,

the soil is improved by adding compost and other biological fertilizers. A soil factory takes care of compost waste in the area in order to be used on site.

Information about soil pollution at Kvillepiren that I had to use for the project consisted of few sample points at Kvillepiren. This provides an inadequate basis for planning the remediating vegetation and should therefore be viewed as an example of how varied planting designs, considering aspects of phytotechnology, could be made at Kvillepiren instead of an exact planting plan for effective phytoremediation. The plantings can be made experimentally or develop with more information on pollution together with professionals within the field.

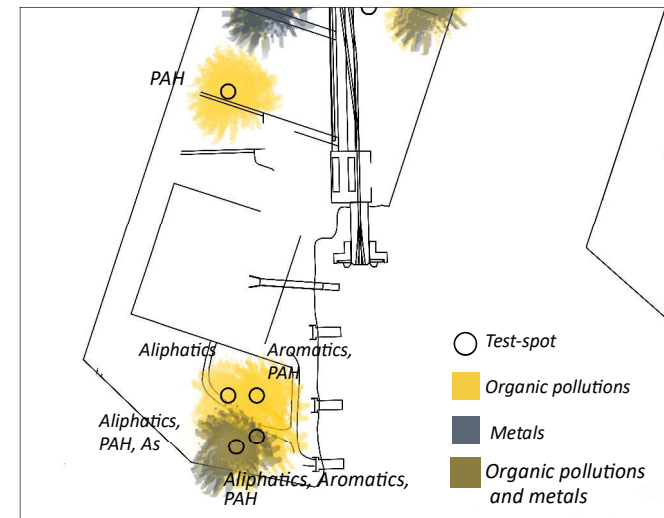


Figure 28. Pollution map. Made with information from Forsman & Holm 2016.

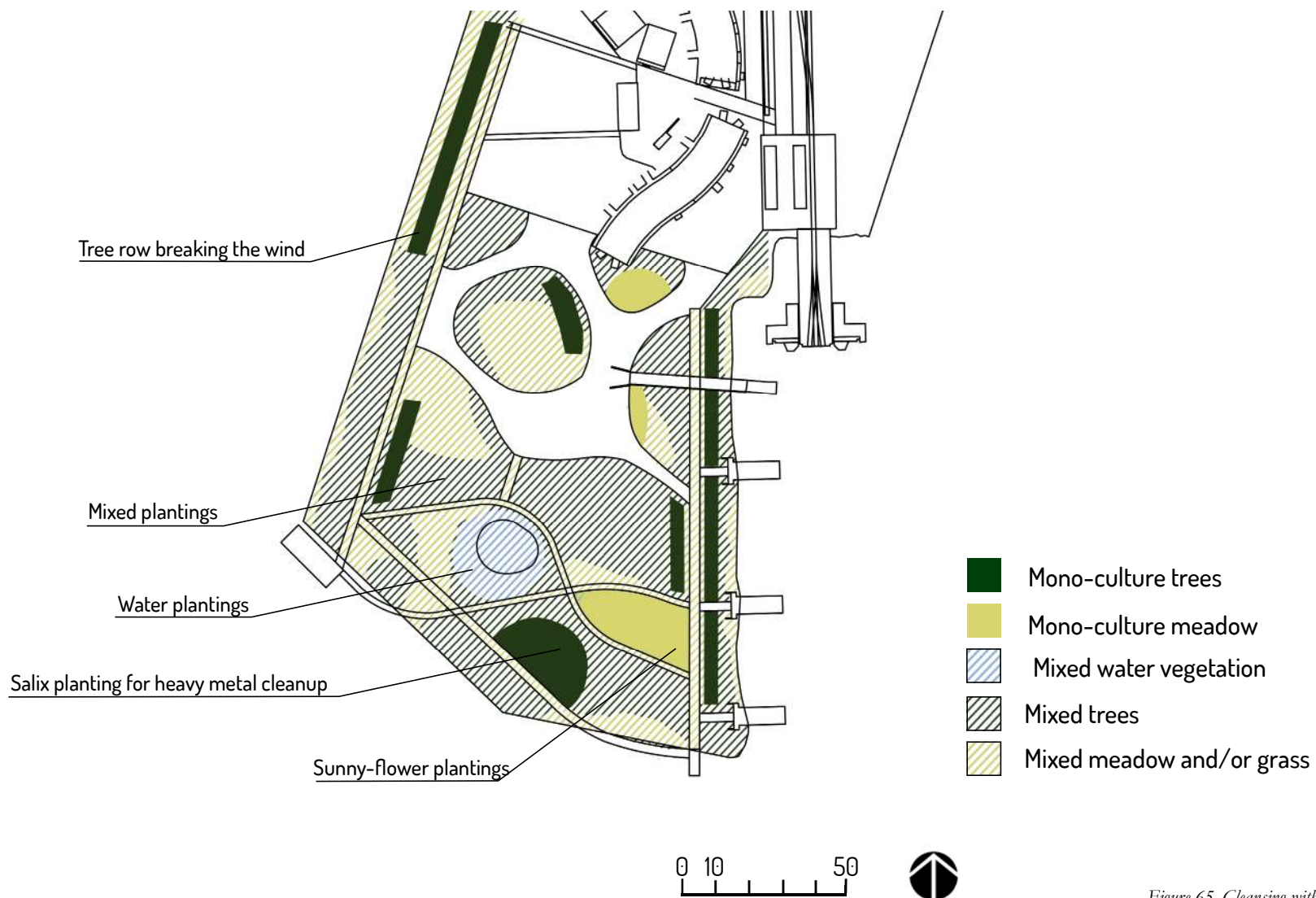


Figure 65. Cleansing with plants.

CLEANSING PLANT LIST

Tress and buches

Betula pendula
Celtis occidentalis
Poppulus nigra var italica
Poppulus spp.
Robinia pseudoacacia
Salix spp.
Hedera helix
Pinus spp

Contaminant

PAH
PAH, organic compounds
PAH
Heavy metals. PAH, Organic compounds
PAH, Organic compounds
Heavy metals PAH
Tolerant
Organic compounds, Tolerant

Aesthetic value

Wite stem colour
Fruits and foliage
The sound of the leaves in the win

Gracile, flowers in white
Green leafs, stemcolour
Winter green
Winter green

Grasses

Bouteloua gracilis
Carex cephalophora
Dactylis glomerata
Festuca spp
Lolium perenne
Miscanthus x giganteus
Panicum virgatum

PAH
PAH
PAH, Organic compounds
PAH
PAH, organic compounds
PAH
PAH, organic compounds

Decorative flower ax
Decorative flower ax
Green
Green
Green
Large grass creating boardes and r
Green and red colored

Perennials/Annuals

Trifolium spp.
Helianthus annuus
Medicago sativa

PAH, organic compounds
PAH
PAH, organic compounds

Flowers in purplue
Flowers in yellow and orange
Flowers in blue and white

Water plants

Scirpus spp
Iris spp.
Lemna minnor
Typha spp

Organic compounds
Organic compounds, Atrazine
Organic compounds
Organic compounds, Atrazine

Greenary and seeds
Flowers in blue and yellow
Small green leafs
Decorative Seedax

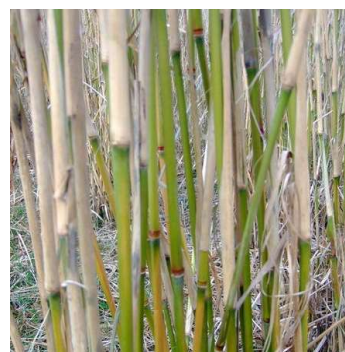


Figure 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80. Cleansing plants.

APPROPRIATING SPACE

Kvillepiren is being **transformed from a deserted piece of land into an accessible park appropriated for public use.** The park is made accessible through elevated walking paths made of wood. On the paths, visitors are led through the lushest part of the pier close to the river. The plants are protected, so that they can remediate soil without unnecessary interference or damage. Also, visitors are kept at a safe distance from the polluted ground so that they do not get unnecessary contact with the contaminated soil. Larger accessible surfaces, such as the area by the water purification tower are built with grating. Plants growing underneath these gratings can have good growing conditions with sun and water reaching through these surfaces. The already existing larger asphalt area at Kvillepiren is partly preserved but is also broken up in some places, where islands of cleansing vegetation are planted. The old asphalt area is kept relatively open, to leave space for a flexible use of the site for temporary events and concerts. Objects placed in this area are movable containers and wagons with soil and plants.

In addition to the physical accessibility of the site, Purifying park provides visual connection to the river and Gothenburg skyline, and a proximity to the purifying vegetation and to other site-specific values. This connection is made with planned walking paths as well as special view spots where visitors can feel free to experience the park. In the park, nature and human co-exist and visitors have the chance to learn and observe the natural processes. The safety and navigation on Kvillepiren are important factors for people to feel comfortable and enjoy the visit at the park. People on site, alternative walking paths and a caring atmosphere create a feeling of

safety. Information boards and clear walking paths enable good navigation in the area. The design for appropriating Kvillepiren is made in relation to neighboring areas and the rest of Kvillepiren. It is important that the rest of Kvillepiren is accessible, linking to Frihamnen, Ringön and Lindholm so that people can reach the park and enjoy a longer walk along the river.

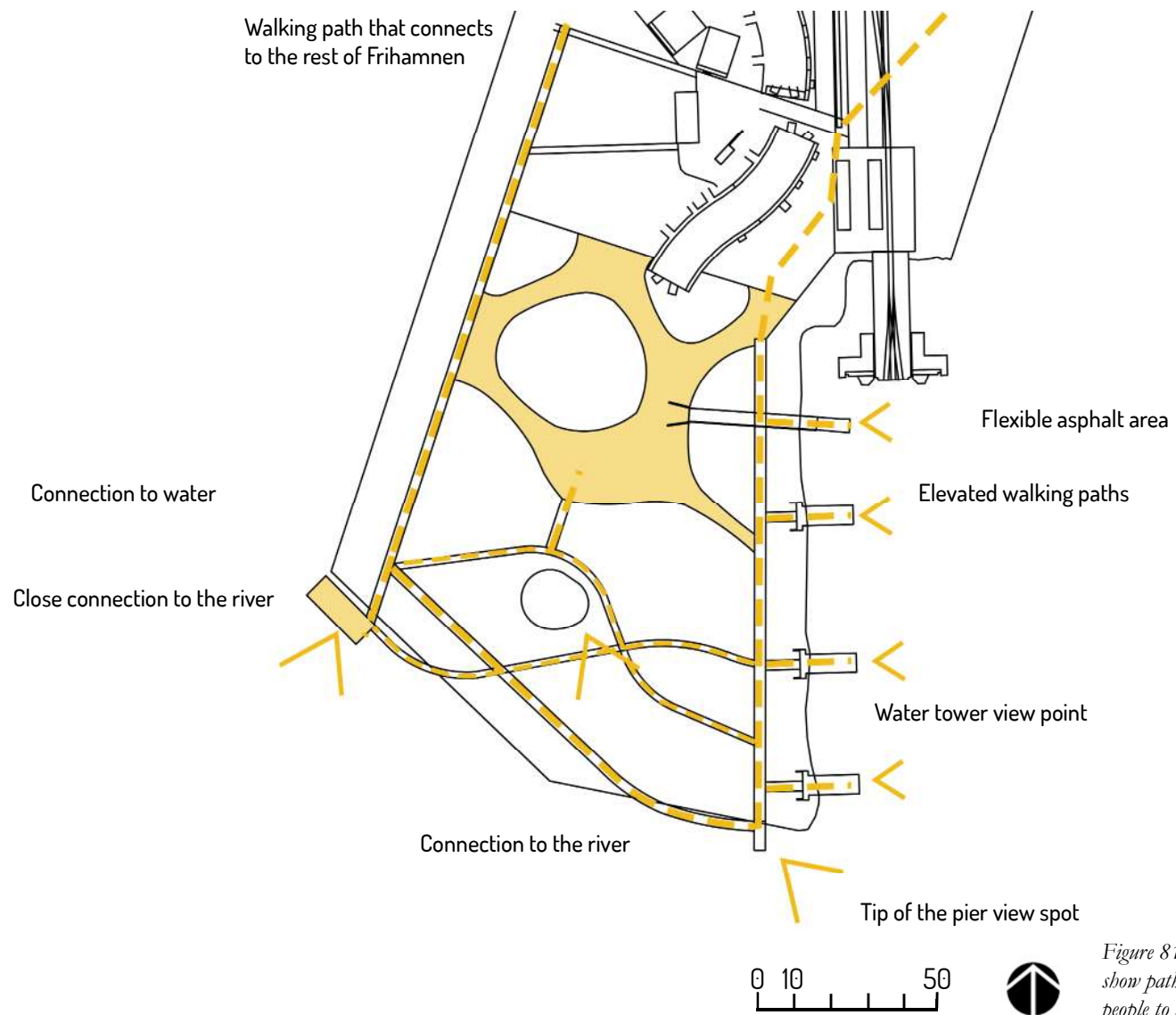


Figure 81. Appropriating space. Yellow in the map show paths and areas which is made accessible to people to appropriate.

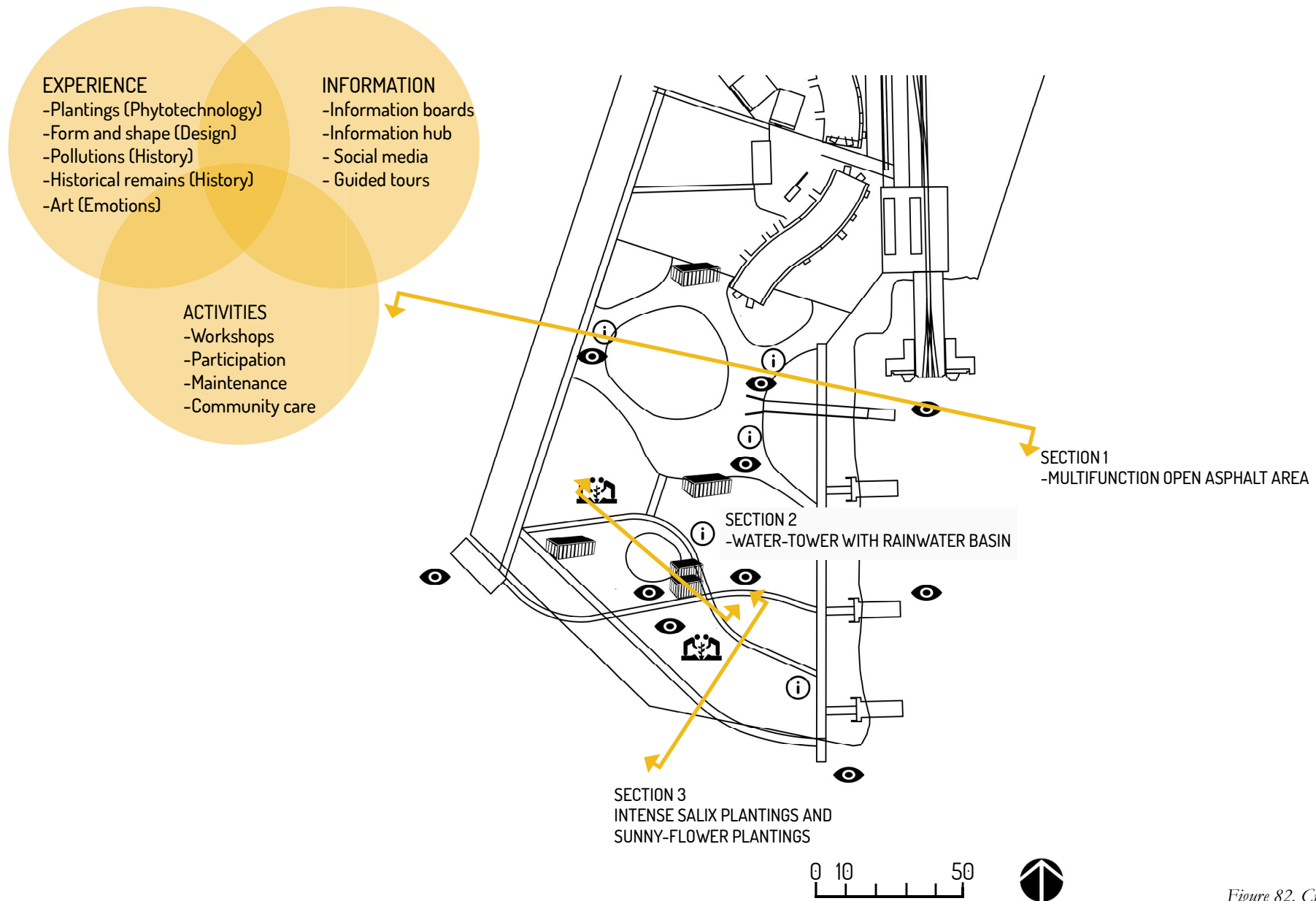
CREATING AWARENESS

Kvillepiren Purifying Park has an important role in influencing visitors and creating awareness of environmental problems by providing rich educational and emotional experiences in the purifying park. This is made by **highlighting site-specific values on site together and providing knowledge about the cleansing processes**. Visitors in the park are given connections between, history present and future in the park. With information about pollution as a post-industrial remnant, the present challenge of dealing with these pollutions and a possible future without pollutions. The purifying park has a calmer atmosphere than its surroundings. The visitor is given time and space to learn, observe and experience the park in a calm contemplating fashion. The walking paths lead people through the area of special vegetation for phytotechnology that lie close to the river with view spots of Göta Älv and Gothenburg skyline.

In addition to the spontaneous understanding and learning about natural processes at the site, pedagogic elements are added in the form of information boards, information hubs, as well as activities such as workshops in environmental sustainability, community gardening and guided tours. The houses and shelters are temporarily placed on site and made from containers, which connects to an industrial history and gives an understanding of the site as temporal and transformational. Wagons with soil and plants are placed and movable in the park to provide and understanding of the site as a historical use as a shipping site. The wagons also aim to give the visitor and sense for the energy and effort it takes to move soil for treatment instead of treatment in-situ. A water-tower that collects and cleans rainwater with plants is centrally located in the park. It has an

important educational purpose regarding water within the city and the role vegetation and nature areas within the city must deal with rainwater. From the roof porch people get a good overview over the adjacent pond, the purifying park, Frihamnen and Gothenburg's skyline.

The different space generators for the site editing that is described in the synthesis diagram come together to create an atmosphere of awareness that helps to create awareness for the environment. Atmosphere is an abstract concept, hard to describe in words or in a plan. Therefore, three illustrative sections are presented on the following pages describing how the space generators come together in the design, creating a special atmosphere supporting development towards awareness when experiencing the park.



MULTI-FUNCTIONAL OPEN ASPHALT AREA

CREATING AWARENESS

Conection to history on site

Closeness to water and vegetation

Movable planting wagons with phyto-plantings

APPROPRIATING SPACE

Elevated walkway

Open flexible asphalt area

CLEANSING WITH PLANTS

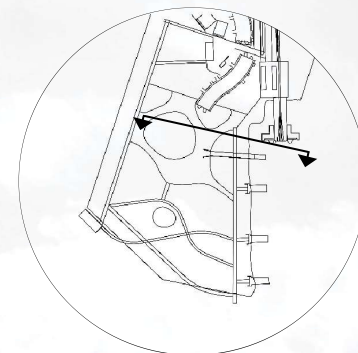
Wind-breaking tree-planting

Small trees and scrubs cleaning soil in wagons

PRESERVING MATERIALS

Old structures are preserved on site





Distance to pollutions

Elevated walkway

Open green flexible for picnic,
sunbathing and/or events.

Asphalt is removed
for phyto-plantings

Soil with pollutions

Landmass preserved

Section 1, 1:400 A3

Figure 83. Purifying Park section 1 Multi-functional area.



WATER-TOWER WITH RAINWATER BASIN

CREATING AWARENESS

Mixed species vegetation

APPROPRIATING SPACE

Elevated walk-path

Access to water

CLEANSING WITH PLANTS

Multilayerd mixed veg

Populus spp
Betula
Salix
Pinus
Celtis occidentalis

Pollutions
PAH
Organic compounds

Gras mix

Pollutions
PAH
Organic compounds

Water veg mix

Iris spp
Typha spp
Lemna minnor
Scirpus spp

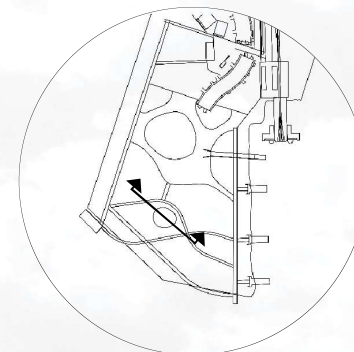
Information

Rooftop vegetation
Cleaning Rainwater

View from
Water tower

Rooftop vegetation
Cleaning Rainwater

Educating about water



0 20 40 Section 2, 1:200 A3

INTENSE SALIX PLANTINGS AND
SUNNY-FLOWER PLANTINGS

CREATING AWARENESS

APPROPRIATING SPACE

CLEANSING WITH PLANTS

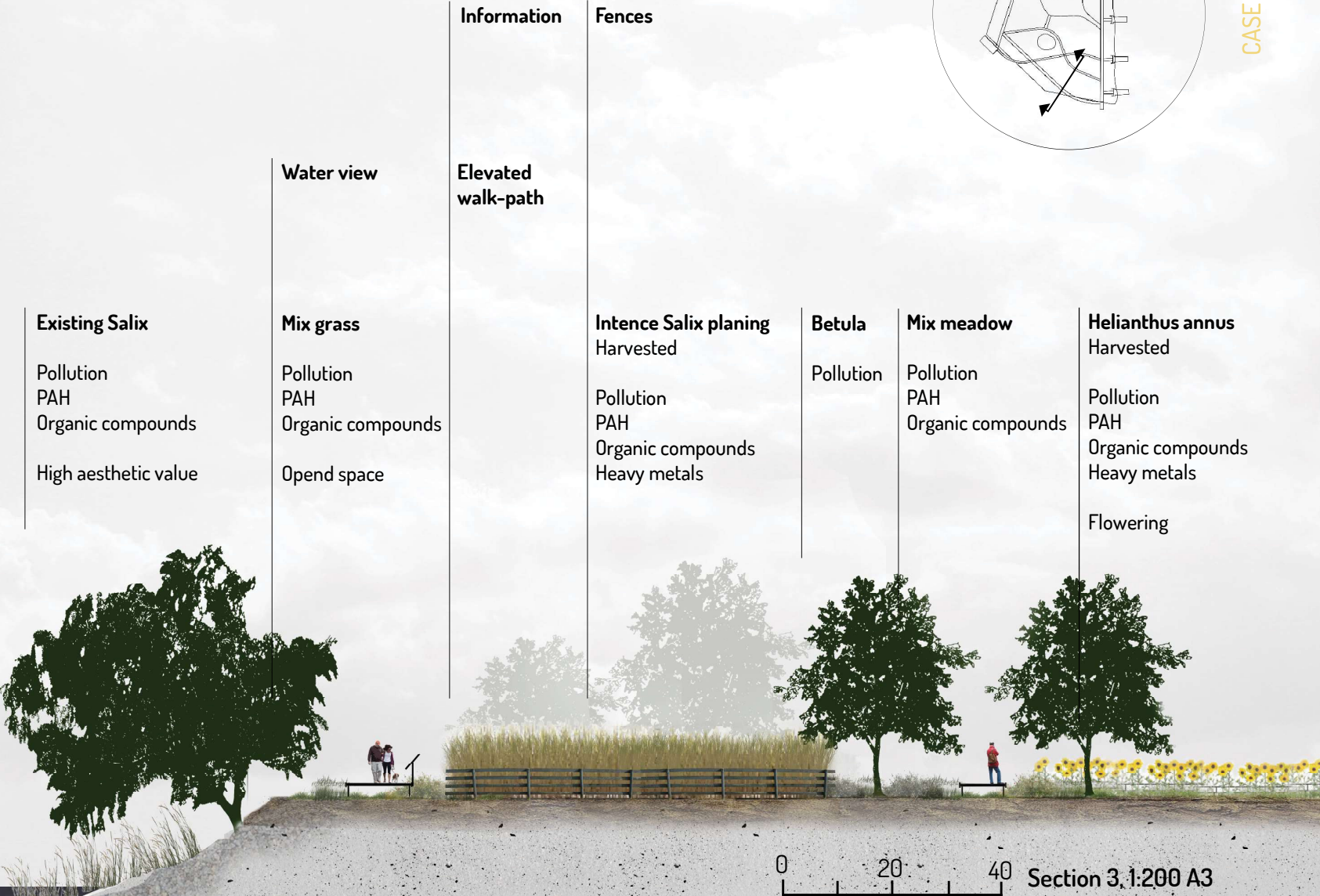
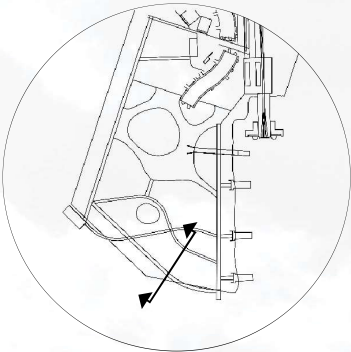


Figure 85. Purifying Park section 3 Intense fenced Salix plantings and sunny-flower field.

PURIFYING PARK WITHIN SURROUNDINGS AND WITH TARGET-POINTS

Kvillepiren Purifying Park will be a special space along the harbour walk in Hisingen. It will provide a rich park experience with a vegetative soft surfaced meeting with the river. The purifying park has a calm atmosphere compared to the developing surroundings. Visitors are given time to learn, observe and experience the park in a relaxing way. The walking paths in the parks lead people through the area of special vegetation for phytotechnology that lie close to the water with view spots over the river and Gothenburg skyline. In the Purifying park visitors are given a unique opportunity to contemplate over the sites industrial history and challenges in developing these post-industrial areas with pollutions. It is important other developing areas in Frihamnen relates to Kvillepiren and connect movement paths to the site in a good way, removing existing barriers. These barriers are today physical fences or a feeling of safety in the area. The temporality of the design at Kvillepiren makes it flexible for future use. The park as temporal makes the site more flexible over time, with a slow development phase which gives future development plans time and space to emerge



Figure 86. Purifying park within surroundings and with target-points.

SITE EDITING: ZOOM IN GROUND PLAN



0 10 50

1:1000 A3



Figure 87. Purifying Park plan 1:400.

EVOLUTION OF KVILLEPIREN PURIFYING PARK

Although the design editing is made for a temporal park, there is reason to look at the evolution and future development of Kvillepiren after the soil has been cleansed. All parks and places evolve and change over time, but a temporal park has transformation as a strong inherent power that can lead to a more static use, form and function or to new temporal stages. The contaminated soil at Kvillepiren, together with other aspects, affects the choice of plants and plant composition as well as other design choices over time. When the soil has been cleansed at Kvillepiren, a larger variety of plants can be planted, without special purpose of phytotechnology. Different functions can be added and new ways to move in the park can also be developed when surfaces are used in other ways than for remediating plantings. The educational focus can shift from being primarily about pollution and phytotechnology to be about more general biological processes at the site and visions for the sustainable cities of the future where care and replanting are an important part.

The trees planted to cleanse the polluted soil are generally fast growing. By planting more slow-growing trees after the first phase, the trees used for phytotechnology can be used as nurse trees and the park get a natural-looking succession. The park can thus develop its plant stock over time without having to clearcut, which would create periods of low aesthetic values in terms of vegetation in the park. The succession that takes place in the park contributes to the visitors' understanding of time aspects in nature and how we can work with plan processes for remediating soil in

a biologically sustainable way. See figure 88 for the visualized process of planting and succession in mixed-vegetation plantings in the park. In parts with intense Salix plantings the area will change a lot when the vegetation is harvested. This will create contrasts and changing experiences in the park with also gives visitors an understanding for the process of cleansing soil contaminated by heavy metals over time. See figure 89.

It is important that different professionals work together with the park over time to follow up, evaluate and develop the park so that it is cleaned in the best way. Even if there is a more permanent solution after the period of phytotechnology, a park is always changing and developing. In order to create a park with a strong connection to the local community, the public should also be invited to participate in the development of the park. When the soil is clean, there are greater opportunities to develop activities such as more general areas, community farming, sport fields, dog yard etc.

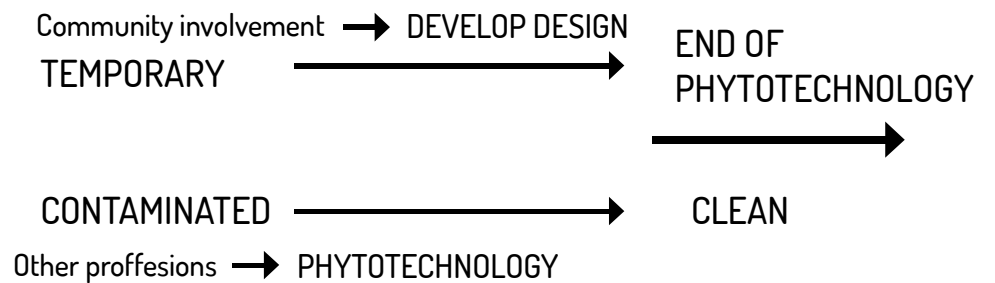


Figure 88. Purifying Park Future development time figure.

EVOLUTION OF MIXED SPECIES VEGETATION

1. PHASE (ca. 1-5 years)

- PHYTOTECHNOLOGY WITH MIXED VEGETATION
FOR RICH BIODIVERSITY AND PARK EXPERIENCE



2. PHASE (ca. 10 years)

- PHYTOTECHNOLOGY PLANING AS COUNTY TREES



3. PHASE (ca. 15 years)

TREES WITHOUT PURPOSE OF PHYTOREMEDIATION

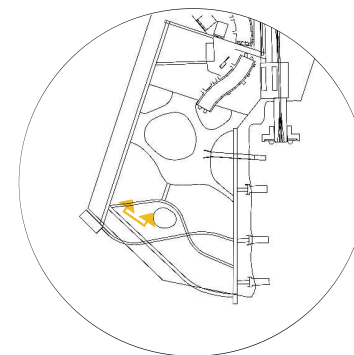
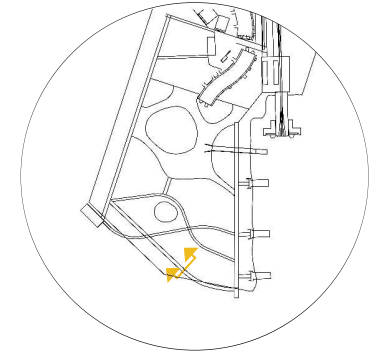


Figure 89. Purifying Park Future development with mixed species for remediation of organic pollutants. Plantings after ca 10 years with trees without special phytotechnological function for succession in the plantings.

EVOLUTION OF INTENSE SALIX PLANTINGS



CASE KVILLEPIREN

1. PHASE (ca. 1-5 years)

- PHYTOTECHNOLOGY WITH SALIX PLANTINGS FOR UPTAKE OF HEAVY METALS



2 PHASE (ca. 5-10 years)

- STILL PHYTOTECHNOLOGY ON MOST CONTAMINATED PARTS



3. PHASE (ca. 15 years)

- NEW WAYS OF USING THE OLD PHYTO-AREAS
- FLOOD PROTECTION FOR FUTURE CLIMATE CHANGE



Figure 90. Purifying Park Future development. Part with intense mono-culture salix plantings for effective phytodegradation of heavy metals.

4. REFLECTION

In this last chapter of the thesis I reflect on the project and the process of working with phytotechnology, site-specifics and aesthetics when designing a purifying park at Kvillepiren. The main parts of the thesis have been Introduction, Method and theory, mainly about site specifics, sustainable aesthetics, phytotechnology and field studies, the case study, with understanding, reading and editing of Kvillepiren and lastly reflection/discussion. The main aspects of the design process, as well as theoretical subjects and their relation to each other, are discussed in this last part of the thesis. I discuss how selected methods have guided and affected the design process, leading to the design proposal. In this chapter I also discuss how feasible the project is to realize and what the next step for realizing the project could be. The reflections connect to the main goals of generating a site-specific design with focus on pedagogic experiences when using phytotechnology which are linked to the main research questions.

METHOD

In this project, the theory and method used in the case study are strongly connected. The understanding and reading of Kvillepiren leads to the site editing which is the design proposal for Kvillepiren. Methods and materials in the project consist of literature research, websites, personal interviews and conversations, field trips, the field method “traveling transect” and studio work. The latter included with processing of materials and sketching towards a design proposal. In the end the project lands in a site editing of Kvillepiren, *Kvillepiren Purifying Park*.

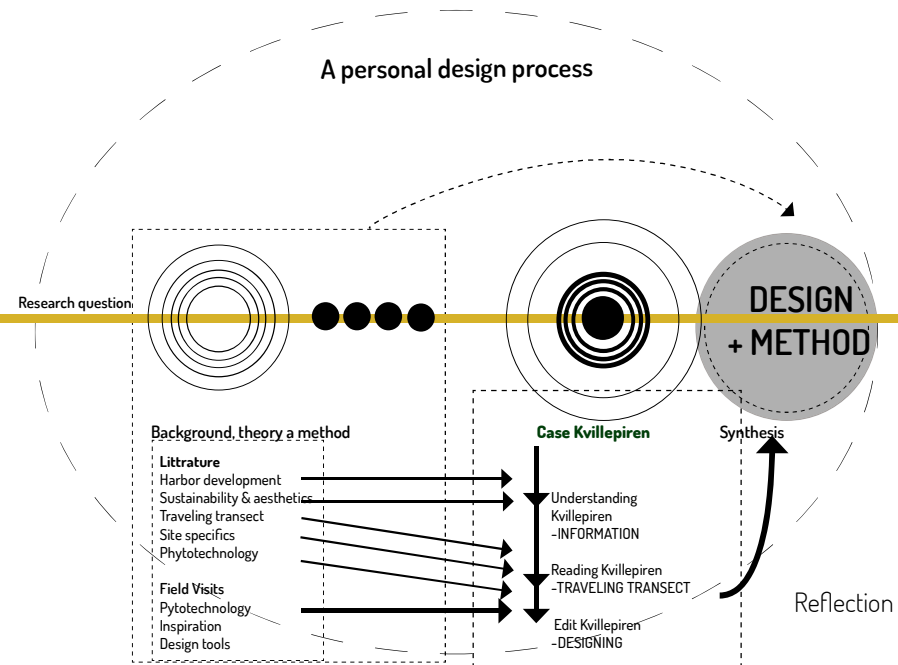


Figure 91. Research design for reflection over process.

Phytotechnology in landscape design

As described in the theory and method part of this thesis, phytotechnology is a plant-based method that can be used to remove pollutants from soil. During my project I have learned about and been inspired by the method through literature and field visits. Early in the process of the project, I wanted to work with site-specific environmental problems and the human relation to natural processes within the urban landscape. One reason for me to work with phytotechnology in the project was the relatively low cost of the method compared to other methods. I have learned about the polluted soil at Kvillepiren and how problematic and costly the process of cleaning the soil in a traditional way can be.

Ecotechnology is a broader subject than phytotechnology and a collective term for using plants and biological systems to actively maximize ecosystem services. During my studies to be a landscape architect and from working as a landscape architect, I have gained a lot of knowledge related to phytotechnology, but not specifically about the method. The lack of specific knowledge could have been a reason for me to instead work with related, more general concepts, such as eco-technology. However, I chose to focus specifically on phytotechnology as an eco-technology in order to delineate the project, but also because this method is site-specific to Kvillepiren's problems with polluted soil. Taking advantage of the site-specifics has been an important part of my work and therefore the site-specific environmental problem needed site-specific solutions.

As a landscape architect, I am trained to understand and combine different aspects when developing projects and designings in an

urban context. For my project I found literature about phytotechnology mainly directed towards other professions, describing mostly technical and scientific aspects of working with the method. There was little information about aspects regarding aesthetics during the design process. In the process of building a well-functioning park with phytotechnology, a project team with different professionals should work together and contribute in the areas they have most knowledge within.

Phytotechnology and aesthetics

Phytotechnology is generally seen and used as a technical method. Still, I have found examples at field visits and in literature of projects that use the method in parks and public areas, which also generates aesthetic values. In contrast to the technical nature of phytotechnology, I have used contemporary literature and methods connected to site-specifics that responds to the debate about the importance of aesthetics as valuable experiences, in creating sustainable design. Elizabeth Meyer and others criticize how contemporary landscape architecture often gets stuck in technical solutions, and how ecotechnologies gets priority over aesthetics. This project is in many ways an attempt to bridge the gap between ecotechnologies and sustainable aesthetics with a site-specific design.

In this project, I wanted to use phytotechnology and apply the method to a specific site, creating a sustainable park rich in experience values. People often say that “the beauty is in the eye of the beholder” and that beauty is a

subjective way of perceiving something. In Meyers later writings, she talks about aesthetics instead of beauty. According to her, aesthetics has more to do with a powerful experience that landscape architects can work with in sustainable design. During the project, I have increasingly understood the educational aspects that landscape design can have when working with aesthetics. For me, creating a sustainable landscape design with aesthetics is very much connected to the choice of method used in the design process. Also, in the choosing of the methods it is important to be open to work with aesthetic qualities. If site-specific aspects that have to do with aesthetics and experiences are the basis of the design work of a place, the aesthetic values and experiences on the sites can be strengthened.

During the process I have learned about site-specific values of Kvillepiren and about possible future values that phytoremediation can provide in a purifying park. Based on my own experience of using phytotechnology, I can say that phytotechnology is an advanced method that is hard to work with for a landscape architect. However, by working with others, I believe that the knowledge gap and lack of technical thinking in my profession can be compensated by working together with other professions. Aside from the technical aspects of the method, the design work of a park with phytotechnology is similar to a design process in a park that does not use phytotechnology. For example, the method limits the number of plants to use. In addition, trees and other plants can be planted in different combinations to create interesting plant compositions. Phytotechnology imposes certain restrictions on plant selection and the use of land during handling time. If the soil is very toxic, human contact with the soil should be restricted.

Vicenzotti and De Block, (2018) presents the importance of preserving and valuing distance to nature and problematizes Meyer's view of aesthetics that creates a sense that human and nature are connected. In my design work I reflected on the tension between human and nature relationship inspired of both the writings of Vicenzotti Block, and Meyers. It has been important to work with both distance to nature, as well as re-connecting people with the close environment when designing Kvillepiren Purifying Park. Distance is created by elevated walking paths that separates people from the vegetation and the contaminated soil. In areas with soil contaminated by heavy metals the vegetation is enclosed with fences. This signals that the place is dangerous and that nature itself is left to heal itself through responsibly planted trees.

Inspiring field trips

Literature about technical aspects of phytotechnology has been easy to find. Texts about aesthetic qualities and how to work with the method in a design has been harder to find, however. To find inspiration and good examples from places that use the method in public urban places I went on field visits. These field visits gave a lot of inspiration and design tools for working at Kvillepiren, both connected to phytotechnology and to other aspects. These tools were very useful in relation to conclusions from the traveling transect and to the site specifics found for Kvillepiren and the surrounding harbour-scape. A personal conclusion from my design process is that it is good to borrow inspiration and solutions from other projects as long as

they are applied with a site-specific focus on the area in question. Especially de Ceutel in Amsterdam was reminiscent of Kvillepiren because this place was of a similar size and was previously a port area. It had been developed through community building and today various workshops and events take place, with sustainability as a goal. The place's educational dimension was important to me. The field visits are presented mainly according to my own experiences on the site. This generates a subjective description. In the same time the field visits are used for my personal design process that is directed towards a specific site. Reference places without personal visits and focus on already documented information about the sites could have given a more objective presentation, with the risk of losing a personal description of the places and subtle site qualities

Case with focus on Site specifics

Kvillepiren as the site for my project has been with me early in the working process. The exact boundaries of the site were set after I had developed an understanding of the site and after I started to read the site-specifics of the area. Theory from Kahn and Burns (2004) as relational construct has helped me to select the exact location for the area of control where the design editing takes place, as well as a larger area for understanding and reading Kvillepiren and the forces of influence and effect. To capture site-specifics, I have used the method of traveling transect which is inspired by traveler and explorer Alexander von Humboldt, and designed by Diedrich and Lee. This method challenges me to explore atmospheres, relationships and dynamics of Kvillepiren and related areas along the river. The method

of traveling transect expands the understanding of the place and its future significance in the contact of a possible harbor walk. The river's often hard encounter with the cityscape is broken up into a softer meeting on Kvillepiren, which has lush vegetation and a soft border towards the water.

Old harbour areas are unfortunately often treated as empty canvases to develop. Lisa Diedrich's writings about the site-specificity of harbour areas have helped me to understand that these places have a lot of site-specific values that can be developed instead of taken away. While traveling I found site-specific qualities at Kvillepiren that was important for a future harbour area (including a harbour walk) along the river in the future. I also found potential in generate a green oasis with focus on restoring healthy non-toxic urban environments by the river. The method of traveling transect connects in many ways to Meyer's writings about aesthetics that according to her is site-specific. I also felt that working with the method of traveling transect made me open to site specifics in a larger geographical context to see what the area of Kvillepiren could provide in influencing the harbor landscape of Gothenburg.

RESULT

The result of this project is mainly the site-editing of Kvillepiren and the answers to the research questions for the project which has been explored through the whole process. The result of the project is to generate a site-specific design at Kvillepiren, using the method of phytotechnology. The technical nature of phytotechnology has challenged me to work with site-specifics and sensory qualities during the design process, in order to generate a sustainable park with strong human-nature relationships. The research questions are repeated below.

Answering research questions

- **How can a site-specific sustainable design at Kvillepiren be made so that the area functions as a park during the cleaning process of using phytoremediation?**
- **Can a park, during the cleaning process of phytotechnology, highlight natural processes and the cleaning processes of the plants with experiences so that visitors are educated in environmental awareness?**

I have answered the first research question by making a design proposal. **The answer is the whole design process described in the thesis with methods, which relates to theory, and a case study leading to the site-editing of Kvillepiren Purifying Park.** The project has been a personal design process, that has affected my methods and conceptions which are strongly affected by my past experiences in life, learned knowledge, and personal values. There are as many answers to the “How”

question as there are landscape architects on earth. For this project I have used particular methods on a particular site. These methods can be applied at other locations in similar ways to create other site-specific purifying parks

Phytotechnology is a transferable method that can be used in the creation of other purifying parks at other locations with pollution problems. The method can clean soil and the planting design used for the cleaning process can generate aesthetic values while educating visitors about pollution and removing pollutants using plants. Many of the sites we deal with as landscape architects are contaminated and phytotechnology is, compared to traditional sanitation methods, relatively cheap and has low environmental impact. Therefore, it is important for landscape architects to know about the method to be able to generate ecologically sustainable designs. Another transferable method I used is the traveling transect. This method has helped me to find site values of Frihamnen that are used in the site editing for a site-specific design. By using the method of traveling transect landscape architects can generate designs that show respect for existing site values. **Merging the technological approach of phytotechnology with more soft values using the traveling transect was shown to work well together in my design proposal.** The combination of these methods can also be used in other projects aiming to address both aesthetics and ecotechnology for sustainable designs.

The other question is answered with the site-editing as well as from field visits. According to my research the answer is yes, **a park with phytoremediation can highlight natural processes and the cleaning processes of the plants.** This is shown both by the site-editing of Kvillepiren and

by looking at field visits using phytotechnology for people to take part of in public areas. It is hard to say if the park will have impact on people's environmental awareness or not, even if the design deals with aspects that would generate awareness. The environmental awareness of the visitors could be measured by social science in future works.

Design as a result or a comment?

This thesis is a presentation and a result of my personal design process and not a result for the site Kvillepiren. Purifying park of Kvillepiren could instead be seen as a comment in the debate regarding the development of Gothenburg. Other people with other backgrounds, other values and interested in using other methods would end up with another result for the site. Site-specific values, used as a base in my project, also tend to change over time. Therefore, I call my work "a comment" rather than a result. With that said, my comment has a lot to say about developing Kvillepiren. The residents of Gothenburg, as well as people that are going to live in the area in question have not yet been part of the process. My recommendation to the municipality is to look at and be inspired by my proposal, but it is not to be seen as an end result for the site. The role of the landscape architect and planners is important in shaping the city. However, this should be done in a transformative way, taking into consideration for the already existing on site, responsibility for the future and democratic aspects which invites people to take part of the development.

REALIZATION AND FUTURE

If the municipality of Gothenburg is interested, the design for Kvillepiren Purifying park has great opportunities to be developed, planned for execution and built in the near future and with a relatively low budget. As mentioned in the reflection and discussion, this project should be seen as a comment in the debate about the future development of Gothenburg more than a finished result to apply directly. Hence, the design is made so that it would be easy to continue to develop and then later build on the site. The fact that the design is based on the existing site, with no need for money spent on expensive traditional soil remediation, makes this proposal economical compared to other development plans. If the soil has not achieved the desired reduction of pollution through phytotechnology during the estimated 15 year life-span of the park, the time for remediation can be extended and / or supplemented by traditional remediation in the most polluted sites.

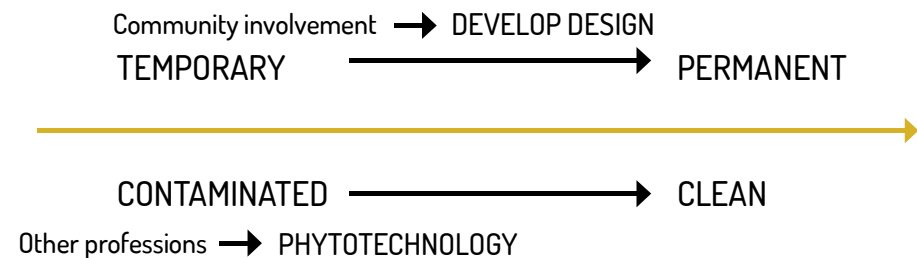


Figure 92. Purifying Park Future development time reflection.

“At the same time, if people learn to love a landscape and then it is taken away, what does that mean? Better to love it or to never love- or have – it at all?” (Diedrich, Bridger, Hendriks, & Moll, 2015, p. 126).

Temporal projects will always at some point meet future development. A new discussion might need to arise after the temporary use concerning more permanent use. 15 years is a relatively short time for a design. Materials and built objects as well as plant materials have been selected to suit this timeframe. After about 15 years when the site is possibly redeveloped, the park can be further developed as shown at the end of the site-editing section with developed plant material, succession, and more permanent structures. This development can be done with residents living in the area and or with workshops, inviting people from the whole of Gothenburg to learn together and develop the area. However, this development is dependent on sites being kept as parkland. The land is economically very valuable to the city and there are risks of nearby construction taking over the cleansing park when the site has been sanitized. Important in preserving the site as a park can be to also highlight other aspects than phytotechnology and develop varied functions in the park. A long-term focus in developing the areas in new ways can create a base for new ways of finding sustainable solutions for the municipality of Gothenburg. Kvillepiren can be turned into a test and a playground for developing sustainable solutions for old harbour areas, inspired by relevant examples but with the site-specifics of Gothenburg harbour areas as a base.

The future of Kvillepiren will be strongly affected by the plans and changes that take place in Frihamnen. It is important to develop the areas in dialog so that the different parts can complement each and function good together. The municipality has a great responsibility for the development of public areas in Frihamnen and for developing them according to present and future development challenges. There are also possibilities to make the area into a place which inspires sustainability work in other parts of the city. My proposal Purifying Park of Kvillepiren is a possibility for a start in such sustainability work. The park takes care of industrial waste, invites people to the before secluded area. The design builds upon Gothenburg's history as a harbour city with site-specific values preserved on site with industrial materials, atmosphere and relation to the surrounding as well as dealing with specific problems with pollutions. If, after about 15 years, the park is still being exploited, the layers of education, accessibility and phytoremediation can be moved to a nearby location. In this way, the park's qualities can be partially shifted, although many place-specific values cannot be replaced. New site-specific world needs crystallization where similar designs can be adapted and lifted to the new location.

FINAL REMARKS

In this work I have explored the method phytotechnic for decontaminating land and how it can be used in a park environment in order to also create aesthetic values. I have been working on site-specific qualities by mainly using the traveling transect method and then developed a site editing that is site-specific for Kvillepiren in Gothenburg. During the project, I have come to the conclusion that phytotechnics can be used within the field of landscape architecture together with site specifics as a base for design working with sustainable landscape designs. The work has been exciting, educational and broadened my view of my future role as a landscape architect and how I can work creatively with sustainability in the future. I hope that through my work, I will show working methods and a scenario for how we should manage post-industrial places and how we can lift these places and the environmental problems they have to instead contribute to visions of the future with faith in the future about healthy living environments. Kvillepiren Purifying park could be a pioneer for future use of old harbour areas and inspire to build up ecological district within the cities. Starting with purifying concepts with aesthetic qualities, inviting people to learn about sustainable development.

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